RENFROE LAND MANAGEMENT

103 SCHNEIDER ROAD
STORMWATER MANAGEMENT REPORT

APRIL 06, 2021

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STORMWATER MANAGEMENT REPORT

RENFROE LAND MANAGEMENT

1ST SUBMISSION

PROJECT NO.: 211-01794-00
CLIENT REF:
DATE: APRIL 06, 2021

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REVISION HISTORY

FIRST ISSUE

April 6th, 2021	Draft SWM Report			
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April 6th, 2021

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April 6th, 2021

[1] Approval of this document is an administrative function indicating readiness for release and does not impart legal liability on to the Approver for any technical content contained herein. Technical accuracy and fit-for-purpose of this content is obtained through the review process. The Approver shall ensure the applicable review process has occurred prior to signing the document.

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1 INTRODUCTION

1.1 SCOPE

WSP Canada Inc. was retained by Renfroe Land Management to prepare a Stormwater Management (SWM) Report for the proposed development at 103 Schneider Road in Ottawa, Ontario. This SWM report examines the potential water quality and quantity impacts of the proposed commercial development and summarizes how each will be addressed in accordance with applicable guidelines.

1.2 SITE LOCATION

The site of the proposed commercial development is located at 103 Schneider Road, Ottawa, Ontario. The subject site is bounded by Carling Avenue to the south, Leggett Drive to the north, and the Kizell Drain to the east. It is noted that portions of the property are located within the 1:100 year floodplain of the Kizell Drain.

1.3 STORMWATER MANAGEMENT PLAN OBJECTIVES

The objectives of the stormwater management plan are as follows:

- → Collect and review background information
- → Determine the site-specific stormwater management requirements to ensure that the proposals are in conformance with the applicable Provincial, Municipal and Conservation Authority stormwater management and development guidelines.
- → Evaluate various stormwater management practices that meet the applicable SWM and development requirements and recommend a preferred strategy.
- → Prepare a stormwater management report documenting the strategy along with the technical information necessary for the justification and sizing of the proposed stormwater management facilities.

1.4 DESIGN CRITERIA

Design criteria were confirmed through pre-consultation with the City of Ottawa held on December 15th, 2020 (meeting minutes include in Appendix A). Criteria for 103 Schneider Road are as follows:

- → **Stormwater Quantity-** control post-development flows to pre-development levels for the 2- to 100-year storm events. The existing drainage patterns for the site should be maintained. Allowable runoff coefficient (C) shall be the lesser of pre-development conditions to a maximum of 0.5.
- → **Storm Quality-** enhanced level of protection per the Mississippi Valley Conservation Authority (MVCA) is required (80% TSS Removal).
- → **Low Impact Development-** LID techniques are recommended for stormwater management and water temperature controls

2 PRE-DEVELOPMENT CONDITIONS

2.1 GENERAL

The subject site is a 2.32 ha parcel of land comprised of undeveloped lots. Under pre-development conditions the subject site consists of entirely pervious surfaces. As such, a runoff coefficient of 0.2 is estimated for existing conditions. An area of 2.01 ha was analyzed as a 0.31 ha area remains untouched in proposed conditions (S-U7).

Existing drainage patterns for the site were determined based on topographic survey information. The pre-development catchment areas are as illustrated in Figure 1.

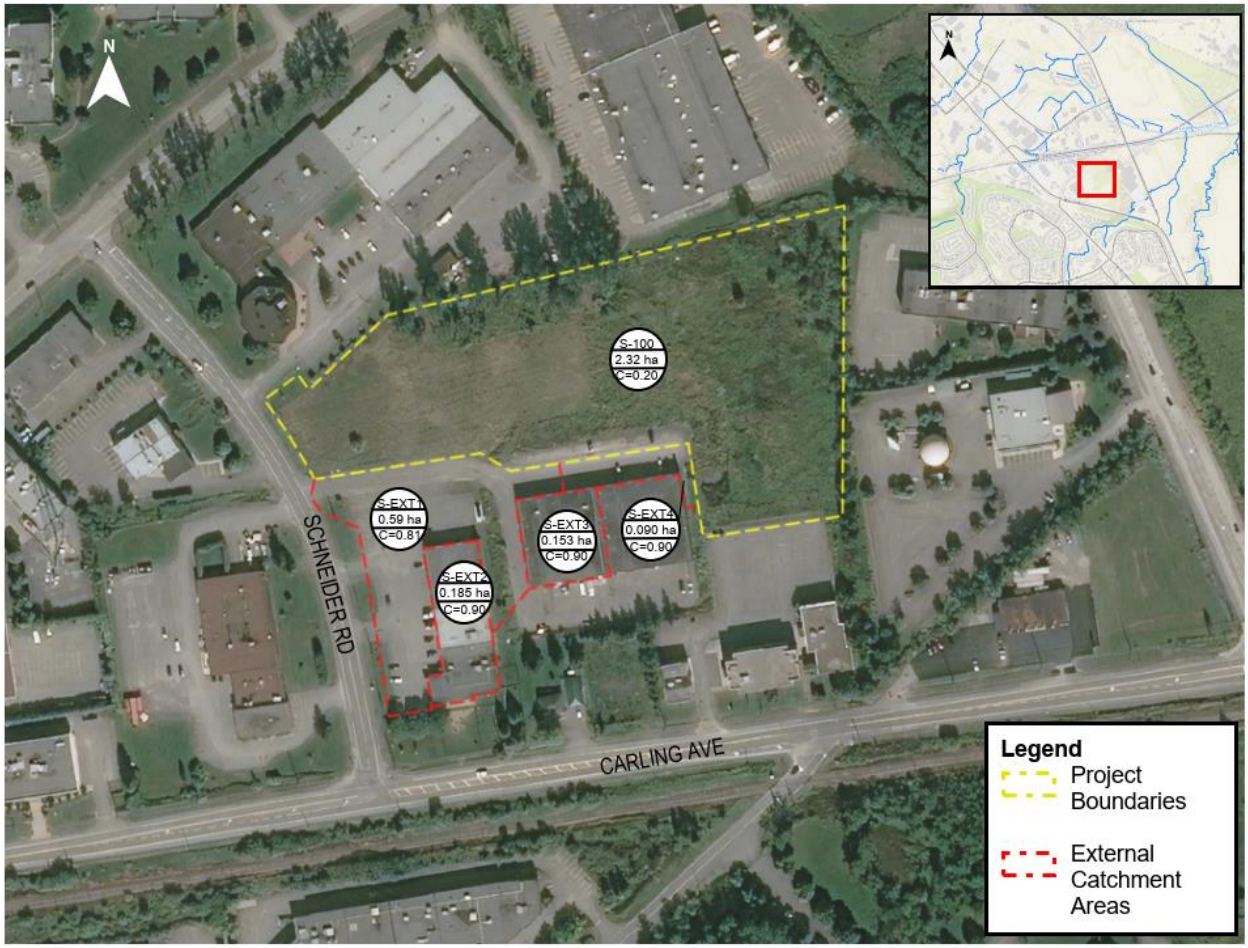


Figure 1: Existing Conditions Catchment Areas

2.2 RAINFALL INFORMATION

The rainfall intensity is calculated in accordance with Section 5.4.2 of the Ottawa Sewer Design Guidelines (October, 2012):

Where;

$$i = \left[\frac{A}{(Td + C)^B}\right]$$

- A, B, C = regression constants for each return period (defined in section 5.4.2)
- i = rainfall intensity (mm/hour)
- Td = storm duration (minutes)

The IDF parameters/regression constants are per the Ottawa Sewer Design Guidelines (October, 2012).

2.3 ALLOWABLE FLOW RATES

As noted in section 1.4, relevant policies from the OSDG and pre-consultation meeting require the post-development discharge rate from the site match pre-development levels for the 2- to 100-year storm events.

Rational method was used to calculate the peak flow rates for the site including external catchments in the pre-development conditions summarized in Table 1. Detailed calculations are provided in **Appendix B**.

Table 1: Pre-Development Peak Flow Rate Calculations (Based on T_d= 10 minutes)

RETURN PERIOD (Years)	RAINFALL INTENSITY, I (mm/hour)	SITE PEAK FLOW RATE (L/sec)	EXTERNAL AREA PEAK FLOW RATE (L/SEC)
2	76.8	86	185
5	104.2	117	251
10	122.1	137	294
25	144.7	178	383
50	161.5	217	457
100	178.6	250	505

3 POST-DEVELOPMENT CONDITIONS

3.1 GENERAL

The proposed Schneider Road project is a commercial development in Ottawa. Post-development condition details are shown in Figure 2 including land uses and estimated stormwater sub-catchments.

The development proposal includes 3 new buildings.

Vehicular access to the site will be provided by private roads from Schneider Road. Similar to existing conditions, the majority of the runoff will discharge to the Kizell drain. Allowances have been made for the safe conveyance of flows from the external catchments.

An estimated area breakdown for the new site layout is provided in Table 2.

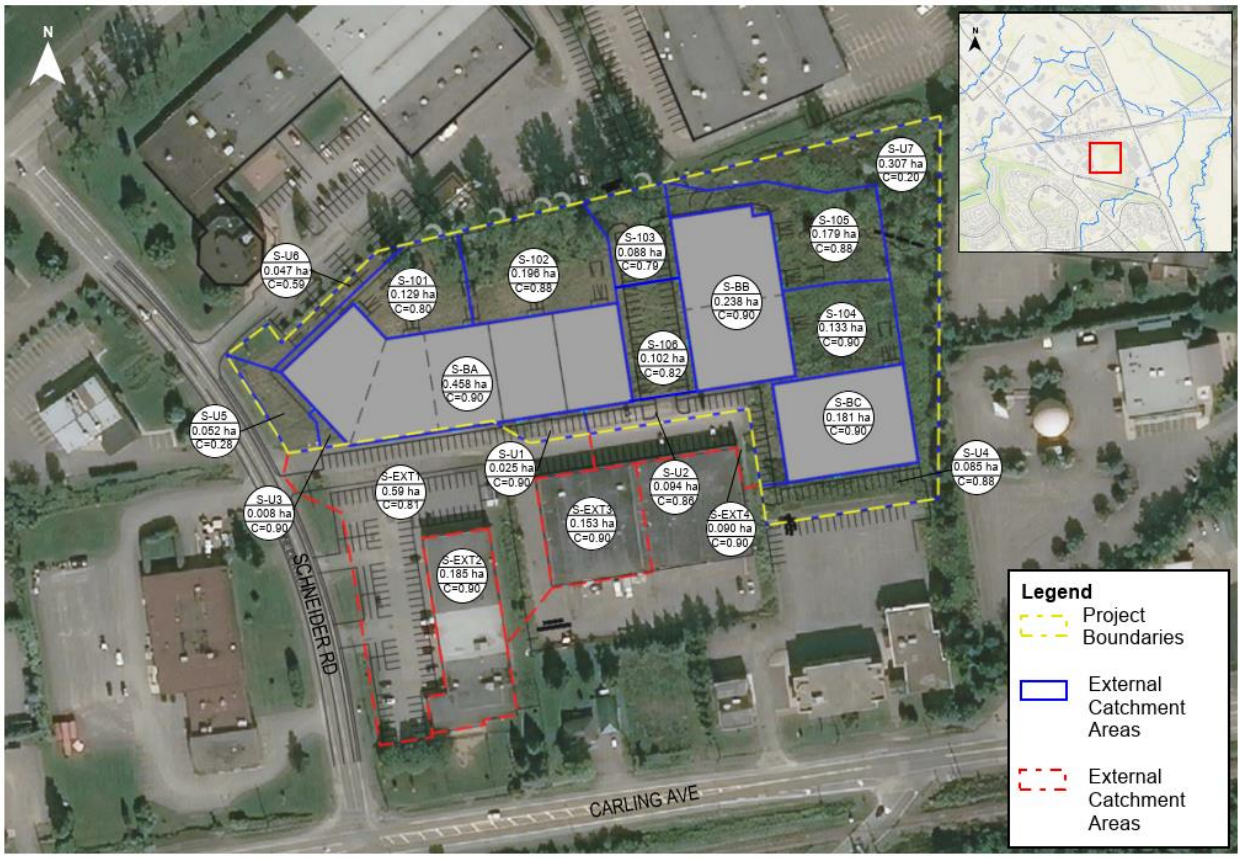


Figure 2: Proposed Conditions Catchment Areas

Table 2: Proposed Land-Use Area Breakdown

CATCHMENT ID	AREA (ha)	% COVERAGE OF PROJECT AREA	RUNOFF COEFFICIENT
External Drainage Areas			
S-EXT1	0.590		0.81
S-EXT2	0.185		0.90
S-EXT3	0.153		0.90
S-EXT4	0.090		0.90
Sub Total	1.020		0.85
Un-Controlled Drainage Areas			
S-U1	0.025	1%	0.90
S-U2	0.094	5%	0.86
S-U3	0.008	<1%	0.90
S-U4	0.085	4%	0.88
S-U5	0.052	3%	0.28
S-U6	0.047	2%	0.59
Sub Total	0.311	15%	0.73
Controlled Drainage Areas			
S-101	0.129	6%	0.80
S-102	0.196	10%	0.88
S-103	0.088	4%	0.79
S-104	0.133	7%	0.90
S-105	0.179	9%	0.88
S-106	0.102	5%	0.82
S-BA	0.458	23%	0.90
S-BB	0.238	12%	0.90
S-BC	0.181	9%	0.90
Sub Total	1.704	85%	0.88
TOTAL PROJECT AREA	2.015	100%	
TOTAL	3.033		

To meet stormwater management objectives, as defined by the design criteria outlined in Section 1.4, the following components have been proposed:

- → Surface storage with inlet control devices
- → Rooftop flow control drains to utilize storage on roof areas
- → OGS unit

The application and sizing of these proposed stormwater management facilities is outlined in the following sections.

3.2 WATER QUANTITY

As noted previously, it is required that the post-development discharge rate from the site match pre-development levels for the 2- to 100-year storm events.

Proposed features to achieve these targets include;

- → Surface storage with inlet control devices
- → Rooftop flow control drains to utilize storage on roof areas

HydroCAD software has been used to model the behaviour of the proposed SWM system and determine its response under various storm events. The software uses Modified Rational Method to calculate flow rates and related storage values. In addition, the software helps identify the critical duration for different components of the system. The critical storm duration (100-year) for peak discharge from the from the site occurs at 10 minutes, but the maximum overall storage utilized occurs at 16 minutes. The critical storm duration for maximum storage at each storage node was also verified to ensure adequate storage volume.

Storage areas were defined using "pond" nodes in the model, with appropriate stage-storage relationships based on the volumes available in each area. Outflow controls from each storage node were defined using orifice control at catch basin lead pipes. Orifice sizes are shown in Table 3.

Table 3: Catchbasin outflow control

Catchbasin	Orifice Size (mm)
CBMH105	75
CB01	75
CB02	75
CBMH107	75
CB03	75
CB04	100

Rooftop storage has been defined based on the average area available per roof drain, up to a maximum depth of 150 mm. Rating curves based on the proposed rooftop flow control drains have been used, and the number of drain outlets has been assumed to be 1 drain per 150 m^2 of area. Approximately 80% of the roof has been assumed to be available for storage. This will be coordinated with the architect at detailed design.

Per Table 2, six uncontrolled drainage areas have been included in the model; S-U1-S-U6. Given grading constraints it has not been possible to configure the drainage system to collect runoff at these locations around the edge of the site, and runoff from these areas will therefore drain directly offsite onto surrounding lands. These uncontrolled areas are included in the analysis however, and the proposed system over-controls as required to ensure net runoff rates (including discharge from the uncontrolled areas) complies with the applicable targets.

A summary of the modelling results is provided in Table 4 and detailed output from the modelling is included in **Appendix B**.

Table 4: Summary of HydroCAD Modelling Results

Return Period (Years)	Time of Conc. (min)	Utilized Storage	Total Flow Leaving Site	Allowable 100-yr Flow Rate
		(m^3)	(L/s)	(L/s)
2	10	106	330	**755**
100 (Peak Discharge)	10	389	**742**	
100 (Peak Storage)	16	471	609	

3.3 WATER QUALITY

As noted previously, a single outlet location at the Kizell drain is proposed for this site and runoff will be released through orifice control at the outlet. A suitably sized oil and grit separator (OGS) unit is proposed to achieve minimum 80% TSS removal ("Enhanced" level, per development criteria) for runoff from the at-grade parking and asphalt areas.

It is assumed that runoff from the proposed rooftop areas, walkways and pervious areas will be free of typical sediment-generating activities and therefore runoff will leave them effectively unchanged, and can be considered clean for the purposes of water quality assessment.

3.4 FLOODPLAIN CONSIDERATIONS

Due to development in the northeast corner of the site, 80 m^3 of floodplain volume is lost. This volume will be compensated elsewhere on the site. This will be coordinated with the developer and MVCA during detailed design. MVCA floodplain mapping has been included in **Appendix C** for reference.

4 CONCLUSIONS

A stormwater management report has been prepared to support the feasibility study for the proposed 103 Schneider Road development project in the City of Ottawa. The key points are summarized below.

WATER QUALITY

An OGS unit (suitably sized Stormceptor unit, or equivalent) is proposed downstream of the orifice control for the Kizell Drain outlet to meet MOE Enhanced treatment standards (80% TSS removal).

WATER QUANTITY

Controlled runoff on site will be controlled on the surface using orifice plates on the catch basin lead pipes, and on the roof using roof drain flow restriction.

This report has demonstrated the proposed SWM strategy will address stormwater management related impacts from this project and meet the applicable design requirements.

APPENDIX

A PRE-CONSULTATION MEETING MINUTES

File No.: PC2020-0342
Date: December 22, 2020

101A, 103 and 105A Schneider Road
Pre-Consultation Meeting Minutes
Meeting Date: December 15, 2020

Attendee	Role	Organization
Lisa Stern	Planner	City of Ottawa
Josiane Gervais	Transportation PM	
Justyna Garbos	Parks	
Adam Palmer	Forestry	
Justin Armstrong	Engineering PM	
Erica Ogden	Planner	Mississippi Valley CA
David Renfroe		Applicant

Additional comments have been provided by email from Urban Design and CREO.

Comments from the Applicant:

1. Will be providing an expansion to 101 Schneider, and two industrial buildings and an office/warehouse at 103 Schneider.
2. Proposing a public park for workers adjacent to Schneider.
3. Proposing to realign access as well as modify the internal circulation. Proposing a one-way access around 101(A) Schneider to allow trucks to come back out to Schneider vs. Carling. Proposing access into the 105 Schneider site.

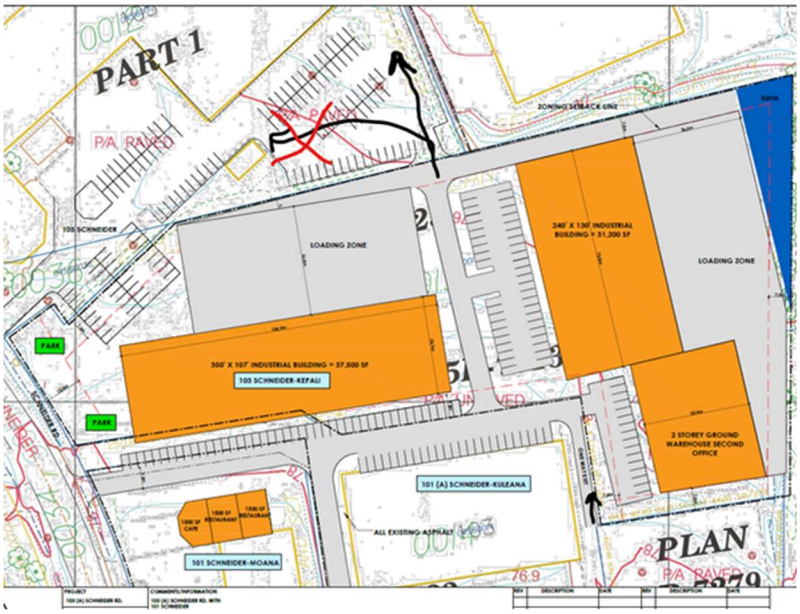
Planning Comments:

1. This is a Complex Site Plan Control Application subject to manager approval and public consultation. The application form, timeline and fees can be found here. A portion of the site is regulated by the Mississippi Valley Conservation Authority, as such CA fees are required.
2. The subject lands are designated Urban Employment Area within the City's Official Plan and are zoned General Industrial Subzone 6 (IG6), 101A Schneider Road is zoned IG6(300) which allows for additional restaurant and service uses.
3. The site will be considered one site for zoning purposes.
4. Please show the entire property on the plans.
5. A consent application is required to formalize any lot line adjustments or easements that are required for access.
6. The site is located within 300m of a rail line, as such a noise and vibration study will be required. Emphasis should be placed on outdoor amenity space and patios.
7. Please show pedestrian pathways on a site plan and ensure that there are no conflicts with vehicle movements.
8. Please provide landscape plans. Hard surfacing should be minimized, including loading areas. Parking and drive aisles should be further broken up by additional landscaping. Landscaped areas should be provided along the north and east lot lines as well as the Schneider Road frontage.
9. Cash-in-lieu of parkland and associated appraisal fee will be required as a condition of approval as per the Parkland Dedication Bylaw.
10. Please consult with the Ward Councillor prior to submission.

Engineering Comments:

1. See attached memo

Transportation Comments:

1. Follow Traffic Impact Assessment Guidelines
    a. A TIA is required. The Scoping report can be submitted directly to josiane.gervais@ottawa.ca
    b. Start this process asap. The application will not be deemed complete until the submission of the draft step 1-4, including the functional draft RMA package (if applicable) and/or monitoring report (if applicable).
    c. Request base mapping asap if RMA is required. Contact Engineering Services (https://ottawa.ca/en/city-hall/planning-and-development/engineering-services)
2. ROW protection on Carling Ave between March Road and Herzberg is 44.5m even. Subject to unequal widening, the 44.5m is measured from the existing south ROW limit. The required property line should be shown on the site plan.
3. The 101 Schneider Rd property falls within 600m of the Teron/March Road BRT transit station.
4. Corner triangles as per OP Annex 1 - Road Classification and Rights-of-Way at the following locations on the final plan will be required (measure on the property line/ROW protected line; no structure above or below this triangle): Local Road to Arterial Road: 5 m x 5 m
5. Sight triangle as per Zoning by-law is 6 m x 6 m measure on the curb line.
6. Utilizing the existing access on Schneider Rd as identified on the site plan is supported.
7. Access consolidation along Schneider is encouraged.
8. Providing access through the 105 Schneider site is possible. However from a transportation perspective, consideration should be given to the impacts to the neighboring site. If vehicles turn left towards Schneider, then the driving aisle on 105 Schneider separates the parking and building, and therefore sending heavy vehicles through the site raises concern for pedestrian safety. If heavy vehicles travel northbound directly to Legget, then it's less a concern. Signage/geometric changes could be provided to address this concern.
9. 

10. Ensure that all movements can be accommodated so that a heavy vehicle may both enter and exit from the main site access off Schneider.

11. Parking lots are preferred over parking along the drive aisles. This encourage separation of pedestrians/personal vehicles from heavy vehicles.
12. A clear throat length of 15m is encouraged off Schneider.
13. Clarify that the "One Way Exit" east of the 101 (A) building is northbound within the site.
14. On site plan:
    a. The site plan should show the entire property.
    b. Show all details of the roads abutting the site up to and including the opposite curb; include such items as pavement markings, accesses and/or sidewalks.
    c. Ensure pedestrian pathways are provided.
    d. Turning movement diagrams required for all accesses showing the largest vehicle to access/egress the site.
    e. Turning movement diagrams required for internal movements (loading areas, garbage).
    f. Show all curb radii measurements; ensure that all curb radii are reduced as much as possible.
    g. Show lane/aisle widths.
    h. Grey out any area that will not be impacted by this application.
15. The City recommends development on private property be in accordance with the City's Accessibility Design Standards (see attached Site Plan Checklist, which summarizes AODA requirements). As the proposed site is industrial and for general public use, AODA legislation applies.

Parks Comments:

1. Cash-in-lieu of parkland will be calculated as 2% of the gross land area of the vacant parcel at 103 Schneider Road. Thomas Quinn in Real Estate prepares land valuations, and the applicant will be required to pay the $565 (including HST) assessment fee.

Corporate Real Estate (CREO) Comments:

1. The proposed development at 101-103 Schneider Road is located within 300 m from the Renfrew Subdivision operating rail corridor. The adopted Guidelines for New Development in Proximity to Rail Operations were created by the Railway Association of Canada and the Federation of Canadian Municipalities, see: https://www.proximityissues.ca/wp-content/uploads/2017/09/2013_05_29_Guidelines_NewDevelopment_E.pdf. CREO's main objective in its adoption of these guidelines is to mitigate railway-oriented impacts such as noise, vibration, and safety hazards, to ensure that the quality of life of a building's occupants and users are not negatively affected and to the maintain the long-term integrity and viability of the rail corridor.
2. It is also recommended that a noise and vibration study should be conducted according to page 28 of the guidelines.

Urban Design Comments:

1. Please provide a landscape plan that illustrates the anticipated pedestrian circulation around the site, between the various parking zones and the buildings and with the public right of way.
2. In one location the drive aisle runs through parking while in other locations to the north there is a separate drive aisle running parallel to a parking drive aisle. Can these be consolidated and the extra land be dedicated to additional landscaping and trees?
3. We would like to better understand the restaurant building, how it is sited, its connectivity for pedestrians and vehicles and with the public right of way.

4. A Design Brief is a required submittal for all Site Plan/Re-zoning applications. Please see the Design Brief Terms of Reference (attached).

Conservation Authority:

1. The Mississippi Valley Conservation Authority (MVCA) confirms that a portion of the subject property is regulated under Ontario Regulation 153/06, *Development, Interference with Wetlands and Alterations to Shorelines and Watercourses*. Under Ontario Regulation 153/06, written permission is required from the MVCA prior to the initiation of development (which includes construction, site grading and the placement or removal of fill) within an area regulated by the Conservation Authority (regulation limit delineated in yellow on the attached regulation mapping) as well as straightening, changing, diverting or interfering in any way with the existing channel or the shoreline of a watercourse.
2. Portions of the property are located within the 1:100 year flood plain (delineated in orange on the enclosed mapping) of the Kizell Drain, which was approved by the MVCA Board of Directors in 2017. We note this updated mapping has not yet been carried forward in the City of Ottawa Zoning By-law.
3. The preliminary plan includes a stormwater management facility within the flood plain, which MVCA does not support. New development should be directed outside the flood plain.
4. The stormwater water quality requirement for the Kizell Drain is an enhanced level of protection, which requires 80% total suspended solids removal.
5. Low Impact Development techniques are recommended for stormwater management and water temperature controls should also be taken into consideration.
6. The Kizell Drain has been assessed as a part of the City Stream Watch Program. A copy of the Kizell Drain Summary Report from 2016 is available on our website https://mvc.on.ca/wp-content/uploads/2020/08/Kizell-2016.pdf
7. Digital copies of the flood plain mapping are available upon request.

Please refer to the links to "Guide to preparing studies and plans" and fees for general information. Additional information is available related to building permits, development charges, and the Accessibility Design Standards. Be aware that other fees and permits may be required, outside of the development review process. You may obtain background drawings by contacting informationcentre@ottawa.ca.

These pre-con comments are valid for one year. If you submit a development application(s) after this time, you may be required to meet for another pre-consultation meeting and/or the submission requirements may change. You are as well encouraged to contact us for a follow-up meeting if the plan/concept will be further refined.
Please contact me at Lisa.Stern@ottawa.ca or at 613-580-2424 extension 21108 if you have any questions.

Sincerely,

Lisa Stern, RPP MCIP
Planner

MEMO

Date: December 15, 2020

To / Destinataire	Lisa Stern, Planner
From / Expéditeur	Justin Armstrong, Project Manager, Infrastructure Approvals
Subject / Objet	**Pre-Application Consultation** **101-105 Schneider Road, Ward 4** **Site Plan Control Application,**
	File No. PC2020-0342

Please note the following information regarding the engineering design submission for the above noted site:

1. The Servicing Study Guidelines for Development Applications are available at the following address: http://ottawa.ca/en/development-application-review-process-0/servicing-study-guidelines-development-applications

2. Servicing and site works shall be in accordance with the following documents:

   - ⇨ Ottawa Sewer Design Guidelines (October 2012)
   - ⇨ Ottawa Design Guidelines – Water Distribution (2010)
   - ⇨ Geotechnical Investigation and Reporting Guidelines for Development Applications in the City of Ottawa (2007)
   - ⇨ City of Ottawa Slope Stability Guidelines for Development Applications (revised 2012)
   - ⇨ City of Ottawa Environmental Noise Control Guidelines (January, 2016)
   - ⇨ City of Ottawa Park and Pathway Development Manual (2012)
   - ⇨ City of Ottawa Accessibility Design Standards (2012)
   - ⇨ Ottawa Standard Tender Documents (latest version)
   - ⇨ Ontario Provincial Standards for Roads & Public Works (2013)

3. Record drawings and utility plans are also available for purchase from the City (Contact the City's Information Centre by email at InformationCentre@ottawa.ca or by phone at (613) 580-2424 x.44455).

4. The Stormwater Management Criteria, for the subject site, is to be based on the following:

    i. Post-development peak flows for the site will need to be controlled to pre-development peak flows. The existing drainage patterns for the site should be maintained.

    ii. Quality control to be provided as specified by the MVCA.

    iii. Note that any stormwater runoff for the site that currently drains to Kizzel Municipal Drain must cross a portion of 302 Legget Drive before reaching the Kizzel Municipal Drain. Drainage rights across this land are not maintained if the portion of the site draining to this location is modified. If this is the case, an agreement will need to be in place with the owner of 302 Leggett in order to maintain this drainage outlet.

5. There is a 250mm diameter concrete sanitary sewer in Schneider Road. The City's Asset Management Branch will be circulated as it relates to a connection to this sewer once a detailed civil design is complete and a formal application has been made.

6. There is a 305mm diameter DI watermain in Schneider Road. A water boundary condition request should be made as it relates to a connection to this main. Water boundary condition requests must include the location of the service and the expected loads required by the proposed development. Please provide Justin Armstrong the following information:

    i. Location of service

    ii. Type of development and the amount of fire flow required (as per FUS, 1999).

    iii. Average daily demand: ___ l/s.

    iv. Maximum daily demand: ___l/s.

v. Maximum hourly daily demand: ___ l/s.

7. Although most infrastructure related comments will largely be dependent on the proposed design, the following are some general comments to consider:

   i. Services should ideally be grouped in a common trench to minimize the number of road cuts.

   ii. A DMA chamber is needed for private developments serviced by a water connection 150mm in diameter or larger.

   iii. A monitoring maintenance hole should be provided for the sanitary connection – it should be located in an accessible location on private property near the property line (ie. Not in a parking area).

   iv. Sewer connections to rigid mains are to be made above the springline of the sewermain as per:

      a. Std Dwg S11 (For rigid main sewers) – lateral must be less than 50% the diameter of the sewermain,

      b. Std Dwg S11.2 (for rigid main sewers using bell end insert method) – for larger diameter laterals where manufactured inserts are not available; lateral must be less than 50% the diameter of the sewermain,

      c. Laterals greater than 50% the diameter of the sewermain require a maintenance hole.

   v. There should be no stormwater ponding in parking areas or drive aisles during the 2-year storm.

8. MOECC ECA Requirements

   It is anticipated that an MOECC Environmental Compliance Approval (ECA) for stormwater works (Private Sewage Works &/or Industrial Sewage Works) will be required, however, this will be confirmed once a detailed civil design is complete and a formal application is made.

9. Phase 1 ESAs and Phase 2 ESAs must conform to clause 4.8.4 of the Official Plan that requires that development applications conform to Ontario Regulation 153/04.

Should you have any questions or require additional information, please contact me directly at (613) 580-2424, x21746 or by email at Justin.Armstrong@ottawa.ca.

APPENDIX

B CALCULATIONS & HYDROCAD OUTPUT

	Project: Schneider Road		No.:	
	By: KK		Date: 2021-04-05	Page:
	Checked: MH		Checked: 2021-04-05	1

Subject:

SWM CALCULATIONS - Pre-Development Peak Flow - Project Site

Calculation of existing runoff rate is undertaken using the Rational Method: $Q = 2.78CiA$

Where: Q = peak flow rate (litres/second)
C = runoff coefficient
i = rainfall intensity (mm/hour)
A = catchment area (hectares)

Site Area, A	20,150	m^2
Site Area, A	2.02	hectares
Runoff Coefficient, C	0.20	

Rainfall intensity calculated in accordance with City of Ottawa Sewer Design Guidelines (section 5.4.2):

$$i = \left[\frac{A}{(Td + C)^B}\right]$$

Where: A, B, C = regression constants for each return period (defined in section 5.4.2)
i = rainfall intensity (mm/hour)
Td = storm duration (minutes) 10 minutes

Return Period (Years)	2	5	10	25	50	100*
A	733.0	998.1	1,174.2	1,402.9	1,569.6	1,735.7
B	0.810	0.814	0.816	0.819	0.820	0.820
C	6.199	6.053	6.014	6.018	6.014	6.014
T (mins)	10	10	10	10	10	10
I (mm/hr)	76.8	104.2	122.1	144.7	161.5	178.6
Runoff Coefficient C	0.20	0.20	0.20	0.20	0.20	0.20
C Multiplier (OSDG Table 5.7)	1.00	1.00	1.00	1.10	1.20	1.25
Revised Runoff Coefficient C	0.20	0.20	0.20	0.22	0.24	0.25
Q (litres/sec)	86	117	137	178	217	250
Q (m3/sec)	0.09	0.12	0.14	0.18	0.22	0.25

	Project: Schneider Road		No.:	
	By: KK		Date: 2021-04-05	Page:
	Checked: MH		Checked: 2021-04-05	1

Subject:

SWM CALCULATIONS - Pre-Development Peak Flow - External Area

Calculation of existing runoff rate is undertaken using the Rational Method: $Q = 2.78CiA$

Where: Q = peak flow rate (litres/second)
C = runoff coefficient
i = rainfall intensity (mm/hour)
A = catchment area (hectares)

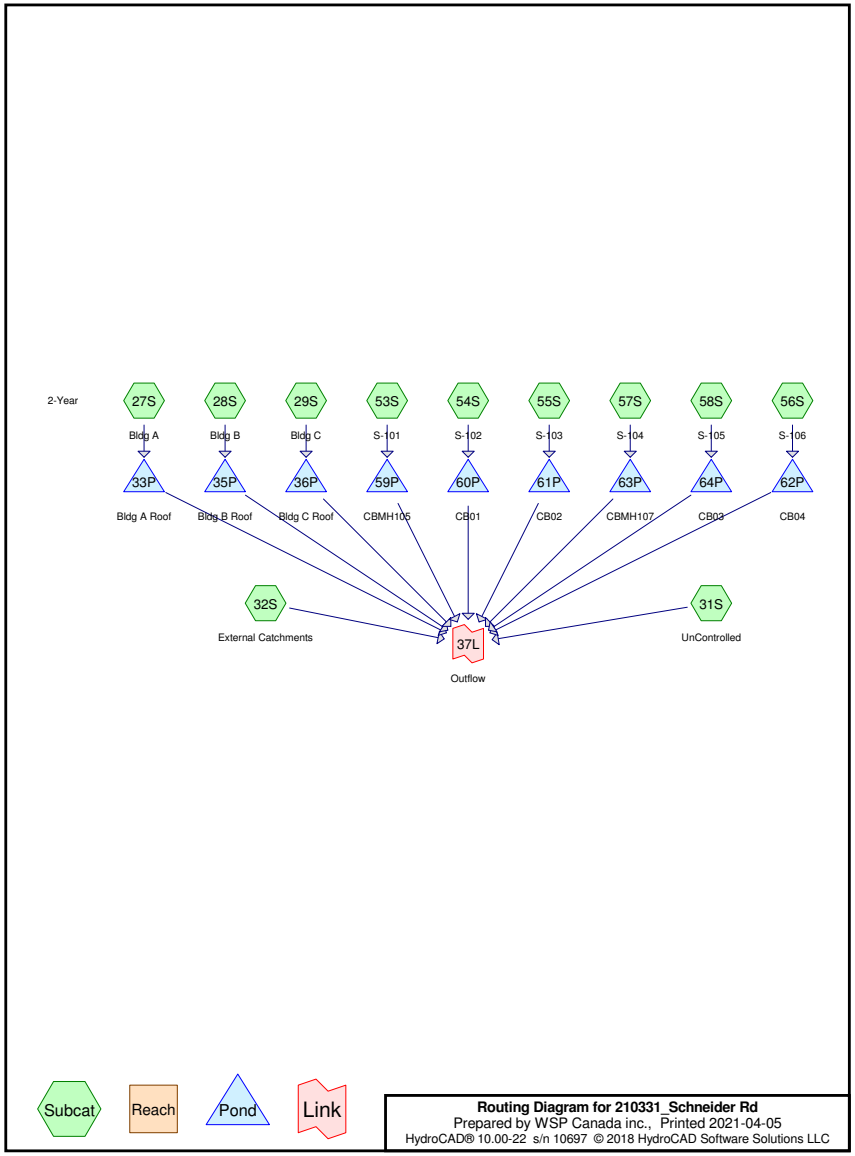
Site Area, A	10,180	m^2
Site Area, A	1.02	hectares
Runoff Coefficient, C	0.85	

Rainfall intensity calculated in accordance with City of Ottawa Sewer Design Guidelines (section 5.4.2):

$$i = \left[\frac{A}{(Td + C)^B}\right]$$

Where: A, B, C = regression constants for each return period (defined in section 5.4.2)
i = rainfall intensity (mm/hour)
Td = storm duration (minutes) 10 minutes

Return Period (Years)	2	5	10	25	50	100*
A	733.0	998.1	1,174.2	1,402.9	1,569.6	1,735.7
B	0.810	0.814	0.816	0.819	0.820	0.820
C	6.199	6.053	6.014	6.018	6.014	6.014
T (mins)	10	10	10	10	10	10
I (mm/hr)	76.8	104.2	122.1	144.7	161.5	178.6
Runoff Coefficient C	0.85	0.85	0.85	0.85	0.85	0.85
C Multiplier (OSDG Table 5.7)	1.00	1.00	1.00	1.10	1.20	1.25
Revised Runoff Coefficient C	0.85	0.85	0.85	0.94	1.00	1.00
Q (litres/sec)	185	251	294	383	457	505
Q (m3/sec)	0.18	0.25	0.29	0.38	0.46	0.51



Area Listing (selected nodes)

Area (sq-meters)	C	Description (subcatchment-numbers)
8,770.0	0.90	(27S, 28S, 29S)
1,290.0	0.80	S-101 (53S)
1,960.0	0.88	S-102 (54S)
880.0	0.79	S-103 (55S)
1,330.0	0.90	S-104 (57S)
1,790.0	0.88	S-105 (58S)
1,020.0	0.82	S-106 (56S)
5,900.0	0.81	S-EXT1 (32S)
1,850.0	0.90	S-EXT2 (32S)
1,530.0	0.90	S-EXT3 (32S)
900.0	0.90	S-EXT4 (32S)
250.0	0.90	S-U1 (31S)
940.0	0.86	S-U2 (31S)
80.0	0.90	S-U3 (31S)
850.0	0.88	S-U4 (31S)
520.0	0.28	S-U5 (31S)
470.0	0.59	S-U6 (31S)
30,330.0	**0.85**	**TOTAL AREA**

Time span=0.00-3.00 hrs, dt=0.01 hrs, 301 points
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 27S: Bldg A Runoff Area=0.4580 ha 0.00% Impervious Runoff Depth=12 mm
Tc=10.0 min C=0.90 Runoff=0.0864 m³/s 52.7 m³

Subcatchment 28S: Bldg B Runoff Area=0.2380 ha 0.00% Impervious Runoff Depth=12 mm
Tc=10.0 min C=0.90 Runoff=0.0449 m³/s 27.4 m³

Subcatchment 29S: Bldg C Runoff Area=0.1810 ha 0.00% Impervious Runoff Depth=12 mm
Tc=10.0 min C=0.90 Runoff=0.0341 m³/s 20.8 m³

Subcatchment 31S: UnControlled Runoff Area=0.3110 ha 0.00% Impervious Runoff Depth=9 mm
Tc=10.0 min C=0.73 Runoff=0.0476 m³/s 29.1 m³

Subcatchment 32S: External Catchments Runoff Area=1.0180 ha 0.00% Impervious Runoff Depth=11 mm
Tc=10.0 min C=0.85 Runoff=0.1814 m³/s 110.7 m³

Subcatchment 53S: S-101 Runoff Area=0.1290 ha 0.00% Impervious Runoff Depth=10 mm
Tc=10.0 min C=0.80 Runoff=0.0216 m³/s 13.2 m³

Subcatchment 54S: S-102 Runoff Area=0.1960 ha 0.00% Impervious Runoff Depth=11 mm
Tc=10.0 min C=0.88 Runoff=0.0362 m³/s 22.1 m³

Subcatchment 55S: S-103 Runoff Area=0.0880 ha 0.00% Impervious Runoff Depth=10 mm
Tc=10.0 min C=0.79 Runoff=0.0146 m³/s 8.9 m³

Subcatchment 56S: S-106 Runoff Area=0.1020 ha 0.00% Impervious Runoff Depth=10 mm
Tc=10.0 min C=0.82 Runoff=0.0175 m³/s 10.7 m³

Subcatchment 57S: S-104 Runoff Area=0.1330 ha 0.00% Impervious Runoff Depth=12 mm
Tc=10.0 min C=0.90 Runoff=0.0251 m³/s 15.3 m³

Subcatchment 58S: S-105 Runoff Area=0.1790 ha 0.00% Impervious Runoff Depth=11 mm
Tc=10.0 min C=0.88 Runoff=0.0330 m³/s 20.2 m³

Pond 33P: Bldg A Roof Peak Elev=100.051 m Storage=42.7 m³ Inflow=0.0864 m³/s 52.7 m³
Outflow=0.0096 m³/s 52.8 m³

Pond 35P: Bldg B Roof Peak Elev=100.064 m Storage=22.1 m³ Inflow=0.0449 m³/s 27.4 m³
Outflow=0.0050 m³/s 27.4 m³

Pond 36P: Bldg C Roof Peak Elev=100.070 m Storage=16.8 m³ Inflow=0.0341 m³/s 20.8 m³
Outflow=0.0037 m³/s 20.8 m³

Pond 59P: CBMH105 Peak Elev=76.006 m Storage=2.7 m³ Inflow=0.0216 m³/s 13.2 m³
Outflow=0.0128 m³/s 13.2 m³

Pond 60P: CB01 Peak Elev=76.024 m Storage=9.3 m³ Inflow=0.0362 m³/s 22.1 m³
Outflow=0.0136 m³/s 22.1 m³

Pond 61P: CB02 Peak Elev=75.777 m Storage=0.6 m³ Inflow=0.0146 m³/s 8.9 m³
Outflow=0.0136 m³/s 8.9 m³

Pond 62P: CB04 Peak Elev=75.316 m Storage=0.3 m³ Inflow=0.0175 m³/s 10.7 m³
Outflow=0.0171 m³/s 10.7 m³

Pond 63P: CBMH107 Peak Elev=75.581 m Storage=4.1 m³ Inflow=0.0251 m³/s 15.3 m³
Outflow=0.0131 m³/s 15.3 m³

Pond 64P: CB03 Peak Elev=75.522 m Storage=7.7 m³ Inflow=0.0330 m³/s 20.2 m³
Outflow=0.0134 m³/s 20.2 m³

Link 37L: Outflow Inflow=0.3299 m³/s 331.2 m³
Primary=0.3299 m³/s 331.2 m³

Total Runoff Area = 30,330.0 m² Runoff Volume = 331.1 m³ Average Runoff Depth = 11 mm
100.00% Pervious = 30,330.0 m² 0.00% Impervious = 0.0 m²

Summary for Subcatchment 27S: Bldg A

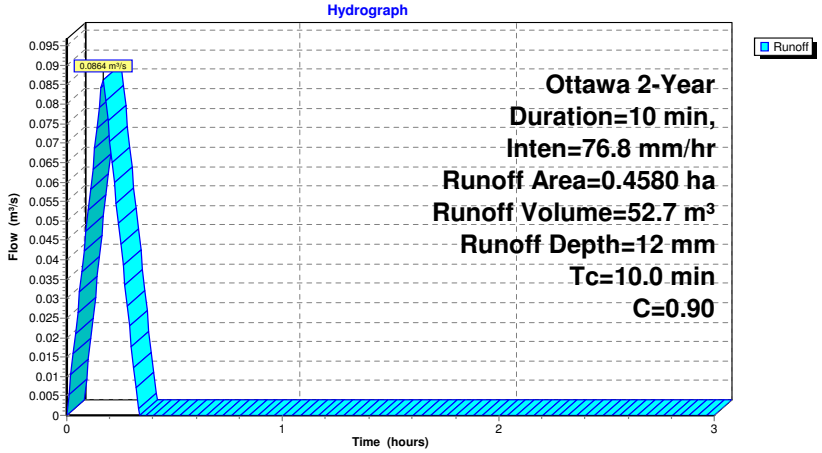
Runoff = 0.0864 m³/s @ 0.17 hrs, Volume= 52.7 m³, Depth= 12 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Ottawa 2-Year Duration=10 min, Inten=76.8 mm/hr

Area (ha)	C	Description
0.4580	0.90	
0.4580		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 27S: Bldg A



Summary for Subcatchment 28S: Bldg B

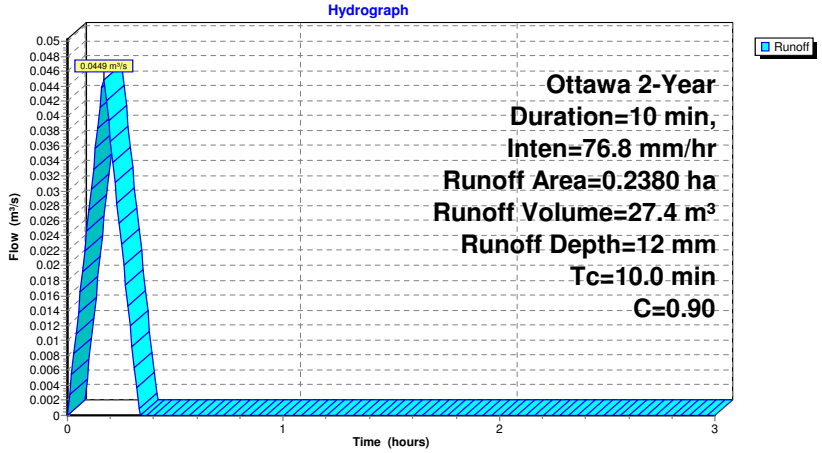
Runoff = 0.0449 m³/s @ 0.17 hrs, Volume= 27.4 m³, Depth= 12 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Ottawa 2-Year Duration=10 min, Inten=76.8 mm/hr

Area (ha)	C	Description
0.2380	0.90	
0.2380		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 28S: Bldg B



Summary for Subcatchment 29S: Bldg C

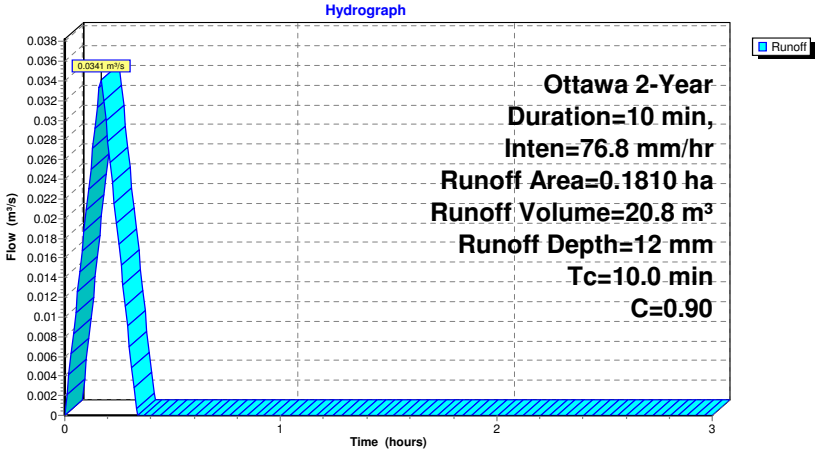
Runoff = 0.0341 m³/s @ 0.17 hrs, Volume= 20.8 m³, Depth= 12 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Ottawa 2-Year Duration=10 min, Inten=76.8 mm/hr

Area (ha)	C	Description
0.1810	0.90	
0.1810		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 29S: Bldg C



Summary for Subcatchment 31S: UnControlled

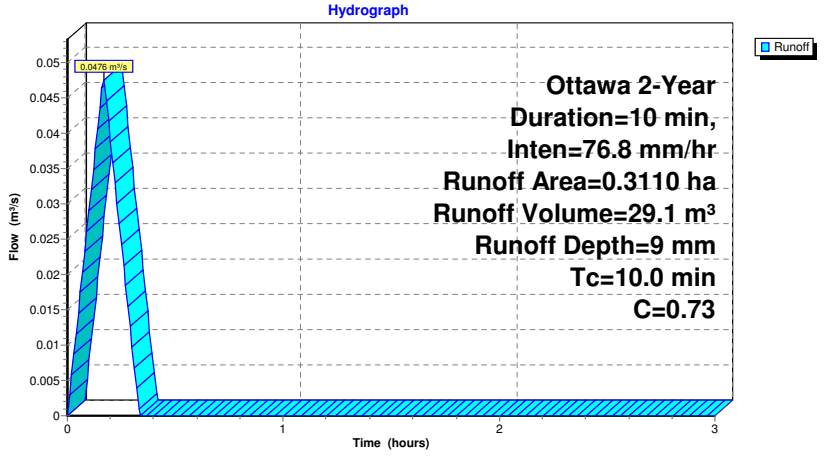
Runoff = 0.0476 m³/s @ 0.17 hrs, Volume= 29.1 m³, Depth= 9 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Ottawa 2-Year Duration=10 min, Inten=76.8 mm/hr

Area (ha)	C	Description
0.0250	0.90	S-U1
0.0940	0.86	S-U2
0.0080	0.90	S-U3
0.0850	0.88	S-U4
0.0520	0.28	S-U5
0.0470	0.59	S-U6
0.3110	0.73	Weighted Average
0.3110		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 31S: UnControlled



Summary for Subcatchment 32S: External Catchments

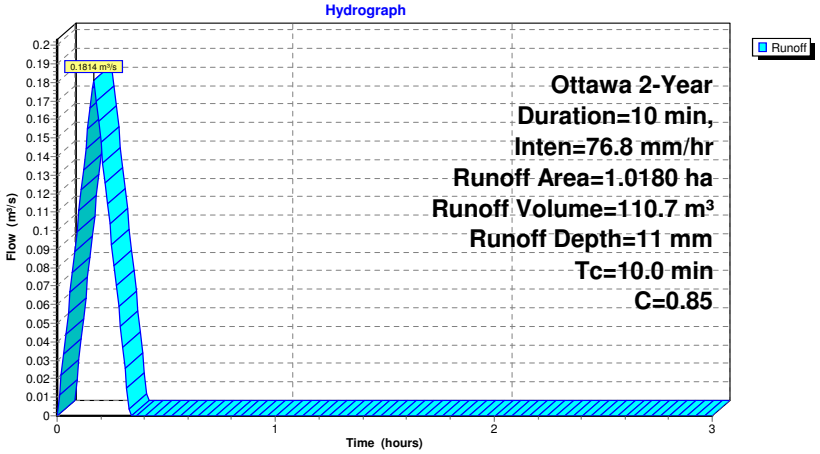
Runoff = 0.1814 m³/s @ 0.17 hrs, Volume= 110.7 m³, Depth= 11 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Ottawa 2-Year Duration=10 min, Inten=76.8 mm/hr

Area (ha)	C	Description
0.5900	0.81	S-EXT1
0.1850	0.90	S-EXT2
0.1530	0.90	S-EXT3
0.0900	0.90	S-EXT4
1.0180	0.85	Weighted Average
1.0180		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 32S: External Catchments



Summary for Subcatchment 53S: S-101

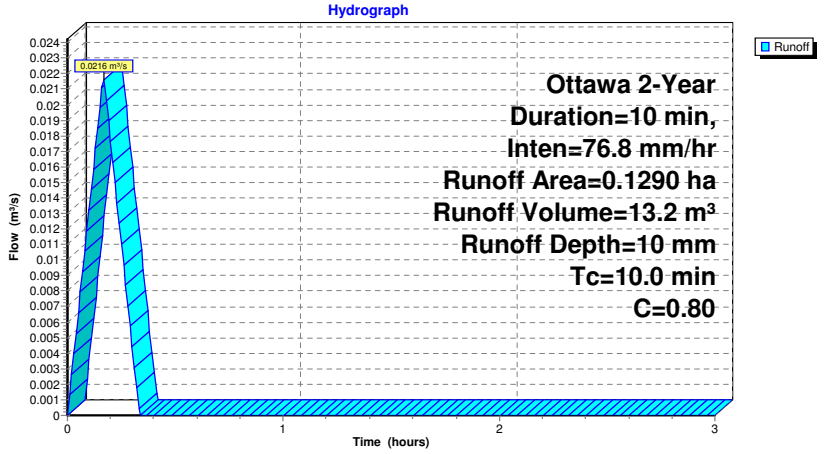
Runoff = 0.0216 m³/s @ 0.17 hrs, Volume= 13.2 m³, Depth= 10 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Ottawa 2-Year Duration=10 min, Inten=76.8 mm/hr

Area (ha)	C	Description
0.1290	0.80	S-101
0.1290		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 53S: S-101



Summary for Subcatchment 54S: S-102

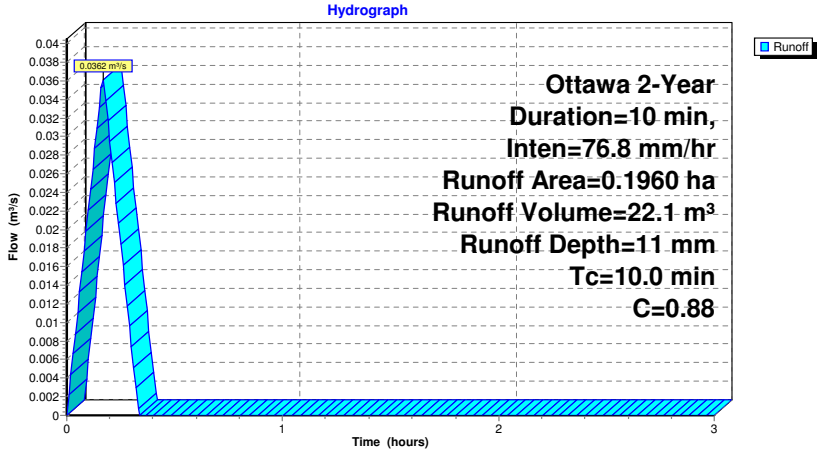
Runoff = 0.0362 m³/s @ 0.17 hrs, Volume= 22.1 m³, Depth= 11 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Ottawa 2-Year Duration=10 min, Inten=76.8 mm/hr

Area (ha)	C	Description
0.1960	0.88	S-102
0.1960		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 54S: S-102



Summary for Subcatchment 55S: S-103

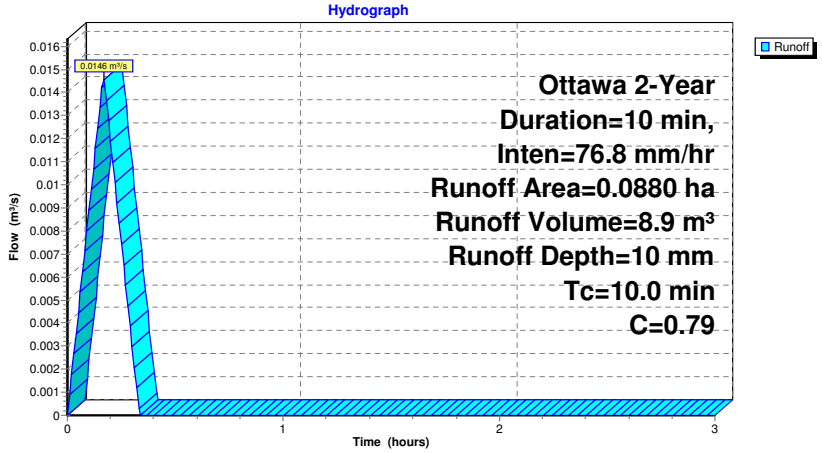
Runoff = 0.0146 m³/s @ 0.17 hrs, Volume= 8.9 m³, Depth= 10 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Ottawa 2-Year Duration=10 min, Inten=76.8 mm/hr

Area (ha)	C	Description
0.0880	0.79	S-103
0.0880		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 55S: S-103



Summary for Subcatchment 56S: S-106

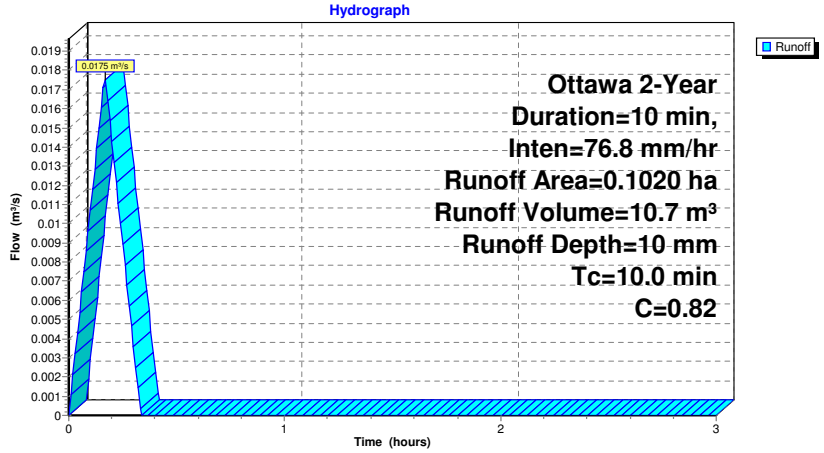
Runoff = 0.0175 m³/s @ 0.17 hrs, Volume= 10.7 m³, Depth= 10 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Ottawa 2-Year Duration=10 min, Inten=76.8 mm/hr

Area (ha)	C	Description
0.1020	0.82	S-106
0.1020		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 56S: S-106



Summary for Subcatchment 57S: S-104

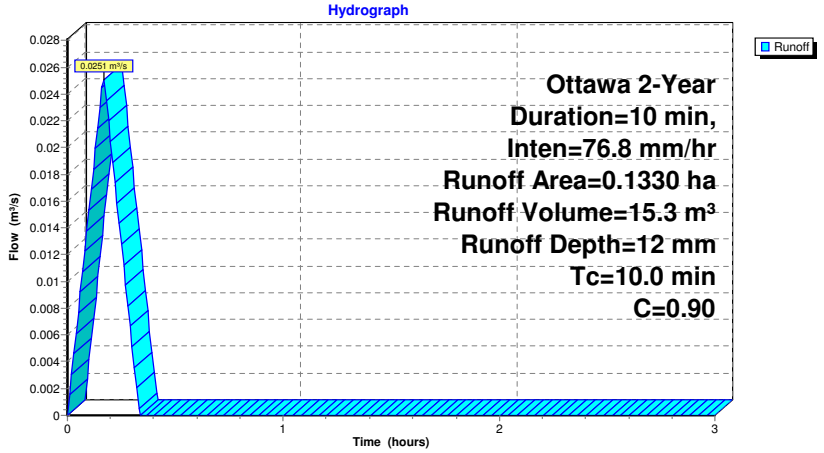
Runoff = 0.0251 m³/s @ 0.17 hrs, Volume= 15.3 m³, Depth= 12 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Ottawa 2-Year Duration=10 min, Inten=76.8 mm/hr

Area (ha)	C	Description
0.1330	0.90	S-104
0.1330		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 57S: S-104



Summary for Subcatchment 58S: S-105

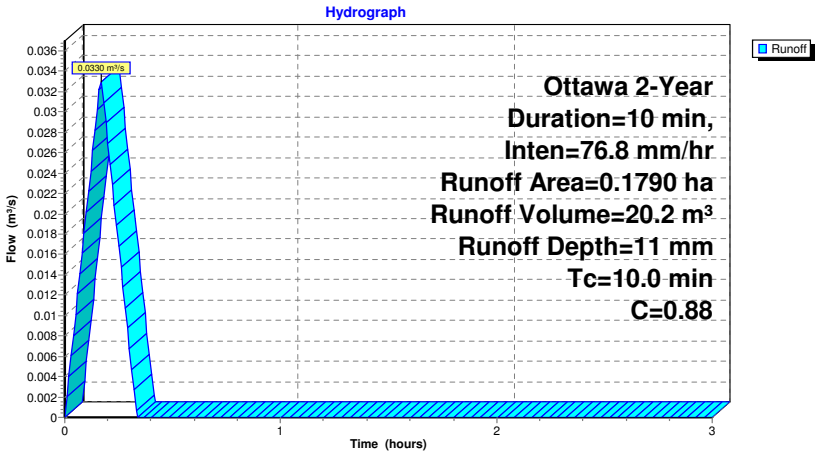
Runoff = 0.0330 m³/s @ 0.17 hrs, Volume= 20.2 m³, Depth= 11 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Ottawa 2-Year Duration=10 min, Inten=76.8 mm/hr

Area (ha)	C	Description
0.1790	0.88	S-105
0.1790		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 58S: S-105



Summary for Pond 33P: Bldg A Roof

Inflow Area = 4,580.0 m², 0.00% Impervious, Inflow Depth = 12 mm for 2-Year event
Inflow = 0.0864 m³/s @ 0.17 hrs, Volume= 52.7 m³
Outflow = 0.0096 m³/s @ 0.09 hrs, Volume= 52.8 m³, Atten= 89%, Lag= 0.0 min
Primary = 0.0096 m³/s @ 0.09 hrs, Volume= 52.8 m³

Routing by Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 100.051 m @ 0.32 hrs Surf.Area= 2,492.7 m² Storage= 42.7 m³

Plug-Flow detention time= 37.8 min calculated for 52.6 m³ (100% of inflow)
Center-of-Mass det. time= 37.9 min (47.9 - 10.0)

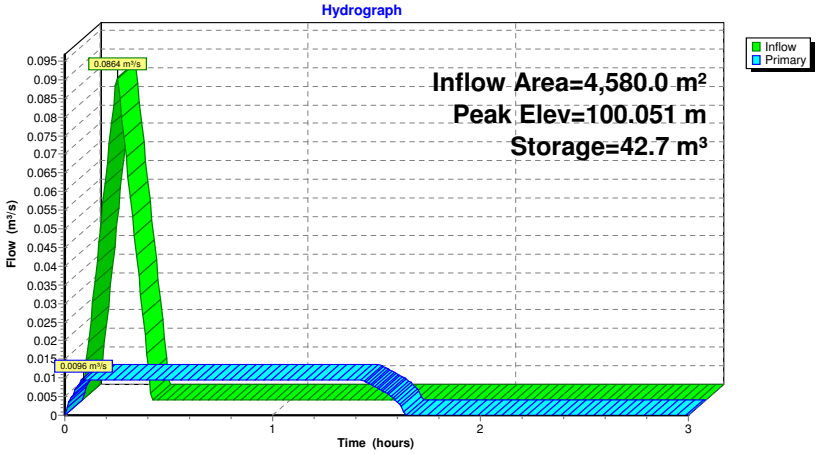
Volume	Invert	Avail.Storage	Storage Description
#1	100.000 m	5,696.0 m³	**Custom Stage Data (Pyramidal)** Listed below (Recalc) x 31

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)	Wet.Area (sq-meters)
100.000	0.0	0.0	0.0	0.0
100.150	686.0	34.3	34.3	686.0
100.300	1,343.0	149.4	183.7	1,343.3

Device	Routing	Invert	Outlet Devices
#1	Primary	100.000 m	**WATTS Accutrol_5-Closed X 31.00** Head (meters) 0.000 0.025 0.051 0.076 0.102 0.127 0.152 Disch. (m³/s) 0.00000 0.00031 0.00031 0.00031 0.00031 0.00031 0.00031

Primary OutFlow Max=0.0096 m³/s @ 0.09 hrs HW=100.026 m (Free Discharge)
↑**1=WATTS Accutrol_5-Closed** (Custom Controls 0.0096 m³/s)

Pond 33P: Bldg A Roof



Summary for Pond 35P: Bldg B Roof

Inflow Area = 2,380.0 m², 0.00% Impervious, Inflow Depth = 12 mm for 2-Year event
Inflow = 0.0449 m³/s @ 0.17 hrs, Volume= 27.4 m³
Outflow = 0.0050 m³/s @ 0.07 hrs, Volume= 27.4 m³, Atten= 89%, Lag= 0.0 min
Primary = 0.0050 m³/s @ 0.07 hrs, Volume= 27.4 m³

Routing by Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 100.064 m @ 0.32 hrs Surf.Area= 1,035.9 m² Storage= 22.1 m³

Plug-Flow detention time= 37.6 min calculated for 27.3 m³ (100% of inflow)
Center-of-Mass det. time= 37.7 min (47.7 - 10.0)

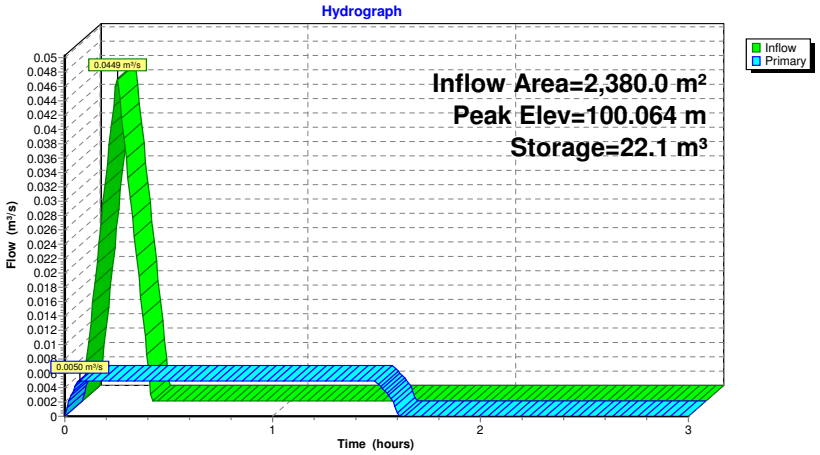
Volume	Invert	Avail.Storage	Storage Description
#1	100.000 m	1,545.2 m³	**Custom Stage Data (Pyramidal)** Listed below (Recalc) x 16

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)	Wet.Area (sq-meters)
100.000	0.0	0.0	0.0	0.0
100.150	357.0	17.9	17.9	357.0
100.300	713.0	78.7	96.6	713.3

Device	Routing	Invert	Outlet Devices
#1	Primary	100.000 m	**WATTS Accutrol_5-Closed X 16.00** Head (meters) 0.000 0.025 0.051 0.076 0.102 0.127 0.152 Disch. (m³/s) 0.00000 0.00031 0.00031 0.00031 0.00031 0.00031 0.00031

Primary OutFlow Max=0.0050 m³/s @ 0.07 hrs HW=100.027 m (Free Discharge)
↑**1=WATTS Accutrol_5-Closed** (Custom Controls 0.0050 m³/s)

Pond 35P: Bldg B Roof



Summary for Pond 36P: Bldg C Roof

Inflow Area = 1,810.0 m², 0.00% Impervious, Inflow Depth = 12 mm for 2-Year event
Inflow = 0.0341 m³/s @ 0.17 hrs, Volume= 20.8 m³
Outflow = 0.0037 m³/s @ 0.06 hrs, Volume= 20.8 m³, Atten= 89%, Lag= 0.0 min
Primary = 0.0037 m³/s @ 0.06 hrs, Volume= 20.8 m³

Routing by Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 100.070 m @ 0.32 hrs Surf.Area= 715.8 m² Storage= 16.8 m³

Plug-Flow detention time= 38.0 min calculated for 20.8 m³ (100% of inflow)
Center-of-Mass det. time= 38.2 min (48.2 - 10.0)

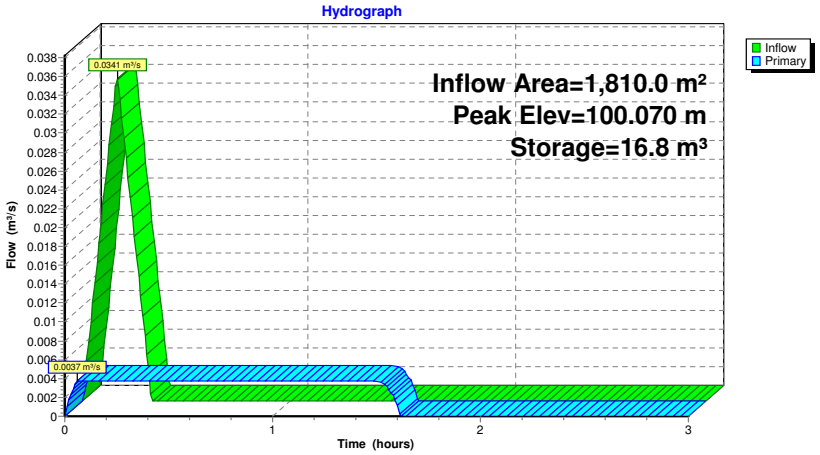
Volume	Invert	Avail.Storage	Storage Description
#1	100.000 m	880.4 m³	**Custom Stage Data (Pyramidal)** Listed below (Recalc) x 12

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)	Wet.Area (sq-meters)
100.000	0.0	0.0	0.0	0.0
100.150	271.0	13.6	13.6	271.0
100.300	542.0	59.8	73.4	542.3

Device	Routing	Invert	Outlet Devices
#1	Primary	100.000 m	**WATTS Accutrol_5-Closed X 12.00** Head (meters) 0.000 0.025 0.051 0.076 0.102 0.127 0.152 Disch. (m³/s) 0.00000 0.00031 0.00031 0.00031 0.00031 0.00031 0.00031

Primary OutFlow Max=0.0037 m³/s @ 0.06 hrs HW=100.026 m (Free Discharge)
↑**1=WATTS Accutrol_5-Closed** (Custom Controls 0.0037 m³/s)

Pond 36P: Bldg C Roof



Summary for Pond 59P: CBMH105

Inflow Area = 1,290.0 m², 0.00% Impervious, Inflow Depth = 10 mm for 2-Year event
Inflow = 0.0216 m³/s @ 0.17 hrs, Volume= 13.2 m³
Outflow = 0.0128 m³/s @ 0.24 hrs, Volume= 13.2 m³, Atten= 41%, Lag= 4.1 min
Primary = 0.0128 m³/s @ 0.24 hrs, Volume= 13.2 m³

Routing by Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 76.006 m @ 0.24 hrs Surf.Area= 80.0 m² Storage= 2.7 m³

Plug-Flow detention time= 2.0 min calculated for 13.2 m³ (100% of inflow)
Center-of-Mass det. time= 2.0 min (12.0 - 10.0)

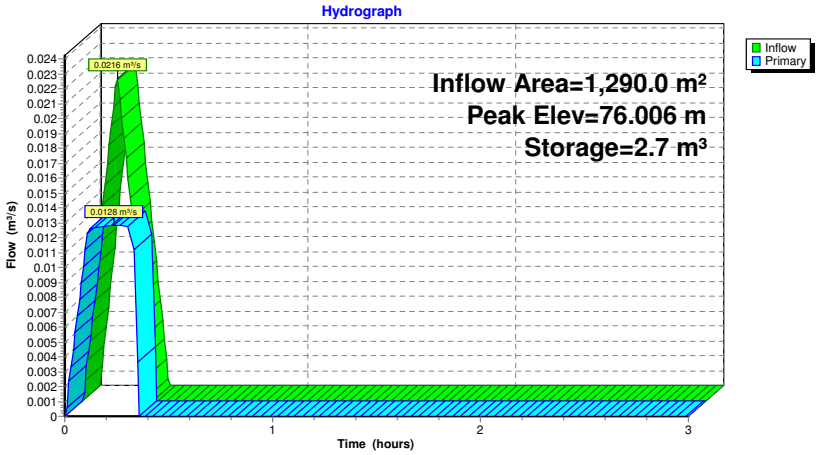
Volume	Invert	Avail.Storage	Storage Description
#1	74.776 m	64.6 m³	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
74.776	0.4	0.0	0.0
75.950	0.4	0.5	0.5
76.250	427.0	64.1	64.6

Device	Routing	Invert	Outlet Devices
#1	Primary	74.776 m	**75 mm Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.0128 m³/s @ 0.24 hrs HW=76.006 m (Free Discharge)
↑**1=Orifice/Grate** (Orifice Controls 0.0128 m³/s @ 2.90 m/s)

Pond 59P: CBMH105



Summary for Pond 60P: CB01

Inflow Area = 1,960.0 m², 0.00% Impervious, Inflow Depth = 11 mm for 2-Year event
Inflow = 0.0362 m³/s @ 0.17 hrs, Volume= 22.1 m³
Outflow = 0.0136 m³/s @ 0.27 hrs, Volume= 22.1 m³, Atten= 62%, Lag= 6.3 min
Primary = 0.0136 m³/s @ 0.27 hrs, Volume= 22.1 m³

Routing by Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 76.024 m @ 0.27 hrs Surf.Area= 236.0 m² Storage= 9.3 m³

Plug-Flow detention time= 6.0 min calculated for 22.0 m³ (100% of inflow)
Center-of-Mass det. time= 6.0 min (16.0 - 10.0)

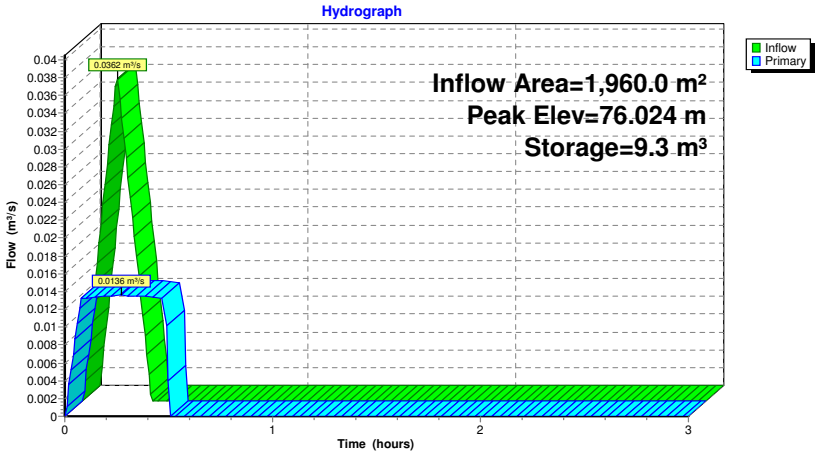
Volume	Invert	Avail.Storage	Storage Description
#1	74.651 m	144.0 m³	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
74.651	0.4	0.0	0.0
75.950	0.4	0.5	0.5
76.250	956.0	143.5	144.0

Device	Routing	Invert	Outlet Devices
#1	Primary	74.651 m	**75 mm Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.0136 m³/s @ 0.27 hrs HW=76.024 m (Free Discharge)
↑**1=Orifice/Grate** (Orifice Controls 0.0136 m³/s @ 3.07 m/s)

Pond 60P: CB01



Summary for Pond 61P: CB02

Inflow Area = 880.0 m², 0.00% Impervious, Inflow Depth = 10 mm for 2-Year event
Inflow = 0.0146 m³/s @ 0.17 hrs, Volume= 8.9 m³
Outflow = 0.0136 m³/s @ 0.18 hrs, Volume= 8.9 m³, Atten= 7%, Lag= 0.8 min
Primary = 0.0136 m³/s @ 0.18 hrs, Volume= 8.9 m³

Routing by Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 75.777 m @ 0.18 hrs Surf.Area= 0.4 m² Storage= 0.6 m³

Plug-Flow detention time= 0.5 min calculated for 8.9 m³ (100% of inflow)
Center-of-Mass det. time= 0.5 min (10.5 - 10.0)

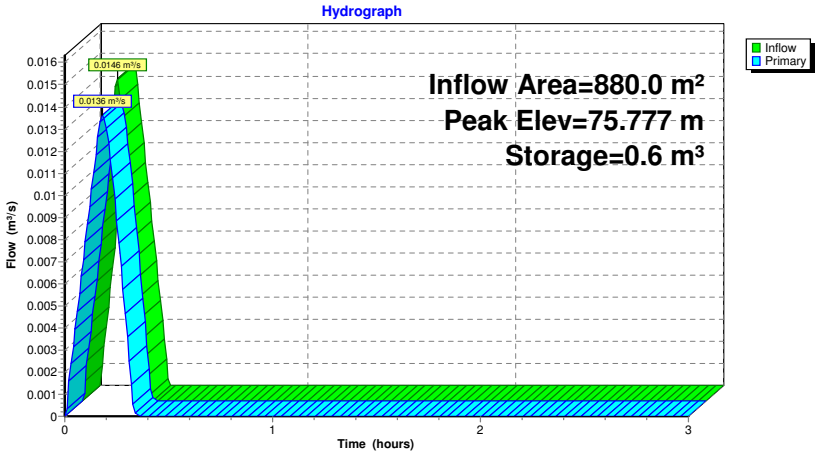
Volume	Invert	Avail.Storage	Storage Description
#1	74.396 m	18.1 m³	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
74.396	0.4	0.0	0.0
75.950	0.4	0.6	0.6
76.150	174.0	17.4	18.1

Device	Routing	Invert	Outlet Devices
#1	Primary	74.396 m	**75 mm Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.0136 m³/s @ 0.18 hrs HW=75.771 m (Free Discharge)
↑**1=Orifice/Grate** (Orifice Controls 0.0136 m³/s @ 3.07 m/s)

Pond 61P: CB02



Summary for Pond 62P: CB04

Inflow Area = 1,020.0 m², 0.00% Impervious, Inflow Depth = 10 mm for 2-Year event
Inflow = 0.0175 m³/s @ 0.17 hrs, Volume= 10.7 m³
Outflow = 0.0171 m³/s @ 0.17 hrs, Volume= 10.7 m³, Atten= 2%, Lag= 0.4 min
Primary = 0.0171 m³/s @ 0.17 hrs, Volume= 10.7 m³

Routing by Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 75.316 m @ 0.17 hrs Surf.Area= 0.4 m² Storage= 0.3 m³

Plug-Flow detention time= 0.2 min calculated for 10.7 m³ (100% of inflow)
Center-of-Mass det. time= 0.2 min (10.2 - 10.0)

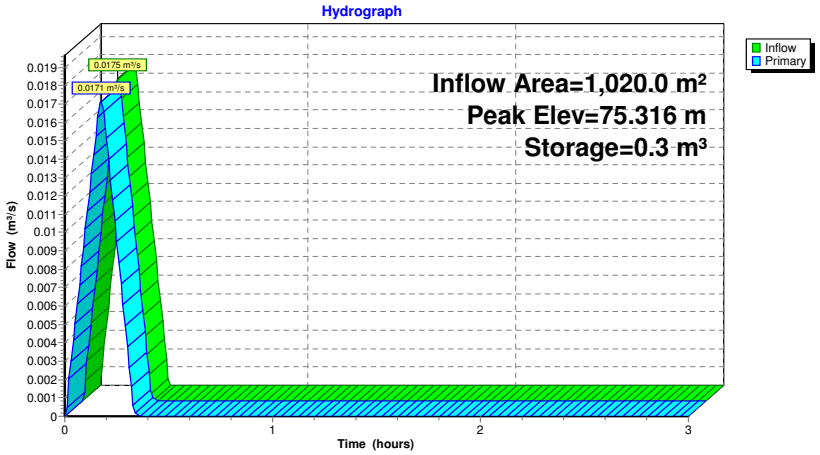
Volume	Invert	Avail.Storage	Storage Description
#1	74.594 m	11.4 m³	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
74.594	0.4	0.0	0.0
76.690	0.4	0.8	0.8
76.840	140.7	10.6	11.4

Device	Routing	Invert	Outlet Devices
#1	Primary	74.594 m	**100 mm Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.0170 m³/s @ 0.17 hrs HW=75.309 m (Free Discharge)
↑**1=Orifice/Grate** (Orifice Controls 0.0170 m³/s @ 2.17 m/s)

Pond 62P: CB04



Summary for Pond 63P: CBMH107

Inflow Area = 1,330.0 m², 0.00% Impervious, Inflow Depth = 12 mm for 2-Year event
Inflow = 0.0251 m³/s @ 0.17 hrs, Volume= 15.3 m³
Outflow = 0.0131 m³/s @ 0.25 hrs, Volume= 15.3 m³, Atten= 48%, Lag= 4.8 min
Primary = 0.0131 m³/s @ 0.25 hrs, Volume= 15.3 m³

Routing by Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 75.581 m @ 0.25 hrs Surf.Area= 89.0 m² Storage= 4.1 m³

Plug-Flow detention time= 2.8 min calculated for 15.3 m³ (100% of inflow)
Center-of-Mass det. time= 2.8 min (12.8 - 10.0)

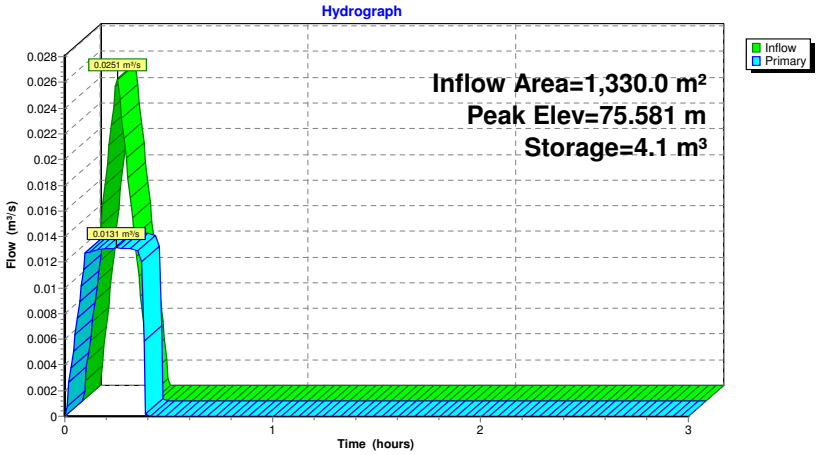
Volume	Invert	Avail.Storage	Storage Description
#1	74.297 m	50.0 m³	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
74.297	0.4	0.0	0.0
75.500	0.4	0.5	0.5
75.800	330.0	49.6	50.0

Device	Routing	Invert	Outlet Devices
#1	Primary	74.297 m	**75 mm Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.0131 m³/s @ 0.25 hrs HW=75.581 m (Free Discharge)
↑**1=Orifice/Grate** (Orifice Controls 0.0131 m³/s @ 2.97 m/s)

Pond 63P: CBMH107



Summary for Pond 64P: CB03

Inflow Area = 1,790.0 m², 0.00% Impervious, Inflow Depth = 11 mm for 2-Year event
Inflow = 0.0330 m³/s @ 0.17 hrs, Volume= 20.2 m³
Outflow = 0.0134 m³/s @ 0.27 hrs, Volume= 20.2 m³, Atten= 59%, Lag= 6.0 min
Primary = 0.0134 m³/s @ 0.27 hrs, Volume= 20.2 m³

Routing by Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 75.522 m @ 0.27 hrs Surf.Area= 198.5 m² Storage= 7.7 m³

Plug-Flow detention time= 5.1 min calculated for 20.1 m³ (100% of inflow)
Center-of-Mass det. time= 5.1 min (15.1 - 10.0)

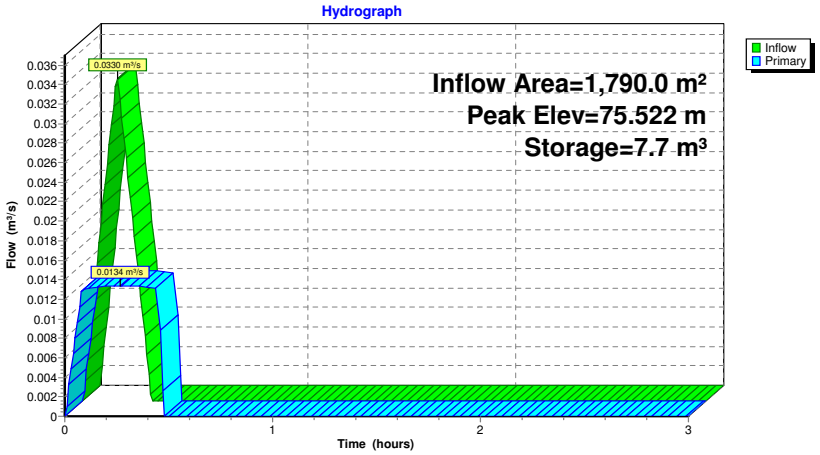
Volume	Invert	Avail.Storage	Storage Description
#1	74.183 m	123.7 m³	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
74.183	0.4	0.0	0.0
75.450	0.4	0.5	0.5
75.750	821.0	123.2	123.7

Device	Routing	Invert	Outlet Devices
#1	Primary	74.183 m	**75 mm Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.0134 m³/s @ 0.27 hrs HW=75.522 m (Free Discharge)
↑**1=Orifice/Grate** (Orifice Controls 0.0134 m³/s @ 3.03 m/s)

Pond 64P: CB03

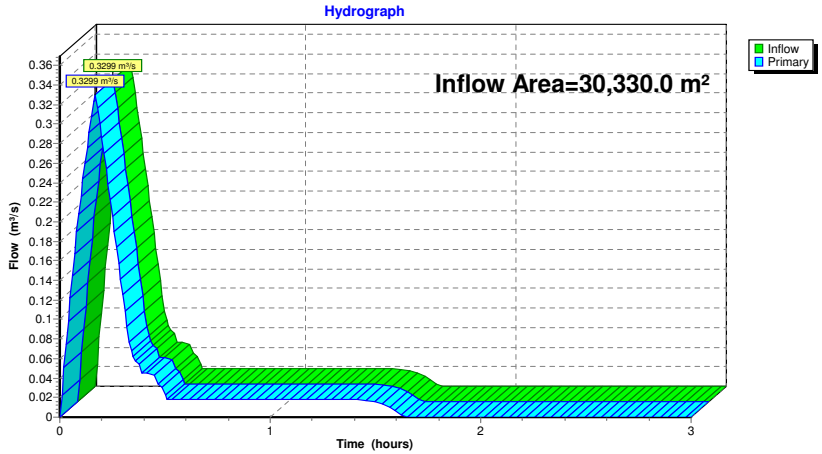


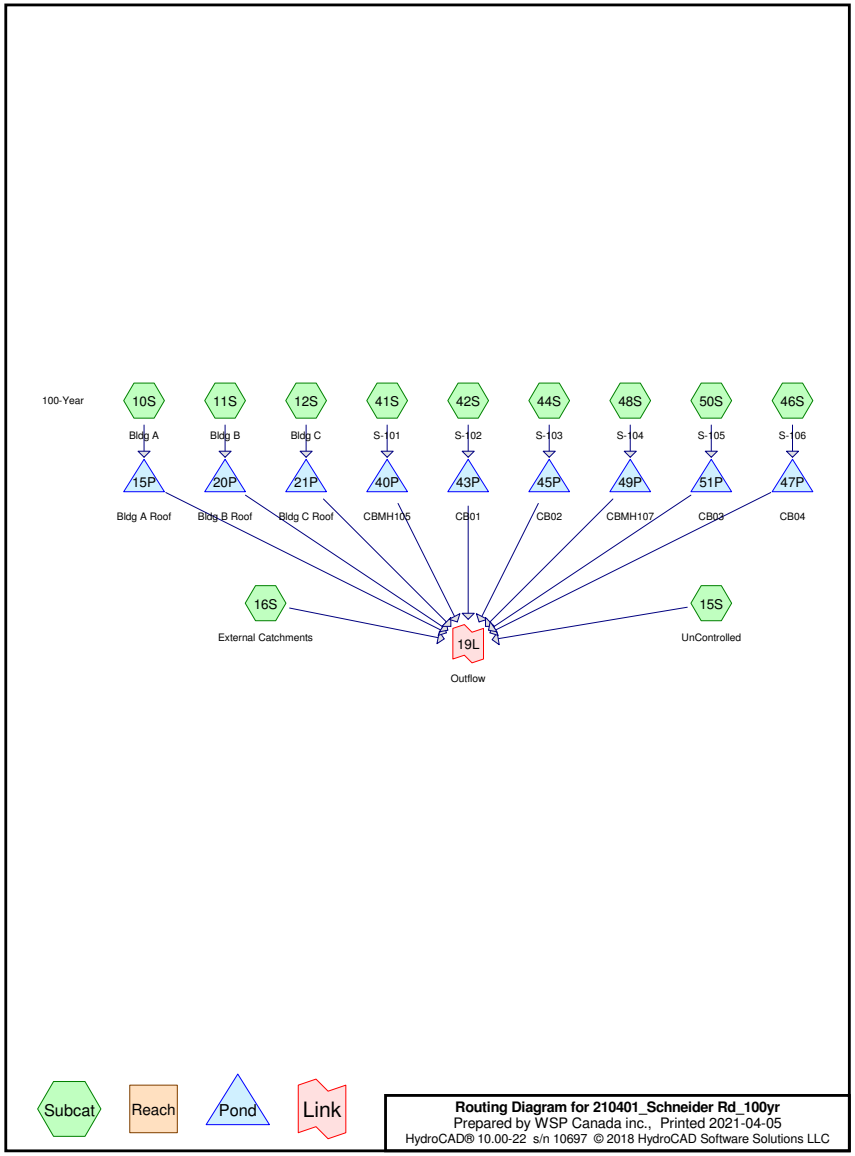
Summary for Link 37L: Outflow

Inflow Area = 30,330.0 m², 0.00% Impervious, Inflow Depth = 11 mm for 2-Year event
Inflow = 0.3299 m³/s @ 0.17 hrs, Volume= 331.2 m³
Primary = 0.3299 m³/s @ 0.17 hrs, Volume= 331.2 m³, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs

Link 37L: Outflow





Area Listing (selected nodes)

Area (sq-meters)	C	Description (subcatchment-numbers)
8,770.0	1.00	(10S, 11S, 12S)
1,290.0	1.00	S-101 (41S)
1,960.0	1.00	S-102 (42S)
880.0	1.00	S-103 (44S)
1,330.0	1.00	S-104 (48S)
1,790.0	1.00	S-105 (50S)
1,020.0	1.00	S-106 (46S)
5,900.0	1.00	S-EXT1 (16S)
1,850.0	1.00	S-EXT2 (16S)
1,530.0	1.00	S-EXT3 (16S)
900.0	1.00	S-EXT4 (16S)
250.0	1.00	S-U1 (15S)
940.0	1.00	S-U2 (15S)
80.0	1.00	S-U3 (15S)
850.0	1.00	S-U4 (15S)
520.0	0.35	S-U5 (15S)
470.0	0.74	S-U6 (15S)
30,330.0	**0.98**	**TOTAL AREA**

Time span=0.00-3.00 hrs, dt=0.01 hrs, 301 points
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 10S: Bldg A Runoff Area=0.4580 ha 100.00% Impervious Runoff Depth=30 mm
Tc=10.0 min C=1.00 Runoff=0.2232 m³/s 136.2 m³

Subcatchment 11S: Bldg B Runoff Area=0.2380 ha 100.00% Impervious Runoff Depth=30 mm
Tc=10.0 min C=1.00 Runoff=0.1160 m³/s 70.8 m³

Subcatchment 12S: Bldg C Runoff Area=0.1810 ha 100.00% Impervious Runoff Depth=30 mm
Tc=10.0 min C=1.00 Runoff=0.0882 m³/s 53.8 m³

Subcatchment 15S: UnControlled Runoff Area=0.3110 ha 68.17% Impervious Runoff Depth=25 mm
Tc=10.0 min C=0.85 Runoff=0.1288 m³/s 78.6 m³

Subcatchment 16S: External Runoff Area=1.0180 ha 100.00% Impervious Runoff Depth=30 mm
Tc=10.0 min C=1.00 Runoff=0.4961 m³/s 302.8 m³

Subcatchment 41S: S-101 Runoff Area=0.1290 ha 100.00% Impervious Runoff Depth=30 mm
Tc=10.0 min C=1.00 Runoff=0.0629 m³/s 38.4 m³

Subcatchment 42S: S-102 Runoff Area=0.1960 ha 100.00% Impervious Runoff Depth=30 mm
Tc=10.0 min C=1.00 Runoff=0.0955 m³/s 58.3 m³

Subcatchment 44S: S-103 Runoff Area=0.0880 ha 100.00% Impervious Runoff Depth=30 mm
Tc=10.0 min C=1.00 Runoff=0.0429 m³/s 26.2 m³

Subcatchment 46S: S-106 Runoff Area=0.1020 ha 100.00% Impervious Runoff Depth=30 mm
Tc=10.0 min C=1.00 Runoff=0.0497 m³/s 30.3 m³

Subcatchment 48S: S-104 Runoff Area=0.1330 ha 100.00% Impervious Runoff Depth=30 mm
Tc=10.0 min C=1.00 Runoff=0.0648 m³/s 39.6 m³

Subcatchment 50S: S-105 Runoff Area=0.1790 ha 100.00% Impervious Runoff Depth=30 mm
Tc=10.0 min C=1.00 Runoff=0.0872 m³/s 53.2 m³

Pond 15P: Bldg A Roof Peak Elev=100.130 m Storage=125.1 m³ Inflow=0.2232 m³/s 136.2 m³
Outflow=0.0096 m³/s 103.6 m³

Pond 20P: Bldg B Roof Peak Elev=100.130 m Storage=65.0 m³ Inflow=0.1160 m³/s 70.8 m³
Outflow=0.0050 m³/s 53.5 m³

Pond 21P: Bldg C Roof Peak Elev=100.131 m Storage=49.5 m³ Inflow=0.0882 m³/s 53.8 m³
Outflow=0.0037 m³/s 40.1 m³

Pond 40P: CBMH105 Peak Elev=76.134 m Storage=24.5 m³ Inflow=0.0629 m³/s 38.4 m³
Outflow=0.0135 m³/s 38.4 m³

Pond 43P: CB01 Peak Elev=76.114 m Storage=43.2 m³ Inflow=0.0955 m³/s 58.3 m³
Outflow=0.0140 m³/s 58.3 m³

Pond 45P: CB02 Peak Elev=76.110 m Storage=11.8 m³ Inflow=0.0429 m³/s 26.2 m³
Outflow=0.0152 m³/s 26.2 m³

Pond 47P: CB04 Peak Elev=76.790 m Storage=5.6 m³ Inflow=0.0497 m³/s 30.3 m³
Outflow=0.0306 m³/s 30.4 m³

Pond 49P: CBMH107 Peak Elev=75.713 m Storage=25.5 m³ Inflow=0.0648 m³/s 39.6 m³
Outflow=0.0138 m³/s 39.6 m³

Pond 51P: CB03 Peak Elev=75.616 m Storage=38.5 m³ Inflow=0.0872 m³/s 53.2 m³
Outflow=0.0139 m³/s 53.2 m³

Link 19L: Outflow Inflow=0.7427 m³/s 824.7 m³
Primary=0.7427 m³/s 824.7 m³

Total Runoff Area = 30,330.0 m² Runoff Volume = 888.4 m³ Average Runoff Depth = 29 mm
3.26% Pervious = 990.0 m² 96.74% Impervious = 29,340.0 m²

Summary for Subcatchment 10S: Bldg A

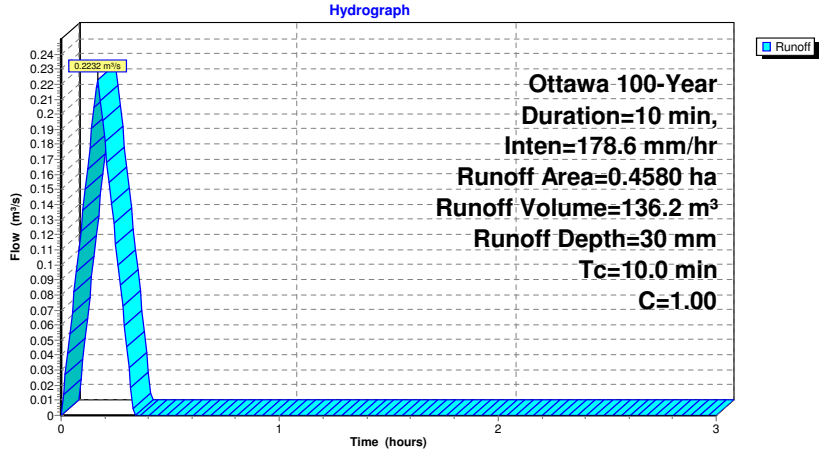
Runoff = 0.2232 m³/s @ 0.17 hrs, Volume= 136.2 m³, Depth= 30 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Ottawa 100-Year Duration=10 min, Inten=178.6 mm/hr

Area (ha)	C	Description
0.4580	1.00	
0.4580		100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 10S: Bldg A



Summary for Subcatchment 11S: Bldg B

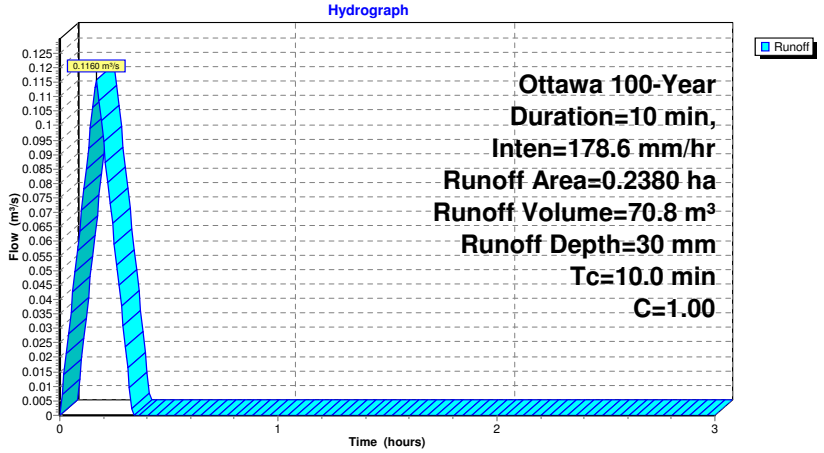
Runoff = 0.1160 m³/s @ 0.17 hrs, Volume= 70.8 m³, Depth= 30 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Ottawa 100-Year Duration=10 min, Inten=178.6 mm/hr

Area (ha)	C	Description
0.2380	1.00	
0.2380		100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 11S: Bldg B



Summary for Subcatchment 12S: Bldg C

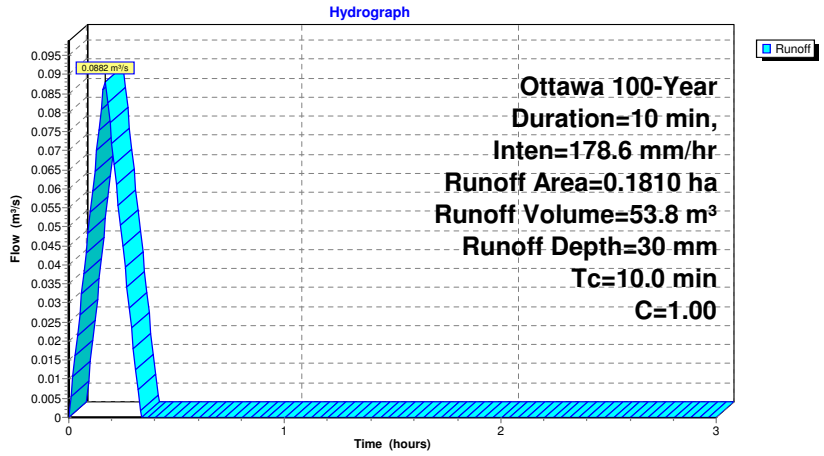
Runoff = 0.0882 m³/s @ 0.17 hrs, Volume= 53.8 m³, Depth= 30 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Ottawa 100-Year Duration=10 min, Inten=178.6 mm/hr

Area (ha)	C	Description
0.1810	1.00	
0.1810		100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 12S: Bldg C



Summary for Subcatchment 15S: UnControlled

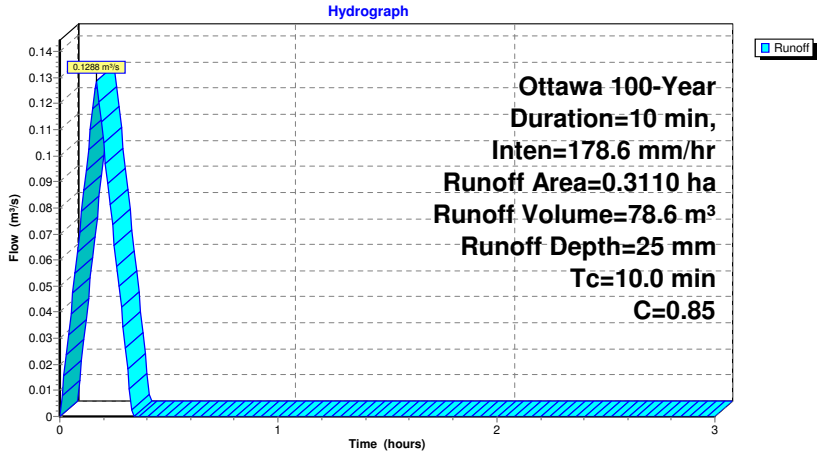
Runoff = 0.1288 m³/s @ 0.17 hrs, Volume= 78.6 m³, Depth= 25 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Ottawa 100-Year Duration=10 min, Inten=178.6 mm/hr

Area (ha)	C	Description
0.0250	1.00	S-U1
0.0940	1.00	S-U2
0.0080	1.00	S-U3
0.0850	1.00	S-U4
0.0520	0.35	S-U5
0.0470	0.74	S-U6
0.3110	0.85	Weighted Average
0.0990		31.83% Pervious Area
0.2120		68.17% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 15S: UnControlled



Summary for Subcatchment 16S: External Catchments

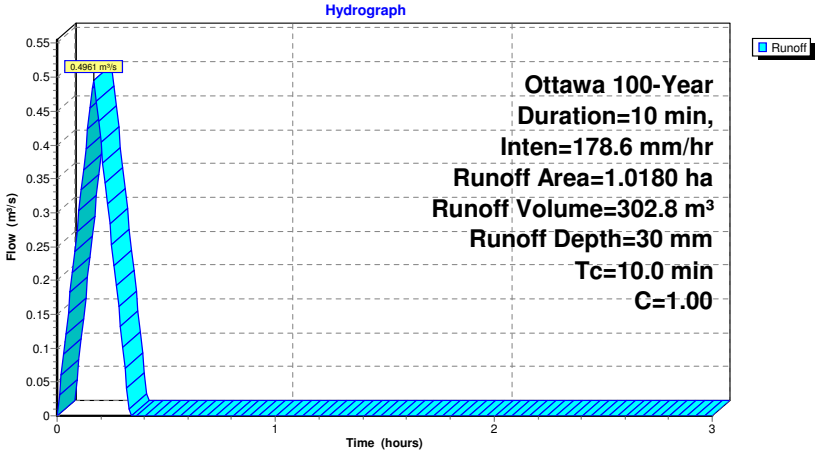
Runoff = 0.4961 m³/s @ 0.17 hrs, Volume= 302.8 m³, Depth= 30 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Ottawa 100-Year Duration=10 min, Inten=178.6 mm/hr

Area (ha)	C	Description
0.5900	1.00	S-EXT1
0.1850	1.00	S-EXT2
0.1530	1.00	S-EXT3
0.0900	1.00	S-EXT4
1.0180	1.00	Weighted Average
1.0180		100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 16S: External Catchments



Summary for Subcatchment 41S: S-101

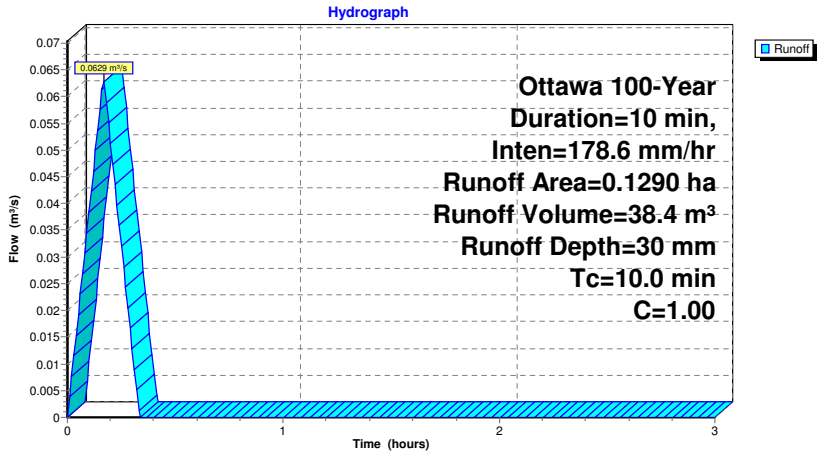
Runoff = 0.0629 m³/s @ 0.17 hrs, Volume= 38.4 m³, Depth= 30 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Ottawa 100-Year Duration=10 min, Inten=178.6 mm/hr

Area (ha)	C	Description
0.1290	1.00	S-101
0.1290		100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 41S: S-101



Summary for Subcatchment 42S: S-102

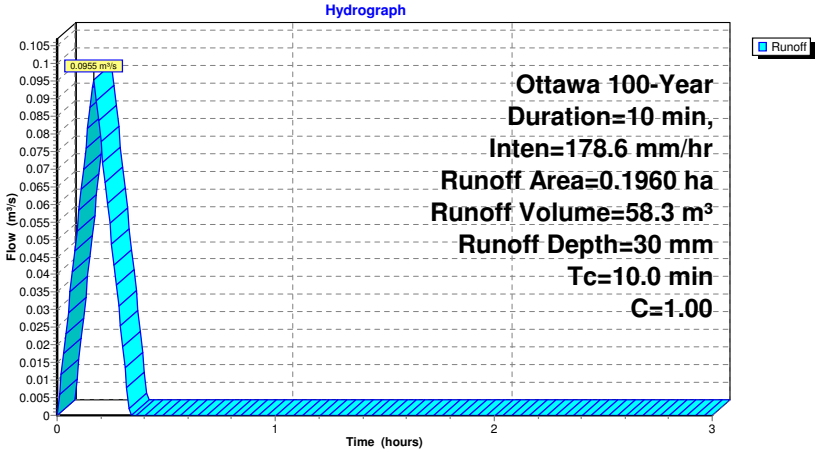
Runoff = 0.0955 m³/s @ 0.17 hrs, Volume= 58.3 m³, Depth= 30 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Ottawa 100-Year Duration=10 min, Inten=178.6 mm/hr

Area (ha)	C	Description
0.1960	1.00	S-102
0.1960		100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 42S: S-102



Summary for Subcatchment 44S: S-103

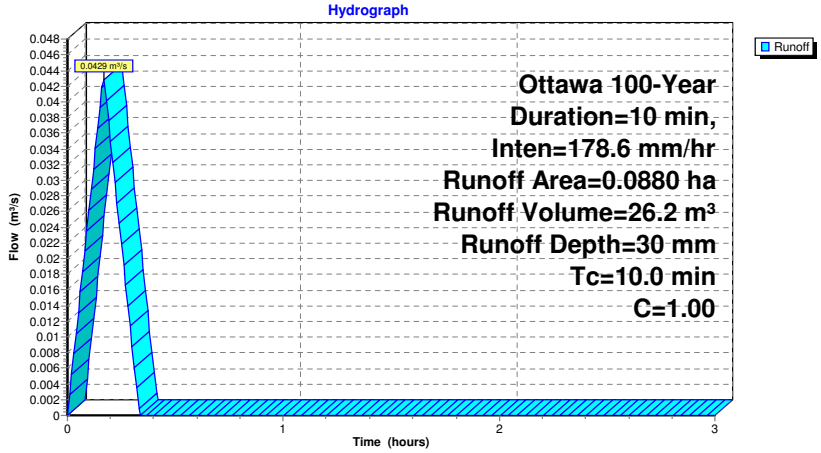
Runoff = 0.0429 m³/s @ 0.17 hrs, Volume= 26.2 m³, Depth= 30 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Ottawa 100-Year Duration=10 min, Inten=178.6 mm/hr

Area (ha)	C	Description
0.0880	1.00	S-103
0.0880		100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 44S: S-103



Summary for Subcatchment 46S: S-106

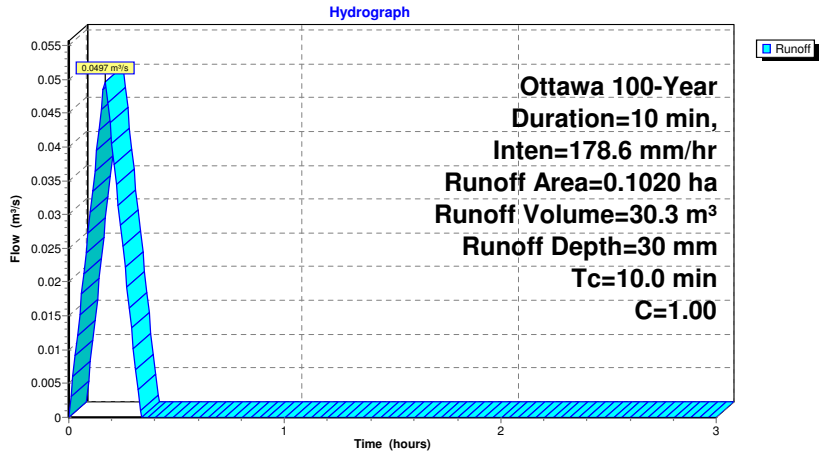
Runoff = 0.0497 m³/s @ 0.17 hrs, Volume= 30.3 m³, Depth= 30 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Ottawa 100-Year Duration=10 min, Inten=178.6 mm/hr

Area (ha)	C	Description
0.1020	1.00	S-106
0.1020		100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 46S: S-106



Summary for Subcatchment 48S: S-104

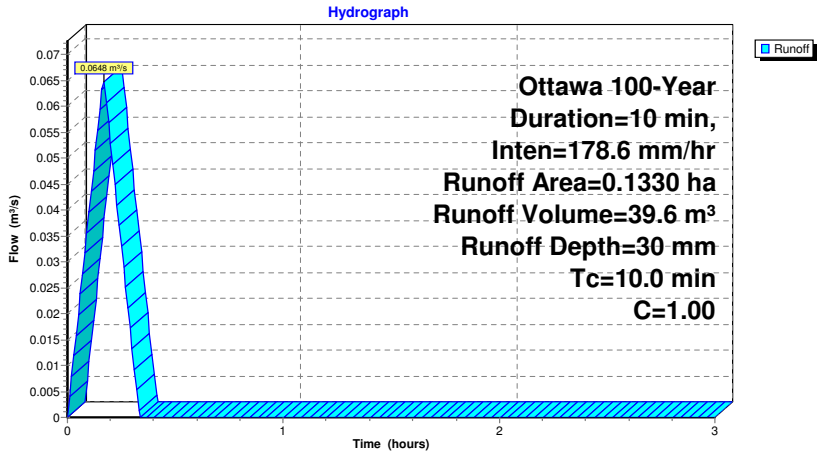
Runoff = 0.0648 m³/s @ 0.17 hrs, Volume= 39.6 m³, Depth= 30 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Ottawa 100-Year Duration=10 min, Inten=178.6 mm/hr

Area (ha)	C	Description
0.1330	1.00	S-104
0.1330		100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 48S: S-104



Summary for Subcatchment 50S: S-105

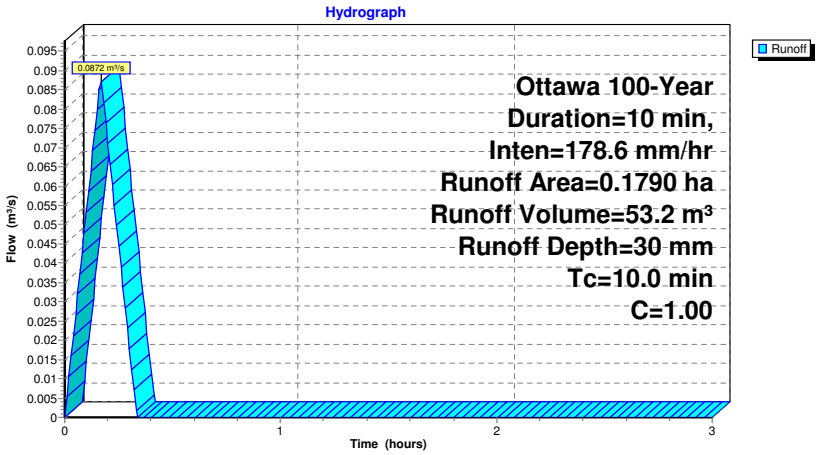
Runoff = 0.0872 m³/s @ 0.17 hrs, Volume= 53.2 m³, Depth= 30 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Ottawa 100-Year Duration=10 min, Inten=178.6 mm/hr

Area (ha)	C	Description
0.1790	1.00	S-105
0.1790		100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 50S: S-105



Summary for Pond 15P: Bldg A Roof

Inflow Area = 4,580.0 m², 100.00% Impervious, Inflow Depth = 30 mm for 100-Year event
Inflow = 0.2232 m³/s @ 0.17 hrs, Volume= 136.2 m³
Outflow = 0.0096 m³/s @ 0.03 hrs, Volume= 103.6 m³, Atten= 96%, Lag= 0.0 min
Primary = 0.0096 m³/s @ 0.03 hrs, Volume= 103.6 m³

Routing by Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 100.130 m @ 0.33 hrs Surf.Area= 2,894.7 m² Storage= 125.1 m³

Plug-Flow detention time= 82.2 min calculated for 103.6 m³ (76% of inflow)
Center-of-Mass det. time= 80.5 min (90.5 - 10.0)

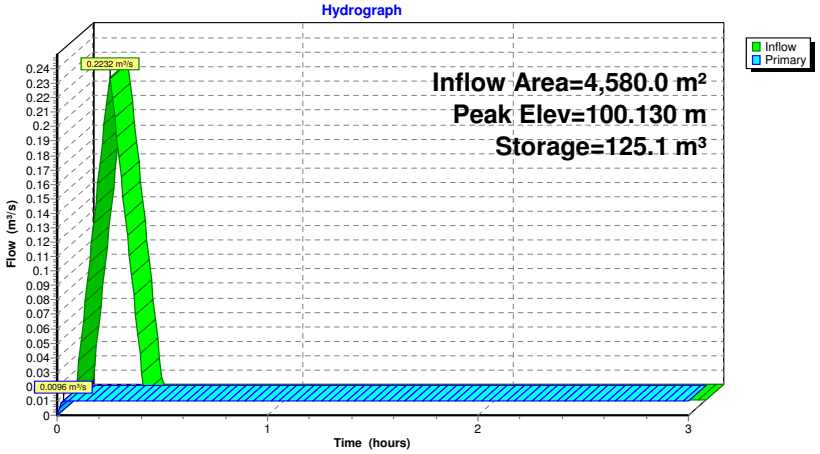
Volume	Invert	Avail.Storage	Storage Description
#1	100.000 m	775.0 m³	**Custom Stage Data (Pyramidal)** Listed below (Recalc) x 31

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)	Wet.Area (sq-meters)
100.000	0.0	0.0	0.0	0.0
100.150	125.0	6.3	6.3	125.0
100.300	125.0	18.7	25.0	131.8

Device	Routing	Invert	Outlet Devices
#1	Primary	100.000 m	**WATTS Accutrol_5-Closed X 31.00** Head (meters) 0.000 0.025 0.051 0.076 0.102 0.127 0.152 Disch. (m³/s) 0.00000 0.00031 0.00031 0.00031 0.00031 0.00031 0.00031

Primary OutFlow Max=0.0096 m³/s @ 0.03 hrs HW=100.030 m (Free Discharge)
↑**1=WATTS Accutrol_5-Closed** (Custom Controls 0.0096 m³/s)

Pond 15P: Bldg A Roof



Summary for Pond 20P: Bldg B Roof

Inflow Area = 2,380.0 m², 100.00% Impervious, Inflow Depth = 30 mm for 100-Year event
Inflow = 0.1160 m³/s @ 0.17 hrs, Volume= 70.8 m³
Outflow = 0.0050 m³/s @ 0.03 hrs, Volume= 53.5 m³, Atten= 96%, Lag= 0.0 min
Primary = 0.0050 m³/s @ 0.03 hrs, Volume= 53.5 m³

Routing by Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 100.130 m @ 0.33 hrs Surf.Area= 1,501.3 m² Storage= 65.0 m³

Plug-Flow detention time= 81.9 min calculated for 53.3 m³ (75% of inflow)
Center-of-Mass det. time= 80.5 min (90.5 - 10.0)

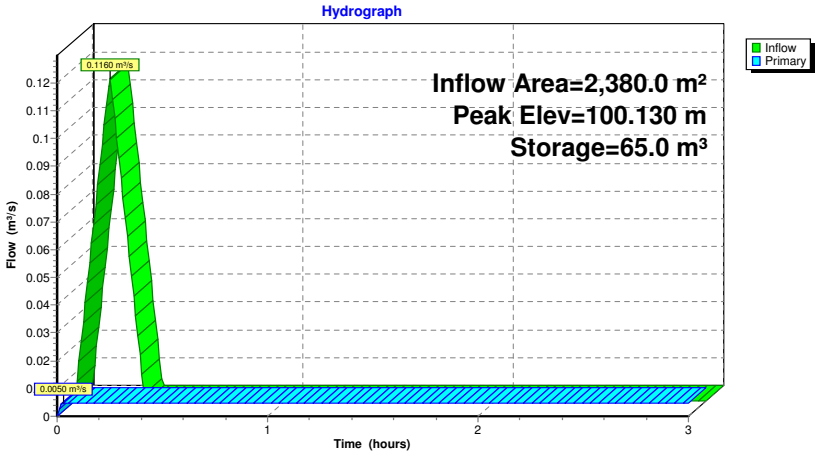
Volume	Invert	Avail.Storage	Storage Description
#1	100.000 m	400.0 m³	**Custom Stage Data (Pyramidal)** Listed below (Recalc) x 16

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)	Wet.Area (sq-meters)
100.000	0.0	0.0	0.0	0.0
100.150	125.0	6.3	6.3	125.0
100.300	125.0	18.7	25.0	131.8

Device	Routing	Invert	Outlet Devices
#1	Primary	100.000 m	**WATTS Accutrol_5-Closed X 16.00** Head (meters) 0.000 0.025 0.051 0.076 0.102 0.127 0.152 Disch. (m³/s) 0.00000 0.00031 0.00031 0.00031 0.00031 0.00031 0.00031

Primary OutFlow Max=0.0050 m³/s @ 0.03 hrs HW=100.030 m (Free Discharge)
↑**1=WATTS Accutrol_5-Closed** (Custom Controls 0.0050 m³/s)

Pond 20P: Bldg B Roof



Summary for Pond 21P: Bldg C Roof

Inflow Area = 1,810.0 m², 100.00% Impervious, Inflow Depth = 30 mm for 100-Year event
Inflow = 0.0882 m³/s @ 0.17 hrs, Volume= 53.8 m³
Outflow = 0.0037 m³/s @ 0.03 hrs, Volume= 40.1 m³, Atten= 96%, Lag= 0.0 min
Primary = 0.0037 m³/s @ 0.03 hrs, Volume= 40.1 m³

Routing by Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 100.131 m @ 0.33 hrs Surf.Area= 1,137.4 m² Storage= 49.5 m³

Plug-Flow detention time= 82.3 min calculated for 40.1 m³ (74% of inflow)
Center-of-Mass det. time= 80.5 min (90.5 - 10.0)

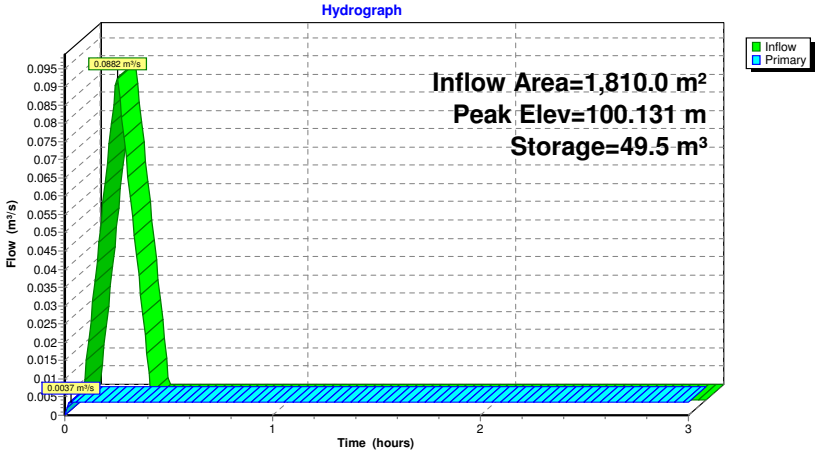
Volume	Invert	Avail.Storage	Storage Description
#1	100.000 m	300.0 m³	**Custom Stage Data (Pyramidal)** Listed below (Recalc) x 12

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)	Wet.Area (sq-meters)
100.000	0.0	0.0	0.0	0.0
100.150	125.0	6.3	6.3	125.0
100.300	125.0	18.7	25.0	131.8

Device	Routing	Invert	Outlet Devices
#1	Primary	100.000 m	**WATTS Accutrol_5-Closed X 12.00** Head (meters) 0.000 0.025 0.051 0.076 0.102 0.127 0.152 Disch. (m³/s) 0.00000 0.00031 0.00031 0.00031 0.00031 0.00031 0.00031

Primary OutFlow Max=0.0037 m³/s @ 0.03 hrs HW=100.030 m (Free Discharge)
↑**1=WATTS Accutrol_5-Closed** (Custom Controls 0.0037 m³/s)

Pond 21P: Bldg C Roof



Summary for Pond 40P: CBMH105

Inflow Area = 1,290.0 m², 100.00% Impervious, Inflow Depth = 30 mm for 100-Year event
Inflow = 0.0629 m³/s @ 0.17 hrs, Volume= 38.4 m³
Outflow = 0.0135 m³/s @ 0.30 hrs, Volume= 38.4 m³, Atten= 79%, Lag= 7.8 min
Primary = 0.0135 m³/s @ 0.30 hrs, Volume= 38.4 m³

Routing by Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 76.134 m @ 0.30 hrs Surf.Area= 261.7 m² Storage= 24.5 m³

Plug-Flow detention time= 15.7 min calculated for 38.3 m³ (100% of inflow)
Center-of-Mass det. time= 15.7 min (25.7 - 10.0)

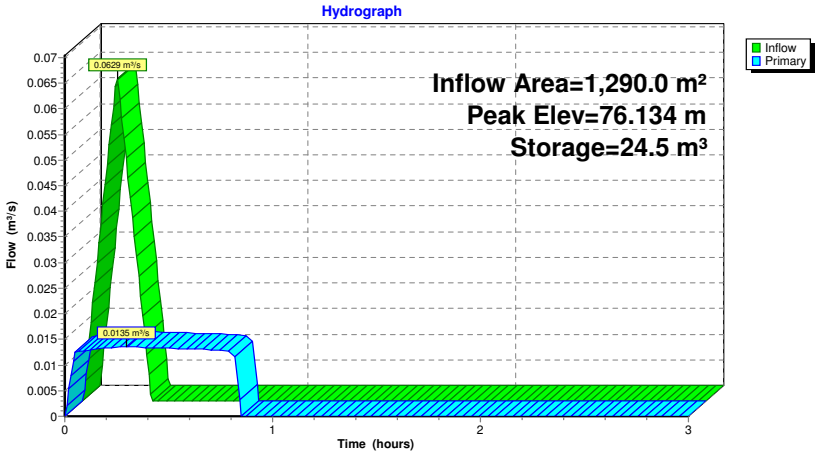
Volume	Invert	Avail.Storage	Storage Description
#1	74.776 m	64.6 m³	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
74.776	0.4	0.0	0.0
75.950	0.4	0.5	0.5
76.250	427.0	64.1	64.6

Device	Routing	Invert	Outlet Devices
#1	Primary	74.776 m	**75 mm Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.0135 m³/s @ 0.30 hrs HW=76.134 m (Free Discharge)
↑**1=Orifice/Grate** (Orifice Controls 0.0135 m³/s @ 3.05 m/s)

Pond 40P: CBMH105



Summary for Pond 43P: CB01

Inflow Area = 1,960.0 m², 100.00% Impervious, Inflow Depth = 30 mm for 100-Year event
Inflow = 0.0955 m³/s @ 0.17 hrs, Volume= 58.3 m³
Outflow = 0.0140 m³/s @ 0.31 hrs, Volume= 58.3 m³, Atten= 85%, Lag= 8.5 min
Primary = 0.0140 m³/s @ 0.31 hrs, Volume= 58.3 m³

Routing by Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 76.114 m @ 0.31 hrs Surf.Area= 521.7 m² Storage= 43.2 m³

Plug-Flow detention time= 26.3 min calculated for 58.1 m³ (100% of inflow)
Center-of-Mass det. time= 26.4 min (36.4 - 10.0)

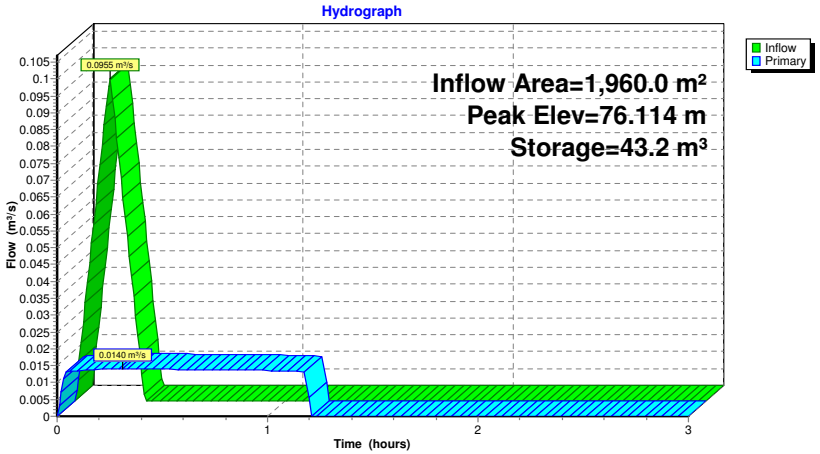
Volume	Invert	Avail.Storage	Storage Description
#1	74.651 m	144.0 m³	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
74.651	0.4	0.0	0.0
75.950	0.4	0.5	0.5
76.250	956.0	143.5	144.0

Device	Routing	Invert	Outlet Devices
#1	Primary	74.651 m	**75 mm Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.0140 m³/s @ 0.31 hrs HW=76.114 m (Free Discharge)
↑**1=Orifice/Grate** (Orifice Controls 0.0140 m³/s @ 3.17 m/s)

Pond 43P: CB01



Summary for Pond 45P: CB02

Inflow Area = 880.0 m², 100.00% Impervious, Inflow Depth = 30 mm for 100-Year event
Inflow = 0.0429 m³/s @ 0.17 hrs, Volume= 26.2 m³
Outflow = 0.0152 m³/s @ 0.28 hrs, Volume= 26.2 m³, Atten= 65%, Lag= 6.5 min
Primary = 0.0152 m³/s @ 0.28 hrs, Volume= 26.2 m³

Routing by Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 76.110 m @ 0.28 hrs Surf.Area= 139.2 m² Storage= 11.8 m³

Plug-Flow detention time= 6.8 min calculated for 26.1 m³ (100% of inflow)
Center-of-Mass det. time= 6.8 min (16.8 - 10.0)

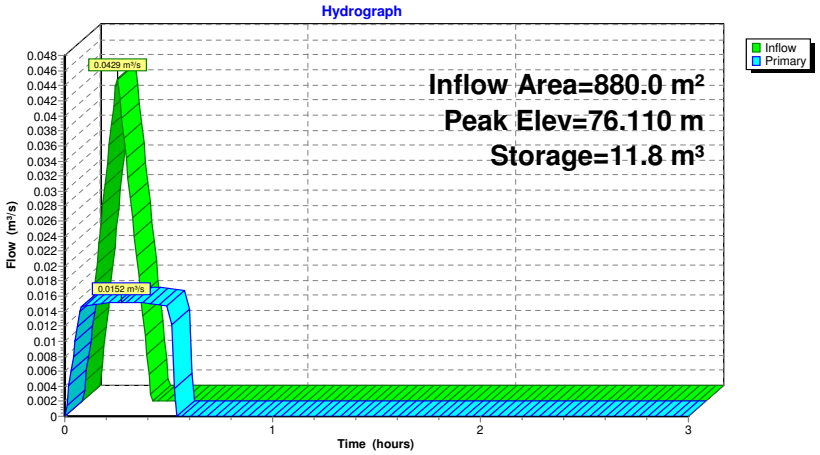
Volume	Invert	Avail.Storage	Storage Description
#1	74.396 m	18.1 m³	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
74.396	0.4	0.0	0.0
75.950	0.4	0.6	0.6
76.150	174.0	17.4	18.1

Device	Routing	Invert	Outlet Devices
#1	Primary	74.396 m	**75 mm Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.0152 m³/s @ 0.28 hrs HW=76.110 m (Free Discharge)
↑**1=Orifice/Grate** (Orifice Controls 0.0152 m³/s @ 3.44 m/s)

Pond 45P: CB02



Summary for Pond 47P: CB04

Inflow Area = 1,020.0 m², 100.00% Impervious, Inflow Depth = 30 mm for 100-Year event
Inflow = 0.0497 m³/s @ 0.17 hrs, Volume= 30.3 m³
Outflow = 0.0306 m³/s @ 0.23 hrs, Volume= 30.4 m³, Atten= 38%, Lag= 3.9 min
Primary = 0.0306 m³/s @ 0.23 hrs, Volume= 30.4 m³

Routing by Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 76.790 m @ 0.23 hrs Surf.Area= 94.0 m² Storage= 5.6 m³

Plug-Flow detention time= 1.6 min calculated for 30.3 m³ (100% of inflow)
Center-of-Mass det. time= 1.7 min (11.7 - 10.0)

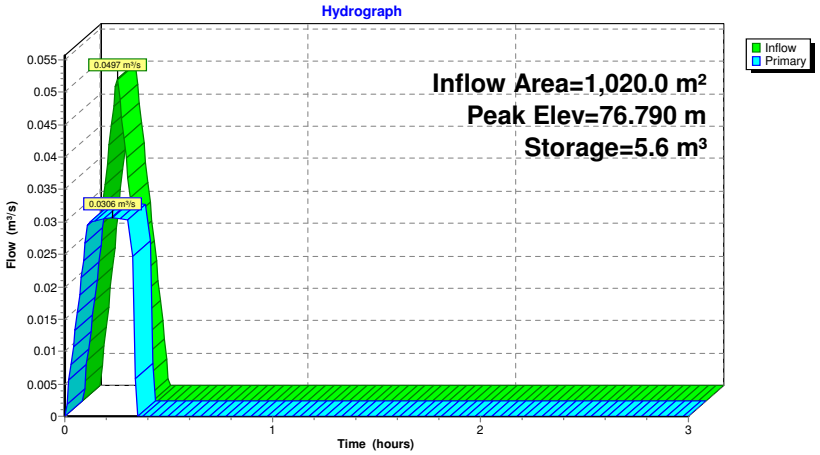
Volume	Invert	Avail.Storage	Storage Description
#1	74.594 m	11.4 m³	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
74.594	0.4	0.0	0.0
76.690	0.4	0.8	0.8
76.840	140.7	10.6	11.4

Device	Routing	Invert	Outlet Devices
#1	Primary	74.594 m	**100 mm Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.0306 m³/s @ 0.23 hrs HW=76.790 m (Free Discharge)
↑**1=Orifice/Grate** (Orifice Controls 0.0306 m³/s @ 3.89 m/s)

Pond 47P: CB04



Summary for Pond 49P: CBMH107

Inflow Area = 1,330.0 m², 100.00% Impervious, Inflow Depth = 30 mm for 100-Year event
Inflow = 0.0648 m³/s @ 0.17 hrs, Volume= 39.6 m³
Outflow = 0.0138 m³/s @ 0.30 hrs, Volume= 39.6 m³, Atten= 79%, Lag= 7.9 min
Primary = 0.0138 m³/s @ 0.30 hrs, Volume= 39.6 m³

Routing by Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 75.713 m @ 0.30 hrs Surf.Area= 234.3 m² Storage= 25.5 m³

Plug-Flow detention time= 15.9 min calculated for 39.4 m³ (100% of inflow)
Center-of-Mass det. time= 16.0 min (26.0 - 10.0)

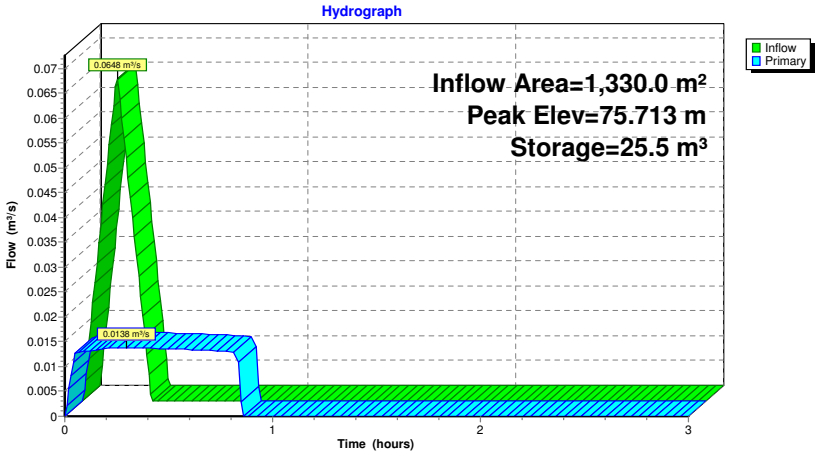
Volume	Invert	Avail.Storage	Storage Description
#1	74.297 m	50.0 m³	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
74.297	0.4	0.0	0.0
75.500	0.4	0.5	0.5
75.800	330.0	49.6	50.0

Device	Routing	Invert	Outlet Devices
#1	Primary	74.297 m	**75 mm Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.0138 m³/s @ 0.30 hrs HW=75.713 m (Free Discharge)
↑**1=Orifice/Grate** (Orifice Controls 0.0138 m³/s @ 3.12 m/s)

Pond 49P: CBMH107



Summary for Pond 51P: CB03

Inflow Area = 1,790.0 m², 100.00% Impervious, Inflow Depth = 30 mm for 100-Year event
Inflow = 0.0872 m³/s @ 0.17 hrs, Volume= 53.2 m³
Outflow = 0.0139 m³/s @ 0.31 hrs, Volume= 53.2 m³, Atten= 84%, Lag= 8.4 min
Primary = 0.0139 m³/s @ 0.31 hrs, Volume= 53.2 m³

Routing by Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 75.616 m @ 0.31 hrs Surf.Area= 455.7 m² Storage= 38.5 m³

Plug-Flow detention time= 23.7 min calculated for 53.1 m³ (100% of inflow)
Center-of-Mass det. time= 23.7 min (33.7 - 10.0)

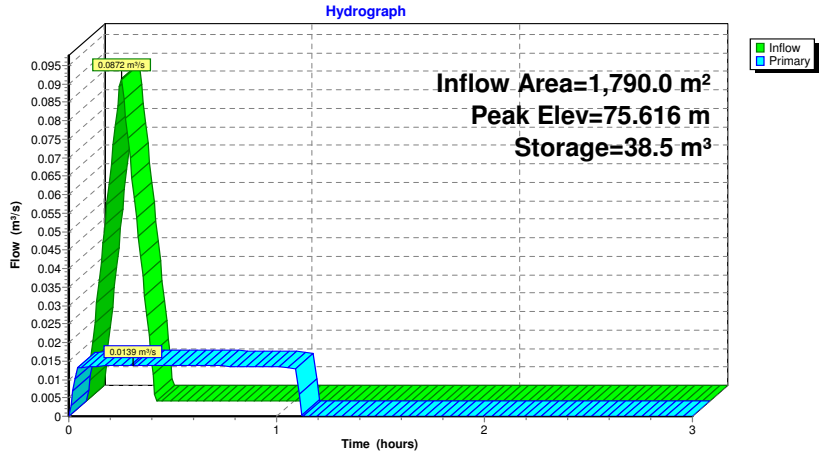
Volume	Invert	Avail.Storage	Storage Description
#1	74.183 m	123.7 m³	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
74.183	0.4	0.0	0.0
75.450	0.4	0.5	0.5
75.750	821.0	123.2	123.7

Device	Routing	Invert	Outlet Devices
#1	Primary	74.183 m	**75 mm Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.0139 m³/s @ 0.31 hrs HW=75.616 m (Free Discharge)
↑**1=Orifice/Grate** (Orifice Controls 0.0139 m³/s @ 3.14 m/s)

Pond 51P: CB03

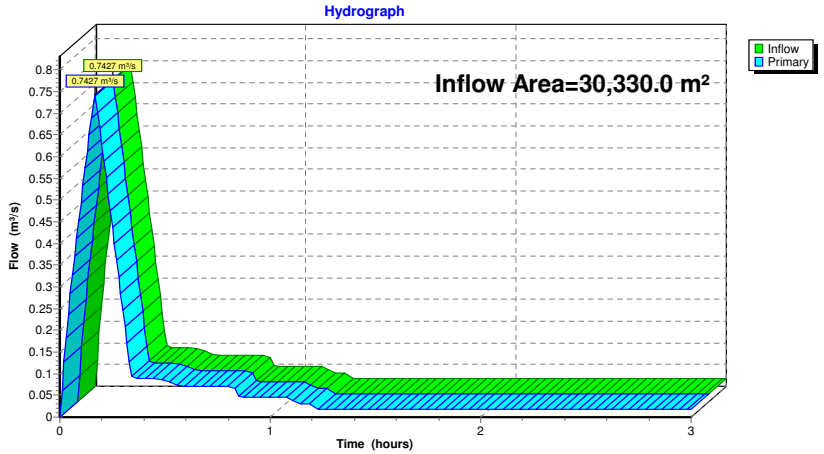


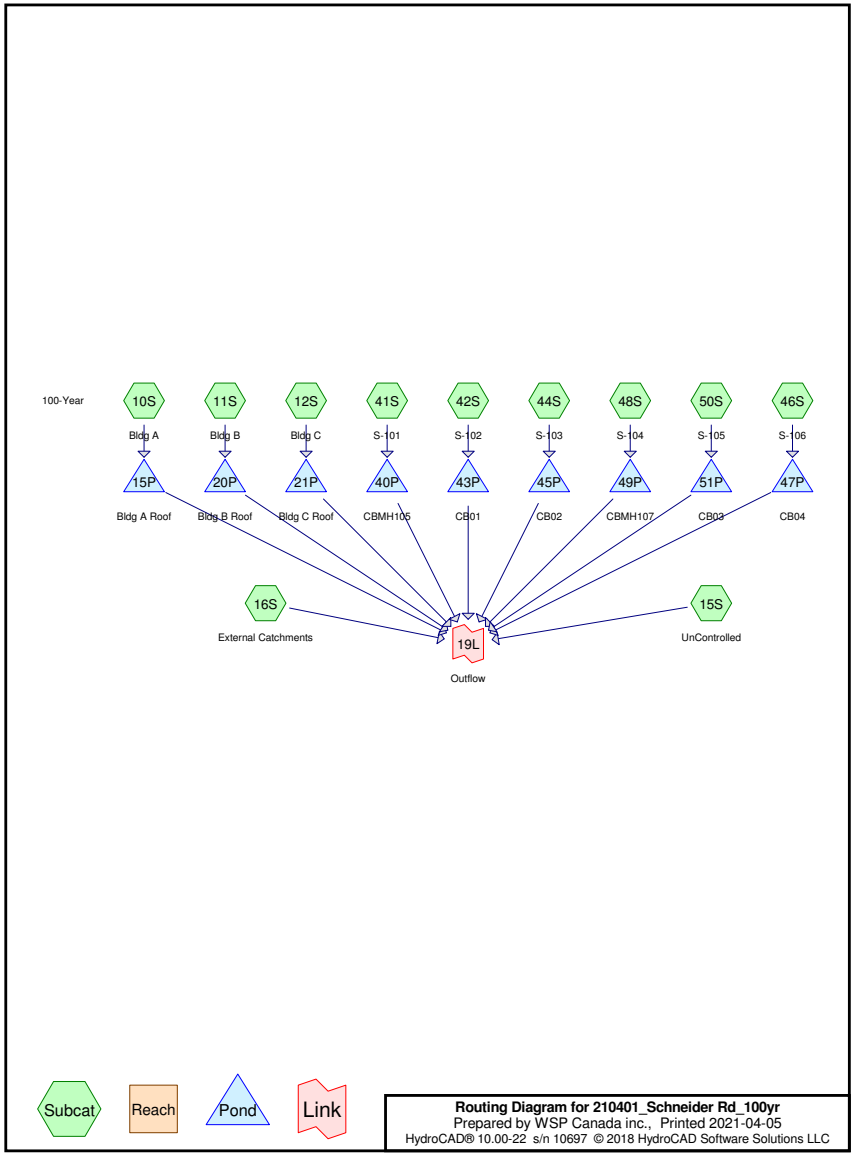
Summary for Link 19L: Outflow

Inflow Area = 30,330.0 m², 96.74% Impervious, Inflow Depth > 27 mm for 100-Year event
Inflow = 0.7427 m³/s @ 0.17 hrs, Volume= 824.7 m³
Primary = 0.7427 m³/s @ 0.17 hrs, Volume= 824.7 m³, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs

Link 19L: Outflow





Area Listing (selected nodes)

Area (sq-meters)	C	Description (subcatchment-numbers)
8,770.0	1.00	(10S, 11S, 12S)
1,290.0	1.00	S-101 (41S)
1,960.0	1.00	S-102 (42S)
880.0	1.00	S-103 (44S)
1,330.0	1.00	S-104 (48S)
1,790.0	1.00	S-105 (50S)
1,020.0	1.00	S-106 (46S)
5,900.0	1.00	S-EXT1 (16S)
1,850.0	1.00	S-EXT2 (16S)
1,530.0	1.00	S-EXT3 (16S)
900.0	1.00	S-EXT4 (16S)
250.0	1.00	S-U1 (15S)
940.0	1.00	S-U2 (15S)
80.0	1.00	S-U3 (15S)
850.0	1.00	S-U4 (15S)
520.0	0.35	S-U5 (15S)
470.0	0.74	S-U6 (15S)
30,330.0	**0.98**	**TOTAL AREA**

Time span=0.00-3.00 hrs, dt=0.01 hrs, 301 points
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 10S: Bldg A Runoff Area=0.4580 ha 100.00% Impervious Runoff Depth=37 mm
Tc=10.0 min C=1.00 Runoff=0.1750 m³/s 168.0 m³

Subcatchment 11S: Bldg B Runoff Area=0.2380 ha 100.00% Impervious Runoff Depth=37 mm
Tc=10.0 min C=1.00 Runoff=0.0909 m³/s 87.3 m³

Subcatchment 12S: Bldg C Runoff Area=0.1810 ha 100.00% Impervious Runoff Depth=37 mm
Tc=10.0 min C=1.00 Runoff=0.0692 m³/s 66.4 m³

Subcatchment 15S: UnControlled Runoff Area=0.3110 ha 68.17% Impervious Runoff Depth=31 mm
Tc=10.0 min C=0.85 Runoff=0.1010 m³/s 96.9 m³

Subcatchment 16S: External Runoff Area=1.0180 ha 100.00% Impervious Runoff Depth=37 mm
Tc=10.0 min C=1.00 Runoff=0.3890 m³/s 373.3 m³

Subcatchment 41S: S-101 Runoff Area=0.1290 ha 100.00% Impervious Runoff Depth=37 mm
Tc=10.0 min C=1.00 Runoff=0.0493 m³/s 47.3 m³

Subcatchment 42S: S-102 Runoff Area=0.1960 ha 100.00% Impervious Runoff Depth=37 mm
Tc=10.0 min C=1.00 Runoff=0.0749 m³/s 71.9 m³

Subcatchment 44S: S-103 Runoff Area=0.0880 ha 100.00% Impervious Runoff Depth=37 mm
Tc=10.0 min C=1.00 Runoff=0.0336 m³/s 32.3 m³

Subcatchment 46S: S-106 Runoff Area=0.1020 ha 100.00% Impervious Runoff Depth=37 mm
Tc=10.0 min C=1.00 Runoff=0.0390 m³/s 37.4 m³

Subcatchment 48S: S-104 Runoff Area=0.1330 ha 100.00% Impervious Runoff Depth=37 mm
Tc=10.0 min C=1.00 Runoff=0.0508 m³/s 48.8 m³

Subcatchment 50S: S-105 Runoff Area=0.1790 ha 100.00% Impervious Runoff Depth=37 mm
Tc=10.0 min C=1.00 Runoff=0.0684 m³/s 65.6 m³

Pond 15P: Bldg A Roof Peak Elev=100.139 m Storage=153.5 m³ Inflow=0.1750 m³/s 168.0 m³
Outflow=0.0096 m³/s 103.5 m³

Pond 20P: Bldg B Roof Peak Elev=100.139 m Storage=79.8 m³ Inflow=0.0909 m³/s 87.3 m³
Outflow=0.0050 m³/s 53.4 m³

Pond 21P: Bldg C Roof Peak Elev=100.140 m Storage=60.8 m³ Inflow=0.0692 m³/s 66.4 m³
Outflow=0.0037 m³/s 40.1 m³

Pond 40P: CBMH105 Peak Elev=76.151 m Storage=29.2 m³ Inflow=0.0493 m³/s 47.3 m³
Outflow=0.0136 m³/s 47.3 m³

Pond 43P: CB01 Peak Elev=76.130 m Storage=52.2 m³ Inflow=0.0749 m³/s 71.9 m³
Outflow=0.0141 m³/s 71.9 m³

Pond 45P: CB02 Peak Elev=76.121 m Storage=13.4 m³ Inflow=0.0336 m³/s 32.3 m³
Outflow=0.0153 m³/s 32.3 m³

Pond 47P: CB04 Peak Elev=76.784 m Storage=5.0 m³ Inflow=0.0390 m³/s 37.4 m³
Outflow=0.0305 m³/s 37.4 m³

Pond 49P: CBMH107 Peak Elev=75.732 m Storage=30.3 m³ Inflow=0.0508 m³/s 48.8 m³
Outflow=0.0139 m³/s 48.8 m³

Pond 51P: CB03 Peak Elev=75.633 m Storage=46.3 m³ Inflow=0.0684 m³/s 65.6 m³
Outflow=0.0140 m³/s 65.6 m³

Link 19L: Outflow Inflow=0.6087 m³/s 970.6 m³
Primary=0.6087 m³/s 970.6 m³

Total Runoff Area = 30,330.0 m² Runoff Volume = 1,095.1 m³ Average Runoff Depth = 36 mm
3.26% Pervious = 990.0 m² 96.74% Impervious = 29,340.0 m²

Summary for Subcatchment 10S: Bldg A

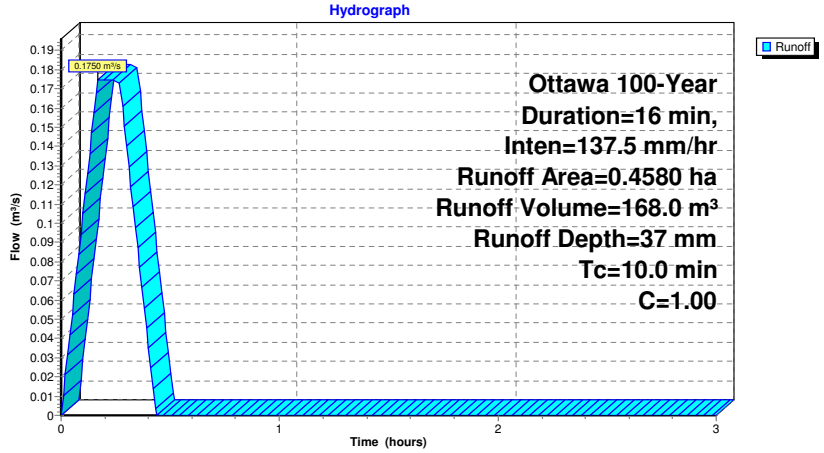
Runoff = 0.1750 m³/s @ 0.17 hrs, Volume= 168.0 m³, Depth= 37 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Ottawa 100-Year Duration=16 min, Inten=137.5 mm/hr

Area (ha)	C	Description
0.4580	1.00	
0.4580		100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 10S: Bldg A



Summary for Subcatchment 11S: Bldg B

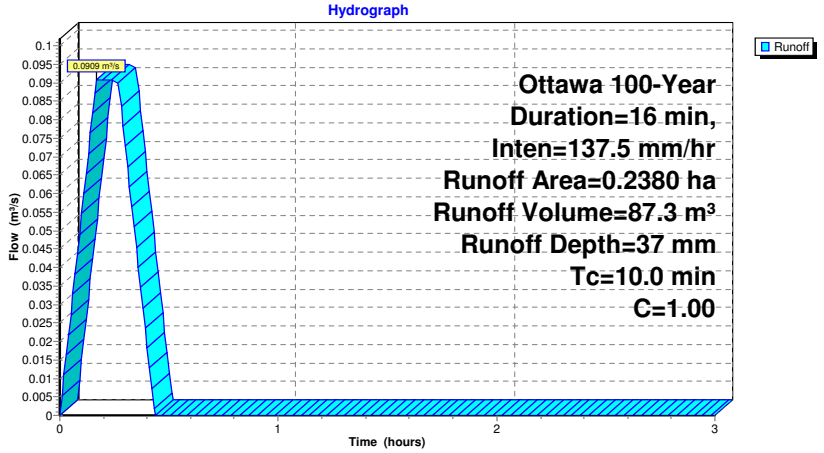
Runoff = 0.0909 m³/s @ 0.17 hrs, Volume= 87.3 m³, Depth= 37 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Ottawa 100-Year Duration=16 min, Inten=137.5 mm/hr

Area (ha)	C	Description
0.2380	1.00	
0.2380		100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 11S: Bldg B



Summary for Subcatchment 12S: Bldg C

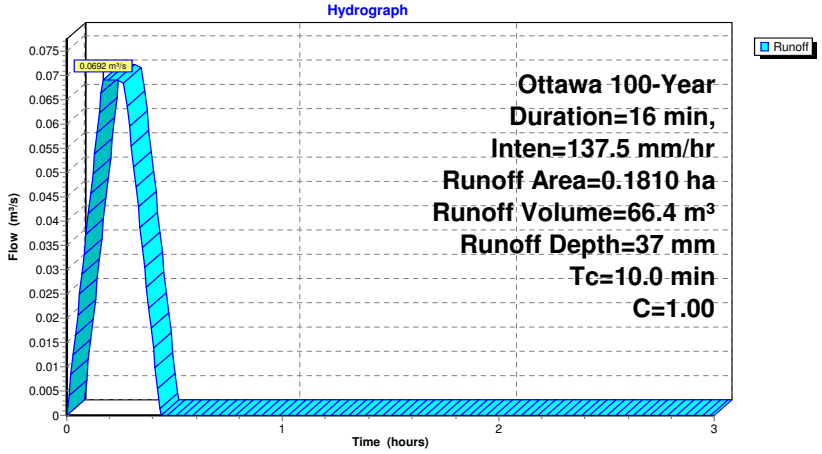
Runoff = 0.0692 m³/s @ 0.17 hrs, Volume= 66.4 m³, Depth= 37 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Ottawa 100-Year Duration=16 min, Inten=137.5 mm/hr

Area (ha)	C	Description
0.1810	1.00	
0.1810		100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 12S: Bldg C



Summary for Subcatchment 15S: UnControlled

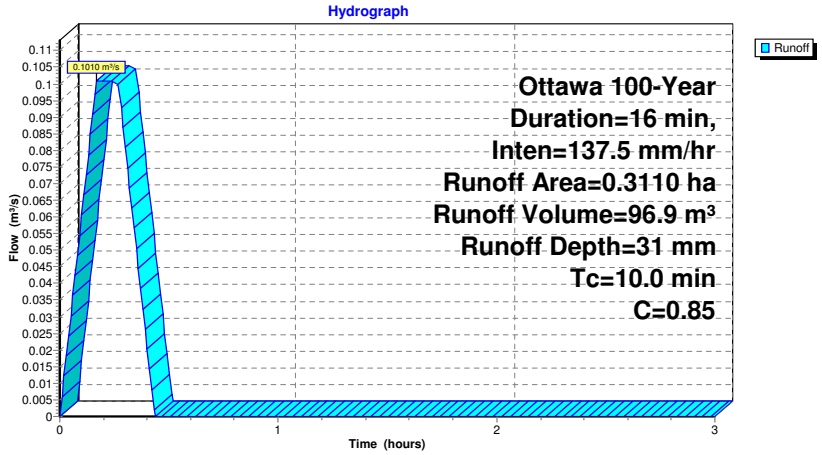
Runoff = 0.1010 m³/s @ 0.17 hrs, Volume= 96.9 m³, Depth= 31 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Ottawa 100-Year Duration=16 min, Inten=137.5 mm/hr

Area (ha)	C	Description
0.0250	1.00	S-U1
0.0940	1.00	S-U2
0.0080	1.00	S-U3
0.0850	1.00	S-U4
0.0520	0.35	S-U5
0.0470	0.74	S-U6
0.3110	0.85	Weighted Average
0.0990		31.83% Pervious Area
0.2120		68.17% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 15S: UnControlled



Summary for Subcatchment 16S: External Catchments

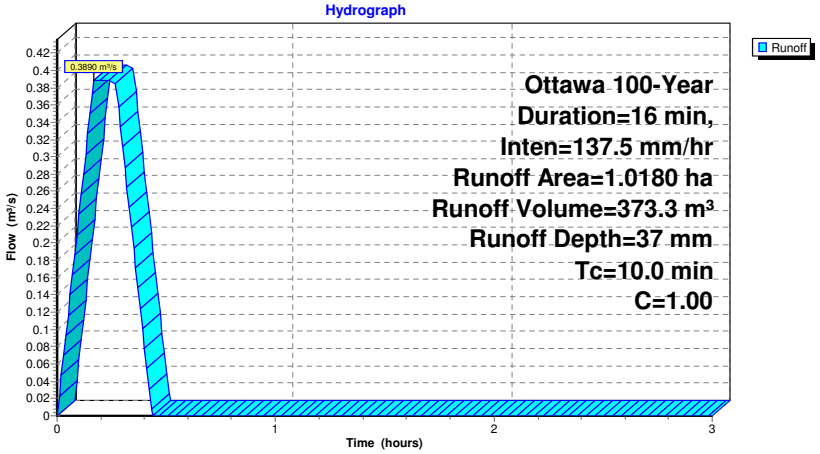
Runoff = 0.3890 m³/s @ 0.17 hrs, Volume= 373.3 m³, Depth= 37 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Ottawa 100-Year Duration=16 min, Inten=137.5 mm/hr

Area (ha)	C	Description
0.5900	1.00	S-EXT1
0.1850	1.00	S-EXT2
0.1530	1.00	S-EXT3
0.0900	1.00	S-EXT4
1.0180	1.00	Weighted Average
1.0180		100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 16S: External Catchments



Summary for Subcatchment 41S: S-101

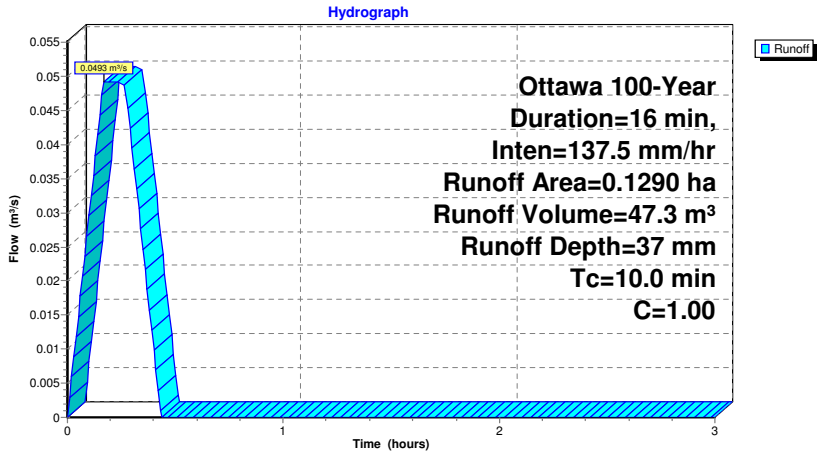
Runoff = 0.0493 m³/s @ 0.17 hrs, Volume= 47.3 m³, Depth= 37 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Ottawa 100-Year Duration=16 min, Inten=137.5 mm/hr

Area (ha)	C	Description
0.1290	1.00	S-101
0.1290		100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 41S: S-101



Summary for Subcatchment 42S: S-102

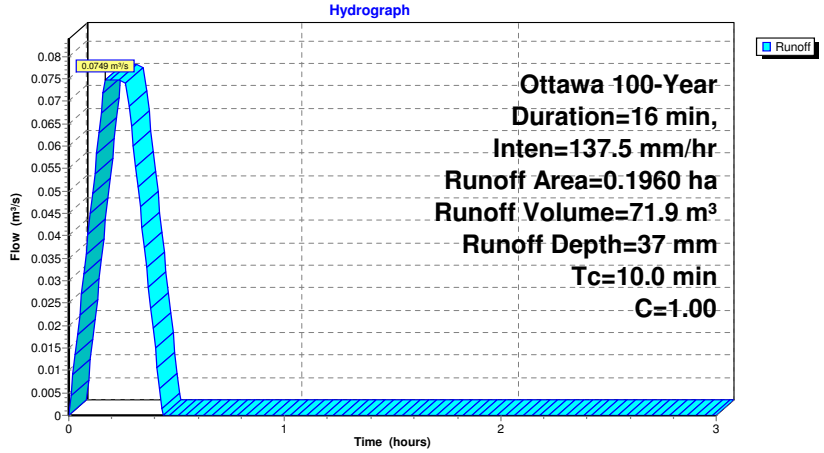
Runoff = 0.0749 m³/s @ 0.17 hrs, Volume= 71.9 m³, Depth= 37 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Ottawa 100-Year Duration=16 min, Inten=137.5 mm/hr

Area (ha)	C	Description
0.1960	1.00	S-102
0.1960		100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 42S: S-102



Summary for Subcatchment 44S: S-103

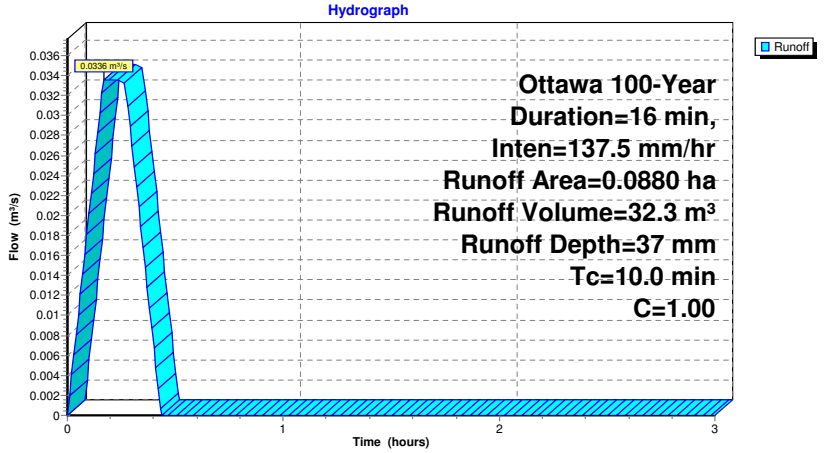
Runoff = 0.0336 m³/s @ 0.17 hrs, Volume= 32.3 m³, Depth= 37 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Ottawa 100-Year Duration=16 min, Inten=137.5 mm/hr

Area (ha)	C	Description
0.0880	1.00	S-103
0.0880		100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 44S: S-103



Summary for Subcatchment 46S: S-106

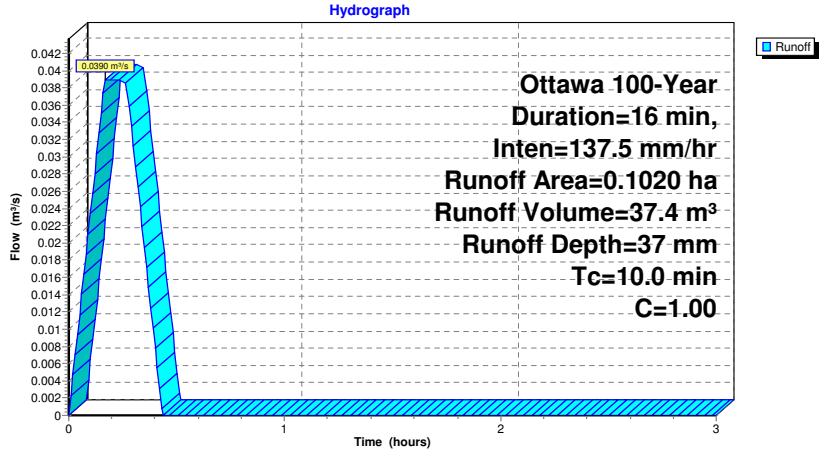
Runoff = 0.0390 m³/s @ 0.17 hrs, Volume= 37.4 m³, Depth= 37 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Ottawa 100-Year Duration=16 min, Inten=137.5 mm/hr

Area (ha)	C	Description
0.1020	1.00	S-106
0.1020		100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 46S: S-106



Summary for Subcatchment 48S: S-104

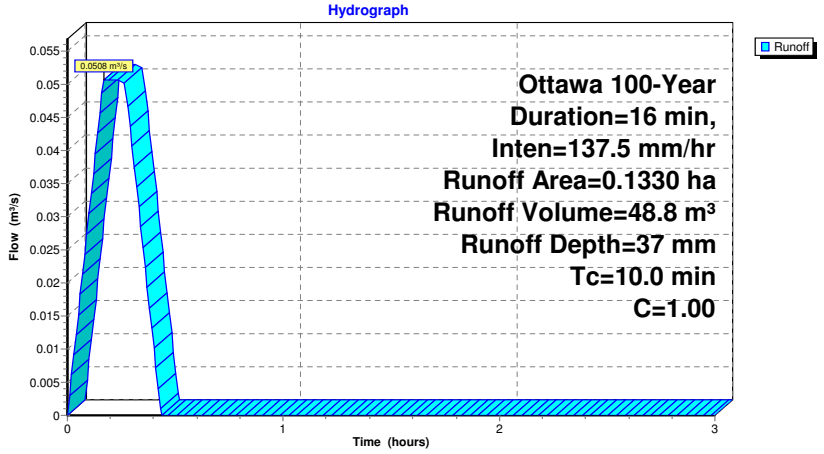
Runoff = 0.0508 m³/s @ 0.17 hrs, Volume= 48.8 m³, Depth= 37 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Ottawa 100-Year Duration=16 min, Inten=137.5 mm/hr

Area (ha)	C	Description
0.1330	1.00	S-104
0.1330		100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 48S: S-104



Summary for Subcatchment 50S: S-105

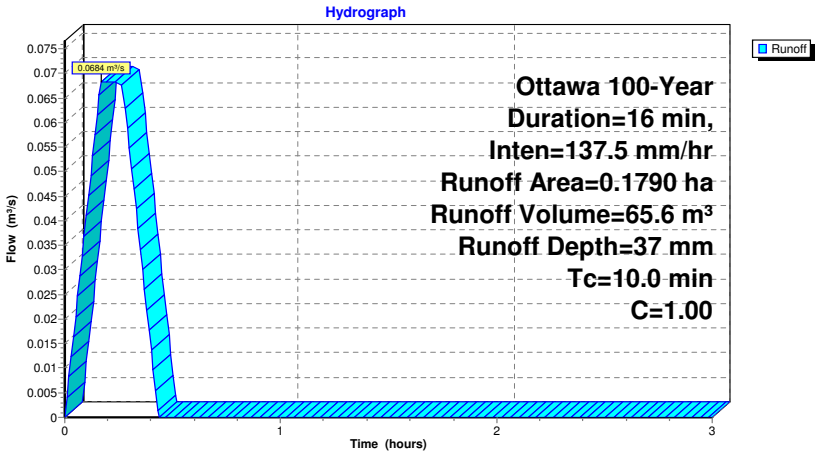
Runoff = 0.0684 m³/s @ 0.17 hrs, Volume= 65.6 m³, Depth= 37 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Ottawa 100-Year Duration=16 min, Inten=137.5 mm/hr

Area (ha)	C	Description
0.1790	1.00	S-105
0.1790		100.00% Impervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
10.0					**Direct Entry,**

Subcatchment 50S: S-105



Summary for Pond 15P: Bldg A Roof

Inflow Area = 4,580.0 m², 100.00% Impervious, Inflow Depth = 37 mm for 100-Year event
Inflow = 0.1750 m³/s @ 0.17 hrs, Volume= 168.0 m³
Outflow = 0.0096 m³/s @ 0.03 hrs, Volume= 103.5 m³, Atten= 95%, Lag= 0.0 min
Primary = 0.0096 m³/s @ 0.03 hrs, Volume= 103.5 m³

Routing by Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 100.139 m @ 0.42 hrs Surf.Area= 3,317.2 m² Storage= 153.5 m³

Plug-Flow detention time= 81.0 min calculated for 103.5 m³ (62% of inflow)
Center-of-Mass det. time= 77.5 min (90.5 - 13.0)

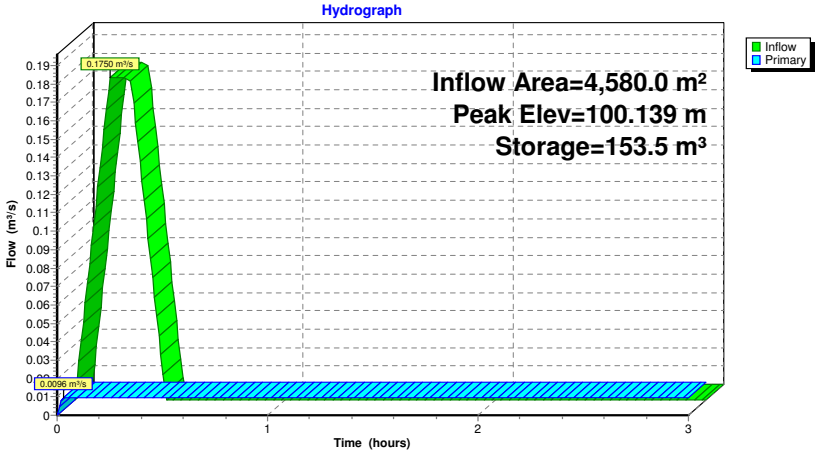
Volume	Invert	Avail.Storage	Storage Description
#1	100.000 m	775.0 m³	**Custom Stage Data (Pyramidal)** Listed below (Recalc) x 31

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)	Wet.Area (sq-meters)
100.000	0.0	0.0	0.0	0.0
100.150	125.0	6.3	6.3	125.0
100.300	125.0	18.7	25.0	131.8

Device	Routing	Invert	Outlet Devices
#1	Primary	100.000 m	**WATTS Accutrol_5-Closed X 31.00** Head (meters) 0.000 0.025 0.051 0.076 0.102 0.127 0.152 Disch. (m³/s) 0.00000 0.00031 0.00031 0.00031 0.00031 0.00031 0.00031

Primary OutFlow Max=0.0096 m³/s @ 0.03 hrs HW=100.027 m (Free Discharge)
↑**1=WATTS Accutrol_5-Closed** (Custom Controls 0.0096 m³/s)

Pond 15P: Bldg A Roof



Summary for Pond 20P: Bldg B Roof

Inflow Area = 2,380.0 m², 100.00% Impervious, Inflow Depth = 37 mm for 100-Year event
Inflow = 0.0909 m³/s @ 0.17 hrs, Volume= 87.3 m³
Outflow = 0.0050 m³/s @ 0.03 hrs, Volume= 53.4 m³, Atten= 95%, Lag= 0.0 min
Primary = 0.0050 m³/s @ 0.03 hrs, Volume= 53.4 m³

Routing by Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 100.139 m @ 0.42 hrs Surf.Area= 1,720.5 m² Storage= 79.8 m³

Plug-Flow detention time= 80.8 min calculated for 53.3 m³ (61% of inflow)
Center-of-Mass det. time= 77.5 min (90.5 - 13.0)

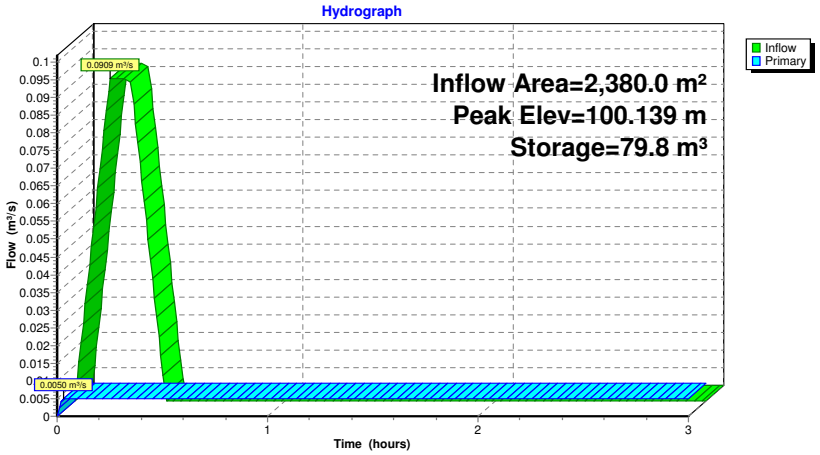
Volume	Invert	Avail.Storage	Storage Description
#1	100.000 m	400.0 m³	**Custom Stage Data (Pyramidal)** Listed below (Recalc) x 16

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)	Wet.Area (sq-meters)
100.000	0.0	0.0	0.0	0.0
100.150	125.0	6.3	6.3	125.0
100.300	125.0	18.7	25.0	131.8

Device	Routing	Invert	Outlet Devices
#1	Primary	100.000 m	**WATTS Accutrol_5-Closed X 16.00** Head (meters) 0.000 0.025 0.051 0.076 0.102 0.127 0.152 Disch. (m³/s) 0.00000 0.00031 0.00031 0.00031 0.00031 0.00031 0.00031

Primary OutFlow Max=0.0050 m³/s @ 0.03 hrs HW=100.027 m (Free Discharge)
↑**1=WATTS Accutrol_5-Closed** (Custom Controls 0.0050 m³/s)

Pond 20P: Bldg B Roof



Summary for Pond 21P: Bldg C Roof

Inflow Area = 1,810.0 m², 100.00% Impervious, Inflow Depth = 37 mm for 100-Year event
Inflow = 0.0692 m³/s @ 0.17 hrs, Volume= 66.4 m³
Outflow = 0.0037 m³/s @ 0.03 hrs, Volume= 40.1 m³, Atten= 95%, Lag= 0.0 min
Primary = 0.0037 m³/s @ 0.03 hrs, Volume= 40.1 m³

Routing by Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 100.140 m @ 0.42 hrs Surf.Area= 1,303.5 m² Storage= 60.8 m³

Plug-Flow detention time= 81.1 min calculated for 40.1 m³ (60% of inflow)
Center-of-Mass det. time= 77.5 min (90.5 - 13.0)

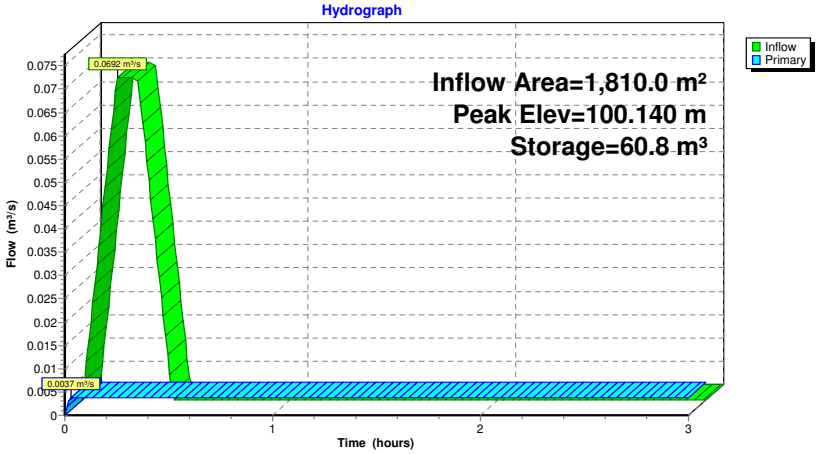
Volume	Invert	Avail.Storage	Storage Description
#1	100.000 m	300.0 m³	**Custom Stage Data (Pyramidal)** Listed below (Recalc) x 12

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)	Wet.Area (sq-meters)
100.000	0.0	0.0	0.0	0.0
100.150	125.0	6.3	6.3	125.0
100.300	125.0	18.7	25.0	131.8

Device	Routing	Invert	Outlet Devices
#1	Primary	100.000 m	**WATTS Accutrol_5-Closed X 12.00** Head (meters) 0.000 0.025 0.051 0.076 0.102 0.127 0.152 Disch. (m³/s) 0.00000 0.00031 0.00031 0.00031 0.00031 0.00031 0.00031

Primary OutFlow Max=0.0037 m³/s @ 0.03 hrs HW=100.027 m (Free Discharge)
↑**1=WATTS Accutrol_5-Closed** (Custom Controls 0.0037 m³/s)

Pond 21P: Bldg C Roof



Summary for Pond 40P: CBMH105

Inflow Area = 1,290.0 m², 100.00% Impervious, Inflow Depth = 37 mm for 100-Year event
Inflow = 0.0493 m³/s @ 0.17 hrs, Volume= 47.3 m³
Outflow = 0.0136 m³/s @ 0.39 hrs, Volume= 47.3 m³, Atten= 72%, Lag= 13.0 min
Primary = 0.0136 m³/s @ 0.39 hrs, Volume= 47.3 m³

Routing by Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 76.151 m @ 0.39 hrs Surf.Area= 285.7 m² Storage= 29.2 m³

Plug-Flow detention time= 18.5 min calculated for 47.2 m³ (100% of inflow)
Center-of-Mass det. time= 18.6 min (31.6 - 13.0)

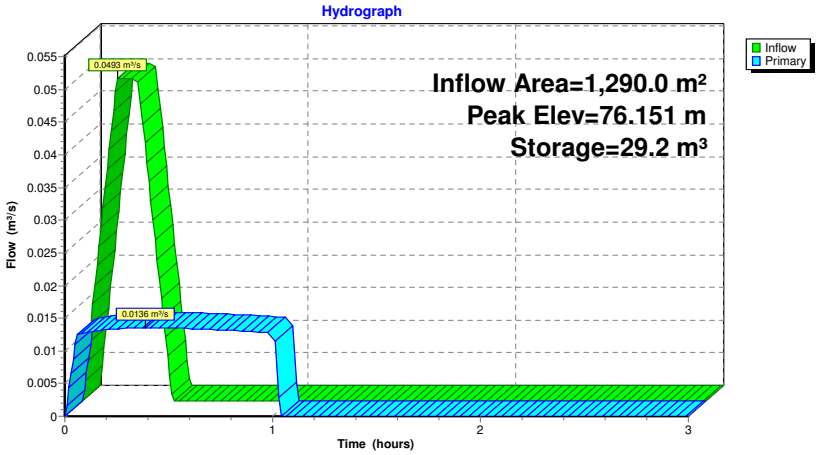
Volume	Invert	Avail.Storage	Storage Description
#1	74.776 m	64.6 m³	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
74.776	0.4	0.0	0.0
75.950	0.4	0.5	0.5
76.250	427.0	64.1	64.6

Device	Routing	Invert	Outlet Devices
#1	Primary	74.776 m	**75 mm Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.0136 m³/s @ 0.39 hrs HW=76.151 m (Free Discharge)
↑**1=Orifice/Grate** (Orifice Controls 0.0136 m³/s @ 3.07 m/s)

Pond 40P: CBMH105



Summary for Pond 43P: CB01

Inflow Area = 1,960.0 m², 100.00% Impervious, Inflow Depth = 37 mm for 100-Year event
Inflow = 0.0749 m³/s @ 0.17 hrs, Volume= 71.9 m³
Outflow = 0.0141 m³/s @ 0.40 hrs, Volume= 71.9 m³, Atten= 81%, Lag= 13.9 min
Primary = 0.0141 m³/s @ 0.40 hrs, Volume= 71.9 m³

Routing by Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 76.130 m @ 0.40 hrs Surf.Area= 573.6 m² Storage= 52.2 m³

Plug-Flow detention time= 31.5 min calculated for 71.6 m³ (100% of inflow)
Center-of-Mass det. time= 31.6 min (44.6 - 13.0)

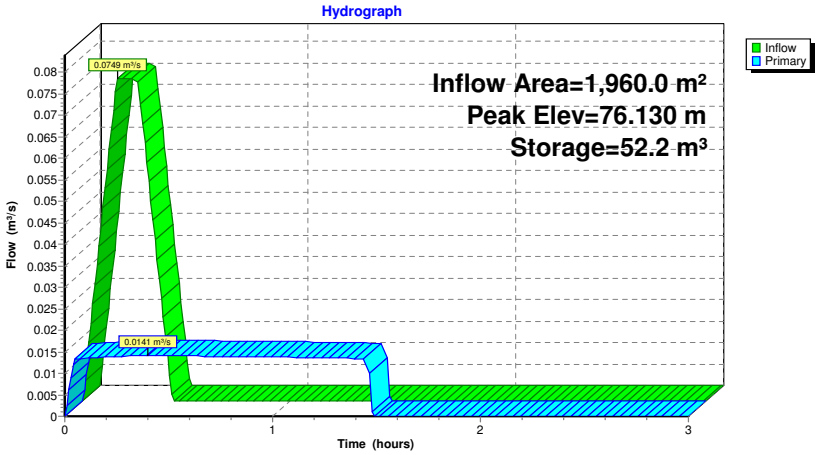
Volume	Invert	Avail.Storage	Storage Description
#1	74.651 m	144.0 m³	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
74.651	0.4	0.0	0.0
75.950	0.4	0.5	0.5
76.250	956.0	143.5	144.0

Device	Routing	Invert	Outlet Devices
#1	Primary	74.651 m	**75 mm Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.0141 m³/s @ 0.40 hrs HW=76.130 m (Free Discharge)
↑**1=Orifice/Grate** (Orifice Controls 0.0141 m³/s @ 3.19 m/s)

Pond 43P: CB01



Summary for Pond 45P: CB02

Inflow Area = 880.0 m², 100.00% Impervious, Inflow Depth = 37 mm for 100-Year event
Inflow = 0.0336 m³/s @ 0.17 hrs, Volume= 32.3 m³
Outflow = 0.0153 m³/s @ 0.36 hrs, Volume= 32.3 m³, Atten= 55%, Lag= 11.3 min
Primary = 0.0153 m³/s @ 0.36 hrs, Volume= 32.3 m³

Routing by Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 76.121 m @ 0.36 hrs Surf.Area= 148.9 m² Storage= 13.4 m³

Plug-Flow detention time= 7.7 min calculated for 32.2 m³ (100% of inflow)
Center-of-Mass det. time= 7.7 min (20.7 - 13.0)

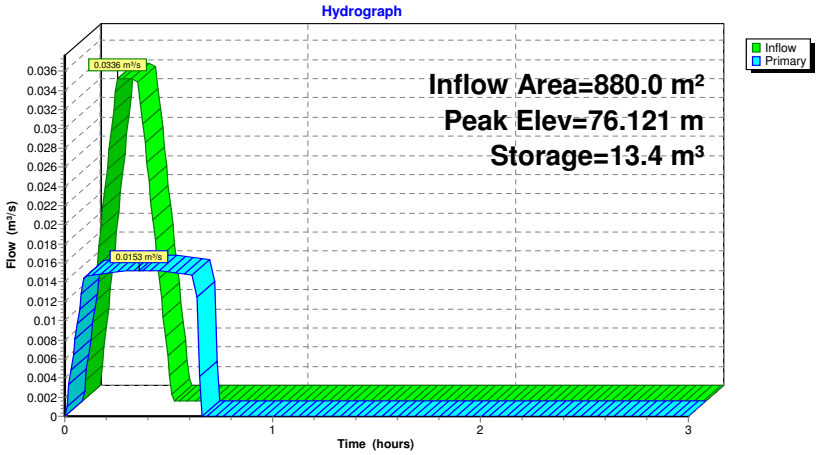
Volume	Invert	Avail.Storage	Storage Description
#1	74.396 m	18.1 m³	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
74.396	0.4	0.0	0.0
75.950	0.4	0.6	0.6
76.150	174.0	17.4	18.1

Device	Routing	Invert	Outlet Devices
#1	Primary	74.396 m	**75 mm Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.0153 m³/s @ 0.36 hrs HW=76.121 m (Free Discharge)
↑**1=Orifice/Grate** (Orifice Controls 0.0153 m³/s @ 3.45 m/s)

Pond 45P: CB02



Summary for Pond 47P: CB04

Inflow Area = 1,020.0 m², 100.00% Impervious, Inflow Depth = 37 mm for 100-Year event
Inflow = 0.0390 m³/s @ 0.17 hrs, Volume= 37.4 m³
Outflow = 0.0305 m³/s @ 0.30 hrs, Volume= 37.4 m³, Atten= 22%, Lag= 8.0 min
Primary = 0.0305 m³/s @ 0.30 hrs, Volume= 37.4 m³

Routing by Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 76.784 m @ 0.30 hrs Surf.Area= 88.0 m² Storage= 5.0 m³

Plug-Flow detention time= 1.5 min calculated for 37.3 m³ (100% of inflow)
Center-of-Mass det. time= 1.5 min (14.5 - 13.0)

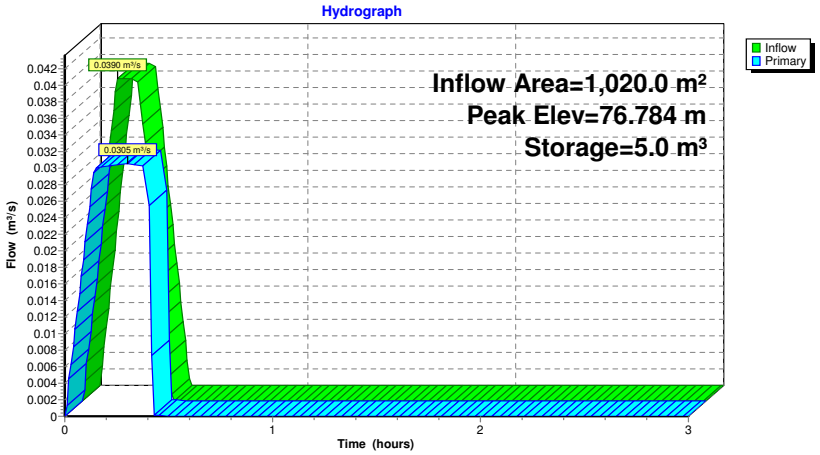
Volume	Invert	Avail.Storage	Storage Description
#1	74.594 m	11.4 m³	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
74.594	0.4	0.0	0.0
76.690	0.4	0.8	0.8
76.840	140.7	10.6	11.4

Device	Routing	Invert	Outlet Devices
#1	Primary	74.594 m	**100 mm Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.0305 m³/s @ 0.30 hrs HW=76.784 m (Free Discharge)
↑**1=Orifice/Grate** (Orifice Controls 0.0305 m³/s @ 3.89 m/s)

Pond 47P: CB04



Summary for Pond 49P: CBMH107

Inflow Area = 1,330.0 m², 100.00% Impervious, Inflow Depth = 37 mm for 100-Year event
Inflow = 0.0508 m³/s @ 0.17 hrs, Volume= 48.8 m³
Outflow = 0.0139 m³/s @ 0.39 hrs, Volume= 48.8 m³, Atten= 73%, Lag= 13.1 min
Primary = 0.0139 m³/s @ 0.39 hrs, Volume= 48.8 m³

Routing by Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 75.732 m @ 0.39 hrs Surf.Area= 255.8 m² Storage= 30.3 m³

Plug-Flow detention time= 18.8 min calculated for 48.6 m³ (100% of inflow)
Center-of-Mass det. time= 18.9 min (31.9 - 13.0)

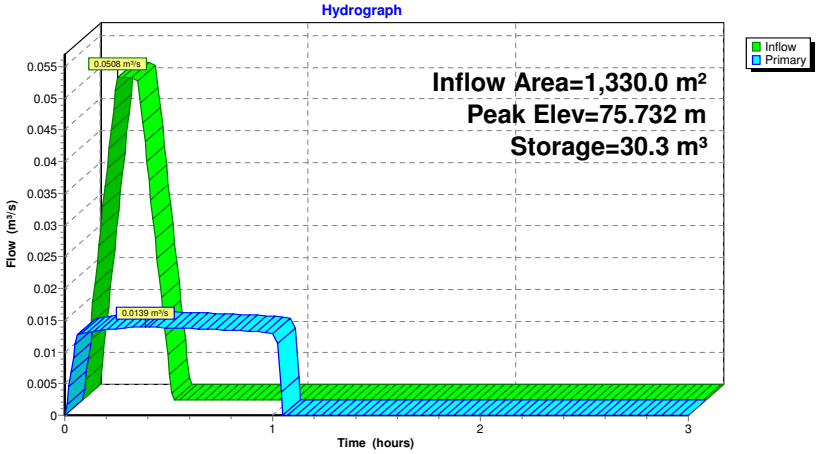
Volume	Invert	Avail.Storage	Storage Description
#1	74.297 m	50.0 m³	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
74.297	0.4	0.0	0.0
75.500	0.4	0.5	0.5
75.800	330.0	49.6	50.0

Device	Routing	Invert	Outlet Devices
#1	Primary	74.297 m	**75 mm Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.0139 m³/s @ 0.39 hrs HW=75.732 m (Free Discharge)
↑**1=Orifice/Grate** (Orifice Controls 0.0139 m³/s @ 3.14 m/s)

Pond 49P: CBMH107



Summary for Pond 51P: CB03

Inflow Area = 1,790.0 m², 100.00% Impervious, Inflow Depth = 37 mm for 100-Year event
Inflow = 0.0684 m³/s @ 0.17 hrs, Volume= 65.6 m³
Outflow = 0.0140 m³/s @ 0.40 hrs, Volume= 65.6 m³, Atten= 80%, Lag= 13.8 min
Primary = 0.0140 m³/s @ 0.40 hrs, Volume= 65.6 m³

Routing by Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
Peak Elev= 75.633 m @ 0.40 hrs Surf.Area= 500.5 m² Storage= 46.3 m³

Plug-Flow detention time= 28.3 min calculated for 65.4 m³ (100% of inflow)
Center-of-Mass det. time= 28.4 min (41.4 - 13.0)

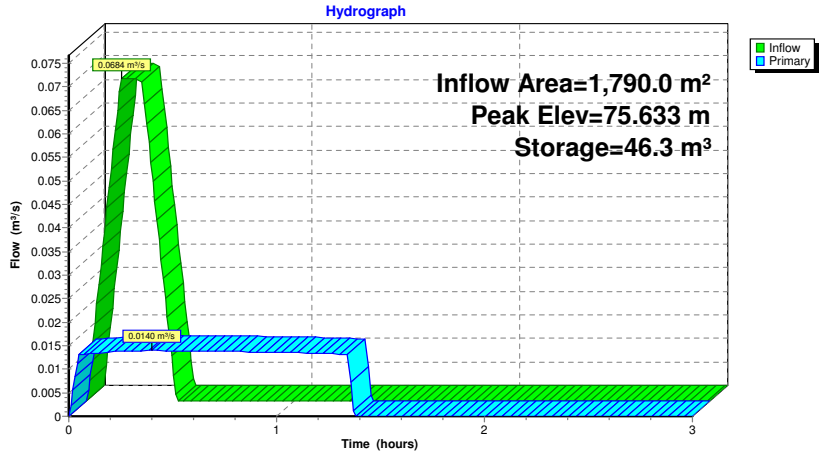
Volume	Invert	Avail.Storage	Storage Description
#1	74.183 m	123.7 m³	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (meters)	Surf.Area (sq-meters)	Inc.Store (cubic-meters)	Cum.Store (cubic-meters)
74.183	0.4	0.0	0.0
75.450	0.4	0.5	0.5
75.750	821.0	123.2	123.7

Device	Routing	Invert	Outlet Devices
#1	Primary	74.183 m	**75 mm Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.0140 m³/s @ 0.40 hrs HW=75.633 m (Free Discharge)
↑**1=Orifice/Grate** (Orifice Controls 0.0140 m³/s @ 3.16 m/s)

Pond 51P: CB03

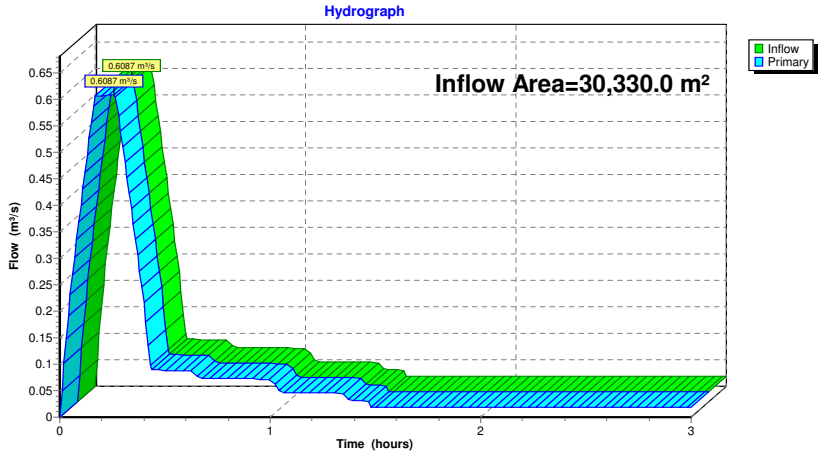


Summary for Link 19L: Outflow

Inflow Area = 30,330.0 m², 96.74% Impervious, Inflow Depth > 32 mm for 100-Year event
Inflow = 0.6087 m³/s @ 0.26 hrs, Volume= 970.6 m³
Primary = 0.6087 m³/s @ 0.26 hrs, Volume= 970.6 m³, Atten= 0%, Lag= 0.0 min

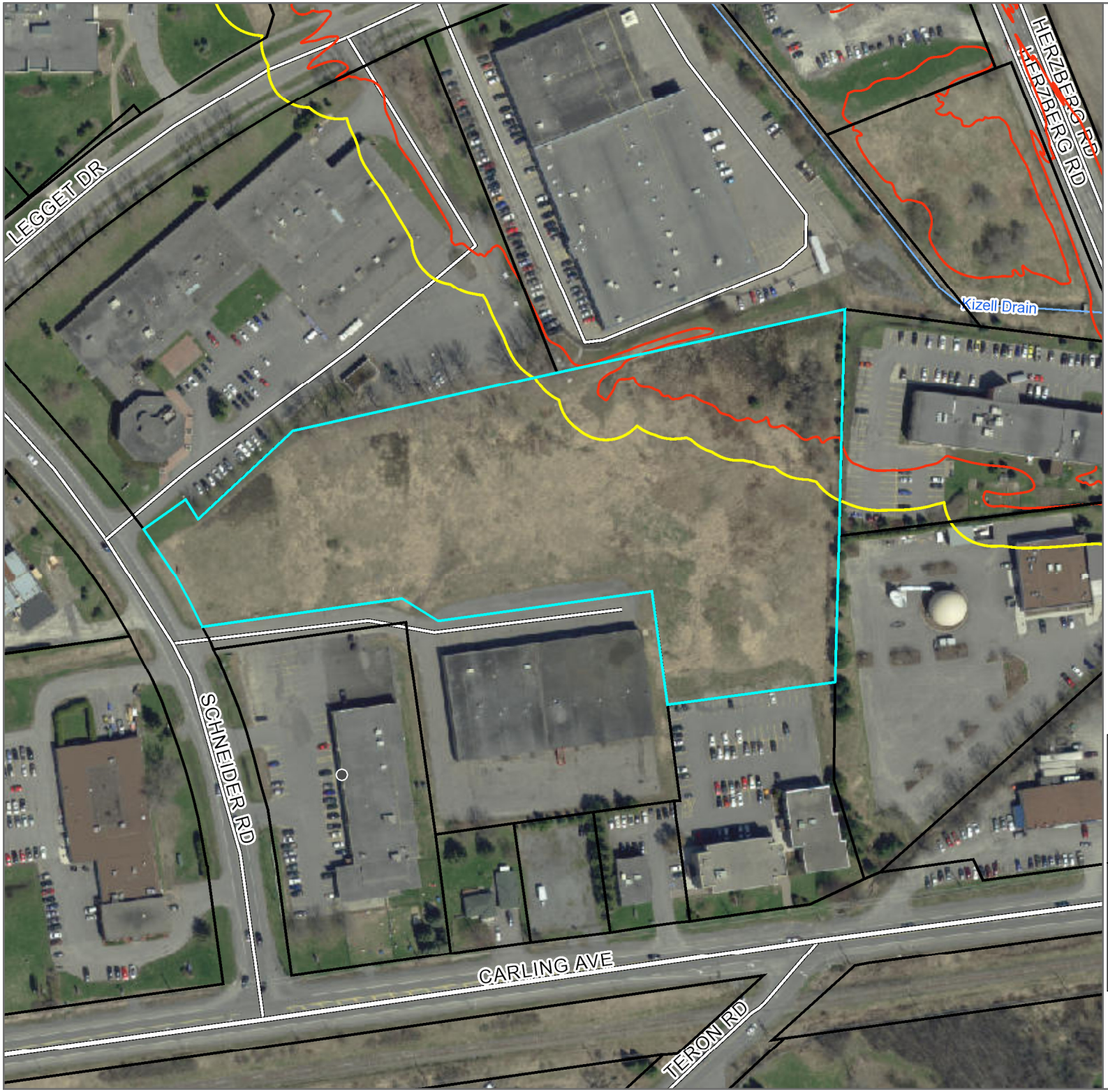
Primary outflow = Inflow, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs

Link 19L: Outflow



APPENDIX

C MVCA FLOODPLAIN MAP



Mississippi Valley Conservation Authority

Ontario Regulation 153/06

103 Schneider Road

Legend

- Parcels - Assessment
- 1:100 yr Flood Plain
- MVCA Regulation Limit
- MVCA Streams

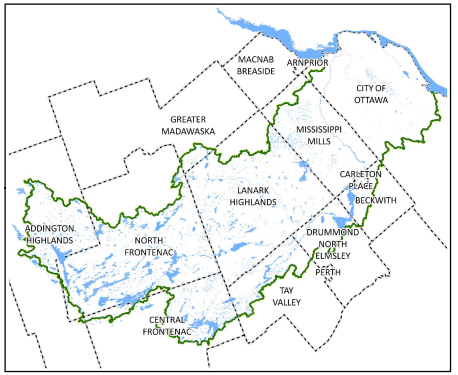
0 0.04 0.08

km

1:2,000

N W E S

Projection: UTM Zone 18- NAD 83 Datum



Date: 12/11/2020