Stormwater Management & Servicing Report
Conroy Business Park
2500 St Laurent Blvd

Client:
Conroy Business Park Inc

Project Number:
OTT-00238830-A0

Prepared By: Marc Lafleur, M.Eng., P.Eng

Reviewed By: Alam Ansari, M.Sc., P. Eng.

exp Services Inc.
100-2650 Queensview Drive
Ottawa, ON K2B 8H6

Date Submitted:
September 19, 2017
Rev February 22, 2018
Rev April 26, 2018

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Prepared By:
exp Services Inc.
100-2650 Queensview Drive
Ottawa, Ontario K2B 8H6
Canada
T: 613 688-1899
F: 613 225-7337
www.exp.com

LICENSED PROFESSIONAL ENGINEER
M.A. ANSARI
April 26, 2018
PROVINCE OF ONTARIO

Marc Lafleur, M.Eng., P.Eng.
Project Engineer
Infrastructure Services

Alam Ansari, M.Sc., P. Eng.
Senior Project Manager
Infrastructure Services

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Legal Notification

This report was prepared by **exp** Services Inc. for the account of Mr. Simon Nehme c/o Ramada Ottawa on the Rideau. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. **Exp** Services Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this project.

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1 Introduction

EXP Services Inc. was retained by Mr. Simon Nehme c/o Ramada Ottawa on the Rideau to prepare site servicing and stormwater management report for the proposed Conroy Business Park in support of site plan control application for the proposed office buildings located at 2500 St. Laurent Boulevard, Ottawa, Ontario. The phased development will be comprised of three office condominium blocks. The buildings will be two-storey, wood frame type construction and will not have basements. The subject site is approximately 1.16 hectares in area. This report outlines the servicing and stormwater management strategy for the subject site.

2 References

Various documents were referred to in preparing the current report including:

- City of Ottawa Sewer Design Guidelines Revision 2, October 2012 (SDG002)
- City of Ottawa Water Distribution Guidelines Revision 1, July 2010 (WDG001)
- Stormwater Management Planning and Design Manual, Ontario Ministry of the Environment, March 2003 (MOE SMPDM)

3 Sanitary Sewer Design

The proposed development will be serviced by a connection to the existing 375mm diameter PVC sanitary sewer on St Laurent Blvd. The anticipated peak sanitary flow from the proposed development has been calculated as per the City of Ottawa Sewer Design Guidelines (SDG02, 2012). The anticipated peak sanitary flow is calculated as follows:

Design Flows

Design Flow for Commercial Use:	50,000 L/day/ha (0.5787 L/s/ha)
Peaking Factor:	1.5
Site Area:	1.16 hectares
Extraneous Flow:	0.28 L/s/ha
Peak Design Flow:	= (0.5787L/s/ha)(1.16ha)(1.5)+(1.16ha)(0.28L/s/ha)
	=**1.33 L/s**

The proposed on-site sanitary sewers will be installed at a minimum grade of 0.60%. At this slope, a 150mm diameter sanitary sewer has a capacity of 11.8 L/s and a full flow velocity of 0.67 m/s and will therefore have sufficient capacity to service the site. The City of Ottawa Sewer Design Guidelines recommend a flow velocity within 0.6m/s to 3m/s. Refer to Site Servicing and Grading Plan (dwg 238830-SSGP1) for details of the sanitary sewers servicing the development.

4 Watermain Design

The proposed development will be serviced by a new 200mm diameter water service which will be connected to the existing 305mm diameter ductile iron municipal watermain on St Laurent Blvd to meet the domestic water requirements for the site. A Fire hydrant will be installed on the site to provide fire protection for the proposed development. Refer to Site Servicing and Grading Plan (dwg 238830-SSGP1) for the location of the proposed fire hydrant.

Fire Water Demand
The fire flow demand calculations were prepared based on the Fire Underwriters Survey (refer to Appendix B). The new buildings will be non-sprinklered and wood construction. The fire flow demand for the proposed development was calculated to be 197 L/s. There are two existing fire hydrants adjacent to the site on St Laurent Blvd and Conroy Rd. However, not all main entrances of the proposed development are within 90m unobstructed from the existing fire hydrant. Therefore, A new fire hydrant will be installed on the site and will provide fire protection for the proposed development.

The domestic water demands for the proposed site were calculated as per the City of Ottawa Water Distribution Guidelines.

Commercial Water Demand

Average daily demand:
=50000 l/ha/day
=1.16 hax 28,000 L/ha/day x (1/86,400 s/day)
= 0.4 L/s

Maximum daily demand:
=1.5 x avg. day
=1.5 x 0.4 L/s
=0.6 L/s

Maximum hourly daily demand:
=1.8 x max.day
=1.8 x 0.6 L/s
=1.1 L/s

The following boundary conditions were provided by the City of Ottawa (refer to Appendix B):

Peak Hour HGL = 122.6m

Maximum HGL = 131.4m

Max Day (0.6 L/s) + FireFlow (197L/s) = 124.5m

The water distribution guidelines require that the system pressure under maximum day plus fire flow conditions shall not be less than 20 psi. Based on the HGL of 124.5m for the max day + fire flow scenario and ground elevation of 85.50 adjacent to the proposed fire hydrant the residual pressure will be approximately 21.8 psi which exceeds the minimum pressure requirement. Therefore, a fire flow of 197 l/s can be provided by the City water supply system at the proposed fire hydrant under maximum day conditions. Based on the minimum HGL of 122.6m for the peak hour domestic demand scenario the residual at the second floor of the buildings was determined to be greater than 40psi. Refer to Appendix B for calculations.

5 Stormwater Management

5.1 Storm Design Criteria

The storm sewer system was designed in conformance with the City of Ottawa Sewer Design Guidelines (SDG02, 2012). The stormwater servicing design criteria for the proposed development are the following:

- The proposed on-site storm sewer network / minor system, is designed using Rational Method and Manning's Equation to convey runoff under free flow conditions for the 5-year return period.
- Flows to the storm sewer in excess of the 5-year storm release rate, up to and including the 100-year event shall be detained on site.
- Maximum allowable ponding depth is 300 mm.
- Flows from storms events greater than the 100-year return period will be directed overland towards St Laurent Blvd.
- Estimated storage volumes based on the Modified Rational Method
- 100 year minor system flows to the sewer on St Laurent Blvd must be controlled to 5 year predevelopment levels using a runoff coefficient of 0.5 and a calculated time of concentration (minimum 10minutes).
- Minimum freeboard of 0.3m between the 100 year overland flow elevation and finished floor.

5.2 Pre-Development Conditions

The site is generally flat with a gentle slope from west to east towards Conroy Road. The stormwater runoff currently sheet drains overland towards St Laurent Blvd.

5.2.1 Peak Runoff Rate (Pre-Dev)

The 5 and 100-year peak runoff rates for the existing condition were calculated using the Rational Method formula as follows:

$$Q = 2.78\, C * I * A$$

Where:

Q	=	Peak Runoff, L/sec
C	=	Estimated average runoff coefficient
I	=	Average rainfall intensity for a given storm return period in mm/hr
	=	$998.071/(T_C+6.053)^{0.814}$ (5yr) and $1735.688/(T_C+6.014)^{0.820}$ (100yr)
Tc	=	Time of concentration= 20.6 mins (Calculated using the FAA equation)
A	=	Drainage area in hectares

Therefore:

I_5 = $998.071/(20.6 + 6.053)^{0.814}$ = 68.93 mm/Q_{5PRE} =
2.78 (0.5) (68.93 mm/hr) (1.16 ha) = 111.15 L/sec

I_{100} = 1735.688 / (20.6 + 142.89)$^{0.820}$ = 189.7 mm/hr
Q_{100PRE} = 2.78 (0.5) (189.7 mm/hr) (1.16 ha) = 189.7L/sec

The 5-year and 100-year pre-development flows were estimated at 111.15 L/sec and 189.7 L/sec respectively. Refer to Appendix A for SWM design sheets.

5.3 Allowable Release Rate

Minor system flows form the site to the 1500mm diameter concrete storm sewer on St Laurent Blvd will be restricted to 111.15 L/s for up to the 100 year event. The allowable release rate criterion was established during the pre-application consultation with the City of Ottawa. The allowable release rate is based on the 5-yr storm event using a runoff coefficient of 0.5 and a calculated time of concentration. Flows to the storm sewer in excess of the 5-year allowable release rate, up to and including the 100-year storm event, shall be detained on site. Refer to Appendix A for SWM design sheets.

5.4 Post-Development Conditions

Stormwater will be controlled and released at a rate less than the allowable release rate for storms up to and including the 100-year storm event. An overland flow route is provided for storms greater than the 100-year event. Flow control devices will be installed in roof drains and various catchbasins/manholes in order to control stormwater prior to its release from the site. The site under post development conditions has been divided into 13 drainage areas, refer to Stormwater Management drawing 238830-SWM-1.

5.4.1 Storage Requirements and Allocation

Post development runoff in excess of the pre-development 5-year release rate will be detained on-site for storms up to and including the 100-year storm. The required SWM storage volumes will be achieved using the surface storage in the parking-lots and underground structures. Surface ponding volumes over catch basins and catch basin manholes were determined by applying the pyramid volume equation of one-third of the depth multiplied by the surface area of the pond. Ponding depths for the subject site shall be equal to or less than 150 mm for the 5-year storm and 300 mm for the 100-year storm event. Major overland flows from storms greater than the 100-year event will be directed to St Laurent Blvd via the overland flow route leading to the main entrances of the site.

The volume of storage required was calculated for both the 5-year and 100-year storm events using the Rational Method. The estimated (100-year) on-site required and available storage volumes were determined to be 317.3m^3 and 465.8m^3, respectively. The estimated (5-year) on-site required and available storage volumes were determined to be 121.6m^3 and 125.6m^3, respectively. Since more storage is available than will be required in both the 5-year and 100-year events, the ponding level will be less than 150mm and 300mm for the 5-year and 100-year events respectively. Detailed stormwater management calculations are shown in Appendix A, including storage requirements and storage quantities provided. Ponding levels and drainage areas for the site are shown on the post-development storm drainage plan.

5.4.2 Flow Control Device Sizing

A simple plug-type insert is suitable if the orifice diameter is 75 mm or greater. For lower release rates a more sophisticated orifice design is employed, such as Hydrovex, to reduce the possibility of clogging often associated with a small orifice. The Hydrovex models are custom-manufactured based on specific head and release rate information. Hydrovex model types were selected based on the manufacturer's selection charts (included in Appendix A). There are no plug type orifices proposed for the site due to the lower release rate required for each drainage area. Inlet control devices and their locations are shown on the Site Servicing and Grading plan 238830-SSGP-1.

Runoff attenuation for the roofs of the proposed buildings will be provided by WATTS RD-200-A-ADJ small areas roof drains with adjustable flow control. Refer to the Stormwater Management Plan SWM1 for roof drain locations and Appendix C for design details including the controlled release rate for each drain, maximum storage depths and volumes. The maximum depth or rooftop storage under the 100-year event is of 150mm. The available rooftop storage volume is greater than the required storage volume for the 100-year storm event.

5.4.3 Summary of Proposed SWM System

A summary of the release rates for the controlled and uncontrolled drainage areas and corresponding storage details is provided in Table 5.1 below. Refer to Appendix A for detailed Stormwater Management spreadsheet calculations and sewer design sheet. The Post development 100 year release rate from the Site is of 106.2L/s, which is less than the allowable limit of 111.15L/s.

Table 5-1: Summary of Proposed On-Site SWM System

Sub Area I.D.	Sub Area (ha)	Composite C'	5 Year Controlled Release (L/s)	5 year Storage Required (m^3)	5 Year Storage Provided (m^3)	100 Year Controlled Release (L/s)	100 year Storage Required (m^3)	100 Year Storage Provided (m^3)
POST 1	0.071	0.900	5.5	8.4	8.8	5.5	22.7	42.7
POST 2	0.075	0.900	7.0	7.8	8.2	7.0	22.0	47.9
POST 3	0.074	0.900	4.5	10.2	10.3	4.5	26.3	47.6
POST 4	0.075	0.900	5.5	9.2	9.6	5.5	24.6	42.3
POST 5	0.055	0.900	4.0	6.8	6.8	4.0	18.1	31.8
POST 6	0.056	0.900	4.0	7.0	8.8	4.0	18.6	35.6
POST 7	0.058	0.900	4.0	7.4	8.2	4.0	19.6	35.4
POST 8	0.064	0.900	5.0	7.5	7.7	5.0	20.4	31.2
POST 9	0.040	0.900	5.0	3.0	3.0	5.0	10.0	16.3
POST 10	0.087	0.900	3.2	15.5	15.5	3.8	34.8	34.8
POST 11	0.110	0.900	3.9	15.5	15.5	4.7	44.3	44.3
POST 12	0.136	0.900	5.4	23.2	23.2	5.4	55.8	55.8
POST 13	0.256	0.400	23.8	0.0	0.0	47.8	0.0	0.0
TOTAL	**1.16**	**Total Release**	**80.8**	**121.6**	**125.6**	**106.2**	**317.3**	**465.8**
Total Allowable Release L/s			**111.15**					

5.4.4 Quality Control

The stormwater runoff from the site is directed to the storm sewers on St Laurent Blvd that drains to the East Community Trunk Storm which outlets to the McEwan Creek Stormwater Management Facility. Quality control for the proposed site will be provided by the existing downstream Stormwater Management Facility. No additional water quality control is required on site. Refer to correspondence from the RVCA in Appendix A.

6 Erosion and Sediment Control

During all construction activities, erosion and sedimentation shall be controlled by the following techniques:

- Extent of exposed soils shall be limited at any given time;
- Exposed areas shall be re-vegetated as soon as possible;
- Minimize the area to be cleared and disruption of adjacent areas;
- Filter cloth shall be installed between frame and cover of all catch basins, catch basin manholes, and storm manholes as identified on the site grading and erosion control plan;
- Visual inspection shall be completed daily on sediment control barriers and any damage repaired immediately. Care will be taken to prevent damage during construction operations;
- In some cases, barriers may be removed temporarily to accommodate the construction operations. The affected barriers will be reinstated at night when construction is completed;
- Sediment control devices will be cleaned of accumulated silt as required. The deposits will be disposed of as per the requirements of the contract;
- During construction, if the engineer believes that additional prevention methods are required to control erosion and sedimentation, the contractor will install additional silt fences or other methods as required to the satisfaction of the engineer; and,
- Construction and maintenance requirements for erosion and sediment controls are to comply with Ontario Provincial Standard Specification (OPSS) 805.

7 Conclusions

This report addresses the adequacy of the existing municipal services to service the proposed development at 2500 St Laurent Blvd, Ottawa, Ontario. Based on the analysis provided in this report, the conclusions are as follows:

- A 200mm diameter water service connected to the 300mm municipal water main on St Laurent Blvd will adequately service the proposed development.
- A fire hydrant will be installed to provide fire protection for the proposed development.
- An existing Fire Hydrant on St Laurent Blvd and Conroy Rd will provide fire protection for the proposed development.
- A 150mm diameter sanitary service connected to the 375mm diameter municipal sanitary sewer on St Laurent Blvd will adequately service the proposed development.
- SWM for the proposed development will be achieved by restricting all storms up to the 100-year post development flow to the pre development 5-year release rate of 111.15L/s.
- Required on-site SWM storage volumes will be achieved using the surface storage in the parking-lots and underground pipes/structures.
- Quality control will be provided by the existing McEwen Creek Stormwater Management Facility which received flows from the 1500mm stormsewer on St Laurent Blvd. No additional water quality measures are proposed.
- Temporary erosion and sediment control measures for the subject site have been identified.
- Overland flow routes have been provided for the subject site.
- During all construction activities, erosion and sedimentation shall be controlled.

Appendix A – SWM System Design Sheets

Conroy Business Park
Client:Conroy Business Park INC.
Project: OTT-00238830-A0

Prepared By: M.Lafleur
Date: September 2017
Rev April 2018

Table A1 Stormwater Management Summary Table

Sub Area I.D.	Sub Area (ha)	Composite C'	5 Year Controlled Release (L/s)	5 year Storage Required (m^3)	5 Year Storage Provided (m^3)	100 Year Controlled Release (L/s)	100 year Storage Required (m^3)	100 Year Storage Provided (m^3)
POST 1	0.071	0.900	5.5	8.4	8.8	5.5	22.7	42.7
POST 2	0.075	0.900	7.0	7.8	8.2	7.0	22.0	47.9
POST 3	0.074	0.900	4.5	10.2	10.3	4.5	26.3	47.6
POST 4	0.075	0.900	5.5	9.2	9.6	5.5	24.6	42.3
POST 5	0.055	0.900	4.0	6.8	6.8	4.0	18.1	31.8
POST 6	0.056	0.900	4.0	7.0	8.8	4.0	18.6	35.6
POST 7	0.058	0.900	4.0	7.4	8.2	4.0	19.6	35.4
POST 8	0.064	0.900	5.0	7.5	7.7	5.0	20.4	31.2
POST 9	0.040	0.900	5.0	3.0	3.0	5.0	10.0	16.3
POST 10	0.087	0.900	3.2	15.5	15.5	3.8	34.8	34.8
POST 11	0.110	0.900	3.9	15.5	15.5	4.7	44.3	44.3
POST 12	0.136	0.900	5.4	23.2	23.2	5.4	56.5	56.5
POST 13	0.256	0.400	23.8	0.0	0.0	47.8	0.0	0.0
TOTAL	**1.16**	**Total Release**	**80.8**	**121.6**	**125.6**	**106.2**	**318.0**	**466.4**
Total Allowable Release L/s			**111.15**					

Conroy Business Park
Client:Conroy Business Park INC.
Project: OTT-00238830-A0

Prepared By: M.Lafleur
Date: July 2017

POST DEVELOPMENT DRAINAGE AREA POST1
STORAGE REQUIREMENTS

Post Dev run-off Coefficient "C"

			5 Year Event		100 Year Event	
Area	**Surface**	**Ha**	**"C"**	**C_{avg}**	**"C" x 1.25**	**$C_{100\ avg}$**
Total	Asphalt	0.071	0.90	**0.90**	1.00	**1.00**
0.07	Roof	0.000	0.90		1.00	
	Grass	0.000	0.25		0.31	

*Areas are approximate based on draft site plan

Runoff Coefficient Equation

$C = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{tot}$

QUANTITY STORAGE REQUIREMENTS - 5 Year

0.07 = Area(ha)
0.90 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Controlled Runoff (L/s)	Net Runoff To Be Stored (L/s)	Storage Req'd m^3
	15	83.56	14.8	5.5	9.3	8.4
	20	70.25	12.5	5.5	7.0	8.4
	25	60.90	10.8	5.5	5.3	8.0
5 YEAR	30	53.93	9.6	5.5	4.1	7.3
	35	48.52	8.6	5.5	3.1	6.5
	40	44.18	7.8	5.5	2.3	5.6

QUANTITY STORAGE REQUIREMENTS - 100 Year

0.07 = Area(ha)
1.00 = *C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Controlled Runoff (L/s)	Net Runoff To Be Stored (L/s)	Storage Req'd m^3
	15	142.89	28.2	5.5	22.7	20.4
	20	119.95	23.7	5.5	18.2	21.8
100 YEAR	25	103.85	20.5	5.5	15.0	22.5
	30	91.87	18.1	5.5	12.6	22.7
	35	82.58	16.3	5.5	10.8	22.7
	40	75.15	14.8	5.5	9.3	22.4
	45	69.05	13.6	5.5	8.1	21.9

Equations:

Flow Equation

$Q = 2.78 \times C \times I \times A$

Where:
C is the runoff coefficient
I is the intensity of rainfall, City of Ottawa IDF
A is the total drainage area

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Date: July 2017

POST DEVELOPMENT DRAINAGE AREA POST2
STORAGE REQUIREMENTS

Post Dev run-off Coefficient "C"

			5 Year Event		100 Year Event	
Area	**Surface**	**Ha**	**"C"**	**C_{avg}**	**"C" x 1.25**	**$C_{100\ avg}$**
Total	Asphalt	0.075	0.90	**0.90**	1.00	**1.00**
0.08	Roof	0.000	0.90		1.00	
	Grass	0.000	0.25		0.31	

*Areas are approximate based on draft site plan

Runoff Coefficient Equation

$C = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{tot}$

QUANTITY STORAGE REQUIREMENTS - 5 Year

0.08 = Area(ha)
0.90 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Controlled Runoff (L/s)	Net Runoff To Be Stored (L/s)	Storage Req'd m^3
	15	83.56	15.7	7.0	8.7	7.8
	20	70.25	13.2	7.0	6.2	7.4
	25	60.90	11.4	7.0	4.4	6.6
5 YEAR	30	53.93	10.1	7.0	3.1	5.6
	35	48.52	9.1	7.0	2.1	4.4
	40	44.18	8.3	7.0	1.3	3.1

QUANTITY STORAGE REQUIREMENTS - 100 Year

0.08 = Area(ha)
1.00 = *C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Controlled Runoff (L/s)	Net Runoff To Be Stored (L/s)	Storage Req'd m^3
	15	142.89	29.8	7.0	22.8	20.5
	20	119.95	25.0	7.0	18.0	21.6
100 YEAR	25	103.85	21.7	7.0	14.7	22.0
	30	91.87	19.2	7.0	12.2	21.9
	35	82.58	17.2	7.0	10.2	21.5
	40	75.15	15.7	7.0	8.7	20.8
	45	69.05	14.4	7.0	7.4	20.0

Equations:

Flow Equation

$Q = 2.78 \times C \times I \times A$

Where:
C is the runoff coefficient
I is the intensity of rainfall, City of Ottawa IDF
A is the total drainage area

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POST DEVELOPMENT DRAINAGE AREA POST3
STORAGE REQUIREMENTS

Post Dev run-off Coefficient "C"

			5 Year Event		100 Year Event	
Area	**Surface**	**Ha**	**"C"**	**C_{avg}**	**"C" x 1.25**	**$C_{100\ avg}$**
Total	Asphalt	0.074	0.90	**0.90**	1.00	**1.00**
0.07	Roof	0.000	0.90		1.00	
	Grass	0.000	0.25		0.31	

*Areas are approximate based on draft site plan

Runoff Coefficient Equation

$C = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{tot}$

QUANTITY STORAGE REQUIREMENTS - 5 Year

0.07 = Area(ha)
0.90 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Controlled Runoff (L/s)	Net Runoff To Be Stored (L/s)	Storage Req'd m^3
	15	83.56	15.5	4.5	11.0	9.9
	20	70.25	13.0	4.5	8.5	10.2
	25	60.90	11.3	4.5	6.8	10.2
5 YEAR	30	53.93	10.0	4.5	5.5	9.9
	35	48.52	9.0	4.5	4.5	9.4
	40	44.18	8.2	4.5	3.7	8.8

QUANTITY STORAGE REQUIREMENTS - 100 Year

0.07 = Area(ha)
1.00 = *C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Controlled Runoff (L/s)	Net Runoff To Be Stored (L/s)	Storage Req'd m^3
	15	142.89	29.4	4.5	24.9	22.4
	20	119.95	24.7	4.5	20.2	24.2
100 YEAR	25	103.85	21.4	4.5	16.9	25.3
	30	91.87	18.9	4.5	14.4	25.9
	35	82.58	17.0	4.5	12.5	26.2
	40	75.15	15.5	4.5	11.0	26.3
	45	69.05	14.2	4.5	9.7	26.2

Equations:
Flow Equation
$Q = 2.78 \times C \times I \times A$
Where:
C is the runoff coefficient
I is the intensity of rainfall, City of Ottawa IDF
A is the total drainage area

Conroy Business Park
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POST DEVELOPMENT DRAINAGE AREA POST4
STORAGE REQUIREMENTS

Post Dev run-off Coefficient "C"

			5 Year Event		100 Year Event	
Area	**Surface**	**Ha**	**"C"**	**C_{avg}**	**"C" x 1.25**	**$C_{100\ avg}$**
Total	Asphalt	0.075	0.90	**0.90**	1.00	**1.00**
0.08	Roof	0.000	0.90		1.00	
	Grass	0.000	0.25		0.31	

*Areas are approximate based on draft site plan

Runoff Coefficient Equation
$C = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{tot}$

QUANTITY STORAGE REQUIREMENTS - 5 Year

0.08 **= Area(ha)**
0.90 **= C**

Return Period	**Time (min)**	**Intensity (mm/hr)**	**Flow Q (L/s)**	**Controlled Runoff (L/s)**	**Net Runoff To Be Stored (L/s)**	**Storage Req'd m^3**
	15	83.56	15.7	5.5	10.2	9.2
	20	70.25	13.2	5.5	7.7	9.2
	25	60.90	11.4	5.5	5.9	8.9
5 YEAR	30	53.93	10.1	5.5	4.6	8.3
	35	48.52	9.1	5.5	3.6	7.6
	40	44.18	8.3	5.5	2.8	6.7

QUANTITY STORAGE REQUIREMENTS - 100 Year

0.08 **= Area(ha)**
1.00 **= *C**

Return Period	**Time (min)**	**Intensity (mm/hr)**	**Flow Q (L/s)**	**Controlled Runoff (L/s)**	**Net Runoff To Be Stored (L/s)**	**Storage Req'd m^3**
	15	142.89	29.8	5.5	24.3	21.9
	20	119.95	25.0	5.5	19.5	23.4
100 YEAR	25	103.85	21.7	5.5	16.2	24.2
	30	91.87	19.2	5.5	13.7	24.6
	35	82.58	17.2	5.5	11.7	24.6
	40	75.15	15.7	5.5	10.2	24.4
	45	69.05	14.4	5.5	8.9	24.0

Equations:
Flow Equation
$Q = 2.78 \times C \times I \times A$
Where:
C is the runoff coefficient
I is the intensity of rainfall, City of Ottawa IDF
A is the total drainage area

Conroy Business Park
Client:Conroy Business Park INC.
Project: OTT-00238830-A0

Prepared By: M.Lafleur
Date: July 2017

POST DEVELOPMENT DRAINAGE AREA POST5
STORAGE REQUIREMENTS

Post Dev run-off Coefficient "C"

			5 Year Event		100 Year Event	
Area	**Surface**	**Ha**	**"C"**	**C_{avg}**	**"C" x 1.25**	**$C_{100\ avg}$**
Total	Asphalt	0.055	0.90	**0.90**	1.00	**1.00**
0.06	Roof	0.000	0.90		1.00	
	Grass	0.000	0.25		0.31	

*Areas are approximate based on draft site plan

Runoff Coefficient Equation
$C = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{tot}$

QUANTITY STORAGE REQUIREMENTS - 5 Year

0.06 = Area(ha)
0.90 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Controlled Runoff (L/s)	Net Runoff To Be Stored (L/s)	Storage Req'd m^3
	15	83.56	11.5	4.0	7.5	6.7
	20	70.25	9.7	4.0	5.7	6.8
	25	60.90	8.4	4.0	4.4	6.6
5 YEAR	30	53.93	7.4	4.0	3.4	6.2
	35	48.52	6.7	4.0	2.7	5.6
	40	44.18	6.1	4.0	2.1	5.0

QUANTITY STORAGE REQUIREMENTS - 100 Year

0.06 = Area(ha)
1.00 = *C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Controlled Runoff (L/s)	Net Runoff To Be Stored (L/s)	Storage Req'd m^3
	15	142.89	21.8	4.0	17.8	16.1
	20	119.95	18.3	4.0	14.3	17.2
100 YEAR	25	103.85	15.9	4.0	11.9	17.8
	30	91.87	14.0	4.0	10.0	18.1
	35	82.58	12.6	4.0	8.6	18.1
	40	75.15	11.5	4.0	7.5	18.0
	45	69.05	10.6	4.0	6.6	17.7

Equations:
Flow Equation
$Q = 2.78 \times C \times I \times A$
Where:
C is the runoff coefficient
I is the intensity of rainfall, City of Ottawa IDF
A is the total drainage area

Conroy Business Park
Client:Conroy Business Park INC.
Project: OTT-00238830-A0

Prepared By: M.Lafleur
Date: July 2017

POST DEVELOPMENT DRAINAGE AREA POST6
STORAGE REQUIREMENTS

Post Dev run-off Coefficient "C"

			5 Year Event		100 Year Event	
Area	**Surface**	**Ha**	**"C"**	**C_{avg}**	**"C" x 1.25**	**$C_{100\ avg}$**
Total	Asphalt	0.056	0.90	**0.90**	1.00	**1.00**
0.06	Roof	0.000	0.90		1.00	
	Grass	0.000	0.25		0.31	

*Areas are approximate based on draft site plan

Runoff Coefficient Equation

$C = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{tot}$

QUANTITY STORAGE REQUIREMENTS - 5 Year

0.06 **= Area(ha)**
0.90 **= C**

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Controlled Runoff (L/s)	Net Runoff To Be Stored (L/s)	Storage Req'd m^3
	15	83.56	11.7	4.0	7.7	6.9
	20	70.25	9.8	4.0	5.8	7.0
	25	60.90	8.5	4.0	4.5	6.8
5 YEAR	30	53.93	7.6	4.0	3.6	6.4
	35	48.52	6.8	4.0	2.8	5.9
	40	44.18	6.2	4.0	2.2	5.3

QUANTITY STORAGE REQUIREMENTS - 100 Year

0.06 **= Area(ha)**
1.00 **= *C**

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Controlled Runoff (L/s)	Net Runoff To Be Stored (L/s)	Storage Req'd m^3
	15	142.89	22.2	4.0	18.2	16.4
	20	119.95	18.7	4.0	14.7	17.6
100 YEAR	25	103.85	16.2	4.0	12.2	18.3
	30	91.87	14.3	4.0	10.3	18.5
	35	82.58	12.9	4.0	8.9	18.6
	40	75.15	11.7	4.0	7.7	18.5
	45	69.05	10.7	4.0	6.7	18.2

Equations:

Flow Equation

$Q = 2.78 \times C \times I \times A$

Where:
C is the runoff coefficient
I is the intensity of rainfall, City of Ottawa IDF
A is the total drainage area

Conroy Business Park
Client:Conroy Business Park INC.
Project: OTT-00238830-A0

Prepared By: M.Lafleur
Date: July 2017

POST DEVELOPMENT DRAINAGE AREA POST7
STORAGE REQUIREMENTS

Post Dev run-off Coefficient "C"

			5 Year Event		100 Year Event	
Area	**Surface**	**Ha**	**"C"**	**C_{avg}**	**"C" x 1.25**	**$C_{100\ avg}$**
Total	Asphalt	0.058	0.90	**0.90**	1.00	**1.00**
0.06	Roof	0.000	0.90		1.00	
	Grass	0.000	0.25		0.31	

*Areas are approximate based on draft site plan

Runoff Coefficient Equation

$C = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{tot}$

QUANTITY STORAGE REQUIREMENTS - 5 Year

0.06 **= Area(ha)**
0.90 **= C**

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Controlled Runoff (L/s)	Net Runoff To Be Stored (L/s)	Storage Req'd m^3
	15	83.56	12.1	4.0	8.1	7.3
	20	70.25	10.2	4.0	6.2	7.4
	25	60.90	8.8	4.0	4.8	7.3
5 YEAR	30	53.93	7.8	4.0	3.8	6.9
	35	48.52	7.0	4.0	3.0	6.4
	40	44.18	6.4	4.0	2.4	5.8

QUANTITY STORAGE REQUIREMENTS - 100 Year

0.06 **= Area(ha)**
1.00 **= *C**

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Controlled Runoff (L/s)	Net Runoff To Be Stored (L/s)	Storage Req'd m^3
	15	142.89	23.0	4.0	19.0	17.1
	20	119.95	19.3	4.0	15.3	18.4
100 YEAR	25	103.85	16.7	4.0	12.7	19.1
	30	91.87	14.8	4.0	10.8	19.5
	35	82.58	13.3	4.0	9.3	19.6
	40	75.15	12.1	4.0	8.1	19.5
	45	69.05	11.1	4.0	7.1	19.3

Equations:

Flow Equation

$Q = 2.78 \times C \times I \times A$

Where:
C is the runoff coefficient
I is the intensity of rainfall, City of Ottawa IDF
A is the total drainage area

Conroy Business Park
Client:Conroy Business Park INC.
Project: OTT-00238830-A0

Prepared By: M.Lafleur
Date: July 2017

POST DEVELOPMENT DRAINAGE AREA POST8
STORAGE REQUIREMENTS

Post Dev run-off Coefficient "C"

			5 Year Event		100 Year Event	
Area	**Surface**	**Ha**	**"C"**	**C_{avg}**	**"C" x 1.25**	**$C_{100\ avg}$**
Total	Asphalt	0.064	0.90	**0.90**	1.00	**1.00**
0.06	Roof	0.000	0.90		1.00	
	Grass	0.000	0.25		0.31	

*Areas are approximate based on draft site plan

Runoff Coefficient Equation

$C = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{tot}$

QUANTITY STORAGE REQUIREMENTS - 5 Year

0.06 **= Area(ha)**
0.90 **= C**

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Controlled Runoff (L/s)	Net Runoff To Be Stored (L/s)	Storage Req'd m^3
	15	83.56	13.4	5.0	8.4	7.5
	20	70.25	11.2	5.0	6.2	7.5
	25	60.90	9.8	5.0	4.8	7.1
5 YEAR	30	53.93	8.6	5.0	3.6	6.5
	35	48.52	7.8	5.0	2.8	5.8
	40	44.18	7.1	5.0	2.1	5.0

QUANTITY STORAGE REQUIREMENTS - 100 Year

0.06 **= Area(ha)**
1.00 **= *C**

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Controlled Runoff (L/s)	Net Runoff To Be Stored (L/s)	Storage Req'd m^3
	15	142.89	25.4	5.0	20.4	18.4
	20	119.95	21.3	5.0	16.3	19.6
100 YEAR	25	103.85	18.5	5.0	13.5	20.2
	30	91.87	16.3	5.0	11.3	20.4
	35	82.58	14.7	5.0	9.7	20.4
	40	75.15	13.4	5.0	8.4	20.1
	45	69.05	12.3	5.0	7.3	19.7

Equations:

Flow Equation

$Q = 2.78 \times C \times I \times A$

Where:
C is the runoff coefficient
I is the intensity of rainfall, City of Ottawa IDF
A is the total drainage area

Conroy Business Park
Client:Conroy Business Park INC.
Project: OTT-00238830-A0

Prepared By: M.Lafleur
Date: July 2017

POST DEVELOPMENT DRAINAGE AREA POST9
STORAGE REQUIREMENTS

Post Dev run-off Coefficient "C"

			5 Year Event		100 Year Event	
Area	**Surface**	**Ha**	**"C"**	**C_{avg}**	**"C" x 1.25**	**$C_{100\ avg}$**
Total	Asphalt	0.040	0.90	**0.90**	1.00	**1.00**
0.04	Roof	0.000	0.90		1.00	
	Grass	0.000	0.25		0.31	

*Areas are approximate based on draft site plan

Runoff Coefficient Equation
$C = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{tot}$

QUANTITY STORAGE REQUIREMENTS - 5 Year

0.04 **= Area(ha)**
0.90 **= C**

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Controlled Runoff (L/s)	Net Runoff To Be Stored (L/s)	Storage Req'd m^3
5 YEAR	15	83.56	8.4	5.0	3.4	3.0
	20	70.25	7.0	5.0	2.0	2.4
	25	60.90	6.1	5.0	1.1	1.6
	30	53.93	5.4	5.0	0.4	0.7
	35	48.52	4.9	5.0	-0.1	-0.3
	40	44.18	4.4	5.0	-0.6	-1.4

QUANTITY STORAGE REQUIREMENTS - 100 Year

0.04 **= Area(ha)**
1.00 **= *C**

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Controlled Runoff (L/s)	Net Runoff To Be Stored (L/s)	Storage Req'd m^3
100 YEAR	15	142.89	15.9	5.0	10.9	9.8
	20	119.95	13.3	5.0	8.3	10.0
	25	103.85	11.5	5.0	6.5	9.8
	30	91.87	10.2	5.0	5.2	9.4
	35	82.58	9.2	5.0	4.2	8.8
	40	75.15	8.4	5.0	3.4	8.1
	45	69.05	7.7	5.0	2.7	7.2

Equations:
Flow Equation
$Q = 2.78 \times C \times I \times A$
Where:
C is the runoff coefficient
I is the intensity of rainfall, City of Ottawa IDF
A is the total drainage area

Conroy Business Park
Client:Conroy Business Park INC.
Project: OTT-00238830-A0

Prepared By: M.Lafleur
Date: July 2017
Rev Feb 2018

POST DEVELOPMENT DRAINAGE AREA POST10
STORAGE REQUIREMENTS

Post Dev run-off Coefficient "C"

			5 Year Event		100 Year Event	
Area	**Surface**	**Ha**	**"C"**	**C_{avg}**	**"C" x 1.25**	**$C_{100\ avg}$**
Total	Asphalt	0.000	0.90	**0.90**	1.00	**1.00**
0.09	Roof	0.087	0.90		1.00	
	Grass	0.000	0.25		0.31	

*Areas are approximate based on draft site plan

Runoff Coefficient Equation
$C = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{tot}$

QUANTITY STORAGE REQUIREMENTS - 5 Year

0.09 = Area(ha)
0.90 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Controlled Runoff (L/s)	Net Runoff To Be Stored (L/s)	Storage Req'd m^3
	15	83.56	18.2	3.2	15.0	13.5
	20	70.25	15.3	3.2	12.1	14.5
	25	60.90	13.3	3.2	10.1	15.1
5 YEAR	30	53.93	11.7	3.2	8.5	15.4
	35	48.52	10.6	3.2	7.4	15.5
	40	44.18	9.6	3.2	6.4	15.4

QUANTITY STORAGE REQUIREMENTS - 100 Year

0.09 = Area(ha)
1.00 = *C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Controlled Runoff (L/s)	Net Runoff To Be Stored (L/s)	Storage Req'd m^3
	15	142.89	34.6	3.8	30.8	27.7
	20	119.95	29.0	3.8	25.2	30.3
100 YEAR	25	103.85	25.1	3.8	21.3	32.0
	30	91.87	22.2	3.8	18.4	33.2
	35	82.58	20.0	3.8	16.2	34.0
	40	75.15	18.2	3.8	14.4	34.5
	45	69.05	16.7	3.8	12.9	34.8
	50	63.95	15.5	3.8	11.7	35.0
	55	59.62	14.4	3.8	10.6	35.0
	60	55.89	13.5	3.8	9.7	35.0
	65	52.65	12.7	3.8	8.9	34.8

Equations:
Flow Equation
$Q = 2.78 \times C \times I \times A$
Where:
C is the runoff coefficient
I is the intensity of rainfall, City of Ottawa IDF
A is the total drainage area

Conroy Business Park
Client:Conroy Business Park INC.
Project: OTT-00238830-A0

Prepared By: M.Lafleur
Date: July 2017

POST DEVELOPMENT DRAINAGE AREA POST11
STORAGE REQUIREMENTS

Post Dev run-off Coefficient "C"

			5 Year Event		100 Year Event	
Area	**Surface**	**Ha**	**"C"**	**C_{avg}**	**"C" x 1.25**	**$C_{100\ avg}$**
Total	Asphalt	0.000	0.90	**0.90**	1.00	**1.00**
0.11	Roof	0.110	0.90		1.00	
	Grass	0.000	0.25		0.31	

*Areas are approximate based on draft site plan

Runoff Coefficient Equation
$C = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{tot}$

QUANTITY STORAGE REQUIREMENTS - 5 Year

0.11 **= Area(ha)**
0.90 **= C**

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Controlled Runoff (L/s)	Net Runoff To Be Stored (L/s)	Storage Req'd m^3
	15	83.56	23.0	3.9	19.1	17.2
	20	70.25	19.3	3.9	15.4	18.5
	25	60.90	16.8	3.9	12.9	19.3
5 YEAR	30	53.93	14.8	3.9	10.9	19.7
	35	48.52	13.4	3.9	9.5	19.9
	40	44.18	12.2	3.9	8.3	19.8

QUANTITY STORAGE REQUIREMENTS - 100 Year

0.11 **= Area(ha)**
1.00 **= *C**

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Controlled Runoff (L/s)	Net Runoff To Be Stored (L/s)	Storage Req'd m^3
	15	142.89	43.7	4.7	39.0	35.1
	20	119.95	36.7	4.7	32.0	38.4
100 YEAR	25	103.85	31.8	4.7	27.1	40.6
	30	91.87	28.1	4.7	23.4	42.1
	35	82.58	25.3	4.7	20.6	43.2
	40	75.15	23.0	4.7	18.3	43.9
	45	69.05	21.1	4.7	16.4	44.3
	50	63.95	19.6	4.7	14.9	44.6
	55	59.62	18.2	4.7	13.5	44.7
	60	55.89	17.1	4.7	12.4	44.6
	65	52.65	16.1	4.7	11.4	44.5

Equations:
Flow Equation
$Q = 2.78 \times C \times I \times A$
Where:
C is the runoff coefficient
I is the intensity of rainfall, City of Ottawa IDF
A is the total drainage area

Conroy Business Park
Client:Conroy Business Park INC.
Project: OTT-00238830-A0

Prepared By: M.Lafleur
Date: July 2017
Revised: April 2018

POST DEVELOPMENT DRAINAGE AREA POST12
STORAGE REQUIREMENTS

Post Dev run-off Coefficient "C"

			5 Year Event		100 Year Event	
Area	**Surface**	**Ha**	**"C"**	**C_{avg}**	**"C" x 1.25**	**$C_{100\ avg}$**
Total	Asphalt	0.000	0.90	**0.90**	1.00	**1.00**
0.14	Roof	0.136	0.90		1.00	
	Grass	0.000	0.25		0.31	

*Areas are approximate based on draft site plan

Runoff Coefficient Equation
$C = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{tot}$

QUANTITY STORAGE REQUIREMENTS - 5 Year

0.14 **= Area(ha)**
0.90 **= C**

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Controlled Runoff (L/s)	Net Runoff To Be Stored (L/s)	Storage Req'd m^3
	15	83.56	28.4	5.4	23.0	20.7
	20	70.25	23.9	5.4	18.5	22.2
	25	60.90	20.7	5.4	15.3	22.9
5 YEAR	30	53.93	18.4	5.4	12.9	23.2
	35	48.52	16.5	5.4	11.1	23.2
	40	44.18	15.0	5.4	9.6	23.0

QUANTITY STORAGE REQUIREMENTS - 100 Year

0.14 **= Area(ha)**
1.00 **= *C**

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Controlled Runoff (L/s)	Net Runoff To Be Stored (L/s)	Storage Req'd m^3
	15	142.89	54.0	5.4	48.6	43.7
	20	119.95	45.4	5.4	39.9	47.9
100 YEAR	25	103.85	39.3	5.4	33.8	50.7
	30	91.87	34.7	5.4	29.3	52.7
	35	82.58	31.2	5.4	25.8	54.1
	40	75.15	28.4	5.4	23.0	55.1
	45	69.05	26.1	5.4	20.7	55.8
	50	63.95	24.2	5.4	18.7	56.2
	55	59.62	22.5	5.4	17.1	56.4
	60	55.89	21.1	5.4	15.7	56.5
	65	52.65	19.9	5.4	14.5	56.4
	70	49.79	18.8	5.4	13.4	56.2
	75	47.26	17.9	5.4	12.4	55.9

Equations:
Flow Equation
$Q = 2.78 \times C \times I \times A$
Where:
C is the runoff coefficient
I is the intensity of rainfall, City of Ottawa IDF
A is the total drainage area

Conroy Business Park
Client:Conroy Business Park INC.
Project: OTT-00238830-A0

PARKING LOT SURFACE STORAGE PROVIDED

Prepared By: M.Lafleur
Date: Septmebr 2017

5 Year Surface Ponding Volumes

Ponding Location	Surface Area (m^2)	Ponding Depth (m)	Volume (m^3)
CB101	192	0.15	9.6
CB102	205	0.15	10.3
CB103	165	0.15	8.2
CB104	175	0.15	8.8
CB105	135	0.15	6.8
CB106	176	0.15	8.8
CB107	163	0.15	8.2
CB108	154	0.15	7.7
CB109	59	0.15	3
Total Area	1424	***Total Volume***	***71.4***

100 Year Surface Ponding Volumes

Ponding Location	Surface Area (m^2)	Ponding Depth (m)	Volume (m^3)
CB101	423	0.30	42.3
CB102	476	0.30	47.6
CB103	479	0.30	47.9
CB104	427	0.30	42.7
CB105	318	0.30	31.8
CB106	356	0.30	35.6
CB107	354	0.3	35.4
CB108	312	0.30	31.2
CB109	163	0.30	16.3
Total Area	3308	***Total Volume***	***330.8***

Conroy Business Park
Client:Conroy Business Park INC.
Project: OTT-00238830-A0

Prepared By: M.Lafleur
Date: September 2017

POST DEVELOPMENT DRAINAGE AREA POST5 UNCONTROLLED FLOW

Runoff Coefficient Equation

$C = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{tot}$

$^*C = (A_{hard} \times 1.0 + A_{soft} \times 0.25)/A_{tot}$

*Runoff coefficients increased by 25% up to a maximum value of 1.00 for the 100-Year event

Post Dev run-off Coefficient "C"

			5 Year Event		100 Year Event	
Area	**Surface**	**Ha**	**"C"**	**C_{avg}**	**"C"+25%**	**$^*C_{avg}$**
Total	Asphalt	0.060	0.90	**0.40**	1.00	**0.47**
0.256	Roof	0.000	0.90		1.00	
	Grass	0.196	0.25		0.31	

Post Dev Free Flow

5 Year Event

Pre Dev.	C	Intensity	Area
5 Year	0.40	83.56	0.26
2.78CIA= 23.79			
23.8 L/S			

**Use a 15 minute time of concentration for 5 year

100 Year Event

Pre Dev.	C	Intensity	Area
100 Year	0.47	142.89	0.26
2.78CIA= 47.80			
47.8 L/S			

**Use a 15 minute time of concentration for 100 year

Equations:
Flow Equation
$Q = 2.78 \times C \times I \times A$
Where:
C is the runoff coefficient
I is the intensity of rainfall, City of Ottawa IDF
A is the total drainage area

Conroy Business Park
Client:Conroy Business Park INC.
Project: OTT-00238830-A0

Prepared By: M.Lafleur
Date:July 2017

Table A2 SEWER DESIGN SHEET-5 YEAR UNCONTROLLED FLOW

LOCATION		Area	R=						PROPOSED SEWER								
FROM	TO	(ha)		INDIV 2.78 AR	ACCUM 2.78 AR	TIME OF CONC.	RAINFALL INTENSITY I	PEAK FLOW Q (l/s)	TYPE OF PIPE	PIPE SIZE (mm)	PIPE SLOPE (%)	LENGTH (m)	CAPACITY (l/s)	FULL FLOW VELOCITY (m/s)	TIME OF FLOW (min.)	EXCESS CAPACITY (l/s)	Q/Qfull
BLDG	STMMH101	0.09	0.90	0.22	0.22	10.00	104.19	22.68	PVC	200.0	1.00	10.0	32.83	1.04	0.16	10.15	0.69
CB101	STMMH101	0.07	0.90	0.18	0.18	10.00	104.19	18.25	PVC	200.0	1.00	2.0	32.83	1.04	0.03	14.58	0.56
CB102	MAIN	0.07	0.90	0.19	0.19	10.00	104.19	19.29	PVC	200.0	1.00	2.0	32.83	1.04	0.03	13.54	0.59
CB103	MAIN	0.08	0.90	0.19	0.19	10.00	104.19	19.55	PVC	200.0	1.00	2.0	32.83	1.04	0.03	13.28	0.60
STMMH101	STMMH102				0.77	10.16	103.36	79.13	PVC	450.0	0.50	57.0	201.80	1.27	0.75	122.67	0.39
CB104	STMMH104	0.07	0.90	0.18	0.18	10.00	104.19	18.25	PVC	200.0	1.00	2.0	32.83	1.04	0.03	14.58	0.56
STMMH102	STMMH203				0.94	10.91	99.62	93.72	PVC	450.0	0.50	35.0	201.80	1.27	0.46	108.08	0.46
BLDG	STMMH205	0.11	0.90	0.28	0.28	10.00	104.19	28.68	PVC	200.0	1.00	11.0	32.83	1.04	0.18	4.16	0.87
CB108	STMMH205	0.06	0.90	0.16	0.16	10.00	104.19	16.68	PVC	200.0	1.00	2.0	32.83	1.04	0.03	16.15	0.51
CB107	MAIN	0.06	0.90	0.15	0.15	10.00	104.19	15.12	PVC	200.0	1.00	2.0	32.83	1.04	0.03	17.71	0.46
CB106	MAIN	0.06	0.90	0.15	0.15	10.00	104.19	15.38	PVC	200.0	1.00	2.0	32.83	1.04	0.03	17.45	0.47
STMMH205	STMMH203				0.73	10.18	103.27	75.19	PVC	375.0	0.50	39.0	124.10	1.12	0.58	48.91	0.61
CB105	STMMG203	0.06	0.90	0.14	0.14	10.00	104.19	14.34	PVC	200.0	1.00	2.0	32.83	1.04	0.03	18.49	0.44
BLDG	MAIN	0.14	0.90	0.34	0.34	10.00	104.19	35.45	PVC	200.0	2.00	10.0	46.43	1.48	0.11	10.98	0.76
CB109	MAIN	0.04	0.90	0.10	0.10	10.00	104.19	10.43	PVC	200.0	1.00	2.0	32.83	1.04	0.03	22.40	0.32
STMMH203	STMMH206				2.25	11.02	99.09	222.63	PVC	525.0	0.50	30.0	304.41	1.40	0.36	81.78	0.73
STMMH206	MAIN				2.25	11.38	97.44	218.92	PVC	525.0	0.50	10.0	304.41	1.40	0.12	85.48	0.72
TOTAL		**0.9**										**220.0**					

Conroy Business Park
Client:Conroy Business Park INC.
Project: OTT-00238830-A0

PRE-DEVELOPMENT FLOWS

Prepared By: M.Lafleur

TIME-OF-CONCENTRATION (Pre-Dev.)

AREA	Cpre	Length (m)	avg Length	Elev 1 (m)	Elev 2 (m)	Slope (%)	avg slope (%)	Calculated Tc (min)
1.16ha	0.50	120	112	85.43	84.25	0.98%	1.01%	20.6
	0.50	104		85.39	84.31	1.04%		

Notes:
1) Time-of-Concentration - FAA Equation: t (min) = 3.258 [(1.1 - C) L^0.5 / S^.33]
Where, L = Longest Watercourse Length, (m); S =Slope in %; C = Runoff Coef.

PEAK RUNOFF RATE

Area Description	Area (ha)	Tc (min)	Storm = 5 yr			Storm = 100 yr		
			I (mm/hr)	C_{avg}	Q (L/sec)	I (mm/hr)	C_{avg}	Q (L/sec)
PRE	1.1600	20.6	68.93	0.50	**111.15**	117.68	0.50	**189.7**

Notes
1) 5-Year Storm Intensity (mm/hr), $I = 998.071/(Tc+6.053)^{0.814}$ (City of Ottawa)
100-year Storm Intensity, $I = 1735.688 / (Tc + 6.199)^{0.810}$ (City of Ottawa)

HYDROVEX®

VHV/SVHV Vortex Flow Regulator

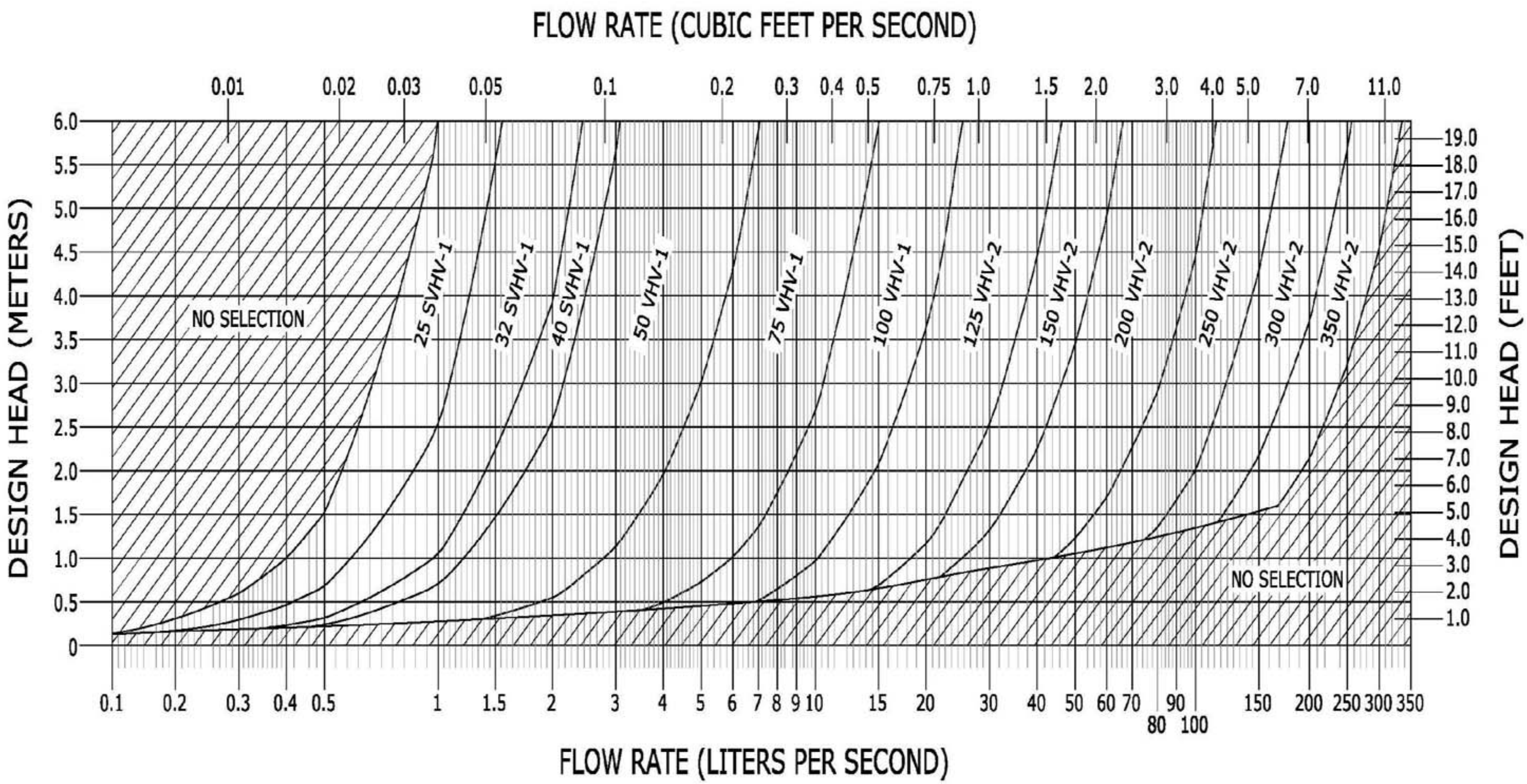


FIGURE 3

JOHN MEUNIER

Adjustable Accutrol Weir	Adjustable Flow Control for Roof Drains
Tag: ______________	

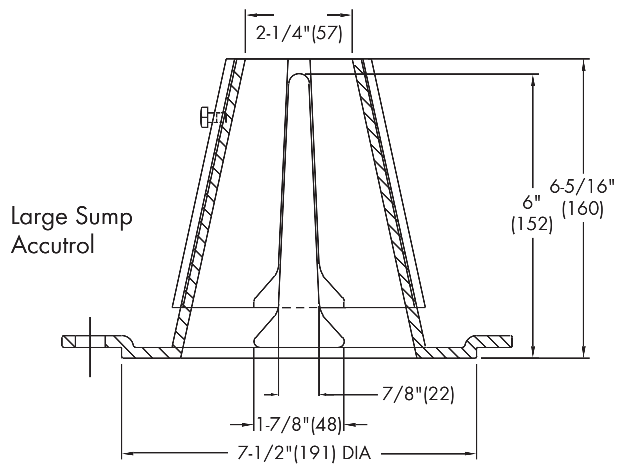
ADJUSTABLE ACCUTROL (for Large Sump Roof Drains only)

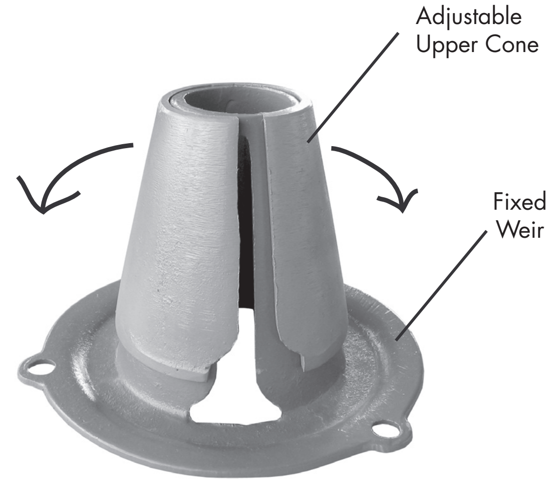
For more flexibility in controlling flow with heads deeper than 2", Watts Drainage offers the Adjustable Accutrol. The Adjustable Accutrol Weir is designed with a single parabolic opening that can be covered to restrict flow above 2" of head to less than 5 gpm per inch, up to 6" of head. To adjust the flow rate for depths over 2" of head, set the slot in the adjustable upper cone according to the flow rate required. Refer to Table 1 below.
Note: Flow rates are directly proportional to the amount of weir opening that is exposed.

EXAMPLE:

For example, if the adjustable upper cone is set to cover 1/2 of the weir opening, flow rates above 2"of head will be restricted to 2-1/2 gpm per inch of head.

Therefore, at 3"of head, the flow rate through the Accutrol Weir that has 1/2 the slot exposed will be:
[5 gpm (per inch of head) x 2 inches of head] + 2-1/2 gpm (for the third inch of head) = 12-1/2 gpm.





1/2 Weir Opening Exposed Shown Above

TABLE 1. Adjustable Accutrol Flow Rate Settings

Weir Opening Exposed	1"	2"	3"	4"	5"	6"
	Flow Rate (gallons per minute)					
Fully Exposed	5	10	15	20	25	30
3/4	5	10	13.75	17.5	21.25	25
1/2	5	10	12.5	15	17.5	20
1/4	5	10	11.25	12.5	13.75	15
Closed	5	5	5	5	5	5

Job Name ______________ Contractor ______________

Job Location ______________ Contractor's P.O. No. ______________

Engineer ______________ Representative ______________

A Watts Water Technologies Company

USA: Tel: (800) 338-2581 • Fax: (828) 248-3929 • Watts.com
Canada: Tel: (905) 332-4090 • Fax: (905) 332-7068 • Watts.ca
Latin America: Tel: (52) 81-1001-8600 • Fax: (52) 81-8000-7091 • Watts.com

Conroy Business Park
Client:Conroy Business Park INC.
Project: OTT-00238830-A0
Date: Feb 2018

ROOF DRAIN - Stormwater Management Summary

Building Drainage Area	Roof Drain Type	No Drains per Area	Runoff Coeff (Cavg)		Drainage Area		5-year Event									100-year Event									Storage Required *(Modified Rational Method)*		Maximium Storage Provided at Spill Elevation			
			5-year	100-year	m^2	ha	Runoff Rate (L/sec)	5yr Ponding Depth (mm)	Ponding Depth at Drain (mm)	5 Year Ponding Volume Provided (m3)	Roof Drain Capacity Per Drain (L/sec)	Total Flow From Roof Drains (L/sec)	Depth of Overlflow Above Drain (mm)	Flow From Overflow (L/sec)	Total Flow Roof Drain + Overflow Drain (L/sec)	Runoff Rate (L/sec)	100yr Pondin g Depth (mm)	Ponding Depth at Drain (mm)	100 Year Ponding Volume Provided (m3)	Roof Drain Capacity Per Drain (L/sec)	Total Flow From Roof Drains (L/sec)	Depth of Overlflow Above Drain (mm)	Flow From Overflow (L/sec)	Total Flow Roof Drain + Overflow Drain (L/sec)	5-year (m^3)	100-year (m^3)	Area Available for Storage (m^2)	RD Depth Below Lowpoint	Max Prism Depth (mm)	Max Prisim Volume (m^3)
Post 10	RD-200-A-ADJ	4	0.90	1.00	870	0.0870	22.7	100	100	19	0.79	3.2			3.2	43.2	150	150	44	0.95	3.8			3.8	15.56	35.09	870.0	-150	150	43.5
Post 11	RD-200-A-ADJ	5	0.90	1.00	1100	0.1100	28.7	100	100	24	0.79	3.9			3.9	54.6	150	150	55	0.95	4.7			4.7	19.77	44.55	1,100.0	-150	150	55.0
Totals					**1,970**	**0.1970**	**51.4**				**1.58**	**7.10**			**7.10**	**97.8**				**1.89**	**8.52**			**8.52**	**35.32**	**79.65**	**1970**			**98.5**

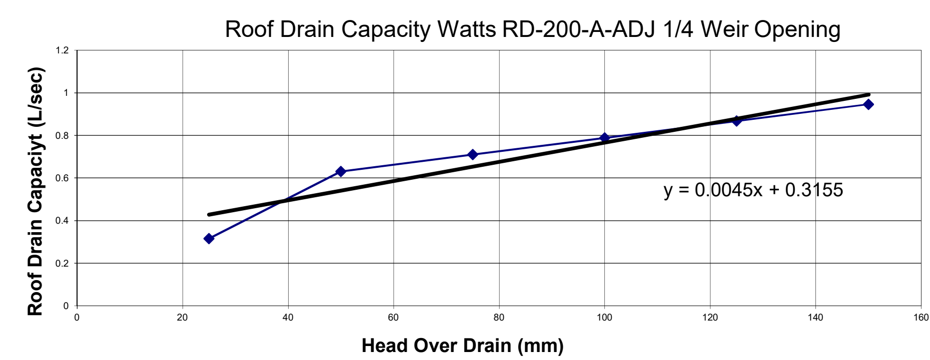
Runoff Based on the Following:

Time of Conc (mins) =	10	10
Storm Frequency (years) =	5	100
Storm Intensity (mm/hr) =	104.19	178.56

Roof Drain Types
RD-200-A-ADJ 1/4 Weir Opening

Roof Drains have follwing Flow Rates:

Head (mm)	25	50	75	100	125	150
weir opening	1/4	1/4	1/4	1/4	1/4	1/4
Flow Rate (uspgm)	5	10	11.25	12.5	13.75	15
Flow Rate (L/sec)	0.31545098	0.6309	0.709765	0.7886275	0.8674902	0.9463529
Eqn for Flow, Q at depth, d	Q = 0.0045 * d + 0.3155					



Conroy Business Park
Client:Conroy Business Park INC.
Project: OTT-00238830-A0
Date: Feb 2018

Building Drainage Area Post 10 Roof Storage Required

5yr C_{AVG} = 0.90 (dimmensionless)
100yr C_{AVG} = 1.00
Time Interval = 5 (mins)
Drainage Area = 0.08700 (hectares)

	5-year					100-year				
	Release Rate = **3.155** (L/sec)					Release Rate = **3.7854** (L/sec)				
	Return Period = 5 (years)					Return Period = 100 (years)				
	IDF Parameters, A = 998.071, B = 0.814					IDF Parameters, A = 1735.688, B = 0.820				
	($I = A/(T_c+C)$), C = 6.053					($I = A/(T_c+C)$), C = 6.014				
Duration (min)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)
1	203.5	44.3	3.15	41.1	2.47	351.4	85.0	3.785	81.2	4.87
6	131.6	28.6	3.15	25.5	9.17	226.0	54.7	3.785	50.9	18.32
11	99.2	21.6	3.15	18.4	12.17	169.9	41.1	3.785	37.3	24.62
16	80.5	17.5	3.15	14.4	13.79	137.5	33.3	3.785	29.5	28.30
21	68.1	14.8	3.15	11.7	14.71	116.3	28.1	3.785	24.3	30.67
26	59.3	12.9	3.15	9.8	15.23	101.2	24.5	3.785	20.7	32.27
31	52.7	11.5	3.15	8.3	15.49	89.8	21.7	3.785	17.9	33.37
36	47.6	10.4	3.15	7.2	15.56	81.0	19.6	3.785	15.8	34.12
41	43.4	9.5	3.15	6.3	15.49	73.8	17.9	3.785	14.1	34.62
46	40.0	8.7	3.15	5.6	15.32	68.0	16.4	3.785	12.7	34.92
51	37.1	8.1	3.15	4.9	15.07	63.0	15.2	3.785	11.5	35.07
56	34.7	7.5	3.15	4.4	14.75	58.8	14.2	3.785	10.4	35.09
61	32.5	7.1	3.15	3.9	14.38	55.2	13.4	3.785	9.6	35.02
66	30.7	6.7	3.15	3.5	13.96	52.0	12.6	3.785	8.8	34.86
71	29.1	6.3	3.15	3.2	13.51	49.3	11.9	3.785	8.1	34.63
76	27.6	6.0	3.15	2.9	13.02	46.8	11.3	3.785	7.5	34.33
81	26.3	5.7	3.15	2.6	12.51	44.6	10.8	3.785	7.0	33.99
86	25.1	5.5	3.15	2.3	11.96	42.6	10.3	3.785	6.5	33.60
91	24.1	5.2	3.15	2.1	11.40	40.8	9.9	3.785	6.1	33.16
96	23.1	5.0	3.15	1.9	10.82	39.1	9.5	3.785	5.7	32.69
101	22.2	4.8	3.15	1.7	10.22	37.6	9.1	3.785	5.3	32.19
106	21.4	4.7	3.15	1.5	9.60	36.2	8.8	3.785	5.0	31.65
111	20.7	4.5	3.15	1.3	8.97	35.0	8.5	3.785	4.7	31.10
116	20.0	4.4	3.15	1.2	8.32	33.8	8.2	3.785	4.4	30.51
121	19.3	4.2	3.15	1.1	7.67	32.7	7.9	3.785	4.1	29.90
Max =					**15.56**					**35.09**

Notes
1) Peak flow is equal to the product of 2.78 x C x I x A
2) Rainfall Intensity, $I = A/(Tc+C)^B$
3) Release Rate = Min (Release Rate, Peak Flow)
4) Storage Rate = Peak Flow - Release Rate
5) Storage = Duration x Storage Rate
6) Maximium Storage = Max Storage Over Duration

Conroy Business Park
Client:Conroy Business Park INC.
Project: OTT-00238830-A0
Date: Feb 2018

Building Drainage Area Post 11 Roof Storage Required

5yr C_{AVG} = 0.90 (dimmensionless)
100yr C_{AVG} = 1.00
Time Interval = 5 (mins)
Drainage Area = 0.11000 (hectares)

	5-year	100-year
Release Rate =	3.943 (L/sec)	4.7318 (L/sec)
Return Period =	5 (years)	100 (years)
IDF Parameters, A =	998.071	1735.688
, B =	0.814	0.820
, C =	6.053	6.014
($I = A/(T_c+C)$)		

Duration (min)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)
1	203.5	56.0	3.94	52.1	3.12	351.4	107.5	4.732	102.7	6.16
6	131.6	36.2	3.94	32.3	11.62	226.0	69.1	4.732	64.4	23.18
11	99.2	27.3	3.94	23.4	15.42	169.9	52.0	4.732	47.2	31.17
16	80.5	22.1	3.94	18.2	17.47	137.5	42.1	4.732	37.3	35.84
21	68.1	18.8	3.94	14.8	18.66	116.3	35.6	4.732	30.8	38.85
26	59.3	16.3	3.94	12.4	19.33	101.2	30.9	4.732	26.2	40.89
31	52.7	14.5	3.94	10.6	19.66	89.8	27.5	4.732	22.7	42.29
36	47.6	13.1	3.94	9.2	19.77	81.0	24.8	4.732	20.0	43.26
41	43.4	11.9	3.94	8.0	19.70	73.8	22.6	4.732	17.8	43.90
46	40.0	11.0	3.94	7.1	19.50	68.0	20.8	4.732	16.1	44.30
51	37.1	10.2	3.94	6.3	19.19	63.0	19.3	4.732	14.5	44.50
56	34.7	9.5	3.94	5.6	18.80	58.8	18.0	4.732	13.3	44.55
61	32.5	9.0	3.94	5.0	18.35	55.2	16.9	4.732	12.2	44.47
66	30.7	8.4	3.94	4.5	17.84	52.0	15.9	4.732	11.2	44.29
71	29.1	8.0	3.94	4.1	17.27	49.3	15.1	4.732	10.3	44.01
76	27.6	7.6	3.94	3.7	16.67	46.8	14.3	4.732	9.6	43.66
81	26.3	7.2	3.94	3.3	16.03	44.6	13.6	4.732	8.9	43.24
86	25.1	6.9	3.94	3.0	15.36	42.6	13.0	4.732	8.3	42.76
91	24.1	6.6	3.94	2.7	14.66	40.8	12.5	4.732	7.7	42.23
96	23.1	6.4	3.94	2.4	13.94	39.1	12.0	4.732	7.2	41.65
101	22.2	6.1	3.94	2.2	13.19	37.6	11.5	4.732	6.8	41.03
106	21.4	5.9	3.94	2.0	12.42	36.2	11.1	4.732	6.3	40.37
111	20.7	5.7	3.94	1.7	11.64	35.0	10.7	4.732	6.0	39.68
116	20.0	5.5	3.94	1.6	10.84	33.8	10.3	4.732	5.6	38.96
121	19.3	5.3	3.94	1.4	10.02	32.7	10.0	4.732	5.3	38.21
Max =					**19.77**					**44.55**

Notes
1) Peak flow is equal to the product of 2.78 x C x I x A
2) Rainfall Intensity, $I = A/(Tc+C)^B$
3) Release Rate = Min (Release Rate, Peak Flow)
4) Storage Rate = Peak Flow - Release Rate
5) Storage = Duration x Storage Rate
6) Maximium Storage = Max Storage Over Duration

Marc Alain Lafleur

From: Alam Ansari
Sent: Monday, July 17, 2017 9:42 AM
To: Marc Alain Lafleur
Subject: FW: 2500 St. Laurent

Follow Up Flag: Follow up
Flag Status: Flagged

Alam Ansari, M.Sc., P. Eng.
Senior Project Manager
Infrastructure Services
t: 613.688.1899 x3254 | c: 613-864-6833 | e: alam.ansari@**exp**.com
100-2650 Queensview Drive
Ottawa, ON K2B 8H6

From: Jamie Batchelor [mailto:jamie.batchelor@rvca.ca]
Sent: Monday, May 08, 2017 1:31 PM
To: Alam Ansari <alam.ansari@exp.com>
Subject: RE: 2500 St. Laurent

Good Afternoon Alam,

This site is within the catchment area for the McEwan Creek Stormwater Management Facility. Storm run off from this site would be directed to the storm sewers on St. Laurent Street and ultimately through to the East Community Trunk Storm which outlets to the McEwan Creek Stormwater Management Facility. This downstream facility provides the required water quality controls, therefore no additional onsite water quality controls would be required.

From: Alam Ansari [mailto:alam.ansari@exp.com]
Sent: Tuesday, May 02, 2017 3:58 PM
To: Jamie Batchelor <jamie.batchelor@rvca.ca>
Subject: 2500 St. Laurent

Hi Jamie:

We are working on the site servicing and SWM design for the proposed offices development at the above mentioned site and would like to know whether there is any water quality requirement for connection of the storm service connection to the City sewer main.

A copy of the site plan is attached.

Thank you

Alam Ansari, M.Sc., P. Eng.
Senior Project Manager
Infrastructure Services
t: 613.688.1899 x3254 | c: 613-864-6833 | e: alam.ansari@**exp**.com
100-2650 Queensview Drive
Ottawa, ON K2B 8H6

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Appendix B – Water

Boundary Condition for 2500 Saint-Laurent

Fire Flow Design Sheet

Project No. OTT-00238830

Date: 1-May-17

Building Design Assumptions - Sprinklered, Non-Combustible

1. An estimate of the Fire Flow required for a given fire area may be estimated by: $F = 220\,C\sqrt{A}$

F = required fire flow in litres per minute
C = coefficient related to the type of construction
- 1.5 for wood construction (structure essentially combustible)
- 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior)
- 0.8 for noncombustible construction (unprotected metal structural components, masonry or metal walls)
- 0.6 for fire-resistive construction (fully protected frame, floors, roof)

A = total floor area in square metres (including all storeys, but excluding basements at least 50% below grade)

A = 1200 m^2
C = 1.5
F = 11431.5 L/min

rounded off to 12,000 L/min (min value of 2000 L/min)

2. The value obtained in 1. may be reduced by as much as 25% for occupancies having a low contents fire hazard.

Non-combustible	-25%
Limited Combustible	-15%
Combustible	0%
Free Burning	15%
Rapid Burning	25%

Reduction due to low occupancy hazard -15% x 12,000 = 10,200 L/min

3. The value obtained in 2. may be reduced by as much as 75% for buildings equipped with automatic sprinkler protection.

Non-combustible c/w Automatic Sprinkler System	-75%
Combustible c/w Automatic Sprinkler System	-50%
No Automatic Sprinkler System	0%

Reduction due to Sprinkler System 0% x 10,200 = 10,200 L/min

4. The value obtained in 3. may be increased for structures exposed within 45 metres by the fire area under consideration.

Separation	Charge
0 to 3 m	25%
3.1 to 10 m	20%
10.1 to 20 m	15%
20.1 to 30 m	10%
30.1 to 45 m	5%

Side 1	15	15%	north side
Side 2	100	0%	east side
Side 3	100	0%	south side
Side 4	100	0%	west side
		15%	(Total shall not exceed 75%)

Increase due to separation 15% x 10,200 = 11,730 L/min

The fire flow requirement is 11,800 L/min
or **197 L/sec**
or 3,117 gpm (us)
or 2,596 gpm (uk)

Based on method described in:
"Water Supply for Public Fire Protection - A Guide to Recommended Practice", 1991
by Fire Underwriters Survey

Marc Alain Lafleur

From:	Oram, Cody <Cody.Oram@ottawa.ca>
Sent:	Tuesday, May 9, 2017 11:22 AM
To:	Marc Alain Lafleur
Cc:	Alam Ansari
Subject:	RE: 2500 Saint Laurent Blvd - Request for Water Boundary Conditions
Attachments:	2500 St-Laurent May 2017.pdf

Hi Marc,

The following are boundary conditions, HGL, for hydraulic analysis at 2500 St-Laurent (zone 2C) assumed to be connected to the 350mm on St-Laurent (see attached PDF for location).

Minimum HGL = 122.6m

Maximum HGL = 131.4m

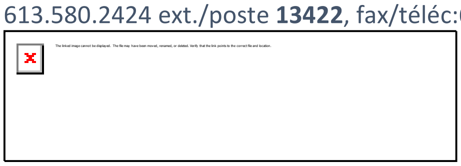
MaxDay (0.6 L/s) + FireFlow (197 L/s) = 124.5m

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

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

Regards,

Cody Oram, P.Eng. Senior Engineer
Development Review, South Services
Planning, Infrastructure and Economic Development Department | Services de planification, d'infrastructure et de développement économique
City of Ottawa | Ville d'Ottawa
110 Laurier Avenue West. Ottawa, ON | 110, avenue. Laurier Ouest. Ottawa (Ontario) K1P 1J1
613.580.2424 ext./poste **13422**, fax/téléc:613-580-2576, cody.oram@ottawa.ca



From: Marc Alain Lafleur [mailto:MarcAlain.Lafleur@exp.com]
Sent: Friday, May 05, 2017 11:27 AM
To: Oram, Cody <Cody.Oram@ottawa.ca>
Cc: Alam Ansari <alam.ansari@exp.com>
Subject: RE: 2500 Saint Laurent Blvd - Request for Water Boundary Conditions

Hi Cody,

We have reviewed the fire flow calculations and the fire flow required for the site is 197L/s.

Thank you,

Marc Alain Lafleur, M.Eng. | exp
EIT-Design Engineer, Infrastructure
exp Services Inc.
t: +1.613.688.1899 x3298 **|** e: marcalain.lafleur@exp.com
100-2650 Queensview Drive
Ottawa, ON K2B 8H6
Canada

From: Oram, Cody [mailto:Cody.Oram@ottawa.ca]
Sent: Wednesday, May 03, 2017 8:28 AM
To: Marc Alain Lafleur <MarcAlain.Lafleur@exp.com>
Cc: Alam Ansari <alam.ansari@exp.com>
Subject: RE: 2500 Saint Laurent Blvd - Request for Water Boundary Conditions

Hi Marc,
Can you confirm the fire flow required is 338L/s, that seems high and would require multiple on-site hydrants to achieve that rate.

Thanks,
Cody

From: Marc Alain Lafleur [mailto:MarcAlain.Lafleur@exp.com]
Sent: Tuesday, May 02, 2017 2:01 PM
To: Oram, Cody <Cody.Oram@ottawa.ca>
Cc: Alam Ansari <alam.ansari@exp.com>
Subject: 2500 Saint Laurent Blvd - Request for Water Boundary Conditions

Hello Cody,

Can you please provide the water boundary conditions for 2500 St Laurent Blvd?
The attached map identifies the anticipated location of the connection to the 300mm diameter watermain on Saint Laurent Blvd.
The proposed development consists of two-storey office buildings.
The amount of fire flow required is of **338L/s** (as per FUS, 1999)
Average daily demand: **0.4L/s**
Max Day Demand: **0.6L/S**
Max hourly daily demand: **1.1L/s**

Thank you,

Marc Alain Lafleur, M.Eng.
EIT-Design Engineer, Infrastructure
exp Services Inc.
t: +1.613.688.1899 x3298 **|** e: marcalain.lafleur@exp.com
100-2650 Queensview Drive
Ottawa, ON K2B 8H6
Canada

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Conroy Business Park

Client:Conroy Business Park INC.

Project: OTT-00238830-A0

Prepared By: M.Lafleur

Date: February 2018

Max day(0.6L/s) + FireFlow(197L/s) HGL= 124.5 m

Max HGL= 131.4 m

Min HGL= 122.6 m

Table B1 Pressure Analysis

Description	From	To	Flow (L/sec)	Pipe Dia (mm)	Dia (m)	Q (m^3/sec)	Area (m2)	C	Vel (m/s)	Slope of HGL (m/m)	Pipe Length (m)	Frictional Head Loss h_f (m)	Equivalent Pipe Length of Fittings (m)	Minor Loss of Fittings h_b (m)	Total Losses (m) $h_b + h_f$	Start Ground Elev(m)	End Ground Elev (m)	Static Head (m)	Pressure From kPa	(psi)	Pressure To kPa	(psi)	Pressure Drop (psi)
Max Day + Fire Flow	Main	Fire Hydrant	197.6	200	0.200	0.1976	0.031	125	6.2898	0.175525	101	17.73	34.0	5.96785	23.69587	85.35	85.50	-0.15	383.9	(55.7)	150.1	(21.8)	33.9
Min HGL	Main	Building #2	1.1	200	0.200	0.0011	0.031	125	0.035	0.000012	125	0.00	46.0	0.00054	0.00201	85.35	85.80	-0.45	365.3	(53.0)	360.9	(52.3)	0.6
	Building #2	2nd floor	1.1	50	0.050	0.0011	0.002	125	0.5602	0.010028	10	0.10	0.0	0.00000	0.10028	85.80	89.50	-3.70	360.9	(52.3)	323.6	(46.9)	5.4

Resistance of Fittings and Valves for 200mm WM From Main to Hydrant

Fittings	Loss in Equiv. Length in Pipe Diameters	Equiv. Length (metres)	Quantity (each)	Total Equiv. Length (m)
Standard 90^0 Elbow	32	6.40	3	19.2
11.25 Degree Elbow	8	1.60	1	1.6
22.5 Degree Elbow	12	2.40	2	4.8
45 Degree Elbow	16	3.20	1	3.2
Gate Valve Full -Open	13	2.60	2	5.2
		Total:	**9**	**34**

Resistance of Fittings and Valves for 200mm WM From Main to Building

Fittings	Loss in Equiv. Length in Pipe Diameters	Equiv. Length (metres)	Quantity (each)	Total Equiv. Length (m)
Standard 90	32	6.40	3	19.2
11.25 Degre	8	1.60	3	4.8
22.5 Degree	12	2.40	3	7.2
45 Degree E	16	3.20	3	9.6
Gate Valve	13	2.60	2	5.2
		Total:	**14**	**46**