REPORT ON

Preliminary Geotechnical Investigation
Proposed Residential Development
12156 Chinguacousy Road, Caledon, Ontario

PREPARED FOR:

Argo Mayfield West III Limited

Project No: 23-266-100
Date: September 25, 2023

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1. INTRODUCTION

DS Consultants Ltd. (DS) was retained by Mayfield West III to undertake a preliminary geotechnical investigation for the proposed residential development located at 12156 Chinguacousy Road, Caledon, Ontario.

It is understood that the project will entail a residential subdivision consisting of low/medium density residential units. A network of underground utilities and roads will be constructed for the proposed development. The finish floor elevation of the proposed residential house/townhouse and the invert of the site services are not known at the time of writing this report.

The purpose of this preliminary geotechnical investigation was to obtain information about the subsurface conditions at three (3) borehole locations (BH23-301 to BH23-303) and from the findings in the boreholes to provide recommendations pertaining to the geotechnical design of underground utilities, subdivision roads, and to comment on the foundation conditions for general house construction.

This report deals with geotechnical issues only. The findings of Phase One and Phase Two Environmental Site Assessment (ESA) by DS will be documented in separate reports. It is understood that the Hydrogeological Study will be conducted by others.

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 format and contents of the report are guided by client specific needs and economics. 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 Mayfield West III and its architect and designers. Third party use of this report without DS consent is prohibited.

2. FIELD AND LABORATORY WORK

In August 2023, three (3) boreholes (BH23-301 through BH23-303, see **Drawing 1** for borehole locations) were drilled to a depth of 6.7 m below the existing grade.

The boreholes were drilled with solid stem continuous flight augers equipment by drilling sub-contractors 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 water contents. Grain size analyses of three (3) selected soil samples (BH23-301/SS3, BH23-302/SS4 and BH23-303/SS6) were conducted and the results are presented on **Drawing 5**. Atterberg Limits testing was conducted on the same samples (BH23-301/SS3, BH23-302/SS4 and BH23-303/SS6) and the results are presented on the respective borehole logs and on **Drawing 6**.

Water level observations were made during and upon completion of drilling. One (1) monitoring wells of 50 mm diameter were installed in selected borehole BH23-303 for long-term groundwater levels monitoring and hydrogeological study.

The elevation surveying of the borehole locations was undertaken by DS personnel, using the differential GPS unit. It should be noted that the elevations at the as-drilled borehole/well locations were not provided by a professional surveyor and should be considered to be approximate. Contractors performing any work referenced to the borehole elevations should confirm the borehole elevations for their work.

3. SITE AND SUBSURFACE CONDITIONS

The site is an approximately 5.787-hectare (14.299 acres) parcel of land in an area situated within a rural setting in the Town of Caledon, Ontario. The site is located approximately 490 m northwest of the intersection of Chinguacousy Road and Mayfield Road.

The borehole location plan is shown on **Drawing 1**. General notes on sample description are provided on **Drawing 1A**. The subsurface conditions in the boreholes by DS are presented in the individual borehole logs presented on **Drawings 2** to **4**.

3.1 SOIL CONDITIONS

Topsoil:

A surficial layer of topsoil, about 200 mm to 250 mm thick, was found at all borehole locations. 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 test-pits can be carried out to further explore the topsoil conditions.

Fill Materials/Reworked Soil:

Below the topsoil, fill materials/reworked soils (weathered/disturbed) consisting of clayey silt to silty clay and silty sand were found extending to depths of about 0.8 to 2.3 m below existing grade. The fill materials/ reworked soils contained trace topsoil and organics. The consistency of fill/reworked clayey

silt to silty clay was very soft to firm, as indicated by measured SPT 'N' values ranging from 2 to 6 blows per 300 mm penetration. The fill materials of silty sand were found in a very loose state with a measured SPT 'N' value of 2 blows per 300 mm of penetration.

Clayey Silt to Silty Clay Till:

Clayey silt to silty clay till deposit was encountered in all boreholes, extending to the maximum exploration depth of 6.7 m below existing grade. All boreholes were terminated in the clayey silt to silty clay till deposit. The clayey silt to silty clay till deposit were found to have a stiff to hard consistency, with measured SPT 'N' values ranging from 10 to over 50 blows per 300 mm of penetration. Cobbles/boulders were inferred within the till deposits during drilling.

Grain size analyses of three (3) clayey silt to silty clay till samples (BH23-301/SS3, BH23-302/SS4 and BH23-303/SS6) were conducted and the results are presented on **Drawing 5**, with the following fractions:

Clay:	25 to 39%
Silt:	44 to 56%
Sand:	16 to 23%
Gravel:	1 to 3%

Atterberg limits tests of the same clayey silt to silty clay (till) samples (BH23-301/SS3, BH23-302/SS4 and BH23-303/SS6) were conducted. The results are shown on the borehole logs and are summarized as follows:

Liquid limit (W_L):	24 to 34%
Plastic limit (W_P):	15 to 17 %
Plasticity index (PI):	8 to 17

3.2 GROUNDWATER CONDITIONS

Groundwater level in the monitoring well (BH23-303) measured on August 29, 2023, was at a depth of 1.7 m below existing ground surface, corresponding to Elevation 258.2 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 tables is recommended in the installed monitoring well. Refer to hydrogeological study by others for more information regarding groundwater level measurements.

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.

Based on the borehole information, preliminary geotechnical discussion and recommendations for the proposed development are presented as follows.

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 existing surficial topsoil, fill materials, reworked/weathered/disturbed soils and other unsuitable materials should be stripped to expose the inorganic 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 in **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 in **Appendix A** are adhered to. To reduce the risk of improperly placed engineered compacted fill, full-time supervision of the contractor is essential.

The following is a recommended procedure for an engineered fill:

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 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. Without this confirmation no responsibility for the performance of the structure can be accepted by DS. Survey drawing of the pre and post fill location and elevations will also be required.

4. The area must be stripped of all topsoil, fill and weathered/disturbed soils. Subgrade must be proof-rolled. Soft spots must be dug out. The stripped native subgrade must be examined and approved by a DS engineer prior to placement of fill.

5. The approved engineered fill must be compacted to 100% Standard Proctor Maximum Dry Density throughout. Granular Fill preferred. Engineered fill should not be placed (where it will support footings) 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.

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

7. The fill must be placed such that the specified geometry is achieved. Refer to 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. Bearing capacity values of 150 kPa at SLS and 225 kPa at ULS may be used provided that all conditions outlined above are adhered to. A minimum footing width of 500 mm (20 inches) is suggested and footings should 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 pad a second contractor may be selected to install footings. All excavations must be backfilled under full time supervision by DS 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 DS.

11. After completion of compaction, the surface of the pad must be protected from disturbance from traffic, rain and frost.

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.

Existing fill material containing topsoil/organics is considered unsuitable for reuse as engineered fill. The native soils 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. Clayey tills are likely to be excavated in cohesive chunks or blocks and will be difficult to compact. They should be pulverized and placed in thin layers not exceeding 200 mm and compacted using heavy equipment suitable for these types of soils (e.g. heavy sheepsfoot compactors).

4.2 ROADS AND PAVEMENTS

The investigation has shown that the predominant subgrade soil, after stripping the topsoil and any other organic and otherwise unsuitable subsoil, will generally consist of clayey silt to silty clay till soil.

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

For Minor Local or Local Roads

40 mm HL3 Asphaltic Concrete

65 mm HL8 Asphaltic Concrete

150 mm Granular 'A'

300 mm Granular 'B'

For Collector Roads

40 mm HL3 Asphaltic Concrete

90 mm HL8 Asphaltic Concrete

150 mm Granular 'A'

450 mm Granular 'B'

These values are according to the Town of Caledon 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, fill, weathered/disturbed soils and 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.

Owing to the clayey (i.e. impervious) nature of some subsoils at the site, 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 selected from 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. 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 Caledon requires 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 sewers will be constructed. The sewer depths are assumed to be within 4 to 5 m below the existing grade. Once the design information if available, the following recommendations and discussion should be further reviewed and amended as necessary.

4.3.1 TRENCHING, EXCAVATION AND GROUNDWATER CONTROL

Excavations can be carried out with heavy hydraulic backhoe. The boreholes show that below the fill materials/reworked native soils, the trenches will be predominantly dug through the clayey silt to silty clay (till) deposits.

Groundwater level in the monitoring well (BH23-303) measured on August 29, 2023, was at a depth of 1.7 m below existing ground surface, corresponding to Elevation 258.2 m.

Groundwater seepage within the clayey silt to silty clay till is expected to be slow and manageable by gravity drainage and pumping from filtered sumps. More significant groundwater seepage/inflow would

be expected from the fill materials and sandy soil layers within the tills below groundwater table. The groundwater level should be lowered to at least 1.0 m below the excavation bases.

It is understood that a hydrogeological assessment at the subject site is currently carried out by others. More comments regarding the type and extent of groundwater control required during construction and permanent drainage can refer to the hydrogeological report by others.

All excavations must be carried out in accordance with the most recent Occupational Health and Safety Act (OHSA). In accordance with OHSA, the fill materials/reworked/weathered soils, firm to stiff clayey silt to silty clay till deposits can be classified as Type 3 Soil above the groundwater level and Type 4 Soil below the groundwater level. The very stiff to hard clayey silt to silty clay till can be classified as Type 2 Soil above the groundwater level and as Type 3 Soil below the groundwater level.

It should be noted that the till is a non-sorted sediment and therefore contain cobble and boulders. Provisions must be made in the excavation contract for the removal of possible boulders in the till deposits.

4.3.2 BEDDING

The native soils and engineered fill 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 or fill materials are encountered at the trench base level. 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 clayey silt to silty clay till soil is considered suitable for re-use as backfill in the service trenches provided their water contents at the time of construction are within 2 percent of their optimum water content.

The clayey deposits 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.

The backfill should be placed in maximum 200 mm thick layers at or near (±2%) their optimum water content and each layer should be compacted to at least 95% SPMDD. In the upper 1.5 m of the subgrade, underneath the road granular 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 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.

4.4 FOUNDATION CONDITIONS

It is understood that the proposed subdivision will consist of low/medium density residential units with one level of basement.

The undisturbed native soils below fill materials and reworked/disturbed/weathered 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 or below the founding levels provided in **Table 1** below:

Table 1: Bearing Values and Founding Levels of Footings on Undisturbed Native Soils

BH No.	Material	Bearing Capacity at SLS (kPa)	Factored Geotechnical Resistance at ULS (kPa)	Minimum Depth below Existing Ground (m)	Founding Level at or Below Elevation (m)
BH23-301	Clayey Silt to Silty Clay Till	150	225	1.1	258.1
BH23-302	Clayey Silt to Silty Clay Till	150	225	1.1	258.2
BH23-303	Clayey Silt to Silty Clay Till	150	225	2.5	257.5

Where the grade needs to be raised by engineered fill, the proposed structures can be supported by spread and strip footings founded on engineered fill for bearing capacity values of 150 kPa at SLS (Serviceability Limit State), and for a factored geotechnical resistance of 225 kPa at ULS (Ultimate Limit State). The engineered fill supporting footings should be constructed in accordance with the guidelines presented in **Appendix A** and in **Section 4.1**.

Variations in the soil conditions are expected in between the borehole locations, and during construction, the soil bearing pressures should be confirmed by the Geotechnical Engineer.

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 1.4 metres of soil cover for frost protection.

All footing bases must be inspected by this office prior to pouring concrete.

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.

4.5 FLOOR SLAB

The floor slab can be supported on grade provided all topsoil, fill, reworked native and surficially softened/disturbed native soils are removed and the base thoroughly proof rolled. The fill required to raise the grade can consist of inorganic soil, placed in shallow lifts and compacted to 98 percent of Standard Proctor Maximum Dry Density (SPMDD).

Where engineered fill is used to support the foundations, the floor slab can also be supported by engineered fill.

A moisture barrier consisting of at least 200 mm of 19 mm clear crushed stone should be installed under the floor slab.

A perimeter and underfloor drainage system will be required around the exterior basement walls, as shown on **Drawing 7**. Seepage rate to the drainage system should be evaluated in the hydrogeological study by others.

4.6 EARTH PRESSURES

The lateral earth pressures acting on foundation walls or retaining 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.

4.7 EARTHQUAKE CONSIDERATIONS

Based on the borehole information and according to Table 4.1.8.4.A of OBC 2012, the subject site for the proposed structures founded on competent native soils or engineered fill can be classified as 'Class D' for seismic site response.

5. GENERAL COMMENTS AND LIMITATIONS OF REPORT

This geotechnical report is preliminary, prepared on the basis of limited borehole information. Additional boreholes are required prior to the final design of the proposed residential development.

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. 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.

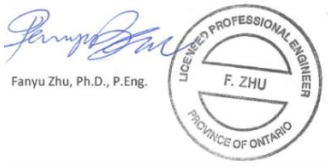
The comments made in this report on potential construction problems and possible methods are intended only for the guidance of the designer. The number of test holes may not be sufficient to determine all the factors that may affect construction methods and costs. For example, the thickness of surficial 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

Derek Wang, P.Eng.
Senior Geotechnical Engineer



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Drawings

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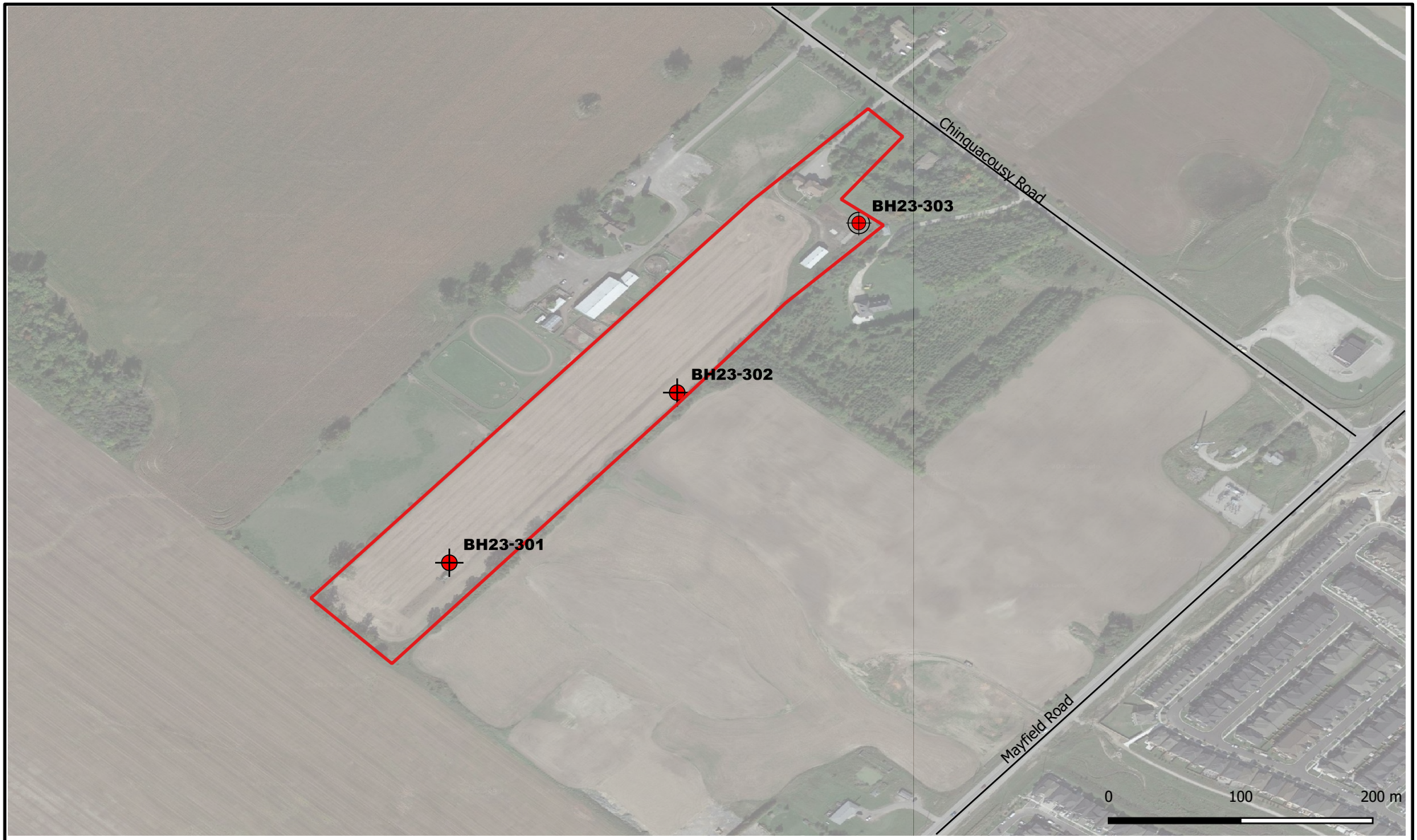

Legend

- Approx Site Boundary
- Borehole
- Monitoring Well

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Project: PRELIMINARY GEOTECHNICAL INVESTIGATION
12156 Chinguacousy Road, Caledon, ON

Title: **BOREHOLE LOCATION PLAN**

N

Client: Mayfield West III

Size:	Approved By:	Drawn By:	Date:
8.5 x 11	D.W	K.T	September 2023
Rev: 0	Scale: As Shown	Project No.: 23-266-100	Figure 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		

0.002 0.006 0.02 0.06 0.2 0.6 2.0 6.0 20 60 200

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 BH23-301

PROJECT: Prelimnary Geotechnical Investigation
CLIENT: Mayfield West III
PROJECT LOCATION: 12156 Chinguacousy Rd., Caledon, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4840633.05 E 592259.73

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Aug-15-2023

REF. NO.: 23-266-100
ENCL NO.: 2

SOIL PROFILE (m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES 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)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
259.2												
0.0 / 258.9	**TOPSOIL:** 250mm											
0.3 / 258.4	**REWORKED SOIL:** clayey silt, trace organics, trace rootlets, brown, moist, soft (weathered/disturbed)		1	SS	2		259					
0.8	**CLAYEY SILT TO SILTY CLAY TILL:** some sand, trace gravel, brown, moist, stiff to very stiff		2	SS	19		258					
1			3	SS	18							1 16 44 39
2			4	SS	27		257					
3			5	SS	29		256					
4	grey below 4.6m		6	SS	14		255					
5							254					
6			7	SS	11		253					
252.5												
6.7	**END OF BOREHOLE:** Notes: 1) Borehole wet at the bottom upon completion.											

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

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

DS SOIL LOG-2021-FINAL 23-266-100GEO.GPJ DS.GDT 23-9-20

DS CONSULTANTS LTD.
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LOG OF BOREHOLE BH23-302

PROJECT: Prelimnary Geotechnical Investigation
CLIENT: Mayfield West III
PROJECT LOCATION: 12156 Chinguacousy Rd., Caledon, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4840813.66 E 592429.91

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Aug-15-2023

REF. NO.: 23-266-100
ENCL NO.: 3

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	SAMPLES 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)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
259.3												
259.1 0.0	**TOPSOIL:** 200mm											
0.2	**REWORKED SOIL:** clayey silt, trace organics, trace rootlets, brown, moist, firm (weathered/disturbed)		1	SS	4		259					
258.5 0.8	**CLAYEY SILT TO SILTY CLAY TILL:** some sand, trace gravel, brown, moist, stiff to very stiff		2	SS	22		258					
			3	SS	19							
			4	SS	20		257					3 16 56 25
	grey below 3.1m		5	SS	20		256					
			6	SS	10		255					
			7	SS	20		254					
252.6							253					
6.7	**END OF BOREHOLE:** Notes: 1) Borehole wet at the bottom upon completion.											

DS SOIL LOG-2021-FINAL 23-266-100GEO.GPJ DS.GDT 23-9-20

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

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

DS CONSULTANTS LTD.
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LOG OF BOREHOLE BH23-303

PROJECT: Prelimnary Geotechnical Investigation
CLIENT: Mayfield West III
PROJECT LOCATION: 12156 Chinguacousy Rd., Caledon, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4840992.38 E 592564.89

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Aug-15-2023

REF. NO.: 23-266-100
ENCL NO.: 4

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS / 0.3 m "N"	ELEVATION
260.0					
259.8 0.0	**TOPSOIL:** 200mm				
0.2 / 259.2	**FILL:** clayey silt, trace organics, trace rootlets, brown, moist, firm	1	SS	6	
1 0.8 / 258.5	**FILL:** silty sand, trace organics, some clay, brown, moist, very loose	2	SS	2	259
1.5 / 257.7	**FILL:** silty clay, trace organics, brown to dark brown, moist, firm	3	SS	6	W. L. 258.2 m Aug 29, 2023
2.3	**CLAYEY SILT TO SILTY CLAY TILL:** some sand to sandy, trace gravel, brown, moist, very stiff to hard	4	SS	30	
3		5	SS	50/ 100mm	257
4					256
	sandy below 4.6m				
5	grey below 4.8m	6	SS	21	255
6					254
253.3		7	SS	23	
6.7	**END OF BOREHOLE:**				

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

Date:	Water Level(mbgl):
Aug 29, 2023	1.73

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

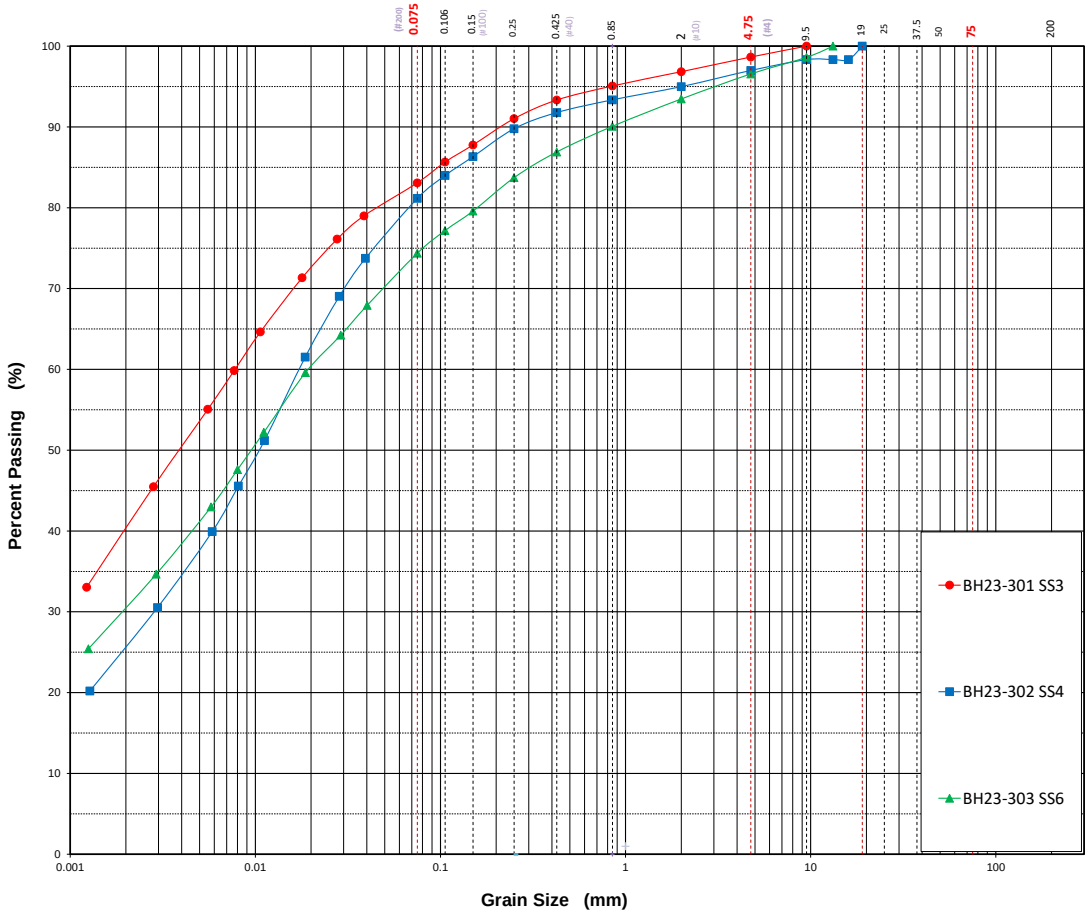
POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
		3 23 44 30

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

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

DS SOIL LOG-2021-FINAL 23-266-100GEO.GPJ DS.GDT 23-9-20

Particle Size Distribution (ASTM-D421/D422)



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

DS CONSULTANTS LTD.
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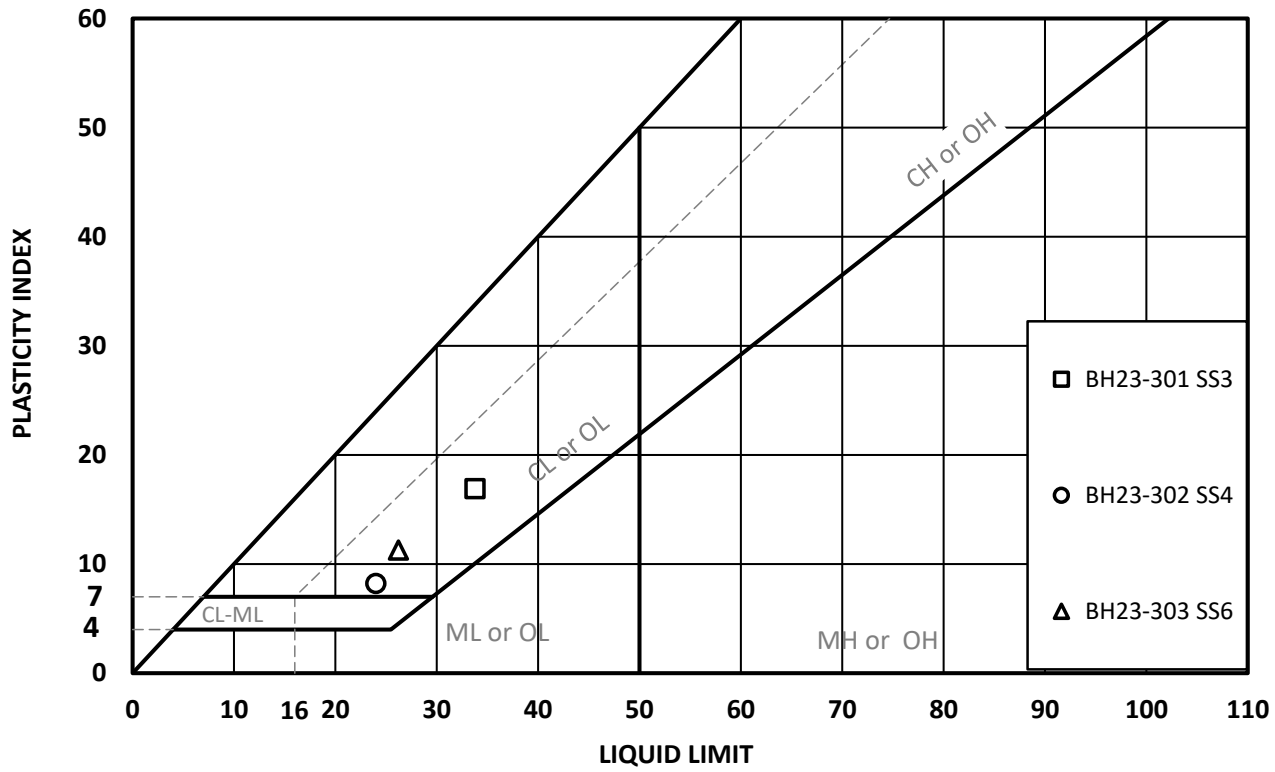
www.dsconsultants.ca

Project	**Preliminary Geotechnical Investigation**	Project No	**23-266-100**
Location	**12156 Chinguacousy Rd., Caledon, ON**	Date	**Aug-21-2023**
Client	**Mayfield West III**	Figure No	**5**

Atterberg Test (ASTM D-4318)



Code	Sample ID	Sample No.		Moisture Contant (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	USCS Symbol
1	□	BH23-301	SS3	16	33.8	16.9	16.9	CL
2	○	BH23-302	SS4	15	24	15.8	8.2	CL
3	△	BH23-303	SS6	15	26.2	14.9	11.3	CL

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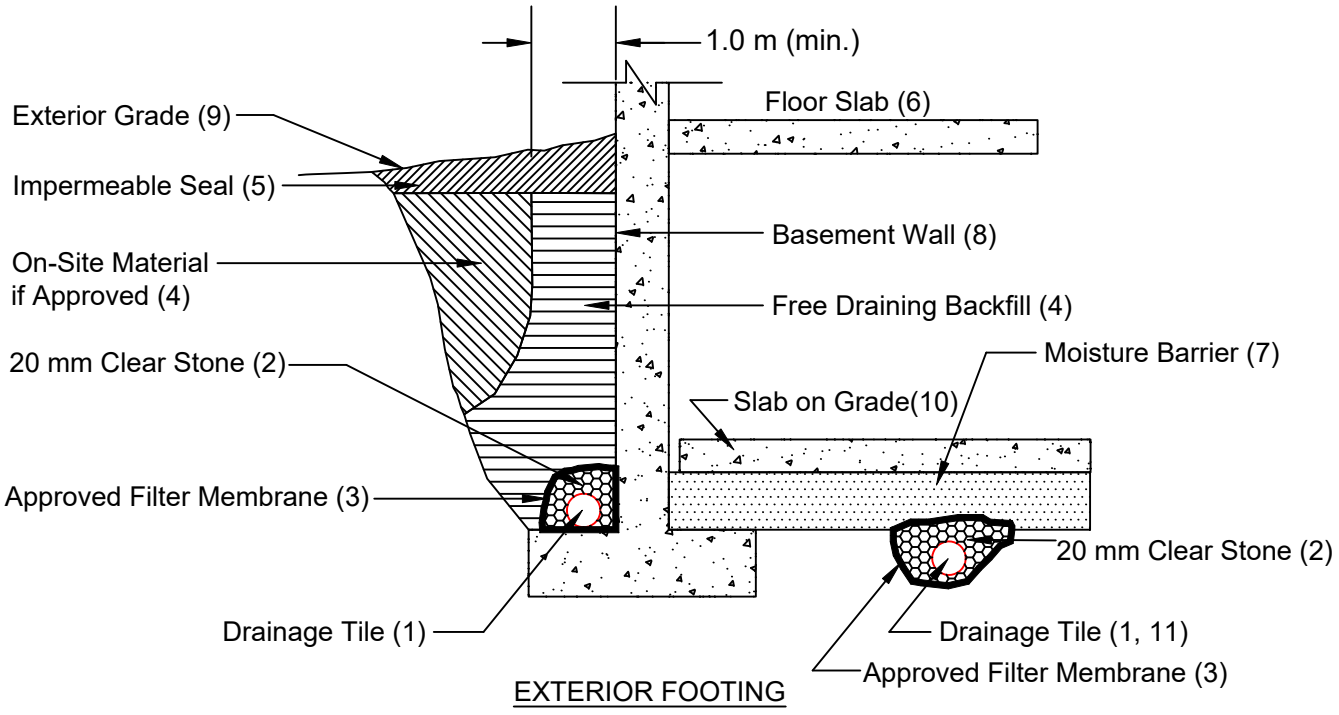
Location	**12156 Chinguacousy Rd., Caledon, ON**	Date	**Aug-21-2023**
Client	**Mayfield West III**	Figure No	**6**



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.

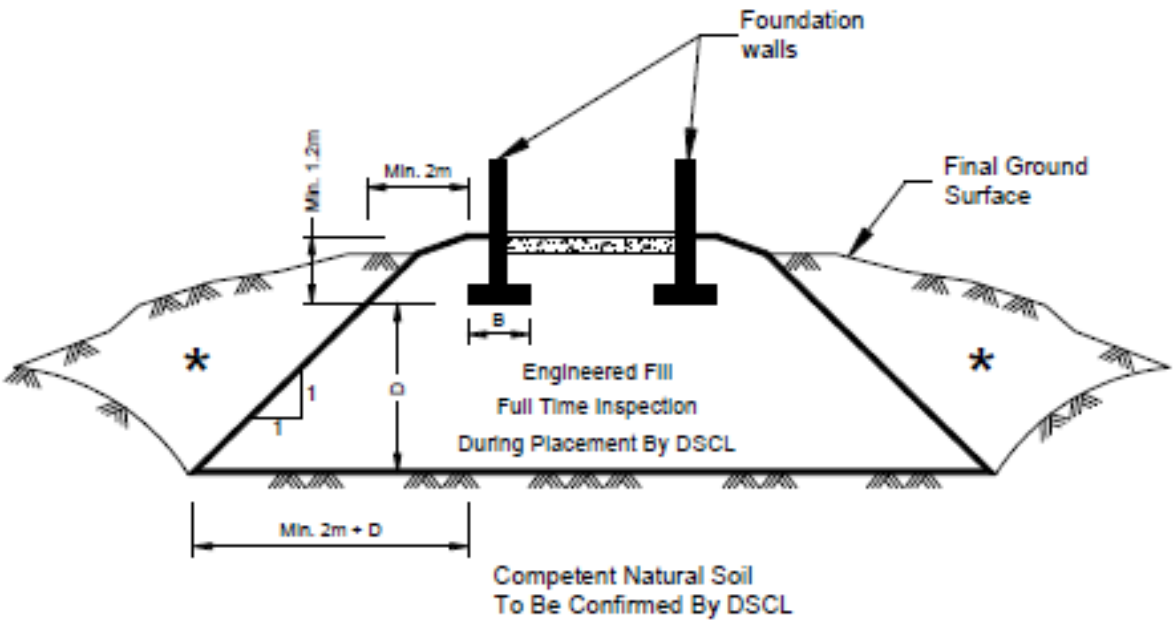
10. After completion of the engineered fill pad a second contractor may be selected to install footings. The prepared footing bases must be evaluated by engineering staff from DSCL prior to footing concrete placements. All excavations must be backfilled under full time supervision by DSCL to the same 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.

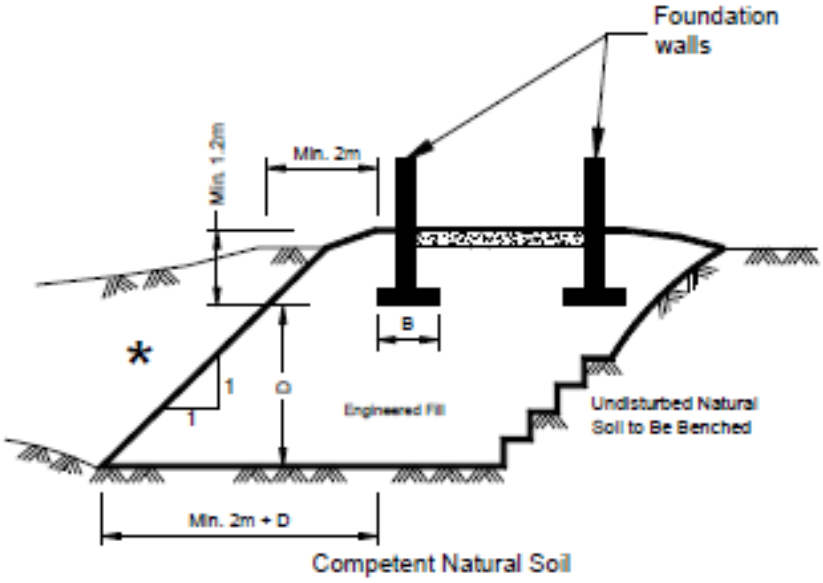
11. After completion of compaction, the surface of the engineered fill pad must be protected from disturbance from traffic, rain and frost. During the course of fill placement, the engineered fill must be smooth-graded, proof-rolled and sloped/crowned at the end of each day, prior to weekends and any 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.