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Geotechnical Investigation
Block 175 on Plan 4M-1689
Shea Road and Cosanti Drive

Ottawa, Ontario

GEMTEC Project: 102166.001-RPT01-Rev1

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Submitted to:

Tartan Homes Corporation
38 Colonnade Road North
Ottawa, Ontario
K2E 7J6

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November 2, 2022
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GEMTEC Consulting Engineers and Scientists Limited
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Ottawa, ON, Canada
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November 2, 2022

File: 102166.001-RPT01-Rev1

Tartan Homes Corporation
38 Colonnade Road North
Ottawa, Ontario
K2E 7J6

Attention: Melissa Cote, MCIP, RPP | Land Planner

Re: Geotechnical Investigation
Block 175 on Plan 4M-1689
Shea Road and Cosanti Drive
Ottawa, Ontario

Enclosed is our geotechnical investigation report for the above noted project, in accordance with our proposal dated August 24th, 2022. This report was prepared by Daire Cummins, M.Sc.E. with a review performed by Lauren Ashe, M.A.Sc., P.Eng.

Do not hesitate to contact the undersigned if you have any questions or require additional information.

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OE/DC/LA/EW

Enclosures
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1.0 INTRODUCTION

This report presents the results of a geotechnical investigation carried out for the proposed residential development to be constructed at Block 175 on Plan 4M-1689 located west of Shea Road and north of Cosanti Drive in Ottawa, Ontario. The purpose of the investigation was to identify the general subsurface conditions at the site by means of a limited number of test pits.

This report has been prepared in accordance with GEMTEC Consulting Engineers and Scientists (GEMTEC) proposal to Tartan Homes, dated August 24th, 2022.

2.0 BACKGROUND

It is understood that plans are underway to develop a parcel of land in the west end of Ottawa for the construction of a residential subdivision (identified as Block 175). The parcel of land is bound by Shea Road to the east, Cosanti Drive to the south and, Fernbank Road to the north (beyond a vacant parcel of land). The lands to the west of the site are being developed as part of the subdivision.

It is understood that the proposed development is to consist of a number of townhouse blocks, access roadways, parking areas and associated site services. At the time of preparation of this report, no information has been provided on the depth of site services or foundation elevations.

3.0 GEOLOGICAL MAPS AND RECORDS OF PREVIOUS GROUND INVESTIGATION

3.1 Geological Maps

Based on our previous experience in the vicinity of the site, and available geology records of the area, the subsurface condition across the site are anticipated to consist of sand/silty sand and glacial till overlying relatively shallow bedrock. Bedrock geology maps indicate that the site is underlain by Paleozoic aged interbedded limestone and dolostone of the Gull River formation. Fill material associated with past uses of the site is also likely to be present.

3.2 Previous Geotechnical Investigation Records

Previous geotechnical investigations were completed by GEMTEC (formerly Houle Chevrier Engineering) at or in the general area of the site for nearby portions of the subdivision, and the results are provided under the following reports:

- Report titled “Geotechnical Investigation, Proposed Residential Subdivision, 5993 Flewellyn Road” dated May 25, 2015 (Report No. 14-420); and,

- Report titled “Supplementary Geotechnical Investigation, Proposed Residential Subdivision, 5993 Flewellyn Road, Ontario” dated October 6, 2016 (Report No. 63900.02).

The findings of these investigations, along with other sources of geotechnical information have been considered in the preparation of this report.

The previous investigations carried out in 2015 and 2016 include a number of test pits which are located with the Block 175 area. The test pits encountered a surficial layer of topsoil, over a layer of silt, silty sand layer or glacial till over bedrock. The upper surface of the bedrock was weathered / fractured at some locations. Refusal to further excavation occurred at depths of about 0.7 to 1.8 metres below ground surface. A series of boreholes were also advanced as part of these investigations, at locations outside of Block 175. Standard penetration testing in the overburden (sand, silt and glacial till units) returned N values indicative of compact or compact to dense compactness condition. Higher N values measured in the glacial till are likely indicative of the presence of frequent cobbles / boulders within the layer. Rotary coring using NQ size diamond drilling equipment recovered faintly weathered limestone bedrock (below a more weathered upper layer). Copies of the test pit logs from the previous investigations are provided in Appendix E along with a site plan showing the test pit locations.

4.0 SUBSURFACE INVESTIGAITON

On September 13, 2022, ten test pits (numbered 22-01 to 22-10, inclusive) were advanced at the locations shown on the Test Pit Location Plan in Figure A.1 (Appendix A).

The test pits were advanced with a 14-ton track mounted Case CX135 excavator supplied and operated by Dave Wright Excavating of Ottawa, Ontario. The excavator was equipped with a tooth bucket. The test pits were excavated to practical refusal at depths of between 0.7 to 2.9 metres below the existing ground surface. The subsurface conditions in the test pits were determined based on visual and tactile examination of soils exposed on the sides and bottom of the excavations. Once the final depth was reached, and the conditions logged, the test pits were loosely backfilled with the excavated material and tamped in placed with the excavator bucket.

The fieldwork was supervised throughout by a member of our engineering staff who directed the excavation operations and logged the samples and test pits. Following completion of the field work, the soil samples were returned to our laboratory for detailed examination by a geotechnical engineer and laboratory testing for soil classification purposes.

The test pit locations were selected and positioned in the field by GEMTEC relative to existing site features. The location and ground surface elevations at each test pit were determined using a Trimble R10 GPS survey instrument. The elevations of ground surface at the test pits are referenced to geodetic datum CGVD28. The co-ordinates and elevations are provided on Figure A.1.

The details of the subsurface conditions encountered in the test pits are provided on the attached Record of Test Pit logs provided in Appendix B. Photographs of the test pit excavations are also provided in Appendix D. Note that photographs for test pit 22-09 are not available.

5.0 SUBSURFACE CONDITIONS

5.1 General

The test pit logs indicate the subsurface conditions at the specific test locations only. Boundaries between zones on the logs are often not distinct, but rather are transitional and have been interpreted. Subsurface conditions at locations other than the test pit locations may vary from the conditions encountered in the test pits. In addition to soil variability, fill of variable physical and chemical composition can be present over portions of the site.

The soil descriptions in this report are based on commonly accepted methods of classification and identification employed in geotechnical practice. Classification and identification of soil involves judgement and GEMTEC does not guarantee descriptions as exact but infers accuracy to the extent that is common in current geotechnical practice.

5.2 Summary of Soil Units

The following presents an overview of the subsurface conditions encountered in the test pits advanced as part of the current investigation. For complete details refer to the record of test pit sheets. The subsurface conditions are relatively consistent with those encountered during the previous investigations carried out in 2015 and 2016 by GEMTEC / Houle Chevrier Engineering.

5.2.1 Topsoil

At all test pit locations, a surficial layer of topsoil was encountered, with a thickness of about 300 to 400 millimetres.

5.2.2 Fill Material

Fill material was encountered below the topsoil at test pits 22-05 and 22-09. The fill extends to depths of about 0.8 metres below ground surface (elevation of about 103.8 and 104.0 metres) at test pits 22-09 and 22-05, respectively.

The composition of the fill material can generally be described as sand and silt, with cobbles, over silt with trace sand, trace clay and some cobbles.

5.2.3 Sand

Sand with varying amounts of silt, was encountered below the topsoil in test pits 22-02 to 22-08 inclusive, and also in test pit 22-10. The sand layer extends to depths of about 0.5 metres to 1.5 metres below ground surface (elevation of about 103.5 and 103.3 metres).

The composition of the sand layer can generally be described as silty sand, with trace gravel.

5.2.4 Silt

Silt was encountered at test pit locations 22-01, 22-03, 22-07, 22-08, and 22-10. In general, the silt was encountered below the sand layer except at test pit 22-01 where silt was encountered below the topsoil. The silt extends to depths of about 0.7 to 2.9 metres below ground surface (or elevation of about 103.7 metres and 101.1 metres).

The composition of the silt layer can generally be described as sandy silt, clayey silt, and silt with trace clay, trace sand (herein referred to as silt). Based on the groundwater seepage observations, as described in Section 5.4, it is inferred that the silt layer becomes coarser at depth.

5.2.5 Glacial Till

Glacial till was encountered below the sand and silt layers at test pits 22-01, 22-05 and 22-06 and 22-08 at a depth of about 0.7, 0.8 and 0.6 metres below ground surface, respectively. Probable glacial till was encountered in test pit 22-08 at a depth of about 1.9 metres. At these locations, the till extends to depths of about 0.9 metres to 2.2 metres (or elevation of about 103.5 and 102.0 metres).

The composition of the till can generally be described as sand and silt, some clay, trace gravel. The glacial till was observed to contain frequent cobbles and boulders. Based on the groundwater seepage observations, as described in Section 5.4, it is inferred that the glacial till becomes coarser at depth.

5.3 Inferred Bedrock

The test pits were terminated on inferred bedrock surface at all test pit locations. The depth to refusal ranged from 0.8 metres (test pit 22-09) to 2.9 metres (test pit 22-10) below ground surface The corresponding range of elevations is from about 103.8 metres to 101.1 metres, respectively. The depth to refusal / inferred bedrock depths and elevations encountered during GEMTEC's 2022 investigation are summarized in Table 5.1. The depths and elevation to refusal in previous investigations are summarised in Table 5.2.

Note the bedrock level, has not been confirmed and may vary from that shown in the table. Also, the condition of the bedrock at / below the refusal level has not been determined.

Table 5.1 – Excavator Refusal Depths/Elevations (Inferred Bedrock), GEMTEC 2022

Test Pit ID	Depth to Excavator Refusal (metres below ground surface)	Elevation of Excavator Refusal (metres, geodetic datum)
22-01	1.9	103.2
22-02	1.5	103.3
22-03	1.1	103.4
22-04	1.1	103.4

Test Pit ID	Depth to Excavator Refusal (metres below ground surface)	Elevation of Excavator Refusal (metres, geodetic datum)
22-05	1.5	103.2
22-06	0.9	103.5
22-07	0.9	103.7
22-08	2.2	102.0
22-09	0.8	103.8
22-10	2.9	101.1

Table 5.2 – Excavator Refusal Depths/Elevations (Inferred Bedrock), Previous Investigations

Test Pit ID	Depth to Excavator Refusal (metres below ground surface)	Elevation of Excavator Refusal (metres, geodetic datum)
1	1.3	104.0
2	0.8	103.4
3	1.1	102.8
4	1.0	102.9
17	1.3	102.4
18	1.7	101.7
24	1.2	103.5
25	1.8	103.4
16-14	1.0	104.3
16-15	0.7	104.3
16-16	0.9	103.1

5.4 Groundwater

Groundwater seepage was noted in test pits 22-02 to 22-06 inclusive, and 22-08 during the relatively short time that the test pits remained open for. An increased rate seepage was noted in TP-22-02, TP-22-03, TP-22-04, TP22-05, TP 22-08, leading to standing water ponding across the base of the test pit. No indications of seepage or groundwater inflow were noted in the other test pits. The depths and elevations at which groundwater seepage was observed are summarized in Table 5.3.

Table 5.3 – Seepage Depths / Elevations Observed in Test Pits, GEMTEC 2022

Test Pit ID	Seepage Level on September 13, 2022 (metres below ground surface)	Seepage Elevation on September 13, 2022 (metres, geodetic datum)
22-01	-	-
22-02	1.4	103.5
22-03	1.0	103.5
22-04	1.0	103.5
22-05	1.3	103.4
22-06	0.9	103.5
22-07	-	-
22-08	2.2	102.0
22-09	-	-
22-10	-	-

The test pits in previous phases of investigation at the site were dry upon completion.

It should be noted that the depth / level at which seepage occurs may not represent the stabilised groundwater level but is indicative of more permeable zone of soil which is water bearing. Groundwater depths / levels will fluctuate during the year and may be higher during or following wet periods of the year or heavy precipitation events.

5.5 Test Pit Sidewall Stability

With the exception of test pit 22-08, no sloughing or collapse of the test pits sidewalls was observed over the relatively short period of time for which the excavations remained open, noting that these test pits were excavated to relatively shallow depth. The sidewalls of test pit 22-08 were unstable and collapsing below a depth of about 1.0 to 1.2 metres below ground surface.

5.6 Summary of Laboratory Soil Classification Testing

Seven grain size distribution tests were carried out soil samples recovered from the test pits. A summary of the results is provided in Table 5.4. The laboratory test sheets are provided in Appendix C. It should be noted that the presence of cobbles and boulders, which were observed in the glacial till is not represented in the results due to sample size limitations.

Table 5.4 – Summary of Grain Size Distribution Test (Silty Sand to Sand and Silt)

Test Pit ID	Sample Number	Sample Depth (metres)	Gravel (%)	Sand (%)	Silt and Clay (%)
22-01	2	0.3 – 0.7	0	28	72 [1]
22-01	3	0.7 – 1.9	0	43	57 [1]
22-02	3	0.7 – 1.5	8	55	37 [1]
22-06	2	0.7 – 0.9	0	10	90 [1]
22-06	3	0.3 – 0.6	1	84	15 [1]
22-07	2	0.3 – 0.6	4	68	28 [1]
22-10	3	1.0 – 1.2	0	7	93 [1]

Notes:

1. Refer to laboratory test sheet in Appendix C for breakdown to Silt and Clay percentage.

6.0 GEOTECHNICAL RECOMMENDATIONS AND GUIDELINES

6.1 General

This section of the report provides engineering recommendations and guidelines on the geotechnical design aspects of the project based on our interpretation of the available test pit information, and the project requirements. It is stressed that the information in the following sections is provided for the guidance of the designers and is intended for this project only. Contractors bidding on or undertaking the works should examine the factual results of the investigation, satisfy themselves as to the adequacy of the information for construction, and make their own interpretation of the factual data as it affects their construction techniques, schedule, safety and equipment capabilities.

The professional services retained for this project include only the geotechnical aspects of the subsurface conditions at this site. The presence or implications of possible surface and/or subsurface contamination resulting from previous uses or activities of this site or adjacent properties, and/or resulting from the introduction onto the site from materials from off-site sources are outside the terms of reference for this report and have not been investigated or addressed.

6.2 Grade Raise Restrictions

The site is underlain by native deposits of sand, silt and glacial till. Based on the test pit information, there are no grade raise restrictions at the site.

The settlement due to compression of the native soils as a result of fill placement should be relatively small and should occur during or shortly after the fill placement.

6.3 Proposed Houses

6.3.1 Excavation

The excavations for the foundations should be taken through any surficial fill, topsoil, or otherwise deleterious material to expose undisturbed suitable soil. This includes portions of the soil which have been disturbed by the test pit excavations.

Excavation of the native soils above the groundwater should not present any excavation constraints. In contrast, excavation in the native silty sand and sand below the groundwater level could present constraints. Groundwater inflow from the silty sand and sand deposits could cause sloughing of the sides of the excavation and disturbance to the soils at the bottom of the excavation – as indicated in the test pit excavations.

The sides of the excavations should be sloped in accordance with the requirements in Ontario Regulation 213/91 under the Occupational Health and Safety Act. According to the Act, the shallow native overburden deposits can be classified as Type 3 and, accordingly, allowance should be made for excavation side slopes of 1 horizontal to 1 vertical extending upwards from the base of the excavation. Flatter side slopes may be required if excavation is required below the groundwater level in sand and silty sand deposits.

Depending on the grading and utility invert levels some bedrock excavation may be required. Guidelines on bedrock excavation are provided below in Section 6.4.1.2.

6.3.2 Placement of Engineered Fill

Imported granular material (engineered fill) should be used to raise the grade in areas where the proposed founding level is above the level of the native soil, or where subexcavation of disturbed material is required below proposed founding level.

The engineered fill should consist of granular material meeting Ontario Provincial Standard Specifications (OPSS) requirements for Granular B Type II and should be compacted in maximum 200-millimetre-thick lifts to at least 95 percent of the standard Proctor maximum dry density. To allow spread of load beneath the footings, the engineered fill should extend horizontally at least 0.3 metres beyond the footings and then down and out from the edges of the footings at 1 horizontal to 1 vertical, or flatter. The excavations should be sized to accommodate this fill placement.

In areas where wet silty or sandy soils are encountered at subgrade level, it may be necessary to place a woven geotextile meeting OPSS 1860 Class I requirements below the engineered fill and to statically compact the first lift of granular material to prevent subgrade disturbance. All seams in the geotextile should overlap at least 0.5 metres.

6.3.3 Spread Footing Design

The proposed houses could be founded on spread footings bearing on or within the native soil or on engineered fill above the native deposits. The topsoil and any fill materials are not considered suitable for the support of the proposed houses or concrete floor slabs and should be removed from the proposed building areas.

Based on the results of the test pit investigation, the following allowable bearing pressures shown in Table 6.1 should be used to size the spread footing foundations.

Table 6.1 – Allowable Bearing Pressures for Foundations

Subgrade Material	Allowable Bearing Pressure for Foundations
Native deposits of silt and sand	100
Glacial till	150
Engineered fill material, over undisturbed native deposits	150
Bedrock	200

It is pointed out that the deposits of silt, sandy silt, and silty sand near or below the groundwater level may become disturbed following excavation. If disturbance to the sandy silt or silt deposits occurs, consideration could be given to waiting several days to allow the soils to dry out. For the silty sand and sand deposits, the groundwater level could be lowered in advance of excavation by pumping from sump pits, possibly combined with ditching around the perimeter of the excavations.

Some of the native soils at this site are sensitive to construction operations, from ponded water and frost action. The construction operations should therefore be carried out in a manner that minimizes disturbance of the subgrade surfaces.

The post construction total and differential settlement of footings should be less than 25 and 15 millimetres, respectively, provided that all loose or disturbed soil is removed from the bearing surfaces and provided that any engineered fill material is compacted to the required density.

The depth to bedrock at the site is somewhat irregular, as indicated by the refusal depths in the test pits, and may be stepped. As such, provision should be made for additional formwork and concrete for footings bearing on the surface of these materials. Any cobbles and boulders or fragments of rock that become loosened during excavation should be sub-excavated.

Where practical, foundations bearing on zones of soil and bedrock should be avoided, to reduce the risk of significant differential settlement occurring. Where this is unavoidable / impractical the foundation walls of the houses should be reinforced, both top and bottom, in areas where the footings transition from overburden to bedrock. The reinforcing steel should extend at least 3 metres on both sides of the transition zone.

6.3.4 Frost Protection of Foundations

All exterior footings should be provided with at least 1.5 metres of earth cover for frost protection purposes. Isolated, unheated exterior footings adjacent to surfaces which are cleaned of snow cover during the winter months should be provided with a minimum of 1.8 metres of earth cover. Alternatively, the required frost protection could be provided by means of a combination of earth cover and extruded polystyrene insulation.

Footings on sound bedrock do not require frost protection. However, to verify this - the frost susceptibility of the bedrock should be assessed by geotechnical personnel at the time of construction.

Further details regarding the insulation of foundations could be provided at the detailed design stage, if necessary.

6.3.5 Basement Foundation Wall Backfill and Drainage

In accordance with the Ontario Building Code, the following alternatives could be considered for drainage of the basement foundation walls:

- Damp proof the exterior of the foundation walls and backfill the walls with free draining, non-frost susceptible sand or sand and gravel such as that meeting OPSS requirements for Granular B Type I or II. OR

- Damp proof the exterior of the foundation walls and install an approved proprietary drainage material on the exterior of the foundation walls and backfill the walls with native material or imported soil.

A perforated plastic foundation drain with a surround of clear crushed stone should be installed on the exterior of the foundation walls. A nonwoven geotextile should be placed between the top of the clear stone and any sandy foundation wall backfill material to avoid loss of sand backfill into the voids in the clear stone (and possible post construction settlement of the ground around the houses). The top of the drain should be located below the bottom of the floor slab. The drain should outlet to a sump from which the water is pumped or should drain by gravity to a storm sewer.

6.3.6 Garage Foundation and Pier Backfill

To avoid adfreeze between the unheated garage foundation walls and the wall backfill and possible jacking (heaving) of the foundation walls, the interior and exterior of the garage foundation walls should be backfilled with free draining, non-frost susceptible sand or sand and gravel such as that meeting OPSS requirements for Granular B Type I or II. The backfill within the garage should be compacted in maximum 300 millimetres thick lifts to at least 95 percent of the standard Proctor dry density value using suitable vibratory compaction equipment.

Alternatively, the interior of the garages could be filled with 19 millimetre clear crushed stone. In areas where the subgrade consists of silt, sandy silt, silty sand, or sand, a suitable nonwoven geotextile should be placed over the subgrade prior to the placement of clear stone to prevent ingress of fines into voids in the clear stone and possible settlement/cracking of the slab.

The backfill against isolated (unheated) walls or piers should consist of free draining, non-frost susceptible material, such as sand/sand and gravel meeting OPSS Granular B Type I or II requirements. Other measures to prevent frost jacking of these foundation elements could be provided, if required.

6.3.7 Basement Concrete Slab Support

To provide predictable settlement performance of the basement slab, all topsoil, fill material, disturbed soil, and other deleterious materials should be removed from the slab area. This includes portions of the soil which have been disturbed by the test pit excavations.

The base for the floor slab should consist of 19 millimetre clear crushed stone. Allowance should be made for between 150 and 200 millimetres of base material.

The clear crushed stone should be nominally compacted in maximum 300 millimetre thick lifts with at least 2 passes of a diesel plate compactor. In areas where the subgrade consists of silt, sandy silt, silty sand, or sand, a suitable nonwoven geotextile should be placed over the subgrade prior to the placement of clear stone to prevent ingress of fines into voids in the clear stone and possible settlement/cracking of the slab.

If clear crushed stone is used below the floor slab, underfloor drains are not considered essential, provided that stub drains are installed to link any hydraulically isolated areas in the basement. The clear stone should outlet by gravity to a sump from which the water is pumped or drained by gravity to a sewer.

Basement floor slabs should be constructed in accordance with guidelines provided in ACI 302.1R-04 “Guide for Concrete Floor and Slab Construction”.

A polyethylene vapour barrier should be installed below the basement floor slabs.

6.4 Site Services

6.4.1 Excavation

6.4.1.1 Overburden Excavation

The overburden excavations for the site services will be carried out through topsoil, and deposits of sand, silt and glacial till.

In the overburden, the excavation for flexible service pipes should be in accordance with Ontario Provincial Standard Drawing (OPSD) 802.010 for Type 3 Soil. The excavation for rigid service pipes should be in accordance with OPSD 802.031 for Type 3 soil.

The sides of the excavations within overburden soils should be sloped in accordance with the requirements in Ontario Regulation 213/91 under the Occupational Health and Safety Act. According to the Act, most of the soils at this site can be classified as Type 3 soils. Therefore, for design purposes, allowance should be made for 1 horizontal to 1 vertical, or flatter, excavation slopes.

Excavation of the native soils above the groundwater should not present any excavation constraints. In contrast, excavation in the native silty sand and sand below the groundwater level could present constraints. Groundwater inflow from the silty sand and sand deposits could cause sloughing of the sides of the excavation and disturbance to the soils at the bottom of the excavation. Flatter side slopes may be required if excavation is required below the groundwater level in sand and silty sand deposits. Loose boulders should be scaled from the excavation side slopes prior to worker entry.

As an alternative or where space constraints dictate, the service installations could be carried out within a tightly fitting, braced steel trench box, which is specifically designed for this purpose.

6.4.1.2 Bedrock Excavation

In bedrock, the excavation for flexible service pipes should be in accordance with OPSD 802.013 for bedrock. The excavation for rigid service pipes should be in accordance with OPSD 802.033 for bedrock.

Localized removal of competent bedrock at this site could likely be carried out using (a) drill and blasting, (b) hoe ramming techniques in conjunction with line drilling on close centres or (c) a combination of both. Provided that good bedrock excavation techniques are used, the competent bedrock could be excavated using vertical side walls.

Any blasting should be carried out under the supervision of a blasting specialist engineer. As a guideline for blasting, the suggested peak vibration limits at the nearest structure or service are provided in Table 6.2.

Table 6.2 – Peak Vibration Limits

Frequency of Vibration (Hz)	Vibration Limits (millimetres/second)
<10	5
10 to 40	5 to 50 (interpolated)
>40	50

It is pointed out that these criteria, although conservative, were established to prevent damage to existing buildings and services that are in good condition; more stringent criteria may be required to prevent damage to freshly placed (uncured) concrete or vibration sensitive equipment or utilities. Monitoring of the blasting should be carried out to ensure that the blasting meets the limiting vibration criteria.

As an alternative to blasting, bedrock removal could be carried out using large hydraulic excavation equipment in combination with hoe ramming. Line drilling on close centres could be used to reduce, not prevent, over break and under break of the bedrock excavation and to define the limit of excavation next to existing structures and services.

Provided that good bedrock excavation techniques are used, the bedrock could be excavated using vertical side walls. Any loose rock should be scaled from the sides of the excavation.

The bedrock at this site has near horizontal bedding planes and near vertical inclined joints. Therefore, some vertical and horizontal over break of the bedrock should be expected. Vertical over break will naturally occur along the bedding planes; as such, additional granular bedding material should be expected for the site services and additional granular fill/concrete should be expected for the house foundations.

6.4.2 Bedding and Cover

The bedding and cover for the proposed utilities should consist of least 150 millimetres of OPSS Granular A backfill placed in accordance with the applicable Ontario Standard Drawings (OPSD) for the type of underground utility installed. The use of 19-millimetre clear stone is not recommended as bedding or cover.

The native soils below the groundwater level are sensitive to disturbance. Allowance should be made for a subbedding composed of at least 300 millimetres of OPSS Granular B Type II where these materials are encountered at subgrade level below the pipe.

Bedding, subbedding and cover materials should be placed in lifts not exceeding 200 millimetres thick and compacted to at least 95 percent of standard Proctor density (ASTM D698) using suitable vibratory compaction equipment.

6.4.3 Trench Backfill

The general backfilling procedures should be carried out in a manner that is compatible with the future use of the area above the service trenches.

In areas where the service trench will be located below or in close proximity to existing or future areas of hard surfacing (i.e., access roadways and parking), acceptable native materials should be used as backfill between the roadway subgrade level and the depth of seasonal frost penetration in order to reduce the potential for differential frost heaving between the area over the trench and the adjacent hard surfaced area. The depth of frost penetration in exposed areas can normally be taken as 1.8 metres below finished grade. It is our experience, however, that the frost penetration can be as much as 2.4 metres when the trench backfill consists solely of relatively open graded rock fill. Where native backfill is used, it should match the native materials exposed on the trench walls. Backfill below the zone of seasonal frost penetration could consist of either acceptable native material or imported granular material conforming to OPSS Granular B Type I.

It is anticipated that most of the inorganic overburden materials encountered during the subsurface investigation will be acceptable for reuse as trench backfill. Topsoil or other organic material should be wasted from the trench. If on-site blast rock is used as backfill within the service trench, it should be mostly 300 millimetres, or smaller, in size and should be well graded. To prevent ingress of fine material into voids in the blast rock, the upper surface of the blast rock should be covered with a thin layer of compacted, well graded crushed stone, such as OPSS Granular B Type II.

To minimize future settlement of the backfill and achieve an acceptable subgrade for the roadways, curbs, driveways, etc., the trench backfill should be compacted in maximum 300-millimetre-thick lifts to at least 95 percent of the standard Proctor dry density value. Rock fill should be placed in maximum 500-millimetre-thick lifts and compacted with a large drum roller, the haulage and spreading equipment, or a combination of both. The specified density for compaction of the backfill materials may be reduced where the trench backfill is not located below or in close proximity to existing or future areas of hard surfacing and/or structures, provided that some settlement above the trench is acceptable.

The soils containing significant fine-grained material (i.e. silt and clay) will likely have water contents that are too high for adequate compaction. Furthermore, depending on the weather conditions at the time of construction, some wetting of materials could occur. As such, the specified densities may not be possible to achieve and, as a consequence, some settlement of these backfill materials should be expected. Consideration could be given to implementing one or a combination of the following measures to reduce post construction settlement above the trenches, depending on the weather conditions encountered during the construction:

- Allow the overburden materials to dry prior to compaction;
- Reuse any wet materials in the lower part of the trenches and make provision to defer final paving of surface course (i.e., the Superpave 12.5 asphaltic concrete) in the roadway for 3 months, or longer, to allow the trench backfill settlement to occur and thereby improve the final roadway appearance.
- Reuse any wet materials outside hard surfaced areas and where post construction settlement is less of a concern (such as landscaped areas).

6.4.4 Seepage Barriers

The granular bedding in the service trench could act as a "French Drain", which could promote groundwater lowering. As such, we suggest that seepage barriers be installed along the service trenches at strategic locations at a horizontal spacing of about 100 metres. The seepage barriers should begin at subgrade level and extend vertically through the granular pipe bedding and granular surround to within the native backfill materials, and horizontally across the full width of the service trench excavation. The seepage barriers could consist of 1.5 metre wide dykes of compacted weathered silty clay. The weathered silty clay should be compacted in maximum 300-millimetre-thick lifts to at least 95 percent of the standard Proctor dry density value. The locations of the seepage barriers could be provided as the design progresses.

6.5 Groundwater Management

Based on our observations on site, groundwater inflow from the overburden deposits into the excavations should be expected and could likely be controlled by pumping from filtered sumps within the excavations. It is not expected that short term pumping during excavation will have any significant affect on nearby structures and services.

Depending on the depth of proposed excavations and groundwater level at the time of construction, an Environmental Activity and Sector Registry (EASR) in accordance with Environmental Protection Act Part II or a Category 3 Permit to Take Water may be required. Further details could be provided as the design progresses.

Suitable detention and filtration will be required before discharging water. The contractor should be required to submit an excavation and groundwater management plan for review.

The groundwater handling should be carried out in accordance with provincial and local regulations. To reduce the volume of groundwater management, we suggest that the excavations be planned for the dry period of the year (i.e. June to September).

6.6 Seismic Site Classification and Liquefaction Potential

Based on the results of the investigation, a seismic Site Class D be (conservatively) used for the design of the residential structures at this site. It is likely that a higher Site Class such as C or B could be applicable either in part or across the site extents if further investigation was carried out specifically to address this aspect.

In our opinion, there is no potential for liquefaction of the overburden deposits at this site.

6.7 Internal Roadways

6.7.1 Subgrade Preparation

In preparation for roadway construction at this site, all surficial topsoil and any soft, wet, disturbed, or deleterious materials should be removed from the proposed roadways.

Prior to placing granular material for internal roads, the exposed subgrade should be heavily proof rolled under suitable (dry) conditions, and inspected and approved by geotechnical personnel. Any soft areas evident from the proof rolling should be subexcavated and replaced with suitable earth borrow or well shattered and graded rock fill material that is frost compatible with the materials exposed on the sides of the area of excavation.

Similarly, should it be necessary to raise the roadway grades at this site, material which meets OPSS specifications for Select Subgrade Material, earth borrow or well shattered and graded rockfill may be used.

The select subgrade material or earth borrow should be placed in maximum 300-millimetre-thick lifts and compacted to at least 95 percent of the standard Proctor maximum dry density value using vibratory compaction equipment. Rock fill should also be placed in thin lifts and suitably compacted either with a large drum roller, the haulage and spreading equipment, or a combination of both.

Truck traffic should be avoided on the native soil subgrade or the trench backfill within the roadways especially under wet conditions.

6.7.2 Pavement Design

The following minimum pavement structure is suggested for local roadways at this site assuming that the roadways will not be used as collector roads or bus routes:

- 90 millimetres of hot mix asphaltic concrete (40 millimetres of Superpave 12.5 (Traffic Level B) over 50 millimetres of Superpave 12.5 (Traffic Level B)), over
- 150 millimetres of OPSS Granular A base, over
- 400 millimetres of OPSS Granular B, Type II subbase

The OPSS Granular B Type II subbase thickness should be increased to 450 millimetres for collector roadways and bus routes. Where bedrock encroaches within the recommended pavement structure, the thickness of Granular B Type II subbase may be reduced accordingly to a minimum of 150 millimetres.

The use of Superpave 19 for base course hot mix asphaltic concrete is considered acceptable if placed and compacted adequately with minimal surface segregation. Increased thickness of the base course asphaltic concrete to a minimum of 60 millimetres is recommended if final surface course paving will be delayed by more than 3 to 5 years.

The above pavement structure assumes that any trench backfill is adequately compacted, and that the access roadway and parking lot subgrade surfaces are prepared as described in this report. If the subgrade surfaces become disturbed or wetted due to construction operations or precipitation, the granular subbase thickness given above may not be adequate and it may be necessary to increase the thickness of the subbase and/or to incorporate a woven geotextile separator between the subgrade surfaces and the granular subbase material. The adequacy of the design pavement thickness should be assessed by geotechnical personnel at the time of construction. In our experience, a geotextile will likely be required in most cases where the subgrade consists of overburden, if the roadway construction is planned during the wet period of the year (such as the spring or fall).

If the granular pavement materials are to be used by construction traffic, it may be necessary to increase the thickness of the granular subbase layer, install a woven geotextile separator between the roadway subgrade surface and the granular subbase material, or a combination of both, to prevent pumping and disturbance to the subbase material. The contractor should be made responsible for their construction access.

6.7.3 Asphalt Cement Type

Performance grade PG 58-34 asphalt cement should be specified for Superpave asphaltic concrete mixes.

6.7.4 Pavement Transitions

Where new pavements will abut existing pavements the following is suggested to improve the performance of the joint between the new and the existing pavements:

- Neatly saw cut the existing asphaltic concrete;
- Remove the asphaltic concrete and slope the bottom of the excavation within the existing granular base and subbase at 1 horizontal to 1 vertical, or flatter, to avoid undermining the existing asphaltic concrete.
- To avoid cracking of the asphaltic concrete due to an abrupt change in the thickness of the roadway granular materials where new pavement areas join with the existing

pavements, the granular depths should taper up or down at 5 horizontal to 1 vertical, or flatter, to match the existing pavement structure.

- Remove (mill off) 40 to 50 millimetres of the existing asphaltic concrete to a distance of 300 millimetres at the joint and tack coat the asphaltic concrete at the joint in accordance with the requirements in OPSS 310.

6.7.5 Pavement Drainage

Adequate drainage of the pavement granular materials and subgrade is important for the long term performance of the pavement at this site. The subgrade surfaces should be crowned and shaped to drain to the ditches and/or catch basins to promote drainage of the pavement granular materials. Catch basins should be equipped with minimum 3-metre-long stub drains extending in two directions at the subgrade level.

6.7.6 Granular Material Compaction

The pavement granular materials should be compacted in maximum 300-millimetre-thick lifts to at least 98 percent of standard Proctor maximum dry density using suitable vibratory compaction equipment.

6.7.7 Transition Treatments

In areas where the new pavement structure will abut existing pavements, the depths of the granular materials should taper up or down at 5 horizontal to 1 vertical, or flatter, to match the depths of the granular material(s) exposed in the existing pavement.

6.7.8 Pavement Drainage

Adequate drainage of the pavement granular materials and subgrade is important for the long-term performance of the pavement at this site. In order to provide drainage of the granular subbase, it is suggested that catch basins be provided with perforated stub drains extending about 3 metres out from the catch basins in two directions parallel to the roadway. These drains should be installed at the bottom of the subbase layer. Where ditches are used, the bottom of the OPSS Granular B Type II should be at least 0.3 metres above the bottom of the ditch and the granular material should extend to the ditch slopes.

7.0 ADDITIONAL CONSIDERATIONS

7.1 Corrosion of Buried Concrete and Steel

Testing to determine the soil / ground water aggressivity towards concrete and steel was not carried out on sample from the test pits with Block 175.

Previous testing on samples recovered from the former phases of investigation (outside of Block 175) indicated sulphate concentrations in the low range according to the Canadian Standards

Association (CSA) “Concrete Materials and Methods of Concrete in Construction”. Also the results indicate that the soil can be classified as non-aggressive towards unprotected steel.

While similar conditions are expected within Block 175, it is recommended that this be confirmed prior to construction by carrying out testing on samples of the soil.

The effects of freeze thaw in the presence of de-icing chemical (sodium chloride) use on the roadway should be considered in selecting the air entrainment and the concrete mix proportions for any concrete. It should be noted that the corrosivity of the soil/groundwater could vary throughout the year due to the application sodium chloride for deicing.

7.2 Additional Considerations

The test pits, including all those advanced during the various phases of investigation at the site, are zones of disturbed ground similar to uncontrolled fill material, which will settle over time. These areas should be remediated if in the future, they are to be used to support settlement sensitive structures such as building foundations, roadways, or under ground services.

7.3 Construction Induced Vibration

Some of the construction operations (such as granular material compaction, overburden and bedrock excavation, etc.) will cause ground vibration on the site. The vibrations will attenuate with distance from the source but may be felt at nearby structures. It is suggested therefore that these construction operations be planned to avoid any adverse effects of such vibrations on freshly placed (uncured) concrete and on existing buildings.

Pre-construction surveys should be carried out on existing, nearby structures and water supply wells to assist with any damage related claims.

7.4 Winter Construction

The soils that exist at this site are highly frost susceptible and are prone to significant ice lensing. In the event that construction is required during freezing temperatures, the soil below the footings should be protected immediately from freezing using straw, propane heaters and insulated tarpaulins, or other suitable means.

Any service trenches should be opened for as short a time as practicable and the excavations should be carried out only in lengths which allow all of the construction operations, including backfilling, to be fully completed in one working day. The materials on the sides of the trenches should not be allowed to freeze. In addition, the backfill should be excavated, stored and replaced without being disturbed by frost or contaminated by snow or ice.

Provision must be made to prevent freezing of any soil below the level of any existing structures or services. Freezing of the soil could result in heaving related damage to structures or services.

7.5 Excess Soil Management Plan

This report does not constitute an excess soil management plan. The disposal requirements for excess soil from the site have not been assessed.

7.6 Tree Planting Guidelines

Based on the subsurface conditions at this site, there is no requirement to adhere to the City of Ottawa Guideline for Tree Planting in Sensitive Marine Clay Soils. The soils at this site are not susceptible to shrinkage due to moisture reduction.

7.7 Design Review and Construction Observations

The details for the proposed construction were not available to us at the time of preparation of this report. It is recommended that the design drawings be reviewed by the geotechnical engineer as the design progresses to ensure that the guidelines provided in this report have been interpreted as intended.

The subgrade surfaces for the proposed structures, utilities and roadways should be inspected by experienced geotechnical personnel to ensure that suitable materials have been reached and properly prepared. The placing and compaction of earth fill and imported granular materials should be inspected to ensure that the materials used conform to the grading and compaction specifications.

In accordance with City of Ottawa requirements, all foundation subgrades and footings should be inspected and approved by geotechnical personnel. Full time inspection is required during placing and compaction of engineered fill and imported granular materials below structures to ensure that the materials used conform to the grading and compaction specifications.

8.0 CLOSURE

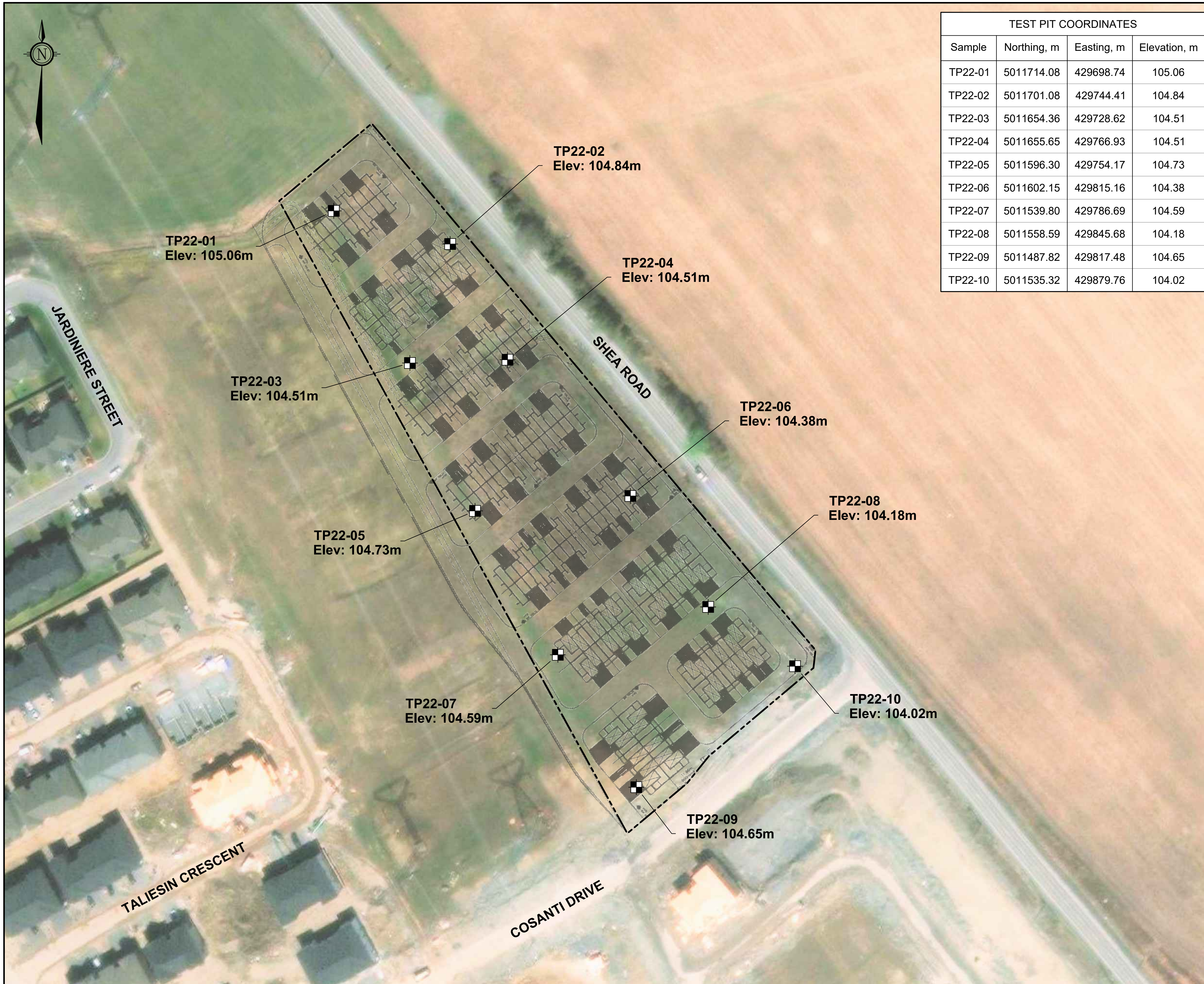
We trust that this report is sufficient for your purposes. If you have any questions or require additional information, please contact the undersigned.

Daire Cummins, M.Sc.E.
Senior Geotechnical Specialist

Lauren Ashe, M.A.Sc., P.Eng.
Senior Geotechnical Engineer,
Manager of Geotechnical Services

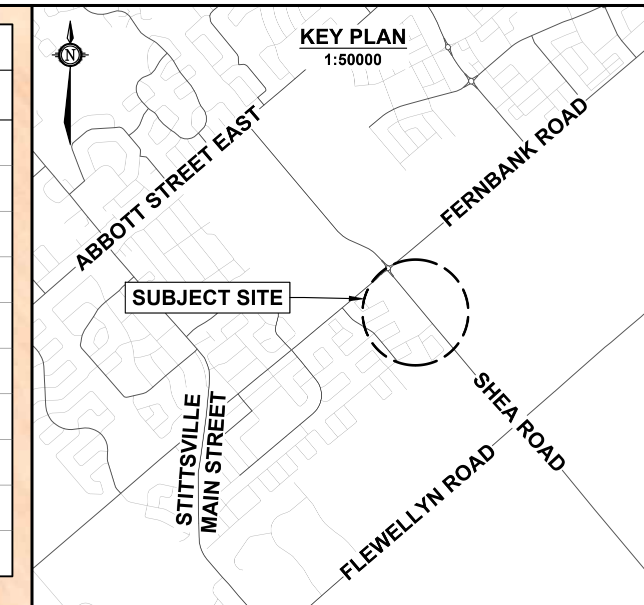
APPENDIX A

Test Pit Location Plan
Figure A.1



TEST PIT COORDINATES			
Sample	Northing, m	Easting, m	Elevation, m
TP22-01	5011714.08	429698.74	105.06
TP22-02	5011701.08	429744.41	104.84
TP22-03	5011654.36	429728.62	104.51
TP22-04	5011655.65	429766.93	104.51
TP22-05	5011596.30	429754.17	104.73
TP22-06	5011602.15	429815.16	104.38
TP22-07	5011539.80	429786.69	104.59
TP22-08	5011558.59	429845.68	104.18
TP22-09	5011487.82	429817.48	104.65
TP22-10	5011535.32	429879.76	104.02

KEY PLAN
1:50000



LEGEND

TP # ← TEST PIT ID

TEST PIT LOCATION (current investigation by GEMTEC)

SITE BOUNDARY

NOTES
1. This survey referenced station 20120110005. Horizontal datum NAD83 (CSRS) CBNV6-2010.0.
2. Survey elevation 144.594m, vertical datum CGVD28.
3. Coordinate system: NAD83(CSRS) / UTM zone 18N.
4. Aerial photograph from 2022. Source: Maxar Imagery Basemap.
5. Contains information licensed under the Open Government Licence – Ontario.

SCALE
1:1500
0 30 60 90m

DRAWING
TEST PIT LOCATION PLAN

CLIENT
TARTAN HOMES CORPORATION

PROJECT
GEOTECHNICAL INVESTIGATION
BLOCK 175, SHEA ROAD AND COSANTI DRIVE
STITTSVILLE, OTTAWA, ON

DRAWN BY	CHECKED BY
CHG	OE
PROJECT NO. 102166.001	REVISION NO. 0
DATE SEPTEMBER 2022	FIGURE NO. **FIGURE A.1**

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ottawa@gemtec.ca

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APPENDIX B

Record of Test Pit Sheets
List of Abbreviations and Symbols

ABBREVIATIONS AND TERMINOLOGY USED ON RECORDS OF BOREHOLES AND TEST PITS

SAMPLE TYPES	
AS	Auger sample
CA	Casing sample
CS	Chunk sample
BS	Borros piston sample
GS	Grab sample
MS	Manual sample
RC	Rock core
SS	Split spoon sampler
ST	Slotted tube
TO	Thin-walled open shelby tube
TP	Thin-walled piston shelby tube
WS	Wash sample

SOIL TESTS	
w	Water content
PL, w_p	Plastic limit
LL, w_L	Liquid limit
C	Consolidation (oedometer) test
D_R	Relative density
DS	Direct shear test
G_S	Specific gravity
M	Sieve analysis for particle size
MH	Combined sieve and hydrometer (H) analysis
MPC	Modified Proctor compaction test
SPC	Standard Proctor compaction test
OC	Organic content test
UC	Unconfined compression test
γ	Unit weight

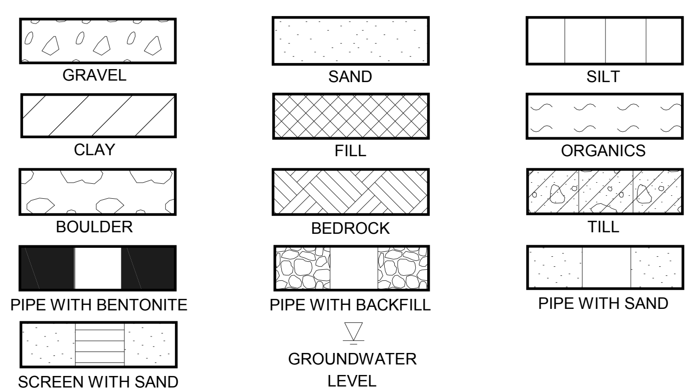
PENETRATION RESISTANCE

Standard Penetration Resistance, N
The number of blows by a 63.5 kg (140 lb) hammer dropped 760 millimetres (30 in.) required to drive a 50 mm split spoon sampler for a distance of 300 mm (12 in.). For split spoon samples where less than 300 mm of penetration was achieved, the number of blows is reported over the sampler penetration in mm.

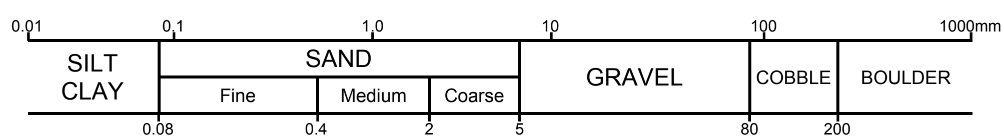
Dynamic Penetration Resistance
The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) to drive a 50 mm (2 in.) diameter 60° cone attached to ‘A’ size drill rods for a distance of 300 mm (12 in.).

WH	Sampler advanced by static weight of hammer and drill rods
WR	Sampler advanced by static weight of drill rods
PH	Sampler advanced by hydraulic pressure from drill rig
PM	Sampler advanced by manual pressure

COHESIONLESS SOIL Compactness		COHESIVE SOIL Consistency	
SPT N-Values	**Description**	**Cu, kPa**	**Description**
0-4	Very Loose	0-12	Very Soft
4-10	Loose	12-25	Soft
10-30	Compact	25-50	Firm
30-50	Dense	50-100	Stiff
>50	Very Dense	100-200	Very Stiff
		>200	Hard



GRAIN SIZE



DESCRIPTIVE TERMINOLOGY
(Based on the CANFEM 4th Edition)

0 – 10	10 – 20	20 – 35	35 –
TRACE	SOME	ADJECTIVE	noun > 35% and main fraction
trace clay, etc	some gravel, etc.	silty, etc.	sand and gravel, etc.

LITHOLOGICAL AND GEOTECHNICAL ROCK DESCRIPTION TERMINOLOGY

WEATHERING STATE	
Fresh	No visible sign of rock material weathering
Faintly weathered	Weathering limited to the surface of major discontinuities
Slightly weathered	Penetrative weathering developed on open discontinuity surfaces but only slight weathering of rock material
Moderately weathered	Weathering extends throughout the rock mass but the rock material is not friable
Completely weathered	Rock is wholly decomposed and in a friable condition but the rock and structure are preserved

CORE CONDITION
Total Core Recovery (TCR) The percentage of solid drill core recovered regardless of quality or length, measured relative to the length of the total core run
Solid Core Recovery (SCR) The percentage of solid drill core, regardless of length, recovered at full diameter, measured relative to the length of the total core run.
Rock Quality Designation (RQD) The percentage of solid drill core, greater than 100 mm length, as measured along the centerline axis of the core, relative to the length of the total core run. RQD varies from 0% for completed broken core to 100% for core in solid segments.

BEDDING THICKNESS	
Description	**Thickness**
Thinly laminated	< 6 mm
Laminated	6 - 20 mm
Very thinly bedded	20 - 60 mm
Thinly bedded	60 - 200 mm
Medium bedded	200 - 600 mm
Thickly bedded	600 - 2000 mm
Very thickly bedded	2000 - 6000 mm

DISCONTINUITY SPACING	
Description	**Spacing**
Very close	20 - 60 mm
Close	60 - 200 mm
Moderate	200 - 600 mm
Wide	600 -2000 mm
Very wide	2000 - 6000 mm

ROCK QUALITY	
RQD	**Overall Quality**
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

ROCK COMPRESSIVE STRENGTH	
Comp. Strength, MPa	**Description**
1 - 5	Very weak
5 - 25	Weak
25 - 50	Moderate
50 - 100	Strong
100 - 250	Very strong

RECORD OF TEST PIT 22-01

CLIENT: Tartan Homes Corporation
PROJECT: Geotechnical Investigation-Block 175 Shea Road and Cosanti Drive
JOB#: 102166.001
LOCATION: Shea Rd/Cosanti Dr, Ottawa, Ontario

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Sep 13 2022

DEPTH SCALE METRES	SOIL PROFILE: DESCRIPTION	ELEV. DEPTH (m)	SAMPLE NUMBER	SAMPLE TYPE	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface	105.1				
	Dark brown SILTY CLAY with roots and rootlets (TOPSOIL)		1	GS		Backfilled with excavated soil
	Light brown SANDY SILT, some clay	104.8 0.3	2	GS	MH	
	Brown to grey sand and silt, some clay, trace gravel, occasional cobbles and boulders (GLACIAL TILL)	104.4 0.7	3	GS	MH	
1						
	Test Pit terminated on inferred bedrock	103.2 1.9				
2						
3						
4						
5						

SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

GEMTEC CONSULTING ENGINEERS AND SCIENTISTS

LOGGED: TAM
CHECKED: L.A

RECORD OF TEST PIT 22-02

CLIENT: Tartan Homes Corporation
PROJECT: Geotechnical Investigation-Block 175 Shea Road and Cosanti Drive
JOB#: 102166.001
LOCATION: Shea Rd/Cosanti Dr, Ottawa, Ontario

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Sep 13 2022

DEPTH SCALE METRES	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLE NUMBER	SAMPLE TYPE	SHEAR STRENGTH (Cu), kPA + NATURAL ⊕ REMOULDED / WATER CONTENT, % W_P — W — W_L (10 20 30 40 50 60 70 80 90)	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface		104.8					
	Dark brown SILTY CLAY with roots and rootlets (TOPSOIL)		104.5 / 0.3	1	GS			Standing water observed at bottom of test pit, backfilled with excavated soil
	Light brown SILTY SAND with rootlets, trace to some gravel		104.1 / 0.8	2	GS			
	Brown to grey SILTY SAND, trace gravel, trace clay		103.3 / 1.5	3	GS		MH	
1								
	Test Pit terminated on inferred bedrock							
2								
3								
4								
5								

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
22/09/13	1.4 ∇	103.49

GEMTEC
CONSULTING ENGINEERS AND SCIENTISTS

LOGGED: TAM
CHECKED: L.A

RECORD OF TEST PIT 22-03

CLIENT: Tartan Homes Corporation
PROJECT: Geotechnical Investigation-Block 175 Shea Road and Cosanti Drive
JOB#: 102166.001
LOCATION: Shea Rd/Cosanti Dr, Ottawa, Ontario

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Sep 13 2022

DEPTH SCALE METRES	DESCRIPTION (SOIL PROFILE)	ELEV. DEPTH (m)	SAMPLE NUMBER	SAMPLE TYPE	SHEAR STRENGTH (Cu), kPA + NATURAL ⊕ REMOULDED / WATER CONTENT, % W_P W W_L (10 20 30 40 50 60 70 80 90)	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface	104.5					
	Dark brown SILTY CLAY with roots and rootlets (TOPSOIL)		1	GS			Standing water observed at bottom of test pit, backfilled with excavated soil
	Light brown SILTY SAND, trace gravel, occasional cobbles	104.2 0.3	2	GS			
	Brown to grey CLAYEY SILT, trace sand, trace gravel	103.9 0.6	3	GS			
1	Test Pit terminated on inferred bedrock	103.4 1.1					
2							
3							
4							
5							

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
22/09/13	1.0 ∇	103.51

GEMTEC
CONSULTING ENGINEERS AND SCIENTISTS

LOGGED: TAM
CHECKED: L.A

RECORD OF TEST PIT 22-04

CLIENT: Tartan Homes Corporation
PROJECT: Geotechnical Investigation-Block 175 Shea Road and Cosanti Drive
JOB#: 102166.001
LOCATION: Shea Rd/Cosanti Dr, Ottawa, Ontario

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Sep 13 2022

DEPTH SCALE METRES	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLE NUMBER	SAMPLE TYPE	SHEAR STRENGTH (Cu), kPA + NATURAL ⊕ REMOULDED / WATER CONTENT, % Wp W WL (10 20 30 40 50 60 70 80 90)	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface		104.5					
	Dark brown SILTY CLAY with roots and rootlets (TOPSOIL)		104.2 0.3	1	GS			Standing water observed at bottom of test pit, backfilled with excavated soil
	Light brown SILTY SAND with rootlets, occasional cobbles		103.4 1.1	2	GS			
1	Test Pit terminated on inferred bedrock							
2								
3								
4								
5								

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
22/09/13	1.0 ∇	103.51

GEMTEC
CONSULTING ENGINEERS AND SCIENTISTS

LOGGED: TAM
CHECKED: L.A

RECORD OF TEST PIT 22-05

CLIENT: Tartan Homes Corporation
PROJECT: Geotechnical Investigation-Block 175 Shea Road and Cosanti Drive
JOB#: 102166.001
LOCATION: Shea Rd/Cosanti Dr, Ottawa, Ontario

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Sep 13 2022

DEPTH SCALE METRES	DESCRIPTION	ELEV. / DEPTH (m)	SAMPLE NUMBER	SAMPLE TYPE	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface	104.7			
	Dark brown SILTY CLAY with roots and rootlets (TOPSOIL)	104.3 / 0.4	1	GS	Standing groundwater observed at bottom of test pit, backfilled with excavated soil
	Light brown SILTY SAND, trace to some gravel (FILL MATERIAL)	104.0 / 0.8	2	GS	
1	Grey sandy silt, trace clay, some gravel, some cobbles, occasional boulders (GLACIAL TILL)	103.2 / 1.5	3	GS	∇
	Test Pit terminated on inferred bedrock				
2					
3					
4					
5					

SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

ADDITIONAL LAB. TESTING

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
22/09/13	1.3 ∇	103.43

GEMTEC
CONSULTING ENGINEERS AND SCIENTISTS

LOGGED: TAM
CHECKED: L.A

RECORD OF TEST PIT 22-06

CLIENT: Tartan Homes Corporation
PROJECT: Geotechnical Investigation-Block 175 Shea Road and Cosanti Drive
JOB#: 102166.001
LOCATION: Shea Rd/Cosanti Dr, Ottawa, Ontario

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Sep 13 2022

DEPTH SCALE METRES	SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)	SAMPLE NUMBER	SAMPLE TYPE	SHEAR STRENGTH (Cu), kPA + NATURAL ⊕ REMOULDED / WATER CONTENT, % W_P W W_L (10 20 30 40 50 60 70 80 90)	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface	104.4					
	Dark brown SILTY CLAY with roots and rootlets (TOPSOIL)	104.1 / 0.3	1	GS			Low rate of groundwater seepage observed at bottom of test pit, backfilled with excavated soil
	Light brown SAND with rootlets, some silt, trace gravel	103.8 / 0.6	2	GS		M	
	Brown to grey silt, some clay, trace sand, trace gravel, occasional boulders (GLACIAL TILL)	103.5 / 0.9	3	GS		MH	∇
1	Test Pit terminated on inferred bedrock						
2							
3							
4							
5							

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
22/09/13	0.9 ∇	103.48

GEMTEC
Consulting Engineers and Scientists

LOGGED: TAM
CHECKED: L.A

RECORD OF TEST PIT 22-07

CLIENT: Tartan Homes Corporation
PROJECT: Geotechnical Investigation-Block 175 Shea Road and Cosanti Drive
JOB#: 102166.001
LOCATION: Shea Rd/Cosanti Dr, Ottawa, Ontario

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Sep 13 2022

DEPTH SCALE METRES	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLE NUMBER	SAMPLE TYPE	SHEAR STRENGTH (Cu), kPA + NATURAL ⊕ REMOULDED / WATER CONTENT, % W_P — W — W_L (10 20 30 40 50 60 70 80 90)	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface		104.6					
	Dark brown SILTY CLAY with roots and rootlets (TOPSOIL)		104.3 0.3	1	GS			Backfilled with excavated soil
	Light brown SILTY SAND, trace gravel		104.0 0.6	2	GS		M	
	Brown to grey SILT, trace sand, trace clay		103.7 0.9	3	GS			
1	Test Pit terminated on inferred bedrock							
2								
3								
4								
5								

GEO - TESTPIT LOG 102166.001 TEST PITS SEP 13 2022.GPJ GEMTEC 2018.GDT 10/13/22

GEMTEC
CONSULTING ENGINEERS AND SCIENTISTS

LOGGED: TAM
CHECKED: L.A

RECORD OF TEST PIT 22-08

CLIENT: Tartan Homes Corporation
PROJECT: Geotechnical Investigation-Block 175 Shea Road and Cosanti Drive
JOB#: 102166.001
LOCATION: Shea Rd/Cosanti Dr, Ottawa, Ontario

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Sep 13 2022

DEPTH SCALE METRES	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLE NUMBER	SAMPLE TYPE	SHEAR STRENGTH (Cu), kPA (+ NATURAL ⊕ REMOULDED) / WATER CONTENT, % (WP W WL) 10 20 30 40 50 60 70 80 90	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface		104.2					
	Dark brown SILTY CLAY with roots and rootlets (TOPSOIL)		103.9 / 0.3	1	GS			Standing water observed at bottom of test pit, backfilled with excavated soil
	Light brown to grey SILTY SAND		103.5 / 0.7	2	GS			
1	Brown to grey SILT, trace sand, trace clay		102.3 / 1.9	3	GS			
2	Brown to grey silt, some clay, trace sand, trace gravel (Probable GLACIAL TILL)		102.0 / 2.2					∇
	Test Pit terminated on inferred bedrock							
3								
4								
5								

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
22/09/13	2.2 ∇	102.03

GEMTEC Consulting Engineers and Scientists

LOGGED: TAM
CHECKED: L.A

RECORD OF TEST PIT 22-09

CLIENT: Tartan Homes Corporation
PROJECT: Geotechnical Investigation-Block 175 Shea Road and Cosanti Drive
JOB#: 102166.001
LOCATION: Shea Rd/Cosanti Dr, Ottawa, Ontario

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Sep 13 2022

DEPTH SCALE METRES	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLE NUMBER	SAMPLE TYPE	SHEAR STRENGTH (Cu), kPA (+ NATURAL ⊕ REMOULDED) / WATER CONTENT, % (W_P — W — W_L) 10 20 30 40 50 60 70 80 90	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface		104.6					
	Dark brown SILTY CLAY with roots and rootlets (TOPSOIL)		104.4 / 0.3	1	GS			Backfilled with excavated soil
	Light brown SILTY SAND, frequent cobbles (FILL MATERIAL)		104.1 / 0.5	2	GS			
	Brown to grey SILT, trace sand, trace clay, frequent cobbles (FILL MATERIAL)		103.8 / 0.8	3	GS			
	Test Pit terminated on inferred bedrock							
1								
2								
3								
4								
5								

GEMTEC Consulting Engineers and Scientists

LOGGED: TAM
CHECKED: L.A

RECORD OF TEST PIT 22-10

CLIENT: Tartan Homes Corporation
PROJECT: Geotechnical Investigation-Block 175 Shea Road and Cosanti Drive
JOB#: 102166.001
LOCATION: Shea Rd/Cosanti Dr, Ottawa, Ontario

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Sep 13 2022

DEPTH SCALE METRES	SOIL PROFILE – DESCRIPTION	ELEV. DEPTH (m)	SAMPLE NUMBER	SAMPLE TYPE	SHEAR STRENGTH (Cu), kPA (+ NATURAL ⊕ REMOULDED) / WATER CONTENT, % (W_P — W — W_L)	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface	104.0					
	Dark brown SILTY CLAY with roots and rootlets (TOPSOIL)	103.7 0.3	1	GS			Backfilled with excavated soil
	Light brown SILTY SAND	103.5 0.5	2	GS			
1	Brown SILT, trace sand, trace clay	102.0 2.0	3	GS		MH	
2	Grey SILT, trace sand, trace clay	101.1 2.9	4	GS			
3	Test Pit terminated on inferred bedrock						
4							
5							

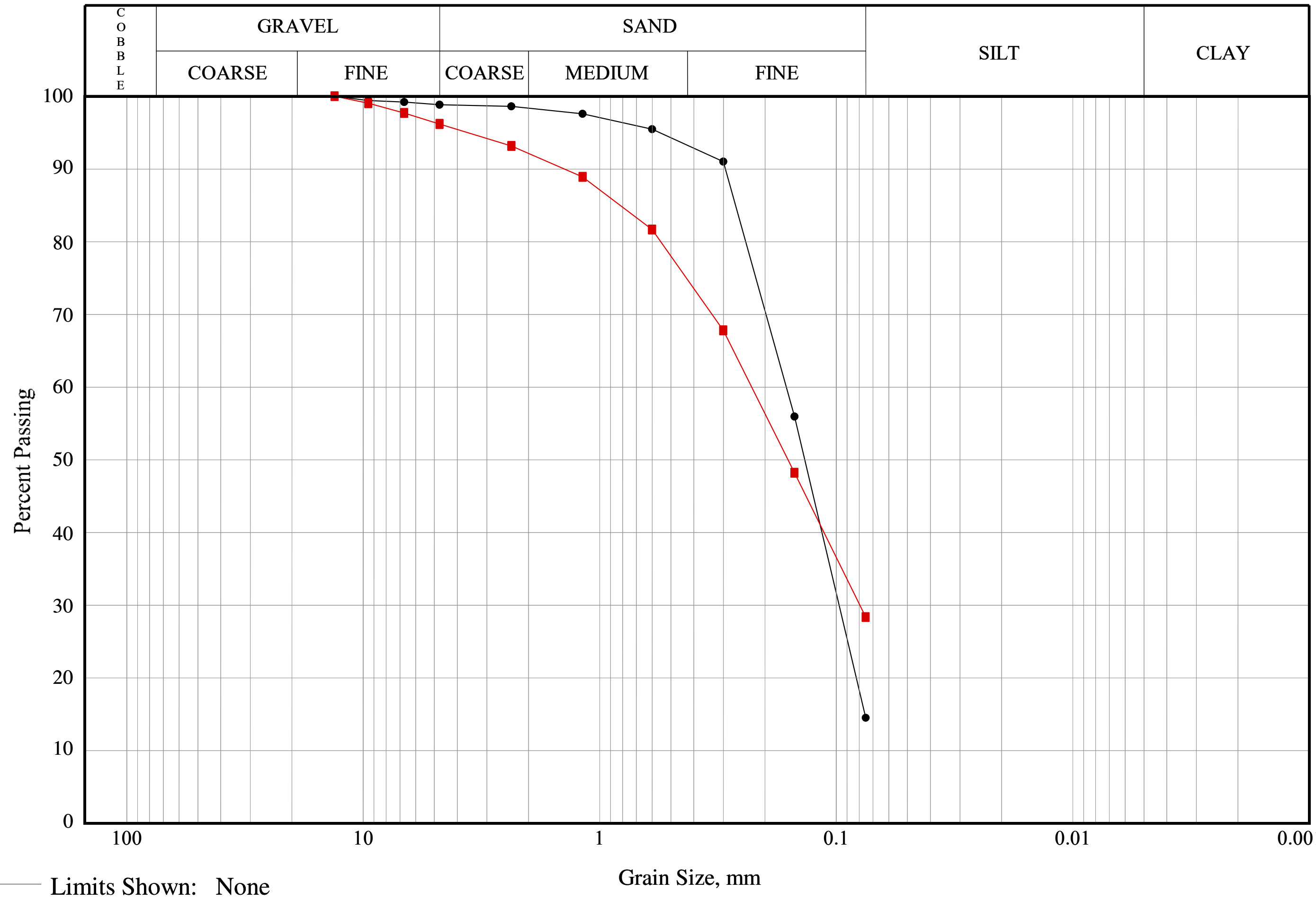
GEMTEC
CONSULTING ENGINEERS AND SCIENTISTS

LOGGED: TAM
CHECKED: L.A

APPENDIX C

Laboratory Analysis

GEMTEC Consulting Engineers and Scientists	Client: Tartan Homes Corporation	# Soils Grading Chart
	Project: Geotechnical Investigation-Block 175 Shea Road and Co	
	Project #: 102166001	

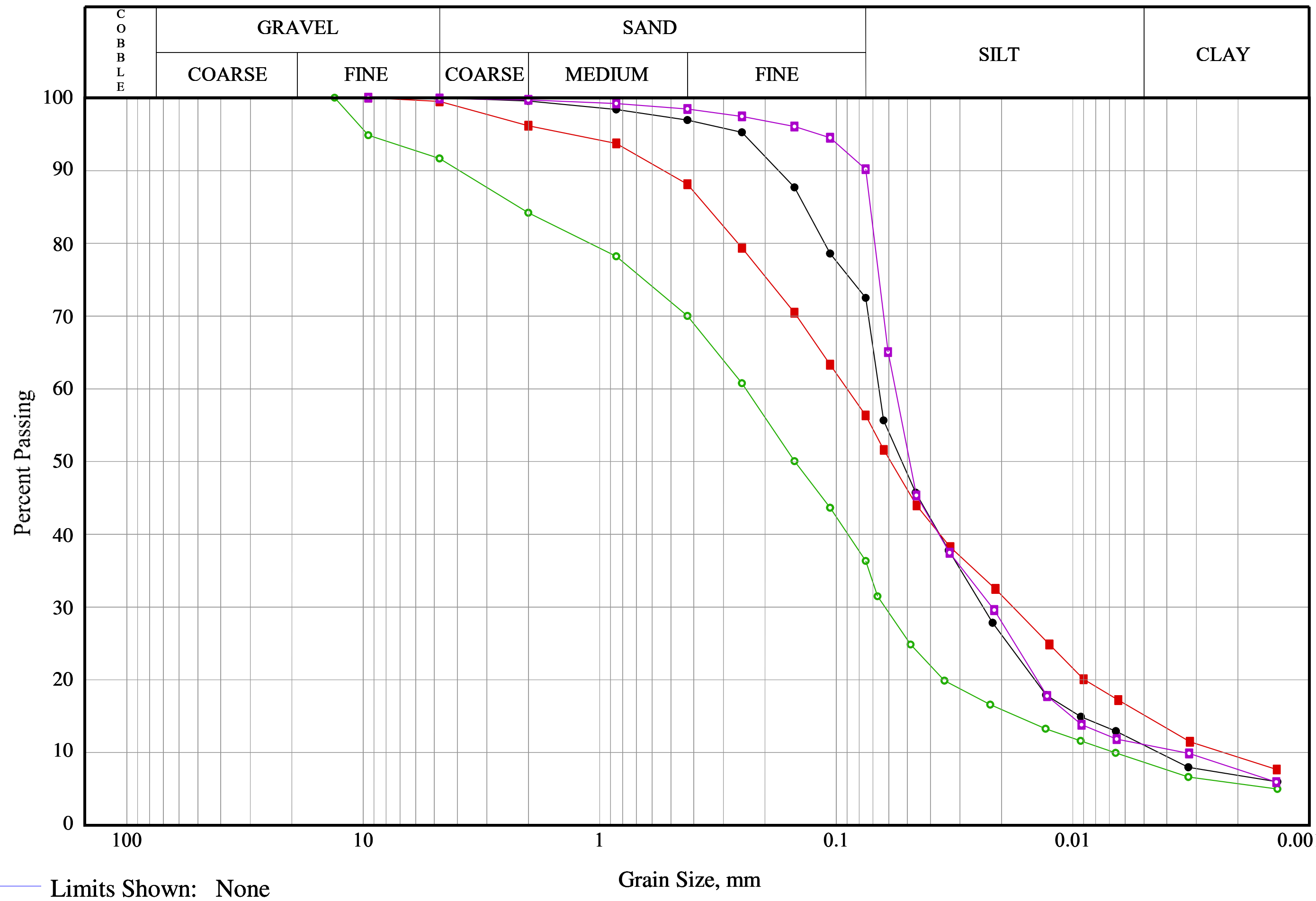


Limits Shown: None

Line Symbol	Sample	Borehole/ Test Pit	Sample Number	Depth	% Cob.+ Gravel	% Sand	% Silt	% Clay
black circle		TP 22-06	GS2	0.25-0.55m	1.2	84.3	14.5	
red square		TP 22-07	GS2	0.3-0.55	3.8	67.8	28.4	

Line Symbol	CanFEM Classification	USCS Symbol	D_{10}	D_{15}	D_{30}	D_{50}	D_{60}	D_{85}	% 5-75µm
black circle	Sand , some silt , trace gravel	N/A	---	0.08	0.10	0.14	0.16	0.27	---
red square	Silty sand , trace gravel	N/A	---	---	0.08	0.16	0.23	0.82	---

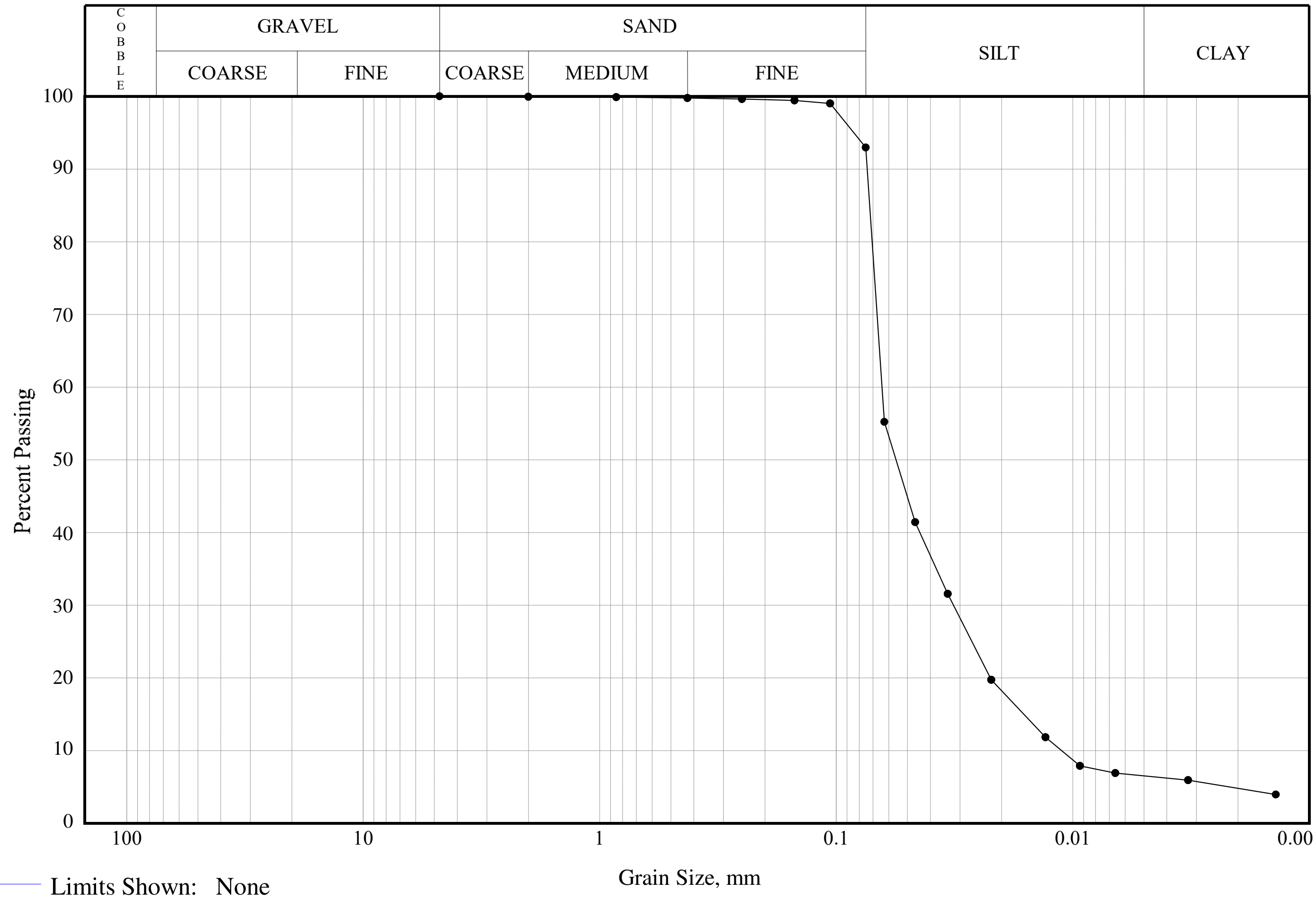
GEMTEC Consulting Engineers and Scientists	Client: Tartan Homes Corporation	Soils Grading Chart (LS-702/ ASTM D-422)
	Project: Geotechnical Investigation-Block 175 Shea Road and Co	
	Project #: 102166001	



Line Symbol	Sample	Borehole/ Test Pit	Sample Number	Depth	% Cob.+ Gravel	% Sand	% Silt	% Clay
black circle		TP 22-01	GS2	0.3-0.7m	0.0	27.5	61.5	11.0
red square		TP 22-01	GS3	0.7-1.9m	0.5	43.2	41.2	15.2
green open circle		TP 22-02	GS3	0.7-1.5m	8.3	55.3	27.7	8.7
purple open square		TP 22-06	GS3	0.55-0.8m	0.1	9.7	79.1	11.1

Line Symbol	CanFEM Classification	USCS Symbol	D_{10}	D_{15}	D_{30}	D_{50}	D_{60}	D_{85}	% 5-75µm
black circle	Sandy silt , some clay	N/A	0.00	0.01	0.02	0.05	0.07	0.14	61.5
red square	Sand and silt , some clay , trace gravel	N/A	0.00	0.00	0.02	0.06	0.09	0.35	41.2
green open circle	Silty sand , trace gravel, trace clay	N/A	0.01	0.02	0.06	0.15	0.24	2.20	27.7
purple open square	Silt , some clay , trace gravel, trace sand	N/A	0.00	0.01	0.02	0.05	0.06	0.07	79.1

GEMTEC Consulting Engineers and Scientists	Client: Tartan Homes Corporation Project: Geotechnical Investigation-Block 175 Shea Road and Co Project #: 102166001	Soils Grading Chart (LS-702/ ASTM D-422)



Limits Shown: None

Line Symbol	Sample	Borehole/ Test Pit	Sample Number	Depth	% Cob.+ Gravel	% Sand	% Silt	% Clay
—●—		TP 22-10	GS3	1.0-1.2m	0.0	7.0	86.4	6.5

Line Symbol	CanFEM Classification	USCS Symbol	D_{10}	D_{15}	D_{30}	D_{50}	D_{60}	D_{85}	% 5-75µm
—●—	Silt , trace sand, trace clay	N/A	0.01	0.02	0.03	0.06	0.06	0.07	86.4

APPENDIX D

Test Pit Photos

TP22-01

GEMTEC Consulting Engineers and Scientists 32 Steacie Drive, Ottawa, ON K2K 2A9 T: (613) 836-1422 | www.gemtec.ca | Ottawa@gemtec.ca	Project Block 175, Shea Rd/Cosanti Drive				
	Drwn By O.E.	Chkd By L.A..	Date September 13, 2022	Project No. 102166.001	**FIGURE D1**

TP22-02

GEMTEC
CONSULTING ENGINEERS AND SCIENTISTS
32 Steacie Drive, Ottawa, ON K2K 2A9
T: (613) 836-1422 | www.gemtec.ca | Ottawa@gemtec.ca

Project				
Block 175, Shea Rd/Cosanti Drive				
Drwn By	Chkd By	Date	Project No.	FIGURE D2
O.E.	L.A..	September 13, 2022	102166.001	

TP22-03

GEMTEC
Consulting Engineers and Scientists

32 Steacie Drive, Ottawa, ON K2K 2A9
T: (613) 836-1422 | www.gemtec.ca | Ottawa@gemtec.ca

Project				
Block 175, Shea Rd/Cosanti Drive				
Drwn By	Chkd By	Date	Project No.	
O.E.	L.A..	September 13, 2022	102166.001	**FIGURE D3**

TP22-04

GEMTEC Consulting Engineers and Scientists 32 Steacie Drive, Ottawa, ON K2K 2A9 T: (613) 836-1422 | www.gemtec.ca | Ottawa@gemtec.ca	Project Block 175, Shea Rd/Cosanti Drive				
	Drwn By O.E.	Chkd By L.A..	Date September 13, 2022	Project No. 102166.001	**FIGURE D4**

TP22-05

GEMTEC Consulting Engineers and Scientists 32 Steacie Drive, Ottawa, ON K2K 2A9 T: (613) 836-1422 | www.gemtec.ca | Ottawa@gemtec.ca	Project: Block 175, Shea Rd/Cosanti Drive			
Drwn By: O.E.	Chkd By: L.A..	Date: September 13, 2022	Project No.: 102166.001	**FIGURE D5**

TP22-06

GEMTEC
CONSULTING ENGINEERS AND SCIENTISTS

32 Steacie Drive, Ottawa, ON K2K 2A9
T: (613) 836-1422 | www.gemtec.ca | Ottawa@gemtec.ca

Project				
Block 175, Shea Rd/Cosanti Drive				
Drwn By	Chkd By	Date	Project No.	FIGURE D6
O.E.	L.A..	September 13, 2022	102166.001	

TP22-07

GEMTEC
CONSULTING ENGINEERS AND SCIENTISTS

32 Steacie Drive, Ottawa, ON K2K 2A9
T: (613) 836-1422 | www.gemtec.ca | Ottawa@gemtec.ca

Project				
Block 175, Shea Rd/Cosanti Drive				
Drwn By	Chkd By	Date	Project No.	FIGURE D7
O.E.	L.A..	September 13, 2022	102166.001	

TP22-08

GEMTEC Consulting Engineers and Scientists 32 Steacie Drive, Ottawa, ON K2K 2A9 T: (613) 836-1422 | www.gemtec.ca | Ottawa@gemtec.ca	Project: Block 175, Shea Rd/Cosanti Drive				
	Drwn By: O.E.	Chkd By: L.A..	Date: September 13, 2022	Project No.: 102166.001	FIGURE D8

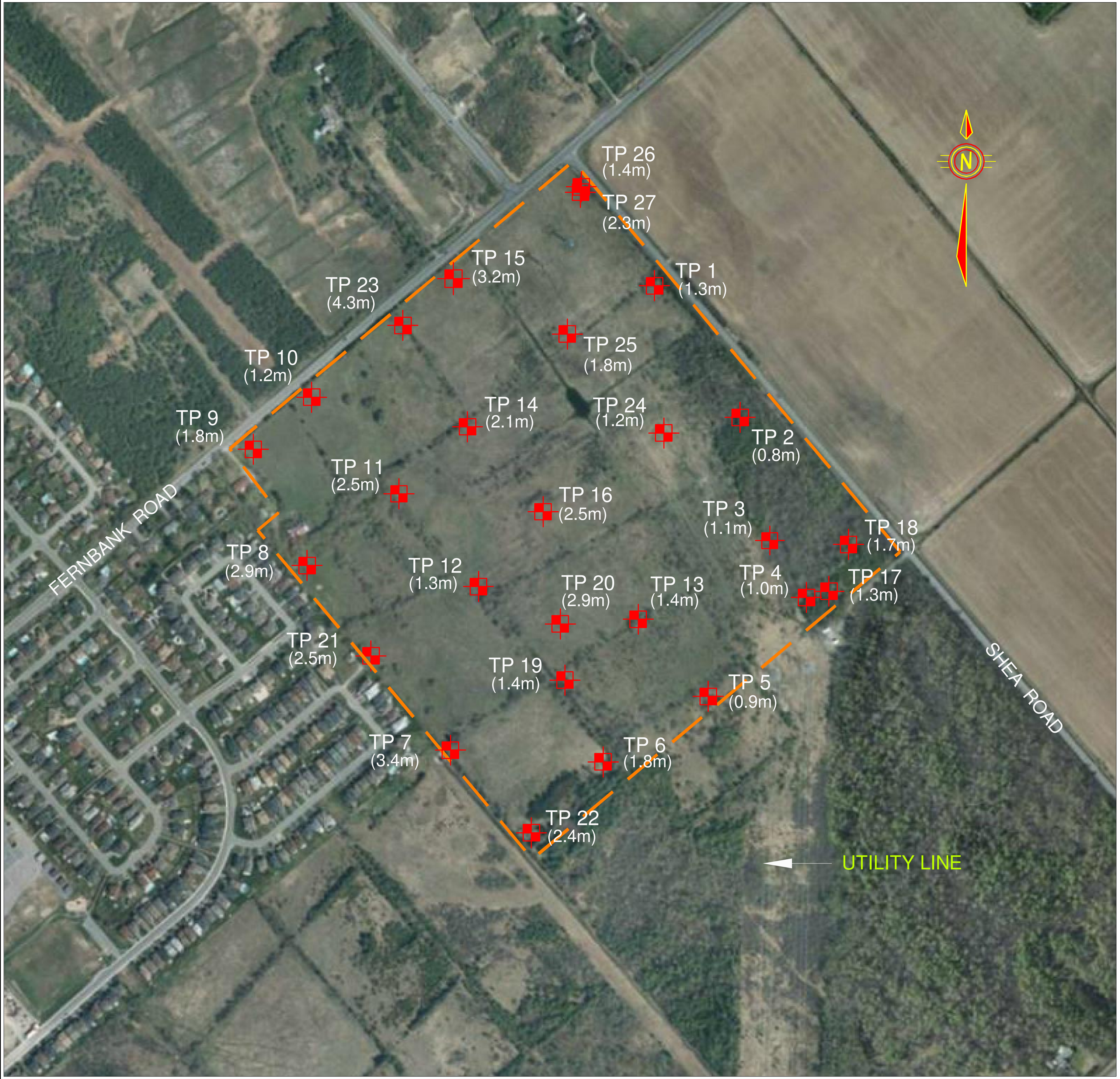
TP22-10

GEMTEC
CONSULTING ENGINEERS AND SCIENTISTS
32 Steacie Drive, Ottawa, ON K2K 2A9
T: (613) 836-1422 | www.gemtec.ca | Ottawa@gemtec.ca

Project				
Block 175, Shea Rd/Cosanti Drive				
Drwn By: O.E.	Chkd By: L.A..	Date: September 13, 2022	Project No.: 102166.001	FIGURE D10

APPENDIX E

Previous Test Pit Logs



LEGEND

TP 1 (1.8) — APPROXIMATE TEST PIT LOCATION IN PLAN, CURRENT INVESTIGATION BY HOULE CHEVRIER ENGINEERING LTD.
DEPTH OF BEDROCK BELOW GROUND SURFACE.

— — APPROXIMATE PROPERTY BOUNDARY

Client	TARTAN HOMES LTD.		Location	FERNBANK ROAD STITTSVILLE, ON.	Revision 0
Drawn by D.J.R		Approved by A.F.C.	Project No. 14-420		Scale 1 : 5,000
Houle Chevrier Engineering			Title	TEST PIT LOCATION PLAN	
			Date	October 2014	FIGURE 2

RECORD OF TEST PIT 1

PROJECT: 14-420
LOCATION: See Test Pit Location Plan, Figure 2
DATE OF EXCAVATION: October 2, 2012

SHEET 1 OF 1
DATUM: Geodetic
TYPE OF EXCAVATOR: Hydraulic Shovel

DEPTH SCALE METRES	SOIL PROFILE – DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLE NUMBER	SHEAR STRENGTH, Cu (kPa) Natural. V - + Remoulded. V - ⊕ (20 40 60 80)	WATER CONTENT (PERCENT) Wp ⊢—○W—⊣ Wl (20 40 60 80)	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface		105.26					
	Topsoil		105.13 / 0.13					
	Brown SILT, trace sand and clay		104.51 / 0.75	1		W ≈ 20	Sieve (See Fig.A1)	
1	Grey brown sandy silt, some gravel (GLACIAL TILL)		103.96 / 1.30	2				
	End of test pit Practical refusal on bedrock Note: Test pit loosely backfilled with excavated material.							Groundwater conditions not observed
2								
3								
4								
5								

DEPTH SCALE
1 to 25

Houle Chevrier Engineering

LOGGED: M.L.
CHECKED:

RECORD OF TEST PIT 2

PROJECT: 14-420

LOCATION: See Test Pit Location Plan, Figure 2

DATE OF EXCAVATION: October 2, 2012

SHEET 1 OF 1

DATUM: Geodetic

TYPE OF EXCAVATOR: Hydraulic Shovel

DEPTH SCALE METRES	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLE NUMBER	SHEAR STRENGTH, Cu (kPa) Natural. V - + Remoulded. V - ⊕ (20 40 60 80)	WATER CONTENT (PERCENT) Wp ⊢ W ⊣ Wl (20 40 60 80)	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface		104.15					
	Topsoil		104.05 0.10					
	Brown SILTY SAND			1		○ (approx. 20)		
	Grey brown silty sand, trace of clay, some gravel, cobbles and boulders (GLACIAL TILL)		103.50 0.65					
	End of test pit Practical refusal on bedrock Note: Test pit loosely backfilled with excavated material.		103.40 0.75					Groundwater conditions not observed
1								
2								
3								
4								
5								

DEPTH SCALE

1 to 25

Houle Chevrier Engineering

LOGGED: M.L.

CHECKED:

RECORD OF TEST PIT 3

PROJECT: 14-420

LOCATION: See Test Pit Location Plan, Figure 2

DATE OF EXCAVATION: October 2, 2012

SHEET 1 OF 1

DATUM: Geodetic

TYPE OF EXCAVATOR: Hydraulic Shovel

DEPTH SCALE METRES	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLE NUMBER	SHEAR STRENGTH, Cu (kPa) Natural. V - + Remoulded. V - ⊕ (20 40 60 80)	WATER CONTENT (PERCENT) Wp —o W— Wl (20 40 60 80)	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface		103.88					
	Topsoil		103.73 0.15					
	Brown SILTY SAND, some gravel							
1			102.78 1.10					
	End of test pit Practical refusal on bedrock Note: Test pit loosely backfilled with excavated material.							Groundwater conditions not observed
2								
3								
4								
5								

DEPTH SCALE

1 to 25

Houle Chevrier Engineering

LOGGED: M.L.

CHECKED:

RECORD OF TEST PIT 4

PROJECT: 14-420

LOCATION: See Test Pit Location Plan, Figure 2

DATE OF EXCAVATION: October 2, 2012

SHEET 1 OF 1

DATUM: Geodetic

TYPE OF EXCAVATOR: Hydraulic Shovel

DEPTH SCALE METRES	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLE NUMBER	SHEAR STRENGTH, Cu (kPa) Natural. V - + Remoulded. V - ⊕ (20 40 60 80)	WATER CONTENT (PERCENT) Wp —o W— Wl (20 40 60 80)	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface		103.82					
	Topsoil		103.67 0.15					
	Grey brown CLAYEY SILT, some sand layers		102.87 0.95	1				
1	End of test pit Practical refusal on bedrock Note: Test pit loosely backfilled with excavated material.							Groundwater conditions not observed
2								
3								
4								
5								

DEPTH SCALE

1 to 25

Houle Chevrier Engineering

LOGGED: M.L.

CHECKED:

RECORD OF TEST PIT 17

PROJECT: 14-420

LOCATION: See Test Pit Location Plan, Figure 2

DATE OF EXCAVATION: October 2, 2012

SHEET 1 OF 1

DATUM: Geodetic

TYPE OF EXCAVATOR: Hydraulic Shovel

DEPTH SCALE METRES	SOIL PROFILE – DESCRIPTION	ELEV. / DEPTH (m)	SAMPLE NUMBER	SHEAR STRENGTH, Cu (kPa) (Natural. V - +; Remoulded. V - ⊕) 20 40 60 80	WATER CONTENT (PERCENT) (Wp ⊢ o W ⊣ Wl) 20 40 60 80	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface	103.71					
	Topsoil	103.61 / 0.10					
	Brown SILTY SAND	103.31 / 0.40	1				
1	Grey brown silty sand, trace clay, some gravel, cobbles and boulders (GLACIAL TILL)	102.41 / 1.30	2		o		
	End of test pit Practical refusal on bedrock Note: Test pit loosely backfilled with excavated material.						Groundwater conditions not observed
2							
3							
4							
5							

DEPTH SCALE

1 to 25

Houle Chevrier Engineering

LOGGED: M.L.

CHECKED:

TESTPIT RECORD 2012 WITH LAB WC 14-420 TESTPITS OCT 2 2012.GPJ 20/10/14

RECORD OF TEST PIT 18

PROJECT: 14-420

LOCATION: See Test Pit Location Plan, Figure 2

DATE OF EXCAVATION: October 2, 2012

SHEET 1 OF 1

DATUM: Geodetic

TYPE OF EXCAVATOR: Hydraulic Shovel

DEPTH SCALE METRES	SOIL PROFILE – DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLE NUMBER	SHEAR STRENGTH, Cu (kPa) Natural. V - + Remoulded. V - ⊕ (20 40 60 80)	WATER CONTENT (PERCENT) Wp —o W— Wl (20 40 60 80)	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface		103.36					
	Topsoil		103.21 0.15					
	Grey brown CLAYEY SILT, some silty sand layers		102.86 0.50	1				
1	Grey brown silty sand, trace clay, some gravel, cobbles and boulders (GLACIAL TILL)		101.66 1.70					
2	End of test pit Practical refusal on bedrock Note: Test pit loosely backfilled with excavated material.							Groundwater conditions not observed
3								
4								
5								

DEPTH SCALE

1 to 25

Houle Chevrier Engineering

LOGGED: M.L.

CHECKED:

PROJECT: 14-420

RECORD OF TEST PIT 24

SHEET 1 OF 1

LOCATION: See Test Pit Location Plan, Figure 2

DATUM: Geodetic

DATE OF EXCAVATION: October 2, 2012

TYPE OF EXCAVATOR: Hydraulic Shovel

DEPTH SCALE METRES	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLE NUMBER	SHEAR STRENGTH, Cu (kPa) Natural. V - + Remoulded. V - ⊕ (20 40 60 80)	WATER CONTENT (PERCENT) Wp —o W— Wl (20 40 60 80)	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface		104.72					
	Topsoil		104.62 0.10					
	Brown SILTY SAND, some gravel		104.02 0.70					
1	Grey brown silty sand, trace clay, some gravel, cobbles and boulders (GLACIAL TILL)		103.52 1.20					
	End of test pit Practical refusal on bedrock Note: Test pit loosely backfilled with excavated material.							Groundwater conditions not observed
2								
3								
4								
5								

DEPTH SCALE

1 to 25

Houle Chevrier Engineering

LOGGED: M.L.

CHECKED:

RECORD OF TEST PIT 25

PROJECT: 14-420

LOCATION: See Test Pit Location Plan, Figure 2

DATE OF EXCAVATION: October 2, 2012

SHEET 1 OF 1

DATUM: Geodetic

TYPE OF EXCAVATOR: Hydraulic Shovel

DEPTH SCALE METRES	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLE NUMBER	SHEAR STRENGTH, Cu (kPa) Natural. V - + Remoulded. V - ⊕ (20 40 60 80)	WATER CONTENT (PERCENT) Wp —o W— Wl (20 40 60 80)	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface		105.17					
	Topsoil		105.07 0.10					
	Brown SILTY SAND							
1			103.77 1.40					
	Grey SILT, some clay, trace sand			1				
			103.37 1.80					
2	End of test pit Practical refusal on bedrock Note: Test pit loosely backfilled with excavated material.							Groundwater conditions not observed
3								
4								
5								

DEPTH SCALE

1 to 25

Houle Chevrier Engineering

LOGGED: M.L.

CHECKED:

TESTPIT RECORD 2012 WITH LAB WC 14-420 TESTPITS OCT 2 2012.GPJ 20/10/14

RECORD OF TEST PIT 16-14

PROJECT: 63900.02

SHEET 1 OF 1

LOCATION: See Test Pit and Borehole Location Plan, Figure 2

DATUM: Geodetic

DATE OF EXCAVATION: August 17, 2016

TYPE OF EXCAVATOR: Hydraulic Shovel

DEPTH SCALE METRES	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLE NUMBER	SHEAR STRENGTH, Cu (kPa) Natural. V - + Remoulded. V - ⊕ (20 40 60 80)	WATER CONTENT (PERCENT) Wp ⊢—○W—⊣ Wl (20 40 60 80)	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface		105.23					
	Dark brown sandy silt, some organic material (TOPSOIL)		104.92 0.31	1				Test pit backfilled with excavated material
	Brown silty sand, some gravel, cobbles and boulders (GLACIAL TILL)		104.34 0.89	2				
	Weathered bedrock		104.26 0.97					
1	Shovel refusal on inferred bedrock End of test pit							Test pit dry upon completion
2								
3								
4								
5								
6								

DEPTH SCALE

1 to 30

Houle Chevrier Engineering

LOGGED: A.N.

CHECKED:

RECORD OF TEST PIT 16-15

PROJECT: 63900.02

SHEET 1 OF 1

LOCATION: See Test Pit and Borehole Location Plan, Figure 2

DATUM: Geodetic

DATE OF EXCAVATION: August 18, 2016

TYPE OF EXCAVATOR: Hydraulic Shovel

DEPTH SCALE METRES	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLE NUMBER	SHEAR STRENGTH, Cu (kPa) Natural. V - + Remoulded. V - ⊕ (20 40 60 80)	WATER CONTENT (PERCENT) Wp ⊢—○W—⊣ Wl (20 40 60 80)	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface		105.02					
	Dark brown sandy silt, some organic material (TOPSOIL)		104.64 0.38	1		○ (~30)		Test pit backfilled with excavated material
	Brown silty sand, some gravel, cobbles and boulders (GLACIAL TILL)		104.28 0.74	2		○ (~10)		
	Shovel refusal on inferred bedrock End of test pit							Test pit dry upon completion
1								
2								
3								
4								
5								
6								

DEPTH SCALE

1 to 30

Houle Chevrier Engineering

LOGGED: A.N.

CHECKED:

RECORD OF TEST PIT 16-16

PROJECT: 63900.02

SHEET 1 OF 1

LOCATION: See Test Pit and Borehole Location Plan, Figure 2

DATUM: Geodetic

DATE OF EXCAVATION: August 18, 2016

TYPE OF EXCAVATOR: Hydraulic Shovel

DEPTH SCALE METRES	SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)	SAMPLE NUMBER	SHEAR STRENGTH, Cu (kPa) Natural. V - + Remoulded. V - ⊕ (20 40 60 80)	WATER CONTENT (PERCENT) Wp ⊢ W ⊣ Wl (20 40 60 80)	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface	103.98					
	Dark brown sandy silt, some organic material (TOPSOIL)	103.70 0.28	1		○ (~53)		Test pit backfilled with excavated material
	Brown SILTY SAND	103.40 0.58	2		○ (~20)		
	Grey brown silty sand, some gravel, with cobbles and boulders (GLACIAL TILL)	103.07 0.91	3		○ (~14)		
1	Shovel refusal on or within inferred bedrock End of test pit						Test pit dry upon completion
2							
3							
4							
5							
6							

DEPTH SCALE

1 to 30

Houle Chevrier Engineering

LOGGED: A.N.

CHECKED:

experience • knowledge • integrity

civil
geotechnical
environmental
structural
field services
materials testing

civil
géotechnique
environnement
structures
surveillance de chantier
service de laboratoire des matériaux

expérience • connaissance • intégrité