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Site Servicing and Stormwater Management Brief – 2070 Scott Street, Ottawa, ON

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1.0 INTRODUCTION AND OBJECTIVE

Stantec Consulting Ltd. has been retained by Azure Urban Developments Inc. to prepare the following site servicing and stormwater management (SWM) brief to satisfy the City of Ottawa Zoning and Site Plan Control Application process. The site is located at 2070/2090 Scott Street, in the south-east quadrant of the intersection of Churchill Avenue and Scott Street in the city of Ottawa (see **Figure 1** below).

The site proposed for re-development measures 0.19 ha. The proposed re-development area was previously occupied by a three-storey building, a one-storey car service station and paved parking areas. The proposed development consists of a twenty-three-storey commercial/residential building with 241 units, four levels of underground parking and associated access and servicing infrastructure. The proposed building will include retail space, indoor and outdoor amenity areas, 3 town-homes, 102 one-bedroom apartments, 76 two-bedroom apartments, 26 three-bedroom apartments, 34 studio apartments, underground parking and a bicycle storage room. The proposed site plan has been included in **Appendix B**.

Figure 1: Site Location

1.1 OBJECTIVE

This site servicing and SWM brief has been prepared to present a servicing scheme that is free of conflicts and which utilizes the existing infrastructure as obtained from available as-built drawings

and in consultation with City of Ottawa staff. Infrastructure requirements for water supply, sanitary and storm sewer services are presented in this report.

Criteria and constraints provided by the City of Ottawa have been used as a basis for the conceptual servicing design of the proposed development. Specific elements and potential development constraints to be addressed are as follows:

- Prepare a grading plan in accordance with the proposed site plan and existing grades.
- Storm Sewer Servicing
    - Define major and minor conveyance systems in conjunction with the proposed grading plan
    - Determine the stormwater management storage requirements to meet the allowable release rate for the site
    - Coordinate with mechanical engineer to convey drainage from roof tops, amenity areas, and private terrace areas to the internal cistern and discharge to the proposed storm service lateral at the allowable release rate.
    - Define and size the proposed storm service lateral that will be connected to the existing 675 mm diameter storm sewer on Winona Avenue.
- Wastewater Servicing
    - Define and size the sanitary service lateral which will be connected to the existing 225 mm diameter sanitary sewer on Winona Avenue.
- Water Servicing
    - Estimate water demands to characterize the proposed feed for the proposed development which will be serviced from the existing 200 mm diameter watermain on Scott Street and the 150 mm diameter watermain on Winona Avenue.
    - Watermain servicing for the development is to be able to provide average day and maximum day (including peak hour) demands (i.e. non-emergency conditions) at pressures within the acceptable range of 50 to 70 psi (350 to 480 kPa).
    - Under fire flow (emergency) conditions, the water distribution system is to maintain a minimum pressure greater than 20 psi (140 kPa).

The accompanying drawings included in the back of this report illustrate the proposed internal servicing scheme for the site.

2.0 REFERENCES

The following background studies have been referenced during the preliminary servicing design of the proposed site:

- *City of Ottawa Design Guidelines – Water Distribution*, City of Ottawa, July 2010
- *City of Ottawa Sewer Design Guidelines*, City of Ottawa, October 2012
- *Technical Bulletin ISDTB-2014-01,* City of Ottawa, February 2014
- *Technical Bulletin ISTB-2018-01*, City of Ottawa, March 21, 2018
- *Technical Bulletin ISTB-2018-02*, City of Ottawa, March 21, 2018
- *Technical Bulletin ISTB-2018-03*, City of Ottawa, March 21, 2018
- *Technical Bulletin PIEDTB -2016-01,* City of Ottawa, September 6, 2016
- *Geotechnical Investigation Proposed Multi-Storey Building 2070 Scott Street – Ottawa,* Paterson Group, July 26, 2019

3.0 WATER DISTRIBUTION

The proposed building is located in Pressure Zone 1W of the City of Ottawa's Water Distribution System. The proposed development will be serviced through the existing 200 mm diameter watermain on Scott Street and the 150 mm watermain on Winona Avenue as shown on the Site Servicing Plan (see **Drawing SSP-1**).

The proposed twenty-three-storey building is to be a high-rise commercial/residential building with retail space, four levels of underground parking, 3 town homes, and a mix of one-bedroom (136 units), two-bedroom (76 units) and three bedroom apartments (26 units) for a total of 241 units. The building is to have a total floor space of approximately 16,753 m^2 above grade.

Water demands were calculated using the City of Ottawa Water Distribution Guidelines (July, 2010) to determine the typical operating pressures to be expected at the building (see detailed calculations in **Appendix A**). A daily rate of 350 L/cap/day has been applied for the population of the proposed site. The average daily (AVDY) residential demand was estimated for an occupancy of 1.4 persons per unit for a one-bedroom apartment, 2.1 persons per unit for a two-bedroom apartment, 3.1 persons per unit for a three-bedroom apartment, and 2.7 persons per unit for townhomes. Water demands for the proposed retail space (601 m^2) were estimated based on 28,000 L/ha/day. Maximum day (MXDY) demands were determined by multiplying the AVDY demands by a factor of 2.5 for residential areas and by a factor of 1.5 for commercial areas. Peak hourly (PKHR) demands were determined by multiplying the MXDY demands by a factor of 2.2 for residential areas and by a factor of 1.8 for commercial areas. The estimated demands are summarized in **Table 1**.

Table 1: Estimated Water Demands

	Population/Area	AVDY (L/s)	MXDY (L/s)	PKHR (L/s)
Residential	439 persons	1.78	4.44	9.77
Commercial	601 m^2	0.02	0.03	0.05
Total Site:		**1.80**	**4.47**	**9.83**

The fire flow requirement was calculated in accordance with Fire Underwriters Survey (FUS) and determined to be approximately 6,000 L/min (100 L/s). The FUS estimate is based on a non-combustible construction building with a two-hour fire separation considered between each floor per requirements for buildings over six-storeys as per the Ontario Building Code (OBC), and vertical openings and external vertical communications properly protected (one-hour rating). As a result, the floor area was estimated as the area of the largest floor plus 25% of each of the two immediately adjoining floors. Additionally, it is anticipated that all buildings will be sprinklered, with final sprinkler design to conform to NFPA 13 (see detailed calculations in **Appendix A**).

Table 2 outlines the boundary conditions provided by the City of Ottawa on September 6, 2019 for the estimated water demands shown in **Table 1**.

Water Distribution

Table 2: Boundary Conditions

	Connection 1 (Scott Street)	Connection 2 (Winona Avenue)
Min. HGL (m)	108.7	108.7
Max. HGL (m)	115.0	115.0
Max. Day + Fire Flow (100 L/s)	109.0	95.0

The desired normal operating objective pressure range as per the City of Ottawa 2010 Water Distribution Design Guidelines is 350 kPa (50 psi) to 480kPa (70 psi) and no *less than 275kPa (40 psi)* at ground elevation. Furthermore, the maximum pressure at any point in the water distribution should not exceed 100 psi as per the Ontario Building/Plumbing Code; pressure reducing measures are required to service areas where pressures *greater than 552kPa (80 psi)* are anticipated.

The ground elevation at the intersection of Scott Street and Winona Avenue, close to where the proposed building is to be connected is approximately 63.60 m. With respect to the peak hour flow conditions, the resulting boundary condition HGL of 108.7 m corresponds to a peak hour pressure of 441 kPa (64 psi). Since the proposed building is a 23-storey building, an additional 34 kPa (5 psi) for every additional storey over two storeys is required to account for the change in elevation head and additional headloss. Given that the lowest pressure is expected to be 441 kPa (64 psi) at ground level, there will be insufficient pressure to reach the top floors and as a result, a pump will be required to maintain an acceptable level of service on the higher floors.

A maximum pressure check can be conducted using the building's lowest finished floor elevation (63.40 m for the townhomes) and the maximum boundary condition HGL of 115.0 m. This results in a pressure of 51.60 m, or 503 kPa (73 psi). This value is below the limit of 80 psi which would require pressure reducing valves.

In regard to available fire flow, boundary conditions provided by the City confirm that a flow rate of 6,000 L/min (100 L/s) would have a residual pressure of 441 kPa (64 psi) on Scott Street (ground elevation of 63.80 m), and a residual pressure of 310 kPa (45 psi) on Winona Avenue (ground elevation of 63.37 m). The fire flow rate should be achievable within the watermain at this proposed location while maintaining a residual pressure of 138kPa (20 psi).

In conclusion, based on the boundary conditions provided, the 200 mm diameter watermain on Scott Street and the 150 mm diameter watermain on Winona Avenue provide adequate fire flow capacity as per the Fire Underwriters Survey. In order to meet the City water supply objective that limits a single feed to 50 m^3/d during basic day demands, three connections are required to service the proposed building; two connections to the existing 200 mm diameter watermain on Scott Street separated by a new isolation valve, and a third connection to the 150 mm diameter watermain on Winona Avenue. The service connections will be capable of providing anticipated demands to the lower storeys but will require a booster pump to maintain minimum pressures of 350 kPa (50 psi) for floors 6 to 23.

4.0 SANITARY SEWER

As illustrated on **Drawing SSP-1**, sanitary servicing for the proposed development will be provided through a proposed 150 mm diameter service lateral connecting to the existing 225 mm diameter sanitary sewer running north on Winona Avenue. The 225 mm Winona Avenue public sewer ultimately discharges to a 375 mm diameter sanitary sewer at the intersection of Winona Avenue and Scott Street.

The proposed 0.19 ha re-development area will consist of a high-rise commercial/residential building with retail space, four levels of underground parking, 3 town homes, and a mix of one-bedroom (136 units), two-bedroom (76 units) and three bedroom apartments (26 units) for a total of 241 units. The anticipated wastewater peak flow generated from the proposed development is summarized in **Table 3** below while a sanitary sewer design sheet is included in **Appendix C**.

Table 3: Estimated Wastewater Peak Flow

Residential/Commercial Peak Flows					Infiltration Flow (L/s)	Total Peak Flow (L/s)
	# of Units/Area	Population	Peak Factor	Peak Flow (L/s)		
Residential	241 units	439	4.0	5.69	0.06	5.78
Commercial	0.060 ha	N/A	1.5	0.03		

1. Average residential flow based on 280 L/p/day
2. Peak factor for residential units calculated using Harmon's formula
3. Apartment population estimated based on 1.4 persons/unit for one-bedroom apartments , 2.1 persons/unit for two-bedroom apartments and 3.1 persons/unit for three-bedroom apartments
4. Townhome population estimated based on 2.7 persons/unit
5. Commercial peak flows estimated based on 28,000 L/ha/day
6. Infiltration flow based on 0.33 L/s/ha.

The proposed sewage peak flows were provided to City of Ottawa staff to conduct a capacity analysis of the sanitary sewer system in the vicinity of the site and confirmation was received that there are no concerns with respect to adding the proposed sanitary peak flows to the existing sewers on Winona Avenue and Scott Street (see correspondence in **Appendix G**).

Detailed sanitary sewage calculations are included in **Appendix C**. A backflow preventer will be required for the proposed building in accordance with the Ottawa sewer design guide and will be coordinated with building mechanical engineers.

All underground parking drains should be connected to the internal building plumbing. A sump pump will be required to drain the underground parking levels to the existing sanitary sewer on Winona Avenue.

4.1 SANITARY SEWER DESIGN CRITERIA

As outlined in the City of Ottawa Sewer Design Guidelines and the MECP's Design Guidelines for Sewage Works, the following criteria were used to calculate estimated wastewater flow rates and to size the sanitary sewer lateral:

- Minimum Velocity – 0.6 m/s (0.8 m/s for upstream sections)
- Maximum Velocity – 3.0 m/s
- Manning roughness coefficient for all smooth wall pipes – 0.013
- 1.4 persons/one-bedroom apartment
- 2.1 persons/two-bedroom apartment
- 3.1 persons/three-bedroom apartment
- 2.7 persons/townhome
- 28,000 L/ha/day for commercial areas
- Harmon's Formula for Residential Peak Factor – Max = 4.0
- Commercial Peak Factor of 1.5
- Extraneous Flow Allowance – 0.33 L/s/ha (conservative value)
- Manhole Spacing – 120 m
- Minimum Cover – 2.5 m

5.0 STORMWATER MANAGEMENT

5.1 OBJECTIVES

The objective of this stormwater management plan is to determine the measures necessary to control the quantity of stormwater released from the proposed development to the required levels and to provide sufficient detail for approval and construction.

5.2 EXISTING CONDITIONS

The proposed re-development area was previously occupied by a three-storey building, a one-storey car service station and paved parking areas. The previous site located at the intersection of Churchill Avenue and Scott Street was serviced through the existing 900 mm diameter storm sewer on Scott Street and included a network of catchbasins that captured runoff from paved parking areas. Similarly, the previous site located at the intersection of Winona Avenue and Scott Street was serviced through the existing 675 mm diameter storm sewer on Winona Avenue and included a network of catchbasins that captured runoff from paved parking areas (see **Drawing EX-1**).

City of Ottawa staff recommended stormwater management peak flows from the proposed site be restricted to the 2-year with a runoff coefficient of 0.60. The proposed 2070 Scott Street re-development encompasses approximately 0.19 ha of land which assuming a time of concentration (Tc) of 10 minutes results in an allowable peak outflow of Q = 2.78 x C x I x A = 2.78 x 0.60 x 76.81 x 0.187 = **24.0 L/s**

5.3 SWM CRITERIA AND CONSTRAINTS

The stormwater management criteria for the proposed site are based on City of Ottawa Sewer Design Guidelines (2012) and on consultation with City of Ottawa Staff. The following summarizes the criteria used in the preparation of this stormwater management plan:

- Control post development peak flows up to the 100-year storm to the 2-year runoff with a runoff coefficient (C) of 0.60 which corresponds to **24.0 L/s**.
- Size storm sewers using an inlet time of concentration (Tc) of 10 minutes
- Post-development runoff coefficient (C) value based on proposed impervious areas as per site plan drawing (see **Appendix B**)

5.4 STORMWATER MANAGEMENT DESIGN

The proposed 0.19 ha re-development area consists of 3 town homes, retail space, and a mix of one-bedroom (136 units), two-bedroom (76 units) and three bedroom apartments (26 units) for a

total of 241 units, underground parking, and associated access infrastructure. The imperviousness of the proposed site is 93% (C = 0.85).

The SWM strategy for the site is to provide an underground cistern to attenuate peak flows in the downstream system to the allowable release rate of 24.0 L/s. The proposed building will capture storm drainage through a combination of uncontrolled roof drains, a trench drain along the southern sidewalk, and area drains that will direct peak flows to a cistern located in the underground parking for attenuation. Controlled peak flows from the cistern will be pumped at the north east corner of the building and ultimately discharged into the existing 675 mm diameter storm sewer on Winona Avenue. Coordination with the mechanical consultant has been ongoing and current plans have been provided and flows identified to size the internal system and the underground cistern.

The proposed site plan, drainage areas and proposed storm sewer infrastructure are shown on **Drawing SD-1**.

5.4.1 Design Methodology

The intent of the stormwater management plan presented herein is to mitigate any negative impact that the proposed development could have on the existing drainage and storm sewer infrastructure, while providing adequate capacity to service the proposed building, parking and access areas. The proposed stormwater management plan is designed to detain runoff in an underground cistern to ensure that peak flows after construction from the proposed re-development area will not exceed the target release rate for the site.

A portion of the site could not be graded to enter the building's internal plumbing system and as such it will sheet drain uncontrolled. Runoff from these uncontrolled area is included in the overall site discharge calculations.

5.4.2 Water Quantity Control

The Modified Rational Method was used to assess the quantity and volume of runoff generated during post development conditions. The site was subdivided into subcatchments (subareas) tributary to storm sewer inlets, as defined by the location of catchbasins / inlet grates, and used in the storm sewer design (see **Appendix D**). A summary of subareas and runoff coefficients is provided in **Appendix D**, and **Drawing SD-1** indicates the stormwater management subcatchments.

5.4.3 Allowable Release Rate

Site discharge rates up to the 100-year storm event are to be restricted to the 2-year storm event with a runoff coefficient ('C' value of 0.60) as outlined below in **Table 4**.

Table 4: Target Release Rate

Rational Method 'C'	Area (ha)	Time of Concentration (min)	Q_{Target} (L/s)
0.60	0.187	10	24.0

5.4.4 Storage Requirements

The site requires quantity control measures to meet the stormwater release criteria. Therefore, it is proposed to use underground storage in a cistern located in the underground parking. Stormwater management calculations are provided in **Appendix D**.

5.4.4.1 Subsurface Storage

It is proposed to detain stormwater within a 54 m^3 cistern below grade with a maximum controlled release rate of 9.4 L/s to the gravity service provided. The modified rational method was used to determine the peak volume requirement for the cistern. Site drainage areas are captured into the building plumbing directed to the cistern for additional control.

Table 5 and **Table 6** summarize the flow rates and storage from the cistern for the 2 and 100 year events respectively.

Table 5: Peak Controlled (Tributary) 2-Year Release Rate

Area ID	Area (ha)	Runoff 'C'	$Q_{release}$ (L/s)	V_{stored} (m^3)
BLDG1, BLDG2, BLDG3, TRENCH, ROOF1, ROOF2	0.153	0.89	9.4	12.3

Table 6: Peak Controlled (Tributary) 100-Year Release Rate

Area ID	Area (ha)	Runoff 'C'	$Q_{release}$ (L/s)	V_{stored} (m^3)
BLDG1, BLDG2, BLDG3, TRENCH, ROOF1, ROOF2	0.153	1.00	9.4	54.0

5.4.5 Uncontrolled Area

A portion of the site around the building (see **Drawing SD-1**) could not be graded to enter the building's internal plumbing system and as such it will sheet drain uncontrolled. **Table 7** and **Table 8** summarize the 2 and 100-year uncontrolled release rates from the proposed development.

Table 7: Peak Uncontrolled (Non-tributary) 2-Year Release Rate

Area ID	Area (ha)	Runoff 'C'	Tc (min)	$Q_{release}$ (L/s)
UNC-1	0.034	0.69	10	5.0

Table 8: Peak Uncontrolled (Non-tributary) 100-Year Release Rate

Area ID	Area (ha)	Runoff 'C'	Tc (min)	$Q_{release}$ (L/s)
UNC-1	0.034	0.86	10	14.6

5.4.6 Results

Table 9 and **Table 10** demonstrate that the proposed stormwater management plan provides adequate attenuation storage to meet the target peak outflow for the site.

Table 9: Estimated Discharge from Site (2-Year)

Area Type	$Q_{release}$ (L/s)	Target (L/s)
Controlled Cistern Discharge	9.4	**24.0**
Uncontrolled Sheet Flow	5.0	
Total	**14.4**	

Table 10: Estimated Discharge From Site (100-Year)

Area Type	$Q_{release}$ (L/s)	Target (L/s)
Controlled Cistern Discharge	9.4	**24.0**
Uncontrolled Sheet Flow	14.6	
Total	**24.0**	

6.0 GRADING AND DRAINAGE

The proposed re-development site measures approximately 0.19 ha in area. A detailed grading plan (see **Drawing GP-1**) has been provided to satisfy the stormwater management requirements and to provide sufficient cover over top of the underground parking garage.

The subject site maintains emergency overland flow routes to the streets surrounding the site as depicted on **Drawings GP-1** and **SD-1**.

7.0 UTILITIES

All utilities (Hydro Ottawa, Bell Canada, Rogers Ottawa, and Enbridge Gas) have existing plants in the area. The site will be serviced through connection to these existing services. Detailed design of the required utility services will be further investigated as part of the composite utility planning process following design circulation.

8.0 EROSION CONTROL DURING CONSTRUCTION

Erosion and sediment controls must be in place during construction. The following recommendations to the contractor will be included in contract documents.

1. Implement best management practices to provide appropriate protection of the proposed drainage system and the receiving water course(s).
2. Limit extent of exposed soils at any given time.
3. Re-vegetate exposed areas as soon as possible.
4. Minimize the area to be cleared and grubbed.
5. Protect exposed slopes with plastic or synthetic mulches.
6. Provide sediment traps and basins during dewatering.
7. Install sediment traps (such as SiltSack® by Terrafix) between catch basins and frames.
8. Plan construction at proper time to avoid flooding.
9. Installation of a mud matt to prevent mud and debris from being transported off site.
10. Installation of a silt fence to prevent sediment runoff.

The contractor will, at every rainfall, complete inspections and guarantee proper performance. The inspection is to include:

1. Verification that water is not flowing under silt barriers.
2. Clean and change silt traps at catch basins.

Refer to **Drawing EC/DS-1** for the proposed location of silt fences, and other erosion control structures.

9.0 GEOTECHNICAL INVESTIGATION

A geotechnical report for the site was prepared by Paterson Group in July 2019 (see **Appendix E**). As stated in the geotechnical report, the subsurface profile across the site generally consists of fill underlying the existing crushed stone surface or 80 to 150 mm thick asphalt surface. The fill material extended to approximate depths of 1.4 to 3.8 m below the existing ground surface and generally consisted of loose to dense, brown silty sand to silty clay with trace to some gravel, cobbles, boulders, and construction debris such as glass, wood chips, brick, and concrete.

Practical refusal to augering or excavation was encountered at the test holes at depths of 1.4 to 3.8 m below the existing ground surface. Bedrock was cored to depths of 7.7 to 13.5 m, and consisted of a poor to excellent quality limestone to limestone with interbedded dolostone and shale.

Groundwater levels were measured in April 2013 and in May 2019 and were found to range between 5.3 m and 7.1 m below ground surface elevation.

Bedrock removal will be required to complete the four (4) levels of underground parking. The geotechnical report recommended line drilling with hoe-ramming and controlled blasting to remove the bedrock. The report also recommended that prior to considering blasting operations, the effects on the existing services, buildings and other structures should be addressed.

An alignment of a large diameter watermain runs along Scott Street. It is expected that the adjacent watermain could be subjected to potential vibrations associated with the bedrock blasting program. To ensure that no detrimental vibrations cause damage to the adjacent watermain, a vibration attenuation trench is recommended for the bedrock along the north excavation face, as well as a vibration monitoring and control program during the blasting and excavation work required for the proposed building excavation (please refer to the Geotechnical report included in **Appendix E** for details).

Given that the proposed building is to have more than 2 underground parking levels, the geotechnical report recommended the following water suppression system to manage and control groundwater water infiltration over the long term. The water suppression system would be installed for the exterior foundation walls and underfloor drainage and would consist of the following (refer to Figure 4 - Water Suppression System in Appendix 2 of the Geotechnical report included in **Appendix E** for an illustration of this system cross-section):

- A concrete mud slab creating a horizontal hydraulic barrier to lessen the water infiltration at the base of the excavation. The thickness of the concrete mud slab will be determined during the excavation program when realistic groundwater infiltration can be properly assessed. However for preliminary design purposes, it is recommended that the concrete mud slab be designed at a minimum thickness of 150 mm.

- A waterproofing membrane to lessen the effect of water infiltration for the lower underground parking level(s) starting at 6 m below finished grade. The waterproofing membrane will consist of a bentonite waterproofing such as Tremco Paraseal or equivalent securely fastened to the temporary shoring system or the vertical bedrock surface. The membrane should extend to the bottom of the excavation at the founding level and extend horizontally over the concrete mud slab a minimum of 300 mm prior to the placement of the footings. Consideration can be given to doubling the bentonite waterproofing panels within the lower portion of the underground parking levels where hydrostatic pressure will be greater.

For foundation drainage, the geotechnical report recommended that a composite drainage layer be placed from finished grade to the bottom of the foundation wall. Where the proposed building is to have more than 2 underground parking levels and the water suppression system is employed, the composite drainage layer should be placed between the waterproofing membrane and the foundation wall.

It is recommended that the composite drainage system consist of DeltaDrain 6000, MiraDrain G100N or an approved equivalent. It is expected that 150 mm diameter sleeves placed at 3 m centres be cast in the foundation wall at the footing interface to allow the infiltration of water to flow to an interior perimeter drainage pipe. The perimeter drainage pipe should direct water to the sump pit(s) within the lower basement area.

Underfloor drainage will be required to control water infiltration below the lowest underground parking level slab. For design purposes, the geotechnical report recommended that 150 mm diameter perforated pipes be placed at approximate 6 m spacing underlying the lowest level floor slab. The final spacing of the underfloor drainage system should be confirmed at the time of completing the excavation when water infiltration can be better assessed.

The contractor should be prepared to direct water away from all bearing surfaces and subgrades, regardless of the source, to prevent disturbance to the founding medium. Infiltration levels are anticipated to be low through the excavation face. The groundwater infiltration will be controllable with open sumps and pumps. A temporary MECP permit to take water (PTTW) may be required for this project if more than 400,000 L/day of ground and/or surface water are to be pumped during the construction phase. A minimum of four to five months should be allocated for completion of the application and issuance of the permit by the MECP.

The geotechnical report recommended that any groundwater encountered along the building's perimeter or sub-slab drainage system be directed to the proposed building's cistern/sump pit. Due to the limited capacity of the existing sewers, it is anticipated that pumped groundwater can be temporarily contained within a cistern/holding tank to permit reduced discharge volumes, if required. Provided the proposed groundwater infiltration control system is properly implemented where more than 3 underground parking levels are built, it is expected that groundwater flow will be low (i.e.- less than 3,000 L/day) with peak periods noted after rain

events. It is anticipated that the groundwater flow will be controllable using conventional open sumps.

10.0 CONCLUSIONS

10.1 WATER SERVICING

The 200 mm diameter watermain on Scott Street and the 150 mm diameter watermain on Winona Avenue provide adequate fire flow capacity as per the Fire Underwriters Survey. In order to meet the City water supply objective that limits a single feed to 50 m^3/d during basic day demands, three connections are required to service the proposed building; two connections to the existing 200 mm diameter watermain on Scott Street and one connection to the 150 mm diameter watermain on Winona Avenue. The service connection will be capable of providing anticipated demands to the lower storeys but will require a booster pump to maintain minimum pressures of 350 kPa (50 psi) for floors 6 to 23.

10.2 SANITARY SERVICING

The proposed sanitary sewer lateral is sufficiently sized to provide gravity drainage for the site. The proposed site will be serviced by a 150 mm diameter service lateral directing wastewater flows to the existing 225 mm diameter sanitary sewer on Winona Avenue. A backflow preventer will be required for the proposed building in accordance with the Ottawa sewer design guide and will be coordinated with building mechanical engineers.

10.3 STORMWATER SERVICING

The proposed stormwater management plan is in compliance with the goals specified through consultation with the City of Ottawa, as well as local standards. Underground storage will be provided within a cistern located in the underground parking. Post development peak flows from the overall site up to the 100-year storm will be restricted to the target release rate. An underground pump will be required to direct flows from the internal building drainage system to the proposed gravity service connected to the existing 675 mm diameter storm sewer running north on Winona Avenue and ultimately discharging into the Scott Street storm sewer.

10.4 GRADING

Erosion and sediment control measures will be implemented during construction to reduce the impact on existing infrastructure. An alignment of a large diameter watermain runs within Scott Street, along the northern property line. It is expected that the adjacent watermain could be subjected to potential vibrations associated with the bedrock blasting program. To ensure that no detrimental vibrations cause damage to the adjacent watermain, a vibration attenuation trench is recommended for the bedrock along the north excavation face, as well as a vibration monitoring and control program during the blasting and excavation work required for the proposed building excavation.

10.5 UTILITIES

All utilities (Hydro Ottawa, Bell Canada, Rogers Ottawa, and Enbridge Gas) have existing plants in the subject area. Exact size, location and routing of utilities will be finalized after design circulation.

10.6 APPROVAL / PERMITS

Ministry of the Environment Conservation and Parks (MECP) Environmental Compliance Approvals (ECA) are not expected to be required for the subject site as the site is private and will remain under singular ownership. A Permit to Take Water may be required for pumping requirements for construction of underground parking level. No other approval requirements from other regulatory agencies are anticipated.

APPENDICES

Appendix A WATER CALCULATIONS

2090 Scott Street - Domestic Water Demand Estimates

Population densities as per City Guidelines:

1 Bedroom Apt	1.4	ppu
2 Bedroom Apt	2.1	ppu
3 Bedroom Apt	3.1	ppu
Townhouse	2.7	ppu

Demand conversion factors as per City Guidelines:

Residential	350	L/c/d
Commercial	28 000	L/ha-day

Building ID	Area (m^2)	Population	Daily Rate of Demand	Avg Day Demand		Max Day Demand [1]		Peak Hour Demand [2]	
				(L/min)	(L/s)	(L/min)	(L/s)	(L/min)	(L/s)
Commercial	601	-	2.8	1.2	0.02	1.8	0.03	3.2	0.05
Residential	-	439	350	106.6	1.78	266.6	4.44	586.5	9.77
Total Site :				**107.8**	**1.80**	**268.3**	**4.47**	**589.6**	**9.83**

For the purpose of this study it is predicted that retail and office facilities will be operated 12 hours per day.

Water demand criteria used to estimate peak demand rates for residential areas are as follows:

1 maximum day demand rate = 2.5 x average day demand rate

2 peak hour demand rate = 2.2 x maximum day demand rate

Water demand criteria used to estimate peak demand rates for commercial areas are as follows:

1 maximum day demand rate = 1.5 x average day demand rate

2 peak hour demand rate = 1.8 x maximum day demand rate

FUS Fire Flow Calculation Sheet

Stantec Project #: 160410249
Project Name: 2070 Scott Street
Date: 10/2/2019
Fire Flow Calculation #: 1
Description: Mixed Use Apartment Building

Notes: Floor assembly to be 2hour fire seperation as per OBC 3.2.2.42

Step	Task	Notes	Value Used	Req'd Fire Flow (L/min)
1	Determine Type of Construction	Non-Combustible Construction	0.8	-
2	Determine Ground Floor Area of One Unit	-	1991	-
	Determine Number of Adjoining Units	-	1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space	1	-
4	Determine Required Fire Flow	(F = 220 x C x $A^{1/2}$). Round to nearest 1000 L/min	-	8000
5	Determine Occupancy Charge	Limited Combustible	-15%	6800
6	Determine Sprinkler Reduction	Conforms to NFPA 13	-30%	-2720
		Standard Water Supply	-10%	
		Not Fully Supervised or N/A	0%	
		% Coverage of Sprinkler System	100%	

7	Determine Increase for Exposures (Max. 75%)	Direction	Exposure Distance (m)	Exposed Length (m)	Exposed Height (Stories)	Length-Height Factor (m x stories)	Construction of Adjacent Wall	-	-
		North	> 45	46	3	> 120	Wood Frame or Non-Combustible	0%	2244
		East	20.1 to 30	22.5	4	61-90	Ordinary or Fire-Resistive with Unprotected Openings	8%	
		South	3.1 to 10	55	2	91-120	Wood Frame or Non-Combustible	20%	
		West	30.1 to 45	28	2	31-60	Wood Frame or Non-Combustible	5%	

8	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min	6000
		Total Required Fire Flow in L/s	100.0
		Required Duration of Fire Flow (hrs)	2.00
		Required Volume of Fire Flow (m^3)	720

From: Wu, John
To: Odam, Cameron
Subject: RE: 2090 Scott Street - Hydraulic Boundary Conditions Request
Date: Friday, September 06, 2019 10:15:59 AM
Attachments: 2070 Scott Option 1 Sept 2019.pdf
2070 Scott Option 2 Sept 2019.pdf

Here is the result:

The following are boundary conditions, HGL, for hydraulic analysis at 2070 Scott (zone 1W) assumed to be connected to:

Option 1: 203mm on Scott (Connection 1) and 406mm on Churchill (Connection 2)

Option 2: 203mm on Scott (Connection 1) and 152mm on Winona (Connection 2)

Option 1:

	Connection 1 (Scott)	Connection 2 (Churchill)
Min HGL	108.7m	108.7m
Max HGL	115.0m	115.0m
Max day + FireFlow (100 L/s)	109.0m	110.0m

Option 2:

	Connection 1 (Scott)	Connection 2 (Winona)
Min HGL	108.7m	108.7m
Max HGL	115.0m	115.0m
Max day + FireFlow (100 L/s)	109.0m	95.0m

These are for current conditions and are based on computer model simulation.

Disclaimer: The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation.

John

From: Odam, Cameron <Cameron.Odam@stantec.com>
Sent: September 4, 2019 2:24 PM
To: Wu, John <John.Wu@ottawa.ca>
Cc: Paerez, Ana <Ana.Paerez@stantec.com>; Kilborn, Kris <kris.kilborn@stantec.com>
Subject: RE: 2090 Scott Street - Hydraulic Boundary Conditions Request

John,

Thanks for pointing that out. As per page 17 of the FUS guidelines, based on the proposed building being fire resistant with adequate protection of the vertical openings, we have now adjusted the area to be equal to the largest floor area (floor 1), with the addition of 25% of the two nearest adjoining floor areas, floor 2 and floor 3 (floor 3 was taken given the basement floors are not to be considered).

Best,

Cameron

From: Wu, John <John.Wu@ottawa.ca>
Sent: Wednesday, September 04, 2019 1:32 PM
To: Odam, Cameron <Cameron.Odam@stantec.com>
Subject: RE: 2090 Scott Street - Hydraulic Boundary Conditions Request

You're A is not right, either use the total area including all areas, or for fire resistant building at least is one floor adding 50% of it's top and 50% of its under ,therefore, it is at least of 2 of ground floor, please read the page 17 in FUS method.

John

From: Odam, Cameron <Cameron.Odam@stantec.com>
Sent: September 4, 2019 1:26 PM
To: Wu, John <John.Wu@ottawa.ca>
Cc: Kilborn, Kris <kris.kilborn@stantec.com>; Paerez, Ana <Ana.Paerez@stantec.com>
Subject: RE: 2090 Scott Street - Hydraulic Boundary Conditions Request

Hi John,

As per your request I have attached the FUS calculation sheet that indicates a fire flow of 4 000 L/min (66.7 L/s)

Please let me know if there is any further information you require at any point.

Best,

Cameron

From: Wu, John <John.Wu@ottawa.ca>
Sent: Wednesday, September 04, 2019 10:57 AM
To: Odam, Cameron <Cameron.Odam@stantec.com>
Subject: RE: 2090 Scott Street - Hydraulic Boundary Conditions Request

Please use FUS method for fire flow calculation.

John

From: Odam, Cameron <Cameron.Odam@stantec.com>
Sent: September 4, 2019 10:30 AM
To: Wu, John <John.Wu@ottawa.ca>
Cc: Kilborn, Kris <kris.kilborn@stantec.com>
Subject: 2090 Scott Street - Hydraulic Boundary Conditions Request

Hi John,

Would you be able to provide me with watermain hydraulic boundary conditions for the proposed site located at 2090 Scott Street? The site consists of a proposed 23 storey mixed use building over a 3 storey underground parking lot. The water service connection location to the building has yet to be finalized but will tie into either the existing 400mm watermain on Churchill Avenue, the 200mm on Scott Street or the 150mm WM on Winona Avenue (within the right of way, adjacent to the site).

It is still in discussion with the architect as to which 2 of the 3 locations will be the confirmed connection points. However, if you can provide all three that would be appreciated.

We have attached the OBC fire flow calculations for the proposed building as there is no private watermain required on site and will use existing municipal hydrants. A site location map with the approximate proposed connection point is also attached

Estimated domestic demands and fire flow requirements for the site are as follows:

Average Day Demand	– 1.77 L/s
Max Day Demand	- 4.41 L/s
Peak Hour Demand	- 9.70 L/s

Fire Flow Requirement per OBC –150 L/s *(9 000 L/min)*

Thanks,

Cameron

Cameron Odam

Direct: +16137244353
Fax: +16137222799
Cameron.Odam@stantec.com

Stantec
400 - 1331 Clyde Avenue
Ottawa ON K2C 3G4

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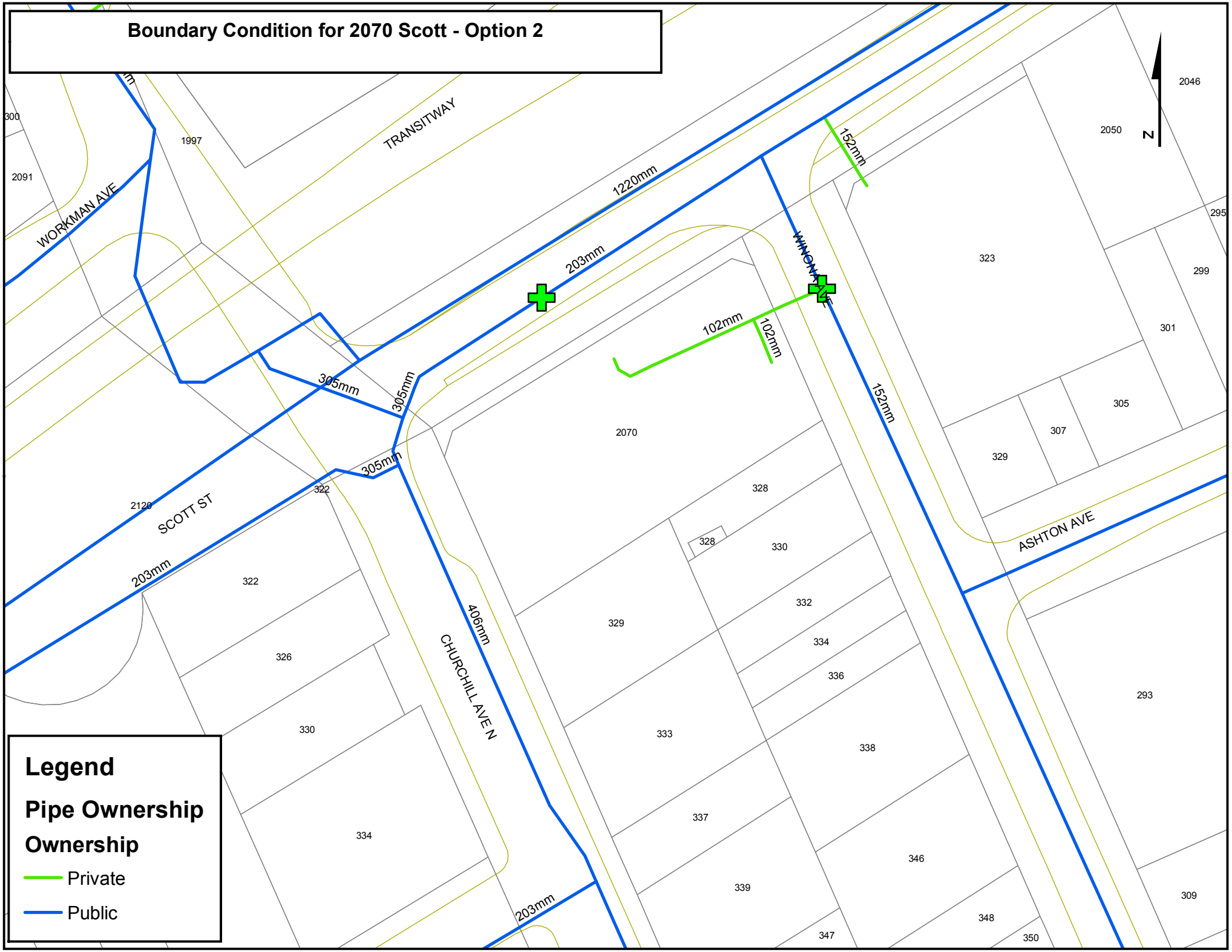
Boundary Condition for 2070 Scott - Option 2
TRANSITWAY
WORKMAN AVE
SCOTT ST
CHURCHILL AVE N
ASHTON AVE
WINONA AVE
1220mm
203mm
305mm
305mm
305mm
203mm
406mm
203mm
152mm
152mm
102mm
102mm
2046
2050
2091
1997
2120
2070
323
295
299
301
305
307
329
328
330
332
334
336
322
326
330
334
329
333
337
339
338
346
293
309
348
347
350
Legend
Pipe Ownership
Ownership
Private
Public

Appendix B PROPOSED SITE PLAN

Quadrangle

Quadrangle Architects Limited
901 King Street West, Suite 701Toronto, ON M5V 3H5
t 416 598 1240 www.quadrangle.ca

2070 Scott Street

Ottawa, ON

for
Azure Urban Developments Inc.

Project No. 19023
Date 2019-09-XX
Issued for

ARCHITECTURAL DRAWINGS

PLANNER	SITE SERVICING - CIVIL	URBAN DESIGN & LANDSCAPE ARCHITECT	INTERIOR DESIGN
STANTEC	STANTEC	STANTEC	Enter interior design consultant name and address here

PROJECT STATISTICS SUMMARY		
Municipal Address:	2070 Scott Street, Ottawa, Ontario	
Lot Area	1868.5 sm	
Zoning By-Law 2008-326		
Average Grade:	64.35 m	
Building Height (Storeys): (excl. Mech Penthouse)	23	
Building Height above Average Grade: (excl. Mech Penthouse)	72.45 m	
GBA - Residential Uses	16,237 sm	174,773 sf
GBA - Non-Residential Uses	516 sm	5,554 sf
Total GFA	16,753 sm	216,613 sf
Floor Space Index (FSI)	9.0	
Number of Residential Suites	241	
Min. Residential Amenity Space Required	1,446 sm	15,565 sf
Total Residential Interior Amenity Space Provided	431 sm	4,639 sf
Total Residential Outdoor Amenity Space Provided	1,015 sm	10,471 sf
Total Residential Amenity Space Provided	1,446 sm	12,215 sf
Vehicular Parking Total Required	144	
Vehicular Parking Total Provided	144	
Bicycle Parking Total Required	123	
Bicycle Parking Total Provided	123	

	Floor	GBA/Typ. Floor (sm)	No. Floors	GBA Gross Building Area (no exclusions)		2008-326 GFA Exempt	By-Law 2008-326 GFA Residential		Indoor Amenity [Private]		Indoor Amenity [Common]		Outdoor Amenity [Private]		Outdoor Amenity [Public Landscape]		Retail	
				sm	sf	sm	sm	sf	sm	sf	sm	sf	sm	sf	sm	sf	sm	sf
PODIUM / TOWER	Mech.Ph	423	1	423	4,553	372	51	545	156	1,679			311	3,348				
	Upper Typ. Tower	*757*	*1*	*757*	*8,148*	*99*	*658*	*7,079*										
	Typ. 16 - 23	757	8	6,056	65,186	795	5,261	56,631										
	Lower Typ. Tower	*757*	*1*	*757*	*8,148*	*99*	*658*	*7,079*										
	Typ. 7 - 15	757	9	6,813	73,335	894	5,919	63,710										
	6	757	1	757	8,148	286	471	5,066	190	2,045			401	4,316				
	Typ. Podium	*1,145*	*1*	*1,145*	*12,325*	*120*	*1,025*	*11,029*										
	Typ. 3-5	1,145	3	3,435	36,974	361	3,074	33,088					77	827				
	2	1,145	1	1,145	12,325	130	1,015	10,922					42	450				
	TH Level 2	168	1	168	1,808	0	168	1,808										
	Ground Floor	1,327	1	1,327	14,284	532	279	3,003			85	915			184	1,981	516	5,554
TOTALS			23	20,124	216,613		16,237	174,773	346	3,724	85	915	831	8,491	184	1,981	516	5,554

Suite Breakdown								
1 Bdrm	1 Bdrm + D	2 Bdrm	2 Bdrm + D	3 Bdrm	Studio	Townhouse	Total Suites	
0	*0*	*0*	*4*	*3*	*0*	*0*	*7*	
0	0	0	32	24	0	0	56	
7	*1*	*1*	*0*	*0*	*3*	*0*	*12*	
63	9	9	0	0	27	0	108	
5	0	1	0	1	0	0	7	
4	*2*	*3*	*6*	*0*	*2*	*0*	*17*	
12	6	9	18	0	6	0	51	
6	1	4	3	1	1	0	16	
0	0	0	0	0	0	0	0	
0	0	0	0	0	0	3	3	
86	16	23	53	26	34	3	241	
36%	7%	10%	22%	11%	14%	1%		*% Suite Type*
570 - 620 sf	675 -725 sm	700 - 750 sf	750 - 800 sf	1050 - 1100 sf	472 - 500 sf	1250 -1300 sf		*Average Suite Area*

AREAS TOTALS & FSI		
Gross Floor Area	16,753	
Site Area	1,868.5	
Floor Space Index (FSI)	9.0	

Total Amenity [Indoor + outdoor]	
1,446 sm	12,215 sf
6.0 sm/unit	
1,446 required [6sm/unit]	

PARKING		Required	Provided
Residential -			
minimum residential	*0.5 / unit*	115	115
minimum visitor	*0.1/unit*	23	23
maximum*	*1.75/ unit*	401	
* combined resident + visitor			
Retail			6
minimum 1.25/100 sm		6	
maximum 3.6/100 sm		19	
Total			144
minimum		144	
maximum		419	

BICYCLE PARKING		Required	Provided
Residential			
	0.5/ suite	121	121
Retail		2	2
	1/250 sm		
TOTAL		123	123

REVISION RECORD

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ISSUE RECORD

Quadrangle

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2070 Scott Street

Ottawa, ON

Azure Urban Developments Inc.

19023 PROJECT | SCALE

DLC DRAWN | LS REVIEWED

Statistics

A001.S

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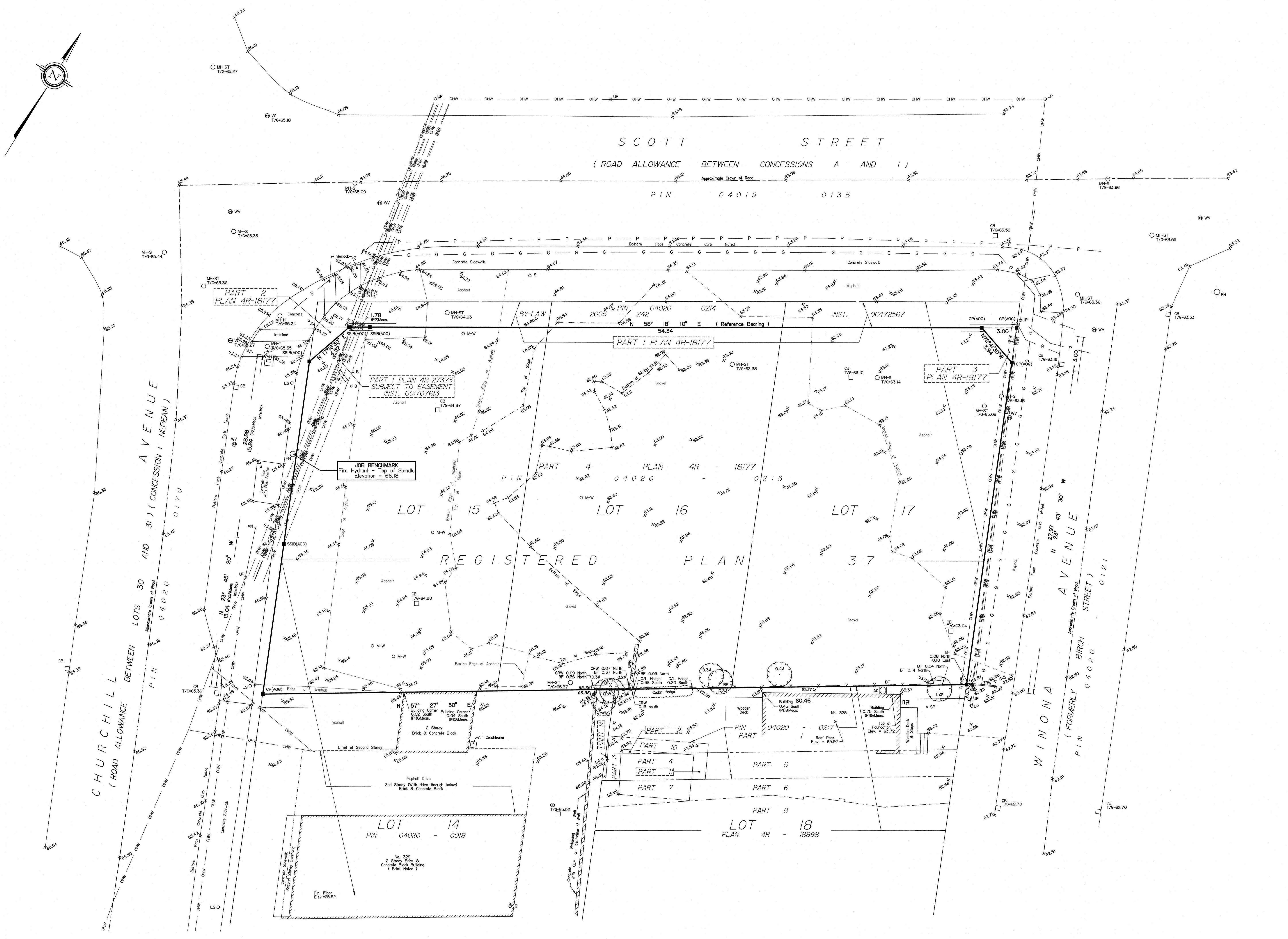

TOPOGRAPHIC PLAN OF SURVEY

PART OF LOTS 15, 16 AND 17
REGISTERED PLAN 37
CITY OF OTTAWA

Surveyed by Annis, O'Sullivan, Vollebekk Ltd.

Scale 1 : 150

6 4.5 3.0 1.5 0 3 6 Metres

Metric

DISTANCES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

Surveyor's Certificate

I CERTIFY THAT :

1. This survey and plan are correct and in accordance with the Surveys Act, the Surveyors Act and the Land Titles Act and the regulations made under them.
2. The survey was completed on the 3rd day of June, 2019.

June 4/19
Date

V. Andrew Shelp
Ontario Land Surveyor

ASSOCIATION OF ONTARIO LAND SURVEYORS
PLAN SUBMISSION FORM
2086248

THIS PLAN IS NOT VALID UNLESS IT IS AN EMBOSSED ORIGINAL COPY ISSUED BY THE SURVEYOR In accordance with Regulation 1026, Section 29 (3).

Notes & Legend

—□—	Denotes	Survey Monument Planted
—■—	"	Survey Monument Found
SIB	"	Standard Iron Bar
SSIB	"	Short Standard Iron Bar
IB	"	Iron Bar
CP	"	Concrete Pin
(WIT)	"	Witness
Meas.	"	Measured
(AOG)	"	Annis, O'Sullivan, Vollebekk Ltd.
(P1)	"	Plan 4R-18177
(P2)	"	Plan 4R-27373
C/L	"	Centreline
CRW	"	Concrete Retaining Wall
TRW	"	Timber Retaining Wall
BF	"	Board Fence
T/G	"	Top of Grate
□ CB	"	Catch Basin
○ MH-ST	"	Maintenance Hole (Storm Sewer)
○ MH-S	"	Maintenance Hole (Sanitary)
○ MH-T	"	Maintenance Hole (Traffic)
○ MH-H	"	Maintenance Hole (Hydro)
VC	"	Valve Chamber (Watermain)
WV	"	Water Valve
FH	"	Fire Hydrant
SP	"	Water Stand Post
HH	"	Handhole
— G —	"	Underground Gas
— P —	"	Underground Power
— OHW —	"	Overhead Wires
○ UP	"	Utility Pole
AN	"	Anchor
LS	"	Light Standard
B	"	Bollard
S	"	Sign
GM	"	Gas Meter
AC	"	Air Conditioner
○ M-W	"	Monitoring Well
	"	Deciduous Tree
	"	Coniferous Tree
ø	"	Diameter
+ 65.00	"	Location of Elevations
+ 65.00	"	Location of Top of Wall Elevations

Bearings are grid, derived from the southerly limit of Scott Street and are referred to the Central Meridian of MTM Zone 9 (76°30' West Longitude) NAD-83 (original).

For bearing comparison, a counter-clockwise rotation of 0°00'30" has been applied to (P1) and (P2).

All bearings and distances between found survey monuments are (P1) and measured unless otherwise noted.

SITE AREA = 1868.5 m²

ELEVATION NOTES

1. Elevations shown are geodetic and are referred to the CGVD28 geodetic datum.
2. It is the responsibility of the user of this information to verify that the job benchmark has not been altered or disturbed and that it's relative elevation and description agrees with the information shown on this drawing.

UTILITY NOTES

1. This drawing cannot be accepted as acknowledging all of the utilities and it will be the responsibility of the user to contact the respective utility authorities for confirmation.
2. Only visible surface utilities were located.
3. A field location of underground plant by the pertinent utility authority is mandatory before any work involving breaking ground, probing, excavating etc.

ANNIS, O'SULLIVAN, VOLLEBEKK LTD.
14 Concourse Gate, Suite 500
Nepean, Ont. K2E 7S6
Phone: (613) 727-0850 / Fax: (613) 727-1079
Email: Nepean@aovltd.com
Ontario Land Surveyors

Job No. 18031-19 Azure PtLts15-17 Pl37 T F | ISW

REVISION RECORD

ISSUE RECORD

Quadrangle

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t 416 598 1240 www.quadrangle.ca

2070 Scott Street

Ottawa, ON
for
Azure Urban Developments Inc.

19023		DLC	LS
PROJECT	SCALE	DRAWN	REVIEWED

Survey Plan

A002.S

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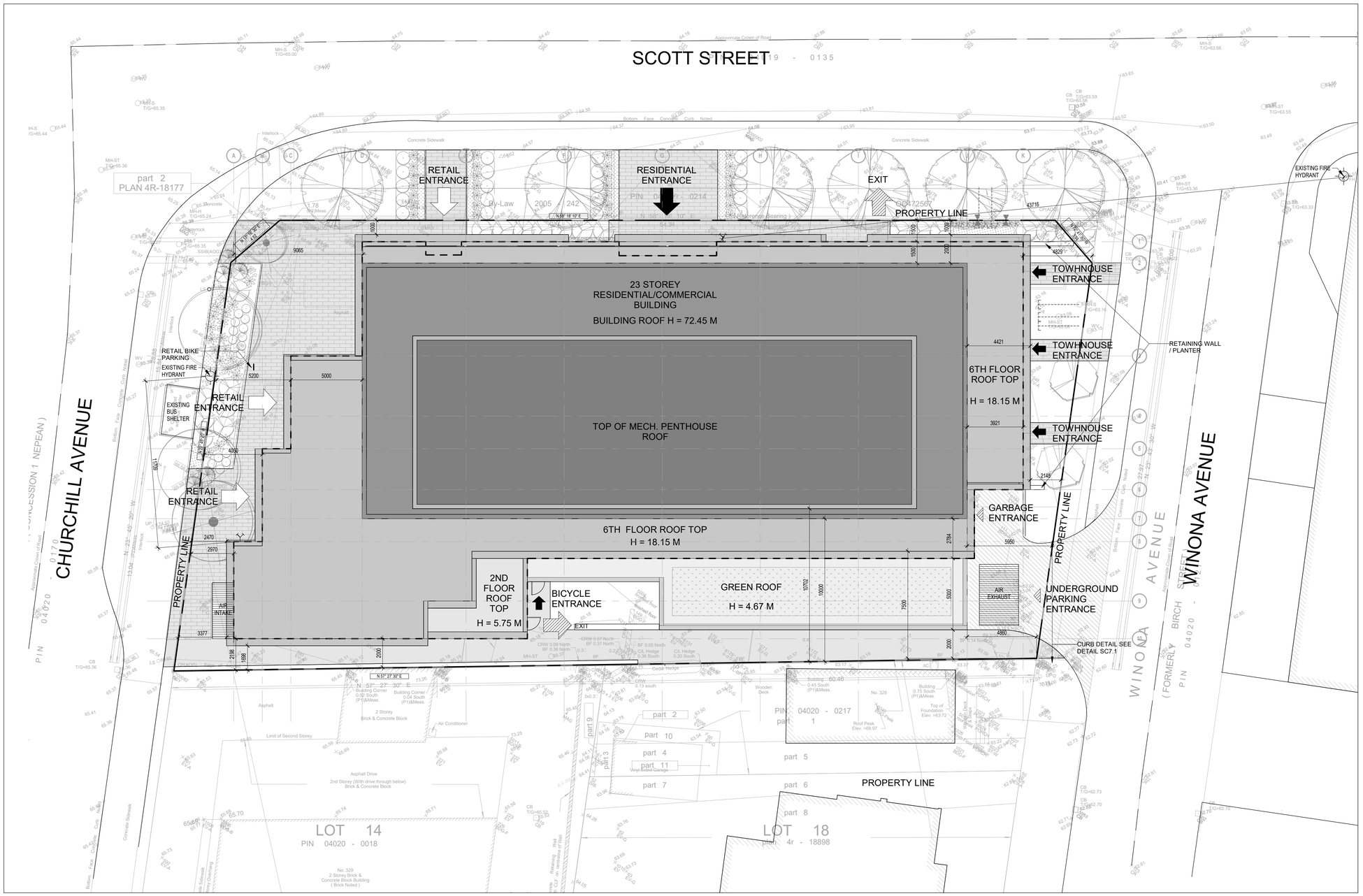
SITE PLAN LEGEND:

- PROPERTY LINE
- LINE OF UNDER GROUND GARAGE BELOW
- MAIN BUILDING ENTRANCE
- RETAIL ENTRANCE
- EXIT
- VEHICLE ENTRANCE / EXIT
- FIRE HYDRANT
- SIAMESE CONNECTION
- MANHOLE COVER
- AREA DRAIN
- CATCH BASIN
- EXISTING LIGHT
- F.F.E. FINISH FLOOR ELEVATION
- 00000 EXISTING ELEVATION
- 00000 PROPOSED ELEVATION
- 00000 TOP OF ROOF
- BUILDING ENVELOPE



1 / A101.S SITE PLAN
SCALE: 1 : 150

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2070 Scott Street

Ottawa, ON

Azure Urban Developments Inc.

19023 As indicated DLC LS
PROJECT SCALE DRAWN REVIEWED

Site Plan

A101.S

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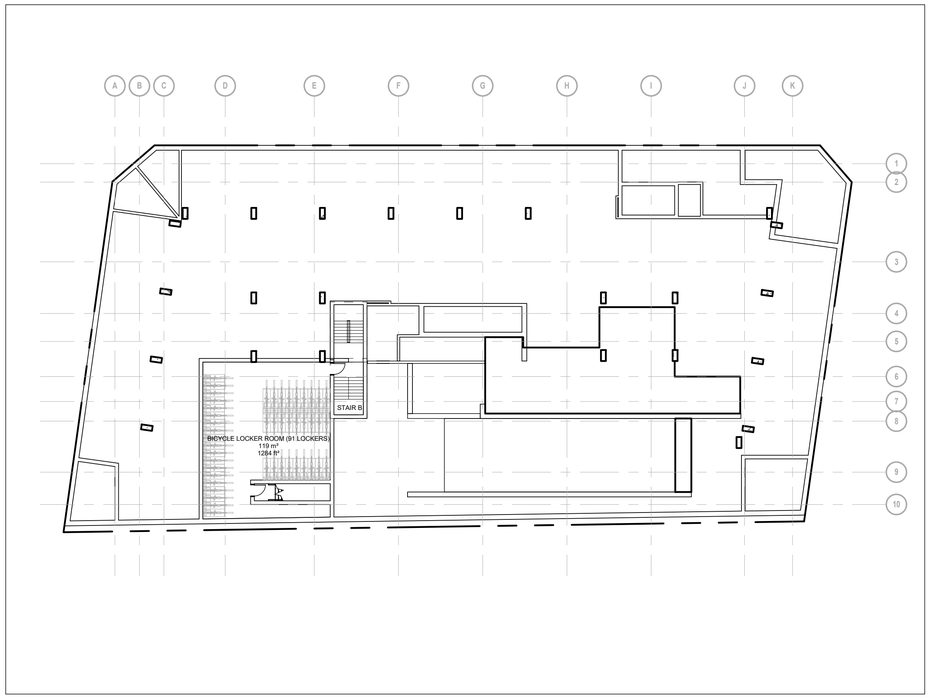
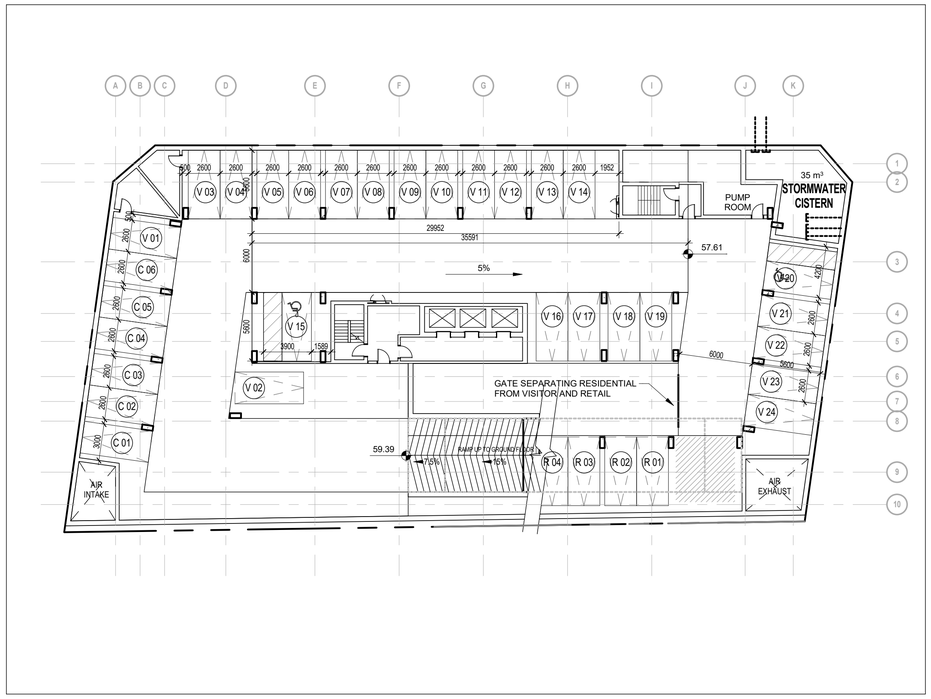
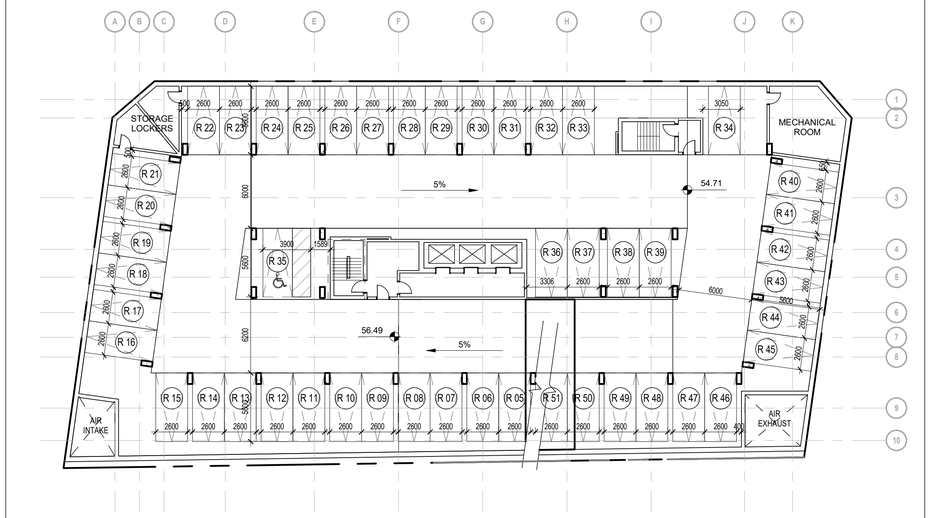


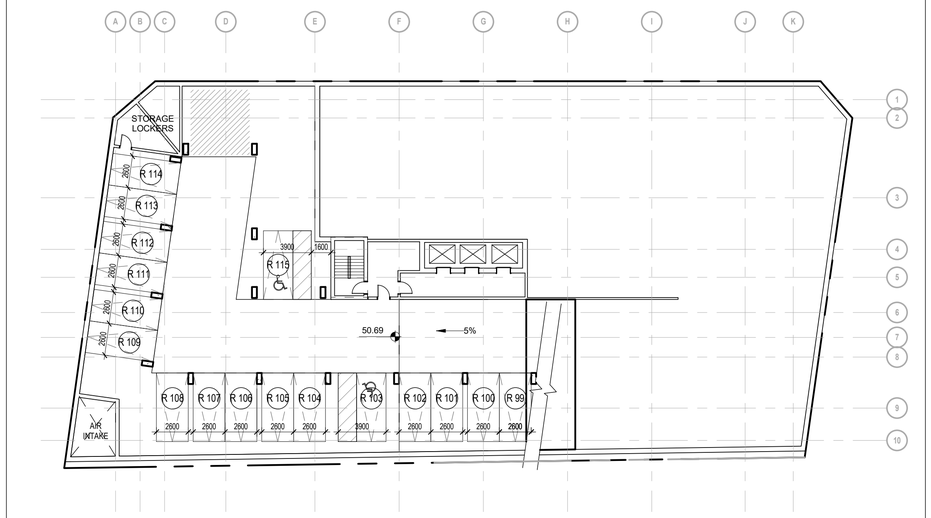
3 A102.S MEZZANINE



1 A102.S P1 Underground Parking Garage Plan



2 A102.S P2 - P3 Underground Parking Garage Plan



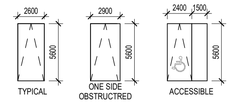
4 A102.S P4 Underground Parking Garage Plan

PARKING NOTES:

1. MINIMUM PARKING SPACE SIZES (UNLESS OTHERWISE NOTED):
   2600mm WIDE X 5600mm LONG (NO SIDES OBSTRUCTED)
   2900mm WIDE X 5600mm LONG (ONE SIDE OBSTRUCTED)
   3200mm WIDE X 5600mm LONG (TWO SIDES OBSTRUCTED)
2. MAINTAIN MININUM DRIVE AISLE WIDTH OF 6000mm UNLESS OTHERWISE NOTED.
3. MAINTAIN MINIMUM HEADROOM CLEARANCE OF 2100mm THROUGHOUT.

PARKING LEGEND:

(C) PARKING SPACE
C=COMMERCIAL PARKING
R=RESIDENTIAL PARKING
V=VISITOR PARKING



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t 416 598 1240 www.quadrangle.ca

2070 Scott Street

Ottawa, ON

Azure Urban Developments Inc.

19023 As indicated DLC LS
PROJECT SCALE DRAWN REVIEWED

Below Grade Floor Plans

A102.S

2019-09-27 11:46:14 AM

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SCOTT STREET

(ROAD ALLOWANCE BETWEEN CONCESSIONS A AND 1)

SCOTT STREET

Approximate Crown of Road

PIN 04019 - 0135

RETAIL ENTRANCE

RESIDENTIAL ENTRANCE

EXIT

EXISTING FIRE HYDRANT

SIAMESE CONNECTION

TOWNHOUSE ENTRANCE

2 STOREY
3B TOWNHOUSE
56 m²
608 ft²
FFE = 63.40

2 STOREY
3B TOWNHOUSE
55 m²
592 ft²
FFE = 63.40

2 STOREY
3B TOWNHOUSE
56 m²
608 ft²
FFE = 63.40

AMENITY
85 m²
912 ft²

FFE = 65.09

RETAIL
429 m²
4617 ft²
FFE = 65.69

RETAIL B.O.H.
87 m²
939 ft²
FFE = 65.69

MAIL ROOM

C.A.C.F

FFE = 64.45

STAIR A
FFE = 64.08

PARCEL ROOM

PROPERTY MANAGEMENT OFFICE

PET WASH

GARBAGE & MOVING
FFE = 63.02

STAIR B
FFE = 69.74

BICYCLE LOCKER ROOM
(30 LOCKERS)
36 m²
388 ft²

STAIR C

EXISTING BUS SHELTER

RETAINING WALL / PLANTER

GARBAGE AND LOADING ENTRANCE

UNDERGROUND PARKING ENTRANCE

AIR EXHAUST

AIR INTAKE

RETAINING WALL

CHURCHILL AVENUE
(ROAD ALLOWANCE BETWEEN LOTS 30 AND 31)
PIN 04020 - 0170

WINONA AVENUE
(FORMERLY BIRCH STREET)
PIN 04020 - 0121

LOT 14
PIN 04020 - 0018

LOT 18
plan 4r - 18898

part 1 PLAN 4R-27373
Subject to Easement
Part OC1137613

part 2
PLAN 4R-18177

PART 4 PLAN 4R - 18177

PIN 04020 - 0214

PIN 04020 - 0217
part 1

part 2
part 3
part 4
part 5
part 6
part 7
part 8
part 9
part 10
part 11

No. 329
2 Storey Brick & Concrete Block Building
(Brick Noted)

No. 328

2 Storey
Brick & Concrete Block

Asphalt Drive
2nd Storey (With drive through below)
Brick & Concrete Block

Wooden Deck

Vinyl Sided Garage

Roof Peak, Elev. =69.97

Top of Foundation Elev. =63.72

Building 0.45 South (P1)&Meas.

Building 0.75 South (P1)&Meas.

Building Corner 0.02 South (P1)&Meas.

Building Corner 0.04 South (P1)&Meas.

N 57° 27' 30" E

N57° 27' 30" E

2000

2000

GROUND FLOOR LEGEND

- AMENITY 1
- BICYCLE
- GARBAGE
- RAMP
- RESIDENTIAL COMMON AREAS
- RESIDENTIAL SUITES
- RETAIL

REVISION RECORD

DRAFT

ISSUE RECORD

Quadrangle

Quadrangle Architects Limited
901 King Street West, Suite 701 Toronto, ON M5V 3H5
t 416 598 1240 www.quadrangle.ca

2070 Scott Street

Ottawa, ON

Azure Urban Developments Inc.

19023 1 : 150 DLC LS
PROJECT SCALE DRAWN REVIEWED

Ground Floor Plan

A201.S

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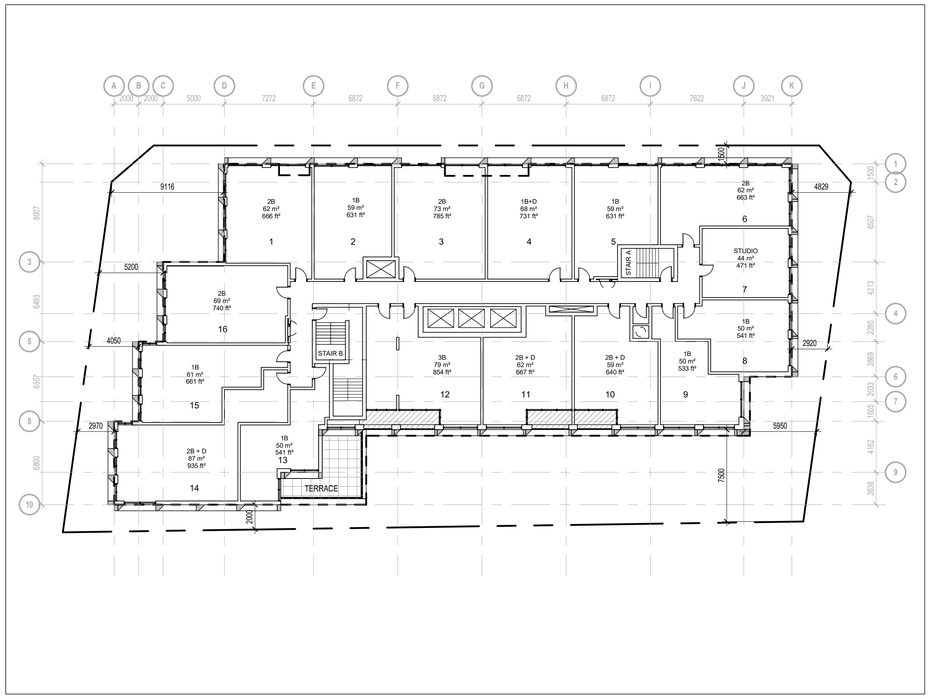
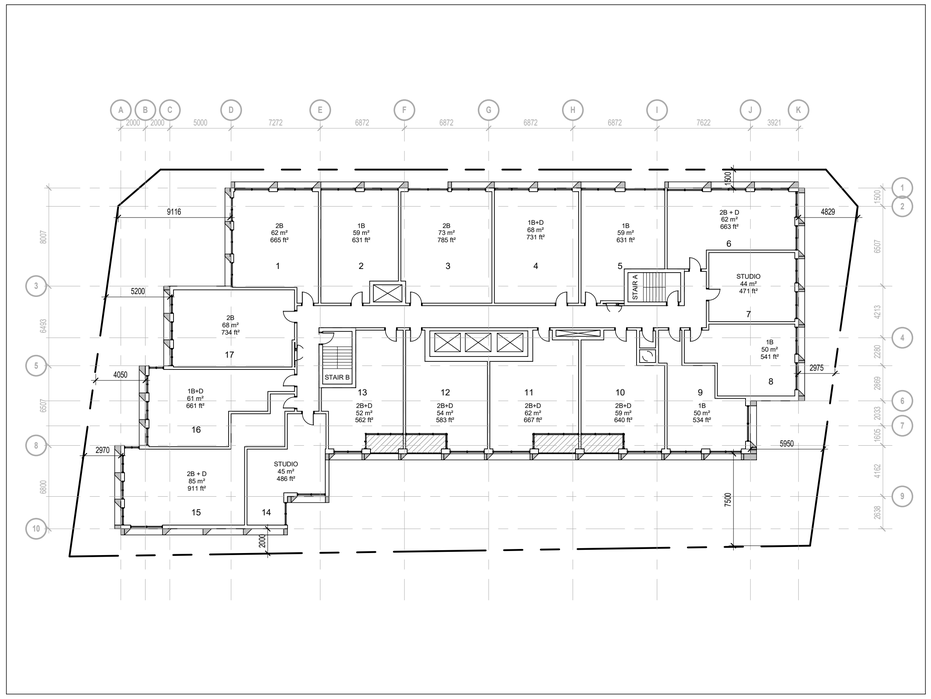
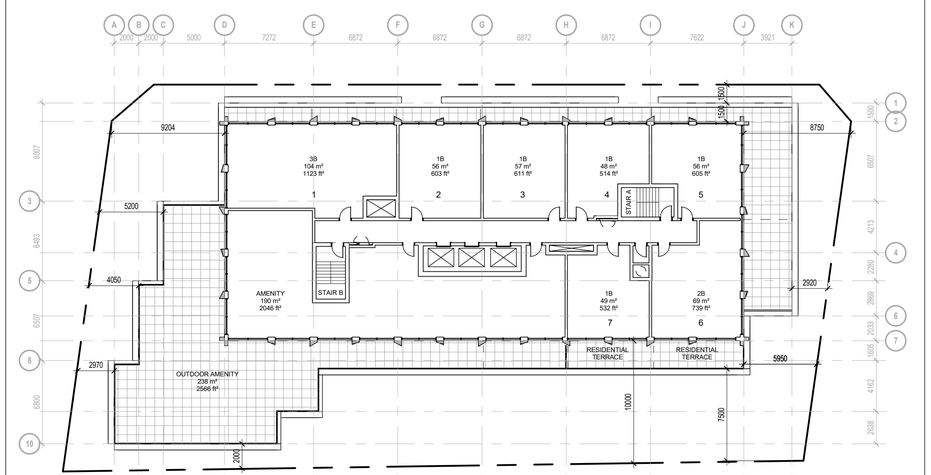


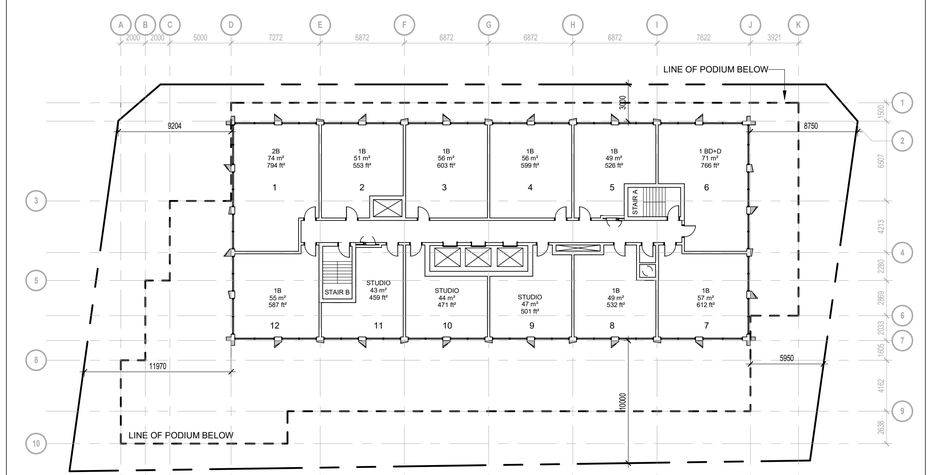
1 A202.S LEVEL 2 FLOOR PLAN



6 A202.S TYPICAL PODIUM FLOOR PLAN (LEVEL 3-5)



2 A202.S LEVEL 6 FLOOR PLAN - AMENITY



3 A202.S LOWER TYPICAL TOWER FLOOR PLAN (LEVEL 7-15)

REVISION RECORD

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2070 Scott Street

Ottawa, ON

Azure Urban Developments Inc.

19023 1 : 250 DLC LS
PROJECT SCALE DRAWN REVIEWED

Floor Plans

A202.S

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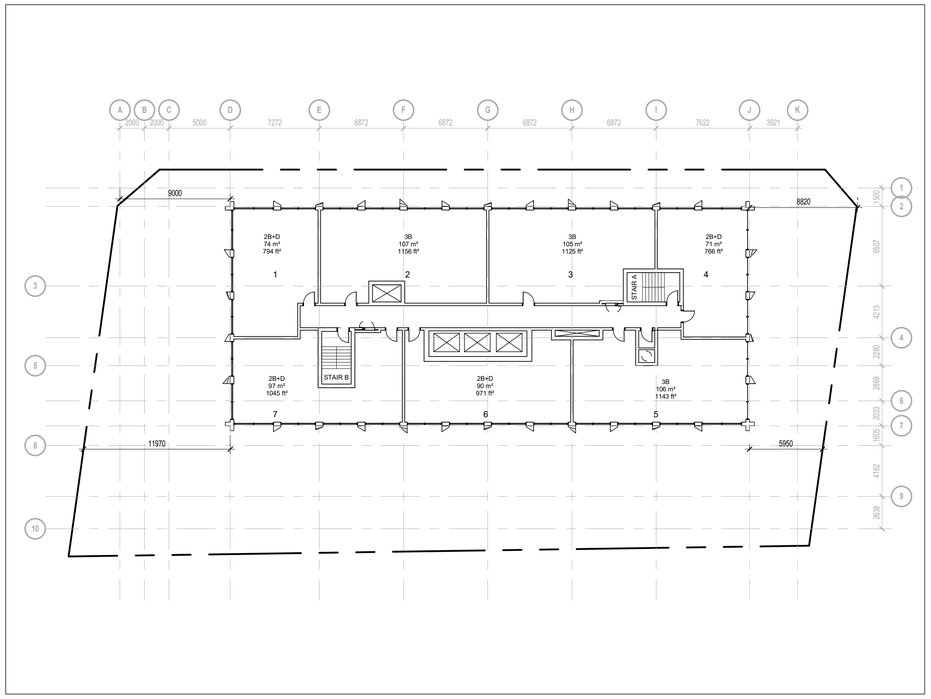
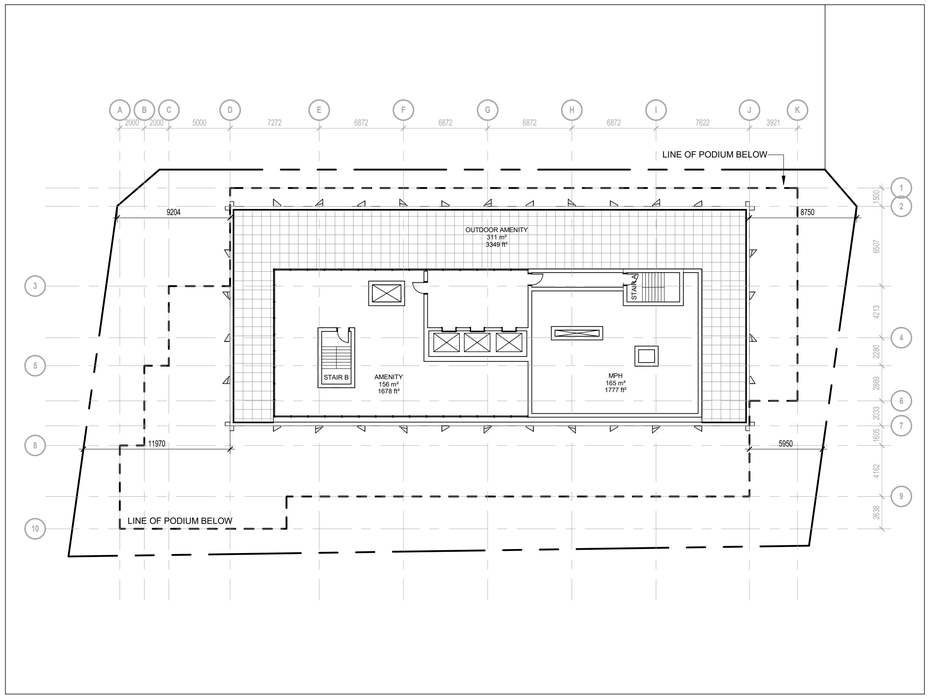


2 A203.S UPPER TYPICAL TOWER FLOOR PLAN (LEVEL16-23)



1 A203.S AMENITY AND MECHANICAL PENTHOUSE

REVISION RECORD

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2070 Scott Street

Ottawa, ON

Azure Urban Developments Inc.

19023	1 : 250	DLC	LS
PROJECT	SCALE	DRAWN	REVIEWED

Floor Plans

A203.S

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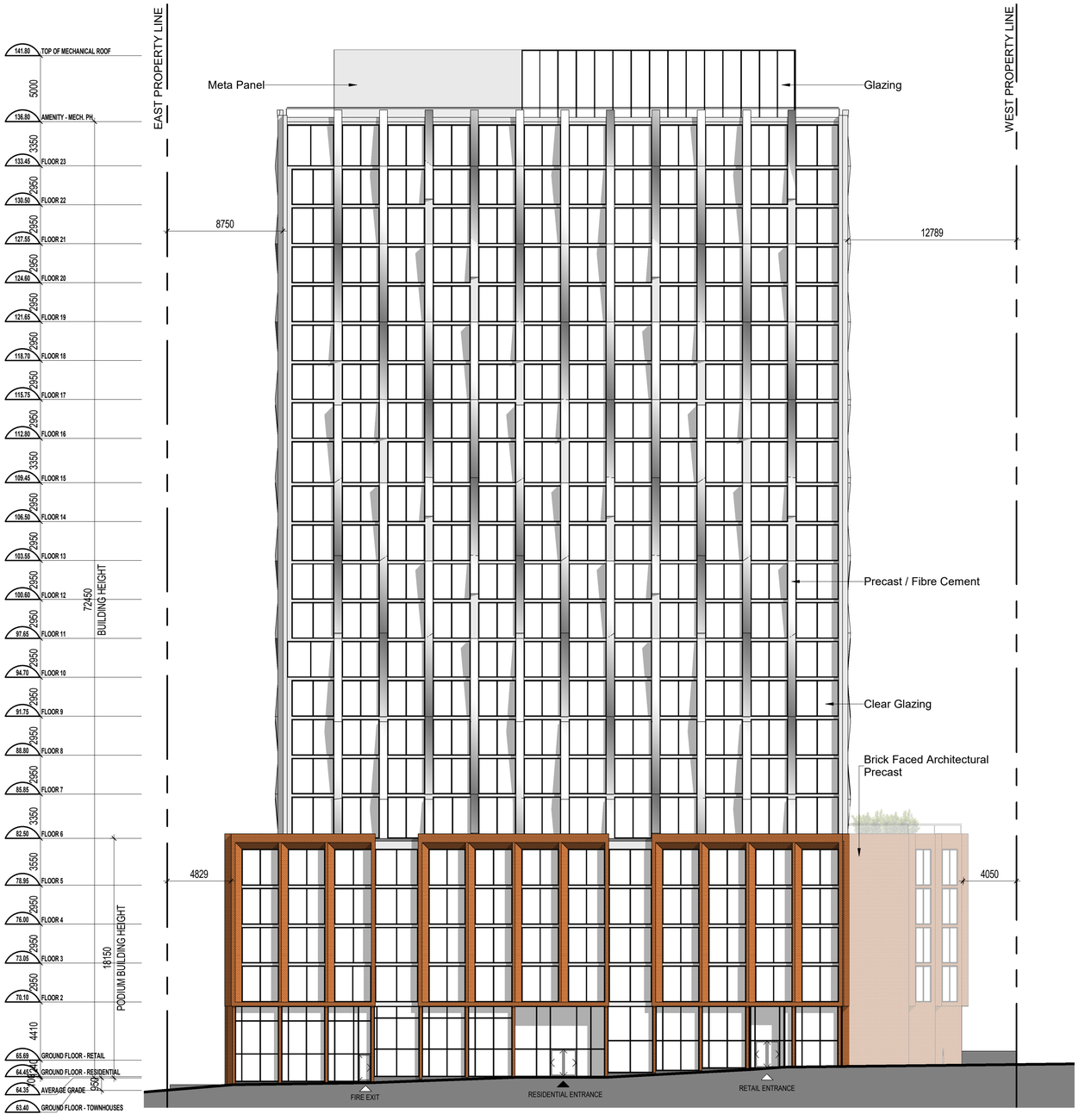
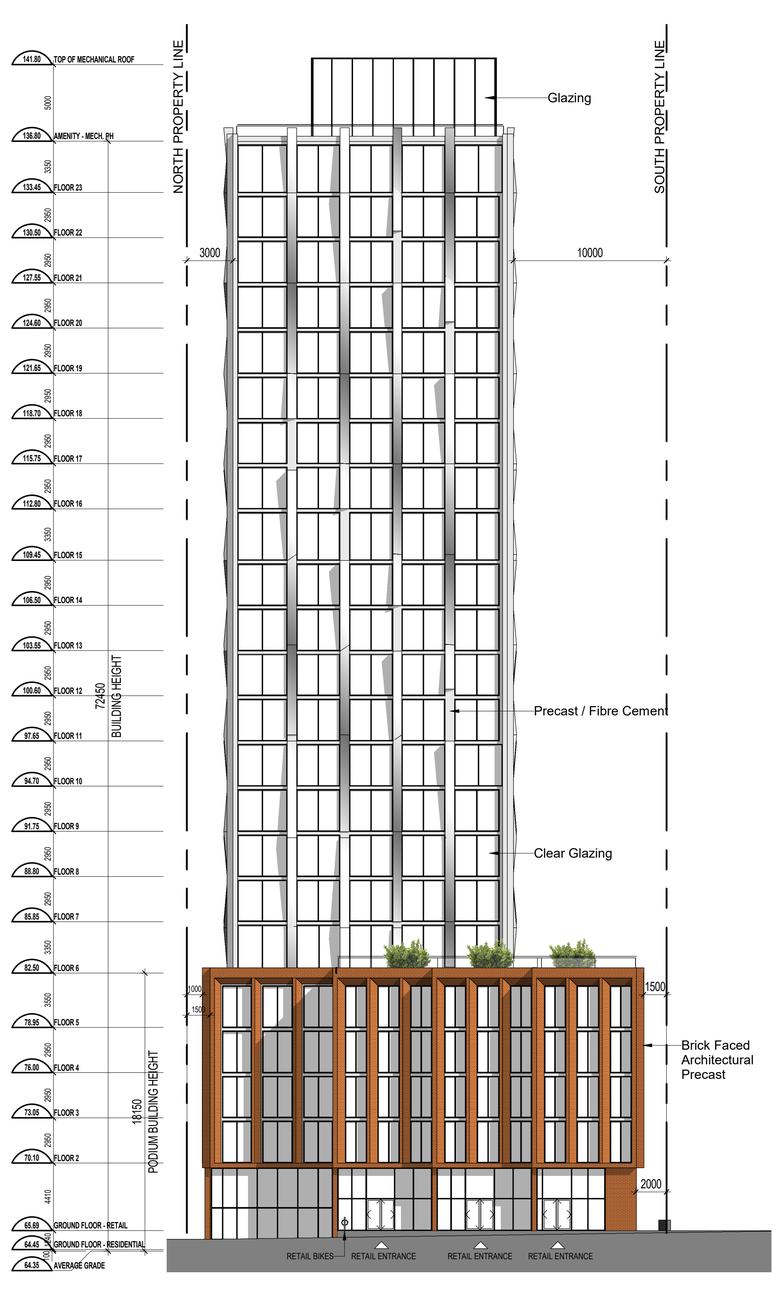


1 A401.S NORTH ELEVATION



2 A401.S WEST ELEVATION

REVISION RECORD

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ISSUE RECORD

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2070 Scott Street

Ottawa, ON

Azure Urban Developments Inc.

19023	1 : 200	DLC	LS
PROJECT	SCALE	DRAWN	REVIEWED

Building Elevations

A401.S

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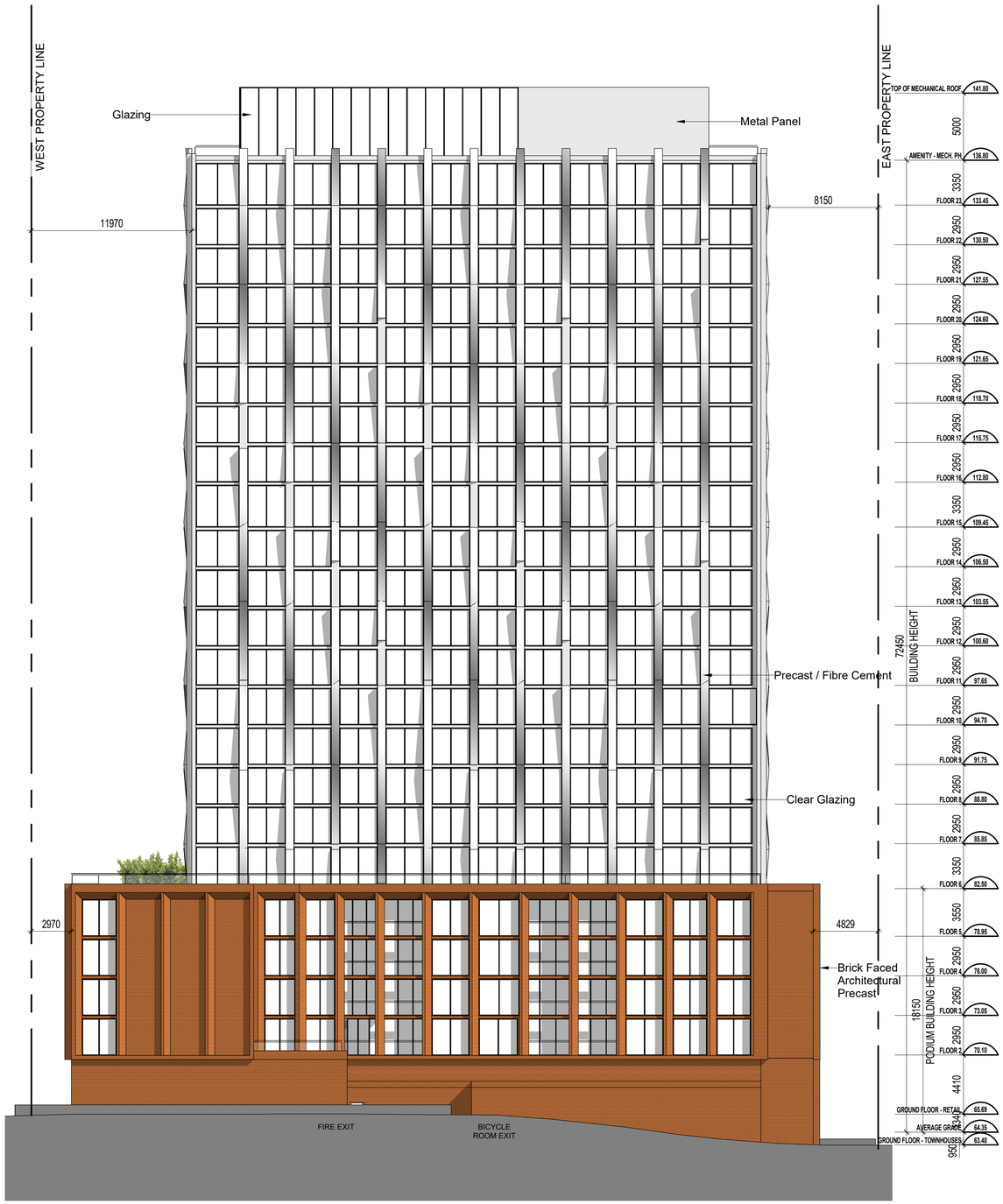
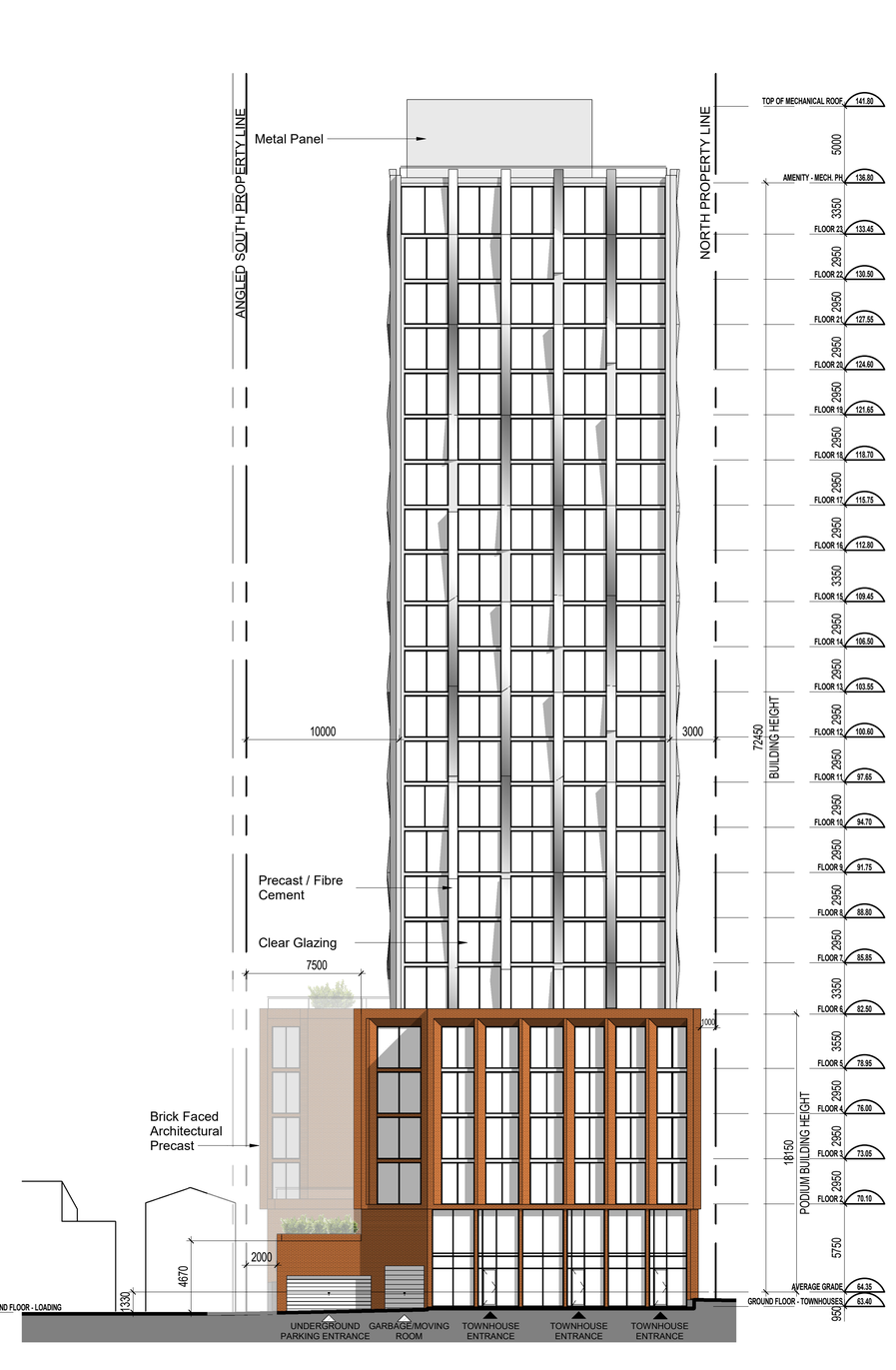


1 A402.S SOUTH ELEVATION



2 A402.S EAST ELEVATION

REVISION RECORD

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ISSUE RECORD

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2070 Scott Street

Ottawa, ON

Azure Urban Developments Inc.

19023 1 : 200 DLC LS
PROJECT SCALE DRAWN REVIEWED

Building Elevations

A402.S

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Appendix C SANITARY SEWER CALCULATIONS

Stantec

SUBDIVISION:
2090 SCOTT STREET

DATE: 10/2/2019
REVISION: 1
DESIGNED BY: WAJ
CHECKED BY: AMP

SANITARY SEWER DESIGN SHEET
(City of Ottawa)

FILE NUMBER: 160410249

DESIGN PARAMETERS

MAX PEAK FACTOR (RES.)=	4.0	AVG. DAILY FLOW / PERSON	280	L/p/day	MINIMUM VELOCITY	0.60	m/s
MIN PEAK FACTOR (RES.)=	2.0	COMMERCIAL	28,000	L/ha/day	MAXIMUM VELOCITY	3.00	m/s
PEAKING FACTOR (INDUSTRIAL):	2.4	INDUSTRIAL (HEAVY)	55,000	L/ha/day	MANNINGS n	0.013	
PEAKING FACTOR (ICI >20%):	1.5	INDUSTRIAL (LIGHT)	35,000	L/ha/day	BEDDING CLASS	B	
PERSONS / 1 BEDROOM	1.4	INSTITUTIONAL	28,000	L/ha/day	MINIMUM COVER	2.50	m
PERSONS / 2 BEDROOM	2.1						
PERSONS / 3 BEDROOM	3.1	INFILTRATION	0.33	L/s/ha	HARMON CORRECTION FACTOR	0.8	
PERSONS / TOWNHOME	2.7						

LOCATION			RESIDENTIAL AREA AND POPULATION									COMMERCIAL		INDUSTRIAL (L)		INDUSTRIAL (H)		INSTITUTIONAL		GREEN / UNUSED		C+I+I	INFILTRATION			TOTAL	PIPE								
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA	1 BEDROOM	2 BEDROOM	3 BEDROOM	TOWNHOME	POP.	CUMULATIVE AREA	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW	AREA	ACCU. AREA	AREA	ACCU. AREA	AREA	ACCU. AREA	AREA	ACCU. AREA	AREA	ACCU. AREA	PEAK FLOW	TOTAL AREA	ACCU. AREA	INFILT. FLOW	FLOW	LENGTH	DIA	MATERIAL	CLASS	SLOPE	CAP. (FULL)	CAP. V PEAK FLOW	VEL. (FULL)	VEL. (ACT.)
			(ha)						(ha)			(L/s)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(L/s)	(ha)	(ha)	(L/s)	(L/s)	(m)	(mm)			(%)	(l/s)	(%)	(m/s)	(m/s)
COM-1, COM-2, RES-1	BLDG	TEE	0.130	136	76	26	3	439	0.130	439	4.00	5.69	0.060	0.060	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.03	0.190	0.190	0.06	5.78	2.8	150	PVC	DR 28	1.00	15.3	**37.70%**	0.86	0.68
																													225							

Appendix D STORMWATER MANAGEMENT CALCULATIONS

Stantec

2090 Scott Street

DATE: 2019-09-30
REVISION: 1
DESIGNED BY: WAJ
CHECKED BY: AMP

STORM SEWER DESIGN SHEET

(City of Ottawa)

FILE NUMBER: 160410249

DESIGN PARAMETERS

$I = a / (t+b)^c$ (As per City of Ottawa Guidelines, 2012)

	1:2 yr	1:5 yr	1:10 yr	1:100 yr
a =	732.951	998.071	1174.184	1735.688
b =	6.199	6.053	6.014	6.014
c =	0.810	0.814	0.816	0.820

MANNING'S n = 0.013 BEDDING CLASS B
MINIMUM COVER: 2.00 m
TIME OF ENTRY 10 min

LOCATION			DRAINAGE AREA																					PIPE SELECTION											
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (2-YEAR) (ha)	AREA (5-YEAR) (ha)	AREA (10-YEAR) (ha)	AREA (100-YEAR) (ha)	AREA (ROOF) (ha)	C (2-YEAR) (-)	C (5-YEAR) (-)	C (10-YEAR) (-)	C (100-YEAR) (-)	A x C (2-YEAR) (ha)	ACCUM AxC (2YR) (ha)	A x C (5-YEAR) (ha)	ACCUM. AxC (5YR) (ha)	A x C (10-YEAR) (ha)	ACCUM. AxC (10YR) (ha)	A x C (100-YEAR) (ha)	ACCUM. AxC (100YR) (ha)	T of C (min)	$I_{2\text{-YEAR}}$ (mm/h)	$I_{5\text{-YEAR}}$ (mm/h)	$I_{10\text{-YEAR}}$ (mm/h)	$I_{100\text{-YEAR}}$ (mm/h)	$Q_{CONTROL}$ (L/s)	ACCUM. $Q_{CONTROL}$ (L/s)	Q_{ACT} (CIA/360) (L/s)	LENGTH (m)	PIPE WIDTH OR DIAMETE (mm)	PIPE HEIGHT (mm)	PIPE SHAPE (-)	MATERIAL (-)	CLASS (-)	SLOPE %	Q_{CAP} (FULL) (L/s)	% FULL (-)	VEL. (FULL) (m/s)	VEL. (ACT) (m/s)	TIME OF FLOW (min)
BLDG-1, BLDG-2, BLDG-3, ROOF-1, ROOF-2, TRENCH	Stub	Ex. MH	0.15	0.00	0.00	0.00	0.00	0.89	0.00	0.00	0.00	0.136	0.136	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	29.0	1.4	200	200	CIRCULAR	PVC	-	1.00	33.3	**87.1%**	1.05	1.06	0.02
																				10.02									200	200									

Stormwater Management Calculations

File No: **160410429**
Project: **2070/2090 Scott Street**
Date: **01-Oct-19**

SWM Approach:
Post development peak flows restricted to the 2-year with a C of 0.60

Post-Development Site Conditions:

Overall Runoff Coefficient for Site and Sub-Catchment Areas

Runoff Coefficient Table

Catchment Type	Sub-catchment Area ID / Description		Area (ha) "A"		Runoff Coefficient "C"	"A x C"		Overall Runoff Coefficient
Uncontrolled - Non-Tributary	UNC-1	Hard	0.024		0.9	0.021		
		Soft	0.010		0.2	0.002		
		Subtotal		0.034			0.02346	0.69
Uncontrolled - Tributary Building	ROOF-1	Hard	0.043		0.9	0.039		
		Soft	0.000		0.2	0.000		
		Subtotal		0.043			0.0387	0.90
Uncontrolled - Tributary Building	ROOF-2	Hard	0.012		0.9	0.011		
		Soft	0.000		0.2	0.000		
		Subtotal		0.012			0.0108	0.90
Uncontrolled - Tributary Building	BLDG-1	Hard	0.033		0.9	0.030		
		Soft	0.000		0.2	0.000		
		Subtotal		0.033			0.0297	0.90
Uncontrolled - Tributary Building	BLDG-2	Hard	0.048		0.9	0.043		
		Soft	0.000		0.2	0.000		
		Subtotal		0.048			0.0432	0.90
Uncontrolled - Tributary Building	BLDG-3	Hard	0.003		0.9	0.003		
		Soft	0.000		0.2	0.000		
		Subtotal		0.003			0.0027	0.90
Uncontrolled - Tributary Sidewalk	TRENCH	Hard	0.012		0.9	0.010		
		Soft	0.002		0.2	0.000		
		Subtotal		0.014			0.01092	0.78
Total				**0.187**			**0.16**	
Overall Runoff Coefficient= C:								**0.85**

Total Controlled Roof Areas	**0.000**	**ha**
Total Uncontrolled Area to Outlet	**0.153**	**ha**
Total Tributary Area to Outlet	**0.153**	**ha**
Total Uncontrolled Areas (Non-Tributary)	**0.034**	**ha**
Total Site	**0.187**	**ha**

Stormwater Management Calculations

Project #160410429, 2070/2090 Scott Street
Modified Rational Method Calculatons for Storage

2 yr Intensity
City of Ottawa

$I = a/(t + b)^c$

a =	732.951
b =	6.199
c =	0.81

t (min)	I (mm/hr)
10	76.81
20	52.03
30	40.04
40	32.86
50	28.04
60	24.56
70	21.91
80	19.83
90	18.14
100	16.75
110	15.57
120	14.56

Project #160410429, 2070/2090 Scott Street
Modified Rational Method Calculatons for Storage

100 yr Intensity
City of Ottawa

$I = a/(t + b)^c$

a =	1735.688
b =	6.014
c =	0.820

t (min)	I (mm/hr)
10	178.56
20	119.95
30	91.87
40	75.15
50	63.95
60	55.89
70	49.79
80	44.99
90	41.11
100	37.90
110	35.20
120	32.89

Predevelopment Target Release from Site

Subdrainage Area: Post development peak flows restricted to C=0.60
Area (ha): 0.187
C: 0.60

Typical Time of Concentration

tc (min)	I (2 yr) (mm/hr)	Qtarget (L/s)
10	76.81	**24.0**

2 YEAR Modified Rational Method for Entire Site

Subdrainage Area: UNC-1 Uncontrolled - Non-Tributary
Area (ha): 0.034
C: 0.69

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	5.0	5.0		
20	52.03	3.4	3.4		
30	40.04	2.6	2.6		
40	32.86	2.1	2.1		
50	28.04	1.8	1.8		
60	24.56	1.6	1.6		
70	21.91	1.4	1.4		
80	19.83	1.3	1.3		
90	18.14	1.2	1.2		
100	16.75	1.1	1.1		
110	15.57	1.0	1.0		
120	14.56	0.9	0.9		

100 YEAR Modified Rational Method for Entire Site

Subdrainage Area: UNC-1 Uncontrolled - Non-Tributary
Area (ha): 0.034
C: 0.86

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	14.6	14.6		
20	119.95	9.8	9.8		
30	91.87	7.5	7.5		
40	75.15	6.1	6.1		
50	63.95	5.2	5.2		
60	55.89	4.6	4.6		
70	49.79	4.1	4.1		
80	44.99	3.7	3.7		
90	41.11	3.4	3.4		
100	37.90	3.1	3.1		
110	35.20	2.9	2.9		
120	32.89	2.7	2.7		

Subdrainage Area: ROOF-1 Uncontrolled - Tributary Building
Area (ha): 0.043
C: 0.90

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	
10	76.81	8.3	8.3			
20	52.03	5.6	5.6			
30	40.04	4.3	4.3			
40	32.86	3.5	3.5			
50	28.04	3.0	3.0			
60	24.56	2.6	2.6			
70	21.91	2.4	2.4			
80	19.83	2.1	2.1			
90	18.14	2.0	2.0			
100	16.75	1.8	1.8			
110	15.57	1.7	1.7			
120	14.56	1.6	1.6			

Subdrainage Area: ROOF-1 Uncontrolled - Tributary Building
Area (ha): 0.043
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)
10	178.56	21.3	21.3			
20	119.95	14.3	14.3			
30	91.87	11.0	11.0			
40	75.15	9.0	9.0			
50	63.95	7.6	7.6			
60	55.89	6.7	6.7			
70	49.79	6.0	6.0			
80	44.99	5.4	5.4			
90	41.11	4.9	4.9			
100	37.90	4.5	4.5			
110	35.20	4.2	4.2			
120	32.89	3.9	3.9			

Stormwater Management Calculations

Project #160410429, 2070/2090 Scott Street
Modified Rational Method Calculatons for Storage

Subdrainage Area: ROOF-2 — Uncontrolled - Tributary Building
Area (ha): 0.012
C: 0.90

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)
10	76.81	2.3	2.3			
20	52.03	1.6	1.6			
30	40.04	1.2	1.2			
40	32.86	1.0	1.0			
50	28.04	0.8	0.8			
60	24.56	0.7	0.7			
70	21.91	0.7	0.7			
80	19.83	0.6	0.6			
90	18.14	0.5	0.5			
100	16.75	0.5	0.5			
110	15.57	0.5	0.5			
120	14.56	0.4	0.4			

Subdrainage Area: BLDG-1 — Uncontrolled - Tributary Building
Area (ha): 0.033
C: 0.90

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	6.3	6.3		
20	52.03	4.3	4.3		
30	40.04	3.3	3.3		
40	32.86	2.7	2.7		
50	28.04	2.3	2.3		
60	24.56	2.0	2.0		
70	21.91	1.8	1.8		
80	19.83	1.6	1.6		
90	18.14	1.5	1.5		
100	16.75	1.4	1.4		
110	15.57	1.3	1.3		
120	14.56	1.2	1.2		

Subdrainage Area: BLDG-2 — Uncontrolled - Tributary Building
Area (ha): 0.048
C: 0.90

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	9.2	9.2		
20	52.03	6.2	6.2		
30	40.04	4.8	4.8		
40	32.86	3.9	3.9		
50	28.04	3.4	3.4		
60	24.56	2.9	2.9		
70	21.91	2.6	2.6		
80	19.83	2.4	2.4		
90	18.14	2.2	2.2		
100	16.75	2.0	2.0		
110	15.57	1.9	1.9		
120	14.56	1.7	1.7		

Subdrainage Area: BLDG-3 — Uncontrolled - Tributary Building
Area (ha): 0.003
C: 0.90

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	0.6	0.6		
20	52.03	0.4	0.4		
30	40.04	0.3	0.3		
40	32.86	0.2	0.2		
50	28.04	0.2	0.2		
60	24.56	0.2	0.2		
70	21.91	0.2	0.2		
80	19.83	0.1	0.1		
90	18.14	0.1	0.1		
100	16.75	0.1	0.1		
110	15.57	0.1	0.1		
120	14.56	0.1	0.1		

Project #160410429, 2070/2090 Scott Street
Modified Rational Method Calculatons for Storage

Subdrainage Area: ROOF-2 — Uncontrolled - Tributary Building
Area (ha): 0.012
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)
10	178.56	6.0	6.0			
20	119.95	4.0	4.0			
30	91.87	3.1	3.1			
40	75.15	2.5	2.5			
50	63.95	2.1	2.1			
60	55.89	1.9	1.9			
70	49.79	1.7	1.7			
80	44.99	1.5	1.5			
90	41.11	1.4	1.4			
100	37.90	1.3	1.3			
110	35.20	1.2	1.2			
120	32.89	1.1	1.1			

Subdrainage Area: BLDG-1 — Uncontrolled - Tributary Building
Area (ha): 0.033
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	16.4	16.4		
20	119.95	11.0	11.0		
30	91.87	8.4	8.4		
40	75.15	6.9	6.9		
50	63.95	5.9	5.9		
60	55.89	5.1	5.1		
70	49.79	4.6	4.6		
80	44.99	4.1	4.1		
90	41.11	3.8	3.8		
100	37.90	3.5	3.5		
110	35.20	3.2	3.2		
120	32.89	3.0	3.0		

Subdrainage Area: BLDG-2 — Uncontrolled - Tributary Building
Area (ha): 0.048
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	23.8	23.8		
20	119.95	16.0	16.0		
30	91.87	12.3	12.3		
40	75.15	10.0	10.0		
50	63.95	8.5	8.5		
60	55.89	7.5	7.5		
70	49.79	6.6	6.6		
80	44.99	6.0	6.0		
90	41.11	5.5	5.5		
100	37.90	5.1	5.1		
110	35.20	4.7	4.7		
120	32.89	4.4	4.4		

Subdrainage Area: BLDG-3 — Uncontrolled - Tributary Building
Area (ha): 0.003
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	1.5	1.5		
20	119.95	1.0	1.0		
30	91.87	0.8	0.8		
40	75.15	0.6	0.6		
50	63.95	0.5	0.5		
60	55.89	0.5	0.5		
70	49.79	0.4	0.4		
80	44.99	0.4	0.4		
90	41.11	0.3	0.3		
100	37.90	0.3	0.3		
110	35.20	0.3	0.3		
120	32.89	0.3	0.3		

Stormwater Management Calculations

Project #160410429, 2070/2090 Scott Street
Modified Rational Method Calculatons for Storage

Subdrainage Area: TRENCH — Uncontrolled - Tributary Sidewalk
Area (ha): 0.014
C: 0.78

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	2.3	2.3		
20	52.03	1.6	1.6		
30	40.04	1.2	1.2		
40	32.86	1.0	1.0		
50	28.04	0.9	0.9		
60	24.56	0.7	0.7		
70	21.91	0.7	0.7		
80	19.83	0.6	0.6		
90	18.14	0.6	0.6		
100	16.75	0.5	0.5		
110	15.57	0.5	0.5		
120	14.56	0.4	0.4		

Subdrainage Area: Site Area Tributary to Internal Cistern
Area (ha): **0.153**

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	29.04	**9.40**	19.64	11.79
20	52.03	19.67	9.40	10.27	**12.33**
30	40.04	15.14	9.40	5.74	10.34
40	32.86	12.43	9.40	3.03	7.27
50	28.04	10.60	9.40	1.20	3.61
60	24.56	9.29	9.29	0.00	0.00
70	21.91	8.29	8.29	0.00	0.00
80	19.83	7.50	7.50	0.00	0.00
90	18.14	6.86	6.86	0.00	0.00
100	16.75	6.33	6.33	0.00	0.00
110	15.57	5.89	5.89	0.00	0.00
120	14.56	5.51	5.51	0.00	0.00

SUMMARY TO OUTLET

			Vrequired	Vavailable*	
Tributary Area	0.153	ha			
2yr Controlled Roof Flow to Cistern	0.0				
2yr Uncontrolled Flow to Cistern	29.0	L/s	12	54 m^3	Ok
2yr Cistern Outflow	9.4	L/s			
Non-Tributary Area	0.034	ha			
Total 2yr Non-Tributary Flow	5.0	L/s			
Total Area	**0.187**	**ha**			
Total 2yr Flow	**14.4**	**L/s**			
Target	**24.0**	**L/s**			

Project #160410429, 2070/2090 Scott Street
Modified Rational Method Calculatons for Storage

Subdrainage Area: TRENCH — Uncontrolled - Tributary Sidewalk
Area (ha): 0.014
C: 0.98

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	6.8	6.8		
20	119.95	4.6	4.6		
30	91.87	3.5	3.5		
40	75.15	2.9	2.9		
50	63.95	2.4	2.4		
60	55.89	2.1	2.1		
70	49.79	1.9	1.9		
80	44.99	1.7	1.7		
90	41.11	1.6	1.6		
100	37.90	1.4	1.4		
110	35.20	1.3	1.3		
120	32.89	1.2	1.2		

Subdrainage Area: Site Area Tributary to Internal Cistern
Area (ha): **0.153**

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	75.77	**9.40**	66.37	39.82
20	119.95	50.90	9.40	41.50	49.80
30	91.87	38.99	9.40	29.59	53.25
40	75.15	31.89	9.40	22.49	**53.97**
50	63.95	27.14	9.40	17.74	53.22
60	55.89	23.72	9.40	14.32	51.55
70	49.79	21.13	9.40	11.73	49.26
80	44.99	19.09	9.40	9.69	46.53
90	41.11	17.45	9.40	8.05	43.45
100	37.90	16.08	9.40	6.68	40.11
110	35.20	14.94	9.40	5.54	36.56
120	32.89	13.96	9.40	4.56	32.83

SUMMARY TO OUTLET

			Vrequired	Vavailable*	
Tributary Area	0.153	ha			
100yr Controlled Roof Flow to Cistern	0.0	L/s			
100yr Uncontrolled Flow to Cistern	75.8	L/s	54	54 m^3	Ok
100yr Cistern Outflow	9.4	L/s			
Non-Tributary Area	0.034	ha			
Total 100yr Non-Tributary Flow	14.6	L/s			
Total Area	**0.187**	**ha**			
Total 100yr Flow	**24.0**	**L/s**			
Target	**24.0**	**L/s**			

Appendix E GEOTECHNICAL REPORT

Geotechnical Engineering

Environmental Engineering

Hydrogeology

Geological Engineering

Materials Testing

Building Science

Archaeological Studies

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Geotechnical Investigation

Proposed Multi-Storey Building
2070 Scott Street
Ottawa, Ontario

Prepared For

Westboro Point Developments Ltd.

July 26, 2019

Report PG4935-1

Table of Contents

Page

Appendices

1.0 Introduction

Paterson Group (Paterson) was commissioned by Westboro Point Developments Ltd. to conduct a geotechnical investigation for the proposed multi-storey building to be located at 2070 Scott Street in the City of Ottawa, Ontario (refer to Figure 1 - Key Plan in Appendix 2).

The objectives of the current investigation were to:

- ❏ determine the subsurface soil and groundwater conditions at this site based on available subsoil information from current and previous investigations.
- ❏ provide geotechnical recommendations for the design of the proposed development including construction considerations which may affect the design.

The following report has been prepared specifically and solely for the aforementioned project which is described herein. This report contains our findings and includes geotechnical recommendations pertaining to the design and construction of the commercial development as understood at the time of writing this report.

2.0 Proposed Project

Based on the preliminary concept drawings, it is our understanding that the proposed project is to consist of a multi-storey building with 2 to 3 levels of underground parking. Associated access lanes, parking areas and landscaped margins are also anticipated as part of the proposed development.

It is further understood that the proposed building will be serviced with municipal water and sewer.

3.0 Method of Investigation

3.1 Field Investigation

Field Program

The field program for the current geotechnical investigation was carried out on May 15, 2019. At that time, a total of three (3) boreholes (BH 4-19 through BH 6-19) were advanced to a maximum depth of 8.3 m below the existing ground surface. The boreholes were distributed in a manner to provide general coverage of the proposed development taking into consideration existing site features and underground utilities.

Previous geotechnical investigations conducted at the subject site by Paterson included three (3) boreholes (BH 1 through BH 3) completed on April 2, 2013, one (1) test pit (TP 1) completed on April 3, 2013, five (5) test pits (TP 1 through TP 5) completed on October 21, 2002, five (5) boreholes (BH 1 through BH 5) completed on October 15, 2001, and four (4) boreholes (BH 1-1 through BH 4-1) completed on November 18, 1996. The locations of the test holes are shown on Drawing PG4935-1 - Test Hole Location Plan included in Appendix 2.

The boreholes were drilled using a track-mounted auger drill rig operated by a two person crew. The drilling procedure consisted of augering to the required depths at the selected locations and sampling the overburden. The test pit procedure consisted of excavating to the required depths at the selected locations and sampling the overburden. The test pits were backfilled with the excavated soil upon completion. All fieldwork was conducted under the full-time supervision of Paterson personnel under the direction of a senior engineer.

A field investigation program was also completed at the subject site by others during the period of April 2 through 5, 2013, consisting of a total of 12 boreholes (BH/MW 1 through BH 12) advanced to a maximum depth of 13.5 m below the existing ground surface. The borehole logs prepared by others are provided in Appendix 1.

Sampling and In Situ Testing

Soil samples were recovered from a 50 mm diameter split-spoon, the auger flights or grab samples. The split-spoon, auger and grab samples were classified on site and placed in sealed plastic bags. All samples were transported to our laboratory. The depths at which the split-spoon, auger and grab samples were recovered from the boreholes are presented as SS, AU and G, respectively, on the Soil Profile and Test Data sheets.

Standard Penetration Tests (SPT) were 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 sample 300 mm into the soil after the initial penetration of 150 mm using a 63.5 kg hammer falling from a height of 760 mm.

Diamond drilling was completed at select locations to confirm the bedrock quality. A recovery value and a Rock Quality Designation (RQD) value were calculated for each drilled section of bedrock and are presented as RC on the Soil Profile and Test Data sheets in Appendix 1. The recovery value is the ratio of the bedrock sample length recovered over the drilled section length, in percentage. The RQD value is the total length ratio of intact rock core length more than 100 mm in one drilled section over the length of the drilled section, in percentage. These values are indicative of the quality of the bedrock.

The subsurface conditions observed in the boreholes were recorded in detail in the field. The soil and bedrock profiles are presented on the Soil Profile and Test Data sheets in Appendix 1.

Groundwater

Monitoring wells were installed in boreholes BH 1, BH 3, BH 4-19, BH 5-19 and BH 6-19 to permit the monitoring of water levels subsequent to the completion of the sampling program.

Sample Storage

All samples will be stored in the laboratory for a period of one month after issuance of this report. They will then be discarded unless we are otherwise directed.

3.2 Field Survey

The test holes completed during the most recent geotechnical investigations on May 15, 2019 and April 2 and 3, 2013 were selected and determined in the field by Paterson personnel to provide general coverage of the subject site. The location and ground surface elevation at these borehole locations were surveyed by Paterson personnel. The test holes were surveyed with respect to a temporary benchmark (TBM), consisting of the top spindle of a fire hydrant located along the west property boundary near Churchill Avenue. A geodetic elevation of 66.18 m was provided for the TBM.

The location and ground surface elevation at each test hole location is presented on Drawing PG4935-1 - Test Hole Location Plan in Appendix 2.

3.3 Laboratory Testing

Soil and bedrock samples recovered from the subject site were visually examined in our laboratory to review the field logs. Two bedrock samples were submitted for uniaxial compressive strength, the results of which are provided in Appendix 1.

3.4 Analytical Testing

One soil sample was submitted for analytical testing to assess the potential for exposed ferrous metals and the sulphate potential against subsurface concrete structures. The sample was submitted to determine the concentration of sulphate and chloride, the resistivity and the pH of the soil. The results are provided in Appendix 1, and are discussed further in Section 6.7.

4.0 Observations

4.1 Surface Conditions

The subject site is currently vacant, with a mixture of asphaltic pavement structure, granular crushed stone and some concrete and construction debris located at the existing ground surface. The site is bordered by Scott Street to the north, Winona Avenue to the east, residential properties to the south, and Churchill Avenue to the west. The existing ground surface across the site slopes downward gradually from west to east, from approximate geodetic elevation 65.5 m at the west property line to approximate geodetic elevation 63 m at the east property line.

It is understood that the site was formerly occupied by two commercial buildings, a 3 storey building with a basement on the west portion of the site and a single storey, slab on grade building on the east portion of the site.

4.2 Subsurface Profile

Overburden

Generally, the subsurface profile at the borehole locations consists of fill underlying the existing crushed stone surface or 80 to 150 mm thick asphalt surface. The fill material extended to approximate depths of 1.4 to 3.8 m below the existing ground surface and generally consisted of loose to dense, brown silty sand to silty clay with trace to some gravel, cobbles, boulders, and construction debris such as glass, wood chips, brick, and concrete.

Bedrock

Practical refusal to augering or excavation was encountered at the test holes at depths of 1.4 to 3.8 m below the existing ground surface. Bedrock was cored at boreholes BH 1, BH 3, BH 4-19, BH 5-19, and BH 6-19 to depths of 7.7 to 13.5 m, and consisted of a poor to excellent quality limestone to limestone with interbedded dolostone and shale.

Based on available geological mapping, bedrock in the area of the subject site consists of interbedded limestone and dolostone of the Gull River Formation with drift thicknesses of 1 to 2 m.

4.3 Groundwater

Groundwater levels were measured in the groundwater monitoring wells BH 1 and BH 3 on April 4, 2013, and in the groundwater monitoring wells BH 4-19 through BH 6-19 on May 15, 2019. The measured groundwater level (GWL) readings are presented in Table 1 below and on the Soil Profile and Test Data sheets in Appendix 1.

However, it should be noted that groundwater levels are subject to seasonal fluctuations. Therefore, the groundwater level could vary at the time of construction.

Table 1 - Measured Groundwater Levels

Test Hole Location	Ground Surface Elevation (m)	Groundwater Level		Date
		Depth (m)	Elevation (m)	
BH 1	65.09	6.93	58.16	April 4, 2013
BH 3	63.07	5.27	57.80	April 4, 2013
BH 4-19	63.71	7.10	56.61	May 22, 2019
BH 5-19	63.34	6.14	57.20	May 22, 2019
BH 6-19	62.99	5.82	57.17	May 22, 2019

Note: - The ground surface elevations are referenced to a temporary benchmark (TBM), consisting of the top spindle of the fire hydrant located along the west property boundary near Churchill Avenue with a geodetic elevation of 66.18 m.

5.0 Discussion

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is adequate for the proposed multi-storey building. The proposed building is expected to be founded on footings placed on clean, surface sounded bedrock.

Bedrock removal will be required to complete the underground parking levels. Line drilling and controlled blasting where large quantities of bedrock need to be removed is recommended. The blasting operations should be planned and completed under the guidance of a professional engineer with experience in blasting operations.

The above and other considerations are discussed in the following sections.

5.2 Site Grading and Preparation

Stripping Depth

Due to the relatively shallow depth of the bedrock at the subject site and the anticipated founding level for the proposed building, all existing overburden material should be excavated from within the proposed building footprint. Bedrock removal will be required for the construction of the underground levels.

Existing foundation walls and other construction debris should be entirely removed from within the building perimeter. Under paved areas, existing construction remnants, such as foundation walls, should be excavated to a minimum of 1 m below final grade.

Bedrock Removal

Based on the volume of the bedrock encountered in the area, it is expected that line-drilling in conjunction with hoe-ramming or controlled blasting will be required to remove the bedrock. In areas of weathered bedrock and where only a small quantity of bedrock is to be removed, bedrock removal may be possible by hoe-ramming.

Prior to considering blasting operations, the blasting effects on the existing services, buildings and other structures should be addressed. A pre-blast or pre-construction survey of the existing structures located in proximity to the blasting operations should be conducted prior to commencing construction. The extent of the survey should be determined by the blasting consultant and sufficient to respond to any inquiries/claims related to the blasting operations.

As a general guideline, peak particle velocity (measured at the structures) should not exceed 25 mm/s during the blasting program to reduce the risks of damage to the existing structures.

The blasting operations should be planned and conducted under the supervision of a licensed professional engineer who is an experienced blasting consultant.

Excavation side slopes in sound bedrock can be completed with almost vertical side walls. A minimum of 1 m horizontal bench, should remain between the bottom of the overburden and the top of the bedrock surface to provide an area for potential sloughing or to provide a stable base for the overburden shoring system.

Vibration Considerations

Construction operations could be the cause of vibrations, and possibly, sources of nuisance to the community. Therefore, means to reduce the vibration levels as much as possible should be incorporated in the construction operations to maintain a cooperative environment with the residents.

The following construction equipment could be the source of vibrations: piling equipment, hoe ram, compactor, dozer, crane, truck traffic, etc. The construction of the shoring system with soldier piles would utilize such equipment. Vibrations, whether it is caused by blasting operations or by construction operations, could be the cause of the source of detrimental vibrations on the adjoining buildings and structures. Therefore, it is recommended that all vibrations be limited.

Two parameters determine the permissible vibrations: the maximum peak particle velocity and the frequency. For low frequency vibrations, the maximum allowable peak particle velocity is less than that for high frequency vibrations. As a guideline, the peak particle velocity should be less than 15 mm/s between frequencies of 4 to 12 Hz, and 50 mm/s above a frequency of 40 Hz (interpolate between 12 and 40 Hz). These guidelines are for current construction standards. Considering there are several sensitive buildings in close proximity to the subject site, consideration to lowering these guidelines is recommended.

These guidelines are above perceptible human level and, in some cases, could be very disturbing to some people. Therefore, a pre-construction survey is recommended to minimize the risks of claims during or following the construction of the proposed building.

Horizontal Rock Anchors

Horizontal rock anchors may be required at specific locations to prevent pop-outs of the bedrock, especially in areas where bedrock fractures are conducive to the failure of the bedrock surface.

The requirement for horizontal rock anchors will be evaluated during the excavation operations and should be discussed with the structural engineer during the design stage.

Fill Placement

Fill placed for grading beneath the building areas should consist, unless otherwise specified, of clean imported granular fill, such as Ontario Provincial Standard Specifications (OPSS) Granular A or Granular B Type II. The imported fill material should be tested and approved prior to delivery to the site. The fill should be placed in maximum of 300 mm thick loose lifts and compacted using suitable compaction equipment. Fill placed beneath the buildings should be compacted to a minimum of 98% of the standard Proctor maximum dry density (SPMDD).

Non-specified existing fill along with site-excavated soil could be placed as general landscaping fill where settlement of the ground surface is of minor concern. These materials should be spread in lifts with a maximum thickness of 300 mm and compacted by the tracks of the spreading equipment to minimize voids. Non-specified existing fill and site-excavated soils are not suitable for placement as backfill against foundation walls, unless used in conjunction with a geocomposite drainage membrane, such as Delta Drain 6000.

5.3 Foundation Design

Footings placed on a clean, surface sounded limestone bedrock surface can be designed using a factored bearing resistance value at ultimate limit states (ULS) of **1,500 kPa**, incorporating a geotechnical resistance factor of 0.5.

A clean, surface-sounded bedrock bearing surface should be free of loose materials, and have no near surface seams, voids, fissures or open joints which can be detected from surface sounding with a rock hammer.

A factored bearing resistance value at ULS of **4,500 kPa**, incorporating a geotechnical resistance factor of 0.5, could be provided if founded on limestone bedrock which is free of seams, fractures and voids within 1.5 m below the founding level. This should be verified by completing and probing 50 mm diameter drill holes to a depth of 1.5 m below the founding level within the all the footing footprints. A minimum of one probe hole should be completed per footing. The drill hole inspection should be completed by the geotechnical consultant.

Settlement

Footings bearing on an acceptable bedrock bearing surface and designed using the bearing resistance values provided herein will be subjected to negligible potential post-construction total and differential settlements.

5.4 Design for Earthquakes

A site specific shear wave velocity test was completed to accurately determine the applicable seismic site classification for foundation design of the proposed building as presented in Table 4.1.8.4.A of the Ontario Building Code 2012. A seismic shear wave velocity test was completed by Paterson at the subject site. Two shear wave velocity profiles are presented in Appendix 2.

Field Program

The shear wave test location is presented in Drawing PG4935-1 - Test Hole Location Plan in Appendix 2. Paterson field personnel installed 24 horizontal geophones in a straight line oriented roughly in a north-south direction along the eastern site boundary. The 4.5 Hz horizontal geophones were mounted to the surface by means of two 75 mm ground spikes attached to the geophone land case. The geophones were spaced at 1 m intervals and connected by a geophone spread cable to a Geode 24 Channel seismograph.

The seismograph was connected to a computer and a trigger switch attached to a 12 pound dead blow hammer. The hammer trigger sends a signal to the seismograph to commence recording. The hammer strikes an I-Beam seated into the ground surface, which produces a polarized shear wave. The shots are repeated between four to eight times at each shot location to provide an accurate signal and reduce noise. The shot locations are completed in forward and reverse directions (i.e. striking both sides of the I-Beam seated parallel to the geophone array). The shot locations were distributed at the centre of the geophone array and 1, 2 and 5 m away from the first and last geophone.

Data Processing and Interpretation

Interpretation for the shear wave velocity results were completed by Paterson. The shear wave velocity measurement was calculated by the reflection/refraction methods. The interpretation is performed by recovering arrival times from direct and refracted waves. The interpretation is repeated at each shot location to provide an average shear wave velocity, V_{s30}, immediately below the proposed building foundation of the upper 30 m profile. To compute the bedrock depth at each location, the layer intercept times, velocities from different layers and critical distances are interpreted from the shear wave graphs. The bedrock velocity was interpreted by the main refractor wave velocity, which is considered a conservative estimate of the bedrock velocity due to the increasing quality of the bedrock with depth. As bedrock quality increases, the bedrock shear wave velocity increases.

The V_{s30} was calculated using the standard equation for average shear wave velocity from the Ontario Building Code (OBC) 2012, as presented below;

$$V_{s30} = \frac{Depth_{OfInterest}(m)}{\left(\frac{(Depth_{Layer1}(m)}{Vs_{Layer1}(m/s)} + \frac{Depth_{Layer2}(m)}{Vs_{Layer2}(m/s)}\right)}$$

$$V_{s30} = \frac{30m}{\left(\frac{0m}{233m/s} + \frac{30m}{1{,}805m/s}\right)}$$

$$V_{s30} = 1{,}805m/s$$

Based on the seismic results, the average shear wave velocity, V_{s30}, for shallow foundations located at the subject site is 1,805 m/s. Therefore, a **Site Class A** is applicable for design of the proposed building at the subject site, as per Table 4.1.8.4.A of the OBC 2012. The soils underlying the subject site are not susceptible to liquefaction.

5.5 Basement Slab

For the subject site development, all overburden soil should be removed from the subject site and the basement floor slab will be founded on a bedrock medium. OPSS Granular A or Granular B Type II, with a maximum particle size of 50 mm, are recommended for backfilling below the floor slab. It is recommended that the upper 150 to 200 mm of sub-slab fill consists of a 19 mm clear crushed stone.

In consideration of the groundwater conditions encountered at the time of the field investigation, an underfloor drainage system, consisting of lines of perforated drainage pipe subdrains connected to a positive outlet, should be provided in the clear stone backfill under the lower basement floor.

5.6 Basement Wall

There are several combinations of backfill materials and retained soils that could be applicable for the basement walls of the subject structure. However, the conditions can be well-represented by assuming the retained soil consists of a material with an angle of internal friction of 30 degrees and a bulk (drained) unit weight of 20 kN/m^3.

It is expected that a portion of the basement walls are to be poured against a composite drainage blanket, which will be placed against the exposed bedrock face. A nominal coefficient of at-rest earth pressure of 0.05 is recommended in conjunction with a bulk unit weight of 23.5 kN/m^3 (effective 15.5 kN/m^3) where this condition occurs. Further, a seismic earth pressure component will not be applicable for the foundation wall which is poured against the bedrock face. It is expected that the seismic earth pressure will be transferred to the underground floor slabs, which should be designed to accommodate these pressures. A hydrostatic groundwater pressure should be added for the portion below the groundwater level.

Undrained conditions are anticipated (i.e. below the groundwater level). Therefore, the applicable effective (undrained) unit weight of the retained soil can be taken as 13 kN/m^3, where applicable. A hydrostatic pressure should be added to the total static earth pressure when using the effective unit weight.

Two (2) distinct conditions, static and seismic, must be reviewed for design calculations. The parameters for design calculations for the two (2) conditions are presented below.

Static Conditions

The static horizontal earth pressure (p_o) can be calculated using a triangular earth pressure distribution equal to $K_o \cdot \gamma \cdot H$ where:

K_o = at-rest earth pressure coefficient of the applicable retained soil or bedrock
γ = unit weight of fill of the applicable retained soil or bedrock (kN/m^3)
H = height of the wall (m)

An additional pressure having a magnitude equal to $K_o \cdot q$ and acting on the entire height of the wall should be added to the above diagram for any surcharge loading, q (kPa), that may be placed at ground surface adjacent to the wall. The surcharge pressure will only be applicable for static analyses and should not be used in conjunction with the seismic loading case.

Actual earth pressures could be higher than the "at-rest" case if care is not exercised during the compaction of the backfill materials to maintain a minimum separation of 0.3 m from the walls with the compaction equipment.

Seismic Conditions

The total seismic force (P_{AE}) includes both the earth force component (P_o) and the seismic component (ΔP_{AE}).

The seismic earth force (ΔP_{AE}) can be calculated using $0.375 \cdot a_c \cdot \gamma \cdot H^2/g$ where:

a_c = $(1.45-a_{max}/g)a_{max}$
γ = unit weight of fill of the applicable retained soil (kN/m^3)
H = height of the wall (m)
g = gravity, 9.81 m/s^2

The peak ground acceleration, (a_{max}), for the Ottawa area is 0.32g according to the OBC 2012. Note that the vertical seismic coefficient is assumed to be zero.

The earth force component (P_o) under seismic conditions can be calculated using $P_o = 0.5\ K_o\ \gamma\ H^2$, where $K_o = 0.5$ for the soil conditions noted above.

The total earth force (P_{AE}) is considered to act at a height, h (m), from the base of the wall, where:

$h = \{P_o \cdot (H/3) + \Delta P_{AE} \cdot (0.6 \cdot H)\}/P_{AE}$

The earth forces calculated are unfactored. For the ULS case, the earth loads should be factored as live loads, as per the OBC 2012.

5.7 Rock Anchor Design

The geotechnical design of grouted rock anchors in limestone bedrock is based upon two possible failure modes. The rock anchor can fail by shear failure along the grout/rock interface or by pullout at 60 to 90 degree cone of rock with the apex of the cone near the middle of the bonded length of the anchor. Interaction may develop between the failure cones of anchors that are relatively close to one another resulting in a total group capacity smaller than the sum of the individual anchor load capacity.

A third failure mode of shear failure along the grout/steel interface should be reviewed by a qualified structural engineer to ensure all typical failure modes have been reviewed. Typical rock anchor suppliers, such as Dywidag Systems International (DSI Canada) or Williams Form Engineering, have qualified personnel on staff to recommend appropriate rock anchor size and materials.

The centre to centre spacing between bond lengths should be a minimum of 1.2 m or four times the anchor hole diameter to ensure the group influence effects are minimized. Anchors in close proximity to each other are recommended to be grouted at the same time to ensure any fractures or voids are completely in-filled and grout fluid does not flow from one hole to an adjacent empty one.

Anchors can be of the “passive” or the “post-tensioned” type, depending on whether the anchor tendon is provided with post-tensioned load or not, prior to servicing.

Regardless of whether an anchor is a passive or the post tensioned type, it is recommended that the anchor is provided with a fixed anchor length at the base, which will provide the capacity, and an free anchor length between the rock surface and the top of the bonded length. As the depth at which the apex of the shear failure cone develops midway along the bonded length, a fully bonded anchor would tend to have a much shallower cone, and therefore less geotechnical resistance, than one where the bonded length is limited to the bottom part of the overall anchor.

Permanent anchors should be provided with corrosion protection. As a minimum, this requires that the entire drill hole be filled with cementitious grout. The free anchor length is provided by installing a sleeve to act as a bond break, with the sleeve filled with grout. Double corrosion protection can be provided with factory assembled systems, such as those available from Dywidag Systems International or Williams Form Engineering Corp.

Grout to Rock Bond

The unconfined compressive strength of limestone at the subject site ranges between 65 and 125 MPa, which is stronger than most routine grouts. A factored tensile grout to rock bond resistance value at ULS of **1.0 MPa**, incorporating a resistance factor of 0.3, should be provided. A minimum grout strength of 40 MPa is recommended.

Rock Cone Uplift

The rock anchor capacity depends on the dimensions of the rock anchors and the anchorage system configuration. Based on existing bedrock information, a **Rock Mass Rating (RMR) of 69** was assigned to the bedrock, and Hoek and Brown parameters (**m and s**) were taken as **0.575 and 0.00293**, respectively.

Recommended Grouted Rock Anchor Lengths

Parameters used to calculate grouted rock anchor lengths are provided in Table 1.

Table 2 - Parameters used in Rock Anchor Review

Grout to Rock Bond Strength - Factored at ULS	1.0 MPa
Compressive Strength - Grout	40 MPa
Rock Mass Rating (RMR) - Good quality Limestone Hoek and Brown parameters	69 m=0.575 and s=0.00293
Unconfined compressive strength - Limestone	65 MPa
Effective unit weight - Bedrock	15 kN/m^3
Apex angle of failure cone	60^o
Apex of failure cone	mid-point of fixed anchor length

The fixed anchor length will depend on the diameter of the drill holes. Recommended anchor lengths are provided in Table 3. The factored tensile resistance values provided are based on a single anchor with no group influence effects.

Table 3 - Recommended Rock Anchor Lengths - Grouted Rock Anchor

Diameter of Drill Hole (mm)	Anchor Lengths (m)			Factored Tensile Resistance (kN)
	Bonded Length	Unbonded Length	Total Length	
75	2.0	0.8	2.8	450
	2.6	1	3.6	600
	3.2	1.2	4.4	750
	4.5	2	6.5	1500
125	1.6	0.6	2.2	600
	2	1	3	750
	2.6	1.4	4.0	1000
	3.2	1.8	5.0	1250

Other Considerations

It is recommended that the anchor drill hole diameter be within 1.5 to 2 times the rock anchor tendon diameter. The anchor drill holes should be inspected by geotechnical personnel and should be flushed clean prior to grouting. A tremie pipe is recommended to place grout from the bottom to top of the anchor holes.

The geotechnical capacity of each rock anchor should be proof tested at the time of construction. More information on test procedures can be provided upon request. Compressive strength testing is recommended to be completed for the rock anchor grout. A set of grout cubes should be tested for each day grout is prepared.

5.8 Pavement Structure

Where paved areas are considered for the project, the recommended pavement structures shown in Tables 4 through 6 would be applicable.

Table 4 - Recommended Pavement Structure - Car Only Parking Areas

Thickness (mm)	Material Description
50	**Wear Course -** HL-3 or Superpave 12.5 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
300	**SUBBASE** - OPSS Granular B Type II
	SUBGRADE - In situ soil, or OPSS Granular B Type I or II material placed over in situ soil

Table 5 - Recommended Pavement Structure
Access Lanes and Heavy Truck Parking Areas

Thickness (mm)	Material Description
40	**Wear Course -** HL-3 or Superpave 12.5 Asphaltic Concrete
50	**Binder Course -** HL-8 or Superpave 19.0 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
400	**SUBBASE** - OPSS Granular B Type II
	SUBGRADE - In situ soil, or OPSS Granular B Type I or II material placed over in situ soil

Table 6 - Recommended Rigid Pavement Structure - Lowest Parking Level

Thickness (mm)	Material Description
150	**32 MPa - C4 - Concrete**
300	**BASE** - OPSS Granular A Crushed Stone
SUBGRADE - Existing imported fill, or OPSS Granular B Type I or II material placed over bedrock.	

Minimum Performance Graded (PG) 58-34 asphalt cement should be used for this project.

If soft spots develop in the subgrade during compaction or due to construction traffic, the affected areas should be sub-excavated and replaced with OPSS Granular B Type II material.

The pavement granular base and subbase should be placed in maximum 300 mm thick lifts and compacted to a minimum of 100% of the SPMDD with suitable vibratory equipment, noting that excessive vibration could lead to subgrade softening.

6.0 Design and Construction Precautions

6.1 Foundation Drainage and Backfill

Water Suppression System

Where the proposed building is to have more than 2 underground parking levels, the following water suppression system is recommended to manage and control groundwater water infiltration over the long term. The water suppression system would be installed for the exterior foundation walls and underfloor drainage and would consist of the following (refer to Figure 4 - Water Suppression System in Appendix 2 for an illustration of this system cross-section):

- A concrete mud slab creating a horizontal hydraulic barrier to lessen the water infiltration at the base of the excavation. The thickness of the concrete mud slab will be determined during the excavation program when realistic groundwater infiltration can be properly assessed. However for preliminary design purposes, it is recommended that the concrete mud slab be designed at a minimum thickness of 150 mm.

- A waterproofing membrane to lessen the effect of water infiltration for the lower underground parking level(s) starting at 6 m below finished grade. The waterproofing membrane will consist of a bentonite waterproofing such as Tremco Paraseal or equivalent securely fastened to the temporary shoring system or the vertical bedrock surface. The membrane should extend to the bottom of the excavation at the founding level and extend horizontally over the concrete mud slab a minimum of 300 mm prior to the placement of the footings. Consideration can be given to doubling the bentonite waterproofing panels within the lower portion of the underground parking levels where hydrostatic pressure will be greater.

Water infiltration will result from two sources. The first will be water infiltration from the upper 6 m which is above the vertical waterproofed area. The second source will be water breaching the waterproofing membrane.

Foundation Drainage

A composite drainage layer should be placed from finished grade to the bottom of the foundation wall. Where the proposed building is to have more than 2 underground parking levels and the water suppression system is employed, the composite drainage layer should be placed between the waterproofing membrane and the foundation wall.

It is recommended that the composite drainage system consist of DeltaDrain 6000, MiraDrain G100N or an approved equivalent. It is expected that 150 mm diameter sleeves placed at 3 m centres be cast in the foundation wall at the footing interface to allow the infiltration of water to flow to an interior perimeter drainage pipe. The perimeter drainage pipe should direct water to the sump pit(s) within the lower basement area.

Underfloor Drainage

Underfloor drainage will be required to control water infiltration below the lowest underground parking level slab. For design purposes, it's recommended that 150 mm diameter perforated pipes be placed at approximate 6 m spacing underlying the lowest level floor slab. The final spacing of the underfloor drainage system should be confirmed at the time of completing the excavation when water infiltration can be better assessed.

Foundation Backfill

Above the bedrock surface, backfill against the exterior sides of the foundation walls should consist of free-draining non frost susceptible granular materials. The greater part of the site excavated materials will be frost susceptible and, as such, are not recommended for re-use as backfill against the foundation walls, unless used in conjunction with a drainage geocomposite, as recommended above, connected to the perimeter foundation drainage system. Imported granular materials, such as clean sand or OPSS Granular B Type I granular material, should otherwise be used for this purpose.

6.2 Protection of Footings Against Frost Action

Perimeter footings of heated structures are recommended to be protected against the deleterious effects of frost action. A minimum of 1.5 m of soil cover alone, or a combination of soil cover and foundation insulation should be provided.

Exterior unheated footings, such as those for isolated exterior piers, are more prone to deleterious movement associated with frost action than the exterior walls of the structure proper and require additional protection, such as soil cover of 2.1 m or a combination of soil cover and foundation insulation.

It is expected that the parking garage will not require protection against frost action due to the founding depth. Unheated structures such as the access ramp may required to be insulated against the deleterious effect of frost action. A minimum of 2.1 m of soil cover alone, or a minimum of 0.6 m of soil cover, in conjunction with foundation insulation, should be provided.

6.3 Excavation Side Slopes and Temporary Shoring

Side Slopes

The excavation side slopes in the overburden, above the groundwater level, extending to a maximum depth of 3 m should be excavated at 1H:1V or shallower. The shallower slope is required for excavation below groundwater level. The subsurface soils are considered to be a Type 2 and 3 soil according to the Occupational Health and Safety Act and Regulations for Construction Projects.

As noted above, excavation side slopes in sound bedrock can be carried out using almost vertical side walls. A minimum 1 m horizontal ledge should be left between the bottom of the overburden excavation and the top of the bedrock surface to provide an area to allow for potential sloughing or to provide a stable base for the overburden shoring system.

Excavated soil should not be stockpiled directly at the top of excavations and heavy equipment should be kept away from the excavation sides.

Slopes in excess of 3 m in height should be periodically inspected by the geotechnical consultant in order to detect if the slopes are exhibiting signs of distress.

A trench box is recommended to protect personnel working in trenches with steep or vertical sides. Services are expected to be installed by “cut and cover” methods and excavations should not remain open for extended periods of time.

Temporary Shoring

Temporary shoring may be required for the overburden soil to complete the required excavations where insufficient room is available for open cut methods. The shoring requirements will depend on the depth of the excavation, the proximity of the adjacent buildings and underground structures and the elevation of the adjacent building foundations and underground services.

The temporary shoring system could consist of soldier pile and lagging system. Any additional loading due to street traffic, construction equipment, adjacent structures and facilities, etc., should be included to the earth pressures described below. These systems can be cantilevered, anchored or braced. Generally, it is expected that the shoring systems will be provided with tie-back rock anchors to ensure the stability. It is further recommended that the toe of the shoring be adequately supported to resist toe failure, if required, by means of rock bolts or extending the piles into the bedrock through pre-augered holes if a soldier pile and lagging system is the preferred method.

The earth pressures acting on the shoring system may be calculated with the following parameters.

Table 7 - Soil Parameters

Parameters	Values
Active Earth Pressure Coefficient (K_a)	0.33
Passive Earth Pressure Coefficient (K_p)	3
At-Rest Earth Pressure Coefficient (K_o)	0.5
Dry Unit Weight (γ), kN/m^3	20
Effective Unit Weight (γ), kN/m^3	13

The active earth pressure should be calculated where wall movements are permissible while the at-rest pressure should be calculated if no movement is permissible.

The dry unit weight should be calculated above the groundwater level while the effective unit weight should be calculated below the groundwater level.

The hydrostatic groundwater pressure should be included to the earth pressure distribution wherever the effective unit weight are calculated for earth pressures. If the groundwater level is lowered, the dry unit weight for the soil/bedrock should be used full weight, with no hydrostatic groundwater pressure component.

For design purposes, the minimum factor of safety of 1.5 should be calculated.

Underpinning of Adjacent Structures

Based on the test pit completed at one of the adjacent building foundations and the relatively shallow depth of the bedrock at the subject site, it is expected that the buildings along the southern boundary of the site are most likely founded on the bedrock surface. Therefore, underpinning is not expected to be required for this project.

However, Paterson should review the condition of the bedrock underlying the adjacent building foundations at the time of construction to evaluate if bedrock stabilization is required.

6.4 Pipe Bedding and Backfill

A minimum of 150 mm of OPSS Granular A should be placed for bedding for sewer or water pipes when placed on soil/bedrock subgrade. The bedding should extend to the spring line of the pipe. Cover material, from the spring line to at least 300 mm above the obvert of the pipe should consist of OPSS Granular A (concrete or PSM PVC pipes) or sand (concrete pipe). The bedding and cover materials should be placed in maximum 225 mm thick lifts compacted to a minimum of 95% of the SPMDD.

Where hard surface areas are considered above the trench backfill, the trench backfill material within the frost zone (about 1.8 m below finished grade) should match the soils exposed at the trench walls to reduce the potential differential frost heaving. The trench backfill should be placed in maximum 300 mm thick loose lifts and compacted to a minimum of 95% of the SPMDD.

6.5 Groundwater Control

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

Groundwater Control for Building Construction

A temporary Ministry of Environment, Conservation and Parks (MECP) permit to take water (PTTW) may be required if more than 400,000 L/day of ground and/or surface water are to be pumped during the construction phase. At least 4 to 5 months should be allowed for completion of the application and issuance of the permit by the MECP.

For typical ground or surface water volumes being pumped during the construction phase, typically between 50,000 to 400,000 L/day, it is required to register on the Environmental Activity and Sector Registry (EASR). A minimum of two to four weeks should be allotted for completion of the EASR registration and the Water Taking and Discharge Plan to be prepared by a Qualified Person as stipulated under O.Reg. 63/16. If a project qualifies for a PTTW based upon anticipated conditions, an EASR will not be allowed as a temporary dewatering measure while awaiting the MECP review of the PTTW application.

Long-term Groundwater Control

Our recommendations for the proposed building's long-term groundwater control are presented in Section 6.1. Any groundwater encountered along the building's perimeter or sub-slab drainage system will be directed to the proposed building's cistern/sump pit. Due to the limited capacity of the existing sewers, it is anticipated that pumped groundwater can be temporarily contained within a cistern/holding tank to permit reduced discharge volumes, if required. Provided the proposed groundwater infiltration control system is properly implemented where more than 3 underground parking levels are built, it is expected that groundwater flow will be low (i.e.- less than 3,000 L/day) with peak periods noted after rain events. It is anticipated that the groundwater flow will be controllable using conventional open sumps.

Impacts on Neighbouring Structures

It is understood that where the underground levels extend below the groundwater level (3 or more underground levels), the lower portion of the foundation will have a groundwater infiltration control system in place. Due to the presence of a groundwater infiltration control system in place against the bedrock face in this scenario, long-term groundwater lowering is anticipated to be negligible for the area.

Further, based on our observations, the groundwater level is anticipated at a 5 to 7 m depth and located within the bedrock. Therefore, local groundwater lowering is not anticipated under short-term conditions due to construction of the proposed building.

The neighbouring structures are founded within native glacial till or directly over a bedrock bearing surface based on available soils information within the area. Due to the current groundwater level noted to be within the bedrock, no issues are expected with respect to groundwater lowering that would cause long term damage to adjacent structures surrounding the proposed building.

6.6 Winter Construction

Precautions must be taken if winter construction is considered for this project.

Where excavations are completed in proximity to existing structures, they may be adversely affected due to the freezing conditions. In particular, it should be recognized that where a shoring system is constructed, the soil behind the shoring system will be subjected to freezing conditions and could result in heaving of the structure(s) placed within or above frozen soil. Provisions should be made in the contract document to protect the walls of the excavations from freezing, if applicable.

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

Trench excavations and pavement construction are difficult activities to complete during freezing conditions without introducing frost in the subgrade or in the excavation walls and bottoms. Precautions should be considered if such activities are to be completed during freezing conditions. Additional information could be provided, if required.

6.7 Corrosion Potential and Sulphate

The results of analytical testing show that the sulphate content is less than 0.1%. This result is indicative that Type 10 Portland cement (normal cement) would be appropriate for this site. The chloride content and the pH of the sample indicate that they are not significant factors in creating a corrosive environment for exposed ferrous metals at this site, whereas the resistivity is indicative of an moderate to aggressive corrosive environment.

7.0 Recommendations

A materials testing and observation services program is a requirement for the provided foundation design data to be applicable. The following aspects of the program should be performed by the geotechnical consultant:

- ❏ Review of the geotechnical aspects of the excavating contractor's shoring design, prior to construction.
- ❏ Review the bedrock stabilization and excavation requirements.
- ❏ Observation of all bearing surfaces prior to the placement of concrete.
- ❏ Sampling and testing of the concrete and fill materials used.
- ❏ Periodic observation of the condition of unsupported excavation side slopes in excess of 3 m in height, if applicable.
- ❏ Observation of all subgrades prior to backfilling.
- ❏ Field density tests to determine the level of compaction achieved.
- ❏ Sampling and testing of the bituminous concrete including mix design reviews.

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

8.0 Statement of Limitations

The recommendations provided in this report are in accordance with our present understanding of the project. We request permission to review our recommendations when the drawings and specifications are completed.

A geotechnical investigation is a limited sampling of a site. The recommendations are based on information gathered at the specific test locations and can only be extrapolated to an undefined limited area around the test locations. Should any conditions at the site be encountered which differ from those at the test locations, Paterson requests notification immediately in order to permit reassessment of the recommendations.

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 Westboro Point Developments Ltd. 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.

Richard Groniger, C. Tech.

Scott S. Dennis, P. Eng.

Report Distribution:

- ❑ Westboro Point Developments Ltd. (3 copies)
- ❑ Paterson Group (1 copy)

APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SOIL PROFILE AND TEST DATA SHEETS BY OTHERS

SYMBOLS AND TERMS

UNIAXIAL COMPRESSIVE STRENGTH TESTING RESULTS

ANALYTICAL RESULTS

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Multi-Storey Building - 2070 and 2090 Scott St.
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located on the west side of Churchill Avenue, along the west property line. Geodetic elevation = 66.18m.

FILE NO. PG2936

REMARKS

HOLE NO. BH 1

BORINGS BY CME 55 Power Auger **DATE** April 2, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	65.09
100mm Asphaltic concrete over crushed stone 0.25		AU	1				
FILL: Brown silty sand with gravel 1.37		SS	2	8	4	1	64.09
Fractured **BEDROCK:** 1.65		RC	1	100	75	2	63.09
BEDROCK: Grey limestone		RC	2	100	72	3	62.09
4.40						4	61.09
BEDROCK: Grey limestone interbedded with dolostone		RC	3	100	100	5	60.09
6.02						6	59.09
		RC	4	100	96	7	58.09
		RC	5	100	84	8	57.09
						9	56.09
BEDROCK: Grey limetone with intermittent dolostone and shale		RC	6	100	71	10	55.09
		RC	7	100	85	11	54.09
						12	53.09
		RC	8	100	100	13	52.09
13.51							
End of Borehole							
(GWL @ 6.93m-April 4, 2013)							

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

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Multi-Storey Building - 2070 and 2090 Scott St.
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located on the west side of Churchill Avenue, along the west property line. Geodetic elevation = 66.18m.

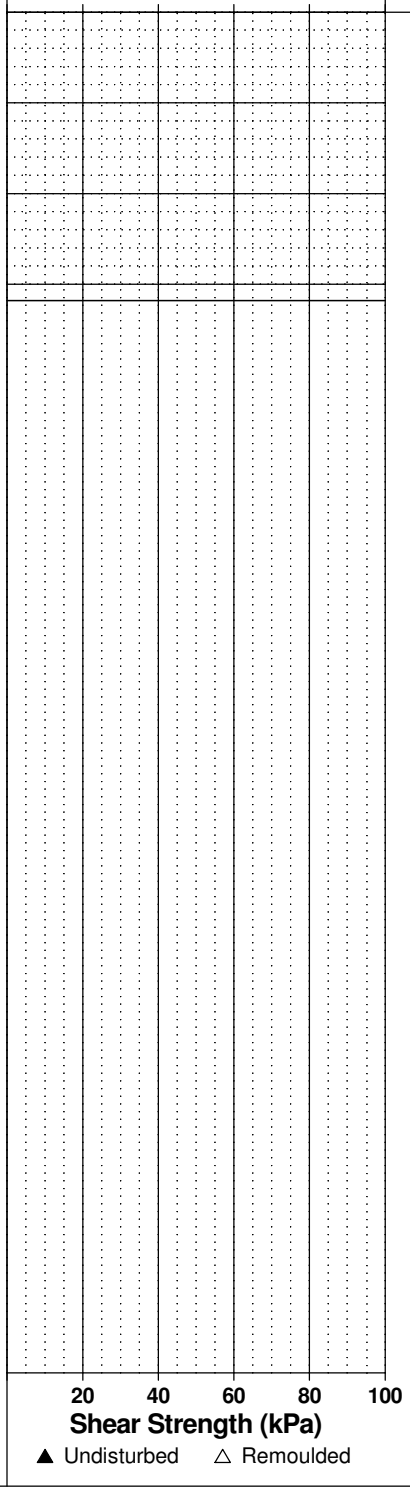
FILE NO. PG2936

REMARKS

HOLE NO. BH 2

BORINGS BY CME 55 Power Auger **DATE** April 2, 2013

SOIL DESCRIPTION		STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Monitoring Well Construction
GROUND SURFACE										
150mm Asphaltic concrete over crushed stone	0.46		AU	1			0	63.77		
FILL: Brown silty clay with sand, gravel, trace glass	1.68		SS	2	21	7	1	62.77		
FILL: Brown silty sand iwth gravel, cobbles, trace boulders	2.29		SS	3	4	48	2	61.77		
FILL: Topsoil, trace wood chips	2.59		SS	4	42	12				
GLACIAL TILL: Brown silty sand with gravel, trace cobbles and boulders	3.18		SS	5	33	50+	3	60.77		
End of Borehole										
Practical refusal to augering at 3.18m depth										
(BH dry upon completion)										



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Multi-Storey Building - 2070 and 2090 Scott St.
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located on the west side of Churchill Avenue, along the west property line. Geodetic elevation = 66.18m.

FILE NO. PG2936

REMARKS

HOLE NO. BH 3

BORINGS BY CME 55 Power Auger **DATE** April 2, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	63.07
25mm Asphaltic concrete over crushed stone 0.60		AU	1				
FILL: Red-brown silty sand 1.45		SS	2	46	11	1	62.07
FILL: Topsoil 1.70		SS	3	71	6	2	61.07
FILL: Brown silty sand with gravel, cobbles, trace boulders 2.46		SS	4	100	50+		
		RC	1	100	75	3	60.07
BEDROCK: Grye limestone 3.91		RC	2	100	67	4	59.07
BEDROCK: Grey to black dolostone interbedded with limestone 5.74		RC	3	71	29	5	58.07
BEDROCK: Grey limestone interbedded with dolostone 7.21		RC	4	100	83	6	57.07
		RC	5	90	60	7	56.07
BEDROCK: Black dolostone interbedded with limestone		RC	6	86	57	8	55.07
		RC	7	100	83	9	54.07
		RC	8	100	80	10	53.07
13.26						11	52.07
End of Borehole						12	51.07
(GWL @ 5.27m-April 4, 2013)						13	50.07

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

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
2070 Scott Street
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located on the west side of Churchill Avenue, along the west property line. Geodetic elevation = 66.18m.

FILE NO. PG4935

REMARKS

HOLE NO. BH 4-19

BORINGS BY CME 55 Power Auger **DATE** 2019 May 15

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	63.71
FILL: Brown silty sand and gravel		AU	1				
		SS	2	21	6	1	62.71
		SS	3	54	53	2	61.71
2.13							
FILL: Brown silty sand with crushed stone		SS	4	56	50+		
2.84						3	60.71
		RC	1	88	45	4	59.71
		RC	2	100	75	5	58.71
BEDROCK: Grey limestone						6	57.71
		RC	3	100	26	7	56.71
		RC	4	100	58	8	55.71
8.31							
End of Borehole							
(GWL @ 7.10m - May 22, 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

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
2070 Scott Street
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located on the west side of Churchill Avenue, along the west property line. Geodetic elevation = 66.18m.

FILE NO. PG4935

REMARKS

HOLE NO. BH 5-19

BORINGS BY CME 55 Power Auger **DATE** 2019 May 15

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Monitoring Well Construction
GROUND SURFACE									
Asphaltic concrete 0.13						0	63.34		
FILL: Brown silty sand		AU	1						
		SS	2	46	11	1	62.34		
1.37									
FILL: Brown silty sand, some clay, trace brick		SS	3	24	3	2	61.34		
2.21									
		RC	1	100	39	3	60.34		
		RC	2	100	52	4	59.34		
BEDROCK: Grey limestone		RC	3	100	56	5	58.34		
		RC	4	100	73	6	57.34		
		RC	5	100	38	7	56.34		
7.67									
End of Borehole									
(GWL @ 6.14m - May 22, 2019)									

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
2070 Scott Street
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located on the west side of Churchill Avenue, along the west property line. Geodetic elevation = 66.18m.

FILE NO. PG4935

REMARKS

HOLE NO. BH 6-19

BORINGS BY CME 55 Power Auger **DATE** 2019 May 15

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	62.99
		AU	1				
FILL: Brown silty sand and crushed rock, some concrete		SS	2	25	13	1	61.99
		SS	3	64	50+		
2.13						2	60.99
		RC	1	100	20		
		RC	2	100	64	3	59.99
BEDROCK: Grey limestone		RC	3	98	60	4	58.99
		RC	4	100	85	5	57.99
		RC	5	100	74	6	56.99
7.75						7	55.99
End of Borehole							
(GWL @ 5.82m - May 22, 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

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Multi-Storey Building - 2070 and 2090 Scott St.
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located on the west side of Churchill Avenue, along the west property line. Geodetic elevation = 66.18m.

FILE NO. PG2936

REMARKS

HOLE NO. TP 1

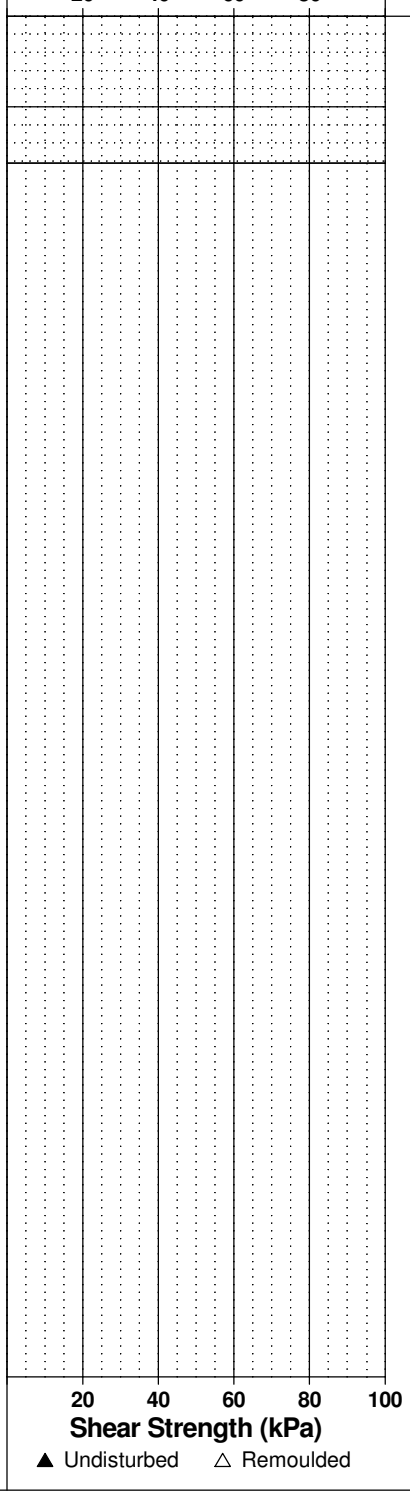
BORINGS BY Hydraulic Shovel **DATE** April 3, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Monitoring Well Construction
GROUND SURFACE									
Asphaltic concrete 0.08						0	65.19		
FILL: Crushed stone 0.76									
FILL: Brown silty sand with gravel, cobbles, trace boulders and topsoil 1.62		G	1			1	64.19		
End of Test Pit									

Practical refusal to excavation at 1.62m depth

Concrete foundation wall founded directly over bedrock surface at 1.62m depth. No footing encountered.

(TP dry upon completion)



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SOIL PROFILE & TEST DATA

Phase II Environmental Site Assessment
2074 Scott Street
Ottawa, Ontario

DATUM

REMARKS

BORINGS BY Backhoe

DATE 21 OCT 02

FILE NO. **E2283**

HOLE NO. **TP 1**

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Lower Explosive Limit %	PIEZOMETER CONSTRUCTION
GROUND SURFACE						0			
FILL: Brown sand		G	1			1			
		G	2						
						2			
2.44		G	3						
Brown SANDY SILT						3			▽
3.05									
Grey SAND		G	4						
3.20 End of Test Pit									
(Soil saturated below 2.9m depth)									

20 40 60 80

100 200 300 400 500

Gastech 1314 Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

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SOIL PROFILE & TEST DATA

Phase II Environmental Site Assessment
2074 Scott Street
Ottawa, Ontario

DATUM

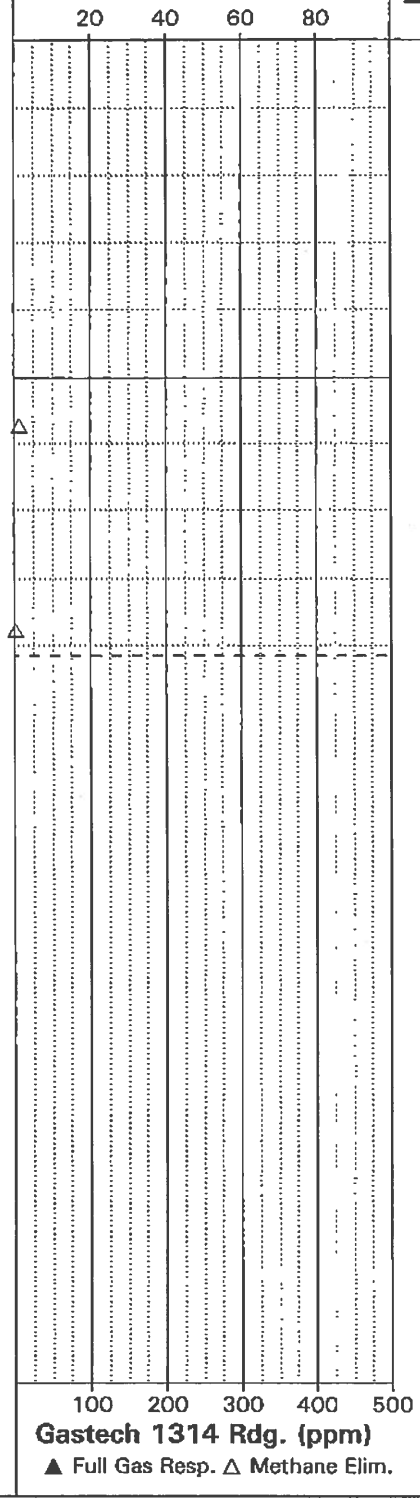
REMARKS

BORINGS BY Backhoe DATE 21 OCT 02

FILE NO. **E2283**

HOLE NO. **TP 2**

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Lower Explosive Limit %	PIEZOMETER CONSTRUCTION
GROUND SURFACE						0			
FILL: Brown sand and gravel, some cobbles and plastic pieces		G	1			1			
1.83		G	2						
End of Test Pit TP terminated on bedrock surface @ 1.83m depth (TP dry upon completion)									



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SOIL PROFILE & TEST DATA

Phase II Environmental Site Assessment
2074 Scott Street
Ottawa, Ontario

DATUM

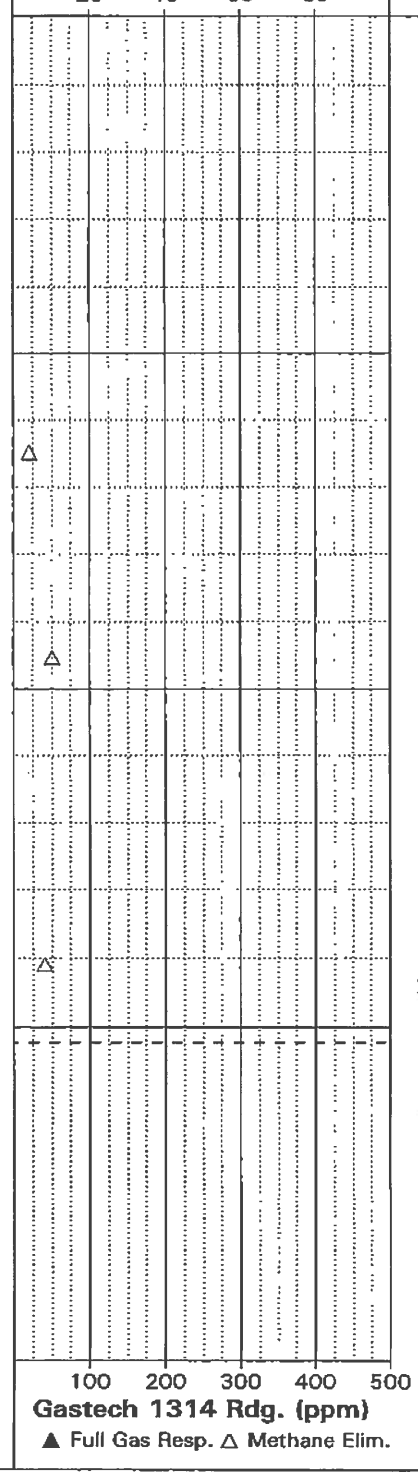
REMARKS

BORINGS BY Backhoe DATE 21 OCT 02

FILE NO. **E2283**

HOLE NO. **TP 3**

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 / ○ Lower Explosive Limit %	PIEZOMETER CONSTRUCTION
GROUND SURFACE						0			
FILL: Dark brown sand and gravel with plastic, asphalt and steel pieces		G	1			1			
		G	2			2			
		G	3			3			▽
3.05 End of Test Pit (Soil saturated below 2.9m depth)									



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SOIL PROFILE & TEST DATA

Phase II Environmental Site Assessment
2074 Scott Street
Ottawa, Ontario

DATUM

REMARKS

BORINGS BY Backhoe DATE 21 OCT 02

FILE NO. **E2283**

HOLE NO. **TP 4**

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Lower Explosive Limit %	PIEZOMETER CONSTRUCTION
GROUND SURFACE						0		20 40 60 80	
FILL: Gravel with miscellaneous debris		G	1			1			
		G	2						
		G	3			2			
2.13									
GLACIAL TILL: Dense, brown silty sand and gravel		G	4						
2.74									
End of Test Pit									
(TP dry upon completion)									

100 200 300 400 500
Gastech 1314 Rdg. (ppm)
▲ Full Gas Resp. △ Methane Elim.

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SOIL PROFILE & TEST DATA

Phase II Environmental Site Assessment
2074 Scott Street
Ottawa, Ontario

DATUM

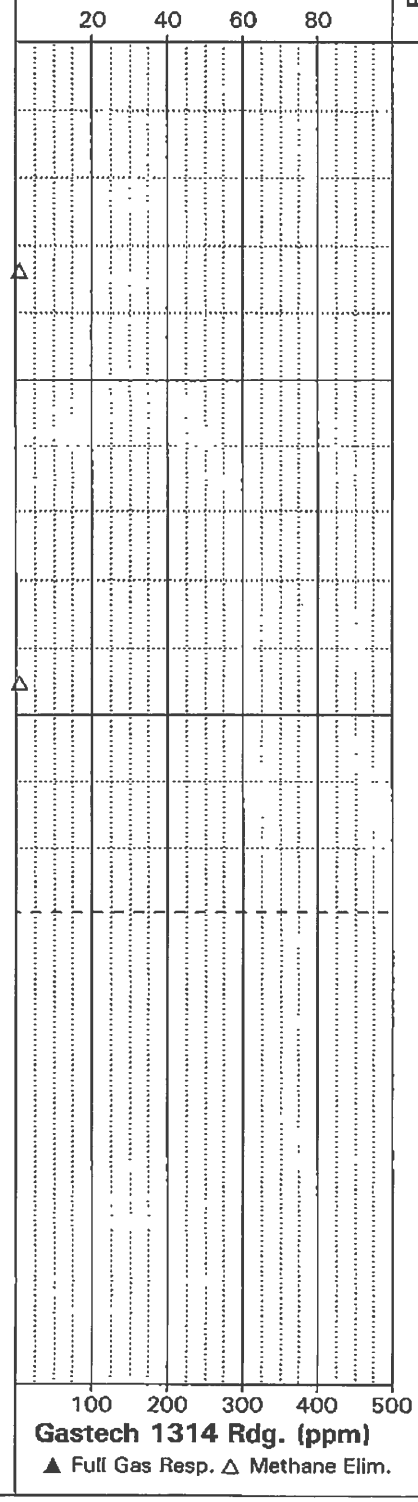
REMARKS

BORINGS BY Backhoe DATE 21 OCT 02

FILE NO. **E2283**

HOLE NO. **TP 5**

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Lower Explosive Limit %	PIEZOMETER CONSTRUCTION
GROUND SURFACE						0			
FILL: Mixture of sand, gravel, boulders, brick and wood pieces		G	1						
		G	2			1			
2.13						2			
GLACIAL TILL: Dense silty sand and gravel									
2.59									
End of Test Pit									
(TP dry upon completion)									



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SOIL PROFILE & TEST DATA

Phase II Environmental Site Assessment
2070 Scott Street
Ottawa, Ontario

DATUM TBM - Top nut of fire hydrant located at the southeast corner of Winona Ave. and Scott St. Assumed elevation = 100.00m.

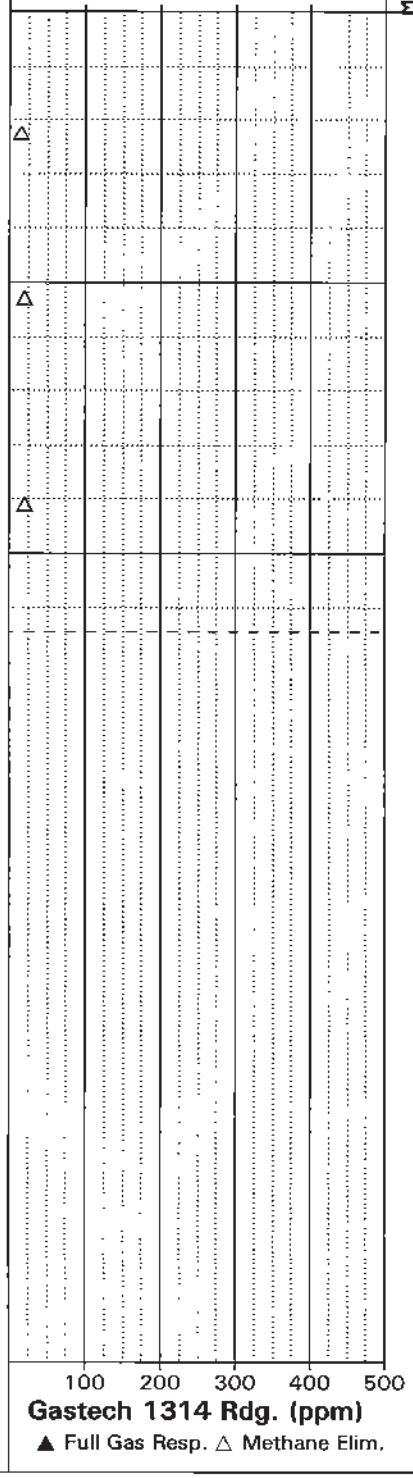
FILE NO. **E2283**

REMARKS

HOLE NO. **BH 1**

BORINGS BY CME 55 Power Auger DATE 15 OCT 01

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Lower Explosive Limit %	MONITORING WELL CONSTRUCTION
GROUND SURFACE									
Asphaltic concrete 0.08						0	98.71		
FILL: Crushed stone 0.25									
FILL: Black silty sand with gravel - light brown by 0.45m depth		AU	1						
		SS	2	33	6	1	97.71		
		SS	3	21	4				
						2	96.71		
2.29									
End of Borehole Auger refusal on inferred bedrock surface @ 2.29m depth (BH dry upon completion)									



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SOIL PROFILE & TEST DATA

Phase II Environmental Site Assessment
2070 Scott Street
Ottawa, Ontario

DATUM TBM - Top nut of fire hydrant located at the southeast corner of Winona Ave. and Scott St. Assumed elevation = 100.00m.

FILE NO. **E2283**

REMARKS

HOLE NO. **BH 2**

BORINGS BY CME 55 Power Auger DATE 15 OCT 01

SOIL DESCRIPTION		STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Lower Explosive Limit %	MONITORING WELL CONSTRUCTION
GROUND SURFACE							0	98.54		
Asphaltic concrete	0.08									
FILL: Crushed stone	0.23									
FILL: Brown silty sand and gravel			AU	4						
			SS	5	33	12	1	97.54		
	1.68		SS	6	100	25				
End of Borehole										
Auger refusal on inferred bedrock surface @ 1.68m depth										
(BH dry upon completion)										

20 40 60 80

100 200 300 400 500

Gastech 1314 Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

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SOIL PROFILE & TEST DATA

Phase II Environmental Site Assessment
2070 Scott Street
Ottawa, Ontario

DATUM TBM - Top nut of fire hydrant located at the southeast corner of Winona Ave. and Scott St. Assumed elevation = 100.00m.

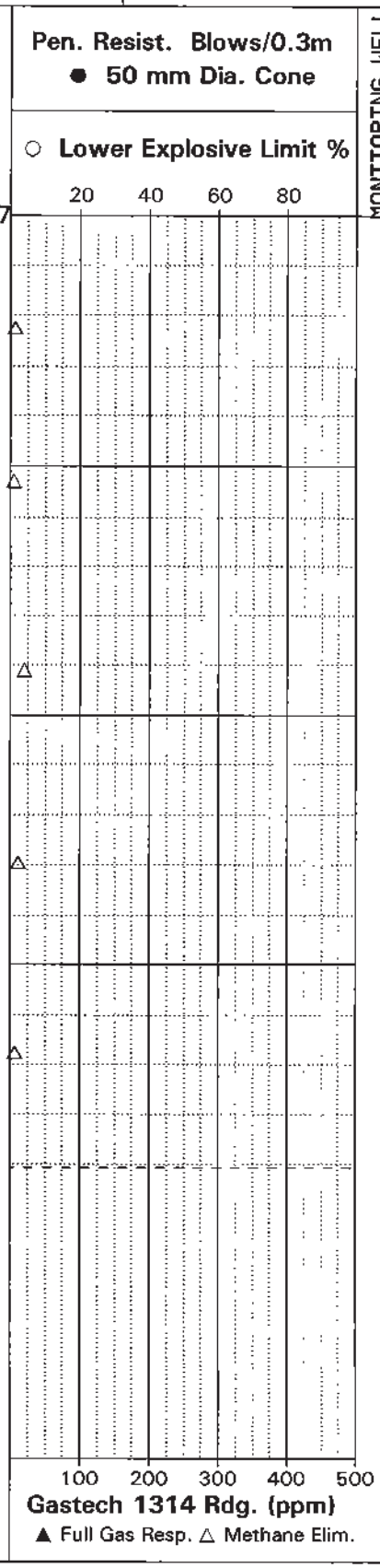
REMARKS

FILE NO. **E2283**

HOLE NO. **BH 3**

BORINGS BY CME 55 Power Auger **DATE** 15 OCT 01

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	100.37
Asphaltic concrete 0.08							
		AU	7				
		SS	8	42	17	1	99.37
FILL: Brown silty sand and gravel, some cobbles and brick pieces		SS	9	25	10	2	98.37
		SS	10	17	7	3	97.37
		SS	11	17	22		
3.81							
End of Borehole							
Auger refusal on inferred bedrock surface @ 3.81m depth							
(BH dry upon completion)							



MONITORING WELL CONSTRUCTION

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SOIL PROFILE & TEST DATA

Phase II Environmental Site Assessment
2070 Scott Street
Ottawa, Ontario

DATUM TBM - Top nut of fire hydrant located at the southeast corner of Winona Ave. and Scott St. Assumed elevation = 100.00m.

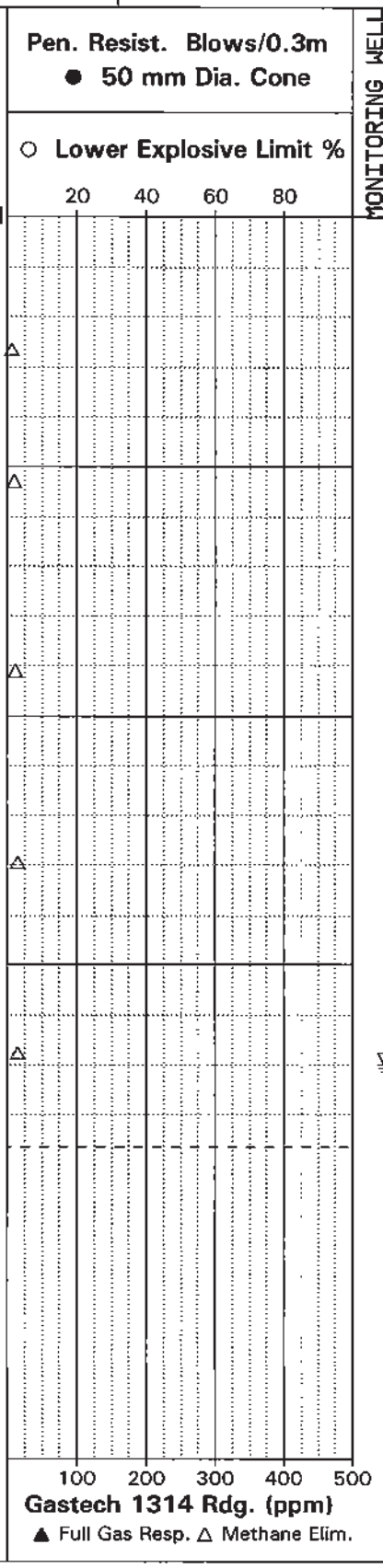
FILE NO. **E2283**

REMARKS

HOLE NO. **BH 4**

BORINGS BY CME 55 Power Auger DATE 15 OCT 01

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	100.51
Asphaltic concrete 0.08							
FILL: Brown sand and gravel 0.60		AU	12				
		SS	13	38	7	1	99.51
		SS	14	42	3		
FILL: Brown silty sand						2	98.51
		SS	15	38	5		
						3	97.51
		SS	16	42	5		
3.73							
End of Borehole							
Auger refusal on inferred bedrock surface @ 3.73m depth							
(Open hole GWL @ 3.4m depth)							



MONITORING WELL CONSTRUCTION

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SOIL PROFILE & TEST DATA

Phase II Environmental Site Assessment
2070 Scott Street
Ottawa, Ontario

DATUM TBM - Top nut of fire hydrant located at the southeast corner of Winona Ave. and Scott St. Assumed elevation = 100.00m.

FILE NO. **E2283**

REMARKS

HOLE NO. **BH 5**

BORINGS BY CME 55 Power Auger DATE 15 OCT 01

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Lower Explosive Limit %	MONITORING WELL CONSTRUCTION
GROUND SURFACE						0	100.74		
Asphaltic concrete 0.08									
FILL: Brown silty sand and gravel		SS	17	42	29	1	99.74		
		SS	18	71	17				
						2	98.74		
2.29									
End of Borehole Auger refusal on inferred bedrock surface @ 2.29m depth (BH dry upon completion)									

Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone
○ Lower Explosive Limit %
20 40 60 80

100 200 300 400 500
Gastech 1314 Rdg. (ppm)
▲ Full Gas Resp. △ Methane Elim.

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SOIL PROFILE & TEST DATA

Environmental Site Characterization
Scott Street @ Churchill Avenue North
Ottawa, Ontario

DATUM TBM - Top nut of fire hydrant located @ the southeast corner of Winona Avenue and Scott Street. Assumed elevation = 100.00m.

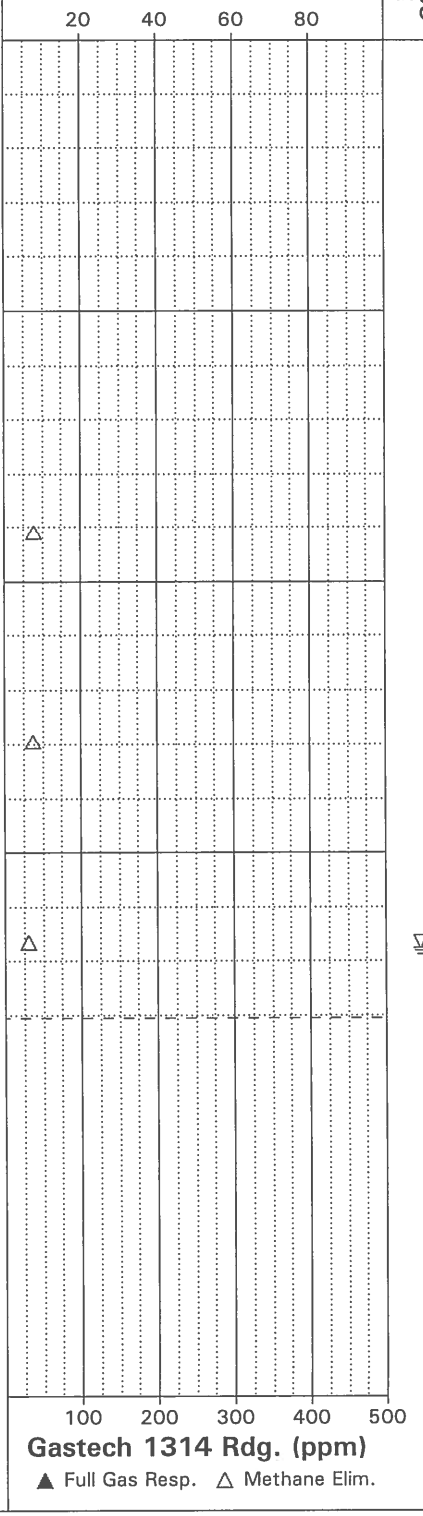
FILE NO. **E1381**

REMARKS

HOLE NO. **BH 1-1**

BORINGS BY Power Auger **DATE** 18 November 1996

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or ROD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Lower Explosive Limit %	PIEZOMETER CONSTRUCTION
GROUND SURFACE						0	100.48		
15mm Asphaltic concrete over grey crushed stone 0.19									
FILL: Brown, mixture of silt, sand, gravel, occ. pcs. of asphaltic concrete		SS	1	62	14	1	99.48		
		SS	2	50	6	2	98.48		
		SS	3	54	2	3	97.48		▽
3.61 End of Borehole									
Auger refusal on inferred bedrock @ 3.61m depth.									
(Open hole WL @ 3.35m depth.)									



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SOIL PROFILE & TEST DATA

Environmental Site Characterization
Scott Street @ Churchill Avenue North
Ottawa, Ontario

DATUM TBM - Top nut of fire hydrant located @ the southeast corner of Winona Avenue and Scott Street. Assumed elevation = 100.00m.

FILE NO. **E1381**

REMARKS

HOLE NO. **BH 2-1**

BORINGS BY Power Auger **DATE** 18 November 1996

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Lower Explosive Limit %	PIEZOMETER CONSTRUCTION
GROUND SURFACE						0	100.70		
Asphaltic concrete 0.05									
Grey crushed stone 0.25									
FILL: Brown, mixture of silt, sand, gravel, occ. pcs. of asphaltic concrete		SS	4	67	6	1	99.70		
		SS	5	54	6	2	98.70		
		SS	6	45	25+	3	97.70		
3.33 End of Borehole									
Auger refusal on inferred bedrock @ 3.33m depth.									
(BH dry upon completion)									

Pen. Resist. Blows/0.3m: ○ Lower Explosive Limit % — 20 40 60 80

100 200 300 400 500
Gastech 1314 Rdg. (ppm)
▲ Full Gas Resp. △ Methane Elim.

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SOIL PROFILE & TEST DATA

Environmental Site Characterization
Scott Street @ Churchill Avenue North
Ottawa, Ontario

DATUM TBM - Top nut of fire hydrant located @ the southeast corner of Winona Avenue and Scott Street. Assumed elevation = 100.00m.

FILE NO. **E1381**

REMARKS

HOLE NO. **BH 3-1**

BORINGS BY Power Auger **DATE** 18 November 1996

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	100.37
Asphaltic concrete 0.05							
Grey crushed stone 0.25							
FILL: Brown, mixture of silt, sand, gravel, some organics, occ. pcs. of asphaltic concrete		SS	7	38	11	1	99.37
		SS	8	33	10	2	98.37
3.17		SS	9	100		3	97.37
End of Borehole							
Auger refusal on inferred bedrock @ 3.17m depth.							
(BH dry upon completion)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Lower Explosive Limit %

20 40 60 80

100 200 300 400 500
Gastech 1314 Rdg. (ppm)
▲ Full Gas Resp. △ Methane Elim.

PIEZOMETER CONSTRUCTION

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SOIL PROFILE & TEST DATA

Environmental Site Characterization
Scott Street @ Churchill Avenue North
Ottawa, Ontario

DATUM TBM - Top nut of fire hydrant located @ the southeast corner of Winona Avenue and Scott Street. Assumed elevation = 100.00m.

FILE NO. **E1381**

REMARKS

HOLE NO. **BH 4-1**

BORINGS BY Power Auger **DATE** 18 November 1996

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Lower Explosive Limit %	PIEZOMETER CONSTRUCTION
GROUND SURFACE						0	98.73		
Asphaltic concrete 0.05									
Grey crushed stone 0.13									
FILL: Dark brown, mixture of silt, sand, gravel, some organics, occ. pcs. of brick		SS	10	58	16	1	97.73		
		SS	11	36	25+				
2.08						2	96.73		
End of Borehole									
Auger refusal on inferred bedrock @ 2.08m depth.									
(BH dry upon completion)									

Lower Explosive Limit % scale: 20 40 60 80

Gastech 1314 Rdg. (ppm): 100 200 300 400 500

▲ Full Gas Resp. △ Methane Elim.

SYMBOLS AND TERMS

SOIL DESCRIPTION

Behavioural properties, such as structure and strength, take precedence over particle gradation in describing soils. Terminology describing soil structure are as follows:

Desiccated	-	having visible signs of weathering by oxidation of clay minerals, shrinkage cracks, etc.
Fissured	-	having cracks, and hence a blocky structure.
Varved	-	composed of regular alternating layers of silt and clay.
Stratified	-	composed of alternating layers of different soil types, e.g. silt and sand or silt and clay.
Well-Graded	-	Having wide range in grain sizes and substantial amounts of all intermediate particle sizes (see Grain Size Distribution).
Uniformly-Graded	-	Predominantly of one grain size (see Grain Size Distribution).

The standard terminology to describe the strength of cohesionless soils is the relative density, usually inferred from the results of the Standard Penetration Test (SPT) 'N' value. The SPT N value is the number of blows of a 63.5 kg hammer, falling 760 mm, required to drive a 51 mm O.D. split spoon sampler 300 mm into the soil after an initial penetration of 150 mm.

Relative Density	'N' Value	Relative Density %
Very Loose	<4	<15
Loose	4-10	15-35
Compact	10-30	35-65
Dense	30-50	65-85
Very Dense	>50	>85

The standard terminology to describe the strength of cohesive soils is the consistency, which is based on the undisturbed undrained shear strength as measured by the in situ or laboratory vane tests, penetrometer tests, unconfined compression tests, or occasionally by Standard Penetration Tests.

Consistency	Undrained Shear Strength (kPa)	'N' Value
Very Soft	<12	<2
Soft	12-25	2-4
Firm	25-50	4-8
Stiff	50-100	8-15
Very Stiff	100-200	15-30
Hard	>200	>30

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

Cohesive soils can also be classified according to their “sensitivity”. The sensitivity is the ratio between the undisturbed undrained shear strength and the remoulded undrained shear strength of the soil.

Terminology used for describing soil strata based upon texture, or the proportion of individual particle sizes present is provided on the Textural Soil Classification Chart at the end of this information package.

ROCK DESCRIPTION

The structural description of the bedrock mass is based on the Rock Quality Designation (RQD).

The RQD classification is based on a modified core recovery percentage in which all pieces of sound core over 100 mm long are counted as recovery. The smaller pieces are considered to be a result of closely-spaced discontinuities (resulting from shearing, jointing, faulting, or weathering) in the rock mass and are not counted. RQD is ideally determined from NXL size core. However, it can be used on smaller core sizes, such as BX, if the bulk of the fractures caused by drilling stresses (called “mechanical breaks”) are easily distinguishable from the normal in situ fractures.

RQD %	ROCK QUALITY
90-100	Excellent, intact, very sound
75-90	Good, massive, moderately jointed or sound
50-75	Fair, blocky and seamy, fractured
25-50	Poor, shattered and very seamy or blocky, severely fractured
0-25	Very poor, crushed, very severely fractured

SAMPLE TYPES

SS	-	Split spoon sample (obtained in conjunction with the performing of the Standard Penetration Test (SPT))
TW	-	Thin wall tube or Shelby tube
PS	-	Piston sample
AU	-	Auger sample or bulk sample
WS	-	Wash sample
RC	-	Rock core sample (Core bit size AXT, BXL, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

GRAIN SIZE DISTRIBUTION

MC%	-	Natural moisture content or water content of sample, %
LL	-	Liquid Limit, % (water content above which soil behaves as a liquid)
PL	-	Plastic limit, % (water content above which soil behaves plastically)
PI	-	Plasticity index, % (difference between LL and PL)
Dxx	-	Grain size which xx% of the soil, by weight, is of finer grain sizes These grain size descriptions are not used below 0.075 mm grain size
D10	-	Grain size at which 10% of the soil is finer (effective grain size)
D60	-	Grain size at which 60% of the soil is finer
Cc	-	Concavity coefficient = $(D30)^2$ / (D10 x D60)
Cu	-	Uniformity coefficient = D60 / D10

Cc and Cu are used to assess the grading of sands and gravels:
Well-graded gravels have: $1 < Cc < 3$ and $Cu > 4$
Well-graded sands have: $1 < Cc < 3$ and $Cu > 6$
Sands and gravels not meeting the above requirements are poorly-graded or uniformly-graded.
Cc and Cu are not applicable for the description of soils with more than 10% silt and clay
(more than 10% finer than 0.075 mm or the #200 sieve)

CONSOLIDATION TEST

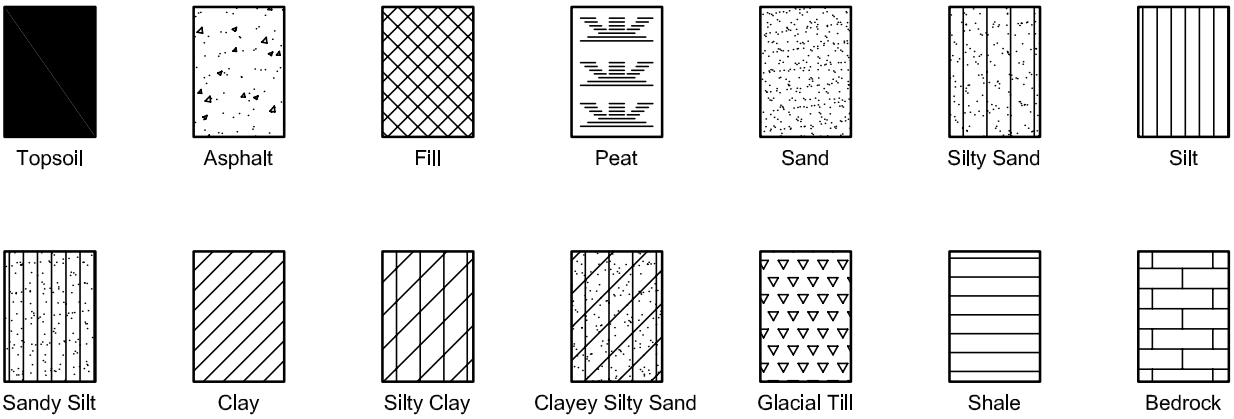
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void Ratio		Initial sample void ratio = volume of voids / volume of solids
Wo	-	Initial water content (at start of consolidation test)

PERMEABILITY TEST

k	-	Coefficient of permeability or hydraulic conductivity is a measure of the ability of water to flow through the sample. The value of k is measured at a specified unit weight for (remoulded) cohesionless soil samples, because its value will vary with the unit weight or density of the sample during the test.

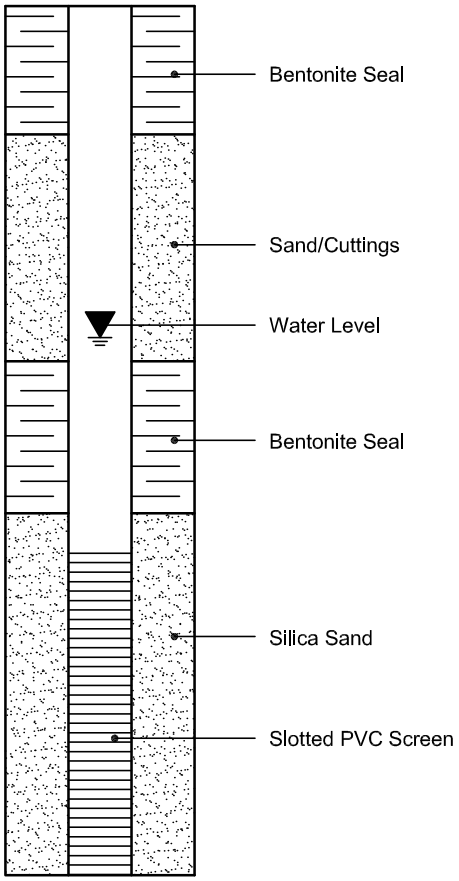
SYMBOLS AND TERMS (continued)

STRATA PLOT

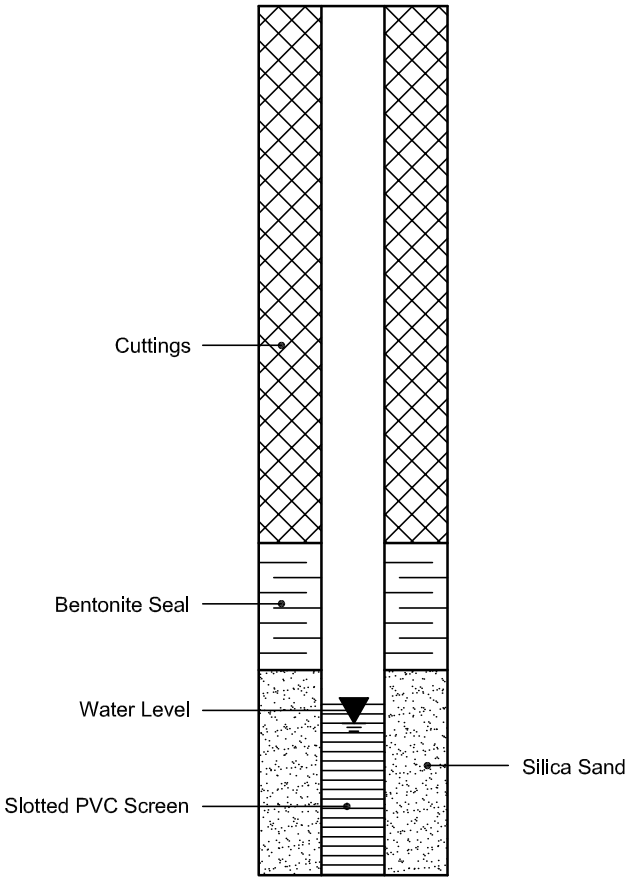


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



BOREHOLE/MONITORING WELL #: BH/MW1

BOREHOLE LOG

Project No: 2471-1301
Project: Phase II ESA, 2070-2074 & 2090 Scott Street, Ottawa, ON
Client: EJSpa Corporation
Borehole Location: N5027060 E440905

TOC Elevation: 98.82 m *
Water Level: 7.18 m btoc (April 11, 2013)
Water Level Elevation: 91.64 m * (April 11, 2013)
Bottom of Well Depth: 13.15 m btoc

SUBSURFACE PROFILE

Depth (m)	Description	Elevation (m) * / Depth (m bgs)
0	Ground Surface	98.887
0	***Asphalt***	0.000
1	***Gravel (FILL)*** grey, dry	97.487
1.4	***Silty Sand and Gravel (FILL)*** brown, trace organics, dry	
3	***Bedrock*** limestone	
13		85.387
13.5	End of Borehole	

SAMPLE

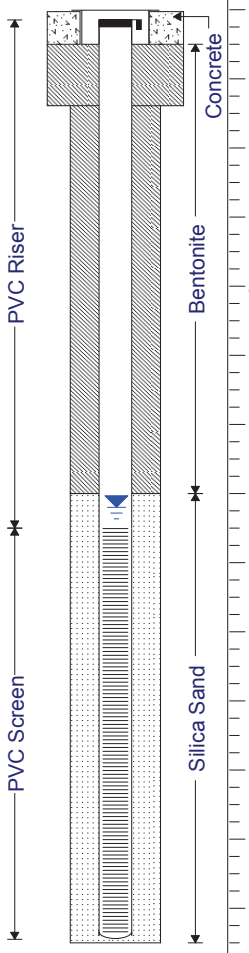
Sample ID	Sample Type	Sample Recovery	Organic Vapour Measurements (ppm)	Lab Analyses
N/S	N/S	N/S	N/S	N/S

Notes:
SS = split spoon sample
ppm = parts per million
m btoc = meters below top of casing
m bgs = meters below ground surface
N/S = no environmental soil sampling performed

*Elevation data based on Franz survey conducted relative to a temporary benchmark (top of yellow and blue fire hydrant on east side of Churchill Avenue North) that was assigned a relative elevation of 100.00 m

MOE Well Cluster Tag No. A140444

Well Completion Details



Drilled By: George Downing Estate Drilling Ltd.
Drill Method: CME 75 (hollow-stem augers/NQ coring)
Drill Date: April 2, 2013
Logged by: David Kiar

Well Pipe Diameter: 0.03 m
Borehole Diameter: 0.20 m / 0.08 m
Checked by: Mike Grinnell
Sheet: 1 of 1

BOREHOLE/MONITORING WELL #: BH/MW2

BOREHOLE LOG

Project No: 2471-1301
Project: Phase II ESA, 2070-2074 & 2090 Scott Street, Ottawa, ON
Client: EJSpa Corporation
Borehole Location: N5027060 E440905

TOC Elevation: 98.73 m *
Water Level: 7.07 m btoc (April 11, 2013)
Water Level Elevation: 91.67 m * (April 11, 2013)
Bottom of Well Depth: 10.07 m btoc

SUBSURFACE PROFILE

Depth (m)	Symbol	Description	Elevation (m) * / Depth (m bgs)
0		Ground Surface	98.879
0		***Asphalt***	0.000
1		***Sand and Gravel (FILL)*** grey/brown, dry to damp	
2		some rock/cobble fragments starting at approximately 1.8 m	96.679
2		***Bedrock*** limestone	2.200
10			88.579
10		End of Borehole	10.300

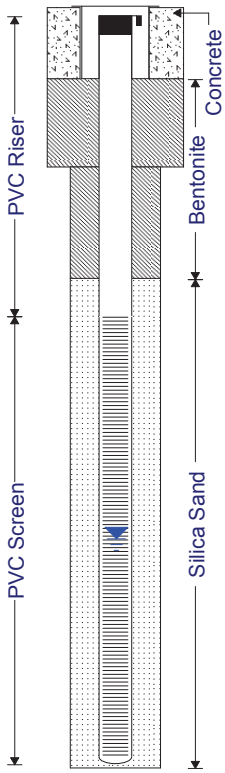
SAMPLE

Sample ID	Sample Type	Sample Recovery	Organic Vapour Measurements (ppm)	Lab Analyses
2-1	SS	50	0	PHCs, BTEX, Metals
2-2	SS	60	0	---
2-3	SS	30	0	---
2-4	SS	30	0	---

Notes:
SS = split spoon sample
ppm = parts per million
m btoc = meters below top of casing
m bgs = meters below ground surface

*Elevation data based on Franz survey conducted relative to a temporary benchmark (top of yellow and blue fire hydrant on east side of Churchill Avenue North) that was assigned a relative elevation of 100.00 m

Well Completion Details



Depth (m): 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14

Drilled By: George Downing Estate Drilling Ltd.
Drill Method: CME 75 (hollow-stem/NQ coring)
Drill Date: April 4, 2013
Logged by: David Kiar

Well Pipe Diameter: 0.03 m
Borehole Diameter: 0.20 m / 0.08 m
Checked by: Mike Grinnell
Sheet: 1 of 1

BOREHOLE/MONITORING WELL #: BH/MW3

BOREHOLE LOG

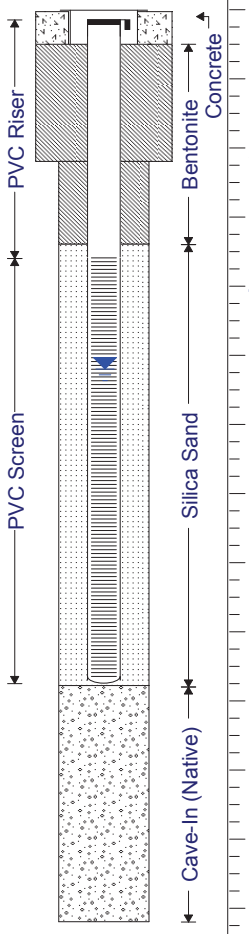
Project No: 2471-1301
Project: Phase II ESA, 2070-2074 & 2090 Scott Street, Ottawa, ON
Client: EJSpa Corporation
Borehole Location: N5027094 E440940

TOC Elevation: 96.85 m *
Water Level: 5.20 m btoc (April 11, 2013)
Water Level Elevation: 91.65 m * (April 11, 2013)
Bottom of Well Depth: 9.65 m btoc

SUBSURFACE PROFILE				SAMPLE					
Depth (m)	Symbol	Description	Elevation (m) * / Depth (m bgs)	Sample ID	Sample Type	Sample Recovery	Organic Vapour Measurements (ppm)	Lab Analyses	Well Completion Details
0		Ground Surface	96.904						
0		***Asphalt***	0.000						
1		***Silty Sand and Gravel (FILL)*** brown, trace organics, dry to damp		N/S	N/S	N/S	N/S	N/S	
2			94.704						
2		***Bedrock*** limestone	2.200						
13			83.704						
13		End of Borehole	13.200						

Notes:
SS = split spoon sample
ppm = parts per million
m btoc = meters below top of casing
m bgs = meters below ground surface
N/S = no environmental soil sampling performed

*Elevation data based on Franz survey conducted relative to a temporary benchmark (top of yellow and blue fire hydrant on east side of Churchill Avenue North) that was assigned a relative elevation of 100.00 m



Depth (m): 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Drilled By: George Downing Estate Drilling Ltd.
Drill Method: CME 75 (hollow-stem/NQ coring)
Drill Date: April 4, 2013
Logged by: David Kiar

Well Pipe Diameter: 0.03 m
Borehole Diameter: 0.20 m / 0.08 m
Checked by: Mike Grinnell
Sheet: 1 of 1

BOREHOLE/MONITORING WELL #: BH4

BOREHOLE LOG

Project No: 2471-1301
Project: Phase II ESA, 2070-2074 & 2090 Scott Street, Ottawa, ON
Client: EJSpa Corporation
Borehole Location: N/A

TOC Elevation: N/A (borehole only)
Water Level: N/A (borehole only)
Water Level Elevation: N/A (borehole only)
Bottom of Well Depth: N/A (borehole only)

SUBSURFACE PROFILE				SAMPLE						
Depth (m)	Symbol	Description	Elevation (m) * / Depth (m bgs)	Sample ID	Sample Type	Sample Recovery	Organic Vapour Measurements (ppm)	Lab Analyses	Well Completion Details	Depth (m)
		Ground Surface								
0		***Asphalt***	0.000							0
		Sand and Gravel (FILL) brown/grey, trace silt, clay and cobble, damp to moist.		4-1	SS	30	0	PHCs, BTEX, Metals		
1				4-2	SS	50	0	---	No Monitoring Well Installed	1
				4-3	SS	0	---	---		
		Bedrock Limestone	1.400							
		End of Borehole								
2										2
3										3

Notes:
SS = split spoon sample
ppm = parts per million
m bgs = meters below ground surface

Drilled By: George Downing Estate Drilling Ltd.
Drill Method: CME 75 (hollow-stem)
Drill Date: April 4, 2013
Logged by: David Kiar

Well Pipe Diameter: N/A
Borehole Diameter: 0.20 m
Checked by: Mike Grinnell
Sheet: 1 of 1

BOREHOLE/MONITORING WELL #: BH5

BOREHOLE LOG

Project No: 2471-1301
Project: Phase II ESA, 2070-2074 & 2090 Scott Street, Ottawa, ON
Client: EJSpa Corporation
Borehole Location: N/A

TOC Elevation: N/A (borehole only)
Water Level: N/A (borehole only)
Water Level Elevation: N/A (borehole only)
Bottom of Well Depth: N/A (borehole only)

SUBSURFACE PROFILE				SAMPLE						
Depth (m)	Symbol	Description	Elevation (m) * / Depth (m bgs)	Sample ID	Sample Type	Sample Recovery	Organic Vapour Measurements (ppm)	Lab Analyses	Well Completion Details	Depth (m)
		Ground Surface								
0		***Asphalt***	0.000							0
		Silty Sand and Gravel (FILL) brown/grey, some cobble, dry to damp.		5-1	SS	40	0	PHCs, BTEX, Metals		
1				5-2	SS	30	0	---	No Monitoring Well Installed	1
				5-3	SS	0	---	---		
		Bedrock limestone	1.400							
		End of Borehole								
2										2
3										3

Notes:
SS = split spoon sample
ppm = parts per million
m bgs = meters below ground surface

Drilled By: George Downing Estate Drilling Ltd.
Drill Method: CME 75 (hollow-stem)
Drill Date: April 4, 2013
Logged by: David Kiar

Well Pipe Diameter: N/A
Borehole Diameter: 0.20 m
Checked by: Mike Grinnell
Sheet: 1 of 1

BOREHOLE/MONITORING WELL #: BH6

BOREHOLE LOG

Project No: 2471-1301
Project: Phase II ESA, 2070-2074 & 2090 Scott Street, Ottawa, ON
Client: EJSpa Corporation
Borehole Location: N/A

TOC Elevation: N/A (borehole only)
Water Level: N/A (borehole only)
Water Level Elevation: N/A (borehole only)
Bottom of Well Depth: N/A (borehole only)

SUBSURFACE PROFILE				SAMPLE					Well Completion Details	
Depth (m)	Symbol	Description	Elevation (m) * / Depth (m bgs)	Sample ID	Sample Type	Sample Recovery	Organic Vapour Measurements (ppm)	Lab Analyses		Depth (m)
0		Ground Surface								0
		Asphalt	0.000							
		Sand and Gravel (FILL) brown, trace asphalt and brick debris, trace silt and clay, some cobble, damp.		6-1	SS	60	0	PHCs, BTEX, Metals	No Monitoring Well Installed	
1				6-2	SS	20	0	---		1
				6-3	SS	0	---	---		
2				6-4	SS	0	---	---		2
		Bedrock limestone	2.100							
		End of Borehole								
3										3

Notes:
SS = split spoon sample
ppm = parts per million
m bgs = meters below ground surface

Drilled By: George Downing Estate Drilling Ltd.
Drill Method: CME 75 (hollow-stem)
Drill Date: April 4, 2013
Logged by: David Kiar

Well Pipe Diameter: N/A
Borehole Diameter: 0.20 m
Checked by: Mike Grinnell
Sheet: 1 of 1

BOREHOLE/MONITORING WELL #: BH7

BOREHOLE LOG

Project No: 2471-1301
Project: Phase II ESA, 2070-2074 & 2090 Scott Street, Ottawa, ON
Client: EJSpa Corporation
Borehole Location: N/A

TOC Elevation: N/A (borehole only)
Water Level: N/A (borehole only)
Water Level Elevation: N/A (borehole only)
Bottom of Well Depth: N/A (borehole only)

SUBSURFACE PROFILE				SAMPLE						
Depth (m)	Symbol	Description	Elevation (m) * / Depth (m bgs)	Sample ID	Sample Type	Sample Recovery	Organic Vapour Measurements (ppm)	Lab Analyses	Well Completion Details	Depth (m)
		Ground Surface								
0		***Asphalt***	0.000							0
		Sand and Gravel (FILL) brown, trace silt and clay, some cobble, dry to damp.		7-1	CS	90	0	---		
1				7-2	CS	90	0	---	No Monitoring Well Installed	1
				7-3	CS	100	0	PHCs, BTEX, Metals		
		Bedrock limestone	1.500							
2		End of Borehole								2
3										3

Notes:
CS = geoprobe core sample
ppm = parts per million
m bgs = meters below ground surface

Drilled By: George Downing Estate Drilling Ltd.
Drill Method: Geoprobe 7822DT
Drill Date: April 5, 2013
Logged by: David Kiar

Well Pipe Diameter: N/A
Borehole Diameter: 0.09 m
Checked by: Mike Grinnell
Sheet: 1 of 1

BOREHOLE/MONITORING WELL #: BH8

BOREHOLE LOG

Project No: 2471-1301
Project: Phase II ESA, 2070-2074 & 2090 Scott Street, Ottawa, ON
Client: EJSpa Corporation
Borehole Location: N/A

TOC Elevation: N/A (borehole only)
Water Level: N/A (borehole only)
Water Level Elevation: N/A (borehole only)
Bottom of Well Depth: N/A (borehole only)

SUBSURFACE PROFILE				SAMPLE						
Depth (m)	Symbol	Description	Elevation (m) * / Depth (m bgs)	Sample ID	Sample Type	Sample Recovery	Organic Vapour Measurements (ppm)	Lab Analyses	Well Completion Details	Depth (m)
0		Ground Surface							No Monitoring Well Installed	0
		Interlock Brick	0.000							
		Silty Sand and Gravel (FILL) brown, some cobble, damp.		8-1	CS	50	0	---		
1										1
				8-2	CS	50	0	PHCs, BTEX, Metals		
2										2
		Sandy Silt light brown, trace gravel, damp to moist.	2.400	8-3	CS	60	0	---		
3				8-4	CS	50	0	---		3
				8-5	CS	95	0	---		
4										4
		Bedrock limestone	4.600							
5		End of Borehole								5
6										6

Notes:
CS = geoprobe core sample
ppm = parts per million
m bgs = meters below ground surface

Drilled By: George Downing Estate Drilling Ltd.
Drill Method: Geoprobe 7822DT
Drill Date: April 5, 2013
Logged by: David Kiar

Well Pipe Diameter: N/A
Borehole Diameter: 0.08 m
Checked by: Mike Grinnell
Sheet: 1 of 1

BOREHOLE/MONITORING WELL #: BH9

BOREHOLE LOG

Project No: 2471-1301
Project: Phase II ESA, 2070-2074 & 2090 Scott Street, Ottawa, ON
Client: EJSpa Corporation
Borehole Location: N/A

TOC Elevation: N/A (borehole only)
Water Level: N/A (borehole only)
Water Level Elevation: N/A (borehole only)
Bottom of Well Depth: N/A (borehole only)

SUBSURFACE PROFILE				SAMPLE					
Depth (m)	Symbol	Description	Elevation (m) * / Depth (m bgs)	Sample ID	Sample Type	Sample Recovery	Organic Vapour Measurements (ppm)	Lab Analyses	Well Completion Details
		Ground Surface							
0		***Grass***	0.000						No Monitoring Well Installed
		Topsoil dark brown, organic, damp.							
		Sand and Gravel brown, trace silt and cobble, damp.	0.600	9-1	CS	50	0	PHCs, BTEX, Metals	
1				9-2	CS	100	0	---	
2		***Bedrock*** limestone	2.000						
		End of Borehole							
3									

Notes:
CS = geoprobe core sample
ppm = parts per million
m bgs = meters below ground surface

Drilled By: George Downing Estate Drilling Ltd.
Drill Method: Geoprobe 7822DT
Drill Date: April 5, 2013
Logged by: David Kiar

Well Pipe Diameter: N/A
Borehole Diameter: 0.08 m
Checked by: Mike Grinnell
Sheet: 1 of 1

BOREHOLE/MONITORING WELL #: BH10

BOREHOLE LOG

Project No: 2471-1301
Project: Phase II ESA, 2070-2074 & 2090 Scott Street, Ottawa, ON
Client: EJSpa Corporation
Borehole Location: N/A

TOC Elevation: N/A (borehole only)
Water Level: N/A (borehole only)
Water Level Elevation: N/A (borehole only)
Bottom of Well Depth: N/A (borehole only)

SUBSURFACE PROFILE				SAMPLE						
Depth (m)	Symbol	Description	Elevation (m) * / Depth (m bgs)	Sample ID	Sample Type	Sample Recovery	Organic Vapour Measurements (ppm)	Lab Analyses	Well Completion Details	Depth (m)
		Ground Surface								
0		***Grass***	0.000							0
		Topsoil dark brown, organic, damp								
		Silty Sand and Gravel brown, some cobble, trace brick debris, damp to moist.	0.600	10-1	CS	70	0	PHCs, BTEX, Metals	No Monitoring Well Installed	
1				10-2	CS	100	0	---		1
2		***Bedrock*** limestone	2.000							2
		End of Borehole								
3										3

Notes:
CS = geoprobe core sample
ppm = parts per million
m bgs = meters below ground surface

Drilled By: George Downing Estate Drilling Ltd.
Drill Method: Geoprobe 7822DT
Drill Date: April 5, 2013
Logged by: David Kiar

Well Pipe Diameter: NA
Borehole Diameter: 0.08 m
Checked by: Mike Grinnell
Sheet: 1 of 1

BOREHOLE/MONITORING WELL #: BH11

BOREHOLE LOG

Project No: 2471-1301
Project: Phase II ESA, 2070-2074 & 2090 Scott Street, Ottawa, ON
Client: EJSpa Corporation
Borehole Location: N/A

TOC Elevation: N/A (borehole only)
Water Level: N/A (borehole only)
Water Level Elevation: N/A (borehole only)
Bottom of Well Depth: N/A (borehole only)

SUBSURFACE PROFILE				SAMPLE						
Depth (m)	Symbol	Description	Elevation (m) * / Depth (m bgs)	Sample ID	Sample Type	Sample Recovery	Organic Vapour Measurements (ppm)	Lab Analyses	Well Completion Details	Depth (m)
		Ground Surface								
0		***Asphalt***	0.000							0
		Sand and Gravel (FILL) brown, some silt, some cobble, trace debris, damp.		11-1	CS	50	0	PHCs, BTEX, PAHs, Metals	No Monitoring Well Installed	
1				11-2	CS	25	0	---		1
2		***Bedrock*** limestone	2.000							2
		End of Borehole								
3										3

Notes:
CS = geoprobe core sample
ppm = parts per million
m bgs = meters below ground surface

Drilled By: George Downing Estate Drilling Ltd.
Drill Method: Geoprobe 7822DT
Drill Date: April 5, 2013
Logged by: David Kiar

Well Pipe Diameter: N/A
Borehole Diameter: 0.08 m
Checked by: Mike Grinnell
Sheet: 1 of 1

BOREHOLE/MONITORING WELL #: BH12

BOREHOLE LOG

Project No: 2471-1301
Project: Phase II ESA, 2070-2074 & 2090 Scott Street, Ottawa, ON
Client: EJSpa Corporation
Borehole Location: N/A

TOC Elevation: N/A (borehole only)
Water Level: N/A (borehole only)
Water Level Elevation: N/A (borehole only)
Bottom of Well Depth: N/A (borehole only)

SUBSURFACE PROFILE				SAMPLE						
Depth (m)	Symbol	Description	Elevation (m) * / Depth (m bgs)	Sample ID	Sample Type	Sample Recovery	Organic Vapour Measurements (ppm)	Lab Analyses	Well Completion Details	Depth (m)
		Ground Surface								
0		***Asphalt***	0.000						No Monitoring Well Installed	0
		Sand and Gravel (FILL) brown, some silt and cobble, trace debris, dry to damp.		12-1	CS	50	150	PHCs, BTEX, PAHs, Metals		
1				12-2	CS	25	0	---		1
		Bedrock limestone	1.700							
		End of Borehole								
2										2

Notes:
CS = geoprobe core sample
ppm = parts per million
m bgs = meters below ground surface

Drilled By: George Downing Estate Drilling Ltd.
Drill Method: Geoprobe 7822DT
Drill Date: April 5, 2013
Logged by: David Kiar

Well Pipe Diameter: N/A
Borehole Diameter: 0.08 m
Checked by: Mike Grinnell
Sheet: 1 of 1

patersongroup
Consulting Engineers
154 Colonnade Road South, Ottawa, Ontario K2E 7 J5
Phone: (613) 226-7381 Fax.: (613) 226-6344

ROCK CORE COMPRESSIVE STRENGTH

CLIENT:	**Slengora Limited c/o Cleland Jardine Engineering**	FILE No.:	**PG2936**
ADDRESS:	472 Tillbury Avenue	REPORT No.:	1
PROJECT:	**2070 & 2090 Scott Street**	DATE:	03-Apr-13
STRUCTURE TYPE & LOCATION:	Rock Cores		

CORE DATA AND TESTING RESULTS

Lab. No.	**63136M**	**63136M**
Core No.	1	2
Location	BH1	BH3
	RC8	RC8
Nominal MSA(mm)		
Date Cast		
Date Cored		
Date Tested	03-Apr-13	03-Apr-13
(D) Ave. Diameter (mm)	46.00	46.00
(H) Height (mm)	88.0	89.5
(W) Weight (g)	415.8	417.3
(A) Area = $\pi D^2/4$ (mm^2)	1661.9	1661.9
(V) Volume = A X H /1000 (cm^3)	146.2	148.7
Unit Weight = W /V x1000 (kg/r	**2843**	**2806**
Capped Height(mm)	88.0	89.5
H / D ratio	1.91	1.95
Correction factor (k)	0.992	0.995
(L) Load (lbs)	46900	23900
Mpa = L x 4.448222 / A	125.5	64.0
MPa (corrected)	**124.5**	**63.7**
Direction of Loading		
Curing Conditions		

REMARKS

Core No.1 Depth: 39' 8" to 40' 0"

Core No.2 Depth: 40' 6" to 40' 10"

DISTRIBUTION	**TECHNICAL PERSONNEL**	
	TECHNICIAN:	G. Brown
	VERIFIED BY:	S. Brown
	APPROVED BY:	Stephen J. Walker, P. Eng.

Certificate of Analysis

Report Date: 08-Apr-2013
Order Date:3-Apr-2013

Client: **Paterson Group Consulting Engineers**
Client PO: 13998

Project Description: PG2936

	Client ID:	BH3-SS2	-	-	-
	Sample Date:	02-Apr-13	-	-	-
	Sample ID:	1314147-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	91.0	-	-	-
General Inorganics					
pH	0.05 pH Units	7.77	-	-	-
Resistivity	0.10 Ohm.m	29.0	-	-	-
Anions					
Chloride	5 ug/g dry	27	-	-	-
Sulphate	5 ug/g dry	106	-	-	-

APPENDIX 2

FIGURE 1 - KEY PLAN

FIGURES 2 AND 3 - SEISMIC SHEAR WAVE VELOCITY PROFILES

FIGURE 4 - GROUNDWATER SUPPRESSION SYSTEM

DRAWING PG4935-1 - TEST HOLE LOCATION PLAN

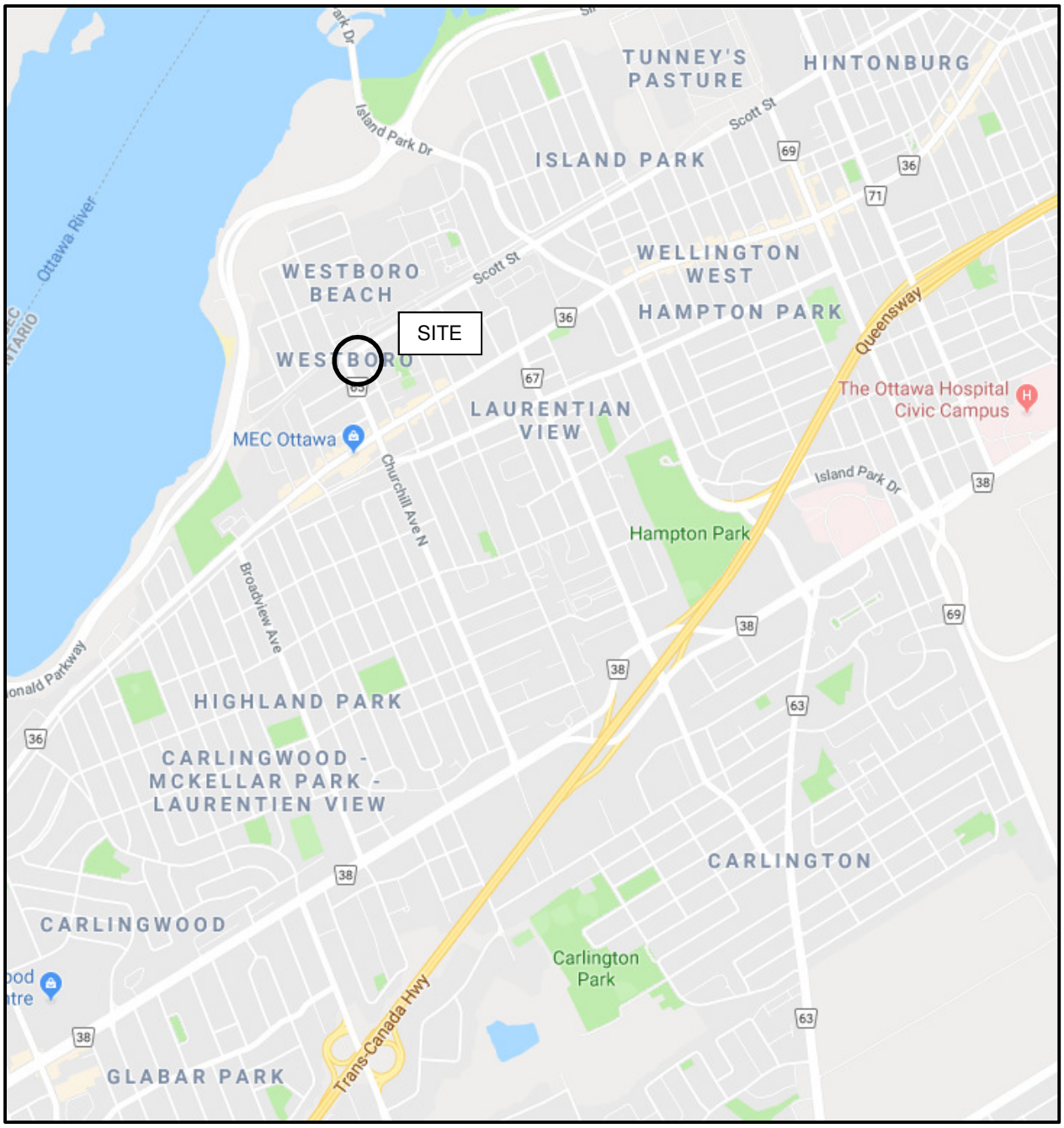


FIGURE 1

KEY PLAN

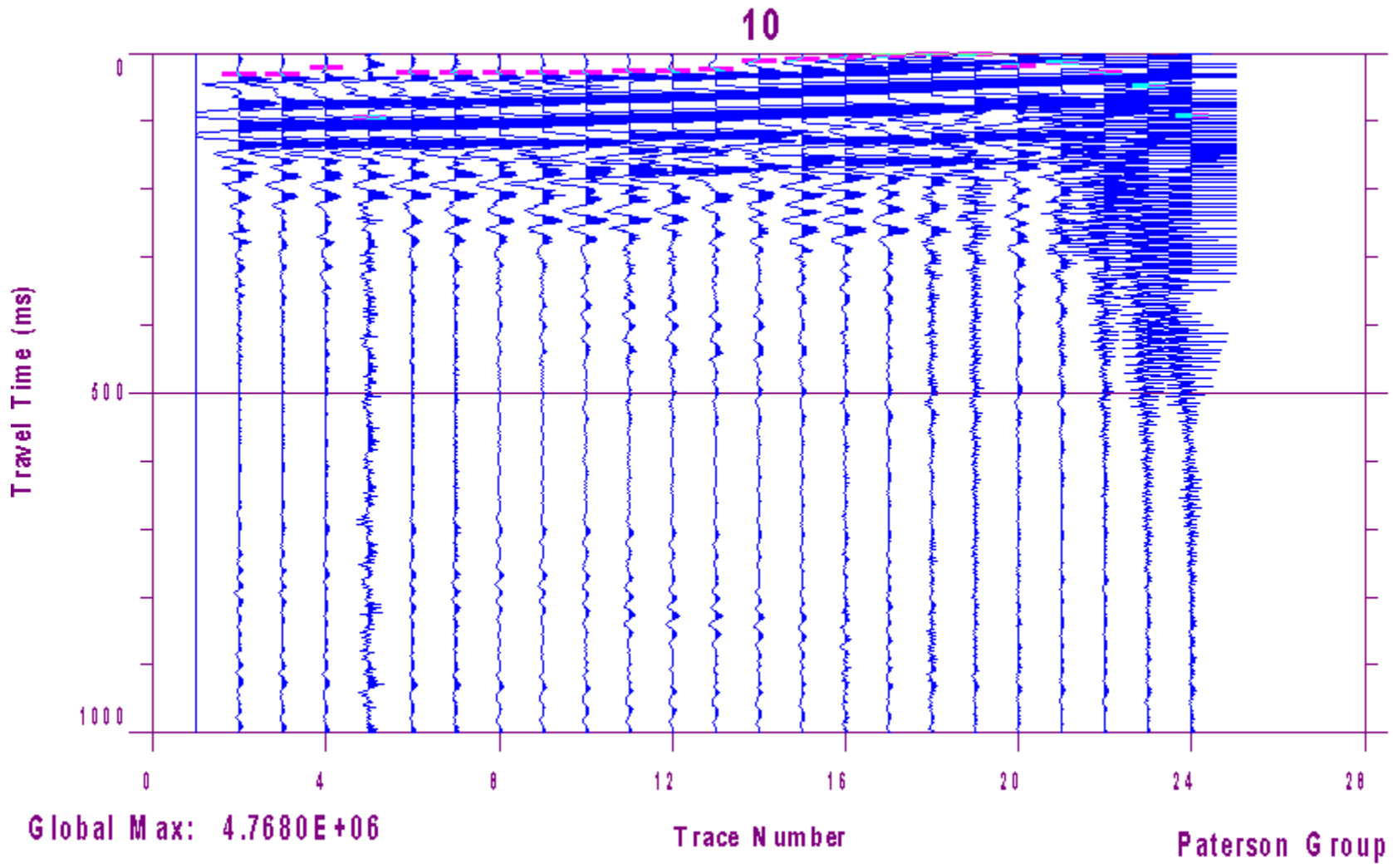


Figure 2 – Shear Wave Velocity Profile at Shot Location 24 m

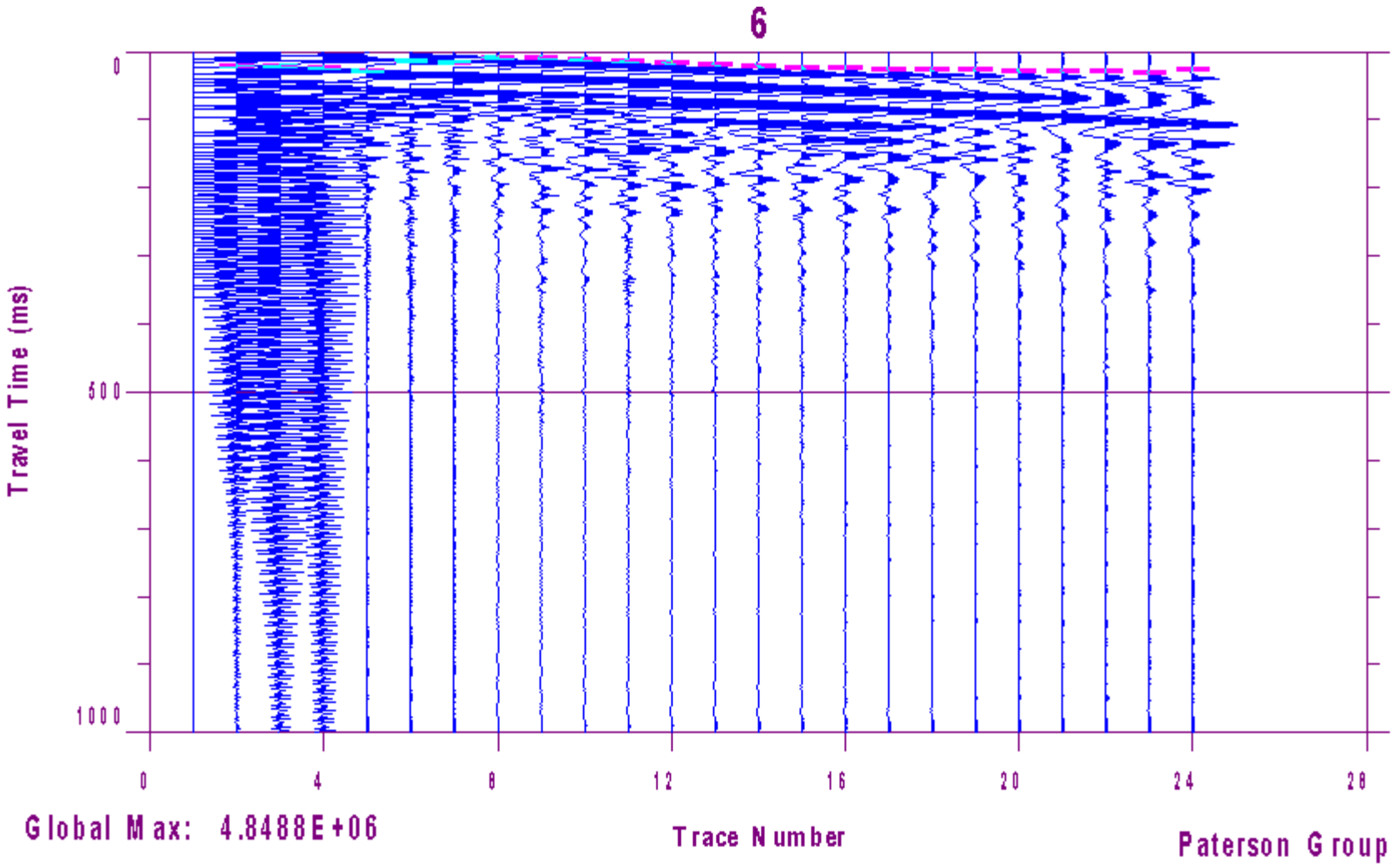
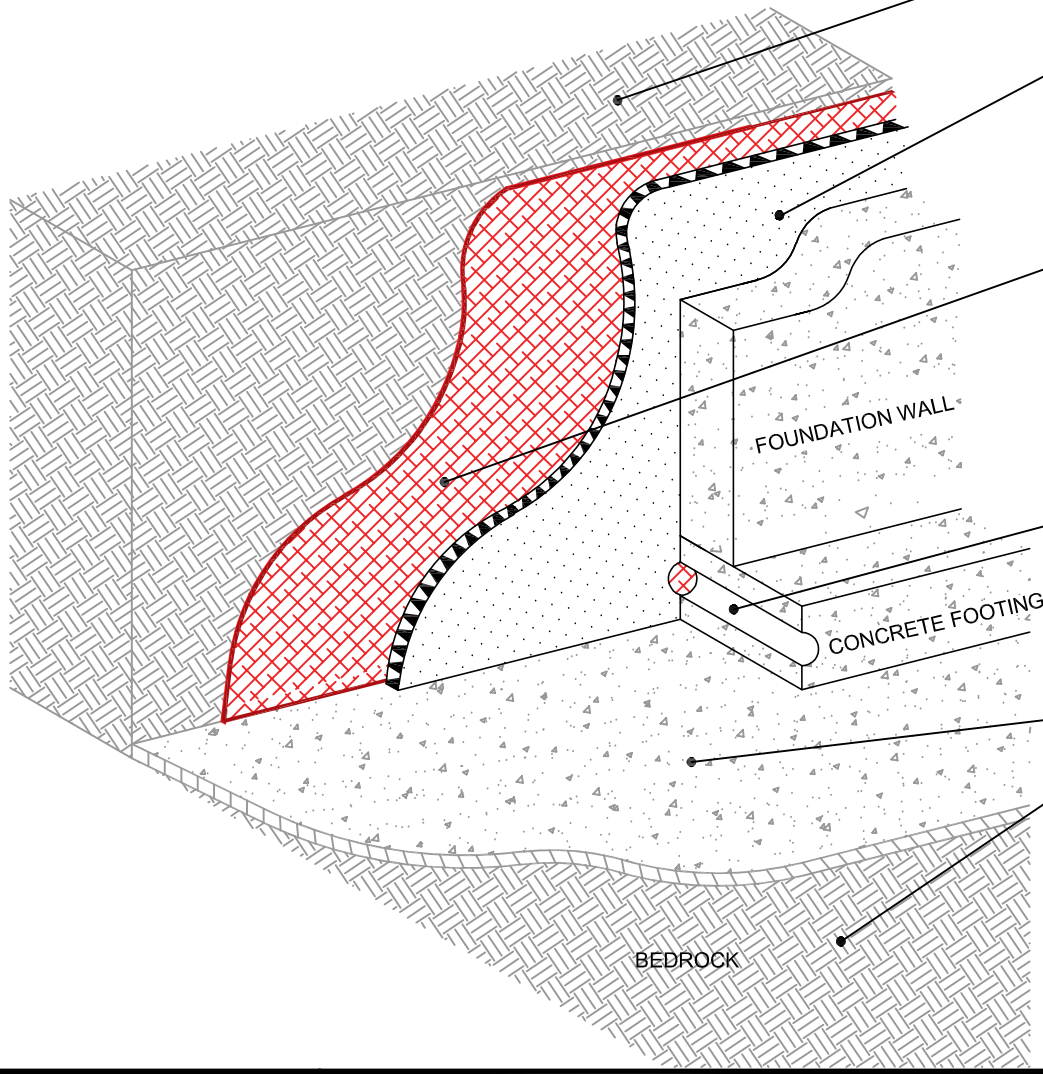


Figure 3 – Shear Wave Velocity Profile at Shot Location -1 m



SMOOTH AND FLAT BEDROCK SURFACE ADEQUATELY PREPARED FOR THE PLACEMENT OF THE WATERPROOFING MEMBRANE

COMPOSITE FOUNDATION DRAINAGE MEMBRANE (SUCH AS DELTA DRAIN 6000, MIRADRAIN G100N OR EQUIVALENT). INSTALL IN HORIZONTAL LIFTS WITH MINIMUM 150mm HORIZONTAL AND VERTICAL OVERLAP IN SHINGLE FASHION WITH GEOTEXTILE FACING AWAY FROM THE APPLICATOR. MECHANICALLY SECURE VERTICAL AND HORIZONTAL JOINTS WITH BLUESKIN WP200 AND BLUESKIN PRIMER OR EQUIVALENT.

WATERPROOFING MEMBRANE WILL CONSIST OF 150miL GRANULAR BENTONITE SURFACING LAMINATED TO 20miL THICK HDPE MEMBRANE SUCH AS TREMCO PARASEAL OR EQUIVALENT. TREMCO PARASEAL TO BE INSTALLED IN HORIZONTAL LIFTS TO MANUFACTURERS SPECIFICATIONS IN SHINGLE FASHION WITH THE HDPE SIDE FACING APPLICATOR TO AN ADEQUATELY PREPARED SUBSTRATE SURFACE. WATERPROOFING MEMBRANE TO EXTEND FROM 3m BELOW GRADE TO UNDERSIDE OF FOOTING

150mm DIAMETER SOLID PVC SLEEVE PLACED THROUGH THE FOOTING AT APPROXIMATELY 3m SPACING AROUND THE EXTERIOR PERIMETER OF THE STRUCTURE. THE SLEEVES SHOULD BE MECHANICALLY CONNECTED TO THE COMPOSITE FOUNDATION DRAINAGE MEMBRANE AND THE 150mm DIAMETER INTERIOR SUBFLOOR DRAINAGE SYSTEM GRAVITY CONNECTED TO THE SUMP PIT.

150mm THICK, 15 MPa CONCRETE MUD SLAB

CLEAN SURFACE SOUNDED BEDROCK APPROVED BY THE GEAOTECHNICAL CONSULTANT

IT IS RECOMMENDED THAT PERIODIC INSPECTIONS BE COMPLETED BY THE GEOTECHNICAL CONSULTANT AT THE TIME OF CONSTRUCTION DURING THE INSTALLATION OF THE WATER RETARDATION SYSTEM .

patersongroup
consulting engineers

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Ottawa, Ontario K2E 7J5
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www.patersongroup.ca

WESTBORO POINT DEVELOPMENTS LTD.

PROPOSED MULTI-STOREY BUILDING
2070 SCOTT STREET

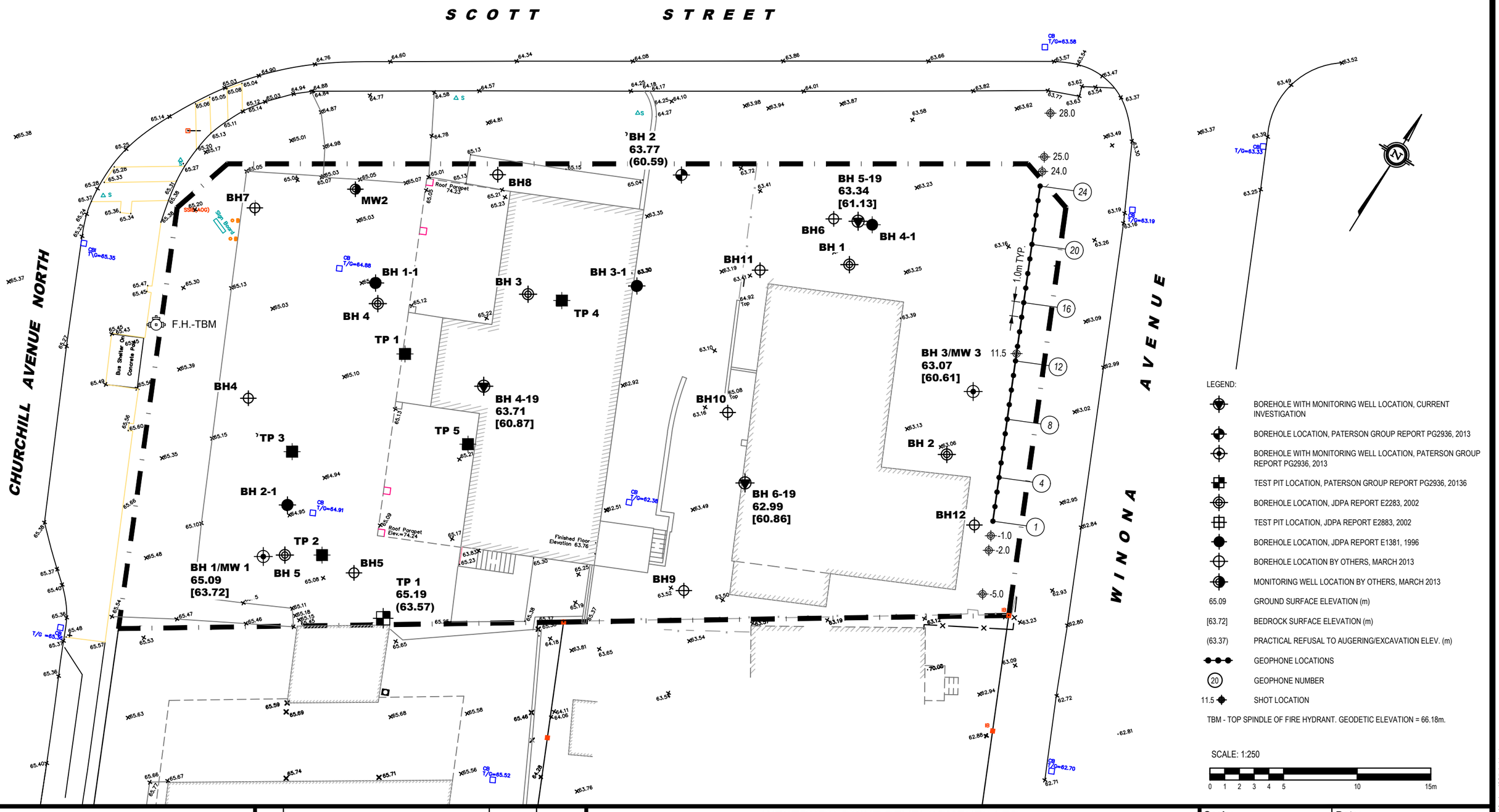
OTTAWA, ONTARIO

Title:

GROUNDWATER SUPPRESSION SYSTEM

Scale: N.T.S.	**Date:** 05/2019
Drawn by: RCG	**Report No.:** PG4935-1
Checked by: RG	**Drawing No.:** FIG. 4
Approved by: CDS	**Revision No.:**

p:\autocad drawings\geotechnical\pg49xx\pg4935 gw suppresion system.dwg



LEGEND:

- BOREHOLE WITH MONITORING WELL LOCATION, CURRENT INVESTIGATION
- BOREHOLE LOCATION, PATERSON GROUP REPORT PG2936, 2013
- BOREHOLE WITH MONITORING WELL LOCATION, PATERSON GROUP REPORT PG2936, 2013
- TEST PIT LOCATION, PATERSON GROUP REPORT PG2936, 20136
- BOREHOLE LOCATION, JDPA REPORT E2283, 2002
- TEST PIT LOCATION, JDPA REPORT E2883, 2002
- BOREHOLE LOCATION, JDPA REPORT E1381, 1996
- BOREHOLE LOCATION BY OTHERS, MARCH 2013
- MONITORING WELL LOCATION BY OTHERS, MARCH 2013
- 65.09 GROUND SURFACE ELEVATION (m)
- [63.72] BEDROCK SURFACE ELEVATION (m)
- (63.37) PRACTICAL REFUSAL TO AUGERING/EXCAVATION ELEV. (m)
- GEOPHONE LOCATIONS
- (20) GEOPHONE NUMBER
- 11.5 SHOT LOCATION

TBM - TOP SPINDLE OF FIRE HYDRANT. GEODETIC ELEVATION = 66.18m.

SCALE: 1:250

0 1 2 3 4 5 10 15m

patersongroup
consulting engineers

154 Colonnade Road South
Ottawa, Ontario K2E 7J5
Tel: (613) 226-7381 Fax: (613) 226-6344

NO.	REVISIONS	DATE	INITIAL
0			

WESTBORO POINT DEVELOPMENTS LTD.

GEOTECHNICAL INVESTIGATION
2070 SCOTT STREET

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:250	Date: 06/2019
Drawn by: MPG	Report No.: PG4935-1
Checked by: SD	Dwg. No.: PG4935-1
Approved by: DJG	Revision No.: 0

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Appendix F CITY OF OTTAWA SERVICING STUDY CHECKLIST

Stantec

Development Servicing Study Checklist

Job#: 160410249

4.1 General Content	Addressed (Y/N/NA)	Section	Comments
Executive Summary (for larger reports only).	N/A	-	Introduction
Date and revision number of the report.	Y	-	
Location map and plan showing municipal address, boundary, and layout of proposed development.	Y	1.0	
Plan showing the site and location of all existing services.	Y		Existing Condtions Plan
Development statistics, land use, density, adherence to zoning and official plan, and reference to applicable subwatershed and watershed plans that provide context to which individual developments must adhere.	Y		Appendix B
Summary of Pre-consultation Meetings with City and other approval agencies.	N/A		
Reference and confirm conformance to higher level studies and reports (Master Servicing Studies, Environmental Assessments, Community Design Plans), or in the case where it is not in conformance, the proponent must provide justification and develop a defendable design criteria.	N/A		
Statement of objectives and servicing criteria.	Y		In each section
Identification of existing and proposed infrastructure available in the immediate area.	Y		In each section
Identification of Environmentally Significant Areas, watercourses and Municipal Drains potentially impacted by the proposed development (Reference can be made to the Natural Heritage Studies, if available).	N/A		
Concept level master grading plan to confirm existing and proposed grades in the development. This is required to confirm the feasibility of proposed stormwater management and drainage, soil removal and fill constraints, and potential impacts to neighbouring properties. This is also required to confirm that the proposed grading will not impede existing major system flow paths.	N/A		
Identification of potential impacts of proposed piped services on private services (such as wells and septic fields on adjacent lands) and mitigation required to addresspotential impacts.	N/A		
Proposed phasing of the development, if applicable.	N/A		
Reference to geotechnical studies and recommendations concerning servicing.		9.0	Report and Appendix
All preliminary and formal site plan submissions should have the following information:			
Metric scale	Y		Appendix H Drawings
North arrow (including construction North)	N/A		Appendix H Drawings
Key plan	Y		Appendix H Drawings
Name and contact information of applicant and property owner	Y		Appendix H Drawings
Property limits including bearings and dimensions	Y		Appendix H Drawings
Existing and proposed structures and parking areas	Y		Appendix H Drawings
Easements, road widening and rights-of-way	Y		Appendix H Drawings
Adjacent street names	Y		Appendix H Drawings

4.2 Water	Addressed (Y/N/NA)	Section	Comments
Confirm consistency with Master Servicing Study, if available	N/A	3.0	
Availability of public infrastructure to service proposed development	Y	3.0	
Identification of system constraints	Y	3.0	
Identify boundary conditions	Y	3.0	
Confirmation of adequate domestic supply and pressure	Y	3.0	

Confirmation of adequate fire flow protection and confirmation that fire flow is calculated as per the Fire Underwriter's Survey. Output should show available fire flow at locations throughout the development.		3.0	Appendix A
Provide a check of high pressures. If pressure is found to be high, an assessment is required to confirm the application of pressure reducing valves.	Y	3.0	
Definition of phasing constraints. Hydraulic modeling is required to confirm servicing for all defined phases of the project including the ultimate design.	N/A		
Address reliability requirements such as appropriate location of shut-off valves	N/A		
Check on the necessity of a pressure zone boundary modification.	N/A		
Reference to water supply analysis to show that major infrastructure is capable of delivering sufficient water for the proposed land use. This includes data that shows that the expected demands under average day, peak hour and fire flow conditions provide water within the required pressure range		3.0	
Description of the proposed water distribution network, including locations of proposed connections to the existing system, provisions for necessary looping, and appurtenances (valves, pressure reducing valves, valve chambers, and fire hydrants) including special metering provisions.	Y	3.0	
Description of off-site required feedermains, booster pumping stations, and other water infrastructure that will be ultimately required to service proposed development, including financing, interim facilities, and timing of implementation.	Y	3.0	
Confirmation that water demands are calculated based on the City of Ottawa Design Guidelines.	Y	3.0	
Provision of a model schematic showing the boundary conditions locations, streets, parcels, and building locations for reference.	N/A		
4.3 Wastewater	**Addressed (Y/N/NA)**	**Section**	**Comments**
Summary of proposed design criteria (Note: Wet-weather flow criteria should not deviate from the City of Ottawa Sewer Design Guidelines. Monitored flow data from relatively new infrastructure cannot be used to justify capacity requirements for proposed infrastructure).	Y	4.0	
Confirm consistency with Master Servicing Study and/or justifications for deviations.	N/A		
Consideration of local conditions that may contribute to extraneous flows that are higher than the recommended flows in the guidelines. This includes groundwater and soil conditions, and age and condition of sewers.	N/A		
Description of existing sanitary sewer available for discharge of wastewater from proposed development.	Y	4.0	
Verify available capacity in downstream sanitary sewer and/or identification of upgrades necessary to service the proposed development. (Reference can be made to previously completed Master Servicing Study if applicable)	N/A		
Calculations related to dry-weather and wet-weather flow rates from the development in standard MOE sanitary sewer design table (Appendix 'C') format.	Y	4.0	Appendix C
Description of proposed sewer network including sewers, pumping stations, and forcemains.	Y	4.0	
Discussion of previously identified environmental constraints and impact on servicing (environmental constraints are related to limitations imposed on the development in order to preserve the physical condition of watercourses, vegetation, soil cover, as well as protecting against water quantity and quality).	N/A		
Pumping stations: impacts of proposed development on existing pumping stations or requirements for new pumping station to service development	N/A		

service development.			
Forcemain capacity in terms of operational redundancy, surge pressure and maximum flow velocity.	N/A		
Identification and implementation of the emergency overflow from sanitary pumping stations in relation to the hydraulic grade line to protect against basement flooding.	N/A		
Special considerations such as contamination, corrosive environment etc.	N		
4.4 Stormwater	**Addressed (Y/N/NA)**	**Section**	**Comments**
Description of drainage outlets and downstream constraints including legality of outlets (i.e. municipal drain, right-of-way, watercourse, or private property)	Y	5.0	
Analysis of available capacity in existing public infrastructure.	N		
A drawing showing the subject lands, its surroundings, the receiving watercourse, existing drainage patterns, and proposed drainage pattern.	Y		Existing Conditions Plan
Water quantity control objective (e.g. controlling post-development peak flows to pre-development level for storm events ranging from the 2 or 5 year event (dependent on the receiving sewer design) to 100 year return period); if other objectives are being applied, a rationale must be included with reference to hydrologic analyses of the potentially affected subwatersheds, taking into account long-term cumulative effects.	Y	5.0	Appendix D
Water Quality control objective (basic, normal or enhanced level of protection based on the sensitivities of the receiving watercourse) and storage requirements.	N/A		
Description of the stormwater management concept with facility locations and descriptions with references and supporting information.	Y	5.0	Appendix D
Set-back from private sewage disposal systems.	N/A		
Watercourse and hazard lands setbacks.	N/A		
Record of pre-consultation with the Ontario Ministry of Environment and the Conservation Authority that has jurisdiction on the affected watershed.	N		
Confirm consistency with sub-watershed and Master Servicing Study, if applicable study exists.	N/A		
Storage requirements (complete with calculations) and conveyance capacity for minor events (1:2 year return period) and major events (1:100 year return period).	Y	5.0	Appendix D
Identification of watercourses within the proposed development and how watercourses will be protected, or, if necessary, altered by the proposed development with applicable approvals.	N		
Calculate pre and post development peak flow rates including a description of existing site conditions and proposed impervious areas and drainage catchments in comparison to existing conditions.	Y	5.0	Appendix D
Any proposed diversion of drainage catchment areas from one outlet to another.	N/A		
Proposed minor and major systems including locations and sizes of stormwater trunk sewers, and stormwater management facilities.	N/A		
If quantity control is not proposed, demonstration that downstream system has adequate capacity for the post-development flows up to and including the 100-year return period storm event.	N/A		
Identification of potential impacts to receiving watercourses	N/A		
Identification of municipal drains and related approval requirements.	N/A		
Descriptions of how the conveyance and storage capacity will be achieved for the development.	Y	5.0	Appendix D
100 year flood levels and major flow routing to protect proposed development from flooding for establishing minimum building elevations (MBE) and overall grading.	N		
Inclusion of hydraulic analysis including hydraulic grade line elevations.	N		

Description of approach to erosion and sediment control during construction for the protection of receiving watercourse or drainage corridors.	Y	8.0	
Identification of floodplains – proponent to obtain relevant floodplain information from the appropriate Conservation Authority. The proponent may be required to delineate floodplain elevations to the satisfaction of the Conservation Authority if such information is not available or if information does not match current conditions.	N/A		
Identification of fill constraints related to floodplain and geotechnical investigation.	N/A		
4.5 Approval and Permit Requirements	**Addressed (Y/N/NA)**	**Section**	**Comments**
Conservation Authority as the designated approval agency for modification of floodplain, potential impact on fish habitat, proposed works in or adjacent to a watercourse, cut/fill permits and Approval under Lakes and Rivers Improvement Act. The Conservation Authority is not the approval authority for the Lakes and Rivers Improvement Act. Where there are Conservation Authority regulations in place, approval under the Lakes and Rivers Improvement Act is not required, except in cases of dams as defined in the Act.	N/A		
Application for Certificate of Approval (CofA) under the Ontario Water Resources Act.	N/A		
Changes to Municipal Drains.	N/A		
Other permits (National Capital Commission, Parks Canada, Public Works and Government Services Canada, Ministry of Transportation etc.)	N/A		
4.6 Conclusion	**Addressed (Y/N/NA)**	**Section**	**Comments**
Clearly stated conclusions and recommendations	Y	10.0	
Comments received from review agencies including the City of Ottawa and information on how the comments were addressed. Final sign-off from the responsible reviewing agency.	N/A		
All draft and final reports shall be signed and stamped by a professional Engineer registered in Ontario	Y		

Appendix G CORRESPONDENCE

From: Tousignant, Eric
To: Paerez, Ana
Cc: Wu, John; Kilborn, Kris
Subject: RE: 2070 Scott Street - Sanitary sewer capacity
Date: Tuesday, September 17, 2019 3:16:27 PM

Hi Anna

There are no concerns with respect to adding the proposed 5.7 L/s into the existing sanitary system along Scott Street as well as on Winona Avenue.

Regards
Eric

Eric Tousignant, P.Eng.
Senior Water Resources Engineer
Infrastructure Services
613-580-2424 ext 25129

From: Paerez, Ana <Ana.Paerez@stantec.com>
Sent: September 05, 2019 12:41 PM
To: Tousignant, Eric <Eric.Tousignant@ottawa.ca>
Cc: Wu, John <John.Wu@ottawa.ca>; Kilborn, Kris <kris.kilborn@stantec.com>
Subject: RE: 2070 Scott Street - Sanitary sewer capacity

Hi Eric,
The proposed site consists of a 23-storey commercial/residential building with three levels of underground parking. The proposed peak flows are 5.7L/s as per the attached sewer design sheet. Please let me know if you need anything else.
Thank you,
Ana

Ana Paerez, P. Eng.
Water Resources Engineer

Direct: 506 204-5856
Fax: 506 858-8698
Ana.Paerez@stantec.com

Stantec

From: Tousignant, Eric <Eric.Tousignant@ottawa.ca>
Sent: Tuesday, September 03, 2019 2:56 PM
To: Paerez, Ana <Ana.Paerez@stantec.com>
Cc: Wu, John <John.Wu@ottawa.ca>
Subject: RE: 2070 Scott Street - Sanitary sewer capacity

Hi Ana

As per our discussion, asset management will do the capacity assessment. Please send me your proposed peak flows and we will enter it into our model.

Eric

Eric Tousignant, P.Eng.
Senior Water Resources Engineer
Infrastructure Services
613-580-2424 ext 25129

From: Paerez, Ana <Ana.Paerez@stantec.com>
Sent: September 03, 2019 12:10 PM
To: Tousignant, Eric <Eric.Tousignant@ottawa.ca>
Subject: 2070 Scott Street - Sanitary sewer capacity

Hi Eric,
We are working on a servicing brief for a mixed-use development on 2070/2090 Scott Street (see below) that will consist of a mixed commercial/residential 23-storey building. John Wu advised that a sanitary sewer capacity analysis will be required for the site and indicated we contact you to obtain any relevant background information including sanitary flow monitoring data.
We would really appreciate any information you can provide. Feel free to contact me if you want to discuss.
Thank you,

Ana Paerez, P. Eng.
Water Resources Engineer

Direct: 506 204-5856
Fax: 506 858-8698
Ana.Paerez@stantec.com

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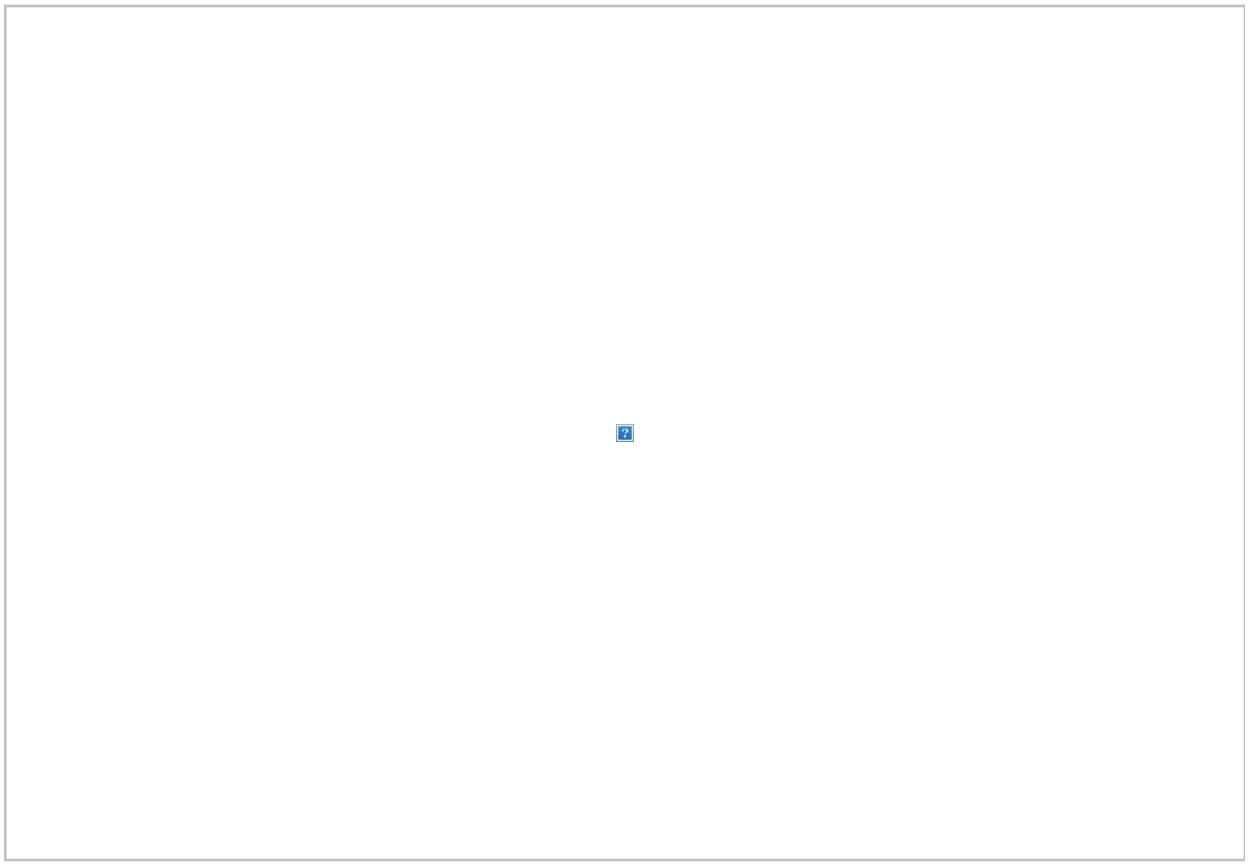

https://maps.ottawa.ca/geoottawa/

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Appendix H DRAWINGS