265 CATHERINE STREET SERVICING AND STORMWATER MANAGEMENT REPORT

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Prepared for:
11034936 Canada Inc.

Prepared by:
Stantec Consulting Ltd.

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160401663

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Prepared by: 

Signature

Michael Wu, EIT

Printed Name

Reviewed by: 

Signature

Dustin Thiffault, P.Eng

Printed Name

Approved by: 

Signature

Kris Kilborn

Printed Name

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1 Introduction

Stantec Consulting Ltd. has been commissioned by 11034936 Canada Inc. to prepare the following Servicing and Stormwater Management Report in support of a Site Plan Control application for the proposed development located at 265 Catherine Street in the City of Ottawa.

The site is 1.0 ha in area and is situated along the north side of Catherine Street, the south side of Arlington Avenue, the west side of Kent Street, and the east side of Lyon Street North. The site is currently zoned GM [1875] S271 and consists of the former Greyhound bus terminal that has now been demolished. The site is bounded by Catherine Street to the south, Kent Street to the east, Lyon Street North to the west, and Arlington Avenue to the north, as shown in **Figure 1.1** below.

Figure 1.1: Key Plan of Site

The proposed 1.0 ha site will be developed in two phases, with the first phase consisting of a 32-storey residential high-rise with a six-storey podium, while the second phase will consist of seven 3-storey townhouses and two residential high-rises, one 34-storey and the other 36-storey, with a six-storey podium. A 0.1 ha park is proposed at the northeast of the site. Quadrangle Architects Ltd. has prepared a

site plan dated September 10th, 2024, as shown in **Appendix A.1**, while the buildings and unit type breakdown are listed in **Table 1.1** below.

Table 1.1: Unit Type Breakdown

Unit Type	Building A	Building B	Building C	Total
Bachelor	103	88	-	**191**
One-bedroom	93	168	-	**261**
One-bedroom with den	91	190	-	**281**
Two-bedroom	100	242	-	**342**
Two-bedroom with den	31	9	-	**40**
Three-bedroom	5	37	-	**42**
Townhouses	-	-	7	**7**
Residential Total	**423**	**734**	**7**	**1164**
Commercial (m^2)	**1454.5**	**1222.9**	**-**	**2677**

1.1 Objective

This site servicing and stormwater management (SWM) report presents a servicing scheme that is free of conflicts, provides on-site servicing in accordance with City of Ottawa Design Guidelines, and uses the existing municipal infrastructure in accordance with any limitations communicated during consultation with the City of Ottawa staff. Details of the existing infrastructure located within the Catherine Street, Lyon Street North, Kent Street, and Arlington Avenue right of ways (ROW) were obtained from available as-built drawings and site topographic survey.

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

- Potable Water Servicing
    - Estimated water demands to characterize the proposed feed(s) for the proposed development which will be serviced from either the existing 127 mm diameter watermains within the Catherine Street and Kent Street ROWs, or the existing 203 mm diameter watermains within the Lyon Street North and Arlington Avenue ROWs.
    - 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 345 to 552 kPa (50 to 80 psi)
    - Under fire flow (emergency) conditions, the water distribution system is to maintain a minimum pressure greater than 140 kPa (20 psi)
- Wastewater (Sanitary) Servicing
    - Define and size the sanitary service lateral which will be connected to the existing 300 mm diameter combined sewers within the Catherine Street ROW, the 450 mm diameter

combined sewer within the Lyon Street North ROW, or the 375 mm diameter combined sewer within the Kent Street ROW.

- 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.
    - Define and size the proposed storm service lateral that will be connected to the existing 525 mm and 600 mm diameter municipal storm sewer within the Arlington Avenue ROW.
- Prepare a grading plan in accordance with the proposed site plan and existing grades.

Drawing SSP-1 illustrate the proposed internal servicing scheme for the site.

2 Background

Documents referenced in preparing of this stormwater and servicing report for the 265 Catherine Street development include:

- *City of Ottawa Sewer Design Guidelines* (SDG), City of Ottawa, October 2012, including all subsequent technical bulletins
- *City of Ottawa Design Guidelines – Water Distribution*, City of Ottawa, July 2010, including all subsequent technical bulletins
- *Design Guidelines for Drinking Water Systems*, Ministry of the Environment, Conservation, and Parks (MECP), 2008
- *Fire Protection Water Supply Guideline* for Part 3 in the Ontario Building Code, Office of the Fire Marshal (OFM), October 2020
- *Water Supply for Public Fire Protection*, Fire Underwriters Survey (FUS), 2020
- *Geotechnical Investigation – Proposed Mixed-Use Development, 265 Catherine Street, Ottawa, Ontario,* Paterson Group Inc., August 13, 2021

3 Water Servicing

3.1 Background

The proposed building is in Pressure Zone 1W of the City of Ottawa's Water Distribution System. The existing watermains along the boundaries of the site consist of a 203 mm diameter ductile iron watermain within Arlington Avenue, 203 mm diameter UCI watermain within Lyon Street North, and 127 mm diameter UCI watermains within Catherine and Kent Streets. There are existing fire hydrants on Arlington Avenue and Catherine Street. According to the Catherine Street as-builts dated 1999 provided by the City, there were plans to upsize the 127 mm diameter watermain to 203 mm, though there are no indications from the infrastructure maps on GeoOttawa or the provided UCC plans that the upsizing has taken place.

3.2 Water Demands

3.2.1 POTABLE (DOMESTIC) WATER DEMANDS

The City of Ottawa Water Distribution Guidelines (July 2010) and ISTB 2021-03 Technical Bulletin were used to determine water demands based on projected population densities for residential areas and associated peaking factors. The population was estimated using an occupancy of 1.4 persons per unit for bachelor and one-bedroom apartments, 2.1 persons per unit for one-bedroom with den and two-bedroom apartments, 3.1 persons per unit for two-bedroom with den, three-bedroom apartments, and the townhouses, which have three bedrooms. Based on the unit type breakdown in **Table 1.1**, the proposed building is estimated to have a total population of 2217 persons.

A daily rate of 280 L/cap/day has been used to estimate average daily (AVDY) potable water demand for the residential units, and 28,000 L/ha/day for the commercial areas. Maximum day (MXDY) demands were determined by multiplying the AVDY demands by a factor of 2.5 for residential areas and 1.5 for commercial areas. Peak hourly (PKHR) demands were determined by multiplying the MXDY by a factor of 2.2 for residential areas and 1.8 for commercial areas. The estimated demands for each tower are summarized in **Table 3.1** below and detailed in **Appendix B.1**.

Table 3.1: Estimated Water Demands

Block/ Building	Comm. Area (m^2)	Total Apartment Units	Total Townhome Units	Population	AVDY (L/s)	MXDY (L/s)	PKHR (L/s)
A	1454.5	423	0	787	2.6	6.4	14.2
B	1222.9	734	0	1408	4.6	11.5	25.2
C	-	-	7	22	0.1	0.2	0.4
Total (Res)					**7.2**	**18.1**	**39.6**
Total (Com)					**0.1**	**0.1**	**0.2**

Total	**2677.4**	**1157**	**7**	**2217**	**7.3**	**18.1**	**39.8**

3.2.2 FIRE FLOW DEMANDS

Based on the site plan, the fire flow requirement was calculated in accordance with Fire Underwriters Survey (FUS) methodology. Through correspondence with the architect (see **Appendix B.4**), Buildings A and B will be constructed out of cast-in-place concrete, sprinklered, and the vertical separations between the floors will be equipped with all the necessary fire separations required by code.

As such, they were estimated based on a building of non-combustible construction type with two-hour fire rated structural members, and full protections of all vertical openings (one hour fire rating), and the final sprinkler design to conform to the NFPA 13 standard. The gross floor area of the largest floor + 25 % of the gross floor area of two additional floors were used in the FUS calculation for the two high-rises, as per Page 22 of the *Fire Underwriters Survey's Water Supply for Public Fire Protection* (2020).

As for Building C, through correspondence with the architect, it is confirmed that the set of three-storey townhouses would likely be of wood frame construction type and not sprinklered. Thus, the gross floor area of all three floors of the townhouses were used in the FUS calculation.

The worst-case scenario for the fire flow was at Buildings B and C, in which their required fire flows were both determined to be 166.7 L/s (10,000 L/min). Detailed fire flow calculations per the FUS methodology and the supporting FUS exposure sketch are provided in **Appendix B.2**.

3.3 Level of Servicing

3.3.1 BOUNDARY CONDITIONS

The estimated domestic potable water demands, and fire flow demands, were used to define the level of servicing required for the proposed development from the municipal watermain and hydrants within the Catherine Street, Lyon Street North, Kent Street, and Arlington Avenue ROWs.

Discussions with the mechanical consultant and architect indicate that as the towers are to exceed 84 metres in height, the site will be required to be serviced from two separate watermains located on opposite sides of the site for adequate servicing. However, the initial boundary conditions provided in April 2023 indicated that the 127 mm diameter watermains on Catherine Street and Kent Street would not be able to provide the required fire flow. Spurred by discussions with the mechanical consultant and by recently revised boundary conditions (April 2024), it is proposed that the watermain along Kent Street between Arlington and Catherine will need to be upsized to 203 mm to meet the required fire flow, which was met as shown in the revised boundary conditions (See **Appendix B.3** for correspondence).

Table 3.2 below outlines the boundary conditions for the two proposed connections servicing the site in consideration of upsizing of the watermain on Lyon Street. The available fire flow is adequate in meeting the site's worst-case fire flow demands.

Table 3.2: Catherine and Kent Boundary Conditions (200 mm Kent Upsize)

Connection	Arlington Street	Kent Street
Min. HGL (m)	106.3	106.3
Max. HGL (m)	115.3	115.3
MXDY+FF (166.7 L/s) (m)	96.7	94.2

3.3.2 ALLOWABLE DOMESTIC PRESSURES

The desired normal operating pressure range in occupied areas as per the City of Ottawa 2010 Water Distribution Design Guidelines is 345 kPa to 552 kPa (50 psi to 80 psi) under a condition of maximum daily flow and no less than 276 kPa (40 psi) under a condition of maximum hourly demand. Furthermore, the maximum pressure at any point in the water distribution should not exceed 689 kPa (100 psi) as per the Ontario Building/Plumbing Code; pressure reducing measures are required to service areas where pressures greater than 552 kPa (80 psi) are anticipated in occupied areas.

The proposed finished floor elevation at the ground floor of 69.0m will serve as the floor elevation for the calculation of residual pressures at ground level. As per the boundary conditions, the on-site pressures are expected to range from 365.7 kPa to 453.9 kPa (53.0 psi to 65.8 psi) under normal operating conditions, which are within the normal operating pressure range defined by the City of Ottawa design guidelines as within 276 kPa to 552 kPa (40 psi to 80 psi). It is anticipated that booster pumps will be required to service the upper floors of the towers.

3.3.3 ALLOWABLE FIRE FLOW PRESSURES

The boundary conditions provided by the City of Ottawa indicate that the upsized watermain within Kent Street is expected to maintain a residual pressure of 25.2m equivalent to 247 kPa (35.8 psi) under the worst-case fire flow conditions. Similarly, the main within Arlington Street is expected to maintain a residual pressure of 27.7m equivalent to 272 kPa (39.4 psi). This demonstrates that with the upsizing and complete looping the watermains and nearby hydrants can provide the required fire flows while maintaining a residual pressure of 20 psi.

3.3.4 FIRE HYDRANT COVERAGE

The building will be sprinklered and two Siamese (fire department) connections are to be provided, one each at the main entrances along Catherine Street for each phase. There are five hydrants in the proximity of the proposed development site, as shown in **Figure 3.1**. The distance of each hydrant from the proposed building is less than 115 m. As the Siamese connections are fronting Catherine Street, only the two hydrants along Catherine Street were considered for the hydrant coverage calculations.

According to the NFPA 1 Table 18.5.4.3 in Appendix I of the City of Ottawa Technical Bulletin ISTB-2018-02, a hydrant situated less than 76 m away from a building can supply a maximum capacity of 5,678 L/min. Hence, the required fire flow for this site (10,000 L/min) can be achieved with the two hydrants

along Catherine Street alone. See **Appendix B.5** for fire hydrant coverage table calculations and NFPA Table 18.5.4.3.

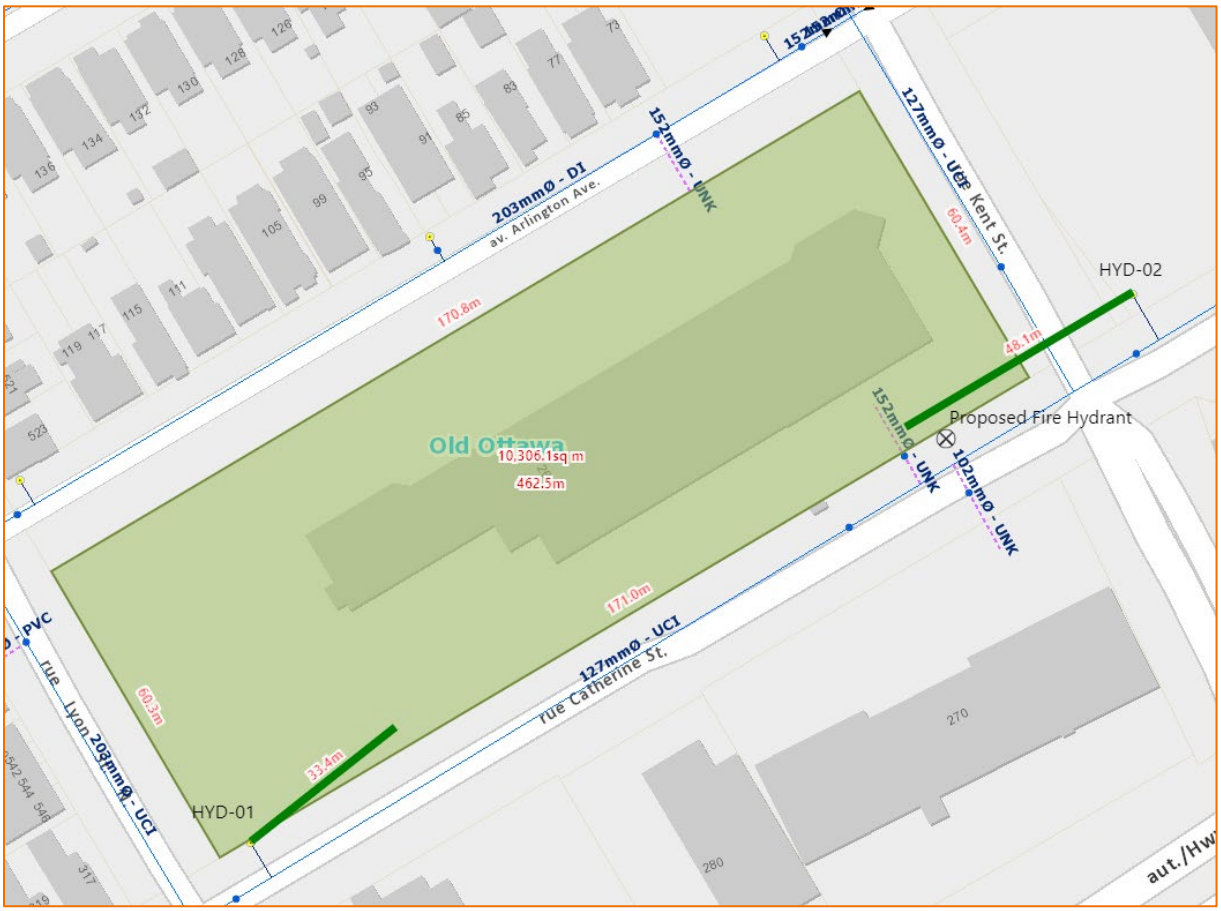

Figure 3.1: Fire Hydrant Coverage Sketch

As per Section 3.2.5.16 of the Ontario Building Code, the distance between the fire department connection and hydrant cannot be obstructed or more than 45 m. As HYD-02 is located across Kent Street from the site and is more than 45 m from the Phase 1 fire department connection, a new fire hydrant is proposed on site to provide an unobstructed distance less than 45 m to the Phase 1 fire department connection and meet OBC requirements.

3.4 Proposed Water Servicing

The development will be serviced by two 150 mm building service connections. One service will be connected to the 203 mm diameter watermain on Arlington Avenue, and the other to the watermain on Kent Street. As the site is required to be serviced by two service laterals on opposite sides of the site, the existing 127 mm diameter watermain on Kent Street will need to be upsized between Arlington and Catherine Street, where a new fire hydrant will be installed on Kent Street near Catherine. The sizing of the service connections is to be confirmed by the mechanical consultant.

The proposed water servicing is shown on **Drawing SSP-1**.

Thermal insulation is required on the water service lateral to Arlington Avenue, as there is less than 2.4 m cover provided per W22. Booster pumps are required for both towers. The mechanical consultant or plumbing contractor will ultimately be responsible to confirm building pressures are adequate to meet building code requirements.

4 Wastewater Servicing

The subject site at 265 Catherine Street is located within a City of Ottawa combined sewage area. The existing sewers adjacent to the development site consist of a pair of combined sewers, one 300mm in diameter and the other 1800mm in diameter within Catherine Street, a pair of combined sewers, one 450 mm in diameter and the other 1350 mm in diameter within Lyon Street North, a 1200mm diameter combined sewer within Arlington Avenue, and a 375 mm diameter combined sewer and the 3000mm diameter Combined Sewage Storage Tunnel (CSST) within Kent Street.

4.1 Design Criteria

As outlined in the City of Ottawa Sewer Design Guidelines and the MECP Design Guidelines for Sewage Works, the following criteria were used to calculate the estimated wastewater flow rates and to determine the size and location of the sanitary service 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
- Minimum size of sanitary sewer service = 135 mm
- Minimum grade of sanitary sewer service = 1.0 % (2.0 % preferred)
- Average wastewater generation = 280 L/person/day (per City Design Guidelines)
- Peak Factor = based on Harmon Equation; maximum of 4.0 (residential)
- Harmon correction factor = 0.8
- Infiltration allowance = 0.33 L/s/ha (per City Design Guidelines)
- Minimum cover for sewer service connections – 2.0 m
- Population density for one-bedroom apartments – 1.4 persons/apartment
- Population density for one-bedroom with den apartments – 2.1 persons/apartment
- Population density for two-bedroom with den and three-bedroom apartments – 3.1 persons/apartment
- Population density for general townhome with three bedrooms – 3.1 persons/townhouse
- Average commercial wastewater generation – 28,000 L/ha/day of building space

4.2 Wastewater Generation and Servicing Design

The estimated peak wastewater flow generated are based on the current site plan and unit breakdown as shown in **Table 1.1**. The anticipated wastewater peak flow generated from the proposed development is summarized in **Table 4.1** below.

The lands to be conveyed to the proposed park do not form part of the site plan development and were not considered as part of the sanitary sewage calculations.

Table 4.1 - Estimated Total Wastewater Peak Flow

Phase	Residential Units				Commercial Areas			Infiltration Flow (L/s)	Total Peak Flow (L/s)
	Number of Units	Population	Peak Factor	Peak Flow (L/s)	Area (ha)	Peak Factor	Peak Flow (L/s)		
1	423	787	3.09	7.9	0.14	1.5	0.1	0.1	8.1
2	741	1430	2.96	13.7	0.12	1.5	0.1	0.2	13.9
Total Estimated Wastewater Peak Flow (L/s):									**22.0**

1. Design residential flow based on 280 L/p/day and design commercial flow based on 28,000 L/ha/day.
2. Peak factor for residential units calculated using Harmon's formula and taken as 1.50 for commercial areas.
3. Residential population estimated based on 1.4 persons/unit for one-bedroom apartments, 2.1 persons/unit for one-bedroom units with dens, 3.1 persons/unit for two-bedroom units with dens, three-bedroom units, and three-bedroom townhouses.
4. Infiltration design flow equals 0.33 L/s/ha.

Detailed sanitary sewage calculations are included in **Appendix C.1**. A full port backwater valve will be required for the proposed building in accordance with the Sewer Design Guidelines and will be coordinated with the building mechanical engineers.

The peak sanitary wastewater design flow is well within the target release rate calculated in **Section 5.4.1**, and serves as a constraint for stormwater release rate in the separate system. The anticipated peak wastewater flows for the proposed development were provided to the City of Ottawa staff to evaluate the adequacy of the receiving municipal combined sewer system in the vicinity of the site and downstream network, and the City has provided the go-ahead for the proposed sanitary discharge into the 1200 mm combined sewer in Arlington Avenue.

4.3 Proposed Sanitary Servicing

A 250 mm diameter sanitary building service for building A and a 300 mm service for Buildings B and C, complete with full port backwater valve as per City standard S14.1, are recommended to service the proposed development. The sanitary laterals are be equipped with a sanitary monitoring sample port per City standard S18.1 before connecting to the sewer main as per City standard S12.2. The proposed sanitary servicing is shown on **Drawing SSP-1** and **Drawing SA-1**.

Existing connections are to be abandoned and full port backwater valves installed on the proposed sanitary services within the site to prevent any surcharge from the downstream sewer main from impacting the proposed property. A sump pump will be required for sewage discharge from the mechanical room. Sizing of the service laterals, sump pit, sump pump, and design of the internal plumbing and associated mechanical systems are to be confirmed by the mechanical consultant.

5 Stormwater Management and Servicing

5.1 Objectives

The goal of this stormwater servicing and stormwater management (SWM) plan is to determine the measures necessary to control the quantity and quality of stormwater released from the proposed development to meet the criteria established during the consultation process with City of Ottawa staff, and to provide sufficient details required for approval.

5.2 Stormwater Management (SWM) Criteria

The Stormwater Management (SWM) criteria were established by combining current design practices outlined by the City of Ottawa Sewer Design Guidelines (SDG) (October 2012), review of project pre-consultation notes with the City of Ottawa, and through consultation with City of Ottawa staff. The following summarizes the criteria, with the source of each criterion indicated in brackets:

General

- Use of the dual drainage principle (City of Ottawa SDG)
- Wherever feasible and practical, site-level measures should be used to reduce and control the volume and rate of runoff (City of Ottawa SDG)
- Assess impact of 100-year event outlined in the City of Ottawa Sewer Design Guidelines on the major and minor drainage systems (City of Ottawa SDG)

Storm Sewer & Inlet Controls

- Discharge for each storm event to be restricted to a 2-year storm event pre-development rate with a maximum pre-development C coefficient of 0.4 (City of Ottawa pre-consultation, **Appendix A.2**)
- Peak flows generated from events greater than the 2-year and including the 100-year storm must be detained on site (City of Ottawa pre-consultation, **Appendix A.2**)
- The preferred stormwater system outlet for this site is the 525 mm and 600 mm diameter storm sewer within the Arlington Avenue ROW. (City of Ottawa pre-consultation, **Appendix A.2**)
- The foundation drainage system is to be independently connected to sewer main unless being pumped with appropriate back up power, sufficient sized pump, and backflow prevention. (City of Ottawa pre-consultation, **Appendix A.2**)
- T_c should be not less than 10 minutes since IDF curves become unrealistic at less than 10 min (City of Ottawa SDG).

Surface Storage & Overland Flow

- Building openings to be a minimum of 0.30 m above the 100-year water level (City of Ottawa SDG)
- Maximum depth of flow under either static or dynamic conditions shall be less than 0.30 m (City of Ottawa SDG)

- Provide adequate emergency overflow conveyance off-site with a minimum vertical clearance of 15 cm between the spill elevation and the ground elevation at the building envelope in the proximity of the flow route or ponding area (City of Ottawa SDG)

5.3 Existing Conditions

The existing site (0.75 ha, not including road widening and the proposed park) is dominated by roofs and asphalt pavement with only around 395.5 m^2 in soft area. As such the overall site pre-development runoff coefficient was established to be C=0.87, in which the hard surface areas use a coefficient of 0.90 while soft surface areas have a coefficient of 0.20. This exceeds the maximum permissible pre-development runoff coefficient of C=0.4 identified in the City of Ottawa pre-consultation for this site. Therefore, the pre-development runoff coefficient of 0.4 was used for the site analysis.

The pre-development release rates for the site have been determined using the rational method and the drainage characteristics identified above. A time of concentration for the pre-development area (12 minutes) was assigned based on the relatively large site area, its high impervious area, and its proximity to the stormwater outfall. The peak pre-development flow rates shown in **Table 5.1** have been calculated using the rational method as follows:

$$Q = 2.78\,(C)(I)(A)$$

Where:
$Q = peak\ flow\ rate, L/s$
$C = site\ runoff\ coefficient$
$I = rainfall\ intensity, mm/hr\ (per\ City\ of\ Ottawa\ IDF\ curves)$
$A = drainage\ area, ha$

Given the outer perimeters of the site will continue to drain uncontrolled to the surrounding rights of way as per existing conditions, only the roofs and controlled portions of the site were included in the target release rate. Furthermore, the site's location in the combined sewer area, as summarized in **Section 4,** has provided for a restrictive target release for the site, in which the stormwater contributions to the sewers are to be restricted to the 2-year pre-development release rate less contribution from sanitary sewer discharge.

As such, the target release rate for the site is summarized in **Table 5.1**: Target Release Rate below:

Table 5.1: Target Release Rate

	Area (ha)	Target Flow Rate to Combined Sewer (L/s)	Less Peak Sanitary Discharge (L/s)
Controlled Site	0.75	58.2	37.8

A target release rate of 58 L/s was obtained using a C of 0.4 and a 2-year storm event for the roof and controlled areas of the site, with the design focusing on measures adopted to provide a storm servicing approach that restricts a 100-year peak storm run-off to the target release rate calculated as 38 L/s as

shown in **Table 5.1**: Target Release Rate. To meet the stormwater quantity control criteria, two stormwater cisterns are proposed to attenuate peak run-off, one for each of the two development phases.

5.4 Stormwater Management Design

The site is to be serviced by two proposed 300 mm diameter storm sewers, which will collect stormwater discharge from the cisterns and connect to the existing 525 mm diameter and 600 mm diameter storm sewers on Arlington Avenue. The site has been subdivided into catchment areas to effectively collect, store, and convey runoff at flowrates not exceeding the target release rate established by consultation with the City of Ottawa (refer to **Drawing SD-1** for drainage areas).

Two stormwater cisterns located in the underground parking area are proposed to attenuate peak flows from the rooftop areas from the towers and the townhouses and the common areas. Area drains will convey stormwater runoff from the surface to the stormwater cisterns via the internal plumbing of the buildings. The stormwater cisterns will be pumped at controlled rates to monitor manholes which outlets to the 525 mm and 600 mm diameter storm sewer on Arlington Avenue via 300 mm diameter pipes. The stormwater cisterns' locations will be coordinated by building's architect in conjunction with mechanical and structural engineers.

Footing drainage will be independent of the internal stormwater cistern quantity control system while sharing the same outlet. The mechanical design for the weeping tile system will include dedicated storm pits and duplex pumps to pump the weeping tile drainage to the storm main downstream of the cistern.

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

5.4.1 QUANTITY CONTROL: STORAGE REQUIREMENTS

The Modified Rational Method (MRM) was used to assess the flow rate and volume of runoff generated under post-development conditions. The site was subdivided into sub-catchments tributary to separate quantity control measures and subject to different inlet controls. **Drawing SD-1** shows the delineated sub-catchment areas. The MRM spreadsheet is included in **Appendix D.1.**

The following assumptions were made in the creation of the storm drainage plan and accompanying MRM spreadsheet:

- Restricted combined release rate is 58.2 L/s. Upon deducting the sanitary peak flow of 20.4 L/s, the storm target release is 37.8 L/s.
- Excess run-off that cannot be captured as surface storage due to grading constraints is to sheet flow uncontrolled to the adjacent roadways (areas UNC-1 and UNC-2).
- Stormwater cistern equipped with mechanical pump to attenuate peak flows from the cistern will be used to manage stormwater flows from the site.

5.4.1.1 Uncontrolled Areas

Uncontrolled areas represent drainage areas that cannot be graded to enter the storm sewer system and are not captured by the proposed storm cistern. As such, they will sheet drain off the site to the adjacent roadways (see **Drawing SD-1**).

Table 5.2: Peak Uncontrolled 2- and 100-Year run-off

Area IDs	Area (ha)	2-Yr uncontrolled peak flow (L/s)	100-Yr uncontrolled peak flow (L/s)
UNC-1	0.04	6.9	18.4
UNC-2	0.11	17.1	49.8

Based on discussions with the City of Ottawa staff, overland flow from all uncontrolled drainage areas will not be considered in the overall development peak discharge rate as it contributes to the controlled system within the public roadways, which are equipped with ICDs.

5.4.1.2 Stormwater Cisterns

As part of the stormwater management design of the site development, two stormwater cisterns located in the underground parking area and equipped with mechanical pumps are proposed to attenuate peak flows from drainage areas CIST 1-1 to CIST 1-4 for Cistern 1 and CIST 2-1 to CIST 2-4 for Cistern 2. The final location of the cisterns within the proposed building is to be coordinated by the architect with mechanical and structural engineers.

Cistern 1 for Phase 1 is to be designed to provide a minimum active storage volume of 110 m^3 with a maximum controlled release rate of 14.3 L/s, while Cistern 2 for Phase 2 is to be designed to provide a minimum active storage volume of 170 m^3 with a maximum controlled release rate of 23.6 L/s. The stormwater cisterns are to discharge at the specified controlled release rate using a pump.**Table 5.3** summarizes the respective flow rates and volume of retained stormwater in the 2-year and 100-year storm events.

Table 5.3: Proposed Cistern 2 and 100-Year Storage Requirement

Cistern	Storm Return Period	Area IDs	Drainage Area (ha)	$Q_{release}$ (L/s)	$V_{required}$ (m^3)	$V_{available}$ (m^3)	Total V (m^3)
1	2-year	CIST 1-1 to CIST 1-4	0.28	14.3	26.8	110	280
	100-year				107.1		
2	2-year	CIST 2-1 to CIST 2-4	0.46	23.6	38.6	170	
	100-year				163.2		

5.4.1.3 Results

The proposed stormwater management plan provides adequate attenuation to meet the target release rate for the 2 and 100-year storm events as shown in **Table 5.4** below.

Table 5.4: Estimated Post-Development Discharge

Area Type	2-Year (L/s)	100-Year (L/s)	Target (L/s)
Uncontrolled	24.0	68.1	-
Controlled Areas	37.8		58.2
Sanitary Contributions	20.4		
Total Flow to Sewer	**58.2**		

Flows from the uncontrolled areas are not considered in the overall release rate for the site as detailed in **Section 5.4.1.1.**

5.4.2 QUALITY CONTROL

Through correspondence with the City of Ottawa, it was confirmed that no stormwater quality control measures apply, as the 525 mm and 600 mm diameter storm sewer in Arlington Avenue ultimately discharges into the 1350 mm diameter combined sewer in Lyon Street North.

5.5 Proposed Stormwater Servicing

Two 300 mm diameter stormwater building services, complete with full port backwater valve as per City standard S14.1, are proposed for the storm service discharge, as per **Drawing SSP-1** and **Drawing SD-1**. A stormwater sump and pump are required for the proposed foundation drain, and the roof drains are to be connected to the cisterns.

The combined foundation drain, roof drain, and subdrain flows will outlet to the cistern, which then pumps the discharge at a controlled rate and to the existing 525 mm and 600 mm diameter storm sewer within the Arlington Avenue ROW. The laterals are to connect to the main as detailed on the servicing drawings via monitoring sample ports. The proposed stormwater servicing is shown on **Drawing SSP-1** and **SD-1**.

6 Site Grading

The proposed re-development site, excluding the park, measures approximately 0.90 ha in area and consists of the former Greyhound bus terminal and asphalt area, with small patches of grassland. The topography across the site generally slopes from the middle towards the Arlington Avenue ROW at the north and the Catherine Street ROW at the south.

A detailed grading plan (see **Drawing GP-1**) has been provided to satisfy the stormwater management requirements as detailed in **Section 5**, adhere to any grade raise restrictions for the site, and provide for minimum cover requirements for storm and sanitary sewers where possible. Site grading has been established to provide emergency overland flow routes required for stormwater management.

7 Utilities

Overhead (OH) hydro-wires run east-west on the north side of Catherine Street and south side of Arlington Avenue, and north-south on the east side of Lyon Street North and on the west side of Kent Street, terminating halfway along the east property line of the site. All utilities within the work area will require relocation during construction. The existing utility poles within the public right of way are to be protected during construction.

As the site is surrounded by existing residential and commercial development, Hydro Ottawa, Bell, Rogers, and Enbridge servicing is readily available through existing infrastructure to service this site. The exact size, location, and routing of utilities will be finalized after design circulation. Existing overhead wires and utility plants may need to be temporarily moved/reconfigured to allow sufficient clearance for the movement of heavy machinery required for construction. The relocation of existing utilities will be coordinated with the individual utility providers upon design circulation.

8 Approvals

The proposed development lies on a private site under singular ownership and the storm discharge drains to an existing storm sewer outlet, therefore, the site will not require an Environmental Compliance Approval (ECA) from the Ministry of the Environment, Conservation and Parks (MECP) under O.Reg. 525/98.

For 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). It is possible that groundwater may be encountered during the foundation excavation on this site. A minimum of two to four weeks should be allotted for completion of the EASR registration and the preparation of the Water Taking and Discharge Plan by a Qualified Person as stipulated under O.Reg. 63/16. An MECP Permit to Take Water (PTTW), which is required for dewatering volumes exceeding 400,000L/day, is not anticipated for the site.

9 Erosion and Sediment Control During Construction

To protect downstream water quality and prevent sediment build-up in catch basins and storm sewers, erosion and sediment control measures must be implemented during construction. The following recommendations will be included in the contract documents and communicated to the Contractor.

1. Implement best management practices to provide appropriate protection of the existing and proposed drainage system and the receiving water course(s).
2. Limit the extent of the 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 geotextiles, geogrid, or synthetic mulches.
6. Install silt barriers/fencing around the perimeter of the site as indicated in **Drawing ECDS-1** to prevent the migration of sediment offsite.
7. Install trackout control mats (mud mats) at the entrance/egress to prevent migration of sediment into the public ROW.
8. Provide sediment traps and basins during dewatering works.
9. Install sediment traps (such as SiltSack® by Terrafix) between catch basins and frames.
10. Schedule the construction works at times which avoid flooding due to seasonal rains.

The Contractor will also be required to complete inspections and guarantee the proper performance of their erosion and sediment control measures at least after every rainfall. The inspections are to include:

- Verification that water is not flowing under silt barriers.
- Cleaning and changing the sediment traps placed on catch basins.

Refer to **Drawing ECDS-1** for the proposed location of silt fences, sediment traps, and other erosion control measures.

10 Geotechnical Investigation

A geotechnical investigation report was prepared by Paterson Group on August 13, 2021 to provide an assessment of the subsurface conditions found at the site. Three (3) boreholes, numbered BH 1-20 to BH 3-20, were advanced to a maximum depth of 14.7 metres below the existing ground surface in the investigation carried out on August 19, 2020. The information obtained from the field investigation will guide the detailed design of the site and identify development constraints. Excerpts from the geotechnical investigation report are attached in **Appendix E**.

The subsurface profile encountered at the test hole locations are characterized primarily by a layer of concrete or asphaltic concrete underlain by fill extending to an approximate depth of 0.6 m to 2.3 m below the existing ground surface. The fill material was observed to generally consist of brown silty sand with crushed stone and occasional brick, metal, and plastic fragments and underlain by a silty clay deposit and silty clay layer. In addition, the silty clay deposit generally consisted of brown silty clay, with the glacial till deposit underlain the silty clay deposit consisting of a grey sandy silt, clayey silt or silty clay with gravel, cobbles, and boulders.

From available geological mapping, the bedrock consists of interbedded limestone and shale of the Verulam formation and shale of the Billings formation at depths ranging from 10 m to 15 m. Groundwater levels were measured from monitoring wells at all three boreholes in the August 2020 investigation and are expected to be 4 metres to 5 metres below the existing ground surface within the silty clay layer, though as groundwater levels are subject to seasonal fluctuations, they could vary at the time of construction.

Based on Paterson's recommendations, the site is suitable for the proposed development. It is recommended that the foundation support for the proposed mixed-use high-rise buildings consist of either a raft foundation bearing on the stiff silty clay and compact glacial till deposit, or a deep foundation extending to the bedrock surface. Due to the presence of the silty clay deposit, grading is subject to a permissible grade raise restriction of 2.0 m.

The recommended rigid pavement structure is further presented in **Table 10.1** below.

Table 10.1: Recommended Pavement Structure

Material	Car-only Parking Areas	Access Lanes, Ramp and Heavy Truck Parking Areas
Wear Course – HL-3 or Superpave 12.5 Asphaltic Concrete	50 mm	40 mm
Binder Course – HL-8 or Superpave 19.0 Asphaltic Concrete	-	50 mm
BASE – OPSS Granular A Crushed Stone	150 mm	
SUBBASE – OPSS Granular B Type II	300 mm	450 mm

11 Conclusions

11.1 Water Servicing

Based on the supplied boundary conditions for existing watermains and calculated domestic and fire flow demands for the subject site, the adjacent watermain on Arlington Avenue has sufficient capacity to sustain both the required domestic and emergency fire flow demands for the development. As the site is required to be serviced by two service laterals on opposite sides of the site, the existing 127 mm diameter watermain on Kent Street will need to be upsized to meet required fire flows. Booster pump(s) are required to provide adequate pressures to the towers' upper stories. One building water service will be connected to the existing 203 mm diameter watermain in Arlington Avenue and the other to the upsized watermain in Kent Street, where a new fire hydrant will be located adjacent to the Catherine Street intersection. Sizing of the water service and requirements for booster pump(s) are to be confirmed by the mechanical consultant.

11.2 Sanitary Servicing

The proposed sanitary sewer service will consist of two sanitary service laterals, a sanitary sump pit, monitoring ports, and sump pump(s) directing wastewater to the existing 1200 mm diameter combined sewer on Arlington Avenue. Existing connections are to be abandoned and full port backwater valves installed on the proposed sanitary service within the site to prevent any surcharge from the downstream sewer main from impacting the proposed property. A sump pump will be required for sewage discharge from the mechanical room. Sizing of the service lateral, sump pit, and sump pump are to be confirmed by the mechanical consultant.

11.3 Stormwater Servicing and Management

Cisterns in the underground parking has been proposed to limit the stormwater discharge rate for all rainfall events up to and including the 100-year event to a peak 2-year predevelopment release rate. The remaining site area drains uncontrolled to the adjacent surrounding ROWs as per existing conditions.

Two 300 mm diameter storm service laterals are proposed for the building's foundation drain and internal storm sewer system, which is to be mechanically pumped and include a full port backwater valve. The roof drains and ramp drain are to be connected through internal plumbing to the cistern, which will pump discharge at a controlled rate through the service lateral and the backwater valve to the 525 mm and 600 mm diameter municipal storm sewer in the Arlington Avenue ROW. Sizing of the service lateral, cistern, and foundation drain pump are to be confirmed by the mechanical consultant.

11.4 Grading

Site grading has been designed to provide an adequate emergency overland flow route. All four sides drain uncontrolled to the adjacent right-of-ways as per existing conditions.

11.5 Erosion and Sediment Control During Construction

Erosion and sediment control measures and best management practices outlined in this report and included in the drawing set, will be implemented during construction to reduce the impact on adjacent properties, the public ROW, and existing facilities.

11.6 Geotechnical Investigation

Based on the geotechnical investigation, the site is considered suitable for the proposed building, and it is recommended that the foundation support for the proposed mixed-use high-rise buildings consist of either a raft foundation bearing on the stiff silty clay and compact glacial till deposit, or a deep foundation extending to the bedrock surface. Due to the presence of the silty clay deposit, grading is subject to a permissible grade raise restriction of 2.0 m.

11.7 Utilities

The site is situated within an established neighbourhood, hence existing utility infrastructure is readily available to service the proposed development. Overhead wires along all boundaries of the site will need to be accommodated during construction. It is anticipated that existing infrastructure will be sufficient to provide a means of distribution for the proposed site. Exact size, location and routing of utilities will be finalized after design circulation.

11.8 Approvals

This site will not be subjected to the Ministry of the Environment, Conservation and Parks (MECP) Environmental Compliance Approval (ECA) process under O.Reg. 525/98. For the expected dewatering needs of 50,000 to 400,000 L/day, the proponent will need to register on the MECP's Environmental Activity and Sector Registry (EASR). A Permit to Take Water, for dewatering needs in excess of 400,000 L/day, is not anticipated for this site.