Terraprobe

Consulting Geotechnical & Environmental Engineering
Construction Materials Inspection & Testing

PRELIMINARY GEOTECHNICAL INVESTIGATION
PROPOSED SIMCOE HOUSING
RESIDENTIAL DEVELOPMENT
2 BORLAND STREET EAST
ORILLIA, ONTARIO

Prepared for: County of Simcoe
1110 Highway 26
Midhurst, ON
L9X 1N6

Attention: Ms. Dawn Hipwell

File No. 3-18-0005 (01)
March 26, 2018

Distribution:

1 cc: County of Simcoe
1 cc: Terraprobe Inc., Barrie

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1.0 INTRODUCTION

We are pleased to present the results of the preliminary subsurface investigation carried out at this Orillia, Ontario residential development site. Authorization to carry out this assessment was provided by Ms. Dawn Hipwell and Ms. Janice Wylde of the County of Simcoe on January 16, 2018.

The purpose of this assessment was to determine the soil and ground water conditions in the area of the proposed residential development in order to address geotechnical aspects of the design and construction of parking, structures, and service installations.

Geotechnical comments and recommendations will be provided with regard to excavation, backfill, foundations, earth pressures, service bedding, pavements, temporary ground water control measures and general geotechnical constraints.

2.0 SITE AND PROJECT DESCRIPTION

The proposed residential development site is located at 2 Borland Street East, Orillia, Ontario. The property is located on the north side of Borland Street East as shown on Figure 1. Terraprobe has concurrently completed a Phase One Environmental Site Assessment (PH1ESA) for this property. The PH1ESA has been completed under a separate cover.

The property is roughly rectangular in shape and is approximately 3.8 hectares in size. The property is currently occupied by a vacant secondary school institution. The property has been developed with an existing 155,000 sq. ft. structure, athletic fields, asphalt surfaced parking and driveway areas. It has been reported to Terraprobe that the existing structure is of slab-on-grade construction. Sub-surface structures or sub-surface features associated with the current development are not anticipated at this time.

Preliminary plan drawings and proposed grade drawings for the residential development were not available for the completion of the geotechnical field work or geotechnical reporting. It is assumed that the existing structure on the property will be demolished, existing services will be upgraded and new residential structures will be constructed to accommodate the re-development. Based on information supplied to Terraprobe from the County of Simcoe, the proposed development will include a 4 storey, slab-on-grade apartment building.

There may possibly be an additional 3 to 4 storey administrative type building included in the possible future re-development. The structures are proposed to be constructed where the existing school structure is currently located.

This preliminary geotechnical investigation included advancing ten (10) boreholes on the property to accommodate the design of structures and parking/access areas. The location of the boreholes are shown approximately on Figure 2.

The ground surface elevations at the borehole locations were surveyed by J.D. Barnes Limited. The survey information was provided to Terraprobe for the completion of this preliminary geotechnical report.

3.0 FIELD WORK

A total of ten (10) borehole locations were advanced for this preliminary geotechnical investigation. The boreholes were advanced at the subject property using a track mounted drilling rig from between February 26 to 28, 2018. The boreholes were advanced at locations as shown approximately on Figure 2. The borehole locations advanced by the drill rig extended to a maximum depth of ±6.6m below existing ground surface.

The borehole locations were selected and located in the field by Terraprobe in order to provide general coverage of the site. The borehole data is presented within the Borehole Logs (BH1 to BH10).

Detectable buried services were cleared with local utility companies and a private service locator prior to commencing the borehole investigation.

The borings were drilled by a specialist drilling contractor using a track mounted D50 power auger. The borings were advanced using both continuous flight solid stem and hollow stem augers, and were sampled at intervals with a conventional 50mm diameter split barrel sampler when the Standard Penetration Test (SPT) was carried out (ASTM D 1586).

The field work (drilling) was observed and recorded by a member of our engineering staff. Samples obtained in the investigation were placed into plastic containers, and transported to our laboratory for detailed inspection and testing. All of the borehole samples were examined (tactile) in detail by the Terraprobe field technician, and classified according to visual and index properties.

Standpipe type piezometers were sealed into seven (7) borehole locations in order to permit the observation of ground water levels. The standpipe type piezometers comprised of 38mm I.D. CPVC tubing, which were slotted near the base, and fitted with a sand filter and bentonite seal as shown on the accompanying Borehole Logs (BH1 to BH3, BH7 to BH10).

Ground water monitoring wells were sealed into three (3) of the borehole locations advanced on the property in order to permit the observation of ground water levels and to possibly obtain future ground water samples and aquifer testing. The ground water monitoring wells comprised of 50m O.D. diameter CPVC riser and screen (3.0m screen length). The monitoring wells were constructed with a sand filter and bentonite seal as shown on the accompanying Borehole logs (BH4, BH5, BH6).

Representative select soil samples were obtained from twelve (12) locations to confirm grain size distribution.

A return visit was made to the site on March 6, 2018 to measure the ground water levels in the installed standpipe type piezometers and ground water monitoring wells.

4.0 SUBSURFACE CONDITIONS

The details of the subsurface conditions encountered at the borehole locations are summarized on the attached Borehole Logs (BH1 to BH10). It should be noted that these conditions are confirmed at the borehole locations only and could vary between or beyond these locations.

It should be noted that the changes in stratigraphy presented on the borehole logs have been inferred from non-continuous sampling. In this regard, these changes should be interpreted as gradual transitions from one soil type to another as opposed to exact planes of geologic change.

A surficial topsoil layer was encountered at some of the borehole locations. The surficial topsoil layer was found to have a thickness of 50mm to 300mm at the borehole locations.

Surficial asphaltic concrete was encountered at BH4, BH5 and BH6. The surficial asphaltic concrete was found to have a thickness of 40mm to 50mm.

Earth fill was noted at all of the Borehole locations advanced at the property. The earth fill varied in texture with drilling locations. The earth fill materials included surficial slag layers (BH1), sand and gravel (granular type) fill material, sandy silt to silty sand material with varied amounts of organics (topsoil), varied amounts of clay and varied amounts of construction rubble. The earth fill soils extended to depths of 0.6m to 2.0m below existing ground surface. Moisture content of the sand fill soil ranged from between 5% to 43% volume by weight (average 16%). Standard Penetration 'N' values within the fill ranged from between 4 to 48 blows per 300 mm of penetration (average 18 blows). Deep pockets of earth fill may be encountered between the borehole locations at this property.

Glacial till deposits were encountered below the upper level fill soils. The glacial till soil matrix had a texture of sandy silt to silty gravelly sand. The glacial till contained various amounts of clay. Cobble and boulder sizes were encountered at some of the borehole locations. The glacial till deposits were found to extend to the termination depth at all of the borehole locations. Standard penetration 'N' values within the glacial till deposits ranged from between 10 to over 50 blows per 300 mm of penetration (compact to very dense), with an average of 38 blows. Soil moisture content of the glacial till deposits ranged from between 4% to 18% volume by weight (moist) with an average of 9%. Wet seams were noted within the glacial till deposit.

Standpipe type piezometers (38mm diameter) were installed at seven (7) of the borehole locations and three (3), 50mm diameter ground water monitoring wells were installed at the property to determine ground water levels. The ground water levels were monitored on March 6, 2018. The ground water levels are summarized on the following table.

SUMMARY OF GROUND WATER LEVELS

Borehole Number	Ground Surface Elevation (masl)	Ground Water Level			
		Noted During Drilling		Measured March 6, 2018	
		Depth (m)	Elevation (masl)	Depth (m)	Elevation (masl)
BH1	267.7	0.6	267.1	Frozen	-
BH2	268.3	1.5	266.8	0.6	267.7
BH3	269.2	3.7	265.5	2.0	267.2
BH4	270.8	Dry	-	1.8	269.0
BH5	269.2	Dry	-	3.1	266.1
BH6	270.0	Dry	-	3.4	266.6
BH7	270.2	Dry	-	5.0	265.2
BH8	267.9	5.5	262.4	4.0	263.9
BH9	267.6	5.5	262.1	2.6	265.0
BH10	268.0	Dry	-	1.3	266.7

The ground water levels encountered within the standpipe type piezometers and ground water monitoring wells (March 6, 2018 monitoring) were found to be 0.6m below existing ground surface to 5.0m below existing ground surface (263.9masl to 269.0masl range), an average of 2.6m below existing grade. The piezometer at BH1 was plugged due to frost/ice conditions within the installation during the March 6, 2018 monitoring event.

Ground water conditions and water levels will vary seasonally and may be higher during wetter seasons/years. It is recommended that ongoing ground water level monitoring continue on a regular basis in order to define the magnitude of seasonal fluctuations and peak levels for design. This information can be used to set foundation levels and can also be used for a possible Construction Dewatering Assessment Report (CDAR) and MOECC Permit to Take Water Application (PTTW).

5.0 DISCUSSION AND RECOMMENDATIONS

The following discussion and recommendations are provided for use by the design engineers only. Contractors bidding on this contract or developing construction schedules should provide their own interpretation of the data and/or provide their own investigations if they feel warranted.

It must be noted that larger size particles (cobbles and boulders) that are not specifically identified in the boreholes may be present in the soils identified at this property (earth fill and glacial till). The size and distribution of such obstructions cannot be predicted with borings, because the borehole sampler size is insufficient to secure representative samples of particles of this size. Provision must be made in the excavation contracts to allocate risks associated with the time spent and equipment utilized to remove or penetrate such obstructions when encountered.

Surficial asphalt concrete with a thickness of 40mm to 50mm was noted at BH4, BH5 and BH6. Topsoil was encountered at some of the borehole locations with a thickness of 50mm to 300mm. Generally, the site is underlain with about 0.6 m to 2.0m of mixed earth fill. Sandy silt to silty gravelly sand glacial till in a compact to very dense state was encountered across the property below the topsoil and earth fill layers. The ground water level was found to be 0.6m to 5.0m below existing ground surface on March 6, 2018 (263.9masl to 269.0masl).

Once the development plans progress and the drawings become finalized for this property, it is recommended that Terraprobe review the drawings/plans for possible additional geotechnical considerations (possible additional test pits or boreholes).

5.1 Building Foundations

Terraprobe has carried out the advancement of ten (10) boreholes on the property. The boreholes extended to a maximum depth of ±6.6m below the existing ground surface to assess the soil and ground water conditions. The building structures are proposed to be constructed as 3 to 4 storey, slab-on-grade units without basement levels. Based on information provided to Terraprobe the proposed structures will be constructed where the existing institution structure is located. Based on information provided to Terraprobe, the existing ground surface at the boreholes varied from elevation 267.6masl to 270.8masl (±3.2m grade differential).

Based on the information obtained from the boreholes, the undisturbed glacial till soil at the property (below the earth fill soils) is suitable for the support of building foundations.

The proposed residential structure foundations can be designed with a maximum geotechnical reaction of 150kPa, Serviceability Limit State (SLS Type II), and a maximum factored geotechnical resistance of 225kPa at Ultimate Limit State (ULS) when placed on the undisturbed glacial till soil as noted on the Table below (Summary of Founding Levels at Building Locations).

SUMMARY OF FOUNDING LEVELS AT BUILDING LOCATIONS

Borehole Number	Ground Elevation (masl)	Recommended Net Geotechnical Resistance (kPa) at SLS	Foundation Level	
			Minimum Depth Below Existing Grade (m)	Maximum Elevation (masl)
1	267.7	150	0.9	266.8
2	268.3	150	1.8	266.5
3	269.2	150	2.4	266.8
4	270.8	150	0.8	270.0
5	269.2	150	1.5	267.7
6	270.0	150	1.5	268.5
7	270.2	150	1.8	268.4
8	267.9	150	2.4	265.5
9	267.6	150	2.4	265.2
10	268.0	150	1.5	266.5

If foundations are required to be placed on engineered fill soils, foundations can be designed with a maximum design bearing pressure of 150kPa SLS (225 kPa ULS). At least 1.0m of engineered fill placed on undisturbed, dewatered glacial till soil is required beneath the footing base elevation to accommodate the design bearing pressures. If engineered fill is required for this site, Terraprobe should be contacted to provide further recommendations for soil placement and foundation construction.

All footings should be stepped along a line of 7 vertical to 10 horizontal or flatter where variable founding levels take place.

All excavated footing bases must be evaluated by a qualified geotechnical engineer to ensure that the founding soils exposed at the excavation base are consistent with the design bearing pressure intended by the geotechnical engineer.

The use of re-bar is also required for the design of foundations. Total and differential settlements are expected to be less than 24mm and 19mm respectively. All exterior foundations or foundations in unheated areas must be provided with a minimum of 1.5 metres of earth cover for frost protection or alternative equivalent insulation.

Prior to placing foundation concrete, the foundation subgrade should be cleaned of all deleterious materials such as organics, peat, topsoil, rubble, unsuitable fill, softened, disturbed or caved materials, as well as any standing water. If construction proceeds during freezing weather conditions, adequate temporary frost protection for the founding subgrade and concrete must be provided.

5.2 Excavation and Backfill

Excavations will need to be carried out for the construction of the footings and servicing. The excavations will encounter loose to dense, moist to wet earth fill soil and sandy silt to silty gravelly sand glacial till soils in a compact to very dense, moist state. Wet seams were noted to exist in the glacial till deposit at some borehole locations.

For the most part, fill soils should be classified as a Type 3 Soil according to the Occupational Health and Safety Act. Dewatered and/or glacial till soils should be classified as a Type 3 soil in this regard, temporary excavation side slopes above the ground water level within the glacial till deposit should be sloped at 1:1 (horizontal to vertical) inclination or flatter from the base of the excavation to ground surface. Wet soils in excavations below the ground water levels will generally perform as a Type 4 soil unless first dewatered. For trenches having narrow widths or for trenches excavated in easily disturbed soils, the use of trench boxes is recommended for temporary support.

TYPE 1 SOIL

a. is hard, very dense and only able to be penetrated with difficulty by a small sharp object;
b. has a low natural moisture content and a high degree of internal strength;
c. has no signs of water seepage; and
d. can be excavated only by mechanical equipment.

TYPE 2 SOIL

a. is very stiff, dense and can be penetrated with moderate difficulty by a small sharp object;
b. has a low to medium natural moisture content and a medium degree of internal strength; and
c. has a damp appearance after it is excavated.

TYPE 3 SOIL

a. is stiff to firm and compact to loose in consistency or is previously-excavated soil;
b. exhibits signs of surface cracking
c. exhibits signs of water seepage;
d. if it is dry, may run easily into a well-defined conical pile; and
e. has a low degree of internal strength.

TYPE 4 SOIL

a. is soft to very soft and very loose in consistency, very sensitive and upon disturbance is significantly reduced in natural strength;
b. runs easily or flows, unless it is completely supported before excavating procedure;
c. has almost no internal strength;
d. is wet or muddy; and
e. exerts substantial fluid pressure on its supporting system.

Temporary excavations should not extend below a line drawn down at 7 vertical to 10 horizontal from existing services without first underpinning or providing temporary shoring and/or bracing.

The moisture content of the earth fill soil and sand silt glacial till soils encountered during this investigation are below or near the optimum moisture content (above the ground water level). They will generally be suitable to be placed and compacted as backfill in service trenches and as general grade fill and/or engineered fill (once approved). Soils from below the ground water level proposed for use as general fill will need moisture adjustments prior to reuse or be wasted. Large sized boulders/cobbles and construction type rubble is not recommended for use within backfill. Topsoil and organics are not recommended for use as backfill and may be stockpiled and re-used for landscaping purposes.

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

General earth fills that are imported or re-used to raise grades on the site should be placed in a maximum 200mm thick loose lift, compacted uniformly to a minimum of 95% of Standard Proctor Maximum Dry Density (SPMDD), ±2% of the optimum moisture content. Soils scheduled for use as engineered fill under structural locations should be compacted to 98% of SPMDD in maximum 150mm loose lifts. Subsurface structures, if encountered during demolition activity must be backfilled to proposed grades using suitable, approved earth fill. General earth fill backfill methods are recommended in non-structural areas. Engineered soil backfill methods must be used in proposed structural areas.

Minor seepage at or near the ground water levels should be handled adequately using filtered sump pumps placed at the base of the excavations for most of the site. More significant dewatering efforts will be required below the ground water levels in sand soils (if encountered).

Structures such as existing buried foundations, previously backfilled excavations, unsuitable fill soils, boulders, rubble, buried organics, etc. may be/are present at the site. The presence of these structures when and if encountered, will likely affect construction methods and cost. Existing ground water wells at this property are required to be decommissioned in accordance with MOECC Regulation 903 and in accordance with local municipal guidelines and regulations.

Testing and inspection by Terraprobe during this operation should be provided in order to document the specified compaction that is achieved and provide recommendations and suggestions with respect to how to optimize the proposed earth works.

5.3 Pipe Bedding

Based on anticipated service inverts of 2 to 3m below proposed grades, the trench base is expected to consist of sandy silt glacial till soil in a compact to dense state. The undisturbed sandy silt glacial till soils identified at the site are suitable for support of sewers and/or watermain pipes. The sandy silt glacial till 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 the stabilization of wet trench bases (if encountered). The granular bedding should consist of a well graded material such as Granular 'A'.

Any soft, loose or disturbed soils encountered as a result of ground water seepage or construction traffic should be subexcavated and replaced with suitably compacted granular fill. Buried organics, if encountered

at this property are also required to be subexcavated below pipe inverts. Granular 'A' bedding material should be placed in thin lifts and compacted to a minimum of 95% of SPMDD.

Note that the sandy silt soil material near ground water levels is easily disturbed. Careful construction practice and dewatering is recommended to minimize disturbance during excavation, pipe placement and backfilling. As previously noted, it is recommended to completely remove the compressible buried organic layer at this property.

5.4 Thrust Blocks and Pipe Restraints

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

The internal angle of friction between the thrust block and the soil may be taken as 33º.
The following design parameters are recommended for design of restrained joints;

- Ultimate friction angle between plastic pipe and compact bedding 24º
- Ultimate friction angle between concrete pipe and compact bedding 33º
- Maximum bearing of thrust pressure of pipe normal to bedding against sandy silt soil at this site 150kPa

5.5 Concrete Slab-on-Grade

It is proposed to construct the residential apartment structures with slab-on-grade design, no basement levels. Conventional lightly loaded concrete slab-on-grade floors can be placed on suitable undisturbed sandy silt glacial till soil above the ground water levels (free of deleterious materials) or on approved "under-floor" fill placed under full time supervision.

Prior to the placement of any type of earth fill to raise grades for slab-on-grade floors, it is recommended that the existing unsuitable fill be subexcavated and re-engineered. The exposed subgrade is recommended to

be inspected by Terraprobe and proof-rolled. Any soft or weak spots should be further excavated and replaced with approved earth fill materials. The final subgrade must be compacted to 95% of SPMDD prior to the placement of grade/under floor fill materials.

All slab-on-grade floors should be constructed at least 0.5m above the seasonally high water level. For bedding and moisture break purposes, a 200mm thick layer of clear 19mm crushed stone or 150mm OPSS Granular 'A' material should be provided under the concrete floor slab, compacted to at least 98% SPMDD.

Where a floor level is within 1m of the water table surface, underfloor drains should be considered. Under floor drainage tiles should consist of placing rows of 100mm diameter perforated drainage pipe leading to a positive sump or outlet. It is recommended that the under floor drain invert be placed at least 300mm below the underside of the floor slab. Drainage tiles should be placed in parallel rows on 3m centres one way. The drainage tile must be surrounded with 100mm of rounded clear stone, completely wrapped in filter fabric. It is essential that the clear stone is separated from the subgrade by using an approved geotextile filter fabric material.

5.6 Seismic Loading for Design

The Ontario Building Code 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. 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 measurements have been taken or alternatively estimated on the basis of rational analysis of undrained shear strength or penetration resistance.

$$\upsilon_{s\text{-}avg} = \frac{\sum_{i=1}^{n} d_i}{\sum_{i=1}^{n} \frac{d_i}{\upsilon_{si}}} \qquad s_{u\text{-}avg} = \frac{\sum_{i=1}^{n} d_i}{\sum_{i=1}^{n} \frac{d_i}{s_{ui}}} \qquad N_{avg} = \frac{\sum_{i=1}^{n} d_i}{\sum_{i=1}^{n} \frac{d_i}{N_i}}$$

Shear wave velocity | **Undrained shear strength** | **SPT N-values**

At this site the stratigraphy consists of loose to compact fill over compact to very dense sandy silt glacial till with a penetration resistance averaging about 10 to greater than 50 blows per 300 mm of penetration. It is known that the deeper native stratigraphy in this area is similar to the conditions encountered at this property.

Although not encountered during this study, the site is underlain by limestone bedrock of the Middle Ordovician, Simcoe Group. Drift thickness at the study area is anticipated to be near ±50m.

For seismic design purposes the weighted average penetration resistance can be taken as greater than 50 blows per 300 mm for the upper 30 metres and the site designation for seismic analysis is Class C (OBC 4.1.8.4 Table 4.1.8.4.A).

The site has been classified as Class C according to Table 4.1.8.4.A of the Ontario Building Code. According to Tables 4.1.8.4.B and 4.1.8.4.C. of the same code the applicable acceleration and velocity based site coefficients are tabulated below.

Site Class	Values of Fa				
	Sa(0.2) ≤ 0.25	Sa(0.2) = 0.50	Sa(0.2) = 0.75	Sa(0.2) = 1.00	Sa(0.2) ≥ 1.25
C	1.0	1.0	1.0	1.0	1.0

Site Class	Values of Fv				
	Sa(1.0) ≤ 0.1	Sa(1.0) = 0.2	Sa(1.0) = 0.3	Sa(1.0) = 0.4	Sa(1.0) ≥ 0.5
C	1.0	1.0	1.0	1.0	1.0

5.7 Pavement Design

Based on the soil conditions encountered at the borehole locations, it is anticipated that the subgrade soils for pavements will comprise of reworked compacted sandy silt soils. Based on the above, the following minimum pavement design is recommended:

Material	Pavement Component Thickness (mm)
HL-3 Surface Asphalt	40
HL-8 or HL-4 Binder Asphalt	60
OPSS Granular "A"	150
OPSS Granular "B"	300
Total Thickness	550

The subgrade should be stripped of all deleterious materials and proof-rolled to achieve a uniform compaction of 98% of SPMDD.

The sandy silt glacial till soils above the ground water level are suitable for re-use as subgrade fill provided all organics, rubble and oversized boulders are removed. Insitu soils below ground water levels may have moisture constraints with regard to re-use as subgrade fill. Soil adjustment may be required for wet soil re-use. Soils to be re-used as general subgrade fill should be compacted to 98% of SPMDD in lifts not exceeding 200mm in thickness, ±3% optimum moisture content.

The subgrade may be raised with approved reusable soils from the site and/or a suitable imported fill material compacted to 98% of SPMDD. Based on the grain size analysis, the soils encountered at the site (above the ground water levels) are suitable for re-use as sub-grade fill.

Immediately prior to placement of the granular subbase, the exposed subgrade should be proof rolled with a heavy rubber tired vehicle and inspected for any loose, soft or unstable areas which should be subexcavated and backfilled with similar compacted earth materials. All granular pavement components should be compacted to 100% of SPMDD.

The hot laid asphaltic concrete materials should be compacted to 97% of the Marshall Bulk Density (MBD) as tested with a nuclear gauge.

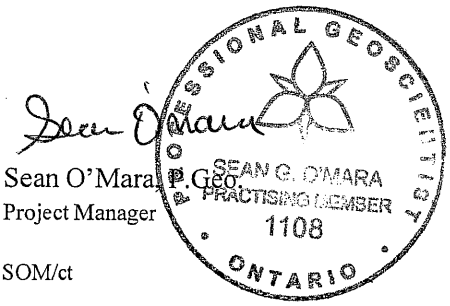
If the pavement construction occurs during inclement weather, it may be necessary to provide additional subgrade support for heavy construction traffic by increasing the thickness of the granular structure. Furthermore, the main traffic areas for construction equipment may experience areas of unstable conditions which may be stabilized by applying additional layers of granular fill.

The need for adequate subgrade drainage cannot be over-emphasized. The subgrade must be free of depressions and sloped (preferably at a minimum grade of two percent) to provide effective drainage toward subgrade drains. Grading adjacent to the pavement areas should be designed to ensure that water is not allowed to pond adjacent to the outside edges of the pavement. Pavement subdrains leading to catchbasins are recommended to facilitate drainage of the subgrade and the granular materials.

It should be noted that in addition to adherence of the above pavement design recommendations, a close control on the pavement construction process will also be required in order to obtain the desired pavement life. Therefore, it is recommended that regular inspection and testing should be conducted during the parking lot and driveway construction to confirm material quality, thickness and to ensure adequate compaction.

We trust that this report is satisfactory for your present requirements. If you should have any questions, or if we can be of further assistance, please do not hesitate to contact the undersigned.

Sincerely,
Terraprobe Inc.



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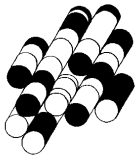
Principal

BOREHOLE LOGS



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ABBREVIATIONS, TERMINOLOGY, GENERAL INFORMATION

BOREHOLE LOGS

SAMPLING METHOD

SS	split spoon
ST	Shelby tube
AS	auger sample
WS	wash sample
RC	rock core
WH	weight of hammer
PH	pressure, hydraulic

PENETRATION RESISTANCE

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.).

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.).

SOIL DESCRIPTION - COHESIONLESS SOILS

Relative Density	'N' value
very loose	< 4
loose	4 - 10
compact	10 - 30
dense	30 - 50
very dense	> 50

SOIL DESCRIPTION - COHESIVE SOILS

Consistency	Undrained Shear Strength, kPa	'N' value
very soft	< 12	< 2
soft	12 - 25	2 - 4
firm	25 - 50	4 - 8
stiff	50 - 100	8 - 16
very stiff	100 - 200	16 - 32
hard	> 200	> 32

SOIL COMPOSITION

	% by weight
'trace' (e.g. trace silt)	< 10
'some' (e.g. some gravel)	10 - 20
adjective (e.g. sandy)	20 - 35
'and' (e.g. sand and gravel)	35 - 50

TESTS, SYMBOLS

MH	mechanical sieve and hydrometer analysis
w, w_c	water content
w_l	liquid limit
w_p	plastic limit
I_p	plasticity index
k	coefficient of permeability
γ	soil unit weight, bulk
ϕ'	angle of internal friction
c'	cohesion shear strength
C_c	compression index

GENERAL INFORMATION, LIMITATIONS

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.

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.

It is recommended Terraprobe be retained to review the project final design and to provide construction inspection and testing.

LOG OF BH1

Terraprobe

Project No. : 3-18-0005	Client : The County of Simcoe	Originated by : BH
Date started : February 26, 2018	Project : 2 Borland St. East	Compiled by : BH
Sheet No. : 1 of 1	Location : Orillia, Ontario	Checked by : SO

Position :
Elevation Datum : Geodetic (NAD83)
Rig type : D50, track-mounted
Drilling Method : Solid stem augers

Depth Scale (m)	Elev / Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
0	267.7 GROUND SURFACE					
	267.5 / 0.2	**FILL**, 180 mm slag		1A	SS	12
		FILL, sand and gravel, some silt, compact, black to brown, wet		1B	SS	25
	267.1 / 0.6	**SANDY SILT**, some clay, some gravel, compact to very dense, brown, moist (GLACIAL TILL)		2	SS	27
1				3	SS	63
2				4	SS	41
3				5	SS	49
4				6	SS	50 / 150mm
5				7	SS	50 / 150mm
6	261.3 / 6.4	**END OF BOREHOLE**				

Elevation Scale (m): 267, 266, 265, 264, 263, 262

Penetration Test Values (Blows / 0.3m)
× Dynamic Cone
10 20 30 40
Undrained Shear Strength (kPa)
○ Unconfined + Field Vane
● Pocket Penetrometer ■ Lab Vane
40 80 120 160

Moisture / Plasticity
Plastic Limit | Natural Water Content | Liquid Limit
PL MC LL
10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments
GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

Unstabilized water level measured at 0.6 m below ground surface; borehole caved to 5.8 m below ground surface upon completion of drilling.

35 mm dia. piezometer installed.
1.5 m screen installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Mar 6, 2018	(frozen)	n/a

file: bh logs.gpj

LOG OF BH2

Terraprobe

Project No. : 3-18-0005	Client : The County of Simcoe	Originated by : BH
Date started : February 26, 2018	Project : 2 Borland St. East	Compiled by : BH
Sheet No. : 1 of 1	Location : Orillia, Ontario	Checked by : SO

Position :
Elevation Datum : Geodetic (NAD83)
Rig type : D50, track-mounted
Drilling Method : Solid stem / hollow stem augers

Depth Scale (m)	Elev / Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
0	268.3	**GROUND SURFACE**				
	268.1	180mm **TOPSOIL**				
	0.2 / 267.7	**FILL**, sand, trace silt, trace organics, brown, wet		1	AS	
	0.6	**FILL**, sandy silt, trace to some clay, trace gravel, loose, brown, wet		2	SS	6
1	266.8					
	1.5	**SANDY SILT**, some clay, some gravel, cobble sizes, compact to very dense, brown, moist (GLACIAL TILL)		3	SS/AS	30
2				4	SS	26
3		...wet seam at 3.0m		5	SS	52
4				6	SS	50 / 150mm
5						
6	262.1			7	SS	50 / 150mm
	6.2	**END OF BOREHOLE**				

Elevation Scale (m): 268, 267, 266, 265, 264, 263

Penetration Test Values (Blows / 0.3m)
Dynamic Cone: 10 20 30 40
Undrained Shear Strength (kPa)
Unconfined, Pocket Penetrometer, Field Vane, Lab Vane
40 80 120 160

Moisture / Plasticity
Plastic Limit, Natural Water Content, Liquid Limit
PL MC LL
10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments
GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

Unstabilized water level measured at 1.5 m below ground surface; borehole caved to 2.4 m below ground surface upon completion of drilling.

35 mm dia. piezometer installed.
1.5 m screen installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Mar 6, 2018	0.6	267.7

file: bh logs.gpj

LOG OF BH3

Terraprobe

Project No. : 3-18-0005	Client : The County of Simcoe	Originated by : BH
Date started : February 26, 2018	Project : 2 Borland St. East	Compiled by : BH
Sheet No. : 1 of 1	Location : Orillia, Ontario	Checked by : SO

Position :
Elevation Datum : Geodetic (NAD83)
Rig type : D50, track-mounted
Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
	269.2	**GROUND SURFACE**				
0	269.0	**FILL**, sand and gravel, trace silt, brown, moist		1	AS	
	0.2	**FILL**, silty sand and organics, compact, brown, moist		2	SS	10
1	268.0					
	1.2	**FILL**, sandy silt, trace to some clay, trace gravel, loose, brown, wet		3	SS	6
2	267.2					
	2.0	**SANDY SILT**, some clay, some gravel, compact to very dense, brown, moist (GLACIAL TILL)		4	SS	18
3				5	SS	34
4		...wet seam at 4.0m		6	SS	50 / 150mm
5						
6	263.0			7	SS	50 / 150mm
	6.2	**END OF BOREHOLE**				

Elevation Scale (m): 269, 268, 267, 266, 265, 264, 263

Penetration Test Values (Blows / 0.3m)
× Dynamic Cone
10 20 30 40
Undrained Shear Strength (kPa)
○ Unconfined + Field Vane
● Pocket Penetrometer ■ Lab Vane
40 80 120 160

Moisture / Plasticity
Plastic Limit | Natural Water Content | Liquid Limit
PL MC LL
10 20 30

Headspace Vapour (ppm): 43

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Mar 6, 2018	2.0	267.2

Unstabilized water level measured at 3.7 m below ground surface; borehole was open upon completion of drilling.

35 mm dia. piezometer installed.
1.5 m screen installed.

file: bh logs.gpj

LOG OF BH4

Terraprobe

Project No. : 3-18-0005	Client : The County of Simcoe	Originated by : BH
Date started : February 27, 2018	Project : 2 Borland St. East	Compiled by : BH
Sheet No. : 1 of 1	Location : Orillia, Ontario	Checked by : SO

Position :
Elevation Datum : Geodetic (NAD83)
Rig type : D50, track-mounted
Drilling Method : Hollow stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0	270.8	**GROUND SURFACE**				
		40mm **ASPHALTIC CONCRETE**				
		FILL, sand and gravel, some silt, dense, brown, moist		1	SS	48
	270.3 / 0.5	**SANDY SILT**, some clay, trace gravel, cobble sizes, compact to very dense, brown, moist to wet (GLACIAL TILL)		2	SS	15
1				3	SS/AS	18
2				4	SS	14
3		...wet seam at 3.0m		5	SS	28
4				6	SS	50 / 75mm
5						
6	264.6 / 6.2			7	SS	50 / 100mm

Elevation Scale (m): 270, 269, 268, 267, 266, 265

Penetration Test Values (Blows / 0.3m)
Dynamic Cone: 10 20 30 40
Undrained Shear Strength (kPa)
Unconfined, Pocket Penetrometer, Field Vane, Lab Vane: 40 80 120 160

Moisture / Plasticity
Plastic Limit, Natural Water Content, Liquid Limit
PL MC LL: 10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments
GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

END OF BOREHOLE

Borehole was dry upon completion of drilling.

50 mm dia. monitoring well installed.
3.0 m screen installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Mar 6, 2018	1.8	269.0

file: bh logs.gpj

Terraprobe

LOG OF BH5

Project No. : 3-18-0005	Client : The County of Simcoe	Originated by : BH
Date started : February 27, 2018	Project : 2 Borland St. East	Compiled by : BH
Sheet No. : 1 of 1	Location : Orillia, Ontario	Checked by : SO

Position :
Elevation Datum : Geodetic (NAD83)
Rig type : D50, track-mounted
Drilling Method : Hollow stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0	269.2	**GROUND SURFACE**				
	269.0	50mm **ASPHALTIC CONCRETE**				
	0.2	**FILL**, sand and gravel, trace silt, compact, brown, moist		1	SS	28
1		**FILL**, silt, some sand to sandy, trace to some clay, trace gravel, compact to dense, brown, moist		2	SS/AS	36
	268.0					
	1.2	**SANDY SILT**, some clay, some gravel, cobble sizes, compact to very dense, brown, moist (GLACIAL TILL)		3	SS/AS	21
2				4	SS/AS	24
3				5	SS	49
4				6	SS	50 / 150mm
5						
6	263.0			7	SS	50 / 100mm
	6.2	**END OF BOREHOLE**				

Elevation Scale (m): 269, 268, 267, 266, 265, 264, 263

Penetration Test Values (Blows / 0.3m)
Dynamic Cone: 10, 20, 30, 40
Undrained Shear Strength (kPa)
Unconfined, Pocket Penetrometer, Field Vane, Lab Vane: 40, 80, 120, 160

Moisture / Plasticity
Plastic Limit, Natural Water Content, Liquid Limit
PL, MC, LL: 10, 20, 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments
GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

Borehole was dry upon completion of drilling.

50 mm dia. monitoring well installed.
3.0 m screen installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Mar 6, 2018	3.1	266.1

file: bh logs.gpj

LOG OF BH6

Terraprobe

Project No. : 3-18-0005	Client : The County of Simcoe	Originated by : BH
Date started : February 27, 2018	Project : 2 Borland St. East	Compiled by : BH
Sheet No. : 1 of 1	Location : Orillia, Ontario	Checked by : SO

Position :
Elevation Datum : Geodetic (NAD83)
Rig type : D50, track-mounted
Drilling Method : Hollow stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value	Elevation Scale (m)
	270.0	**GROUND SURFACE**					270
0		40mm **ASPHALTIC CONCRETE**		1	SS	19	
		FILL, sand and gravel, trace silt, compact, brown, moist					
		FILL, sandy silt to silty sand, and organics, some clay, some gravel, compact to dense, dark brown, moist		2	SS	46	
1	268.8						269
	1.2	**SANDY SILT**, some clay, some gravel, cobble sizes, compact to very dense, brown, moist (GLACIAL TILL)		3	SS	16	
2							268
				4	SS	22	
3							267
				5	SS	31	
4							266
				6	SS	80	
5							265
				7	SS	50 / 150mm	
6	263.8						264
	6.2	**END OF BOREHOLE**					

Penetration Test Values (Blows / 0.3m)
× Dynamic Cone
10 20 30 40
Undrained Shear Strength (kPa)
○ Unconfined + Field Vane
● Pocket Penetrometer ■ Lab Vane
40 80 120 160

Moisture / Plasticity
Plastic Limit | Natural Water Content | Liquid Limit
PL MC LL
10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments
GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

Borehole was dry upon completion of drilling.

50 mm dia. monitoring well installed.
3.0 m screen installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Mar 6, 2018	3.4	266.6

file: bh logs.gpj

LOG OF BH7

Terraprobe

Project No. : 3-18-0005	Client : The County of Simcoe	Originated by : BH
Date started : February 27, 2018	Project : 2 Borland St. East	Compiled by : BH
Sheet No. : 1 of 1	Location : Orillia, Ontario	Checked by : SO

Position :
Elevation Datum : Geodetic (NAD83)
Rig type : D50, track-mounted
Drilling Method : Solid stem augers

Depth Scale (m)	Elev / Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0	270.2	**GROUND SURFACE**				
		FILL, silt and topsoil, some sand, trace gravel, trace brick fragments, loose, dark brown, moist		1	AS	
1				2	SS	4
	268.7 / 1.5					
		SANDY SILT, some clay, some gravel, cobble sizes, compact to very dense, brown, moist (GLACIAL TILL)		3	SS	10
2				4	SS	19
3				5	SS	19
4				6	SS	50 / 150mm
5				7	SS/AS	50 / 50mm
6	264.0 / 6.2					

Elevation Scale (m): 270, 269, 268, 267, 266, 265, 264

Penetration Test Values (Blows / 0.3m)
Dynamic Cone: 10, 20, 30, 40
Undrained Shear Strength (kPa)
Unconfined, Pocket Penetrometer, Field Vane, Lab Vane
40, 80, 120, 160

Moisture / Plasticity
Plastic Limit, Natural Water Content, Liquid Limit
PL, MC, LL
10, 20, 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

35 mm dia. piezometer installed.
1.5 m screen installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Mar 6, 2018	5.0	265.2

file: bh logs.gpj

LOG OF BH8

Terraprobe

Project No. : 3-18-0005	Client : The County of Simcoe	Originated by : BH
Date started : February 28, 2018	Project : 2 Borland St. East	Compiled by : BH
Sheet No. : 1 of 1	Location : Orillia, Ontario	Checked by : SO

Position :
Elevation Datum : Geodetic (NAD83)
Rig type : D50, track-mounted
Drilling Method : Solid stem augers

Depth Scale (m)	Elev / Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0	267.9	**GROUND SURFACE**				
	267.6	300mm **TOPSOIL**		1	AS	
	0.3	**FILL**, silt and topsoil to silty sand, trace to some clay, some gravel, trace organics, loose, dark brown to brown, moist to wet		2	SS	4
1						
				3	SS	6
2	265.9					
	2.0	**SANDY SILT**, some clay, some gravel, compact to very dense, brown, moist (GLACIAL TILL)		4	SS	13
3						
				5	SS	22
4						
				6	SS	50 / 150mm
5						
				7	SS	50 / 150mm
6	261.5					
	6.4	**END OF BOREHOLE**				

Elevation Scale (m): 267, 266, 265, 264, 263, 262

Penetration Test Values (Blows / 0.3m)
Dynamic Cone: 10 20 30 40
Undrained Shear Strength (kPa)
Unconfined, Pocket Penetrometer, Field Vane, Lab Vane: 40 80 120 160

Moisture / Plasticity
Plastic Limit, Natural Water Content, Liquid Limit
PL MC LL: 10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments
GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

Unstabilized water level measured at 5.5 m below ground surface; borehole was open upon completion of drilling.

35 mm dia. piezometer installed.
1.5 m screen installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Mar 6, 2018	4.0	263.9

file: bh logs.gpj

LOG OF BH9

Terraprobe

Project No. : 3-18-0005	Client : The County of Simcoe	Originated by : BH
Date started : February 28, 2018	Project : 2 Borland St. East	Compiled by : BH
Sheet No. : 1 of 1	Location : Orillia, Ontario	Checked by : SO

Position :
Elevation Datum : Geodetic (NAD83)
Rig type : D50, track-mounted
Drilling Method : Solid stem augers

Depth Scale (m)	Elev / Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
0	267.6 GROUND SURFACE					
		FILL, topsoil, mixed with silt, some clay, trace sand, dark brown, moist		1	AS	
	266.7 / 0.9					
1		**FILL**, silt, some sand, trace to some clay, trace gravel, trace organics, loose, brown, moist		2	SS	7
				3	SS	8
2	265.6 / 2.0					
		SILTY GRAVELLY SAND, some clay, compact to very dense, brown, moist (GLACIAL TILL)		4	SS	21
3				5	SS	23
4						
				6	SS	58
5		...wet seam at 5.5m				
6				7	SS	75
	261.0 / 6.6					

Elevation Scale (m): 267, 266, 265, 264, 263, 262

Penetration Test Values (Blows / 0.3m)
Dynamic Cone: 10, 20, 30, 40
Undrained Shear Strength (kPa)
Unconfined, Pocket Penetrometer, Field Vane, Lab Vane
40, 80, 120, 160

Moisture / Plasticity
Plastic Limit, Natural Water Content, Liquid Limit
PL, MC, LL
10, 20, 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments
GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

END OF BOREHOLE

Unstabilized water level measured at 5.5 m below ground surface; borehole was open upon completion of drilling.

35 mm dia. piezometer installed.
1.5 m screen installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Mar 6, 2018	2.6	265.0

file: bh logs.gpj

LOG OF BH10

Terraprobe

Project No. : 3-18-0005	Client : The County of Simcoe	Originated by : BH
Date started : February 26, 2018	Project : 2 Borland St. East	Compiled by : BH
Sheet No. : 1 of 1	Location : Orillia, Ontario	Checked by : SO

Position :
Elevation Datum : Geodetic (NAD83)
Rig type : D50, track-mounted
Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0	**268.0**	**GROUND SURFACE**				
	267.8	50mm **TOPSOIL**				
	0.2	**FILL**, sand and gravel, trace silt, compact, brown, moist		1	SS	16
		FILL, gravelly silty sand, trace clay, trace organics, loose, brown, wet		2	SS	6
1	266.8					
	1.2	**SANDY SILT**, some clay, some gravel, cobble sizes, compact to very dense, brown, moist (GLACIAL TILL)		3	SS	13
2				4	SS	18
3				5	SS	50
4				6	SS	50 / 125mm
5						
6	261.8			7	SS	50 / 125mm
	6.2	**END OF BOREHOLE**				

Elevation Scale (m): 268, 267, 266, 265, 264, 263, 262

Penetration Test Values (Blows / 0.3m)
Dynamic Cone: 10, 20, 30, 40
Undrained Shear Strength (kPa)
Unconfined, Pocket Penetrometer, Field Vane, Lab Vane
40, 80, 120, 160

Moisture / Plasticity
Plastic Limit, Natural Water Content, Liquid Limit
PL, MC, LL
10, 20, 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments
GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

Borehole was dry and open upon completion of drilling.

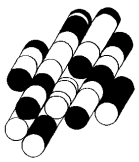
35 mm dia. piezometer installed.
1.5 m screen installed.

WATER LEVEL READINGS

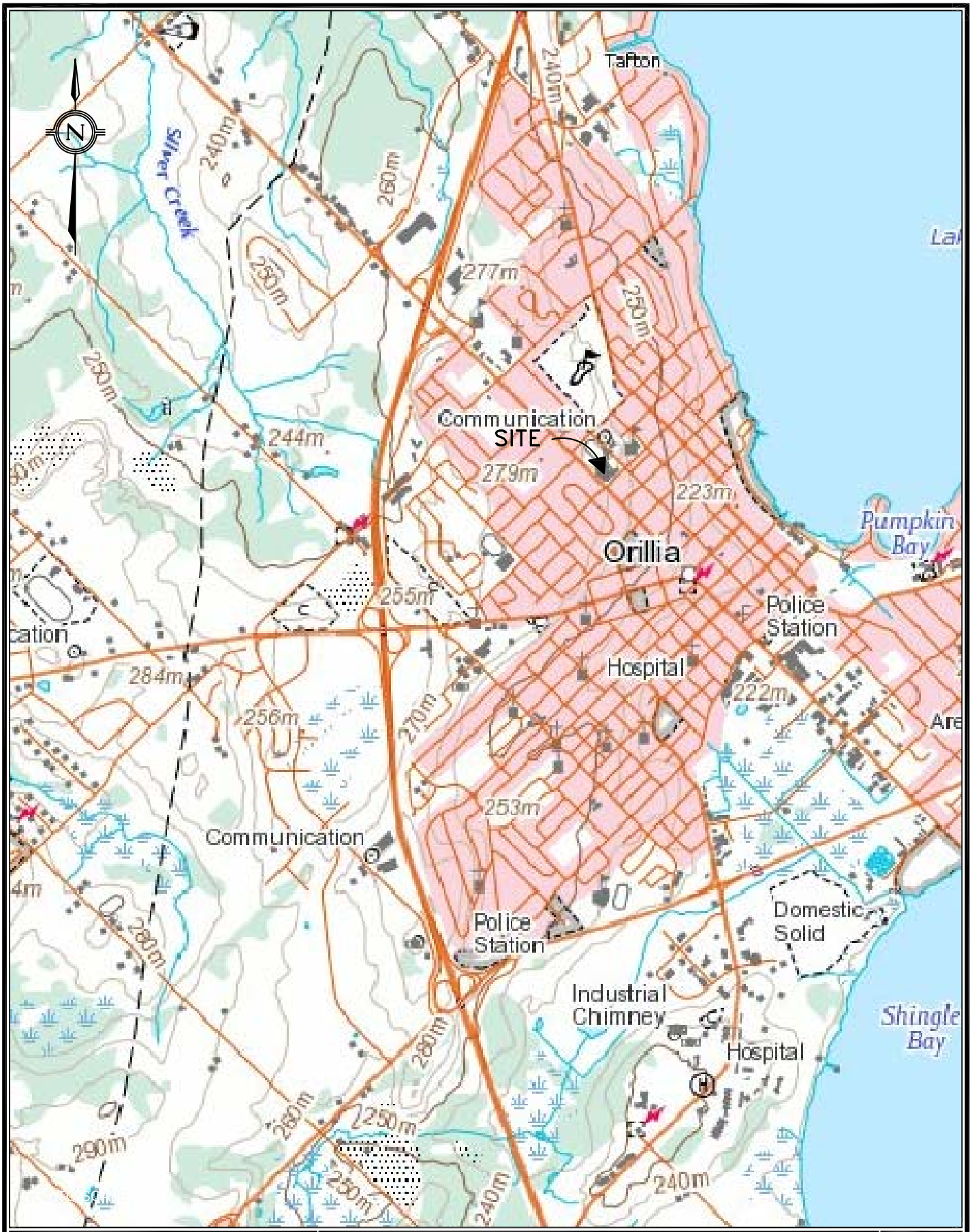
Date	Water Depth (m)	Elevation (m)
Mar 6, 2018	1.3	266.7

file: bh logs.gpj

FIGURES



Terraprobe Inc.



Terraprobe Inc.
Consulting Geotechnical & Environmental Engineering
Construction Materials, Inspection & Testing
220 Bayview Drive, Unit 25 - Barrie, Ontario L4N 4Y8 (705) 739-8355

Title: SITE LOCATION PLAN

File No. 3-18-0005-01

FIGURE : 1

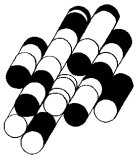
Terraprobe Inc.
Consulting Geotechnical & Environmental Engineering
Construction Materials, Inspection & Testing
220 Bayview Drive, Unit 25 - Barrie, Ontario L4N 4Y8 (705) 739-8355

Title: BOREHOLE LOCATION PLAN

File No. 3-18-0005-01

FIGURE : 2

GRAIN SIZE ANALYSIS



Terraprobe Inc.

Terraprobe

SIEVE GRADATION ANALYSIS
TEST RESULTS

PROJECT : **2 Borland Street East**
LOCATION: **Orillia, ON**
CLIENT : **The Corporation of the County of Simcoe, Procurement, Fleet and Property**
SAMPLE MATERIAL: **Granular B**

SAMPLE SOURCE: **Borehole 4, sample 1 Depth = 0 to 2'**

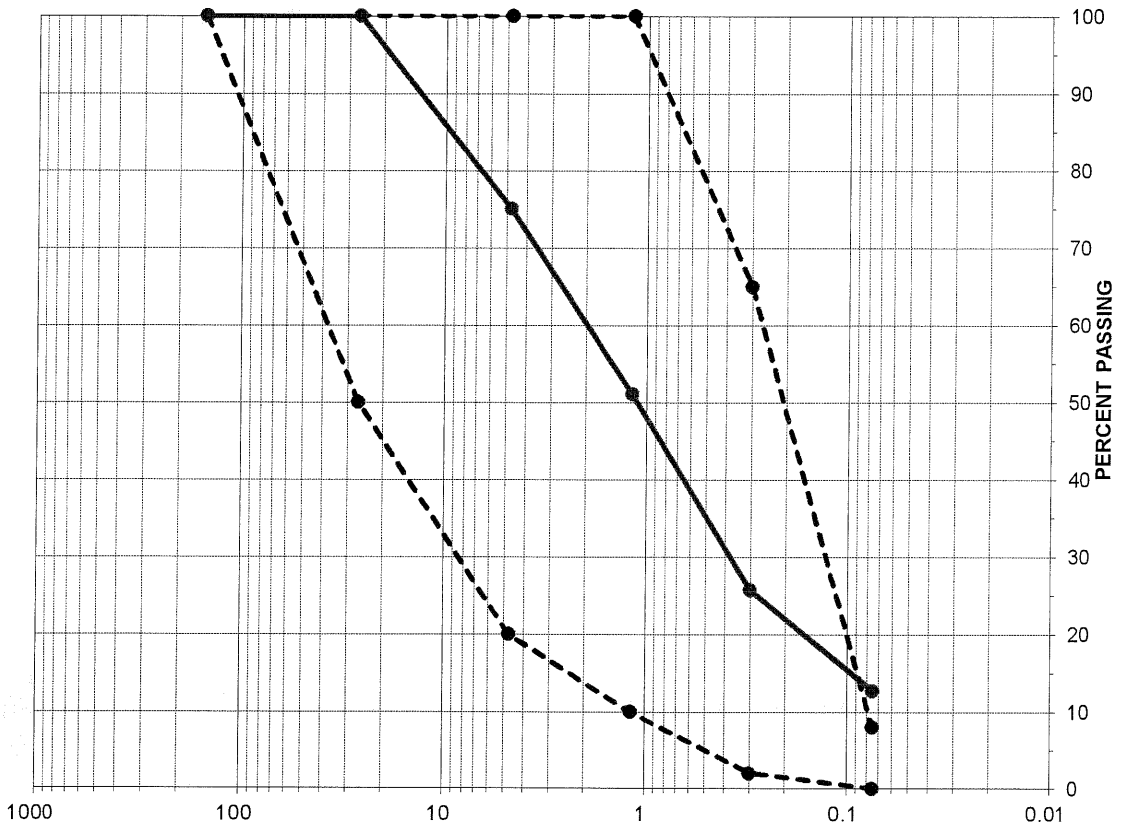
FILE NO. **3-18-0005**
LAB NO: **1901a**

SAMPLE DATE: **Mar-01-18**

SAMPLED BY: **B.H.**

CERTIFIED BY CCIL

GRAIN SIZE DISTRIBUTION



SIEVE SIZE mm	PERCENT PASSING SPECIFIED MIN.	SPECIFIED MAX.	SAMPLE	NOTES: GRANULAR 'B' (Type 1) OPSS.MUNI FORM 1010
150.0	100	100	100	
26.5	50	100	100.0	**Sample tested does not conform to**
4.75	20	100	75.1	**OPSS 1010 for gradation**
1.18	10	100	51.1	
0.300	2	65	25.7	
0.075	0	8	**12.8**	Note: Boldface denotes not meeting specifications

TTBarrie MAR 2007

Reviewed By:_____

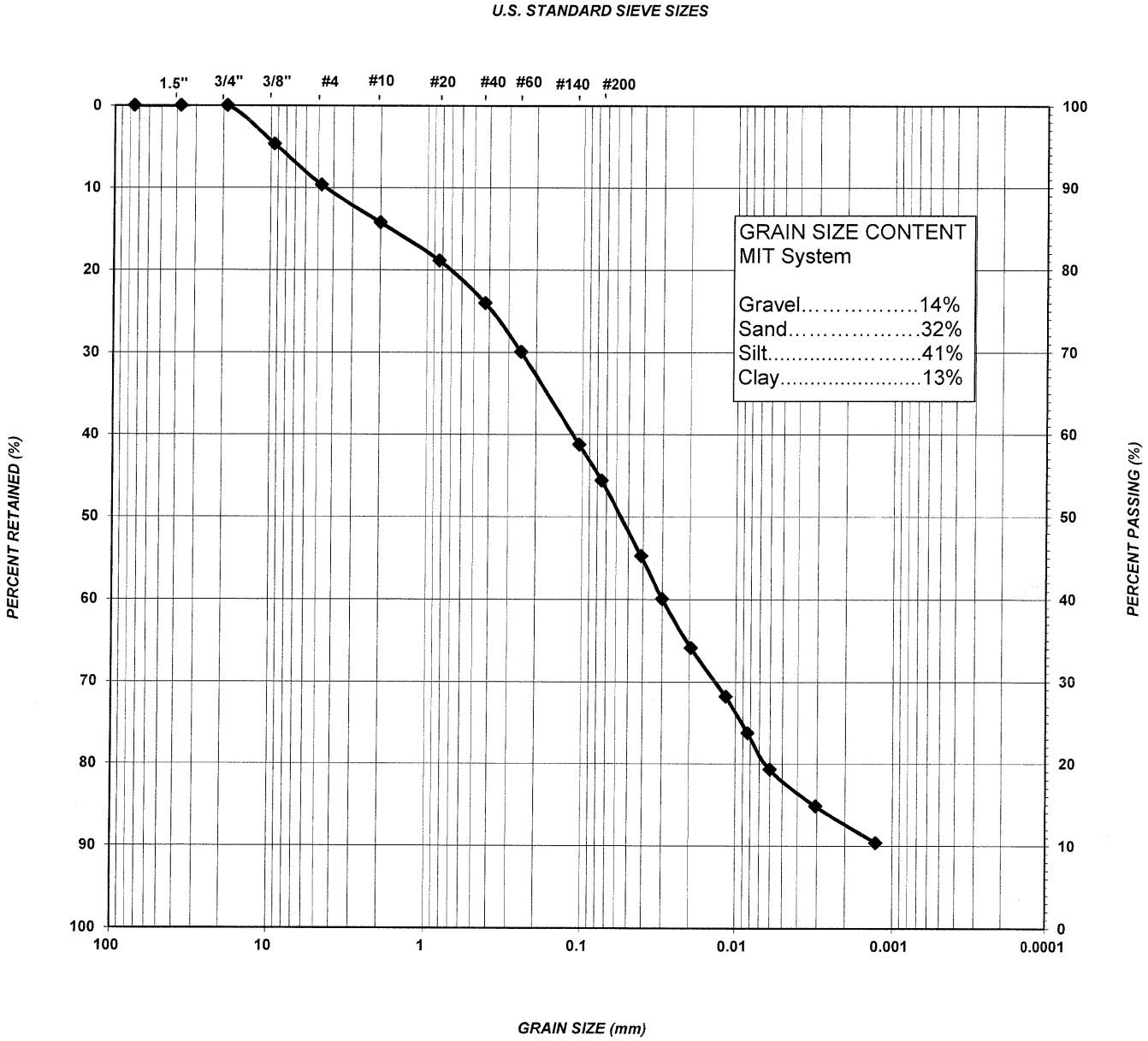
Terraprobe

SIEVE AND HYDROMETER ANALYSIS TEST REPORT

PROJECT: **2 Borland Street East**
LOCATION: **Orillia, ON**
CLIENT: **The Corporation of the County of Simcoe, Procurement, Fleet and Property**
BOREHOLE NUMBER: **3** SAMPLE DEPTH: **7.5 to 9'**
SAMPLE NUMBER: **4**
SAMPLE LOCATION: **as above**
SAMPLE DESCRIPTION: **Sandy silt, some gravel, some clay**

FILE NO.: **3-18-0005**
LAB NO.: **1899a**
SAMPLE DATE: **Feb-28-18**
SAMPLED BY: **B.H.**

GRAIN SIZE DISTRIBUTION



MIT SYSTEM	GRAVEL	COARSE	MEDIUM	FINE	SILT	CLAY
		SAND				

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

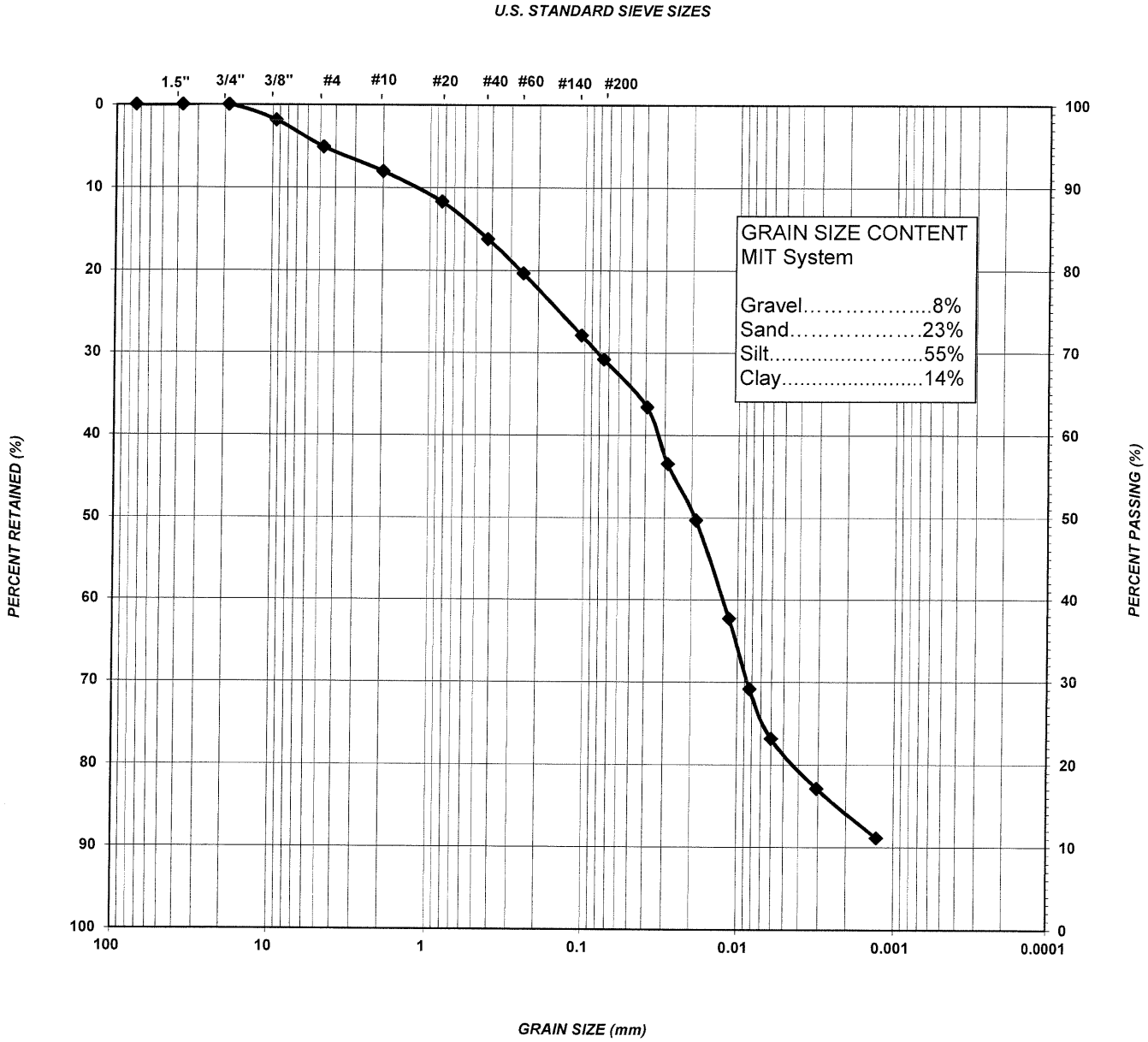
Terraprobe

SIEVE AND HYDROMETER ANALYSIS TEST REPORT

PROJECT: **2 Borland Street East**
LOCATION: **Orillia, ON**
CLIENT: **The Corporation of the County of Simcoe, Procurement, Fleet and Property**
BOREHOLE NUMBER: **4** SAMPLE DEPTH: **7.5 to 9'**
SAMPLE NUMBER: **4**
SAMPLE LOCATION: **as above**
SAMPLE DESCRIPTION: **Sandy silt, some clay, trace gravel**

FILE NO.: **3-18-0005**
LAB NO.: **1902a**
SAMPLE DATE: **Mar-01-18**
SAMPLED BY: **B.H.**

GRAIN SIZE DISTRIBUTION



MIT SYSTEM						
	GRAVEL	COARSE	MEDIUM	FINE	SILT	CLAY
		SAND				

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

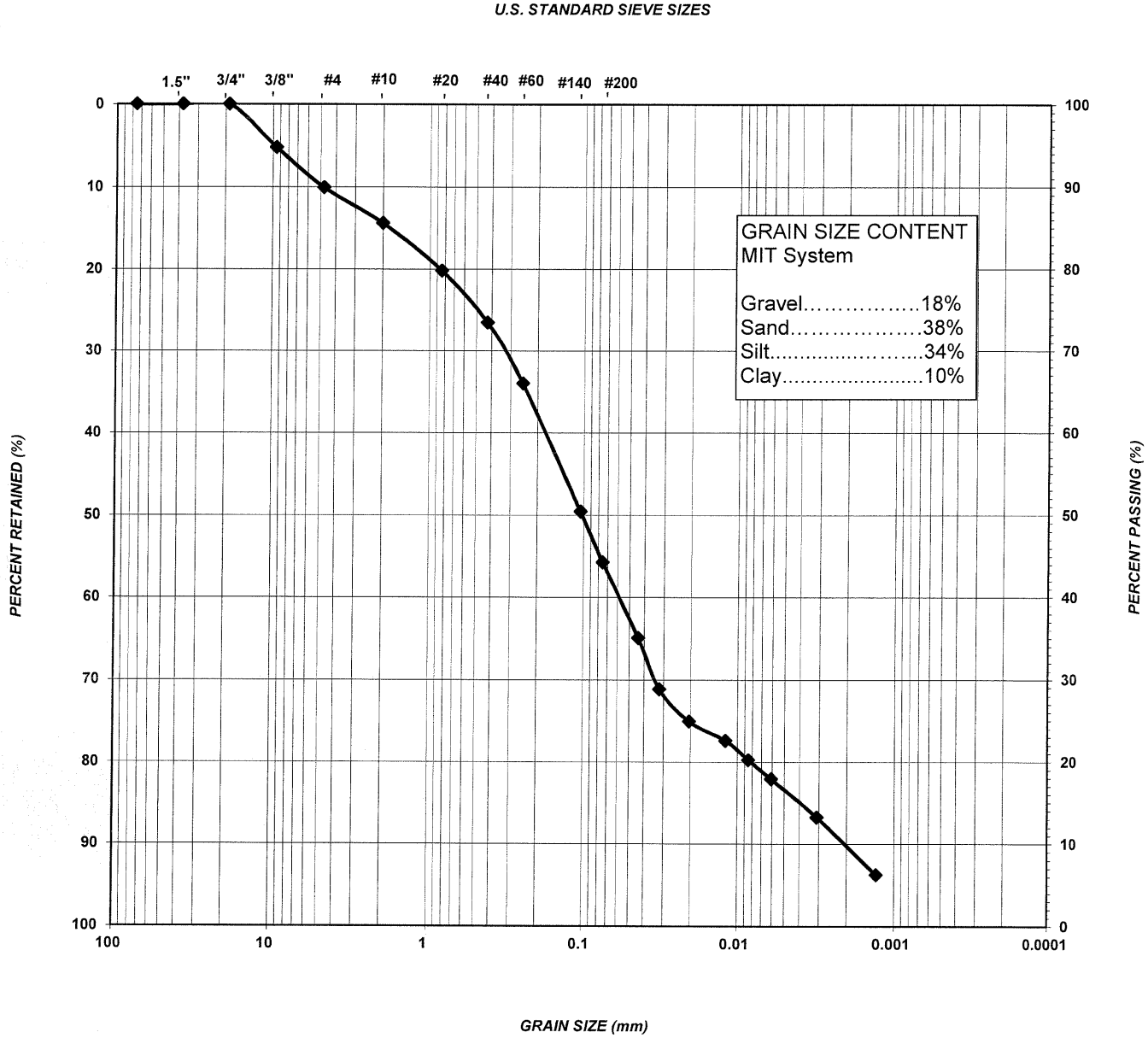
Terraprobe

SIEVE AND HYDROMETER ANALYSIS TEST REPORT

PROJECT: **2 Borland Street East**
LOCATION: **Orillia, ON**
CLIENT: **The Corporation of the County of Simcoe, Procurement, Fleet and Property**
BOREHOLE NUMBER: **8** SAMPLE DEPTH: **5 to 6.5'**
SAMPLE NUMBER: **3**
SAMPLE LOCATION: **as above**
SAMPLE DESCRIPTION: **Silty sand, some gravel, trace clay**

FILE NO.: **3-18-0005**
LAB NO.: **1902b**
SAMPLE DATE: **Mar-01-18**
SAMPLED BY: **B.H.**

GRAIN SIZE DISTRIBUTION



MIT SYSTEM	GRAVEL	COARSE	MEDIUM	FINE	SILT	CLAY
		SAND				

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

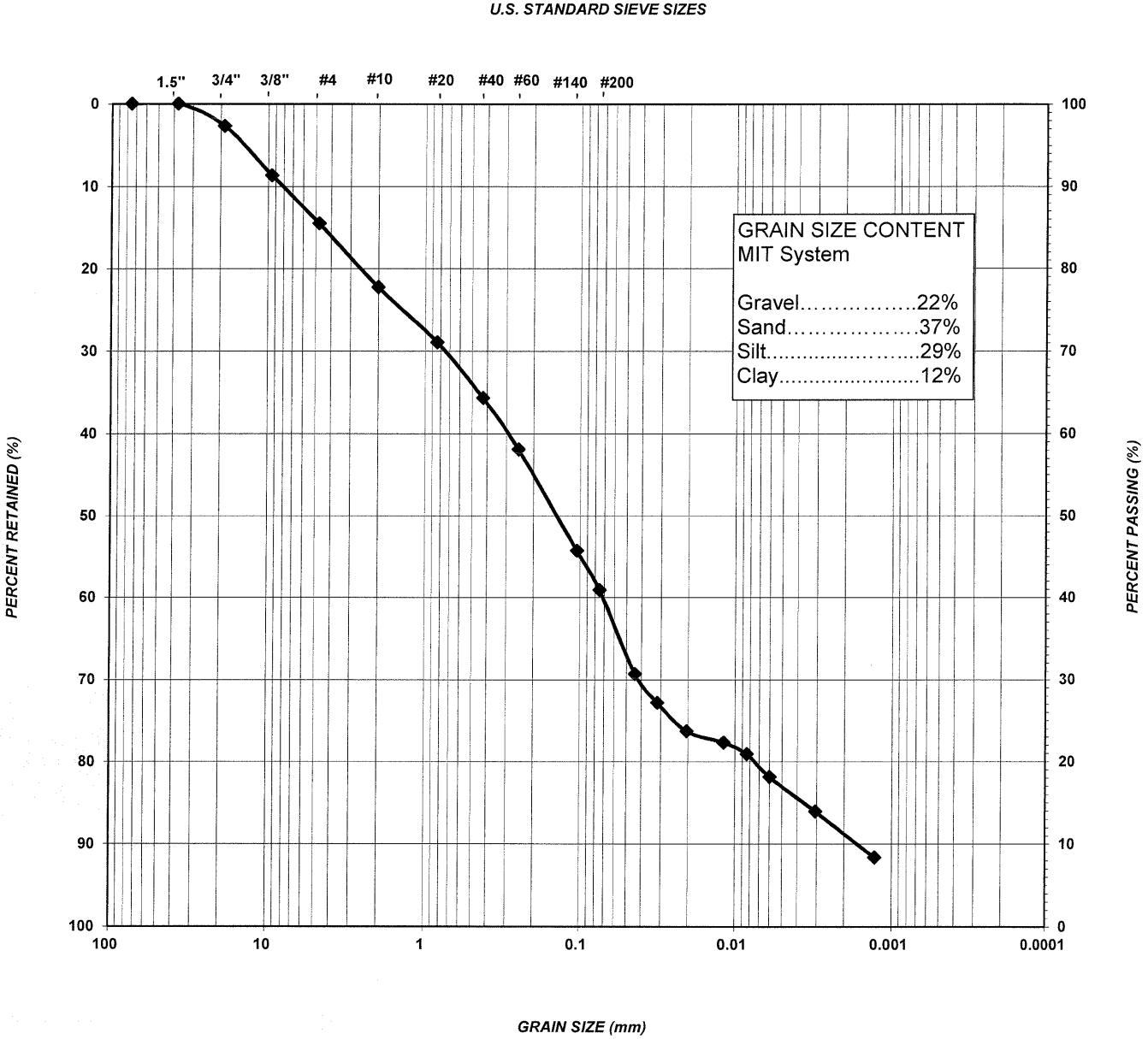
Terraprobe

SIEVE AND HYDROMETER ANALYSIS TEST REPORT

PROJECT: **2 Borland Street East**
LOCATION: **Orillia, ON**
CLIENT: **The Corporation of the County of Simcoe, Procurement, Fleet and Property**
BOREHOLE NUMBER: **9** SAMPLE DEPTH: **10 to 11.5'**
SAMPLE NUMBER: **5**
SAMPLE LOCATION: **as above**
SAMPLE DESCRIPTION: **Silty gravelly sand, some clay**

FILE NO.: **3-18-0005**
LAB NO.: **1901b**
SAMPLE DATE: **Mar-01-18**
SAMPLED BY: **B.H.**

GRAIN SIZE DISTRIBUTION



MIT SYSTEM	GRAVEL	COARSE	MEDIUM	FINE	SILT	CLAY
		SAND				

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

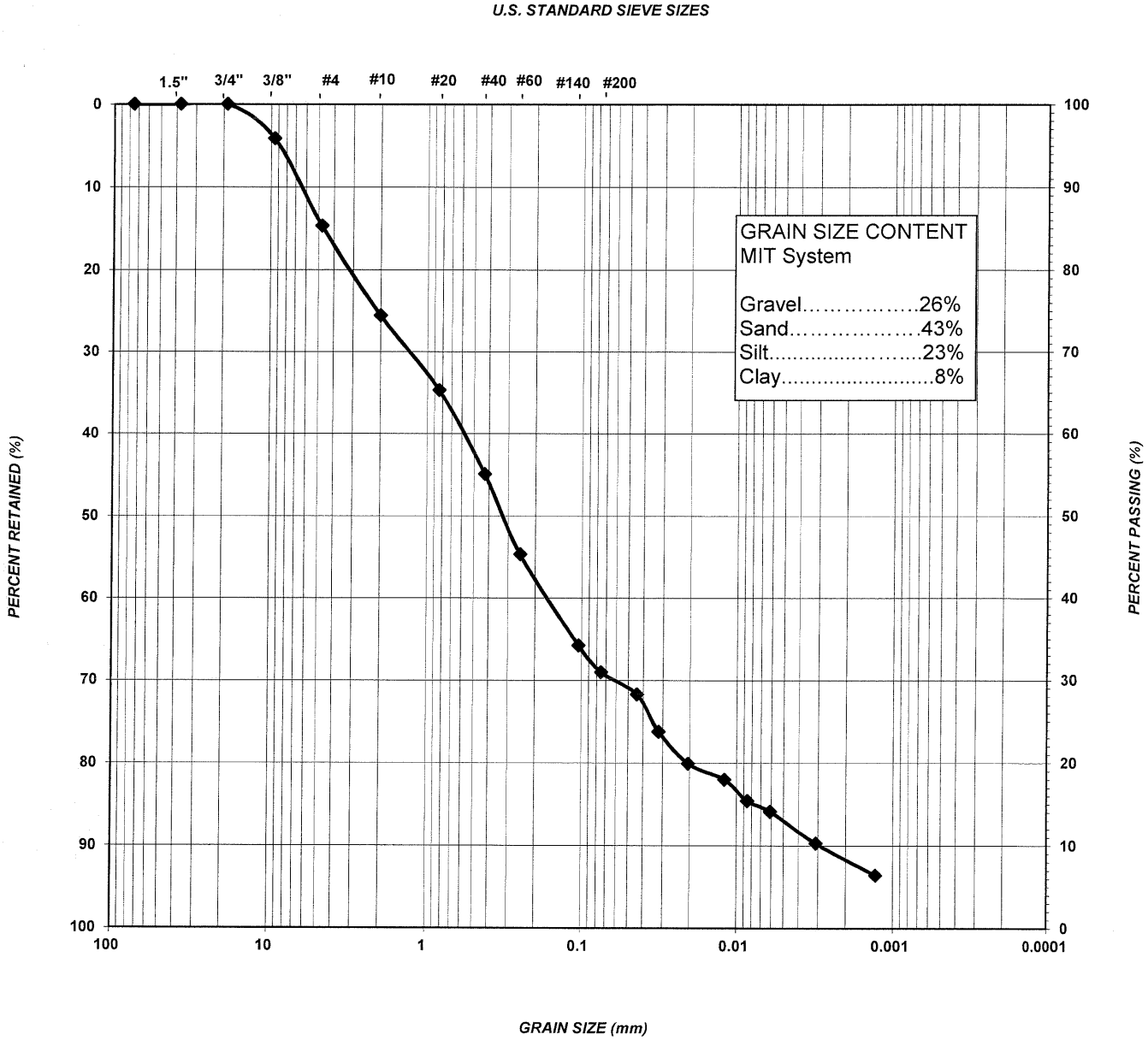
Terraprobe

SIEVE AND HYDROMETER ANALYSIS TEST REPORT

PROJECT: **2 Borland Street East**
LOCATION: **Orillia, ON**
CLIENT: **The Corporation of the County of Simcoe, Procurement, Fleet and Property**
BOREHOLE NUMBER: **10** SAMPLE DEPTH: **0 to 2'**
SAMPLE NUMBER: **1**
SAMPLE LOCATION: **as above**
SAMPLE DESCRIPTION: **Gravelly silty sand, trace clay**

FILE NO.: **3-18-0005**
LAB NO.: **1899b**
SAMPLE DATE: **Feb-28-18**
SAMPLED BY: **B.H.**

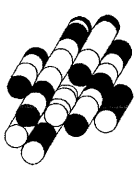
GRAIN SIZE DISTRIBUTION



MIT SYSTEM	GRAVEL	COARSE	MEDIUM	FINE	SILT	CLAY
		SAND				

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

APPENDIX



Terraprobe Inc.

Ontario — Ministry of the Environment and Climate Change

3-18-0005-01

Well Record for Well Cluster – Part 1 of 3

(Only for Multiple Test Holes or Dewatering Wells)

Regulation 903 Ontario Water Resources Act

Page 1 of 1

All measurements recorded in: ☐ Metric ☒ Imperial

Follow instructions on the front and back of this form. Print or Type

Well Tag No. of Deepest Well: *(Print Well Tag No.)* A235881

Well No. on Drawing of Deepest Well: ~~4~~ 6

☐ Dewatering wells

☒ Test holes

No. of wells reported 10

Well Cluster Location Information

Address of Well Location (Street Number(s)/Name(s), RR, if available)	Lot(s)	Concession(s)	Geographic Township	County/District/Upper Tier Municipality
#2 BORELAND ST. E				SIMCOE COUNTY

City, Town, Village or Hamlet	Province	GPS Unit Make	Model	Unit Mode of Operation
ORILLIA.	Ontario			☐ Undifferentiated ☐ Averaged ☐ Differentiated, specify:

Mandatory Attachments/Additional Information

☒ Land Owner Consent Form must be attached.

☒ Detailed Drawing of All Well Locations must be attached.

I, the person constructing the well, will promptly submit to the Director, on request, any additional information in my custody or control related to any well in the well cluster that I have constructed.

Signature of Technician/Contractor — Date (yyyy/mm/dd): 2018/03/19

Well Details

Well # on Drawing	UTM Coordinates Zone	Easting	Northing	Hole Depth (m/ft)	Hole Diameter (cm/in)	Method of Construction	Casing Material; Diameter (cm/in)	Casing (m/ft) From	Casing (m/ft) To	Screen Interval (m/ft) From	Screen Interval (m/ft) To	Annular Space Material (m/ft) From	Annular Space Material (m/ft) To	Annular Space Material: Material:	Overburden/Bedrock or Abandonment Filing Material Intervals (m/ft)	Static Water Level (m/ft)	Date of Completion (yyyy/mm/dd)
BH6	17	622489	4941503	20	8.5	Auger	2"	10	0	20	10	0 1	1 20	TOPSOIL SILT TILL	SILICA SAND FROM 20FT TO 9FT. HYDRATED BENTONITE FROM 9FT TO 0FT	—	2018/02/27
BH4	17	622494	4941541	20	8.5	Auger	2"	10	0	20	10	0 1	1 20	TOPSOIL SILT TILL	SILICA SAND FROM 20 TO 9FT HYDRATED BENTONITE FROM 9 TO 0	—	2018/02/27
BH5	17	622497	4941517	20	8.5	Auger	2"	10	0	20	10	0 1	1 20	TOPSOIL SILT TILL	SILICA SAND FROM 20 TO 9 HYDRATED BENTONITE FROM 9 TO 0	—	2018/02/27
BH10	17	622492	4941477	20	6.5	Auger	1.25	15	+3	20	15	0 3	3 20	FILL SILT TILL	SILICA SAND FROM 20 TO 14 HYDRATED BENTONITE FROM 14 TO 0	—	2018/02/26
BH8	17	622501	4941418	20	6.5	Auger	1.25	15	+3	20	15	0 3	3 20	FILL SILT TILL	SIL SAND FROM 20 TO 14 HYD BENT CHIPS 14 TO 0	—	2018/02/26
BH9	17	622503	4941536	20	6.5	Auger	1.25	15	+3	20	15	0 3	3 20	FILL SILT TILL	SILICA SAND 20 TO 14 HYDRATED BENTONITE 14 TO 0	—	2018/02/26
BH3	17	622485	4941557	20	6.5	Auger	1.25	15	+3	20	15	0 3	3 20	FILL SILT TILL	SILICA SAND 20 TO 14 HYDRATED BENTONITE 14 TO 0	—	2018/02/26
BH7	17	622498	4941601	20	6.5	Auger	1.25	15	+3	20	15	0 3	3 20	FILL SILT TILL	SILICA SAND 20 TO 14 HYDRATED BENTONITE 14 TO 0	—	2018/02/28
BH1	17	622481	4941677	20	6.5	Auger	1.25	15	+3	20	15	0 1	1 20	TOPSOIL SILT TILL	SILICA SAND 20 TO 14 HYDRATED BENTONITE 14 TO 0	—	2018/02/28
BH2	17	622485	4941639	20	6.5	Auger	1.25	15	+3	20	15	0 1	1 20	TOPSOIL SILT TILL	SILICA SAND 20 TO 14 HYDRATED BENTONITE 14 TO 0	—	2018/02/28

Well Contractor and Well Technician Information

LONDON SOIL TEST LTD.
712078 Southgate Sdrd. 71, RR #6
Dundalk, ON N0C 1B0
519-455-5777 info@londonsoil.com

Business Name of Well Contractor	Business Address (Street Number/Name, RR)	Municipality	Province

Contractor's Licence No.	Business E-mail Address
7190	

Name of Well Technician (First Name, Last Name)	Well Technician's Licence No.	Signature of Well Technician	Date Submitted (yyyy/mm/dd)
Mike WATTS	1471		2018/03/19

Date First Well in Cluster Constructed or Abandoned (yyyy/mm/dd)	Date Last Well in Cluster Completed (yyyy/mm/dd)
2018/02/26	2018/02/28

Well Abandonment

Person Abandoning the Wells:

Name _____
(Print or Type) - See instruction 11 on the back of this form

Ministry Use Only

Date Received (yyyy/mm/dd)	Audit No.
	C 39464

Comments:

Well Owner's Copy

Well Owner Information Package

Protect your health and our shared groundwater

Now that you have a well on your property, you are legally responsible for the proper maintenance and abandonment (plugging and sealing) of your well.

A poorly maintained or improperly abandoned well could result in contaminated well water and groundwater, and it could affect your health.

The following tips will help you protect your well:

- Test the quality of your well water on a regular basis and look for changes in the water's appearance (e.g. colour, taste, odour)
- Keep surface water and foreign materials (e.g. insects and mice) from entering the well by securing the well cap in place and checking your well regularly for signs of rust and wear, cracks, holes or gaps in the well's structure
- If materials get in your well, safely remove them
- Keep ponded water, vehicles, pet waste, salt and fertilizer away from the well
- Make sure the ground around your well slopes away from your well
- Ensure the well is accessible for future repairs and maintain the minimum above ground height (typically 40 cm above the surface)
- Check for and identify abnormal sounds. They could indicate wear on the well's pump, waterlines or electrical cables or other issues
- Check the pump's efficiency. If the pump is continually running or losing pressure, it may be a sign of a crack or hole in the waterlines
- Ensure your septic tank system works and is pumped out regularly to prevent contamination of your well water

For information on testing the quality of your well water, visit:

- publichealthontario.ca (search "water testing") to request a drinking water sample collection kit for free bacterial testing
- ontario.ca/page/list-licensed-laboratories to find a licensed laboratory for chemical testing (note: laboratories charge a fee for this service)

Inspecting your well can be dangerous work. If you are not familiar with wells, let an experienced and licensed well technician do the work.

Ontario

Before inspecting a well, make sure to:

- Shut off the power supply to the pump
- Assess the structure of the well and nearby ground to make sure they are stable before approaching the well
- Carefully remove the well cap and take all necessary precautions to make sure people and animals cannot fall into the well

If you no longer use your well or aren't maintaining it for future use as a well, it must be properly abandoned (plugged and sealed).

If you have a water quality or quantity problem or your well is in need of repair, upgrade or abandonment, see the licensed well contractor list on ontario.ca/findwellcontractors.

For more information on properly maintaining or abandoning your well:

- visit ontario.ca/propertywells
- call 1-888-396-9355 (WELL)
- email wellshelpdesk@ontario.ca

For more information on your legal obligations, the Wells Regulation (under the Ontario Water Resources Act) is available at ontario.ca/laws.

Oct. 15, 2017

Ontario