January 3, 2020
Ref. No.: T19782

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

Attention: Mr. Ben Pattenick

Dear Sir:

RE: **SUPPLEMENTAL GEOTECHNICAL INVESTIGATION REPORT**
SGGC PROPERTY
BURNHAMTHORPE ROAD WEST, WEST OF SIXTH LINE
OAKVILLE, ONTARIO

Please find enclosed our supplemental Geotechnical Investigation Report prepared for the above-mentioned project. We will be glad to discuss any questions arising from this work.

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

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SUPPLEMENTAL GEOTECHNICAL INVESTIGATION REPORT
SGGC PROPERTY
BURNHAMTHORPE ROAD WEST, WEST OF SIXTH LINE
OAKVILLE, ONTARIO

Submitted to:

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

Attention:

Mr. Ben Pattenick

Submitted by:

Shad & Associates Inc.
83 Citation Drive, Unit 9
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TABLE OF CONTENTS

EXPLANATION OF BOREHOLE LOGS

ENCLOSURES

Enclosure A: Laboratory Test Results (Gradation Analysis & Atterberg Limits)

APPENDICES

Appendix A: Record of Previous Boreholes
(AMEC Boreholes 306, 307, 309, 310 and 312 to 315)

1.0 INTRODUCTION

Shad & Associates Inc. was retained by Mattamy Homes and Hulme Developments Limited (Client) to carry out a supplementary geotechnical investigation at a site known as the SGGC property located on the north side of Burnhamthorpe Road West, west of Sixth Line, in Oakville, Ontario, as shown in Figure 1. As requested by the Client, for this supplemental investigation, the emphasis is placed on the southern part of the property where a stormwater management pond and some residential lots are proposed.

We wish to mention that a preliminary geotechnical investigation was carried out at the site by AMEC Earth & Environmental Limited in 2006, covering the entire SGGC property ('AMEC', Report Ref. No. TT5309406, dated April 6, 2006). During this preliminary investigation, altogether fifteen boreholes were drilled at the site and they were extended down to depths ranging from approximately 5.0 to 6.6 m below the existing ground surface. Boreholes 306, 307, 309, 310 and 312 to 315 of the AMEC investigation appear to be within the area under our current study. The location on these boreholes are shown in Figure 2 and the record of boreholes are provided in Appendix A.

The purpose of this supplemental geotechnical investigation was to obtain some additional information about the existing subsurface conditions on the southern part of the property by means of a number of boreholes. Based on our interpretation of the data obtained, some preliminary recommendations are provided on the geotechnical aspects of design for the proposed stormwater management pond as well as the residential dwellings and site servicing.

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 during the period of December 9 to 13, 2019 and consisted of drilling and sampling seven boreholes (BH 401 to 407), extending down to depths ranging from approximately 5.0 to 13.2 m below the existing ground surface. The boreholes were numbered in 400-series in order to distinguish them from the previous investigation carried out at the site by others. The borehole locations were staked-out and surveyed by Rady-Pentak & Edward Surveying Ltd., O.L.S., who also provided us with their geodetic ground surface elevations. The borehole locations are shown in Figure 2.

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 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, Gradation Analysis (Sieve and Hydrometer) and Atterberg Limits (Liquid and Plastic Limits) were performed on representative soil samples. The results of the in-situ and laboratory tests are presented on the corresponding Record of Borehole Sheets. The Gradation Analysis curves are shown in Enclosure A.

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, generally below the surficial topsoil and/or fill, the site is predominantly underlain by a clayey silt till deposit with trace sand seams. This was then underlain by a silty sand till layer at most of the deeper boreholes.

The stratigraphic units and groundwater conditions are summarized below. For more detailed information, reference should be made to the Record of Borehole Sheets.

3.1 Topsoil and Fill

Due to the agricultural use of the lands, the ground surface was generally underlain by topsoil and/or ploughed fill, that generally extended down to depths ranging from about 0.5 to 0.9 m below existing grade. However, at the location of Boreholes 401 and 403, the fill was noted to extend deeper, to approximately 1.7 m below existing grade. Furthermore, as Borehole 406 was located close to a staging area for an onsite temporary trailer, some granular fill, silty sand fill and asphalt were noted to have been placed over the clayey silt fill. We wish to mention that the ground surface was frozen at the time of our fieldwork.

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 as well as the limited diameter of the auger hole and the time of drilling, it is recommended that allowance be made for possible variations when making construction estimates.

3.2 Clayey Silt Till

Clayey silt till is the predominant deposit at the site and was encountered at all borehole locations, extending from below the surficial fill down to depths ranging from approximately 9.8 to 11.4 m at Boreholes 401 to 403 and to the completion of all remaining boreholes. Trace to some oxidized

fissures, trace sand seams/zones and occasional shale fragments were generally noted within the cohesive till deposit.

Standard Penetration Tests were performed at the site and the recorded 'N'-values within the clayey silt till were found to predominantly range from 15 to more than 30 blows/0.3 m penetration with a lower value of 14 blows/0.3 m measured at Borehole 401. Considering these results, the clayey silt till is generally very stiff to hard. Selected samples from this layer were also tested for natural moisture content and the results were found to range from 7 to 15%. Considering these results as well as visual and tactile examination of the recovered soil samples, the clayey silt till is generally damp or damp to moist with occasional moist sand seams/zones.

Selected samples from the clayey silt till were tested for Gradation Analysis (Sieve Analysis and Hydrometer) as well as Atterberg Limits (Liquid and Plastic Limits). The results are summarized below and they are presented on Record of Boreholes and in Enclosure A.

	BH401:S4	**BH401:S9**	**BH402:S4**	**BH403:S6**
Gravel	4%	4%	3%	6%
Sand	20%	23%	24%	21%
Silt	47%	45%	48%	47%
Clay	29%	28%	25%	26%
Liquid Limit	30%	31%	33%	32%
Plastic Limit	19%	19%	21%	19%
Plasticity Index	11%	12%	12%	13%

Considering the above results, the clayey deposit has low plasticity.

It should be noted that due to the nature of their formation, cobbles and boulders should be expected to occur within the glacial deposits.

3.3 Silty Sand Till

Silty Sand till was contacted at lower elevations at Boreholes 401 to 403, underlying the clayey silt till, and it extended down to their completion. Some sand interbedding was also noted within this deposit at Borehole 401.

The recorded 'N'-values within the silty sand till were all well in excess of 50 blows/0.3 m penetration, indicating a very dense relative density. Samples from this deposit were also tested for natural moisture content determination and the results were found to range from 7 to 12%. Considering these results as well as the visual and tactile examination of the recovered soil samples, the silty sand till was predominantly damp to moist with occasional moist sand interbeddings.

As mentioned previously, the occurrence of cobbles and boulders should always be expected when working in glacial till deposits.

3.4 Groundwater Conditions

Groundwater conditions were monitored during and upon the completion of drilling as well as by installing standpipe piezometers in all seven boreholes. The results are summarized below:

Table 1: Measured Groundwater Data

Borehole	Existing Ground Surface Elevation (m)	Measured Groundwater Depth / Elevation (m)		
		Upon Borehole Completion	Dec. 23, 2019	Jan.2, 2020
401	188.6	11.0 / 177.6	2.6 / 186.0	2.5 /186.1
402	189.3	Dry	3.5 / 185.8	3.5 / 185.8
403	~186.8	Dry	3.0 / 183.8	3.0 / 183.8
404	188.5	Dry	3.1 / 185.4	3.2 / 185.3
405	184.0	Dry	1.2 / 182.8	1.2 / 182.8
406	~185.3	5.3 / 185.7	1.4 / 183.9	1.3 / 184.0
407	183.3	6.4 / 182.8	3.4 / 179.9	3.4 / 179.9

*The groundwater within the wells were not frozen at the time of monitoring.

The groundwater level measured at parts of the site was noted to be high. However, considering the visual and tactile examination of auger cuttings and the recovered soil samples as well as the moisture content tests performed on representative samples, this is believed to be due to the presence of oxidized fissures and sand seams/zones within the glacial till deposits that are possibly under minor hydrostatic pressure.

It should be pointed out that the groundwater at the site would fluctuate seasonally and can be expected to be somewhat higher during the spring months and in response to major weather events. Furthermore, perched water conditions may also exist within the fill overlying the practically impermeable clayey silt till.

4.0 DISCUSSION AND RECOMMENDATIONS

Based on the preliminary information provided to us, we understand that the area under our current supplemental study may be developed for a stormwater management pond and some residential dwellings with paved roads and underground services. However, the exact project details were not known at the time of preparation of this report.

Based on the subsurface conditions encountered at the boreholes drilled on the site, generally below some surficial topsoil and fill, the site is predominantly underlain by very stiff to hard clayey silt till, which is quite similar to the subsurface conditions that were previously encountered by AMEC. However, at the deeper boreholes, some very dense silty sand till was also contacted at lower elevations. The groundwater conditions at the site was monitored during drilling and by installing standpipe piezometers at all boreholes and the highest groundwater levels were measured at 1.2 to 3.5 m below existing ground surface. The relatively high water levels measured at some of the boreholes is believed to be due to the presence of oxidized fissures and sand seams/zones within the glacial till deposit that appear to be under some confined hydrostatic pressure.

Considering the above details, some preliminary discussion and recommendations are provided in the following sections. However, these would need to be reviewed and confirmed once the development details are known.

4.1 Site Grading

The development of the site will require clearing and stripping of all topsoil and organic rich fill. Since all areas could be developed as either residential lots or road/driveways, it is recommended that all fill be placed as engineered fill to provide competent subgrade. Prior to placement of engineered fill, all the surficial topsoil and any fill containing excessive organic matters should be stripped from planned fill areas to expose the inorganic 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. Reference is made to Section 4.5 for recommendations regarding engineered fill placement.

Provided the above recommendations are followed, and all topsoil and compressible materials are stripped or sub-excavated, the existing deposits are not considered to be highly compressible and long-term settlements should be minimal.

4.2 Stormwater Management Pond

According to the preliminary information provided to us, we understand that a stormwater management pond is proposed to be constructed on north part of the supplemental study area. However, the design details were not available for our review at the time of preparation of this report.

Based on the subsurface conditions encountered at Boreholes 401 to 404 drilled on the north part of the site, below the surficial topsoil and/or fill, the site is predominantly underlain by a very stiff to hard clayey silt till with occasional sand seams/zones, extending down to elevations ranging from approximately 177.0 to 177.9 m at Boreholes 401 to 403, respectively, and to below Elevation 178.1 at BH 404. At Boreholes 401 to 403, the clayey silt till was then underlain by very dense silty sand till. Furthermore, based on the short-term monitoring of the standpipe piezometers installed in Boreholes 401 to 404, the highest groundwater levels were measured at Elevations 183.8 to 186.1 m.

During excavation of the pond, any groundwater seepage from the clayey silt till should be minor and manageable with gravity drainage and pumping from filtered sumps, if required. However, increased seepage should be expected from the sand seams/zones and also if the excavation is extended down into the silty sand till, that may require increased number of sump pumps. We would recommend the groundwater conditions to be further assessed by test pitting to ensure that the most suitable dewatering scheme is selected.

We recommend that once the pond design is available, we should be given the opportunity to review and carry out slope stability of the pond walls under various ponding conditions. We would also assess the need for a liner and also the needs for any subdrains to protect the liner against hydraulic fracturing.

4.3 Foundations

Based on the subsurface conditions encountered at the borehole locations, the footings would need to be extended to below the fill layer and into the competent native till deposits. The recommended spread footing depths and allowable soil bearing pressures are given in the following Table 2.

Table 2: Recommended Soil Bearing Capacity Values

Borehole	Depth Below Existing Grade (m)	Recommended Geotechnical Reaction at SLS (kPa)	Factored Geotechnical Resistance at ULS (with a Geotechnical Resistance Factor of 0.5), (kPa)
BH 403	± 1.7	150	225
BH 404	± 0.9	150	225
BH 405	± 0.9	150	225
BH 406	± 1.1	150	225
BH 407	± 0.9	150	225

*Higher Allowable Soil Bearing Capacity values are available at some lower elevations at most boreholes, if required.

The minimum footing sizes, footing thickness, excavations and other footing requirements should be designed in accordance to the latest edition of the Ontario Building Code.

The footing subgrade should be inspected and evaluated by the Geotechnical Engineer prior to concreting to ensure that the footings are founded on competent subgrade capable of supporting the recommended design pressure.

Design frost penetration depth 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. 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 footings designed and constructed in accordance with the above criteria, total and differential settlements should be less than 25 mm and 15 mm, respectively. These values are usually within tolerable limits for most types of structures.

4.4 Earthquake Considerations

In conformance to the Criteria in Table 4.1.8.4.A of the Ontario Building Code (OBC 2012), for footings designed as recommended in Section 4.3, the subject site is classified as Site Class

"D-Stiff Soil".

4.5 Engineered Fill

Based on the site grades, engineered fill may be required to replace the topsoil and organic rich ploughed fill as well as to raise the site grades for the support of footings and/or floor slabs. Engineered fill could be placed after stripping all topsoil, any soils containing excessive organics and otherwise unsuitable soils, within an area extending at least 2.5 m beyond the perimeter of the footprint of the proposed structures. Engineered fill would then be suitable to support the foundations including the house slabs provided that the following criteria are strictly followed. Engineered fill may also be carried out to raise the existing grades below proposed roads.

The following placement procedure is recommended.

(i) The areal extent of engineered fill should be controlled by proper surveying techniques to ensure that the top of the engineered fill extends a minimum of 2.5 m beyond the perimeter of the buildings to be supported. Where the depth of engineered fill exceeds 1.5 m, this horizontal distance of 2.5 m beyond the perimeter of the building should be increased by at least 1.0 m for each 1.0 m depth of fill.

(ii) 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.

(iii) 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.

(iv) The on-site inorganic soils are generally acceptable for use as engineered fill, provided they are not contaminated with the overlying 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.

(v) 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.

(vi) 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.

The allowable soil bearing pressure is 150 kPa for footings supported by at least 1.0 m of engineered fill constructed in accordance with the above recommendations. We also recommend that the footing subgrade be evaluated by the geotechnical engineer prior to placing the formwork.

It is recommended to increase the rigidity of foundations of structures erected over engineered fill, and this is generally achieved by making the footings at least 0.5 m wide and adding nominal reinforcing to the footings. This measure helps to bridge over eventual weak spots in the fill. The need for rebar should be assessed on site.

All footings should have at least 1.2 m of earth cover or equivalent artificial insulation for frost protection.

For footings designed and constructed in accordance with the above criteria, total and differential settlements should be less than 25 mm and 15 mm, respectively. These values are usually within tolerable limits.

4.6 Excavating and Dewatering

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:

-Granular Fill	Type 4
-Topsoil / Clayey Fill	Type 3
-Stiff Clayey Silt Till	Type 3
-Very Stiff to Hard Clayey Silt Till, Very Dense Silty Sand Till (above groundwater level)	Type 2

Accordingly, a side slope of 1H:1V is required for excavations in accordance with the Ontario Health and Safety Regulations. However, in Type 2 soils, the bottom 1.2 m of excavations could be kept near vertical. Near the surface within the granular fill and below the groundwater level in silty sand till, flatter side slopes may be required.

Stockpiles of excavated materials should be kept at least 3.0 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.

Assuming the proposed dwellings to consist of the conventional two-storey structures with one level of basement, the excavations for the house basements should be within about 2.5 m of the existing ground surface. Considering this, no major dewatering problems are anticipated, although some dewatering may have to be carried out for excavations due to surface runoff or from any perched water within the fill layer or groundwater seepage from sand seams/zones within the native deposits. We are of the opinion that these should be minor and manageable by pumping from temporary sumps protected against erosion, if required. Such sumps should be dug outside the footprint of the building to minimize disturbance to the footing grade.

No major excavation difficulties are foreseen but allowance should be made for boulders and cobbles which occur randomly in glacial deposits.

4.7 Basement Slab Construction

Concrete basement floor slab may be built on properly prepared subgrade or engineered fill. If the existing topsoil and fill are left underneath the basement slab, long-term settlement and/or cracks may occur. The existing fill materials should be removed and replaced with compacted engineered fill in order to support the basement floor slab. For engineered fill subgrade, Section 4.5 should be followed.

Underneath the slabs, a 150 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).

4.8 Backfill, Perimeter Drainage and Basement Floor Drainage

The basement walls of the buildings should be backfilled with granular material placed in 125 mm thick loose lifts that can be compacted with light equipment to avoid damaging the basement walls. Heavy compaction equipment should not be operated along basement walls, especially when the walls are unsupported at their top. The backfill should not be over-compacted to avoid damage to basement walls. Due to its high permeability, the granular material will permit quick drainage of water to perimeter drains, but in order to reduce the quantity of water percolating into the backfill, the uppermost 0.5 m of the backfill should consist of clayey soils.

Due to their rigidity and unyielding character, basement walls should be designed for the at-rest earth pressure condition calculated in accordance with the Canadian Foundation Engineering Manual, 4^{th} Edition. The following parameters may be adopted:

Coefficient of lateral earth pressure = 0.45

Bulk unit weight of retained soils = 21 kN/m^3

We recommend that for basements, a permanent drainage system consisting of weeping tiles, damp-proofing and an underfloor granular drainage layer as indicated in Section 4.6 be installed. Weeping tiles should be installed along the perimeters of the building to prevent accumulation of water in the backfill and possible dampness of floor slabs. The weeping tile system should be installed to provide a positive discharge to a non-frost susceptible sump or outlet. The weeping tiles should be surrounded by a designed graded granular filter or wrapped with an approved geotextile to prevent migration of fines into the system.

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.

4.9 Sewers and Watermain

The following discussion is based on the assumption that the sewers will be placed within 4 m of the existing ground surface.

4.9.1 Trenching

Trench excavations should be carried out as per the Safety Regulations of the Province of Ontario. The boreholes show that below the existing fill, the sewer trenches will be predominantly excavated within clayey silt till. These deposits are classified in Section 4.6 in accordance with the Ontario Health and Safety Regulations. Within this soil, the side slopes of excavations are expected to be temporarily stable at 1H:1V, although within the very stiff to hard clayey silt till, the bottom 1.2 m of the trench walls could be excavated close to vertical. Flatter slopes may be required in surficial layers. Trench boxes or equivalent may be used to limit the extent of the excavation, if required.

Groundwater seepage within the clayey silt till should be minor and manageable by gravity drainage and pumping from filtered sumps. However, increased seepage may occur from the perched water within the fill or surface water flow as well as from any sand seams/zones within the till deposit that may require increased number of sump pumps. Increased effort will also be required if the trench excavations are extended deeper into the moist silty sand till. We recommend that once the pipe inverts are known, the groundwater conditions at the site to be further assessed by test pitting in the presence of a dewatering consultant/contractor to ensure that the most suitable dewatering methodology is selected. In no case should the pipes be placed on dilated or disturbed subsoil.

Attention is called to the possible presence of cobbles and/or boulders that may be encountered during the excavation in the glacial till deposits.

Normal excavation equipment will be suitable for making trenches within soils in which the proposed underground services will be installed. The terms describing the consistency (stiff, very stiff, hard) and relative density (very dense) of soil strata give an indication of the effort needed for excavation.

4.9.2 Bedding

The boreholes show that the sewer pipes will be predominantly laid within a very stiff to hard clayey silt till or engineered fill which are considered to be suitable to support the pipes. The recommended minimum thickness of granular bedding for normal Class 'B' Type of bedding (i.e., compacted granular bedding material – OPSD-802) below the invert is 150 mm. The thickness of the bedding may, however, have to be increased depending on the pipe diameter or if wet or weak subgrade conditions are encountered.

4.9.3 Backfill

Based on the visual and tactile examination of the soil samples, the inorganic on-site excavated soils could be re-used as backfill in service trenches. The moisture contents at the time of construction should be at or near optimum. The clayey soils will likely be excavated in cohesive chunks and blocks and will be difficult to handle and compact. For use as backfill, the soils will

have to be reduced to be smaller than 100 mm in size and placed in thin layers. The clayey soils will have to be compacted using heavy equipment suitable for these soils that may be difficult to operate in the narrow confines of the trenches. Unless the clayey materials are properly reduced in sizes, all organics and debris removed and compacted in sufficiently thin lifts, post-construction settlements could occur. The backfill should be placed in maximum 200 mm thick layers at or near (±2%) their optimum moisture content, and each layer should be compacted to at least 95% Standard Proctor Maximum Dry Density. This value should be increased to at least 98% within 1.0 m of the road subgrade surface.

The excavated clayey soils may require reconditioning (e.g., wetting or drying) prior to reuse. The on-site excavated soils should not be used in confined areas (e.g., around catch-basins and laterals under roadways) where heavy compaction equipment cannot be operated. The use of good backfill together with an appropriate frost taper would be preferable in confined areas. Unsuitable materials such as organic soils, boulders, cobbles, frozen soils, etc., should not be used for backfilling.

We recommend that frost tapers be provided at backfilled trenches to ensure gradual transition from the frost-free materials to the frost susceptible natural soil, otherwise differential frost heaving may occur. Frost taper would not be necessary if the backfill material can be matched within the frost zone (i.e. within about 1.2 m depth below the pavement surface) with subgrade-type material.

4.10 Pavement Thickness

4.10.1 Pavement Structure

The clayey silt till or properly placed engineered fill may be used as subgrade. Using good engineering and construction practice, the following minimum pavement structure may be used as per the Town of Oakville standards:

Table 3: Recommended Minimum Pavement Structure

PAVEMENT STRUCTURE	COMPACTION	LOCAL ROADS & LANEWAYS (mm)
HL-3 Asphaltic Concrete HL-8 Asphaltic Concrete	97 % Marshall Density	40 50
Granular 'A' Base	100 %	150
Granular 'B' Sub-base	100 %	350

NOTE: HL-3 and HL-8 asphaltic concrete to conform to OPSS 1150 & 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 (Terrafix 270R or approved equal) 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.

4.10.2 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. 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 95% Standard Proctor Maximum Dry Density, before placing the next lift.

The uppermost zones of the roadfill, within 600 mm of the roadbed, should be compacted to minimum 98% Standard Proctor Maximum Dry Density. If construction of the roadfill is carried out in wet weather, the thickness of the sub-base course should be increased.

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.

5.0 CLOSURE

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

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

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.

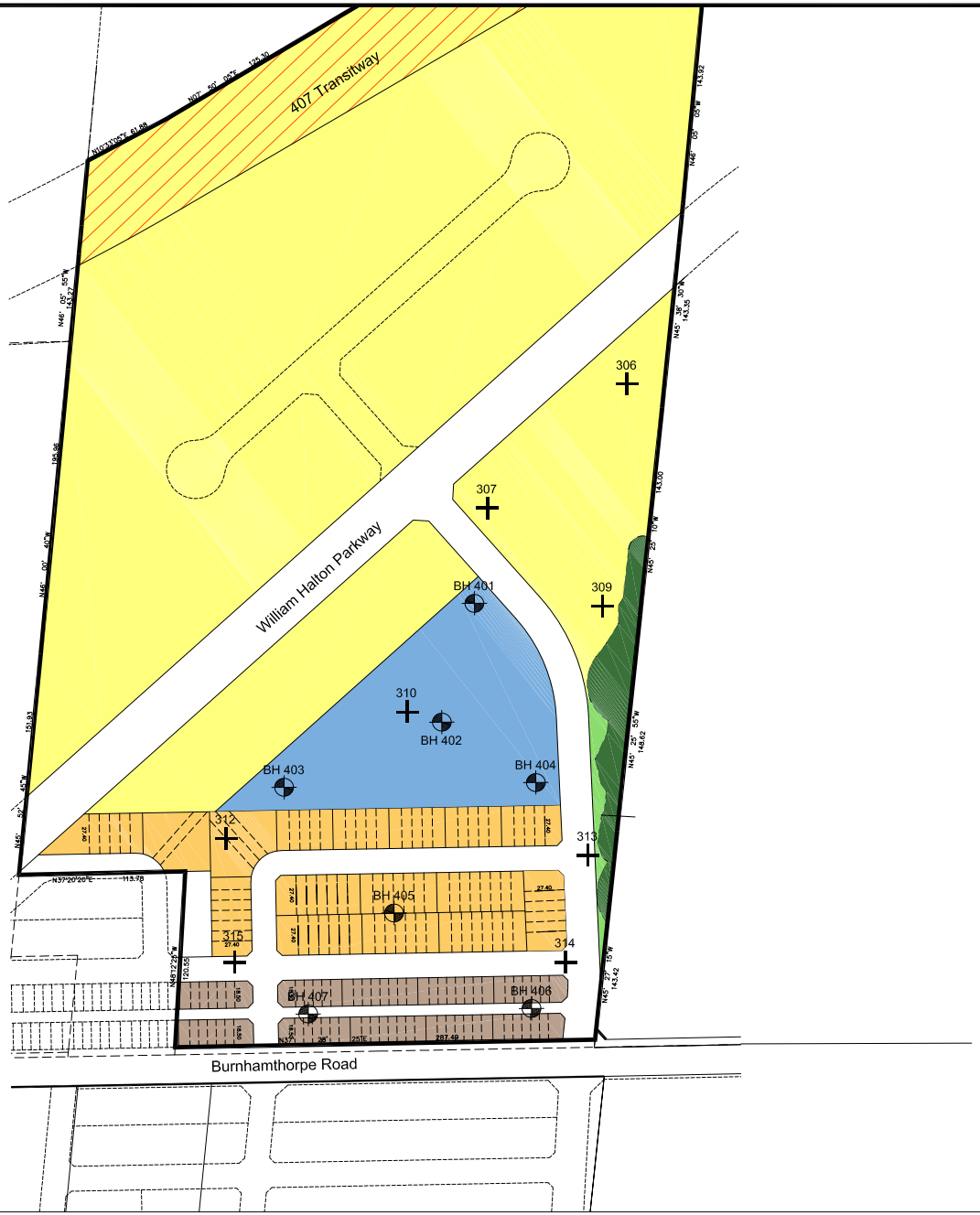
The comments given in this report on potential construction problems and possible methods are intended only for the guidance of the designer. The number of the testholes may not be sufficient to determine all the factors that may affect construction methods and costs. The contractors bidding on this 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:** N.S.	**TITLE:** **SITE LOCATION PLAN**	Date: January 2020
	Checked By: H.S.		Project No.: **T19782**
SHAD & ASSOCIATES INC. GEOTECHNICAL, ENVIRONMENTAL AND MATERIALS CONSULTING ENGINEERS 83 Citation Drive, Unit 9 Vaughan, Ontarulo, L4K 2Z6 Tel: (905) 760-5566 Fax: (905) 760-5567 www.shadinc.ca	**Datum:** -	**PROJECT:** **Geotechnical Investigation** SGGC Property Burnhamthorpe Road West, West of Sixth Line Oakville, Ontario	Figure No.: **1**
SHAD & ASSOCIATES INC.	**Projection:** -		
	Scale: N.T.S.		



LEGEND:

BH 101 — Borehole Location

306 — Previous Boreholes By Others

NOTE:

1- All borehole locations are approximate.
2- Base plan was provided by the Client.
3- The drawing should be read in conjunction with the associated report by Shad & Associates Inc. T19782

CLIENT: Mattamy Development Corporation

TITLE: BOREHOLE LOCATION PLAN

PROJECT: Geotechnical Investigation
SGGC Property
Burnhamthorpe Road West, West of Sixth Line
Oakville, Ontario

Drawn By: R.H.
Checked By: H.S.
Datum: -
Projection: -
Scale: N.T.S.

Date: January, 2020
Project No.: T19782
Figure No.: 2

SHAD & ASSOCIATES INC.
GEOTECHNICAL, ENVIRONMENTAL AND MATERIALS CONSULTING ENGINEERS
83 Citation Drive, Unit 9
Vaughan, Ontario, L4K 2Z6
Tel: (905) 760-5566
Fax: (905) 760-5567
www.shadinc.com

Record of Boreholes

RECORD OF BOREHOLE 401

Project No.: T19782 **CLIENT:** Mattamy Homes - Hulme Dev. Ltd. **ORIGINATED BY:** N.S.

DATE: December 9-13, 2019 **LOCATION:** Burnhamthorpe Road, Oakville **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
188.6		Ground Surface										
	0	brown **Clayey Silt Fill** some topsoil some rootlets, trace organic stains moist		1	SS	30	8			23		Ground surface was frozen at the time of the fieldwork
187.9												
	1	brown **Silty Sand Fill** trace to some clay, moist		2	SS	36	13			16		
186.9				3	SS	30	34			13 12		
	2	reddish brown **Clayey Silt Till** trace shale fragments, trace sand seams some oxidized fissures damp, hard										
		brown		4	SS	36	50			12		Gradation Analysis & Atterberg Limits, S(4): 4 20 47 29 LL: 30 % PL: 19 % PI: 11 %
	3	reddish grey damp to moist very stiff		5	SS	25	21			10		
	4											
		grey damp to moist, stiff		6	SS	20	14			11		
	5											
		very stiff		7	SS	30	19			11		
	6											
				8	SS	41	19			12		
	7											

RECORD OF BOREHOLE 401

Project No.: T19782 **CLIENT:** Mattamy Homes - Hulme Dev. Ltd. **ORIGINATED BY:** N.S.

DATE: December 9-13, 2019 **LOCATION:** Burnhamthorpe Road, Oakville **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
	8											
	9	damp, hard		9	SS	30	16			12		Gradation Analysis & Atterberg Limits, S(9): 4 23 45 28 LL: 31 % PL: 19 % PI: 12 %
				10	SS	20	35			11		
177.7	10			11	SS	36	92/25	▼ December 9, 2019		10 12		
	11	grey **Silty Sand TIll** occ. moist sand interbedding damp to moist, very dense		12	SS	10	50/13			11		
	12											
175.4	13			13	SS	15	50/8			11		
	14	**End of Borehole** Cave-In Depth on Completion: 12.8m Groundwater Depth on Completion: 11.0m Measured Groundwater Level in Installed Standpipe Piezometer on: Dec. 23, 2019: 2.6m Jan 2, 2020: 2.5m										
174.1												

RECORD OF BOREHOLE 402

Project No.: T19782 **CLIENT:** Mattamy Homes - Hulme Dev. Ltd. **ORIGINATED BY:** N.S.

DATE: December 9-13, 2019 **LOCATION:** Burnhamthorpe Road, Oakville **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
189.3		Ground Surface						
	0	reddish brown **Clayey Silt Fill** some rootlets, organic stains moist		1	SS	25	8	
188.6		stiff		2	SS	36	30	
	1	brown **Clayey Silt Till** some oxidized fissures damp, hard		3	SS	30	36	
	2	trace oxidized fissures occ. sand seams		4	SS	41	43	
	3			5	SS	36	42	
	4	brown, occ. grey trace sand seams		6	SS	46	31	
	5							
	6	grey damp to moist very stiff		7	SS	41	26	
	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

	WATER CONTENT (%)
1	25
2	12
3	13
4	12
5	12
6	12
7	11

MONITORING WELL

December 23, 2019
January 2, 2020

REMARKS AND

GRAIN SIZE DISTRIBUTION (%)

GR SA SI CL

Ground surface was frozen at the time of fieldwork.

Gradation Analysis & Atterberg Limits, S(4):
3 24 48 25
LL: 33 %
PL: 21 %
PI: 12 %

RECORD OF BOREHOLE 402

Project No.: T19782 | CLIENT: Mattamy Homes - Hulme Dev. Ltd. | ORIGINATED BY: N.S.

DATE: December 9-13, 2019 | LOCATION: Burnhamthorpe Road, Oakville | 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
	8			8	SS	46	24	
	9	grey, occ. reddish grey some sand zones damp		9	SS	36	27	
	10							
	11	reddish grey moist		10	SS	36	16	
177.9		grey **Silty Sand Till** moist, very dense		11	SS	15	50/8	
177.4	12	**End of Borehole**						
		Cave-In Depth on Completion: None Groundwater Depth on Completion: Dry Measured Groundwater Level in Installed Standpipe Piezometer on: Dec. 23, 2019: 3.5m Jan. 2, 2020: 3.5m						
	13							
	14							
174.8								

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH kPa
20 40 60 80 100

WATER CONTENT (%)
5 15 25 35

11
7
13
11

MONITORING WELL

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

RECORD OF BOREHOLE 403

Project No.: T19782 **CLIENT:** Mattamy Homes - Hulme Dev. Ltd. **ORIGINATED BY:** N.S.

DATE: December 9-13, 2019 **LOCATION:** Burnhamthorpe Road, Oakville **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
~ 186.8		Ground Surface						
	0	brown		1	SS	30	8	
	1	brown, occ. dark brown **Clayey Silt Fill** some topsoil interbeddings occ. rootlets, trace topsoil damp		2	SS	20	8	
185.1		very stiff		3	SS	46	27	
	2			4	SS	25	43	
	3	brown **Clayey Silt Till** occ. oxidized fissures damp, hard		5	SS	46	44	
	4							
	5	grey, occ. reddish grey damp to moist very stiff		6	SS	36	20	
	6			7	SS	36	25	
	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

13		
37		
39		
17		
13		
12		
12		
13		
11		

MONITORING WELL

December 23, 2019
January 2, 2020

REMARKS AND

GRAIN SIZE DISTRIBUTION (%)

GR SA SI CL

Borehole was drilled ~10m southeast of staked location due to ponding water.

Ground surface was frozen at the time of fieldwork.

Gradation Analysis & Atterberg Limits, S(6):
6 21 47 26
LL: 32 %
PL: 19 %
PI: 13 %

RECORD OF BOREHOLE 403

Project No.: T19782 **CLIENT:** Mattamy Homes - Hulme Dev. Ltd. **ORIGINATED BY:** N.S.

DATE: December 9-13, 2019 **LOCATION:** Burnhamthorpe Road, Oakville **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
	8			8	SS	41	26			11		
	9	grey grey, occ. reddish grey, hard		9	SS	41	41			11		
177.0												
176.8	10	grey **Silty Fine Sand Till** damp, very dense		10	SS	10	50/10			7		
		End of Borehole										
	11	Cave-In Depth on Completion: None Groundwater Depth on Completion: Dry Measured Groundwater Level in Installed Standpipe Piezometer on: Dec. 23, 2019: 3.0m Jan. 2, 2020: 3.0m										
	12											
	13											
	14											
172.3												

RECORD OF BOREHOLE 404

Project No.: T19782 CLIENT: Mattamy Homes - Hulme Dev. Ltd. ORIGINATED BY: N.S.

DATE: December 9-13, 2019 LOCATION: Burnhamthorpe Road, Oakville 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
188.5		Ground Surface						
188.0	0	**Topsoil**		1	SS	30	8	
187.8		mottled brown **Clayey Silt Fill** occ. rootlets, damp trace organic stains						
	1	reddish brown **Clayey Silt Till** some oxidized fissures damp, hard		2	SS	25	31	
				3	SS	36	38	
	2	trace oxidized fissures		4	SS	41	41	
	3	trace sand seams		5	SS	41	37	
	4	grey. occ. reddish grey damp to moist very stiff		6	SS	36	21	
	5							
	6	occ. sand seams		7	SS	36	19	
	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

WATER CONTENT (%): 21, 13, 12, 11, 12, 12, 12, 13

MONITORING WELL: December 23, 2019; January 2, 2020

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

Ground surface was frozen at the time of fieldwork.

RECORD OF BOREHOLE 404

Project No.: T19782 CLIENT: Mattamy Homes - Hulme Dev. Ltd. ORIGINATED BY: N.S.

DATE: December 9-13, 2019 LOCATION: Burnhamthorpe Road, Oakville 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
	8											
				8	SS	46	16			13		
	9	damp to moist		9	SS	41	19			12		
178.1	10			10	SS	30	20			14		
		End of Borehole Cave-In Depth on Completion: None Groundwater Depth on Completion: Dry Measured Groundwater Level in Installed Standpipe Piezometer on: Dec 23, 2019: 3.1m Jan. 2, 2020: 3.2m										
	11											
	12											
	13											
	14											
174.0												

RECORD OF BOREHOLE 405

Project No.: T19782 **CLIENT:** Mattamy Homes - Hulme Dev. Ltd. **ORIGINATED BY:** N.S.

DATE: December 9-13, 2019 **LOCATION:** Burnhamthorpe Road, Oakville **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
184.0		Ground Surface						
	0	**Topsoil**						
183.7		mottled brown **Clayey Silt Fill** some organic stains damp to moist		1	SS	36	6	
183.3		brown **Clayey Silt Till** some oxidized fissures damp to moist, hard		2	SS	30	33	
	1							
		brown, occ. grey		3	SS	25	43	
	2							
		brown, occ. reddish brown		4	SS	25	42	
	3							
				5	SS	36	39	
		grey damp to moist very stiff		6	SS	20	15	
	4							
		reddish grey		7	SS	46	17	
178.9	5	**End of Borehole** Cave-In Depth on Completion: None Groundwater Depth on Completion: Dry Measured Groundwater Level in Installed Standpipe Piezometer on: Dec 23, 2019: 1.2m Jan. 2, 2020: 1.2m						
	6							
	7							
176.6								

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH kPa
20 40 60 80 100

WATER CONTENT (%)
5 15 25 35

28
14
12
12
12
12
11
11

MONITORING WELL

December 23, 2019
January 2, 2020

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

Ground surface was frozen at the time of fieldwork.

RECORD OF BOREHOLE 406

Project No.: T19782 **CLIENT:** Mattamy Homes - Hulme Dev. Ltd. **ORIGINATED BY:** N.S.

DATE: December 9-13, 2019 **LOCATION:** Burnhamthorpe Road, Oakville **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
~ 185.3		Ground Surface						
185.1	0	**Granular Fill**						
		brown **Silty Sand Fill** some asphalt fragments		1	SS	46	34	
184.8								
184.7		**Asphalt**						
184.4		mottled brown **Clayey Silt Fill** some organic stains damp to moist		2	SS	30	18	
	1	reddish brown **Clayey Silt Till** some oxidized fissures damp, very stiff		3	SS	30	22	
	2			4	SS	25	34	
		brown, hard						
	3			5	SS	46	46	
	4			6	SS	25	46	
		greyish brown		7	SS	25	34	
180.3	5	**End of Borehole** Cave-In Depth on Completion: None Groundwater Depth on Completion: Dry Measured Groundwater Level in Installed Standpipe Piezometer on: Dec. 23, 2019: 1.4m Jan. 2, 2020: 1.3m						
	6							
	7							
178.0								

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 (%): 4, 8, 15, 15, 13, 12, 12, 10, 9

MONITORING WELL

REMARKS AND

GRAIN SIZE DISTRIBUTION (%)

GR SA SI CL

Borehole was drilled ~5m south of staked location due to the existing trailer.

Ground surface was frozen at the time of fieldwork.

RECORD OF BOREHOLE 407

Project No.: T19782 **CLIENT:** Mattamy Homes - Hulme Dev. Ltd. **ORIGINATED BY:** N.S.

DATE: December 9-13, 2019 **LOCATION:** Burnhamthorpe Road, Oakville **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
183.3		Ground Surface										
183.0	0	**Topsoil**										Ground surface was frozen at the time of fieldwork.
		mottled brown **Clayey Silt Fill** damp some organic stains		1	SS	30	7			28 23		
182.6		brown occ. reddish brown **Clayey Silt Till** some oxidized fissures damp, hard		2	SS	36	31			12		
	1			3	SS	30	40			12		
	2	trace oxidized fissures some shale fragments		4	SS	36	49			11		
	3	greyish brown		5	SS	41	59			11		
	4	grey		6	SS	25	42			10		
178.3		grey, occ. reddish grey very stiff		7	SS	36	28			11		
	5	**End of Borehole** Cave-In Depth on Completion: None Groundwater Depth on Completion: Dry Measured Groundwater Level in Installed Standpipe Piezometer on: Dec. 23, 2019: 3.4m Jan. 2, 2020: 3.4m									December 23, 2019 January 2, 2020	
	6											
	7											
176.0												

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.

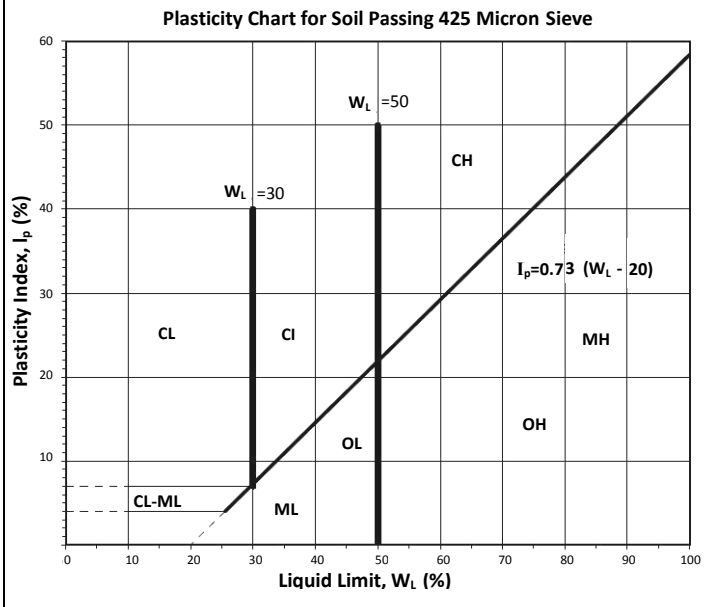
SHAD & ASSOCIATES INC.

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.

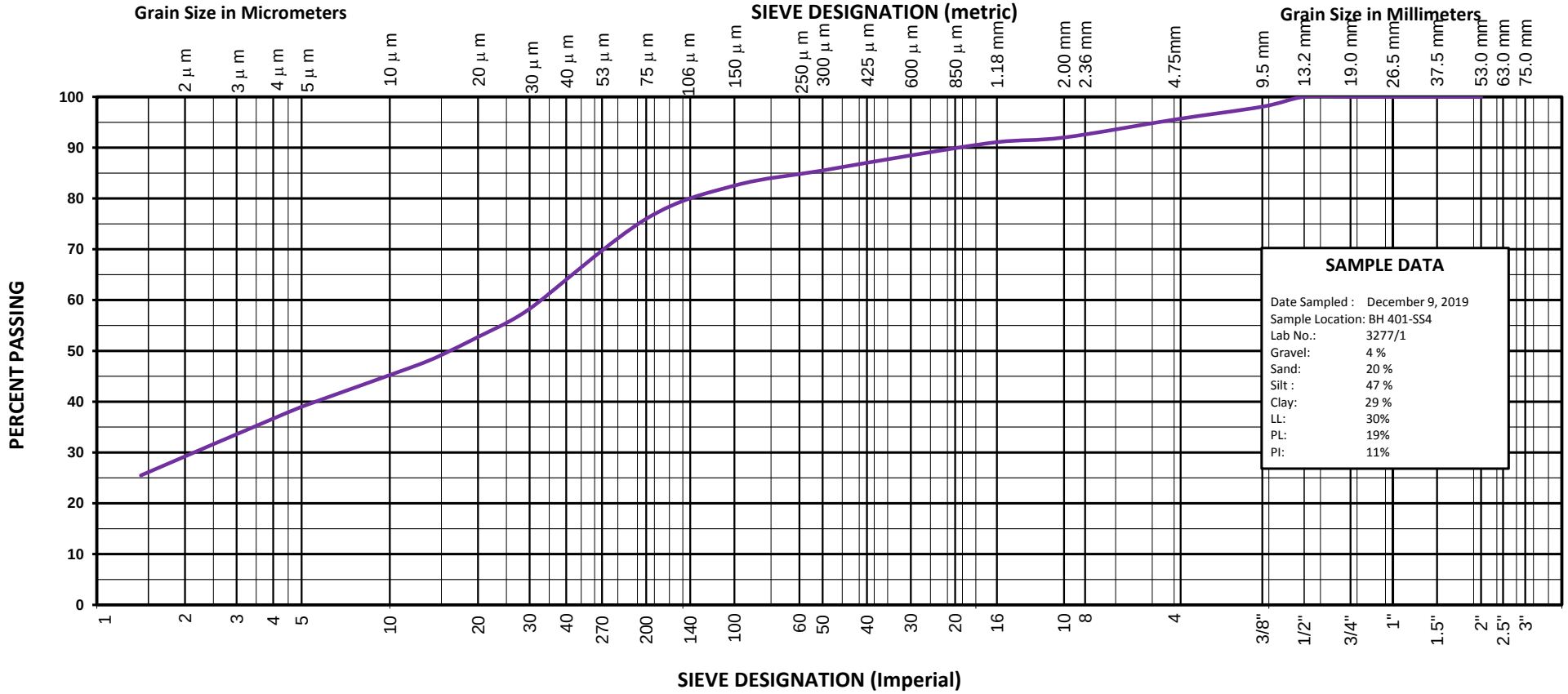
Note 2: The modifying adjectives used to define the actual or estimated percentage range by weight of minor components are consistent with the Canadian Foundation Engineering Manual (3rd Edition, Canadian Geotechnical Society, 1992)

Enclosures

Enclosure A:
Laboratory Test Results (Gradation Analysis & Atterberg Limits)

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY & SILT	SAND			GRAVEL	
	FINE	MEDIUM	COARSE	FINE	COARSE



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SHAD & ASSOCIATES INC.

GRAIN SIZE ANALYSIS

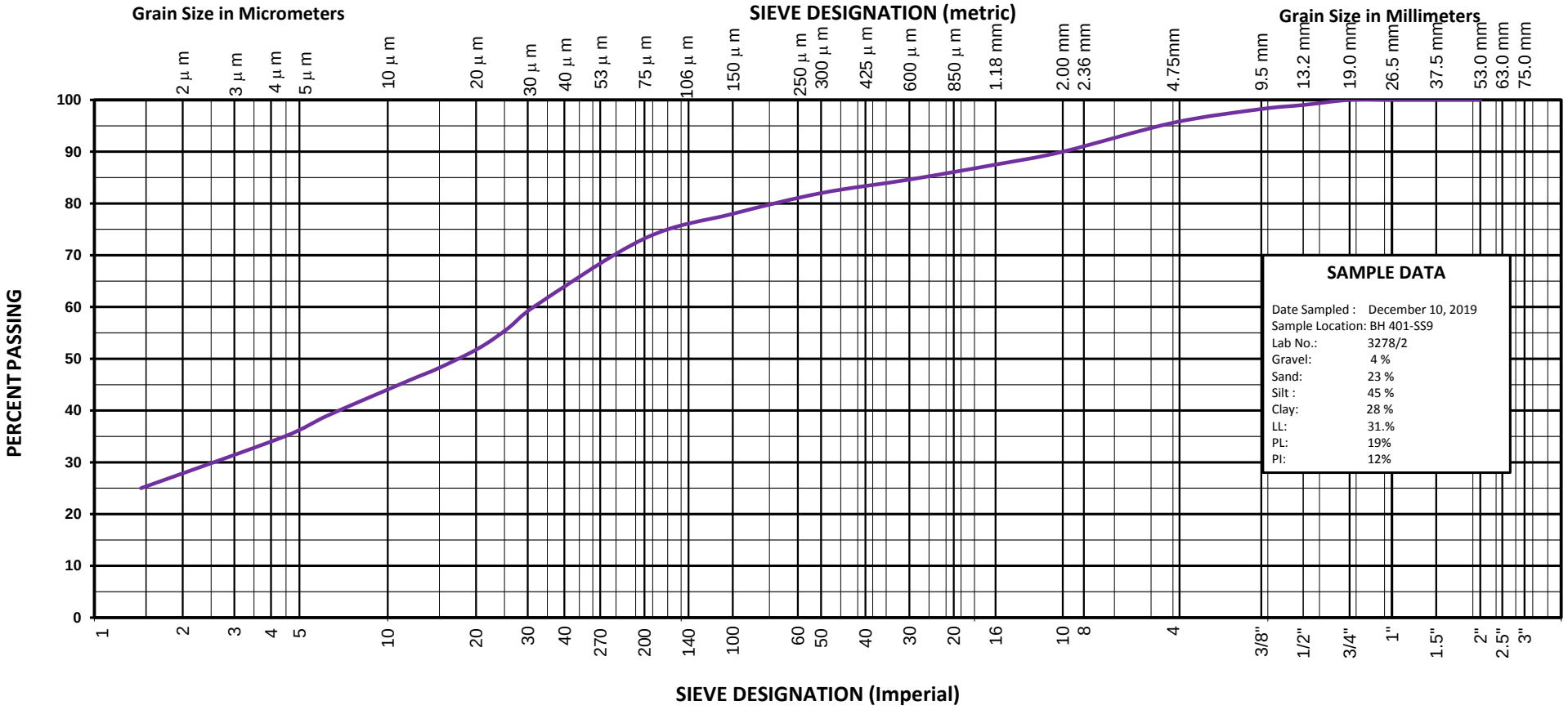
Project : Proposed Residential Subdivision

Project No.: T19782

Client: Mattamy Development Corporation

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY & SILT	SAND			GRAVEL	
	FINE	MEDIUM	COARSE	FINE	COARSE



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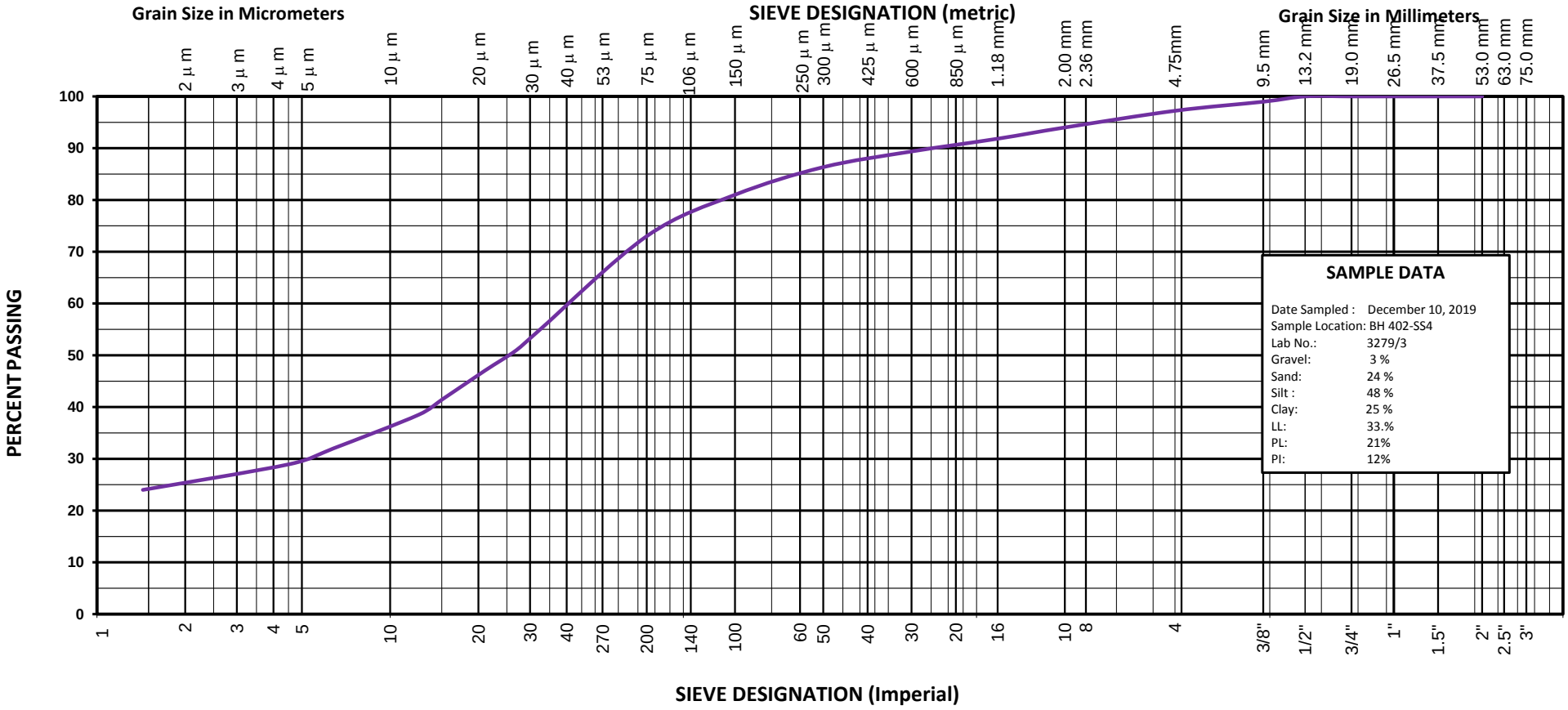

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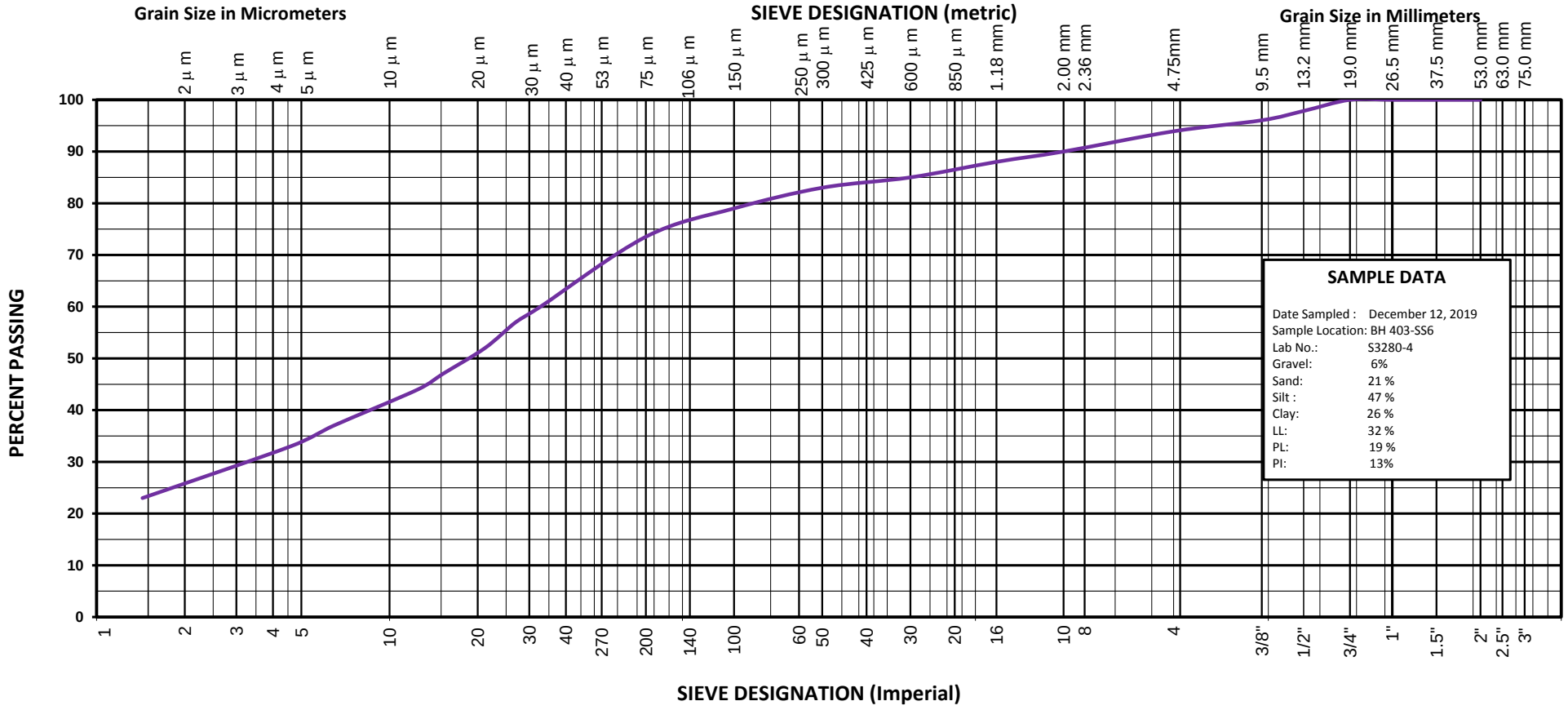
UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY & SILT	SAND			GRAVEL	
	FINE	MEDIUM	COARSE	FINE	COARSE



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SHAD & ASSOCIATES INC.

GRAIN SIZE ANALYSIS

Project : Proposed Residential Subdivision

Project No.: T19782

Client: Mattamy Development Corporation

Appendices

Appendix A:
Record of Previous Boreholes

(AMEC Boreholes 306, 307, 309, 310 and 312 to 315)

amec

RECORD OF BOREHOLE No BH 306 1 OF 1

CLIENT Mattamy Homes Ltd. (Halton Div.) LOCATION S.G.G.C Property, Burnhamthorpe Road West & West of 6th Line, Oakville, Ontario ORIGINATED BY MA

REF. TT5309406 BOREHOLE TYPE Solid Stem Augering COMPILED BY SN

DATUM Geodetic DATE 15 February 2006 CHECKED BY IH

ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	DEPTH (m)	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	SHEAR STRENGTH kPa ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w_L	WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
190.6 0.0	**about 150 mm TOPSOIL**															
190.4 0.2	reddish brown **CLAYEY SILT** (Disturbed native soil) trace gravel and rootlets soft		1	SS	4											
190.0 0.6	moist brown to reddish brown **CLAYEY SILT TILL** trace to some sand and gravel trace shale fragments very stiff to hard damp		2	SS	24		1	190								
			3	SS	33		2	189								
			4	SS	42		3	188								Hard augering
			5	SS	54		4	187								
185.6	grey and brown		6	SS	17		5	186								
5.0	**End of Borehole** No noticeable groundwater in open borehole on completion															

$+^3$ $\times^3$ Numbers refer to Sensitivity

RECORD OF BOREHOLE No BH 307 1 OF 1

CLIENT Mattamy Homes Ltd. (Halton Div.) LOCATION S.G.G.C Property, Burnhamthorpe Road West & West of 6th Line, Oakville, Ontario ORIGINATED BY MA

REF. TT5309406 BOREHOLE TYPE Solid Stem Augering COMPILED BY SN

DATUM Geodetic DATE 15 February 2006 CHECKED BY IH

ELEV / DEPTH (m)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS	DEPTH (m)	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
191.8												
0.0	**about 300 mm TOPSOIL**											
191.5			1	SS	4							
0.3	brown **CLAYEY SILT** (Disturbed native soil) trace gravel and rootlets soft moist											
191.1			2	SS	20		1	191				
0.6	brown to reddish brown **CLAYEY SILT TILL** trace to some sand and gravel trace shale fragments very stiff damp		3	SS	28		2	190				
			4	SS	28		3	189				
	---------- grey and brown		5	SS	28		4	188				
186.7			6	SS	17		5	187				
5.0	**End of Borehole**											

No noticeable groundwater in open borehole on completion

Standpipe piezometer installed to 4.6 m depth

Water level in standpipe piezometer on 3 March 2006: 2.8 m

$+^3$ $\times^3$ Numbers refer to Sensitivity

amec

RECORD OF BOREHOLE No BH 309 1 OF 1

CLIENT Mattamy Homes Ltd. (Halton Div.) LOCATION S.G.G.C Property, Burnhamthorpe Road West & West of 6th Line, Oakville, Ontario ORIGINATED BY MA

REF. TT5309406 BOREHOLE TYPE Solid Stem Augering COMPILED BY SN

DATUM Geodetic DATE 15 February 2006 CHECKED BY IH

ELEV / DEPTH (m)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS	DEPTH (m)	ELEVATION SCALE
188.3 / 0.0	about 150 mm TOPSOIL							
188.1 / 0.2	reddish brown CLAYEY SILT (Disturbed native soil) trace gravel and rootlets soft moist		1	SS	4			188
187.7 / 0.6	brown to reddish brown CLAYEY SILT TILL trace to some sand and gravel trace shale fragments stiff to very stiff damp		2	SS	22		1	187
			3	SS	29		2	
			4	SS	22			186
			5	SS	16		3	185
			6	SS	13		4	184
							5	183
	grey and brown moist		7	SS	16		6	182
181.7 / 6.6	End of Borehole							

No noticeable groundwater in open borehole on completion

Standpipe piezometer installed to 6.1 m depth

Water level in standpipe piezometer on 3 March 2006: 5.8 m

DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100

SHEAR STRENGTH kPa
○ UNCONFINED + FIELD VANE
● 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

UNIT WEIGHT γ kN/m³

REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

$+^3$ $\times^3$ Numbers refer to Sensitivity

amec

RECORD OF BOREHOLE No BH 310 1 OF 1

CLIENT Mattamy Homes Ltd. (Halton Div.) LOCATION S.G.G.C Property, Burnhamthorpe Road West & West of 6th Line, Oakville, Ontario ORIGINATED BY MA

REF. TT5309406 BOREHOLE TYPE Solid Stem Augering COMPILED BY SN

DATUM Geodetic DATE 15 February 2006 CHECKED BY IH

ELEV / DEPTH (m)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	DEPTH (m)	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED + FIELD VANE ● 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)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
186.9												
0.0	**about 360 mm TOPSOIL**											
186.6			1	SS	10							
0.4	reddish brown											
186.3	**CLAYEY SILT**											
0.6	(Disturbed native soil) trace gravel and rootlets stiff mgist		2	SS	34		1	186				
	brown to reddish brown **CLAYEY SILT TILL** trace to some sand and gravel trace shale fragments hard to very stiff damp		3	SS	53		2	185				
			4	SS	59		3	184				
			5	SS	35		4	183				
	grey and brown moist		6	SS	18		5	182				
181.9												
5.0	**End of Borehole**											
	No noticeable groundwater in open borehole on completion											

x^3 x^3 Numbers refer to Sensitivity

amec

RECORD OF BOREHOLE No BH 312 1 OF 1

CLIENT Mattamy Homes Ltd. (Halton Div.) LOCATION S.G.G.C Property, Burnhamthorpe Road West & West of 6th Line, Oakville, Ontario ORIGINATED BY MA

REF. TI5309406 BOREHOLE TYPE Solid Stem Augering COMPILED BY SN

DATUM Geodetic DATE 15 February 2006 CHECKED BY IH

ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	DEPTH (m)	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
187.2												
0.0 / 187.0	**about 180 mm TOPSOIL**							187				
0.2	dark brown to brown **CLAYEY SILT** (Disturbed native soil) trace rootlets stiff to very stiff moist		1	SS	10		1					
			2	SS	24			186				
186.1 / 1.1	brown to reddish brown **CLAYEY SILT TILL** trace to some sand and gravel trace shale fragments very stiff to hard damp		3	SS	39		2					
			4	SS	50			185				
			5	SS	44		3	184				
	grey and brown		6	SS	28		4	183				
182.1 / 5.0	**End of Borehole** No noticeable groundwater in open borehole on completion						5					

+3 x3 Numbers refer to Sensitivity

amec

RECORD OF BOREHOLE No BH 313 1 OF 1

CLIENT Mattamy Homes Ltd. (Halton Div.) LOCATION S.G.G.C Property, Burnhamthorpe Road West & West of 6th Line, Oakville, Ontario ORIGINATED BY MA

REF. TT5309406 BOREHOLE TYPE Solid Stem Augering COMPILED BY SN

DATUM Geodetic DATE 15 February 2006 CHECKED BY IH

ELEV / DEPTH (m)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS	DEPTH (m)	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● 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	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
187.7 0.0	**about 180 mm TOPSOIL**											
187.6 0.2	brown **CLAYEY SILT** (Disturbed native soil) trace gravel and rootlets firm moist		1	SS	5							
187.1 0.6	brown to reddish brown **CLAYEY SILT TILL** trace to some sand and gravel trace shale fragments very stiff to hard damp		2	SS	23		1	187				
			3	SS	32		2	186				
			4	SS	40		3	185				
			5	SS	43		4	184				
	grey and brown moist		6	SS	25		5	183				
182.7 5.0	**End of Borehole** No noticeable groundwater in open borehole on completion											

+3 x3 Numbers refer to Sensitivity

RECORD OF BOREHOLE No BH 314 1 OF 1

CLIENT Mattamy Homes Ltd. (Halton Div.) LOCATION S.G.G.C Property, Burnhamthorpe Road West & West of 6th Line, Oakville, Ontario ORIGINATED BY MA

REF. TT5309406 BOREHOLE TYPE Solid Stem Augering COMPILED BY SN

DATUM Geodetic DATE 15 February 2006 CHECKED BY IH

ELEV / DEPTH (m)	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	DEPTH (m)	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● 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)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
185.7												
0.0	**about 150 mm TOPSOIL**											
185.5												
0.2	dark brown **CLAYEY SILT** (Disturbed native soil) trace gravel and rootlets soft moist		1	SS	3							
185.1												
0.6	brown to reddish brown **CLAYEY SILT TILL** trace to some sand and gravel trace shale fragments stiff to hard damp		2	SS	27		1	185				
			3	SS	37		2	184				
			4	SS	26		3	183				
			5	SS	29							
	---------- grey and brown		6	SS	12		4	182				
							5	181				
							6	180				
179.1			7	SS	13							
6.6	**End of Borehole**											
	No noticeable groundwater in open borehole on completion											

$+^3$ $\times^3$ Numbers refer to Sensitivity

amec

RECORD OF BOREHOLE No BH 315 1 OF 1

CLIENT Mattamy Homes Ltd. (Halton Div.) LOCATION S.G.G.C Property, Burnhamthorpe Road West & West of 6th Line, Oakville, Ontario ORIGINATED BY MA

REF. TT5309406 BOREHOLE TYPE Solid Stem Augering COMPILED BY SN

DATUM Geodetic DATE 17 February 2006 CHECKED BY IH

ELEV / DEPTH (m)	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	DEPTH (m)	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● 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)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
184.6												
0.0 / 184.4	**about 200 mm TOPSOIL**											
0.2 / 184.0	dark brown **CLAYEY SILT** (Disturbed native soil) trace gravel and rootlets very soft moist		1	SS	2							
0.6	brown to reddish brown **CLAYEY SILT TILL** trace to some sand and gravel trace shale fragments very stiff to hard damp		2	SS	27		1	184				
			3	SS	32		2	183				hard augering
			4	SS	30		3	182				
			5	SS	45		4	181				
179.6			6	SS	21		5	180				
5.0	**End of Borehole** No noticeable groundwater in open borehole on completion											

$+^3$ $\times^3$ Numbers refer to Sensitivity