ARCHITECTURE 49

CLUBHOUSE FACILITY DEVELOPMENT, 5650 MITCH OWENS ROAD, OTTAWA, ON

SITE SERVICING AND STORMWATER MANAGEMENT REPORT

MAY 12, 2023

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ARCHITECTURE 49

SITE PLAN APPLICATION

PROJECT NO.: 211-13935-00
DATE: MAY 12, 2023

WSP
2611 QUEENSVIEW DRIVE, SUITE 300
OTTAWA, ON, CANADA, K2B 8K2

T: +1 613 829-8299
WSP.COM

SIGNATURES

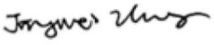
PREPARED BY

May 12, 2023

Kathryn Kerker, M.A.Sc.
Designer

Date

APPROVED[1] BY



May 12, 2023

Jingwei Zhang, P.Eng.
Senior Engineer

Date

[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 EXECUTIVE SUMMARY

WSP was retained by Architecture 49 to provide servicing, grading and stormwater management design services in support of the site plan approval for the proposed clubhouse facility development located at 5650 Mitch Owens Road, in the City of Ottawa. The proposed work consists of the construction of a clubhouse and walkways. The proposed clubhouse will provide educational and meeting rooms, a fitness area, and changerooms including washrooms and showers. This report will provide sufficient detail to demonstrate that the proposed development can be supported by the existing and proposed site infrastructure services (well and septic) and that the servicing design conforms to the applicable standards and guidelines. The report will also include measures to be taken during the construction to minimize erosion and sedimentation. In addition, this report details the stormwater management approach and addresses the quantity control and quality measures in accordance with the applicable guidelines.

Currently, the site is undeveloped except for a paved parking area and two storage sheds. The total property area is 12.95 ha in size. The site sits north-west of the Mitch Owens Rd. and Limebank Rd. intersection and is bounded by St. Mark High School to the east, and a mix of agricultural fields, grassland, and large residential lots.

The subject site is a rectangular shaped property bounded by Mitch Owens Rd. to the north. The site generally slopes towards existing ditches located along the property boundaries, and ultimately discharges to the Keith Moodie Drain. The existing site is currently equipped with a well as well as ditches which drain the site.

The City of Ottawa requires that the design of a drainage and stormwater management system in this development must be prepared in accordance with the following documents:

- Sewer Design Guidelines, City of Ottawa, October 2012
- Stormwater Management Planning and Design Manual, Ministry of the Environment, March 2003
- Stormwater Management Facility Design Guidelines, City of Ottawa, April 2012

Additionally, the design must adhere to the following Technical Bulletins:

- Technical Bulletin ISDTB-2012-6
- Technical Bulletin ISD 2014-01
- Technical Bulletin PIEDTB-2016-01
- Technical Bulletin ISTB-2018-01
- Technical Bulletin ISTB-2018-04
- Technical Bulletin ISTB-2019-02

This report was prepared utilizing servicing design criteria obtained from the City of Ottawa and outlines the design for water, sanitary wastewater, and stormwater facilities.

The format of this report matches that of the servicing study checklist found in Section 4 of the City of Ottawa's Servicing Study Guidelines for Development Applications, November 2009

No municipal services are currently available in proximity to the development.

It is proposed that an on-site enhanced grass swale will be provided to collect and attenuate flow rates and control water quality leaving the site.

1.2 SITE LOCATION

The proposed development is located at 5650 Mitch Owens Road, Ottawa, Ontario. The subject site is bounded by St. Mark High School to the east, and a mix of agricultural fields, grassland, and large residential lots. The overall site sits south-west of the Mitch Owens Rd. and Limebank Rd. intersection and is 12.95 ha in size. The location of the proposed development is illustrated in Figure 1. The proposed development will consist of a one storey clubhouse facility located adjacent to the existing parking area measuring less than 600m^2.

Figure 1: Site Location (GeoOttawa)

2 WATER SERVICE

2.1 EXISTING WATER SERVICE

No City services are currently present on or adjacent to the site. A well is currently located on site but very limited information is available.

2.2 PROPOSED WATER SERVICE

Based on the coordination with Mechanical engineer and the demands of building usage, a 38mm water service is proposed to service the proposed building for domestic use and will tie into the existing well or into any service lead that may already be existing. Very little information is known regarding the well, and slight changes to the water service location may be required as the existing system is uncovered. Refer to Mechanical report for the building fixture demands.

3 SEWER SERVICE

3.1 EXISTING SANITARY SERVICE

No City services are currently present on or adjacent to the site.

3.2 PROPOSED SANITARY SERVICE

A 100 mm sanitary service is proposed to the building and will tie into the proposed septic system. Please see drawing SSD-01 for more information regarding the septic system and sizing of the sanitary service.

4 STORMWATER MANAGEMENT

4.1 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 – specifically related to the applicable quantity and quality control criteria.

4.2 DESIGN CRITERIA

The City of Ottawa and the RVCA were consulted to establish design criteria. Correspondence is included in **Appendix A**.

It was determined that the criteria for the 5650 Mitch Owens Rd. development are as follows:

→ **Stormwater Quantity-** Post-development peak stormwater flows should be controlled to pre-development peak flow rates for the 2-year through 100-year events (OSDG 8.3.6).

→ **Storm Quality-** Enhanced treatment (80% TSS removal) is required for added driving surface areas.

4.2.1 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).

4.3 PRE-DEVELOPMENT DRAINAGE

4.3.1 GENERAL

Under existing conditions, the site is undeveloped except for a paved parking area and two storage sheds. Vehicular access to the site is available from Mitch Owens Rd. Under existing conditions, the site drains to ditches which run along the site boundaries and between the sports fields. The ditches discharge to the Keith Moodie Drain which runs along the western boundary of the site.

The overall site is an approximately 12.95 ha area. The total modelled area is 11.61 ha as it excludes the undeveloped area that drains directly to the Keith Moodie Drain. The ditch draining subcatchment EX02-03 splits in either direction toward OF2 and OF3. The site subcatchments are shown in Figure 2 with the land use breakdown shown in Table 1.

Figure 2: Existing Conditions Catchment Areas and Runoff Coefficients

Table 1: Existing Land Use Area Breakdown

Name	Area (ha)	Imperviousness (%)	Runoff Coefficient
EX01	1.77	19.5	0.32
EX02	3.81	18.1	0.31
EX02-03	3.76	14.4	0.28
EX03	2.27	12.5	0.27
TOTAL	**11.61**	**16.0**	**0.29**

4.3.2 ALLOWABLE FLOW RATES

As noted in Section 1.4, it is required that post development peak flows are equal to or less than pre-development peak flows for the 2-year through 100-year events.

A PCSWMM model was created to accurately represent the pre-development peak flow rates for the 2-year through 100-year storm events, with results summarized in Table 2. The peak flows were taken as the maximum of the timeseries summation of the outfalls shown in Figure 2. An example showing the 100-year existing flow from each outlet and the resulting total flow is shown in Figure 3. PCSWMM output is included in **Appendix B1**.

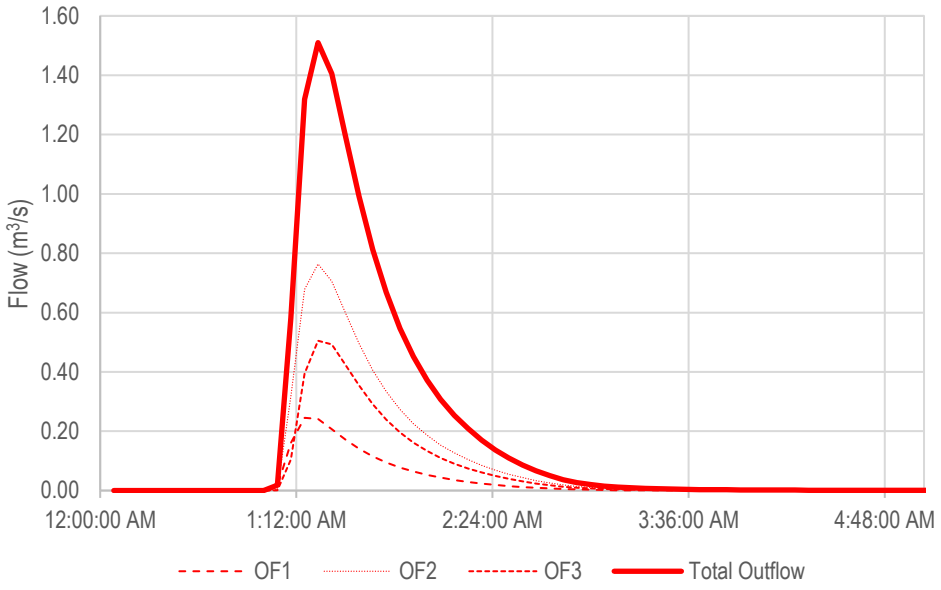


Figure 3: 100-year existing total outflow

Table 2: Pre-Development Peak Flow Rates (3-hr Chicago Storm Events)

Return Period	Peak Flow (m^3/s)
2-year	0.04
5-year	0.31
10-year	0.55
25-year	0.88
50-year	1.18
100-year	1.51

4.4 POST-DEVELOPMENT CONDITIONS

4.4.1 GENERAL

The proposed development includes a one storey clubhouse and pedestrian walkways. Under proposed conditions the site will continue to be accessed from Mitch Owens Road. An estimated area breakdown of the proposed site layout is summarized in Table 3 and shown on Figure 4.

Table 3: Proposed Land-Use Area Breakdown

Name	Area (ha)	Imperviousness (%)	Runoff Coefficient
PR01	1.78	19.5	0.32
PR02	3.85	20.0	0.32
PR02-03	3.39	10.0	0.25
PR03	2.59	18.8	0.31
Total	**11.61**	**16.7**	**0.30**

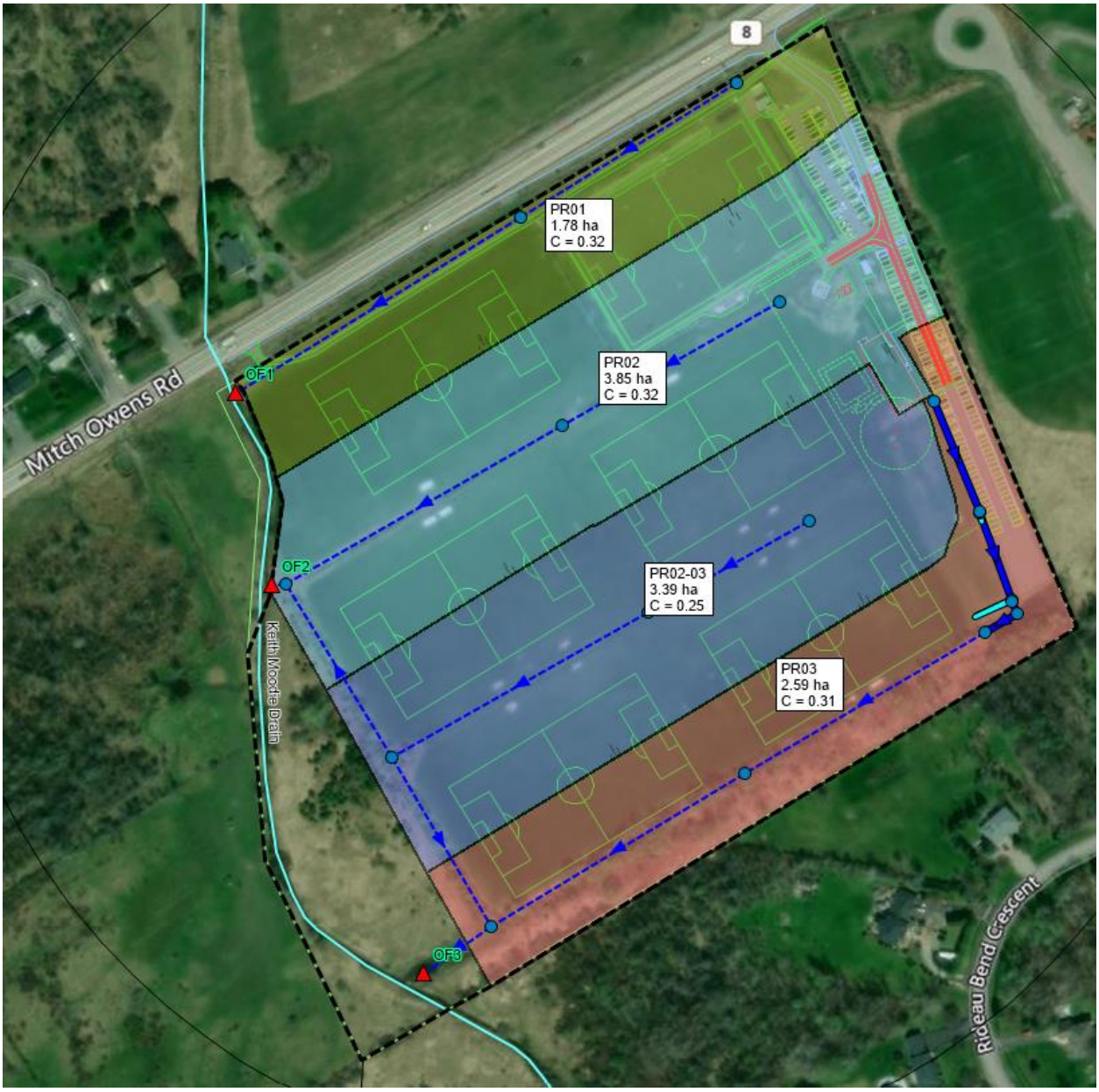


Figure 4: Proposed Conditions Catchment Areas and Runoff Coefficients

4.4.2 WATER QUANTITY

As previously noted, it is required that post development discharge rates for the 2-year through 100-year storm events be controlled to pre-development conditions.

An enhanced grass swale is proposed along the west side of the parking area to control and treat the runoff to the design criteria defined in Section 4.2. Runoff from part of the existing parking area and the surrounding grassed area will drain to the enhanced grass swale. Two checkdams will be placed within the enhanced grass swale to slow the flow and provide storage.

The checkdams are 300 mm in height with a 150 mm diameter opening at the base. Riverstone is used on both the upstream and downstream sides of the check dam to dissipate energy and prevent erosion. Check dam details are included in the civil drawing package.

The existing conditions PCSWMM model was modified to include the new impervious area, swale, check dams, and flow patterns. As shown in Table 4, the proposed peak flows meet the existing peak flow targets for all return periods from the 2-year to the 100-year. PCSWMM output is included in **Appendix B2**.

Table 4: Post-Development Peak Flow Rates (3-hr Chicago Storm Events)

Return Period	Existing Peak Flow (m^3/s)	Proposed Peak Flow (m^3/s)
2-year	0.04	0.04
5-year	0.31	0.29
10-year	0.55	0.52
25-year	0.88	0.86
50-year	1.18	1.12
100-year	1.51	1.44

4.4.3 WATER QUALITY

As per Section 4.2, enhanced treatment (80% TSS removal) is required for added driving surface areas. As impervious surfaces for the new clubhouse building include only roof and walking paths, no quality control is required.

As there is no increase in parking area compared to existing conditions, no treatment is required. However, an opportunity exists to provide quality treatment for the existing parking area. Treatment will be provided by an enhanced grass swale running along the west side of the existing parking area. A properly designed enhanced grass swale is able to meet the target quality treatment of 80% TSS removal.

The following design guidance has been applied for the enhanced grass swales as per TRCA guidelines (TRCA, 2010):

- Shape: Grass swales should be designed with a trapezoidal or parabolic cross section. Trapezoidal swales will generally evolve into parabolic swales over time, so the initial trapezoidal cross section design should be checked for capacity and conveyance assuming it is a parabolic cross section. Swale length between culverts should be 5 metres or greater;
- Bottom Width: Grass swales should be designed with a bottom width between 0.75 and 3.0 metres. The design width should allow for shallow flows and adequate water quality treatment, while preventing flows from concentrating and creating gullies;
- Longitudinal Slope: Slopes should be between 0.5% and 4%. Check dams should be incorporated on slopes greater than 3%;

- Length: When used to convey and treat road runoff, the length simply parallels the road, and therefore should be equal to, or greater than the contributing roadway length;
- Flow Depth: The maximum flow depth should correspond to two-thirds the height of the vegetation. Vegetation in some grass swales may reach heights of 150 mm; therefore, a maximum flow depth of 100 mm is recommended during a 4-hour, 25 mm Chicago storm event; and
- Side Slopes: The side slopes should be as flat as possible to aid in providing pre-treatment for lateral incoming flows and to maximize the swale filtering surface. Steeper side slopes are likely to have erosion gullying from incoming lateral flows. A maximum slope of 2.5:1 (H:V) is recommended and a 4:1 slope is preferred where space permits.

Based on the above design guidance, the enhanced grass swale is designed with 3:1 side slopes and a minimum 1 m bottom width. Calculations showing swale performance during a water quality event (25mm, 4-hour) are included in **Appendix C**. A typical detail for the enhanced grass swale is included in the civil drawing package.

4.5 STORMWATER MANAGEMENT CONCLUSIONS

For stormwater management, runoff from the site will be controlled to pre-development targets, with the 100-year post-development flow of 1.44 m^3/s meeting the pre-development 100-year flow of 1.51 m^3/s. Control is provided within an enhanced grass swale with two check dams, each of which contains a 150 mm orifice at the base. Quality control for the existing paved area is provided by the enhanced grass swale.

5 SEDIMENT AND EROSION CONTROL

Prior to topsoil stripping, earthworks or underground construction, erosion and sediment controls will be implemented and will be maintained throughout construction. Silt fences will be installed around the perimeter of the site and will be cleaned and maintained throughout construction. Silt fences will remain in place until the working areas have been stabilized or re-vegetated. A mud mat will be installed at the construction access to reduce risk of mud tracking onto adjacent roads.

Erosion and sediment controls must be in place during construction. Recommendations to the contractor will be included in the erosion and sediment control plan and are summarized below:

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

Prior to start of construction:

- Install silt fence as show in the Grading and Erosion Control Drawing.
- Install mud mat (gravel mat on geotextile) at construction site entrance to reduce mud tracking from site onto road.

During construction:

- Minimize the extent of disturbed areas and the duration of exposure and impacts to existing grading.
- Perimeter vegetation to remain in place until permanent storm water management is in place otherwise, immediately install silt fence when the existing site is disturbed at the perimeter.
- Protect disturbed areas from overland flow by providing temporary swales to the satisfaction of the field engineer.
- Provide temporary cover such as seeding or mulching if disturbed area will not be rehabilitated within 30 days.
- Inspect silt fences weekly and within 24 hours after a storm event. Clean and repair when necessary.
- Drawing to be reviewed and revised as required during construction.
- Erosion control fencing to be also installed around the base of all stockpiles.
- Do not locate topsoil piles and excavation material closer than 2.5m from any paved surface, or one which is to be paved before the pile is removed. All topsoil piles are to be seeded if they are to remain on site long enough for seeds to grow (longer than 30 days).
- Control dust blown off-site by seeding topsoil piles and other areas temporarily (provide watering as required and to the satisfaction of the engineer).
- No alternate methods of erosion protection shall be permitted unless approved by the field engineer.
- During wet conditions, tires of all vehicles/equipment leaving the site are to be scrapped.
- Any mud/material tracked onto the road shall be removed immediately by hand or rubber tire loader.
- Take all necessary steps to prevent building material, construction debris or waste being spilled or tracked onto abutting properties or public streets during construction and proceed immediately to clean up any areas so affected.
- All erosion control structure to remain in place until all disturbed ground surfaces have been stabilized either by paving or restoration of vegetative ground cover.
- During the course of construction, if the engineer believes that additional prevention methods are required to control erosion and sedimentation, the contractor will install additional silt fences or other methods as required to the satisfaction of the engineer.

- The contractor shall implement best management practices, to provide for protection of the area drainage system and the receiving watercourse, during construction activities. The contractor acknowledges that failure to implement appropriate erosion and sediment control measures may be subject to penalties imposed by any applicable regulatory agency.

6 CONCLUSIONS AND RECOMMENDATIONS

It is concluded that the proposed development can meet all provided and associated requirements. It is recommended that this report be submitted to the City of Ottawa in support of the application for site plan approval.

APPENDIX

A CORRESPONDENCE

Kerker, Kathryn

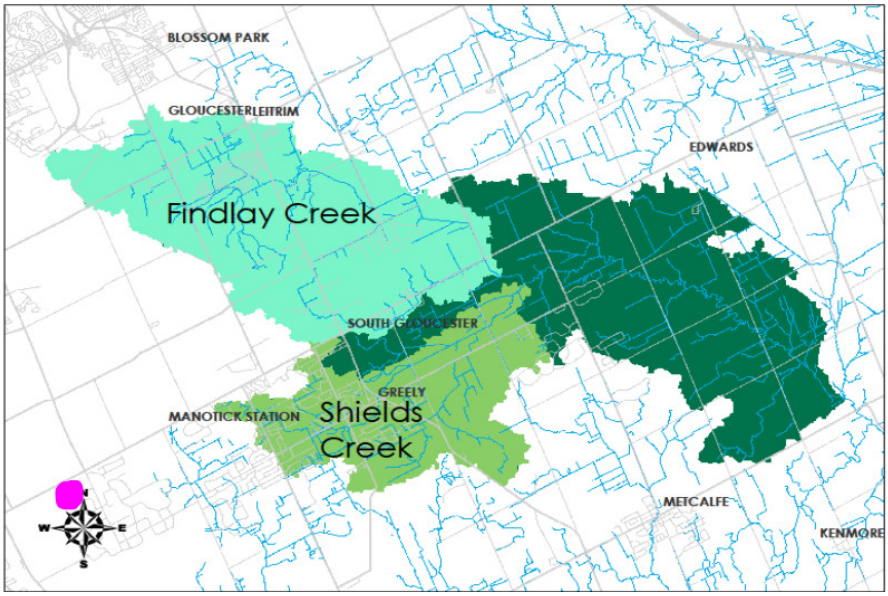
From: Blanchette, Erin
Sent: June 16, 2022 11:50 AM
To: Kerker, Kathryn
Subject: FW: Stormwater Quality and Fire Flow Requirements for 5650 Mitch Owens Rd

OSU City correspondence below.
Thanks for reminding me!

From: Blanchette, Erin
Sent: May 12, 2022 2:12 PM
To: Hall, Kevin <Kevin.Hall@ottawa.ca>; McAlpine, Anissa <anissa.mcalpine@ottawa.ca>
Subject: RE: Stormwater Quality and Fire Flow Requirements for 5650 Mitch Owens Rd

Thanks for the reply Kevin,

It appears as though our site (pink dot) is quite far from the Shields Creek subwatershed, but I will ensure the flow is controlled to the pre-development rates as you mentioned.



Much appreciated,
Erin

From: Hall, Kevin <Kevin.Hall@ottawa.ca>
Sent: April 28, 2022 11:44 AM
To: Blanchette, Erin <Erin.Blanchette@wsp.com>; McAlpine, Anissa <anissa.mcalpine@ottawa.ca>
Subject: RE: Stormwater Quality and Fire Flow Requirements for 5650 Mitch Owens Rd

Erin

Adding more parking for the property should not change our requirements, but it may change your design since you will have more water to control. Stormwater will need to be control post development rates to the pre-development rate. I think this site is withing the boundary of the Shields Creek subwatershed study which will affect the stormwater design.

Fire flow will be based on the fact that the site will be on private services. I believe that the size of the building triggers the need for firefighting storage tanks or not. This may be spelled out in the Ontario Building Code, or you can confirm with Fire Servicies.

Hope this helps.

Kevin Hall, C.E.T.
Senior Project Manager
Development Review - Rural Services
Gestionnaire de projet, Approbation des demandes d'infrastructure
Examen des demandes d'aménagement (Services ruraux)
City of Ottawa | Ville d'Ottawa
613.580.2424 ext./poste 27824
Fax 613.580.2576
ottawa.ca/planning / ottawa.ca/urbanisme

I will be working from home for the duration of the COVID-19 situation. Email is the best way to contact me.

From: Blanchette, Erin <Erin.Blanchette@wsp.com>
Sent: April 28, 2022 10:30 AM
To: McAlpine, Anissa <anissa.mcalpine@ottawa.ca>; Hall, Kevin <Kevin.Hall@ottawa.ca>
Subject: RE: Stormwater Quality and Fire Flow Requirements for 5650 Mitch Owens Rd

Thank you Anissa,

@Hall, Kevin There has been a design change and we are now proposing 630m^2 of new paved area (previously grass) for a fire route and adjacent parking. I expect this might affect your response to our stormwater management requirements.

Your recommendation on fire flow requirements will also be useful when you get a chance.

Thank you,
Erin

From: McAlpine, Anissa <anissa.mcalpine@ottawa.ca>
Sent: April 25, 2022 12:18 PM
To: Blanchette, Erin <Erin.Blanchette@wsp.com>
Cc: Hall, Kevin <Kevin.Hall@ottawa.ca>
Subject: RE: Stormwater Quality and Fire Flow Requirements for 5650 Mitch Owens Rd

Hello Erin, I am CCing Kevin Hall on this email who should be able to confirm if there are any additional SWM requirements, or Fire flow requirements.

Thanks,

Anissa McAlpine *MCIP RPP* (she/her)
Planner, Parks and Facilities Planning Services | Services planification des installations et des parcs
City of Ottawa | Ville d'Ottawa
100 Constellation Crescent | 100, croissant Constellation
Ottawa ON K2G 6J8

From: Blanchette, Erin <Erin.Blanchette@wsp.com>
Sent: April 22, 2022 4:55 PM
To: McAlpine, Anissa <anissa.mcalpine@ottawa.ca>
Subject: Stormwater Quality and Fire Flow Requirements for 5650 Mitch Owens Rd

Hi Anissa,

I have a two questions I'm hoping you can help me with, or direct me to someone who can assist.
We are currently working on a site development project located at 5650 Mitch Owens Rd (near the Limebank Rd intersection). The project is to construct a field house (approximately 600m^2) which will be located in the circled area on the site below. There are currently ditches running around the site but major flow paths follow the magenta ditches highlighted below.

1. I have reached out to the RVCA regarding on-site stormwater quality treatment requirements given the proposed work and their response is below. Are there any other elements that need to be considered regarding quality control?

RVCA response: *Based on the proposal being a filed house with no proposed parking, we would not require any additional onsite water quality controls as rooftop drainage is considered clean for the purposes of aquatic habitat and water quality.*

2. For a proposed structure of this size/function, what fire flow requirements need to be met?

Please let me know if you require any additional information to answer the above.
Thank you,
Erin

Erin Blanchette, P.Eng
Project Engineer
Municipal Engineering

T (613) 690-1087
2611 Queensview Drive, Suite 300
Ottawa, Ontario, Canada K2B 8K2

erin.blanchette@wsp.com | wsp.com

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From: Jamie Batchelor <jamie.batchelor@rvca.ca>
Sent: May 18, 2022 3:40 PM
To: Blanchette, Erin <Erin.Blanchette@wsp.com>
Subject: RE: Stormwater Quality Requirements for 5650 Mitch Owens Rd

Good Afternoon Erin,

I can confirm that the RVCA would require on-site water quality control of 80% TSS removal. Given the proposed changes and the potential impact to the water budget/balance, it is recommended that further pre-consultation occur with RVCA technical staff with respect to the water budget component prior to undertaking the report.

Jamie Batchelor, MCIP, RPP
Planner, ext. 1191
Jamie.batchelor@rvca.ca

Rideau Valley Conservation Authority
3889 Rideau Valley Drive
PO Box 599, Manotick ON K4M 1A5
T 613-692-3571 | 1-800-267-3504 F 613-692-0831 | www.rvca.ca

From: Blanchette, Erin <Erin.Blanchette@wsp.com>
Sent: Tuesday, May 17, 2022 11:48 AM
To: Jamie Batchelor <jamie.batchelor@rvca.ca>
Subject: RE: Stormwater Quality Requirements for 5650 Mitch Owens Rd

Hi Jamie,

I'm following up on my last email (see below). Should I expect a new set of SWM control requirements given the change?

Thanks in advance and please let me know if you require any additional details.
Erin

From: Blanchette, Erin
Sent: April 28, 2022 10:25 AM
To: Jamie Batchelor <jamie.batchelor@rvca.ca>
Cc: Yang, Winston <Winston.Yang@wsp.com>
Subject: RE: Stormwater Quality Requirements for 5650 Mitch Owens Rd

Hi Jamie,

There has been a design change and we are now proposing 630m^2 of new paved area (previously grass) for a fire route and adjacent parking.
Could you please indicate the stormwater management controls we may need to adhere to in this case?

Thanks in advance,
Erin

From: Jamie Batchelor <jamie.batchelor@rvca.ca>
Sent: April 14, 2022 3:04 PM
To: Blanchette, Erin <Erin.Blanchette@wsp.com>
Cc: Yang, Winston <Winston.Yang@wsp.com>
Subject: RE: Stormwater Quality Requirements for 5650 Mitch Owens Rd

Good Afternoon Erin,

Based on the proposal being a filed house with no proposed parking, we would not require any additional onsite water quality controls as rooftop drainage is considered clean for the purposes of aquatic habitat and water quality. We would however, strongly recommend that the water balance/budget be completed and it be demonstrated that it will result in minimal impact.

Jamie Batchelor, MCIP, RPP
Planner, ext. 1191
Jamie.batchelor@rvca.ca

Rideau Valley Conservation Authority
3889 Rideau Valley Drive
PO Box 599, Manotick ON K4M 1A5
T 613-692-3571 | 1-800-267-3504 F 613-692-0831 | www.rvca.ca

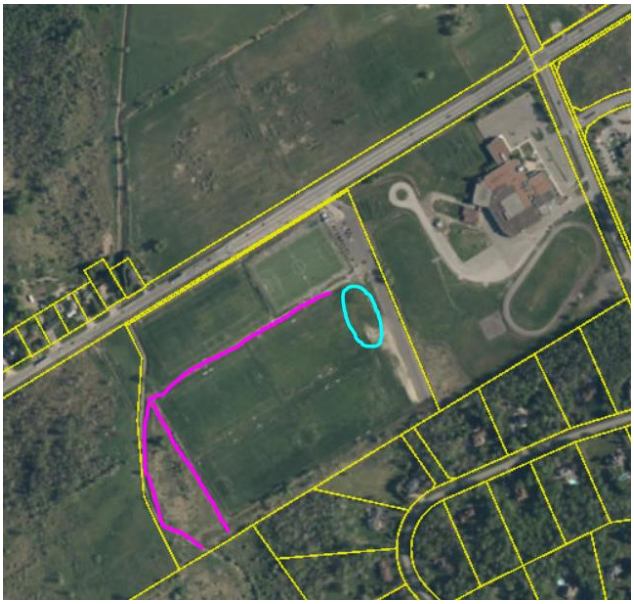
From: Blanchette, Erin <Erin.Blanchette@wsp.com>
Sent: Wednesday, April 13, 2022 2:03 PM
To: Jamie Batchelor <jamie.batchelor@rvca.ca>
Cc: Yang, Winston <Winston.Yang@wsp.com>
Subject: Stormwater Quality Requirements for 5650 Mitch Owens Rd

Hi Jamie,

We are currently working on a site development project within the RVCA boundary located at 5650 Mitch Owens Rd (near the Limebank Rd intersection). The project is to construct a field house (approximately 600m^2) which will be located in the circled area on the site below. There are currently ditches running around the site but major flow paths follow the magenta ditches highlighted below.

I am reaching out to ask if any on-site stormwater quality treatment will be required for this site given the proposed work?

Please let me know if you require any additional information.
Thank you,
Erin



Erin Blanchette, E.I.T.
Designer
Municipal Engineering

T (613) 690-1087
2611 Queensview Drive, Suite 300
Ottawa, Ontario, Canada K2B 8K2

erin.blanchette@wsp.com | wsp.com

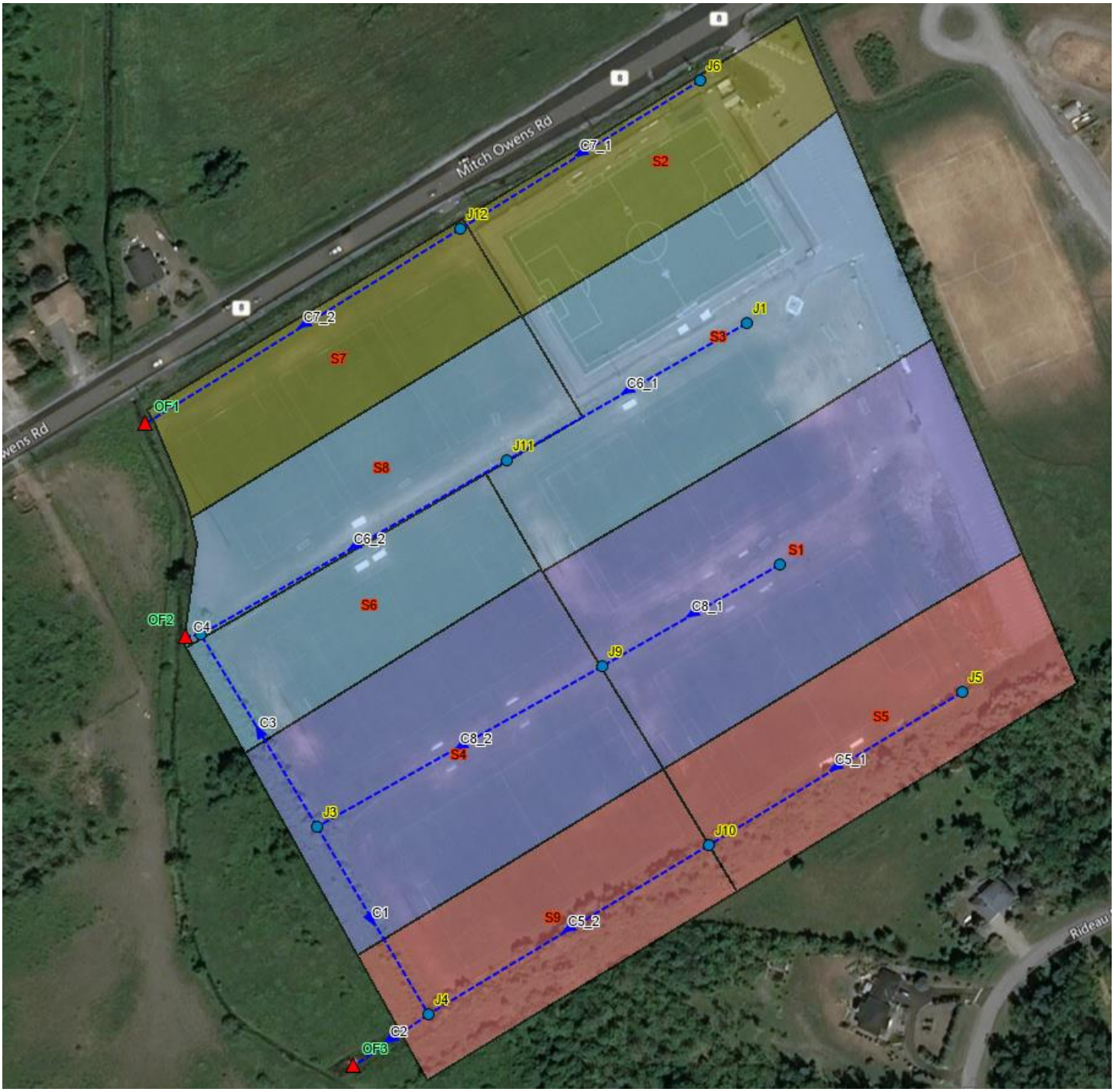
APPENDIX

B MODELLING RESULTS

APPENDIX

B-1 EXISTING CONDITIONS PCSWMM OUTPUT

APPENDIX


Mitch Owens Rd
J6
C7_1
S2
J12
C7_2
S7
J1
S3
C6_1
OF1
J11
S8
C6_2
S1
OF2
C4
C8_1
J9
J5
C3
S5
C8_2
S4
C5_1
J3
J10
C1
S9
C5_2
J4
C2
OF3

EXISTING CONDITIONS 100-YEAR

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)

****
Element Count
****
Number of rain gages 16
Number of subcatchments ... 9
Number of nodes 14
Number of links 12
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
100yr_3hr_Chicago	100yr_3hr_Chicago	INTENSITY	10 min.
100yr_3hr_Chicago_Climate_Change	100yr_3hr_Chicago_Increase_20percent	INTENSITY	10 min.
100yr_6hr_Chicago	100yr_6hr_Chicago	INTENSITY	10 min.
100yr_6hr_Chicago_Climate_Change	100yr_6hr_Chicago_Increase_20percent	INTENSITY	10 min.
10yr_3hr_Chicago	10yr_3hr_Chicago	INTENSITY	10 min.
10yr_6hr_Chicago	10yr_6hr_Chicago	INTENSITY	10 min.
25mm_3hr_Chicago	25mm_3hr_Chicago	INTENSITY	10 min.
25mm_4hr_Chicago	25mm_4hr_Chicago	INTENSITY	10 min.
25yr_3hr_Chicago	25yr_3hr_Chicago	INTENSITY	10 min.
25yr_6hr_Chicago	25yr_6hr_Chicago	INTENSITY	10 min.
2yr_3hr_Chicago	2yr_3hr_Chicago	INTENSITY	10 min.
2yr_6hr_Chicago	2yr_6hr_Chicago	INTENSITY	10 min.
50yr_3hr_Chicago	50yr_3hr_Chicago	INTENSITY	10 min.
50yr_6hr_Chicago	50yr_6hr_Chicago	INTENSITY	10 min.
5yr_3hr_Chicago	5yr_3hr_Chicago	INTENSITY	10 min.
5yr_6hr_Chicago	5yr_6hr_Chicago	INTENSITY	10 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
S1	2.06	412.22	18.08	1.5000	100yr_3hr_Chicago	J8
S2	0.89	178.38	28.89	0.5000	100yr_3hr_Chicago	J6
S3	1.99	397.54	25.49	1.0000	100yr_3hr_Chicago	J1
S4	1.70	339.74	10.00	1.2000	100yr_3hr_Chicago	J9
S5	1.20	240.26	14.77	1.5000	100yr_3hr_Chicago	J5
S6	0.83	165.02	10.00	1.2000	100yr_3hr_Chicago	J11
S7	0.88	176.76	10.00	1.2000	100yr_3hr_Chicago	J12
S8	0.99	198.42	10.00	1.2000	100yr_3hr_Chicago	J11
S9	1.07	213.18	10.00	1.2000	100yr_3hr_Chicago	J10

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J1	JUNCTION	93.38	3.00	0.0	
J10	JUNCTION	92.68	3.00	0.0	
J11	JUNCTION	92.74	3.00	0.0	
J12	JUNCTION	92.98	3.00	0.0	
J2	JUNCTION	91.92	3.00	0.0	
J3	JUNCTION	92.50	3.00	0.0	
J4	JUNCTION	92.04	3.00	0.0	
J5	JUNCTION	93.26	3.00	0.0	
J6	JUNCTION	93.85	3.00	0.0	
J8	JUNCTION	93.43	3.00	0.0	
J9	JUNCTION	93.07	3.00	0.0	
OF1	OUTFALL	91.84	0.76	0.0	
OF2	OUTFALL	91.82	1.34	0.0	
OF3	OUTFALL	91.57	1.34	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	J3	J4	CONDUIT	98.5	0.4689	0.0100
C2	J4	OF3	CONDUIT	41.0	1.1401	0.0100
C3	J3	J2	CONDUIT	102.3	0.5663	0.0100
C4	J2	OF2	CONDUIT	6.6	1.4741	0.0100
C5_1	J5	J10	CONDUIT	134.9	0.4300	0.0100
C5_2	J10	J4	CONDUIT	149.0	0.4302	0.0100
C6_1	J1	J11	CONDUIT	125.8	0.5105	0.0100
C6_2	J11	J2	CONDUIT	160.2	0.5106	0.0100
C7_1	J6	J12	CONDUIT	128.2	0.6772	0.0100

C7_2	J12	OF1	CONDUIT	168.7	0.6770	0.0100
C8_1	J8	J9	CONDUIT	93.1	0.3834	0.0100
C8_2	J9	J3	CONDUIT	148.9	0.3842	0.0100

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	EXSwale8	0.71	5.47	0.41	13.20	1	20.60
C2	EXSwale7	1.34	17.40	0.87	19.63	1	169.59
C3	EXSwale8	0.71	5.47	0.41	13.20	1	22.63
C4	EXSwale7	1.34	17.40	0.87	19.63	1	192.83
C5_1	EXSwale5	0.31	2.68	0.15	17.25	1	5.05
C5_2	EXSwale6	0.61	5.13	0.39	12.91	1	18.08
C6_1	ExSwale2	0.56	5.53	0.21	26.45	1	13.86
C6_2	ExSwale2	0.56	5.53	0.21	26.45	1	13.86
C7_1	EXSwale1	0.76	5.75	0.34	16.59	1	23.16
C7_2	EXSwale1	0.76	5.75	0.34	16.59	1	23.16
C8_1	EXSwale3	0.24	3.55	0.14	25.47	1	5.89
C8_2	EXSwale4	0.24	10.20	0.16	62.64	1	18.77

****
Transect Summary
****

Transect EXSwale1
Area:

0.0011	0.0043	0.0084	0.0131	0.0185
0.0246	0.0313	0.0385	0.0461	0.0542
0.0628	0.0718	0.0813	0.0913	0.1017
0.1126	0.1239	0.1357	0.1481	0.1609
0.1743	0.1883	0.2028	0.2179	0.2341
0.2515	0.2699	0.2901	0.3118	0.3344
0.3577	0.3818	0.4067	0.4323	0.4585
0.4855	0.5130	0.5413	0.5702	0.6001
0.6316	0.6649	0.7006	0.7396	0.7823
0.8254	0.8687	0.9122	0.9560	1.0000

Hrad:

0.0222	0.0521	0.0846	0.1142	0.1420
0.1688	0.1999	0.2299	0.2588	0.2870
0.3144	0.3413	0.3680	0.3942	0.4201
0.4457	0.4709	0.4955	0.5170	0.5386
0.5602	0.5818	0.6034	0.6124	0.6143
0.6186	0.6187	0.6070	0.6193	0.6420
0.6646	0.6872	0.7097	0.7345	0.7597
0.7847	0.8095	0.8343	0.8587	0.8619
0.8637	0.8505	0.8333	0.7832	0.8040
0.8436	0.8830	0.9222	0.9612	1.0000

Width:

0.0520	0.0836	0.0993	0.1150	0.1307
0.1462	0.1569	0.1675	0.1781	0.1888
0.1994	0.2101	0.2206	0.2310	0.2414
0.2519	0.2623	0.2730	0.2854	0.2978
0.3101	0.3225	0.3348	0.3546	0.3800
0.4054	0.4353	0.4771	0.5027	0.5200
0.5374	0.5548	0.5722	0.5876	0.6027
0.6177	0.6328	0.6478	0.6629	0.6953
0.7304	0.7811	0.8403	0.9445	0.9732
0.9786	0.9839	0.9893	0.9946	1.0000

Transect ExSwale2
Area:

0.0026	0.0068	0.0122	0.0183	0.0250
0.0323	0.0400	0.0482	0.0568	0.0659
0.0754	0.0853	0.0955	0.1062	0.1173
0.1288	0.1408	0.1532	0.1660	0.1794
0.1932	0.2076	0.2225	0.2379	0.2538
0.2702	0.2872	0.3046	0.3226	0.3411
0.3600	0.3795	0.3996	0.4204	0.4419
0.4640	0.4870	0.5111	0.5364	0.5641
0.5943	0.6272	0.6630	0.7025	0.7461
0.7945	0.8443	0.8951	0.9468	1.0000

Hrad:

0.0393	0.0744	0.1152	0.1528	0.1915
0.2322	0.2712	0.3089	0.3456	0.3824
0.4192	0.4551	0.4904	0.5250	0.5591
0.5917	0.6220	0.6522	0.6814	0.7089
0.7363	0.7637	0.7911	0.8184	0.8442
0.8700	0.8968	0.9245	0.9521	0.9797
1.0073	1.0309	1.0506	1.0707	1.0912
1.1101	1.1130	1.1137	1.0945	1.0481
1.0137	0.9885	0.9478	0.9108	0.8747
0.8692	0.9049	0.9406	0.9727	1.0000

Width:

0.0652	0.0921	0.1058	0.1195	0.1307
0.1392	0.1476	0.1560	0.1644	0.1723
0.1797	0.1872	0.1946	0.2021	0.2096
0.2174	0.2260	0.2345	0.2433	0.2526
0.2620	0.2714	0.2808	0.2901	0.3001
0.3100	0.3196	0.3289	0.3382	0.3475

0.3568 0.3674 0.3797 0.3919 0.4042
0.4172 0.4368 0.4582 0.4894 0.5376
0.5857 0.6339 0.6991 0.7711 0.8527
0.9140 0.9330 0.9515 0.9734 1.0000

Transect EXSwale3
Area:
0.0010 0.0033 0.0063 0.0100 0.0143
0.0195 0.0255 0.0323 0.0399 0.0482
0.0572 0.0672 0.0778 0.0893 0.1015
0.1147 0.1287 0.1435 0.1591 0.1754
0.1925 0.2103 0.2290 0.2484 0.2686
0.2894 0.3110 0.3334 0.3566 0.3807
0.4055 0.4311 0.4575 0.4847 0.5126
0.5415 0.5718 0.6035 0.6354 0.6675
0.6999 0.7324 0.7652 0.7982 0.8314
0.8647 0.8983 0.9320 0.9659 1.0000
Hrad:
0.0188 0.0431 0.0646 0.0848 0.1042
0.1197 0.1348 0.1532 0.1720 0.1898
0.2061 0.2228 0.2404 0.2580 0.2730
0.2879 0.3054 0.3229 0.3410 0.3594
0.3771 0.3934 0.4103 0.4293 0.4481
0.4662 0.4838 0.5006 0.5155 0.5314
0.5490 0.5666 0.5841 0.6016 0.6170
0.6319 0.6195 0.6491 0.6786 0.7078
0.7369 0.7658 0.7950 0.8247 0.8542
0.8836 0.9129 0.9421 0.9711 1.0000
Width:
0.0557 0.0770 0.0976 0.1177 0.1377
0.1625 0.1890 0.2109 0.2318 0.2538
0.2778 0.3014 0.3238 0.3461 0.3719
0.3985 0.4215 0.4445 0.4665 0.4881
0.5104 0.5347 0.5582 0.5788 0.5994
0.6209 0.6429 0.6660 0.6918 0.7163
0.7387 0.7610 0.7833 0.8057 0.8308
0.8570 0.9230 0.9297 0.9364 0.9431
0.9497 0.9564 0.9626 0.9680 0.9733
0.9786 0.9840 0.9893 0.9947 1.0000

Transect EXSwale4
Area:
0.0011 0.0039 0.0083 0.0142 0.0215
0.0307 0.0421 0.0557 0.0702 0.0853
0.1007 0.1165 0.1327 0.1492 0.1662
0.1836 0.2014 0.2196 0.2381 0.2570
0.2762 0.2959 0.3159 0.3364 0.3572
0.3785 0.4004 0.4226 0.4453 0.4684
0.4919 0.5158 0.5401 0.5648 0.5899
0.6155 0.6413 0.6674 0.6938 0.7204
0.7472 0.7743 0.8016 0.8291 0.8570
0.8851 0.9134 0.9420 0.9708 1.0000
Hrad:
0.0167 0.0322 0.0492 0.0642 0.0788
0.0896 0.1014 0.1182 0.1430 0.1688
0.1945 0.2197 0.2444 0.2683 0.2917
0.3145 0.3372 0.3605 0.3836 0.4062
0.4276 0.4490 0.4707 0.4921 0.5105
0.5285 0.5475 0.5671 0.5870 0.6064
0.6250 0.6446 0.6641 0.6829 0.7016
0.7224 0.7442 0.7667 0.7892 0.8122
0.8350 0.8577 0.8802 0.9017 0.9232
0.9446 0.9665 0.9892 1.0098 1.0000
Width:
0.0677 0.1210 0.1683 0.2210 0.2737
0.3434 0.4159 0.4717 0.4920 0.5059
0.5184 0.5309 0.5434 0.5568 0.5704
0.5845 0.5979 0.6097 0.6213 0.6333
0.6467 0.6597 0.6720 0.6844 0.7005
0.7171 0.7322 0.7461 0.7595 0.7732
0.7879 0.8011 0.8142 0.8280 0.8418
0.8529 0.8626 0.8713 0.8798 0.8876
0.8954 0.9032 0.9112 0.9199 0.9286
0.9372 0.9452 0.9523 0.9613 1.0000

Transect EXSwale5
Area:
0.0006 0.0025 0.0056 0.0098 0.0150
0.0209 0.0275 0.0349 0.0429 0.0517
0.0611 0.0712 0.0820 0.0936 0.1059
0.1188 0.1325 0.1468 0.1618 0.1774
0.1937 0.2106 0.2281 0.2465 0.2656
0.2855 0.3061 0.3273 0.3492 0.3720
0.3958 0.4205 0.4461 0.4727 0.5003
0.5287 0.5581 0.5883 0.6195 0.6514
0.6840 0.7172 0.7508 0.7850 0.8196
0.8547 0.8901 0.9260 0.9623 1.0000
Hrad:
0.0198 0.0396 0.0594 0.0821 0.1061
0.1315 0.1558 0.1793 0.2024 0.2251
0.2473 0.2692 0.2905 0.3107 0.3313
0.3528 0.3741 0.3964 0.4187 0.4407
0.4627 0.4844 0.5024 0.5203 0.5384
0.5573 0.5793 0.6012 0.6176 0.6325
0.6471 0.6609 0.6751 0.6903 0.7064

0.7237 0.7411 0.7586 0.7763 0.7972
0.8231 0.8487 0.8741 0.9006 0.9288
0.9569 0.9847 1.0124 1.0398 1.0000

Width:
0.0313 0.0627 0.0940 0.1196 0.1415
0.1595 0.1774 0.1953 0.2129 0.2304
0.2480 0.2655 0.2834 0.3023 0.3207
0.3381 0.3555 0.3718 0.3879 0.4040
0.4201 0.4362 0.4557 0.4754 0.4951
0.5141 0.5302 0.5463 0.5674 0.5903
0.6137 0.6385 0.6632 0.6873 0.7108
0.7333 0.7558 0.7783 0.8009 0.8199
0.8336 0.8472 0.8609 0.8733 0.8837
0.8942 0.9046 0.9150 0.9255 1.0000

Transect EXSwale6
Area:
0.0006 0.0026 0.0057 0.0097 0.0146
0.0204 0.0272 0.0352 0.0442 0.0541
0.0649 0.0765 0.0890 0.1024 0.1166
0.1317 0.1477 0.1648 0.1829 0.2017
0.2211 0.2411 0.2617 0.2829 0.3048
0.3275 0.3510 0.3755 0.4008 0.4269
0.4539 0.4811 0.5085 0.5360 0.5636
0.5914 0.6193 0.6474 0.6756 0.7041
0.7327 0.7615 0.7906 0.8199 0.8494
0.8791 0.9090 0.9391 0.9694 1.0000
Hrad:
0.0154 0.0307 0.0492 0.0671 0.0842
0.1002 0.1136 0.1275 0.1432 0.1604
0.1776 0.1947 0.2116 0.2282 0.2448
0.2604 0.2738 0.2873 0.3042 0.3246
0.3447 0.3645 0.3844 0.4045 0.4201
0.4345 0.4490 0.4635 0.4781 0.4928
0.5135 0.5413 0.5690 0.5965 0.6240
0.6512 0.6784 0.7054 0.7322 0.7572
0.7821 0.8068 0.8314 0.8559 0.8802
0.9044 0.9285 0.9525 0.9763 1.0000
Width:
0.0424 0.0847 0.1165 0.1454 0.1742
0.2043 0.2403 0.2763 0.3090 0.3379
0.3661 0.3939 0.4217 0.4494 0.4772
0.5065 0.5405 0.5746 0.6024 0.6224
0.6424 0.6624 0.6819 0.7003 0.7264
0.7546 0.7828 0.8110 0.8392 0.8674
0.8849 0.8896 0.8944 0.8991 0.9039
0.9087 0.9134 0.9182 0.9231 0.9301
0.9371 0.9441 0.9511 0.9581 0.9651
0.9721 0.9790 0.9860 0.9930 1.0000

Transect EXSwale7
Area:
0.0021 0.0066 0.0132 0.0216 0.0320
0.0434 0.0559 0.0692 0.0833 0.0981
0.1135 0.1292 0.1453 0.1617 0.1785
0.1956 0.2131 0.2308 0.2490 0.2674
0.2862 0.3054 0.3248 0.3446 0.3647
0.3852 0.4059 0.4271 0.4485 0.4704
0.4927 0.5153 0.5384 0.5619 0.5858
0.6101 0.6348 0.6598 0.6852 0.7111
0.7377 0.7651 0.7933 0.8221 0.8513
0.8806 0.9102 0.9399 0.9699 1.0000
Hrad:
0.0181 0.0365 0.0539 0.0694 0.0898
0.1110 0.1314 0.1543 0.1764 0.1979
0.2222 0.2475 0.2724 0.2969 0.3210
0.3447 0.3680 0.3911 0.4138 0.4362
0.4585 0.4806 0.5025 0.5241 0.5454
0.5666 0.5876 0.6074 0.6266 0.6456
0.6644 0.6820 0.6994 0.7170 0.7359
0.7546 0.7731 0.7916 0.8100 0.8182
0.8257 0.8336 0.8416 0.8560 0.8803
0.9045 0.9285 0.9525 0.9763 1.0000
Width:
0.1168 0.1839 0.2470 0.3152 0.3601
0.3951 0.4298 0.4534 0.4769 0.5005
0.5154 0.5266 0.5378 0.5490 0.5602
0.5713 0.5825 0.5937 0.6049 0.6161
0.6271 0.6380 0.6489 0.6598 0.6707
0.6816 0.6925 0.7045 0.7171 0.7297
0.7425 0.7565 0.7706 0.7844 0.7967
0.8090 0.8213 0.8336 0.8459 0.8691
0.8936 0.9181 0.9429 0.9608 0.9673
0.9739 0.9804 0.9869 0.9935 1.0000

Transect EXSwale8
Area:
0.0010 0.0039 0.0084 0.0141 0.0209
0.0288 0.0377 0.0477 0.0586 0.0706
0.0834 0.0971 0.1117 0.1272 0.1437
0.1608 0.1787 0.1974 0.2168 0.2368
0.2571 0.2777 0.2987 0.3201 0.3418
0.3638 0.3861 0.4087 0.4317 0.4549
0.4785 0.5024 0.5267 0.5512 0.5761
0.6013 0.6268 0.6527 0.6790 0.7056

```
            0.7326     0.7600     0.7880     0.8165     0.8456
            0.8751     0.9052     0.9358     0.9670     1.0000
Hrad:
            0.0173     0.0347     0.0567     0.0769     0.0980
            0.1183     0.1381     0.1575     0.1765     0.1954
            0.2173     0.2365     0.2555     0.2743     0.2947
            0.3159     0.3368     0.3575     0.3778     0.4049
            0.4320     0.4588     0.4853     0.5115     0.5380
            0.5642     0.5902     0.6159     0.6414     0.6666
            0.6916     0.7164     0.7410     0.7654     0.7895
            0.8124     0.8351     0.8576     0.8800     0.9022
            0.9225     0.9390     0.9555     0.9720     0.9886
            1.0051     1.0217     1.0383     1.0379     1.0000
Width:
            0.0568     0.1131     0.1489     0.1847     0.2154
            0.2457     0.2755     0.3052     0.3349     0.3642
            0.3870     0.4138     0.4406     0.4675     0.4912
            0.5129     0.5345     0.5561     0.5778     0.5887
            0.5988     0.6090     0.6191     0.6292     0.6385
            0.6478     0.6571     0.6664     0.6757     0.6850
            0.6943     0.7036     0.7128     0.7221     0.7314
            0.7418     0.7521     0.7625     0.7729     0.7833
            0.7952     0.8105     0.8259     0.8412     0.8565
            0.8718     0.8871     0.9025     0.9321     1.0000


************************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
************************************************************

***************
Analysis Options
***************
Flow Units ............... CMS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ YES
  Water Quality .......... NO
Infiltration Method ...... HORTON
Flow Routing Method ...... DYNWAVE
Starting Date ............ 11/10/2013 00:00:00
Ending Date .............. 11/10/2013 06:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:05:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 00:05:00
Routing Time Step ........ 1.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 20
Number of Threads ........ 2
Head Tolerance ........... 0.001500 m


*************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
*************************     ---------       -------
Total Precipitation ......         0.832        71.677
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.491        42.290
Surface Runoff ...........         0.343        29.587
Final Storage ............         0.003         0.252
Continuity Error (%) .....        -0.631


*************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
*************************     ---------     ----------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.343         3.434
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.343         3.431
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.002
Continuity Error (%) .....         0.059


************************
Highest Continuity Errors
************************
Node J3 (2.35%)
Node J9 (-1.88%)


**************************
```

Time-Step Critical Elements
****
None

****
Highest Flow Instability Indexes
****
All links are stable.

****
Routing Time Step Summary
****
Minimum Time Step : 0.50 sec
Average Time Step : 1.00 sec
Maximum Time Step : 1.00 sec
Percent in Steady State : 0.00
Average Iterations per Step : 2.00
Percent Not Converging : 0.00

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
S1	71.68	0.00	0.00	41.12	30.78	0.63	0.34	0.429
S2	71.68	0.00	0.00	37.97	33.70	0.30	0.14	0.470
S3	71.68	0.00	0.00	38.51	33.26	0.66	0.35	0.464
S4	71.68	0.00	0.00	44.77	27.16	0.46	0.22	0.379
S5	71.68	0.00	0.00	42.47	29.45	0.35	0.19	0.411
S6	71.68	0.00	0.00	44.77	27.16	0.22	0.11	0.379
S7	71.68	0.00	0.00	44.77	27.16	0.24	0.12	0.379
S8	71.68	0.00	0.00	44.77	27.16	0.27	0.13	0.379
S9	71.68	0.00	0.00	44.77	27.16	0.29	0.14	0.379

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.01	0.10	93.48	0 01:15	0.10
J10	JUNCTION	0.02	0.13	92.81	0 01:15	0.13
J11	JUNCTION	0.02	0.13	92.87	0 01:15	0.13
J12	JUNCTION	0.02	0.11	93.09	0 01:16	0.11
J2	JUNCTION	0.02	0.11	92.03	0 01:20	0.11
J3	JUNCTION	0.02	0.10	92.60	0 01:24	0.10
J4	JUNCTION	0.02	0.10	92.14	0 01:21	0.10
J5	JUNCTION	0.01	0.08	93.34	0 01:14	0.08
J6	JUNCTION	0.02	0.08	93.93	0 01:15	0.08
J8	JUNCTION	0.01	0.09	93.52	0 01:12	0.09
J9	JUNCTION	0.01	0.05	93.12	0 01:15	0.05
OF1	OUTFALL	0.02	0.11	91.94	0 01:16	0.11
OF2	OUTFALL	0.02	0.11	91.93	0 01:20	0.11
OF3	OUTFALL	0.02	0.10	91.67	0 01:21	0.10

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
J1	JUNCTION	0.345	0.345	0 01:15	0.661	0.661	-0.092
J10	JUNCTION	0.140	0.324	0 01:14	0.289	0.645	-0.068
J11	JUNCTION	0.238	0.580	0 01:15	0.494	1.16	-0.111
J12	JUNCTION	0.116	0.252	0 01:15	0.24	0.541	0.105
J2	JUNCTION	0.000	0.764	0 01:19	0	1.73	0.058
J3	JUNCTION	0.000	0.557	0 01:15	0	1.12	2.411
J4	JUNCTION	0.000	0.513	0 01:21	0	1.16	0.163
J5	JUNCTION	0.186	0.186	0 01:10	0.354	0.354	-0.490
J6	JUNCTION	0.139	0.139	0 01:15	0.301	0.301	-0.061
J8	JUNCTION	0.338	0.338	0 01:10	0.634	0.634	-0.184
J9	JUNCTION	0.223	0.561	0 01:12	0.461	1.1	-1.842
OF1	OUTFALL	0.000	0.250	0 01:16	0	0.54	0.000
OF2	OUTFALL	0.000	0.764	0 01:20	0	1.73	0.000
OF3	OUTFALL	0.000	0.512	0 01:21	0	1.16	0.000

****
Node Surcharge Summary

****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
OF1	82.93	0.030	0.250	0.540
OF2	82.52	0.097	0.764	1.733
OF3	82.35	0.065	0.512	1.158
System	82.60	0.192	1.511	3.431

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CHANNEL	0.217	0 01:24	1.05	0.01	0.14
C2	CHANNEL	0.512	0 01:21	1.56	0.00	0.07
C3	CHANNEL	0.242	0 01:24	1.08	0.01	0.15
C4	CHANNEL	0.764	0 01:20	1.92	0.00	0.08
C5_1	CHANNEL	0.184	0 01:14	0.55	0.04	0.35
C5_2	CHANNEL	0.323	0 01:17	1.38	0.02	0.19
C6_1	CHANNEL	0.343	0 01:15	0.96	0.02	0.20
C6_2	CHANNEL	0.581	0 01:16	1.54	0.04	0.21
C7_1	CHANNEL	0.137	0 01:15	0.92	0.01	0.12
C7_2	CHANNEL	0.250	0 01:16	1.38	0.01	0.14
C8_1	CHANNEL	0.339	0 01:12	1.02	0.06	0.29
C8_2	CHANNEL	0.557	0 01:15	0.60	0.03	0.31

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C1	1.00	0.17	0.00	0.00	0.03	0.80	0.00	0.00	0.03	0.00
C2	1.00	0.17	0.00	0.00	0.00	0.83	0.00	0.00	0.26	0.00
C3	1.00	0.17	0.00	0.00	0.04	0.79	0.00	0.00	0.12	0.00
C4	1.00	0.17	0.00	0.00	0.00	0.83	0.00	0.00	0.26	0.00
C5_1	1.00	0.17	0.00	0.00	0.82	0.01	0.00	0.00	0.82	0.00
C5_2	1.00	0.17	0.00	0.00	0.20	0.63	0.00	0.00	0.25	0.00
C6_1	1.00	0.17	0.00	0.00	0.74	0.09	0.00	0.00	0.81	0.00
C6_2	1.00	0.17	0.00	0.00	0.61	0.22	0.00	0.00	0.77	0.00
C7_1	1.00	0.17	0.00	0.00	0.52	0.31	0.00	0.00	0.81	0.00
C7_2	1.00	0.17	0.00	0.00	0.00	0.83	0.00	0.00	0.21	0.00
C8_1	1.00	0.17	0.00	0.00	0.58	0.25	0.00	0.00	0.56	0.00
C8_2	1.00	0.17	0.00	0.00	0.80	0.03	0.00	0.00	0.80	0.00

****
Conduit Surcharge Summary
****

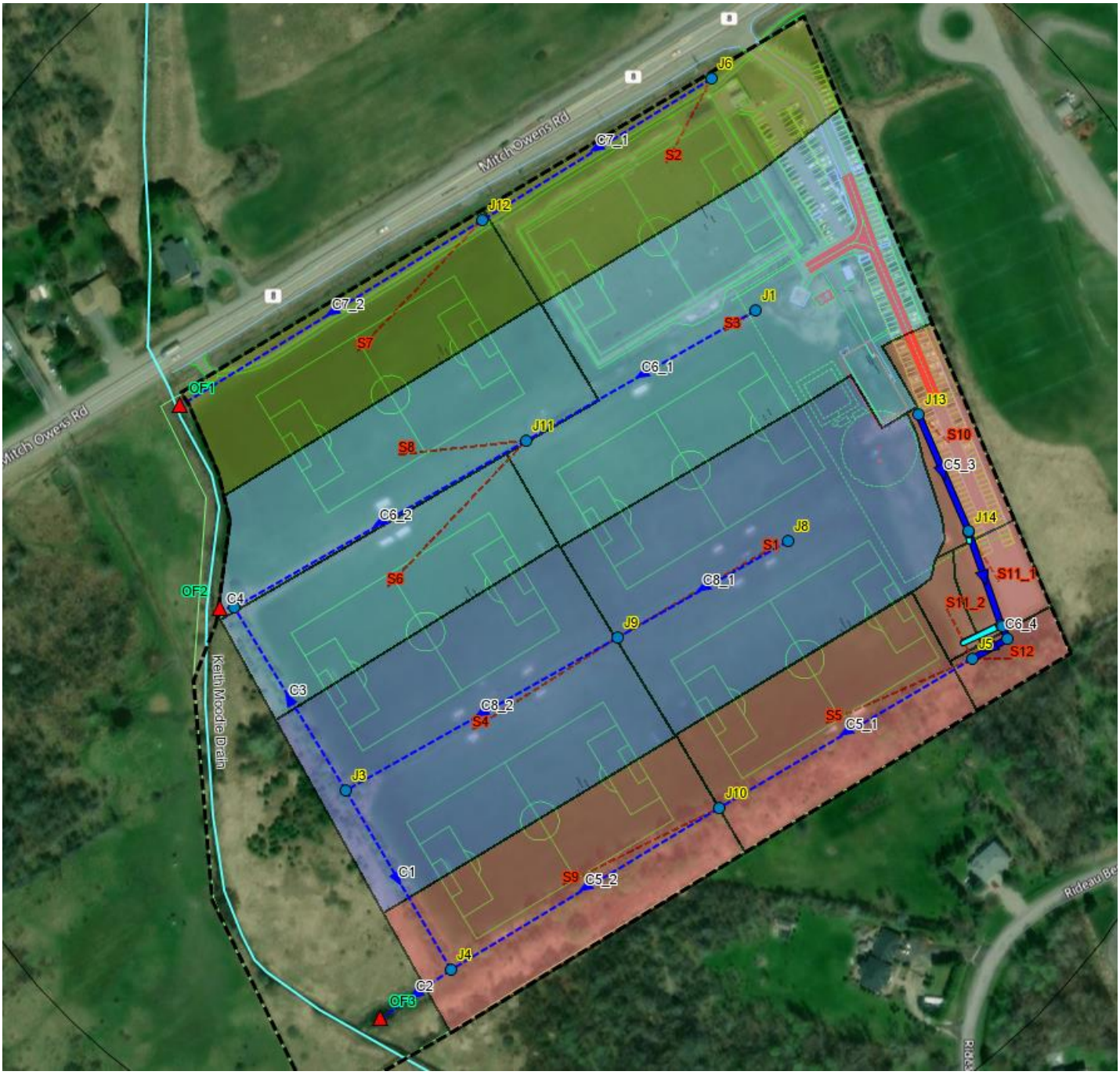
No conduits were surcharged.

Analysis begun on: Thu Jun 23 09:50:27 2022
Analysis ended on: Thu Jun 23 09:50:28 2022
Total elapsed time: 00:00:01

APPENDIX

B-2 PROPOSED CONDITIONS PCSWMM OUTPUT

APPENDIX


Mitch Owens Rd
Mitch Owens Rd
Keith Moodie Drain
J6
C7_1
S2
J12
C7_2
S7
J1
S3
C6_1
OF1
J13
S10
J11
S8
C5_3
C6_2
J14
J8
S1
S6
S11_1
OF2
C4
C8_1
S11_2
C6_4
J9
J5
S12
C3
C8_2
S4
S5
C5_1
J3
J10
C1
S9
C5_2
J4
C2
OF3

PROPOSED CONDITIONS 100-YEAR

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)

****
Element Count
****
Number of rain gages 16
Number of subcatchments ... 13
Number of nodes 20
Number of links 20
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
100yr_3hr_Chicago	100yr_3hr_Chicago	INTENSITY	10 min.
100yr_3hr_Chicago_Climate_Change	100yr_3hr_Chicago_Increase_20percent	INTENSITY	10 min.
100yr_6hr_Chicago	100yr_6hr_Chicago	INTENSITY	10 min.
100yr_6hr_Chicago_Climate_Change	100yr_6hr_Chicago_Increase_20percent	INTENSITY	10 min.
10yr_3hr_Chicago	10yr_3hr_Chicago	INTENSITY	10 min.
10yr_6hr_Chicago	10yr_6hr_Chicago	INTENSITY	10 min.
25mm_3hr_Chicago	25mm_3hr_Chicago	INTENSITY	10 min.
25mm_4hr_Chicago	25mm_4hr_Chicago	INTENSITY	10 min.
25yr_3hr_Chicago	25yr_3hr_Chicago	INTENSITY	10 min.
25yr_6hr_Chicago	25yr_6hr_Chicago	INTENSITY	10 min.
2yr_3hr_Chicago	2yr_3hr_Chicago	INTENSITY	10 min.
2yr_6hr_Chicago	2yr_6hr_Chicago	INTENSITY	10 min.
50yr_3hr_Chicago	50yr_3hr_Chicago	INTENSITY	10 min.
50yr_6hr_Chicago	50yr_6hr_Chicago	INTENSITY	10 min.
5yr_3hr_Chicago	5yr_3hr_Chicago	INTENSITY	10 min.
5yr_6hr_Chicago	5yr_6hr_Chicago	INTENSITY	10 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
S1	1.69	338.16	10.15	1.5000	100yr_3hr_Chicago	J9
S10	0.29	48.30	65.76	1.2000	100yr_3hr_Chicago	J13
S11_1	0.17	33.16	50.27	1.2000	100yr_3hr_Chicago	J14
S11_2	0.08	16.44	10.00	1.2000	100yr_3hr_Chicago	J5
S12	0.14	31.09	10.00	1.5000	100yr_3hr_Chicago	J5
S2	0.89	178.38	28.89	0.5000	100yr_3hr_Chicago	J6
S3	2.04	264.62	28.84	1.0000	100yr_3hr_Chicago	J1
S4	1.70	339.74	10.00	1.2000	100yr_3hr_Chicago	J9
S5	0.84	168.80	10.00	1.5000	100yr_3hr_Chicago	J5
S6	0.83	165.02	10.00	1.2000	100yr_3hr_Chicago	J11
S7	0.88	176.76	10.00	1.2000	100yr_3hr_Chicago	J12
S8	0.99	198.42	10.00	1.2000	100yr_3hr_Chicago	J11
S9	1.07	213.18	10.00	1.2000	100yr_3hr_Chicago	J10

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
J1	JUNCTION	93.38	3.00	0.0	
J10	JUNCTION	92.68	3.00	0.0	
J11	JUNCTION	92.74	3.00	0.0	
J12	JUNCTION	92.98	3.00	0.0	
J13	JUNCTION	94.06	3.00	0.0	
J14	JUNCTION	93.76	3.00	0.0	
J15	JUNCTION	93.50	3.00	0.0	
J16	JUNCTION	93.50	3.00	0.0	
J17	JUNCTION	93.76	3.00	0.0	
J2	JUNCTION	91.92	3.00	0.0	
J3	JUNCTION	92.50	3.00	0.0	
J4	JUNCTION	92.04	3.00	0.0	
J5	JUNCTION	93.30	2.96	0.0	
J6	JUNCTION	93.85	3.00	0.0	
J7	JUNCTION	93.44	2.96	0.0	
J8	JUNCTION	93.43	3.00	0.0	
J9	JUNCTION	93.07	3.00	0.0	
OF1	OUTFALL	91.84	0.76	0.0	
OF2	OUTFALL	91.82	1.34	0.0	
OF3	OUTFALL	91.57	1.34	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	J3	J4	CONDUIT	98.5	0.4689	0.0100
C2	J4	OF3	CONDUIT	41.0	1.1401	0.0100
C3	J3	J2	CONDUIT	102.3	0.5663	0.0100
C4	J2	OF2	CONDUIT	6.6	1.4741	0.0100
C5_1	J5	J10	CONDUIT	140.3	0.4427	0.0100
C5_2	J10	J4	CONDUIT	149.0	0.4302	0.0100
C5_3	J13	J17	CONDUIT	60.2	0.4986	0.0350
C6_1	J1	J11	CONDUIT	125.8	0.5105	0.0100
C6_2	J11	J2	CONDUIT	160.2	0.5106	0.0100
C6_3	J14	J15	CONDUIT	46.7	0.5562	0.0350
C6_4	J16	J7	CONDUIT	6.3	0.9548	0.0350
C6_5	J7	J5	CONDUIT	18.9	0.7413	0.0350
C7_1	J6	J12	CONDUIT	128.2	0.6772	0.0100
C7_2	J12	OF1	CONDUIT	168.7	0.6770	0.0100
C8_1	J8	J9	CONDUIT	93.1	0.3834	0.0100
C8_2	J9	J3	CONDUIT	148.9	0.3842	0.0100
C5_4	J17	J14	ORIFICE			
OR1	J15	J16	ORIFICE			
W1	J15	J16	WEIR			
W2	J17	J14	WEIR			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	EXSwale8	0.71	5.47	0.41	13.20	1	20.60
C2	EXSwale7	1.34	17.40	0.87	19.63	1	169.59
C3	EXSwale8	0.71	5.47	0.41	13.20	1	22.63
C4	EXSwale7	1.34	17.40	0.87	19.63	1	192.83
C5_1	EXSwale5	0.31	2.68	0.15	17.25	1	5.12
C5_2	EXSwale6	0.61	5.13	0.39	12.91	1	18.08
C5_3	TRAPEZOIDAL	0.60	1.98	0.37	5.10	1	2.07
C6_1	ExSwale2	0.56	5.53	0.21	26.45	1	13.86
C6_2	ExSwale2	0.56	5.53	0.21	26.45	1	13.86
C6_3	TRAPEZOIDAL	0.60	1.98	0.37	5.10	1	2.19
C6_4	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	4.54
C6_5	TRAPEZOIDAL	0.60	2.88	0.42	6.60	1	4.00
C7_1	EXSwale1	0.76	5.75	0.34	16.59	1	23.16
C7_2	EXSwale1	0.76	5.75	0.34	16.59	1	23.16
C8_1	EXSwale3	0.24	3.55	0.14	25.47	1	5.89
C8_2	EXSwale4	0.24	10.20	0.16	62.64	1	18.77

****
Transect Summary
****

Transect EGS
Area:

0.0102	0.0208	0.0318	0.0432	0.0550
0.0672	0.0798	0.0928	0.1062	0.1200
0.1342	0.1488	0.1638	0.1792	0.1950
0.2112	0.2278	0.2448	0.2622	0.2800
0.2982	0.3168	0.3358	0.3552	0.3750
0.3952	0.4158	0.4368	0.4582	0.4800
0.5022	0.5248	0.5478	0.5712	0.5950
0.6192	0.6438	0.6688	0.6942	0.7200
0.7462	0.7728	0.7998	0.8272	0.8550
0.8832	0.9118	0.9408	0.9702	1.0000

Hrad:

0.0302	0.0593	0.0873	0.1143	0.1405
0.1659	0.1907	0.2148	0.2384	0.2614
0.2840	0.3061	0.3278	0.3492	0.3702
0.3910	0.4114	0.4316	0.4515	0.4711
0.4906	0.5099	0.5289	0.5478	0.5665
0.5851	0.6035	0.6218	0.6399	0.6580
0.6759	0.6936	0.7113	0.7289	0.7464
0.7638	0.7811	0.7984	0.8155	0.8326
0.8496	0.8665	0.8834	0.9002	0.9170
0.9337	0.9504	0.9670	0.9835	1.0000

Width:

0.3467	0.3600	0.3733	0.3867	0.4000
0.4133	0.4267	0.4400	0.4533	0.4667
0.4800	0.4933	0.5067	0.5200	0.5333
0.5467	0.5600	0.5733	0.5867	0.6000
0.6133	0.6267	0.6400	0.6533	0.6667
0.6800	0.6933	0.7067	0.7200	0.7333
0.7467	0.7600	0.7733	0.7867	0.8000
0.8133	0.8267	0.8400	0.8533	0.8667
0.8800	0.8933	0.9067	0.9200	0.9333
0.9467	0.9600	0.9733	0.9867	1.0000

Transect EXSwale1
Area:

0.0011	0.0043	0.0084	0.0131	0.0185
0.0246	0.0313	0.0385	0.0461	0.0542
0.0628	0.0718	0.0813	0.0913	0.1017
0.1126	0.1239	0.1357	0.1481	0.1609
0.1743	0.1883	0.2028	0.2179	0.2341

0.2515 0.2699 0.2901 0.3118 0.3344
0.3577 0.3818 0.4067 0.4323 0.4585
0.4855 0.5130 0.5413 0.5702 0.6001
0.6316 0.6649 0.7006 0.7396 0.7823
0.8254 0.8687 0.9122 0.9560 1.0000
Hrad:
0.0222 0.0521 0.0846 0.1142 0.1420
0.1688 0.1999 0.2299 0.2588 0.2870
0.3144 0.3413 0.3680 0.3942 0.4201
0.4457 0.4709 0.4955 0.5170 0.5386
0.5602 0.5818 0.6034 0.6124 0.6143
0.6186 0.6187 0.6070 0.6193 0.6420
0.6646 0.6872 0.7097 0.7345 0.7597
0.7847 0.8095 0.8343 0.8587 0.8619
0.8637 0.8505 0.8333 0.7832 0.8040
0.8436 0.8830 0.9222 0.9612 1.0000
Width:
0.0520 0.0836 0.0993 0.1150 0.1307
0.1462 0.1569 0.1675 0.1781 0.1888
0.1994 0.2101 0.2206 0.2310 0.2414
0.2519 0.2623 0.2730 0.2854 0.2978
0.3101 0.3225 0.3348 0.3546 0.3800
0.4054 0.4353 0.4771 0.5027 0.5200
0.5374 0.5548 0.5722 0.5876 0.6027
0.6177 0.6328 0.6478 0.6629 0.6953
0.7304 0.7811 0.8403 0.9445 0.9732
0.9786 0.9839 0.9893 0.9946 1.0000

Transect ExSwale2
Area:
0.0026 0.0068 0.0122 0.0183 0.0250
0.0323 0.0400 0.0482 0.0568 0.0659
0.0754 0.0853 0.0955 0.1062 0.1173
0.1288 0.1408 0.1532 0.1660 0.1794
0.1932 0.2076 0.2225 0.2379 0.2538
0.2702 0.2872 0.3046 0.3226 0.3411
0.3600 0.3795 0.3996 0.4204 0.4419
0.4640 0.4870 0.5111 0.5364 0.5641
0.5943 0.6272 0.6630 0.7025 0.7461
0.7945 0.8443 0.8951 0.9468 1.0000
Hrad:
0.0393 0.0744 0.1152 0.1528 0.1915
0.2322 0.2712 0.3089 0.3456 0.3824
0.4192 0.4551 0.4904 0.5250 0.5591
0.5917 0.6220 0.6522 0.6814 0.7089
0.7363 0.7637 0.7911 0.8184 0.8442
0.8700 0.8968 0.9245 0.9521 0.9797
1.0073 1.0309 1.0506 1.0707 1.0912
1.1101 1.1130 1.1137 1.0945 1.0481
1.0137 0.9885 0.9478 0.9108 0.8747
0.8692 0.9049 0.9406 0.9727 1.0000
Width:
0.0652 0.0921 0.1058 0.1195 0.1307
0.1392 0.1476 0.1560 0.1644 0.1723
0.1797 0.1872 0.1946 0.2021 0.2096
0.2174 0.2260 0.2345 0.2433 0.2526
0.2620 0.2714 0.2808 0.2901 0.3001
0.3100 0.3196 0.3289 0.3382 0.3475
0.3568 0.3674 0.3797 0.3919 0.4042
0.4172 0.4368 0.4582 0.4894 0.5376
0.5857 0.6339 0.6991 0.7711 0.8527
0.9140 0.9330 0.9515 0.9734 1.0000

Transect EXSwale3
Area:
0.0010 0.0033 0.0063 0.0100 0.0143
0.0195 0.0255 0.0323 0.0399 0.0482
0.0572 0.0672 0.0778 0.0893 0.1015
0.1147 0.1287 0.1435 0.1591 0.1754
0.1925 0.2103 0.2290 0.2484 0.2686
0.2894 0.3110 0.3334 0.3566 0.3807
0.4055 0.4311 0.4575 0.4847 0.5126
0.5415 0.5718 0.6035 0.6354 0.6675
0.6999 0.7324 0.7652 0.7982 0.8314
0.8647 0.8983 0.9320 0.9659 1.0000
Hrad:
0.0188 0.0431 0.0646 0.0848 0.1042
0.1197 0.1348 0.1532 0.1720 0.1898
0.2061 0.2228 0.2404 0.2580 0.2730
0.2879 0.3054 0.3229 0.3410 0.3594
0.3771 0.3934 0.4103 0.4293 0.4481
0.4662 0.4838 0.5006 0.5155 0.5314
0.5490 0.5666 0.5841 0.6016 0.6170
0.6319 0.6195 0.6491 0.6786 0.7078
0.7369 0.7658 0.7950 0.8247 0.8542
0.8836 0.9129 0.9421 0.9711 1.0000
Width:
0.0557 0.0770 0.0976 0.1177 0.1377
0.1625 0.1890 0.2109 0.2318 0.2538
0.2778 0.3014 0.3238 0.3461 0.3719
0.3985 0.4215 0.4445 0.4665 0.4881
0.5104 0.5347 0.5582 0.5788 0.5994
0.6209 0.6429 0.6660 0.6918 0.7163
0.7387 0.7610 0.7833 0.8057 0.8308
0.8570 0.9230 0.9297 0.9364 0.9431

0.9497 0.9564 0.9626 0.9680 0.9733
0.9786 0.9840 0.9893 0.9947 1.0000

Transect EXSwale4
Area:
0.0011 0.0039 0.0083 0.0142 0.0215
0.0307 0.0421 0.0557 0.0702 0.0853
0.1007 0.1165 0.1327 0.1492 0.1662
0.1836 0.2014 0.2196 0.2381 0.2570
0.2762 0.2959 0.3159 0.3364 0.3572
0.3785 0.4004 0.4226 0.4453 0.4684
0.4919 0.5158 0.5401 0.5648 0.5899
0.6155 0.6413 0.6674 0.6938 0.7204
0.7472 0.7743 0.8016 0.8291 0.8570
0.8851 0.9134 0.9420 0.9708 1.0000
Hrad:
0.0167 0.0322 0.0492 0.0642 0.0788
0.0896 0.1014 0.1182 0.1430 0.1688
0.1945 0.2197 0.2444 0.2683 0.2917
0.3145 0.3372 0.3605 0.3836 0.4062
0.4276 0.4490 0.4707 0.4921 0.5105
0.5285 0.5475 0.5671 0.5870 0.6064
0.6250 0.6446 0.6641 0.6829 0.7016
0.7224 0.7442 0.7667 0.7892 0.8122
0.8350 0.8577 0.8802 0.9017 0.9232
0.9446 0.9665 0.9892 1.0098 1.0000
Width:
0.0677 0.1210 0.1683 0.2210 0.2737
0.3434 0.4159 0.4717 0.4920 0.5059
0.5184 0.5309 0.5434 0.5568 0.5704
0.5845 0.5979 0.6097 0.6213 0.6333
0.6467 0.6597 0.6720 0.6844 0.7005
0.7171 0.7322 0.7461 0.7595 0.7732
0.7879 0.8011 0.8142 0.8280 0.8418
0.8529 0.8626 0.8713 0.8798 0.8876
0.8954 0.9032 0.9112 0.9199 0.9286
0.9372 0.9452 0.9523 0.9613 1.0000

Transect EXSwale5
Area:
0.0006 0.0025 0.0056 0.0098 0.0150
0.0209 0.0275 0.0349 0.0429 0.0517
0.0611 0.0712 0.0820 0.0936 0.1059
0.1188 0.1325 0.1468 0.1618 0.1774
0.1937 0.2106 0.2281 0.2465 0.2656
0.2855 0.3061 0.3273 0.3492 0.3720
0.3958 0.4205 0.4461 0.4727 0.5003
0.5287 0.5581 0.5883 0.6195 0.6514
0.6840 0.7172 0.7508 0.7850 0.8196
0.8547 0.8901 0.9260 0.9623 1.0000
Hrad:
0.0198 0.0396 0.0594 0.0821 0.1061
0.1315 0.1558 0.1793 0.2024 0.2251
0.2473 0.2692 0.2905 0.3107 0.3313
0.3528 0.3741 0.3964 0.4187 0.4407
0.4627 0.4844 0.5024 0.5203 0.5384
0.5573 0.5793 0.6012 0.6176 0.6325
0.6471 0.6609 0.6751 0.6903 0.7064
0.7237 0.7411 0.7586 0.7763 0.7972
0.8231 0.8487 0.8741 0.9006 0.9288
0.9569 0.9847 1.0124 1.0398 1.0000
Width:
0.0313 0.0627 0.0940 0.1196 0.1415
0.1595 0.1774 0.1953 0.2129 0.2304
0.2480 0.2655 0.2834 0.3023 0.3207
0.3381 0.3555 0.3718 0.3879 0.4040
0.4201 0.4362 0.4557 0.4754 0.4951
0.5141 0.5302 0.5463 0.5674 0.5903
0.6137 0.6385 0.6632 0.6873 0.7108
0.7333 0.7558 0.7783 0.8009 0.8199
0.8336 0.8472 0.8609 0.8733 0.8837
0.8942 0.9046 0.9150 0.9255 1.0000

Transect EXSwale6
Area:
0.0006 0.0026 0.0057 0.0097 0.0146
0.0204 0.0272 0.0352 0.0442 0.0541
0.0649 0.0765 0.0890 0.1024 0.1166
0.1317 0.1477 0.1648 0.1829 0.2017
0.2211 0.2411 0.2617 0.2829 0.3048
0.3275 0.3510 0.3755 0.4008 0.4269
0.4539 0.4811 0.5085 0.5360 0.5636
0.5914 0.6193 0.6474 0.6756 0.7041
0.7327 0.7615 0.7906 0.8199 0.8494
0.8791 0.9090 0.9391 0.9694 1.0000
Hrad:
0.0154 0.0307 0.0492 0.0671 0.0842
0.1002 0.1136 0.1275 0.1432 0.1604
0.1776 0.1947 0.2116 0.2282 0.2448
0.2604 0.2738 0.2873 0.3042 0.3246
0.3447 0.3645 0.3844 0.4045 0.4201
0.4345 0.4490 0.4635 0.4781 0.4928
0.5135 0.5413 0.5690 0.5965 0.6240
0.6512 0.6784 0.7054 0.7322 0.7572
0.7821 0.8068 0.8314 0.8559 0.8802

```
            0.9044     0.9285     0.9525     0.9763     1.0000
Width:
            0.0424     0.0847     0.1165     0.1454     0.1742
            0.2043     0.2403     0.2763     0.3090     0.3379
            0.3661     0.3939     0.4217     0.4494     0.4772
            0.5065     0.5405     0.5746     0.6024     0.6224
            0.6424     0.6624     0.6819     0.7003     0.7264
            0.7546     0.7828     0.8110     0.8392     0.8674
            0.8849     0.8896     0.8944     0.8991     0.9039
            0.9087     0.9134     0.9182     0.9231     0.9301
            0.9371     0.9441     0.9511     0.9581     0.9651
            0.9721     0.9790     0.9860     0.9930     1.0000

Transect EXSwale7
Area:
            0.0021     0.0066     0.0132     0.0216     0.0320
            0.0434     0.0559     0.0692     0.0833     0.0981
            0.1135     0.1292     0.1453     0.1617     0.1785
            0.1956     0.2131     0.2308     0.2490     0.2674
            0.2862     0.3054     0.3248     0.3446     0.3647
            0.3852     0.4059     0.4271     0.4485     0.4704
            0.4927     0.5153     0.5384     0.5619     0.5858
            0.6101     0.6348     0.6598     0.6852     0.7111
            0.7377     0.7651     0.7933     0.8221     0.8513
            0.8806     0.9102     0.9399     0.9699     1.0000
Hrad:
            0.0181     0.0365     0.0539     0.0694     0.0898
            0.1110     0.1314     0.1543     0.1764     0.1979
            0.2222     0.2475     0.2724     0.2969     0.3210
            0.3447     0.3680     0.3911     0.4138     0.4362
            0.4585     0.4806     0.5025     0.5241     0.5454
            0.5666     0.5876     0.6074     0.6266     0.6456
            0.6644     0.6820     0.6994     0.7170     0.7359
            0.7546     0.7731     0.7916     0.8100     0.8182
            0.8257     0.8336     0.8416     0.8560     0.8803
            0.9045     0.9285     0.9525     0.9763     1.0000
Width:
            0.1168     0.1839     0.2470     0.3152     0.3601
            0.3951     0.4298     0.4534     0.4769     0.5005
            0.5154     0.5266     0.5378     0.5490     0.5602
            0.5713     0.5825     0.5937     0.6049     0.6161
            0.6271     0.6380     0.6489     0.6598     0.6707
            0.6816     0.6925     0.7045     0.7171     0.7297
            0.7425     0.7565     0.7706     0.7844     0.7967
            0.8090     0.8213     0.8336     0.8459     0.8691
            0.8936     0.9181     0.9429     0.9608     0.9673
            0.9739     0.9804     0.9869     0.9935     1.0000

Transect EXSwale8
Area:
            0.0010     0.0039     0.0084     0.0141     0.0209
            0.0288     0.0377     0.0477     0.0586     0.0706
            0.0834     0.0971     0.1117     0.1272     0.1437
            0.1608     0.1787     0.1974     0.2168     0.2368
            0.2571     0.2777     0.2987     0.3201     0.3418
            0.3638     0.3861     0.4087     0.4317     0.4549
            0.4785     0.5024     0.5267     0.5512     0.5761
            0.6013     0.6268     0.6527     0.6790     0.7056
            0.7326     0.7600     0.7880     0.8165     0.8456
            0.8751     0.9052     0.9358     0.9670     1.0000
Hrad:
            0.0173     0.0347     0.0567     0.0769     0.0980
            0.1183     0.1381     0.1575     0.1765     0.1954
            0.2173     0.2365     0.2555     0.2743     0.2947
            0.3159     0.3368     0.3575     0.3778     0.4049
            0.4320     0.4588     0.4853     0.5115     0.5380
            0.5642     0.5902     0.6159     0.6414     0.6666
            0.6916     0.7164     0.7410     0.7654     0.7895
            0.8124     0.8351     0.8576     0.8800     0.9022
            0.9225     0.9390     0.9555     0.9720     0.9886
            1.0051     1.0217     1.0383     1.0379     1.0000
Width:
            0.0568     0.1131     0.1489     0.1847     0.2154
            0.2457     0.2755     0.3052     0.3349     0.3642
            0.3870     0.4138     0.4406     0.4675     0.4912
            0.5129     0.5345     0.5561     0.5778     0.5887
            0.5988     0.6090     0.6191     0.6292     0.6385
            0.6478     0.6571     0.6664     0.6757     0.6850
            0.6943     0.7036     0.7128     0.7221     0.7314
            0.7418     0.7521     0.7625     0.7729     0.7833
            0.7952     0.8105     0.8259     0.8412     0.8565
            0.8718     0.8871     0.9025     0.9321     1.0000


************************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
************************************************************

***************
Analysis Options
***************
Flow Units ..... CMS
Process Models:
```

```
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ YES
  Water Quality .......... NO
Infiltration Method ...... HORTON
Flow Routing Method ...... DYNWAVE
Starting Date ............ 11/10/2013 00:00:00
Ending Date .............. 11/10/2013 06:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:05:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 00:05:00
Routing Time Step ........ 1.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 20
Number of Threads ........ 2
Head Tolerance ........... 0.001500 m
```

Runoff Quantity Continuity	Volume hectare-m	Depth mm
Total Precipitation	0.832	71.677
Evaporation Loss	0.000	0.000
Infiltration Loss	0.489	42.135
Surface Runoff	0.345	29.722
Final Storage	0.003	0.264
Continuity Error (%)	-0.621	

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.345	3.450
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.345	3.446
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.002
Continuity Error (%)	0.068	

```
*************************
Highest Continuity Errors
*************************
Node J3 (2.48%)
Node J9 (-2.16%)


***************************
Time-Step Critical Elements
***************************
None


*********************************
Highest Flow Instability Indexes
*********************************
All links are stable.


************************
Routing Time Step Summary
************************
Minimum Time Step           :     0.50 sec
Average Time Step           :     1.00 sec
Maximum Time Step           :     1.00 sec
Percent in Steady State     :     0.00
Average Iterations per Step :     2.00
Percent Not Converging      :     0.00


***************************
Subcatchment Runoff Summary
***************************
```

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff CMS	Runoff Coeff
S1	71.68	0.00	0.00	44.34	27.62	0.47	0.24	0.385
S10	71.68	0.00	0.00	19.78	51.81	0.15	0.10	0.723
S11_1	71.68	0.00	0.00	27.17	44.48	0.07	0.05	0.621
S11_2	71.68	0.00	0.00	44.77	27.16	0.02	0.01	0.379
S12	71.68	0.00	0.00	44.09	27.92	0.04	0.02	0.390
S2	71.68	0.00	0.00	37.97	33.70	0.30	0.14	0.470

S3	71.68	0.00	0.00	38.27	33.38	0.68	0.30	0.466
S4	71.68	0.00	0.00	44.77	27.16	0.46	0.22	0.379
S5	71.68	0.00	0.00	44.41	27.56	0.23	0.12	0.385
S6	71.68	0.00	0.00	44.77	27.16	0.22	0.11	0.379
S7	71.68	0.00	0.00	44.77	27.16	0.24	0.12	0.379
S8	71.68	0.00	0.00	44.77	27.16	0.27	0.13	0.379
S9	71.68	0.00	0.00	44.77	27.16	0.29	0.14	0.379

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
J1	JUNCTION	0.02	0.09	93.47	0 01:15	0.09
J10	JUNCTION	0.03	0.14	92.82	0 01:21	0.14
J11	JUNCTION	0.02	0.12	92.86	0 01:16	0.12
J12	JUNCTION	0.02	0.11	93.09	0 01:16	0.11
J13	JUNCTION	0.01	0.12	94.18	0 01:15	0.12
J14	JUNCTION	0.02	0.18	93.94	0 01:19	0.18
J15	JUNCTION	0.09	0.43	93.93	0 01:19	0.43
J16	JUNCTION	0.01	0.08	93.58	0 01:19	0.08
J17	JUNCTION	0.07	0.41	94.17	0 01:16	0.40
J2	JUNCTION	0.02	0.11	92.03	0 01:20	0.11
J3	JUNCTION	0.02	0.09	92.59	0 01:24	0.09
J4	JUNCTION	0.02	0.10	92.14	0 01:23	0.10
J5	JUNCTION	0.02	0.09	93.39	0 01:20	0.09
J6	JUNCTION	0.02	0.08	93.93	0 01:15	0.08
J7	JUNCTION	0.01	0.08	93.52	0 01:20	0.08
J8	JUNCTION	0.00	0.00	93.43	0 00:00	0.00
J9	JUNCTION	0.01	0.05	93.12	0 01:14	0.05
OF1	OUTFALL	0.02	0.11	91.94	0 01:16	0.11
OF2	OUTFALL	0.02	0.11	91.93	0 01:21	0.11
OF3	OUTFALL	0.02	0.10	91.67	0 01:23	0.10

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent	
J1	JUNCTION	0.300	0.300	0 01:15	0.68	0.68	-0.040	
J10	JUNCTION	0.140	0.379	0 01:20	0.289	0.808	-0.058	
J11	JUNCTION	0.238	0.533	0 01:15	0.494	1.17	-0.111	
J12	JUNCTION	0.116	0.252	0 01:15	0.24	0.541	0.105	
J13	JUNCTION	0.103	0.103	0 01:15	0.15	0.15	-0.752	
J14	JUNCTION	0.048	0.133	0 01:16	0.0738	0.224	-0.261	
J15	JUNCTION	0.000	0.121	0 01:17	0	0.224	0.360	
J16	JUNCTION	0.000	0.117	0 01:19	0	0.224	0.013	
J17	JUNCTION	0.000	0.102	0 01:15	0	0.151	0.821	
J2	JUNCTION	0.000	0.694	0 01:20	0	1.66	0.065	
J3	JUNCTION	0.000	0.458	0 01:14	0	0.948	2.544	
J4	JUNCTION	0.000	0.547	0 01:22	0	1.25	0.145	
J5	JUNCTION	0.153	0.253	0 01:19	0.294	0.518	-0.129	
J6	JUNCTION	0.139	0.139	0 01:15	0.301	0.301	-0.061	
J7	JUNCTION	0.000	0.117	0 01:19	0	0.224	0.022	
J8	JUNCTION	0.000	0.000	0 00:00	0	0	0.000	ltr
J9	JUNCTION	0.465	0.465	0 01:10	0.928	0.928	-2.113	
OF1	OUTFALL	0.000	0.250	0 01:16	0	0.54	0.000	
OF2	OUTFALL	0.000	0.693	0 01:21	0	1.66	0.000	
OF3	OUTFALL	0.000	0.545	0 01:23	0	1.25	0.000	

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr

OF1	82.93	0.030	0.250	0.540
OF2	82.51	0.093	0.693	1.659
OF3	82.32	0.070	0.545	1.247
System	82.59	0.193	1.462	3.446

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days	hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CHANNEL	0.179	0	01:24	0.91	0.01	0.14
C2	CHANNEL	0.545	0	01:23	1.59	0.00	0.08
C3	CHANNEL	0.196	0	01:24	0.97	0.01	0.14
C4	CHANNEL	0.693	0	01:21	1.86	0.00	0.08
C5_1	CHANNEL	0.250	0	01:20	0.59	0.05	0.38
C5_2	CHANNEL	0.373	0	01:21	1.38	0.02	0.20
C5_3	CONDUIT	0.102	0	01:15	0.32	0.05	0.44
C6_1	CHANNEL	0.297	0	01:15	0.90	0.02	0.19
C6_2	CHANNEL	0.532	0	01:16	1.47	0.04	0.20
C6_3	CONDUIT	0.121	0	01:17	0.31	0.06	0.51
C6_4	CONDUIT	0.117	0	01:19	0.46	0.03	0.13
C6_5	CONDUIT	0.117	0	01:20	0.42	0.03	0.14
C7_1	CHANNEL	0.137	0	01:15	0.92	0.01	0.12
C7_2	CHANNEL	0.250	0	01:16	1.38	0.01	0.14
C8_1	CHANNEL	0.000	0	00:00	0.00	0.00	0.10
C8_2	CHANNEL	0.458	0	01:14	0.56	0.02	0.28
C5_4	ORIFICE	0.025	0	01:14			1.00
OR1	ORIFICE	0.029	0	01:19			1.00
W1	WEIR	0.087	0	01:19			0.13
W2	WEIR	0.065	0	01:16			0.11

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
C1	1.00	0.17	0.00	0.00	0.03	0.80	0.00	0.00	0.11	0.00
C2	1.00	0.17	0.00	0.00	0.00	0.83	0.00	0.00	0.13	0.00
C3	1.00	0.17	0.00	0.00	0.04	0.79	0.00	0.00	0.22	0.00
C4	1.00	0.17	0.00	0.00	0.00	0.83	0.00	0.00	0.30	0.00
C5_1	1.00	0.17	0.00	0.00	0.83	0.00	0.00	0.00	0.82	0.00
C5_2	1.00	0.17	0.00	0.00	0.00	0.83	0.00	0.00	0.00	0.00
C5_3	1.00	0.15	0.00	0.00	0.85	0.00	0.00	0.00	0.79	0.00
C6_1	1.00	0.17	0.00	0.00	0.70	0.13	0.00	0.00	0.81	0.00
C6_2	1.00	0.17	0.00	0.00	0.57	0.26	0.00	0.00	0.75	0.00
C6_3	1.00	0.15	0.00	0.00	0.85	0.00	0.00	0.00	0.69	0.00
C6_4	1.00	0.17	0.00	0.00	0.83	0.00	0.00	0.00	0.79	0.00
C6_5	1.00	0.17	0.01	0.00	0.82	0.00	0.00	0.00	0.82	0.00
C7_1	1.00	0.17	0.00	0.00	0.52	0.31	0.00	0.00	0.81	0.00
C7_2	1.00	0.17	0.00	0.00	0.00	0.83	0.00	0.00	0.21	0.00
C8_1	1.00	0.17	0.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C8_2	1.00	0.17	0.00	0.00	0.80	0.03	0.00	0.00	0.80	0.00

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Tue Apr 11 08:44:29 2023
Analysis ended on: Tue Apr 11 08:44:29 2023
Total elapsed time: < 1 sec

APPENDIX

C ENHANCED GRASS SWALE CALCULATIONS

SWALE CALCULATION SHEET

5650 MITCH OWENS ROAD - 25 mm, 4 hour storm

Check for satisfaction of criteria for enhanced grass swales (TRCA, 2010)

Designed by: Kathryn Kerker **Date:** 2023-04-11
Checked by: Jingwei Zhang **Date:** 2023-04-11
Approved by: Jingwei Zhang **Date:** 2023-04-11
Drawing Ref:

Standard Design Calculation Sheet (Rational Method)

Location			Drainage Areas			Rational Method Runoff					Swale Data							Comment
Swale Name	From	To	Runoff Coefficients 0.25 ha	0.70 ha	0.90 ha	Individual AC	Accum. AC	Runoff Coefficient C	Rainfall Intensity i mm/h	Q L/s	Side Slope x:1	Bottom Width m	Depth m	Slope %	Length m	Q L/s	Vel. m/s	
C5_3	J13	J17	0.10		0.19	0.20	0.20	0.68	35.0	19	3	1.50	0.05	0.50	60	19	0.2	OK
C6_3	J14	J15	0.08		0.08	0.10	0.29	0.64	33.5	27	3	1.50	0.06	0.50	47	27	0.3	OK

Notes:

The slope of open channels will depend on various factors including roadway longitudinal grade and natural topography;
The minimum allowable ditch/swale slope is 0.5% (1% is desirable);
For Runoff Coefficient (C), grassed area = 0.25, gravel area = 0.7, paved area = 0.9
Also for C, add 10% for 25-year storm event, 20% for 50-year storm event and 25% for 100-year storm event (update this in appropriate drainage cell)
A minimum time of concentration of 10min shall be used
Rainfall intensity determined by MOE Stormwater Management Planning and Design Manual (2003) i = 43C + 5.9
Maximum velocity = 0.5m/s, Flow depth below 0.1m preferred
Channel protection in the form of sodding, gabion, armour stone, riprap, asphalt, and concrete lining may be required depending on design flow and velocities; and
Roughness Coefficient (n) = 0.035
Permissible velocities for channels lined with grass are included in Appendix 6-C of the Ottawa Sewer Design Guidelines.
Depths will be greater where checkdams are used