Servicing and Stormwater Management Report – 114 Richmond Road Phase 2A/2B

Project #160400864

May 4, 2023

Prepared for:

Ashcroft Homes

Prepared by:

Stantec Consulting Ltd.

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1.0 INTRODUCTION

Stantec Consulting Ltd. has been commissioned by Ashcroft Homes to prepare the following servicing study in support of a proposal to develop Phase 2 of the 114 Richmond Road property. The property is situated on the south side of Richmond Road at the southwest quadrant at the intersection of Richmond Road and Leighton Terrace, and terminating at Byron Avenue. The site is located in the City of Ottawa and is indicated in **Figure 1**. The 2.22 ha site was previously convent land. The existing convent building and much of the land has been deemed a heritage site and is to be preserved. The site development plan used for the purpose of this servicing brief consists of three (3) development phases as indicated on **Drawing SP-1**. Phase 1 of the site plan has been previously approved and constructed, and consists of three 9-storey condominium towers and renovation of the existing convent building into a primarily commercial facility. The current site plan for Phase 2A consists of one multi-storey residential building (Building B). The future Phase 2B includes two additional multi-storey residential buildings C and D. The servicing study herein considers ultimate buildout of the development.

Figure 1-1: Overall Development Location Plan

2.0 BACKGROUND

Documents referenced in preparation of the design for the 114 Richmond Road (Phase 2A/2B) Development include:

- Geotechnical Investigation – Proposed Residential Development Phases 2– 114 Richmond Road, Patersongroup Consulting Engineers, March 20, 2019.
- City of Ottawa Sewer Design Guidelines, City of Ottawa, October 2012.
- City of Ottawa Design Guidelines – Water Distribution, City of Ottawa, July 2010.
- Assessment of Adequacy of Public Services Report – Proposed Development at 114 Richmond Road, Trow Associates Inc., March 12, 2010.
- 114 Richmond Road – Potable Water Servicing Analysis, Stantec Consulting Ltd., August 2011.
- Serviceability Report – Ashcroft Homes – 114 Richmond Road, Stantec Consulting Ltd., June 26, 2013.

3.0 WATER SERVICING

3.1 BACKGROUND

The site is located within Pressure Zone 1W of the City of Ottawa's Water Distribution System. The proposed development is expected to be serviced from the existing 305 mm diameter PVC and UCI watermain within Byron Avenue. There are existing fire hydrants on Byron Avenue.

3.2 WATER DEMANDS

3.2.1 Potable (Domestic) Water Demands

For each phase of development, water demands were estimated based on the unit mix of the site plan provided by M. David Blakely Architects. Building B is a 9-storey residential mid-rise building with 93 one-bedroom units and 94 two-bedroom units. Building C is a 4-storey residential mid-rise building with a single studio unit, 24 one-bedroom units, 36 two-bedroom units, and a single three-bedroom unit. Building D is a 9-storey residential mid-rise building with 16 studio units, 29 one-bedroom units, 97 two-bedroom units, and 58 rooming units.

The City of Ottawa Water Distribution Guidelines (July 2010), ISTB 2021-03 Technical Bulletin, and Ministry of Environment's Design Guidelines for Drinking Water Systems (2008) were used to determine water demands based on projected population densities for residential areas and peaking factors. The population was estimated using an occupancy of 1.4 persons per unit for studio, rooming, and one-bedroom apartments, 2.1 persons per unit for two-bedroom apartments, and 3.1 persons per unit for three-bedroom apartments.

A daily rate of 280 L/cap/day has been used to estimate average daily (AVDY) potable water demand for the residential units. Maximum day (MXDY) demands were determined by multiplying the AVDY demands by a factor of 2.5 for residential areas, while peak hourly (PKHR) demands were determined by multiplying the MXDY by a factor of 2.2 for residential areas as per ISD-2010-02 Technical Bulletin. The estimated demands for each residential plot are summarized in **Table 3-1** below and detailed in **Appendix A.1**.

Table 3-1: Estimated Water Demands

Block/Building	Total Apartment Units	Population	AVDY (L/s)	MXDY (L/s)	PKHR (L/s)
B	187	327	1.06	2.65	5.84
C	62	114	0.37	0.92	2.03
D	200	325	0.46	2.68	5.78
Total	**449**	**766**	**2.48**	**6.21**	**13.65**

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. The construction of Buildings B and D were assumed to correspond to Section 3.2.2.42 of the Ontario Building Code (OBC), which denotes a non-combustible construction.

As such, required fire flows for on-site buildings were estimated based on buildings of non-combustible construction type with two-hour fire rated structural members, and considering all vertical openings as fully protected per FUS guidelines. 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).

Building C is assumed to correspond to Section 3.2.2.43A of the OBC, which considers structural elements with a minimum 1-hour fire resistance rating. Required fire flows were estimated based on a building of Type IV-B mass timber construction without protected vertical openings. Thus, the sum of the two largest floor areas + 50 % of the gross floor area of up to eight additional floors were used in the FUS calculation.

All three buildings are equipped with a fully supervised sprinkler system to conform to the NFPA 13 standard. The worst-case required fire flows were determined to be for Buildings C and D corresponding to 100 L/s (6,000 L/min). Detailed fire flow calculations per the FUS methodology are included in **Appendix A.2**.

3.2.3 Boundary Conditions

The estimated domestic potable water and fire flow demands were supplied as part of a boundary conditions request to City of Ottawa staff. A conservative fire flow requirement of 166.7 L/s was also submitted to ensure any minor potential changes in building layout would not require further boundary condition requests and can be used as a conservative development scenario. **Table 3-2** outlines the boundary conditions provided by the City of Ottawa on March 27, 2023 (See **Appendix A.3** for correspondence).

Table 3-2: Boundary Conditions

Connection	Byron Avenue
Min. HGL (m)	108.4
Max. HGL (m)	114.8
Max Day + Fire Flow (100.0 L/s) (m)	109.3
Max Day + Fire Flow (166.7 L/s) (m)	107.7

3.3 PROPOSED WATERMAIN SERVICING AND LAYOUT

The proposed development will consist of three residential apartment buildings and an underground parking garage. The site will be serviced by 250mm diameter watermain, which is then downsized to 150mm at

Node 3 to suit a hydrant connection, fed by connections to the 305mm diameter watermain on Byron Avenue and separated by a valve (see **Drawing SSP-1** and **Figure 3-1**: Proposed Watermain Network).

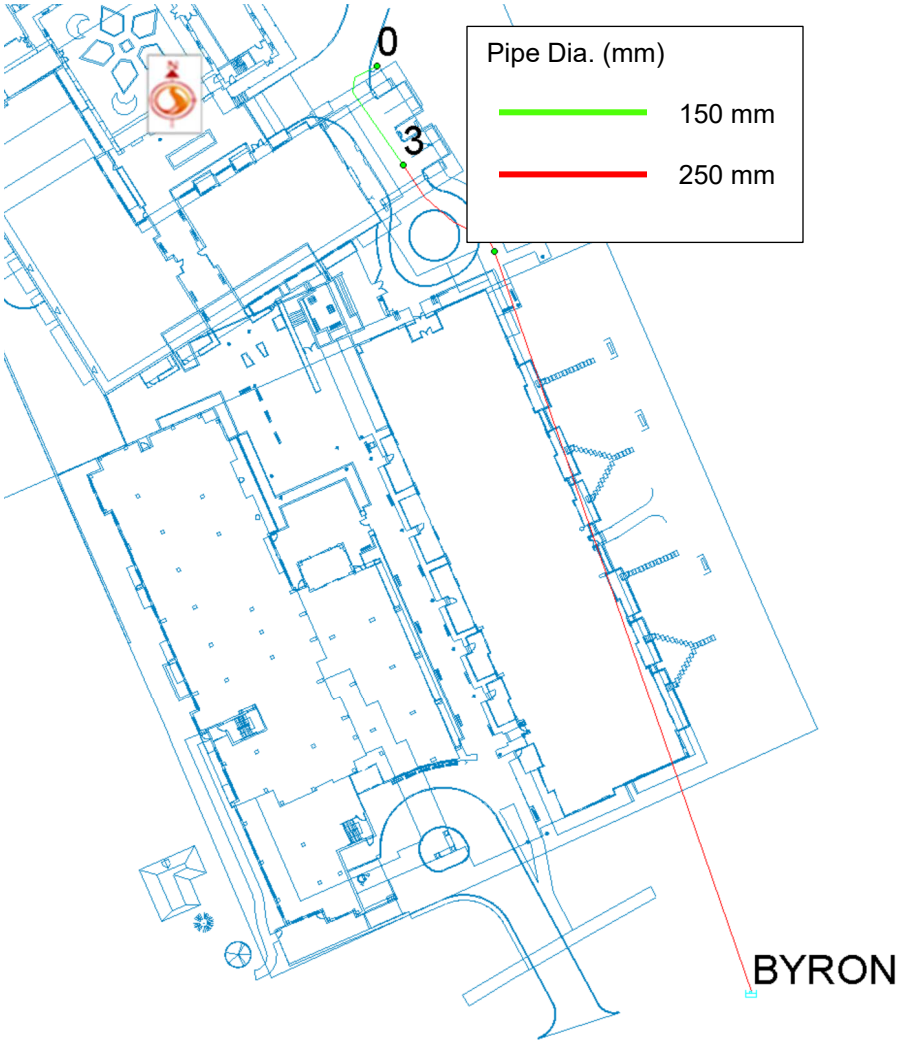

Figure 3-1: Proposed Watermain Network

Two new fire hydrants are proposed to service the site, one of which will be located at the end of the 150 mm watermain. Both fire hydrants are located within 45 m from the fire department connections servicing the building, as per Section 3.2.5.16 of the Ontario Building Code.

3.4 HYDRAULIC ASSESSMENT

3.4.1 Level of Service

Based on the *City of Ottawa Design Guidelines – Water Distribution*, the desired range of pressure under basic day, maximum day and peak hour demands is 345 kPa to 552 kPa (50 psi to 80 psi) and no less than 276 kPa (40 psi) at ground elevation. Furthermore, the maximum pressure at any point in the water distribution should not exceed 689 kPa (100 psi); pressure reducing measures are required to service areas where pressures greater than 552 kPa (80 psi) are anticipated.

3.4.2 Model Development

The proposed watermain within site were modeled in a H2OMAP hydraulic model to simulate the proposed water network. Hazen-Williams coefficients ("C-Factors") were applied to the new watermain in accordance with the City of Ottawa's Water Distribution Design Guidelines and as shown in **Table 3-3** below.

Table 3-3: Proposed Watermain C-Factors

Pipe Diameter (mm)	C-Factor
150	100
200 to 250	110
300 to 600	120
> 600	130

3.5 HYDRAULIC MODEL RESULTS

The H2OMAP hydraulic model was used to simulate the proposed water demand scenarios based on boundary conditions provided by the City of Ottawa. Specifically, the boundary conditions from the 305 mm diameter watermain along Byron Avenue were applied for all three scenarios. The model was tested under average day, peak hour, and maximum day plus fire flow conditions.

3.5.1 Average Day Demand (AVDY)

The hydraulic modeling results indicate that under the average day demands, the pressure in the proposed watermain is estimated at 456kPa (66.1 psi) at the proposed building. This pressure is within the serviceable limit of 276 kPa to 552 kPa (40 psi to 80 psi) as specified in the City of Ottawa Design Guidelines – Water Distribution. Results are shown in **Figure 3-2** below.

Figure 3-2: Pressures (psi) under AVDY Demands

3.5.2 Peak Hour Demand (PKHR)

The hydraulic modeling results indicate that under peak hour demands, the pressure in the proposed watermain ranges from 393 kPa to 392kPa (57.0 psi to 56.9 psi). These pressures are within the serviceable limit of 276 kPa to 552 kPa (40 psi to 80 psi) as specified in the City of Ottawa Design Guidelines – Water Distribution. Figure 3-3

Figure 3-3: Pressures (psi) under PKHR Demands

3.5.3 Maximum Day Demand + Fire Flow (MXDY + FF)

Hydraulic modelling was carried out to determine if the proposed watermain can provide the maximum day and fire flow demands to the proposed development while maintaining a residual pressure of 138 kPa (20 psi) per the City of Ottawa Design Guidelines – Water Distribution. The analysis was accomplished

using a steady-state maximum day demand scenario along with the automated fire flow simulation feature of H2O Map.

Figure 3-4 illustrates that the proposed watermain can deliver 166.7 L/s of fire flow and meet the critical demand scenario at the specified nodes while maintaining the required residual pressure of 138 kPa (20 psi).

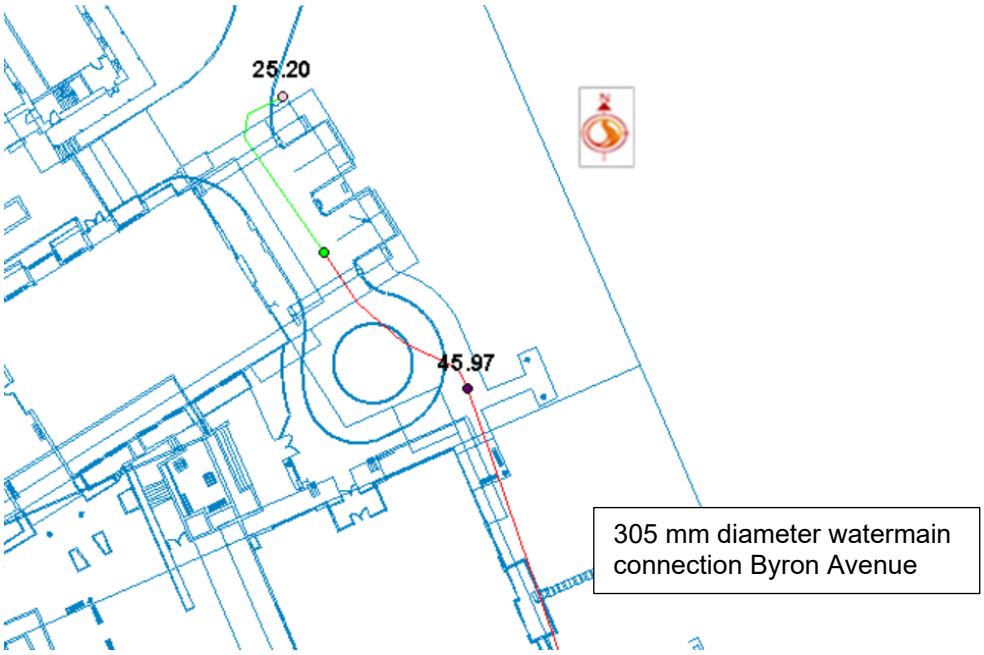

Figure 3-4: Residual pressure (psi) for MXDY+FF Demands

3.6 CONCLUSION

Based on the boundary conditions provided by the City of Ottawa and results of the hydraulic analysis, the proposed water servicing can provide sufficient flow and pressure to satisfy the needs of the development per the Fire Underwriters Survey calculation method while respecting City of Ottawa design guidelines. The proposed water servicing layout will meet the domestic demands of the site. A booster pump to be designed by the buildings' mechanical engineer, will be required to maintain acceptable pressures for the upper storeys of Buildings B and D.

4.0 WASTEWATER SERVICING

4.1 BACKGROUND

The proposed development includes Phases 2A and 2B of the multi-phased development as indicated in **Figure 1**. The site is located on the south side of Richmond Road and west of Leighton Terrace. Wastewater servicing for Phase 2A/2B of the development will be extended from the 375mm diameter sewer constructed as part of Phase 1 (**Drawing SSP-1**). The sanitary sewer within the development lands discharges to an existing 375mm diameter sanitary sewer running along Richmond Road, which outlets in turn to the 450mm diameter sewer running north on Patricia Avenue.

For detailed information regarding the wastewater servicing for the Phase 1 area, please refer to the *Serviceability Report – Ashcroft Homes – 114 Richmond Road* (Stantec, June 2013).

4.2 DESIGN CRITERIA

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

- 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 – 200mm dia. for residential areas, 250mm for commercial areas
- Average Wastewater Generation (Commercial) – 28,000L/ha/day
- Average Wastewater Generation (Residential) – 280L/cap/day
- Peak Factor (Commercial) – 1.5 (if Commercial over 25%+ contributing area, 1.0 otherwise)
- Peak Factor (Residential) – Per Harmon's w/ correction factor of 0.8
- Extraneous Flow Allowance – 0.33 l/s/ha (conservative value)
- Manhole Spacing – 120 m
- Minimum Cover – 2.5m

4.3 PROPOSED SERVICING

The proposed site will be serviced by gravity sewers which will direct the wastewater flows from the entire development site (approx. 15.3 L/s with allowance for infiltration) to the existing 375mm diameter sanitary sewer. As basement levels of the proposed underground parking structure lie below the connecting 375mm sewer, drains from these areas will be required to be pumped up to the existing gravity sewer stub. The proposed drainage pattern is detailed on **Drawing SA-1**. A sanitary sewer design sheet for the proposed service lateral is included in **Appendix B.1**. Full port backwater valves are to be installed on all sanitary

services within the site to prevent any potential surcharge from the downstream sanitary sewer from impacting the proposed property.

As outlined in the Serviceability Report for Phase 1 of the 114 Richmond Road site, an anticipated peak flow rate from the development was determined to be 21.5L/s, which was well within the available capacity within downstream sewers on Patricia Avenue. Based on revised sanitary sewer peak flow parameters per updates to the City's Sewer Design Guidelines, the estimated peak flow rate from the development is well within that of the approved serviceability study (see excerpts in **Appendix B.2**).

5.0 STORMWATER MANAGEMENT

5.1 OBJECTIVES

The objective of this stormwater management plan is to determine the measures necessary to control the quantity/quality of stormwater released from the proposed development to criteria established within the previously approved serviceability report for the site, and to provide sufficient detail for approval and construction.

5.2 SWM CRITERIA AND CONSTRAINTS

Criteria were established by combining current design practices outlined by the City of Ottawa Design Guidelines (2012), through the report titled Assessment of Adequacy of Public Services Report" by Trow Associates (March 2010), 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).
- Wherever feasible and practical, site-level measures should be used to reduce and control the volume and rate of runoff. (City of Ottawa)
- Assess impact of 100-year event outlined in the City of Ottawa Sewer Design Guidelines on major & minor drainage system (City of Ottawa)
- No quality control criteria have been previously identified for the subject site (Stantec, Trow)

Storm Sewer & Inlet Controls

- Size storm sewers to convey 5-year storm event under free-flow conditions using City of Ottawa I-D-F parameters (City of Ottawa).
- Site discharge rates for each storm event to be restricted to 5-year storm event pre-development rates with a maximum pre-development C coefficient of 0.45, and time of concentration of 23.8 minutes (**205L/s**) (Stantec, Trow).
- Proposed site to discharge the existing 300mm diameter storm sewer within the Daly Avenue ROW at the northern boundary of the subject site (City of Ottawa).
- 100-year Storm HGL to be a minimum of 0.30 m below building foundation footing (City of Ottawa).

Surface Storage & Overland Flow

- Building openings to be a minimum of 0.15m above the 100-year water level (City of Ottawa)
- Maximum depth of flow under either static or dynamic conditions shall be less than 0.35m (City of Ottawa)

- Balance of flows in excess of allowable release rate up to and including the 100-year storm event to be detained on-site. (Stantec, Trow)
- Provide adequate emergency overflow conveyance off-site for events beyond the 100-year storm (City of Ottawa)
- Where possible, major flow from the site is to be safely conveyed by surface routing towards Leighton Terrace and Richmond Road. (Stantec)

5.3 STORMWATER MANAGEMENT

The Modified Rational Method was employed to assess the rate and volume of runoff generated during post-development conditions. The site was subdivided into subcatchments (subareas) tributary to stormwater controls as defined by the location of inlet control devices. A summary of subareas and runoff coefficients is provided in **Appendix C.2** and **Drawing SD-1** indicates the stormwater management subcatchments. C coefficient values have been increased by 25% for the post-development 100-year storm event based on MTO Drainage Manual recommendations. Rational method storm sewer design sheets have been supplied as part of **Appendix C.1**.

5.3.1 Allowable Release Rate

Based on prior consultation with City of Ottawa staff during Phase 1 of the development, the peak post-development discharge from the subject site is to be limited to that of the 5-year event discharge under pre-development conditions, to a maximum discharge coefficient C of 0.45 at a time of concentration of 23.8 minutes (see report excerpts in **Appendix C.3**) Peak flow rates have been calculated using the rational method as follows:

Q = 2.78 CiA
Where: Q = peak flow rate, L/s
A = drainage area, ha
I = rainfall intensity, mm/hr (per Ottawa IDF curves)
C = site runoff coefficient

The target release rate for the site is summarized in **Table 4** below:

Table 4: Target Release Rates

Design Storm	Target Flow Rate (L/s)
All Events	205

5.3.2 Storage Requirements

The site requires quantity control measures to meet the restrictive stormwater release criteria. It is proposed that rooftop storage via restricted roof release in combination with the subsurface storage pipe constructed in Phase 1, as well as a proposed storage cistern to reduce site peak outflow to target rates.

5.3.2.1 Rooftop Storage

It is proposed to retain stormwater on the building rooftops by installing restricted flow roof drains. The following calculations assume the proposed roofs will be equipped with standard Watts Model R1100 Accuflow Roof Drains. Design for Roof A is as per the approved Phase 1 Stormwater Management Report for the development.

Watts Drainage “Accutrol” roof drain weir data has been used to calculate a practical roof release rate and detention storage volume for the rooftops. It should be noted that the “Accutrol” weir has been used as an example only, and that other products may be specified for use, provided that the total roof drain release rate is restricted to match the maximum rate of release indicated in Table 2, and that sufficient roof storage is provided to meet (or exceed) the resulting volume of detained stormwater. Proposed drain release rates have been calculated based on the Accutrol weir setting defined in the table below. Storage volume and controlled release rate are summarized in **Table 5**:

Table 5: Roof Control Areas

Design Storm	Roof Area ID	Depth (mm)	Accutrol Setting (%)	Discharge (L/s)	Volume Stored (m^3)
5-Year	ROOF A (Existing)	27	N/A	9.2	44.2
	ROOF B1	111	25% Open	2.5	9.9
	ROOF B2	113	50% Open	2.1	9.9
	ROOF C	112	50% Open	7.1	30.4
	ROOF D1	112	50% Open	5.1	22.6
	ROOF D3	108	25% Open	1.6	5.1
	ROOF D5	111	25% Open	1.6	6.3
100-Year	ROOF A (Existing)	51	N/A	17.4	83.6
	ROOF B1	148	25% Open	2.8	23.0
	ROOF B2	150	50% Open	2.5	22.3
	ROOF C	148	50% Open	8.7	68.7
	ROOF D1	149	50% Open	6.3	51.1
	ROOF D3	145	25% Open	1.9	12.1
	ROOF D5	148	25% Open	1.9	15.2

5.3.2.2 Uncontrolled Catchments

Due to grading constraints, some subcatchments were designed without a storage component. These areas flow offsite uncontrolled to Richmond Road and Byron Avenue, and are not tributary to the on-site storm sewer outlet. Areas that discharge offsite without entering the proposed stormwater management system must be compensated for in areas with controls, as drainage will re-enter storm sewers tributary

to Richmond Road further downstream of the site. **Table 6** summarizes the peak uncontrolled 5 and 100-year catchment release rates for areas that are non-tributary to the outlet sewer:

Table 6: Peak Uncontrolled (Non-Tributary) Release Rate

Design Storm	Area ID	Area (ha)	C	Tc (min)	Intensity (mm/hr)	Qrelease (L/s)
5-Year	UNC1	0.09	0.80	10	104.19	20.9
5-Year	UNC2	0.06	0.64	10	104.19	11.1
100-Year	UNC1	0.09	1.00	10	178.56	44.7
100-Year	UNC2	0.06	0.80	10	178.56	23.8

5.3.2.3 Surface Storage

Surface drainage directed to proposed CB 500 is proposed to be restricted prior to further control by the downstream 3000mm x 1500mm superpipe within the previously constructed Phase 1 of the development. Additional control is necessary to ensure peak inflow rates do not cause surcharge of the downstream system. Flow control will be provided by a proposed IPEX Tempest 95mm ICD (slide type) to be installed at the outlet invert of the catch basin. Storage volumes and controlled release rates for the catch basin are summarized below.

Design Storm	Area IDs	Tributary Area (ha)	Design Head (m)	Elevation (m)	Discharge (L/s)	$V_{required}$ (m^3)	$V_{available}$ (m^3)
5-Year	A4	0.062	0.73	67.32	15.3	0.0	0.5
100-Year	A4	0.062	1.19	68.17	19.6	6.7	7.0

5.3.2.4 Subsurface Storage

Per the modified rational method calculations included as part of **Appendix C.2**, the remainder of the site is to be directed towards either the existing 3000mm x 1500mm storage pipe, or a proposed subsurface cistern sized to meet the target peak discharge rate for the during the 100-year event.

Storage volumes for the existing storage pipe and associated structures were previously determined within the approved development Phase 1 stormwater management report. A change in diameter to the ICD downstream of the superpipe is required to suit the current development plan catchment area and imperviousness.

It is anticipated that the subsurface cistern will be located below the outlet sewer invert elevation and will be required to be pumped to the gravity sewer outlet at the discharge rate specified. Storage volumes and controlled release rates for the two systems are summarized below:

Table 7: Controlled Tributary Area (3000mm x 1500mm Superpipe)

Design Storm	Area IDs	Tributary Area (ha)	Design Head (m)	Elevation (m)	Discharge (L/s)	$V_{required}$ (m^3)	$V_{available}$ (m^3)
5-Year	A1, A3, A4, EXT2	1.003	0.65	65.96	31.2	122.4	292.2
100-Year	A1, A3, A4, EXT2	1.003	1.67	66.98	50.0	288.3	292.2

Table 8: Controlled Tributary Area (Cistern)

Design Storm	Area IDs	Tributary Area (ha)	Design Head (m)	Discharge (L/s)	$V_{required}$ (m^3)	$V_{available}$ (m^3)
5-Year	COURT, A2, B3-B6, D2, D4, EXT1	0.651	-	45.0	54.3	190.0
100-Year	COURT, A2, B3-B6, D2, D4, EXT1	0.651	-	45.0	184.6	190.0

5.3.3 Results

Table 9 demonstrates the proposed stormwater management plan and demonstrates adherence to target peak outflow rates for the site.

Table 9: Summary of Total 5 and 100-Year Event Release Rates

	5-Year Peak Discharge (L/s)	100-Year Peak Discharge (L/s)
Uncontrolled	32	69
Controlled - Roof	29	42
Controlled – Surface / Subsurface	121	94
Total	**182**	**205**
Target	**205**	**205**

6.0 GRADING AND DRAINAGE

The proposed development including Phase 1 measures approximately 2.23ha in area. The topography across the site is a gradual slope draining from south to north with a difference in elevation of approximately 3m. A detailed grading plan (see **Drawing GP-1**) has been provided to satisfy the stormwater management requirements, adhere to any permissible grade raise restrictions (see **Section 10.0**) 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 in accordance with City of Ottawa requirements.

The subject site maintains emergency overland flow routes for flows deriving from storm events in excess of the maximum design event to the proposed municipal rights-of-way at the southern and northern boundaries of the development, and ultimately to Richmond Road and Byron Avenue as depicted in **Drawing GP-1.** Existing rear yards along the western and eastern boundary of the site that previously drained onto the subject site area will be maintained.

7.0 UTILITIES

As the subject site is bound to the east and west by an existing residential area / commercial main street, and by municipal right-of-ways to the north, south, and east, Hydro, Bell, Gas and Cable servicing for the proposed development should be readily available. Pole mounted Hydro infrastructure may exist along the western property line, and will be relocated prior to development. 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.

8.0 APPROVALS

Environmental Compliance Approvals (ECAs, formerly Certificates of Approval (CofA)) under the Ontario Water Resources Act are not expected to be a requirement for Phases 2A/2B of the development as approval was previously obtained for storm and sanitary sewers connecting to Richmond Road / Leighton Terrace as part of Phase 1. The Phase 2A/2B property is of non-industrial use, and discharges to approved sewer stubs constructed as part of Phase 1 designed to accommodate the current phase. Conservation Authority clearance will be required along with site plan approval for the development.

9.0 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 existing and 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.

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

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

Refer to **Drawing ECDS-1** for the proposed location of silt fences, straw bales and other erosion control structures.

10.0 GEOTECHNICAL INVESTIGATION AND ENVIRONMENTAL ASSESSMENT

A geotechnical Investigation Report was prepared by Patersongroup dated March, 2019. The report summarizes the existing soil conditions within the entirety of the development and construction recommendations. For details which are not summarized below, please see the original Paterson report.

Subsurface soil conditions within the subject area were determined from 5 boreholes distributed across the development. In general, soil stratigraphy consisted of topsoil underlain by glacial till, followed by limestone bedrock. Bedrock/inferred bedrock elevations range from depths of 8.7 to 10.7m below ground surface. Groundwater Levels were measured in July 2010, and vary in elevation from 1.02m to 2.22m below ground surface.

No grade raise limitations were identified for the subject site.

The required pavement structure for proposed hard surfaced areas are outlined in **Table 7 and 8** below:

Table 10: 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 – Either fill, in situ soil, or OPSS Granular B Type I or II material placed over in situ soil or bedrock.

Table 11: 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 – Either fill, in situ soil or OPSS Granular B Type I or II material placed over in situ soil or bedrock.

11.0 CONCLUSIONS

11.1 WATER SERVICING

Based on the supplied boundary conditions for existing watermains and hydraulic analysis from the estimated domestic and fire flow demands for the subject site, the proposed servicing in this development can provide sufficient capacity to sustain the required domestic demands and emergency fire flow demands of the proposed site per the Fire Underwriters Survey calculation method while respecting City of Ottawa design guidelines. A booster pump to be designed by the buildings' mechanical engineer, will be required to maintain acceptable pressures for the upper storeys of Buildings B and D.

11.2 SANITARY SERVICING

The proposed sanitary sewer network is sufficiently sized to provide gravity drainage of the site. The proposed development will be serviced by a network of gravity sewers which will direct wastewater flows to the existing 375mm dia. sanitary sewer stub constructed as part of Phase 1. The proposed drainage outlet to the north has sufficient capacity to receive sanitary discharge from the site based on the findings of the Serviceability Report for Phase 1 of the development.

11.3 STORMWATER SERVICING

The proposed stormwater management plan is in compliance with the goals specified previously through consultation with the City of Ottawa for Phase 1 of the development. An on-site subsurface storage cistern, superpipe, and associated ICDs have been proposed to limit peak storm sewer inflows to downstream storm sewers to 205L/s as determined by background reports. The downstream receiving sewer has sufficient capacity to receive runoff volumes from the site based on the findings of the Serviceability Report for Phase 1 of the development.

11.4 GRADING

Grading for the site has been designed to provide an emergency overland flow route as per City requirements and reflects the recommendations made in the Geotechnical Investigation Report prepared by Patersongroup. Erosion and sediment control measures will be implemented during construction to reduce the impact on existing facilities.

11.5 UTILITIES

Utility infrastructure exists within the Richmond Road and Byron Avenue ROWs at the northern and southern boundaries of the proposed site. It is anticipated that existing infrastructure will be sufficient to provide a means of distribution for the entirety of the development. Exact size, location and routing of utilities will be finalized after design circulation.

11.6 APPROVALS/PERMITS

An MECP Environmental Compliance Approval is not expected to be required as approval was obtained for the receiving storm and sanitary sewers as part of Phase 1. Conservation Authority clearance will be required along with site plan approval for the development. No other approval requirements from other regulatory agencies are anticipated.

APPENDICES

Appendix A WATER SERVICING

A.1 DOMESTIC WATER DEMANDS

Q West Phases 2A/2B - Domestic Water Demand Estimates

Based on conceptual development plans from M.David Blakely (2023/03/09)

Ottawa Design Guidelines - Water Distribution

Table 4.1 Per Unit Populations		
Studio	1.4	ppu
1 Bedroom	1.4	ppu
2 Bedroom	2.1	ppu
3 Bedroom	3.1	ppu

Development Block/Area ID	Commercial Area (m^2)	Number of Residential Units	Population	Daily Demand Rate (L/cap/day or L/ha/d)	Avg. Day Demand [1,2]		Max. Day Demand [1, 2]		Peak Hour Demand [1, 2]	
					(L/min)	(L/s)	(L/min)	(L/s)	(L/min)	(L/s)
Building B (9 Storeys)										
Studio	-	0	0	280	0.0	0.00	0.0	0.00	0.0	0.00
1 Bedroom	-	93	130	280	25.3	0.42	63.3	1.05	139.2	2.32
2 Bedroom	-	94	197	280	38.4	0.64	96.0	1.60	211.1	3.52
3 Bedroom	-	0	0	280	0.0	0.00	0.0	0.00	0.0	0.00
Building C (4 Storeys)										
Studio	-	1	1	280	0.3	0.00	0.7	0.01	1.5	0.02
1 Bedroom	-	24	34	280	6.5	0.11	16.3	0.27	35.9	0.60
2 Bedroom	-	36	76	280	14.7	0.25	36.8	0.61	80.9	1.35
3 Bedroom	-	1	3	280	0.6	0.01	1.5	0.03	3.3	0.06
Building D (9 Storeys)										
Studio	-	16	22	280	4.4	0.07	10.9	0.18	24.0	0.40
1 Bedroom	-	29	41	280	7.9	0.13	19.7	0.33	43.4	0.72
2 Bedroom	-	97	204	280	39.6	0.7	99.0	1.7	217.8	3.63
Rooming Unit	-	58	58	280	11.3	0.19	28.2	0.47	62.0	1.03
Total Site :	**0**	**449**	**766**	**-**	**148.9**	**2.48**	**372.4**	**6.21**	**819.2**	**13.65**

1 Water demand criteria used to estimate peak demand rates for residential areas are as follows:
maximum daily demand rate = 2.5 x average day demand rate
peak hour demand rate = 2.2 x maximum day demand rate

2 Water demand criteria used to estimate peak demand rates for commercial areas are as follows:
maximum daily demand rate = 1.5 x average day demand rate
peak hour demand rate = 1.8 x maximum day demand rate

3 Population density for all residential units based on an population densities provided in *Table 4.1 - Per Unit Populations* of the City of Ottawa Water Distribution Design Guidelines (July 2010).

A.2 FIRE FLOW DEMANDS (FUS 2020)

FUS Fire Flow Calculation Sheet - 2020 FUS Guidelines

Stantec Project #: 160400864
Project Name: Qwest Phase 2A/2B
Date: 3/9/2023
Fire Flow Calculation #: 1
Description: High Rise Residential

Notes: Assumed to correspond to OBC 3.2.2.42 - non-combustible construction

Step	Task	Notes										Value Used	Req'd Fire Flow (L/min)
1	Determine Type of Construction	Type II - Noncombustible Construction / Type IV-A - Mass Timber Construction										0.8	-
2	Determine Effective Floor Area	Sum of Largest Floor + 25% of Two Additional Floors					Vertical Openings Protected?					YES	-
		1495	1782	1782	1782	1680	1680	1205	1205	1156		2673	-
3	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min										-	9000
4	Determine Occupancy Charge	Limited Combustible										-15%	7650
5	Determine Sprinkler Reduction	Conforms to NFPA 13										-30%	-3825
		Standard Water Supply										-10%	
		Fully Supervised										-10%	
		% Coverage of Sprinkler System										100%	
6	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	Firewall / Sprinklered ?				-	-
		North	10.1 to 20	23	3	61-80	Type V	NO				13%	995
		East	> 30	21	2	41-60	Type V	NO				0%	
		South	3.1 to 10	22.5	9	> 100	Type III-IV - Unprotected Openings	YES				0%	
		West	10.1 to 20	42	2	81-100	Type III-IV - Unprotected Openings	YES				0%	
7	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min											5000
		Total Required Fire Flow in L/s											83.3
		Required Duration of Fire Flow (hrs)											1.75
		Required Volume of Fire Flow (m^3)											525

FUS Fire Flow Calculation Sheet - 2020 FUS Guidelines

Stantec Project #: 160400864
Project Name: Qwest Phase 2A/2B
Date: 3/9/2023
Fire Flow Calculation #: 2
Description: 4-Storey Residential, Group C

Notes: Assumed to correspond to OBC 3.2.2.43A - considers structural elements with minimum 1hr fire resistance rating.

Step	Task	Notes										Value Used	Req'd Fire Flow (L/min)
1	Determine Type of Construction	Type IV-B Mass Timber Construction										0.9	-
2	Determine Effective Floor Area	Sum of Two Largest Floors + 50% of Eight Additional Floors					Vertical Openings Protected?					NO	-
		1810	1810	1810	1810							5430	-
3	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min										-	15000
4	Determine Occupancy Charge	Limited Combustible										-15%	12750
5	Determine Sprinkler Reduction	Conforms to NFPA 13										-30%	-6375
		Standard Water Supply										-10%	
		Fully Supervised										-10%	
		% Coverage of Sprinkler System										100%	
6	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	Firewall / Sprinklered ?				-	-
		North	10.1 to 20	22.6	4	81-100	Type I-II - Protected Openings	YES				0%	0
		East	> 30	81	2	> 100	Type V	NO				0%	
		South	> 30	22.6	2	41-60	Type V	NO				0%	
		West	10.1 to 20	81	4	> 100	Type I-II - Protected Openings	YES				0%	
7	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

FUS Fire Flow Calculation Sheet - 2020 FUS Guidelines

Stantec Project #: 160400864
Project Name: Qwest Phase 2A/2B
Date: 3/9/2023
Fire Flow Calculation #: 3
Description: High Rise Residential - Retirement Home

Notes: Assumed to correspond to OBC 3.2.2.48A - non-combustible construction

Step	Task	Notes										Value Used	Req'd Fire Flow (L/min)
1	Determine Type of Construction	Type II - Noncombustible Construction / Type IV-A - Mass Timber Construction										0.8	-
2	Determine Effective Floor Area	Sum of Largest Floor + 25% of Two Additional Floors					Vertical Openings Protected?					YES	-
		2447	2015	2015	2015	1627	1627	1296	1296	1296		3454.5	-
3	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min										-	10000
4	Determine Occupancy Charge	Limited Combustible										-15%	8500
5	Determine Sprinkler Reduction	Conforms to NFPA 13										-30%	-4250
		Standard Water Supply										-10%	
		Fully Supervised										-10%	
		% Coverage of Sprinkler System										100%	
6	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	Firewall / Sprinklered ?				-	-
		North	3.1 to 10	21	9	> 100	Type I-II - Protected Openings	YES				0%	1275
		East	10.1 to 20	81	12	> 100	Type III-IV - Unprotected Openings	YES				0%	
		South	> 30	37	2	61-80	Type V	NO				0%	
		West	3.1 to 10	10	2	0-20	Type V	NO				15%	
7	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

A.3 BOUNDARY CONDITIONS

Wu, Michael

From: Jhamb, Nishant <nishant.jhamb@ottawa.ca>
Sent: Monday, 27 March, 2023 13:47
To: Kilborn, Kris
Cc: Mottalib, Abdul; Shahzadeh, Serene; Thiffault, Dustin; Sharp, Mike; Wessel, Shawn; Gorni, Colette
Subject: RE: QWest - Revised Boundary Condition Request (D07-12-18-0080)
Attachments: Q West 2A-2B (114 Richmond Road) March 2023.pdf

Hello Kris,

From the point load perspective there is enough pressure in the 300mm UCI watermain to deliver the required 167L/s. Please note a Multi Hydrant analysis is required to ensure there are enough public hydrants within 150m of the building entrance (along the travel path) to meet this requirement. Please provide a sketch showing the public hydrants within 150m of proposed Building entrances for the multi hydrant analysis

Also Ensure that proposed **Siamese connections** are within 45 meters of a Fire Hydrant.

Please feel free to reach out if you wish to discuss further.

The following are boundary conditions, HGL, for hydraulic analysis at Q West Phases 2A/2B (zone 1W) assumed to be a dual connection to the 305 mm on Byron Avenue (see attached PDF for location).

Minimum HGL: 108.4 m

Maximum HGL: 114.8 m

Max Day + Fire Flow (100 L/s:) 109.3 m

Max Day + Fire Flow (167 L/s:) 107.7 m (Multi Hydrant analysis required)

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.

Thanks
Nishant Jhamb, P.Eng
Project Manager |Gestionnaire de projet
Planning, Real Estate and Economic Development Department

Development Review - Central Branch
City of Ottawa | Ville d'Ottawa
110 Laurier Avenue West Ottawa, ON | 110, avenue. Laurier Ouest. Ottawa (Ontario) K1P 1J1
613.580.2424 ext./poste 23112, nishant.jhamb@ottawa.ca

From: Kilborn, Kris <kris.kilborn@stantec.com>
Sent: March 27, 2023 7:59 AM
To: Jhamb, Nishant <nishant.jhamb@ottawa.ca>
Cc: Mottalib, Abdul <Abdul.Mottalib@ottawa.ca>; Shahzadeh, Serene <Serene.Shahzadeh@stantec.com>; Thiffault, Dustin <dustin.thiffault@stantec.com>; Sharp, Mike <Mike.Sharp@stantec.com>; Wessel, Shawn <shawn.wessel@ottawa.ca>; Gorni, Colette <colette.gorni@ottawa.ca>
Subject: RE: QWest - Revised Boundary Condition Request (D07-12-18-0080)

Good morning Nishant

I am just following up on our request for boundary conditions for the Qwest property.
You had mentioned that if may take up to two weeks and we are at that now. Could you follow up
And advise.

Sincerely

Kris Kilborn
Principal, Community Development
Business Center Practice Leader

Mobile: 613 297-0571
Fax: 613 722-2799
kris.kilborn@stantec.com
Stantec
300 - 1331 Clyde Avenue
Ottawa ON K2C 3G4

OUT OF OFFICE ALERT. I WILL BE OUT OF THE OFFICE ON THURSDAY MARCH 30 AND FRIDAY MARCH 31 FOR A PROCEDURE AND RETURNING ON MONDAY APRIL 3.
The Ottawa office is open however many staff are working remotely. To contact me please use email, or my mobile and leave a message.
Please note our reception is on the 3rd floor.

From: Jhamb, Nishant <nishant.jhamb@ottawa.ca>
Sent: Friday, March 10, 2023 2:20 PM
To: Kilborn, Kris <kris.kilborn@stantec.com>
Cc: Mottalib, Abdul <Abdul.Mottalib@ottawa.ca>; Shahzadeh, Serene <Serene.Shahzadeh@stantec.com>; Thiffault, Dustin <Dustin.Thiffault@stantec.com>; Sharp, Mike <Mike.Sharp@stantec.com>; Wessel, Shawn

<shawn.wessel@ottawa.ca>; Gorni, Colette <colette.gorni@ottawa.ca>
Subject: RE: QWest - Revised Boundary Condition Request (D07-12-18-0080)

Good Afternoon Kris,

I have submitted the request to Water Department, please note it may take up to 2 weeks to receive boundary conditions.

Regards

Nishant Jhamb, P.Eng
Project Manager |Gestionnaire de projet
Planning, Real Estate and Economic Development Department
Development Review - Central Branch
City of Ottawa | Ville d'Ottawa
110 Laurier Avenue West Ottawa, ON | 110, avenue. Laurier Ouest. Ottawa (Ontario) K1P 1J1
613.580.2424 ext./poste 23112, nishant.jhamb@ottawa.ca

From: Gorni, Colette <colette.gorni@ottawa.ca>
Sent: March 10, 2023 9:17 AM
To: Kilborn, Kris <kris.kilborn@stantec.com>; Jhamb, Nishant <nishant.jhamb@ottawa.ca>
Cc: Mottalib, Abdul <Abdul.Mottalib@ottawa.ca>; Shahzadeh, Serene <Serene.Shahzadeh@stantec.com>; Thiffault, Dustin <dustin.thiffault@stantec.com>; Sharp, Mike <Mike.Sharp@stantec.com>; Wessel, Shawn <shawn.wessel@ottawa.ca>
Subject: RE: QWest - Revised Boundary Condition Request (D07-12-18-0080)

Hi Kris,

Hope all is well with you too. I am forwarding you along to Nishant Jhamb who will assist with this request.

Thanks,

Colette Gorni
Planner II | Urbaniste II
Development Review Central | Services d'examen demandes d'aménagements secteur centre
Planning, Real Estate and Economic Development Department
City of Ottawa | Ville d'Ottawa
613-580-2424, ext./poste 21239
Colette.Gorni@ottawa.ca

From: Kilborn, Kris <kris.kilborn@stantec.com>
Sent: March 09, 2023 3:19 PM
To: Gorni, Colette <colette.gorni@ottawa.ca>
Cc: Mottalib, Abdul <Abdul.Mottalib@ottawa.ca>; Shahzadeh, Serene <Serene.Shahzadeh@stantec.com>; Thiffault,

Dustin <dustin.thiffault@stantec.com>; Sharp, Mike <Mike.Sharp@stantec.com>
Subject: FW: QWest - Revised Boundary Condition Request (D07-12-18-0080)

Good afternoon Colette and hope all is well.

Stantec is working on the Qwest Site with Ashcroft Homes. As we are preparing for our resubmission to Phase 2 we were hoping that you could send this email and attachments
To the City Infrastructure Reviewer to forward along to the Water Department. I was not entirely sure if Abdul Mottalib was still on this file.

Below is our request for new boundary conditions and appreciate you forwarding along and copying me when you send it.

We are anticipating two separate water service connections for Phases 2A/2B of the Qwest development to the 300mm watermain within Byron Avenue east of the Kensington Avenue intersection and separated by a valve to be cut into the existing watermain per the attached sketch. Previous designs of Qwest had considered a second source of water supply for Phases 2A/2B from plumbing within Phase 1, which has been determined to be very difficult to achieve. As such, we are requesting a revised boundary condition to consider the entirety of Phases 2A/2B serviced from the Byron Avenue main. Plumbing within Phase 2A/2B buildings are to be looped internally to ensure system redundancy.

Demands for Phases 2A/2B are as follows:

Average Day:	2.5L/s
Max Day:	6.2L/s
Peak Hour:	13.7L/s
Required Fire Flow:	6,000L/min (100L/s)

We would also request a boundary condition in consideration of a conservative fire flow of 10,000L/min (167L/s) to ensure available fire flow should any building revisions occur up until site plan approval.

Sincerely

Kris Kilborn
Principal, Community Development
Business Center Practice Leader

Mobile: 613 297-0571
Fax: 613 722-2799
kris.kilborn@stantec.com
Stantec
300 - 1331 Clyde Avenue
Ottawa ON K2C 3G4

The Ottawa office is open however many staff are working remotely. To contact me please use email, or my mobile and leave a message.
Please note our reception is on the 3rd floor.

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Atención: Este correo electrónico proviene de fuera de Stantec. Por favor, tome precauciones adicionales.

A.4 POTABLE WATER SERVICING ANALYSIS RESULTS

Junction Results - Basic Day

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (psi)	Pressure (kPa)
0	0.00	68.26	114.80	66.16	456.16
3	0.00	68.26	114.80	66.16	456.16
7	2.48	68.30	114.80	66.10	455.74

Link Results - Basic Day

ID	FROM	TO	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)
11	7	BYRON	120.01	250	110	-2.48	0.05
13	7	3	20.29	250	110	0.00	0.00
15	3	0	20.09	155	100	0.00	0.00

Junction Results - Peak Hour

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (psi)	Pressure (kPa)
0	0.00	68.26	108.34	56.97	392.79
3	0.00	68.26	108.34	56.98	392.86
7	13.65	68.30	108.34	56.91	392.38

Link Results - Peak Hour

ID	FROM	TO	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)
11	7	BYRON	120.01	250	110	-13.65	0.28
13	7	3	20.29	250	110	0.00	0.00
15	3	0	20.09	155	100	0.00	0.00

Fire Flow Results - Max Day + 166.7 L/s

ID	Static Demand (L/s)	Static Pressure (kPa)	Static Pressure (psi)	Static Head (m)	Fire Flow Demand (L/s)	Residual Pressure (psi)	Available Flow (L/s)	Available Pressure (psi)
0	0.00	386.45	56.05	107.69	167.00	25.20	181.8	20
7	6.21	386.04	55.99	107.69	167.00	45.97	345.2	20

Appendix B: SANITARY SEWER

B.1 SANITARY SEWER DESIGN SHEET

Stantec

SUBDIVISION: **Q-WEST PHASE 2**

DATE: 5/4/2023
REVISION: 2
DESIGNED BY: DT
CHECKED BY: MJS

SANITARY SEWER DESIGN SHEET
(City of Ottawa)

FILE NUMBER: 160400864

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
1 BED	1.4	INSTITUTIONAL	28,000 l/ha/day	MINIMUM COVER	2.50 m
2 BED	2.1	INFILTRATION	0.33 l/s/Ha	HARMON CORRECTION FACTOR	0.8
3 BED	3.1				

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	APARTMENT UNITS 1 BED	2 BED	3 BED	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)
BLDG B	STUB 1	2	0.50	93	94	0	328	0.50	328	3.45	3.7	0.21	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.72	0.72	0.2	4.0	3.5	375	PVC	SDR 35	1.00	162.3	**2.47%**	1.54	0.53
BLDG C AND D	STUB 2	2	0.79	128	133	1	462	1.30	462	3.39	5.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.79	0.79	0.3	5.3	34.2	250	PVC	SDR 35	1.00	60.6	**8.80%**	1.22	0.62
	2	1	0.00	0	0	0	0	0.00	789	3.29	8.4	0.00	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	0.00	1.51	0.7	15.3	3.500	375	PVC	SDR 35	1.00	162.3	**9.41%**	1.539	0.803

B.2 BACKGROUND REPORT EXCERPTS (SANITARY SEWER)

3.0 Water Servicing

A Potable Water Servicing Study was prepared by Stantec Consulting on February 12, 2013 and revised on April 10, 2013 to reflect servicing changes. A 250mm watermain connection is proposed within Richmond Road to service phase 1 of the development. The remaining development area will be serviced with a 250mm watermain connection in Hilson Avenue and another 250mm connection in Byron Avenue. The report outlines estimated water demands and residual pressures under average day, maximum day and peak hour demand conditions. The report indicates that minimum pressures are maintained during all demand scenarios. Fire flow calculations as per the Fire Underwriters Survey (FUS) indicate a required fire flow of 250L/s. The hydraulic analysis indicated that the proposed water servicing could provide the required fire flow while meeting minimum pressure requirements of 20psi (140kPa). Due to additional losses in the high rise buildings, additional pumping will be required at these buildings to maintain minimum pressures to each unit.For the detailed report see **Appendix D**.

4.0 Wastewater Servicing

As illustrated on **Drawing SP-1**, a 250mm diameter sanitary sewer exists within Richmond Road which flows easterly towards the intersection of Richmond Road and Leighton Terrace. A 450mm diameter sanitary sewer exists at the intersection of Patricia Avenue and Richmond Road which runs northerly down Patricia Avenue. This existing sanitary sewer is a 450mm diameter pipe with a slope of minimum 1%. Based upon the size and slope of the existing pipe it is determined that this sewer has a flow capacity of 300 l/s. The existing sanitary service lateral from the existing building within the 114 Richmond Road property is currently serviced through this outlet at Patricia Avenue and will be removed.

It is proposed that the development will be constructed in 3 separate phases. The first Phase of the development will consist of construction of three - nine storey mixed use buildings and renovations to the existing 3 storey building. The second phase will consist of construction of 5 buildings consisting of residential and mixed use. The third phase will consist of 1 building with a mix of residential and commercial use. The entire site will be serviced through one connection onto Richmond Road. Residential unit counts and commercial areas were determined from the October 22, 2012 site plan and stats prepared by Roderick Lahey Architects in **Appendix A** of this report.

It is proposed to service the entire development through a new 375mm diameter sanitary sewer connection to Richmond Road. The servicing for the first phase will be connected within the building mechanical room via the 375mm diameter pipe, as illustrated in **Drawing SP-2**. The transition between PVC material and cast iron will occur within the building and will be designed

by the mechanical engineer. The cast iron sewer will continue southerly within the Phase 1 building servicing corridor and exit the foundation wall. This 375mm diameter sanitary sewer will be extended within a common trench, with the storm and utilities, along the westerly property edge to service the Phase 2 and 3 developments. The 375mm diameter sewer will be constructed between two existing manholes in Richmond Road, as indicated on Drawing SP-1. It is proposed to install a 1200mm diameter manhole within the Richmond road right of way which will connect to the existing 450mm diameter sanitary through the existing manhole located at the intersection of Patricia Avenue and Richmond Road. As there is insufficient room for the placement of a monitoring manhole for phase 1 commercial, a monitoring port will be placed within the outlet sewer pipe for the commercial areas.

A sanitary drainage area plan and sanitary sewer design sheets were prepared by Novatech Engineering Consultants on behalf of the City of Ottawa in May 2005, which identified the 114 Richmond road property tributary to the Patricia Avenue sanitary sewer. (See **Appendix C**.)

The calculations outlined below represent the flows anticipated for each phase of this development.

Phase 1

The City of Ottawa's Sewer Design Guidelines for commercial development indicate the allocation of capacity in the receiving sanitary sewer required.

Total Site Area = 0.829ha
Peaking Factor Commercial 1.5
Commercial Average Peak Flow = 50000 L/gross ha/d
Commercial Operational Flow = 17000 L/gross ha/d
Infiltration Rate = 0.28 L/s/ha
Total Infiltration Flow = (Area x infiltration rate) = 0.23 L/s
Total Flow = (Peak Flow x Site Area /86400) x Peak Factor + Infiltration Flow
Total Flow as per guidelines = 0.95 L/s.

By implementing the City of Ottawa's sewer design guidelines the following sanitary flows are calculated for the proposed condominium development.

Residential (Apartment)	Population	= 276 units x 1.8 persons/unit = 497 people
		= 497 x 350 L/c/d
		≈ 2.01 L/s average residential sanitary flow using a peaking factor of 4;
		≈ 8.05 L/s

Total peak sewage flow for commercial and residential Phase 1 ≈ 9.00 L/s

Phase 2

The City of Ottawa's Sewer Design Guidelines for commercial development indicate the allocation of capacity in the receiving sanitary sewer required.

Total Commercial Area = 0.49ha
Infiltration area = 0.45ha
Peaking Factor Commercial 1.5
Commercial Average Peak Flow = 50000 L/gross ha/d
Commercial Operational Flow = 17000 L/gross ha/d
Infiltration Rate = 0.28 L/s/ha
Total Infiltration Flow = (Area x infiltration rate) = 0.13 L/s
Total Flow = (Peak Flow x Site Area /86400) x Peak Factor + Infiltration Flow
Total Flow as per guidelines = 0.56 L/s.

By implementing the City of Ottawa's sewer design guidelines the following sanitary flows are calculated for the proposed condominium development.

Residential (Apartment)

1 Bedroom:

Population 282 units x 1.4 person/unit
= 394.8 persons
(394.8 persons x 350L/p/d)/86400s/day
= 1.60 L/s average residential sanitary flow
using a peaking factor of 4;
= 6.40 L/s

2 Bedroom:

Population 138 units x 2.1 person/unit
= 289.8
(193.2 persons x 350L/p/d)/86400s/day
= 1.17
using a peaking factor of 4;
= 4.70 L/s

Total peak sewage flow for commercial and residential Phase 2 ≈ **11.66L/s**

Phase 3

The City of Ottawa's Sewer Design Guidelines for commercial development indicate the allocation of capacity in the receiving sanitary sewer required.

Total Commercial Area = 0.26ha
Infiltration area = 0.26ha
Peaking Factor Commercial 1.5
Commercial Average Peak Flow = 50000 L/gross ha/d
Commercial Operational Flow = 17000 L/gross ha/d
Infiltration Rate = 0.28 L/s/ha
Total Infiltration Flow = (Area x infiltration rate) = 0.07 L/s
Total Flow = (Peak Flow x Site Area /86400) x Peak Factor + Infiltration Flow
Total Flow as per guidelines = 0.30 L/s.

By implementing the City of Ottawa's sewer design guidelines the following sanitary flows are calculated for the proposed condominium development.

Residential (Apartment)

1 Bedroom:

Population 24 units x 1.4 person/unit
= 33.6 persons
(33.6 persons x 350L/p/d)/86400s/day
= 0.14 L/s average residential sanitary flow
using a peaking factor of 4;
= 0.54 L/s

Total peak sewage flow for commercial and residential Phase 3 ≈ **0.84L/s**

Total anticipated peak flow from phase 1, 2 and 3 is approximately **21.5L/s**

A review of the downstream sanitary sewers was completed from the intersection of Patricia Avenue and Richmond Road to the connection to the West Nepean Collector located at the intersection of Island Park Drive and Scott Street (approx 320 metres).

Included in **Appendix C** is a sanitary sewer design sheet that was prepared for the City of Ottawa in 2005 during the reconstruction of Richmond Road. In the design sheet associated sanitary drainage area plan, the proposed site is denoted as area B3.

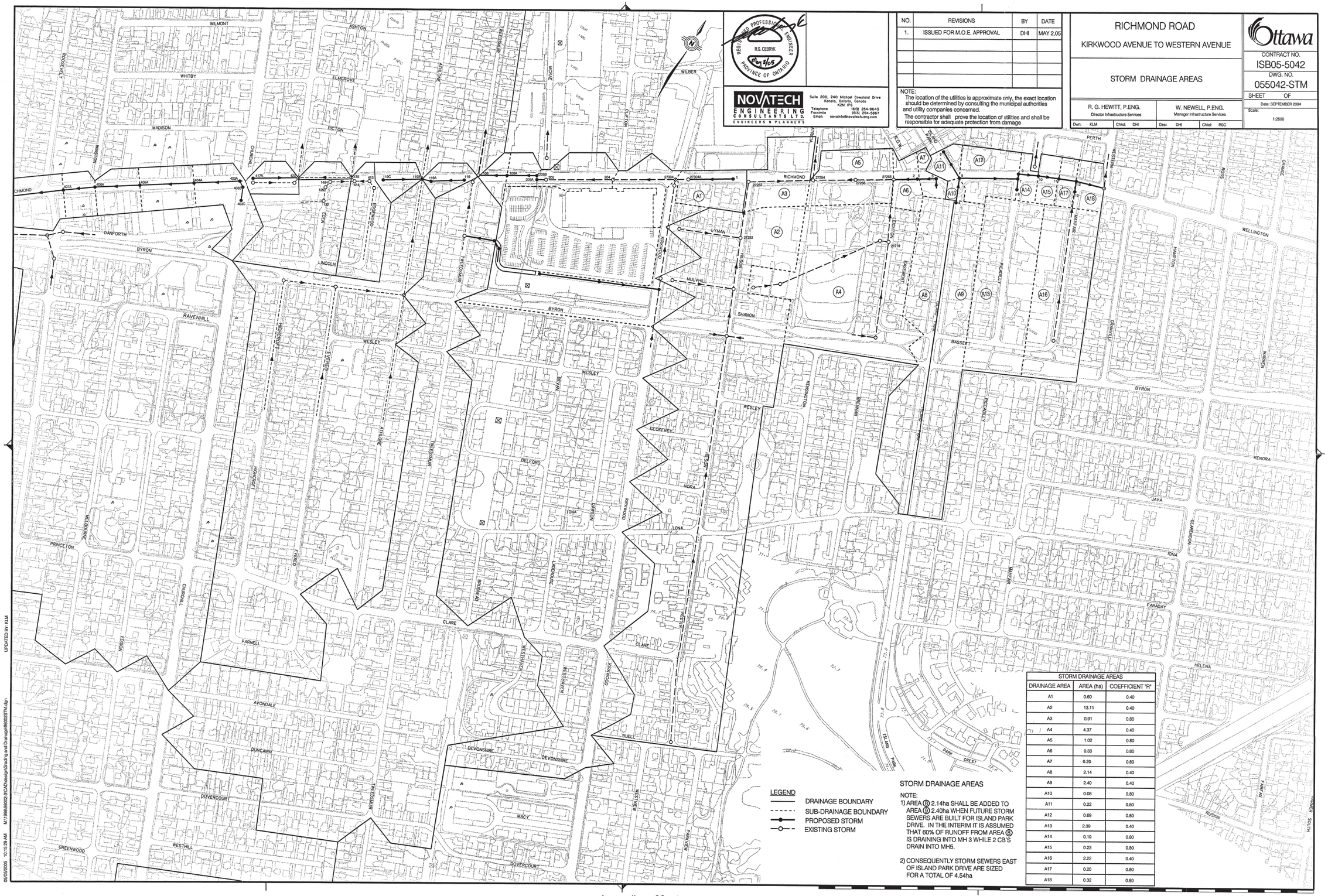
This information was expanded to include additional sanitary areas on Patricia Avenue to the collector sewer. The estimated sewage flows into the existing manhole at the intersection of

Patricia Avenue and Richmond Road are 73 L/sec (existing) + 23 L/sec (114 Richmond Rd). Additional commercial flows and residential flows of 17 L/sec are accumulated along Patricia Avenue.

An existing 450mm & 750mm sanitary sewer is present on Patricia Avenue, with a slope of between 1% and 2%. Based on this the minimum capacity for a 450mm sanitary sewer at 1.0% is 300 L/sec.

The total estimated sewage flows along Patricia Avenue including the new flows from the development of 114 Richmond Road are 111 L/sec. As the capacity of the existing 450mm sanitary sewer is approximately 300 L/sec the receiving sanitary sewer has adequate capacity to convey the necessary flow generated as a result to the proposed development.

Refer to **Appendix C** of this report for sanitary sewer design sheet and drainage areas indicating downstream flows within the 450mm diameter at Patricia Avenue indicating capacity within the receiving sewer for the 114 Richmond Road Development.



REGISTERED PROFESSIONAL ENGINEER
R.S. CEBRYK
PROVINCE OF ONTARIO

NOVATECH ENGINEERING CONSULTANTS LTD.
ENGINEERS & PLANNERS

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Kanata, Ontario, Canada
K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Email: novatech@novatech-eng.com

NO.	REVISIONS	BY	DATE
1.	ISSUED FOR M.O.E. APPROVAL	DHI	MAY 2,05

NOTE:
The location of the utilities is approximate only, the exact location should be determined by consulting the municipal authorities and utility companies concerned.
The contractor shall prove the location of utilities and shall be responsible for adequate protection from damage

RICHMOND ROAD

KIRKWOOD AVENUE TO WESTERN AVENUE

STORM DRAINAGE AREAS

Ottawa

CONTRACT NO.
ISB05-5042
DWG. NO.
055042-STM
SHEET OF
Date: SEPTEMBER 2004
Scale:
1:2500

R. G. HEWITT, P.ENG.
Director Infrastructure Services

W. NEWELL, P.ENG.
Manager Infrastructure Services

Dwn: KLM | Chkd: DHI | Des: DHI | Chkd: RSC

UPDATED BY: KLM
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LEGEND
- DRAINAGE BOUNDARY
- SUB-DRAINAGE BOUNDARY
- PROPOSED STORM
- EXISTING STORM

STORM DRAINAGE AREAS

NOTE:
1) AREA (A) 2.14ha SHALL BE ADDED TO AREA (A) 2.40ha WHEN FUTURE STORM SEWERS ARE BUILT FOR ISLAND PARK DRIVE. IN THE INTERIM IT IS ASSUMED THAT 60% OF RUNOFF FROM AREA (A) IS DRAINING INTO MH 3 WHILE 2 CB'S DRAIN INTO MH5.

2) CONSEQUENTLY STORM SEWERS EAST OF ISLAND PARK DRIVE ARE SIZED FOR A TOTAL OF 4.54ha

STORM DRAINAGE AREAS

DRAINAGE AREA	AREA (ha)	COEFFICIENT "R"
A1	0.60	0.40
A2	13.11	0.40
A3	0.91	0.80
A4	4.37	0.40
A5	1.02	0.80
A6	0.33	0.80
A7	0.20	0.80
A8	2.14	0.40
A9	2.40	0.40
A10	0.08	0.80
A11	0.22	0.80
A12	0.69	0.80
A13	2.39	0.40
A14	0.19	0.80
A15	0.23	0.80
A16	2.22	0.40
A17	0.20	0.80
A18	0.32	0.80

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STORM SEWER DESIGN SHEET

DESIGNED BY : DHI
CHECKED BY : RSC

PROJECT: Richmond Road
DEVELOPER: City of Ottawa

DATE: 2-May-05
REVISION:

LOCATION			AREA (ha)			INDIV	ACCUM	TIME OF	RAINFALL	PEAK FLOW	PROPOSED SEWER							
STREET	FROM M.H.	TO M.H.	R= 0.40	R = 0.60	R= 0.80	2.78 AR	2.78 AR	CONC (min)	INTENSITY (mm/hr)	Q (l/s)	TYPE OF PIPE	PIPE SIZE (mm)	PIPE ID (mm)	GRADE %	LENGTH (m)	CAPACITY (L/s)	FULL FLOW VELOCITY	TIME OF FLOW (min)
Richmond Road	1	27304 A	0.600			0.67	0.67	10.00	122.14	81.5	DR 35	300	299	1.47	71.5	116.6	1.66	0.72
Richmond Road (sized for current conditions)	3	2	1.280		0.200	1.87	1.87	10.00	122.14	228.3	CONC	525	533	0.30	27.5	245.2	1.10	0.42
Richmond Road	2	27255			0.330	0.73	2.60	10.42	119.61	311.2	CONC	525	533	0.50	32.7	316.6	1.42	0.38
Leighton Terrace	*27219*	*27255*	*4.370*			*4.86*	*4.86*	*16.50*	*79.00*	*383.9*	*CONC*	*525*	*533*	*1.62*	*75.0*	*569.9*	*2.55*	*0.49*
Richmond Road	*27255*	*27254*			*1.020*	*2.27*	*9.00*	*16.50*	*92.50*	*832.1*	*CONC*	*600*	*610*	*0.80*	*128.4*	*574.9*	*1.96*	*1.09*
Hilson Avenue	*27252*	*27253*	*13.110*			*14.58*	*14.58*	*25.00*	*60.90*	*887.8*	*CONC*	*1050*	*1067*	*0.57*	*85.0*	*2151.9*	*2.41*	*0.59*
Richmond Road	*27253*	*27254*			*0.910*	*2.02*	*16.60*	*25.00*	*71.22*	*1182.5*	*CONC*	*1050*	*1067*	*0.93*	*93.0*	*2748.7*	*3.07*	*0.50*
Patricia Avenue	*27254*	*EXIST*			*0.000*	*0.00*	*25.60*	*25.50*	*60.10*	*2192.5*	*CONC*	*900*	*914*	*1.24*	*110.0*	*2100.6*	*3.20*	*0.57*
Island Park Drive (Sized for future conditions)	4	5	4.540		0.080	5.23	5.23	24.00	73.15	382.3	CONC	525	533	0.90	35.0	424.8	1.90	0.31
Island Park Drive	6	5			0.220	0.49	0.49	10.00	122.14	59.8	DR 35	300	299	0.50	34.0	68.0	0.97	0.59
Richmond Road	5	7			0.690	1.53	7.25	24.31	72.55	526.0	CONC	675	685	0.45	94.0	586.4	1.59	0.98
Picadilly Avenue	8	7	2.390			2.66	2.66	16.50	79.00	210.0	DR 35	450	448	0.60	11.0	218.1	1.38	0.13
Richmond Road	7	9				0.00	9.91	25.29	70.68	700.3	CONC	750	762	0.60	5.0	899.6	1.97	0.04
	9	10			0.190	0.42	10.33	25.33	70.61	729.4	CONC	750	762	0.60	28.0	899.6	1.97	0.24
	10	11			0.230	0.51	10.84	25.57	70.17	760.8	CONC	750	762	0.60	34.0	899.6	1.97	0.29
	11	12			0.200	0.44	11.29	25.86	69.66	786.2	CONC	750	762	0.60	27.0	899.6	1.97	0.23
Mayfair Avenue	*EXIST*	13	*2.220*			*2.47*	*2.47*	*16.50*	*79.00*	*195.0*	*DR 35*	*450*	*448*	*1.60*	*53.0*	*356.1*	*2.26*	*0.39*
Mayfair Avenue	13	12				0.00	0.00	16.50	79.00	0.0	DR 35	450	448	1.60	10.0	356.1	2.26	0.07
Richmond Road	12	EXIST			0.32	0.71	12.00	26.09	69.25	830.9	CONC	900	914	0.60	40.0	1461.2	2.23	0.30
Western Avenue	*EXIST*	*EXIST*			*0.000*	*0.00*	*12.00*	26.38	*58.77*	*705.2*	*CONC*	*900*	*914*	*0.50*	*16.0*	*1333.9*	*2.03*	*0.13*

Q = 2.78*A*I*R
Intensity / Duration Curve = 10 years
Inlet Time = 10 min. (Minimum)
Manning's Coefficient = 0.013

Italic Text = Existing

Grey Tone = Under Sized Sewer

NOTE: 10 years storm is used for Richmond Road and 5 year storm for Local Streets

LICENSED PROFESSIONAL ENGINEER
R. S. CEBRYK
May 3/05
PROVINCE OF ONTARIO

Appendix C STORM SEWER

C.1 STORM SEWER DESIGN SHEET

Stantec

	Q-WEST PHASE 2
DATE:	2022-05-04
REVISION:	2
DESIGNED BY:	DT
CHECKED BY:	MJS

STORM SEWER DESIGN SHEET
(City of Ottawa)

FILE NUMBER: **160400864**

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
MINIMUM COVER: 2.00 m
TIME OF ENTRY 10 min
BEDDING CLASS = B

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 DIAMETEI (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)
A2, EXT1	501	BLDG	0.00	0.30	0.00	0.00	0.00	0.00	0.63	0.00	0.00	0.000	0.000	0.188	0.188	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	54.3	6.8	250	250	CIRCULAR	PVC	-	1.50	74.0	**73.36%**	1.49	1.43	0.08
																				10.08																		
A4	500	109	0.00	0.06	0.00	0.00	0.00	0.00	0.85	0.00	0.00	0.000	0.000	0.053	0.053	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	15.3	12.7	200	200	CIRCULAR	PVC	-	1.00	33.3	**45.79%**	1.05	0.87	0.24
A1, EXT2	109	107	0.00	0.48	0.00	0.00	0.00	0.00	0.43	0.00	0.00	0.000	0.000	0.208	0.260	0.000	0.000	0.000	0.000	10.24	75.88	102.93	120.65	176.37	0.0	0.0	74.4	64.7	375	375	CIRCULAR	PVC	-	1.00	164.8	**45.16%**	1.56	1.30	0.83
																				11.17									3000	1500									
CISTERN, B1, B2, C, D1, D3, D5	3	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	70.0	70.0	70.0	34.2	375	375	CIRCULAR	PVC	-	1.00	164.8	**42.47%**	1.56	1.27	0.45
ROOF A	2	MAIN	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.45	75.13	101.88	119.42	174.56	9.2	79.2	79.2	64.0	375	375	CIRCULAR	PVC	-	0.50	116.6	**67.95%**	1.11	1.03	1.03
																				11.48									600	600									

C.2 MODIFIED RATIONAL METHOD CALCULATIONS

Stormwater Management Calculations

File No: **160400864**
Project: **Q-WEST PHASE 2**
Date: **04-May-23**

SWM Approach:
Post-development to Pre-development flows

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
Controlled - Tributary	COURT, B3-6, A2, D2, D4, D6, EXT1	Hard	0.474		0.9	0.427		
		Soft	0.177		0.2	0.035		
		Subtotal		0.651			0.46221	0.710
Controlled - Tributary	A4	Hard	0.058		0.9	0.052		
		Soft	0.004		0.2	0.001		
		Subtotal		0.062			0.0527	0.850
Controlled - Tributary	A1, A3, EXT2	Hard	0.573		0.9	0.516		
		Soft	0.430		0.2	0.086		
		Subtotal		1.003			0.6018	0.600
Uncontrolled - Non-Tributary	UNC2	Hard	0.038		0.9	0.034		
		Soft	0.022		0.2	0.004		
		Subtotal		0.06			0.0384	0.640
Uncontrolled - Non-Tributary	UNC1	Hard	0.077		0.9	0.069		
		Soft	0.013		0.2	0.003		
		Subtotal		0.09			0.072	0.800
Roof	A	Hard	0.250		0.9	0.225		
		Soft	0.000		0.2	0.000		
		Subtotal		0.25			0.225	0.900
Roof	D5	Hard	0.038		0.9	0.034		
		Soft	0.000		0.2	0.000		
		Subtotal		0.038			0.0342	0.900
Roof	D3	Hard	0.033		0.9	0.030		
		Soft	0.000		0.2	0.000		
		Subtotal		0.033			0.0297	0.900
Roof	D1	Hard	0.131		0.9	0.118		
		Soft	0.000		0.2	0.000		
		Subtotal		0.131			0.1179	0.900
Roof	C	Hard	0.178		0.9	0.160		
		Soft	0.000		0.2	0.000		
		Subtotal		0.178			0.1602	0.900
Roof	B2	Hard	0.056		0.9	0.050		
		Soft	0.000		0.2	0.000		
		Subtotal		0.056			0.0504	0.900
Roof	B1	Hard	0.059		0.9	0.053		
		Soft	0.000		0.2	0.000		
		Subtotal		0.059			0.0531	0.900
Total				**2.611**			**1.898**	
Overall Runoff Coefficient= C:								**0.73**

Total Roof Areas	**0.745 ha**
Total Tributary Surface Areas (Controlled and Uncontrolled)	**1.716 ha**
Total Tributary Area to Outlet	**2.461 ha**
Total Uncontrolled Areas (Non-Tributary)	**0.150 ha**
Total Site	**2.611 ha**

Stormwater Management Calculations

Project #160400864, Q-WEST PHASE 2
Modified Rational Method Calculatons for Storage

5 yr Intensity
City of Ottawa

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

a =	998.071
b =	6.053
c =	0.814

t (min)	I (mm/hr)
5	141.18
10	104.19
15	83.56
20	70.25
25	60.90
30	53.93
35	48.52
40	44.18
45	40.63
50	37.65
55	35.12
60	32.94

5 YEAR Predevelopment Target Release from Portion of Site

Subdrainage Area: Predevelopment Tributary Area to Outlet
Area (ha): 2.6100
C: 0.45

Typical Time of Concentration

tc (min)	I (5 yr) (mm/hr)	Qtarget (L/s)
23.8	62.88	**205**

5 YEAR Modified Rational Method for Entire Site

Subdrainage Area: COURT, B3-6, A2, D2, D4, D6, EXT1 — Controlled - Tributary
Area (ha): 0.65
C: 0.71

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	133.9	45.0	88.9	53.3
20	70.25	90.3	45.0	45.3	**54.3**
30	53.93	69.3	45.0	24.3	43.7
40	44.18	56.8	45.0	11.8	28.3
50	37.65	48.4	45.0	3.4	10.1
60	32.94	42.3	42.3	0.0	0.0
70	29.37	37.7	37.7	0.0	0.0
80	26.56	34.1	34.1	0.0	0.0
90	24.29	31.2	31.2	0.0	0.0
100	22.41	28.8	28.8	0.0	0.0
110	20.82	26.8	26.8	0.0	0.0
120	19.47	25.0	25.0	0.0	0.0

Storage: Building Cistern

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
5-year Water Level	-	-	45.0	54.3	190.0	OK

Subdrainage Area: A4 — Controlled - Tributary
Area (ha): 0.06
C: 0.85

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	15.3	15.3	0.0	**0.0**
20	70.25	10.3	10.3	0.0	**0.0**
30	53.93	7.9	7.9	0.0	**0.0**
40	44.18	6.5	6.5	0.0	**0.0**
50	37.65	5.5	5.5	0.0	**0.0**
60	32.94	4.8	4.8	0.0	**0.0**
70	29.37	4.3	4.3	0.0	**0.0**
80	26.56	3.9	3.9	0.0	**0.0**
90	24.29	3.6	3.6	0.0	**0.0**
100	22.41	3.3	3.3	0.0	**0.0**
110	20.82	3.1	3.1	0.0	**0.0**
120	19.47	2.9	2.9	0.0	**0.0**

Storage: Surface Storage Above CB

Orifice Equation: $= CdA(2gh)^{0.5}$ Where C = 0.572
Orifice Diameter: 95.00 mm
Invert Elevation 66.59 m
T/G Elevation 67.97 m
Max Ponding Depth 0.00 m
Downstream W/L 65.96 m
CB Storage 0.50

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
5-year Water Level	67.32	0.73	15.3	0.0	0.5	OK

Project #160400864, Q-WEST PHASE 2
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)
5	242.70
10	178.56
15	142.89
20	119.95
25	103.85
30	91.87
35	82.58
40	75.15
45	69.05
50	63.95
55	59.62
60	55.89

100 YEAR Predevelopment Target Release from Portion of Site

Subdrainage Area: Predevelopment Tributary Area to Outlet
Area (ha): 2.6100
C: 0.45

Estimated Time of Concentration after Development

tc (min)	I (100 yr) (mm/hr)	Q100yr (L/s)
23.8	62.88	**205**

100 YEAR Modified Rational Method for Entire Site

Subdrainage Area: COURT, B3-6, A2, D2, D4, D6, EXT1 — Controlled - Tributary
Area (ha): 0.65
C: 0.89

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	286.8	45.0	241.8	145.1
20	119.95	192.7	45.0	147.7	177.2
30	91.87	147.6	45.0	102.6	**184.6**
40	75.15	120.7	45.0	75.7	181.7
50	63.95	102.7	45.0	57.7	173.2
60	55.89	89.8	45.0	44.8	161.2
70	49.79	80.0	45.0	35.0	146.9
80	44.99	72.3	45.0	27.3	130.9
90	41.11	66.0	45.0	21.0	113.6
100	37.90	60.9	45.0	15.9	95.3
110	35.20	56.5	45.0	11.5	76.2
120	32.89	52.8	45.0	7.8	56.4

Storage: Building Cistern

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	-	-	45.0	184.6	190.0	OK

Subdrainage Area: A4 — Controlled - Tributary
Area (ha): 0.06
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	30.8	19.6	11.2	**6.7**
20	119.95	20.7	19.6	1.1	1.3
30	91.87	15.8	15.8	0.0	0.0
40	75.15	13.0	13.0	0.0	0.0
50	63.95	11.0	11.0	0.0	0.0
60	55.89	9.6	9.6	0.0	0.0
70	49.79	8.6	8.6	0.0	0.0
80	44.99	7.8	7.8	0.0	0.0
90	41.11	7.1	7.1	0.0	0.0
100	37.90	6.5	6.5	0.0	0.0
110	35.20	6.1	6.1	0.0	0.0
120	32.89	5.7	5.7	0.0	0.0

Storage: Surface Storage Above CB

Orifice Equation: $Q = CdA(2gh)^{0.5}$ Where C = 0.572
Orifice Diameter: 95.00 mm
Invert Elevation 66.59 m
T/G Elevation 67.97 m
Max Ponding Depth 0.20 m
Downstream W/L 66.98 m
Surface Storage 6.50
CB Storage 0.50

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	68.17	1.19	19.6	6.7	7.0	OK

Stormwater Management Calculations

Project #160400864, Q-WEST PHASE 2
Modified Rational Method Calculatons for Storage

Subdrainage Area: A1, A3, EXT2 — Controlled - Tributary
Area (ha): 1.00 — *Includes peak runoff from Area A4.
C: 0.60

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	189.6	31.2	158.4	95.0
20	70.25	127.8	31.2	96.6	115.9
30	53.93	98.1	31.2	66.9	**120.4**
40	44.18	80.4	31.2	49.2	118.1
50	37.65	68.5	31.2	37.3	111.9
60	32.94	59.9	31.2	28.7	103.4
70	29.37	53.4	31.2	22.2	93.4
80	26.56	48.3	31.2	17.1	82.2
90	24.29	44.2	31.2	13.0	70.1
100	22.41	40.8	31.2	9.6	57.4
110	20.82	37.9	31.2	6.7	44.1
120	19.47	35.4	31.2	4.2	30.4

Storage: Storage Within Subsurface Pipe

Orifice Equation: = CdA(2gh)^0.5 — Where C = 0.61

Orifice Diameter:	135.00	mm	300x1500 Pipe	102.3
Invert Elevation	65.31	m	3x 2440x3810 Manholes	18.2
Max Ponding Depth	0.65	m	375mm Pipe	0.0
Downstream W/L	65.31	m	1200 CBMH	0.0

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
5-year Water Level	65.96	0.65	31.2	120.4	120.5	OK

Subdrainage Area: UNC2 — Uncontrolled - Non-Tributary
Area (ha): 0.06
C: 0.64

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	11.1	11.1		
20	70.25	7.5	7.5		
30	53.93	5.8	5.8		
40	44.18	4.7	4.7		
50	37.65	4.0	4.0		
60	32.94	3.5	3.5		
70	29.37	3.1	3.1		
80	26.56	2.8	2.8		
90	24.29	2.6	2.6		
100	22.41	2.4	2.4		
110	20.82	2.2	2.2		
120	19.47	2.1	2.1		

Subdrainage Area: UNC1 — Uncontrolled - Non-Tributary
Area (ha): 0.09
C: 0.80

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	20.9	20.9		
20	70.25	14.1	14.1		
30	53.93	10.8	10.8		
40	44.18	8.8	8.8		
50	37.65	7.5	7.5		
60	32.94	6.6	6.6		
70	29.37	5.9	5.9		
80	26.56	5.3	5.3		
90	24.29	4.9	4.9		
100	22.41	4.5	4.5		
110	20.82	4.2	4.2		
120	19.47	3.9	3.9		

Subdrainage Area: A — Roof
Area (ha): 0.25 — Maximum Storage Depth: 150 mm
C: 0.90

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	104.19	65.2	7.2	57.9	34.8	21.4	0.00
20	70.25	43.9	8.8	35.2	42.2	26.0	0.00
30	53.93	33.7	9.2	24.5	44.2	27.2	0.00
40	44.18	27.6	9.2	18.4	**44.2**	27.2	0.00
50	37.65	23.6	9.0	14.5	43.5	26.8	0.00
60	32.94	20.6	8.8	11.8	42.4	26.1	0.00
70	29.37	18.4	8.6	9.8	41.2	25.3	0.00
80	26.56	16.6	8.3	8.3	39.9	24.6	0.00
90	24.29	15.2	8.0	7.2	38.6	23.8	0.00
100	22.41	14.0	7.8	6.2	37.4	23.0	0.00
110	20.82	13.0	7.5	5.5	36.2	22.3	0.00
120	19.47	12.2	7.3	4.9	35.1	21.6	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
5-year Water Level	27.2	0.03	9.2	44.2	243.8	0.00

Project #160400864, Q-WEST PHASE 2
Modified Rational Method Calculatons for Storage

Subdrainage Area: A1, A3, EXT2 — Controlled - Tributary
Area (ha): 1.00 — *Includes peak runoff from Area A4.
C: 0.75

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	393.0	50.0	343.0	205.8
20	119.95	270.4	50.0	220.5	264.5
30	91.87	208.0	50.0	158.0	284.4
40	75.15	170.1	50.0	120.1	**288.3**
50	63.95	144.8	50.0	94.8	284.4
60	55.89	126.5	50.0	76.5	275.6
70	49.79	112.7	50.0	62.7	263.4
80	44.99	101.8	50.0	51.9	248.9
90	41.11	93.1	50.0	43.1	232.6
100	37.90	85.8	50.0	35.8	214.9
110	35.20	79.7	50.0	29.7	196.1
120	32.89	74.5	50.0	24.5	176.3

Storage: Storage Within Subsurface Pipe

Orifice Equation: Q = CdA(2gh)^0.5 — Where C = 0.61

Orifice Diameter:	135.00	mm	300x1500 Pipe	235.8
Invert Elevation	65.31	m	3x 2440x3810 Manholes	46.6
Max Ponding Depth	1.67	m	375mm Pipe	9.0
Downstream W/L	65.31	m	1200 CBMH	0.8

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	66.98	1.67	50.0	288.3	292.2	OK

Subdrainage Area: UNC2 — Uncontrolled - Non-Tributary
Area (ha): 0.06
C: 0.80

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: UNC1 — Uncontrolled - Non-Tributary
Area (ha): 0.09
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	44.7	44.7		
20	119.95	30.0	30.0		
30	91.87	23.0	23.0		
40	75.15	18.8	18.8		
50	63.95	16.0	16.0		
60	55.89	14.0	14.0		
70	49.79	12.5	12.5		
80	44.99	11.3	11.3		
90	41.11	10.3	10.3		
100	37.90	9.5	9.5		
110	35.20	8.8	8.8		
120	32.89	8.2	8.2		

Subdrainage Area: A — Roof
Area (ha): 0.25 — Maximum Storage Depth: 150 mm
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	124.1	13.8	110.3	66.2	40.7	0.00
20	119.95	83.4	16.6	66.7	80.1	49.3	0.00
30	91.87	63.8	17.4	46.5	**83.6**	51.5	0.00
40	75.15	52.2	17.4	34.8	83.6	51.5	0.00
50	63.95	44.4	17.1	27.4	82.1	50.5	0.00
60	55.89	38.8	16.6	22.2	80.0	49.2	0.00
70	49.79	34.6	16.1	18.5	77.6	47.7	0.00
80	44.99	31.3	15.6	15.6	75.1	46.2	0.00
90	41.11	28.6	15.1	13.5	72.7	44.7	0.00
100	37.90	26.3	14.6	11.7	70.3	43.3	0.00
110	35.20	24.5	14.2	10.3	68.1	41.9	0.00
120	32.89	22.9	13.7	9.2	65.9	40.6	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
100-year Water Level	51.5	0.05	17.4	83.6	243.8	0.00

Stormwater Management Calculations

Project #160400864, Q-WEST PHASE 2
Modified Rational Method Calculatons for Storage

Subdrainage Area: D5 — Roof
Area (ha): 0.04 — Maximum Storage Depth: 150 mm
C: 0.90

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	104.19	9.9	1.6	8.3	5.0	102.8	0.00
20	70.25	6.7	1.6	5.0	6.1	109.0	0.00
30	53.93	5.1	1.6	3.5	**6.3**	110.3	0.00
40	44.18	4.2	1.6	2.6	6.2	109.6	0.00
50	37.65	3.6	1.6	2.0	5.9	107.9	0.00
60	32.94	3.1	1.6	1.5	5.5	105.6	0.00
70	29.37	2.8	1.6	1.2	5.0	103.0	0.00
80	26.56	2.5	1.6	0.9	4.5	100.2	0.00
90	24.29	2.3	1.6	0.8	4.1	96.0	0.00
100	22.41	2.1	1.5	0.6	3.6	91.7	0.00
110	20.82	2.0	1.5	0.5	3.2	87.3	0.00
120	19.47	1.9	1.5	0.4	2.7	83.1	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
5-year Water Level	110.3	0.11	1.6	6.3	15.2	0.0

Subdrainage Area: D3 — Roof
Area (ha): 0.03 — Maximum Storage Depth: 150 mm
C: 0.90

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	104.19	8.6	1.6	7.0	4.2	102.0	0.00
20	70.25	5.8	1.6	4.2	5.0	107.4	0.00
30	53.93	4.5	1.6	2.8	**5.1**	107.9	0.00
40	44.18	3.6	1.6	2.0	4.9	106.4	0.00
50	37.65	3.1	1.6	1.5	4.5	104.1	0.00
60	32.94	2.7	1.6	1.1	4.1	101.2	0.00
70	29.37	2.4	1.6	0.9	3.6	97.0	0.00
80	26.56	2.2	1.5	0.7	3.2	92.1	0.00
90	24.29	2.0	1.5	0.5	2.7	87.2	0.00
100	22.41	1.9	1.5	0.4	2.3	82.3	0.00
110	20.82	1.7	1.4	0.3	1.9	77.5	0.00
120	19.47	1.6	1.4	0.2	1.5	71.8	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
5-year Water Level	107.9	0.11	1.6	5.1	13.2	0.0

Subdrainage Area: D1 — Roof
Area (ha): 0.13 — Maximum Storage Depth: 150 mm
C: 0.90

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	104.19	34.2	4.8	29.3	17.6	103.5	0.00
20	70.25	23.0	5.1	18.0	21.6	110.2	0.00
30	53.93	17.7	5.1	12.6	**22.6**	112.0	0.00
40	44.18	14.5	5.1	9.4	22.5	111.8	0.00
50	37.65	12.3	5.1	7.3	21.8	110.6	0.00
60	32.94	10.8	5.0	5.8	20.8	108.9	0.00
70	29.37	9.6	5.0	4.7	19.6	106.9	0.00
80	26.56	8.7	4.9	3.8	18.4	104.8	0.00
90	24.29	8.0	4.8	3.1	17.0	102.5	0.00
100	22.41	7.3	4.7	2.6	15.6	100.2	0.00
110	20.82	6.8	4.6	2.2	14.4	97.0	0.00
120	19.47	6.4	4.5	1.8	13.3	93.8	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
5-year Water Level	112.0	0.11	5.1	22.6	52.4	0.0

Subdrainage Area: C — Roof
Area (ha): 0.18 — Maximum Storage Depth: 150 mm
C: 0.90

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	104.19	46.4	6.8	39.6	23.8	103.3	0.00
20	70.25	31.3	7.1	24.2	29.1	109.9	0.00
30	53.93	24.0	7.1	16.9	**30.4**	111.6	0.00
40	44.18	19.7	7.1	12.6	30.1	111.2	0.00
50	37.65	16.8	7.1	9.7	29.1	110.0	0.00
60	32.94	14.7	7.0	7.7	27.7	108.2	0.00
70	29.37	13.1	6.9	6.2	26.0	106.1	0.00
80	26.56	11.8	6.8	5.0	24.2	103.8	0.00
90	24.29	10.8	6.7	4.1	22.3	101.5	0.00
100	22.41	10.0	6.6	3.4	20.5	98.7	0.00
110	20.82	9.3	6.4	2.9	18.8	95.4	0.00
120	19.47	8.7	6.3	2.4	17.2	92.1	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
5-year Water Level	111.6	0.11	7.1	30.4	71.2	0.0

Project #160400864, Q-WEST PHASE 2
Modified Rational Method Calculatons for Storage

Subdrainage Area: D5 — Roof
Area (ha): 0.04 — Maximum Storage Depth: 150 mm
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	18.9	1.8	17.1	10.3	130.7	0.00
20	119.95	12.7	1.8	10.8	13.0	141.4	0.00
30	91.87	9.7	1.9	7.8	14.1	145.7	0.00
40	75.15	7.9	1.9	6.1	14.5	147.5	0.00
50	63.95	6.8	1.9	4.9	**14.6**	147.8	0.00
60	55.89	5.9	1.9	4.0	14.5	147.3	0.00
70	49.79	5.3	1.9	3.4	14.2	146.3	0.00
80	44.99	4.8	1.9	2.9	13.9	144.9	0.00
90	41.11	4.3	1.8	2.5	13.5	143.2	0.00
100	37.90	4.0	1.8	2.2	13.0	141.4	0.00
110	35.20	3.7	1.8	1.9	12.5	139.4	0.00
120	32.89	3.5	1.8	1.7	12.0	137.4	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
100-year Water Level	147.8	0.15	1.9	14.6	15.2	0.0

Subdrainage Area: D3 — Roof
Area (ha): 0.03 — Maximum Storage Depth: 150 mm
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	16.4	1.8	14.6	8.8	130.1	0.00
20	119.95	11.0	1.8	9.2	11.0	140.1	0.00
30	91.87	8.4	1.9	6.6	11.8	143.9	0.00
40	75.15	6.9	1.9	5.0	**12.1**	145.0	0.00
50	63.95	5.9	1.9	4.0	12.0	144.7	0.00
60	55.89	5.1	1.9	3.3	11.8	143.7	0.00
70	49.79	4.6	1.8	2.7	11.4	142.1	0.00
80	44.99	4.1	1.8	2.3	11.0	140.2	0.00
90	41.11	3.8	1.8	2.0	10.6	138.1	0.00
100	37.90	3.5	1.8	1.7	10.0	135.8	0.00
110	35.20	3.2	1.8	1.4	9.5	133.4	0.00
120	32.89	3.0	1.8	1.2	9.0	131.0	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
100-year Water Level	145.0	0.14	1.9	12.1	13.2	0.0

Subdrainage Area: D1 — Roof
Area (ha): 0.13 — Maximum Storage Depth: 150 mm
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	65.0	5.7	59.3	35.6	131.0	0.00
20	119.95	43.7	6.1	37.6	45.2	141.8	0.00
30	91.87	33.5	6.2	27.3	49.1	146.2	0.00
40	75.15	27.4	6.2	21.1	50.7	148.1	0.00
50	63.95	23.3	6.3	17.0	**51.1**	148.5	0.00
60	55.89	20.4	6.3	14.1	50.8	148.2	0.00
70	49.79	18.1	6.2	11.9	50.0	147.3	0.00
80	44.99	16.4	6.2	10.2	49.0	146.1	0.00
90	41.11	15.0	6.1	8.8	47.7	144.7	0.00
100	37.90	13.8	6.1	7.7	46.3	143.1	0.00
110	35.20	12.8	6.0	6.8	44.8	141.4	0.00
120	32.89	12.0	6.0	6.0	43.2	139.6	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
100-year Water Level	148.5	0.15	6.3	51.1	52.4	0.0

Subdrainage Area: C — Roof
Area (ha): 0.18 — Maximum Storage Depth: 150 mm
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	88.4	8.0	80.4	48.2	130.8	0.00
20	119.95	59.4	8.5	50.9	61.1	141.6	0.00
30	91.87	45.5	8.7	36.8	66.3	145.9	0.00
40	75.15	37.2	8.7	28.5	68.3	147.6	0.00
50	63.95	31.6	8.7	22.9	**68.7**	147.9	0.00
60	55.89	27.7	8.7	18.9	68.2	147.5	0.00
70	49.79	24.6	8.7	16.0	67.0	146.5	0.00
80	44.99	22.3	8.6	13.6	65.5	145.2	0.00
90	41.11	20.3	8.6	11.8	63.7	143.7	0.00
100	37.90	18.8	8.5	10.3	61.6	142.0	0.00
110	35.20	17.4	8.4	9.0	59.5	140.3	0.00
120	32.89	16.3	8.3	8.0	57.3	138.4	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
100-year Water Level	147.9	0.15	8.7	68.7	71.2	0.0

Stormwater Management Calculations

Project #160400864, Q-WEST PHASE 2
Modified Rational Method Calculatons for Storage

Subdrainage Area: B2 — Roof
Area (ha): 0.06 — Maximum Storage Depth: 150 mm
C: 0.90

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	104.19	14.6	1.9	12.7	7.6	103.8	0.00
20	70.25	9.8	2.0	7.8	9.4	110.8	0.00
30	53.93	7.6	2.1	5.5	9.9	112.9	0.00
40	44.18	6.2	2.1	4.1	**9.9**	113.0	0.00
50	37.65	5.3	2.0	3.2	9.7	112.1	0.00
60	32.94	4.6	2.0	2.6	9.3	110.6	0.00
70	29.37	4.1	2.0	2.1	8.9	108.8	0.00
80	26.56	3.7	2.0	1.7	8.4	106.8	0.00
90	24.29	3.4	2.0	1.5	7.8	104.7	0.00
100	22.41	3.1	1.9	1.2	7.3	102.6	0.00
110	20.82	2.9	1.9	1.0	6.7	100.4	0.00
120	19.47	2.7	1.9	0.9	6.2	97.4	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
5-year Water Level	113.0	0.11	2.1	9.9	22.4	0.0

Subdrainage Area: B1 — Roof
Area (ha): 0.06 — Maximum Storage Depth: 150 mm
C: 0.90

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	104.19	15.4	2.4	13.0	7.8	103.0	0.00
20	70.25	10.4	2.5	7.9	9.5	109.4	0.00
30	53.93	8.0	2.5	5.5	**9.9**	110.8	0.00
40	44.18	6.5	2.5	4.1	9.7	110.3	0.00
50	37.65	5.6	2.4	3.1	9.3	108.8	0.00
60	32.94	4.9	2.4	2.4	8.8	106.6	0.00
70	29.37	4.3	2.4	1.9	8.1	104.2	0.00
80	26.56	3.9	2.4	1.5	7.4	101.5	0.00
90	24.29	3.6	2.3	1.2	6.7	98.1	0.00
100	22.41	3.3	2.3	1.0	6.0	93.9	0.00
110	20.82	3.1	2.3	0.8	5.3	89.6	0.00
120	19.47	2.9	2.2	0.6	4.6	85.5	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
5-year Water Level	110.8	0.11	2.5	9.9	23.6	0.0

SUMMARY TO OUTLET

		Vrequired	Vavailable*	
Tributary Area	2.461 ha			
Total 5yr Flow to Sewer	151 L/s	0	0 m^3	Ok
Non-Tributary Area	0.150 ha			
Total 5yr Flow Uncontrolled	32 L/s			
Total Area	2.611 ha			
Total 5yr Flow	182 L/s			
Target	205 L/s			

Project #160400864, Q-WEST PHASE 2
Modified Rational Method Calculatons for Storage

Subdrainage Area: B2 — Roof
Area (ha): 0.06 — Maximum Storage Depth: 150 mm
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	27.8	2.3	25.5	15.3	131.2	0.00
20	119.95	18.7	2.4	16.2	19.5	142.3	0.00
30	91.87	14.3	2.5	11.8	21.3	147.0	0.00
40	75.15	11.7	2.5	9.2	22.0	149.1	0.00
50	63.95	10.0	2.5	7.4	**22.3**	149.8	0.00
60	55.89	8.7	2.5	6.2	22.3	149.6	0.00
70	49.79	7.8	2.5	5.2	22.0	149.0	0.00
80	44.99	7.0	2.5	4.5	21.6	148.0	0.00
90	41.11	6.4	2.5	3.9	21.2	146.7	0.00
100	37.90	5.9	2.5	3.4	20.6	145.3	0.00
110	35.20	5.5	2.4	3.0	20.0	143.7	0.00
120	32.89	5.1	2.4	2.7	19.4	142.1	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
100-year Water Level	149.8	0.15	2.5	22.3	22.4	0.0

Subdrainage Area: B1 — Roof
Area (ha): 0.06 — Maximum Storage Depth: 150 mm
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	29.3	2.7	26.6	16.0	130.8	0.00
20	119.95	19.7	2.8	16.9	20.3	141.7	0.00
30	91.87	15.1	2.8	12.3	22.1	146.2	0.00
40	75.15	12.3	2.8	9.5	22.8	148.0	0.00
50	63.95	10.5	2.8	7.7	**23.0**	148.5	0.00
60	55.89	9.2	2.8	6.3	22.8	148.1	0.00
70	49.79	8.2	2.8	5.4	22.5	147.2	0.00
80	44.99	7.4	2.8	4.6	22.0	145.9	0.00
90	41.11	6.7	2.8	4.0	21.4	144.4	0.00
100	37.90	6.2	2.8	3.4	20.7	142.7	0.00
110	35.20	5.8	2.8	3.0	19.9	140.8	0.00
120	32.89	5.4	2.7	2.7	19.2	138.8	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
100-year Water Level	148.5	0.15	2.8	23.0	23.6	0.0

SUMMARY TO OUTLET

		Vrequired	Vavailable*	
Tributary Area	2.461 ha			
Total 100yr Flow to Sewer	136 L/s	0	0 m^3	Ok
Non-Tributary Area	0.150 ha			
Total 100yr Flow Uncontrolled	69 L/s			
Total Area	2.611 ha			
Total 100yr Flow	205 L/s			
Target	205 L/s			

Project #160400864, Q-WEST PHASE 2
Roof Drain Design Sheet, Area A
Standard Zurn Model Z-105-5 Control-Flo Single Notch Roof Drain

Rating Curve				Volume Estimation				
Elevation (m)	Discharge Rate (cu.m/s)	Outlet Discharge (cu.m/s)	Storage (cu. m)	Elevation (m)	Area (sq. m)	Volume (cu. m) Increment	Volume (cu. m) Accumulated	Water Depth (m)
0.000	0.0000	0.0000	0	0.000	0	0	0	0.000
0.025	0.0004	0.0084	41	0.025	1625	41	41	0.025
0.050	0.0008	0.0169	81	0.050	1625	41	81	0.050
0.075	0.0012	0.0253	122	0.075	1625	41	122	0.075
0.100	0.0015	0.0338	163	0.100	1625	41	163	0.100
0.125	0.0019	0.0422	203	0.125	1625	41	203	0.125
0.150	0.0023	0.0507	244	0.150	1625	41	244	0.150

Drawdown Estimate			
Total Volume (cu.m)	Total Time (sec)	Vol (cu.m)	Detention Time (hr)
0.0	0.0	0.0	0
40.6	2404.4	40.6	0.66789
81.3	1602.9	40.6	1.11316
121.9	1202.2	40.6	1.4471
162.5	961.8	40.6	1.71426
203.1	801.5	40.6	1.93689

Rooftop Storage Summary

Total Building Area (sq.m)		2500
Assume Available Roof Area (sq.	65%	1625
Roof Imperviousness		0.99
Roof Drain Requirement (sq.m/Notch)		232
Number of Roof Notches*		22
Max. Allowable Depth of Roof Ponding (m)		0.15
Max. Allowable Storage (cu.m)		244
Estimated 100 Year Drawdown Time (h)		1.1

* As per Ontario Building Code section OBC 7.4.10.4.(2)(c).

* Note: Number of drains can be reduced if multiple-notch drain used.

From Zurn Drain Catalogue

Head (m)	L/min	L/s	Notch Rating
0.051	45.5	0.00076	232

Calculation Results	5yr	100yr	Available
Qresult (cu.m/s)	0.009	0.017	-
Depth (m)	0.027	0.051	0.150
Volume (cu.m)	44.2	83.6	243.8
Draintime (hrs)	0.7	1.1	

Project #160400864, Q-WEST PHASE 2
Roof Drain Design Sheet, Area B1
Standard Watts Accuflow Drain

Rating Curve				Volume Estimation				
Elevation (m)	Discharge Rate (cu.m/s)	Outlet Discharge (cu.m/s)	Storage (cu. m)	Elevation (m)	Area (sq. m)	Volume (cu. m) Increment	Volume (cu. m) Accumulated	Water Depth (m)
0.000	0.0000	0.0000	0	0.000	0	0	0	0.000
0.025	0.0003	0.0009	0	0.025	13	0	0	0.025
0.050	0.0006	0.0019	1	0.050	52	1	1	0.050
0.075	0.0007	0.0021	3	0.075	118	2	3	0.075
0.100	0.0008	0.0024	7	0.100	210	4	7	0.100
0.125	0.0009	0.0026	14	0.125	328	7	14	0.125
0.150	0.0009	0.0028	24	0.150	472	10	24	0.150

Drawdown Estimate			
Total Volume (cu.m)	Total Time (sec)	Vol (cu.m)	Detention Time (hr)
0.0	0.0	0.0	0
0.8	404.1	0.8	0.11225
2.8	974.9	2.1	0.38306
6.9	1708.7	4.0	0.8577
13.5	2561.0	6.7	1.56908
23.5	3502.1	9.9	2.54188

Rooftop Storage Summary

Total Building Area (sq.m)		590
Assume Available Roof Area (sq.	80%	472
Roof Imperviousness		0.99
Roof Drain Requirement (sq.m/Notch)		232
Number of Roof Notches*		3
Max. Allowable Depth of Roof Ponding (m)		0.15
Max. Allowable Storage (cu.m)		24
Estimated 100 Year Drawdown Time (h)		2.5

* As per Ontario Building Code section OBC 7.4.10.4.(2)(c).

From Watts Drain Catalogue

Head (m)	L/s Open	0.75	0.5	**0.25**	Closed
0.025	0.3155	0.3155	0.3155	**0.3155**	0.3155
0.05	0.6309	0.6309	0.6309	**0.6309**	0.3155
0.075	0.9464	0.8675	0.7886	**0.7098**	0.3155
0.1	1.2618	1.1041	0.9464	**0.7886**	0.3155
0.125	1.5773	1.3407	1.1041	**0.8675**	0.3155
0.15	1.8927	1.5773	1.2618	**0.9464**	0.3155

* Note: Number of drains can be reduced if multiple-notch drain used.

Calculation Results	5yr	100yr	Available
Qresult (cu.m/s)	0.002	0.003	-
Depth (m)	0.111	0.148	0.150
Volume (cu.m)	9.9	23.0	23.6
Draintime (hrs)	1.2	2.5	

Project #160400864, Q-WEST PHASE 2
Roof Drain Design Sheet, Area B2
Standard Watts Accuflow Drain

Rating Curve				Volume Estimation				
Elevation (m)	Discharge Rate (cu.m/s)	Outlet Discharge (cu.m/s)	Storage (cu. m)	Elevation (m)	Area (sq. m)	Volume (cu. m) Increment	Volume (cu. m) Accumulated	Water Depth (m)
0.000	0.0000	0.0000	0	0.000	0	0	0	0.000
0.025	0.0003	0.0006	0	0.025	12	0	0	0.025
0.050	0.0006	0.0013	1	0.050	50	1	1	0.050
0.075	0.0008	0.0016	3	0.075	112	2	3	0.075
0.100	0.0009	0.0019	7	0.100	199	4	7	0.100
0.125	0.0011	0.0022	13	0.125	311	6	13	0.125
0.150	0.0013	0.0025	22	0.150	448	9	22	0.150

Drawdown Estimate			
Total Volume (cu.m)	Total Time (sec)	Vol (cu.m)	Detention Time (hr)
0.0	0.0	0.0	0
0.7	575.3	0.7	0.15981
2.7	1249.2	2.0	0.50682
6.5	2027.3	3.8	1.06995
12.9	2864.8	6.3	1.86573
22.3	3739.5	9.4	2.90448

Rooftop Storage Summary

Total Building Area (sq.m)		560
Assume Available Roof Area (sq.	80%	448
Roof Imperviousness		0.99
Roof Drain Requirement (sq.m/Notch)		232
Number of Roof Notches*		2
Max. Allowable Depth of Roof Ponding (m)		0.15
Max. Allowable Storage (cu.m)		22
Estimated 100 Year Drawdown Time (h)		2.9

* As per Ontario Building Code section OBC 7.4.10.4.(2)(c).

* Note: Number of drains can be reduced if multiple-notch drain used.

From Watts Drain Catalogue

Head (m)	L/s				
	Open	0.75	**0.5**	0.25	Closed
0.025	0.3155	0.3155	**0.3155**	0.3155	0.3155
0.05	0.6309	0.6309	**0.6309**	0.6309	0.3155
0.075	0.9464	0.8675	**0.7886**	0.7098	0.3155
0.1	1.2618	1.1041	**0.9464**	0.7886	0.3155
0.125	1.5773	1.3407	**1.1041**	0.8675	0.3155
0.15	1.8927	1.5773	**1.2618**	0.9464	0.3155

Calculation Results	**5yr**	**100yr**	**Available**
Qresult (cu.m/s)	0.002	0.003	-
Depth (m)	0.113	0.150	0.150
Volume (cu.m)	9.9	22.3	22.4
Draintime (hrs)	1.5	2.9	

Project #160400864, Q-WEST PHASE 2
Roof Drain Design Sheet, Area C
Standard Watts Accuflow Drain

Rating Curve				Volume Estimation				
Elevation (m)	Discharge Rate (cu.m/s)	Outlet Discharge (cu.m/s)	Storage (cu. m)	Elevation (m)	Area (sq. m)	Volume (cu. m) Increment	Volume (cu. m) Accumulated	Water Depth (m)
0.000	0.0000	0.0000	0	0.000	0	0	0	0.000
0.025	0.0003	0.0022	0	0.025	40	0	0	0.025
0.050	0.0006	0.0044	3	0.050	158	2	3	0.050
0.075	0.0008	0.0055	9	0.075	356	6	9	0.075
0.100	0.0009	0.0066	21	0.100	633	12	21	0.100
0.125	0.0011	0.0077	41	0.125	989	20	41	0.125
0.150	0.0013	0.0088	71	0.150	1424	30	71	0.150

Drawdown Estimate			
Total Volume (cu.m)	Total Time (sec)	Vol (cu.m)	Detention Time (hr)
0.0	0.0	0.0	0
2.3	522.5	2.3	0.14513
8.6	1134.5	6.3	0.46027
20.8	1841.1	12.2	0.97169
40.9	2601.7	20.1	1.69439
70.9	3396.1	30.0	2.63774

Rooftop Storage Summary

Total Building Area (sq.m)		1780
Assume Available Roof Area (sq.	80%	1424
Roof Imperviousness		0.99
Roof Drain Requirement (sq.m/Notch)		232
Number of Roof Notches*		7
Max. Allowable Depth of Roof Ponding (m)		0.15
Max. Allowable Storage (cu.m)		71
Estimated 100 Year Drawdown Time (h)		2.6

* As per Ontario Building Code section OBC 7.4.10.4.(2)(c).

* Note: Number of drains can be reduced if multiple-notch drain used.

From Watts Drain Catalogue

Head (m)	L/s				
	Open	0.75	**0.5**	0.25	Closed
0.025	0.3155	0.3155	**0.3155**	0.3155	0.3155
0.05	0.6309	0.6309	**0.6309**	0.6309	0.3155
0.075	0.9464	0.8675	**0.7886**	0.7098	0.3155
0.1	1.2618	1.1041	**0.9464**	0.7886	0.3155
0.125	1.5773	1.3407	**1.1041**	0.8675	0.3155
0.15	1.8927	1.5773	**1.2618**	0.9464	0.3155

Calculation Results	**5yr**	**100yr**	**Available**
Qresult (cu.m/s)	0.007	0.009	-
Depth (m)	0.112	0.148	0.150
Volume (cu.m)	30.4	68.7	71.2
Draintime (hrs)	1.3	2.6	

Project #160400864, Q-WEST PHASE 2
Roof Drain Design Sheet, Area D1
Standard Watts Accuflow Drain

Rating Curve				Volume Estimation				
Elevation (m)	Discharge Rate (cu.m/s)	Outlet Discharge (cu.m/s)	Storage (cu. m)	Elevation (m)	Area (sq. m)	Volume (cu. m) Increment	Volume (cu. m) Accumulated	Water Depth (m)
0.000	0.0000	0.0000	0	0.000	0	0	0	0.000
0.025	0.0003	0.0016	0	0.025	29	0	0	0.025
0.050	0.0006	0.0032	2	0.050	116	2	2	0.050
0.075	0.0008	0.0039	7	0.075	262	5	7	0.075
0.100	0.0009	0.0047	16	0.100	466	9	16	0.100
0.125	0.0011	0.0055	30	0.125	728	15	30	0.125
0.150	0.0013	0.0063	52	0.150	1048	22	52	0.150

Drawdown Estimate			
Total Volume (cu.m)	Total Time (sec)	Vol (cu.m)	Detention Time (hr)
0.0	0.0	0.0	0
1.7	538.3	1.7	0.14953
6.3	1168.9	4.6	0.47424
15.3	1897.0	9.0	1.00117
30.1	2680.6	14.8	1.74579
52.2	3499.1	22.1	2.71776

Rooftop Storage Summary

Total Building Area (sq.m)		1310
Assume Available Roof Area (sq.	80%	1048
Roof Imperviousness		0.99
Roof Drain Requirement (sq.m/Notch)		232
Number of Roof Notches*		5
Max. Allowable Depth of Roof Ponding (m)		0.15
Max. Allowable Storage (cu.m)		52
Estimated 100 Year Drawdown Time (h)		2.7

* As per Ontario Building Code section OBC 7.4.10.4.(2)(c).

* Note: Number of drains can be reduced if multiple-notch drain used.

From Watts Drain Catalogue

Head (m)	L/s Open	0.75	**0.5**	0.25	Closed
0.025	0.3155	0.3155	**0.3155**	0.3155	0.3155
0.05	0.6309	0.6309	**0.6309**	0.6309	0.3155
0.075	0.9464	0.8675	**0.7886**	0.7098	0.3155
0.1	1.2618	1.1041	**0.9464**	0.7886	0.3155
0.125	1.5773	1.3407	**1.1041**	0.8675	0.3155
0.15	1.8927	1.5773	**1.2618**	0.9464	0.3155

Calculation Results	5yr	100yr	Available
Qresult (cu.m/s)	0.005	0.006	-
Depth (m)	0.112	0.149	0.150
Volume (cu.m)	22.6	51.1	52.4
Draintime (hrs)	1.4	2.7	

Project #160400864, Q-WEST PHASE 2
Roof Drain Design Sheet, Area D3
Standard Watts Accuflow Drain

Rating Curve				Volume Estimation				
Elevation (m)	Discharge Rate (cu.m/s)	Outlet Discharge (cu.m/s)	Storage (cu. m)	Elevation (m)	Area (sq. m)	Volume (cu. m) Increment	Volume (cu. m) Accumulated	Water Depth (m)
0.000	0.0000	0.0000	0	0.000	0	0	0	0.000
0.025	0.0003	0.0006	0	0.025	7	0	0	0.025
0.050	0.0006	0.0013	0	0.050	29	0	0	0.050
0.075	0.0007	0.0014	2	0.075	66	1	2	0.075
0.100	0.0008	0.0016	4	0.100	117	2	4	0.100
0.125	0.0009	0.0017	8	0.125	183	4	8	0.125
0.150	0.0009	0.0019	13	0.150	264	6	13	0.150

Drawdown Estimate			
Total Volume (cu.m)	Total Time (sec)	Vol (cu.m)	Detention Time (hr)
0.0	0.0	0.0	0
0.4	339.0	0.4	0.09417
1.6	818.0	1.2	0.32138
3.9	1433.6	2.3	0.7196
7.6	2148.6	3.7	1.31643
13.1	2938.2	5.6	2.13259

Rooftop Storage Summary

Total Building Area (sq.m)		330
Assume Available Roof Area (sq.	80%	264
Roof Imperviousness		0.99
Roof Drain Requirement (sq.m/Notch)		232
Number of Roof Notches*		2
Max. Allowable Depth of Roof Ponding (m)		0.15
Max. Allowable Storage (cu.m)		13
Estimated 100 Year Drawdown Time (h)		2.0

* As per Ontario Building Code section OBC 7.4.10.4.(2)(c).

* Note: Number of drains can be reduced if multiple-notch drain used.

From Watts Drain Catalogue

Head (m)	L/s Open	0.75	0.5	**0.25**	Closed
0.025	0.3155	0.3155	0.3155	**0.3155**	0.3155
0.05	0.6309	0.6309	0.6309	**0.6309**	0.3155
0.075	0.9464	0.8675	0.7886	**0.7098**	0.3155
0.1	1.2618	1.1041	0.9464	**0.7886**	0.3155
0.125	1.5773	1.3407	1.1041	**0.8675**	0.3155
0.15	1.8927	1.5773	1.2618	**0.9464**	0.3155

Calculation Results	**5yr**	**100yr**	**Available**
Qresult (cu.m/s)	0.002	0.002	-
Depth (m)	0.108	0.145	0.150
Volume (cu.m)	5.1	12.1	13.2
Draintime (hrs)	0.9	2.0	

Project #160400864, Q-WEST PHASE 2
Roof Drain Design Sheet, Area D5
Standard Watts Accuflow Drain

Rating Curve				Volume Estimation				
Elevation (m)	Discharge Rate (cu.m/s)	Outlet Discharge (cu.m/s)	Storage (cu. m)	Elevation (m)	Area (sq. m)	Volume (cu. m) Increment	Volume (cu. m) Accumulated	Water Depth (m)
0.000	0.0000	0.0000	0	0.000	0	0	0	0.000
0.025	0.0003	0.0006	0	0.025	8	0	0	0.025
0.050	0.0006	0.0013	1	0.050	34	0	1	0.050
0.075	0.0007	0.0014	2	0.075	76	1	2	0.075
0.100	0.0008	0.0016	5	0.100	135	3	5	0.100
0.125	0.0009	0.0017	9	0.125	211	4	9	0.125
0.150	0.0009	0.0019	15	0.150	304	6	15	0.150

Drawdown Estimate			
Total Volume (cu.m)	Total Time (sec)	Vol (cu.m)	Detention Time (hr)
0.0	0.0	0.0	0
0.5	390.4	0.5	0.10844
1.8	941.9	1.3	0.37008
4.4	1650.8	2.6	0.82863
8.7	2474.1	4.3	1.51589
15.1	3383.4	6.4	2.45571

Rooftop Storage Summary

Total Building Area (sq.m)		380
Assume Available Roof Area (sq.	80%	304
Roof Imperviousness		0.99
Roof Drain Requirement (sq.m/Notch)		232
Number of Roof Notches*		2
Max. Allowable Depth of Roof Ponding (m)		0.15
Max. Allowable Storage (cu.m)		15
Estimated 100 Year Drawdown Time (h)		2.4

* As per Ontario Building Code section OBC 7.4.10.4.(2)(c).

* Note: Number of drains can be reduced if multiple-notch drain used.

From Watts Drain Catalogue

Head (m)	L/s Open	0.75	0.5	**0.25**	Closed
0.025	0.3155	0.3155	0.3155	**0.3155**	0.3155
0.05	0.6309	0.6309	0.6309	**0.6309**	0.3155
0.075	0.9464	0.8675	0.7886	**0.7098**	0.3155
0.1	1.2618	1.1041	0.9464	**0.7886**	0.3155
0.125	1.5773	1.3407	1.1041	**0.8675**	0.3155
0.15	1.8927	1.5773	1.2618	**0.9464**	0.3155

Calculation Results	5yr	100yr	Available
Qresult (cu.m/s)	0.002	0.002	-
Depth (m)	0.110	0.148	0.150
Volume (cu.m)	6.3	14.6	15.2
Draintime (hrs)	1.1	2.4	

C.3 BACKGROUND REPORT EXCERPTS (STORM SEWER)

5.0 Stormwater Management and Servicing

The stormwater management (SWM) criteria for 114 Richmond Road were established in a report titled "Assessment of Adequacy of Public Services Report" prepared by Trow Associates Inc. and dated March 12, 2010. This report indicated a 5-year predevelopment release rate of 194.3L/s based on a site area of 2.21ha and a pre-development runoff coefficient of 0.45. (see **Appendix C** for Excerpts from Trow's report). As per the City of Ottawa's request in an email received September 6, 2011, the allowable release rate has been revised to reflect a calculated time of concentration of 23.8 minutes, based on existing site conditions. Note that the proposed site also receives external drainage from neighbouring properties. These external flows will be captured and conveyed by the proposed system. The target rate for the site is therefore **205 L/s** when external drainage areas are included.

This SWM analysis will demonstrate that the proposed development meets the above criteria, as well as the following:

- Maximum permitted hydraulic grade line (HGL) to be a minimum of 0.30 m below building foundation will be addressed through installation of pumps.
- Size storm sewers to convey 5 year storm event under free-flow conditions using 2004 City of Ottawa I-D-F parameters *(City of Ottawa).* Due to servicing restrictions on the west side of the site, the sewers connecting to Richmond Road are sized to convey the 100 year restricted release rate from roof tops and the underground storm reservoir.
- All flows in excess of the allowable release rate, up to and including the 100-year storm, are to be detained onsite.
- Where possible, maximum ponding depth of 0.30 m (*City of Ottawa*). Note that due to grading restrictions a depression exists within the treed area that is to be preserved and cannot be regraded. No overland flow route is available from this area and as such maximum ponding depths of 0.3m cannot be achieved.
- Standing water depths at parking lot sags not to cause surface flooding on any building or structure *(City of Ottawa)*
- Subdrains required in swales where longitudinal gradient is less than 1.5% *(City of Ottawa)*
- Where possible, major flow from the site is to be safely conveyed by surface routing towards Leighton Terrace and Richmond Road. A depression exists currently within the treed area that is to be preserved and cannot be regraded. Due to elevation changes across the site no overland flow route can be provided at this location. Flows in this area will be captured in a catchbasin and conveyed through the proposed storm sewers but no overland flow route can be provided.

Appendix D CITY CORRESPONDENCE & CHECKLIST

Servicing study guidelines for development applications

4. Development Servicing Study Checklist

The following section describes the checklist of the required content of servicing studies. It is expected that the proponent will address each one of the following items for the study to be deemed complete and ready for review by City of Ottawa Infrastructure Approvals staff.

The level of required detail in the Servicing Study will increase depending on the type of application. For example, for Official Plan amendments and re-zoning applications, the main issues will be to determine the capacity requirements for the proposed change in land use and confirm this against the existing capacity constraint, and to define the solutions, phasing of works and the financing of works to address the capacity constraint. For subdivisions and site plans, the above will be required with additional detailed information supporting the servicing within the development boundary.

4.1 General Content

- NA ☐ Executive Summary (for larger reports only).
- ☒ Date and revision number of the report.
- ☒ Location map and plan showing municipal address, boundary, and layout of proposed development.
- ☒ Plan showing the site and location of all existing services.
- ☒ 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.
- ☒ Summary of Pre-consultation Meetings with City and other approval agencies.
- ☒ 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.
- ☒ Statement of objectives and servicing criteria.
- ☒ Identification of existing and proposed infrastructure available in the immediate area.
- NA ☒ 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).
- NA ☒ 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.
- NA ☒ Identification of potential impacts of proposed piped services on private services (such as wells and septic fields on adjacent lands) and mitigation required to address potential impacts.
- ☒ Proposed phasing of the development, if applicable.

- ☒ Reference to geotechnical studies and recommendations concerning servicing.

- ☒ All preliminary and formal site plan submissions should have the following information:
  - Metric scale
  - North arrow (including construction North)
  - Key plan
  - Name and contact information of applicant and property owner
  - Property limits including bearings and dimensions
  - Existing and proposed structures and parking areas
  - Easements, road widening and rights-of-way
  - Adjacent street names

4.2 Development Servicing Report: Water

- ☒ Confirm consistency with Master Servicing Study, if available
- ☒ Availability of public infrastructure to service proposed development
- ☒ Identification of system constraints
- ☒ Identify boundary conditions
- ☒ Confirmation of adequate domestic supply and pressure
- ☒ 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.
- ☒ 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.
- ☒ Definition of phasing constraints. Hydraulic modeling is required to confirm servicing for all defined phases of the project including the ultimate design
- ☒ Address reliability requirements such as appropriate location of shut-off valves
- ☒ Check on the necessity of a pressure zone boundary modification.
- ☒ 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

- ☒ 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.
- ☒ 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.
- ☒ Confirmation that water demands are calculated based on the City of Ottawa Design Guidelines.
- ☒ Provision of a model schematic showing the boundary conditions locations, streets, parcels, and building locations for reference.

4.3 Development Servicing Report: Wastewater

- ☒ 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).
- ☒ Confirm consistency with Master Servicing Study and/or justifications for deviations.
- ☒ 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.
- ☒ Description of existing sanitary sewer available for discharge of wastewater from proposed development.
- ☒ 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)
- ☒ Calculations related to dry-weather and wet-weather flow rates from the development in standard MOE sanitary sewer design table (Appendix ‘C’) format.
- ☒ Description of proposed sewer network including sewers, pumping stations, and forcemains.
- NA ☒ 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).
- ☒ Pumping stations: impacts of proposed development on existing pumping stations or requirements for new pumping station to service development.
- NA ☒ Forcemain capacity in terms of operational redundancy, surge pressure and maximum flow velocity.
- NA ☒ Identification and implementation of the emergency overflow from sanitary pumping stations in relation to the hydraulic grade line to protect against basement flooding.
- ☒ Special considerations such as contamination, corrosive environment etc.

4.4 Development Servicing Report: Stormwater Checklist

- ☒ Description of drainage outlets and downstream constraints including legality of outlets (i.e. municipal drain, right-of-way, watercourse, or private property)
- ☒ Analysis of available capacity in existing public infrastructure.
- ☒ A drawing showing the subject lands, its surroundings, the receiving watercourse, existing drainage patterns, and proposed drainage pattern.
- ☒ 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.
- ☒ Water Quality control objective (basic, normal or enhanced level of protection based on the sensitivities of the receiving watercourse) and storage requirements.
- ☒ Description of the stormwater management concept with facility locations and descriptions with references and supporting information.
- NA ☒ Set-back from private sewage disposal systems.
- NA ☒ Watercourse and hazard lands setbacks.
- ☒ Record of pre-consultation with the Ontario Ministry of Environment and the Conservation Authority that has jurisdiction on the affected watershed.
- ☒ Confirm consistency with sub-watershed and Master Servicing Study, if applicable study exists.
- ☒ Storage requirements (complete with calculations) and conveyance capacity for minor events (1:5 year return period) and major events (1:100 year return period).
- NA ☒ Identification of watercourses within the proposed development and how watercourses will be protected, or, if necessary, altered by the proposed development with applicable approvals.
- ☒ 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.
- ☒ Any proposed diversion of drainage catchment areas from one outlet to another.
- ☒ Proposed minor and major systems including locations and sizes of stormwater trunk sewers, and stormwater management facilities.
- ☒ 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.
- NA ☒ Identification of potential impacts to receiving watercourses
- NA ☒ Identification of municipal drains and related approval requirements.
- ☒ Descriptions of how the conveyance and storage capacity will be achieved for the development.
- ☒ 100 year flood levels and major flow routing to protect proposed development from flooding for establishing minimum building elevations (MBE) and overall grading.

- ☒ Inclusion of hydraulic analysis including hydraulic grade line elevations.
- ☒ Description of approach to erosion and sediment control during construction for the protection of receiving watercourse or drainage corridors.
- NA ☒ 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.
- NA ☒ Identification of fill constraints related to floodplain and geotechnical investigation.

4.5 Approval and Permit Requirements: Checklist

The Servicing Study shall provide a list of applicable permits and regulatory approvals necessary for the proposed development as well as the relevant issues affecting each approval. The approval and permitting shall include but not be limited to the following:

- ☒ 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.
- NA ☒ Application for Certificate of Approval (CofA) under the Ontario Water Resources Act.
- NA ☒ Changes to Municipal Drains.
- ☒ Other permits (National Capital Commission, Parks Canada, Public Works and Government Services Canada, Ministry of Transportation etc.)

4.6 Conclusion Checklist

- ☒ Clearly stated conclusions and recommendations
- ☒ 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.
- ☒ All ~~draft and~~ final reports shall be signed and stamped by a professional Engineer registered in Ontario

Stantec Consulting Ltd.
400 - 1331 Clyde Avenue, Ottawa ON K2C 3G4

April 23, 2020
File: 160400864

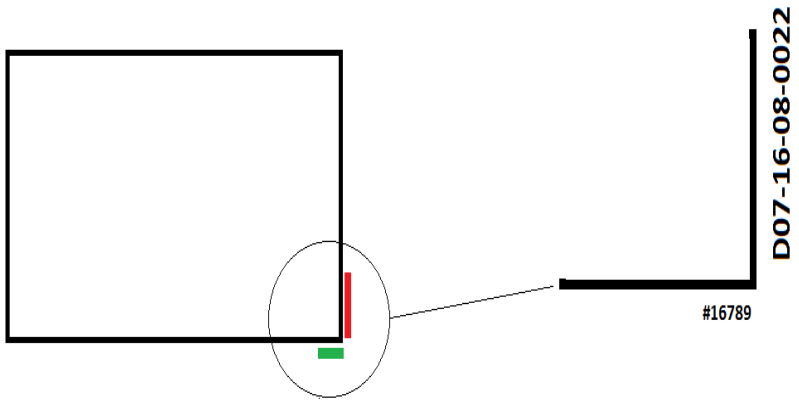
Attention: Shawn Wessel, Project Manager
City of Ottawa
Development Review

Dear Shawn,

Reference: 114 Richmond Road City Comments – D07-12-18-0080

General:

1. Place City of Ottawa project # D07 # on all plans using **BOLD BLACK TEXT** as per this sample where the D07 # is shown as **D07-16-08-0022**.



For the purpose of this application, this file number is D07-12-18-0080. In addition, the Plan number (for GIS & Data Mgmt) will be **# 18016** for this project.

R/ Text added to drawings as indicated.

2. Please refer to City of Ottawa website portal **for "Guide to preparing Studies and Plans"** at https://ottawa.ca/en/city-hall/planning-and-development/information-developers/development-application-review-process/development-application-submission/guide-preparing-studies-and-plans.

R/ Noted

3. Please ensure you are using the current guidelines, bylaws and standards including materials of construction, disinfection and all relevant reference to OPSS/D and AWWA guidelines - all current and as amended, such as:

Reference: **114 Richmond Road City Comments – D07-12-18-0080**

City of Ottawa Sewer Design Guidelines (**CoOSDG**) complete with ISTDB 2012-01, 2014-01, 2016-01, 2018-01 & 2019-02 technical bulletin updates as well as current Sewer , Landscape, Road Standard Detail Drawings as well as Sewer Material Specifications (MS Docs).
Sewer Connection (2003-513) & Sewer Use (2003-514) By-Laws.

City of Ottawa Water Distribution Design Guidelines (**CoOWDDG**) complete with ISTDB 2010-02, 2014-02 & 2018-02 technical bulletin updates as well as current Watermain/ Services Material Specifications (MS Docs) as well as Water and Road Standard Detail Drawings.
Water (2018-167) By-Law

Ensure to include version date and add "(as amended)" when referencing all standards, detail drwaings, by-Laws and guidelines.

R/ Noted

4. All plans or reports stamped or noted with "NOT FOR CONSTRUCTION" to be removed prior to review, if applicable. Suggested that "Preliminary Drawings" and/or "Subject to Approval" or similar wording is used in its place.

   R/ Noted

5. A gas pressure release station is required now for buildings that exceed 12 units. Be sure to include this on the Grading, Site Servicing, SWM and Landscape plans.

   Gas Blow Off Station.pdf

   R/ Pressure release station to be included on composite utility plan drawings.

6. Water services greater than 19 mm require a Water Data Card. Please complete card and submit when completed, *once design has been finalized* and in preparation for Commence Work Notification and Water Permit Application.

   2019 Water Data Card.xls

   R/ Noted & will be submitted after approval.

Site Servicing & Stormwater Management Report, prepared by Stantec Consulting Ltd., dated April 1, 2019:

1. Revise the report and plans in the report based upon your changes to the plans as mentioned below. Review and revise accordingly.
   R/ Revised as per below.
2. Please see the attached city guidelines and add a completed checklist with the report.

Reference: 114 Richmond Road City Comments – D07-12-18-0080

R/ Checklist added to report appendices.

3. Please speak to pumping sanitary to 375 mm Ø sanitary sewer pipe extension from building as per the corresponding **Site Servicing Plan,** Dwg SSP-1, prepared by Stantec Consulting Ltd., revision 1 dated April 1, 2019
   R/ Note added to report section 4.3.

4. Re: Water and FUS
   - why the demands in Appendix A don't match the ones in section 3.2 of the report?
     R/ Demands shown in the appendices were confirmed to match section 3.2
   - confirm if redundancy (looped watermain, service separated by valve, ..) will be provided considering that number of units at each connection exceeds 50?
     R/ Further clarification highlighting second connection added to report. Internal watermain looping previously identified in section 3.1 of the report.
   - Are hydrants being proposed on this site? If not, what's the distance from the furthest proposed building to the nearest existing hydrant?
     R/ On-site fire hydrants serviced by building internal plumbing added to plan and have been placed to be within 45m of building fire department connections.
   - This report speaks to provided fire flow results at nodes J3, J8 and J6 (as per Fig 1-5 in Appendix A). Please confirmed what the resulting pressure would be at the furthest building? Why hasn't the model been extended to the furthest buildings?
     R/ The model was originally prepared considering separate connections to serve Phases 1 and 2 without interconnection between the two phases, with dead-end junction J3 corresponding to the point of entry to the building at Phase 1, and junctions J8 and J6 corresponding to the property line at Byron in Phase 2. With internal looping of the development, head losses across the development are effectively minimized, with potential to provide the required fire flows at any location along the proposed site.

5. Report references Geotechnical Investigation Report. Please ensure the most recent report is sited.
   R/ Reference revised.
6. Please demonstrate that you have taken into account redudancy for this proposed connection due to the base flow of the building being greater than 50 m³/d (0.58 l/s) as per Ottawa Design Guidelines – Water Distribution 2010 (as ammended), Section 4.3.1.
   We understand that the existing water service from Phase I (off Richmond Road) is to feed Phase II-A development.
   R/ See response to Comment 4 above.
7. Please clearly show where outlet is for Cistern that is proposed to be pumped.
   R/ Cistern outlet clearly identified within note on Drawing SSP-1.
8. The Geotechnical Investigation Report dated March 20, 2019
   Indicates that a subfloor drainage system, consisting of lines of perforted drainage pipe subdrains connected to a positive outlet should be provided. Reference this in your report.
   R/ As stated in the geotechnical report section 6.1, "The perimeter drainage pipe should direct water to the sump pit(s) within the lower basement area". These sump pits are expected to be pumped as the basement is well below existing sewer depth. As noted on the servicing plan, a storm stub has been identified as the outlet location for the pumped footing drain. Refer to mecahnical drawings for internal plumbing details.
9. This report did not discuss the quality control measures for stormwater runoff, which is a requirement for a SWM report. Please add a quality control section and add information regarding local RVCA concerns on this issue for this site.

Reference: **114 Richmond Road City Comments – D07-12-18-0080**

R/ No quality controls were identified at Phase 1 of the development, with ultimate buildout of Phase 2 clearly indicated at time of approval. Sign-off will be obtained from the RVCA to confirm assumptions made during Phase 1.

10. Provide Flow Control Roof Drainage Declaration as per Ontario Building Code (OBC) Section 7.4.10.4. Alternatively, provide a stamped and sealed memo that confirms the new roof will be designed with flow control drains to meet the Stormwater Management objectives with roof spill scuppers and in accordance with the requirements of clause 7.4.10.4 of the latest edition of the Ontario Building code, as ammended.

Flow_Control_Declaration.pdf

R/ A roof flow control declaration is to be provided by the building mechanical engineer for the current submission and under separate cover.

11. It is recommended that a pressurized drainpipe type material be used for the roof drain leader pipe in the event of surcharge in the system.
R. Consideration of pressure pipe highlighted to building mechanical consultant.
12. Neither the report, nor the plans, speak to the footing drains and how they will be integrated into the site service design. Footing drains are to be independently connected unless utilizing a pumping system with electrical and pump backup with an integrated ICD. Revise report and drawings as necessary.
R/ Footing drains assumed to be pumped, and to discharge into storm sewer upstream of ex MH2 and downstream of the proposed cistern to remain uncontrolled. Details of the connection to occur within building footprint per building mechanical consultant design.
13. In the body of the report - provide HWL for the site in regard to the required storage that was determined.
R/ Water elevation added to table 4 of the report. Cistern water elevation dependent on design of cistern by others.
14. Underground storage is mentioned and taking into account for the SWM for this site in this report. Provide information on type of underground storage system including product name and model, number of chambers, chamber configuration, confirm invert of chamber system, top of chamber system, required cover over system and details, interior bottom slope (for self cleansing), chart of storage values, length, width and height, capacity etc.
R/ Building cistern is to be pumped, with maximum release rate and minimum volume as specified on Drawing SD-1, and elsewhere within the report/drawings. Remaining design elements are under purview of building mechanical consultant – please refer to mechanical design for details.
15. Above and below ground storage is permitted although uses ½ Peak Flow Rate or is modeled. Please confirm that this has been accounted for and/or revise.
R/ The rationale provided within this comment is applicable in consideration of a gravity controlled ICD or otherwise where peak outflow rate varies by head in the storage tank. As the cistern is expected to be pumped out at a constant rate to the peak value specified in the report, the average release rate equates directly to the peak release rate. No further increase in required volume is justfified.

Rationale:
The Modified Rational Method for storage computation in the Sewer Design Guidelines was originally intended to be used for above ground storage (i.e. parking lot) where the change in head over the orifice varied from 1.5 m to 1.2 m (assuming a 1.2 m deep CB and a max ponding depth of 0.3 m). This change

in head was small and hence the release rate fluctuated little, therefore there was no need to use an average release rate.

When underground storage is used, the release rate fluctuates from a maximum peak flow based on maximum head down to a release rate of zero. This difference is large and has a significant impact on storage requirements. We therefore require that an average release rate be used to estimate the required volume. Alternatively, the consultant may choose to use a submersible pump in the design to ensure a constant release rate.

In the event that there is differing opinion from the designer's perspective regarding the required storage, The City will require that the designer demonstrate their rationale utilizing dynamic modelling, that will then be reviewed by City modellers in the Water Resources Group.

Note that the above, including roof areas (all SWM Storage) will added to upcoming revised Sewer Design Guidelines to account for underground/surface storage, which is now widely used.

16. What will be the actual underground storage provided during the major (100 year) and minor (2 year) storm events?
    R/ Please see V(required) columns of previously provided Tables 4 and 5 within the report for storage within the 5 and 100 year event.
17. Provide a cross section of underground chamber system showing invert and obvert/top, major and minor HWLs, top of ground, system volume provided during major and minor events. Provide manufacturer specifications if applicable.
    R/ Please see response to comment 14 above.
18. Report should reference roof drainage area and approiate plan showing drainage area and roof drain locations.
    R/ Assumed number of roof drains and attributed drainage area previously noted in calculations within appendix C and storm drainage area plan SD-1. Location of roof drains and individual drainage areas subject to roof design by others to overall peak release rates noted within the schedule of roof release rates on drawing SD-1. Please see response to above comment 10.

Plan Specific Comments:

Grading Plan, Dwg GP-1, prepared by Stantec Consulting Ltd., revision 1 dated April 1, 2019:

1. Provide a Note: Contractor is responsible to keep the roads free and clean from mud or debris.
   R/ Note added to drawing.
2. Please provide top and bottom retaining wall elevations on Phase I part of property (West property line). Is this part of the retaining wall already built? If so, please use a different layer or appropriate identify the existing vs proposed wall area.
   R/ Additional elevations shown, with linetype adjusted to demonstrate previously constructed wall.
3. No water ponding against building or on public lands. Finish grade at foundation wall of proposed 6-storey building (N/W corner) has same grade as top of curb in roadway. Please ensure this does not occur at any other location on site.
   R/ Grade adjusted to ensure emergency overland flow path progresses away from building edge.

4. Indicate if you will have ponding at the proposed CB and CBMH's. You should show the ponding on the plans. Revise if applicable.
   R/ No surface ponding is proposed with the exception of area A4 (CB 500). Ponding area shown on drawing GP-1.

Site Servicing Plan, Dwg SSP-1, prepared by Stantec Consulting Ltd., revision 1 dated April 1, 2019:

1. See notes above regarding SWM report.
   R/ See responses above regarding SWM report.
2. Revise all that is required and ensure these revisions are captured in the Servicing and Stormwater Management Report.
   R/ Revised as noted.
3. Back flow valves for service lateral connections are to be shown on the plans.
   R/ Backflow valves are internal to proposed building, and will form part of building permit application package to meet building code requirements.

Storm Drainage Area Plan. Dwg SD-1, prepared by Stantec Consulting Ltd., revision 1 dated April 1, 2019:

1. See notes above regarding SWM report.
   R/ See responses above regarding SWM report.
2. Revise all that is required and ensure these revisions are captured in the Servicing and Stormwater Management Report.
   R/ Revised as noted.
3. Show all ponding area (particularly at CBs and CBMHs) relative to 5 and 100-year storm event(s) if applicable. Ensure this information is in the Servicing and Stormwater Management Report.
   R/ Ponding area note revised for CB 500.
4. Provide information on type of underground storage system including product name and model, number of chambers, chamber configuration, confirm invert of chamber system, top of chamber system, required cover over system and details, etc., interior bottom slope (for self cleansing), chart of storage values, width and height, capacity etc.
   R/ See responses above relating to subsurface storage cistern. Subsurface storage pipe for drainage areas A1, A3, EXT2, A4 is existing, and detailed on previously approved Phase 1 drawings.

Erosion & Sediment Control Plan, Dwg EC/DS-1, prepared by Stantec Consulting Ltd., revision 1 dated April 1, 2019:

1. Provide a Note: Contractor is responsible to keep the roads free and clean from mud or debris.
   R/ Additional note added to plan.
2. Insert the following opening paragraph in Notes*, "The contractor shall implement best management practices, to provide for protection of the area drainage system and the receiving watercourse, during construction activities. The contractor acknowledges that failure to implement appropriate erosion and sediment control measures may be subject to penalties imposed by any applicable regulatory agency."*
   R/ Additional note added to plan.
3. Provide North Arrow on plan.
   R/ Revised as noted.
4. Silt fence should be extended along property line to northern development limits at east side of property.
   R/ Revised as noted.

Reference: **114 Richmond Road City Comments – D07-12-18-0080**

Roof Drainage Plan:

1. Not provided. Please submit a plan of proposed roof drainage or revise SWM or Site Plan accordingly.
   R/ Not provided – please see responses to servicing and stormwater management report above.
2. Provide roof drain type with specified opening setting and/or controlled Q.
   R/ Assumed roof drain type and release rates previously provided within section 5.3.2.1, and calculations within Appendix C
3. Provide 2, 5 and 100 year storm event flood plain area on roof.
   R/ Assumed ponding areas noted on previously provided calculations within Appendix C. Note that assumed ponding regions are subject to roof design by others to be designed to meet SWM objectives based on flow control roof drainage declaration – see responses to servicing report comments above.
4. Provide scupper locations with outlet elevation.
   R / Scupper locations to be designed by others at time of building permit application to meet building code requirements & those identified within the flow control roof drainage declaration.

Regards,

Stantec Consulting Ltd.

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