Preliminary Geotechnical Investigation
Proposed Condominium
71 – 79 Main Street South
Georgetown, Ontario

Client

Silvercreek Commercial Builders Inc.
66 Mill Street
Georgetown, Ontario
L7G 3H7

Attention: Mr. Don Jackson

Project Number

BRM-00603467-B0

Prepared By:

Exp Services Inc.
1595 Clark Boulevard
Brampton, ON L6T 4V1
Canada

Date Submitted

May 9, 2013

Table of Contents

1. Introduction

This report presents the results of a Preliminary Geotechnical Investigation carried out at the site for a proposed condominium development in Georgetown, Ontario. The work was authorized by Mr. Don Jackson of Silvercreek Commercial Builders Inc.

The Site is located at 71 – 79 Main Street South in Georgetown, Ontario. It is irregular in shape and is located at the northeast corner of Main Street South and Mill Street in Georgetown. The western half of the site is currently occupied by existing buildings while the eastern half is open and currently used as paved parking area.

The purpose of the preliminary geotechnical investigation was to determine the subsurface soil and groundwater conditions at the site by drilling a limited number of boreholes and, based on this information, to provide an engineering report with preliminary assessments for the geotechnical aspects of the future development.

The comments and recommendations given in this report are considered to be general in nature for the site currently under investigation. Once the proposed development scheme is finalized, additional boreholes/investigation should be carried out to further established a detailed subsoil and groundwater conditions for the proposed development.

A Phase II Environmental Site Assessment (ESA) was carried out in conjunction with the preliminary geotechnical investigation. The Phase II ESA will be reported under separate cover.

2. Procedure

Drilling and sampling operations, carried out in the period of April 16 to 21, 2014, were completed by a combination of auger and split-spoon techniques using truck mounted equipment owned and operated by a specialist contractor.

For this investigation, a total of four (4) boreholes were drilled to depths of about 14.2 to 14.3 m below existing ground surface. The approximate borehole locations are shown on the attached Borehole Location Plan (Drawing No. 1).

Prior to the commencement of drilling operations, public utility companies were contacted to provide service clearance for the borehole drilling. In addition, a private locator was employed to scan around each borehole location to minimize the risk of contacting any buried services during the drilling operations.

The boreholes were completed by a combination of auger and split-spoon techniques using track mounted equipment owned and operated by a specialist contractor. A representative of **exp** was present throughout the fieldwork operation to monitor and direct the drilling and test pit operations, and to record information revealed. In the drilling operation, representative samples of the subsurface soils were recovered at regular intervals using conventional 50 mm O.D. split spoon sampling equipment driven in accordance with Standard Penetration Test procedures (ASTM D1586). All recovered split spoon samples were returned to **exp**'s Brampton laboratory for detailed evaluation. Laboratory testing included moisture content determinations on selected samples.

A Dynamic Cone Penetration Test (DCPT) was performed adjacent to Boreholes 1, 2 and 4 starting from about a depth of about 9 m below existing ground surface. This test consists of driving a 51 mm diameter, 60 degree apex steel cone, attached to A-size (41.3 mm diameter) drill rod(s), into the undisturbed ground without casing and by applying the same energy as in the Standard Penetration Test. The number of blows to advance the cone each 30.5 cm (1 foot) is recorded and the result of the test is a continuous record of the driving resistance which indicates variations in the relative density (compactness condition) of the subsurface deposits. The DCPT results are shown on the attached borehole logs.

The groundwater conditions at the site were assessed by observing the water levels in the open boreholes during the course of the fieldwork. Monitoring wells and piezometers were installed in three (3) selected boreholes for subsequent water level monitoring and groundwater sampling.

The locations and ground surface elevation of the boreholes were determined in the field by **exp** Services Inc. The ground surface elevation of each borehole was referenced to the top of a sanitary manhole which is shown to have an elevation of El. 249.09 m (Geodetic) on a survey plan provided by the client. The survey plan was issued by Dolliver Surveying Inc., File No. 1488-3, dated February 21, 2014.

3. Site Description

The Site is located at 71 – 79 Main Street South in Georgetown, Ontario. It is irregular in shape and is located at the northeast corner of Main Street South and Mill Street in Georgetown. The western half of the site is currently occupied by existing buildings while the eastern half is open and currently used as paved parking area.

4. Subsurface Conditions

The detailed soil profiles encountered in each borehole and the results of moisture content and unit weight determinations are indicated on the attached borehole logs. It should be noted that the soil boundaries indicated on the borehole logs are inferred from non-continuous sampling and observations during drilling. These boundaries are intended to reflect approximate transition zones for the purpose of geotechnical design and should not be interpreted as exact planes of geological change.

The "Notes on Sample Description" preceding the borehole logs form an integral part of and should be read in conjunction with this report.

The following is a brief description of the soil conditions encountered during the investigation:

Asphalt

Asphalt with thicknesses of about 40 to 75 mm was encountered at ground surface at all borehole locations.

Fill

Fill ranging from sand and gravel to clayey silt with brick fragments was encountered below the asphalt cover at all borehole locations. Pieces of plastic, glass and metal were noted in the fill in Borehole 2. The fill extends to about 2.4 to 4.0 m below existing ground surface (El. ~247.0 to 245.6 m).

Sand and Gravel

A sand and gravel deposit was encountered below the fill in Boreholes 1 and 3 and was "sandwiched" between the upper and lower sand in Boreholes 2 and 4. The sand and gravel deposit is brown in colour, exists in a moist to wet condition and has a compactness of compact to very dense. The sand and gravel deposit extends to depths of about 8.5 m in all boreholes (El. 241.4 to 240.6 m).

A lower sand and gravel layer was encountered in Borehole 2 between depths of about 11.0 and 11.8 m below existing grade. This material contains cobbles, is wet and exists in a dense state.

Sand

An upper sand deposit was encountered below the fill in Boreholes 2 and 4. This material is fine to medium grained, contains some gravel and exists in a compact to very dense state (recorded "N"-values ranging from 17 to 58). This upper sand deposit extends to about 5.5 m below existing ground surface (El. ~243.6 to 243.9 m).

A lower sand deposit was encountered below the sand and gravel in all borehole locations. This deposit is fine to medium grained in upper level and becomes finer grained with depth. The sand is moist and becomse wet at about 11.0 to 11.5 m depth. With recorded "N"-values ranging from 14 to 53, the lower sand deposit is in a compact to very dense state. The lower sand deposit extends to depths of about 11.0 to 14.3 m (El. ~238.1 to 235.0 m). Boreholes 1, 3 and 4 were terminated in the lower sand deposit at a depth of about 14.3 m below existing ground surface.

Silty Sand

In Borehole 2, the lower sand and gravel was underlain by a silty sand deposit. This deposit is fine grained, brown in colour and wet. The silty sand deposit exists in a compact state (recorded "N"-values ranging from 11 to 14) and extends to the termination depth of about 14.3 m below existing grade (El. ~234.7 m).

Groundwater Conditions

Groundwater conditions were assessed by taking readings in open holes during the course of the fieldwork. Subsequent water level monitoring was carried out in monitoring wells and piezometers installed in Boreholes 1, 2 and 4. Short-term observations are recorded on the attached borehole logs and summarized in Table 1 below.

Table 1: Summary of Observed Groundwater Levels

Borehole Number	Completion Date	Depth to Groundwater Level Below Existing Grade (m)			
		April 17, 2014	April 21, 2014	April 28, 2014	May 8, 2014
1	April 17, 2014	N/A	11.6	11.6	11.5
2	April 16, 2014	11.0	10.9	10.9	10.8
3	April 17, 2014	N/A	N/A	N/A	N/A
4	April 17, 2014	N/A	11.0	10.9	10.8

Seasonal fluctuations in groundwater levels should be anticipated.

5. Geotechnical Assessment

The Site is located at 71 – 79 Main Street South in Georgetown, Ontario. It is irregular in shape and is located at the northeast corner of Main Street South and Mill Street in Georgetown. The western half of the site is currently occupied by existing buildings while the eastern half is open and currently used as paved parking area.

It is our understanding that the preliminary development plan comprises a condominium structure of 10-storey high with 2.5 levels of underground parking. It is further understood that the development plan had not yet been finalized.

The following sub-sections provide preliminary geotechnical guidelines for the design and construction of the proposed development.

5.1 Foundation Considerations

For the proposed structure with 2.5 levels of underground parking, it is anticipated that the foundations will be set at about 8 to 10 m below existing grade, i.e. El. 239.5 to 241.5 m (assuming the ground elevation is at El. 249.5 m). Soils at this level comprise either the native dense to very dense sand and gravel or the compact to very dense sand. It is considered that the proposed structure may be supported on spread and strip footings. For preliminary design purposes, a SLS bearing resistance of 300 kPa and factored ULS bearing value of 450 kPa may be used. It is recommended that the footings be founded above the observed groundwater level to minimize extensive dewatering requirements during construction.

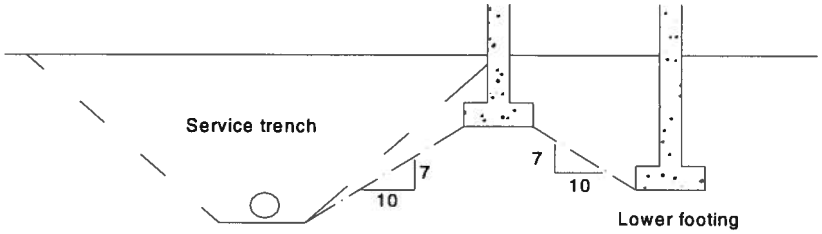
Since the boreholes only covered approximately half of the site area. Once the development plan is finalized and the existing building is demolished, it is recommended that a detailed investigation be carried out to further determine the subsurface soil and groundwater conditions for the proposed development.

5.2 Foundations General

Footings at different elevations should be located such that higher footing is set below a line drawn up at 10 Horizontal to 7 Vertical from the near edge of the lower footing. This concept should also be applied to excavations for new foundations in relation to existing footings or underground services.

All footings exposed to freezing conditions must be provided with a minimum of 1.2 m of earth cover or equivalent insulation for frost protection, depending on the final grade requirements.

Provided that the soil is not disturbed due to groundwater, precipitation, traffic, etc., and the aforementioned bearing pressure is not exceeded, then total and differential settlements should be small and within the normally tolerated limits of 25 mm and 19 mm, respectively.



FOOTINGS NEAR SERVICE TRENCHES OR AT DIFFERENT ELEVATIONS

The recommended bearing capacities have been calculated by **exp** from the borehole information for the design stage only. The investigation and comments are necessarily on-going as new information of underground conditions becomes available. For example, it should be appreciated that modifications to bearing levels may be required if unforeseen subsoil conditions are revealed after the excavation is exposed to full view or if final design decisions differ from those assumed in this report. For this reason this office should be retained to review final foundation drawings and to provide field inspections during the construction stage.

5.3 Temporary Shoring

For the proposed structure with 2.5 basement levels, it is anticipated that the excavation will extend up to about 10 m below existing grade and temporary shoring may be required. For the most part, the temporary shoring system will be retaining the fill, upper sand and sand and gravel deposits.

The excavation is expected to terminate above the groundwater table (shown to be about 10.9 to 11.6 m depth (El. ~238.0 to 238.5 m) from the borehole findings). A soldier pile and lagging system can be used and minor seepage from the overburden granular deposits should be anticipated. The lagging boards should retain all soil while allowing groundwater seepage to drain from behind. To accomplish this, the spaces behind the lagging boards and any spaces between the lagging boards should be lined with a filter fabric secured on the lagging board and the annular space filled with the excavated granular materials. A Terrafix 370RS or equivalent filter fabric should be used in this application. Insulated blankets should be provided for the winter months to prevent ice built up in the sand layer behind the lagging.

Assuming that the lagging boards will be installed in 1.2 m lifts, the filter fabric should be nailed to the excavated face of the lowest lagging and then line the fabric up behind the lagging in a continuous sheet. At the junction of the upper lagging, the spaces should be filled with filter fabric so that no soil particles can escape from behind the lagging boards. Where the groundwater flow is significant, localized dewatering and the use of shallower lifts should be carried out.

The temporary shoring of the soil boundaries for this project should be designed on the basis of the state-of-the-art information given in the latest edition of the Canadian Foundation Engineering Manual (CFEM). The parameters that are considered to be applicable for this project and have been used successfully on many other deep excavations in the downtown area are as follows:

Earth pressure coefficient

= 0.25 (where small movements permissible)

= 0.35 (where utilities, roads, sidewalks must be protected from significant movement, or where vibration from traffic is a factor)

= 0.40 (where adjacent building footings or movement sensitive services, i.e., gas and water mains, are above a line 60 degrees from the horizontal extending from the bottom edge of the excavation)

Approximate soil unit weight (γ) = 22.0 kN/m^3

Bond resistance for soil anchors in sand = 75 kPa*

* For regroutable anchors, the effective bond resistance will be higher. This will have to be designed and verified by the shoring designer / contractor.

A rectangular pressure distribution as outlined in the CFEM can be used for calculating the earth pressures. If the shoring system does not extend up to the top of the ground, the sloped bank should either be treated as a surcharge to the shoring system or alternatively, a higher K_a value, reflecting the sloping ground, should be used.

Due to the presence of sandy native deposits, all tieback holes should be cased to minimize loss of soil during the tieback installation and re-groutable type anchors would likely be more cost effective than the conventional soil anchors.

The recommended design parameters should be confirmed by load testing a number of anchors to 200% design load in accordance with the current edition of the CFEM. As a minimum for this site, at least four 200% anchor load tests, two in the upper level and two in the lower level, should be carried out to verify the capacity of the anchors. The design for the production anchors should then be modified based on the test results, where necessary. All remaining anchors must be installed in similar procedures and proof tested to 1.33 times the design load.

It is recommended that the contract have a performance specification limiting movement. A maximum of 13 mm is generally acceptable for a street where movement sensitive utilities are not nearby. Otherwise, the engineering departments of the utility companies must be contacted to assess what movement is acceptable. Anchor spacing and elevation, and the timing of the excavation and anchoring operations are critical in determining the movements.

Exp should be retained to review the shoring design, to monitor installation and testing of the system, and to monitor the shoring movements during all phases of the excavation. Inclinometers should be installed at locations where sensitive buildings or services lie close to the excavation. Careful monitoring is needed in any shored excavation, especially when buildings are located in close proximity. This is necessary not only to anticipate when and if additional support is needed, but also to provide data to mitigate possible claims from adjacent property owners. In this regard, it is essential that detailed precondition surveys be made on adjacent infrastructures.

5.4 Excavations and Groundwater Control

Excavation for the proposed structure can be carried out utilizing conventional hydraulic type backhoe and must be carried out in accordance with the latest edition of the Occupational Health and Safety Act (OHSA). The soil encountered at this site can be classified as follows:

- Fill: Type 3
- Sand, Sand and Gravel: Type 3 (above groundwater table or dewatered)
- Sand, Sand and Gravel: Type 3 (below groundwater table)

Provided the excavation does not extend below the groundwater table (El. ~238.0 to 238.5 m), no major groundwater control is required. Some seepage of free water perched in the fill or from the native sand deposit should be anticipated during construction. Depending on the groundwater conditions at the time of construction, it may be possible to control and remove any such seepage by pumping from temporary sumps.

A positive dewatering system should be installed to lower the groundwater table to facilitate construction if the excavation is required to extend below the groundwater table (i.e. elevator shaft, etc.). The dewatering system should be designed and installed by an experienced specialist contractor who can provide an estimate of time to dewater the site and the amount of groundwater anticipated.

The actual groundwater condition at the time of construction should be established to verify the suitability and/or adequacy of the proposed dewatering system in the context of the actual design of the project. **Exp** Services Inc. will be pleased to review and comment on the contractor's proposed dewatering system.

5.5 Unheated Garage

There is no official rule governing the required founding depth for footings below unheated basement floors. Certainly it will not be greater than the 1.2 m required in Southern Ontario for exterior footings. Unmonitored experience in the last few years indicates that a shallower depth of 0.9 m for interior column footings and 0.4 m for wall footings has been successful where 2 or more basement levels apply. Adjacent to air shafts and entrance and exit doors, a footing depth of 1.2 m below floor surface level is required or, alternatively, insulation protection must be provided.

It should be emphasized that adequate perimeter drainage or equivalent frost insulation is essential in order to prevent frost action which could be detrimental to structures. It is also emphasized that underfloor drainage and/or an adequate free draining gravel base is required to minimize the risk of floor dampness. Floor dampness could lead to temporary icing and the risk of accidents.

5.6 Backfill Considerations

Backfill used to satisfy underfloor slab requirements, in footings and service trenches, etc., should be compactible fill, i.e., inorganic soil with its moisture content close to its optimum moisture content determined in the standard Proctor maximum dry density test. For ease of compaction and quality control in confined areas, sand fill, such as Ontario Provincial Standard Specifications (OPSS) 1010 Granular 'B' is recommended. The backfill should be placed in lifts not more than 200 mm thick in the loose state, each lift being compacted to at least 98 per cent Standard Proctor maximum dry density, before subsequent lifts are placed. The degree of compaction achieved in the field should be checked by in-place density tests.

The excavated sand and sand and gravel may be reuse as backfill. Some water content adjustment may be required for efficient compaction. Where free-draining backfill is required, or in confined areas, imported granular such as OPSS Granular B is recommended.

5.7 Floor Slabs and Permanent Drainage

For the proposed structure with 2.5 levels of basement, normal slab-on-grade construction is feasible and may be carried out in accordance with the following recommendations. Prior to the slab-on-grade construction, all disturbed materials should be removed from the underfloor area. Any over excavated areas should be brought up to design grades using approved compactible fill in the manner described in the "Backfill Considerations" section of this report.

A 200 mm layer of 19 mm clear stone should be placed between the prepared subgrade and the floor slab to serve as a moisture barrier.

As the proposed structure will have 2.5 levels of basement, perimeter and underfloor drainage will be required. Since the excavation will probably come up to the boundary limits, commercially available wall drains, such as Terradrain 600, will be required. The wall drains should extend continuous laterally and from about 1.0 m below ground level to the base of the excavation. Prior to placing the wall drains, a Terrafix 600R or equivalent filter fabric should be nailed to the lagging to minimize the risk of plugging the wall drains. A suggested perimeter drainage system against shoring is shown on the enclosed Drawing No. 6: Suggested Exterior Drainage Against Soldier Pile and Lagging Shoring System. Full coverage of the basement walls is recommended.

A solid pipe should be installed to within 1 m of the exterior wall to collect seepage from the wall drains. Underfloor drains and perimeter drains should not be connected into the same collector pipe. Further comments can be provided once design plans are finalized.

For basement slab founded on the sand deposit and above the groundwater table, one row of underfloor drainage pipe per bay installed in the subgrade should suffice based on the preliminary borehole information. A suggested underfloor drainage system is shown on the enclosed Drawing No. 7: Basement Drainage Drawing. A filter fabric should be provided over the prepared subgrade and a 200 mm thick layer of 19 mm clear stone should be placed between the filter fabric and the floor slab to serve as a moisture barrier.

Underfloor drainage pipes should be installed in the upper portion of the subgrade below the clear stone and filter fabric. To prevent loss of fine particles into the drainage system, the filter fabric wrapped drainage pipes should be wrapped with a double layer of filter fabric, Terrafix 600R or equivalent, and surrounded by at least 200 mm concrete sand in all direction. The entire underfloor drainage assembly should then be wrapped with an exterior layer of filter fabric during installation in drainage trenches.

Around the perimeter of the building the ground surface should be sloped on a positive grade away from the structure to promote surface water run-off and reduce groundwater infiltration adjacent to the foundations.

5.8 Earth Pressure

The lateral earth pressure acting on basement walls may be calculated from the following equation:

$$p = K(\gamma h + q)$$

where p = lateral earth pressure in kPa acting at depth h;

K = earth pressure coefficient a value of 0.4 is recommended;

γ = unit weight of retained soil, a value of 22 kN/m^3 is recommended

h = depth to point of interest in m; and

q = equivalent value of any surcharge on the ground surface in kPa.

The above expression assumes that the perimeter drainage system is effective to prevent the build-up of any hydrostatic pressure behind the perimeter walls. If water is retained such as in the case of the use of a contiguous caisson wall, submerged unit weight can be used for the retained soil below the groundwater table and full hydrostatic pressure should be added to the above equation. All subsurface walls should be waterproofed.

5.9 Earthquake Considerations

The recommendations for the geotechnical aspects to determine the earthquake loading for design using the OBC 2012 are presented below.

Subsoil Conditions

The subsoil and groundwater information at this site have been examined in relation to Section 4.1.8.4 of the OBC 2012. The subsoil generally consisted of fill, sand and sand and gravel. For the proposed structure with 2.5 basement levels, the foundation will likely be conventional spread and strip footings founded on the native sand deposit.

Depth of Boreholes

Table 4.1.8.4.A. Site Classification for Seismic Site Response in OBC 2006 indicated that to determine the site classification, the average properties in the top 30 m (below the lowest basement level) are to be used. The boreholes advanced at this site ranged from about 14.2 to 14.3 m depth. Therefore, the site classification recommendation would be based on the available information as well as our interpretation of conditions below the boreholes based on our knowledge of the soil conditions in the area.

Site Classification

For the proposed structure with 2.5 level of underground parking, it is anticipated that the lowest basement floor slab of the proposed structure will be set at about 8 to 10 m below existing grade (El. ~239.5 to 241.5 m assuming the existing ground surface elevation is El. 249.5 m) and the proposed structure will be supported on conventional spread and strip footings founded on the native compact to dense sand.

Based on the above assumptions, interpretations in combination with the known local geological conditions, the Site Class for the proposed structure is "D" as per Table 4.1.8.4.A, Site Classification for Seismic Site Response, OBC 2012.

5.10 Subsurface Concrete Structures

A representative soil sample was analyzed for pH and sulphate concentrations and the test results are summarized in Table 2 below:

Table 2: Summary of pH and Sulphate Test Results

Sample Identification	Sample Location	pH	Sulphate (µg/g)
BH1 SS6 (VP2728)	Borehole 1 – 4.0 to 4.3 m	7.87	130

The sulphate content of the samples analyzed indicates a negligible degree of sulphate attack on buried concrete structures. The Certificate of Analysis is included in Appendix A.

For information regarding the selection of cement type for subsurface concrete structures, reference is made to CSA Standard CAN 3-A23.

6. General Comments

The information presented in this report is based on a limited investigation designed to provide information to support an overall assessment of the current geotechnical conditions of the subject property. The conclusions presented in this report reflect site conditions existing at the time of the investigation.

Exp Services Inc. should be retained for a general review of the final design and specifications to verify that this report has been properly interpreted and implemented. If not accorded the privilege of making this review, **exp** Services Inc. will assume no responsibility for interpretation of the recommendations in the report.

The preliminary comments given in this report are intended only for the guidance of design engineers. The number of boreholes required to determine the localized underground conditions between boreholes affecting construction costs, techniques, sequencing, equipment, scheduling, etc., would be much greater than has been carried out for design purposes. Contractors bidding on or undertaking the works should, in this light, decide on their own investigations, as well as their own interpretations of the factual borehole results, so that they may draw their own conclusions as to how the subsurface conditions may affect them.

The information contained in this report in no way reflects on the environmental aspects of the soils, which has not been addressed as this is beyond our terms of reference for the preliminary geotechnical investigation. More specific information, with respect to the conditions between samples, or the lateral and vertical extent of materials, may become apparent during excavation operations. Consequently, during the future development of the property, conditions not observed during this investigation may become apparent; should this occur, **exp** Services Inc. should be contacted to assess the situation and additional testing and reporting may be required. **exp** Services Inc. has qualified personnel to provide assistance in regards to future geotechnical and environmental issues related to this property.

We trust this report is satisfactory for your purposes. Should you have any questions, please do not hesitate to contact this office.

exp Services Inc.

LICENSED PROFESSIONAL ENGINEER
K. W. Y. LEUNG
May 9, 2014
PROVINCE OF ONTARIO

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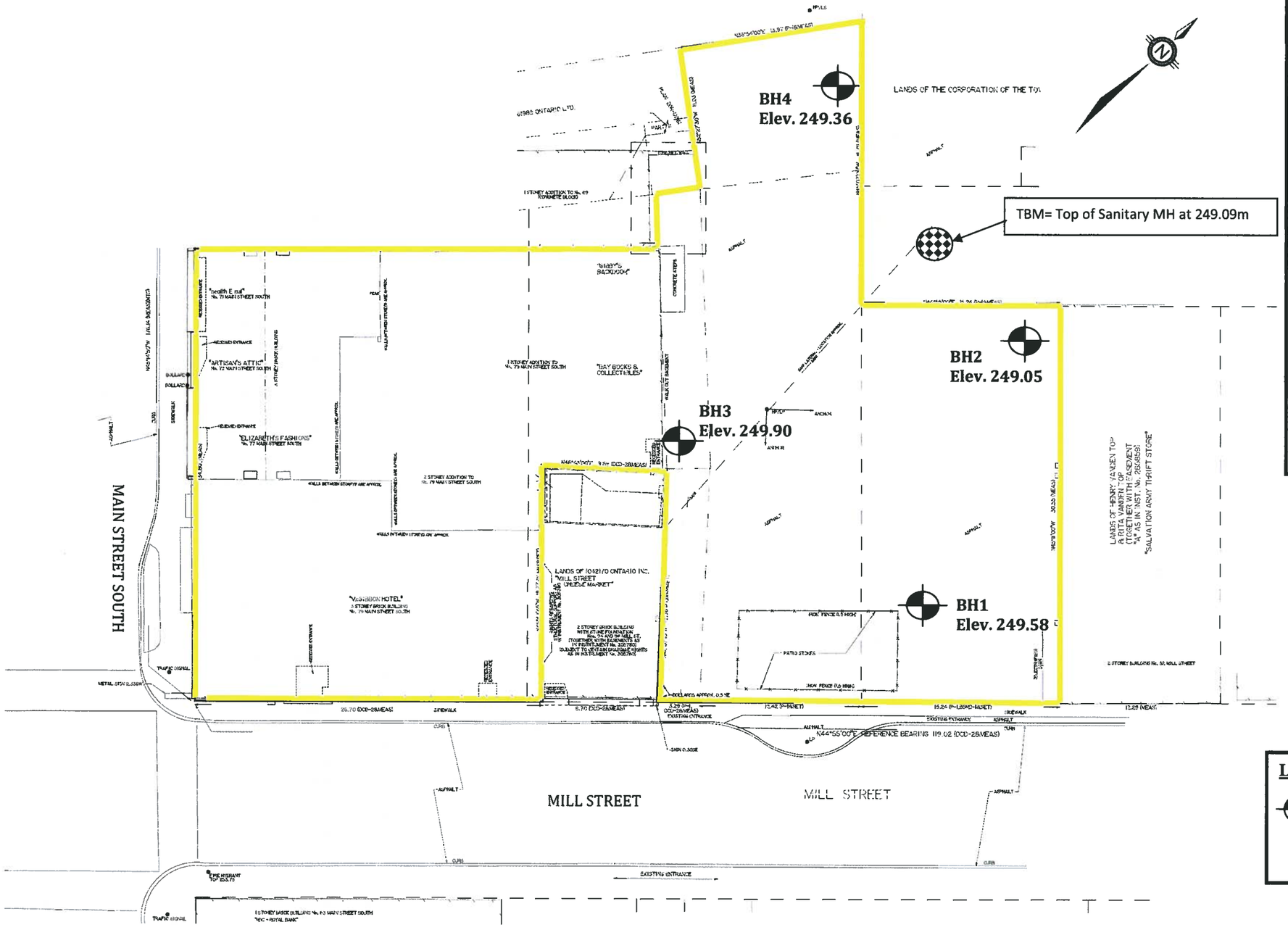
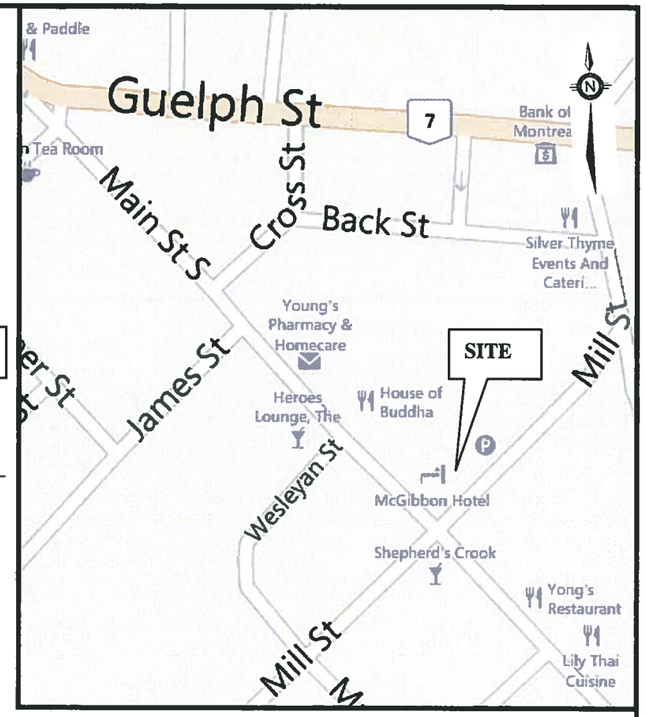
Drawings





Legend

Approximate Borehole Location

Scale (m)

0 15

exp Services Inc.
1595 Clark Boulevard
Brampton, Ontario
L6T 4V1
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Fax: (905) 793-0641

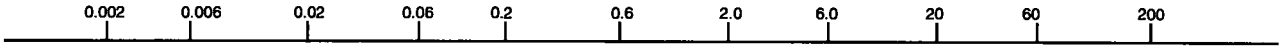
SCALE: As shown		**Borehole Location Plan** Preliminary Geotechnical Investigation 71-79 Main Street South Georgetown, Town of Halton Hills, Ontario	
DATE: April 2014			
DWN.:AA	**CHKD.:**	**PROJECT NO.:** BRM-00603467-B0	**DWG. NO.: 1**

Notes On Sample Descriptions Drawing 1A

1. All sample descriptions included in this report follow the Canadian Foundations Engineering Manual soil classification system. This system follows the standard proposed by the International Society for Soil Mechanics and Foundation Engineering. Laboratory grain size analyses provided by **exp** Services Inc. also follow the same system. Different classification systems may be used by others; one such system is the Unified Soil Classification. Please note that, with the exception of those samples where a grain size analysis has been made, all samples are classified visually. Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems.

ISSMFE SOIL CLASSIFICATION

CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE		



EQUIVALENT GRAIN DIAMETER IN MILLIMETRES

CLAY (PLASTIC) TO	FINE	MEDIUM	CRS.	FINE	COARSE
SILT (NONPLASTIC)	SAND			GRAVEL	

UNIFIED SOIL CLASSIFICATION

2. Fill: Where fill is designated on the borehole log it is defined as indicated by the sample recovered during the boring process. The reader is cautioned that fills are heterogeneous in nature and variable in density or degree of compaction. The borehole description may therefore not be applicable as a general description of site fill materials. All fills should be expected to contain obstruction such as wood, large concrete pieces or subsurface basements, floors, tanks, etc.; none of these may have been encountered in the boreholes. Since boreholes cannot accurately define the contents of the fill, test pits are recommended to provide supplementary information. Despite the use of test pits, the heterogeneous nature of fill will leave some ambiguity as to the exact composition of the fill. Most fills contain pockets, seams, or layers of organically contaminated soil. This organic material can result in the generation of methane gas and/or significant ongoing and future settlements. Fill at this site may have been monitored for the presence of methane gas and, if so, the results are given on the borehole logs. The monitoring process does not indicate the volume of gas that can be potentially generated nor does it pinpoint the source of the gas. These readings are to advise of the presence of gas only, and a detailed study is recommended for sites where any explosive gas/methane is detected. Some fill material may be contaminated by toxic/hazardous waste that renders it unacceptable for deposition in any but designated land fill sites; unless specifically stated the fill on this site has not been tested for contaminants that may be considered toxic or hazardous. This testing and a potential hazard study can be undertaken if requested. In most residential/commercial areas undergoing reconstruction, buried oil tanks are common and are generally not detected in a conventional geotechnical site investigation.

3. Till: The term till on the borehole logs indicates that the material originates from a geological process associated with glaciation. Because of this geological process the till must be considered heterogeneous in composition and as such may contain pockets and/or seams of material such as sand, gravel, silt or clay. Till often contains cobbles (60 to 200 mm) or boulders (over 200 mm). Contractors may therefore encounter cobbles and boulders during excavation, even if they are not indicated by the borings. It should be appreciated that normal sampling equipment cannot differentiate the size or type of any obstruction. Because of the horizontal and vertical variability of till, the sample description may be applicable to a very limited zone; caution is therefore essential when dealing with sensitive excavations or dewatering programs in till materials.

Log of Borehole 1

Project No. BRM-00603467-B0

Drawing No. 2

Project: Preliminary Geotechnical Investigation and Phase II ESA

Sheet No. 1 of 1

Location: 71 - 79 Main Street South, Georgetown, Ontario

Date Drilled: April 16 & 17, 2014

Drill Type: Hollow Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

Soil Description	ELEV. m
~50 mm **ASPHALT** over **FILL** - sand and gravel, some silt, trace black stains in upper level, brown, moist	249.58
- cobble layer between 1.2 and 1.5 m depth	248.1
FILL - clayey to sandy silt, trace gravel, trace clay pockets, occasional wet seams, trace rootlets, dark brown to brown, moist to very moist	
SAND and GRAVEL - brown, moist, compact to very dense	245.6
SAND - medium grained with occasional gravel in upper level, becoming silty below ~10 m depth, brown, moist, compact	241.1
- becoming wet below ~11.5 m depth	
End of Borehole	235.2

SPT (N Value) 20 40 60 80
Shear Strength kPa 100 200
Combustible Vapour Reading (ppm) 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30

Depth (m): 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14

SPT N values: 15, 15, 3, 6, 7, 16, 19, 55, 37, 28, 30, 18, 16

Notes:
1. Borehole advanced to completion at ~14.3 m depth by conventional soil sampling methods using a specialist drilling subcontractor. For borehole definitions, see notes prior to logs.
2. This drawing forms part of and must be read in conjunction with the subject report (Ref. No.: BRM-00603467-B0); borehole data requires interpretation assistance by exp professional staff before use by others.

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	11.6	13.3
After 4 days	11.6	Well
After 11 days	11.6	Well
After 21 days	11.5	Well

New identity of Trow Associates Inc.
Brampton

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Log of Borehole 2

Project No. BRM-00603467-B0

Drawing No. 3

Project: Preliminary Geotechnical Investigation and Phase II ESA

Sheet No. 1 of 1

Location: 71 - 79 Main Street South, Georgetown, Ontario

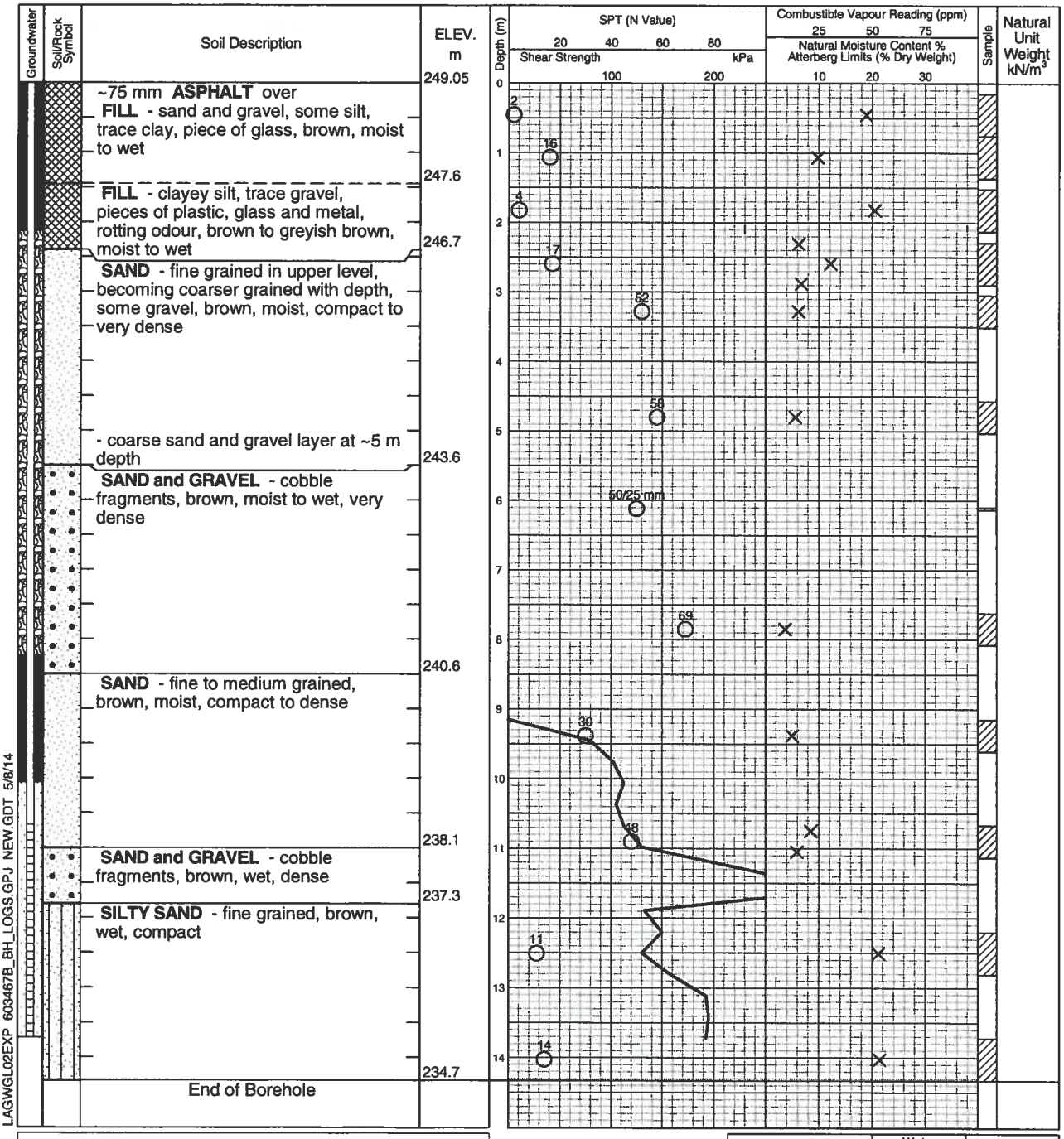
Date Drilled: April 16, 2014

Drill Type: Hollow Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



LAGWGL02EXP 603467B_BH_LOGS.GPJ NEW.GDT 5/8/14

Notes:
1. Borehole advanced to completion at ~14.3 m depth by conventional soil sampling methods using a specialist drilling subcontractor. For borehole definitions, see notes prior to logs.
2. This drawing forms part of and must be read in conjunction with the subject report (Ref. No.: BRM-00603467-B0); borehole data requires interpretation assistance by exp professional staff before use by others.

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	11.7	-
After 1 day	11.0	Piezo
After 5 days	10.9	Piezo
After 12 days	10.9	Piezo
After 22 days	10.8	Piezo

New identity of Trow Associates Inc.
Brampton

Log of Borehole 3

Project No. BRM-00603467-B0

Drawing No. 4

Project: Preliminary Geotechnical Investigation and Phase II ESA

Sheet No. 1 of 1

Location: 71 - 79 Main Street South, Georgetown, Ontario

Date Drilled: April 17, 2014

Drill Type: Hollow Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

Groundwater	Soil/Rock Symbol	Soil Description	ELEV. m	Depth (m)
		~40 mm **ASPHALT** over	249.90	0
		FILL - sand and gravel, some silt, brown, moist	249.6	
		FILL - silty sand, trace gravel, occasional brick fragments, trace cinders, black stained pocket from ~0.8 to 1.1 m depth, brown to black, moist to wet		1
				2
				3
			246.9	
		SAND and GRAVEL - brown, moist, compact to very dense		4
		- cobble layer between ~5 & 6 m depth		5
				6
				7
				8
			241.4	
		SAND - medium grained with occasional gravel in upper level, becoming silty below ~11 m depth, brown, moist, compact to dense		9
				10
				11
		- becoming wet below ~11.5 m depth		12
				13
			235.7	14
		End of Borehole		

SPT (N Value): 20 40 60 80
Shear Strength kPa: 100 200
Combustible Vapour Reading (ppm): 25 50 75
Natural Moisture Content % / Atterberg Limits (% Dry Weight): 10 20 30

SPT values: 15, 2, 4, 1, 12, 50/75 mm, 91/250 mm, 73, 29, 39, 29, 24

Sample | Natural Unit Weight kN/m³

LAGWGL02EXP 603467B_BH_LOGS.GPJ NEW.GDT 5/8/14

Notes:
1. Borehole advanced to completion at ~14.2 m depth by conventional soil sampling methods using a specialist drilling subcontractor. For borehole definitions, see notes prior to logs.
2. This drawing forms part of and must be read in conjunction with the subject report (Ref. No.: BRM-00603467-B0); borehole data requires interpretation assistance by exp professional staff before use by others.

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	No Free Water	5.2

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Brampton

Log of Borehole 4

Project No. BRM-00603467-B0

Drawing No. 5

Project: Preliminary Geotechnical Investigation and Phase II ESA

Sheet No. 1 of 1

Location: 71 - 79 Main Street South, Georgetown, Ontario

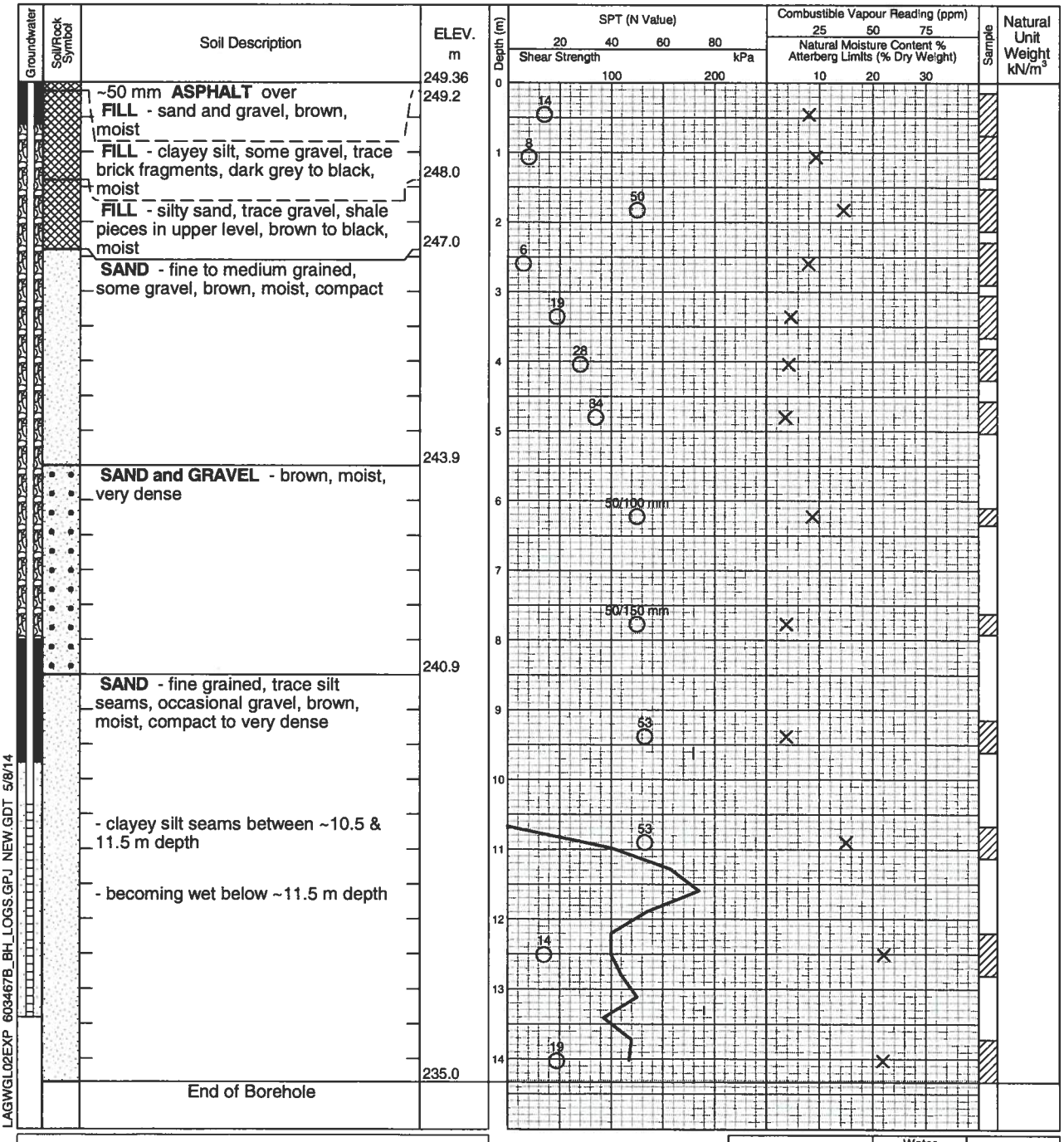
Date Drilled: April 17, 2014

Drill Type: Hollow Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



LAGWGL02EXP 603467B_BH_LOGS.GPJ NEW.GDT 5/8/14

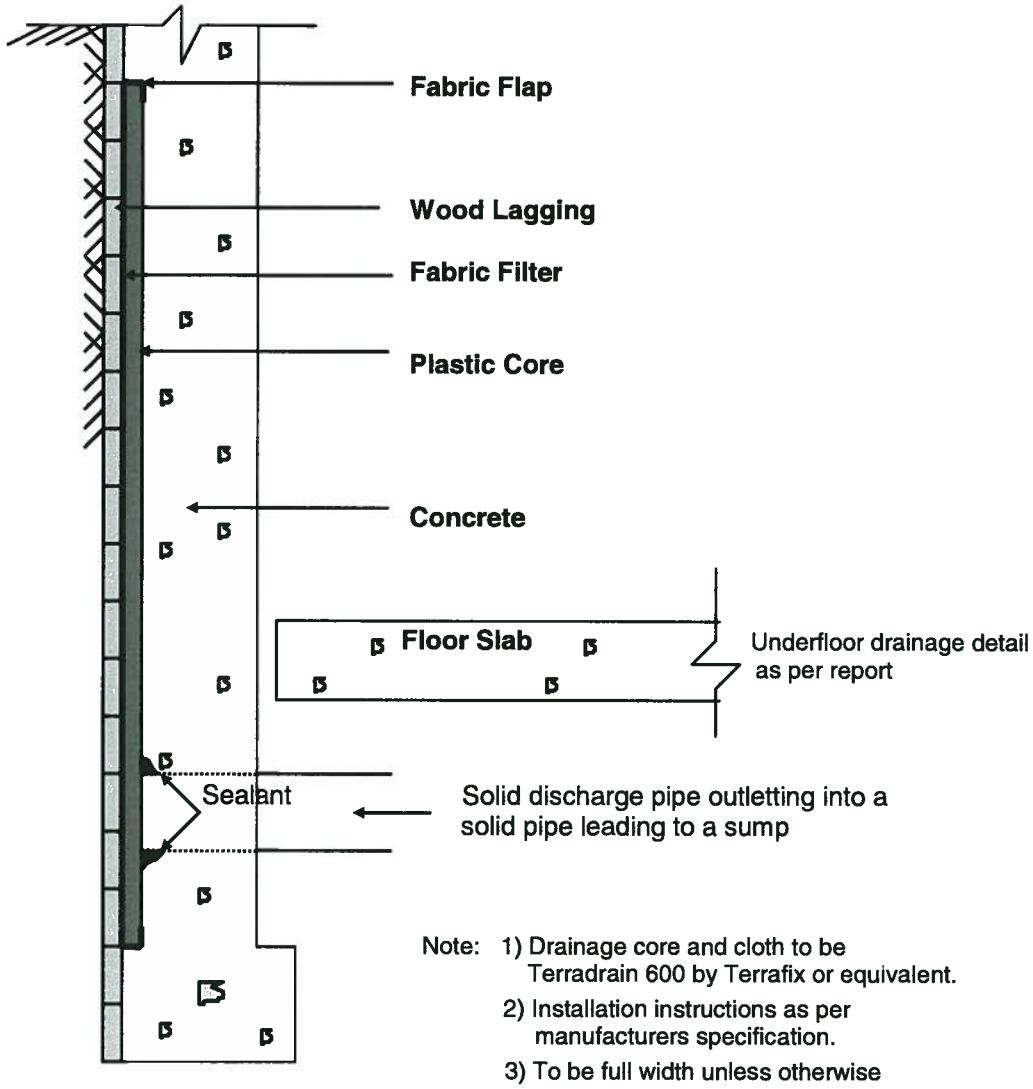
Notes:
1. Borehole advanced to completion at ~14.3 m depth by conventional soil sampling methods using a specialist drilling subcontractor. For borehole definitions, see notes prior to logs.
2. This drawing forms part of and must be read in conjunction with the subject report (Ref. No.: BRM-00603467-B0); borehole data requires interpretation assistance by exp professional staff before use by others.

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	11.2	-
After 4 days	11.0	Well
After 11 days	10.9	Well
After 21 days	10.8	Well

New identity of Trow Associates Inc.

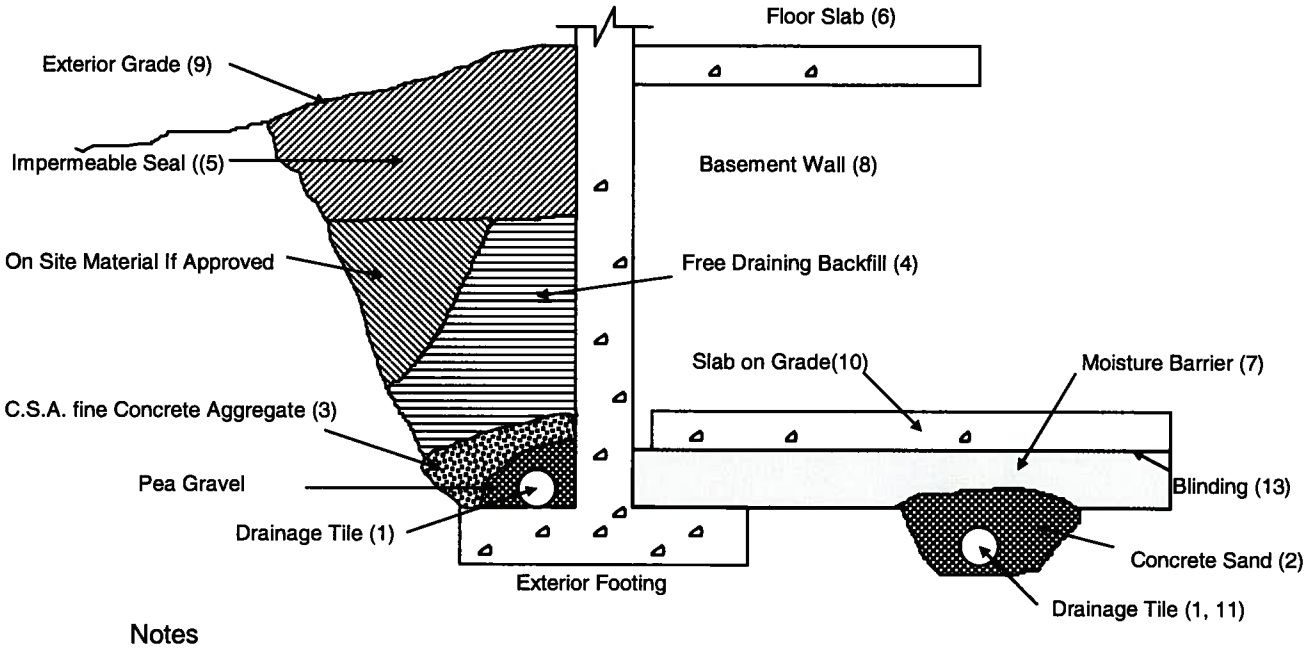
Brampton

Project: BRM-00603467-B0 **Drawing No. 6**



Note: 1) Drainage core and cloth to be Terradrain 600 by Terrafix or equivalent.
2) Installation instructions as per manufacturers specification.
3) To be full width unless otherwise recommended by the engineer.
4) Final detail must be approved before system is considered acceptable.
5) Teradrain 600 should be kept a minimum of 1.2 m below exterior finished grade.

SUGGESTED EXTERIOR DRAINAGE AGAINST SOLDIER PILE AND LAGGING SHORING SYSTEM



Notes

1. Drainage tile to consist of 100 mm (4") diameter weeping tile or equivalent perforated pipe leading to a positive sump or outlet.
2. Concrete sand - 150 mm (6") top and side of drain. If drain is not on footing, place 100 mm (4 inches) of pea gravel below drain. 20 mm (3/4") clear stone is an alternative provided it is surrounded by an approved filter fabric (Terrafix 600R or equivalent).
3. C.S.A. fine concrete aggregate to act as filter material. Minimum 300 mm (12") top and side of tile drain. This may be replaced by an approved filter fabric as indicated in (2).
4. Free Draining backfill - OPSS Granular B or equivalent compacted to the specified density. Do not use heavy compaction equipment within 450 mm (18") of the wall. Use hand controlled light compaction equipment within 1.8 m (6') of wall.
5. Impermeable backfill seal - compacted clay, clayey silt or equivalent. If original soil is free-draining, seal may be omitted.
6. Do not backfill until wall is supported by basement and floor slabs or adequate bracing.
7. Moisture barrier to be at least 200 mm (8") of compacted clear 20 mm (3/4") stone.
8. Basement wall to be damp-proofed or waterproofed as per report.
9. Exterior grade to slope away from building.
10. Slab on grade should not be structurally connected to the wall or footing.
11. Underfloor drain invert to be at least 300 mm(12") below underside of floor slab. Drainage tile placed in parallel rows 6 to 8 m (20 to 25') centres one way. Place drain below subgrade with 150 mm(6") of concrete sand on top and sides.
12. Do not connect the underfloor drains to perimeter drains.
13. If the 20 mm (3/4") stone requires surface blinding, use 6 mm (1/4") clear stone chips.

DRAINAGE AND BACKFILL RECOMMENDATIONS

(not to scale)

Appendix A:
Certificates of Analysis

Maxxam

Success Through Science®

Your Project #: BRM00603467-B0
Site Location: 71-79 KING ST SOUTH GEORGETOWN (HALTON HILLS)
Your C.O.C. #: 36808

Attention: Aamna Arora
exp Services Inc
1595 Clark Blvd
Brampton, ON
L6T 4V1

Report Date: 2014/05/08
Report #: R3023974
Version: 4R

CERTIFICATE OF ANALYSIS – REVISED REPORT

MAXXAM JOB #: B463089
Received: 2014/04/19, 10:45

Sample Matrix: Soil
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
pH CaCl2 EXTRACT	1	2014/04/24	2014/04/24	CAM SOP-00413	SM 4500H+ B
Sulphate (20:1 Extract)	1	N/A	2014/05/01	CAM SOP-00464	EPA 375.4

Remarks:

Maxxam Analytics has performed all analytical testing herein in accordance with ISO 17025 and the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act. All methodologies comply with this document and are validated for use in the laboratory. The methods and techniques employed in this analysis conform to the performance criteria (detection limits, accuracy and precision) as outlined in the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act. Reporting results to two significant figures at the RDL is to permit statistical evaluation and is not intended to be an indication of analytical precision.

The CWS PHC methods employed by Maxxam conform to all prescribed elements of the reference method and performance based elements have been validated. All modifications have been validated and proven equivalent following the 'Alberta Environment Draft Addenda to the CWS-PHC, Appendix 6, Validation of Alternate Methods'. Documentation is available upon request. Maxxam has made the following improvements to the CWS-PHC reference benchmark method: (i) Headspace for F1; and, (ii) Mechanical extraction for F2-F4. Note: F4G cannot be added to the C6 to C50 hydrocarbons. The extraction date for samples field preserved with methanol for F1 and Volatile Organic Compounds is considered to be the date sampled.

Maxxam Analytics is accredited for all specific parameters as required by Ontario Regulation 153/04. Maxxam Analytics is limited in liability to the actual cost of analysis unless otherwise agreed in writing. There is no other warranty expressed or implied. Samples will be retained at Maxxam Analytics for three weeks from receipt of data or as per contract.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
* Results relate only to the items tested.

Encryption Key

Krystal Seedial
08 May 2014 16:21:09 -04:00

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Sara Singh, B.Sc, Senior Project Manager
Email: sarasingh@maxxam.ca
Phone# (905) 817-5821

==========

Maxxam Job #: B463089
Report Date: 2014/05/08

exp Services Inc
Client Project #: BRM00603467-B0
Site Location: 71-79 KING ST SOUTH GEORGETOWN (HALTON HILLS)
Sampler Initials: AA

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total cover pages: 2

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel (905) 817-5700 Toll-Free 800-563-6266 Fax (905) 817-5777 www.maxxam.ca

Maxxam Job #: B463089
Report Date: 2014/05/08

exp Services Inc
Client Project #: BRM00603467-B0
Site Location: 71-79 KING ST SOUTH GEORGETOWN (HALTON HILLS)
Sampler Initials: AA

RESULTS OF ANALYSES OF SOIL

Maxxam ID		VP2728		
Sampling Date		2014/04/16		
	Units	**BH1 (13'-14')**	**RDL**	**QC Batch**
Inorganics				
Available (CaCl2) pH	pH	7.87		3582553
Soluble (20:1) Sulphate (SO4)	ug/g	130	20	3589536

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B463089
Report Date: 2014/05/08

exp Services Inc
Client Project #: BRM00603467-B0
Site Location: 71-79 KING ST SOUTH GEORGETOWN (HALTON HILLS)
Sampler Initials: AA

Test Summary

Maxxam ID VP2728
Sample ID BH1 (13'-14')
Matrix Soil

Collected 2014/04/16
Shipped
Received 2014/04/19

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
pH CaCl2 EXTRACT		3582553	2014/04/24	2014/04/24	Neil Dassanayake
Sulphate (20:1 Extract)	AC/EC	3589536	N/A	2014/05/01	Deonarine Ramnarine

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Maxxam Job #: B463089
Report Date: 2014/05/08

exp Services Inc
Client Project #: BRM00603467-B0
Site Location: 71-79 KING ST SOUTH GEORGETOWN (HALTON HILLS)
Sampler Initials: AA

Package 1	5.0°C

Each temperature is the average of up to three cooler temperatures taken at receipt

GENERAL COMMENTS

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B463089
Report Date: 2014/05/08

exp Services Inc
Client Project #: BRM00603467-B0
Site Location: 71-79 KING ST SOUTH GEORGETOWN (HALTON HILLS)
Sampler Initials: AA

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits
3589536	Soluble (20:1) Sulphate (SO4)	2014/05/01	115	70 - 130	106	70 - 130	<20	ug/g	NC	35

N/A = Not Applicable
RPD = Relative Percent Difference
Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.
Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.

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Validation Signature Page

Maxxam Job #: B463089

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Cristina Carriere, Scientific Services

Ewa Pranjic, M.Sc., C.Chem, Scientific Specialist

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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