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REPORT ON

GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENTIAL DEVELOPMENT
3200 REIDS LANE, OSGOODE
CITY OF OTTAWA, ONTARIO

Project # 210064

Submitted to:

Crestview Innovations Inc.
12 Escade Drive
Nepean, ON
K2G 6R9

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March 2021

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March 16, 2021 210064

Crestview Innovations Inc.
12 Escade Drive
Nepean, ON
K2G 6R9

RE: GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENTIAL SUBDIVISION
3200 REIDS LANE, OSGOODE WARD
CITY OF OTTAWA, ONTARIO

1.0 INTRODUCTION

This report presents the results of a geotechnical investigation carried out for the above noted proposed residential subdivision to be located at 3200 Reids Lane in Osgoode, City of Ottawa, Ontario(see Key Plan, Figure 1). The property is situated north of Osgoode Main Street, and east of the Osgoode Link Pathway. The site is approximately 3.4 hectares in area, and is currently partially vegetated with a mix of trees and brush. It is proposed to develop the property into a seven (7) lot residential subdivision.

The purpose of the investigation was to:

- Identify the subsurface conditions at the site by means of a limited number of boreholes;
- Based on the factual information obtained, provide recommendations and guidelines on the geotechnical engineering aspects of the project design; including bearing capacity and other construction considerations, which could influence design decisions.

2.0 BACKGROUND INFORMATION AND SITE GEOLOGY

2.1 Existing Conditions and Site Geology

The subject site for this assessment consists of about a 3.4 hectare (8.4 acres) irregular shaped property rectangular located north of Osgoode Main Street, south of Lombardy Drive and east of the Osgoode Link Pathway. The property has a civic address known as 3200 Reids Lane, Osgoode, City of Ottawa, Ontario (see Key Plan, Figure 1). An easement for Reids Lane is located along the east boundary of the site.

For the purposes of this assessment, project north lies in a direction perpendicular to Osgoode Main Street which is located south of the subject site.

Surrounding land use is currently a mixture of residential development and farmland. The site is bordered on the north by a residential subdivision, on the east by undeveloped land, on the south by residential dwellings along Osgoode Main Street and on the west by the Osgoode Link Pathway (former railway corridor) followed by scattered residential development and farmland. The site is currently vacant, undeveloped land. The site has been recently cleared of some of the trees.

Based on a review of the surficial geology map for the site area, it is expected that the site is underlain by fine to medium grained sand overlying silty clays or glacial tills. Bedrock geology maps indicate that the bedrock underlying the site consists of dolomite and limestone of the Oxford Formation.

Based on a review of overburden thickness mapping for the site area, the overburden is estimated to be between about 11 to 15 metres in thickness above bedrock.

The ground surface slopes to the northwest. It is expected that regional groundwater flow direction is to the northwest. The Rideau River is located approximately 2 kilometres to the west of the site.

2.2 Proposed Development

It is understood that preliminary plans are being prepared for the construction of a seven (7) lot residential subdivision at the site. The lot sizes will range from about 0.4 to 0.5 hectares and will be serviced by individual wells and septic systems. It is understood that the proposed dwellings will be wood framed and cast-in-place concrete construction with conventional concrete spread footing foundations with basements. The proposed dwellings will be provided with asphaltic concrete driveways.

Surface drainage for the proposed dwellings will be by means of swales and ditches.

3.0 PROCEDURE

The field work for this investigation was carried out on February 3 and 4, 2021 at which time six boreholes numbered BH1 to BH6 inclusive were put down at the site. The approximate locations of the boreholes are shown on the attached Site Plan, Figure 2. The boreholes were advanced using a track mounted drill rig equipped with a 200 mm hollow stem auger owned and operated by CCC Drilling of Ottawa, Ontario.

The boreholes put down during the subsurface investigation were for geotechnical purposes only. Identification of the presence or absence of surface or subsurface contamination was outside the scope of work for the investigation. As such, an environmental technician was not on site for environmental sampling or assessment purposes.

Sampling of the overburden materials encountered at the borehole locations were carried out at regular 0.75 metre depth intervals using a 50 millimetre diameter drive open conventional split spoon sampler in conjunction with standard penetration testing (ASTM D-1586 – Penetration Test and Split Barrel Sampling of Soils) and in situ vane shear testing (ASTM D-2573 Standard Test Method for Field Shear Test in Cohesive Soil). The boreholes were put down throughout the site. The boreholes were advanced to depths of approximately 4.4 to 9.75 metres below the existing ground surface using 200 mm hollow stem augers. Borehole BH1 was continued to a depth of about 14.52 metres below the existing ground surface as a probe hole using dynamic cone penetration testing. The soils were classified using the Unified Soil Classification System.

The subsurface soil conditions encountered at the boreholes were classified based on visual and tactile examination of the samples recovered (ASTM D2488 - Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), standard penetration tests (ASTM D-1586) as well as laboratory test results on select samples. Groundwater conditions at the boreholes were noted at the time of drilling. Groundwater was also measured at a later date in standpipes installed within the boreholes at the time of drilling. The boreholes were loosely backfilled with the auger cuttings upon completion of the fieldwork.

Two soil samples (BH2 - SS9 - 7.62 - 8.22m and BH4 - SS7 - 4.52 - 5.18m) were submitted for Particle Size Analysis (ASTM D422) and one soil sample (BH6 - SS6 - 4.52 - 5.18m) was submitted for Atterberg Limits (D4318) and Moisture Content (ASTM D2216). Sieve analysis (ASTM C136) was performed on three samples (BH1 - SS2 - 0.76 - 1.37m, BH3 - SS2 - 0.76 - 1.37m and BH5 - SS2 - 0.76 - 1.37m). The samples were selected based on depth and tactile examination to be representative of the various soil conditions encountered at the site. A total of 35 soil samples recovered from the boreholes were also tested for moisture content (ASTM D2216). The soils were classified using the Unified Soil Classification System.

One soil sample (BH4 - SS3 - 1.52 - 2.13m) was delivered to a chemical laboratory for testing for any indication of potential soil sulphate attack on concrete and corrosivity to buried steel.

The field work was supervised throughout by a member of our engineering staff who located the boreholes in the field, logged the boreholes and cared for the samples obtained. Descriptions of the subsurface conditions encountered at the boreholes are given in the attached Record of Borehole sheets following this report. The results of the laboratory testing of the soil samples are presented in the Laboratory Test Results section and Attachments A and B following the text in this report. The approximate locations of the boreholes are shown on the attached Site Plan, Figure 2.

The existing ground surface elevation at the borehole locations were derived from GPS Cannet Services.

4.0 SUBSURFACE CONDITIONS

4.1 General

As previously indicated, a description of the subsurface conditions encountered at the boreholes is provided in the attached Record of Borehole Sheets following the text of this report. The borehole logs indicate the subsurface conditions at the specific drill 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 borehole locations may vary from the conditions encountered at the boreholes.

The soil descriptions in this report are based on commonly accepted methods of classification and identification employed in geotechnical practice. Classification was in general completed by visual-manual procedures in accordance with ASTM 2488 - Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) with select samples being classified by laboratory testing in accordance with ASTM 2487. Classifications were confirmed by laboratory testing by test methods conforming to ASTM D4318, ASTM D2216, ASTM C136 and ASTM D422.

Classification and identification of soil involves judgement and Kollaard Associates Inc. does not guarantee descriptions as exact, but infers accuracy to the extent that is common in current geotechnical practice.

The groundwater conditions described in this report refer only to those observed at the location and on the date the observations were noted in the report and on the test hole logs. Groundwater conditions may vary seasonally, or may be affected by construction activities on or in the vicinity of the site.

The following is a brief overview of the subsurface conditions encountered at the boreholes.

4.2 Fill

Fill materials consisting of topsoil and yellow brown sand and gravel was encountered from the surface at boreholes BH1 and BH4. The fill materials had a thicknesses of about 0.4 and 1.15 metres, respectively, at the borehole locations. The fill materials were fully penetrated at the borehole locations.

4.3 Topsoil

About a 0.15 to 0.45 metre thickness of topsoil was encountered below the ground surface at all of the test holes, except boreholes BH1 and BH4 and below the layer of fill materials at BH1 and BH4. The material was classified as topsoil based on the colour and the presence of organic materials. The identification of the topsoil layer is for geotechnical purposes only and does not constitute a statement as to the suitability of this layer for cultivation and sustainable plant growth.

4.4 Sand

A deposit of red brown to grey fine to medium sand was encountered beneath the topsoil and fill materials at all of the boreholes. The deposit of sand ranged in thickness from about 0.7 to 2.96 metres and extended from the underside of the topsoil and fill between about 0.35 to 3.66 metres below the existing ground surface where encountered. The results of the standard penetration tests carried out in the sand gave N values of about 2 to 14 blows per 0.3 metres of penetration, indicating a very loose to compact state of compaction.

The results of a sieve analysis (ASTM C136) on three samples of sand (BH1 - SS2 - 0.76 - 1.37m, BH3 - SS2 - 0.76 - 1.37m and BH5 - SS2 - 0.76 - 1.37m) indicates the samples have the following:

Sample	Depth(metres)	% Gravel	% Sand	% Silt & Clay
BH1	0.76 - 1.37m	0.0	96.5	3.5
BH3	0.76 - 1.37m	0.0	94.9	5.1
BH5	0.76 - 1.37m	0.0	96.7	3.3

The results of the laboratory testing are located in Attachment A.

4.5 Sandy Silty Clay

Beneath the sand deposit, a layer of grey sandy silty clay was encountered at all of the boreholes with the exception of borehole BH1. The deposits of sandy silty clay ranged in thickness from about 0.39 to 1.23 metres and extended from the underside of the sand layer to depths of between about 1.1 to 4.42 metres below the existing ground surface where encountered. The results of standard penetration testing carried out in the sandy silty clay material, indicates a very loose to loose state of packing. The sandy silty clay was fully penetrated at boreholes BH2, BH3 and BH4. Borehole BH5 was terminated within the sandy silty clay at a depth of about 4.42 metres below the existing ground surface.

4.6 Silty Sand

A deposit of grey silty sand was encountered beneath the sandy silty clay at boreholes BH2, BH3, BH4 and BH6. The deposit of silty sand ranged in thickness from about 0.7 to 1.37 metres and extended from the underside of the sandy silty clay to between about 2.3 to 4.72 metres below the existing ground surface where encountered. The results of the standard penetration tests carried out in the sand gave N values of about 18 to 69 blows per 0.3 metres of penetration, indicating a compact to very dense state of compaction.

The results of a hydrometer test (ASTM D422 and D2216) on one sample of soil (BH4 - SS7 4.52 - 5.18m) indicates the sample consists of fine sand with some silt and a trace of clay as follows:

Sample	Depth(metres)	% Gravel	% Sand	% Silt	% Clay
BH4-SS7	4.52 - 5.18m	0.0	85.9	10.1	4.0

The results of the laboratory testing are located in Attachment A.

4.7 Silty Clay

Beneath the sand, sandy silty clay and silty sand, a deposit of grey silty clay was encountered at boreholes BH2, BH4 and BH6. In situ vane shear tests carried out in the silty clay deposit in the boreholes gave undrained shear strength values ranging from about 29 to 68 kilopascals in the boreholes. The results of the in situ vane shear testing and tactile examination carried out for the silty clay material indicate that the silty clay is firm to stiff in consistency.

Borehole BH4 was terminated within the silty clay at a depth of about 9.75 metres below the existing ground surface. The silty clay layer was fully penetrated at both boreholes BH2 and BH6 at depths of 7.15 and 5.64 metres, respectively, below the existing ground surface. The thickness of the silty clay ranged between about 2.6 to 3.3 metres.

The results of Atterberg Limits test and moisture content (ASTM D422) conducted on one soil sample (BH6 – 4.52-5.18 metres) of the silty clay are presented in the following table and in Attachment A at the end of the report. The tested silty clay sample classifies as medium plasticity in accordance with the Unified Soil Classification System.

Table I – Atterberg Limit and Water Content Results

Sample	Depth(metres)	LL (%)	PL (%)	PI (%)	% Moisture
BH6	4.52 - 5.18m	42.4	20.2	22.2	49.4

LL: Liquid Limit PL: Plastic Limit PI: Plasticity Index w: water content
CH: Inorganic Medium Plastic Clays

The results of the laboratory testing are located in Attachment A.

4.6 Glacial Till

A deposit of grey silty sand glacial till was encountered beneath the silty clay at boreholes BH2 and BH6. The glacial till consists of gravel in a matrix of silty sand with some clay, gravel and cobbles. The glacial till was encountered in both boreholes BH2 and BH6 at depths of 7.15 and 5.64 metres, respectively, below the existing ground surface. The results of standard penetration test N values at boreholes BH2 and BH6 ranged from 2 to 57 blows per 0.3 metres of penetration were obtained within the glacial till indicating a very loose to very dense state of packing. Both boreholes were terminated on practical refusal on bedrock at depths between about 8.99 and 6.7 metres, respectively, below the existing ground surface.

The results of a hydrometer test (ASTM D422 and D2216) on a sample of soil (BH2 - SS9- 7.62 - 8.22m) indicate the sample consists of glacial till as follows:

Sample	Depth(metres)	% Gravel	% Sand	% Silt	% Clay
BH2-SS9	7.62 - 8.22m	17.7	32.1	45.8	5.0

The results are located in Attachment A.

4.7 Moisture Contents

A total of 35 soil samples recovered from the boreholes were tested for moisture content (ASTM D2216). The measured moisture contents of the soil samples ranged from about 9 to 89 percent. The results of the moisture content are located on the Record of Borehole sheets following the text of this report.

4.8 Groundwater

Some groundwater seepage was encountered within each of the boreholes at the time of the field work. The groundwater levels ranged from about 0.9 to 1.8 metres below the existing ground surface. On February 12, 2021, groundwater was measured within standpipes installed within boreholes BH1, BH3 and BH5 at depths of about 0.5, 1.4 and 1.7 metres, respectively, below the existing ground surface. It should be noted that the groundwater levels may be higher during wet periods of the year such as the early spring.

4.9 Corrosivity on Reinforcement and Sulphate Attack on Portland Cement

The results of the laboratory testing of a soil sample for submitted for chemistry testing related to corrosivity is summarized in the following table.

Item	**Threshold of Concern**	**Test Result**	**Comment**
Chlorides (Cl)	Cl > 0.04 %	0.00085	Negligible concern
pH	5.0 < pH	7.38	Basic Negligible concern
Resistivity	R < 20,000 ohm-cm	15300	Mildly Corrosive
Sulphates (SO_4)	SO_4 > 0.1%	<0.0020	Negligible concern

The results were compared with Canadian Standards Association (CSA) Standards A23.1 for sulphate attack potential on concrete structures and posses a "negligible" risk for sulphate attack on concrete materials and accordingly, conventional GU or MS Portland cement may be used in the construction of the proposed concrete elements.

The pH value for the soil sample was reported to be at 7.38, indicating a durable condition against corrosion. This value was evaluated using Table 2 of Building Research Establishment (BRE) Digest 362 (July 1991).The pH is greater than 5.5 indicating the concrete will not be exposed to attack from acids.

The chloride content of the sample was also compared with the threshold level and present negligible concrete corrosion potential.

Corrosivity Rating for soils ranges from extremely corrosive to non-corrosive as follows:

Soil Resistivity (ohm-cm)	Corrosivity Rating
> 20,000	non- corrosive
10,000 to 20,000	mildly corrosive
5,000 to 10,000	moderately corrosive
3,000 to 5,000	corrosive
1,000 to 3,000	highly corrosive
< 1,000	extremely corrosive

The Soil resistivity was found to be 15300 ohm-cm for the sample analyzed making the soil mildly corrosive for buried steel. Consideration to increasing the specified strength and/or adding air entrainment into any reinforced concrete in contact with the soil should be given. Consideration should also be given to increasing the minimum concrete cover over reinforcing steel.

Based on the chemical test results, Type GU General use Hydraulic Cement may be used for this proposed development. Special protection is required for reinforcement steel within the concrete walls.

5.0 GEOTECHNICAL GUIDELINES AND RECOMMENDATIONS

5.1 General

This section of the report provides engineering guidelines on the geotechnical design aspects of the project based on our interpretation of the information from the test holes 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 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 at this site or adjacent properties, and/or resulting from the introduction onto the site of materials from offsite sources are outside the terms of reference for this report.

5.2 Foundations for Proposed Residential Buildings

The subsurface conditions at the site encountered at the boreholes advanced during the investigation consisted of some fill materials overlying topsoil or topsoil from the surface overlying fine to medium sand followed by sandy silty clay, then grey silty sand over grey silty clay followed by glacial till with depth. A thin layer of fill materials was encountered in the east portion of the site. Based on the undrained shear strength measurements within the silty clay deposit, the silty clay has a firm to stiff consistency and has some limitations to support loads from footings and grade raise fill.

5.3 Foundation Design and Bearing Capacity

The allowable bearing pressure for any footings depends on the depth of the footings below original ground surface, the width of the footings, and the height above the original ground surface of any landscape grade raise adjacent to the foundations and the thickness of the soils deposit beneath the footings.

With the exception of the fill materials and topsoil, the subsurface conditions encountered at the test holes advanced during the investigation are suitable for the support of the proposed buildings on conventional spread footing foundations placed on a native subgrade or on engineered fill placed on the native subgrade. The excavations for the foundations should be taken through any fill materials, topsoil or otherwise deleterious material to expose the native, undisturbed red brown to grey brown fine to medium sand. It is suggested that the buildings be founded either directly on the underlying red brown fine to medium sand or on engineered fill placed on the red brown fine to medium sand. In the west portion of the site, it is considered that the buildings will likely be required to be placed on engineered pads after the topsoil is removed due to high groundwater levels encountered below the topsoil in those locations.

Strip and pad footings, a minimum 0.5 metres in width bearing on the native undisturbed red brown fine to medium sand at a founding depth of about 0.4 to 0.7 metres below the existing ground surface and above the groundwater level or on a suitably constructed engineering pad placed on the native red brown sand or engineered pad placed on the native grey sand layer and above the ground water level may be designed using a maximum allowable bearing pressure of 75 kilopascals for serviceability limit states and 150 kilopascals for the factored ultimate bearing resistance.

The above allowable bearing pressure is subject to a maximum grade raise of 2.0 metres above the existing ground surface and to maximum strip and pad footing widths of 1.5 metres.

Provided that any loose and/or disturbed soil is removed from the bearing surfaces prior to pouring concrete, the total and differential settlement of the footings should be less than 25 millimetres and 20 millimetres, respectively.

5.4 Engineered Fill

Any fill required to raise the footings for the proposed buildings to founding level should consist of imported granular material (engineered fill). The engineered fill should consist of granular material meeting Ontario Provincial Standards Specifications (OPSS) requirements for Granular A or Granular B Type II and should be compacted in maximum 300 millimetre thick loose lifts to at least 98 percent of the standard Proctor maximum dry density. It is considered that the engineered fill should be compacted using dynamic compaction with a large diameter vibratory steel drum roller or diesel plate compactor. If a diesel plate compactor is used, the lift thickness may need to be restricted to less than 300 mm to achieve proper compaction. Compaction should be verified by a suitable field compaction test method.

To allow the spread of load beneath the footings, the engineered fill should extend out 0.5 metres horizontally from the edges of the footing then down and out at 1 horizontal to 1 vertical, or flatter. The excavations for the proposed residential building should be sized to accommodate this fill placement.

The first lift of engineered fill material should have a thickness of 300 millimetres in order to protect the subgrade during compaction. It is considered that the placement of a geotextile fabric between the engineered fill and the subgrade is not necessary where granular materials meeting the grading requirements for OPSS Granular B Type II or OPSS Granular A are placed on a silty clay subgrade above the normal ground water level. It is recommended that trucks are not used to place the engineered fill on the subgrade. The fill should be dumped at the edge of the excavation and moved into place with a tracked bulldozer or excavator.

The native sandy soils at this site will be sensitive to disturbance from construction operations and from rainwater or snowmelt, and frost. In order to minimize disturbance, construction traffic operating directly on the subgrade should be kept to an absolute minimum and the subgrade should be protected from below freezing temperatures.

5.4.1 Foundation Excavations

Any excavation for the proposed structures will likely be carried out through fill material and topsoil to bear within the native sand subgrade. The sides of the excavations should be sloped in accordance with the requirements of Ontario Regulation 213/91, s. 226 under the Occupational Health and Safety Act. According to the Act, the native soils at the site can be classified as Type 3 soil, however this classification should be confirmed by qualified individuals as the site is excavated and if necessary, adjusted.

Based on the expected depths of excavation for the foundations, it is expected that the side slopes of the excavation will be stable provided the walls are sloped at 1H:1V provided no excavated materials are stockpiled within 2 metres of the top of the excavations.

5.4.2 Ground Water in Excavation and Construction Dewatering

Groundwater inflow from the native soils into the excavations during construction, if any should be handled by pumping from sumps within the excavation.

Groundwater was measured within standpipes installed within boreholes BH1, BH3 and BH5 at depths of about 0.5, 1.4 and 1.7 metres, respectively, below the existing ground surface. Since the soils at the site below the topsoil layer consist of sand or silty sand it is considered that the excavations should not extend below the ground water level. As such a permit to take water is will not be required prior to excavation.

5.4.3 Effect of Dewatering of Foundation or Site Services Excavations on Adjacent Structures

Since the existing ground water level at the site will be below the expected underside of footing elevations, dewatering of the excavation will not remove water from historically saturated soils. As such dewatering of the foundations or site services excavations, if required, will not have a detrimental impact on the adjacent structures.

5.4 Frost Protection Requirements for Spread Footing Foundations

In general, all exterior foundation elements and those in any unheated parts of the proposed buildings should be provided with at least 1.5 metres of earth cover for frost protection purposes. Isolated, unheated foundation elements adjacent to surfaces, which are cleared of snow cover during winter months should be provided with a minimum 1.8 metres of earth cover for frost protection purposes.

Where less than the required depth of soil cover can be provided, the foundation elements should be protected from frost by using a combination of earth cover and extruded polystyrene rigid insulation. A typical frost protection insulation detail could be provided upon request, if required.

5.5 Foundation Wall Backfill and Drainage

The native soils encountered at this site are considered to be slightly frost susceptible. As such, to prevent possible foundation frost jacking due to frost adhesion, the backfill against the foundation walls and isolated walls or piers should consist of free draining, non-frost susceptible material. If imported material is required, it should consist of sand or sand and gravel meeting OPSS Granular B Type I grading requirements. Alternatively, foundations could be backfilled with native material in conjunction with the use of an approved proprietary drainage layer system such as "System Platon" against the foundation wall. It is pointed out that there is potential for possible frost jacking of the upper portion of some types of these drainage layer systems if frost susceptible material is used as backfill. This could be mitigated by backfilling the upper approximately 0.6 metres with non-frost susceptible granular material.

Where the backfill material will ultimately support a pavement structure or walkway, it is suggested that the foundation wall backfill material be compacted in 250 millimetre thick lifts to 95 percent of the standard Proctor dry density value. In that case any native material proposed for foundation backfill should be inspected and approved by the geotechnical engineer.

The basement foundation walls should be designed to resist the earth pressure, P, acting against the walls at any depth, h, calculated using the following equation.

$$P = k_0 (\gamma h + q)$$

Where:	P	=	the pressure, at any depth, h, below the finished ground surface
	k_0	=	earth pressure at-rest coefficient, 0.5
	γ	=	unit weight of soil to be retained, estimated at 22 kN/m^3
	q	=	surcharge load (kPa) above backfill material
	h	=	the depth, in metres, below the finished ground surface at which the pressure, P, is being computed

This expression assumes that the water table would be maintained at the founding level by the above mentioned foundation perimeter drainage and backfill requirements.

A conventional, perforated perimeter drain, with a 150 millimetre surround of 20 millimetre minus crushed stone, should be provided at the founding level for the cast-in-place concrete basement floor slab and should lead by gravity flow to a sump/sump pump. If a sump is used, the sump should be equipped with an emergency backup pump. The sump discharge should be equipped with a backup flow protector.

5.6 Basement Floor Slab Support

As stated above, it is expected that the proposed buildings will be founded on native sand subgrade or on an engineered pad placed on the native sand subgrade. For predictable performance of the proposed concrete basement floor slab all existing fill material, topsoil and any otherwise deleterious material should be removed from below the proposed floor slab area. The exposed native subgrade surface should then be inspected and approved by geotechnical personnel. Any soft areas evident should be subexcavated and replaced with suitable engineered fill. Any fill materials consisting of granular material, removed from the proposed concrete floor slab area, could be stockpiled for possible reuse with approval from the geotechnical engineer.

The fill materials beneath the proposed concrete floor slab on grade should consist of a minimum of 150 millimetre thickness of crushed stone meeting OPSS Granular A immediately beneath the concrete floor slab followed by sand, or sand and gravel meeting the OPSS for Granular B Type I, or crushed stone meeting OPSS grading requirements for Granular B Type II, or other material approved by the Geotechnical Engineer. The fill materials should be compacted in maximum 300 millimetre thick lifts to at least 95 percent of the standard Proctor maximum dry density.

It is common practice to backfill from the underside of footing level to the basement floor slab using clear crushed stone. Since the subgrade soils are expected to consist of sand or silty sand, it is recommended that clear crushed stone not be used as backfill below the concrete floor slab without the use of a Type 1 geotextile fabric between the clearstone and the native subgrade. If clear crushed stone is used, the clear stone should be properly consolidated using several passes with a large diesel plate compactor.

The slab should be structurally independent from walls and columns, which are supported by the foundations. This is to reduce any structural distress that may occur as a result of differential soil movement. If it is intended to place any internal non-load bearing partitions directly on the slab-on-grade, such walls should also be structurally independent from other elements of the building founded on the conventional foundation system so that some relative vertical movement between the floor slab and foundation can occur freely.

The concrete floor slab should be saw cut at regular intervals to minimize random cracking of the slab due to shrinkage of the concrete. The saw cut depth should be about one quarter of the thickness of the slab. The crack control cuts should be placed at a grid spacing not exceeding the lesser of 25 times the slab thickness or 4.5 metres. The slab should be cut as soon as it is possible to work on the slab without damaging the surface of the slab.

5.7 Seismic Design for the Proposed Residential Buildings

5.7.1 Seismic Site Classification

Based on the limited information from the boreholes, for seismic design purposes, in accordance with the 2012 OBC Section 4.1.8.4, Table 4.1.8.4.A., the site classification for seismic site response is Site Class C. The subsurface conditions in the upper 30 metres below the proposed footing design levels are indicated to consist of the following:

Topsoil from the surface followed by sand overlying interlayered sandy silty clay and silty sand then silty clay over glacial till with depth. Practical refusal on the surface of a large boulder or bedrock was encountered at a depth of approximately 14.5 metres below the existing ground surface.

5.7.2 National Building Code Seismic Hazard Calculation

The online 2015 National Building Code Seismic Hazard Calculation was used to verify the seismic conditions at the site. The design Peak Ground Acceleration (PGA) for the site was calculated as 0.302 with a 2% probability of exceedance in 50 years based on the interpolation of the 2015 National Building Code Seismic Hazard calculation. The seismic site classification for the site is indicated to be Seismic Site Class C. The results of the calculation are attached following the text of this report.

5.7.3 Potential for Soil Liquefaction

As indicated above, the results of the boreholes and information from geological maps indicate that the native deposits underlying the site consist of a relatively thin layer of sand followed by interlayered sandy silty clay and sandy silt underlain by silty clay then glacial till and bedrock.

These native soils are not considered to be prone to liquefaction during a seismic event at the degree of compaction and thickness present at the site.

6.0 SITE SERVICES

The proposed development will not be provided with municipal services. As such, site servicing will be limited to the installation of the water service between the drilled well and the proposed dwelling.

6.1 Excavation

The excavations for the site services will be carried out through topsoil, possibly some minor fill materials and native sand, silty sand and sandy silty clay. For the purposes of Ontario Regulation 213/91 the soils at the site can be considered to be Type 3 soil. The sides of the excavations in overburden materials should be sloped in accordance with the requirements in Ontario Regulation 213/91 under the Ontario Occupational Health and Safety Act. That is, open cut excavations with overburden deposits should be carried out with side slopes of 1 horizontal to 1 vertical, or flatter. Where space constraints dictate, the excavation and backfilling operations should be carried out within a tightly fitting, braced steel trench box.

Based on the depths at which groundwater was measured at the time of drilling, significant groundwater flow into any excavation is likely. It is considered, however, that the extent of the excavations on individual lots will be sufficiently shallow that a permit to take water will not be required. However, it is possible that registration under the Environmental Activity and Sector Registry O.Reg 63/16 will be required. Any groundwater inflow into the service trenches should be handled by pumping from sumps from within the excavations.

6.2 Backfill

The service trench should be backfilled in keeping with the usage of the area above the trench. Where no vehicular traffic or hard surfaces are expected, the trenches can be backfilled with native materials compacted with the equipment used to backfill the trench. Where the trench will ultimately support a structure, roadway or sidewalk, the upper portion of the trench should be backfilled with granular fill compacted to a minimum of 95 percent standard proctor maximum dry density.

7.0 ROADWAY PAVEMENTS

7.1 Subgrade Preparation

In preparation for pavement construction at this site any fill and topsoil and any soft, wet or deleterious materials should be removed from the proposed roadway areas. The exposed subgrade surface should then be proof inspected and approved by geotechnical personnel. Based on the results of the boreholes, the subsurface conditions in the roadway areas in general consist of fill and/or topsoil followed by red brown to grey fine to medium sand. Any soft or unacceptable areas evident should be subexcavated and replaced with suitable earth borrow material. The subgrade should be shaped and crowned to promote drainage of the roadway and parking area granulars. Following approval of the preparation of the subgrade, the pavement granulars may be placed.

For any areas of the site that require the subgrade to be raised to proposed roadway subgrade level, the material used should consist of OPSS select subgrade material or OPSS Granular B Type I or Type II. Materials used for raising the subgrade to proposed roadway area subgrade level should be placed in maximum 300 millimetre thick loose lifts and be compacted to at least 95 percent of the standard Proctor maximum dry density using suitable compaction equipment.

If the subgrade surface consists of native fine to medium areas subject to cars and light trucks the pavement should consist of:

40 millimetres of Superpave 12.5 asphaltic concrete over
50 millimetres of Superpave 19 asphaltic concrete over
150 millimetres of OPSS Granular A base over
300 millimetres of OPSS Granular B, Type II subbase over
(50 or 100 millimetre minus crushed stone)

If the subgrade surface consists of existing fill materials:

40 millimetres of Superpave 12.5 asphaltic concrete over
50 millimetres of Superpave 19 asphaltic concrete over
150 millimetres of OPSS Granular A base over
450 millimetres of OPSS Granular B, Type II subbase

Non-woven geotextile fabric (4oz/sy) such as Terrafix 270R or Thrace-Ling 130EX or approved alternative.

Performance grade PG 58-34 asphaltic concrete should be specified. Compaction of the granular pavement materials should be carried out in maximum 300 millimetre thick loose lifts to 100 percent of the standard Proctor maximum dry density value using suitable vibratory compaction equipment.

The above pavement structures will be adequate on an acceptable sub-grade, that is, one where any roadway fill and service trench backfill has been adequately compacted. If the roadway sub-grade is disturbed or wetted due to construction operations or precipitation, the granular thicknesses given above may not be adequate and it may be necessary to increase the thickness of the Granular B Type II subbase and/or incorporate a non-woven geotextile separator between the roadway sub-grade surface and the granular subbase material. The adequacy of the design of the pavement thickness should be assessed by the geotechnical personnel at the time of construction.

8.0 TREES

The upper soils at the site consist of sand, silty sand, sandy silty clay and sandy silt overlying silty clay. The silty clay is of medium plasticity.

In keeping with the City of Ottawa, Tree Planting in Sensitive Marine Clay Soils - 2017 Guidelines small and medium sized trees can be planted as close as 4.5 metres from the proposed dwelling provided sufficient soil volume is available around the proposed tree location. Large trees should be planted no closer than 1 times their height from a proposed dwelling.

9.0 CONSTRUCTION CONSIDERATIONS

It is suggested that the final design drawings for the project, including the proposed site grading plan, be reviewed by the geotechnical engineer to ensure that the guidelines provided in this report have been interpreted as intended and to re-evaluate the guidelines provided in the report with respect to the actual project plans.

The engagement of the services of the geotechnical consultant during construction is recommended to confirm that the subsurface conditions throughout the proposed development do not materially differ from those given in the report and that the construction activities do not adversely affect the intent of the design.

All foundation areas and any engineered fill areas for the proposed residential buildings should be inspected by Kollaard Associates Inc. to ensure that a suitable sub-grade has been reached and properly prepared. The placing and compaction of any granular materials beneath the foundations should be inspected to ensure that the materials used conform to the grading and compaction specifications.

The subgrade for the site services, access roadways and driveway should be inspected and approved by geotechnical personnel. In situ density testing should be carried out on the pavement granular materials to ensure the materials meet the specifications from a compaction point of view.

The native soils at this site will be sensitive to disturbance from construction operations, from rainwater or snow melt, and frost. In order to minimize disturbance, construction traffic operating directly on the subgrade should be kept to an absolute minimum and the subgrade should be protected from below freezing temperatures.

We trust this report provides sufficient information for your present purposes. If you have any questions concerning this report or if we may be of further services to you, please do not hesitate to contact our office.

Regards,
Kollaard Associates Inc.

LICENSED PROFESSIONAL ENGINEER
18.03.2021
S.E. deWit
100079612
PROVINCE OF ONTARIO

Dean Tataryn, B.E.S., EP.

Steve DeWit, P.Eng.

RECORD OF BOREHOLE BH1

PROJECT: Proposed Residential Subdivision
CLIENT: Mr. Miles Yang
LOCATION: 3200 Reids Lane, Osgoode, Ottawa, Ontario
PENETRATION TEST HAMMER: 63.5kg, Drop, 0.76mm

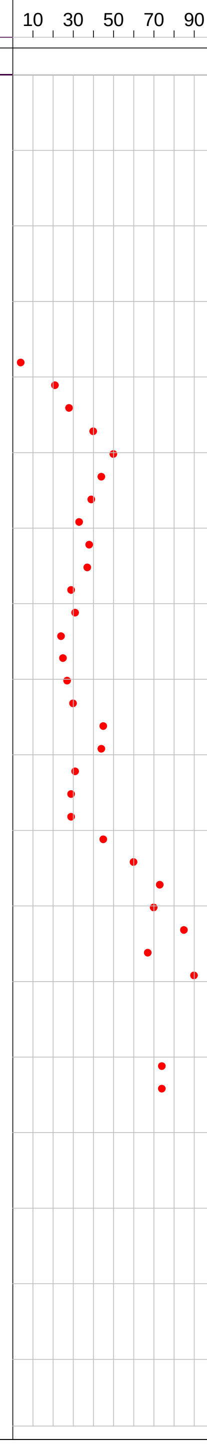
PROJECT NUMBER: 210064
DATE OF BORING: February 10, 2021
SHEET 1 of 1
DATUM: GEODETIC

DEPTH SCALE (meters)	SOIL PROFILE – DESCRIPTION	ELEV. DEPTH (M)	SAMPLE NUMBER	TYPE	BLOWS/0.3m	ADDITIONAL LAB TESTING (%M)
0	Ground Surface	60.35				
	Topsoil (FILL)	0.00	1	SS	31	9
	Yellow brown sand and gravel (FILL)	59.65 / 0.70				
1	TOPSOIL		2	SS	14	
	Red brown fine to medium SAND, trace silt	58.98 / 1.37				
2	Grey fine to medium SAND		3	SS	5	23
			4	SS	12	26
3		56.69	5	SS	9	
4	Borehole continued as Probehole	3.66				
14		45.83				
15	End of Borehole, refusal on large boulder or bedrock	14.52				

UNDIST. SHEAR STRENGTH × Cu, kPa × 20 40 60 80

REM. SHEAR STRENGTH ○ Cu, kPa ○ 20 40 60 80

DYNAMIC CONE PENETRATION TEST blows/300 mm



PIEZOMETER OR STANDPIPE INSTALLATION

Water observed in borehole at approximately 1.5 metres below the existing ground surface on February 4, 2021. Water measured in standpipe at approximately 0.5 metres below the existing ground surface on February 12, 2021.

DEPTH SCALE: 1 to 100
BORING METHOD: Power Auger
AUGER TYPE: 200 mm Hollow Stem
LOGGED: DT
CHECKED: SD

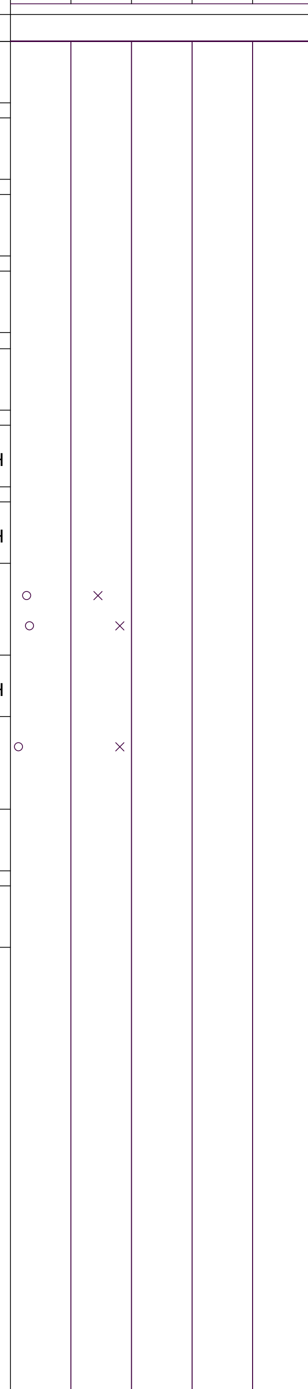
RECORD OF BOREHOLE BH2

PROJECT: Proposed Residential Subdivision
CLIENT: Mr. Miles Yang
LOCATION: 3200 Reids Lane, Osgoode, Ottawa, Ontario
PENETRATION TEST HAMMER: 63.5kg, Drop, 0.76mm

PROJECT NUMBER: 210064
DATE OF BORING: February 4, 2021
SHEET 1 of 1
DATUM: GEODETIC

DEPTH SCALE (meters)	SOIL PROFILE – DESCRIPTION	ELEV. / DEPTH (M)	SAMPLE NUMBER	TYPE	BLOWS/0.3m	ADDITIONAL LAB TESTING (%M)	PIEZOMETER OR STANDPIPE INSTALLATION
	Ground Surface	58.42					
0	TOPSOIL	0.00					
	Grey fine to medium SAND	58.02 / 0.40	1	SS	4	21	
1			2	SS	5		
2	Grey Sandy CLAY, trace silt	56.62 / 1.80	3	SS	7	22	▼ (water level)
	Grey SILTY SAND	55.82 / 2.60	4	SS	5	23	
3			5	SS	18	20	Water observed in borehole at approximately 1.8 metres below the existing ground surface on February 4, 2021.
4	Grey SILTY CLAY	54.56 / 3.86	6	SS	WH	49	
5			7	SS	WH	43	
6			8	SS	WH	58	
7	Grey silty sand, trace to some gravel, cobbles and boulders, trace clay (GLACIAL TILL)	51.27 / 7.15					
8			9	SS	13		
			10	SS	57	11	
9	End of Borehole in Glacial Till	49.43 / 8.99					
10							
11							
12							
13							

UNDIST. SHEAR STRENGTH × Cu, kPa (20, 40, 60, 80)
REM. SHEAR STRENGTH ○ Cu, kPa (20, 40, 60, 80)
DYNAMIC CONE PENETRATION TEST blows/300 mm (10, 30, 50, 70, 90)



DEPTH SCALE: 1 to 75
BORING METHOD: Power Auger
AUGER TYPE: 200 mm Hollow Stem
LOGGED: DT
CHECKED: SD

RECORD OF BOREHOLE BH3

PROJECT: Proposed Residential Subdivision
CLIENT: Mr. Miles Yang
LOCATION: 3200 Reids Lane, Osgoode, Ottawa, Ontario
PENETRATION TEST HAMMER: 63.5kg, Drop, 0.76mm

PROJECT NUMBER: 210064
DATE OF BORING: February 4, 2021
SHEET 1 of 1
DATUM: GEODETIC

DEPTH SCALE (meters)	SOIL PROFILE – DESCRIPTION	STRATA PLOT	ELEV. DEPTH (M)	SAMPLES – NUMBER	SAMPLES – TYPE	SAMPLES – BLOWS/0.3m	UNDIST. SHEAR STRENGTH × Cu, kPa 20 40 60 80 / REM. SHEAR STRENGTH ○ Cu, kPa 20 40 60 80	DYNAMIC CONE PENETRATION TEST blows/300 mm 10 30 50 70 90	ADDITIONAL LAB TESTING %M	PIEZOMETER OR STANDPIPE INSTALLATION
	Ground Surface		57.83							
0	TOPSOIL		0.00							
			57.43	1	SS	2			21	
	Grey fine to medium SAND		0.40							
1			56.73	2	SS	3				
	Grey SANDY SILTY CLAY, trace silt		1.10							
2				3	SS	3			25	
			55.50							
	Grey SILTY SAND		2.33	4	SS	19			25	
			54.94							
3	End of Borehole		2.89							
4										
5										
6										
7										
8										

Water observed in borehole at approximately 0.9 metres below the existing ground surface on February 4, 2021. Water measured in standpipe at approximately 1.4 metres below the existing ground surface on February 12, 2021.

DEPTH SCALE: 1 to 100
BORING METHOD: Power Auger
AUGER TYPE: 200 mm Hollow Stem
LOGGED: DT
CHECKED: SD

RECORD OF BOREHOLE BH4

PROJECT: Proposed Residential Subdivision
CLIENT: Mr. Miles Yang
LOCATION: 3200 Reids Lane, Osgoode, Ottawa, Ontario
PENETRATION TEST HAMMER: 63.5kg, Drop, 0.76mm

PROJECT NUMBER: 210064
DATE OF BORING: February 3, 2021
SHEET 1 of 1
DATUM: GEODETIC

DESCRIPTION	ELEV. (M)	DEPTH (M)	NUMBER	TYPE	BLOWS/0.3m	%M
Ground Surface	50.75					
Topsoil (FILL)		0.00				
Yellow brown sand and gravel (FILL)			1	SS	15	14
TOPSOIL	49.60	1.15	2	SS	13	11
Red brown fine to medium SAND, trace silt						
Grey fine to medium SAND	48.95	1.80	3	SS	6	21
			4	SS	3	25
			5	SS	2	25
Grey Sandy CLAY, trace silt	47.15	3.60	6	SS	2	18
Grey SILTY SAND	46.03	4.72	7	SS	15	19
			8	SS	69	
Grey SILTY CLAY	44.66	6.09	9	SS	12	60
			10	SS	WH	59
			11	SS	1	68
End of Borehole	41.00	9.75				

UNDIST. SHEAR STRENGTH × Cu, kPa (20, 40, 60, 80)
REM. SHEAR STRENGTH ○ Cu, kPa (20, 40, 60, 80)
DYNAMIC CONE PENETRATION TEST blows/300 mm (10, 30, 50, 70, 90)
ADDITIONAL LAB TESTING
PIEZOMETER OR STANDPIPE INSTALLATION

Water observed in borehole at approximately 1.5 metres below the existing ground surface on February 3, 2021.

DEPTH SCALE: 1 to 75
BORING METHOD: Power Auger
AUGER TYPE: 200 mm Hollow Stem
LOGGED: DT
CHECKED: SD

RECORD OF BOREHOLE BH5

PROJECT: Proposed Residential Subdivision
CLIENT: Mr. Miles Yang
LOCATION: 3200 Reids Lane, Osgoode, Ottawa, Ontario
PENETRATION TEST HAMMER: 63.5kg, Drop, 0.76mm

PROJECT NUMBER: 210064
DATE OF BORING: February 3, 2021
SHEET 1 of 1
DATUM: GEODETIC

DEPTH SCALE (meters)	DESCRIPTION	ELEV. DEPTH (M)	NUMBER	TYPE	BLOWS/0.3m	ADDITIONAL LAB TESTING %M
	Ground Surface					
0	TOPSOIL	0.00	1	SS	8	21
	Red brown fine to medium SAND	0.45	2	SS	12	
1	Grey fine to medium SAND	1.20	3	SS	4	25
2			4	SS	3	25
3	Grey SANDY SILTY CLAY, trace silt	3.20	5	SS	2	
4			6	SS	32	
	End of Borehole	4.42				

UNDIST. SHEAR STRENGTH × Cu, kPa 20 40 60 80

REM. SHEAR STRENGTH ○ Cu, kPa 20 40 60 80

DYNAMIC CONE PENETRATION TEST blows/300 mm 10 30 50 70 90

PIEZOMETER OR STANDPIPE INSTALLATION

Water observed in borehole at approximately 1.2 metres below the existing ground surface on February 3, 2021. Water measured in standpipe at approximately 1.7 metres below the existing ground surface on February 12, 2021.

DEPTH SCALE: 1 to 50
BORING METHOD: Power Auger
AUGER TYPE: 200 mm Hollow Stem
LOGGED: DT
CHECKED: SD

RECORD OF BOREHOLE BH6

PROJECT: Proposed Residential Subdivision
CLIENT: Mr. Miles Yang
LOCATION: 3200 Reids Lane, Osgoode, Ottawa, Ontario
PENETRATION TEST HAMMER: 63.5kg, Drop, 0.76mm

PROJECT NUMBER: 210064
DATE OF BORING: February 4, 2021
SHEET 1 of 1
DATUM: GEODETIC

SOIL PROFILE – DESCRIPTION	ELEV. / DEPTH (M)	SAMPLE NUMBER	TYPE	BLOWS/0.3m	ADDITIONAL LAB TESTING (%M)
Ground Surface	57.58				
TOPSOIL	0.00	1	SS	2	17
Red brown fine to medium SAND, trace silt	57.23 / 0.35				
Grey fine to medium SAND	56.68 / 0.90	2	SS	4	28
Grey Sandy CLAY, trace silt	55.68 / 1.90	3	SS	5	21
Grey SILTY SAND	55.29 / 2.29	4	SS	20	21
Grey SILTY CLAY	54.58 / 3.00	5	SS	2	89
		6	SS	WH	
Grey silty sand, trace to some gravel, cobbles and boulders, trace clay (GLACIAL TILL)	51.94 / 5.64	7	SS	2	12
End of Borehole in Glacial Till	50.88 / 6.70				

UNDIST. SHEAR STRENGTH × Cu, kPa 20 40 60 80
REM. SHEAR STRENGTH ○ Cu, kPa 20 40 60 80
DYNAMIC CONE PENETRATION TEST blows/300 mm 10 30 50 70 90

PIEZOMETER OR STANDPIPE INSTALLATION: Water observed in borehole at approximately 0.9 metres below the existing ground surface on February 4, 2021.

DEPTH SCALE: 1 to 75
BORING METHOD: Power Auger
AUGER TYPE: 200 mm Hollow Stem
LOGGED: DT
CHECKED: SD

LIST OF ABBREVIATIONS AND TERMINOLOGY

SAMPLE TYPES

AS auger sample
CS chunk sample
DO drive open
MS manual sample
RC rock core
ST slotted tube .
TO thin-walled open Shelby tube
TP thin-walled piston Shelby tube
WS wash sample

PENETRATION RESISTANCE

Standard Penetration Resistance, N ,
The number of blows by a 63.5 kg hammer dropped 760 millimeter required to drive a 50 mm drive open sampler for a distance of 300 mm. 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 hammer dropped 760 mm to drive a 50 mm diameter, 60° cone attached to 'A' size drill rods for a distance of 300 mm.

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.

SOIL TESTS

C consolidation test
H hydrometer analysis
M sieve analysis
MH sieve and hydrometer analysis
U unconfined compression test
Q undrained triaxial test
V field vane, undisturbed and remolded shear strength

SOIL DESCRIPTIONS

Relative Density	'N' Value
Very Loose	0 to 4
Loose	4 to10
Compact	10 to 30
Dense	30 to 50
Very Dense	over 50

Consistency	Undrained Shear Strength (kPa)
Very soft	0 to 12
Soft	12 to 25
Firm	25 to 50 ,
Stiff	50 to100
Very Stiff	over100

LIST OF COMMON SYMBOLS

Cu undrained shear strength
e void ratio
Cc compression index
Cv coefficient of consolidation
k coefficient of permeability
Ip plasticity index
n porosity
u pore pressure
w moisture content
wL liquid limit
Wp plastic limit
$\$^1$ effective angle of friction
r unit weight of soil
y^1 unit weight of submerged soil
cr normal stress

KEY PLAN	FIGURE 1

NOT TO SCALE

Kollaard Associates
Engineers

Project No. 210064

Date March 2021

DRAWING NUMBER:
SITE PLAN, FIGURE 2

LEGEND:

BH1 APPROXIMATE BOREHOLE LOCATION

REFERENCE: PLAN SUPPLIED BY CITY OF OTTAWA EMAPS.

SPECIAL NOTE: THIS DRAWING TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING REPORT.

REV.	NAME	DATE	DESCRIPTION

Kollaard Associates
Engineers
PO, BOX 189, 210 PRESCOTT ST
KEMPTVILLE ONTARIO
K0G 1J0 FAX (613) 258-0475
http://www.kollaard.ca
(613) 860-0923
info@kollaard.ca

CLIENT:
CRESTVIEW INNOVATIONS INC.

PROJECT:
GEOTECHNICAL INVESTIGATION FOR PROPOSED RESIDENTIAL DEVELOPMENT

LOCATION:
3200 REIDS LANE
CITY OF OTTAWA, ONTARIO

DESIGNED BY:	DATE:
--	MAR 12, 2021
DRAWN BY: DT	SCALE: N.T.S

KOLLAARD FILE NUMBER:
210064

Laboratory Test Results for Chemical Properties

Kollaard Associates (Kemptville)
ATTN: Dean Tataryn
210 Prescott Street Unit 1
P.O. Box 189
Kemptville ON K0G 1J0

Date Received: 11-FEB-21
Report Date: 19-FEB-21 14:12 (MT)
Version: FINAL

Client Phone: 613-860-0923

Certificate of Analysis

Lab Work Order #: L2557074

Project P.O. #: NOT SUBMITTED
Job Reference: 210064
C of C Numbers:
Legal Site Desc:

Emily Smith
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2557074-1 BH4 SS3 5-7							
Sampled By: CLIENT on 10-FEB-21							
Matrix: SOIL							
Physical Tests							
Conductivity	0.0653		0.0040	mS/cm		19-FEB-21	R5381581
% Moisture	17.4		0.25	%	16-FEB-21	17-FEB-21	R5377499
pH	7.38		0.10	pH units		17-FEB-21	R5378398
Resistivity	15300		1.0	ohm*cm		19-FEB-21	
Leachable Anions & Nutrients							
Chloride	0.00085		0.00050	%	18-FEB-21	18-FEB-21	R5381016
Anions and Nutrients							
Sulphate	<0.0020		0.0020	%	12-FEB-21	12-FEB-21	R5376323

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
CL-R511-WT	Soil	Chloride-O.Reg 153/04 (July 2011)	EPA 300.0

5 grams of dried soil is mixed with 10 grams of distilled water for a minimum of 30 minutes. The extract is filtered and analyzed by ion chromatography.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

EC-WT	Soil	Conductivity (EC)	MOEE E3138

A representative subsample is tumbled with de-ionized (DI) water. The ratio of water to soil is 2:1 v/w. After tumbling the sample is then analyzed by a conductivity meter.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

MOISTURE-WT	Soil	% Moisture	CCME PHC in Soil - Tier 1 (mod)
PH-WT	Soil	pH	MOEE E3137A

A minimum 10g portion of the sample is extracted with 20mL of 0.01M calcium chloride solution by shaking for at least 30 minutes. The aqueous layer is separated from the soil and then analyzed using a pH meter and electrode.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

RESISTIVITY-CALC-WT	Soil	Resistivity Calculation	APHA 2510 B

"Soil Resistivity (calculated)" is determined as the inverse of the conductivity of a 2:1 water:soil leachate (dry weight). This method is intended as a rapid approximation for Soil Resistivity. Where high accuracy results are required, direct measurement of Soil Resistivity by the Wenner Four-Electrode Method (ASTM G57) is recommended.

SO4-WT	Soil	Sulphate	EPA 300.0

5 grams of soil is mixed with 50 mL of distilled water for a minimum of 30 minutes. The extract is filtered and analyzed by ion chromatography.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid weight of sample
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Laboratory Test Results for Physical Properties

Stantec

Stantec Consulting Ltd
2781 Lancaster Rd, Suite 100 A&B
Ottawa, ON K1B 1A7
Tel: (613) 738-6075
Fax: (613) 722-2799

February 23, 2021
File: 122410003

Attention: **Dean Tataryn, Kollaard Associates Engineers**

Reference: **Kollaard File #210064, ASTM D4318 Atterberg Limit, ASTM D2216 Moisture Content**

The following table summarizes Atterberg Limit results.

Source	Depth	Moisture Content	Liquid Limit	Plastic Limit	Plasticity Index
BH-6 SS6	4.52-5.18m	49.4%	42.4	20.2	22.2

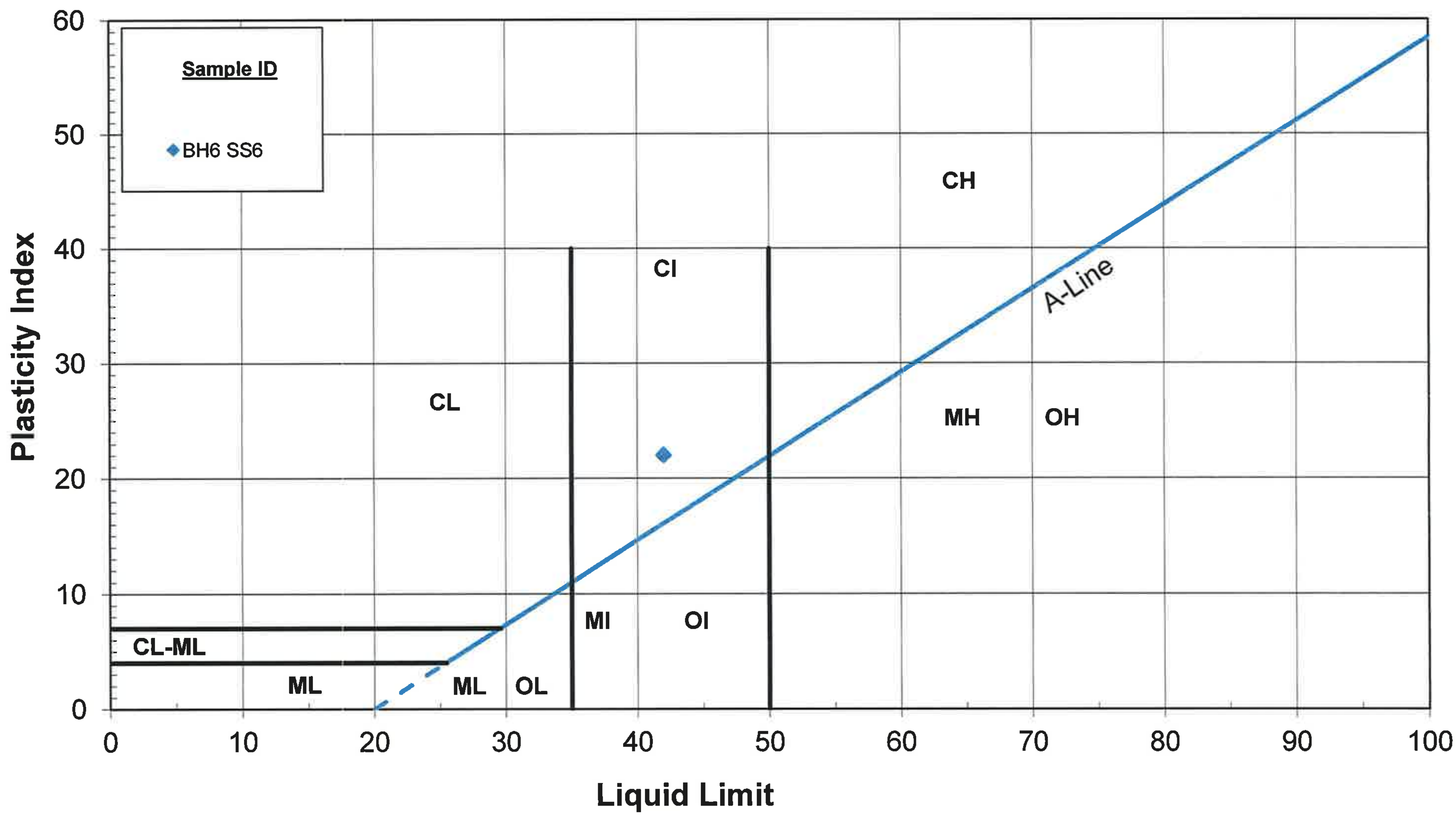
Sincerely,

Stantec Consulting Ltd

Brian Prevost

Brian Prevost
Laboratory Supervisor
Tel: 613-738-6075
Fax: 613-722-2799
brian.prevost@stantec.com

Attachments: Atterberg Limit Plasticity Chart



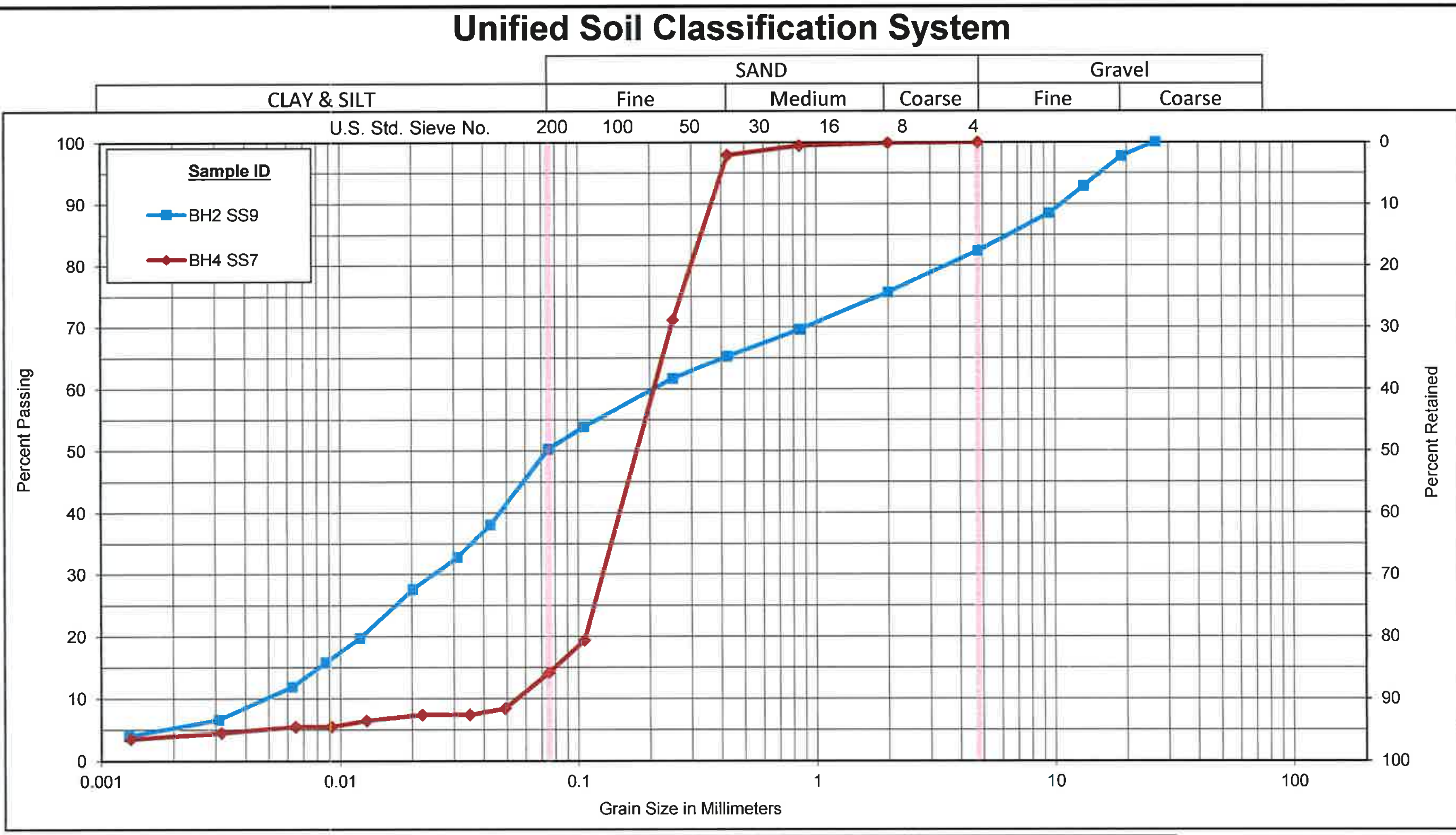
Kollaard Associates Inc. File # 210064

3200 Reid Lane, Osgoode

PLASTICITY CHART

Figure No.

Project No. 122410003



Sample ID	Depth	% Gravel	% Sand	% Silt	% Clay
BH2 SS9	7.62-8.22 m	17.7	32.1	45.2	5.0
BH4 SS7	4.52-5.18 m	0.0	85.9	10.1	4.0

Stantec

GRAIN SIZE DISTRIBUTION

Kollaard Associates Inc. File # 210064

3200 Reid Lane, Osgoode

Figure No.

Project No. 122410003

Stantec

Particle-Size Analysis of Soils
LS702
AASHTO T88

PROJECT DETAILS

Client:	Kollaard Associates Inc. File # 210064	Project No.:	122410003
Project:	3200 Reid Lane, Osgoode	Test Method:	LS702
Material Type:	Soil	Sampled By:	Kollaard Associates Inc.
Source:	BH2	Date Sampled:	February 4, 2021
Sample No.:	SS9	Tested By:	Denis Rodriguez
Sample Depth	7.62-8.22 m	Date Tested:	February 15, 2021

WASH TEST DATA

Oven Dry Mass In Hydrometer Analysis (g)	56.48
Sample Weight after Hydrometer and Wash (g)	20.26
Percent Passing No. 200 Sieve (%)	64.1
Percent Passing Corrected (%)	48.50

PERCENT LOSS IN SIEVE

Sample Weight Before Sieve (g)	1062.00
Sample Weight After Sieve (g)	1059.20
Percent Loss in Sieve (%)	0.26

SOIL INFORMATION

Liquid Limit (LL)		
Plasticity Index (PI)		
Soil Classification		
Specific Gravity (G_s)	2.750	
Sg. Correction Factor (α)	0.978	
Mass of Dispersing Agent/Litre	40	g

CALCULATION OF DRY SOIL MASS

Oven Dried Mass (W_o), (g)	101.04
Air Dried Mass (W_a), (g)	101.21
Hygroscopic Corr. Factor ($F=W_o/W_a$)	0.9983
Air Dried Mass in Analysis (M_a), (g)	56.58
Oven Dried Mass in Analysis (M_o), (g)	56.48
Percent Passing 2.0 mm Sieve (P_{10}), (%)	75.62
Sample Represented (W), (g)	74.69

SIEVE ANALYSIS

Sieve Size mm	Cum. Wt. Retained	Percent Passing
75.0		100.0
63.0		100.0
53.0		100.0
37.5		100.0
26.5	0.0	100.0
19.0	25.1	97.6
13.2	76.8	92.8
9.5	122.9	88.4
4.75	187.6	82.3
2.00	258.9	75.6
Total (C + F)[1]	1059.20	
0.850	4.50	69.60
0.425	7.77	65.22
0.250	10.43	61.66
0.106	16.24	53.88
0.075	18.98	50.21
PAN	20.26	

Note 1: (C + F) = Coarse + Fine

HYDROMETER DETAILS

Volume of Bulb (V_B), (cm^3)	63.0
Length of Bulb (L_2), (cm)	14.47
Length from '0' Reading to Top of Bulb (L_1), (cm)	10.29
Scale Dimension (h_s), (cm/Div)	0.155
Cross-Sectional Area of Cylinder (A), (cm^2)	27.25
Meniscus Correction (H_m), (g/L)	1.0

START TIME 9:33 AM

HYDROMETER ANALYSIS

Date	Time	Elapsed Time T Mins	H_s Divisions g/L	H_c Divisions g/L	Temperature T_c °C	Corrected Reading $R = H_s - H_c$ g/L	Percent Passing P %	L cm	η Poise	K	Diameter D mm
15-Feb-21	9:34 AM	1	36.0	7.0	21.0	29.0	37.99	10.63404	9.84835	0.013126	0.04280
15-Feb-21	9:35 AM	2	32.0	7.0	21.0	25.0	32.75	11.25404	9.84835	0.013126	0.03114
15-Feb-21	9:38 AM	5	28.0	7.0	21.0	21.0	27.51	11.87404	9.84835	0.013126	0.02023
15-Feb-21	9:48 AM	15	22.0	7.0	21.0	15.0	19.65	12.80404	9.84835	0.013126	0.01213
15-Feb-21	10:03 AM	30	19.0	7.0	21.0	12.0	15.72	13.26904	9.84835	0.013126	0.00873
15-Feb-21	10:33 AM	60	16.0	7.0	21.0	9.0	11.79	13.73404	9.84835	0.013126	0.00628
15-Feb-21	1:43 PM	250	12.0	7.0	22.0	5.0	6.5492	14.35404	9.61570	0.012970	0.00311
16-Feb-21	9:33 AM	1440	10.0	7.0	22.0	3.0	3.9295	14.66404	9.61570	0.012970	0.00131

Remarks:

Reviewed By: Brian Prevost
Date: February 23/2021

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Stantec

Particle-Size Analysis of Soils

LS702
AASHTO T88

PROJECT DETAILS

Client:	Kollaard Associates Inc. File # 210064	Project No.:	122410003
Project:	3200 Reid Lane, Osgoode	Test Method:	LS702
Material Type:	Soil	Sampled By:	Kollaard Associates Inc.
Source:	BH4	Date Sampled:	February 3, 2021
Sample No.:	SS7	Tested By:	Denis Rodriguez
Sample Depth	4.52-5.18 m	Date Tested:	February 15, 2021

WASH TEST DATA

Oven Dry Mass in Hydrometer Analysis (g)	99.19
Sample Weight after Hydrometer and Wash (g)	87.02
Percent Passing No. 200 Sieve (%)	12.3
Percent Passing Corrected (%)	12.25

PERCENT LOSS IN SIEVE

Sample Weight Before Sieve (g)	623.50
Sample Weight After Sieve (g)	623.40
Percent Loss in Sieve (%)	0.02

SOIL INFORMATION

Liquid Limit (LL)		
Plasticity Index (PI)		
Soil Classification		
Specific Gravity (G_s)	2.750	
Sg. Correction Factor (α)	0.978	
Mass of Dispersing Agent/Litre	24	g

CALCULATION OF DRY SOIL MASS

Oven Dried Mass (W_o), (g)	80.13
Air Dried Mass (W_a), (g)	80.22
Hygroscopic Corr. Factor ($F=W_o/W_a$)	0.9989
Air Dried Mass in Analysis (M_a), (g)	99.30
Oven Dried Mass in Analysis (M_o), (g)	99.19
Percent Passing 2.0 mm Sieve (P_{10}), (%)	99.89
Sample Represented (W), (g)	99.30

SIEVE ANALYSIS

Sieve Size mm	Cum. Wt. Retained	Percent Passing
75.0		100.0
63.0		100.0
53.0		100.0
37.5		100.0
26.5		100.0
19.0		100.0
13.2		100.0
9.5		100.0
4.75	0.0	100.0
2.00	0.7	99.9
Total (C + F)[1]	623.40	
0.850	0.44	99.44
0.425	1.99	97.88
0.250	28.60	71.09
0.106	80.00	19.32
0.075	85.18	14.11
PAN	86.94	

Note 1: (C + F) = Coarse + Fine

HYDROMETER DETAILS

Volume of Bulb (V_B), (cm^3)	63.0
Length of Bulb (L_2), (cm)	14.47
Length from '0' Reading to Top of Bulb (L_1), (cm)	10.29
Scale Dimension (h_s), (cm/Div)	0.155
Cross-Sectional Area of Cylinder (A), (cm^2)	27.25
Meniscus Correction (H_m), (g/L)	1.0

START TIME 9:40 AM

HYDROMETER ANALYSIS

Date	Time	Elapsed Time T Mins	H_s Divisions g/L	H_c Divisions g/L	Temperature T_c °C	Corrected Reading $R = H_s - H_c$ g/L	Percent Passing P %	L cm	η Poise	K	Diameter D mm
15-Feb-21	9:41 AM	1	12.0	3.5	22.0	8.5	8.37	14.35404	9.61570	0.012970	0.04914
15-Feb-21	9:42 AM	2	11.0	3.5	22.0	7.5	7.39	14.50904	9.61570	0.012970	0.03493
15-Feb-21	9:45 AM	5	11.0	3.5	22.0	7.5	7.39	14.50904	9.61570	0.012970	0.02209
15-Feb-21	9:55 AM	15	10.0	3.5	21.5	6.5	6.40	14.66404	9.73081	0.013047	0.01290
15-Feb-21	10:10 AM	30	9.0	3.5	21.5	5.5	5.42	14.81904	9.73081	0.013047	0.00917
15-Feb-21	10:40 AM	60	9.0	3.5	21.5	5.5	5.42	14.81904	9.73081	0.013047	0.00648
15-Feb-21	1:50 PM	250	8.0	3.5	22	4.5	4.43	14.97404	9.61570	0.012970	0.00317
16-Feb-21	9:40 AM	1440	7.0	3.5	22	3.5	3.45	15.12904	9.61570	0.012970	0.00133

Remarks:

Reviewed By: Brian Prasad
Date: February 23/2021

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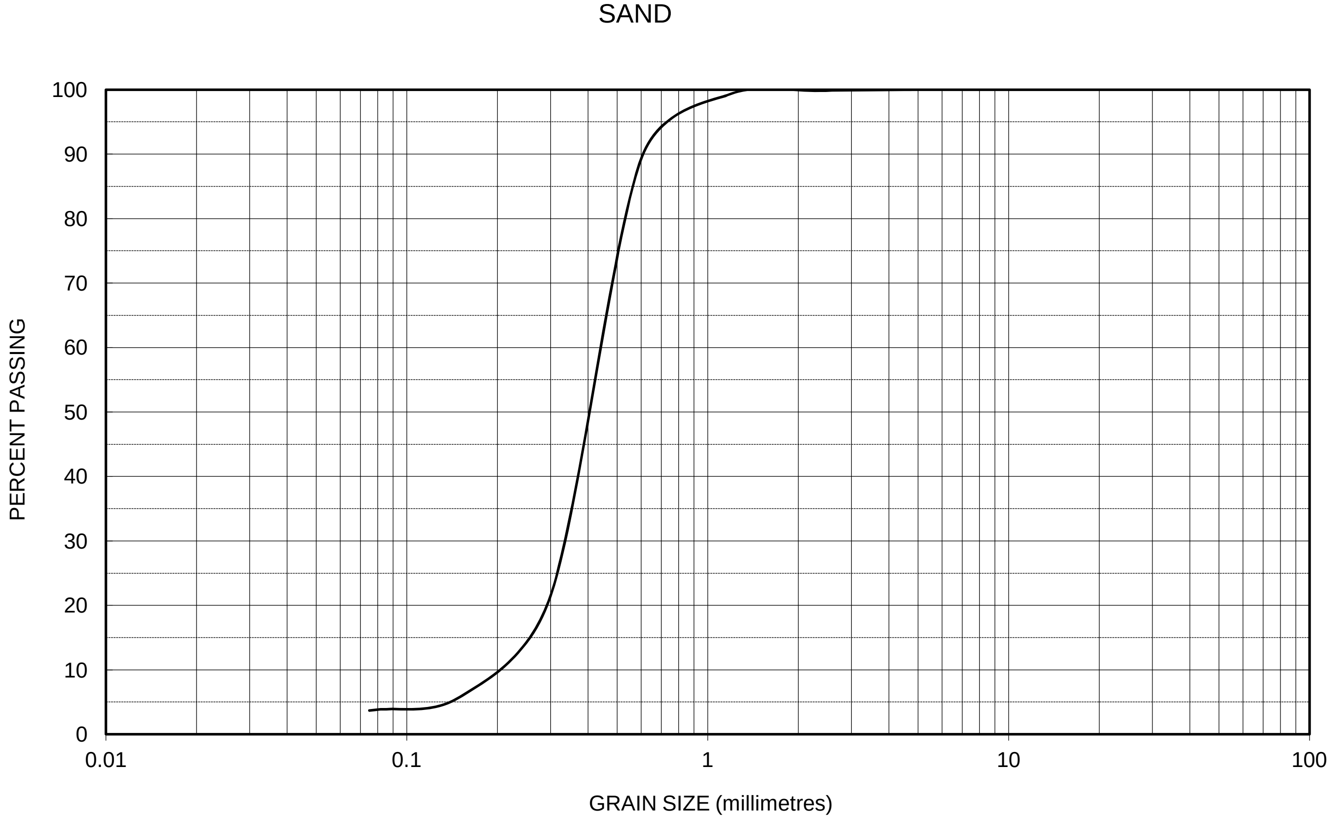
Grain Size Distribution Analysis

Kollaard Associates Engineers



SIEVE SIZE (mm)	76.2	53	26.5	19.0	16	13..2	9.5	4.75	2.36	1.180	0.600	0.300	0.15	0.075
SAMPLE PASSING								100.0	99.8	99.3	89.2	21.4	5.8	3.7

CLIENT: Crestview Innovations Inc.

PROJECT: 3200 Reids Lane,Ossgoode   OUR REF.: 210064

TYPE OF MATERIAL: Sand   INTENDED USE: Residential

DATE SAMPLED: February 3, 2021   DATE TESTED: February 11, 2021

SOURCE: BH1 - 0.76-1.37   SAMPLE NO: SS2

REMARKS:

Kollaard Associates Engineers

Box 189, 210 Prescott Street
Kemptville, Ontario K0G 1J0
(613) 860-0923, FAX: (613) 258-0475

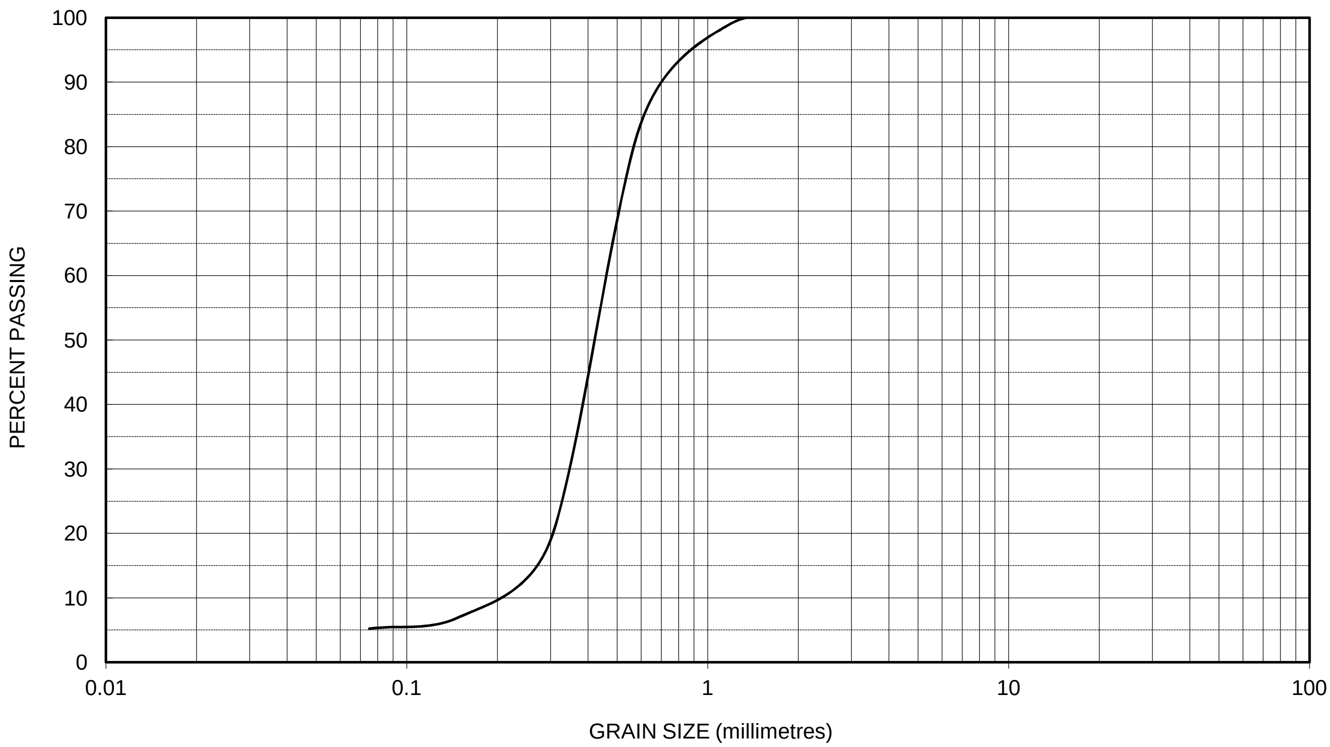
Issued by: Dean Tataryn, B.E.S., EP

Date: February 12, 2021

Grain Size Distribution Analysis

Kollaard Associates Engineers

SAND



SIEVE SIZE (mm)	76.2	53	26.5	19.0	16	13..2	9.5	4.75	2.36	1.180	0.600	0.300	0.15	0.075
SAMPLE PASSING									100.0	99.0	83.7	19.0	7.1	5.2

CLIENT: Crestview Innovations Inc.

PROJECT: 3200 Reids Lane,Ossgoode

OUR REF.: 210064

TYPE OF MATERIAL: Sand

INTENDED USE: Residential

DATE SAMPLED: February 3, 2021

DATE TESTED: February 11, 2021

SOURCE: BH3 - 0.76 - 1.37

SAMPLE NO: SS2

REMARKS:

Kollaard Associates Engineers
Box 189, 210 Prescott Street
Kemptville, Ontario K0G 1J0
(613) 860-0923, FAX: (613) 258-0475

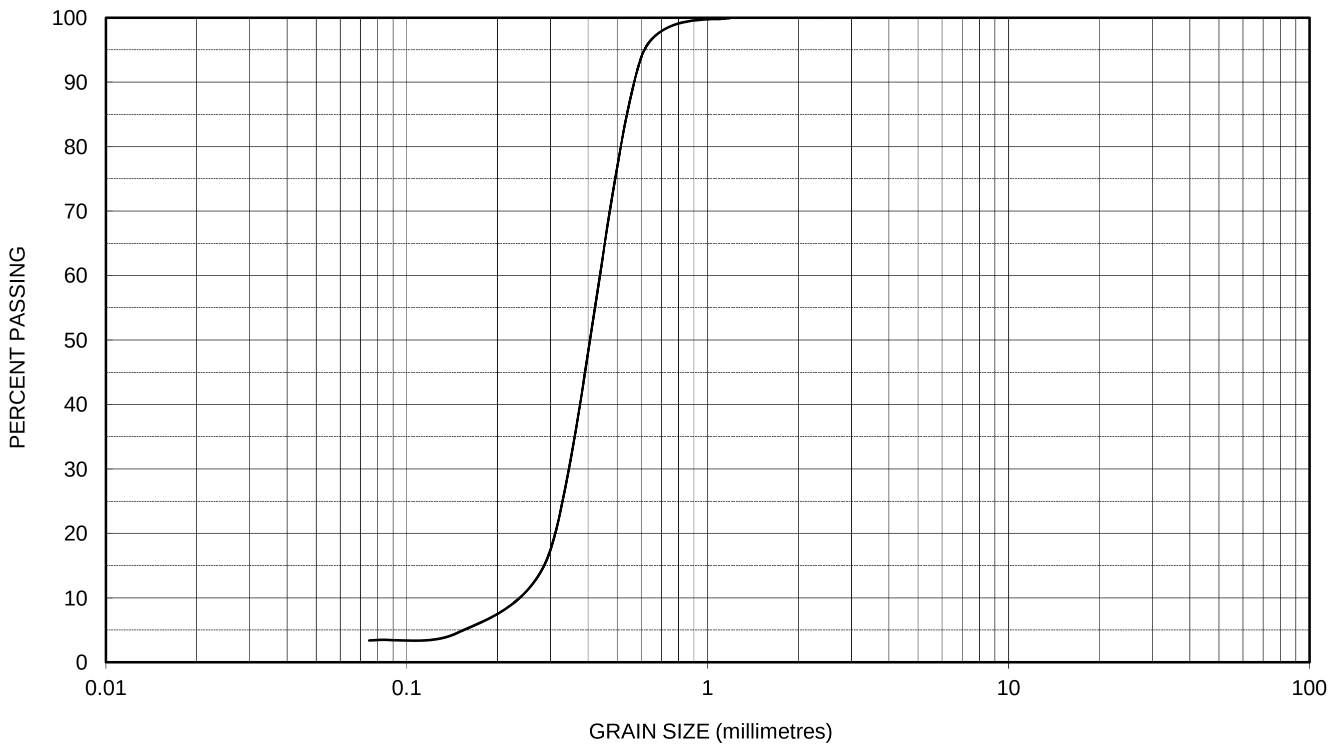
Issued by: Dean Tartaryn, B.E.S. EP

Date: February 12, 2021

Grain Size Distribution Analysis

Kollaard Associates Engineers

SAND



SIEVE SIZE (mm)	76.2	53	26.5	19.0	16	13..2	9.5	4.75	2.36	1.180	0.600	0.300	0.15	0.075
SAMPLE PASSING									100.0	99.9	93.8	17.5	4.7	3.4

CLIENT: Crestview Innovations Inc.

PROJECT: 3200 Reids Lane,Ossgoode

OUR REF.: 210064

TYPE OF MATERIAL: Sand

INTENDED USE: Residential

DATE SAMPLED: February 3, 2021

DATE TESTED: February 11, 2021

SOURCE: BH5 - 0.76 - 1.37

SAMPLE NO: SS2

REMARKS:

Kollaard Associates
Engineers
Box 189, 210 Prescott Street
Kemptville, Ontario K0G 1J0
(613) 860-0923, FAX: (613) 258-0475

Issued by: Dean Tataryn, B.E.S. EP

Date: February 12, 2021

Moisture Content

LS - 701 / ASTM D 2216

PROJECT NO.: 210064	DATE SAMPLED: Feb 3, 2021	DATE TESTED: Feb 11, 2021
CLIENT: Crestview Innovations Inc.	DATE RECEIVED:	TESTED BY: KMH
LOCATION: 3200 Reids Lane	DATE REQUESTED:	FILE NO.:

METHOD A ■ METHOD B □

Water Content Recorded to +/- 1%			Water Content Recorded to +/- 0.1%		
Sieve Size, mm	Specimen Mass	Balance Readability, g	Sieve Size, mm	Specimen Mass	Balance Readability, g
75.0	5 kg	10	75.0	5 kg	10
37.5	1 kg	10	37.5	1 kg	10
19	250 g	0.1	19	250 g	0.1
9.5	50 g	0.1	9.5	50 g	0.1
4.75	20 g	0.1	4.75	20 g	0.1
2.00	20 g	0.1	2.00	20 g	0.1

ASTM D 2216 TABLE 1

Bore Hole:	BH1			BH2					
Sample No.:	SS1	SS3	SS4	SS1	SS3	SS4	SS5	SS6	SS7
Depth:	0-0.60	1.50-2.10	2.29-2.89	0-0.60	1.50-2.10	2.29-2.89	3.00-3.60	3.81-4.42	4.52-5.18
Tare No.:	13	14	15	16	17	18	19	20	21
Tare +Wet Soil (gms)	59.42	92.57	100.42	74.46	113.83	118.24	88.28	66.04	59.52
Tare + Dry Soil (gms)	56.41	79.17	84.23	65.15	97.21	99.90	77.27	51.30	48.24
Mass of Water (gms)	3.01	13.40	16.19	9.31	16.62	18.34	11.01	14.74	11.28
Mass of Tare (gms)	22.41	21.01	21.37	20.99	20.87	21.22	21.42	21.42	22.12
Mass of Solids (gms)	34.00	58.16	62.86	44.16	76.34	78.68	55.85	29.88	26.12
WATER CONTENT (%)	9	23	26	21	22	23	20	49	43
Drying Tempterature (^{0}C), if other than 110 ±5^{0}C									

Bore Hole:	BH2		BH3			BH4			
Sample No.:	SS8	SS9	SS1	SS3	SS4	SS1	SS2	SS3	SS4
Depth:	6.01-6.70	8.38-8.99	0-0.60	1.50-2.10	2.29-2.89	0-0.60	0.76-1.37	1.50-2.10	2.29-2.89
Tare No.:	22	23	24	25	26	27	28	29	30
Tare +Wet Soil (gms)	88.79	92.46	61.96	97.68	80.79	53.03	52.69	76.50	95.00
Tare + Dry Soil (gms)	64.18	85.51	54.79	82.15	68.81	49.04	49.44	67.07	80.31
Mass of Water (gms)	24.61	6.95	7.17	15.53	11.98	3.99	3.25	9.43	14.69
Mass of Tare (gms)	21.56	21.04	20.98	20.87	20.86	20.98	20.92	21.10	21.09
Mass of Solids (gms)	42.62	64.47	33.81	61.28	47.95	28.06	28.52	45.97	59.22
WATER CONTENT (%)	58	11	21	25	25	14	11	21	25
Drying Tempterature (^{0}C), if other than 110 ±5^{0}C									

Moisture Content

LS - 701 / ASTM D 2216

PROJECT NO.: 210064	DATE SAMPLED: Feb 3, 2021	DATE TESTED: Feb 11, 2021
CLIENT: Miles Yang	DATE RECEIVED:	TESTED BY: KMH
LOCATION: 3200 Reids Lane	DATE REQUESTED:	FILE NO.:

METHOD A ■ METHOD B ☐

Water Content Recorded to +/- 1%			Water Content Recorded to +/- 0.1%		
Sieve Size, mm	Specimen Mass	Balance Readability, g	Sieve Size, mm	Specimen Mass	Balance Readability, g
75.0	5 kg	10	75.0	5 kg	10
37.5	1 kg	10	37.5	1 kg	10
19	250 g	0.1	19	250 g	0.1
9.5	50 g	0.1	9.5	50 g	0.1
4.75	20 g	0.1	4.75	20 g	0.1
2.00	20 g	0.1	2.00	20 g	0.1

ASTM D 2216 TABLE 1

Bore Hole:	BH4						BH5		
Sample No.:	SS5	SS6	SS7	SS9	SS10	SS11	SS1	SS3	SS4
Depth:	3.00-3.60	3.81-4.42	4.57-5.18	6.09-6.70	7.62-8.22	9.14-9.75	0-0.60	1.50-2.10	2.29-2.89
Tare No.:	31	32	33	34	35	36	37	38	39
Tare +Wet Soil (gms)	84.85	94.54	75.62	95.65	81.52	72.93	55.85	65.13	94.14
Tare + Dry Soil (gms)	72.10	83.10	66.76	67.59	58.99	51.88	51.97	56.32	81.52
Mass of Water (gms)	12.75	11.44	8.86	28.06	22.53	21.05	3.88	8.81	12.62
Mass of Tare (gms)	20.96	20.85	21.04	21.07	20.91	20.83	21.34	20.97	20.90
Mass of Solids (gms)	51.14	62.25	45.72	46.52	38.08	31.05	30.63	35.35	60.62
WATER CONTENT (%)	25	18	19	60	59	68	13	25	21
Drying Tempterature (^{0}C), if other than 110 ±5^{0}C									

Bore Hole:	BH5		BH6						
Sample No.:	SS5	SS6	SS1	SS2	SS3	SS4	SS5	SS7	
Depth:	3.00-3.60	3.81-4.42	0-0.60	0.76-1.37	1.50-2.10	2.29-2.89	3.00-3.60	6.01-6.70	
Tare No.:	40	41	42	43	44	45	46	47	
Tare +Wet Soil (gms)	99.99	95.51	37.16	108.87	83.42	100.4	74.02	116.24	
Tare + Dry Soil (gms)	86.61	82.72	34.83	89.76	72.49	86.59	49.05	106.14	
Mass of Water (gms)	13.38	12.79	2.33	19.11	10.93	13.81	24.97	10.10	
Mass of Tare (gms)	21.01	20.95	20.8	20.99	20.88	20.89	20.91	20.98	
Mass of Solids (gms)	65.6	61.77	14.03	68.77	51.61	65.7	28.14	85.16	
WATER CONTENT (%)	20	21	17	28	21	21	89	12	
Drying Tempterature (^{0}C), if other than 110 ±5^{0}C									

National Building Code Seismic Hazard Calculation

2015 National Building Code Seismic Hazard Calculation

INFORMATION: **Eastern Canada English (613) 995-5548 français (613) 995-0600 Facsimile (613) 992-8836**
Western Canada English (250) 363-6500 Facsimile (250) 363-6565

Site: 45.146N 75.611W **User File Reference:** 3200 Reids Lane, Osgoode, ON 2021-03-16 19:52 UT

Probability of exceedance per annum	0.000404	0.001	0.0021	0.01
Probability of exceedance in 50 years	2 %	5 %	10 %	40 %
Sa (0.05)	0.491	0.263	0.152	0.042
Sa (0.1)	0.570	0.317	0.191	0.058
Sa (0.2)	0.471	0.267	0.164	0.053
Sa (0.3)	0.354	0.202	0.126	0.042
Sa (0.5)	0.248	0.142	0.089	0.030
Sa (1.0)	0.121	0.070	0.045	0.015
Sa (2.0)	0.057	0.033	0.021	0.006
Sa (5.0)	0.015	0.008	0.005	0.001
Sa (10.0)	0.005	0.003	0.002	0.001
PGA (g)	0.302	0.171	0.104	0.031
PGV (m/s)	0.205	0.114	0.069	0.021

Notes: Spectral (Sa(T), where T is the period in seconds) and peak ground acceleration (PGA) values are given in units of g (9.81 m/s^2). Peak ground velocity is given in m/s. Values are for "firm ground" (NBCC2015 Site Class C, average shear wave velocity 450 m/s). NBCC2015 and CSAS6-14 values are highlighted in yellow. Three additional periods are provided - their use is discussed in the NBCC2015 Commentary. Only 2 significant figures are to be used. **These values have been interpolated from a 10-km-spaced grid of points. Depending on the gradient of the nearby points, values at this location calculated directly from the hazard program may vary. More than 95 percent of interpolated values are within 2 percent of the directly calculated values.**

References

National Building Code of Canada 2015 NRCC no. 56190; Appendix C: Table C-3, Seismic Design Data for Selected Locations in Canada

Structural Commentaries (User's Guide - NBC 2015: Part 4 of Division B)
Commentary J: Design for Seismic Effects

Geological Survey of Canada Open File 7893 Fifth Generation Seismic Hazard Model for Canada: Grid values of mean hazard to be used with the 2015 National Building Code of Canada

See the websites www.EarthquakesCanada.ca and www.nationalcodes.ca for more information