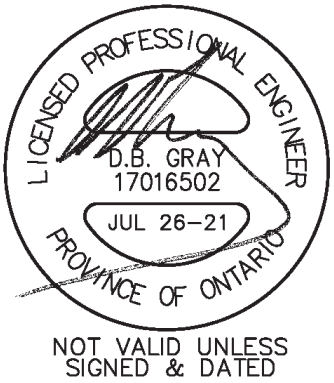
SERVICING BRIEF &
STORMWATER MANAGEMENT REPORT

2167 McGee Side Road
Ottawa, Ontario

Report No. 20086

March 12, 2021
Revised June 10, 2021
Revised July 26, 2021



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SIGNED & DATED

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SERVICING BRIEF &
STORMWATER MANAGEMENT REPORT

2167 McGee Side Road
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This Servicing Brief & Stormwater Management Report is a description of the services for a 599 sq.m. office / warehouse building and addresses the stormwater management requirements of 7,621 sq.m. of land located at 2167 McGee Side Road, at the corner of John Cavanaugh Drive, in Ottawa. A 12 m drainage easement, 922 sq.m. in area, located adjacent to the north property line will remain wooded and undeveloped. The remaining developable area (6,699 sq.m.) is currently vacant with approximately 70% of the area covered with compacted granular material.

This report forms part of the stormwater management design for the proposed development. Also refer to drawings C-1 to C-5 prepared by D. B. Gray Engineering Inc.

WATER SUPPLY FOR FIREFIGHTING:

Since the proposed building design is 599 sq.m. in area it is understood that it will be exempt from requiring an on-site water supply for firefighting.

ON-SITE WELL:

A drilled well, which has been constructed approximately 20 m west of the southwest corner of the proposed building, will provide the domestic water supply.

ON-SITE SEWAGE SYSTEM:

An on-site septic system is proposed. It will be is a Class 4 system consisting of a 8,775 L (minimum) septic tank, a 2,000 L (minimum) dosing reservoir, an ECOFLO STB-840BR biofilter treatment unit and an dispersal bed. To prevent having an adverse effect on the bacterial action in the septic system, floor drains will drain to the Cavanaugh Drive roadside ditch via an oil interceptor. An application for a septic permit will be submitted to the Ottawa Septic System Office (OSSO) shortly.

STORMWATER MANAGEMENT:

Water Quality:

The Mississippi Valley Conservation Authority (MVCA) advises that the property is within the Carp River watershed area and that a normal water quality protection (70% TSS removal) and

infiltration target of 104 mm/yr are required for the site development.

Rainfall runoff from 90% of the developable portion of the property and virtually all of the hard surfaces (97%) will drain to a grassed stormwater detention area. The grassed detention areas and the swales leading to the detention areas will have minimal slopes that will keep flow velocities low making them effective for pre-treatment and they will tend to increase the removal of TSS. The low flow conditions in these grassed areas will aid in filtering out coarse sediment from runoff and the grass will take up nutrients.

An infiltration trench located at the bottom of the stormwater detention area has been sized to remove 70% TSS as per the MOE Design Manual. Based on the geotechnical report the underlying soil is silty sand and has an estimated infiltration rate of 30 to 75 mm /hr. To be conservative 30 mm/hr was used. The infiltration trench has a total storage volume of 14.1 cu.m. and has a draw down time of 25 hours. As per the geotechnical report the long-term groundwater level is expected to be 2 to 3 m depth or 1 to 2 m below the bottom of the infiltration trench. The auger refusal at borehole closest to the proposed infiltration trench was at 2.7 m depth or about 1.7 m below the bottom of the infiltration trench. Therefore, since bedrock and groundwater are at least 1 m below the bottom of the infiltration trench neither are expected to be an issue. For the infiltration trench to function adequately, the stormwater detention area requires regular maintenance: the grass needs to be maintained at a minimum 75mm height and annually, in the spring (and more frequently if necessary), any accumulated sediment needs to be removed from the grass.

More than half of the property is currently covered with compacted granular material, and has been that way for over 20 years, and since the granular material is considered impervious in water balance and infiltration calculations, the pre-development (existing) conditions has an annual infiltration of only 95 mm/yr. (It is calculated that the pre-development conditions that existed prior to the placement of the granular material (sometime in the 1990s), had an annual infiltration of 348 mm/yr.) As previously mentioned, a 922 sq.m. drainage easement will remain wooded and undeveloped. Also, post development, the grassed areas will increase by about 33% and impervious areas will decrease by about 15% over existing conditions. For these reasons it is calculated that the post development annual infiltration will increase to 116 mm/yr, greater than minimum required target of 104 mm/yr.

An erosion and sediment control plan has been developed to be implemented during construction, (see drawing C-3 and notes 2.1 to 2.6 on drawing C-5). In summary: to filter out construction sediment a silt fence barrier will be installed around the perimeter of the site where runoff will drain off the site; straw bale check dams will be installed at culverts; and any material deposited on a public road will be removed.

Water Quantity:

The stormwater quantity control measures detailed in this report are based on the following criteria: The post development release rate for the 5 and 100-year storm events shall be controlled to equal to or less than the flow produced by the pre-development conditions. Since the drainage easement at the north end of the property is undevelopable it is not included in the calculations.

It is calculated that the pre-development (existing) conditions reflect a 5-year runoff coefficient of 0.58 and 0.73 for the 100-year. Using time of concentration of 20 minutes and the Rational Method; the pre-development (existing) 5-year peak flow is 76.07 L/s and 162.35 L/s for the 100-year.

However, although 70% of the area is covered with granular material and has been that way for over 20 years, the City requires that the pre-development conditions be the conditions that existed prior to the placement of the granular material (sometime in the 1990s), which was a grassed field. It is calculated that this pre-development condition reflects a 5-year runoff coefficient of 0.30 and 0.375 for the 100-year. Using time of concentration of 20 minutes and the Rational Method; the pre-development 5-year peak flow is 39.25 L/s and 83.77 L/s for the 100-year. Therefore, the maximum allowable release rate is 39.25 L/s and 83.77 L/s for the 5 and 100-year events respectively.

Flow and storage calculations are based on the Modified Rational Method. The runoff coefficients for the 100-year event are increased by 25% to maximum 1.00.

Stormwater will be stored within the development in a stormwater detention area (depressed grassed area). The stormwater released from the detention area will discharge to the roadside ditch.

Drainage Area I (Uncontrolled Flow Off Site – 647 sq.m.):
The runoff from the perimeter of the site will be allowed to flow uncontrolled off the site.

	100-year	5-year
Maximum flow rate:	12.37 L/s	6.11 L/s

Drainage Area II (6,052 sq.m.):
During the five-year event an inlet control device (ICD) located in the inlet of the culvert in the stormwater detention area will control the release of stormwater from the property. During the one hundred-year event, in addition to the ICD, a broad-crested weir will control the release of stormwater. The ICD and weir will restrict the flow and force the stormwater to back up into the detention area. The ICD and weir will discharge to the roadside ditch near the southeast corner of the property. The broad-crested weir will be a concrete curb with a 2.00 m long depressed section which will release 30.22 L/s at 0.04 m water depth above the weir. To be conservative the depressed portion of the curb will be at the 100-year ponding elevation. The ICD shall be a plug style with a round orifice design manufactured by Pedro Plastics (or approved equal) and each shall be sized by the manufacturer for a discharge rate of 41.18 L/s at 0.37 m head. It is calculated that an orifice area of 25,157 sq.mm. (±179mm diameter) and a discharge coefficient of 0.61 will restrict the outflow rate to 41.18 L/s at a head of 0.37 m. Based on this orifice the maximum outflow rate for the 1:5 year storm event is calculated to be 33.14 L/s at 0.24 m.

	100-year	5-year
Maximum ICD release rate:	41.18 L/s	33.14 L/s
Maximum weir release rate:	30.22 L/s	0.00 L/s
Maximum release rate:	71.40 L/s	33.14 L/s
Maximum ponding elevation:	116.99 m	116.86 m
Maximum ponding depth:	0.46 m	0.33 m
Maximum stored volume:	88.78 cu.m.	46.96 cu.m.

The Entire Site:

	100-year	5-year
Pre-development flow rate:	162.35 L/s	76.07 L/s
Maximum allowable release rate:	83.77 L/s	39.25 L/s
Maximum release rate:	83.77 L/s	39.25 L/s
Maximum stored volume:	88.78 cu.m.	46.96 cu.m.

Therefore, the maximum post-development release rate for both the 100-year and 5-year storm event is calculated to be equal to the maximum allowable; and 48% lower than the existing conditions.

Pre and post development flows off the site outlets to the McGee Side Road roadside ditch. The existing culvert crossing John Cavanaugh Drive has capacity of approximately 500 L/s before overtopping the road. Upstream and downstream of this culvert the roadside ditches have greater capacities. As mentioned above, the proposed stormwater management quantity control measures will significantly reduce the existing (pre-development flow) by almost 50% during the 100-year and 5-year events. The post development flowrates from the subject site will represent only about 17% of the capacity of the culvert during the 100-year event (reduced from 32%) and only about 8% during the 5-year event (reduced from 15%). Therefore, post development the residual capacity of the roadside ditches will increase.

CONCLUSIONS:

1. Since the proposed building design is 599 sq.m. in area it is understood that it will be exempt from requiring an on-site water supply for firefighting.

2. A drilled well will provide the domestic water supply for the proposed building.

3. An on-site Class 4 septic system is proposed; an application for a septic permit will be submitted to the Ottawa Septic System Office (OSSO) shortly.

4. To meet the water quality target of normal treatment an infiltration trench located at the bottom of the stormwater detention area has been sized to remove 70% TSS.

5. The pre-development (existing) conditions has an annual infiltration of only 95 mm/yr. The post development annual infiltration will increase to 116 mm/yr, greater than minimum required target of 104 mm/yr.

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

7. The post development release rate for the 5 and 100-year storm events are controlled to be equal to or less than the flow produced by the pre-development conditions. Although 70% of the area is covered with compacted granular material and has been that way for over 20 years, the City requires that the pre-development conditions be considered to be a grassed field. The maximum post-development release rate for both the 100-year and 5-

year storm event is calculated to be equal to the maximum allowable; and 48% lower than the existing conditions.

8. The proposed stormwater management quantity control measures will significantly reduce the existing pre-development flow, such that, the post development flowrates from the subject site will represent only about 17% of the capacity of the culvert during the 100-year event and only about 8% during the 5-year event. Post development residual capacity of the roadside ditches will increase.

27-Jan-21
01-Jun-21

2167 McGee Side Road

Ottawa, Ontario

INFILTRATION CALCULATIONS

DRAINAGE AREA II

Roof Area:	599	sq.m
Asphalt/Concrete Area:	1882	sq.m
Gravel Area:	1451	sq.m
Landscaped Area:	2120	sq.m
Total Catchment Area	6052	sq.m.
Pervious(Landscaped) Area:	2120	sq.m.
Total Catchment Area:	6052	sq.m.
Percentage Pervious:	35%	
Percentage Impervious:	65%	

Require Storage Volume *: 65% Impervious Level 23.3 cu.m./ha (extrapolated from Table 3.2 *)
(for 70% TSS removal) 14.1 cu.m. (6052) sq.m.

* As per MOE Stormwater Management Planning and Design Manual, March 2003

Infiltration Trench

Depth m	Area sq.m.	Total Volume cu.m.	Void Volume 40% cu.m.
0.75	47.0	35.3	14.1

Percolation Rate: 30 mm/hr (silty sand)

Time to Draw Down: 25 Hours

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Water Balance and Infiltration Calculations

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

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

Therefore: Mean Annual Precipitation - Evapotranspiration = Runoff + Infiltration

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

Pre-development
(assume agricultural pasture - prior to circa 1990)

	Area (sq.m.)	Precipitation + (mm/yr)	Evapo-transpiration ++ (mm/yr)	Surplus (mm/yr)	Topography Factor *	Soil Factor **	Vegetation Factor ***	Infiltration Coefficient ****	Infiltration (mm/yr)
Wooded Ravine	922	943	560	383	0.1	0.4	0.2	0.70	268
Agricultural	6699	943	390	553	0.15	0.4	0.1	0.65	359
Total:	7621							Weighted Average:	348

Pre (Existing) Development

	Area (sq.m.)	Precipitation + (mm/yr)	Evapo-transpiration ++ (mm/yr)	Surplus (mm/yr)	Topography Factor *	Soil Factor **	Vegetation Factor ***	Infiltration Coefficient ****	Infiltration (mm/yr)
Wooded Ravine	922	943	560	383	0.1	0.4	0.2	0.70	268
Urban Lawn	1986	943	575	368	0.15	0.4	0.1	0.65	239
Hard Surfaces	4713	943	150	793				0.00	0
Total:	7621							Weighted Average:	95

Post Development

	Area (sq.m.)	Precipitation + (mm/yr)	Evapo-transpiration ++ (mm/yr)	Surplus (mm/yr)	Topography Factor *	Soil Factor **	Vegetation Factor ***	Infiltration Coefficient ****	Infiltration (mm/yr)
Wooded Ravine	922	943	560	383	0.1	0.4	0.2	0.70	268
Urban Lawn	2650	943	575	368	0.15	0.4	0.1	0.65	239
Hard Surfaces	4049	943	150	793				0.00	0
Total:	7621							Weighted Average:	116

\+ Ottawa International Airport (1981-2010)

++ Eastern Ontario Water Resources Management Study (2001) & Carp River Watershed / Subwatershed Study

		Factor	Subject Property
* Topography:	Flat Land, average slope < 0.6m/km (<.06%)	0.3	
	Rolling Land, average slope 2.8 to 3.8m/km (0.28% to 0.38%)	0.2	= 0.15 (+/- 1.5% ave. slope except ravine)
	Hilly Land, average slope 28 to 47m/km (2.8 to 4.7%)	0.1	= 0.1 for ravine
** Soil:	Tight impervious clay	0.1	
	Medium combination of clay and loam	0.2	
	Open sandy loam	0.4	=0.4 (glacial till: silty sand with gravel, cobbles and boulders - as per geotechnical report)
*** Cover:	Cultivated Lands	0.1	= 0.1 (pre-development cultivated lands and post development urban lawns except ravine)
	Woodland	0.2	= 0.2 (wooded ravine)
	As per MOE SWM Planning & Design Manual, 2003		

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

The length of the broad-crested weir is based on the following formula:

$$L = Q / (1.705 \times H^{3/2})$$

where:

L = the length of the weir in m
Q = the flow rate in m^3/s
H = the depth of water above the top of the weir

Storage calculations for the stormwater detention area are based on the following formula for volume of a prismodal shape (the formula is accurate if both length and width are changing proportionally):

$$V = (A_{top} + A_{bottom} + (A_{top} \times A_{bottom}))^{0.5}) / 3 \times d$$

where:

V = volume in cu.m.
A_{top} = area of pond in sq.m.
A_{bottom} = area of bottom of depressed area
d = ponding depth in meters

Summary Tables

ONE HUNDRED YEAR EVENT					
Drainage Area	Pre Development Flow Rate (L/s)	Maximum Allowable Release Rate (L/s)	Maximum Release Rate (L/s)	Maximum Volume Required (cu.m)	Maximum Volume Stored (cu.m)
AREA I (Uncontrolled Flow Off Site)	-	-	12.37	-	-
AREA II	-	-	71.40	88.78	88.78
TOTAL	162.35	83.77	83.77	88.78	88.78

FIVE YEAR EVENT					
Drainage Area	Pre Development Flow Rate (L/s)	Maximum Allowable Release Rate (L/s)	Maximum Release Rate (L/s)	Maximum Volume Required (cu.m)	Maximum Volume Stored (cu.m)
AREA I (Uncontrolled Flow Off Site)	-	-	6.11	-	-
AREA II	-	-	33.14	46.96	46.96
TOTAL	76.07	39.25	39.25	46.96	46.96

2167 McGee Side Road

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STORMWATER MANAGEMENT CALCULATIONS
Rational Method

ONE HUNDRED YEAR EVENT

Pre (Existing) Development Flow Rate

			C	
Roof Area:	0	sq.m	1.00	
Asphalt/Concrete Area:	0	sq.m	1.00	
Gravel Area:	4713	sq.m	0.875	(City of Ottawa Sewer Design Guidelines - Table 5.7) x 1.25
Flat Woodland / Pasture Area:	1986	sq.m	0.375	
Total Catchment Area:	6699	sq.m	0.73	
Area (A):	6699	sq.m		
Time of Concentration:	20	min		
Rainfall Intensity (i):	120	mm/hr (100-year event)		
Runoff Coeficient (C):	0.73			
100-Year Pre-development Flow Rate (2.78AiC):	162.35	L/s		

Maximum Allowable Release Rate

			C	
Roof Area:	0	sq.m	1.00	
Asphalt/Concrete Area:	0	sq.m	1.00	
Gravel Area:	0	sq.m	0.875	(City of Ottawa Sewer Design Guidelines - Table 5.7) x 1.25
Flat Woodland / Pasture Area:	6699	sq.m	0.375	
Total Catchment Area:	6699	sq.m	0.375	
Area (A):	6699	sq.m		
Time of Concentration:	20	min		
Rainfall Intensity (i):	120	mm/hr (100-year event)		
Runoff Coeficient (C):	0.375			
100-Year Maximum Allowable Release Rate (2.78AiC):	83.77	L/s		

DRAINAGE AREA I (Uncontrolled Flow Off Site)

(ONE HUNDRED YEAR EVENT)

			C
Roof Area:	0	sq.m	1.00
Asphalt/Concrete Area:	115	sq.m	1.00
Gravel Area:	2	sq.m	0.875
Landscaped Area:	530	sq.m	0.25
Total Catchment Area:	647	sq.m	0.39
Area (A):	647	sq.m	
Time of Concentration:	10	min	
Rainfall Intensity (i):	179	mm/hr	
Runoff Coeficient (C):	0.39		
Release Rate (2.78AiC):	12.37	L/s	

DRAINAGE AREA II

(ONE HUNDRED YEAR EVENT)

			C
Roof Area:	599	sq.m	1.00
Asphalt/Concrete Area:	1882	sq.m	1.00
Gravel Area:	1451	sq.m	0.875
Landscaped Area:	2120	sq.m	0.25
Total Catchment Area:	6052	sq.m	0.71

Water Elevation:	116.99	m
Invert of Inlet of Culvert:	116.53	m
Centroid of ICD Orifice: (ICD in Inlet of Culvert) Head:	116.62	m
	0.37	m
Orifice Diameter:	179	mm
Orifice Area:	25157	sq.mm
Coefficient of Discharge:	0.61	
Maximum ICD Release Rate:	41.18	L/s
Maximum Weir Release Rate:	30.22	L/s
Total Maximum Release Rate:	71.40	L/s

Bottom Area (sq.m)	Top Area (sq.m)	Avg. Depth (m)	Volume	
223	365	0.31	88.78	cu.m

Achieved Volume:	88.78	cu.m
Maximum Volume Required:	88.78	cu.m

Time (min)	i (mm/hr)	2.78AiC (L/s)	ICD Release Rate (L/s)	Weir Release Rate (L/s)	Total Release Rate (L/s)	Stored Rate (L/s)	Stored Volume (cu.m)
5	243	288.82	41.18	0.00	41.18	247.64	74.29
10	179	212.49	41.18	23.34	64.52	147.97	88.78
15	143	170.05	41.18	30.22	71.40	98.64	88.78
20	120	142.74	41.18	27.58	68.76	73.98	88.78
25	104	123.58	41.18	23.21	64.39	59.19	88.78
30	92	109.32	41.18	18.82	60.00	49.32	88.78
35	83	98.27	41.18	14.82	55.99	42.28	88.78
40	75	89.42	41.18	11.25	52.43	36.99	88.78
45	69	82.17	41.18	8.11	49.29	32.88	88.78
50	64	76.11	41.18	5.33	46.51	29.59	88.78
55	60	70.95	41.18	2.87	44.05	26.90	88.78
60	56	66.52	41.18	0.68	41.85	24.66	88.78
65	53	62.65	41.18	0.00	41.18	21.47	83.74
70	50	59.25	41.18	0.00	41.18	18.07	75.90
75	47	56.23	41.18	0.00	41.18	15.06	67.75
80	45	53.54	41.18	0.00	41.18	12.36	59.34
85	43	51.12	41.18	0.00	41.18	9.94	50.68
90	41	48.92	41.18	0.00	41.18	7.74	41.82
95	39	46.93	41.18	0.00	41.18	5.75	32.77
100	38	45.11	41.18	0.00	41.18	3.93	23.56
105	36	43.43	41.18	0.00	41.18	2.25	14.20
110	35	41.89	41.18	0.00	41.18	0.71	4.71
115	34	40.47	40.47	0.00	40.47	0.00	0.00
120	33	39.15	39.15	0.00	39.15	0.00	0.00
125	32	37.92	37.92	0.00	37.92	0.00	0.00
130	31	36.77	36.77	0.00	36.77	0.00	0.00
135	30	35.70	35.70	0.00	35.70	0.00	0.00
140	29	34.69	34.69	0.00	34.69	0.00	0.00
145	28	33.75	33.75	0.00	33.75	0.00	0.00
150	28	32.86	32.86	0.00	32.86	0.00	0.00
180	24	28.44	28.44	0.00	28.44	0.00	0.00

FIVE YEAR EVENT

Pre (Existing) Development Flow Rate

			C
Roof Area:	0	sq.m	0.90
Asphalt/Concrete Area:	0	sq.m	0.90
Gravel Area:	4713	sq.m	0.70
Flat Woodland / Pasture Area:	1986	sq.m	0.30

(City of Ottawa Sewer Design Guidelines - Table 5.7)

Total Catchment Area:	6699	sq.m
Area (A):	6699	sq.m
Time of Concentration:	20	min
Rainfall Intensity (i):	70	mm/hr (5-year event)
Runoff Coeficient (C):	0.58	
100-Year Pre-development Flow Rate (2.78AiC):	76.07	L/s

Maximum Allowable Release Rate

			C	
Roof Area:	0	sq.m	0.90	
Asphalt/Concrete Area:	0	sq.m	0.90	
Gravel Area:	0	sq.m	0.70	(City of Ottawa Sewer Design Guidelines - Table 5.7)
Flat Woodland / Pasture Area:	6699	sq.m	0.30	

(City of Ottawa Sewer Design Guidelines - Table 5.7)

Total Catchment Area:	6699	sq.m	0.30
Area (A):	6699	sq.m	
Time of Concentration:	20	min	
Rainfall Intensity (i):	70	mm/hr (5-year event)	
Runoff Coeficient (C):	0.30		
5 Year Maximum Allowable Release Rate (2.78AiC):	39.25	L/s	

DRAINAGE AREA I (Uncontrolled Flow Off Site)

(FIVE YEAR EVENT)

			C
Roof Area:	0	sq.m	0.90
Asphalt/Concrete Area:	115	sq.m	0.90
Gravel Area:	2	sq.m	0.70
Landscaped Area:	530	sq.m	0.20
Total Catchment Area:	647	sq.m	0.33
Area (A):	647	sq.m	
Time of Concentration:	10	min	
Rainfall Intensity (i):	104	mm/hr	
Runoff Coeficient (C):	0.33		
Release Rate (2.78AiC):	6.11	L/s	

DRAINAGE AREA II

(FIVE YEAR EVENT)

			C
Roof Area:	599	sq.m	0.90
Asphalt/Concrete Area:	1882	sq.m	0.90
Gravel Area:	1451	sq.m	0.70
Landscaped Area:	2120	sq.m	0.20
Total Catchment Area:	6052	sq.m	0.61

Water Elevation:	116.86	m
Invert of Inlet of Culvert:	116.53	m
Centroid of ICD Orifice: (ICD in Inlet of Culvert) Head:	116.62	m
	0.24	m
Orifice Diameter:	179	mm
Orifice Area:	25157	sq.mm
Coefficient of Discharge:	0.61	
Maximum ICD Release Rate:	33.14	L/s
Maximum Weir Release Rate:	0.00	L/s
Total Maximum Release Rate:	33.14	L/s

Bottom Area (sq.m)	Top Area (sq.m)	Avg. Depth (m)	Volume	
223	314	0.18	46.96	cu.m

Achieved Volume:	46.96	cu.m
Maximum Volume Required:	46.96	cu.m

Time (min)	i (mm/hr)	2.78AiC (L/s)	ICD Release Rate (L/s)	Weir Release Rate (L/s)	Total Release Rate (L/s)	Stored Rate (L/s)	Stored Volume (cu.m)
5	141	144.14	33.14	0.00	33.14	111.00	33.30
10	104	106.38	33.14	0.00	33.14	73.24	43.94
15	84	85.31	33.14	0.00	33.14	52.17	46.96
20	70	71.73	33.14	0.00	33.14	38.59	46.30
25	61	62.17	33.14	0.00	33.14	29.04	43.55
30	54	55.06	33.14	0.00	33.14	21.92	39.46
35	49	49.54	33.14	0.00	33.14	16.40	34.43
40	44	45.11	33.14	0.00	33.14	11.97	28.74
45	41	41.48	33.14	0.00	33.14	8.34	22.53
50	38	38.44	33.14	0.00	33.14	5.31	15.92
55	35	35.86	33.14	0.00	33.14	2.72	8.98
60	33	33.63	33.14	0.00	33.14	0.50	1.79
65	31	31.70	31.70	0.00	31.70	0.00	0.00
70	29	29.99	29.99	0.00	29.99	0.00	0.00
75	28	28.47	28.47	0.00	28.47	0.00	0.00
80	27	27.12	27.12	0.00	27.12	0.00	0.00
85	25	25.90	25.90	0.00	25.90	0.00	0.00
90	24	24.80	24.80	0.00	24.80	0.00	0.00
95	23	23.79	23.79	0.00	23.79	0.00	0.00
100	22	22.88	22.88	0.00	22.88	0.00	0.00
105	22	22.04	22.04	0.00	22.04	0.00	0.00
110	21	21.26	21.26	0.00	21.26	0.00	0.00
115	20	20.54	20.54	0.00	20.54	0.00	0.00
120	19	19.88	19.88	0.00	19.88	0.00	0.00
125	19	19.26	19.26	0.00	19.26	0.00	0.00
130	18	18.68	18.68	0.00	18.68	0.00	0.00
135	18	18.14	18.14	0.00	18.14	0.00	0.00
140	17	17.63	17.63	0.00	17.63	0.00	0.00
145	17	17.15	17.15	0.00	17.15	0.00	0.00
150	16	16.71	16.71	0.00	16.71	0.00	0.00
180	14	14.48	14.48	0.00	14.48	0.00	0.00

08-Mar-21

2167 McGee Side Road

Ottawa, Ontario

BROAD CRESTED WEIR CALCULATIONS

1:100 YEAR EVENT

DRAINAGE AREA II

(ONE HUNDRED YEAR EVENT)

Length of Weir based on an assumed coefficient of discharge (Cd):

if Q =	30.22	L/s	(maximum permited flow)	assumes Cd= 0.577
=	0.03022	cu.m/s		(assumes P/H is large)
& H =	0.04	m	(max. depth of water above top of weir)	
then L =	2.00	m	(length of weir) L = Q / ((1.705) x H^(3/2))	

Length of Weir based on a calculated coefficient of discharge (Cd):

if P =	0.38	m	(depth of pond)
& Lp =	17.0	m	(width of pond perpendicular to direction of flow)
then Vp =	0.00	m/s	(velocity in pond) Vp = Q / ((P+H) / Lp
& E =	0.04	m	(energy) E = H + V^2/2g
& Cd =	0.577		= 0.577 x (E/H)^(3/2)

if Q =	30.22	L/s	(maximum permited flow)
=	0.03022	cu.m/s	
& H =	0.04	m	(depth of water above top of weir)
then L =	2.00	m	(length of weir) L = Q / (Cd^(2/3) x (2x9.81)^(1/2) x H^(3/2))

HY-8 Analysis Results

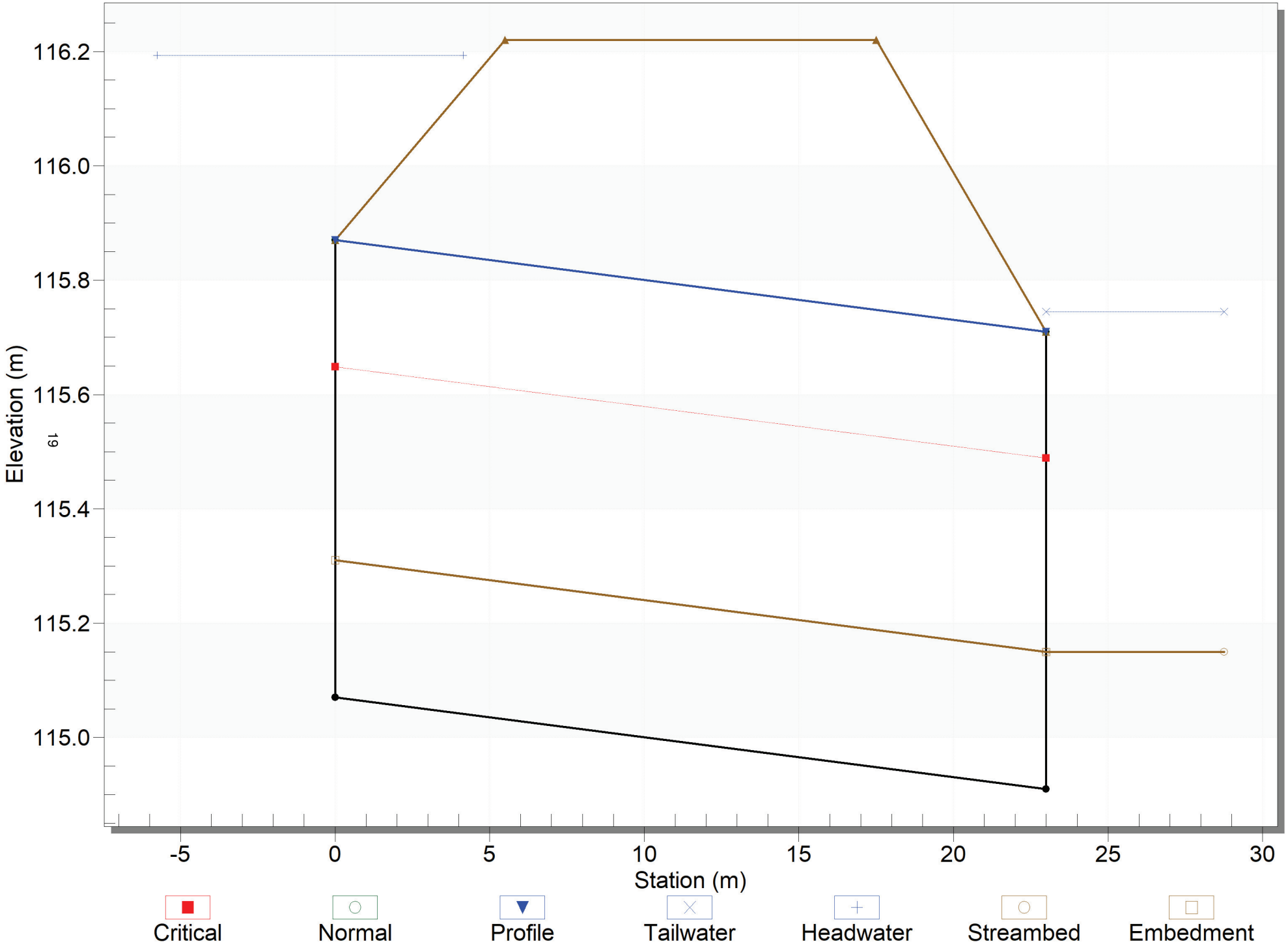
Culvert Summary Table - Existing 23m - 800mm

Culvert Crossing: 2267 McGee Side Rd

Total Discharge (cms)	Culvert Discharge (cms)	Headwater Elevation (m)	Inlet Control Depth(m)	Outlet Control Depth(m)	Flow Type	Normal Depth (m)	Critical Depth (m)	Outlet Depth (m)	Tailwater Depth (m)	Outlet Velocity (m/s)	Tailwater Velocity (m/s)
0.00	0.00	115.31	0.00	0.0	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
0.05	0.05	115.46	0.11	0.15	3-M1t	0.10	0.07	0.25	0.25	0.26	0.26
0.10	0.10	115.55	0.16	0.24	3-M1t	0.15	0.12	0.33	0.33	0.40	0.32
0.15	0.15	115.62	0.22	0.31	3-M1t	0.20	0.16	0.38	0.38	0.52	0.35
0.20	0.20	115.69	0.26	0.38	3-M1t	0.24	0.19	0.42	0.42	0.63	0.37
0.25	0.25	115.76	0.31	0.45	3-M1t	0.29	0.22	0.46	0.46	0.74	0.40
0.30	0.30	115.82	0.35	0.51	3-M1t	0.33	0.25	0.49	0.49	0.85	0.41
0.35	0.35	115.89	0.38	0.58	7-M1t	0.39	0.27	0.52	0.52	0.96	0.43
0.40	0.40	115.98	0.42	0.67	3-M2t	0.56	0.29	0.55	0.55	1.07	0.45
0.45	0.45	116.08	0.46	0.77	4-FFf	0.56	0.32	0.56	0.57	1.20	0.46
0.50	0.50	116.19	0.50	0.88	4-FFf	0.56	0.34	0.56	0.59	1.34	0.47

Crossing - 2267 McGee Side Rd, Design Discharge - 0.50 cms

Culvert - Existing 23m - 800mm, Culvert Discharge - 0.50 cms



2167 McGee Side Road
Ottawa, Ontario

McGee Roadside Ditch Upstream of Existing Culvert Crossing John Cavanaugh Drive

Culvert capacity:	0.5	cu.m./s	
Ditch Slope:	3.9%		
Ditch Manning Roughness Coefficient n:	0.10	dense weeds as high as flow	
Road Side Slope:	3	:1	
Lot Side Slope:	3	:1	
Ditch Bottom Width:	-	m	
Water Depth:	0.48	m	
Water Top Width:	2.87		
Water Cross-Section Area:	0.69	sq.m.	
Wetted Perimeter:	3.02	m	
Hydraulic Radius:	0.23	m	
Velocity:	0.73	m/s	Based on water depth
Velocity:	0.73	m/s	Using Manning's Formula:

McGee Roadside Ditch Downstream of Existing Culvert Crossing John Cavanaugh Drive

Culvert capacity:	0.5	cu.m./s	
Ditch Slope:	1.2%		
Ditch Manning Roughness Coefficient n:	0.10	dense weeds as high as flow	
Road Side Slope:	3	:1	
Lot Side Slope:	3	:1	
Ditch Bottom Width:	-	m	
Water Depth:	0.60	m	
Water Top Width:	3.57		
Water Cross-Section Area:	1.06	sq.m.	
Wetted Perimeter:	3.76	m	
Hydraulic Radius:	0.28	m	
Velocity:	0.47	m/s	Based on water depth
Velocity:	0.47	m/s	Using Manning's Formula:

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-5

Plan showing the site and location of all existing services: see drawings C-1 to C-5

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-5

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-5

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-5

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: not applicable

Identification of system constraints: not applicable

Confirmation of adequate domestic supply and pressure: not applicable

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: not applicable

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: not applicable

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 2 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 2 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. not applicable

Description of proposed sewer network including sewers, pumping stations, and forcemains: see not applicable

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-1 & 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: the pre-application consultation record has not 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-5 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-5 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 2.6 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 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