115 ECHO DRIVE
OTTAWA, ONTARIO

SERVICING BRIEF AND STORMWATER MANAGEMENT REPORT

Prepared for:

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August 2015
(Revised August 23, 2018)

Novatech File: 115105
Ref. No: R-2015-130

NOVATECH
Engineers, Planners & Landscape Architects

August 23, 2018 COURIER

City of Ottawa
Planning and Growth Management Department
Development Review (Urban) Branch
110 Laurier Street West, 4th Floor
Ottawa, ON K1P 1J1

Attention: **Mr. Andrew McCreight, MCIP, RPP**
Planner II

Dear Sir:

Reference: **115 Echo Drive**
Servicing Design Brief
Our File No.: 115105

Enclosed herein is the Servicing Brief and Stormwater Management Report for the proposed development located at 115 Echo Drive. This report is submitted in support of the Site Plan Control submission. It outlines how the site will be serviced with sanitary sewer, storm sewer and watermain.

Should you have any questions, or require additional information, please contact me.

Yours truly,

NOVATECH

Bassam Bahia, M.Eng., P.Eng.
Project Manager I Land Development

/bs

cc: Annibale Ferro, Uniform Urban Developments

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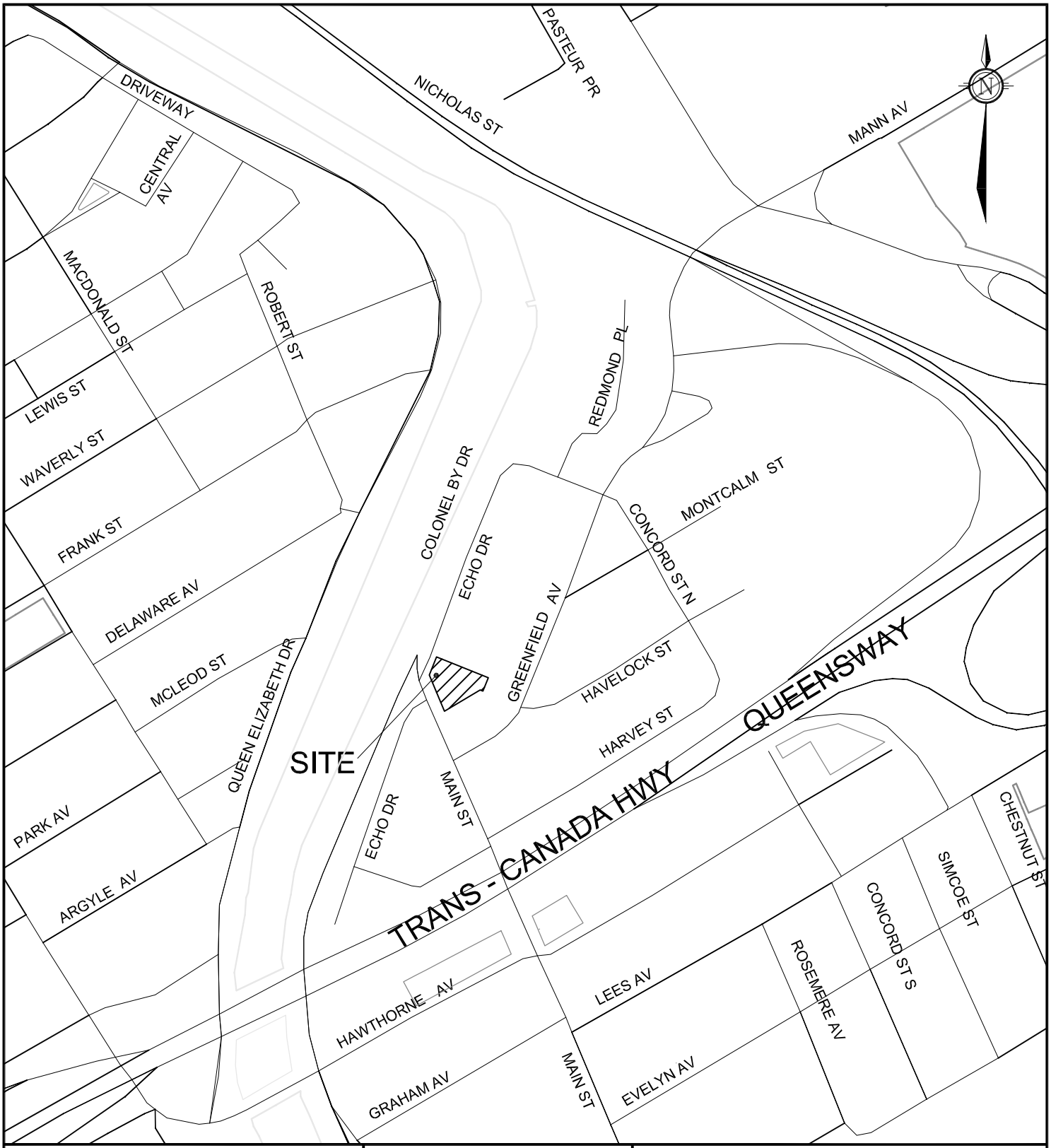
115105-GP General Plan of Services
115105-GR Grading Plan
115105-STM Storm Drainage Plan
115105-CUP Composite Utility Plan
115105-TCR1 Tree Conservation Plan
115105-L1 Layout & Surfacing Plan
115105-L2 Planting Plan
115105-L3 Landscape Details

1.0 INTRODUCTION

The development planned at 113 and 115 Echo Drive (Subject Site) is located on the north-east corner of Main Street and Echo Drive in the City of Ottawa, as shown in **Figure 1**. The Subject Site will consist of a six-storey mid-rise condominium building with forty apartment/ condominium units on Floors 1 to 6. Two levels of underground parking will be provided with access off Echo Drive at the north side of the building.

The Subject Site's area is approximately 0.154 hectares. New construction will replace a one storey building which contains a Community Center/Church and a two-storey detached residential dwelling, and a large shared paved parking area. The existing buildings have an access onto Main Street and Echo Drive. Access on Main Street is for the shared parking and the Echo Drive access is a paved laneway. The existing conditions are shown in **Figure 2** and **Figure 3**.

This servicing design brief will outline how the Subject Site will be serviced with sanitary sewer, storm sewer and watermain. A general plan of services and grading plan of the proposed development is included in the back of this report.



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KEY PLAN

CITY OF OTTAWA

115 ECHO DRIVE

DATE	JOB	FIGURE
JULY 2018	115105	FIG 1

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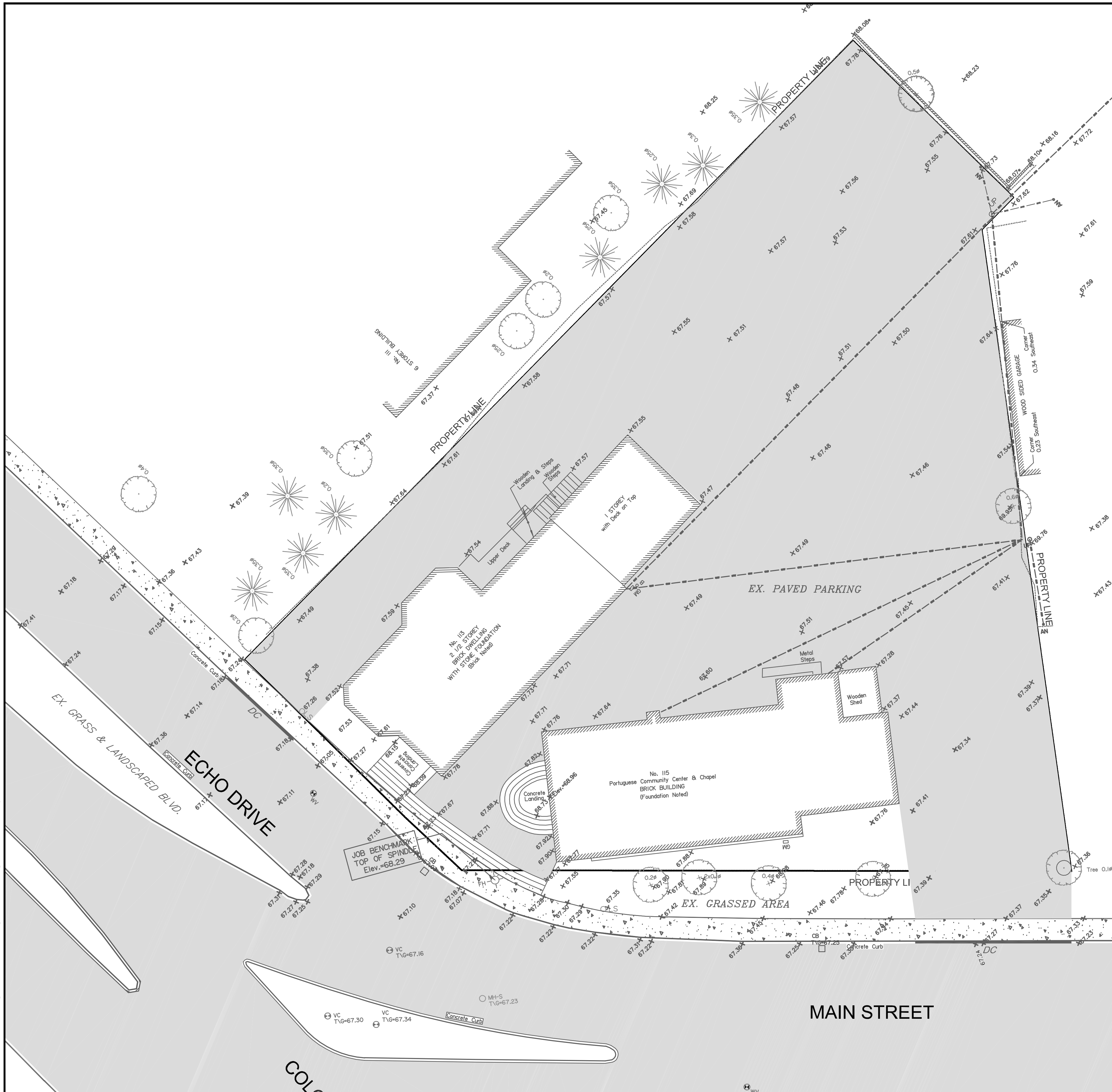

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115 ECHO DRIVE

EXISTING CONDITIONS

SCALE 1 : 250

DATE JULY 2018 | JOB 115105 | FIGURE FIG 2

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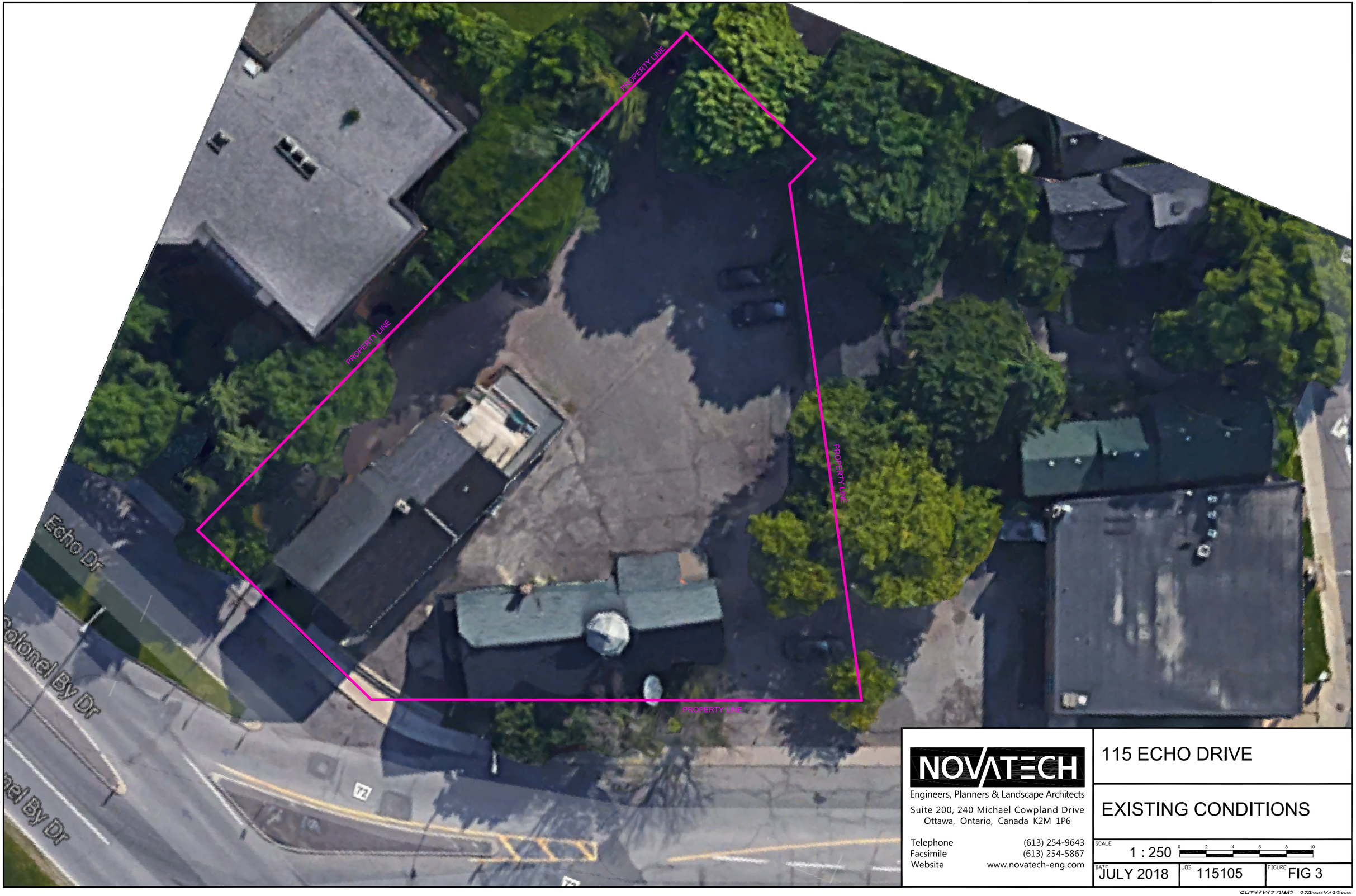

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115 ECHO DRIVE

EXISTING CONDITIONS

SCALE 1 : 250 (0 2 4 6 8 10)

DATE JULY 2018 | JOB 115105 | FIGURE FIG 3

SHT11X17.DWG 279mmX432mm

2.0 REFERENCES AND SUPPORTING DOCUMENTS

2.1 Guidelines and Supporting Studies

The following guidelines and supporting documents were utilized in the preparation of this report:

1. **City of Ottawa Water Distribution Guidelines** (OWDG)
   City of Ottawa, October 2012.

2. **Revisions to OWDG** (ISTB-2010-01, ISTB-2014-02 & ISTB-2018-02)
   City of Ottawa, December 2010, May 2014, and March 2018.

3. **City of Ottawa Sewer Design Guidelines** (OSDG)
   City of Ottawa, October 2012.

4. **Revisions to OSDG** (ISTB-2016-02 & ISTB-2018-01)
   City of Ottawa, September 2016 and March 2018.

5. **City of Ottawa Stormwater Management Facility Design Guidelines** (OSWMFDG)
   City of Ottawa, Draft October 2012.

6. **Design Guidelines for Sewage Works and Drinking Water System** (MOE Guidelines)
   Ontario's Ministry of the Environment, 2008.

The City of Ottawa Servicing Study Guidelines for Development Applications checklist has been completed and is provided in **Appendix D**.

2.2 Geotechnical Investigations

The following geotechnical studies were utilized in the preparation of this report:

1. **Geotechnical Investigation – Proposed Multi-Storey Building 113 and 115 Echo Drive Ottawa, Ontario** (Geotechnical Investigation)
   Paterson Group, January 2014, Report No. PG3142-1.

Based on the above geotechnical studies, it is not anticipated that there will be any detrimental geotechnical concerns with respect to servicing the proposed development.

3.0 MAIN STREET RE-CONSTRUCTION

3.1 Existing Conditions of Main Street

Main Street fronting the Subject Site currently has the following municipal services:

- 375mm diameter combined sewer
- 200mm diameter watermain
- 400mm diameter watermain

3.2 Proposed Reconstruction of Main Street

As part of the Main Street Reconstruction initiative by the City, a sewer separation and replacement program is to abandon the existing 375mm diameter combined sewer with a 450mm diameter storm and a 250mm diameter sanitary sewer fronting the Subject Site. Further modifications such as roadway realignment and 2.0m sidewalk are also being proposed fronting the Subject Site, however it should be noted the timeline for the stretch of Main Street from Harvey Street to Colonel By Drive has yet to be verified.

This report considers the connection of the service laterals to the existing infrastructure along Main Street, with provisions for connecting to the future separated services based on the Main Street 2014 preliminary design.

4.0 STORM DRAINAGE AND STORMWATER MANAGEMENT

4.1 Study Objectives

The City will require that on-site stormwater management be implemented to control post-development stormwater discharge for the 2-year, 10-year, and 100-year storm events. Although sewer upgrades are currently underway along Main Street, the Subject Site will be connecting to the combined sewer in the interim and as such the allowable release rate will be established on this basis. Stormwater management will be achieved using storage in the rear yard, and on the roof of the Subject Site.

4.2 Pre-development Conditions

4.2.1 Existing Conditions

The Subject Site currently consists of a paved parking surface and two buildings. The Subject Site's pre-development flows are generated by a significant amount of hard surface area, totaling 90% of the parcel. Drainage from the Subject Site sheet drains to public roadways to the combined sewer on Main Street. Existing conditions are shown in **Figure 2** and **Figure 3**.

4.2.2 Criteria and Allowable Release Rate

The City requires that on-site stormwater management be implemented to control post-development stormwater discharge for the 100-year storm event to the applicable pre-development storm event.

The interim servicing consist of connecting the Subject Site's storm service to the existing 375mm diameter combined sewer. The allowable release rate was determined using a runoff coefficient (C) of 0.40 (pre-development), a time of concentration (T_c) of 10 minutes, and a 2-year storm control. The allowable release rate was determined as follows:

Total Drainage Area (A) = 0.154 ha
Runoff Coefficient (C) = 0.40
Intensity (I_2) = 76.81 mm/hr

$Q_{allow\ (interim)}$ = 2.78 CIA
$Q_{allow\ (interim)}$ = 2.78 x 0.40 x 76.81 mm/hr x 0.154 ha
$Q_{allow\ (interim)}$ = 13.15 L/s

Notwithstanding the above, it is important to note that due to the Subject Site's current condition and significant impervious (C of 0.875), the current release rate is in the magnitude of 26L/s, which is twice the allowable rate. The foregoing should be considered and contemplate a degree of flexibility should the interim release rate be exceeded, as the Subject Site's post-development released flow rate would provide a substantial reduction in flow and inherent stormwater storage when comparing post-development conditions to the existing pre-development conditions.

Allowable Release Rate

The allowable release rate for the proposed 0.154 ha development was calculated using the Rational Method to be 13.15 L/s. To meet this release rate, stormwater flows from the Subject Site will consist of uncontrolled direct runoff and controlled flows. The Subject Site will be graded such that flows in excess of the 100-year storm event will be conveyed overland to Echo Drive and Main Street.

4.3 Post-Development Conditions

4.3.1 Development Proposal

Due to the extent of hard surfaced areas and limited allowable release rate from the Subject Site, there will be storage utilized in the rear yard surface, and on the roof of the proposed building, for up to and including the 1:100-year design event.

4.3.2 Post-Development Flow

The post-development flow from the building consists of controlled flow from the building roof, and the landscaped rear yard terraces, and uncontrolled overland flows at the front of the building. Refer to the Storm Drainage Area Plan (Drawing 115105-STM) for details and drainage areas.

Area A-1: Uncontrolled Areas

The areas in the front of the buildings along Main Street and Echo Drive will flow overland uncontrolled to road catch basins on those streets. Runoff from the parking access ramp will be directed to the storm service inside the building. The uncontrolled area for A-1 is 0.0284 ha. Uncontrolled development flows for the 2-year, 10-year, and 100-year design events are calculated below using the Rational Method (refer to **Figure 3** for storm drainage areas).

2-year Event

Drainage Area (A) = 0.0284 ha
Runoff Coefficient (C) = 0.69
Intensity (I_2) = 45.17 mm/hr

Q_2= 2.78 CIA
Q_2= 2.78 x 0.69 x 45.17 mm/hr x 0.0284 ha
Q_2= 2.47 L/s

10-year Event

Drainage Area (A) = 0.0284 ha
Runoff Coefficient (C) = 0.69
Intensity (I_{10}) = 71.22 mm/hr

Q_{10}= 2.78 CIA
Q_{10}= 2.78 x 0.69 x 71.22 mm/hr x 0.0284 ha
Q_{10}= 3.90 L/s

100-year Event

Drainage Area (A) = 0.0284 ha
Runoff Coefficient (C) = 0.78
Intensity (I_{100}) = 103.85 mm/hr

Q_{100}= 2.78 CIA
Q_{100}= 2.78 x 0.78 x 103.85 mm/hr x 0.0284 ha
Q_{100}= 6.38 L/s

Remaining Allowable Release Rate

The maximum allowable storm flow for the remaining areas is the allowable release rate for the Subject Site less the uncontrolled flow. The following table indicates the allowable release rate for the Subject Site, the uncontrolled runoff and the remaining allowable release rate for the rest of the site areas for the 2-year, 10-year, and 100-year storm events.

Table 4.1 Remaining Allowable Release Rate Summary

Area		Flow (L/s)		
		2-YR	10-YR	100-YR
Entire Site (Legal Boundary)	Allowable	13.15	13.15	13.15
	Uncontrolled	2.47	3.90	6.38
Remaining Allowable Flow		**10.68**	**9.25**	**6.77**

Area A-02: Controlled Rear Yard Ground Surface Flows

The post-development flow from area A-02 (at rear of Subject Site) was calculated using the Rational Method to be 2.56 L/s, 4.06 L/s, and 6.63 L/s for the 2-year, 10-year, and 100-year design event, respectively. These flows will be controlled by Zurn area drain (restricted by a 51mm diameter pipe outlet) located in the rear yard of the Subject Site in order to utilize some surface storage. The controlled flows will then be directed into the buildings storm system. Flow from the rear yard area has been summarized in Table 4.2.

Table 4.2 Area Drain Inlet Control Flows

Area No.	Structure No.	INLET CONTROL PARAMETERS					
		2-YR EVENT		10-YR EVENT		100-YR EVENT	
		Head (m)	Q (L/s)	Head (m)	Q (L/s)	Head (m)	Q (L/s)
A-02	AD-1	0.00	3.05	0.07	3.39	0.12	3.61
Total			**3.05**		**3.39**		**3.61**

The Modified Rational Method was used to determine the storage volume required for the area drain. Based on a controlled flow provided via the Area Drain restricted inlet (51mm diameter), the ponding depth in the rearyards will be approximately 0.00 m, 0.07 m, and 0.12 m for the 2-year, 10-year, and 100-year design events, respectively, as determined through iterative calculations between the release rate, head, and corresponding storage. Refer to **Appendix A** for detailed calculations and to the Area, Roof, and Planter Drain Tables shown on the General Plan of Services (Drawing 115105-GP) and the Storm Drainage Area Plan (Drawing 115105-STM) in the back of report.

Area R-1 to R-17: Controlled Rooftop Drain Flows

The post-development flow from areas R-1 to R-17 were calculated using the Rational Method to be 19.93 L/s, 31.69 L/s, and 51.48 L/s for the 2-year, 10-year, and 100-year design event, respectively. The 10-year and 100-year events, combined with the uncontrolled area, exceed the maximum allowable flow. Therefore, the majority of flow from the building roof will be controlled by Zurn rooftop drains and then directed into the buildings storm system. Flow through these drains is dependent on the height of water above the drain (H – Head) and the number of notches in the drain. Flow from the rooftop area has been summarized in Table 4.3.

Table 4.3 Rooftop Drain peak flows

Area No.	Notches	INLET CONTROL PARAMETERS					
		2-YR EVENT		10-YR EVENT		100-YR EVENT	
		Head (m)	Q (L/s)	Head (m)	Q (L/s)	Head (m)	Q (L/s)
R-1	1	0.06	0.23	0.07	0.26	0.09	0.35
R-2	1	0.07	0.25	0.08	0.28	0.10	0.37
R-3	1	0.06	0.22	0.09	0.34	0.09	0.34
R-4	1	0.06	0.24	0.10	0.36	0.10	0.36
R-5	1	0.06	0.22	0.09	0.34	0.09	0.34
R-6	1	0.04	0.16	0.05	0.20	0.08	0.28
R-7	1	0.05	0.17	0.06	0.21	0.08	0.29
R-8	1	0.07	0.24	0.07	0.28	0.10	0.37
R-9	1	0.06	0.24	0.07	0.27	0.10	0.36
R-10	1	0.11	0.40	0.12	0.45	0.15	0.57
R-11	1	0.06	0.22	0.07	0.25	0.09	0.34
R-12	1	0.06	0.22	0.07	0.25	0.09	0.34
R-13	1	0.08	0.29	0.09	0.33	0.12	0.44
R-14	1	0.07	0.25	0.08	0.28	0.10	0.37
R-15	1	0.08	0.31	0.10	0.35	0.12	0.46
R-16	1	0.08	0.31	0.09	0.35	0.12	0.46
R-17	1	0.08	0.30	0.09	0.34	0.12	0.45
Total			**4.26**		**5.33**		**6.49**

The Modified Rational Method was used to determine the storage volume required for the various rooftop drainage areas. Based on a controlled flow provided via the Zurn rooftop drains, the ponding depth on the roof above the drains will be approximately 0.07 m, 0.08 m, and 0.10 m for the 2-year, 10-year, and 100-year design event, respectively, as determined through iterative calculations between the release rate, head and corresponding storage. Refer to **Appendix A** for detailed calculations and to the Area, Roof, and Planter Drain Tables shown on the General Plan of Services (Drawing 115105-GP) and the Storm Drainage Area Plan (Drawing 115105-STM) in the back of report.

Area SC-1: Controlled Rooftop Scupper Flows

The post-development flow from area SC-1 were calculated using the Rational Method to be 0.21 L/s, 0.34 L/s, and 0.55 L/s for the 2-year, 10-year, and 100-year design event, respectively. This small portion of flow from a rooftop terrace will be controlled by a single scupper (51 mm in width) and then directed to the uncontrolled areas of the subject site. Flow from the rooftop area has been summarized in Table 4.4.

Table 4.4 Rooftop Scupper Peak Flows

Area No.	Notches	INLET CONTROL PARAMETERS					
		2-YR EVENT		10-YR EVENT		100-YR EVENT	
		Head (m)	Q (L/s)	Head (m)	Q (L/s)	Head (m)	Q (L/s)
SC-1	1	0.02	0.20	0.03	0.49	0.03	0.48
Total			**0.20**		**0.49**		**0.48**

The Modified Rational Method was used to determine the storage volume required for this rooftop area. Based on a controlled flow provided via the drainage scupper, the ponding depth will be 0.02 m for the 2-year event, and 0.03 m for the 10-year and 100-year design events, as determined through iterative calculations between the release rate, head, and corresponding storage. Refer to **Appendix A** for detailed calculations.

Proposed Flow

As mentioned in the relevant sections above, the stormwater captured from the Zurn area drain (A-02), and the Zurn rooftop drains (R-1 to R-17), will be controlled and directed into the buildings storm system and then to the existing sewer fronting the Subject Site. The controlled flow will outlet to the 300mm diameter storm lateral service.

The following table summarizes the controlled and uncontrolled flow for the 2-year, 10-year, and 100-year design events.

Table 4.6 Proposed Post-Development Peak Flows

Area ID	Area (ha)	Runoff			Storage available (m^3)	Storage used		
		2 YR EVENT (L/s)	10 YR EVENT (L/s)	100 YR EVENT (L/s)		2 YR EVENT (m^3)	10 YR EVENT (m^3)	100 YR EVENT (m^3)
Uncontrolled - Direct Runoff								
A-01	0.0284	2.47	3.90	6.38	-	-	-	-
Controlled - Storage								
A-02	0.0203	3.05	3.39	3.61	2.92	0.00	0.60	2.72
R-1 to R-17	0.1037	4.26	5.33	6.49	42.94	12.37	22.58	39.65
SC-1	0.0011	0.20	0.49	0.48	0.18	0.01	0.04	0.04
Total:	**0.1535**	**9.98**	**13.11**	**16.95**	**46.04**	**12.38**	**23.22**	**42.41**

The post-development flow from the site will be controlled to 9.98 L/s, 13.11 L/s, 16.95 L/s for the 2-year, 10-year, and 100-year design events, respectively. The foregoing post-development release rates would meet the allowable release rate (13.15 L/s), with exception to the 100-year event which is marginally greater by 3.80 L/s.

As mentioned in previous sections above, given that the existing site conditions has a significant impervious area, which yields a release rate of 26 L/s, the proposed post-development release rate is a significant improvement that feasibly reduces the downstream impact. Nonetheless, an analysis of the existing combined sewers has been done to demonstrate that there is sufficient capacity in the downstream sewers to facilitate this additional flow. Please refer to Section 6.0 below.

4.3.3 Additional Groundwater Considerations

Based on Paterson's findings per the Geotechnical Investigation, it is expected that a portion of the proposed building foundation walls will be located below the long-term groundwater table. Any groundwater which breaches the buildings perimeter groundwater infiltration control system will be

directed to the proposed building's sump pit. The expected groundwater flow is expected to be less than 10,000 L/day (0.116 L/s). It is proposed that a groundwater pump be located on the lowest underground parking level and be operated manually. The sump pump would have a pumping capacity of 50 USgpm (3.15 L/s). Refer to the Geotechnical Investigation and Mechanical plans for further details.

Given that the manual operation of the groundwater pump may require concurrent operation during typical storm events (i.e. 2-year design event), the post-development flow of the 2-year design event at 9.98 L/s and combination of the full sump pump rate of 3.15 L/s, would result in a total outflow of 13.13 L/s, which is less than the allowable release rate.

4.3.4 Minor Flow Route

The Subject Site will be serviced by a 300 mm dia. service that will connect to the existing 375 mm dia. combined sewer on Main Street which outlets to the Rideau Canal Interceptor.

This service has been sized for both the proposed flow and the additional groundwater considerations. At a slope of 1.0%, the service has a capacity of 96.2 L/s and a flow velocity of 1.37 m/s.

4.3.5 Major Overland Flow Route

The Subject Site will be graded such that flows in excess of the 100-year storm event will be conveyed overland to Main Street and Echo Drive.

5.0 SANITARY SEWER

The Subject Site will be serviced by a 200 mm dia. service that will connect to the existing 375 mm dia. combined sewer on Main Street which outlets to the Rideau Canal Interceptor. The proposed sanitary service connection to the building will be equipped with a full-port backwater valve.

Proposed development flows are presented below.

115 Echo Drive Sanitary Flows Under Proposed Use

Residential Flow

Population = (40 units x 2.1 persons/unit)
= 84 persons

Q_{SAN} = Residential Flow + Extraneous Flow
Q_{SAN} = (84 persons x 350 L/person/day) + (0.154 ha * 24,192 L/day/ha) = 33,126 L/day
Total Average Sanitary Flow = 33,126 L/day = 0.38 L/sec
Total Peak Sanitary Flow = 1.53 L/sec (with PF = 4.0)

Average Sanitary Flows Under Current Zoning

Currently, the Subject Site is being used as community center and church. Based on this, sanitary flows based on current zoning and use which were directed to the combined sewer on Main Street are as follows:

Total Site Area = 0.154 ha
Q_{ave} = Institutional Average Flow + Extraneous Flow
Q_{ave} = (Site Area x 50,000L/gross ha/day) + (0.154 ha * 24,192 L/day/ha) = 11,426 L/day
Q_{peak} = 11,426 L/day * 1.5 = 17,139 L/day

Therefore,

Total Average Sanitary Flow = 0.132 L/sec
Total Peak Sanitary Flow = 0.198 L/sec (with PF)

Since the development sanitary flows are greater than the flows under existing conditions, an analysis of the existing downstream combined sewer has been completed and is included in **Appendix C** and discussed in Section 6.0. Based on the analysis; the existing sewer has adequate capacity for the proposed development flows.

6.0 COMBINED SEWER SYSTEM

The proposed development will direct both sanitary and stormwater flows to the existing 375 mm diameter combined sewer on Main Street. An analysis of the existing combined sewer system was completed beginning at the furthest upstream manholes and continuing to the intersection of Harvey Street and Echo Drive (i.e. one pipe upstream of the Rideau Canal Interceptor).

Existing sanitary flows were based on current land use and Ottawa Sewer Design Guidelines Figure 4.3. The existing land use was determined by on-site inspection. Existing storm flows were taken for all areas for a 2-year design storm with a Time of Concentration, Tc of 20 minutes, and a run-off coefficient, C of 0.40.

Accounting for the additional storm and sanitary flows from the proposed development, the existing combined sewer system will still have excess capacity ranging from 47.18 L/s to 175.08 L/s.

For added protection against flooding, Full-port backwater valves are to be installed on all storm and sanitary unit services as per City of Ottawa Material Specifications.

7.0 WATER SUPPLY

7.1 Domestic Demand

The Subject Site will be serviced by a 150mm dia. watermain service, which will connect to the existing 400 mm dia. watermain located on Main Street Avenue. Estimated domestic water demands for the development have been calculated below as per Table 4.2 of the Ottawa Water Distribution Design Guidelines.

115 Echo Drive Residential Demand

Residential Demand

Population = (40 units x 2.1 persons/unit)
= 84 persons

Residential Average Demand = 84 persons x 350 L/person/day = 29,400 L/day = 0.34 L/sec

Residential Max Daily Demand = 29,400 L/day x 2.5 = 73,500 L/day = 0.85 L/sec

Residential Max Hourly Demand = 73,500 L/day x 2.2 = 161,700 L/day = 1.87 L/sec

Total Average Water Demand = 0.34 L/sec
Total Max Daily Water Demand = 0.85 L/sec
Total Max Hourly Demand = 1.87 L/sec

Based on the data provided by the City, the existing watermains in the area are adequate to meet the domestic water demands. Refer to **Appendix B** for watermain data.

7.2 Fire Demand

The fire flows for the Subject Site were calculated using two methods; the Fire Underwriters Survey (FUS), and the Ontario Building Code (OBC).

As per the City of Ottawa Water Design, the FUS method is required. The fire flow supply required as per the FUS method is 2,642 USgpm. Refer to **Appendix B** for detailed calculations.

However, the Fire Underwriters Survey is used to assess the performance of the water distribution system on a “City Block” basis rather than an individual building basis and in this particular scenario the OBC governs the assessment of fire demand for individual buildings.

Section 7.2.11.1 of the OBC states that the design, construction, installation and testing of fire service mains and water service pipe combined with fire service mains shall be in conformance with NFPA 24. NFPA 24 is the standard for the “Installation of Private Fire Service Mains and their Appurtenances”. Chapter 13 of NFPA 24 discusses sizing the private service fire mains for fire protection systems which shall be approved by the authority having jurisdiction, considering the following factors:

- Construction and Occupancy of the building
- Fire Flow and Pressure of the Water Required
- Adequacy of the Water Supply

Specific to this project the building will be sprinklered per Section 3.2.2.45 of the OBC. Section 3.2.5.7 of the OBC requires that an adequate water supply for fire fighting be provided to each building, and references Appendix A of the OBC. Sentence 3 of Section A 3.2.5.7 of the OBC states that NFPA 13 should be used for determining both sprinkler and hose stream demands for a sprinklered building.

The design of the sprinkler system is completed by a Fire Protection Engineer, or typically computed by the sprinkler contractor and approved by the Fire Protection Engineer. The process involves detailed hydraulic calculations based on building layout, pipe runs, head losses, fire pump requirements, etc. At this stage in the development process (Site Plan Control submission), these details are not available. However, using Chapter 7 of NFPA 13, it is possible to provide a fairly accurate estimate of the fire demand for the building. This estimate is provided below.

NFPA 13 – 2013: Chapter 1 Calculation

Six-Storey Residential Building – Light Hazard
Underground Parking – Ordinary Hazard (Group 1)

Section 11.2.3 of NFPA 13, "Water Demand Requirements – Hydraulic Calculation Methods" is used to estimate the hose stream demand and the sprinkler demand. The water demand for sprinklers is estimated using the most remote area in the building. Figure 11.2.3.1.2 – Area/Density Curves is used for the worst-case scenario, which in this case is the Ordinary Hazard Classification in the underground parking garage. For this classification, Figure 11.2.3.1.2 provides a density of 0.15 USgpm /ft^2 using coverage of 1500 ft^2, or 225 gpm (US).

Table 11.2.3.1.1 is used to determine the hose stream demand. For Ordinary Hazard a total combined inside and outside hose stream demand of 250 USgpm is required. Typically, 150 USgpm would be drawn off the hydrant and 100 USgpm off the hose cabinets.

Therefore, total estimated demand would be 225 USgpm + 250 USgpm = 475 USgpm. Adding an allowance for head losses though out the sprinkler system, an estimated fire demand of between 550 – 600 USgpm (2,270 L/min) would be required. The building will also be equipped with a fire pump, if necessary, to provide the minimum residual pressure at the sprinkler heads. As the foregoing method is based on a preliminary calculation to facilitate this development application, a Mechanical or Fire Protection Engineer should assess the NFPA demand and supply method in greater detail, as part of the Subject Site's detailed design and building permit application.

Below is a summary of the fire demand based on the various methods:

- FUS Method = 2642 USgpm.
- OBC and NFPA 13 Method = 600 USgpm (to be confirmed by others)

According to the hydraulic boundary conditions provided by the City, the existing watermains on Main Street can deliver the demand for the foregoing methods.

8.0 EROSION AND SEDIMENT CONTROL

Temporary erosion and sediment control measures will be implemented both prior to commencement and during construction, in accordance with the "Guidelines on Erosion and Sediment Control for Urban Construction Sites", (Government of Ontario, May 1987) and "Construction Specification for Temporary Erosion and Sediment Control Measures" (OPSS 805). Regular inspection and maintenance of the erosion control measures will be undertaken. These measures will include:

- Installment of straw bales at all-natural runoff outlets from the property as per OPSD 219.100;
- Placement of filter fabric under all catchbasins and maintenance hatches;
- Silt fences around the area under construction as per OPSD 219.110.

9.0 UTILITIES

The Subject Site will be serviced by Hydro Ottawa, Bell Canada, Rogers Communications, and Enbridge Gas Distribution Inc. The utility companies have been contacted and their designs to service the development are underway. The respective designs have been complied to produce a Composite Utility Plan. For information purposes only, refer to drawing 115105-CUP.

10.0 COORDINATION AND A*PPROVA*LS

Coordination with the City required for final configuration of Main Street Re-construction. The coordination is required to ensure that future curb or sidewalk locations and elevations will not affect the overall development plans of 115 Echo Drive.

An application for MOE Environmental Compliance Approval (ECA) will be required for this site if the interim approach of connecting the service laterals to the combined sewer is required. It is recommended that the City provide comments and feedback for the design report and drawings in order to advance and apply for the direct submission ECA, which may take up to 4 to 8 months.

Should Main Street reconstruction take place in advance of 115 Echo Drive re-development, the connection of the proposed service laterals will be made to the separated sanitary and storm sewers along Main Street. Upon site plan approval of the proposed development, a road cut permit and water permit will be applied for and construction can commence.

11.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the foregoing, development of the site will be supported by the following:

Stormwater Management

- Storm flows will be controlled onsite and directed to the existing 375mm diameter combined sewer in the interim.
- Water quantity control will be achieved by storage on the roof of the proposed building, and in the rear yard surface of the Subject Site.
- Stormwater from the rooftop, rear yard terraces, and the ramp to the underground parking levels will be directed to the storm service.
- Groundwater which breaches the buildings perimeter groundwater infiltration control system will be directed to the proposed buildings sump pit and will be pumped to the storm service.
- The allowable release rate of the subject site is 13.15 L/s.
- The 2-year, 10-year, and 100-year design event post-development flows are 9.98 L/s, 13.11 L/s, 16.95 L/s. There is an additional 3.80 L/s of flow during the 100-year design event.
- Given that the existing site conditions has a significant impervious area, which yields a release rate of 26 L/s, the proposed post-development release rate is a significant improvement that feasibly reduces the downstream impact. An analysis of the existing combined sewers has been done to demonstrate that there is sufficient capacity in the downstream sewers to facilitate this additional flow.

Sanitary Servicing

- Sanitary flows will be directed to the proposed 250mm diameter sanitary sewer along Main Street.
- The existing sewers along Main Street have sufficient capacity to meet the demand of the proposed development which is in the magnitude of 1.53 L/s.

Combined Sewers

- Negligible impact to the existing combined system.

Water Supply

- Water service will be provided by an existing 400mm diameter watermain on Main Street.
- Domestic demand will be provided by 150mm diameter service lateral.
- Firefighting protection will be achieved by proximity to existing fire hydrants and an automated sprinkler system.

Erosion and Sediment Control

- Temporary erosion and sediment control measures will be implemented during construction.

Utilities

- Coordination with the utilities will be required in order to provide each proposed lot with Hydro Ottawa, Bell Canada, Rogers Communications, and Enbridge Gas Distribution Inc. servicing.

Coordination and Approvals

- Coordination with the City required for final configuration of Main Street Re-construction.
- MOE ECA required if connection of proposed building service laterals are made to the existing combined sewer along Main Street.
- Site plan approval, road cut permit and water permit required for implementation.

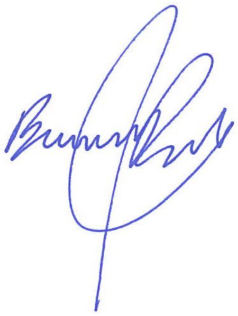
Based on the foregoing, adequate sanitary, storm and water services are available to support the proposed re-zoning and this development. Additional details are provided in the servicing and grading drawings.

NOVATECH

Prepared By:

Ben Sweet, P.Eng.
Project Engineer I Land Development

Reviewed By:



Bassam Bahia, M.Eng., P.Eng.
Project Manager I Land Development

APPENDIX A

IDF CURVES, RATIONAL METHOD, RUNOFF

AND SWM CALCULATIONS

RATIONAL METHOD

The Rational Method was used to determine both the allowable runoff as well as the post-development runoff for the proposed site. The equation is as follows:

$Q=2.78\ CIA$

Where:
Q is the runoff in L/s
C is the weighted runoff coefficient*
I is the rainfall intensity in mm/hr**
A is the area in hectares

*The weighted runoff coefficient is determined for each of the catchment areas as follows:

$$C = \frac{(A_{perv} \times C_{perv}) + (A_{imp} \times C_{imp})}{A_{tot}}$$

Where:
A_{perv} is the pervious area in hectares
C_{perv} is the pervious area runoff coefficient (C_{perv}=0.20)
A_{imp} is the impervious area in hectares
C_{imp} is the impervious area runoff coefficient (C_{imp}=0.90)
A_{tot} is the catchment area (A_{perv} + A_{imp}) in hectares

** The rainfall intensity is taken from the City of Ottawa IDF Curves with a time of concentration of 10 min (refer to attached IDF Curves) as specified by the City of Ottawa.

ALLOWABLE RELEASE RATE AS SPECIFIED BY THE CITY

The allowable release rate was calculated for the 0.154-hectare site, using a runoff coefficient of 0.40 and a time of concentration of 10 minutes, as specified by the City of Ottawa.

Drainage Area (A) = 0.154 ha
Runoff Coefficient (C) = 0.40
Intensity (I_2) = 76.81 mm/hr

Q_2= 2.78 CIA
Q_2= 2.78 x 0.40 x 76.81 x 0.154
Q_2= 13.15 L/s

POST-DEVELOPMENT FLOW

The post-development uncontrolled flows from the building roof. These sample calculation below shows a typical uncontrolled flow calculation for the rooftop area. These area are to be controlled by the Zurn rooftop drains.

SAMPLE CALCULATION:

ROOF AREA R-01

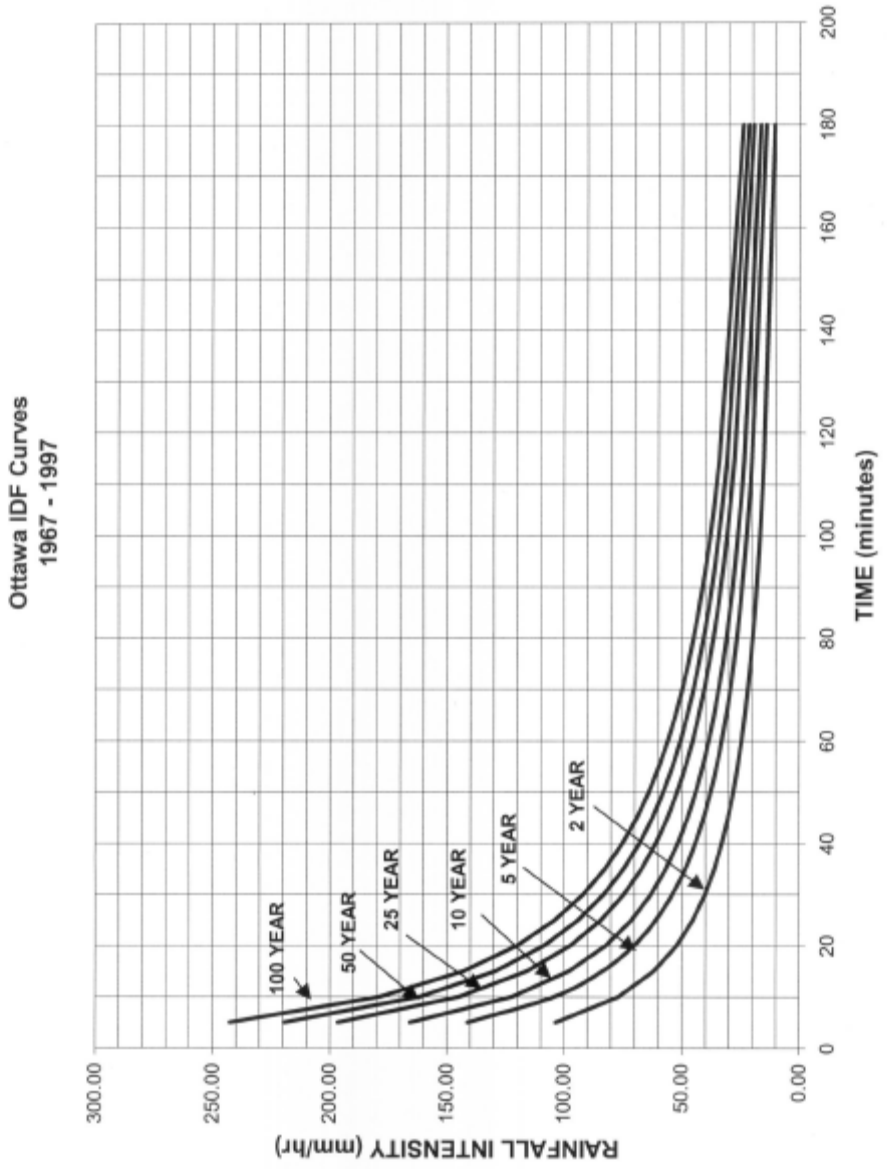
Drainage Area (A) = 0.0035 ha
Impervious Area = 0.0035 ha
Pervious Area = 0.0000 ha
Runoff Coefficient (C_2) = 0.90
Runoff Coefficient (C_{10}) = 0.90
Runoff Coefficient (C_{100}) = 1.00 (C_{10} x 1.25 or a maximum of 1.00)
Tc = 10 minutes
Intensity (I_2) = 76.81 mm/hr
Intensity (I_{10}) = 122.14 mm/hr
Intensity (I_{100}) = 178.56 mm/hr

Q_2= 2.78 CIA
Q_2= 2.78 x 0.90 x 76.81 x 0.0035
Q_2= 0.67 L/

Q_{10}= 2.78 CIA
Q_{10}= 2.78 x 0.90 x 122.14 x 0.0035
Q_{10}= 1.07 L/s

Q_{100}= 2.78 CIA
Q_{100}= 2.78 x 1.00 x 178.56 x 0.0035
Q_{100}= 1.74 L/s

APPENDIX 5-A OTTAWA INTENSITY DURATION FREQUENCY (IDF) CURVE



** IDF CURVE FROM OTTAWA SEWER DESIGN GUIDELINES – NOV 2004*

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2 YR

Area No.	Area (ha)	C_{2yr}	Time (min)	intensity mm/hr	Uncontrolled runoff L/s	Control System	Zurn Model Number	Release Rate (L/s/m of head)	Notches	Depth (m)	Controlled Flow (L/s)	Storage available (m^3)	Storage used (m^3)
A-01	0.0284	0.69	25.00	45.17	2.47	Direct Runoff	-	-	-	-	2.47	-	-
A-02	0.0203	0.73	15.00	61.77	2.56	Zurn Area Drain	Z610-H-ADJ-2NH-G-VP-Y	-	-	0.00	3.05	2.92	0.00
R-1	0.0035	0.90	10.00	76.81	0.67	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.06	0.23	1.17	0.28
R-2	0.0052	0.90	10.00	76.81	1.00	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.07	0.25	1.73	0.51
R-3	0.0029	0.90	10.00	76.81	0.56	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.06	0.22	0.97	0.21
R-4	0.0042	0.90	10.00	76.81	0.81	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.06	0.24	1.40	0.37
R-5	0.0028	0.90	10.00	76.81	0.54	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.06	0.22	0.93	0.19
R-6	0.0011	0.90	10.00	76.81	0.21	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.04	0.16	0.37	0.03
R-7	0.0013	0.90	10.00	76.81	0.25	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.05	0.17	0.43	0.05
R-8	0.0046	0.90	10.00	76.81	0.88	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.07	0.24	1.53	0.43
R-9	0.0041	0.90	10.00	76.81	0.79	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.06	0.24	1.37	0.35
R-10	0.0294	0.90	10.00	76.81	5.65	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.11	0.40	15.25	5.09
R-11	0.0026	0.90	10.00	76.81	0.50	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.06	0.22	0.87	0.17
R-12	0.0026	0.90	10.00	76.81	0.50	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.06	0.22	0.87	0.17
R-13	0.0065	0.90	10.00	76.81	1.25	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.08	0.29	2.71	0.67
R-14	0.0050	0.90	10.00	76.81	0.96	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.07	0.25	1.67	0.48
R-15	0.0097	0.90	10.00	76.81	1.86	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.08	0.31	4.11	1.19
R-16	0.0098	0.90	10.00	76.81	1.88	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.08	0.31	4.08	1.21
R-17	0.0084	0.90	10.00	76.81	1.61	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.08	0.30	3.50	0.97
SC-1	0.0011	0.90	10.00	76.81	0.21	Scupper	Weir 50mm	-	1	0.02	0.20	0.18	0.01
Total:	**0.1535**				**25.17**						**9.98**	**46.04**	**12.38**

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5 YR

Area ID	Area (ha)	C_{5yr}	Time (min)	intensity mm/hr	Uncontrolled runoff L/s	Control System	Zurn Model Number	Release Rate (L/s/m of head)	Notches	Depth (m)	Controlled Flow (L/s)	Storage available (m^3)	Storage used (m^3)
A-01	0.0284	0.69	25.00	60.90	3.33	Direct Runoff	-	-	-	-	3.33	-	-
A-02	0.0203	0.73	15.00	83.56	3.46	Zurn Area Drain	Z610-H-ADJ-2NH-G-VP-Y	-	-	0.05	3.27	2.92	0.17
R-1	0.0035	0.90	10.00	104.19	0.91	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.07	0.26	1.17	0.42
R-2	0.0052	0.90	10.00	104.19	1.36	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.08	0.28	1.73	0.77
R-3	0.0029	0.90	10.00	104.19	0.76	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.09	0.34	0.97	0.32
R-4	0.0042	0.90	10.00	104.19	1.09	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.10	0.36	1.40	0.56
R-5	0.0028	0.90	10.00	104.19	0.73	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.09	0.34	0.93	0.30
R-6	0.0011	0.90	10.00	104.19	0.29	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.05	0.20	0.37	0.05
R-7	0.0013	0.90	10.00	104.19	0.34	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.06	0.21	0.43	0.08
R-8	0.0046	0.90	10.00	104.19	1.20	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.07	0.28	1.53	0.63
R-9	0.0041	0.90	10.00	104.19	1.07	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.07	0.27	1.37	0.54
R-10	0.0294	0.90	10.00	104.19	7.66	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.12	0.45	15.25	7.22
R-11	0.0026	0.90	10.00	104.19	0.68	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.07	0.25	0.87	0.26
R-12	0.0026	0.90	10.00	104.19	0.68	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.07	0.25	0.87	0.26
R-13	0.0065	0.90	10.00	104.19	1.69	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.09	0.33	2.71	0.99
R-14	0.0050	0.90	10.00	104.19	1.30	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.08	0.28	1.67	0.72
R-15	0.0097	0.90	10.00	104.19	2.53	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.10	0.35	4.11	1.74
R-16	0.0098	0.90	10.00	104.19	2.55	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.09	0.35	4.08	1.76
R-17	0.0084	0.90	10.00	104.19	2.19	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.09	0.34	3.50	1.43
SC-1	0.0011	0.90	10.00	104.19	0.29	Scupper	Weir 50mm	-	1	0.02	0.27	0.18	0.01
Total:	**0.1535**				**34.11**						**12.02**	**46.04**	**18.24**

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10 YR

Area ID	Area (ha)	C_{10yr}	Time (min)	intensity mm/hr	Uncontrolled runoff L/s	Control System	Zurn Model Number	Release Rate (L/s/m of head)	Notches	Depth (m)	Controlled Flow (L/s)	Storage available (m^3)	Storage used (m^3)
A-01	0.0284	0.69	25.00	71.22	3.90	Direct Runoff	-	-	-	-	3.90	-	-
A-02	0.0203	0.73	15.00	97.85	4.06	Zurn Area Drain	Z610-H-ADJ-2NH-G-VP-Y	-	-	0.07	3.39	2.92	0.60
R-1	0.0035	0.90	10.00	122.14	1.07	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.08	0.29	1.17	0.55
R-2	0.0052	0.90	10.00	122.14	1.59	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.08	0.31	1.73	0.97
R-3	0.0029	0.90	10.00	122.14	0.89	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.07	0.28	0.97	0.41
R-4	0.0042	0.90	10.00	122.14	1.28	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.08	0.30	1.40	0.72
R-5	0.0028	0.90	10.00	122.14	0.86	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.07	0.28	0.93	0.39
R-6	0.0011	0.90	10.00	122.14	0.34	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.06	0.23	0.37	0.08
R-7	0.0013	0.90	10.00	122.14	0.40	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.06	0.24	0.43	0.11
R-8	0.0046	0.90	10.00	122.14	1.41	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.08	0.30	1.53	0.81
R-9	0.0041	0.90	10.00	122.14	1.25	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.08	0.30	1.37	0.69
R-10	0.0294	0.90	10.00	122.14	8.98	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.13	0.48	15.25	8.83
R-11	0.0026	0.90	10.00	122.14	0.79	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.07	0.27	0.87	0.35
R-12	0.0026	0.90	10.00	122.14	0.79	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.07	0.27	0.87	0.35
R-13	0.0065	0.90	10.00	122.14	1.99	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.10	0.36	2.71	1.25
R-14	0.0050	0.90	10.00	122.14	1.53	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.08	0.30	1.67	0.92
R-15	0.0097	0.90	10.00	122.14	2.96	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.10	0.38	4.11	2.17
R-16	0.0098	0.90	10.00	122.14	2.99	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.10	0.38	4.08	2.20
R-17	0.0084	0.90	10.00	122.14	2.57	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.10	0.37	3.50	1.79
SC-1	0.0011	0.90	10.00	122.14	0.34	Scupper	Weir 50mm	-	1	0.03	0.49	0.18	0.04
Total:	**0.1535**				**39.98**						**13.11**	**46.04**	**23.22**

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100 YR

Area ID	Area (ha)	C_{100yr}	Time (min)	intensity mm/hr	Uncontrolled runoff L/s	Control System	Zurn Model Number	Release Rate (L/s/m of head)	Notches	Depth (m)	Controlled Flow (L/s)	Storage available (m^3)	Storage used (m^3)
A-01	0.0284	0.78	25.00	103.85	6.38	Direct Runoff	-	-	-	-	6.38	-	-
A-02	0.0203	0.82	15.00	142.89	6.63	Zurn Area Drain	Z610-H-ADJ-2NH-G-VP-Y	-	-	0.12	3.61	2.92	2.72
R-1	0.0035	1.00	10.00	178.56	1.74	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.09	0.35	1.17	0.99
R-2	0.0052	1.00	10.00	178.56	2.58	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.10	0.37	1.73	1.73
R-3	0.0029	1.00	10.00	178.56	1.44	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.09	0.34	0.97	0.75
R-4	0.0042	1.00	10.00	178.56	2.08	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.10	0.36	1.40	1.28
R-5	0.0028	1.00	10.00	178.56	1.39	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.09	0.34	0.93	0.71
R-6	0.0011	1.00	10.00	178.56	0.55	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.08	0.28	0.37	0.16
R-7	0.0013	1.00	10.00	178.56	0.65	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.08	0.29	0.43	0.21
R-8	0.0046	1.00	10.00	178.56	2.28	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.10	0.37	1.53	1.45
R-9	0.0041	1.00	10.00	178.56	2.04	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.10	0.36	1.37	1.24
R-10	0.0294	1.00	10.00	178.56	14.59	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.15	0.57	15.25	15.23
R-11	0.0026	1.00	10.00	178.56	1.29	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.09	0.34	0.87	0.64
R-12	0.0026	1.00	10.00	178.56	1.29	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.09	0.34	0.87	0.63
R-13	0.0065	1.00	10.00	178.56	3.23	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.12	0.44	2.71	2.21
R-14	0.0050	1.00	10.00	178.56	2.48	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.10	0.37	1.67	1.63
R-15	0.0097	1.00	10.00	178.56	4.82	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.12	0.46	4.11	3.79
R-16	0.0098	1.00	10.00	178.56	4.86	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.12	0.46	4.08	3.85
R-17	0.0084	1.00	10.00	178.56	4.17	Zurn Roof Drain	ZCF121-1W-X4-Z-105-10-77	3.73	1	0.12	0.45	3.50	3.14
SC-1	0.0011	1.00	10.00	178.56	0.55	Scupper	Weir 50mm	-	1	0.03	0.48	0.18	0.04
Total:	**0.1535**				**65.03**						**16.95**	**46.04**	**42.41**

Note: In all cases, there is only one notch in the Zurn roof drain and flows through each drain is further reduced with an adjustable weir. See Zurn roof drains sheet and adjustable weir specification for more details on the reduction of flow.

Allowable release rate

Area	0.154	ha
C_2	0.4	
C_{10}	0.8	
tc_2	10	min
tc_{10}	20	min
i_2	76.81	mm/hr
i_5	104.19	mm/hr
i_{10}	82.21	mm/hr
i_{100}	178.56	mm/hr
$Q_{Allowable}$	2.78 x C x i x A	
$Q_{2\ Allowable}$	13.15	L/s

Summary table

Area ID	Area (ha)	Runoff 2 yr event L/s	Runoff 5 yr event L/s	Runoff 10 yr event L/s	Runoff 100 yr L/s	Storage available (m^3)	Storage used 2 yr event (m^3)	Storage used 5 yr event (m^3)	Storage used 10 yr event L/s	Storage used 100 yr event (m^3)
Uncontrolled - Direct Runoff										
A-01	0.0284	2.47	3.33	3.90	6.38	-	-	-	-	-
Controlled - Storage										
A-02	0.0203	3.05	3.27	3.39	3.61	2.92	0.00	0.17	0.60	2.72
R-1 to R-17	0.1037	4.26	5.16	5.33	6.49	42.94	12.37	18.06	22.58	39.65
SC-1	0.0011	0.20	0.27	0.49	0.48	0.18	0.01	0.01	0.04	0.04
Total:	**0.1535**	**9.98**	**12.02**	**13.11**	**16.95**	**46.04**	**12.38**	**18.24**	**23.22**	**42.41**

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Runoff Coefficients

Drainage Area	Total Area (m^2)	Hard Surface Area		Soft Surface Area		2-YR, 5-YR, 10-YR Runoff Coefficient	100-YR Runoff Coefficient
		Area (m^2)	C	Area (m^2)	C		
R-01	35.0	35.0	0.90	0.0	0.20	0.90	1.00
R-02	52.0	52.0	0.90	0.0	0.20	0.90	1.00
R-03	29.0	29.0	0.90	0.0	0.20	0.90	1.00
R-04	42.0	42.0	0.90	0.0	0.20	0.90	1.00
R-05	28.0	28.0	0.90	0.0	0.20	0.90	1.00
R-06	11.0	11.0	0.90	0.0	0.20	0.90	1.00
R-07	13.0	13.0	0.90	0.0	0.20	0.90	1.00
R-08	46.0	46.0	0.90	0.0	0.20	0.90	1.00
R-09	41.0	41.0	0.90	0.0	0.20	0.90	1.00
R-10	294.0	294.0	0.90	0.0	0.20	0.90	1.00
R-11	26.0	26.0	0.90	0.0	0.20	0.90	1.00
R-12	26.0	26.0	0.90	0.0	0.20	0.90	1.00
R-13	65.0	65.0	0.90	0.0	0.20	0.90	1.00
R-14	50.0	50.0	0.90	0.0	0.20	0.90	1.00
R-15	97.0	97.0	0.90	0.0	0.20	0.90	1.00
R-16	98.0	98.0	0.90	0.0	0.20	0.90	1.00
R-17	84.0	84.0	0.90	0.0	0.20	0.90	1.00
SC-1	11.0	11.0	0.90	0.0	0.20	0.90	1.00
A-01	284.0	199.9	0.90	84.1	0.20	0.69	0.78
A-02	203.0	155.0	0.90	48.0	0.20	0.73	0.82
Total	**1535.00**	**1402.9**	**0.90**	**132.10**	**0.20**	**0.84**	**0.94**

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REQUIRED STORAGE - 2-YEAR EVENT
AREA A-02
OTTAWA IDF CURVE
Area = 0.020 ha Qallow = 3.05
C = 0.73 Vol(max) = 0.00
Dia 51

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	103.57	4.29	1.24	0.37
10	76.81	3.18	0.13	0.08
15	61.77	2.56	-0.49	-0.44
20	52.03	2.16	-0.89	-1.07
25	45.17	1.87	-1.18	-1.77
30	40.04	1.66	-1.39	-2.50
35	36.06	1.49	-1.56	-3.27
40	32.86	1.36	-1.69	-4.05
45	30.24	1.25	-1.80	-4.85
50	28.04	1.16	-1.89	-5.66
55	26.17	1.08	-1.97	-6.49
60	24.56	1.02	-2.03	-7.32
65	23.15	0.96	-2.09	-8.15
70	21.91	0.91	-2.14	-9.00
75	20.81	0.86	-2.19	-9.84
80	19.83	0.82	-2.23	-10.69
85	18.94	0.79	-2.26	-11.55
90	18.14	0.75	-2.30	-12.41

REQUIRED STORAGE - 5-YEAR EVENT
AREA A-02
OTTAWA IDF CURVE
Area = 0.020 ha Qallow = 3.27
C = 0.73 Vol(max) = 0.17
Dia 51

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	141.18	5.85	2.58	0.77
10	104.19	4.32	1.05	0.63
15	83.56	3.46	0.19	0.17
20	70.25	2.91	-0.36	-0.43
25	60.90	2.52	-0.75	-1.12
30	53.93	2.24	-1.03	-1.86
35	48.52	2.01	-1.26	-2.64
40	44.18	1.83	-1.44	-3.45
45	40.63	1.68	-1.59	-4.28
50	37.65	1.56	-1.71	-5.13
55	35.12	1.46	-1.81	-5.99
60	32.94	1.37	-1.90	-6.86
65	31.04	1.29	-1.98	-7.73
70	29.37	1.22	-2.05	-8.62
75	27.89	1.16	-2.11	-9.51
80	26.56	1.10	-2.17	-10.41
85	25.37	1.05	-2.22	-11.31
90	24.29	1.01	-2.26	-12.22

REQUIRED STORAGE - 10-YEAR EVENT
AREA A-02
OTTAWA IDF CURVE
Area = 0.020 ha Qallow = 3.39
C = 0.73 Vol(max) = 0.60
Dia 51

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	165.77	6.87	3.48	1.04
10	122.14	5.06	1.67	1.00
15	97.85	4.06	0.67	0.60
20	82.21	3.41	0.02	0.02
25	71.22	2.95	-0.44	-0.66
30	63.05	2.61	-0.78	-1.40
35	56.70	2.35	-1.04	-2.18
40	51.62	2.14	-1.25	-3.00
45	47.45	1.97	-1.42	-3.84
50	43.97	1.82	-1.57	-4.70
55	41.00	1.70	-1.69	-5.58
60	38.45	1.59	-1.80	-6.47
65	36.23	1.50	-1.89	-7.36
70	34.27	1.42	-1.97	-8.27
75	32.54	1.35	-2.04	-9.19
80	30.98	1.28	-2.11	-10.11
85	29.59	1.23	-2.16	-11.03
90	28.32	1.17	-2.22	-11.97

REQUIRED STORAGE - 100-YEAR EVENT
AREA A-02
OTTAWA IDF CURVE
Area = 0.020 ha Qallow = 3.61
C = 0.82 Vol(max) = 2.72
Dia (mm) 51

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	242.70	11.27	7.66	2.30
10	178.56	8.29	4.68	2.81
15	142.89	6.63	3.02	2.72
20	119.95	5.57	1.96	2.35
25	103.85	4.82	1.21	1.82
30	91.87	4.27	0.66	1.18
35	82.58	3.83	0.22	0.47
40	75.15	3.49	-0.12	-0.29
45	69.05	3.21	-0.40	-1.09
50	63.95	2.97	-0.64	-1.92
55	59.62	2.77	-0.84	-2.78
60	55.89	2.59	-1.02	-3.65
65	52.65	2.44	-1.17	-4.55
70	49.79	2.31	-1.30	-5.45
75	47.26	2.19	-1.42	-6.37
80	44.99	2.09	-1.52	-7.30
85	42.95	1.99	-1.62	-8.24
90	41.11	1.91	-1.70	-9.19

Ponding Depth (2-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
1	0.01	0.02
3	0.02	0.03
5	0.06	0.04
9	0.14	0.05
14	0.25	0.06
19	0.41	0.07
25	0.63	0.08
32	0.92	0.09
40	1.28	0.10
49	1.73	0.11
59	2.27	0.12
70	**2.92**	**0.13**

Ponding Depth (5-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
1	0.01	0.02
3	0.02	0.03
5	0.06	0.04
9	0.14	0.05
14	0.25	0.06
19	0.41	0.07
25	0.63	0.08
32	0.92	0.09
40	1.28	0.10
49	1.73	0.11
59	2.27	0.12
70	**2.92**	**0.13**

Ponding Depth (10-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
1	0.01	0.02
3	0.02	0.03
5	0.06	0.04
9	0.14	0.05
14	0.25	0.06
19	0.41	0.07
25	0.63	0.08
32	0.92	0.09
40	1.28	0.10
49	1.73	0.11
59	2.27	0.12
70	**2.92**	**0.13**

Ponding Depth (100-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
1	0.01	0.02
3	0.02	0.03
5	0.06	0.04
9	0.14	0.05
14	0.25	0.06
19	0.41	0.07
25	0.63	0.08
32	0.92	0.09
40	1.28	0.10
49	1.73	0.11
59	2.27	0.12
70	**2.92**	**0.13**

Linear Interpolation

0.01	H	0.00		H =	0.005 m
0.00	0.00	-0.01		Q_{allow} =	3.05 L/s

Linear Interpolation

0.06	H	0.05		H =	0.048 m
0.25	0.17	0.14		Q_{allow} =	3.27 L/s

Linear Interpolation

0.08	H	0.07		H =	0.074 m
0.63	0.60	0.41		Q_{allow} =	3.39 L/s

Linear Interpolation

0.13	H	0.12		H =	0.122 m
2.92	2.72	2.27		Q_{allow} =	3.61 L/s

PREPARED BY: NOVATECH
DATE: August 5th, 2016
REVISED: March 2, 2018

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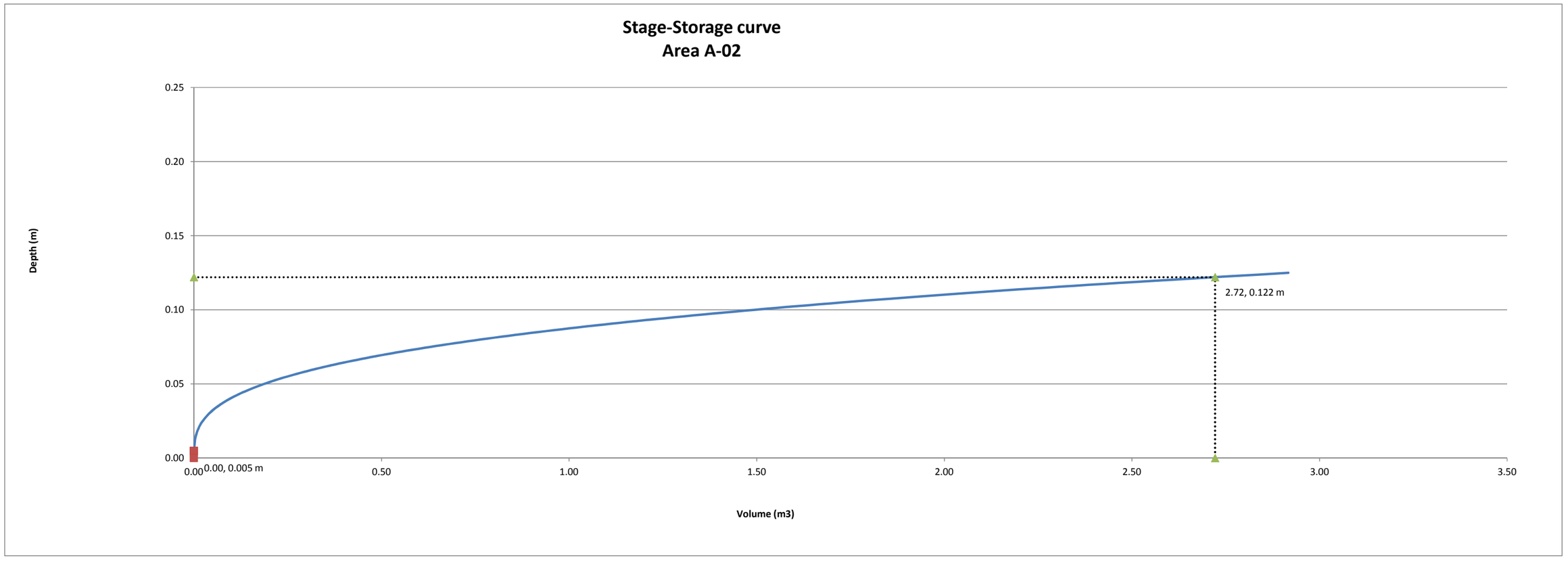

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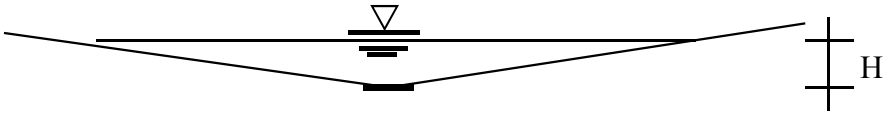
Zurn Roof Drains

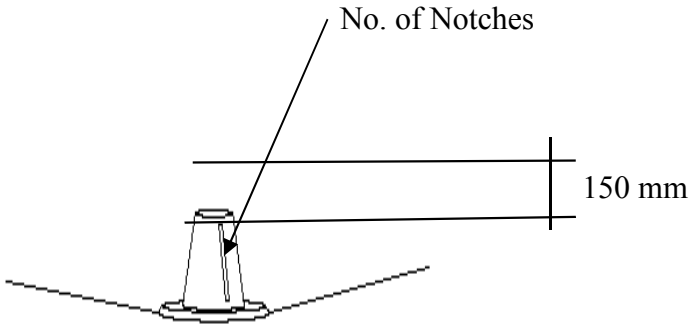
Opening	G.P.M. Per Inch of Head	L.P.M. Per Inch (25 mm) of Head	L/s Per Metre of Head	L/s Per 0.15 m of Head
Standard - X1	5.00	22.73	14.92	2.24
Reduced - X2	3.75	17.05	11.19	1.68
Reduced - X3	2.50	11.37	7.46	1.12
Max Reduced - X4	1.25	5.68	3.73	0.56



SAMPLE CALCULATION:

AREA R-01

Number of notches (N) = 1
Head (H) = 0.062 m for 5-year event
Head (H) = 0.094 m for 100-year event



$Q_{2\ all}$ = 3.729 L/s/m/notch x H x N
$Q2_{all}$ = 3.729 L/s/m/notch x .062 m x 1 notch
$Q2_{all}$ = 0.23 L/s

$Q_{5\ all}$ = 3.729 L/s/m/notch x H x N
Q_{5all} = 3.729 L/s/m/notch x .071 m x 1 notch
$Q_{5\ all}$ = 0.26 L/s

$Q_{100\ all}$ = 3.729 L/s/m/notch x H x N
$Q_{100\ all}$ = 3.729 L/s/m/notch x .094 m x 1 notch
$Q_{100\ all}$ = 0.35 L/s

PREPARED BY: NOVATECH
DATE: August 5th, 2016
REVISED: March 2, 2018

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REQUIRED STORAGE - 2-YEAR EVENT
AREA R-1

OTTAWA IDF CURVE
Area = 0.004 ha Qallow = 0.23
C = 0.90 Vol(max) = 0.28
Notches = 1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	103.57	0.91	0.68	0.20
10	76.81	0.67	0.44	0.27
15	61.77	0.54	0.31	0.28
20	52.03	0.46	0.23	0.27
25	45.17	0.40	0.17	0.25
30	40.04	0.35	0.12	0.22
35	36.06	0.32	0.09	0.18
40	32.86	0.29	0.06	0.14
45	30.24	0.26	0.03	0.09
50	28.04	0.25	0.02	0.05
55	26.17	0.23	0.00	0.00
60	24.56	0.22	-0.01	-0.05
65	23.15	0.20	-0.03	-0.11
70	21.91	0.19	-0.04	-0.16
75	20.81	0.18	-0.05	-0.21
80	19.83	0.17	-0.06	-0.27
85	18.94	0.17	-0.06	-0.33
90	18.14	0.16	-0.07	-0.38

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (2-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.00
0	0.00	0.01
1	0.01	0.02
3	0.03	0.03
6	0.07	0.04
9	0.15	0.05
13	0.25	0.06
17	0.40	0.07
22	0.60	0.08
28	0.85	0.09
35	**1.17**	**0.10**

Linear Interpolation					
0.07	H	0.06		H =	0.062 m
0.40	0.28	0.25		Q_{allow} =	0.23 L/s

REQUIRED STORAGE - 5-YEAR EVENT
AREA R-1

OTTAWA IDF CURVE
Area = 0.004 ha Qallow = 0.26
C = 0.90 Vol(max) = 0.42
Notches = 1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	140.99	1.23	0.97	0.29
10	104.10	0.91	0.65	0.39
15	83.50	0.73	0.47	0.42
20	70.21	0.61	0.35	0.42
25	60.87	0.53	0.27	0.40
30	53.91	0.47	0.21	0.37
35	48.50	0.42	0.16	0.34
40	44.17	0.39	0.12	0.29
45	40.62	0.36	0.09	0.25
50	37.64	0.33	0.07	0.20
55	35.11	0.31	0.04	0.14
60	32.94	0.29	0.02	0.09
65	31.04	0.27	0.01	0.03
70	29.37	0.26	-0.01	-0.03
75	27.88	0.24	-0.02	-0.09
80	26.56	0.23	-0.03	-0.15
85	25.36	0.22	-0.04	-0.21
90	24.29	0.21	-0.05	-0.28

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (5-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.00
0	0.00	0.01
1	0.01	0.02
3	0.03	0.03
6	0.07	0.04
9	0.15	0.05
13	0.25	0.06
17	0.40	0.07
22	0.60	0.08
28	0.85	0.09
35	**1.17**	**0.10**

Linear Interpolation					
0.08	H	0.07		H =	0.071 m
0.60	0.42	0.40		Q_{allow} =	0.26 L/s

REQUIRED STORAGE - 10-YEAR EVENT
AREA R-1

OTTAWA IDF CURVE
Area = 0.004 ha Qallow = 0.29
C = 0.90 Vol(max) = 0.55
Notches = 1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	165.77	1.45	1.19	0.36
10	122.14	1.07	0.81	0.48
15	97.85	0.86	0.59	0.53
20	82.21	0.72	0.46	0.55
25	71.22	0.62	0.36	0.54
30	63.05	0.55	0.29	0.52
35	56.70	0.50	0.23	0.49
40	51.62	0.45	0.19	0.45
45	47.45	0.42	0.15	0.41
50	43.97	0.39	0.12	0.36
55	41.00	0.36	0.10	0.31
60	38.45	0.34	0.07	0.26
65	36.23	0.32	0.05	0.21
70	34.27	0.30	0.04	0.15
75	32.54	0.28	0.02	0.09
80	30.98	0.27	0.01	0.04
85	29.59	0.26	0.00	-0.03
90	28.32	0.25	-0.04	-0.23

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (10-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.00
0	0.00	0.01
1	0.01	0.02
3	0.03	0.03
6	0.07	0.04
9	0.15	0.05
13	0.25	0.06
17	0.40	0.07
22	0.60	0.08
28	0.85	0.09
35	**1.17**	**0.10**

Linear Interpolation					
0.08	H	0.07		H =	0.077 m
0.60	0.55	0.40		Q_{allow} =	0.29 L/s

REQUIRED STORAGE - 100-YEAR EVENT
AREA R-1

OTTAWA IDF CURVE
Area = 0.004 ha Qallow = 0.35
C = 1.00 Vol(max) = 0.99
Notches = 1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	242.70	2.36	2.01	0.60
10	178.56	1.74	1.39	0.83
15	142.89	1.39	1.04	0.94
20	119.95	1.17	0.82	0.98
25	103.85	1.01	0.66	0.99
30	91.87	0.89	0.54	0.98
35	82.58	0.80	0.45	0.95
40	75.15	0.73	0.38	0.91
45	69.05	0.67	0.32	0.87
50	63.95	0.62	0.27	0.82
55	59.62	0.58	0.23	0.76
60	55.89	0.54	0.19	0.70
65	52.65	0.51	0.16	0.63
70	49.79	0.48	0.13	0.56
75	47.26	0.46	0.11	0.49
80	44.99	0.44	0.09	0.42
85	42.95	0.42	0.07	0.35
90	41.11	0.40	0.05	0.27

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (100-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.00
0	0.00	0.01
1	0.01	0.02
3	0.03	0.03
6	0.07	0.04
9	0.15	0.05
13	0.25	0.06
17	0.40	0.07
22	0.60	0.08
28	0.85	0.09
35	**1.17**	**0.10**

Linear Interpolation					
0.10	H	0.09		H =	0.094 m
1.17	0.99	0.85		Q_{allow} =	0.35 L/s

Note: Qallow is the flow rate through an overcontrolled Zurn Roof Drain (3.73 L/s/m of head.)

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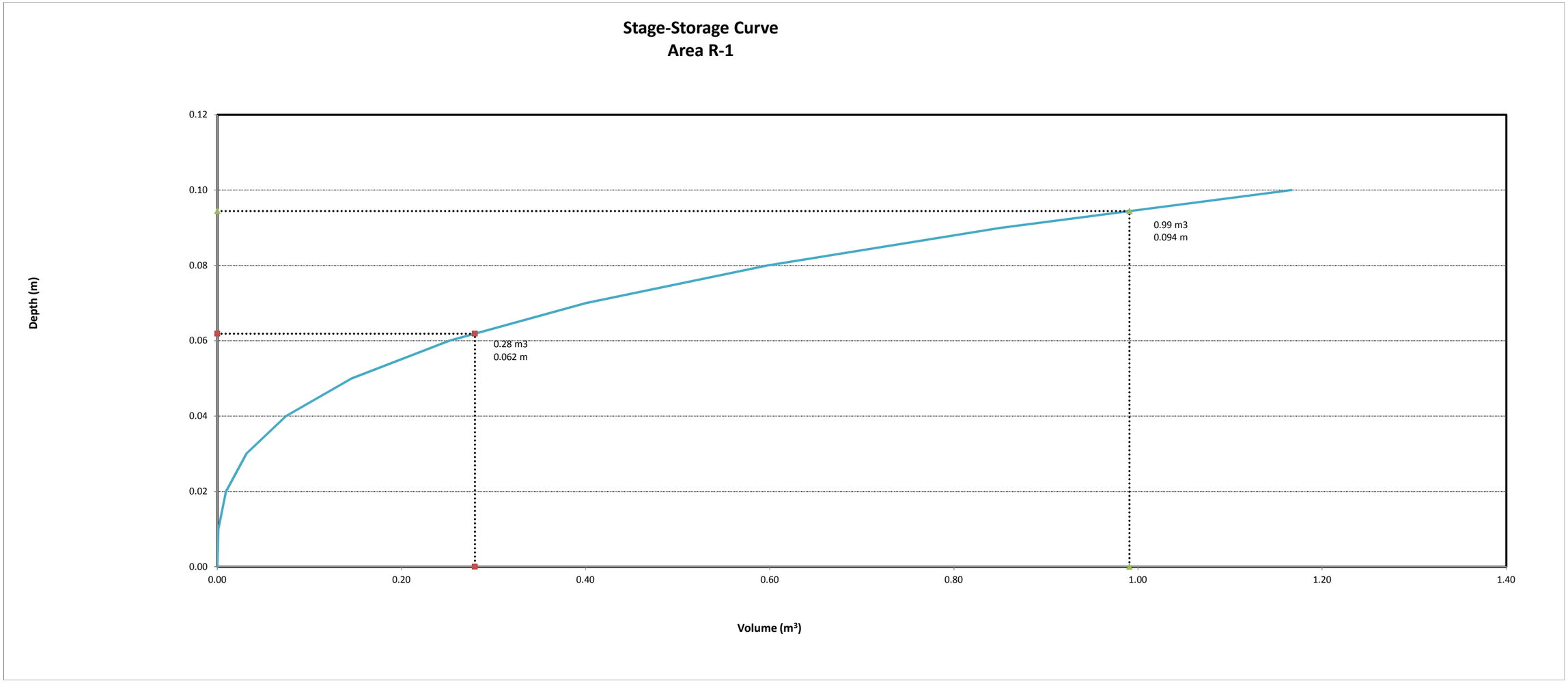

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REQUIRED STORAGE - 2-YEAR EVENT
AREA R-2

OTTAWA IDF CURVE
Area = 0.005 ha Qallow = 0.25
C = 0.90 Vol(max) = 0.51
Notches = 1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	103.57	1.35	1.10	0.33
10	76.81	1.00	0.75	0.45
15	61.77	0.80	0.55	0.50
20	52.03	0.68	0.43	0.51
25	45.17	0.59	0.34	0.51
30	40.04	0.52	0.27	0.49
35	36.06	0.47	0.22	0.46
40	32.86	0.43	0.18	0.43
45	30.24	0.39	0.14	0.39
50	28.04	0.36	0.11	0.34
55	26.17	0.34	0.09	0.30
60	24.56	0.32	0.07	0.25
65	23.15	0.30	0.05	0.20
70	21.91	0.29	0.04	0.15
75	20.81	0.27	0.02	0.09
80	19.83	0.26	0.01	0.04
85	18.94	0.25	0.00	-0.02
90	18.14	0.24	-0.01	-0.08

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (2-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.00
1	0.00	0.01
2	0.01	0.02
5	0.05	0.03
8	0.11	0.04
13	0.22	0.05
19	0.37	0.06
25	0.59	0.07
33	0.89	0.08
42	1.26	0.09
52	**1.73**	**0.10**

Linear Interpolation					
0.07	H	0.06		H =	0.066 m
0.59	0.51	0.37		Q_{allow} =	0.25 L/s

REQUIRED STORAGE - 5-YEAR EVENT
AREA R-2

OTTAWA IDF CURVE
Area = 0.005 ha Qallow = 0.28
C = 0.90 Vol(max) = 0.77
Notches = 1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	140.99	1.83	1.55	0.47
10	104.10	1.35	1.07	0.64
15	83.50	1.09	0.81	0.73
20	70.21	0.91	0.63	0.76
25	60.87	0.79	0.51	0.77
30	53.91	0.70	0.42	0.76
35	48.50	0.63	0.35	0.74
40	44.17	0.57	0.29	0.71
45	40.62	0.53	0.25	0.67
50	37.64	0.49	0.21	0.63
55	35.11	0.46	0.18	0.58
60	32.94	0.43	0.15	0.53
65	31.04	0.40	0.12	0.48
70	29.37	0.38	0.10	0.43
75	27.88	0.36	0.08	0.37
80	26.56	0.35	0.07	0.31
85	25.36	0.33	0.05	0.26
90	24.29	0.32	0.04	0.19

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (5-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.00
1	0.00	0.01
2	0.01	0.02
5	0.05	0.03
8	0.11	0.04
13	0.22	0.05
19	0.37	0.06
25	0.59	0.07
33	0.89	0.08
42	1.26	0.09
52	**1.73**	**0.10**

Linear Interpolation					
0.08	H	0.07		H =	0.076 m
0.89	0.77	0.59		Q_{allow} =	0.28 L/s

REQUIRED STORAGE - 10-YEAR EVENT
AREA R-2

OTTAWA IDF CURVE
Area = 0.005 ha Qallow = 0.31
C = 0.90 Vol(max) = 0.97
Notches = 1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	165.77	2.16	1.88	0.56
10	122.14	1.59	1.31	0.79
15	97.85	1.27	0.99	0.89
20	82.21	1.07	0.79	0.95
25	71.22	0.93	0.65	0.97
30	63.05	0.82	0.54	0.97
35	56.70	0.74	0.46	0.96
40	51.62	0.67	0.39	0.94
45	47.45	0.62	0.34	0.91
50	43.97	0.57	0.29	0.88
55	41.00	0.53	0.25	0.84
60	38.45	0.50	0.22	0.79
65	36.23	0.47	0.19	0.75
70	34.27	0.45	0.17	0.70
75	32.54	0.42	0.14	0.64
80	30.98	0.40	0.12	0.59
85	29.59	0.38	0.10	0.54
90	28.32	0.37	0.06	0.32

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (10-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.00
1	0.00	0.01
2	0.01	0.02
5	0.05	0.03
8	0.11	0.04
13	0.22	0.05
19	0.37	0.06
25	0.59	0.07
33	0.89	0.08
42	1.26	0.09
52	**1.73**	**0.10**

Linear Interpolation					
0.09	H	0.08		H =	0.082 m
1.26	0.97	0.89		Q_{allow} =	0.31 L/s

REQUIRED STORAGE - 100-YEAR EVENT
AREA R-2

OTTAWA IDF CURVE
Area = 0.005 ha Qallow = 0.37
C = 1.00 Vol(max) = 1.73
Notches = 1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	242.70	3.51	3.14	0.94
10	178.56	2.58	2.21	1.33
15	142.89	2.07	1.70	1.53
20	119.95	1.73	1.36	1.64
25	103.85	1.50	1.13	1.70
30	91.87	1.33	0.96	1.72
35	82.58	1.19	0.82	1.73
40	75.15	1.09	0.72	1.72
45	69.05	1.00	0.63	1.70
50	63.95	0.92	0.55	1.66
55	59.62	0.86	0.49	1.62
60	55.89	0.81	0.44	1.58
65	52.65	0.76	0.39	1.53
70	49.79	0.72	0.35	1.47
75	47.26	0.68	0.31	1.41
80	44.99	0.65	0.28	1.35
85	42.95	0.62	0.25	1.28
90	41.11	0.59	0.22	1.21

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (100-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.00
1	0.00	0.01
2	0.01	0.02
5	0.05	0.03
8	0.11	0.04
13	0.22	0.05
19	0.37	0.06
25	0.59	0.07
33	0.89	0.08
42	1.26	0.09
52	**1.73**	**0.10**

Linear Interpolation					
0.10	H	0.09		H =	0.100 m
1.73	1.73	1.26		Q_{allow} =	0.37 L/s

Note: Qallow is the flow rate through an overcontrolled Zurn Roof Drain (3.73 L/s/m of head.)

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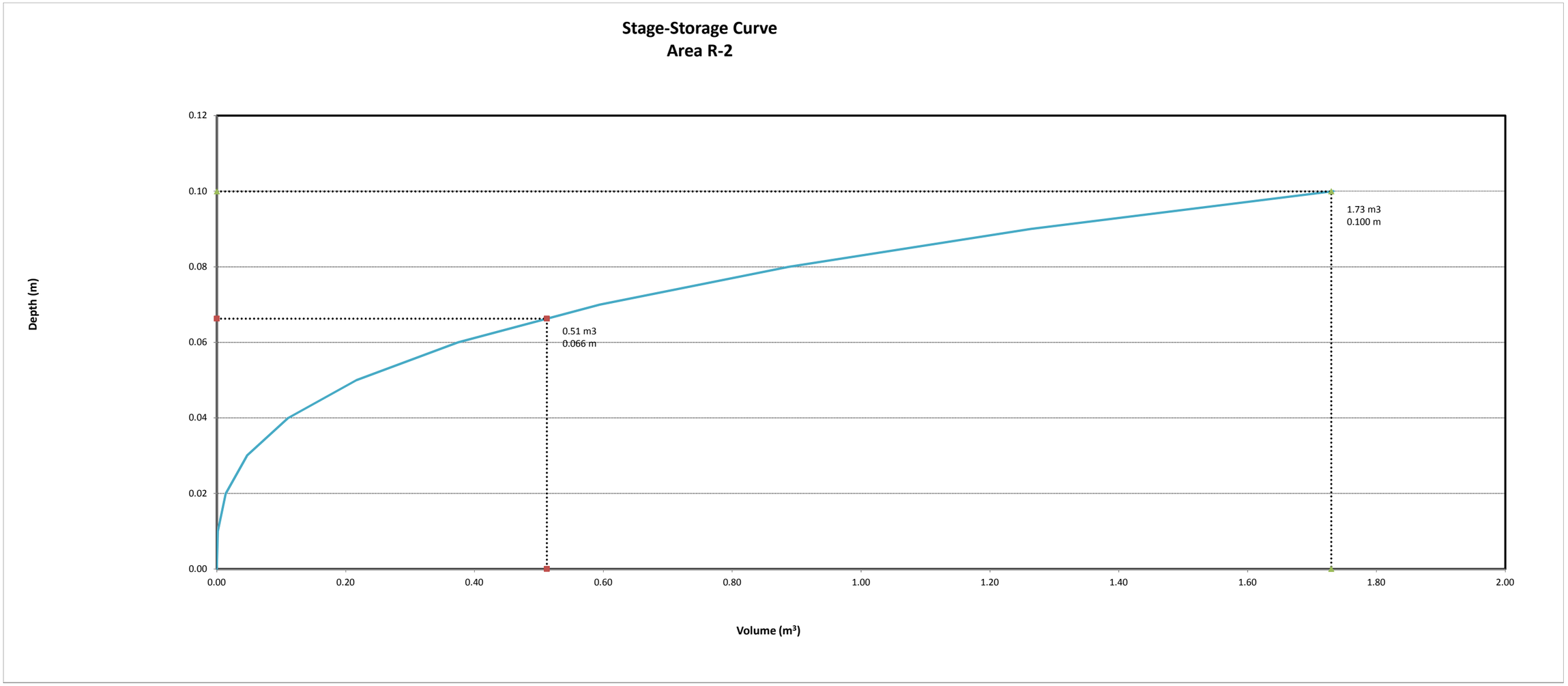

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REQUIRED STORAGE - 2-YEAR EVENT
AREA R-3

OTTAWA IDF CURVE

Area =	0.003	ha	Qallow =	0.22
C =	0.90		Vol(max) =	0.21
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	103.57	0.75	0.53	0.16
10	76.81	0.56	0.34	0.20
15	61.77	0.45	0.23	0.21
20	52.03	0.38	0.16	0.19
25	45.17	0.33	0.11	0.16
30	40.04	0.29	0.07	0.13
35	36.06	0.26	0.04	0.09
40	32.86	0.24	0.02	0.04
45	30.24	0.22	0.00	0.00
50	28.04	0.20	-0.02	-0.05
55	26.17	0.19	-0.03	-0.10
60	24.56	0.18	-0.04	-0.15
65	23.15	0.17	-0.05	-0.20
70	21.91	0.16	-0.06	-0.26
75	20.81	0.15	-0.07	-0.31
80	19.83	0.14	-0.08	-0.37
85	18.94	0.14	-0.08	-0.42
90	18.14	0.13	-0.09	-0.48

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (2-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
1	0.01	0.02
3	0.03	0.03
5	0.06	0.04
7	0.12	0.05
10	0.21	0.06
14	0.33	0.07
19	0.49	0.08
23	0.70	0.09
29	**0.97**	**0.10**

Linear Interpolation					
0.06	H	0.05		H =	0.060 m
0.21	0.21	0.12		Q_{allow} =	0.22 L/s

REQUIRED STORAGE - 5-YEAR EVENT
AREA R-3

OTTAWA IDF CURVE

Area =	0.003	ha	Qallow =	0.26
C =	0.90		Vol(max) =	0.32
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	140.99	1.02	0.77	0.23
10	104.10	0.76	0.50	0.30
15	83.50	0.61	0.35	0.32
20	70.21	0.51	0.25	0.31
25	60.87	0.44	0.19	0.28
30	53.91	0.39	0.14	0.25
35	48.50	0.35	0.10	0.20
40	44.17	0.32	0.07	0.16
45	40.62	0.29	0.04	0.11
50	37.64	0.27	0.02	0.05
55	35.11	0.25	0.00	0.00
60	32.94	0.24	-0.02	-0.06
65	31.04	0.23	-0.03	-0.12
70	29.37	0.21	-0.04	-0.18
75	27.88	0.20	-0.05	-0.24
80	26.56	0.19	-0.06	-0.30
85	25.36	0.18	-0.07	-0.36
90	24.29	0.18	-0.08	-0.43

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (5-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
1	0.01	0.02
3	0.03	0.03
5	0.06	0.04
7	0.12	0.05
10	0.21	0.06
14	0.33	0.07
19	0.49	0.08
23	0.70	0.09
29	**0.97**	**0.10**

Linear Interpolation					
0.07	H	0.06		H =	0.069 m
0.33	0.32	0.21		Q_{allow} =	0.26 L/s

REQUIRED STORAGE - 10-YEAR EVENT
AREA R-3

OTTAWA IDF CURVE

Area =	0.003	ha	Qallow =	0.28
C =	0.90		Vol(max) =	0.41
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	165.77	1.20	0.95	0.28
10	122.14	0.89	0.63	0.38
15	97.85	0.71	0.45	0.41
20	82.21	0.60	0.34	0.41
25	71.22	0.52	0.26	0.39
30	63.05	0.46	0.20	0.36
35	56.70	0.41	0.16	0.33
40	51.62	0.37	0.12	0.29
45	47.45	0.34	0.09	0.24
50	43.97	0.32	0.06	0.19
55	41.00	0.30	0.04	0.14
60	38.45	0.28	0.02	0.09
65	36.23	0.26	0.01	0.03
70	34.27	0.25	-0.01	-0.03
75	32.54	0.24	-0.02	-0.09
80	30.98	0.22	-0.03	-0.14
85	29.59	0.21	-0.04	-0.21
90	28.32	0.21	-0.07	-0.40

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (10-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
1	0.01	0.02
3	0.03	0.03
5	0.06	0.04
7	0.12	0.05
10	0.21	0.06
14	0.33	0.07
19	0.49	0.08
23	0.70	0.09
29	**0.97**	**0.10**

Linear Interpolation					
0.08	H	0.07		H =	0.075 m
0.49	0.41	0.33		Q_{allow} =	0.28 L/s

REQUIRED STORAGE - 100-YEAR EVENT
AREA R-3

OTTAWA IDF CURVE

Area =	0.003	ha	Qallow =	0.34
C =	1.00		Vol(max) =	0.75
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	242.70	1.96	1.62	0.49
10	178.56	1.44	1.10	0.66
15	142.89	1.15	0.81	0.73
20	119.95	0.97	0.63	0.75
25	103.85	0.84	0.50	0.75
30	91.87	0.74	0.40	0.72
35	82.58	0.67	0.33	0.68
40	75.15	0.61	0.27	0.64
45	69.05	0.56	0.22	0.59
50	63.95	0.52	0.18	0.53
55	59.62	0.48	0.14	0.46
60	55.89	0.45	0.11	0.40
65	52.65	0.42	0.08	0.33
70	49.79	0.40	0.06	0.26
75	47.26	0.38	0.04	0.18
80	44.99	0.36	0.02	0.11
85	42.95	0.35	0.01	0.03
90	41.11	0.33	-0.01	-0.05

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (100-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
1	0.01	0.02
3	0.03	0.03
5	0.06	0.04
7	0.12	0.05
10	0.21	0.06
14	0.33	0.07
19	0.49	0.08
23	0.70	0.09
29	**0.97**	**0.10**

Linear Interpolation					
0.1	H	0.09		H =	0.092 m
0.97	0.75	0.70		Q_{allow} =	0.34 L/s

Note: Qallow is the flow rate through an overcontrolled Zurn Roof Drain (3.73 L/s/m of head.)

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DATE: August 5th, 2016
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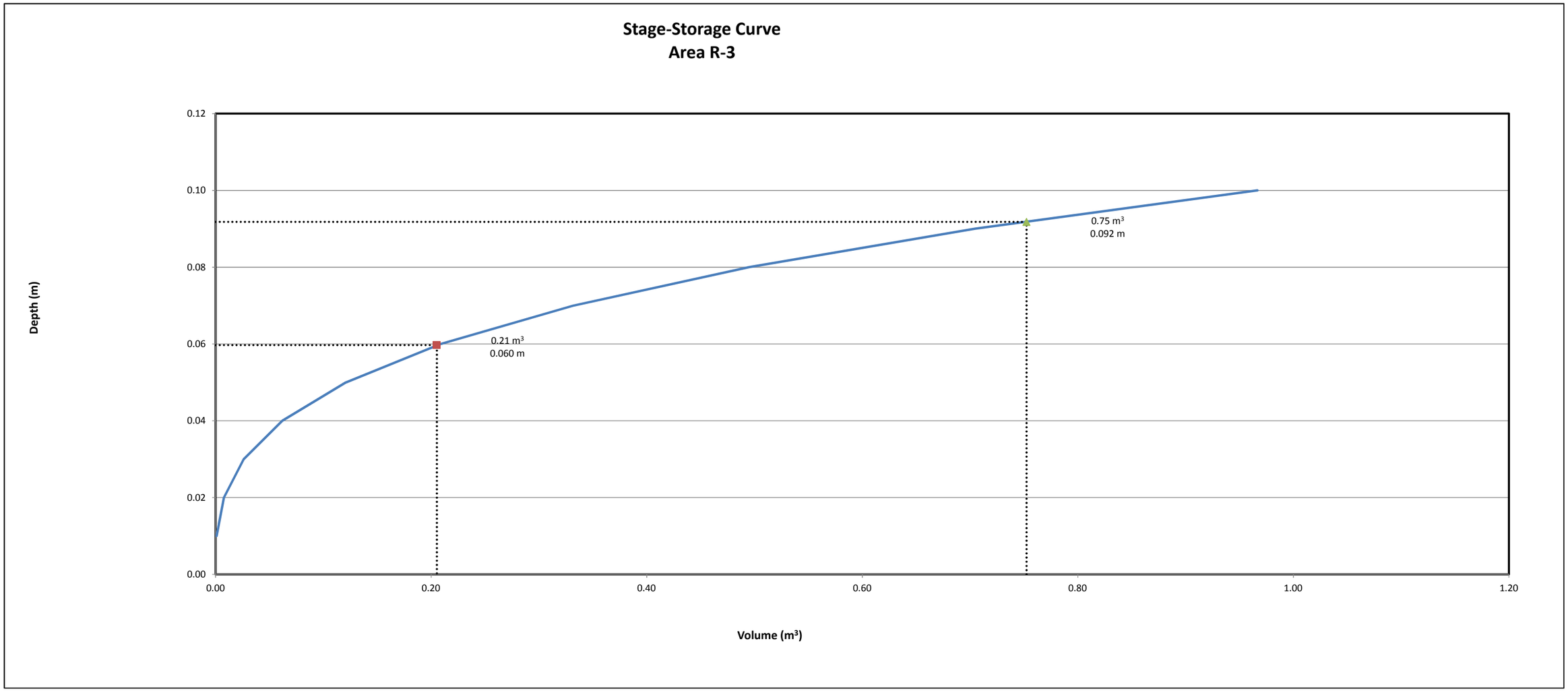

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REQUIRED STORAGE - 2-YEAR EVENT
AREA R-4

OTTAWA IDF CURVE

Area = 0.004 ha | Qallow = 0.24
C = 0.90 | Vol(max) = 0.37
Notches = 1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	103.57	1.09	0.85	0.25
10	76.81	0.81	0.57	0.34
15	61.77	0.65	0.41	0.37
20	52.03	0.55	0.31	0.37
25	45.17	0.47	0.23	0.35
30	40.04	0.42	0.18	0.33
35	36.06	0.38	0.14	0.29
40	32.86	0.35	0.11	0.25
45	30.24	0.32	0.08	0.21
50	28.04	0.29	0.05	0.16
55	26.17	0.28	0.04	0.12
60	24.56	0.26	0.02	0.07
65	23.15	0.24	0.00	0.01
70	21.91	0.23	-0.01	-0.04
75	20.81	0.22	-0.02	-0.10
80	19.83	0.21	-0.03	-0.15
85	18.94	0.20	-0.04	-0.21
90	18.14	0.19	-0.05	-0.27

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (2-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.00
0	0.00	0.01
2	0.01	0.02
4	0.04	0.03
7	0.09	0.04
11	0.18	0.05
15	0.30	0.06
21	0.48	0.07
27	0.72	0.08
34	1.02	0.09
42	**1.40**	**0.10**

Linear Interpolation					
0.07	H	0.06		H =	0.064 m
0.48	0.37	0.30		Q_{allow} =	0.24 L/s

REQUIRED STORAGE - 5-YEAR EVENT
AREA R-4

OTTAWA IDF CURVE

Area = 0.004 ha | Qallow = 0.27
C = 0.90 | Vol(max) = 0.56
Notches = 1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	140.99	1.48	1.21	0.36
10	104.10	1.09	0.82	0.49
15	83.50	0.88	0.61	0.55
20	70.21	0.74	0.47	0.56
25	60.87	0.64	0.37	0.55
30	53.91	0.57	0.30	0.53
35	48.50	0.51	0.24	0.50
40	44.17	0.46	0.19	0.47
45	40.62	0.43	0.16	0.42
50	37.64	0.40	0.13	0.38
55	35.11	0.37	0.10	0.33
60	32.94	0.35	0.08	0.27
65	31.04	0.33	0.06	0.22
70	29.37	0.31	0.04	0.16
75	27.88	0.29	0.02	0.10
80	26.56	0.28	0.01	0.04
85	25.36	0.27	0.00	-0.02
90	24.28	0.26	-0.01	-0.08

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (5-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.00
0	0.00	0.01
2	0.01	0.02
4	0.04	0.03
7	0.09	0.04
11	0.18	0.05
15	0.30	0.06
21	0.48	0.07
27	0.72	0.08
34	1.02	0.09
42	**1.40**	**0.10**

Linear Interpolation					
0.08	H	0.07		H =	0.073 m
0.72	0.56	0.48		Q_{allow} =	0.27 L/s

REQUIRED STORAGE - 10-YEAR EVENT
AREA R-4

OTTAWA IDF CURVE

Area = 0.004 ha | Qallow = 0.30
C = 0.90 | Vol(max) = 0.72
Notches = 1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	165.77	1.74	1.47	0.44
10	122.14	1.28	1.01	0.61
15	97.85	1.03	0.76	0.68
20	82.21	0.86	0.59	0.71
25	71.22	0.75	0.48	0.72
30	63.05	0.66	0.39	0.71
35	56.70	0.60	0.33	0.68
40	51.62	0.54	0.27	0.65
45	47.45	0.50	0.23	0.62
50	43.97	0.46	0.19	0.58
55	41.00	0.43	0.16	0.53
60	38.45	0.40	0.13	0.48
65	36.23	0.38	0.11	0.43
70	34.27	0.36	0.09	0.38
75	32.54	0.34	0.07	0.32
80	30.98	0.33	0.06	0.27
85	29.59	0.31	0.04	0.21
90	28.32	0.30	0.03	0.15

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (10-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.00
0	0.00	0.01
2	0.01	0.02
4	0.04	0.03
7	0.09	0.04
11	0.18	0.05
15	0.30	0.06
21	0.48	0.07
27	0.72	0.08
34	1.02	0.09
42	**1.40**	**0.10**

Linear Interpolation					
0.09	H	0.08		H =	0.080 m
1.02	0.72	0.72		Q_{allow} =	0.30 L/s

REQUIRED STORAGE - 100-YEAR EVENT
AREA R-4

OTTAWA IDF CURVE

Area = 0.004 ha | Qallow = 0.36
C = 1.00 | Vol(max) = 1.28
Notches = 1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	242.70	2.83	2.47	0.74
10	178.56	2.08	1.72	1.03
15	142.89	1.67	1.31	1.18
20	119.95	1.40	1.04	1.25
25	103.85	1.21	0.85	1.28
30	91.87	1.07	0.71	1.28
35	82.58	0.96	0.60	1.27
40	75.15	0.88	0.52	1.24
45	69.05	0.81	0.45	1.20
50	63.95	0.75	0.39	1.16
55	59.62	0.70	0.34	1.11
60	55.89	0.65	0.29	1.05
65	52.65	0.61	0.25	0.99
70	49.79	0.58	0.22	0.93
75	47.26	0.55	0.19	0.86
80	44.99	0.53	0.17	0.79
85	42.95	0.50	0.14	0.72
90	41.11	0.48	0.12	0.65

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (100-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.00
0	0.00	0.01
2	0.01	0.02
4	0.04	0.03
7	0.09	0.04
11	0.18	0.05
15	0.30	0.06
21	0.48	0.07
27	0.72	0.08
34	1.02	0.09
42	**1.40**	**0.10**

Linear Interpolation					
0.1	H	0.09		H =	0.097 m
1.40	1.28	1.02		Q_{allow} =	0.36 L/s

Note: Qallow is the flow rate through an overcontrolled Zurn Roof Drain (3.73 L/s/m of head.)

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DATE: August 5th, 2016
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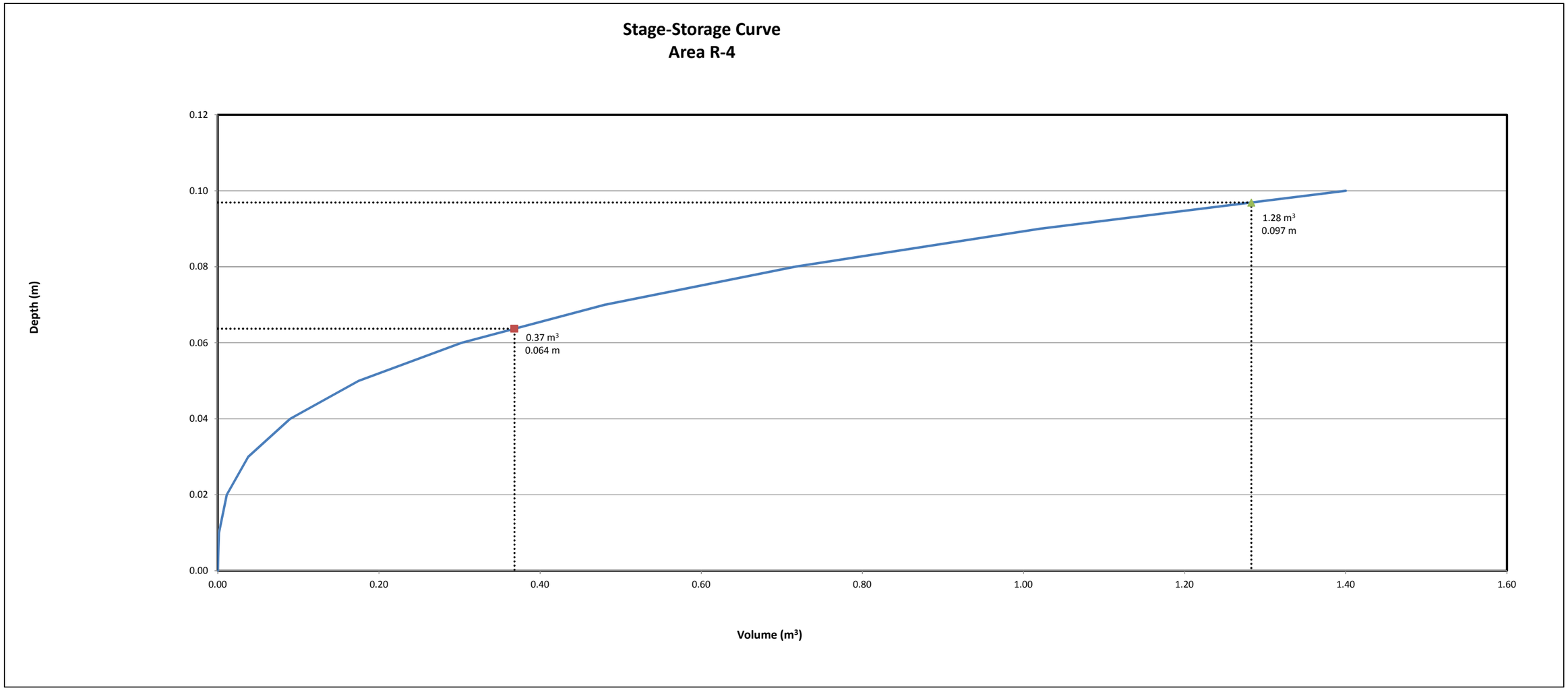

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REQUIRED STORAGE - 2-YEAR EVENT
AREA R-5

OTTAWA IDF CURVE

Area =	0.003	ha	Qallow =	0.22
C =	0.90		Vol(max) =	0.19
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	103.57	0.73	0.51	0.15
10	76.81	0.54	0.32	0.19
15	61.77	0.43	0.21	0.19
20	52.03	0.36	0.14	0.17
25	45.17	0.32	0.10	0.14
30	40.04	0.28	0.06	0.11
35	36.06	0.25	0.03	0.07
40	32.86	0.23	0.01	0.02
45	30.24	0.21	-0.01	-0.02
50	28.04	0.20	-0.02	-0.07
55	26.17	0.18	-0.04	-0.12
60	24.56	0.17	-0.05	-0.17
65	23.15	0.16	-0.06	-0.23
70	21.91	0.15	-0.07	-0.28
75	20.81	0.15	-0.07	-0.33
80	19.83	0.14	-0.08	-0.39
85	18.94	0.13	-0.09	-0.45
90	18.14	0.13	-0.09	-0.50

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (2-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
1	0.01	0.02
3	0.03	0.03
4	0.06	0.04
7	0.12	0.05
10	0.20	0.06
14	0.32	0.07
18	0.48	0.08
23	0.68	0.09
28	**0.93**	**0.10**

Linear Interpolation					
0.06	H	0.05		H =	0.059 m
0.20	0.19	0.12		Q_{allow} =	0.22 L/s

REQUIRED STORAGE - 5-YEAR EVENT
AREA R-5

OTTAWA IDF CURVE

Area =	0.003	ha	Qallow =	0.25
C =	0.90		Vol(max) =	0.30
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	140.99	0.99	0.73	0.22
10	104.10	0.73	0.48	0.29
15	83.50	0.58	0.33	0.30
20	70.21	0.49	0.24	0.29
25	60.87	0.43	0.17	0.26
30	53.91	0.38	0.12	0.22
35	48.50	0.34	0.09	0.18
40	44.17	0.31	0.06	0.13
45	40.62	0.28	0.03	0.08
50	37.64	0.26	0.01	0.03
55	35.11	0.25	-0.01	-0.03
60	32.94	0.23	-0.02	-0.08
65	31.04	0.22	-0.04	-0.14
70	29.37	0.21	-0.05	-0.20
75	27.88	0.20	-0.06	-0.26
80	26.56	0.19	-0.07	-0.33
85	25.36	0.18	-0.08	-0.39
90	24.28	0.17	-0.08	-0.45

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (5-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
1	0.01	0.02
3	0.03	0.03
4	0.06	0.04
7	0.12	0.05
10	0.20	0.06
14	0.32	0.07
18	0.48	0.08
23	0.68	0.09
28	**0.93**	**0.10**

Linear Interpolation					
0.07	H	0.06		H =	0.068 m
0.32	0.30	0.20		Q_{allow} =	0.25 L/s

REQUIRED STORAGE - 10-YEAR EVENT
AREA R-5

OTTAWA IDF CURVE

Area =	0.003	ha	Qallow =	0.28
C =	0.90		Vol(max) =	0.39
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	165.77	1.16	0.91	0.27
10	122.14	0.86	0.60	0.36
15	97.85	0.69	0.43	0.39
20	82.21	0.58	0.32	0.39
25	71.22	0.50	0.24	0.37
30	63.05	0.44	0.19	0.34
35	56.70	0.40	0.14	0.30
40	51.62	0.36	0.11	0.26
45	47.45	0.33	0.08	0.21
50	43.97	0.31	0.05	0.16
55	41.00	0.29	0.03	0.11
60	38.45	0.27	0.02	0.06
65	36.23	0.25	0.00	0.00
70	34.27	0.24	-0.01	-0.06
75	32.54	0.23	-0.03	-0.12
80	30.98	0.22	-0.04	-0.18
85	29.59	0.21	-0.05	-0.24
90	28.32	0.20	-0.06	-0.30

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (10-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
1	0.01	0.02
3	0.03	0.03
4	0.06	0.04
7	0.12	0.05
10	0.20	0.06
14	0.32	0.07
18	0.48	0.08
23	0.68	0.09
28	**0.93**	**0.10**

Linear Interpolation					
0.08	H	0.07		H =	0.074 m
0.48	0.39	0.32		Q_{allow} =	0.28 L/s

REQUIRED STORAGE - 100-YEAR EVENT
AREA R-5

OTTAWA IDF CURVE

Area =	0.003	ha	Qallow =	0.34
C =	1.00		Vol(max) =	0.71
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	242.70	1.89	1.55	0.46
10	178.56	1.39	1.05	0.63
15	142.89	1.11	0.77	0.70
20	119.95	0.93	0.59	0.71
25	103.85	0.81	0.47	0.70
30	91.87	0.72	0.38	0.68
35	82.58	0.64	0.30	0.64
40	75.15	0.58	0.24	0.59
45	69.05	0.54	0.20	0.53
50	63.95	0.50	0.16	0.47
55	59.62	0.46	0.12	0.41
60	55.89	0.44	0.10	0.34
65	52.65	0.41	0.07	0.27
70	49.79	0.39	0.05	0.20
75	47.26	0.37	0.03	0.13
80	44.99	0.35	0.01	0.05
85	42.95	0.33	-0.01	-0.03
90	41.11	0.32	-0.02	-0.11

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (100-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
1	0.01	0.02
3	0.03	0.03
4	0.06	0.04
7	0.12	0.05
10	0.20	0.06
14	0.32	0.07
18	0.48	0.08
23	0.68	0.09
28	**0.93**	**0.10**

Linear Interpolation					
0.10	H	0.09		H =	0.091 m
0.93	0.71	0.68		Q_{allow} =	0.34 L/s

Note: Qallow is the flow rate through an overcontrolled Zurn Roof Drain (3.73 L/s/m of head.)

PREPARED BY: NOVATECH
DATE: August 5th, 2016
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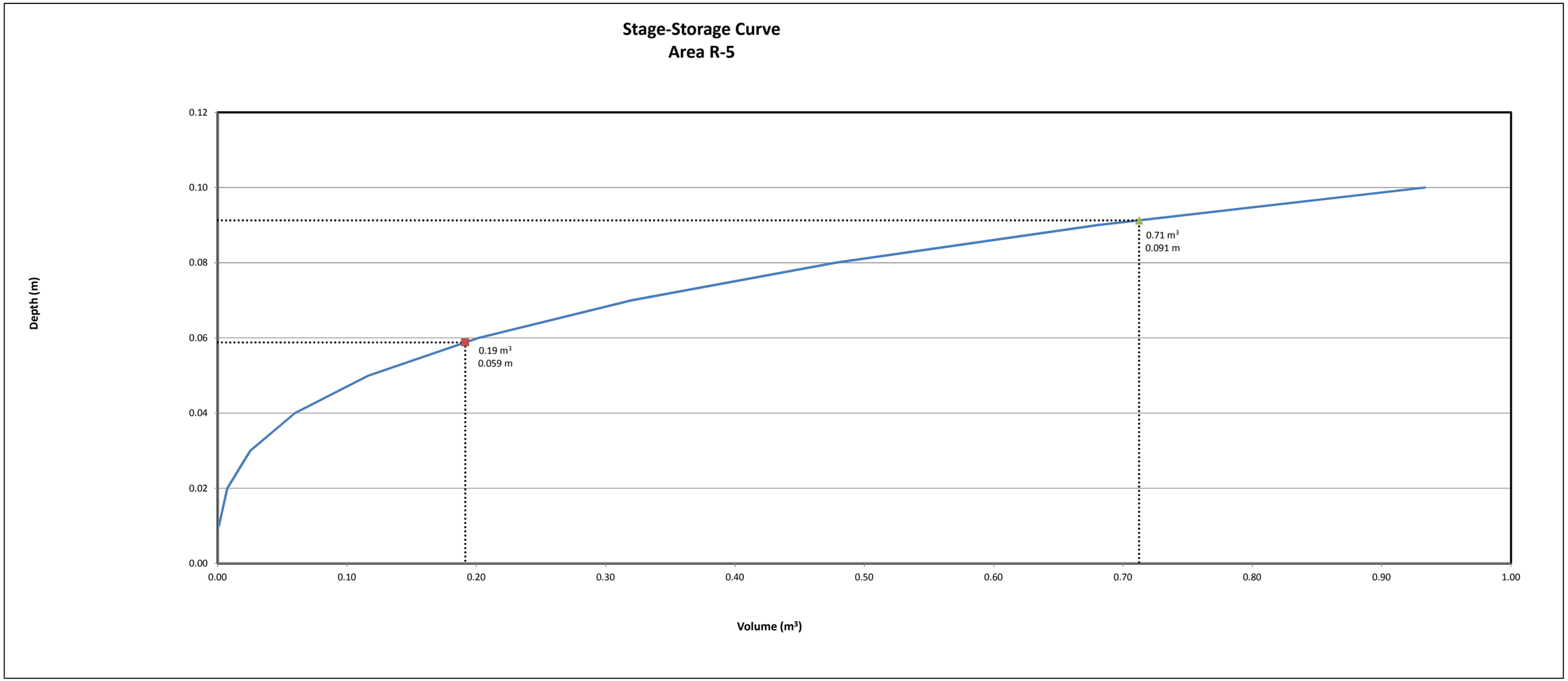

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REQUIRED STORAGE - 2-YEAR EVENT
AREA R-6

OTTAWA IDF CURVE

Area =	0.001	ha	Qallow =	0.16
C =	0.90		Vol(max) =	0.03
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	103.57	0.29	0.13	0.04
10	76.81	0.21	0.05	0.03
15	61.77	0.17	0.01	0.01
20	52.03	0.14	-0.02	-0.02
25	45.17	0.12	-0.04	-0.05
30	40.04	0.11	-0.05	-0.09
35	36.06	0.10	-0.06	-0.13
40	32.86	0.09	-0.07	-0.17
45	30.24	0.08	-0.08	-0.21
50	28.04	0.08	-0.08	-0.25
55	26.17	0.07	-0.09	-0.29
60	24.56	0.07	-0.09	-0.33
65	23.15	0.06	-0.10	-0.38
70	21.91	0.06	-0.10	-0.42
75	20.81	0.06	-0.10	-0.46
80	19.83	0.05	-0.11	-0.51
85	18.94	0.05	-0.11	-0.55
90	18.14	0.05	-0.11	-0.59

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (2-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
0	0.00	0.02
1	0.01	0.03
2	0.02	0.04
3	0.05	0.05
4	0.08	0.06
5	0.13	0.07
7	0.19	0.08
9	0.27	0.09
11	**0.37**	**0.10**

Linear Interpolation					
0.05	H	0.04		H =	0.043 m
0.05	0.03	0.02		Q_{allow} =	0.16 L/s

REQUIRED STORAGE - 5-YEAR EVENT
AREA R-6

OTTAWA IDF CURVE

Area =	0.001	ha	Qallow =	0.20
C =	0.90		Vol(max) =	0.05
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	140.99	0.39	0.19	0.06
10	104.10	0.29	0.09	0.05
15	83.50	0.23	0.03	0.03
20	70.21	0.19	0.00	0.00
25	60.87	0.17	-0.03	-0.04
30	53.91	0.15	-0.05	-0.08
35	48.50	0.13	-0.06	-0.13
40	44.17	0.12	-0.07	-0.18
45	40.62	0.11	-0.08	-0.22
50	37.64	0.10	-0.09	-0.27
55	35.11	0.10	-0.10	-0.32
60	32.94	0.09	-0.10	-0.38
65	31.04	0.09	-0.11	-0.43
70	29.37	0.08	-0.11	-0.48
75	27.88	0.08	-0.12	-0.53
80	26.56	0.07	-0.12	-0.59
85	25.36	0.07	-0.13	-0.64
90	24.28	0.07	-0.13	-0.69

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (5-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
0	0.00	0.02
1	0.01	0.03
2	0.02	0.04
3	0.05	0.05
4	0.08	0.06
5	0.13	0.07
7	0.19	0.08
9	0.27	0.09
11	**0.37**	**0.10**

Linear Interpolation					
0.06	H	0.05		H =	0.053 m
0.08	0.05	0.05		Q_{allow} =	0.20 L/s

REQUIRED STORAGE - 10-YEAR EVENT
AREA R-6

OTTAWA IDF CURVE

Area =	0.001	ha	Qallow =	0.23
C =	0.90		Vol(max) =	0.08
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	165.77	0.46	0.26	0.08
10	122.14	0.34	0.14	0.08
15	97.85	0.27	0.07	0.07
20	82.21	0.23	0.03	0.04
25	71.22	0.20	0.00	0.00
30	63.05	0.17	-0.02	-0.04
35	56.70	0.16	-0.04	-0.08
40	51.62	0.14	-0.05	-0.13
45	47.45	0.13	-0.06	-0.17
50	43.97	0.12	-0.07	-0.22
55	41.00	0.11	-0.08	-0.27
60	38.45	0.11	-0.09	-0.32
65	36.23	0.10	-0.10	-0.37
70	34.27	0.09	-0.10	-0.42
75	32.54	0.09	-0.11	-0.47
80	30.98	0.09	-0.11	-0.53
85	29.59	0.08	-0.11	-0.58
90	28.32	0.08	-0.12	-0.63

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (10-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
0	0.00	0.02
1	0.01	0.03
2	0.02	0.04
3	0.05	0.05
4	0.08	0.06
5	0.13	0.07
7	0.19	0.08
9	0.27	0.09
11	**0.37**	**0.10**

Linear Interpolation					
0.07	H	0.06		H =	0.061 m
0.13	0.08	0.08		Q_{allow} =	0.23 L/s

REQUIRED STORAGE - 100-YEAR EVENT
AREA R-6

OTTAWA IDF CURVE

Area =	0.001	ha	Qallow =	0.28
C =	1.00		Vol(max) =	0.16
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	242.70	0.74	0.46	0.14
10	178.56	0.55	0.27	0.16
15	142.89	0.44	0.16	0.14
20	119.95	0.37	0.09	0.10
25	103.85	0.32	0.04	0.06
30	91.87	0.28	0.00	0.00
35	82.58	0.25	-0.03	-0.06
40	75.15	0.23	-0.05	-0.12
45	69.05	0.21	-0.07	-0.19
50	63.95	0.20	-0.08	-0.25
55	59.62	0.18	-0.10	-0.32
60	55.89	0.17	-0.11	-0.39
65	52.65	0.16	-0.12	-0.46
70	49.79	0.15	-0.13	-0.54
75	47.26	0.14	-0.14	-0.61
80	44.99	0.14	-0.14	-0.68
85	42.95	0.13	-0.15	-0.76
90	41.11	0.13	-0.15	-0.83

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (100-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
0	0.00	0.02
1	0.01	0.03
2	0.02	0.04
3	0.05	0.05
4	0.08	0.06
5	0.13	0.07
7	0.19	0.08
9	0.27	0.09
11	**0.37**	**0.10**

Linear Interpolation					
0.08	H	0.07		H =	0.075 m
0.19	0.16	0.13		Q_{allow} =	0.28 L/s

Note: Qallow is the flow rate through an overcontrolled Zurn Roof Drain (3.73 L/s/m of head.)

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DATE: August 5th, 2016
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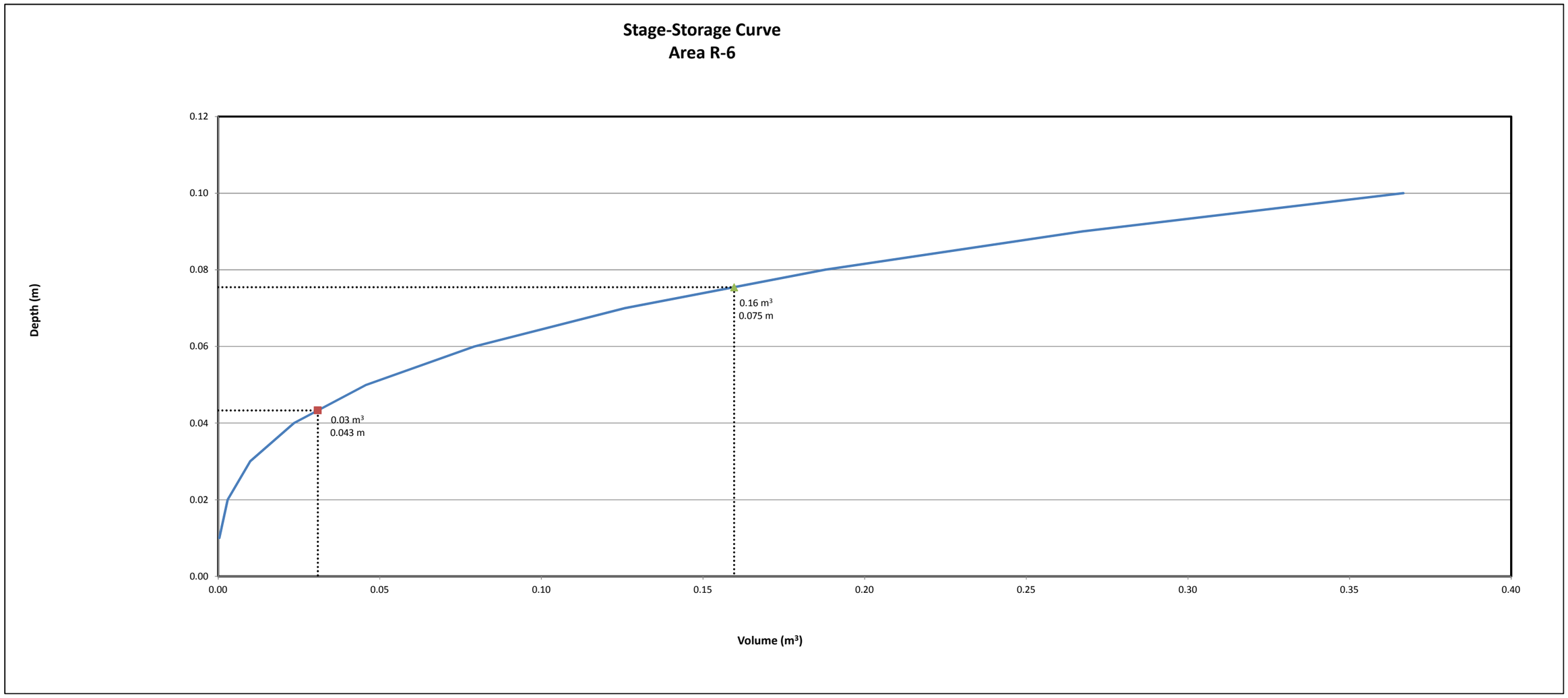

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REQUIRED STORAGE - 2-YEAR EVENT
AREA R-7

OTTAWA IDF CURVE

Area =	0.001	ha	Qallow =	0.17
C =	0.90		Vol(max) =	0.05
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	103.57	0.34	0.16	0.05
10	76.81	0.25	0.08	0.05
15	61.77	0.20	0.03	0.02
20	52.03	0.17	0.00	-0.01
25	45.17	0.15	-0.03	-0.04
30	40.04	0.13	-0.04	-0.08
35	36.06	0.12	-0.06	-0.12
40	32.86	0.11	-0.07	-0.16
45	30.24	0.10	-0.08	-0.20
50	28.04	0.09	-0.08	-0.25
55	26.17	0.09	-0.09	-0.29
60	24.56	0.08	-0.09	-0.34
65	23.15	0.08	-0.10	-0.38
70	21.91	0.07	-0.10	-0.43
75	20.81	0.07	-0.11	-0.48
80	19.83	0.06	-0.11	-0.53
85	18.94	0.06	-0.11	-0.57
90	18.14	0.06	-0.11	-0.62

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (2-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
1	0.00	0.02
1	0.01	0.03
2	0.03	0.04
3	0.05	0.05
5	0.09	0.06
6	0.15	0.07
8	0.22	0.08
11	0.32	0.09
13	**0.43**	**0.10**

Linear Interpolation					
0.05	H	0.04		H =	0.047 m
0.05	0.05	0.03		Q_{allow} =	0.17 L/s

REQUIRED STORAGE - 5-YEAR EVENT
AREA R-7

OTTAWA IDF CURVE

Area =	0.001	ha	Qallow =	0.21
C =	0.90		Vol(max) =	0.08
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	140.99	0.46	0.25	0.07
10	104.10	0.34	0.13	0.08
15	83.50	0.27	0.06	0.06
20	70.21	0.23	0.02	0.02
25	60.87	0.20	-0.01	-0.02
30	53.91	0.18	-0.03	-0.06
35	48.50	0.16	-0.05	-0.11
40	44.17	0.14	-0.07	-0.16
45	40.62	0.13	-0.08	-0.21
50	37.64	0.12	-0.09	-0.26
55	35.11	0.11	-0.10	-0.32
60	32.94	0.11	-0.10	-0.37
65	31.04	0.10	-0.11	-0.43
70	29.37	0.10	-0.11	-0.48
75	27.88	0.09	-0.12	-0.54
80	26.56	0.09	-0.12	-0.59
85	25.36	0.08	-0.13	-0.65
90	24.28	0.08	-0.13	-0.71

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (5-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
1	0.00	0.02
1	0.01	0.03
2	0.03	0.04
3	0.05	0.05
5	0.09	0.06
6	0.15	0.07
8	0.22	0.08
11	0.32	0.09
13	**0.43**	**0.10**

Linear Interpolation					
0.06	H	0.05		H =	0.056 m
0.09	0.08	0.05		Q_{allow} =	0.21 L/s

REQUIRED STORAGE - 10-YEAR EVENT
AREA R-7

OTTAWA IDF CURVE

Area =	0.001	ha	Qallow =	0.24
C =	0.90		Vol(max) =	0.11
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	165.77	0.54	0.33	0.10
10	122.14	0.40	0.19	0.11
15	97.85	0.32	0.11	0.10
20	82.21	0.27	0.06	0.07
25	71.22	0.23	0.02	0.03
30	63.05	0.21	0.00	-0.01
35	56.70	0.18	-0.03	-0.05
40	51.62	0.17	-0.04	-0.10
45	47.45	0.15	-0.06	-0.15
50	43.97	0.14	-0.07	-0.20
55	41.00	0.13	-0.08	-0.25
60	38.45	0.13	-0.08	-0.31
65	36.23	0.12	-0.09	-0.36
70	34.27	0.11	-0.10	-0.41
75	32.54	0.11	-0.10	-0.47
80	30.98	0.10	-0.11	-0.52
85	29.59	0.10	-0.11	-0.58
90	28.32	0.09	-0.12	-0.64

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (10-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
1	0.00	0.02
1	0.01	0.03
2	0.03	0.04
3	0.05	0.05
5	0.09	0.06
6	0.15	0.07
8	0.22	0.08
11	0.32	0.09
13	**0.43**	**0.10**

Linear Interpolation					
0.07	H	0.06		H =	0.063 m
0.15	0.11	0.09		Q_{allow} =	0.24 L/s

REQUIRED STORAGE - 100-YEAR EVENT
AREA R-7

OTTAWA IDF CURVE

Area =	0.001	ha	Qallow =	0.29
C =	1.00		Vol(max) =	0.21
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	242.70	0.88	0.59	0.18
10	178.56	0.65	0.36	0.21
15	142.89	0.52	0.23	0.20
20	119.95	0.43	0.14	0.17
25	103.85	0.38	0.09	0.13
30	91.87	0.33	0.04	0.08
35	82.58	0.30	0.01	0.02
40	75.15	0.27	-0.02	-0.04
45	69.05	0.25	-0.04	-0.11
50	63.95	0.23	-0.06	-0.18
55	59.62	0.22	-0.07	-0.25
60	55.89	0.20	-0.09	-0.32
65	52.65	0.19	-0.10	-0.39
70	49.79	0.18	-0.11	-0.46
75	47.26	0.17	-0.12	-0.54
80	44.99	0.16	-0.13	-0.61
85	42.95	0.16	-0.13	-0.69
90	41.11	0.15	-0.14	-0.76

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (100-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
1	0.00	0.02
1	0.01	0.03
2	0.03	0.04
3	0.05	0.05
5	0.09	0.06
6	0.15	0.07
8	0.22	0.08
11	0.32	0.09
13	**0.43**	**0.10**

Linear Interpolation					
0.08	H	0.07		H =	0.079 m
0.22	0.21	0.15		Q_{allow} =	0.29 L/s

Note: Qallow is the flow rate through an overcontrolled Zurn Roof Drain (3.73 L/s/m of head.)

PREPARED BY: NOVATECH
DATE: August 5th, 2016
REVISED: March 2, 2018

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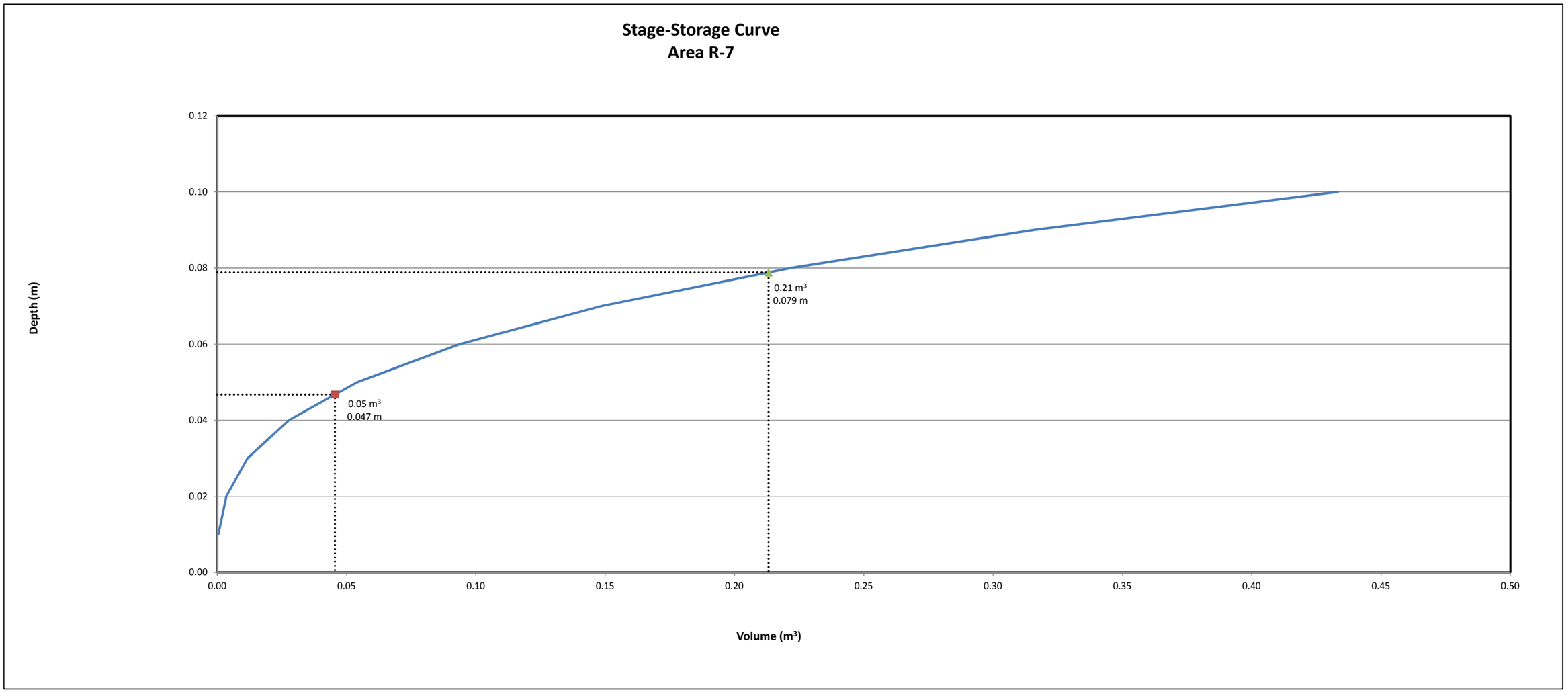

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REQUIRED STORAGE - 2-YEAR EVENT
AREA R-8

OTTAWA IDF CURVE

Area =	0.005	ha	Qallow =	0.24
C =	0.90		Vol(max) =	0.43
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	103.57	1.19	0.95	0.29
10	76.81	0.88	0.64	0.39
15	61.77	0.71	0.47	0.42
20	52.03	0.60	0.36	0.43
25	45.17	0.52	0.28	0.42
30	40.04	0.46	0.22	0.40
35	36.06	0.42	0.18	0.37
40	32.86	0.38	0.14	0.33
45	30.24	0.35	0.11	0.29
50	28.04	0.32	0.08	0.25
55	26.17	0.30	0.06	0.20
60	24.56	0.28	0.04	0.15
65	23.15	0.27	0.03	0.10
70	21.91	0.25	0.01	0.05
75	20.81	0.24	0.00	0.00
80	19.83	0.23	-0.01	-0.06
85	18.94	0.22	-0.02	-0.11
90	18.14	0.21	-0.03	-0.17

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (2-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
2	0.01	0.02
4	0.04	0.03
7	0.10	0.04
12	0.19	0.05
17	0.33	0.06
23	0.53	0.07
29	0.79	0.08
37	1.12	0.09
46	**1.53**	**0.10**

Linear Interpolation					
0.07	H	0.06		H =	0.065 m
0.53	0.43	0.33		Q_{allow} =	0.24 L/s

REQUIRED STORAGE - 5-YEAR EVENT
AREA R-8

OTTAWA IDF CURVE

Area =	0.005	ha	Qallow =	0.28
C =	0.90		Vol(max) =	0.63
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	140.99	1.62	1.34	0.40
10	104.10	1.20	0.92	0.55
15	83.50	0.96	0.68	0.61
20	70.21	0.81	0.53	0.63
25	60.87	0.70	0.42	0.63
30	53.91	0.62	0.34	0.61
35	48.50	0.56	0.28	0.58
40	44.17	0.51	0.23	0.55
45	40.62	0.47	0.19	0.51
50	37.64	0.43	0.15	0.46
55	35.11	0.40	0.12	0.41
60	32.94	0.38	0.10	0.36
65	31.04	0.36	0.08	0.30
70	29.37	0.34	0.06	0.24
75	27.88	0.32	0.04	0.18
80	26.56	0.31	0.03	0.12
85	25.36	0.29	0.01	0.06
90	24.28	0.28	0.00	0.00

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (5-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
2	0.01	0.02
4	0.04	0.03
7	0.10	0.04
12	0.19	0.05
17	0.33	0.06
23	0.53	0.07
29	0.79	0.08
37	1.12	0.09
46	**1.53**	**0.10**

Linear Interpolation					
0.08	H	0.07		H =	0.074 m
0.79	0.63	0.53		Q_{allow} =	0.28 L/s

REQUIRED STORAGE - 10-YEAR EVENT
AREA R-8

OTTAWA IDF CURVE

Area =	0.005	ha	Qallow =	0.30
C =	0.90		Vol(max) =	0.81
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	165.77	1.91	1.63	0.49
10	122.14	1.41	1.13	0.68
15	97.85	1.13	0.85	0.76
20	82.21	0.95	0.67	0.80
25	71.22	0.82	0.54	0.81
30	63.05	0.73	0.45	0.80
35	56.70	0.65	0.37	0.78
40	51.62	0.59	0.31	0.75
45	47.45	0.55	0.27	0.72
50	43.97	0.51	0.23	0.68
55	41.00	0.47	0.19	0.63
60	38.45	0.44	0.16	0.59
65	36.23	0.42	0.14	0.53
70	34.27	0.39	0.11	0.48
75	32.54	0.37	0.09	0.43
80	30.98	0.36	0.08	0.37
85	29.59	0.34	0.06	0.31
90	28.32	0.33	0.05	0.25

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (10-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
2	0.01	0.02
4	0.04	0.03
7	0.10	0.04
12	0.19	0.05
17	0.33	0.06
23	0.53	0.07
29	0.79	0.08
37	1.12	0.09
46	**1.53**	**0.10**

Linear Interpolation					
0.09	H	0.08		H =	0.081 m
1.12	0.81	0.79		Q_{allow} =	0.30 L/s

REQUIRED STORAGE - 100-YEAR EVENT
AREA R-8

OTTAWA IDF CURVE

Area =	0.005	ha	Qallow =	0.37
C =	1.00		Vol(max) =	1.45
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	242.70	3.10	2.73	0.82
10	178.56	2.28	1.91	1.15
15	142.89	1.83	1.46	1.31
20	119.95	1.53	1.16	1.40
25	103.85	1.33	0.96	1.44
30	91.87	1.17	0.80	1.45
35	82.58	1.06	0.69	1.44
40	75.15	0.96	0.59	1.42
45	69.05	0.88	0.51	1.39
50	63.95	0.82	0.45	1.34
55	59.62	0.76	0.39	1.30
60	55.89	0.71	0.34	1.24
65	52.65	0.67	0.30	1.18
70	49.79	0.64	0.27	1.12
75	47.26	0.60	0.23	1.05
80	44.99	0.58	0.21	0.99
85	42.95	0.55	0.18	0.91
90	41.11	0.53	0.16	0.84

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (100-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
2	0.01	0.02
4	0.04	0.03
7	0.10	0.04
12	0.19	0.05
17	0.33	0.06
23	0.53	0.07
29	0.79	0.08
37	1.12	0.09
46	**1.53**	**0.10**

Linear Interpolation					
0.1	H	0.09		H =	0.098 m
1.53	1.45	1.12		Q_{allow} =	0.37 L/s

Note: Qallow is the flow rate through an overcontrolled Zurn Roof Drain (3.73 L/s/m of head.)

PREPARED BY: NOVATECH
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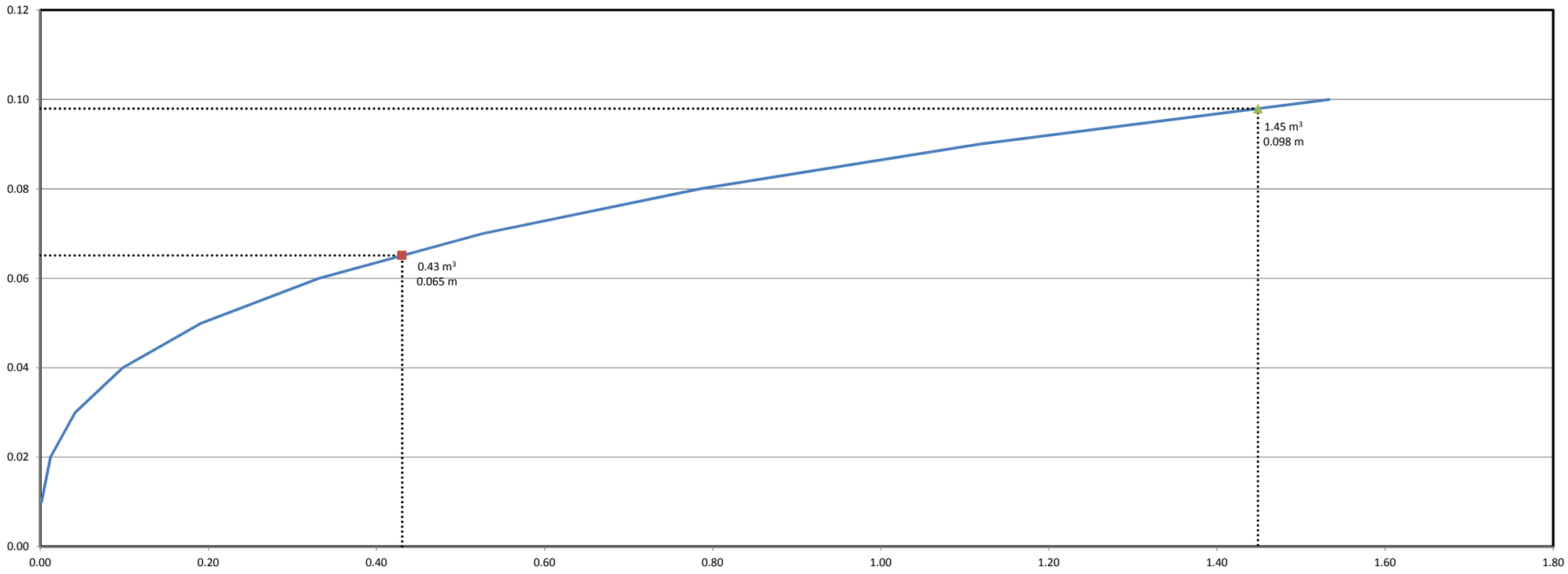
Stage-Storage Curve
Area R-8



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DATE: August 5th, 2016
REVISED: March 2, 2018

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REQUIRED STORAGE - 2-YEAR EVENT
AREA R-9

OTTAWA IDF CURVE

Area =	0.004	ha	Qallow =	0.24
C =	0.90		Vol(max) =	0.35
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	103.57	1.06	0.82	0.25
10	76.81	0.79	0.55	0.33
15	61.77	0.63	0.39	0.35
20	52.03	0.53	0.29	0.35
25	45.17	0.46	0.22	0.33
30	40.04	0.41	0.17	0.31
35	36.06	0.37	0.13	0.27
40	32.86	0.34	0.10	0.23
45	30.24	0.31	0.07	0.19
50	28.04	0.29	0.05	0.14
55	26.17	0.27	0.03	0.09
60	24.56	0.25	0.01	0.04
65	23.15	0.24	0.00	-0.01
70	21.91	0.22	-0.02	-0.06
75	20.81	0.21	-0.03	-0.12
80	19.83	0.20	-0.04	-0.18
85	18.94	0.19	-0.05	-0.23
90	18.14	0.19	-0.05	-0.29

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (2-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
2	0.01	0.02
4	0.04	0.03
7	0.09	0.04
10	0.17	0.05
15	0.30	0.06
20	0.47	0.07
26	0.70	0.08
33	1.00	0.09
41	**1.37**	**0.10**

Linear Interpolation					
0.07	H	0.06		H =	0.063 m
0.47	0.35	0.30		Q_{allow} =	0.24 L/s

REQUIRED STORAGE - 5-YEAR EVENT
AREA R-9

OTTAWA IDF CURVE

Area =	0.004	ha	Qallow =	0.27
C =	0.90		Vol(max) =	0.54
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	140.99	1.45	1.18	0.35
10	104.10	1.07	0.80	0.48
15	83.50	0.86	0.59	0.53
20	70.21	0.72	0.45	0.54
25	60.87	0.62	0.35	0.53
30	53.91	0.55	0.28	0.51
35	48.50	0.50	0.23	0.48
40	44.17	0.45	0.18	0.44
45	40.62	0.42	0.15	0.40
50	37.64	0.39	0.12	0.35
55	35.11	0.36	0.09	0.30
60	32.94	0.34	0.07	0.24
65	31.04	0.32	0.05	0.19
70	29.37	0.30	0.03	0.13
75	27.88	0.29	0.02	0.07
80	26.56	0.27	0.00	0.01
85	25.36	0.26	-0.01	-0.05
90	24.28	0.25	-0.02	-0.11

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (5-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
2	0.01	0.02
4	0.04	0.03
7	0.09	0.04
10	0.17	0.05
15	0.30	0.06
20	0.47	0.07
26	0.70	0.08
33	1.00	0.09
41	**1.37**	**0.10**

Linear Interpolation					
0.08	H	0.07		H =	0.073 m
0.70	0.54	0.47		Q_{allow} =	0.27 L/s

REQUIRED STORAGE - 10-YEAR EVENT
AREA R-9

OTTAWA IDF CURVE

Area =	0.004	ha	Qallow =	0.30
C =	0.90		Vol(max) =	0.69
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	165.77	1.70	1.43	0.43
10	122.14	1.25	0.98	0.59
15	97.85	1.00	0.73	0.66
20	82.21	0.84	0.57	0.69
25	71.22	0.73	0.46	0.69
30	63.05	0.65	0.38	0.68
35	56.70	0.58	0.31	0.65
40	51.62	0.53	0.26	0.62
45	47.45	0.49	0.22	0.59
50	43.97	0.45	0.18	0.54
55	41.00	0.42	0.15	0.50
60	38.45	0.39	0.12	0.45
65	36.23	0.37	0.10	0.40
70	34.27	0.35	0.08	0.34
75	32.54	0.33	0.06	0.29
80	30.98	0.32	0.05	0.23
85	29.59	0.30	0.03	0.17
90	28.32	0.29	0.02	0.11

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (10-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
2	0.01	0.02
4	0.04	0.03
7	0.09	0.04
10	0.17	0.05
15	0.30	0.06
20	0.47	0.07
26	0.70	0.08
33	1.00	0.09
41	**1.37**	**0.10**

Linear Interpolation					
0.08	H	0.07		H =	0.080 m
0.70	0.69	0.47		Q_{allow} =	0.30 L/s

REQUIRED STORAGE - 100-YEAR EVENT
AREA R-9

OTTAWA IDF CURVE

Area =	0.004	ha	Qallow =	0.36
C =	1.00		Vol(max) =	1.24
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	242.70	2.77	2.41	0.72
10	178.56	2.04	1.68	1.01
15	142.89	1.63	1.27	1.14
20	119.95	1.37	1.01	1.21
25	103.85	1.18	0.82	1.24
30	91.87	1.05	0.69	1.24
35	82.58	0.94	0.58	1.22
40	75.15	0.86	0.50	1.19
45	69.05	0.79	0.43	1.15
50	63.95	0.73	0.37	1.11
55	59.62	0.68	0.32	1.05
60	55.89	0.64	0.28	1.00
65	52.65	0.60	0.24	0.94
70	49.79	0.57	0.21	0.87
75	47.26	0.54	0.18	0.80
80	44.99	0.51	0.15	0.73
85	42.95	0.49	0.13	0.66
90	41.11	0.47	0.11	0.59

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (100-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
2	0.01	0.02
4	0.04	0.03
7	0.09	0.04
10	0.17	0.05
15	0.30	0.06
20	0.47	0.07
26	0.70	0.08
33	1.00	0.09
41	**1.37**	**0.10**

Linear Interpolation					
0.1	H	0.09		H =	0.096 m
1.37	1.24	1.00		Q_{allow} =	0.36 L/s

Note: Qallow is the flow rate through an overcontrolled Zurn Roof Drain (3.73 L/s/m of head.)

PREPARED BY: NOVATECH
DATE: August 5th, 2016
REVISED: March 2, 2018

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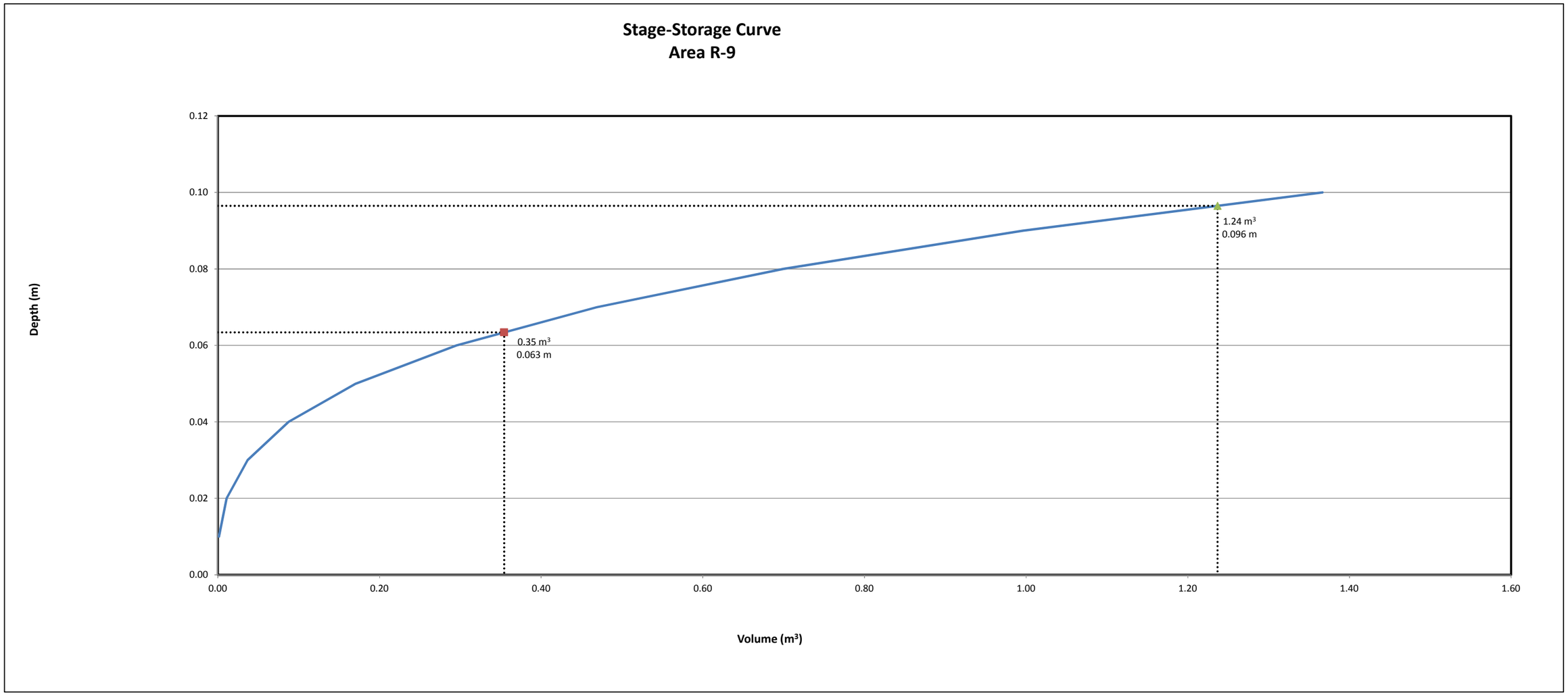

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REQUIRED STORAGE - 2-YEAR EVENT
AREA R-10

OTTAWA IDF CURVE

Area =	0.029	ha	Qallow =	0.40
C =	0.90		Vol(max) =	5.09
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	103.57	7.62	7.22	2.17
10	76.81	5.65	5.25	3.15
15	61.77	4.54	4.14	3.73
20	52.03	3.83	3.43	4.11
25	45.17	3.32	2.92	4.38
30	40.04	2.95	2.55	4.58
35	36.06	2.65	2.25	4.73
40	32.86	2.42	2.02	4.84
45	30.24	2.22	1.82	4.93
50	28.04	2.06	1.66	4.99
55	26.17	1.93	1.53	5.03
60	24.56	1.81	1.41	5.06
65	23.15	1.70	1.30	5.08
70	21.91	1.61	1.21	5.09
75	20.81	1.53	1.13	5.09
80	19.83	1.46	1.06	5.08
85	18.94	1.39	0.99	5.07
90	18.14	1.33	0.93	5.05

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (2-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.00
2	0.01	0.01
7	0.06	0.02
14	0.16	0.03
24	0.36	0.04
37	0.66	0.05
51	1.09	0.06
69	1.69	0.07
88	2.47	0.08
111	3.47	0.09
135	4.70	0.10
163	6.18	0.11
193	7.96	0.12
225	10.04	0.13
260	12.46	0.14
297	**15.25**	**0.15**

Linear Interpolation					
0.11	H	0.10		H =	0.107 m
6.18	5.09	4.70		Q_{allow} =	0.40 L/s

REQUIRED STORAGE - 5-YEAR EVENT
AREA R-10

OTTAWA IDF CURVE

Area =	0.029	ha	Qallow =	0.45
C =	0.90		Vol(max) =	7.22
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	140.99	10.37	9.92	2.98
10	104.10	7.66	7.21	4.32
15	83.50	6.14	5.69	5.12
20	70.21	5.16	4.71	5.66
25	60.87	4.48	4.03	6.04
30	53.91	3.97	3.52	6.33
35	48.50	3.57	3.12	6.55
40	44.17	3.25	2.80	6.72
45	40.62	2.99	2.54	6.85
50	37.64	2.77	2.32	6.96
55	35.11	2.58	2.13	7.04
60	32.94	2.42	1.97	7.10
65	31.04	2.28	1.83	7.15
70	29.37	2.16	1.71	7.18
75	27.88	2.05	1.60	7.20
80	26.56	1.95	1.50	7.22
85	25.36	1.87	1.42	7.22
90	24.28	1.79	1.34	7.22

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (5-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.00
2	0.01	0.01
7	0.06	0.02
14	0.16	0.03
24	0.36	0.04
37	0.66	0.05
51	1.09	0.06
69	1.69	0.07
88	2.47	0.08
111	3.47	0.09
135	4.70	0.10
163	6.18	0.11
193	7.96	0.12
225	10.04	0.13
260	12.46	0.14
297	**15.25**	**0.15**

Linear Interpolation					
0.12	H	0.11		H =	0.120 m
7.96	7.22	6.18		Q_{allow} =	0.45 L/s

REQUIRED STORAGE - 10-YEAR EVENT
AREA R-10

OTTAWA IDF CURVE

Area =	0.029	ha	Qallow =	0.48
C =	0.90		Vol(max) =	8.83
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	165.77	12.19	11.74	3.52
10	122.14	8.98	8.53	5.12
15	97.85	7.20	6.75	6.07
20	82.21	6.05	5.60	6.72
25	71.22	5.24	4.79	7.18
30	63.05	4.64	4.19	7.54
35	56.70	4.17	3.72	7.81
40	51.62	3.80	3.35	8.03
45	47.45	3.49	3.04	8.21
50	43.97	3.23	2.78	8.35
55	41.00	3.02	2.57	8.47
60	38.45	2.83	2.38	8.56
65	36.23	2.66	2.21	8.64
70	34.27	2.52	2.07	8.70
75	32.54	2.39	1.94	8.74
80	30.98	2.28	1.83	8.78
85	29.59	2.18	1.73	8.80
90	28.32	2.08	1.63	8.82

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (10-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.00
2	0.01	0.01
7	0.06	0.02
14	0.16	0.03
24	0.36	0.04
37	0.66	0.05
51	1.09	0.06
69	1.69	0.07
88	2.47	0.08
111	3.47	0.09
135	4.70	0.10
163	6.18	0.11
193	7.96	0.12
225	10.04	0.13
260	12.46	0.14
297	**15.25**	**0.15**

Linear Interpolation					
0.13	H	0.12		H =	0.128 m
10.04	8.83	7.96		Q_{allow} =	0.48 L/s

REQUIRED STORAGE - 100-YEAR EVENT
AREA R-10

OTTAWA IDF CURVE

Area =	0.029	ha	Qallow =	0.57
C =	1.00		Vol(max) =	15.23
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	242.70	19.84	19.26	5.78
10	178.56	14.59	14.02	8.41
15	142.89	11.68	11.11	9.99
20	119.95	9.80	9.23	11.08
25	103.85	8.49	7.91	11.87
30	91.87	7.51	6.93	12.48
35	82.58	6.75	6.18	12.97
40	75.15	6.14	5.57	13.36
45	69.05	5.64	5.07	13.69
50	63.95	5.23	4.65	13.96
55	59.62	4.87	4.30	14.19
60	55.89	4.57	3.99	14.38
65	52.65	4.30	3.73	14.54
70	49.79	4.07	3.50	14.68
75	47.26	3.86	3.29	14.80
80	44.99	3.68	3.10	14.90
85	42.95	3.51	2.94	14.98
90	41.11	3.36	2.79	15.04

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (100-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.00
2	0.01	0.01
7	0.06	0.02
14	0.16	0.03
24	0.36	0.04
37	0.66	0.05
51	1.09	0.06
69	1.69	0.07
88	2.47	0.08
111	3.47	0.09
135	4.70	0.10
163	6.18	0.11
193	7.96	0.12
225	10.04	0.13
260	12.46	0.14
297	**15.25**	**0.15**

Linear Interpolation					
0.154	H	0.144		H =	0.154 m
15.25	15.23	12.46		Q_{allow} =	0.57 L/s

Note: Qallow is the flow rate through an overcontrolled Zurn Roof Drain (3.73 L/s/m of head.)

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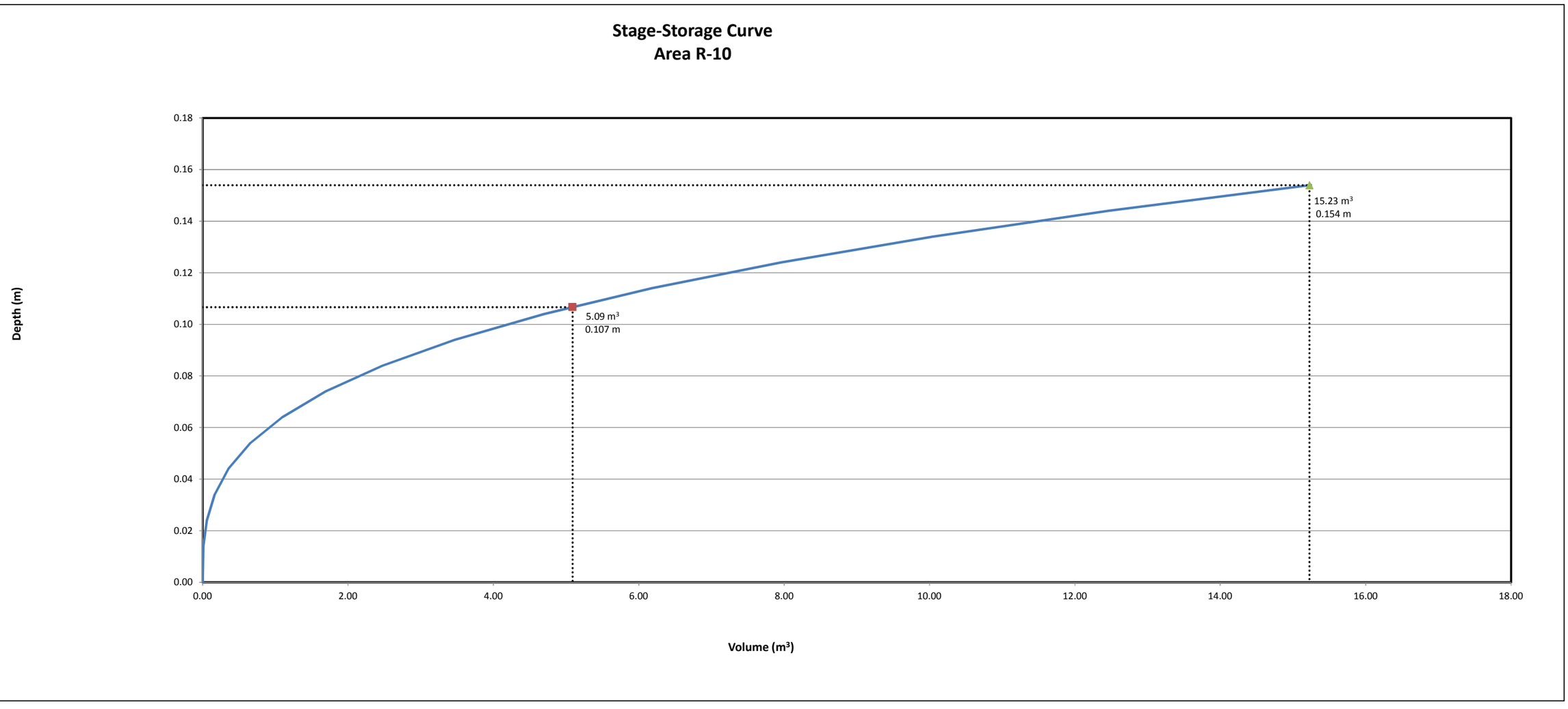
Stage-Storage Curve
Area R-10



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REQUIRED STORAGE - 2-YEAR EVENT
AREA R-11

OTTAWA IDF CURVE

Area =	0.003	ha	Qallow =	0.22
C =	0.90		Vol(max) =	0.17
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	103.57	0.67	0.46	0.14
10	76.81	0.50	0.28	0.17
15	61.77	0.40	0.19	0.17
20	52.03	0.34	0.12	0.15
25	45.17	0.29	0.08	0.12
30	40.04	0.26	0.05	0.08
35	36.06	0.23	0.02	0.04
40	32.86	0.21	0.00	0.00
45	30.24	0.20	-0.02	-0.05
50	28.04	0.18	-0.03	-0.10
55	26.17	0.17	-0.04	-0.15
60	24.56	0.16	-0.06	-0.20
65	23.15	0.15	-0.06	-0.25
70	21.91	0.14	-0.07	-0.30
75	20.81	0.14	-0.08	-0.36
80	19.83	0.13	-0.09	-0.41
85	18.94	0.12	-0.09	-0.47
90	18.14	0.12	-0.10	-0.52

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (2-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
1	0.01	0.02
2	0.02	0.03
4	0.06	0.04
7	0.11	0.05
9	0.19	0.06
13	0.30	0.07
17	0.44	0.08
21	0.63	0.09
26	**0.87**	**0.10**

Linear Interpolation					
0.06	H	0.05		H =	0.058 m
0.19	0.17	0.11		Q_{allow} =	0.22 L/s

REQUIRED STORAGE - 5-YEAR EVENT
AREA R-11

OTTAWA IDF CURVE

Area =	0.003	ha	Qallow =	0.25
C =	0.90		Vol(max) =	0.26
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	140.99	0.92	0.67	0.20
10	104.10	0.68	0.43	0.26
15	83.50	0.54	0.29	0.26
20	70.21	0.46	0.21	0.25
25	60.87	0.40	0.15	0.22
30	53.91	0.35	0.10	0.18
35	48.50	0.32	0.07	0.14
40	44.17	0.29	0.04	0.09
45	40.62	0.26	0.01	0.04
50	37.64	0.24	-0.01	-0.02
55	35.11	0.23	-0.02	-0.07
60	32.94	0.21	-0.04	-0.13
65	31.04	0.20	-0.05	-0.19
70	29.37	0.19	-0.06	-0.25
75	27.88	0.18	-0.07	-0.31
80	26.56	0.17	-0.08	-0.37
85	25.36	0.17	-0.08	-0.43
90	24.28	0.16	-0.09	-0.50

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (5-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
1	0.01	0.02
2	0.02	0.03
4	0.06	0.04
7	0.11	0.05
9	0.19	0.06
13	0.30	0.07
17	0.44	0.08
21	0.63	0.09
26	**0.87**	**0.10**

Linear Interpolation					
0.07	H	0.06		H =	0.067 m
0.30	0.26	0.19		Q_{allow} =	0.25 L/s

REQUIRED STORAGE - 10-YEAR EVENT
AREA R-11

OTTAWA IDF CURVE

Area =	0.003	ha	Qallow =	0.27
C =	0.90		Vol(max) =	0.35
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	165.77	1.08	0.83	0.25
10	122.14	0.79	0.54	0.33
15	97.85	0.64	0.39	0.35
20	82.21	0.53	0.28	0.34
25	71.22	0.46	0.21	0.32
30	63.05	0.41	0.16	0.29
35	56.70	0.37	0.12	0.25
40	51.62	0.34	0.09	0.21
45	47.45	0.31	0.06	0.16
50	43.97	0.29	0.04	0.11
55	41.00	0.27	0.02	0.06
60	38.45	0.25	0.00	0.00
65	36.23	0.24	-0.01	-0.06
70	34.27	0.22	-0.03	-0.11
75	32.54	0.21	-0.04	-0.17
80	30.98	0.20	-0.05	-0.23
85	29.59	0.19	-0.06	-0.29
90	28.32	0.18	-0.07	-0.36

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (10-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
1	0.01	0.02
2	0.02	0.03
4	0.06	0.04
7	0.11	0.05
9	0.19	0.06
13	0.30	0.07
17	0.44	0.08
21	0.63	0.09
26	**0.87**	**0.10**

Linear Interpolation					
0.08	H	0.07		H =	0.073 m
0.44	0.35	0.30		Q_{allow} =	0.27 L/s

REQUIRED STORAGE - 100-YEAR EVENT
AREA R-11

OTTAWA IDF CURVE

Area =	0.003	ha	Qallow =	0.34
C =	1.00		Vol(max) =	0.64
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	242.70	1.75	1.42	0.43
10	178.56	1.29	0.96	0.57
15	142.89	1.03	0.70	0.63
20	119.95	0.87	0.53	0.64
25	103.85	0.75	0.42	0.62
30	91.87	0.66	0.33	0.59
35	82.58	0.60	0.26	0.55
40	75.15	0.54	0.21	0.50
45	69.05	0.50	0.16	0.44
50	63.95	0.46	0.13	0.38
55	59.62	0.43	0.10	0.32
60	55.89	0.40	0.07	0.25
65	52.65	0.38	0.05	0.18
70	49.79	0.36	0.02	0.10
75	47.26	0.34	0.01	0.03
80	44.99	0.33	-0.01	-0.05
85	42.95	0.31	-0.02	-0.13
90	41.11	0.30	-0.04	-0.20

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (100-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
1	0.01	0.02
2	0.02	0.03
4	0.06	0.04
7	0.11	0.05
9	0.19	0.06
13	0.30	0.07
17	0.44	0.08
21	0.63	0.09
26	**0.87**	**0.10**

Linear Interpolation					
0.1	H	0.09		H =	0.090 m
0.87	0.64	0.63		Q_{allow} =	0.34 L/s

Note: Qallow is the flow rate through an overcontrolled Zurn Roof Drain (3.73 L/s/m of head.)

PREPARED BY: NOVATECH
DATE: August 5th, 2016
REVISED: March 2, 2018

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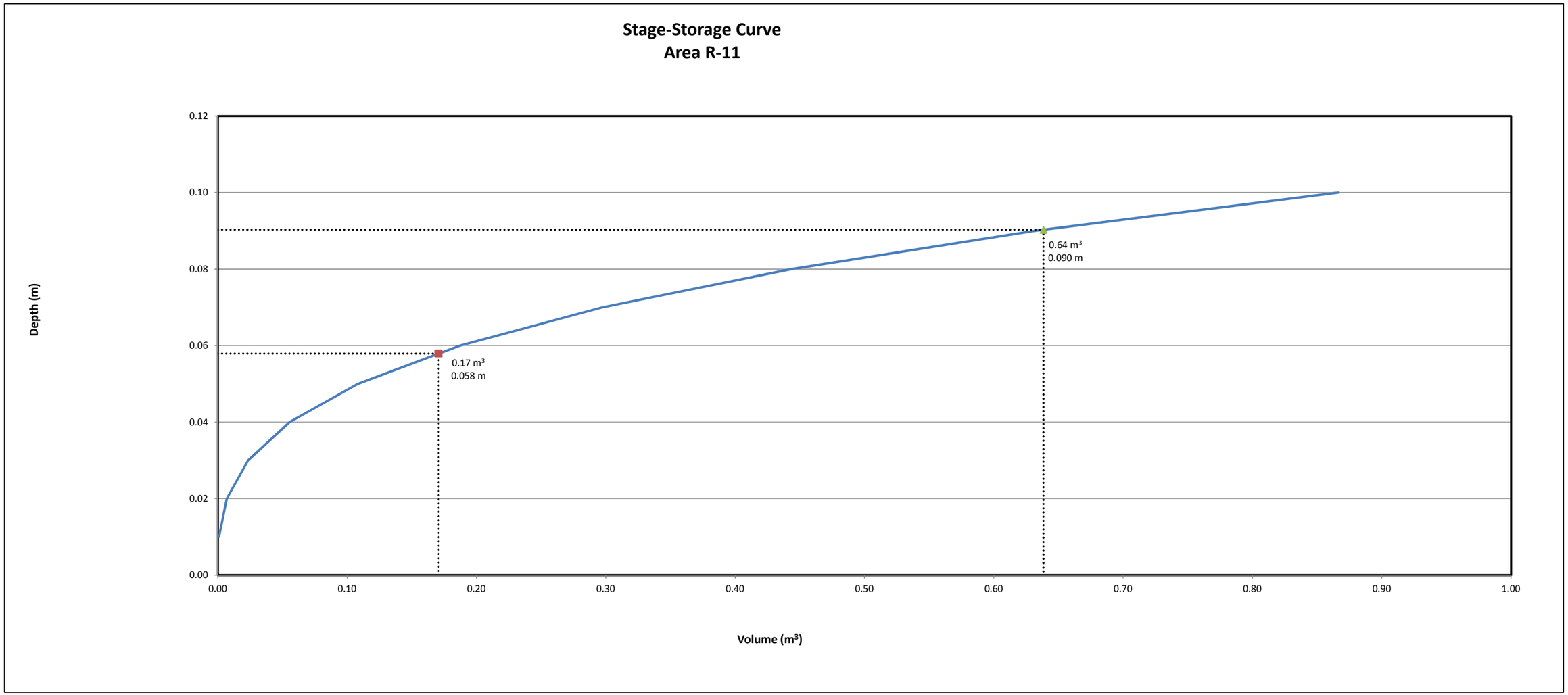

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REQUIRED STORAGE - 2-YEAR EVENT
AREA R-12

OTTAWA IDF CURVE

Area =	0.003	ha	Qallow =	0.22
C =	0.90		Vol(max) =	0.17
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	103.57	0.67	0.46	0.14
10	76.81	0.50	0.28	0.17
15	61.77	0.40	0.19	0.17
20	52.03	0.34	0.12	0.15
25	45.17	0.29	0.08	0.12
30	40.04	0.26	0.05	0.08
35	36.06	0.23	0.02	0.04
40	32.86	0.21	0.00	0.00
45	30.24	0.20	-0.02	-0.05
50	28.04	0.18	-0.03	-0.10
55	26.17	0.17	-0.04	-0.15
60	24.56	0.16	-0.06	-0.20
65	23.15	0.15	-0.06	-0.25
70	21.91	0.14	-0.07	-0.30
75	20.81	0.14	-0.08	-0.36
80	19.83	0.13	-0.09	-0.41
85	18.94	0.12	-0.09	-0.47
90	18.14	0.12	-0.10	-0.52

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (2-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
1	0.01	0.02
2	0.02	0.03
4	0.06	0.04
7	0.11	0.05
9	0.19	0.06
13	0.30	0.07
17	0.44	0.08
21	0.63	0.09
26	**0.87**	**0.10**

Linear Interpolation					
0.06	H	0.05		H =	0.058 m
0.19	0.17	0.11		Q_{allow} =	0.22 L/s

REQUIRED STORAGE - 5-YEAR EVENT
AREA R-12

OTTAWA IDF CURVE

Area =	0.003	ha	Qallow =	0.25
C =	0.90		Vol(max) =	0.26
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	140.99	0.92	0.67	0.20
10	104.10	0.68	0.43	0.26
15	83.50	0.54	0.29	0.26
20	70.21	0.46	0.21	0.25
25	60.87	0.40	0.15	0.22
30	53.91	0.35	0.10	0.18
35	48.50	0.32	0.07	0.14
40	44.17	0.29	0.04	0.09
45	40.62	0.26	0.01	0.04
50	37.64	0.24	-0.01	-0.02
55	35.11	0.23	-0.02	-0.07
60	32.94	0.21	-0.04	-0.13
65	31.04	0.20	-0.05	-0.19
70	29.37	0.19	-0.06	-0.25
75	27.88	0.18	-0.07	-0.31
80	26.56	0.17	-0.08	-0.37
85	25.36	0.17	-0.08	-0.43
90	24.28	0.16	-0.09	-0.50

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (5-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
1	0.01	0.02
2	0.02	0.03
4	0.06	0.04
7	0.11	0.05
9	0.19	0.06
13	0.30	0.07
17	0.44	0.08
21	0.63	0.09
26	**0.87**	**0.10**

Linear Interpolation					
0.07	H	0.06		H =	0.067 m
0.30	0.26	0.19		Q_{allow} =	0.25 L/s

REQUIRED STORAGE - 10-YEAR EVENT
AREA R-12

OTTAWA IDF CURVE

Area =	0.003	ha	Qallow =	0.27
C =	0.90		Vol(max) =	0.35
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	165.77	1.08	0.83	0.25
10	122.14	0.79	0.54	0.33
15	97.85	0.64	0.39	0.35
20	82.21	0.53	0.28	0.34
25	71.22	0.46	0.21	0.32
30	63.05	0.41	0.16	0.29
35	56.70	0.37	0.12	0.25
40	51.62	0.34	0.09	0.21
45	47.45	0.31	0.06	0.16
50	43.97	0.29	0.04	0.11
55	41.00	0.27	0.02	0.06
60	38.45	0.25	0.00	0.00
65	36.23	0.24	-0.01	-0.06
70	34.27	0.22	-0.03	-0.11
75	32.54	0.21	-0.04	-0.17
80	30.98	0.20	-0.05	-0.23
85	29.59	0.19	-0.06	-0.29
90	28.32	0.18	-0.07	-0.36

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (10-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
1	0.01	0.02
2	0.02	0.03
4	0.06	0.04
7	0.11	0.05
9	0.19	0.06
13	0.30	0.07
17	0.44	0.08
21	0.63	0.09
26	**0.87**	**0.10**

Linear Interpolation					
0.08	H	0.07		H =	0.073 m
0.44	0.35	0.30		Q_{allow} =	0.27 L/s

REQUIRED STORAGE - 100-YEAR EVENT
AREA R-12

OTTAWA IDF CURVE

Area =	0.003	ha	Qallow =	0.34
C =	1.00		Vol(max) =	0.63
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	242.70	1.75	1.41	0.42
10	178.56	1.29	0.95	0.57
15	142.89	1.03	0.69	0.62
20	119.95	0.87	0.53	0.63
25	103.85	0.75	0.41	0.62
30	91.87	0.66	0.32	0.58
35	82.58	0.60	0.26	0.54
40	75.15	0.54	0.20	0.49
45	69.05	0.50	0.16	0.43
50	63.95	0.46	0.12	0.37
55	59.62	0.43	0.09	0.30
60	55.89	0.40	0.06	0.23
65	52.65	0.38	0.04	0.16
70	49.79	0.36	0.02	0.08
75	47.26	0.34	0.00	0.01
80	44.99	0.33	-0.01	-0.07
85	42.95	0.31	-0.03	-0.15
90	41.11	0.30	-0.04	-0.23

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (100-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
1	0.01	0.02
2	0.02	0.03
4	0.06	0.04
7	0.11	0.05
9	0.19	0.06
13	0.30	0.07
17	0.44	0.08
21	0.63	0.09
26	**0.87**	**0.10**

Linear Interpolation					
0.1	H	0.09		H =	0.090 m
0.87	0.63	0.63		Q_{allow} =	0.34 L/s

Note: Qallow is the flow rate through an overcontrolled Zurn Roof Drain (3.73 L/s/m of head.)

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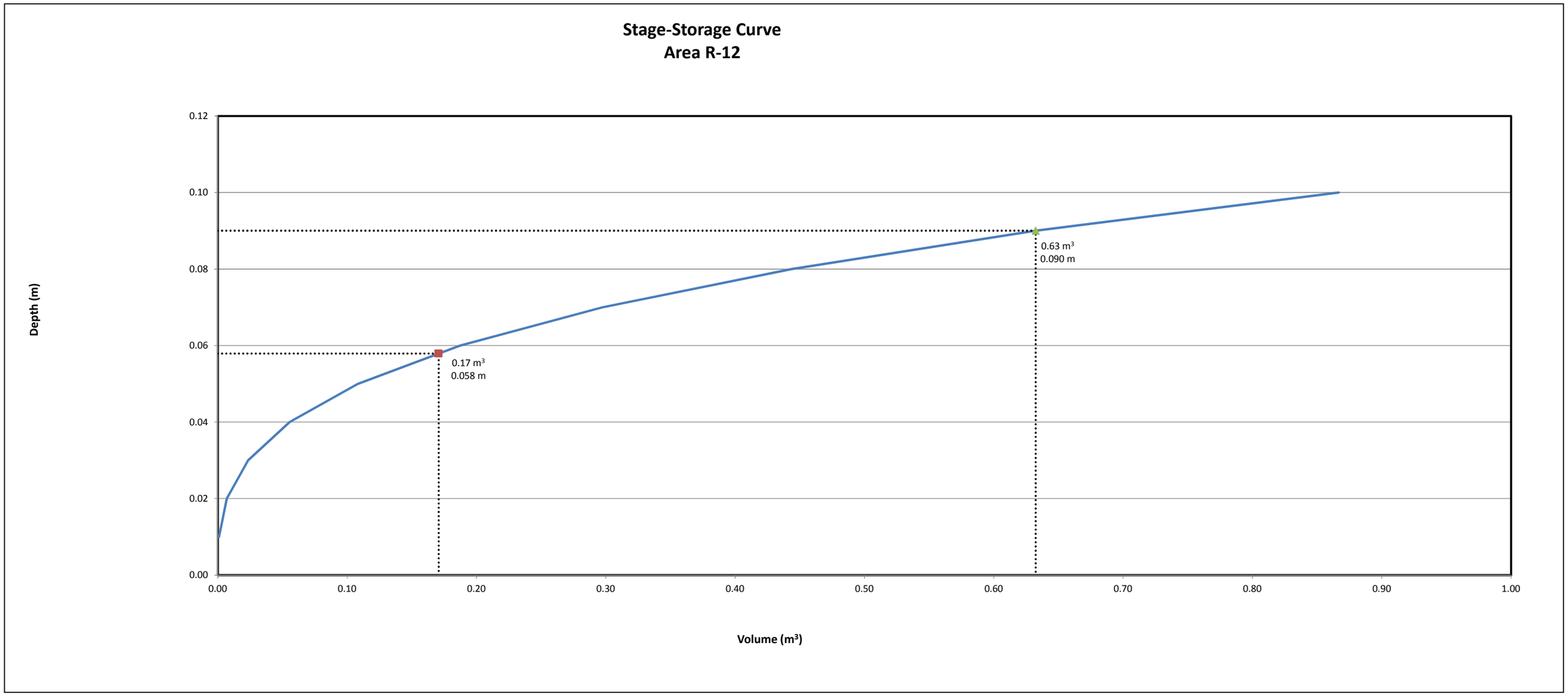

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REQUIRED STORAGE - 2-YEAR EVENT
AREA R-13

OTTAWA IDF CURVE

Area =	0.007	ha	Qallow =	0.29
C =	0.90		Vol(max) =	0.67
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	103.57	1.68	1.39	0.42
10	76.81	1.25	0.96	0.58
15	61.77	1.00	0.71	0.64
20	52.03	0.85	0.56	0.67
25	45.17	0.73	0.44	0.67
30	40.04	0.65	0.36	0.65
35	36.06	0.59	0.30	0.62
40	32.86	0.53	0.24	0.59
45	30.24	0.49	0.20	0.54
50	28.04	0.46	0.17	0.50
55	26.17	0.43	0.14	0.45
60	24.56	0.40	0.11	0.39
65	23.15	0.38	0.09	0.34
70	21.91	0.36	0.07	0.28
75	20.81	0.34	0.05	0.22
80	19.83	0.32	0.03	0.16
85	18.94	0.31	0.02	0.09
90	18.14	0.30	0.01	0.03

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (2-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
1	0.00	0.02
3	0.02	0.03
5	0.06	0.04
8	0.13	0.05
13	0.23	0.06
18	0.38	0.07
23	0.59	0.08
30	0.85	0.09
38	1.19	0.10
46	1.61	0.11
55	2.11	0.12
65	**2.71**	**0.13**

Linear Interpolation					
0.09	H	0.08		H =	0.078 m
0.85	0.67	0.59		Q_{allow} =	0.29 L/s

REQUIRED STORAGE - 5-YEAR EVENT
AREA R-13

OTTAWA IDF CURVE

Area =	0.007	ha	Qallow =	0.33
C =	0.90		Vol(max) =	0.99
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	140.99	2.29	1.96	0.59
10	104.10	1.69	1.36	0.82
15	83.50	1.36	1.03	0.93
20	70.21	1.14	0.81	0.97
25	60.87	0.99	0.66	0.99
30	53.91	0.88	0.55	0.98
35	48.50	0.79	0.46	0.96
40	44.17	0.72	0.39	0.93
45	40.62	0.66	0.33	0.89
50	37.64	0.61	0.28	0.85
55	35.11	0.57	0.24	0.80
60	32.94	0.54	0.21	0.74
65	31.04	0.50	0.17	0.68
70	29.37	0.48	0.15	0.62
75	27.88	0.45	0.12	0.56
80	26.56	0.43	0.10	0.49
85	25.36	0.41	0.08	0.42
90	24.28	0.39	0.06	0.35

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (5-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
1	0.00	0.02
3	0.02	0.03
5	0.06	0.04
8	0.13	0.05
13	0.23	0.06
18	0.38	0.07
23	0.59	0.08
30	0.85	0.09
38	1.19	0.10
46	1.61	0.11
55	2.11	0.12
65	**2.71**	**0.13**

Linear Interpolation					
0.10	H	0.09		H =	0.089 m
1.19	0.99	0.85		Q_{allow} =	0.33 L/s

REQUIRED STORAGE - 10-YEAR EVENT
AREA R-13

OTTAWA IDF CURVE

Area =	0.007	ha	Qallow =	0.36
C =	0.90		Vol(max) =	1.25
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	165.77	2.70	2.37	0.71
10	122.14	1.99	1.66	0.99
15	97.85	1.59	1.26	1.14
20	82.21	1.34	1.01	1.21
25	71.22	1.16	0.83	1.24
30	63.05	1.03	0.70	1.25
35	56.70	0.92	0.59	1.24
40	51.62	0.84	0.51	1.22
45	47.45	0.77	0.44	1.19
50	43.97	0.72	0.39	1.16
55	41.00	0.67	0.34	1.11
60	38.45	0.63	0.30	1.06
65	36.23	0.59	0.26	1.01
70	34.27	0.56	0.23	0.95
75	32.54	0.53	0.20	0.90
80	30.98	0.50	0.17	0.83
85	29.59	0.48	0.15	0.77
90	28.32	0.46	0.13	0.71

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (10-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
1	0.00	0.02
3	0.02	0.03
5	0.06	0.04
8	0.13	0.05
13	0.23	0.06
18	0.38	0.07
23	0.59	0.08
30	0.85	0.09
38	1.19	0.10
46	1.61	0.11
55	2.11	0.12
65	**2.71**	**0.13**

Linear Interpolation					
0.11	H	0.10		H =	0.097 m
1.61	1.25	1.19		Q_{allow} =	0.36 L/s

REQUIRED STORAGE - 100-YEAR EVENT
AREA R-13

OTTAWA IDF CURVE

Area =	0.007	ha	Qallow =	0.44
C =	1.00		Vol(max) =	2.21
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	242.70	4.39	3.95	1.18
10	178.56	3.23	2.79	1.67
15	142.89	2.58	2.14	1.93
20	119.95	2.17	1.73	2.07
25	103.85	1.88	1.44	2.15
30	91.87	1.66	1.22	2.20
35	82.58	1.49	1.05	2.21
40	75.15	1.36	0.92	2.20
45	69.05	1.25	0.81	2.18
50	63.95	1.16	0.72	2.15
55	59.62	1.08	0.64	2.10
60	55.89	1.01	0.57	2.05
65	52.65	0.95	0.51	1.99
70	49.79	0.90	0.46	1.93
75	47.26	0.85	0.41	1.86
80	44.99	0.81	0.37	1.79
85	42.95	0.78	0.34	1.71
90	41.11	0.74	0.30	1.64

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (100-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
1	0.00	0.02
3	0.02	0.03
5	0.06	0.04
8	0.13	0.05
13	0.23	0.06
18	0.38	0.07
23	0.59	0.08
30	0.85	0.09
38	1.19	0.10
46	1.61	0.11
55	2.11	0.12
65	**2.71**	**0.13**

Linear Interpolation					
0.125	H	0.115		H =	0.117 m
2.71	2.21	2.11		Q_{allow} =	0.44 L/s

Note: Qallow is the flow rate through an overcontrolled Zurn Roof Drain (3.73 L/s/m of head.)

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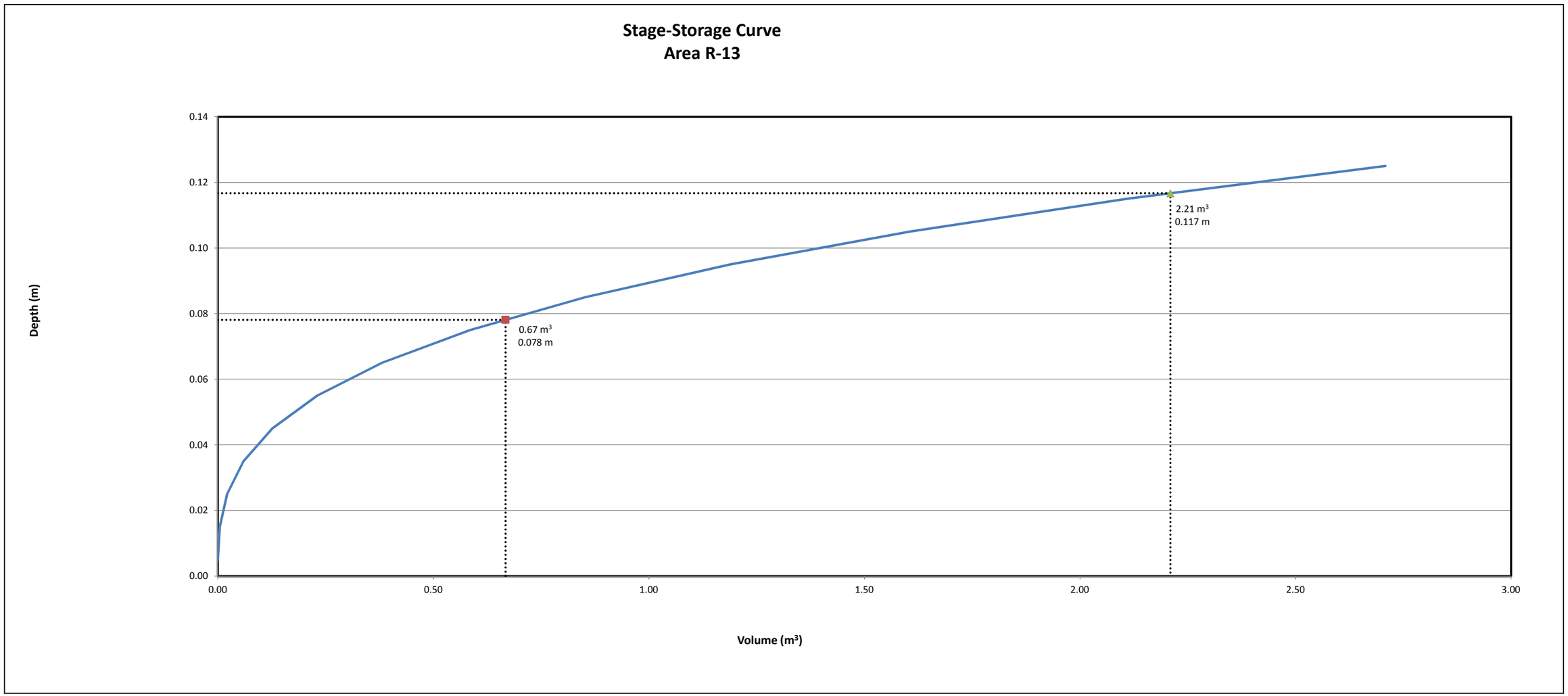
Stage-Storage Curve
Area R-13



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REQUIRED STORAGE - 2-YEAR EVENT
AREA R-14

OTTAWA IDF CURVE

Area =	0.005	ha	Qallow =	0.25
C =	0.90		Vol(max) =	0.48
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	103.57	1.30	1.05	0.31
10	76.81	0.96	0.71	0.43
15	61.77	0.77	0.52	0.47
20	52.03	0.65	0.40	0.48
25	45.17	0.57	0.32	0.47
30	40.04	0.50	0.25	0.45
35	36.06	0.45	0.20	0.42
40	32.86	0.41	0.16	0.39
45	30.24	0.38	0.13	0.35
50	28.04	0.35	0.10	0.30
55	26.17	0.33	0.08	0.26
60	24.56	0.31	0.06	0.21
65	23.15	0.29	0.04	0.15
70	21.91	0.27	0.02	0.10
75	20.81	0.26	0.01	0.05
80	19.83	0.25	0.00	-0.01
85	18.94	0.24	-0.01	-0.07
90	18.14	0.23	-0.02	-0.12

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (2-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.00
1	0.00	0.01
2	0.01	0.02
5	0.05	0.03
8	0.11	0.04
13	0.21	0.05
18	0.36	0.06
25	0.57	0.07
32	0.85	0.08
41	1.22	0.09
50	**1.67**	**0.10**

Linear Interpolation					
0.07	H	0.06		H =	0.066 m
0.57	0.48	0.36		Q_{allow} =	0.25 L/s

REQUIRED STORAGE - 5-YEAR EVENT
AREA R-14

OTTAWA IDF CURVE

Area =	0.005	ha	Qallow =	0.28
C =	0.90		Vol(max) =	0.72
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	140.99	1.76	1.48	0.45
10	104.10	1.30	1.02	0.61
15	83.50	1.04	0.76	0.69
20	70.21	0.88	0.60	0.72
25	60.87	0.76	0.48	0.72
30	53.91	0.67	0.39	0.71
35	48.50	0.61	0.33	0.69
40	44.17	0.55	0.27	0.65
45	40.62	0.51	0.23	0.62
50	37.64	0.47	0.19	0.57
55	35.11	0.44	0.16	0.53
60	32.94	0.41	0.13	0.48
65	31.04	0.39	0.11	0.42
70	29.37	0.37	0.09	0.37
75	27.88	0.35	0.07	0.31
80	26.56	0.33	0.05	0.25
85	25.36	0.32	0.04	0.19
90	24.28	0.30	0.02	0.13

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (5-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.00
1	0.00	0.01
2	0.01	0.02
5	0.05	0.03
8	0.11	0.04
13	0.21	0.05
18	0.36	0.06
25	0.57	0.07
32	0.85	0.08
41	1.22	0.09
50	**1.67**	**0.10**

Linear Interpolation					
0.08	H	0.07		H =	0.075 m
0.85	0.72	0.57		Q_{allow} =	0.28 L/s

REQUIRED STORAGE - 10-YEAR EVENT
AREA R-14

OTTAWA IDF CURVE

Area =	0.005	ha	Qallow =	0.30
C =	0.90		Vol(max) =	0.92
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	165.77	2.07	1.79	0.54
10	122.14	1.53	1.25	0.75
15	97.85	1.22	0.94	0.85
20	82.21	1.03	0.75	0.90
25	71.22	0.89	0.61	0.92
30	63.05	0.79	0.51	0.92
35	56.70	0.71	0.43	0.90
40	51.62	0.65	0.37	0.88
45	47.45	0.59	0.31	0.85
50	43.97	0.55	0.27	0.81
55	41.00	0.51	0.23	0.77
60	38.45	0.48	0.20	0.72
65	36.23	0.45	0.17	0.68
70	34.27	0.43	0.15	0.62
75	32.54	0.41	0.13	0.57
80	30.98	0.39	0.11	0.52
85	29.59	0.37	0.09	0.46
90	28.32	0.35	0.07	0.40

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (10-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.00
1	0.00	0.01
2	0.01	0.02
5	0.05	0.03
8	0.11	0.04
13	0.21	0.05
18	0.36	0.06
25	0.57	0.07
32	0.85	0.08
41	1.22	0.09
50	**1.67**	**0.10**

Linear Interpolation					
0.09	H	0.08		H =	0.082 m
1.22	0.92	0.85		Q_{allow} =	0.30 L/s

REQUIRED STORAGE - 100-YEAR EVENT
AREA R-14

OTTAWA IDF CURVE

Area =	0.005	ha	Qallow =	0.37
C =	1.00		Vol(max) =	1.63
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	242.70	3.37	3.00	0.90
10	178.56	2.48	2.11	1.27
15	142.89	1.99	1.62	1.45
20	119.95	1.67	1.30	1.56
25	103.85	1.44	1.07	1.61
30	91.87	1.28	0.91	1.63
35	82.58	1.15	0.78	1.63
40	75.15	1.04	0.67	1.62
45	69.05	0.96	0.59	1.59
50	63.95	0.89	0.52	1.56
55	59.62	0.83	0.46	1.51
60	55.89	0.78	0.41	1.46
65	52.65	0.73	0.36	1.41
70	49.79	0.69	0.32	1.35
75	47.26	0.66	0.29	1.29
80	44.99	0.63	0.26	1.23
85	42.95	0.60	0.23	1.16
90	41.11	0.57	0.20	1.09

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (100-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.00
1	0.00	0.01
2	0.01	0.02
5	0.05	0.03
8	0.11	0.04
13	0.21	0.05
18	0.36	0.06
25	0.57	0.07
32	0.85	0.08
41	1.22	0.09
50	**1.67**	**0.10**

Linear Interpolation					
0.1	H	0.09		H =	0.099 m
1.67	1.63	1.22		Q_{allow} =	0.37 L/s

Note: Qallow is the flow rate through an overcontrolled Zurn Roof Drain (3.73 L/s/m of head.)

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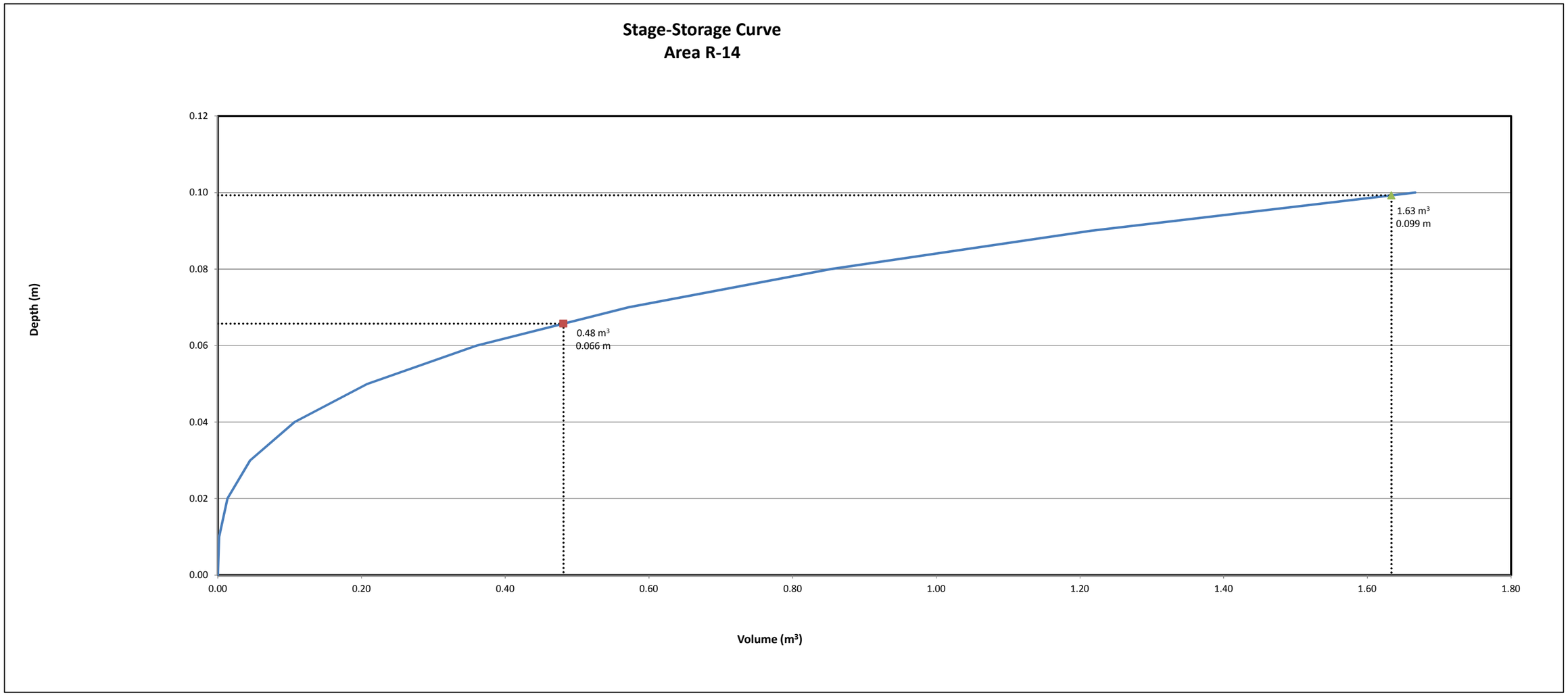

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REQUIRED STORAGE - 2-YEAR EVENT
AREA R-15

OTTAWA IDF CURVE

Area =	0.010	ha	Qallow =	0.31
C =	0.90		Vol(max) =	1.19
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	103.57	2.51	2.20	0.66
10	76.81	1.86	1.55	0.93
15	61.77	1.50	1.19	1.07
20	52.03	1.26	0.95	1.14
25	45.17	1.10	0.79	1.18
30	40.04	0.97	0.66	1.19
35	36.06	0.88	0.57	1.19
40	32.86	0.80	0.49	1.17
45	30.24	0.73	0.42	1.14
50	28.04	0.68	0.37	1.11
55	26.17	0.64	0.33	1.07
60	24.56	0.60	0.29	1.03
65	23.15	0.56	0.25	0.98
70	21.91	0.53	0.22	0.93
75	20.81	0.51	0.20	0.88
80	19.83	0.48	0.17	0.82
85	18.94	0.46	0.15	0.76
90	18.14	0.44	0.13	0.70

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (2-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
2	0.01	0.02
4	0.04	0.03
8	0.10	0.04
13	0.21	0.05
20	0.37	0.06
27	0.60	0.07
36	0.92	0.08
46	1.32	0.09
57	1.83	0.10
69	2.46	0.11
82	3.21	0.12
97	**4.11**	**0.13**

Linear Interpolation					
0.09	H	0.08		H =	0.084 m
1.32	1.19	0.92		Q_{allow} =	0.31 L/s

REQUIRED STORAGE - 5-YEAR EVENT
AREA R-15

OTTAWA IDF CURVE

Area =	0.010	ha	Qallow =	0.35
C =	0.90		Vol(max) =	1.74
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	140.99	3.42	3.07	0.92
10	104.10	2.53	2.18	1.31
15	83.50	2.03	1.68	1.51
20	70.21	1.70	1.35	1.62
25	60.87	1.48	1.13	1.69
30	53.91	1.31	0.96	1.72
35	48.50	1.18	0.83	1.74
40	44.17	1.07	0.72	1.73
45	40.62	0.99	0.64	1.72
50	37.64	0.91	0.56	1.69
55	35.11	0.85	0.50	1.66
60	32.94	0.80	0.45	1.62
65	31.04	0.75	0.40	1.57
70	29.37	0.71	0.36	1.52
75	27.88	0.68	0.33	1.47
80	26.56	0.64	0.29	1.41
85	25.36	0.62	0.27	1.35
90	24.28	0.59	0.24	1.29

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (5-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
2	0.01	0.02
4	0.04	0.03
8	0.10	0.04
13	0.21	0.05
20	0.37	0.06
27	0.60	0.07
36	0.92	0.08
46	1.32	0.09
57	1.83	0.10
69	2.46	0.11
82	3.21	0.12
97	**4.11**	**0.13**

Linear Interpolation					
0.10	H	0.09		H =	0.095 m
1.83	1.74	1.32		Q_{allow} =	0.35 L/s

REQUIRED STORAGE - 10-YEAR EVENT
AREA R-15

OTTAWA IDF CURVE

Area =	0.010	ha	Qallow =	0.38
C =	0.90		Vol(max) =	2.17
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	165.77	4.02	3.67	1.10
10	122.14	2.96	2.61	1.57
15	97.85	2.37	2.02	1.82
20	82.21	2.00	1.65	1.97
25	71.22	1.73	1.38	2.07
30	63.05	1.53	1.18	2.12
35	56.70	1.38	1.03	2.15
40	51.62	1.25	0.90	2.17
45	47.45	1.15	0.80	2.16
50	43.97	1.07	0.72	2.15
55	41.00	1.00	0.65	2.13
60	38.45	0.93	0.58	2.10
65	36.23	0.88	0.53	2.06
70	34.27	0.83	0.48	2.02
75	32.54	0.79	0.44	1.98
80	30.98	0.75	0.40	1.93
85	29.59	0.72	0.37	1.88
90	28.32	0.69	0.34	1.82

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (10-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
2	0.01	0.02
4	0.04	0.03
8	0.10	0.04
13	0.21	0.05
20	0.37	0.06
27	0.60	0.07
36	0.92	0.08
46	1.32	0.09
57	1.83	0.10
69	2.46	0.11
82	3.21	0.12
97	**4.11**	**0.13**

Linear Interpolation					
0.11	H	0.10		H =	0.102 m
2.46	2.17	1.83		Q_{allow} =	0.38 L/s

REQUIRED STORAGE - 100-YEAR EVENT
AREA R-15

OTTAWA IDF CURVE

Area =	0.010	ha	Qallow =	0.46
C =	1.00		Vol(max) =	3.79
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	242.70	6.54	6.08	1.83
10	178.56	4.82	4.36	2.61
15	142.89	3.85	3.39	3.05
20	119.95	3.23	2.77	3.33
25	103.85	2.80	2.34	3.51
30	91.87	2.48	2.02	3.63
35	82.58	2.23	1.77	3.71
40	75.15	2.03	1.57	3.76
45	69.05	1.86	1.40	3.79
50	63.95	1.72	1.26	3.79
55	59.62	1.61	1.15	3.79
60	55.89	1.51	1.05	3.77
65	52.65	1.42	0.96	3.74
70	49.79	1.34	0.88	3.71
75	47.26	1.27	0.81	3.66
80	44.99	1.21	0.75	3.62
85	42.95	1.16	0.70	3.56
90	41.11	1.11	0.65	3.50

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (100-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
2	0.01	0.02
4	0.04	0.03
8	0.10	0.04
13	0.21	0.05
20	0.37	0.06
27	0.60	0.07
36	0.92	0.08
46	1.32	0.09
57	1.83	0.10
69	2.46	0.11
82	3.21	0.12
97	**4.11**	**0.13**

Linear Interpolation					
0.127	H	0.117		H =	0.124 m
4.11	3.79	3.21		Q_{allow} =	0.46 L/s

Note: Qallow is the flow rate through an overcontrolled Zurn Roof Drain (3.73 L/s/m of head.)

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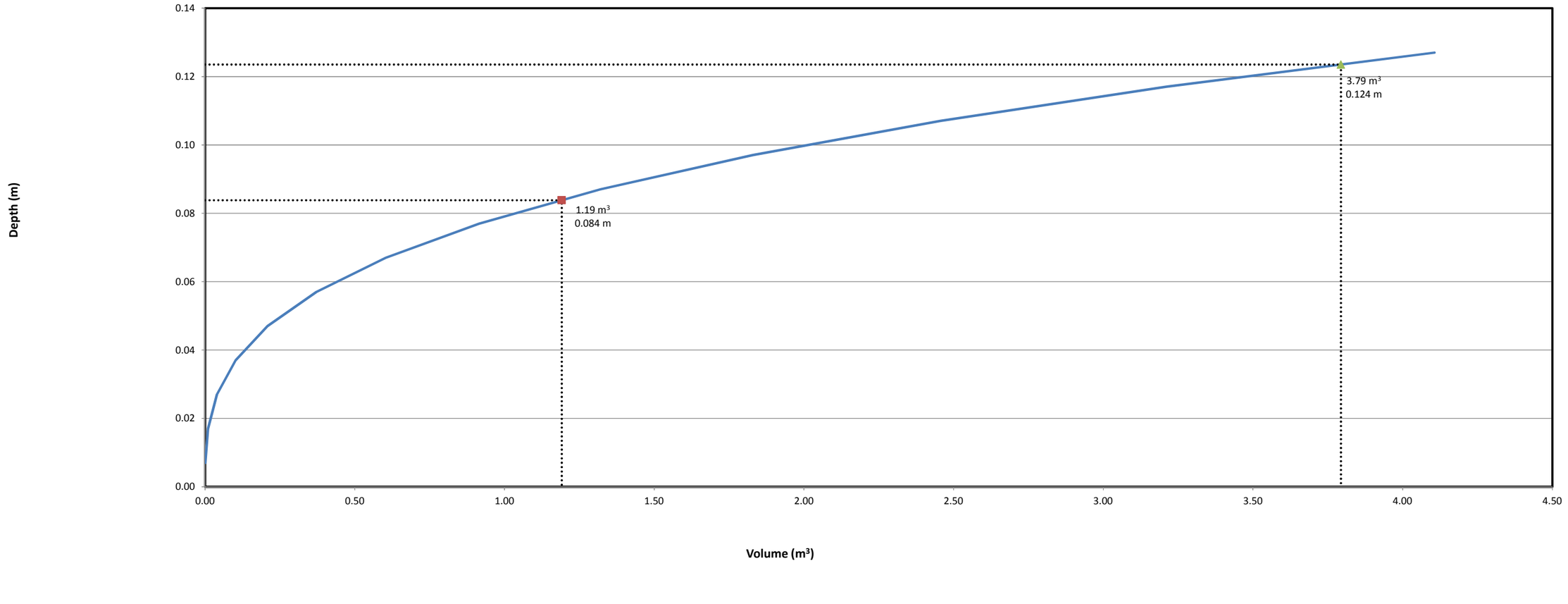
Stage-Storage Curve
Area R-15



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REQUIRED STORAGE - 2-YEAR EVENT
AREA R-16

OTTAWA IDF CURVE

Area =	0.010	ha	Qallow =	0.31
C =	0.90		Vol(max) =	1.21
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	103.57	2.54	2.23	0.67
10	76.81	1.88	1.57	0.94
15	61.77	1.51	1.20	1.08
20	52.03	1.28	0.97	1.16
25	45.17	1.11	0.80	1.20
30	40.04	0.98	0.67	1.21
35	36.06	0.88	0.57	1.21
40	32.86	0.81	0.50	1.19
45	30.24	0.74	0.43	1.16
50	28.04	0.69	0.38	1.13
55	26.17	0.64	0.33	1.09
60	24.56	0.60	0.29	1.05
65	23.15	0.57	0.26	1.00
70	21.91	0.54	0.23	0.95
75	20.81	0.51	0.20	0.90
80	19.83	0.49	0.18	0.85
85	18.94	0.46	0.15	0.79
90	18.14	0.44	0.13	0.73

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (2-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
1	0.01	0.02
4	0.03	0.03
8	0.09	0.04
13	0.19	0.05
19	0.35	0.06
26	0.57	0.07
35	0.88	0.08
45	1.28	0.09
57	1.79	0.10
69	2.42	0.11
83	3.18	0.12
98	**4.08**	**0.13**

Linear Interpolation					
0.09	H	0.08		H =	0.083 m
1.28	1.21	0.88		Q_{allow} =	0.31 L/s

REQUIRED STORAGE - 5-YEAR EVENT
AREA R-16

OTTAWA IDF CURVE

Area =	0.010	ha	Qallow =	0.35
C =	0.90		Vol(max) =	1.76
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	140.99	3.46	3.11	0.93
10	104.10	2.55	2.20	1.32
15	83.50	2.05	1.70	1.53
20	70.21	1.72	1.37	1.65
25	60.87	1.49	1.14	1.71
30	53.91	1.32	0.97	1.75
35	48.50	1.19	0.84	1.76
40	44.17	1.08	0.73	1.76
45	40.62	1.00	0.65	1.74
50	37.64	0.92	0.57	1.72
55	35.11	0.86	0.51	1.69
60	32.94	0.81	0.46	1.65
65	31.04	0.76	0.41	1.60
70	29.37	0.72	0.37	1.55
75	27.88	0.68	0.33	1.50
80	26.56	0.65	0.30	1.45
85	25.36	0.62	0.27	1.39
90	24.28	0.60	0.25	1.33

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (5-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
1	0.01	0.02
4	0.03	0.03
8	0.09	0.04
13	0.19	0.05
19	0.35	0.06
26	0.57	0.07
35	0.88	0.08
45	1.28	0.09
57	1.79	0.10
69	2.42	0.11
83	3.18	0.12
98	**4.08**	**0.13**

Linear Interpolation					
0.10	H	0.09		H =	0.094 m
1.79	1.76	1.28		Q_{allow} =	0.35 L/s

REQUIRED STORAGE - 10-YEAR EVENT
AREA R-16

OTTAWA IDF CURVE

Area =	0.010	ha	Qallow =	0.38
C =	0.90		Vol(max) =	2.20
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	165.77	4.06	3.71	1.11
10	122.14	2.99	2.64	1.59
15	97.85	2.40	2.05	1.84
20	82.21	2.02	1.67	2.00
25	71.22	1.75	1.40	2.09
30	63.05	1.55	1.20	2.15
35	56.70	1.39	1.04	2.18
40	51.62	1.27	0.92	2.20
45	47.45	1.16	0.81	2.20
50	43.97	1.08	0.73	2.18
55	41.00	1.01	0.66	2.16
60	38.45	0.94	0.59	2.13
65	36.23	0.89	0.54	2.10
70	34.27	0.84	0.49	2.06
75	32.54	0.80	0.45	2.01
80	30.98	0.76	0.41	1.97
85	29.59	0.73	0.38	1.91
90	28.32	0.69	0.34	1.86

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (10-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
1	0.01	0.02
4	0.03	0.03
8	0.09	0.04
13	0.19	0.05
19	0.35	0.06
26	0.57	0.07
35	0.88	0.08
45	1.28	0.09
57	1.79	0.10
69	2.42	0.11
83	3.18	0.12
98	**4.08**	**0.13**

Linear Interpolation					
0.11	H	0.10		H =	0.101 m
2.42	2.20	1.79		Q_{allow} =	0.38 L/s

REQUIRED STORAGE - 100-YEAR EVENT
AREA R-16

OTTAWA IDF CURVE

Area =	0.010	ha	Qallow =	0.46
C =	1.00		Vol(max) =	3.85
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	242.70	6.61	6.15	1.85
10	178.56	4.86	4.40	2.64
15	142.89	3.89	3.43	3.09
20	119.95	3.27	2.81	3.37
25	103.85	2.83	2.37	3.55
30	91.87	2.50	2.04	3.68
35	82.58	2.25	1.79	3.76
40	75.15	2.05	1.59	3.81
45	69.05	1.88	1.42	3.84
50	63.95	1.74	1.28	3.85
55	59.62	1.62	1.16	3.84
60	55.89	1.52	1.06	3.83
65	52.65	1.43	0.97	3.80
70	49.79	1.36	0.90	3.77
75	47.26	1.29	0.83	3.72
80	44.99	1.23	0.77	3.68
85	42.95	1.17	0.71	3.62
90	41.11	1.12	0.66	3.56

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (100-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
1	0.01	0.02
4	0.03	0.03
8	0.09	0.04
13	0.19	0.05
19	0.35	0.06
26	0.57	0.07
35	0.88	0.08
45	1.28	0.09
57	1.79	0.10
69	2.42	0.11
83	3.18	0.12
98	**4.08**	**0.13**

Linear Interpolation					
0.125	H	0.115		H =	0.122 m
4.08	3.85	3.18		Q_{allow} =	0.46 L/s

Note: Qallow is the flow rate through an overcontrolled Zurn Roof Drain (3.73 L/s/m of head.)

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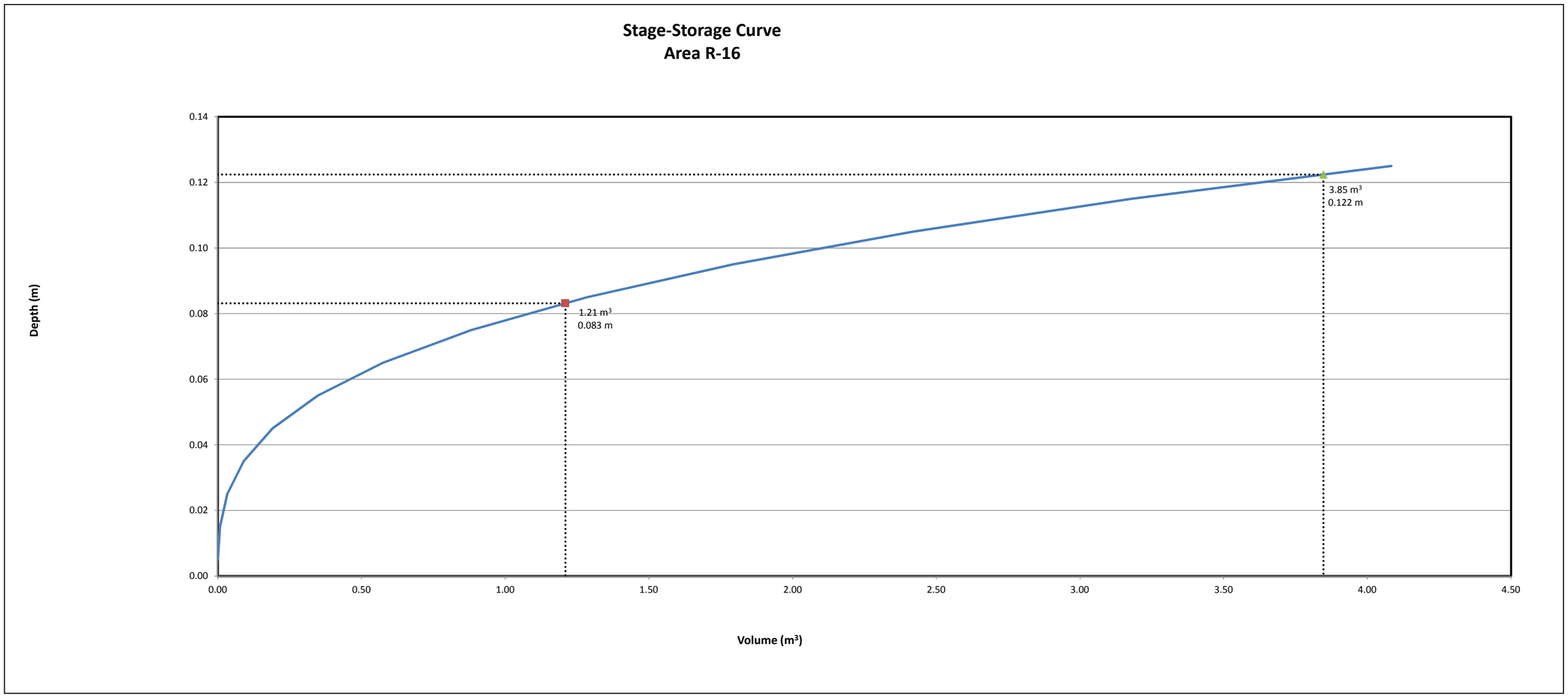

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REQUIRED STORAGE - 2-YEAR EVENT
AREA R-17

OTTAWA IDF CURVE

Area =	0.008	ha	Qallow =	0.30
C =	0.90		Vol(max) =	0.97
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	103.57	2.18	1.88	0.56
10	76.81	1.61	1.31	0.79
15	61.77	1.30	1.00	0.90
20	52.03	1.09	0.79	0.95
25	45.17	0.95	0.65	0.97
30	40.04	0.84	0.54	0.97
35	36.06	0.76	0.46	0.96
40	32.86	0.69	0.39	0.94
45	30.24	0.64	0.34	0.91
50	28.04	0.59	0.29	0.87
55	26.17	0.55	0.25	0.83
60	24.56	0.52	0.22	0.78
65	23.15	0.49	0.19	0.73
70	21.91	0.46	0.16	0.67
75	20.81	0.44	0.14	0.62
80	19.83	0.42	0.12	0.56
85	18.94	0.40	0.10	0.50
90	18.14	0.38	0.08	0.44

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (2-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
1	0.01	0.02
3	0.03	0.03
7	0.08	0.04
11	0.16	0.05
16	0.30	0.06
23	0.49	0.07
30	0.76	0.08
39	1.10	0.09
49	1.54	0.10
59	2.07	0.11
71	2.73	0.12
84	**3.50**	**0.13**

Linear Interpolation					
0.09	H	0.08		H =	0.081 m
1.10	0.97	0.76		Q_{allow} =	0.30 L/s

REQUIRED STORAGE - 5-YEAR EVENT
AREA R-17

OTTAWA IDF CURVE

Area =	0.008	ha	Qallow =	0.34
C =	0.90		Vol(max) =	1.43
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	140.99	2.96	2.62	0.79
10	104.10	2.19	1.85	1.11
15	83.50	1.75	1.41	1.27
20	70.21	1.48	1.14	1.36
25	60.87	1.28	0.94	1.41
30	53.91	1.13	0.79	1.43
35	48.50	1.02	0.68	1.43
40	44.17	0.93	0.59	1.41
45	40.62	0.85	0.51	1.39
50	37.64	0.79	0.45	1.35
55	35.11	0.74	0.40	1.31
60	32.94	0.69	0.35	1.27
65	31.04	0.65	0.31	1.22
70	29.37	0.62	0.28	1.16
75	27.88	0.59	0.25	1.11
80	26.56	0.56	0.22	1.05
85	25.36	0.53	0.19	0.98
90	24.28	0.51	0.17	0.92

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (5-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
1	0.01	0.02
3	0.03	0.03
7	0.08	0.04
11	0.16	0.05
16	0.30	0.06
23	0.49	0.07
30	0.76	0.08
39	1.10	0.09
49	1.54	0.10
59	2.07	0.11
71	2.73	0.12
84	**3.50**	**0.13**

Linear Interpolation					
0.10	H	0.09		H =	0.092 m
1.54	1.43	1.10		Q_{allow} =	0.34 L/s

REQUIRED STORAGE - 10-YEAR EVENT
AREA R-17

OTTAWA IDF CURVE

Area =	0.008	ha	Qallow =	0.37
C =	0.90		Vol(max) =	1.79
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	165.77	3.48	3.14	0.94
10	122.14	2.57	2.23	1.34
15	97.85	2.06	1.72	1.54
20	82.21	1.73	1.39	1.67
25	71.22	1.50	1.16	1.74
30	63.05	1.33	0.99	1.77
35	56.70	1.19	0.85	1.79
40	51.62	1.08	0.74	1.79
45	47.45	1.00	0.66	1.77
50	43.97	0.92	0.58	1.75
55	41.00	0.86	0.52	1.72
60	38.45	0.81	0.47	1.69
65	36.23	0.76	0.42	1.64
70	34.27	0.72	0.38	1.60
75	32.54	0.68	0.34	1.55
80	30.98	0.65	0.31	1.49
85	29.59	0.62	0.28	1.44
90	28.32	0.60	0.26	1.38

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (10-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
1	0.01	0.02
3	0.03	0.03
7	0.08	0.04
11	0.16	0.05
16	0.30	0.06
23	0.49	0.07
30	0.76	0.08
39	1.10	0.09
49	1.54	0.10
59	2.07	0.11
71	2.73	0.12
84	**3.50**	**0.13**

Linear Interpolation					
0.11	H	0.10		H =	0.100 m
2.07	1.79	1.54		Q_{allow} =	0.37 L/s

REQUIRED STORAGE - 100-YEAR EVENT
AREA R-17

OTTAWA IDF CURVE

Area =	0.008	ha	Qallow =	0.45
C =	1.00		Vol(max) =	3.14
			Notches =	1

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	242.70	5.67	5.22	1.57
10	178.56	4.17	3.72	2.23
15	142.89	3.34	2.89	2.60
20	119.95	2.80	2.35	2.82
25	103.85	2.43	1.98	2.96
30	91.87	2.15	1.70	3.05
35	82.58	1.93	1.48	3.10
40	75.15	1.75	1.30	3.13
45	69.05	1.61	1.16	3.14
50	63.95	1.49	1.04	3.13
55	59.62	1.39	0.94	3.11
60	55.89	1.31	0.86	3.08
65	52.65	1.23	0.78	3.04
70	49.79	1.16	0.71	2.99
75	47.26	1.10	0.65	2.94
80	44.99	1.05	0.60	2.88
85	42.95	1.00	0.55	2.82
90	41.11	0.96	0.51	2.75

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (100-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.01
1	0.01	0.02
3	0.03	0.03
7	0.08	0.04
11	0.16	0.05
16	0.30	0.06
23	0.49	0.07
30	0.76	0.08
39	1.10	0.09
49	1.54	0.10
59	2.07	0.11
71	2.73	0.12
84	**3.50**	**0.13**

Linear Interpolation					
0.125	H	0.115		H =	0.120 m
3.50	3.14	2.73		Q_{allow} =	0.45 L/s

Note: Qallow is the flow rate through an overcontrolled Zurn Roof Drain (3.73 L/s/m of head.)

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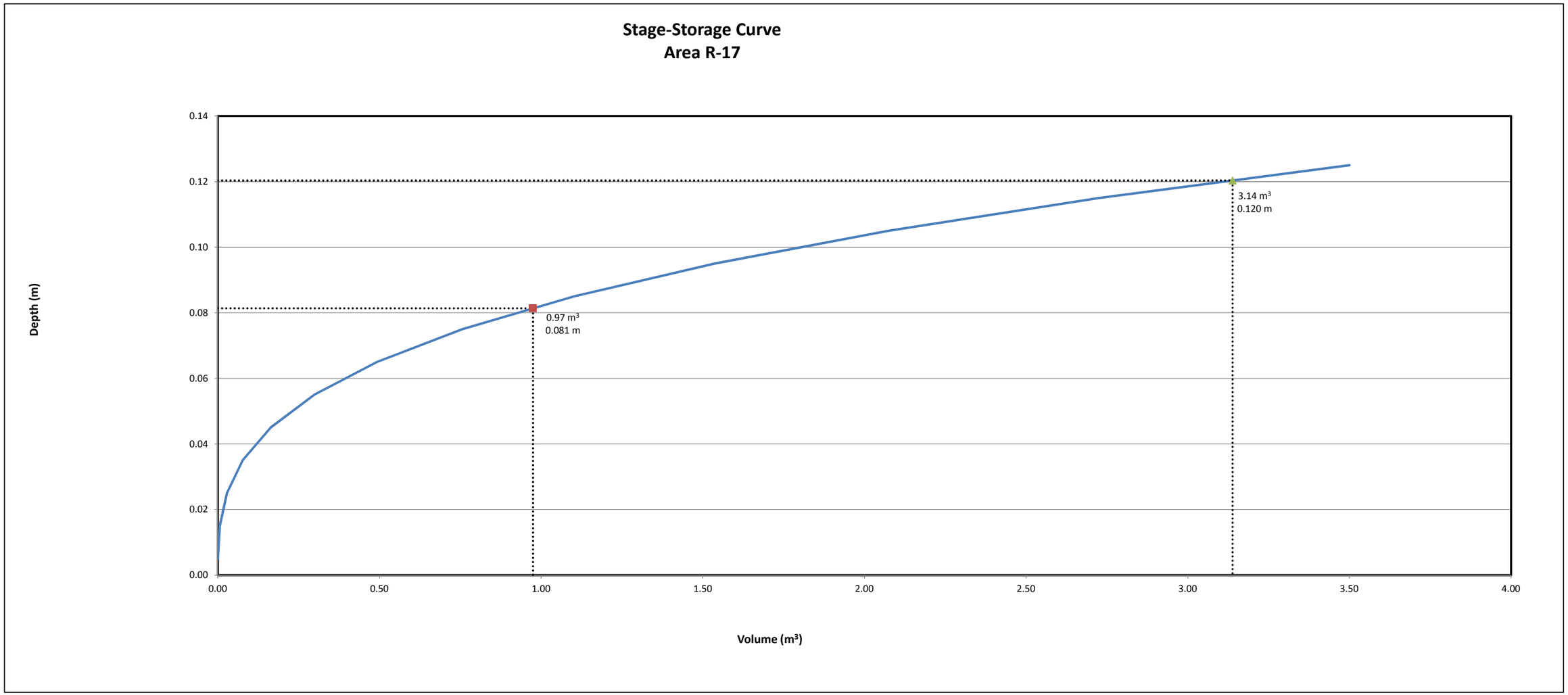

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REQUIRED STORAGE - 2-YEAR EVENT
AREA SC-1

OTTAWA IDF CURVE

Area =	0.001	ha	Qallow =	0.20
C =	0.90		Vol(max) =	0.01
			Scupper Width (mm) =	50

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	103.57	0.29	0.09	0.03
10	76.81	0.21	0.01	0.01
15	61.77	0.17	-0.03	-0.02
20	52.03	0.14	-0.05	-0.06
25	45.17	0.12	-0.07	-0.11
30	40.04	0.11	-0.09	-0.16
35	36.06	0.10	-0.10	-0.21
40	32.86	0.09	-0.11	-0.26
45	30.24	0.08	-0.11	-0.31
50	28.04	0.08	-0.12	-0.36
55	26.17	0.07	-0.12	-0.41
60	24.56	0.07	-0.13	-0.47
65	23.15	0.06	-0.13	-0.52
70	21.91	0.06	-0.14	-0.57
75	20.81	0.06	-0.14	-0.63
80	19.83	0.05	-0.14	-0.68
85	18.94	0.05	-0.14	-0.74
90	18.14	0.05	-0.15	-0.79

Notes: Vol = Qnet x time
Qnet = Q - Qallow

REQUIRED STORAGE - 5-YEAR EVENT
AREA SC-1

OTTAWA IDF CURVE

Area =	0.001	ha	Qallow =	0.27
C =	0.90		Vol(max) =	0.01
			Scupper Width (mm) =	50

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	140.99	0.39	0.12	0.04
10	104.10	0.29	0.02	0.01
15	83.50	0.23	-0.04	-0.03
20	70.21	0.19	-0.07	-0.09
25	60.87	0.17	-0.10	-0.15
30	53.91	0.15	-0.12	-0.21
35	48.50	0.13	-0.13	-0.28
40	44.17	0.12	-0.14	-0.34
45	40.62	0.11	-0.15	-0.41
50	37.64	0.10	-0.16	-0.48
55	35.11	0.10	-0.17	-0.56
60	32.94	0.09	-0.17	-0.63
65	31.04	0.09	-0.18	-0.70
70	29.37	0.08	-0.18	-0.77
75	27.88	0.08	-0.19	-0.85
80	26.56	0.07	-0.19	-0.92
85	25.36	0.07	-0.20	-1.00
90	24.28	0.07	-0.20	-1.07

Notes: Vol = Qnet x time
Qnet = Q - Qallow

REQUIRED STORAGE - 10-YEAR EVENT
AREA SC-1

OTTAWA IDF CURVE

Area =	0.001	ha	Qallow =	0.49
C =	0.90		Vol(max) =	0.04
			Notches =	50

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	165.77	0.46	0.19	0.06
10	122.14	0.34	0.07	0.04
15	97.85	0.27	0.00	0.00
20	82.21	0.23	-0.04	-0.05
25	71.22	0.20	-0.07	-0.10
30	63.05	0.17	-0.09	-0.16
35	56.70	0.16	-0.11	-0.23
40	51.62	0.14	-0.12	-0.30
45	47.45	0.13	-0.13	-0.36
50	43.97	0.12	-0.14	-0.43
55	41.00	0.11	-0.15	-0.50
60	38.45	0.11	-0.16	-0.57
65	36.23	0.10	-0.17	-0.64
70	34.27	0.09	-0.17	-0.72
75	32.54	0.09	-0.18	-0.79
80	30.98	0.09	-0.18	-0.86
85	29.59	0.08	-0.18	-0.94
90	28.32	0.08	-0.19	-1.01

Notes: Vol = Qnet x time
Qnet = Q - Qallow

REQUIRED STORAGE - 100-YEAR EVENT
AREA SC-1

OTTAWA IDF CURVE

Area =	0.001	ha	Qallow =	0.48
C =	1.00		Vol(max) =	0.04
			Scupper Width (mm) =	50

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m^3)
5	242.70	0.74	0.26	0.08
10	178.56	0.55	0.07	0.04
15	142.89	0.44	-0.04	-0.04
20	119.95	0.37	-0.11	-0.14
25	103.85	0.32	-0.16	-0.24
30	91.87	0.28	-0.20	-0.36
35	82.58	0.25	-0.23	-0.48
40	75.15	0.23	-0.25	-0.60
45	69.05	0.21	-0.27	-0.73
50	63.95	0.20	-0.28	-0.85
55	59.62	0.18	-0.30	-0.98
60	55.89	0.17	-0.31	-1.11
65	52.65	0.16	-0.32	-1.24
70	49.79	0.15	-0.33	-1.38
75	47.26	0.14	-0.34	-1.51
80	44.99	0.14	-0.34	-1.64
85	42.95	0.13	-0.35	-1.78
90	41.11	0.13	-0.35	-1.91

Notes: Vol = Qnet x time
Qnet = Q - Qallow

Ponding Depth (2-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.00
0	0.00	0.01
2	0.01	0.02
4	0.04	0.03
7	0.09	0.04
11	**0.18**	**0.05**

Ponding Depth (5-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.00
0	0.00	0.01
2	0.01	0.02
4	0.04	0.03
7	0.09	0.04
11	**0.18**	**0.05**

Ponding Depth (10-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.00
0	0.00	0.01
2	0.01	0.02
4	0.04	0.03
7	0.09	0.04
11	**0.18**	**0.05**

Ponding Depth (100-Year Storm)

Area m^2	V m^3	H m
0	0.00	0.00
0	0.00	0.01
2	0.01	0.02
4	0.04	0.03
7	0.09	0.04
11	**0.18**	**0.05**

Linear Interpolation

0.02	H	0.01	H =	0.017 m	
0.01	0.01	0.00	Q_{allow} =	0.20 L/s	

Linear Interpolation

0.03	H	0.02	H =	0.020 m	
0.04	0.01	0.01	Q_{allow} =	0.27 L/s	

Linear Interpolation

0.04	H	0.03	H =	0.031 m	
0.09	0.04	0.04	Q_{allow} =	0.49 L/s	

Linear Interpolation

0.04	H	0.03	H =	0.030 m	
0.09	0.04	0.04	Q_{allow} =	0.48 L/s	

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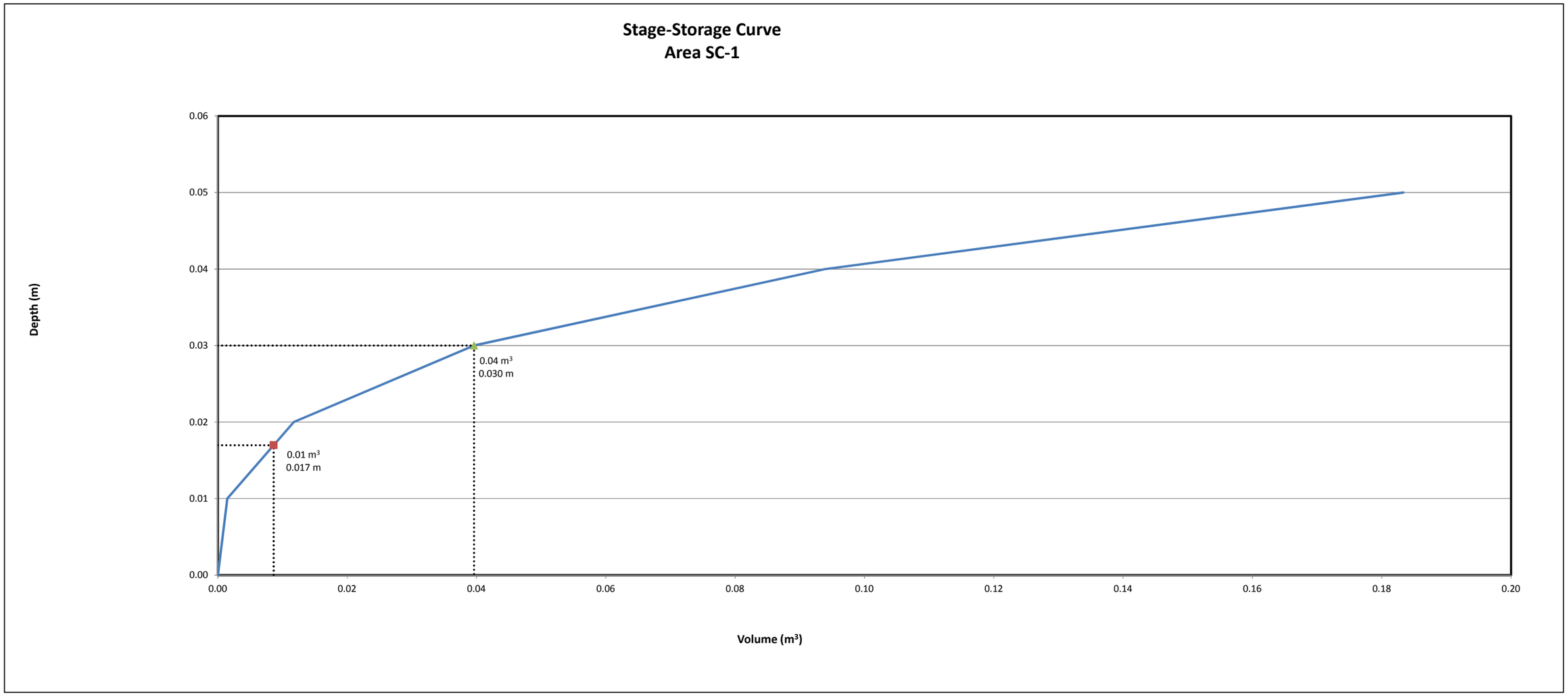


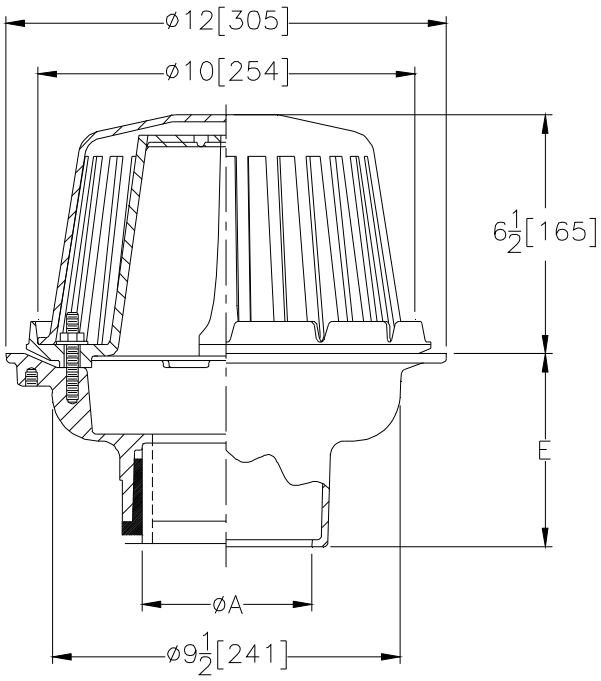
ZCF121

Ø12 [305] CONTROL-FLO ROOF DRAIN

SPECIFICATION SHEET

TAG _____

Dimensional Data (inches and [mm]) are Subject to Manufacturing Tolerances and Change Without Notice



A Pipe Size In. [mm]	Approx. Wt. Lb. [kg]	Dome Open Area Sq. In. [cm²]
2,3,4 [51,76,102]	22 [10]	78 [503]
6 [152]		

ENGINEERING SPECIFICATION: ZURN ZCF121
12" [305mm] diameter "Control-Flo" roof drain for dead-level roof construction, Dura-Coated cast iron body. Combination membrane flashing clamp/gravel guard, aluminum "Control-Flo" weir, and Poly-Dome. "Control-Flo" weir shall be linear functioning with flow rate of 5 GPM [23 LPM] per inch of water buildup above drain. All data shall be verified proportional to flow rates.

OPTIONS (Check/specify appropriate options)

PIPE SIZE

2,3,4,6 [51,76,102,152]
2,3,4,6 [51,76,102,152]
2,3,4,6 [51,76,102,152]
2,3,4 [51,76,102]

(Specify size/type) **OUTLET**

_____ IC Inside Caulk
_____ IP Threaded
_____ NH No-Hub
_____ NL Neo-Loc

E BODY HT. DIM.

5-1/4 [133]
3-3/4 [95]
5-1/4 [133]
4-5/8 [117]

PREFIXES

____ Z D.C.C.I. Body with Poly-Dome*
____ ZA D.C.C.I. Body with Aluminum Dome

SUFFIXES

____ -A Waterproof Flange
____ -AR Acid Resistant Epoxy Coated Finish
____ -C Underdeck Clamp
____ -DP Top Set® Roof Deck Plate (Replaces both the -C and -R)
____ -DR Adjustable Drain Riser Extension Assembly 3-5/8 [92] to 7-1/4 [184]
____ -E Static Extension 1 [25] thru 4 [102] (Specify Ht.)
____ -EB Elevating Body Plate
____ -G Galvanized Cast Iron
____ -R Roof Sump Receiver
____ -SC Secondary Clamp Collar
____ -TC Neo-LocTest CapGasket (2,3,4 [51,76,102] NL Bottom Outlet Only)
____ -VP Vandal Proof Secured Top
____ -90 90º Threaded Side Outlet Body (2,3,4 [51,76,102])

* Regularly furnished unless otherwise specified.

Zurn Industries, LLC | **Specification Drainage Operation**
1801 Pittsburgh Avenue, Erie, PA U.S.A. 16502 · Ph. 855-663-9876, Fax 814-454-7929
In Canada | **Zurn Industries Limited**
3544 Nashua Drive, Mississauga, Ontario L4V 1L2 · Ph. 905-405-8272, Fax 905-405-1292
www.zurn.com

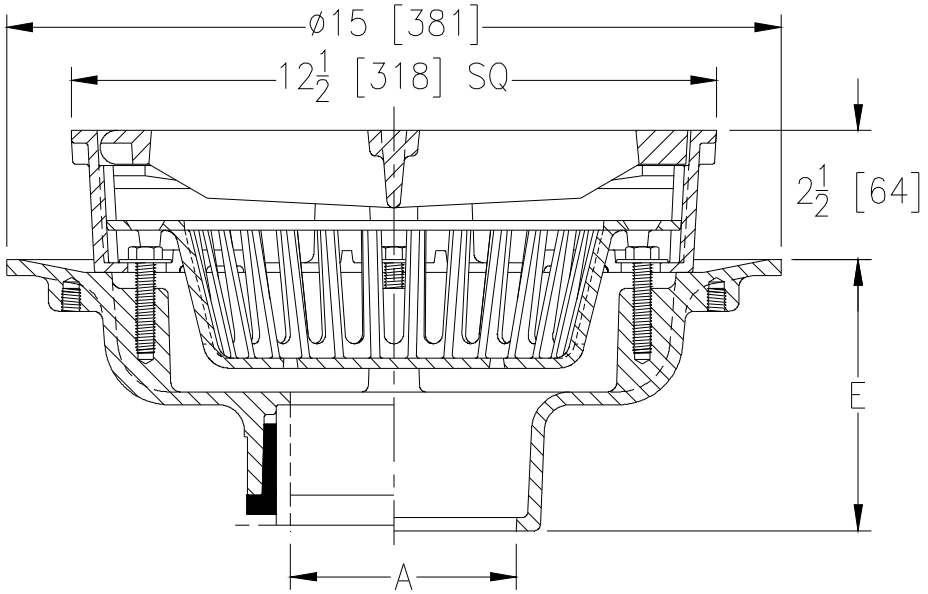
Rev. D
Date: 09/21/2017
C.N. No. 137768
Prod. | Dwg. No. ZCF121

Z610
12 [305] HEAVY-DUTY DRAIN

SPECIFICATION SHEET

TAG _____

Dimensional Data (inches and [mm]) are Subject to Manufacturing Tolerances and Change Without Notice



A Pipe Size	Approx. Wt. Lbs. [kg]	Grate Open Area Sq. In. [cm²]
2-3-4-5-6 [51-76-102-127-152]	54 [24]	42 [271]
8-10 [203-254]	56 [25]	

ENGINEERING SPECIFICATION: ZURN Z610
12 [305] Square top drain, Dura-Coated cast iron body with bottom outlet, seepage pan and combination membrane flashing clamp and frame for heavy-duty cast iron loose slotted grate, with suspended polypropylene sediment bucket.

OPTIONS (Check/specify appropriate options)

PIPE SIZE	(Specify size/type) **OUTLET**		**'E' BODY HT. DIM.**
2 thru 6, 8, 10 [51 thru 152, 203, 254]	____ IC	Inside Caulk	5-1/4 [133]
2 thru 4, 6 [51 thru 102, 152]	____ IG	Inside Gasket	5-1/4 [133]
2 thru 6, 8, 10 [51 thru 152, 203, 254]	____ IP	Threaded	3-3/4 [95]
2 thru 6, 8, 10 [51 thru 152, 203, 254]	____ NH	No-Hub	5-1/4 [133]
2 thru 4 [51 thru 102]	____ NL	Neo-Loc	4-5/8 [117]

PREFIXES

____ Z D.C.C.I. Body and Top*
____ ZB D.C.C.I Body w/Polished Bronze Top (Add 3/16 [5] to 2-1/2 [64] Dim. and 3/4 [19] to 12-1/2 [318] Dim.)
____ ZN D.C.C.I Body w/Polished Nickel Bronze Top (Add 3/16 [5] to 2-1/2 [64] Dim. and 3/4 [19] to 12-1/2 [318] Dim.)

SUFFIXES

____ -AR Acid Resistant Epoxy Coated Cast Iron
____ -DG Duresist Grate
____ -DS Ductile Iron Solid Cover
____ -DX Dex-o-tex Flange (ZB, ZN Only)
____ -F 2 [51] High Extension
____ -G Galvanized Cast Iron
____ -H Hinged Grate
____ -HC Hinged Solid Cover
____ -HL Hinged Locking Grate
____ -HLC Hinged Locking Cover
____ -LY (Less) Sediment Bucket
____ -P Trap Primer Connection
____ -S Secondary Strainer
____ -SC Solid Cover
____ -SS Stainless Steel Mesh Liner for Bucket
____ -TC Neo-Loc Test Cap Gasket (2 [51] - 4 [102] NL Bottom Outlet Only)
____ -TS Top Secured with Slotted Screws
____ -V Backwater Valve (See Z1099)
____ -VP Vandal-Proof Secured Top
____ -YA Aluminum Sediment Bucket
____ -YC Cast Iron Sediment Bucket
____ -90 90º Threaded Side Outlet Body

*REGULARLY FURNISHED UNLESS OTHERWISE SPECIFIED

REV. G DATE: 11/10/10 C.N. NO. 120320

DWG. NO. 59240 PRODUCT NO. Z610

ZURN INDUSTRIES, LLC. ♦ SPECIFICATION DRAINAGE OPERATION ♦ 1801 Pittsburgh Ave. ♦ Erie, PA 16514
Phone: 814/455-0921 ♦ Fax: 814/454-7929 ♦ World Wide Web: www.zurn.com
In Canada: ZURN INDUSTRIES LIMITED ♦ 3544 Nashua Drive ♦ Mississauga, Ontario L4V1L2 ♦ Phone: 905/405-8272 Fax: 905/405-1292

APPENDIX B

WATERMAIN AND FIRE INFORMATION

Ben Sweet

Subject: RE: 115 Echo Drive

From: Wu, John [mailto:John.Wu@ottawa.ca]
Sent: Tuesday, August 18, 2015 9:36 AM
To: Sam Bahia <s.bahia@novatech-eng.com>
Subject: RE: 115 Echo Drive

Here is the result for your options:
The following are boundary conditions, HGL, for hydraulic analysis at 115 Echo (zone 1W) assumed to be connected to:

Option 1: 203mm on Main St
Option 2: 406mm on Main St

Option 1

Minimum HGL = 105.0m

Maximum HGL = 116.4m

MaxDay (0.98 L/s) + FireFlow (166.7 L/s) = 102.5m

Option 2

Minimum HGL = 105.6m

Maximum HGL = 116.2m

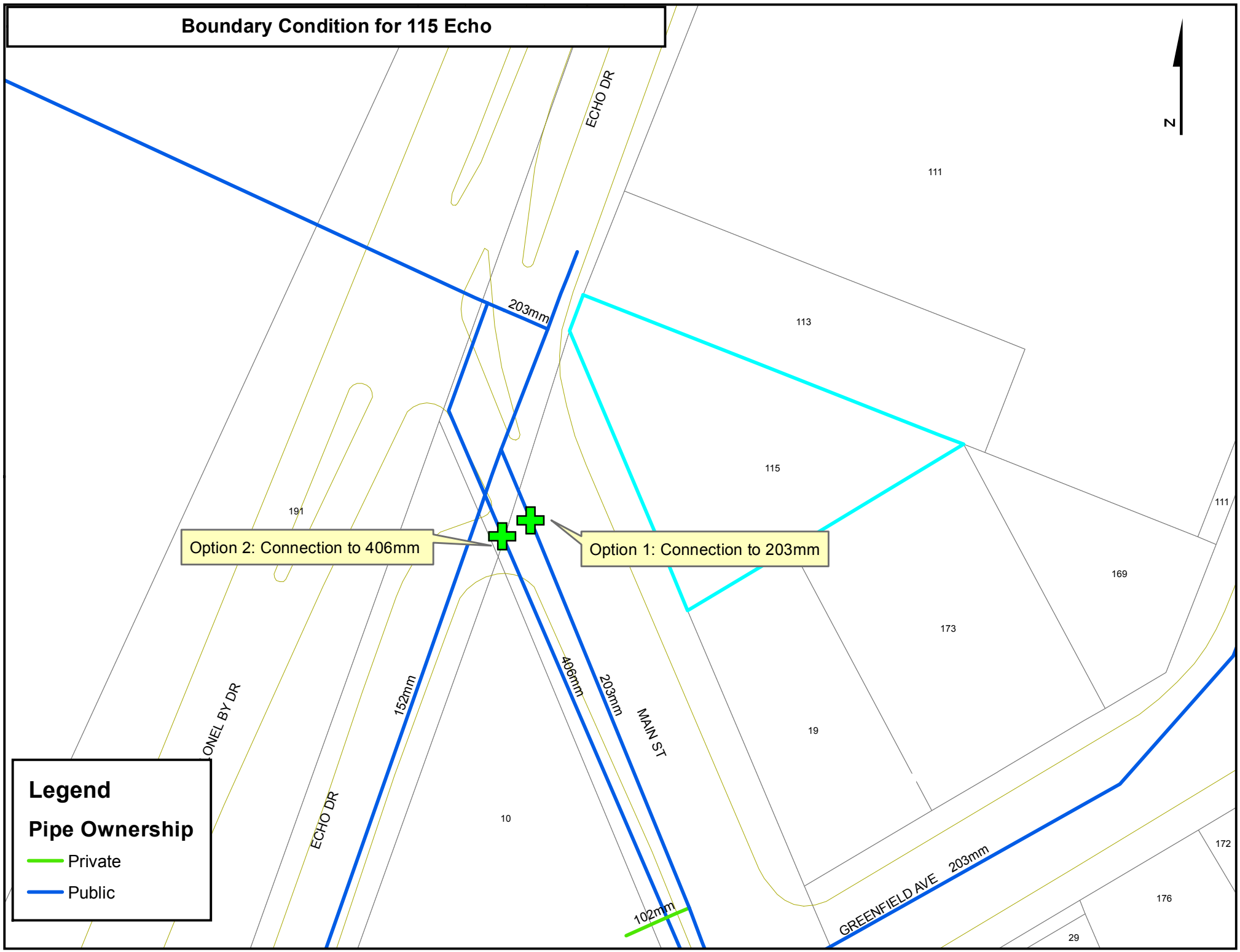
MaxDay (0.98 L/s) + FireFlow (166.7 L/s) = 108.1m

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.

I told you that there is no big difference.

John


Boundary Condition for 115 Echo
N
ECHO DR
111
203mm
113
115
191
Option 2: Connection to 406mm
Option 1: Connection to 203mm
111
169
173
19
ONEL BY DR
152mm
406mm
203mm
MAIN ST
ECHO DR
10
172
GREENFIELD AVE
203mm
102mm
176
29
Legend
Pipe Ownership
Private
Public

NOVATECH
Engineers, Planners & Landscape Architects

Project: 115 Echo Drive
Proj. No.: 115105
Design: BHB/BS

Reference: City of Ottawa Water Distribtuion Guidelines
Ontario Building Code 2006
National Fire Protection Association NFPA 13 - 2013 9 (Chapters 5 & 11)

Basic Residential Water Demand

Type of Units	=	Condominum Apartments		
No of. Units	=	40		
Condominum Apartments	=	2.1	People/unit	
Flow/capita	=	350	L/day/person	
Domestic Flow Daily	=	29400	L/day	(# Units x # People x Residential Flow)
	=	0.340	L/s	Less than 50m³ NO
Max Daily	=	73500	L/day	(2.5 x Domestic)
	=	0.851	L/s	
Max Hour =	=	6737.5	L/hour	(2.2 x Max Daily / 24)
	=	1.872	L/s	

Basic ICI Water Demand

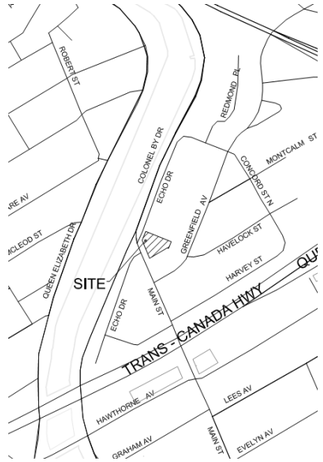
Type of Use	=	NA		
Area	=	0	m²	
Flow/capita/area	=	5	L/day/m²	(Commercial)
Domestic Flow Daily	=	0	L/day	(# Units x # People x Residential Flow)
	=	0	L/s	Less than 50m³ NO
Max Daily	=	0	L/day	(1.5 x Domestic)
	=	0	L/s	
Max Hour =	=	0	L/hour	(1.8 x Max Daily / 24)
	=	0	L/s	

Fire Demand

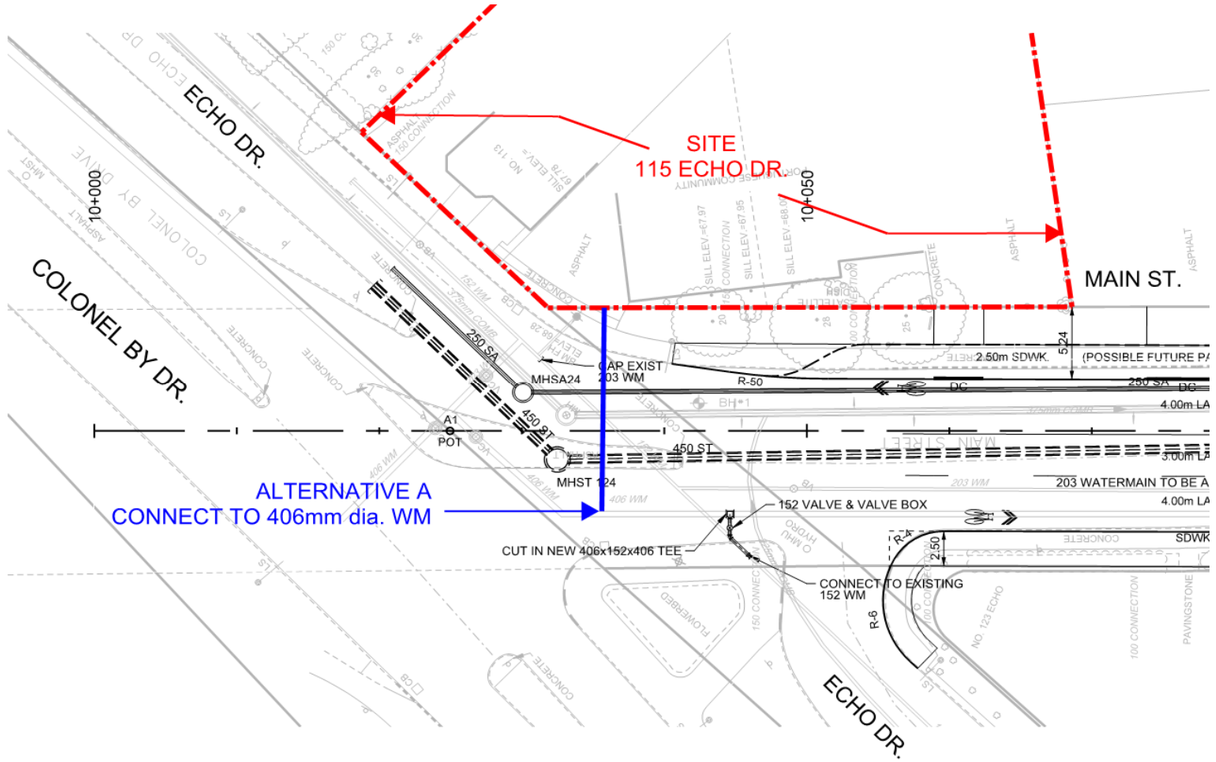
Building Name	Units / Hazard Rating	OBC Part 3 Flow - unsprinkled (US gpm)	OBC Part 3 Flow - sprinkled per NFPA 13 (US gpm)	FUS Flow (us gpm)
115 Echo Dr	46	NA		
	Ordinary Group 1		850	2642

Building Name	Units / Hazard Rating	OBC Part 3 Flow - unsprinkled (L/s)	OBC Part 3 Flow - sprinkled per NFPA 13 (L/s)	FUS Flow (L/s)
115 Echo Dr	46	NA		NA
	Ordinary Group 1		53.62	166.67

Key Plan



Diagram



Novatech
Suite 200 - 240 Michael Cowpland Drive Ottawa, Ontario, K2M 1P6

NOVATECH ENGINEERING CONSULTANTS LTD.
ENGINEERS & PLANNERS

Fire Flow Calculations - 115 Echo Drive

As per Fire Underwriter's Survey Guidelines

PROJECT: 115 Echo Drive **DATE: October 2017**

JOB#: 115105

C	**Coefficient related to type of construction**	[yes/no]		
	◆ Wood frame		1.5	
	◆ Ordinary construction		1	
	◆ Non-combustible construction		0.8	
	◆ Fire resistive construction (< 2 hrs)	yes	0.7	
	◆ Fire resistive construction (> 2 hrs)		0.6	
	◆ Interpolation (Using FUS Tables)	*Procedure A*		
A	**Area of structure considered (m^2)**	***4,853***	<==>	52,240 ft^2
	Max. Storey Area (m^2)	*1,079*	*Procedure B*	
	Effective Stories	*4.5*	*Procedure C*	
F	**Required fire flow (L/min)**			
	$F = 220\ C\ (A)^{0.5}$	*Procedure D*		***11,000 L/min***
	Occupancy hazard reduction of surcharge	[yes/no]		
	◆ Non-combustible	yes	-25%	
	◆ Limited combustible		-15%	
	◆ Combustible		0%	
	◆ Free burning		15%	
	◆ Rapid burning		25%	
		Procedure E		***8,250 L/min*** **(1)**
	Sprinkler Reduction	[yes/no]		
	◆ Sprinkler System	yes	30%	
	◆ Siamese Twin	yes	10%	
	◆ Fully Supervised System	yes	10%	
	Total Reduction Applied		50%	
		Procedure F		***4,125 L/min*** **(2)**
	Exposure surcharge (cumulative (%), 2 sides)	[yes/no]		
	0 - 3 m	yes	25%	4 side 100%
	3.1 - 10 m		20%	
	10.1 - 20 m		15%	
	20.1 - 30 m		10%	
	30.1- 45 m		5%	
				Cuml. Total **75%**
	Fire Wall Separation			6,188 L/min
	◆ Number of Party Walls * 1000 L/min	0 walls		
	(As per City of Ottawa Standard)	*Procedure G*		***6,188 L/min*** **(3)**

REQUIRED FIRE FLOW [(1) - (2) + (3)]		10,313 L/min
(2,000 L/min < Fire Flow < 45,000 L/min)	***Rounded to***	***10,000 L/min***
	or	***166.7 L/s***
	or	***2642 USGPM***
	or	***2,202 IGPM***

BY: *Sam Bahia*

Notes: Structure areas are an estimate based on the architectural drawings

APPENDIX C

COMBINED SEWER ASSESSMENT

COMBINED SEWER DESIGN SHEET

115 Echo Drive

JOB #115105

NOVATECH ENGINEERING CONSULTANTS LTD.

LOCATION			INDIVIDUAL AREA AND POPULATION						CUMULATIVE AREA & POPULATION			FLOWS						EXISTING SEWER						
Street	From MH	To MH	Area	Occupancy Area					Area	Pop.	Comm Area	Peak Factor (Res)	Peak Factor (Com)	Pop. Flow (L/s)	Infiltration Flow (L/s)	Commercial Flow (L/s)	Storm Flow (L/s)	Total Flow (L/s)	Length (m)	Dia Act (mm)	Dia Nom (mm)	Slope (%)	Velocity (Full) (m/s)	Capacity (Full) (L/s)	Ratio Q/Qfull (%)
				Residential Units			Population	Commercial																	
			(ha)	Single	Townhouse	Apartment			(ha)																
Concord St.	1C	1B	0.20						0.20	0.0	0.0	4.00	1.50	0.00	0.06	0.00	11.60	11.66	10.3	304.8	300	4.10	2.80	204.1	6%
Greenfield Ave.	Prive Site	1B	1.48	63.00			214.20		1.48	214.2	0.0	4.00	1.50	3.47	0.41	0.00	95.30	99.19	12.3	609.6	600	0.10	0.69	202.4	49%
Greenfield Ave.	1B	1A	0.36	5.00			17.0		1.84	231.2	0.0	4.00	1.50	3.75	0.52	0.00	123.05	127.31	73.4	609.6	600	0.10	0.69	202.4	63%
Greenfield Ave.	1A	A	0.00				0.0		1.84	231.2	0.0	4.00	1.50	3.75	0.52	0.00	117.61	121.88	16.1	609.6	600	0.10	0.69	202.4	60%
Concord	C	B	0.15	1			3.4	0.00	0.15	3.4	0.0	4.00	1.50	0.06	0.04	0.00	8.49	8.59	54.60	228.6	225	0.50	0.81	33.1	26%
Montcalm	D	B	0.29	1	12		35.8	0.00	0.44	39.2	0.0	4.00	1.50	0.64	0.12	0.00	16.74	17.50	66.50	228.6	225	0.16	0.46	18.7	93%
Concord	E	B	0.41	6	2		25.8	0.00	0.84	65.0	0.0	4.00	1.50	1.05	0.24	0.00	23.75	25.04	72.90	228.6	225	1.00	1.14	46.8	54%
44/46 Concord	B	A	0.10		10		27.0	0.00	0.10	27.0	0.0	4.00	1.50	0.44	0.03	0.00		0.47	8.60	203.2	200	1.00	1.05	34.2	1%
Montcalm	B	A	0.31	0	14		37.8	0.00	1.84	172.4	0.0	4.00	1.50	2.79	0.51	0.00	67.90	71.21	75.90	457.2	450	0.33	1.03	169.4	42%
Greenfield Ave	A	10	0.81		12		32.4		4.49	436.0	0.0	4.00	1.50	7.06	1.26	0.00	216.10	224.42	120.70	609.6	600	0.18	0.93	271.6	83%
Havelock Street	H	G	0.70	6	12		52.8		0.70	52.8	0.0	4.00	1.50	0.86	0.20	0.00		1.05	68.60	254.0	250	1.00	1.22	62.0	2%
Havelock Street	G	10	0.48	4	6		29.8		1.18	82.6	0.0	4.00	1.50	1.34	0.33	0.00		1.67	78.10	254.0	250	1.00	1.22	62.0	3%
Main Street	10	6	0.38	5	3		25.1		6.05	518.6	0.0	3.97	1.50	8.33	1.69	0.00	276.52	286.55	79.60	609.6	600	0.35	1.30	378.7	76%
Echo Drive	9	8	0.42			150	270.0		0.42	270.0	0.0	4.00	1.50	4.38	0.12	0.00	24.40	28.89	60.90	304.8	300	0.40	0.87	63.7	45%
Echo Drive	8	7	0.85			150	270.0		1.27	540.0	0.0	3.96	1.50	8.66	0.36	0.00	71.15	80.16	152.10	381.0	375	0.35	0.95	108.1	74%
Main Street (115 ECHO ENTERS)	7	6	0.43			94	169.2	0.15	1.70	709.2	0.2	3.89	1.50	11.18	0.48	0.65	97.78	110.08	80.80	381.0	375	0.55	1.19	135.5	81%
Main Street	6	5	0.56	3	4	75	156.0		8.31	1383.8	0.2	3.70	1.50	20.77	2.33	0.65	379.19	402.94	81.69	685.8	675	0.40	1.50	554.3	73%
Havelock Street	19	17	0.20	1	4		14.2		0.20	14.2	0.0	4.00	1.50	0.23	0.06	0.00	11.73	12.01	48.00	254.0	250	0.50	0.86	43.8	27%
Havelock Street SEPERATED	17	15	0.34	4			13.6		0.54	27.8	0.0	4.00	1.50	0.45	0.15	0.00	30.79	31.39	65.70	254.0	250	0.30	0.67	33.9	92%
Havelock Street	15	13	0.00				0.0		0.54	27.8	0.0	4.00	1.50	0.45	0.15	0.00	29.68	30.28	20.80	254.0	250	0.30	0.67	33.9	89%
Havelock Street	13	11	0.57	9			30.6		1.11	58.4	0.0	4.00	1.50	0.95	0.31	0.00	60.06	61.32	124.93	254.0	250	0.30	0.67	33.9	181%
Havelock Street	11	5	0.55	7			23.8		1.67	82.2	0.0	4.00	1.50	1.33	0.47	0.00	84.89	86.69	115.96	254.0	250	0.30	0.67	33.9	255%
Harvey Street	5	2	0.85		21		56.7		10.83	1522.7	0.2	3.67	1.50	22.67	3.03	0.65	444.71	471.06	149.80	762.0	750	0.30	1.39	635.8	74%

DESIGN PARAMETERS

Population Density =	3.4	person/unit	Single	Infiltration Flow =	0.28 L/s/ha
	2.7	person/unit	Townhouse		
	1.8	person/unit	Apartment		
Commercial Average Flow =	5	L/m^2/day			
Residential Average Flow =	350	L/person/day		Manning's n=	0.013
Peak factor based on Harmon Equation =			1+[14/(4+Pop/1000)]^1/2*1 - (Maximum of 4.0)		

Notes:

1. Occupancy taken as per existing conditions
2. For detailed storm flow calculations see Storm Design Sheet
3. Data for shaded cells is taken from design sheet for existing sewers

Project: 115 Echo Drive

Client:

Date: August 14, 2015

All flows taken from the Ottawa Sewer Design Guide Figure 4.3

Designed: BS

Checked: BHB

Dwg. Reference: 115105-COMB

CONCORD/MONTCALM RESIDENTIAL

STORM SEWER DESIGN SHEET (2-YEAR EVENT)
JOB# 115105

NOVATECH ENGINEERING CONSULTANTS LTD.

LOCATION			AREA (ha)				FLOW								SEWER DATA							
Street	From Node	To Node	R= 0.40	R= 0.60	R= 0.70	R= 0.88	Indiv 2.78 AC	Accum 2.78 AC	Time of Conc.	Design Storm	Rainfall Intensity (2-yr)	Peak Flow (L/sec) Q 2	San Flow	Qtotal	Dia. (m) Actual	Dia. (mm)	Type	Slope (%)	Length (m)	Capacity (L/s)	Velocity (m/s)	Flow Time (min)	Ratio Q/Q full
I. Existing Upstream Flows to MHA																						
Concord St.	1C	1B	0.2				0.22	0.22	20.00	2	52.16	11.6	0.1	11.7	0.305	300		4.10	10.3	204.1	2.80	0.06	6%
Greenfield Ave.	Prive Site	1B		1.24			2.07	2.07	24.32	2	46.08	95.3	3.9	99.2	0.610	600		0.10	12.3	202.4	0.69	0.30	49%
Greenfield Ave.	1B	1A	0.3604				0.40	2.69	24.62	2	45.72	123.1	4.3	127.3	0.610	600		0.10	73.4	202.4	0.69	1.76	63%
Greenfield Ave.	1A	A					0.00	2.69	26.38	2	43.70	117.6	4.3	121.9	0.610	600		0.10	16.1	202.4	0.69	0.39	60%
Concord	C	B	0.1464				0.16	0.16	20.00	2	52.16	8.5	0.1	8.6	0.229	225	Conc	0.50	54.6	33.1	0.81	1.13	26%
Montcalm	D	B	0.2886				0.32	0.32	20.00	2	52.16	16.7	0.8	17.5	0.229	225	Conc	0.16	66.5	18.7	0.46	2.43	93%
Concord	E	B	0.4095				0.46	0.46	20.00	2	52.16	23.8	1.3	25.0	0.229	225	Conc	1.00	72.9	46.8	1.14	1.07	54%
44/46 Concord	Site	B-A Pipe	0.1014				0.12	0.12	15.00	2	61.96	7.2		7.2	0.305	300	Conc	1.00	8.6	100.8	1.38	0.10	7%
Montcalm	B	A	0.3097				0.34	1.40	22.43	2	48.53	67.9	3.3	71.2	0.457	450	Conc	0.33	75.9	169.4	1.03	1.23	42%
Greenfield Ave	A	10	0.8114				0.90	4.99	26.77	2	43.28	216.1	8.3	224.4	0.610	600	Conc	0.18	120.0	271.6	0.93	2.15	83%
Havelock Street	K	J	0.6988				0.78	0.78	20.00	2	52.16	40.5		40.5	0.381	375		0.70	83.7	152.9	1.34	1.04	27%
Havelock Street	J	10	0.4825				0.54	1.31	21.04	2	50.54	66.4		66.4	0.381	375		1.00	78.6	182.8	1.60	0.82	36%
Main Street	10	6	0.3765				0.42	6.73	28.92	2	41.12	276.5	10.0	286.5	0.610	600		0.35	79.6	378.7	1.30	1.02	76%
Echo Drive	9	8	0.4207				0.47	0.47	20.00	2	52.16	24.4	4.5	28.9	0.305	300		0.40	60.9	63.7	0.87	1.16	45%
Echo Drive	8	7	0.85				0.95	1.41	21.16	2	50.35	71.2	9.0	80.2	0.381	375		0.35	152.1	108.1	0.95	2.67	74%
Main Street (115 Echo Enters)	7	6	0.276			0.154	0.68	2.09	23.83	2	46.68	97.8	12.3	110.1	0.381	375		0.55	80.8	135.5	1.19	1.13	81%
Main Street	6	3	0.5574				0.62	9.44	29.94	2	40.17	379.2	23.7	402.9	0.686	675		0.40	81.7	554.3	1.50	0.91	73%

CONCORD/MONTCALM RESIDENTIAL

STORM SEWER DESIGN SHEET (2-YEAR EVENT)
JOB# 115105

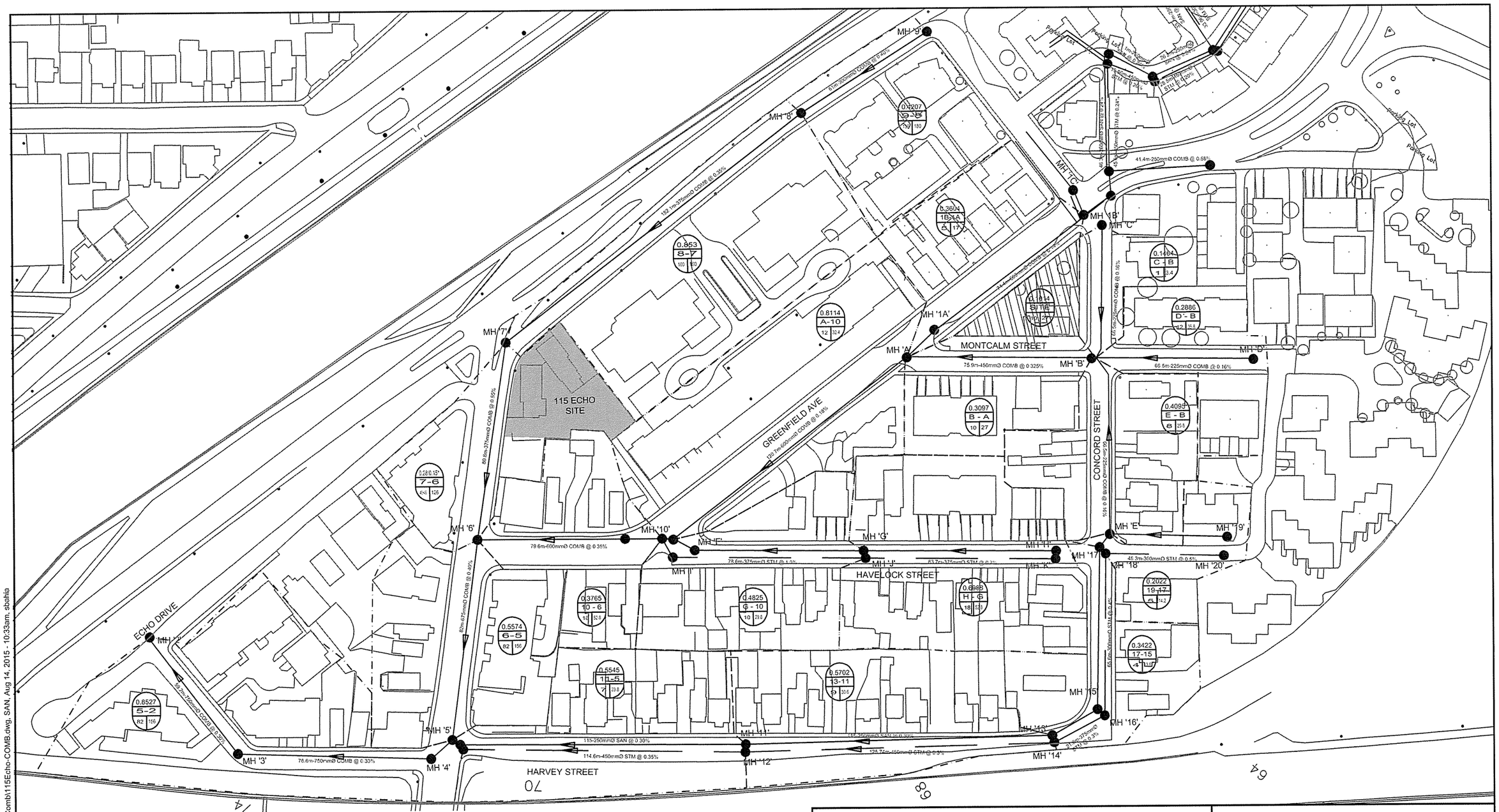
NOVATECH ENGINEERING CONSULTANTS LTD.

LOCATION			AREA (ha)				FLOW								SEWER DATA							
Street	From Node	To Node	R= 0.40	R= 0.60	R= 0.70	R= 0.88	Indiv 2.78 AC	Accum 2.78 AC	Time of Conc.	Design Storm	Rainfall Intensity (2-yr)	Peak Flow (L/sec) Q 2	San Flow	Qtotal	Dia. (m) Actual	Dia. (mm)	Type	Slope (%)	Length (m)	Capacity (L/s)	Velocity (m/s)	Flow Time (min)	Ratio Q/Q full
Havelock Street	20	18	0.2022				0.22	0.22	20.00	2	52.16	11.7		11.7	0.305	300		0.50	48.3	71.3	0.98	0.82	16%
Havelock Street	18	16	0.3422				0.38	0.61	20.82	2	50.86	30.8		30.8	0.305	300		0.40	65.6	63.7	0.87	1.25	48%
Havelock Street	16	14	0				0.00	0.61	22.08	2	49.03	29.7		29.7	0.381	375		0.30	21.6	100.1	0.88	0.41	30%
Havelock Street	14	12	0.5702				0.63	1.24	22.49	2	48.46	60.1		60.1	0.457	450		0.30	125.8	162.8	0.99	2.11	37%
Havelock Street	12	3	0.5545				0.62	1.86	24.60	2	45.74	84.9		84.9	0.457	450		0.35	114.6	175.8	1.07	1.78	48%
Harvey Street	3	2					0.00	11.30	30.85	2	39.37	444.7	26.4	471.1	0.762	750		0.30	149.8	635.8	1.39	1.79	74%

Q = 2.78 AIR, where
Q= Peak Flow (l/s)
A= Area in hectares (ha)
I= Rainfall Intensity (mm/hr)
R= Runoff Coefficient

1) Ottawa Rainfall-Intensity Curve
2) Min Pipe Velocity = 0.80 m/s
3) Inlet Time = 15 min
4) Data for shaded cells taken from design sheets for existing sewers
5) For detailed sanitary flow calculations see Sanitary Design Sheet

Consultant: Novatech Engineering Consultants Ltd.			
Date:		August 14, 2015	
Design By:	BS		
Client:	**Dwg. Reference:**	**Checked and Stamped:**	
	115105-COMB	B.H. Bahia	



LEGEND

0.317 / 139-137 / 4 | 10.8	DRAINAGE AREA (hectares) / MANHOLE TO MANHOLE / UNIT COUNT AND POPULATION
MH 100	EXISTING SANITARY SEWER AND MANHOLE
	SANITARY DRAINAGE AREA
	DIRECTION OF FLOW

NOVATECH
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N.T.S.

CITY OF OTTAWA
115 ECHO DRIVE RESIDENTIAL
EXISTING COMBINED DRAINAGE PLAN

AUG. 2015 115105 115105-COMB

SHT11X17.DWG - 279mmX432mm

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APPENDIX D

DEVELOPMENT SERVICING STUDY CHECKLIST

Development Servicing Study Checklist

4.1 General Content	Addressed (Y/N/NA)	Section	Comments
Executive Summary (for larger reports only).	NA		
Date and revision number of the report.	Y	Cover	
Location map and plan showing municipal address, boundary, and layout of proposed development.	Y	Fig 1	
Plan showing the site and location of all existing	Y	Fig 2 / GP	
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.	NA		
Summary of Pre-consultation Meetings with City and other approval agencies.	NA		
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.	Y	2	
Statement of objectives and servicing criteria.	Y	1	
Identification of existing and proposed infrastructure available in the immediate area.	Y	3,4,5,6 & 7	
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).	NA		
Concept level master grading plan to confirm existing and proposed grades in the development. This is required to confirm the feasibility of proposed stormwater management and drainage, soil removal and fill constraints, and potential impacts to neighboring properties. This is also required to confirm that the proposed grading will not impede existing major system flow paths.	Y	GR	

Development Servicing Study Checklist

4.1 General Content	Addressed (Y/N/NA)	Section	Comments
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.	NA		
Proposed phasing of the development, if applicable.	NA		
Reference to geotechnical studies and recommendations concerning servicing.	Y	2	
All preliminary and formal site plan submissions should have the following information:			
Metric scale	Y		
North arrow (including construction North)	Y		
Key plan	Y		
Name and contact information of applicant and property owner	Y		
Property limits including bearings and	Y		
Existing and proposed structures and parking	Y		
Easements, road widening and rights-of-way	Y		
Adjacent street names	Y		

Development Servicing Study Checklist

4.2 Water	Addressed (Y/N/NA)	Section	Comments
Confirm consistency with Master Servicing Study, if available.	NA		
Availability of public infrastructure to service proposed development.	Y	7	
Identification of system constraints.	Y	7 / Appendix B	
Identify boundary conditions.	Y	7 / Appendix B	
Confirmation of adequate domestic supply and pressure.	Y	7 / Appendix B	
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 at locations throughout the development.	Y	7 /Appendix B	
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.	NA		
Definition of phasing constraints. Hydraulic modeling is required to confirm servicing for all defined phases of the project including the ultimate design.	NA		
Address reliability requirements such as appropriate location of shut-off valves.	Y	GP	
Check on the necessity of a pressure zone boundary modification.	NA		
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.	Y	7	
Description of the proposed water distribution network, including locations of proposed connections to the existing system, provisions for necessary looping, and appurtenances (valves, pressure reducing valves, valve chambers, and fire hydrants) including special metering provisions.	Y	7 / GP	
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.	NA		
Confirmation that water demands are calculated based on the City of Ottawa Design Guidelines.	Y	7	
Provision of a model schematic showing the boundary conditions locations, streets, parcels, and building locations for reference.	Y	7 / Appendix B	

Development Servicing Study Checklist

4.3 Wastewater	Addressed (Y/N/NA)	Section	Comments
Summary of proposed design criteria (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	Y	5 & 6	
Confirm consistency with Master Servicing Study and/or justifications for deviations.	N		
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 condition of sewers.	N		
Description of existing sanitary sewer available for discharge of wastewater from proposed development.	Y	5 & 6	
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)	Y	5 & 6 / Appendix C	
Calculations related to dry-weather and wet-weather flow rates from the development in standard MOE sanitary sewer design table (Appendix 'C') format.	N		
Description of proposed sewer network including sewers, pumping stations, and forcemains.	Y	5 & 6	
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).	NA		
Pumping stations: impacts of proposed development on existing pumping stations or requirements for new pumping station to service development.	NA		
Forcemain capacity in terms of operational redundancy, surge pressure and maximum flow velocity.	NA		
Identification and implementation of the emergency overflow from sanitary pumping stations in relation to the hydraulic grade line to protect against basement flooding.	NA		
Special considerations such as contamination, corrosive environment etc.	NA		

Development Servicing Study Checklist

4.4 Stormwater	Addressed (Y/N/NA)	Section	Comments
Description of drainage outlets and downstream constraints including legality of outlet (i.e. municipal drain, right-of-way, watercourse, or private property).	Y	4	
Analysis of the available capacity in existing public infrastructure.	Y	4 & 6 / Appendix C	
A drawing showing the subject lands, its surroundings, the receiving watercourse, existing drainage patterns and proposed drainage patterns.	Y	Fig. 3 / GR	
Water quantity 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.	Y	4	
Water Quality control objective (basic, normal or enhanced level of protection based on the sensitivities of the receiving watercourse) and storage requirements.	Y	4	
Description of stormwater management concept with facility locations and descriptions with references and supporting information.	Y	4	
Set-back from private sewage disposal systems.	NA		
Watercourse and hazard lands setbacks.	NA		
Record of pre-consultation with the Ontario Ministry of Environment and the Conservation Authority that has jurisdiction on the affected watershed.	NA		
Confirm consistency with sub-watershed and Master Servicing Study, if applicable study exists.	NA		
Storage requirements (complete with calcs) and conveyance capacity for 5 yr and 100 yr events.	Y	4 / Appendix A	
Identification of watercourse within the proposed development and how watercourses will be protected, or, if necessary, altered by the proposed development with applicable approvals.	NA		
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.	Y	4	
Any proposed diversion of drainage catchment areas from one outlet to another.	NA		
Proposed minor and major systems including locations and sizes of stormwater trunk sewers, and SWM	Y	4	
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.	NA		

Development Servicing Study Checklist

4.4 Stormwater	**Addressed (Y/N/NA)**	**Section**	**Comments**
Identification of municipal drains and related approval requirements.	NA		
Description of how the conveyance and storage capacity will be achieved for the development.	Y	4	
100 year flood levels and major flow routing to protect proposed development from flooding for establishing minimum building elevations (MBE) and overall grading.	Y	4, GR	
Inclusion of hydraulic analysis including HGL elevations.	NA		
Description of approach to erosion and sediment control during construction for the protection of receiving watercourse or drainage corridors.	Y	8	
Identification of floodplains – proponent to obtain relevant floodplain information from the appropriate Conservation Authority. The proponent may be required to delineate floodplain elevations to the satisfaction of the Conservation Authority if such information is not available or if information does not match current conditions.	NA		
Identification of fill constrains related to floodplain and geotechnical investigation.	NA		

Development Servicing Study Checklist

4.5 Approval and Permit Requirements	Addressed (Y/N/NA)	Section	Comments
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 the 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.	NA		
Application for Certificate of Approval (CofA) under the Ontario Water Resources Act.	NA		
Changes to Municipal Drains.	NA		
Other permits (National Capital Commission, Parks Canada, Public Works and Government Services Canada, Ministry of Transportation etc.)	NA		

Development Servicing Study Checklist

4.6 Conclusion	**Addressed (Y/N/NA)**	**Section**	**Comments**
Clearly stated conclusions and recommendations.	Y	11	
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.	NA		
All draft and final reports shall be signed and stamped by a professional Engineer registered in Ontario.	Y	11	

ATTACHED PLANS