Geotechnical Engineering

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Hydrogeological Study

National Capital Business Park
4055 & 4120 Russell Road
Ottawa, Ontario

Prepared For

Avenue 31 Capital Incorporated

July 31, 2020

Report: PH4055-1

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EXECUTIVE SUMMARY

Assessment

Further to the request and authorization of Avenue 31 Capital Incorporated, Paterson Group (Paterson) completed a Hydrogeological Study for the National Capital Business Park to be located at 4055 & 4120 Russell Road in the City of Ottawa, as per the agreed upon scope of work. The purpose of this study is to:

- characterize the existing geological and hydrogeological conditions at the subject site
- determine the hydrogeological function of the subject site, to identify infiltration potential and to identify opportunities for Low Impact Development (LID) measures by way of water budget analyses.
- provide specific recommendations with respect to existing water wells, construction practices, the potential for environmental contamination, infiltration potential and LID considerations.

This report incorporates the findings of a previous geotechnical investigation by Paterson and an Environmental Impact Statement completed by Kilgour and Associates at the subject site in 2019.

4055 Russell Road is located on the east side of Russell Road, west of Highway 417 in the City of Ottawa, Ontario. 4120 Russell Road is located on the southwest side of Russell Road and north of Hunt Club Road. The location of the subject site is shown on Drawing PH4055-1 - Site Plan appended to this report. The study area currently consists of a mixture of meadows (agricultural fields), thicket, deciduous forest and marshland. The property is surrounded to the north and west by commercial developments and an electrical substation, to the east by Hunt Club Road/Highway 417 and undeveloped land, and to the south by an existing stormwater management pond, Hunt Club Road and wooded areas.

The Mather Award Drain is the only significant water feature identified within the boundaries of the study area. It transects the southern portion of 4055 Russell Road in a northwest to southeast direction, where it eventually intercepts Ramsay Creek approximately 700 m east of the site. There is also a cattail marsh located in the northwest corner of the site. It is not fed by any headwater drainage features, but likely provides stormwater attenuation of surface runoff from various sources.

Overburden soils identified during the geotechnical investigation by Paterson were generally consistent with the available mapping. Overburden thickness varied from approximately 3 to 10 m across the subject site, with greater depths of overburden materials typically present at the eastern portion of the site. Soils generally consisted of topsoil overlying either silty sand or silty clay, dependent on location across the site. This stratum was generally underlain by a glacial till deposit comprised of a silty clay matrix with sand, gravel, cobbles and boulders. Bedrock was not cored as part of the geotechnical investigation. However, based on available mapping, bedrock in the area is expected to consist of shale from the Carlsbad formation.

Based on hydraulic conductivity estimates obtained from previous studies and published literature, the silty sand unit is considered to have a higher hydraulic conductivity than the silty clay overburden soil, which is generally considered to act as a confining layer. It is our interpretation that the majority of surface water will either flow down-gradient as sheet drainage where silty clay is present, or infiltrate the upper silty sand deposit before being intercepted by the underlying silty clay deposit where it will flow laterally down-gradient as perched water (interflow). Isolated pockets were identified where recharge may be occurring (BH 3 and 4 – areas where silty clay was not identified). However, given the discontinuous nature of the silty sand deposit being connected to the underlying glacial till, the volume of recharge occurring within the site boundaries is expected to be minimal.

With regards to discharge zones, neither the topographical or geological conditions are suitable for discharge to be occurring on a large scale at the subject site. While the Mather Award Drain located at the southeastern corner of the site could theoretically be considered a discharge zone, the volume is anticipated to be minimal given the limited reach length present within the boundaries of the study area (approximately 350 m) and limited recharge potential of the surrounding areas.

The pre-development water budget analysis conducted for the study area determined that an estimated 66,770 m^3/year of surplus water currently infiltrates the surface soils and either recharges local bedrock aquifer systems or travels laterally as interflow at the silty sand/silty clay interface. The remaining estimated 73,137 m^3/year of surplus leaves the site as runoff, draining either towards the Mather Award Drain or McEwan Creek, dependent on location. The post-development water budget analysis determined that an estimated 32,161 m^3/year of surplus water will infiltrate the surface soils and approximately 135,264 m^3/year will leave the site as runoff. These values equate to an approximate decrease in infiltration of 51.8% and an increase in runoff of 85.0%.

No wells were found to exist within the theoretical radius of influence at the subject site. Additionally, the wells located closest to the subject site (approximately 150 m to the southeast) are completed at significant depth within the bedrock aquifer system, well below the anticipated maximum depth of excavation required to install services. As such, the wells are currently not expected to be impacted by construction dewatering activities at the subject site. However, should blasting be required as part of servicing installations in proximity to the southeast corner of the site (nearest the potentially active wells), consideration should be given to conducting a baseline water quality sampling program for the well users located closest to the site. This recommendation can be explored once detailed servicing drawings are available.

A review of the MECP's Brownfield Environmental Site Registry did not identify any environmental concerns in the immediate vicinity of the study area. Based on observations of Paterson staff during field work, no groundwater contamination was identified with respect to the site.

The EIS prepared by Kilgour and Associates indicates that the reach of the Mather Award Drain that transects the site (Reach 1), has important functions in terms of hydrology, riparian vegetation and fish habitat, with contributing functions to terrestrial habitat (Kilgour and Associates, 2019). As such, Reach 1 was recommended for protection in the EIS, with an emphasis on maintaining the existing condition of the channel by avoiding changes in temperature, sediment load and hydroperiod (Kilgour and Associates, 2019). Water levels in the drain are expected to vary naturally to some extent on an annual basis due to many factors such as weather, seasonal patterns and fluctuations in rainfall volumes. However, the anticipated increase in flow contributions to the drain under post-development conditions is expected to be larger in scale when compared to the potential annual fluctuations that occur naturally. Therefore, additional stormwater management systems will be required to mitigate the increase in flow contributions to the drain. In that regard, it is currently understood that a compensation area intended to mimic the function of the existing cattail marsh is expected to be constructed. Additionally, an OGS system is to be installed where the storm sewer system outlets to the drain in order to manage flow velocity and sediment load.

Recommendations

A brief summary of the recommendations of the hydrogeological study is provided as follows:

- Prior to and during site development, it is recommended that construction best management practices with respect to fuels and chemical handling, spill prevention, and erosion and sediment control be followed.

- It is recommended that the oil and grit separator be periodically inspected to ensure operational standards are maintained. It is also recommended that adherence to the City of Ottawa Salt Management Plan - Appendix A (October, 2011) is enforced to ensure that chloride levels in stormwater runoff are as low as possible.

- During development, construction activities such as soil compaction and removal/importation of fill material should not take place within the designated setbacks from the Mather Award Drain.

- Should potential dewatering volumes during construction activities be anticipated to exceed 50,000 L/day, it is recommended that either an EASR or PTTW (dependent on pumping requirements) be obtained prior to construction commencing at the site.

- This report has been completed as per the agreed-upon scope of work for this project. It is recommended that the sufficiency of these conclusions be re-evaluated at the detail design phase and that any data gaps be addressed accordingly.

- No wells were found within the theoretical radius of influence for the site. However, should blasting be required for servicing installation in close proximity to the southeastern border of the property, consideration should be given to conducting a baseline water quality sampling program for the well users located closest to the site. This recommendation can be explored once detailed servicing drawings are available.

- Various LID measures are being considered for the proposed development. Site specific testing is recommended at the detailed design stage to refine the theoretical infiltration rates and identify suitable locations for implementation of measures.

1.0 INTRODUCTION

1.1 Background

Paterson Group (Paterson) was retained by Avenue 31 Capital Incorporated to complete a hydrogeological study, water budget assessment and groundwater impact assessment for the National Capital Business Park. The site is located at 4055 and 4120 Russell Road in the City of Ottawa (hereinafter referred to as the “subject site”). This report incorporates the findings of the previous Geotechnical Investigation Report (PG4854-1 Revision 3 dated March 18, 2020) prepared by Paterson.

1.2 Scope of Work

Paterson has completed this report in accordance with the scope prepared by Paterson. As per the agreed upon scope, the purpose of this study was to:

- Characterize the hydrogeological setting of the subject site. Consideration was given to bedrock and surficial geology, aquifer systems, groundwater levels, hydraulic properties and catchment characteristics.

Additionally, as per the scope, the study was to include the following:

- A groundwater impact assessment outlining potential impacts to nearby structures/environment/existing well users and adjacent Permits to Take Water (PTTWs), Environmental Activity and Sector Registries (EASRs) and Environmental Compliance Approvals (ECAs).
- Pre and post-development water budget analyses to determine the hydrogeological function of the subject site, to identify infiltration potential and to identify opportunities for Low Impact Development (LID) measures.

2.0 PREVIOUS REPORTS

In addition to a review of the general literature summarized in the following sections and in the ‘References’ section of this report (MECP water well mapping, available geological and physiographic mapping), Paterson reviewed the following site-specific reports:

- “Geotechnical Investigation – National Capital Business Park” - prepared by Paterson Group – March 18, 2020.
- “Environmental Impact Statement for 4055 and 4120 Russell Road, Ottawa (draft)”, prepared by Kilgour and Associates Limited, November 20, 2019.
- "Characterization of Ottawa's Watersheds", Prepared for the City of Ottawa, Dated March 2011.

3.0 METHOD OF INVESTIGATION

3.1 Records Review

A review of available physiographic, geological, and hydrogeological data was completed as a part of this assessment. However, the literature review and previous reports did not provide site-specific data regarding overburden and bedrock aquifers, recharge and discharge conditions or flow contributions to the nearby water features. Further detail is provided in the following sections.

3.2 Field Program

A field program was developed to assess geology, groundwater conditions, and hydraulic gradients in the overburden at the subject site. The test holes were advanced to various depths across the site to assess hydrogeological and geotechnical conditions at the approximate depth of the proposed construction activities.

A total of 16 boreholes were advanced to a maximum depth of 10.2 m below ground surface (bgs). The test holes were distributed in a manner to provide general coverage of the proposed development. Each of the test holes were instrumented with either groundwater monitoring wells or flexible standpipe piezometers. The location of the test holes is shown on Drawing PG4854-1 - Test Hole Location Plan, located in Appendix 1.

The field program was conducted from August 28 to September 4, 2019. The boreholes were advanced using a track-mounted drill rig and the drilling occurred under full-time supervision of Paterson personnel.

Soil samples were obtained from the test holes by means of split spoon sampling and the sampling of shallow soils directly from auger flights. Split-spoon samples were taken at approximate 0.76 m intervals. The depth at which split-spoon and auger flight samples were obtained from the test holes are shown as "**SS**" and "**AU**" respectively on the Soil Profile and Test Data sheets, appended to this report.

The Standard Penetration Test (SPT) was conducted in conjunction with the recovery of the split-spoon samples. The SPT results are recorded as "N" values on the Soil Profile and Test Data sheets. The "N" value is the number of blows required to drive the split-spoon sampler 300 mm into the ground after an initial penetration of 150 mm using a 63.5 kg hammer falling from a height of 760 mm. This test was done in accordance with ASTM D1586-11 - Standard Method for Penetration Test and Split-Barrel Sampling of Soils.

All samples were classified on site, placed in sealed plastic bags and were transported to our laboratory for further review and testing. Transportation of the samples was completed in accordance with ASTM D4220-95 (2007) - Standard Practice for Preserving and Transporting Soils.

Subsurface conditions observed in the test holes were recorded in detail in the field. Reference should be made to the Soil Profile and Test Data sheets presented in Appendix 2 for specific details of the soil profiles encountered at the test hole locations.

3.3 Laboratory Testing

All soil samples were retained for laboratory review following the field portion of the subsurface investigation. The soils were classified in general accordance with ASTM D2488-09a, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). Based on the soil descriptions across the subject site during the geotechnical investigation, these samples are considered to be sufficiently representative of the site.

3.4 Groundwater Monitoring Well/Piezometer Installation

Groundwater monitoring wells and flexible polyethylene standpipes were installed in all boreholes to permit the monitoring of groundwater levels subsequent to the completion of the field program.

3.5 Groundwater Level Measurement

Following the 2019 geotechnical field program, groundwater levels were measured at the groundwater monitoring well and piezometer installations using an electronic water level meter. Groundwater levels were measured relative to the ground surface elevation at each location. Groundwater levels at each location are noted on the Soil Profile and Test Data sheets, appended to this report. Groundwater level measurements were completed on September 18 and

27, 2019. Groundwater levels at the subject site were found to range between 1.0 m and 5.5 m bgs.

3.6 Surveying

The test hole locations and ground surface elevations were surveyed by Annis O'Sullivan Vollebekk Ltd. (AOV). The locations and ground surface elevations for each test hole are presented on Drawing PG4854-1 - Test Hole Location Plan, included in Appendix 1.

3.7 Water Budget

The site specific water budget analyses conducted at the subject site employed the method derived by Thornthwaite and Mather (1957). This method utilizes soil water holding capacity along with the mean monthly air temperature and precipitation values to estimate the actual evapotranspiration (AET) at a specific location over the same time period (referred to as the water balance of the site). By subtracting the average annual AET from the average annual precipitation, it was possible to determine the average annual water surplus available for either infiltration or runoff. The water holding capacities used in the water balance calculations at the subject site were obtained from the MOE Stormwater Management Planning and Design Manual (2003). The water balance information was then provided by Environment Canada's Engineering Climate Services division. The water balance information is presented in Appendix 2 of this report.

The average annual water surplus obtained from the water balance calculations were separated into infiltration and runoff using the approach taken from MOEE (1995). This method multiplies the sum of three factors (topography, soil type and land cover) by the annual water surplus to provide an estimated annual infiltration potential. The topography factor was derived from mapping provided by the City of Ottawa and work done by AOV as part of the geotechnical work completed at the subject site. The soil factor was based on the average composition of the overburden materials found at the subject site during the geotechnical field program conducted in August and September of 2019. The vegetation factor was based on the vegetation mapping provided in the Environmental Impact Statement prepared by Kilgour and Associates (2019). Both the water balance and water budget calculations are discussed in greater detail within Section 5.0 of this report.

4.0 REVIEW AND EVALUATION

4.1 Physical Setting

4055 Russell Road is located on the east side of Russell Road, west of Highway 417 in the City of Ottawa, Ontario. 4120 Russell Road is located on the southwest side of Russell Road and north of Hunt Club Road. The location of the subject site is shown on Drawing PH4055-1 - Site Plan appended to this report.

The study area currently consists of a mixture of meadows (agricultural fields), thicket, deciduous forest and marshland. The property is surrounded to the north and west by commercial developments and an electrical substation, to the east by Hunt Club Road/Highway 417 and undeveloped land, and to the south by an existing stormwater management pond, Hunt Club Road and wooded areas.

The subject site is situated within the Green Creek watershed. Within that, the site is subdivided between a number of subwatersheds. The northern portion of the site is situated in the Green Creek Mid subwatershed, the central portion of the site is situated in the Mather Award Drain subwatershed, and the southern portion of the site is situated in the McEwan Creek subwatershed.

Site topography is generally flat, with elevations ranging from approximately 68 to 72 m above sea level (asl). The exception to this is in the southwest portion of the study area, where the elevation rises to approximately 79 m asl over a ridge that transects the site from northwest to southeast.

The Mather Award Drain is the only significant water feature identified within the boundaries of the study area. It transects the southern portion of 4055 Russell Road in a northwest to southeast direction, where it eventually intercepts Ramsay Creek approximately 700 m east of the site. There is also a cattail marsh located in the northwest corner of the site. It is isolated, and not fed by any headwater drainage features, but likely provides stormwater attenuation of surface runoff from various sources in the surrounding area.

According to available mapping, the subject site is located in the Ottawa valley Clay Plains physiographic region (Chapman and Putnam, 1984). The region is characterized by relatively flat clay plains interrupted by rock ridges, which is generally consistent with field observations at the subject site.

4.2 Geology

Surficial Geology

Overburden mapping provided by the Ontario Geological Survey online mapping tool was reviewed as a part of this assessment. Available mapping indicates that overburden soils throughout the majority of the subject site consist primarily of fine textured glacio-marine deposits (silt and clay, with minor sand and gravel) associated with the Champlain Sea, with older alluvial deposits (clay, silt, sand and gravel) found in the northwest corner of the property. Overburden soils mapping is shown on Drawing PH4055-3 - Surficial Geology Mapping.

Overburden soils identified during the geotechnical investigation by Paterson were generally consistent with the available mapping. Overburden thickness varied from approximately 3 to 10 m across the subject site, with greater depths of overburden materials typically present at the eastern portion of the site. Soils generally consisted of topsoil overlying either silty sand or silty clay, dependent on location across the site. This was generally underlain by a glacial till deposit comprised of a silty clay matrix with sand, gravel, cobbles and boulders.

Specific details are provided on the Soil Profile and Test Data Sheets attached within Appendix 1 of this report.

Bedrock Geology

Bedrock coring was not completed as part of the geotechnical investigation for the proposed development. However, bedrock mapping, provided by Natural Resources Canada Urban Geology of the National Capital Region mapping, was reviewed as a part of this assessment. Available mapping indicates that bedrock at the subject site consists of Shale from the Carlsbad formation. Bedrock geology mapping is shown on Drawing PH4055-4 - Bedrock Geology Mapping.

Karst Features

The term 'karst' refers to a geologic formation characterized by the dissolution of carbonate bedrock, such as limestone or dolostone. Based on the bedrock characteristics of the site noted above in Subsection 4.2, the bedrock formations present within the study area are not expected to have any potential for karistification to occur. Additionally, the depth of surficial soils typically overlying the bedrock in the area that are non-conducive to groundwater infiltration would not be anticipated to allow for large scale karstification to occur, even if karst susceptible bedrock units were present at the site.

4.3 Hydrogeological Setting

Existing Aquifer Systems

Aquifer systems may be defined as geological media, either overburden soils or fractured bedrock, which permit the movement of groundwater under hydraulic gradients. In general, aquifer systems may be present in overburden soils or bedrock. Although groundwater has been observed within overburden soils at the subject site, the typical overburden materials found at the site do not allow for the development of significant water supply wells. Water supply wells in the vicinity are instead likely found in bedrock aquifers.

Bedrock aquifer mapping, provided by Natural Resources Canada Urban Geology of the National Capital Region mapping, was reviewed as a part of this assessment. Using this tool, one water supply aquifer system has been identified in the vicinity of the study area - the Carlsbad formation aquifer system.

The Carlsbad formation aquifer system is located throughout the site and extends out further beyond the boundary of the study area. Based on a review of water well records in the area, it is expected that the aquifer system is present at depths ranging from approximately 30 to 50 m bgs.

Groundwater Levels

Groundwater was observed both in the piezometers and the groundwater monitoring wells installed at the borehole locations. Based on a review of water well records, groundwater is also present in the bedrock at greater depths.

Groundwater levels in the overburden were observed to range from approximately 1.0 to 5.5 m bgs at the time of the geotechnical investigation. Based on the colour and consistency of the recovered soil samples, the long-term groundwater level within the overburden is expected to be between 1.5 and 3 m bgs across the majority of the site, with the exception of the southwest corner, where the long-term groundwater level is expected to range from approximately 4.5 to 5.5 m bgs.

Horizontal Hydraulic Gradients

Due to the nature of the water levels obtained from field work conducted at the subject site (groundwater monitoring wells and piezometers), the absolute direction of horizontal hydraulic gradients in the vicinity of the subject site was not determined. However, using the available data, it was possible to approximate the horizontal hydraulic gradients in the overburden material given that the horizontal hydraulic gradient between any 2 points is the slope of the hydraulic head between those points:

$$i=h_2-h_1/L$$

Where: i = horizontal gradient
h = water level (m bgs)
L = horizontal distance between test hole locations

Using the above noted formula, the horizontal hydraulic gradient was observed within 4055 Russell Road property with an approximate north/northwest-to-south/southeast orientation and a magnitude ranging from 0.006 to 0.01. The horizontal hydraulic gradient within the 4120 Russell Road property was observed with an approximate west/southwest-to-east/northeast orientation and a magnitude of approximately 0.02. Groundwater flow in the vicinity of the subject site is generally expected to reflect local topography.

Vertical Hydraulic Gradients

Vertical hydraulic gradients were not measured within the study area as the previous studies completed at the site did not warrant the installation of monitoring well nests. If the vertical hydraulic gradient were to be measured, it is inferred that the direction would be slightly downward in areas with higher elevation and sandy materials, as is typical where recharge is occurring. Lower lying areas in downgradient zones (clay and sand deposits within southeastern portion of the site) may exhibit upward vertical hydraulic gradients and provide discharge to the Mather Award Drain.

Hydraulic Conductivity

The hydraulic conductivity values were conservatively estimated based upon previous experience at similar sites in the area and typical published values for similar stratigraphy obtained from Freeze and Cherry (1979). The values are interpreted to be in the order of:

- 1×10^{-7} to 1×10^{-9} m/sec for stiff brown silty clay
- 1×10^{-9} to 1×10^{-12} m/sec for grey silty clay
- 1×10^{-5} to 1×10^{-10} m/sec for glacial till
- 1.0×10^{-4} to 1×10^{-7} m/sec for silty sand

The hydraulic conductivity range given above for glacial till is wide in order to account for fluctuations in the majority composition of the matrix and accessory materials at a given location.

Groundwater Recharge and Discharge

In general, groundwater will follow the path of least resistance from areas of higher hydraulic head to areas of lower hydraulic head. While upward and downward hydraulic gradients may be indicative of areas of discharge and recharge respectively, other factors must be considered.

Based on hydraulic conductivity estimates obtained from previous studies and published literature, the silty sand unit is considered to have a higher hydraulic conductivity than the silty clay overburden soil, which is generally considered to act as a confining layer. It is our interpretation that the majority of surface water will either flow down-gradient as sheet drainage where silty clay is present, or infiltrate the upper silty sand deposit before being intercepted by the underlying silty clay deposit where it will flow laterally down-gradient as perched water (interflow). Isolated pockets were identified where recharge may be occurring (BH 3 and 4 – areas where silty clay was not identified). However, given the intermittent nature of the silty sand deposit being connected to the underlying glacial till, the volume of recharge occurring within the site boundaries is expected to be minimal.

With regards to discharge zones, neither the topographical or geological conditions are suitable for discharge to be occurring on a large scale at the subject site. While the Mather Award Drain located at the southeastern corner of the site could theoretically be considered a discharge zone, the volume is anticipated to be minimal given the limited reach length present within the boundaries of the study area (approximately 350 m) and limited recharge potential of the surrounding areas.

Catchment Areas

The study area is comprised of two main catchment areas, one retained within 4055 Russell Road and one within 4120 Russell Road. The overburden soils within 4055 Russell Road consist primarily of topsoil overlying a thin layer of silty sand, which is typically underlain by a deposit of silty clay (or glacial till, dependent on location). Within the study area, drainage in this catchment is expected to consist primarily of perched flow (interflow), with water infiltrating the thin layer of silty sand before flowing down-gradient towards the Mather Award Drain. Isolated areas in the central portion of the catchment also provide potential for minor volumes of recharge. The property boundaries of 4055 Russell Road shown on Drawing PH4055-1 – Site Plan can be interpreted as the boundaries of the catchment within the study area.

The overburden soils within 4120 Russell Road consist primarily of topsoil overlying silty clay, with a small portion of this property containing a layer of heterogeneous fill overlying the silty clay deposit. Within the study area, drainage in this catchment is expected to consist primarily of sheet drainage, with water flowing down-gradient towards McEwan Creek. A portion of the sheet drainage may be intercepted by the existing stormwater management pond (SWMP) located south of the proposed development. The property boundaries of 4120 Russell Road shown on Drawing PH4055-1 – Site Plan can be interpreted as the boundaries of the catchment within the study area.

Based on existing site plans, the majority of both catchments are expected to be covered by either landscaped areas (lawns, parks) or impervious surfaces (roadways, parking lots, rooftops) under post-development conditions. Additionally, the flows captured by the impervious surfaces within the catchment area that drains towards McEwan Creek (4120 Russell Road) will be diverted via municipal servicing to an oil and grit separator (OGS) system that outlets to the Mather Award Drain.

Mather Award Drain Characteristics

The Mather Award Drain is a headwater drainage feature of Ramsay Creek. It transects the southern portion of 4055 Russell Road in a northwest to southeast direction, where it eventually intercepts Ramsay Creek approximately 700 m east of the site. Within the boundaries of the study area, the drain has an approximate span of 350 m, with a mean depth of approximately 0.22 m.

In reference to the EIS completed by Kilgour and Associates, the substrate consists primarily of cobbles with larger rocks dispersed throughout, underlain by finer gravel and coarse sand. The channel is well defined with evidence of sedimentation and sorted substrate. It has minimal submerged aquatic vegetation; the channel is predominantly open flowing water (Kilgour and Associates, 2019). Based on the lack of aquatic vegetation present, and the typical grain size of the substrate in comparison to the soils of the surrounding area, it is expected that the flow in the drain is moderate in energy and constant.

5.0 SITE SPECIFIC WATER BUDGET ASSESSMENT

The site specific water budget assessment (SSWB) was conducted to determine the hydrogeological function of the subject site, to identify infiltration potential and to identify opportunities for Low Impact Development (LID) measures. The study area currently consists of a mixture of meadows (agricultural fields), thicket, deciduous forest and marshland. Post-development, approximately 22.9 hectares will become hard surfaces (rooftops, roadways, parking lots) and can be considered impervious. The remaining portions of the study area are considered to remain pervious and able to accept infiltration (although infiltration rates may change depending on surface alterations such as landscaped areas and parks as opposed to the currently existing agricultural fields). Both pre and post-development terrain compositions are illustrated on Drawings PH4055-6 - Pre-Development Terrain Composition and PH4055-7 - Post-Development Terrain Composition, both appended to this report.

5.1 Calculations

Thornthwaite and Mather Water Balance Calculations

When falling precipitation intercepts the ground, three possible outcomes arise. The water can either evaporate back into the atmosphere (evapotranspiration), infiltrate into the surface soils (infiltration) or leave the area as runoff.

As mentioned earlier in this report, the method employed by Thornthwaite and Mather (1957) was used along with modelling software to determine the partitioning of water throughout various portions of the hydrologic cycle. Inputs into the modelling program included monthly temperature, precipitation, water holding capacities and site latitude. Using the long-term averages of these variables, it was possible to calculate annual potential and actual evapotranspiration, change in soil moisture storage and the water surplus.

The formula employed by Thornthwaite and Mather is as follows:

$$S = R + I = P - ET$$

Where: S = surplus (mm/year)
R = annual runoff (mm/year)
I = annual infiltration (mm/year)
P = annual precipitation (mm/year)
ET = annual evapotranspiration (mm/year).

Soils within the study area generally consisted of topsoil overlying either silty sand or silty clay, dependent on location across the site. Therefore, the above noted calculations were carried out for the soil moisture holding capacities of each material found on site.

Based on the location of the site within the Ottawa area, climatic data was obtained from the climate station located at the McDonald-Cartier International Airport and the Township of Appleton covering the period of January 1939 to December 2019. The information was provided by Environment Canada's Engineering Climate Services Unit and is presented in Appendix 2 of the report.

Table 1, below, displays the soil types present within the study area and their associated water holding capacities (WHC) as well as the actual evapotranspiration (AET) and surplus data. For the purposes of this study, AET values were used as they account for accumulated soil moisture deficit. This deficit represents the volume of water retained within the available pore spaces of the soil and is subtracted from the potential evapotranspiration (PET) value to more accurately calculate the water surplus. The monthly/annual water balance and water budget data is presented in Appendix 2 of the report.

As noted below, the table was produced using WHC values from the document MOE (2003) - Stormwater Management Planning and Design Manual. The WHC value of 5 mm was chosen for anthropogenic surfaces given the fact that the majority of surfaces existing under post-development conditions (roadways, rooftops) will have some measure of water retention potential (no surface is 100% impermeable and will degrade over time).

Table 1: Site Specific Water Surplus Information			
Soil Type	**Water Holding Capacity (mm)**	**Actual Evapotranspiration (mm/year)**	**Surplus Water (mm/year)**
Anthropogenic Sources (buildings and roadways)	5	454	449
Fine Sand (moderately rooted crops)	75	523	379
Clay Loam (urban lawns)	100	559	333
Fine Sand (pasture and shrubs)	100	559	333
Fine Sandy Loam (pasture and shrubs)	150	572	330
Clay (moderately rooted crops)	150	572	330
Clay (pasture and shrubs)	200	588	312

Table reproduced using WHC values from MOE (2003) - Stormwater Management Planning and Design Manual and modelling data from Environment Canada.

Infiltration Factors

In order to break down the surplus water values for the various materials into infiltration and runoff, various factors must be considered. The MOEE Technical Guidelines for the Preparation of Hydrogeological Studies for Land Development Applications (1995) lists three main factors that contribute to surface water infiltration rates.

The first factor is topography, which is broken down further into three sections: flat and average slope, rolling land and hilly land. Flat and average slope provides the greatest potential for infiltration and has the largest factor applied to it (0.3), while the other two have progressively lower factors (rolling land is 0.2 and hilly land is 0.1).

The second factor is soil, which is also broken down further into three sections: tight impervious clay, medium combinations of clay and loam and open sandy loam. Open sandy loam provides the greatest potential for infiltration (factor of 0.4) while the other two have progressively lower potential for infiltration to occur (factors for medium combinations of clay and loam is 0.2 and tight impervious clay is 0.1).

The final factor the MOEE manual uses to partition infiltration from runoff is land cover. It is broken down into two sections: open fields/cultivated lands and woodlands. Woodlands have greater infiltration potential and a factor of 0.2. Open fields and cultivated lands have lower potential and with a factor of 0.1. A summary of the MOEE manual's descriptors and their associated infiltration factors is shown below in Table 2.

Table 2: MOEE (1995) Infiltration Factors

Description of Area/Development Site	Value of Infiltration Factor
Topography	
Flat and average slope (<0.6 m/km)	0.30
Rolling land (slope of 2.8-3.8 m/km)	0.20
Hilly land (slope of 28-47 m/km)	0.10
Soil	
Tight impervious clay	0.10
Medium combinations of clay and loam	0.20
Open sandy loam	0.40
Cover	
Open fields/cultivated lands	0.10
Woodlands	0.20

Table reproduced from MOEE (1995) - Technical Guidelines for the Preparation of Hydrogeological Studies for Land Development Applications.

The topography of the study area within 4055 Russell Road consists primarily of rolling land, with the maximum slope approaching 9 m/km at the steepest areas (the south side of the property has less slope). Therefore, a pre-development topography factor of 0.2 was given for the materials analysed on this property. The topography of the study area within 4120 Russell Road consists primarily of hilly land, with a steeper gradient than that found at 4055 Russell Road (approximately 46 m/km at the steepest slope). Therefore, a pre-development topography factor of 0.1 was given for the materials analysed on this property. In order for development to proceed, it is expected that alterations will be made to the topography of the site. In general, it is expected that the overall slope of the site will be reduced to accommodate buildings and parking areas. Therefore, the post-development topography factor for select materials (clay loam) was elevated to 0.2.

As previously discussed, soils within the study area generally consisted of topsoil overlying either silty sand or silty clay, dependent on location across the site. Therefore, the pre-development soils factors ranged from 0.1 for silty clay to 0.3 for the silty sand. Under post-development conditions, the majority of the site will consist of either landscaped areas or impervious surfaces, with soil factors ranging from 0.2 for clay loam to 0 for anthropogenic sources.

The majority of the proposed development was historically cleared for agricultural purposes, with only isolated areas retaining some tree cover. The pre-development vegetation factors of 0.10 was therefore used for all materials. Post-development, it is expected the majority of the trees remaining on site will be removed to accommodate buildings, parking areas and roadways. As such, post-development vegetation factors remained at 0.1, with the exception of anthropogenic sources, which was given a factor of 0 due to its negligible potential to benefit from vegetation cover.

The pre and post-development infiltration factors for all materials considered are included in the water budget calculations provided in Table C6 and C7 included in Appendix 2 of this report.

5.2 Pre and Post-Development Water Budget

The pre-development water budget analysis conducted for the study area determined that an estimated 66,770 m^3/year of surplus water currently infiltrates the surface soils and either recharges local bedrock aquifer systems or travels laterally as interflow at the silty sand/silty clay interface. The remaining estimated

73,137 m^3/year of surplus leaves the site as runoff, draining either towards the Mather Award Drain or McEwan Creek, dependent on location.

The post-development water budget analysis determined that an estimated 32,161 m^3/year of surplus water will infiltrate the surface soils and approximately 135,264 m^3/year will leave the site as runoff. These values equate to an approximate decrease in infiltration of 51.8% and an increase in runoff of 85.0%.

The main variable that changed from the pre-development conditions to the post-development conditions was the addition of over 22.9 hectares of anthropogenic sources and the conversion of the majority of the remaining surface area to urban lawn (landscaped surfaces). The result is the replacement of all silty sand within the study area by clay loam, which has lower hydraulic properties and less infiltration potential. The extent of landscaped areas was unknown at the time of report preparation. Therefore, as a conservative approach, it was assumed that all land involved in the development would be converted to either impervious surface or soft landscaping.

It is important to note that the post-development water budget analysis for the subject site does not consider any potential infiltration of the anthropogenic sources (100% runoff was taken as a conservative approach). In reality, some portion (15 to 30%) of surface water that lands on impervious surfaces either evaporates, infiltrates (asphalt is not 100% impervious) or is diverted to grassed areas where additional infiltration may occur. As such, the post-development runoff volumes should be considered a conservative estimate, and not expected to definitively represent future conditions.

Details of both the pre and post-development water budget analyses are presented in Tables C6 and C7 included in Appendix 2 of this report.

6.0 GROUNDWATER IMPACT ASSESSMENT

6.1 Impact of Proposed Development on Surrounding Infrastructure

As previously discussed, soils within the study area generally consisted of topsoil overlying either silty sand or silty clay, dependent on location across the site. There are several buildings within the projected steady state radius of influence calculated in the following section of this report, located adjacent to the north and west sides of the development. However, dewatering activities are expected to be short term in duration and will generally require only low levels of pumping due to the nature of the materials on site. Any large quantities of water removed from the site will be in relation to precipitation events or if areas of perched groundwater are encountered above the silty clay deposit. As such, the impacts of the proposed development on the surrounding infrastructure are expected to be negligible.

6.2 Impact of Proposed Development on Existing Well Users

A search of the Ontario Water Well Records database indicated that there are a large number of wells within a 500 m radius of the proposed development. Upon investigation, it was determined that the majority of wells in the area are either no longer in use or are monitoring well installations. There is a cluster of wells located approximately 150 m southeast of the site near the intersection of Russell Road and Blake Road. However, available mapping indicates that several of these homes are connected privately to municipal services. It should be noted that the homes located further east down Blake Road do not appear to be connected to those services and may remain on well water supply.

The steady-state radius of influence calculations completed were based upon the Sichardt equation as shown below. The assumed setting for the analytical solution was one in which open cut trenches were used to install the services at the subject site, creating an unconfined condition which would allow use of the equation to determine the radius of influence.

$$R = r_e + 3000 * \Delta h(K^{0.5})$$

Where: R = radius of influence (m)
r_e = equivalent radius of influence (m)
Δh = expected groundwater drawdown (m)
K = hydraulic conductivity (m/sec).

For the purposes of completing the calculations, the following values were used in the analysis:

- r_e = 7.96 m, based on the typical dimensions of the servicing excavations at the subject site.
- Δh = 3 to 5 m, to account for variable minimum/maximum drawdown conditions.
- K = 1 x 10^{-4} to 1 x 10^{-9} m/sec, to account for variability in the material encountered, and based upon previous experience with similar materials as well as published values.

Using the above equation and assumptions, a radius of influence ranging from approximately 1 to 150 m will develop as a steady state condition in the area of the servicing excavations. The larger radius of influence is only expected during servicing excavations on the property at 4055 Russell Road, where deposits of silty sand were encountered. The radius of influence that develops during excavations on the property at 4120 Russell Road are expected to be significantly smaller (<50 m), based on the prevalence of silty clay soils in the area.

There are several commercial and industrial developments located within the vicinity of the subject site. However, as these developments are serviced by municipal supplies, and there are no active domestic wells located within the theoretical radius of influence for the site, it is not expected that the proposed development will negatively affect the water quantity and/or quality of nearby well users.

6.3 Impact of Proposed Development on the Environment

A review of the MECP's Brownfield Environmental Site Registry identified one Record of Site Condition (RSC) located within 500 m of the study area. The registration number for the RSC is 206387, and it was registered at 3985 Belgreen Drive, approximately 400 m northwest of the property at 4120 Russell Road. The filing indicated that no ongoing groundwater monitoring controls were required. Based on observations of Paterson staff during field work for a Phase II Environmental Site Assessment (ESA), no potential groundwater contamination concerns were identified on site. The only potential source of concern would be if the fill material located at the western end of the property at 4120 Russell Road were to be removed. While the fill met applicable site standards, it failed background (Table 1) standards for molybdenum and PHC (F4), and therefore would need to be disposed of if removed from site. It was also noted in the Phase II ESA that additional isolated pockets of contamination may exist but were not identified at the time of investigation due to the size of the property. It was concluded that future environmental investigations could be completed on a smaller scale for specific areas of the development.

Considerations relevant to the water budget analyses are discussed below. Additional details of the potential environmental impacts with regards to terrestrial habitat, wildlife and species at risk are provided in the EIS completed by Kilgour and Associates (2019) for the subject site.

Pre and post-development water budget analyses were completed at the subject site to determine the hydrogeological function of the subject site, to identify infiltration potential and to identify opportunities for LID measures. With regards to hydrogeological function, the results of the analyses indicated that the flow contributions to the Mather Award Drain would increase under post-development conditions. It is therefore expected that water levels in the drain will, at a minimum, remain the same, but could also have the potential to increase under post-development conditions. While significant increases in water levels within the drain have the potential to be detrimental to its health, it is important to note that the increase in runoff volumes at the subject site is expected to be minimized by the inclusion of LID measures and a compensation area to replace the existing cattail marsh, with subsequently minimal increases in water levels expected as a result.

The EIS prepared by Kilgour and Associates indicates that the reach of the Mather Award Drain that transects the site (Reach 1), has important functions in terms of hydrology, riparian vegetation and fish habitat, with contributing functions to terrestrial habitat (Kilgour and Associates, 2019). As such, Reach 1 was recommended for protection in the EIS, with an emphasis on maintaining the existing condition of the channel by avoiding changes in temperature, sediment load and hydroperiod (Kilgour and Associates, 2019). Water levels in the drain are expected to vary naturally to some extent on an annual basis due to many factors such as weather, seasonal patterns and fluctuations in rainfall volumes. However, the anticipated increase in flow contributions to the drain under post-development conditions is expected to be larger in scale when compared to the potential annual fluctuations that occur naturally. Therefore, additional stormwater management systems will be required to mitigate the increase in flow contributions to the drain. In that regard, it is currently understood that a compensation area intended to mimic the function of the existing cattail marsh is expected to be constructed. Additionally, an OGS system is to be installed where the storm sewer system outlets to the drain in order to manage flow velocity and sediment load.

In terms of biological activity within the study area, while several common species of fish habitat are likely to exist within the Mather Award Drain, the only species at risk (SAR) identified in the EIS was the Barn Swallow. The EIS notes that additional investigation is required to determine the existence of nests located within 200 m of the site. Dependent on the results of the investigation, the site may need to be registered with the MECP indicating their presence, and mitigation measures will be required. There is also a small possibility that Bobolinks and SAR bats may be present on site at specific times of the year. The EIS provides further guidance on procedures if these species are in fact encountered. As none of the potential SAR found at the subject are aquatic, the post-development hydrological conditions are not expected to have any impact on biological activity within the study area, provided the appropriate stormwater management strategy is implemented to limit changes in temperature, sediment load or hydroperiod to the Mather Award Drain, as noted above.

Notwithstanding the results of the water budget analyses, several potential impacts remain to the ecological systems as a result of the development, which are discussed in detail within the EIS completed by Kilgour and Associates (2019).

6.4 Adjacent PTTW/EASR/ECA's

A search of the MECP Permit to Take Water database provided no active permits within a 1 km radius of the subject site. With regards to the Environmental Activity and Sector Registry (EASR), no active registries were found for water taking within a 1 km radius of the subject site on the MECP EASR database.

With respect to Environmental Compliance Approvals (ECA's), given the nature of the development in the area (commercial and industrial), there are a large number of ECA’s that exist for the various purposes in the areas bordering the site. Upon review of the ECA’s, only one was found to be in relation to existing stormwater management systems in the area. As this is type of ECA that discusses the actual discharge rates to local water bodies, this is the one that will be included in this study.

The ECA is applied for in relation to the construction of the stormwater management facility located directly south of the property at 4120 Russell Road. The ECA number is 3609-98RPYA and dictates that a combined controlled water quality storm release rate of 89.39 L/sec during a 100-year return storm will be maintained. This discharge leads from the stormwater management pond located south of the development through two outlet structures to a culvert running under Hunt Club Road that drains into McEwan Creek.

7.0 ASSESSMENT AND RECOMMENDATIONS

Existing Wells

No wells were found to exist within the theoretical radius of influence at the subject site. Additionally, the wells located closest to the subject site (approximately 150 m to the southeast) are completed at significant depth within the bedrock aquifer system, well below the anticipated maximum depth of excavation required to install services. As such, the wells are currently not expected to be impacted by construction dewatering activities at the subject site. However, should blasting be required as part of servicing installations in proximity to the southeast corner of the site (nearest the potentially active wells), consideration should be given to conducting a baseline water quality sampling program for the well users located closest to the site. This requirement can be explored once detailed servicing drawings are available.

Sources of Contamination

No concerns were identified with respect to sources of contamination at the time of completion of this study. As previously noted, it is expected that additional environmental work will be carried out at a later date on a smaller scale for specific areas of the proposed development, should it be required.

Prior to and during site development, it is recommended that construction best management practices with respect to fuels and chemical handling, spill prevention, and erosion and sediment control be followed. This will minimize the potential for the introduction of contaminants to the soil, surface water, or groundwater at the subject site. It is also recommended that during development, construction activities such as soil compaction and removal/importation of fill material not take place within the designated setbacks from the Mather Award Drain.

With respect to stormwater runoff quality, it is recommended that the oil and grit separator be periodically inspected to ensure operational standards are maintained. It is also recommended that adherence to the City of Ottawa Salt Management Plan - Appendix A (October, 2011) included in Appendix 3 is enforced to ensure that chloride levels in stormwater runoff are as low as possible.

Services

It is our understanding that the subject site is to be developed with municipal sewer and water services. General recommendations regarding site servicing are provided under separate cover in our geotechnical investigation report. Specific hydrogeological and geotechnical recommendations will be provided during the detail design phase. Although specific details regarding site servicing are not currently available, it is our expectation that site servicing depths will not exceed 6 m bgs. The vegetated setback from the drain and limited potential diameter of the outlet are anticipated to limit the velocity of water entering the drain and avoid sedimentation and erosional issues. It is recommended that the outlet elevation and capacity be maintained in order to reduce the risk of detrimental effects to the drain.

Permit To Take Water

For any water taking of greater than 50,000 L/day, either an Environmental Activity and Sector Registration (EASR) or a Permit To Take Water (PTTW) is required from the MECP, dependent on dewatering requirements. At the subject site, an EASR or PTTW may be required for construction dewatering or works below the water table. The requirement for either will be determined during the detail design phase. The information contained in this report may be used as supporting documentation for an EASR or PTTW application for the subject site. Depending on the nature of the proposed water taking, an additional hydrogeological investigation may be required.

Infiltration Potential and Low Impact Development (LID) Considerations

As previously discussed, soils within the study area generally consisted of topsoil overlying either silty sand or silty clay, dependent on location across the site. With regards to infiltration rates for the soils found on site, these are expected to range from <5 to 10 mm/hr for brown silty clay and 20 to 50 mm/hr for silty sand. These values are theoretical and are based on both published literature as well as experience at sites with similar soils in the Ottawa area. Site specific testing at the detailed design stage is recommended to refine these infiltration rates and determine suitable locations for the proposed measures discussed below.

As noted above, the results of the water budget analyses completed at the subject site indicated that there would be an approximate decrease in infiltration of 51.8% and an increase in runoff of 85.0% under post-development conditions. While a conservative approach was taken to obtain these values (a certain percentage of precipitation intercepted by anthropogenic sources is expected to be infiltrated), it will likely be necessary to incorporate various stormwater management measures into the design of the development.

It is currently understood that a compensation area is being considered to replace the loss of the cattail marsh located at the northwestern portion of the property at 4120 Russell Road. It is also understood that an OGS system is being used to discharge servicing flows from the development at 4120 Russell Road to the Mather Award Drain. The system will limit flow rates to the drain, which will also help control water temperature, and will remove sediment, preventing additional load from being added to the drain.

Based on the type of development being considered (commercial business park), a suitable LID measure to complement the items noted above would be to create a series depressions (bioswales) within the landscaped areas surrounding the proposed buildings. These depressions would provide stormwater attenuation and aid in reducing post-development peak runoff flows towards the Mather Award Drain, which is expected to require protection, as per the EIS completed by Kilgour and Associates (2019). Locations for these bioswales can be chosen based on the results of the above noted site specific testing recommended to be completed during detailed design.

8.0 CLOSURE

The client should be aware that any information pertaining to soils and all test hole logs are furnished as a matter of general information only, and test hole descriptions or logs are not to be interpreted as descriptive of conditions at locations other than those of the test holes.

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 Avenue 31 Capital Incorporated, or their agent(s) is not authorized without review by Paterson Group for the applicability of our recommendations to the altered use of the report.

Paterson Group Inc.

Michael Laflamme, P.Geo.

Michael S. Killam, P.Eng.

Report Distribution:

- Avenue 31 Capital Incorporated
- Paterson Group Inc.
- Rideau Valley Conservation Authority

9.0 REFERENCES

Chapman, L.J., and Putnam, D. F. “The Physiography of Southern Ontario, Third Edition”. Ontario Ministry of Natural Resources, 1984.

Freeze, R.A., and Cherry, J.A. “Groundwater”. Prentice-Hall, Inc., 1979.

Natural Resources Canada. “Urban Geology of the National Capital Region”, mapping released 1994.

Ontario Ministry of Northern Development and Mines “Geology of Ontario, Ontario Geological Survey Special Volume 4”, Queen's Printer for Ontario, 1992.

Ontario Ministry of the Environment. “Technical Terms of Reference for Groundwater Studies” (excerpts), Queen’s Printer for Ontario, 2001.

Ontario Ministry of Environment and Energy. "MOEE Hydrogeological Technical Information Requirements for Land Development Applications", Queen's Printer for Ontario, April, 1995.

Ontario Ministry of the Environment. "Stormwater Management Planning and Design Manual", Queen's Printer for Ontario, March, 2003.

Paterson Group Incorporated. “Geotechnical Investigation – National Capital Business Park”, March 18, 2020.

Kilgour and Associates Limited. “Environmental Impact Statement for 4055 and 4120 Russell Road, Ottawa (draft)”, November 20, 2019.

City of Ottawa - Public Works and Services Department - Surface Operations Branch. "Material Applications Policy, Revision 3.2 - Salt Management Plan - Appendix A", October 31, 2011.

FIGURES

Drawing PH4055-1 - Site Plan
Drawing PH4055-2 - MECP Water Well Plan
Drawing PH4055-3 - Surficial Geology Mapping
Drawing PH4055-4 - Bedrock Geology Mapping
Drawing PH4055-5 - Bedrock Aquifer Mapping
Drawing PH4055-6 - Pre-Development Terrain Composition
Drawing PH4055-7 - Post-Development Terrain Composition

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NO.	REVISIONS	DATE	INITIAL
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AVENUE 31 CAPITAL INC.

WATER BUDGET ASSESSMENT
4055 AND 4120 RUSSELL ROAD

OTTAWA, ONTARIO

Title:

SITE PLAN

Scale: 1:10000	Date: 07/2020
Drawn by: RCG	Report No.: PH4055-1
Checked by: NZ	Dwg. No.: PH4055-1
Approved by: MK	Revision No.:

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AVENUE 31 CAPITAL INC.

WATER BUDGET ASSESSMENT
4055 AND 4120 RUSSELL ROAD

OTTAWA, ONTARIO

Title: **MECP WATER WELL LOCATION PLAN**

Scale: 1:10000	Date: 07/2020
Drawn by: RCG	Report No.: PH4055-1
Checked by: NZ	Dwg. No.: PH4055-2
Approved by: MK	Revision No.:

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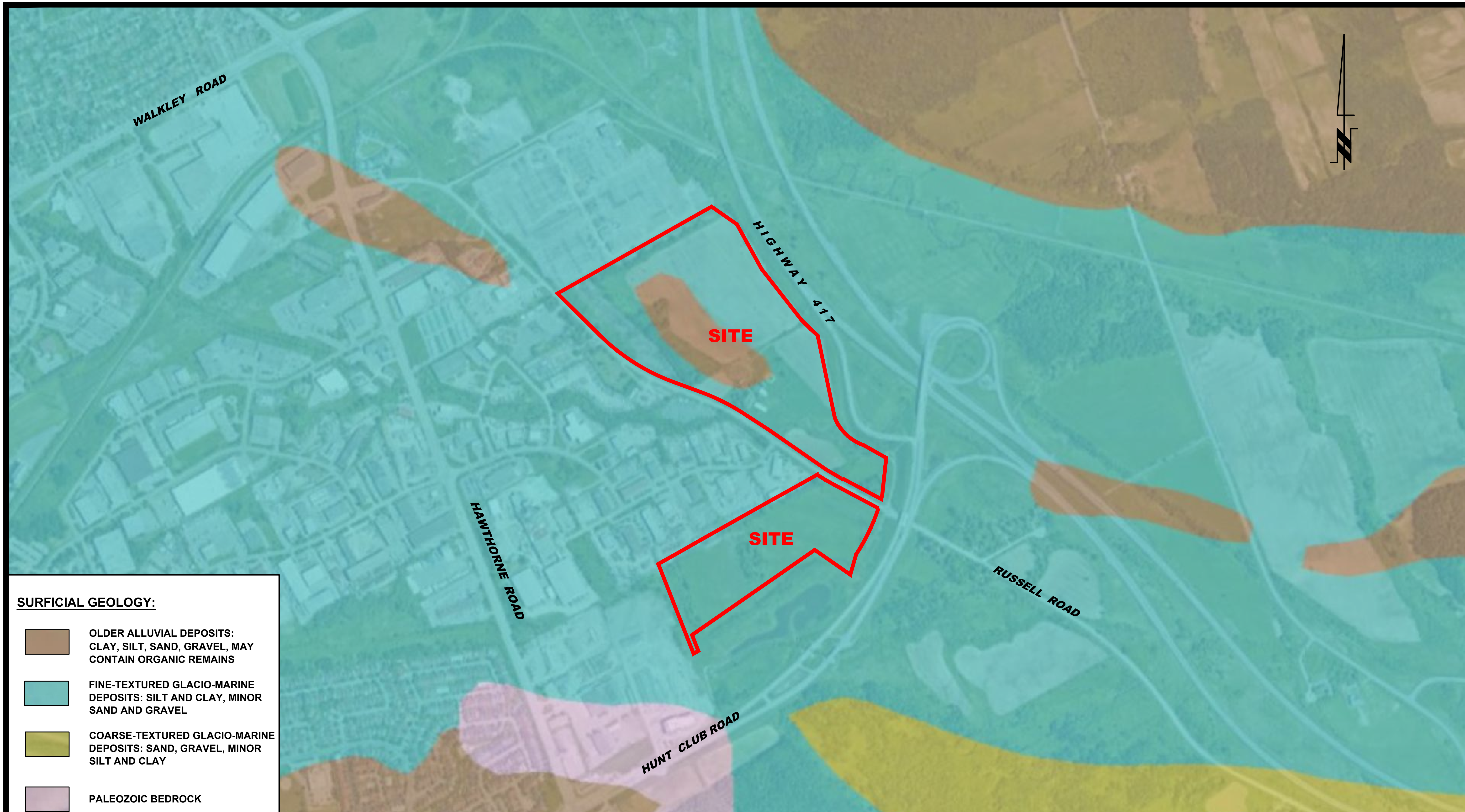

SURFICIAL GEOLOGY:

- OLDER ALLUVIAL DEPOSITS: CLAY, SILT, SAND, GRAVEL, MAY CONTAIN ORGANIC REMAINS
- FINE-TEXTURED GLACIO-MARINE DEPOSITS: SILT AND CLAY, MINOR SAND AND GRAVEL
- COARSE-TEXTURED GLACIO-MARINE DEPOSITS: SAND, GRAVEL, MINOR SILT AND CLAY
- PALEOZOIC BEDROCK

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AVENUE 31 CAPITAL INC.

WATER BUDGET ASSESSMENT
4055 AND 4120 RUSSELL ROAD

OTTAWA, ONTARIO

Title: **SURFICIAL GEOLOGY MAP**

Scale: 1:10000	Date: 07/2020
Drawn by: MPG	Report No.: PH4055-1
Checked by: NZ	Dwg. No.: PH4055-3
Approved by: MK	Revision No.:

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AVENUE 31 CAPITAL INC.

WATER BUDGET ASSESSMENT
4055 AND 4120 RUSSELL ROAD

OTTAWA, ONTARIO

Title:

BEDROCK GEOLOGY

Scale: 1:10000	Date: 07/2020
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Checked by: NZ	Dwg. No.: PH4055-4
Approved by: MK	Revision No.:

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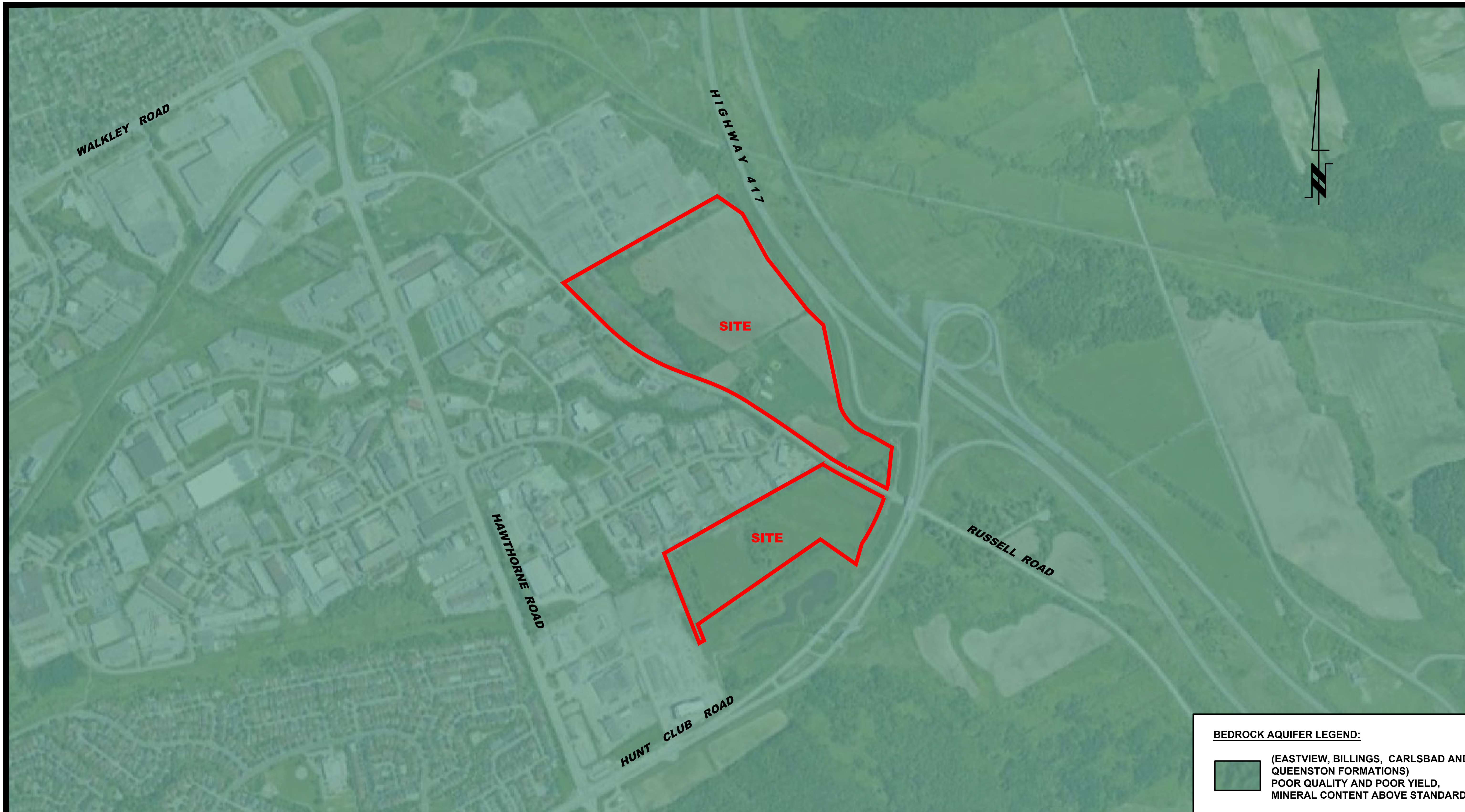

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AVENUE 31 CAPITAL INC.

WATER BUDGET ASSESSMENT
4055 AND 4120 RUSSELL ROAD

OTTAWA, ONTARIO

Title:

BEDROCK AQUIFER MAP

Scale: 1:10000	Date: 07/2020
Drawn by: MPG	Report No.: PH4055-1
Checked by: NZ	Dwg. No.: PH4055-5
Approved by: MK	Revision No.:

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AVENUE 31 CAPITAL INC.

WATER BUDGET ASSESSMENT
4055 AND 4120 RUSSELL ROAD

OTTAWA, ONTARIO

Title:

PRE-DEVELOPMENT TERRAIN COMPOSITION

Scale: 1:10000	Date: 07/2020
Drawn by: RCG	Report No.: PH4055-1
Checked by: NZ	Dwg. No.: PH4055-6
Approved by: MK	Revision No.:

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AVENUE 31 CAPITAL INC.

WATER BUDGET ASSESSMENT
4055 AND 4120 RUSSELL ROAD

OTTAWA, ONTARIO

Title:
POST-DEVELOPMENT TERRAIN COMPOSITION

Scale: 1:10000	Date: 07/2020
Drawn by: RCG	Report No.: PH4055-1
Checked by: NZ	Dwg. No.: PH4055-7
Approved by: MK	Revision No.:

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APPENDIX 1

Soil Profile and Test Data Sheets
Symbols and Terms
Drawing PG4854-1 - Test Hole Location Plan

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Proposed Commercial / Industrial Complex
4055 and 4120 Russell Road, Ottawa, Ontario

DATUM Ground surface elevations provided Annis, O'Sullivan, Vollebekk Ltd.

REMARKS

BORINGS BY CME 55 Power Auger **DATE** 2019 August 28

FILE NO. PG4854

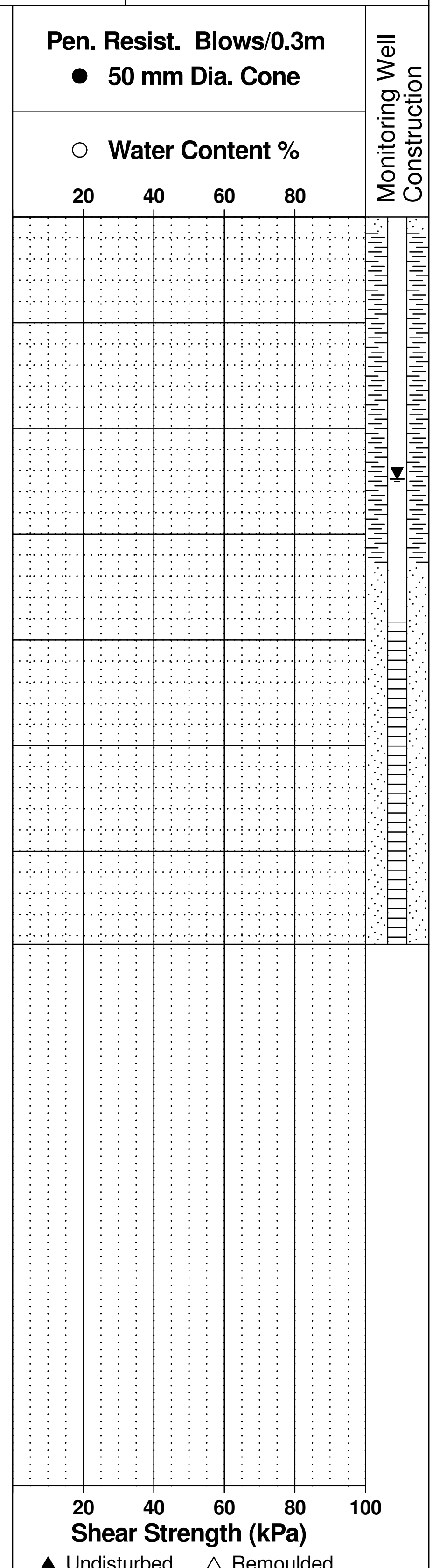
HOLE NO. BH 1

SOIL DESCRIPTION	Strata depth (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	69.48
TOPSOIL	0.20	AU	1				
Brown **SILTY SAND**	0.30						
		SS	2	38	5	1	68.48
		SS	3	100	5	2	67.48
Brown **SILTY CLAY**		SS	4	100	4		
- grey by 3.0m depth						3	66.48
		SS	5	100	3	4	65.48
		SS	6	100	3		
	5.18	SS	7	62	6	5	64.48
GLACIAL TILL: Brown silty clay with sand, gravel, cobbles and boulders		SS	8	43	8	6	63.48
	6.88	SS	9	100	50+		

End of Borehole

Practical refusal to augering at 6.88m depth

(GWL @ 2.48m - Sept. 18, 2019)



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SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Proposed Commercial / Industrial Complex
4055 and 4120 Russell Road, Ottawa, Ontario

DATUM Ground surface elevations provided Annis, O'Sullivan, Vollebekk Ltd.

FILE NO. **PG4854**

REMARKS

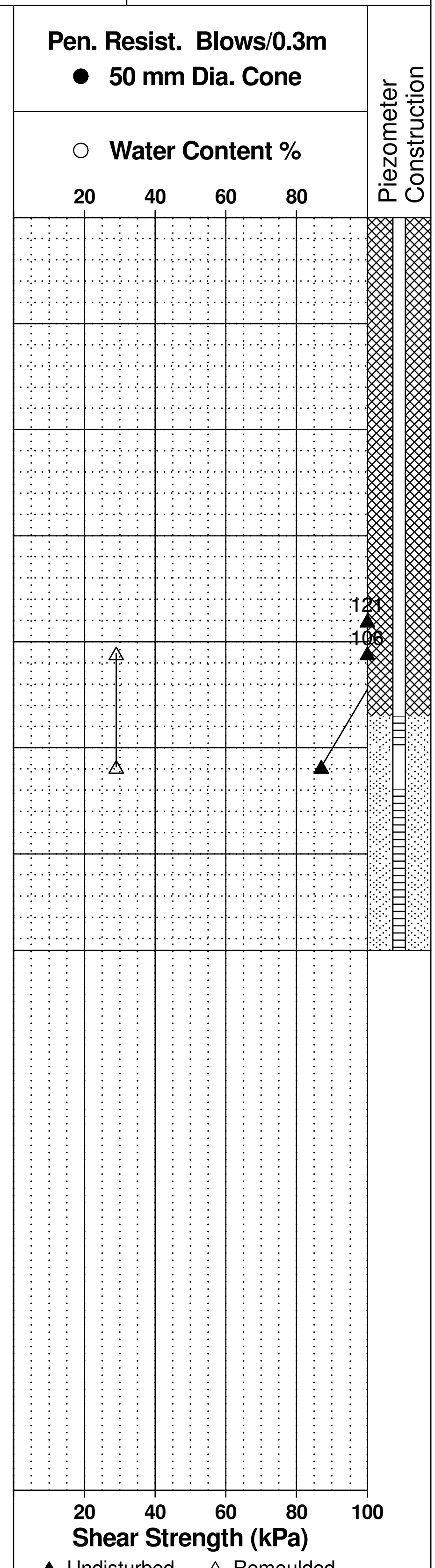
HOLE NO. **BH 2**

BORINGS BY CME 55 Power Auger **DATE** 2019 August 28

SOIL DESCRIPTION	Layer depth (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	69.43
TOPSOIL	0.15						
Loose, brown **SILTY SAND**	1.01	AU	1				
Very stiff to stiff, brown **SILTY CLAY**		SS	2	83	5	1	68.43
		SS	3	100	4	2	67.43
		SS	4	100	2	3	66.43
- grey by 3.8m depth		SS	5	100	2		
	5.20	SS	6	100	2	4	65.43
						5	64.43
GLACIAL TILL: Grey silty clay with gravel, cobbles and boulders		SS	7	17	15	6	63.43
	6.91	SS	8	100	55		
End of Borehole		SS	9	100	50+		

Practical refusal to augering at 6.91m depth

(Piezometer inaccessible - Sept. 7, 2019)



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SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Proposed Commercial / Industrial Complex
4055 and 4120 Russell Road, Ottawa, Ontario

DATUM Ground surface elevations provided Annis, O'Sullivan, Vollebekk Ltd.

REMARKS

BORINGS BY CME 55 Power Auger

DATE 2019 August 28

FILE NO. PG4854

HOLE NO. BH 3

SOIL DESCRIPTION	Depth to base (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	71.57
Brown **SILTY SAND** with gravel	0.28	AU	1				
Loose, brown **SILTY SAND**		SS	2	50	8	1	70.57
		SS	3	58	10	2	69.57
	2.90	SS	4	54	2		
GLACIAL TILL: Grey silty sand with gravel, cobbles, boulders, trace clay		SS	5	42	12	3	68.57
		SS	6	54	24	4	67.57
	4.88	SS	7	67	50+		

End of Borehole

Practical refusal to augering at 4.88m depth

(GWL @ 3.87m - Sept. 18, 2019)

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

Monitoring Well Construction

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Proposed Commercial / Industrial Complex
4055 and 4120 Russell Road, Ottawa, Ontario

DATUM Ground surface elevations provided Annis, O'Sullivan, Vollebekk Ltd.

FILE NO. **PG4854**

REMARKS

HOLE NO. **BH 4**

BORINGS BY CME 55 Power Auger

DATE 2019 August 29

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	67.49
TOPSOIL 0.18		AU	1				
Loose to compact, brown **SILTY SAND**		SS	2	96	8	1	66.49
2.13		SS	3	100	21	2	65.49
GLACIAL TILL: Brown silty sand with gravel, cobbles and boulders		SS	4	83	17		
3.12		SS	5	100	50+	3	64.49
End of Borehole Practical refusal to augering at 3.12m depth (Piezometer inaccessible - Sept. 7, 2019)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

Piezometer Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

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Proposed Commercial / Industrial Complex
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DATUM Ground surface elevations provided Annis, O'Sullivan, Vollebekk Ltd.

FILE NO. PG4854

REMARKS

HOLE NO. BH 5

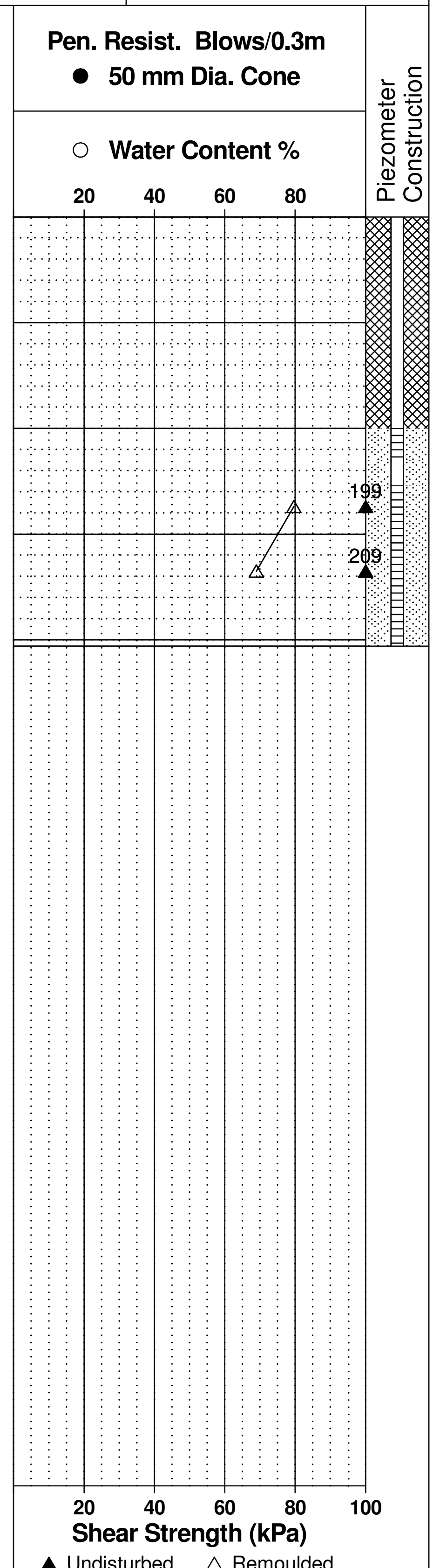
BORINGS BY CME 55 Power Auger **DATE** 2019 August 29

SOIL DESCRIPTION	Depth to base (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	68.91
TOPSOIL	0.13	AU	1				
Compact, brown **SILTY SAND**	1.37	SS	2	62	11	1	67.91
Very stiff to hard, brown **SILTY CLAY**	3.66	SS	3	100	7	2	66.91
						3	65.91
GLACIAL TILL: Brown silty clay with gravel, some cobbles, boulders	4.06	SS	4	60	50+	4	64.91

End of Borehole

Practical refusal to augering at 4.06m depth

(Piezometer inaccessible - Sept. 7, 2019)



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SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Proposed Commercial / Industrial Complex
4055 and 4120 Russell Road, Ottawa, Ontario

DATUM Ground surface elevations provided Annis, O'Sullivan, Vollebekk Ltd.

FILE NO. PG4854

REMARKS

HOLE NO. BH 6

BORINGS BY CME 55 Power Auger **DATE** 2019 August 29

SOIL DESCRIPTION	Depth to base (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	70.60
TOPSOIL	0.20	AU	1				
Compact, brown **SILTY SAND**	1.37	SS	2	75	10	1	69.60
Grey **SILTY CLAY**	2.13	SS	3	92	5	2	68.60
GLACIAL TILL: Grey silty sand with gravel, cobbles, boulders	2.29						

End of Borehole

Practical refusal to augering at 2.29m depth

(GWL @ 1.01m - Sept. 18, 2019)

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

Monitoring Well Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Proposed Commercial / Industrial Complex
4055 and 4120 Russell Road, Ottawa, Ontario

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REMARKS

BORINGS BY CME 55 Power Auger

DATE 2019 August 29

FILE NO. PG4854

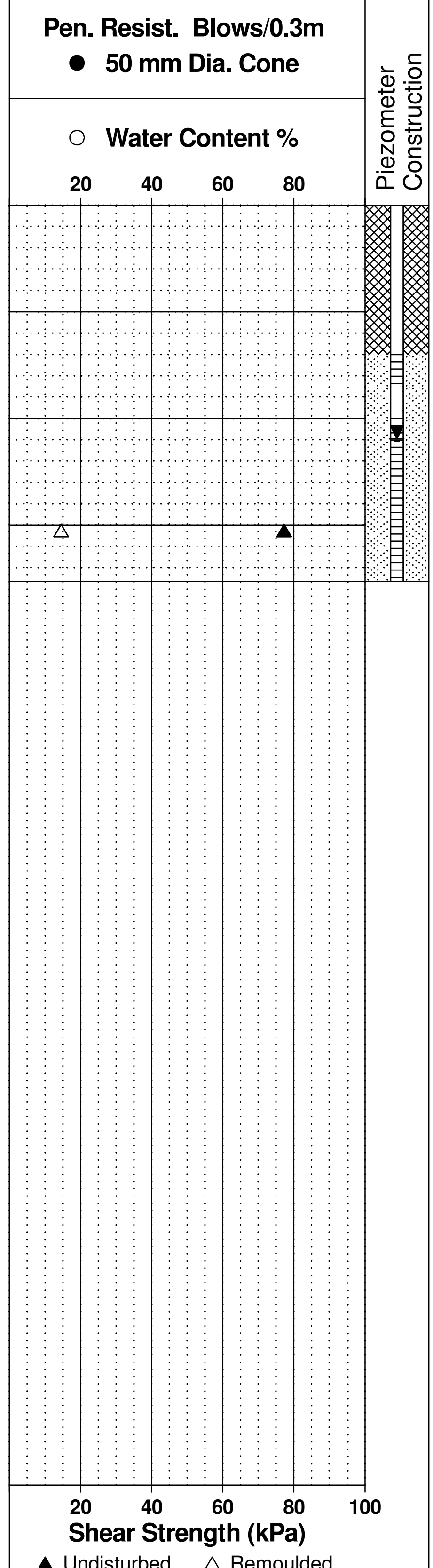
HOLE NO. BH 7

SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	71.39
TOPSOIL (0.20)	AU	1				
Loose, brown SILTY SAND	SS	2	67	6	1	70.39
	SS	3	79	8	2	69.39
(2.29)						
Stiff, grey SILTY CLAY	SS	4	96	1	3	68.39
(3.53)						

End of Borehole

Practical refusal to augering at 3.53m depth

(GWL @ 2.19m - Sept. 27, 2019)



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SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Proposed Commercial / Industrial Complex
4055 and 4120 Russell Road, Ottawa, Ontario

DATUM Ground surface elevations provided Annis, O'Sullivan, Vollebekk Ltd.

FILE NO. **PG4854**

REMARKS

HOLE NO. **BH 8**

BORINGS BY CME 55 Power Auger **DATE** 2019 August 29

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	68.59		
TOPSOIL 0.23		AU	1						
Very stiff, brown **SILTY CLAY**		SS	2	75	8	1	67.59		
- grey by 1.5m depth		SS	3	100	4	2	66.59		
2.90						3	65.59	169 ▲	
GLACIAL TILL: Grey silty clay, trace gravel, cobbles and boulders 3.76		SS	4	75	3				
End of Borehole									
Practical refusal to augering at 3.76m depth									
(Piezometer dry - Sept. 27, 2019)									

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Proposed Commercial / Industrial Complex
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DATUM Ground surface elevations provided Annis, O'Sullivan, Vollebekk Ltd.

FILE NO. **PG4854**

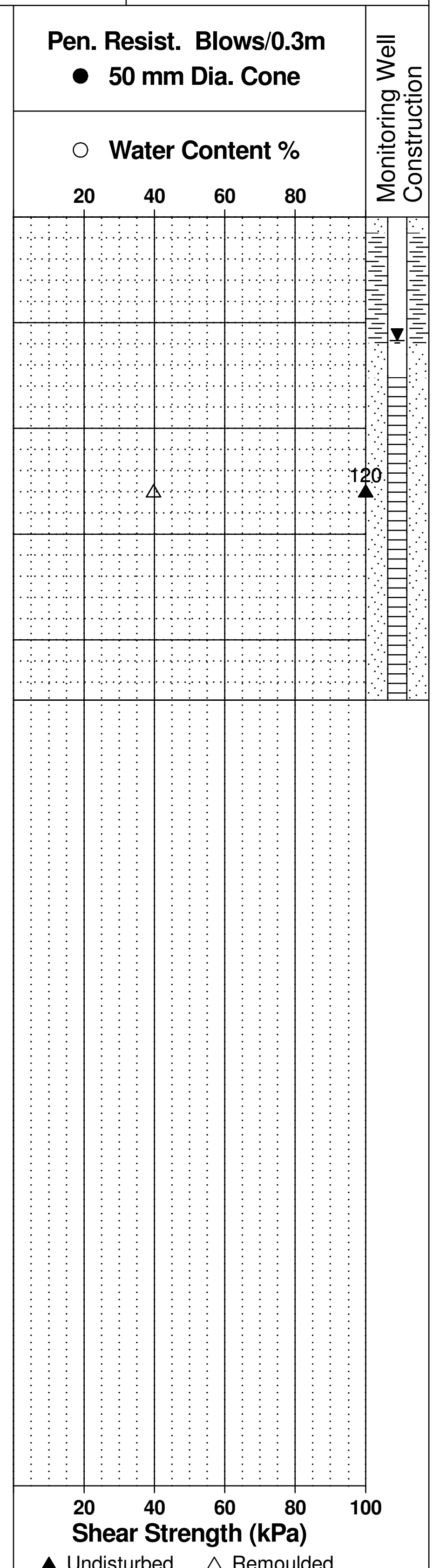
REMARKS

HOLE NO. **BH 9**

BORINGS BY CME 55 Power Auger

DATE 2019 August 29

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	70.95
TOPSOIL 0.25		AU	1				
Loose, brown **SILTY SAND** 1.52		SS	2	46	9	1	69.95
Very stiff to stiff, grey **SILTY CLAY**		SS	3	75	3	2	68.95
		SS	4	100	1		
		SS	5	100	1	3	67.95
4.57		SS	6	100	1	4	66.95
End of Borehole							
(GWL @ 1.17m - Sept. 18, 2019)							



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SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Proposed Commercial / Industrial Complex
4055 and 4120 Russell Road, Ottawa, Ontario

DATUM Ground surface elevations provided Annis, O'Sullivan, Vollebekk Ltd.

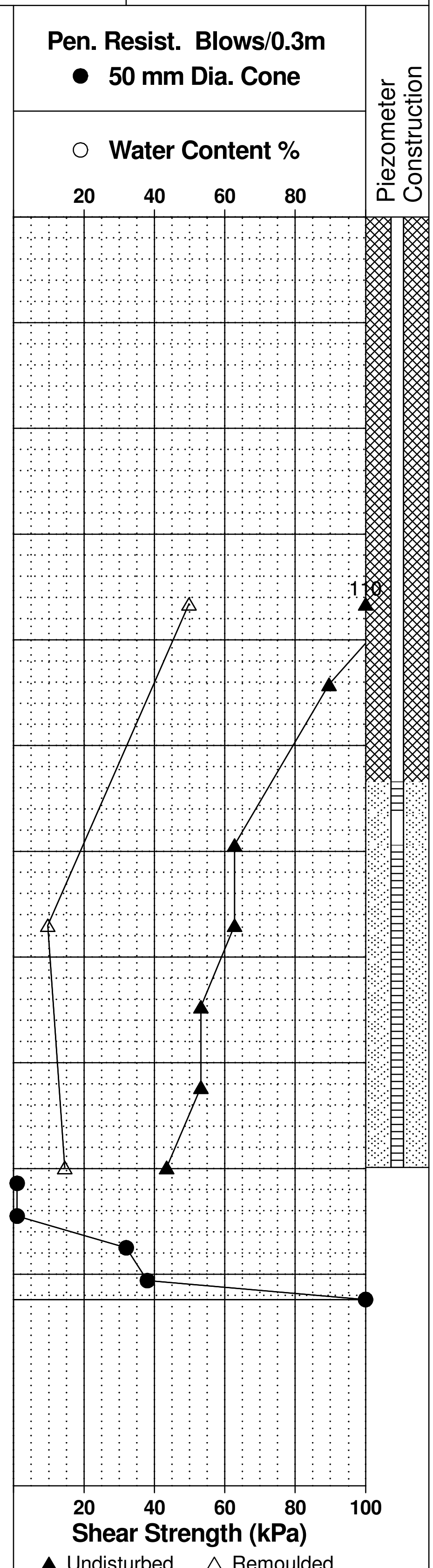
FILE NO. PG4854

REMARKS

HOLE NO. BH10

BORINGS BY CME 55 Power Auger **DATE** 2019 August 29

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	70.69
TOPSOIL 0.15		AU	1				
Compact, brown **SILTY SAND**		SS	2	54	10	1	69.69
1.52							
		SS	3	83	6	2	68.69
		SS	4	100	2	3	67.69
						4	66.69
Very stiff to stiff, grey **SILTY CLAY**		SS	5	100	1	5	65.69
						6	64.69
						7	63.69
- firm by 8.4m depth						8	62.69
8.99						9	61.69
Dynamic Cone Penetration Test commenced at 8.99m depth.						10	60.69
10.24							
End of Borehole Practical DCPT refusal at 10.24m depth (Piezometer blocked - Sept. 27, 2019)							



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SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Proposed Commercial / Industrial Complex
4055 and 4120 Russell Road, Ottawa, Ontario

DATUM Ground surface elevations provided Annis, O'Sullivan, Vollebekk Ltd.

FILE NO. PG4854

REMARKS

HOLE NO. BH11

BORINGS BY CME 55 Power Auger

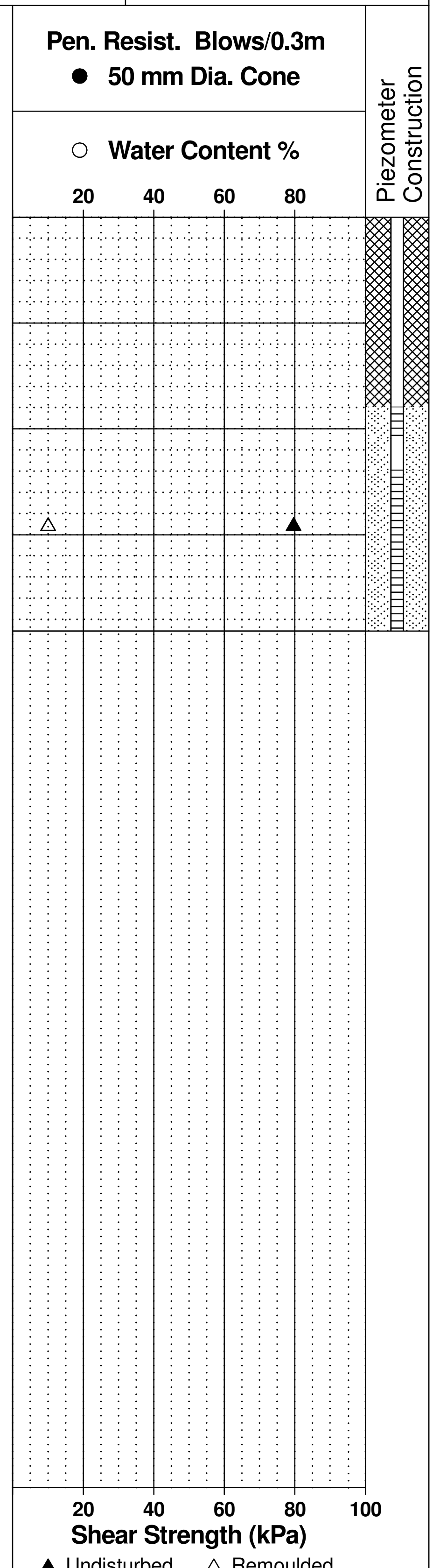
DATE 2019 August 30

SOIL DESCRIPTION	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	66.78
TOPSOIL 0.15	AU	1				
Very stiff to stiff, brown **SILTY CLAY**	SS	2	88	8	1	65.78
- grey by 1.5m depth	SS	3	92	4		
					2	64.78
3.05					3	63.78
GLACIAL TILL: Grey silty clay with sand, gravel, cobbles, boulders	SS	4	100	12		
3.91	SS	5	0	50+		

End of Borehole

Practical refusal to augering at 3.91m depth

(Piezometer blocked - Sept. 27, 2019)



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SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Proposed Commercial / Industrial Complex
4055 and 4120 Russell Road, Ottawa, Ontario

DATUM Ground surface elevations provided Annis, O'Sullivan, Vollebekk Ltd.

FILE NO. PG4854

REMARKS

HOLE NO. BH12

BORINGS BY CME 55 Power Auger **DATE** 2019 August 30

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	70.67
TOPSOIL — 0.10		AU	1				
Very stiff to stiff, brown **SILTY CLAY**		SS	2	79	8	1	69.67
- grey by 1.5m depth		SS	3	100	5	2	68.67
		SS	4	100	5		
— 3.81		SS	5	100	4	3	67.67
GLACIAL TILL: Brown silty clay with gravel, cobbles and boulders		SS	6	50	6	4	66.67
		SS	7	54	18	5	65.67
		SS	8	100	12	6	64.67
— 7.32						7	63.67

End of Borehole

Practical refusal to augering at 7.32m depth

(GWL @ 1.35m - Sept. 27, 2019)

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %
20 40 60 80

Piezometer Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Proposed Commercial / Industrial Complex
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DATUM Ground surface elevations provided Annis, O'Sullivan, Vollebekk Ltd.

FILE NO. PG4854

REMARKS

HOLE NO. BH13

BORINGS BY CME 55 Power Auger

DATE 2019 August 30

SOIL DESCRIPTION	Depth to base (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	70.20
TOPSOIL	0.08	AU	1				
Very stiff, brown **SILTY CLAY**	1.52	SS	2	100	8	1	69.20
GLACIAL TILL: Brown silty clay with gravel, cobbles and boulders	4.57	SS	3	100	5	2	68.20
		SS	4	62	7	3	67.20
		SS	5	38	7	4	66.20
		SS	6	33	15		

End of Borehole

Practical refusal to augering at 4.57m depth

(GWL @ 0.85m - Sept. 18, 2019)

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %
20 40 60 80

Monitoring Well Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Proposed Commercial / Industrial Complex
4055 and 4120 Russell Road, Ottawa, Ontario

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REMARKS

BORINGS BY CME 55 Power Auger **DATE** 2019 September 4

FILE NO. PG4854

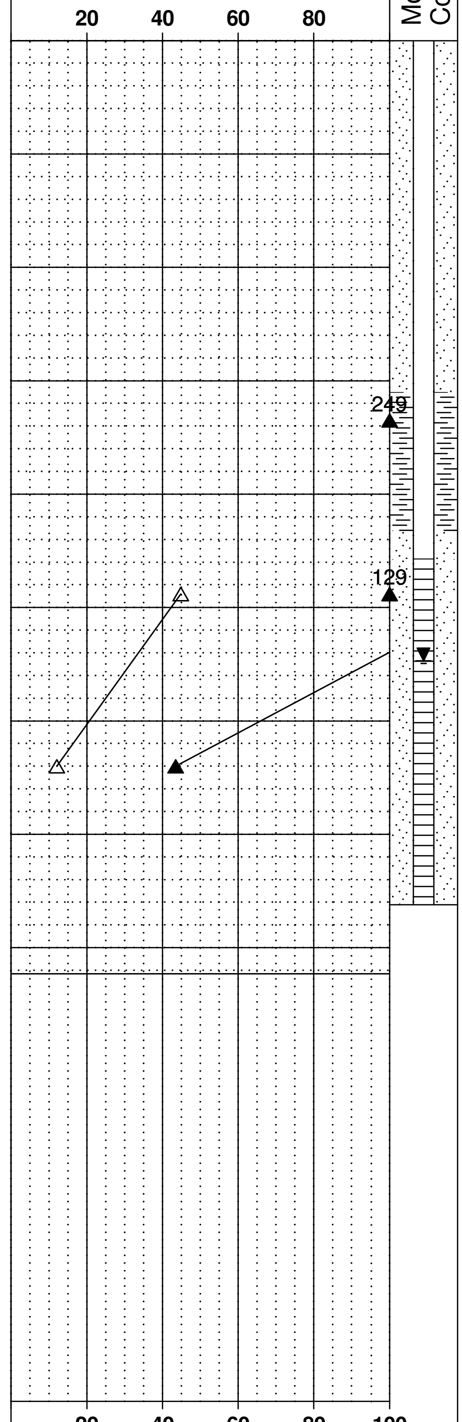
HOLE NO. BH14

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	79.45
TOPSOIL 0.20		AU	1				
FILL: Brown silty clay with sand, some gravel 1.52		SS	2	12	17	1	78.45
Hard to very stiff, brown **SILTY CLAY**		SS	3	96	15	2	77.45
		SS	4	100	9	3	76.45
		SS	5	100	7		
		SS	6	100	4	4	75.45
		SS	7	100	1	5	74.45
- stiff to firm and grey by 5.3m depth		SS	8	100	W	6	73.45
		SS	9	100	W		
		SS	10	100	1	7	72.45
7.92							
GLACIAL TILL: Grey silty clay with sand, gravel, cobbles and boulders 8.23		SS	11	10	2	8	71.45
End of Borehole							
(GWL @ 5.47m - Sept. 18, 2019)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

Monitoring Well Construction



Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Proposed Commercial / Industrial Complex
4055 and 4120 Russell Road, Ottawa, Ontario

DATUM Ground surface elevations provided Annis, O'Sullivan, Vollebekk Ltd.

REMARKS

BORINGS BY CME 55 Power Auger

DATE 2019 September 4

FILE NO. PG4854

HOLE NO. BH15

SOIL DESCRIPTION	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	79.23
TOPSOIL 0.10						
FILL: Brown silty sand, trace gravel 0.76	SS	1	67	7		
Very stiff, brown **SILTY CLAY**	SS	2	75	13	1	78.23
	SS	3	92	11	2	77.23
	SS	4	100	9		
	SS	5	100	5	3	76.23
	SS	6	100	4	4	75.23
- grey by 4.8m depth 5.64	SS	7	100	2	5	74.23
GLACIAL TILL: Grey silty sand with gravel, cobbles, boulders 6.25	SS	8	67	50	6	73.23
	SS	9	60	50+		

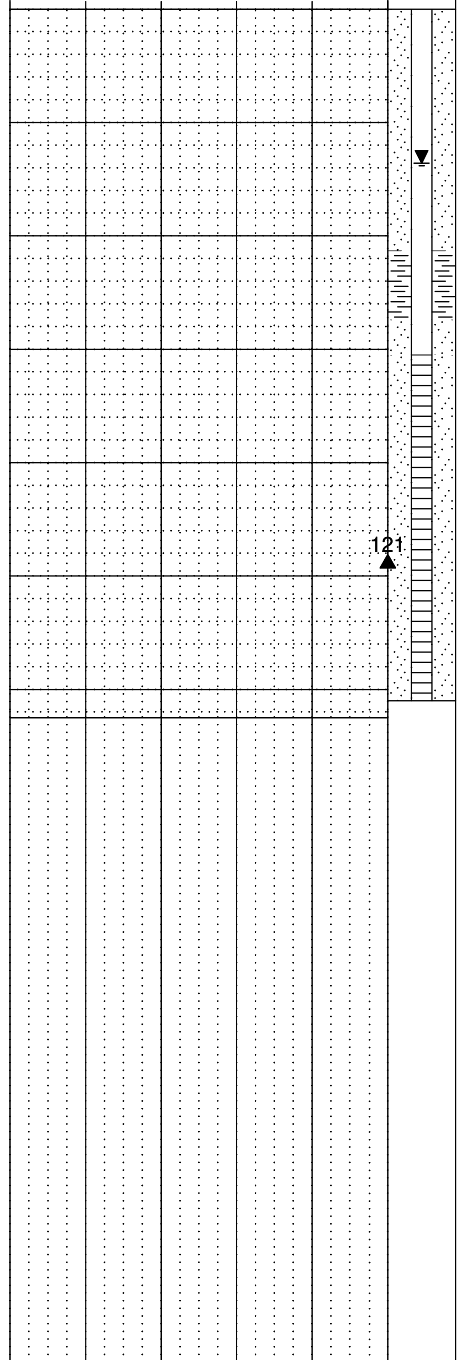
End of Borehole

Practical refusal to augering at 6.25m depth

(GWL @ 1.36m - Sept. 18, 2019)

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %

20 40 60 80



20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

Monitoring Well Construction

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SOIL PROFILE AND TEST DATA

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DATUM Ground surface elevations provided Annis, O'Sullivan, Vollebekk Ltd.

FILE NO. PG4854

REMARKS

HOLE NO. BH16

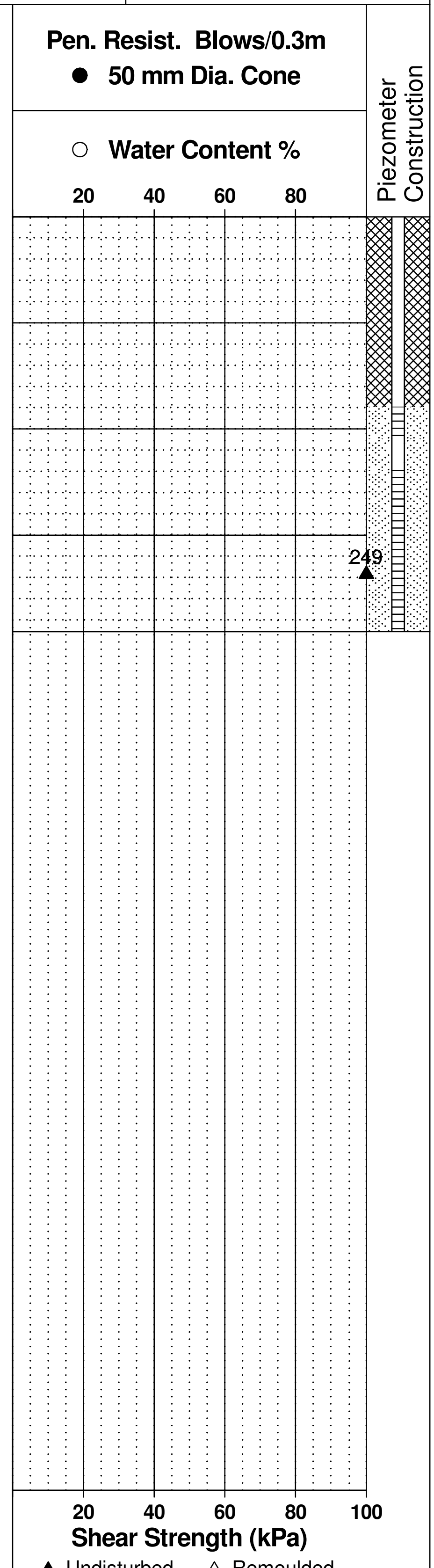
BORINGS BY CME 55 Power Auger **DATE** 2019 September 4

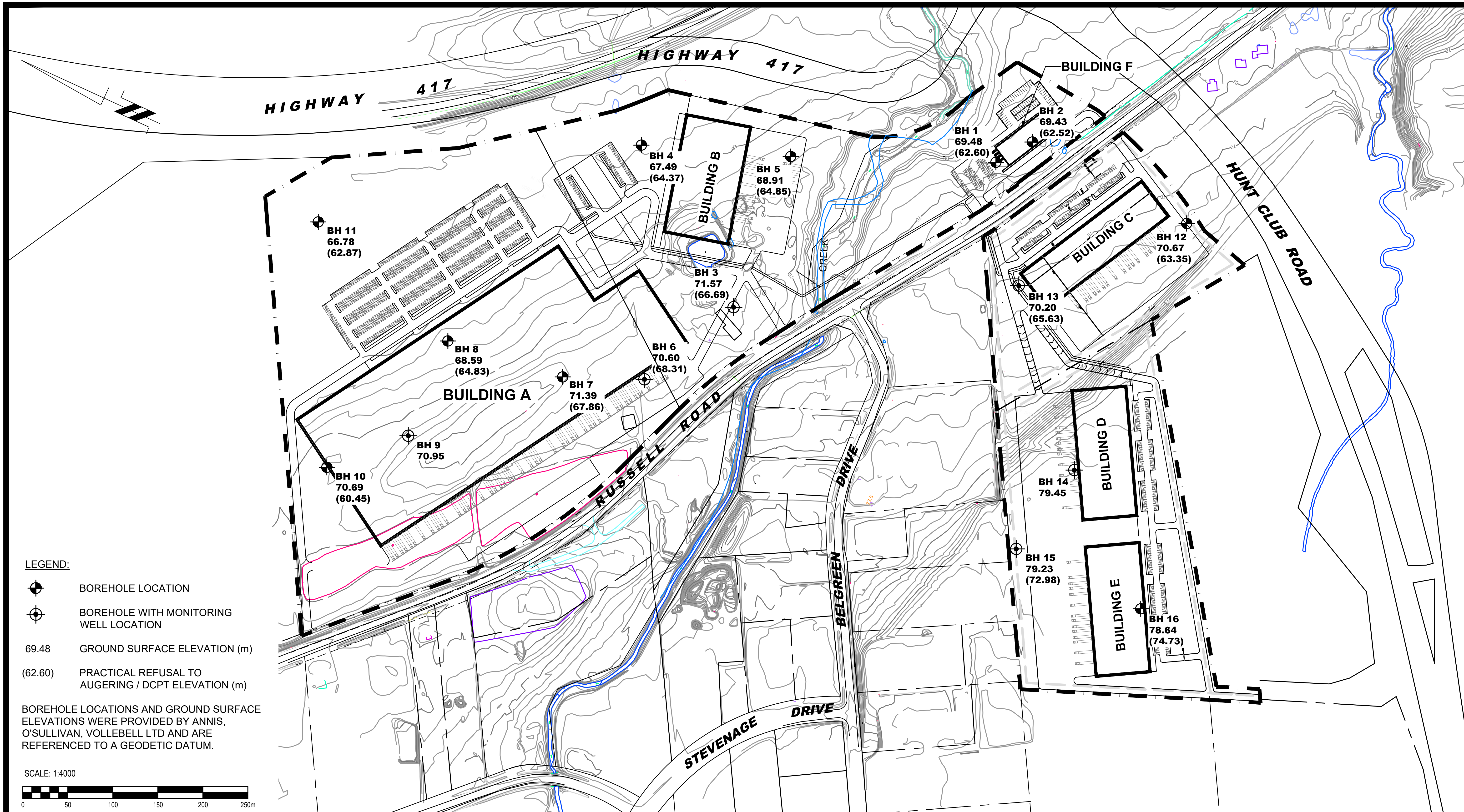
SOIL DESCRIPTION		SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	78.64
TOPSOIL	0.20	AU	1				
Hard, brown **SILTY CLAY,** trace sand		SS	2	88	19	1	77.64
		SS	3	100	15	2	76.64
		SS	4	100	9	3	75.64
	3.81						
GLACIAL TILL: Brown silty sand with ground rock	3.91	SS	5	100	50+		

End of Borehole

Practical refusal to augering at 3.91m depth

(Piezometer dry - Sept. 27, 2019)





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NO.	REVISIONS	DATE	INITIAL
2	UPDATED TO LATEST CONCEPTUAL PLAN	18/03/2020	SD
1	UPDATED NEW BASE PLAN	13/01/2020	SD

AVENUE 31

GEOTECHNICAL INVESTIGATION - NATIONAL CAPITAL BUSINESS PARK
4055 AND 4120 RUSSELL ROAD

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:4000	Date: 10/2019
Drawn by: YA	Report No.: PG4854-1
Checked by: SD	Dwg. No.: **PG4854-1**
Approved by: DJG	Revision No.: 2

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11x17

APPENDIX 2

Environment Canada Water Balance Data
Table C1 - Monthly Water Balance for Soil With 5 mm Water Holding Capacity at National Capital Business Park
Table C2 - Monthly Water Balance for Soil With 75 mm Water Holding Capacity at National Capital Business Park
Table C3 - Monthly Water Balance for Soil With 100 mm Water Holding Capacity at National Capital Business Park
Table C4 - Monthly Water Balance for Soil With 150 mm Water Holding Capacity at National Capital Business Park
Table C5 - Monthly Water Balance for Soil With 200 mm Water Holding Capacity at National Capital Business Park
Table C6 - Pre-Development Annual Water Budget Calculations for National Capital Business Park
Table C7 - Post-Development Annual Water Budget Calculations for National Capital Business Park

Ottawa Intl A WATER BUDGET MEANS FOR THE PERIOD 1939-2019 DC20492

LAT.... 45.32 WATER HOLDING CAPACITY... 5 MM HEAT INDEX... 36.68
LONG... 75.67 LOWER ZONE.............. 3 MM A............ 1.079

DATE	TEMP (C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	-10.7	62	11	14	0	0	0	25	84	5	295
28- 2	-9.0	56	11	16	1	1	0	26	113	5	350
31- 3	-2.9	65	31	77	5	5	0	103	70	5	416
30- 4	5.7	73	68	75	31	31	0	112	0	5	490
31- 5	13.1	76	76	0	80	65	-16	15	0	2	566
30- 6	18.3	85	85	0	116	81	-35	5	0	1	651
31- 7	20.9	88	88	0	136	83	-53	5	0	1	739
31- 8	19.6	84	84	0	118	79	-38	4	0	1	823
30- 9	14.8	82	82	0	75	63	-12	17	0	2	905
31-10	8.3	77	77	0	37	35	-2	40	0	4	77
30-11	1.2	76	59	8	10	10	0	57	9	5	154
31-12	-6.9	79	26	14	1	1	0	40	48	5	233
AVE	6.0 TTL	904	698	204	610	454	-156	449			

Ottawa Intl A STANDARD DEVIATIONS FOR THE PERIOD 1939-2019 DC20492

DATE	TEMP (C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	2.9	25	15	18	1	1	0	28	44	0	59
28- 2	2.6	27	14	26	1	1	0	35	59	0	63
31- 3	2.6	28	22	49	5	5	0	56	87	0	71
30- 4	1.8	32	33	88	9	9	1	89	3	1	80
31- 5	1.8	34	34	3	12	15	20	25	0	2	94
30- 6	1.2	38	38	0	8	29	30	16	0	2	105
31- 7	1.1	45	45	0	8	32	34	21	0	2	118
31- 8	1.3	37	37	0	8	28	31	13	0	2	127
30- 9	1.5	39	39	0	8	17	17	27	0	2	133
31-10	1.5	37	37	1	7	7	7	34	0	2	37
30-11	1.8	27	27	8	4	4	0	26	13	0	45
31-12	3.0	30	22	14	1	1	0	29	34	0	55

Ottawa Intl A WATER BUDGET MEANS FOR THE PERIOD 1939-2019 DC20492

LAT.... 45.32 WATER HOLDING CAPACITY...100 MM HEAT INDEX... 36.68
LONG... 75.67 LOWER ZONE............... 60 MM A............ 1.079

DATE	TEMP (C)		PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	-10.7		62	11	14	0	0	0	24	84	98	295
28- 2	-9.0		56	11	16	1	1	0	26	113	98	350
31- 3	-2.9		65	31	77	5	5	0	101	70	100	416
30- 4	5.7		73	68	75	31	31	0	112	0	100	490
31- 5	13.1		76	76	0	80	80	0	14	0	81	566
30- 6	18.3		85	85	0	116	112	-4	5	0	49	651
31- 7	20.9		88	88	0	136	114	-22	3	0	20	739
31- 8	19.6		84	84	0	118	87	-31	1	0	16	823
30- 9	14.8		82	82	0	75	65	-10	3	0	30	905
31-10	8.3		77	77	0	37	36	-1	9	0	63	77
30-11	1.2		76	59	8	10	10	0	31	9	89	154
31-12	-6.9		79	26	14	1	1	0	32	48	97	233
AVE	6.0	TTL	904	698	204	610	542	-68	361			

Ottawa Intl A STANDARD DEVIATIONS FOR THE PERIOD 1939-2019 DC20492

DATE	TEMP (C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	2.9	25	15	18	1	1	0	28	44	8	59
28- 2	2.6	27	14	26	1	1	0	35	59	7	63
31- 3	2.6	28	22	49	5	5	0	55	87	0	71
30- 4	1.8	32	33	88	9	9	0	89	3	2	80
31- 5	1.8	34	34	3	12	12	0	25	0	22	94
30- 6	1.2	38	38	0	8	12	10	16	0	36	105
31- 7	1.1	45	45	0	8	28	29	17	0	30	118
31- 8	1.3	37	37	0	8	28	30	4	0	29	127
30- 9	1.5	39	39	0	8	16	16	13	0	35	133
31-10	1.5	37	37	1	7	7	2	19	0	35	37
30-11	1.8	27	27	8	4	4	0	32	13	20	45
31-12	3.0	30	22	14	1	1	0	30	34	9	55

Ottawa Intl A WATER BUDGET MEANS FOR THE PERIOD 1939-2019 DC20492

LAT.... 45.32 WATER HOLDING CAPACITY...150 MM HEAT INDEX... 36.68
LONG... 75.67 LOWER ZONE.............. 90 MM A............ 1.079

DATE	TEMP (C)		PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	-10.7		62	11	14	0	0	0	21	84	142	295
28- 2	-9.0		56	11	16	1	1	0	24	113	144	350
31- 3	-2.9		65	31	77	5	5	0	98	70	149	416
30- 4	5.7		73	68	75	31	31	0	111	0	150	490
31- 5	13.1		76	76	0	80	80	0	14	0	131	566
30- 6	18.3		85	85	0	116	116	0	5	0	96	651
31- 7	20.9		88	88	0	136	127	-9	3	0	54	739
31- 8	19.6		84	84	0	118	98	-20	1	0	39	823
30- 9	14.8		82	82	0	75	67	-8	2	0	52	905
31-10	8.3		77	77	0	37	36	-1	7	0	86	77
30-11	1.2		76	59	8	10	10	0	20	9	123	154
31-12	-6.9		79	26	14	1	1	0	24	48	139	233
AVE	6.0	TTL	904	698	204	610	572	-38	330			

Ottawa Intl A STANDARD DEVIATIONS FOR THE PERIOD 1939-2019 DC20492

DATE	TEMP (C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	2.9	25	15	18	1	1	0	29	44	18	59
28- 2	2.6	27	14	26	1	1	0	35	59	17	63
31- 3	2.6	28	22	49	5	5	0	54	87	5	71
30- 4	1.8	32	33	88	9	9	0	88	3	2	80
31- 5	1.8	34	34	3	12	12	0	25	0	22	94
30- 6	1.2	38	38	0	8	8	1	16	0	41	105
31- 7	1.1	45	45	0	8	19	20	17	0	43	118
31- 8	1.3	37	37	0	8	22	24	4	0	43	127
30- 9	1.5	39	39	0	8	14	13	12	0	48	133
31-10	1.5	37	37	1	7	7	2	17	0	47	37
30-11	1.8	27	27	8	4	4	0	29	13	34	45
31-12	3.0	30	22	14	1	1	0	28	34	22	55

Ottawa Intl A WATER BUDGET MEANS FOR THE PERIOD 1939-2019 DC20492

LAT.... 45.32 WATER HOLDING CAPACITY...200 MM HEAT INDEX... 36.68
LONG... 75.67 LOWER ZONE...............120 MM A............ 1.079

DATE	TEMP (C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	-10.7	62	11	14	0	0	0	19	84	185	295
28- 2	-9.0	56	11	16	1	1	0	22	113	189	350
31- 3	-2.9	65	31	77	5	5	0	94	70	198	416
30- 4	5.7	73	68	75	31	31	0	110	0	200	490
31- 5	13.1	76	76	0	80	80	0	14	0	181	566
30- 6	18.3	85	85	0	116	116	0	5	0	146	651
31- 7	20.9	88	88	0	136	132	-4	3	0	98	739
31- 8	19.6	84	84	0	118	106	-12	1	0	75	823
30- 9	14.8	82	82	0	75	70	-6	2	0	86	905
31-10	8.3	77	77	0	37	36	0	6	0	120	77
30-11	1.2	76	59	8	10	10	0	17	9	160	154
31-12	-6.9	79	26	14	1	1	0	19	48	180	233
AVE	6.0 TTL	904	698	204	610	588	-22	312			

Ottawa Intl A STANDARD DEVIATIONS FOR THE PERIOD 1939-2019 DC20492

DATE	TEMP (C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	2.9	25	15	18	1	1	0	28	44	28	59
28- 2	2.6	27	14	26	1	1	0	34	59	25	63
31- 3	2.6	28	22	49	5	5	0	54	87	8	71
30- 4	1.8	32	33	88	9	9	0	87	3	2	80
31- 5	1.8	34	34	3	12	12	0	25	0	22	94
30- 6	1.2	38	38	0	8	8	0	16	0	42	105
31- 7	1.1	45	45	0	8	11	10	17	0	50	118
31- 8	1.3	37	37	0	8	17	18	4	0	53	127
30- 9	1.5	39	39	0	8	11	10	12	0	58	133
31-10	1.5	37	37	1	7	7	1	17	0	55	37
30-11	1.8	27	27	8	4	4	0	27	13	44	45
31-12	3.0	30	22	14	1	1	0	27	34	31	55

Ottawa Intl A WATER BUDGET MEANS FOR THE PERIOD 1939-2019 DC20492

LAT.... 45.32 WATER HOLDING CAPACITY... 75 MM HEAT INDEX... 36.68
LONG... 75.67 LOWER ZONE............... 45 MM A............ 1.079

DATE	TEMP (C)		PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	-10.7		62	11	14	0	0	0	24	84	74	295
28- 2	-9.0		56	11	16	1	1	0	26	113	74	350
31- 3	-2.9		65	31	77	5	5	0	102	70	75	416
30- 4	5.7		73	68	75	31	31	0	112	0	75	490
31- 5	13.1		76	76	0	80	80	0	14	0	57	566
30- 6	18.3		85	85	0	116	107	-9	5	0	30	651
31- 7	20.9		88	88	0	136	104	-32	3	0	11	739
31- 8	19.6		84	84	0	118	83	-34	1	0	11	823
30- 9	14.8		82	82	0	75	65	-10	4	0	24	905
31-10	8.3		77	77	0	37	36	-1	14	0	51	77
30-11	1.2		76	59	8	10	10	0	38	9	70	154
31-12	-6.9		79	26	14	1	1	0	36	48	74	233
AVE	6.0	TTL	904	698	204	610	523	-86	379			

Ottawa Intl A STANDARD DEVIATIONS FOR THE PERIOD 1939-2019 DC20492

DATE	TEMP (C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	2.9	25	15	18	1	1	0	28	44	3	59
28- 2	2.6	27	14	26	1	1	0	35	59	3	63
31- 3	2.6	28	22	49	5	5	0	55	87	0	71
30- 4	1.8	32	33	88	9	9	0	89	3	2	80
31- 5	1.8	34	34	3	12	12	0	25	0	22	94
30- 6	1.2	38	38	0	8	18	18	16	0	29	105
31- 7	1.1	45	45	0	8	31	32	17	0	22	118
31- 8	1.3	37	37	0	8	29	31	4	0	21	127
30- 9	1.5	39	39	0	8	16	16	15	0	29	133
31-10	1.5	37	37	1	7	7	2	21	0	27	37
30-11	1.8	27	27	8	4	4	0	32	13	12	45
31-12	3.0	30	22	14	1	1	0	30	34	4	55

Table C1 - Monthly Water Balance for Soil With 5 mm Water Holding Capacity at National Capital Business Park				
Month	**Temperature (°C)**	**Total Precipitation (mm)**	**Actual Evapotranspiration (mm)**	**Water Surplus (mm)**
January	-10.7	62	0	25
February	-9	56	1	26
March	-2.9	65	5	103
April	5.7	73	31	112
May	13.1	76	65	15
June	18.3	85	81	5
July	20.9	88	83	5
August	19.6	84	79	4
September	14.8	82	63	17
October	8.3	77	35	40
November	1.2	76	10	57
December	-6.9	80	1	40
Annual	**6**	**904**	**454**	**449**

Table C2 - Monthly Water Balance for Soil With 75 mm Water Holding Capacity at National Capital Business Park				
Month	**Temperature (°C)**	**Total Precipitation (mm)**	**Actual Evapotranspiration (mm)**	**Water Surplus (mm)**
January	-10.7	62	0	24
February	-9	56	1	26
March	-2.9	65	5	102
April	5.7	73	31	112
May	13.1	76	80	14
June	18.3	85	107	5
July	20.9	88	104	3
August	19.6	84	83	1
September	14.8	82	65	4
October	8.3	77	36	14
November	1.2	76	10	38
December	-6.9	80	1	36
Annual	**6**	**904**	**523**	**379**

Table C3 - Monthly Water Balance for Soil With 100 mm Water Holding Capacity at National Capital Business Park				
Month	**Temperature (°C)**	**Total Precipitation (mm)**	**Actual Evapotranspiration (mm)**	**Water Surplus (mm)**
January	-10.7	62	0	24
February	-9	56	1	26
March	-2.9	65	5	101
April	5.7	73	31	112
May	13.1	76	80	14
June	18.3	85	112	5
July	20.9	88	114	3
August	19.6	84	87	1
September	14.8	82	65	3
October	8.3	77	36	9
November	1.2	76	10	31
December	-6.9	80	1	32
Annual	**6**	**904**	**542**	**361**

Table C4 - Monthly Water Balance for Soil With 150 mm Water Holding Capacity at National Capital Business Park				
Month	**Temperature (°C)**	**Total Precipitation (mm)**	**Actual Evapotranspiration (mm)**	**Water Surplus (mm)**
January	-10.7	62	0	21
February	-9	56	1	24
March	-2.9	65	5	98
April	5.7	73	31	111
May	13.1	76	80	14
June	18.3	85	116	5
July	20.9	88	127	3
August	19.6	84	98	1
September	14.8	82	67	2
October	8.3	77	36	7
November	1.2	76	10	20
December	-6.9	80	1	24
Annual	**6**	**904**	**572**	**330**

Table C5 - Monthly Water Balance for Soil With 200 mm Water Holding Capacity at National Capital Business Park				
Month	**Temperature (°C)**	**Total Precipitation (mm)**	**Actual Evapotranspiration (mm)**	**Water Surplus (mm)**
January	-10.7	62	0	19
February	-9	56	1	22
March	-2.9	65	5	94
April	5.7	73	31	110
May	13.1	76	80	14
June	18.3	85	116	5
July	20.9	88	132	3
August	19.6	84	106	1
September	14.8	82	70	2
October	8.3	77	36	6
November	1.2	76	10	17
December	-6.9	80	1	19
Annual	**6**	**904**	**588**	**312**

Table C6 - Pre-Development Annual Water Budget Calculations for 4055 and 4120 Russell Road

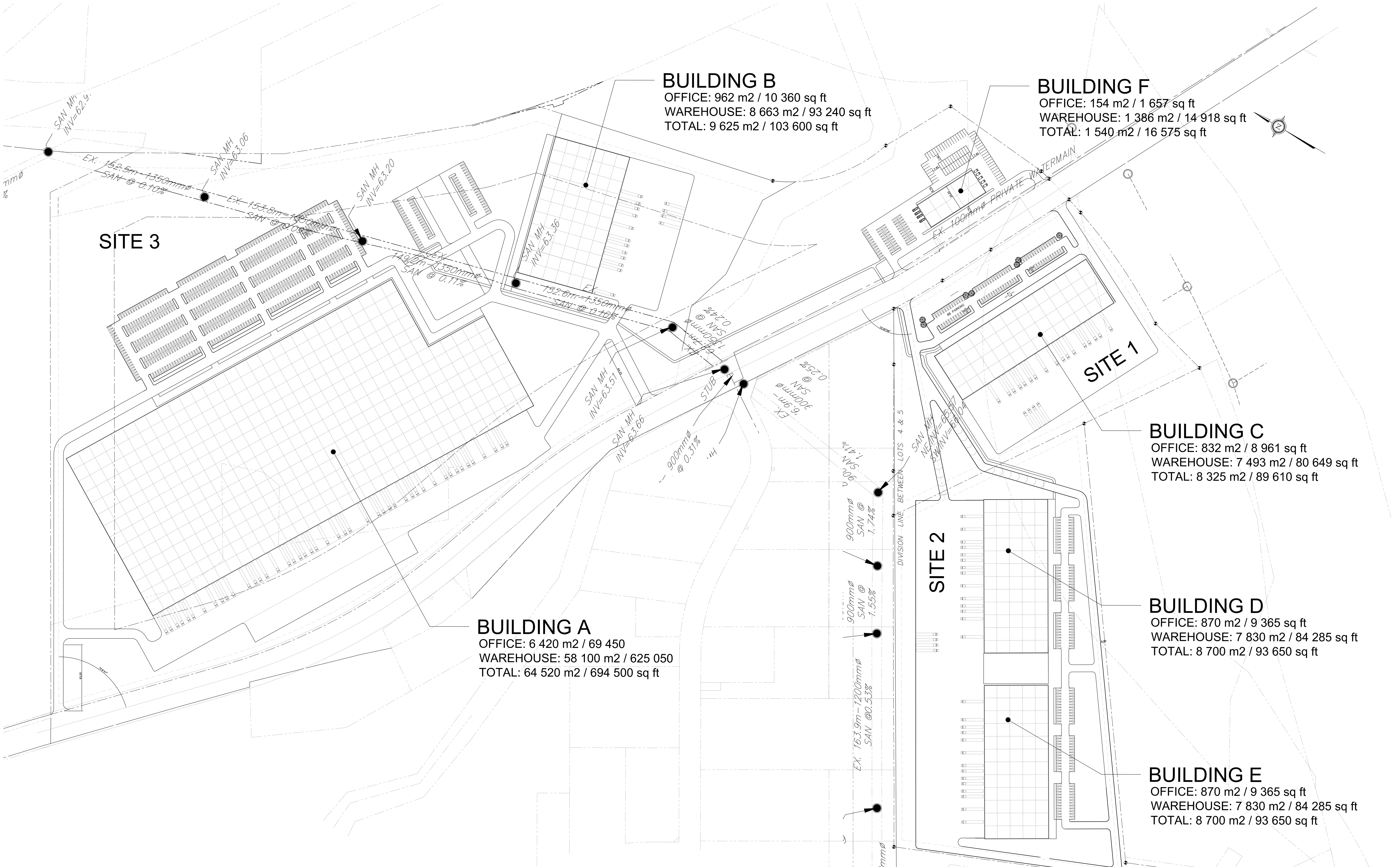
Geologic Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/year)	Total Infiltration (L/year)	Total Runoff (mm/year)	Total Runoff (L/year)
Clay (Pasture and Shrubs)	110,793	312	0.1	0.1	0.1	0.3	0.7	93.6	10,370,225	218.4	24,197,191
Clay (Moderately Rooted Crops)	82,914	330	0.2	0.1	0.1	0.4	0.6	132	10,944,648	198	16,416,972
Fill - Fine Sandy Loam (Pasture and Shrubs)	20,173	330	0.1	0.2	0.1	0.4	0.6	132	2,662,836	198	3,994,254
Fine Sand (Pasture and Shrubs)	120,924	361	0.2	0.3	0.1	0.6	0.4	216.6	26,192,138	144.4	17,461,426
Fine Sand (Moderately Rooted Crops)	73,000	379	0.2	0.3	0.1	0.6	0.4	227.4	16,600,200	151.6	11,066,800
Totals	**407,804**								**66,770,047**		**73,136,643**

Table C7 - Post-Development Annual Water Budget Calculations for 4055 and 4120 Russell Road

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/year)	Total Infiltration (L/year)	Total Runoff (mm/year)	Total Runoff (L/year)
Clay Loam (Urban Lawn)	178,176	361	0.2	0.2	0.1	0.5	0.5	180.5	32,160,768	180.5	32,160,768
Anthropogenic Sources (Roof, Roads, Parking Lot)	229,628	449	0	0	0	0	1	0	0	449	103,102,972
Totals	**407,804**								**32,160,768**		**135,263,740**
Difference (L/year)									**-34,609,279**		**62,127,097**
Percentage Variation									**-51.83%**		**84.95%**

APPENDIX 3

Figurr Collectif D'architectes – Drawing A101 – Site Plan
City of Ottawa - Salt Management Plan - Appendix A - October 31, 2011



SITE 1	
PROPERTY DESCRIPTION	
HEAVY OR LIGHT INDUSTRIAL BUILDING	
CITY OF OTTAWA PIN NUMBER	
MUNICIPAL ADDRESS	4120 RUSSELL RD, OTTAWA, ON
SITE INFORMATION	
LOT AREA: 46 652 m²	
LOT FRONTAGE: 195 m	
LOT DEPTH: 183 m /	
BUILDING INFORMATION	
BUILDING AREA: 8325m²	
BUILDING FLOOR AREA (GFA): 8325m²	
PROPOSED USE: LIGHT INDUSTRIAL BUILDING	

ZONING TABLE	IH	
CITY OF OTTAWA ZONING BY-LAW No. 2008-250	REQUIRED	PROPOSED
MINIMUM LOT AREA	4,000m²	46 652 m²
MINIMUM LOT WIDTH	No minimum	249 m
FRONT YARD SETBACK	7.5m	55 m
MINIMUM INTERIOR SIDE YARD SETBACK	7.5m	23m
MINIMUM REAR YARD SETBACK	7.5m	69 m
MAXIMUM BUILDING HEIGHT	22m	9.15m
MAXIMUM FLOOR SPACE INDEX	2	.18
PARKING AREA	N/A	2 711 m²
LANDSCAPED AREA (19 670 m2 OF LOT AREA)	0% of parking area (Section 110) 0% of Lot	476 m2 of parking area 17.8 % of parking area 42% of Lot area
VEHICLE PARKING REQUIREMENTS (AREA C, SCHEDULE 1A)	.8 per 100m2 of GFA 83 spaces required	86 new SPACES

SITE 2	
PROPERTY DESCRIPTION	
HEAVY OR LIGHT INDUSTRIAL BUILDING	
CITY OF OTTAWA PIN NUMBER	
MUNICIPAL ADDRESS	4120 RUSSELL RD, OTTAWA, ON
SITE INFORMATION	
LOT AREA: 74 718 m²	
LOT FRONTAGE: 198 m	
LOT DEPTH: 370 m /	
BUILDING INFORMATION	
BUILDING AREA: 17400m²	
BUILDING FLOOR AREA (GFA): 17400m²	
PROPOSED USE: LIGHT INDUSTRIAL BUILDING	

ZONING TABLE	IH	
CITY OF OTTAWA ZONING BY-LAW No. 2008-250	REQUIRED	PROPOSED
MINIMUM LOT AREA	4,000m²	74 718 m²
MINIMUM LOT WIDTH	No minimum	201 m
FRONT YARD SETBACK	7.5m	17.48 m
MINIMUM INTERIOR SIDE YARD SETBACK	7.5m	53.4m
MINIMUM REAR YARD SETBACK	7.5m	18.38 m
MAXIMUM BUILDING HEIGHT	22m	9.15m
MAXIMUM FLOOR SPACE INDEX	2	.23
PARKING AREA	N/A	4943.12m²
LANDSCAPED AREA (26 188 m2 OF LOT AREA)	0% of parking area (Section 110) 0% of Lot	844.29 m2 of parking area 17 % of parking area 35 % of Lot area
VEHICLE PARKING REQUIREMENTS (AREA C, SCHEDULE 1A)	.8 per 100m2 of GFA 126 spaces required	156 new SPACES

SITE 3	
PROPERTY DESCRIPTION	
HEAVY OR LIGHT INDUSTRIAL BUILDING	
CITY OF OTTAWA PIN NUMBER	
MUNICIPAL ADDRESS	4055 RUSSELL RD, OTTAWA, ON
SITE INFORMATION	
LOT AREA: 283 698 m²	
LOT FRONTAGE: 1 072 m	
LOT DEPTH: 337 m /	
BUILDING INFORMATION	
BUILDING AREA: 75 685 m²	
BUILDING FLOOR AREA (GFA): 75 685m²	
PROPOSED USE: LIGHT INDUSTRIAL BUILDING	

ZONING TABLE	IH	
CITY OF OTTAWA ZONING BY-LAW No. 2008-250	REQUIRED	PROPOSED
MINIMUM LOT AREA	4,000m²	283 698 m²
MINIMUM LOT WIDTH	No minimum	942 m
FRONT YARD SETBACK	7.5m	48.68 m
MINIMUM INTERIOR SIDE YARD SETBACK	7.5m	14.5m
MINIMUM REAR YARD SETBACK	7.5m	7.5 m
MAXIMUM BUILDING HEIGHT	22m	9.15m
MAXIMUM FLOOR SPACE INDEX	2	.26
PARKING AREA	N/A	21 604.30 m²
LANDSCAPED AREA (137 008.67 m2 OF LOT AREA)	0% of parking area (Section 110) 0% of Lot	1 950.70 m2 of parking area 9 % of parking area 48 % of Lot area
VEHICLE PARKING REQUIREMENTS (AREA C, SCHEDULE 1A)	.8 per 100m2 of GFA 601 spaces required	734 new SPACES

01 A101 SITE PLAN
1 = 2000

Architecte paysagiste
PROJET | PAYSAGE

Client
AVENUE 31

Architecte / Architect
figurr collectif d'architectes

Sceau / Seal

Note:

L'entrepreneur doit vérifier toutes les dimensions et informations sur le site et aviser immédiatement l'architecte de toutes erreurs ou omissions.

Contractor shall verify all information and dimensions on site and immediately report any errors or omissions to the architect.

Projet / Project

NATIONAL CAPITAL BUSINESS PARK

Titre / Title

SITE PLAN

Dessiné par / Drawn by: Author	No. projet / Project number: 1959	
Vérifié par / Verified by: Checker	No. dessin / Drawing number: A101	Révision: 0
Échelle / Scale: 1:2000		
Date: 2020-03-04		

City of Ottawa

Public Works and Services Department
Surface Operations Branch

Salt Management Plan
Appendix A

MATERIAL APPLICATION POLICY

CONTENT

The Surface Operations Branch District Managers, Area Managers and Zone Supervisors have been consulted through the development of this document.

REVISION INFO

Rev	Date	By	Description
3.1	Jan 10 2007		
3.2	Oct 31 2011	D Vander Wal	• Removed 50/50 mix per Dan O'Keefe. • Removed specific references to Sodium and Calcium Chloride as new product for 2011 is a Multi-Chloride Brine. Changed liquid application rate from 46 (6%) to 39L/tonne (5%). • Removed Dry and Wet salt rates for pavement temperatures below -18C. • Updated Epoke rates to match Appendix B and added wet rates to obtain 20% reduction when pre-wetting. • Removed separate rate table for Hwy 174 Epoke spreaders since the resulting lane-km rates are the same as other bare pavement.

COUNCIL APPROVED MAINTENANCE QUALITY STANDARDS

For snow clearing, resources are to be deployed and snow clearing completed as defined in the Table below. If the depth of snow accumulation is less than the minimum for deployment, then resources may be deployed subject to road conditions resulting from previous snow accumulations or from forecasted weather conditions.

For treating icy roads, resources are to be deployed as soon as practicable after becoming aware of the icy conditions. Icy roads are to be treated within the times defined in the Table below after becoming aware of the icy conditions.

MAINTENANCE QUALITY STANDARD SNOW AND ICE CONTROL ON ROADS					Treatment Standard		
Road Maintenance Class		**Road Type**	**Minimum Depth of Snow Accumulation for Deployment of Resources** ***(Depth as per MMSMH)***	**Time to Clear Snow Accumulation From the End of Snow Accumulation or Time to Treat Icy Conditions** ***(Time as per MMSMH)***	**Bare Pavement**	**Centre Bare**	**Snow Packed**
1	A	High Priority Roads	As accumulation begins *(2.5-8 cm depending on class)*	2 h *(3-4 h)*	√		
	B				√		
2	A	Most Arterials		3 h *(3-6 h)*	√		
	B				√		
3	A	Most Major Collectors		4 h *(8-12 h)*	√		
	B				√		
4	A	Most Minor Collectors	5 cm *(8 cm)*	6 h *(12-16 h)*	√		
	B					√	
	C						√
5	A, C	Residential Roads and Lanes	7 cm *(10 cm)*	10 h *(16-24 h)*			√
	B		10 cm *(not defined)*	16 h *(not defined)*			√

Note - MMSMH refers to Ontario Regulation 239/02, Minimum Maintenance Standards for Municipal Highways shown for comparison purposes.

- **Bare Pavement:** requires that snow and ice be controlled, cleared and/or prevented for the full traveled road pavement width, including flush medians of 2 m width or less, paved shoulders and/or adjacent cycling lanes. It does not include parking lanes.
- **Centre-Bare:** requires that snow and ice be controlled, cleared and/or prevented in a strip down the middle of the road pavement width for a minimum width of 2.5 m on each side of centre-line.
- **Snow-Packed:** requires that snow and ice be cleared and that ruts and/or potholes that may cause poor vehicle control be leveled off. Abrasive or deicing materials are applied at intersections, hills and sharp curves.

LIQUID CHEMICALS

Application Rates and Reductions

USE OF LIQUID CHEMICALS					
Chemical	**Use**	**Application Ratio**	**Chemical Concentration**	**Application Rate**	**Dry Salt Reduction**
CaCl, MgCl, or Multi-Chloride	Pre-Wetting	5% by weight	Varies (28%-35%)	39L / t	20%[1]
CaCl, MgCl, or Multi-Chloride	Straight Liquid Application	N/A	Varies	60 to 100L/ lane-km	-

[1] The Epoke controller does not support setting a separate reduction percentage – the rate will only be reduced by the set liquid application ratio (5%).

Pre-Wetted Salt

- Pre-wetting salt is a recommended practice to enhance the performance of the road salt.
- When salt is pre-wet, the brine solution is formed quicker than dry salt and more material is retained on the road surface. It is the brine solution that prevents or breaks the bond between the road surface and snow/ice.
- The enhanced performance of the salt as well as the retention of salt on the road surface facilitates achieving a bare road more quickly and maintains bare pavement longer. As a result, a reduction in salt application rates can achieve the same effectiveness as dry salt application at traditional rates.

Practical temperature ranges for Pre-Wetted Salt (WET SALT)

- Sodium Chloride Brine (NaCl):
  - From 0 to –9ºC (0 to -12ºC as per pre-wetting practices in urban areas)
- Calcium Chloride ($CaCl_2$), Magnesium Chloride (MgCl), and Multi-Chloride Brines with a minimum eutectic temperature of -30°C:
  - From 0 to –15ºC (0 to -18ºC as per pre-wetting practices in urban areas)

Direct Liquid Applications (DLA)

- Anti-icing by Direct Liquid Application is a recommended practice to treat frost and black ice conditions in the shoulder seasons at pavement temperatures between 0 and –10ºC.
- Liquid should be applied to treat forecasted conditions at the following rates:

Winter Event	**Litres / LaneKm**	**mL / m^2 (at 3m width)**
Frost	60	20
Light Snow	60 to 80	25
Moderate to Heavy Snow, Freezing Rain	80 to 100	30

- DLA should be applied:
  - As close to the beginning of the winter event as possible
  - When the air and pavement temperatures are both below +5°C currently and forecasted to remain below +5°C within the next 12 hours.
  - When the air and pavement temperatures are a minimum of 10°C above the eutectic temperature of the DLA liquid and forecasted to do so for the next 24 hours.
- DLA should NOT be applied:

  - When the relative humidity is below 60% and the air and pavement temperatures are between 0°C and +5°C.
  - More than once in a three-day period unless a Winter Event (frost, snow, freezing rain or rain) has removed the product from the pavement. Note that DLA liquid can remain on the pavement up to several days after the initial application.

GENERAL INFORMATION

When the Pavement Temperature is below –18ºC

- Below –18ºC, the salt melting action is close to none.
- Below –18ºC, the use of salt shall be discontinued and replaced by an abrasive.
- Multiple factors can affect the performance of de-icing chemicals and abrasives below pavement temperature of –18ºC. Under such conditions, supervisors shall select the most appropriate material based on the current and expected traffic volume, current and forecasted weather and road conditions.

Abrasives

- Accepted abrasives are Sand and Grit
- Straight abrasive does contain salt to prevent the stockpile from freezing. The goal is to minimize the amount of salt mixed with the abrasives. The objective is to use an engineered abrasive of 5% salt / 95% sand or grit by volume. The following interim abrasive ratios are accepted (where the engineered ratio cannot be achieved due to equipment and material storage constraints)
  - 10% salt / 90% sand or grit by volume

Rush Hours and Forecasted Conditions

- Supervisors are responsible for making timely material application calls based on forecasted conditions and expected traffic peak hours.

Freezing Rain

- When Freezing Rain occurs, abrasive materials (sand or grit) will be applied on snow packed roads on a continuous basis (to the full Road Width).
- Snow Packed Roads – where available, graders with ice blades shall drag the roads to aid traction.

MATERIAL APPLICATION POLICY BARE PAVEMENT					
Pavement Temperature ºC	**Material**	**Frost and Black Ice *Kg/2-lane km***	**Light Snow <1cm/hr *Kg/2-lane km***	**Heavy Snow >1cm/hr *Kg/2-lane km***	**Freezing Rain *Kg/2-lane km***
0 to –5ºC	DRY SALT	70	100	140	230
	WET SALT	55	80	110	185
-5 to –10ºC	DRY SALT	85	140	180	230
	WET SALT	70	110	145	185
-10 to –18ºC	DRY SALT	85	180	230	230
	WET SALT	70	145	185	185
< -18ºC*	ABRASIVE	350	350	350	-

* Refer to the General Information Section for additional information when the Pavement Temperature is below –18ºC. When forecasted warming conditions are expected, dry/wet rates of 180/145, and 230/185 may provide some baring-off benefit.
* Note: Use wet rates where pre-wetting capable spreaders and liquid supply is available.

<u>Timing of Application – BARE PAVEMENT ROADS</u>

Salt application at the start of the storm as accumulation begins

Spot application during the storm
In some extreme cases, salt could be applied during a storm to prevent the formation of snow pack

Salt application at the end of the storm, after roads have been plowed

Proactive approach – To create a Brine Solution to Prevent Snow-Pack

Start of Storm

Care of Trouble Spots
(Application of salt at Intersections, hills, sharp curves and turning lanes)

End of Storm

Final Pass –to bare the road using the right amount of salt

<u>Start of the Storm</u>
Salt shall be spread just at the beginning of the icy precipitation.

<u>End of Storm</u>
Salt shall not be spread once bare pavement is achieved and when no further precipitation is forecasted.

MATERIAL APPLICATION POLICY
BARE PAVEMENT
(EPOKE SPREADERS)

Pavement Temperature ºC	Material	Frost and Black Ice		Light Snow <1cm/hr		Heavy Snow >1cm/hr		Freezing Rain	
		g/m2	*Width*	*g/m2*	*Width*	*g/m2*	*Width*	*g/m2*	*Width*
0 to –5ºC	DRY Salt (WET Salt)*	70kg/2ln-km		100kg/2ln-km		140kg/2ln-km		230kg/2ln-km	
		35 (30)	2m	50 (43)	2m	70 (60)	2m	115 (98)	2m
		23 (20)	3m	35 (30)	3m	45 (38)	3m	77 (65)	3m
		17 (14)	4m	23 (20)	4m	35 (30)	4m	58 (49)	4m
		17 (14)	5m	20 (17)	5m	28 (24)	5m	45 (38)	5m
-5 to –10ºC	DRY Salt (WET Salt)*	85kg/2ln-km		140kg/2ln-km		180kg/2ln-km		230kg/2ln-km	
		45 (38)	2m	70 (60)	2m	90 (77)	2m	115 (98)	2m
		28 (24)	3m	45 (38)	3m	58 (49)	3m	77 (65)	3m
		20 (17)	4m	35 (30)	4m	45 (38)	4m	58 (49)	4m
		17 (14)	5m	28 (24)	5m	35 (30)	5m	45 (38)	5m
-10 to –18ºC	DRY Salt (WET Salt)*	85kg/2ln-km		180kg/2ln-km		230kg/2ln-km		230kg/2ln-km	
		45 (38)	2m	90 (77)	2m	115 (98)	2m	115 (98)	2m
		28 (24)	3m	58 (49)	3m	77 (65)	3m	77 (65)	3m
		20 (17)	4m	45 (38)	4m	58 (49)	4m	58 (49)	4m
		17 (14)	5m	35 (30)	5m	45 (38)	5m	45 (38)	5m
< -18ºC†	ABRASIVE	350kg/2ln-km		350kg/2ln-km		350kg/2ln-km		-	
		175	2m	175	2m	175	2m	-	-
		115	3m	115	3m	115	3m		
		88	4m	88	4m	88	4m		
		70	5m	70	5m	70	5m		

* When the pre-wetting system is engaged, the dry material output is reduced. The Epoke controller does not support setting a separate reduction percentage – the rate is only reduced by the set liquid application ratio (5%). Material 2 was therefore configured with rates reduced by 15%.
* Use wet rates where pre-wetting capable spreaders and liquid supply is available.
† Refer to the General Information Section for additional information when the Pavement Temperature is below –18ºC. When forecasted warming conditions are expected, dry/wet rates of 180/145, and 230/185 may provide some baring-off benefit.

Notes
There are 2 variables affecting the material output on an Epoke salt spreader:

-Material Application Rate in **g/m²** AND Application Width in **m**.

Examples:

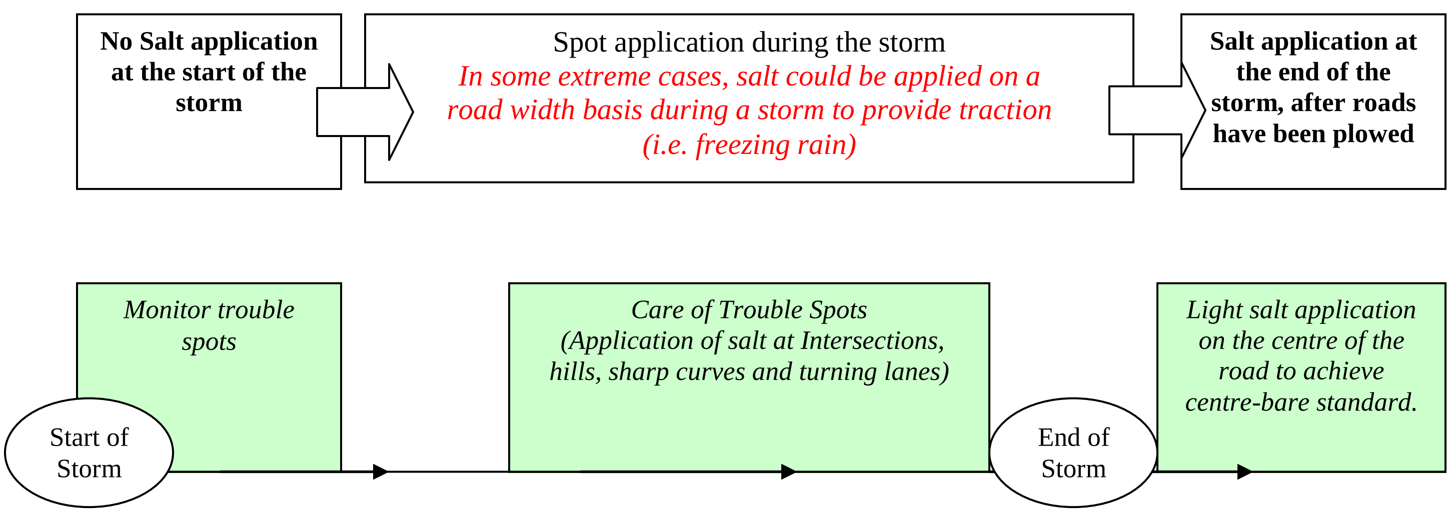
1- For a rate of 100kg/2ln-km, the Epoke Setup would be 25g/m² at a Width of 4m. **OR** a rate of 50g/m² at a Width of 2m.

2- For a rate of 170kg/2ln-km, the Epoke Setup would be 42g/m² at a Width of 4m. **OR** a rate of 57g/m² at a Width of 3m.

MATERIAL APPLICATION POLICY CENTRE-BARE PAVEMENT				
Pavement Temperature ºC	**Material**	**Frost and Black Ice** ***Kg/2-lane km***	**Snow** ***Kg/2-lane km***	**Freezing Rain** ***Kg/2-lane km***
0 to –5ºC	DRY SALT	70	100	230
	WET SALT	55	80	185
-5 to –18ºC	DRY SALT	85	140	230
	WET SALT	70	110	185
< -18ºC	ABRASIVE	350	350	-

Note: Use wet rates where pre-wetting capable spreaders and liquid supply is available.

Timing of Application – CENTRE-BARE PAVEMENT ROADS

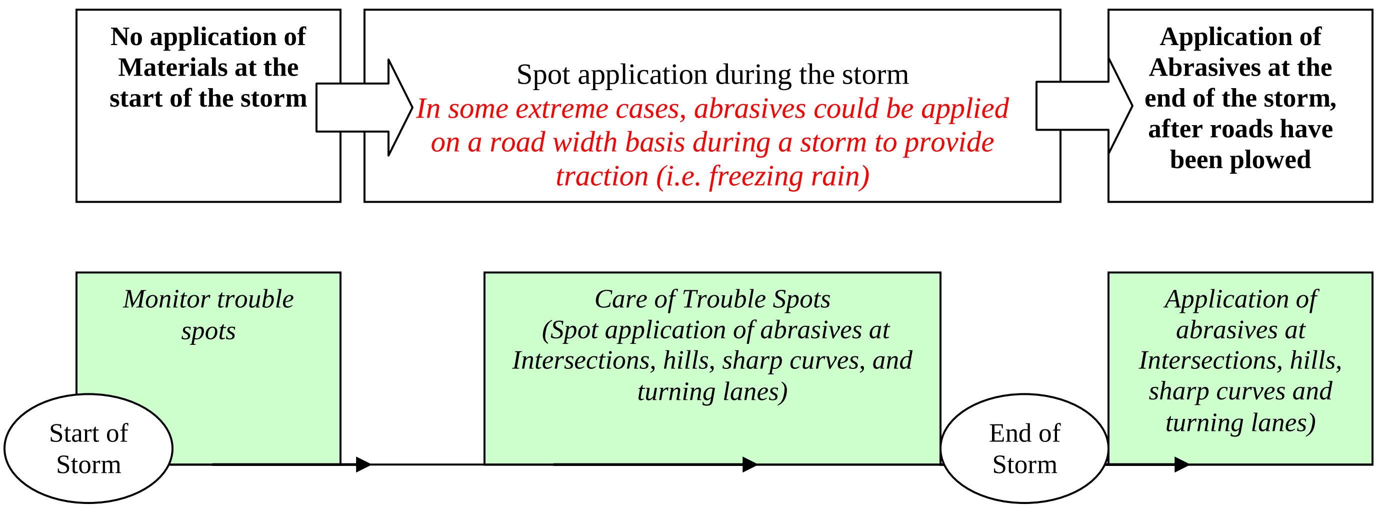


Start of the Storm
No Salt application at the start of the storm. Monitor trouble spots.

End of Storm
Salt shall not be spread once centre-bare pavement is achieved and when no further precipitation is forecasted.

MATERIAL APPLICATION POLICY (Intersections, Hills and Sharp Curves) SNOW PACKED				
Pavement Temperature ºC	**Material**	**Frost and Black Ice** *Kg/2-lane km*	**Snow** *Kg/2-lane km*	**Freezing Rain** *Kg/2-lane km*
0 to –30ºC and below	ABRASIVE	350	350	500

Timing of Application – SNOW PACKED ROADS



Start of the Storm
No application of abrasives at the start of the storm. Monitor trouble spots.

End of Storm
Abrasives shall not be spread once traction is provided.

BLASTING POLICY

The On-Board Electronic Controller's Blast function is an important tool for roadway de-icing operations. It allows operational staff to timely increase the amount of spread material at trouble locations such as steep hills and sharp curves. Although the blast function is indispensable, it should be used with care as it its liberal use can lead to significant increases in salt consumption and environmental impacts.

- Supervisory staff shall work toward minimizing the amount of salt being spread using the Blast function to achieve the required maintenance quality standard.
- Many variables come into play during a winter weather event. As such, the call to allow the use of the Blast Function during a winter event is left to the judgment of the supervisory staff, as the first priority is the safety of the traveling public.

The Blast function shall only be used at the following locations:

- Steep Hills
- Elevated Curves
- Intersections (within 30m of the stop line on the approach side only)
- Shade areas
- Right and Left Turning Lanes
- Bus Bays
- Railways (within 30m of the railway crossing on the approach side only)
- Bridge Decks

  Caution: when blasting salt on a bridge deck. Rock salt needs heat to dissolve. Spreading salt on a bridge deck could lower its surface temperature to a point where the brine solution will refreeze.

Application:

- The Blast function shall only be used under severe winter conditions
- The Blast function shall not be used during light winter weather events such as light snow, frost, etc.
- The blast function shall not be used while clearing the roads (stripping) at the end of a storm.

On-Board Electronic Controller's Blast function

- The Epoke controllers will blast at the highest material calibration setting.
- The CS-230 controller will blast to its maximum hydraulic power (which can be adjusted if too high)
- The CS-440 controller can be calibrated at a defined Blast rate for each material.
  - The Blast Rate for Salt is to be set at 300kg/2 lane-km
  - The Blast Rate for Abrasive is to be set at 500kg/2 lane-km. Note: Suburban/Rural District has a requirement to Blast Abrasives on gravel roads at a rate of 700kg/2 lane-km. To achieve this rate, the spreaders need to be calibrated using two gate settings. The District will provide, every fall, a list of spreaders requiring this specific calibration.