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SITE SERVICING & STORMWATER MANAGEMENT REPORT

PROPOSED REDEVELOPMENT OF WESTGATE SC
PHASE 1B (BUILDING B)
1309 CARLING AVENUE
OTTAWA, ONTARIO

REPORT NO. 25013

MAY 9, 2025
REVISED JULY 7, 2025
REVISED AUGUST 13, 2025
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1.0 INTRODUCTION

This report has been prepared in support of the Site Plan Control application for the Phase 1B redevelopment of Westgate Shopping Centre located on a 3.05-hectare property at 1309 Carling Avenue in Ottawa, Ontario. Phase 1B includes a 2,572 m^2 one-storey retail building and the construction of a new parking area. Phase 1B is part of a multi-phase, multi-year development that is expected to be built over many years. The ultimate development may not include the currently proposed building, and the currently proposed site layout may be different. Refer to Pre-Application Consultation meeting notes in Appendix A.

This report forms part of the site servicing and stormwater management design for the proposed development. Also refer to drawings C-1 to C-16 prepared by D.B. Gray Engineering Inc.

2.0 WATER SERVICING

2.1 WATER SUPPLY FOR FIREFIGHTING

The existing Building A has a sprinkler system with the fire department connection located at the NW corner of the building. The proposed Phase 1B Building will have a sprinkler system internally branched off within the existing Building A. The sprinkler system is expected to be designed, installed and maintained in accordance with NFPA standards and the Fire Underwriters Survey. Refer to Appendix B. The closest existing fire hydrant is an onsite private located at the northwest corner of the Phase 1B Building. It is about 80 m unobstructed distance to the existing fire department connection (FDC), which is greater than the maximum 45 m required by the Ontario Building Code (OBC); therefore, an additional fire hydrant is required. A private fire hydrant is proposed to be located next to the Phase 1B Building loading docks. It is a 40 m unobstructed distance to the existing FDC.

In accordance with City of Ottawa Technical Bulletin IWSTB-2024-05, when calculating the required fire flow on private property in urban areas, the OBC method is to be used. Using the OBC method, the required fire flow of the existing Building A and Phase 1B Building is calculated to be 9,000 L/min (150 L/s). In accordance with City of Ottawa Technical Bulletin IWSTB-2024-05, when the OBC method yields a required fire flow of 9,000 L/min (150 L/s), the Fire Underwriters Survey (FUS) method is to be used instead. The Phase 1B Building is expected to be of noncombustible construction (Type II) in accordance with the Fire Underwriters Survey. Refer to Appendix B. Using the FUS method, the required fire flow of the existing Building A and Phase 1B Building is calculated to be 7,000 L/min (116.7 L/s). Refer to calculations in Appendix B.

The boundary conditions in the 400 mm Carling Avenue municipal watermain provided by the City of Ottawa for the 116.7 L/s fire flow at the subject property indicate a hydraulic grade line (HGL) of 125.0 m at Connection 1. Refer to Appendix B. This HGL calculates to 498 kPa (72 psi). Since the pressure is above the Ontario Building Code's minimum required pressure of 140 kPa (20 psi), there is an adequate water supply for firefighting from the existing municipal water distribution system. Fire hydrant flow tests were also performed on the two nearest existing private fire hydrants. Refer to Appendix B. Using the Hazen-Williams Formula, it is calculated that 116.7 L/s is available from each of the two fire hydrants tested, one at 337 (49 psi) and the other at 350 kPa (51 psi). (Using EPANET, a model was created to analyze the hydraulics of the private watermain, and the results agree with the fire hydrant flow tests: At a fire flow of 116.7 L/s the pressure at the proposed hydrant is 361 kPa (52 psi). Refer to Appendix B – 37th & 38th page of this report.) Since the pressure is above the OBC's minimum required pressure of 140 kPa (20 psi), the

private fire hydrant can be classified as Class AA and can contribute 5,700 L/min (95 L/s). Since the pressure is greater than the required minimum of 140 kPa (20 psi), there is an adequate water supply for firefighting from the existing private water distribution system. (Using the Hazen-Williams Formula, 169.0 L/s and 172.2 L/s is available at 140 kPa (20 psi) at the two fire hydrants tested.)

2.2 DOMESTIC WATER SUPPLY

In accordance with the City of Ottawa Water Design Guidelines for the consumption rate and peaking factors, the average daily demand is calculated to be 1.0 L/s, the maximum daily demand is calculated to be 1.5 L/s, and the maximum hourly demand is calculated to be 2.7 L/s. There is also a proposed irrigation system that will have three zones at 15 USgpm per zone, with each zone operating 30 minutes every 3 to 4 days. Including the irrigation system the average daily demand, maximum daily demand and maximum hourly demand are 1.0 L/s, 2.5 L/s and 3.6 L/s, respectively. Refer to calculations in Appendix B.

The boundary conditions in the 400 mm Carling Avenue municipal watermain provided by the City of Ottawa at the subject property indicate a minimum HGL of 124.4 m and a maximum HGL of 132.8 m. Refer to Appendix B. Based on these boundary conditions, the pressure at the water meter is calculated to vary between 481 kPa (70 psi) and 563 kPa (82 psi). This is an acceptable range of water pressures; however, since the water pressure may be above 80 psi at times, a pressure-reducing valve may be required to be installed immediately after the water meter.

The fire hydrant flow tests performed on the two nearest existing private fire hydrants measured the static pressure to be 78 and 80 psi which is within the above range of pressures, and, therefore, agrees with the boundary conditions. This indicates that range of water pressures in the private watermain is acceptable, and a pressure reducing valve may be required. Refer to Appendix B.

A 150 mm water service connecting to the existing 200 mm private watermain is currently servicing the existing Building A sprinkler system and will also service the Phase 1B Building sprinkler system. The same 150 mm water service will provide an adequate domestic water and irrigation supply to the Phase 1B Building.

3.0 SANITARY SERVICING

In accordance with

i. the City of Ottawa Sewer Design Guidelines for the peaking factor, and
ii. City of Ottawa Technical Bulletin ISTB-2018-01 for the average daily flow and infiltration allowance,

the post-development sanitary flow rate of the existing Building A is calculated to be 1.24 L/s, and the post-development sanitary flow rate of the Phase 1B Building is calculated to be 1.24 L/s. A 200 mm sanitary sewer service at 2% slope (46.38 L/s capacity) is proposed to service the Phase 1B Building. At the design flow rate the sanitary sewer service will only be at 3% of its capacity. The proposed 200 mm sanitary sewer service will connect to an existing 250 mm private sanitary sewer, which at 0.3% slope has a capacity of 32.57 L/s. The pre-development sanitary flow rate is calculated to be 2.49 L/s. Refer to calculations in Appendix C. The Phase 1B redevelopment is expected to have a negligible impact on the existing sanitary sewers.

4.0 STORMWATER MANAGEMENT

4.1 QUANTITY CONTROL

As per the conceptual stormwater management design that was approved as part of the Master Site Plan: The stormwater quantity control criterion is to control the Phase 1B post-development peak flows to 97.5 L/s/ha. Phase 1B of the redevelopment includes 14,932 m^2 of the property; therefore, the maximum allowable release rate for Phase 1B is calculated to be 145.59 L/s.

The Rational and Modified Rational Methods are used to calculate the post-development flow rates and corresponding storage volumes. Refer to calculations in Appendix D.

It is calculated that the pre-development conditions reflect a runoff coefficient of 1.00 during the 100-year event and 0.90 during the 2-year event. Using the Rational Method with a time of concentration of 10 minutes, the pre-development flow rates are calculated to be 741.22 L/s during the 100-year event and 286.94 L/s during the 2-year event.

Drainage Area 'Northwest (PH 1B)' (Uncontrolled Flow – 451 m^2)
The loading dock area will drain uncontrolled off site. Refer to the Drainage Plan on drawing C-16. The flow rates are calculated at a time of concentration of 10 minutes.

	100-Year Event	2-Year Event
Maximum Flow Rate	22.39 L/s	8.67 L/s

Drainage Area 'South (PH 1B)' (Uncontrolled Flow – 1,558 m^2)
The southern part of the area being redeveloped currently drains uncontrolled off site. It is not practical to control this area in Phase 1B; therefore, this condition will remain. Refer to the Drainage Plan on drawing C-16. The flow rates are calculated at a time of concentration of 10 minutes.

	100-Year Event	2-Year Event
Maximum Flow Rate	74.96 L/s	28.98 L/s

Drainage Area I (Roof – 2,614 m^2)
Each of the 10 roof drains on the roof of the proposed building are to be flow control type roof drains, which will restrict the flow of stormwater and cause it to pond on the roof. Each roof drain is to be installed with a single-parabolic slotted weir and release 0.01242 L/s/mm (5 USgpm/in). Roof drains are to be Watts with an Accutrol Weir RD-100-A1 or approved equivalent. The opening at the top of the flow control weir is to be a minimum of 50 mm in diameter. A minimum of 10 scuppers each, a minimum 760 mm wide, are to be installed 150 mm above the roof drains. Refer to architectural for exact locations and details. The roof is to be designed to carry the load of water having a 50 mm depth at the scuppers (i.e. 200 mm depth at the roof drains). Refer to structural.

	100-Year Event	2-Year Event
Maximum Release Rate	15.86 L/s	10.15 L/s
Maximum Depth at Roof Drains	128 mm	82 mm
Maximum Volume Required	93.00 m^3	29.08 m^3
Maximum Volume Available	143.13 m^3	143.13 m^3

Drainage Area II (Phase 1B – 5,666 m^2)

An inlet control device (ICD) located in the outlet pipe of catch basin / manhole CB/MH-8 will restrict the flow of stormwater and cause it to backup into the upstream infrastructure and pond above catch basin/ manholes CB/MH-1, CB/MH-2, CB/MH-3, CB/MH-5, CB/MH-6, CB/MH-7, CB/MH-8 and CB-8A. (Stormwater will also pond in the grassed area above catch basin CB-4. However, this temporary and in Phase 2 CB-4 will be removed and the grassed area will not be available for storage. Therefore, this storage is ignored for now. See Drainage Area II (Phase 1B + Phase 2) below.) The ICD will be a plug style with a round orifice located at the bottom of the plug manufactured by Pedro Plastics or approved equivalent, sized by the manufacturer for a release rate of 24.80 L/s at 1.64 m. It is calculated that an orifice area of 7,163 sq.mm (±96 mm dia.) with a discharge coefficient of 0.61 will restrict the outflow rate to 24.80 L/s at a head of 1.64 m. Based on this orifice the maximum outflow rate for the 2-year storm event is calculated to be 14.13 L/s at 0.53 m. Since some of the restricted stormwater is proposed to be stored using underground infrastructure, an average release rate equal to 50% of the maximum release rate is used to calculate the required storage volumes. The underground infrastructure will consist of 165 – Soleno HydroStor HS31 chambers or approved equivalent surrounded by clear stone wrapped in an impermeable thermoplastic liner.

	100-Year Event	2-Year Event
Maximum Release Rate	24.80 L/s	14.13 L/s
Maximum Water Elevation	74.07 m	72.96 m
Maximum Volume Required	271.22 m^3	96.11 m^3
Maximum Volume Available	372.38 m^3	372.38 m^3

Drainage Area III (Phase 1B – 4,493 m^2)

An inlet control device (ICD) located in the outlet pipe of catch basin / manhole CB/MH-16 will restrict the flow of stormwater and cause it to backup into the upstream infrastructure and pond above catch basin/ manhole CB/MH-15. (Stormwater will also drain from areas not being developed at this time. This drainage is ignored for now. See Drainage Area III (Phase 1B) + Post Northwest) below.) The ICD will be a vortex style manufactured by Hydrovex (or approved equal) sized by the manufacturer for 6.12 L/s at 0.89 m. It is calculated that an orifice area of 7,854 mm2 (100 mm dia.) with a discharge coefficient of 0.187 will achieve the release rate of 6.12 L/s at 0.89 m. Based on this orifice the maximum release rate for the 2-year event is calculated to be 3.63 L/s at 0.31 m. Since stormwater is proposed to be stored using underground infrastructure, an average release rate equal to 50% of the maximum release rate is used to calculate the required storage volumes. The underground infrastructure will consist of 84 – Soleno HydroStor HS180 chambers or approved equivalent surrounded by clear stone wrapped in an impermeable thermoplastic liner.

	100-Year Event	2-Year Event
Maximum Release Rate	6.12 L/s	3.93 L/s
Maximum Water Elevation	73.20 m	72.62 m
Maximum Volume Required	293.70 m^3	107.12 m^3
Maximum Volume Available	417.91 m^3	417.91 m^3

Summary

	100-Year Event	2-Year Event
Pre-development Flow Rate	733.77 L/s	284.06 L/s
Maximum Allowable Release Rate	144.12 L/s	144.12 L/s
Maximum Release Rate	144.12 L/s	65.56 L/s
Max. Allowable Release Rate per Ha	97.5 L/s/ha	97.5 L/s/ha
Maximum Volume Required	657.92 m^3	107.12 m^3
Maximum Volume Available	933.42 m^3	933.42 m^3

The maximum post-development release rate during the 100-year event is calculated to be 80% less than the pre-development flow rate during the 100-year event; 77% less during the 2-year event. The maximum post-development release rate during the 100-year event is calculated to be equal to the maximum allowable flow rate during the 100-year event; 45% less than the maximum allowable during the 2-year event. To achieve the release rates, a maximum storage volume of 657.92 m^3 is required during the 100-year event; 933.42 m^3 is available. The Phase 1B post-development reduction in flow is expected to have a positive impact on the existing private and municipal storm sewers.

Drainage Area II (Phase 1B + Phase 2 – 9,466 m^2)
Until Phase 2 is built, stormwater will pond in the grassed area above catch basin CB-4, providing a significant amount of temporary storage. This will temporarily result in lower release rates and significantly lower ponding elevations during the 100-year event.

	100-Year Event	2-Year Event
Maximum Release Rate	24.26 L/s	15.52 L/s
Maximum Water Elevation	74.00 m	73.07 m
Maximum Volume Required	335.15 m^3	112.87 m^3
Maximum Volume Available	688.78 m^3	688.78 m^3

Drainage Area III (Phase 1B) + Post Northwest) – 13,357 m^2)
The proposed storage infrastructure for Drainage Area III will also receive drainage from areas not being developed at this time (Post Northwest drainage area).

	100-Year Event	2-Year Event
Maximum ICD Release Rate	7.86 L/s	5.67 L/s
Maximum Overflow Rate	29.28 L/s	0.00 L/s
Maximum Total Release Rate	37.14 L/s	5.67 L/s
Maximum Water Elevation	73.77 m	73.07 m
Maximum Volume Required	548.02 m^3	255.86 m^3
Maximum Volume Available	417.91 m^3	417.91 m^3

4.2 QUALITY CONTROL

The existing development has no permanent quality control measures, and none are proposed.

4.3 EROSION & SEDIMENT CONTROL

Erosion & Sediment Control Plans have been developed to be implemented during construction. Refer to drawings C-10 and C-11, and notes on drawing C-12. Sediment capture filter sock inserts are to be installed in all existing and proposed catch-basins and catch-basin/manholes adjacent to and within the site; any material deposited on the public road is to be removed; and water spraying and other dust suppression measures will be implemented when dust generating activities are taking place.

4.4 STORM SERVICING

The peak unrestricted Phase 1B Building roof flow rate during the 2-year event is calculated to be 50.23 L/s. A 300 mm storm sewer service at 2% slope (136.76 L/s capacity) is proposed to service the building. At the peak unrestricted 2-year flow rate the storm sewer service would only be at 37% of its capacity. The peak restricted flow rate through the flow control roof drains during the 2-year event is calculated to be 10.15 L/s. At the peak restricted 2-year flow rate the storm sewer service will only be at 7% of its capacity. Refer to calculations in Appendix D.

The peak unrestricted flow rate draining into the Drainage Area II private storm sewer system during the 2-year event is calculated to be 151.90 L/s. A 375 mm storm sewer at 0.27% slope (91.10 L/s capacity) is proposed to connect to the existing 900 mm private storm sewer, which at 0.4% slope has a capacity of 1,193 L/s. At the peak unrestricted 2-year flow rate the proposed 375 mm storm sewer would be at 167% of its capacity; however, the peak restricted flow rate draining into this private storm sewer system during the 2-year event is calculated to be only 15.92 L/s; only 17% of the capacity of the 375 mm sewer. Refer to calculations in Appendix D.

The peak unrestricted flow rate draining into the Drainage Area III private storm sewer system during the 2-year event is calculated to be 252.91 L/s. This proposed system connects to an existing 450 mm storm sewer at 0.22% slope (138.53 L/s capacity). At the peak unrestricted 2-year flow rate the existing 450 mm storm sewer would be at 183% of its capacity; however, the peak restricted flow rate draining into this private storm sewer system during the 2-year event is calculated to be only 63.41 L/s; only 46% of the capacity of the 450 mm sewer. Refer to calculations in Appendix D.

The rainwater leaders inside the Phase 1B Building are to be constructed to withstand the pressure from a water column the height of the rainwater leader. Pressure tests are to be performed on the systems in accordance with the mechanical engineer's instructions.

4.5 SITE DRAINAGE

Approximately 1.29 ha from adjacent lands drains onto the subject property. Refer to drawings C-15 (Pre-development Drainage Plan) and C-16 (Post development Drainage Plan) and calculations on the 42nd to 50th pages of this report.

East Drainage Area:
Pre-development about 1.43 ha drains east; post development the area is reduced by 31% to 0.98 ha; and the flowrate is reduced by 35%.

Northwest Drainage Area:
Pre-development about 1.86 ha drains north onto the Hydro lands (then drains west); post development the area is reduced by 12%. Due to the proposed stormwater management facility, the flowrate is reduced by 94% during the 100-year event and 92% during the 2-year event.

West Drainage Area:
Pre-development this drainage area is about 0.06 ha; post development the area and flowrate decreases by 12%.

South Drainage Area:
Pre-development about 0.99 ha drains south; post development the area increases by 68% to 1.66 ha; but due to the controlled Drainage Area II (controlled by an ICD in the outlet pipe of CB/MH-8), the flowrate is reduced by 25% during the 100-year event and 22% during the 2-year event.

Total Drainage Area:
Post development flowrate is reduced by 57% during the 100-year event and by 55% during the 2-year event.

4.6 ENVIRONMENTAL COMPLIANCE APPROVAL / ENVIRONMENTAL ACTIVITY AND SECTOR REGISTRY

Since the proposed stormwater management facility serves two adjacent properties, either an Environmental Compliance Approval (ECA) or an Environmental Activity and Sector Registry (EASR) is expected to be required. There may be an existing ECA for the property that either needs to be amended or replaced with an EASR.

5.0 CONCLUSIONS

1. A private fire hydrant is required and provided.

2. There is an adequate water supply for firefighting from the existing municipal water distribution system.

3. Based on fire hydrant flow tests there is an adequate water supply for firefighting from the existing private water distribution system.

4. There is an acceptable range of water pressures in the existing municipal water distribution system.

5. Based on fire hydrant flow tests, the water pressure in the existing private water distribution system is acceptable.

6. Since the water pressure may be above 80 psi at times, a pressure reducing valve may be required to be installed immediately after the water meter.

7. The Phase 1B Building sanitary flow rate will be adequately handled by the proposed sanitary sewer service.

8. The Phase 1B redevelopment is expected to have a negligible impact on the existing sanitary sewers.

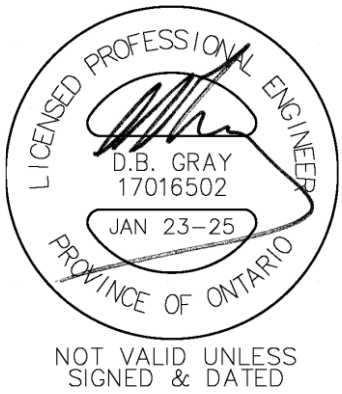
9. The Phase 1B post-development reduction in stormwater flow is expected to have a positive impact on the existing storm sewers.

10. Erosion & Sediment Control Plans have been developed to be implemented during construction.

11. The Phase 1B peak unrestricted flow rates during the 2-year event will be adequately handled by the proposed storm sewer service and private storm sewer systems.

12. The rainwater leaders inside the Phase 1B Building are to be constructed to withstand the pressure from a water column the height of the rainwater leader. Pressure tests are to be performed on the systems in accordance with the mechanical engineer's instructions.

Prepared by D.B. Gray Engineering Inc.



APPENDIX A

PRE-APPLICATION CONSULTATION MEETING NOTES

File No.: PC2024-0461

December 4, 2024

Mark McElligott
Fotenn
Via email: mcelligott@fotenn.com

Subject: Pre-Consultation: Meeting Feedback
Proposed Site Plan Control Application – 1309 Carling Avenue

Please find below information regarding next steps as well as consolidated comments from the above-noted pre-consultation meeting held on November 15, 2024.

Pre-Consultation Preliminary Assessment

1 ☐	**2** ☐	**3** ☐	**4** ☒	**5** ☐

One (1) indicates that considerable major revisions are required while five (5) suggests that the proposal appears to meet the City's key land use policies and guidelines. This assessment is purely advisory and does not consider technical aspects of the proposal or in any way guarantee application approval.

Supporting Information and Material Requirements

1. The attached **Study and Plan Identification List** outlines the information and material that has been identified, during this phase of pre-consultation, as either required (R) or advised (A) as part of a future complete application submission.

    a. The required plans and studies must meet the City's Terms of Reference (ToR) and/or Guidelines, as available on Ottawa.ca. These ToR and Guidelines outline the specific requirements that must be met for each plan or study to be deemed adequate.

Consultation with Technical Agencies

1. You are encouraged to consult with technical agencies early in the development process and throughout the development of your project concept. A list of technical agencies and their contact information is enclosed.

Proposal Overview

1. Proposed 30,000 sq ft (2,787 sqm) food store. It would abut the existing Shoppers Drug Mart store. The remainder of the existing Westgate shopping mall building would be demolished. The existing surface parking lot would be

realigned per the concept site plan. There would be a total 725 parking spaces (101 spaces removed; 137 spaces added).

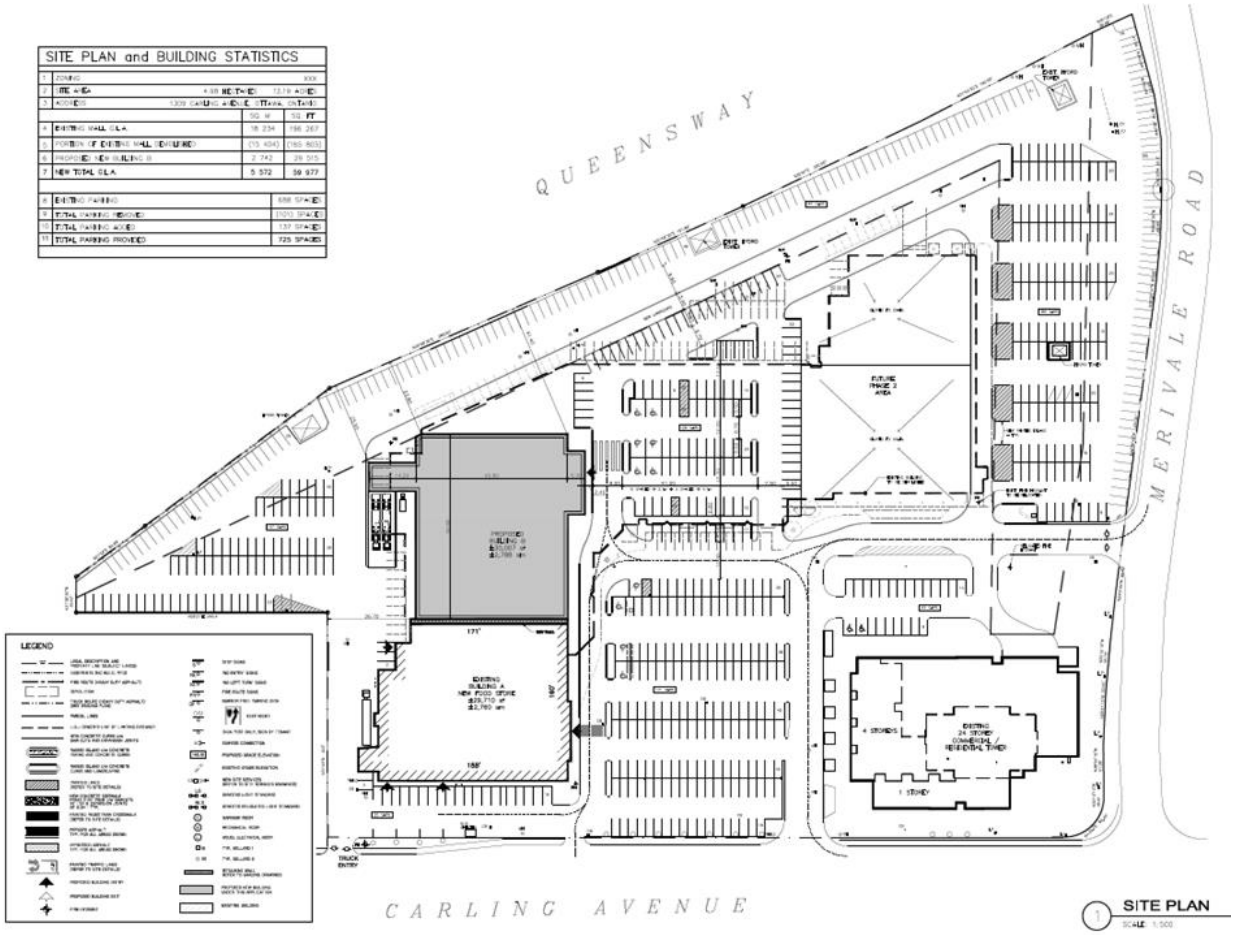


Figure 1 Conceptual Site Plan (dated October 28, 2024, prepared by LLA Architecture)

Planning

Comments:

1. The site is subject to Area Specific Policies #31 - Westgate in Volume 2C of the Official Plan. These policies outline specific requirements during future development onsite.

    a. This development can be considered an interim phase within the wider scope of the Area-Specific Policy.

    b. Policies 31.3, 31.8 and 31.14 refer to new development (not to phase 2) therefore please ensure compliance.

31.3 Applications for new development shall demonstrate how they provide pedestrian and cycling facilities, Privately-Owned Public Spaces (POPS), streets, and other considerations, consistent with Schedule 31.A - Designation Plan, Volume 2C - Official Plan, and the wider objectives for this policy area.

31.8 The Westgate promenade and shared space, shown on Schedule 31.A - Designation Plan, Volume 2C - Official Plan, are to be designed and function as private roads. Active building facades will abut the Westgate POPS. The Westgate Promenade is to be designed to accommodate all users with an emphasis on active modes of transportation. Intersections are to be pedestrianized, using appropriate design cues, to ensure motor vehicle drivers are aware of these pedestrian priority areas. Animated ground floor frontages facing the Westgate promenade are also required.

31.14 Pedestrian and cycling connections are required, as identified on Schedule 31.A - Designation Plan, Volume 2C - Official Plan, across private land in the Westgate Lands and Westgate-Carling South Transition Area, at time of redevelopment, to connect the surrounding community to the mid-block crossing points on Carling Avenue, as designated for the policy area.

c. Policy 31.7(a) requires 40% POPS be provided in "second phase of Westgate Lands redevelopment". Given the understanding that this is an interim phase the 40% is not required at this time but it is strongly suggested that it be advanced through this application if possible.

d. Although many of the cycling policies are not applicable through this interim plan, proper cycling and/or pedestrian connections through the site are still required.

2. The site is located within the Inner Urban Area transect in the City's Official Plan and is designated as a Hub (whole site) and as Corridor - Mainstreet (along Carling Avenue). Additionally, the O-train station identified at abutting corner of Carling and Merivale.

3. The site is zoned AM10[2393] S368, please provide a Zoning Confirmation Report.

    a. It was confirmed by the By-law Interpreters and Zoning Plans Examiners that (10)(b)(ii)2) in AM10 is not applicable in this case.

4. A new phasing plan will be required to be approved through this new application.

5. Any existing easements on site should be clearly identified and related details provided.

Urban Design

Comments:

6. Staff require an Urban Design Brief, architectural plans (Site Plan, Building Elevations, etc.), and a Landscape Plan. Please refer to the attached Urban Design Brief Terms of Reference.

7. Design Priority Area – the proposal at the scale proposed would not require a visit to the UDRP.

8. Please provide a revised phasing diagram and timeline estimate for each development phase taking the current proposal into consideration.

9. Staff are keen to see the Carling Avenue frontage developed to align with the original development plan and phasing strategy.

10. Staff support the addition of a food store on the property but would prefer to see the food store in the base of a mixed-use development.

11. If large format retail is deemed to be an appropriate interim use (approximately 20 years), staff would prefer that the new plaza be constructed at the rear or the site so that public road edges could be developed over time with mixed-use developments as originally planned.

Feel free to contact Nader Kadri, Planner III – Urban Design, for follow-up questions.

Engineering

Comments:

12. The Stormwater Management Criteria, for the subject site, is to be based on the ***"Site Servicing and Stormwater Management Report – 1309 Carling Avenue Phase 1"****, Project No. 18-1028. Prepared by DSEL, revision 3, dated July 2019,* and the "***Assessment of Adequacy of Public Services – 1309 & 1335 Carling Avenue****", Project No. 15-793. Prepared by DSEL, revision 2, dated May 2016* reports*:*

    a. Application of the IDF information derived from the Meteorological Services of Canada rainfall data, taken from the MacDonald Cartier Airport, collected 1966 to 1997.

    b. A calculated time of concentration (cannot be less than 10 minutes).

    c. Flows to the storm sewer in excess of the established allowable storm release rate, up to and including the 100-year storm event, must be detained on site.

a. Storm sewer outlets should not be submerged.

d. The quantity control criteria is to attenuate all storms up to and including the City of Ottawa 100-year design event on site to an equivalent rate of 97.5 L/s/ha.

e. Quality control is not required for the proposed development due to the site's distance from the outlet; however, opportunities to enhance water quality by use of LIDs and best-management practices are recommended and encouraged for this application.

13. Deep Services (Storm, Sanitary and/or Water Supply) shall be as contemplated in the aforementioned reports. If servicing locations change from what was proposed in the Adequacy of Public Services report, contact the City Project Manager to confirm design criteria.

Water

a. Serviced internally from existing private watermains.

Sanitary

b. 250 mm dia. SAN Sewer on Carling Avenue

c. 1050 mm dia Conc. SAN Sewer on Merivale Avenue. Connection to be into existing maintenance hole.

Stormwater

d. 375 mm dia. STM Sewer on Merivale Avenue

Servicing Details

e. Connections to trunk sewers and easement sewers are typically not permitted. Contact City Project Manager if a connection to a trunk sewer is required. Additional submission/design requirements will be confirmed at the time of the request.

f. A sanitary monitoring maintenance hole will be required. Place the monitoring maintenance hole outside of vehicular traffic paths, and place as close to the property line (on the private property side) as possible.

g. Review provision of a high-level sewer.

h. Sewer connections to be made above the springline of the sewermain as per:

i. Std Dwg S11.1 for flexible main sewers – connections made using approved tee or wye fittings.

ii. Std Dwg S11 (For rigid main sewers) – lateral must be less that 50% the diameter of the sewermain,

iii. Std Dwg S11.2 (for rigid main sewers using bell end insert method) – for larger diameter laterals where manufactured inserts are not available; lateral must be less that 50% the diameter of the sewermain,

iv. Connections to manholes permitted when the connection is to rigid main sewers where the lateral exceeds 50% the diameter of the sewermain. – Connect obvert to obvert with the outlet pipe unless pipes are a similar size.

14. An MECP Environmental Compliance Approval **Private Sewage Works** may be required for the proposed development. A Ministry contact has been provided below but please work with City staff on the need (or not) of an application.

    a. Shannon Hamilton-Browne at (613) 521-3450 or Shannon.Hamilton-Browne@ontario.ca

15. Water

    a. Capacity should be verified. Submit a request for boundary conditions to the City of Ottawa Project Manager.

    b. A Water Data Card will be required for each building to determine the meter size. A Water Data Card can be submitted post-approval, prior to issuing a Commence Work Notification.

    c. Water Boundary condition requests must include the location of the service (map or plan with connection location(s) indicated) and the expected loads required by the proposed development, including calculations. Please provide the following information:

        i. Location of service

        ii. Type of development

        iii. The amount of fire flow required (per OBC or FUS).

        iv. Average daily demand: ___ l/s.

        v. Maximum daily demand: ___l/s.

        vi. Maximum hourly daily demand: ___ l/s.

16. Sewer Capacity (sanitary and storm)

a. Submit the proposed wastewater peak flow for this phase to the City of Ottawa Project Manager to confirm available capacity and/or any specific design criteria.

b. Submit the proposed stormwater peak flow for this phase to the City of Ottawa Project Manager to confirm available capacity and/or any specific design criteria.

17. Fire-fighting flow rate(s) shall be calculated per the FUS2020 methodology.

18. A site-specific Geotechnical investigation is required (including, where applicable, detailed sensitive marine clay investigation). Consider shoring/encroachments details and impacts to neighbouring properties and/or the public realm.

19. A Slope stability investigation will be required if there are any retaining walls with heights more than 1.0m proposed on-site.

Feel free to contact Tyler Cassidy, P.Eng., Project Manager, for follow-up questions.

Noise

Comments:

20. Noise study is not required.

Feel free to contact Reed Adams, TPM, for follow-up questions.

Transportation

Comments:

21. TIA:

    a. Not required

22. ROW:

    a. Ensure that the development proposal complies with the Right-of-Way protection requirements of the Official Plan's Schedule C16.

        i. Any requests for exceptions to ROW protection requirements must be discussed with Transportation Planning and concurrence provided by Transportation Planning management.

23. Site Plan:

    a. As the proposed site is commercial and for general public use, AODA legislation applies.

i. Ensure all crosswalks located internally on the site provide a TWSI at the depressed curb, per requirements of the Integrated Accessibility Standards Regulation under the AODA.

ii. Clearly define accessible parking stalls and ensure they meet AODA standards (include an access aisle next to the parking stall and a pedestrian curb ramp at the end of the access aisle, as required).

iii. Please consider using the City's Accessibility Design Standards, which provide a summary of AODA requirements.

b. Show all details of the roads abutting the site; include such items as pavement markings, accesses and/or sidewalks.

c. Turning movement diagrams required for all accesses showing the largest vehicle to access/egress the site.

d. Turning movement diagrams required for internal movements (loading areas, garbage).

e. Show all curb radii measurements; ensure that all curb radii are reduced as much as possible and fall within TAC guidelines (Figure 8.5.1).

f. Show dimensions for site elements (i.e. lane/aisle widths, access width and throat length, parking stalls, sidewalks, pedestrian pathways, etc.)

Feel free to contact Reed Adams, Transportation Project Manager, for follow-up questions.

Transportation Planning (Cycling)

Comments:

24. Please ensure that any works to either the Merivale Road frontage or the Carling Avenue frontage do not compromise city plans to add transit and cycling reserved lanes. The cycling facilities will be upgraded from the existing Carling westbound bike lanes and the Merivale southbound bike lanes to cycle tracks (ie. grade-separated from motor traffic).

Feel free to contact Robin Bennett, Project Manager – Cycling Programs, for follow-up questions.

Environmental Planner

Comments:

1. The City's Bird Safe Design Guidelines will apply to this application. Please review the document and incorporate mitigation measures as necessary.

2. The City has strong guidance for tree planting to help meet the urban forest canopy goals as well as to reduce the impacts of climate change and the urban heat island effect. Seek out opportunities for additional plantings where possible.

3. The parking lots are a high priority for tree planting as the large tracts of impermeable surface represent a particularly high risk of contributing the urban heat island.

4. Please note that the City prefers tree plantings to be of native and non-invasive species.

Feel free to contact Mark Elliott, Environmental Planner, for follow-up questions.

Parkland

Comments:

5. Cash-in-lieu of parkland conveyance will be required as a condition of site plan approval based on a rate of 2% of the gross land area for commercial uses in accordance with the provisions of Parkland Dedication By-law No. 2022-280. For commercial redevelopment, gross land area is defined as the portion of the property that is impacted by the proposed development.

Feel free to contact Burl Walker, Parks Planner, for follow-up questions.

Other

6. The High Performance Development Standard (HPDS) is a collection of voluntary and required standards that raise the performance of new building projects to achieve sustainable and resilient design and will be applicable to Site Plan Control and Plan of Subdivision applications.

    a. The HPDS was passed by Council on April 13, 2022, but is not in effect at this time, as Council has referred the 2023 HPDS Update Report back to staff with the direction to bring forward an updated report to Committee at a later date. The timing of an updated report to Committee is unknown at this time, and updates will be shared when they are available.

    b. Please refer to the HPDS information at ottawa.ca/HPDS for more information.

Submission Requirements and Fees

1. The following application type is required: New Complex Site Plan Control ($72,000.22 plus Initial Engineering Design Review and Inspection Fee plus

Consevantion Authority Fee $125.00). Please note that this is based on the 2024 fees which are subject to change in 2025.

   a. Additional information regarding fees related to planning applications can be found here.

2. The attached **Study and Plan Identification List** outlines the information and material that has been identified as either required (R) or advised (A) as part of a future complete application submission.

   a. The required plans and studies must meet the City's Terms of Reference (ToR) and/or Guidelines, as available on Ottawa.ca. These ToR and Guidelines outline the specific requirements that must be met for each plan or study to be deemed adequate.

3. All of the above comments or issues should be addressed to ensure the effectiveness of the application submission review.

Should there be any questions, please do not hesitate to contact myself or the contact identified for the above areas / disciplines.

Yours Truly,
Mélanie Gervais, MCIP, RPP

Encl. Study and Plan Identification List (SPIL)
Pre-con Supplementary Development Information
HPDS Overview for Applicants
HPDS Example Checklist
Urban Design Brief Terms of Reference

c.c.
Nader Kadri, Urban Design
Tyler Cassidy, IPM
Reed Adams, TPM
Burl Walker, Parks
Robin Bennett, Transportation Planning
Samantha Gatchene, Planning
Nathan Li, Planning

APPENDIX B

WATER SERVICING

D.B. Gray Engineering Inc.

Stormwater Management - Grading & Drainage - Storm & Sanitary Sewers - Watermains

700 Long Point Circle
Ottawa, Ontario K1T 4E9

613-425-8044
d.gray@dbgrayengineering.com

March 4, 2025

1309 Carling Avenue

Existing Building A and Phase 1B Building

Ottawa, Ontario

FIRE FLOW CALCULATIONS

OBC Method

Q = Required water supply in litres
= KVS_{Total}

K = Water supply coefficient as per OBC A-3.2.5.7. Table 1
= 10 Building is of noncombustible construction with fire separations with fire resistance ratings.

V = Building volume in cubic meters

	Floor Area (sq.m)	Height (m)	Volume (cu.m)
1st Floor:	5,580	6.1	34,038
			34,038

S_{Total} = Total of spatial coefficients from exposure distances
= $1.0 + S_{Side\ 1} + S_{Side\ 2} + S_{Side\ 3} + S_{Side\ 4}$

	Spatial Coefficient	Exposure Distance (m)	
$S_{Side\ 1}$	0.5	0.4	(to north property line)
$S_{Side\ 2}$	0.0	88	(east to Existing Building)
$S_{Side\ 3}$	0.0	38	(to centerline of Carling Avenue)
$S_{Side\ 4}$	0.0	28	(to centerline of Blohm Drive)
S_{Total}	1.5		

Q = 510,570 L
= 9,000 L/min as per OBC A-3.2.5.7. Table 2
= 150 L/s

D.B. Gray Engineering Inc.

Stormwater Management - Grading & Drainage - Storm & Sanitary Sewers - Watermains

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Ottawa, Ontario K1T 4E9

613-425-8044
d.gray@dbgrayengineering.com

March 4, 2025

1309 Carling Avenue

Existing Building A and Phase 1B Building

Ottawa, Ontario

FIRE FLOW CALCULATIONS

FUS Method

RFF = Required Fire Flow in litres per minute
= $220CA^{0.5}$

C = Construction Coefficient related to the type of construction of the building
= 0.8 Type II Noncombustible Construction

A = Total Effective Floor Area in square meters of the building

Mezzanine:	178	sq.m
1st Floor:	5,402	sq.m
	5,580	sq.m

RFF = 13,147 L/min
= 13,000 L/min (rounded to nearest 1,000 L/min)

Occupancy and Contents Adjustment Factor

	-15%	Limited Combustible Contents
=	-1,950	L/min Occupancy and Contents Adjustment Factor

RFF = 11,050 L/min

Automatic Sprinkler Protection Credit

	30%	Sprinkler system designed, installed and maintained in accordance with NFPA standards
	10%	Standard water supply for both the sprinkler system and fire department hose lines
=	4,420	L/min - Automatic Sprinkler Protection Credit

Exposure Adjustment Charge

Side	Charge	Distance	Construction	Length	Storeys	Factor
North	0%	over 30 m				
East	0%	over 30 m				
South	0%	over 30 m				
West	5%	20.1 m to 30 m	Type III	31	6	186

5% Exposure Adjustment Charge
= 553 L/min Exposure Adjustment Charge

RFF = 7,183 L/min
= 7,000 L/min (rounded to nearest 1,000 L/min)
= 116.7 L/s

116.7 L/s Fire Flow HGL:	125.0	m				
Grade Elevation at Connection 1 (approximate)	74.0	m				
Static Pressure at Fire Hydrant:	51.0	m	500	kPa	72.5	psi

WATER SUPPLY
FOR
PUBLIC FIRE PROTECTION

A Guide to Recommended Practice in Canada

2020

Fire Underwriters Survey

Construction Coefficient (C)

Note that the construction typology used by the insurance industry and public fire protection differs from the terms of reference in the National Building Code of Canada (NBC).

The following Construction Types and Coefficients are used in the required fire flow formula:

C	=	1.5 for **Type V** Wood Frame Construction
	=	0.8 for **Type IV-A** Mass Timber Construction
	=	0.9 for **Type IV-B** Mass Timber Construction
	=	1.0 for **Type IV-C** Mass Timber Construction
	=	1.5 for **Type IV-D** Mass Timber Construction
	=	1.0 for **Type III** Ordinary Construction
	=	0.8 for **Type II** Noncombustible Construction
	=	0.6 for **Type I** Fire Resistive Construction

When determining the predominate Construction Coefficient of a building, the following reference terms are used by fire underwriters and fire departments.

Wood Frame Construction (Type V)
A building is considered to be of Wood Frame construction (Type V) when structural elements, walls, arches, floors, and roofs are constructed entirely or partially of wood or other material.

Note: Includes buildings with exterior wall assemblies that are constructed with any materials that do not have a fire resistance rating that meets the acceptance criteria of CAN/ULC-S114. May include exterior surface brick, stone, or other masonry materials where they do not meet the acceptance criteria.

Mass Timber (Type IV)
Mass timber construction, including Encapsulated Mass Timber, Heavy Timber and other forms of Mass Timber are considered as one of the following sub-types relating to the fire resistance ratings of assemblies as follows:

- Type IV-A (Encapsulated Mass Timber)
    - A building is considered to be of Mass Timber Type IV-A (Encapsulated Mass Timber) construction when structural elements, walls, arches, and floors have a minimum 2-hour fire resistance rating and the roof has a minimum 1 hour fire resistance rating. Additionally all elements of the building must meet the requirements set out for Encapsulated Mass Timber Construction within the 2020 National Building Code of Canada . For types of mass timber construction that do not fully meet these criteria, treat as Type IV-B, Type IV-C or Type IV-D.
- Type IV-B (Rated Mass Timber)
    - A building is considered to be of Mass Timber Type IV-B (Rated Mass Timber) construction when the building assemblies include mass timber construction elements and all structural elements, exterior walls, interior bearing walls and roof have a minimum 1-hour fire resistance rating.

- Type IV-C (Ordinary Mass Timber)
    - A building is considered to be of Mass Timber Type IV-C (Partially Rated Mass Timber) construction when exterior walls are of Mass Timber construction with a minimum 1-hour fire resistance rating. Other structural elements, interior bearing walls and the roof may not have a fire resistance rating.
- Type IV-D (Un-Rated Mass Timber)
    - A building is considered to be of Mass Timber Type IV-D (Un-Rated Mass Timber) construction when exterior walls do not have a minimum 1-hour fire resistance rating, regardless of the fire resistance rating of other structural elements, interior bearing walls and the roof.

Ordinary Construction (Type III also known as joisted masonry)

A building is considered to be of Ordinary construction (Type III) when exterior walls are of masonry construction (or other approved material) with a minimum 1-hour fire resistance rating, but where other elements such as interior walls, arches, floors and/or roof do not have a minimum 1 hour fire resistance rating.

Noncombustible Construction (Type II)

A building is considered to be of Noncombustible construction (Type II) when all structural elements, walls, arches, floors, and roofs are constructed with a minimum 1-hour fire resistance rating and are constructed with noncombustible materials.

Fire-Resistive Construction (Type I)

A building is considered to be of Fire-resistive construction (Type I) when all structural elements, walls, arches, floors, and roofs are constructed with a minimum 2-hour fire resistance rating, and all materials used in the construction of the structural elements, walls, arches, floors, and roofs are constructed with noncombustible materials.

Items of Note Regarding Construction Coefficients

i. Unprotected noncombustible construction (example unprotected steel) should be considered within ordinary construction or noncombustible construction based on the minimum fire resistance rating of the structural elements, exterior walls, and interior bearing walls;
    - If minimum fire resistance rating of exterior walls is 1 hr, apply Ordinary Construction Coefficient (1.0)
    - If minimum fire resistance rating of all structural elements, walls, arches, floors, and roofs is 1 hr, apply Noncombustible Construction Coefficient (0.8).

ii. If a building cannot be defined within a single Construction Coefficient, the Construction Coefficient is determined by the predominate Construction Coefficient that makes up more than 66% or over of the Total Floor Area.

Automatic Sprinkler Protection

The required fire flow may be reduced by up to 50 percent for complete Automatic Sprinkler Protection depending upon adequacy of the system. Where only part of a building is protected by Automatic Sprinkler Protection, credit should be interpolated by determining the percentage of the Total Floor Area being protected by the automatic sprinkler system.

To be able to apply the full 50 percent reduction, the following areas should be reviewed to determine the appropriate level of credit for having Automatic Sprinkler Protection as per the table below:

Table 4 Sprinkler Credits

Automatic Sprinkler System Design	Credit	
	With complete building coverage	With partial building coverage of X%
Automatic sprinkler protection designed and installed in accordance with NFPA 13	30%	30% × Percentage of Total Floor Area Serviced by Sprinkler System
Water supply is standard for both the system and Fire Department hose lines	10%	10% × Percentage of Total Floor Area Serviced by Sprinkler System
Fully supervised system	10%	10% × Percentage of Total Floor Area Serviced by Sprinkler System

Automatic Sprinkler Protection Designed and Installed in Accordance with Applicable NFPA Standards (30%)

The initial credit for Automatic Sprinkler Protection is a maximum of 30% based on the system being designed and installed in accordance with the applicable criteria of NFPA 13, *Standard for Installation of Sprinkler Systems,* NFPA 13R, *Standard for the Installation of Sprinkler Systems in Low-Rise Residential* Occupancies, or NFPA 13D, *Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes* and being maintained in accordance with the applicable criteria of NFPA 25, *Standard for the Inspections, Testing and Maintenance of Water-Based Fire* (see Recognition of Automatic Sprinkler Protection).

Water Supply is Standard for both the Sprinkler System and Fire Department Hose Lines (10%)

To qualify to apply an additional 10% reduction, a water supply that is standard for both the sprinkler system and fire department hose lines is required, to qualify the following conditions should be satisfied:

a) Sprinkler system is supplied by a pressurized water supply system (public or private) that is designed and built with no major non-conformance issues (i.e. water supply system is designed in accordance with Part 1 of the Water Supply for Public Fire Protection to qualify for fire insurance grading recognition).
b) Calculated demand for maximum sprinkler design area operation in addition to hose stream requirements are below the available water supply curve (at the corresponding flow rate and pressure). An appropriate safety margin is used to take into account the difference between the available water supply curve at the time of hydrant flow testing as compared to the available water supply curve during Maximum Day Demand.

c) Volume of water available is adequate for the total flow rate including the maximum sprinkler design area operation plus required hose streams plus Maximum Day Demand for the full duration of the design fire event.
d) Residual pressure at all points in the water supply system can be maintained at not less than 150 kPa during the flowing of the sprinkler and required hose streams (plus Maximum Day Demand).

Fully Supervised System (10%)

To qualify to apply an additional 10% reduction, an automatic sprinkler system should be fully supervised. The purpose of the supervisory signal is to ensure that malfunctions of the automatic sprinkler system will be discovered and corrected promptly, while the water flow alarm serves to notify emergency services of the fire as soon as the automatic sprinkler system activates.

- a distinctive supervisory signal to indicate conditions that could impair the satisfactory operation of the sprinkler system (a fault alarm), which is to sound and be displayed, either at a location within the building that is constantly attended by qualified personnel (such as a security room), or at an approved remotely located receiving facility (such as a monitoring facility of the sprinkler system manufacturer); and
- a water flow alarm to indicate that the sprinkler system has been activated, which is to be transmitted to an approved, proprietary alarm-receiving facility, a remote station, a central station or the fire department.

Additional Reductions for Community Level Automatic Sprinkler Protection of Area

Buildings located within communities or subdivisions that are completely sprinkler protected may apply up to a maximum additional 25% reduction in required fire flows beyond the normal maximum of 50% reduction for sprinkler protection of an individual building.
This additional reduction may be applied where all the following conditions are met:

a) the community has a bylaw requiring all buildings that may be built within 30 m of the subject building to be fully sprinkler protected. I.e. future development will not create unsprinklered buildings within 30 m of the subject building, and
b) all buildings within 30 meters of the subject building are fully sprinkler protected with systems that are designed and installed in accordance with the applicable criteria of NFPA 13, *Standard for Installation of Sprinkler Systems,* NFPA 13R, *Standard for the Installation of Sprinkler Systems in Low-Rise Residential* Occupancies, or NFPA 13D, *Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes,* and
c) the community has in place a Fire Prevention Program that provides a system of ensuring that installed fire sprinkler systems are inspected, tested, and maintained in accordance with NFPA 25: *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, and
d) the community maintains the pressure and flow rate requirements for fire sprinkler installations. I.e. the community does not make significant reductions to the operating pressures or flows across the distribution network.

Adjustment of Sprinkler Reductions for Community Level Oversight of Sprinkler Maintenance, Testing and Water Supply Requirements

The reduction in required fire flows for sprinkler protection may be reduced or eliminated if

a) the community does not have a Fire Prevention Program that provides a system of ensuring that installed fire sprinkler systems are inspected, tested, and maintained in accordance with NFPA 25: *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, or
b) the community does not maintain the pressure and flow rate requirements for fire sprinkler installations, or otherwise allows the flow rates and pressure levels that were available during sprinkler system design to significantly degrade, increasing the probability of inadequate water supply for effective sprinkler operation.

Recognition of Automatic Sprinkler Protection

A property should be considered as "sprinkler protected" for the purposes of determining required fire flows, if the building has an automatic fire sprinkler system:

- designed and installed throughout all areas in accordance with NFPA 13, *Standard for Installation of Sprinkler Systems*, and maintained in accordance with the NFPA 25, *Standard for the Inspections, Testing and Maintenance of Water-Based Fire Protection Systems*, and
- supplied by water infrastructure capable of meeting all pressure and flow requirements of the sprinkler system concurrently with Max Day Demand (if connected to a domestic system)

Evidence of the sprinkler system design, installation should be acquired from the party responsible for the building (the owner, building engineer or property manager) or the municipal fire prevention office.

On site, the sprinkler system should carry test tags verifying that a qualified person has conducted tests including:

- flushing and hydrostatic tests of both the underground and overhead piping in accordance with NFPA 13;
- full-flow main drain test within the previous 48 months.
- dry-pipe trip test (if applicable) conducted within the last 48 months
- fire-pump test (if applicable) conducted within the last 48 months

Items of Note for Sprinkler Systems

i. It is important to note that installation of automatic sprinkler systems provides a highly effective and reliable system of fire protection however, this does not preclude the need for manual fire flows entirely as some fires, for various reasons, grow beyond the capability of sprinkler protection to be effective, and in these cases, manual fire fighting intervention is required.

D.B. Gray Engineering Inc.

Stormwater Management - Grading & Drainage - Storm & Sanitary Sewers - Watermains

700 Long Point Circle
Ottawa, Ontario K1T 4E9

613-425-8044
d.gray@dbgrayengineering.com

January 21, 2026

1309 Carling Avenue

Existing Building A and Phase 1B Building

Ottawa, Ontario

WATER DEMAND CALCULATIONS

Average Daily Demand:	3.05	ha				
	28,000	L/ha/day				
	85,400	L/day				
	24	hour day				
	59.3	L/min	1.0	L/s	15.7	USgpm
Maximum Daily Demand:	1.5	(Peaking factor as per City of Ottawa Water Design Guidelines)				
	89.0	L/min	1.5	L/s	23.5	USgpm
Maximum Hourly Demand:	1.8	(Peaking factor as per City of Ottawa Water Design Guidelines)				
	160	L/min	2.7	L/s	42.3	USgpm
Irrigation						
	(three zones at 15 USgpm per zone - 30 minutes each zone every 3-4 days - assume 3.5 days					
Average Daily Demand:						
	5,110	L/day			1,350	USgallons/da
	3.5	L/min	0.1	L/s	0.9	USgpm
Maximum Daily Demand:	57	L/min	0.9	L/s	15.0	USgpm
Maximum Hourly Demand:	57	L/min	0.9	L/s	15.0	USgpm
Average Daily Demand: (including irrigation)	63	L/min	1.0	L/s	16.6	USgpm
Maximum Daily Demand: (including irrigation)	152	L/min	2.5	L/s	40.1	USgpm
Maximum Hourly Demand: (including irrigation)	217	L/min	3.6	L/s	57.3	USgpm

---

Elevation of Water Meter:	75.37	m				
Finished Floor Elevation:	74.47	m				
Minimum HGL:	124.4	m				
Static Pressure at Water Meter:	49.0	m	481	kPa	70	psi
Maximum HGL:	132.8	m				
Static Pressure at Water Meter:	57.4	m	563	kPa	82	psi

D.B. Gray Engineering Inc.

Ryan Faith <r.faith@dbgrayengineering.com>

RE: Request for Boundary Conditions - 1309 Carling Avenue

1 message

Thakur, Roshni <roshni.thakur@ottawa.ca> Wed, Feb 19, 2025 at 8:54 AM
To: Ryan Faith <r.faith@dbgrayengineering.com>
Cc: "Cassidy, Tyler" <tyler.cassidy@ottawa.ca>, Douglas Gray <d.gray@dbgrayengineering.com>

Good morning Ryan,

The following are boundary conditions, HGL, for hydraulic analysis at 1309 Carling Avenue Crescent (zone 2W2C) assumed to be connected via two connections to the 406mm watermain on Carling Avenue (see attached PDF for location).

Both Connections:

Minimum HGL = 124.4 m

Maximum HGL = 132.8 m

Max Day + Fire Flow (116.7 L/s) = 125.0 m (Connection 1), 124.8 m (Connection 2)

The maximum pressure is estimated to be more than 80 psi. A pressure check at completion of construction is recommended to determine if pressure control is 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. Fire Flow analysis is a reflection of available flow in the watermain; there may be additional restrictions that occur between the watermain and the hydrant that the model cannot take into account.

Best Regards,
Roshni Thakur

Engineering Graduate

Planning, Development and Building Services department (PDBS)/ Direction générale des services de la planification, de l'aménagement et du bâtiment (DGSPAB)

Development Review – South Branch | Examen du Développement - Succursale Sud

City of Ottawa | Ville d'Ottawa

110 Laurier Avenue West Ottawa, ON | 110, avenue Laurier Ouest. Ottawa (Ontario) K1P 1J1

613-580-2424 ext. 15380, roshni.thakur@ottawa.ca

From: Ryan Faith <r.faith@dbgrayengineering.com>
Sent: January 22, 2025 10:56 AM
To: Thakur, Roshni <roshni.thakur@ottawa.ca>
Cc: Cassidy, Tyler <tyler.cassidy@ottawa.ca>; Douglas Gray <d.gray@dbgrayengineering.com>
Subject: Fwd: Request for Boundary Conditions - 1309 Carling Avenue

Hi Roshni,

See below. Applicant wants to submit ASAP so I'd appreciate if this can be expedited or at least not wait until Tyler returns.

Thanks,

Ryan Faith
D.B. Gray Engineering Inc.
700 Long Point Circle
Ottawa, Ontario K1T 4E9
613-425-8044

---------- Forwarded message ---------
From: **Ryan Faith** <r.faith@dbgrayengineering.com>
Date: Wed, Jan 22, 2025 at 10:51 AM
Subject: Request for Boundary Conditions - 1309 Carling Avenue
To: Tyler Cassidy <tyler.cassidy@ottawa.ca>
Cc: Douglas Gray <d.gray@dbgrayengineering.com>

Hi Tyler,

Please provide the boundary conditions for the 400 mm Carling Avenue municipal watermain at 1309 Carling Avenue. Existing points of connection can be seen on geoOttawa south of the Shoppers Drug Mart and south of the new residential tower. We have calculated the following expected demands:

Fire flow demand: 116.7 L/s
Average daily demand: 1.6 L/s
Maximum daily demand: 2.4 L/s
Maximum hourly demand: 4.3 L/s

Calculations are attached.

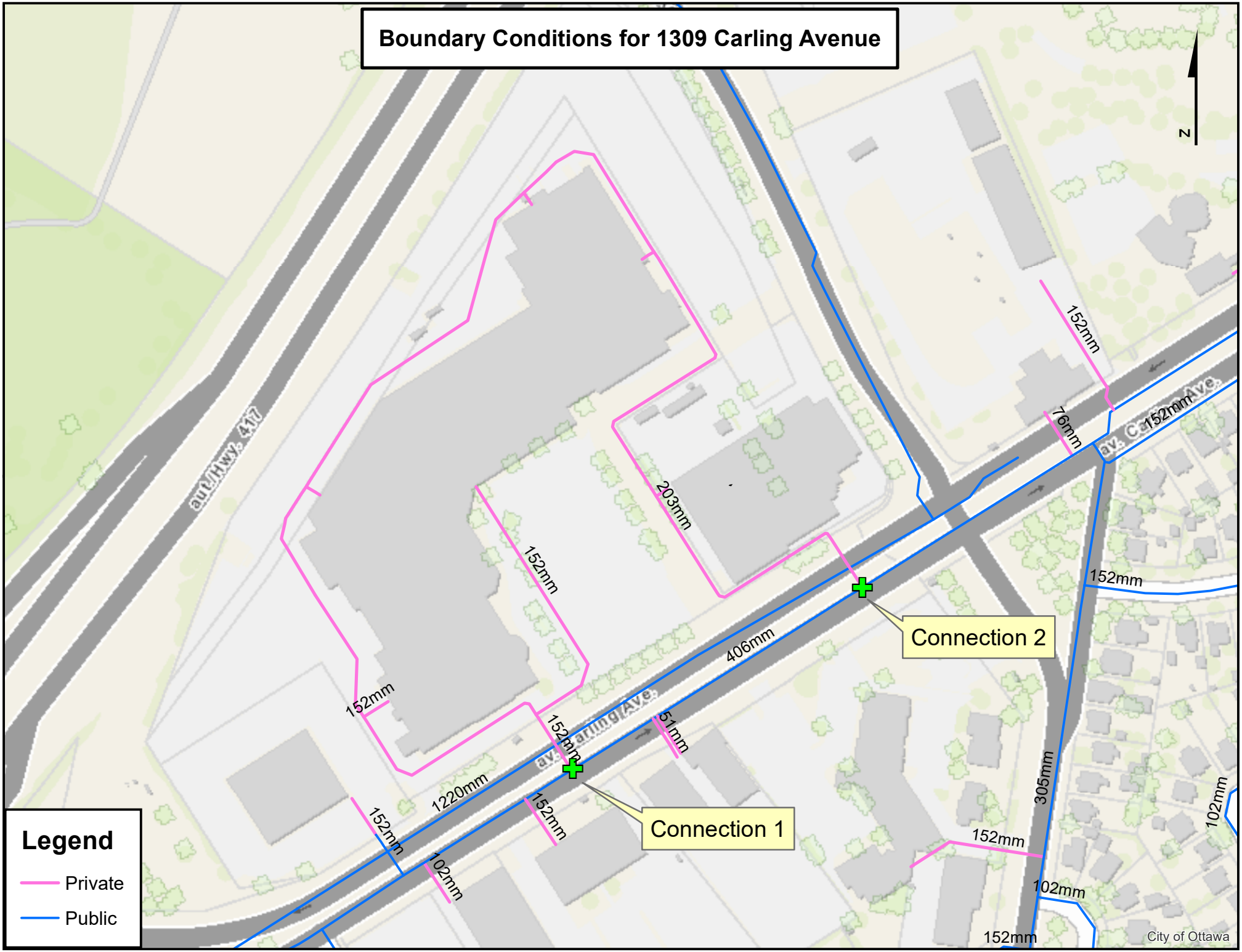
Thanks,

Ryan Faith
D.B. Gray Engineering Inc.
700 Long Point Circle
Ottawa, Ontario K1T 4E9
613-425-8044

'

'

1309 Carling Avenue February 2025.pdf
1060K


Boundary Conditions for 1309 Carling Avenue
N
Connection 2
Connection 1
406mm
1220mm
305mm
203mm
152mm
152mm
152mm
152mm
152mm
152mm
152mm
152mm
152mm
152mm
102mm
102mm
102mm
76mm
51mm
Legend
Private
Public
City of Ottawa

DATE	24-May-23

CLIENT	LLA Architecture+ Inc.	INSPECTOR NAME	Chris Lytle
BUILDING NAME	Westgate Mall	COMPANY	Avangard Fire & Life Safety
STREET	1309 Carling Avenue	STREET	2979 Merivale Road
CITY	Ottawa, Ontario	CITY	Ottawa, Ontario
SITE CONTACT	0	PHONE #	(613) 223-2223
PHONE #	0	LICENSE #	400129528

FIRE HYDRANT FLOW TEST RESULTS

HYDRANT #1 FLOW TEST

FLOW HYDRANT LOCATION: HYDRANT #1 (SEE ATTACHED MAP)

PRESSURE GAUGE HYDRANT LOCATION: HYDRANT #2 (SEE ATTACHED MAP)

DEVICES USED TO MEASURE FLOW/PRESSURE: HOSE MONSTER

STATIC PRESSURE (PSI)	NOZZLE SIZE (INCH)	PITOT READING (PSI)	GPM	RESIDUAL PRESSURE (PSI)
80	1x 2.5"	22	787	74

HYDRANT #2 FLOW TEST

FLOW HYDRANT LOCATION: HYDRANT #3 (SEE ATTACHED MAP)

PRESSURE GAUGE HYDRANT LOCATION: HYDRANT #4 (SEE ATTACHED MAP)

DEVICES USED TO MEASURE FLOW/PRESSURE: HOSE MONSTER

STATIC PRESSURE (PSI)	NOZZLE SIZE (INCH)	PITOT READING (PSI)	GPM	RESIDUAL PRESSURE (PSI)
78	1x 2.5"	22	787	72

HYDRANT #3 FLOW TEST

FLOW HYDRANT LOCATION:

PRESSURE GAUGE HYDRANT LOCATION:

DEVICES USED TO MEASURE FLOW/PRESSURE:

STATIC PRESSURE (PSI)	NOZZLE SIZE (INCH)	PITOT READING (PSI)	GPM	RESIDUAL PRESSURE (PSI)

HYDRANT #4 FLOW TEST

FLOW HYDRANT LOCATION:

PRESSURE GAUGE HYDRANT LOCATION:

DEVICES USED TO MEASURE FLOW/PRESSURE:

STATIC PRESSURE (PSI)	NOZZLE SIZE (INCH)	PITOT READING (PSI)	GPM	RESIDUAL PRESSURE (PSI)


Hampton Park
(Dog Park)
Trans-Canada Hwy
Capital City Dance
ServiceOntario
HYDRANT #4
Superior Photo
Westgate Mall
Merivale Rd
Merivale Rd
417
HYDRANT #2
Rhythm Apartments
HYDRANT #3
Mada Ottawa
Canada Post
38
HYDRANT #1

D.B. Gray Engineering Inc.

Stormwater Management - Grading & Drainage - Storm & Sanitary Sewers - Watermains

700 Long Point Circle
Ottawa, Ontario K1T 4E9

613-425-8044
d.gray@dbgrayengineering.com

August 8, 2025

1309 Carling Avenue

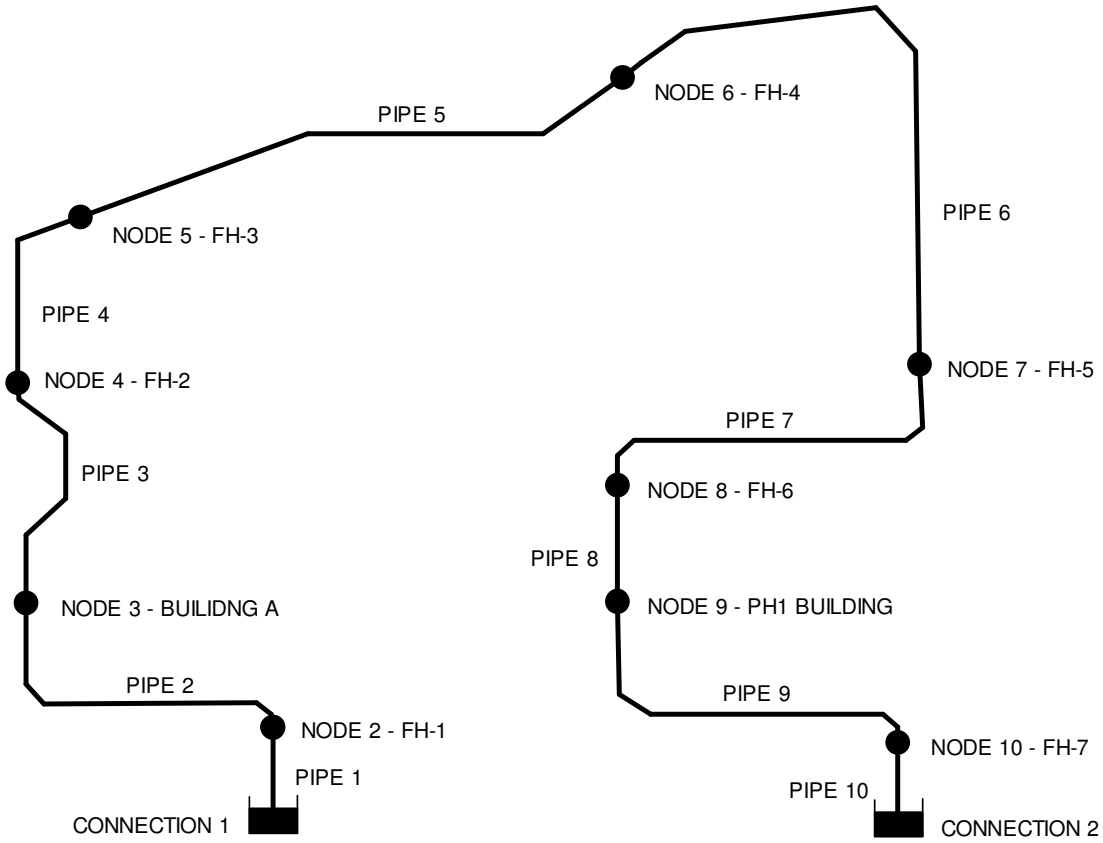
Ottawa, Ontario

EPANET RESULTS

Fire Flow Demand:	116.7	L/s
Maximum Daily Demand (MDD):	1.5	L/s
Phase 1 MDD (as per DSEL Rpt):	4.2	L/s (249.7 L/min)
Fire Flow + MDD:	122.4	L/s

Node ID	Demand (L/s)	HGL (m)	Elevation (m)	Pressure (m)	Pressure (kPa)	Pressure (psi)
1 - Reservoir (Connection 1)	-71.33	125.00	73.95	51.1	501	73
2 - Tee to Existing FH-1	0.00	117.43	73.80	43.6	428	62
3 - Tee to Existing Builiding A	1.50	113.33	74.00	39.3	386	56
4 - Tee to New FH-2	95.00	110.87	74.07	36.8	361	52
5 - Tee to Existing FH-3 (demand 116.7L/s - 95 L/s)	21.70	111.14	73.79	37.4	366	53
6 - Tee to Existing FH-4	0.00	113.81	74.39	39.4	386	56
7 - Tee to Existing FH-5	0.00	116.85	74.30	42.6	417	61
8 - Tee to Existing FH-6	0.00	118.46	74.12	44.3	435	63
9 - Tee to Existing PH1 Builiding	4.20	118.94	74.50	44.4	436	63
10 - Tee to Existing FH-7	0.00	121.08	74.77	46.3	454	66
11 - Reservoir (Connection 2)	-51.07	124.80	74.76	50.0	491	71

Link ID	Length (m)	Diameter (mm)	Roughness Coefficient	Minor Loss Coefficient	Flow (L/s)	Velocity (m/s)
1 - Reservoir (Connection 1) TO Tee to Existing FH-1	28	150	100	3.60	71.33	4.04
2 - Tee to Existing FH-1 TO Tee to Existing Builiding A	89	200	110	4.20	71.33	2.27
3 - Tee to Existing Builiding A TO Tee to New FH-2	51	200	110	3.20	69.83	2.22
4 - Tee to New FH-2 TO Tee to Existing FH-3	48	200	110	1.25	25.17	0.80
5 - Tee to Existing FH-3 TO Tee to Existing FH-4	136	200	110	4.90	46.87	1.49
6 - Tee to Existing FH-4 TO Tee to Existing FH-5	143	200	110	7.25	46.87	1.49
7 - Tee to Existing FH-5 TO Tee to Existing FH-6	73	200	110	4.20	46.87	1.49
8 - Tee to Existing FH-6 TO Tee to Existing PH1 Builiding	27	200	110	0.60	46.87	1.49
9 - Tee to Existing PH1 Builiding TO Tee to Existing FH-7	101	200	110	2.20	51.07	1.63
10 - Tee to Existing FH-7 TO Reservoir (Connection 2)	22	150	100	4.20	51.07	2.89


NODE 6 - FH-4
PIPE 5
PIPE 6
NODE 5 - FH-3
PIPE 4
NODE 4 - FH-2
NODE 7 - FH-5
PIPE 7
PIPE 3
NODE 8 - FH-6
PIPE 8
NODE 3 - BUILIDNG A
NODE 9 - PH1 BUILDING
PIPE 2
PIPE 9
NODE 2 - FH-1
NODE 10 - FH-7
PIPE 1
PIPE 10
CONNECTION 1
CONNECTION 2

EPANET 2.2

APPENDIX C

SANITARY SERVICING

SANITARY SEWER CALCULATIONS

D.B. Gray Engineering Inc.

Stormwater Management - Grading & Drainage - Storm & Sanitary Sewers - Watermains

700 Long Point Circle
Ottawa, Ontario K1T 4E9

613-425-8044
d.gray@dbgrayengineering.com

Project: 1309 Carling Avenue
Phase 1B Redevelopment
Ottawa, Ontario

Date: May 9, 2025

Location		Commercial				Infiltration	Q	Sewer Data						
		Individual	Cumulative			Cumulative	Total		Nominal	Actual			Q_{Full}	
From	To	Area (ha)	Area (ha)	Peaking Factor	Flow Rate (L/s)	Flow Rate (L/s)	Flow Rate (L/s)	Length (m)	Diameter (mm)	Diameter (mm)	Slope (%)	Velocity (m/s)	Capacity (L/s)	Q / Q_{Full}
Existing Building	Novatech 109	3.05	3.0500	1.5	1.48	1.01	2.49							
Existing Building A	MH-SA.1	1.525	1.5250	1.5	0.74	0.50	1.24							
Proposed Building B	MH-SA.1	1.525	1.5250	1.5	0.74	0.50	1.24	8.9	200	200	2	1.48	46.38	3%
MH-SA.1	Novatech 107	0.0000	3.0500	1.5	1.48	1.01	2.49	15.8	250	250	0.3	0.66	32.57	8%

Commercial Average Daily Flow: 28,000 L/ha/day
Commercial Peaking Factor: 1.5

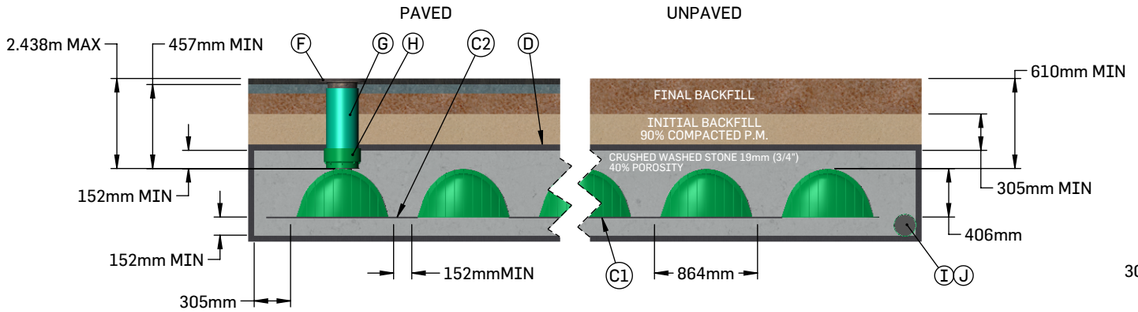
Infiltration Allowance: 0.33 L/s/ha

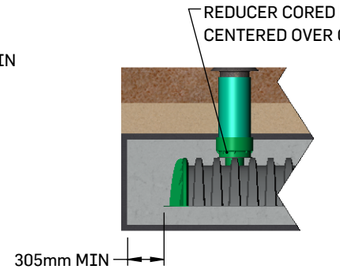
Manning's Roughness Coefficient: 0.013

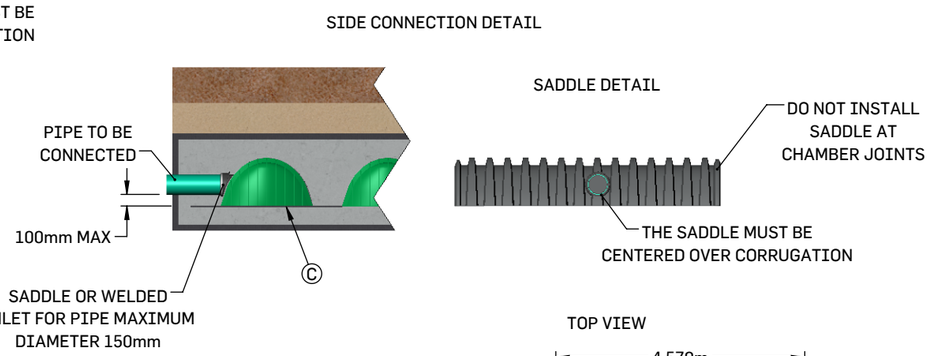
APPENDIX D

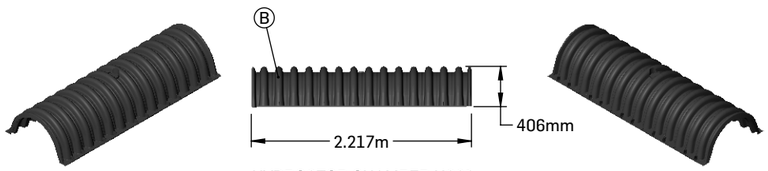
STORMWATER MANAGEMENT

SOLENO HYDROSTOR HS31 SYSTEM WITH SETTLING ROW

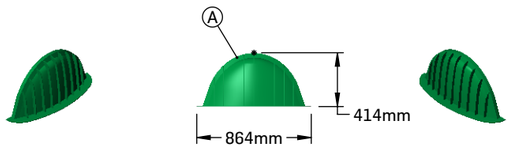








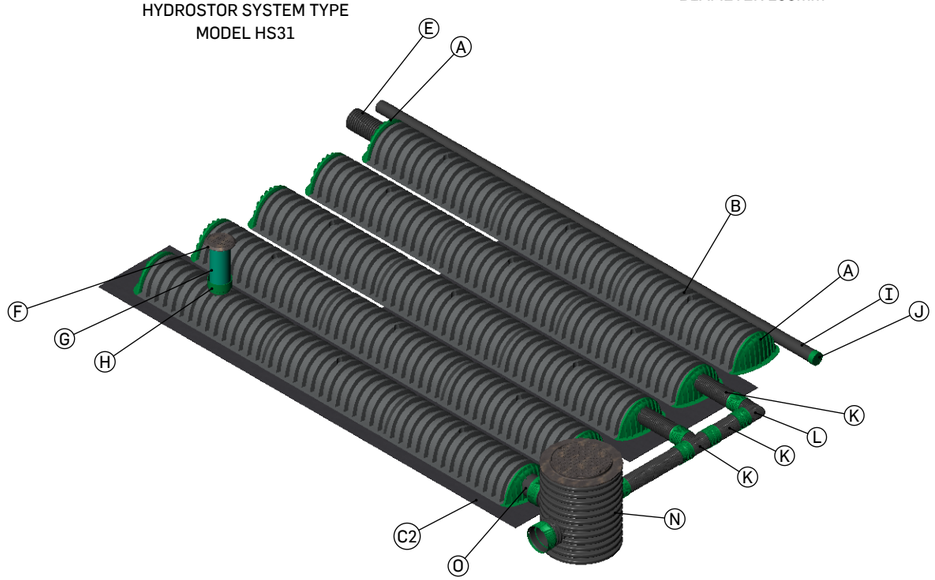
HYDROSTOR CHAMBER HS31

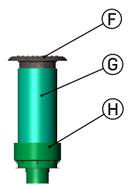


HYDROSTOR END CAP HS31

ASSEMBLED LENGTH

HYDROSTOR SYSTEM TYPE
MODEL HS31

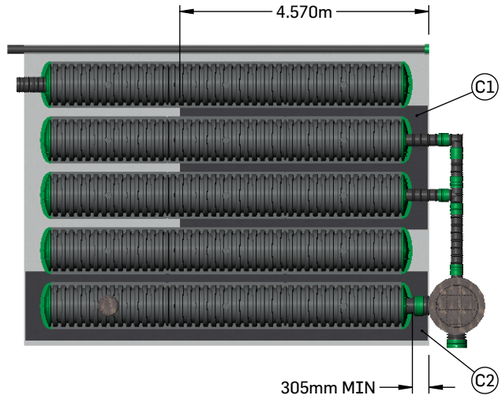




REDUCER 250mm - 150mm PVC
FOR INSPECTION PORT

AJUSTABLE FRAME
AND COVER 250mm

TOP VIEW

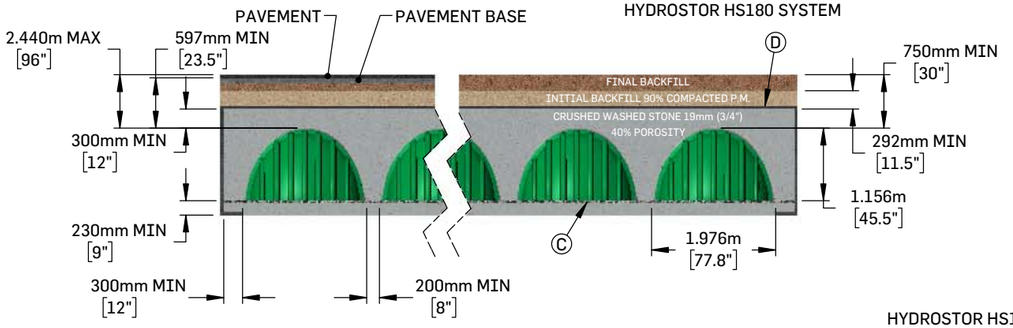


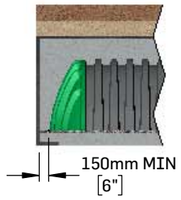
PART	DESCRIPTION
A	HYDROSTOR END CAP HS31
B	HYDROSTOR CHAMBER HS31
C1	SCOUR PROTECTION WOVEN GEOTEXTILE 2006W
C2	SEDIMENTATION WOVEN GEOTEXTILE 2006W, 2 LAYERS UNDER THE ROW
D	SOLENO TX-90 SEPARATION NONWOVEN GEOTEXTILE, ABOVE, UNDER AND ON THE SIDES
E	OUTLET SOLFLO MAX MAXIMUM DIAMETER 300mm (OPTIONAL)
F	AJUSTABLE FRAME AND COVER 250mm (OPTIONAL)
G	PVC PIPE INSPECTION PORT 250mm (PROVIDED BY OTHER) (RECOMMENDED)
H	REDUCER 250mm - 150mm PVC DR35 (OPTIONAL)
I	PERFORATED SOLFLO 150mm (OPTIONAL)
J	END CAP 150mm (OPTIONAL)
K	PIPE SOLFLO MAX 200mm
L	ELBOW SOLFLO MAX 200mm
M	TEE SOLFLO MAX 200mm
N	CORRUGATED MANHOLE SOLFLO MAX 900mm (OPTIONAL)
O	INLET SOLFLO MAX MAXIMUM DIAMETER 300mm

1. INSTALLATION MUST BE MADE IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.
2. SYSTEM IS DESIGNED TO WITHSTAND TRAFFIC LOAD CL-625 (CSA-S6), H-25 AND HS-25 (AASHTO).
3. HS31 CHAMBERS MUST BE MINIMALLY BACKFILLED WITH 152 mm OF CRUSHED STONE AND 305 mm OF GRANULAR MATERIAL COMPACTED AT 90% P.M.
4. THE SCOUR PROTECTION GEOTEXTILE 2006W IS PROVIDED UNDER ALL CHAMBERS WITH WATER INTAKE (OVER A LENGTH OF 4.57m).
5. SITE DESIGN ENGINEER IS RESPONSIBLE FOR ENSURING THE SUITABILITY OF THE SUBGRADE SOILS FOR THE PROPOSED STORMWATER STORAGE SYSTEM.

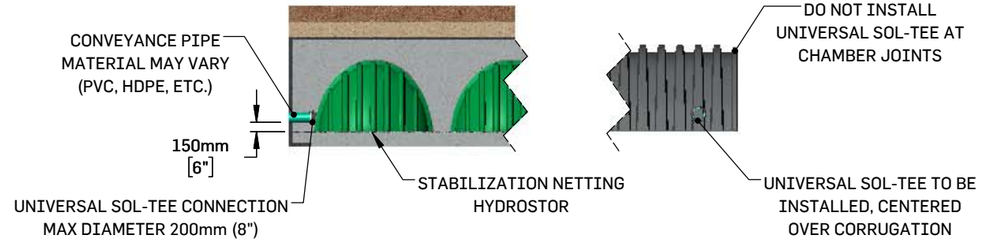
SOLENO HYDROSTOR HS180 SYSTEM

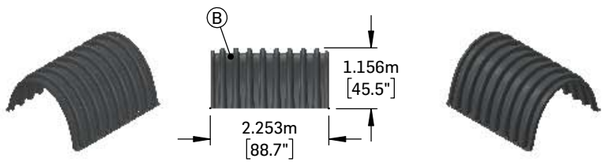
RECOMMENDED INSTALLATION OF
HYDROSTOR HS180 SYSTEM



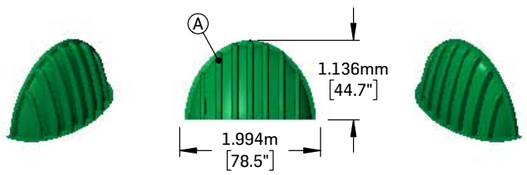


LATERAL UNIVERSAL SOL-TEE DETAIL

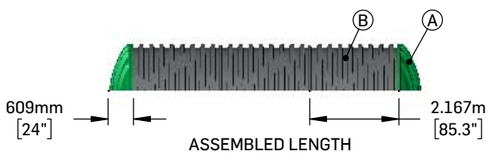




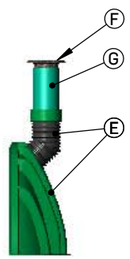
HYDROSTOR CHAMBER HS180



HYDROSTOR END CAP HS180

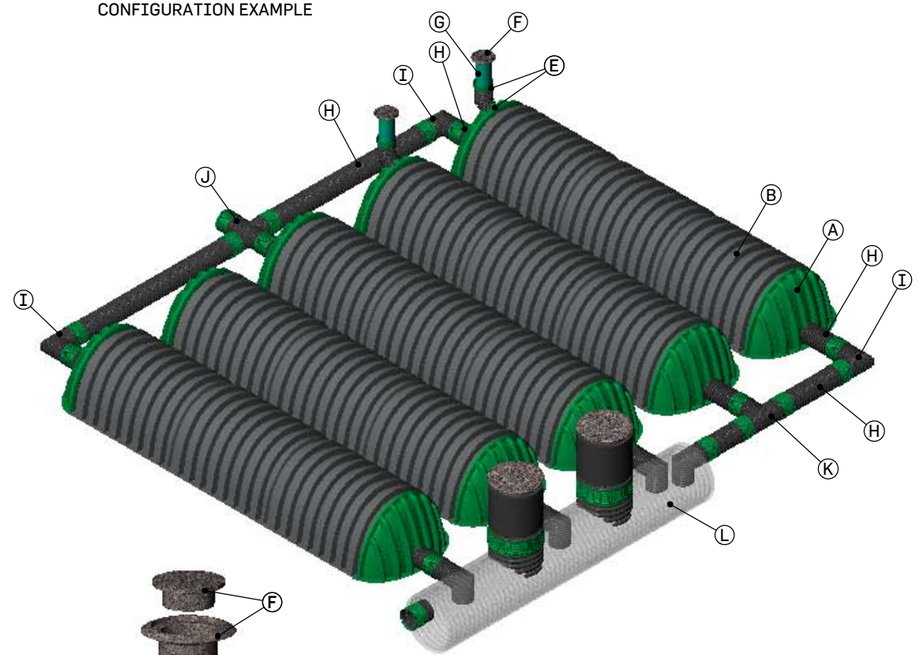


ASSEMBLED LENGTH



HYDROSTOR END CAP HS180 WITH WELDED ELBOW
SOLFLO MAX 250mm (10") FOR ACCESS WELL

HYDROSTOR HS180
CONFIGURATION EXAMPLE



ADJUSTABLE FRAME
AND COVER
250mm (10")

PART	DESCRIPTION
A	HYDROSTOR END CAP HS180
B	HYDROSTOR CHAMBER HS180
C	STABILIZATION NETTING HYDROSTOR
D	SOLENO TX-90 SEPARATION NONWOVEN GEOTEXTILE, ABOVE AND ON THE SIDES
E	HYDROSTOR END CAP HS180 WITH WELDED ELBOW SOLFLO MAX 250mm (10") FOR ACCESS WELL
F	ADJUSTABLE FRAME AND COVER 250mm (10")
G	PVC PIPE ACCESS WELL 250mm (10") (PROVIDED BY OTHERS)
H	STD LENGTH 6m (236") SOLFLO MAX 300mm (12")
I	ELBOW SOLFLO MAX 300mm (12")
J	CROSS SOLFLO MAX 300mm (12")
K	TEE SOLFLO MAX 300mm (12")
L	PRETREATEMENT UNIT

1. INSTALLATION MUST BE MADE IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.
2. SYSTEM IS DESIGNED TO WITHSTAND TRAFFIC LOAD CSA CL-625 AND AASHTO H-20.
3. HS180 CHAMBERS MUST BE MINIMALLY BACKFILLED WITH 300mm (12") OF CRUSHED STONE AND 292mm (11.5") OF GRANULAR MATERIAL COMPACTED AT 90% P.M.
4. HYDROSTOR GEOGRID FOR FOUNDATION STABILIZATION IS CONSIDERED UNDER ALL THE CHAMBERS.

SUMMARY TABLES

TOTAL DRAINAGE AREA

1309 Carling Avenue (& Adjacent Areas)

Ottawa, Ontario

100-YEAR EVENT

Drainage Area	Pre-Development Drainage Area (sq.m.)	Pre-Development Flow Rate (L/s)	Post Development Drainage Area (sq.m.)	Post Development Flow Rate (L/s)
EAST	14,317	705.81	9,847	462.07
NORTHWEST	16,060	750.82	13,688	46.11
WEST	3,142	155.97	3,142	155.97
SOUTH	9,868	489.84	16,560	366.50
TOTAL	43,387	2102.44	43,237	1030.64

2-YEAR EVENT

Drainage Area	Pre-Development Drainage Area (sq.m.)	Pre-Development Flow Rate (L/s)	Post Development Drainage Area (sq.m.)	Post Development Flow Rate (L/s)
EAST	14,317	273.17	9,847	178.49
NORTHWEST	16,060	290.00	13,688	24.49
WEST	3,142	60.38	3,142	60.38
SOUTH	9,868	189.63	16,560	147.87
TOTAL	43,387	813.17	43,237	411.23

January 21, 2026

TOTAL DRAINAGE AREA

1309 Carling Avenue (& Adjacent Areas)

Ottawa, Ontario

STORMWATER MANAGEMENT CALCULATIONS

Rational / Modified Rational Method

100-YEAR EVENT

EAST DRAINAGE AREA

PRE-DEVELOPMENT CONDITIONS

DRAINAGE AREA 'PRE EAST'

			C
Hard Surface Area:	14,186	sq.m	1.00
Soft Surface Area:	131	sq.m	0.25
Total Catchment Area:	14,317	sq.m	0.99
Time of Concentration:	10	min	
Rainfall Intensity (i):	179	mm/hr (100-year)	
Flow Rate (2.78AiC):	705.81	L/s	

POST DEVELOPMENT CONDITIONS

DRAINAGE AREA 'POST EAST'

			C
Hard Surface Area:	9,129	sq.m	1.00
Soft Surface Area:	718	sq.m	0.25
Total Catchment Area:	9,847	sq.m	0.95
Time of Concentration:	10	min	
Rainfall Intensity (i):	179	mm/hr (100-year event)	
Flow Rate (2.78AiC):	462.07	L/s	

100-YEAR EVENT
NORTHWEST DRAINAGE AREA
PRE-DEVELOPMENT CONDITIONS
DRAINAGE AREA 'PRE NORTHWEST'

			C
Hard Surfaces Area:	14,814	sq.m	1.00
Soft Surafces Area:	1,246	sq.m	0.25
Total Catchment Area:	16,060	sq.m	0.94
Time of Concentration:	10	min	
Rainfall Intensity (i):	179	mm/hr (100-year event)	
Flow Rate (2.78AiC):	750.82	L/s	

POST DEVELOPMENT CONDITIONS
DRAINAGE AREA 'NORTHWEST (PH 1B)' (Uncontrolled)

			C
Hard Surface Area:	451	sq.m	1.00
Soft Surface Area:	0	sq.m	0.25
Catchment Area:	451	sq.m	1.00
Time of Concentration:	10	min	
Rainfall Intensity (i):	179	mm/hr (100-year event)	
Flow Rate (2.78AiC):	22.39	L/s	

DRAINAGE AREA 'I (PH 1B)' (Roof - Controlled)

Catchment Area:	2,614	sq.m
Maximum Release Rate:	15.86	L/s
(See Drainage Area I (Roof) below)		

DRAINAGE AREA 'III (PH 1B)' + DRAINAGE AREA 'POST NORTHWEST'

Catchment Area:	10,623	sq.m
Maximum Release Rate:	7.86	L/s
(See Drainage Area II (Phase 1 + Phase 2) below)		
Total Catchment Area:	13,688	sq.m
Total Flow Rate (2.78AiC):	46.11	L/s

100-YEAR EVENT
WEST DRAINAGE AREA
PRE-DEVELOPMENT CONDITIONS
DRAINAGE AREA 'PRE WEST'

			C
Hard Surfaces Area:	3,142	sq.m	1.00
Soft Surafces Area:	0	sq.m	0.25
Total Catchment Area:	3,142	sq.m	1.00
Time of Concentration:	10	min	
Rainfall Intensity (i):	179	mm/hr (100-year event)	
Flow Rate (2.78AiC):	155.97	L/s	

POST DEVELOPMENT CONDITIONS
DRAINAGE AREA 'POST WEST'

			C
Hard Surface Area:	3,142	sq.m	1.00
Soft Surface Area:	0	sq.m	0.25
Catchment Area:	3,142	sq.m	1.00
Time of Concentration:	10	min	
Rainfall Intensity (i):	179	mm/hr	
Flow Rate (2.78AiC):	155.97	L/s	

100-YEAR EVENT
SOUTH DRAINAGE AREA
PRE-DEVELOPMENT CONDITIONS
DRAINAGE AREA 'PRE SOUTH'

			C
Hard Surface Area:	9,868	sq.m	1.00
Soft Surface Area:	0	sq.m	0.25
Total Catchment Area:	9,868	sq.m	1.00
Time of Concentration:	10	min	
Rainfall Intensity (i):	179	mm/hr (100-year event)	
Flow Rate (2.78AiC):	489.84	L/s	

POST DEVELOPMENT CONDITIONS
DRAINAGE AREA 'POST SOUTH'

			C
Hard Surface Area:	5,334	sq.m	1.00
Soft Surface Area:	202	sq.m	0.25
Catchment Area:	5,536	sq.m	0.97
Time of Concentration:	10	min	
Rainfall Intensity (i):	179	mm/hr (100-year event)	
Flow Rate (2.78AiC):	267.28	L/s	

DRAINAGE AREA 'SOUTH (PH 1B)' (Uncontrolled)

			C
Hard Surface Area:	1,494	sq.m	1.00
Soft Surface Area:	64	sq.m	0.25
Catchment Area:	1,558	sq.m	0.97
Time of Concentration:	10	min	
Rainfall Intensity (i):	179	mm/hr (100-year event)	
Flow Rate (2.78AiC):	74.96	L/s	

DRAINAGE AREA 'II (PH 1B)' + DRAINAGE AREA 'II (PH 2)' (Controlled)

Catchment Area:	9,466	sq.m
Maximum Release Rate:	24.26	L/s
(See Drainage Area II (Phase 1 + Phase 2) below)		
Total Catchment Area:	16,560	sq.m
Total Flow Rate (2.78AiC):	366.50	L/s

2-YEAR EVENT
EAST DRAINAGE AREA
PRE-DEVELOPMENT CONDITIONS
DRAINAGE AREA 'PRE EAST'

			C
Hard Surface Area:	14,186	sq.m	0.90
Soft Surface Area:	131	sq.m	0.20
Total Catchment Area:	14,317	sq.m	0.89
Time of Concentration:	10	min	
Rainfall Intensity (i):	77	mm/hr (2-year event)	
Flow Rate (2.78AiC):	273.17	L/s	

POST DEVELOPMENT CONDITIONS
DRAINAGE AREA 'POST EAST'

			C
Hard Surface Area:	9,129	sq.m	0.90
Soft Surface Area:	718	sq.m	0.20
Total Catchment Area:	9,847	sq.m	0.85
Time of Concentration:	10	min	
Rainfall Intensity (i):	77	mm/hr (2-year event)	
Flow Rate (2.78AiC):	178.49	L/s	

2-YEAR EVENT
NORTHWEST DRAINAGE AREA
PRE-DEVELOPMENT CONDITIONS
DRAINAGE AREA 'PRE NORTHWEST'

			C
Hard Surfaces Area:	14,814	sq.m	0.90
Soft Surafces Area:	1,246	sq.m	0.20
Total Catchment Area:	16,060	sq.m	0.85
Time of Concentration:	10	min	
Rainfall Intensity (i):	77	mm/hr (2-year event)	
Flow Rate (2.78AiC):	290.00	L/s	

POST DEVELOPMENT CONDITIONS
DRAINAGE AREA 'NORTHWEST (PH 1B)' (Uncontrolled)

			C
Hard Surface Area:	451	sq.m	0.90
Soft Surface Area:	0	sq.m	0.20
Catchment Area:	451	sq.m	0.90
Time of Concentration:	10	min	
Rainfall Intensity (i):	77	mm/hr (2-year event)	
Flow Rate (2.78AiC):	8.67	L/s	

DRAINAGE AREA 'I (PH 1B)' (Roof - Controlled)

Catchment Area:	2,614	sq.m
Maximum Release Rate:	10.15	L/s
(See Drainage Area I (Roof) below)		

DRAINAGE AREA 'III (PH 1B)' + DRAINAGE AREA 'POST NORTHWEST'

Catchment Area:	10,623	sq.m
Maximum Release Rate:	5.67	L/s
(See Drainage Area II (Phase 1 + Phase 2) below)		
Total Catchment Area:	13,688	sq.m
Total Flow Rate (2.78AiC):	24.49	L/s

2-YEAR EVENT
WEST DRAINAGE AREA
PRE-DEVELOPMENT CONDITIONS
DRAINAGE AREA 'PRE WEST'

			C
Hard Surface Area:	3,142	sq.m	0.90
Soft Surface Area:	0	sq.m	0.20
Total Catchment Area:	3,142	sq.m	0.90
Time of Concentration:	10	min	
Rainfall Intensity (i):	77	mm/hr (2-year event)	
Flow Rate (2.78AiC):	60.38	L/s	

POST DEVELOPMENT CONDITIONS
DRAINAGE AREA 'POST WEST'

			C
Hard Surface Area:	3,142	sq.m	0.90
Soft Surface Area:	0	sq.m	0.20
Catchment Area:	3,142	sq.m	0.90
Time of Concentration:	10	min	
Rainfall Intensity (i):	77	mm/hr (2-year event)	
Flow Rate (2.78AiC):	60.38	L/s	

2-YEAR EVENT
SOUTH DRAINAGE AREA
PRE-DEVELOPMENT CONDITIONS
DRAINAGE AREA 'PRE SOUTH'

			C
Hard Surface Area:	9,868	sq.m	0.90
Soft Surface Area:	0	sq.m	0.20
Total Catchment Area:	9,868	sq.m	0.90
Time of Concentration:	10	min	
Rainfall Intensity (i):	77	mm/hr (2-year event)	
Flow Rate (2.78AiC):	189.63	L/s	

POST DEVELOPMENT CONDITIONS
DRAINAGE AREA 'POST SOUTH'

			C
Hard Surface Area:	5,334	sq.m	0.90
Soft Surface Area:	202	sq.m	0.20
Catchment Area:	5,536	sq.m	0.87
Time of Concentration:	10	min	
Rainfall Intensity (i):	77	mm/hr (2-year event)	
Flow Rate (2.78AiC):	103.36	L/s	

DRAINAGE AREA 'SOUTH (PH 1B)' (Uncontrolled)

			C
Hard Surface Area:	1,494	sq.m	0.90
Soft Surface Area:	64	sq.m	0.20
Catchment Area:	1,558	sq.m	0.87
Time of Concentration:	10	min	
Rainfall Intensity (i):	77	mm/hr (2-year event)	
Flow Rate (2.78AiC):	28.98	L/s	

DRAINAGE AREA 'II (PH 1B)' + DRAINAGE AREA 'II (PH 2)' (Controlled)

Catchment Area:	9,466	sq.m
Maximum Release Rate:	15.52	L/s
(See Drainage Area II (Phase 1 + Phase 2) below)		
Total Catchment Area:	16,560	sq.m
Total Flow Rate (2.78AiC):	147.87	L/s

SUMMARY TABLES

100-YEAR EVENT						
Drainage Area	Pre-Development Flow Rate (L/s)	Maximum Allowable Release Rate (L/s)	Maximum Release Rate (L/s)	Maximum Volume Required (cu.m)	Maximum Volume Stored (cu.m)	Maximum Volume Available (cu.m)
AREA 'NORTHWEST (PH 1B)' (Uncontrolled)	-	-	22.39	-	-	-
AREA 'SOUTH (PH 1B)' (Uncontrolled)	-	-	74.96	-	-	-
AREA I (Phase 1B - Roof)	-	-	15.86	93.00	93.00	143.13
AREA II (Phase 1B)	-	-	24.80	271.22	271.22	372.38
AREA III (Phase 1B)	-	-	6.12	293.70	293.70	417.91
TOTAL	733.77	144.12	144.12	657.92	657.92	933.42

AREA II (Phase 1B + Phase 2)	-	-	24.26	335.15	335.15	688.78
AREA III (Phase 1B) + POST NORTHWEST	-	-	37.14	417.91	417.91	417.91

SUMMARY TABLES

2-YEAR EVENT

Drainage Area	Pre-Development Flow Rate (L/s)	Maximum Allowable Release Rate (L/s)	Maximum Release Rate (L/s)	Maximum Volume Required (cu.m)	Maximum Volume Stored (cu.m)	Maximum Volume Available (cu.m)
AREA 'NORTHWEST (PH 1B)' (Uncontrolled)	-	-	8.67	-	-	-
AREA 'SOUTH (PH 1B)' (Uncontrolled)	-	-	28.98	-	-	-
AREA I (Phase 1B - Roof)	-	-	10.15	29.08	29.08	143.13
AREA II (Phase 1B)	-	-	14.13	96.11	96.11	372.38
AREA III (Phase 1B)	-	-	3.63	107.12	107.12	417.91
TOTAL	284.06	144.12	65.56	203.23	203.23	933.42

AREA II (Phase 1B + Phase 2)	-	-	15.52	112.87	112.87	688.78
AREA III (Phase 1B) + POST NORTHWEST	-	-	5.67	255.86	255.86	417.91

January 21, 2026

PHASE 1B REDEVELOPMENT

1309 Carling Avenue

Ottawa, Ontario

STORMWATER MANAGEMENT CALCULATIONS

Rational / Modified Rational Method

PRE-DEVELOPMENT CONDITIONS

100-YEAR EVENT

			C
Roof Area:	7,671	sq.m	1.00
Hard Area:	7,111	sq.m	1.00
Gravel Area:	0	sq.m	1.00
Soft Area:	0	sq.m	0.25
Total Catchment Area:	14,782	sq.m	1.00

Time of Concentration:	10	min
Rainfall Intensity (i):	179	mm/hr (100-year event)
Pre-development Flow Rate (2.78AiC):	733.77	L/s

2-YEAR EVENT

			C
Roof Area:	7,671	sq.m	0.90
Hard Area:	7,111	sq.m	0.90
Gravel Area:	0	sq.m	0.80
Soft Area:	0	sq.m	0.20
Total Catchment Area:	14,782	sq.m	0.90

Time of Concentration:	10	min
Rainfall Intensity (i):	77	mm/hr (2-year event)
Pre-development Flow Rate (2.78AiC):	284.06	L/s

MAXIMUM ALLOWABLE RELEASE RATE

Area (A):	14,782	sq.m
Criterion:	97.5	L/s/ha
Maximum Allowable Release Rate (2.78AiC):	144.12	L/s

100-YEAR EVENT

DRAINAGE AREA 'NORTHWEST (PH 1B)' (Uncontrolled)

			C
Hard Surface Area:	451	sq.m	1.00
Soft Surface Area:	0	sq.m	0.25
Catchment Area:	451	sq.m	1.00
Time of Concentration:	10	min	
Rainfall Intensity (i):	179	mm/hr (100-year event)	
Flow Rate (2.78AiC):	22.39	L/s	

DRAINAGE AREA 'SOUTH (PH 1B)' (Uncontrolled)

			C
Hard Surface Area:	1,494	sq.m	1.00
Soft Surface Area:	64	sq.m	0.25
Catchment Area:	1,558	sq.m	0.97
Time of Concentration:	10	min	
Rainfall Intensity (i):	179	mm/hr (100-year event)	
Flow Rate (2.78AiC):	74.96	L/s	

DRAINAGE AREA I (Phase 1B - Roof)

(100-YEAR EVENT)

			C	
Total Catchment Area:	2,614	sq.m	1.00	
No. of Roof Drains:	10			
Slots per Wier:	1	0.01242 L/s/mm/slot (5 USgpm/in/slot)		
Depth at Roof Drains:	128	mm		
Maximum Release Rate:	15.86	L/s	Pond Area:	1,937 sq.m
			Maximum Volume Stored:	93.00 cu.m
			Maximum Volume Required:	93.00 cu.m

Time (min)	i (mm/hr)	2.78AiC (L/s)	Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	179	129.76	15.86	113.90	68.34
15	143	103.84	15.86	87.98	79.18
20	120	87.17	15.86	71.31	85.57
25	104	75.46	15.86	59.61	89.41
30	92	66.76	15.86	50.90	91.62
35	83	60.01	15.86	44.15	92.72
40	75	54.61	15.86	38.75	93.00
45	69	50.18	15.86	34.32	92.66
50	64	46.47	15.86	30.62	91.85
55	60	43.33	15.86	27.47	90.65
60	56	40.62	15.86	24.76	89.13
65	53	38.26	15.86	22.40	87.36
70	50	36.18	15.86	20.32	85.36
75	47	34.34	15.86	18.48	83.17
80	45	32.69	15.86	16.84	80.81
85	43	31.21	15.86	15.36	78.31
90	41	29.87	15.86	14.02	75.69
95	39	28.66	15.86	12.80	72.95
100	38	27.54	15.86	11.68	70.11
105	36	26.52	15.86	10.66	67.18
110	35	25.58	15.86	9.72	64.17
115	34	24.71	15.86	8.85	61.08
120	33	23.90	15.86	8.05	57.93
150	28	20.06	15.86	4.21	37.85
180	24	17.37	15.86	1.51	16.32
210	21	15.37	15.37	0.00	0.00
240	19	13.81	13.81	0.00	0.00
270	17	12.57	12.57	0.00	0.00
300	16	11.55	11.55	0.00	0.00
330	15	10.70	10.70	0.00	0.00
360	14	9.97	9.97	0.00	0.00

DRAINAGE AREA II (Phase 1B)

(100-YEAR EVENT)

			C
Roof Area:	0	sq.m	1.00
Hard Area:	5,398	sq.m	1.00
Gravel Area:	0	sq.m	1.00
Soft Area:	268	sq.m	0.25
Total Catchment Area:	5,666	sq.m	0.96

Water Elevation:	74.07	m
Head:	1.64	m
Centroid of ICD Orifice:	72.43	m
Invert of Outlet Pipe of CB/MH-8:	72.38	m
Orifice Diameter:	96	mm
Orifice Area:	7,163	sq.mm
Discharge Coefficient:	0.610	

Maximum Release Rate: 24.80 L/s

Surface Storage

CB/MH	Top Area	Depth	Volume	
CB/MH-1	453	0.17	25.55	cu.m
CB/MH-2	392	0.17	22.09	cu.m
CB-3	235	0.14	10.90	cu.m
CB-4				
CB/MH-5	215	0.12	8.54	cu.m
CB/MH-6	178	0.12	7.06	cu.m
CB/MH-7	425	0.17	23.98	cu.m
CB/MH-8	347	0.17	19.55	cu.m
CB-8A	460	0.17	25.96	cu.m

Chamber Storage

No. of Chambers	Volume Per Chamber	No. of Rows	No. of End Caps	Volume Per End Cap	Volume	
165	0.43	15	30	0.02	71.55	cu.m

Clear Stone Storage

Length	Width	Depth	Volume	40% Voids	
24.783	15.308	0.56	140.14	56.06	cu.m

Maximum Volume Stored:	271.22	cu.m
Maximum Volume Required:	271.22	cu.m

DRAINAGE AREA II (Phase 1B)

(100-YEAR EVENT)

Time (min)	i (mm/hr)	2.78AiC (L/s)	50% Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	179	271.28	12.40	258.88	155.33
15	143	217.09	12.40	204.70	184.23
20	120	182.24	12.40	169.84	203.81
25	104	157.77	12.40	145.37	218.06
30	92	139.57	12.40	127.17	228.91
35	83	125.46	12.40	113.06	237.43
40	75	114.17	12.40	101.77	244.24
45	69	104.91	12.40	92.51	249.77
50	64	97.16	12.40	84.77	254.30
55	60	90.58	12.40	78.19	258.02
60	56	84.92	12.40	72.52	261.08
65	53	79.98	12.40	67.59	263.59
70	50	75.64	12.40	63.25	265.63
75	47	71.79	12.40	59.40	267.28
80	45	68.35	12.40	55.96	268.59
85	43	65.26	12.40	52.86	269.59
90	41	62.46	12.40	50.06	270.33
95	39	59.91	12.40	47.51	270.83
100	38	57.58	12.40	45.19	271.12
105	36	55.45	12.40	43.05	271.22
110	35	53.48	12.40	41.08	271.16
115	34	51.66	12.40	39.27	270.93
120	33	49.98	12.40	37.58	270.56
150	28	41.95	12.40	29.55	265.95
180	24	36.31	12.40	23.92	258.30
210	21	32.12	12.40	19.73	248.55
240	19	28.87	12.40	16.48	237.27
270	17	26.28	12.40	13.88	224.81
300	16	24.14	12.40	11.75	211.42
330	15	22.36	12.40	9.96	197.27
360	14	20.85	12.40	8.45	182.50
420	12	18.41	12.40	6.01	151.43
480	11	16.52	12.40	4.12	118.77
540	10	15.02	12.40	2.62	84.88
600	9.1	13.79	12.40	1.39	50.01
660	8.4	12.76	12.40	0.36	14.34
720	7.8	11.89	11.89	0.00	0.00
780	7.3	11.14	11.14	0.00	0.00
840	6.9	10.49	10.49	0.00	0.00
900	6.5	9.91	9.91	0.00	0.00
960	6.2	9.41	9.41	0.00	0.00
1020	5.9	8.95	8.95	0.00	0.00
1080	5.6	8.55	8.55	0.00	0.00
1140	5.4	8.18	8.18	0.00	0.00
1200	5.2	7.84	7.84	0.00	0.00
1260	5.0	7.54	7.54	0.00	0.00
1320	4.8	7.25	7.25	0.00	0.00
1380	4.6	7.00	7.00	0.00	0.00
1440	4.4	6.76	6.76	0.00	0.00

DRAINAGE AREA II (Phase 1B + Phase 2)

(100-YEAR EVENT)

			C
Roof Area:	0	sq.m	1.00
Hard Area:	5,400	sq.m	1.00
Gravel Area:	0	sq.m	1.00
Soft Area:	4,066	sq.m	0.25
Total Catchment Area:	9,466	sq.m	0.68

Water Elevation:	74.00	m
Head:	1.57	m
Centroid of ICD Orifice:	72.43	m
Invert of Outlet Pipe of CB/MH-8:	72.38	m
Orifice Diameter:	96	mm
Orifice Area:	7,163	sq.mm
Discharge Coefficient:	0.610	

Maximum Release Rate: 24.26 L/s

Surface Storage

CB/MH	Top Area	Depth	Volume	
CB/MH-1	155	0.10	5.10	cu.m
CB/MH-2	134	0.10	4.40	cu.m
CB-3	57	0.07	1.32	cu.m
CB-4	1,093	0.50	181.79	cu.m
CB/MH-5	36	0.05	0.59	cu.m
CB/MH-6	30	0.05	0.49	cu.m
CB/MH-7	145	0.10	4.78	cu.m
CB/MH-8	118	0.10	3.90	cu.m
CB-8A	157	0.10	5.18	cu.m

Chamber Storage

No. of Chambers	Volume Per Chamber	No. of Rows	No. of End Caps	Volume Per End Cap	Volume	
165	0.43	15	30	0.02	71.55	cu.m

Clear Stone Storage

Length	Width	Depth	Volume	40% Voids	
24.783	15.308	0.56	140.14	56.06	cu.m

Maximum Volume Stored:	335.15	cu.m
Maximum Volume Required:	335.15	cu.m

DRAINAGE AREA II (Phase 1B + Phase 2)

(100-YEAR EVENT)

Time (min)	i (mm/hr)	2.78AiC (L/s)	50% Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	179	318.51	12.13	306.38	183.83
15	143	254.89	12.13	242.76	218.49
20	120	213.97	12.13	201.84	242.20
25	104	185.24	12.13	173.11	259.67
30	92	163.87	12.13	151.74	273.14
35	83	147.30	12.13	135.17	283.86
40	75	134.04	12.13	121.91	292.59
45	69	123.17	12.13	111.04	299.81
50	64	114.08	12.13	101.95	305.85
55	60	106.36	12.13	94.23	310.95
60	56	99.70	12.13	87.57	315.27
65	53	93.91	12.13	81.78	318.94
70	50	88.81	12.13	76.68	322.08
75	47	84.29	12.13	72.16	324.74
80	45	80.25	12.13	68.12	327.00
85	43	76.62	12.13	64.49	328.91
90	41	73.33	12.13	61.20	330.50
95	39	70.34	12.13	58.21	331.82
100	38	67.61	12.13	55.48	332.89
105	36	65.10	12.13	52.97	333.74
110	35	62.79	12.13	50.66	334.38
115	34	60.66	12.13	48.53	334.85
120	33	58.68	12.13	46.55	335.15
150	28	49.25	12.13	37.12	334.10
180	24	42.64	12.13	30.51	329.48
210	21	37.72	12.13	25.59	322.41
240	19	33.90	12.13	21.77	313.53
270	17	30.85	12.13	18.72	303.27
300	16	28.35	12.13	16.22	291.92
330	15	26.25	12.13	14.12	279.67
360	14	24.48	12.13	12.35	266.69
420	12	21.61	12.13	9.48	238.95
480	11	19.40	12.13	7.27	209.34
540	10	17.63	12.13	5.50	178.29
600	9.1	16.19	12.13	4.06	146.09
660	8.4	14.98	12.13	2.85	112.94
720	7.8	13.96	12.13	1.83	79.02
780	7.3	13.08	12.13	0.95	44.42
840	6.9	12.31	12.13	0.18	9.25
900	6.5	11.64	11.64	0.00	0.00
960	6.2	11.04	11.04	0.00	0.00
1020	5.9	10.51	10.51	0.00	0.00
1080	5.6	10.03	10.03	0.00	0.00
1140	5.4	9.60	9.60	0.00	0.00
1200	5.2	9.21	9.21	0.00	0.00
1260	5.0	8.85	8.85	0.00	0.00
1320	4.8	8.52	8.52	0.00	0.00
1380	4.6	8.21	8.21	0.00	0.00
1440	4.4	7.93	7.93	0.00	0.00

DRAINAGE AREA III (Phase 1B)

(100-YEAR EVENT)

			C
Roof Area:	0	sq.m	1.00
Hard Area:	4,325	sq.m	1.00
Gravel Area:	0	sq.m	1.00
Soft Area:	168	sq.m	0.25
Total Catchment Area:	4,493	sq.m	0.97

Water Elevation:	73.20	m
Head:	0.89	m
Centroid of ICD Orifice:	72.31	m
Invert of Outlet Pipe of CB/MH-16:	72.26	m
Orifice Diameter:	100	mm
Orifice Area:	7,854	sq.mm
Discharge Coefficient:	0.187	

Maximum Release Rate: 6.12 L/s

Surface Storage

CB/MH	Top Area	Depth	Volume	
CB/MH-15	0	0.00	0.00	cu.m

Chamber Storage

No. of Chambers	Volume Per Chamber	No. of Rows	No. of End Caps	Volume Per End Cap	Volume	
84	2.78	4	8	0.37	236.27	cu.m

Clear Stone Storage

Length	Width	Depth	Volume	40% Voids	
46.883	9.254	0.88	143.59	57.44	cu.m

Maximum Volume Stored: 293.70 cu.m

Maximum Volume Required: 293.70 cu.m

DRAINAGE AREA III (Phase 1B)

(100-YEAR EVENT)

Time (min)	i (mm/hr)	2.78AiC (L/s)	50% Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	179	216.78	3.06	213.71	128.23
15	143	173.48	3.06	170.42	153.37
20	120	145.62	3.06	142.56	171.07
25	104	126.07	3.06	123.01	184.52
30	92	111.53	3.06	108.47	195.24
35	83	100.25	3.06	97.19	204.10
40	75	91.23	3.06	88.17	211.60
45	69	83.83	3.06	80.77	218.07
50	64	77.64	3.06	74.58	223.74
55	60	72.38	3.06	69.32	228.77
60	56	67.86	3.06	64.80	233.27
65	53	63.91	3.06	60.85	237.33
70	50	60.45	3.06	57.38	241.02
75	47	57.37	3.06	54.31	244.39
80	45	54.62	3.06	51.56	247.48
85	43	52.15	3.06	49.09	250.34
90	41	49.91	3.06	46.85	252.98
95	39	47.87	3.06	44.81	255.44
100	38	46.02	3.06	42.95	257.73
105	36	44.31	3.06	41.25	259.86
110	35	42.74	3.06	39.68	261.86
115	34	41.28	3.06	38.22	263.73
120	33	39.94	3.06	36.87	265.49
150	28	33.52	3.06	30.46	274.13
180	24	29.02	3.06	25.96	280.34
210	21	25.67	3.06	22.61	284.87
240	19	23.07	3.06	20.01	288.18
270	17	21.00	3.06	17.94	290.55
300	16	19.29	3.06	16.23	292.17
330	15	17.87	3.06	14.81	293.19
360	14	16.66	3.06	13.60	293.70
420	12	14.71	3.06	11.65	293.52
480	11	13.20	3.06	10.14	292.07
540	10	12.00	3.06	8.94	289.64
600	9.1	11.02	3.06	7.96	286.42
660	8.4	10.20	3.06	7.14	282.56
720	7.8	9.50	3.06	6.44	278.17
780	7.3	8.90	3.06	5.84	273.32
840	6.9	8.38	3.06	5.32	268.09
900	6.5	7.92	3.06	4.86	262.51
960	6.2	7.52	3.06	4.46	256.64
1020	5.9	7.15	3.06	4.09	250.50
1080	5.6	6.83	3.06	3.77	244.13
1140	5.4	6.53	3.06	3.47	237.54
1200	5.2	6.27	3.06	3.21	230.76
1260	5.0	6.02	3.06	2.96	223.81
1320	4.8	5.80	3.06	2.74	216.70
1380	4.6	5.59	3.06	2.53	209.45
1440	4.4	5.40	3.06	2.34	202.06

DRAINAGE AREA III (Phase 1B) +POST NORTHWEST

(100-YEAR EVENT)

			C
Roof Area:	0	sq.m	1.00
Hard Area:	9,243	sq.m	1.00
Gravel Area:	0	sq.m	1.00
Soft Area:	1,380	sq.m	0.25
Total Catchment Area:	10,623	sq.m	0.90

Water Elevation:	73.77	m
Head:	1.46	m
Centroid of ICD Orifice:	72.31	m
Invert of Outlet Pipe of CB/MH-16:	72.26	m
Orifice Diameter:	100	mm
Orifice Area:	7,854	sq.mm
Discharge Coefficient:	0.187	

Maximum ICD Release Rate:	7.86	L/s
Maximum Overflow Rate:	29.28	L/s
Maximum Total Release Rate:	37.14	L/s

Surface Storage

CB/MH	Top Area	Depth	Volume	
CB/MH-15	48	0.12	1.92	cu.m

Chamber Storage

No. of Chambers	Volume Per Chamber	No. of Rows	No. of End Caps	Volume Per End Cap	Volume	
84	3.22	4	8	0.43	273.92	cu.m

Clear Stone Storage

Length	Width	Depth	Volume	40% Voids	
46.883	9.254	1.45	355.17	142.07	cu.m

Maximum Volume Stored:	417.91	cu.m
Maximum Volume Required:	417.91	cu.m

DRAINAGE AREA III (Phase 1B) +POST NORTHWEST

(100-YEAR EVENT)

Time (min)	i (mm/hr)	2.78AiC (L/s)	50% Release Rate (L/s)	Overflow Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	179	475.94	3.93	0.00	472.01	283.21
15	143	380.88	3.93	0.00	376.95	339.25
20	120	319.72	3.93	0.00	315.79	378.95
25	104	276.80	3.93	0.00	272.87	409.31
30	92	244.87	3.93	8.77	232.17	417.91
35	83	220.11	3.93	17.18	199.00	417.91
40	75	200.30	3.93	22.24	174.13	417.91
45	69	184.05	3.93	25.34	154.78	417.91
50	64	170.47	3.93	27.23	139.30	417.91
55	60	158.93	3.93	28.36	126.64	417.91
60	56	148.99	3.93	28.97	116.09	417.91
65	53	140.33	3.93	29.24	107.16	417.91
70	50	132.71	3.93	29.28	99.50	417.91
75	47	125.96	3.93	29.16	92.87	417.91
80	45	119.92	3.93	28.93	87.06	417.91
85	43	114.49	3.93	28.62	81.94	417.91
90	41	109.58	3.93	28.26	77.39	417.91
95	39	105.11	3.93	27.86	73.32	417.91
100	38	101.03	3.93	27.45	69.65	417.91
105	36	97.28	3.93	27.02	66.33	417.91
110	35	93.83	3.93	26.58	63.32	417.91
115	34	90.64	3.93	26.14	60.57	417.91
120	33	87.68	3.93	25.71	58.04	417.91
150	28	73.60	3.93	23.23	46.43	417.91
180	24	63.71	3.93	21.09	38.70	417.91
210	21	56.36	3.93	19.26	33.17	417.91
240	19	50.66	3.93	17.71	29.02	417.91
270	17	46.10	3.93	16.37	25.80	417.91
300	16	42.36	3.93	15.21	23.22	417.91
330	15	39.23	3.93	14.19	21.11	417.91
360	14	36.57	3.93	13.30	19.35	417.91
420	12	32.29	3.93	11.78	16.58	417.91
480	11	28.99	3.93	10.55	14.51	417.91
540	10	26.35	3.93	9.52	12.90	417.91
600	9.1	24.19	3.93	8.65	11.61	417.91
660	8.4	22.39	3.93	7.90	10.55	417.91
720	7.8	20.86	3.93	7.25	9.67	417.91
840	6.9	18.40	3.93	6.18	8.29	417.91
960	6.2	16.50	3.93	5.32	7.26	417.91
1080	5.6	14.99	3.93	4.61	6.45	417.91
1200	5.2	13.76	3.93	4.02	5.80	417.91
1320	4.8	12.73	3.93	3.52	5.28	417.91
1440	4.4	11.86	3.93	3.09	4.84	417.91
1560	4.2	11.10	3.93	2.71	4.46	417.91
1680	3.9	10.45	3.93	2.38	4.15	417.91
1800	3.7	9.88	3.93	2.08	3.87	417.91
1920	3.5	9.37	3.93	1.81	3.63	417.91
2040	3.3	8.92	3.93	1.57	3.41	417.91
2160	3.2	8.51	3.93	1.36	3.22	417.91
2280	3.1	8.14	3.93	1.16	3.05	417.91
2400	2.9	7.81	3.93	0.98	2.90	417.91
2520	2.8	7.50	3.93	0.81	2.76	417.91
2640	2.7	7.22	3.93	0.65	2.64	417.91
2760	2.6	6.97	3.93	0.51	2.52	417.91
2880	2.5	6.73	3.93	0.38	2.42	417.91
3000	2.4	6.51	3.93	0.25	2.32	417.91
3120	2.4	6.30	3.93	0.14	2.23	417.91
3240	2.3	6.11	3.93	0.03	2.15	417.91
3360	2.2	5.93	3.93	0.00	2.00	403.01
3480	2.2	5.76	3.93	0.00	1.83	382.35
3600	2.1	5.60	3.93	0.00	1.67	361.47
3720	2.0	5.46	3.93	0.00	1.53	340.39
3840	2.0	5.32	3.93	0.00	1.39	319.12
3960	1.9	5.18	3.93	0.00	1.25	297.67
4080	1.9	5.06	3.93	0.00	1.13	276.06
4200	1.9	4.94	3.93	0.00	1.01	254.28
4320	1.8	4.83	3.93	0.00	0.90	232.35

2-YEAR EVENT

DRAINAGE AREA 'NORTHWEST (PH 1B)' (Uncontrolled)

			C
Hard Surface Area:	451	sq.m	0.90
Soft Surface Area:	0	sq.m	0.20
Catchment Area:	451	sq.m	0.90
Time of Concentration:	10	min	
Rainfall Intensity (i):	77	mm/hr (2-year event)	
Flow Rate (2.78AiC):	8.67	L/s	

DRAINAGE AREA 'SOUTH (PH 1B)' (Uncontrolled)

			C
Hard Surface Area:	1,494	sq.m	0.90
Soft Surface Area:	64	sq.m	0.20
Catchment Area:	1,558	sq.m	0.87
Time of Concentration:	10	min	
Rainfall Intensity (i):	77	mm/hr (2-year event)	
Flow Rate (2.78AiC):	28.98	L/s	

DRAINAGE AREA I (Phase 1B - Roof)

(2-YEAR EVENT)

			C
Total Catchment Area:	2,614	sq.m	0.90

No. of Roof Drains: 10

Slots per Wier: 1 0.01242 L/s/mm/slot (5 USgpm/in/slot)

Depth at Roof Drains: 82 mm

Maximum Release Rate: 10.15 L/s Pond Area: 908 sq.m

Maximum Volume Stored: 29.08 cu.m

Maximum Volume Required: 29.08 cu.m

Time (min)	i (mm/hr)	2.78AiC (L/s)	Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	77	50.23	10.15	40.08	24.05
15	62	40.40	10.15	30.24	27.22
20	52	34.03	10.15	23.88	28.65
25	45	29.54	10.15	19.39	29.08
30	40	26.19	10.15	16.03	28.86
35	36	23.58	10.15	13.43	28.20
40	33	21.49	10.15	11.34	27.21
45	30	19.78	10.15	9.62	25.98
50	28	18.34	10.15	8.19	24.56
55	26	17.12	10.15	6.96	22.97
60	25	16.06	10.15	5.91	21.26
65	23	15.14	10.15	4.99	19.45
70	22	14.33	10.15	4.18	17.54
75	21	13.61	10.15	3.46	15.56
80	20	12.97	10.15	2.81	13.51
85	19	12.39	10.15	2.24	11.40
90	18	11.87	10.15	1.71	9.24
95	17	11.39	10.15	1.23	7.04
100	17	10.95	10.15	0.80	4.79
105	16	10.55	10.15	0.40	2.50
110	16	10.18	10.15	0.03	0.18
115	15	9.84	9.84	0.00	0.00
120	15	9.52	9.52	0.00	0.00
150	12	8.01	8.01	0.00	0.00
180	11	6.95	6.95	0.00	0.00
210	9.4	6.16	6.16	0.00	0.00
240	8.5	5.54	5.54	0.00	0.00
270	7.7	5.05	5.05	0.00	0.00
300	7.1	4.65	4.65	0.00	0.00
330	6.6	4.31	4.31	0.00	0.00
360	6.1	4.02	4.02	0.00	0.00

DRAINAGE AREA II (Phase 1B)

(2-YEAR EVENT)

			C
Roof Area:	0	sq.m	0.90
Hard Area:	5,398	sq.m	0.90
Gravel Area:	0	sq.m	0.80
Soft Area:	268	sq.m	0.20
Total Catchment Area:	5,666	sq.m	0.87

Water Elevation:	72.96	m
Head:	0.53	m
Centroid of ICD Orifice:	72.43	m
Invert of Outlet Pipe of CB/MH-8:	72.38	m
Orifice Diameter:	96	mm
Orifice Area:	7,163	sq.mm
Discharge Coefficient:	0.61	

Maximum Release Rate: 14.13 L/s

Surface Storage

CB/MH	Top Area	Depth	Volume	
CB/MH-1	0	0.00	0.00	cu.m
CB/MH-2	0	0.00	0.00	cu.m
CB-3	0	0.00	0.00	cu.m
CB-4		0.00		
CB/MH-5	0	0.00	0.00	cu.m
CB/MH-6	0	0.00	0.00	cu.m
CB/MH-7	0	0.00	0.00	
CB/MH-8	0	0.00	0.00	cu.m
CB-8A	0	0.00	0.00	cu.m

Chamber Storage

No. of Chambers	Stage Volume	No. of Rows	No. of End Caps	Stage Volume	Volume	
165	0.43	15	30	0.02	71.55	cu.m

Clear Stone Storage

Length	Width	Depth	Volume	40% Voids	
24.783	15.308	0.35	61.39	24.56	cu.m

Maximum Volume Stored:	96.11	cu.m
Maximum Volume Required:	96.11	cu.m

DRAINAGE AREA II (Phase 1B)

(2-YEAR EVENT)

Time (min)	i (mm/hr)	2.78AiC (L/s)	50% Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	77	104.88	7.06	97.81	58.69
15	62	84.34	7.06	77.28	69.55
20	52	71.05	7.06	63.98	76.78
25	45	61.67	7.06	54.61	81.92
30	40	54.68	7.06	47.62	85.71
35	36	49.24	7.06	42.18	88.57
40	33	44.88	7.06	37.81	90.75
45	30	41.29	7.06	34.23	92.42
50	28	38.29	7.06	31.23	93.68
55	26	35.74	7.06	28.67	94.62
60	25	33.53	7.06	26.47	95.29
65	23	31.61	7.06	24.55	95.74
70	22	29.92	7.06	22.86	96.01
75	21	28.42	7.06	21.36	96.11
80	20	27.08	7.06	20.01	96.07
85	19	25.87	7.06	18.81	95.91
90	18	24.77	7.06	17.71	95.64
95	17	23.78	7.06	16.71	95.27
100	17	22.87	7.06	15.80	94.82
105	16	22.03	7.06	14.97	94.29
110	16	21.26	7.06	14.20	93.70
115	15	20.55	7.06	13.48	93.03
120	15	19.88	7.06	12.82	92.31
125	14	19.27	7.06	12.21	91.54
130	14	18.69	7.06	11.63	90.72
135	13	18.16	7.06	11.09	89.85
140	13	17.65	7.06	10.59	88.94
145	13	17.18	7.06	10.11	87.99
150	12	16.73	7.06	9.67	87.00
180	11	14.51	7.06	7.45	80.43
210	9.4	12.86	7.06	5.79	73.00
240	8.5	11.57	7.06	4.51	64.94
270	7.7	10.54	7.06	3.48	56.38
300	7.1	9.70	7.06	2.64	47.44
330	6.6	8.99	7.06	1.93	38.18
360	6.1	8.39	7.06	1.33	28.66
420	5.4	7.42	7.06	0.36	8.99
480	4.9	6.67	6.67	0.00	0.00
540	4.4	6.07	6.07	0.00	0.00
600	4.1	5.58	5.58	0.00	0.00
660	3.8	5.17	5.17	0.00	0.00
720	3.5	4.82	4.82	0.00	0.00
780	3.3	4.52	4.52	0.00	0.00
840	3.1	4.26	4.26	0.00	0.00
900	2.9	4.03	4.03	0.00	0.00
960	2.8	3.82	3.82	0.00	0.00
1020	2.7	3.64	3.64	0.00	0.00
1080	2.5	3.48	3.48	0.00	0.00
1140	2.4	3.33	3.33	0.00	0.00
1200	2.3	3.19	3.19	0.00	0.00
1260	2.2	3.07	3.07	0.00	0.00
1320	2.2	2.96	2.96	0.00	0.00
1380	2.1	2.85	2.85	0.00	0.00
1440	2.0	2.76	2.76	0.00	0.00

DRAINAGE AREA II (Phase 1B + Phase 2)

(2-YEAR EVENT)

			C
Roof Area:	0	sq.m	0.90
Hard Area:	5,400	sq.m	0.90
Gravel Area:	0	sq.m	0.80
Soft Area:	4,066	sq.m	0.20
Total Catchment Area:	9,466	sq.m	0.60

Water Elevation:	73.07	m
Head:	0.64	m
Centroid of ICD Orifice:	72.43	m
Invert of Outlet Pipe of CB/MH-8:	72.38	m
Orifice Diameter:	96	mm
Orifice Area:	7,163	sq.mm
Discharge Coefficient:	0.61	
Maximum Release Rate:	15.52	L/s

Surface Storage

CB/MH	Top Area	Depth	Volume	
CB/MH-1	0	0.00	0.00	cu.m
CB/MH-2	0	0.00	0.00	cu.m
CB-3	0	0.00	0.00	cu.m
CB-4	0	0.00	0.00	cu.m
CB/MH-5	0	0.00	0.00	cu.m
CB/MH-6	0	0.00	0.00	cu.m
CB/MH-7	0	0.00	0.00	cu.m
CB/MH-8	0	0.00	0.00	cu.m
CB-8A	0	1.00	0.00	cu.m

Chamber Storage

No. of Chambers	Stage Volume	No. of Rows	No. of End Caps	Stage Volume	Volume	
165	0.43	15	30	0.02	71.55	cu.m

Clear Stone Storage

Length	Width	Depth	Volume	40% Voids	
24.783	15.308	0.46	103.29	41.32	cu.m

Maximum Volume Stored:	112.87	cu.m
Maximum Volume Required:	112.87	cu.m

DRAINAGE AREA II (Phase 1B + Phase 2)

(2-YEAR EVENT)

Time (min)	i (mm/hr)	2.78AiC (L/s)	50% Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	77	121.13	7.76	113.37	68.02
15	62	97.42	7.76	89.66	80.69
20	52	82.06	7.76	74.30	89.16
25	45	71.24	7.76	63.47	95.21
30	40	63.15	7.76	55.39	99.71
35	36	56.87	7.76	49.11	103.13
40	33	51.83	7.76	44.07	105.77
45	30	47.69	7.76	39.93	107.82
50	28	44.22	7.76	36.46	109.39
55	26	41.27	7.76	33.51	110.60
60	25	38.73	7.76	30.97	111.49
65	23	36.51	7.76	28.75	112.13
70	22	34.56	7.76	26.80	112.56
75	21	32.83	7.76	25.07	112.79
80	20	31.27	7.76	23.51	112.87
85	19	29.88	7.76	22.12	112.80
90	18	28.61	7.76	20.85	112.61
95	17	27.46	7.76	19.70	112.31
100	17	26.41	7.76	18.65	111.90
105	16	25.45	7.76	17.68	111.41
110	16	24.55	7.76	16.79	110.84
115	15	23.73	7.76	15.97	110.20
120	15	22.97	7.76	15.21	109.48
150	12	19.32	7.76	11.56	104.06
180	11	16.76	7.76	9.00	97.19
210	9.4	14.85	7.76	7.09	89.32
240	8.5	13.37	7.76	5.61	80.72
270	7.7	12.18	7.76	4.42	71.56
300	7.1	11.20	7.76	3.44	61.94
330	6.6	10.38	7.76	2.62	51.96
360	6.1	9.69	7.76	1.93	41.68
420	5.4	8.57	7.76	0.81	20.39
480	4.9	7.70	7.70	0.00	0.00
540	4.4	7.01	7.01	0.00	0.00
600	4.1	6.44	6.44	0.00	0.00
660	3.8	5.97	5.97	0.00	0.00
720	3.5	5.57	5.57	0.00	0.00
780	3.3	5.22	5.22	0.00	0.00
840	3.1	4.92	4.92	0.00	0.00
900	2.9	4.65	4.65	0.00	0.00
960	2.8	4.42	4.42	0.00	0.00
1020	2.7	4.21	4.21	0.00	0.00
1080	2.5	4.02	4.02	0.00	0.00
1140	2.4	3.85	3.85	0.00	0.00
1200	2.3	3.69	3.69	0.00	0.00
1260	2.2	3.55	3.55	0.00	0.00
1320	2.2	3.42	3.42	0.00	0.00
1380	2.1	3.30	3.30	0.00	0.00
1440	2.0	3.19	3.19	0.00	0.00

DRAINAGE AREA III (Phase 1B)

(2-YEAR EVENT)

			C
Roof Area:	0	sq.m	0.90
Hard Area:	4,325	sq.m	0.90
Gravel Area:	0	sq.m	0.80
Soft Area:	168	sq.m	0.20
Total Catchment Area:	4,493	sq.m	0.87

Water Elevation:	72.62	m
Head:	0.31	m
Centroid of ICD Orifice:	72.31	m
Invert of Outlet Pipe of CB/MH-16:	72.26	m
Orifice Diameter:	100	mm
Orifice Area:	7,854	sq.mm
Discharge Coefficient:	0.187	

Maximum Release Rate: 3.63 L/s

Surface Storage

CB/MH	Top Area	Depth	Volume	
CB/MH-15	0	0.00	0.00	cu.m

Chamber Storage

No. of Chambers	Volume Per Chamber	No. of Rows	No. of End Caps	Volume Per End Cap	Volume	
84	1.07	4	8	0.14	91.37	cu.m

Clear Stone Storage

Length	Width	Depth	Volume	40% Voids	
46.883	9.254	0.30	39.37	15.75	cu.m

Maximum Volume Stored: 107.12 cu.m

Maximum Volume Required: 107.12 cu.m

DRAINAGE AREA III (Phase 1B)

(2-YEAR EVENT)

Time (min)	i (mm/hr)	2.78AiC (L/s)	50% Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	76.8	83.83	1.81	82.01	49.21
15	61.8	67.42	1.81	65.60	59.04
20	52.0	56.79	1.81	54.97	65.97
25	45.2	49.30	1.81	47.48	71.22
30	40.0	43.71	1.81	41.89	75.40
35	36.1	39.36	1.81	37.54	78.84
40	32.9	35.87	1.81	34.05	81.73
45	30.2	33.00	1.81	31.19	84.21
50	28.0	30.61	1.81	28.79	86.37
55	26.2	28.56	1.81	26.75	88.27
60	24.6	26.80	1.81	24.99	89.96
65	23.2	25.27	1.81	23.45	91.47
70	21.9	23.92	1.81	22.10	92.83
75	20.8	22.72	1.81	20.90	94.06
80	19.8	21.64	1.81	19.83	95.18
85	18.9	20.68	1.81	18.86	96.20
90	18.1	19.80	1.81	17.99	97.13
95	17.4	19.01	1.81	17.19	97.99
100	16.7	18.28	1.81	16.46	98.78
105	16.1	17.61	1.81	15.79	99.50
110	15.6	16.99	1.81	15.18	100.17
115	15.0	16.42	1.81	14.61	100.79
120	14.6	15.89	1.81	14.08	101.37
150	12.3	13.37	1.81	11.56	104.01
180	10.6	11.60	1.81	9.78	105.66
210	9.4	10.28	1.81	8.46	106.62
240	8.5	9.25	1.81	7.43	107.06
270	7.7	8.43	1.81	6.61	107.12
300	7.1	7.75	1.81	5.94	106.87
330	6.6	7.19	1.81	5.37	106.36
360	6.1	6.71	1.81	4.89	105.65
420	5.4	5.93	1.81	4.12	103.71
480	4.9	5.33	1.81	3.52	101.24
540	4.4	4.85	1.81	3.04	98.36
600	4.1	4.46	1.81	2.64	95.16
660	3.8	4.13	1.81	2.32	91.68
720	3.5	3.85	1.81	2.04	87.98
780	3.3	3.61	1.81	1.80	84.08
840	3.1	3.40	1.81	1.59	80.02
900	2.9	3.22	1.81	1.40	75.82
960	2.8	3.06	1.81	1.24	71.49
1020	2.7	2.91	1.81	1.10	67.05
1080	2.5	2.78	1.81	0.96	62.51
1140	2.4	2.66	1.81	0.85	57.88
1200	2.3	2.55	1.81	0.74	53.17
1260	2.2	2.46	1.81	0.64	48.39
1320	2.2	2.36	1.81	0.55	43.53
1380	2.1	2.28	1.81	0.47	38.62
1440	2.0	2.20	1.81	0.39	33.65

DRAINAGE AREA III (Phase 1B) +POST NORTHWEST

(2-YEAR EVENT)

			C
Roof Area:	0	sq.m	0.90
Hard Area:	9,243	sq.m	0.90
Gravel Area:	0	sq.m	0.80
Soft Area:	1,380	sq.m	0.20
Total Catchment Area:	10,623	sq.m	0.81

Water Elevation:	73.07	m
Head:	0.76	m
Centroid of ICD Orifice:	72.31	m
Invert of Outlet Pipe of CB/MH-16:	72.26	m
Orifice Diameter:	100	mm
Orifice Area:	7,854	sq.mm
Discharge Coefficient:	0.187	

Maximum ICD Release Rate:	5.67	L/s
Maximum Overflow Rate:	0.00	L/s
Maximum TOTAL Release Rate:	5.67	L/s

Surface Storage

CB/MH	Top Area	Depth	Volume	
CB/MH-15	0	0.00	0.00	cu.m

Chamber Storage

No. of Chambers	Volume Per Chamber	No. of Rows	No. of End Caps	Volume Per End Cap	Volume	
84	2.46	4	8	0.33	209.59	cu.m

Clear Stone Storage

Length	Width	Depth	Volume	40% Voids	
46.883	9.254	0.75	115.68	46.27	cu.m

Maximum Volume Stored:	255.86	cu.m
Maximum Volume Required:	255.86	cu.m

DRAINAGE AREA III (Phase 1B) +POST NORTHWEST

(2-YEAR EVENT)

Time (min)	i (mm/hr)	2.78AiC (L/s)	50% Release Rate (L/s)	Overflow Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	77	183.51	2.84	0.00	180.68	108.41
15	62	147.58	2.84	0.00	144.75	130.27
20	52	124.32	2.84	0.00	121.48	145.78
25	45	107.92	2.84	0.00	105.08	157.63
30	40	95.68	2.84	0.00	92.84	167.11
35	36	86.16	2.84	0.00	83.32	174.98
40	33	78.52	2.84	0.00	75.69	181.65
45	30	72.25	2.84	0.00	69.42	187.42
50	28	67.00	2.84	0.00	64.16	192.49
55	26	62.53	2.84	0.00	59.69	196.99
60	25	58.68	2.84	0.00	55.84	201.03
65	23	55.32	2.84	0.00	52.48	204.67
70	22	52.36	2.84	0.00	49.52	207.99
75	21	49.73	2.84	0.00	46.89	211.02
80	20	47.38	2.84	0.00	44.54	213.81
85	19	45.26	2.84	0.00	42.43	216.39
90	18	43.35	2.84	0.00	40.51	218.78
95	17	41.61	2.84	0.00	38.77	220.99
100	17	40.01	2.84	0.00	37.18	223.06
105	16	38.55	2.84	0.00	35.71	224.99
110	16	37.20	2.84	0.00	34.36	226.80
115	15	35.95	2.84	0.00	33.12	228.50
120	15	34.79	2.84	0.00	31.96	230.10
150	12	29.27	2.84	0.00	26.44	237.94
180	11	25.39	2.84	0.00	22.56	243.60
210	9.4	22.50	2.84	0.00	19.66	247.74
240	8.5	20.25	2.84	0.00	17.41	250.76
270	7.7	18.45	2.84	0.00	15.61	252.94
300	7.1	16.97	2.84	0.00	14.14	254.43
330	6.6	15.73	2.84	0.00	12.90	255.37
360	6.1	14.68	2.84	0.00	11.85	255.86
420	5.4	12.98	2.84	0.00	10.15	255.72
480	4.9	11.67	2.84	0.00	8.83	254.41
540	4.4	10.62	2.84	0.00	7.78	252.21
600	4.1	9.76	2.84	0.00	6.92	249.28
660	3.8	9.04	2.84	0.00	6.21	245.76
720	3.5	8.43	2.84	0.00	5.60	241.75
840	3.1	7.45	2.84	0.00	4.61	232.54
960	2.8	6.69	2.84	0.00	3.86	222.06
1080	2.5	6.09	2.84	0.00	3.25	210.59
1200	2.3	5.59	2.84	0.00	2.75	198.34
1320	2.2	5.18	2.84	0.00	2.34	185.44
1440	2.0	4.83	2.84	0.00	1.99	171.99
1560	1.9	4.52	2.84	0.00	1.69	158.08
1680	1.8	4.26	2.84	0.00	1.43	143.77
1800	1.7	4.03	2.84	0.00	1.20	129.11
1920	1.6	3.83	2.84	0.00	0.99	114.14
2040	1.5	3.64	2.84	0.00	0.81	98.90
2160	1.5	3.48	2.84	0.00	0.64	83.42
2280	1.4	3.33	2.84	0.00	0.50	67.72
2400	1.3	3.20	2.84	0.00	0.36	51.82
2520	1.3	3.07	2.84	0.00	0.24	35.74
2640	1.2	2.96	2.84	0.00	0.12	19.49
2760	1.2	2.85	2.84	0.00	0.02	3.09
2880	1.2	2.76	2.76	0.00	0.00	0.00
3000	1.1	2.67	2.67	0.00	0.00	0.00
3120	1.1	2.58	2.58	0.00	0.00	0.00
3240	1.0	2.51	2.51	0.00	0.00	0.00
3360	1.0	2.43	2.43	0.00	0.00	0.00
3480	1.0	2.37	2.37	0.00	0.00	0.00
3600	1.0	2.30	2.30	0.00	0.00	0.00
3720	0.9	2.24	2.24	0.00	0.00	0.00
3840	0.9	2.19	2.19	0.00	0.00	0.00
3960	0.9	2.13	2.13	0.00	0.00	0.00
4080	0.9	2.08	2.08	0.00	0.00	0.00
4200	0.9	2.03	2.03	0.00	0.00	0.00
4320	0.8	1.99	1.99	0.00	0.00	0.00

DRAINAGE AREA I (Phase 1B - Roof)

Maximum Volume Available:

No. of Roof Drains: 10
Slots per Weir: 1 0.01242 L/s/mm/slot (5 USgpm/in/slot)

Depth at Roof Drains: 150 mm Pond Area: 2,572 sq.m

Maximum Volume Available: 143.13 cu.m

DRAINAGE AREA II (Phase 1B)

Water Elevation: 74.10 m

Surface Storage

CB/MH	Top Area	Depth	Volume	
CB/MH-1	634	0.20	42.27	cu.m
CB/MH-2	548	0.20	36.53	cu.m
CB-3	351	0.17	19.89	cu.m
CB/MH-5	341	0.15	17.05	cu.m
CB/MH-6	282	0.15	14.10	cu.m
CB/MH-7	595	0.20	39.67	cu.m
CB/MH-8	485	0.20	32.33	cu.m
CB-8A	644	0.20	42.93	cu.m

Chamber Storage

No. of Chambers	Volume Per Chamber	No. of Rows	No. of End Caps	Volume Per End Cap	Volume	
165	0.43	15	30	0.02	71.55	cu.m

Clear Stone Storage

Length	Width	Depth	Volume	40% Voids	
24.783	15.308	0.56	140.14	56.06	cu.m

Maximum Volume Available: 372.38 cu.m

DRAINAGE AREA II (Phase 1B + Phase 2)

Water Elevation: 74.10 m

Surface Storage

CB/MH	Top Area	Depth	Volume	
CB/MH-1	634	0.20	42.27	cu.m
CB/MH-2	548	0.20	36.53	cu.m
CB-3	351	0.17	19.89	cu.m
CB-4	1,582	0.60	316.40	cu.m
CB/MH-5	341	0.15	17.05	cu.m
CB/MH-6	282	0.15	14.10	cu.m
CB/MH-7	595	0.20	39.67	cu.m
CB/MH-8	485	0.20	32.33	cu.m
CB-8A	644	0.20	42.93	cu.m

Chamber Storage

No. of Chambers	Volume Per Chamber	No. of Rows	No. of End Caps	Volume Per End Cap	Volume	
165	0.43	15	30	0.02	71.55	cu.m

Clear Stone Storage

Length	Width	Depth	Volume	40% Voids	
24.783	15.308	0.56	140.14	56.06	cu.m

Maximum Volume Available: 688.78 cu.m

DRAINAGE AREA III (Phase 1B)

Water Elevation: 73.77 m

Surface Storage

CB/MH	Top Area	Depth	Volume	
CB/MH-15	48	0.12	1.92	cu.m

Chamber Storage

No. of Chambers	Volume Per Chamber	No. of Rows	No. of End Caps	Volume Per End Cap	Volume	
84	3.22	4	8	0.43	273.92	cu.m

Clear Stone Storage

Length	Width	Depth	Volume	40% Voids	
46.883	9.254	1.45	355.17	142.07	cu.m

Maximum Volume Available: 417.91 cu.m

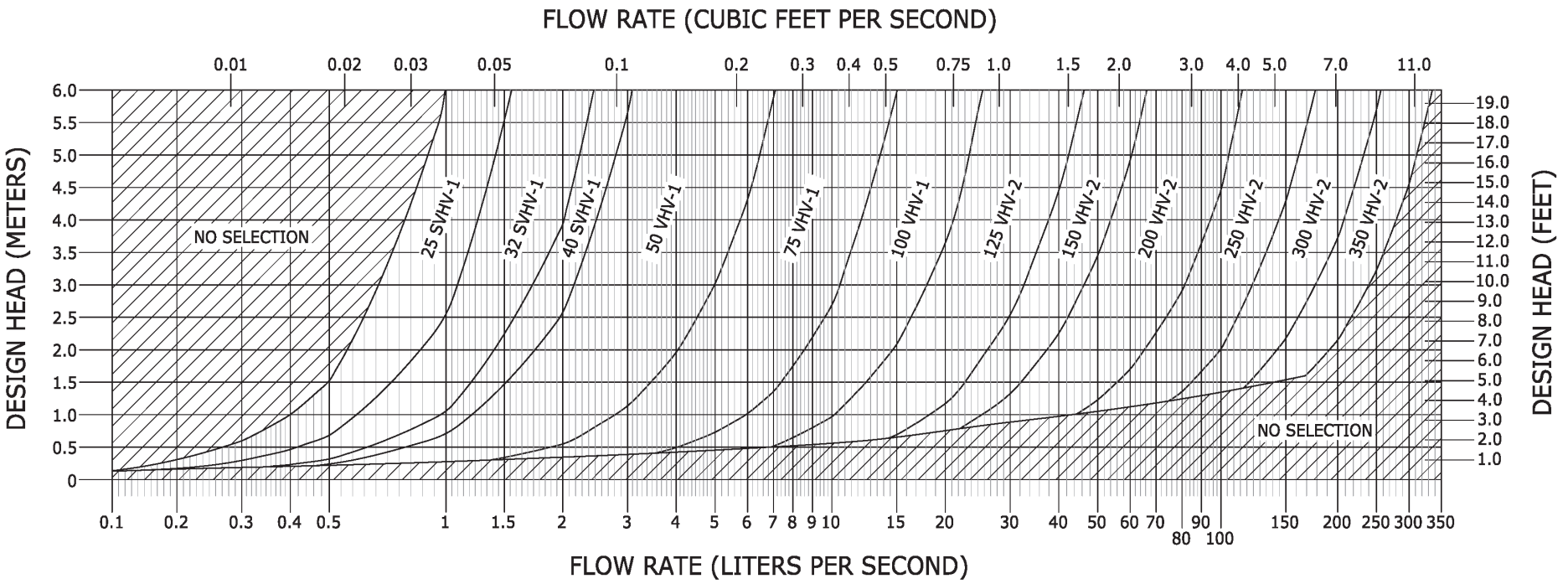


Figure 3 : HYDROVEX® VHV/SVHV Selection Chart

D.B. Gray Engineering Inc.

Stormwater Management - Grading & Drainage - Storm & Sanitary Sewers - Watermains

700 Long Point Circle
Ottawa, Ontario K1T 4E9

613-425-8044
d.gray@dbgrayengineering.com

STORM SEWER CALCULATIONS

Rational Method

2-YEAR EVENT

Project: 1309 Carling Avenue
Phase 1B Redevelopment
Ottawa, Ontario

Date: January 21, 2026

Manning's Roughness Coefficient: 0.013

Location		Individual					Cumulative				Sewer Data							
From	To	Roof C = 0.90 (ha)	Hard C = 0.90 (ha)	Gravel C = 0.70 (ha)	Soft C = 0.20 (ha)	2.78AC	2.78AC	Time (min)	Rainfall Intensity (mm/hr)	Q Flow Rate (L/s)	Length (m)	Nominal Diameter (mm)	Actual Diameter (mm)	Slope (%)	Velocity (m/s)	Q_{Full} Capacity (L/s)	Time (min)	Q / Q_{Full}
Phase 1B Roof Drains	MH-17	0.2614				0.6540	0.6540	10.00	77	50.23	2.3	300	300	2.00	1.93	136.76	0.02	37%
							Flow through flow control roof drains:			10.15	2.3	300	300	2.00	1.93	136.76	0.02	7%
Trench Drain	MH-17		0.0451			0.1128	0.1128	10.00	77	8.67	2.3	200	200	2.00	1.48	46.38	0.03	19%
MH-17	CB/MH-18					0.0000	0.7669	10.03	77	58.82	45.4	450	456	0.20	0.81	132.09	0.94	45%
CB/MH-18	MH-19					0.0000	0.7669	10.96	73	56.21	8.6	450	456	0.23	0.87	141.65	0.17	40%
EXIST. MH	MH-13		0.5743		0.0168	1.4462	1.4462	12.00	70	101.08	24.6	450	456	0.28	0.96	156.29	0.43	65%
MH-13	MH-14					0.0000	1.4462	12.43	69	99.20	36.7	450	456	0.27	0.94	153.47	0.65	65%
MH-14	CB/MH-15					0.0000	1.4462	13.08	67	96.47	13.2	450	456	0.21	0.83	135.35	0.27	71%
CB/MH-15	CB/MH-16		0.6254		0.1212	1.6321	3.0784	13.34	66	203.09	2.7	450	456	0.37	1.10	179.66	0.04	113%
								Flow through ICD		7.20	2.7	450	456	0.37	1.10	179.66	0.04	4%
CB/MH-16	MH-19					0.0000	3.0784	13.39	66	202.74	2.3	450	456	0.43	1.19	193.68	0.03	105%
								Flow through ICD		7.20	2.3	450	456	0.43	1.19	194.13	0.03	4%
MH-19	EXIST. MH					0.0000	3.8452	13.42	66	252.91	40.9	450	456	0.22	0.85	138.53	0.80	183%
							Flow from CB/MH-18 + Flow through ICD			63.41	40.9	450	456	0.22	0.85	138.53	0.80	46%
CB/MH-1	CB/MH-2		0.0869		0.0043	0.2198	0.2198	10.00	77	16.88	26.5	250	250	0.45	0.81	39.89	0.54	42%
CB/MH-2	CB/MH-8		0.0975		0.0050	0.2467	0.4665	10.54	75	34.89	25.6	250	250	0.43	0.80	39.09	0.54	89%
CB-3	CB/MH-5		0.0697		0.0042	0.1767	0.1767	10.00	77	13.57	26.1	250	250	0.43	0.80	39.09	0.55	35%
CB-4	CB/MH-5		0.0002		0.3798	0.2117	0.2117	10.00	77	16.26	20.0	250	250	0.45	0.81	39.89	0.41	41%
CB/MH-5	CB/MH-6		0.0338			0.0846	0.4730	10.55	75	35.36	23.2	250	250	0.43	0.80	39.09	0.49	90%
CB/MH-6	MH-6A		0.0278			0.0696	0.5425	11.03	73	39.63	17.8	250	250	0.45	0.81	39.89	0.37	99%
CB/MH-7	MH-6A		0.0741		0.0043	0.1878	0.7303	10.00	77	56.09	23.0	300	300	0.34	0.80	56.39	0.48	99%
MH-6A	CB/MH-8					0.0000	1.2728	11.40	72	91.42	3.6	375	375	0.56	1.19	131.21	0.05	70%
CB-8A	CB/MH-8		0.0932		0.0035	0.2351	0.2351	10.00	77	18.06	20.8	250	250	0.43	0.80	39.09	0.44	46%
CB/MH-8	DSEL STM102		0.0568		0.0055	0.1452	2.1197	11.45	72	151.90	22.2	375	375	0.27	0.82	91.10	0.45	167%
								Flow through ICD		15.92	22.2	375	375	0.27	0.82	91.10	0.45	17%
									Existing 900 mm Private Storm Sewer:			900	914	0.4	1.82	1,193		
CB-12B	CB/MH-12A		0.0334		0.0027	0.0851	0.0851	10.00	77	6.53	17.1	250	250	0.47	0.83	40.77	0.34	16%
CB/MH-12A	CB/MH-12		0.0704			0.1761	0.2612	10.34	76	19.72	30.0	250	250	0.34	0.71	34.68	0.71	57%