RE: GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENTIAL DEVELOPMENT
1335, 1349 AND 1355 PLAINS ROAD EAST
BURLINGTON, ONTARIO

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FOR: 1967012 Ontario Inc.
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ATTENTION: Ms. Amy Chiang

REPORT NO.: 2017-11151

DATE: December 6, 2017

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## 1.0 INTRODUCTION

Sola Engineering Inc. (Sola) was retained by S2S Environmental Inc. (the Client) on behalf of 1967012 Ontario Inc. to carry out a geotechnical investigation and review for the proposed Residential Development located at 1335, 1349 and 1355 Plains Road East in Burlington, Ontario (the "subject site" or "site"). Authorization to proceed with the investigation was received on October 16, 2017 through the acceptance of Sola's Proposal No. 2017-1338RRR.

The Client provide Sola a site plan, Drawing No. A001 and Underground Parking Drawing No. A002, dated July, 26, 2016, prepared by Chamberlain Architect Services Limited.

The Client provide Sola a revised site plan, Drawing No. A001, A001a and A201 dated May 2017, prepared by Chamberlain Architect Services Limited.

It is understood that the Client has carried out an environmental sampling at the subject site in tandem with this geotechnical investigation. As per the scope of services detailed on Sola's Proposal dated October 13, 2017, it is understood that the purpose of this study is to provide recommendations for the design and construction of the proposed residential townhouse development.

This report presents the details of Sola's fieldwork and laboratory testing, outlines the subsoil and groundwater conditions at the subject site, and provides recommendations on the aforementioned items.

This report has been prepared for the Client, and their nominated engineers and designers. Third party use or reproduction, in part or in full, of this report is prohibited without written authorization from Sola. This report is also subject to the Statement of Limitations which forms an integral part of this document.

## 2.0 SITE SETTING

### 2.1 SITE LOCATION

The proposed site is located at 1335, 1349 and 1355 Plains Road East in Burlington, Ontario. Site works will consist of the construction of proposed residential development, which consist of thirty-one (31) back-to-back townhouses, nine (9) traditional townhouses with backyards,

accesses road and associated driveways and common Amenity Area. All three (3) blocks will be three (3) storey with no basement level.

### 2.2 SITE DESCRIPTION

At the time of the fieldwork for this investigation, the site was occupied by several separate lots each containing an existing building, parking lots and driveways. The existing two (2) residential units in the west consist one (1) level underground basement and two (2) commercial units at east have no basement. The subject site is bounded by Helena Street to the North, Glendor Avenue to the East and residential properties to the South and West. The ground surface was generally flat.

## 3.0 GROUND INVESTIGATION

### 3.1 SOIL INVESTIGATION

Prior to undertaking field drilling, Sola obtained the clearance of existing public utility services from Ontario One Call and a private locator was arranged by the Client to clear the existing utility services on private property.

The geotechnical investigation was carried out on October 17, 18 and 19, 2017 and comprised of drilling of total sixteen (16) boreholes. Fifteen (15) boreholes (BH1 through BH15) for geotechnical and environmental purpose and one (1) borehole (BH16) for environmental only. All the boreholes were advanced using a truck mounted CME 75 drilling rig. The borehole locations are as shown in Enclosure 1 prepared by the Client. The boreholes were advanced to a maximum depth of 6.5 m below the ground surface (bgs).

Groundwater monitoring wells were installed in Boreholes BH7, BH8 and BH11 through BH16 as per the Client's instructions. Each monitoring well comprised a 50-mm diameter of PVC pipe including a screen section at the lower end with slots. The base of each monitoring well was covered with a PVC cap to prevent the influx of sediments. The slotted section was embedded in a silica sand enclosure, the upper end of which was sealed with bentonite extending to the ground surface.

The boreholes were advanced using a truck mounted, 115 mm diameter solid stem auger drill rig, equipped for soil sampling. Standard Penetration Tests (SPTs) were conducted at frequent depth intervals according to ASTM D-1586. Representative soil samples were recovered from the split spoon sampler used in the SPTs.

The boreholes were advanced using standard geotechnical drilling procedures starting from the

ground surface. All drilling equipment was supplied and operated by Strong Soil Search Inc. of Claremont, Ontario. The drilling works for the geotechnical investigation were completed under the full-time supervision of a qualified Sola Technician.

The soil samples were identified in the field, properly sealed, labelled and brought to the Sola laboratory.

A Sola technologist, under the direction of a Senior Geotechnical Engineer, supervised the fieldwork. The borehole locations were selected by the Client and concurred by Sola. Boreholes were laid out by Sola field personnel.

### 3.2 GROUNDWATER INVESTIGATION

Groundwater level observations were made during drilling and in the open boreholes upon completion of the drilling operations.

Details pertaining to groundwater observations for each borehole are provided on the respective borehole logs presented in Enclosures 2 through 16. Further discussion on groundwater is provided in **Section 4.2** of this report.

### 3.3 SURVEY

The existing grade elevations at the borehole locations were surveyed and the survey data provided by the Client for the preparation of this report.

### 3.4 GEOTECHNICAL FIELD AND LABORATORY TESTING

Standard Penetration Tests (SPTs) were undertaken at selected intervals with depth using a 50 mm outer diameter and 35 mm inner diameter split barrel sampler driven with an automatic hammer of mass 63.5 kg dropping 760 mm in accordance with the ASTM D 1586-11 test method – "The Standard Method of Standard Penetration Testing (SPT)". The results of these tests (SPT "N" values) are presented on the borehole logs in **Enclosures 2 through 16** of this report.

All soil samples were returned to Sola's laboratory for natural moisture content determination. The results of the moisture content are presented in the borehole logs in **Enclosures 2 through 16**. In addition, two (2) representative soil samples, were subjected to particle size analysis, hydrometer analysis and determination of Atterberg Limits. The results of the laboratory tests are presented in **Enclosures 20 and 21**.

## 4.0 SUBSURFACE CONDITIONS

The detailed descriptions of the sub-soil conditions, encountered at each borehole location, are given in the Borehole Logs in **Enclosures 2 through 16**.

The borehole data collected by Sola represents the subsurface conditions only at the borehole locations. It should be pointed out that the material boundaries indicated on the Borehole Logs are approximate and based on visual observations, and interpolation between successive samples. These boundaries typically represent a transition from one material type to another and should not be regarded as an exact plane of geological change. It should also be noted that the subsurface conditions may vary across the site. A summary of the characteristics of each unit of subsoil encountered within the borehole depths is given in the ensuing paragraphs.

### 4.1 SOIL CHARACTERISATION

#### 4.1.1 Topsoil

A layer of topsoil was initially encountered at boreholes BH9, BH10 and BH15. The thickness of the topsoil layer varied from 150 mm to 300mm. These boreholes were drilled on landscaped area.

It is important to note that topsoil thicknesses may vary throughout the site area, depending upon their location. As such, these findings should not be relied upon for any estimation of quantities to be stripped prior to construction.

#### 4.1.2 Pavement

Initially, a layer of asphalt pavement was encountered in borehole BH1 through BH8 and BH11 through BH14, ranging in thickness from approximately 25 mm (BH5 and BH14) to 100 mm (BH13). Below the asphalt cover, a granular basecourse layer (sand and gravel) was encountered ranging in thickness from approximately 25 mm (BH12) to 560 mm (BH2).

#### 4.1.3 Fill

A layer of fill was encountered below the topsoil layer and pavement structure at all borehole locations. The depth of fill material extended to the depths between approximately 0.76 m (in BH10) to 1.9 m (in BH14) below the existing grade.

The fill material encountered consisted of sandy silt to silty sand to clayey silt trace gravel

and occasionally with trace of organics or rootlets. In-situ resistance testing results ranged from 3 (BH3) to 26 (BH1) blows per 300 mm of spoon penetration, indicating that the fill was loose to moderately compacted.

The natural moisture content of the soil varied from approximately 4.2% (BH10) to 20.6% (BH14) indicating moist to wet conditions.

It is important to note that fill thicknesses may vary throughout the site area, depending upon their locations. As such, these findings should not be relied upon for any estimation of fill quantities to be stripped prior to construction.

### 4.1.4 Native Soil

Native soil varying from cohesive soil to till deposits was encountered below the fill layers at all borehole locations.

#### 4.1.4.1. Cohesive Soils

The cohesive soil layers varying from clayey silt to silty clay was encountered in boreholes BH6, BH7 and BH11. The cohesive soils were observed to be brown.

The N-values for cohesive soils was in the range from 4 (BH6) to 18 (BH7) for 300 mm of penetration, suggesting that the soil is soft to very stiff in consistency.

The natural moisture content of the cohesive soil layers was in the range of approximately 15.3% (BH11) to 17.2% (BH7), indicating a moist condition of the layers.

#### 4.1.4.2. Till Deposits

The till deposits varying from clayey silt till to silty clay till were encountered in all the boreholes. The deposits were observed to be brown in the upper horizon turning grey with depth.

The N-values for till deposits were in the range from 16 (BH12) to more than 50 blows for 300 mm of penetration (multiple boreholes), suggesting that the soil is very stiff to hard in consistency.

The natural moisture content of the deposits was in the range of approximately

3.1% (BH4) to 18.6% (BH15), indicating moist to wet conditions of the layers.

All the boreholes were terminated in the till stratum.

## 4.2 GROUNDWATER CONDITIONS

The boreholes were advanced using a dry auguring system. No seepage water accumulation was found in the boreholes advanced except borehole BH14, where some seepage water was observed during the completion of drilling.

Eight (8) groundwater monitoring wells were installed on October 17, 18 and 19, 2017, in Boreholes BH8, BH9 and BH11 through BH16 to monitor the "stabilized" water levels by the Client. All the water level records including the calculated water level elevations are summarized in **Table 1** below.

**Table 1: Summary of Groundwater Levels**

| Borehole | Cave Depth (m) | Geodetic Elevation at Top of Boreholes | Geodetic Elevation for Groundwater Table |
|---|---|---|---|
| BH1 | N/A | 99.25 | Not a monitoring well |
| BH2 | N/A | 99.26 | Not a monitoring well |
| BH3 | N/A | 99.23 | Not a monitoring well |
| BH4 | N/A | 99.24 | Not a monitoring well |
| BH5 | N/A | 99.23 | Not a monitoring well |
| BH6 | N/A | 98.78 | Not a monitoring well |
| BH7 | N/A | 99.52 | Dry |
| BH8 | N/A | 99.49 | Dry |
| BH9 | N/A | 99.38 | Not a monitoring well |
| BH10 | N/A | 99.25 | Not a monitoring well |
| BH11 | N/A | 99.36 | Dry |
| BH12 | N/A | 99.33 | 95.51 |
| BH13 | N/A | 99.35 | Dry |
| BH14 | 4.26 | 99.39 | 97.818 |
| BH15 | N/A | 99.37 | Dry |
| BH16 | N/A | 99.38 | 95.872 |

It should be noted that water levels can vary in response to seasonal fluctuations and major weather. In addition, a perched water condition can occur due to the accumulation of surface water in the more pervious fill overlying less pervious deposits, especially during seasonally wetter periods.

Based on the above data and the examination of soil samples in the laboratory, in Sola's opinion, the water found in the boreholes may be perched water.

**It is recommended that the Client should conduct the hydrogeology investigation.**

Once construction commences, the monitoring wells should be decommissioned properly in accordance with prevailing regulations.

## 5.0 DISCUSSIONS AND RECOMMENDATIONS

It is understood that the existing several structures with unground basement and without basement level will be demolished. The site re-grading may be necessary depending on the design finished grade elevation. The engineered filling may be carried out as per the *"Methodology of Engineered Fill Construction"* presented in **Section 5.8**.

The subject site will be re-developed as proposed residential development, which consist of thirty-one (31) back-to-back townhouses, nine (9) traditional townhouses with backyards, accesses road and associated driveways and a common Amenity Area. All three (3) blocks will be three (3) storey without underground basement level, our recommendations are presented in the following sections.

The investigation and comments should be considered on-going as new information of the underground conditions will continue to become available. For example, when more specific information is available with respect to conditions between boreholes when foundation construction is underway. The interpretation between boreholes and the recommendations of this report must be checked through field inspections carried out by a Geotechnical Engineer to validate the information for use during construction.

### 5.1 FROST PROTECTION

In Greater Toronto Areas, all footings exposed to seasonal freezing conditions must be buried at a minimum depth of 1.2 m below the ground surface for frost protection.

Where construction is undertaken during winter conditions, footing subgrades should be protected from freezing. Foundation walls and columns should be protected against heave due to soil adfreeze.

## 5.2 FOOTINGS

### 5.2.1 Conventional Spread or Strip Footings

At the time of preparation of this report, design loading requirements have not been made available. The following discussions are provided to assist advancing the design phase of the new townhouses development. Based on our understanding, the footings may be positioned at undisturbed native or engineered fill at a depth of approximately 1.2 m to 2.3 m below the existing grade is capable of supporting the foundations for the proposed residential development conventional spread or strip footings

The footings on undisturbed native soil can be designed based on a geotechnical reaction at Serviceability Limit States (SLS) of 150 kPa, and a factored geotechnical resistance at Ultimate Limit States (ULS) of 225 kPa at the depths outlined in **Table 2.**

**Table 2: Recommended Footing Depths and Soil Bearing Pressures**

| Borehole | Recommended Depth Below Existing Grade (m) | Bearing Capacities | |
|---|---|---|---|
| | | Serviceability Limit State (SLS) | Factored Ultimate Limit State (ULS) |
| BH1 | 1.5 | 150 | 225 |
| BH2 | 2.3 | 150 | 225 |
| BH3 | 1.5 | 150 | 225 |
| BH4 | 1.5 | 150 | 225 |
| BH5 | 1.2 | 150 | 225 |
| BH6 | 2.3 | 150 | 225 |
| BH7 | 1.8 | 150 | 225 |
| BH8 | 1.5 | 150 | 225 |
| BH9 | 1.8 | 150 | 225 |
| BH10 | 1.4 | 150 | 225 |
| BH11 | 1.5 | 150 | 225 |
| BH12 | 1.5 | 150 | 225 |
| BH13 | 1.5 | 150 | 225 |
| BH14 | 2.0 | 150 | 225 |
| BH15 | 1.5 | 150 | 225 |

Where it is necessary to place footings on soil at different levels, the upper footing must be founded below an imaginary 10 horizontal to 7 vertical line (10H:7V) drawn up from

the base of the lower footing. The lower footing must be installed first to help minimize the risk of undermining the upper footing.

The above design values are provided on the assumption that the allowable bearing pressure at SLS is governed by total and differential settlements of 25 and 19 mm respectively, and the structure will tolerate an angular distortion of 1 in 300.

Prior to pouring the concrete footings, the founding subgrade should be inspected by a Geotechnical Engineer.

### 5.2.2 Footings on Engineered Fill

The footings supported by the engineered fill, constructed in accordance with the methodology given in **section 6.8**, should be placed at a minimum depth of 300 mm below the finished engineered fill top elevation. These footings may be designed using an allowable soil bearing pressure of 150 kPa (SLS) and 230 kPa (ULS), provided the footings are constructed at an engineered fill age of at least 6 months. For footings constructed less than 6 months waiting periods, the Client is advised to consult Sola for the appropriate allowable soil bearing pressure(s).

The exterior footings on engineered fill should be provided a frost cover of 1.2 m of soil.

Footings and foundation walls supported by the engineered fill should be adequately reinforced by the Project Structural Engineer to minimize the potential of differential settlements.

## 5.3 Slab-On-Grade And Permanent Drainage

The subgrade preparation constructed as described in Section 6.10.1 would be capable of supporting the slab-on-grade of the proposed development. A granular layer consisting of at least 200 mm of 19 mm Crusher Run Limestone (CRL) or OPSS Granular A should be installed under the floor slab as a bedding layer. The CRL or the OPSS Granular A should be compacted to 100% of its SPMDD.

Such a layer has been proven to be an effective moisture barrier for conventional floor surfaces. However, if special floor coverings such as sheet P.V.C. with heat sealed seams, are considered, either a high efficiency vapour barrier or venting may be added to the granular layer to prevent moisture accumulating between the concrete floor and the P.V.C. flooring. The design of the concrete slabs may be made on the basis of a value of modulus of subgrade

reaction of 20 MPa/m on the surface of the granular base.

Slabs should be constructed separately from any load bearing structural elements.

## 5.4 VIBRATION MONITORING

The use of vibratory equipment shall be subject to vibratory monitoring and in accordance with the City Bylaws. In some cases, even when the vibration levels are within acceptable limits, it may cause annoyance to the neighbors who may complain to the City, and in turn, the City may not allow the Contractor to use vibratory equipment, especially vibro hammers. In such cases, the Contractor should be prepared to provide alternatives in lieu of vibratory equipment.

## 5.5 EARTHQUAKE CONSIDERATIONS

Based on the borehole information, for the proposed buildings supported on undisturbed native deposits, the subject site is classified as "Site Class 'D"' for seismic site response according to **Table 4.1.8.4.A** of **Ontario Building Code (OBC)**.

## 5.6 TEMPORARY SHORING CONSIDERATIONS

Where site space, construction sequence, or surface loading conditions (e.g. traffic) restrict the above-mentioned side slope configurations, the excavation side slope should be appropriately shored to support surface loading during construction.

Where permissible under the "*Occupational Health and Safety Act*"(OHSA), the preferred temporary trench support is generally in the form of trench boxes. Consideration should be given to the time taken between completing the excavation section and installing the trench boxes, as trench boxes need to be installed quickly and efficiently. When a trench box is to be moved, the void space between the outer walls of the trench box and the trench has to be backfilled and compacted, which may require the trench box to be raised sequentially prior to sliding it laterally into its new position.

It is also important to ensure that the trench is not over-excavated so that there is a suitably tight fit between the trench box and the excavated trench walls. Post-construction ground settlements may occur along the line of the trench walls, or adjacent to the excavated trench area, if the excavation is not adequately supported throughout the entire service installation procedure.

The earth pressure acting on the trench box bracing may be evaluated using the earth pressure diagram given on **Section 26** of **Canadian Foundation Engineering Manual (CFEM)**, 4th Edition.

## 5.7 EARTH PRESSURES

At the time of writing this report, it is not known if shoring will be required to facilitate the construction of the proposed development. It should be noted however, that, if shoring is required, a specialist shoring contractor should be consulted to establish the most appropriate design and seating depths for the temporary shoring solution.

The shoring system may be designed in accordance with the CFEM. Though not a design code, the CFEM design manual provides a comprehensive guide for shoring and anchor design, and still considered the most widely used and accepted design approach in the Greater Toronto Area (herein "*GTA*").

Shoring subject to unbalanced earth pressures must be designed to resist a pressure distribution that can be calculated as follows:

$$p = K[\gamma (h-h_w) + \gamma' h_w + q] + \gamma_w h_w$$

where: $p$ = Lateral earth pressure in kPa acting at depth h

$K$ = parameters are provided below
$h$ = the depth below the ground surface (m)
$h_w$ = the depth below the ground water level (m)
$\gamma$ = the bulk unit weight of soil, (kN/m$^3$) use 20.0
$\gamma'$ = the submerged unit weight of the exterior soil, ($\gamma$ - 9.8 kN/m$^3$)
$q$ = equivalent value of surcharge on the ground surface in kPa (min 12 kPa)

The above expression can be simplified by eliminating hydrostatic pressure term on the wall when free draining granular backfill is used and the internal drainage system prevents the build-up of any hydrostatic pressure.

Where the backfill against the buried structure can be drained effectively to eliminate hydrostatic pressure on the wall, this equation can be simplified to:

$$p = K[\gamma h + q]$$

## 5.8 ENGINEERED FILL

On-site excavated, clean inorganic earth (native and/or fill) may be reused as engineered fill material, provided the moisture contents are strictly controlled.

If imported inorganic mineral soils are used for engineered fill construction, they must meet the applicable environmental guidelines, and their moisture contents should preferably be close to their respective optimum water content values.

For the on-site excavated clean fill/native soils or similar imported soils, heavy compaction equipment should be employed to achieve the specified degree of field density.
Consideration may be also given to backfilling excavations with a well graded, compacted granular soil such as Granular B as it, if thoroughly compacted, would reduce the post construction settlements to an acceptable level and may also expedite the compaction process.

Fill materials required for replacing locally softened soils, or raising grades within the footprint of the structures are to comprise suitably organic free materials approved for use by the Geotechnical Engineer. Fill materials are to be placed in lifts of a maximum thickness of 300 mm and compacted, using appropriate compaction equipment, to 98 % of its Standard Proctor Maximum Dry Density (SPMDD).

Fill located in areas outside of the footprint of any proposed structure or driveway should be compacted to at least 95 % of the material's SPMDD to within 1.0 m of the subgrade level, and then to 98 % of its SPMDD up to the required grade. Imported granular fill used in confined areas should be compacted using only hand-held compaction equipment only.

Sola recommends that any and all engineered subgrades beneath proposed structures are to be inspected and/or proof rolled prior to construction.

## 5.9 EXCAVATION AND BACKFILL

### 5.9.1 Excavatability

Based on the findings of the investigation, it is considered that excavation of the overburden fill and native soils at the site can be carried out using a conventional backhoe excavator.

### 5.9.2 Excavations

It is assumed that the groundwater, if encountered, will be lowered to 0.5 m below the required excavation depth to effect the construction to be carried out in the 'dry'

condition. It is expected that the 'perched water' can be controlled by conventional 'sump and pump' methodology. If more aggressive dewatering methods are required, a dewatering consultant should be consulted. Given the layout of the proposed development in relation to the site area, it has been assumed that all excavations will be open cut in the 'dry'. In order to enable entry into excavations during the construction process, all excavations must comply with the definitions prescribed by the "Occupational Health and Safety Act"(OHSA), Ontario Regulation 213/91 "Construction Projects".

The various soils that will be encountered at this site during construction are classified, as per OHSA, and presented in **Table 3**.

**Table 3:Soil Types as per Occupational Health & Safety Act (OHSA)**

| Soil Description | Soil Types, According to OHSA |
|---|---|
| Fill | Type 3 |
| Native Soil | Type 2 |

Based on these definitions, excavation walls within these soils will require battering back at slopes no steeper than 1H (horizontal):1V (vertical). Depending on the construction feasibility, the excavation walls can be supported by temporary shoring systems. During excavations, adjacent existing structures must be protected by proper shoring or sloping. This should be verified by the Geotechnical Engineer when large-scale excavation can be observed safely and with ease.

## 5.10 CONSTRUCTION CONSIDERATIONS

### 5.10.1 Site Preparatory Works

The site preparation work should include stripping of the pavement structure, dismantling the existing structures and existing fill in order to develop the required construction or engineered fill subgrades. Stripping depths will likely vary locally and should be adjusted to remove all unsuitable material.

It is recommended that a Geotechnical Engineer monitor the stripping operations to ensure that unsuitable materials have been fully removed prior to construction works or the placement of engineered fill. Unacceptable areas identified are to be remediated as soon as practicable and, the procedures for which would be dependent upon conditions encountered.

Any unsupervised demolished areas must be reworked.

### 5.10.2 General Considerations

Load bearing soils are susceptible to disturbance from environmental (temperature, moisture change, etc.) and construction activity, as such, due care should be given to minimizing trafficking of such areas during periods of excavation and the construction of floor slab and footings to minimize disturbance of the bearing soils.

Any excessive disturbances of the load bearing and underlying soils affected during construction works could influence the long-term settlement of the structures and will therefore require further excavation and replacement of such impacted soils with suitably engineered fill.

A Geotechnical Engineer should evaluate all subgrade surfaces to confirm that the subgrade and founding conditions are consistent with the recommendations given by this report.

## 5.11 SERVICE INSTALLATION

At the time of writing this report, there was no information provided to Sola as to the depths of the services or inverts for the pipes. It is assumed that the preliminary service invert subgrade is to comprise of undisturbed, native soils, which is capable of supporting pipes, manholes, etc.

Further information in regards to the construction consideration can be provided when more design details can be made available.

## 5.12 PAVEMENT

For pavement thickness design, we have made assumptions for the pavement to be constructed over the roof of the basement and/or native ground.

### 5.12.1 Pavement Thickness Design

For pavement structure supported by the structural roof of the basement, the pavement structure (assuming for heavy duty traffic loading) should consist of the following:

- 50 mm HL1
- 200 mm 25 MPa Portland Cement Concrete (5 to 8% air entrainment)

- 150 mm Granular A base (to be compacted to 100% of the material's standard Proctor maximum dry density (SPMDD))
- (Roof Structure by others)

Undisturbed native ground, the existing fill soils (re-compacted as required under Sola's supervision) and new engineered fill (if constructed) can support the proposed access road and driveway pavements. Transitions between different subgrade types must be prepared to include a 3H:1V profile to avoid differential settlement.

It is anticipated that the final subgrade will comprise predominantly on-site re-engineered soils. Accordingly, in view of the frost susceptibility and drainage characteristics of the final subgrade soils and the expected volume of traffic for a residential development, the following pavement designs presented in **Table 4** are recommended.

**Table 4: Recommended Pavement Design (New Construction)**

| Pavement Component | Driveway Thickness (mm) | Compaction Requirements |
|---|---|---|
| Asphaltic Concrete Surface Course (HL-3) | 40 | Minimum of 92.0% of Maximum Relative Density (MRD) |
| Asphaltic Concrete Binder Course (HL-8) | 80 | Minimum of 92.0% of Maximum Relative Density (MRD) |
| Granular Base (20 mm Crusher Run Limestone or OPSS Granular A) | 150 | 100% SPMDD |
| Granular Sub-base (50 mm Crusher Run Limestone or OPSS Granular B-Type 1) | 300 | 100% SPMDD |

The 20 mm Crusher Run Limestone (CRL) shall meet the Ontario Provincial Standard Specification (OPSS) for Granular A. The 50 mm CRL shall meet the OPSS for Granular B "Type I" gradation specification. The granular base and subbase should be compacted to at least 100% of their SPMDD.

The asphaltic concrete courses are to be hot-mixed and hot-laid in accordance with current OPSS specifications, Forms 310 and 1150 (Ontario PGAC grades PG 58-28 equivalency), and compacted to a minimum of 92% of Maximum Relative Density (MRD).

The pavement design as presented above is based on the assumption that construction will be undertaken under dry weather conditions and that the subgrade is stable and not heaving under construction equipment traffic. However, if the construction conditions are non-ideal, with the final subgrade being wet and/or unstable, additional imported subbase material may become necessary.

The pavement make-up for the entrance driveways from city roads should match the respective road pavement design at the road/driveway interface.
Prior to placing the granular subbase, the final subgrade should be proof-rolled to identify soft spots, if any, and rectified as required in consultation with a Geotechnical Engineer from Sola.

The recommended pavement structure should be considered for preliminary design purposes only. A functional design life of eight (8) to ten (10) years has been used to establish the pavement recommendations. This represents the number of years to the first rehabilitation, assuming regular maintenance is carried out. If required, a more refined pavement structure can be designed based on specific traffic data and design life requirements. Such further analysis will also involve specific laboratory tests to determine frost susceptibility and strength characteristics of the subgrade soils, as well as specific traffic loading data input from the Client.

**Pavement Drainage:** The ability of the soils to provide adequate subgrade support is reduced if allowed to become too wet. Therefore, in order to intercept infiltrating water and provide drainage of the subgrade and pavement material, it is recommended that 100 mm diameter sub-drains, wrapped in filter cloth, be provided along both sides of the driveways. Furthermore, the subgrade should be graded to promote flow of water towards the subdrains.

### 5.12.2 Pavement Construction Considerations

For pavement construction, the subgrade must be compacted to at least 98 % of its SPMDD for at least the upper 300 mm unless an alternative is approved by Sola.

The long-term performance of the pavement structure is highly dependent upon the subgrade support conditions. Stringent construction control procedures should be maintained to ensure uniform subgrade moisture and density conditions are achieved.

Additional comments on the construction of pavement areas are as follows:

- The subgrade preparation should include stripping of any objectionable

materials, e.g. loose fill with organics. The base should be properly shaped and thoroughly proof rolled using a loaded truck. Soft and/or unstable subgrade areas should be further sub-excavated and backfilled to the design subgrade level using approved material, placed in thin lifts and compacted to 98% of its SPMDD;

- The locations and extent of sub-drainage required within the paved areas should be reviewed by this office in conjunction with the proposed grading. Assuming that satisfactory crossfalls in the order of 3.0% have been provided, subdrains extending from and between catch basins may be satisfactory. In the event that flatter crossfalls are considered, a more extensive system of sub-drainage may be necessary and should be reviewed by Sola; and,
- The most severe loading conditions on the pavement areas and subgrade may occur during construction. Consequently, special provisions such as restricted access routes, half-loads during paving, etc., may be required, especially if construction is carried out during unfavorable weather.

It is recommended that Sola be retained to review the final pavement structure designs and drainage plans prior to construction to ensure that they are consistent with the recommendations in this report.

## 6.0 CLOSURE

This report is subject to the Statement of Limitations which forms an integral part of this document. The Statement of Limitations is not intended to reduce the level of responsibility accepted by Sola, but rather to ensure that all parties who have been given reliance for this report are aware of the responsibilities each assumes in so doing.

We trust that this report meets your needs. Should you have any queries, please contact the Sola office.

Sincerely
**SOLA ENGINEERING INC.**

Kuljit S. Brar P. Eng.

LICENSED PROFESSIONAL ENGINEER
B. FENG
100050651
Dec 6, 2017
PROVINCE OF ONTARIO

Bill Feng, P. Eng.

\\SERVER02\Company\PROJECTS\10278-(1338RR)-S2S-GEO-Residential-1335 through 1355 Plains Rd E-Burlington-Sep\GEO\08 Draft Reports\2017-11151-10278-S0068-GEO-Final.docx

Enclosures

## STATEMENT OF LIMITATIONS

**Standard of Care and Basis of this Report**
Sola Engineering Inc. ("Sola Engineering") has prepared this report in a manner consistent with generally accepted engineering and/or environmental practices in the jurisdiction in which the specified services were provided. The information and conclusions set out in this report reflects Sola Engineering's best professional judgment in light of the information available to Sola Engineering at the time of preparation. Sola Engineering disclaims any and all warranties, express or implied, including without limitation any warranty of merchantability and/or fitness for a particular purpose, and makes no representations concerning the legal effect, interpretation or significance of this report or the information, conclusions or recommendations contained in it.

The conclusions and recommendations provided in this report have been prepared in relation to the specified site (the "Site") and the proposed project (the "Project"), as described by the Client to Sola Engineering. Given the nature of the work undertaken by Sola Engineering as part of this report, the Client acknowledges that ground conditions may vary over distances and may change over time. Should there arise any changes to the conditions of the Site or the Project (as to purpose or design), Sola Engineering is to be notified within a reasonable period of time, and in any event within 24 hours of the Client's learning of such changes, so as to give Sola Engineering an opportunity to review and revise this report in light of such changes. Sola Engineering accepts no liability or responsibility for any use of this report or reliance on this report following any changes to the conditions of the Site or the Project.

The scope of professional services provided by Sola Engineering for the Project are as set out in this report. Should such services be limited to those of a geotechnical nature, Sola Engineering shall not be held liable or responsible for any environmental services that may be required, nor shall this report be interpreted to reflect any environmental aspects of the Project. Alternatively, should such services be limited to those of an environmental nature, Sola Engineering shall not be held liable or responsible for any geotechnical services that may be required, nor shall this report be interpreted to reflect any geotechnical aspects of the Project.

This report is not intended to provide recommendations for possible future conditions or use of the Site or adjoining properties. Should the need arise for such recommendations Sola Engineering may need to conduct further investigations.

**Use of this Report**
This report is intended to be read and used in its entirety. No reliance may be made upon any individual portion or section of this report without reference to the entire report as a whole. In preparing this report, Sola Engineering has relied on information, instructions and communications given by the Client to Sola Engineering, the applicability, truth and accuracy of which is the sole responsibility of the Client.

This report with the information, sampling data, analysis, conclusions and recommendations contained in it (if any), has been prepared for and may only be used by the Client and only for the specific purpose as specified by the Client to Sola Engineering in connection with the Project. Without prior written consent from Sola Engineering, use of this report or any portion thereof by any person or entity other than the Client, or for any purpose other than as communicated by the Client to Sola Engineering, is strictly prohibited. Sola Engineering accepts no liability or responsibility for the unauthorized use of this report. This report and all documents that form part of it are the sole property of Sola Engineering. Sola Engineering relies on and retains any and all intellectual property rights it has in this report, including any copyright to which it is entitled. The Client shall not give, lend or sell this report, or any portion thereof, to any entity, person or association without the express prior written consent of Sola Engineering. This report and the information contained herein shall be treated as strictly confidential.

The contents of this report, inclusive of Sola Engineering's conclusions and recommendations in relation to the Project, are intended only for the guidance of the Client in carrying out the specified services for the Project, as described by the Client to Sola Engineering. Accordingly, Sola Engineering does not accept any liability or responsibility for any inaccuracy contained in this report arising as a result of or in any way connected with any exclusion, oversight or falsification of the information provided to Sola Engineering by the Client. This report, including the effect of the subsurface conditions as described in this report, is to be interpreted at the risk and discretion of the Client and any contractors or others bidding on or undertaking contractual work to be performed as part of the Project who may come into possession of or learn of this report or its contents. It is exigent that all contractors bidding or undertaking the work are to rely on their own interpretations of the data contained in this report in addition to their own investigations and conclusions. Sola Engineering shall not be held liable or responsible for any interpretation of or conclusions that may be drawn from the data or information contained in this report.

The information, recommendations and conclusions presented in this report are based on Sola Engineering's interpretation of conditions revealed through the limited investigation conducted within a defined scope of services. In no event will Sola Engineering be held responsible or liable to the Client or any other person or entity for any special, indirect, incidental, punitive or consequential loss or damage (including, loss of use, lost profits or expenses incurred) resulting from or in any way related to the independent interpretations, interpolations, conclusions or decisions of the Client or any other person or entity, based on the information contained in this report. The restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.

Notwithstanding the exclusions of liability contained herein but without in any way limiting their effect or generality, if there is found to be any finding of liability or responsibility whatsoever on the part of Sola Engineering which in any way relates to or arises from this report, or the information, conclusions or recommendations contained in it, such liability and/or responsibility shall cease and forever be extinguished from and after the date which is two (2) years from the date of this report. In no event shall any liability or responsibility of Sola Engineering exceed the fees charged by Sola Engineering to the Client for the preparation of this report (excluding any arms' length disbursements or expenditures made or incurred by Sola Engineering as a result thereof and reimbursed by the Client).

**Site Conditions**
The material conditions, classifications, conclusions and recommendations contained in this report were based on the site conditions observed or tested by Sola Engineering or otherwise communicated to Sola Engineering by the Client. The description, identification and classification of soils, rocks, chemical contamination and other materials have been made based on limited investigations, sampling and testing of materials performed by Sola Engineering and its qualified representatives in reliance on the use of relevant or applicable equipment, all in accordance with commonly acceptable standards in the geotechnical and/or environmental disciplines. Accordingly, this report may include assumptions of conditions which are based on discrete sample locations and thus some conditions may not have been detected. The Client accepts all liability and risk for the use of this report and the information and data contained in it. Sola Engineering shall not be held liable or responsible for any conditions beyond the scope of tests conducted on samples of the subsurface and soil conditions of the subject property as set out in this report.

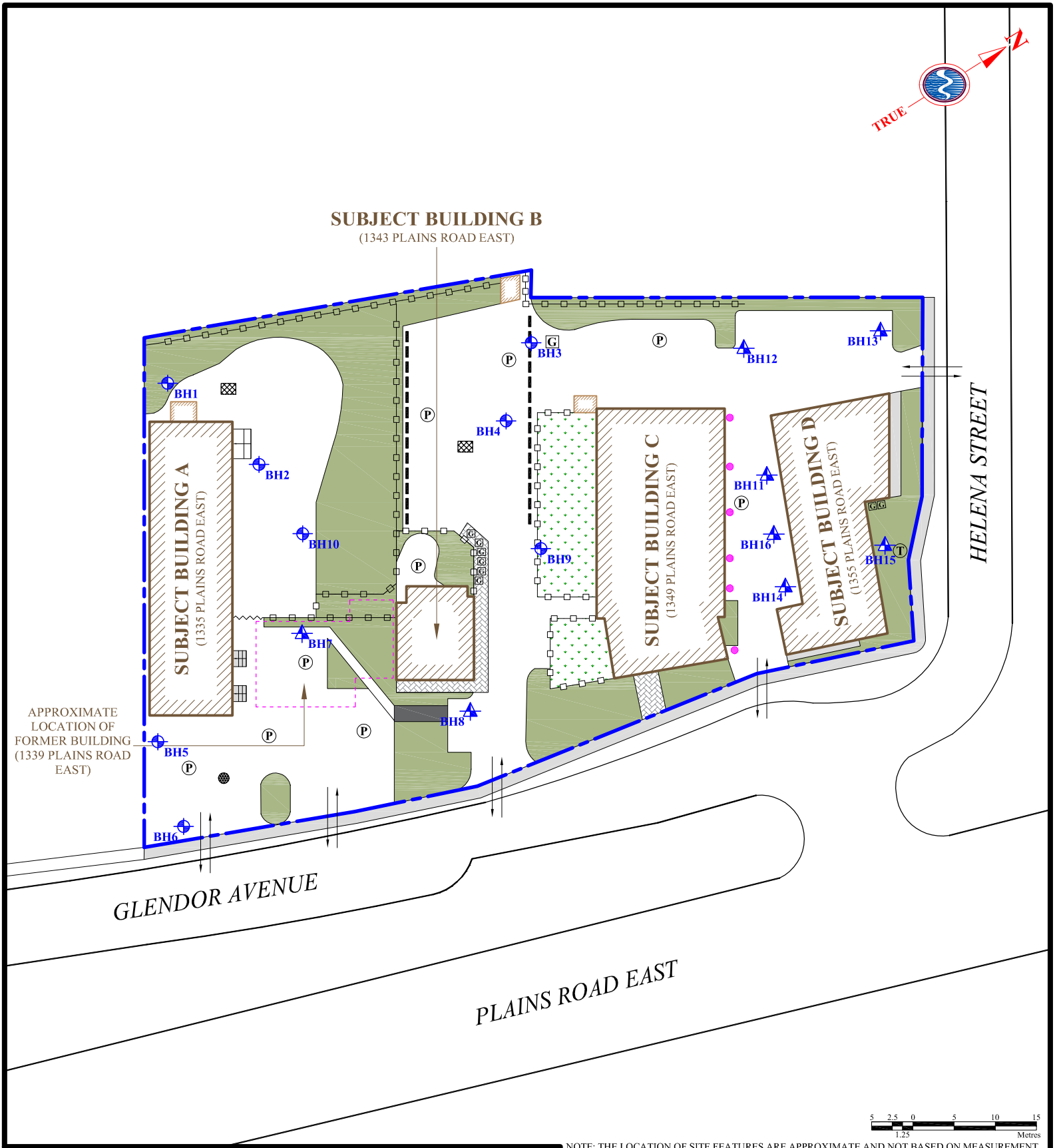
For clarity, the Client acknowledges and accepts that unique risks exist whenever engineering or related disciplines are applied to identify subsurface conditions and even a comprehensive sampling and testing program may fail to detect certain conditions. The environmental, geological, geotechnical, geochemical and hydrogeological conditions that Sola Engineering interprets to exist between sampling points may differ from those that actually exist. As a result, the Client acknowledges and accepts that because of the inherent uncertainties in subsurface evaluations, unanticipated underground conditions may occur or become known subsequent to Sola Engineering's investigation that could affect conclusions, recommendations, total Project cost and/or execution.

**Indemnification of Risk**
Though Sola Engineering adheres to the highest degree of integrity and employs due diligence in limiting the potential release of toxins and hazardous substances, the risk of accidental release of such substances is a possibility when providing geotechnical and environmental services.

In consideration of the provision of services by Sola Engineering, the Client agrees to defend, indemnify and hold Sola Engineering and its employees and agents harmless from and against any and all claims, liabilities, damages, causes of action, judgments, costs or expenses (including reasonable legal fees and disbursements), resulting from or arising by reason of the death or bodily injury to persons, damage to property, or other loss, whether related to an accidental release of pollutants or hazardous substances occurring as a result of carrying out this Project or otherwise, and whether or not resulting from Sola Engineering's negligent actions or omissions. This indemnification shall include and extend to any and all third party claims brought or threatened against Sola Engineering under any federal or provincial law or statute as a result of Sola Engineering conducting work on the Project. In addition to and notwithstanding the foregoing, the Client further agrees to unconditionally and irrevocably release Sola Engineering from, and not to bring any claims against Sola Engineering in connection with, any of the aforementioned claims or causes.

**Subconsultants and Contractor Services**
In conjunction with the services provided by Sola Engineering's own employees, external services provided by other persons or entities that are specializing in services other than those offered by Sola Engineering, such as drilling, excavation and laboratory testing, are often employed in order to carry out the defined scope of work. If such external services have been employed for this Project, the Client acknowledges that Sola Engineering is not in any way liable or responsible for any costs, claims or damages in relation to the services rendered by such other persons or entities or payment therefor, nor shall Sola Engineering be liable or responsible for damages for errors, omissions or negligence caused by such other persons or entities while providing such external services.

**Work and Job Site Safety**
Sola Engineering shall be responsible only for its activities and that of its employees on the Site. Sola Engineering shall not direct any of the fieldwork nor the work of any other person or entity on the Project. The presence of Sola Engineering staff on the Site does not relieve the Client or any contractor on the Site from their responsibilities pertaining to site safety. The Client at all times retains any and all responsibility for the safety of those individuals present on the Site and/or working on the Project, including Sola Engineering's employees.




NOTE: THE LOCATION OF SITE FEATURES ARE APPROXIMATE AND NOT BASED ON MEASUREMENT AND ARE SHOWN FOR ILLUSTRATIVE PURPOSES ONLY.

## LEGEND

- ASSUMED PROPERTY LINE
- SITE ACCESS
- PRE-CAST CONCRETE CAR STOPS
- WOODEN FENCE
- EXTERIOR CONCRETE STAIRS WITH METAL BAR RAILING
- EXTERIOR METAL STAIRS WITH METAL BAR RAILING
- (P) ASPHALT PAVED PARKING AND DRIVEWAY
- CATCH BASIN
- [G] GARBAGE BIN
- MANHOLE
- APPROXIMATE LOCATION OF BOREHOLE
- SUBJECT BUILDING
- SHED
- CONCRETE WALKWAY
- LANDSCAPED AREA
- PLAYGROUND AREA
- INTERLOCKING BRICK
- CONCRETE PAVERS
- CONCRETE BOLLARDS
- APPROXIMATE LOCATION OF BOREHOLE

S2S Environmental Inc.

| SCALE: | |
|---|---|
| AS SHOWN | |

| PROJECT NO: | SITE LOCATION: | DRAWING NO: |
|---|---|---|
| 7072 | 1335-1355 PLAINS ROAD EAST TORONTO, ONTARIO | 1 |

# SITE PLAN SHOWING BOREHOLE/ MONITORING WELL LOCATIONS

| DATE: NOV 03, 2017 | DRAWN BY: YP |
|---|---|

ENCLOSURE 2
PAGE 1 OF 1

# BOREHOLE LOG

## BOREHOLE NO.: 1

SOLA ENGINEERING

**PROJECT NO.:** 10278 **DATE:** October 19, 2017
**PROJECT:** Proposed Residential Development

**CLIENT:** 1967012 Ontario Inc. c/o S2S Environmental Inc.
**LOCATION:** 1335,1349 and 1355 Plains Road East, Burlington, ON
**ELEVATION (M):** 99.25 Geodatic **CAVED AT DEPTH (M):** ----
**WATER LEVEL DEPTH (M):** ---- **DRILLING METHOD:** Solid Stem
**DRILLER:** Strong Soil Inc. **DRILL RIG:** CME 75
**LOGGED BY:** KK **REVIEWED BY:** KB

LEGEND:
- SS - SPLIT SPOON
- AS - AUGER SAMPLE
- ST - SHELBY TUBE
- CS - CORE SAMPLE
- STABILIZED WATER LEVEL
- CAVED AT
- "N" BLOWS / 0.3 M
- M.C. NATURAL MOISTURE CONTENT (%)
- O.V.M ORGANIC VAPOUR MONITOR
- P.L. PLASTIC LIMIT (%)
- L.L. LIQUID LIMIT (%)

| ELEV./ DEPTH (m) | WELL/ PIEZO. DETAIL | SYMBOLS, SAMPLERS TEST DATA | DESCRIPTION | Moisture Content | STANDARD PENETRATION TESTS BLOW COUNTS | STANDARD PENETRATION TESTS "N" VALUE | ELEV./ DEPTH (m) |
|---|---|---|---|---|---|---|---|
| 99 | | 1 | ASPHALTIC CONCRETE - 40 mm<br>Sand and Gravel - 140 mm | 12.8 | 6-7-8-7 | 15 | |
| | | | FILL - silty sand, trace clay, red, moist | 11.6 | | | |
| 98 | | 2 | | 8.4<br>14.4 | 3-10-16-17 | 26 | |
| | | | SILTY CLAY TILL - trace gravel, brown, very stiff, moist | | | | |
| | | 3 | | 11.5 | 3-10-11-13 | 21 | |
| 97 | | 4 | | 10.3 | 5-6-11-14 | 17 | |
| | | | - grayish brown | | | | |
| 96 | | 5 | | 7.0 | 6-11-17-40 | 28 | |
| | | | - hard | | | | |
| 95 | | 6 | | 9.4 | 12-25-30-35 | 55 | |
| | | | End of borehole at target depth of 5.18 m; Borehole was open and dry upon completion of drilling. | | | | |
| 94 | | | | | | | |
| 93 | | | | | | | |
| 92 | | | | | | | |

P.L.-L.L. M.C. "N" Value
20 40 60 80

Notes:

This information pertains only to this borehole and should not be interpreted as being indicative of the site.

ENCLOSURE 3
PAGE 1 OF 1

# BOREHOLE LOG

## BOREHOLE NO.: 2

SOLA ENGINEERING

**PROJECT NO.:** 10278 **DATE:** October 19, 2017
**PROJECT:** Proposed Residential Development

**CLIENT:** 1967012 Ontario Inc. c/o S2S Environmental Inc.
**LOCATION:** 1335,1349 and 1355 Plains Road East, Burlington, ON
**ELEVATION (M):** 99.26 Geodatic **CAVED AT DEPTH (M):** ----
**WATER LEVEL DEPTH (M):** ---- **DRILLING METHOD:** Solid Stem
**DRILLER:** Strong Soil Inc. **DRILL RIG:** CME 75
**LOGGED BY:** KA **REVIEWED BY:** KB

LEGEND:

| | |
|---|---|
| | SS - SPLIT SPOON |
| | AS - AUGER SAMPLE |
| | ST - SHELBY TUBE |
| | CS - CORE SAMPLE |
| | STABILIZED WATER LEVEL |
| | CAVED AT |
| "N" | BLOWS / 0.3 M |
| M.C. | NATURAL MOISTURE CONTENT (%) |
| O.V.M | ORGANIC VAPOUR MONITOR |
| P.L. | PLASTIC LIMIT (%) |
| L.L. | LIQUID LIMIT (%) |

| ELEV./ DEPTH (m) | WELL/ PIEZO. DETAIL | SYMBOLS, SAMPLERS TEST DATA | DESCRIPTION | Moisture Content | STANDARD PENETRATION TESTS | | ELEV./ DEPTH (m) | P.L.-L.L. M.C. "N" Value 20 40 60 80 |
|---|---|---|---|---|---|---|---|---|
| | | | | | BLOW COUNTS | "N" VALUE | | |
| 99 (0) | | 1 | ASPHALTIC CONCRETE - 50 mm<br>Sand and Gravel - 560 mm | 3.2 | 7-8-6-6 | 14 | | |
| 98 (1) | | 2 | Crusher Run Lomestone (2") | 3.8 | 3-3-3-5 | 6 | | |
| | | 3 | FILL - clayey silt, trace gravel, brown, wet | 6.9<br>14.4 | 3-4-2-3 | 6 | | |
| 97 (2) | | 4 | SILTY CLAY TILL - trace gravel, brown, very stiff to hard, moist | 15.4 | 3-7-13-50****/8 | 20 | | |
| 96 (3) | | 5 | | 11.3 | 8-12-26-26 | 38 | | |
| 95 (4) | | | | | | | | |
| 94 (5) | | 6 | | 9.3 | 16-22-31-33 | 53 | | |
| 93 (6) | | | End of borehole at target depth of 5.18 m; Borehole was open and dry upon completion of drilling. | | | | | |
| 92 (7) | | | | | | | | |

Notes: 50****/8 denotes 50 plus blows for 8 cm of sampler penetration after first 45 cm;

This information pertains only to this borehole and should not be interpreted as being indicative of the site.

ENCLOSURE 4
PAGE 1 OF 1

# BOREHOLE LOG

## BOREHOLE NO.: 3

SOLA ENGINEERING

**PROJECT NO.:** 10278 **DATE:** October 18, 2017
**PROJECT:** Proposed Residential Development

**CLIENT:** 1967012 Ontario Inc. c/o S2S Environmental Inc.
**LOCATION:** 1335,1349 and 1355 Plains Road East, Burlington, ON
**ELEVATION (M):** 99.23 Geodatic **CAVED AT DEPTH (M):** ----
**WATER LEVEL DEPTH (M):** ---- **DRILLING METHOD:** Solid Stem
**DRILLER:** Strong Soil Inc. **DRILL RIG:** CME 75
**LOGGED BY:** KA **REVIEWED BY:** KB

LEGEND:

| | |
|---|---|
| | SS - SPLIT SPOON |
| | AS - AUGER SAMPLE |
| | ST - SHELBY TUBE |
| | CS - CORE SAMPLE |
| | STABILIZED WATER LEVEL |
| | CAVED AT |
| "N" | BLOWS / 0.3 M |
| M.C. | NATURAL MOISTURE CONTENT (%) |
| O.V.M | ORGANIC VAPOUR MONITOR |
| P.L. | PLASTIC LIMIT (%) |
| L.L. | LIQUID LIMIT (%) |

| ELEV./ DEPTH (m) | WELL/ PIEZO. DETAIL | SYMBOLS, SAMPLERS TEST DATA | DESCRIPTION | Moisture Content | STANDARD PENETRATION TESTS: BLOW COUNTS | STANDARD PENETRATION TESTS: "N" VALUE | ELEV./ DEPTH (m) | P.L.-L.L. / M.C. / "N" Value (20 40 60 80) |
|---|---|---|---|---|---|---|---|---|
| 99 / 0 | | 1 | ASPHALTIC CONCRETE - 50 mm<br>Sand and Gravel - 250 mm | 4.1 | 5-3-2-2 | 5 | | |
| | | | FILL - sandy silt, trace clay, red, wet | 9.5 | | | | |
| 98 / 1 | | 2 | - trace gravel<br>SILTY CLAY TILL - trace gravel, trace sand, brown, soft, highly moist | 7.1<br>20.8 | 2-1-2-3 | 3 | | |
| 97 / 2 | | 3 | CLAYEY SILT TILL - trace gravel, trace sand, brown, stiff, moist | 17.3 | 5-6-6-8 | 12 | | |
| | | 4 | SILTY CLAY TILL - trace gravel, brown, very stiff, moist | 11.7 | 6-8-12-16 | 20 | | |
| 96 / 3 | | | - trace sand, hard | | | | | |
| 95 / 4 | | 5 | | 9.3 | 10-19-37-28 | 56 | | |
| 94 / 5 | | 6 | | 10.8 | 11-20-27-29 | 47 | | |
| 93 / 6 | | | End of borehole at target depth of 5.18 m; Borehole was open and dry upon completion of drilling. | | | | | |
| 92 / 7 | | | | | | | | |

Notes:

This information pertains only to this borehole and should not be interpreted as being indicative of the site.

ENCLOSURE 5
PAGE 1 OF 1

# BOREHOLE LOG

## BOREHOLE NO.: 4

SOLA ENGINEERING

**PROJECT NO.:** 10278 **DATE:** October 18, 2017
**PROJECT:** Proposed Residential Development

**CLIENT:** 1967012 Ontario Inc. c/o S2S Environmental Inc.
**LOCATION:** 1335,1349 and 1355 Plains Road East, Burlington, ON
**ELEVATION (M):** 99.24 Geodatic **CAVED AT DEPTH (M):** ----
**WATER LEVEL DEPTH (M):** ---- **DRILLING METHOD:** Solid Stem
**DRILLER:** Strong Soil Inc. **DRILL RIG:** CME 75
**LOGGED BY:** KA **REVIEWED BY:** KB

LEGEND:

| | |
|---|---|
| | SS - SPLIT SPOON |
| | AS - AUGER SAMPLE |
| | ST - SHELBY TUBE |
| | CS - CORE SAMPLE |
| | STABILIZED WATER LEVEL |
| | CAVED AT |
| "N" | BLOWS / 0.3 M |
| M.C. | NATURAL MOISTURE CONTENT (%) |
| O.V.M | ORGANIC VAPOUR MONITOR |
| P.L. | PLASTIC LIMIT (%) |
| L.L. | LIQUID LIMIT (%) |

| ELEV./ DEPTH (m) | WELL/ PIEZO. DETAIL | SYMBOLS, SAMPLERS TEST DATA | DESCRIPTION | Moisture Content | STANDARD PENETRATION TESTS: BLOW COUNTS | STANDARD PENETRATION TESTS: "N" VALUE | ELEV./ DEPTH (m) |
|---|---|---|---|---|---|---|---|
| 99 / 0 | | 1 | ASPHALTIC CONCRETE - 50 mm<br>Sand and Gravel - 250 mm | 1.7 | 7-5-4-4 | 9 | |
| | | | FILL - sandy silt, trace rootlets, trace clay, red, moist | 14.3 | | | |
| 98 / 1 | | 2 | | 16.8 | 3-4-2-4 | 6 | |
| | | 3 | SILTY CLAY TILL - trace gravel, brown, very stiff, moist | 12.4 | 7-8-11-13 | 19 | |
| 97 / 2 | | 4 | | 3.1 | 5-8-14-14 | 22 | |
| | | | - trace sand | | | | |
| 96 / 3 | | 5 | | 10.6 | 10-21-27-47 | 48 | |
| 95 / 4 | | | | | | | |
| 94 / 5 | | 6 | | 13.9 | 10-22-26-32 | 48 | |
| | | | End of borehole at target depth of 5.18 m; Borehole was open and dry upon completion of drilling. | | | | |
| 93 / 6 | | | | | | | |
| 92 / 7 | | | | | | | |

P.L.-L.L. M.C. "N" Value 20 40 60 80

Notes:

This information pertains only to this borehole and should not be interpreted as being indicative of the site.

ENCLOSURE 6
PAGE 1 OF 1

# BOREHOLE LOG

## BOREHOLE NO.: 5

SOLA ENGINEERING

**PROJECT NO.:** 10278 **DATE:** October 18, 2017
**PROJECT:** Proposed Residential Development

**CLIENT:** 1967012 Ontario Inc. c/o S2S Environmental Inc.
**LOCATION:** 1335,1349 and 1355 Plains Road East, Burlington, ON
**ELEVATION (M):** 99.23 Geodatic **CAVED AT DEPTH (M):** ----
**WATER LEVEL DEPTH (M):** ---- **DRILLING METHOD:** Solid Stem
**DRILLER:** Stong Soil Inc. **DRILL RIG:** CME 75
**LOGGED BY:** KA **REVIEWED BY:** KB

LEGEND:

| | |
|---|---|
| | SS - SPLIT SPOON |
| | AS - AUGER SAMPLE |
| | ST - SHELBY TUBE |
| | CS - CORE SAMPLE |
| | STABILIZED WATER LEVEL |
| | CAVED AT |
| "N" | BLOWS / 0.3 M |
| M.C. | NATURAL MOISTURE CONTENT (%) |
| O.V.M | ORGANIC VAPOUR MONITOR |
| P.L. | PLASTIC LIMIT (%) |
| L.L. | LIQUID LIMIT (%) |

| ELEV./ DEPTH (m) | WELL/ PIEZO. DETAIL | SYMBOLS, SAMPLERS TEST DATA | DESCRIPTION | Moisture Content | STANDARD PENETRATION TESTS | | ELEV./ DEPTH (m) | P.L.-L.L. M.C. "N" Value 20 40 60 80 |
|---|---|---|---|---|---|---|---|---|
| | | | | | BLOW COUNTS | "N" VALUE | | |
| 99 | | 1 | ASPHALTIC CONCRETE - 25 mm<br>Sand and Gravel - 400 mm | 4.0 | 6-3-2-2 | 5 | | |
| | | | FILL - silty sand, red, moist | 13.0 | | | | |
| | | | - trace clay | 17.1 | | | | |
| 98 | | 2 | SILTY CLAY TILL - trace gravel, brown, very stiff, moist | 15.9 | 1-6-13-19 | 19 | | |
| | | 3 | | 15.9 | 7-12-16-20 | 28 | | |
| 97 | | | - brownish grey | | | | | |
| | | 4 | | 12.6 | 6-9-12-18 | 21 | | |
| 96 | | | - reddish brown, hard | | | | | |
| | | 5 | | 11.3 | 8-12-30-37 | 42 | | |
| 95 | | | - grey | | | | | |
| 94 | | 6 | | 13.8 | 10-16-22-32 | 38 | | |
| | | | End of borehole at target depth of 5.18 m; Borehole was open and dry upon completion of drilling. | | | | | |
| 93 | | | | | | | | |
| 92 | | | | | | | | |

Notes:

This information pertains only to this borehole and should not be interpreted as being indicative of the site.

ENCLOSURE 7
PAGE 1 OF 1

# BOREHOLE LOG

## BOREHOLE NO.: 6

SOLA ENGINEERING

**PROJECT NO.:** 10278 **DATE:** October 19, 2017
**PROJECT:** Proposed Residential Development

**CLIENT:** 1967012 Ontario Inc. c/o S2S Environmental Inc.
**LOCATION:** 1335,1349 and 1355 Plains Road East, Burlington, ON
**ELEVATION (M):** 98.78 Geodatic **CAVED AT DEPTH (M):** ----
**WATER LEVEL DEPTH (M):** ---- **DRILLING METHOD:** Solid Stem
**DRILLER:** Strong Soil Inc. **DRILL RIG:** CME 75
**LOGGED BY:** KA **REVIEWED BY:** KB

LEGEND:
- SS - SPLIT SPOON
- AS - AUGER SAMPLE
- ST - SHELBY TUBE
- CS - CORE SAMPLE
- STABILIZED WATER LEVEL
- CAVED AT
- "N" BLOWS / 0.3 M
- M.C. NATURAL MOISTURE CONTENT (%)
- O.V.M ORGANIC VAPOUR MONITOR
- P.L. PLASTIC LIMIT (%)
- L.L. LIQUID LIMIT (%)

| ELEV./ DEPTH (m) | WELL/ PIEZO. DETAIL | SYMBOLS, SAMPLERS TEST DATA | DESCRIPTION | Moisture Content | STANDARD PENETRATION TESTS BLOW COUNTS | STANDARD PENETRATION TESTS "N" VALUE | ELEV./ DEPTH (m) |
|---|---|---|---|---|---|---|---|
| 98 / 0 | | 1 | ASPHALTIC CONCRETE - 40 mm<br>Sand and gravel - 150 mm | 3.8 | 6-4-4-4 | 8 | |
| | | | FILL - silty clay, brown, moist | 14.3 | | | |
| 98 / 1 | | 2 | - clayey silt, with sand, red, wet | 18.5 | 1-2-2-4 | 4 | |
| | | | CLAYEY SILT - trace sand, brown, soft, highly moist | 16.7 | | | |
| 97 / 2 | | 3 | SILTY CLAY TILL - trace gravel, greyish brown, soft, highly moist | 17.2 | 1-1-3-5 | 4 | |
| | | | - hard, moist | | | | |
| 96 / 3 | | 4 | | | 5-13-18-23 | 31 | |
| | | 5 | | 8.7 | 13-22-28-32 | 50 | |
| 95 / 4 | | | | | | | |
| | | | - silty sand seems, grey | 9.7 | | | |
| 94 / 5 | | 6 | | 10.2 | 13-17-22-50*/13 | 39 | |
| | | | End of borehole at target depth of 5.18 m; Borehole was open and dry upon completion of drilling. | | | | |
| 93 / 6 | | | | | | | |
| 92 / 7 | | | | | | | |

P.L.-L.L. M.C. "N" Value
20 40 60 80

Notes: 50*/13 denotes 50 plus blows for 13 cm sampler penetration after 1st 45 cm;

This information pertains only to this borehole and should not be interpreted as being indicative of the site.

ENCLOSURE 8
PAGE 1 OF 1

# BOREHOLE LOG

## BOREHOLE NO.: 7

SOLA ENGINEERING

**PROJECT NO.:** 10278 **DATE:** October 18, 2017
**PROJECT:** Proposed Residential Development

**CLIENT:** 1967012 Ontario Inc. c/o S2S Environmental Inc.
**LOCATION:** 1335,1349 and 1355 Plains Road East, Burlington, ON
**ELEVATION (M):** 99.52 Geodatic **CAVED AT DEPTH (M):** ----
**WATER LEVEL DEPTH (M):** ---- **DRILLING METHOD:** Solid Stem
**DRILLER:** Stong Soil Inc. **DRILL RIG:** CME 75
**LOGGED BY:** KA **REVIEWED BY:** KB

LEGEND:

| | |
|---|---|
| | SS - SPLIT SPOON |
| | AS - AUGER SAMPLE |
| | ST - SHELBY TUBE |
| | CS - CORE SAMPLE |
| | STABILIZED WATER LEVEL |
| | CAVED AT |
| "N" | BLOWS / 0.3 M |
| M.C. | NATURAL MOISTURE CONTENT (%) |
| O.V.M | ORGANIC VAPOUR MONITOR |
| P.L. | PLASTIC LIMIT (%) |
| L.L. | LIQUID LIMIT (%) |

| ELEV./ DEPTH (m) | WELL/ PIEZO. DETAIL | SYMBOLS, SAMPLERS TEST DATA | DESCRIPTION | Moisture Content | STANDARD PENETRATION TESTS: BLOW COUNTS | STANDARD PENETRATION TESTS: "N" VALUE | ELEV./ DEPTH (m) | P.L.-L.L. / M.C. / "N" Value 20 40 60 80 |
|---|---|---|---|---|---|---|---|---|
| 99.52 (0) | | 1 | ASPHALTIC CONCRETE - 50 mm<br>Sand and gravel - 300 mm | 9.0 | 7-8-6-9 | 14 | | |
| 98.52 (1) | | 2 | FILL - silty sand, trace organic, reddish brown, moist | 9.9 | 3-3-3-5 | 6 | | |
| | | | - trace clay | 18.2 | | | | |
| 97.52 (2) | | 3 | SILTY CLAY - trace rootlets, brown, very stiff, moist | 16.5 | 6-8-10-14 | 18 | | |
| | | 4 | SILTY CLAY TILL - trace gravel, brown, very stiff, moist | 16.1 | 5-10-13-19 | 23 | | |
| 96.52 (3) | | 5 | | 11.0 | 7-16-20-21 | 36 | | |
| 95.52 (4) | | | | | | | | |
| 94.52 (5) | | 6 | | 11.0 | 10-16-21-26 | 37 | | |
| | | | End of borehole at target depth of 5.18 m; Borehole was open and dry upon completion of drilling. | | | | | |
| 93.52 (6) | | | | | | | | |
| 92.52 (7) | | | | | | | | |

Notes:

This information pertains only to this borehole and should not be interpreted as being indicative of the site.

ENCLOSURE 9
PAGE 1 OF 1

# BOREHOLE LOG

## BOREHOLE NO.: 8

SOLA ENGINEERING

**PROJECT NO.:** 10278 **DATE:** October 18, 2017
**PROJECT:** Proposed Residential Development

**CLIENT:** 1967012 Ontario Inc. c/o S2S Environmental Inc.
**LOCATION:** 1335,1349 and 1355 Plains Road East, Burlington, ON
**ELEVATION (M):** 99.49 Geodatic **CAVED AT DEPTH (M):** ----
**WATER LEVEL DEPTH (M):** ---- **DRILLING METHOD:** Solid Stem
**DRILLER:** Strong Soil Inc. **DRILL RIG:** CME 75
**LOGGED BY:** KA **REVIEWED BY:** KB

LEGEND:

| | |
|---|---|
| | SS - SPLIT SPOON |
| | AS - AUGER SAMPLE |
| | ST - SHELBY TUBE |
| | CS - CORE SAMPLE |
| | STABILIZED WATER LEVEL |
| | CAVED AT |
| "N" | BLOWS / 0.3 M |
| M.C. | NATURAL MOISTURE CONTENT (%) |
| O.V.M | ORGANIC VAPOUR MONITOR |
| P.L. | PLASTIC LIMIT (%) |
| L.L. | LIQUID LIMIT (%) |

| ELEV./ DEPTH (m) | WELL/ PIEZO. DETAIL | SYMBOLS, SAMPLERS TEST DATA | DESCRIPTION | Moisture Content | STANDARD PENETRATION TESTS: BLOW COUNTS | STANDARD PENETRATION TESTS: "N" VALUE | ELEV./ DEPTH (m) | P.L.-L.L. / M.C. / "N" Value 20 40 60 80 |
|---|---|---|---|---|---|---|---|---|
| 99 / 0 | | 1 | ASPHALTIC CONCRETE - 50 mm<br>Sand and Gravel - 250 mm | 1.6 | 5-4-3-4 | 7 | | |
| | | | FILL - silty sand, reddish brown, moist | 14.3 | | | | |
| 98 / 1 | | 2 | | 20.4 | 2-4-4-4 | 8 | | |
| | | 3 | SILTY CLAY TILL - trace gravel, brown, very stiff, moist | 16.0 | 4-7-12-13 | 19 | | |
| 97 / 2 | | 4 | | 17.4 | 5-7-12-17 | 19 | | |
| 96 / 3 | | 5 | | 13.5 | 4-12-16-17 | 28 | | |
| 95 / 4 | | | - trace shale fragments, hard | | | | | |
| 94 / 5 | | 6 | | 10.2 | 12-19-27-26 | 46 | | |
| 93 / 6 | | | End of borehole at target depth of 5.18 m; The borehole was open and dry upon completion of drilling | | | | | |
| 92 / 7 | | | | | | | | |

Notes:

This information pertains only to this borehole and should not be interpreted as being indicative of the site.

ENCLOSURE 10
PAGE 1 OF 1

# BOREHOLE LOG

## BOREHOLE NO.: 9

SOLA ENGINEERING

**PROJECT NO.:** 10278 **DATE:** October 19, 2017
**PROJECT:** Proposed Residential Development

**CLIENT:** 1967012 Ontario Inc. c/o S2S Environmental Inc.
**LOCATION:** 1335,1349 and 1355 Plains Road East, Burlington, ON
**ELEVATION (M):** 99.38 Geodatic **CAVED AT DEPTH (M):** ----
**WATER LEVEL DEPTH (M):** ---- **DRILLING METHOD:** Soliod Stem
**DRILLER:** Strong Soil inc. **DRILL RIG:** CME 75
**LOGGED BY:** KA **REVIEWED BY:** KB

LEGEND:

| | |
|---|---|
| | SS - SPLIT SPOON |
| | AS - AUGER SAMPLE |
| | ST - SHELBY TUBE |
| | CS - CORE SAMPLE |
| | STABILIZED WATER LEVEL |
| | CAVED AT |
| "N" | BLOWS / 0.3 M |
| M.C. | NATURAL MOISTURE CONTENT (%) |
| O.V.M | ORGANIC VAPOUR MONITOR |
| P.L. | PLASTIC LIMIT (%) |
| L.L. | LIQUID LIMIT (%) |

| ELEV./ DEPTH (m) | WELL/ PIEZO. DETAIL | SYMBOLS, SAMPLERS TEST DATA | DESCRIPTION | Moisture Content | STANDARD PENETRATION TESTS: BLOW COUNTS | STANDARD PENETRATION TESTS: "N" VALUE | ELEV./ DEPTH (m) |
|---|---|---|---|---|---|---|---|
| 99 / 0 | | 1 | TOPSOIL - 150 mm | 20.3 | 1-4-4-4 | 8 | |
| | | | FILL - sandy silt, trace clay, trace organic, reddish brown, moist | 16.9 | | | |
| 98 / 1 | | 2 | - silty clay, brown, wet | 18.0 | 0-1-6-8 | 7 | |
| | | | FILL - silty sand, red, wet | 17.3 | | | |
| 97 / 2 | | 3 | SILTY CLAY TILL - trace gravel, brown, stiff, moist | 20.1<br>18.4 | 5-6-8-9 | 14 | |
| | | 4 | | 12.9 | 3-6-11-12 | 17 | |
| 96 / 3 | | 5 | | 11.4 | 8-15-20-23 | 35 | |
| 95 / 4 | | | | | | | |
| 94 / 5 | | 6 | | 11.0 | 8-22-30-30 | 52 | |
| | | | End of borehole at target depth of 5.18 m; The borehole was open and dry upon completion of drilling | | | | |
| 93 / 6 | | | | | | | |
| 92 / 7 | | | | | | | |

P.L.-L.L. M.C. "N" Value 20 40 60 80

Notes:

This information pertains only to this borehole and should not be interpreted as being indicative of the site.

ENCLOSURE 11
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# BOREHOLE LOG

## BOREHOLE NO.: 10

SOLA ENGINEERING

**PROJECT NO.:** 10278 **DATE:** October 19, 2017
**PROJECT:** Proposed Residential Development

**CLIENT:** 1967012 Ontario Inc. c/o S2S Environmental Inc.
**LOCATION:** 1335,1349 and 1355 Plains Road East, Burlington, ON
**ELEVATION (M):** 99.25 Geodatic **CAVED AT DEPTH (M):** ----
**WATER LEVEL DEPTH (M):** ---- **DRILLING METHOD:** Solid Stem
**DRILLER:** Strong Soil Inc. **DRILL RIG:** CME 75
**LOGGED BY:** KA **REVIEWED BY:** KB

LEGEND:

| | |
|---|---|
| | SS - SPLIT SPOON |
| | AS - AUGER SAMPLE |
| | ST - SHELBY TUBE |
| | CS - CORE SAMPLE |
| | STABILIZED WATER LEVEL |
| | CAVED AT |
| "N" | BLOWS / 0.3 M |
| M.C. | NATURAL MOISTURE CONTENT (%) |
| O.V.M | ORGANIC VAPOUR MONITOR |
| P.L. | PLASTIC LIMIT (%) |
| L.L. | LIQUID LIMIT (%) |

| ELEV./ DEPTH (m) | WELL/ PIEZO. DETAIL | SYMBOLS, SAMPLERS TEST DATA | DESCRIPTION | Moisture Content | STANDARD PENETRATION TESTS: BLOW COUNTS | STANDARD PENETRATION TESTS: "N" VALUE | ELEV./ DEPTH (m) |
|---|---|---|---|---|---|---|---|
| 99 / 0 | | 1 | TOPSOIL - 150 mm | 13.4 | 2-4-8-10 | 12 | |
| | | | FILL - silty sand, brown, moist | 4.2 | | | |
| 98 / 1 | | 2 | - sandy silt, red, compact, moist | 14.8 | 5-7-10-12 | 17 | |
| | | | SILTY CLAY TILL - trace gravel, grayish brown, hard, moist | | | | |
| 97 / 2 | | 3 | | 14.8 | 8-14-16-18 | 30 | |
| | | | - very stiif to hard | | | | |
| | | 4 | | 15.9 | 5-11-17-20 | 28 | |
| 96 / 3 | | 5 | | 10.6 | 9-18-22-25 | 40 | |
| 95 / 4 | | | | | | | |
| 94 / 5 | | 6 | | 9.8 | 15-22-30-38 | 52 | |
| | | | End of borehole at target depth of 5.18 m; The borehole was open and dry upon completion of drilling | | | | |
| 93 / 6 | | | | | | | |
| 92 / 7 | | | | | | | |

P.L.-L.L. M.C. "N" Value 20 40 60 80

Notes:

This information pertains only to this borehole and should not be interpreted as being indicative of the site.

ENCLOSURE 12
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# BOREHOLE LOG

## BOREHOLE NO.: 11

SOLA ENGINEERING

**PROJECT NO.:** 10278 **DATE:** October 17, 2017
**PROJECT:** Proposed Residential Development

**CLIENT:** 1967012 Ontario Inc. c/o S2S Environmental Inc.
**LOCATION:** 1335,1349 and 1355 Plains Road East, Burlington, ON
**ELEVATION (M):** 99.36 Geodatic **CAVED AT DEPTH (M):** ----
**WATER LEVEL DEPTH (M):** ---- **DRILLING METHOD:** Solid Stem
**DRILLER:** Strong Soil Inc. **DRILL RIG:** CME 75
**LOGGED BY:** KA **REVIEWED BY:** KB

LEGEND:

| | |
|---|---|
| | SS - SPLIT SPOON |
| | AS - AUGER SAMPLE |
| | ST - SHELBY TUBE |
| | CS - CORE SAMPLE |
| | STABILIZED WATER LEVEL |
| | CAVED AT |
| "N" | BLOWS / 0.3 M |
| M.C. | NATURAL MOISTURE CONTENT (%) |
| O.V.M | ORGANIC VAPOUR MONITOR |
| P.L. | PLASTIC LIMIT (%) |
| L.L. | LIQUID LIMIT (%) |

| ELEV./ DEPTH (m) | WELL/ PIEZO. DETAIL | SYMBOLS, SAMPLERS TEST DATA | DESCRIPTION | Moisture Content | STANDARD PENETRATION TESTS | | ELEV./ DEPTH (m) | P.L.-L.L. M.C. "N" Value 20 40 60 80 |
|---|---|---|---|---|---|---|---|---|
| | | | | | BLOW COUNTS | "N" VALUE | | |
| 99 | | 1 | ASPHALTIC CONCRETE - 40 mm<br>Sand and Gravel - 560 mm | 2.3 | 12-9-9-10 | 18 | | |
| 98 | | 2 | FILL - silty sand, brown, moist | 17.5 | 0-1-3-7 | 4 | | |
| | | | SILTY CLAY - trace sand, brown, soft, moist | | | | | |
| 97 | | 3 | SILTY CLAY - trace gravel, brown, very stiff, moist | 15.3 | 5-7-9-12 | 16 | | |
| | | 4 | CLAYEY SILT TILL - trace gravel, brown, very stiff, moist | 13.4 | 4-7-10-16 | 17 | | |
| 96 | | 5 | SILTY CLAY TILL - some gravel, trace shale fragments, reddish brown, hard, slightly moist | 11.4 | 6-9-24-31 | 33 | | |
| 95 | | 6 | SILTY CLAY TILL - trace gravel, dark brown, hard, slightly moist | 11.2 | 10-16-23-30 | 39 | | |
| 94 | | | End of borehole at target depth of 5.18 m; The borehole was open and dry upon completion of drilling | | | | | |
| 93 | | | | | | | | |
| 92 | | | | | | | | |

Notes:

This information pertains only to this borehole and should not be interpreted as being indicative of the site.

ENCLOSURE 13
PAGE 1 OF 1

# BOREHOLE LOG

## BOREHOLE NO.: 12

SOLA ENGINEERING

**PROJECT NO.:** 10278 **DATE:** October 19, 2017
**PROJECT:** Proposed Residential Development

**CLIENT:** 1967012 Ontario Inc. c/o S2S Environmental Inc.
**LOCATION:** 1335,1349 and 1355 Plains Road East, Burlington, ON
**ELEVATION (M):** 99.33 Geodatic **CAVED AT DEPTH (M):** ----
**WATER LEVEL DEPTH (M):** 3.82 **DRILLING METHOD:** Solid Stem
**DRILLER:** Strong soil Inc. **DRILL RIG:** CME 75
**LOGGED BY:** KA **REVIEWED BY:** KB

LEGEND:

| | |
|---|---|
| | SS - SPLIT SPOON |
| | AS - AUGER SAMPLE |
| | ST - SHELBY TUBE |
| | CS - CORE SAMPLE |
| | STABILIZED WATER LEVEL |
| | CAVED AT |
| "N" | BLOWS / 0.3 M |
| M.C. | NATURAL MOISTURE CONTENT (%) |
| O.V.M | ORGANIC VAPOUR MONITOR |
| P.L. | PLASTIC LIMIT (%) |
| L.L. | LIQUID LIMIT (%) |

| ELEV./ DEPTH (m) | WELL/ PIEZO. DETAIL | SYMBOLS, SAMPLERS TEST DATA | DESCRIPTION | Moisture Content | STANDARD PENETRATION TESTS: BLOW COUNTS | STANDARD PENETRATION TESTS: "N" VALUE | ELEV./ DEPTH (m) | P.L.-L.L. / M.C. / "N" Value 20 40 60 80 |
|---|---|---|---|---|---|---|---|---|
| 99 / 0 | | 1 | ASPHALTIC CONCRETE - 50 mm<br>Sand and Gravel - 25 mm | 3.0 | 7-6-7-7 | 13 | | |
| | | | FILL - silty sand, grey, moist | 7.7 | | | | |
| 98 / 1 | | 2 | - reddish brown, wet | 14.3 | 2-2-7-13 | 9 | | |
| | | | SILTY CLAY TILL -trace gravel, brown, very stiff, moist | | | | | |
| 97 / 2 | | 3 | | 14.6 | 5-7-9-11 | 16 | | |
| | | 4 | | 12.0 | 5-8-20-25 | 28 | | |
| 96 / 3 | | | - hard | | | | | |
| | | 5 | | 8.8 | 14-28-39-36 | 67 | | |
| 95 / 4 | | | | | | | | |
| 94 / 5 | | 6 | | 10.5 | 11-26-13-50*/13 | 50* | | |
| | | | End of borehole due to spoon refusal at 5.16 m;<br>Borehole was open and dry upon completion of drilling. | | | | | |
| 93 / 6 | | | | | | | | |
| 92 / 7 | | | | | | | | |

Notes: 50*/13 denotes 50 plus blows for 13 cm sampler penetration after 1st 45 cm;

This information pertains only to this borehole and should not be interpreted as being indicative of the site.

ENCLOSURE 14
PAGE 1 OF 1

# BOREHOLE LOG

## BOREHOLE NO.: 13

SOLA ENGINEERING

**PROJECT NO.:** 10278 **DATE:** October 17, 2017
**PROJECT:** Proposed Residential Development

**CLIENT:** 1967012 Ontario Inc. c/o S2S Environmental Inc.
**LOCATION:** 1335,1349 and 1355 Plains Road East, Burlington, ON
**ELEVATION (M):** 99.35 Geodatic **CAVED AT DEPTH (M):** ----
**WATER LEVEL DEPTH (M):** ---- **DRILLING METHOD:** Solid Stem
**DRILLER:** Strong Soil Inc. **DRILL RIG:** CME 75
**LOGGED BY:** KA **REVIEWED BY:** KB

LEGEND:

| | |
|---|---|
| | SS - SPLIT SPOON |
| | AS - AUGER SAMPLE |
| | ST - SHELBY TUBE |
| | CS - CORE SAMPLE |
| | STABILIZED WATER LEVEL |
| | CAVED AT |
| "N" | BLOWS / 0.3 M |
| M.C. | NATURAL MOISTURE CONTENT (%) |
| O.V.M | ORGANIC VAPOUR MONITOR |
| P.L. | PLASTIC LIMIT (%) |
| L.L. | LIQUID LIMIT (%) |

| ELEV./ DEPTH (m) | WELL/ PIEZO. DETAIL | SYMBOLS, SAMPLERS TEST DATA | DESCRIPTION | Moisture Content | STANDARD PENETRATION TESTS: BLOW COUNTS | STANDARD PENETRATION TESTS: "N" VALUE | ELEV./ DEPTH (m) | P.L.-L.L. / M.C. / "N" Value 20 40 60 80 |
|---|---|---|---|---|---|---|---|---|
| 99 | | | ASPHALTIC CONCRETE - 100 mm<br>Sand and Gravel - 125 mm | 4.2 | | | | |
| | | 1 | FILL - silty sand, reddish brown, moist | 10.3 | 4-4-3-3 | 7 | | |
| | | 2 | | 19.2 | 1-2-2-7 | 4 | | |
| 98 | | | SILTY CLAY TILL - trace gravel, brown, soft, moist | 18.1 | | | | |
| | | 3 | | 15.6 | 6-8-12-12 | 20 | | |
| 97 | | 4 | | 11.0 | 4-12-20-24 | 32 | | |
| 96 | | 5 | | 9.7 | 12-20-30-32 | 50 | | |
| | | | - trace shale fragments, hard | | | | | |
| | | 6 | | 10.1 | 9-18-30-29 | 48 | | |
| 95 | | 7 | | 8.1 | 12-18-28-42 | 46 | | |
| 94 | | | | | | | | |
| 93 | | 8 | SILTY CLAY TILL - grayish brown, hard, slightly moist | 14.8 | 20-36-50*/14 | 50* | | |
| | | | End of borehole due to spoon refusal at 6.53 m;<br>Borehole was open and dry upon completion of drilling | | | | | |
| 92 | | | | | | | | |

Notes: 50*/14 denotes 50 plus blows for 14 cm sampler penetration after 1st 30 cm;

This information pertains only to this borehole and should not be interpreted as being indicative of the site.

ENCLOSURE 15
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# BOREHOLE LOG

## BOREHOLE NO.: 14

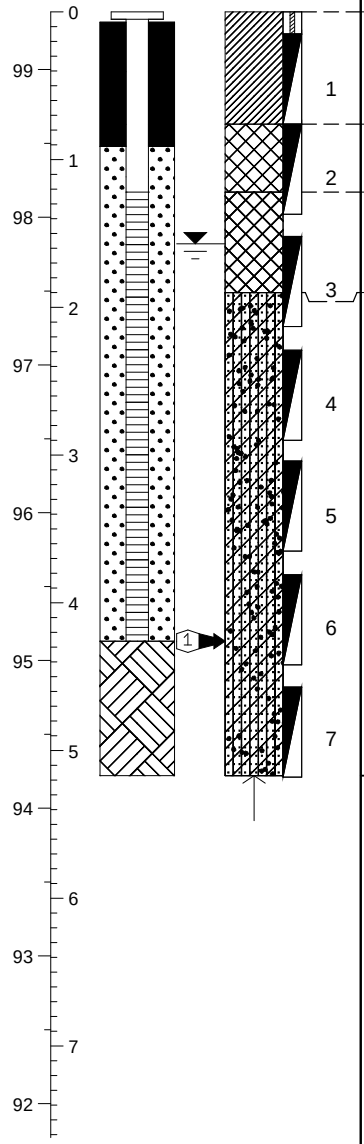
SOLA ENGINEERING

**PROJECT NO.:** 10278 **DATE:** October 17, 2017
**PROJECT:** Proposed Residential Development

**CLIENT:** 1967012 Ontario Inc. c/o S2S Environmental Inc.
**LOCATION:** 1335,1349 and 1355 Plains Road East, Burlington, ON
**ELEVATION (M):** 99.39 Geodatic **CAVED AT DEPTH (M):** 4.26
**WATER LEVEL DEPTH (M):** 1.57 **DRILLING METHOD:** Solid Stem
**DRILLER:** Strong Soil Inc. **DRILL RIG:** CME 75
**LOGGED BY:** KA **REVIEWED BY:** KB

LEGEND:

| | |
|---|---|
| | SS - SPLIT SPOON |
| | AS - AUGER SAMPLE |
| | ST - SHELBY TUBE |
| | CS - CORE SAMPLE |
| | STABILIZED WATER LEVEL |
| | CAVED AT |
| "N" | BLOWS / 0.3 M |
| M.C. | NATURAL MOISTURE CONTENT (%) |
| O.V.M | ORGANIC VAPOUR MONITOR |
| P.L. | PLASTIC LIMIT (%) |
| L.L. | LIQUID LIMIT (%) |




| ELEV./ DEPTH (m) | DESCRIPTION | Moisture Content | STANDARD PENETRATION TESTS: BLOW COUNTS | STANDARD PENETRATION TESTS: "N" VALUE | ELEV./ DEPTH (m) |
|---|---|---|---|---|---|
| 0.0 | ASPHALTIC CONCRETE - 25 mm<br>Sand and Gravel - 650 mm | 7.5 | 6-9-9-3 | 18 | |
| 0.7 | FILL - silty sand, trace clay, reddish brown, wet | 17.5 | 2-3-3-4 | 6 | |
| 1.5 | FILL - silty sand, reddish brown, moist | 20.6 | 3-5-8-8 | 13 | |
| 2.3 | SILTY CLAY TILL - trace gravel, brown, stiff, moist | 16.0 | | | |
| | - very stiff to hard | 12.8 | 5-9-12-13 | 21 | |
| | | 9.6 | 6-13-10-23 | 23 | |
| | | 9.9 | 8-18-29-35 | 47 | |
| 5.17 | End of borehole due to spoon refusal at 5.17 m;<br>Borehole caved at 4.26 m and water level at 3.81 upon completion of drilling | 9.6 | 14-30-40-50*/13 | 50* | |

P.L.-L.L.
M.C.
"N" Value
20 40 60 80

Notes:

This information pertains only to this borehole and should not be interpreted as being indicative of the site.

ENCLOSURE 16
PAGE 1 OF 1

# BOREHOLE LOG

## BOREHOLE NO.: 15

SOLA ENGINEERING

**PROJECT NO.:** 10278 **DATE:** October 17, 2017
**PROJECT:** Proposed Residential Development

**CLIENT:** 1967012 Ontario Inc. c/o S2S Environmental Inc.
**LOCATION:** 1335,1349 and 1355 Plains Road East, Burlington, ON
**ELEVATION (M):** 99.37 Geodatic **CAVED AT DEPTH (M):** ----
**WATER LEVEL DEPTH (M):** ----- **DRILLING METHOD:** Solid Stem
**DRILLER:** Strong Soil Inc. **DRILL RIG:** CME 75
**LOGGED BY:** KA **REVIEWED BY:** KB

LEGEND:

| | |
|---|---|
| | SS - SPLIT SPOON |
| | AS - AUGER SAMPLE |
| | ST - SHELBY TUBE |
| | CS - CORE SAMPLE |
| | STABILIZED WATER LEVEL |
| | CAVED AT |
| "N" | BLOWS / 0.3 M |
| M.C. | NATURAL MOISTURE CONTENT (%) |
| O.V.M | ORGANIC VAPOUR MONITOR |
| P.L. | PLASTIC LIMIT (%) |
| L.L. | LIQUID LIMIT (%) |

| ELEV./ DEPTH (m) | WELL/ PIEZO. DETAIL | SYMBOLS, SAMPLERS TEST DATA | DESCRIPTION | Moisture Content | STANDARD PENETRATION TESTS: BLOW COUNTS | STANDARD PENETRATION TESTS: "N" VALUE | ELEV./ DEPTH (m) |
|---|---|---|---|---|---|---|---|
| 99 / 0 | | 1 | TOPSOIL - 300 mm | 22.6 | 1-2-3-3 | 5 | |
| | | | FILL - silty sand, reddish brown, moist | 11.3 | | | |
| 98 / 1 | | 2 | - trace clay | 14.6 | 1-2-3-9 | 5 | |
| | | 3 | SILTY CLAY TILL - trace gravel, brown, very stiff, moist | 18.6 | 4-7-10-12 | 17 | |
| 97 / 2 | | 4 | | 14.9 | 5-9-12-17 | 21 | |
| | | | - hard | | | | |
| 96 / 3 | | 5 | | 12.5 | 7-8-26-35 | 34 | |
| | | | - slightly moist | | | | |
| 95 / 4 | | 6 | | 12.2 | 8-21-27-28 | 48 | |
| 94 / 5 | | 7 | | 11.3 | 9-19-23-38 | 42 | |
| | | | End of borehole at target depth of 5.18 m; Borehole was open and dry upon completion of drilling. | | | | |
| 93 / 6 | | | | | | | |
| 92 / 7 | | | | | | | |

P.L.-L.L. M.C. "N" Value 20 40 60 80

Notes:

This information pertains only to this borehole and should not be interpreted as being indicative of the site.

# KEY TO SYMBOLS

**Enclosure 17**

| Symbol | Description |
|---|---|
| **Strata symbols** | |
|  | **Pavement** |
|  | **Fill** |
|  | **Silty clay till** |
|  | **Fill clayey** |
|  | **Clayey silt till** |
|  | **Clayey silt** |
|  | **Silty clay** |
|  | **Topsoil** |

| Symbol | Description |
|---|---|
|  | **Description not given for: "FFF"** |
|  | **Description not given for: "CZCZ"** |
| **Misc. Symbols** | |
| △ | **Natural Moisture Content** |
|  | **Stabilized Water Level** |
|  | **Drill Refusal** |
|  | **Description not given for: "RNOTE1"** |
| **Soil Samplers** | |
|  | **Split Spoon** |

**Notes:**

**Terms describing RELATIVE DENSITY, based on Standard Penetration Test "N"-Value for COURSE GRAINED soils (major portion retained on No. 200 sieve).**

**DESCRIPTIVE TERM [ "N"-Value (blows/0.3m), Relative Density (%) ]**

- **Very Loose [ less than 4, less than 15 ]**
- **Loose [ 4 to 10, 15 to 35 ]**
- **Compact or Medium [ 10 to 30, 35 to 65 ]**
- **Dense [ 30 to 50, 65 to 85 ]**
- **Very Dense [ greater than 50, greater than 85 ]**

**Terms describing CONSISTENCY, based on Standard Penetration Test "N"-Value for FINE GRAINED soils (major portion passing No. 200 sieve)**

**DESCRIPTIVE TERM [ Unconfined Compressive Strength (kPa), "N"-Value (blows/0.3m) ]**

**Very Soft [ less than 25, less than 2 ]**
**Soft [ 25 to 50, 2 to 4 ]**
**Firm [ 50 to 100, 4 to 8 ]**
**Stiff [ 100 to 200, 8 to 15 ]**
**Very Stiff [ 200 to 400, 15 to 30 ]**
**Hard [ greater than 400, greater than 30 ]**

# KEY TO SYMBOLS

**Enclosure 17**

**Symbol** **Description**

**Soil Samplers**



**Description not given for:**
**"AS"**

**Monitor Well Details**



**Flush-mount**
**Cover**



**Pipe Riser**



**Bentonite Slurry**



**Silica sand, Blank PVC**



**Slotted Pipe w/ Sand**



**No Pipe, Sealed**



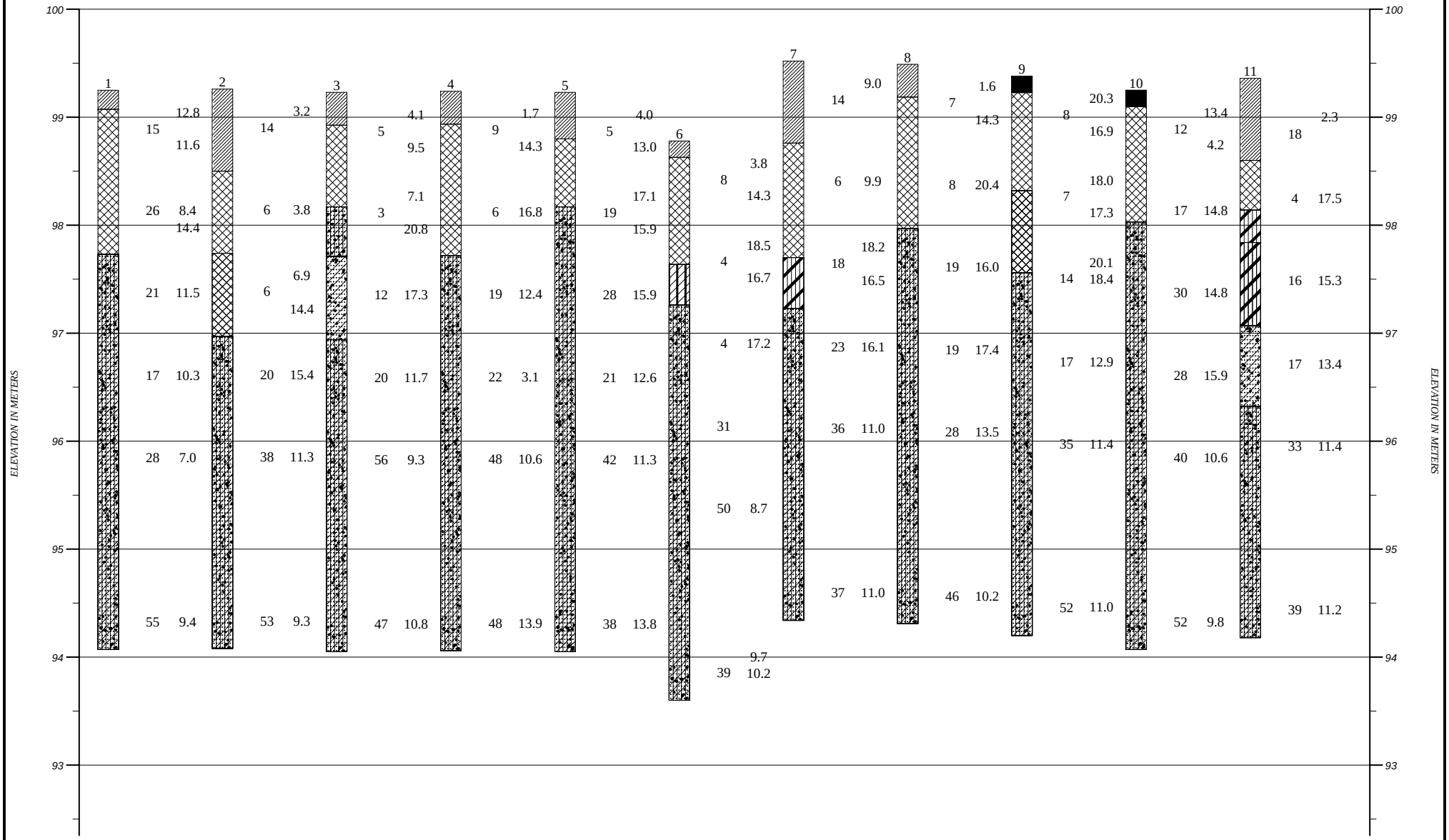
**Bentonite Pellets**



**Silica Sand, No Pipe**
**(End Plug)**



**No Pipe, Filler Material**




Plan View

Strata symbols

- Pavement
- Fill
- Silty clay till
- Fill clayey
- Clayey silt till
- Clayey silt
- Silty clay
- Topsoil
- Description not given for: "FFF"
- Description not given for: "CZCZ"

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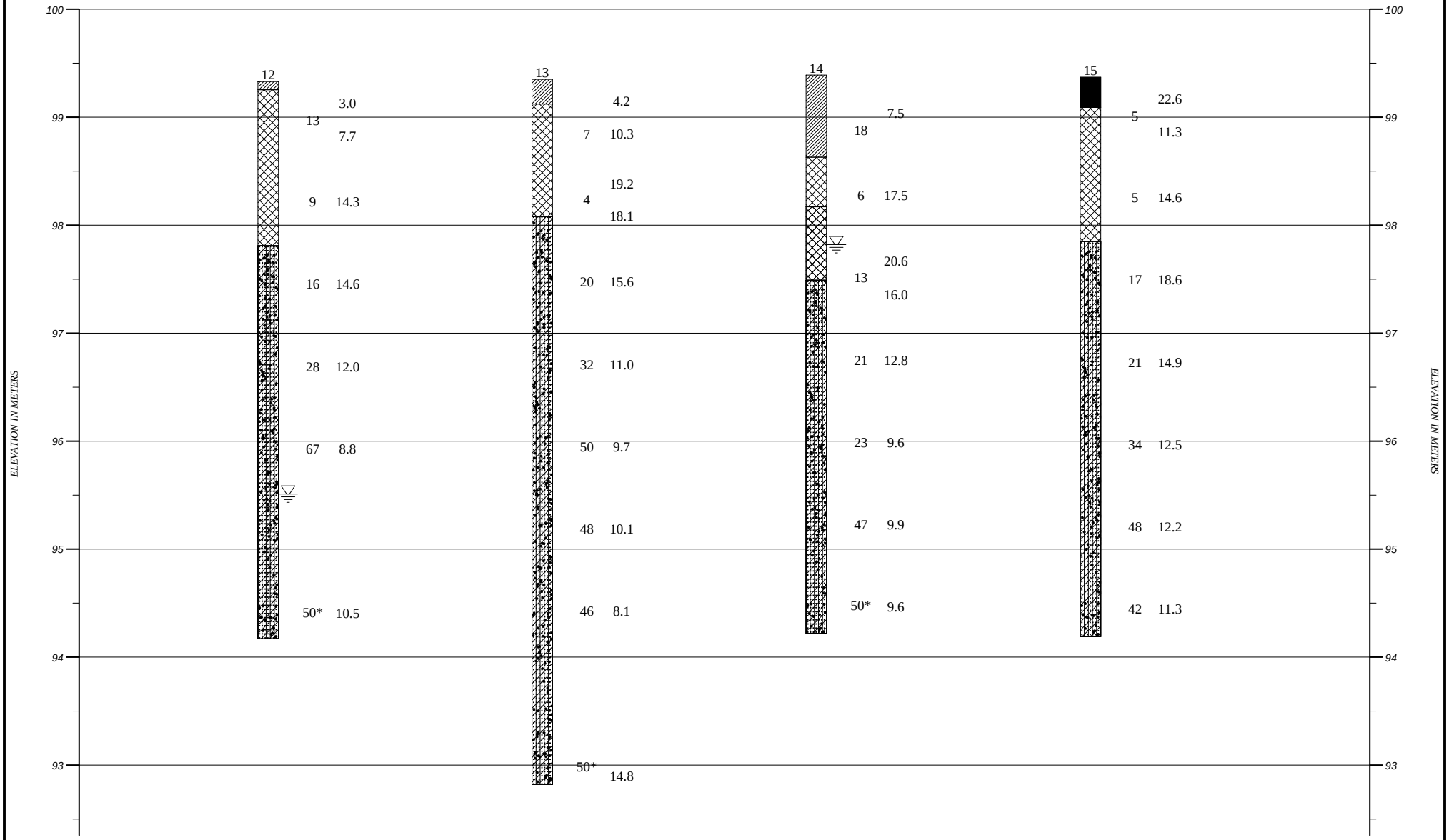
CONCEPTUAL SOIL PROFILE

| | |
|---|---|
| HORIZONTAL SCALE: | DRAWN BY/APPROVED BY |
| VERTICAL SCALE: 1"=50' | |

Proposed Residential Development

PROJECT NO. 10278

Enclosure 18




Plan View

Strata symbols

- Pavement
- Fill
- Silty clay till
- Fill clayey
- Clayey silt till
- Clayey silt
- Silty clay
- Topsoil
- Description not given for: "FFF"
- Description not given for: "CZCZ"

SOLA ENGINEERING INC.

CONCEPTUAL SOIL PROFILE

| | |
|---|---|
| HORIZONTAL SCALE: | DRAWN BY/APPROVED BY |
| VERTICAL SCALE: 1"=50' | |

Proposed Residential Development

PROJECT NO. 10278

Enclosure 18