D.B. Gray Engineering Inc.

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

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SITE SERVICING & STORMWATER MANAGEMENT REPORT

2928 BANK STREET
OTTAWA, ONTARIO

REPORT NO. 23019

JANUARY 15, 2025
REVISED MARCH 13, 2025

CONTENTS

LIST OF APPENDICES

1.0 INTRODUCTION

This report has been prepared in support of the Site Plan Control application for the proposed 4-storey, 25-unit apartment building located at 2928 Bank Street in Ottawa, Ontario. The property was occupied by a pharmacy building, now demolished. 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-8 prepared by D.B. Gray Engineering Inc.

2.0 WATER SERVICING

2.1 WATER SUPPLY FOR FIREFIGHTING

A sprinkler system is proposed to be installed in the proposed building. The closest existing municipal fire hydrants are located on the southwest corner of the intersection of Bank Street and Kingsdale Avenue, and in front of 2950 Bank Street in the Queensdale Avenue ROW. They are ±110 m and ±148 m unobstructed distance, respectively, to the proposed fire department connection (FDC); which are more than the maximum 45 m required by the Ontario Building Code. Therefore, an additional fire hydrant is required. A new municipal fire hydrant is proposed to be located directly across the street from the subject property within the Queensdale Avenue right-of-way.

In accordance with City of Ottawa Technical Bulletin ISTB-2021-03, when calculating the required fire flow where pipe sizing is affected, the Fire Underwriters Survey (FUS) method is to be used. Using the FUS method, the required fire flow is calculated to be 10,000 L/min (166.7 L/s). Refer to calculations in Appendix B. The City of Ottawa indicated that 11,240 L/min (187.3 L/s) is available (3,800 L/min from the Kingsdale Avenue fire hydrant and 7,440 L/min from the Queensdale Avenue watermain). Refer to Appendix B. Therefore, there is an adequate water supply for firefighting from the existing municipal water distribution system.

Since only 10,000 L/min is required for firefighting, and assuming 3,800 L/min is available from the Kingsdale hydrant, only 6,200 L/min is required from the Queensdale Avenue. The City indicated that the 7,440 L/min is available at 20 psi (at 93.0m grade elevation). Calculations estimate that 6,200 L/min is available at about 28 psi (refer to Appendix B).

In accordance with City of Ottawa Technical Bulletin ISTB-2018-02, the aggregate flow of all contributing fire hydrants within 150 m of the building shall not be less than the required fire flow. In accordance with City of Ottawa Technical Bulletin ISTB-2018-02 Appendix I:

Class	Distance (m)	Contribution (L/min)
AA	≤ 75	5,700
	> 75 and ≤ 150	3,800

The proposed new Queensdale municipal fire hydrant can contribute 5,700 L/min (95 L/s); and the existing Queensdale fire hydrant can contribute 1,740 L/min (29 L/s) (totaling 7,440 L/min from Queensdale); and, as previously mentioned, the existing Kingsdale fire hydrant can contribute 3,800 L/min (63.3 L/s).

Therefore, the aggregate flow of the three contributing fire hydrants is 11,240 L/min (187.3 L/s), which is greater than the required fire flow of 10,000 L/min (166.7 L/s).

2.2 DOMESTIC WATER SUPPLY

In accordance with;

i. the City of Ottawa Water Design Guidelines for the populations,
ii. City of Ottawa Technical Bulletin ISTB-2021-03 for the consumption rate,
iii. the Ministry of the Environment Water Design Guidelines for the peaking factors, and

based on the 8 1-bedroom apartment units and 17 2-bedroom apartment units, the average daily demand is calculated to be 0.2 L/s, the maximum daily demand is calculated to be 1.3 L/s and the maximum hourly demand is calculated to be 2.0 L/s. Refer to calculations in Appendix B.

The boundary conditions in the 150 mm Queensdale Avenue municipal watermain provided by the City of Ottawa at the subject property indicate a minimum HGL of 123.7 m and a maximum HGL of 131.0 m. Refer to Appendix B. Based on these boundary conditions, the pressure at the water meter is calculated to vary between 302 kPa (44 psi) and 374 kPa (54 psi). This is an acceptable range for the proposed development.

A 150 mm water service connecting to the existing 150 mm Queensdale Avenue municipal watermain is required for the proposed sprinkler system; the same water service will be adequate for the domestic water supply.

3.0 SANITARY SERVICING

In accordance with;

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

based on the 8 1-bedroom apartment units and 17 2-bedroom apartment units, the post-development sanitary flow rate is calculated to be 0.53 L/s.

A 150 mm sanitary sewer service at 2.2% slope (22.59 L/s capacity) is proposed to service the development. At the design flow rate the sanitary sewer service will only be at 2% of its capacity. The proposed 150 mm sanitary sewer service will connect to the existing 450 mm Queensdale Avenue municipal sanitary sewer, which at 0.23% slope has a capacity of 141.65 L/s. The pre-development sanitary flow rate is calculated to be 0.11 L/s (refer to calculations in Appendix C); therefore, the 0.42 L/s post-development increase in flow is expected to have an acceptable impact on the 450 mm Queensdale Avenue municipal sanitary sewer.

4.0 STORMWATER MANAGEMENT

4.1 QUANTITY CONTROL

The stormwater quantity control criterion is to control the post-development 100-year peak flow rate to the pre-development 2-year peak flow rate using a calculated pre-development runoff coefficient not more than

0.5 and a calculated pre-development time of concentration not less than 10 minutes. It is calculated that the pre-development conditions reflect a runoff coefficient of 0.77 during the 100-year event and 0.69 during the 2-year event. Using the Bransby Williams Formula, the pre-development time of concentration is calculated to be 3 minutes. Using the Rational Method with a time of concentration of 10 minutes, the pre-development flow rates were calculated to be 50.05 L/s during the 100-year event and 19.17 L/s during the 2-year event. Using the Rational Method with a time of concentration of 10 minutes and runoff coefficient of 0.5, the maximum allowable release rate is calculated to be 13.91 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.

Drainage Area I (Uncontrolled Flow Off Site – 393 sq.m)
The perimeter of the property will drain uncontrolled off site. The flow rates are calculated at a time of concentration of 10 minutes.

	100-Year Event	2-Year Event
Maximum Flow Rate	9.70 L/s	3.61 L/s

Drainage Area II (Roof – 626 sq.m)
The 4 roof drains are to be flow control type roof drains, which will restrict the flow of stormwater and cause it to pond on the roof. Roof drains are to be Watts RD-100 c/w a Watts Adjustable Accutrol Weir in the ¼ open position and release 0.95 L/s at 150 mm (15 USgpm at 6”). The opening at the top of the flow control weir is to be a minimum of 50 mm in diameter. A minimum of 6 scuppers, each a minimum 300 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	3.62 L/s	3.01 L/s
Maximum Depth at Roof Drains	138 mm	89 mm
Maximum Volume Stored	22.70 m^3	6.16 m^3

Drainage Area III (284 sq.m)
Runoff draining to CB/MH-1 (including runoff from the low roofs) will drain to a cistern inside the building having a working volume of 15.09 m^3. A pump will control the outflow from the cistern to 0.36 L/s (pressure gauges and a control valve will be installed to verify the pump flow rate). Refer to mechanical, architectural and structural.

	100-Year Event	2-Year Event
Pump Flow Rate	0.36 L/s	0.36 L/s
Maximum Volume Stored	14.16 m^3	4.033.87 m^3

Summary

	100-Year Event	2-Year Event
Pre-Development Flow Rate	50.05 L/s	19.17 L/s
Maximum Allowable Release Rate	13.91 L/s	13.91 L/s
Maximum Release Rate	13.75 L/s	7.01 L/s
Maximum Volume Required	36.28 m^3	10.03 m^3
Volume Provided	44.13 m^3	44.13 m^3

The maximum post-development release rate during the 100-year event is calculated to be 13.75 L/s, which is 73% less than the pre-development flow rate during the 100-year event and slightly less than the maximum allowable release rate. To achieve the maximum allowable release rate, a maximum storage volume of 36.86 m^3 is required during the 100-year event; 44.13 m^3 is provided. The maximum post-development release rate during the 2-year event is calculated to be 6.99 L/s, which is 64% less than the pre-development flow rate and 50% less than the maximum allowable release rate. The post-development reduction in flow is expected to have a positive impact on the 525 mm Queensdale Avenue municipal storm sewer.

4.2 QUALITY CONTROL

The property is located under the jurisdiction of the Rideau Valley Conservation Authority.

As per the 'Sawmill Creek Subwatershed Study Update' an enhanced level of protection (80% TSS – total suspended solids removal) is required. To achieve this requirement catchbasin/manhole CB/MH-1 is proposed to be an oil grit separator (OGS) manhole. Calculations by the manufacturer indicate that the proposed CDS PMSU2015-4 OGS will remove 92% of total suspended solids. Refer to Appendix D.

As stated in the 'Sawmill Creek Subwatershed Study Update' for Reach 5 ('The Queensdale Reach' – about 160 m west of the subject property): *"New development must ensure no increase in downstream peak flows or erosive impulse, and must be designed to maintain annual and seasonal volumes of watertable recharge through specific site-design measures."*

To promote infiltration and groundwater recharge; in addition to the proposed development having about 19% soft landscaping and the outlet of the flow control roof drains sheet draining across a flat landscaped area (having a 2% slope – the minimum permitted by the City), over half (52%) of all hard surface areas will be permeable pavers (130 m^2 with a subdrain is proposed at the parking stalls at the west side of the property and 20 m^2 (without sub-drains) at the walkway leading to the main entrance).

In eastern Ontario, on hard surfaces, approximately 150 mm of the 943 mm annual precipitation is lost to evapotranspiration ('Eastern Ontario Water Resources Management Study (2001) & Carp River Watershed / Subwatershed Study'). Permeable pavers have showed a 16% increase in evaporation rates relative impermeable pavements ('Effects on Evaporation Rates from Different Water-Permeable Pavement Designs'; P. Starke, P. Göbel & W. G. Coldewey). Therefore, assuming 174 mm (a 16% increase from 150 mm) of the 943 mm annual precipitation is lost to evaporation; 769 mm of the precipitation on permeable pavers is available for infiltration. As per the 'Sustainable Technologies Evaluation Program Low Impact Development Stormwater Management Planning and Design Guide' (referenced in the 'City of Ottawa Low

Impact Development Technical Guidance Report') permeable structures provides a volumetric runoff reduction of about 85%, and 45% with sub-drains.

(Based on the above reductions the 'annual' runoff coefficient of permeable pavers is calculated to be 0.12, and 0.46 with subdrains; however, 5-year runoff coefficients are 7% higher than the 'annual' runoff coefficient for hard surfaces and 29% for soft landscaped surfaces; therefore, to be conservative, when using the Rational and Modified Ration Method, 5-year runoff coefficients of 0.25 (108% higher) are used or permeable pavers, and 0.60 (30% higher) for permeable paver with subdrains.)

Based on water balance calculations, the weighted average of the annual infiltration for the pre-development conditions (i.e. the conditions that existed circa 2017) is 66 mm/year. Post development, with permeable pavers, the weighted average of the annual infiltration is calculated to be 83 mm/year; a 25% increase from pre-development conditions. Therefore, the proposed development is designed to maintain annual volumes of groundwater recharge. Refer to calculations in Appendix D.

Permeable Paver Maintenance: Based on the 'Sustainable Technologies Evaluation Program Low Impact Development Stormwater Management Planning and Design Guide', the following maintenance procedures and preventative measures should be incorporated into a maintenance plan:

- Annual inspections of permeable pavement should be conducted in the spring. These inspections should check for evidence of spills and surface ponding (staining or sediment accumulation on pavement surface), damage and deterioration.
- Keep the pavement surface free of organic material through regular sweeping and vacuuming.
- Surface sweeping should occur once or twice a year with a commercial vacuum sweeping unit. Permeable pavement should not be washed with high pressure water systems or compressed air units, because they will push particles deeper into the pavement.
- Vacuuming of the surface should occur on an annual basis.
- Seal coats should never be applied to permeable pavements.
- An uneven paver surface can be repaired by pulling up the pavers, redistributing the bedding course, and then placing the pavers back. New joint filling will need to be swept into the replaced pavers. A set of replacement pavers should be kept onsite for making future repairs.

Winter Maintenance:

- Sand should not be spread on permeable pavement as it can quickly lead to clogging.
- De-icers should only be used in moderation and only when needed.
- Snow should not be stored on top of permeable pavements.

An Erosion & Sediment Control Plan has been developed to be implemented during construction. Refer to drawing C-4 and notes 4.1 to 4.9 on drawing C-6.

i. 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.
ii. A silt fence barrier is to be installed along the perimeter of the site.
iii. Any material deposited on the public road is to be removed.

4.3 STORM SERVICING

The peak flow rate draining to the cistern during the 100-year event is calculated to be 12.24 L/s; which results in the proposed 250 mm storm sewer (at 0.43% slope – 39.41 L/s capacity) being 31% of its capacity. A 150 mm storm sewer service at 2% slope (20.41 L/s capacity) is proposed to service the development. Since the pump that controls the outflow from the cistern is 0.36 L/s, the storm sewer connection will only be at 2% of its capacity. The proposed 150 mm storm sewer service will connect to the existing 525 mm

Queensdale Avenue municipal storm sewer, which at 1.37% slope has a capacity of 524.09 L/s. Refer to calculations in Appendix D.

The rainwater leaders inside the 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.

The foundation drain will drain to a storm sump and be pumped to a storm drain. The point of connection to the storm drain is to be at a high level in the basement. Refer to mechanical.

An Environmental Compliance Approval from the Ministry of the Environment, Conservation and Parks is not expected to be required.

5.0 CONCLUSIONS

1. An additional fire hydrant is required, and a new municipal fire hydrant is proposed to be located directly across the street from the subject property within the Queensdale Avenue right-of-way.

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

3. The aggregate flow of the three contributing fire hydrants (including the proposed hydrant) is greater than the required fire flow.

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

5. The post-development sanitary flow rate will be adequately handled by the proposed sanitary sewer service.

6. The post-development increase in sanitary flow is expected to have an acceptable impact on the existing municipal sanitary sewer.

7. The maximum post-development release rate during the 100-year event is 73% less than the pre-development flow rate during the 100-year event and slightly less than the maximum allowable release rate. The maximum post-development release rate during the 2-year event is calculated to be 64% less than the pre-development flow rate and 50% less than the maximum allowable release rate.

8. The post-development reduction in stormwater flow is expected to have a positive impact on the 525 mm Queensdale Avenue municipal storm sewer.

9. The proposed oil grit separator (OGS) manhole will achieve an enhanced (minimum 80% TSS removal) level of protection.

10. To promote infiltration and groundwater recharge; in addition to the proposed development having about 19% soft landscaping, and the outlet of the flow control roof drains will sheet draining across a flat landscaped area, about half of all pavement areas will be permeable pavers. Post development, with permeable pavers, the weighted average of the annual infiltration is calculated to be 83 mm/year; a 25% increase from pre-development conditions. Therefore, the proposed development is designed to maintain annual volumes of groundwater recharge.

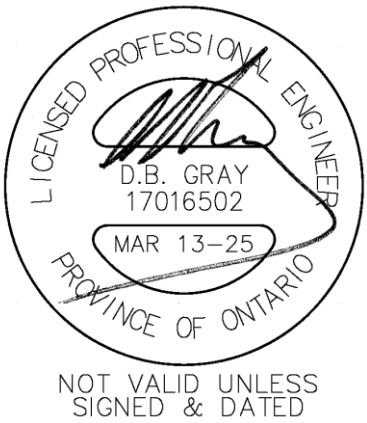
11. An Erosion & Sediment Control Plan has been developed to be implemented during construction.

12. The peak flow rate during the 100-year event will be adequately handled by the proposed storm sewers and storm sewer service connection.

13. The rainwater leaders inside the 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.

14. An Environmental Compliance Approval (ECA) from the Ministry of the Environment, Conservation and Parks is not expected to be required.

Prepared by D.B. Gray Engineering Inc.



APPENDIX A

PRE-APPLICATION CONSULTATION MEETING NOTES

Site Plan Pre- Application Consultation Notes

Date: January 27, 2023
Site Location: 2928 Bank Street
Type of Development: ☒ Residential (☐ townhomes, ☐ stacked, ☐ singles, ☒ apartments), ☐ Office Space, ☐ Commercial, ☐ Retail, ☐ Institutional, ☐ Industrial, Other:
Representative/Agent: Q9 Planning + Design
Project Manager: Tyler Cassidy, P.Eng.
Assigned Planner: Craig Hamilton

Infrastructure

MAP OF EXISTING PUBLIC SERVICES

Water

Existing public services (Queensdale Avenue):

- *152 mm dia. CI watermain*
- Watermain Frontage Fees to be paid ($190.00 per metre) ☐ **Yes** ☒ **No**
- Service areas with a basic day demand greater than 50 m^3/day shall provide a minimum of two water main connections to avoid the creation of vulnerable service areas.

Sanitary Sewer

Existing public services:

- *450 mm dia. Conc. Sanitary sewer.*

Storm Sewer

Existing public services:

- *525 mm dia. Conc. Storm sewer.*

Stormwater Management

Quality Control:

- Quality control is to be provided on site.
- Quality control is to be based on the Sawmill Creek Subwatershed Study Update ("enhanced" level of TSS Removal (80%)) and Rideau Valley Conservation Authority recommendations.
- If the soils are conducive to LIDs then explore LID measures on-site or use the City's Low Impact Development Technical Guidance Report (Dillon – February 2021) to develop Best Management Practices

Quantity Control:

- Quantity Control is to be based on:
    - Predevelopment Runoff Coefficient or 0.5, which is more conservative
    - Time of Concentration is to be calculated based on pre-development conditions or the recommendations provided in the subwatershed study.
    - Allowable release rate is to be based on the approved Sawmill Creek Subwatershed Study Update by CH2MHILL dated May 2003. In this case it is the 2-year storm pre-development release rate.
    - All runoff beyond the minor system allowable release rate is to be controlled/stored on site up to the 100 year design storm

Other

Are there any Capital Works Projects scheduled that will impact the application? ☐ **Yes** ☒ **No**

General Service Design Comments:

- *The site is located within the Sawmill Creek Subwatershed Area and is subject to the criteria identified in the Sawmill Creek Subwatershed Study Update by CH2MHILL, dated May 2003*
- The City of Ottawa requests that all new services be located within the existing service trench to minimize necessary road cuts.
- Monitoring manholes should be located within the property near the property line in an accessible location to City forces and free from obstruction (i.e. not a parking).
- Where service length is greater than 30 m between the building and the first maintenance hole / connection, a cleanout is required.
- The City of Ottawa Standard Detail Drawings should be referenced where possible for all work within the Public Right-of-Way.
- The upstream and downstream manhole top of grate and invert elevations are required for all new sewer connections.
- Services crossing the existing watermain or sewers need to clearly provide the obvert/invert elevations to demonstration minimum separation distances. A watermain crossing table may be provided.
- 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:
    - Location of service
    - Type of development and the amount of fire flow required (as per FUS)
    - FUS calculations
        - Completed FUS design declaration
    - Average daily demand: ___ l/s.
    - Maximum daily demand: ___l/s.
    - Maximum hourly daily demand: ___ l/s

Exterior Site Lighting:

Require certification by a licensed professional engineer confirming the design complies with the

following:

- The location of the fixtures, fixture type (make, model, part number and the mounting height) must be shown on one of the approved plans.
- Lighting will be designed only using fixtures that meet the criteria for Full Cut-off classification, as recognized by the Illuminating Engineering Society of North America (IESNA or IES), and
- Minimal light spillage onto adjacent properties of 0.5 foot-candle

Sensitive Marine Clay:
Sensitive Marine Clay (SMC) is widely found across Ottawa- geotechnical reports should include Atterberg Limits, consolidation testing, sensitivity values, and vane shear test results (at a minimum).

MECP ECA:
An industrial sewage works and stormwater management works Environmental Compliance Approval from the Ministry of Environment, Conservation and Parks may be required. Consultant determines if an approval for sewage works under Section 53 of OWRA is required. Consultant then determines what type of application is required and the City's project manager confirms. (If the consultant is not clear if an ECA is required, they will work with the City to determine what is required. If the consultant is still unclear or there is a difference of opinion only then will the City PM approach the MECP.

References and Resources

- As per section 53 of the Professional Engineers Act, O. Reg 941/40, R.S.O. 1990, all documents prepared by engineers must be signed and dated on the seal.
- All required plans & reports are to be provided in *.pdf format (at application submission and for any, and all, re-submissions)
- Servicing and site works shall be in accordance with the following documents:
  - Ottawa Sewer Design Guidelines (October 2012)
  - Ottawa Design Guidelines – Water Distribution (2010)
  - Geotechnical Investigation and Reporting Guidelines for Development Applications in the City of Ottawa (2007)
  - City of Ottawa Slope Stability Guidelines for Development Applications (revised 2012)
  - City of Ottawa Environmental Noise Control Guidelines (January, 2016)
  - City of Ottawa Park and Pathway Development Manual (2012)
  - City of Ottawa Accessibility Design Standards (2012)
  - Ottawa Standard Tender Documents (latest version)
  - City of Ottawa Low impact Development Technical Guidance Report (February 2021)
  - Ontario Provincial Standards for Roads & Public Works (2013)
  - *Sawmill Creek Subwatershed Study Update, prepared by CH2MHILL, dated May 2003.*
- Please find relevant City of Ottawa Links to Preparing Studies and Plans below: https://ottawa.ca/en/city-hall/planning-and-development/information-developers/development-application-review-process/development-application-submission/guide-preparing-studies-and-plans#standards-policies-and-guidelines
- To request City of Ottawa plan(s) or report information please contact the City of Ottawa Information Centre:
  geoinformation@ottawa.ca
  (613) 580-2424 ext. 44455
- geoOttawa
  http://maps.ottawa.ca/geoOttawa/

PLEASE NOTE – THESE ARE ONLY THE INFRASTRUCTURE PLANS & STUDIES REQUIREMENTS ONLY. THE COMBINED SUBMISSION REQUIREMENTS WILL BE PROVIDED BY THE FILE LEAD FOR THE APPLICATION.

For information on preparing required studies and plans refer to:
http://ottawa.ca/en/development-application-review-process-0/guide-preparing-studies-and-plans

Y	Number of copies	ENGINEERING		Y	Number of copies
x		1. Site Servicing Plan	2. Assessment of Adequacy of Public Services (Urban) or Reasonable Use Study (Rural) / Site Servicing Study / Brief	x	
x		3. Grade Control and Drainage Plan	4. Geotechnical Study / Slope Stability Study	x	
		5. Composite Utility Plan	6. Groundwater Impact Study		

		7. Servicing Options Report (Urban)	8. Wellhead Protection Study		
			9. Erosion and Sediment Control Plan / Brief	x	
x		10. Storm water Management Report / Brief	11. Hydro-geological and Terrain Analysis (Not for Commercial/Industrial)		
		12. Hydraulic Water main Analysis	13. Confederation Line Proximity Study		

It is important to note that the need for additional studies and plans may result during application review. If following the submission of your application, it is determined that material that is not identified in this checklist is required to achieve complete application status, in accordance with the Planning Act and Official Plan requirements, City Planning will notify you of outstanding material required within the required 30 day period. Mandatory pre-application consultation will not shorten the City's standard processing timelines, or guarantee that an application will be approved. It is intended to help educate and inform the applicant about submission requirements as well as municipal processes, policies, and key issues in advance of submitting a formal development application. This list is valid for one year following the meeting date. If the application is not submitted within this timeframe the applicant must again pre-consult with the City.

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
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March 12, 2025

2928 Bank Street

4-Storey Apartment 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
= 1.5 Type V Wood Frame Construction

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

4th Floor:	624	sq.m
3rd Floor:	624	sq.m
2nd Floor:	624	sq.m
1st Floor:	460	sq.m
	2,332	sq.m

RFF = 15,936 L/min
= 16,000 L/min (rounded to nearest 1,000 L/min)

Occupancy and Contents Adjustment Factor
-15% Limited Combustible Contents
= -2,400 L/min Occupancy and Contents Adjustment Factor

RFF = 13,600 L/min

Automatic Sprinkler Protection Credit
50% No automatic sprinkler system
= 6,800 L/min Automatic Sprinkler Protection Credit

Exposure Adjustment Charge

Side	Charge	Distance	Construction	Length	Storeys	Factor
North	15%	3.1 m to 10 m	Type V	10	2	20
East	0%	over 30 m				
South	0%	over 30 m				
West	10%	10.1 m to 20 m	Type V	10	1	10

25% Exposure Adjustment Charge

= 3,400 L/min Exposure Adjustment Charge

RFF = 10,200 L/min
= 10,000 L/min (rounded to nearest 1,000 L/min)
= 166.7 L/s

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April 26, 2024

2928 Bank Street

4-Storey Apartment Building

Ottawa, Ontario

WATER DEMAND CALCULATIONS

	Number of Units	Persons per Unit	Population
1 Bedroom:	8	1.4	11.2
2 Bedroom:	17	2.1	35.7
3 Bedroom:	0	3.1	0
Average:	0	1.8	0
Total:	25		46.9

Average Daily Demand:	280	L/capita/day				
	9.1	L/min	0.2	L/s	2.4	USgpm
Maximum Daily Demand:	8.9	(Peaking factor for a population of 46.9 interpolated from MOE Design Guidelines for Drinking Water Systems Table 3-3)				
	80.7	L/min	1.3	L/s	21.3	USgpm
Maximum Hourly Demand:	13.3	(Peaking factor for a population of 46.9 interpolated from MOE Design Guidelines for Drinking Water Systems Table 3-3)				
	121.5	L/min	2.0	L/s	32.1	USgpm

Elevation of Water Meter:	92.90	m				
Basement Floor Elevation:	92.00	m				
Minimum HGL:	123.7	m				
Static Pressure at Water Meter:	30.8	m	302	kPa	44	psi
Maximum HGL:	131.0	m				
Static Pressure at Water Meter:	38.1	m	374	kPa	54	psi

D.B. Gray Engineering Inc.

Ryan Faith <r.faith@dbgrayengineering.com>

RE: Request for Boundary Conditions - 2928 Bank Street

1 message

Cassidy, Tyler <tyler.cassidy@ottawa.ca> Fri, Jan 19, 2024 at 3:31 PM
To: Ryan Faith <r.faith@dbgrayengineering.com>
Cc: Douglas Gray <d.gray@dbgrayengineering.com>

Hi Ryan,

I've touched based with our Water Resources group and Ottawa Fire Services to confirm fire flow availability for this site. After some back and forth, it was determined that the fire hydrants on the opposing side of Bank Street had to be excluded from the analysis. Ottawa Fire Services confirmed this as an existing policy with the reasoning that it is unsafe for firefighters to cross a major 4-lane arterial/collector to combat a blaze.

With this information in hand, water resources confirmed the available fire flow of 7,440 L/min from Queensdale Avenue + 3,800 L/min from Kingsdale Avenue (hydrant ID: H061) for a total of **11,240 L/min**. Note that this 11,240 L/min is exclusive of any hydraulic losses in the hose(s), it will be your consultancy's responsibility to confirm availability inclusive of losses. The caveat to achieving 7,440 L/min on Queensdale Ave. is that a new hydrant fronting the property will need to be installed and within 45m of the building entrance to maintain coverage.

I trust the above is sufficient to satisfy your inquiry.

Thank you,

Tyler Cassidy, P.Eng

Infrastructure Project Manager,

Planning, Real Estate and Economic Development Department / Direction générale de la planification, des biens immobiliers et du développement économique - South Branch

City of Ottawa | Ville d'Ottawa

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

613.580.2424 ext./poste 12977, Tyler.Cassidy@ottawa.ca

From: Ryan Faith <r.faith@dbgrayengineering.com>
Sent: January 12, 2024 10:38 AM
To: Cassidy, Tyler <tyler.cassidy@ottawa.ca>
Cc: Douglas Gray <d.gray@dbgrayengineering.com>
Subject: Re: Request for Boundary Conditions - 2928 Bank Street

Hi Tyler,

See below.

1. Fire hydrant ID 372023H064 located at the intersection of Bank and Queensdale - 130 m
2. Fire hydrant ID 372023H061 located on the SW corner of the intersection of Bank and Kingsdale - 110 m
3. Fire hydrant ID 372023H100 located on the NE corner of the intersection of Bank and Kingsdale - 100 m
4. Fire hydrant ID 372023H036 located in front of 2950 Bank in the Queensdale ROW - 148 m
5. Fire hydrant ID 372023H066 located in front of 2959 Bank - 140 m

Thanks,

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

On Fri, Jan 12, 2024 at 10:15 AM Cassidy, Tyler <tyler.cassidy@ottawa.ca> wrote:

> Hi Ryan,
>
> Could you please provide the final total distances for each hydrant? Most of that information can't be deduced from the drawing as there are text conflicts.
>
> Thank you,
>
> **Tyler Cassidy, P.Eng**
>
> Infrastructure Project Manager,
>
> Planning, Real Estate and Economic Development Department / Direction générale de la planification, des biens immobiliers et du développement économique - South Branch
>
> City of Ottawa | Ville d'Ottawa
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> 110 Laurier Avenue West Ottawa, ON | 110, avenue. Laurier Ouest. Ottawa (Ontario) K1P 1J1
>
> 613.580.2424 ext./poste 12977, Tyler.Cassidy@ottawa.ca
>
> ---
>
> **From:** Ryan Faith <r.faith@dbgrayengineering.com>
> **Sent:** January 11, 2024 1:29 PM
> **To:** Cassidy, Tyler <tyler.cassidy@ottawa.ca>
> **Cc:** Douglas Gray <d.gray@dbgrayengineering.com>
> **Subject:** Re: Request for Boundary Conditions - 2928 Bank Street

Hi Tyler,

See attached.

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

On Thu, Jan 11, 2024 at 12:46 PM Cassidy, Tyler <tyler.cassidy@ottawa.ca> wrote:

> Hi Ryan,
>
> I touched base with Water Resources regarding the multi-hydrant analysis. We can't move forward until we receive the marked-up site plan/schematic which clearly identifies the following:
>
> - Building entrance of the proposed building.
> - Property boundaries
> - Measurements from each hydrant to the building entrance. The measurements must be made in the right-of-way and cannot cut across any properties.
>
> Please provide the above information in PDF format. This information needs to be provided by your consultancy; I am unable to provide that information to WR.
>
> Thank you,
>
> **Tyler Cassidy, P.Eng**
>
> Infrastructure Project Manager,
>
> Planning, Real Estate and Economic Development Department / Direction générale de la planification, des biens immobiliers et du développement économique - South Branch
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> City of Ottawa | Ville d'Ottawa
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> 110 Laurier Avenue West Ottawa, ON | 110, avenue. Laurier Ouest. Ottawa (Ontario) K1P 1J1
>
> 613.580.2424 ext./poste 12977, Tyler.Cassidy@ottawa.ca

From: Ryan Faith <r.faith@dbgrayengineering.com>
Sent: January 04, 2024 9:50 AM
To: Cassidy, Tyler <tyler.cassidy@ottawa.ca>
Cc: Douglas Gray <d.gray@dbgrayengineering.com>
Subject: Re: Request for Boundary Conditions - 2928 Bank Street

Hi Tyler,

Happy New Year. Hope you had a good break. Can you give me a call when you get a chance?

Thanks,

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

On Thu, Dec 14, 2023 at 11:59 AM Ryan Faith <r.faith@dbgrayengineering.com> wrote:

> Hi Tyler,
>
> Can you give me a call when you get a chance?
>
> Thanks,
>
> **Ryan Faith**
> **D.B. Gray Engineering Inc.**
> 700 Long Point Circle
> Ottawa, Ontario K1T 4E9
> 613-425-8044
>
> On Thu, Dec 14, 2023 at 11:37 AM Cassidy, Tyler <tyler.cassidy@ottawa.ca> wrote:
>
> > Hi Ryan,
> >
> > Can you mark that up on a GeoOttawa screenshot for me? Please also include the distance from each hydrant to the proposed site entrance.

Thank you,

Tyler Cassidy, P.Eng

Infrastructure Project Manager,

Planning, Real Estate and Economic Development Department / Direction générale de la planification, des biens immobiliers et du développement économique - South Branch

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

613.580.2424 ext./poste 12977, Tyler.Cassidy@ottawa.ca

From: Ryan Faith <r.faith@dbgrayengineering.com>
Sent: December 14, 2023 10:49 AM
To: Cassidy, Tyler <tyler.cassidy@ottawa.ca>
Cc: Douglas Gray <d.gray@dbgrayengineering.com>
Subject: Re: Request for Boundary Conditions - 2928 Bank Street

Hi Tyler,

There are five existing municipal Class AA fire hydrants within 150 m of the proposed building.

1. Fire hydrant ID 372023H064 located at the intersection of Bank and Queensdale
2. Fire hydrant ID 372023H061 located on the SW corner of the intersection of Bank and Kingsdale
3. Fire hydrant ID 372023H100 located on the NE corner of the intersection of Bank and Kingsdale
4. Fire hydrant ID 372023H036 located in front of 2950 Bank in the Queensdale ROW
5. Fire hydrant ID 372023H066 located in front of 2959 Bank

Can they open all five hydrants and see what they get?

Thanks,

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

On Wed, Dec 13, 2023 at 3:01 PM Cassidy, Tyler <tyler.cassidy@ottawa.ca> wrote:

> HI Ryan,

I'll go ahead and request the analysis. Can you provide me with a site schematic which includes the following:

- Fire Hydrants to be used in the analysis.
- Distance from each hydrant to the building entrance.
- Building footprint

Thank you,

Tyler Cassidy, P.Eng

Infrastructure Project Manager,

Planning, Real Estate and Economic Development Department / Direction générale de la planification, des biens immobiliers et du développement économique - South Branch

City of Ottawa | Ville d'Ottawa

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

613.580.2424 ext./poste 12977, Tyler.Cassidy@ottawa.ca

From: Ryan Faith <r.faith@dbgrayengineering.com>
Sent: December 07, 2023 12:52 PM
To: Cassidy, Tyler <tyler.cassidy@ottawa.ca>
Cc: Douglas Gray <d.gray@dbgrayengineering.com>
Subject: Re: Request for Boundary Conditions - 2928 Bank Street

Hi Tyler,

I knew we were unlikely to get 17,000 L/min out of Queensdale but I thought they'd do a multi hydrant analysis. Can you request?

Thanks,

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

On Thu, Dec 7, 2023 at 12:28 PM Cassidy, Tyler <tyler.cassidy@ottawa.ca> wrote:

> Hi Ryan,

The boundary condition results are provided below for 2928 Bank Street. Note that the available Fire Flow at 20 psi is only 124.4 L/s. Please investigate ways to reduce the RFF for this application.

The following are boundary conditions, HGL, for hydraulic analysis at 2928 Bank Street (zone 2W2C) assumed to be connected to the 152 mm watermain on Queensdale Avenue (see attached PDF for location).

Minimum HGL: 123.7 m

Maximum HGL: 131.0 m

Available Fire Flow at 20 (psi): 124.4 L/s, assuming ground elevation of 93.0 m

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.

Tyler Cassidy, P.Eng

Infrastructure Project Manager,

Planning, Real Estate and Economic Development Department / Direction générale de la planification, des biens immobiliers et du développement économique - South Branch

City of Ottawa | Ville d'Ottawa

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

613.580.2424 ext./poste 12977, Tyler.Cassidy@ottawa.ca

From: Ryan Faith <r.faith@dbgrayengineering.com>
Sent: November 08, 2023 11:38 AM
To: Cassidy, Tyler <tyler.cassidy@ottawa.ca>
Cc: Douglas Gray <d.gray@dbgrayengineering.com>
Subject: Re: Request for Boundary Conditions - 2928 Bank Street

Hi Tyler,

Thanks for correcting. I agree we are unlikely to get 17,000 L/min out of Queensdale but perhaps with a multi hydrant analysis. We'll see what they come back with.

Cheers,

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

On Wed, Nov 8, 2023 at 11:26 AM Cassidy, Tyler <tyler.cassidy@ottawa.ca> wrote:

> Hi Ryan,
>
> I've submitted your request for boundary conditions to our Water Resources group. Please allow for up to 10 business days for results to be provided.
>
> I took the liberty of correcting your "Fire flow + maximum daily demand" amount from **184.3 L/s** to **284.3 L/s.** I should note that 17,000 L/min is a high RFF for this location and may not be serviceable from the 150mm dia. watermain on Queensdale. Results to confirm.
>
> Regards,
>
> **Tyler Cassidy, P.Eng**
>
> Infrastructure Project Manager,
>
> Planning, Real Estate and Economic Development Department / Direction générale de la planification, des biens immobiliers et du développement économique - South Branch
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>
> 613.580.2424 ext./poste 12977, Tyler.Cassidy@ottawa.ca
>
> ---
>
> **From:** Ryan Faith <r.faith@dbgrayengineering.com>
> **Sent:** November 07, 2023 11:39 AM
> **To:** Cassidy, Tyler <tyler.cassidy@ottawa.ca>
> **Cc:** Douglas Gray <d.gray@dbgrayengineering.com>
> **Subject:** Request for Boundary Conditions - 2928 Bank Street

Hi Tyler,

Please provide the boundary conditions for the 150 mm Queensdale Avenue municipal watermain at 2928 Bank Street. Point of connection will be in the SE corner of the property. We have calculated the following expected demands:

Fire flow demand: 283.3 L/s
Average daily demand: 0.1 L/s
Maximum daily demand: 1.0 L/s
Maximum hourly demand: 1.5 L/s

Fire flow + maximum daily demand: 184.3 L/s

Calculations are attached.

Thanks,

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

'

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'


Boundary Conditions for 2928 Bank Street
N
203
305
rue Bank St.
av.
203
2920
2928
1662
1656
1659
1655
av. Queensdale Ave.
152
Legend
Public
Private
City of Ottawa

March 13, 2025

2928 Bank Street

Ottawa, Ontario

Calculated Boundary Conditions for a Fire Flow of 6,200 L/min

Based on Boundary Conditions Provided (Minimum & Maximum HGL and for a Fire Flow of 7,440 L/min)

Assumed Ground Elevation:	93.0	m				
Available Fire Flow: (Queensdale Ave)	7,440	L/min	124.0	L/s	1,965	USgpm
Available Fire Flow HGL:	107.1	m				
(calculated based on available fire flow at 20 psi assuming a ground elelvation of 93.0m)						
Static Pressure (at 93.0m):	14.1	m	138	kPa	20.0	psi
Provided Minimum HGL:	123.7	m				
	30.7	m	301	kPa	43.7	psi
Provided Maximum HGL:	131.0	m				
	38.0	m	373	kPa	54.0	psi

Required Fire Flow:	6,200.0	L/min	103.3	L/s	1,638	USgpm
Fire Flow HGL:	113.0	m				
Static Pressure:	19.9	m	195	kPa	28.3	psi

(at 93.12 m - grade elevation at FH) (based on the non-fire flow static pressure is the average of the minimum and maximum HGL and calculated using Hazen-Williams formula for Fire hydrant testing)

APPENDIX C

SANITARY 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

2928 Bank Street
4-Storey Apartment Building
Ottawa, Ontario

March 13, 2025

SANITARY SEWER CALCULATIONS

Residential Average Daily Flow:	280	L/capita/day	Residential Peaking Factor:	Harmon Formula
Commercial Average Daily Flow:	28,000	L/ha/day	Harmon Formula Correction Factor:	0.8
Institutional Average Daily Flow:	28,000	L/ha/day	Commercial Peaking Factor:	1.5
Light Industrial Average Daily Flow:	35,000	L/ha/day	Institutional Peaking Factor:	1.5
Heavy Industrial Average Daily Flow:	55,000	L/ha/day	Industrial Peaking Factor:	Ministry of the Environment
Infiltration Allowance:	0.33	L/s/ha	Manning's Roughness Coefficient:	0.013

		Residentia													Commercial				Infiltration			Q	Sewer Data						
		Individual							Cumulative						Individual	Cumulative			Individual	Cumulative		Total							
Location		Single	Semi	Duplex	Apartment	Apartment	Apartment	Apartment	Area	Population	Area	Population	Peaking	Flow Rate	Area	Area	Peaking	Flow Rate	Area	Area	Flow Rate	Flow Rate	Length	Nominal Diameter	Actual Diameter	Slope	Velocity	Q_{Full} Capacity	
From	To	Family	Detached		(1 Bed)	(2 Bed)	(3 Bed)	(Average)	(ha)		(ha)		Factor	(L/s)	(ha)	(ha)	Factor	(L/s)	(ha)	(ha)	(L/s)	(L/s)	(m)	(mm)	(mm)	(%)	(m/s)	(L/s)	Q / Q_{Full}
		ppu = 3.4	ppu = 2.7	ppu = 2.3	ppu = 1.4	ppu = 2.1	ppu = 3.1	ppu = 1.8																					
Existing Building	Existing 450 SAN														0.1303	0.1303	1.5	0.06	0.1303	0.1303	0.04	0.11							
Proposed Building	Existing 450 SAN				8	17			0.1303	46.9	0.1303	46.9	3.2	0.49					0.1303	0.1303	0.04	0.53	19.4	150	150	2.2	1.28	22.59	2%
																						Existing 450 mm Queensdale Avenue Municipal Sanitary Sewer:		450	456	0.23	0.87	141.65	

APPENDIX D

STORMWATER MANAGEMENT

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 Available (cu.m)
AREA I (Uncontrolled Flow Off Site)	-	-	9.70	-	-
AREA II (Main Roof)	-	-	3.62	22.70	29.04
AREA III	-	-	0.36	14.16	15.09
TOTAL	50.05	13.91	13.68	36.86	44.13

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 Available (cu.m)
AREA I (Uncontrolled Flow Off Site)	-	-	3.61	-	-
AREA II (Main Roof)	-	-	3.01	6.16	29.04
AREA III	-	-	0.36	4.03	15.09
TOTAL	19.17	13.91	6.99	10.20	44.13

March 13, 2025

2928 Bank Street

Ottawa, Ontario

STORMWATER MANAGEMENT CALCULATIONS
Modified Rational Method

PRE-DEVELOPMENT CONDITIONS

100-YEAR EVENT

			C
Roof Area:	70	sq.m	1.00
Hard Area:	840	sq.m	1.00
Soft Area:	393	sq.m	0.25
Total Catchment Area:	1,303	sq.m	0.77

Bransby Williams Formula

$$Tc = \frac{0.057 \bullet L}{Sw^{0.2} \bullet A^{0.1}} \text{ min}$$

Sheet Flow Distance (L):	50	m
Slope of Land (Sw):	2	%
Area (A):	0.1303	ha
Time of Concentration (Sheet Flow):	3	min
Time of Concentration:	10	min
Rainfall Intensity (i):	179	mm/hr
100-Year Pre-Development Flow Rate (2.78AiC):	50.05	L/s

2-YEAR EVENT

			C
Roof Area:	70	sq.m	0.90
Hard Area:	840	sq.m	0.90
Soft Area:	393	sq.m	0.20
Total Catchment Area:	1,303	sq.m	0.69

Time of Concentration:	10	min
Rainfall Intensity (i):	77	mm/hr
2-Year Pre-Development Flow Rate (2.78AiC):	19.17	L/s

MAXIMUM ALLOWABLE RELEASE RATE

Area (A):	1,303	sq.m
Time of Concentration:	10	min
Rainfall Intensity (i):	77	mm/hr (2-Year Event)
Runoff Coeficient (C):	0.5	
Maximum Allowable Release Rate (2.78AiC):	13.91	L/s

100-YEAR EVENT

DRAINAGE AREA I (Uncontrolled Flow Off Site)

(100-YEAR EVENT)

			C
Roof Area:	18	sq.m	1.00
Hard Area:	110	sq.m	1.00
Permeable Paver Area:	20	sq.m	0.3125
Soft Area:	245	sq.m	0.25
Total Catchment Area:	393	sq.m	0.50
Area (A):	393	sq.m	
Time of Concentration:	10	min	
Rainfall Intensity (i):	179	mm/hr	
Runoff Coeficient (C):	0.50		
Flow Rate (2.78AiC):	9.70	L/s	

DRAINAGE AREA II (Main Roof)

(100-YEAR EVENT)

				C		
Total Catchment Area:	626	sq.m		1.00		
No. of Roof Drains:	4		Maximum Volume Available:		29.04	cu.m
Wier Opening:	1/4					
Depth at Roof Drains:	138	mm				
	.					
Maximum Release Rate:	3.62	L/s	Pond Area:		492.9	sq.m
			Maximum Volume Stored:		22.70	cu.m
			Maximum Volume Required:		22.70	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	31.07	3.62	27.46	16.47
15	143	24.87	3.62	21.25	19.12
20	120	20.87	3.62	17.26	20.71
25	104	18.07	3.62	14.45	21.68
30	92	15.99	3.62	12.37	22.26
35	83	14.37	3.62	10.75	22.58
40	75	13.08	3.62	9.46	22.70
45	69	12.02	3.62	8.40	22.67
50	64	11.13	3.62	7.51	22.53
55	60	10.38	3.62	6.76	22.30
60	56	9.73	3.62	6.11	21.99
65	53	9.16	3.62	5.54	21.62
70	50	8.66	3.62	5.05	21.19
75	47	8.22	3.62	4.61	20.72
80	45	7.83	3.62	4.21	20.21
85	43	7.48	3.62	3.86	19.67
90	41	7.15	3.62	3.54	19.09
95	39	6.86	3.62	3.24	18.49
100	38	6.60	3.62	2.98	17.86
105	36	6.35	3.62	2.73	17.22
110	35	6.13	3.62	2.51	16.55
115	34	5.92	3.62	2.30	15.86
120	33	5.72	3.62	2.11	15.16
125	32	5.54	3.62	1.93	14.45
130	31	5.38	3.62	1.76	13.72
135	30	5.22	3.62	1.60	12.97
140	29	5.07	3.62	1.45	12.22
145	28	4.94	3.62	1.32	11.45
150	28	4.81	3.62	1.19	10.68
180	24	4.16	3.62	0.54	5.84
210	21	3.68	3.62	0.06	0.77
240	19	3.31	3.31	0.00	0.00
270	17	3.01	3.01	0.00	0.00
300	16	2.77	2.77	0.00	0.00
330	15	2.56	2.56	0.00	0.00
360	14	2.39	2.39	0.00	0.00
390	13	2.24	2.24	0.00	0.00
420	12	2.11	2.11	0.00	0.00
450	11	1.99	1.99	0.00	0.00
480	11	1.89	1.89	0.00	0.00
510	10	1.80	1.80	0.00	0.00
540	10	1.72	1.72	0.00	0.00
570	9	1.65	1.65	0.00	0.00
600	9	1.58	1.58	0.00	0.00

DRAINAGE AREA III

(100-YEAR EVENT)

			C
Roof Area:	123	sq.m	1.00
Hard Area:	31	sq.m	1.00
Permeable Pavers (with subdrains) Area:	130	sq.m	0.75
Soft Area:	0	sq.m	0.25
Total Catchment Area:	284	sq.m	0.89

Pump Flow Rate: 0.36 L/s

Maximum Volume Available: 15.09 cu.m

Maximum Volume Required: 14.16 cu.m

Time (min)	i (mm/hr)	2.78AiC (L/s)	Pump Flow Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	179	12.48	0.36	12.12	7.27
15	143	9.99	0.36	9.63	8.67
20	120	8.39	0.36	8.03	9.63
25	104	7.26	0.36	6.90	10.35
30	92	6.42	0.36	6.06	10.91
35	83	5.77	0.36	5.41	11.37
40	75	5.25	0.36	4.89	11.75
45	69	4.83	0.36	4.47	12.06
50	64	4.47	0.36	4.11	12.33
55	60	4.17	0.36	3.81	12.57
60	56	3.91	0.36	3.55	12.77
65	53	3.68	0.36	3.32	12.95
70	50	3.48	0.36	3.12	13.11
75	47	3.30	0.36	2.94	13.25
80	45	3.15	0.36	2.79	13.37
85	43	3.00	0.36	2.64	13.48
90	41	2.87	0.36	2.51	13.58
95	39	2.76	0.36	2.40	13.66
100	38	2.65	0.36	2.29	13.74
105	36	2.55	0.36	2.19	13.81
110	35	2.46	0.36	2.10	13.87
115	34	2.38	0.36	2.02	13.92
120	33	2.30	0.36	1.94	13.97
125	32	2.23	0.36	1.87	14.01
130	31	2.16	0.36	1.80	14.04
135	30	2.10	0.36	1.74	14.07
140	29	2.04	0.36	1.68	14.10
145	28	1.98	0.36	1.62	14.12
150	28	1.93	0.36	1.57	14.13
180	24	1.67	0.36	1.31	14.16
210	21	1.48	0.36	1.12	14.09
240	19	1.33	0.36	0.97	13.95
270	17	1.21	0.36	0.85	13.76
300	16	1.11	0.36	0.75	13.52
330	15	1.03	0.36	0.67	13.25
360	14	0.96	0.36	0.60	12.95
390	13	0.90	0.36	0.54	12.62
420	12	0.85	0.36	0.49	12.27
450	11	0.80	0.36	0.44	11.91
480	11	0.76	0.36	0.40	11.53
510	10	0.72	0.36	0.36	11.14
540	10	0.69	0.36	0.33	10.73
570	9	0.66	0.36	0.30	10.31
600	9	0.63	0.36	0.27	9.88

2-YEAR EVENT

DRAINAGE AREA I (Uncontrolled Flow Off Site)

(2-YEAR EVENT)

			C
Roof Area:	18	sq.m	0.90
Hard Area:	110	sq.m	0.90
Permeable Pavers Area:	20	sq.m	0.25
Soft Area:	245	sq.m	0.20
Total Catchment Area:	393	sq.m	0.43
Area (A):	393	sq.m	
Time of Concentration:	10	min	
Rainfall Intensity (i):	77	mm/hr	
Runoff Coeficient (C):	0.43		
Flow Rate (2.78AiC):	3.61	L/s	

DRAINAGE AREA II (Main Roof)

(2-YEAR EVENT)

				C		
Total Catchment Area:	626	sq.m		0.90		
No. of Roof Drains:	4		Maximum Volume Available:		29.04	cu.m
Wier Opening:	1/4					
Depth at Roof Drains:	89	mm	89.53			
Maximum Release Rate:	3.01	L/s	Pond Area:		207	sq.m
			Maximum Volume Stored:		6.16	cu.m
			Maximum Volume Required:		6.16	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	12.03	3.01	9.02	5.41
15	62	9.67	3.01	6.66	5.99
20	52	8.15	3.01	5.14	6.16
25	45	7.07	3.01	4.06	6.09
30	40	6.27	3.01	3.26	5.86
35	36	5.65	3.01	2.63	5.53
40	33	5.15	3.01	2.13	5.12
45	30	4.74	3.01	1.72	4.65
50	28	4.39	3.01	1.38	4.13
55	26	4.10	3.01	1.09	3.58
60	25	3.85	3.01	0.83	3.00
65	23	3.63	3.01	0.61	2.39
70	22	3.43	3.01	0.42	1.76
75	21	3.26	3.01	0.25	1.11
80	20	3.11	3.01	0.09	0.44
85	19	2.97	2.97	0.00	0.00
90	18	2.84	2.84	0.00	0.00
95	17	2.73	2.73	0.00	0.00
100	17	2.62	2.62	0.00	0.00
105	16	2.53	2.53	0.00	0.00
110	16	2.44	2.44	0.00	0.00
115	15	2.36	2.36	0.00	0.00
120	15	2.28	2.28	0.00	0.00
125	14	2.21	2.21	0.00	0.00
130	14	2.14	2.14	0.00	0.00
135	13	2.08	2.08	0.00	0.00
140	13	2.02	2.02	0.00	0.00
145	13	1.97	1.97	0.00	0.00
150	12	1.92	1.92	0.00	0.00
180	11	1.66	1.66	0.00	0.00
210	9	1.47	1.47	0.00	0.00
240	8	1.33	1.33	0.00	0.00
270	8	1.21	1.21	0.00	0.00
300	7	1.11	1.11	0.00	0.00
330	7	1.03	1.03	0.00	0.00
360	6	0.96	0.96	0.00	0.00
390	6	0.90	0.90	0.00	0.00
420	5	0.85	0.85	0.00	0.00

DRAINAGE AREA III

(2-YEAR EVENT)

			C
Roof Area:	123	sq.m	0.90
Hard Area:	31	sq.m	0.90
Permeable Pavers (with subdrains) Area:	130	sq.m	0.60
Soft Area:	0	sq.m	0.20
Total Catchment Area:	284	sq.m	0.76

Pump Flow Rate: 0.36 L/s

Maximum Volume Available: 15.09 cu.m

Maximum Volume Required: 4.03 cu.m

Time (min)	i (mm/hr)	2.78AiC (L/s)	Pump Flow Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
10	77	4.62	0.36	4.26	2.56
15	62	3.72	0.36	3.36	3.02
20	52	3.13	0.36	2.77	3.33
25	45	2.72	0.36	2.36	3.54
30	40	2.41	0.36	2.05	3.69
35	36	2.17	0.36	1.81	3.80
40	33	1.98	0.36	1.62	3.89
45	30	1.82	0.36	1.46	3.94
50	28	1.69	0.36	1.33	3.99
55	26	1.58	0.36	1.22	4.01
60	25	1.48	0.36	1.12	4.03
65	23	1.39	0.36	1.03	4.03
70	22	1.32	0.36	0.96	4.03
75	21	1.25	0.36	0.89	4.02
80	20	1.19	0.36	0.83	4.00
85	19	1.14	0.36	0.78	3.98
90	18	1.09	0.36	0.73	3.96
95	17	1.05	0.36	0.69	3.92
100	17	1.01	0.36	0.65	3.89
105	16	0.97	0.36	0.61	3.85
110	16	0.94	0.36	0.58	3.81
115	15	0.91	0.36	0.55	3.77
120	15	0.88	0.36	0.52	3.72
125	14	0.85	0.36	0.49	3.67
130	14	0.82	0.36	0.46	3.62
135	13	0.80	0.36	0.44	3.57
140	13	0.78	0.36	0.42	3.51
145	13	0.76	0.36	0.40	3.46
150	12	0.74	0.36	0.38	3.40
180	11	0.64	0.36	0.28	3.02
210	9	0.57	0.36	0.21	2.61
240	8	0.51	0.36	0.15	2.16
270	8	0.46	0.36	0.10	1.70
300	7	0.43	0.36	0.07	1.22
330	7	0.40	0.36	0.04	0.72
360	6	0.37	0.36	0.01	0.22
390	6	0.35	0.35	0.00	0.00
420	5	0.33	0.33	0.00	0.00

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION
BASED ON THE RATIONAL RAINFALL METHOD
BASED ON A FINE PARTICLE SIZE DISTRIBUTION

Project Name: 2928 Bank Street
Location: Ottawa, ON
OGS #: 1

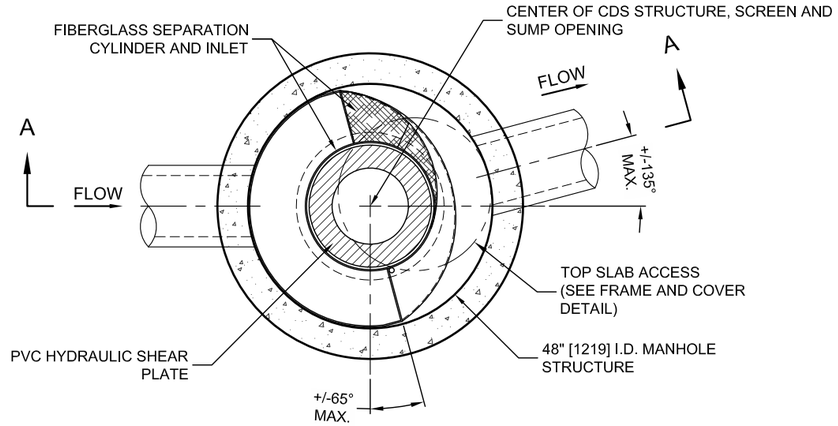
Engineer: D.B. Gray Engineering
Contact: Ryan Faith
Report Date: 12-Apr-24

Area	0.017	ha	**Rainfall Station #**	215	
Weighted C	0.90		**Particle Size Distribution**	FINE	
CDS Model	2015-4		**CDS Treatment Capacity**	20	l/s

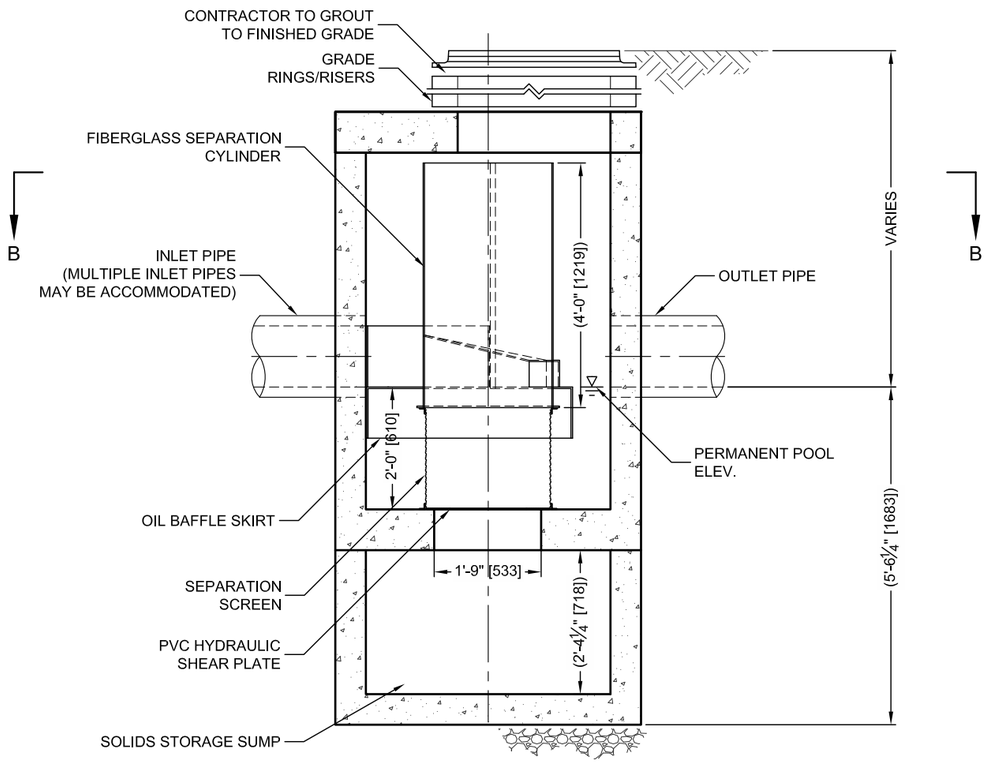
Rainfall Intensity[1] (mm/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (l/s)	Treated Flowrate (l/s)	Operating Rate (%)	Removal Efficiency (%)	Incremental Removal (%)
1.0	10.6%	19.8%	0.0	0.0	0.2	98.8	10.5
1.5	9.9%	29.7%	0.1	0.1	0.3	98.8	9.8
2.0	8.4%	38.1%	0.1	0.1	0.4	98.7	8.3
2.5	7.7%	45.8%	0.1	0.1	0.5	98.7	7.6
3.0	5.9%	51.7%	0.1	0.1	0.6	98.7	5.9
3.5	4.4%	56.1%	0.1	0.1	0.8	98.6	4.3
4.0	4.7%	60.7%	0.2	0.2	0.9	98.6	4.6
4.5	3.3%	64.0%	0.2	0.2	1.0	98.6	3.3
5.0	3.0%	67.1%	0.2	0.2	1.1	98.5	3.0
6.0	5.4%	72.4%	0.3	0.3	1.3	98.5	5.3
7.0	4.4%	76.8%	0.3	0.3	1.5	98.4	4.3
8.0	3.5%	80.3%	0.3	0.3	1.7	98.4	3.5
9.0	2.8%	83.2%	0.4	0.4	1.9	98.3	2.8
10.0	2.2%	85.3%	0.4	0.4	2.1	98.2	2.1
15.0	7.0%	92.3%	0.6	0.6	3.2	97.9	6.8
20.0	4.5%	96.9%	0.9	0.9	4.3	97.6	4.4
25.0	1.4%	98.3%	1.1	1.1	5.4	97.3	1.4
30.0	0.7%	99.0%	1.3	1.3	6.4	97.0	0.7
35.0	0.5%	99.5%	1.5	1.5	7.5	96.7	0.5
40.0	0.5%	100.0%	1.7	1.7	8.6	96.4	0.5
45.0	0.0%	100.0%	1.9	1.9	9.7	96.1	0.0
50.0	0.0%	100.0%	2.1	2.1	10.7	95.8	0.0
							98.5

Removal Efficiency Adjustment[2] = 6.5%
Predicted Net Annual Load Removal Efficiency = 92.0%
Predicted Annual Rainfall Treated = 99.0%

1 - Based on 42 years of hourly rainfall data from Canadian Station 6105976, Ottawa ON
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.
3 - CDS Efficiency based on testing conducted at the University of Central Florida
4 - CDS design flowrate and scaling based on standard manufacturer model & product specifications



PLAN VIEW B-B
N.T.S.



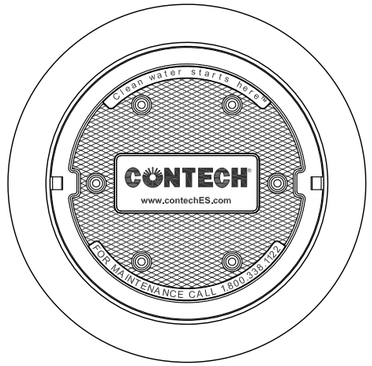
ELEVATION A-A
N.T.S.

THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING U.S. PATENTS: 5,788,848; 6,641,720; 8,511,500; 6,581,783; RELATED FOREIGN PATENTS, OR OTHER PATENTS PENDING.

CDS PMSU2015-4-C DESIGN NOTES

THE STANDARD CDS PMSU2015-4-C CONFIGURATION IS SHOWN. ALTERNATE CONFIGURATIONS ARE AVAILABLE AND ARE LISTED BELOW. SOME CONFIGURATIONS MAY BE COMBINED TO SUIT SITE REQUIREMENTS.

CONFIGURATION DESCRIPTION
GRATED INLET ONLY (NO INLET PIPE)
GRATED INLET WITH INLET PIPE OR PIPES
CURB INLET ONLY (NO INLET PIPE)
CURB INLET WITH INLET PIPE OR PIPES
CUSTOMIZABLE SUMP DEPTH AVAILABLE
ANTI-FLOTATION DESIGN AVAILABLE UPON REQUEST



FRAME AND COVER
(DIAMETER VARIES)
N.T.S.

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID	
WATER QUALITY FLOW RATE (CFS OR L/s)	*
PEAK FLOW RATE (CFS OR L/s)	*
RETURN PERIOD OF PEAK FLOW (YRS)	*
SCREEN APERTURE (2400 OR 4700)	*

PIPE DATA:	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	*	*	*
INLET PIPE 2	*	*	*
OUTLET PIPE	*	*	*

RIM ELEVATION	*

ANTI-FLOTATION BALLAST	WIDTH	HEIGHT
	*	*

NOTES/SPECIAL REQUIREMENTS:

* PER ENGINEER OF RECORD

GENERAL NOTES
1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH ( ) ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
3. FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.contechES.com
4. CDS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
5. STRUCTURE SHALL MEET AASHTO HS20 AND CASTINGS SHALL MEET HS20 (AASHTO M 306) LOAD RATING, ASSUMING GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION.
6. PVC HYDRAULIC SHEAR PLATE IS PLACED ON SHELF AT BOTTOM OF SCREEN CYLINDER. REMOVE AND REPLACE AS NECESSARY DURING MAINTENANCE CLEANING.

INSTALLATION NOTES
A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CDS MANHOLE STRUCTURE (LIFTING CLUTCHES PROVIDED).
C. CONTRACTOR TO ADD JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS, AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH PIPE INVERTS WITH ELEVATIONS SHOWN.
E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

CONTECH® ENGINEERED SOLUTIONS LLC
www.contechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CDS PMSU2015-4-C INLINE CDS STANDARD DETAIL

13-Mar-25

2928 Bank Street

Ottawa, Ontario

Water Balance and Infiltration Calculations

Water Balance is based on the equation: Mean Annual Precipitation - Change in Groundwater Storage - Evapotranspiration = Runoff + Infiltration

Where: Long term changes to groundwater storage are assumed to be negligible
and
Short term or seasonal changes to groundwater are assumed to balance out over the year.

Therefore: Mean Annual Precipitation - Evapotranspiration = Runoff + Infiltration

Infiltration is based on the equations: Surplus (available for infiltration) = Mean Annual Precipitation - Evapotranspiration
and
Infiltration = Surplus x Infiltration Coefficient
and
Infiltration Coefficient = Topography Factor + Soil Factor + Vegetation Factor
(as per the MOE SWM Planning & Design Manual, 2003 - see below)

Pre-Development (existing development - circa 2017)

	Area (sq.m.)	Precipitation + (mm/yr)	Evapo-transpiration ++ (mm/yr)	Surplus (mm/yr)	Topography Factor *	Soil Factor **	Vegetation Factor ***	Infiltration Coefficient	Infiltration (mm/yr)
Landscaped	393	943	577	366	0.1	0.4	0.1	0.60	220
Hard Surfaces	910	943	150	793				0.00	0
Total:	1303							Weighted Average:	66

Post Development (without permeable pavers)

	Area (sq.m.)	Precipitation + (mm/yr)	Evapo-transpiration ++ (mm/yr)	Surplus (mm/yr)	Topography Factor *	Soil Factor **	Vegetation Factor ***	Infiltration Coefficient	Infiltration (mm/yr)
Landscaped	245	943	577	366	0.1	0.4	0.1	0.60	220
Hard Surfaces	1058	943	150	793				0.00	0
Total:	1303							Weighted Average:	41

Post Development (with permeable pavers)

	Area (sq.m.)	Precipitation + (mm/yr)	Evapo-transpiration ++ (mm/yr)	Surplus (mm/yr)	Topography Factor *	Soil Factor **	Vegetation Factor ***	Infiltration Coefficient	Infiltration (mm/yr)	Permeable Pavers Runoff Reduction
Landscaped	245	943	577	366	0.1	0.4	0.1	0.60	220	
Permeable Pavers (with sub-drains)	130	943	174	769	0.1	0.33	0	0.43	331	45%
Permeable Pavers (no sub-drains)	20	943	174	769	0.1	0.75	0	0.85	654	85%
Hard Surfaces	928	943	150	793				0.00	0	
Total:	1323							Weighted Average:	83	

\+ Ottawa International Airport (1981-2010)
++ Eastern Ontario Water Resources Management Study (2001); Carp River Watershed / Subwatershed Study; & Effects On Evaporation Rates From Different Water-Permeable Pavement Designs, P. Starke, P. Göbel & W. G. Coldewey (16% increase relative impermeable pavements)

		Factor	Subject Property
* Topography:	Flat Land, average slope < 0.6m/km (<.06%)	0.3	
	Rolling Land, average slope 2.8 to 3.8m/km (0.28% to 0.38%)	0.2	
	Hilly Land, average slope 28 to 47m/km (2.8% to 4.7%)	0.1	typically 2%- 7%
** Soil:	Tight impervious clay	0.1	
	Medium combination of clay and loam	0.2	
	Open sandy loam (top soil)	0.4	
	Permeable pavers (clear stone - no sub-drains)	0.75	Factors achieve volumetric runoff reduction of 85%, and 45% with sub-drains as per 'Sustainable Technologies Evaluation Program Low Impact Development Stormwater Management Planning and Design Guide' (referenced in the 'City of Ottawa Low Impact Development Technical Guidance Report')
	Permeable pavers (clear stone with sub-drains)	0.33	
*** Cover:	Urban Lawn / Cultivated Lands	0.1	Landscaped (Urban Lawn)
	Woodland	0.2	

As per MOE SWM Planning & Design Manual, 2003

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

100-YEAR EVENT

Project: 2928 Bank Street
4-Storey Apartment Building
Ottawa, Ontario

Date: March 13, 2025

Manning's Roughness Coefficient: 0.013

Location		Individual					Cumulative				Sewer Data							
From	To	Roof C = 1.00 (ha)	Hard C = 1.00 (ha)	Perm. Pavers C = 0.75 (ha)	Soft C = 0.25 (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}
CB/MH-1	MH-2	0.0123	0.0031	0.0130		0.0699	0.0699	10.00	179	12.48	18.6	250	251	0.43	0.80	39.41	0.39	32%
MH-2	Cistern					0.0000	0.0699	10.39	175	12.24	3.7	250	251	0.43	0.80	39.41	0.08	31%
Cistern	525 ST					0.0000		Pump Flow Rate		0.36	5.8	150	147	2.00	1.20	20.41	0.08	2%
										Existing 525 mm Queensdale Avenue Municipal Storm Sewer:		525	533	1.37	2.35	524.09		