REPORT ON

Preliminary Geotechnical Investigation
Proposed residential Development
1326 - 1342 Bronte Road
Oakville, Ontario

PREPARED FOR:

ARGO Development

Project No: 20-186-100
Date: September 15, 2020

DS CONSULTANTS LTD.
6221 Highway 7, Unit 16
Vaughan, Ontario, L4H 0K8
Telephone: (905) 264-9393
www.dsconsultants.ca

Table of Contents

1. INTRODUCTION

DS Consultants Ltd. (DS) was retained by ARGO Development to undertake a preliminary geotechnical investigation for the proposed residential subdivision located at 1326-1342 Bronte Road, Oakville, Ontario.

It is understood that the proposed development will consist of single-family houses, serviced by a network of roads and sewers. A storm water management pond will also be constructed as a part of this development.

The purpose of this geotechnical investigation was to obtain information about the subsurface conditions at boreholes locations and from the findings in the boreholes to make recommendations pertaining to the geotechnical design of underground utilities, roads and to comment on the foundation conditions for the building construction.

DS has carried out environmental investigations at the subject site and the reports will be documented under separate covers. This report deals only with the geotechnical aspects of the site.

The design drawings are not available to us at the time of writing this report. Additional boreholes will be required before the final design of the development.

This report is provided on the basis of the terms of reference presented above and on the assumption that the design will be in accordance with the applicable codes and standards. If there are any changes in the design features relevant to the geotechnical analyses, or if any questions arise concerning the geotechnical aspects of the codes and standards, this office should be contacted to review the design. It may then be necessary to carry out additional borings and reporting before the recommendations of this office can be relied upon.

The site investigation and recommendations follow generally accepted practice for geotechnical consultants in Ontario. The format and contents are guided by client specific needs and economics and do not conform to generalized standards for services. Laboratory testing for most part follows ASTM or CSA Standards or modifications of these standards that have become standard practice.

This report has been prepared for ARGO Development and its architect and designers. Third party use of this report without DS consent is prohibited.

2. FIELD AND LABORATORY WORK

Fourteen (14) boreholes (BH20-1 through BH20-14, see **Drawing 1** for borehole locations) were drilled at the subject site to depths ranging from 6.7 to 8.2m below ground surface.

Boreholes were drilled with hollow stem continuous flight augers equipment by a drilling sub-contractor under the direction and supervision of DS personnel. Samples were retrieved at regular intervals with a 50 mm O.D. split-barrel sampler driven with a hammer weighing 624 N and dropping 760 mm in accordance with the Standard Penetration Test (SPT) method. The samples were logged in the field and

returned to the DS laboratory for detailed examination by the project engineer and for laboratory testing.

As well as visual examination in the laboratory, all soil samples from geotechnical boreholes were tested for moisture contents. Selected soil samples were subjected to grain size analyses and Atterberg Limits testing. Gradation curves for the grain size analyses are presented on Drawing 16.

Water level observations were made during and upon completion of drilling. Eight (8) boreholes were equipped with 50mm dia. monitoring wells for the long-term groundwater monitoring and environmental testing.

The ground surface elevations at the borehole locations were measured by DS personnel using a differential GPS unit leased from Sokkia Canada.

3. SITE AND SUBSURFACE CONDITIONS

The borehole location plans are shown on **Drawing 1**. General notes on sample description are provided on **Drawing 1A**. The subsurface conditions in the boreholes are presented in the individual borehole logs presented on **Drawings 2 and 15**.

3.1 Soil Conditions

Topsoil and Fill Materials

A surficial layer of topsoil ranging in thickness from 75mm to 150mm was found in the boreholes. It should be noted that the thickness of the topsoil explored at the borehole locations may not be representative for the site and should not be relied on to calculate the amount of topsoil at the site. Shallow hand-dug test-pits should be carried out to measure the topsoil thickness at site.

Fill material consisting of sandy silt to silty sand, sand and gravel and clayey silt was found in boreholes, extending to depths varying from 0.8 to 3.0m below the ground surface. The fill was present in a very loose to compact state, with measured SPT 'N' values ranging from 2 to 22 blows per 300 mm penetration. Inclusion of topsoil/organics were found in fill material in varying proportions.

Cohesionless Deposits (Silt, Sandy Silt/Silty Sand/Sand and Gravel/Gravelly Sand):

Below the fill, silt, silty sand to sandy silt, and gravelly sand to sand and gravel were encountered in all boreholes except BH20-5 to BH20-7 and BH20-11, extending to depths ranging from 2.3m to 6.0m. A lower layer of sand and gravel was found in boreholes BH20-8 and BH20-14 below the sandy silt till deposits, extending to the termination depths of boreholes. These deposits were water bearing and found in a very loose to compact state, with occasional very dense layers. The measured SPT 'N' values in cohesionless deposits ranged from 6 to more than 50 blows per 300 mm of penetration.

Cohesive Deposits (Silty Clay/Clayey Silt Till):

Cohesive deposits of silty clay and clayey silt till were encountered in all boreholes below the upper cohesionless deposits, extending to maximum drilled depths of BH20-1 to BH20-3 and underlain by sandy silt till deposits in other boreholes. These deposits were found to generally have a firm to stiff consistency with occasional very stiff to hard layers, with measured SPT 'N' values ranging from 7 to more than 50 blows per 300 mm penetration.

Sandy Silt Till:

Sandy silt till deposits were encountered below the cohesive deposits in Boreholes BH20-4 through BH20-14, extending to depths ranging from 6.0m to 8.2m below ground surface. Boreholes BH20-4 to BH20-7, BH20-9 to BH20-11 and BH20-13 were terminated in sandy silt till deposit. The sandy silt till deposits were found in a dense to very dense state, with measured SPT 'N' values ranging from 34 to more than 50 blows per 300 mm penetration.

3.2 Groundwater Conditions

All boreholes were found wet to saturated during and upon completion of drilling and the short-term (unstabilized) groundwater was found at depths of 0.8 to 2.3m below the ground surface. Eight (8) boreholes BH20-1, BH20-2, BH20-3, BH20-5, BH20-8, BH20-10, BH20-11 and BH20-13 were equipped with 50mm dia. monitoring wells. The groundwater levels measured in wells on August 18, 2020 ranged from 1.2m to 4.6m below the existing grade, corresponding to Elev. 129.4 to 125.3m, as summarized on **Table 1**. BH20-11 was found dry on August 18, 2020.

Table 1: Groundwater Levels Observed in Monitoring Wells

Borehole	Borehole Elevation (m)	Date of Observation	Water Level Depth (mbgs)	Water Level Elev. (m)
BH20-1	129.0	August 18, 2020	2.0	127.0
BH20-2	131.9	August 18, 2020	3.1	128.8
BH20-3	130.2	August 18, 2020	2.5	127.7
BH20-5	129.9	August 18, 2020	1.6	128.3
BH20-8	129.9	During drilling August 18, 2020	0.8 4.6	129.1 125.3
BH20-10	130.4	August 18, 2020	1.2	129.2
BH20-11	129.7	During drilling August 18, 2020	0.8 Dry	128.9 -
BH20-13	131.0	August 18, 2020	1.6	129.4

It should be noted that the groundwater levels can vary and are subject to seasonal fluctuations in response to major weather events. Further monitoring of groundwater levels in the wells is recommended.

4. DISCUSSION AND RECOMMENDATIONS

It is proposed to develop the site as a residential subdivision. The lots will therefore be serviced by a network of roads, storm and sanitary sewers and watermains.

4.1 SITE GRADING & ENGINEERED FILL

The site will be developed as residential subdivision with residential lots, roads and driveways, it is recommended that all fill to be placed for grading purposes be constructed as engineered fill to provide competent subgrade below house foundations, roads, boulevards, etc.

Prior to placement of engineered fill, the topsoil and existing fill materials should be removed to expose the inorganic competent native subgrade. The exposed subgrade should then be proof rolled with a heavy sheepsfoot roller to identify weak areas. Any weak or excessively wet zones identified during proof-rolling should be sub-excavated and replaced with compacted competent material to establish stable and uniform conditions. Prior to placement of engineered fill, the subgrade should be inspected and approved by a geotechnical engineer. Dewatering will be required prior to any excavation below the groundwater table.

The competent subgrade after the removal of existing fill materials is expected to be very wet, therefore, we recommend use of inorganic granular soils as the engineered fill material. Consideration can be given to the use of Granular B layer (600mm thick) engineered fill to cover the subgrade and on top of it, engineered fill consisting of inorganic soil can be used.

General guidelines for the placement and preparation of engineered fill are presented on **Appendix A**. Bearing capacity values of 150 kPa at SLS and 225 kPa at ULS can be used on engineered fill, provided that all requirements on **Appendix A** are adhered to. To reduce the risk of improperly placed engineered compacted fill, full-time supervision of the contractor is essential.

The existing fill materials free from topsoil and organics to be excavated from cut-areas are considered suitable for re-use as engineered fill, provided that their moisture contents at the time of construction are at or near optimum. Significant aeration of the excavated soils will be required, prior to their re-use as engineered fill.

4.2 ROADS

The investigation has shown that the predominant subgrade soil, after stripping the topsoil and existing fill materials will generally consist of cohesionless sandy soils or glacial tills.

Based on the above and assuming that traffic usage will be residential local road, the following minimum pavement thickness is recommended for roads to be constructed within the development:

40 mm HL3 Asphaltic Concrete

60 mm HL8 Asphaltic Concrete

150 mm Granular 'A'

350 mm Granular 'B'

These values may need to be adjusted according to the Town of Oakville Standards. The site subgrade and weather conditions (i.e. if wet) at the time of construction may necessitate the placement of thicker granular sub-base layer in order to facilitate the construction. Furthermore, heavy construction equipment may have to be kept off the newly constructed roads before the placement of asphalt and/or immediately thereafter, to avoid damaging the weak subgrade by heavy truck traffic.

4.2.1 STRIPPING, SUB-EXCAVATION AND GRADING

The site should be stripped of all topsoil, existing fill material and weathered or otherwise unsuitable soils to the full depth of the roads, both in cut and fill areas. Following stripping, the site should be graded to the subgrade level and approved. The subgrade should then be proof-rolled, in the presence of the Geotechnical Engineer, by at least several passes of a heavy compactor having a rated capacity of at least 8 tonnes. Any soft spots thus exposed should be removed and replaced by select fill material, similar to the existing subgrade soil and approved by the Geotechnical Engineer. The subgrade should then be re-compacted from the surface to at least 98% of its Standard Proctor Maximum Dry Density (SPMDD). The final subgrade should be cambered or otherwise shaped properly to facilitate rapid drainage and to prevent the formation of local depressions in which water could accumulate.

Proper cambering and allowing the water to escape towards the sides (where it can be removed by means of subdrains) is considered to be beneficial for this project. Otherwise, any water collected in the granular sub-base materials could be trapped thus causing problems due to softened subgrade, differential frost heave, etc. For the same reason damaging the subgrade during and after placement of the granular materials by heavy construction traffic should be avoided. If the moisture content of the local material cannot be maintained at ±2% of the optimum moisture content, imported granular material may need to be used.

Any fill required for re-grading the site or backfill should be select, clean material, free of topsoil, organic or other foreign and unsuitable matter. The fill should be placed in thin layers and compacted to at least 95% of its SPMDD. The degree of compaction should be increased to 98% within the top 1.0 m of the subgrade, or as per Township Standards. The compaction of the new fill should be checked by frequent field density tests.

4.2.2 CONSTRUCTION

Once the subgrade has been inspected and approved, the granular base and sub-base course materials should be placed in layers not exceeding 200 mm (uncompacted thickness) and should be compacted to at least 100% of their respective SPMDD. The grading of the material should conform to current OPS Specifications.

The placing, spreading and rolling of the asphalt should be in accordance with OPS Specifications or, as required by the local authorities.

Frequent field density tests should be carried out on both the asphalt and granular base and sub-base materials to ensure that the required degree of compaction is achieved.

4.2.3 DRAINAGE

The Town of Oakville will require the installation of full-length subdrains on all roads. The subdrains should be properly filtered to prevent the loss of (and clogging by) soil fines.

All paved surfaces should be sloped to provide satisfactory drainage towards catch-basins. As discussed in Section 4.2.1, by means of good planning any water trapped in the granular sub-base materials should be drained rapidly towards subdrains or other interceptors.

4.3 SEWERS

As a part of the site development, a network of new storm and sanitary sewers is to be constructed. It is assumed that the trenches are generally within 4 to 5 m below the existing grade.

4.3.1 TRENCHING

Based on the boreholes, the trenches in most of the boreholes will be dug mainly through the water bearing cohesionless sandy soils and till deposits. The groundwater levels in the boreholes generally ranged from 0.8 to 3.1m below the existing grade, corresponding to Elev. 127.0 to 129.4m. Any excavation in cohesionless sandy soils below the groundwater table will require positive dewatering, otherwise, it will result in an unstable base and flowing sides. Groundwater table must be lowered to 1m below the lowest excavation level.

The sides of excavations in the natural strata, when dewatered, can be expected to be temporarily stable at relatively steep side slopes for short periods of time but they should be cut back at slopes no steeper than 1:1 in order to comply with the safety regulations. Otherwise, excavation slopes of 3:1V or flatter inclination in wet soils will be required.

All excavations must be carried out in accordance with the most recent Occupational Health and Safety Act (OHSA). In accordance with OHSA, the fill and cohesionless sandy soils (sandy silt, silty sand and sand and gravel can be classified as Type 3 Soil above the groundwater and Type 4 Soil below the groundwater table. The very stiff to hard clayey soils can be classified as Type 2 soil above groundwater and Type 3 Soil below water table.

4.3.2 BEDDING

The boreholes show that the sewer pipes will predominantly be laid within the native soils, which when dewatered, will provide adequate support for the sewer pipes and allow the use of normal Class B type

bedding. The bedding should conform to the current Ontario Provincial Standard specifications (OPSS 401/OPSD 802) and/or standards set by the local municipality.

The recommended minimum thickness of granular bedding below the invert of the pipes is 150 mm. The thickness of the bedding may, however, have to be increased depending on the pipe diameter or in accordance with local standards or if wet or weak subgrade conditions are encountered, especially when the soil at the trench base level consists of wet, dilatant silt. The bedding material should consist of well graded granular material such as Granular 'A' or equivalent. After installing the pipe on the bedding, a granular surround of approved bedding material, which extends at least 300 mm above the obvert of the pipe, or as set out by the local Authority, should be placed.

To avoid the loss of soil fines from the subgrade, uniformly graded clear stone should not be used unless, below the granular bedding material, a suitable, approved filter fabric (geotextile) is placed. The geotextile should extend along the sides of the trench and should be wrapped all around the poorly graded bedding material.

4.3.3 BACKFILLING OF TRENCHES

Based on visual and tactile examination, the on-site excavated inorganic native soils are considered to be suitable for re-use as backfill in the service trenches provided their moisture contents at the time of construction are within 2 percent of their optimum moisture content. Significant aeration of the wet sandy and silty soils will be required prior to their re-use as backfill material.

The clayey soils especially when its consistency is hard is likely to be excavated in cohesive chunks or blocks and will be difficult to compact in confined areas. For use as backfill, the clayey material will have to pulverized and placed in thin layers. The clayey soils will have to be compacted using heavy equipment suitable for these soils which may be difficult to operate in the narrow confines of the trenches. Unless the clayey materials are properly pulverized and compacted in sufficiently thin lifts post-construction settlements could occur. Their use in narrow trenches such as laterals (where heavy compaction equipment cannot be operated) may not be feasible.

Selected inorganic fill and the native soils free from topsoil and organics can be used as general construction backfill where it can be compacted with sheep's foot type compactors. Loose lifts of soil, which are to be compacted, should not exceed 200 mm. Depending on the time of construction and weather, some excavated material may be too wet to compact and will require aeration prior to its use.

Imported granular fill, which can be compacted with hand held equipment, should be used in confined areas. The excavated soils are not considered to be free draining. Where free draining backfill is required, imported granular fill such as OPSS Granular B should be used.

The backfill should be placed in maximum 200 mm thick layers at or near (±2%) their optimum moisture content and each layer should be compacted to at least 95% SPMDD. In the upper 1.0 m, underneath

the road base, the compaction should be increased to 98% SPMDD. Unsuitable materials such as organic soils, boulders, cobbles, frozen soils, etc. should not be used for backfilling.

The on-site excavated soils and especially the clayey soils should not be used in confined areas (e.g. around catch-basins and laterals under roadways) where heavy compaction equipment cannot be operated. The use of imported granular fill together with an appropriate frost taper would be preferable in confined areas and around structures, such as catch-basins.

It should be noted that the excavated soils are subject to moisture content increase during wet weather which would make these materials too wet for adequate compaction. Stockpiles should be compacted at the surface or be covered with tarpaulins to minimize moisture uptake.

The topsoil encountered at the site can be used for landscaping fill to raise the grades. Topsoil cannot be reused as foundation and trench backfill material.

4.4 FOUNDATION CONDITIONS

It is understood that the proposed subdivision will consist of single-family homes with one level basement. The finish floor elevations of these proposed houses are not known to us at the time of writing this report.

The native soils encountered in the boreholes are competent to support the proposed houses on conventional footings. The spread and strip footings founded on the undisturbed native soils can be designed for a bearing capacity of 75 to 150 kPa at SLS (Serviceability Limit State), and for a factored geotechnical resistance of 112 to 225 kPa at ULS (Ultimate Limit State).

Alternatively, the proposed houses can also be supported by spread and strip footings founded on engineered fill for a bearing capacity of 150 kPa at the serviceability limit states (SLS) and for a factored geotechnical resistance of 225 kPa at the ultimate limit states (ULS), provided all requirements on Appendix C are adhered to.

Foundations designed to the specified bearing capacities at the serviceability limit states (SLS) are expected to settle less than 25 mm total and 19 mm differential.

All footings exposed to seasonal freezing conditions must have at least 1.2 metres of soil cover for frost protection.

Where it is necessary to place footings at different levels, the upper footing must be founded below an imaginary 10 horizontal to 7 vertical line 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.

It should be noted that the recommended bearing capacities have been calculated by DS from the borehole information for the design stage only. The investigation and comments are necessarily on-going as new information of the underground conditions becomes available. For example, 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 therefore be checked through field inspections provided by DS to validate the information for use during the construction stage..

5. EARTH PRESSURES

The lateral earth pressures acting on foundation and basement walls may be calculated from the following expression:

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

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

K = Earth pressure coefficient, assumed to be 0.40 for vertical walls and horizontal backfill for permanent construction

γ = Unit weight of backfill, a value of 21 kN/m3 may be assumed

h = Depth to point of interest in metres

q = Equivalent value of surcharge on the ground surface in kPa

The above expression assumes that the perimeter drainage system prevents the build up of any hydrostatic pressure behind the wall.

6. STORMWATER MANAGEMENT POND

It is understood that a stormwater management pond will also be constructed at the subject site as part of the proposed residential development. The bottom of the proposed pond will be at about 4.0m below the existing grade.

Three (3) boreholes BH20-5, BH20-8 and BH20-9 were drilled in the area of the proposed pond. Based on the borehole information, the pond will mainly be excavated through the existing cohesionless sandy fill to silty clay/clayey silt till and silt deposits. Groundwater levels in BH20-5 and BH20-8 were recorded at depths of 0.8 to 1.6m below the existing grade. The existing fill material was found to be wet below a depth of 0.8m.

As the site is characterized by a high-water table as typically indicated in BH20-5, we recommend that the elevation of the bottom of the pond be kept as high as possible for the ease of construction and for uplift stability considerations. We recommend that the side slopes be no steeper that 4H:1V and should be adequately protected against erosion.

Considering the cohesionless nature of the existing soils, a clay liner on the bottom and sides of the will be required, extending to the high-water level in the pond. The clay liner should consist of inorganic silty clay with minimum clay content of 20 percent, plasticity Index of 8 and compacted to 100% SPMDD with maximum loose lift thickness of 200 mm. The thickness of liner with depend upon the design pond

bottom elevation and long-term groundwater table in this area. Under liner drainage may be required depending upon the pond depth.

The prepared foundation for the berms (if any) should be inspected by the geotechnical engineer prior to the placement of berm fill. The berm fill (engineered) should consist of inorganic silty clay with minimum clay content of 20 percent, plasticity Index of 8 and compacted to 100% SPMDD with maximum loose lift thickness of 200 mm. The existing onsite silty clay till is considered suitable for reuse as berm engineered fill, provided its moisture content is within 2 percent of its optimum moisture content. Any cobbles or boulders greater than 100 mm in size should be excluded from the earth berm fill. The fill must be placed and compacted under the full-time supervision of a qualified geotechnical personnel from DS.

Excavation can be carried out with heavy hydraulic backhoe. Any excavation in fill materials with perched water condition and cohesionless sandy soils below the groundwater table will require positive dewatering, otherwise, it will result in an unstable base and flowing sides. Groundwater table must be lowered to 1m below the lowest excavation level.

It should be noted that the till is a non-sorted sediment and therefore may contain boulders. Possible large obstructions such as buried concrete pieces are also anticipated in the fill material. Provisions must be made in the excavation contract for the removal of possible boulders in the till or obstructions in the fill material.

It is understood that the design of pond is still at a preliminary stage. The design drawings including the depth of the pond, side slopes and permanent pool level is not available to us at the time of writing this report. A slope stability analyses of the pond excavation and/or berm slopes should be carried out once the final design is available.

7. GENERAL COMMENTS AND LIMITATIONS OF REPORT

DS Consultants Ltd. (DS) should be retained for a general review of the final design and specifications to verify that this report has been properly interpreted and implemented. If not accorded the privilege of making this review, DS will assume no responsibility for interpretation of the recommendations in the report.

This report is intended solely for the Client named. The material in it reflects our best judgment in light of the information available to DS at the time of preparation. Unless otherwise agreed in writing by DS, it shall not be used to express or imply warranty as to the fitness of the property for a particular purpose. No portion of this report may be used as a separate entity, it is written to be read in its entirety.

The conclusions and recommendations given in this report are based on information determined at the test hole locations. The information contained herein in no way reflects on the environment aspects of the project, unless otherwise stated. Subsurface and groundwater conditions between and beyond the

test holes may differ from those encountered at the test hole locations, and conditions may become apparent during construction, which could not be detected or anticipated at the time of the site investigation. The benchmark and elevations used in this report are primarily to establish relative elevation differences between the test hole locations and should not be used for other purposes, such as grading, excavating, planning, development, etc.

The design recommendations given in this report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report.

The comments made in this report on potential construction problems and possible methods are intended only for the guidance of the designer. The number of test holes may not be sufficient to determine all the factors that may affect construction methods and costs. For example, the thickness of surficial topsoil or fill layers may vary markedly and unpredictably. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusions as to how the subsurface conditions may affect their work. This work has been undertaken in accordance with normally accepted geotechnical engineering practices.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. DS accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report. We accept no responsibility for any decisions made or actions taken as a result of this report unless we are specifically advised of and participate in such action, in which case our responsibility will be as agreed to at that time.

We trust that the information contained in this report is satisfactory. Should you have any questions, please do not hesitate to contact this office.

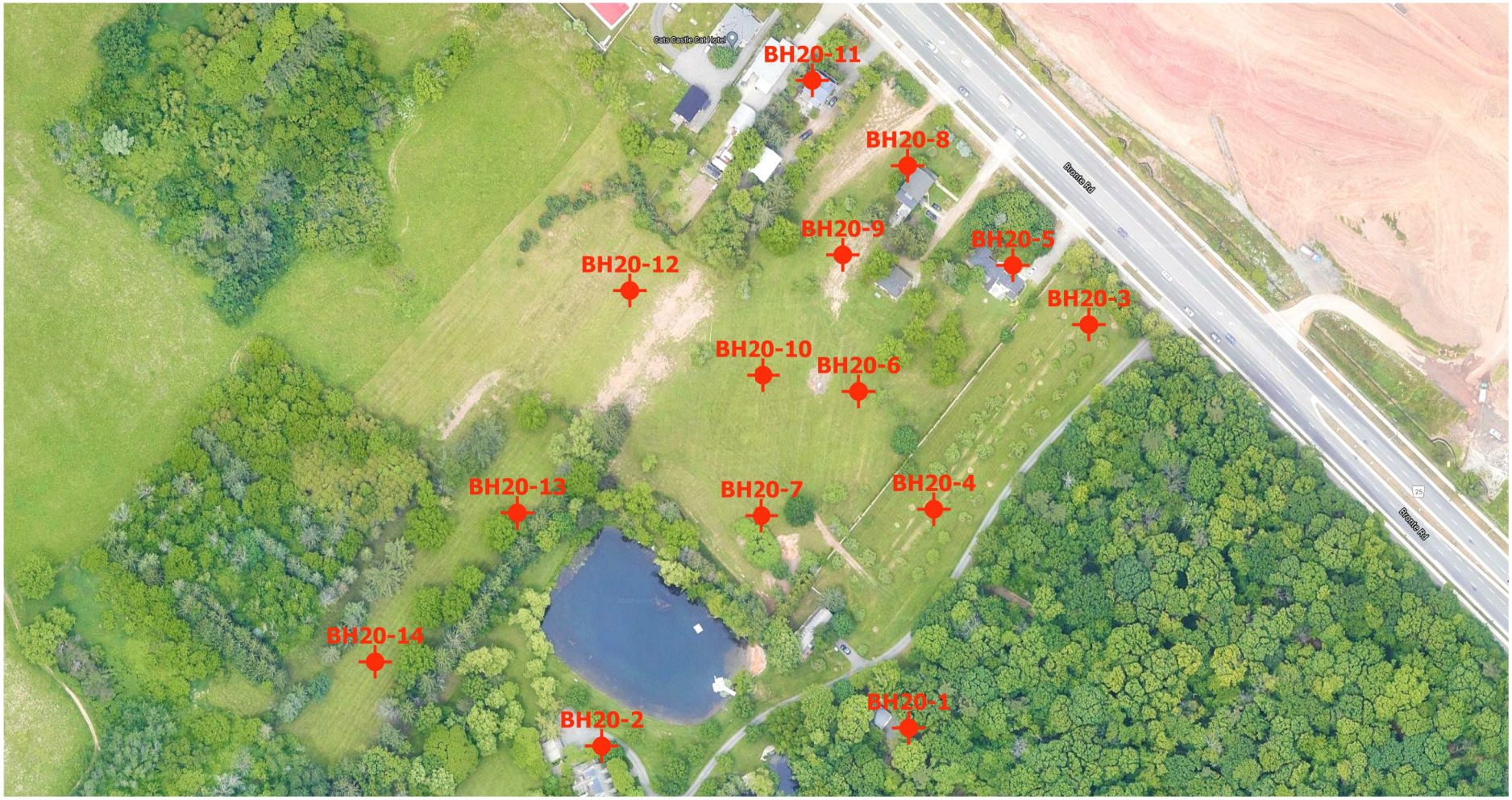
DS CONSULTANTS LTD.

Naeem Ehsan, M.Eng., P.Eng.

Alka Sangar, M.Eng., P.Eng.

Fanyu Zhu, Ph.D., P.Eng.

Drawings



Legend

Borehole Location

DS CONSULTANTS LTD.
6221 Highway 7, UNIT 16
Vaughan, Ontario L4H 0K8
Telephone: (905) 264-9393
www.dsconsultants.ca

Project: Geotechnical Investigation - 1326 Bronte Road, Oakville, ON

Title: **Borehole Location Plan**

N

Client: Argo Development

Size:	Approved By:	Drawn By:	Date:
8.5 x 11	NE	MM	August, 2020
Rev: 0	Scale: As Shown	Project No.: 20-186-100	Figure No.: 1

Image/Map Source: *Google Satellite Image*

DS CONSULTANTS LTD.
Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE BH20-1

PROJECT: Preliminary Geotechnical Investigation - proposed Subdivision
CLIENT: Argo Development
PROJECT LOCATION: 1326 Bronte Road, Oakville, ON
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4807732.72 E 601031.73

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Aug/13/2020

REF. NO.: 20-186-100
ENCL NO.: 2

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	METHANE AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
129.0												
129.0	**TOPSOIL:** 150mm											
0.2	**FILL:** sandy silt, trace organics, brown, moist, loose		1	SS	4							
128.2												
0.8	**FILL:** silty sand, trace clay, trace gravel, brown, moist, loose		2	SS	7		128					
127.5							Bentonite					
1.5	**FILL:** sand, trace gravel, brown, wet, very loose		3	SS	3	▽	127					
126.7							W. L. 127.0 m Aug 18, 2020					
2.3	**SANDY SILT:** trace clay, brown, wet, dense		4	SS	31							
126.4												
2.6	**SILTY CLAY:** trace sand, brown, moist, hard											
126.0							126					
3.0	**SILT TO SANDY SILT:** trace clay, brown, wet, compact		5	SS	12							0 15 78 7
			6	SS	14		125					
							Filter Pack					
							Slotted Pipe					
			7	SS	16		124					
123.7												
5.3	**CLAYEY SILT TILL:** sandy, trace gravel, occasional cobble, reddish brown to grey, moist, stiff to very stiff		8	SS	18							8 29 48 15
							123					
			9	SS	13		Bentonite: Bottom of hole					
122.3												
6.7	**END OF BOREHOLE:**											

Notes:
1) Water depth at 1.5m below grade during drilling.
2) 50mm dia. monitoring well installed upon completion.
3) Water level Reading:

Date:	Water Level (mbgl):
Aug 18, 2020	2.0

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

DS SOIL LOG 20-186-100 1326 BRONTE ROAD_ARGO DEVELOPMENT.GPJ DS.GDT 9/15/20

DS CONSULTANTS LTD.
Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE BH20-2

PROJECT: Preliminary Geotechnical Investigation - proposed Subdivision
CLIENT: Argo Development
PROJECT LOCATION: 1326 Bronte Road, Oakville, ON
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4807723.7 E 600908.24

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Aug/13/2020

REF. NO.: 20-186-100
ENCL NO.: 3

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION
131.9					
131.8	**TOPSOIL:** 75mm				
0.1	**FILL:** sand and gravel, trace organics, brown, moist, compact	1	SS	14	Concrete
131.1					Bentonite
0.8	**FILL:** sandy silt, trace clay, trace gravel, brown, moist, compact	2	SS	14	131
		3	SS	13	130
129.6					
2.3	**FILL:** silty sand, trace organics, trace wood pieces, brown, wet, loose	4	SS	5	
128.9					129
3.0	**SAND:** trace silt, trace clay, reddish brown, wet, loose	5	SS	6	Filter Pack W. L. 128.8 m Aug 18, 2020
					128
		6	SS	8	127
					Bentonite: Bottom of hole
125.9					126
6.0	**CLAYEY SILT TILL:** sandy, trace gravel, occasional cobble/ boulder, reddish brown to grey, moist, stiff	7	SS	11	
125.2					
6.7	**END OF BOREHOLE:**				

Notes:
1) Water depth at 2.3m below grade during drilling.
2) 50mm dia. monitoring well installed upon completion.
3) Water level Reading:

Date:	Water Level (mbgl):
Aug 18, 2020	3.1

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)

METHANE AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

DS SOIL LOG 20-186-100 1326 BRONTE ROAD_ARGO DEVELOPMENT.GPJ DS.GDT 9/15/20

DS CONSULTANTS LTD.
Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE BH20-3

PROJECT: Preliminary Geotechnical Investigation - proposed Subdivision
CLIENT: Argo Development
PROJECT LOCATION: 1326 Bronte Road, Oakville, ON
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4807894.84 E 601101.6

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Aug/13/2020

REF. NO.: 20-186-100
ENCL NO.: 4

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	METHANE AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
130.2												
130.0 / 0.1	**TOPSOIL:** 75mm											
	FILL: sand and gravel, trace organics, brown, moist, very loose		1	SS	3		130					
129.4												
0.8	**FILL:** sandy silt, trace clay, trace to some gravel, brown, moist, compact		2	SS	10		129					
			3	SS	22							
127.9							128					
2.3	**SILTY SAND:** trace clay, brown, wet, compact		4	SS	10	▽						
127.2								W. L. 127.7 m Aug 18, 2020				
3.0	**SILT:** some sand, some clay, trace gravel, brown, wet, disturbed		5	SS disturbed			127					2 13 72 13
126.4												
3.8	**SAND:** trace silt, brown, wet, compact		6	SS	16		126					
			7	SS	26							
	very dense below 5.4m		8	SS	50/ 140mm		125	Bentonite: Bottom of hole				
124.2												
6.0	**CLAYEY SILT TILL:** sandy, trace gravel, occasional cobble/ boulder, reddish brown to grey, moist, hard		9	SS	50/ 140mm		124					
123.5												
6.7	**END OF BOREHOLE:**											

Notes:
1) Water depth at 2.3m below grade during drilling.
2) 50mm dia. monitoring well installed upon completion.
3) Water level Reading:

Date:	Water Level (mbgl):
Aug 18, 2020	2.5

Bentonite

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

DS SOIL LOG 20-186-100 1326 BRONTE ROAD_ARGO DEVELOPMENT.GPJ DS.GDT 9/15/20

DS CONSULTANTS LTD.
Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE BH20-4

PROJECT: Preliminary Geotechnical Investigation - proposed Subdivision
CLIENT: Argo Development
PROJECT LOCATION: 1326 Bronte Road, Oakville, ON
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4807820.2 E 601040.5

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Aug/13/2020

REF. NO.: 20-186-100
ENCL NO.: 5

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS / 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION
130.9							
130.8 / 0.1	**TOPSOIL:** 100mm **FILL:** sandy silt, trace gravel, brown, moist, loose		1	SS	4		
130.1							
0.8 / 129.6	**FILL:** silty sand, some gravel, brown, moist, compact		2	SS	10		130
1.3	**SILTY SAND:** trace clay, trace gravel, brown, wet, compact to dense		3	SS	19		129
			4	SS	31		128
			5	SS	29		127
126.4							
4.5	**SILTY CLAY TILL:** sandy, trace gravel, occasional cobble/ boulder, grey, very moist, very stiff		6	SS	15		126
124.9							125
6.0	**SANDY SILT TILL:** trace clay, trace gravel, occasional cobble/ boulder, grey, moist, very dense		7	SS	52		
124.2							
6.7	**END OF BOREHOLE:** Notes: 1) Water depth at 1.3m below grade during drilling.						

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)
METHANE AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

DS SOIL LOG 20-186-100 1326 BRONTE ROAD_ARGO DEVELOPMENT.GPJ DS.GDT 9/15/20

DS CONSULTANTS LTD.
Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE BH20-5

PROJECT: Preliminary Geotechnical Investigation - proposed Subdivision
CLIENT: Argo Development
PROJECT LOCATION: 1326 Bronte Road, Oakville, ON
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4807918.06 E 601070.76

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Aug/14/2020

REF. NO.: 20-186-100
ENCL NO.: 6

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION
129.9						
129.8	**TOPSOIL:** 100mm					
0.1	**FILL:** sandy silt, trace gravel, brown, moist, loose	1	SS	4		
129.1						
0.8	**FILL:** clayey silt, sand seams, trace to some organics, brown to grey, wet, very loose	2	SS	3		
128.4						
1.5	**FILL:** sandy silt, trace gravel, brown, wet, loose	3	SS	8		
127.6						
2.3	**SILTY CLAY TILL:** sandy, trace gravel, occasional cobble/ boulder, brown to grey, moist, firm (weathered/ disturbed)	4	SS	7		
126.9						
3.0	**CLAYEY SILT TILL:** sandy, trace gravel, occasional cobble/ boulder, grey, moist, very stiff to hard	5	SS	20		
		6	SS	20		
	grey to reddish brown below 4.5m	7	SS	37		
124.6						
5.3	**SANDY SILT TILL:** trace clay, trace gravel, occasional cobble/ boulder, reddish brown, moist, very dense	8	SS	92/ 280mm		
		9	SS	87		
123.2						
6.7	**END OF BOREHOLE:**					

Notes:
1) Water depth at 1.5m below grade during drilling.
2) 50mm dia. monitoring well installed upon completion.
3) Water level Reading:

Date:	Water Level (mbgl):
Aug 18, 2020	1.6

Bentonite
Filter Pack
Slotted Pipe
Bentonite: Bottom of hole
W. L. 128.3 m Aug 18, 2020

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)
METHANE AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

DS SOIL LOG 20-186-100 1326 BRONTE ROAD_ARGO DEVELOPMENT.GPJ DS.GDT 9/15/20

DS CONSULTANTS LTD.
Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE BH20-6

PROJECT: Preliminary Geotechnical Investigation - proposed Subdivision
CLIENT: Argo Development
PROJECT LOCATION: 1326 Bronte Road, Oakville, ON
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4807866.75 E 601009.6

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Aug/14/2020

REF. NO.: 20-186-100
ENCL NO.: 7

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS 0.3 m	ELEVATION
130.5					
130.4 / 0.1	**TOPSOIL:** 100mm				
	FILL: sandy silt, some clay, trace gravel, trace organics, brown, moist, loose	1	SS	5	130
129.7					
0.8	**FILL:** silty sand, trace gravel, brown, wet, compact to loose	2	SS	10	
		3	SS	6	129
128.2					
2.3	**FILL:** silt to sandy silt, trace gravel, occasional cobble/ boulder, brown to grey, wet, loose	4	SS	5	128
127.5					
3.0	**CLAYEY SILT TILL:** sandy, trace gravel, occasional cobble/ boulder, brown, moist, stiff to hard	5	SS	11	127
	grey to reddish brown below 4.5m	6	SS	30	126
124.5					125
6.0	**SANDY SILT TILL:** trace clay, trace gravel, occasional cobble/ boulder, brown, moist, very dense	7	SS	50/150mm	124
123.8					
6.7	**END OF BOREHOLE:** Notes: 1) Water depth at 0.8m below grade during drilling.				

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH (kPa): ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE; 20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L

WATER CONTENT (%): 10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

METHANE AND GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL
1	18	74	7

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

DS SOIL LOG 20-186-100 1326 BRONTE ROAD_ARGO DEVELOPMENT.GPJ DS.GDT 9/15/20

DS CONSULTANTS LTD.
Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE BH20-7

PROJECT: Preliminary Geotechnical Investigation - proposed Subdivision
CLIENT: Argo Development
PROJECT LOCATION: 1326 Bronte Road, Oakville, ON
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4807816.61 E 600971.29

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Aug/12/2020

REF. NO.: 20-186-100
ENCL NO.: 8

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS / 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION
130.6 / 0.0	**TOPSOIL:** 100mm						
130.4 / 0.2	**FILL:** sandy silt, some clay, trace gravel, trace organics, brown, moist, loose		1	SS	5		130
129.8 / 0.8	**FILL:** sand and gravel, trace silt, trace clay, reddish brown, wet, loose		2	SS	7		
128.8 / 1.8	**FILL:** silt, some clay, brown, wet, loose		3	SS	8		129
128.3 / 2.3	**CLAYEY SILT TILL:** sandy, trace gravel, occasional cobble/ boulder, brown, moist, stiff to very stiff		4	SS	18		128
			5	SS	12		127
126.1 / 4.5	**SANDY SILT TILL:** trace clay, trace gravel, occasional cobble/ boulder, brown to grey, moist, dense to very dense		6	SS	34		126
			7	SS	66		125
123.9 / 6.7	**END OF BOREHOLE:** Notes: 1) Water depth at 0.8m below grade during drilling.						124

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

METHANE AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

DS SOIL LOG 20-186-100 1326 BRONTE ROAD_ARGO DEVELOPMENT.GPJ DS.GDT 9/15/20

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

DS CONSULTANTS LTD.
Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE BH20-8

PROJECT: Preliminary Geotechnical Investigation - proposed Subdivision
CLIENT: Argo Development
PROJECT LOCATION: 1326 Bronte Road, Oakville, ON
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4807957.17 E 601027.93

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Aug/12/2020

REF. NO.: 20-186-100
ENCL NO.: 9

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 10 20 30	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	METHANE AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
129.9												
0.0 / 129.1	**FILL:** sandy silt, mixed with topsoil, brown, moist, loose		1	SS	4							
0.8 / 127.6	**FILL:** silty sand, clay seams, brown, wet, loose to compact		2	SS	4		129					
			3	SS	9		128					
2.3 / 125.4	**CLAYEY SILT TILL:** sandy, trace gravel, occasional cobble/ boulder, brown, moist, stiff to hard		4	SS	10		127					
			5	SS	12							
			6	SS	47		126					
4.5 / 122.4	**SANDY SILT TILL:** trace clay, trace gravel, occasional cobble/ boulder, brown, moist, very dense		7	SS	50/ 140mm	W. L. 125.3 m Aug 18, 2020						
			8	SS	99/ 290mm		124					
			9	SS	58		123					
7.5 / 121.7	**GRAVELLY SAND:** some silt, trace clay, brown, wet, very dense		10	SS	90		122					25 57 14 4
8.2	**END OF BOREHOLE:**											

Notes:
1) Water depth at 0.8m below grade during drilling.
2) 50mm dia. monitoring well installed upon completion.
3) Water level Reading:

Date:	Water Level (mbgl):
Aug 18, 2020	4.6

Bentonite
Filter Pack
Slotted Pipe
Bentonite: Bottom of hole

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ε=3% Strain at Failure

DS SOIL LOG 20-186-100 1326 BRONTE ROAD_ARGO DEVELOPMENT.GPJ DS.GDT 9/15/20

DS CONSULTANTS LTD.
Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE BH20-9

PROJECT: Preliminary Geotechnical Investigation - proposed Subdivision
CLIENT: Argo Development
PROJECT LOCATION: 1326 Bronte Road, Oakville, ON
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4807921.2 E 601002.49

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Aug/12/2020

REF. NO.: 20-186-100
ENCL NO.: 10

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION
130.6							
130.5 / 0.1	**TOPSOIL:** 100mm						
	FILL: silty sand, trace topsoil, trace rootlets, brown, moist, loose		1	SS	5		130
129.8 / 0.8							
	FILL: sand, trace silt, trace clay, reddish brown, wet, loose		2	SS	5		
129.1 / 1.5							129
	SILT: trace clay, trace sand, brown, wet, loose to compact		3	SS	8		
	grey below 2.3m		4	SS	12		128
127.6 / 3.0							
	CLAYEY SILT TILL: sandy, trace gravel, occasional cobble/ boulder, brown, moist, stiff to hard		5	SS	12		
							127
			6	SS	55		126
124.6 / 6.0							
	SANDY SILT TILL: trace clay, trace gravel, occasional cobble/ boulder, brown, moist, very dense		7	SS	50/ 140mm		125
							124
			8	SS	98/ 280mm		123
122.4 / 8.2							
	END OF BOREHOLE: Notes: 1) Water depth at 0.8m below grade during drilling.						

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)

METHANE AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

DS SOIL LOG 20-186-100 1326 BRONTE ROAD_ARGO DEVELOPMENT.GPJ DS.GDT 9/15/20

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

DS CONSULTANTS LTD.
Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE BH20-10

PROJECT: Preliminary Geotechnical Investigation - proposed Subdivision
CLIENT: Argo Development
PROJECT LOCATION: 1326 Bronte Road, Oakville, ON
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4807872.68 E 600971.17

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Aug/12/2020

REF. NO.: 20-186-100
ENCL NO.: 11

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION
130.4					
0.0 / 130.1	**TOPSOIL:** 300mm				
0.3 / 129.6	**FILL:** silty sand, trace topsoil, brown, moist, loose	1	SS	5	
0.8 / 128.9	**SAND:** trace silt, trace clay, grey, wet, compact	2	SS	13	
1.5 / 128.1	**SILTY SAND:** trace clay, brown, wet, compact	3	SS	10	
2.3 / 127.0	**SILT TO SANDY SILT:** trace clay, brown, wet, compact	4	SS	17	
		5	SS	15	
3.4 / 126.6	**SILTY CLAY:** grey, moist, very stiff				
3.8	**CLAYEY SILT TILL:** sandy, trace gravel, occasional cobble/ boulder, brown, moist, very stiff to hard	6	SS	17	
125.1		7	SS	20	
5.3	**SANDY SILT TILL:** trace clay, trace gravel, occasional cobble/ boulder, brown, moist, very dense	8	SS	50/ 125mm	
123.7		9	SS	50/ 150mm	
6.7	**END OF BOREHOLE:**				

Notes:
1) Water depth at 0.8m below grade during drilling.
2) 50mm dia. monitoring well installed upon completion.
3) Water level Reading:

Date:	Water Level (mbgl):
Aug 18, 2020	1.2

Bentonite
Filter Pack
Slotted Pipe
Bentonite: Bottom of hole
W. L. 129.2 m
Aug 18, 2020

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)
SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
(20 40 60 80 100)

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)

METHANE AND GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL
0	12	81	7

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ε=3% Strain at Failure

DS SOIL LOG 20-186-100 1326 BRONTE ROAD_ARGO DEVELOPMENT.GPJ DS.GDT 9/15/20

DS CONSULTANTS LTD.
Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE BH20-11

PROJECT: Preliminary Geotechnical Investigation - proposed Subdivision
CLIENT: Argo Development
PROJECT LOCATION: 1326 Bronte Road, Oakville, ON
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4807990.65 E 600989.21

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Aug/19/2020

REF. NO.: 20-186-100
ENCL NO.: 12

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION
129.7 / 0.0	**TOPSOIL:** 125mm				
129.6 / 0.1	**FILL:** silty sand, mixed with topsoil, brown, moist, loose	1	SS	7	Bentonite
128.9 / 0.8	**SILTY SAND:** sandy silt, brown, wet, loose	2	SS	7	129
128.2 / 1.5	**FILL:** clayey silt to silty clay, brown, wet, firm	3	SS	6	128
127.2 / 2.5	**CLAYEY SILT TILL:** trace sand, trace gravel, grey, very moist, firm to stiff occasional cobble/ boulder below 3m	4	SS	7	Filter Pack Slotted Pipe
		5	SS	11	126
125.2 / 4.5	**SANDY SILT TILL:** trace clay, trace gravel, occasional cobble/ boulder, brown, moist, very dense	6	SS	50/ 125mm	125
					Bentonite: Bottom of hole
123.5 / 6.2	**END OF BOREHOLE:**	7	SS	50/ 100mm	124

Notes:
1) Water depth at 0.8m below grade during drilling.
2) 50mm dia. monitoring well installed upon completion.
3) Water level Reading:

Date:	Water Level (mbgl):
Aug 18, 2020	Dry

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)
METHANE AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

DS SOIL LOG 20-186-100 1326 BRONTE ROAD_ARGO DEVELOPMENT.GPJ DS.GDT 9/15/20

DS CONSULTANTS LTD.
Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE BH20-12

PROJECT: Preliminary Geotechnical Investigation - proposed Subdivision
CLIENT: Argo Development
PROJECT LOCATION: 1326 Bronte Road, Oakville, ON
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4807905.67 E 600916.81

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Aug/14/2020

REF. NO.: 20-186-100
ENCL NO.: 13

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION
131.5							
0.0 / 131.2	**TOPSOIL:** 300mm		1	SS	7		
0.3 / 130.7	**FILL:** sandy silt, some gravel/ cobble, trace rootlets, brown, moist, loose						131
1 0.8 / 130.0	**FILL:** sand and gravel, some silt, trace clay, brown, moist, loose		2	SS	7		
1.5	**SAND:** sand, trace silt, trace gravel, brown, wet, compact		3	SS	10		130
2 / 129.2							
2.3	**SAND AND GRAGEL:** silt seams, brown, wet, loose		4	SS	8		129
3 128.5							
3.0	**CLAYEY SILT TILL:** sandy, trace gravel, occasional cobble/ boulder, brown, moist, stiff to hard		5	SS	9		128
4							
			7	SS	35		127
5							
6 125.5							126
6.0 / 124.8	**SANDY SILT TILL:** trace clay, trace gravel, occasional cobble/ boulder, brown, wet, very dense		9	SS	50/ 90mm		125
6.7	**END OF BOREHOLE:** Notes: 1) Water depth at 1.5m below grade during drilling.						

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)
METHANE AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

DS SOIL LOG 20-186-100 1326 BRONTE ROAD_ARGO DEVELOPMENT.GPJ DS.GDT 9/15/20

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

DS CONSULTANTS LTD.
Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE BH20-13

PROJECT: Preliminary Geotechnical Investigation - proposed Subdivision
CLIENT: Argo Development
PROJECT LOCATION: 1326 Bronte Road, Oakville, ON
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4807816.25 E 600872.96

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Aug/14/2020

REF. NO.: 20-186-100
ENCL NO.: 14

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 10 20 30	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	METHANE AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
131.0												
0.0 / 130.8	**TOPSOIL:** 200mm											
0.2 / 130.2	**FILL:** silty sand, trace gravel, trace orgaics, brown, moist, very loose		1	SS	3		Bentonite		○			
0.8 / 129.5	**FILL:** sand and gravel, silty, brown, moist, loose		2	SS	6		130		○			
1.5 / 128.7	**FILL:** sand and gravel, trace silt, trace clay, wet, loose		3	SS	7	▽	W. L. 129.4 m Aug 18, 2020		○			
2.3 / 128.4	**FILL:** clayey silt, brown, very moist, loose		4	SS	8		129		○			
2.6 / 128.0	**FILL:** sandy silt, brown, wet, loose						Filter Pack					
3.0 / 127.2	**SILT:** trace sand, trace clay, brown, wet, compact		5	SS	15		Slotted Pipe		○			1 9 82 8
3.8 / 126.5	**CLAYEY SILT TILL:** sandy, trace gravel, occasional cobble/ boulder, brown, moist, very stiff		6	SS	18		127		○			
4.5	**SANDY SILT TILL:** trace clay, trace gravel, occasional cobble/ boulder, brown, moist to very moist, very dense		7	SS	50/ 140mm		126		○			
			8	SS	50/ 125mm		Bentonite: Bottom of hole		○			
			9	SS	50/ 140mm		125		○			
6.6 / 124.4	**END OF BOREHOLE:** Notes: 1) Water depth at 1.5m below grade during drilling. 2) 50mm dia. monitoring well installed upon completion. 3) Water level Reading: Date: Aug 18, 2020 Water Level (mbgl): 1.6											

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

DS SOIL LOG 20-186-100 1326 BRONTE ROAD_ARGO DEVELOPMENT.GPJ DS.GDT 9/15/20

DS CONSULTANTS LTD.
Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE BH20-14

PROJECT: Preliminary Geotechnical Investigation - proposed Subdivision
CLIENT: Argo Development
PROJECT LOCATION: 1326 Bronte Road, Oakville, ON
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4807755.92 E 600816.81

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Aug/13/2020

REF. NO.: 20-186-100
ENCL NO.: 15

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS / 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION
130.6 / 0.0	**TOPSOIL:** 200mm						
130.4 / 0.2	**FILL:** sandy silt, brown, moist, loose		1	SS	5		
129.8 / 0.8	**FILL:** silty sand, brown, wet, loose to very loose		2	SS	2		
	silt seams at 1.7m		3	SS	5		
128.3 / 2.3	**SANDY SILT:** some clay, brown, wet, compact		4	SS	10		
127.6 / 3.0	**SILTY CLAY:** trace gravel, grey, very moist, firm		5	SS	7		
126.1 / 4.5	**SANDY SILT TILL:** trace clay, trace gravel, occasional cobble/ boulder, brown, moist, very dense		6	SS	75		
124.6 / 6.0	**SAND AND GRAVEL:** brown, moist, very dense		7	SS	66		
123.9 / 6.7	**END OF BOREHOLE:** Notes: 1) Water depth at 0.8m below grade during drilling.						

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)

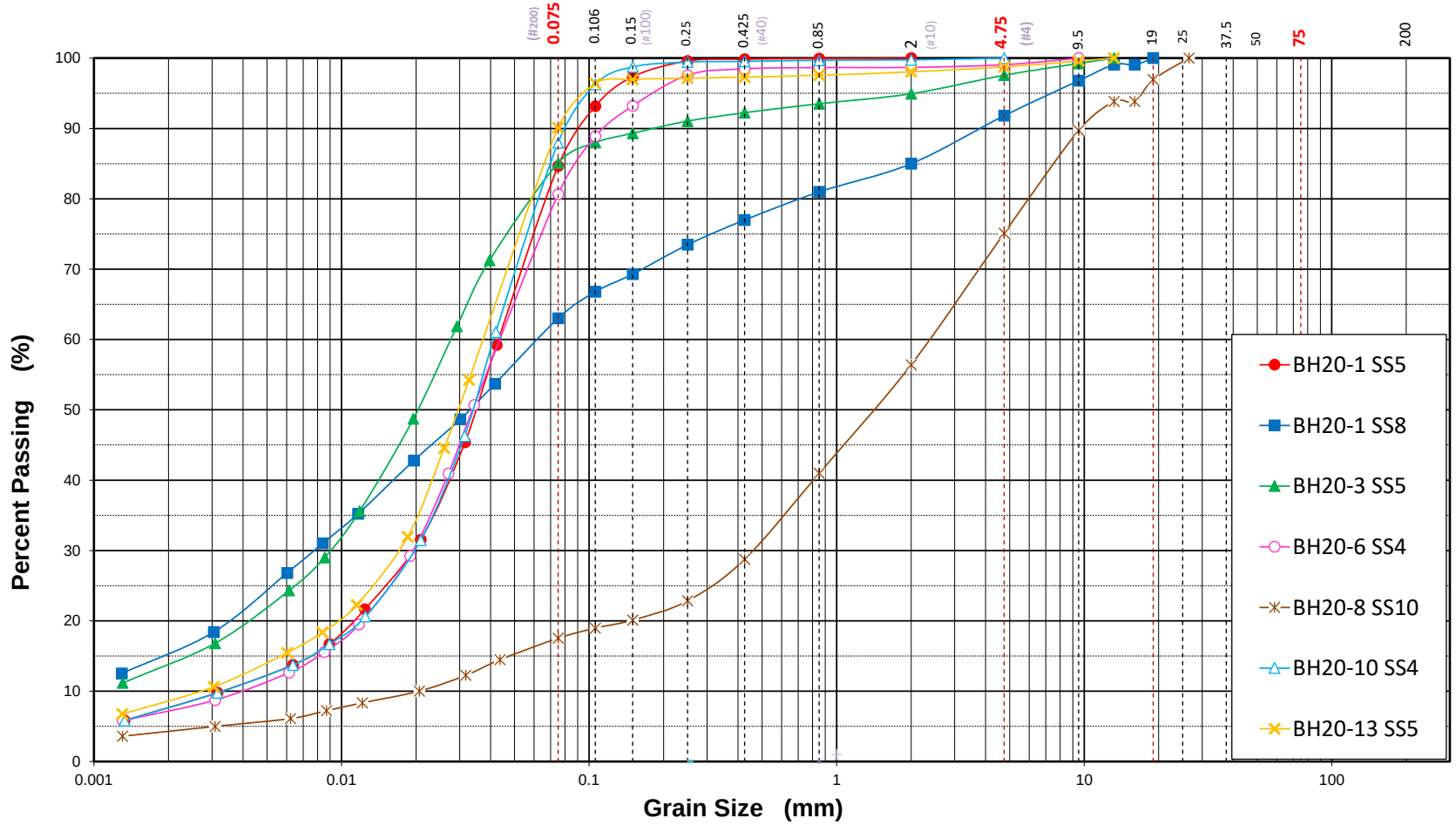
METHANE AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

DS SOIL LOG 20-186-100 1326 BRONTE ROAD_ARGO DEVELOPMENT.GPJ DS.GDT 9/15/20

Particle Size Distribution (ASTM-D421/D422)



Silt and Clay		Sand			Gravel		Cobble +
Clay	Silt	Fine	Medium	Coarse	Fine	Coarse	

DS CONSULTANTS LTD.
6221 Highway 7, Unit 16
Vaughan, Ontario, L4H 0K8
Telephone: (905) 264-9393
www.dsconsultants.ca

Project	**Preliminary Geotechnical Investigation**	Project No	**20-186-100**
Location	**1326 Bronte Rd, Oakville, ON**	Date	**Aug/31/2020**
Client	**Argo Development**	Figure No	16

Appendix A

Engineered Fill Guidelines

GENERAL REQUIREMENTS FOR ENGINEERED FILL

Compacted imported soil that meets specific engineering requirements and is free of organics and debris and that has been continually monitored on a full-time basis by a qualified geotechnical representative is classified as engineered fill. Engineered fill that meets these requirements and is bearing on suitable native subsoil can be used for the support of foundations.

Imported soil used as engineered fill can be removed from other portions of a site or can be brought in from other sites. In general, most of Ontario soils are too wet to achieve the 100% Standard Proctor Maximum Dry Density (SPMDD) and will require drying and careful site management if they are to be considered for engineered fill. Imported non-cohesive granular soil is preferred for all engineered fill. For engineered fill, we recommend use of OPSS Granular 'B' sand and gravel fill material.

Adverse weather conditions such as rain make the placement of engineered fill to the required degree of density difficult or impossible; engineered fill cannot be placed during freezing conditions, i.e. normally not between December 15 and April 1 of each year.

The location of the foundations on the engineered fill pad is critical and certification by a qualified surveyor that the foundations are within the stipulated boundaries is mandatory. Since layout stakes are often damaged or removed during fill placement, offset stakes must be installed and maintained by the surveyors during the course of fill placement so that the contractor and engineering staff are continually aware of where the engineered fill limits lie. Excavations within the engineered fill pad must be backfilled with the same conditions and quality control as the original pad.

To perform satisfactorily, engineered fill requires the cooperation of the designers, engineers, contractors and all parties must be aware of the requirements. The minimum requirements are as follows; however, the geotechnical report must be reviewed for specific information and requirements.

1. Prior to site work involving engineered fill, a site meeting to discuss all aspects must be convened. The surveyor, contractor, design engineer and geotechnical engineer must attend the meeting. At this meeting, the limits of the engineered fill will be defined. The contractor must make known where all fill material will be obtained from and samples must be provided to the geotechnical engineer for review, and approval before filling begins.

2. Detailed drawings indicating the lower boundaries as well as the upper boundaries of the engineered fill must be available at the site meeting and be approved by the geotechnical engineer.

3. The building footprint and base of the pad, including basements, garages, etc. must be defined by offset stakes that remain in place until the footings and service connections are all constructed. Confirmation that the footings are within the pad, service lines are in place, and that the grade conforms to drawings, must be obtained by the owner in writing from the surveyor and DS Consultants Ltd (DSCL). Without this confirmation no responsibility for the performance of the structure can be accepted by DSCL. Survey drawing of the pre and post fill location and elevations will also be required.

4. The area must be stripped of all topsoil and fill materials. Subgrade must be proof-rolled. Soft spots must be dug out. The stripped native subgrade must be examined and approved by a DSCL engineer prior to placement of fill.

5. The approved engineered fill material must be compacted to 100% Standard Proctor Maximum Dry Density throughout. Engineered fill should not be placed during the winter months. Engineered fill compacted to 100% SPMDD will settle under its own weight approximately 0.5% of the fill height and the structural engineer must be aware of this settlement. In addition to the settlement of the fill, additional settlement due to consolidation of the underlying soils from the structural and fill loads will occur and should be evaluated prior to placing the fill.

6. Full-time geotechnical inspection by DSCL during placement of engineered fill is required. Work cannot commence or continue without the presence of the DSCL representative.

7. The fill must be placed such that the specified geometry is achieved. Refer to the attached sketches for minimum requirements. Take careful note that the projection of the compacted pad beyond the footing at footing level is a minimum of 2 m. The base of the compacted pad extends 2 m plus the depth of excavation beyond the edge of the footing.

8. A bearing capacity of 150 kPa at SLS (225 kPa at ULS) can be used provided that all conditions outlined above are adhered to. A minimum footing width of 500 mm (20 inches) is suggested and footings must be provided with nominal steel reinforcement.

9. All excavations must be done in accordance with the Occupational Health and Safety Regulations of Ontario.

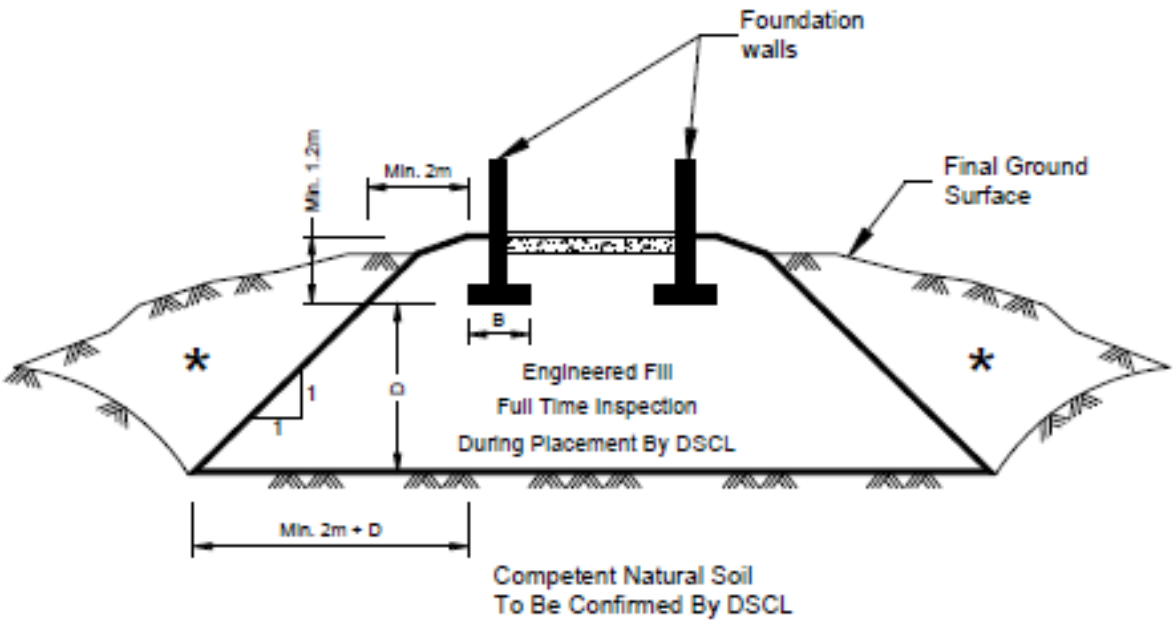
10. After completion of the engineered fill pad a second contractor may be selected to install footings. The prepared footing bases must be evaluated by engineering staff from DSCL prior to footing concrete placements. All excavations must be backfilled under full time supervision by DSCL to the same degree as the engineered fill pad. Surface water cannot be allowed to pond in excavations or to be trapped in clear stone backfill. Clear stone backfill can only be used with the approval of DSCL.

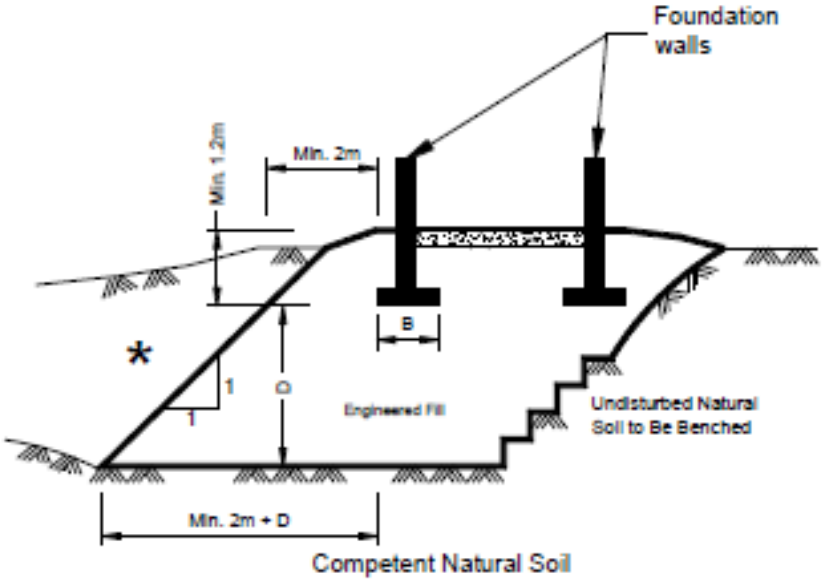
11. After completion of compaction, the surface of the engineered fill pad must be protected from disturbance from traffic, rain and frost. During the course of fill placement, the engineered fill must be smooth-graded, proof-rolled and sloped/crowned at the end of each day, prior to weekends and any stoppage in work in order to promote rapid runoff of rainwater and to avoid any ponding surface water. Any stockpiles of fill intended for use as engineered fill must also be smooth-bladed to promote runoff and/or protected from excessive moisture take up.

12. If there is a delay in construction, the engineered fill pad must be inspected and accepted by the geotechnical engineer. The location of the structure must be reconfirmed that it remains within the pad.

13. The geometry of the engineered fill as illustrated in these General Requirements is general in nature. Each project will have its own unique requirements. For example, if perimeter sidewalks are to be constructed around the building, then the projection of the engineered fill beyond the foundation wall may need to be greater.

14. These guidelines are to be read in conjunction with DS Consultants Ltd report attached.





* Backfill in this area to be as per the DSCL report.

REPORT ON

Preliminary Geotechnical Investigation
Proposed Residential Development
1350 Bronte Road
Oakville, Ontario

PREPARED FOR:

Bronte River Limited Partnership

Project No: 20-186-101
Date: November 17, 2021

DS CONSULTANTS LTD.
6221 Highway 7, Unit 16
Vaughan, Ontario, L4H 0K8
Telephone: (905) 264-9393
www.dsconsultants.ca

Table of Contents

1. INTRODUCTION

DS Consultants Ltd. (DS) was retained by Bronte River Limited Partnership to undertake a preliminary geotechnical investigation for the proposed residential subdivision located at 1350 Bronte Road, Oakville, Ontario.

It is understood that the proposed development will consist of single-family houses, serviced by a network of roads and sewers.

The purpose of this geotechnical investigation was to obtain information about the subsurface conditions at boreholes locations and from the findings in the boreholes to make recommendations pertaining to the geotechnical design of underground utilities, roads and to comment on the foundation conditions for the building construction.

DS has carried out environmental investigations at the subject site and the reports will be documented under separate covers. This report deals only with the geotechnical aspects of the site.

The design drawings are not available to us at the time of writing this report. Additional boreholes will be required before the final design of the development.

This report is provided on the basis of the terms of reference presented above and on the assumption that the design will be in accordance with the applicable codes and standards. If there are any changes in the design features relevant to the geotechnical analyses, or if any questions arise concerning the geotechnical aspects of the codes and standards, this office should be contacted to review the design. It may then be necessary to carry out additional borings and reporting before the recommendations of this office can be relied upon.

The site investigation and recommendations follow generally accepted practice for geotechnical consultants in Ontario. The format and contents are guided by client specific needs and economics and do not conform to generalized standards for services. Laboratory testing for most part follows ASTM or CSA Standards or modifications of these standards that have become standard practice.

This report has been prepared for Bronte River Limited Partnership and its architect and designers. Third party use of this report without DS consent is prohibited.

2. FIELD AND LABORATORY WORK

Two (2) boreholes (MW21-1 and BH21-2, see **Drawing 1** for borehole locations) were drilled at the subject site to depths ranging from 8.2 to 8.9m below ground surface.

Boreholes were drilled with hollow stem continuous flight augers equipment by a drilling sub-contractor under the direction and supervision of DS personnel. Samples were retrieved at regular intervals with a 50 mm O.D. split-barrel sampler driven with a hammer weighing 624 N and dropping 760 mm in accordance with the Standard Penetration Test (SPT) method. The samples were logged in the field and

returned to the DS laboratory for detailed examination by the project engineer and for laboratory testing.

As well as visual examination in the laboratory, all soil samples from geotechnical boreholes were tested for moisture contents. Selected soil samples were subjected to grain size analyses and Atterberg Limits testing. Gradation curves for the grain size analyses are presented on Drawing 5.

Water level observations were made during and upon completion of drilling. One (1) borehole BH21-1/MW21-1 was equipped with 50mm dia. monitoring well for the long-term groundwater monitoring and environmental testing.

The ground surface elevations at the borehole locations were measured by DS personnel using a differential GPS unit leased from Sokkia Canada.

3. SITE AND SUBSURFACE CONDITIONS

The Property is a 0.080 hectares (0.20 acres) rectangular parcel of land which is currently developed with one (1) rectangular shaped residential building that includes one level of basement, a detached single car garage, a work/storage shed and a greenhouse. The property is currently utilized for residential purposes only.

The borehole location plans are shown on **Drawing 1**. General notes on sample description are provided on **Drawing 1A**. The subsurface conditions in the boreholes are presented in the individual borehole logs presented on **Drawings 2 and 3**. A generalized sub-surface profile is presented on **Drawing 4**.

3.1 Soil Conditions

Topsoil/Concrete pavement and Fill /Weathered/disturbed Soils:

One borehole (BH21-1/MW21-1) was drilled on the paved area and encountered 100 mm of thick concrete at surface overlying 100 mm of granular base. A layer of topsoil, about 180 mm in thickness, was present at the surface of boreholes BH21-2.

It should be noted that the thickness of the topsoil explored at the borehole locations may not be representative for the site and should not be relied on to calculate the amount of topsoil at the site. Shallow hand-dug test-pits should be carried out to measure the topsoil thickness at site.

Fill material and weathered/disturbed soils consisting of silty clay, silty sand, sand and clayey silt were found in boreholes, extending to depths of 1.5 m below the ground surface. The fill was present in a very loose to loose state, with measured SPT 'N' values ranging from 3 to 8 blows per 300 mm penetration. Inclusion of topsoil/organics were found in fill material in varying proportions.

Silty Clay Till:

Below the weathered disturbed soils and silt to sandy silt, native soils consisting of silty clay till were encountered in all the boreholes extending to depth of 4.6 m below the existing grade. These deposits

were found in a stiff to hard consistency, with measured SPT 'N' values ranging from 13 to more than 50 blows per 300 mm penetration.

Grain size analysis of one (1) silty clay till sample (MW21-1/SS4) was conducted and the results are presented in Drawing 5, with the following fractions:

Clay:	21%
Silt:	48%
Sand:	25%
Gravel:	6%

Atterberg Limits test was conducted on the same silty clay till sample (MW21-1/SS4) and the results are presented on the respective borehole logs, with the following values:

Liquid Limit:	24%
Plastic Limit:	14%
Plasticity Index:	10

Silty Sand to Sandy Silt Till:

Silty sand to sandy silt till deposits were encountered below the cohesive deposits in all the boreholes, extending to depth of 7.6 m below ground surface. The silty sand to sandy silt till deposits were found in a very dense state, with measured SPT 'N' values more than 50 blows per 300 mm penetration.

Grain size analysis of one (1) silty sand till sample (MW21-1/SS7) was conducted and the results are presented in Drawing 5, with the following fractions:

Clay:	7%
Silt:	31%
Sand:	51%
Gravel:	11%

Cohesionless Deposits (Silt to Sandy Silt/Sand and Gravel/Gravelly Sand):

Below the fill and silty sand to sandy silt till deposits, silt to sandy silt, and gravelly sand to sand and gravel were encountered in all boreholes, extending to maximum explored depth of boreholes. These deposits were water bearing and found in a compact to very dense state. The measured SPT 'N' values in cohesionless deposits ranged from 13 to more than 50 blows per 300 mm of penetration.

3.2 Groundwater Conditions

During drilling, short-term (unstabilized) water was found in boreholes at depths of 7.6 m below the existing grade. One (1) borehole MW21-1 was equipped with 50 mm dia. monitoring well. The groundwater level measured in well on October 12, 2021, was 7.7m below the existing grade, corresponding of Elev. 122.4 m.

It should be noted that the groundwater levels can vary and are subject to seasonal fluctuations in response to major weather events. Further monitoring of groundwater levels in the wells is recommended.

4. DISCUSSION AND RECOMMENDATIONS

It is proposed to develop the site as a residential subdivision. The lots will therefore be serviced by a network of roads, storm and sanitary sewers and watermains.

4.1 SITE GRADING & ENGINEERED FILL

The site will be developed as residential subdivision with residential lots, roads and driveways, it is recommended that all fill to be placed for grading purposes be constructed as engineered fill to provide competent subgrade below house foundations, roads, boulevards, etc.

Prior to placement of engineered fill, all topsoil, existing fill/weathered disturbed materials and other unsuitable materials must be removed to expose the inorganic competent native subgrade. The exposed subgrade should then be proof rolled with a heavy sheepsfoot roller to identify weak areas. Any weak or excessively wet zones identified during proof-rolling should be sub-excavated and replaced with compacted competent material to establish stable and uniform conditions. Prior to placement of engineered fill, the subgrade should be inspected and approved by a geotechnical engineer.

General guidelines for the placement and preparation of engineered fill are presented on **Appendix A**. Bearing capacity values of 150 kPa at SLS and 225 kPa at ULS can be used on engineered fill, provided that all requirements on **Appendix A** are adhered to. To reduce the risk of improperly placed engineered compacted fill, full-time supervision of the contractor is essential.

The existing fill materials free from topsoil and organics to be excavated from cut-areas are considered suitable for re-use as engineered fill, provided that their moisture contents at the time of construction are at or near optimum. Significant aeration of the excavated soils will be required, prior to their re-use as engineered fill.

4.2 ROADS

The investigation has shown that the predominant subgrade soil, after stripping the topsoil and existing fill materials will generally consist of cohesionless silt to sandy silt and glacial tills.

Based on the above and assuming that traffic usage will be residential local road, the following minimum pavement thickness is recommended for roads to be constructed within the development:

40 mm HL3 Asphaltic Concrete

70 mm HL8 Asphaltic Concrete

150 mm Granular ‘A’

350 mm Granular ‘B’

These values may need to be adjusted according to the Town of Oakville Standards. The site subgrade and weather conditions (i.e. if wet) at the time of construction may necessitate the placement of thicker granular sub-base layer in order to facilitate the construction. Furthermore, heavy construction equipment may have to be kept off the newly constructed roads before the placement of asphalt and/or immediately thereafter, to avoid damaging the weak subgrade by heavy truck traffic.

4.2.1 STRIPPING, SUB-EXCAVATION AND GRADING

The site should be stripped of all topsoil, existing fill material and weathered or otherwise unsuitable soils to the full depth of the roads, both in cut and fill areas. Following stripping, the site should be graded to the subgrade level and approved. The subgrade should then be proof-rolled, in the presence of the Geotechnical Engineer, by at least several passes of a heavy compactor having a rated capacity of at least 8 tonnes. Any soft spots thus exposed should be removed and replaced by select fill material, similar to the existing subgrade soil and approved by the Geotechnical Engineer. The subgrade should then be re-compacted from the surface to at least 98% of its Standard Proctor Maximum Dry Density (SPMDD). The final subgrade should be cambered or otherwise shaped properly to facilitate rapid drainage and to prevent the formation of local depressions in which water could accumulate.

Proper cambering and allowing the water to escape towards the sides (where it can be removed by means of subdrains) is considered to be beneficial for this project. Otherwise, any water collected in the granular sub-base materials could be trapped thus causing problems due to softened subgrade, differential frost heave, etc. For the same reason damaging the subgrade during and after placement of the granular materials by heavy construction traffic should be avoided. If the moisture content of the local material cannot be maintained at ±2% of the optimum moisture content, imported granular material may need to be used.

Any fill required for re-grading the site or backfill should be select, clean material, free of topsoil, organic or other foreign and unsuitable matter. The fill should be placed in thin layers and compacted to at least 98% of its SPMDD or as per Township Standards. The compaction of the new fill should be checked by frequent field density tests.

4.2.2 CONSTRUCTION

Once the subgrade has been inspected and approved, the granular base and sub-base course materials should be placed in layers not exceeding 200 mm (uncompacted thickness) and should be compacted to at least 100% of their respective SPMDD. The grading of the material should conform to current OPS Specifications.

The placing, spreading and rolling of the asphalt should be in accordance with OPS Specifications or, as required by the local authorities.

Frequent field density tests should be carried out on both the asphalt and granular base and sub-base materials to ensure that the required degree of compaction is achieved.

4.2.3 DRAINAGE

The Town of Oakville will require the installation of full-length subdrains on all roads. The subdrains should be properly filtered to prevent the loss of (and clogging by) soil fines.

All paved surfaces should be sloped to provide satisfactory drainage towards catch-basins. As discussed in Section 4.2.1, by means of good planning any water trapped in the granular sub-base materials should be drained rapidly towards subdrains or other interceptors.

4.3 SEWERS

As a part of the site development, a network of new storm and sanitary sewers is to be constructed. It is assumed that the trenches are generally within 4 to 5 m below the existing grade.

4.3.1 TRENCHING

Excavations can be carried out with heavy hydraulic backhoe. Due to the low permeability of the glacial till deposits, it is expected that the water seepage through the silty clay till deposits can be controlled by conventional pumping methods. Groundwater table in the monitoring well was recorded at depths of 7.7m below the existing grade. Any excavation in cohesionless sandy soils below the groundwater table will require positive dewatering, otherwise, it will result in an unstable base and flowing sides. Groundwater table must be lowered to 1m below the lowest excavation level.

The sides of excavations in the natural strata, when dewatered, can be expected to be temporarily stable at relatively steep side slopes for short periods of time but they should be cut back at slopes no steeper than 1:1 in order to comply with the safety regulations. Otherwise, excavation slopes of 3:1V or flatter inclination in wet soils will be required.

All excavations must be carried out in accordance with the most recent Occupational Health and Safety Act (OHSA). In accordance with OHSA, the fill and cohesionless sandy soils (silt to sandy silt and sand and gravel can be classified as Type 3 Soil above the groundwater and Type 4 Soil below the groundwater table. The very stiff to hard clayey soils can be classified as Type 2 soil above groundwater and Type 3 Soil below water table.

4.3.2 BEDDING

The boreholes show that the sewer pipes will predominantly be laid within the native soils, which when dewatered, will provide adequate support for the sewer pipes and allow the use of normal Class B type bedding. The bedding should conform to the current Ontario Provincial Standard specifications (OPSS 401/OPSD 802) and/or standards set by the local municipality.

The recommended minimum thickness of granular bedding below the invert of the pipes is 150 mm. The thickness of the bedding may, however, have to be increased depending on the pipe diameter or in accordance with local standards or if wet or weak subgrade conditions are encountered, especially when the soil at the trench base level consists of wet, dilatant silt. The bedding material should consist of well graded granular material such as Granular 'A' or equivalent. After installing the pipe on the bedding, a granular surround of approved bedding material, which extends at least 300 mm above the obvert of the pipe, or as set out by the local Authority, should be placed.

To avoid the loss of soil fines from the subgrade, uniformly graded clear stone should not be used unless, below the granular bedding material, a suitable, approved filter fabric (geotextile) is placed. The geotextile should extend along the sides of the trench and should be wrapped all around the poorly graded bedding material.

4.3.3 BACKFILLING OF TRENCHES

Based on visual and tactile examination, the on-site excavated inorganic native soils are considered to be suitable for re-use as backfill in the service trenches provided their moisture contents at the time of construction are within 2 percent of their optimum moisture content. Significant aeration of the wet sandy and silty soils will be required prior to their re-use as backfill material.

The clayey soils especially when its consistency is hard is likely to be excavated in cohesive chunks or blocks and will be difficult to compact in confined areas. For use as backfill, the clayey material will have to pulverized and placed in thin layers. The clayey soils will have to be compacted using heavy equipment suitable for these soils which may be difficult to operate in the narrow confines of the trenches. Unless the clayey materials are properly pulverized and compacted in sufficiently thin lifts post-construction settlements could occur. Their use in narrow trenches such as laterals (where heavy compaction equipment cannot be operated) may not be feasible.

Selected inorganic fill and the native soils free from topsoil and organics can be used as general construction backfill where it can be compacted with sheep's foot type compactors. Loose lifts of soil, which are to be compacted, should not exceed 200 mm. Depending on the time of construction and weather, some excavated material may be too wet to compact and will require aeration prior to its use.

Imported granular fill, which can be compacted with hand held equipment, should be used in confined areas. The excavated soils are not considered to be free draining. Where free draining backfill is required, imported granular fill such as OPSS Granular B should be used.

The backfill should be placed in maximum 200 mm thick layers at or near (±2%) their optimum moisture content and each layer should be compacted to at least 95% SPMDD. In the upper 1.0 m, underneath the road base, the compaction should be increased to 98% SPMDD. Unsuitable materials such as organic soils, boulders, cobbles, frozen soils, etc. should not be used for backfilling.

The on-site excavated soils and especially the clayey soils should not be used in confined areas (e.g. around catch-basins and laterals under roadways) where heavy compaction equipment cannot be operated. The use of imported granular fill together with an appropriate frost taper would be preferable in confined areas and around structures, such as catch-basins.

It should be noted that the excavated soils are subject to moisture content increase during wet weather which would make these materials too wet for adequate compaction. Stockpiles should be compacted at the surface or be covered with tarpaulins to minimize moisture uptake.

The topsoil encountered at the site can be used for landscaping fill to raise the grades. Topsoil cannot be reused as foundation and trench backfill material.

4.4 FOUNDATION CONDITIONS

It is understood that the proposed subdivision will consist of single-family homes with one level basement. The finish floor elevations of these proposed houses are not known to us at the time of writing this report.

The native soils encountered in the boreholes are competent to support the proposed houses on conventional footings. The spread and strip footings founded on the undisturbed native soils can be designed for a bearing capacity of 150 kPa at SLS (Serviceability Limit State), and for a factored geotechnical resistance of 225 kPa at ULS (Ultimate Limit State), at least 300 mm below the bottom of fill.

Alternatively, the proposed houses can also be supported by spread and strip footings founded on engineered fill for a bearing capacity of 150 kPa at the serviceability limit states (SLS) and for a factored geotechnical resistance of 225 kPa at the ultimate limit states (ULS), provided all requirements on Appendix A are adhered to.

Foundations designed to the specified bearing capacities at the serviceability limit states (SLS) are expected to settle less than 25 mm total and 19 mm differential.

All footings exposed to seasonal freezing conditions must have at least 1.2 metres of soil cover for frost protection.

Where it is necessary to place footings at different levels, the upper footing must be founded below an imaginary 10 horizontal to 7 vertical line 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.

It should be noted that the recommended bearing capacities have been calculated by DS from the borehole information for the design stage only. The investigation and comments are necessarily on-going as new information of the underground conditions becomes available. For example, 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

therefore be checked through field inspections provided by DS to validate the information for use during the construction stage.

5. EARTH PRESSURES

The lateral earth pressures acting on foundation and basement walls may be calculated from the following expression:

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

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

K = Earth pressure coefficient, assumed to be 0.40 for vertical walls and horizontal backfill for permanent construction

γ = Unit weight of backfill, a value of 21 kN/m^3 may be assumed

h = Depth to point of interest in metres

q = Equivalent value of surcharge on the ground surface in kPa

The above expression assumes that the perimeter drainage system prevents the build up of any hydrostatic pressure behind the wall.

7. GENERAL COMMENTS AND LIMITATIONS OF REPORT

DS Consultants Ltd. (DS) should be retained for a general review of the final design and specifications to verify that this report has been properly interpreted and implemented. If not accorded the privilege of making this review, DS will assume no responsibility for interpretation of the recommendations in the report.

This report is intended solely for the Client named. The material in it reflects our best judgment in light of the information available to DS at the time of preparation. Unless otherwise agreed in writing by DS, it shall not be used to express or imply warranty as to the fitness of the property for a particular purpose. No portion of this report may be used as a separate entity, it is written to be read in its entirety.

The conclusions and recommendations given in this report are based on information determined at the test hole locations. The information contained herein in no way reflects on the environment aspects of the project, unless otherwise stated. Subsurface and groundwater conditions between and beyond the test holes may differ from those encountered at the test hole locations, and conditions may become apparent during construction, which could not be detected or anticipated at the time of the site investigation. The benchmark and elevations used in this report are primarily to establish relative elevation differences between the test hole locations and should not be used for other purposes, such as grading, excavating, planning, development, etc.

The design recommendations given in this report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report.

The comments made in this report on potential construction problems and possible methods are intended only for the guidance of the designer. The number of test holes may not be sufficient to determine all the factors that may affect construction methods and costs. For example, the thickness of surficial topsoil or fill layers may vary markedly and unpredictably. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusions as to how the subsurface conditions may affect their work. This work has been undertaken in accordance with normally accepted geotechnical engineering practices.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. DS accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report. We accept no responsibility for any decisions made or actions taken as a result of this report unless we are specifically advised of and participate in such action, in which case our responsibility will be as agreed to at that time.

We trust that the information contained in this report is satisfactory. Should you have any questions, please do not hesitate to contact this office.

DS CONSULTANTS LTD.

Simerjeet Singh Gill, M.Eng., P.Eng.

Shabbir Bandukwala, M. Eng., P.Eng.

Fanyu Zhu, Ph.D., P.Eng.

Drawings

Legend

Borehole Location

DS CONSULTANTS LTD.
6221 Highway 7, UNIT 16
Vaughan, Ontario L4H 0K8
Telephone: (905) 264-9393
www.dsconsultants.ca

Project: Geotechnical Investigation -1350 Bronte Road, Oakville, ON

Title: **Borehole Location Plan**

N

Client: Bronte River Limited Partnership

Size:	Approved By:	Drawn By:	Date:
8.5 x 11	FZ	SG	November, 2021
Rev: 0	Scale: As Shown	Project No.: 20-186-101	Drawing No.: 1

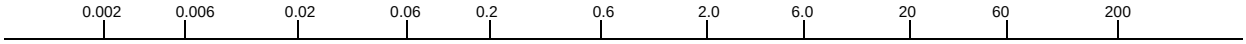
Image/Map Source: *Google Satellite Image*

Drawing 1A: Notes On Sample Descriptions

1. All sample descriptions included in this report generally follow the Unified Soil Classification. Laboratory grain size analyses provided by DSCL also follow the same system. Different classification systems may be used by others, such as the system by the International Society for Soil Mechanics and Foundation Engineering (ISSMFE). Please note that, with the exception of those samples where a grain size analysis and/or Atterberg Limits testing have been made, all samples are classified visually. Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems.

ISSMFE SOIL CLASSIFICATION

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



EQUIVALENT GRAIN DIAMETER IN MILLIMETRES

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

UNIFIED SOIL CLASSIFICATION

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

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

DS CONSULTANTS LTD.
Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE MW21-1

PROJECT: Geotechnical Investigation-Proposed Residential Development
CLIENT: Bronte River Limited Partnership
PROJECT LOCATION: 1350 Bronte Road, Oakville, ON
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4807988.96 E 600965.02

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Oct-07-2021

REF. NO.: 20-186-101
ENCL NO.: 2

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS / 0.3 m "N"	ELEVATION
130.1					
130.0 / 0.0	**CONCRETE:** 100mm				130
129.9 / 0.2	**GRANULAR BASE:** sand and gravel, trace cobbles, 100mm	1	SS	6	
129.3 / 0.8	**FILL:** clayey silt, trace organics, trace sand, trace cobbles, brown, very moist, firm				
1	**FILL:** silty sand, trace clay, trace gravel, reddish brown, wet, loose	2	SS	8	129
128.9 / 1.2	**SILTY CLAY TILL:** sandy, trace gravel, trace shale fragments, brown, moist, stiff (weathered)				
128.6 / 1.5	**SILTY CLAY TILL:** sandy, trace gravel, brown, moist, very stiff	3	SS	18	
2	grey below 2.3m	4	SS	18	128
3		5	SS	24	127
4					126
125.5					
4.6	**SILTY SAND TO SANDY SILT TILL:** trace clay, trace to some gravel, greyish brown, moist, very dense	6	SS	50/ 130mm	
5					125
6		7	SS	50/ 25mm	124
7					123
122.5					
7.6	**SAND AND GRAVEL:** trace silt, trace cobbles, brown, wet, very dense	8	SS	87	
8					122
121.2		9	SS	50/ 100mm	
8.9	**END OF BOREHOLE:**				

Notes:
1) 50mm dia. monitoring well installed upon completion.
2) Water Level Readings:

Date: Water Level(mbgl):
Oct. 12, 2021 7.7

W. L. 122.4 m
Oct 12, 2021

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

METHANE AND GRAIN SIZE DISTRIBUTION (%)	GR	SA	SI	CL
	6	25	48	21
	11	51	31	7

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

DS SOIL LOG 20-186-101-GEO COPY.GPJ DS.GDT 21-11-18

DS CONSULTANTS LTD.
Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE BH21-2

PROJECT: Geotechnical Investigation-Proposed Residential Development
CLIENT: Bronte River Limited Partnership
PROJECT LOCATION: 1350 Bronte Road, Oakville, ON
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4807965.68 E 600948.56

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Oct-07-2021

REF. NO.: 20-186-101
ENCL NO.: 3

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION
130.6							
130.4 / 0.2	**TOPSOIL:** 180mm						
	FILL: silty sand, trace clay, trace rootlets,trace gravel, brown, wet, loose		1	SS	4		
129.8 / 0.8	**FILL:** sand, trace silt, brown, wet, very loose		2	SS	3		
129.1 / 1.5	**SILT TO SANDY SILT:** some clay, brown, wet, compact		3	SS	13		
128.8 / 1.8	**SILTY CLAY TILL:** sandy, trace gravel, occasional cobble, greyish brown, moist, stiff to hard		4	SS	19		
	grey below 3.1m		5	SS	64		
126.0 / 4.6	**SILTY SAND TO SANDY SILT TILL:** trace clay, trace gravel/cobble, brown, moist, very dense		6	SS	50/ 50mm		
	reddish brown below 6.1m		7	SS	50/ 50mm		
123.0 / 7.6	**GRAVELLY SAND:** trace silt, reddish brown, wet, very dense		8	SS	56		
122.4 / 8.2	**END OF BOREHOLE:** Notes: 1) Water at depth of 7.6m during drilling.						

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)
SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
(20 40 60 80 100)

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)

POCKET PEN. (Cu) (kPa) | NATURAL UNIT WT (kN/m³) | METHANE AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

DS SOIL LOG 20-186-101-GEO COPY.GPJ DS.GDT 21-11-18

Distance Along Baseline (Not to Scale)

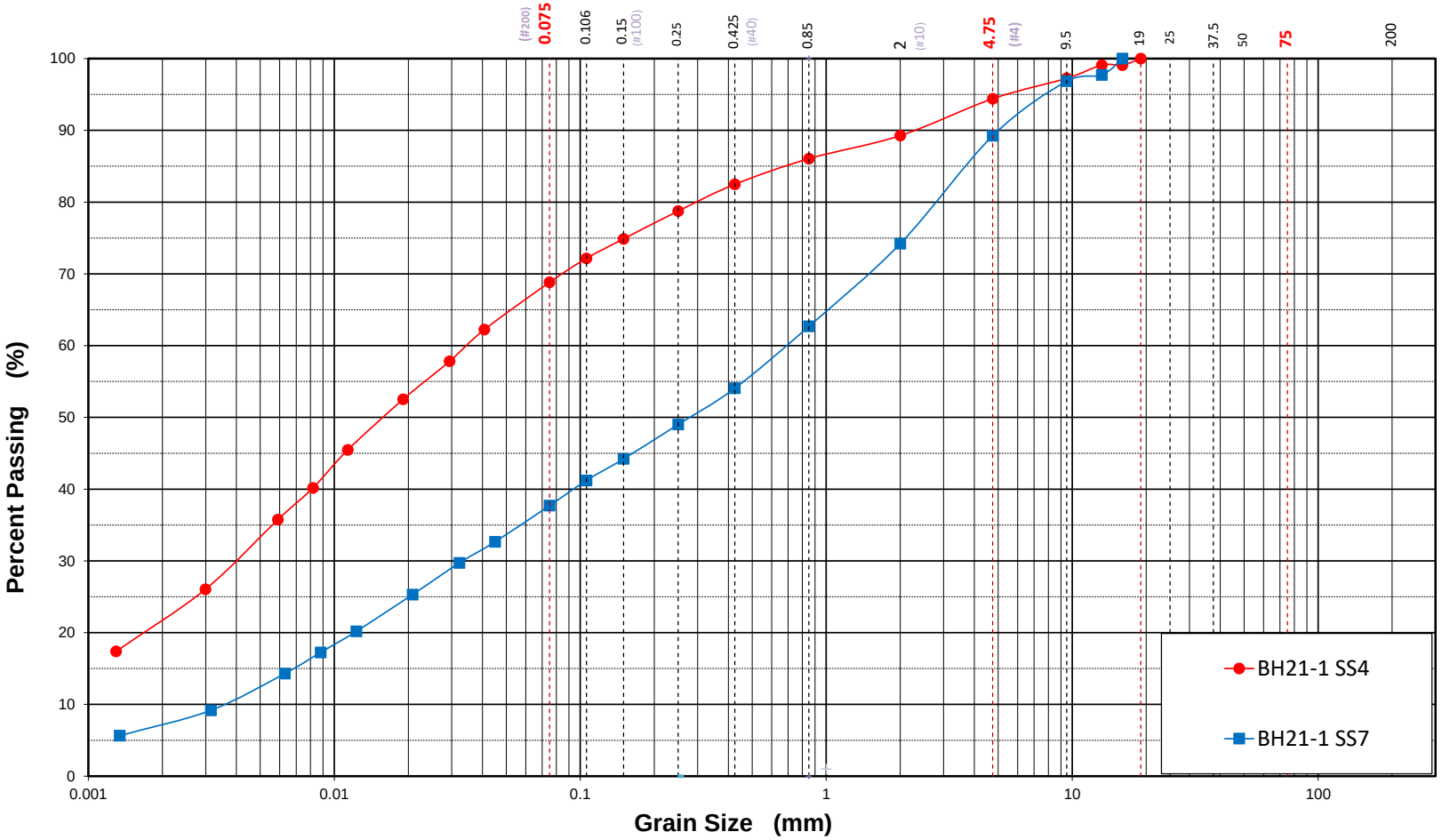
DS CONSULTANTS LTD.
Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

Generalized Sub-surface Profile

DRAWING NO.	4
JOB NO.	20-186-101
DATE	November, 2021

DS FENCE (M) 20-186-101-GEO COPY.GPJ DS.GDT 21-11-17

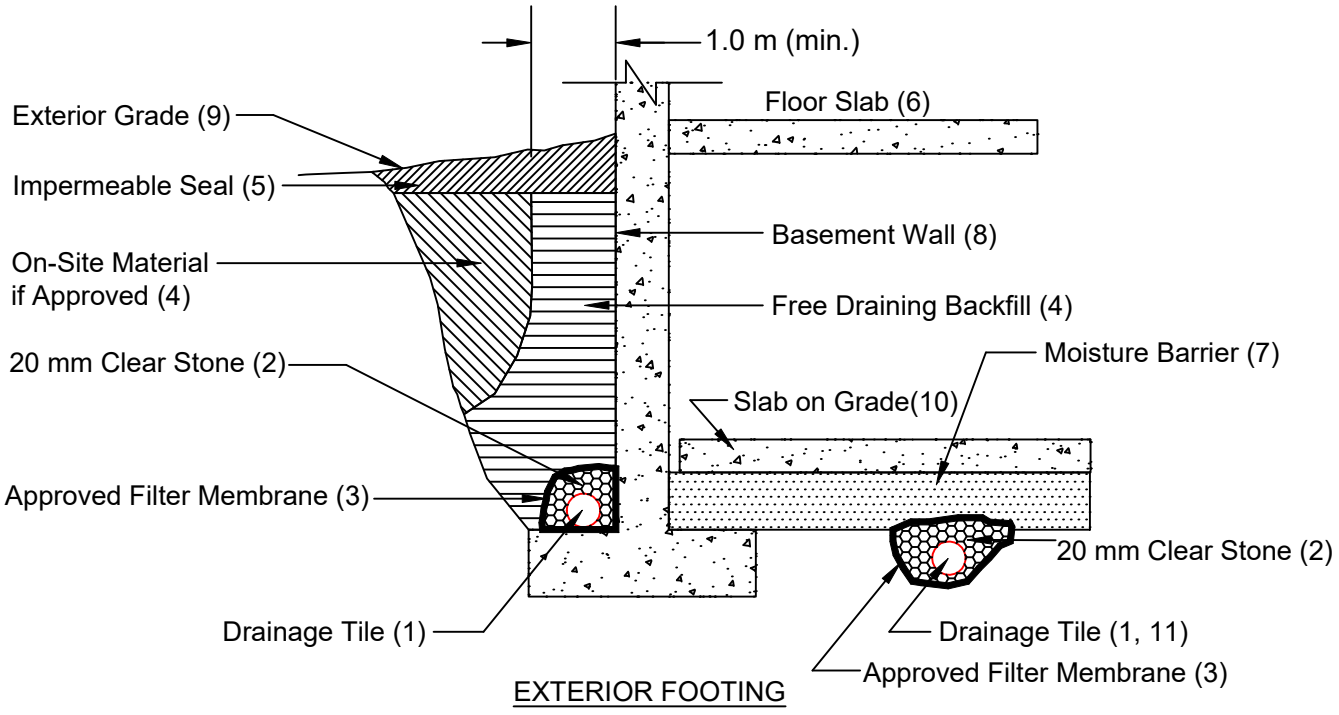
Particle Size Distribution (ASTM-D421/D422)



Silt and Clay		Sand			Gravel		Cobble +
Clay	Silt	Fine	Medium	Coarse	Fine	Coarse	

DS CONSULTANTS LTD.
6221 Highway 7, Unit 16
Vaughan, Ontario, L4H 0K8
Telephone: (905) 264-9393
www.dsconsultants.ca

Project	**Preliminary Geo. Investigation**	Project No	**20-186-101**
Location	**1350 Bronte Road, Oakville**	Date	**Nov-10-2021**
Client	**Bronte River Limited Partnership**	Figure No	5



EXTERIOR FOOTING

Notes

1. Drainage tile to consist of 100 mm (4") diameter weeping tile or equivalent perforated pipe leading to a positive sump or outlet.
2. 20 mm (3/4") clear stone - 150 mm (6") top and side of drain. If drain is not on footing, place100 mm (4 inches) of stone below drain .
3. Wrap the clear stone with an approved filter membrane (Terrafix 270R or equivalent).
4. Free Draining backfill - OPSS Granular B or equivalent compacted to the specified density. Do not use heavy compaction equipment within 450 mm (18") of the wall. Use hand controlled light compaction equipment within 1.8 m (6') of wall. The minimum width of the Granular 'B' backfill must be 1.0 m.
5. Impermeable backfill seal - compacted clay, clayey silt or equivalent. If original soil is free-draining, seal may be omitted. Maximum thickness of seal to be 0.5 m.
6. Do not backfill until wall is supported by basement and floor slabs or adequate bracing.
7. Moisture barrier to be at least 200 mm (8") of compacted clear 20 mm (3/4") stone or equivalent free draining material. A vapour barrier may be required for specialty floors.
8. Basement wall to be damp proofed /water proofed.
9. Exterior grade to slope away from building.
10. Slab on grade should not be structurally connected to the wall or footing.
11. Underfloor drain invert to be at least 300 mm (12") below underside of floor slab.
12. Drainage tile placed in parallel rows 6 to 8 m (20 to 25') centers one way. Place drain on 100 mm (4") clear stone with 150 mm (6") of clear stone on top and sides. Enclose stone with filter fabric as noted in (3).
13. The entire subgrade to be sealed with approved filter fabric (Terrafix 270R or equivalent) if non-cohesive (sandy) soils below ground water table encountered.
14. Do not connect the underfloor drains to perimeter drains.
15. Review the geotechnical report for specific details.

DRAINAGE AND BACKFILL RECOMMENDATIONS
Basement with Underfloor Drainage

(not to scale)

Appendix A

General Requirements For Engineered Fill

GENERAL REQUIREMENTS FOR ENGINEERED FILL

Compacted imported soil that meets specific engineering requirements and is free of organics and debris and that has been continually monitored on a full-time basis by a qualified geotechnical representative is classified as engineered fill. Engineered fill that meets these requirements and is bearing on suitable native subsoil can be used for the support of foundations.

Imported soil used as engineered fill can be removed from other portions of a site or can be brought in from other sites. In general, most of Ontario soils are too wet to achieve the 100% Standard Proctor Maximum Dry Density (SPMDD) and will require drying and careful site management if they are to be considered for engineered fill. Imported non-cohesive granular soil is preferred for all engineered fill. For engineered fill, we recommend use of OPSS Granular 'B' sand and gravel fill material.

Adverse weather conditions such as rain make the placement of engineered fill to the required degree of density difficult or impossible; engineered fill cannot be placed during freezing conditions, i.e. normally not between December 15 and April 1 of each year.

The location of the foundations on the engineered fill pad is critical and certification by a qualified surveyor that the foundations are within the stipulated boundaries is mandatory. Since layout stakes are often damaged or removed during fill placement, offset stakes must be installed and maintained by the surveyors during the course of fill placement so that the contractor and engineering staff are continually aware of where the engineered fill limits lie. Excavations within the engineered fill pad must be backfilled with the same conditions and quality control as the original pad.

To perform satisfactorily, engineered fill requires the cooperation of the designers, engineers, contractors and all parties must be aware of the requirements. The minimum requirements are as follows; however, the geotechnical report must be reviewed for specific information and requirements.

1. Prior to site work involving engineered fill, a site meeting to discuss all aspects must be convened. The surveyor, contractor, design engineer and geotechnical engineer must attend the meeting. At this meeting, the limits of the engineered fill will be defined. The contractor must make known where all fill material will be obtained from and samples must be provided to the geotechnical engineer for review, and approval before filling begins.

2. Detailed drawings indicating the lower boundaries as well as the upper boundaries of the engineered fill must be available at the site meeting and be approved by the geotechnical engineer.

3. The building footprint and base of the pad, including basements, garages, etc. must be defined by offset stakes that remain in place until the footings and service connections are all constructed. Confirmation that the footings are within the pad, service lines are in place, and that the grade conforms to drawings, must be obtained by the owner in writing from the surveyor and DS Consultants Ltd (DSCL). Without this confirmation no responsibility for the performance of the structure can be accepted by DSCL. Survey drawing of the pre and post fill location and elevations will also be required.

4. The area must be stripped of all topsoil and fill materials. Subgrade must be proof-rolled. Soft spots must be dug out. The stripped native subgrade must be examined and approved by a DSCL engineer prior to placement of fill.

5. The approved engineered fill material must be compacted to 100% Standard Proctor Maximum Dry Density throughout. Engineered fill should not be placed during the winter months. Engineered fill compacted to 100% SPMDD will settle under its own weight approximately 0.5% of the fill height and the structural engineer must be aware of this settlement. In addition to the settlement of the fill, additional settlement due to consolidation of the underlying soils from the structural and fill loads will occur and should be evaluated prior to placing the fill.

6. Full-time geotechnical inspection by DSCL during placement of engineered fill is required. Work cannot commence or continue without the presence of the DSCL representative.

7. The fill must be placed such that the specified geometry is achieved. Refer to the attached sketches for minimum requirements. Take careful note that the projection of the compacted pad beyond the footing at footing level is a minimum of 2 m. The base of the compacted pad extends 2 m plus the depth of excavation beyond the edge of the footing.

8. A bearing capacity of 150 kPa at SLS (225 kPa at ULS) can be used provided that all conditions outlined above are adhered to. A minimum footing width of 500 mm (20 inches) is suggested and footings must be provided with nominal steel reinforcement.

9. All excavations must be done in accordance with the Occupational Health and Safety Regulations of Ontario.

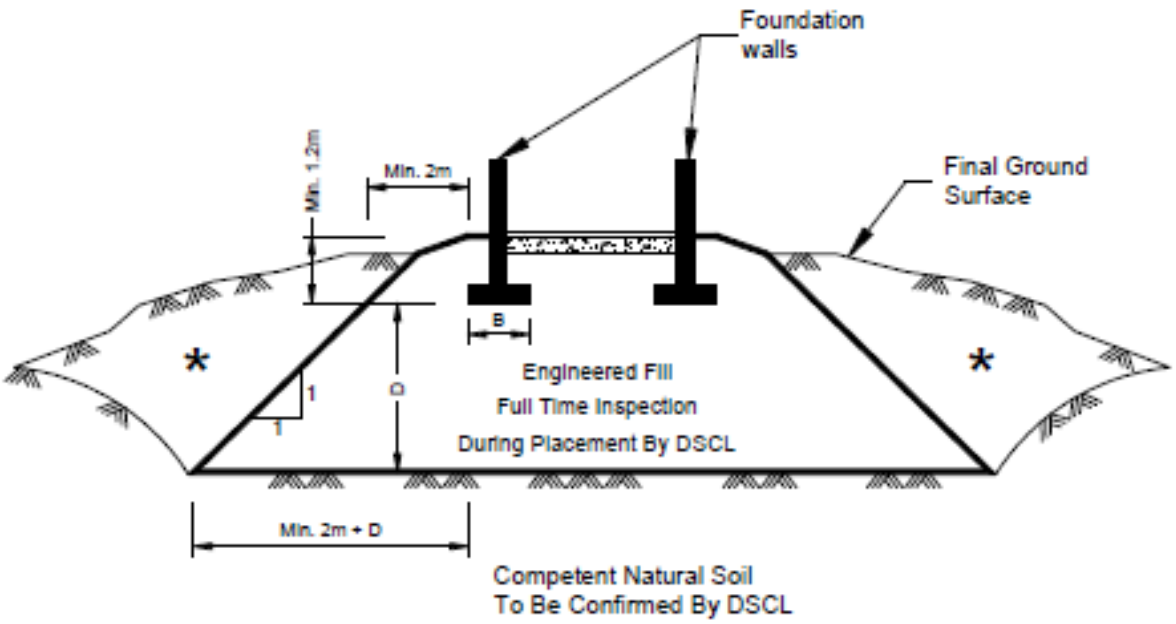
10. After completion of the engineered fill pad a second contractor may be selected to install footings. The prepared footing bases must be evaluated by engineering staff from DSCL prior to footing concrete placements. All excavations must be backfilled under full time supervision by DSCL to the same degree as the engineered fill pad. Surface water cannot be allowed to pond in excavations or to be trapped in clear stone backfill. Clear stone backfill can only be used with the approval of DSCL.

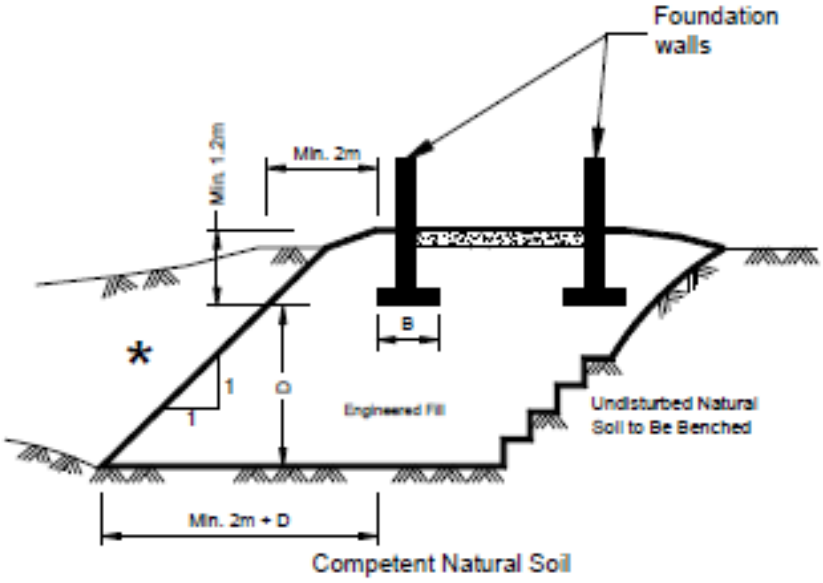
11. After completion of compaction, the surface of the engineered fill pad must be protected from disturbance from traffic, rain and frost. During the course of fill placement, the engineered fill must be smooth-graded, proof-rolled and sloped/crowned at the end of each day, prior to weekends and any stoppage in work in order to promote rapid runoff of rainwater and to avoid any ponding surface water. Any stockpiles of fill intended for use as engineered fill must also be smooth-bladed to promote runoff and/or protected from excessive moisture take up.

12. If there is a delay in construction, the engineered fill pad must be inspected and accepted by the geotechnical engineer. The location of the structure must be reconfirmed that it remains within the pad.

13. The geometry of the engineered fill as illustrated in these General Requirements is general in nature. Each project will have its own unique requirements. For example, if perimeter sidewalks are to be constructed around the building, then the projection of the engineered fill beyond the foundation wall may need to be greater.

14. These guidelines are to be read in conjunction with DS Consultants Ltd report attached.





* Backfill in this area to be as per the DSCL report.