Kollaard Associates
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Civil • Geotechnical •
Structural • Environmental •
Hydrogeology

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REPORT ON

GEOTECHNICAL INVESTIGATION
PROPOSED COMMERCIAL BUILDING ADDITION
7409 CENOTE ROAD
CITY OF OTTAWA, ONTARIO

Project # 180138

Submitted to:

Capital Truck Sales
7409 Cenote Road
Metcalfe, Ontario
K0A 2P0

DISTRIBUTION

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April 26, 2019

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April 26, 2019 180138

Capital Truck Sales
7409 Cenote Road
Metcalfe, Ontario
K0A 2P0

RE: GEOTECHNICAL INVESTIGATION
PROPOSED COMMERCIAL BUILDING ADDITION
7409 CENOTE ROAD
CITY OF OTTAWA, ONTARIO

Dear Sir:

This report presents the results of a geotechnical investigation carried out for the above noted proposed commercial addition. The purpose of the investigation was to identify the subsurface conditions at the site based on a limited number of test pits. Based on the factual information obtained, Kollaard Associates Inc. was to provide guidelines on the geotechnical engineering aspects of the project design; including construction considerations, which could influence design decisions.

BACKGROUND INFORMATION AND SITE GEOLOGY

Plans are being prepared to construct a building addition at 7409 Cenote Road in the City of Ottawa, Ontario (see Key Plan, Figure 1). In total, the site consists of about 0.56 hectares (1.38 acres) of land located on the east side of Bank Street, immediately north of the intersection of Cenote Road and Bank Street, City of Ottawa, Ontario. The site is currently occupied by an existing commercial building and a gravel surfaced parking lot.

It is understood that plans are being prepared for the construction of a two storey metal clad, wood/steel frame addition measuring approximately 325 square metres (50' by 70') in total area. It is understood that the proposed building addition will be used for storage of merchandise. The proposed building addition will be placed on a thickened edge concrete slab-on-grade foundation and tie into the existing thickened edge concrete slab-on-grade foundation. The existing building and addition will continue to be serviced by an existing cased well and an onsite septic system. It is also understood that the existing gravel surfaced parking lot will continue to service the site.

For the purposes of this report, Cenote Road is considered to be oriented along a north south axis with the site located on the west side of Cenote Avenue. The site is located within an existing industrial park. Surrounding land use is industrial or commercial development.

Based on a review of the surficial geology map for the site area (*Surficial Geology Map*: Geological Survey of Canada, Surficial Geology, Ottawa, Ontario, Map 1506A, published 1982, scale 1:50,000.), it is expected that the site is generally underlain by glacial till followed by relatively shallow bedrock. A review of the bedrock geology map indicates that the bedrock underlying the site consists of limestone with some shaly partings of the Ottawa Formation (*Bedrock Geology Map*: Geological Survey of Canada, Generalized Bedrock Geology, Ottawa-Hull, Ontario and Quebec, Map 1508A, published 1979, scale 1:125,000.). Based on a review of the topographical map for the site area, it is expected that the upper groundwater flow at the site is towards Shields Creek that exists about 270 metres south of the site.

Based on a review of overburden thickness mapping for the site area, the overburden thickness above bedrock is estimated to be about one to two metres.

PROCEDURE

The field work for this investigation was carried out on April 16, 2019 at which time two test pits, numbered test pits 1 and 2 inclusive (TP1 and TP2) were put down across the site using a rubber tired mounted excavator supplied and operated by a local excavating contractor.

The test pits were advanced to depths of about 1.7 to 2.2 metres below the existing ground surface. The subsurface conditions encountered at the test pits were classified based on visual and tactile examination of the materials exposed on the sides and bottom of the test pits (ASTM D2488 - Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) and an assessment of the difficulty of digging. The soils were classified using the Unified Soil Classification

System. The groundwater conditions were observed in the open test pits at the time of excavating. The test pits were loosely backfilled with the excavated materials upon completion of the fieldwork.

In situ vane shear testing (ASTM D-2573 Standard Test Method for Field Shear Test in Cohesive Soil) was not carried out as no cohesive materials were encountered at any of the test pits.

One soil sample (TP1) was submitted for Particle Size Analysis (ASTM D422) testing. The soils were classified using the Unified Soil Classification System. A sample of soil obtained from TP2 was delivered to a chemical laboratory for testing for any indication of potential soil sulphate attack and soil corrosion on buried concrete and steel.

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

SUBSURFACE CONDITIONS

General

As previously indicated, a description of the subsurface conditions encountered at the test pits is provided in the attached Record of Test Pits section following the text of this report. The test pit logs indicate the subsurface conditions at the specific test pit locations only. Boundaries between zones in the test pit locations are often not distinct, but rather are transitional and have been interpreted. Subsurface conditions at locations other than test pit locations may vary from the conditions encountered at the test holes.

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 in by laboratory testing in accordance with ASTM 2487. 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 pit logs. Groundwater conditions may vary seasonally, or may be affected by construction activities on or in the vicinity of the site.

The ground surface elevation at the boreholes were determined, in the field, relative to a site topographic survey completed by Kollaard Associates Inc using a geodetic datum. The site benchmark is described as a nail in a hydro pole located approximately 10 metres north of the driveway entrance located on Cenote Road. The elevation of the benchmark is 91.21 metres geodetic datum.

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

Fill

Both test pits advanced during this investigation encountered a surficial layer of grey crushed stone, fill materials. The layer of grey crushed stone measured about 300 millimetres in thickness at both test pit locations.

Beneath the crushed stone material, fill materials consisting of yellow brown to grey brown silty clay with a trace of sand, gravel, boulders, ash and organics were encountered at test pit TP1. The fill materials had a thickness of about 0.95 metres at about 0.3 to 1.25 metres below the existing ground surface.

Beneath the crushed stone material at test pit TP2, a layer of topsoil fill material measuring about 0.15 metres in thickness was encountered at about 0.3 to 0.45 metres below the existing ground surface. Following the topsoil fill material, similar fill materials consisting of yellow brown silty clay with a trace of sand, gravel and boulders were also encountered. The fill materials had a thickness of about 0.25 metres and were encountered from about 0.45 to 0.7 metres below the existing ground surface at test pit TP2.

The fill materials were fully penetrated at both of the test pits.

Topsoil

A layer of topsoil was encountered beneath the fill materials at TP1 and TP2. The topsoil thickness measured about 200 millimetres in both test pits. 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. The topsoil layer was fully penetrated.

Glacial Till

Glacial till was encountered beneath the fill materials and topsoil layers at both of the test pits. The glacial till consisted of gravel, cobbles and boulders in a matrix of grey brown silty clay, with a trace of sand. The glacial till was encountered at depths of 0.9 and 1.45 metres, respectively, below the existing ground surface. The glacial till had a thickness of about 0.8 metres at both test pit locations. Based on the difficulty of digging the glacial till is considered to be dense to very dense.

One soil sample of glacial till (TP1 - 1.45 to 2.2 metres) was submitted to Stantec for Particle Size Analysis (ASTM D422). The results of the Particle Size Analysis testing indicated that the samples consist of about 19.9 percent gravel, 37.4 percent sand, 35.7 percent silt and 7.0 percent clay size particles. Moisture content for the sample was 11.2 percent for TP1. The results are located in Attachment A.

Bedrock

Practical refusal was encountered at all of the test pits, below the glacial till deposit, on the surface of bedrock at depths ranging between 1.7 to 2.2 metres below the existing ground surface. The surface of the bedrock was scraped using the bucket of the excavator to determine the quality of the upper bedrock. The surface of the bedrock was observed to be mostly smooth and flat lying. The surface of the bedrock could not be verified for fractures due to the depth of the test pits. The type of bedrock was observed to consist of limestone which is known to the area based on the bedrock mapping.

Groundwater

Some water was observed in test pit TP1 at a depth of about 1.5 metres below the existing ground surface at the time of the field work. Test pit TP2 was dry upon completion of excavating.

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 %	<0.00050	Negligible
pH	5.0 < pH	7.55	Basic Negligible concern
Resistivity	R < 20,000 ohm-cm	6170	Moderately Corrosive
Sulphates (SO_4)	SO_4 > 0.1%	0.00422	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 7.55, 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 with a resistivity rating <1000 ohm-cm to moderately corrosive with a resistivity of 5000 to 10,000 ohm-cm to non-corrosive with a resistivity of >20,000 ohm-cm. The Soil resistivity was found to be 6.17 ohm-m (6170 ohm-cm) for the sample analyzed making the soil moderately 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. Special protection is required for reinforcement steel within the concrete foundation walls.

GEOTECHNICAL RECOMMENDATIONS AND DESIGN GUIDELINES

PROPOSED BUILDING ADDITION FOUNDATIONS

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.

Foundations for Proposed Building Addition

As previously indicated, the subsurface conditions at the site encountered at the test pits advanced during the investigation within the proposed building addition consisted of fill materials followed by topsoil overlying glacial till then bedrock.

With the exception of the fill materials and topsoil, the subsurface conditions encountered at the test pits are suitable for the support of the proposed new building on a thickened edge, cast-in-place, concrete, slab on grade foundation bearing on an engineering granular pad placed on a native subgrade. The excavations for the foundation should be taken through any fill, topsoil or otherwise deleterious material to expose the native, undisturbed glacial till.

For predictable performance of the proposed foundations, all existing fill, topsoil and any deleterious materials should be removed from within the proposed foundation areas and should be replaced to the proposed founding level using suitable engineered fill. It is expected that the subgrade, beneath the topsoil, consists of native undisturbed glacial till. The subgrade surface should be inspected and approved by geotechnical personnel prior to placement of any granulars. To allow the spread of load beneath the foundations, the engineered fill should extend out from the outside edges of the thickened edge slab for a horizontal distance of 0.5 metres and then down and out at a slope of 1 horizontal to 1 vertical, or flatter. The excavations for the structure should be sized to accommodate this fill placement.

The fill materials beneath the proposed thickened edge slab on grade should consist of a minimum of 150 millimetre thickness of crushed stone meeting the grading requirements for 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.

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 I or Type II are placed on a sand or silty clay subgrade above the normal ground water level. If trucks are used to place the engineered fill on the subgrade, a thickened path of 0.6 metres should be used to protect the subgrade from the truck traffic.

The engineered fill materials should be compacted in maximum 300 millimetre thick 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.

The proposed building addition, when founded on engineered fill as described above, should be designed with a maximum allowable bearing pressure of 100 kilopascals for serviceability limit states design and a maximum of 300 kPa for factored ultimate limit states design; when considering the thickened edge portion of the slab only. The maximum total and differential settlement of the footings are expected to be less than 25 millimetres and 20 millimetres, respectively, using the above allowable bearing pressure and resistance.

No grade raise limitations are proposed for the site.

The native 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.

The thickened edged slab could be saw cut at regular intervals to prevent random cracking of the slab due to shrinkage and expansion 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.

Foundation Drainage

Provided the proposed finished floor surface is above the exterior finished grade, the granular materials beneath the proposed floor slab are properly compacted and provided the exterior grade is adequately sloped away from the proposed industrial building, no perimeter foundation drainage or under slab drainage systems are required.

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

Excavations

Any excavation for the proposed building addition will likely be carried out through fill material, topsoil to bear on an undisturbed glacial till subgrade. The sides of the excavation 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 glacial till soils at the site can be classified as Type 2 soil, however this classification should be confirmed by qualified individuals as the site is excavated and if necessary, adjusted. It is expected that the side slopes of the glacial till will be stable in the short term at an inclination of 1 horizontal to 1 vertical to 1.2 metres above the base of the excavation then near vertical below. No stock piled material should be placed on the ground surface adjacent the excavation for a distance, at minimum, equal to the depth of the excavation.

Engineered Fill

Any fill required to raise the subgrade for the proposed building addition 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 foundations, the engineered fill should extend out from the outside edges of the footings for a horizontal distance of 0.5 metres and then down and out at a slope of 1 horizontal to 1 vertical, or flatter. The excavations for the structure should be sized to accommodate this fill placement.

The excavations within the glacial till above any groundwater level should not present any serious constraints.

The subgrade surface should be inspected by geotechnical personnel prior to the placement of engineered fill material and concrete. Field density testing should be carried out on the engineered fill during placement.

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 A or Granular B Type II are placed on the subgrade above the normal ground water level.

The native glacial till 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.

Ground Water in Excavation and Construction Dewatering

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

Since ground water was not encountered in any of the test pits, it is considered unlikely that excavation will extend below the ground water level. Removal of surface water runoff from an excavation is considered to be construction dewatering. Surface water runoff should be directed away from the excavation as much as possible. A permit to take water is will not be required prior to excavation.

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

Since the existing ground water level at the site is below the bedrock surface at the site, dewatering of the excavation will not remove water from historically saturated soils. In addition soils encountered at the site consist of glacial till over bedrock which is not sensitive to changing moisture conditions. As such dewater of the foundation or site services excavations, if required, will not have a detrimental impact on the adjacent structures. There are no settlement concerns to the adjacent dwellings and structures due to potential groundwater removal from the foundation excavation or excavation for services at this site.

Seismic Design for the Proposed Building Addition

For seismic design purposes, in accordance with the 2012 OBC Section 4.1.8.4, Table 4.1.8.4.A., the proposed building may be designed for a site classification for seismic site response of Site Class C. The proposed building addition will be founded within 3 metres of limestone bedrock.

Potential for Soil Liquefaction

The proposed building addition will be founded on engineered fill underlain by glacial till and/or bedrock. These materials are not considered to be liquefiable under seismic conditions. Therefore, it is considered that no damage to the proposed building addition should occur due to liquefaction of the native subgrade under seismic conditions.

National Building Code Seismic Hazard Calculation

The design Peak Ground Acceleration (PGA) for the site was calculated as 0.280g with a 2% probability of exceedance in 50 years based on the interpolation of the 2015 National Building Code Seismic Hazard calculation. The results of the test are attached following the text of this report.

ACCESS ROADWAY AND PARKING LOT PAVEMENTS

Subgrade Preparation

To avoid soft spots and/or surface depressions within the parking area structure any existing fill and underlying topsoil and any deleterious materials should be removed from within the proposed access roadway and parking lot areas. The exposed subgrade surface should then be proof inspected and approved by geotechnical personnel. 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 and parking area 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 and parking 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.

Parking Area Structure

For pavement areas subject to heavy truck loading the pavement should consist of:

40 millimetres of hot mix asphaltic concrete (HL3) over
40 millimetres of hot mix asphaltic concrete (HL8) over
150 millimetres of OPSS Granular A base over
350 millimetres of OPSS Granular B, Type II subbase
(50 or 100 millimetre minus crushed stone), over

Non-woven geotextile fabric (4 oz/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 subgrade, that is, one where any roadway fill has been adequately compacted. If the roadway subgrade 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. The adequacy of the design of the pavement thickness should be assessed by the geotechnical personnel at the time of construction.

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.

Items such as actual foundation wall/column loads, whether or not the basement is heated, etc could have significant impacts on foundation type, frost protection requirements, etc.

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 footing areas and any engineered fill areas for the proposed building addition should be inspected by Kollaard Associates Inc. to ensure that a suitable subgrade 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 access roadway and parking areas should be inspected and approved by geotechnical personnel. In situ density testing should be carried out on the roadway 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
May 3.2019
S.E. deWit
100079612
PROVINCE OF ONTARIO

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

Steve DeWit, P.Eng.

Attachments: Appendix A – Summary of Geotechnical Recommendations
Record of Test Pits
Key Plan - Figure 1
Site Plan - Figure 2
Laboratory Test Results for Chemical Properties - Sulphate, Resistivity and pH
Laboratory Test Results for Physical Properties – Stantec Laboratory Test Results for Soils
National Building Code Seismic Hazard Calculation Results

APPENDIX A – SUMMARY OF GEOTECHNICAL RECOMMENDATIONS

This report provides geotechnical recommendations under the Headings: Proposed Building Addition Foundations; Retaining Walls; Site Services; Access Roadway Pavements; Construction Considerations:

These geotechnical recommendations include:

Corrosivity on Reinforcement and Sulphate Attack on Portland Cement
Foundation Excavation
Shoring Design
Ground Water in Excavation and Construction Dewatering
Effect of Dewatering of Foundation on Site Services Excavations on Adjacent Structures
Thickened Edge Slab on Grade Foundation Design
Bearing Capacity
Foundation Drainage
Settlement
Subgrade preparation
Engineered Fill and Compaction
Frost Protection
Foundation Backfill
Floor Slab
Seismic Design

RECORD OF TEST PIT 1

PROJECT: Proposed Building Addition
CLIENT: Capital Truck Sales
LOCATION: 7409 Cenote Road, Ottawa, ON

PROJECT NUMBER: 180138
DATE OF EXCAVATING: April 16, 2019
SHEET 1 of 1
DATUM: Geodetic

DEPTH SCALE (meters)	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (M)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	UNDIST. SHEAR STRENGTH × Cu, kPa (20 40 60 80) / REM. SHEAR STRENGTH ○ Cu, kPa (20 40 60 80)	WATER CONTENT % (10 20 30 40)	ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
	Ground Surface		92.11							
0	Grey crushed stone (FILL)		0.00 91.81							
	Yellow brown to grey borwn silty clay, trace sand, gravel, boulders, ash and organics (FILL)		0.30 90.86							
1	TOPSOIL		1.25 90.66							
	Grey brown silty sand, some gravel, cobbles and boulders, trace clay (GLACIAL TILL)		1.45 89.91							Some water observed in test pit at about 1.5 metres below existing ground surface, April 16, 2019.
2	End of test pit, Refusal on BEDROCK		2.20							
3										
4										
5										

DEPTH SCALE: 1:30
EXCAVATOR TYPE: Rubber Tire Mounted Backhoe

LOGGED: DT
CHECKED: SD

RECORD OF TEST PIT 2

PROJECT: Proposed Building Addition
CLIENT: Capital Truck Sales
LOCATION: 7409 Cenote Road, Ottawa, ON

PROJECT NUMBER: 180138
DATE OF EXCAVATING: April 16, 2019
SHEET 1 of 1
DATUM: Geodetic

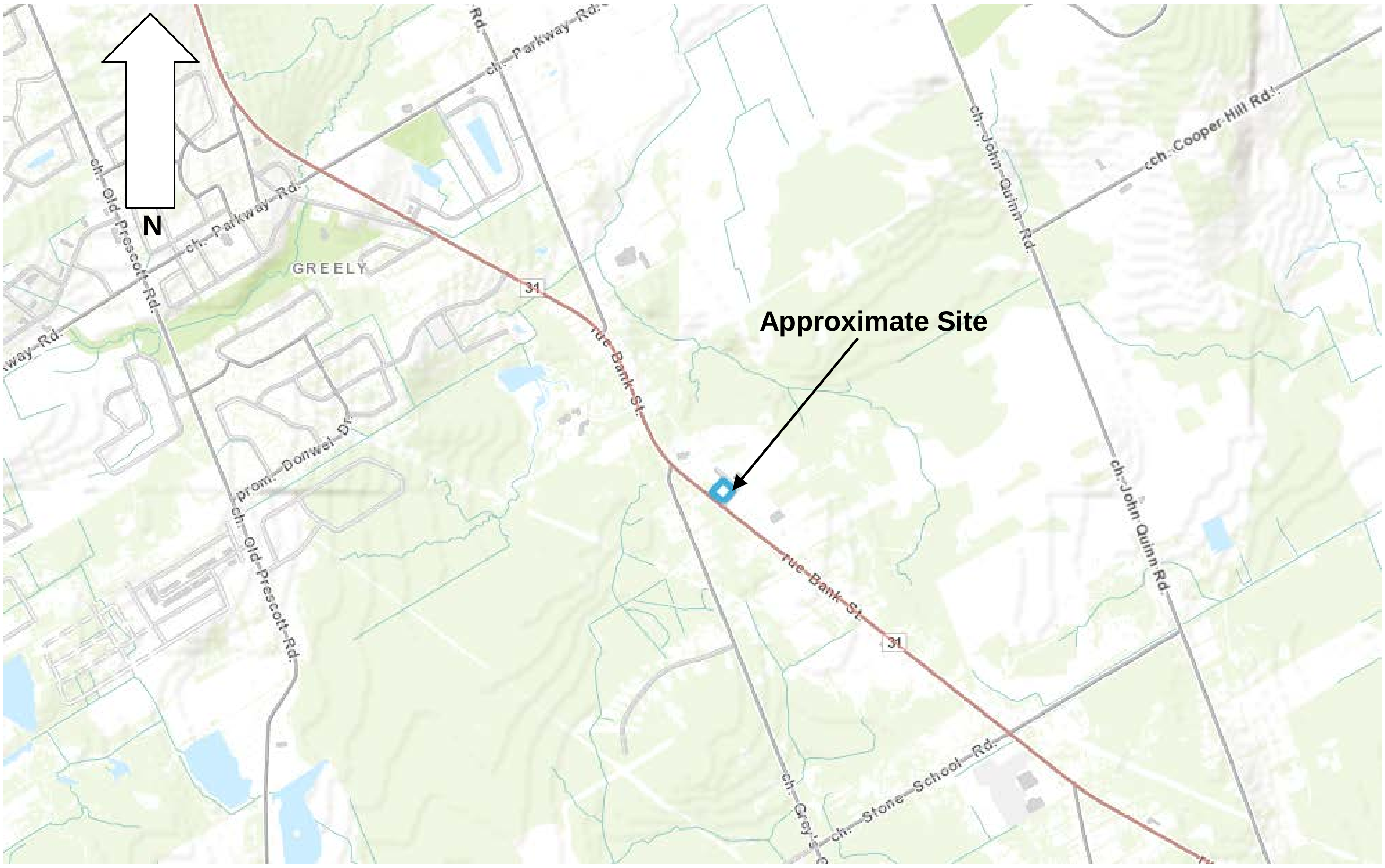
DEPTH SCALE (meters)	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (M)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	UNDIST. SHEAR STRENGTH × Cu, kPa 20 40 60 80 / REM. SHEAR STRENGTH ○ Cu, kPa 20 40 60 80	WATER CONTENT % 10 20 30 40	ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
	Ground Surface		91.74							
0	Grey crushed stone (FILL)		0.00 91.44							
	Topsoil (FILL)		0.30 91.29							
	Yellow brown silty clay, trace sand, gravel and boulders (FILL)		0.45 91.04							
	TOPSOIL		0.70 90.84							
1	Grey brown silty sand, some gravel, cobbles and boulders, trace clay (GLACIAL TILL)		0.90 90.04							Test pit dry, April 16, 2019.
	End of test pit, Practical refusal on large boulder or bedrock		1.70							
2										
3										
4										
5										

DEPTH SCALE: 1:30
EXCAVATOR TYPE: Rubber Tire Mounted Backhoe

LOGGED: DT
CHECKED: SD

KEY PLAN

FIGURE 1



NOT TO SCALE

Kollaard Associates
Engineers

Project No. 180138

Date May 2019

DRAWING NUMBER:
SITE PLAN, FIGURE 2

LEGEND:

TP1 ▪ APPROXIMATE TEST PIT 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

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http://www.kollaard.ca
(613) 860-0923
info@kollaard.ca

CLIENT: CAPITAL TRUCK SALES

PROJECT: PROPOSED GEOTECHNICAL INVESTIGATION FOR PROPOSED BUILDING ADDITION

LOCATION: 7409 CENOTE ROAD OTTAWA, ONTARIO

DESIGNED BY: --	DATE: APRIL 25, 2019
DRAWN BY: DT	SCALE: N.T.S

KOLLAARD FILE NUMBER: 180138

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: 18-APR-19
Report Date: 25-APR-19 15:00 (MT)
Version: FINAL

Client Phone: 613-860-0923

Certificate of Analysis

Lab Work Order #: L2260695
Project P.O. #: NOT SUBMITTED
Job Reference: 180138
C of C Numbers:
Legal Site Desc:

Melanie Moshi
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2260695-1 TP2 GS1 Sampled By: CLIENT on 17-APR-19 Matrix: SOIL							
Physical Tests							
Conductivity	0.162		0.0040	mS/cm		24-APR-19	R4610686
% Moisture	10.2		0.10	%	23-APR-19	24-APR-19	R4610016
pH	7.55		0.10	pH units		24-APR-19	R4611585
Resistivity	6170		1.0	ohm*cm		24-APR-19	
Leachable Anions & Nutrients							
Chloride	<0.00050		0.00050	%	24-APR-19	24-APR-19	R4612267
Anions and Nutrients							
Sulphate	0.0042		0.0020	%	23-APR-19	23-APR-19	R4610205

* 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).

ALS Test Code	Matrix	Test Description	Method Reference**
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).

ALS Test Code	Matrix	Test Description	Method Reference**
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).

ALS Test Code	Matrix	Test Description	Method Reference**
RESISTIVITY-CALC-WT	Soil	Resistivity Calculation	APHA 2510 B

Resistivity are calculated based on the conductivity using APHA 2510B where Conductivity is the inverse of Resistivity.

ALS Test Code	Matrix	Test Description	Method Reference**
RESISTIVITY-CALC-WT	Soil	Resistivity Calculation	MOECC E3138

Resistivity are calculated based on the conductivity using APHA 2510B where Conductivity is the inverse of Resistivity.

ALS Test Code	Matrix	Test Description	Method Reference**
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.

Quality Control Report

Workorder: L2260695 Report Date: 25-APR-19

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

Contact: Dean Tataryn

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CL-R511-WT	**Soil**							
Batch R4612267								
WG3033211-3 CRM		**AN-CRM-WT**						
Chloride			86.8		%		70-130	24-APR-19
WG3033211-4 DUP		**L2260694-1**						
Chloride		145	147		ug/g	1.4	30	24-APR-19
WG3033211-2 LCS								
Chloride			101.1		%		80-120	24-APR-19
WG3033211-1 MB								
Chloride			<5.0		ug/g		5	24-APR-19
EC-WT	**Soil**							
Batch R4610686								
WG3033183-4 DUP		**WG3033183-3**						
Conductivity		0.224	0.233		mS/cm	3.9	20	24-APR-19
WG3033183-2 IRM		**WT SAR3**						
Conductivity			105.3		%		70-130	24-APR-19
WG3033393-1 LCS								
Conductivity			98.9		%		90-110	24-APR-19
WG3033183-1 MB								
Conductivity			<0.0040		mS/cm		0.004	24-APR-19
MOISTURE-WT	**Soil**							
Batch R4610016								
WG3032375-3 DUP		**L2260524-1**						
% Moisture		11.1	11.1		%	0.0	20	24-APR-19
WG3032375-2 LCS								
% Moisture			99.5		%		90-110	24-APR-19
WG3032375-1 MB								
% Moisture			<0.10		%		0.1	24-APR-19
PH-WT	**Soil**							
Batch R4611585								
WG3032264-1 DUP		**L2260690-9**						
pH		7.94	8.00	J	pH units	0.06	0.3	24-APR-19
WG3033527-1 LCS								
pH			6.97		pH units		6.9-7.1	24-APR-19
SO4-WT	**Soil**							
Batch R4610205								
WG3032295-4 CRM		**AN-CRM-WT**						
Sulphate			118.8		%		60-140	23-APR-19
WG3032295-3 DUP		**L2257461-15**						

Quality Control Report

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

Test		Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SO4-WT		**Soil**							
Batch	**R4610205**								
WG3032295-3	**DUP**		**L2257461-15**						
Sulphate			69	68		mg/kg	2.6	30	23-APR-19
WG3032295-2	**LCS**								
Sulphate				99.5		%		80-120	23-APR-19
WG3032295-1	**MB**								
Sulphate				<20		mg/kg		20	23-APR-19

Quality Control Report

Workorder: L2260695 Report Date: 25-APR-19

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

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental
www.alsglobal.com

Canada Toll Free: 1 800 668 9878

L2260695-COFC

COC Number: 17 -

Page of

Report To	Contact and company name below will appear on the final report
Company:	Kollaard Associates (27196)
Contact:	Dean Tataryn
Phone:	613.860.0923, ext.225
	Company address below will appear on the final report
Street:	210 Prescott Street, Unit 1 P.O. Box 189
City/Province:	Kemptville, Ontario
Postal Code:	K0G 1J0
Invoice To	Same as Report To ☐ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)

Quality Control (QC) Report with Report ☐ YES ☐ NO

☐ Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: ☐ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax dean@kollaard.ca

Email 2

Email 3

Invoice Distribution

Select Invoice Distribution: ☐ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax mary@kollaard.ca

Email 2

Contact your AM to confirm all E&P TATs (surcharges may apply)

Regular [R] ☒ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4-20%] ☐ 3 day [P3-25%] ☐ 2 day [P2-50%] ☐

EMERGENCY: 1 Business day [E1 - 100%] ☐ Same Day, Weekend or Statutory holiday [E2 -200% (Laboratory opening fees may apply)] ☐

Date and Time Required for all E&P TATs:

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information

ALS Account # / Quote #: Q71021

Job #: 180138

PO / AFE:

LSD:

ALS Lab Work Order # (lab use only): L2260695 ZOA 28

Oil and Gas Required Fields (client use)

AFE/Cost Center: | PO#

Major/Minor Code: | Routing Code:

Requisitioner:

Location:

ALS Contact: Melanie M. | Sampler:

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Corrosivity (KOLLAARD-CORR-WT)	Subdivision-Chem (KOLLAARD-SDCHEM-W)	Subdivision-Micro (KOLLAARD-SDMICRO-W)	BTEX / F1-F4	SAMPLES ON HOLD	Sample is hazardous (please provide further detail)	NUMBER OF CONTAINERS
2.	TP2 GS1	Apr17/19		Soil	✓						

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

Are samples for human consumption/ use? ☐ YES ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C: 22.1

FINAL COOLER TEMPERATURES °C: 7.6

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: [signature]	Date:	Time:	Received by: [signature]	Date: Apr/18/19	Time: 2:00	Received by: MM	Date: Apr 20/19	Time: 9:30

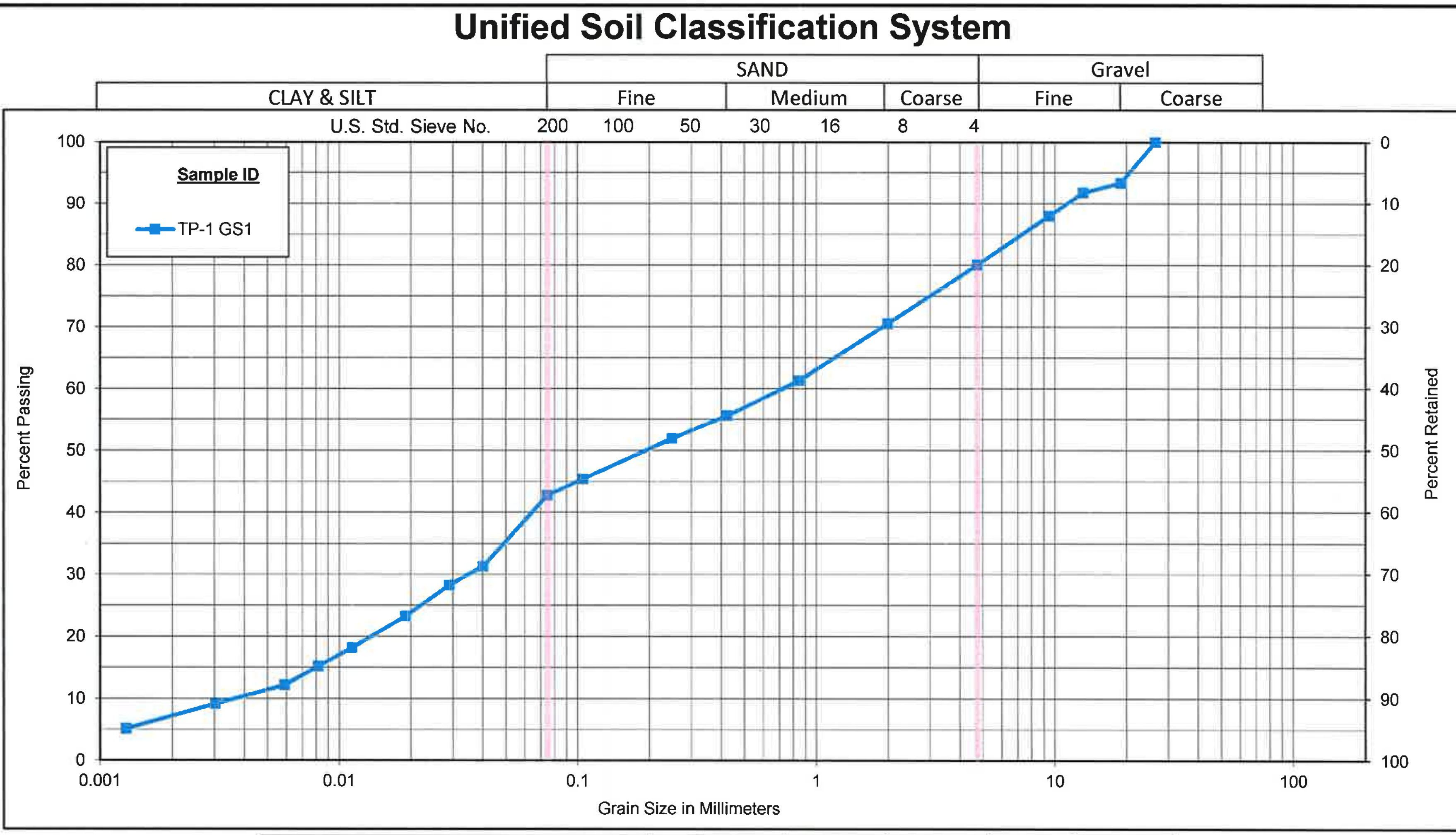
REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION WHITE - LABORATORY COPY YELLOW - CLIENT COPY

SEPT 2017 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

Laboratory Test Results for Physical Properties



Sample ID	Depth	% Gravel	% Sand	% Silt	% Clay
TP-1 GS1	N/A	19.9	37.4	35.7	7.0

Stantec

GRAIN SIZE DISTRIBUTION

Kollaard Associates, File #180138
7409 Genote Road, Ottawa

Figure No.

Project No. 122410003

Stantec

Particle-Size Analysis of Soils

LS702

ASTM D422

PROJECT DETAILS

Client:	**Kollaard Associates, File #180138**	Project No.:	**122410003**
Project:	**7409 Genote Road, Ottawa**	Test Method:	**LS702**
Material Type:	**Soil**	Sampled By:	**Kollaard Associates**
Source:	**TP-1**	Date Sampled:	**April 16, 2019**
Sample No.:	**GS1**	Tested By:	**Daniel Boateng**
Sample Depth	**N/A**	Date Tested:	**April 25, 2019**

WASH TEST DATA

Oven Dry Mass In Hydrometer Analysis (g)	68.52
Sample Weight after Hydrometer and Wash (g)	27.20
Percent Passing No. 200 Sieve (%)	**60.3**
Percent Passing Corrected (%)	**42.53**

PERCENT LOSS IN SIEVE

Sample Weight Before Sieve (g)	**939.10**
Sample Weight After Sieve (g)	**937.10**
Percent Loss in Sieve (%)	**0.21**

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)	90.55
Air Dried Mass (W_a), (g)	90.92
Hygroscopic Corr. Factor ($F=W_o/W_a$)	0.9959
Air Dried Mass in Analysis (M_a), (g)	68.80
Oven Dried Mass in Analysis (M_o), (g)	68.52
Percent Passing 2.0 mm Sieve (P_{10}), (%)	70.52
Sample Represented (W), (g)	97.16

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	62.3	93.4
13.2	76.7	91.8
9.5	112.8	88.0
4.75	187.0	80.1
2.00	276.8	70.5
Total (C + F)[1]	937.10	
0.850	8.96	61.30
0.425	14.50	55.60
0.250	18.12	51.87
0.106	24.40	45.41
0.075	27.02	42.71
PAN	27.30	

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 7:02 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
25-Apr-19	7:03 AM	1	38.0	7.0	25.0	31.0	31.22	10.32404	8.97259	0.012529	0.04026
25-Apr-19	7:04 AM	2	35.0	7.0	25.0	28.0	28.20	10.78904	8.97259	0.012529	0.02910
25-Apr-19	7:07 AM	5	30.0	7.0	25.0	23.0	23.16	11.56404	8.97259	0.012529	0.01905
25-Apr-19	7:17 AM	15	25.0	7.0	25.0	18.0	18.13	12.33904	8.97259	0.012529	0.01136
25-Apr-19	7:32 AM	30	22.0	7.0	25.0	15.0	15.10	12.80404	8.97259	0.012529	0.00818
25-Apr-19	8:02 AM	60	19.0	7.0	24.5	12.0	12.08	13.26904	9.07441	0.012599	0.00593
25-Apr-19	11:12 AM	250	16.0	7.0	22.0	9.0	9.0630	13.73404	9.61570	0.012970	0.00304
26-Apr-19	7:02 AM	1440	12.0	7.0	22.5	5.0	5.0350	14.35404	9.50295	0.012894	0.00129

Remarks:

Reviewed By: Brian Prevost
Date: April 29/2019

V:\01216\active\laboratory_standing_offers\2019 Laboratory Standing Offers\122410003 Kollaard Associates Engineers\April 16, Sieve & MC_Kollaard #180138\Hydrometer Analysis MTO Projects May2014.xlsx

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: 45.250N 75.533W **User File Reference:** 7409 Cenote Road 2019-04-25 20:00 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)	0.514	0.277	0.161	0.045
Sa (0.1)	0.595	0.332	0.201	0.062
Sa (0.2)	0.492	0.279	0.172	0.056
Sa (0.3)	0.370	0.211	0.131	0.044
Sa (0.5)	0.259	0.148	0.092	0.031
Sa (1.0)	0.126	0.073	0.046	0.015
Sa (2.0)	0.059	0.034	0.021	0.006
Sa (5.0)	0.015	0.008	0.005	0.001
Sa (10.0)	0.006	0.003	0.002	0.001
PGA (g)	0.315	0.179	0.109	0.033
PGV (m/s)	0.214	0.118	0.071	0.022

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

Natural Resources Canada Ressources naturelles Canada

Canada