SERVICING BRIEF &
STORMWATER MANAGEMENT REPORT

386 Richmond Road
Ottawa, Ontario

Report No. 17045

October 10, 2017
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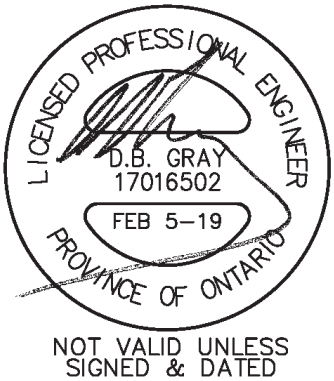
Revised February 5, 2019



D. B. GRAY ENGINEERING INC.

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

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SERVICING BRIEF &
STORMWATER MANAGEMENT REPORT

386 Richmond Road
Ottawa, Ontario

This report describes the services for a proposed 3-storey 8-unit apartment building with ground floor commercial and addresses the stormwater management requirements of the 343 sq.m. property it is to be located on at 386 Richmond Road. A building, to be demolished, is currently located on the property.

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

WATER SUPPLY FOR FIREFIGHTING:

There is an existing fire hydrant in the Richmond Road right-of-way, located approximately 7m unobstructed distance from the entrances to the building. Since it less than the required 90m, an on-site fire hydrant is not required.

The proposed building will either be wood-framed or non-combustible construction. A sprinkler system is not proposed in either scenario. A fire flow of 266.7 l/s (16,000 L/min) is required, as calculated as per the Fire Underwriter Survey "Water Supply For Fire Protection", if it is wood-framed construction and for non-combustible 116.7 l/s (7,000 L/min) is required.

The boundary conditions received from the city (based on the city's computer model of the municipal water distribution system) includes the HGL of 106.0m during the 266.7 l/s fire flow conditions at the subject location which calculates to be 367 kPa (53 psi). During the 116.7 l/s fire flow the HGL is 109.0 which calculates to be 396 kPa (57 psi). In either case, since the pressure is above 138 kPa (20 psi) there is an adequate water supply for firefighting.

WATER SERVICE:

The proposed 50mm water service will connect to an existing 300mm municipal watermain in Richmond Road.

Based on the AWWA water flow demand curve, an estimated water pressure at the meter of 427 kPa (62 psi), the peak demand is expected to be 2.1 l/s (124 L/min / 33 USgpm). The AWWA method calculates the instantaneous demand and is used to size the water service. This peak demand will produce an acceptable velocity of 1.1 m/s in the proposed 50mm water service connection.

Based on the City of Ottawa Water Distribution Design Guidelines for residential properties (8 one-bedroom apartment units / 1.4 persons per unit – 350 l/person/day); and adding a 192 sq.m. commercial component (at 5 l / sq.m. / 8 hour) and the Ministry of the Environment Design Guidelines for peaking factors the daily average flow is 0.1 l/s with a maximum daily and maximum hourly demand of 0.5 and 0.7 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, are required. In summary, we requested the boundary conditions for the subject area based on the following:

Average Daily Demand: 0.1 l/s.
Maximum Daily Demand: 0.5 l/s.
Maximum Hourly Demand: 0.7 l/s

Based on the boundary conditions received from the city, the minimum HGL (hydraulic grade line) is 108.7 m and the maximum is 115.0 m. With these HGLs the water pressure at the water meter is calculated to vary from 391 kPa to 453 kPa (57 to 66 psi). This is an acceptable range of pressures for the proposed development.

SANITARY SERVICE:

Based on the City of Ottawa Sewer Design Guidelines for a residential property (8 one-bedroom apartment units / 1.4 persons per unit – 280 l/person/day – 3.2 peaking factor); and a 192 sq.m. commercial component (at 5 l / sq.m. – 4.5 peaking factor (1.5 peaking factor x 24 / 8 hours); and a 0.33 l/s/ha infiltration flow) the post development flow is calculated to be 0.18 l/s.

This flow will be adequately handled by the proposed sanitary sewer service connection (150mm at 1% - 15.9 l/s capacity). The 0.18 l/s in sanitary flows contributing to the existing 300mm municipal sanitary sewer is expected to have an acceptable impact given its capacity of 59.7 l/s (300mm at 0.35%).

STORMWATER MANAGEMENT:

Water Quality:

The proposed building will occupy virtually the entire site, so almost all of the drainage from the site (92%) is from the roofs. Roof drainage is typically considered “clean”, therefore it is expected that the Rideau Valley Conservation Authority (RVCA) will not require permanent on-site quality control measures and none are proposed.

An erosion and sediment control plan has been developed to be implemented during construction, (see notes 2.1 to 2.5 on drawing C-3). In summary: to filter out

construction sediment; sediment capture filter sock inserts will be installed in all existing catch basins adjacent to the site.

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 peak flows during the 5-year storm event using a runoff coefficient of 0.50 and 10 minute time of concentration. Calculations are based on the Rational Method. The runoff coefficients for the 100-year event were increased by 25% to maximum 1.00. Using the Rational Method; the maximum allowable release rate is calculated to be 4.97 l/s for all storm events.

However, it is not practical to control the area around the perimeter of the site, such that during the 100-year event 4.17 l/s drain off the site uncontrolled. As a result, during the 100-year event the above maximum allowable release rate of 4.97 l/s cannot be achieved without underground storage (there is no basement so there is little opportunity for storage tanks inside the building). Since the proposed building virtually lot-line to lot-line there is little space left to accommodate underground storage. Using flow control roof drains it is proposed that stormwater be stored on the roof of the building. It is calculated that during the 100-year event the maximum release rate will be 7.16 l/s. While this is greater than the maximum allowable, the 7.16 l/s is more than half (52%) of the flow generated from existing conditions (14.87 l/s). During the 5-year event only 2.19 l/s drain off the site uncontrolled so the maximum release rate is less than the maximum allowable (and 43% less than the than the flow generated from existing conditions).

Drainage Area I (Uncontrolled Flow Off Site – 84 sq.m.):
The runoff from part of 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
The maximum flow rate:	4.17 l/s	2.19 l/s

Drainage Area II (Roof – 259 sq.m.):
Two roof drains on the 3rd Level Roof will be flow control types which will restrict the flow and cause the storm water to pond on the roof. All flow control type roof drains shall be installed with a parabolic shaped slotted weir (1 slot per weir drain at 0.0124 l/s per mm per slot - 5 USgpm per inch per slot): Watts roof drain with a Watts Accutrol Weir RD-100-A1 or equal. The roof drains shall be installed at the low points of the roof which shall be 145mm lower than the perimeter of the roof. As per the Ontario Building Code scuppers shall be installed so that the maximum depth of water on the roof cannot exceed 150mm.

	100-year	5-year
The maximum release rate:	2.99 l/s	2.24 l/s
The maximum ponding depth:	120 mm	90 mm
The maximum stored volume:	6.78 cu.m.	2.86 cu.m.

The unrestricted flowrate resulting from one in five-year storm event will produce a peak flow of 8.5 l/s which will be adequately handled by a proposed storm sewer (150mm at 1.00% - 15.9 l/s capacity)

The stormwater flows contributing to the existing 600mm municipal storm sewer (at 0.30% - 350.8 l/s capacity) is expected to have a positive impact since the flows off the site are being reduced by 52% and 43% for the 5 and 100-year storm event respectively.

CONCLUSIONS:

1. There is an adequate water supply for firefighting.

2. The existing water pressure is adequate for the proposed development.

3. The proposed water service connection is adequately sized to serve the development.

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

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

6. Permanent on-site quality control measures are not expected to be required.

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

8. The maximum release rate will be 52% less than the flow generated from existing conditions during the 100-year event and 43% less during the 5-year event.

9. The flowrate produced by a one in five-year storm event will be adequately handled by the proposed storm sewer connection.

10. The restricted stormwater flow contributing to the existing municipal storm sewer is expected to have a positive impact.

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1-Sep-17
REVISED 8-Sep-17
REVISED 11-Oct-18
REVISED 19-Oct-18

386 Richmond Rd
Ottawa, Ontario
Three-Storey Mixed Use Building
8 Apartment Units / Partial Ground Floor Commerical

Fire Flow Requirements

Wood Frame Construction

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

F = the required fire flow in litres per minute

C = coefficient related to the type of construction
= 1.5 Wood Frame Construction

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

Proposed Building:	Ground Floor	192	sq.m.	Retail
		103	sq.m.	Residential
		295		
	2nd Floor	261	sq.m.	
	3rd Floor	261	sq.m.	
	4th Floor	71	sq.m.	
		888		
383 Danforth Avenue Exising Building (Residential):	Ground Floor	61	sq.m.	
	Second Floor	61	sq.m.	
		122		
382 Danforth Avenue Existing Building (Commerciall):	Ground Floor	113	sq.m.	
	Second Floor	113	sq.m.	
		226		
	TOTAL FIRE AREA:	1,236	sq.m.	

F = 11,602 L/min
= 12,000 L/min (rounded off to the nearest 1,000 L/min)

-9.9% Change for Limited-Combustible Occupancy & for Combustible Occupancy
((((236 + 103 sq.m.) x (0%)) + (1236 - 418 sq.m.) x (-15%)) / 1236 sq.m.)

= 10,809 L/min

0% Reduction for No Sprinkler System

= - L/min

Increase for Separation Exposed Buildings

			Adjacent Building			Length-Height
			Constuction	Length m	Storeys	Factor
6%	North	20.1 to 30m	Ordinary w/Unprotected Opening	10	2	20
22%	East	0 to 3m	Ordinary w/Unprotected Opening	32	2	64
0%	South	>45m	N/A	N/A	N/A	N/A
17%	West	3.1 to 10m	W-F	12	2	24
45%	Total Increase for Exposure (maximum 75%)					

= 4,864 L/min Increase

= 15,673 L/min
F = 16,000 L/min (rounded off to the nearest 1,000 L/min)
= 266.7 l/s

Elevation at Fire Hydrant	68.61	m ASL				
			Static Pressure at Fire Hydrant			
267 l/s FIRE FLOW:	106.0	m ASL	53	psi	367	kPa

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386 Richmond Rd
Ottawa, Ontario
Three-Storey Mixed Use Building
8 Apartment Units / Partial Ground Floor Commerical

Fire Flow Requirements

Non-Combustible Construction

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

F = the required fire flow in litres per minute

C = coefficient related to the type of construction
= 0.8 Non-Combustible Construction (unprotected structural components)

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

Proposed Building:	Ground Floor	192	sq.m.	Retail
		103	sq.m.	Residential
		295		
	2nd Floor	261	sq.m.	
	3rd Floor	261	sq.m.	
	4th Floor	71	sq.m.	
	TOTAL FIRE AREA:	888	sq.m.	

F = 5,245 L/min
= 5,000 L/min (rounded off to the nearest 1,000 L/min)

-11.8% Change for Limited-Combustible Occupancy & for Combustible Occupancy
(((103 sq.m. x 0%) + (888 - 103 sq.m.) x (-15%)) / 888 sq.m.)

= 4,412 L/min

0% Reduction for No Sprinkler System

= - L/min

Increase for Separation Exposed Buildings

				Adjacent Building		
			Constuction	Length m	Storeys	Length-Height Factor
6%	North	20.1 to 30m	Ordinary w/Unprotected Opening	10	2	20
22%	East	0 to 3m	Ordinary w/Unprotected Opening	32	2	64
22%	South	0 to 3m	W-F	10	2	20
0%	West	0 to 3m	Ordinary	32	1	32
50%	Total Increase for Exposure (maximum 75%)					

= 2,206 L/min Increase

= 6,618 L/min
F = 7,000 L/min (rounded off to the nearest 1,000 L/min)
= 116.7 l/s

Elevation at Fire Hydrant 68.61 m ASL

			Static Pressure at Fire Hydrant			
117 l/s FIRE FLOW:	109.0	m ASL	57	psi	396	kPa

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386 Richmond Rd
Three-Storey Mixed Use Building
8 Apartment Units / Partial Ground Floor Commercial
Ottawa, Ontario

Water Demand

	Number of Units	Persons Per Unit	Population
APARTMENTS:			
Bachelor	0	1.4	0
1 Bedroom:	8	1.4	11
2 Bedroom:	0	2.1	0
3 Bedroom:	0	3.1	0
Average Apartment:	0	1.8	0
TOTAL:	8		11

APARTMENTS

DAILY AVERAGE:	350	litres / person / day				
	2.7	l / min	0.0	l / sec	0.7	USgpm
MAXIMUM DAILY DEMAND:	9.5	(Peaking Factor for a equivalent population of 30: Table 3-3 MOE Design Guidelines for Drinking-Water Systems)				
	25.9	l / min	0.4	l/s	7	USgpm
MAXIMUM HOURLY DEMAND:	14.3	(Peaking Factor for a equivalent population of 30: Table 3-3 MOE Design Guidelines for Drinking-Water Systems)				
	38.9	l / min	0.6	l/s	10	USgpm

GROUND FLOOR COMMERCIAL

DAILY AVERAGE:	5	l/sq.m./day (as per Appendix 4A Ottawa Design Guidelines)				
	192	sq.m.				
	960	l / day				
	8	hour day				
	2.0	l/min	0.0	l/s	0.5	USgpm
MAXIMUM DAILY DEMAND:	1.5	(Peaking Factor as per Ottawa Design Guidelines)				
	3.0	l/min	0.1	l/s	0.8	USgpm
MAXIMUM HOURLY DEMAND:	1.8	(Peaking Factor as per Ottawa Design Guidelines)				
	5.4	l/min	0.1	l/s	1.4	USgpm

TOTAL:

DAILY AVERAGE:	4.7	l/min	0.1	l/s	1.2	USgpm
MAXIMUM DAILY DEMAND:	28.9	l/min	0.5	l/s	7.6	USgpm
MAXIMUM HOURLY DEMAND:	44.3	l/min	0.7	l/s	11.7	USgpm

			Static Pressure at Water Meter			
Elevation of Water Meter:	68.83	m ASL				
Finish Floor Elevation:	67.93	m ASL				
MINIMUM HGL:	108.7	m ASL	57	psi	391	kPa
MAXIMUM HGL:	115.0	m ASL	66	psi	453	kPa

Gmail by Google

Douglas Gray <d.gray@dbgrayengineering.com>

FW: 386 Richmond Rd

1 message

Buchanan, Richard <Richard.Buchanan@ottawa.ca> Fri, Oct 19, 2018 at 8:28 AM
To: Douglas Gray <d.gray@dbgrayengineering.com>

Hi Doug

The following are boundary conditions, HGL, for hydraulic analysis at 386 Richmond (zone 1W), assumed to be connected to the 305mm watermain on Richmond (see attached PDF for location).

Minimum HGL = 108.7m

Maximum HGL = 115.0m

MaxDay (0.5 L/s) + FireFlow (267 L/s) = 106.0m

MaxDay (0.5 L/s) + FireFlow (117 L/s) = 109.0m

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.

Richard Buchanan, CET

Project Manager, Development Approvals

Planning, Infrastructure and Economic Development Department

Planning & Growth Management Branch

City of Ottawa | Ville d'Ottawa

613.580.2424 ext./poste 27801

ottawa.ca/planning / ottawa.ca/urbanisme

From: Douglas Gray <d.gray@dbgrayengineering.com>
Sent: Friday, October 12, 2018 8:13 AM
To: Buchanan, Richard <Richard.Buchanan@ottawa.ca>
Cc: Lucio Renna <l.renna@dbgrayengineering.com>
Subject: 386 Richmond Rd

Hi Richard

The apartment building at 386 Richmond Rd is being re-designed..

Please provide the boundary conditions at 386 Richmond Rd. I have calculated the following expected demands for a 8-unit wood-framed apartment building.

Average daily demand: 0.1 l/s.

Maximum daily demand: 0.5 l/s.

Maximum hourly daily demand: 0.7 l/s

Fire Flow demand: 266.7 l/s

Fire Flow + Max Day: 267.2 l/s

The building may be of non-combustible construction so please provide the boundary conditions for the following scenario.

Average daily demand: 0.1 l/s.

Maximum daily demand: 0.5 l/s.

Maximum hourly daily demand: 0.7 l/s

Fire Flow demand: 116.7 l/s

Fire Flow + Max Day: 117.2 l/s

Our calculations are attached.

Thanks, Doug

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386 Richmond Oct 2018.pdf
106K


Boundary Condition for 386 Richmond
N
RICHMOND RD
WINSTON AVE
152mm
DANFORTH AVE
152mm
BYRON AVE
152mm
305mm
102mm
102mm
386
388
390
399
389
387
385
383
382
380
378
375
372
366
369
379
375
399
394
396
395
403
12
358
Legend
Pipe Ownership
Private
Public

31-Oct-18

386 Richmond Rd
3 Storey - Mixed-Use Building
Ottawa, Ontario

Peak Water Demand

WATER FIXTURE VALUE
(AWWA Manual M22 - Sizing Water Service Lines and Meters)

	No.	F.V.	Total		
Bathtub	8	8	64	8	Units
Tiolet - tank	10	6	60		
Tiolet - flush valve	0	24	0		
Lavs.	10	1.5	15		
Bidet	0	2	0		
Urinal - wall flush valve	0	10	0		
Shower	0	2.5	0		
K. Sink	8	1.8	14.4		
Dishwasher	8	1.3	10.4		
Clothes Washer	8	6	48		
Commercial Sink	2	4	8		
J. Sink	0	4	0		
Commercial Dishwasher	1	4	4		
Commercial Washer	0	4	0		
Hose 1/2 in	0	5	0		
Hose 3/4 in	0	12	0		
			223.8		

Peak Demand (fig 4-2 or 4-3 AWWA M22)			32	USgpm		
Pressure @ Meter	427	kPa	62	psi		
Pressure Factor (table 4-1 AWWA M22)			1.02			
Peak Demand			33	USgpm		
Irrigation - hose 1/2 in	0		0	USgpm (includes pressure factor)		
TOTAL PEAK DEMAND	124	l/min	33	USgpm	2.1	l/s
		Nominal Size	2.0	in	50	mm
			3.5	ft/s	1.1	m/s

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SANITARY SEWER DESIGN FORM

Average Daily Flows:
Residential: 280 l / capita / day
Commercial: 28,000 l / ha / day
Institutional: 28,000 l / ha / day
Light Industrial: 35,000 l / ha / day
Heavy Industrial: 55,000 l / ha / day

Infiltration Allowance: 0.33 l / s / ha

Peaking Factor:
Residential (Harmon Equation): $P.F. = 1 + \frac{14}{4 + P^{0.5}}$
P = Population / 1000
Harmon Correction Factor 0.8
Commercial & Institutional: 1.5 If contrinbution > 20%
Commercial & Institutional: 1.0 If contrinbution < 20%
Industrial: As per Ottawa Guidelines Appendix 4-B

PROJECT: 386 Richmond Rd
Designed By: DBG
31-Oct-18

LOCATION			Section								Cumulative Residential		Section Non-Residential			Cumulative					SEWER DATA								COMMENTS
			Single Family	Semi/Town house	Duplex / Triplex	Apartment (average)	Apartment (1 Bed.)	Apartment (2 Bed.)	Apartment (3 Bed.)	Resid-ential Area											n = 0.013								
STREET	FROM	TO	ppu = 3.4	ppu = 2.7	ppu = 2.3	ppu = 1.8	ppu = 1.4	ppu = 2.1	ppu = 3.1		Pop.	Peaking Factor	Area	Flow	Peaking Factor	Flow	Area	Sewage Flow	Infil-tration Flow	Total Flow	Type of Pipe	Dia. Actual	Dia. Nom.	Slope	Length	Capacity	Velocity	Ratio	
			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	
																													Non-residential (commercial) - 192 sq.m. x 5 l / sq.m. x 1.5 peaking factor x 24 / 8 hours
	BUILDING	EXISTING 300 SAN					8				11	3.2	0.034	27988	4.5	0.1	0.034	0.17	0.01	0.18	PVC SDR 2	152.4	150	1.00	12.6	15.9	0.87	0.01	
																						MUNICIPAL SANITARY SEWER IN RICHMOND RD							
																						304.8	300	0.35		59.7	0.82		

STORMWATER MANAGEMENT CALCULATIONS

Flow control roof drain calculations are based on the following formula:

$$Q = N \times S \times d \times F$$

where:

- Q = flowrate in litres per second
- N = number of roof drains
- S = slots per weir
- d = pond depth at roof drain in mm
- F = flowrate through each slot
  - 0.0124 litres per second per mm pond depth (5 USgpm per inch)

Storage calculations on the roof are based on the following formula for volume of a cone:

$$V = (A \times d)/3$$

where:

- V = volume in cu.m.
- A = ponding area in sq.m.
- d = ponding depth in meters

Summary Tables

ONE HUNDRED YEAR EVENT				
Drainage Area	Pre-Development Flow Rate	Maximum Allowable Release Rate	Maximum Release Rate	Maximum Volume Stored
	l/s	l/s	l/s	cu.m.
AREA I (Uncontrolled flow off site)	-	-	4.17	-
AREA II (Roof - Drains to AREA III)	-	-	2.99	6.78
TOTAL (AREA I + III)	14.87	4.97	7.16	6.78

FIVE YEAR EVENT				
Drainage Area	Pre-Development Flow Rate	Maximum Allowable Release Rate	Maximum Release Rate	Maximum Volume Stored
	l/s	l/s	l/s	cu.m.
AREA I (Uncontrolled flow off site)	-	-	2.19	-
AREA II (Roof - Drains to AREA III)	-	-	2.24	2.86
TOTAL (AREA I + III)	7.77	4.97	4.43	2.86

	6-Oct-17
Revised	20-Feb-18
Revised	30-Oct-18
Revised	5-Feb-19

386 RICHMOND ROAD

Ottawa, Ontario

STORM WATER MANAGEMENT CALCULATIONS

Rational Method

ONE HUNDRED YEAR EVENT

Pre-development Conditions

			C
Roof Area:	137	sq.m.	1.00
Asphalt/Concrete Area:	148	sq.m.	1.00
Landscaped Areas:	58	sq.m.	0.25
Total Catchment Area	343	sq.m.	0.87

Area (A):	343	sq.m.
Time of Concentration:	10	min.
Rainfall Intensity (i):	179	mm/hr (100 year event)
Runoff Coeficient (C):	0.87	(see above)
Pre-development Flow Rate (2.78AiC):	14.87	l/s

Maximum Allowable Release Rate

Area (A):	343	sq.m.
Time of Concentration:	10.0	min. (see below - use not less than 10 min.)
Rainfall Intensity (i):	104	mm/hr (5 year event)
Runoff Coeficient (C):	0.50	
Maximum Allowable Release Rate (2.78AiC):	4.97	l/s

DRAINAGE AREA I (Uncontrolled Flow Off Site):

(ONE HUNDRED YEAR EVENT)

			C
Roof Area:	61	sq.m.	1.00
Asphalt/Concrete Area:	23	sq.m.	1.00
Landscaped Areas:	0	sq.m.	0.25
Total Catchment Area	84	sq.m.	1.00

Area (A):	84	sq.m.
Time of Concentration:	10	min.
Rainfall Intensity (i):	179	mm/hr (100 year event)
Runoff Coeficient (C):	1.00	
Flow Rate (2.78AiC):	4.17	l/s

DRAINAGE AREA II (Roof):

(ONE HUNDRED YEAR EVENT)

			C
Roof Area:	259	sq.m.	1.00
Paved Area:	0	sq.m.	1.00
Landscaped Areas:	0	sq.m.	0.25
Total Catchment Area	259	Ave. C	1.00

No. of Roof Drains: 2
Slots per Wier: 1 0.0124 l/s/mm/slot (5 USgpm/in/slot)

Depth at Roof Drain: 120 mm Pond Area: 169 sq.m.

Maximum Release Rate 2.99 l/s Achieved Vol: 6.78 cu.m.

Max. Vol. Required: 6.78 cu.m.

Time	i	2.78AiC	Release Rate	Stored Rate	Stored Volume
min.	mm/hr	l/s	l/s	l/s	cu.m.
5	243	17.48	2.99	14.49	4.35
10	179	12.86	2.99	9.87	5.92
15	143	10.29	2.99	7.30	6.57
20	120	8.64	2.99	5.65	6.78
25	104	7.48	2.99	4.49	6.74
30	92	6.61	2.99	3.63	6.53
35	83	5.95	2.99	2.96	6.22
40	75	5.41	2.99	2.42	5.82
45	69	4.97	2.99	1.99	5.36
50	64	4.60	2.99	1.62	4.86
55	60	4.29	2.99	1.31	4.31
60	56	4.02	2.99	1.04	3.74
65	53	3.79	2.99	0.80	3.14
70	50	3.58	2.99	0.60	2.52
75	47	3.40	2.99	0.42	1.87
80	45	3.24	2.99	0.25	1.22
85	43	3.09	2.99	0.11	0.54
90	41	2.96	2.96	0.00	0.00
95	39	2.84	2.84	0.00	0.00
100	38	2.73	2.73	0.00	0.00
105	36	2.63	2.63	0.00	0.00
110	35	2.53	2.53	0.00	0.00
115	34	2.45	2.45	0.00	0.00
120	33	2.37	2.37	0.00	0.00
125	32	2.29	2.29	0.00	0.00
130	31	2.22	2.22	0.00	0.00
135	30	2.16	2.16	0.00	0.00
140	29	2.10	2.10	0.00	0.00
145	28	2.04	2.04	0.00	0.00
150	28	1.99	1.99	0.00	0.00
180	24	1.72	1.72	0.00	0.00
210	21	1.52	1.52	0.00	0.00
240	19	1.37	1.37	0.00	0.00
270	17	1.25	1.25	0.00	0.00
300	16	1.14	1.14	0.00	0.00

FIVE YEAR EVENT

Pre-development Conditions

			C
Roof Area:	137	sq.m.	0.90
Asphalt/Concrete Area:	148	sq.m.	0.90
Landscaped Areas:	58	sq.m.	0.20
Total Catchment Area	343	sq.m.	0.78

Area (A):	343	sq.m.
Time of Concentration:	10	min.
Rainfall Intensity (i):	104	mm/hr (5 year event)
Runoff Coeficient (C):	0.78	(see above)
Pre-development Flow Rate (2.78AiC):	7.77	l/s

Maximum Allowable Release Rate

Area (A):	343	sq.m.
Time of Concentration:	10.0	min. (see below - use not less than 10 min.)
Rainfall Intensity (i):	104	mm/hr (5 year event)
Runoff Coeficient (C):	0.50	
Flow Rate (2.78AiC):	4.97	l/s

DRAINAGE AREA I (Uncontrolled Flow Off Site):

(FIVE YEAR EVENT)

			C
Roof Area:	61	sq.m.	0.90
Asphalt/Concrete Area:	23	sq.m.	0.90
Landscaped Areas:	0	sq.m.	0.20
Total Catchment Area	84	sq.m.	0.90

Area (A):	84	sq.m.
Time of Concentration:	10	min.
Rainfall Intensity (i):	104	mm/hr (100 year event)
Runoff Coeficient (C):	0.90	
Flow Rate (2.78AiC):	2.19	l/s

DRAINAGE AREA II (Roof):

(FIVE YEAR EVENT)

			C
Roof Area:	259	sq.m.	0.90
Paved Area:	0	sq.m.	0.90
Landscaped Areas:	0	sq.m.	0.20
Total Catchment Area	259	Ave. C	0.90

No. of Roof Drains: 2
Slots per Wier: 1 0.0124 l/s/mm/slot (5 USgpm/in/slot)

Depth at Roof Drain: 90 mm Pond Area: 95 sq.m.

Maximum Release Rate 2.24 l/s Achieved Vol: 2.86 cu.m.

Max. Vol. Required: 2.86 cu.m.

Time	i	2.78AiC	Release Rate	Stored Rate	Stored Volume
min.	mm/hr	l/s	l/s	l/s	cu.m.
5	141	9.15	2.24	6.91	2.07
10	104	6.75	2.24	4.51	2.71
15	84	5.41	2.24	3.18	2.86
20	70	4.55	2.24	2.31	2.78
25	61	3.95	2.24	1.71	2.56
30	54	3.49	2.24	1.26	2.26
35	49	3.14	2.24	0.91	1.90
40	44	2.86	2.24	0.62	1.50
45	41	2.63	2.24	0.39	1.06
50	38	2.44	2.24	0.20	0.60
55	35	2.28	2.24	0.04	0.12
60	33	2.13	2.13	0.00	0.00
65	31	2.01	2.01	0.00	0.00
70	29	1.90	1.90	0.00	0.00
75	28	1.81	1.81	0.00	0.00
80	27	1.72	1.72	0.00	0.00
85	25	1.64	1.64	0.00	0.00
90	24	1.57	1.57	0.00	0.00
95	23	1.51	1.51	0.00	0.00
100	22	1.45	1.45	0.00	0.00
105	22	1.40	1.40	0.00	0.00
110	21	1.35	1.35	0.00	0.00
115	20	1.30	1.30	0.00	0.00
120	19	1.26	1.26	0.00	0.00
125	19	1.22	1.22	0.00	0.00
130	18	1.19	1.19	0.00	0.00
135	18	1.15	1.15	0.00	0.00
140	17	1.12	1.12	0.00	0.00
145	17	1.09	1.09	0.00	0.00
150	16	1.06	1.06	0.00	0.00
180	14	0.92	0.92	0.00	0.00
210	13	0.81	0.81	0.00	0.00
240	11	0.73	0.73	0.00	0.00
270	10	0.67	0.67	0.00	0.00
300	9	0.61	0.61	0.00	0.00

D.B. GRAY ENGINEERING INC.

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

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STORM SEWER COMPUTATION FORM

RATIONAL METHOD Q = 2.78 A I R FIVE YEAR EVENT

n = 0.013

PROJECT: 386 Richmond Rd

Designed By: DBG

Date: 5-Feb-19

LOCATION			AREA (ha)				Individual 2.78 A R	Accum. 2.78 A R	Time of Conc. (min)	Rainfall Intensity I (mm/hr)	Peak Flow Q (l/s)	SEWER DATA									COMMENTS
			Hard Surface	Gravel	Grass / Landscape	Roof															
STREET	FROM	TO	R = 0.90	R = 0.70	R = 0.20	R = 0.90						Type of Pipe	Dia. Actual (mm)	Dia. Nom. (mm)	Slope (%)	Length (m)	Capacity (l/s)	Velocity (m/s)	Time of Flow (min)	Ratio Q/Qfull	
	BUILIDNG	EXISTING 600 ST				0.0320	0.080	0.080	10.00	104.2	8.3	PVC SDR 28	152.4	150	1.00	12.6	15.9	0.87	0.24	0.53	
													600mm MUNICIPAL STORM SEWER IN RICHMOND RD								
													609.6	600	0.30		350.8	1.20			

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 2 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 of Servicing Brief

Identification of system constraints: see page 2 of Servicing Brief

Confirmation of adequate domestic supply and pressure: see page 2 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 & 6 to 9 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: not applicable

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 2 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 10 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 4 to 6 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-2

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: not applicable

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 4 to 6 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 2.4 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 5 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