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REPORT ON

GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENTIAL DEVELOPMENT
5574 ROCKDALE ROAD
VARS, ONTARIO

Project # 220863

Submitted to:

Bergeron Construction (1457932 Ontario Inc.)
1801 Russland Road
Vars, Ontario
K0A 3H0

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Bergeron Construction
1801 Russland Road
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RE: GEOTECHNICAL INVESTIGATION
PROPOSED TWO-STOREY APARTMENT BUILDING
5574 ROCKDALE ROAD
VARS, ONTARIO

1.0 INTRODUCTION

This report presents the results of a geotechnical investigation carried out for the above noted proposed residential development at 5574 Rockdale Road, in Vars, Ontario (See Key Plan, Figure 1).

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 1.75 hectare (4.3 acres) property located at 5574 Rockdale Road in Vars, Ontario (see Key Plan, Figure 1).

For the purposes of this assessment, project north lies in a direction parallel to Rockdale Road, which is located immediately east of the subject site.

Surrounding land use is residential development. The site is bordered on the north by vacant forested land, south and west by residential development, and on the east by Rockdale Road followed by residential development.

The ground surface at the site is currently unmaintained grasses graded such that surface water drains to the west.

Based on a review of the surficial geology map for the site area, it is expected that the site is underlain by medium to fine grained sand. Bedrock geology maps indicate that the bedrock underlying the site consists of shale and limestone of the Carlsbad Formation.

Based on a review of available borehole information in the vicinity of the site, the overburden at and near the site likely consists of some 1.8 to 5.5 metres of overburden overlying bedrock.

2.2 Proposed Development

It is understood that preliminary plans are being prepared for the construction of a 12 unit, 2-storey residential apartment building. It is understood that the building will be of wood frame construction with one storey of brick veneer and one storey of underground parking. The building will be supported by conventional concrete spread footing foundations bearing below the expected frost level. The basement floor will consist of a cast-in-place concrete slab on grade construction. The proposed building will be serviced by municipal water and an onsite septic system.

Surface drainage for the proposed building will be by means of swales, catch basins and storm sewers.

3.0 PROCEDURE

The field work for this investigation was carried out on May 21, 2024, at which time five (5) boreholes, numbered BH1 to BH5, were put down at the site using a truck mounted drill rig equipped with a solid stem auger owned and operated by Limitless Drilling of Renfrew, Ontario. BH1 and BH2 were put down within the proposed building footprint. Boreholes BH4 and BH5 were put down within the proposed septic area. Borehole BH3 was put down within the proposed access roadway.

Sampling of the overburden materials encountered at the borehole locations was 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). The five boreholes (BH1 to BH5) were advanced to depths of about 1.8 to 7.2 metres below the existing ground surface using 200 mm hollow stem augers. Bedrock was confirmed through rock coring. 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 measured at a later date in a standpipe put down within one of the boreholes (BH2). The boreholes were loosely backfilled with the auger cuttings upon completion of drilling.

One soil sample (BH1 – SS4 – 2.3 – 2.9 m) was delivered to a chemical laboratory for testing for any indication of potential soil sulphate attack on concrete and corrosivity to buried steel.

One soil sample (BH2 – SS4 – 2.3 – 2.9 m) was submitted for Particle Size Analysis (ASTM D422). 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 17 soil samples recovered from the boreholes were also tested for moisture content (ASTM D2216).

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. A description of the subsurface conditions encountered at the boreholes is given in the attached Record of Borehole Sheets. 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 elevations at the borehole locations were extrapolated from topographic data provided as a part of drawing Kollaard #220863 - GR. The elevations are indicated to be geodetic.

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 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 borehole 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 Topsoil

From the surface, a layer of topsoil measuring about 0.1 metres in thickness was encountered in borehole BH1, BH2, BH4, and BH5. 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.

4.3 Fill Materials

From the surface, a layer of fill materials consisting of yellow brown silty clay was encountered in BH3 and BH4. The fill materials were about 0.8 metres in thickness. The fill materials were fully penetrated in boreholes BH3 and BH4.

4.3 Sand Materials

Yellow brown fine to medium sand and/or grey medium to coarse sand was encountered beneath the topsoil or fill materials in all boreholes. The results of the standard penetration testing carried out in the sand materials ranged from 4 to 11 to a depths ranging between 1.1 to 3.0 metres below grade indicating a loose state of packing in the upper portion of the sand deposit. The sand materials were fully penetrated in boreholes BH1 and BH2, and had a thickness of 1.1 to 1.8 metres. The sand materials extended to depths of 1.8 to 3.1 metres, below the existing ground surface in boreholes BH3 to BH5. The measured moisture contents of the sand ranged from about 7 to 27 percent.

4.5 Glacial Till

Grey brown glacial till was encountered beneath the sand in boreholes BH1 and BH2. The glacial till consisted of silty sand with some gravel, cobbles, boulders and a trace of clay. The results of the standard penetration testing carried out in the glacial till material ranged from 15 to 39 blows per 0.3 metres, indicating a compact to dense state of packing. The glacial till was fully penetrated in borehole BH2, and had a thickness of 1.9 metres. Borehole BH1 was terminated with practical refusal at the base of the glacial till on bedrock or large boulders, at a depth of about 2.9 metres below the existing ground surface. The measured moisture contents of the glacial till ranged from about 9 to 15 percent.

The results of a hydrometer test (ASTM D422) on a sample of soil (BH2 – SS4 – 2.3 – 2.9 m) indicates the sample has the following:

Sample	Depth(metres)	% Gravel	% Sand	% Silt	% Clay
BH2 – SS4	2.3 – 2.9	23.7	50.0	20.3	6.0

The results are located in Attachment A.

4.6 Groundwater

Some groundwater was observed in borehole BH3 at depth of about 1.5 metres below the existing ground surface at the time of drilling on May 21, 2024. Groundwater was measured in a standpipe installed within borehole BH2 at a depth of about 0.8 metres below the existing ground surface on June 3, 2024. Groundwater levels are expected to fluctuate seasonally. Higher groundwater levels are expected during wet periods of the year, such as early spring.

4.7 Corrosivity on Reinforcement and Sulphate Attack on Portland Cement

The results of the laboratory testing of a soil sample (BH1 – SS4 – 2.3 – 2.9 m) 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 %	0.00084	Negligible
pH	5.5 > pH	7.90	Basic Negligible concern
Resistivity	R < 20,000 ohm-cm	6290	Moderately corrosive
Sulphates (SO_4)	SO_4 > 0.1%	0.0052	Negligible concern

The results of the laboratory testing of a soil sample for sulphate gave a percent sulphate of less than 0.0052. The National Research Council of Canada (NRC) recognizes four categories of potential sulphate attack of buried concrete based on percent sulphate in soil. From 0 to 0.10 percent the potential is negligible, from 0.10 to 0.20 percent the potential is mild but positive, from 0.20 to 0.50 percent the potential is considerable and 0.50 percent and greater the potential is severe. Based on the above, the soils are considered to have a negligible potential for sulphate attack on buried 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 7.90, 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 presents negligible concern.

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 6290 ohm-cm for the sample analyzed making the soil moderately corrosive for buried steel within below grade concrete walls. 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. Alternatively, a glass fiber reinforced product (GFRP) could be used in place of steel reinforcing in below grade applications.

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 Building

It is understood that the proposed residential building will consist of conventional concrete spread footing foundations complete with cast-in-place concrete foundation walls and concrete slab-on-grade construction.

Based on the results of the geotechnical assessment, the native sand is considered suitable for the support of the proposed building on conventional spread footing foundations bearing on native sand or an engineered fill pad placed on the native sand.

The allowable bearing pressure for any footings depends on the depth of the footings below original ground surface, the width of the footings, 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.

5.3 Foundation Design and Bearing Capacity

The subsurface conditions at the site encountered at the boreholes advanced for this investigation consisted of topsoil or fill materials (topsoil and silty clay) overlying sand followed by compact to dense glacial till overlying bedrock. For predictable performance and to reduce the potential for differential movement of the proposed foundations, all fill materials, and any deleterious materials should be removed from within the proposed foundation areas to expose the native sand.

Based on a review of the proposed grading plan drawing #220863 – GR prepared by Kollaard Associates Inc it is understood that the proposed footings will be founded at an elevation of 77.36 m. This elevation corresponds to a depth of between 0.6 and 0.7 below the existing ground surface at the proposed building location.

Strip and pad footings, a minimum 0.5 metres in width bearing on sand at the above noted elevation or on a suitably constructed engineering pad placed on the sand may be designed using a maximum allowable bearing pressure of 95 kilopascals for serviceability limit states and 180 kilopascals for the factored ultimate bearing resistance.

The above allowable bearing pressure is subject to a maximum grade raise of 2.5 metres with the above allowable bearing pressure.

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.
The subgrade surface should be inspected and approved by geotechnical personnel prior to placement of any granulars.

5.4 Engineered Fill

Should the complete removal of all fill materials, topsoil, loose sand, and any otherwise deleterious material result in a subgrade below the proposed founding level, any fill required to raise the footings for the proposed building to founding level 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 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 first lift of engineered fill material should have a thickness of 300 millimetres in order to protect the subgrade during compaction. Should the subgrade surface consist of sand below the water table, a 6 ounce per square yard non woven geotextile fabric should be placed between the engineered fill and the sand subgrade. 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 sands 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.

5.5 Foundation Excavation

5.5.1 Excavation Side Slopes

Excavations for the proposed foundations will be taken through the fill materials (topsoil, silty clay) to expose the native sand 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 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.

It is expected that the side slopes of the excavation will be stable in the short term provided the walls are sloped at 1H:1V through the fill materials and native sand to the bottom of the excavation and provided no excavated materials are stockpiled within 3 metres of the top of the excavations.

5.5.2 Ground Water in Excavation and Construction Dewatering

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

Groundwater was encountered in borehole BH3 at depth of about 1.5 metres below the existing ground surface at the time of drilling on May 21, 2024. Boreholes BH1, BH2, BH4, and BH5 were dry at the time of drilling on May 21, 2024. On June 3, 2024 water was measured in a standpipe placed within borehole BH2 at about 0.8 metres below the existing ground surface.

It is expected that the groundwater will be below the underside of footing elevation. Groundwater and/or surface water inflow if present, can be controlled by pumping from filtered sumps within the excavation. The water removed from the excavation should be discharged into temporary settling ponds to allow for the settlement of suspended sand particles prior to discharge from the site.

Based on the results of the boreholes, we do not expect significant groundwater inflow into the excavation for the proposed development. However, if groundwater is encountered, at minimum, registration on the Environmental Activity Sector Registry (EASR) as per O.Reg. 63/16 is expected to be required.

5.6 Frost Protection Requirements for Spread Footing Foundations

In general, all exterior foundation elements and those in any unheated parts of the proposed building 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.

5.7 Foundation Wall Backfill and Drainage

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.

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 the existing ground surface or to a sump. If the perimeter drain tile is discharged by gravity to the Storm Sewer a backup flow valve must be used. If

a sump is used, the sump should be equipped with a backup pump and generator. The sump discharge should be equipped with a backup flow protector.

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.

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.

5.8 Parking Floor Slab

As stated above, it is expected that the proposed building will be founded on native sand or on an engineered pad placed on the native sand. For predictable performance of the proposed concrete basement floor slab all existing fill materials, and any otherwise deleterious material should be removed from below the proposed floor slab area. The exposed native sand surface should then be inspected and approved by geotechnical personnel.

Engineered fill materials provided to support the concrete floor slab 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.

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.

5.9 Seismic Design for the Proposed Residential Building

5.9.1 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 D. The proposed building will be founded either directly on native sand or on an engineered pad placed on the native sand.

5.9.2 National Building Code Seismic Hazard Calculation

The design Peak Ground Acceleration (PGA) for the site was calculated as 0.347 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.

5.9.3 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 topsoil or fill materials overlying native sand followed by compact to dense glacial till overlying bedrock.

Consideration for the potential for soil liquefaction was determined by considering the ratio between the cyclic resistance ratio (CRR) and the cyclic stress ratio (CSR) for the soils between the proposed underside of footing level and the depth at which refusal to further advancement using standard penetration testing was attained. The CRR value was determined from a mathematical expression as determined by Rauch (1997) of the base curve obtained from Robertson and Fear (1996). The CSR was determined from Seed and Idriss (1971). It is considered that a soil with a normalized SPT of greater than 30 is non-liquefiable. It is also considered that a soil with a CRR/CSR ratio of greater than one is not liquefiable. The average CRR / CSR ratio for the materials encountered to the depth explored excluding the normalized SPT values above 30 is 11.8. As such the underlying soils below the proposed foundations are not considered to be liquefiable.

Therefore, it is considered that no damage to the proposed building will occur due to liquefaction of the native subgrade under seismic conditions.

6.0 SITE SERVICES

6.1 Excavation

The excavations for the site services will be carried out through topsoil or fill materials (topsoil, silty clay), native sand, and glacial till. 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.

For the purposes of Ontario Regulation 213/91, the subsurface conditions at the site can be considered to be Soil Type 3. The existing fill and glacial till should be sloped at 1H:1V through the fill materials and native sand to the bottom of the excavation and provided no excavated materials are stockpiled within 3 metres of the top of the excavations.

Boreholes BH3 encountered groundwater at about 1.5 metres below the existing ground surface at the time of drilling on May 21, 2024. Water was measured at borehole BH2 in a standpipe at about 0.8 metres below the existing ground surface on June 3, 2024. As such, significant groundwater flow into any excavation is unlikely. Any groundwater inflow into the service trenches should be handled by pumping from sumps from within the excavations.

6.2 Pipe Bedding and Cover Materials

It is suggested that the service pipe bedding material consist of at least 150 millimetres of granular material meeting OPSS requirements for Granular A. A provisional allowance should, however, be made for sub-excavation of any existing fill or disturbed material encountered at sub-grade level. Granular material meeting OPSS specifications for Granular A should also be used as a sub-bedding material. The use of clear crushed stone as bedding or sub-bedding material should not be permitted.

Cover material, from pipe spring line to at least 300 millimetres above the top of the pipe, should consist of OPSS Granular A. The sub-bedding, bedding and cover materials should be compacted in maximum 200 millimetre thick lifts to at least 95 percent of the standard Proctor maximum dry density using suitable vibratory compaction equipment.

6.3 Trench Backfill

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

In areas where the service trench will be located below or in close proximity to existing or future roadway areas, acceptable native materials should be used as backfill between the roadway sub-grade level and the depth of seasonal frost penetrations (i.e. 1.8 metres below finished grade) in order to reduce the potential for differential frost heaving between the area over the trench and the adjacent section of roadway.

Where native backfill is used, it should match the native materials exposed on the trench walls. Some of the native materials from the lower part of the trench excavations may be wet of optimum for compaction. Depending on the weather conditions encountered during construction, some drying

of materials and/or recompaction may be required. Any wet materials that cannot be compacted to the required density should either be wasted from the site or should be used outside of existing or future roadway areas. Any boulders larger than 300 millimetres in size should not be used as service trench backfill. Backfill below the zone of seasonal frost penetration could consist of either acceptable native material or imported granular material conforming to OPSS Granular B Type I. If the native material is not suitable for backfill, imported granular material may have to be used. If imported granular materials are used, suitable frost tapers should be used in accordance with OPSD 802.013.

To minimize future settlement of the backfill and achieve an acceptable sub-grade for the roadways, sidewalks, etc., the trench should be compacted in maximum 300 millimetre thick lifts to at least 95 percent of the standard Proctor maximum dry density. The specified density may be reduced where the trench backfill is not located in close proximity to existing or future roadways, driveways, sidewalks, or any other type of permanent structure.

7.0 ACCESS ROADWAY PAVEMENTS

7.1 Subgrade Preparation

Based on the results of the boreholes, the subsurface conditions in the access roadway and parking areas consist of a thin layer of topsoil or fill materials (silty clay) followed by native sand. For predictable performance of the pavement structures, it is considered that the topsoil and any other deleterious material will have to be removed to a depth of about 0.15 metres below the existing ground surface in preparation for pavement construction at this site.

The exposed subgrade at a depth of 0.15 metres below the existing grade is expected to consist fill material (silty clay) or of fine to medium native sand. The deleterious and loose or disturbed materials should be removed to their full depth. The silty clay fill and/or the fine to medium sand is considered to constitute an acceptable subgrade.

Once topsoil and any deleterious material have been removed, the exposed sub-grade should be inspected and approved by geotechnical personnel and any soft areas evident should be sub-excavated and replaced with suitable earth borrow or granular crushed stone approved by the geotechnical engineer. The sub-grade should be shaped and crowned to promote drainage of the

roadway area granular. Following approval of the preparation of the sub-grade, the pavement granulars may be placed.

For any areas of the site that require the sub-grade to be raised to proposed pavement sub-grade level, the material used should consist of OPSS select sub-grade material or OPSS Granular B Type I or Type II. Recycled crushed concrete meeting the grading specifications for Granular B Type II could also be used. Materials used for raising the sub-grade to proposed roadway area sub-grade 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.

7.2 Pavement Structure

For pavement areas subject to cars and light trucks the pavement should consist of:

50 millimetres of Superpave 12.5 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)
Non-woven geotextile fabric (4 oz/sy) such as Terrafix 270R or Thrace-Ling 130EX or approved alternative.

Where heavy traffic is expected such as the fire route or garbage truck route the pavement structure should be increased to:

40 millimetres of Superpave 12.5 asphaltic concrete over
50 millimetres of Superpave 19 asphaltic concrete over
200 millimetres of OPSS Granular A base over
300 millimetres of OPSS Granular B, Type II subbase over
(50 or 100 millimetre minus crushed stone)
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 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. The adequacy of the design of the pavement thickness should be assessed by the geotechnical personnel at the time of construction.

8.0 CONSTRUCTION CONSIDERATIONS

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.

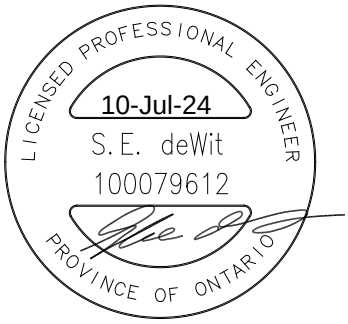
All foundation areas and any engineered fill areas for the proposed building should be inspected by Kollaard Associates Inc. to ensure that a suitable sub-grade has been reached and properly prepared. The placing and compaction of any granular materials beneath the foundations should be inspected to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

The subgrade for the site services 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 sand and glacial till deposits 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.



Isaac Bacon, P.Eng. Dean Tataryn, B.E.S., EP. Steven deWit, P.Eng.

Kollaard Associates
Engineers

BOREHOLE BH1

PROJECT: Proposed Residential Development
CLIENT: Bergeron Construction
LOCATION: 5574 Rockdale Road, Vars
PENETRATION TEST HAMMER: 63.5 kg, Drop, 0.76m

PROJECT NUMBER: 220863
DATE OF BORING: 2024-05-21
SHEET: 1 of 1
DATUM:

DEPTH SCALE (meters)	DESCRIPTION	DEPTH (m)	STRATA PLOT	ELEV. (m)	NUMBER	TYPE	BLOWS/0.3m	UNDIST SHEAR STRENGTH x Cu. kPa x / REM SHEAR STRENGTH o Cu. kPa o (0 20 40 60 80 100)	DYNAMIC CONE PENETRATION TEST blows/300 mm (0 20 40 60 80 100)	MOISTURE CONTENT (%)	PIEZOMETER OR STANDPIPE INSTALLATION
	TOPSOIL	0.00		78.04							
	Yellow brown fine to medium SAND, trace silt	0.10		77.94	1	SS	4			27	
1.0					2	SS	15			15	
	Grey brown silty sand, some gravel, cobbles, boulders, trace clay (GLACIAL TILL)	1.06		76.98							
2.0					3	SS	39			9	
					4	SS	34				
	Grey silty sand, some gravel, cobbles, boulders, trace clay (GLACIAL TILL)	2.79		75.25							
	Practical refusal on BEDROCK	2.92		75.12							

Borehole dry at time of drilling May 21, 2024.

DEPTH SCALE: 1 to 45
LOGGED: KH

BORING METHOD: Power Auger
AUGER TYPE: Hollow Stem
CHECKED: SD

Kollaard Associates
Engineers

BOREHOLE BH2

PROJECT: Proposed Residential Development
CLIENT: Bergeron Construction
LOCATION: 5574 Rockdale Road, Vars
PENETRATION TEST HAMMER: 63.5 kg, Drop, 0.76m

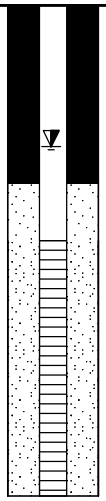
PROJECT NUMBER: 220863
DATE OF BORING: 2024-05-21
SHEET: 1 of 1
DATUM:

DEPTH SCALE (meters)	DESCRIPTION	DEPTH (m)	ELEV. (m)	NUMBER	TYPE	BLOWS/0.3m	MOISTURE CONTENT (%)
	TOPSOIL	0.00	77.78				
	Yellow brown fine to medium SAND, trace silt	0.10	77.68	1	SS	3	15
1.0				2	SS	10	22
	Grey medium to coarse SAND	1.22	76.56				
2.0	Grey brown silty sand, some gravel, cobbles, boulders, trace clay (GLACIAL TILL)	1.83	75.95	3	SS	20	9
				4	SS	39	
3.0	Cored through BEDROCK	2.94	74.84	1	RC		
4.0							
5.0				2	RC		
6.0							
				3	RC		
7.0	Rock core terminated in bedrock	7.16	70.62				

UNDIST SHEAR STRENGTH (x Cu. kPa x) / REM SHEAR STRENGTH (o Cu. kPa o): 0 20 40 60 80 100

DYNAMIC CONE PENETRATION TEST, blows/300 mm: 0 20 40 60 80 100

PIEZOMETER OR STANDPIPE INSTALLATION



Borehole dry at time of drilling May 21, 2024.
Groundwater measured in standpipe at about 0.8 below ground surface, June 3, 2024.

DEPTH SCALE: 1 to 45
LOGGED: KH

BORING METHOD: Power Auger and Coring
AUGER TYPE: Hollow Stem
CHECKED: SD

Kollaard Associates
Engineers

BOREHOLE BH3

PROJECT: Proposed Residential Development
CLIENT: Bergeron Construction
LOCATION: 5574 Rockdale Road, Vars
PENETRATION TEST HAMMER: 63.5 kg, Drop, 0.76m

PROJECT NUMBER: 220863
DATE OF BORING: 2024-05-21
SHEET: 1 of 1
DATUM:

DEPTH SCALE (meters)	SOIL PROFILE: DESCRIPTION	DEPTH (m)	STRATA PLOT	ELEV. (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	UNDIST SHEAR STRENGTH x Cu. kPa x / REM SHEAR STRENGTH o Cu. kPa o (0 20 40 60 80 100)	DYNAMIC CONE PENETRATION TEST blows/300 mm (0 20 40 60 80 100)	MOISTURE CONTENT (%)	PIEZOMETER OR STANDPIPE INSTALLATION
	Yellow brown silty clay, trace organics, trace sand (FILL)	0.00		78.14	1	SS	8			21	
1.0	Yellow brown fine to medium SAND, trace silt	0.76		77.38	2	SS	10			20	
					3	SS	11			27	▽
2.0	Grey medium to coarse SAND, trace silt	1.88		76.26	4	SS	6			22	
					5	SS	9			23	
3.0	Borehole terminated in SAND	3.05		75.09							

Groundwater encountered at about 1.5 metres below the existing surface May 21, 2024.

DEPTH SCALE: 1 to 45
LOGGED: KH

BORING METHOD: Power Auger
AUGER TYPE: Hollow Stem
CHECKED: SD

Kollaard Associates
Engineers

BOREHOLE BH4

PROJECT: Proposed Residential Development
CLIENT: Bergeron Construction
LOCATION: 5574 Rockdale Road, Vars
PENETRATION TEST HAMMER: 63.5 kg, Drop, 0.76m

PROJECT NUMBER: 220863
DATE OF BORING: 2024-05-21
SHEET: 1 of 1
DATUM:

DEPTH SCALE (meters)	DESCRIPTION	DEPTH (m)	STRATA PLOT	ELEV. (m)	NUMBER	TYPE	BLOWS/0.3m	UNDIST SHEAR STRENGTH x Cu. kPa x / REM SHEAR STRENGTH o Cu. kPa o (0 20 40 60 80 100)	DYNAMIC CONE PENETRATION TEST blows/300 mm (0 20 40 60 80 100)	MOISTURE CONTENT (%)	PIEZOMETER OR STANDPIPE INSTALLATION
	Topsoil (FILL)	0.00		77.65							
	Grey brown silty clay (FILL)	0.15		77.50	1	SS	3			38	
1.0	Grey brown fine to medium SAND	0.81		76.84	2	SS	10			24	
	Grey brown medium to coarse SAND	1.22		76.43	3	SS	8			7	
	Borehole terminated in SAND	1.83		75.82							

Borehole dry at time of drilling May 21, 2024.

DEPTH SCALE: 1 to 45
LOGGED: KH

BORING METHOD: Power Auger
AUGER TYPE: Hollow Stem
CHECKED: SD

Kollaard Associates
Engineers

BOREHOLE BH5

PROJECT: Proposed Residential Development
CLIENT: Bergeron Construction
LOCATION: 5574 Rockdale Road, Vars
PENETRATION TEST HAMMER: 63.5 kg, Drop, 0.76m

PROJECT NUMBER: 220863
DATE OF BORING: 2024-05-21
SHEET: 1 of 1
DATUM:

DEPTH SCALE (meters)	DESCRIPTION	DEPTH (m)	STRATA PLOT	ELEV. (m)	NUMBER	TYPE	BLOWS/0.3m	UNDIST SHEAR STRENGTH x Cu. kPa x / REM SHEAR STRENGTH o Cu. kPa o (0 20 40 60 80 100)	DYNAMIC CONE PENETRATION TEST blows/300 mm (0 20 40 60 80 100)	MOISTURE CONTENT (%)	PIEZOMETER OR STANDPIPE INSTALLATION
	TOPSOIL	0.00		77.17							
	Yellow brown fine to medium SAND, trace silt	0.15		77.02	1	SS	4			7	
1.0					2	SS	8			24	
	Grey fine to medium SAND, trace silt	1.07		76.10	3	SS	11			30	
	Borehole terminated in SAND	1.83		75.34							

Borehole dry at time of drilling May 21, 2024.

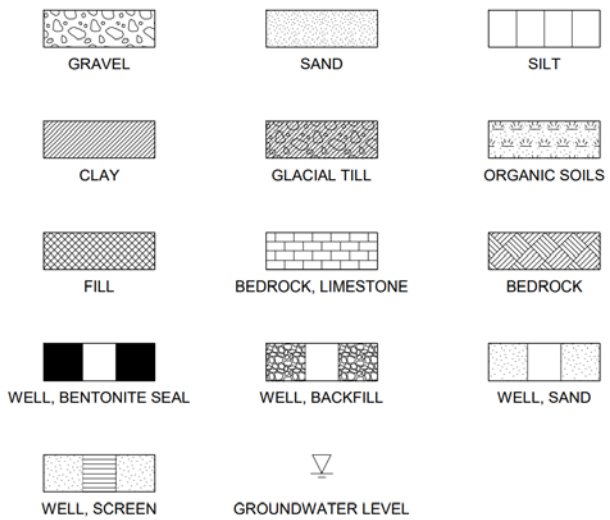
DEPTH SCALE: 1 to 45
LOGGED: KH

BORING METHOD: Power Auger
AUGER TYPE: Hollow Stem
CHECKED: SD

LIST OF ABBREVIATIONS AND TERMINOLOGY

SAMPLE TYPES	
AS	Auger Sample
CS	Chunk Sample
DO	Drive Open
MS	Manual Sample
RC	Rock Core
SS	Split Spoon Sample
TO	Thin-Walled Open Shelby Tube
WS	Wash Sample

PENETRATION RESISTANCE	
Standard Penetration Resistance (N) The number of blows by a 63.5 kg hammer dropped 760 millimeters required to drive a 50 mm drive open sampler for a distance of 300 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 DESCRIPTIONS

Relative Density	'N' Value
Very Loose	0 – 4
Loose	4 – 10
Compact	10 – 30
Dense	30 – 50
Very Dense	>50

Consistency	Cu, kPa
Very Soft	0 – 12
Soft	12 – 25
Firm	25 – 50
Stiff	50 – 100
Very Stiff	>100

LIST OF COMMON SYMBOLS	
Cu	Undrained Shear Strength
e	Void Ratio
Cc	Compression Index
Cv	Coefficient of Consolidation
k	Coefficient of Permeability
PI	Plasticity Index
n	Porosity
u	Pore Pressure
W	Moisture Content
LL	Liquid Limit
PL	Plastic Limit
r	Unit Weight of Soil
y	Unit Weight of Submerged Soil
cr	Normal Stress

SOIL TESTS	
C	Consolidation Test
H	Hydrometer Analysis
M	Sieve Analysis
MH	Sieve and Hydrometer Analysis
U	Unconfined Compression Test
Q	Undrained Triaxial Test
VA	Field Vane, Undisturbed and Remolded Shear Strength

KEY PLAN

FIGURE 1

NOT TO SCALE

Kollaard Associates
Engineers

Project No. 220863

Date May 2024

DRAWING NUMBER:
SITE PLAN, FIGURE 2

LEGEND:

BH1 APPROXIMATE BOREHOLE LOCATION

REFERENCE: PLAN SUPPLIED BY COSINE

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:
BERGERON CONSTRUCTION

PROJECT:
GEOTECHNICAL INVESTIGATION FOR PROPOSED RESIDENTIAL DEVELOPMENT

LOCATION:
5574 ROCKDALE ROAD
VARS, ONTARIO

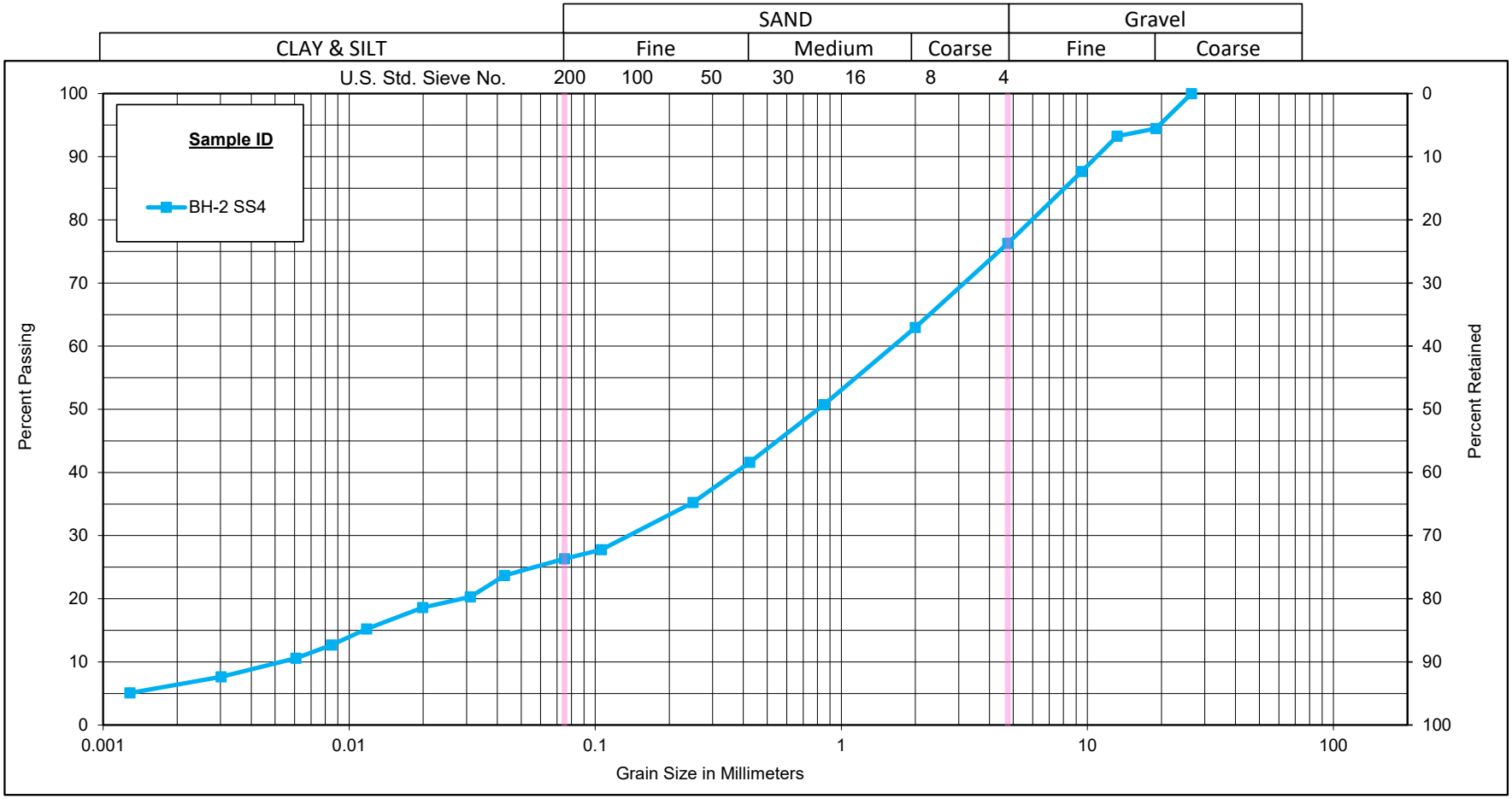
DESIGNED BY:	*DATE:*
--	MAY 8, 2024
DRAWN BY:	*SCALE:*
DT	N.T.S

KOLLAARD FILE NUMBER:
220863

ATTACHMENT A

Laboratory Test Results for Physical Properties

Unified Soil Classification System



Sample ID	Depth	% Gravel	% Sand	% Silt	% Clay
BH-2 SS4	2.3-2.9m	23.7	50.0	20.3	6.0

Stantec

GRAIN SIZE DISTRIBUTION

Kollaard Associates, File #220863

5574 Rockdale Road, Vars

Figure No.

Project No. 121625581

Stantec

Particle-Size Analysis of Soils

LS702

AASHTO T88

PROJECT DETAILS			
Client:	**Kollaard Associates, File #220863**	Project No.:	**121625581**
Project:	**5574 Rockdale Road, Vars**	Test Method:	**LS702**
Material Type:	**Soil**	Sampled By:	**Kollaard Associates**
Source:	**BH-2**	Date Sampled:	**May 21, 2024**
Sample No.:	**SS4**	Tested By:	**Brian Prevost**
Sample Depth	**2.3-2.9m**	Date Tested:	**June 6, 2024**

WASH TEST DATA	
Oven Dry Mass In Hydrometer Analysis (g)	72.81
Sample Weight after Hydrometer and Wash (g)	42.51
Percent Passing No. 200 Sieve (%)	**41.6**
Percent Passing Corrected (%)	**26.21**

PERCENT LOSS IN SIEVE	
Sample Weight Before Sieve (g)	**697.10**
Sample Weight After Sieve (g)	**695.80**
Percent Loss in Sieve (%)	**0.19**

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)	186.44
Air Dried Mass (W_a), (g)	188.07
Hygroscopic Corr. Factor ($F=W_o/W_a$)	0.9913
Air Dried Mass in Analysis (M_a), (g)	73.45
Oven Dried Mass in Analysis (M_o), (g)	72.81
Percent Passing 2.0 mm Sieve (P_{10}), (%)	62.98
Sample Represented (W), (g)	115.62

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

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	38.7	94.4
13.2	47.0	93.3
9.5	86.1	87.6
4.75	165.4	76.3
2.00	258.1	63.0
Total (C + F)[1]	695.80	
0.850	14.16	50.73
0.425	24.69	41.62
0.250	32.05	35.26
0.106	40.72	27.76
0.075	42.36	26.34
PAN	42.40	

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

START TIME 10:19 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
06-Jun-24	10:20 AM	1	32.0	4.0	23.5	28.0	23.69	11.25404	9.28431	0.012744	0.04275
06-Jun-24	10:21 AM	2	28.0	4.0	23.5	24.0	20.31	11.87404	9.28431	0.012744	0.03105
06-Jun-24	10:24 AM	5	26.0	4.0	23.5	22.0	18.62	12.18404	9.28431	0.012744	0.01989
06-Jun-24	10:34 AM	15	22.0	4.0	23.5	18.0	15.23	12.80404	9.28431	0.012744	0.01177
06-Jun-24	10:49 AM	30	19.0	4.0	23.5	15.0	12.69	13.26904	9.28431	0.012744	0.00848
06-Jun-24	11:19 AM	60	16.5	4.0	23.5	12.5	10.58	13.65654	9.28431	0.012744	0.00608
06-Jun-24	2:29 PM	250	13.0	4.0	24.0	9.0	7.6156	14.19904	9.17830	0.012671	0.00302
07-Jun-24	10:19 AM	1440	10.0	4.0	23.5	6.0	5.0771	14.66404	9.28431	0.012744	0.00129

Remarks: **Moisture Content 9.1%**

Reviewed By: Brian Prevost

Date: June 7, 2024

V:\01216\active\laboratory_standing_offers\2024 Laboratory Standing Offers\121625581 Kollaard Associate Engineers\May 21, Hyd_MC, BH2_SS4, Kollaard #220863\Hydrometer-Lab Standing Offers.xlsx

ATTACHMENT B

Laboratory Test Results for Chemical Properties

CERTIFICATE OF ANALYSIS

Work Order	: **WT2413658**	Page	: 1 of 3
Client	: **Kollaard Associates Inc.**	Laboratory	: ALS Environmental - Waterloo
Contact	: Dean Tataryn	Account Manager	: Costas Farassoglou
Address	: 210 Prescott Street Unit 1 Kemptville ON Canada K0G1J0	Address	: 60 Northland Road, Unit 1 Waterloo ON Canada N2V 2B8
Telephone	: 613 860 0923	Telephone	: 613 225 8279
Project	: 220863	Date Samples Received	: 28-May-2024 14:00
PO	: ----	Date Analysis Commenced	: 29-May-2024
C-O-C number	: ----	Issue Date	: 03-Jun-2024 22:11
Sampler	: CLIENT		
Site	: ----		
Quote number	: SOA 2024		
No. of samples received	: 1		
No. of samples analysed	: 1		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Amanda Ganouri-Lumsden	Department Manager - Microbiology and Prep	Centralized Prep, Waterloo, Ontario
Nik Perkio	Senior Analyst	Inorganics, Waterloo, Ontario

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances

LOR: Limit of Reporting (detection limit).

Unit	*Description*
%	percent
µS/cm	microsiemens per centimetre
mg/kg	milligrams per kilogram
mV	millivolts
ohm cm	ohm centimetres (resistivity)
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical Results

Sub-Matrix: Soil/Solid (Matrix: Soil/Solid)				Client sample ID	BH1-SS4 (2.3m to 2.9m)	----	----	----	----
				Client sampling date / time	21-May-2024 10:00	----	----	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit	WT2413658-001	--------	--------	--------	--------
					Result	----	----	----	----
Physical Tests									
Conductivity (1:2 leachate)	----	E100-L/WT	5.00	µS/cm	159	----	----	----	----
Moisture	----	E144/WT	0.25	%	12.9	----	----	----	----
Oxidation-reduction potential [ORP]	----	E125/WT	0.10	mV	329	----	----	----	----
pH (1:2 soil:CaCl2-aq)	----	E108A/WT	0.10	pH units	7.90	----	----	----	----
Resistivity	----	EC100R/WT	100	ohm cm	6290	----	----	----	----
Inorganics									
Sulfides, acid volatile	----	E396-L/WT	0.20	mg/kg	0.36	----	----	----	----
Leachable Anions & Nutrients									
Chloride, soluble ion content	16887-00-6	E236.Cl/WT	5.0	mg/kg	8.4	----	----	----	----
Sulfate, soluble ion content	14808-79-8	E236.SO4/WT	20	mg/kg	52	----	----	----	----

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

ALS Canada Ltd.

right solutions.
right partner.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **WT2413658**	Page	: 1 of 7
Client	: **Kollaard Associates Inc.**	Laboratory	: ALS Environmental - Waterloo
Contact	: Dean Tataryn	Account Manager	: Costas Farassoglou
Address	: 210 Prescott Street Unit 1 Kemptville ON Canada K0G1J0	Address	: 60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8
Telephone	: 613 860 0923	Telephone	: 613 225 8279
Project	: 220863	Date Samples Received	: 28-May-2024 14:00
PO	: ----	Issue Date	: 03-Jun-2024 22:11
C-O-C number	: ----		
Sampler	: CLIENT		
Site	: ----		
Quote number	: SOA 2024		
No. of samples received	: 1		
No. of samples analysed	: 1		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	*Method*	*Sampling Date*	*Extraction / Preparation*				*Analysis*			
			Preparation Date	*Holding Times* Rec	*Holding Times* Actual	*Eval*	*Analysis Date*	*Holding Times* Rec	*Holding Times* Actual	*Eval*
Inorganics : Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)										
Glass soil jar/Teflon lined cap [ON MECP] BH1-SS4 (2.3m to 2.9m)	E396-L	21-May-2024	03-Jun-2024	14 days	13 days	✓	03-Jun-2024	7 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Chloride by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH1-SS4 (2.3m to 2.9m)	E236.Cl	21-May-2024	31-May-2024	30 days	10 days	✓	31-May-2024	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Sulfate by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH1-SS4 (2.3m to 2.9m)	E236.SO4	21-May-2024	31-May-2024	30 days	10 days	✓	31-May-2024	28 days	0 days	✓
Physical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)										
Glass soil jar/Teflon lined cap [ON MECP] BH1-SS4 (2.3m to 2.9m)	E100-L	21-May-2024	30-May-2024	30 days	9 days	✓	31-May-2024	30 days	10 days	✓
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP] BH1-SS4 (2.3m to 2.9m)	E144	21-May-2024	----	----	----		29-May-2024	----	8 days	
Physical Tests : ORP by Electrode										
Glass soil jar/Teflon lined cap [ON MECP] BH1-SS4 (2.3m to 2.9m)	E125	21-May-2024	29-May-2024	180 days	8 days	✓	31-May-2024	180 days	10 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
Glass soil jar/Teflon lined cap [ON MECP] BH1-SS4 (2.3m to 2.9m)	E108A	21-May-2024	30-May-2024	30 days	9 days	✓	31-May-2024	30 days	10 days	✓

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Soil/Solid**

Evaluation: × = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)	E396-L	1473358	1	10	10.0	4.7	✓
Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)	E100-L	1464914	1	15	6.6	5.0	✓
Moisture Content by Gravimetry	E144	1464706	1	3	33.3	5.0	✓
ORP by Electrode	E125	1465798	1	2	50.0	5.0	✓
pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received	E108A	1464583	1	17	5.8	5.0	✓
Water Extractable Chloride by IC	E236.Cl	1464913	1	3	33.3	5.0	✓
Water Extractable Sulfate by IC	E236.SO4	1464912	1	3	33.3	5.0	✓
Laboratory Control Samples (LCS)							
Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)	E396-L	1473358	1	10	10.0	4.7	✓
Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)	E100-L	1464914	2	15	13.3	10.0	✓
Moisture Content by Gravimetry	E144	1464706	1	3	33.3	5.0	✓
ORP by Electrode	E125	1465798	1	2	50.0	5.0	✓
pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received	E108A	1464583	1	17	5.8	5.0	✓
Water Extractable Chloride by IC	E236.Cl	1464913	2	3	66.6	10.0	✓
Water Extractable Sulfate by IC	E236.SO4	1464912	2	3	66.6	10.0	✓
Method Blanks (MB)							
Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)	E396-L	1473358	1	10	10.0	4.7	✓
Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)	E100-L	1464914	1	15	6.6	5.0	✓
Moisture Content by Gravimetry	E144	1464706	1	3	33.3	5.0	✓
Water Extractable Chloride by IC	E236.Cl	1464913	1	3	33.3	5.0	✓
Water Extractable Sulfate by IC	E236.SO4	1464912	1	3	33.3	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)	E100-L ALS Environmental - Waterloo	Soil/Solid	CSSS Ch. 15 (mod)/APHA 2510 (mod)	Conductivity, also known as Electrical Conductivity (EC) or Specific Conductance, is measured by immersion of a conductivity cell with platinum electrodes into a soil sample that has been added in a defined ratio of soil to deionized water, then shaken well and allowed to settle. Conductance is measured in the fluid that is observed in the upper layer.
pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received	E108A ALS Environmental - Waterloo	Soil/Solid	MECP E3530	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C) and is carried out in accordance with procedures described in the Analytical Protocol (prescriptive method). A minimum 10g portion of the sample, as received, 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 by centrifuging, settling, or decanting and then analyzed using a pH meter and electrode. This method is equivalent to ASTM D4972 and is acceptable for topsoil analysis.
ORP by Electrode	E125 ALS Environmental - Waterloo	Soil/Solid	APHA 2580 (mod)	Oxidation Redution Potential (ORP) is reported as the oxidation-reduction potential of the platinum metal-reference electrode employed in the analysis, measured in mV.
Moisture Content by Gravimetry	E144 ALS Environmental - Waterloo	Soil/Solid	CCME PHC in Soil - Tier 1	Moisture is measured gravimetrically by drying the sample at 105°C. Moisture content is calculated as the weight loss (due to water) divided by the wet weight of the sample, expressed as a percentage.
Water Extractable Chloride by IC	E236.Cl ALS Environmental - Waterloo	Soil/Solid	EPA 300.1	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection using a soil sample that has been added in a defined ratio of soil to deionized water, then shaken well and allowed to settle. Anions are measured in the fluid that is observed in the upper layer.
Water Extractable Sulfate by IC	E236.SO4 ALS Environmental - Waterloo	Soil/Solid	EPA 300.1	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection using a soil sample that has been added in a defined ratio of soil to deionized water, then shaken well and allowed to settle. Anions are measured in the fluid that is observed in the upper layer.
Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)	E396-L ALS Environmental - Waterloo	Soil/Solid	APHA 4500S2J	This analysis is carried out in accordance with the method described in APHA 4500 S2-J. After extraction the Acid Volatile Sulphide is determined colourimetrically.
Resistivity Calculation for Soil Using E100-L	EC100R ALS Environmental - Waterloo	Soil/Solid	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.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Leach 1:2 Soil:Water for pH/EC	EP108 ALS Environmental - Waterloo	Soil/Solid	BC WLAP METHOD: PH, ELECTROMETRIC, SOIL	The procedure involves mixing the dried (at <60°C) and sieved (No. 10 / 2mm) sample with deionized/distilled water at a 1:2 ratio of sediment to water.
Leach 1:2 Soil : 0.01CaCl2 - As Received for pH	EP108A ALS Environmental - Waterloo	Soil/Solid	MOEE E3137A	A minimum 10g portion of the sample, as received, 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 by centrifuging, settling or decanting and then analyzed using a pH meter and electrode.
Preparation of ORP by Electrode	EP125 ALS Environmental - Waterloo	Soil/Solid	APHA 2580 (mod)	Field-moist sample is extracted in a 1:2 ratio with DI water and then analyzed by ORP meter.
Anions Leach 1:10 Soil:Water (Dry)	EP236 ALS Environmental - Waterloo	Soil/Solid	EPA 300.1	5 grams of dried soil is mixed with 50 grams of distilled water for a minimum of 30 minutes. The extract is filtered and analyzed by ion chromatography.
Distillation for Acid Volatile Sulfide in Soil	EP396-L ALS Environmental - Waterloo	Soil/Solid	APHA 4500S2J	Acid Volatile Sulfide is determined by colourimetric measurement on a sediment sample that has been treated with hydrochloric acid within a purge and trap system, where the evolved hydrogen sulfide gas is carried into a basic solution by argon gas for analysis.

QUALITY CONTROL REPORT

Work Order	: **WT2413658**	Page	: 1 of 5
Client	: Kollaard Associates Inc.	Laboratory	: ALS Environmental - Waterloo
Contact	: Dean Tataryn	Account Manager	: Costas Farassoglou
Address	: 210 Prescott Street Unit 1 Kemptville ON Canada K0G1J0	Address	: 60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8
Telephone	: 613 860 0923	Telephone	: 613 225 8279
Project	: 220863	Date Samples Received	: 28-May-2024 14:00
PO	: ----	Date Analysis Commenced	: 29-May-2024
C-O-C number	: ----	Issue Date	: 03-Jun-2024 22:11
Sampler	: CLIENT		
Site	: ----		
Quote number	: SOA 2024		
No. of samples received	: 1		
No. of samples analysed	: 1		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Reference Material (RM) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Amanda Ganouri-Lumsden	Department Manager - Microbiology and Prep	Waterloo Centralized Prep, Waterloo, Ontario
Nik Perkio	Senior Analyst	Waterloo Inorganics, Waterloo, Ontario

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include 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 predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Physical Tests (QC Lot: 1464583)											
WT2413607-001	Anonymous	pH (1:2 soil:CaCl2-aq)	----	E108A	0.10	pH units	7.66	7.67	0.130%	5%	----
Physical Tests (QC Lot: 1464706)											
HA2400993-003	Anonymous	Moisture	----	E144	0.25	%	<0.25	<0.25	0	Diff <2x LOR	----
Physical Tests (QC Lot: 1464914)											
WT2413612-002	Anonymous	Conductivity (1:2 leachate)	----	E100-L	5.00	µS/cm	3.15 mS/cm	3240	2.82%	20%	----
Physical Tests (QC Lot: 1465798)											
WT2410281-014	Anonymous	Oxidation-reduction potential [ORP]	----	E125	0.10	mV	396	324	20.0%	25%	----
Inorganics (QC Lot: 1473358)											
EO2404053-001	Anonymous	Sulfides, acid volatile	----	E396-L	0.26	mg/kg	<0.27	<0.26	0.26	Diff <2x LOR	----
Leachable Anions & Nutrients (QC Lot: 1464912)											
WT2410281-014	Anonymous	Sulfate, soluble ion content	14808-79-8	E236.SO4	20	mg/kg	<20	<20	0	Diff <2x LOR	----
Leachable Anions & Nutrients (QC Lot: 1464913)											
WT2410281-014	Anonymous	Chloride, soluble ion content	16887-00-6	E236.Cl	5.0	mg/kg	140	138	1.51%	30%	----

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Soil/Solid**

Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	*Result*	*Qualifier*
Physical Tests (QCLot: 1464706)						
Moisture	----	E144	0.25	%	<0.25	----
Physical Tests (QCLot: 1464914)						
Conductivity (1:2 leachate)	----	E100-L	5	µS/cm	<5.00	----
Inorganics (QCLot: 1473358)						
Sulfides, acid volatile	----	E396-L	0.2	mg/kg	<0.20	----
Leachable Anions & Nutrients (QCLot: 1464912)						
Sulfate, soluble ion content	14808-79-8	E236.SO4	20	mg/kg	<20	----
Leachable Anions & Nutrients (QCLot: 1464913)						
Chloride, soluble ion content	16887-00-6	E236.Cl	5	mg/kg	<5.0	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Target Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 1464583)									
pH (1:2 soil:CaCl2-aq)	----	E108A	----	pH units	7 pH units	100	98.0	102	----
Physical Tests (QCLot: 1464706)									
Moisture	----	E144	0.25	%	50 %	100	90.0	110	----
Physical Tests (QCLot: 1464914)									
Conductivity (1:2 leachate)	----	E100-L	5	µS/cm	1410 µS/cm	100	90.0	110	----
Inorganics (QCLot: 1473358)									
Sulfides, acid volatile	----	E396-L	0.2	mg/kg	100 mg/kg	88.0	70.0	130	----
Leachable Anions & Nutrients (QCLot: 1464912)									
Sulfate, soluble ion content	14808-79-8	E236.SO4	20	mg/kg	1000 mg/kg	98.2	80.0	120	----
Leachable Anions & Nutrients (QCLot: 1464913)									
Chloride, soluble ion content	16887-00-6	E236.Cl	5	mg/kg	1000 mg/kg	97.7	80.0	120	----

Reference Material (RM) Report

A Reference Material (RM) is a homogenous material with known and well-established analyte concentrations. RMs are processed in an identical manner to test samples, and are used to monitor and control the accuracy and precision of a test method for a typical sample matrix. RM results are expressed as percent recovery of the target analyte concentration. RM targets may be certified target concentrations provided by the RM supplier, or may be ALS long-term mean values (for empirical test methods).

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Physical Tests (QCLot: 1464914)									
QC-1464914-003	RM	Conductivity (1:2 leachate)	----	E100-L	3460 µS/cm	94.1	70.0	130	----
Physical Tests (QCLot: 1465798)									
QC-1465798-001	RM	Oxidation-reduction potential [ORP]	----	E125	475 mV	108	90.0	110	----
Leachable Anions & Nutrients (QCLot: 1464912)									
QC-1464912-003	RM	Sulfate, soluble ion content	14808-79-8	E236.SO4	172 mg/kg	102	70.0	130	----
Leachable Anions & Nutrients (QCLot: 1464913)									
QC-1464913-003	RM	Chloride, soluble ion content	16887-00-6	E236.Cl	601 mg/kg	95.6	70.0	130	----

SOL-224

Chain of Custody (COC) / Analytical Request Form

ALS Environmental
www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here
(lab use only)

COC Numl

AB

Environmental Division
Waterloo
Work Order Reference
WT2413658

Telephone : +1 519 886 6910

Report To	Contact and company name below will appear on the final report	Report Format / Distribution	Select Service Level Below - Contact your
Company:	Kollaard Associates (27196)	Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL	Regular [R] ☑ Standard TAT if received
Contact:	Dean Tataryn	Quality Control (QC) Report with Report ☑ Y ☐ N	PRIORITY (Business Days): 4 day [P4-20%] ☐ / 3 day [P3-25%] ☐ / 2 day [P2-50%] ☐ — EMERGENCY: 1 Bus / Same / (Labor
Phone:	613.860.0923, ext.230	☑ Compare Results to Criteria on Report - provide details below if box checked	
	Company address below will appear on the final report	Select Distribution: ☐ EMAIL ☐ MAIL ☐ FAX	Date and Time Required for all E&P TATs:
Street:	210 Prescott Street, Unit 1 P.O. Box 189	Email 1 or Fax dean@kollaard.ca	For tests that can not be performed according to the service le
City/Province:	Kemptville, Ontario	Email 2	Analy
Postal Code:	K0G 1J0	Email 3	
Invoice To	Same as Report To ☑ Y ☐ N	**Invoice Distribution**	
	Copy of Invoice with Report ☐ Y ☑ N	Select Invoice Distribution: ☐ EMAIL ☐ MAIL ☐ FAX	
Company:	Kollaard Associates Inc.	Email 1 or Fax admin@kollaard.ca	
Contact:	admin@kollaard.ca	Email 2	

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:	Q71021	AFE/Cost Center:	PO#
Job #:	220863	Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only):		ALS Contact:	Sampler:

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	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below	SAMPLES ON HOLD	Sample is hazardous (please provide further detail	NUMBER OF CONTAINERS
	BH1 - SS4 (2.3m to 2.9m)	21-May-24	10:00	Product	R				
	5 x Silicone OD Tubing ($2.50)								
	5x Foot Valve -D-25 ($6.50)								
	5x Inline Disposable Filter 600 sqcm, 0.45um ($21)								

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? ☐ Y ☑ N	
Are samples for human consumption/ use? ☐ Y ☑ N	

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				FINAL COOLER TEMPERATURES °C			
22.1				8.4			

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
	May 21 2024	16:00	Lara R.	28/05/24	14:00	BB	07/29/24	10:10

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**.

ATTACHMENT 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: 45.360N 75.357W

2024-05-28 17:16 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)	0.578	0.312	0.181	0.050
Sa (0.1)	0.664	0.370	0.223	0.068
Sa (0.2)	0.544	0.308	0.189	0.061
Sa (0.3)	0.407	0.232	0.143	0.047
Sa (0.5)	0.282	0.160	0.100	0.033
Sa (1.0)	0.135	0.077	0.048	0.016
Sa (2.0)	0.062	0.035	0.022	0.006
Sa (5.0)	0.016	0.009	0.005	0.001
Sa (10.0)	0.006	0.003	0.002	0.001
PGA (g)	0.347	0.198	0.121	0.036
PGV (m/s)	0.233	0.128	0.077	0.023

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