



# ***Soil Engineers Ltd.***

CONSULTING ENGINEERS

GEOTECHNICAL • ENVIRONMENTAL • HYDROGEOLOGICAL • BUILDING SCIENCE

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**A REPORT TO  
CROSSTRAIL ESTATES INC. AND TWKD DEVELOPEMTNS INC.  
C/O CRYSTAL HOMES**

**A GEOTECHNICAL INVESTIGATION FOR  
PROPOSED RESIDENTIAL DEVELOPMENT**

**40, 64 AND 84 BURNHAMTHORPE ROAD EAST**

**TOWN OF OAKVILLE**

**REFERENCE NO. 2304-S100**

**MAY 2023**

**DISTRIBUTIONS**

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## 1.0 **INTRODUCTION**

In accordance with Purchase Order dated April 17, 2023, from Crystal Homes on behalf of Crosstrail Estates Inc. and TWKD Developments Inc., Soil Engineers Ltd. was retained to prepare a comprehensive geotechnical report using borehole data from the Preliminary Geotechnical Investigation Report prepared by Golder Associates Ltd. (Golder) at 40, 64 and 84 Burnhamthorpe Road East in the Town of Oakville, dated August 9, 2018.

This report provides a factual summary of the subsurface conditions and determine the engineering properties of the disclosed soils for the design and construction of proposed residential development. The geotechnical findings and resulting recommendations are presented in this Report.

Soil Engineers Ltd. confirms that this Geotechnical Report has been completed in compliance with Ontario Building Code 2012 Subsection 4.2.4.

## 2.0 **SITE AND PROJECT DESCRIPTION**

The site is situated on Halton till plain where the stratigraphy consists of silty clay till overlying a shale bedrock of Queenston Formation which occurs at a shallow depth.

The subject site, approximately 14.13 hectares in area, is located to the southeast of Burnhamthorpe Road East and Sixth Line in the Town of Oakville. At the time of Golder's investigation, majority of the site was vacant with multiple residential dwellings. A soil stockpile was identified in the central portion of the site. It is also understood that evidence of fill importation was observed by Golder's staff during the investigation. According to the existing topographic information from the Site Grading Plan, prepared by Urbantech Consulting (Urbantech), the existing site gradient is undulating, but with a general descend towards the south and east.

Based on Urbantech's drawing set (Town File No. 24T-21001/1315) dated December 24, 2022, it is understood that subject site will be constructed with low-rise residential dwellings, serviced with municipal sewers and roadways. A stormwater management (SWM) pond is proposed at Block 13.

## 3.0 **GOLDER'S PRELIMINARY GEOTECHNICAL INVESTIGATION**

A total of twelve (12) boreholes, along with four (4) monitoring wells installed at selected borehole locations, were completed on June 20 and 21, 2018. The borehole and monitoring well locations are illustrated in Drawing No.1, enclosed.



The borehole investigation has revealed that beneath a topsoil veneer or a layer of earth fill in two of the boreholes, the site is generally underlain by a glacial till deposit with a layer of silty sand beneath the till in one of the boreholes.

Detailed descriptions of the encountered subsurface conditions from the boreholes are presented on the Record of Boreholes sheets, attached in Appendix 'A' of this report. The engineering properties of the disclosed soils are discussed herein.

### 3.1 **Topsoil**

A topsoil veneer, approximately 150 to 690 mm in thickness, was encountered at the ground surface in majority of the boreholes, except BH18-02 and BH18-08. Thicker topsoil layer may be encountered beyond the borehole locations, especially in the low-lying areas and treed areas.

### 3.2 **Earth Fill**

A layer of earth fill was contacted at the ground surface of BH18-02 and BH18-08. The fill generally consists of silty clay with trace amounts of sand, gravel, asphalt and shale fragments. The fill generally extended to a depth of 1.5 m below grade. The recorded SPT-N values were 8, 18 and 20 blows per 30 cm of penetration.

### 3.3 **Glacial Till**

Native glacial till deposit, denoted as silty clay till in the borehole logs, predominated the soil stratigraphy within the investigated depths of the boreholes. The recorded SPT-N values range from 7 to 88 blows per 30 cm of penetration, showing the till is firm to hard in consistency. The relatively lower SPT-N values in the sample near the ground surface may indicate the disturbance by farming activities and/or weathering process.

Laboratory test, such as sieve analysis and Atterberg Limits testing, were carried out by Golder and the results are included in Appendix B of this report.

### 3.4 **Silty Sand**

A localized layer of silty sand was contacted beneath the glacial till in BH18-06 was terminated within the silty sand deposit. The recorded SPT-N value of 50 blows per 10 cm of penetration indicated that the silty sand is very dense in relative density.



### 3.5 **Groundwater Condition**

Upon completion of the drilling program, all boreholes remained dry and open. Groundwater monitoring was completed on July 19 and 24, 2018. The data are summarized in Table 1.

**Table 1 - Water Levels**

| Borehole No. | Recorded Water Level in Monitoring Wells |               |               |               |
|--------------|------------------------------------------|---------------|---------------|---------------|
|              | July 19, 2018                            |               | July 24, 2018 |               |
|              | Depth (m)                                | Elevation (m) | Depth (m)     | Elevation (m) |
| 18-01        | 3.0                                      | 179.7         | -             | -             |
| 18-07        | 4.3                                      | 181.2         | -             | -             |
| 18-08        | -                                        | -             | 3.6           | 184.0         |
| 18-09        | -                                        | -             | 4.9           | 184.3         |

Based on the groundwater records, continuous groundwater is not anticipated within the depth of investigation. The recorded water level may represent the perched groundwater condition within the sand seams within the glacial till stratum, which can be subject to seasonal fluctuation.

### 4.0 **DISCUSSION AND RECOMMENDATIONS**

The boreholes revealed that beneath a topsoil veneer or a layer of earth fill in two of the boreholes, the site is generally underlain by a firm to hard glacial till deposit with a layer of very dense silty sand beneath the till in one of the boreholes.

Upon completion of the drilling program, all boreholes remained dry and open. On July 19 and 24, 2018, groundwater level was recorded in the monitoring wells at the depths ranging from 3.0 to 4.9 m below grade, or between El. 179.7 m and El.184.3 m.

It is understood that subject site will be constructed with low-rise residential dwellings, serviced with municipal sewers and roadways. A SWM pond is also proposed at Block 13. The geotechnical findings which warrant special consideration are presented below:

1. The topsoil must be stripped for the development. It can be reused in landscaped areas of the subdivision. Any surplus should be disposed of off-site.
2. Existing earth fill and badly weathered soils are not suitable for supporting any structure sensitive to movement. They should be subexcavated, sorted free of organics,



- deleterious, and contaminated material, before reuse as structural backfill. Otherwise, they should be wasted.
3. Based on the grading plans, additional fill will be required for site grading. The earth fill can be constructed in an engineered manner for foundations, underground services and pavement construction.
  4. The structures can be constructed on conventional footings founded on the undisturbed native soil or on engineered fill. The footing subgrade must be inspected by either a geotechnical engineer, or a geotechnical technician under the supervision of a geotechnical engineer, to ensure that its condition is compatible with the design of the foundation.
  5. In conventional design, the basement structures should be damp-proofed and provided with a subdrain system on the perimeter walls. The subdrains should be shielded by a fabric filter and discharge into a positive outlet.
  6. A Class 'B' bedding, consisting of 19-mm Crusher-Run Limestone (CRL), or equivalent, is suitable for underground service construction.

The recommendations appropriate for the project are presented herein. One must be aware that the subsurface conditions may vary between boreholes. Should this become apparent during construction, a geotechnical engineer must be consulted to determine whether the following recommendations require revision.

#### 4.1 **Site Preparation**

Prior to site grading, the vegetation and topsoil must be removed. The topsoil can be stockpiled on site for reuse in landscaped areas. Any surplus must be removed off-site.

Based on the site grading plans, it is understood that additional fill is required. The earth fill should be constructed in an engineered manner for house foundations, municipal services, slab-on-grade, and pavement construction. The engineering requirements for a certifiable fill are presented below:

1. Once the topsoil is stripped, the badly weathered soils and existing earth fill should be subexcavated, sorted free of topsoil inclusions and deleterious materials, if any, aerated and properly compacted in layers. The exposed subgrade must be inspected and proof-rolled prior to any fill placement. Any identified weak subgrade must be further subexcavated to competent ground and properly backfill and compacted to engineered fill specifications.
2. Inorganic soils must be used for engineered fill construction, and they must be uniformly compacted in 20 cm thick lifts to at least 98% of their maximum Standard Proctor dry density (SPDD) up to the proposed finished grade. The soil moisture must



be properly controlled near the optimum. If the foundations are to be built soon after the fill placement, the densification process for the engineered fill must be increased to 100% SPDD.

3. If imported fill is to be used, it should be inorganic soils, free of deleterious or any material with environmental issue (contamination). Any potential imported earth fill from off site must be reviewed for geotechnical and environmental quality by the appropriate personnel as authorized by the developer or agency, before it is hauled to the site.
4. The engineered fill must not be placed during the period when freezing ambient temperatures occur either persistently or intermittently. This is to ensure that the fill is free of frozen soils, ice and snow. If the engineered fill is to be left over the winter months, adequate earth cover, or equivalent, must be provided for protection against frost action.
5. The sides of the engineered fill must be maintained at a gradient equal to or flatter than 1V:3H, so that it is suitable for safe operation of the compactor for proper compaction.
6. The fill operation must be inspected on a full-time basis by a technician under the direction of a geotechnical engineer.
7. The engineered fill must extend over the entire graded area; the engineered fill envelope and finished elevations must be clearly and accurately defined in the field, and they must be precisely documented by qualified surveyors.
8. The foundations and underground services subgrade must be inspected by the geotechnical consulting firm that inspected the engineered fill placement. This is to ensure that the foundations are placed within the engineered fill envelope, and the integrity of the fill has not been compromised by interim construction, environmental degradation and/or disturbance by the footing excavation.
9. Any excavation carried out in certified engineered fill must be reported to the geotechnical consultant who supervised the fill placement in order to document the locations of the excavation and/or to supervise reinstatement of the excavated areas to engineered fill status. If construction on the engineered fill does not commence within a period of 2 years from the date of certification, the condition of the engineered fill must be assessed for re-certification.
10. Despite stringent control in the placement of the engineered fill, variations in soil type and density may occur in the engineered fill. Therefore, the foundations must be reinforced and designed by a structural engineer.
11. In sewer construction, the engineered fill is considered to have the same structural proficiency as a natural inorganic soil.



## 4.2 **Foundations**

The proposed residential dwellings can be supported on conventional spread and strip footings, founded on engineered fill or sound native soil. The recommended soil bearing pressures for the design of footings are provided below:

- Maximum Soil Bearing Pressure, at Serviceability Limit State (SLS) = 150 kPa
- Factored Ultimate Bearing Pressure, at Ultimate Limit State (ULS) = 250 kPa

The total and differential settlements of the conventional spread and strip footings, designing with the bearing pressure at SLS, are estimated to be 25 mm and 20 mm, respectively.

Footings exposed to weathering, or in unheated areas, should have at least 1.2 m of earth cover for protection against frost action; otherwise, proper insulation must be applied.

The footing subgrade must be inspected by a geotechnical engineer, or a geotechnical technician under the supervision of a geotechnical engineer, to assess its suitability for bearing the designed foundations.

Where stepped footings are required, a gradient of 10 horizontal: 7 vertical must be maintained.

The foundations should meet the requirements specified in the latest Ontario Building Code, and the structure should be designed to resist an earthquake force using Site Classification 'D' (stiff soil).

## 4.3 **Basement and Slab-On-Grade Construction**

In conventional design, the perimeter walls of basement structure should be damp-proofed and provided with perimeter subdrain system at the wall base. The subdrains should be shielded by a fabric filter and connected into a positive outlet as shown on Drawing No. 2.

The subgrade of the basement slab should consist of sound native soil or properly compacted inorganic earth fill. Any new fill should consist of organic free soil, compacted to at least 98% SPDD. Prior to the placement of the granular bedding, the subgrade must be proof-rolled and/or inspected. Any weak or wet areas identified must be rectified.

The concrete slab should be constructed on a granular bedding, consisting of 19-mm CRL, minimum 15 cm in thickness, compacted to 100% SPDD.



The exterior grade should slope away from the structures to prevent ponding of water adjacent to the structures.

#### 4.4 **Underground Services**

The subgrade for underground services should consist of sound native soils or engineered fill. Where weak soil is encountered, it should be subexcavated and replaced with the bedding material, compacted to at least 98% SPDD.

A Class 'B' bedding, consisting of compacted 19-mm CRL, or equivalent, is recommended for the construction of the underground services.

The pipe joints connecting into manholes and catch basins should be leak-proof, or wrapped with an appropriate waterproof membrane. Openings to subdrains and catch basins should be shielded with a fabric filter to prevent blockage by silting.

In order to prevent pipe floatation when the sewer trench is deluged with water, a soil cover with a thickness equal to the diameter of the pipe should be in place at all times after completion of the pipe installation.

All metal fittings for the underground services should be protected against soil corrosion. In determining the mode of protection, the estimated electrical resistivity of the disclosed soils can be used. The anode weight should meet the minimum requirement as stipulated by the municipality.

#### 4.5 **Backfilling in Trenches and Excavated Areas**

The on-site soils are suitable for backfill. Wet soils, if any, should be spread thinly on the ground in a dry and warm weather for aeration prior to be reused.

The backfill materials should be free of organics, deleterious material and oversized (over 15 cm) cobbles and boulders. The backfill in service trenches should be compacted to at least 95% SPDD. In zone within 1.0 m below the pavement subgrade or slab-on-grade, the backfill must be compacted to at least 98% SPDD with the water content at 2% to 3% drier than the optimum. The lift thickness should be limited to no more than 20 cm, or the lift thickness should be determined by test strips.

Narrow trenches should be cut at 1V:2H or flatter so that the backfill can be effectively compacted. Otherwise, soil arching will prevent the achievement of proper compaction.



In normal construction practice, the problem areas of settlement largely occur adjacent to manholes, catch basins, service crossings, foundation walls and columns. In areas which are inaccessible to a heavy compactor, imported sand backfill can be used and compacted using a light duty compactor.

One must be aware of the possible consequences during trench backfilling and exercise caution as described below:

- When construction is carried out in freezing winter weather, allowance should be made for these following conditions. Despite stringent backfill monitoring, frozen soil layers may inadvertently be mixed with the structural trench backfill. Should the in-situ soils have a water content on the dry side of the optimum, it would be impossible to wet the soils due to the freezing condition, rendering difficulties in obtaining uniform and proper compaction. Furthermore, the freezing condition will prevent flooding of the backfill when it is required, such as in a narrow vertical trench section, or when the trench box is removed. The above will invariably cause backfill settlement that may become evident within 1 to several years, depending on the depth of the trench which has been backfilled.
- In areas where the underground services construction is carried out during the winter months, prolonged exposure of the trench walls will result in frost heave within the soil mantle of the walls. This may result in some settlement as the frost recedes, and repair costs will be incurred prior to final surfacing of the new pavement and the slab-on-grade.
- To backfill a deep trench, one must be aware that future settlement is to be expected, unless the side of the cut is flattened to at least 1V:1.5+H, and the lifts of the fill and its moisture content are stringently controlled; i.e., lifts should be no more than 20 cm (or less if the backfilling conditions dictate) and uniformly compacted to achieve at least 95% SPDD, with the moisture content on the wet side of the optimum.
- It is often difficult to achieve uniform compaction of the backfill in the lower vertical section of a trench which is an open cut or is stabilized by a trench box, particularly in the sector close to the trench walls or the sides of the box. These sectors must be backfilled with sand. In a trench stabilized by a trench box, the void left after the removal of the box will be filled by the backfill. It is necessary to backfill this sector with sand, and the compacted backfill must be flooded for 1 day, prior to the placement of the backfill above this sector, i.e., in the upper sloped trench section. This measure is necessary in order to prevent consolidation of inadvertent voids and loose backfill which will compromise the compaction of the backfill in the upper section. In areas where groundwater movement is expected, anti-seepage collars (OPSD 802.095) should be provided. The recommended locations of anti-seepage collar are illustrated on Drawing No. 3.



#### 4.6 **Pavement Design**

The minimum pavement design for local roads and collectors is presented in Table 2.

**Table 2 - Pavement Design**

| Course            | Thickness (mm) | OPS Specifications         |
|-------------------|----------------|----------------------------|
| Asphalt Surface   | 40             | HL3                        |
| Asphalt Binder    |                | HL8                        |
| Local Roads       | 50             |                            |
| Collectors        | 80             |                            |
| Granular Base     | 150            | Granular 'A' or equivalent |
| Granular Sub-base |                | Granular 'B' or equivalent |
| Local Roads       | 350            |                            |
| Collectors        | 400            |                            |

After fine grading, the pavement subgrade should be inspected and proof-rolled. Any soft spots identified should be subexcavated and replaced with selected on-site material, free of organics, compacted to 98% SPDD.

In the zone within 1.0 m below the road subgrade, the backfill should be compacted to at least 98% SPDD with the water content at 2% to 3% drier than the optimum. All the granular bases should be compacted to 100% SPD.

The subgrade will suffer a strength regression if water is allowed to saturate the mantle. The following measures should, therefore, be incorporated in the construction procedures and road design:

- If the pavement construction does not immediately follow the trench backfilling, the subgrade should be properly crowned and smooth-rolled to allow interim precipitation to be properly drained.
- Areas adjacent to the pavement should be properly graded to prevent ponding of large amounts of water. Otherwise, the water will seep into the subgrade mantle and induce a regression of the subgrade strength with costly consequences for the pavement construction.
- Fabric filter-encased curb subdrains should be provided on both sides of roadways.
- If the pavement is to be constructed during wet seasons and extensively soft subgrade occurs, the granular sub-base should be thickened in order to compensate for the inadequate strength of the subgrade. This can be assessed during construction.



#### 4.7 **Stormwater Management Pond**

A SWM pond is proposed in Block 13, which consists of a wet cell with Armourstone retaining walls proposed along north, east and partial of the south edges of the pond. The details of the pond design are summarized below:

|                       |              |
|-----------------------|--------------|
| Pond Bottom:          | El. 178.50 m |
| Permanent Pool:       | El. 179.80 m |
| Extended Detention:   | El. 180.30 m |
| Regional Flood Level: | El. 181.80 m |

According to the findings from Boreholes 18-01 and 18-06, the sides and the bottom of the pond generally consist of native silty clay till with an estimated coefficient of permeability of  $10^{-7}$  cm/sec. Due to its low-permeability, the use of clay liner is not anticipated.

In areas where sand seams or water seepage is evident on the sides or bottom of excavation during the construction of the pond, they can be subexcavated to at least 1.0 m in depth, and replaced with on-site material with clay content higher than 30%, compacted to at least 98% SPDD in lifts no more than 200 mm thick.

It is understood that the proposed gradient for the side slopes of the pond is generally 3H:1V or flatter, which is considered acceptable for the pond design. The sides of the pond should be properly vegetated to prevent surface erosion.

Where earth berm is to be constructed at the pond, the subgrade should be free of topsoil and organics. The exposed subgrade must be inspected and proof-rolled prior to construction of the earth berm. The earth fill must be placed in lifts no more than 20 cm thick and compacted to at least 95% SPDD.

Foundation of the control structures should be designed in accordance to Section 6.2 of this report. In addition, the foundation of the control structure should extend below the frost penetration depth or below the scouring depth, whichever is deeper. The inlet and outlet of the pond should be lined with gabion mats to prevent erosion from scouring.

#### 4.8 **Retaining Walls**

Armourstone retaining walls are proposed along north, east and partial of the south edges of the SWM pond. Where the height of the retaining wall exceeded 1.0 m, the retaining wall must be properly designed by qualified personnel. Recommended bearing pressures as shown in Section 6.2 of this report can be used for retaining wall foundation design on native



soil or engineered fill. Soil parameters in Section 4.9 should be used for the retaining wall design.

Any anticipated surcharge loading in the vicinity behind the retaining wall, should be included in the design.

#### 4.9 Soil Parameters

The recommended soil parameters for the project design are given in Table 3.

**Table 3 - Soil Parameters**

| Table 3 Soil Parameters                                                        |                                                |                              |                      |
|--------------------------------------------------------------------------------|------------------------------------------------|------------------------------|----------------------|
| <u>Unit Weight and Bulk Factor</u>                                             | <u>Bulk Unit Weight<br/>(kN/m<sup>3</sup>)</u> | <u>Estimated Bulk Factor</u> |                      |
|                                                                                |                                                | <u>Loose</u>                 | <u>Compacted</u>     |
| Existing Earth Fill                                                            | 21.0                                           | 1.25                         | 1.03                 |
| Silty Clay Till                                                                | 22.0                                           | 1.30                         | 1.03                 |
| Silty Sand                                                                     | 20.5                                           | 1.20                         | 1.00                 |
| <u>Lateral Earth Pressure Coefficients</u>                                     | <u>Active</u>                                  | <u>At Rest</u>               | <u>Passive</u>       |
|                                                                                | <u>K<sub>a</sub></u>                           | <u>K<sub>0</sub></u>         | <u>K<sub>p</sub></u> |
| Compacted Earth Fill                                                           | 0.40                                           | 0.55                         | 2.50                 |
| Silty Clay Till/Silty Sand                                                     | 0.33                                           | 0.50                         | 3.00                 |
| <u>Estimated Coefficients of Permeability (K) and<br/>Percolation Time (T)</u> |                                                | <u>K</u>                     | <u>T</u>             |
|                                                                                |                                                | <u>(cm/sec)</u>              | <u>(min/cm)</u>      |
| Silty Clay Till                                                                |                                                | 10 <sup>-7</sup>             | Over 80              |
| Silty Sand                                                                     |                                                | 10 <sup>-4</sup>             | 12                   |
| <u>Estimated Electrical Resistivity</u>                                        |                                                |                              |                      |
| Silty Sand                                                                     |                                                | 4500                         |                      |
| Silty Clay Till                                                                |                                                | 3500                         |                      |
| <u>Coefficients of Friction</u>                                                |                                                |                              |                      |
| Between Concrete and Granular Base                                             |                                                | 0.50                         |                      |
| Between Concrete and Sound Native Soils                                        |                                                | 0.35                         |                      |



#### 4.10 **Excavation**

Excavation should be carried out in accordance with Ontario Regulation 213/91. The types of soils are classified in Table 4.

**Table 4** - Classification of Soils for Excavation

| Material                  | Type |
|---------------------------|------|
| Sound Silty Clay Till     | 2    |
| Earth Fill and Silty Sand | 3    |
| Saturated Soils, if any   | 4    |

The groundwater yield during excavation from the silty clay till is expected to be slow in rate and limited in quantity. The water seepage can be collected in sump pits and removed by conventional pumping.

Prospective contractors must be asked to assess the in situ subsurface conditions for soil cuts by digging test pits to 0.5 m below the anticipated depth of excavation. These test pits should be allowed to remain open for a few hours to assess the trenching conditions.

#### 5.0 **LIMITATIONS OF REPORT**

This report was prepared by Soil Engineers Ltd. for the account of Crosstrail Estates Inc. and TWKD Developments Inc., and for review by their designated consultants and government agencies. Use of this report is subject to the conditions and limitations of the contractual agreement.

The material in the report reflects the judgement of Daric Yang, B.A.Sc. and Kin Fung Li, P.Eng., in light of the information available to it at the time of preparation. Any use which a Third Party makes of this report, or any reliance on decisions to be made based on it, is the responsibility of such Third Parties. Soil Engineers Ltd. accepts no responsibility for damages, if any, suffered by any Third Party as a result of decisions made or actions based on this report.

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## **APPENDIX 'A'**

### **LOGS OF BOREHOLES**

**REFERENCE NO. 2304-S100**

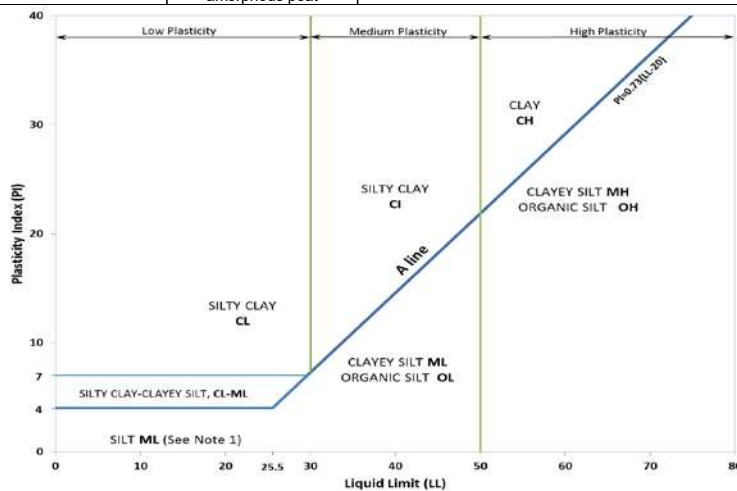
**APPENDIX A**

Method of Soil Classification  
Abbreviations and Terms Used on  
Records of Boreholes And Test Pits  
List of Symbols  
Record Of Boreholes BH18-01 To  
BH18-12

# METHOD OF SOIL CLASSIFICATION

The Golder Associates Ltd. Soil Classification System is based on the Unified Soil Classification System (USCS)

| Organic or Inorganic                                      | Soil Group                                                            | Type of Soil                                                                    |                                          | Gradation or Plasticity | $Cu = \frac{D_{60}}{D_{10}}$ |                 | $Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ |                              |                 | Organic Content   | USCS Group Symbol      | Group Name    |  |
|-----------------------------------------------------------|-----------------------------------------------------------------------|---------------------------------------------------------------------------------|------------------------------------------|-------------------------|------------------------------|-----------------|------------------------------------------------|------------------------------|-----------------|-------------------|------------------------|---------------|--|
| INORGANIC<br>(Organic Content $\leq 30\%$ by mass)        | COARSE-GRAINED SOILS<br>( $>50\%$ by mass is larger than 0.075 mm)    | GRAVELS<br>( $>50\%$ by mass of coarse fraction is larger than 4.75 mm)         | Gravels with $\leq 12\%$ fines (by mass) | Poorly Graded           | $<4$                         |                 | $\leq 1$ or $\geq 3$                           |                              |                 | $\leq 30\%$       | GP                     | GRAVEL        |  |
|                                                           |                                                                       |                                                                                 |                                          | Well Graded             | $\geq 4$                     |                 | 1 to 3                                         |                              |                 |                   | GW                     | GRAVEL        |  |
|                                                           |                                                                       |                                                                                 | Gravels with $> 12\%$ fines (by mass)    | Below A Line            | n/a                          |                 |                                                |                              |                 |                   | GM                     | SILTY GRAVEL  |  |
|                                                           |                                                                       |                                                                                 |                                          | Above A Line            | n/a                          |                 |                                                |                              |                 |                   | GC                     | CLAYEY GRAVEL |  |
|                                                           |                                                                       | SANDS<br>( $\geq 50\%$ by mass of coarse fraction is smaller than 4.75 mm)      | Sands with $\leq 12\%$ fines (by mass)   | Poorly Graded           | $<6$                         |                 | $\leq 1$ or $\geq 3$                           |                              |                 |                   | SP                     | SAND          |  |
|                                                           |                                                                       |                                                                                 |                                          | Well Graded             | $\geq 6$                     |                 | 1 to 3                                         |                              |                 |                   | SW                     | SAND          |  |
|                                                           |                                                                       |                                                                                 | Sands with $> 12\%$ fines (by mass)      | Below A Line            | n/a                          |                 |                                                |                              |                 |                   | SM                     | SILTY SAND    |  |
|                                                           |                                                                       |                                                                                 |                                          | Above A Line            | n/a                          |                 |                                                |                              |                 |                   | SC                     | CLAYEY SAND   |  |
| Organic or Inorganic                                      | Soil Group                                                            | Type of Soil                                                                    | Laboratory Tests                         | Field Indicators        |                              |                 |                                                |                              | Organic Content | USCS Group Symbol | Primary Name           |               |  |
|                                                           |                                                                       |                                                                                 |                                          | Dilatancy               | Dry Strength                 | Shine Test      | Thread Diameter                                | Toughness (of 3 mm thread)   |                 |                   |                        |               |  |
| INORGANIC<br>(Organic Content $\leq 30\%$ by mass)        | FINE-GRAINED SOILS<br>( $\geq 50\%$ by mass is smaller than 0.075 mm) | SILTS<br>(Non-Plastic or PI and LL plot below A-Line on Plasticity Chart below) | Liquid Limit $<50$                       | Rapid                   | None                         | None            | $>6$ mm                                        | N/A (can't roll 3 mm thread) | $<5\%$          | ML                | SILT                   |               |  |
|                                                           |                                                                       |                                                                                 |                                          | Slow                    | None to Low                  | Dull            | 3mm to 6 mm                                    | None to low                  | $<5\%$          | ML                | CLAYEY SILT            |               |  |
|                                                           |                                                                       |                                                                                 | Liquid Limit $\geq 50$                   | Slow to very slow       | Low to medium                | Dull to slight  | 3mm to 6 mm                                    | Low                          | 5% to 30%       | OL                | ORGANIC SILT           |               |  |
|                                                           |                                                                       |                                                                                 |                                          | Slow to very slow       | Low to medium                | Slight          | 3mm to 6 mm                                    | Low to medium                | $<5\%$          | MH                | CLAYEY SILT            |               |  |
|                                                           |                                                                       | CLAYS<br>(PI and LL plot above A-Line on Plasticity Chart below)                | Liquid Limit $<30$                       | None                    | Low to medium                | Slight to shiny | $\sim 3$ mm                                    | Low to medium                | 0% to 30%       | CL                | SILTY CLAY             |               |  |
|                                                           |                                                                       |                                                                                 | Liquid Limit 30 to 50                    | None                    | Medium to high               | Slight to shiny | 1 mm to 3 mm                                   | Medium                       |                 | CI                | SILTY CLAY             |               |  |
|                                                           |                                                                       |                                                                                 | Liquid Limit $\geq 50$                   | None                    | High                         | Shiny           | $<1$ mm                                        | High                         | (see Note 2)    | CH                | CLAY                   |               |  |
|                                                           |                                                                       |                                                                                 |                                          |                         |                              |                 |                                                |                              |                 |                   |                        |               |  |
| HIGHLY ORGANIC SOILS<br>(Organic Content $>30\%$ by mass) |                                                                       | Peat and mineral soil mixtures                                                  |                                          |                         |                              |                 |                                                |                              | 30% to 75%      | PT                | SILTY PEAT, SANDY PEAT |               |  |
|                                                           |                                                                       | Predominantly peat, may contain some mineral soil, fibrous or amorphous peat    |                                          |                         |                              |                 |                                                |                              | 75% to 100%     |                   | PEAT                   |               |  |



Note 1 – Fine grained materials with PI and LL that plot in this area are named (ML) SILT with slight plasticity. Fine-grained materials which are non-plastic (i.e. a PL cannot be measured) are named SILT.

Note 2 – For soils with  $<5\%$  organic content, include the descriptor “trace organics” for soils with between 5% and 30% organic content include the prefix “organic” before the Primary name.

**Dual Symbol** — A dual symbol is two symbols separated by a hyphen, for example, GP-GM, SW-SC and CL-ML.

For non-cohesive soils, the dual symbols must be used when the soil has between 5% and 12% fines (i.e. to identify transitional material between “clean” and “dirty” sand or gravel.

For cohesive soils, the dual symbol must be used when the liquid limit and plasticity index values plot in the CL-ML area of the plasticity chart (see Plasticity Chart at left).

**Borderline Symbol** — A borderline symbol is two symbols separated by a slash, for example, CL/CI, GM/SM, CL/ML.

A borderline symbol should be used to indicate that the soil has been identified as having properties that are on the transition between similar materials. In addition, a borderline symbol may be used to indicate a range of similar soil types within a stratum.

## ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES AND TEST PITS

### PARTICLE SIZES OF CONSTITUENTS

| Soil Constituent | Particle Size Description | Millimetres                                     | Inches (US Std. Sieve Size)                  |
|------------------|---------------------------|-------------------------------------------------|----------------------------------------------|
| BOULDERS         | Not Applicable            | >300                                            | >12                                          |
| COBBLES          | Not Applicable            | 75 to 300                                       | 3 to 12                                      |
| GRAVEL           | Coarse<br>Fine            | 19 to 75<br>4.75 to 19                          | 0.75 to 3<br>(4) to 0.75                     |
| SAND             | Coarse<br>Medium<br>Fine  | 2.00 to 4.75<br>0.425 to 2.00<br>0.075 to 0.425 | (10) to (4)<br>(40) to (10)<br>(200) to (40) |
| SILT/CLAY        | Classified by plasticity  | <0.075                                          | < (200)                                      |

### MODIFIERS FOR SECONDARY AND MINOR CONSTITUENTS

| Percentage by Mass | Modifier                                                                       |
|--------------------|--------------------------------------------------------------------------------|
| >35                | Use 'and' to combine major constituents (i.e., SAND and GRAVEL)                |
| > 12 to 35         | Primary soil name prefixed with "gravelly, sandy, SILTY, CLAYEY" as applicable |
| > 5 to 12          | some                                                                           |
| ≤ 5                | trace                                                                          |

### PENETRATION RESISTANCE

#### Standard Penetration Resistance (SPT), N:

The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) split-spoon sampler for a distance of 300 mm (12 in.). Values reported are as recorded in the field and are uncorrected.

#### Cone Penetration Test (CPT)

An electronic cone penetrometer with a 60° conical tip and a project end area of 10 cm<sup>2</sup> pushed through ground at a penetration rate of 2 cm/s. Measurements of tip resistance (q<sub>t</sub>), porewater pressure (u) and sleeve frictions are recorded electronically at 25 mm penetration intervals.

#### Dynamic Cone Penetration Resistance (DCPT); N<sub>d</sub>:

The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) to drive uncased a 50 mm (2 in.) diameter, 60° cone attached to "A" size drill rods for a distance of 300 mm (12 in.).

**PH:** Sampler advanced by hydraulic pressure

**PM:** Sampler advanced by manual pressure

**WH:** Sampler advanced by static weight of hammer

**WR:** Sampler advanced by weight of sampler and rod

### SAMPLES

|          |                                                                |
|----------|----------------------------------------------------------------|
| AS       | Auger sample                                                   |
| BS       | Block sample                                                   |
| CS       | Chunk sample                                                   |
| DD       | Diamond Drilling                                               |
| DO or DP | Seamless open ended, driven or pushed tube sampler – note size |
| DS       | Denison type sample                                            |
| GS       | Grab Sample                                                    |
| MC       | Modified California Samples                                    |
| MS       | Modified Shelby (for frozen soil)                              |
| RC       | Rock core                                                      |
| SC       | Soil core                                                      |
| SS       | Split spoon sampler – note size                                |
| ST       | Slotted tube                                                   |
| TO       | Thin-walled, open – note size (Shelby tube)                    |
| TP       | Thin-walled, piston – note size (Shelby tube)                  |
| WS       | Wash sample                                                    |

### SOIL TESTS

|                    |                                                                                                     |
|--------------------|-----------------------------------------------------------------------------------------------------|
| w                  | water content                                                                                       |
| PL, w <sub>p</sub> | plastic limit                                                                                       |
| LL, w <sub>L</sub> | liquid limit                                                                                        |
| C                  | consolidation (oedometer) test                                                                      |
| CHEM               | chemical analysis (refer to text)                                                                   |
| CID                | consolidated isotropically drained triaxial test <sup>1</sup>                                       |
| CIU                | consolidated isotropically undrained triaxial test with porewater pressure measurement <sup>1</sup> |
| D <sub>R</sub>     | relative density (specific gravity, G <sub>s</sub> )                                                |
| DS                 | direct shear test                                                                                   |
| GS                 | specific gravity                                                                                    |
| M                  | sieve analysis for particle size                                                                    |
| MH                 | combined sieve and hydrometer (H) analysis                                                          |
| MPC                | Modified Proctor compaction test                                                                    |
| SPC                | Standard Proctor compaction test                                                                    |
| OC                 | organic content test                                                                                |
| SO <sub>4</sub>    | concentration of water-soluble sulphates                                                            |
| UC                 | unconfined compression test                                                                         |
| UU                 | unconsolidated undrained triaxial test                                                              |
| V (FV)             | field vane (LV-laboratory vane test)                                                                |
| γ                  | unit weight                                                                                         |

1. Tests anisotropically consolidated prior to shear are shown as CAD, CAU.

### NON-COHESIVE (COHESIONLESS) SOILS

#### Compactness<sup>2</sup>

| Term       | SPT 'N' (blows/0.3m) <sup>1</sup> |
|------------|-----------------------------------|
| Very Loose | 0 to 4                            |
| Loose      | 4 to 10                           |
| Compact    | 10 to 30                          |
| Dense      | 30 to 50                          |
| Very Dense | >50                               |

1. SPT 'N' in accordance with ASTM D1586, uncorrected for the effects of overburden pressure.

2. Definition of compactness terms are based on SPT 'N' ranges as provided in Terzaghi, Peck and Mesri (1996). Many factors affect the recorded SPT 'N' value, including hammer efficiency (which may be greater than 60% in automatic trip hammers), overburden pressure, groundwater conditions, and grain size. As such, the recorded SPT 'N' value(s) should be considered only an approximate guide to the soil compactness. These factors need to be considered when evaluating the results, and the stated compactness terms should not be relied upon for design or construction.

#### Field Moisture Condition

| Term  | Description                                                   |
|-------|---------------------------------------------------------------|
| Dry   | Soil flows freely through fingers.                            |
| Moist | Soils are darker than in the dry condition and may feel cool. |
| Wet   | As moist, but with free water forming on hands when handled.  |

### COHESIVE SOILS

#### Consistency

| Term       | Undrained Shear Strength (kPa) | SPT 'N' <sup>1,2</sup> (blows/0.3m) |
|------------|--------------------------------|-------------------------------------|
| Very Soft  | <12                            | 0 to 2                              |
| Soft       | 12 to 25                       | 2 to 4                              |
| Firm       | 25 to 50                       | 4 to 8                              |
| Stiff      | 50 to 100                      | 8 to 15                             |
| Very Stiff | 100 to 200                     | 15 to 30                            |
| Hard       | >200                           | >30                                 |

1. SPT 'N' in accordance with ASTM D1586, uncorrected for overburden pressure effects; approximate only.

2. SPT 'N' values should be considered ONLY an approximate guide to consistency; for sensitive clays (e.g., Champlain Sea clays), the N-value approximation for consistency terms does NOT apply. Rely on direct measurement of undrained shear strength or other manual observations.

#### Water Content

| Term   | Description                                                |
|--------|------------------------------------------------------------|
| w < PL | Material is estimated to be drier than the Plastic Limit.  |
| w ~ PL | Material is estimated to be close to the Plastic Limit.    |
| w > PL | Material is estimated to be wetter than the Plastic Limit. |

## LIST OF SYMBOLS

Unless otherwise stated, the symbols employed in the report are as follows:

### I. GENERAL

|             |                                       |
|-------------|---------------------------------------|
| $\pi$       | 3.1416                                |
| $\ln x$     | natural logarithm of x                |
| $\log_{10}$ | x or log x, logarithm of x to base 10 |
| g           | acceleration due to gravity           |
| t           | time                                  |

### II. STRESS AND STRAIN

|                                |                                                                            |
|--------------------------------|----------------------------------------------------------------------------|
| $\gamma$                       | shear strain                                                               |
| $\Delta$                       | change in, e.g. in stress: $\Delta \sigma$                                 |
| $\varepsilon$                  | linear strain                                                              |
| $\varepsilon_v$                | volumetric strain                                                          |
| $\eta$                         | coefficient of viscosity                                                   |
| $\nu$                          | Poisson's ratio                                                            |
| $\sigma$                       | total stress                                                               |
| $\sigma'$                      | effective stress ( $\sigma' = \sigma - u$ )                                |
| $\sigma'_{vo}$                 | initial effective overburden stress                                        |
| $\sigma_1, \sigma_2, \sigma_3$ | principal stress (major, intermediate, minor)                              |
| $\sigma_{oct}$                 | mean stress or octahedral stress<br>$= (\sigma_1 + \sigma_2 + \sigma_3)/3$ |
| $\tau$                         | shear stress                                                               |
| u                              | porewater pressure                                                         |
| E                              | modulus of deformation                                                     |
| G                              | shear modulus of deformation                                               |
| K                              | bulk modulus of compressibility                                            |

### III. SOIL PROPERTIES

#### (a) Index Properties

|                    |                                                                                                      |
|--------------------|------------------------------------------------------------------------------------------------------|
| $\rho(\gamma)$     | bulk density (bulk unit weight)*                                                                     |
| $\rho_d(\gamma_d)$ | dry density (dry unit weight)                                                                        |
| $\rho_w(\gamma_w)$ | density (unit weight) of water                                                                       |
| $\rho_s(\gamma_s)$ | density (unit weight) of solid particles                                                             |
| $\gamma'$          | unit weight of submerged soil<br>( $\gamma' = \gamma - \gamma_w$ )                                   |
| $D_R$              | relative density (specific gravity) of solid particles ( $D_R = \rho_s / \rho_w$ ) (formerly $G_s$ ) |
| e                  | void ratio                                                                                           |
| n                  | porosity                                                                                             |
| S                  | degree of saturation                                                                                 |

#### (a) Index Properties (continued)

|             |                                                                                      |
|-------------|--------------------------------------------------------------------------------------|
| w           | water content                                                                        |
| $w_l$ or LL | liquid limit                                                                         |
| $w_p$ or PL | plastic limit                                                                        |
| $I_p$ or PI | plasticity index = $(w_l - w_p)$                                                     |
| NP          | non-plastic                                                                          |
| $w_s$       | shrinkage limit                                                                      |
| $I_L$       | liquidity index = $(w - w_p) / I_p$                                                  |
| $I_C$       | consistency index = $(w_l - w) / I_p$                                                |
| $e_{max}$   | void ratio in loosest state                                                          |
| $e_{min}$   | void ratio in densest state                                                          |
| $I_D$       | density index = $(e_{max} - e) / (e_{max} - e_{min})$<br>(formerly relative density) |

#### (b) Hydraulic Properties

|   |                                                         |
|---|---------------------------------------------------------|
| h | hydraulic head or potential                             |
| q | rate of flow                                            |
| v | velocity of flow                                        |
| i | hydraulic gradient                                      |
| k | hydraulic conductivity<br>(coefficient of permeability) |
| j | seepage force per unit volume                           |

#### (c) Consolidation (one-dimensional)

|             |                                                       |
|-------------|-------------------------------------------------------|
| $C_c$       | compression index<br>(normally consolidated range)    |
| $C_r$       | recompression index<br>(over-consolidated range)      |
| $C_s$       | swelling index                                        |
| $C_\alpha$  | secondary compression index                           |
| $m_v$       | coefficient of volume change                          |
| $C_v$       | coefficient of consolidation (vertical direction)     |
| $C_h$       | coefficient of consolidation (horizontal direction)   |
| $T_v$       | time factor (vertical direction)                      |
| U           | degree of consolidation                               |
| $\sigma'_p$ | pre-consolidation stress                              |
| OCR         | over-consolidation ratio = $\sigma'_p / \sigma'_{vo}$ |

#### (d) Shear Strength

|                  |                                                          |
|------------------|----------------------------------------------------------|
| $\tau_p, \tau_r$ | peak and residual shear strength                         |
| $\phi'$          | effective angle of internal friction                     |
| $\delta$         | angle of interface friction                              |
| $\mu$            | coefficient of friction = $\tan \delta$                  |
| $c'$             | effective cohesion                                       |
| $c_u, s_u$       | undrained shear strength ( $\phi = 0$ analysis)          |
| p                | mean total stress $(\sigma_1 + \sigma_3)/2$              |
| $p'$             | mean effective stress $(\sigma'_1 + \sigma'_3)/2$        |
| q                | $(\sigma_1 - \sigma_3)/2$ or $(\sigma'_1 - \sigma'_3)/2$ |
| $q_u$            | compressive strength $(\sigma_1 - \sigma_3)$             |
| $S_t$            | sensitivity                                              |

\* Density symbol is  $\rho$ . Unit weight symbol is  $\gamma$  where  $\gamma = \rho g$  (i.e. mass density multiplied by acceleration due to gravity)

Notes: 1  
2

$$\tau = c' + \sigma' \tan \phi'$$

$$\text{shear strength} = (\text{compressive strength})/2$$

PROJECT: 1792964

## RECORD OF BOREHOLE: BH18-01

SHEET 1 OF 1

LOCATION: See Figure 1

BORING DATE: June 20, 2018

DATUM: Geodetic

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

| DEPTH SCALE<br>METRES | BORING METHOD | SOIL PROFILE                                                                                                                                                     |             | SAMPLES               |        | HEADSPACE COMBUSTIBLE<br>VAPOUR CONCENTRATIONS [PPM] ⊕ |             |                                                    |     | HYDRAULIC CONDUCTIVITY,<br>k, cm/s |     |                       |                  | ADDITIONAL<br>LAB. TESTING | PIEZOMETER<br>OR<br>STANDPIPE<br>INSTALLATION |  |  |
|-----------------------|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-----------------------|--------|--------------------------------------------------------|-------------|----------------------------------------------------|-----|------------------------------------|-----|-----------------------|------------------|----------------------------|-----------------------------------------------|--|--|
|                       |               | DESCRIPTION                                                                                                                                                      | STRATA PLOT | ELEV.<br>DEPTH<br>(m) | NUMBER | TYPE                                                   | BLOWS/0.3m  | HEADSPACE ORGANIC VAPOUR<br>CONCENTRATIONS [PPM] □ |     |                                    |     | WATER CONTENT PERCENT |                  |                            |                                               |  |  |
|                       |               |                                                                                                                                                                  |             |                       |        |                                                        |             | ND = Not Detected                                  |     |                                    |     | Wp — W — Wl           |                  |                            |                                               |  |  |
|                       |               |                                                                                                                                                                  |             |                       |        |                                                        |             | 100                                                | 200 | 300                                | 400 | 10 <sup>-6</sup>      | 10 <sup>-5</sup> | 10 <sup>-4</sup>           | 10 <sup>-3</sup>                              |  |  |
|                       |               |                                                                                                                                                                  |             |                       |        |                                                        |             |                                                    |     |                                    |     |                       |                  |                            |                                               |  |  |
| 0                     |               | GROUND SURFACE                                                                                                                                                   |             | 182.70                |        |                                                        |             |                                                    |     |                                    |     |                       |                  |                            |                                               |  |  |
|                       |               | TOPSOIL (230 mm)                                                                                                                                                 |             | 0.00                  | 1A     |                                                        |             |                                                    |     |                                    |     |                       |                  |                            |                                               |  |  |
|                       |               | (CL) SILTY CLAY, trace to some sand to sandy SILTY CLAY, trace to some gravel, trace shale fragments; mottled brown to grey (TILL); cohesive, w<PL, firm to hard |             | 182.47                | 1B     | SS                                                     | 7           |                                                    |     |                                    |     |                       |                  |                            |                                               |  |  |
|                       |               |                                                                                                                                                                  |             |                       | 0.23   |                                                        |             |                                                    |     |                                    |     |                       |                  |                            |                                               |  |  |
|                       |               |                                                                                                                                                                  |             |                       |        |                                                        |             |                                                    |     |                                    |     |                       |                  |                            |                                               |  |  |
| 1                     |               |                                                                                                                                                                  |             |                       |        | 2                                                      | SS          | 21                                                 |     |                                    |     |                       |                  |                            |                                               |  |  |
|                       |               |                                                                                                                                                                  |             |                       |        |                                                        |             |                                                    |     |                                    |     |                       |                  |                            |                                               |  |  |
|                       |               |                                                                                                                                                                  |             |                       |        |                                                        |             |                                                    |     |                                    |     |                       |                  |                            |                                               |  |  |
|                       |               |                                                                                                                                                                  |             |                       |        |                                                        |             |                                                    |     |                                    |     |                       |                  |                            |                                               |  |  |
|                       |               |                                                                                                                                                                  |             |                       | 3      | SS                                                     | 35          |                                                    |     |                                    |     |                       |                  |                            |                                               |  |  |
| 2                     |               |                                                                                                                                                                  |             |                       |        |                                                        |             |                                                    |     |                                    |     |                       |                  |                            |                                               |  |  |
|                       |               |                                                                                                                                                                  |             |                       |        |                                                        |             |                                                    |     |                                    |     |                       |                  |                            |                                               |  |  |
|                       |               |                                                                                                                                                                  |             |                       | 4      | SS                                                     | 88          |                                                    |     |                                    |     |                       |                  |                            |                                               |  |  |
|                       |               |                                                                                                                                                                  |             |                       |        |                                                        |             |                                                    |     |                                    |     |                       |                  |                            |                                               |  |  |
|                       |               |                                                                                                                                                                  |             |                       | 5      | SS                                                     | 48          |                                                    |     |                                    |     |                       |                  |                            |                                               |  |  |
|                       |               |                                                                                                                                                                  |             |                       |        |                                                        |             |                                                    |     |                                    |     |                       |                  |                            |                                               |  |  |
|                       |               |                                                                                                                                                                  |             |                       | 6      | SS                                                     | 31          |                                                    |     |                                    |     |                       |                  |                            |                                               |  |  |
|                       |               |                                                                                                                                                                  |             |                       |        |                                                        |             |                                                    |     |                                    |     |                       |                  |                            |                                               |  |  |
|                       |               |                                                                                                                                                                  |             |                       | 7      | SS                                                     | 50/<br>0.03 |                                                    |     |                                    |     |                       |                  |                            |                                               |  |  |
|                       |               |                                                                                                                                                                  |             |                       |        |                                                        |             |                                                    |     |                                    |     |                       |                  |                            |                                               |  |  |
|                       |               | END OF BOREHOLE                                                                                                                                                  |             | 176.27                |        |                                                        |             |                                                    |     |                                    |     |                       |                  |                            |                                               |  |  |
|                       |               |                                                                                                                                                                  |             | 6.43                  |        |                                                        |             |                                                    |     |                                    |     |                       |                  |                            |                                               |  |  |
| 7                     |               | NOTES:                                                                                                                                                           |             |                       |        |                                                        |             |                                                    |     |                                    |     |                       |                  |                            |                                               |  |  |
|                       |               | 1. Borehole dry upon completion of drilling.                                                                                                                     |             |                       |        |                                                        |             |                                                    |     |                                    |     |                       |                  |                            |                                               |  |  |
|                       |               | 2. Groundwater level measured in monitoring well at a depth of 3.0 m below ground surface (Elev. 179.7 m) on July 19/18.                                         |             |                       |        |                                                        |             |                                                    |     |                                    |     |                       |                  |                            |                                               |  |  |
| 8                     |               |                                                                                                                                                                  |             |                       |        |                                                        |             |                                                    |     |                                    |     |                       |                  |                            |                                               |  |  |
|                       |               |                                                                                                                                                                  |             |                       |        |                                                        |             |                                                    |     |                                    |     |                       |                  |                            |                                               |  |  |
| 9                     |               |                                                                                                                                                                  |             |                       |        |                                                        |             |                                                    |     |                                    |     |                       |                  |                            |                                               |  |  |
|                       |               |                                                                                                                                                                  |             |                       |        |                                                        |             |                                                    |     |                                    |     |                       |                  |                            |                                               |  |  |
| 10                    |               |                                                                                                                                                                  |             |                       |        |                                                        |             |                                                    |     |                                    |     |                       |                  |                            |                                               |  |  |

DEPTH SCALE

1 : 50



GOLDER

LOGGED: CL

CHECKED: EM

GTA-BHS 001 S:\CLIENTS\KLM PLANNING PARTNERS\ON OAKVILLE 40 64 86 BURNHAMTHORPE RD E\02 DATA\GINT\BURNHAMTHORPE-RD-E.GPJ GAL-MIS.GDT 8/7/18



PROJECT: 1792964  
LOCATION: See Figure 1

# RECORD OF BOREHOLE: BH18-03

SHEET 1 OF 1  
DATUM: Geodetic

BORING DATE: June 20, 2018

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

| DEPTH SCALE<br>METRES | BORING METHOD                                | SOIL PROFILE                                                                                                                                                  |             |                       | SAMPLES |      | HEADSPACE COMBUSTIBLE<br>VAPOUR CONCENTRATIONS [PPM] ⊕ |                                                    |     |     | HYDRAULIC CONDUCTIVITY,<br>k, cm/s |                                                                     |  |    | ADDITIONAL<br>LAB. TESTING | PIEZOMETER<br>OR<br>STANDPIPE<br>INSTALLATION |    |  |  |
|-----------------------|----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-----------------------|---------|------|--------------------------------------------------------|----------------------------------------------------|-----|-----|------------------------------------|---------------------------------------------------------------------|--|----|----------------------------|-----------------------------------------------|----|--|--|
|                       |                                              | DESCRIPTION                                                                                                                                                   | STRATA PLOT | ELEV.<br>DEPTH<br>(m) | NUMBER  | TYPE | BLOWS/0.3m                                             | ND = Not Detected                                  |     |     |                                    | 10 <sup>-6</sup> 10 <sup>-5</sup> 10 <sup>-4</sup> 10 <sup>-3</sup> |  |    |                            |                                               |    |  |  |
|                       |                                              |                                                                                                                                                               |             |                       |         |      |                                                        | HEADSPACE ORGANIC VAPOUR<br>CONCENTRATIONS [PPM] □ |     |     |                                    | WATER CONTENT PERCENT                                               |  |    |                            |                                               |    |  |  |
|                       |                                              |                                                                                                                                                               |             |                       |         |      |                                                        | ND = Not Detected                                  |     |     |                                    | Wp   W   Wi                                                         |  |    |                            |                                               |    |  |  |
|                       |                                              |                                                                                                                                                               |             |                       |         |      |                                                        | 100                                                | 200 | 300 | 400                                |                                                                     |  | 10 | 20                         | 30                                            | 40 |  |  |
| 0                     |                                              | GROUND SURFACE                                                                                                                                                |             | 186.77                |         |      |                                                        |                                                    |     |     |                                    |                                                                     |  |    |                            |                                               |    |  |  |
|                       |                                              | TOPSOIL (180 mm)                                                                                                                                              |             | 0.00<br>186.59        | 1A      |      |                                                        |                                                    |     |     |                                    |                                                                     |  |    |                            |                                               |    |  |  |
|                       |                                              | (CL) SILTY CLAY, trace to some sand,<br>trace to some gravel; mottled brown to<br>grey, some shale fragments (TILL);<br>cohesive, w<PL to w~PL, stiff to hard |             | 0.18                  |         |      |                                                        |                                                    |     |     |                                    |                                                                     |  |    |                            |                                               |    |  |  |
|                       |                                              |                                                                                                                                                               | 1B          | SS                    | 13      | ⊕    |                                                        |                                                    |     |     |                                    |                                                                     |  |    |                            |                                               |    |  |  |
| 1                     |                                              |                                                                                                                                                               | 2           | SS                    | 38      | ⊕    | ND                                                     |                                                    |     |     |                                    |                                                                     |  |    |                            |                                               |    |  |  |
|                       |                                              |                                                                                                                                                               |             |                       |         |      |                                                        |                                                    |     |     |                                    |                                                                     |  |    |                            |                                               |    |  |  |
|                       |                                              |                                                                                                                                                               | 3           | SS                    | 25      | ⊕    | ND                                                     |                                                    |     |     |                                    |                                                                     |  |    |                            |                                               |    |  |  |
| 2                     |                                              |                                                                                                                                                               |             |                       |         |      |                                                        |                                                    |     |     |                                    |                                                                     |  |    |                            |                                               |    |  |  |
|                       |                                              |                                                                                                                                                               | 4           | SS                    | 33      | ⊕    | ND                                                     |                                                    |     |     |                                    |                                                                     |  |    |                            |                                               |    |  |  |
|                       |                                              |                                                                                                                                                               |             |                       |         |      |                                                        |                                                    |     |     |                                    |                                                                     |  |    |                            |                                               |    |  |  |
| 3                     |                                              |                                                                                                                                                               |             |                       | 5       | SS   | 26                                                     | ⊕                                                  | ND  |     |                                    |                                                                     |  |    |                            |                                               |    |  |  |
| 4                     | Power Auger<br>153 mm O.D. Solid Stem Augers |                                                                                                                                                               |             |                       |         |      |                                                        |                                                    |     |     |                                    |                                                                     |  |    |                            |                                               |    |  |  |
|                       |                                              |                                                                                                                                                               |             |                       |         |      |                                                        |                                                    |     |     |                                    |                                                                     |  |    |                            |                                               |    |  |  |
| 5                     |                                              |                                                                                                                                                               |             |                       | 6       | SS   | 13                                                     | ⊕                                                  | ND  |     |                                    |                                                                     |  |    |                            |                                               |    |  |  |
| 6                     |                                              |                                                                                                                                                               |             |                       |         |      |                                                        |                                                    |     |     |                                    |                                                                     |  |    |                            |                                               |    |  |  |
|                       |                                              |                                                                                                                                                               |             |                       | 7       | SS   | 9                                                      | ⊕                                                  | ND  |     |                                    |                                                                     |  |    |                            |                                               |    |  |  |
| 7                     |                                              | END OF BOREHOLE                                                                                                                                               |             | 180.06<br>6.71        |         |      |                                                        |                                                    |     |     |                                    |                                                                     |  |    |                            |                                               |    |  |  |
|                       |                                              | NOTE:<br><br>1. Borehole dry upon completion of<br>drilling.                                                                                                  |             |                       |         |      |                                                        |                                                    |     |     |                                    |                                                                     |  |    |                            |                                               |    |  |  |
| 8                     |                                              |                                                                                                                                                               |             |                       |         |      |                                                        |                                                    |     |     |                                    |                                                                     |  |    |                            |                                               |    |  |  |
| 9                     |                                              |                                                                                                                                                               |             |                       |         |      |                                                        |                                                    |     |     |                                    |                                                                     |  |    |                            |                                               |    |  |  |
| 10                    |                                              |                                                                                                                                                               |             |                       |         |      |                                                        |                                                    |     |     |                                    |                                                                     |  |    |                            |                                               |    |  |  |

DEPTH SCALE

1 : 50



GOLDER

LOGGED: CL

CHECKED: EM

GTA-BHS 001 S:\CLIENTS\KLM PLANNING PARTNERS\ON OAKVILLE 40.64 86 BURNHAMTHORPE RD E102 DATA\GINT\BURNHAMTHORPE-RD-E.GPJ GAL-MIS.GDT 8/7/18



PROJECT: 1792964

## RECORD OF BOREHOLE: BH18-05

SHEET 1 OF 1

LOCATION: See Figure 1

BORING DATE: June 20, 2018

DATUM: Geodetic

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

GTA-BHS 001 S:\CLIENTS\KLM PLANNING PARTNERS\ON OAKVILLE 40.64 86 BURNHAMTHORPE RD E\02 DATA\GINT\BURNHAMTHORPE-RD-E.GPJ GAL-MIS.GDT 8/7/18

| DEPTH SCALE<br>METRES | BORING METHOD | SOIL PROFILE                                                                                                                          |             |                       | SAMPLES |      |            | HEADSPACE COMBUSTIBLE<br>VAPOUR CONCENTRATIONS [PPM] ⊕ |         |     |     | HYDRAULIC CONDUCTIVITY,<br>k, cm/s                                  |  |  |  | ADDITIONAL<br>LAB. TESTING | PIEZOMETER<br>OR<br>STANDPIPE<br>INSTALLATION |                       |  |
|-----------------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------|-------------|-----------------------|---------|------|------------|--------------------------------------------------------|---------|-----|-----|---------------------------------------------------------------------|--|--|--|----------------------------|-----------------------------------------------|-----------------------|--|
|                       |               | DESCRIPTION                                                                                                                           | STRATA PLOT | ELEV.<br>DEPTH<br>(m) | NUMBER  | TYPE | BLOWS/0.3m | ND = Not Detected                                      |         |     |     | 10 <sup>-6</sup> 10 <sup>-5</sup> 10 <sup>-4</sup> 10 <sup>-3</sup> |  |  |  |                            |                                               |                       |  |
|                       |               |                                                                                                                                       |             |                       |         |      |            | HEADSPACE ORGANIC VAPOUR<br>CONCENTRATIONS [PPM] □     |         |     |     | ND = Not Detected                                                   |  |  |  |                            |                                               | WATER CONTENT PERCENT |  |
|                       |               |                                                                                                                                       |             |                       |         |      |            | 100                                                    | 200     | 300 | 400 |                                                                     |  |  |  |                            |                                               |                       |  |
|                       |               |                                                                                                                                       |             |                       |         |      |            |                                                        |         |     |     |                                                                     |  |  |  |                            |                                               |                       |  |
| 0                     |               | GROUND SURFACE                                                                                                                        |             | 183.61                |         |      |            |                                                        |         |     |     |                                                                     |  |  |  |                            |                                               |                       |  |
|                       |               | TOPSOIL (180 mm)                                                                                                                      |             | 0.00<br>183.43        | 1A      |      |            |                                                        |         |     |     |                                                                     |  |  |  |                            |                                               |                       |  |
|                       |               | (CL) SILTY CLAY, trace to some sand,<br>trace to some gravel; brown to brownish<br>grey (TILL); cohesive, w<PL, very stiff to<br>hard |             | 0.18                  | 1B      | SS   | 24         | □ ⊕<br>ND                                              |         |     |     |                                                                     |  |  |  |                            | PHC's<br>PARTS<br>METALS<br>and<br>INORG      |                       |  |
|                       |               |                                                                                                                                       |             |                       |         |      |            |                                                        |         |     |     |                                                                     |  |  |  |                            |                                               |                       |  |
| 1                     |               |                                                                                                                                       |             |                       |         | 2    | SS         | 31                                                     | □<br>ND |     |     |                                                                     |  |  |  |                            |                                               |                       |  |
|                       |               |                                                                                                                                       |             |                       |         |      |            |                                                        |         |     |     |                                                                     |  |  |  |                            |                                               |                       |  |
|                       |               |                                                                                                                                       |             |                       |         | 3    | SS         | 28                                                     | □<br>ND |     |     |                                                                     |  |  |  |                            |                                               |                       |  |
| 2                     |               |                                                                                                                                       |             |                       |         |      |            |                                                        |         |     |     |                                                                     |  |  |  |                            |                                               |                       |  |
|                       |               |                                                                                                                                       |             |                       |         | 4    | SS         | 58                                                     | □<br>ND |     |     |                                                                     |  |  |  |                            |                                               |                       |  |
|                       |               |                                                                                                                                       |             |                       |         |      |            |                                                        |         |     |     |                                                                     |  |  |  |                            |                                               |                       |  |
|                       |               |                                                                                                                                       |             |                       | 5       | SS   | 46         | □<br>ND                                                |         |     |     |                                                                     |  |  |  |                            |                                               |                       |  |
|                       |               |                                                                                                                                       |             |                       |         |      |            |                                                        |         |     |     |                                                                     |  |  |  |                            |                                               |                       |  |
|                       |               |                                                                                                                                       |             |                       | 6       | SS   | 36         | □<br>ND                                                |         |     |     |                                                                     |  |  |  |                            |                                               |                       |  |
|                       |               |                                                                                                                                       |             |                       |         |      |            |                                                        |         |     |     |                                                                     |  |  |  |                            |                                               |                       |  |
|                       |               |                                                                                                                                       |             |                       | 7       | SS   | 24         | □<br>ND                                                |         |     |     |                                                                     |  |  |  |                            |                                               |                       |  |
|                       |               |                                                                                                                                       |             |                       |         |      |            |                                                        |         |     |     |                                                                     |  |  |  |                            |                                               |                       |  |
|                       |               | END OF BOREHOLE                                                                                                                       |             | 176.90<br>6.71        |         |      |            |                                                        |         |     |     |                                                                     |  |  |  |                            |                                               |                       |  |
| 7                     |               | NOTE:<br><br>1. Borehole dry upon completion of<br>drilling.                                                                          |             |                       |         |      |            |                                                        |         |     |     |                                                                     |  |  |  |                            |                                               |                       |  |
| 8                     |               |                                                                                                                                       |             |                       |         |      |            |                                                        |         |     |     |                                                                     |  |  |  |                            |                                               |                       |  |
| 9                     |               |                                                                                                                                       |             |                       |         |      |            |                                                        |         |     |     |                                                                     |  |  |  |                            |                                               |                       |  |
| 10                    |               |                                                                                                                                       |             |                       |         |      |            |                                                        |         |     |     |                                                                     |  |  |  |                            |                                               |                       |  |

DEPTH SCALE

1 : 50



GOLDER

LOGGED: CL

CHECKED: EM



PROJECT: 1792964

## RECORD OF BOREHOLE: BH18-07

SHEET 1 OF 1

LOCATION: See Figure 1

BORING DATE: June 22, 2018

DATUM: Geodetic

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

| DEPTH SCALE<br>METRES | BORING METHOD | SOIL PROFILE                                                                                                                                                                                       |             |                       | SAMPLES |      | HEADSPACE COMBUSTIBLE<br>VAPOUR CONCENTRATIONS [PPM] ⊕ |                                                    |     |     | HYDRAULIC CONDUCTIVITY,<br>k, cm/s |                       |                  |                  | ADDITIONAL<br>LAB. TESTING | PIEZOMETER<br>OR<br>STANDPIPE<br>INSTALLATION |  |
|-----------------------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-----------------------|---------|------|--------------------------------------------------------|----------------------------------------------------|-----|-----|------------------------------------|-----------------------|------------------|------------------|----------------------------|-----------------------------------------------|--|
|                       |               | DESCRIPTION                                                                                                                                                                                        | STRATA PLOT | ELEV.<br>DEPTH<br>(m) | NUMBER  | TYPE | BLOWS/0.3m                                             | HEADSPACE ORGANIC VAPOUR<br>CONCENTRATIONS [PPM] □ |     |     |                                    | WATER CONTENT PERCENT |                  |                  |                            |                                               |  |
|                       |               |                                                                                                                                                                                                    |             |                       |         |      |                                                        | ND = Not Detected                                  |     |     |                                    | Wp — W — Wi           |                  |                  |                            |                                               |  |
|                       |               |                                                                                                                                                                                                    |             |                       |         |      |                                                        | 100                                                | 200 | 300 | 400                                | 10 <sup>-6</sup>      | 10 <sup>-5</sup> | 10 <sup>-4</sup> | 10 <sup>-3</sup>           |                                               |  |
|                       |               |                                                                                                                                                                                                    |             |                       |         |      |                                                        |                                                    |     |     |                                    |                       |                  |                  |                            |                                               |  |
| 0                     |               | GROUND SURFACE                                                                                                                                                                                     |             | 185.45                |         |      |                                                        |                                                    |     |     |                                    |                       |                  |                  |                            |                                               |  |
|                       |               | TOPSOIL (250 mm)                                                                                                                                                                                   |             | 0.00                  | 1A      |      |                                                        |                                                    |     |     |                                    |                       |                  |                  |                            |                                               |  |
|                       |               | (CL) SILTY CLAY, trace to some sand,<br>trace to some gravel, some shale<br>fragments; mottled brown to brown to<br>grey, with oxidation staining (TILL);<br>cohesive, w<PL to w~PL, stiff to hard |             | 185.20                | 1B      |      | 12                                                     | ND                                                 |     |     |                                    |                       |                  |                  |                            |                                               |  |
|                       |               |                                                                                                                                                                                                    |             | 0.25                  |         |      |                                                        |                                                    |     |     |                                    |                       |                  |                  |                            |                                               |  |
| 1                     |               |                                                                                                                                                                                                    |             |                       | 2       | SS   | 46                                                     | ND                                                 |     |     |                                    |                       |                  |                  |                            |                                               |  |
|                       |               |                                                                                                                                                                                                    |             |                       |         |      |                                                        |                                                    |     |     |                                    |                       |                  |                  |                            |                                               |  |
|                       |               |                                                                                                                                                                                                    |             |                       | 3       | SS   | 41                                                     | ND                                                 |     |     |                                    |                       |                  |                  |                            |                                               |  |
| 2                     |               |                                                                                                                                                                                                    |             |                       |         |      |                                                        |                                                    |     |     |                                    |                       |                  |                  |                            |                                               |  |
|                       |               |                                                                                                                                                                                                    |             |                       | 4       | SS   | 52                                                     | ND                                                 |     |     |                                    |                       |                  |                  |                            |                                               |  |
|                       |               |                                                                                                                                                                                                    |             |                       |         |      |                                                        |                                                    |     |     |                                    |                       |                  |                  |                            |                                               |  |
| 3                     |               |                                                                                                                                                                                                    |             |                       | 5       | SS   | 51                                                     | ND                                                 |     |     |                                    |                       |                  |                  |                            |                                               |  |
|                       |               |                                                                                                                                                                                                    |             |                       |         |      |                                                        |                                                    |     |     |                                    |                       |                  |                  |                            |                                               |  |
| 4                     |               |                                                                                                                                                                                                    |             |                       |         |      |                                                        |                                                    |     |     |                                    |                       |                  |                  |                            |                                               |  |
|                       |               |                                                                                                                                                                                                    |             |                       | 6       | SS   | 20                                                     | ND                                                 |     |     |                                    |                       |                  |                  |                            |                                               |  |
| 5                     |               |                                                                                                                                                                                                    |             |                       |         |      |                                                        |                                                    |     |     |                                    |                       |                  |                  |                            |                                               |  |
|                       |               |                                                                                                                                                                                                    |             |                       |         |      |                                                        |                                                    |     |     |                                    |                       |                  |                  |                            |                                               |  |
| 6                     |               |                                                                                                                                                                                                    |             |                       |         |      |                                                        |                                                    |     |     |                                    |                       |                  |                  |                            |                                               |  |
|                       |               |                                                                                                                                                                                                    |             |                       | 7       | SS   | 20                                                     | ND                                                 |     |     |                                    |                       |                  |                  |                            |                                               |  |
|                       |               |                                                                                                                                                                                                    |             |                       |         |      |                                                        |                                                    |     |     |                                    |                       |                  |                  |                            |                                               |  |
| 7                     |               | END OF BOREHOLE                                                                                                                                                                                    |             | 178.74                |         |      |                                                        |                                                    |     |     |                                    |                       |                  |                  |                            |                                               |  |
|                       |               | NOTES:                                                                                                                                                                                             |             | 6.71                  |         |      |                                                        |                                                    |     |     |                                    |                       |                  |                  |                            |                                               |  |
|                       |               | 1. Borehole dry upon completion of<br>drilling.                                                                                                                                                    |             |                       |         |      |                                                        |                                                    |     |     |                                    |                       |                  |                  |                            |                                               |  |
| 8                     |               | 2. Groundwater level measured in<br>monitoring well at a depth of 4.3 m<br>below ground surface (Elev. 181.2 m) on<br>July 19/18.                                                                  |             |                       |         |      |                                                        |                                                    |     |     |                                    |                       |                  |                  |                            |                                               |  |
| 9                     |               |                                                                                                                                                                                                    |             |                       |         |      |                                                        |                                                    |     |     |                                    |                       |                  |                  |                            |                                               |  |
| 10                    |               |                                                                                                                                                                                                    |             |                       |         |      |                                                        |                                                    |     |     |                                    |                       |                  |                  |                            |                                               |  |

DEPTH SCALE

1 : 50



GOLDER

LOGGED: CL

CHECKED: EM

GTA-BHS 001 S:\CLIENTS\KLM PLANNING PARTNERS\ON OAKVILLE 40.64 86 BURNHAMTHORPE RD E\02 DATA\GINT\BURNHAMTHORPE-RD-E.GPJ GAL-MIS.GDT 8/7/18

PROJECT: 1792964

## RECORD OF BOREHOLE: BH18-08

SHEET 1 OF 1

LOCATION: See Figure 1

BORING DATE: June 22, 2018

DATUM: Geodetic

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

GTA-BHS 001 S:\CLIENTS\KLM PLANNING PARTNERS\ON OAKVILLE 40 64 86 BURNHAMTHORPE RD E\02 DATA\GINT\BURNHAMTHORPE-RD-E.GPJ GAL-MIS.GDT 8/7/18

| DEPTH SCALE<br>METRES | BORING METHOD                                | SOIL PROFILE                                                                                                                                                                               |             | SAMPLES               |        | HEADSPACE COMBUSTIBLE<br>VAPOUR CONCENTRATIONS [PPM] ⊕ |            |                                                    |     | HYDRAULIC CONDUCTIVITY,<br>k, cm/s |     |                       |  | ADDITIONAL<br>LAB. TESTING | PIEZOMETER<br>OR<br>STANDPIPE<br>INSTALLATION |    |    |
|-----------------------|----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-----------------------|--------|--------------------------------------------------------|------------|----------------------------------------------------|-----|------------------------------------|-----|-----------------------|--|----------------------------|-----------------------------------------------|----|----|
|                       |                                              | DESCRIPTION                                                                                                                                                                                | STRATA PLOT | ELEV.<br>DEPTH<br>(m) | NUMBER | TYPE                                                   | BLOWS/0.3m | HEADSPACE ORGANIC VAPOUR<br>CONCENTRATIONS [PPM] □ |     |                                    |     | WATER CONTENT PERCENT |  |                            |                                               |    |    |
|                       |                                              |                                                                                                                                                                                            |             |                       |        |                                                        |            | ND = Not Detected                                  |     |                                    |     | Wp — W — Wl           |  |                            |                                               |    |    |
|                       |                                              |                                                                                                                                                                                            |             |                       |        |                                                        |            | 100                                                | 200 | 300                                | 400 |                       |  | 10                         | 20                                            | 30 | 40 |
| 0                     |                                              | GROUND SURFACE                                                                                                                                                                             |             | 187.58                |        |                                                        |            |                                                    |     |                                    |     |                       |  |                            |                                               |    |    |
|                       | Power Auger<br>153 mm O.D. Solid Stem Augers | FILL - (SM-GP) SILTY SAND and GRAVEL; brown; non-cohesive, moist, compact                                                                                                                  |             | 0.00                  | 1A     | SS                                                     | 20         | 6                                                  | ND  |                                    |     |                       |  |                            |                                               |    |    |
|                       |                                              |                                                                                                                                                                                            |             | 187.07                | 1B     |                                                        |            |                                                    |     |                                    |     |                       |  |                            |                                               |    |    |
|                       |                                              | FILL - (CL) SILTY CLAY, some sand, trace gravel; brown to grey; cohesive, w<PL, firm                                                                                                       | 0.51        | 2                     | SS     | 8                                                      | 6          | ND                                                 |     |                                    |     |                       |  |                            |                                               |    |    |
| 1                     |                                              |                                                                                                                                                                                            |             |                       |        |                                                        |            |                                                    |     |                                    |     |                       |  |                            |                                               |    |    |
|                       |                                              | (CL) SILTY CLAY, trace to some sand, trace to some gravel, trace shale fragments; brown to grey (TILL); cohesive, w<PL, very stiff to hard                                                 | 1.45        | 3                     | SS     | 23                                                     | 6          | ND                                                 |     |                                    |     |                       |  |                            |                                               |    |    |
| 2                     |                                              |                                                                                                                                                                                            |             |                       |        |                                                        |            |                                                    |     |                                    |     |                       |  |                            |                                               |    |    |
|                       |                                              |                                                                                                                                                                                            |             |                       |        | 4                                                      | SS         | 74                                                 | 6   | ND                                 |     |                       |  |                            |                                               |    |    |
| 3                     |                                              |                                                                                                                                                                                            |             |                       |        |                                                        |            |                                                    |     |                                    |     |                       |  |                            |                                               |    |    |
|                       |                                              |                                                                                                                                                                                            |             |                       | 5      | SS                                                     | 64         | 6                                                  | ND  |                                    |     |                       |  |                            |                                               |    |    |
| 4                     |                                              |                                                                                                                                                                                            |             |                       |        |                                                        |            |                                                    |     |                                    |     |                       |  |                            |                                               |    |    |
|                       |                                              |                                                                                                                                                                                            |             |                       | 6      | SS                                                     | 58         | 6                                                  | ND  |                                    |     |                       |  |                            |                                               |    |    |
| 5                     |                                              |                                                                                                                                                                                            |             |                       |        |                                                        |            |                                                    |     |                                    |     |                       |  |                            |                                               |    |    |
|                       |                                              |                                                                                                                                                                                            |             |                       | 7      | SS                                                     | 24         | 6                                                  | ND  |                                    |     |                       |  |                            |                                               |    |    |
| 6                     |                                              |                                                                                                                                                                                            |             |                       |        |                                                        |            |                                                    |     |                                    |     |                       |  |                            |                                               |    |    |
| 7                     |                                              | END OF BOREHOLE                                                                                                                                                                            |             | 180.87                |        |                                                        |            |                                                    |     |                                    |     |                       |  |                            |                                               |    |    |
|                       |                                              |                                                                                                                                                                                            |             | 6.71                  |        |                                                        |            |                                                    |     |                                    |     |                       |  |                            |                                               |    |    |
| 8                     |                                              | NOTES:<br><br>1. Borehole dry upon completion of drilling.<br><br>2. Groundwater level measured in monitoring well at a depth of 3.6 m below ground surface (Elev. 184.0 m) on July 24/18. |             |                       |        |                                                        |            |                                                    |     |                                    |     |                       |  |                            |                                               |    |    |
| 9                     |                                              |                                                                                                                                                                                            |             |                       |        |                                                        |            |                                                    |     |                                    |     |                       |  |                            |                                               |    |    |
| 10                    |                                              |                                                                                                                                                                                            |             |                       |        |                                                        |            |                                                    |     |                                    |     |                       |  |                            |                                               |    |    |

DEPTH SCALE

1 : 50



GOLDER

LOGGED: CL

CHECKED: EM

PROJECT: 1792964

## RECORD OF BOREHOLE: BH18-09

SHEET 1 OF 1

LOCATION: See Figure 1

BORING DATE: June 21, 2018

DATUM: Geodetic

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

GTA-BHS 001 S:\CLIENTS\KLM PLANNING PARTNERS\ON OAKVILLE 40.64 86 BURNHAMTHORPE RD E102 DATA\GINT\BURNHAMTHORPE-RD-E.GPJ GAL-MIS.GDT 8/7/18

| DEPTH SCALE<br>METRES | BORING METHOD | SOIL PROFILE                                                                                                                                                           |             | SAMPLES               |        | HEADSPACE COMBUSTIBLE<br>VAPOUR CONCENTRATIONS [PPM] ⊕ |            |                                                    |     | HYDRAULIC CONDUCTIVITY,<br>k, cm/s |     |                       |                  | ADDITIONAL<br>LAB. TESTING | PIEZOMETER<br>OR<br>STANDPIPE<br>INSTALLATION |  |  |
|-----------------------|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-----------------------|--------|--------------------------------------------------------|------------|----------------------------------------------------|-----|------------------------------------|-----|-----------------------|------------------|----------------------------|-----------------------------------------------|--|--|
|                       |               | DESCRIPTION                                                                                                                                                            | STRATA PLOT | ELEV.<br>DEPTH<br>(m) | NUMBER | TYPE                                                   | BLOWS/0.3m | HEADSPACE ORGANIC VAPOUR<br>CONCENTRATIONS [PPM] □ |     |                                    |     | WATER CONTENT PERCENT |                  |                            |                                               |  |  |
|                       |               |                                                                                                                                                                        |             |                       |        |                                                        |            | ND = Not Detected                                  |     |                                    |     | Wp — W — Wl           |                  |                            |                                               |  |  |
|                       |               |                                                                                                                                                                        |             |                       |        |                                                        |            | 100                                                | 200 | 300                                | 400 | 10 <sup>-6</sup>      | 10 <sup>-5</sup> | 10 <sup>-4</sup>           | 10 <sup>-3</sup>                              |  |  |
|                       |               |                                                                                                                                                                        |             |                       |        |                                                        |            | 100                                                | 200 | 300                                | 400 | 10                    | 20               | 30                         | 40                                            |  |  |
| 0                     |               | GROUND SURFACE                                                                                                                                                         |             | 189.15                |        |                                                        |            |                                                    |     |                                    |     |                       |                  |                            |                                               |  |  |
|                       |               | TOPSOIL (180 mm)                                                                                                                                                       |             | 0.00<br>188.97        | 1A     |                                                        |            |                                                    |     |                                    |     |                       |                  |                            |                                               |  |  |
|                       |               | (CL) SILTY CLAY, trace to some sand,<br>trace to some gravel, some shale<br>fragments; mottled brown and grey<br>(TILL); cohesive, w<PL to w~PL, very<br>stiff to hard |             | 0.18                  | 1B     | SS                                                     | 22         | ND                                                 |     |                                    |     |                       |                  |                            |                                               |  |  |
|                       |               |                                                                                                                                                                        |             | 2                     | SS     | 20                                                     | ND         |                                                    |     |                                    |     |                       |                  |                            |                                               |  |  |
| 1                     |               |                                                                                                                                                                        |             |                       |        | 3                                                      | SS         | 28                                                 | ND  |                                    |     |                       |                  |                            |                                               |  |  |
|                       |               |                                                                                                                                                                        |             |                       |        | 4                                                      | SS         | 28                                                 | ND  |                                    |     |                       |                  |                            |                                               |  |  |
| 2                     |               |                                                                                                                                                                        |             |                       |        | 5                                                      | SS         | 35                                                 | ND  |                                    |     |                       |                  |                            |                                               |  |  |
|                       |               |                                                                                                                                                                        |             |                       |        | 6                                                      | SS         | 18                                                 | ND  |                                    |     |                       |                  |                            |                                               |  |  |
|                       |               |                                                                                                                                                                        |             |                       |        | 7                                                      | SS         | 18                                                 | ND  |                                    |     |                       |                  |                            |                                               |  |  |
|                       |               | END OF BOREHOLE                                                                                                                                                        |             | 182.44<br>6.71        |        |                                                        |            |                                                    |     |                                    |     |                       |                  |                            |                                               |  |  |
| 7                     |               | NOTES:                                                                                                                                                                 |             |                       |        |                                                        |            |                                                    |     |                                    |     |                       |                  |                            |                                               |  |  |
|                       |               | 1. Borehole dry upon completion of<br>drilling.                                                                                                                        |             |                       |        |                                                        |            |                                                    |     |                                    |     |                       |                  |                            |                                               |  |  |
|                       |               | 2. Water level measured in<br>monitoring well at a depth of 4.9 m<br>below ground surface (Elev. 184.3 m) on<br>July 24/18.                                            |             |                       |        |                                                        |            |                                                    |     |                                    |     |                       |                  |                            |                                               |  |  |
| 8                     |               |                                                                                                                                                                        |             |                       |        |                                                        |            |                                                    |     |                                    |     |                       |                  |                            |                                               |  |  |
| 9                     |               |                                                                                                                                                                        |             |                       |        |                                                        |            |                                                    |     |                                    |     |                       |                  |                            |                                               |  |  |
| 10                    |               |                                                                                                                                                                        |             |                       |        |                                                        |            |                                                    |     |                                    |     |                       |                  |                            |                                               |  |  |

DEPTH SCALE

1 : 50



GOLDER

LOGGED: CL

CHECKED: EM

PROJECT: 1792964

## RECORD OF BOREHOLE: BH18-10

SHEET 1 OF 1

LOCATION: See Figure 1

BORING DATE: June 22, 2018

DATUM: Geodetic

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

GTA-BHS 001 S:\CLIENTS\KLM PLANNING PARTNERS\ON OAKVILLE 40.64 86 BURNHAMTHORPE RD E102 DATA\GINT\BURNHAMTHORPE-RD-E.GPJ GAL-MIS.GDT 8/7/18

| DEPTH SCALE<br>METRES | BORING METHOD | SOIL PROFILE                                                                                                                                                                                 |             |                       | SAMPLES |      |            | HEADSPACE COMBUSTIBLE<br>VAPOUR CONCENTRATIONS [PPM] ⊕ |     |     |     | HYDRAULIC CONDUCTIVITY,<br>k, cm/s |    |    |    | ADDITIONAL<br>LAB. TESTING | PIEZOMETER<br>OR<br>STANDPIPE<br>INSTALLATION |
|-----------------------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-----------------------|---------|------|------------|--------------------------------------------------------|-----|-----|-----|------------------------------------|----|----|----|----------------------------|-----------------------------------------------|
|                       |               | DESCRIPTION                                                                                                                                                                                  | STRATA PLOT | ELEV.<br>DEPTH<br>(m) | NUMBER  | TYPE | BLOWS/0.3m | HEADSPACE ORGANIC VAPOUR<br>CONCENTRATIONS [PPM] □     |     |     |     | WATER CONTENT PERCENT              |    |    |    |                            |                                               |
|                       |               |                                                                                                                                                                                              |             |                       |         |      |            | ND = Not Detected                                      |     |     |     | Wp — W — WI                        |    |    |    |                            |                                               |
|                       |               |                                                                                                                                                                                              |             |                       |         |      |            | 100                                                    | 200 | 300 | 400 | 10                                 | 20 | 30 | 40 |                            |                                               |
| 0                     |               | GROUND SURFACE                                                                                                                                                                               |             | 189.28                |         |      |            |                                                        |     |     |     |                                    |    |    |    |                            |                                               |
|                       |               | TOPSOIL (280 mm)                                                                                                                                                                             |             | 0.00                  |         |      |            |                                                        |     |     |     |                                    |    |    |    |                            |                                               |
|                       |               | (CL) SILTY CLAY, trace to some sand,<br>trace to some gravel, some shale and<br>limestone fragments; brown to mottled<br>brown to grey (TILL); cohesive, w<PL to<br>w~PL, very stiff to hard |             | 189.00                | 1       | SS   | 9          |                                                        |     |     |     |                                    |    |    |    |                            |                                               |
|                       |               |                                                                                                                                                                                              |             | 0.28                  |         |      |            |                                                        |     |     |     |                                    |    |    |    |                            |                                               |
| 1                     |               |                                                                                                                                                                                              |             |                       | 2       | SS   | 24         | ND                                                     |     |     |     |                                    |    |    |    |                            |                                               |
|                       |               |                                                                                                                                                                                              |             |                       |         |      |            |                                                        |     |     |     |                                    |    |    |    |                            |                                               |
|                       |               |                                                                                                                                                                                              |             |                       | 3       | SS   | 49         | ND                                                     |     |     |     |                                    |    |    |    |                            |                                               |
| 2                     |               |                                                                                                                                                                                              |             |                       |         |      |            |                                                        |     |     |     |                                    |    |    |    |                            |                                               |
|                       |               |                                                                                                                                                                                              |             |                       | 4       | SS   | 31         | ND                                                     |     |     |     |                                    |    |    |    |                            |                                               |
|                       |               |                                                                                                                                                                                              |             |                       |         |      |            |                                                        |     |     |     |                                    |    |    |    |                            |                                               |
| 3                     |               |                                                                                                                                                                                              |             |                       | 5       | SS   | 51         | ND                                                     |     |     |     |                                    |    |    |    |                            |                                               |
|                       |               |                                                                                                                                                                                              |             |                       |         |      |            |                                                        |     |     |     |                                    |    |    |    |                            |                                               |
| 4                     |               |                                                                                                                                                                                              |             |                       |         |      |            |                                                        |     |     |     |                                    |    |    |    |                            |                                               |
|                       |               |                                                                                                                                                                                              |             |                       | 6       | SS   | 18         | ND                                                     |     |     |     |                                    |    |    |    |                            |                                               |
| 5                     |               |                                                                                                                                                                                              |             |                       |         |      |            |                                                        |     |     |     |                                    |    |    |    |                            |                                               |
|                       |               |                                                                                                                                                                                              |             |                       |         |      |            |                                                        |     |     |     |                                    |    |    |    |                            |                                               |
| 6                     |               |                                                                                                                                                                                              |             |                       |         |      |            |                                                        |     |     |     |                                    |    |    |    |                            |                                               |
|                       |               |                                                                                                                                                                                              |             |                       | 7       | SS   | 17         | ND                                                     |     |     |     |                                    |    |    |    |                            |                                               |
|                       |               |                                                                                                                                                                                              |             |                       |         |      |            |                                                        |     |     |     |                                    |    |    |    |                            |                                               |
| 7                     |               | END OF BOREHOLE                                                                                                                                                                              |             | 182.57                |         |      |            |                                                        |     |     |     |                                    |    |    |    |                            |                                               |
|                       |               | NOTE:<br><br>1. Borehole dry upon completion of<br>drilling.                                                                                                                                 |             | 6.71                  |         |      |            |                                                        |     |     |     |                                    |    |    |    |                            |                                               |
| 8                     |               |                                                                                                                                                                                              |             |                       |         |      |            |                                                        |     |     |     |                                    |    |    |    |                            |                                               |
|                       |               |                                                                                                                                                                                              |             |                       |         |      |            |                                                        |     |     |     |                                    |    |    |    |                            |                                               |
| 9                     |               |                                                                                                                                                                                              |             |                       |         |      |            |                                                        |     |     |     |                                    |    |    |    |                            |                                               |
|                       |               |                                                                                                                                                                                              |             |                       |         |      |            |                                                        |     |     |     |                                    |    |    |    |                            |                                               |
| 10                    |               |                                                                                                                                                                                              |             |                       |         |      |            |                                                        |     |     |     |                                    |    |    |    |                            |                                               |

DEPTH SCALE

1 : 50



GOLDER

LOGGED: CL

CHECKED: EM

PROJECT: 1792964

## RECORD OF BOREHOLE: BH18-11

SHEET 1 OF 1

LOCATION: See Figure 1

BORING DATE: June 21, 2018

DATUM: Geodetic

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

| DEPTH SCALE<br>METRES | BORING METHOD                                | SOIL PROFILE                                                                                                                                                                 |                                                                                    |                        | SAMPLES |      |            | HEADSPACE COMBUSTIBLE<br>VAPOUR CONCENTRATIONS [PPM] ⊕ |     |     |     | HYDRAULIC CONDUCTIVITY,<br>k, cm/s                                  |    |    |    | ADDITIONAL<br>LAB. TESTING | PIEZOMETER<br>OR<br>STANDPIPE<br>INSTALLATION |  |  |
|-----------------------|----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|------------------------|---------|------|------------|--------------------------------------------------------|-----|-----|-----|---------------------------------------------------------------------|----|----|----|----------------------------|-----------------------------------------------|--|--|
|                       |                                              | DESCRIPTION                                                                                                                                                                  | STRATA PLOT                                                                        | ELEV.<br>DEPTH<br>(m)  | NUMBER  | TYPE | BLOWS/0.3m | ND = Not Detected                                      |     |     |     | 10 <sup>-6</sup> 10 <sup>-5</sup> 10 <sup>-4</sup> 10 <sup>-3</sup> |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            | HEADSPACE ORGANIC VAPOUR<br>CONCENTRATIONS [PPM] □     |     |     |     | WATER CONTENT PERCENT                                               |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            | ND = Not Detected                                      |     |     |     | Wp — W — Wi                                                         |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            | 100                                                    | 200 | 300 | 400 | 10                                                                  | 20 | 30 | 40 |                            |                                               |  |  |
| 0                     |                                              | GROUND SURFACE                                                                                                                                                               |                                                                                    | 189.28                 |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       | Power Auger<br>153 mm O.D. Solid Stem Augers | TOPSOIL (200 mm)                                                                                                                                                             |   | 0.00<br>189.08<br>0.20 | 1A      |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              | (CL) SILTY CLAY, trace to some sand,<br>trace to some gravel, some shale<br>fragments; mottled brown to grey (TILL),<br>oxidation staining; cohesive, w<PL, stiff<br>to hard |  |                        | 1B      | SS   | 10         |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
| 1                     |                                              |                                                                                                                                                                              |                                                                                    |                        | 2       | SS   | 23         | 6                                                      |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        | 3       | SS   | 30         | 6                                                      |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
| 2                     |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        | 4       | SS   | 61         | 6                                                      |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        | 5       | SS   | 50         | 6                                                      |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
| 3                     |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
| 4                     |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              | 6                                                                                                                                                                            | SS                                                                                 | 32                     | 6       |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
| 5                     |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
| 6                     |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |
|                       |                                              |                                                                                                                                                                              |                                                                                    |                        |         |      |            |                                                        |     |     |     |                                                                     |    |    |    |                            |                                               |  |  |

DEPTH SCALE

1 : 50



GOLDER

LOGGED: CL

CHECKED: EM

GTA-BHS 001 S:\CLIENTS\KLM PLANNING PARTNERS\ON OAKVILLE 40.64 86 BURNHAMTHORPE RD E102 DATA\GINT\BURNHAMTHORPE-RD-E.GPJ GAL-MIS.GDT 8/7/18





# ***Soil Engineers Ltd.***

CONSULTING ENGINEERS

GEOTECHNICAL • ENVIRONMENTAL • HYDROGEOLOGICAL • BUILDING SCIENCE

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90 WEST BEAVER CREEK ROAD, SUITE 100, RICHMOND HILL, ONTARIO L4B 1E7 · TEL: (416) 754-8515 · FAX: (905) 881-8335

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|                     |                     |                     |                     |                     |                     |
|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| <b>BARRIE</b>       | <b>MISSISSAUGA</b>  | <b>OSHAWA</b>       | <b>NEWMARKET</b>    | <b>MUSKOKA</b>      | <b>HAMILTON</b>     |
| TEL: (705) 721-7863 | TEL: (905) 542-7605 | TEL: (905) 440-2040 | TEL: (905) 853-0647 | TEL: (705) 684-4242 | TEL: (905) 777-7956 |
| FAX: (705) 721-7864 | FAX: (905) 542-2769 | FAX: (905) 725-1315 | FAX: (905) 881-8335 | FAX: (705) 684-8522 | FAX: (905) 542-2769 |

## **APPENDIX 'B'**

### **LABORATORY TEST RESULTS**

**REFERENCE NO. 2304-S100**

**APPENDIX B**

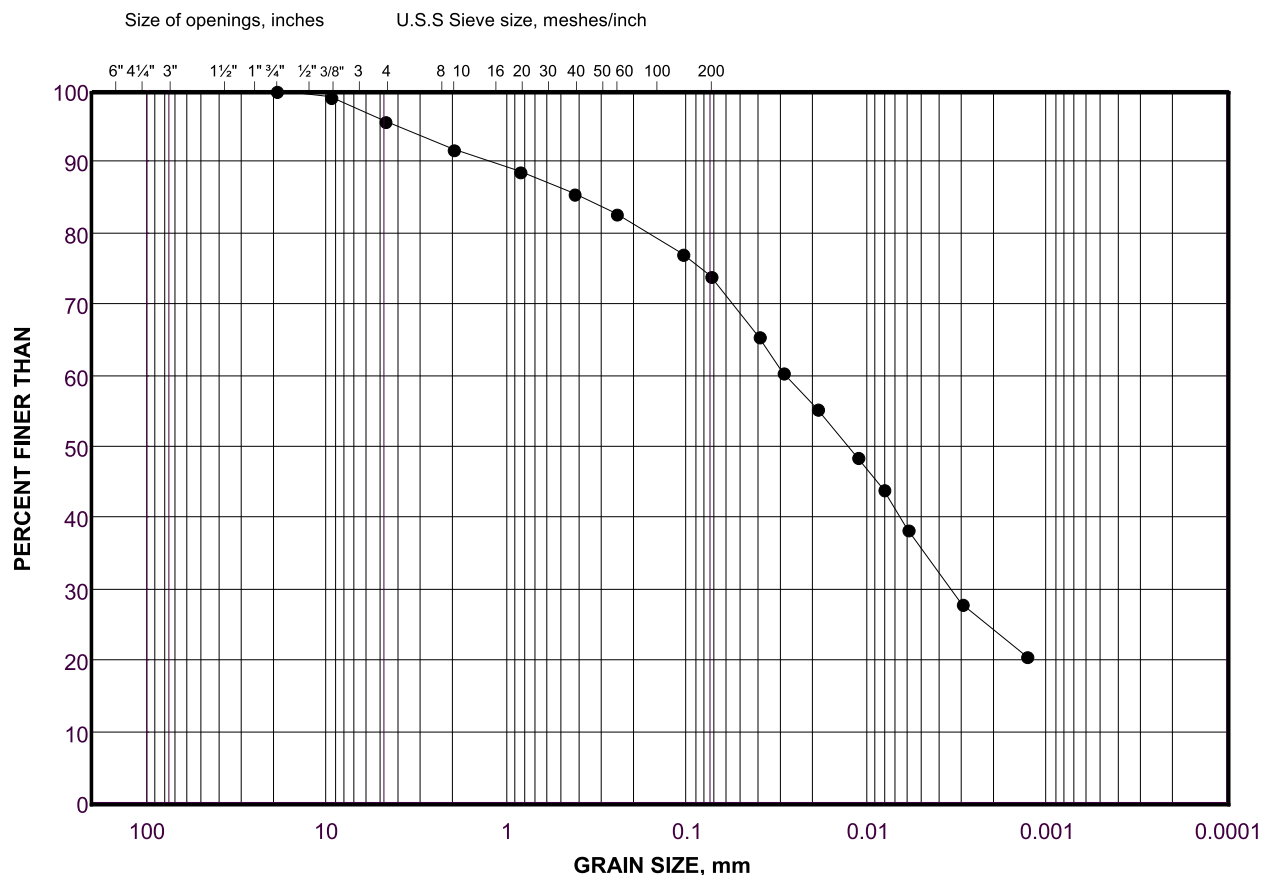
Figure B-1: Grain Size Distribution:  
(CI) SILTY CLAY – TILL

Figure B-2: Plasticity Chart (CI)  
SILTY CLAY - TILL

# GRAIN SIZE DISTRIBUTION

(CL) SILTY CLAY-TILL

FIGURE B-1



| COBBLE<br>SIZE | COARSE      | FINE | COARSE    | MEDIUM | FINE | SILT AND CLAY SIZES |
|----------------|-------------|------|-----------|--------|------|---------------------|
|                | GRAVEL SIZE |      | SAND SIZE |        |      | FINE GRAINED        |

## LEGEND

| SYMBOL | Borehole | SAMPLE | DEPTH(m)    |
|--------|----------|--------|-------------|
| •      | BH18-01  | 3      | 1.52 - 2.13 |

Project Number: 1792964

Checked By: JET

**Golder Associates**

Date: 19-Jul-18





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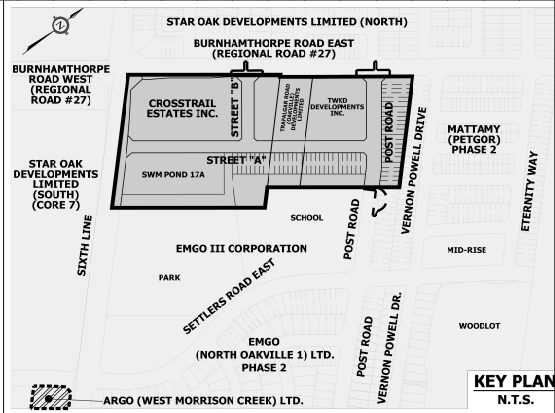
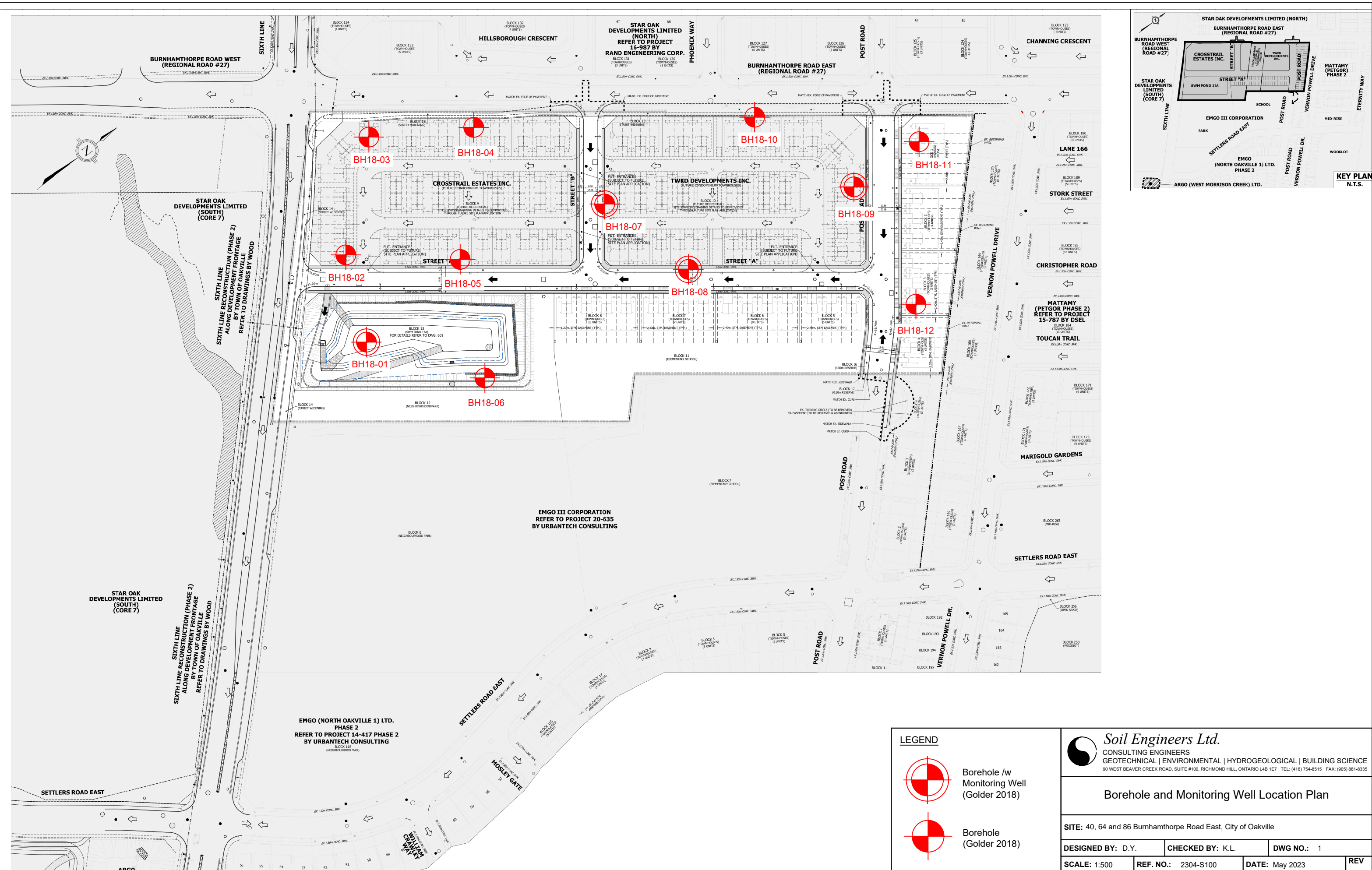
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|                                                             |                                                                  |                                                             |                                                                |                                                              |                                                               |
|-------------------------------------------------------------|------------------------------------------------------------------|-------------------------------------------------------------|----------------------------------------------------------------|--------------------------------------------------------------|---------------------------------------------------------------|
| <b>BARRIE</b><br>TEL: (705) 721-7863<br>FAX: (705) 721-7864 | <b>MISSISSAUGA</b><br>TEL: (905) 542-7605<br>FAX: (905) 542-2769 | <b>OSHAWA</b><br>TEL: (905) 440-2040<br>FAX: (905) 725-1315 | <b>NEWMARKET</b><br>TEL: (905) 853-0647<br>FAX: (905) 881-8335 | <b>MUSKOKA</b><br>TEL: (705) 684-4242<br>FAX: (705) 684-8522 | <b>HAMILTON</b><br>TEL: (905) 777-7956<br>FAX: (905) 542-2769 |
|-------------------------------------------------------------|------------------------------------------------------------------|-------------------------------------------------------------|----------------------------------------------------------------|--------------------------------------------------------------|---------------------------------------------------------------|

## **DRAWINGS**

**BOREHOLE AND MONITORING WELL LOCATION PLAN – DRAWING NO. 1**  
**PERIMETER SUBDRAIN SYSTEM - DRAWING NO. 2**  
**LOCATION OF ANTI-SEEPAGE COLLAR - DRAWING NO. 3**

**REFERENCE NO. 2304-S100**



**LEGEND**

Borehole w/  
Monitoring Well  
(Golder 2018)

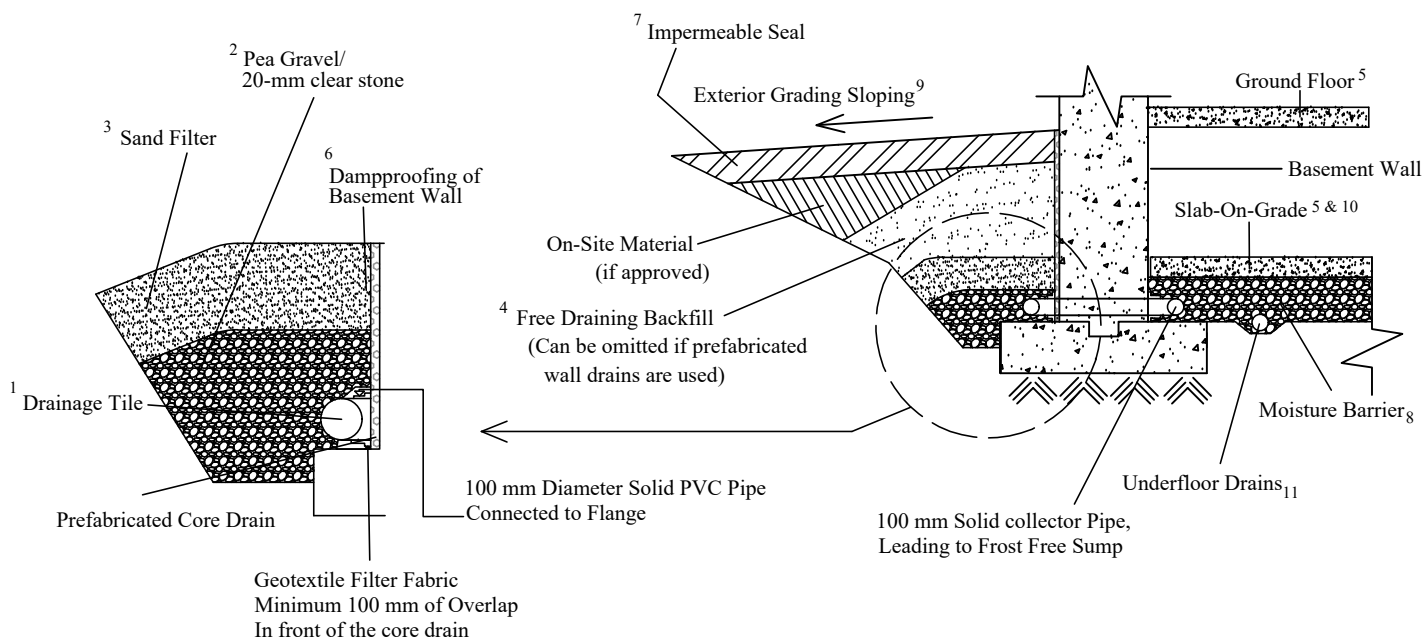
Borehole  
(Golder 2018)

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90 WEST BEAVER CREEK ROAD, SUITE #100, RICHMOND HILL, ONTARIO L4B 1E7 · TEL: (416) 754-8515 · FAX: (905) 881-8335

**Borehole and Monitoring Well Location Plan**

SITE: 40, 64 and 86 Burnhamthorpe Road East, City of Oakville

|                   |                     |                |
|-------------------|---------------------|----------------|
| DESIGNED BY: D.Y. | CHECKED BY: K.L.    | DWG NO.: 1     |
| SCALE: 1:500      | REF. NO.: 2304-S100 | DATE: May 2023 |
|                   |                     | REV            |

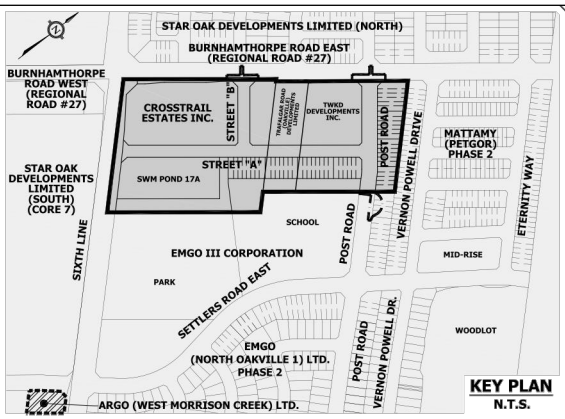
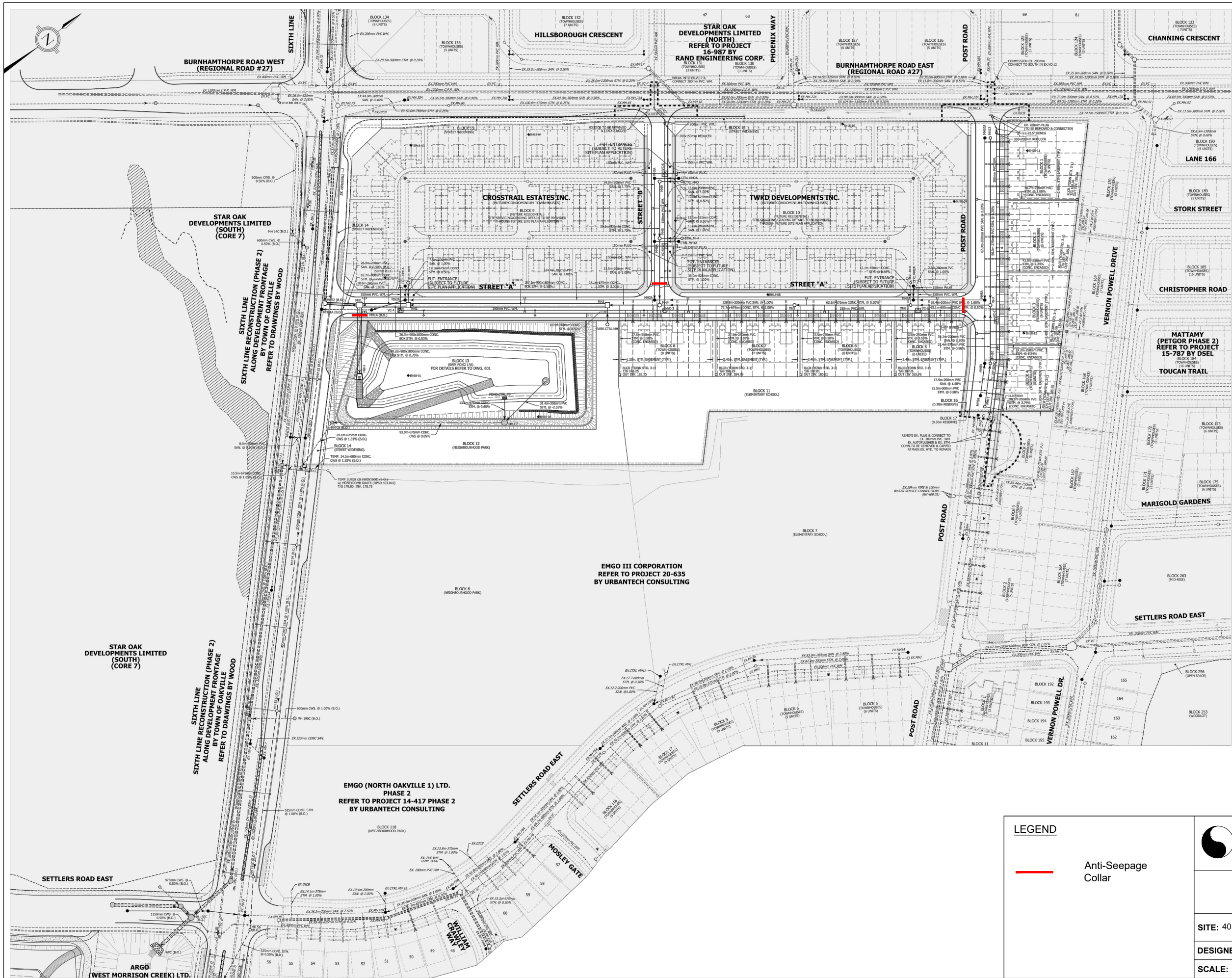


## NOTES:

1. **Drainage tile:** consists of 100 mm (4") diameter weeping tile or equivalent perforated pipe leading to a positive sump or outlet.  
Invert to be at minimum of 150 mm (6") below underside of basement floor slab.
2. **Pea gravel:** at 150 mm (6") on the top and sides of drain. If drain is not placed on concrete footing, provide 100 mm (4") of pea gravel below drain.  
The pea gravel may be replaced by 20 mm clear stone provided that the drain is covered by a porous geotextile membrane of Terrafix 270R or equivalent.
3. **Filter material:** consists of C.S.A. fine concrete aggregate. A minimum of 300 mm (12") on the top and sides of gravel.  
This may be replaced by an approved porous geotextile membrane of Terrafix 270R or equivalent.
4. **Free-draining backfill:** OPSS Granular 'B' or equivalent, compacted to 95% to 98% (maximum) Standard Proctor dry density.  
Do not compact closer than 1.8 m (6') from wall with heavy equipment.  
This may be replaced by on-site material if prefabricated wall drains (Miradrain) extending from the finished grade to the bottom of the basement wall are used.
5. **Do not backfill** until the wall is supported by the basement floor slab and ground floor framing, or adequate bracing.
6. **Dampproofing** of the basement wall is required before backfilling
7. **Impermeable backfill seal** of compacted clay, clayey silt or equivalent. If the original soil in the vicinity is a free-draining sand, the seal may be omitted.
8. **Moisture barrier:** 20-mm clear stone or compacted OPSS Granular 'A', or equivalent. The thickness of this layer should be 150 mm (6") minimum.
9. **Exterior Grade:** slope away from basement wall on all the sides of the building.
10. **Slab-On-Grade** should not be structurally connected to walls or foundations.
11. **Underfloor drains\*** should be placed in parallel rows at 6 to 8 m (20'-25') centre, on 100 mm (4") of pea gravel with 150 mm (6") of pea gravel on top and sides. The invert should be at least 300 mm (12") below the underside of the floor slab.  
The drains should be connected to positive sumps or outlets. Do not connect the underfloor drains to the perimeter drains.

\* Underfloor drains can be deleted where not required.

|                                                                                                                                                                                                                                                                                                                      |                    |               |       |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------------|-------|
|  <b>Soil Engineers Ltd.</b><br>CONSULTING ENGINEERS<br>GEOTECHNICAL   ENVIRONMENTAL   HYDROGEOLOGICAL   BUILDING SCIENCE<br>90 WEST BEAVER CREEK, SUITE 100, RICHMOND HILL, ONTARIO · TEL: (416) 754-8515 · FAX: (416) 754-8516 |                    |               |       |
| <b>PERIMETER SUBDRAIN SYSTEM</b>                                                                                                                                                                                                                                                                                     |                    |               |       |
| SITE 40, 64 AND 86 BURNHAMTHORPE ROAD EAST, CITY OF OAKVILLE                                                                                                                                                                                                                                                         |                    |               |       |
| DESIGNED BY K.L.                                                                                                                                                                                                                                                                                                     | CHECKED BY B.S.    | DWG NO. 2     |       |
| SCALE N.T.S.                                                                                                                                                                                                                                                                                                         | REF. NO. 2304-S100 | DATE MAY 2023 | REV - |



| LEGEND                                                                                |  |  |  |
|---------------------------------------------------------------------------------------|--|--|--|
|  |  |  |  |
| Anti-Seepage Collar                                                                   |  |  |  |

|                                                                                                                                                                                                                                                                                                                                    |                     |                |     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|----------------|-----|
|  <b>Soil Engineers Ltd.</b><br>CONSULTING ENGINEERS<br>GEOTECHNICAL   ENVIRONMENTAL   HYDROGEOLOGICAL   BUILDING SCIENCE<br>90 WEST BEAVER CREEK ROAD, SUITE #100, RICHMOND HILL, ONTARIO L4B 1E7 • TEL: (416) 754-8515 • FAX: (905) 881-8335 |                     |                |     |
| Location of Anti-Seepage Collar                                                                                                                                                                                                                                                                                                    |                     |                |     |
| SITE: 40, 64 and 86 Burnhamthorpe Road East, City of Oakville                                                                                                                                                                                                                                                                      |                     |                |     |
| DESIGNED BY: D.Y.                                                                                                                                                                                                                                                                                                                  | CHECKED BY: K.L.    | DWG NO.: 2     |     |
| SCALE: 1:1250                                                                                                                                                                                                                                                                                                                      | REF. NO.: 2304-S100 | DATE: May 2023 | REV |