June 20, 2020
**Ref. No.: T20799W**

**Mattamy Development Corporation**
433 Steeles Ave. E., Suite #110
Milton, Ontario
L9T 8Z4

**Attention:** **Mr. Tim Schnarr**
**Land Development Manager**

**Subject:** **Geotechnical Investigation Report**
**Proposed Residential Condominium Development**
**Block 300**
**Preserve Property**
**Northwest Corner of Carding Mill Trail & North Park Boulevard**
**Oakville, Ontario**

Please find enclosed our Geotechnical Investigation Report prepared for the above captioned project. Should you have any questions or require any clarifications, please do not hesitate to contact our office.

We thank you for giving us this opportunity to be of service to you.

Sincerely,
**Shad & Associates Inc.**

H. Shad

Houshang Shad, Ph.D., P. Eng.
Principal

**SHAD & ASSOCIATES INC.** **GEOTECHNICAL, ENVIRONMENTAL AND MATERIALS CONSULTING ENGINEERS**
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# Geotechnical Investigation Report
# Proposed Residential Condominium Development
# Block 300
# Preserve Property
# Northwest Corner of Carding Mill Trail & North Park Boulevard
# Oakville, Ontario

Submitted to:

**Mattamy Development Corporation**
433 Steeles Ave. E., Suite #110
Milton, Ontario
L9T 8Z4

Attention:

**Mr. Tim Schnarr**

Submitted by:

**Shad & Associates Inc.**
83 Citation Drive, Unit 9
Vaughan, Ontario, L4K 2Z6
Canada

Tel: (905) 760-5566
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June 20, 2020

Ref. No.: T20799W

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## FIGURES



## ENCLOSURES

## 1.0 INTRODUCTION

Shad & Associates Inc. was retained by Mattamy Development Corporation ('Client') to carry out a geotechnical investigation for a proposed residential condominium development to be constructed on Block 300 of the Preserve property, located on the northwest corner of Carding Mill Trail and North Park Boulevard, in Oakville, Ontario, as shown in Figure 1W.

According to the preliminary information provided to us, we understand that the proposed condominium will consist of a five-storey structure with one level of underground parking. However, the exact project details were not available at the time of preparation of this report.

The purpose of the geotechnical investigation was to obtain some information about the existing subsurface conditions within the site. Based on our interpretation of the data obtained, some recommendations are provided on the geotechnical aspects of design for the development.

This geotechnical investigation was completed in accordance with Shad Proposal P20724 dated March 16, 2020, authorized by the Client.

This report contains the findings of our geotechnical investigation together with our recommendations and comments. These recommendations and comments are based on factual information and are intended only for use by the design engineers.

We recommend on-going liaison with Shad & Associates Inc. during the design and construction phases of the project to ensure that the recommendations in this report are applicable and/or correctly interpreted and implemented. Also, any queries concerning the geotechnical aspects of the proposed project should be directed to Shad & Associates Inc. for further elaboration and/or clarification.

## 2.0 INVESTIGATION PROCEDURES

The fieldwork was performed on June 2 and 3, 2020 and consisted of drilling and sampling altogether eight boreholes at the site (i.e., Boreholes 1W to 8W) extending down to depths ranging from approximately 6.1 to 7.1 m below existing ground surface where practical refusal to augering was reached. The approximate borehole locations are shown in Figure 2W. The boreholes were staked out on site by RP-E Surveying Limited, O.L.S., who also provided us with their approximate ground surface elevations. We understand the elevations to be geodetic.

The boreholes were advanced using solid stem continuous flight augers with a track-mounted power auger drilling rig under the full-time supervision of experienced geotechnical personnel from Shad & Associates Inc. Soil samples were taken at 0.76 to 1.5 m intervals for the full depth of the investigation and Standard Penetration Tests (SPT) were performed in accordance with ASTM D1586. This consists of freely dropping a 63.5 kg (140 lbs) hammer a vertical distance of 0.76 m (30 inches) to drive a 51 mm (2 inches) diameter o.d. split-barrel (split spoon) sampler into the ground. The number of blows of the hammer required to drive the sampler into the relatively

undisturbed ground by a vertical distance of 0.30 m (12 inches) is recorded as the SPT 'N' value of the soil and this gives an indication of the consistency or the relative density of the soil deposit.

Upon completion of boreholes, the collected samples were transported to our Soil Laboratory for further examination and laboratory testing. Soil laboratory testing, consisting of moisture content determination, were performed on representative samples. The results of the in-situ and laboratory tests are presented on the corresponding Record of Borehole Sheets.

It should be noted that samples obtained during this investigation will be stored in our Soil Laboratory for three months and will be disposed thereafter.

## 3.0 SUB-SURFACE CONDITIONS

Based on the subsurface conditions encountered at the borehole locations, below some surficial asphalt layer and/or fill, the site is predominantly underlain by a glacial till deposits, generally consisting of silty clay to clayey silt till with occasional layers of sandy silt till. These were then underlain by till-shale and/or highly weathered to weathered shale extending down to the completion of all boreholes where practical refusal to augering was reached.

The stratigraphic units and groundwater conditions are briefly discussed in the following sections. For more detailed information, reference should be made to the Record of Borehole Sheets.

### 3.1 Pavement Structure and Fill

An asphalt pavement structure was encountered at Borehole 1 that extended down to approximately 0.5 m below existing ground surface. Some surficial granular fill was also contacted at Boreholes 3W and 6W located inside the Mattamy homebuilder's compound. The granular fill at these locations and the ground surface at the remaining boreholes were underlain by fill, generally consisting of silty clay to clayey silt, and occasionally shale fill, that extended down to depths ranging from about 1.4 (at Borehole 8W, located near the northeast corner of the site) to 4.4 m (at Borehole 1W, located at the southwest end of the block). Occasional seams of rootlets, topsoil and organic stains were generally within the fill layer.

It should be noted that the thickness and quality of topsoil and fill may vary significantly in between and beyond the borehole locations. Considering this, the extent of fill as well as the limited diameter of the auger hole, it is recommended that allowance be made for possible variations when making construction estimates.

### 3.2 Native Glacial Till

The fill at all boreholes were underlain by glacial till deposits, generally consisting of silty clay to clayey silt till with occasional layer of sandy silt till with trace to some clay that extended down to

depths ranging from approximately 3.2 m ( at Borehole 5W) to 5.2 m (at Boreholes 1W and 4W) below existing ground surface.

Standard Penetration Tests were carried out at the site and the recorded 'N'-values within the silty clay to clayey silt till were found to range from 21 to more than 30 blows/0.3 m, indicating a very stiff to hard, but generally hard consistency. Representative samples from this deposit were also tested for natural moisture content and the results were found to range from 10 to 18%. Considering these results as well as the visual and tactile examination of the recovered soil samples, the silty clay to clayey silt till was generally damp. The sandy silt till layers with trace to some clay were also damp with measured moisture content values of 10 to 16%. This deposit was also compact with recorded 'N'-values of 23 and 26 blows/0.3 m.

It should however be noted that the occurrence of cobbles and boulders should always be expected when working in glacial till deposits.

### 3.3 Till-Shale

The sandy silt till layer at Borehole 5W was underlain by a till-shale complex. The deposit was hard and damp with a measured 'N'-value of 42 blows/0.3 m and a moisture content value of 11%.

### 3.4 Highly Weathered to Weathered Shale

The till-shale complex at Borehole 5W and the silty clay to clayey silt till at the remaining borehole locations were underlain by highly weathered to weathered shale at depths ranging from approximately 3.3 m (at Borehole 7W) to 5.2 m ( at Boreholes 1W and 4W) below existing grade. The measured 'N'-values within the highly weathered to weathered shale were all well in excess of 50 blows/0.3 m, indicating a hard condition.

It should be noted the quality and depth of the shale deposit was inferred from drilling rather than proven by rock coring.

### 3.5 Groundwater Conditions

Groundwater conditions were monitored during and upon the completion of drilling as well as by installing standpipe piezometers in Boreholes 1W to 3W, 7W and 8W. The results are summarized in Table 1.

**Table 1: Measured Groundwater levels**

| Borehole No. | Approx. Ground Surface Elevation (m) | Measured Groundwater Depth/Elevation Upon Borehole Completion (m) | Measured Groundwater Depth/Elevation in Standpipe Piezometer on June 10, 2020 (m) | Measured Groundwater Depth/Elevation in Standpipe Piezometer on June 17, 2020 (m) |
|---|---|---|---|---|
| 1W | ~171.0 | Dry | Dry | Dry |
| 2W | 170.8 | Dry | 4.2 / 166.6 | 4.8 / 166.0 |
| 3W | 170.6 | 4.7 / 165.9 | 4.1 / 166.5 | 4.2 / 166.4 |
| 4W | 170.8 | 5.8 / 165.0 | N/A | N/A |
| 5W | 170.5 | Dry | N/A | N/A |
| 6W | 170.7 | Dry | N/A | N/A |
| 7W | ~171.0 | Dry | Dry | Dry |
| 8W | 171.6 | Dry | Dry | Dry |

It should however be pointed out that the groundwater at the site would fluctuate seasonally and can be expected to be somewhat higher during the wet months. Furthermore, perched water conditions could also be present within the fill deposit overlying the relatively less-permeable native deposits.

## 4.0 DISCUSSION AND RECOMMENDATION

According to the preliminary information provided to us by the Client, we understand that the proposed development would consist of a five-storey structure with one a level of underground parking. However, the exact project details were not available at the time of preparation of this report.

Considering the above preliminary development details and the subsurface conditions encountered at the borehole locations, some discussions and recommendations are provided in this section. However, they should be considered as preliminary and would need to be reviewed and confirmed once the exact project details are known.

### 4.1 Foundations

Considering the proposed one level of underground parking garage, the footing invert may be at about 3 to 4 m below the existing grade. Considering this and the subsurface conditions encountered at the borehole locations, our recommendations for soil bearing pressure for spread and strip footings are provided in Table 2.

**Table 2: Recommended Soil Bearing Capacity Values**

| Borehole No. | Approximate Existing Ground Surface Elevation (m) | Recommended Footing Depth / Elevation (m) | Recommended Geotechnical Reaction at SLS* (kPa) | Factored Geotechnical Resistance at ULS (with a Geotechnical Resistance Factor of 0.5) (kPa) |
|---|---|---|---|---|
| 1W | ~171.0 | 4.7 to 5.5 / 166.3 to 165.5<br>Below 5.6 / 165.4 | 300<br>1,000 | 450<br>1,500 |
| 2W | 170.8 | 4.1 to 4.7 / 166.7 to 166.1<br>4.8 to 5.3 / 166.0 to 165.5<br>Below 5.4 / 165.4 | 200<br>400<br>1,000 | 300<br>600<br>1,500 |
| 3W | 170.6 | 3.2 to 4.0 / 167.4 to 166.6<br>4.1 to 4.6 / 166.5 to 166.0<br>Below 4.7 / 165.9 | 200<br>300<br>1,000 | 300<br>450<br>1,500 |
| 4W | 170.8 | 4.0 to 5.5 / 166.8 to 165.3<br>Below 5.6 / 165.2 | 400<br>1,000 | 600<br>1,500 |
| 5W | 170.5 | 2.4 to 3.2 / 168.1 to 167.3<br>3.3 to 4.6 / 167.2 to 165.9<br>Below 4.7 / 165.8 | 200<br>350<br>1,000 | 300<br>525<br>1,500 |
| 6W | 170.7 | 2.6 to 3.9 / 168.1 to 166.8<br>Below 4.0 / 166.7 | 300<br>1,000 | 450<br>1,500 |
| 7W | ~171.0 | 1.7 to 2.4 / 169.3 to 168.6<br>2.5 to 3.3 / 168.5 to 167.7<br>Below 3.4 / 167.6 | 200<br>300<br>1,000 | 300<br>450<br>1,500 |
| 8W | 171.6 | 1.7 to 2.4 / 169.9 to 169.2<br>2.5 to 3.9 / 169.1 to 167.7<br>Below 4.0 / 167.6 | 200<br>300<br>1,000 | 300<br>450<br>1,500 |

*Higher soil bearing capacity values are available at lower depths, if required.

The minimum foundation size, footing thickness, excavations and other footing requirements should be designed in accordance to the latest edition of the Ontario Building Code. For bearing capacity values of 500 kPa or higher, the footings should be at least 1.0 m wide.

The foundation subgrade should be inspected and evaluated by the Geotechnical Engineer prior to concreting to ensure that the foundations are founded on competent subgrade capable of supporting the recommended design pressure. It should be noted that the shale deposits are prone to softening when exposed to weather elements. We would recommend that for footings placed on shale, once the footing subgrade has been inspected and approved, it should be protected by a 50 mm thick (minimum) layer of non-shrinkable concrete.

Design frost penetration for the general area is 1.2 m. Therefore, a permanent soil cover of 1.2 m or its thermal equivalent is required for frost protection of foundations exposed to seasonal freezing conditions. All exterior footings and footings beneath unheated areas should have at least 1.2 m of earth cover or equivalent synthetic insulation for frost protection.

Where necessary, the stepping of the footings at different elevations should be carried out at an angle no steeper than 2 horizontal (clear horizontal distance between footings) to 1 vertical (difference in elevation) and no individual footing step should be greater than 0.6 m and may have to be as low as 0.3 m if weaker soils are encountered.

For spread footings designed and constructed in accordance with our recommendations provided in Table 1, the total and differential settlements should be less than 25 mm and 15 mm, respectively.

## 4.2 Earthquake Considerations

In conformance to the Criteria in Table 4.1.8.4.A of the Ontario Building Code (OBC 2012), considering the recommended footing inverts, the subject site is generally classified as Site Class "C-Very Dense Soil and Soft Rock". The four values of the Spectral Response Acceleration Sa (T) for the different periods and the peak ground acceleration (PGA) as well as the design values of $F_a$ and $F_v$ for the project site should be calculated in accordance to the code.

## 4.3 Floor Slab & Permanent Drainage

Considering the proposed one level of underground parking garage, the excavation for the building floor slab could extend 3 to 4 m below existing ground surface. Based on this and considering the subsurface conditions encountered at the borehole locations, the building slab should generally be placed on the very stiff to hard silty clay to clayey till, compact sandy silt till, hard till-shale complex or highly weathered to weathered shale that are considered to be competent to carry the concrete floor slab structure. However, considering the presence of considerable amount of fill at some boreholes (such as Boreholes 1W to 4W), depending on the slab invert design, should the slab invert occur within the existing fill, the fill would need to be excavated out and replaced with properly placed and compacted engineered fill. For recommendations on the construction of engineered fill reference should be made to Section 4.4.

Underneath the slab, a 200 mm thick base course consisting of 20 mm size clear stone or OPSS Granular A should be placed to improve the support for the floor slab and function as drainage layer. This base course should be compacted with vibratory equipment to a uniform high density. If the subgrade is wet, the clear stone or OPSS Granular A base should be separated from the subgrade by an approved filter fabric (e.g. non-woven geotextile, with FOS of 75 - 150 µm, Class II).

A perimeter drainage system will be required around the exterior basement walls. Furthermore, we would recommend the need for any additional sub-floor drainage to be confirmed at the time of excavation.

The thickness of the concrete slab and the reinforcement (if any) should be designed by a structural engineer. A Modulus of Subgrade Reaction ($K_s$) of 24,000 kN/m$^3$ may be used for the

design of the slab provided that the construction is in accordance with the recommendations provided herein.

The floor slab should not be tied to any load-bearing walls or columns unless they have been designed accordingly. Contraction/expansion joints should be provided for the slab as required by the structural engineer.

The requirement for waterproofing of the basement walls should be provided by Project Engineer or the Waterproofing Consultant.

The upper 0.5 m of backfill should consist of a relatively impermeable clayey soil, which will minimize the ingress of surface water. The site should be graded for drainage away from foundations. A minimum cross fall of three percent (3%) immediately adjacent to foundations is recommended to allow for some settlement and promote good surface drainage.

### 4.4 Engineered Fill

Based on the design elevation for the building slab, engineered fill may be required to replace the existing fill. The following placement procedure is recommended:

(i) The area to receive the engineered fill should be stripped of any topsoil, fill and other compressible, weak and deleterious materials. After stripping, the entire area should be inspected and approved by the geotechnical engineer. Spongy, wet or soft/loose spots should be sub-excavated to stable subgrade and replaced with compactable approved soil, compatible with subgrade conditions, as directed by the geotechnical engineer.

(ii) The fill material should be placed in thin layers not exceeding approximately 200 mm when loose. Oversize particles (cobbles and boulders) larger than 120 mm should be discarded, and each fill layer should be uniformly compacted with heavy compactors, suitable for the type of fill used, to at least 98% of its Standard Proctor Maximum Dry Density.

(iii) The on-site inorganic soils are generally acceptable for use as engineered fill, provided that they are not contaminated with the organic rich deposits and any organic inclusions are removed. Depending on the construction season, the on-site soils may require some reconditioning, wetting or drying.

(iv) Full-time geotechnical inspection and quality control (by means of frequent field density and laboratory testing) are necessary for the construction of a certifiable engineered fill. Compaction procedures and efficiency should be controlled by a qualified geotechnical technician.

(v) The engineered fill should not be frozen and should be placed at a moisture content within 2% of the optimum value for compaction. The engineered fill should not be

performed during winter months when freezing ambient temperatures occur persistently or intermittently.

## 4.5 Excavations and Groundwater Control

All excavations should be carried out in accordance with the Ontario Health and Safety Regulations. The soils to be excavated can be classified as follows:

- Fill, Compact Sandy Silt Till — Type 3

- Very Stiff to Hard Silty Clay/Clayey Silt Till
  Hard Till-Shale Complex,
  Highly Weathered to Weathered Shale — Type 2

Accordingly, a side slope of 1H:1V is required for excavations in accordance with the Ontario Health and Safety Regulations. However, within the very stiff to hard silty clay/clayey silt till, hard till-shale complex and highly weathered to weathered shale, the bottom 1.2 m may be kept close to vertical. However, near the surface within the existing fill, flatter slopes may be required.

Stockpiles of excavated materials should be kept at least 5.0 m from the edge of the excavation to avoid slope instability. Care should also be taken to avoid overloading of any underground services/structures by stockpiles.

Based on the subsurface conditions encountered at the boreholes, with the anticipated maximum depth of excavation for the proposed structure of about 3 to 4 m, the excavation within the native deposits should generally occur within the relatively impermeable very stiff to hard silty clay to clayey silt till, compact sandy silt with trace to some clay as well as till-shale complex and highly weathered to weathered shale. Considering these, the amount of seepage is expected to be minor and manageable with gravity drainage and filtered sump pumps. However, increased seepage should be expected from any perched water condition within the overlying fill, as well as from the water bearing seams within the glacial till deposits, till-shale and highly weathered to weathered shale. We are of the opinion that this should also be manageable with gravity drainage and increased number of sump pumps, if required.

No major excavation difficulties are foreseen but allowance should be made for boulders and cobbles, which occur randomly in the fill and glacial deposits. The terms describing the consistency (very stiff, hard) and relative density (compact) of the soil strata, give an indication of the effort need for excavation. Furthermore, excavation within the till-shale and highly weathered to weathered shale would need additional effort in the form of possible use of large backhoes, hydraulic hammers, etc.

## 4.6 Temporary Shoring

Considering the proposed one level of underground parking and the recommended side slopes for temporary excavations, we are of the opinion that excavation may occur without the need for shoring. Should shoring systems be required, we should be informed to provide additional

information and they should be designed in accordance with the Canadian Foundation Engineering Manual.

## 4.7 Lateral Earth Pressures

The lateral earth pressures acting on the 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: Coefficient of lateral earth pressure (=0.5),
- $\gamma$: Unit weight of backfill, (a value of 21.5 kN/m$^3$ may be used),
- h: Depth to the point of interest in meters,
- q: Surcharge loads, kN/m$^2$.

The above expression assumes that the perimeter drainage system prevents the build-up of any hydrostatic pressure behind the wall, and that the wall backfill is level.

## 4.8 Pavement Thickness

### 4.8.1 Pavement Thickness Outside the Underground Parking Structure

Depending on the design invert elevation for the proposed road subgrade outside the parking deck structure, existing fill may be encountered. In such a case, in an attempt to minimize future road settlements and/or cracking, we would recommend assessing the fill quality by proof-rolling and if required to be removed down to competent subgrade and then raised up using inorganic fill materials similar to the existing subgrade conditions. All new fill should be placed in maximum 200 mm loose lifts within ±2% of its optimum moisture content, and each lift compacted with suitable equipment to minimum 98% Standard Proctor Maximum Dry Density, before placing the next lift. If construction of the roadfill is carried out in wet weather, the thickness of the sub-base course should be increased.

The native undisturbed deposits or properly placed engineered fill may be used as subgrade. Using good engineering and construction practice, the minimum pavement structure outside the parking deck is provided in Table 3.

**Table 3: Recommended Pavement Thickness**

| Pavement Structure | Compaction | Light Duty (mm) | Heavy Duty (mm) |
|---|---|---|---|
| HL-3 Asphaltic Concrete<br>HL-8 Asphaltic Concrete | 97% Marshall Density | 40<br>75 | 40<br>100 |
| Granular 'A' Base | 100 % | 150 | 150 |
| Granular 'B' Sub-base | 100 % | 250 | 450 |

**NOTE: HL-3 and HL-8 asphaltic concrete to conform to OPSS Form 1150 and 310.**

To ensure the longevity of the pavement, the roadbed should be well drained at all times. We recommend that full-length perforated sub-drain pipes of 150 mm diameter be installed along both sides of the road, below the roadbed level, to ensure effective drainage. The sub-drain pipes should be surrounded by 20 mm size clear stone drainage zone of minimum 150 mm thickness, which should have non-woven geotextile (non-woven geotextile, with FOS of 75 – 150 µm, Class II) wraparound to minimize infiltration of fines in pipes which would reduce their effectiveness.

The granular materials should be compacted as per American Society for Testing and Material's Number D698. The placing, spreading and rolling of the asphalt should be in accordance with Ontario Provincial Standard Specifications Form 310, or equivalent.

Construction traffic over exposed subgrade materials should be minimized, and temporary construction hauling routes should be established. If these routes coincide with future paved areas, adequately reinforced haul roads (increased thickness of granular base, use of geo-fabrics, etc.) should be constructed to reduce disturbance to the subgrade soils. These provisions are particularly important if the construction is scheduled during wet and cold seasons.

### 4.8.2 Construction Comments

In order to provide a durable pavement structure, the following pavement construction method is recommended.

The subgrade should be adequately prepared to receive the sub-base course. Any disturbed and wet subgrade materials should be removed and the top of the subgrade should then be inspected and approved, by proof-rolling, by qualified geotechnical personnel. Cavities created by the removal of unsuitable materials should be backfilled with approved, inorganic fill materials similar to the existing subgrade material, as discussed above.

Special attention should be paid to proper grading of the subgrade surface. Depressions and undulations should be eliminated and, to permit quick drainage, the subgrade surface should be sloped towards ditches, sub-drains and/or catch-basins.

It is recommended that a programme of geotechnical/material inspection and testing be carried out during the construction phase of the project to confirm that the conditions exposed in the excavations are consistent with those encountered in the boreholes and the design assumptions, and to confirm that the various project specifications and materials requirements are being met.

### 4.8.3 Recommended Pavement Make-up Over the Parking Structure

For the proposed roads over the concrete deck, our recommendations for the pavement structure is provided in Table 4.

**Table 4: Recommended Pavement Thickness Over the Parking Structure**

| Pavement Structure | Compaction | Light Duty (mm) | Heavy Duty (mm) |
|---|---|---|---|
| HL-3 Asphaltic Concrete<br>HL-8 Asphaltic Concrete | 97% Marshall Density | 40<br>50 | 50<br>85 |
| Granular 'A' Base | 100 % | 150 | 150 |
| Free-Draining and Grading Sand Layer | - | 100 | 100 |

**NOTE: HL-3 and HL-8 asphaltic concrete to conform to OPSS Form 1150 and 310.**

The above pavement make-up should be placed over the asphaltic protection board over waterproofing membrane. Proper drainage should be provided to ensure a well-drained pavement structure.

## 5.0 CLOSURE

We recommend that once the project details are known and before final design, we should be given the opportunity to review and provide additional geotechnical recommendations that may be required.

The attached Report Limitations are an integral part of this report.

Sincerely,
**Shad & Associates Inc.**


Stephen Chong, P. Eng.
Senior Engineer

Houshang Shad, Ph. D., P. Eng.
Principal

# STATEMENT OF LIMITATION

The conclusions and recommendations given in this report are based on information obtained at the testhole locations. Subsurface and groundwater conditions between and beyond the testholes may differ from those encountered at the testhole locations, and conditions may become apparent during construction which could not be detected or foreseen at the time of the site investigation.

The information contained herein in no way reflects on the environmental aspects of the project, unless stated otherwise.

The benchmark and elevations used in this report are primarily to establish relative elevation differences between the testhole locations and should not be used for other purposes, such as planning, grading, excavating, etc.

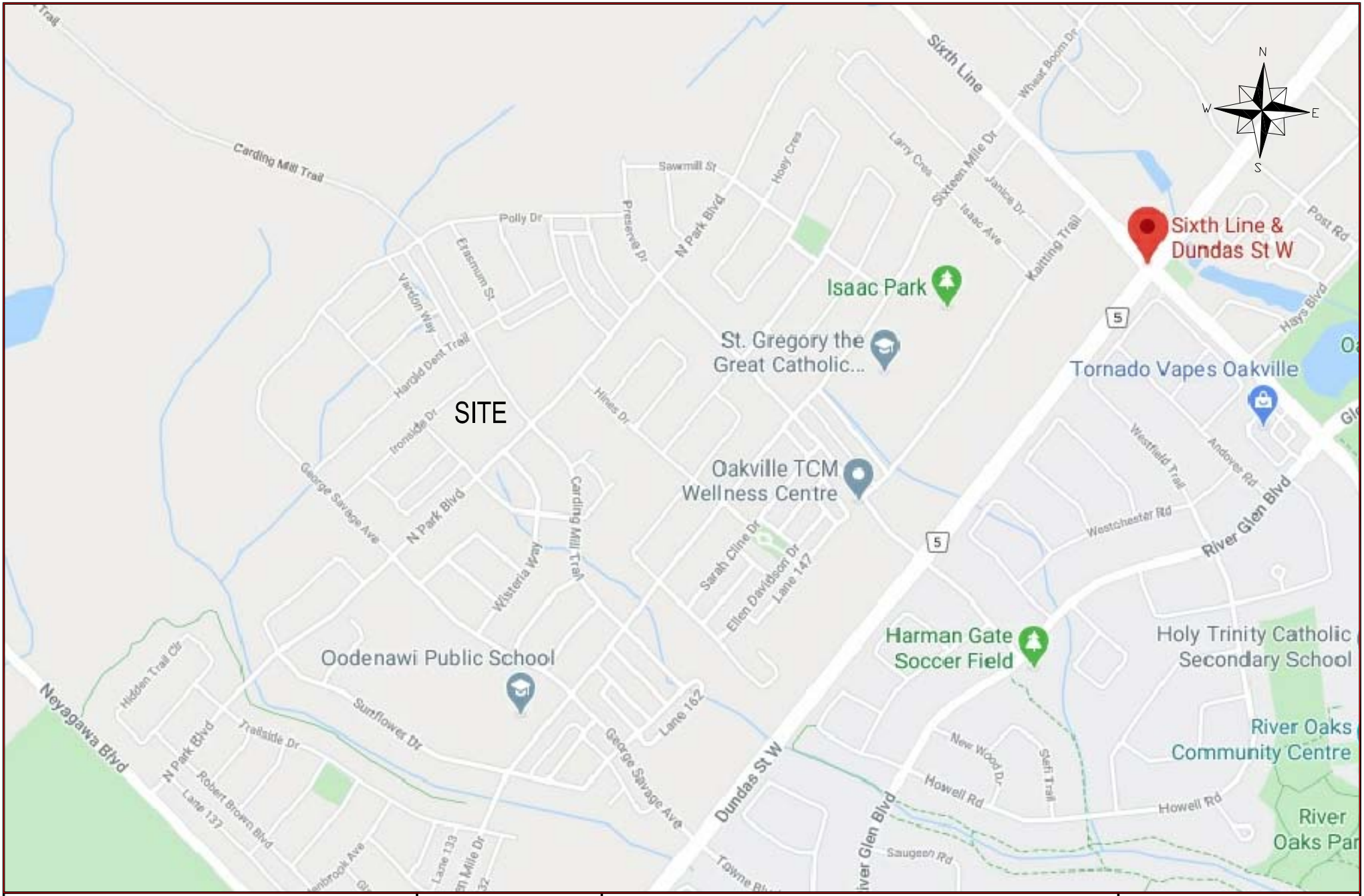
The design recommendations given in this report are project as well as site specific and then only if constructed substantially in accordance with the details stated in this report. We recommend, therefore, that we be retained during the final design stage to review the design drawings and to verify that they are consistent with our recommendations or the assumptions made in our analysis.

The comments given in this report on potential construction problems and possible methods are intended only for the guidance of the designer. The number of the testholes may not be sufficient to determine all the factors that may affect construction methods and costs. The contractors bidding on this project or undertaking 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.

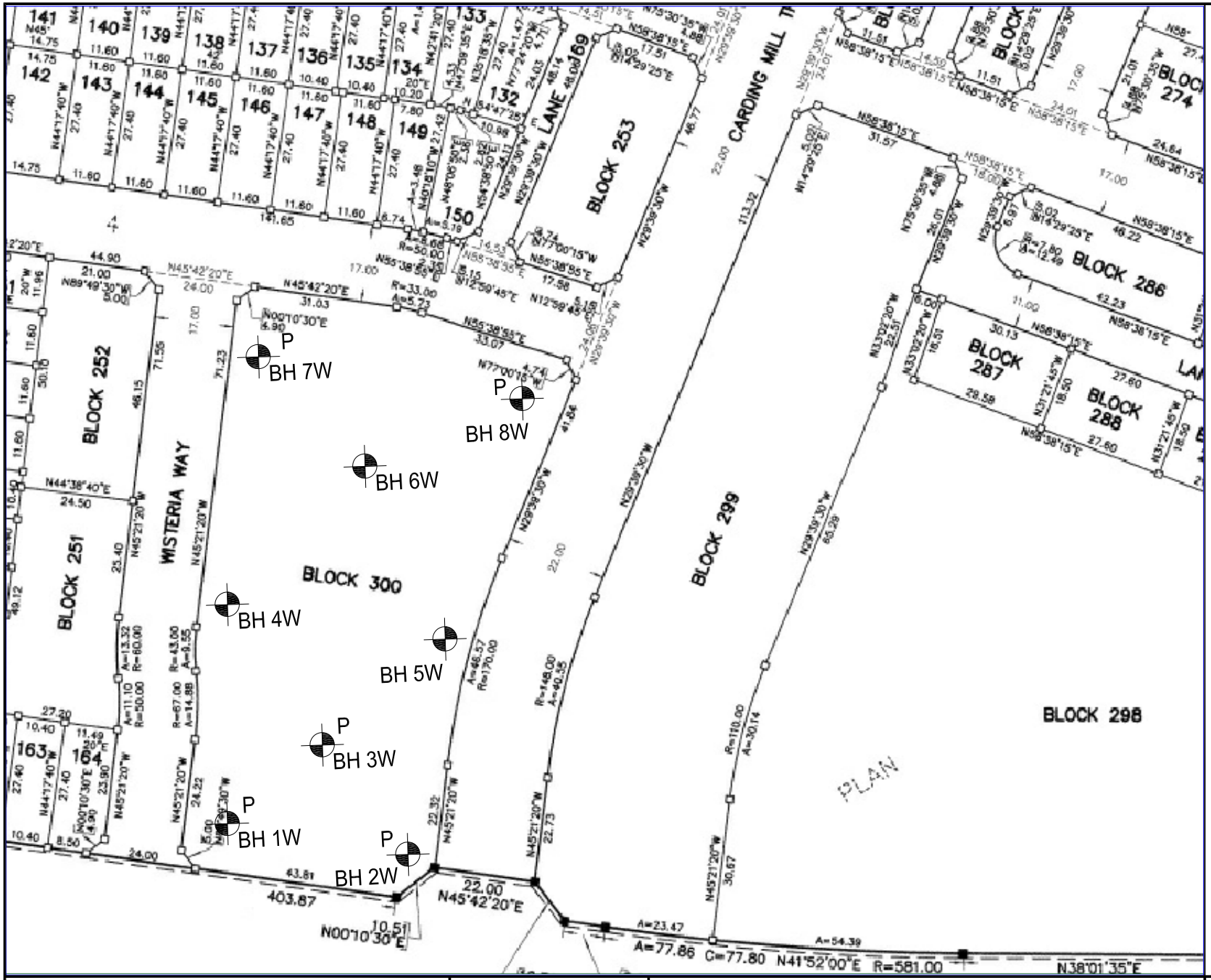
We recommend that we be retained during construction to confirm that the subsurface conditions throughout the site do not deviate materially from those encountered in the testholes.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, is the responsibility of such third party. We accept no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

# FIGURES




| | | | |
|---|---|---|---|
| **CLIENT:** **Mattamy Development Corporation** | **Drawn By:** R.H. | **TITLE:** **SITE LOCATION PLAN** | **Date:** June 2020 |
| | **Checked By:** H.S. | | **Project No.:** **T20799W** |
| **SHAD & ASSOCIATES INC.**<br>GEOTECHNICAL, ENVIRONMENTAL AND MATERIALS CONSULTING ENGINEERS<br>83 Citation Drive, Unit 9<br>Vaughan, Ontarulo, L4K 2Z6<br>Tel: (905) 760-5566<br>Fax: (905) 760-5567<br>www.shadinc.ca | **Datum:** - | **PROJECT:** **Geotechnical Investigation**<br>Preserve Condo: Block 300<br>West of Sixth Line, North of Dundas Street West<br>Oakville, Ontario | Figure No.: **1W** |
| SHAD & ASSOCIATES INC. | **Projection:** - | | |
| | **Scale:** N.T.S. | | |




## LEGEND:

**BH1**
Borehole Locations

**P**
Piezometer Borehole Locations

## NOTES:

1. Borehole locations are approximate.
2. Drawing not to scale.
3. The base drawing was provided by client.
4. The drawing should be read in conjunction with the associated reports by Shad & Associates Inc., T20799W.

**CLIENT:**
Mattamy Development Corporation


**SHAD & ASSOCIATES INC.**
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| | |
|---|---|
| Drawn By: | R.H. |
| Checked By: | H.S. |
| Datum: | - |
| Projection: | - |
| Scale: | N.T.S. |

**TITLE:** BOREHOLE LOCATION PLAN

**PROJECT:** Geotechnical Investigation
Preserve Condo: Bock 300
West of Sixth Line & North of Dundas Street West
Oakville, ON

| | |
|---|---|
| Date: | June 2020 |
| Project No.: | T20799W |
| Figure No.: | 2W |

# ENCLOSURES

# RECORD OF BOREHOLE 1W

**Project No.:** T20799 W **CLIENT:** Mattamy Development Corporation **ORIGINATED BY:** R.H.

**DATE:** June 2-3, 2020 **LOCATION:** Carding Mill Trail, Oakville, Ontario **COMPILED BY:** R.H.

**DATUM:** Geodetic **BOREHOLE TYPE:** Solid Stem **CHECKED BY:** H.S.

SHAD & ASSOCIATES INC.
83 Citation Dr, Unit 9,
Vaughan, Ontario, L4K 2Z6

| ELEVATION (metres) | DEPTH SCALE (metres) | DESCRIPTION | STRATA PLOT | SAMPLE NUMBER | TYPE | RECOVERY (cm) | "N" VALUES | GROUND WATER CONDITIONS |
|---|---|---|---|---|---|---|---|---|
| ~ 171.0 | | Ground Surface | | | | | | |
| | 0 | **100mm Asphalt** | | | | | | |
| 170.5 | | **Granular Fill** | | 1 | SS | 46 | 5 | |
| 170.3 | | brown<br>**Silty Clay/Clayey Silt Fill**<br>some gravels<br>moist | | | | | | |
| | 1 | grey<br>**Shale Fill**<br>damp | | 2 | SS | 15 | 17 | |
| 169.6 | | | | | | | | |
| | | | | 3 | SS | 15 | 35 | |
| | 2 | reddish brown<br>**Silty Clay/Clayey Silt Fill**<br>some shale fragments<br>damp to moist | | 4 | SS | 46 | 12 | |
| | 3 | | | 5 | SS | 46 | 16 | |
| | | brown, occ. reddish brown<br>trace rootlets | | | | | | |
| | | trace topsoil | | 6 | SS | 25 | 16 | |
| | 4 | | | | | | | |
| 166.6 | | greyish brown | | | | | | |
| | | brown, occ. greyish brown<br>occ. reddish brown<br>**Silty Clay/Clayey Silt Till**<br>occ. sand seams, occ. oxidized fissures<br>occ. shale fragments<br>damp, hard | | 7 | SS | 46 | 34 | |
| 165.8 | 5 | | | | | | | |
| | | | | 8 | SS | 20 | 50/13cm | |
| | | reddish brown<br>**Highly Weathered** | | 9 | SS | 5 | 50/5cm | |
| | 6 | | | | | | | |
| | | **Weathered Shale**<br>occ. limestone seams | | | | | | |
| 163.9 | 7 | | | 10 | SS | 5 | 50/5cm | |

**DYNAMIC CONE PENETRATION RESISTANCE PLOT**
20 40 60 80 100

**SHEAR STRENGTH kPa**
20 40 60 80 100

**WATER CONTENT (%)**
5 15 25 35

WC values: 10, 14, 8, 11, 10, 11, 20, 12, 8, 6, 5

**MONITORING WELL**

**REMARKS AND GRAIN SIZE DISTRIBUTION (%)**
GR SA SI CL

Borehole was moved 2m west of stake due to Mattamy's existing construction trailer.

# RECORD OF BOREHOLE 1W

**Project No.:** T20799 W **CLIENT:** Mattamy Development Corporation **ORIGINATED BY:** R.H.

**DATE:** June 2-3, 2020 **LOCATION:** Carding Mill Trail, Oakville, Ontario **COMPILED BY:** R.H.

**DATUM:** Geodetic **BOREHOLE TYPE:** Solid Stem **CHECKED BY:** H.S.

SHAD & ASSOCIATES INC.
83 Citation Dr, Unit 9,
Vaughan, Ontario, L4K 2Z6

| SOIL PROFILE | | | | SAMPLES | | | | | DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa 20 40 60 80 100 | WATER CONTENT (%) 5 15 25 35 | MONITORING WELL | REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ELEVATION (metres) | DEPTH SCALE (metres) | DESCRIPTION | STRATA PLOT | SAMPLE NUMBER | TYPE | RECOVERY (cm) | " N " VALUES | GROUND WATER CONDITIONS | | | | |
| | | **End of Borehole**<br><br>Practical Auger Refusal @ 7.1m.<br>Cave-in Depth on Completion: None<br>Groundwater Depth on Completion: Dry<br><br>Measured Groundwater Level in Installed Standpipe Piezometer on:<br>June 10, 2020: Dry<br>June 17, 2020: Dry | | | | | | | | | | |
| 156.1 | 8<br>9<br>10<br>11<br>12<br>13<br>14 | | | | | | | | | | | |

# RECORD OF BOREHOLE 2W

**Project No.:** T20799 W **CLIENT:** Mattamy Development Corporation **ORIGINATED BY:** R.H.

**DATE:** June 2-3, 2020 **LOCATION:** Carding Mill Trail, Oakville, Ontario **COMPILED BY:** R.H.

**DATUM:** Geodetic **BOREHOLE TYPE:** Solid Stem **CHECKED BY:** H.S.

SHAD & ASSOCIATES INC.
83 Citation Dr, Unit 9,
Vaughan, Ontario, L4K 2Z6

| ELEVATION (metres) | DEPTH SCALE (metres) | DESCRIPTION | STRATA PLOT | SAMPLE NUMBER | TYPE | RECOVERY (cm) | "N" VALUES | GROUND WATER CONDITIONS |
|---|---|---|---|---|---|---|---|---|
| 170.8 | | Ground Surface | | | | | | |
| | 0 | brown **Silty Clay/Clayey Silt Fill** some granulars, trace rootlets damp | | 1 | SS | 30 | 8 | |
| 170.2 | | | | | | | | |
| | 1 | | | 2 | SS | 36 | 17 | |
| | | grey **Shale Fill** damp | | 3 | SS | 46 | 22 | |
| | 2 | | | 4 | SS | 46 | 26 | |
| | | brown, occ. dark brown occ. greyish brown trace rootlets | | | | | | |
| 167.5 | 3 | | | 5 | SS | 46 | 13 | |
| | | brown **Silty Clay/Clayey Silt Fill** some shale fragments damp | | | | | | |
| 166.9 | 4 | brown, occ. greyish brown **Silty Clay/Clayey Silt Till** some sand damp, very stiff | | 6 | SS | 46 | 21 | |
| 166.0 | | hard | | 7 | SS | 46 | 43 | |
| | 5 | reddish brown **Highly Weathered** | | 8 | SS | 5 | 50/8cm | |
| | | **Weathered Shale** | | | | | | |
| 164.7 | 6 | | | 9 | SS | 5 | 50/5cm | |
| | | **End of Borehole** | | | | | | |
| | | Practical Auger Refusal @ 6.2m. Cave-in Depth on Completion: None Groundwater Depth on Completion: Dry | | | | | | |
| | 7 | Measured Groundwater Level in Installed Standpipe Piezometer on: June 10, 2020: 4.2m June 17, 2020: 4.6m | | | | | | |
| 163.4 | | | | | | | | |

**DYNAMIC CONE PENETRATION RESISTANCE PLOT** 20 40 60 80 100

**SHEAR STRENGTH kPa** 20 40 60 80 100

**WATER CONTENT (%)** 5 15 25 35

WATER CONTENT values: 10, 9, 10, 9, 16, 17, 17, 11, 9, 5, 5

**MONITORING WELL**


**REMARKS AND**

**GRAIN SIZE DISTRIBUTION (%)**

**GR SA SI CL**

# RECORD OF BOREHOLE 3W

**Project No.:** T20799 W | **CLIENT:** Mattamy Development Corporation | **ORIGINATED BY:** R.H.

**DATE:** June 2-3, 2020 | **LOCATION:** Carding Mill Trail, Oakville, Ontario | **COMPILED BY:** R.H.

**DATUM:** Geodetic | **BOREHOLE TYPE:** Solid Stem | **CHECKED BY:** H.S.

SHAD & ASSOCIATES INC.
83 Citation Dr, Unit 9,
Vaughan, Ontario, L4K 2Z6

| ELEVATION (metres) | DEPTH SCALE (metres) | DESCRIPTION | STRATA PLOT | SAMPLE NUMBER | TYPE | RECOVERY (cm) | "N" VALUES | GROUND WATER CONDITIONS | DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa 20 40 60 80 100 | WATER CONTENT (%) 5 15 25 35 | MONITORING WELL | REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 170.6 | | Ground Surface | | | | | | | | | | |
| 170.1 | 0 | grey **Granular Fill** | | 1 | SS | 46 | 29 | | | 2, 11 | | |
| | | brown **Silty Clay/Clayey Silt Fill** | | | | | | | | | | |
| | 1 | trace organic stains damp | | 2 | SS | 46 | 16 | | | 11 | | |
| | | | | 3 | SS | 46 | 14 | | | 12 | | |
| | 2 | trace rootlets trace topsoil | | | | | | | | | | |
| 167.7 | | | | 4 | SS | 46 | 14 | | | 19 | | |
| | 3 | brown, occ. grey **Silty Clay/Clayey Silt Till** some oxidized fissures damp, very stiff to hard | | 5 | SS | 46 | 30 | | | 12 | | |
| | 4 | reddish brown some sand seams some shale fragments, hard | | 6 | SS | 46 | 33 | | | 12 | | |
| 166.1 | | reddish brown, occ. grey **Highly Weathered** | | 7 | SS | 10 | 50/13cm | June 02, 2020 | | 4 | | |
| | 5 | **Weathered Shale** | | 8 | SS | 10 | 50/10cm | | | 11 | | |
| | | occ. limestone seams | | | | | | | | | | |
| 164.4 | 6 | **End of Borehole** | | 9 | SS | 5 | 50/5cm | | | 11 | | |
| | | Practical Auger Refusal @ 6.2m. Cave-in Depth on Completion: None Groundwater Depth on Completion: 4.7m | | | | | | | | | | |
| | 7 | Measured Groundwater Level in Installed Standpipe Piezometer on: June 10, 2020: 4.1m June 17, 2020: 4.2m | | | | | | | | | | |
| 163.2 | | | | | | | | | | | | |

June 10, 2020
June 17, 2020

# RECORD OF BOREHOLE 4W

**Project No.:** T20799 W **CLIENT:** Mattamy Development Corporation **ORIGINATED BY:** R.H.

**DATE:** June 2-3, 2020 **LOCATION:** Carding Mill Trail, Oakville, Ontario **COMPILED BY:** R.H.

**DATUM:** Geodetic **BOREHOLE TYPE:** Solid Stem **CHECKED BY:** H.S.

SHAD & ASSOCIATES INC.
83 Citation Dr, Unit 9,
Vaughan, Ontario, L4K 2Z6

| ELEVATION (metres) | DEPTH SCALE (metres) | DESCRIPTION | STRATA PLOT | SAMPLE NUMBER | TYPE | RECOVERY (cm) | "N" VALUES | GROUND WATER CONDITIONS | DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa 20 40 60 80 100 | WATER CONTENT (%) 5 15 25 35 | MONITORING WELL | REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 170.8 | | Ground Surface | | | | | | | | | | |
| | 0 | brown<br>**Silty Clay/Clayey Silt Fill**<br>damp | | 1 | SS | 46 | 14 | | | 11 | | |
| | 1 | | | 2 | SS | 20 | 25 | | | 10 | | |
| | | | | 3 | SS | 30 | 22 | | | 12 | | |
| | 2 | brown, occ. dark brown<br>occ. rootlets | | 4 | SS | 46 | 17 | | | 12 | | |
| | 3 | greyish brown<br>some rootlets, trace organic stains<br>damp to moist | | 5 | SS | 46 | 12 | | | 23 | | |
| 167.1 | | brown | | | | | | | | | | |
| | 4 | brown, occ. grey<br>occ. reddish brown<br>**Silty Clay/Clayey Silt Till**<br>some sand seams<br>some shale fragments<br>damp, hard | | 6 | SS | 46 | 48 | | | 13 | | |
| | | shale interbedding | | 7 | SS | 46 | 46 | | | 11 | | |
| | 5 | brown, occ. reddish brown | | | | | | | | | | |
| 165.6 | | reddish brown<br>**Highly Weathered** | | 8 | SS | 15 | 50/10cm | June 03, 2020 | | 6 | | |
| | | **Weathered Shale** | | | | | | | | | | |
| 164.7 | 6 | **End of Borehole**<br>Practical Auger Refusal @ 6.2m<br>Cave-in Depth on Completion: None<br>Groundwater Depth on Completion: 5.8m | | 9 | SS | 5 | 50/5cm | | | 10 | | |
| 163.3 | 7 | | | | | | | | | | | |

# RECORD OF BOREHOLE 5W

**Project No.:** T20799 W | **CLIENT:** Mattamy Development Corporation | **ORIGINATED BY:** R.H.

**DATE:** June 2-3, 2020 | **LOCATION:** Carding Mill Trail, Oakville, Ontario | **COMPILED BY:** R.H.

**DATUM:** Geodetic | **BOREHOLE TYPE:** Solid Stem | **CHECKED BY:** H.S.

SHAD & ASSOCIATES INC.
83 Citation Dr, Unit 9,
Vaughan, Ontario, L4K 2Z6

| ELEVATION (metres) | DEPTH SCALE (metres) | DESCRIPTION | STRATA PLOT | SAMPLE NUMBER | TYPE | RECOVERY (cm) | "N" VALUES | GROUND WATER CONDITIONS | DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa 20 40 60 80 100 | WATER CONTENT (%) 5 15 25 35 | MONITORING WELL | REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 170.5 | | Ground Surface | | | | | | | | | | |
| | 0 | brown<br>**Silty Clay/Clayey Silt Fill**<br>moist | | 1 | SS | 46 | 6 | | | 14 | | |
| | 1 | brown, occ. reddish brown<br>some shale fragments<br>damp to moist | | 2 | SS | 20 | 9 | | | 15 | | |
| | | | | 3 | SS | 20 | 6 | | | 14 | | |
| 168.3 | 2 | greyish brown<br>**Sandy Silt Till**<br>trace to stone clay<br>occ. oxidized fissures<br>damp to moist, compact | | 4 | SS | 46 | 23 | | | 12 | | |
| 167.3 | 3 | reddish brown<br>**Till-Shale**<br>damp, hard | | 5 | SS | 46 | 42 | | | 10<br>11 | | |
| 166.8 | 4 | reddish brown<br>**Highly Weathered** | | 6 | SS | 46 | 48 | | | 7 | | |
| | | **Weathered Shale**<br>occ. limestone seams | | 7 | SS | 5 | 50/10cm | | | 3 | | |
| 164.4 | 6 | **End of Borehole**<br>Practical Auger Refusal @ 6.1m.<br>Cave-in Depth on Completion: None<br>Groundwater Depth on Completion: Dry | | 8 | SS | 5 | 50/5cm | | | 3 | | |
| 163.0 | 7 | | | | | | | | | | | |

# RECORD OF BOREHOLE 6W

**Project No.:** T20799 W **CLIENT:** Mattamy Development Corporation **ORIGINATED BY:** R.H.

**DATE:** June 2-3, 2020 **LOCATION:** Carding Mill Trail, Oakville, Ontario **COMPILED BY:** R.H.

**DATUM:** Geodetic **BOREHOLE TYPE:** Solid Stem **CHECKED BY:** H.S.

SHAD & ASSOCIATES INC.
83 Citation Dr, Unit 9,
Vaughan, Ontario, L4K 2Z6

| ELEVATION (metres) | DEPTH SCALE (metres) | DESCRIPTION | STRATA PLOT | SAMPLE NUMBER | TYPE | RECOVERY (cm) | "N" VALUES | GROUND WATER CONDITIONS |
|---|---|---|---|---|---|---|---|---|
| 170.7 | | Ground Surface | | | | | | |
| | 0 | grey<br>**Granular Fill** | | 1 | SS | 46 | 13 | |
| 170.3 | | moist | | | | | | |
| | 1 | brown<br>**Silty Clay/Clayey Silt Fill**<br>damp | | 2 | SS | 46 | 13 | |
| | | | | 3 | SS | 46 | 12 | |
| | 2 | brown, occ. reddish brown | | 4 | SS | 46 | 40 | |
| 168.1 | | occ. sand interbeddings | | | | | | |
| | 3 | grey<br>**Silty Clay/Clayey Silt Till**<br>occ. shale interbeddings<br>damp, hard | | 5 | SS | 41 | 36 | |
| 167.1 | | | | 6 | SS | 25 | 50/10cm | |
| | 4 | reddish brown<br>**Highly Weathered** | | 7 | SS | 5 | 50/5cm | |
| | 5 | **Weathered Shale**<br>occ. limestone seams | | 8 | SS | 5 | 50/5cm | |
| 164.6 | 6 | **End of Borehole** | | 9 | SS | 5 | 50/5cm | |
| | | Practical Auger Refusal @ 6.2m.<br>Cave-in Depth on Completion: None<br>Groundwater Depth on Completion: Dry | | | | | | |
| 163.2 | 7 | | | | | | | |

**DYNAMIC CONE PENETRATION RESISTANCE PLOT**
20 40 60 80 100

**SHEAR STRENGTH kPa**
20 40 60 80 100

**WATER CONTENT (%)**
5 15 25 35

| SAMPLE NUMBER | WATER CONTENT (%) |
|---|---|
| 1 | 11 |
| 2 | 12 |
| 3 | 19 |
| 4 | 20 |
| 5 | 15 |
| 6 | 18 |
| 7 | 13 |
| 8 | 9 |
| 9 | 5 |
| | 6 |

**MONITORING WELL**

**REMARKS AND**

**GRAIN SIZE DISTRIBUTION (%)**

**GR SA SI CL**

# RECORD OF BOREHOLE 7W

**Project No.:** T20799 W **CLIENT:** Mattamy Development Corporation **ORIGINATED BY:** R.H.

**DATE:** June 2-3, 2020 **LOCATION:** Carding Mill Trail, Oakville, Ontario **COMPILED BY:** R.H.

**DATUM:** Geodetic **BOREHOLE TYPE:** Solid Stem **CHECKED BY:** H.S.

SHAD & ASSOCIATES INC.
83 Citation Dr, Unit 9,
Vaughan, Ontario, L4K 2Z6

| ELEVATION (metres) | DEPTH SCALE (metres) | DESCRIPTION | STRATA PLOT | SAMPLE NUMBER | TYPE | RECOVERY (cm) | "N" VALUES | GROUND WATER CONDITIONS | DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa 20 40 60 80 100 | WATER CONTENT (%) 5 15 25 35 | MONITORING WELL | REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ~171.0 | | Ground Surface | | | | | | | | | | |
| | 0 | brown, occ. dark brown **Silty Clay/Clayey Silt Fill** some shale fragments damp | | 1 | SS | 36 | 31 | | | 9 | | Borehole location was moved ~ 2m east of stake due to material storage. |
| | | brown, occ. reddish brown | | 2 | SS | 46 | 15 | | | 15 | | |
| | 1 | greyish brown some rootlets, some organic stains | | | | | | | | | | |
| 169.3 | | greyish brown **Sandy Silt Till** trace to some clay damp, compact | | 3 | SS | 46 | 26 | | | 16 | | |
| 168.8 | 2 | brown **Silty Clay/Clayey Silt Till** some oxidized fissures damp, hard | | 4 | SS | 46 | 34 | | | 11 | | |
| | 3 | reddish brown | | 5 | SS | 41 | 67/25cm | | | 10 4 | | |
| 167.6 | | reddish brown, occ. grey **Highly Weathered** | | 6 | SS | 15 | 50/8cm | | | 6 | | |
| | 4 | | | 7 | SS | 5 | 50/5cm | | | 4 | | |
| | | **Weathered Shale** occ. limestone seams/ interbeddings | | | | | | | | | | |
| | 5 | | | | | | | | | | | |
| 164.9 | 6 | | | 8 | SS | 5 | 50/5cm | | | 4 | | |
| | | **End of Borehole** Practical Auger Refusal @ 6.1m Cave-in Depth on Completion: None Groundwater Depth on Completion: Dry Measured Groundwater Level in Installed Standpipe Piezometer on: June 10, 2020: Dry June 17, 2020: Dry | | | | | | | | | | |
| 163.6 | 7 | | | | | | | | | | | |

# RECORD OF BOREHOLE 8W

**Project No.:** T20799 W **CLIENT:** Mattamy Development Corporation **ORIGINATED BY:** R.H.

**DATE:** June 2-3, 2020 **LOCATION:** Carding Mill Trail, Oakville, Ontario **COMPILED BY:** R.H.

**DATUM:** Geodetic **BOREHOLE TYPE:** Solid Stem **CHECKED BY:** H.S.

SHAD & ASSOCIATES INC.
83 Citation Dr, Unit 9,
Vaughan, Ontario, L4K 2Z6

| ELEVATION (metres) | DEPTH SCALE (metres) | DESCRIPTION | STRATA PLOT | SAMPLE NUMBER | TYPE | RECOVERY (cm) | "N" VALUES | GROUND WATER CONDITIONS | DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa 20 40 60 80 100 | WATER CONTENT (%) 5 15 25 35 | MONITORING WELL | REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 171.6 | | Ground Surface | | | | | | | | | | |
| | 0 | brown<br>**Silty Clay/Clayey Silt Fill**<br>trace gravels<br>damp | | 1 | SS | 36 | 13 | | | 11 | | |
| | 1 | trace rootlets<br>trace organic stains | | 2 | SS | 36 | 15 | | | 13 | | |
| 170.3 | | greyish brown<br>**Silty Clay/Clayey Silt Till**<br>some sand seams<br>some oxidized fissures<br>damp, hard | | 3 | SS | 46 | 27 | | | 11 | | |
| | 2 | grey | | 4 | SS | 46 | 42 | | | 10 | | |
| | 3 | brown, occ. reddish brown<br>some shale fragments | | 5 | SS | 46 | 36 | | | 10 | | |
| 168.0 | | reddish brown, occ. grey<br>**Highly Weathered** | | 6 | SS | 10 | 50/8cm | | | 3 | | |
| | 4 | | | 7 | SS | 5 | 50/5cm | | | 5 | | |
| | 5 | **Weathered Shale**<br>occ. limestone seams | | | | | | | | | | |
| 165.5 | 6 | | | 8 | SS | 5 | 50/5cm | | | 5 | | |
| | | **End of Borehole**<br><br>Practical Auger Refusal @ 6.1m<br>Cave-in Depth on Completion: None<br>Groundwater Depth on Completion: Dry<br><br>Measured Groundwater Level in Installed Standpipe Piezometer on:<br>June 10, 2020: Dry<br>June 17, 2020: Dry | | | | | | | | | | |
| 164.2 | 7 | | | | | | | | | | | |

SHAD & ASSOCIATES INC.

# EXPLANATION OF BOREHOLE LOG

This form describes some of the information provided on the borehole logs, which is based primarily on examination of the recovered samples, and the results of the field and laboratory tests. It should be noted that materials, boundaries and conditions have been established only at the borehole locations at the time of investigation and are not necessarily representative of subsurface conditions elsewhere across the site. Additional description of the soil/rock encountered is given in the accompanying geotechnical report.

## GENERAL INFORMATION

Project details, borehole number, location coordinates and type of drilling equipment used are given at the top of the borehole log.

## SOIL LITHOLOGY

### *Elevation and depth*

This column gives the elevation and depth of inferred geologic layers. The elevation is referred to the datum shown in the Description column.

### *Lithology Plot*

This column presents a graphic depiction of the soil and rock stratigraphy encountered within the borehole.

### *Description*

This column gives a description of the soil stratums, based on visual and tactile examination of the samples augmented with field and laboratory test results. Each stratum is described according to the following classification and terminology (Ref. Unified Soil Classification System):

The compactness condition of cohesionless soils (SPT) and the consistency of cohesive soils (undrained shear strength) are defined as follows (Ref. Canadian Foundation Engineering Manual):

| Compactness of Cohesionless Soils | SPT N-Value |
|---|---|
| Very loose | 0 to 4 |
| Loose | 4 to 10 |
| Compact | 10 to 30 |
| Dense | 30 to 50 |
| Very Dense | > 50 |
| | |

| Consistency of Cohesive Soils | SPT N-Value | Undrained Shear Strength kPa | Undrained Shear Strength psf |
|---|---|---|---|
| Very soft | 0 to 2 | 0 to 12 | 0 to 250 |
| Soft | 2 to 4 | 12 to 25 | 250 to 500 |
| Firm | 4 to 8 | 25 to 50 | 500 to 1000 |
| Stiff | 8 to 15 | 50 to 100 | 1000 to 2000 |
| Very stiff | 15 to 30 | 100 to 200 | 2000 to 4000 |
| Hard | > 30 | Over 200 | Over 4000 |

### *Soil Sampling*

Sample types are abbreviated as follows:

| | | | | | |
|---|---|---|---|---|---|
| SS | Split Spoon | TW | Thin Wall Open (Pushed) | RC | Rock Core |
| AS | Auger Sample | TP | Thin Wall Piston (Pushed) | WS | Washed Sample |

Additional information provided in this section includes sample numbering, sample recovery and numerical testing results.

### *Field and Laboratory Testing*

Results of field testing (e.g., SPT, pocket penetrometer, and vane testing) and laboratory testing (e.g., natural moisture content, and limits) executed on the recovered samples are plotted in this section.

### *Instrumentation Installation*

Instrumentation installations (monitoring wells, piezometers, inclinometers, etc.) are plotted in this section. Water levels, if measured during fieldwork, are also plotted. These water levels may or may not be representative of the static groundwater level depending on the nature of soil stratum where the piezometer tips are located, the time elapsed from installation to reading and other applicable factors.

### *Comments*

This column is used to describe non-standard situations or notes of interest.

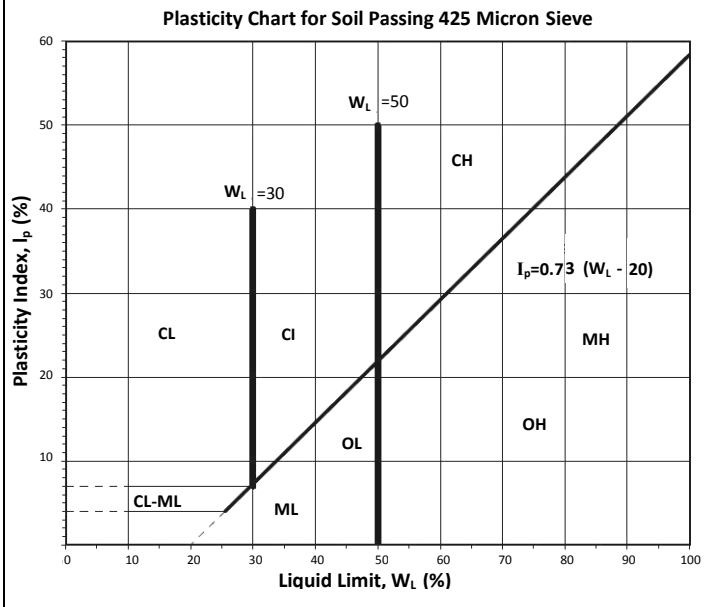
SHAD & ASSOCIATES INC.

MODIFIED * UNIFIED CLASSIFICATION SYSTEM FOR SOILS

*The soil of each stratum is described using the Unified Soil Classification System (Technical Memorandum 36-357 prepared by Waterways Experiment Station, Vicksburg, Mississippi, Corps of Engineers, U.S Army. Vol. 1 March 1953.) modified slightly so that an inorganic clay of "medium plasticity" is recognized.

| MAJOR DIVISION | | | GROUP SYMBOL | TYPICAL DESCRIPTION | LABORATORY CLASSIFICATION CRITERIA |
|---|---|---|---|---|---|
| COARSE GRAINED SOILS (MORE THAN HALF BY WEIGHT LARGER THAN 75µm) | GRAVELS MORE THAN HALF THE COARSE FRACTION LARGER THAN 4.75mm | CLEAN GRAVELS (TRACE OR NO FINES) | GW | WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES | $C_u = \frac{D_{60}}{D_{10}} > 4;\ C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1 \text{ to } 3$ |
| | | | GP | POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES | NOT MEETING ABOVE REQUIREMENTS |
| | | DIRTYGRAVELS (WITH SOME OR MORE FINES) | GM | SILTY GRAVELS, GRAVEL-SAND- SILT MIXTURES | ATTERBERG LIMITS BELOW "A" LINE OR P.I. MORE THAN 4 |
| | | | GC | CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES | ATTERBERG LIMITS BELOW "A" LINE OR P.I. MORE THAN 7 |
| | SANDS MORE THAN HALF THE COARSE FRACTION SMALLER THAN 4.75mm | CLEAN SANDS (TRACE OR NO FINES) | SW | WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES | $C_u = \frac{D_{60}}{D_{10}} > 6;\ C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1 \text{ to } 3$ |
| | | | SP | POORLY GRADED GRAVELS, GRAVEL- SAND MIXTURES, LITTLE OR NO FINES | NOT MEETING ABOVE REQUIREMENTS |
| | | DIRTY SANDS (WITH SOME OR MORE FINES) | SM | SILTY SANDS, SAND-SILT MIXTURES | ATTERBERG LIMITS BELOW "A" LINE OR P.I MORE THAN 4 |
| | | | SC | CLAYEY SANDS, SAND-CLAY MIXTURES | ATTERBERG LIMITS BELOW "A" LINE OR P.I MORE THAN 7 |
| FINE-GRAINED SOILS (MORE THAN HALF BY WEIGHT SMALLER THAN 75µm) | SILTS BELOW "A" LINE NEGLIGIBLE ORGANIC CONTENT | $W_L$ < 50% | ML | INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY SANDS OF SLIGHT PLASTICITY | CLASSIFICATION IS BASED UPON PLASTICITY CHART (SEE BELOW) |
| | | $W_L$ < 50% | MH | INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS, FINE SANDY OR SILTY SOILS | |
| | CLAY ABOVE "A" LINE NEGLIGIBLE ORGANIC CONTENT | $W_L$ < 30% | CL | INORGANIC CLAYS OF LOW PLASTICITY, GRAVELLY, SANDY OR SILTY CLAYS, LEAN CLAYS | |
| | | 30% < $W_L$ < 50% | CI | INORGANIC CLAYS OF MEDIUM PLASTICITY, SILTY CLAYS | |
| | | $W_L$ < 50% | CH | INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS | |
| | ORGANIC SILTS & CLAYS BELOW "A" LINE | $W_L$ < 50% | OL | ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY | WHENEVER THE NATURE OF THE FINES CONTENT HAS NOT BEEN DETERMINED, IT IS DESIGNATED BY THE LETTER "F", E.G SF IS A MIXTURE OF SAND WITH SILT OR CLAY |
| | | $W_L$ < 50% | OH | ORGANIC CLAYS OF HIGH PLASTICITY | |
| HIGH ORGANIC SOILS | | | Pt | PEAT AND OTHER HIGHLY ORGANIC SOILS | STRONG COLOUR OR ODOUR, AND OFTEN FIBROUS TEXTURE |

| SOIL COMPONENTS | | | | | |
|---|---|---|---|---|---|
| FRACTION | U.S STANDARD SIEVE SIZE | | DEFINING RANGES OF PERCENTAGE BY WEIGHT OF MINOR COMPONENTS | | |
| GRAVEL | COARSE | PASSING | RETAINED | PERCENT | DESCRIPTOR |
| | | 76 mm | 19 mm | 35-50 | AND |
| | | | | 20-35 | Y/EY |
| | FINE | 19 mm | 4.75 mm | 10-20 | SOME |
| | | | | 1-10 | TRACE |
| SAND | COARSE | 4.75 mm | 2.00 mm | | |
| | MEDIUM | 2.00 mm | 425 µm | | |
| | FINE | 425 µm | 75 µm | | |
| FINES (SILT OR CLAY BASED ON PLASTICITY) | | 75 µm | | | |
| OVERSIZED MATERIAL | | | | | |
| ROUNDED OR SUBROUNDED: COBBLES 76 mm TO 200 mm BOULDERS > 200 mm | | | | NOT ROUNDED: ROCK FRAGMENTS > 76 mm ROCKS> 0.76 CUBIC METRE IN VOLUME | |




Note 1: Soils are classified and described according to their engineering properties and behavior.

Note 2: The modifying adjectives used to define the actual or estimated percentage range by weight of minor components are consistent with the Canadian Foundation Engineering Manual ( 3rd Edition, Canadian Geotechnical Society, 1992)