



Terraprobe

Consulting Geotechnical & Environmental Engineering
Construction Materials Inspection & Testing

GEOTECHNICAL INVESTIGATION PROPOSED HOME FARM RESIDENTIAL DEVELOPMENT TOWN OF THE BLUE MOUNTAINS, ONTARIO

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Attention: Mr. Stewart Higgins, P. Eng.

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Table of Contents

1.0	INTRODUCTION	1
2.0	SITE AND PROJECT DESCRIPTION	1
3.0	FIELD WORK	1
4.0	SUBSURFACE CONDITIONS	2
5.0	DISCUSSION AND RECOMMENDATIONS	3
5.1	Foundations	4
5.2	Concrete Slab-On-Grade or Basement Floors	5
5.3	Excavations	5
5.4	Backfill	6
5.5	Lateral Earth Pressures on Subsurface Walls	7
5.6	Pipe Bedding	7
5.7	Thrust Blocks and Pipe Restraints	8
5.8	Pavement Design Thickness	8
5.9	Earthquake Design Parameters	10
5.10	Stormwater Management Facilities	11

Table 1: Summary of Test Pits
Table 2: Summary of Groundwater Levels
Borehole Logs
Grain Size Analyses
Figures

1.0 INTRODUCTION

We are pleased to present our report on the subsurface investigation carried out for the proposed residential development in The Town of the Blue Mountains, Ontario. Authorization to complete this investigation was initially provided by Mr. Russell Higgins on April 21, 2011. Authorization to proceed with the additional field work was provided at later dates.

The purpose of the investigation was to determine the soil, bedrock and groundwater conditions on the site as they pertain to the design and installation of proposed municipal services, stormwater management facilities, a pumping station, internal road construction and general structure foundations. Excavation, dewatering, backfill and general construction constraints are also considered and discussed below.

2.0 SITE AND PROJECT DESCRIPTION

The site is located on the east side of Grey County Road 19, just north of Helen Street, in the Town of the Blue Mountains, Ontario (see Figure 1 & 2).

It is proposed to proceed with design and construction of full municipal services and internal streets associated with a residential subdivision development.

The property is currently treed and overgrown, agricultural land for the most part. The site generally falls in grade by about 40m from the southwest to northeast with a bluff cutting diagonally across the site.

Two (2) blocks of land dedicated for the Stormwater Management Ponds (SWMP) are located in the south and central parts of the property, near existing valley drainage courses (BH's 10 and 13). A sewage pumping station is proposed in the central part of the site on the upper plateau (BH3).

3.0 FIELD WORK

The initial field work associated with this project comprised of the advancement of twenty (20) sampled boreholes to depths of 1.4 to 16.5m below existing grade. Three (3) of the boreholes were deepened at a later date to confirm overburden or bedrock conditions with coring techniques.

In addition, five (5) test pits were excavated on June 1, 2011 using a large excavator in an attempt to prove the bedrock conditions. The test pits were terminated in the overburden soils due to the very dense and bouldery conditions.

The field drilling was carried out between May 25 and June 13, 2011, using track-mounted CME45 and D50T power augers provided by a specialist soil drilling contractor.

The boreholes were advanced using Standard Penetration Test methods at regular 0.75 to 1.5 m intervals in each borehole. Boreholes 3, 10 and 19 were deepened using rock coring techniques to prove soil or bedrock conditions at previous refusal depths. All soil samples were sealed in plastic containers and returned to our laboratory for further evaluation and testing including moisture content determination and select grain size analyses.

Following completion of the advancement of the boreholes, a standpipe type piezometer comprising of 19 mm diameter PVC tubing slotted at the base was installed in select boreholes and bentonite seals placed.

Return visits were made to the site on June 13 and July 4, 2011 to measure static water levels in the installed standpipes. It is our understanding that continuing monthly monitoring of groundwater levels across the site may be considered.

The field work (drilling, sampling, testing) was observed and recorded by a member of our engineering staff, who also transported the samples to our geotechnical testing laboratory.

4.0 SUBSURFACE CONDITIONS

The details of the subsurface conditions encountered at each test hole are presented on the attached Borehole Logs and Table 1: Summary of Test Pits. It should be noted that the conditions are confirmed at the test hole locations only and could vary between and beyond these locations. In addition, the changes in soil stratigraphy delineated on the Borehole Logs have been inferred from non-continuous sampling. In this regard, the changes should be taken as transitions from one soil type to another as opposed to exact planes of geologic change.

In general, the boreholes encountered about 0 to 600mm of topsoil and/or organic stained sand. Some variance in layering was observed across the site, especially with respect to occasional sand and clayey silt layers. The native soils were primarily sandy silt glacial till with some clay and trace to some gravel (see attached grain size analyses). Frequent cobbles and boulders were also present causing difficult augering and excavating conditions.

Boreholes 3, 13, 18 and 20 encountered sand deposits in the area of the existing bluff. Boreholes 1 to 4, 6 to 12 and 14 to 18 were terminated prematurely on probable cobbles and boulders in very dense till soils. Boulders 3, 10 and 19 were deepened using rock coring techniques on a return visit. Shale to limestone bedrock was confirmed at Borehole 19 below about elevation 186.1m. Probable bedrock was also encountered below about 184.7m at Borehole 20 and about elevation 188.9m at Borehole 13. The remaining boreholes were terminated in overburden soils.

The native soils exhibited moisture contents varying between about 2 to 44% and generally decreased with depth. Some perched groundwater was encountered above and within the sandy silt glacial till soils.

Across the site, Standard Penetration Tests conducted in each borehole generally indicated 'N' values of about 5 to greater than 50 blows per 0.3 m of penetration increasing with depth in the native soils. Therefore, these soils are considered to be loose to very dense. The very dense glacial tills with cobbles and boulders were made up of such a tight matrix that the drilling augers and the large excavator used for test pits could not advance below the depths noted on the logs and Table 1.

Many of the shallow test holes encountered groundwater within the upper soils at this time. The levels noted during drilling and measured during our return site visits are summarized on the attached Table 2.

It is anticipated that some fluctuations of the groundwater table will occur seasonally and may be higher during wetter seasons and/or years. It is our recommendation that ongoing monthly monitoring of static groundwater levels continue through the winter/spring of 2012 as a minimum. Shallow groundwater flow direction appears to be towards the northeast.

The attached Table 1 summarizes the test pits which were excavated in an attempt to prove bedrock conditions. Due to very dense soils, the test pits were all terminated in the overburden glacial tills.

5.0 DISCUSSION AND RECOMMENDATIONS

The following discussion and recommendations are based on the factual data obtained from this investigation and are intended for use by the design engineers only. Contractors bidding on this project or conducting work associated with this project should make their own interpretation of the factual data and/or carry out their own investigations.

Generally, the site is underlain with compact to very dense native silty sand to sandy silt soils with frequent boulders. Potential groundwater constraints are anticipated for the installation of the proposed services and other excavations depending on the final design depths. Difficult excavation conditions even with large mechanical excavators should be anticipated.

5.1 Foundations

The undisturbed soils beneath the topsoil and/or any fill are considered suitable for the support of conventional spread and/or strip footings for structures.

The marginally compact to very dense native conditions encountered below about 0.8m depth (i.e, typical 'N' values greater than 15 to 20 blows per 0.3m of penetration) will allow structure foundations, etc. to be designed for a maximum soil bearing pressure of 200 kPa (SLS). A corresponding factored bearing capacity at Ultimate Limit State (ULS) of approximately 300 kPa may be used. Greater capacity may be available at greater depth and can be assessed by Terraprobe if required for specific structures. At the proposed pumping station site (Borehole 3), a soil bearing pressure of 350 kPa (SLS) may be considered below 1.5m (below elevation 210.7m).

A minimum soil cover of 1.2m or equivalent insulation is recommended for frost protection to footings in exterior or unheated areas. Construction during cold weather should also ensure temporary frost protection of footing bases.

The minimum footing widths to be used in conjunction with the above recommended soil bearing pressures should be 0.5m for continuous footings and 0.8m for individual footings. The above recommended bearing capacities are based on estimated maximum total settlement of 25 mm and differential settlement of 19mm.

It should also be noted that due to the variable conditions in the upper 1.0 to 2.0m of the site, some downward stepping of footings should be anticipated in order to extend to competent soils.

Prior to placement of concrete for footings, the footing bases should be cleaned of all deleterious materials such as topsoil, fill, softened or disturbed materials as well as any standing water. It is recommended that the foundations be inspected by Terraprobe in order to confirm the exposed soil conditions and recommended bearing capacities. If construction proceeds during freezing weather conditions, adequate temporary frost protection for the footing bases and concrete must be provided.

Perimeter drainage measures for basements as per the Ontario Building Code should be implemented.

Areas of the property may require engineered fill to raise grades. This should be completed under full time supervision by Terraprobe to monitor extent, lift thickness, compaction, material quality and the like.

Where structures are placed on at least 0.5m of engineered fill constructed on an approved subgrade, the recommended maximum bearing capacity may be 150 kPa (SLS). Engineered fill material may consist of granular type soils placed with moisture control in maximum 150 mm loose lifts and compacted uniformly to a minimum of 98% of Standard Proctor Maximum Dry Density. Terraprobe's detailed engineered fill specifications will need to be followed if this option is pursued.

5.2 Concrete Slab-On-Grade or Basement Floors

Conventional lightly loaded concrete slab-on-grade or basement floors can be placed on the existing native inorganic soil subgrade below all deleterious materials, or on engineered fill placed under full time supervision. A moisture break consisting of a minimum of 150 mm of OPSS Granular 'A' type material compacted to a minimum of 100% of Standard Proctor Maximum Dry Density (SPMDD) should be placed directly below the slab.

All basement floors should be constructed at least 0.3m above the seasonally high water level. Perimeter, filtered, weeping drains must also be installed leading to positive outlets such as a sump pump in the basement. Basement walls must be backfilled either with imported Granular 'B' type backfill or drainage mediums as per the Ontario Building Code.

5.3 Excavations

The recommended safe side slope configuration for temporary unbraced excavations above the groundwater level through the native compact to very dense soils is 1 to 1 (horizontal to vertical) typically. However, the glacial tills will stand near vertical for temporary excavations.

A Type 3 soil is characteristic of the sandy site soils above the water level where 1 to 1 side slopes from the base of the trench to ground surface should be used when workers must enter trenches deeper than 1.2m. Soils below the groundwater level in sandy soils should be considered as Type 4. The very dense glacial till soils are considered Type 2 soils.

Excavations deeper than about 0.3m below the encountered water level in sandy soils will require positive dewatering such as well points and/or deep wells. Significant volumes of water should be anticipated from the native sand soils (i.e. Borehole 3) and therefore a Permit to Take Water from the MOE will likely be required for construction works at this site (ie: more than 50,000 litres per day dewatering).

The attached grain size analyses indicate permeabilities of the native sand soils in the range of 10^{-2} to 10^{-3} cm/s while the sandy silt deposits would be in the range of 10^{-5} to 10^{-6} cm/s.

The limit of grinding auger refusal generally represents the practical extent of excavation using heavy excavation equipment. Below this level, pneumatic hammers, rippers and/or blasting will likely be required.

5.4 Backfill

Based on our experience with silty sand to sandy silt soils, the water contents of the upper native site soils (ie: 3 to 4m depth) are primarily in the range of 30 to 3% by weight. The estimated optimum water content for Standard Proctor compaction is about 9 to 12%. Generally, soils can be sufficiently compacted at moisture contents up to about 3% wetter than optimum. In this regard, most of the upper native site soils fall within this range and will be suitable for reuse as compacted fills during the construction process if no excess moisture is added. The upper 1m is often wet of optimum and may need to be wasted, dried and/or mixed with drier soils.

Significant sorting out of cobbles and boulders from backfill will be required to achieve uniform adequate compaction in trenches and around foundations.

Earth fill materials placed beneath settlement sensitive areas such as floor slabs, sidewalks, pavement structures and the like should be compacted to a minimum of 95% of Standard Proctor Maximum Dry Density in lifts not exceeding 200 mm.

The topsoil materials encountered at the site should not be used as backfill in settlement sensitive areas such as those noted above. The topsoil material may be stockpiled and reused for landscaping purposes or wasted.

Should construction be conducted during the winter season, it is imperative to ensure that frozen materials are not utilized as trench backfill.

It is recommended that inspection and testing be carried out by Terraprobe during construction to confirm trench backfill quality, thickness and to ensure adequate compaction.

5.5 Lateral Earth Pressures on Subsurface Walls

The boreholes encountered primarily silty sand to sandy silt soils, for the most part in a compact to very dense condition within the upper 2 to 3m of ground surface.

For design of rigid concrete walls, the following design parameters are recommended.

		Loose to Dense
soil unit weight	γ	19 kN/m ³
angle of internal friction	ϕ'	30°
coefficient of lateral earth pressure "at rest"	k_o	0.5

The recommended design angle of friction between concrete and the native soil is 24°. Associated with the above is the inherent assumption that hydrostatic pressure will not be allowed to develop behind these wall structures. In this regard, perimeter drainage systems will need to be implemented.

5.6 Pipe Bedding

Based on anticipated service inverts of about 3 to 4m below existing grade, the trench base is expected to consist of compact to very dense sandy silt or sand soils in most cases. The undisturbed native soils encountered at the site will generally be suitable for support of underground services with conventional Class 'B' granular bedding. Additional granular bedding may be necessary for stabilization of wet trench bases. The granular bedding should consist of a well graded material such as Granular 'A'. Excavation bases should be free of standing water prior to and during bedding and service placement.

Any soft, loose or disturbed soils encountered as a result of groundwater seepage or construction traffic should be subexcavated and replaced with suitably compacted granular fill. Granular 'A' bedding material should be placed in thin lifts and compacted to a minimum of 95% of SPMDD. If HL 8 course aggregate or 19mm clear stone is used this will require light tamping only. However, it should be cautioned that this HL8 aggregate or clear stone should not be used directly against native deposits unless a geotextile fabric is also considered as a complete wrap to prevent migration of fines into the bedding from the surrounding fine soil.

5.7 Thrust Blocks and Pipe Restraints

It is recommended that the thrust blocks be cast directly against undisturbed native ground. The maximum allowable bearing pressures for design of thrust blocks against undisturbed native soil where there is soil cover over the block that equals the height of the block, is 150 kPa.

The internal angle of friction between the thrust block and the soil may be taken as 33°.

The following design parameters are recommended for design of restrained joints;

- Ultimate friction angle between plastic or ductile iron pipe and compact bedding 24°
- Ultimate friction angle between concrete pipe and compact bedding 33°
- Maximum bearing of thrust pressure of pipe normal to bedding against native soil 150 kPa

5.8 Pavement Design Thickness

The pavement subgrade is expected to comprise of a sandy silt in most cases or perhaps clean earth fill compacted to a minimum of 95% of SPMDD. The exposed subgrade should be shaped and graded with a typical 3% cross-fall, directed towards continuous subdrains and/or open ditches with inverts at least 0.5m below subgrade level.

The pavement subgrade should be proof rolled to evaluate its stability. All unstable areas will require sub-excavation and re-compaction or increased thickness of granular subbase. It should be noted that the majority of the upper site soils are considered somewhat frost susceptible. Therefore, adequate subgrade drainage is recommended. Uncompacted fill requiring subexcavation and removal or recompaction may be encountered above the previously installed services at the site.

Based on the soil conditions encountered during our investigation, we recommend that a sufficient pavement structure for internal, local roads will be as follows;

HL 3 (surface) asphalt	40 mm
HL 8 or HL4 (binder) asphalt	50 mm
OPSS Granular 'A' (base course)	150 mm
OPSS Granular 'B' (subbase course)	450 mm
Total	690 mm

The recommended pavement structure thicknesses may exceed the Town standards due to the subsurface soil and groundwater conditions encountered during this investigation.

The above design assumes that sub-drainage of the granular fill will be provided. This should consist of continuous subdrains leading to catch basins and/or open ditches.

It should be reiterated that while the subgrade may be sandy in some cases, the fine sand is often silty and frost susceptible. The subdrains are considered a valuable protection against frost heave damage and subgrade softening particularly impacting the long term performance of the pavement.

All topsoil and any organic-rich material should be removed from below settlement sensitive areas such as pavements. Immediately prior to placement of the pavement granular courses, the subgrade should be proof rolled with a heavy rubber tired vehicle (such as a grader) and any loose, soft or unstable areas should be subexcavated and backfilled with compacted materials.

The granular subbase and base fill materials should be compacted to a minimum of 100% of Standard Proctor Maximum Dry Density (SPMDD), placed in lifts of 150 mm or less. Asphaltic concrete materials should be rolled and compacted to a minimum of 97% of Marshall Bulk Density (MBD) based on nuclear density testing.

The above pavement design thicknesses are considered adequate for the design traffic. However, if pavement construction occurs in wet inclement weather it may be necessary to provide additional subgrade support for heavy construction traffic by increasing the thickness of the granular subbase or base course materials. Further, main traffic access areas for construction equipment may experience unstable subgrade conditions. These may need stabilization utilizing additional thickness of granular materials.

It is recommended that inspection and testing be carried out during construction to confirm material quality, thickness and to ensure adequate compaction.

5.9 Earthquake Design Parameters

The Ontario Building Code (2006) stipulates the methodology for earthquake design analysis, as set out in Subsection 4.1.8.7. The determination of the type of analysis is predicated on the importance of the structure, the spectral response acceleration and the site classification.

The parameters for determination of Site Classification for Seismic Site Response are set out in Table 4.1.8.4A of the Ontario Building Code (2006). The classification is based on the determination of the average shear wave velocity in the top 30 metres of the site stratigraphy, where shear wave velocity (v_s) measurements have been taken. Alternatively, the classification is estimated on the basis of rational analysis of undrained shear strength (s_u) or penetration resistance.

$$v_{s-avg} = \frac{\sum_{i=1}^n d_i}{\sum_{i=1}^n \frac{d_i}{v_{si}}}$$

Shear wave velocity

$$s_{u-avg} = \frac{\sum_{i=1}^n d_i}{\sum_{i=1}^n \frac{d_i}{s_{ui}}}$$

Undrained shear strength

$$N_{avg} = \frac{\sum_{i=1}^n d_i}{\sum_{i=1}^n \frac{d_i}{N_i}}$$

SPT N-values

At this site the stratigraphy beneath the buildings will consist of at least 16 metres of soil and/or rock with a penetration resistance averaging at least 50 blows per 300 mm. The soils are primarily very dense at depth. It is known that the deeper stratigraphy in this area is at least as competent. On this basis, the site designation for seismic analysis is Class C, according to Table 4.1.8.4.A of the Ontario Building Code (2206). Tables 4.1.8.4B and 4.1.8.4C of the same code provide the applicable acceleration and velocity based site coefficients.

Site Class	Values of F_a				
	$S_a(0.2) \leq 0.25$	$S_a(0.2) = 0.50$	$S_a(0.2) = 0.75$	$S_a(0.2) = 1.00$	$S_a(0.2) \geq 1.25$
C	1.0	1.0	1.0	1.0	1.0

Site Class	Values of F_v				
	$S_a(1.0) \leq 0.1$	$S_a(1.0) = 0.2$	$S_a(1.0) = 0.3$	$S_a(1.0) = 0.4$	$S_a(1.0) \geq 0.5$
C	1.0	1.0	1.0	1.0	1.0

5.10 Stormwater Management Facilities

Boreholes 10 and 13 were advanced in or near the proposed storm pond areas as shown approximately on Figure 2.

It is our understanding that the storm pond details have not yet been refined.

The attached reports indicate grain size analyses for the different strata encountered in these boreholes. We would expect the base of the proposed pond to be situated in sandy silt soils with sand seams/layers depending on the final design. We would estimate a coefficient of permeability of about 10^{-2} to 10^{-3} cm/s in the sand with trace to some silt and about 10^{-5} to 10^{-6} cm/s in the sandy silt glacial till.

Pond geometry of 4:1 (horizontal to vertical) internal side slopes below the permanent pond level are appropriate for the type and density of the soils encountered during our investigation. Exterior and upper berm slopes may be cut to 3:1 which will also be suitable from a geotechnical perspective.

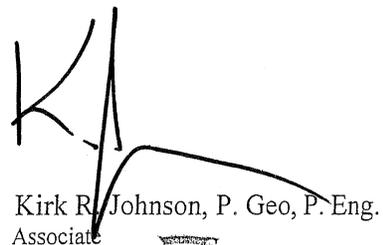
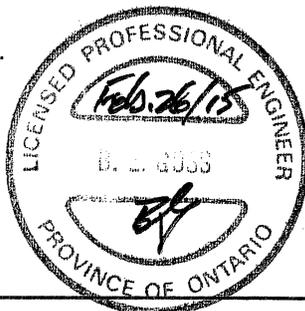
We trust the foregoing information will satisfy your present requirements. If you should have any questions, or if we can be of further assistance, please do not hesitate to contact us.

Sincerely,
Terraprobe Inc.



Blair E. Goss, P. Eng.
Associate

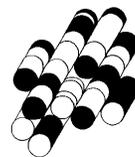
BEG/ct
Barrie Office



Kirk R. Johnson, P. Geo, P. Eng.
Associate



TABLE



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Table 1
Summary of Test Pits
Proposed Home Farm Development, The Blue Mountains, Ontario
 (Excavated June 1, 2011)

Test Pit Number	Depth (m)	Soil Description	Comments
9/10	0 - 0.3 0.3 - 2.5	Silty Topsoil , with cobbles & boulders, dark brown Sandy Silt Till , some gravel, with cobbles & boulders, brown, compact to very dense, moist, excavator refusal in very dense till at 2.5m	No seepage or free water noted in open excavation. Located between Boreholes 9 & 10.
14	0 - 0.2 0.2 - 2.0	Silty Topsoil , dark brown Sandy Silt Till , some gravel, with cobbles & boulders, brown to grey below 2m, compact to very dense, moist, excavator refusal in very dense till at 2.0m	No seepage or free water noted in open excavation. Located adjacent to Borehole 14.
16	0 - 0.3 0.3 - 0.6 0.6 - 1.5 1.5 - 2.0	Silty Topsoil , dark brown Sand & Gravel Fill , black, loose to compact, wet Sandy Silt Fill , some gravel, with many cobbles & boulders, brown, compact, moist Sandy Silt Till , some gravel, with cobbles & boulders, brown to grey, compact to very dense, moist, excavator refusal in very dense till at 2.0m	Seepage of perched water noted in upper sands. Located adjacent to Borehole 16.
21	0 - 0.9 0.9 - 3.2	Silt Fill , some sand, trace clay, trace to some organics, dark brown, compact, moist Silt to Sandy Silt Till , some gravel, with cobbles & boulders, brown to grey below 3m, compact to very dense, moist, excavator refusal in very dense till at 3.2m	No seepage or free water noted in open excavation. Located near boulder piles in staging area.
22	0 - 0.6 0.6 - 3.3	Silty Topsoil , dark brown Sandy Silt Till , some gravel, with cobbles & boulders, brown to grey below 2.9m, compact to very dense, moist, excavator refusal in very dense till at 3.3m	Slight seepage below topsoil noted in open excavation. Located opposite trailer on south side of access road.

NB - to be read with accompanying report.

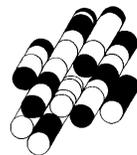
Table 2
Summary of Groundwater Levels
Proposed Residential Subdivision - Home Farm
Town of The Blue Mountains, Ontario

Test Hole Number	Ground Surface Elevation (m)	Water Level (m)					
		Noted During Drilling		Measured June 13/11		Measured July 4/11	
		Depth	Elevation	Depth	Elevation	Depth	Elevation
BH 1	216.6	Dry to 3.7	< 212.9	(0.2)	216.8	0.2	216.4
BH 2	221.6	0.9	220.7	-	-	-	-
BH 3	212.2	0.5 * 4.4 **	211.7 207.8	1.4 -	210.8 -	2.0 3.5	210.2 208.7
BH 4	215.7	2.0	213.7	0.2	215.5	-	-
BH 5	223.6	4.0	219.6	1.0	222.6	-	-
BH 6	224.4	Dry to 3.8	< 220.6	-	-	-	-
BH 7	214.2	1.0	213.2	-	-	-	-
BH 8	223.8	Dry to 5.8	< 218.0	0.6	223.2	-	-
BH 9	220.2	Dry to 2.9	< 217.3	-	-	-	-
BH 10	218.7	0.8 * 4.8 **	217.9 213.9	0.4 -	218.3 -	0.9 1.6	217.8 217.1
BH 11	211.8	Dry to 1.4	< 210.4	-	-	-	-
BH 12	199.8	Dry to 3.0	< 196.8	-	-	-	-
BH 13	205.4	4.5 * 13.4 **	200.9 192.0	3.1 13.5	202.3 191.9	- -	- -
BH 14	209.6	Dry to 1.5	< 208.1	-	-	-	-
BH 15	216.4	Dry to 2.6	< 213.8	1.6	214.8	-	-
BH 16	221.8	Dry to 2.3	< 219.5	-	-	-	-
BH 17	226.1	Dry to 4.7	< 221.4	-	-	-	-
BH 18	190.8	0.9	189.9	0.8	190.0	-	-
BH 19	187.3	1.0	186.3	1.9	185.4	-	-
BH 20	189.9	0.7	189.2	0.6	189.3	-	-
TP 9/10	-	Dry to 2.5	-	-	-	-	-
TP 14	-	Dry to 2.0	-	-	-	-	-
TP 16	-	0.4	-	-	-	-	-
TP 21	-	Dry to 3.2	-	-	-	-	-
TP22	-	0.6	-	-	-	-	-

* - shallow standpipe

** - deep standpipe

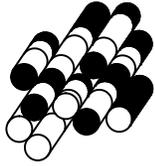
BOREHOLE LOGS



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BOREHOLE LOGS

SAMPLING METHOD		PENETRATION RESISTANCE		
SS	split spoon	Standard Penetration Test (SPT) resistance ('N' values) is defined as the number of blows by a hammer weighing 63.6 kg (140 lb.) falling freely for a distance of 0.76 m (30 in.) required to advance a standard 50 mm (2 in.) diameter split spoon sampler for a distance of 0.3 m (12 in.).		
ST	Shelby tube			
AS	auger sample	Dynamic Cone Test (DCT) resistance is defined as the number of blows by a hammer weighing 63.6 kg (140 lb.) falling freely for a distance of 0.76 m (30 in.) required to advance a conical steel point of 50 mm (2 in.) diameter and with 60° sides on 'A' size drill rods for a distance of 0.3 m (12 in.).		
WS	wash sample			
RC	rock core			
WH	weight of hammer			
PH	pressure, hydraulic			
SOIL DESCRIPTION - COHESIONLESS SOILS		SOIL DESCRIPTION - COHESIVE SOILS		
Relative Density	'N' value	Consistency	Undrained Shear Strength, kPa	'N' value
very loose	< 4	very soft	< 12	< 2
loose	4 - 10	soft	12 - 25	2 - 4
compact	10 - 30	firm	25 - 50	4 - 8
dense	30 - 50	stiff	50 - 100	8 - 16
very dense	> 50	very stiff	100 - 200	16 - 32
		hard	> 200	> 32
SOIL COMPOSITION		TESTS, SYMBOLS		
	% by weight	MH	mechanical sieve and hydrometer analysis	
'trace' (e.g. trace silt)	< 10	w, w _c	water content	
'some' (e.g. some gravel)	10 - 20	w _l	liquid limit	
adjective (e.g. sandy)	20 - 35	w _p	plastic limit	
'and' (e.g. sand and gravel)	35 - 50	I _p	plasticity index	
		k	coefficient of permeability	
		Y	soil unit weight, bulk	
		φ'	angle of internal friction	
		c'	cohesion shear strength	
		C _c	compression index	
GENERAL INFORMATION, LIMITATIONS				
<p>The conclusions and recommendations provided in this report are based on the factual information obtained from the boreholes and/or test pits. Subsurface conditions between the test holes may vary.</p>				
<p>The engineering interpretation and report recommendations are given only for the specific project detailed within, and only for the original client. Any third party decision, reliance, or use of this report is the sole and exclusive responsibility of such third party. The number and siting of boreholes and/or test pits may not be sufficient to determine all factors required for different purposes.</p>				
<p>It is recommended Terraprobe be retained to review the project final design and to provide construction inspection and testing.</p>				



Terraprobe

LOG OF BOREHOLE ..1..

PROJECT NAME: Home Farm Subdivision

PROJECT No.: 3-11-7059

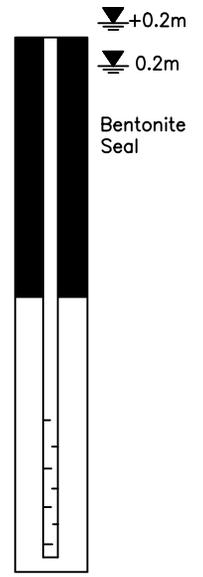
CLIENT: MacPherson Builders (Blue Mountains) Limited

BORING DATE: May 25, 2011

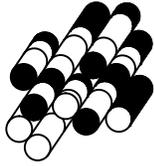
LOCATION: Town of Blue Mountains, Ontario

ELEVATION DATUM: Geodetic

BORING METHOD DEPTH SCALE IN METRES	SOIL PROFILE			SAMPLES		PENETRATION RESISTANCE PLOT $\times \times \times$				WATER CONTENT (%)			INSTALLATION INFORMATION	
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	"N" VALUE	SHEAR STRENGTH kPa							
							20	40	60	80				
0	GROUND SURFACE		216.6											
	125mm - Silty TOPSOIL		0.0											
	Brown to Grey	Compact to Very Dense		1	SS	6 x								
1	SANDY SILT, trace gravel to gravelly, some clay, with frequent cobbles & boulders, difficult augering, TILL			2	SS	27 x								
				3	SS	50/150mm								
				4	SS	50/150mm								
				5	SS	50/100mm								
				6	AS									
4	Grinding auger refusal on probable boulders.		3.7											
5														
6														
7														
8														
9														



- Borehole remained open and dry upon completion of drilling.
- Water level on June 13, 2011 measured at 0.2m above existing grade (elev.216.8m).
- Water level on July 4, 2011 measured at 0.2m (elev. 216.4m).



Terraprobe

LOG OF BOREHOLE ..2..

PROJECT NAME: Home Farm Subdivision

PROJECT No.: 3-11-7059

CLIENT: MacPherson Builders (Blue Mountains) Limited

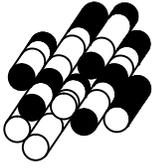
BORING DATE: May 25, 2011

LOCATION: Town of Blue Mountains, Ontario

ELEVATION DATUM: Geodetic

BORING METHOD DEPTH SCALE IN METRES	SOIL PROFILE			SAMPLES			PENETRATION RESISTANCE PLOT $\times \times \times$				WATER CONTENT (%)			INSTALLATION INFORMATION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	"N" VALUE	SHEAR STRENGTH kPa							
							20	40	60	80	10	20	30	
0	GROUND SURFACE		221.6											
	175mm - Silty TOPSOIL		0.0											
	Brown to Grey	Compact to Very Dense		1	SS	6	x							
1	SANDY SILT, trace gravel to gravelly, some clay, with frequent cobbles & boulders, difficult augering, TILL			2	AS	18	x							
2	Grey			3	SS	50/125mm								
				4	AS	50/125mm								
3	Grinding auger refusal on probable boulders after three attempts.		218.9											
4			2.7											
5														
6														
7														
8														
9														

- Borehole remained open upon completion of drilling.
- Perched water noted at 0.9m during drilling.



Terraprobe

LOG OF BOREHOLE ..3..

PROJECT NAME: Home Farm Subdivision

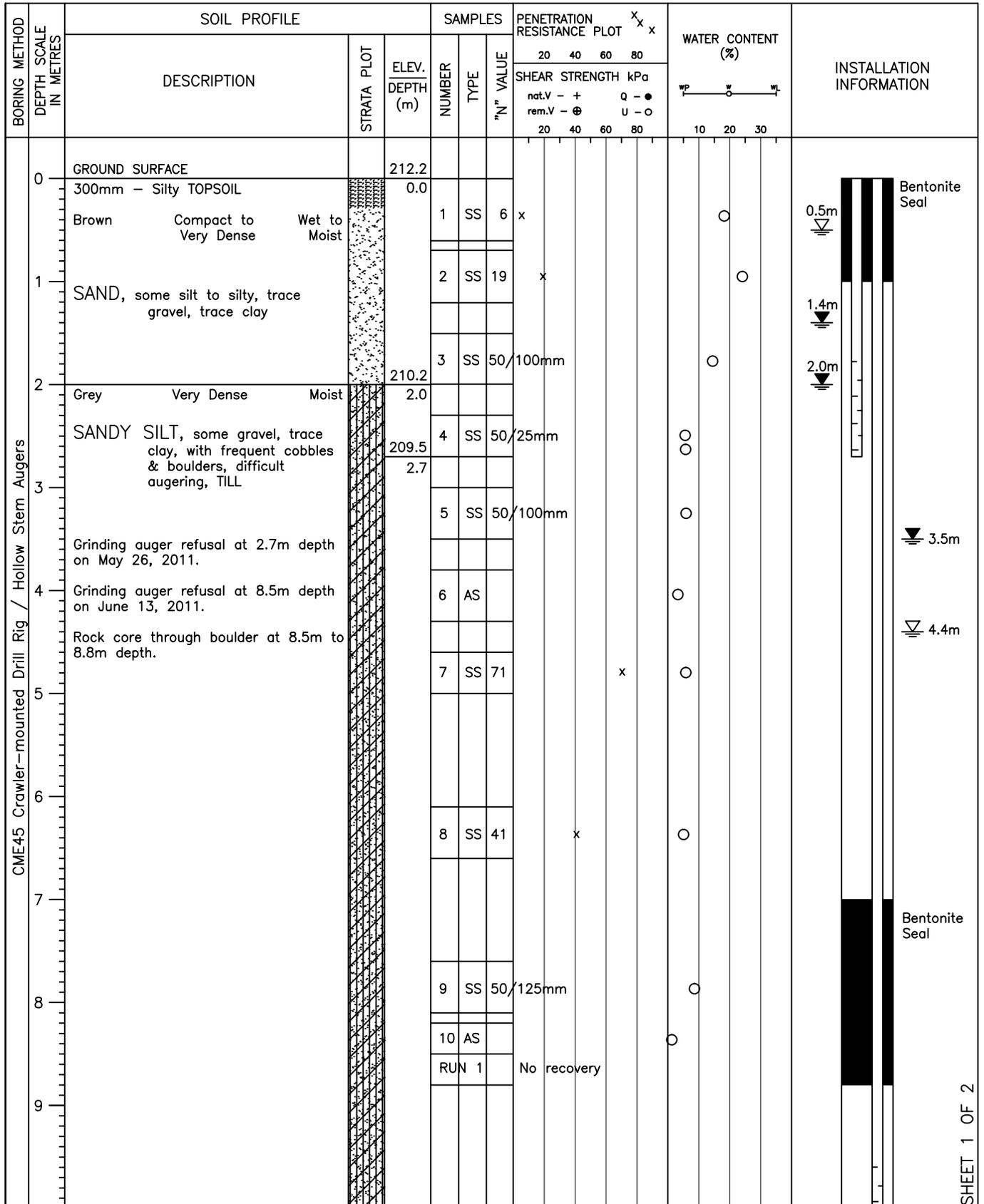
PROJECT No.: 3-11-7059

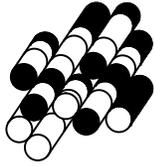
CLIENT: MacPherson Builders (Blue Mountains) Limited

BORING DATE: May 26 & June 13, 2011

LOCATION: Town of Blue Mountains, Ontario

ELEVATION DATUM: Geodetic





Terraprobe

LOG OF BOREHOLE ..3..

PROJECT NAME: Home Farm Subdivision

PROJECT No.: 3-11-7059

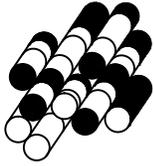
CLIENT: MacPherson Builders (Blue Mountains) Limited

BORING DATE: May 26 & June 13, 2011

LOCATION: Town of Blue Mountains, Ontario

ELEVATION DATUM: Geodetic

BORING METHOD DEPTH SCALE IN METRES	SOIL PROFILE			SAMPLES			PENETRATION RESISTANCE PLOT				WATER CONTENT (%)			INSTALLATION INFORMATION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	"N" VALUE	SHEAR STRENGTH kPa							
							20 40 60 80		20 40 60 80					
10	Continued As above.		202.2 10.0											<ol style="list-style-type: none"> Borehole remained open upon completion of drilling. Perched water noted at 0.5m during drilling on May 26, 2011. Water level on June 13, 2011 measured at 1.4m (elev. 210.8m) in 2.7m deep standpipe. Water level noted at 4.4m during drilling on June 13, 2011. Water level on July 4, 2011 measured at 2.0m (elev. 210.2m) in 2.7m deep standpipe and at 3.5m (elev. 208.7m) in 10.6m deep standpipe.
11	End of Borehole.		201.4 10.8	11	SS	50/50mm								
12														
13														
14														
15														
16														
17														
18														
19														



Terraprobe

LOG OF BOREHOLE ..4..

PROJECT NAME: Home Farm Subdivision

PROJECT No.: 3-11-7059

CLIENT: MacPherson Builders (Blue Mountains) Limited

BORING DATE: May 26, 2011

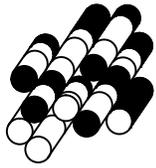
LOCATION: Town of Blue Mountains, Ontario

ELEVATION DATUM: Geodetic

BORING METHOD DEPTH SCALE IN METRES	SOIL PROFILE			SAMPLES		PENETRATION RESISTANCE PLOT $\times \times \times$				WATER CONTENT (%)			INSTALLATION INFORMATION	
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	"N" VALUE	SHEAR STRENGTH kPa							
							20	40	60	80				
0	GROUND SURFACE		215.7											
	600mm - Silty TOPSOIL		0.0											
	Brown to Grey	Dense to Very Dense		1	SS	4 x								
1	SANDY SILT, trace gravel to gravelly, some clay, with frequent cobbles & boulders, difficult augering, TILL			2	SS	53								
2	Grey			3	SS	50/150mm								
				4	SS	50/150mm								
3	Grinding auger refusal on probable boulders.		212.7	5	AS									
3			3.0											

0.2m
Bentonite Seal
2.0m

- Borehole remained open upon completion of drilling.
- Perched water noted in seam at 2m during drilling.
- Water level on June 13, 2011 measured at 0.2m (elev. 215.5m).



Terraprobe

LOG OF BOREHOLE ..5..

PROJECT NAME: Home Farm Subdivision

PROJECT No.: 3-11-7059

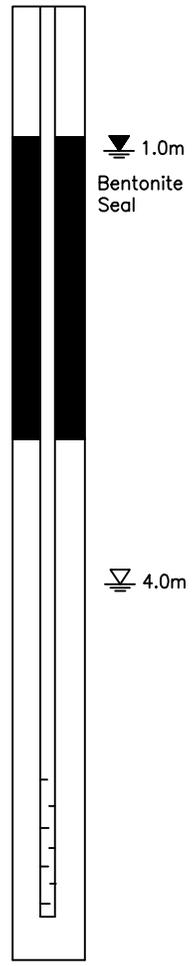
CLIENT: MacPherson Builders (Blue Mountains) Limited

BORING DATE: May 25, 2011

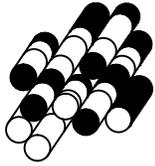
LOCATION: Town of Blue Mountains, Ontario

ELEVATION DATUM: Geodetic

BORING METHOD DEPTH SCALE IN METRES	SOIL PROFILE			SAMPLES			PENETRATION RESISTANCE PLOT				WATER CONTENT (%)			INSTALLATION INFORMATION	
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	"N" VALUE	SHEAR STRENGTH kPa				WATER CONTENT (%)				
							20	40	60	80	10	20	30		
0	GROUND SURFACE		223.6												
	175mm - Silty TOPSOIL		0.0												
	Brown to Grey	Very Dense Moist		1	SS	9	x								
1	SANDY SILT, trace gravel to gravelly, some clay, with frequent cobbles & boulders difficult augering, wet silt & sand seam at 4 to 4.5m, TILL --- Grey			2	SS	62			x						
					3	SS	50	100mm							
					4	SS	50	150mm							
					5	SS	75				x				
					6	SS	71				x				
					7	SS	50	75mm							
					217.0										
7	End of Borehole		6.6												
8															
9															



1. Borehole remained open upon completion of drilling.
2. Water level noted at 4m during drilling.
3. Water level on June 13, 2011 measured at 1.0m (elev. 222.6m).



Terraprobe

LOG OF BOREHOLE ..6..

PROJECT NAME: Home Farm Subdivision

PROJECT No.: 3-11-7059

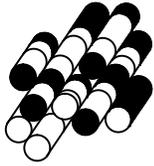
CLIENT: MacPherson Builders (Blue Mountains) Limited

BORING DATE: May 25, 2011

LOCATION: Town of Blue Mountains, Ontario

ELEVATION DATUM: Geodetic

BORING METHOD DEPTH SCALE IN METRES	SOIL PROFILE			SAMPLES			PENETRATION RESISTANCE PLOT				WATER CONTENT (%)			INSTALLATION INFORMATION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	"N" VALUE	SHEAR STRENGTH kPa				WATER CONTENT (%)			
							20	40	60	80	10	20	30	
0	GROUND SURFACE		224.4											
	400mm - Silty TOPSOIL		0.0											
	Brown to Grey	Compact to Very Dense		1	SS	2 x							44	
1	SANDY SILT, trace gravel to gravelly, some clay, with frequent cobbles & boulders difficult augering, TILL			2	SS	18	x							
2				3	SS	38		x						
3				4	SS	53			x					
3	Grey			5	SS	58				x				
4	Grinding auger refusal on probable boulders.		220.6	6	SS	50/12.5mm								
			3.8											1. Borehole remained open and dry upon completion of drilling.
5														
6														
7														
8														
9														



Terraprobe

LOG OF BOREHOLE ..7..

PROJECT NAME: Home Farm Subdivision

PROJECT No.: 3-11-7059

CLIENT: MacPherson Builders (Blue Mountains) Limited

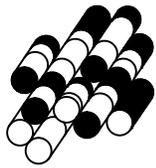
BORING DATE: May 26, 2011

LOCATION: Town of Blue Mountains, Ontario

ELEVATION DATUM: Geodetic

BORING METHOD DEPTH SCALE IN METRES	SOIL PROFILE			SAMPLES			PENETRATION RESISTANCE PLOT				WATER CONTENT (%)			INSTALLATION INFORMATION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	"N" VALUE	20	40	60	80	10	20	30	
0	GROUND SURFACE		214.2											
	150mm - Silty TOPSOIL		0.0											
	Brown Very Dense Moist to Wet			1	SS	50/100mm								
1	SANDY SILT, some gravel to gravelly		212.9	2	SS	50/150mm								
	Grey Very Dense Moist		1.3											
2	SANDY SILT, trace gravel to gravelly, some clay, with frequent cobbles & boulders difficult augering, TILL		211.5	3	SS	50/150mm								
				4	SS	50/100mm								
3	Grinding auger refusal on probable boulders.		2.7											
4														
5														
6														
7														
8														
9														

- Borehole remained open upon completion of drilling.
- Perched water noted at 1.0m during drilling.



Terraprobe

LOG OF BOREHOLE ..8..

PROJECT NAME: Home Farm Subdivision

PROJECT No.: 3-11-7059

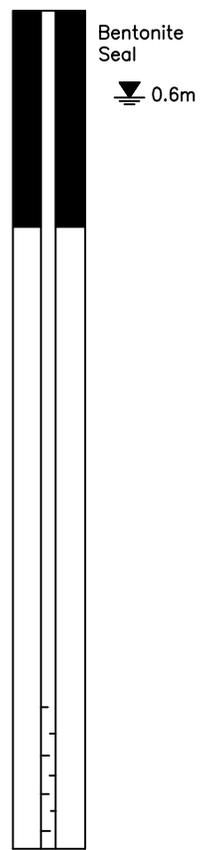
CLIENT: MacPherson Builders (Blue Mountains) Limited

BORING DATE: May 25, 2011

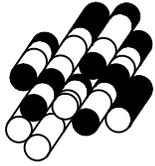
LOCATION: Town of Blue Mountains, Ontario

ELEVATION DATUM: Geodetic

BORING METHOD DEPTH SCALE IN METRES	SOIL PROFILE			SAMPLES			PENETRATION RESISTANCE PLOT ^x _x ^x				WATER CONTENT (%)			INSTALLATION INFORMATION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	"N" VALUE	20	40	60	80				
							SHEAR STRENGTH kPa							
							nat.V - +				Q - ●			
							rem.V - ⊕				U - ○			
							20	40	60	80				
CME45 Crawler-mounted Drill Rig / Solid Stem Augers	0	GROUND SURFACE	223.8											
		300mm - Silty TOPSOIL	0.0											
		Brown to Grey		1	SS	12	x							
		Compact to Very Dense												
		Moist												
		SANDY SILT, trace gravel to gravelly, some clay, with frequent cobbles & boulders difficult augering, TILL		2	SS	18	x							
				3	SS	50/125mm								
				4	SS	50/150mm								
				5	SS	48				x				
				6	SS	51					x			
				7	SS	50/25mm								
			218.0											
			5.8											
		Grinding auger refusal on probable boulders.												



- Borehole remained open and dry upon completion of drilling.
- Water level on June 13, 2011 measured at 0.6m (elev. 223.2m).



Terraprobe

LOG OF BOREHOLE ..9..

PROJECT NAME: Home Farm Subdivision

PROJECT No.: 3-11-7059

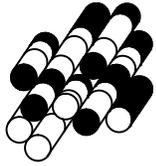
CLIENT: MacPherson Builders (Blue Mountains) Limited

BORING DATE: May 27, 2011

LOCATION: Town of Blue Mountains, Ontario

ELEVATION DATUM: Geodetic

BORING METHOD DEPTH SCALE IN METRES	SOIL PROFILE		SAMPLES			PENETRATION RESISTANCE PLOT				WATER CONTENT (%)			INSTALLATION INFORMATION		
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	"N" VALUE	SHEAR STRENGTH kPa				WATER CONTENT (%)				
							20	40	60	80	10	20		30	
0	GROUND SURFACE		220.2												
	300mm - Silty TOPSOIL		0.0												
	Brown Dense to Very Dense Moist			1	SS	6	x								
1	SANDY SILT, trace gravel to gravelly, some clay, with frequent cobbles & boulders difficult augering, TILL			2	SS	46			x						
						3	SS	50/125mm							
						4	SS	50/50mm							
3	Grinding auger refusal on probable boulders.		217.3 2.9											1. Borehole remained open and dry upon completion of drilling.	
4															
5															
6															
7															
8															
9															



Terraprobe

LOG OF BOREHOLE ..10..

PROJECT NAME: Home Farm Subdivision

PROJECT No.: 3-11-7059

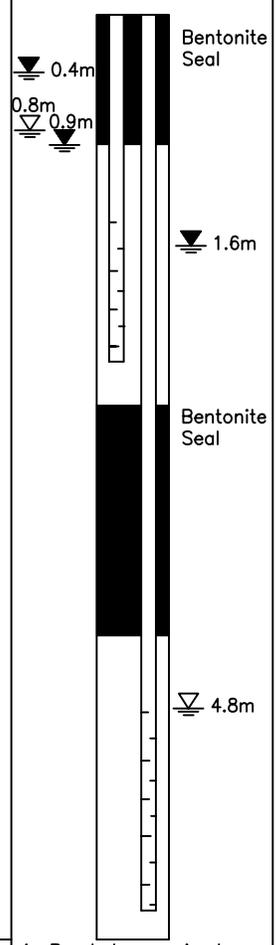
CLIENT: MacPherson Builders (Blue Mountains) Limited

BORING DATE: May 27 & June 14, 2011

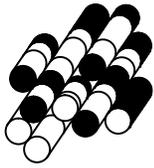
LOCATION: Town of Blue Mountains, Ontario

ELEVATION DATUM: Geodetic

BORING METHOD DEPTH SCALE IN METRES	SOIL PROFILE			SAMPLES			PENETRATION RESISTANCE PLOT				WATER CONTENT (%)			INSTALLATION INFORMATION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	"N" VALUE	SHEAR STRENGTH kPa				WATER CONTENT (%)			
							20	40	60	80	10	20	30	
0	GROUND SURFACE		218.7											
	250mm - Silty TOPSOIL		0.0											
	Brown Dense to Very Dense Dry to Moist			1	SS	8	x							
1	SANDY SILT, trace gravel to gravelly, some clay, with frequent cobbles & boulders difficult augering, TILL			2	SS	36		x						
				3	SS	74			x					
2				4	SS	50/75mm								
	Grinding auger refusal at 2.3m on May 27, 2011.		216.4											
	Auger through boulders on June 14, 2011.		2.3											
3				5	SS	50/75mm								
4														
5				6	SS	36		x						
6														
	End of Borehole		212.3	7	SS	50/100mm								
			6.4											



- Borehole remained open upon completion of drilling.
- Perched water noted at 0.8m during drilling on May 27, 2011.
- Water level on June 13, 2011 measured at 0.4m (elev. 218.3m) in 2.4m deep standpipe.
- Water level noted at 4.8m during drilling on June 14, 2011.
- Water level on July 4, 2011 measured at 0.9m (elev. 217.8m) in 2.4m deep standpipe and at 1.6m (elev. 217.1m) in 6.2m deep standpipe.



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LOG OF BOREHOLE ..11..

PROJECT NAME: Home Farm Subdivision

PROJECT No.: 3-11-7059

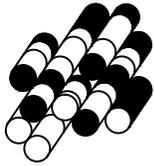
CLIENT: MacPherson Builders (Blue Mountains) Limited

BORING DATE: May 27, 2011

LOCATION: Town of Blue Mountains, Ontario

ELEVATION DATUM: Geodetic

BORING METHOD DEPTH SCALE IN METRES	SOIL PROFILE			SAMPLES			PENETRATION RESISTANCE PLOT X_x				WATER CONTENT (%)			INSTALLATION INFORMATION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	"N" VALUE	20	40	60	80				
0	GROUND SURFACE		211.8											
	150mm - Silty TOPSOIL Brown Compact to Very Dense Moist		0.0	1	SS	19	x							
1	SANDY SILT, trace gravel to gravelly, some clay, with frequent cobbles & boulders, difficult augering, TILL		210.4	2	SS	50	100mm							
2	Grinding auger refusal on probable boulders after four attempts.		1.4											1. Borehole remained open and dry upon completion of drilling.
3														
4														
5														
6														
7														
8														
9														



Terraprobe

LOG OF BOREHOLE ..12..

PROJECT NAME: Home Farm Subdivision

PROJECT No.: 3-11-7059

CLIENT: MacPherson Builders (Blue Mountains) Limited

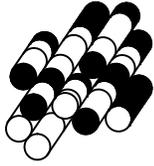
BORING DATE: June 1, 2011

LOCATION: Town of Blue Mountains, Ontario

ELEVATION DATUM: Geodetic

BORING METHOD DEPTH SCALE IN METRES	SOIL PROFILE			SAMPLES			PENETRATION RESISTANCE PLOT				WATER CONTENT (%)			INSTALLATION INFORMATION	
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	"N" VALUE	SHEAR STRENGTH kPa								
							20	40	60	80					
0	GROUND SURFACE		199.8												
	150mm - Silty TOPSOIL		0.0												
	Brown to Grey	Compact to Very Dense	Moist	1	SS	10	x								
1	SANDY SILT, trace gravel to gravelly, some clay, with frequent cobbles & boulders, difficult augering, TILL			2	SS	52				x					
				3	SS	50/100mm									
				4	SS	50/125mm									
				5	AS	50/50mm									
3				Grinding auger refusal on probable cobbles/boulders.		3.0									
4															
5															
6															
7															
8															
9															

1. Borehole remained open and dry upon completion of drilling.



Terraprobe

LOG OF BOREHOLE ..13..

PROJECT NAME: Home Farm Subdivision

PROJECT No.: 3-11-7059

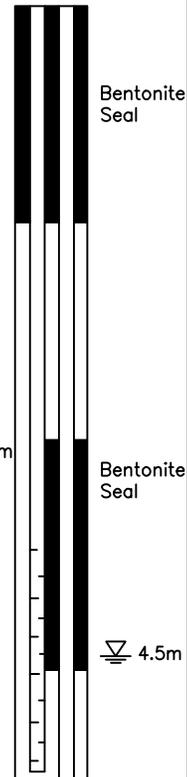
CLIENT: MacPherson Builders (Blue Mountains) Limited

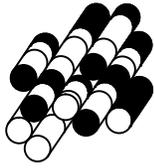
BORING DATE: June 1, 2011

LOCATION: Town of Blue Mountains, Ontario

ELEVATION DATUM: Geodetic

BORING METHOD	DEPTH SCALE IN METRES	SOIL PROFILE			SAMPLES			PENETRATION RESISTANCE PLOT				WATER CONTENT (%)	INSTALLATION INFORMATION	
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	"N" VALUE	20	40	60	80			
D50T Crawler-mounted Drill Rig / Hollow Stem Augers	0	GROUND SURFACE		205.4										
		Dark Brown Compact Moist		0.0	1	SS	14	x						
		SILTY SAND, some topsoil, FILL		204.8										
	1	Brown Dense to Very Dense Moist to Wet		0.6	2	SS	45		x					
		SANDY SILT, fine, to some sand, trace clay			3	SS	46			x				
					4	SS	80				x			
					5	SS	72					x		
					6	SS	50/150mm							
					7	SS	50/125mm							
					8	SS	50/125mm							
	9	Brown Very Dense to Compact Moist to Wet		196.9										
		SAND, fine, some to trace silt		8.5	9	SS	50/125mm							





Terraprobe

LOG OF BOREHOLE ..13..

PROJECT NAME: Home Farm Subdivision

PROJECT No.: 3-11-7059

CLIENT: MacPherson Builders (Blue Mountains) Limited

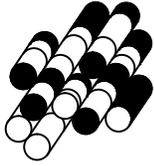
BORING DATE: June 1, 2011

LOCATION: Town of Blue Mountains, Ontario

ELEVATION DATUM: Geodetic

BORING METHOD DEPTH SCALE IN METRES	SOIL PROFILE			SAMPLES			PENETRATION RESISTANCE PLOT $\times \times \times$				WATER CONTENT (%)			INSTALLATION INFORMATION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	"N" VALUE	SHEAR STRENGTH kPa							
							20	40	60	80	nat.V - +	rem.V - ⊕	U - ○	
10	Continued As above		195.4											
11			10.0											
12				10	SS	23								
13			192.0											
14	Grey SILT, trace fine sand, trace clay	Compact Wet	13.4											
15														
16			188.9											
17	Grinding auger refusal on probable bedrock.		16.5											
18														
19														

- Borehole remained open upon completion of drilling.
- Water level noted at 4.5m and 13.4m during drilling.
- Water level on June 13, 2011 measured at 3.1m (elev. 202.3m) in 5.3m deep standpipe and 13.5m (elev. 191.9m) in 16.3m deep standpipe.



Terraprobe

LOG OF BOREHOLE ..14..

PROJECT NAME: Home Farm Subdivision

PROJECT No.: 3-11-7059

CLIENT: MacPherson Builders (Blue Mountains) Limited

BORING DATE: May 27, 2011

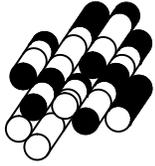
LOCATION: Town of Blue Mountains, Ontario

ELEVATION DATUM: Geodetic

BORING METHOD DEPTH SCALE IN METRES	SOIL PROFILE			SAMPLES			PENETRATION RESISTANCE PLOT $\times \times \times$				WATER CONTENT (%)	INSTALLATION INFORMATION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	"N" VALUE	SHEAR STRENGTH kPa					
							20	40	60	80		
0	GROUND SURFACE		209.6									
	450mm - Silty TOPSOIL		0.0									
	Brown Very Dense Moist			1	SS	6 x						
1	SANDY SILT, trace gravel to gravelly, some clay, with frequent cobbles & boulders, difficult augering, TILL			2	SS	50/75mm						
	Grinding auger refusal on probable boulders after two attempts.		208.1									
2			1.5									
3												
4												
5												
6												
7												
8												
9												

CME45 Crawler-mounted Drill Rig / Solid Stem Augers

1. Borehole remained open and dry upon completion of drilling.



Terraprobe

LOG OF BOREHOLE ..15..

PROJECT NAME: Home Farm Subdivision

PROJECT No.: 3-11-7059

CLIENT: MacPherson Builders (Blue Mountains) Limited

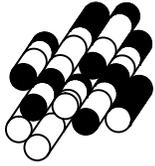
BORING DATE: May 27, 2011

LOCATION: Town of Blue Mountains, Ontario

ELEVATION DATUM: Geodetic

BORING METHOD DEPTH SCALE IN METRES	SOIL PROFILE			SAMPLES			PENETRATION RESISTANCE PLOT $\times \times \times$				WATER CONTENT (%)			INSTALLATION INFORMATION
	DESCRIPTION	STRAITS PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	"N" VALUE	SHEAR STRENGTH kPa							
							20	40	60	80	20	40	60	
0	GROUND SURFACE		216.4											<p>Bentonite Seal</p> <p>1.6m</p>
	300mm - Silty TOPSOIL		0.0											
	Brown Dense to Very Dense Moist			1	SS	7	x							
1	SANDY SILT, trace gravel to gravelly, some clay, with frequent cobbles & boulders, difficult augering, TILL			2	SS	36		x						
2				3	SS	50	150mm							
			213.8	4	SS	50	125mm							
3	Grinding auger refusal on probable boulders.		2.6											<p>1. Borehole remained open and dry upon completion of drilling.</p> <p>2. Water level on June 13, 2011 measured at 1.6m (elev. 214.8m).</p>
4														
5														
6														
7														
8														
9														

CME45 Crawler-mounted Drill Rig / Solid Stem Augers



Terraprobe

LOG OF BOREHOLE ..16..

PROJECT NAME: Home Farm Subdivision

PROJECT No.: 3-11-7059

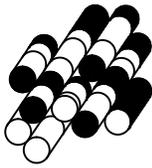
CLIENT: MacPherson Builders (Blue Mountains) Limited

BORING DATE: May 27, 2011

LOCATION: Town of Blue Mountains, Ontario

ELEVATION DATUM: Geodetic

BORING METHOD DEPTH SCALE IN METRES	SOIL PROFILE			SAMPLES			PENETRATION RESISTANCE PLOT				WATER CONTENT (%)			INSTALLATION INFORMATION	
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	"N" VALUE	SHEAR STRENGTH kPa				WATER CONTENT (%)				
							20	40	60	80					
0	GROUND SURFACE		221.8												
	150mm - Silty TOPSOIL		0.0												
	Brown Very Dense Moist			1	SS	6 x									
1	SANDY SILT, trace gravel to gravelly, some clay, with frequent cobbles & boulders, difficult augering, TILL			2	SS	52									
					3	SS	50/150mm								
2					4	SS	50/125mm								
	Grinding auger refusal on probable boulders after two attempts.		2.3											1. Borehole remained open and dry upon completion of drilling.	
3															
4															
5															
6															
7															
8															
9															



Terraprobe

LOG OF BOREHOLE ..17..

PROJECT NAME: Home Farm Subdivision

PROJECT No.: 3-11-7059

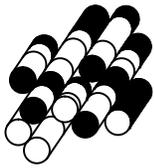
CLIENT: MacPherson Builders (Blue Mountains) Limited

BORING DATE: May 25, 2011

LOCATION: Town of Blue Mountains, Ontario

ELEVATION DATUM: Geodetic

BORING METHOD DEPTH SCALE IN METRES	SOIL PROFILE			SAMPLES			PENETRATION RESISTANCE PLOT $\times \times$				WATER CONTENT (%)			INSTALLATION INFORMATION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	"N" VALUE	SHEAR STRENGTH kPa							
							20	40	60	80	nat.V - +	Q - ●	rem.V - ⊕	
0	GROUND SURFACE		226.1											
	150mm - Silty TOPSOIL		0.0											
	Brown to Grey	Compact to Very Dense	Moist	1	SS	17	x						40	
1	SANDY SILT, trace gravel to gravelly, some clay, with frequent cobbles & boulders difficult augering, TILL			2	SS	32		x					○	
				3	SS	50/100mm							○	
				4	SS	50/150mm							○	
	Grey			5	SS	50/100mm							○	
			221.4	6	SS	50/50mm							○	
5	Grinding auger refusal on probable boulders.		4.7											1. Borehole remained open and dry upon completion of drilling.
6														
7														
8														
9														



Terraprobe

LOG OF BOREHOLE ..18..

PROJECT NAME: Home Farm Subdivision

PROJECT No.: 3-11-7059

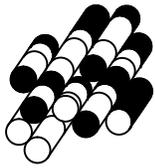
CLIENT: MacPherson Builders (Blue Mountains) Limited

BORING DATE: June 1, 2011

LOCATION: Town of Blue Mountains, Ontario

ELEVATION DATUM: Geodetic

BORING METHOD DEPTH SCALE IN METRES	SOIL PROFILE			SAMPLES			PENETRATION RESISTANCE PLOT				WATER CONTENT (%)			INSTALLATION INFORMATION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	"N" VALUE	20	40	60	80				
0	GROUND SURFACE		190.8											<p>Bentonite Seal 0.8m 0.9m</p>
	300mm - TOPSOIL		0.0											
	Brown Compact Moist			1	SS	5 x								
1	SILT, trace sand, trace clay		189.6	2	SS	22								
	Brown Very Dense Wet		1.2											
2	SAND, trace silt, trace gravel		188.7	3	SS	50/100mm								
	Grey Very Dense Wet		2.1											
	SILTY GRAVELLY SAND, with cobbles/boulders		187.8	4	AS	50/100mm								
				5	AS	50/25mm								
3	Grinding auger refusal on probable boulders.		3.0											
4														<ol style="list-style-type: none"> Borehole remained open upon completion of drilling. Water level noted at 0.9m during drilling. Water level on June 13, 2011 measured at 0.8m (elev. 190.0m).
5														
6														
7														
8														
9														



Terraprobe

LOG OF BOREHOLE ..19..

PROJECT NAME: Home Farm Subdivision

PROJECT No.: 3-11-7059

CLIENT: MacPherson Builders (Blue Mountains) Limited

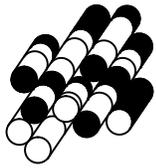
BORING DATE: May 31, 2011

LOCATION: Town of Blue Mountains, Ontario

ELEVATION DATUM: Geodetic

BORING METHOD	DEPTH SCALE IN METRES	SOIL PROFILE			SAMPLES			PENETRATION RESISTANCE PLOT				WATER CONTENT (%)			INSTALLATION INFORMATION
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	"N" VALUE	20	40	60	80	10	20	30	
D50T Crawler-mounted Drill Rig / Solid Stem Augers	0	GROUND SURFACE		187.3											<p>Bentonite Seal</p> <p>▽ 1.0m</p> <p>▽ 1.9m</p>
		50mm - TOPSOIL		0.0											
		Brown Very Dense Moist			1	SS	13	x							
	1	SANDY SILT, some gravel to gravelly		186.1	2	SS	50	25mm							
		Dark Grey to Black SHALE, weathered, with wet seams with interbed limestone, fossiliferous, poor becoming excellent quality.		1.2	3	AS									
	2					CORE RUN	1								
						CORE RUN	2								
						CORE RUN	3								
		Grinding auger refusal on probable bedrock on May 31, 2011.		3.4											
	4														
	5														
	6														
	7														
	8														
	9														

- Borehole remained open upon completion of drilling.
- Water level noted at 1.0m during drilling.
- Water level on June 13, 2011 measured at 1.9m (elev. 185.4m).



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LOG OF BOREHOLE ..20..

PROJECT NAME: Home Farm Subdivision

PROJECT No.: 3-11-7059

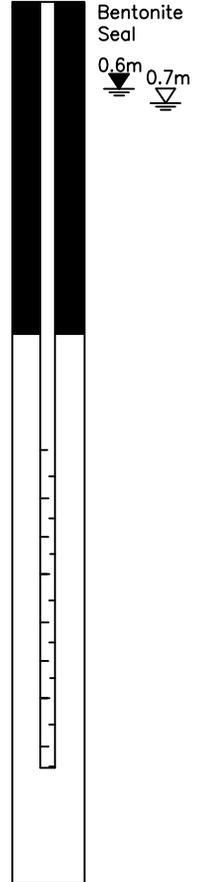
CLIENT: MacPherson Builders (Blue Mountains) Limited

BORING DATE: May 31, 2011

LOCATION: Town of Blue Mountains, Ontario

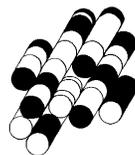
ELEVATION DATUM: Geodetic

BORING METHOD DEPTH SCALE IN METRES	SOIL PROFILE			SAMPLES			PENETRATION RESISTANCE PLOT				WATER CONTENT (%)			INSTALLATION INFORMATION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	"N" VALUE	20	40	60	80	10	20	30	
0	GROUND SURFACE		189.9											
	250mm - TOPSOIL		0.0											
	Brown Compact to Very Dense Moist to Wet			1	SS	12	x							
1	SILTY SAND & GRAVEL, with cobbles/boulders			2	SS	39		x						
2	Brown to Grey Compact to Very Dense Wet		188.0	3	SS	50								
			1.9											
	SAND, fine, some silt			4	SS	21	x							
				5	SS	55			x					
4	Grey Very Dense Wet		185.9											
			4.0											
	SILT, trace fine sand			6	SS	86				x				
5	Dark Grey Very Dense Wet		184.7											
			5.2											
6	SHALE, weathered, with wet seams		183.8											
	Grinding auger refusal on probable bedrock.		6.1											



1. Borehole caved at 2.5m upon completion of drilling.
2. Water level noted at 0.7m during drilling.
3. Water level on June 13, 2011 measured at 0.6m (elev. 189.3m).

GRAIN SIZE ANALYSIS



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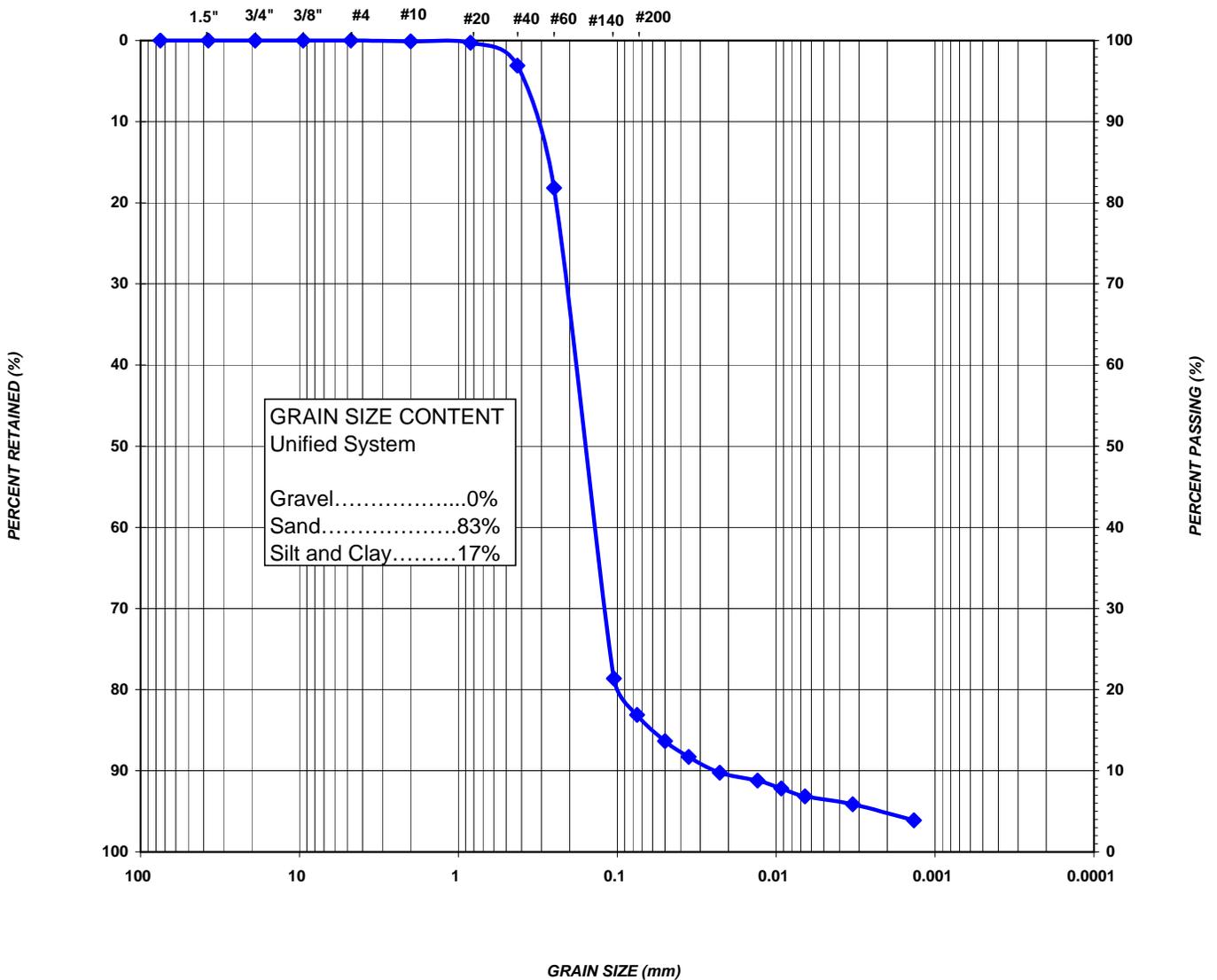
PROJECT: Home Farm Subdivision
 LOCATION: Town of the Blue Mountains, ON
 CLIENT: MacPherson Builders (Blue Mountains) Ltd.
 c/o Higgins Engineering Ltd.

FILE NO.: 3-11-7059
 LAB NO.: 442a
 SAMPLE DATE: May-31-11
 SAMPLED BY: B.H.

BOREHOLE NUMBER: 3 SAMPLE DEPTH: 2.5' to 4'
 SAMPLE NUMBER: 2
 SAMPLE LOCATION: as above
 SAMPLE DESCRIPTION: Sand, some silt, trace clay

GRAIN SIZE DISTRIBUTION

U.S. STANDARD SIEVE SIZES



MIT SYSTEM	GRAVEL			COARSE	MEDIUM	FINE	SILT	CLAY
	SAND							
UNIFIED SYSTEM	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY		
	GRAVEL		SAND					



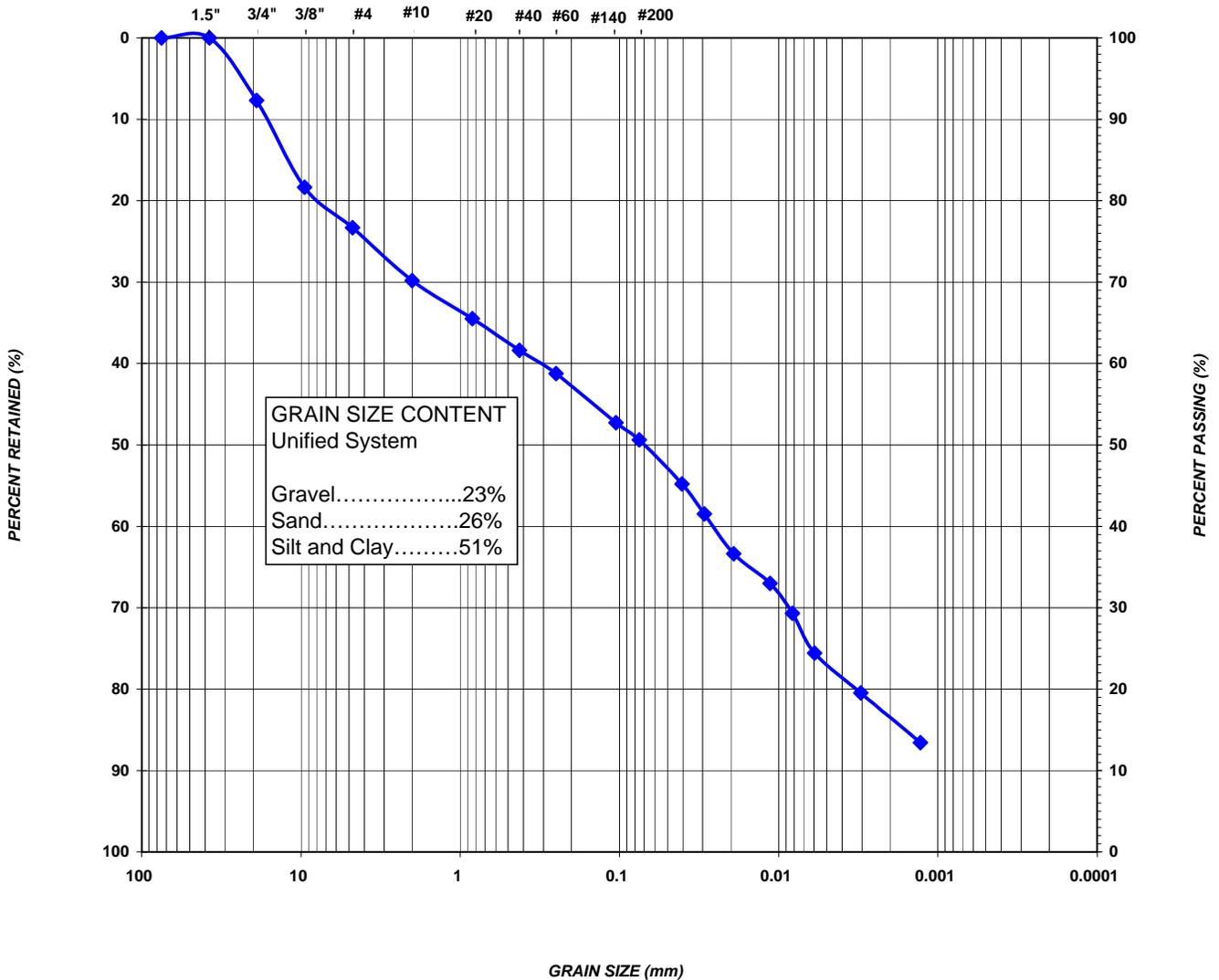
PROJECT: Home Farm Subdivision
 LOCATION: Town of the Blue Mountains, ON
 CLIENT: MacPherson Builders (Blue Mountains) Ltd.
 c/o Higgins Engineering Ltd.

FILE NO.: 3-11-7059
 LAB NO.: 442b
 SAMPLE DATE: May-31-11
 SAMPLED BY: B.H.

BOREHOLE NUMBER: 8 SAMPLE DEPTH: 10' to 11.5'
 SAMPLE NUMBER: 5
 SAMPLE LOCATION: as above
 SAMPLE DESCRIPTION: Sandy, gravelly silt, some clay

GRAIN SIZE DISTRIBUTION

U.S. STANDARD SIEVE SIZES



MIT SYSTEM	GRAVEL		COARSE	MEDIUM	FINE	SILT	CLAY
			SAND				
UNIFIED SYSTEM	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY	
	GRAVEL		SAND				



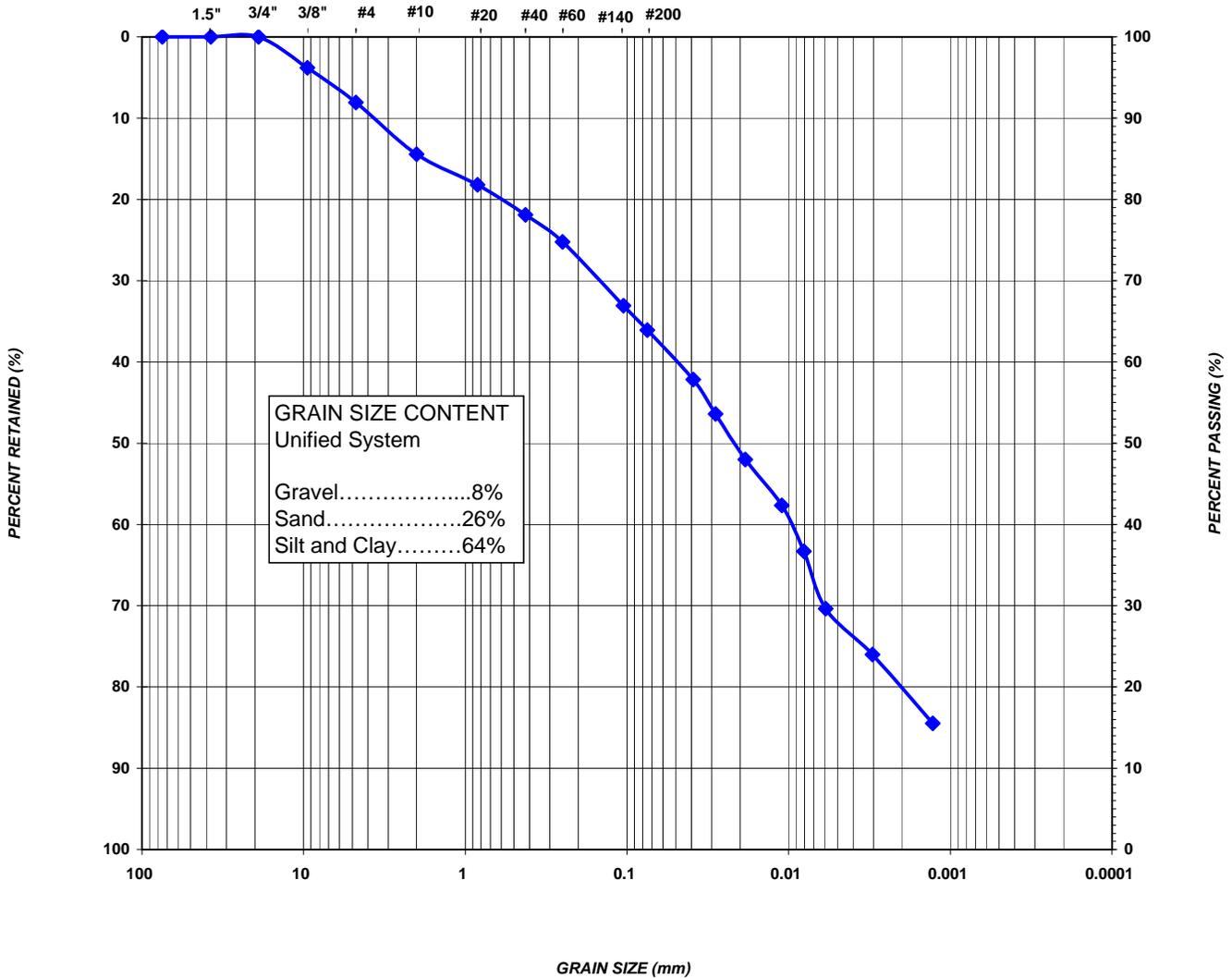
PROJECT: Home Farm Subdivision
 LOCATION: Town of the Blue Mountains, ON
 CLIENT: MacPherson Builders (Blue Mountains) Ltd.
 c/o Higgins Engineering Ltd.

FILE NO.: 3-11-7059
 LAB NO.: 442c
 SAMPLE DATE: May-31-11
 SAMPLED BY: B.H.

BOREHOLE NUMBER: 15 SAMPLE DEPTH: 2.5' to 4'
 SAMPLE NUMBER: 2
 SAMPLE LOCATION: as above
 SAMPLE DESCRIPTION: Sandy silt, some clay, trace gravel

GRAIN SIZE DISTRIBUTION

U.S. STANDARD SIEVE SIZES



MIT SYSTEM	GRAVEL		COARSE	MEDIUM	FINE	SILT	CLAY
			SAND				
UNIFIED SYSTEM	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY	
	GRAVEL		SAND				



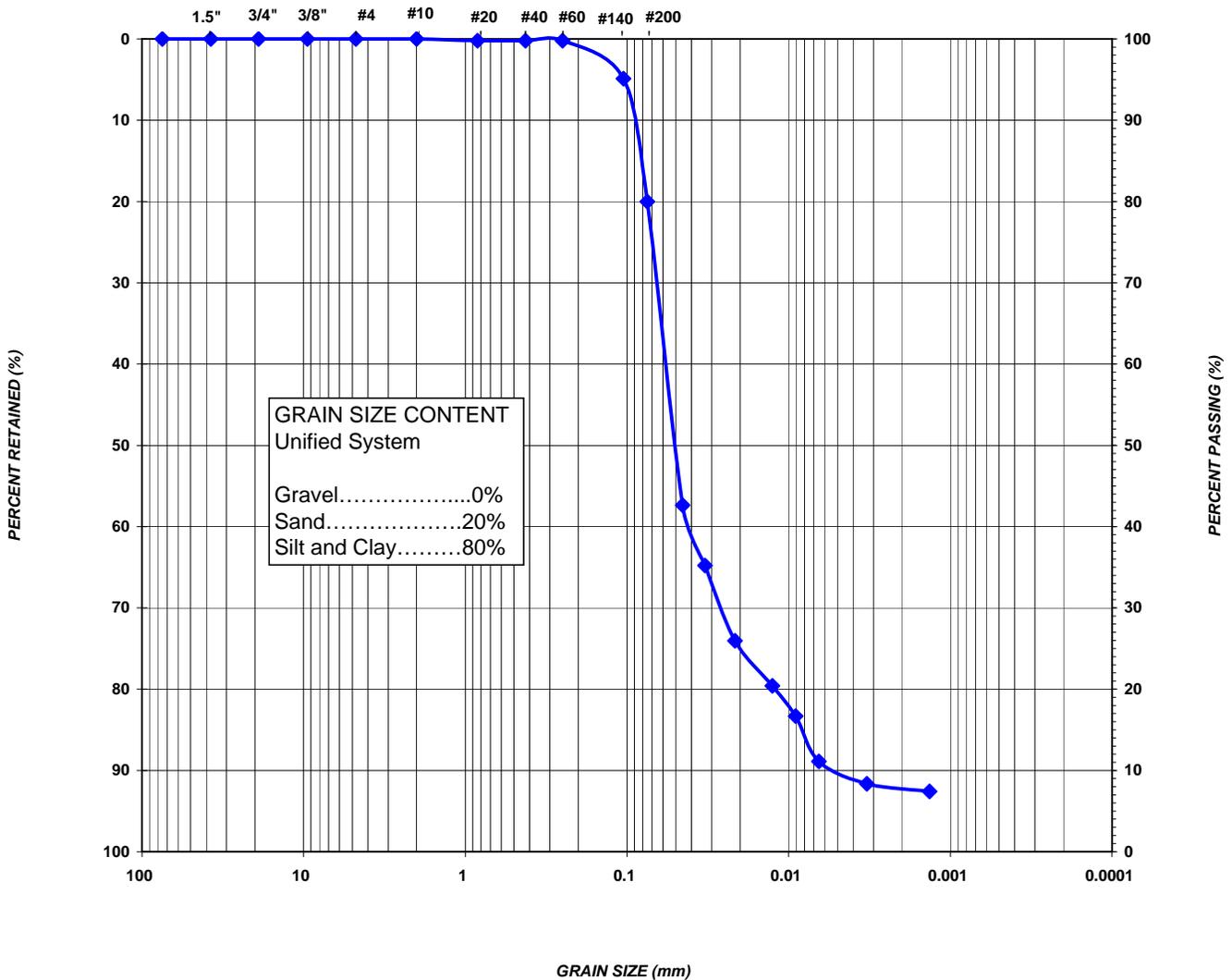
PROJECT: Home Farm Subdivision
 LOCATION: Town of the Blue Mountains, ON
 CLIENT: MacPherson Builders (Blue Mountains) Limited
 c/o Higgins Engineering Limited

FILE NO.: 3-11-7059
 LAB NO.: 494a
 SAMPLE DATE: June-08-11
 SAMPLED BY: B.H.

BOREHOLE NUMBER: 13 SAMPLE DEPTH: 7.5' to 9'
 SAMPLE NUMBER: 4
 SAMPLE LOCATION: as above
 SAMPLE DESCRIPTION: Silt, some sand, trace clay

GRAIN SIZE DISTRIBUTION

U.S. STANDARD SIEVE SIZES



MIT SYSTEM	GRAVEL		COARSE	MEDIUM	FINE	SILT	CLAY
	SAND						
UNIFIED SYSTEM	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY	
	GRAVEL		SAND				



TEST REPORT

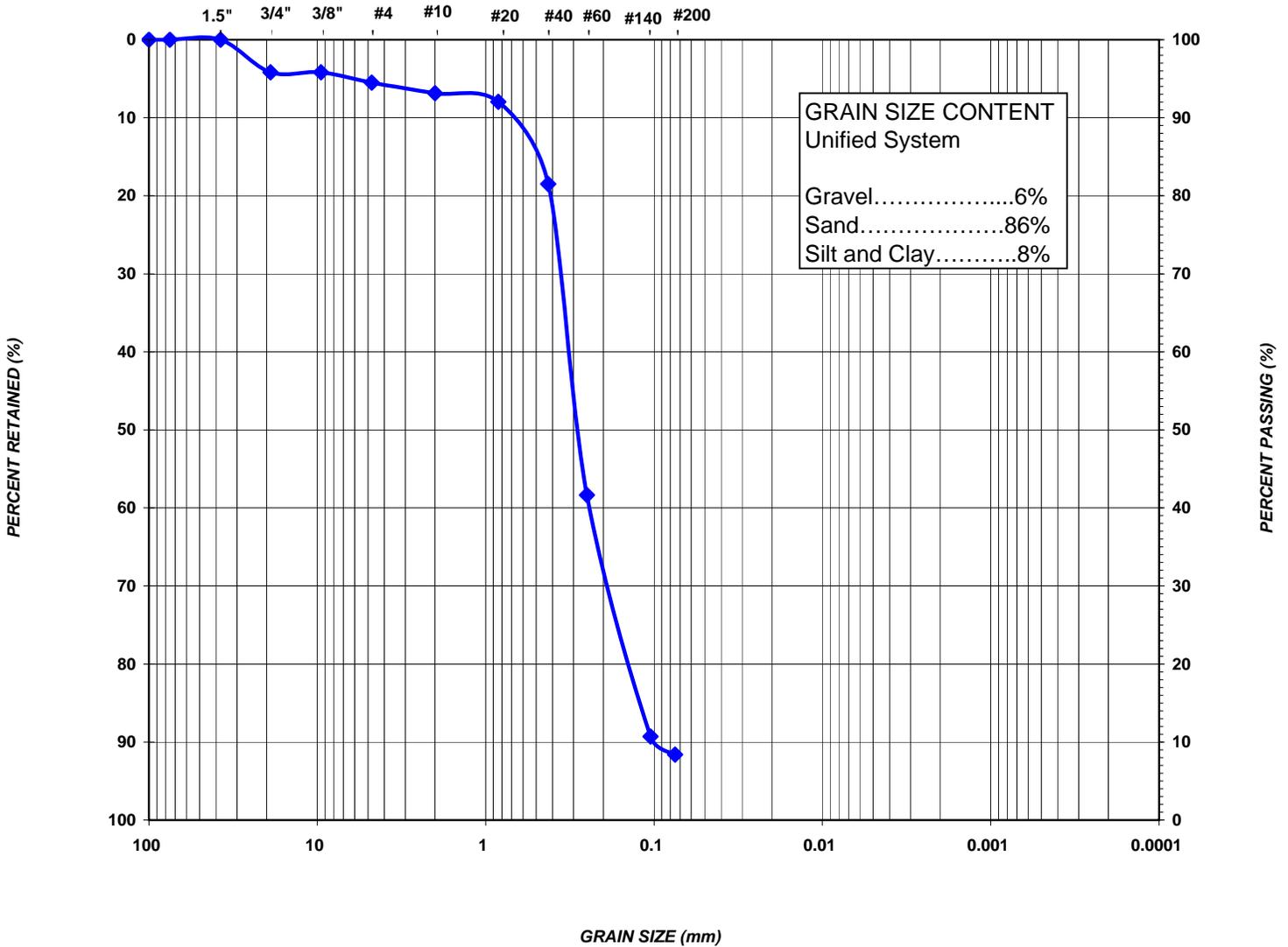
PROJECT: **Home Farm Subdivision**
 LOCATION: **Town of the Blue Mountains, ON**
 CLIENT: **MacPherson Builders (Blue Mountains) Limited**
c/o Higgins Engineering Limited

FILE NO.: **3-11-7059**
 LAB NO.: **494b**
 SAMPLE DATE: **June-08-11**
 SAMPLED BY: **B.H.**

TEST HOLE NUMBER: **18** SAMPLE DEPTH: **5' to 6.5'**
 SAMPLE NUMBER: **3**
 SAMPLE LOCATION: **as above**
 SAMPLE DESCRIPTION: **Sand, trace silt, trace gravel**

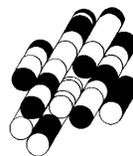
GRAIN SIZE DISTRIBUTION

U.S. STANDARD SIEVE SIZES

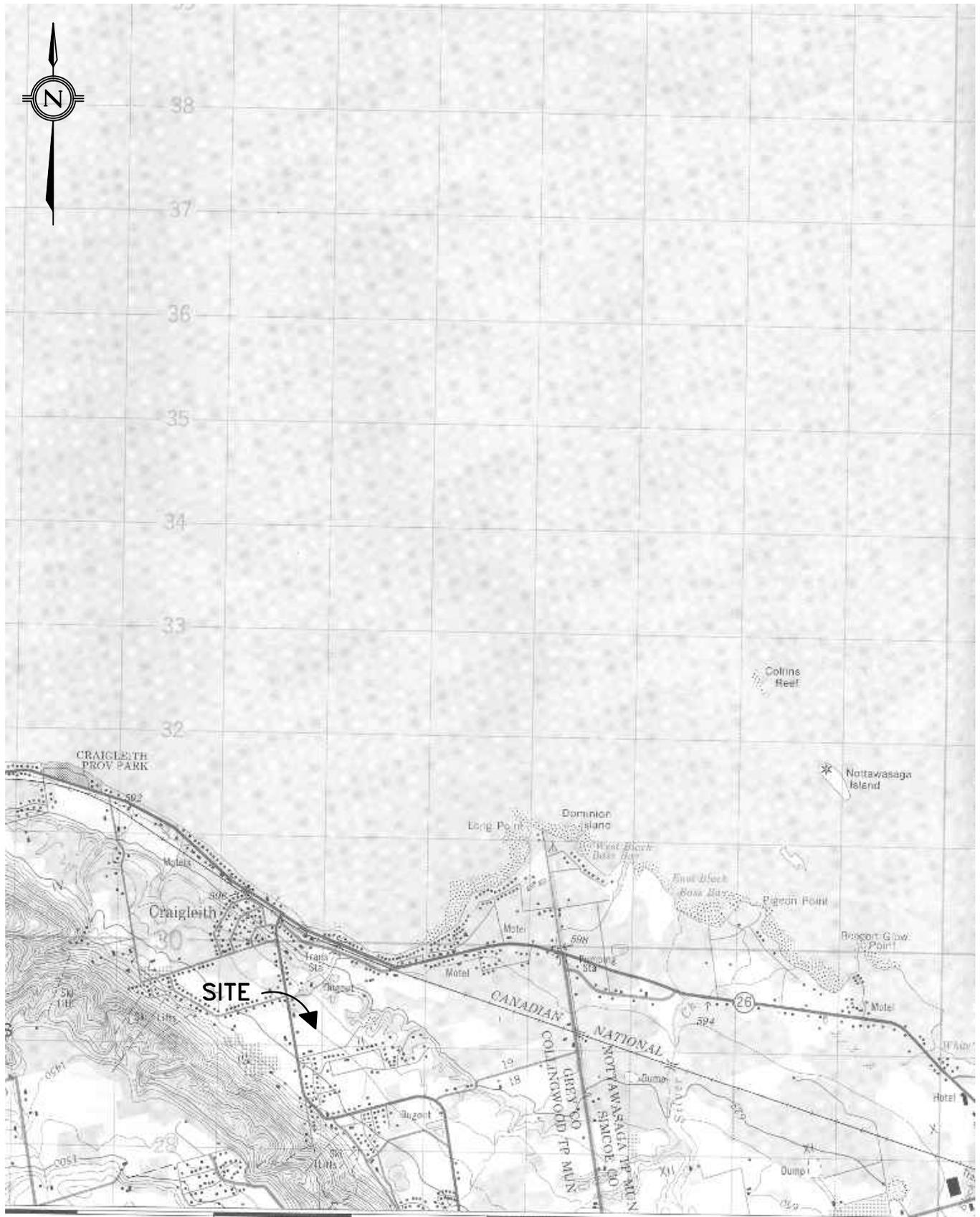


MIT SYSTEM	GRAVEL			COARSE	MEDIUM	FINE	SILT	CLAY
	SAND							
UNIFIED SYSTEM	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY		
	GRAVEL		SAND					

FIGURES



Terraprobe Inc.



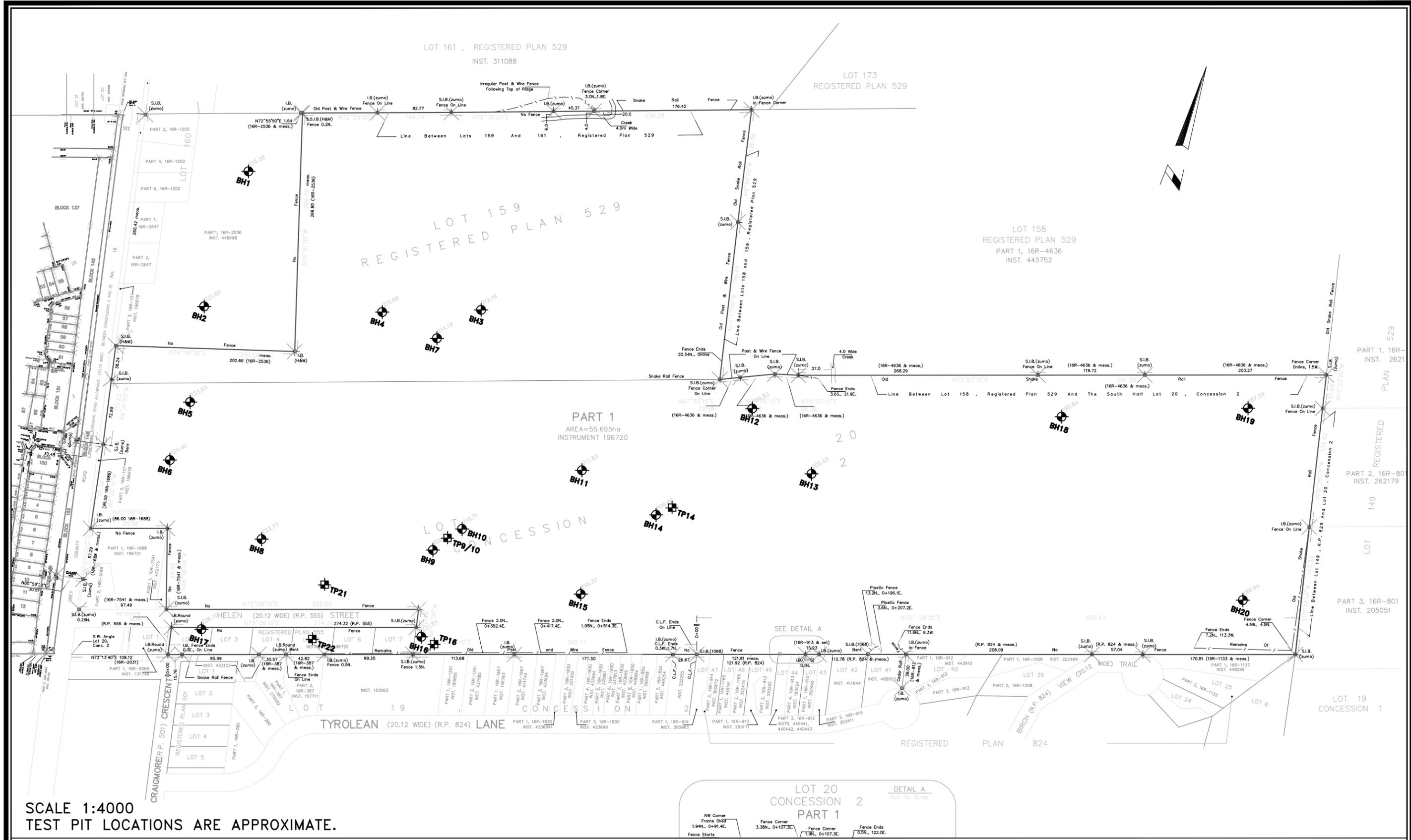
JUNE 2011

SITE LOCATION PLAN

3-11-7059



FIGURE 1



JUNE 2011

BOREHOLE & TEST PIT LOCATION PLAN

3-11-7059



FIGURE 2