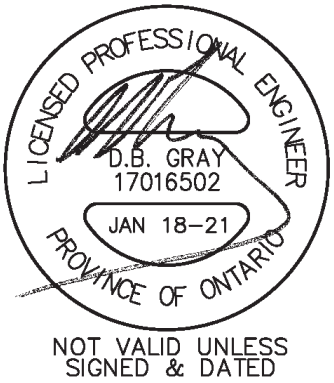
SERVICING BRIEF &
STORMWATER MANAGEMENT REPORT

406 Bank Street
Ottawa, Ontario

Report No. 20100

January 18, 2021



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

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SERVICING BRIEF &
STORMWATER MANAGEMENT REPORT

406 Bank Street
Ottawa, Ontario

This report describes the services and addresses the stormwater management requirements of a property 304 sq.m. in area, located 406 Bank Street at the corner of Florence Street in Ottawa. The property is currently vacant. A six-storey mixed-use building, with 30 apartment units and ground floor commercial, is proposed.

This report forms part of the stormwater management design for the proposed development. Refer to drawings C-1 to C-3 also prepared by D. B. Gray Engineering Inc.

WATER SUPPLY FOR FIREFIGHTING:

The proposed building will be installed with a sprinkler system with the fire department connection (FDC) located on the south façade of the proposed building. There is an existing municipal fire hydrant on the south side of the Florence Street ROW about 19 m unobstructed distance to the FDC. Since the municipal fire hydrant is located less than the maximum 45 m permitted, an additional fire hydrant is not required. There are two other existing municipal fire hydrants in the vicinity; one at the southeast corner of the Bank Street / Waverly Street intersection about 21 m unobstructed distance to the proposed building; and the other is near the northeast corner of the Bank Street / Frank Street intersection about 48 m unobstructed distance to the proposed building.

The proposed building will be built with heavy steel frame cage with light gauge steel stud infill for the exterior walls and wood floor joists bearing onto the steel cage. A sprinkler system is proposed. A fire flow of 233.3 L/s (14,000 L/min) is required, as calculated as per the Fire Underwriter Survey (FUS) "Water Supply For Fire Protection".

The boundary conditions for the 233.3 L/s fire flow (based on the city's computer model of the municipal water distribution system) were received from the City. They include a HGL (hydraulic grade line) of 108.2 m for the above flow rate in the 300mm municipal watermain in Bank Street at the subject location. This HGL calculates to be 353 kPa (51 psi). Since the pressure is above 138 kPa (20 psi) there is an adequate water supply for firefighting from the existing local municipal water distribution system.

As per City of Ottawa Technical Bulletin ISTB-2018-02, the aggregate flow of all contributing fire hydrants within 150 m of the building can used to supply the required fire flow. All existing municipal hydrants in the vicinity are Class AA. The three closest hydrants are within 75 m and can contribute 5,700 L/min (95 L/s) each (as per Table 1 of ISTB-2018-02). Therefore, the aggregate flow from all three hydrants is 17,100 L/min (285 L/s), which is greater than the required fire flow of 233.3 L/s.

WATER SERVICE:

As previously mentioned the proposed building will have a sprinkler system. To service the sprinkler system, a 150 mm water service (connecting to a 200 mm municipal watermain in Florence Street) is proposed. The 150 mm service will be adequate for the domestic demand.

Based on the City of Ottawa Water Distribution Design Guidelines for residential properties (30 one-bedroom apartment units / 1.4 person per unit; and 350 L/person/day) and Ministry of the Environment Design Guidelines for peaking factors the daily average flow is 0.17 L/s with a maximum daily and maximum hourly demand of 1.54 and 2.32 L/s respectively. Based on the City of Ottawa Design Guidelines the daily average consumption rate for a commercial development is 28,000 litres per day per hectare. The maximum daily peaking factors is 1.5 of the daily average demand and maximum hourly peaking factor is 1.8 of the maximum daily demand. Based on this rate, using the entire area of the property, and assuming an 8-hour day, the maximum daily demand is calculated to be 0.03 L/s. Based on the peaking factors the maximum daily demand is 0.04 L/s and maximum hourly demand is 0.08 L/s. The total daily demand is, therefore, 0.2 L/s; and the maximum daily and hourly demands are 1.6 L/s and 2.4 L/s respectively.

To determine water pressure under these demands, boundary conditions, based on the City of Ottawa computer simulation of the water distribution system, at the subject location, were requested from the City. Based on the boundary conditions received from the City, the minimum HGL (hydraulic grade line) is 106.9 m and the maximum is 115.4 m. With these HGLs the water pressure at the water meter is calculated to vary from 369 kPa to 452 kPa (53 to 66 psi). This is an acceptable range of water pressures for the proposed development.

SANITARY SERVICE:

Based on the City of Ottawa Sewer Design Guidelines for a residential property (30 one-bedroom apartment units / 1.4 person per unit; and a 3.2 peaking factor); based on City guidelines for commercial property (28,000 L / ha / day x 0.0304 ha); and based on a 0.33 L/s/ha infiltration flow; the post development flow is calculated to be 0.49 L/s. This flow will be adequately handled by the proposed sanitary sewer service connection (150 mm at 1% - 15.89 L/s capacity) since, at the design flow, it will only be about 3% full.

The proposed 150mm sanitary service connection will connect to the 1050mm municipal combined sewer in Florence Street which, with a 0.45% slope, has a capacity of 1912 L/s. The 0.49 L/s increase in sanitary flows contributing to the existing 1050 mm combined sewer is expected to have an acceptable impact.

STORMWATER MANAGEMENT:

Water Quality:

Since the drainage off the site will be from the roof, it is expected that the Rideau Valley Conservation Authority (RVCA) will not require onsite water quality measures. Therefore, no permanent quality control measures are proposed.

An erosion and sediment control plan has been developed to be implemented during construction, (see drawing C-2 and notes 2.1 to 2.5 on drawing C-3). In summary: to filter out construction sediment capture filter sock inserts will be installed in all existing catch basins adjacent to the site; and any material deposited on a public road shall be removed.

Water Quantity:

The stormwater management criteria for quantity control are to control the post development peak flows for the 5-year and 100-year storm events to the peak flows during the 2-year storm event using the pre-development runoff coefficient or runoff coefficient of 0.40, whichever is less; and a calculated time of concentration (not less than 10 minutes). It is calculated that the pre-development conditions reflect a 5-year runoff coefficient of 0.70 and a time of concentration of 2.0 minutes. Therefore, based on runoff coefficient of 0.40, a 10 minute time of concentration; and using the Rational Method; the maximum allowable release rate is 2.60 L/s for all storm events. The runoff coefficients for the 100 year event are increased by 25% to maximum 1.00.

Stormwater will be stored within the development in a cistern under a loading area garage.

Drainage Area I
(Uncontrolled Flow Off Site – 2 sq.m.):
The runoff from a small area at the perimeter of the site will be allowed to flow uncontrolled off the site. The flow from is calculated at 10 minutes concentration.

	100-year	5-year
Maximum flow rate:	0.10 L/s	0.05 L/s

Drainage Area IV (includes Cistern – 302 sq.m.):
All roof drains drain to a cistern located under a loading area garage. An inlet control device (ICD) located at the outlet pipe of the cistern will control the release of stormwater from the property. The ICD will restrict the flow and force the stormwater to back up into the cistern. To calculate the required storage volume in the cistern an average release rate is assumed to be equal to 50% of the maximum release rate. The ICD shall be a Hydrovex "50 VHV Vertical Vortex Flow Regulator" (or approved equal) and shall be sized by the manufacturer for a discharge rate of 2.50 L/s at 0.91 m head. It is calculated that an orifice area of 1,963 sq.mm. (50 mm in diameter) and a discharge coefficient of 0.301 will restrict the outflow rate to 2.50 L/s at 0.91 m. Based on this orifice the maximum outflow rate for the 1:5 year storm event is calculated to be 1.71 L/s at 0.42 m.

	100-year	5-year
Maximum release rate:	2.50 L/s	1.71 L/s
Maximum water elevation:	69.63 m	69.14 m
Maximum stored volume:	12.39 cu.m.	5.98 cu.m.

The Entire Site:

	100-year	5-year
Pre-development flow rate:	13.20 L/s	6.16 L/s
Maximum permitted release rate:	2.60 L/s	2.60 L/s
Maximum release rate:	2.60 L/s	1.78 L/s
Reduction from pre-development conditions:	80 %	58 %

The maximum post-development release rate for the 100-year storm event is calculated to be equal to the maximum allowable and 80% less than the pre-development flow rate. For the 5-year event, the maximum post-development release is 32% less than the maximum allowable and it is 58% less than the pre-development flow rate.

The unrestricted flowrate resulting from one in five-year storm event will produce a peak flow of 7.87 L/s which will be adequately handled by the proposed storm sewer connection (200mm at 2% - 48.4 L/s capacity) being only at 16% of its capacity. (The restricted flowrate (through the ICD) during a five-year storm event will produce a peak flow of 1.78 L/s; only 4% of the capacity of the storm sewer connection.) The storm sewer service will connect to a 1050 mm combined sewer in Florence Street.

The 58% to 80% reduction in stormwater flows contributing to the municipal storm sewers is expected to have a positive impact.

As required by the City a second independent (150 mm) storm sewer service, also connecting to the 1050 mm combined sewer in Florence Street, be provided for the foundation drains.

MINISTRY OF ENVIRONMENT, CONSERVATION, AND PARKS (MECP)
ENVIRONMENTAL COMPLIANCE APPROVAL (ECA):

Since the proposed storm sewer services connect to a combined sewer it is expected that a MECP ECA will be required.

CONCLUSIONS:

1. A private on-site fire hydrant is not required.

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

3. The aggregate flow of three contributing fire hydrants within 75 m of the building is greater than the required fire flow.

4. A 150 mm water service is proposed to service a sprinkler system. The 150mm service will be adequate for the domestic demand.

5. There is an acceptable range of water pressures in the municipal watermain for the proposed development.

6. The expected sanitary sewage flow rate will be adequately handled by the proposed sanitary sewer service connection.

7. The sanitary flow contributing to the existing municipal combined sewer is expected to have an acceptable impact.

8. The proposed development has no surface parking so it is expected that the RVCA will not require onsite water quality treatment, so no permanent quality control measures are proposed.

9. An erosion and sediment control plan has been developed to be implemented during construction.

10. The stormwater management criteria for quantity control are to control the post development peak flows for the 5-year and 100-year storm events to peak flows during the 2-year storm event using a runoff coefficient of 0.40 and a 10 minute time of concentration. The maximum allowable release rate is 2.60 L/s for all storm events. To achieve quantity control stormwater will be stored within the development in an underground cistern.

11. The maximum post-development release rate for the 100-year storm event is calculated to be equal to the maximum allowable and is 80% less than the pre-development flow rate. For the 5-year event, the maximum post-development release is 32% less than the maximum allowable and it is 58% less than the pre-development flow rate.

12. The unrestricted flowrate resulting from one in five-year storm event will be adequately handled by the proposed storm sewer service connection.

13. The 58% to 80% reduction in stormwater flows contributing to the municipal storm sewers is expected to have a positive impact.

14. Since the proposed storm sewer services connect to a combined sewer it is expected that a MECP ECA will be required.

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19-Nov-20

406-408 Bank Street
Ottawa, Ontario

Fire Flow Requirements

Proposed Six-Storey Apartment Building with Ground Floor Commercial

Fire flow requirement as calculated as per Fire Undewriter Survey "Water Supply For Fire Protection".

F = 220 C $A^{0.5}$ = the required fire flow in litres per minute

C = coefficient related to the type of construction
= 1.25 (heavy steel frame cage with light gauge steel stud infill for the exterior walls and wood floor joists bearing onto the steel cage)

A = total floor area (all storeys excluding basements at least 50% below grade)

406-408 Bank Street	6th Floor	272 sq.m.
	5th Floor	301 sq.m.
	4th Floor	301 sq.m.
	3rd Floor	301 sq.m.
	2nd Floor	301 sq.m.
	Ground Floor	282 sq.m.
	TOTAL FIRE AREA:	1759 sq.m.

F = 11,535 L/min
= 12,000 L/min (rounded off to the nearest 1,000 L/min)

-10% -15% Charge for Limited-combustible Occupancy (1477 sq.m. Apartments)
15% Charge for Free-burning Occupancy (282 sq.m. Commercial)

= 10,777 L/min

40% Reduction for Sprinkler System

= 4,311 L/min

Increase for Separation Exposed Buildings

			Adjacent Building			Length-Height
			Constuction	Length m	Storeys	Factor
22%	North	0 to 3m	Ordnary	18	2	36
13%	East	10.1 to 20m	Ordnary	17	2	34
13%	South	10.1 to 20m	Ordnary	18	2	36
23%	West	0 to 3m	W-F	17	3	51
71%	Total Increase for Exposure (maximum 75%)					

= 7,652 L/min Increase

= 14,118 L/min
F = 14,000 L/min (rounded off to the nearest 1,000 L/min)
= 233.3 l/s

Elevation at Fire Hydrant 72.19 m ASL

Static Pressure at Fire Hydrant

233 L/s FIRE FLOW: 108.2 m ASL 51 psi 353 kPa

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18-Nov-20
REVISED 30-Nov-20
REVISED 15-Jan-21

406-408 Bank Street
Six-Storey Mixed Use Building
30 Apartment Units / Ground Floor Commercial
Ottawa, Ontario

Water Demand

	Number of Units	Persons Per Unit	Population
APARTMENTS:			
1 Bedroom:	30	1.4	42
2 Bedroom:	0	2.1	0
3 Bedroom:	0	3.1	0
Average Apartment:	0	1.8	0
TOTAL:	30		42

APARTMENTS:

DAILY AVERAGE:	350	litres / person / day				
	10.2	L/min	0.17	L/s	2.7	USgpm
MAXIMUM DAILY DEMAND:	9.0	(Peaking Factor for a equivalent population of 42: Table 3-3 MOE Design Guidelines for Drinking-Water Systems)				
	92.3	L/min	1.54	L/s	24	USgpm
MAXIMUM HOURLY DEMAND:	13.6	(Peaking Factor for a equivalent population of 42: Table 3-3 MOE Design Guidelines for Drinking-Water Systems)				
	138.9	L/min	2.32	L/s	37	USgpm

GROUND FLOOR COMMERCIAL:

DAILY AVERAGE:	28,000	L /gross ha / day (as per Ottawa Design Guidelines)				
	0.03	ha (land area)				
	840	L/day				
	8	hour day				
	1.8	L/min	0.03	L/s	0.5	USgpm
MAXIMUM DAILY DEMAND:	1.5	(Peaking Factor as per Ottawa Design Guidelines)				
	2.6	L/min	0.04	L/s	0.7	USgpm
MAXIMUM HOURLY DEMAND:	1.8	(Peaking Factor as per Ottawa Design Guidelines)				
	4.7	L/min	0.08	L/s	1.2	USgpm
TOTAL DAILY AVERAGE:	12.0	L/min	0.2	L/s	3.2	USgpm
TOTAL MAXIMUM DAILY DEMAND:	94.9	L/min	1.6	L/s	25.1	USgpm
TOTAL MAXIMUM HOURLY DEMAND:	143.7	L/min	2.4	L/s	38.0	USgpm

			Static Pressure at Water Meter			
Elevation of Water Meter:	69.29	m ASL				
Basement Finish Floor Elevation:	68.39	m ASL				
MINIMUM HGL:	106.9	m ASL	53	psi	369	kPa
MAXIMUM HGL:	115.4	m ASL	66	psi	452	kPa

D.B. Gray Engineering Inc.

Douglas Gray <d.gray@dbgrayengineering.com>

RE: 406-408 Bank St - Boundary Condition Request

1 message

Wu, John <John.Wu@ottawa.ca> Fri, Nov 27, 2020 at 11:23 AM
To: Douglas Gray <d.gray@dbgrayengineering.com>

Here is the result:

******The following information may be passed on to the consultant, but do NOT forward this e-mail directly.******

The following are boundary conditions, HGL, for hydraulic analysis at 406 Bank Street (zone 1W) assumed to be connected to the 305mm on Bank Street (see attached PDF for location).

Minimum HGL = 106.9m

Maximum HGL = 115.4m

MaxDay + Fire Flow (233.3 L/s) = 108.2m

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

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

John

From: Douglas Gray <d.gray@dbgrayengineering.com>
Sent: November 19, 2020 1:50 PM
To: Wu, John <John.Wu@ottawa.ca>
Cc: Caoimhin Kennedy <c.kennedy@dbgrayengineering.com>
Subject: 406-408 Bank St - Boundary Condition Request

Hi John

Please provide the boundary conditions at 406-408 Bank St (at the corner of Florence St). We have calculated the following expected demands based on a 24-unit apartment building with ground floor commercial.

Average daily demand: 0.2 L/s.

Maximum daily demand: 1.3 L/s.

Maximum hourly daily demand: 2.0 L/s

Fire Flow demand: 233.3 L/s

Fire Flow + Max Day: 234.6 L/s

Calculations are attached.

The water service will connect to the Florence St watermain.

Thanks, Doug

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

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406 Bank Street November 2020.pdf
76K


Boundary Conditions for 406 Bank Street
N
WAVERLEY ST W
203
366
403
390
152
BANK ST
394
413
305
11
406
152
417
19
203
FRANK ST
380
21
FLORENCE ST
203
380
384
425
410
429
433
14
431
422
305
Legend
PRIVATE
PUBLIC

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SANITARY SEWER DESIGN FORM

Average Daily Flows
Residential: 280 l / capita / day
Commercial: 28000 l / ha / day
Instituational: 28000 l / ha / day
Light Industrial: 35000 l / ha / day
Heavy Industrial: 55000 l / ha / day

Infiltration Allowance: 0.33 l / s / ha

Peaking Factor:
Residential (Harmon Equation): $1 + \frac{14}{4 + P^{0.5}}$
P = Population / 1000
Harmon Correction Factor: 0.8
Commercial & Institutional: 1.5 If contrinbution > 20%
Commercial & Institutional: 1 If contrinbution < 20%
Industrial: As per Ottawa Guidelines Appendix 4-B

Project: 406-408 Bank Street

Designed By: D.B.G.

15-Jan-21

Page: 1 of 1

Location		Section								Cumulative Residential		Section Non-Residential			Cumulative					Sewer Data n = 0.013								Comments
		Single Family	Semi/Townhouse	Duplex / Triplex	Apartment (average)	Apartment (1 Bed.)	Apartment (2 Bed.)	Apartment (3 Bed.)	Residential Area	Pop.	Peaking Factor	Area	Flow	Peaking Factor	Flow	Area	Sewage Flow	Infiltration Flow	Total Flow	Type of Pipe	Dia. Actual	Dia. Nom.	Slope	Length	Capacity	Velocity	Ratio	
		ppu = 3.4	ppu = 2.7	ppu = 2.3	ppu = 1.8	ppu = 1.4	ppu = 2.1	ppu = 3.1																			
FROM	TO	No. of Units	No. of Units	No. of Units	No. of Units	No. of Units	No. of Units	No. of Units	ha			ha	l/ha/day		l/s	ha	l/s	l/s	l/s		(mm)	(mm)	(%)	(m)	(l/s)	(m/s)	Q/Qfull	
	Exist																											
BLDG	1050					30				42.0	3.2	0.03	28000	4.5	0.044	0.030	0.48	0.01	0.49	PVC	152.4	150	1.00	7.4	15.89	0.87	0.03	
	SAN																											
																				EXISTING 1050 SANITARY SEWER IN FLORENCE AVE								
																					1067	1050	0.45		1912	2.14		

STORMWATER MANAGEMENT CALCULATIONS

The orifice calculations are based on the following formula:

$$Q = C_d \times A_o \sqrt{2gh} \times 1000$$

where:

- Q = flowrate in litres per second
- C_d = coefficient of discharge
- A_o = orifice area in sq.m.
- g = 9.81 m/s2
- h = head above orifice in meters

Summary Tables

ONE HUNDRED 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)
AREA I (Uncontrolled Flow Off Site)	-	-	0.10	-	-
AREA II	-	-	2.50	12.39	12.39
TOTAL	13.20	2.60	2.60	12.39	12.39

FIVE 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)
AREA I (Uncontrolled Flow Off Site)	-	-	0.05	-	-
AREA II	-	-	1.71	5.98	5.98
TOTAL	6.16	2.60	1.76	5.98	5.98

406 Bank Street

Ottawa, Ontario

STORMWATER MANAGEMENT CALCULATIONS
Rational Method

PRE-DEVELOPMENT CONDITIONS

100-Year Flow Rate

			C
Roof Area:	0	sq.m	1.00
Asphalt/Concrete Area:	0	sq.m	1.00
Gravel Area:	304	sq.m	0.875
Landscaped Area:	0	sq.m	0.25
Total Catchment Area:	304	sq.m	0.875

Bransby William Formula (Used when C > 0.40)

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

Sheet Flow Distance (L):	25	m
Slope of Land (Sw):	1	%
Area (A):	0.0304	ha
Time of Concentration (Sheet Flow):	2.0	min
Area (A):	304	sq.m
Time of Concentration:	10	min
Rainfall Intensity (i):	179	mm/hr
Runoff Coeficient (C):	0.875	
100-Year Pre-Development Flow Rate (2.78AiC):	13.20	L/s

5-Year Flow Rate

			C
Roof Area:	0	sq.m	0.90
Asphalt/Concrete Area:	0	sq.m	0.90
Gravel Area:	304	sq.m	0.70
Landscaped Area:	0	sq.m	0.20
Total Catchment Area:	304	sq.m	0.70

Area (A):	304	sq.m
Time of Concentration:	10	min
Rainfall Intensity (i):	104	mm/hr
Runoff Coeficient (C):	0.70	
5-Year Pre-Development Flow Rate (2.78AiC):	6.16	L/s

Maximum Allowable Release Rate

Area (A):	304	sq.m	
Time of Concentration:	10	min	
Rainfall Intensity (i):	77	mm/hr	(2 year event)
Runoff Coeficient (C):	0.40		
Maximum Allowable Release Rate (2.78AiC):	2.60	L/s	

ONE HUNDRED-YEAR EVENT

DRAINAGE AREA I (Uncontrolled Flow Off Site)

(ONE HUNDRED-YEAR EVENT)

			C
Roof Area:	0	sq.m	1.00
Asphalt/Concrete Area:	2	sq.m	1.00
Gravel Area:	0	sq.m	0.875
Landscaped Area:	0	sq.m	0.25
Total Catchment Area:	2	sq.m	1.00
Area (A):	2	sq.m	
Time of Concentration:	10	min	
Rainfall Intensity (i):	179	mm/hr	
Runoff Coeficient (C):	1.00		
Release Rate (2.78AiC):	0.10	L/s	

DRAINAGE AREA II

(ONE HUNDRED-YEAR EVENT)

			C
Roof Area:	302	sq.m	1.00
Asphalt/Concrete Area:	0	sq.m	1.00
Gravel Area:	0	sq.m	0.875
Landscaped Area:	0	sq.m	0.25
Total Catchment Area:	302	sq.m	1.00

Water Elevation:	69.63	m
Invert of Outlet Pipe:	68.69	m
Centroid of ICD Orifice:	68.72	m
Head:	0.91	m
Orifice Diameter:	50	mm
Orifice Area:	1963	sq.mm
Coefficient of Discharge:	0.301	
Maximum Release Rate:	2.50	L/s

Inside Length (m)	Inside Width (m)	Depth (m)	Volume	
5.50	2.40	0.94	12.39	cu.m

Achieved Volume: 12.39 cu.m

Maximum Volume Required: 12.39 cu.m

Time (min)	i (mm/hr)	2.78AiC (L/s)	Release Rate (L/s)	Stored Rate (L/s)	Stored Volume (cu.m)
5	243	20.38	1.25	19.13	5.74
10	179	14.99	1.25	13.74	8.24
15	143	12.00	1.25	10.75	9.67
20	120	10.07	1.25	8.82	10.58
25	104	8.72	1.25	7.47	11.20
30	92	7.71	1.25	6.46	11.63
35	83	6.93	1.25	5.68	11.93
40	75	6.31	1.25	5.06	12.14
45	69	5.80	1.25	4.55	12.27
50	64	5.37	1.25	4.12	12.35
55	60	5.01	1.25	3.75	12.39
60	56	4.69	1.25	3.44	12.39
65	53	4.42	1.25	3.17	12.36
70	50	4.18	1.25	2.93	12.30
75	47	3.97	1.25	2.72	12.22
80	45	3.78	1.25	2.53	12.13
85	43	3.61	1.25	2.36	12.01
90	41	3.45	1.25	2.20	11.88
95	39	3.31	1.25	2.06	11.74
100	38	3.18	1.25	1.93	11.59
105	36	3.06	1.25	1.81	11.42
110	35	2.96	1.25	1.70	11.25
115	34	2.85	1.25	1.60	11.07
120	33	2.76	1.25	1.51	10.88
125	32	2.67	1.25	1.42	10.68
130	31	2.59	1.25	1.34	10.48
135	30	2.52	1.25	1.27	10.27
140	29	2.45	1.25	1.20	10.05
145	28	2.38	1.25	1.13	9.83
150	28	2.32	1.25	1.07	9.60
180	24	2.01	1.25	0.76	8.16
210	21	1.78	1.25	0.52	6.60
240	19	1.60	1.25	0.34	4.96
270	17	1.45	1.25	0.20	3.25
300	16	1.33	1.25	0.08	1.50
330	15	1.24	1.24	0.00	0.00
360	14	1.15	1.15	0.00	0.00

FIVE-YEAR EVENT

DRAINAGE AREA I (Uncontrolled Flow Off Site)

(FIVE-YEAR EVENT)

			C
Roof Area:	0	sq.m	0.90
Asphalt/Concrete Area:	2	sq.m	0.90
Gravel Area:	0	sq.m	0.70
Landscaped Area:	0	sq.m	0.20
Total Catchment Area:	2	sq.m	0.90
Area (A):	2	sq.m	
Time of Concentration:	10	min	
Rainfall Intensity (i):	104	mm/hr	
Runoff Coeficient (C):	0.90		
Release Rate (2.78AiC):	0.05	L/s	

DRAINAGE AREA II

(FIVE-YEAR EVENT)

			C
Roof Area:	302	sq.m	0.90
Asphalt/Concrete Area:	0	sq.m	0.90
Gravel Area:	0	sq.m	0.70
Landscaped Area:	0	sq.m	0.20
Total Catchment Area:	302	sq.m	0.90

Water Elevation:	69.14	m
Invert of Outlet Pipe:	68.69	m
Centroid of ICD Orifice:	68.72	m
Head:	0.43	m
Orifice Diameter:	50	mm
Orifice Area:	1963	sq.mm
Coefficient of Discharge:	0.301	
Maximum Release Rate:	1.71	L/s

Inside Length (m)	Inside Width (m)	Depth (m)	Volume	
5.50	2.40	0.45	5.98	cu.m

Achieved Volume: 5.98 cu.m

Maximum Volume Required: 5.98 cu.m

Time (min)	i (mm/hr)	2.78AiC (L/s)	Release Rate (L/s)	Stored Rate (L/s)	Stored Volume (cu.m)
5	141	10.67	0.86	9.81	2.94
10	104	7.87	0.86	7.02	4.21
15	84	6.31	0.86	5.46	4.91
20	70	5.31	0.86	4.45	5.34
25	61	4.60	0.86	3.75	5.62
30	54	4.07	0.86	3.22	5.79
35	49	3.67	0.86	2.81	5.90
40	44	3.34	0.86	2.48	5.96
45	41	3.07	0.86	2.21	5.98
50	38	2.85	0.86	1.99	5.97
55	35	2.65	0.86	1.80	5.93
60	33	2.49	0.86	1.63	5.88
65	31	2.35	0.86	1.49	5.81
70	29	2.22	0.86	1.36	5.73
75	28	2.11	0.86	1.25	5.63
80	27	2.01	0.86	1.15	5.52
85	25	1.92	0.86	1.06	5.41
90	24	1.84	0.86	0.98	5.29
95	23	1.76	0.86	0.90	5.16
100	22	1.69	0.86	0.84	5.02
105	22	1.63	0.86	0.77	4.88
110	21	1.57	0.86	0.72	4.73
115	20	1.52	0.86	0.66	4.58
120	19	1.47	0.86	0.61	4.43
125	19	1.43	0.86	0.57	4.27
130	18	1.38	0.86	0.53	4.10
135	18	1.34	0.86	0.49	3.94
140	17	1.30	0.86	0.45	3.77
145	17	1.27	0.86	0.41	3.60
150	16	1.24	0.86	0.38	3.42
180	14	1.07	0.86	0.22	2.33
210	13	0.95	0.86	0.09	1.17
240	11	0.85	0.85	0.00	0.00
270	10	0.78	0.78	0.00	0.00
300	9	0.71	0.71	0.00	0.00
330	9	0.66	0.66	0.00	0.00
360	8	0.62	0.62	0.00	0.00

STORM SEWER DESIGN FORM — FIVE YEAR EVENT

Rational Method — Q = 2.78 A i C

January 15, 2021

n = 0.013

Location		Areas (ha)									Pipe Data									Notes
		Hard	Gravel	Landscape	Roof	Individual	Accum.	Time of Conc.	Rainfall Intensity i	Peak Flow Q		Actual Diameter	Nominal Diameter	Slope	Length	Capacity	Velocity	Time of Flow	Ratio	
From	To	C = 0.9	C = 0.7	C = 0.2	C = 0.9	2.78AC	2.78AC	(min)	(mm/hr)	(L/s)	Material	(mm)	(mm)	(%)	(m)	(L/s)	(m/s)	(min)	Q/Qfull	
Building (Cistern)	Existing 1050 COMB																			
					0.0302	0.0756	0.0756	10.00	104	7.87	PVC	203.2	200	2.00	8.6	48.4	1.49	0.10	0.16	
										1.78	PVC	203.2	200	2.00	8.6	48.4	1.49	0.10	0.04	Through ICD
												Existing 1050 COMBINED Sewer in Florence Street								
												1066.8	1050	0.45		1911.0	2.14			

City of Ottawa Servicing Study Checklist

General Content

Executive Summary (for large reports only): not applicable

Date and revision number of the report: see page 1 of Servicing Brief and Stormwater Management Report

Location map and plan showing municipal address, boundary, and layout of proposed development: see drawings C-1 to C-3

Plan showing the site and location of all existing services: see drawings C-1 to C-3

Development statistics, land use, density, adherence to zoning and official plan, and reference to applicable subwatershed and watershed plans that provide context to which individual developments must adhere: not applicable

Summary of Pre-consultation Meetings with City and other approval agencies: not available

Reference and confirm conformance to higher level studies and reports (Master Servicing Studies, Environmental Assessments, Community Design Plans), or in the case where it is not in conformance, the proponent must provide justification and develop a defendable design criteria: not applicable

Statement of objectives and servicing criteria: see page 2 of Servicing Brief and Stormwater Management Report

Identification of existing and proposed infrastructure available in the immediate area: see drawings C-1 to C-3

Identification of Environmentally Significant Areas, watercourses and Municipal Drains potentially impacted by the proposed development (Reference can be made to the Natural Heritage Studies, if available). see drawings C-1 to C-3

Concept level master grading plan to confirm existing and proposed grades in the development and drainage, soil removal and fill constraints, and potential impacts to neighbouring properties. This is also required to confirm that the proposed grading will not impede existing major system flow paths: not applicable

Identification of potential impacts of proposed piped services on private services (such as wells and septic fields on adjacent lands) and mitigation required to address potential impacts: not applicable

Proposed phasing of the development, if applicable: not applicable

Reference to geotechnical studies and recommendations concerning servicing: see note 1.5 on drawing C-3

All preliminary and formal site plan submissions should have the following information:

- **Metric scale:** included
- **North arrow:** included
    - **(including construction North):** not included
- **Key Plan:** included

- **Name and contact information of applicant and property owner:** not available
- **Property limits**: included
    - **including bearings and dimensions:** not included
- **Existing and proposed structures and parking areas:** included
- **Easements, road widening and rights-of-way:** included
- **Adjacent street names:** included

Development Servicing Report: Water

Confirm consistency with Master Servicing Study, if available: not applicable

Availability of public infrastructure to service proposed development: see page 2 & 3 of Servicing Brief

Identification of system constraints: see page 2 & 3 of Servicing Brief

Confirmation of adequate domestic supply and pressure: see page 2 & 3 of Servicing Brief

Confirmation of adequate fire flow protection and confirmation that fire flow is calculated as per the Fire Underwriter's Survey. Output should show available fire flow locations throughout the development: see page 2, 3 & 7 of Servicing Brief

Provide a check of high pressures. If pressure is found to be high, an assessment is required to confirm the application of pressure reducing valves: see page 3 of Servicing Brief

Definition of phasing constraints. Hydraulic modeling is required to confirm servicing for all defined phases of the project including the ultimate design: not applicable

Address reliability requirements such as appropriate location of shut-off valves: not applicable

Check on the necessity of a pressure zone boundary modification:. not applicable

Reference to water supply analysis to show that major infrastructure is capable of delivering sufficient water for the proposed land use. This includes data that shows that the expected demands under average day, peak hour and fire flow conditions provide water within the required pressure range: not applicable

Description of the proposed water distribution network, including locations of proposed connections to the existing systems, provisions for necessary looping, and appurtenances (valves, pressure reducing valves, valve chambers, and fire hydrants) including special metering provisions: not applicable

Description of off-site required feedermains, booster pumping stations, and other water infrastructure that will be ultimately required to service proposed development, including financing, interim facilities, and timing of implementation: not applicable

Confirmation that water demands are calculated based on the City of Ottawa Design Guidelines: see page 3 of Servicing Brief

Provision of a model schematic showing the boundary conditions locations, streets , parcels, and building locations for reference: not applicable

Development Servicing Report: Wastewater

Summary of proposed design criteria: see page 3 of Servicing Brief

(Note: Wet-weather flow criteria should not deviate from the City of Ottawa Sewer Design Guidelines. Monitored flow data from relatively new infrastructure cannot be used to justify capacity requirements for proposed infrastructure): not applicable

Confirm consistency with Master Servicing Study and /or justification for deviations: not applicable

Consideration of local conditions that may contribute to extraneous flows that are higher than the recommended flows in the guidelines. This includes groundwater and soil conditions, and age and conditions of sewers: not applicable

Descriptions of existing sanitary sewer available for discharge of wastewater from proposed development: see page 3 of Servicing Brief

Verify available capacity in downstream sanitary sewer and / or identification of upgrades necessary to service the proposed development. (Reference can be made to previously completed Master Servicing Study if applicable): not applicable

Calculations related to dry-weather and wet-weather flow rates from the development in standard MOE sanitary sewer design table (Appendix C) format. see page 11 of Servicing Brief

Description of proposed sewer network including sewers, pumping stations, and forcemains: see page 3 of Servicing Brief

Discussion of previously identified environmental constraints and impact on servicing (environmental constraints are related to limitations imposed on the development in order to preserve the physical condition of watercourses, vegetation, soil cover, as well as protecting against water quantity and quality): not applicable

Pumping stations: impacts of proposed development on existing pumping stations or requirements for new pumping station to service development: not applicable

Forcemain capacity in terms of operational redundancy, surge pressure and maximum flow velocity: not applicable

Identification and implementation of the emergency overflow from sanitary pumping stations in relation to the hydraulic grade line to protect against basement flooding: not applicable

Special considerations such as contamination, corrosive environment etc: not applicable

Development Servicing Report: Stormwater Checklist

Description of drainage outlets and downstream constraints including legality of outlets (i.e. municipal drain, right-of-way, watercourse, or private property): see page 5 of Servicing Brief and Stormwater Management Report

Analysis of available capacity in existing public infrastructure. not applicable

A drawing showing the subject lands, its surroundings, the receiving watercourse, existing drainage patterns, and proposed drainage pattern: see drawing C-1 to C-3

Water quality control objective (e/g/ controlling post-development peak flows to pre-development level for storm events ranging from the 2 or 5 year event (dependent on the receiving sewer design) to 100 year return period); if other objectives are being applied, a rationale must be included with reference to hydrologic analyses of the potentially affected subwatersheds, taking

into account long-term cumulative effects: see Stormwater Management Report Servicing Brief and Stormwater Management Report

Water Quality control objective (basic, normal or enhanced level of protection based on the sensitivities of the receiving watercourse) and storage requirements: Servicing Brief and Stormwater Management Report

Descriptions of the references and supporting information.
Set-back from private sewage disposal systems. not applicable

Watercourse and hazard lands setbacks: not applicable

Record of pre-consultation with the Ontario Ministry of Environment and the Conservation Authority that has jurisdiction on the affected watershed: the pre-application consultation record is not yet been issued

Confirm consistency with sub-waterched and Master Servicing Study, if applicable study exists: not applicable

Storage requirements (complete with calculations) and conveyance capacity for minor events (1:5 year return period) and major events (1:100 year return period). see drawings C-1 to C-3 and Servicing Brief and Stormwater Management Report

Identification of watercourses within the proposed development and how watercourses will be protected, or , if necessary, altered by the proposed development with applicable approvals. see drawings C-1 to C-3 and Servicing Brief and Stormwater Management Report

Calculate pre and post development peak flow rates including a description of existing site conditions and proposed impervious areas and drainage catchments in comparison to existing conditions: see Servicing Brief and Stormwater Management Report

Any proposed diversion of drainage catchment areas from one outlet to another. : not applicable

Proposed minor and major systems including locations and sizes of stormwater trunk sewers, and stormwater management facilities. : not applicable

If quantity control is not proposed, demonstration that downstream system has adequate capacity for the post-development flows up to and including the 100-year return period storm event: not applicable

Identification of potential impacts to receiving watercourses: Servicing Brief and Stormwater Management Report

Identification of municipal drains and related approval requirements. : not applicable

Descriptions of how the conveyance and storage capacity will be achieved for the development: see page 5 of Servicing Brief and Stormwater Management Report

100 year flood levels and major flow routing to protect proposed development from flooding for establishing minimum building elevations (MBE) and overall grading:

Inclusion of hydraulic analysis including hydraulic grade line elevations. : not applicable

Description of approach to erosion and sediment control during construction for the protection of receiving watercourses of drainage corridors: see notes 2.1 to 2.5 on drawing C-2

Identification of floodplains – proponent to obtain relevant floodplain information from the appropriate Conservation Authority. The proponent may be required to delineate floodplains elevations to the satisfaction of the Conservation Authority if such information is not available or if information does not match current: not applicable

Identification of fill constraints related to floodplain and geotechnical investigation. : not applicable

Approval and Permit Requirements: Checklist

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

Conservation Authority as the designated approval agency for modification of floodplain, potential impact on fish habitat, proposed works in or adjacent to a watercourse, cut/fill permits and Approval under Lakes and Rivers Improvement Act. The Conservation Authority is not approval authority for the Lakes and Rivers Improvement Act. Where there are Conservation Authority regulations in place, approval under the Lakes and Rivers Improvement Act is not required, except in cases of dams as defined in the Act: not applicable

Application for Certificate of Approval (CofA) under the Ontario Water Resources Act:

Changes to Municipal Drains. : not applicable

Other permits (National Capital commission, Parks Canada, public Works and Government Services Canada, Ministry of transportation etc.) : not applicable

Conclusion Checklist

Clearly stated conclusions and recommendations: see page 6 of Servicing Brief

Comments received from review agencies including the City of Ottawa and information on how the comments were addressed. Final sign-off from the responsible reviewing agency.

All draft and final reports shall be signed and stamped by a professional Engineer registered in Ontario: included