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April 1, 2022
File No. PG6223-LET.01

Dunrobin Distilleries Limited
530 Berry Side Road
Ottawa, ON
K0A 1T0

Attention: **Mr. Mark Watson**

Subject: **Updated Geotechnical Assessment**
Proposed Two Storey Distillery
1498 Stittsville Main Street - Ottawa

Re: **D07-12-22-0035**

Dear Sir,

As requested, Paterson Group Inc. (Paterson) has prepared this updated Geotechnical Assessment for a proposed two storey distillery development to be located at 1498 Stittsville Main Street, in Ottawa, Ontario. This letter updates our Geotechnical Assessment memo, File PM12770-MEMO.01, dated October 1, 2020. This letter provides additional geotechnical information requested by the City of Ottawa.

1.0 Proposed Development

At the time of our previous memo, the existing building on the site was to be renovated. The present development will consist of a new building constructed over the footprint of the existing building, that is to be demolished. The existing gravel-surface parking areas will be upgraded to pavement. In order to promote infiltration of storm runoff, a permeable pavers pavement structure will be provided to the rear (west) of the new distillery building, as shown on drawings prepared by D.B. Gray Engineering Inc. Asphalt pavement and/or conventional interlock pavement will be provided to the south and east of the proposed building in the pedestrian areas.

2.0 Investigation and Observations

The investigation fieldwork for was carried out in conjunction with the previous memo and consisted of the logging of conditions in 2 test pits that had been dug by others within the existing building prior to our site visit of September 29, 2020.

The first test pit was located adjacent to the interior side of the south wall, of the existing building, at approximately 3 m from the southeast corner of the building. At that location, a 100 mm thick layer of rubble concrete (i.e. floor slab) was found to be underlain by fill material comprised of large cobbles in a matrix of silty sand. A 50 mm thick layer of ashes or cinders was encountered below the cobble fill, at a depth of 0.55 m below the top of slab. Fill material comprised of light brown sand with silt layers and debris was encountered at a depth of 0.6 m below slab surface. A plastic pipe was noted at a depth of approximately 0.8 m below the slab surface within the fill material.

Native compact reddish brown silty fine sand was encountered at a depth of 0.9 m below the slab surface. A hand auger hole put down below the bottom of the first test pit terminated in silty fine sand at a depth of 1.8 m below the floor slab surface.

The second test pit was located adjacent to the north wall, of the existing building, at approximately 2 m from the northwest corner of the building. The concrete floor slab was found to be 120 mm thick at this location. The existing building was supported on a rubble concrete foundation wall at this location. The underside of the foundation wall was encountered at a depth of 1.1 m below the slab surface. The rubble concrete foundation wall was observed to be rather weak and deteriorated. Adjacent to the foundation wall, the fill material consists primarily of rubble (cobbles in a matrix of silty sand).

A thin dark brown silty topsoil was encountered at a depth of 1.2 m below the slab surface. Native compact reddish brown silty fine sand was encountered at a depth of 1.25 m below the slab surface. The second test hole terminated in silty fine sand at a depth of 1.5 m below the slab surface.

Groundwater was not encountered in either test pit to the depths investigated.

The compact silty fine sand deposit is typical of conditions in this area, and is typically underlain by a silty sand and gravel (with cobbles and boulders) glacial till deposit that , in turn, overlies bedrock. Based on available geological mapping, the bedrock underlying the subject site consists of limestone and dolomite interbeds of the Gull River Formation. Based on the geological mapping, bedrock is expected to be encountered between depths of 5 and 10 m.

3.0 Geotechnical Assessment

From a geotechnical perspective, the subject site is suitable for the proposed development. The following sections provide recommendations for foundation, slab-on-grade and pavement design and construction.

Stripping Depth

All foundation remnants, topsoil and any non-specified existing fill materials should be removed from within the proposed building perimeter.

Fill Placement

Fill used for grading beneath the proposed building should consist of clean imported granular fill, such as Ontario Provincial Standard Specifications (OPSS) Granular A or Granular B Type II. The fill should be placed in lifts no greater than 300 mm thick and compacted using suitable compaction equipment for the lift thickness. Engineered fill placed beneath the building and structures should be compacted to at least 98% of its standard Proctor maximum dry density (SPMDD).

Foundation Design

Footings placed on an undisturbed compact silty sand bearing surface, or on engineered fill placed directly over the undisturbed, compact to dense glacial till or clean bedrock, can be designed using a bearing resistance at serviceability limit states (SLS) value of **100 kPa** and a factored bearing resistance at ultimate limit states (ULS) value of **150 kPa**. A geotechnical resistance factor of 0.5 was incorporated into the bearing resistance at ULS value.

Footings placed on a suitable soil bearing surface and designed using the above-noted bearing resistance value at SLS will be subjected to potential post-construction total and differential settlements of 25 and 20 mm, respectively.

An undisturbed soil bearing surface consists of one from which all unspecified fill, topsoil, and other deleterious materials, such as loose, frozen or disturbed soil, whether in situ or not, have been removed, in the dry, prior to the placement of concrete for footings.

Lateral Support

The bearing medium under footing-supported structures is required to be provided with adequate lateral support with respect to excavations and different foundation levels. Adequate lateral support is provided to a compact silty sand bearing medium when a plane extending down and out from the bottom edge of the footing at a maximum slope of 1.5H:1V passes through that soil and/or soil or fill material of similar strength.

Design for Earthquakes

The site class for seismic site response can be taken as **Class C**, as presented in Table 4.1.8.4.A of the Ontario Building Code (OBC) 2012.

Soils underlying the subject site are not susceptible to seismic liquefaction. Reference should be made to the latest revision of the Ontario Building Code 2012 for a full discussion of the earthquake design requirements.

Slab-on-Grade and Basement Slab

With the removal of all unspecified fill, topsoil and/or deleterious materials within the footprint of the proposed building, the native soil surface or engineered fill will be considered an acceptable subgrade on which to commence backfilling for floor slab construction.

For slabs-on-grade, provision should be made for proof-rolling the soil subgrade using heavy vibratory compaction equipment prior to placing and compacting the granular fill materials. Any poor performing areas should be removed and reinstated with an engineered fill, such as Granular B Type II. The upper 150 mm of sub-floor fill should consist of Granular A crushed stone for slab-on-grade floors. For basement floor slabs, if applicable, it is recommended that the upper 200 mm of sub-floor fill consists of 19 mm clear crushed stone.

Pavement Structures

Permeable Pavers and Stormwater Infiltration

It is our understanding that a permeable pavers pavement will be used for the parking, roadway and staging areas to the rear (west) of the proposed building. This is intended to address the spirit of the recommendations of the Carp River Watershed Study (2004), which identifies the subject site to be within a high groundwater recharge area, with an infiltration target of 262 mm/yr.

The expected silty fine sand over glacial till subgrade medium is expected to have hydraulic conductivity within the range of 10^{-5} to 10^{-8} m/s, with the lower values applicable where the sand is thinner or siltier. These hydraulic conductivity values correlate to infiltration rates within the range of 75 to 12 mm/hr and, therefore, indicate that infiltration of stormwater into the subgrade should occur to recharge the groundwater regime.

Note that infiltration rates for subgrades are influenced by the effects of compaction during placement of the overlying pavement materials. As such, where finer subgrade soils, such as the glacial till are encountered, the subgrade surface should be scarified, rather than proof-rolled, prior to placing the subbase granular layer.

Recommended Minimum Pavement Structures

For design purposes, the pavement structures presented in the following tables can be used for the design of pedestrian and car only asphalt pavement parking and walkway areas and access lanes and heavy truck traffic.

Table 1: Recommended Medium-Duty Permeable Pavement Structure Parking Areas and Driveways

Thickness (mm)	Material Description
70	**PERMEABLE PAVER** - Concrete Permeable Pavers generally installed with 3 mm tight butt joints and drainage voids filled with open-graded fill
25	**BEDDING:** Permeable 2.5 to 10 mm open-graded aggregate fill
150	**PERMEABLE BASE:** 5 to 28 mm open-graded aggregate fill
300	**PERMEABLE SUBBASE:** 40 to 80 mm open-graded aggregate fill
SUBGRADE - Either in situ soil or additional permeable subbase material placed over in situ soil. Scarify the subgrade to a depth of 100 mm where it consists of a fine-grained soil (i.e. glacial till).	

Table 2: Recommended Light-Duty Asphalt Pavement Structure Pedestrian Walkways and Patios

Thickness (mm)	Material Description
50	**WEAR COURSE** - HL-3 or Superpave 12.5 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
200	**SUBBASE** - OPSS Granular B Type II
SUBGRADE - Either in situ soils or OPSS Granular B Type I or II material placed over in situ soil or suitable inorganic fill.	

For asphaltic concrete materials, minimum Performance Graded (PG) 58-34 asphalt cement should be used for this project.

The pavement granular base and subbase layers should be placed in maximum 300 mm thick lifts and compacted to a minimum of 100% of the SPMDD (or equivalent) using suitable vibratory equipment. Where permeable fill materials are used, the field density can be judged by visual inspection and/or a specified number of passes of the compaction equipment, as appropriate at the time of placement, as part of field review and testing by Paterson staff.

4.0 Design and Construction Precautions

Foundation Drainage and Backfill

A perimeter foundation drainage system is recommended to be provided for the proposed structure. The system should consist of a 100 mm diameter perforated corrugated plastic pipe, surrounded on all sides by 150 mm of 10 mm clear crushed stone, placed at the footing level around the exterior perimeter of the structure(s). The pipe should have a positive outlet, such as a gravity connection to the storm sewer.

Foundation drainage is not a requirement for basementless. However, the provision of drainage helps with controlling potential frost action around the building (heaving of hard landscaping, etc.) as well as reducing the potential for moisture through the perimeter of the interior floor slab. Foundation drainage is a requirement for structures with a basement level.

Backfill against the exterior sides of the foundation walls should consist of free-draining, non frost susceptible granular materials. Imported granular materials, such as clean sand or OPSS Granular B Type I granular material, should be used for this purpose. The greater part of the site excavated materials will be frost susceptible and, as such, are not recommended for re-use as backfill against the foundation walls, unless used in conjunction with an air-gap membrane, such as System Platon, or a composite drainage blanket, such as Miradrain G100N or Delta Drain 6000.

Protection of Footings Against Frost Action

The perimeter footings of heated buildings are required to be insulated against the deleterious effect of frost action. A minimum of 1.5 m of soil cover alone, or a minimum of 0.3 m of soil cover in conjunction with foundation insulation, should be provided in this regard.

Exterior footings in unheated areas should be provided with a minimum 1.8 m thick soil cover or a combination of soil cover and foundation insulation.

If foundation insulation is used, care should be taken to ensure that the insulation is not damaged during construction. All joints between insulation boards should be tightly butted, or overlapped while providing full support to the insulation. Foundation insulation recommendations or details can be provided upon request.

Groundwater Control

It is anticipated that any groundwater infiltration into the excavations should be low to moderate and controllable using open sumps. Pumping from open sumps should be sufficient to control the groundwater influx through the sides of shallow excavations. The contractor should be prepared to direct water away from all bearing surfaces and subgrades, regardless of the source, to prevent disturbance to the founding medium.

Landscaping Considerations

The subject site is not underlain by sensitive clay deposits and, as such, there is no special requirement for tree separation distance from the foundations relating to clay soils.

At this site, with the expectation that dense glacial till soils underlie the silty sand, it may be of concern to provide a sufficient volume of suitable soil for a tree to grow. This could require local additional excavation of dense glacial till, and its replacement with suitable growing soil medium, in cases where additional soil volume is required (as determined by the landscape architect or contractor) for a particular tree.

Winter Construction

The subsoil conditions at this site mostly consist of frost susceptible materials. In presence of water and freezing conditions ice could form within the soil mass. Heaving and settlement upon thawing could occur. Precautions should be taken if winter construction is considered for this project.

In the event of construction during below zero temperatures, the founding stratum should be protected from freezing temperatures by the use of straw, propane heaters, tarpaulins or other suitable means. In this regard, the base of the excavations should be insulated from sub-zero temperatures immediately upon exposure and until such time as heat is adequately supplied to the building and the footings are protected with sufficient soil cover to prevent freezing at founding level.

Field Review and Materials Testing

It is a requirement for the foundation design data provided herein to be applicable that the following field review and material testing program be performed by the geotechnical consultant.

- ❑ Observation of all bearing surfaces prior to the placement of concrete.
- ❑ Sampling and testing of the concrete and fill materials used.
- ❑ Observation of all subgrades prior to backfilling.
- ❑ Field density tests for well-graded fill materials and/or observation for open-graded fill materials during compaction to assess compaction level achieved.

A report confirming that these works have been conducted in general accordance with our recommendations could be issued, upon request, following the completion of a satisfactory material testing and observation program by the geotechnical consultant.

5.0 Statement of Limitations

The recommendations provided in this report are in accordance with our present understanding of the project.

A geotechnical assessment is a limited sampling of the site. Should any conditions at the site be encountered which differ from those at the test locations, we request immediate notification to permit reassessment of our recommendations.

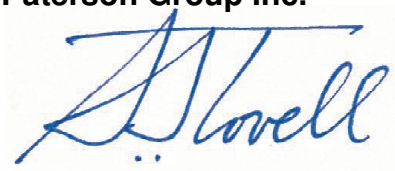
The recommendations provided herein should only be used by the design professionals associated with this project. They are not intended for contractors bidding on or undertaking the work. The latter should evaluate the factual information provided in this report and determine its suitability and completeness for their intended construction schedule and methods. Additional testing may be required for their purposes.

The present report applies only to the project described in this document. Use of this report for purposes other than those described herein or by person(s) other than Dunrobin Distilleries Limited or its agent(s) is not authorized without review by Paterson Group Inc. for the applicability of our recommendations to the altered use of the report.

We trust that the information provided in this Geotechnical Assessment satisfies your present requirements.

Best Regards,

Paterson Group Inc.



Andrew J. Tovell, P.Eng.

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