Wastell Homes

Geotechnical Report

FINAL

Project Name:
George Street, Port Stanley

Project Number:
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Prepared by:
exp Services Inc.
15701 Robin's Hill Road
London, ON N5V 0A5
Canada

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Prepared by:
exp Services Inc.
15701 Robin's Hill Road
London, ON, N5V 0A5
Canada
T: +519.963.3000
F: +519.963.1152
www.exp.com

Vickie J. Coatsworth, P. Eng.
Geotechnical Services

Idib Sadoun, M. Sc., P. Eng.
Senior Engineer, Geotechnical Services

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1. Introduction

As requested, **exp** has provided a final geotechnical report for the site located at George Street in Port Stanley, Ontario. This report summarizes the findings of all other work that **exp** has conducted for the client at this site.

The subject site is located along the north side of George Street, just east of the River Road intersection in Port Stanley, Ontario. A golf course exists to the north, and vacant commercial/industrial land is located to the east.

The site encompasses an area of about 24 hectares. The site is characterized by generally flat land within the south, centre and northern portions of the property. A 30 metre high slope traverses the northwestern quadrant of the site, with a table land area of about 1 hectare atop the slope at the northwest corner of the site. The slope and table land are covered with mature trees and heavy brush. A ridge also intrudes the eastern portion of the site, the north side of which is steeply sloped and surfaced with trees and brush. The remaining southern, central and northeastern portions of the site are generally characterized by low lying flat land, currently used for agricultural purposes.

It is proposed to develop the site for residential use.

1.1 Terms of Reference

Exp was retained by Wastell Homes, Ontario (client) to provide a final report from the various investigations and reports provided by **exp** at this site.

The purpose of the investigations was to examine the subsoil and groundwater conditions at the site by advancing a series of sampled boreholes and test pits at the locations illustrated on the attached Site Plan (**Drawing 1**). A slope stability assessment was also provided for the site and is addressed under a separate report.

Based on an interpretation of the factual test hole data, and a review of soil and groundwater information from test holes advanced at the site, **exp** has provided engineering guidelines for the preliminary geotechnical design of the proposed residential subdivision. More specifically, this report provides preliminary comments on excavations, site preparation, foundations, bedding, backfill, pavement design, slope stability assessment, and preliminary environmental comments.

This report is provided based on the terms of reference presented above and on the assumption that the design will be in accordance with applicable codes and standards. If there are any changes in the design features relevant to the geotechnical analyses, or if any questions arise concerning geotechnical aspects of the codes and standards, this office should be contacted to review the design.

The information contained in this report in no way reflects on the environmental aspects of the soil. Should specific information in this regard be needed, additional testing may be required.

1.2 Previous Work

Several geotechnical investigations have been conducted for this site. Two were by Golder Associates Ltd. in April 1989 and July 1990, referenced 891-3089 and 901-3098, respectively. Borehole and test pit logs from the Golder investigations are provided in **Appendix A**. The locations of these test holes are shown on **Drawing 1**, Site Plan.

In November 2008 and February 2009 **exp** (Trow) conducted a preliminary geotechnical investigation for the development of the property.

A geotechnical desk top review was conducted by **exp** (Trow) in December 2009 along with a supplemental preliminary geotechnical investigation for the development of the property. Report Ref: LNGE00009968A was issued in February 2010 and revised in March 2010.

The fieldwork for the two investigations by **exp** (Trow) listed above are summarized below:

- November 8, 2008 – twenty-two (22) boreholes at the locations denoted on **Drawing1** as BH08-1 to BH08-22 inclusive; and
- December 22, 2009 – eight (8) boreholes at the locations denoted on **Drawing 1** as BH09-1 to BH09-8, inclusive. The boreholes were drilled in the central portion of the site to confirm past findings.

2. Methodology

For the current investigation done on July 21 and 22, 2016, thirty-seven (37) test pits and five (5) monitoring wells were excavated. The test pits are designated as TP1 through TP37 while the monitoring wells are designated as MW1 to MW5 inclusive on **Drawing 1**.

The test pits were excavated to depths which ranged from 3.0 to 5.0 m below ground surface (bgs) using a locally sub-contracted excavator.

The monitoring wells were drilled using a subcontracted track-mounted drill rig, equipped with continuous flight solid stem augers, and termination depths were about 6.6 m. Within the boreholes, Standard Penetration Tests (SPTs) were performed to assess the compactness or consistency of the underlying soils and to obtain representative samples. During the drilling, the stratigraphy in the boreholes was examined and logged in the field by **exp** geotechnical personnel.

Representative samples of the various soil strata encountered at the test locations were taken to our laboratory in London for further examination by a geotechnical engineer and laboratory classification testing. Laboratory testing for this investigation comprised of routine moisture content determinations; results presented on the Borehole and Test Pit Logs found in **Appendix A**.

Following the drilling, water levels were measured in the open boreholes, and then monitoring wells were installed to assess the groundwater table. Two return trips were made on July 21 and August 1, 2016 to record water levels.

3. Site and Subsurface Conditions

3.1 Site Description

The subject site is located along the north side of George Street, just east of the River Road intersection in Port Stanley, Ontario. A golf course exits to the north, and vacant commercial/industrial land is located to the east.

The site encompasses an area of about 24 hectares. The site is characterized by generally flat land within the south, centre and northern portions of the property. A 30 metre high slope traverses the northwestern quadrant of the site, with a table land area of about 1 hectare atop the slope at the northwest corner of the site. The slope and table land are covered with mature trees and heavy brush. A ridge also intrudes the eastern portion of the site, the north side of which is steeply sloped and surfaced with trees and brush. The remaining southern, central and northeastern portions of the site are generally characterized by low lying flat land, currently used for agricultural purposes.

3.2 Site Physiography

Overburden deposits in the study area were formed by numerous glacial events during the Wisconsinan ice age approximately 15,000 to 25,000 years ago. Thick glacial ice advanced several times into the southern part of the province and then receded creating the present configuration of moraines, abandoned spillways, drumlins, eskers, and various still water sediments.

The surficial deposits were mapped and categorized into physiographic regions by Chapman and Putnam (1984). The site is situated within the physiographic region known as the Norfolk Sand Plain. The sands and silts of the Norfolk Sand Plain were deposited as a delta in glacial Lakes Whittlesey and Warren. Typically, silt or clay strata or beds of boulder clay occur within 30 ft of the surface.

Bedrock mapping for the area indicates the study area is generally underlain by limestone, dolostone, and shale (Marcellus Formation) of the Middle Devonian Era.

3.3 Soil Stratigraphy

The detailed stratigraphy encountered in each test hole and the results of routine laboratory tests carried out on representative samples of the subsoils are given in the Borehole and Test Pit Logs found in **Appendix A**, and summarized in the following paragraphs. The findings are generally consistent with the past studies. It must be noted that boundaries of soil indicated on the borehole logs are inferred from non-continuous sampling and observations during drilling. These boundaries are intended to reflect transition zones for the purposes of geotechnical design and should not be interpreted as exact planes of geological change. One cross section has been done to show the stratigraphy in the boreholes:

- Cross Section A – ‘A’ runs west to east through the property fronting onto George Street.

The Cross Section is provided as **Drawing 2**.

3.3.1 Topsoil

Each borehole was surfaced with a layer of topsoil. The topsoil, generally described as brown, soft, moist sandy silt loam, extended to depths ranging between about 250 mm and 500 mm.

It should be noted that topsoil quantities should not be established from the information provided at the borehole locations only. If required, a more detailed analysis (involving shallow test pits) is recommended to accurately quantify the amount of topsoil to be removed for construction purposes.

3.3.2 Sandy Silt

The predominant natural soil encountered beneath the topsoil was alluvial sandy silt. The sandy silt was generally described as brown becoming grey with depth, with trace to some clay, and very loose to loose, based on observed drill resistance and Standard Penetration Test (SPT) N Values of 1 to 10. *In situ* moisture contents of the sandy silt soils ranged between about 14.2 and 48.5 percent, indicative of very moist to wet conditions.

BH09-3 was the only borehole to encounter very stiff to hard soils below a depth of 4.6 m.

3.3.3 Clayey Silt

With depth, the clay content in the sandy silt increased to become deposits of clayey silt within boreholes BH09-2, BH09-4 and BH09-8. The clayey silt was generally described as grey, with trace sand and gravel, very soft to firm (based on SPT N Values of 1 to 6) and wet, based on *in situ* moisture contents that ranged between about 28.1 and 43.5 percent. Shear vane tests done in this deposit at Borehole BH09-2 at depths of 4.6 and 6.1 m had Sensitivity Values of 2.0 and 2.4 respectively.

3.3.4 Sand and Gravel

A layer of sand and gravel was encountered at BH09-4 at a depth of 5.6 m. The sand and gravel was grey, compact (SPT N Value of 21) in consistency and moist (*in situ* moisture content of 11.3 percent).

3.3.5 Peat

Boreholes BH09-5 to BH09-8 inclusive, encountered and were terminated in a peat layer. The peat was black in colour, and very loose to loose (based on tactile observations and a SPT N Value of 5). The *in situ* moisture content of the peat (presented graphically on the Borehole Logs) ranged between about 93.4 and 110.4 percent, indicating wet soil conditions.

3.4 Groundwater Conditions

Observations of groundwater conditions during the 2016 investigation and measured depths to the groundwater are provided on the Test Pit Logs found in **Appendix A**.

During the excavating, groundwater was encountered within all of the test pits at depths which ranged between about 1.7 m to 2.7 m below existing grades. It is noted that insufficient time was available to establish the depth to the stabilized groundwater table prior to backfilling the test pits.

The depth to the groundwater table may vary in response to climatic or seasonal conditions, and, as such, may differ at the time of construction, with higher levels in wet seasons. Capillary rise effects should also be anticipated within fine grained soil deposits.

Measured groundwater levels in the monitoring wells installed in July 2016 are summarized in the table below and on the borehole logs found in **Appendix A**.

Table 1 – Groundwater Levels Recorded in the Monitoring Wells

Monitoring Well	Water Level, m			
	July 21, 2016		August 1, 2016	
	Depth, bgs	Elevation	Depth, bgs	Elevation
MW1	2.0	181.3	2.2	181.1
MW2	2.0	180.0	2.4	179.6
MW3	2.0	180.7	2.1	180.6
MW4	4.2	181.5	3.6	182.1
MW5	2.4	180.0	2.5	179.9

3.5 Methane Gas

No significant readings of methane gas were detected in the open boreholes at the time of drilling.

4. Discussion and Geotechnical Recommendations

4.1 General

It is understood that the proposed development will consist primarily of single family residential dwellings. The residential development is expected to have complete municipal servicing (extending into the site from George Street), and will be accessed with paved local roads.

The following sections of this report provides geotechnical comments and recommendations regarding site preparation, excavations and dewatering, foundations and basement design, site servicing and pavement design requirements.

Based on the results of **exp**'s investigation, the predominant soils encountered within the flat, low-lying areas of the site are loose/soft, wet deposits of silt, sand and clay which overlie glacial till at depth (as indicated in the Golder Borehole logs). The loose/soft and wet alluvial deposits will generally not support conventional strip and spread foundations without risk of excessive settlements. In addition, conventional construction of site services through loose/soft alluvial deposits may also result in undesirable vertical movement of the service piping.

Along with showing borehole and test pit locations **Drawing 1**, also delineates the site into areas that would require different foundational approaches based on the soils observed. It is noted that the extent of the Areas indicated have been inferred from the results of widely spaced test holes, and that verification of these extents would be required at the time of site grading. The various areas are discussed below.

4.2 Residential Foundations – Areas '1', '2' and '3'

In general, Areas 1 and 2 encompass areas of the site where competent glacial till soils were encountered within about 1.8 m depth of existing grades. These areas are generally well drained, and can support single family residences with basements founded on conventional strip and spread footings.

Area '3' encompasses a portion of the site where competent bearing soils were encountered at depths ranging between about 1.8 m and 3.5 m below existing grades. Conventional construction of residential foundations can be carried out within this zone of the site provided the competent subgrade is reconstructed to the design Underside of Footing (USF) elevation.

Construction in these areas should be carried out in accordance with the following recommendations.

4.2.1 Site Preparation

Prior to placement of foundations, pipe bedding and/or engineered fill, all surficial topsoil, vegetation and/or otherwise deleterious materials should be stripped. Additional test holes would be required to determine quantities for cut/fill calculations, as deeper areas of topsoil or loose/soft alluvial deposits may be encountered in areas not directly assessed. The excavated materials may be stockpiled on site for possible reuse as landscaping fill.

Following the removal of the topsoil and/or soft/wet soils, and prior to fill placement, the exposed subgrade should be inspected by a geotechnical engineer. Any loose or soft zones noted in the inspection should be over-excavated and replaced with approved fill.

In the building areas where the grade will be raised, the fill material should be comprised of imported granular or other approved material. The fill material should be inspected and approved

by a geotechnical engineer, and should be placed in maximum 300 mm (12 inch) thick lifts and uniformly compacted to 100 percent Standard Proctor Maximum Dry Density (SPMDD). The geometric requirements for engineered fill are provided on **Drawing 3**.

Based on the *in situ* moisture contents recorded from the test hole samples, the excavated onsite soils from Areas '1' and '2' could be near the optimum moisture content for compaction. This material may be suitable for reuse as engineered fill but should be examined and approved by a geotechnical engineer prior to reuse. Where engineered fill in excess of 3 metres is required to achieve the design elevations, the engineered fill mat should consist entirely of granular material, approved by a geotechnical engineer.

Any material imported to the site for proposed use within the engineered fill mat should be examined for its overall suitability and approved by the geotechnical consultant prior to use onsite.

In situ compaction testing should be carried out during the fill placement to ensure that the specified compaction is being achieved.

4.2.2 Foundations and Basements

Within Areas '1', '2' and '3', the proposed residential units can be supported on conventional spread and strip footings founded below topsoil, fill or unsuitable soils on the natural competent subgrade soils, or engineered fill. For design of the footings, an allowable Serviceability Limit States (SLS) bearing pressure of 120 kPa (2,500 psf) can be used for footings set below a typical depth of approximately 1.2 m (4 ft) below existing grade. All footings exposed to seasonal freezing conditions should be protected from frost action by at least 1.2 m (4 ft) of soil cover or equivalent insulation.

Ideally, a minimum of 1 metre separation between the groundwater table and the basement floor slab should be maintained. In the event that less than 1 m is provided (at least 0.5 m above the water table), then the basement design and foundation construction should include water-proofing measures such as installation of a water-stop between the footings and foundation walls, and foundation wall backfill using low-permeability soils, perimeter weeping tiles and underfloor drains, dedicated pumps and sumps to a positive outlet. If less than 0.5 m of separation distance is available, full water-proofing on the slab and foundations would be required.

The basement floors can be cast slab-on-grade provided the subgrade is stripped of all topsoil and other obviously objectionable material. The subgrade should then be thoroughly proof-rolled. Any soft spots detected during the proof-rolling should be dug out and replaced with clean compactable excavated material, placed in accordance with the requirements outlined in the previous Section 4.2.1.

A minimum 200 mm (8 inch) thick compacted layer of 19 mm (¾ inch) clear stone should be placed between the prepared subgrade and the floor slab to serve as a moisture barrier.

All basement walls should be damp-proofed and must be designed to resist a horizontal earth pressure 'p' at any depth 'h' below the surface as given by the following expression:

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

where: p = lateral earth pressure in kPa (psf) acting at a depth h:
K = earth pressure coefficient, assumed to be 0.45;
γ = unit weight of backfill, a value of 20.4 kN/m^3 (130 pcf) may be assumed;
h = depth to point of interest in m (ft) and,
q = equivalent value of any surcharge on the ground surface.

Where basements are constructed, installation of perimeter drains are required. The above expression assumes that the perimeter drainage system prevents the build-up of any hydrostatic pressure behind the wall. Suggestions for permanent perimeter drainage are given on **Drawing 4**.

4.3 Residential Foundations – Area '4'

In general, Area '4' encompasses the portion of the property fronting onto George Street and the central portion of the property. Existing elevations within Area 4 were similar to George Street. The results of the borehole investigation indicated that the soils within this area generally consisted of alluvial deposits of silt, sand and clay to depths in excess of 6 metres below existing grades. This area will **not** support the construction of residences on conventional strip and spread foundations without excessive differential and total settlements.

The fill for grading purposes around dwellings in Area '4' should be limited to 1.2 m. Based on the results of the investigation, Area 4 will support the construction of lightly loaded structures (i.e., maximum two storey residences) on shallow, stiffened, slab-on-grade foundations, with no basements, constructed in accordance with the following preliminary recommendations.

4.3.1 Stiffened Slab Foundation

In general, a stiffened slab foundation consists of a reinforced concrete slab-on-grade, with thickened sections beneath exterior and load-bearing walls, in lieu of footings. Provided the following preliminary recommendations are adhered to, a bearing pressure of 50 kPa can be used beneath the thickened slab sections, constructed on a minimum of 150 mm of granular fill as discussed below.

Ideally, a minimum of 1 metre separation between the groundwater table and the slab on grade should be maintained.

Prior to placement of foundations, all topsoil, peat and obvious deleterious soils must be removed from the footprint of the proposed structure. The subgrade should then be inspected by a geotechnical engineer and then thoroughly proof-rolled. Any soft spots detected during the proof-rolling should be excavated out and replaced with clean compactable excavated material, placed in accordance with the requirements outlined in **Section 4.2.1 Site Preparation**. The subgrade should be compacted prior to the placement of the structural fill. Due to inconsistent subsurface conditions encountered at the site and to minimize the total and deferential settlements, it is recommended that a single layer of geogrid should be placed between the subgrade and granular materials. The geogrid can be a Tensar Geogrid, biaxial geogrid BX-1200 reinforcement or equivalent. If unpredicted conditions are encountered during constructing, further measures to improve the soil conditions may be required**.**

The structural fill should consist of OPSS Granular 'A', and should be compacted to a minimum of 100 percent Standard Proctor Maximum Dry Density (SPMDD). The structural fill should also extend laterally beyond the edges of the proposed building footprint for a distance equal to the depth of structural fill beneath the footing. (See **Drawing 3 for details of Geometric Requirements for Foundations on Engineered Fill**).

In the event groundwater conditions preclude the compaction of the structural fill to the required density, a well-graded clear stone (such as HL4 stone), or recycled concrete could be used in lieu of OPSS Granular 'A'.

Construction of this nature with foundation depths of less than about 1.2 m will require additional protection against frost protection. For a stiffened slab-on-grade with an edge thickness of about 450 mm, a minimum of 50 mm of rigid board extruded polystyrene insulation, such as DOW SM, should be provided, and should have a minimum lateral extension of 1.2 m. A minimum soil cover of 300 mm should be provided over the insulation. The insulation should be sloped in a manner that promotes groundwater drainage away from the foundation. Perimeter subdrains may be required due to site grading and groundwater conditions. Stiffened slab foundation with various existing grades are demonstrated on attached **Drawings 5, 6, and 7**.

4.3.2 Foundation Preloading

In general, where a grade raise of more than about 0.5 m is required, preloading of the residential building footprint may be required in order to facilitate soil improvement prior to placement of the stiffened slab-on-grade foundation, thereby reducing the potential for excessive total and differential settlements beneath the residential foundations. In general, preloading involves the placement of a surcharge over the development area with a bearing pressure equivalent to that of the proposed development. During and following the preload, settlement of the grade is monitored using settlement plates in order to ensure that the predicted settlements are achieved, and that overall settlement has stabilized. In order to accelerate the settlement and further reduce the risk of long term settlements, additional surcharge may also be provided.

The amount of preloading required for this site, if any, will vary depending upon the area of the site and the amount of grade raise required. Accordingly, ongoing liaison with this office will be required.

4.4 Area '5'

Based on the current information, building conventional residential foundations may not be feasible in this area but constructing medium size buildings supported on deep foundations could be feasible. To determine depths of competent soils and to provide recommendations for deep foundations, a few additional deep boreholes should be advanced across Area '5' once the precise building envelopes are established so that foundations can be designed.

4.5 General Excavation and Dewatering Comments

Side slopes of temporary excavations must conform to Regulation 213/91 of the Occupational Health and Safety Act of Ontario. The predominant silt, sand and clay soils encountered throughout the site are classified as Type 3 soil. Temporary excavation sidewalls which extend through Type 3 soils must be cut back at a maximum inclination of 1 horizontal to 1 vertical from the base of the excavation. The wet soils of Areas '4', and '5' are considered Type 4 soils. Type 4 soils should have walls sloped from the base of the excavation with a maximum inclination of 3 horizontal to 1 vertical. Where groundwater egress is encountered, flatter slopes may be required.

Dilatant silt and sand will be susceptible to disturbance by construction traffic. It is recommended that construction traffic be minimized on the finished subgrade, and the subgrade be sloped to promote surface water drainage. Because some trafficability problems may be encountered for earth-scrapers in the low-lying areas, or where sensitive subgrade soils are exposed, tracked hydraulic excavators may be required to move some of the topsoil and fill material.

If imported fill material is utilized at the site, verification of the suitability of the fill may be required from an environmental standpoint. Conventional geotechnical testing will not determine the suitability of the material in this regard. Analytical testing and environmental site assessment may be required at the source. This will best be assessed prior to the selection of the material source. A quality assurance program should be implemented to ensure that the fill material will comply with the current MOECC standards for placement and transportation.

The disposal of excess excavated materials must also conform to the MOECC Guidelines and requirements. **Exp** can be of assistance if an assessment of the materials is required.

Groundwater infiltration should be anticipated within excavations into low lying areas, particularly from depths below about 1.7 metres below existing grades. Groundwater infiltration can likely be accommodated using conventional sump pumping techniques in Areas '1', '2', and '3'; however, more extensive dewatering measures will likely be required in Areas '4'and '5' and a Permit to Take Water will likely be required. Pretender test pits done prior to construction will give a better appreciation of the groundwater infiltration potential.

It is recommended that prior to tendering, a series of test pits should be dug to obtain a better appreciation of the behavior of excavations at design depths, and to provide additional input on dewatering requirements. Contractors (including specialist dewatering contractors) who might be involved in the job should witness these test pits. **Exp** can assist in observing and documenting the findings in the test pits.

For projects requiring positive groundwater control with a removal rate in excess of 50,000 litres per day, an Environmental Activity and Sector Registry (EASR) or a Permit to Take Water (PTTW) will be required. EASR's are required for dewatering volumes up to 400,000 litres per day. For volumes of 400,000 litres or more per day, PTTW applications will need to be approved by the Ministry of Environment and Climate Change (MOECC) according to Sections 34 and 98 of the Ontario Water Resources Act R.S.O. 1990 and the Water Taking and Transfer Regulation O. Reg. 387/04. It is noted that a standard geotechnical investigation will not determine all the groundwater parameters which may be required to support the application.

4.6 Site Servicing

It is anticipated that municipal sanitary sewer and water services will be tied into existing infrastructure along George Street.

Water and sewer lines should be provided with a minimum 1.2 m (4 ft) of soil cover for frost protection.

The subgrade soils beneath the water and sewer pipes within Areas '1', '2' and '3' which service the site are generally expected to comprise of native silt, sand and clayey soils. For services constructed on the native soil or engineered fill, above a depth of approximately 1.7 m bgs. Localized base improvements may be required for services bedded in wet silty soils or deeper than 1.7 m bgs, particularly in wet weather seasons. Some areas of crushed stone bedding enclosed with a geotextile may be required. This is best determined onsite during construction by a geotechnical engineer. Bedding aggregate should also be placed around the pipe to at least 300 mm (12 inch) above the pipe, and be compacted to a minimum 95 percent SPMDD.

Base stability should not be an issue for Areas '1', '2', and '3' if the pipes are bedded on firm, competent soil above approximately 1.7 m bgs. However, if soft soil is excavated, bedding improvements may be required such as the incorporation of geotextile or subgrade enhancement (with stone). Additional information can be provided in this regard as site servicing design elevations become available.

Where site servicing is deeper than 1.7 m bgs, or extends to George Street crossing low-lying areas (including Areas '4'), the natural soils on site would not provide a stable base for bedding. The site servicing should be constructed beyond the zone of influence of any structures in order to minimize the potential for differential movements as a result of additional soil loading. In addition, grade raises along the services should be minimized to avoid surcharging soils in these areas. The natural material would be too wet to achieve adequate compaction with around the pipes and within the trenches. Standard backfill materials (Granular 'B') would be too heavy and cause consolidation and settlement of the natural soils below; therefore, a light weight fill such as Styrofoam or lightweight cellular concrete would be needed. The lightweight fill should be placed up to pavement subbase depth.

The trenches above the specified pipe bedding should be backfilled with inorganic soils placed in maximum 300 mm thick lifts and uniformly compacted to at least 95% SPMDD. A program of *in situ* density testing should be set up to ensure that satisfactory levels of compaction are achieved. If the depth of services is significantly lower than the groundwater table, the backfill load will need to be reduced by using a light weight fill. This will best be determined during construction.

Based on the results of this investigation, the majority of the excavated natural soils from Areas '1' and '2' may be used for construction backfill provided reasonable care is exercised in handling, and construction is carried out in favorable weather. In this regard the material should be within 3 percent of the optimum moisture as determined in the standard Proctor density test, and stockpiling of material for prolonged periods of time should be avoided. This is particularly important if construction is carried out in wet or otherwise adverse weather. It should be noted that peat soils would not be suitable for pipe bedding or backfill use.

Soils excavated from below the stabilized groundwater table may be too wet for reuse as backfill unless adequate time is allowed for drying, or if the material is blended with approved dry fill; otherwise, it may be stockpiled onsite for reuse as landscape fill.

In Area '5', further investigation and/or studies may be required depending on the future development.

As noted previously, disposal of excavated materials off site should conform to current MOECC guidelines.

In addition to above, the following general recommendations are provided related to site servicing:

- The bedding should conform to OPS Standards.
- Peat pockets encountered at pipe inverts should be removed and replaced with proper soils. These are best determined onsite during construction by a geotechnical engineer.
- Sewers should be designed to tolerate settlement and differential settlements.

4.7 Preliminary Pavement Design

Areas to be paved should be stripped of all topsoil, organics and other obviously unsuitable material. The exposed subgrade must then be thoroughly proof-rolled. Any soft spots revealed by this or any other observations must be over-excavated and backfilled with approved material. All fill required to backfill service trenches, or to raise the subgrade to design levels must conform to requirements discussed previously. Preferably, the natural inorganic excavated soils should be used to maintain uniform subgrade conditions, provided adequate compaction can be achieved.

Provided the preceding recommendations are followed, the pavement thickness design requirements given in Table 2 are recommended for the anticipated specified street classifications and subgrade conditions.

Table 2 – Recommended Pavement Structure Thickness

Pavement Layer	Compaction Requirements	Local Road	Collector Road
Asphaltic Concrete	97% Marshall Density	35 mm HL-3 45 mm HL-8	45 mm HL-3 65 mm HL-8
Granular 'A' (Base)	100% SPMDD*	150 mm	150 mm
Granular 'B' (Subbase)	100% SPMDD*	350 mm^	450 mm^

Notes: 1) SPMDD* denotes Standard Proctor Maximum Dry Density.
2) The subgrade must be compacted to 98% SPMDD.
3) The above recommendations are minimum requirements.
4) ^Additional granular base may be required if the moisture content of the subgrade is high.

Other granular configurations may also be possible provided the granular base equivalency (GBE) thickness is maintained. These recommendations on thickness design are not intended to support heavy and concentrated construction traffic, particularly where only a portion of the pavement section is installed.

If construction is undertaken under adverse weather conditions (i.e., wet or freezing conditions) subgrade preparation and granular sub-base requirements should be reviewed by the geotechnical engineer. As well, if only a portion of the pavement will be in place during construction, the granular subbase may have to be thickened, and/or the subgrade improved with a geotextile separator.

Samples of both the Granular 'A' and Granular 'B' aggregates should be checked for conformance to OPSS 1010 prior to utilization on site, and during construction. The Granular 'B' subbase and the Granular 'A' base courses must be compacted to 100 percent SPMDD.

The asphaltic concrete paving materials should conform to the requirements of OPSS 1150. The asphalt should be placed in accordance with OPSS 310 and compacted to at least 97 percent of the Marshall mix design bulk density.

Good drainage provisions will optimize pavement performance. The finished pavement surface should be free of depressions and should be sloped (preferably at a minimum grade of two percent) to provide effective surface drainage toward catchbasins. Surface water should not be allowed to pond adjacent to the outside edges of pavement areas. In low areas, subdrains should be installed to intercept excess subsurface moisture and prevent subgrade softening, as shown on **Drawing 8**. This is particularly important in heavier traffic areas at the site entrances. The locations and extent of subdrainage required within the paved areas should be reviewed by this office in conjunction with the proposed grading.

A program of *in situ* density testing must be carried out to verify that satisfactory levels of compaction are being achieved.

To minimize the effects of differential settlements of service trench fill, it is recommended that wherever practical, placement of surface course asphalt should be delayed for two to three years. Prior to the surface asphalt being placed, it is recommended that a pavement evaluation be carried out on the base asphalt to identify repair areas or areas requiring remedial works prior to surface asphalt being placed.

A layer of geogrid could be required at Areas ‘4’ and ‘5’. This is best determined onsite during construction by a proof rolling inspection by an **exp** representative.

4.8 Curbs and Sidewalks

The concrete for the curbs and gutters should be proportioned, mixed, placed and cured in accordance with the requirements of OPSS 353 and OPSS 1350.

During cold weather, the freshly placed concrete should be covered with insulating blankets to protect against freezing.

The subgrade for the sidewalks should comprise of undisturbed natural soil or well-compacted fill. A minimum 150 mm thick layer of compacted (100 percent SPMDD) Granular 'A' should be placed below the sidewalk slabs. Construction traffic should be kept off the placed curbs and sidewalks as they are not designed to withstand heavy traffic load.

5. General Comments

The information presented in this report is based on a limited investigation designed to provide information to support an assessment of the current geotechnical conditions within the subject property. The conclusions and recommendations presented in this report reflect site conditions existing at the time of the investigation. 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 the need for additional testing and reporting. **exp** has qualified personnel to provide assistance in regards to any future geotechnical and environmental issues related to this property.

Our undertaking at **exp**, therefore, is to perform our work within limits prescribed by our clients, with the usual thoroughness and competence of the engineering profession.

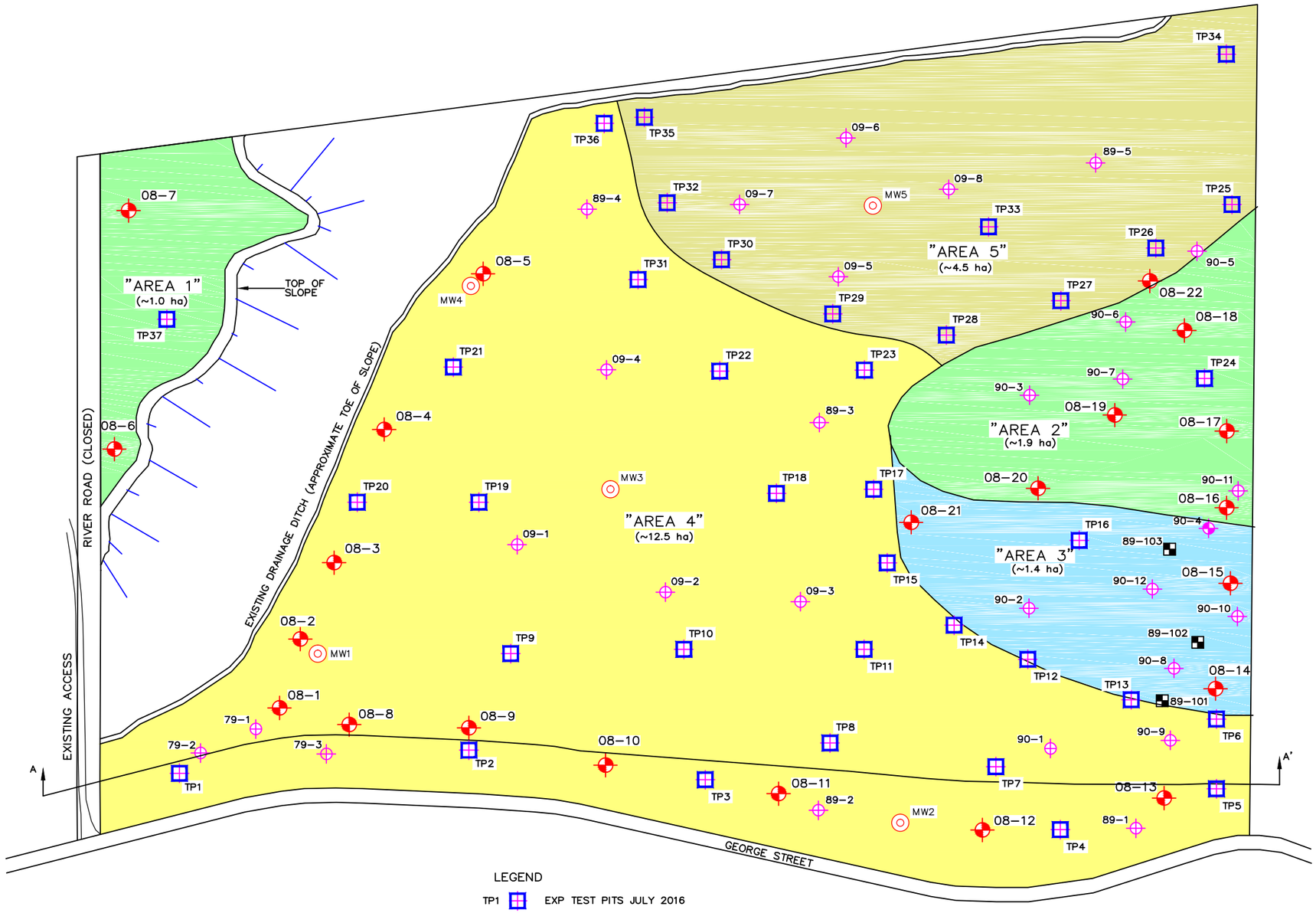
The comments given in this report are intended only for the guidance of design engineers. The number of test holes required to determine the localized underground conditions between test holes affecting construction costs, techniques, sequencing, equipment, scheduling, etc. would be much greater than 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.

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 afforded the privilege of making this review, **exp** Services Inc. will assume no responsibility for interpretation of the recommendations in this report.

This report was prepared for the exclusive use of **Wastell Homes** and may not be reproduced in whole or in part, without the prior written consent of **exp**, or used or relied upon in whole or in part by other parties for any purposes whatsoever. Any use which a third party makes of this report, or any part thereof, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. **exp** Services Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

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

Drawings



LEGEND

TP1	EXP TEST PITS JULY 2016	89–1	BOREHOLE BY GOLDER 1989
MW1	EXP MONITORING WELLS JULY 2016	89–101	TEST PIT BY GOLDER 1989
09–1	BOREHOLE BY TROW 2009	79–1	BOREHOLE BY GOLDER 1979
08–1	BOREHOLE BY TROW 2008		
90–1	BOREHOLE BY GOLDER 1990		

NOTES:

1. The boundaries and soil types have been established only at test hole locations. Between test holes they are assumed and may be subject to considerable error.
2. Soil samples will be retained in storage for 3 months and then destroyed unless client advises that an extended time period is required.
3. Topsoil quantities should not be established from the information provided at the test hole locations.
4. The site plan was reproduced from drawing provided by client and should be read in conjunction with exp consolidated Geotechnical Report LON-00014790-GE.

Final Geotechnical Investigation

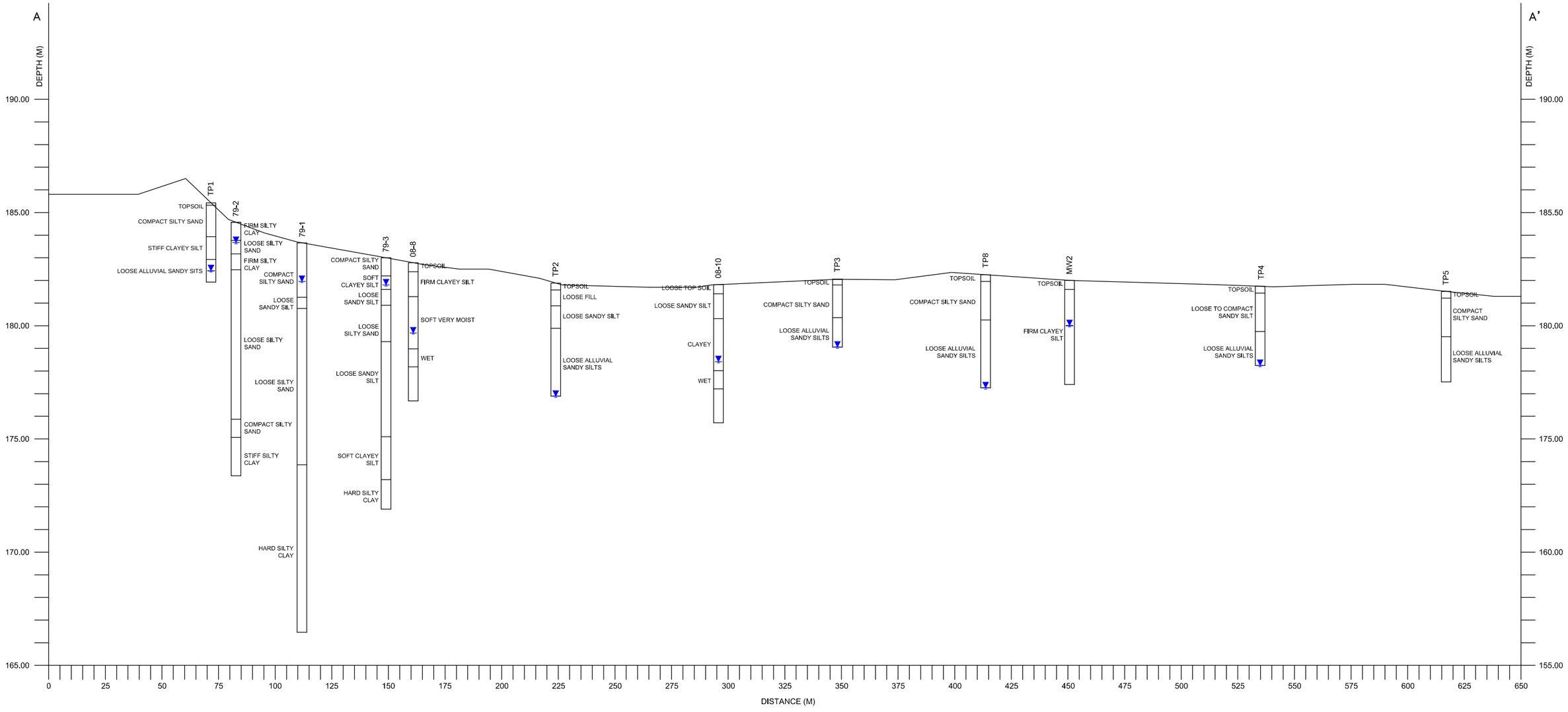
Proposed Residential Development

George Street, Port Stanley, Ontario

CLIENT	Wastell House
TITLE	Borehole & Monitoring Well Location Plan
DRAWN BY	E.B.
REVIEWED BY	V.C.

exp Services Inc.
15701 Robin's Hill Road, London, ON, N5V 0A5

DATE	SCALE	PROJECT NO.	DWG.
AUGUST 2017	NTS	LON-00014790-GE	1



SECTION A-A'

NOTES:

1. The boundaries and soil types have been established only at test hole locations. Between test holes they are assumed and may be subject to considerable error.
2. Soil samples will be retained in storage for 3 months and then destroyed unless client advises that an extended time period is required.
3. Topsoil quantities should not be established from the information provided at the test hole locations.
4. The drawing was reproduced from drawing provided by client and should be read in conjunction with exp consolidated Geotechnical Report LON-00014790-GE.

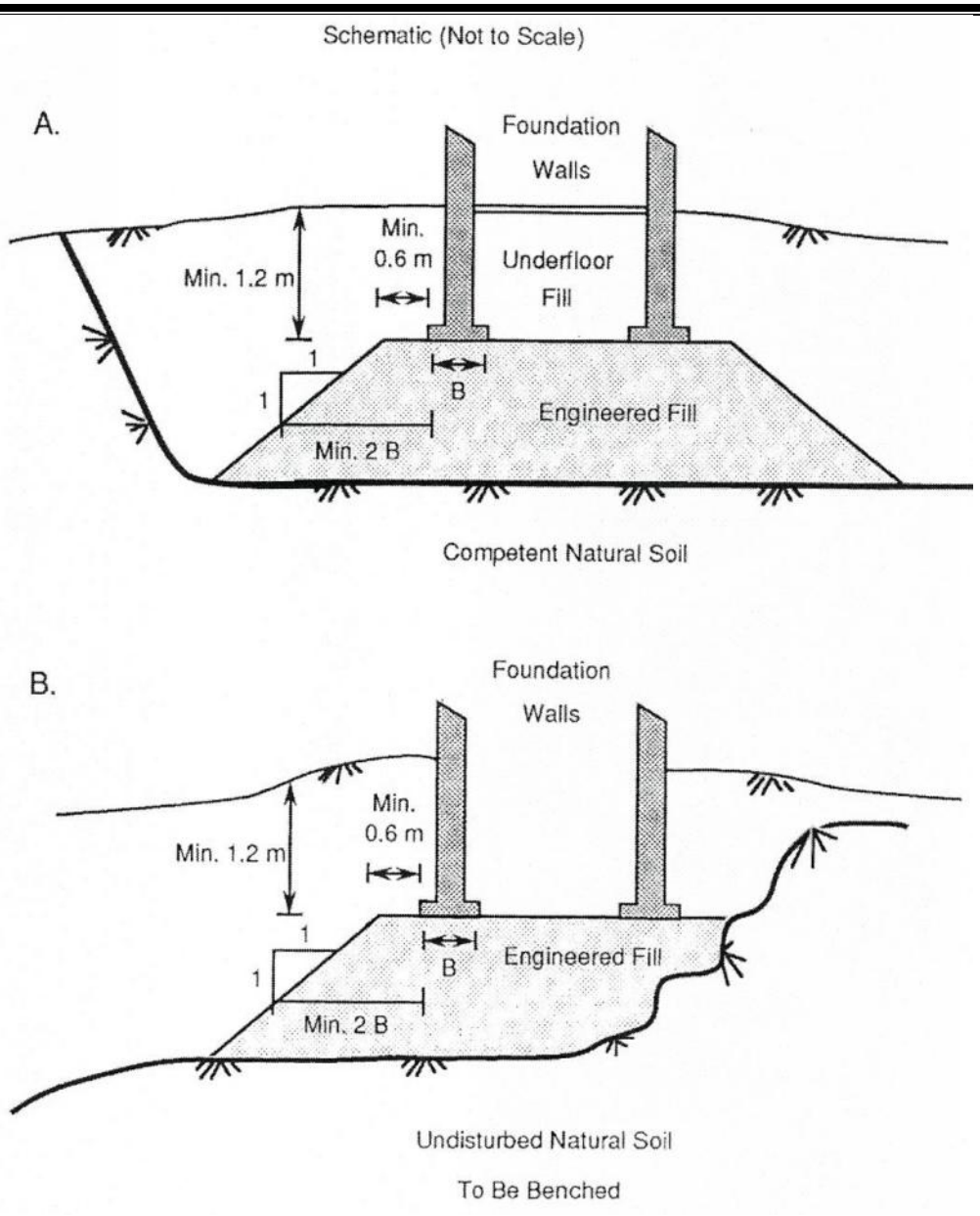
Final Geotechnical Investigation

Proposed Residential Development

George Street, Port Stanley, Ontario

CLIENT: Wastell House			
TITLE: SECTION A-A'			
DRAWN BY: J.T.	REVIEWED BY: I.S.		
exp Services Inc. 15701 Robin's Hill Road, London, ON, N5V 0A5			
DATE: JULY 2017	SCALE: NTS	PROJECT NO.: LON-00014790-GE	DWG.: 2

DRAWING 3 – GEOMETRIC REQUIREMENTS FOR FOUNDATIONS ON ENGINEERED FILL



SECTION VIEW

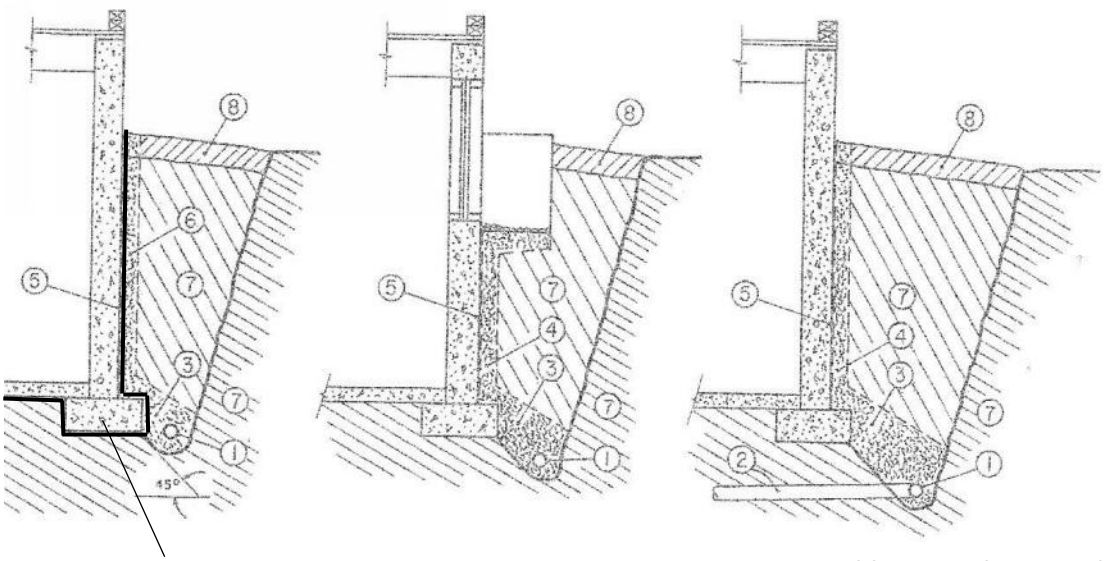
Section A – Typical Section of Slab-on-Grade Building
Section B – Typical Section of Building with Basement

Refer to Detailed Notes on following page.

NOTES FOR ENGINEERED FILL PLACMENT:

1. The area must be stripped of all topsoil contaminated fill material, and other unsuitable soils, and proof rolled. Soft spots must be dug out. The stripped native subgrade must be examined and approved by an **exp** Engineer prior to placement of engineered fill.
2. In areas where engineered fill is placed on a slope, the fill should be benched into the approved subgrade soils. **Exp** would be pleased to provide additional comments and recommendations in this regard, if required.
3. All excavations must be carried out in accordance with the Occupational Health and Safety Regulation of Ontario (Construction Projects - O.Reg. 213.91)
4. Material used for engineered fill must be free of topsoil, organics, frost and frozen material, and otherwise unsuitable or compressible soils, as determined by a Geotechnical Engineer. Any material proposed for use as engineered fill must be examined and approved by **exp**, prior to use onsite. Clean compactable granular fill is preferred. The imported fill should be reviewed to satisfy MOECC Requirements.
5. Approved engineered fill should be placed in maximum 300 mm thick lifts, and uniformly compacted to 100% Standard Proctor dry density throughout. For best compaction results, engineered fill should be within 3 percent of its optimum moisture content, as determined by the Standard Proctor density test.
6. Full time geotechnical monitoring, inspection and *in situ* density (compaction) testing by **exp** is required during placement of the engineered fill.
7. Site grades should be maintained during area grading activities to promote drainage, and to minimize ponding of surface water on the engineered fill mat. Rutting by construction equipment should be kept to a minimum, where possible. Additional work to ensure suitability of engineered fill may be required if fill is placed in extreme (hot/cold) weather.
8. The fill must be placed such that the specified geometry is achieved. Refer to sketches (previous page) for minimum requirements. Proper environmental protection will be required, such as providing frost penetration during construction, and after the completion of the engineered fill mat.
9. An allowable bearing pressure (SLS) of 120 kPa (2,500 psf) may be used for foundations set on engineered fill, provided that all conditions outlined above, and in the Geotechnical Report are adhered to.
10. These guidelines are to be read in conjunction with the attached Geotechnical Report (**exp** Project No. LON-00014790-GE).
11. Footing Base inspections are required to verify the suitability of the subgrade soils, at the time of construction. *In situ* density tests may also be required at the footing base level to confirm material density.

DRAWING 4 – BACKFILL AND BASEMENT DRAINAGE DRAWING, (NOT TO SCALE)

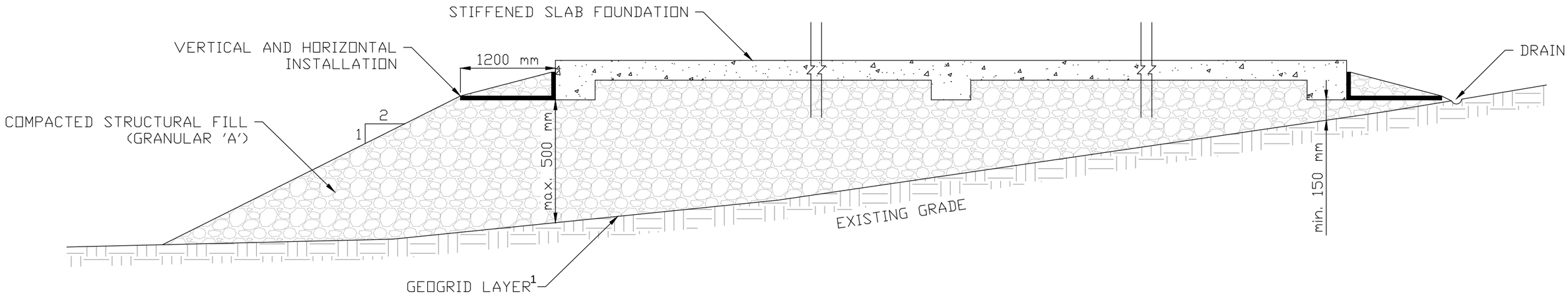


(9) Geomembrane Product

NOTES:

1. Perforated or slotted pipe placed about 300 mm below the upper level of the basement floor slab;
2. Unperforated drain pipe connected to a positive sump; connect to appropriate trap and backwater valve before connecting to sewer, where applicable. Provide appropriate access to the trap for inspection and cleaning;
3. Filter material that is compatible with the grain size characteristics of the foundation and backfill soils, as well as the perforations of the pipe;
4. Filter material continuously or intermittently placed next to the foundation wall to intercept water from window wells and low areas near building (see also 6);
5. Damp-proofing on wall;
6. Use of sheet drain or synthetic filter blanket next to foundation wall as per OBC to replace the soil filter described in 4;
7. Foundation and backfill soils, which may contain fine grain and erodible materials; and,
8. "Topping-off" material, graded away from the building to redirect surface water from the foundations. Low permeability soils, or concrete or asphalt, are preferred.
9. As illustrated in left figure above, provide continuous geomembrane product beneath slab and footings where prevailing groundwater levels may be higher than basement floor slab elevation; extend geomembrane up to existing grade along exterior face of foundation wall.

Reference: Canadian Geotechnical Society 2006, *Canadian Foundation Engineering Manual, 4th Edition, (Figure 12.1, p184).*



NOTES:

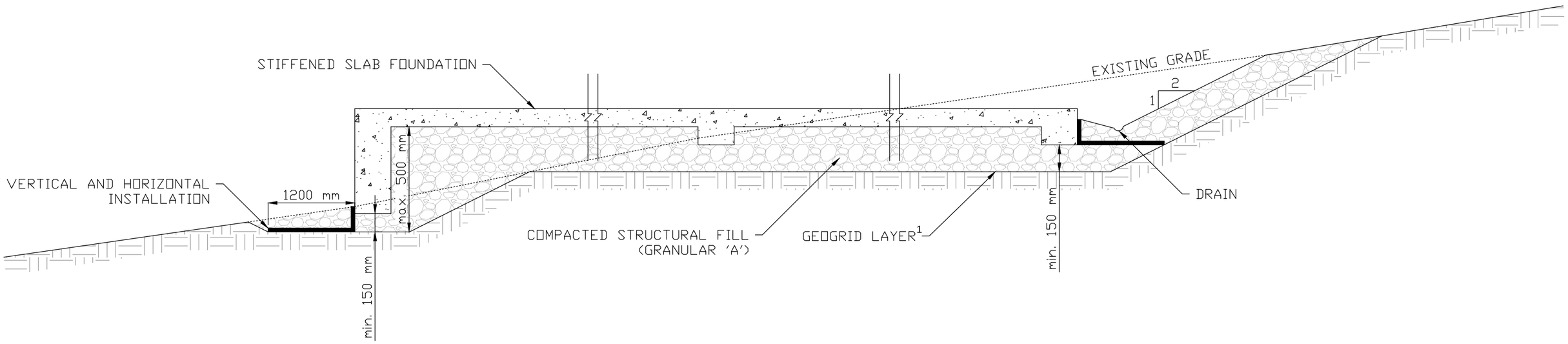
1. Install geogrid between the subgrade and structural fill as required during construction.
2. The drawing should be read in conjunction with exp consolidated Geotechnical Report LON-00014790-GE.

Final Geotechnical Investigation

Proposed Residential Development

George Street, Port Stanley, Ontario

CLIENT: Wastell House			
TITLE: Case 1 - Slab Foundation Above Sloping Grade			
DRAWN BY: E.B.	REVIEWED BY: I.S.		
exp Services Inc. 15701 Robin's Hill Road, London, ON, N5V 0A5			
DATE: AUGUST 2017	SCALE: NTS	PROJECT NO.: LON-00014790-GE	DWG.: 5



NOTES:

1. Install geogrid between the subgrade and structural fill as required during construction.
2. The drawing should be read in conjunction with exp consolidated Geotechnical Report LON-00014790-GE.

Final Geotechnical Investigation

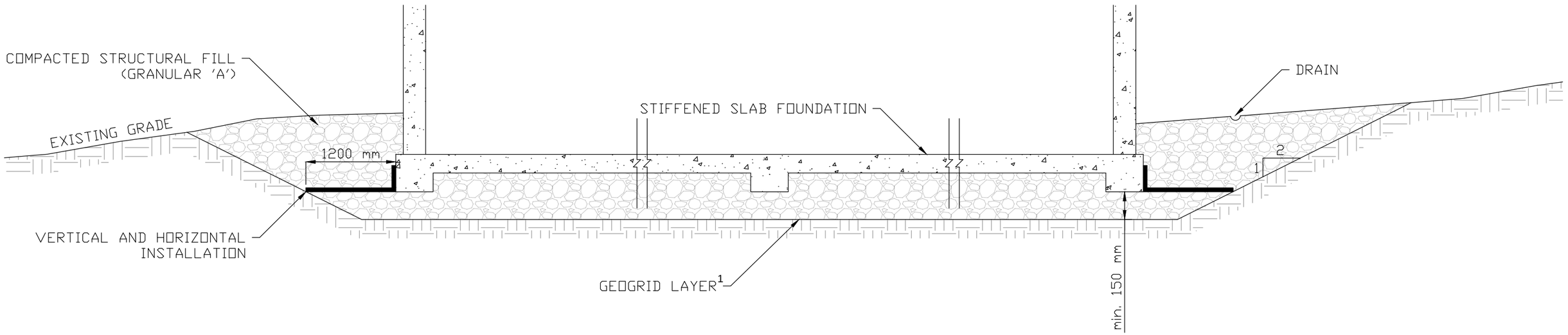
Proposed Residential Development

George Street, Port Stanley, Ontario

CLIENT	Wastell House
TITLE	Case 2 - Slab Foundation Through Sloping Grade
DRAWN BY	E.B.
REVIEWED BY	I.S.

exp Services Inc.
15701 Robin's Hill Road, London, ON, N5V 0A5

DATE	SCALE	PROJECT NO.	DWG.
AUGUST 2017	NTS	LON-00014790-GE	6



NOTES:

1. Install geogrid between the subgrade and structural fill as required during construction.
2. The drawing should be read in conjunction with exp consolidated Geotechnical Report LON-00014790-GE.

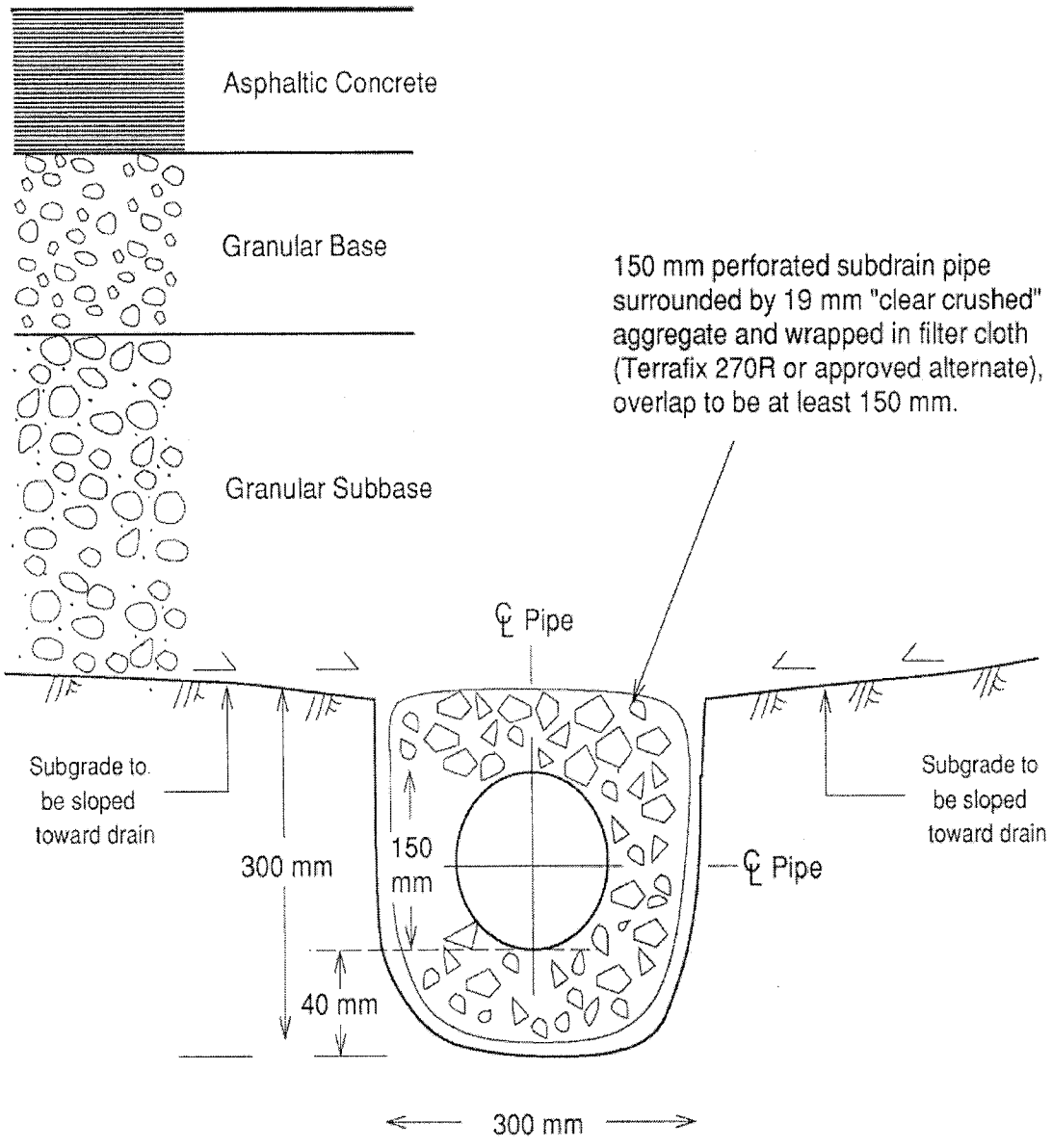
Final Geotechnical Investigation

Proposed Residential Development

George Street, Port Stanley, Ontario

CLIENT: Wastell House			
TITLE: Case 3 - Slab Foundation Below Grade			
DRAWN BY: E.B.	REVIEWED BY: I.S.		
exp Services Inc. 15701 Robin's Hill Road, London, ON, N5V 0A5			
DATE: AUGUST 2017	SCALE: NTS	PROJECT NO.: LON-00014790-GE	DWG. 7

DRAWING 8 – PAVEMENT SUBDRAIN DETAIL



NOTES:

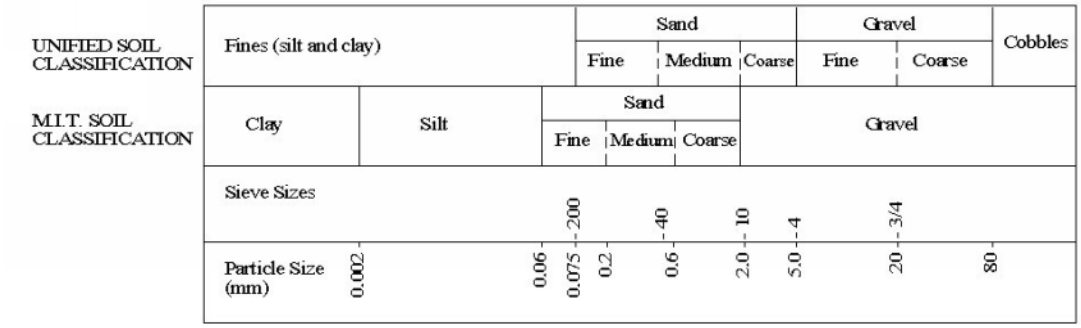
1. All dimensions in millimetres.
2. All subdrains to be set on at least 1% grade draining to a positive outlet.
3. Subgrade soil conditions should be verified onsite, during subgrade preparation works, following site servicing installations.

Scale: NTS

Appendix A – Borehole and Test Pit Logs

NOTES ON SAMPLE DESCRIPTIONS

1. All descriptions included in this report follow the 'modified' Massachusetts Institute of Technology (M.I.T.) soil classification system. The laboratory grain-size analysis also follows this classification system. Others may designate the Unified Classification System as their source; a comparison of the two is shown for your information. Please note that, with the exception of those samples where the grain size analysis has been carried out, all samples are classified visually and the accuracy of the visual examination is not sufficient to differentiate between the classification systems or exact grain sizing. The M.I.T. system has been modified and the **exp** classification includes a designation for cobbles above the 75 mm size and boulders above the 200 mm size.



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 therefore, may not be applicable as a general description of the site fill material. All fills should be expected to contain obstructions such as large concrete pieces or subsurface basements, floors, tanks, even though none of these obstructions may have been encountered in the borehole. 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 and correct 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. The fill at this site has been monitored for the presence of methane gas and the results are recorded on the borehole logs. The monitoring process neither indicates the volume of gas that can be potentially generated or pinpoints the source of the gas. These readings are to advise of a potential or existing problem (if they exist) and a detailed study is recommended for sites where any explosive gas/methane is detected. Some fill material may be contaminated by toxic waste that renders the material unacceptable for deposition in any but designated land fill sites; unless specifically stated, the fill on the site has not been tested for contaminants that may be considered hazardous. This testing and a potential hazard study can be carried out if you so request. In most residential/commercial areas undergoing reconstruction, buried oil tanks are common, but not detectable using conventional geotechnical procedures.

3. **Glacial 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 (75 to 200 mm in diameter) or boulders (greater than 200 mm diameter) and therefore, contractors may encounter them during excavation, even if they are not indicated on the borehole logs. It should be appreciated that normal sampling equipment can not differentiate the size or type of obstruction. Because of the horizontal and vertical variability of till, the sample description may be applicable to a very limited area; therefore, caution is essential when dealing with sensitive excavations or dewatering programs in till material.

Golder Borehole Logs

RECORD OF BOREHOLE 1

SHEET 1

LOCATION - SEE FIGURE 1

BORING DATE MAR. 30, 1990

DATUM GEODETIC

SAMPLER HAMMER, 140lb; DROP, 30in

PENETRATION TEST HAMMER, 140lb; DROP, 30in

PROJECT 901-3098

DEPTH SCALE FEET	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (FT)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FT.	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		GROUND SURFACE		598.1					Backfill
		Brown silty TOPSOIL		0.0 / 597.1					
		Compact mottled brown SANDY SILT occ. clayey silt layers		1.0	1	2" DO	11		
5				592.3	2	2" DO	5		
		Firm brown SILTY CLAY		5.8 / 591.1					
	POWER AUGER (HOLLOW STEM)	Firm to very soft grey CLAYEY SILT trace organic material occ. shell fragments and sandy silt layers		7.0	3	2" DO	5		
10					4	2" DO	2		
					5	2" DO	2	MH	
15				581.1	8	2" DO	5		
		Loose grey SAND AND GRAVEL		17.0 / 579.1	7	2" DO	9		
20		Very stiff to hard grey CLAYEY SILT trace sand occ. gravel (TILL) occ. sandy silt layers		19.0	8	2" DO	17		
					9	2" DO	32		
25				571.8	10	2" DO	23		
		END OF BOREHOLE		26.5					
30									
35									

DYNAMIC PENETRATION RESISTANCE, BLOWS/FT

SHEAR STRENGTH Cu, LB/SQ.FT. nat.V.- + Q.- ● rem.V.- ⊕ U.- ○

HYDRAULIC CONDUCTIVITY, k, CM/SEC

WATER CONTENT, PERCENT Wp W Wl (10 20 30 40)

0 / 16 6 PERCENT AXIAL STRAIN AT FAILURE / 10

WL ENCOUNTERED ATELEV. 597.1 DURING DRILLING MAR. 30, 1990

WL IN STANDPIPE AT ELEV. 598.8 APR. 8, 1990

DEPTH SCALE

1 inch to 5 feet

Golder Associates

LOGGED F.F.

CHECKED

RECORD OF BOREHOLE 2

SHEET 1

LOCATION - SEE FIGURE 1

BORING DATE MAR 30, 1990

DATUM GEODETIC

SAMPLER HAMMER, 140lb; DROP, 30in

PENETRATION TEST HAMMER, 140lb; DROP, 30in

PROJECT 901-3098

DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (FT)	SAMPLES: NUMBER	TYPE	BLOWS/FT.	DYNAMIC PENETRATION RESISTANCE, BLOWS/FT	SHEAR STRENGTH Cu, LB/SQ.FT. nat.V.- + Q.- ● rem.V.- ⊕ U.- ○	HYDRAULIC CONDUCTIVITY, k, CM/SEC	WATER CONTENT, PERCENT Wp W Wl 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		GROUND SURFACE		598.6									
		Brown silty TOPSOIL		0.0 / 597.6									
	POWER AUGER (HOLLOW STEM)	Compact brown SANDY SILT trace clay occ. sand layers		1.0 / 594.1	1	2" DO	13						Backfill
5		Compact to dense brown SAND AND GRAVEL trace silt		4.5 / 589.1	2	2" DO	14						
					3	2" DO	31					WS	
10		Very stiff brown becoming grey about elev. 589 CLAYEY SILT trace sand		9.5 / 586.6	4	2" DO	26						
		Dense to compact grey SANDY SILT trace clay		12.0 / 581.8	5	2" DO	41						
15					6	2" DO	29						
		Very stiff to hard grey SILTY CLAY trace sand occ. gravel (TILL)		17.0 / 572.1	7	2" DO	24						
20					8	2" DO	24						
					9	2" DO	60						
25					10	2" DO	68						
		END OF BOREHOLE		26.5									
30													
35													

WL ENCOUNTERED AT ELEV. 597.6 DURING DRILLING MAR. 30, 1990

WL IN STANDPIPE AT ELEV. 598.6 APR. 6, 1990

0 16 ⊕ 6 10 PERCENT AXIAL STRAIN AT FAILURE

DEPTH SCALE

1 inch to 5 feet

Golder Associates

LOGGED F.F.

CHECKED

RECORD OF BOREHOLE 3

SHEET 1

LOCATION - SEE FIGURE 1

BORING DATE MAR 30, 1990

DATUM GEODETIC

SAMPLER HAMMER, 140lb; DROP, 30in

PENETRATION TEST HAMMER, 140lb; DROP, 30in

PROJECT 901-3098

DEPTH SCALE FEET	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (FT)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FT.
0		GROUND SURFACE		611.9			
		Brown silty TOPSOIL		0.0 / 610.9			
		Very stiff brown CLAYEY SILT occ. topsoil		1.0 / 607.4	1	2" DO	17
5	POWER AUGER (HOLLOW STEM)	Very dense to dense brown becoming grey about elev. 602 SANDY SILT trace clay occ. gravel (TILL) occ. silty sand layers		4.5 / 597.4	2	2" DO	52
					3	2" DO	44
10					4	2" DO	38
					5	2" DO	44
15		Dense to very dense grey SILT trace to some clay occ. clayey silt layers		14.5 / 585.4	6	2" DO	61
					7	2" DO	49
20					8	2" DO	52
					9	2" DO	100
25					10	2" DO	84
		END OF BOREHOLE		26.5			
30							
35							

DYNAMIC PENETRATION RESISTANCE, BLOWS/FT

SHEAR STRENGTH Cu, LB/SQ.FT. nat.V.- + Q.- ● rem.V.- ⊕ U.- O

HYDRAULIC CONDUCTIVITY, k, CM/SEC

WATER CONTENT, PERCENT

Wp W Wl

10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

Backfill

WL ENCOUNTERED AT ELEV. 595.9 DURING DRILLING MAR. 30, 1990

WL IN STANDPIPE AT ELEV. 604.8 APR. 6, 1990

0 / 16 / 10 5 PERCENT AXIAL STRAIN AT FAILURE

DEPTH SCALE

1 inch to 5 feet

Golder Associates

LOGGED F.F.

CHECKED

RECORD OF BOREHOLE 4

SHEET 1

LOCATION - SEE FIGURE 1

BORING DATE MAR 30, 1990

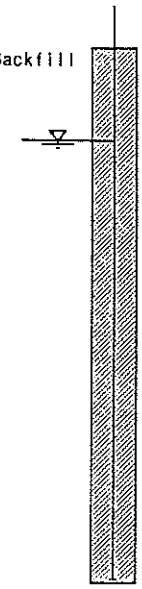
DATUM GEODETIC

SAMPLER HAMMER, 140lb; DROP, 30in

PENETRATION TEST HAMMER, 140lb; DROP, 30in

PROJECT 901-3098

DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (FT)	SAMPLES: NUMBER	TYPE	BLOWS/FT.	DYNAMIC PENETRATION RESISTANCE, BLOWS/FT / SHEAR STRENGTH Cu, LB/SQ.FT. (nat.V.- + Q.- ● rem.V.- ⊕ U.- O)	HYDRAULIC CONDUCTIVITY, k, CM/SEC / WATER CONTENT, PERCENT (Wp, W, Wl; 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		GROUND SURFACE		602.5							
	POWER AUGER (UNCASED)	Brown silty TOPSOIL		0.0 / 601.5							
		Loose to compact brown SANDY SILT trace clay occ. gravel and topsoil		1.0	1	2" DO	9				
5					2	2" DO	31				
				595.5							
		Compact grey SANDY SILT trace to some clay occ. gravel (TILL)		7.0	3	2" DO	30				
10					4	2" DO	28				
				590.5							
		Very dense grey SILT		12.0	5	2" DO	72				
				588.5							
15		END OF BOREHOLE		14.0							
20											
25											
30											
35											



WL ENCOUNTERED AT ELEV. 602.5 DURING DRILLING. MAR. 30, 1990

WL IN STANDPIPE AT ELEV. 600.1 APR. 8, 1990

0 / 15 ⊕ 6 PERCENT AXIAL STRAIN AT FAILURE / 10

DEPTH SCALE

1 inch to 5 feet

Golder Associates

LOGGED F.F.

CHECKED F.F.

RECORD OF BOREHOLE 5

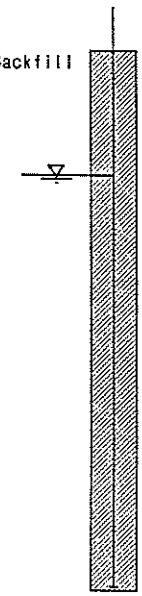
SHEET 1

LOCATION - SEE FIGURE 1 | BORING DATE APR. 2, 1990 | DATUM GEODETIC

SAMPLER HAMMER, 140lb; DROP, 30in | PENETRATION TEST HAMMER, 140lb; DROP, 30in

PROJECT 901-3098

DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (FT)	SAMPLES: NUMBER	TYPE	BLOWS/FT.	DYNAMIC PENETRATION RESISTANCE, BLOWS/FT / SHEAR STRENGTH Cu, LB/SQ.FT. (nat.V.- + Q.- ●, rem.V.- ⊕ U.- ○)	HYDRAULIC CONDUCTIVITY, k, CM/SEC / WATER CONTENT, PERCENT (Wp, W, Wl; 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	POWER AUGER (UNCASED)	GROUND SURFACE		599.5							
		Brown silty TOPSOIL		0.3							
		Brown CLAYEY SILT occ. topsoil		597.5							
		Very loose brown SILT trace to some sand		2.0	1	2" DO	4		o		
5				594.0	2	2" DO	4		o o		
		Firm to very stiff brown becoming grey about elev. 591 CLAYEY SILT trace sand occ. gravel (TILL) occ. sandy silt layers		5.5	3	2" DO	25		o		
10					4	2" DO	22		o		
				587.5							
		Very dense grey SILT trace sand trace clay		12.0	5	2" DO	59		o		
				585.5							
15		END OF BOREHOLE		14.0							
20											
25											
30											
35											



WL ENCOUNTERED AT ELEV. 597.5 DURING DRILLING APR. 2, 1990

WL IN STANDPIPE AT ELEV. 596.3 APR. 6, 1990

0 15 10 6 PERCENT AXIAL STRAIN AT FAILURE

DEPTH SCALE

1 inch to 5 feet

Golder Associates

LOGGED T.T.

CHECKED T.T.

RECORD OF BOREHOLE 6

SHEET 1

LOCATION - SEE FIGURE 1

BORING DATE APR. 2, 1990

DATUM GEODETIC

SAMPLER HAMMER, 140lb; DROP, 30in

PENETRATION TEST HAMMER, 140lb; DROP, 30in

PROJECT 901-3098

DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (FT)	SAMPLES: NUMBER	TYPE	BLOWS/FT.	DYNAMIC PENETRATION RESISTANCE, BLOWS/FT / SHEAR STRENGTH Cu, LB/SQ.FT. (nat.V.- + Q.- ● rem.V.- ⊕ U.- O)	HYDRAULIC CONDUCTIVITY, k, CM/SEC / WATER CONTENT, PERCENT (WP W WL; 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		GROUND SURFACE		600.2							
		Brown silty TOPSOIL		0.4							
		Brown CLAYEY SILT		598.2							
5	POWER AUGER (UNCASED)	Loose brown becoming grey about elev. 593 SANDY SILT occ. clayey silt layers		2.0	1	2" DO	4		o		
					2	2" DO	8		o		
					3	2" DO	5		o		
				590.7							
10		Very loose grey SILT tr clay occ. shell and wood fragments and organic material		9.5	4	2" DO	3		o		
				588.2							
		Very stiff grey CLAYEY SILT trace sand occ. gravel (TILL)		12.0	5	2" DO	19		o		
15			C		6	2" DO	23		o		
				583.7							
		END OF BOREHOLE		16.5							
20											
25											
30											
35											

Backfill

Caved

WL ENCOUNTERED AT ELEV. 598.2 DURING DRILLING APR. 2, 1990

WL IN STANDPIPE AT ELEV. 599.1 APR. 6, 1990

0 15 10 PERCENT AXIAL STRAIN AT FAILURE

DEPTH SCALE

1 inch to 5 feet

Golder Associates

LOGGED F.F.

CHECKED

RECORD OF BOREHOLE 7

SHEET 1

LOCATION - SEE FIGURE 1

BORING DATE APR. 2, 1990

DATUM GEODETIC

SAMPLER HAMMER, 140lb; DROP, 30in

PENETRATION TEST HAMMER, 140lb; DROP, 30in

PROJECT 901-3068

DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (FT)	SAMPLES: NUMBER	TYPE	BLOWS/FT.	DYNAMIC PENETRATION RESISTANCE, BLOWS/FT / SHEAR STRENGTH Cu, LB/SQ.FT. (nat.V.- + O.- ● rem.V.- ⊕ U.- O)	HYDRAULIC CONDUCTIVITY, k, CM/SEC / WATER CONTENT, PERCENT (Wp, W, Wl; 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		GROUND SURFACE		617.8							
		Brown clayey TOPSOIL		0.3							
		Brown CLAYEY SILT trace sand occ. topsoil pockets		615.8							
				2.0	1	2" DO	22		O		Backfill
5	POWER AUGER (UNCASED)	Very stiff brown SILTY CLAY trace sand occ. gravel (TILL)			2	2" DO	25		O		
					3	2" DO	24		O		
10					4	2" DO	25		O		
				605.8							
		Hard brown becoming grey about elev. 603 CLAYEY SILT occ. silty sand layers		12.0	5	2" DO	59		O		
15					6	2" DO	64		O		Caved
				601.3							
		END OF BOREHOLE		16.5							
20											
25											
30											
35											

BOREHOLE DRY DURING DRILLING APR. 2, 1990

WL IN STANDPIPE AT ELEV. 609.3 APR. 6, 1990

0 16 ⊕ 6 10 PERCENT AXIAL STRAIN AT FAILURE

DEPTH SCALE

1 inch to 5 feet

Golder Associates

LOGGED F.F.

CHECKED

RECORD OF BOREHOLE 8

SHEET 1

LOCATION - SEE FIGURE 1

BORING DATE APR. 2, 1990

DATUM GEODETIC

SAMPLER HAMMER, 140lb; DROP, 30in

PENETRATION TEST HAMMER, 140lb; DROP, 30in

PROJECT 901-3098

DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (FT)	SAMPLES: NUMBER	TYPE	BLOWS/FT.	DYNAMIC PENETRATION RESISTANCE, BLOWS/FT	SHEAR STRENGTH Cu, LB/SQ.FT. nat.V.- + Q.- ● rem.V.- ⊕ U.- ○	HYDRAULIC CONDUCTIVITY, k, CM/SEC	WATER CONTENT, PERCENT Wp W Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		GROUND SURFACE		596.1									
	POWER AUGER (UNCASED)	Brown silty TOPSOIL		0.0									
		Loose brown SANDY SILT trace clay		0.8	1	2" DO	6						Backfill
5				591.6									
		Soft grey CLAYEY SILT shell & wood fragments, trace organics		4.5 590.3	2	2" DO	4						
		Loose to compact grey SANDY SILT		5.8	3	2" DO	11						Caved
10				586.6									
		Compact grey SILTY SAND occ. to some gravel		9.5	4	2" DO	14					MH	
				584.1									
		Compact to dense grey CLAYEY SILT trace sand occ. gravel (TILL)		12.0	5	2" DO	26						
15					6	2" DO	51						
				579.6									
		END OF BOREHOLE		16.5									
20													
25													
30													
35													

WL IN BOREHOLE AT ELEV. 595.1 DURING DRILLING APR. 2, 1990

WL IN STANDPIPE AT ELEV. 595.8 APR. 8, 1990

0 15 10 5 PERCENT AXIAL STRAIN AT FAILURE

DEPTH SCALE

1 inch to 5 feet

Golder Associates

LOGGED F.F.

CHECKED

RECORD OF BOREHOLE 9

SHEET 1

LOCATION - SEE FIGURE 1

BORING DATE APR. 2, 1990

DATUM GEODETIC

SAMPLER HAMMER, 140lb; DROP, 30in

PENETRATION TEST HAMMER, 140lb; DROP, 30in

PROJECT 901-3098

DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (FT)	SAMPLES: NUMBER	TYPE	BLOWS/FT.	DYNAMIC PENETRATION RESISTANCE, BLOWS/FT	SHEAR STRENGTH Cu, LB/SQ.FT. nat.V.- + Q.- ● rem.V.- ⊕ U.- O	HYDRAULIC CONDUCTIVITY, k, CM/SEC	WATER CONTENT, PERCENT Wp W Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		GROUND SURFACE		596.5									
		Brown silty TOPSOIL		0.0									
		Very loose brown SANDY SILT trace clay		0.9	1	2" DO	2				O		
				592.0									
5	POWER AUGER (UNCASED)			4.5	2	2" DO	2						
											O		
		Very soft to firm mottled brown becoming grey about elev. 590 CLAYEY SILT occ. shell, wood fragments and organic material			3	2" DO	5				O		
10					4	2" DO	1				O		
					5	2" DO	3				O		
				582.0									
15		Compact grey SANDY SILT occ. sand layer		14.5	6	2" DO	11				O		
				580.0									
		END OF BOREHOLE		16.5									
20													
25													
30													
35													

PIEZOMETER OR STANDPIPE INSTALLATION: Backfill; Caved

WL IN BOREHOLE AT ELEV. 594.5 DURING DRILLING APR. 2, 1990

WL IN STANDPIPE AT ELEV. 595.7 APR. 6, 1990

0 15 10 PERCENT AXIAL STRAIN AT FAILURE

DEPTH SCALE

1 inch to 5 feet

Golder Associates

LOGGED F.F.

CHECKED

RECORD OF BOREHOLE 10

SHEET 1

LOCATION - SEE FIGURE 1

BORING DATE MAY 31, 1990

DATUM GEODETIC

SAMPLER HAMMER, 140lb; DROP, 30in

PENETRATION TEST HAMMER, 140lb; DROP, 30in

PROJECT 901-3098

DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (FT)	SAMPLES: NUMBER	TYPE	BLOWS/FT.	DYNAMIC PENETRATION RESISTANCE, BLOWS/FT	SHEAR STRENGTH Cu, LB/SQ.FT. nat.V.- + Q.- ● rem.V.- ⊕ U.- ○	HYDRAULIC CONDUCTIVITY, k, CM/SEC	WATER CONTENT, PERCENT Wp W Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		GROUND SURFACE		595.3									
		Brown silty TOPSOIL		595.0									
	POWER AUGER (HOLLOW STEM)	Very loose brown SILT trace sand trace clay occ. pockets of organic material		0.5	1	2" DO	3						
5				589.3	2	2" DO	4						
		Loose to compact brown SILTY fine SAND occ. sand and gravel layer		6.0	3	2" DO	16						
10				584.8	4	2" DO	24						
		Compact to very dense grey SANDY SILT trace clay		10.7	5	2" DO	85						
15				579.3	6	2" DO	77						
		END OF BOREHOLE		16.0									
20													
25													
30													
35													

Bentonite Seal

Granular Filter

Caved

WL ENCOUNTERED AT ELEV. 592.8 DURING DRILLING MAY 31, 1990

WL IN PIEZOMETER AT ELEV. 593.2 JUNE 7, 1990

0 / 16 / 10 6 PERCENT AXIAL STRAIN AT FAILURE

DEPTH SCALE

1 inch to 5 feet

Golder Associates

LOGGED F.F.

CHECKED F.F.

RECORD OF BOREHOLE 11

SHEET 1

LOCATION - SEE FIGURE 1

BORING DATE MAY 31, 1990

DATUM GEODETIC

SAMPLER HAMMER, 140lb; DROP, 30in

PENETRATION TEST HAMMER, 140lb; DROP, 30in

PROJECT 901-3098

DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (FT)	SAMPLES: NUMBER	TYPE	BLOWS/FT.	DYNAMIC PENETRATION RESISTANCE, BLOWS/FT	HYDRAULIC CONDUCTIVITY, k, CM/SEC	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
								SHEAR STRENGTH Cu, LB/SQ.FT. nat.V.- + Q.- ● rem.V.- ⊕ U.- O	WATER CONTENT, PERCENT Wp W Wl (10 20 30 40)		
0		GROUND SURFACE		598.4							
	POWER AUGER (HOLLOW STEM)	Black silty TOPSOIL		0.0							
		Loose brown SILTY SAND occ. gravel		0.7							
				595.4	1	2" DO	6				
		Firm mottled brown CLAYEY SILT trace sand		3.0							
5				593.9							
		Dense grey SANDY SILT trace clay occ. gravel occ. silt layer (TILL)		4.5	2	2" DO	39				
				589.4	3	2" DO	31				
10		END OF BOREHOLE		9.0							
15											
20											
25											
30											
35											

PIEZOMETER OR STANDPIPE INSTALLATION: Bentonite Seal; Granular Filter; Caved

WL ENCOUNTERED AT ELEV. 596.4 DURING DRILLING. MAY 31, 1990

WL IN PIEZOMETER AT ELEV. 595.6 JUNE 7, 1990

0 15 10 5 PERCENT AXIAL STRAIN AT FAILURE

DEPTH SCALE

1 inch to 5 feet

Golder Associates

LOGGED F.F.

CHECKED

RECORD OF BOREHOLE 12

SHEET 1

LOCATION - SEE FIGURE 1

BORING DATE MAY 31, 1990

DATUM GEODETIC

SAMPLER HAMMER, 140lb; DROP, 30in

PENETRATION TEST HAMMER, 140lb; DROP, 30in

PROJECT 901-3098

DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (FT)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/FT.	DYNAMIC PENETRATION RESISTANCE, BLOWS/FT	SHEAR STRENGTH Cu, LB/SQ.FT. nat.V.- + Q.- ● rem.V.- ⊕ U.- O	HYDRAULIC CONDUCTIVITY, k, CM/SEC	WATER CONTENT, PERCENT Wp W Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		GROUND SURFACE		597.9									
	POWER AUGER (HOLLOW STEM)	Black silty TOPSOIL		0.0									
		Brown SANDY SILT occ. gravel		0.8	1	2" DO	5				O		Backfill
5				593.4									
		Very stiff to hard brown CLAYEY SILT trace sand occ. gravel (TILL) occ. silt layers		4.5	2	2" DO	29				O	MH	
				588.9	3	2" DO	38				O		Caved
10		END OF BOREHOLE		9.0									WL ENCOUNTERED AT ELEV. 595.4 DURING DRILLING MAY 31, 1990
													STANDPIPE BLOCKED AT ELEV. 595.2 JUNE 7, 1990
15													
20													
25													
30													
35													

0 / 15 / 10 PERCENT AXIAL STRAIN AT FAILURE

DEPTH SCALE

1 inch to 5 feet

Golder Associates

LOGGED F.F.

CHECKED F.F.

RECORD OF BOREHOLE 1

SHEET 1

LOCATION SEE PLAN FIGURE 1 | BORING DATE MAR.28,1989 | DATUM GEODETIC

SAMPLER HAMMER, 140lb; DROP, 30in | PENETRATION TEST HAMMER, 140lb; DROP, 30in

DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (FT)	SAMPLES: NUMBER	TYPE	BLOWS/FT.	DYNAMIC PENETRATION RESISTANCE, BLOWS/FT	SHEAR STRENGTH Cu, LB/SQ.FT. nat.V.- + Q.- ● rem.V.- ⊕ U.- O	HYDRAULIC CONDUCTIVITY, k, CM/SEC	WATER CONTENT, PERCENT Wp W Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		GROUND SURFACE		597.5									
		Brown silty TOPSOIL.		0.0 / 596.5									
		Loose to very loose mottled brown SILTY SAND trace organic material occ. sandy silt layer.		1.0 / 591.8	1	2" DO	8						
5				5.7	2	2" DO	3						
		Soft mottled brown SILTY CLAY trace organic material, occ. shell fragments.		588.0	3	2" DO	4						
10				9.5	4	2" DO	3						
	POWER AUGER 7.6in. DIAM. (HOLLOW STEM)	Soft to very soft grey CLAYEY SILT trace organic material occ. shell fragments and sandy silt layers.			5	2" DO	4						
15					6	2" DO	2						
				579.5									
		Very loose grey SANDY SILT occ. vegetation layers.		18.0 / 573.5	7	2" DO	3						
20				24.0									
25		Very stiff grey SILTY CLAY occ. gravel (TILL).			8	2" DO	16						
30				566.0	9	2" DO	18						
		END OF BOREHOLE		31.5									
35													

Backfill

STANDPIPE

WL ENCOUNTERED AT ELEV. 579.5' DURING DRILLING MAR.28,1989

WL IN STANDPIPE AT ELEV. 592.5' MAR. 31, 1989

15 8 6 PERCENT AXIAL STRAIN AT FAILURE

DEPTH SCALE

1 inch to 5 feet

Golder Associates

LOGGED P.H.S.

CHECKED

RECORD OF BOREHOLE 2

SHEET 1

LOCATION SEE PLAN FIGURE 1 | BORING DATE MAR.28,1989 | DATUM GEODETIC

SAMPLER HAMMER, 140lb; DROP, 30in | PENETRATION TEST HAMMER, 140lb; DROP, 30in

DEPTH SCALE FEET	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (FT)	NUMBER	TYPE	BLOWS/FT.
0		GROUND SURFACE		599.0			
		Brown silty TOPSOIL		0.0 598.0			
				1.0	1	2" DO	8
5	POWER AUGER 7.5in. DIAM. (HOLLOW STEM)	Very soft to firm brown becoming grey at about elev. 590.7' CLAYEY SILT trace organic material, occ. sandy silt layers, occ. vegetation layers and fragments.			2	2" DO	3
					3	2" DO	2
10					4	2" DO	WH
					5	2" DO	WH
15					6	2" DO	WH
				580.0			
20		Very loose grey fine to medium SAND.		19.0	7	2" DO	WR
				574.5			
25		Very stiff to hard grey CLAYEY SILT occ. gravel (TILL).		24.5	8	2" DO	29
30					9	2" DO	39
				567.5			
		END OF BOREHOLE		31.5			
35							

SAMPLES

DYNAMIC PENETRATION RESISTANCE, BLOWS/FT

SHEAR STRENGTH Cu, LB/SQ.FT. nat.V.- + Q.- ● rem.V.- ⊕ U.- O

HYDRAULIC CONDUCTIVITY, k, CM/SEC

WATER CONTENT, PERCENT
WP W WL
10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

Backfill

STANDPIPE

WL ENCOUNTERED AT ELEV. 591.0' DURING DRILLING MAR.29,1989

WL IN STANDPIPE AT ELEV. 596.5' MAR. 31,1989

0
16-18-6 PERCENT AXIAL STRAIN AT FAILURE
10

DEPTH SCALE
1 inch to 5 feet

Golder Associates

LOGGED P.H.S.
CHECKED

RECORD OF BOREHOLE 3

SHEET 1

LOCATION SEE PLAN FIGURE 1 | BORING DATE MAR.28,1989 | DATUM GEODETIC

SAMPLER HAMMER, 140lb; DROP, 30in | PENETRATION TEST HAMMER, 140lb; DROP, 30in

DEPTH SCALE FEET	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (FT)	NUMBER	TYPE	BLOWS/FT.	DYNAMIC PENETRATION RESISTANCE, BLOWS/FT	HYDRAULIC CONDUCTIVITY, k, CM/SEC	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		GROUND SURFACE		601.9							
		Brown silty TOPSOIL		601.1							
				0.8							
		Loose brown SANDY SILT trace clay trace organic material.			1	2" DO	6				
5					2	2" DO	6				
				594.9							
				7.0							
		Very loose brown SILTY FINE SAND.			3	2" DO	1				
				592.4							
10				9.5							
					4	2" DO	1				
		Very soft grey CLAYEY SILT some organic material numerous silt and sand layers, occ. shell fragments and peat layers.			5	2" DO	2			MH	
15					6	2" DO	4				
	POWER AUGER 7.5in. DIAM. (HOLLOW STEM)			583.9							
				18.0							
20		Very loose grey SILTY FINE SAND trace organic material.			7	2" DO	3				
				578.9							
				23.0							
		Soft grey CLAYEY SILT trace organic material occ. sandy silt and silty sand layers.			8	2" DO	3				
25											
					9	2" DO	9				
30				570.9							
		Compact grey SAND AND GRAVEL.		31.0							
				568.9							STANDPIPE
				33.0							
35		Hard grey SILTY CLAY occ. silt partings occ. gravel (TILL).			10	2" DO	33				
				565.4							
		END OF BOREHOLE		36.5							
40											

SHEAR STRENGTH Cu, LB/SQ.FT. nat.V.- + Q.- ● rem.V.- ⊕ U.- ○

WATER CONTENT, PERCENT Wp W Wl 10 20 30 40

Backfill

WL ENCOUNTERED AT ELEV. 592.9' DURING DRILLING MAR. 28,1989

WL IN STANDPIPE AT ELEV. 601.2' MAR. 31,1989.

0 15-⊕-5 PERCENT AXIAL STRAIN AT FAILURE 10

DEPTH SCALE 1 inch ic 5 feet

Golder Associates

LOGGED P.H.S.

CHECKED PS.

RECORD OF BOREHOLE 4

SHEET 1

LOCATION SEE PLAN FIGURE 1 | BORING DATE MAR.29,1989 | DATUM GEODETIC

SAMPLER HAMMER, 140lb; DROP, 30in | PENETRATION TEST HAMMER, 140lb; DROP, 30in

DEPTH SCALE FEET	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (FT)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FT.	DYNAMIC PENETRATION RESISTANCE, BLOWS/FT	SHEAR STRENGTH Cu, LB/SQ.FT. nat.V.- + Q.- ● rem.V.- ⊕ U.- O	HYDRAULIC CONDUCTIVITY, k, CM/SEC	WATER CONTENT, PERCENT Wp W Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		GROUND SURFACE		602.5									
		Brown silty TOPSOIL		601.8									
				0.7									Backfill
5	POWER AUGER 7.5in. DIAM. (HOLLOW STEM)	Very soft to firm brown CLAYEY SILT numerous silty sand and sandy silt layers occ. shell fragments.			1	2" DO	6				O		
					2	2" DO	2				O		
				595.5									
				7.0									
		Very loose grey SILTY FINE SAND.			3	2" DO	2				O		
				593.0									
10				9.5	4	2" DO	3				O		
					5	2" DO	2				O		
15		Soft to very soft grey CLAYEY SILT numerous layers of sandy silt and silty sand occ. wood and shell fragments, occ. peat layers.			6	2" DO	2				O		
					7	2" DO	4				O		
				578.5									
				24.0									STANDPIPE
25		Loose grey SILTY SAND occ. gravel.			8	2" DO	9				O		
				575.5									
				27.0									
		Very stiff grey SILTY CLAY occ. gravel (TILL).											
30					9	2" DO	26				O		
				571.0									
		END OF BOREHOLE		31.5									
35													

16 - Ø - 6 PERCENT AXIAL STRAIN AT FAILURE

WL ENCOUNTERED AT ELEV. 594.5' DURING DRILLING MAR.29,1989

WL IN STANDPIPE AT ELEV. 602.2' MAR. 29,1989.

DEPTH SCALE

1 inch to 5 feet

Golder Associates

LOGGED P.H.S.

CHECKED

RECORD OF BOREHOLE 5

SHEET 1

LOCATION SEE PLAN FIGURE 1 | BORING DATE MAR.29,1989 | DATUM GEODETIC

SAMPLER HAMMER, 140lb; DROP, 30in | PENETRATION TEST HAMMER, 140lb; DROP, 30in

DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (FT)	SAMPLES: NUMBER	TYPE	BLOWS/FT.	DYNAMIC PENETRATION RESISTANCE, BLOWS/FT	HYDRAULIC CONDUCTIVITY, k, CM/SEC	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	POWER AUGER 7.6in. DIAM. (HOLLOW STEM)	GROUND SURFACE		600.2							Backfill
		Brown silty TOPSOIL		0.0							
		Soft mottled brown CLAYEY SILT trace organic material.		0.8	1	2" DO	3				
				595.7							
5		Loose to very loose grey SILTY FINE SAND trace organic material.		4.5	2	2" DO	7				
					3	2" DO	2				
				590.7							
10		Very soft grey CLAYEY SILT occ. silt pockets numerous vegetation layers.		9.5	4	2" DO	2				
					5	2" DO	2				
				585.7							
15		Brown FIBROUS PEAT.		14.5	6	2" DO	7				
				583.2							
		Very soft grey SILTY CLAY occ. silt partings.		17.0							
20				579.2	7	2" DO	6				
		Compact grey SAND AND GRAVEL.		21.0							
25					8	2" DO	18				
				573.7							
		END OF BOREHOLE		26.5							
30											
35											

SHEAR STRENGTH Cu, LB/SQ.FT. nat.V.- + Q.- ● rem.V.- ⊕ U.- O

WATER CONTENT, PERCENT Wp W Wl (10 20 30 40)

239

WL ENCOUNTERED AT ELEV. 596.2' DURING DRILLING MAR.29,1989

WL IN STANDPIPE AT ELEV. 600.1' MAR.31,1989

16 ε 6 PERCENT AXIAL STRAIN AT FAILURE

DEPTH SCALE

1 inch ic 5 feet

Golder Associates

LOGGED P.H.S.

CHECKED

PENETRATION TEST 101

SHEET 1

LOCATION SEE PLAN FIGURE 1 | BORING DATE MAR. 29,1989 | DATUM GEODETIC

SAMPLER HAMMER, 140lb; DROP, 30in | PENETRATION TEST HAMMER, 140lb; DROP, 30in

DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (FT)	SAMPLES: NUMBER	TYPE	BLOWS/FT.	DYNAMIC PENETRATION RESISTANCE, BLOWS/FT (20 40 60 80)	SHEAR STRENGTH Cu, LB/SQ.FT. nat.V.- + Q.- ● rem.V.- ⊕ U.- ○	HYDRAULIC CONDUCTIVITY, k, CM/SEC	WATER CONTENT, PERCENT Wp W Wl	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
-5													
0		GROUND SURFACE		0.0									
5													
10													
15													
20													
25													
30		END OF PENETRATION TEST		30.0				END OF PEN. TEST (53 blows / last ft.)					
35													

16 (0 / 10) % PERCENT AXIAL STRAIN AT FAILURE

DEPTH SCALE

1 inch to 6 feet

Golder Associates

LOGGED P.H.S.

CHECKED

RECORD OF TEST PIT 101

LOCATION See Figure 1 | DATE June 30,1989 | DATUM Geodetic

PROJECT 891-3247

DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (FT)	SAMPLES: NUMBER	TYPE	BLOWS/FT.	DYNAMIC PENETRATION RESISTANCE, BLOWS/FT / SHEAR STRENGTH Cu, LB/SQ.FT. (nat.V.- + Q.- ● rem.V.- ⊕ U.- O)	HYDRAULIC CONDUCTIVITY, k, CM/SEC / WATER CONTENT, PERCENT (WP, W, WL; 20, 40, 60, 80)	ADDITIONAL LAB. TESTING	GROUNDWATER CONDITIONS
0		GROUND SURFACE		597.2							
		Brown silty TOPSOIL		0.0 596.2							
		Brown SAND trace to some silt occ. sandy silt and clayey silt layers		1.0 592.2	1	CS			O		
5		Grey CLAYEY SILT numerous shell fragments occ. peat layers some organic material		5.0 588.2	2	CS			O		SEEPAGE INTO TEST PIT AT ELEV. 593.2 JUNE 30,1989.
10		Grey SANDY SILT occ. organic material		9.0 585.7	3	CS			O		
		END OF TEST PIT		11.5							
15											
20											
25											
30											
35											

0 / 15 / 10 PERCENT AXIAL STRAIN AT FAILURE

DEPTH SCALE
1 Inch to 5 feet

Golder Associates

LOGGED P.H.S.
CHECKED

RECORD OF TEST PIT 102

LOCATION See Figure 1 | DATE June 30,1989 | DATUM Geodetic

PROJECT 891-3247

DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (FT)	SAMPLES: NUMBER	TYPE	BLOWS/FT.	DYNAMIC PENETRATION RESISTANCE, BLOWS/FT / SHEAR STRENGTH Cu, LB/SQ.FT. (nat.V.- + Q.- ● rem.V.- ⊕ U.- O)	HYDRAULIC CONDUCTIVITY, k, CM/SEC / WATER CONTENT, PERCENT (Wp, W, Wl; 20 40 60 80)	ADDITIONAL LAB. TESTING	GROUNDWATER CONDITIONS
0		GROUND SURFACE		598.0							
		Brown silty TOPSOIL		0.0 594.2							
		Brown SILTY SAND occ. sandy silt and clayey silt layers		1.8 591.5	1	CS			O		
5		Mottled brown CLAYEY SILT trace organic material		4.5 590.0	2	CS			O		SEEPAGE INTO TEST PIT AT ELEV. 592.0 JUNE 30,1989.
		Brown SANDY SILT		6.0 588.5	3	CS			O		
		Grey SAND & GRAVEL		7.5							
		Brown becoming grey at about elev. 587.5 CLAYEY SILT (TILL)		8.0 586.5	4	CS			O		
10		END OF TEST PIT		9.5							
15											
20											
25											
30											
35											

0 / 16 6 PERCENT AXIAL STRAIN AT FAILURE / 10

DEPTH SCALE
1 inch to 5 feet

Golder Associates

LOGGED P.H.S.
CHECKED

RECORD OF TEST PIT 103

LOCATION See Figure 1 | DATE June 30,1989 | DATUM Geodetic

PROJECT 891-3247

DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (FT)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/FT.	DYNAMIC PENETRATION RESISTANCE, BLOWS/FT	SHEAR STRENGTH Cu, LB/SQ.FT. nat.V.- + Q.- ● rem.V.- ⊕ U.- O	HYDRAULIC CONDUCTIVITY, k, CM/SEC	WATER CONTENT, PERCENT Wp W Wl 20 40 60 80	ADDITIONAL LAB. TESTING	GROUNDWATER CONDITIONS
0		GROUND SURFACE		599.1									
		Brown silty TOPSOIL		0.0 / 597.9									
		Brown SILTY SAND trace to some organic material		1.2									
		Brown medium to coarse SAND trace silt occ. gravel		1.9 / 2.8	1	CS					O		
5		Mottled brown CLAYEY SILT occ. gravel (TILL) becoming grey at about elev. 592.1, occ. silt seams below elev. 591.1		590.1	2	CS					O		TEST PIT DRY DURING EXCAVATION JUNE 30,1989.
10		END OF TEST PIT		9.0									
15													
20													
25													
30													
35													

0 / 15 / 10 PERCENT AXIAL STRAIN AT FAILURE

DEPTH SCALE
1 inch to 5 feet

Golder Associates

LOGGED P.H.S.
CHECKED

RECORD OF BOREHOLE 1

LOCATION See Figure 1 BORING DATE MAY 30, 1979 DATUM LOCAL

SAMPLER HAMMER WEIGHT 140 LBS DROP 30 IN. PENETRATION TEST HAMMER WEIGHT — DROP —

ELEV'N. / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS/FT.
102·9 / 0·0	GROUND SURFACE			
	COMPACT TO VERY LOOSE BROWN & GREY SILTY SAND TRACE CLAY, ROOTS WOOD FRAGMENTS SHELLS (ALLUVIUM)	1	2" D-D	10
		2	"	10
94·9 / 8·0	VERY LOOSE GREY SANDY SILT OCC. ROOTS (ALLUVIUM)	3	"	3
93·4 / 9·5	VERY LOOSE TO LOOSE GREY SILTY SAND POCKETS OF SANDY SILT TRACE CLAY OCC. SHELLS AND WOOD FRAGMENTS (ALLUVIUM)	4	"	3
		5	"	2
		6	"	2
		7	"	3
		8	"	2
		9	"	4
		10	"	3
		11	"	3
70·9 / 32·0	HARD GREY SILTY CLAY TRACE SAND OCC. GRAVEL (TILL)	12	"	8
		13	"	30
		14	"	34
		15	"	39
		16	"	34
		17	"	39
46·4 / 56·5	END OF BOREHOLE	18	"	50

POWER AUGER 7·5" DIA. HOLLOW STEM

ELEVATION SCALE: 105, 100, 95, 90, 85, 80, 75, 70, 65, 60, 55, 50, 45

DYNAMIC PENETRATION RESISTANCE, BLOWS/

SHEAR STRENGTH Cu. NAT. V. + 0. • REM. V. ⊖ U. ○

COEFFICIENT OF PERMEABILITY, k, CM./SEC. 1x10 1x10 1x10 1x10

WATER CONTENT, PERCENT W_P W W_L 10 20 30 40

ADDITIONAL LAB. TESTING: MH, MH

PIEZOMETER OR STANDPIPE INSTALLATION

GROUND SURFACE

PLASTIC TUBING

AUGERED BACKFILL

FILTER GRAVEL

STANDPIPE

CAVED MATERIAL

WATER LEVEL IN BOREHOLE AT ELEV. 97·4 ON COMPLETION OF DRILLING MAY 30, 1979.

STANDPIPE DRY MAY 31, 1979

15 ⊖ 3 Percent axial strain at failure

VERTICAL SCALE REDUCTION N.T.S.

Golder Associates

DRAWN K. GALLEANO

CHECKED DWS

RECORD OF BOREHOLE 2

LOCATION See Figure 1 BORING DATE MAY 30, 1979 DATUM LOCAL

SAMPLER HAMMER WEIGHT 140 LBS DROP 30 IN. PENETRATION TEST HAMMER WEIGHT – DROP –

BORING METHOD	ELEV'N. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	BLOWS/FT.
	104.1	GROUND SURFACE				
POWER AUGER 7.5" DIA. HOLLOW STEM	0.0 / 101.6	FIRM BROWN TO GREY SILTY CLAY SOME SAND OCC. GRAVEL **(FILL)**				
	2.5 / 99.6	LOOSE GREY **SILTY SAND** SOME CLAY OCC. WOOD FRAGMENTS (ALLUVIUM)		1	2" D.O.	9
	4.5 / 97.1	FIRM BROWN **CLAYEY SILT** TRACE SAND OCC. ROOTS & WOOD FRAGMENTS (ALLUVIUM)		2	"	7
	7.0	VERY LOOSE TO LOOSE GREY **SILTY SAND** POCKETS OF SANDY SILT OCC. GRAVEL WOOD FRAGMENTS SHELLS (ALLUVIUM)		3	"	2
				4	"	1
				5	"	1
				6	"	2
				7	"	8
				8	"	4
	75.6 / 28.5 / 72.8	COMPACT GREY **SILTY SAND & GRAVEL**		9	"	14
	31.3 / 67.6	STIFF TO HARD GREY **SILTY CLAY** TRACE SAND OCC. GRAVEL **(TILL)**		10	"	35
	36.5	END OF BOREHOLE				

ELEVATION SCALE: 105, 100, 95, 90, 85, 80, 75, 70, 65

DYNAMIC PENETRATION RESISTANCE, BLOWS/

SHEAR STRENGTH Cu. NAT. V. - + Q. - ⊗ REM. V. · ⊕ U. · ○

COEFFICIENT OF PERMEABILITY, k, CM./SEC. 1x10 1x10 1x10 1x10

WATER CONTENT, PERCENT W_P W W_L 10 20 30 40

67 %

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

WATER LEVEL IN BOREHOLE AT ELEV. 101.1 ON COMPLETION OF DRILLING MAY 30, 1979

AT ELEV. 102.1 MAY 31, 1979.

C / 15 ε 10 = ε Percent axial strain at failure

VERTICAL SCALE REDUCTION N.T.S.

Golder Associates

DRAWN E. GALLERNO

CHECKED D.M.

RECORD OF BOREHOLE 3

LOCATION See Figure 1 BORING DATE MAY 30, 1979 DATUM LOCAL

SAMPLER HAMMER WEIGHT 140 LBS. DROP 30 IN. PENETRATION TEST HAMMER WEIGHT – DROP –

BORING METHOD	ELEV'N / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FT.
POWER AUGER 7.5" DIA. HOLLOW STEM.	100.2	GROUND SURFACE				
	0.0 / 97.7	COMPACT BROWN **SILTY SAND TO SANDY SILT** (ALLUVIUM)		1	2" D-O	4
	2.5 / 95.7	SOFT BROWN **CLAYEY SILT** (ALLUVIUM)		2	"	8
	4.5 / 93.2	LOOSE BROWN **SILTY SAND** (ALLUVIUM)		3	"	2
	7.0 / 88.2	VERY LOOSE GREY **SILTY SAND** OCC. GRAVEL WOOD & ROOTS (ALLUVIUM)		4	"	3
	12.0 / 74.2	VERY LOOSE TO LOOSE GREY **SANDY SILT** POCKETS OF SILTY SAND OCC ROOTS SHELLS & WOOD FRAGMENTS (ALLUVIUM)		5	"	3
				6	"	7
				7	"	3
				8	"	1
	26.0 / 68.2	SOFT TO VERY SOFT GREY **CLAYEY SILT** TRACE SAND (ALLUVIUM)		9	"	43
	32.0 / 65.7	HARD GREY **SILTY CLAY** TRACE SAND OCC. GRAVEL (TILL)		10	"	34
	36.5	END OF BOREHOLE				

ELEVATION SCALE: 105, 100, 95, 90, 85, 80, 75, 70, 65, 60

DYNAMIC PENETRATION RESISTANCE, BLOWS/

SHEAR STRENGTH Cu. NAT. V. - + O. - ⊕ REM.V. - ⊕ U. - O

COEFFICIENT OF PERMEABILITY, k_v, CM./SEC. 1x10 1x10 1x10 1x10

WATER CONTENT, PERCENT W_P W W_L 10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

WATER LEVEL IN BOREHOLE AT ELEV. 96.4 ON COMPLETION OF DRILLING MAY 30, 1979 AND AT ELEV. 98.7 MAY 31, 1979.

ε_f: Percent axial strain at failure

VERTICAL SCALE REDUCTION N.T.S

Golder Associates

DRAWN E. GALLERNO

CHECKED DPM

Exp Borehole and Test Pit Logs

November 2008 Borehole Summary Table

Boreholes were advanced using a locally contracted track-mounted Canterra drilling unit on November 8, 2008.

Depth (m)	Moisture Content (%)	Penetrometer (kg/cm^2)	Soil Description
BH 08-1			
0.0 – 0.2			TOPSOIL – black, silty loam, loose, moist
0.2 – 3.1			CLAYEY SILT – brown, trace fine sand and gravel, stiff, moist
0.8	14.1		
2.3	18.7	1.5	SANDY SILT – grey/brown, fine grained, trace clay, loose to compact, very moist to wet
3.1 – 6.1			-becoming loose and wet below 3.65m depth
3.7	24.3		
6.1	30.7		BOREHOLE TERMINATED at 6.1m depth
			Groundwater measured at 1.4 m depth upon completion
BH 08-2			
0.0 – 0.2			TOPSOIL – black, silty loam, loose, moist
0.2 – 2.3		1.1	CLAYEY SILT – brown, trace fine sand and gravel, firm to stiff, moist
0.8	14.8		
2.3	23.1		
2.3 – 6.1			SANDY SILT – grey/brown, fine grained, trace clay, loose, very moist
3.7	26.2		
6.1	26.7		-becoming wet below 3.1m depth
			BOREHOLE TERMINATED at 6.1m depth
			Groundwater measured at 3.1 m depth upon completion
BH 08-3			
0.0 – 0.2			TOPSOIL – black, silty loam, loose, moist
0.3 – 4.5			SANDY SILT – brown, fine grained, loose to compact, very moist to wet
0.8	24.2		
2.3	25.8		-becoming grey with trace clay and wet below 2.7m depth
3.7	29.3		
4.5- 6.1			-becoming CLAYEY SILT, soft below 4.5m depth
6.1	28.7		
			BOREHOLE TERMINATED at 6.1m depth
			Groundwater measured at 3.1 m depth upon completion

Depth (m)	Moisture Content (%)	Penetrometer (kg/cm^2)	Soil Description
BH 08-4			
0.0 – 0.3			TOPSOIL – black, silty loam, loose, moist
0.3 – 3.7		0.5	SANDY SILT – brown, fine grained, loose to compact, very
0.8	22.9		moist to wet
2.3	24.9		-trace clay below 2.7m depth
3.7 – 6.1			-becoming CLAYEY SILT, grey, soft below 3.7m depth
3.8	31.4		
6.1	22.0		
			BOREHOLE TERMINATED at 6.1m depth
			Groundwater measured at 3.1 m depth upon completion
BH 08-5			
0.0 – 0.3			TOPSOIL – black, silty loam, loose, moist
0.3 – 5.2		1.5	SANDY SILT – brown, fine grained, trace clay, loose to
0.8	19.3		compact, very moist to wet
2.3	24.6		-some clay, loose, wet
3.8	25.6		-becoming grey
5.2 – 6.1			-becoming CLAYEY SILT, soft, wet below 5.2m depth
6.1	40.4		
			BOREHOLE TERMINATED at 6.1 m depth
			Groundwater measured at 3.1 m depth upon completion
BH 08-6			
0.0 – 0.4			TOPSOIL – black, silty loam, loose, moist
0.4 – 2.3			SAND – brown, fine to medium grained, compact, moist
0.8	11.1		-some silt to silty
2.3	13.7		
2.3 – 3.4			
3.4 – 4.6		3.5	SILT TILL – brown, trace sand and gravel, dense, moist
3.8	16.0		
4.6 – 6.1		2.0	-becoming grey and clayey
6.1	14.6		
			BOREHOLE TERMINATED at 6.1 m depth
			Open and dry upon completion
BH 08-7			
0.0 – 0.4			TOPSOIL – black, silty loam, loose, moist
0.4 – 0.8		1.0	CLAYEY SILT – brown, trace sand and gravel, stiff, moist
0.8	22.0		
0.8 – 1.8		4.0	SILT TILL – brown, trace sand and gravel, dense, moist
1.8 – 4.6		3.5	-some silt layering
2.3	16.4		
3.8	15.7		
4.6 – 6.1		2.5	-becoming grey and clayey
6.1	14.8		
			BOREHOLE TERMINATED at 6.1 m depth
			Open and dry upon completion

Depth (m)	Moisture Content (%)	Penetrometer (kg/cm^2)	Soil Description
BH 08-8			
0.0 – 0.4			TOPSOIL – black, silty loam, loose, moist
0.4 – 1.5		1.0	CLAYEY SILT – brown, trace gravel, trace topsoil, firm/stiff,
0.8	17.5		moist
1.5 – 3.8		0.5	-becoming grey, firm and very moist
2.3	28.9		
3.8 – 4.6			-soft, very moist to wet
3.8	27.4		
4.6 – 6.1			-wet
6.1	27.5		
			BOREHOLE TERMINATED at 6.1 m depth
			Groundwater measured at 3.1 m depth upon completion
BH 08-9			
0.0 – 0.4			TOPSOIL – black, silty loam, loose, moist
0.4 – 1.5			CLAYEY SILT – brown, some fine sand, soft, moist to very
0.8	30.6		moist
1.5 – 3.8			-becoming grey
2.3	34.8		
3.8 – 4.6			
3.8	29.0		-wet
4.6 – 6.1			
6.1	28.9		BOREHOLE TERMINATED at 6.1 m depth
			Groundwater measured at 4.6 m depth upon completion
BH 08-10			
0.0 – 0.4			TOPSOIL – black, silty loam, loose, moist
0.4 – 1.5			SANDY SILT – brown, trace to some clay, loose, very moist
0.8	22.0		
1.5 – 3.8			-becoming grey and clayey
2.3	29.3		
3.8 – 4.6			-wet
3.8	27.9		
4.6 – 6.1			-trace till layering
6.1	30.6		
			BOREHOLE TERMINATED at 6.1 m depth
			Groundwater measured at 3.4 m depth upon completion

Depth (m)	Moisture Content (%)	Penetrometer (kg/cm^2)	Soil Description
BH 08-11			
0.0 – 0.4			TOPSOIL – black, silty loam, loose, moist
0.4 – 1.5			SANDY SILT – brown, trace to some clay, loose, very moist
0.8	23.0		
1.5 – 3.8			-becoming grey
2.3	26.7		
3.8 – 4.6			-clayey
3.8	33.4		
4.6 – 6.1			-wet
6.1	29.8		
			BOREHOLE TERMINATED at 6.1 m depth *Groundwater measured at 5.4 m depth upon completion*
BH 08-12			
0.0 – 0.4			TOPSOIL – black, silty loam, loose, moist
0.4 – 1.5		0.5	CLAYEY SILT – brown, some fine sand, firm, moist to very moist
0.8	33.5		
1.5 – 3.8			-becoming soft and very moist to wet
2.3	30.6		
3.8 – 4.6			-grey
3.8	29.6		
4.6 – 6.1			
6.1	28.3		
			BOREHOLE TERMINATED at 6.1 m depth *Groundwater measured at 5.7 m depth upon completion*
BH 08-13			
0.0 – 0.4			TOPSOIL – black, silty loam, loose, moist
0.4 – 1.5			SANDY SILT – brown, trace to some clay, loose, very moist to wet; becoming grey and clayey below 0.8 m bgs
0.8	22.2		
1.5 – 3.8			
2.3	29.3		
3.8 – 4.6			-wet
3.8	48.3		
4.6 – 6.1			
6.1	27.7		
			BOREHOLE TERMINATED at 6.1 m depth *Groundwater measured at 5.7 m depth upon completion*

Depth (m)	Moisture Content (%)	Penetrometer (kg/cm^2)	Soil Description
BH 08-14			
0.0 – 0.3			TOPSOIL – black, silty loam, loose, moist
0.3 – 1.5			CLAYEY SILT – brown, some fine sand, soft, very moist
0.8	28.5		
1.5 – 3.8			-becoming grey with increasing clay content
2.3	29.3		
3.8 – 4.6		2.5	CLAYEY SILT TILL– brown, trace sand and gravel, very stiff, moist
3.8	20.4		
4.6 – 6.1		2.5	
6.1			BOREHOLE TERMINATED at 6.1 m depth *Groundwater measured at 1.5 m depth upon completion*
BH 08-15			
0.0 – 0.5			TOPSOIL – black, silty loam, loose, moist
0.5 – 2.1		0.5	CLAYEY SILT – brown, some fine sand, soft, very moist
0.8	28.4		
2.1 – 3.1		3.0	CLAYEY SILT TILL– brown, trace sand and gravel, very stiff, moist
2.3	18.0		
3.1			BOREHOLE TERMINATED at 3.1 m depth *Open and dry upon completion*
BH 08-16			
0.0 – 0.3			TOPSOIL – black, silty loam, loose, moist
0.3 – 1.8			SAND AND GRAVEL – brown, coarse grained, loose to compact, wet
0.8	15.1		
1.8 – 3.1		3.0	SILT TILL– brown, trace sand and gravel, trace clay, very stiff, moist
1.8	17.7		
3.1			BOREHOLE TERMINATED at 3.1 m depth *Groundwater measured at 0.6 m depth upon completion*
BH 08-17			
0.0 – 0.3			TOPSOIL – black, silty loam, loose, moist
0.3 – 1.5			SANDY SILT – brown, trace clay, loose to compact, very moist
0.8	22.8		
1.5 – 3.8		1.0	
2.3	18.6		
3.8 – 4.9		1.0	
3.8	18.3		
4.9 – 6.1		1.5	SILT TILL– grey, trace clay, trace sand and gravel, dense, moist
6.1	17.4		
			BOREHOLE TERMINATED at 6.1 m depth *Open and dry upon completion*

Depth (m)	Moisture Content (%)	Penetrometer (kg/cm^2)	Soil Description
BH 08-18			
0.0 – 0.3			TOPSOIL – black, silty loam, loose, moist
0.3 – 1.5		4.5	SILT TILL– grey, trace clay, trace sand and gravel, dense, moist
1.5	20.2		
			BOREHOLE TERMINATED at 1.5 m depth
			Open and dry upon completion
BH 08-19			
0.0 – 0.3			TOPSOIL – black, silty loam, loose, moist
0.3 – 1.5		3.0	CLAYEY SILT TILL– grey, trace sand and gravel, dense, moist
0.8	16.2		
1.5			BOREHOLE TERMINATED at 1.5 m depth
			Open and dry upon completion
BH 08-20			
0.0 – 0.3			TOPSOIL – black, silty loam, loose, moist
0.3 – 2.1			SANDY SILT – brown, fine grained, loose to compact, wet
0.8	22.7		
2.1 – 3.1		3.0	SILT TILL– grey, trace/some clay, trace sand and gravel, dense, moist
2.3	14.1		
6.1			BOREHOLE TERMINATED at 6.1 m depth
			Open and dry upon completion
BH 08-21			
0.0 – 0.3			TOPSOIL – black, silty loam, loose, moist
0.3 – 2.1			SANDY SILT – brown, fine grained, loose to compact, wet
.8	22.7		
2.1 – 3.1		3.5	SILT TILL– grey, trace/some clay, trace sand and gravel, dense, moist
3.1	14.1		
			BOREHOLE TERMINATED at 3.1 m depth
			Open and dry upon completion
BH 08-22			
0.0 – 0.3			TOPSOIL – black, silty loam, loose, moist
0.3 – 1.5			SANDY SILT – brown, fine grained, dilatant, loose/compact, very moist
0.8	22.2		
1.5 – 4.0			
2.3	25.3		
4.0 – 4.6		2.0	CLAYEY SILT TILL– grey, trace sand and gravel, very stiff, moist
4.6	22.2		
			BOREHOLE TERMINATED at 4.6 m depth
			Open and dry upon completion

Trow
London Branch

BOREHOLE LOG

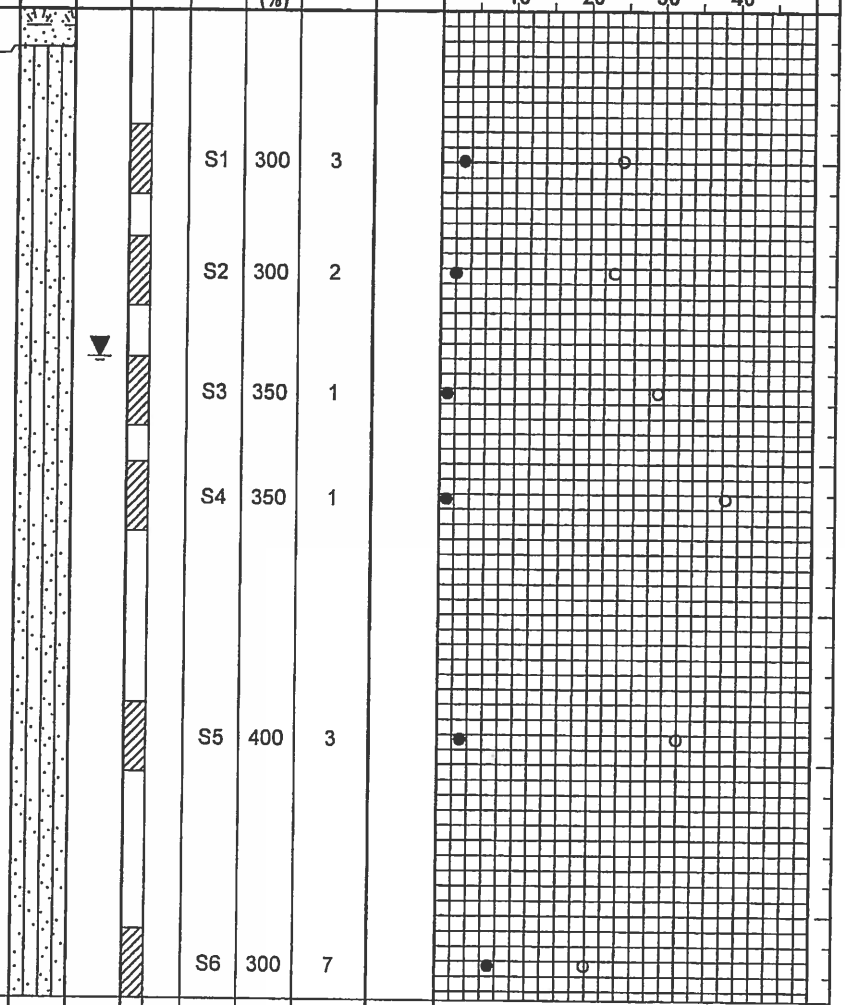
BH09-1
Sheet 1 of 1

PROJECT Proposed Residential Developement, George Street, Port Stanley, Ontario PROJECT NO. LNGE00009968A
CLIENT 387476 Ontario Ltd. DATUM N/A
DRILL TYPE/METHOD Track-mounted CME-55 DATES: Boring Dec 22/09 Water Level Dec 22/09

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or (%)	SAMPLES N VALUE (blows) or RQD (%)	OTHER TESTS
0	0.25	**TOPSOIL**, brown/black sandy loam, trace cobbles, loose, moist					
		SANDY SILT, brown, trace fine gravel, loose, wet					
1				S1	300	3	
2				S2	300	2	
		-becoming grey below 2.3 m depth		S3	350	1	
3		-trace organics and trace to some clay below 3.0 m depth		S4	350	1	
4							
5				S5	400	3	
6							
	6.56			S6	300	7	
7		**End of Borehole at 6.56 m depth**					

SHEAR STRENGTH
♣ S Field Vane Test (#=Sensitivity)
▲ Penetrometer ■ Torvane
40 80 kPa
Atterberg Limits and Moisture
W_P W W_L
● SPT N Value × Dynamic Cone
10 20 30 40

WELL LOG / STRATA PLOT



NOTES

1) Borehole interpretation requires assistance by Trow before use by others. Borehole Logs must be read in conjunction with Trow Report LNGE00009968A. For definition of terms used on logs, see sheets prior to logs.

2) Borehole open to 3.0 m depth upon completion of drilling; groundwater measured at 2.3 m depth upon completion of drilling.

3) No significant levels of methane were detected during drilling and upon completion of borehole.

SAMPLE LEGEND
☒ AS Auger Sample ▨ SS Split Spoon ■ ST Shelby Tube
▥ Rock Core (eg. BQ, NQ, etc.) ▣ VN Vane Sample

OTHER TESTS

G Specific Gravity	C Consolidation
H Hydrometer	CD Consolidated Drained Triaxial
S Sieve Analysis	CU Consolidated Undrained Triaxial
γ Unit Weight	UU Unconsolidated Undrained Triaxial
P Field Permeability	UC Unconfined Compression
K Lab Permeability	DS Direct Shear

WATER LEVELS
▽ Apparent ▼ Measured ▲ Artesian (see Notes)

Trow
London Branch

BOREHOLE LOG

BH09-2

Sheet 1 of 1

PROJECT Proposed Residential Developement, George Street, Port Stanley, Ontario PROJECT NO. LNGE00009968A

CLIENT 387476 Ontario Ltd. DATUM N/A

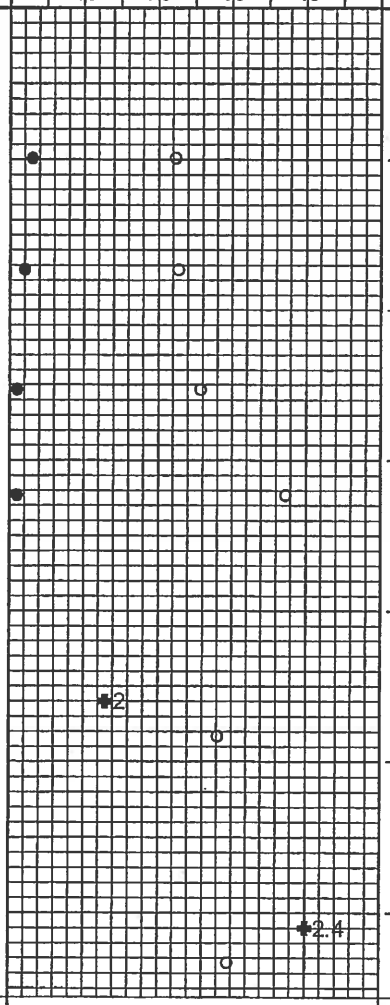
DRILL TYPE/METHOD Track-mounted CME-55 DATES: Boring Dec 22/09 Water Level Dec 22/09

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or (%)	SAMPLES N VALUE (blows) or RQD (%)
0	0.30	**TOPSOIL**, brown/black sandy loam, trace cobbles, loose, moist				
		SANDY SILT, brown, trace gravel, loose, moist		S1	200	3
1		-becoming grey, dilatant and very moist below 1.5 m depth		S2	250	2
2				S3	300	1
3	3.00	**CLAYEY SILT**, grey, trace sand and gravel, very soft, wet		S4	300	1
4						
5				S5	400	
6	6.56			S6	300	
7		**End of Borehole at 6.56 m depth**				

OTHER TESTS

SHEAR STRENGTH
✚ S Field Vane Test (#=Sensitivity)
▲ Penetrometer ■ Torvane
40 80 kPa

Atterberg Limits and Moisture
W_P W W_L
● SPT N Value × Dynamic Cone
10 20 30 40



NOTES

1) Borehole interpretation requires assistance by Trow before use by others. Borehole Logs must be read in conjunction with Trow Report LNGE00009968A. For definition of terms used on logs, see sheets prior to logs.

2) Borehole open to 2.7 m depth upon completion of drilling; groundwater measured at 2.3 m depth upon completion of drilling.

3) No significant levels of methane were detected during drilling and upon completion of borehole.

SAMPLE LEGEND
☒ AS Auger Sample ▨ SS Split Spoon ■ ST Shelby Tube
▥ Rock Core (eg. BQ, NQ, etc.) ▣ VN Vane Sample

OTHER TESTS
G Specific Gravity
H Hydrometer
S Sieve Analysis
γ Unit Weight
P Field Permeability
K Lab Permeability
C Consolidation
CD Consolidated Drained Triaxial
CU Consolidated Undrained Triaxial
UU Unconsolidated Undrained Triaxial
UC Unconfined Compression
DS Direct Shear

WATER LEVELS
▽ Apparent ▼ Measured ▲ Artesian (see Notes)

Trow
London Branch

BOREHOLE LOG

BH09-3

Sheet 1 of 1

PROJECT Proposed Residential Developement, George Street, Port Stanley, Ontario PROJECT NO. LNGE00009968A

CLIENT 387476 Ontario Ltd. DATUM N/A

DRILL TYPE/METHOD Track-mounted CME-55 DATES: Boring Dec 22/09 Water Level Dec 22/09

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or (%)	SAMPLES N VALUE (blows) or RQD (%)
0						
	0.30	**TOPSOIL**, brown/black sandy loam, trace cobbles, loose, moist				
		SANDY SILT, brown, trace gravel, loose, very moist		S1	300	7
1						
				S2	300	6
2						
		-becoming grey and very loose below 2.3 m depth		S3	300	2
3		-some clay to clayey and very soft below 3.0 m depth		S4	400	2
4						
		-coarse gravel and trace cobbles below 4.6 m depth		S5	0	19
5						
6		-becoming hard below 6.1 m depth		S6	200	75
	6.56					
		End of Borehole at 6.56 m depth				
7						

OTHER TESTS

SHEAR STRENGTH
✤ S Field Vane Test (#=Sensitivity)
▲ Penetrometer ■ Torvane
40 80 kPa

Atterberg Limits and Moisture
W_P W W_L
● SPT N Value × Dynamic Cone
10 20 30 40

75

NOTES

1) Borehole interpretation requires assistance by Trow before use by others. Borehole Logs must be read in conjunction with Trow Report LNGE00009968A. For definition of terms used on logs, see sheets prior to logs.

2) Borehole open to 2.1 m depth upon completion of drilling; groundwater measured at 2.1 m depth upon completion of drilling.

3) No significant levels of methane were detected during drilling and upon completion of borehole.

SAMPLE LEGEND
☒ AS Auger Sample ▨ SS Split Spoon ■ ST Shelby Tube
▥ Rock Core (eg. BQ, NQ, etc.) ▣ VN Vane Sample

OTHER TESTS
G Specific Gravity
H Hydrometer
S Sieve Analysis
γ Unit Weight
P Field Permeability
K Lab Permeability
C Consolidation
CD Consolidated Drained Triaxial
CU Consolidated Undrained Triaxial
UU Unconsolidated Undrained Triaxial
UC Unconfined Compression
DS Direct Shear

WATER LEVELS
▽ Apparent ▼ Measured ▲ Artesian (see Notes)

Trow
London Branch

BOREHOLE LOG

BH09-4
Sheet 1 of 1

PROJECT Proposed Residential Developement, George Street, Port Stanley, Ontario PROJECT NO. LNGE00009968A
CLIENT 387476 Ontario Ltd. DATUM N/A
DRILL TYPE/METHOD Track-mounted CME-55 DATES: Boring Dec 22/09 Water Level Dec 22/09

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or (%)	SAMPLES N VALUE (blows) or RQD (%)
0						
	0.30	**TOPSOIL**, brown/black sandy loam, trace cobbles, loose, moist				
		SANDY SILT, brown, fine grained, trace clay, loose, very moist		S1	300	8
1						
		-becoming dilatant, wet and very loose below 1.5 m depth		S2	300	4
2						
		-becoming grey with trace to some clay and very moist to wet		S3	300	1
3				S4	150	2
4						
	4.60					
		CLAYEY SILT, grey, some fine grained sand, firm, wet		S5	175	6
5	5.56					
		SAND AND GRAVEL, grey, compact, moist				
6	6.56			S6	150	21
		End of Borehole at 6.56 m depth				
7						

WELL LOG: ▼ (Measured)

OTHER TESTS

SHEAR STRENGTH
✙ S Field Vane Test (#=Sensitivity) ▲ Penetrometer ■ Torvane
40 80 kPa

Atterberg Limits and Moisture
W_P W W_L

● SPT N Value × Dynamic Cone
10 20 30 40

NOTES

1) Borehole interpretation requires assistance by Trow before use by others. Borehole Logs must be read in conjunction with Trow Report LNGE00009968A. For definition of terms used on logs, see sheets prior to logs.

2) Borehole open to 2.3 m depth upon completion of drilling; groundwater measured at 2.3 m depth upon completion of drilling.

3) No significant levels of methane were detected during drilling and upon completion of borehole.

SAMPLE LEGEND
☒ AS Auger Sample ▨ SS Split Spoon ■ ST Shelby Tube
▥ Rock Core (eg. BQ, NQ, etc.) ▣ VN Vane Sample

OTHER TESTS

G Specific Gravity	C Consolidation
H Hydrometer	CD Consolidated Drained Triaxial
S Sieve Analysis	CU Consolidated Undrained Triaxial
γ Unit Weight	UU Unconsolidated Undrained Triaxial
P Field Permeability	UC Unconfined Compression
K Lab Permeability	DS Direct Shear

WATER LEVELS
▽ Apparent ▼ Measured ▲ Artesian (see Notes)

Trow
London Branch

BOREHOLE LOG

BH09-5

Sheet 1 of 1

PROJECT **Proposed Residential Developement, George Street, Port Stanley, Ontario** PROJECT NO. **LNGE00009968A**

CLIENT **387476 Ontario Ltd.** DATUM **N/A**

DRILL TYPE/METHOD **Track-mounted CME-55** DATES: Boring **Dec 22/09** Water Level **Dec 22/09**

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or (%)	SAMPLES N VALUE (blows) or RQD (%)
0						
	0.35	**TOPSOIL**, brown/black sandy loam, trace cobbles, loose, moist				
		SANDY SILT, brown, trace clay, loose, very moist		S1	200	5
1						
		-becoming dilatant, wet and very loose below 1.5 m depth		S2	450	2
2						
		-becoming grey with trace clay below 2.3 m depth		S3	300	4
3				S4	300	2
4						
5				S5	300	4
	5.20					
		PEAT, black, trace organics, very loose to loose, wet				
6						
	6.56			S6	200	5
7		**End of Borehole at 6.56 m depth**				

OTHER TESTS

SHEAR STRENGTH
✚ S Field Vane Test (#=Sensitivity)
▲ Penetrometer ■ Torvane
40 80 kPa

Atterberg Limits and Moisture
W_P W W_L

● SPT N Value × Dynamic Cone
10 20 30 40

110.4

NOTES

1) Borehole interpretation requires assistance by Trow before use by others. Borehole Logs must be read in conjunction with Trow Report LNGE00009968A. For definition of terms used on logs, see sheets prior to logs.

2) Borehole open to 0.9 m depth upon completion of drilling; groundwater measured at 0.9 m depth upon completion of drilling.

3) No significant levels of methane were detected during drilling and upon completion of borehole.

SAMPLE LEGEND
☒ AS Auger Sample ▨ SS Split Spoon ■ ST Shelby Tube
▥ Rock Core (eg. BQ, NQ, etc.) ▣ VN Vane Sample

OTHER TESTS
G Specific Gravity — C Consolidation
H Hydrometer — CD Consolidated Drained Triaxial
S Sieve Analysis — CU Consolidated Undrained Triaxial
γ Unit Weight — UU Unconsolidated Undrained Triaxial
P Field Permeability — UC Unconfined Compression
K Lab Permeability — DS Direct Shear

WATER LEVELS
▽ Apparent ▼ Measured ⏃ Artesian (see Notes)

Trow
London Branch

BOREHOLE LOG

BH09-6
Sheet 1 of 1

PROJECT Proposed Residential Developement, George Street, Port Stanley, Ontario PROJECT NO. LNGE00009968A
CLIENT 387476 Ontario Ltd. DATUM N/A
DRILL TYPE/METHOD Track-mounted CME-55 DATES: Boring Dec 22/09 Water Level Dec 22/09

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or (%)	SAMPLES N VALUE (blows) or RQD (%)	OTHER TESTS
0									
	0.30	**TOPSOIL**, brown/black sandy loam, trace cobbles, loose, moist							
		SANDY SILT, brown, loose to compact, very moist				S1	350	10	
1									
		-becoming dilatant, wet and very loose below 1.5 m depth				S2	450	4	
2									
						S3			
3									
						S4	300	2	
4									
		-trace organics below 4.6 m depth							
	5.00					S5	300	3	
5		**PEAT**, black, trace organics, very loose to loose, wet							
6									
	6.56					S6			
		End of Borehole at 6.56 m depth							
7									

SHEAR STRENGTH
S Field Vane Test (#=Sensitivity)
Penetrometer Torvane
40 80 kPa
Atterberg Limits and Moisture
W_P W W_L
SPT N Value × Dynamic Cone
10 20 30 40

68.4
99.9

NOTES

1) Borehole interpretation requires assistance by Trow before use by others. Borehole Logs must be read in conjunction with Trow Report LNGE00009968A. For definition of terms used on logs, see sheets prior to logs.

2) Borehole open to 0.9 m depth upon completion of drilling; groundwater measured at 0.6 m depth upon completion of drilling.

3) No significant levels of methane were detected during drilling and upon completion of borehole.

SAMPLE LEGEND
AS Auger Sample SS Split Spoon ST Shelby Tube
Rock Core (eg. BQ, NQ, etc.) VN Vane Sample

OTHER TESTS
G Specific Gravity C Consolidation
H Hydrometer CD Consolidated Drained Triaxial
S Sieve Analysis CU Consolidated Undrained Triaxial
γ Unit Weight UU Unconsolidated Undrained Triaxial
P Field Permeability UC Unconfined Compression
K Lab Permeability DS Direct Shear

WATER LEVELS
Apparent Measured Artesian (see Notes)

Trow
London Branch

BOREHOLE LOG

BH09-7

Sheet 1 of 1

PROJECT **Proposed Residential Developement, George Street, Port Stanley, Ontario** PROJECT NO. **LNGE00009968A**

CLIENT **387476 Ontario Ltd.** DATUM **N/A**

DRILL TYPE/METHOD **Track-mounted CME-55** DATES: Boring **Dec 22/09** Water Level **Dec 22/09**

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or (%)	SAMPLES N VALUE (blows) or RQD (%)
0						
	0.35	**TOPSOIL**, brown/black sandy loam, trace cobbles, loose, moist				
		SANDY SILT, brown, fine grained, loose to compact, very moist to wet				
1				S1	450	6
				S2	200	6
2						
		-becoming grey below 2.3 m depth		S3		
3				S4	250	2
4						
		-trace clay, very loose and wet below 4.6 m depth		S5	275	4
5	5.20					
		PEAT, black, trace organics, very loose to loose, wet				
6				S6		
	6.56					
		End of Borehole at 6.56 m depth				
7						

OTHER TESTS

SHEAR STRENGTH
✤ S Field Vane Test (#=Sensitivity)
▲ Penetrometer ■ Torvane
40 80 kPa

Atterberg Limits and Moisture
W_P W W_L
● SPT N Value × Dynamic Cone
10 20 30 40

9374

NOTES

1) Borehole interpretation requires assistance by Trow before use by others. Borehole Logs must be read in conjunction with Trow Report LNGE00009968A. For definition of terms used on logs, see sheets prior to logs.

2) Borehole open to 2.7 m depth upon completion of drilling; groundwater measured at 2.7 m depth upon completion of drilling.

3) No significant levels of methane were detected during drilling and upon completion of borehole.

SAMPLE LEGEND
☒ AS Auger Sample ▨ SS Split Spoon ■ ST Shelby Tube
▥ Rock Core (eg. BQ, NQ, etc.) ▣ VN Vane Sample

OTHER TESTS
G Specific Gravity — C Consolidation
H Hydrometer — CD Consolidated Drained Triaxial
S Sieve Analysis — CU Consolidated Undrained Triaxial
γ Unit Weight — UU Unconsolidated Undrained Triaxial
P Field Permeability — UC Unconfined Compression
K Lab Permeability — DS Direct Shear

WATER LEVELS
▽ Apparent ▼ Measured ▲ Artesian (see Notes)

Trow
London Branch

BOREHOLE LOG

BH09-8
Sheet 1 of 1

PROJECT **Proposed Residential Developement, George Street, Port Stanley, Ontario** PROJECT NO. **LNGE00009968A**
CLIENT **387476 Ontario Ltd.** DATUM **N/A**
DRILL TYPE/METHOD **Track-mounted CME-55** DATES: Boring **Dec 22/09** Water Level **Dec 22/09**

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or (%)	SAMPLES N VALUE (blows) or RQD (%)	OTHER TESTS
0									
	0.30	**TOPSOIL**, brown/black sandy loam, trace cobbles, loose, moist							
		SANDY SILT, brown, loose, very moist to wet				S1			
1									
						S2	250	3	
2									
		-becoming grey below 2.3 m depth				S3			
3				▼					
						S4	275	2	
	3.80								
4		**CLAYEY SILT**, grey, some fine grained sand, soft, wet							
	5.00					S5	275	4	
5		**PEAT**, black, trace organics, very loose to loose, wet							
6									
	6.56					S6			
		End of Borehole at 6.56 m depth							
7									

SHEAR STRENGTH
✚ S Field Vane Test (#=Sensitivity)
▲ Penetrometer ■ Torvane
40 80 kPa

Atterberg Limits and Moisture
W_P W W_L
● SPT N Value × Dynamic Cone
10 20 30 40

NOTES

1) Borehole interpretation requires assistance by Trow before use by others. Borehole Logs must be read in conjunction with Trow Report LNGE00009968A. For definition of terms used on logs, see sheets prior to logs.

2) Borehole open to 3.0 m depth upon completion of drilling; groundwater measured at 3.0 m depth upon completion of drilling.

3) No significant levels of methane were detected during drilling and upon completion of borehole.

SAMPLE LEGEND
☒ AS Auger Sample ▨ SS Split Spoon ■ ST Shelby Tube
▥ Rock Core (eg. BQ, NQ, etc.) ▥ VN Vane Sample

OTHER TESTS
G Specific Gravity C Consolidation
H Hydrometer CD Consolidated Drained Triaxial
S Sieve Analysis CU Consolidated Undrained Triaxial
γ Unit Weight UU Unconsolidated Undrained Triaxial
P Field Permeability UC Unconfined Compression
K Lab Permeability DS Direct Shear

WATER LEVELS
▽ Apparent ▼ Measured ▲ Artesian (see Notes)

2016 TP LOGS

TP1-150mm topsoil, sandy
0.15m-0.5m, Fill, Sandy Silt, brn/gry, trace clay, organics, comp, moist
0.5m-1.5m, Sandy Silt, brn/gry, trace clay, fine gravel, comp, moist
1.5m-2.5m, Clayey Silt, brn/gry, trace sand and gravel, stiff
2.5m-3.5m, Alluvial Sandy Silts, gry, trace clay, containing peat pockets, occasional shells, v loose, wet
Sidewalls unstable 2.5-3.5m, water@3m

TP2, 300mm topsoil, sandy
0.3m-1m, Fill, Sandy Silt, drk brn, traces steel, wood, loose, moist
1m-2m, Sandy Silt, brn/gry, trace clay, weathered, loose, v.moist, dilatant with depth
2m-5m, Alluvial Sandy Silts, gry, trace clay, containing peat pockets, occasional shells, v loose, wet
Sidewalls unstable 3m-5m, water@5m

TP3, 250mm topsoil, sandy
0.25m-1.7m, Silty Sand, brn, weathered, comp, moist, dilatant with depth, trace shells
1.7m-3m, Alluvial Sandy Silts, gry, trace clay, containing peat pockets, occasional shells, v loose, wet
Sidewalls very unstable 2m-3m, water @ 3m

TP4, 300mm topsoil, sandy
0.3m-2m, Sandy Silt, brn, trace peat, loose to comp, moist
2m-3.5m, Alluvial Sandy Silts, gry, trace clay, containing peat pockets, occasional shells, v loose, wet
Sidewalls very unstable 2.5m-3.5m, water @3.5m

TP5, 300mm topsoil, sandy
0.3m-2m, Silty Sand, brn, weathered, comp, moist, dilatant with depth
2m-4m, Alluvial Sandy Silts, gry, some clay, containing peat pockets, occasional shells, v loose, wet

TP6, 300mm topsoil, sandy
0.3m-1.7m, Silty Sand, brn, weathered, comp, moist, dilatant with depth
1.7m-5m, Alluvial Sandy Silts, gry, trace clay, containing peat pockets, occasional shells, v loose, wet
Sidewalls unstable 3m-5m, water @5m

TP7, 300mm topsoil, sandy
0.3m-2.7m, Sandy Silt Till, brn/gry, trace clay, stiff, dtpl
2.7m-4.2m, Alluvial Sandy Silts, gry, trace clay, trace peat pockets, occasional shells, loose, very moist
Sidewalls stable, dry

TP8, 300mm topsoil, sandy
0.3m-1.5m, Sandy Silt, brn, comp, moist
1.5m-2m, Silty Sand, brn, weathered, comp, moist, dilatant with depth
2m-5m, Alluvial Sandy Silts, gry, trace clay, containing peat pockets, occasional shells, v loose, wet
Sidewalls unstable 4m-5m, water @5m

TP9, 250mm topsoil, sandy
0.25m-2.5m, Sandy Silt, brn, trace clay, weathered, loose, v.moist, dilatant with depth
2.5m-5m, Alluvial Sandy Silts, gry, trace clay, containing peat pockets, occasional shells, v loose, wet
Sidewalls unstable 4m-5m, water @5m

TP10, 300mm topsoil, sandy
0.3m-2.3m, Sandy Silt, brn, trace clay, weathered, loose, v.moist, dilatant with depth
2.3m-4m, Alluvial Sandy Silts, gry, trace clay, containing peat pockets, occasional shells, v loose, wet
Sidewalls unstable 3m-4m, water@4m

TP11, 300mm topsoil, sandy
0.3m-1.2m, Sandy Silt, brn, trace clay, weathered, loose, v.moist, dilatant with depth
1.2m-2.8m, Clayey Silt, brn, with sand, weathered, firm, moist
2.8m-4.5m, Alluvial Sandy Silts, gry, trace clay, trace peat pockets, occasional shells, loose, very moist
Sidewalls unstable 3.5m-4.5m, water@4.5m

TP12, 300mm topsoil, sandy
0.3m-1.1m, Sandy Silt, brn, comp, moist
1.1m-2m, Silty Sand, brn, weathered, comp, moist, dilatant with depth
2m-4m, Alluvial Sandy Silts, gry, trace clay, trace peat pockets, occasional shells, loose, very moist
Sidewalls unstable 3m-4m, water @4m

TP13, 250mm topsoil, sandy
0.25m-1m, Sandy Silt, brn, comp, moist
1m-1.7m, Sandy Silt, brn, trace clay, weathered, loose, v.moist, dilatant with depth
1.7m-4m Silty Sand, brn, weathered, comp, moist
Sidewalls unstable 3-4m, water@4m

TP14, 300mm topsoil, sandy
0.3m-2.3m, Sandy Silt, brn, trace clay, weathered, loose, v.moist, dilatant with depth
2.3m-2.6m, Coarse Sand and Gravel, brn, comp, wet
2.6m-4m, Sandy Silt Till, gry, trace clay, stiff, moist
Sidewalls unstable 2m-2.6m, water@3m upon completion

TP15, 200mm topsoil, sandy
0.2m-2m, Sandy Silt, brn, trace clay, weathered, loose, v.moist, dilatant with depth
2m-3.5m, Coarse Sand and Gravel, brn, comp, wet
3.5-4m, Alluvial Sandy Silts, gry, trace clay, trace peat pockets, occasional shells, loose, very moist
Sidewalls unstable 2-4m, water@3.5m

TP16, 300mm topsoil, sandy
0.3m-0.8m, Sandy Silt, brn, comp, moist
0.8m-2m, Sandy Silt Till, brn, with clay, stiff, moist
2m-3.5m, SAA but grey
Sidewalls stable, dry

TP17, 300mm topsoil, sandy
0.3m-0.6m, Fill, Sandy Silt, brn/gry, trace clay, organics, comp, moist
0.6m-2.9m, Sandy Silt, brn, trace clay, weathered, loose, v.moist, dilatant with depth
2.9m-3.5m, Clayey Silt Till, brn/gry, embedded sand and gravel, stiff
Sidewalls stable, dry

TP18, 250mm topsoil, sandy
0.25m-1.5m, Sandy Silt, brn, comp, moist
1.5m-3m, Sandy Silt, brn, trace clay, weathered, loose, v.moist, dilatant with depth
3m-4m, Clayey Silt Till, brn/gry, embedded sand and gravel,some wet sand seams, stiff,
Sidewalls stable, water seepage at 3.5m

TP19, 250mm topsoil, sandy
0.25m-1.5m, Sandy Silt, brn, comp, moist
1.5m-4m, Silty Sand, brn, weathered, comp, v moist, dilatant with depth
Sidewalls unstable 3m-4m, water@4m

TP20, 300mm topsoil, sandy
0.3m-2.5m, Sandy Silt, brn, trace clay, weathered, loose, v.moist, dilatant with depth
2.5m-3.5m, Silty Sand, gry, weathered, loose, wet
3.5m-3.75m, Alluvial Sandy Silts, gry, trace clay, containing peat pockets, occasional shells, v loose, wet
Sidewalls unstable 3m-3.75, water@3.75m

TP21, 300mm topsoil, sandy
0.3m-1m, Silty Sand, brn, trace clay, comp, moist
1m-2.5m, Silty Sand, brn, weathered, loose, v moist, dilatant with depth
2.5m-3m, SAA but gry, wet
3m-5m, Alluvial Sandy Silts, gry, trace clay, containing peat pockets, occasional shells, v loose, wet
Sidewalls unstable, water@5m

TP22, 200mm topsoil, sandy
0.2m-1.5m, Sandy Silt, brn, comp, moist
1.5m-2.7m, Silty Sand, brn, weathered, loose, v moist, dilatant with depth
2.7m-5m, Alluvial Sandy Silts, gry, trace clay, containing peat pockets, occasional shells, v loose, wet
Sidewalls unstable 3m-5m, water@5m

TP23, 300mm topsoil, sandy
0.3m-2.1m, Silty Sand, brn, weathered, comp, v moist, dilatant with depth
2.1m-5m, Alluvial Sandy Silts, gry, trace clay, trace peat pockets, occasional shells, loose, v moist
Sidewalls unstable 3m-5m, water @5m

TP24, 150mm topsoil, sandy
0.15m-2m, Clayey Silt Till, brn, embedded sand and gravel, stiff, dtpl
2m-3.5m. SAA but gry
Stable, dry

TP25, 300mm topsoil, sandy
0.3m-1m, Silty Sand, brn, comp, moist
1m-3m, Silty Sand, brn/gry, weathered, loose, v moist, dilatant with depth
3m-4m, Alluvial Sandy Silts, gry, trace clay, containing peat pockets, occasional shells, v loose, wet
Sidewalls unstable 3m-4m, water @4m

TP26, 300mm topsoil, sandy
0.3m-2m, Sandy Silt, brn, trace clay, weathered, loose, moist, dilatant with depth
2m-3.5m, Alluvial Sandy Silts, gry, trace clay, containing peat pockets, occasional shells, v loose, wet

Sidewalls very unstable, water@3m

TP27, 300mm topsoil, sandy
0.3m-1.5m, Silty Sand, brn, comp, moist
1.5m-2m, Sandy Silt, brn/gry, trace clay, weathered, loose, moist, dilatant with depth
2m-4m, Sandy Silt, gry, trace clay, weathered, loose, v moist, dilatant with depth, trace shells
Sidewalls unstable, water@4m

TP28, 300mm topsoil, sandy
0.3m-1m, Silty Sand, brn, comp, moist
1m-2.3m, Sandy Silt, brn/gry, trace clay, weathered, loose, moist, dilatant with depth
2.3m-3.5m, Alluvial Sandy Silts, gry, trace clay, trace peat pockets, occasional shells, loose, v moist
Sidewall unstable 3m-3.5m, dry

TP29, 300mm topsoil, sandy
0.3m-1m, Silty Sand, brn, comp, moist
1m-2m, Sandy Silt, brn/gry, trace clay, weathered, loose, moist, dilatant with depth
2m-3m, Alluvial Sandy Silts, gry, trace clay, containing peat pockets, occasional shells, v loose, wet
Sidewalls very unstable 2m-3m, water@3m

TP30, 250mm topsoil, sandy
0.25m-1m, Silty Sand, brn, comp, moist
1m-2m, Sandy Silt, brn/gry, trace clay, weathered, loose, v moist, dilatant with depth
2m-4m, Alluvial Sandy Silts, gry, trace clay, containing peat pockets, occasional shells, v loose, wet
Sidewalls unstable 3m-4m, water@4m

TP31, 300mm topsoil, sandy
0.3m-1.2m, Silty Sand, brn, weathered, comp, moist
1.2m-2m, SAA but dilatant
2m-3.5m, Alluvial Sandy Silts, gry, trace clay, containing peat pockets, occasional shells, v loose, wet
Sidewalls unstable 3m-3.5m, water@3m

TP32, 300mm topsoil, sandy
0.3m-1.2m, Sandy Silt, brn, comp, moist
1.2m-1.7m, Silty Sand, brn/gry, weathered, loose, v moist, dilatant with depth
1.7m-4.5m, Alluvial Sandy Silts, gry, trace clay, containing peat pockets, occasional shells, v loose, wet
Sidewalls unstable 4m-4.5m, water@4.5m

TP33, 300mm topsoil, sandy
0.3m-2.3m, Sandy Silt, brn, weathered, loose, moist, dilatant with depth
2.3m-4m, SAA but gry, trace clay, shells, loose, v moist
Sidewalls stable,

TP34, 200mm topsoil, sandy
0.2m-1m, Sandy Silt, brn/gry, comp, moist, trace shells
1m-3.5m, SAA but gry, trace clay, loose, v moist, trace shells
Sidewalls unstable 3-3.5m, water @3.5m

TP35, 500mm topsoil, sandy
0.5m-1.5m, Silty Sand, brn, weathered, comp, moist
1.5m-2.5m, Silty Sand, brn, weathered, comp, moist, dilatant with depth
2.5m-5m, Alluvial Sandy Silts, gry, trace clay, containing peat pockets, occasional shells, v loose, wet
Sidewalls unstable 4m-5m, water@5m

TP36, 250mm topsoil, sandy
0.25m-0.6m, Fill, Fill, Sandy Silt, brn/gry, trace clay, organics, comp, moist
0.6m-2.7m, Silty Sand, brn, weathered, comp, moist, dilatant with depth
2.7m-4m, Alluvial Sandy Silts, gry, trace clay, containing peat pockets, occasional shells, v loose, wet
Sidewalls unstable 3m-4m, water@4m

TP1A, 300mm topsoil, sandy
0.3m-2m, Sandy Silt, brn, weathered, loose, moist, dilatant with depth
2m-3.5m, Sandy Silt Till, gry, with clay, trace wet gravel seams, stiff, dtpl
Sidewalls unstable 3m-3.5, water @3.2m

Note:
brn: brown
gry: grey
v: very
drk: dark
comp: compact
SAA: same as above

BOREHOLE LOG

MW1
Sheet 1 of 1

CLIENT **Wastell Homes** PROJECT NO. **LON-00014790-GE**
PROJECT **Proposed Residential Development** DATUM **Geodetic**
LOCATION **George Street, Port Stanley, Ontario** DATES: Boring **July 21, 2016** Water Level **Aug. 1/16**

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (%)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
	183.3						
0	183.2	**TOPSOIL** - 150 mm					
		FILL - silty sand, grey, coarse grained, very loose, very moist					
1			SS	S1	75	2	17
	181.9						
		ALLUVIAL SANDY SILT - grey, trace to some clay, trace to some peat, trace to some shells, very loose to loose, very moist to wet	SS	S2	75	4	26
2							
			SS	S3	75	1	39
3							
		- some coarse sand seams near 3.3 m bgs	SS	S4	75	2	39
4			SS	S5	100	1	29
		- some coarse sand and stiff clays with depth					
			SS	S6	100	3	29
5							
6							
			SS	S7	100	4	27
	176.8						
		End of Borehole at 6.6 m bgs.					
7							

SHEAR STRENGTH
S Field Vane Test (#=Sensitivity)
Penetrometer Torvane
100 200 kPa
Atterberg Limits and Moisture
W_P W W_L
SPT N Value Dynamic Cone
10 20 30 40

NOTES

1) Borehole Log interpretation requires assistance by exp before use by others. Borehole Logs must be read in conjunction with exp Report LON-00014790-GE. For definition of terms used on logs, see sheet prior to logs.
2) bgs denotes below ground surface.
3) Water Level Readings:
July 21, 2016 - 2.0 m bgs, 181.3 m ASL
August 1, 2016 - 2.2 m bgs, 181.1 m ASL

SAMPLE LEGEND
AS Auger Sample SS Split Spoon ST Shelby Tube
Rock Core (eg. BQ, NQ, etc.) VN Vane Sample

OTHER TESTS
G Specific Gravity C Consolidation
H Hydrometer CD Consolidated Drained Triaxial
S Sieve Analysis CU Consolidated Undrained Triaxial
γ Unit Weight UU Unconsolidated Undrained Triaxial
P Field Permeability UC Unconfined Compression
K Lab Permeability DS Direct Shear

WATER LEVELS
Apparent Measured Artesian (see Notes)

BOREHOLE LOG

MW2
Sheet 1 of 1

CLIENT **Wastell Homes** PROJECT NO. **LON-00014790-GE**
PROJECT **Proposed Residential Development** DATUM **Geodetic**
LOCATION **George Street, Port Stanley, Ontario** DATES: Boring **July 21, 2016** Water Level **Aug. 1/16**

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (%)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)	SHEAR STRENGTH / Atterberg Limits and Moisture
0	182.0	**TOPSOIL** - 400 mm								
	181.6	**CLAYEY SILT** - brown, some fine sand, firm, moist to very moist								
1										
2										
		- becoming grey near 2.3 m bgs								
3										
4	177.4									
		End of Borehole at 4.6 m bgs.								
5										
6										
7										

SHEAR STRENGTH
S Field Vane Test (#=Sensitivity)
Penetrometer Torvane
100 200 kPa
Atterberg Limits and Moisture
W_P W W_L
SPT N Value Dynamic Cone
10 20 30 40

NOTES

1) Borehole Log interpretation requires assistance by exp before use by others. Borehole Logs must be read in conjunction with exp Report LON-00014790-GE. For definition of terms used on logs, see sheet prior to logs.
2) bgs denotes below ground surface.
3) Water Level Readings:
July 21, 2016 - 2.0 m bgs, 180.0 m ASL
August 1, 2016 - 2.4 m bgs, 179.6 m ASL

SAMPLE LEGEND
AS Auger Sample SS Split Spoon ST Shelby Tube
Rock Core (eg. BQ, NQ, etc.) VN Vane Sample

OTHER TESTS

G Specific Gravity	C Consolidation
H Hydrometer	CD Consolidated Drained Triaxial
S Sieve Analysis	CU Consolidated Undrained Triaxial
γ Unit Weight	UU Unconsolidated Undrained Triaxial
P Field Permeability	UC Unconfined Compression
K Lab Permeability	DS Direct Shear

WATER LEVELS
Apparent Measured Artesian (see Notes)

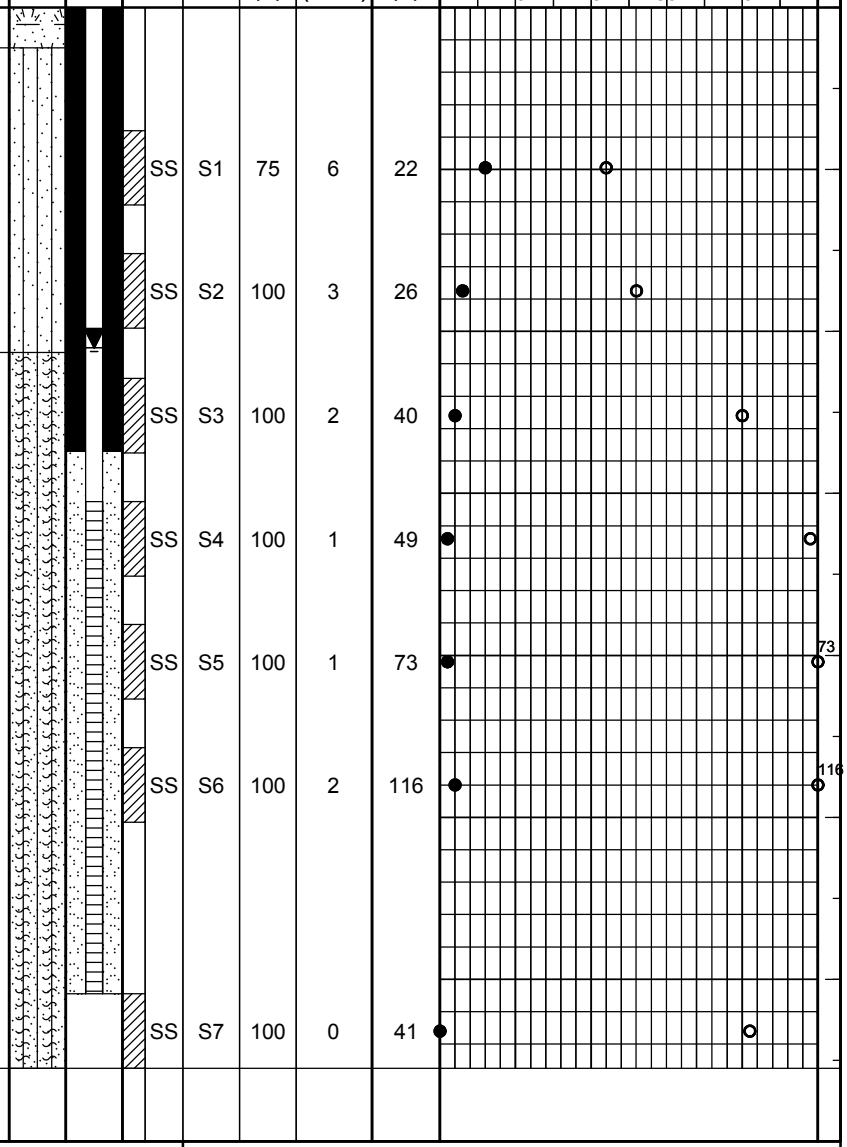
BOREHOLE LOG

MW3
Sheet 1 of 1

CLIENT **Wastell Homes** PROJECT NO. **LON-00014790-GE**
PROJECT **Proposed Residential Development** DATUM **Geodetic**
LOCATION **George Street, Port Stanley, Ontario** DATES: Boring **July 21, 2016** Water Level **Aug. 1/16**

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	TYPE	NUMBER	RECOVERY (%)	N VALUE (blows)	MOISTURE CONTENT (%)
0	182.7						
	182.5	**TOPSOIL** - 250 mm					
		SANDY SILT - brown, weathered, dilatant with depth, very loose to loose, very moist to wet	SS	S1	75	6	22
1			SS	S2	100	3	26
2	180.6						
		ALLUVIAL SANDY SILT - grey, some clay, some peat, some shells, very loose, very moist to wet	SS	S3	100	2	40
3			SS	S4	100	1	49
4			SS	S5	100	1	73
			SS	S6	100	2	116
5		- some coarser sands near 5.6 m bgs					
6			SS	S7	100	0	41
	176.2						
7		**End of Borehole at 6.6 m bgs.**					

SHEAR STRENGTH
S Field Vane Test (#=Sensitivity)
Penetrometer Torvane
100 200 kPa
Atterberg Limits and Moisture
W_P W W_L
SPT N Value Dynamic Cone
10 20 30 40



NOTES

1) Borehole Log interpretation requires assistance by exp before use by others. Borehole Logs must be read in conjunction with exp Report LON-00014790-GE. For definition of terms used on logs, see sheet prior to logs.
2) bgs denotes below ground surface.
3) Water Level Readings:
July 21, 2016 - 2.0 m bgs, 180.7 m ASL
August 1, 2016 - 2.1 m bgs, 180.6 m ASL

SAMPLE LEGEND
AS Auger Sample SS Split Spoon ST Shelby Tube
Rock Core (eg. BQ, NQ, etc.) VN Vane Sample

OTHER TESTS

G Specific Gravity	C Consolidation
H Hydrometer	CD Consolidated Drained Triaxial
S Sieve Analysis	CU Consolidated Undrained Triaxial
γ Unit Weight	UU Unconsolidated Undrained Triaxial
P Field Permeability	UC Unconfined Compression
K Lab Permeability	DS Direct Shear

WATER LEVELS
Apparent Measured Artesian (see Notes)

BOREHOLE LOG

MW4
Sheet 1 of 1

CLIENT **Wastell Homes** PROJECT NO. **LON-00014790-GE**
PROJECT **Proposed Residential Development** DATUM **Geodetic**
LOCATION **George Street, Port Stanley, Ontario** DATES: Boring **July 21, 2016** Water Level **Aug. 1/16**

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (%)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)	SHEAR STRENGTH / Atterberg Limits and Moisture
0	185.7	**TOPSOIL** - 300 mm								
	185.4	**SANDY SILT** - brown, fine grained, trace to some clay, loose to compact, very moist to wet								
1										
2										
3										
4		- becoming grey near 3.8 m bgs								
	181.1									
5		**End of Borehole at 4.6 m bgs.**								
6										
7										

SHEAR STRENGTH
S Field Vane Test (#=Sensitivity)
Penetrometer Torvane
100 200 kPa
Atterberg Limits and Moisture
W_P W W_L
SPT N Value Dynamic Cone
10 20 30 40

NOTES

1) Borehole Log interpretation requires assistance by exp before use by others. Borehole Logs must be read in conjunction with exp Report LON-00014790-GE. For definition of terms used on logs, see sheet prior to logs.
2) bgs denotes below ground surface.
3) Water Level Readings:
July 21, 2016 - 4.2 m bgs, 181.5 m ASL
August 1, 2016 - 3.6 m bgs, 182.1 m ASL

SAMPLE LEGEND
AS Auger Sample SS Split Spoon ST Shelby Tube
Rock Core (eg. BQ, NQ, etc.) VN Vane Sample

OTHER TESTS
G Specific Gravity
H Hydrometer
S Sieve Analysis
γ Unit Weight
P Field Permeability
K Lab Permeability
C Consolidation
CD Consolidated Drained Triaxial
CU Consolidated Undrained Triaxial
UU Unconsolidated Undrained Triaxial
UC Unconfined Compression
DS Direct Shear

WATER LEVELS
Apparent Measured Artesian (see Notes)

BOREHOLE LOG

MW5
Sheet 1 of 1

CLIENT **Wastell Homes** PROJECT NO. **LON-00014790-GE**
PROJECT **Proposed Residential Development** DATUM **Geodetic**
LOCATION **George Street, Port Stanley, Ontario** DATES: Boring **July 21, 2016** Water Level **Aug. 1/16**

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (%)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
0	182.4								
	182.2	**TOPSOIL** - 250 mm							
1		**SANDY SILT** - brown, weathered, dilatant with depth, loose to compact, very moist to wet			SS	S1	75	12	21
2					SS	S2	75	6	24
	180.3	- becoming grey near 1.8 m bgs							
		ALLUVIAL SANDY SILT - grey, trace to some clay, trace to some peat, trace to some shells, very loose, very moist to wet			SS	S3	100	2	50
3					SS	S4	100	1	26
4					SS	S5	100	0	31
5					SS	S6	100	1	74
	176.8								
6		**SAND** - grey, fine grained, loose, wet			SS	S7	100	4	22
	175.9								
7		**End of Borehole at 6.6 m bgs.**							

SHEAR STRENGTH
S Field Vane Test (#=Sensitivity)
Penetrometer Torvane
100 200 kPa

Atterberg Limits and Moisture
W_P W W_L
SPT N Value Dynamic Cone
10 20 30 40

74

NOTES

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2) bgs denotes below ground surface.
3) Water Level Readings:
July 21, 2016 - 2.4 m bgs, 180.0 m ASL
August 1, 2016 - 2.5 m bgs, 179.9 m ASL

SAMPLE LEGEND
AS Auger Sample SS Split Spoon ST Shelby Tube
Rock Core (eg. BQ, NQ, etc.) VN Vane Sample

OTHER TESTS

G Specific Gravity	C Consolidation
H Hydrometer	CD Consolidated Drained Triaxial
S Sieve Analysis	CU Consolidated Undrained Triaxial
γ Unit Weight	UU Unconsolidated Undrained Triaxial
P Field Permeability	UC Unconfined Compression
K Lab Permeability	DS Direct Shear

WATER LEVELS
Apparent Measured Artesian (see Notes)

Appendix B – Limitations and Use of Report

LIMITATIONS AND USE OF REPORT

BASIS OF REPORT

This report (the "Report") is based on site conditions known or inferred by the geotechnical investigation undertaken as of the date of the Report. Should changes occur which potentially impact the geotechnical condition of the site (for example, construction is implemented more than one year following the date of the Report), the recommendations of this report require re-evaluation.

The Report is provided solely for the guidance of design engineers and on the assumption that the design will be in accordance with applicable codes and standards. Any changes in the design features which potentially impact the geotechnical analyses or issues concerning the geotechnical aspects of applicable codes and standards may necessitate a review of the design by exp. Additional field work and reporting may also be required.

Where applicable, recommended field services are the minimum necessary to ascertain that construction is being carried out in general conformity with building code guidelines, generally accepted practices and exp's recommendations. Any reduction in the level of services recommended will result in exp providing qualified opinions regarding the adequacy of the work. exp can assist design professionals or contractors retained by the Client to review applicable plans, drawings and specifications as they relate to the Report or to conduct the aforementioned during construction.

Contractors contemplating work on the site are responsible for conducting an independent investigation and interpretation of the borehole results contained in the Report. The number of boreholes necessary to determine the localized underground conditions affecting construction costs, techniques, sequencing, equipment and scheduling may be greater than those carried out for the purpose of the Report.

Classification and identification of soils, rocks, geological units, contaminant materials, building envelope assessments and engineering estimates are based on investigations performed in accordance with the standard of care set out below and require the exercise of judgment. As a result, even comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations or building envelope descriptions involve an inherent risk that some conditions will not be detected. All documents or records summarizing investigations are based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated. Some conditions are subject to change over time. The Report presents the conditions at the sampled points at the time of sampling. Where specific concerns exist or the Client has special considerations or requirements, these should be disclosed to exp to allow for additional or special investigations to be undertaken not otherwise within the scope of investigation considered for the purpose of the Report.

RELIANCE ON INFORMATION PROVIDED

The evaluation and conclusions contained in the Report are based on conditions in evidence at the time of site inspection and information provided to exp by the Client and others. The Report has been prepared for the specific site development, building design or building assessment objectives and purpose as communicated by the Client. exp has relied in good faith upon such representations, information and instructions and accepts no responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of any misstatements, omissions, misrepresentation or fraudulent acts of persons providing information. Unless specifically stated otherwise, the applicability and reliability of the findings, recommendations, suggestions or opinions expressed in the Report are only valid to the extent that there has been no material alteration to or variation from any of the information provided to exp.

STANDARD OF CARE

The Report has been prepared in a manner consistent with the degree of care and skill ordinarily exercised by members of the engineering and environmental consulting profession currently practicing under similar circumstances and locale. No other warranty is made. Unless specifically stated otherwise, the Report does not contain environmental consulting advice.

COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment form part of the Report. The material includes, but is not limited to, the terms of reference given by the Client, correspondence between exp and the Client, other reports, proposals or documents prepared by exp for the Client in connection with the site described in the Report. In order to properly understand the suggestions, recommendations and opinions expressed in the Report, reference must be made to the Report in its entirety. exp is not responsible for use by any party of portions of the Report.