# GEOTECHNICAL INVESTIGATION REPORT
# PROPOSED RESIDENTIAL DEVELOPMENT
# FALLIS LINE
# CAVAN-MONAGHAN, ONTARIO
# GEO-LOGIC INC PROJECT NO. G024822A1

Prepared for:

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## 1.0 INTRODUCTION

This report presents the results of a geotechnical investigation that was completed for the proposed design and construction of a new residential development to be located at part of Lots 11 & 12, Concession 5 and part of Lot 12, Concession 6, within the Township of Cavan-Monaghan, in the County of Peterborough, Ontario. Geo-Logic Inc. (Geo-Logic) was retained by the Towerhill Developments Inc. (the Client), being represented by Innovative Planning Solutions (IPS), to complete this geotechnical investigation. The work conducted for this investigation was carried out under the authorization of Mr. Darren Vella of IPS, representing the Client, in accordance with our proposal PG-2466 dated February 14, 2014.

It is Geo-Logic's understanding that this project shall include design and construction of a new residential development, containing typical 1- and 2- storey homes, with associated stormwater management ponds (SWP's), asphalt-paved roadways, and servicing. Based on correspondence with Mr. Peter Zourntos (of Valdor Engineering), following authorization to proceed with this investigation, it is Geo-Logic's further understanding that proposed servicing will be installed at depths of up to approximately 10 metres below existing grade (mbeg) or shallower.

## 2.0 PURPOSE AND SCOPE

The purpose of this geotechnical investigation is to define the subsurface soil and groundwater conditions at the project site, and to develop geotechnical recommendations regarding earthwork construction, dewatering and drainage, service installation (including trenching, bedding and backfilling), roadway construction (including pavement design), SWP design, house foundations, and slab-on-grades.

Please note that the contents of this report must in no way be construed as an opinion of this site's environmental status.

The following scope of work was performed in order to accomplish the foregoing purposes.

1. Underground services were cleared prior to the advancement of the test holes. The test holes were located as agreed by Mr. Peter Zourntos of Valdor Engineering, and as shown on the Test Hole Location Plan (Plate 1).
2. The subsurface conditions were explored by advancing, sampling and logging a total of thirty-nine (39) test holes. The subsurface conditions were recorded, and are summarized in detail on the logs attached in Appendix A. The test holes were performed as follows:
   a) Sanitary Sewer Alignment: ten (10) boreholes to depths ranging from 6.1 to 9.8 mbeg;
   b) SWPs: two (2) test pits (one at each SWP), to 4.9 mbeg;
   c) Building foundations:
      i) Five (5) boreholes to depths of approximately 6.1 mbeg;
      ii) Sixteen (16) test pits to depths ranging from 3.0 to 6.1 mbeg; and
   d) "Open area" to the west: six (6) test pits to 6.1 mbeg.
3. Temporary piezometers were installed in selected boreholes to facilitate measurement of groundwater levels.
4. The ground at the test holes was reinstated as close as possible to its original condition upon completion of the fieldwork.
5. Geotechnical analyses of materials encountered was performed by means of laboratory testing to obtain relevant soil properties, including grain size and moisture content. The laboratory results are attached in Appendix B.
6. Geotechnical engineering analysis of acquired field and laboratory data, and preparation of a geotechnical investigation report outlining our findings, conclusions, and recommendations.

## 3.0 FIELD AND LABORATORY PROCEDURES

A field investigation was conducted under the supervision of Geo-Logic staff between March 14, 2014 and March 18, 2014. The work consisted of subsurface exploration by means of advancing and sampling a total of fifteen (15) exploratory boreholes to depths ranging from about 6.1 to 9.8 mbeg, and twenty-four (24) test pits to depths ranging from 3.0 to 6.1 mbeg, at locations shown on Plate 1. A log of each test hole was maintained, and representative samples of the soils encountered were obtained and returned to the laboratory.

The boreholes were advanced using a track mounted drill rig equipped with continuous flight, solid stem power augers. Representative, disturbed samples of the strata penetrated were obtained using a split-barrel, 50 mm outer-diameter (OD) sampler advanced by a 63.5 kg hammer dropping approximately 760 mm. The results of these standard penetration tests (SPT) are reported as "N" values on the borehole logs at the corresponding depths. Samples were also collected directly from auger cuttings.

The test pits were advanced using a tracked excavator, and representative disturbed samples of the strata penetrated were collected directly from the test pits walls or excavator's bucket.
Soil samples obtained from the test holes were inspected in the field immediately upon retrieval for type, texture, and colour. All test holes were backfilled following completion of the fieldwork. All samples were sealed in clean plastic containers and transported to the Geo-Logic laboratory for further visual-tactile examination, and to select appropriate samples for laboratory analysis.

Groundwater measurements and observations were obtained from the open test holes during the drilling and excavation operations, and again on March 25, 2014 via temporary piezometers installed in selected test holes. Groundwater data is presented on individual test hole logs.

Laboratory testing of various soil properties was conducted on selected samples, and consisted of moisture content tests on all recovered soil samples, Atterberg limits test on one (1) soil sample, and gradation analysis of seven (7) representative soil samples (including hydrometers). The analytical results of the moisture content tests are plotted on the borehole logs (Appendix A), while the results of the Atterberg limits tests and gradation tests are presented graphically in Appendix B.

Ground surface elevations at the test hole locations were interpolated from the drawing prepared by Valdor Engineering Inc., entitled "Preliminary Sewer Alignment", provided to Geo-Logic by email dated February 27, 2014. These interpolated elevations are for analytical purposes only, and must be verified prior to finalizing any design or contract parameters upon which they are based.

## 4.0 SURFACE CONDITIONS

The Property is located south of Hwy-115, west of County Road 10 (CR-10) and on the south and north sides of Fallis Line, within the Township of Cavan-Monaghan, in County of Peterborough, Ontario. The surrounding properties are generally rural residential and agricultural properties. The site is predominantly cleared farmland containing a few residential dwellings generally facing Fallis Line. The site generally has a rolling topography, with localized low points along the northern and southern portions of the site and along Fallis Line. Maximum change in ground surface elevation at the test hole locations was approximately 26 metres.

# 5.0 SUBSURFACE CONDITIONS

## 5.1 GENERAL

Details of the subsurface conditions encountered at the site are presented graphically on the test hole logs in Appendix A. It should be noted that the boundaries between the strata have been inferred from the test hole observations and non-continuous samples. They generally represent a transition from one soil type to another, and should not be inferred to represent an exact plane of geological change. Further, conditions may vary between and beyond the test holes.

The test holes typically encountered a surficial layer of topsoil, over native soils consisting predominantly of clayey/sandy silt till. Groundwater seepage or accumulation was observed in seventeen (17) of the open test holes during the fieldwork, at depths ranging from 0.0 to 4.6 mbeg. Waterlevels obtained March 25, 2014 from temporary piezometers installed in selected test holes (BH-1, 3, 5, 7, 13 and 15) yielded waterlevels ranging from approximately 0.3 to 3.2 mbeg.

The following sections describe the major soil strata and subsurface conditions encountered during this investigation in more detail.

## 5.2 TOPSOIL

A layer of surficial topsoil was encountered in all of the test holes. The topsoil ranged in thickness from approximately 150 to 600 mm. This soil was observed to be in a moist, loose state, with a silty, occasionally sandy highly organic content. As such, it is expected to be devoid of any structural engineering properties.

## 5.3 FILL

A layer of fill was observed beneath the topsoil in test hole TP-34, and extended to a depth of 1.8 mbeg. This fill consisted of brown sand and gravel, and was in a generally moist in-situ state. A moisture content test conducted on a sample of this fill yielded a value of 11 % moisture by weight.

## 5.4 TILL

A layer of till was encountered immediately beneath the fill layer in test hole TP-34 and immediately beneath the topsoil in all remaining test holes. This soil was first encountered at depths ranging from approximately 0.6 to 2.0 mbeg and extended to the full depth of investigation. The till generally appeared brown grading to grey in colour and typically consisted of clayey silt or silt clay with varying amounts of sand and gravel and occasional cobbles / boulders. This soil was typically compact to very dense, with a few finer-grained zones of soil exhibiting firm to hard consistency.

Moisture content tests conducted on samples of the till yielded values that ranged from approximately 4 to 31 % moisture by weight. Grain size distribution tests performed on representative samples of the till suggest the following compositional ranges: 1 to 26 % gravel, 3 to 36 % sand, and 40 to 96 % silt and clay-sized particles (Plates B-1 to B-7). Hydrometer analyses conducted on finer-grained samples of the till suggest it contains between approximately 23 to 48 % particles between 5 and 75 μm in size. An Atterberg analysis conducted on a sample of this soil yielded a liquid limit of 21 % and a plasticity index of 7 % (Plate B-8).

## 5.5 GROUNDWATER

Seventeen (17) of the open test holes encountered ground water seepage or accumulation during the drilling/excavation operations at depths ranging from approximately 0.0 to 4.6 mbeg. The remaining test holes stayed dry throughout the drilling/excavation operations.

On March 25 and April 15, 2014, water levels were obtained from seven (7) temporarily-installed piezometers. The following table summarizes the depths at which water was encountered in each of these piezometers.

Table 1: Waterlevel Depths

| Borehole | Depth (mbeg) | |
|---|---|---|
| | March 25, 2014 | April 15, 2014 |
| BH-1 | 0.4 | 0.1 |
| BH-3 | 2.2 | 2.2 |
| BH-5 | 0.1 | 0.0 |
| BH-7 | -0.1 | 0.0 |
| BH-13 | 1.3 | 0.2 |
| BH-15 | 0.7 | 0.4 |

It should be noted that groundwater levels are transient and tend to fluctuate with the seasons, periods of precipitation, and temperature.

# 6.0 DISCUSSION AND RECOMMENDATIONS

## 6.1 GENERAL

Supporting data upon which our recommendations are based have been presented in the foregoing sections of this report. The following recommendations are governed by the physical properties of the subsurface materials that were encountered at the site, and assumes that they are representative of the overall site conditions. It should be noted that these conclusions and recommendations are intended for use by the designers only. Contractors bidding on or undertaking any work at the site should examine the factual results of the investigation, satisfy themselves as to the adequacy of the information for construction, and make their own interpretation of this factual data as it affects their proposed construction techniques, equipment capabilities, costs, sequencing, and the like. Comments, techniques, or recommendations pertaining to construction should not be construed as instructions to the contractor.

The test holes typically encountered a surficial layer of topsoil, over native soils consisting predominantly of clayey/sandy silt till. Groundwater seepage or accumulation was observed in seventeen (17) of the open test holes during the fieldwork at depths ranging from 0.0 to 4.6 mbeg. Waterlevels obtained March 25, 2014 from temporary piezometers installed in selected test holes (BH-1, 3, 5, 7, 13 and 15) yielded waterlevels ranging from approximately 0.3 to 3.2 mbeg.

Details regarding our conclusions and recommendations are outlined in the following sections.

## 6.2 SITE PREPARATION, EXCAVATION, AND DEWATERING

It is recommended that any and all topsoil, fill, vegetation, organic and organic-bearing materials be stripped and removed from the proposed roadway and building envelope (including floor slab) areas prior to commencing earthwork construction. The subexcavated surfaces must be proof rolled and/or approved by a member of Geo-Logic prior to placement of fill or foundations.

Excavations should be carried out to conform to the manner specified in Ontario Regulation 213/91 and the Occupational Health and Safety Act and Regulations for Construction Projects (OHSA). All excavations above the water table not exceeding 1.2 m in depth may be constructed with vertical, unsupported slopes. The soils encountered above the groundwater table during this investigation are classed by OHSA as Type 3 soils. As such, unsupported / unshored walls of excavations in these soils must be sloped to the bottom of the excavation, with a slope having a gradient of 1 horizontal to 1 vertical (1H:1V) or flatter, or be retained using a suitably designed shoring system.

Based on groundwater measurements, it is anticipated that groundwater seepage into open excavations will be encountered in some locations. It is expected that pumping from collection sumps to an acceptable outlet will control this groundwater infiltration. Should any excavations require more intensive dewatering / groundwater control, the use of filtered sumps, or other suitable method of dewatering and/or sheet piling may be necessary. Well points can be considered for excavations extending significantly below the groundwater, however will not be feasible within finer-grained soils (ie, an excess of silt and clay). Should dewatering exceed 50,000 litres per day, a Permit to Take Water (PTTW) must be obtained from the MOE. For dewatering purposes, hydraulic conductivities in the order of about $10^{-4}$ to $10^{-6}$ cm/sec may be expected for the subgrade soils encountered in our boreholes. Note that hydraulic conductivities can vary over a vertical and horizontal extent, and may be outside the stated range if pockets or seams of soils with different grain size (eg: sand seams) are encountered.

Some excavated native soils can be considered for reuse as backfill material, provided they are workable, the moisture content is adequate to achieve required levels of compaction, and conditional on geotechnical inspections, assessments and monitoring throughout construction. Note that the moisture content of some native soils will be higher than optimal for compaction purposes, and therefore would require processing (such as aeration) to lower the moisture content to appropriate levels for the minimum required compaction. Further, some native soils are naturally susceptible and sensitive to climatic conditions including frost and rain – this should be taken into account when considering the season in which the construction earthworks will occur.

## 6.3 SERVICE INSTALLATION

The materials encountered during this investigation at the anticipated service invert elevations typically consist of native till soil. As such, a normal compacted Class “B” bedding conforming to Ontario Provincial Standard Drawing (OPSD) 802.010 type 3 soils is recommended for all underground services. Class “B” bedding is Granular “A”, or 19 mm crusher run (angular) limestone, as per Ontario Provincial Standards (OPSS 1010). The minimum recommended bedding thickness for the underground services is 150 mm. All bedding should be compacted to 98 % of its Standard Proctor Maximum Dry Density (SPMDD).

It is recommended that cover backfilling of the underground services be accomplished using Granular "A", sand, or other suitable material as allowed by the Municipality's standards, to a minimum of 300 mm above the pipe. Compaction of this material should attain 100 % SPMDD. It is expected some of the excavated, native till soils may be suitable for reuse as trench backfill, conditional upon suitable moisture content (within 2 % of optimum) and final review and approval by an experienced geotechnical engineer at the time of construction. Compaction of any native soil in service trenches is recommended to be a minimum of 98 % of its SPMDD. The soils observed may require processing (such as aeration) to lower their moisture content to appropriate levels prior to being considered as backfill material.

## 6.4 ROADS

Based on the results of this investigation, we would recommend the following procedures be implemented to prepare the proposed new roadways for their construction:

1. Remove any free organic topsoil, fill, organics and organic-bearing materials, loam, frozen earth, and boulders larger than 150 mm in diameter encountered at subgrade elevation for the full width of construction.
2. Proof roll the subgrade for the purpose of detecting possible zones of overly wet or soft subgrade. Any deleterious areas thus delineated should be replaced with acceptable earth fill or granular material compacted to a minimum of 98 % of its SPMDD.
3. Contour the subgrade surface to prevent ponding of water during the construction and to promote rapid drainage of the sub-base and base course materials. 150 mm diameter perforated pipe subdrains should be installed along any curb lines. The pipe should be encased in filter fabric and surrounded by clear stone aggregate. It is recommended that the subdrains outlet to the storm sewer system.
4. Construct transitions between varying depths of granular base materials at a rate of 1:25 minimum.

The subgrade soils encountered in these areas consisted of soils possessing generally moderate frost susceptibility. In this regard, the following minimum flexible pavement structure is recommended for the construction of the new roadway areas.

Table 2: Pavement Structure

| Profile | Material | Minimum Thickness (mm) | In Conformance with OPSS Form |
|---|---|---|---|
| Asphalt Surface | H.L. 3 | 40 | 1150 |
| Asphalt Base | H.L. 8 | 50 | |
| Granular Base | Granular "A" | 150 | 1010 |
| Granular Subbase | Granular "B" | 300 | |

The following steps are recommended for optimum construction of these planned paved areas:

1 The Granular "A" and "B" courses should be compacted to a minimum 100 % of their respective SPMDD's.
2 All asphaltic concrete courses should be placed, spread and compacted conforming to OPSS Form 310 or equivalent. All asphaltic concrete should be compacted to a minimum of 92.0 % of their respective laboratory Maximum Relative Densities (MRD's).
3 Adequate drainage should be provided to ensure satisfactory pavement performance.

It is recommended that all fill material be placed in uniform lifts not exceeding 200 mm in thickness before compaction. It is suggested that all granular material used as fill should have an in-situ moisture content within 2 % of their optimum moisture content. All granular materials should be compacted to 100 % SPMDD. Granular materials should consist of Granular "A" and "B" conforming to the requirements of OPSS Form 1010 or equivalent

It is noted that the above recommended pavement structures are for the end use of the project. During construction of the project the recommended granular depths may not be sufficient to support loadings encountered.

## 6.5 STORMWATER MANAGEMENT PONDS

It is Geo-Logic's understanding that two (2) SWPs are proposed for this development and are to be located in the area of test holes TP-16 and TP-17, as shown on Plate 1. Details regarding the SWPs including design depth and final grades, were not available at the time of writing this report. Howeber, based on the anticipated depth of the SWPs beneath existing grade, it is expected that the bottom of the SWPs will consist of clayey/sandy silt till. The gradation of the soil samples obtained from the proposed SWPs areas suggests the following compositional range: 1 to 8 % gravel, 3 to 31 % sand, and 48 to 61 % silt and clay-sized particles. The hydraulic conductivity of such soils is expected to be on the order of about of $10^{-4}$ to $10^{-6}$ cm/sec. It is noted, however, that slight variations in the soil stratigraphy may cause variations in the permeability of the soil in both vertical and horizontal orientations.

Based on the soils observed, and the anticipated base elevations, it appears that construction of the SWP in this area is feasible. In general, excavation of the soils for the SWPs are expected to be straightforward, provided that appropriate measures are taken during construction to minimize any overland or near-surficial flow of water into the area. Some groundwater and surficial water inflow into the open SWP excavations may be expected, however this is expected to be controlled by pumping from within the excavation.

It is recommended that the SWP subgrade surfaces be proof rolled, and a representative of Geo-Logic approve the subgrade prior to construction of the berms. Construction of the berms may utilize excess site till soils having a hydraulic conductivity of at least $10^{-5}$ cm/sec. Such operations should place the till soils in lifts no thicker than 150mm prior to compaction, and compacted to at least 95% SPMDD. The native, disturbed till soils in a re-compacted form would generally not be suitable to form the SWP's "liner" since the expected permeability would be too high. Conversely, native, undisturbed till would have a sufficiently low permeability where they could substitute for a liner. An inspection of the excavated and exposed SWP surfaces should be performed at the time of construction, to assess whether any discrete or localized areas of increased hydraulic conductivity are present within the exposed soils, in which case such areas may be lined with a more suitable (ie, less hydraulically conductive) material.

For the purpose of the proposed SWPs, the soils observed should be stable from slip circle failure if sloped at 3 horizontal to 1 vertical (3H:1V) or flatter in the long term both above and below the water table. Between the stable water level and the expected high water level, it is recommended that the slopes be lessened to 5H:1V (or flatter) to guard against erosion by wavelet action. The till material will require vegetative root mass (or otherwise suitable erosion protection) to minimize erosional forces on exposed slopes.

Slopes and berms of the SWP should be constructed so as to reduce or eliminate the effects of surficial erosion. Features to do so may include slope vegetation, installation of erosion or gabion mats, rip rap, and/or other acceptable stabilizing features.

It is recommended that a regular maintenance program for the SWP include monitoring of it for any potential slope erosion, degradation, or otherwise undesirable structural conditions. Should any such conditions become evident, immediate mitigative actions must be performed.

## 6.6 FOUNDATION DESIGN

In general, it is recommended that structural loading for one to two-storey homes be supported on spread and continuous strip footings for column and load bearing walls, respectively. The footings should be founded on the compact to dense native soils, which were encountered in the test holes below approximately 0.8 to 1.5 mbeg (2.0 mbeg in TP-34). Alternatively, suitably reinforced footings may be founded on engineered fill placed directly on the compact to dense native soil.

For design purposes, and based on one- to two-storey residential houses, it is generally recommended that footings constructed on the compact to dense native soils or engineered fill be proportioned using the following bearing capacities:

Table 3: Bearing Pressures for Footing Design

| Parameter | Bearing Pressure | | | |
|---|---|---|---|---|
| | Compact to dense, undisturbed native soil | Engineered Fill | | |
| | | Rock-based Fill (1) | Granular Fill (2) | Earth Borrow Fill (2) |
| Factored Bearing Capacity at ULS | 215 kPa (4,500 psf) | 255 kPa (5,300 psf) | 205 kPa (4,300 psf) | 155 kPa (3,300 psf) |
| Bearing Capacity at SLS | 120 kPa (2,500 psf) | 150 kPa (3,100 psf) | 120 kPa (2,500 psf) | 90 kPa (1,900 psf) |

Notes:

(1) At least 1m of Rock-based fill. Quality of material is to be approved prior to use as engineered fill.

(2) At least 0.3m of Granular or Earth Borrow fill. Quality of material is to be approved prior to use as engineered fill.

Any engineered fill upon which footings are placed must be a minimum thickness corresponding to the notes that accompany the above table. Rock-based fill must be completely encapsulated with suitable filter fabric to minimize any migration of fine-grained particles from surrounding soils into the voids within the rock fill. Footings (and foundation walls) placed on engineered fill must be suitably reinforced; as a minimum, and where not already specified in the design drawings, this reinforcing should use 2 continuous runs of 15M rebar throughout the footings, and 2 runs of 15M rebar throughout near the top and bottom of the foundation walls.

The following is recommended for the construction of any engineered fill for the footings:

1. Remove any and all existing vegetation, topsoil, fill, organics, and organic-bearing soils to the competent, undisturbed native soil from within the area of the proposed engineered fill.
2. The area of the engineered fill should extend horizontally 1m beyond the outside edge of the building foundations and then extend downward at a 1:1 slope to the competent native soil.
3. The base of the engineered fill area must be approved by a member of Geo-Logic prior to placement of any fill, to ensure that all unsuitable materials have been removed, that the materials encountered are similar to those observed, and that the subgrade is suitable for the engineered fill.
4. All engineered fill material is to be approved by Geo-Logic at the time of construction.
5. Place approved engineered fill, in maximum 300 mm lifts, compacted to 100% of its SPMDD. Any fill material placed under sufficiently wet conditions should consist of an approved, rock-based fill, with the inclusion of appropriate geotextile fabric around the rock-based fill should the rock fill contain enough voids to warrant.
6. Full time testing and inspection of the engineered fill will be required, to ensure compliance with material and compaction specifications.

Should any larger buildings (i.e., larger that the anticipated one to two-storey residential dwellings) be proposed, it is recommended that further subsurface exploration be conducted to assess the soil properties in that area.

All exterior footings or footings in unheated areas, should be founded at least 1.2 m below the final adjacent grade for frost protection. Footings and walls exposed to frost action should be backfilled with non-frost susceptible granular material.

Under no circumstances should the foundations be placed above organic materials, loose, frozen subgrade, construction debris, or within ponded water. Prior to forming, all foundation excavations must be inspected and approved by a member of Geo-Logic. This will ensure that the foundation bearing material has been prepared properly at the foundation subgrade level and that the soils exposed are similar to those encountered during this investigation.

For design purposes this site is conservatively classed as Site Class D for Seismic Site Response, in accordance with the Ontario Building Code.

Should basement or otherwise subgrade areas be incorporated into any of the buildings' designs, it is recommended that for drainage purposes, perimeter drains be installed about the structure. The subdrains would serve to drain seepage water that infiltrates the backfill, intersect the groundwater, and help relieve hydrostatic pressures due to any seasonally high groundwater levels. The perimeter drain should consist of a perforated pipe, at least 150 mm in diameter, surrounded by clear, crushed stone and suitable filter protection. The subdrain should discharge to a positive sump or other permanent frost free outlet.

For foundations constructed in accordance with the foregoing manner, total and differential settlements are estimated to be less than 25 mm.

## 6.7 SLAB ON GRADE

Floors may generally be constructed as normal slabs-on-grade, on granular fill over native, inorganic subsoils prepared in accordance with Section 6.2 of this report. The floor slab should be formed over a base course consisting of at least 150 mm of Granular "A" backfill as per OPSS (or 19mm clear stone beneath basement or otherwise subgrade areas) compacted to a minimum of 100% of its SPMDD. All grade increases or infilling below the granular or clearstone should utilize well graded, free draining Granular "B", Type 1 backfill as per OPSS 1010 (or otherwise approved material), compacted to a minimum of 98% of its SPMDD. All fill placed as engineered fill must be inspected, approved and compaction verified by personnel from Geo-Logic.

For basement or otherwise subgrade areas, it is further recommended that:

- An underslab drainage system be utilized based on using perforated pipe, at least 150 mm in diameter, surrounded by clear, crushed stone and suitable filter protection. The underslab drains should discharge to a positive sump or other permanent frost free outlet.
- A vapour barrier be installed between the final course level of crushed stone and the concrete slab.

Finally, it is important to remember that the drainage system's role is to protect the building from potential hydrostatic pressures and infiltrations by evacuating the water collected underneath and around the building's periphery. The drainage system will not protect the building from the migration of humidity through the concrete. Therefore, the waterproofing aspect must not be overlooked. We recommend that the building's foundation walls and slab-on-grade be waterproofed.

## 6.8 GENERAL RECOMMENDATIONS

### 6.8.1 Test Pits During Tendering

It is strongly recommended that test pits be dug at representative locations of this site during the tendering phase, with mandatory attendance of interested contractors. This will allow them to make their own assessments of the groundwater and soil conditions at the site and how these will affect their proposed construction methods, techniques and schedules.

### 6.8.2 Sensitivity of Subsoil

The native subsoil are susceptible to strength loss or deformation if saturated or disturbed by construction traffic. Therefore, care must be taken to protect the exposed subgrade from excess moisture and from construction traffic.

### 6.8.3 Winter Construction

The subsoils encountered across the site are frost-susceptible and freezing conditions could cause problems to the structure. As preventive measures, the following recommendations are presented:

1. During winter construction, exposed surfaces intended to support foundations must be protected against freezing by means of loose straw and tarpaulins, heating, etc.

2. Care must be exercised so that any sidewalks and/or asphalt pavements do not interfere with the opening of doors during the winter when the soils are subject to frost heave. This problem may be minimised by any one of several means, such as keeping the doors well above outside grade, installing structural slabs at the doors, and by using well-graded backfill and positive drainage, etc.

3. Because of the frost heave potential of the soils during winter, it is recommended that the trenches for exterior underground services be excavated with shallow transition slopes in order to minimise the abrupt change in density between the granular backfill, which is relatively non-frost susceptible, and the more frost-susceptible native soils.

## 6.9 DESIGN REVIEW & INSPECTION

Due to the preliminary nature of the design details at the time of this report, it is recommended that Geo-Logic Inc. be allowed to review the building design prior to its finalization. In addition, we strongly recommend that our firm be retained to review the foundation design and grading proposals when they are available.

If there are any proposed structures other than 1 to 2 storey residential dwellings (ie, greater structural loads), the soils in the location of such structure(s) must be verified through further geotechnical analysis.

Geotechnical inspection and review of foundation excavations and compaction procedures must be carried out to ensure compliance with our recommendations.

## 7.0 STATEMENT OF LIMITATIONS

The attached Statement of Limitations is an integral part of this report. Should questions arise regarding any aspect of this report, please contact our office

Sincerely yours,

Geo-Logic Inc.
GEOTECHNICAL ENGINEERS
AND HYDROGEOLOGISTS


Pete Hynes, B.A.Sc.

Garnet Brenchley, P.Eng.

## STATEMENT OF LIMITATIONS

This report is intended solely for the Towerhill Developments Inc. and other parties explicitly identified in the report and is prohibited for use by others without Geo-Logic's prior written consent. This report is considered Geo-Logic's professional work product and shall remain the sole property of Geo-Logic. Any unauthorized reuse, redistribution of or reliance on the report shall be at the Client and recipient's sole risk, without liability to Geo-Logic. Client shall defend, indemnify and hold Geo-Logic harmless from any liability arising from or related to Client's unauthorized distribution of the report. No portion of this report may be used as a separate entity; it is to be read in its entirety and shall include all supporting drawings and appendices.

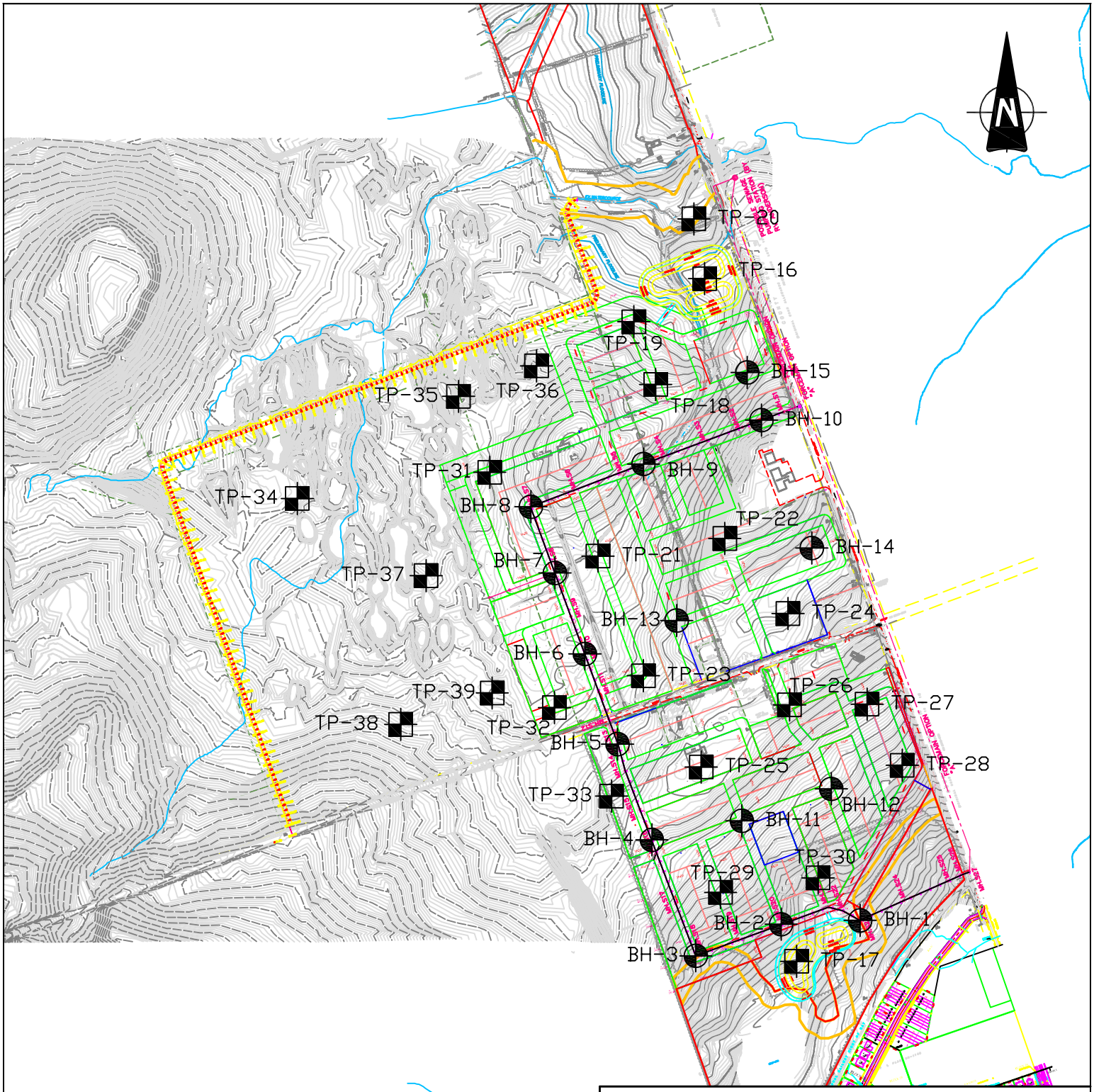
The recommendations made in this report are in accordance with our present understanding of the project, the current site use, ground surface elevations and conditions, and are based on the work scope approved by the Client and described in the report. The services were performed in a manner consistent with that level of care and skill ordinarily exercised by members of geotechnical engineering professions currently practicing under similar conditions in the same locality. No other representations, and no warranties or representations of any kind, either expressed or implied, are made. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties.

All details of design and construction are rarely known at the time of completion of a geotechnical study. The recommendations and comments made in the study report are based on our subsurface investigation and resulting understanding of the project, as defined at the time of the study. We should be retained to review our recommendations when the drawings and specifications are complete. Without this review, Geo-Logic will not be liable for any misunderstanding of our recommendations or their application and adaptation into the final design.

By issuing this report, Geo-Logic is the geotechnical engineer of record. It is recommended that Geo-Logic be retained during construction of all foundations and during earthwork operations to confirm the conditions of the subsoil are actually similar to those observed during our study. The intent of this requirement is to verify that conditions encountered during construction are consistent with the findings in the report and that inherent knowledge developed as part of our study is correctly carried forward to the construction phases.

It is important to emphasize that a soil investigation is, in fact, a random sampling of a site and the comments included in this report are based on the results obtained at the thirty-nine (39) test hole locations only. The subsurface conditions confirmed at the 39 test hole locations may vary at other locations. The subsurface conditions can also be significantly modified by the construction activities on site (ex. excavation, dewatering and drainage, blasting, pile driving, etc.). These conditions can also be modified by exposure of soils or bedrock to humidity, dry periods or frost. Soil and groundwater conditions between and beyond the test locations may differ both horizontally and vertically from those encountered at the test locations and conditions may become apparent during construction which could not be detected or anticipated at the time of our investigation. Should any conditions at the site be encountered which differ from those found at the test locations, we request that we be notified immediately in order to permit a reassessment of our recommendations. If changed conditions are identified during construction, no matter how minor, the recommendations in this report shall be considered invalid until sufficient review and written assessment of said conditions by Geo-Logic is completed.

ENCLOSURES




Source:
Portion of drawing prepared by Valdor Engineering Inc., entitled "preliminary Sewer Alignment", provided to Geo-Logic on February 27, 2014.

# TEST HOLE LOCATION PLAN

HYDROGEOLOGICAL ASSESSMENT
PROPOSED RESIDENTIAL DEVELOPMENT
FALLIS LINE
CAVAN-MONAGHAN, ONTARIO

| | |
|---|---|
| PROJECT NO. : | G024822A1 |
| SCALE : | 1:10,000 |
| DATE : | APRIL, 2014 |
| PLATE NO. : | 4 |

GEO-LOGIC INC.
347 PIDO ROAD, UNIT 29
PETERBOROUGH, ON K9J 6X7
(705) 749-3317 FAX (705) 749-9248 WEB: www.geo-logic.ca

# APPENDIX A

# TEST HOLE LOGS

REFERENCE No.: G024822A1 ENCLOSURE No.: A-1

www.geo-logic.ca

**BOREHOLE No.:** BH-1
**ELEVATION:** 230.8 m

# BOREHOLE REPORT

Page: 1 of 1

CLIENT: Towerhill Development
PROJECT: Proposed Fallis Line Residential Development
LOGGED BY: B. McFarlane DATE: March 14, 2014
DRILLING COMPANY: Eastern Soil Investigation METHOD: Track mounted drill rig
NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

**LEGEND**

- SS - SPLIT SPOON
- AS - AUGER SAMPLE
- ST - SHELBY TUBE
- CS - CORE SAMPLE
- ▼ - WATER LEVEL

| Depth (ft) | Depth (m) | m Below Existing Grade | Stratigraphy | DESCRIPTION OF SOIL AND BEDROCK | Type and Number | Recovery % | Moisture Content % | Blows per 6 in. / 15 cm | Penetration Index N | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 0.0 | | GROUND SURFACE | | | | | | |
| | | 0.3 | | **TOPSOIL** (300 mm) | | | | | | |
| | | | | **TILL** - Light brown Clayey Silt, trace Sand, moist to wet, compact | | | | | | |
| | 1.0 | | | | SS-1 | 100 | 18 | 1 3 5 | 8 | WL - 0.1 m 4/15/2014 |
| | | | | | | | | | | WL - 0.4 m 3/25/2014 |
| | | | | | SS-2 | 100 | 21 | 5 7 11 | 18 | |
| | 2.0 | | | | | | | | | |
| | 3.0 | | | | SS-3 | 100 | 20 | 7 11 15 | 16 | |
| | 4.0 | | | | AS-4 | | 26 | | | WL - 4.6 m 3/14/2014 Upon completion of drilling |
| | 5.0 | | | | | | | | | |
| | 6.0 | 6.1 | | END OF BOREHOLE | AS-5 | | 19 | | | Borehole caved at 5.9 m |
| | 7.0 | | | | | | | | | |
| | 8.0 | | | | | | | | | |
| | 9.0 | | | | | | | | | |
| | 10.0 | | | | | | | | | |

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
$W_P$ $W_l$ Atterberg limits (%)
× "N" Value (blows / 0.3 m) ◆ RQD ◎ CONE

10 20 30 40 50 60 70 80 90

BOREHOLE LOG GEOTECH G024822A1, 14-04-02, TESTHOLE LOGS.GPJ GEOLOGIC.GDT 4/21/14

REFERENCE No.: G024822A1 ENCLOSURE No.: A-2

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**BOREHOLE No.:** BH-2
**ELEVATION:** 238.1 m

# BOREHOLE REPORT

Page: 1 of 1

CLIENT: Towerhill Development
PROJECT: Proposed Fallis Line Residential Development
LOGGED BY: B. McFarlane DATE: March 14, 2014
DRILLING COMPANY: Eastern Soil Investigation METHOD: Track mounted drill rig
NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

**LEGEND**

- SS - SPLIT SPOON
- AS - AUGER SAMPLE
- ST - SHELBY TUBE
- CS - CORE SAMPLE
- ▼ - WATER LEVEL

| Depth (ft) | Depth (m) | m Below Existing Grade | Stratigraphy | DESCRIPTION OF SOIL AND BEDROCK | Type and Number | Recovery % | Moisture Content % | Blows per 6 in. / 15 cm | Penetration Index N | Shear test (Cu) / Sensitivity (S) / Water content (%) / Atterberg limits (%) / "N" Value (blows / 0.3 m) / Field / Lab / RQD / CONE | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0.0 | | GROUND SURFACE | | | | | | 10 20 30 40 50 60 70 80 90 | |
| | | 0.3 | | **TOPSOIL** (300 mm) | | | | | | | |
| | | | | **TILL** - Light brown Clayey Silt, wtih Sand, trace Gravel, moist, compact | | | | | | | |
| | | 1.5 | | Dense | SS-1 | 50 | 12 | 16<br>17<br>11 | 28 | | Open borehole remained dry throughout drilling operation |
| | | | | | SS-2 | 100 | 10 | 23<br>30<br>17 | 47 | | |
| | | | | | AS-3 | | 16 | | | | |
| | | | | | AS-4 | | 13 | | | | |
| | | 6.1 | | END OF BOREHOLE | | | | | | | |

BOREHOLE LOG GEOTECH G024822A1, 14-04-02, TESTHOLE LOGS.GPJ GEOLOGIC.GDT 4/21/14

REFERENCE No.: G024822A1 ENCLOSURE No.: A-3

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**BOREHOLE No.:** BH-3
**ELEVATION:** 242.9 m

# BOREHOLE REPORT

Page: 1 of 1

CLIENT: Towerhill Development
PROJECT: Proposed Fallis Line Residential Development
LOGGED BY: B. McFarlane DATE: March 14, 2014
DRILLING COMPANY: Eastern Soil Investigation METHOD: Track mounted drill rig
NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

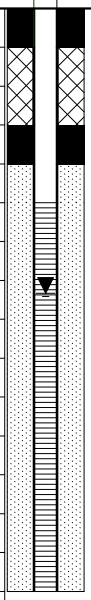
**LEGEND**

- SS - SPLIT SPOON
- AS - AUGER SAMPLE
- ST - SHELBY TUBE
- CS - CORE SAMPLE
- ▼ - WATER LEVEL

| Depth (ft) | Depth (m) | m Below Existing Grade | Stratigraphy | DESCRIPTION OF SOIL AND BEDROCK | Type and Number | Recovery % | Moisture Content % | Blows per 6 in. / 15 cm | Penetration Index N |
|---|---|---|---|---|---|---|---|---|---|
| | | 0.0 | | GROUND SURFACE | | | | | |
| | | 0.2 | | **TOPSOIL** (200 mm) | | | | | |
| 1 | | | | **TILL** - Light brown Clayey Silt, wtih Sand, trace Gravel, moist, compact | SS-1 | 100 | 14 | 6<br>7<br>9 | 16 |
| 3 | 1.0 | | | | | | | | |
| 4 | | | | | | | | | |
| 5 | | 1.5 | | Brown Silty Sand, moist, very dense to dense | SS-2 | 100 | 9 | 15<br>29<br>41 | 70 |
| 6 | 2.0 | | | | | | | | |
| 7 | | | | | | | | | |
| 8 | | | | | SS-3 | 100 | 13 | 15<br>21<br>19 | 40 |
| 9 | | | | | | | | | |
| 10 | 3.0 | 3.0 | | Wet | SS-4 | 100 | 17 | 10<br>19<br>21 | 40 |
| 11 | | | | | | | | | |
| 12 | | | | | | | | | |
| 13 | 4.0 | | | | | | | | |
| 14 | | | | | | | | | |
| 15 | | 4.6 | | Trace Gravel, compact | SS-5 | 100 | 19 | 11<br>23<br>34 | 67 |
| 16 | 5.0 | | | | | | | | |
| 17 | | | | | | | | | |
| 18 | | | | | | | | | |
| 19 | | | | | | | | | |
| 20 | 6.0 | | | | SS-6 | 100 | 17 | 7<br>7<br>21 | 28 |
| 21 | | | | | | | | | |
| 22 | | 6.6 | | END OF BOREHOLE | | | | | |
| 23 | 7.0 | | | | | | | | |
| 24 | | | | | | | | | |
| 25 | | | | | | | | | |
| 26 | 8.0 | | | | | | | | |
| 27 | | | | | | | | | |
| 28 | | | | | | | | | |
| 29 | | | | | | | | | |
| 30 | 9.0 | | | | | | | | |
| 31 | | | | | | | | | |
| 32 | | | | | | | | | |
| 33 | 10.0 | | | | | | | | |
| 34 | | | | | | | | | |

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
$W_P$ $W_l$ Atterberg limits (%)
× "N" Value (blows / 0.3 m) ◆ RQD ◎ CONE

10 20 30 40 50 60 70 80 90



COMMENTS

WL - 2.2 m 4/15/2014
WL - 2.2 m 4/15/2014
WL - 2.8 m 3/14/2014 Upon completion of drilling

Borehole caved at 3.4 m

BOREHOLE LOG GEOTECH G024822A1, 14-04-02, TESTHOLE LOGS.GPJ GEOLOGIC.GDT 4/21/14

REFERENCE No.: G024822A1 ENCLOSURE No.: A-4

www.geo-logic.ca

**BOREHOLE No.:** BH-4
**ELEVATION:** 251.4 m

# BOREHOLE REPORT

Page: 1 of 1

CLIENT: Towerhill Development
PROJECT: Proposed Fallis Line Residential Development
LOGGED BY: B. McFarlane DATE: March 14, 2014
DRILLING COMPANY: Eastern Soil Investigation METHOD: Track mounted drill rig
NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

**LEGEND**

- SS - SPLIT SPOON
- AS - AUGER SAMPLE
- ST - SHELBY TUBE
- CS - CORE SAMPLE
- ▼ - WATER LEVEL

| Depth (ft) | Depth (m) | m Below Existing Grade | Stratigraphy | DESCRIPTION OF SOIL AND BEDROCK | Type and Number | Recovery % | Moisture Content % | Blows per 6 in. / 15 cm | Penetration Index N | Shear test (Cu) / Sensitivity (S) / Water content (%) / Atterberg limits (%) / "N" Value (blows / 0.3 m) / Field △ / Lab □ / RQD / CONE | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0.0 | | GROUND SURFACE | | | | | | 10 20 30 40 50 60 70 80 90 | |
| | | 0.3 | | **TOPSOIL** (300 mm) | | | | | | | Open borehole remained dry throughout drilling operation |
| | | | | **TILL** - Light brown Clayey Silt, wtih Sand, trace Gravel, moist, compact to very dense | | | | | | | |
| | 1.0 | | | | SS-1 | 100 | 6 | 50=4" | 100+ | ○ × | |
| | 2.0 | | | | | | | | | | |
| | 3.0 | | | | SS-2 | 100 | 8 | 14<br>17<br>16 | 33 | ○ × | |
| | 4.0 | | | | | | | | | | |
| | | 4.6 | | Light brown Silty Sand, trace Gravel, damp, very dense | SS-3 | 100 | 8 | 50=5" | 100+ | ○ × | |
| | 5.0 | | | | | | | | | | |
| | 6.0 | | | | SS-4 | 100 | 4 | 50=5" | 100+ | ○ × | |
| | 7.0 | | | | | | | | | | |
| | 8.0 | | | | SS-5 | 100 | 5 | 28<br>50=5" | 100+ | ○ × | |
| | 9.0 | | | | | | | | | | |
| | | 9.3 | | END OF BOREHOLE | SS-6 | 100 | 6 | 50=5" | 100+ | ○ × | |
| | 10.0 | | | | | | | | | | |

BOREHOLE LOG GEOTECH G024822A1, 14-04-02, TESTHOLE LOGS.GPJ GEOLOGIC.GDT 4/21/14

REFERENCE No.: G024822A1 ENCLOSURE No.: A-5

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**BOREHOLE No.:** BH-5
**ELEVATION:** 249.3 m

# BOREHOLE REPORT

Page: 1 of 1

CLIENT: Towerhill Development
PROJECT: Proposed Fallis Line Residential Development
LOGGED BY: B. McFarlane DATE: March 14, 2014
DRILLING COMPANY: Eastern Soil Investigation METHOD: Track mounted drill rig
NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

**LEGEND**

- SS - SPLIT SPOON
- AS - AUGER SAMPLE
- ST - SHELBY TUBE
- CS - CORE SAMPLE
- ▼ - WATER LEVEL

| Depth (ft) | Depth (m) | m Below Existing Grade | Stratigraphy | DESCRIPTION OF SOIL AND BEDROCK | Type and Number | Recovery % | Moisture Content % | Blows per 6 in. / 15 cm | Penetration Index N |
|---|---|---|---|---|---|---|---|---|---|
| | | 0.0 | | GROUND SURFACE | | | | | |
| | | 0.0 | | **TOPSOIL** (350 mm) | | | | | |
| | | 0.4 | | **TILL** - Light brown Clayey Silt, wtih Sand, moist, compact | SS-1 | 100 | 27 | 2 3 7 | 10 |
| | | 1.5 | | Moist to wet | SS-2 | 100 | 19 | 12 13 11 | 24 |
| | | 2.3 | | Wet, very dense | SS-3 | 100 | 9 | 11 15 17 | 32 |
| | | 3.0 | | Light brown Silty Clay, wet, firm to hard | SS-4 | 100 | 11 | 12 23 26 | 49 |
| | | 4.6 | | Trace Gravel | SS-5 | 100 | 31 | 3 4 3 | 7 |
| | | 6.1 | | Light brown Silty Sand, with Clay and Gravel, wet, compact to dense | SS-6 | 100 | 9 | 5 19 7 | 26 |
| | | | | | SS-7 | 100 | 10 | 9 21 18 | 39 |
| | | | | | SS-8 | 50 | 8 | 11 8 8 7 | 16 |
| | | 9.8 | | END OF BOREHOLE | | | | | |

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
$W_P$ $W_l$ Atterberg limits (%)
× "N" Value (blows / 0.3 m) ◆ RQD ◎ CONE

10 20 30 40 50 60 70 80 90

**COMMENTS**

WL - 0.0 m 4/15/2014

WL - 0.1 m 3/25/2014

WL - 2.4 m 3/14/2014 Upon completion of drilling

SS-8: 26% Gravel 34% Sand 40% Silt and Clay 23% between 5-75 µm

BOREHOLE LOG GEOTECH G024822A1, 14-04-02, TESTHOLE LOGS.GPJ GEOLOGIC.GDT 4/21/14

REFERENCE No.: G024822A1 ENCLOSURE No.: A-6

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**BOREHOLE No.:** BH-6
**ELEVATION:** 246.1 m

# BOREHOLE REPORT

Page: 1 of 1

CLIENT: Towerhill Development
PROJECT: Proposed Fallis Line Residential Development
LOGGED BY: B. McFarlane DATE: March 17, 2014
DRILLING COMPANY: Eastern Soil Investigation METHOD: Track mounted drill rig
NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

**LEGEND**

- SS - SPLIT SPOON
- AS - AUGER SAMPLE
- ST - SHELBY TUBE
- CS - CORE SAMPLE
- ▼ - WATER LEVEL

| Depth (ft) | Depth (m) | m Below Existing Grade | Stratigraphy | DESCRIPTION OF SOIL AND BEDROCK | Type and Number | Recovery % | Moisture Content % | Blows per 6 in. / 15 cm | Penetration Index N | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 0.0 | | GROUND SURFACE | | | | | | |
| | | 0.4 | | **TOPSOIL** (400 mm) | | | | | | |
| | 1.0 | | | **TILL** - Light brown Clayey Silt, wtih Sand, moist, compact | SS-1 | 25 | 69 | 2 3 3 | 6 | ▼ WL - 0.9 m 3/17/2014 Upon completion of drilling |
| | | 1.5 | | Light brown Silty Clay, wet, stiff | SS-2 | 100 | 16 | 4 5 9 | 14 | |
| | 2.0 | 2.3 | | Trace Gravel | SS-3 | 100 | 27 | 7 9 7 | 16 | |
| | 3.0 | 3.0 | | Light brown Clayey Silt, with Sand, trace Gravel, wet, very dense | SS-4 | 100 | 17 | 4 6 4 | 10 | SS-4: 12% Gravel 19% Sand 69% Silt and Clay 36% between 5-75 µm PI: 7 % LL: 21 % |
| | 4.0 | | | | SS-5 | 100 | 7 | 16 30 50=3" | 100+ | Borehole caved at 5.0 m |
| | 5.0 | | | | | | | | | |
| | 6.0 | | | | SS-6 | 100 | 7 | 36 22 28 | 50 | |
| | | 6.6 | | END OF BOREHOLE | | | | | | |
| | 7.0 | | | | | | | | | |
| | 8.0 | | | | | | | | | |
| | 9.0 | | | | | | | | | |
| | 10.0 | | | | | | | | | |

Shear test (Cu) △ Field ☐ Lab
Sensitivity (S)
○ Water content (%)
$W_p$ $W_l$ Atterberg limits (%)
× "N" Value (blows / 0.3 m) ◆ RQD ◎ CONE

10 20 30 40 50 60 70 80 90

BOREHOLE LOG GEOTECH G024822A1, 14-04-02, TESTHOLE LOGS.GPJ GEOLOGIC.GDT 4/21/14

REFERENCE No.: G024822A1 ENCLOSURE No.: A-7

www.geo-logic.ca

**BOREHOLE No.:** BH-7
**ELEVATION:** 245.3 m

# BOREHOLE REPORT

Page: 1 of 1

CLIENT: Towerhill Development
PROJECT: Proposed Fallis Line Residential Development
LOGGED BY: B. McFarlane DATE: March 17, 2014
DRILLING COMPANY: Eastern Soil Investigation METHOD: Track mounted drill rig
NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

**LEGEND**

- SS - SPLIT SPOON
- AS - AUGER SAMPLE
- ST - SHELBY TUBE
- CS - CORE SAMPLE
- ▼ - WATER LEVEL

| Depth (ft) | Depth (m) | m Below Existing Grade | Stratigraphy | DESCRIPTION OF SOIL AND BEDROCK | Type and Number | Recovery % | Moisture Content % | Blows per 6 in. / 15 cm | Penetration Index N | Shear test (Cu) / Sensitivity (S) / Water content (%) / Atterberg limits (%) / "N" Value (blows / 0.3 m) / RQD / CONE — 10 20 30 40 50 60 70 80 90 | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0.0 | | GROUND SURFACE | | | | | | | WL - -0.1 m 3/25/2014 |
| | | 0.2 | | **TOPSOIL** (200 mm) | | | | | | | |
| 1 | | | | **TILL** - Light brown Clayey Silt, wtih Sand, trace Gravel, moist, compact | | | | | | | WL - 0.0 m 4/15/2014 |
| 2 | | | | | | | | | | | |
| 3 | 1.0 | | | | SS-1 | 100 | 22 | 5<br>8<br>11 | 19 | | |
| 4 | | | | | | | | | | | |
| 5 | | | | | | | | | | | |
| 6 | 2.0 | | | | SS-2 | 100 | 17 | 7<br>8<br>10 | 18 | | |
| 7 | | | | | | | | | | | |
| 8 | | | | | SS-3 | 100 | 11 | 6<br>11<br>11 | 22 | | WL - 2.1 m 3/17/2014 Upon completion of drilling |
| 9 | | | | | | | | | | | |
| 10 | 3.0 | 3.0 | | Wet | | | | | | | |
| 11 | | | | | SS-4 | 100 | 16 | 6<br>7<br>8 | 15 | | |
| 12 | | | | | | | | | | | |
| 13 | 4.0 | | | | | | | | | | |
| 14 | | | | | | | | | | | |
| 15 | | | | | SS-5 | 100 | 10 | 5<br>4<br>6 | 10 | | |
| 16 | | | | | | | | | | | |
| 17 | 5.0 | | | | | | | | | | Borehole caved at 5.2 m |
| 18 | | | | | | | | | | | |
| 19 | | | | | | | | | | | |
| 20 | 6.0 | | | | SS-6 | 100 | 10 | 8<br>10<br>10 | 20 | | |
| 21 | | | | | | | | | | | |
| 22 | | 6.6 | | END OF BOREHOLE | | | | | | | |
| 23 | 7.0 | | | | | | | | | | |
| 24 | | | | | | | | | | | |
| 25 | | | | | | | | | | | |
| 26 | 8.0 | | | | | | | | | | |
| 27 | | | | | | | | | | | |
| 28 | | | | | | | | | | | |
| 29 | 9.0 | | | | | | | | | | |
| 30 | | | | | | | | | | | |
| 31 | | | | | | | | | | | |
| 32 | | | | | | | | | | | |
| 33 | 10.0 | | | | | | | | | | |
| 34 | | | | | | | | | | | |

BOREHOLE LOG GEOTECH G024822A1, 14-04-02, TESTHOLE LOGS.GPJ GEOLOGIC.GDT 4/21/14

REFERENCE No.: G024822A1 ENCLOSURE No.: A-8

www.geo-logic.ca

**BOREHOLE No.:** BH-8
**ELEVATION:** 247.5 m

# BOREHOLE REPORT

Page: 1 of 1

CLIENT: Towerhill Development
PROJECT: Proposed Fallis Line Residential Development
LOGGED BY: B. McFarlane DATE: March 17, 2014
DRILLING COMPANY: Eastern Soil Investigation METHOD: Track mounted drill rig
NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

**LEGEND**

- SS - SPLIT SPOON
- AS - AUGER SAMPLE
- ST - SHELBY TUBE
- CS - CORE SAMPLE
- ▼ - WATER LEVEL

| Depth (ft) | Depth (m) | m Below Existing Grade | Stratigraphy | DESCRIPTION OF SOIL AND BEDROCK | Type and Number | Recovery % | Moisture Content % | Blows per 6 in. / 15 cm | Penetration Index N | Shear test (Cu) / Sensitivity (S) / Water content (%) / Atterberg limits (%) / "N" Value (blows / 0.3 m) / RQD / CONE (10 20 30 40 50 60 70 80 90) | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0.0 | | GROUND SURFACE | | | | | | | |
| | | 0.3 | | **TOPSOIL** (300 mm) | | | | | | | |
| | 1.0 | | | **TILL** - Light brown Clayey Silt, wtih Sand, trace Gravel, moist, compact | SS-1 | 50 | 30 | 4 6 6 | 12 | × ○ | Open borehole remained dry throughout drilling operation |
| | 2.0 | | | | SS-2 | 100 | 19 | 6 8 9 | 17 | × ⊗ | |
| | | | | | SS-3 | 100 | 19 | 9 13 14 | 27 | ○ × | |
| | 3.0 | | | | SS-4 | 100 | 17 | 7 13 13 | 26 | ○ × | |
| | 4.0 | | | | | | | | | | |
| | | 4.6 | | Very dense | SS-5 | 75 | 10 | 10 8 10 | 18 | ○ × | |
| | 5.0 | | | | | | | | | | |
| | 6.0 | | | | SS-6 | 100 | 11 | 30 38 27 | 65 | ○ × | |
| | | 6.6 | | END OF BOREHOLE | | | | | | | |
| | 7.0 | | | | | | | | | | |
| | 8.0 | | | | | | | | | | |
| | 9.0 | | | | | | | | | | |
| | 10.0 | | | | | | | | | | |

BOREHOLE LOG GEOTECH G024822A1, 14-04-02, TESTHOLE LOGS.GPJ GEOLOGIC.GDT 4/21/14

REFERENCE No.: G024822A1 ENCLOSURE No.: A-9

www.geo-logic.ca

**BOREHOLE No.:** BH-9
**ELEVATION:** 245.7 m

# BOREHOLE REPORT

Page: 1 of 1

CLIENT: Towerhill Development
PROJECT: Proposed Fallis Line Residential Development
LOGGED BY: B. McFarlane DATE: March 18, 2014
DRILLING COMPANY: Eastern Soil Investigation METHOD: Track mounted drill rig
NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

**LEGEND**

- SS - SPLIT SPOON
- AS - AUGER SAMPLE
- ST - SHELBY TUBE
- CS - CORE SAMPLE
- ▼ - WATER LEVEL

| Depth (ft) | Depth (m) | m Below Existing Grade | Stratigraphy | DESCRIPTION OF SOIL AND BEDROCK | Type and Number | Recovery % | Moisture Content % | Blows per 6 in. / 15 cm | Penetration Index N | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 0.0 | | GROUND SURFACE | | | | | | |
| | | 0.3 | | **TOPSOIL** (300 mm) | | | | | | |
| | | | | **TILL** - Light brown Clayey Silty Sand, wtih Gravel, moist, compact | SS-1 | 50 | 25 | 2<br>5<br>7 | 12 | Open borehole remained dry throughout drilling operation |
| | | 1.5 | | Very dense | SS-2 | 100 | 25 | 4<br>10<br>12 | 22 | |
| | | | | | SS-3 | 100 | 9 | 49<br>37<br>50=3" | 100+ | |
| | | | | | SS-4 | 100 | 8 | 26<br>28<br>44 | 72 | SS-4:<br>16% Gravel<br>36% Sand<br>48% Silt and Clay<br>27% between 5-75 µm |
| | | | | | SS-5 | 100 | 6 | 37<br>50=4" | 100+ | |
| | | | | | AS-6 | | 11 | | | |
| | | 6.1 | | END OF BOREHOLE | | | | | | |

Shear test (Cu) △ Field ☐ Lab
Sensitivity (S)
○ Water content (%)
$W_p$ $W_l$ Atterberg limits (%)
× "N" Value (blows / 0.3 m) ◆ RQD ◎ CONE

10 20 30 40 50 60 70 80 90

BOREHOLE LOG GEOTECH G024822A1, 14-04-02, TESTHOLE LOGS.GPJ GEOLOGIC.GDT 4/21/14

REFERENCE No.: G024822A1 ENCLOSURE No.: A-10

www.geo-logic.ca

**BOREHOLE No.:** BH-10
**ELEVATION:** 253.1 m

# BOREHOLE REPORT

Page: 1 of 1

CLIENT: Towerhill Development
PROJECT: Proposed Fallis Line Residential Development
LOGGED BY: B. McFarlane DATE: March 18, 2014
DRILLING COMPANY: Eastern Soil Investigation METHOD: Track mounted drill rig
NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

**LEGEND**

- SS - SPLIT SPOON
- AS - AUGER SAMPLE
- ST - SHELBY TUBE
- CS - CORE SAMPLE
- ▼ - WATER LEVEL

| Depth ft | Depth m | m Below Existing Grade | Stratigraphy | DESCRIPTION OF SOIL AND BEDROCK | Type and Number | Recovery % | Moisture Content % | Blows per 6 in. / 15 cm | Penetration Index N | Shear test (Cu) / Sensitivity (S) / Water content (%) / Atterberg limits (%) / "N" Value (blows / 0.3 m) / Field / Lab / RQD / CONE | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0.0 | | GROUND SURFACE | | | | | | 10 20 30 40 50 60 70 80 90 | |
| | | 0.3 | | **TOPSOIL** (300 mm) | | | | | | | |
| | 1.0 | | | **TILL** - Brown Sandy Silt, wtih Clay, trace Gravel, moist, compact to very dense | SS-1 | 100 | 10 | 5<br>11<br>22 | 33 | | |
| | 2.0 | | | | SS-2 | 100 | 7 | 12<br>20<br>17 | 37 | | |
| | | | | | SS-3 | 100 | 6 | 18<br>25<br>28 | 53 | | |
| | 3.0 | 3.0 | | Wet | SS-4 | 100 | 10 | 50=2" | 100+ | | |
| | 4.0 | | | | | | | | | | ▼ WL - 4.3 m 3/18/2014 Upon completion of drilling Borehole caved at 5.0 m |
| | | | | | SS-5 | 100 | 9 | 7<br>10<br>11 | 21 | | |
| | 6.0 | 6.2 | | END OF BOREHOLE | SS-6 | 100 | 10 | 50=4" | 100+ | | |
| | 7.0 | | | | | | | | | | |
| | 8.0 | | | | | | | | | | |
| | 9.0 | | | | | | | | | | |
| | 10.0 | | | | | | | | | | |

BOREHOLE LOG GEOTECH G024822A1, 14-04-02, TESTHOLE LOGS.GPJ GEOLOGIC.GDT 4/21/14

REFERENCE No.: G024822A1 ENCLOSURE No.: A-11

www.geo-logic.ca

**BOREHOLE No.:** BH-11
**ELEVATION:** 248.8 m

# BOREHOLE REPORT

Page: 1 of 1

CLIENT: Towerhill Development
PROJECT: Proposed Fallis Line Residential Development
LOGGED BY: B. McFarlane DATE: March 14, 2014
DRILLING COMPANY: Eastern Soil Investigation METHOD: Track mounted drill rig
NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

**LEGEND**

- SS - SPLIT SPOON
- AS - AUGER SAMPLE
- ST - SHELBY TUBE
- CS - CORE SAMPLE
- ▼ - WATER LEVEL

| Depth (ft) | Depth (m) | m Below Existing Grade | Stratigraphy | DESCRIPTION OF SOIL AND BEDROCK | Type and Number | Recovery % | Moisture Content % | Blows per 6 in. / 15 cm | Penetration Index N | Shear test (Cu) / Sensitivity (S) / Water content (%) / Atterberg limits (%) / "N" Value (blows / 0.3 m) / RQD / CONE — 10 20 30 40 50 60 70 80 90 | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0.0 | | GROUND SURFACE | | | | | | | |
| | | 0.3 | | **TOPSOIL** (250 mm) | | | | | | | |
| | | | | **TILL** - Brown Clayey Silt, wtih Sand, trace Gravel, moist, compact to very dense | SS-1 | 100 | 18 | 4 6 7 | 13 | | Open borehole remained dry throughout drilling operation |
| | | | | | SS-2 | 75 | 18 | 21 16 17 | 33 | | |
| | | | | | SS-3 | 100 | 14 | 9 15 18 | 33 | | |
| | | | | | SS-4 | 100 | 11 | 6 20 31 | 51 | | |
| | | | | | AS-5 | | 8 | | | | |
| | | | | | AS-6 | | 8 | | | | |
| | | 6.1 | | END OF BOREHOLE | | | | | | | |

BOREHOLE LOG GEOTECH G024822A1, 14-04-02, TESTHOLE LOGS.GPJ GEOLOGIC.GDT 4/21/14

REFERENCE No.: G024822A1 ENCLOSURE No.: A-12

www.geo-logic.ca

**BOREHOLE No.:** BH-12
**ELEVATION:** 246.2 m

# BOREHOLE REPORT

Page: 1 of 1

CLIENT: Towerhill Development
PROJECT: Proposed Fallis Line Residential Development
LOGGED BY: B. McFarlane DATE: March 14, 2014
DRILLING COMPANY: Eastern Soil Investigation METHOD: Track mounted drill rig
NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

**LEGEND**

- SS - SPLIT SPOON
- AS - AUGER SAMPLE
- ST - SHELBY TUBE
- CS - CORE SAMPLE
- ▼ - WATER LEVEL

| Depth (ft) | Depth (m) | m Below Existing Grade | Stratigraphy | DESCRIPTION OF SOIL AND BEDROCK | Type and Number | Recovery % | Moisture Content % | Blows per 6 in. / 15 cm | Penetration Index N | Shear test (Cu) / Sensitivity (S) / Water content (%) / Atterberg limits (%) / "N" Value (blows / 0.3 m) / △ Field / □ Lab / ◆ RQD / ◎ CONE (10 20 30 40 50 60 70 80 90) | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0.0 | | GROUND SURFACE | | | | | | | |
| | | 0.3 | | **TOPSOIL** (300 mm) | | | | | | | |
| | | | | **TILL** - Brown Clayey Silt, wtih Sand, trace Gravel, moist, compact to very dense | SS-1 | 100 | 23 | 3 3 7 | 10 | | Open borehole remained dry throughout drilling operation |
| | | | | | SS-2 | 100 | 11 | 6 7 15 | 22 | | |
| | | | | | SS-3 | 100 | 9 | 50=3" | 100+ | | |
| | | | | | SS-4 | 100 | 9 | 13 17 17 | 34 | | |
| | | | | | AS-5 | | 9 | | | | |
| | | | | | AS-6 | | 9 | | | | |
| | | 6.1 | | END OF BOREHOLE | | | | | | | |

BOREHOLE LOG GEOTECH G024822A1, 14-04-02, TESTHOLE LOGS.GPJ GEOLOGIC.GDT 4/21/14

REFERENCE No.: G024822A1 ENCLOSURE No.: A-13

www.geo-logic.ca

**BOREHOLE No.:** BH-13
**ELEVATION:** 250.1 m

# BOREHOLE REPORT

Page: 1 of 1

CLIENT: Towerhill Development
PROJECT: Proposed Fallis Line Residential Development
LOGGED BY: B. McFarlane DATE: March 18, 2014
DRILLING COMPANY: Eastern Soil Investigation METHOD: Track mounted drill rig
NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

**LEGEND**

- SS - SPLIT SPOON
- AS - AUGER SAMPLE
- ST - SHELBY TUBE
- CS - CORE SAMPLE
- ▼ - WATER LEVEL

| Depth (ft) | Depth (m) | m Below Existing Grade | Stratigraphy | DESCRIPTION OF SOIL AND BEDROCK | Type and Number | Recovery % | Moisture Content % | Blows per 6 in. / 15 cm | Penetration Index N |
|---|---|---|---|---|---|---|---|---|---|
| | | 0.0 | | GROUND SURFACE | | | | | |
| | | 0.4 | | **TOPSOIL** (350 mm) | | | | | |
| | | 0.8 | | **TILL** - Light brown Clayey Silt, wtih Sand, moist, compact | | | | | |
| | 1.0 | | | Trace Gravel, compact to very dense | SS-1 | 25 | 30 | 4<br>8<br>17 | 25 |
| | 2.0 | | | | SS-2 | 100 | 13 | 13<br>20<br>20 | 40 |
| | 3.0 | | | | SS-3 | 100 | 11 | 10<br>20<br>19 | 39 |
| | | 3.0 | | Wet | SS-4 | 25 | 13 | 20<br>25<br>39 | 64 |
| | 4.0 | | | | | | | | |
| | 5.0 | | | | SS-5 | 100 | 10 | 38<br>50=4" | 100+ |
| | 6.0 | 6.2 | | END OF BOREHOLE | SS-6 | 100 | 8 | 50=4" | 100+ |
| | 7.0 | | | | | | | | |
| | 8.0 | | | | | | | | |
| | 9.0 | | | | | | | | |
| | 10.0 | | | | | | | | |

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
$W_P$ $W_l$ Atterberg limits (%)
× "N" Value (blows / 0.3 m) ◆ RQD ◎ CONE

10 20 30 40 50 60 70 80 90

COMMENTS

WL - 0.1 m
4/15/2014

WL - 1.3 m
3/25/2014

WL - 3.7 m
3/18/2014
Upon completion of drilling

BOREHOLE LOG GEOTECH G024822A1, 14-04-02, TESTHOLE LOGS.GPJ GEOLOGIC.GDT 4/21/14

REFERENCE No.: G024822A1 ENCLOSURE No.: A-14

www.geo-logic.ca

**BOREHOLE No.:** BH-14
**ELEVATION:** 251.3 m

# BOREHOLE REPORT

Page: 1 of 1

CLIENT: Towerhill Development
PROJECT: Proposed Fallis Line Residential Development
LOGGED BY: B. McFarlane DATE: March 18, 2014
DRILLING COMPANY: Eastern Soil Investigation METHOD: Track mounted drill rig
NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

**LEGEND**

- SS - SPLIT SPOON
- AS - AUGER SAMPLE
- ST - SHELBY TUBE
- CS - CORE SAMPLE
- ▼ - WATER LEVEL

| Depth (ft) | Depth (m) | m Below Existing Grade | Stratigraphy | DESCRIPTION OF SOIL AND BEDROCK | Type and Number | Recovery % | Moisture Content % | Blows per 6 in. / 15 cm | Penetration Index N |
|---|---|---|---|---|---|---|---|---|---|
| | | 0.0 | | GROUND SURFACE | | | | | |
| | | 0.4 | | **TOPSOIL** (350 mm) | | | | | |
| | | | | **TILL** - Brown Sandy Silt, wtih Clay, trace Gravel, moist, compact to very dense | SS-1 | 25 | 19 | 4 5 7 | 12 |
| | | | | | SS-2 | 100 | 14 | 6 11 30 | 41 |
| | | | | | SS-3 | 75 | 13 | 21 23 43 | 66 |
| | | | | | SS-4 | 100 | 10 | 18 16 20 | 36 |
| | | | | | AS-5 | | 5 | | |
| | | | | | AS-6 | | 5 | | |
| | | 6.1 | | END OF BOREHOLE | | | | | |

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
$W_P$ $W_l$ Atterberg limits (%)
× "N" Value (blows / 0.3 m)
◆ RQD
◎ CONE

10 20 30 40 50 60 70 80 90

COMMENTS

Open borehole remained dry throughout drilling operation

BOREHOLE LOG GEOTECH G024822A1, 14-04-02, TESTHOLE LOGS.GPJ GEOLOGIC.GDT 4/21/14

REFERENCE No.: G024822A1 ENCLOSURE No.: A-15

www.geo-logic.ca

**BOREHOLE No.:** BH-15
**ELEVATION:** 245.2 m

# BOREHOLE REPORT

Page: 1 of 1

CLIENT: Towerhill Development
PROJECT: Proposed Fallis Line Residential Development
LOGGED BY: B. McFarlane DATE: March 18, 2014
DRILLING COMPANY: Eastern Soil Investigation METHOD: Track mounted drill rig
NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

**LEGEND**

- SS - SPLIT SPOON
- AS - AUGER SAMPLE
- ST - SHELBY TUBE
- CS - CORE SAMPLE
- ▼ - WATER LEVEL

| Depth (ft) | Depth (m) | m Below Existing Grade | Stratigraphy | DESCRIPTION OF SOIL AND BEDROCK | Type and Number | Recovery % | Moisture Content % | Blows per 6 in. / 15 cm | Penetration Index N | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 0.0 | | GROUND SURFACE | | | | | | |
| | | 0.3 | | **TOPSOIL** (300 mm) | | | | | | |
| | | 0.8 | | **TILL** - Brown Clayey Silt, wtih Sand, trace Gravel, moist, compact to dense | | | | | | |
| | 1.0 | | | Wet | SS-1 | 50 | 27 | 3 4 6 | 10 | WL - 0.4 m 4/15/2014 WL - 0.7 m 3/25/2014 |
| | | | | | SS-2 | 100 | 31 | 5 8 12 | 20 | |
| | 2.0 | | | | SS-3 | 100 | 9 | 14 22 22 | 44 | |
| | 3.0 | | | | SS-4 | 100 | 8 | 21 22 20 | 42 | WL - 3.0 m 3/18/2014 Upon completion of drilling |
| | 4.0 | | | | | | | | | |
| | 5.0 | | | | SS-5 | 75 | 17 | 10 12 15 | 27 | |
| | 6.0 | 6.1 | | | AS-6 | | 12 | | | |
| | | | | END OF BOREHOLE | | | | | | |
| | 7.0 | | | | | | | | | |
| | 8.0 | | | | | | | | | |
| | 9.0 | | | | | | | | | |
| | 10.0 | | | | | | | | | |

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
$W_p$ $W_l$ Atterberg limits (%)
× "N" Value (blows / 0.3 m) ◆ RQD ◎ CONE

10 20 30 40 50 60 70 80 90

BOREHOLE LOG GEOTECH G024822A1, 14-04-02, TESTHOLE LOGS.GPJ GEOLOGIC.GDT 4/21/14

REFERENCE No.: G024822A1 ENCLOSURE No.: A-16

www.geo-logic.ca

**TEST PIT No.:** TP-16
**ELEVATION:** 240.6 m

# TEST PIT REPORT

Page: 1 of 1

CLIENT: Towerhill Development
PROJECT: Proposed Fallis Line Residential Development
LOGGED BY: P. Hynes DATE: March 17, 2014
EXCAVATION COMPANY: Terry Dunford Excavating METHOD: Track mounted excavator
NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

**LEGEND**
GS - GRAB SAMPLE
▼ - WATER LEVEL

| Depth (ft / m) | m Below Existing Grade | Stratigraphy | DESCRIPTION OF SOIL AND BEDROCK | Type and Number | Moisture Content (%) | Shear test (Cu) / Sensitivity (S) / Water content (%) / Atterberg limits (%) (△ Field, □ Lab) | COMMENTS |
|---|---|---|---|---|---|---|---|
| ft / m | 0.0 | | GROUND SURFACE | | % | 10 20 30 40 50 60 70 80 90 | |
| | 0.3 | | **TOPSOIL** (300 mm) | | | | No seepage observed during the excavation of the test pit |
| | 0.6 | | **SANDY LOAM** - Brown to reddish brown Sandy Loam | | | | |
| 1.0 | | | **TILL** - Brown to grey Clayey Silty Sand, with Gravel, mottled, moist, compact | GS-1 | 9 | ○ | |
| 2.0 | 2.1 | | Brown Clayey Sandy Silt, trace Gravel, moist, very dense | GS-2 | 10 | ○ | GS-2: 8% Gravel 31% Sand 61% Silt and Clay 30% between 5-75 µm |
| 3.0 | | | | | | | |
| 4.0 | | | | GS-3 | 23 | ○ | |
| 5.0 | 4.9 | | END OF TEST PIT | | | | |
| 6.0 | | | | | | | |
| 7.0 | | | | | | | |
| 8.0 | | | | | | | |
| 9.0 | | | | | | | |
| 10.0 | | | | | | | |

TEST PIT LOG GEOTECH G024822A1, 14-04-02, TESTHOLE LOGS.GPJ GEOLOGIC.GDT 4/2/14

REFERENCE No.: G024822A1 ENCLOSURE No.: A-17

www.geo-logic.ca

**TEST PIT No.:** TP-17
**ELEVATION:** 233.8 m

# TEST PIT REPORT

Page: 1 of 1

CLIENT: Towerhill Development
PROJECT: Proposed Fallis Line Residential Development
LOGGED BY: P. Hynes DATE: March 18, 2014
EXCAVATION COMPANY: Terry Dunford Excavating METHOD: Track mounted excavator
NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

**LEGEND**
GS - GRAB SAMPLE
▼ - WATER LEVEL

| Depth (ft / m) | m Below Existing Grade | Stratigraphy | DESCRIPTION OF SOIL AND BEDROCK | Type and Number | Moisture Content (%) | COMMENTS |
|---|---|---|---|---|---|---|
| 0 / 0.0 | 0.0 | | GROUND SURFACE | | | |
| | 0.2 | | **TOPSOIL** (200 mm) | | | |
| 1 | | | **TILL** - Brown to grey Clayey Silty Sand, with Gravel, mottled, moist, compact | | | |
| 2 | | | | | | |
| 3 / 1.0 | | | | | | |
| 4 | | | | GS-1 | 23 | No seepage observed during the excavation of the test pit |
| 5 | | | | | | |
| 6 | | | | | | |
| 7 / 2.0 | 2.1 | | Brown Clayey Silt, trace Sand, occasional Cobbles and Boulders, moist, compact | | | |
| 8 | | | | | | |
| 9 | | | | | | |
| 10 / 3.0 | | | | GS-2 | 21 | GS-2:<br>1% Gravel<br>3% Sand<br>96% Silt and Clay<br>48% between 5-75 µm |
| 11 | | | | | | |
| 12 | 3.7 | | With Gravel, moist to wet | | | |
| 13 / 4.0 | | | | | | |
| 14 | | | | | | |
| 15 | | | | GS-3 | 12 | |
| 16 | 4.9 | | END OF TEST PIT | | | |
| 17 / 5.0 | | | | | | |
| 18 | | | | | | |
| 19 | | | | | | |
| 20 / 6.0 | | | | | | |
| 21 | | | | | | |
| 22 | | | | | | |
| 23 / 7.0 | | | | | | |
| 24 | | | | | | |
| 25 | | | | | | |
| 26 / 8.0 | | | | | | |
| 27 | | | | | | |
| 28 | | | | | | |
| 29 / 9.0 | | | | | | |
| 30 | | | | | | |
| 31 | | | | | | |
| 32 | | | | | | |
| 33 / 10.0 | | | | | | |
| 34 | | | | | | |

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
$w_p$ $w_l$ Atterberg limits (%)

10 20 30 40 50 60 70 80 90

TEST PIT LOG GEOTECH G024822A1, 14-04-02, TESTHOLE LOGS.GPJ GEOLOGIC.GDT 4/2/14

REFERENCE No.: G024822A1 ENCLOSURE No.: A-18

www.geo-logic.ca

**TEST PIT No.:** TP-18
**ELEVATION:** 244.6 m

# TEST PIT REPORT

Page: 1 of 1

CLIENT: Towerhill Development
PROJECT: Proposed Fallis Line Residential Development
LOGGED BY: P. Hynes DATE: March 17, 2014
EXCAVATION COMPANY: Terry Dunford Excavating METHOD: Track mounted excavator
NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

**LEGEND**
GS - GRAB SAMPLE
▼ - WATER LEVEL

| Depth (ft / m) | m Below Existing Grade | Stratigraphy | DESCRIPTION OF SOIL AND BEDROCK | Type and Number | Moisture Content (%) | Shear test (Cu) / Sensitivity (S) / Water content (%) / Atterberg limits (%) (△ Field, □ Lab) | COMMENTS |
|---|---|---|---|---|---|---|---|
| | 0.0 | | GROUND SURFACE | | | 10 20 30 40 50 60 70 80 90 | |
| | | | **TOPSOIL** (350 mm) | | | | No seepage observed during the excavation of the test pit |
| | 0.4 | | **TILL** - Brown to grey Clayey Silty Sand, with Gravel, mottled, moist, compact | | | | |
| 1.0 | | | | | | | |
| 2.0 | 2.1 | | With Boulders | GS-1 | 11 | ○ | |
| 3.0 | | | | | | | |
| | 3.7 | | Brown Silty Sand, with Clay and Gravel, moist, very dense | | | | |
| 4.0 | | | | | | | |
| | | | | GS-2 | 8 | ○ | |
| 5.0 | | | | | | | |
| 6.0 | 6.1 | | END OF TEST PIT | | | | |
| 7.0 | | | | | | | |
| 8.0 | | | | | | | |
| 9.0 | | | | | | | |
| 10.0 | | | | | | | |

TEST PIT LOG GEOTECH G024822A1, 14-04-02, TESTHOLE LOGS.GPJ GEOLOGIC.GDT 4/2/14

REFERENCE No.: G024822A1 ENCLOSURE No.: A-19

www.geo-logic.ca

**TEST PIT No.:** TP-19
**ELEVATION:** 241.7 m

# TEST PIT REPORT

Page: 1 of 1

CLIENT: Towerhill Development

PROJECT: Proposed Fallis Line Residential Development

LOGGED BY: P. Hynes DATE: March 17, 2014

EXCAVATION COMPANY: Terry Dunford Excavating METHOD: Track mounted excavator

NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

**LEGEND**

GS - GRAB SAMPLE

▼ - WATER LEVEL

| Depth (ft) | Depth (m) | m Below Existing Grade | Stratigraphy | DESCRIPTION OF SOIL AND BEDROCK | Type and Number | Moisture Content (%) | COMMENTS |
|---|---|---|---|---|---|---|---|
| | | 0.0 | | GROUND SURFACE | | | |
| | | 0.5 | | **TOPSOIL** (450 mm) | | | |
| | 1.0 | | | **TILL** - Brown to grey Clayey Silty Sand, with Gravel, mottled, moist, compact | | | |
| | 2.0 | | | | GS-1 | 12 | |
| | 3.0 | 3.0 | | Grey Silty Clay to Clayey Silt, stiff, moist to wet | | | |
| | 5.0 | | | | GS-2 | 18 | |
| | 6.0 | 6.1 | | END OF TEST PIT | | | |
| | 7.0 | | | | | | |
| | 8.0 | | | | | | |
| | 9.0 | | | | | | |
| | 10.0 | | | | | | |

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
$w_p$ $w_l$ Atterberg limits (%)

10 20 30 40 50 60 70 80 90

WL - 0.5 m
3/25/2014

Seepage observed at 0.9 m and 1.5 m

TEST PIT LOG GEOTECH G024822A1, 14-04-02, TESTHOLE LOGS.GPJ GEOLOGIC.GDT 4/2/14

REFERENCE No.: G024822A1 ENCLOSURE No.: A-20

www.geo-logic.ca

**TEST PIT No.:** TP-20
**ELEVATION:** 235.2 m

# TEST PIT REPORT

Page: 1 of 1

CLIENT: Towerhill Development
PROJECT: Proposed Fallis Line Residential Development
LOGGED BY: P. Hynes DATE: March 17, 2014
EXCAVATION COMPANY: Terry Dunford Excavating METHOD: Track mounted excavator
NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

**LEGEND**
GS - GRAB SAMPLE
▼ - WATER LEVEL

| Depth (ft) | Depth (m) | m Below Existing Grade | Stratigraphy | DESCRIPTION OF SOIL AND BEDROCK | Type and Number | Moisture Content (%) | Shear test (Cu) / Sensitivity (S) / Water content (%) / Atterberg limits (%) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| | 0.0 | | | GROUND SURFACE | | | | WL - 0.0 m 3/17/2014 Seepage observed throughout |
| | | 0.3 | | **PEAT** (300 mm) | | | | |
| | | | | **TILL** - Brown Silty Sand, with Gravel, moist | | | | |
| | | 0.9 | | Grey Silty Clay to Clayey Silt, stiff, moist to wet | GS-1 | 10 | | |
| | 3.0 | 3.0 | | END OF TEST PIT | | | | Excavation terminated at 3.0 m due to seepage and cave |

TEST PIT LOG GEOTECH G024822A1, 14-04-02, TESTHOLE LOGS.GPJ GEOLOGIC.GDT 4/2/14

REFERENCE No.: G024822A1 ENCLOSURE No.: A-21

www.geo-logic.ca

**TEST PIT No.:** TP-21
**ELEVATION:** 245.1 m

# TEST PIT REPORT

Page: 1 of 1

CLIENT: Towerhill Development
PROJECT: Proposed Fallis Line Residential Development
LOGGED BY: P. Hynes DATE: March 17, 2014
EXCAVATION COMPANY: Terry Dunford Excavating METHOD: Track mounted excavator
NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

**LEGEND**
GS - GRAB SAMPLE
▼ - WATER LEVEL

| Depth (ft) | Depth (m) | m Below Existing Grade | Stratigraphy | DESCRIPTION OF SOIL AND BEDROCK | Type and Number | Moisture Content (%) | Shear test (Cu) / Sensitivity (S) / Water content (%) / Atterberg limits (%) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| | | 0.0 | | GROUND SURFACE | | | 10 20 30 40 50 60 70 80 90 | |
| | | | | **TOPSOIL** (325 mm) | | | | |
| | | 0.3 | | **TILL** - Brown to grey Clayey Sandy Silt, with Gravel, occasional Cobbles and Boulders, mottled, moist, compact | | | | ▼ Seepage observed at 0.9 m |
| | 1.0 | | | | GS-1 | 11 | ○ | GS-1: 12% Gravel, 31% Sand, 57% Silt and Clay, 26% between 5-75 µm |
| | 2.0 | | | | | | | |
| | 3.0 | 3.0 | | Grey | | | | |
| | 4.0 | | | | | | | |
| | | 4.6 | | Brown Silty Sand, with Clay and Gravel, moist, very dense | GS-2 | 10 | ○ | |
| | 5.0 | | | | | | | |
| | 6.0 | 6.1 | | END OF TEST PIT | | | | |
| | 7.0 | | | | | | | |
| | 8.0 | | | | | | | |
| | 9.0 | | | | | | | |
| | 10.0 | | | | | | | |

TEST PIT LOG GEOTECH G024822A1, 14-04-02, TESTHOLE LOGS.GPJ GEOLOGIC.GDT 4/2/14

REFERENCE No.: G024822A1 ENCLOSURE No.: A-22

www.geo-logic.ca

**TEST PIT No.:** TP-22
**ELEVATION:** 256.6 m

# TEST PIT REPORT

Page: 1 of 1

CLIENT: Towerhill Development
PROJECT: Proposed Fallis Line Residential Development
LOGGED BY: P. Hynes DATE: March 17, 2014
EXCAVATION COMPANY: Terry Dunford Excavating METHOD: Track mounted excavator
NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

**LEGEND**
GS - GRAB SAMPLE
▼ - WATER LEVEL

| Depth (ft / m) | m Below Existing Grade | Stratigraphy | DESCRIPTION OF SOIL AND BEDROCK | Type and Number | Moisture Content (%) | Shear test (Cu) △ Field □ Lab; Sensitivity (S); ○ Water content (%); $w_p$ $w_l$ Atterberg limits (%) | COMMENTS |
|---|---|---|---|---|---|---|---|
| ft / m | 0.0 | | GROUND SURFACE | | % | 10 20 30 40 50 60 70 80 90 | |
| | 0.3 | | **TOPSOIL** (300 mm) | | | | No seepage observed during the excavation of the test pit |
| 1 | | | **TILL** - Brown Silty Sand, with Gravel, trace Clay, occasional Cobbles and Boulders, moist | | | | |
| 1.0 | | | | | | | |
| 2.0 | | | | GS-1 | 10 | ○ | |
| 3.0 | | | | | | | |
| 4.0 | | | | GS-2 | 6 | ○ | |
| 5.0 | | | | | | | |
| 6.0 | 6.1 | | END OF TEST PIT | | | | |
| 7.0 | | | | | | | |
| 8.0 | | | | | | | |
| 9.0 | | | | | | | |
| 10.0 | | | | | | | |

TEST PIT LOG GEOTECH G024822A1, 14-04-02, TESTHOLE LOGS.GPJ GEOLOGIC.GDT 4/2/14

REFERENCE No.: G024822A1 ENCLOSURE No.: A-23

www.geo-logic.ca

**TEST PIT No.:** TP-23
**ELEVATION:** 249.1 m

# TEST PIT REPORT

Page: 1 of 1

CLIENT: Towerhill Development
PROJECT: Proposed Fallis Line Residential Development
LOGGED BY: P. Hynes DATE: March 17, 2014
EXCAVATION COMPANY: Terry Dunford Excavating METHOD: Track mounted excavator
NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

**LEGEND**
GS - GRAB SAMPLE
▼ - WATER LEVEL

| Depth (ft / m) | m Below Existing Grade | Stratigraphy | DESCRIPTION OF SOIL AND BEDROCK | Type and Number | Moisture Content (%) | Shear test (Cu) △ Field □ Lab; Sensitivity (S); ○ Water content (%); $w_p$ $w_l$ Atterberg limits (%) | COMMENTS |
|---|---|---|---|---|---|---|---|
| ft / m | 0.0 | | GROUND SURFACE | | % | 10 20 30 40 50 60 70 80 90 | |
| | 0.2 | | **TOPSOIL** (200 mm) | | | | No seepage observed during the excavation of the test pit |
| | | | **SANDY LOAM** - Brown to reddish brown Sandy Loam, moist | | | | |
| | 0.6 | | **TILL** - Brown to grey Clayey Silty Sand, with Gravel, occasional Cobbles and Boulders, mottled, moist, compact | | | | |
| 1.0 | | | | GS-1 | 22 | ○ | |
| | 1.8 | | Very dense | | | | |
| 2.0 | | | | | | | |
| 3.0 | | | | GS-2 | 11 | ○ | |
| 4.0 | | | | | | | |
| | 4.6 | | END OF TEST PIT | | | | Test pit terminated at practical refusal (due to presence of very dense till) |
| 5.0 | | | | | | | |
| 6.0 | | | | | | | |
| 7.0 | | | | | | | |
| 8.0 | | | | | | | |
| 9.0 | | | | | | | |
| 10.0 | | | | | | | |

TEST PIT LOG GEOTECH G024822A1, 14-04-02, TESTHOLE LOGS.GPJ GEOLOGIC.GDT 4/2/14

REFERENCE No.: G024822A1 ENCLOSURE No.: A-24

www.geo-logic.ca

**TEST PIT No.:** TP-24
**ELEVATION:** 252.2 m

# TEST PIT REPORT

Page: 1 of 1

CLIENT: Towerhill Development
PROJECT: Proposed Fallis Line Residential Development
LOGGED BY: P. Hynes DATE: March 17, 2014
EXCAVATION COMPANY: Terry Dunford Excavating METHOD: Track mounted excavator
NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

**LEGEND**
GS - GRAB SAMPLE
▼ - WATER LEVEL

| Depth (ft / m) | m Below Existing Grade | Stratigraphy | DESCRIPTION OF SOIL AND BEDROCK | Type and Number | Moisture Content (%) | Shear test (Cu) △ Field / □ Lab; Sensitivity (S); ○ Water content (%); $w_p$ $w_l$ Atterberg limits (%) | COMMENTS |
|---|---|---|---|---|---|---|---|
| ft / m | 0.0 | | GROUND SURFACE | | % | 10 20 30 40 50 60 70 80 90 | |
| | | | **TOPSOIL** (400 mm) | | | | No seepage observed during the excavation of the test pit |
| | 0.4 | | **TILL** - Brown Clayey Silt, with Sand, trace Gravel, mottled, moist | | | | |
| 1.0 | | | | GS-1 | 19 | ○ | |
| | 1.5 | | Brown Silty Sand, with Gravel, trace Clay, occasional Cobbles and Boulders, moist | | | | |
| 2.0 | | | | | | | |
| 3.0 | | | | | | | |
| | | | | GS-2 | 5 | ○ | |
| 4.0 | | | | | | | |
| 5.0 | | | | | | | |
| 6.0 | 6.1 | | END OF TEST PIT | | | | |
| 7.0 | | | | | | | |
| 8.0 | | | | | | | |
| 9.0 | | | | | | | |
| 10.0 | | | | | | | |

TEST PIT LOG GEOTECH G024822A1, 14-04-02, TESTHOLE LOGS.GPJ GEOLOGIC.GDT 4/2/14

REFERENCE No.: G024822A1 ENCLOSURE No.: A-25

www.geo-logic.ca

**TEST PIT No.:** TP-25
**ELEVATION:** 253.3 m

# TEST PIT REPORT

Page: 1 of 1

CLIENT: Towerhill Development
PROJECT: Proposed Fallis Line Residential Development
LOGGED BY: P. Hynes DATE: March 18, 2014
EXCAVATION COMPANY: Terry Dunford Excavating METHOD: Track mounted excavator
NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

**LEGEND**
GS - GRAB SAMPLE
▼ - WATER LEVEL

| Depth (ft / m) | m Below Existing Grade | Stratigraphy | DESCRIPTION OF SOIL AND BEDROCK | Type and Number | Moisture Content (%) | Shear test (Cu) △ Field / □ Lab; Sensitivity (S); ○ Water content (%); $w_p$ $w_l$ Atterberg limits (%) | COMMENTS |
|---|---|---|---|---|---|---|---|
| ft / m | 0.0 | | GROUND SURFACE | | % | 10 20 30 40 50 60 70 80 90 | |
| | | | **TOPSOIL** (250 mm) | | | | No seepage observed during the excavation of the test pit |
| | 0.3 | | **TILL** - Brown Silty Sand, with Gravel, trace Clay, occasional Cobbles and Boulders, moist, compact | | | | |
| 1.0 | | | | GS-1 | 26 | ○ | |
| 2.0 | 2.3 | | With Clay, very dense | | | | |
| 3.0 | | | | GS-2 | 12 | ○ | |
| 4.0 | | | | GS-3 | 8 | ○ | |
| | 4.6 | | END OF TEST PIT | | | | Test pit terminated at practical refusal (due to presence of very dense till) |
| 5.0 | | | | | | | |
| 6.0 | | | | | | | |
| 7.0 | | | | | | | |
| 8.0 | | | | | | | |
| 9.0 | | | | | | | |
| 10.0 | | | | | | | |

TEST PIT LOG GEOTECH G024822A1, 14-04-02, TESTHOLE LOGS.GPJ GEOLOGIC.GDT 4/2/14

REFERENCE No.: G024822A1 ENCLOSURE No.: A-26

www.geo-logic.ca

**TEST PIT No.:** TP-26
**ELEVATION:** 253.4 m

# TEST PIT REPORT

Page: 1 of 1

CLIENT: Towerhill Development
PROJECT: Proposed Fallis Line Residential Development
LOGGED BY: P. Hynes DATE: March 18, 2014
EXCAVATION COMPANY: Terry Dunford Excavating METHOD: Track mounted excavator
NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

**LEGEND**
GS - GRAB SAMPLE
▼ - WATER LEVEL

| Depth (ft) | Depth (m) | m Below Existing Grade | Stratigraphy | DESCRIPTION OF SOIL AND BEDROCK | Type and Number | Moisture Content (%) | COMMENTS |
|---|---|---|---|---|---|---|---|
| | | 0.0 | | GROUND SURFACE | | | |
| | | 0.3 | | **TOPSOIL** (300 mm) | | | No seepage observed during the excavation of the test pit |
| | | | | **TILL** - Brown Silty Sand, with Gravel, trace Clay, occasional Cobbles and Boulders, moist, compact | GS-1 | 8 | GS-1: 9% Gravel 40% Sand 51% Silt and Clay 30% between 5-75 µm |
| | | 3.7 | | With Clay | GS-2 | 10 | |
| | | 6.1 | | END OF TEST PIT | GS-3 | 12 | |

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
$w_p$ $w_l$ Atterberg limits (%)

10 20 30 40 50 60 70 80 90

TEST PIT LOG GEOTECH G024822A1, 14-04-02, TESTHOLE LOGS.GPJ GEOLOGIC.GDT 4/2/14

REFERENCE No.: G024822A1 ENCLOSURE No.: A-27

www.geo-logic.ca

**TEST PIT No.:** TP-27
**ELEVATION:** 249.2 m

# TEST PIT REPORT

Page: 1 of 1

CLIENT: Towerhill Development
PROJECT: Proposed Fallis Line Residential Development
LOGGED BY: P. Hynes DATE: March 18, 2014
EXCAVATION COMPANY: Terry Dunford Excavating METHOD: Track mounted excavator
NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

**LEGEND**
GS - GRAB SAMPLE
▼ - WATER LEVEL

| Depth (ft) | Depth (m) | m Below Existing Grade | Stratigraphy | DESCRIPTION OF SOIL AND BEDROCK | Type and Number | Moisture Content (%) | Shear test (Cu) / Sensitivity (S) / Water content (%) / Atterberg limits ($w_p$ $w_l$) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| | | 0.0 | | GROUND SURFACE | | | | |
| | | 0.3 | | **TOPSOIL** (300 mm) | | | | No seepage observed during the excavation of the test pit |
| | | | | **TILL** - Brown Silty Sand, with Gravel, trace Clay, occasional Cobbles and Boulders, moist, compact | | | | |
| | 1.0 | | | | GS-1 | 14 | ○ | |
| | 2.0 | | | | | | | |
| | 3.0 | | | | | | | |
| | | 3.7 | | With Clay | | | | |
| | 4.0 | | | | GS-2 | 8 | ○ | |
| | 5.0 | | | | | | | |
| | 6.0 | | | | GS-3 | 7 | ○ | |
| | | 6.1 | | END OF TEST PIT | | | | |
| | 7.0 | | | | | | | |
| | 8.0 | | | | | | | |
| | 9.0 | | | | | | | |
| | 10.0 | | | | | | | |

10 20 30 40 50 60 70 80 90

TEST PIT LOG GEOTECH G024822A1, 14-04-02, TESTHOLE LOGS.GPJ GEOLOGIC.GDT 4/2/14

REFERENCE No.: G024822A1 ENCLOSURE No.: A-28

www.geo-logic.ca

**TEST PIT No.:** TP-28
**ELEVATION:** 243.4 m

# TEST PIT REPORT

Page: 1 of 1

CLIENT: Towerhill Development
PROJECT: Proposed Fallis Line Residential Development
LOGGED BY: P. Hynes DATE: March 18, 2014
EXCAVATION COMPANY: Terry Dunford Excavating METHOD: Track mounted excavator
NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

**LEGEND**
GS - GRAB SAMPLE
▼ - WATER LEVEL

| Depth (ft / m) | m Below Existing Grade | Stratigraphy | DESCRIPTION OF SOIL AND BEDROCK | Type and Number | Moisture Content (%) | Shear test (Cu) / Sensitivity (S) / Water content (%) / Atterberg limits (%) (△ Field, □ Lab) | COMMENTS |
|---|---|---|---|---|---|---|---|
| ft / m | 0.0 | | GROUND SURFACE | | % | 10 20 30 40 50 60 70 80 90 | |
| | 0.3 | | **TOPSOIL** (300 mm) | | | | No seepage observed during the excavation of the test pit |
| 1 | | | **TILL** - Brown Silty Sand, with Gravel, trace Clay, occasional Cobbles and Boulders, moist, compact | | | | |
| 1.0 | | | | GS-1 | 14 | ○ | |
| 2.0 | | | | | | | |
| 3.0 | | | | | | | |
| | 3.7 | | With Clay | | | | |
| 4.0 | | | | GS-2 | 8 | ○ | |
| 5.0 | | | | | | | |
| 6.0 | | | | GS-3 | 8 | ○ | |
| | 6.1 | | END OF TEST PIT | | | | |
| 7.0 | | | | | | | |
| 8.0 | | | | | | | |
| 9.0 | | | | | | | |
| 10.0 | | | | | | | |

TEST PIT LOG GEOTECH G024822A1, 14-04-02, TESTHOLE LOGS.GPJ GEOLOGIC.GDT 4/2/14

REFERENCE No.: G024822A1 ENCLOSURE No.: A-29

www.geo-logic.ca

**TEST PIT No.:** TP-29
**ELEVATION:** 246.9 m

# TEST PIT REPORT

Page: 1 of 1

CLIENT: Towerhill Development
PROJECT: Proposed Fallis Line Residential Development
LOGGED BY: P. Hynes DATE: March 18, 2014
EXCAVATION COMPANY: Terry Dunford Excavating METHOD: Track mounted excavator
NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

**LEGEND**
GS - GRAB SAMPLE
▼ - WATER LEVEL

| Depth (ft / m) | m Below Existing Grade | Stratigraphy | DESCRIPTION OF SOIL AND BEDROCK | Type and Number | Moisture Content (%) | Shear test (Cu) / Sensitivity (S) / Water content (%) / Atterberg limits (%) (△ Field, □ Lab) | COMMENTS |
|---|---|---|---|---|---|---|---|
| ft / m | 0.0 | | GROUND SURFACE | | % | 10 20 30 40 50 60 70 80 90 | |
| | 0.3 | | **TOPSOIL** (250 mm) | | | | No seepage observed during the excavation of the test pit |
| 1 | | | **TILL** - Brown Silty Sand, with Gravel, trace Clay, occasional Cobbles and Boulders, moist, compact | | | | |
| 2 | | | | | | | |
| 3 | 1.0 | | | | | | |
| 4 | | | | GS-1 | 19 | ○ | |
| 5 | | | | | | | |
| 6 | | | | | | | |
| 7 | 2.0 | | | | | | |
| 8 | | | | | | | |
| 9 | 2.7 | | With Clay | GS-2 | 22 | ○ | |
| 10 | 3.0 | | | | | | |
| 11 | | | | | | | |
| 12 | | | | | | | |
| 13 | 4.0 | | | | | | |
| 14 | | | | GS-3 | 7 | ○ | |
| 15 | | | | | | | |
| 16 | | | | | | | |
| 17 | 5.0 | | | | | | |
| 18 | | | | | | | |
| 19 | | | | | | | |
| 20 | 6.0 | | | | | | |
| | 6.1 | | END OF TEST PIT | | | | |
| 21 | | | | | | | |
| 22 | | | | | | | |
| 23 | 7.0 | | | | | | |
| 24 | | | | | | | |
| 25 | | | | | | | |
| 26 | 8.0 | | | | | | |
| 27 | | | | | | | |
| 28 | | | | | | | |
| 29 | 9.0 | | | | | | |
| 30 | | | | | | | |
| 31 | | | | | | | |
| 32 | | | | | | | |
| 33 | 10.0 | | | | | | |
| 34 | | | | | | | |

REFERENCE No.: G024822A1 ENCLOSURE No.: A-30

www.geo-logic.ca

**TEST PIT No.:** TP-30
**ELEVATION:** 237.5 m

# TEST PIT REPORT

Page: 1 of 1

CLIENT: Towerhill Development
PROJECT: Proposed Fallis Line Residential Development
LOGGED BY: P. Hynes DATE: March 18, 2014
EXCAVATION COMPANY: Terry Dunford Excavating METHOD: Track mounted excavator
NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

**LEGEND**
GS - GRAB SAMPLE
▼ - WATER LEVEL

| Depth (ft / m) | m Below Existing Grade | Stratigraphy | DESCRIPTION OF SOIL AND BEDROCK | Type and Number | Moisture Content (%) | Shear test (Cu) △ Field □ Lab; Sensitivity (S); ○ Water content (%); $w_p$ $w_l$ Atterberg limits (%) | COMMENTS |
|---|---|---|---|---|---|---|---|
| ft / m | 0.0 | | GROUND SURFACE | | % | 10 20 30 40 50 60 70 80 90 | |
| | 0.4 | | **TOPSOIL** (350 mm) | | | | |
| | | | **TILL** - Brown to grey Clayey Silty Sand, with Gravel, occasional Cobbles, mottled, moist, compact | GS-1 | 10 | ○ | |
| | 1.5 | | Grey Sandy Silt, with Gravel, trace Clay, occasional Cobbles and Boulders, moist to wet, compact | | | | ▼ Slight seepage observed at 1.5 m |
| | | | | GS-2 | 8 | ○ | |
| | | | | GS-3 | 9 | ○ | |
| | | | | GS-4 | 10 | ○ | |
| | 6.1 | | END OF TEST PIT | | | | |

TEST PIT LOG GEOTECH G024822A1, 14-04-02, TESTHOLE LOGS.GPJ GEOLOGIC.GDT 4/2/14

REFERENCE No.: G024822A1 ENCLOSURE No.: A-31

www.geo-logic.ca

**TEST PIT No.:** TP-31
**ELEVATION:** 245.5 m

# TEST PIT REPORT

Page: 1 of 1

CLIENT: Towerhill Development
PROJECT: Proposed Fallis Line Residential Development
LOGGED BY: P. Hynes DATE: March 17, 2014
EXCAVATION COMPANY: Terry Dunford Excavating METHOD: Track mounted excavator
NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

**LEGEND**
GS - GRAB SAMPLE
▼ - WATER LEVEL

| Depth (ft / m) | m Below Existing Grade | Stratigraphy | DESCRIPTION OF SOIL AND BEDROCK | Type and Number | Moisture Content (%) | COMMENTS |
|---|---|---|---|---|---|---|
| 0 / 0.0 | 0.0 | | GROUND SURFACE | | | |
| | 0.3 | | **TOPSOIL** (325 mm) | | | |
| 1 / | | | **TILL** - Brown to grey Clayey Silty Sand, with Gravel, occasional Cobbles, mottled, moist, compact | | | |
| 1.0 | | | | GS-1 | 18 | |
| 2 / | 1.8 | | Brown to grey Silty Sand to Sandy Silt, with Clay, occasional gravel, moist, compact | | | |
| 2.0 | | | | GS-2 | 19 | |
| 3 / 3.0 | | | | | | |
| 4 / | 3.7 | | Grey Silty Clay, moist to wet, firm | | | |
| 4.0 | | | | GS-3 | 26 | |
| 5 / 5.0 | | | | | | |
| 6 / | 5.5 | | Occasional Cobbles and Boulders | | | ▼ Slight seepage observed at 5.8 m |
| 6.0 | 6.1 | | END OF TEST PIT | | | |
| 7 / 7.0 | | | | | | |
| 8 / 8.0 | | | | | | |
| 9 / 9.0 | | | | | | |
| 10 / 10.0 | | | | | | |

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
$w_p$ $w_l$ Atterberg limits (%)

10 20 30 40 50 60 70 80 90

TEST PIT LOG GEOTECH G024822A1, 14-04-02, TESTHOLE LOGS.GPJ GEOLOGIC.GDT 4/2/14

REFERENCE No.: G024822A1 ENCLOSURE No.: A-32

www.geo-logic.ca

**TEST PIT No.:** TP-32
**ELEVATION:** 246.4 m

# TEST PIT REPORT

Page: 1 of 1

CLIENT: Towerhill Development

PROJECT: Proposed Fallis Line Residential Development

LOGGED BY: P. Hynes DATE: March 17, 2014

EXCAVATION COMPANY: Terry Dunford Excavating METHOD: Track mounted excavator

NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

**LEGEND**

GS - GRAB SAMPLE

▼ - WATER LEVEL

| Depth (ft) | Depth (m) | m Below Existing Grade | Stratigraphy | DESCRIPTION OF SOIL AND BEDROCK | Type and Number | Moisture Content (%) | COMMENTS |
|---|---|---|---|---|---|---|---|
| | | 0.0 | | GROUND SURFACE | | | |
| | | 0.4 | | **TOPSOIL** (350 mm) | | | |
| | | | | **TILL** - Brown to grey Clayey Silty Sand, with Gravel, occasional Cobbles, mottled, moist, compact | GS-1 | 19 | WL - 0.3 m 3/25/2014 |
| | | | | | | | Seepage observed at 1.5 m |
| | | 3.7 | | Moist to wet, occasional Boulders | GS-2 | 16 | |
| | | 4.3 | | Brown Silty Sand, with Clay and Gravel, moist, very dense | GS-3 | 11 | |
| | | 6.1 | | END OF TEST PIT | | | |

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
$W_p$ $W_l$ Atterberg limits (%)

10 20 30 40 50 60 70 80 90

TEST PIT LOG GEOTECH G024822A1, 14-04-02, TESTHOLE LOGS.GPJ GEOLOGIC.GDT 4/2/14

REFERENCE No.: G024822A1 ENCLOSURE No.: A-33

www.geo-logic.ca

**TEST PIT No.:** TP-33
**ELEVATION:** 250.7 m

# TEST PIT REPORT

Page: 1 of 1

CLIENT: Towerhill Development

PROJECT: Proposed Fallis Line Residential Development

LOGGED BY: P. Hynes DATE: March 18, 2014

EXCAVATION COMPANY: Terry Dunford Excavating METHOD: Track mounted excavator

NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

**LEGEND**

GS - GRAB SAMPLE

▼ - WATER LEVEL

| Depth (ft) | Depth (m) | m Below Existing Grade | Stratigraphy | DESCRIPTION OF SOIL AND BEDROCK | Type and Number | Moisture Content (%) | COMMENTS |
|---|---|---|---|---|---|---|---|
| | | 0.0 | | GROUND SURFACE | | | |
| | | 0.4 | | **TOPSOIL** (375 mm) | | | No seepage observed during the excavation of the test pit |
| | | | | **TILL** - Brown Clayey Silty Sand, with Gravel, occasional Cobbles and Boulders, mottled, moist, compact | | | |
| | 1.0 | | | | GS-1 | 12 | |
| | 2.0 | | | | | | |
| | 3.0 | | | | GS-2 | 13 | |
| | 4.0 | | | | | | |
| | 5.0 | | | | GS-3 | 13 | |
| | 6.0 | 6.1 | | END OF TEST PIT | | | |
| | 7.0 | | | | | | |
| | 8.0 | | | | | | |
| | 9.0 | | | | | | |
| | 10.0 | | | | | | |

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
$w_p$ $w_l$ Atterberg limits (%)

10 20 30 40 50 60 70 80 90

TEST PIT LOG GEOTECH G024822A1, 14-04-02, TESTHOLE LOGS.GPJ GEOLOGIC.GDT 4/2/14

REFERENCE No.: G024822A1 ENCLOSURE No.: A-34

www.geo-logic.ca

**TEST PIT No.:** TP-34
**ELEVATION:** 246.1 m

# TEST PIT REPORT

Page: 1 of 1

CLIENT: Towerhill Development
PROJECT: Proposed Fallis Line Residential Development
LOGGED BY: P. Hynes DATE: March 17, 2014
EXCAVATION COMPANY: Terry Dunford Excavating METHOD: Track mounted excavator
NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

**LEGEND**
GS - GRAB SAMPLE
▼ - WATER LEVEL

| Depth (ft) | Depth (m) | m Below Existing Grade | Stratigraphy | DESCRIPTION OF SOIL AND BEDROCK | Type and Number | Moisture Content (%) | COMMENTS |
|---|---|---|---|---|---|---|---|
| | | 0.0 | | GROUND SURFACE | | | |
| | | 0.2 | | **TOPSOIL** (150 mm) | | | |
| 1–5 | 1.0 | | | **FILL** - Brown Sand and Gravel, moist | GS-1 | 11 | |
| 6 | | 1.8 | | **TOPSOIL** | | | |
| 7 | 2.0 | 2.0 | | **TILL** - Brown to grey Clayey Silty Sand, with Gravel, occasional Cobbles, mottled, moist, compact | | | |
| 8–10 | 3.0 | | | | GS-2 | 19 | ▼ Seepage observed at 3.0 m |
| 11–20 | 4.0–6.0 | | | | | | |
| | | 6.1 | | END OF TEST PIT | | | |
| 21–34 | 7.0–10.0 | | | | | | |

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
$w_p$ $w_l$ Atterberg limits (%)

10 20 30 40 50 60 70 80 90

TEST PIT LOG GEOTECH G024822A1, 14-04-02, TESTHOLE LOGS.GPJ GEOLOGIC.GDT 4/2/14

REFERENCE No.: G024822A1 ENCLOSURE No.: A-35

www.geo-logic.ca

**TEST PIT No.:** TP-35
**ELEVATION:** 244.6 m

# TEST PIT REPORT

Page: 1 of 1

CLIENT: Towerhill Development

PROJECT: Proposed Fallis Line Residential Development

LOGGED BY: P. Hynes DATE: March 17, 2014

EXCAVATION COMPANY: Terry Dunford Excavating METHOD: Track mounted excavator

NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

**LEGEND**

GS - GRAB SAMPLE

▼ - WATER LEVEL

| Depth (ft) | Depth (m) | m Below Existing Grade | Stratigraphy | DESCRIPTION OF SOIL AND BEDROCK | Type and Number | Moisture Content (%) | Shear test (Cu) / Sensitivity (S) / Water content (%) / Atterberg limits (%) | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| | | 0.0 | | GROUND SURFACE | | | 10 20 30 40 50 60 70 80 90 | |
| | | 0.2 | | **TOPSOIL** (150 mm) | | | | No seepage observed during the excavation of the test pit |
| | | | | **TILL** - Brown to grey Clayey Silty Sand, with Gravel, occasional Cobbles, mottled, moist, compact | | | | |
| | 1.0 | | | | GS-1 | 18 | ○ | |
| | 2.0 | | | | | | | |
| | 3.0 | 3.0 | | Brown to grey Silty Sand to Sandy Silt, with Clay, occasional gravel, moist, compact | | | | |
| | 4.0 | | | | GS-2 | 19 | ○ | |
| | 5.0 | | | | | | | |
| | 6.0 | 6.1 | | END OF TEST PIT | | | | |
| | 7.0 | | | | | | | |
| | 8.0 | | | | | | | |
| | 9.0 | | | | | | | |
| | 10.0 | | | | | | | |

TEST PIT LOG GEOTECH G024822A1, 14-04-02, TESTHOLE LOGS.GPJ GEOLOGIC.GDT 4/2/14

REFERENCE No.: G024822A1 ENCLOSURE No.: A-36

www.geo-logic.ca

**TEST PIT No.:** TP-36
**ELEVATION:** 245.0 m

# TEST PIT REPORT

Page: 1 of 1

CLIENT: Towerhill Development
PROJECT: Proposed Fallis Line Residential Development
LOGGED BY: P. Hynes DATE: March 17, 2014
EXCAVATION COMPANY: Terry Dunford Excavating METHOD: Track mounted excavator
NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

**LEGEND**
GS - GRAB SAMPLE
▼ - WATER LEVEL

| Depth (ft / m) | m Below Existing Grade | Stratigraphy | DESCRIPTION OF SOIL AND BEDROCK | Type and Number | Moisture Content (%) | Shear test (Cu) / Sensitivity (S) / Water content (%) / Atterberg limits (%) (△ Field, □ Lab) | COMMENTS |
|---|---|---|---|---|---|---|---|
| 0.0 | 0.0 | | GROUND SURFACE | | | | |
| | 0.4 | | **TOPSOIL** (375 mm) | | | | No seepage observed during the excavation of the test pit |
| | | | **TILL** - Brown to grey Clayey Silty Sand, with Gravel, occasional Cobbles, mottled, moist, compact | GS-1 | 10 | ○ | |
| | | | | GS-2 | 10 | ○ | |
| | 6.1 | | END OF TEST PIT | | | | |

TEST PIT LOG GEOTECH G024822A1, 14-04-02, TESTHOLE LOGS.GPJ GEOLOGIC.GDT 4/2/14

REFERENCE No.: G024822A1 ENCLOSURE No.: A-37

www.geo-logic.ca

**TEST PIT No.:** TP-37
**ELEVATION:** 244.7 m

# TEST PIT REPORT

Page: 1 of 1

CLIENT: Towerhill Development

PROJECT: Proposed Fallis Line Residential Development

LOGGED BY: P. Hynes DATE: March 17, 2014

EXCAVATION COMPANY: Terry Dunford Excavating METHOD: Track mounted excavator

NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

**LEGEND**

GS - GRAB SAMPLE

▼ - WATER LEVEL

| Depth (ft) | Depth (m) | m Below Existing Grade | Stratigraphy | DESCRIPTION OF SOIL AND BEDROCK | Type and Number | Moisture Content (%) | COMMENTS |
|---|---|---|---|---|---|---|---|
| | | 0.0 | | GROUND SURFACE | | | |
| | | 0.2 | | **TOPSOIL** (150 mm) | | | |
| | | | | **TILL** - Brown to grey Clayey Silty Sand, with Gravel, occasional Cobbles, mottled, moist, compact | | | |
| | 1.0 | | | | GS-1 | 23 | WL - 0.7 m 3/25/2014 |
| | 2.0 | | | | | | |
| | 3.0 | 3.0 | | | GS-2 | 24 | |
| | | | | Brown to grey Silty Sand to Sandy Silt, with Clay, occasional gravel, moist, compact | | | Seepage observed at 3.0 m |
| | 4.0 | | | | | | |
| | | 4.6 | | Grey Silty Clay, moist to wet, firm | | | |
| | 5.0 | | | | | | |
| | 6.0 | 6.1 | | END OF TEST PIT | | | |
| | 7.0 | | | | | | |
| | 8.0 | | | | | | |
| | 9.0 | | | | | | |
| | 10.0 | | | | | | |

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
$w_p$ $w_l$ Atterberg limits (%)

10 20 30 40 50 60 70 80 90

TEST PIT LOG GEOTECH G024822A1, 14-04-02, TESTHOLE LOGS.GPJ GEOLOGIC.GDT 4/2/14

REFERENCE No.: G024822A1 ENCLOSURE No.: A-38

www.geo-logic.ca

**TEST PIT No.:** TP-38
**ELEVATION:** 250.6 m

# TEST PIT REPORT

Page: 1 of 1

CLIENT: Towerhill Development
PROJECT: Proposed Fallis Line Residential Development
LOGGED BY: P. Hynes DATE: March 17, 2014
EXCAVATION COMPANY: Terry Dunford Excavating METHOD: Track mounted excavator
NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

**LEGEND**
GS - GRAB SAMPLE
▼ - WATER LEVEL

| Depth (ft / m) | m Below Existing Grade | Stratigraphy | DESCRIPTION OF SOIL AND BEDROCK | Type and Number | Moisture Content (%) | Shear test (Cu) / Sensitivity (S) / Water content (%) / Atterberg limits (%) (△ Field, □ Lab) | COMMENTS |
|---|---|---|---|---|---|---|---|
| ft / m | 0.0 | | GROUND SURFACE | | % | 10 20 30 40 50 60 70 80 90 | |
| 1 | 0.3 | | **TOPSOIL** (300 mm) | | | | |
| 1 / 1.0 | | | **TILL** - Brown to grey Clayey Silty Sand, with Gravel, occasional Cobbles, mottled, moist, compact | | | | |
| 2 / 2.0 | 2.1 | | Occasional Boulders, moist to wet | | | | ▼ Seepage observed at 2.1 m |
| 3 / 3.0 | | | | GS-1 | 14 | ○ | |
| 4 / 4.0 | | | | | | | |
| 5 / 5.0 | 4.6 | | Brown Silty Sand, with Clay and Gravel, moist, very dense | GS-2 | 11 | ○ | |
| 6 / 6.0 | 6.1 | | END OF TEST PIT | | | | |
| 7 / 7.0 | | | | | | | |
| 8 / 8.0 | | | | | | | |
| 9 / 9.0 | | | | | | | |
| 10 / 10.0 | | | | | | | |

TEST PIT LOG GEOTECH G024822A1, 14-04-02, TESTHOLE LOGS.GPJ GEOLOGIC.GDT 4/2/14

REFERENCE No.: G024822A1 ENCLOSURE No.: A-39

www.geo-logic.ca

**TEST PIT No.:** TP-39
**ELEVATION:** 246.8 m

# TEST PIT REPORT

Page: 1 of 1

CLIENT: Towerhill Development
PROJECT: Proposed Fallis Line Residential Development
LOGGED BY: P. Hynes DATE: March 17, 2014
EXCAVATION COMPANY: Terry Dunford Excavating METHOD: Track mounted excavator
NOTES: Elevations interpolated from Valdor Engineering's drawing "Preliminary Sewer Alignment", provided on February 27, 2014

**LEGEND**
GS - GRAB SAMPLE
▼ - WATER LEVEL

| Depth (ft / m) | m Below Existing Grade | Stratigraphy | DESCRIPTION OF SOIL AND BEDROCK | Type and Number | Moisture Content (%) | COMMENTS |
|---|---|---|---|---|---|---|
| 0 / 0.0 | 0.0 | | GROUND SURFACE | | | |
| | 0.3 | | **TOPSOIL** (275 mm) | | | |
| | | | **TILL** - Brown to grey Clayey Silty Sand, with Gravel, occasional Cobbles, mottled, moist, compact | GS-1 | 21 | ▼ Seepage observed at 1.5 m |
| | 2.7 | | Occasional Boulders, moist to wet | GS-2 | 12 | |
| | 4.6 | | Grey Silty Clay to Clayey Silt, moist to wet, stiff | GS-3 | 28 | |
| | 6.1 | | END OF TEST PIT | | | |

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
$w_p$ $w_l$ Atterberg limits (%)

10 20 30 40 50 60 70 80 90

TEST PIT LOG GEOTECH G024822A1, 14-04-02, TESTHOLE LOGS.GPJ GEOLOGIC.GDT 4/2/14

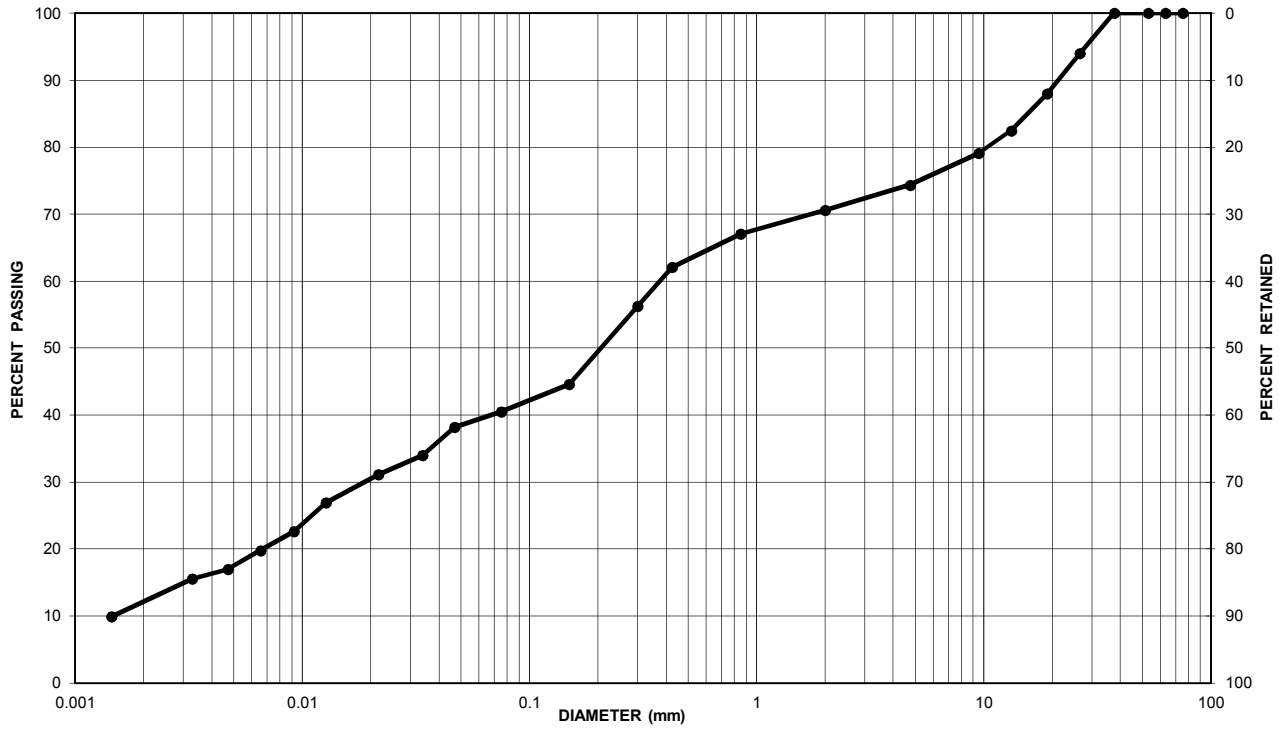
# APPENDIX B

# LABORATORY DATA

Member of the INSPEC-SOL Group

# PARTICLE-SIZE ANALYSIS OF SOILS (GEOTECHNICAL) (USCS) (ASTM D422)

| | | | |
|---|---|---|---|
| **CLIENT:** | Towerhill Developments | **LAB No.:** | SS-14-24 |
| **PROJECT/ SITE:** | Proposed Fallis Line Residential Development | **PROJECT No.:** | G024822A1 |
| Borehole No.: | BH-5 | Sample No.: | SS-8 |
| Depth: | 9.1-9.8 mbeg | Enclosure: | B-1 |




| CLAY & SILT | SAND | | | GRAVEL | |
|---|---|---|---|---|---|
| | FINE | MEDIUM | COARSE | FINE | COARSE |
| UNIFIED SOIL CLASSIFICATION SYSTEM | | | | | |

| Soil Description | Gravel | Sand | Clay & Silt |
|---|---|---|---|
| BH-5, SS-8 | 26 | 34 | 40 |

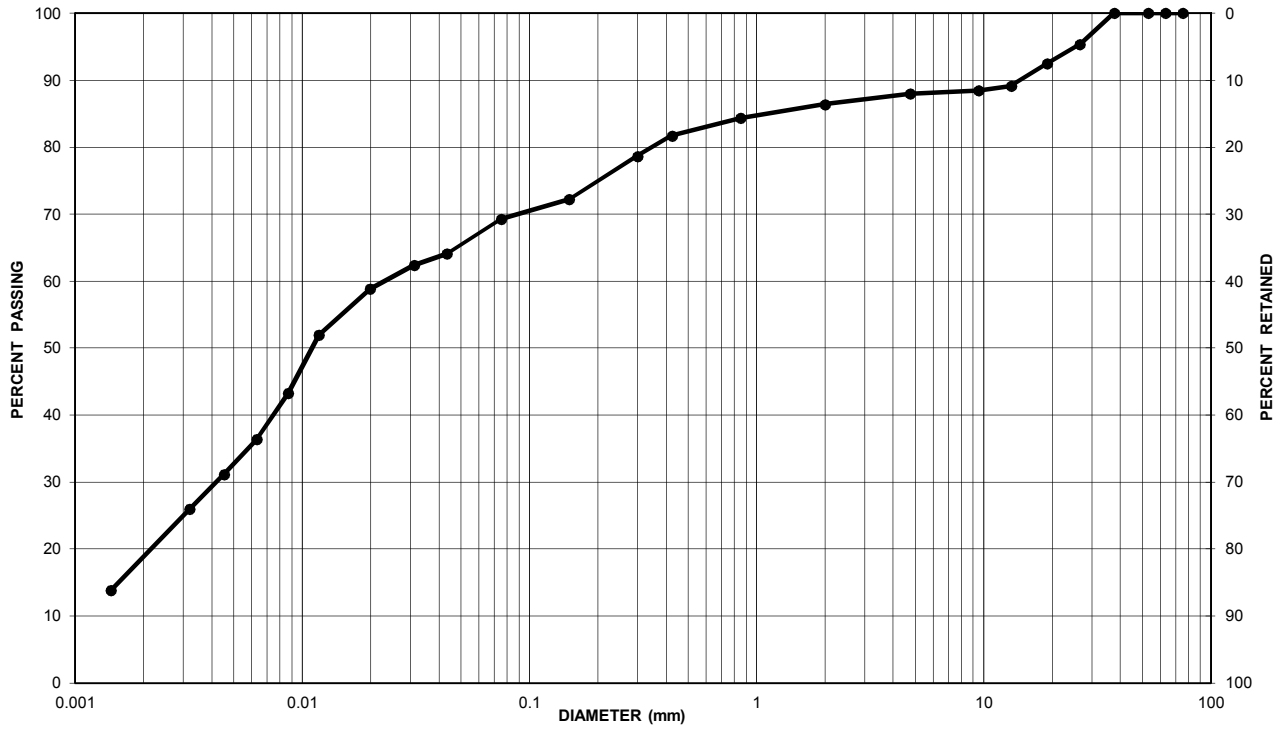
**REMARKS:**

| | | | |
|---|---|---|---|
| **PERFORMED BY:** | | **DATE:** | March 26, 2014 |
| **VERIFIED BY:** | | **DATE:** | March 26, 2014 |

Member of the INSPEC-SOL Group

# PARTICLE-SIZE ANALYSIS OF SOILS (GEOTECHNICAL) (USCS) (ASTM D422)

| | | | |
|---|---|---|---|
| **CLIENT:** | Towerhill Developments | **LAB No.:** | SS-14-24 |
| **PROJECT/ SITE:** | Proposed Fallis Line Residential Development | **PROJECT No.:** | G024822A1 |
| Borehole No.: | BH-6 | Sample No.: | SS-4 |
| Depth: | 3.0-3.5 mbeg | Enclosure: | B-2 |




| CLAY & SILT | SAND | | | GRAVEL | |
|---|---|---|---|---|---|
| | FINE | MEDIUM | COARSE | FINE | COARSE |
| UNIFIED SOIL CLASSIFICATION SYSTEM | | | | | |

| Soil Description | Gravel | Sand | Clay & Silt |
|---|---|---|---|
| BH-6, SS-4 | 12 | 19 | 69 |

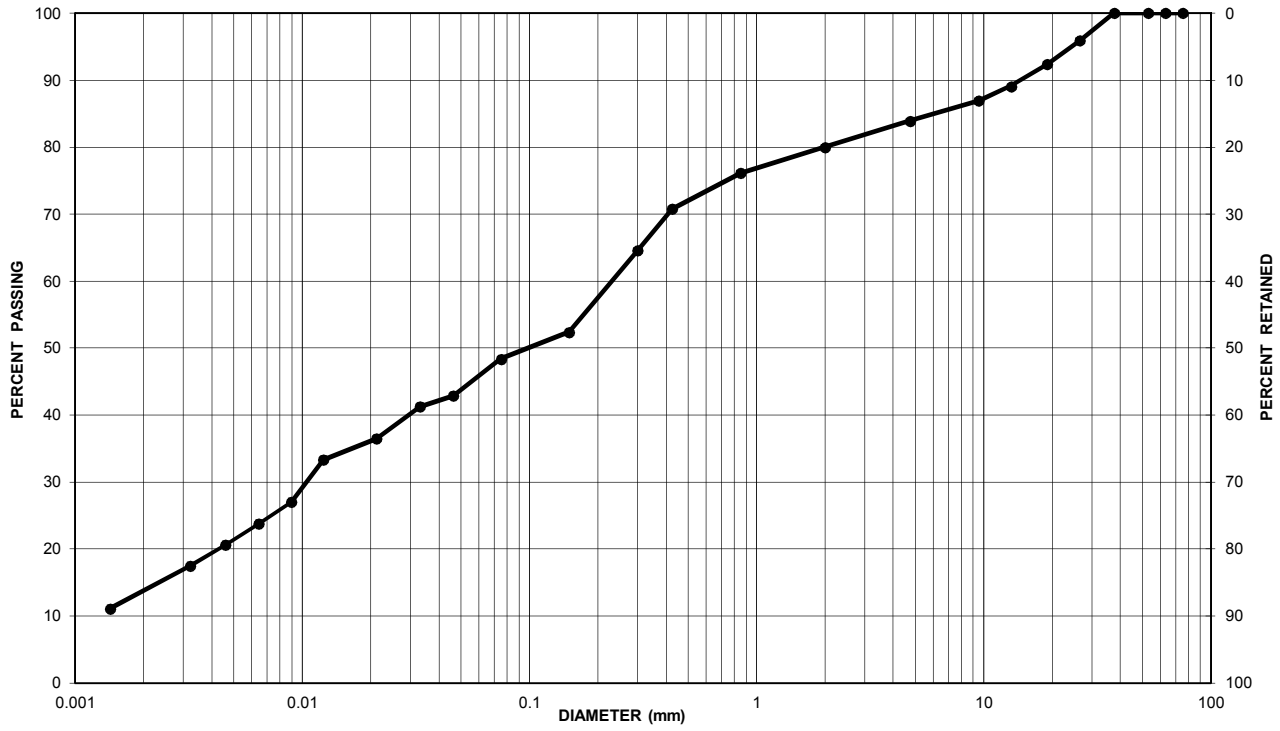
**REMARKS:**

| | | | |
|---|---|---|---|
| **PERFORMED BY:** | | **DATE:** | March 26, 2014 |
| **VERIFIED BY:** | | **DATE:** | March 26, 2014 |

Member of the INSPEC-SOL Group

# PARTICLE-SIZE ANALYSIS OF SOILS (GEOTECHNICAL) (USCS) (ASTM D422)

| | | | |
|---|---|---|---|
| **CLIENT:** | Towerhill Developments | **LAB No.:** | SS-14-24 |
| **PROJECT/ SITE:** | Proposed Fallis Line Residential Development | **PROJECT No.:** | G024822A1 |
| Borehole No.: | BH-9 | Sample No.: | SS-4 |
| Depth: | 3.0-3.5 mbeg | Enclosure: | B-3 |




| CLAY & SILT | SAND | | | GRAVEL | |
|---|---|---|---|---|---|
| | FINE | MEDIUM | COARSE | FINE | COARSE |
| UNIFIED SOIL CLASSIFICATION SYSTEM | | | | | |

| Soil Description | Gravel | Sand | Clay & Silt |
|---|---|---|---|
| BH-9, SS-4 | 16 | 36 | 48 |

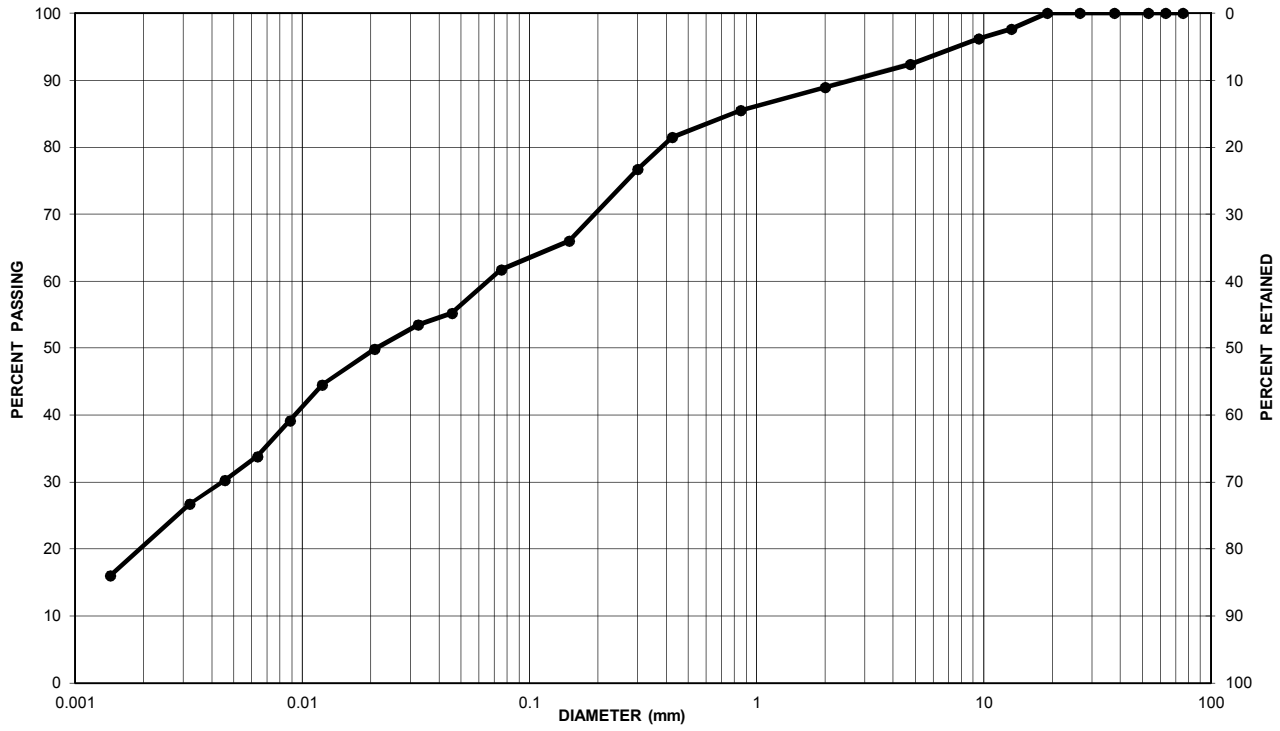
**REMARKS:**

| | | | |
|---|---|---|---|
| **PERFORMED BY:** | | **DATE:** | March 26, 2014 |
| **VERIFIED BY:** | | **DATE:** | March 26, 2014 |

Member of the INSPEC-SOL Group

# PARTICLE-SIZE ANALYSIS OF SOILS (GEOTECHNICAL) (USCS) (ASTM D422)

| | | | |
|---|---|---|---|
| **CLIENT:** | Towerhill Developments | **LAB No.:** | SS-14-24 |
| **PROJECT/ SITE:** | Proposed Fallis Line Residential Development | **PROJECT No.:** | G024822A1 |
| Borehole No.: | TP-16 | Sample No.: | GS-2 |
| Depth: | 2.7-3.0 mbeg | Enclosure: | B-4 |




| CLAY & SILT | SAND | | | GRAVEL | |
|---|---|---|---|---|---|
| | FINE | MEDIUM | COARSE | FINE | COARSE |
| UNIFIED SOIL CLASSIFICATION SYSTEM | | | | | |

| Soil Description | Gravel | Sand | Clay & Silt |
|---|---|---|---|
| TP-16, GS-2 | 8 | 31 | 61 |

**REMARKS:**

| | | | |
|---|---|---|---|
| **PERFORMED BY:** | | **DATE:** | March 2014 |
| **VERIFIED BY:** | | **DATE:** | March 2014 |

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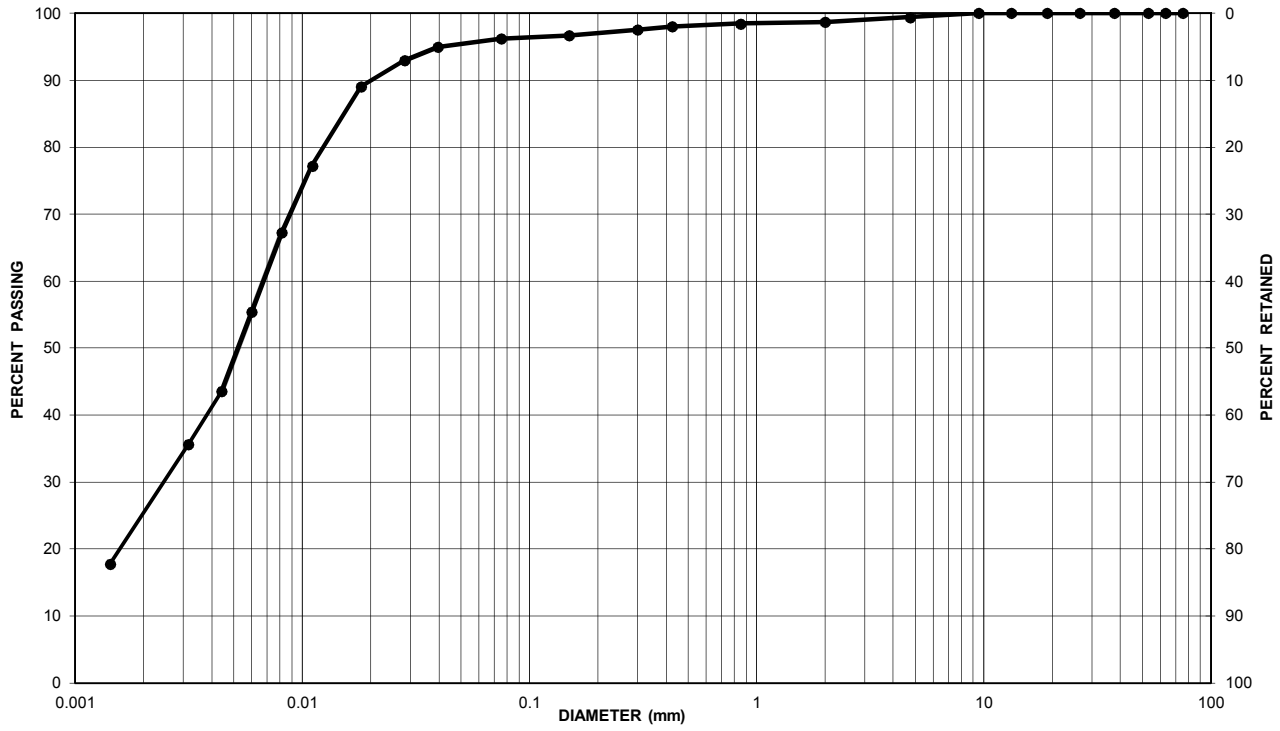
# PARTICLE-SIZE ANALYSIS OF SOILS (GEOTECHNICAL) (USCS) (ASTM D422)

| | | | |
|---|---|---|---|
| **CLIENT:** | Towerhill Developments | **LAB No.:** | SS-14-24 |
| **PROJECT/ SITE:** | Proposed Fallis Line Residential Development | **PROJECT No.:** | G024822A1 |
| Borehole No.: | TP-17 | Sample No.: | GS-2 |
| Depth: | 2.7-3.0 mbeg | Enclosure: | B-5 |




| CLAY & SILT | SAND | | | GRAVEL | |
|---|---|---|---|---|---|
| | FINE | MEDIUM | COARSE | FINE | COARSE |
| UNIFIED SOIL CLASSIFICATION SYSTEM | | | | | |

| Soil Description | Gravel | Sand | Clay & Silt |
|---|---|---|---|
| TP-17, GS-2 | 1 | 3 | 96 |

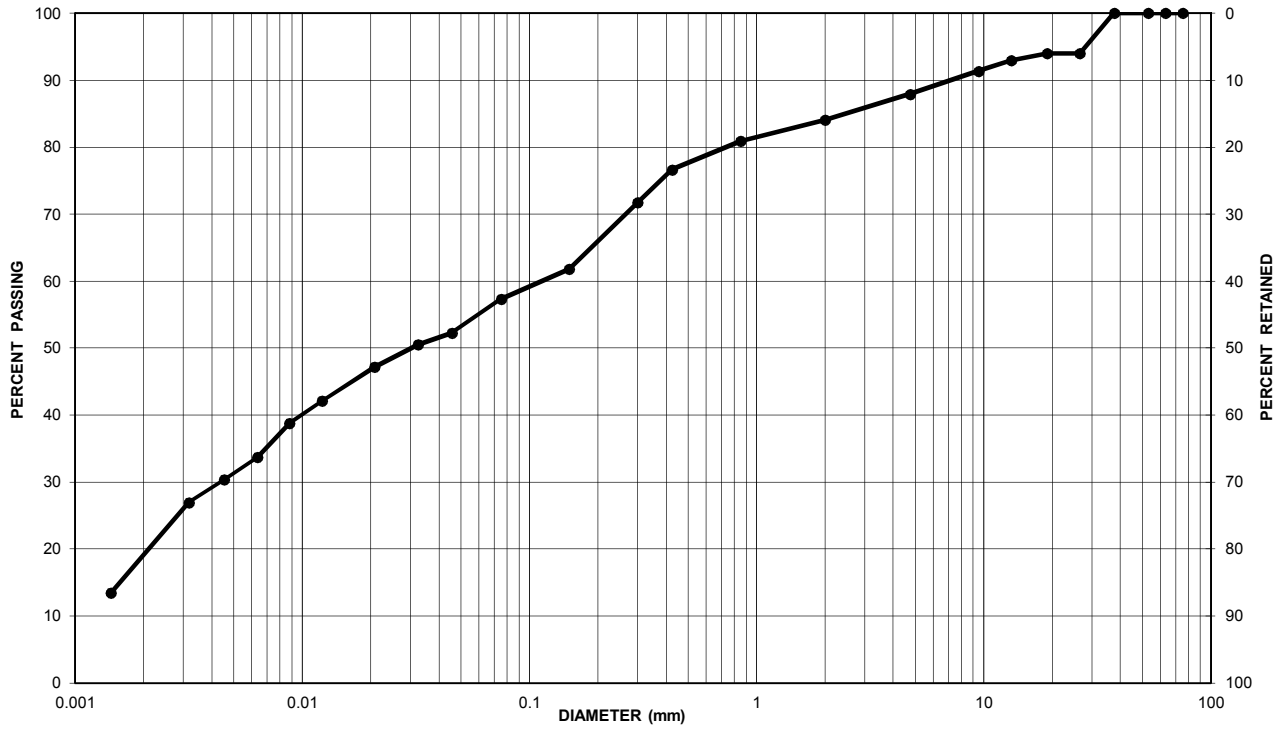
**REMARKS:**

| | | | |
|---|---|---|---|
| **PERFORMED BY:** | | **DATE:** | March 2014 |
| **VERIFIED BY:** | | **DATE:** | March 2014 |

Member of the INSPEC-SOL Group

# PARTICLE-SIZE ANALYSIS OF SOILS (GEOTECHNICAL) (USCS) (ASTM D422)

| | | | |
|---|---|---|---|
| **CLIENT:** | Towerhill Developments | **LAB No.:** | SS-14-24 |
| **PROJECT/ SITE:** | Proposed Fallis Line Residential Development | **PROJECT No.:** | G024822A1 |
| Borehole No.: | TP-21 | Sample No.: | GS-1 |
| Depth: | 1.2-1.5 mbeg | Enclosure: | B-6 |




| CLAY & SILT | SAND | | | GRAVEL | |
|---|---|---|---|---|---|
| | FINE | MEDIUM | COARSE | FINE | COARSE |
| UNIFIED SOIL CLASSIFICATION SYSTEM | | | | | |

| Soil Description | Gravel | Sand | Clay & Silt |
|---|---|---|---|
| TP-21, GS-1 | 12 | 31 | 57 |

**REMARKS:**

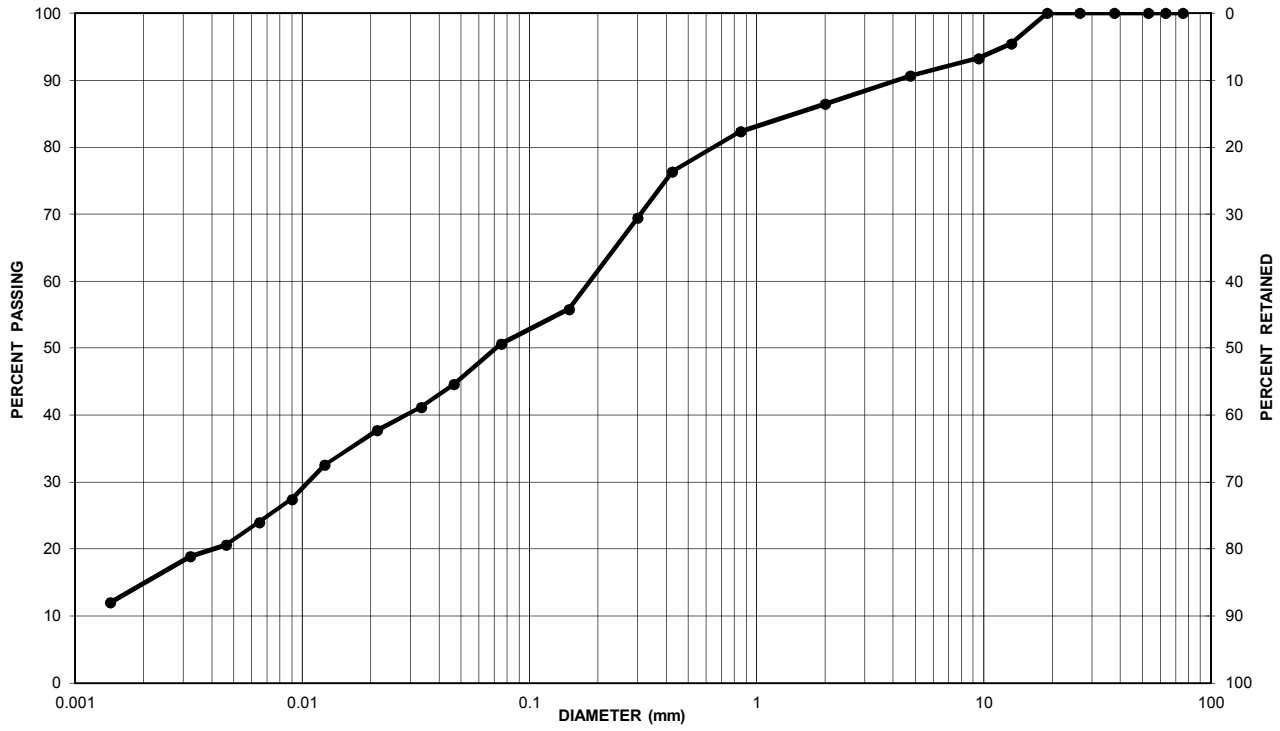
| | | | |
|---|---|---|---|
| **PERFORMED BY:** | | **DATE:** | March 26, 2014 |
| **VERIFIED BY:** | | **DATE:** | March 26, 2014 |

GEO-LOGIC INC.
Member of the INSPEC-SOL Group

# PARTICLE-SIZE ANALYSIS OF SOILS (GEOTECHNICAL) (USCS) (ASTM D422)

| | | | |
|---|---|---|---|
| **CLIENT:** | Towerhill Developments | **LAB No.:** | SS-14-24 |
| **PROJECT/ SITE:** | Proposed Fallis Line Residential Development | **PROJECT No.:** | G024822A1 |

| | | | |
|---|---|---|---|
| Borehole No.: | TP-26 | Sample No.: | GS-1 |
| Depth: | 1.2-1.5 mbeg | Enclosure: | B-7 |




| CLAY & SILT | SAND | | | GRAVEL | |
|---|---|---|---|---|---|
| | FINE | MEDIUM | COARSE | FINE | COARSE |
| UNIFIED SOIL CLASSIFICATION SYSTEM | | | | | |

| Soil Description | Gravel | Sand | Clay & Silt |
|---|---|---|---|
| TP-26, GS-1 | 9 | 40 | 51 |

**REMARKS:**

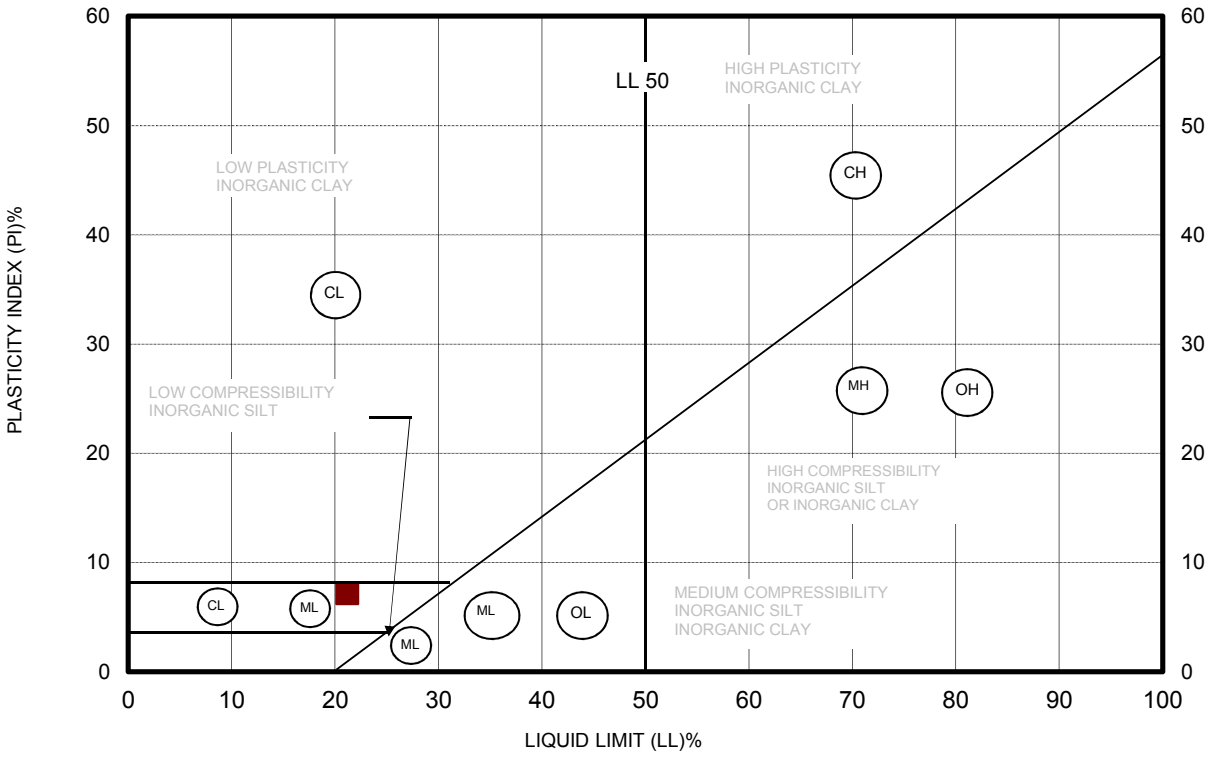
| | | | |
|---|---|---|---|
| **PERFORMED BY:** | | **DATE:** | March 26, 2014 |
| **VERIFIED BY:** | | **DATE:** | March 26, 2014 |

GEO-LOGIC INC. 347 Pido Road Unit 29, Peterborough, ON, K9J 6Y3 Tel: (705) 749-3317 Fax: (705) 749-9248

# PLASTICITY CHART

| | | | |
|---|---|---|---|
| Project Name: | *Proposed Fallis Line Residential Development* | Ref No.: | *G024822A1/SS-14-24* |
| Client: | *Towerhill Developments* | Depth: | *3.0-3.5 mbeg* |
| Borehole No.: | *BH-6* | Sample No.: | *SS-4* |

| Low | High |
|---|---|




| Symbol | Borehole | Sample | Depth | Sample Results | Value |
|---|---|---|---|---|---|
| ■ | BH-6 | SS-4 | 3.0-3.5 mbeg | Plasticity Index (%) | 7.2 |
| | | | | Liquid Limit (%) | 21.2 |

| Enclosure No. | B-8 |
|---|---|