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Geotechnical Investigation
Proposed Truck Repair Facility
Badger Daylighting, 3025 Carp Road
Ottawa, Ontario

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Submitted to:

Argue Construction Ltd.
2900 Carp Road
Ottawa, Ontario
K0A 1L0

Geotechnical Investigation
Proposed Truck Repair Facility
Badger Daylighting, 3025 Carp Road
Ottawa, Ontario

February 18, 2020
Project: 61730.61

experience • knowledge • integrity

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February 18, 2020 File: 61730.61

Argue Construction Ltd.
2900 Carp Road
Ottawa, Ontario
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Attention: Keith Riley, Chief Estimator and Project Manager

Re: Geotechnical Investigation, Proposed Truck Repair Facility, Badger Daylighting, 3025 Carp Road, Ottawa, Ontario

Please find enclosed our geotechnical investigation report for the above noted project based on the scope of work provided in our proposal dated July 17, 2019. This report was prepared by Mr. Alex Meacoe, P.Eng., and reviewed by Mr. John Cholewa, Ph.D., P.Eng.

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

W. Alex Meacoe

Alex Meacoe, P.Eng.

John Cholewa, Ph.D., P.Eng.

WAM/JC

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1.0 INTRODUCTION

This report presents the results of a geotechnical investigation carried out for the proposed truck repair facility to be located at 3025 Carp Road in Ottawa, Ontario. The purpose of the investigation was to identify the general subsurface conditions at the site by means of a limited number of test holes and, based on the factual information obtained, to provide engineering guidelines on the geotechnical design aspects of the project, including construction considerations that could influence design decisions.

The subsurface investigation was carried out in general accordance with our proposal dated July 17, 2019.

2.0 BACKGROUND

2.1 Project Description

Plans are being prepared to construct a truck repair facility for Badger Daylighting at 3025 Carp Road in Ottawa, Ontario. The proposed development includes a warehouse building with office space, access roadway, truck and office parking areas and a new water well and septic system. The building will consist of a slab on grade warehouse building with a footprint of about 875 square metres. Based on the plans provided, an area for a future building expansion is located on the northwest side of the proposed warehouse building.

The fieldwork for this investigation was carried out on September 6 and 12, 2019 and the borehole locations were based on the building location from the site plan prepared by A+ Architecture provided to us on August 16, 2019. The location of the proposed building on site has since changed and some of the boreholes are now located outside of the proposed building location. A copy of the most current site development plan is provided in the Appendix C.

The site is currently undeveloped with gravel access road and parking on the site and a pond on the west side of the site.

2.2 Review of Geology Maps

Surficial geology maps of the Ottawa area indicate that the site is underlain by nearshore marine sediments (silt and sand) and glacial till overlying relatively shallow bedrock. Bedrock geology maps indicate that bedrock is comprised of interbedded limestone and shale of the Verulam formation at depths ranging between about 1 and 5 metres.

3.0 SUBSURFACE INVESTIGATION

The field work for the geotechnical investigation was carried out on September 6 and 12, 2019. During that time, seven (7) boreholes, numbered 19-1, 19-2, 19-3a, 19-3b, 19-4, 19-5, and 19-6 were advanced at the location of the proposed building, septic system, parking areas, and access roadway using a truck mounted drill rig supplied and operated by George Downing Estate Drilling of Grenville-sur-la-rouge, Quebec. The boreholes were advanced to practical auger refusal encountered at depths between about 0.3 and 3.3 metres below ground surface level.

In addition, five (5) test pits, numbered 19-1a, 19-1b, 19-2 to 19-5, inclusive, were excavated using a track mounted excavator that was on site and arranged by Argue Construction Ltd. The test pits were advanced to practical excavation refusal at depths between about 1.0 and 2.4 metres below ground surface level.

Standard penetration tests were carried out in the boreholes at regular intervals of depth and samples of the soils encountered were recovered using a 50 millimetre diameter drive open sampler. The field work was supervised throughout by a member of our engineering staff.

One (1) well screen was sealed in the overburden at borehole 19-3b to measure the groundwater level. The groundwater conditions in the other test holes were observed on completion of drilling or excavating.

Following completion of the drilling, the soil samples were returned to our laboratory for examination by a geotechnical engineer. One (1) soil sample obtained from borehole 19-6 was sent to Paracel Laboratories Limited for basic chemical testing relating to corrosion of buried concrete and steel.

The results of the test holes are provided on the Record of Borehole and Test Pit sheets in Appendix A. The locations of the test holes are shown on the Test Hole Location Plan, Figure 1.

The test hole locations were selected by GEMTEC Consulting Engineers and Scientists Limited personnel. The ground surface elevations at the location of the test holes were determined using a Trimble R10 global positioning system. The elevations are referenced to geodetic datum and are considered to be accurate within the tolerance of the instrument.

4.0 SUBSURFACE CONDITIONS

4.1 General

The soil and groundwater conditions logged in the test holes are given on the Record of Borehole and Test Pit sheets in Appendix A. The borehole logs indicate the subsurface conditions at the specific test locations only. Boundaries between zones on the logs are often not distinct, but rather are transitional and have been interpreted. Subsurface conditions at locations other than the test hole locations may vary from the conditions encountered in the test holes. In addition to soil variability, fill of variable physical and chemical composition can be present over portions of the site.

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

The following presents an overview of the subsurface conditions encountered in the test holes advanced during this investigation.

4.2 Existing Granular Pavement Structure

Boreholes 19-5 and 19-6 were advanced through the existing drive lane on the south east side of the site. The drive lane consists of a 280 and 530 millimetre thick layer of grey crushed sand and gravel with trace silt at boreholes 19-5 and 19-6, respectively.

Two (2) standard penetration tests carried out in the existing road base encountered in boreholes 19-5 and 19-6 gave N values of 60 and greater than 50 blows per 0.3 metres of penetration, which reflect a very dense relative density, or the presence of cobbles within the road base.

4.3 Fill Material

Fill material, having a thickness of between 0.4 and 1.8 metres, was encountered below the temporary road base at borehole 19-6 and at the ground surface at boreholes 19-1, 19-2, 19-3a, 19-3b, and 19-4 and test pits 19-1a, 19-1b, 19-2, 19-3, and 19-4. The composition of the fill material generally ranges from silty sand some gravel to sand and gravel some silt. The fill material also contains cobbles, boulders, organics, and wood, plastic, metal, and concrete pieces.

Standard penetration tests carried out in the fill material encountered gave N values ranging from 11 to greater than 50 blows per 0.3 metres of penetration, which reflect a variable compact to very dense relative density and/or the presence of cobbles and boulders within the fill material.

4.4 Silty Sand

At borehole 19-3b and test pits 19-1a, 19-1b, and 19-2, the fill material is underlain by a deposit of reddish brown to brown silty sand to sand with some silt. The silty sand to sand deposit has a thickness ranging from about 0.2 to 0.6 metres and extends to depths ranging from about 1.2 to 2.3 metres below ground surface (elevations of about 117.7 to 119.6 metres).

One (1) Standard penetration test carried out in the silty sand to sand deposit encountered gave an N value of 34 blows per 0.3 metres of penetration, indicating a dense relative density.

4.5 Glacial Till

A deposit of glacial till was encountered in boreholes 19-3b and 19-5. The glacial till deposit has a thickness of about 0.2 and 0.1 metres and extends to depths of about 2.4 and 0.3 metres below ground surface (elevation 117.8 and 120.0 metres) in boreholes 19-3b and 19-5, respectively. The glacial till can generally be described as grey brown silty sand with some gravel and probable cobbles and boulders.

One standard penetration test attempted in the glacial till gave an N value of greater than 50 blows for less than 0.3 metres of penetration, which indicates a dense relative density. The high blow count likely reflects the presence of the bedrock surface rather than the state of packing of the soil matrix.

4.6 Inferred Bedrock

Practical auger or excavator refusal occurred in all of the test holes between 0.3 and 3.3 metres below ground surface (elevation 116.2 to 118.4 metres). In borehole 19-3b, the upper 0.9 metres of the bedrock was weathered and was penetrated by the augers.

It should be noted that practical auger refusal can sometimes occur within cobbles and boulders and may not necessarily be representative of the upper surface of the bedrock.

4.7 Groundwater Levels

All of the test holes were dry upon completion of drilling or excavating.

One (1) well screen was installed in borehole 19-3b. Table 4.5 summarizes the groundwater level observed on September 24, 2019.

Table 4.5 – Summary of Groundwater Levels

Borehole	Well Screen	Groundwater Depth (metres)	Groundwater Elevation (metres)
19-3b	Fill / Silty Sand	Dry	Below 117.8

The groundwater levels may be higher during wet periods of the year such as the early spring or following periods of precipitation.

4.8 Soil Chemistry Relating to Corrosion

The results of chemical testing on a soil sample recovered from borehole 19-6 are provided in Appendix B and are summarized in Table 4.8 below.

Table 4.8: Summary of Corrosion Testing

Parameter	Borehole 19-6 Sample No. 2
Chloride Content (µg/g)	9
Resistivity (Ohm.m)	44.0
pH	6.8

Parameter	Borehole 19-6 Sample No. 2
Sulphate Content (µg/g)	25

5.0 RECOMMENDATIONS AND GUIDELINES

5.1 General

The information in the following sections is provided for the guidance of the design engineers and is intended for the design of this project only. Contractors bidding on or undertaking the works should examine the factual results of the investigation, satisfy themselves as to the adequacy of the information for construction, and make their own interpretation of the factual data as it affects their construction techniques, schedule, safety and equipment capabilities.

The professional services retained for this project include only the geotechnical aspects of the subsurface conditions at this site. The presence or implications of possible surface and/or subsurface contamination resulting from previous uses or activities of this site or adjacent properties, and/or resulting from the introduction onto the site from materials from off-site sources are outside the terms of reference for this report.

As discussed in Section 2.1, the fieldwork for this investigation was carried out on September 6 and 12, 2019 and the borehole locations were based on the building location from the site plan prepared by A+ Architecture provided to us on August 16, 2019. The location of the proposed building on site has since changed and some of the boreholes are now located outside of the proposed building location.

5.2 Proposed Building

5.2.1 Excavation

The excavations for the footings of the proposed structure will be carried out mostly through the fill material, and possibly silty sand and glacial till. The sides of the excavation in overburden should be sloped in accordance with the requirements in Ontario Regulation 213/91 under the Occupational Health and Safety Act. According to the Act, the fill material at this site can be classified as Type 3 soil and, accordingly, allowance should be made for excavation side slopes of 1 horizontal to 1 vertical, or flatter.

As indicated in Section 5.2.2, the existing fill material should be removed from the building area. It should be noted that at boreholes 19-1, 19-2, and 19-4, auger refusal occurred at about elevation 119.3 to 120.3 metres; however, as indicated in Section 4.6, practical auger refusal can sometimes occur within cobbles and boulders. As such, the auger refusal depths at boreholes 19-1, 19-2, and 19-3 may not necessarily be indicative of the underside of the fill material. The excavation should be sized to accommodate a pad of imported granular material which extends at least 0.3 metres horizontally beyond the edge of the footings and down and out from this point at 1 horizontal to 1 vertical, or flatter.

In areas where space constraints dictate, the sides of the excavation could be supported with temporary shoring. If required, geotechnical parameters for the selection and design of temporary shoring could be provided.

Groundwater inflow, if any, from the overburden deposits should be relatively small and controlled by pumping from filtered sumps within the excavation. It is not expected that short term pumping during excavation will have a significant effect on nearby structures and services.

5.2.2 Footing Design

The proposed structure could be founded on footings bearing on the bedrock or possibly the native overburden deposits. The fill material is considered to be highly compressible and should be removed from below any foundations and slabs on grade.

In areas where the fill material is encountered below proposed founding level, following removal of the fill material, the grade could be raised with compacted granular material (engineered fill). The engineered fill should consist of granular material meeting Ontario Provincial Standard Specifications (OPSS) requirements for Granular B Type II and should be compacted in maximum 200 millimetre thick lifts to at least 95 percent of the standard Proctor maximum dry density. To provide adequate spread of load beneath the footings, the engineered fill should extend horizontally at least 0.3 metres beyond the footings and then down and out from this point at 1 horizontal to 1 vertical, or flatter. The excavations for the foundation should be sized to accommodate this fill placement.

The spread footing foundations should be sized using the bearing pressures provided in Table 5.2 below

Table 5.2: Foundation Bearing Pressures

Subgrade Material	Geotechnical Reaction at Serviceability Limit State (kilopascals)	Factored Geotechnical Resistance at Ultimate Limit State (kilopascals)
Native silty sand or glacial till, or a pad of engineered fill above native silty sand or glacial till	100[1]	200
Pad of engineered fill above competent bedrock	300[1]	450
Competent bedrock	n/a[2]	500[3]

Notes:

1. Provided that the subgrade surface and engineered fill are prepared as described in this report, the post construction total and differential settlement of the footings at SLS should be less than 25 and 15 millimetres, respectively.

2. The geotechnical reaction at SLS for 25 millimetres of settlement will be greater than the factored resistance at ULS; as such, ULS conditions will govern for footings founded directly on the competent bedrock surface.
3. The above bearing pressure assumes that all soil, and disturbed or loosened bedrock is removed from the bearing surface. Allowance should be made in the contract for concrete fill below the foundations due to vertical overbreak of the bedrock.

5.2.3 Seismic Design of Proposed Structure

Based on the results of the investigation, it is anticipated that the proposed foundations will be supported on a pad of engineered fill constructed on bedrock. As such, in our opinion, the proposed structure should be designed for seismic Site Class C. It may be possible to improve the seismic Site Class to A or B if shear wave velocity testing is carried out. Additional details on shear wave velocity testing could be provided as the design progresses.

There is no potential for liquefaction of the overburden deposits at this site.

5.2.4 Frost Protection of the Foundations

All exterior footings in unheated portions of the proposed building should be provided with at least 1.5 metres of earth cover for frost protection purposes. Isolated, unheated exterior footings adjacent to surfaces which are cleaned of snow cover during the winter months should be provided with a minimum of 1.8 metres of earth cover. The required depth of frost protection can be reduced by the thickness of any engineered fill beneath the foundations. Alternatively, the required frost protection could be provided by means of a combination of earth cover and extruded polystyrene insulation. An insulation detail could be provided upon request.

5.2.5 Foundation Wall Backfill and Drainage

To avoid frost adhesion and possible heaving, the foundations should be backfilled with imported, free-draining, non-frost susceptible granular material such as that meeting OPSS Granular B Type I or II requirements. The existing fill material could be excavated, where required, stockpiled on site, and tested for grain size distribution to assess whether it could be reused on the site for foundation wall backfill.

Where the backfill will ultimately support areas of hard surfacing (pavement, sidewalks or other similar surfaces), the backfill should be placed in maximum 200 millimetre thick lifts and should be compacted to at least 95 percent of the standard Proctor maximum dry density value using suitable vibratory compaction equipment. Light, walk behind compaction equipment should be used next to foundation walls to avoid excessive compaction induced stress on the foundation walls. Where future landscaped areas will exist next to the proposed structure and if some settlement of the backfill is acceptable, the backfill could be compacted to at least 90 percent of the standard Proctor maximum dry density value.

Where areas of hard surfacing (pavement or pathways, etc.) abut the proposed structure, a gradual transition should be provided between those areas of hard surfacing underlain by non-frost susceptible granular wall backfill and those areas underlain by existing frost susceptible material to reduce the effects of differential frost heaving. It is suggested that granular frost tapers be constructed from 1.5 metres below finished grade to the underside of the granular subbase material for the hard surfaced areas. The frost tapers should be sloped at 1 horizontal to 1 vertical, or flatter.

5.2.6 Slab on Grade Support

Based on the results of the investigation, the area of the proposed building is underlain by fill material over the bedrock. The adequacy of the existing fill material should be assessed during excavation by geotechnical personnel. However, based on the results of the test holes, for predictable performance of the concrete slab, it is likely that the existing fill material will have to be removed from below the slab on grade.

The grade within the proposed building could be raised, where necessary, with granular material meeting OPSS requirements for Granular B Type I or II. The use of Granular B Type II material is preferred under wet conditions. The granular base for the proposed slab on grade should consist of at least 150 millimetres of OPSS Granular A.

All imported granular materials placed below the proposed floor slab should be compacted in maximum 200 millimetre thick lifts to at least 95 percent of the standard Proctor maximum dry density value.

To prevent hydrostatic pressure build up beneath the load out area slabs, it is suggested that the granular base for the slabs be positively drained.

5.3 Proposed Services

5.3.1 Excavation

In the overburden, the excavation for flexible service pipes should be in accordance with Ontario Provincial Standard Drawing (OPSD) 802.010 for Type 3 soil. The excavation for rigid service pipes should be in accordance with OPSD 802.031 for Type 3 soil. The sides of the excavations within overburden soils should be sloped in accordance with the requirements in Ontario Regulation 213/91 under the Occupational Health and Safety Act. According to the Act, the soils at this site can be classified as Type 3 soils. Therefore, for design purposes, allowance should be made for 1 horizontal to 1 vertical, or flatter, excavation slopes. As an alternative or where space constraints dictate, the service installations could be carried out within a tightly fitting, braced steel trench box, which is specifically designed for this purpose.

Based on the results of the boreholes, bedrock removal may be required in order to install the site services. The excavation for flexible and rigid service pipes in bedrock could be in accordance with OPSD 802.013 and 802.033, respectively. Where required, the excavation of the bedrock can likely be carried out using large excavation equipment in conjunction with pneumatic hoe ramming equipment. Line drilling on close centres could be used to reduce, not prevent, over break and under break of the bedrock excavation and to define the limit of excavation next to existing structures and services. For the bedrock at this site, it is suggested that allowance be made for line drilling 75 to 100 millimetre diameter holes on 200 to 300 millimetre centres.

Groundwater seepage into excavations is expected and should be controlled, as necessary, by pumping from within the excavations. It is not expected that short term pumping during excavation will have a significant effect on nearby structures and services.

5.3.2 Pipe Bedding

The pipe bedding should be in accordance with OPSD 802.010 and 802.031 for flexible and rigid pipes in Type 3 soils, respectively. The bedding for flexible and rigid service pipes in bedrock should be in accordance with OPSD 802.013 and 802.033, respectively.

The bedding for service pipes should consist of at least 150 millimetres of crushed stone meeting OPSS requirements for Granular A. Cover material, from spring line to at least 300 millimetres above the tops of the pipes, should consist of granular material, such as that meeting OPSS Granular A.

Where bedrock excavation is required, some overbreak should be expected and allowance should be made for thickening the bedding material, as required.

In areas where the subsoil is disturbed or where unsuitable material (fill or organic material) exists below the pipe subgrade level, the disturbed/unsuitable material should be removed and replaced with a subbedding layer of compacted granular material, such as that meeting OPSS Granular B Type I or II. To provide adequate support for the sewer pipes in the long term in areas where subexcavation of material is required below design subgrade level, the excavations should be sized to allow a 1 horizontal to 1 vertical or 2 horizontal to 1 vertical spread of granular material down and out from the bottom of the pipes.

The granular bedding and subbedding materials should be compacted in maximum 200 millimetre thick lifts to at least 95 percent of the standard Proctor dry density value.

The use of clear crushed stone as a bedding, subbedding or cover material should not be permitted on this project.

5.3.3 Trench Backfill

In areas where the service trench will be located below or in close proximity to existing or future areas of hard surfacing (pavement, sidewalk, etc.), acceptable native materials should be used as backfill between subgrade level for the hard surfacing and the depth of seasonal frost penetration in order to reduce the potential for differential frost heaving between the area over the trench and the adjacent hard surfaced area. The depth of frost penetration in exposed areas can normally be taken as 1.8 metres below finished grade. Where native backfill is used, it should match the native materials exposed on the trench walls. Backfill below the zone of seasonal frost penetration could consist of either acceptable native material, imported granular material conforming to OPSS Granular B Type I, or well shattered and graded excavated bedrock.

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

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

5.4 Access Roadways and Parking Areas

5.4.1 Gravel Roadways and Parking Areas

Based on the development plans provided, it is understood that the majority of the site will be finished as gravel parking areas or gravel access roadways.

Prior to placing granular material, the subgrade surface should be proof rolled with a large steel drum roller under dry conditions. Any soft areas should be subexcavated and replaced with compacted earth borrow. To reduce the potential for differential frost heave, the earth borrow should match the material exposed on the sides of the subexcavation.

For light duty traffic use, it is suggested that the following minimum thicknesses of the base and subbase layers be used:

- 150 millimetres of OPSS Granular A, over
- 350 millimetres of OPSS Granular B Type II (100 millimetre minus crushed stone)

For any areas which will be used by heavy trucks or fire trucks, the following minimum thicknesses of base and subbase layers are suggested:

- 150 millimetres of OPSS Granular A, over
- 450 millimetres of OPSS Granular B Type II (100 millimetre minus crushed stone)

The granular base and subbase materials should be compacted in maximum 200 millimetre thick lifts to at least 98 percent of the standard Proctor maximum dry density value.

The above base and subbase thicknesses assume that the subgrade surface is prepared as described in this report. If the subgrade surface is disturbed or wetted due to construction operations or precipitation, the granular thicknesses given above may not be adequate and it may be necessary to increase the thickness of the Granular B Type II subbase and/or to incorporate a woven geotextile separator between the roadway subgrade surface and the granular subbase material. The adequacy of the design pavement thickness should be assessed by geotechnical personnel at the time of construction.

5.4.2 Asphalt Access Roadway

It is understood that a portion of the access roadway from Carp Road into the site will be paved with asphaltic concrete. If the access roadway is to be used by light vehicles (cars, etc.) the following minimum pavement structure is recommended:

- 80 millimetres of hot mix asphaltic concrete (Two 40 millimetre thick lifts of Superpave 12.5), over
- 150 millimetres of OPSS Granular A base over
- 300 millimetres of OPSS Granular B, Type II subbase

If the access roadway is to be used by heavy truck traffic the suggested minimum pavement structure is:

- 100 millimetres of hot mix asphaltic concrete (40 millimetres of Superpave 12.5 over 60 millimetres of Superpave 19.0), over
- 150 millimetres of OPSS Granular A base over
- 450 millimetres of OPSS Granular B, Type II subbase

The above base and subbase thicknesses assume that the subgrade surface is prepared as described in this report. If the subgrade surface is disturbed or wetted due to construction operations or precipitation, the granular thicknesses given above may not be adequate and it may be necessary to increase the thickness of the Granular B Type II subbase and/or to incorporate a woven geotextile separator between the roadway subgrade surface and the granular subbase material. The adequacy of the design pavement thickness should be assessed by geotechnical personnel at the time of construction.

5.4.3 Asphalt Cement Type

Performance grade PG 58-34 asphalt cement should be specified for Superpave asphaltic concrete mixes, based on a Traffic Category B.

5.4.4 Pavement Transitions

As part of the access roadway/parking lot construction, the new pavement will abut the existing pavement at Carp Road. The following is suggested to improve the performance of the joint between the new and the existing pavements:

- Neatly saw cut the existing asphaltic concrete;
- Remove the asphaltic concrete and slope the bottom of the excavation within the existing granular base and subbase at 1 horizontal to 1 vertical, or flatter, to avoid undermining the existing asphaltic concrete.
- To avoid cracking of the asphaltic concrete due to an abrupt change in the thickness of the roadway granular materials where new pavement areas join with the existing pavements, the granular depths should taper up or down at 5 horizontal to 1 vertical, or flatter, to match the existing pavement structure.
- Remove (mill off) 40 to 50 millimetres of the existing asphaltic concrete to a distance of 300 millimetres at the joint and tack coat the asphaltic concrete at the joint in accordance with the requirements in OPSS 310.

5.4.5 Pavement Drainage

Adequate drainage of the pavement granular materials and subgrade is important for the long term performance of the pavement at this site. The subgrade surfaces should be crowned and shaped to drain to the ditches and/or catch basins to promote drainage of the pavement granular materials.

5.4.6 Granular Material Compaction

The granular base and subbase materials should be compacted in maximum 300 millimetre thick lifts to at least 98 percent of the standard Proctor maximum dry density value.

5.5 Corrosion of Buried Concrete and Steel

The measured sulphate concentration in soil sample collected from borehole 19-6 was found to be 25 ug/g. According to the Canadian Standards Association “Concrete Materials and Methods of Concrete Construction” (CSA A23.1-14 Table 3), the concentration of water-soluble sulphate in the soil recovered from borehole 19-6 is less than the minimum concentration for ‘Moderate’ sulfate exposure (0.10 – 0.20 percent). As such, the CSA A23.1 Class of Exposure is not a sulfate class. Other factors (structurally reinforced or non-structurally reinforced, freeze-thaw environment, chloride exposure, agricultural environment) should be considered in selecting the Class of Exposure and associated air entrainment and concrete mix proportions for any concrete.

Based on the conductivity and pH of the soil, the soil sampled from borehole 19-6 can be classified as non-aggressive toward unprotected steel. The manufacturer of any buried steel elements that will be in contact with the soil or groundwater should be consulted to ensure that the durability of the intended product is appropriate. It is noted that the corrosivity of the groundwater could vary throughout the year due to the application of de-icing chemicals.

6.0 SLOPE STABILITY ANALYSIS

6.1 General

In order to determine a suitable setback from the pond, slope stability analyses were carried out along the existing pond using SLIDE, a state of the art, two dimensional limit equilibrium slope stability program. The location of the slope for the analysis was chosen to represent a "worst case scenario" from a slope stability perspective.

The slopes were assessed at various locations along the pond based on the topographic plan prepared by Annis O'Sullivan, Vollebekk Limited (AOV), dated February 19, 2019 (Job No. 18184-18). The change in elevation between the crest of the slope and the toe of the slope (at the pond water level) is about 4.5 metres with the top of the slope at about elevation 120 metres and the bottom of the slope at the pond water level at about elevation 115.6 metres. The inclination of the slope at the pond ranges from about 22 to 40 degrees.

6.2 Input Parameters

The soil conditions used in the stability analyses were based on geology maps, our field observations, and the results of the test holes. For the purposes of the analyses, we have assumed that the slope is composed of fill material over thin deposits of native silty sand and glacial till. We have also assumed that the ground surface follows the same slope below the water level in the pond with the bedrock surface located at about 5 metres below the pond water level.

The slope stability analyses were carried out using parameters typical for the Ottawa valley. The following table summarizes the soil parameters used in the analyses.

Table 6.2 Slope Stability Soil Parameters

Soil Type	Effective Angle of Internal Friction, φ	Effective Cohesion, c'	Unit Weight, γ
Fill Material	30	0	19
Silty Sand	30	0	19
Glacial Till	22	0	34

The results of a stability analysis are highly dependent on the assumed groundwater conditions. Based on the dry conditions of the monitoring well in borehole 19-3, the groundwater within the slope was assumed to be at the pond water level, which is located below the bedrock surface, at about elevation 115.6 metres.

6.3 Existing Factor of Safety

The slope stability analysis was carried out using soil parameters, groundwater conditions and a slope profile that attempt to model the slope in question. For the purposes of this study, a computed factor of safety of less than 1.0 to 1.3 is considered to represent a slope bordering on failure to marginally stable, respectively; a factor of safety of 1.3 to 1.5 is considered to indicate a slope that is less likely to fail in the long term and provides a degree of confidence against failure ranging from marginal (1.3) to adequate (1.4 and greater) should conditions vary from the assumed conditions. A factor of safety of 1.5, or greater, is considered to indicate adequate long term stability.

The slope stability analysis indicates that the existing slope, in its current configuration, has a factor of safety against overall rotational failure of less than 1.0 for static loading conditions, which is considered unstable from a geotechnical point of view.

6.4 Setback Requirements

For unstable slopes, the distance from the unstable slope to the safe setback line is called ‘Erosion Hazard Limit’. In accordance with the Ministry of Natural Resources (MNR) Technical Guide “Understanding Natural Hazards” dated 2001, the Erosion Hazard Limit consists of three components: (1) Stable Slope Allowance, (2) Toe Erosion Allowance, and (3) Erosion Access Allowance. The area between the Erosion hazard limit and the crest of the slope should not be developed with permanent structures, or any other valuable infrastructure.

The slope stability analysis indicates the existing slope, in its current configuration, is considered unstable. Using the same analysis results, a setback from the crest of the slope which would provide a factor of safety greater than 1.5 was calculated to be about 5.6 metres. Therefore, for this preliminary analysis, a minimum setback of 5.6 metres measured perpendicular from the crest of the slope along the pond is required.

As indicated above, the watercourse is located at the toe of the slope. In accordance with the MNR documents, we have included a Toe Erosion Allowance of 6 metres to allow for continual erosion at the toe of the slope.

The MNR procedures also include the application of a 6 metre wide Erosion Access Allowance beyond the Stable Slope and Toe Erosion Allowances to allow for access by equipment to repair a possible failed slope. The MNR documents do not indicate when an Erosion Access Allowance need, or need not, be applied. However, industry standards advocate that the Erosion Access Allowance should be included whenever *both* of the following conditions are met:

- The slope is considered unstable; and
- Development plans would prevent equipment access to the slope (e.g. where rear lot lines of residential lots will be constructed right up to the Erosion Hazard Limit).

Based on the results of the slope stability analysis, the slope in its current configuration is considered unstable. However, based on the proposed site development plan, an approximate 10 metre wide drainage ditch is proposed along the crest of the slope and a gravel parking area is proposed adjacent to the drainage ditch. It is considered acceptable from a geotechnical point of view to construct the proposed drainage ditch and parking lot within the Erosion Assess Allowance as the drainage ditch and the parking lot will not negatively impact the stability of the existing slope or impede future access to slope for repairs.

As such, the Erosion Hazard Limit along the crest of the slopes of the pond is 11.6 metres.

6.5 Seismic Slope Stability

The slope was also analysed for pseudo-static (seismic) conditions. A seismic coefficient of about 0.13 was used in the pseudo-static analysis (i.e., half of the Peak Ground Acceleration for the site according to the 2015 National Building Code).

For seismic loading conditions, the Erosion Hazard Limit could consist of only the Stable Slope Allowance (i.e., the Toe Erosion Allowance and Erosion Access Allowance are not considered). During a seismic event, the Stable Slope Allowance is the area between the crest of the slope and location where a factor of safety of greater than 1.1 against overall rotational failure is calculated. A Toe Erosion Allowance is not considered since erosion is not the trigger of seismic slope instability. Furthermore, an Erosion Access Allowance is also not considered given that, in general, the philosophy for seismic design corresponds to post-disaster conditions (i.e., to avoid immediate collapse and loss of life).

The slope stability analysis indicates that the existing slope, in its current configuration, has a factor of safety against overall rotational failure of less than 1.0 for pseudo-static (seismic) loading conditions, which is considered unstable from a geotechnical point of view. Using the same analysis results, a setback from the crest of the slope which would provide a factor of safety greater than 1.1 was calculated to be about 5.6 metres. Therefore, the Erosion Hazard Limit determined for static loading conditions governs for this site.

7.0 ADDITIONAL CONSIDERATIONS

7.1 Winter Construction

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

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

7.2 Effects of Construction Induced Vibration

Some of the construction operations (such as granular material compaction, excavation, hoe ramming, foundation construction etc.) will cause ground vibration on and off of the site. The vibrations will attenuate with distance from the source, but may be felt at nearby structures. We recommend that preconstruction surveys be carried out on the adjacent structures and that vibration monitoring be carried out during the construction so that any construction related claims can be dealt with in a fair manner.

7.3 Disposal of Excess Soil

It is noted that the professional services retained for this project include only the geotechnical aspects of the subsurface conditions at this site. The presence or implications of possible surface and/or subsurface contamination, including naturally occurring source of contamination, are outside the terms of reference for this report.

7.4 Design Review and Construction Observation

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

The engagement of the services of the geotechnical consultant during construction is recommended to confirm that the subsurface conditions throughout the proposed excavations do not materially differ from those given in the report and that the construction activities do not adversely affect the intent of the design. The subgrade surfaces for the building and site should be inspected by experienced geotechnical personnel to ensure that suitable materials have been reached and properly prepared. The placing and compaction of earth fill and imported granular materials should be inspected to ensure that the materials used conform to the grading and compaction specifications. In accordance with Ontario Building Code requirements, full time compaction testing is required for engineered fill below buildings.

8.0 CLOSURE

We trust this report provides sufficient information for your present purposes. If you have any questions concerning this report, please do not hesitate to contact our office.

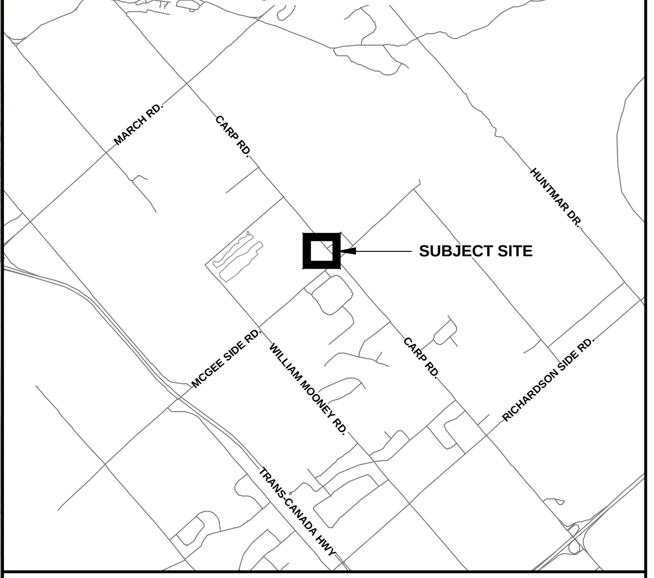
W. Alex Meacoe

Alex Meacoe, P.Eng.
Geotechnical Engineer

Johnathan A. Cholewa, Ph.D., P.Eng.
Senior Geotechnical Engineer

LICENSED PROFESSIONAL ENGINEER
J. A. CHOLEWA
100119055
18 Feb 2020
PROVINCE OF ONTARIO

KEY PLAN
1:100,000



LEGEND

PROPERTY BOUNDARY

PROPOSED GRAVEL PARKING AREA

BOREHOLE LOCATION IN PLAN
(current investigation by GEMTEC)

TEST PIT LOCATION IN PLAN
(current investigation by GEMTEC)

BH/TP # ← TEST HOLE ID
XX.XX ← GROUND SURFACE ELEVATION, IN METRES GEODETIC DATUM

Scale 1:750
0 15 30 45m

GEMTEC
CONSULTING ENGINEERS AND SCIENTISTS

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

Client ARGUE CONSTRUCTION LTD.	Project 61730.61

Location
3025 CARP ROAD
OTTAWA, ON

Drwn by P.C.	Chkd by W.A.M.	SITE PLAN
Date OCTOBER 2019	Rev. 0	**FIGURE 1**

P:\0. Files\61700\61730.61\Phase 1 - Geotech\Drafting\Drawings\61730.61_Geotech_FG1_V01_2019-09-19.dwg, 19/10/24 9:23:52 AM

APPENDIX A

List of Abbreviations and Terminology
Record of Borehole and Test Pit Sheets

RECORD OF BOREHOLE 19-1

CLIENT: Argue Construction Ltd
PROJECT: Geotechnical Investigation, 3025 Carp Road, Ottawa, ON
JOB#: 61730.61
LOCATION: See Figure 1, Site Plan

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Sep 6 2019

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE			SAMPLES				● PENETRATION RESISTANCE (N), BLOWS/0.3m; ▲ DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH (Cu), kPA + NATURAL ⊕ REMOULDED; WATER CONTENT, % W_P ⊢ W ⊣ W_L; 10 20 30 40 50 60 70 80 90	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m			
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		120.27							
		Compact, dark to grey brown silt, sand, gravel, organics (FILL MATERIAL)	▨		1	SS	406	11	●		
		Compact, grey brown silty sand some gravel (Possible Fill)	▨	119.94 0.33							
		Very dense, grey brown silty sand to sandy silt (Possible Fill)	▨	119.46 0.81	2	SS	76	50 for 127 mm			
1		Auger refusal. End of borehole.		119.33 0.94							No groundwater inflow observed at the time of drilling.
2											
3											

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LOGGED: AN
CHECKED: MR

RECORD OF BOREHOLE 19-2

CLIENT: Argue Construction Ltd
PROJECT: Geotechnical Investigation, 3025 Carp Road, Ottawa, ON
JOB#: 61730.61
LOCATION: See Figure 1, Site Plan

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Sep 6 2019

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	● PENETRATION RESISTANCE (N), BLOWS/0.3m ▲ DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m SHEAR STRENGTH (Cu), kPA + NATURAL ⊕ REMOULDED WATER CONTENT, % W_P W W_L 10 20 30 40 50 60 70 80 90	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Ground Surface		120.74							
0	Power Auger Hollow Stem Auger (210mm OD)	Very dense, dark to grey brown silt, sand, gravel, organics (FILL MATERIAL)	▨								
		Very dense, grey brown silty sand, some gravel (Possible Fill).	▨	120.59 0.15	1	SS	229	63 for 76 mm			
		Auger refusal. End of borehole.		120.31 0.43							No groundwater inflow observed at the time of drilling.
1											
2											
3											

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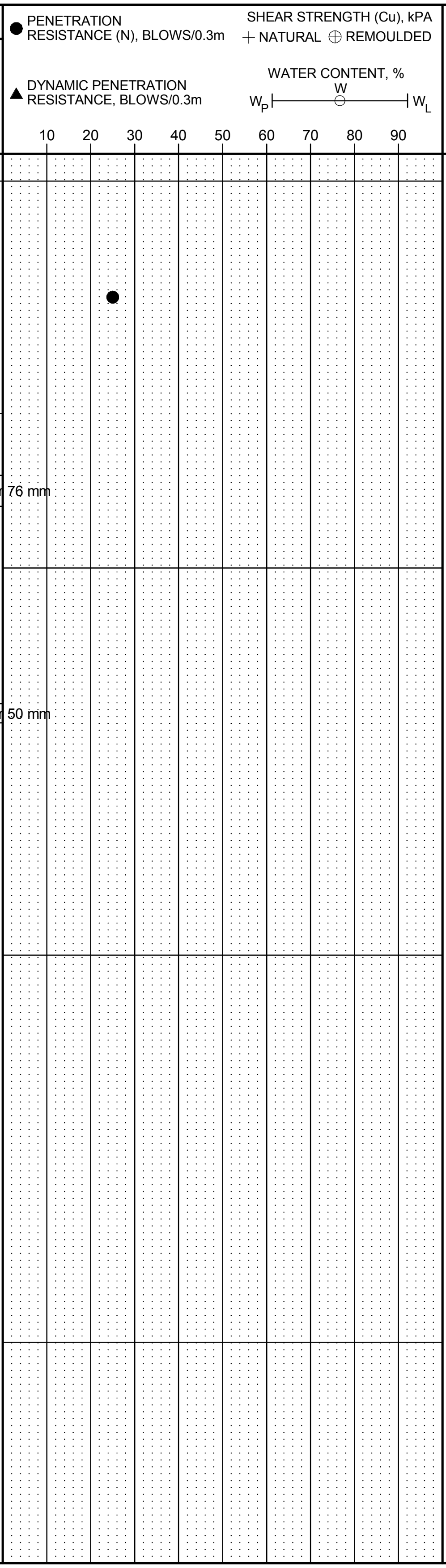
RECORD OF BOREHOLE 19-3a

CLIENT: Argue Construction Ltd
PROJECT: Geotechnical Investigation, 3025 Carp Road, Ottawa, ON
JOB#: 61730.61
LOCATION: See Figure 1, Site Plan

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Sep 6 2019

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		120.19
		Dark to grey brown silt, sand, gravel, organics (FILL MATERIAL)	▨	120.06 0.13
1		Compact to very dense, brown fine to medium sand and gravel, trace silt, cobbles, possible boulders (Possible Fill).	▨	118.79 1.40
		Auger refusal. End of borehole. Moved north about 3.5 m (see 19-3b)		
2				
3				

SAMPLES NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m
1	SS	457	25
2	SS	0	50 for 76 mm
3	SS	51	50 for 50 mm



ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

No groundwater inflow observed at the time of drilling.

GEO - BOREHOLE LOG 6173061.GPJ GEMTEC 2018.GDT 10-24-19

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CHECKED: MR

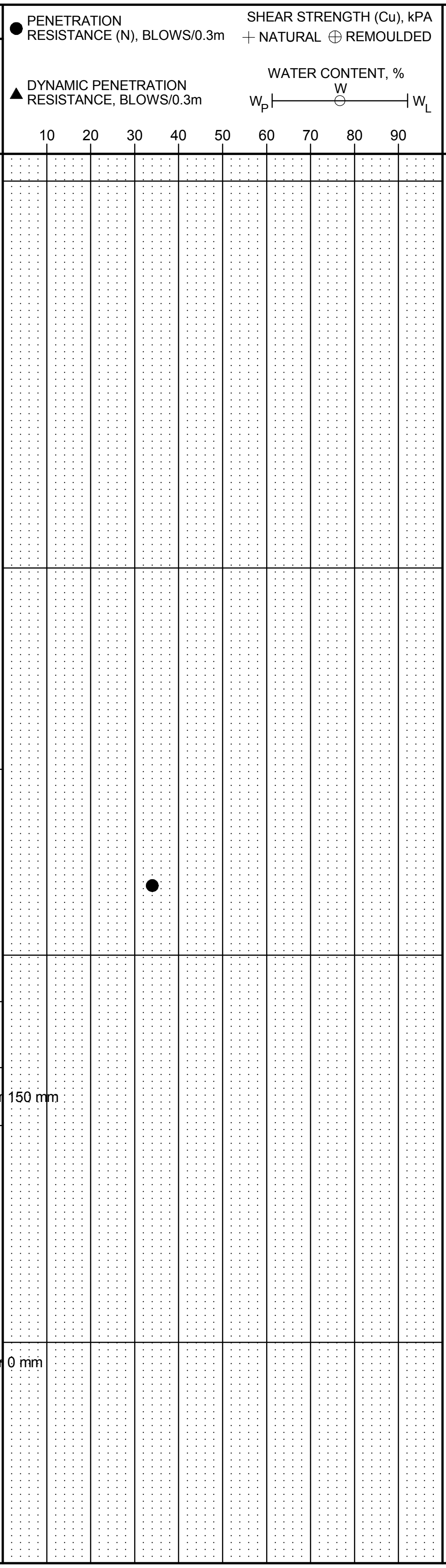
RECORD OF BOREHOLE 19-3b

CLIENT: Argue Construction Ltd
PROJECT: Geotechnical Investigation, 3025 Carp Road, Ottawa, ON
JOB#: 61730.61
LOCATION: See Figure 1, Site Plan

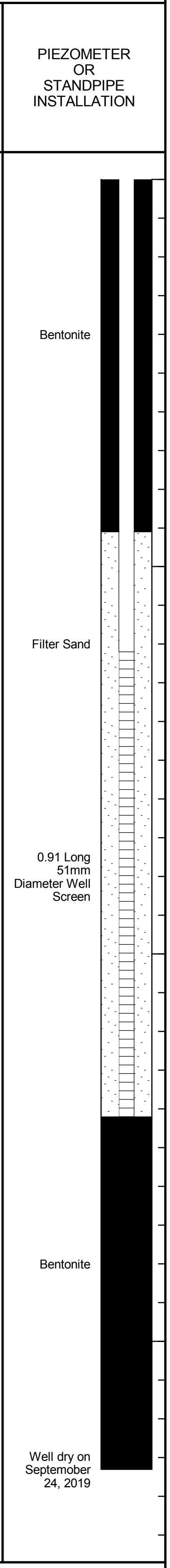
SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Sep 6 2019

BORING METHOD: Power Auger, Hollow Stem Auger (210mm OD)

SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)	SAMPLES NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m
Ground Surface	120.19				
Auger throughout, no sampling (see 19-3a)					
Dense, dark brown to brown sand, silt, gravel, cobbles, possible boulders (FILL MATERIAL)	118.69 1.50				
Very dense brown silty sand, with wood pieces (FILL MATERIAL)	118.46 1.73	4	SS	600	34
Dense, reddish brown SILTY SAND to SAND, some silt	118.34 1.85				
Very dense, grey brown SILTY SAND, some gravel, cobbles	117.90 2.29	5	SS	150	50 for 150 mm
Possible Weathered Bedrock	117.75 2.44	~~6~~	~~SS~~	~~0~~	~~50 for 0 mm~~
Auger refusal. End of borehole.	116.86 3.33				



ADDITIONAL LAB. TESTING



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CHECKED: MR

RECORD OF BOREHOLE 19-4

CLIENT: Argue Construction Ltd
PROJECT: Geotechnical Investigation, 3025 Carp Road, Ottawa, ON
JOB#: 61730.61
LOCATION: See Figure 1, Site Plan

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Sep 6 2019

BORING METHOD: Power Auger, Hollow Stem Auger (210mm OD)

DEPTH SCALE METRES	SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)
	Ground Surface	120.41
0	Dark to grey brown silt, sand, gravel, organics (FILL MATERIAL)	120.33 0.08
	Compact to very dense, brown silty sand, some gravel (Possible Fill)	119.44 0.97
1	Auger refusal. End of borehole.	

SAMPLES NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m
1	SS	200	13
2	SS	100	50 for 100 mm

● PENETRATION RESISTANCE (N), BLOWS/0.3m
▲ DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA + NATURAL ⊕ REMOULDED
WATER CONTENT, % W_P W W_L
10 20 30 40 50 60 70 80 90

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

No groundwater inflow observed at the time of drilling.

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RECORD OF BOREHOLE 19-5

CLIENT: Argue Construction Ltd
PROJECT: Geotechnical Investigation, 3025 Carp Road, Ottawa, ON
JOB#: 61730.61
LOCATION: See Figure 1, Site Plan

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Sep 6 2019

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	SOIL PROFILE STRATA PLOT	SOIL PROFILE ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, mm	SAMPLES BLOWS/0.3m	● PENETRATION RESISTANCE (N), BLOWS/0.3m ▲ DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m SHEAR STRENGTH (Cu), kPA + NATURAL ⊕ REMOULDED WATER CONTENT, % W_P W W_L 10 20 30 40 50 60 70 80 90	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Ground Surface		120.30							
0	Power Auger Hollow Stem Auger (210mm OD)	Grey crushed sand and gravel, trace silt. (BASE/SUBBASE MATERIAL)			1	SS	200	57 for 229 mm			
		Grey brown silty sand, some gravel (GLACIAL TILL).		120.02 0.28							
		Auger refusal. End of borehole.		0.33							No groundwater inflow observed at the time of drilling.
1											
2											
3											

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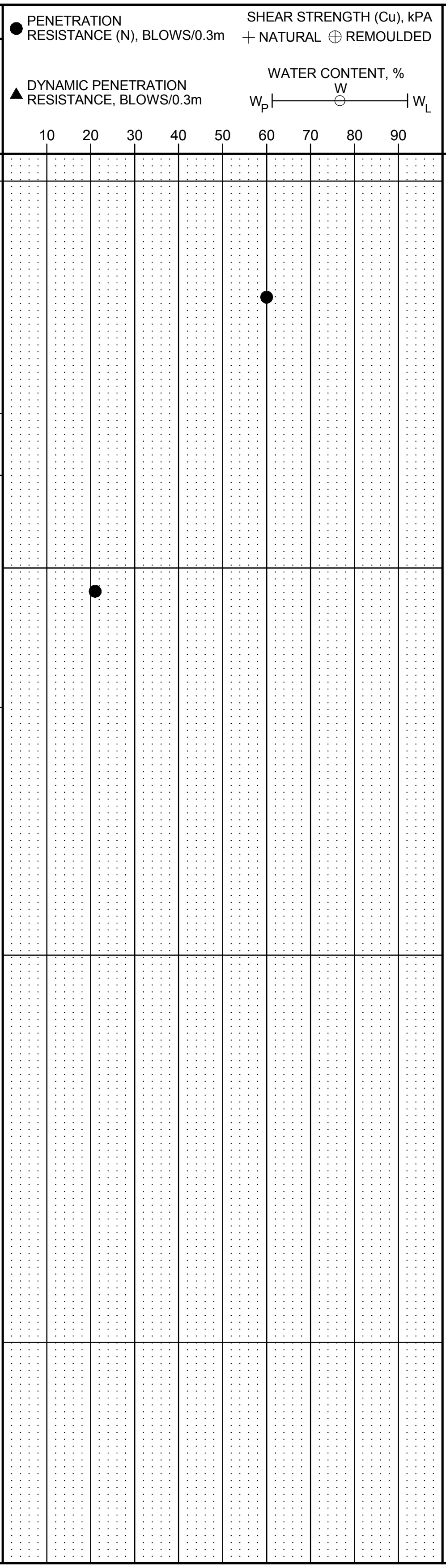
CHECKED: MR

RECORD OF BOREHOLE 19-6

CLIENT: Argue Construction Ltd
PROJECT: Geotechnical Investigation, 3025 Carp Road, Ottawa, ON
JOB#: 61730.61
LOCATION: See Figure 1, Site Plan

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Sep 6 2019

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE			SAMPLES				ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m		
		Ground Surface		120.60						
0	Power Auger Hollow Stem Auger (210mm OD)	Grey crushed sand and gravel, trace silt (temporary road base)			1	SS	355	60		
		Grey brown silty sand to sandy silt (FILL MATERIAL)		120.07 0.53						
1		Compact, grey brown silty sand, some gravel and organics (FILL MATERIAL)		120.00 0.60	2	SS	508	21		
		Auger refusal. End of borehole.		119.20 1.40						No groundwater inflow observed at the time of drilling.
2										
3										



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CHECKED: MR

GEO - BOREHOLE LOG 6173061.GPJ GEMTEC 2018.GDT 10-24-19

RECORD OF TEST PIT 19-1a

CLIENT: Argue Construction Ltd.
PROJECT: Geotechnical Investigation, 3025 Carp Road, Ottawa, ON
JOB#: 61730.61
LOCATION: See Figure 1, Site Plan

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Sep 12 2019

DEPTH SCALE METRES	SOIL PROFILE: DESCRIPTION	SOIL PROFILE: STRATA PLOT	SOIL PROFILE: ELEV. DEPTH (m)	SAMPLE NUMBER	SAMPLE TYPE	SHEAR STRENGTH (Cu), kPA + NATURAL ⊕ REMOULDED / WATER CONTENT, % W_P W W_L (10 20 30 40 50 60 70 80 90)	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface		120.1					
1	Dark brown to brown sand and gravel, some silt, cobbles, boulders, wood pieces and concrete (FILL MATERIAL)	▨	118.3 1.8					
2	Red brown to brown SILTY SAND		117.7 2.4					
3	Refusal on inferred bedrock							No groundwater inflow observed at time of excavation.
4								
5								
6								
7								
8								
9								
10								

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RECORD OF TEST PIT 19-1b

CLIENT: Argue Construction Ltd.
PROJECT: Geotechnical Investigation, 3025 Carp Road, Ottawa, ON
JOB#: 61730.61
LOCATION: See Figure 1, Site Plan

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Sep 12 2019

DEPTH SCALE METRES	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLE NUMBER	SAMPLE TYPE	SHEAR STRENGTH (Cu), kPA + NATURAL ⊕ REMOULDED; WATER CONTENT, % W_P ⊢ W ⊖ ⊣ W_L (10 20 30 40 50 60 70 80 90)	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface		120.1					
	Dark brown to brown sand and gravel, some silt, cobbles, boulders, wood pieces and concrete (FILL MATERIAL)	▨						
1								
			118.5 1.6					
	Red brown to brown SILTY SAND							
2			118.0 2.1					
	Refusal on inferred bedrock							No groundwater inflow observed at time of excavation.
3								
4								
5								
6								
7								
8								
9								
10								

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LOGGED: M.R.

CHECKED:

RECORD OF TEST PIT 19-2

CLIENT: Argue Construction Ltd.
PROJECT: Geotechnical Investigation, 3025 Carp Road, Ottawa, ON
JOB#: 61730.61
LOCATION: See Figure 1, Site Plan

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Sep 12 2019

DEPTH SCALE METRES	SOIL PROFILE			SAMPLE NUMBER	SAMPLE TYPE	SHEAR STRENGTH (Cu), kPA + NATURAL ⊕ REMOULDED WATER CONTENT, % W_P ⊢ W ⊣ W_L 10 20 30 40 50 60 70 80 90	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)					
0	Ground Surface		120.8					
	Dark brown to brown silty sand, some gravel, cobbles, boulders, wood pieces, and concrete (FILL MATERIAL)	▨	119.8 1.0					
1	Red brown SILTY SAND	░	119.6 1.2					No groundwater inflow observed at time of excavation.
	Refusal on inferred bedrock							
2								
3								
4								
5								
6								
7								
8								
9								
10								

GEMTEC
Consulting Engineers and Scientists

LOGGED: M.R.

CHECKED:

RECORD OF TEST PIT 19-3

CLIENT: Argue Construction Ltd.
PROJECT: Geotechnical Investigation, 3025 Carp Road, Ottawa, ON
JOB#: 61730.61
LOCATION: See Figure 1, Site Plan

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Sep 12 2019

DEPTH SCALE METRES	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLE NUMBER	SAMPLE TYPE	SHEAR STRENGTH (Cu), kPA + NATURAL ⊕ REMOULDED WATER CONTENT, % W_P ⊢—W ○—⊣ W_L 10 20 30 40 50 60 70 80 90	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface		120.7					
	Dark brown to brown sand and gravel, some silt, cobbles, boulders, wood pieces, and concrete (FILL MATERIAL)	▨						
1								
	Refusal on inferred bedrock		119.5 1.3					No groundwater inflow observed at time of excavation.
2								
3								
4								
5								
6								
7								
8								
9								
10								

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CONSULTING ENGINEERS AND SCIENTISTS

LOGGED: M.R.
CHECKED:

RECORD OF TEST PIT 19-4

CLIENT: Argue Construction Ltd.
PROJECT: Geotechnical Investigation, 3025 Carp Road, Ottawa, ON
JOB#: 61730.61
LOCATION: See Figure 1, Site Plan

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Sep 12 2019

DEPTH SCALE METRES	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLE NUMBER	SAMPLE TYPE	SHEAR STRENGTH (Cu), kPA + NATURAL ⊕ REMOULDED WATER CONTENT, % W_P ├─ W ─┤ W_L 10 20 30 40 50 60 70 80 90	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface		120.6					
	Dark brown to brown sand and gravel, some silt, cobbles, boulders, concrete, plastic, and steel (FILL MATERIAL)	▨	119.6 1.0					
1	Refusal on inferred bedrock							No groundwater inflow observed at time of excavation.
2								
3								
4								
5								
6								
7								
8								
9								
10								

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CHECKED:

GEO - TESTPIT LOG 6173061_TP.GPJ GEMTEC 2018.GDT 10-24-19

ABBREVIATIONS AND TERMINOLOGY USED ON RECORDS OF BOREHOLES AND TEST PITS

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

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

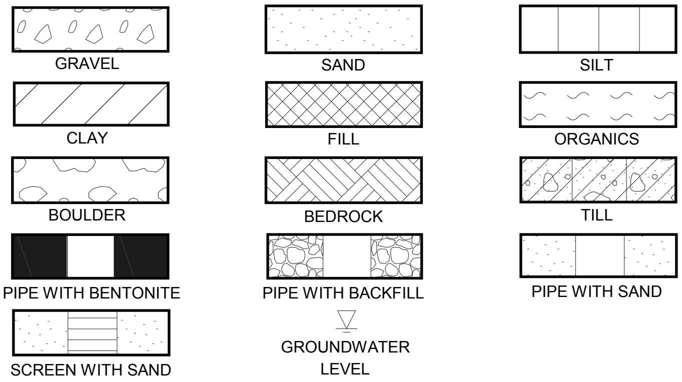
PENETRATION RESISTANCE

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

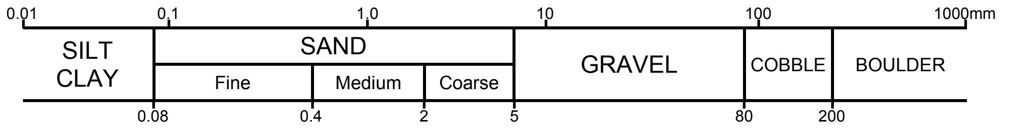
Dynamic Penetration Resistance
The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) to drive a 50 mm (2 in.) diameter 60° cone attached to 'A' size drill rods for a distance of 300 mm (12 in.).

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

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



GRAIN SIZE



DESCRIPTIVE TERMINOLOGY

(Based on the CANFEM 4th Edition)

0 10 20 35

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

GEMTEC

descriptive terms.pub
Modified May 2018

APPENDIX B

Laboratory Testing
Soil Chemistry Relating to Corrosion

Report to: Argue Construction Ltd.
Project: 61730.61 (February 18, 2020)

Certificate of Analysis

Client: GEMTEC Consulting Engineers and Scientists Limited

Client PO:

Report Date: 01-Oct-2019

Order Date: 26-Sep-2019

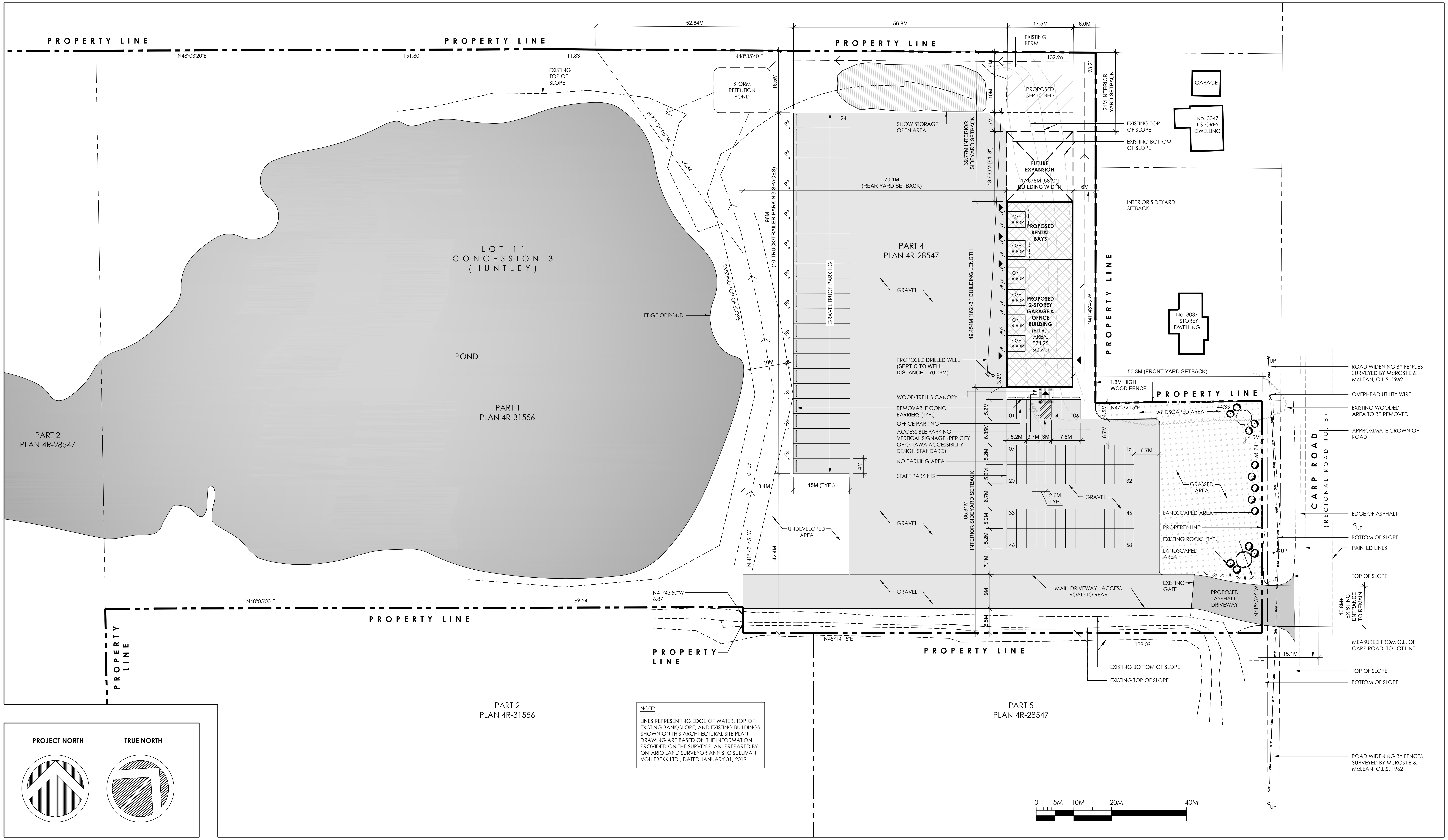
Project Description: 61730.61

	Client ID:	BH 19-6 SA2 (2'6"-4'6")	-	-	-
	Sample Date:	24-Sep-19 09:00	-	-	-
	Sample ID:	1939537-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	83.2	-	-	-
General Inorganics					
Conductivity	5 uS/cm	227	-	-	-
pH	0.05 pH Units	6.82	-	-	-
Resistivity	0.10 Ohm.m	44.0	-	-	-
Anions					
Chloride	5 ug/g dry	9	-	-	-
Sulphate	5 ug/g dry	25	-	-	-

APPENDIX C

Site Development Plan

Report to: Argue Construction Ltd.
Project: 61730.61 (February 18, 2020)



NOTE:

LINES REPRESENTING EDGE OF WATER, TOP OF EXISTING BANK/SLOPE, AND EXISTING BUILDINGS SHOWN ON THIS ARCHITECTURAL SITE PLAN DRAWING ARE BASED ON THE INFORMATION PROVIDED ON THE SURVEY PLAN, PREPARED BY ONTARIO LAND SURVEYOR ANNIS, O'SULLIVAN, VOLLEBEKK LTD., DATED JANUARY 31, 2019.

1
A1.0
SITE PLAN
SCALE 1:500

ZONING DATA (BASED ON ZONING BY-LAW 2008-250)

Municipal Address:
3025 Carp Road, Ottawa, Ontario

Legal Description:
Part of Lot 11, Concession 3, Geographic Township of Huntley, City of Ottawa

Zoning Designation:
Rural Commercial Zone; Carp Road Corridor (RC9); Area D - Rural

Site Area: 1.828 Ha (18,281.3 Sq.M.)

Building Area:
- **New Building:** 874.25 Sq.M.
- **Existing/Relocated Buildings:** N/A
- **Total Buildings Gross Area:** 874.25 Sq.M.

Lot Coverage: (874.25/18281.3) x 100 = 4.78%

Gross Floor Area (Principal Use Bldg.):
- **First Floor Area:** 874.25 Sq.M.
- **Second Floor Area:** 133.15 Sq.M.
- **Total GFA:** 1,007.4 Sq.M.

RC9 ZONING PROVISIONS

ZONING MECHANISM	REQUIRED	PROVIDED
FRONT YARD SET BACK	10M (min.)	50.3M
REAR YARD SET BACK	10M (min.)	70.1M
INTERIOR SIDE YARD SET BACK	3M (min.)	6M
PRINCIPAL BUILDING HEIGHT	11M (max.)	
LOT COVERAGE	25% (max.)	4.78%
PARKING REQUIREMENTS	**Heavy Equipment Servicing:** **(Table 101 - Row N41)** 0.75/100 Sq.M. GFA (741.10 Sq.M./100) X 0.75 = 5.6 parking spaces **Office:** **(Table 101 - Row N59)** 2.4/100 Sq.M. GFA (266.3 Sq.M./100) X 2.4 = 6.4 parking spaces **Total: 5.6 + 6.4 = 12 spaces**	58 Spaces
DISABLED PARKING SPACES	1 Parking Space	1 Space

LOADING SPACES REQUIREMENTS

USE	REQUIRED	PROVIDED
REPAIR GARAGE (741.1 Sq.M.)	1	X
OFFICE (266.3 Sq.M.)	0	X

ACCESSIBLE PARKING STALL PROVISIONS

REQUIRED	PROVIDED
2.4M WIDE + 1.5M WIDE ACCESS AISLE (min.)	3.7M (W) + 3M (W) ACCESS AISLE

AISLE AND DRIVEWAY PROVISIONS

REQUIRED	PROVIDED
6.7M (min.) FOR DOUBLE TRAFFIC LANE	9M

SETBACK FROM WATERCOURSES PROVISIONS

REQUIRED	PROVIDED
30M FROM HIGH WATER MARK/15M FROM T.O. BANK	30M SETBACK FROM T.O. BANK

LEGEND

▬ · · ▬ · ·	PROPERTY LINE
— – —	CENTRELINE OF FIRE ACCESS ROUTE/ TRUCK ACCESS ROUTE
- - - -	APPROXIMATE OUTLINE OF MVCA MEANDER BELT
▨	OUTLINE OF NEW BUILDING
▩	OUTLINE OF ASPHALT AREA
▢	OUTLINE OF GRAVEL AREA
⁘	OUTLINE OF LANDSCAPED AREA
▧	OUTLINE OF STORAGE YARD DESIGNATED FOR SNOW STORAGE
LS ✧	EXISTING LIGHT STANDARD
▫ PP	PROPOSED TRUCK POWER PLUG/BOLLARD
• B	PROPOSED PAINTED GALVANIZED STEEL BOLLARD
○ UP	EXISTING UTILITY POLE

ARGUE CONSTRUCTION LTD.

PLAN NO.: #####

GENERAL NOTES

- CONTRACTOR SHALL VERIFY ALL DIMENSIONS ON SITE AND SHALL REPORT ANY DISCREPANCIES TO THE ARCHITECT PRIOR TO COMMENCEMENT OF WORK.
- CONTRACTOR MUST COMPLY WITH ALL CODES AND BYLAWS AND OTHER REGULATIONS BY AUTHORITIES HAVING JURISDICTION OVER THE WORK.
- DO NOT SCALE THIS DRAWING.
- THIS DRAWING MAY NOT BE USED FOR CONSTRUCTION UNLESS SEALED/SIGNED BY THE ARCHITECT.
- COPYRIGHT OF THIS DRAWINGS IS RESERVED.

SURVEY PLAN DISCLAIMER

THIS ARCHITECTURAL SITE PLAN DRAWING IS PREPARED BASED ON A SURVEY PLAN PROVIDED TO A+ ARCHITECTURE INC. OF EXISTING LAND FEATURES, INCLUDING BUT NOT LIMITED TO, EXISTING LEGAL BOUNDARIES, LOT LINES, GRADES, TOPOGRAPHY, VEGETATION ETC., SHOWN ON THIS DRAWING FOR COORDINATION PURPOSES ONLY AND ARE BASED ON THE SURVEY PLAN PREPARED BY **ANNIS, O'SULLIVAN, VOLLEBEKK LTD.**, ONTARIO LAND SURVEYOR, DATED **JANUARY 31, 2019**.

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NO.	ISSUE	DATE (YY/MM/DD)

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CLIENT

BADGER DAYLIGHTING™

PROJECT

BADGER DAYLIGHTING EQUIPMENT STORAGE AND OFFICE BUILDING
3025 CARP ROAD, OTTAWA, ON

DRAWING TITLE

SITE PLAN

DRAWN BY	A.A.	DRAWING NO.	
REVIEWED BY	A.A.		**A1.0**
START DATE	2019/08/06		
PROJECT NO.	19011	REVISION NO.	00

FILE NO.: X##-##-##-#####

SHEET SIZE: ARCH D 24" X 36" (609.6mm X 914.4mm) | PLOT DATE: October 22, 2019 experience • knowledge • integrity

civil	civil
geotechnical	géotechnique
environmental	environnementale
field services	surveillance de chantier
materials testing	service de laboratoire des matériaux

expérience • connaissance • intégrité