SERVICING BRIEF &
STORMWATER MANAGEMENT REPORT

5986-5992 Hazeldean Road
Ottawa, Ontario

Report No. 19042

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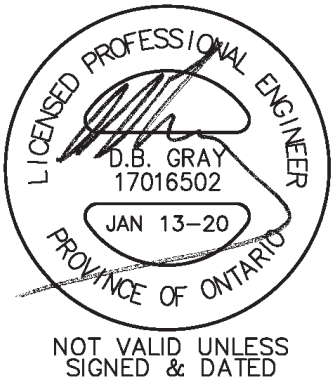

D.B. Gray Engineering Inc.

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

700 Long Point Circle
Ottawa, Ontario K1T 4E9

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

SERVICING BRIEF &
STORMWATER MANAGEMENT REPORT

5986-5992 Hazeldean Road
Ottawa, Ontario

This report describes the services and addresses the stormwater management requirements of a 3,543 sq.m. property at 5986-5992 Hazeldean Road in Ottawa. There are four buildings currently on the property, all being used commercially. Two formerly residential buildings (having footprint areas of 142 and 161 sq.m.) and a garage (112 sq.m.) will be demolished. A fourth existing building, 523 sq.m. in area, will be retained.

A three-storey mixed-use building with a 594 sq.m. footprint is proposed. The ground floor will be commercial, the second floor offices and the third floor will have six apartment units.

This report forms part of the stormwater management design for the proposed development. Refer to drawing C-1 to C-6 also prepared by D. B. Gray Engineering Inc.

WATER SUPPLY FOR FIREFIGHTING:

There is an existing fire hydrant in the municipal road right-of-way located near the southeast corner of the Hazeldean Road / Springbrook Drive intersection. It is about 88 m unobstructed distance to the far end of the proposed building. Therefore, since it is less than 90 m, a private on-site fire hydrant is not required.

A fire flow of 216.7 L/s (13,000 L/min) is required, as calculated as per the Fire Underwriter Survey "Water Supply For Fire Protection".

The boundary conditions for the 216.7 L/s fire flow (based on the city's computer model of the municipal water distribution system) were received from the City. During the above flow rate, they include a HGL (hydraulic grade line) of 155.8 m in the municipal watermains adjacent to the subject location which calculates to be 371 kPa (54 psi). Since the pressure is above 138 kPa (20 psi) there is an adequate water supply for firefighting from the existing municipal fire hydrant.

WATER SERVICE:

One of the formerly residential buildings (to be demolished) has a water service connecting the 200 mm municipal watermain in Hazeldean Road. The other formerly residential building (also to be demolished) has 32 mm water service connection connecting to the 200 mm municipal watermain in Old Orchard Crescent. The subject property backs onto, but does not have frontage, on Old Orchard Crescent. The 32 mm

water service (and a 200 mm sanitary service – see below) is located in an existing 8.0 m wide easement on the adjacent landowner's (a condominium corporation) property. Both existing services will be decommissioned.

An existing 19mm water service stub connecting to the existing 200 mm municipal watermain in Hazeldean Road will be extended to the existing building.

Based on the City of Ottawa Water Distribution Design Guidelines for residential properties (6 apartment units / 1.8 person per unit – 350 L/person/day) and Ministry of the Environment Design Guidelines for peaking factors the daily average flow is 0.04 L/s with a maximum daily and maximum hourly demand of 0.4 and 0.6 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 and peaking factors, and assuming an eight hour day, the maximum daily demand is calculated to be 0.3 L/s. Based on the peaking factors the maximum daily demand is 0.5 L/s and maximum hourly demand is 0.9 L/s. Therefore, the total daily average flow (residential + commercial) is 0.4 L/s, with a maximum daily and maximum hourly demand of 0.9 and 1.6 L/s, respectively.

To determine the 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 have requested the boundary conditions for the subject area based on the following:

Average Daily Demand: 0.4 L/s.
Maximum Daily Demand: 0.9 L/s.
Maximum Hourly Demand: 1.6 L/s
Fire Flow Demand: 216.7 L/s
Maximum Daily + Fire Flow Demand: 217.6 L/s

Based on the boundary conditions received from the City, the minimum HGL (hydraulic grade line) is 157.4 m and the maximum is 160.8 m. With these HGLs the static water pressure at the water meter is calculated to vary from 414 kPa to 380 kPa (55 to 60 psi).

A 38 mm water service, connecting to the 200 mm municipal watermain in Hazeldean Road, will service the proposed building. Based on the AWWA water flow demand curve and an assumed water pressure at the meter of 414 kPa (60 psi), the peak demand is expected to be 2.8 L/s (170 L/min / 45 USgpm). The AWWA method calculates the instantaneous demand and is used to size the water service. This peak demand will produce a velocity of 2.5 m/s in the proposed 38 mm water service connection. Since this is slightly outside the acceptable range of 1.5 to 2.4 m/s is acceptable) a model was created using EPANET software to analyze the hydraulics of the proposed 38 mm water service. Using the minimum HGL boundary condition of 157.4 m the pressure at the water meter was determined to be 286 kPa (41.5 psi). Since the pressure is above 200 kPa (29 psi) this is acceptable minimum water

pressure for the proposed development. Regardless, to ensure adequate pressure in the third floor residential units the mechanical has been advised that the domestic water supply pipes to the third floor residential units shall be one pipe size larger than normal.

SANITARY SERVICE:

One of the formerly residential buildings (to be demolished) is on a septic system which will be decommissioned. The other formerly residential building (also to be demolished) has 200 mm sanitary sewer connection connecting to a 250 mm municipal sanitary sewer in Meadowmist Court at a manhole in the Meadowmist / Old Orchard intersection. The portion of the existing 200 mm sanitary sewer within the 8.0 m easement will be retained. The portion of the existing sanitary sewer from the end of the easement to the existing building to be retained will be decommissioned.

Based on the City of Ottawa Sewer Design Guidelines for a residential property (6 apartment units / 1.8 person per unit – 280 l/person/day – 3.2 peaking factor); and based on the City of Ottawa Sewer Design Guidelines for a commercial property (28,000 L/ha/day; 1.5 peaking factor; 8 hour day and a 0.33 L/s/ha infiltration flow) the post development flow is calculated to be 0.72 L/s. This flow will be adequately handled by the existing 200 mm sanitary sewer service connection having a slope of 6.1% (8.45 L/s capacity at 1%).

The 0.72 L/s in sanitary flows contributing to the existing 250mm municipal sanitary sewer is expected to have an acceptable impact given its capacity of 50.8 L/s (250 mm at 0.67%).

STORMWATER MANAGEMENT:

Water Quality:

There are currently no quality control measures on the subject property and 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; a sediment capture filter sock inserts will be installed in all existing catch basins adjacent to the site and all new catch basins as they are installed.

An erosion and sediment control plan has been developed to be implemented during construction, (see drawing C-4 and notes 2.1 to 2.7 on drawing C-5). In summary: to filter out construction sediment a silt fence barrier will be installed around the perimeter of the property; sediment capture filter sock inserts will be installed in all existing catch basins adjacent to the site and all new catch basins as they are installed; geotextile

fabric mud mats will be install at all points of egress to public roads; and any material deposited on a public road will be removed at the end of each day.

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 pre-development runoff coefficient or runoff coefficient of 0.50, whichever is less; and a calculated time of concentration (but not less than 10 minutes). It is calculated that the pre-development conditions reflect a 5-year runoff coefficient of 0.56 and a time of concentration of 11.6 minutes. Therefore, based on runoff coefficient of 0.56, an 11.6 minute time of concentration; and using the Rational Method; the maximum allowable release rate is 47.40 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 on the roof and on the surface above three catch basins.

Drainage Area I
(Uncontrolled Flow Off Site – 656 sq.m.):
The runoff from the north perimeter and a portion of the south 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:	19.24 L/s	9.84 L/s

Drainage Area II (Roof – 741 sq.m.):
Each of three roof drains will be a flow control type which will restrict the flow and cause the storm water to pond on the roof. The flow control type roof drain 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 drain will be installed at the low point of the roof which will be 145mm lower than the perimeter of the roof. Six scuppers, 400mm wide and installed 145 mm above the roof drains, are required so that the maximum depth of water on the roof cannot exceed 150 mm as per the Ontario Building Code.

	100-year	5-year
The maximum release rate:	4.96 L/s	3.79 L/s
The maximum ponding depth:	133 mm	102 mm
The maximum stored volume:	25.30 cu.m.	11.25 cu.m.

Drainage Area III (2,146 sq.m.):
An inlet control device (ICD) located at the outlet pipe of manhole CB/MH-4 will control the release of stormwater from Drainage Area III. The ICD will restrict the flow and force the stormwater to back up onto the surface of the parking area and swale to the

south and west of the proposed building. The ICD shall be a plug style with a round orifice design manufactured by Pedro Plastics (or approved equal manufactured by IPEX) and shall be sized by the manufacturer for a discharge rate of 23.20 L/s at 2.23 m head. It is calculated that an orifice area of 5,748 sq.mm. (±86 mm diameter) and a discharge coefficient of 0.61 will restrict the outflow rate to 23.20 L/s at a head of 2.23 m. Based on this orifice the maximum outflow rate for the 1:5 year storm event is calculated to be 22.96 L/s at 2.18 m.

	100-year	5-year
Maximum release rate:	23.20 L/s	22.96 L/s
Maximum water elevation:	117.43 m	117.39 m
Maximum stored volume:	38.08 cu.m.	11.70 cu.m.

The Entire Site:

	100-year	5-year
Maximum allowable release rate:	47.40 L/s	47.40 L/s
Maximum release rate:	47.40 L/s	36.59 L/s
Maximum stored volume:	63.38 cu.m.	22.95 cu.m.

Therefore the maximum post-development release rate for the 100-year storm event is equal to the maximum allowable at 47.40 L/s and is less than the maximum allowable for the 5-year storm event. To achieve these release rates the maximum required stored volume is 63.38 cu.m. is required for the 100-year event and is 22.95 cu.m. for the 5-year event.

As per City Sewer Design Guidelines Technical Bulletin PIEDTB-2016-01 ponding in drive aisles and parking areas is not permitted during the 2-year event. Calculating the underground storage capacity of the sewer pipes, manholes and catch basins no water pond on the surface in the drive aisles and parking areas. (To calculate the required underground storage volume an average release rate was assumed to be equal to 50% of the maximum release rate was used.

Stormwater released through the ICD will be conveyed off the site via a 375mm storm sewer connecting existing 375 mm municipal storm sewer in Hazeldean Road at a new manhole.

The unrestricted flowrate resulting from one in five-year storm event will produce a peak flow of 60.2 L/s which will be adequately by the proposed storm sewer system with the last pipe segment (375mm at 0.25% - 91.5 L/s capacity) being at 66% of its capacity. However, the flow control roof drains and the inlet control device (ICD) will restrict the flow to 26.8 L/s during the one in five storm event so that flow in the last segment will be only at 29% its capacity.

The 26.8 L/s in stormwater flows contributing to the existing 375mm municipal storm sewer (at 0.39% - 114.2 l/s capacity) is expected to have an acceptable impact.

CONCLUSIONS:

1. An existing fire municipal hydrant is about 88 m unobstructed distance to the far end of the proposed building, therefore, a private on-site fire hydrant is not required.

2. There is an adequate water supply for firefighting from the existing municipal fire hydrant.

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

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

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

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

7. There are currently no quality control measures on the subject property and none are proposed.

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

9. The maximum post-development release rate for the 100-year storm event is equal to the maximum allowable at 47.40 L/s and is less than the maximum allowable for the 5-year storm event. To achieve these release rates the maximum required stored volume is 63.38 cu.m. is required for the 100-year event and is 22.95 cu.m. for the 5-year event.

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

11. The restricted stormwater flow contributing to the existing municipal storm sewer is expected to have an acceptable impact.

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700 Long Point Circle
Ottawa, Ontario K1T 4E9

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

20-Aug-19
REVISED 9-Sep-19

5992 Hazeldean Road
Ottawa, Ontario

Fire Flow Requirements

Proposed 3 Storey Mixed Use Building

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
= 1.5 Wood Frame Construction

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

Proposed Building	Ground Floor	594	sq.m.
	2nd Floor	594	sq.m.
	3rd Floor	594	sq.m.
	TOTAL FIRE AREA:	1782	sq.m.

F = 13,931 L/min
= 14,000 L/min (rounded off to the nearest 1,000 L/min)

-15% Charge for Limited-combustible Occupancy

= 11,900 L/min

0% Reduction for Sprinkler System

= - L/min

Increase for Separation Exposed Buildings

			Adjacent Building			Length-Height
			Constuction	Length m	Storeys	Factor
0%	North	>45m				0
12%	East	10.1 to 20m	W-F	13	1	13
0%	South	>45m				0
0%	West	>45m				0
12%	Total Increase for Exposure (maximum 75%)					

= 1,428 L/min Increase

= 13,328 L/min
F = 13,000 L/min (rounded off to the nearest 1,000 L/min)
= 216.7 L/s

Elevation at Fire Hydrant (at Hazeldean at Springbrook)	117.92	m ASL				
			Static Pressure at Fire Hydrant			
216.7 L/s FIRE FLOW:	155.8	m ASL	54	psi	371	kPa

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20-Aug-19
REVISED 9-Sep-19

5992 Hazeldean Road
Ottawa, Ontario

Fire Flow Requirements

Proposed 3 Storey Mixed Use Building
With Firewall

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
= 1.5 Wood Frame Construction

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

Proposed Building	Ground Floor	297	sq.m.
	2nd Floor	297	sq.m.
	3rd Floor	297	sq.m.
	TOTAL FIRE AREA:	891	sq.m.

F = 9,850 L/min
= 10,000 L/min (rounded off to the nearest 1,000 L/min)

-15% Charge for Limited-combustible Occupancy

= 8,500 L/min

0% Reduction for Sprinkler System

= - L/min

Increase for Separation Exposed Buildings

			Adjacent Building			Length-Height
			Constuction	Length m	Storeys	Factor
0%	North	>45m				0
12%	East	10.1 to 20m	W-F	13	1	13
10%	South	Firewall				0
0%	West	>45m				0
22%	Total Increase for Exposure (maximum 75%)					

= 1,870 L/min Increase

= 10,370 L/min
F = 10,000 L/min (rounded off to the nearest 1,000 L/min)
= 166.7 L/s

Elevation at Fire Hydrant (at Hazeldean at Springbrook)	117.92	m ASL				
			Static Pressure at Fire Hydrant			
166.7 L/s FIRE FLOW:	157.2	m ASL	56	psi	385	kPa

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20-Aug-19

5592 Hazeldean Road
Three-Storey Mixed Use Building
6 Apartment Units / Ground & 2nd Floor Commercial
Ottawa, Ontario

Water Demand

RESIDENTIAL:		Number of Units	Persons Per Unit	Population			
	Average Apartment:	6	1.8	11			
			TOTAL:	11			
DAILY AVERAGE:	350	litres / person / day					
	2.6	l / min	0.04	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)					
	24.9	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)					
	37.5	l / min	0.6	l/s	10	USgpm	
COMMERCIAL							
DAILY AVERAGE:	28,000	l /gross ha / day (as per Ottawa Design Guidelines)					
	0.35	ha (land area)					
	9918	l / day					
	8	hour day					
	20.7	l/min	0.3	l/s	5.5	USgpm	
MAXIMUM DAILY DEMAND:	1.5	(Peaking Factor as per Ottawa Design Guidelines)					
	31.0	l/min	0.5	l/s	8.2	USgpm	
MAXIMUM HOURLY DEMAND:	1.8	(Peaking Factor as per Ottawa Design Guidelines)					
	55.8	l/min	0.9	l/s	14.7	USgpm	
TOTAL:							
TOTAL DAILY AVERAGE:	23.3	l/min	0.4	l/s	6.2	USgpm	
TOTAL MAXIMUM DAILY DEMAND:	55.9	l/min	0.9	l/s	14.8	USgpm	
TOTAL MAXIMUM HOURLY DEMAND:	93.3	l/min	1.6	l/s	24.7	USgpm	

5-Sep-19

REVISED 10-Jan-20

5986-5992 Hazeldean Road
Ottawa, Ontario

Peak Water Demand

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

	No.	F.V.	Total
Bathtub	0	8	0
Tiolet - tank	16	6	96
Tiolet - flush valve	0	24	0
Lavs.	16	1.5	24
Bidet	0	2	0
Urinal - wall flush valve	0	10	0
Shower	6	2.5	15
K. Sink	7	1.8	12.6
Dishwasher	6	1.3	7.8
Clothes Washer	0	6	0
Commercial Sink	0	4	0
J. Sink	0	4	0
Commercial Dishwasher	0	4	0
Commercial Washer	0	4	0
Hose 1/2 in	0	5	0
Hose 3/4 in	0	12	0
			155.4

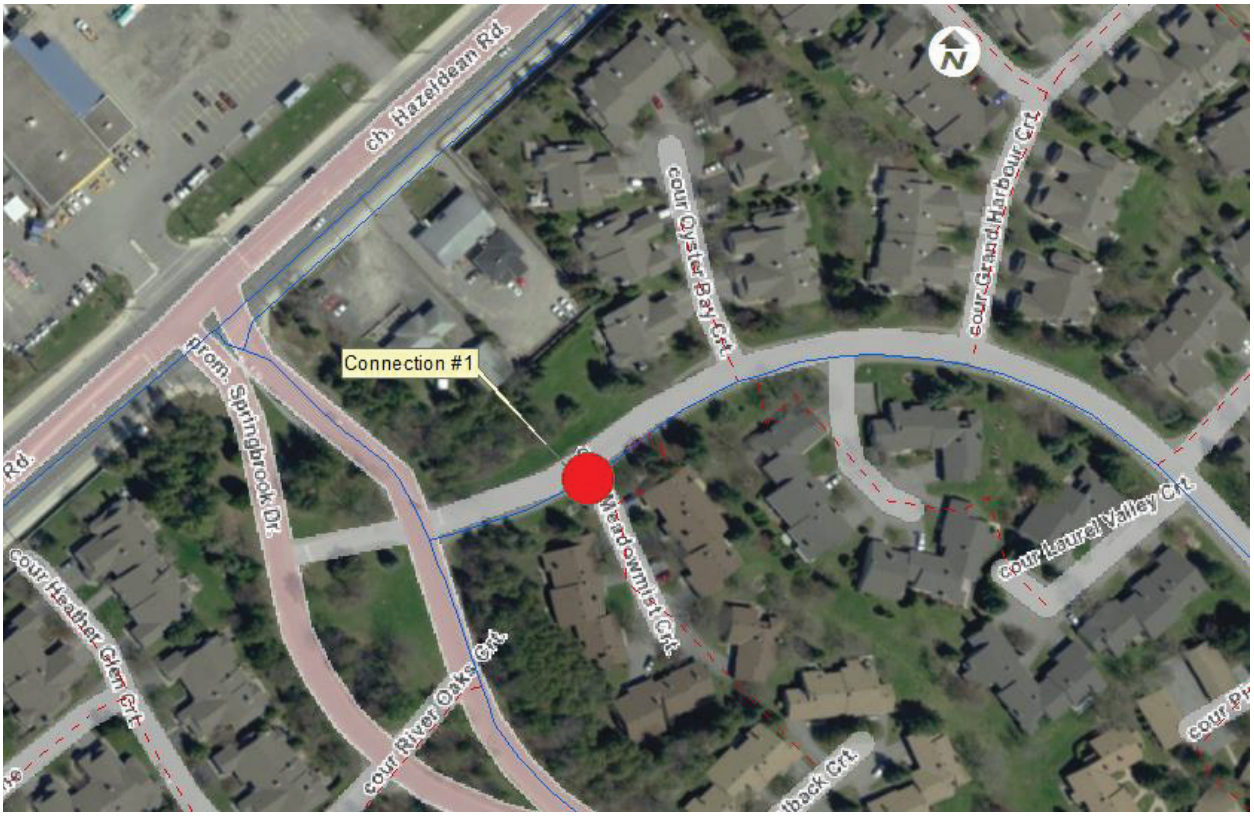
Peak Demand (fig 4-2 or 4-3 AWWA M22)			45	USgpm		
Pressure @ Meter	414	kPa	60	psi (assumed)		
Pressure Factor (table 4-1 AWWA M22)			1.00			
Peak Demand			45	USgpm		
Irrigation - hose 1/2 in	0		0	USgpm (includes pressure factor)		
TOTAL PEAK DEMAND	170	l/min	45	USgpm	2.8	l/s
		Nominal Size	1.5	in	38	mm
			8.2	ft/s	2.5	m/s

5986-5992 Hazeldean Road Boundary Conditions

Information Provided:
Date provided: Sept 2019

Scenario	Demand	
	L/min	L/s
Average Daily Demand	24	0.4
Maximum Daily Demand	54	0.9
Peak Hour	96	1.6
Fire Flow Demand # 1	10000	166.7
Fire Flow Demand # 2	13000	216.7

Location:



Results:

Connection 1 - Old Orchard

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	160.8	61.5
Peak Hour	157.4	56.7
Max Day plus Fire (10,000 l/min)	157.2	56.4
Max Day plus Fire (13,000 l/min)	155.8	54.4

[1] Ground Elevation = 117.5 m

Notes:

Disclaimer

The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation. Fire Flow analysis is a reflection of available flow in the watermain; there may be additional restrictions that occur between the watermain and the hydrant that the model cannot take into account.

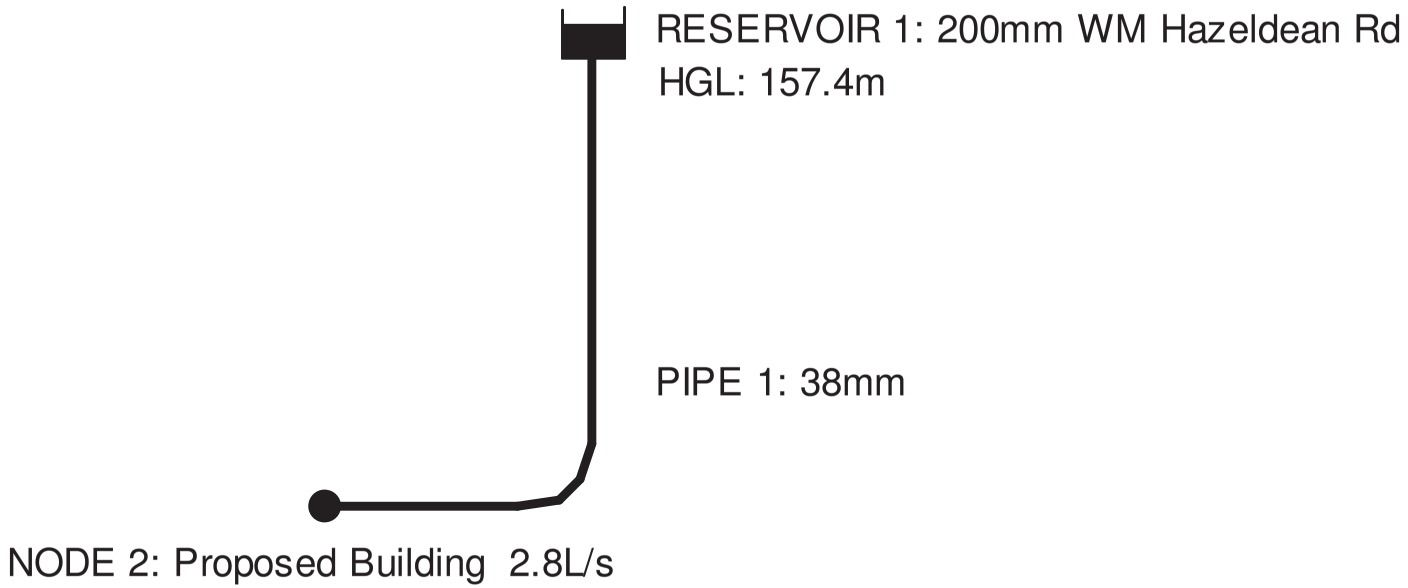
10-Jan-20

5992 Hazeldean Road
Ottawa, Ontario

EPANET HYDRAULIC MODELLING RESULTS

Node ID	Demand	Head	Elevation	Pressure		
	L/s	m	m	m	psi	kPa
1 Reservoir 1 (200 WM - Hazeldean Rd)	-2.80	157.40	116.63	40.77	58.0	400
2 Water Meter	2.80	147.80	118.61	29.19	41.5	286

Link ID	Diameter	Length	Roughness	Loss Coeff.	Flow	Velocity
	mm	m			L/s	m/s
Pipe 1	38	27.5	100	2.00	2.80	2.47


RESERVOIR 1: 200mm WM Hazeldean Rd
HGL: 157.4m
PIPE 1: 38mm
NODE 2: Proposed Building 2.8L/s

Network Table - Nodes

Node ID	Elevation m	Demand LPS	Head m	Pressure m
Junc 2	118.61	2.80	147.80	29.19
Resvr 1	157.4	-2.80	157.40	0.00

Network Table - Links

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s
Pipe 1	27.5	38	100	2.80	2.47

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SANITARY SEWER DESIGN FORM

Average Daily Flows:
- Residential: 280 l / capita / day
- Commercial: 28,000 l / ha / day
- Instituational: 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: 5986-5992 Hazeldean

Designed By: D.B.G.

18-Nov-19

LOCATION			Section								Cumulative Residential		Section Non-Residential			Cumulative					SEWER DATA								COMMENTS
			Single Family	Semi/Townhouse	Duplex / Triplex	Apartments (average)	Apartments (1 Bed.)	Apartments (2 Bed.)	Apartments (3 Bed.)	Residential 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	Infiltration 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	
Existing 1 Storey		MH-SA.1											0.106	28000	4.5	0.16	0.106	0.16	0.04	0.19	PVC	152.4	150	1.0	43.9	15.9	0.87	0.01	
Proposed 3 Storey		MH-SA.1					6				8.4	3.2	0.248	28000	4.5	0.36	0.248	0.45	0.08	0.53	PVC	152.4	150	1.0	28.2	15.9	0.87	0.03	
	MH-SA.1	Existing MH									8.4	3.2				0.52	0.354	0.60	0.12	0.72	PVC	203.2	200	6.1	36.2	84.5	2.61	0.01	
																													DOWNSTREAM OF CONNECTION TO EXISTING SANITARY MANHOLE
																						254.0	250	0.67		50.8	1.00	0.00	

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

Storage calculations on surface above the catch basins 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

Calculations for sub-surface storage (manholes and sewer pipes) are based on the following formula for volume of a cylinder:

$$V = L \times Pi \times (d/2)2$$

where:

V = volume in cu.m.
L = depth of water in manhole or length of pipe in meters
d = diameter of manhole or pipe in meters

Summary Tables

ONE HUNDRED YEAR EVENT

Drainage Area	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)	-	19.24	-	-
AREA II (Roof)	-	4.96	25.30	25.30
AREA III	-	23.20	38.08	38.08
TOTAL	47.40	47.40	63.38	63.38

FIVE YEAR EVENT

Drainage Area	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)	-	9.84	-	-
AREA II (Roof)	-	3.79	11.25	11.25
AREA III	-	22.96	11.70	11.70
TOTAL	47.40	36.59	22.95	22.95

TWO YEAR EVENT

Drainage Area	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)	-	7.26	-	-
AREA II (Roof)	-	3.32	7.59	7.59
AREA III	-	22.36	12.59	12.59
TOTAL	47.40	32.93	20.18	20.18

5986-5992 Hazeldean Road

Ottawa, Ontario

STORM WATER MANAGEMENT CALCULATIONS
Rational Method

5 Year Pre-Development Conditions

Roof Area:	668	sq.m	0.90
Asphalt/Concrete Area:	1141	sq.m	0.90
Gravel Area:	0	sq.m	0.70
Landscaped Area:	1734	sq.m	0.20
Total Catchment Area:	3543	sq.m	0.56

Airport Formula

$$Tc = \frac{3.26\,(1.1 - C)\,(L)^{1/2}}{Sw^{0.33}}$$ min

Runoff Coefficient (C):	0.50	see above
Sheet Flow Distance (L):	56	m
Slope of Land (Sw):	2	%
Time of Concentration (Sheet Flow):	11.6	min
Area (A):	3543	sq.m
Time of Concentration:	11.6	min
Rainfall Intensity (i):	96	mm/hr
Runoff Coeficient (C):	0.50	
Maximum Allowable Release Rate (2.78AiC):	47.40	L/s

ONE HUNDRED YEAR EVENT

DRAINAGE AREA I (Uncontrolled Flow Off Site)

(ONE HUNDRED YEAR EVENT)

Roof Area:	126	sq.m	1.00
Asphalt/Concrete Area:	172	sq.m	1.00
Gravel Area:	0	sq.m	0.875
Landscaped Area:	358	sq.m	0.25
Total Catchment Area:	656	sq.m	0.59
Area (A):	656	sq.m	
Time of Concentration:	10.0	min	
Rainfall Intensity (i):	179	mm/hr	
Runoff Coeficient (C):	0.59		
Flow Rate (2.78AiC):	19.24	L/s	

DRAINAGE AREA II (Roof)

(ONE HUNDRED YEAR EVENT)

Roof Area:	741	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:	741	sq.m	1.00

No. of Roof Drains: 3

Slots per Wier: 1 0.0124 l/s/mm/slot (5 USgpm/in/slot)

Depth at Roof Drain: 133 mm

Maximum Release Rate: 4.96 L/s

Pond Area: 569 sq.m

Achieved Volume: 25.30 cu.m

Maximum Volume Required: 25.30 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	50.00	4.96	45.03	13.51
10	179	36.78	4.96	31.82	19.09
15	143	29.44	4.96	24.47	22.03
20	120	24.71	4.96	19.75	23.70
25	104	21.39	4.96	16.43	24.64
30	92	18.92	4.96	13.96	25.13
35	83	17.01	4.96	12.05	25.30
40	75	15.48	4.96	10.52	25.24
45	69	14.22	4.96	9.26	25.01
50	64	13.17	4.96	8.21	24.63
55	60	12.28	4.96	7.32	24.15
60	56	11.51	4.96	6.55	23.58
65	53	10.85	4.96	5.88	22.94
70	50	10.26	4.96	5.29	22.23
75	47	9.73	4.96	4.77	21.47
80	45	9.27	4.96	4.31	20.66
85	43	8.85	4.96	3.89	19.82
90	41	8.47	4.96	3.51	18.93
95	39	8.12	4.96	3.16	18.01
100	38	7.81	4.96	2.84	17.07
105	36	7.52	4.96	2.56	16.10
110	35	7.25	4.96	2.29	15.10
115	34	7.01	4.96	2.04	14.09
120	33	6.78	4.96	1.81	13.06
125	32	6.56	4.96	1.60	12.00
130	31	6.36	4.96	1.40	10.94
135	30	6.18	4.96	1.22	9.85
140	29	6.01	4.96	1.04	8.75
145	28	5.84	4.96	0.88	7.64
150	28	5.69	4.96	0.72	6.52
180	24	4.92	4.92	0.00	0.00
210	21	4.36	4.36	0.00	0.00
240	19	3.92	3.92	0.00	0.00
270	17	3.56	3.56	0.00	0.00
300	16	3.27	3.27	0.00	0.00

DRAINAGE AREA III

(ONE HUNDRED YEAR EVENT)

Roof Area:	126	sq.m	1.00
Asphalt/Concrete Area:	1355	sq.m	1.00
Gravel Area:	0	sq.m	0.875
Landscaped Area:	665	sq.m	0.25
Total Catchment Area:	2146	sq.m	0.77

Water Elevation:	117.43	m
Invert of Outlet Pipe - MH-4:	115.16	m
Centroid of ICD Orifice: (ICD in Outlet Pipe of MH-4)	115.20	m
Head:	2.23	m
Orifice Diameter:	86	mm
Orifice Area:	5748	sq.mm
Coefficient of Discharge:	0.61	
Maximum Release Rate:	23.20	L/s

	Top Area (sq.m)	Depth (m)	Volume	
Swale	150	0.21	10.67	cu.m
CB-3	358	0.16	12.36	cu.m
CB/MH-4	408	0.16	15.05	cu.m
		Achieved Volume:	38.08	cu.m

Maximum Volume Required: 38.08 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	111.14	23.20	87.94	26.38
10	179	81.77	23.20	58.57	35.14
15	143	65.44	23.20	42.24	38.01
20	120	54.93	23.20	31.73	38.08
25	104	47.56	23.20	24.36	36.53
30	92	42.07	23.20	18.87	33.97
35	83	37.82	23.20	14.62	30.70
40	75	34.41	23.20	11.21	26.91
45	69	31.62	23.20	8.42	22.74
50	64	29.29	23.20	6.09	18.26
55	60	27.30	23.20	4.11	13.55
60	56	25.60	23.20	2.40	8.63
65	53	24.11	23.20	0.91	3.55
70	50	22.80	22.80	0.00	0.00
75	47	21.64	21.64	0.00	0.00
80	45	20.60	20.60	0.00	0.00
85	43	19.67	19.67	0.00	0.00
90	41	18.83	18.83	0.00	0.00
95	39	18.06	18.06	0.00	0.00
100	38	17.36	17.36	0.00	0.00
105	36	16.71	16.71	0.00	0.00
110	35	16.12	16.12	0.00	0.00
115	34	15.57	15.57	0.00	0.00
120	33	15.06	15.06	0.00	0.00
125	32	14.59	14.59	0.00	0.00
130	31	14.15	14.15	0.00	0.00
135	30	13.74	13.74	0.00	0.00
140	29	13.35	13.35	0.00	0.00
145	28	12.99	12.99	0.00	0.00
150	28	12.64	12.64	0.00	0.00
180	24	10.95	10.95	0.00	0.00
210	21	9.68	9.68	0.00	0.00
240	19	8.70	8.70	0.00	0.00
270	17	7.92	7.92	0.00	0.00
300	16	7.28	7.28	0.00	0.00

FIVE YEAR EVENT

DRAINAGE AREA I (Uncontrolled Flow Off Site)

(FIVE YEAR EVENT)

Roof Area:	126	sq.m	0.90
Asphalt/Concrete Area:	172	sq.m	0.90
Gravel Area:	0	sq.m	0.70
Landscaped Area:	358	sq.m	0.20
Total Catchment Area:	656	sq.m	0.52
Area (A):	656	sq.m	
Time of Concentration:	10.0	min	
Rainfall Intensity (i):	104	mm/hr	
Runoff Coeficient (C):	0.52		
Flow Rate (2.78AiC):	9.84	L/s	

DRAINAGE AREA II (Roof)

(FIVE YEAR EVENT)

Roof Area:	741	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:	741	sq.m	0.90

No. of Roof Drains: 3

Slots per Wier: 1 0.0124 l/s/mm/slot (5 USgpm/in/slot)

Depth at Roof Drain: 102 mm

Maximum Release Rate: 3.79 L/s

Pond Area: 331 sq.m

Achieved Volume: 11.25 cu.m

Maximum Volume Required: 11.25 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	26.17	3.79	22.39	6.72
10	104	19.32	3.79	15.53	9.32
15	84	15.49	3.79	11.70	10.53
20	70	13.02	3.79	9.24	11.08
25	61	11.29	3.79	7.50	11.25
30	54	10.00	3.79	6.21	11.18
35	49	9.00	3.79	5.21	10.93
40	44	8.19	3.79	4.40	10.57
45	41	7.53	3.79	3.74	10.11
50	38	6.98	3.79	3.19	9.58
55	35	6.51	3.79	2.72	8.99
60	33	6.11	3.79	2.32	8.35
65	31	5.76	3.79	1.97	7.67
70	29	5.45	3.79	1.66	6.96
75	28	5.17	3.79	1.38	6.22
80	27	4.92	3.79	1.14	5.45
85	25	4.70	3.79	0.91	4.67
90	24	4.50	3.79	0.71	3.86
95	23	4.32	3.79	0.53	3.03
100	22	4.15	3.79	0.37	2.20
105	22	4.00	3.79	0.21	1.34
110	21	3.86	3.79	0.07	0.48
115	20	3.73	3.73	0.00	0.00
120	19	3.61	3.61	0.00	0.00
125	19	3.50	3.50	0.00	0.00
130	18	3.39	3.39	0.00	0.00
135	18	3.29	3.29	0.00	0.00
140	17	3.20	3.20	0.00	0.00
145	17	3.11	3.11	0.00	0.00
150	16	3.03	3.03	0.00	0.00
180	14	2.63	2.63	0.00	0.00
210	13	2.33	2.33	0.00	0.00
240	11	2.09	2.09	0.00	0.00
270	10	1.91	1.91	0.00	0.00
300	9	1.75	1.75	0.00	0.00

DRAINAGE AREA III

(FIVE YEAR EVENT)

Roof Area:	126	sq.m	0.90
Asphalt/Concrete Area:	1355	sq.m	0.90
Gravel Area:	0	sq.m	0.70
Landscaped Area:	665	sq.m	0.20
Total Catchment Area:	2146	sq.m	0.68

Water Elevation:	117.39	m
Invert of Outlet Pipe - MH-4:	115.16	m
Centroid of ICD Orifice: (ICD in Outlet Pipe of MH-4)	115.20	m
Head:	2.18	m
Orifice Diameter:	86	mm
Orifice Area:	5748	sq.mm
Coefficient of Discharge:	0.61	
Maximum Release Rate:	22.96	L/s

	Top Area (sq.m)	Depth (m)	Volume	
Swale	117	0.17	6.56	cu.m
CB-3	185	0.12	2.07	cu.m
CB/MH-4	210	0.12	3.07	cu.m
Achieved Volume:			11.70	cu.m

Maximum Volume Required: 11.70 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	57.53	22.96	34.58	10.37
10	104	42.46	22.96	19.50	11.70
15	84	34.05	22.96	11.09	9.98
20	70	28.63	22.96	5.67	6.81
25	61	24.82	22.96	1.86	2.79
30	54	21.98	21.98	0.00	0.00
35	49	19.77	19.77	0.00	0.00
40	44	18.01	18.01	0.00	0.00
45	41	16.56	16.56	0.00	0.00
50	38	15.34	15.34	0.00	0.00
55	35	14.31	14.31	0.00	0.00
60	33	13.43	13.43	0.00	0.00
65	31	12.65	12.65	0.00	0.00
70	29	11.97	11.97	0.00	0.00
75	28	11.37	11.37	0.00	0.00
80	27	10.82	10.82	0.00	0.00
85	25	10.34	10.34	0.00	0.00
90	24	9.90	9.90	0.00	0.00
95	23	9.50	9.50	0.00	0.00
100	22	9.13	9.13	0.00	0.00
105	22	8.80	8.80	0.00	0.00
110	21	8.49	8.49	0.00	0.00
115	20	8.20	8.20	0.00	0.00
120	19	7.93	7.93	0.00	0.00
125	19	7.69	7.69	0.00	0.00
130	18	7.46	7.46	0.00	0.00
135	18	7.24	7.24	0.00	0.00
140	17	7.04	7.04	0.00	0.00
145	17	6.85	6.85	0.00	0.00
150	16	6.67	6.67	0.00	0.00
180	14	5.78	5.78	0.00	0.00
210	13	5.12	5.12	0.00	0.00
240	11	4.60	4.60	0.00	0.00
270	10	4.19	4.19	0.00	0.00
300	9	3.85	3.85	0.00	0.00

TWO YEAR EVENT

DRAINAGE AREA I (Uncontrolled Flow Off Site)

(TWO YEAR EVENT)

Roof Area:	126	sq.m	0.90
Asphalt/Concrete Area:	172	sq.m	0.90
Gravel Area:	0	sq.m	0.70
Landscaped Area:	358	sq.m	0.20
Total Catchment Area:	656	sq.m	0.52
Area (A):	656	sq.m	
Time of Concentration:	10.0	min	
Rainfall Intensity (i):	77	mm/hr	
Runoff Coeficient (C):	0.52		
Flow Rate (2.78AiC):	7.26	L/s	

DRAINAGE AREA II (Roof)

(TWO YEAR EVENT)

Roof Area:	741	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:	741	sq.m	0.90

No. of Roof Drains: 3

Slots per Wier: 1 0.0124 l/s/mm/slot (5 USgpm/in/slot)

Depth at Roof Drain: 89 mm

Maximum Release Rate: 3.32 L/s

Pond Area: 255 sq.m

Achieved Volume: 7.59 cu.m

Maximum Volume Required: 7.59 cu.m

Time (min)	i (mm/hr)	2.78AiC (L/s)	Release Rate (L/s)	Stored Rate (L/s)	Stored Volume (cu.m)
5	104	19.20	3.32	15.88	4.76
10	77	14.24	3.32	10.92	6.55
15	62	11.45	3.32	8.13	7.32
20	52	9.65	3.32	6.32	7.59
25	45	8.37	3.32	5.05	7.58
30	40	7.42	3.32	4.10	7.38
35	36	6.69	3.32	3.36	7.06
40	33	6.09	3.32	2.77	6.65
45	30	5.61	3.32	2.28	6.17
50	28	5.20	3.32	1.88	5.63
55	26	4.85	3.32	1.53	5.05
60	25	4.55	3.32	1.23	4.43
65	23	4.29	3.32	0.97	3.78
70	22	4.06	3.32	0.74	3.11
75	21	3.86	3.32	0.54	2.41
80	20	3.68	3.32	0.35	1.70
85	19	3.51	3.32	0.19	0.97
90	18	3.36	3.32	0.04	0.22
95	17	3.23	3.23	0.00	0.00
100	17	3.10	3.10	0.00	0.00
105	16	2.99	2.99	0.00	0.00
110	16	2.89	2.89	0.00	0.00
115	15	2.79	2.79	0.00	0.00
120	15	2.70	2.70	0.00	0.00
125	14	2.62	2.62	0.00	0.00
130	14	2.54	2.54	0.00	0.00
135	13	2.46	2.46	0.00	0.00
140	13	2.40	2.40	0.00	0.00
145	13	2.33	2.33	0.00	0.00
150	12	2.27	2.27	0.00	0.00
180	11	1.97	1.97	0.00	0.00
210	9	1.75	1.75	0.00	0.00
240	8	1.57	1.57	0.00	0.00
270	8	1.43	1.43	0.00	0.00
300	7	1.32	1.32	0.00	0.00

DRAINAGE AREA III

(TWO YEAR EVENT)

Roof Area:	126	sq.m	0.90
Asphalt/Concrete Area:	1355	sq.m	0.90
Gravel Area:	0	sq.m	0.70
Landscaped Area:	665	sq.m	0.20
Total Catchment Area:	2146	sq.m	0.68

Water Elevation:	117.27	m		Sewers		Volume	
				Length	Diameter		
Invert of Outlet Pipe - MH-4:	115.16	m		m	mm		
				40.8	375	1.43	cu.m
				17.3	600	1.56	cu.m
Centroid of ICD Orifice:	115.20	m		Manholes & Catch Basins			
(ICD in Outlet Pipe of MH-4)				Invert	Diameter		
				m	mm		
Head:	2.07	m	CB-1	115.24	600	0.73	cu.m
			MH-2	115.19	1500	3.68	cu.m
Orifice Diameter:	86	mm	CB-3	115.21	600	0.74	cu.m
			CB/MH-4	115.16	1500	3.74	cu.m
Orifice Area:	5748	sq.mm		Top Area	Depth		
				(sq.m)	(m)		
Coefficient of Discharge:	0.61		Swale	38	0.05	0.70	cu.m
			CB-3	0	0.00	0.00	cu.m
Maximum Release Rate:	22.36	L/s	CB/MH-4	0	0.00	0.00	cu.m
					Achieved Volume:	12.59	cu.m
					Maximum Volume Required:	12.59	cu.m

Time	i	2.78AiC	50% of Release Rate	Stored Rate	Stored Volume
(min)	(mm/hr)	(L/s)	(L/s)	(L/s)	(cu.m)
5	104	42.21	11.18	31.03	9.31
10	77	31.30	11.18	20.12	12.07
15	62	25.17	11.18	13.99	12.59
20	52	21.20	11.18	10.03	12.03
25	45	18.41	11.18	7.23	10.84
30	40	16.32	11.18	5.14	9.25
35	36	14.69	11.18	3.52	7.38
40	33	13.39	11.18	2.21	5.31
45	30	12.32	11.18	1.14	3.09
50	28	11.43	11.18	0.25	0.75
55	26	10.67	10.67	0.00	0.00
60	25	10.01	10.01	0.00	0.00
65	23	9.43	9.43	0.00	0.00
70	22	8.93	8.93	0.00	0.00
75	21	8.48	8.48	0.00	0.00
80	20	8.08	8.08	0.00	0.00
85	19	7.72	7.72	0.00	0.00
90	18	7.39	7.39	0.00	0.00
95	17	7.10	7.10	0.00	0.00
100	17	6.82	6.82	0.00	0.00
105	16	6.57	6.57	0.00	0.00
110	16	6.34	6.34	0.00	0.00
115	15	6.13	6.13	0.00	0.00
120	15	5.93	5.93	0.00	0.00
125	14	5.75	5.75	0.00	0.00
130	14	5.58	5.58	0.00	0.00
135	13	5.42	5.42	0.00	0.00
140	13	5.27	5.27	0.00	0.00
145	13	5.13	5.13	0.00	0.00
150	12	4.99	4.99	0.00	0.00
180	11	4.33	4.33	0.00	0.00
210	9	3.84	3.84	0.00	0.00
240	8	3.45	3.45	0.00	0.00
270	8	3.15	3.15	0.00	0.00
300	7	2.89	2.89	0.00	0.00

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 COMPUTATION FORM

RATIONAL METHOD Q = 2.78 A I R FIVE YEAR EVENT

n = 0.013

Project: 5986-5992 Hazeldean Road

Designed By: DBG

Date: November 22, 2019

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	Gravel	Landscape	Roof						Type of Pipe	Dia. Actual (mm)	Dia. Nominal (mm)	Slope (%)	Length (m)	Capacity (L/s)	Velocity (m/s)	Time of Flow (min)	Ratio Q/Qfull	
STREET	FROM	TO	R = 0.90	R = 0.70	R = 0.20	R = 0.90															
	CB-1	MH-2	0.0010		0.0258		0.017	0.017	10.00	104.2	1.8	PVC	381.0	375	0.43	20.4	119.9	1.05	0.32	0.01	
	MH-2	CB/MH-4						0.017	10.32	102.5	1.7	PVC	609.6	600	0.43	17.3	420.0	1.44	0.20	0.00	
	CB-3	CB/MH-4	0.0568		0.0256	0.0126	0.188	0.188	10.00	104.2	19.6	PVC	381.0	375	0.43	20.4	119.9	1.05	0.32	0.16	
	ROOF	CB/MH-4				0.0741	0.185	0.185	10.00	104.2	19.3	PVC	203.2	200	1.00	20.4	34.2	1.06	0.32	0.56	
	CB/MH-4	MH-5	0.0777		0.0151		0.203	0.593	10.52	101.5	60.2	PVC	381.0	375	0.25	63.4	91.5	0.80	1.32	0.66	
											26.8	PVC	381.0	375	0.25	63.4	91.5	0.80	1.32	0.29	FLOW THROUGH ICD & FLOW CONTROL RDs
													EXISTING 375 ST IN HAZELDEAN ROAD								
													381.0	375	1.06		188.3	1.65			

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-6

Plan showing the site and location of all existing services: see drawings C-1 to C-6

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 1 of Servicing Brief and Stormwater Management Report

Identification of existing and proposed infrastructure available in the immediate area: see drawings C-1 to C-6

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 C6

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-4

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 & 5 to 8 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 2 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 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 12 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 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-3 & C-6

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-6 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-6 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 3 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 2.7 on drawing C-5

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: see page 19 of Servicing Brief and Stormwater Management Report

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