

ACCESS PROPERTY DEVELOPMENT INC

# 864 LADY ELLEN PLACE STORMWATER MANAGEMENT REPORT

DECEMBER 16, 2022





# 864 LADY ELLEN PLACE STORMWATER MANAGEMENT REPORT

ACCESS PROPERTY DEVELOPMENT INC.

1<sup>ST</sup> SUBMISSION

PROJECT NO.: 221-04646-00

CLIENT REF:

DATE: DECEMBER 15, 2022

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# REVISION HISTORY

## FIRST ISSUE

October 22 <sup>nd</sup> , 2021	SWM Report			
Prepared by	Reviewed by	Approved By		
AJ	CF	CF		

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# SIGNATURES

## PREPARED BY

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Ayham Jadallah, M.Eng., P.Eng.  
Project Engineer, Water Resources

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December 16, 2022

## APPROVED<sup>1</sup> BY

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Chris Folett, P.Eng.  
Project Engineer, Water Resources

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December 16, 2022

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# CONTRIBUTORS

## CLIENT

Access Property Development Inc.

## WSP

Water Resources, Project Engineer

Ayham Jadallah



# TABLE OF CONTENTS

1	INTRODUCTION.....	1
1.1	Scope .....	1
1.2	Site Location.....	1
1.3	Stormwater Management Plan Objectives.....	2
1.4	Design Criteria .....	2
2	PRE-DEVELOPMENT CONDITIONS .....	3
2.1	General.....	3
2.2	Rainfall Information .....	4
2.3	Allowable Flow Rates .....	4
2.4	external drainage areas .....	5
3	POST-DEVELOPMENT CONDITIONS .....	6
3.1	General.....	6
3.2	Water Quantity .....	7
3.3	Water Quality .....	8
4	CONCLUSIONS .....	9

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## *TABLES*

TABLE 1: PRE-DEVELOPMENT PEAK FLOW RATE ..	4
TABLE 2: PCSWMM MODELING RESULTS.....	8

---

## *FIGURES*

FIGURE 1. SITE LOCATION.....	1
FIGURE 2: EXISTING CONDITIONS CATCHMENT CHARACTERISTICS.....	3
FIGURE 3. RUNOFF FROM EXTERNAL DRAINAGE AREA .....	5
FIGURE 4: PROPOSED CONDITIONS CATCHMENT CHARACTERISTICS.....	6

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## *APPENDICES*

<b>A</b>	PRE-CONSULTATION MEETING MINUTES AND TECHNICAL COMMENTS
<b>B</b>	CALCULATIONS & PCSWMM OUTPUT
<b>C</b>	SUPPORTING DOCUMENTS

# 1 INTRODUCTION

## 1.1 SCOPE

WSP Canada Inc. was retained by Access Property Development Inc. to prepare a Stormwater Management (SWM) report for the proposed development at 864 Lady Ellen Place 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 864 Lady Ellen Place, Ottawa, Ontario. The subject site is bounded by Highway 417 to the north, other commercial properties to the east and west and south. The site is accessed via Lady Ellen Place.

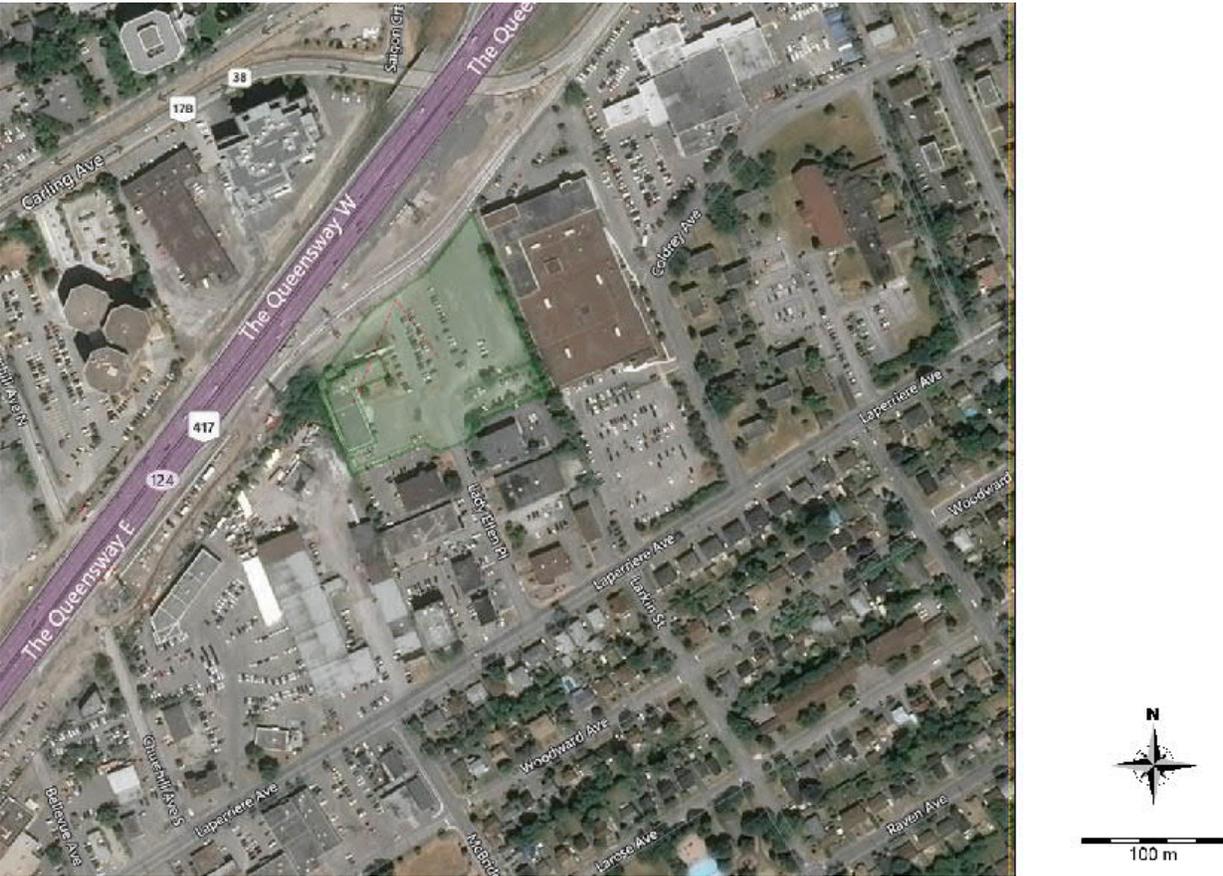


Figure 1. Site Location

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## 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.

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## 1.4 DESIGN CRITERIA

Design criteria were obtained through pre-consultation with the City of Ottawa held on September 27<sup>th</sup>, 2021 (meeting minutes included in **Appendix A**). Criteria for 864 Lady Ellen 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 (TBD)**-WSP has requested the Rideau Valley Conservation authority (RVCA) to provide their requirements regarding the water quality control, however RVCA has not yet provided the required quality control measures.

# 2 PRE-DEVELOPMENT CONDITIONS

## 2.1 GENERAL

The subject site is a 1.36 ha parcel of land comprised of a paved parking area and an approximately 1300 m<sup>2</sup> commercial building. Vehicular access to the site is via entrance on Lady Ellen Place. Under pre-development conditions the subject site consists of primarily impervious building and parking area. Existing drainage patterns for the site were determined based on topographic survey information and found that existing drainage is towards the existing municipal storm sewer which penetrates the site from south to north via Lady Ellen PL and continues along 417 Exit to Kirkwood. The existing runoff coefficient for the site is estimated as 0.9. Per the City of Ottawa Sewer Design Guidelines section 8.3.7.3, a pre-development runoff coefficient of 0.5 was used to analyze the pre-development conditions. The pre-development catchment characteristics are illustrated in Figure 2.



**Figure 2: Existing Conditions Catchment Characteristics**

**Catchment areas:** Subcatchments were delineated based on the existing conditions. The standard City of Ottawa values were used for infiltration, depression storage, and roughness coefficient values.

PCSWMM Parameter	Value
N Imperv	0.013
N Perv	0.25
Dstore Imperv (mm)	1.57
Dstore Perv (mm)	4.67

Max. Infil. Rate (mm/hr)	76.2
Min. Infil. Rate (mm/hr)	13.2
Decay Constant (1/hr)	4.14
Drying Time (days)	7

**Ditches:** Ditches were modelled as conduits using V shape cross section and a roughness coefficient of 0.035.

**Boundary Conditions:** Existing storm sewer manhole MHST65789, located out of the site near the northeast corner, is considered as the model outfall, the tailwater condition at the outfall was set as a free outfall for evaluating the quantity control and was verified using the 100-year flood elevation.

## 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 for a re-development and the pre-consultation meeting require the post-development discharge rate from the site match pre-development levels for the 2- to 100-year storm events where pre-development conditions are analyzed using the lesser of the actual runoff coefficient and a runoff coefficient of 0.5.

As Previously discussed, runoff from the existing building was not considered as part of the stormwater management analysis as it will remain unchanged under proposed conditions. PCSWMM was used to analyze the existing conditions for the remaining 1.48 ha of the site and determine the allowable peak flow rates from the site into the existing storm sewer, results are summarized in Error! Reference source not found.. Detailed results are provided in **Appendix B**.

**Table 1: Pre-Development Peak Flow Rate**

RETURN PERIOD (Years)	SITE PEAK FLOW RATE (m <sup>3</sup> /sec)
2	0.26
5	0.37
10	0.44
25	0.53
50	0.59



# 3 POST-DEVELOPMENT CONDITIONS

## 3.1 GENERAL

The proposed Lady Ellen project is a commercial development in Ottawa. Post development condition catchment characteristics are shown in Figure 4. The proposed development mainly includes the construction of two commercial buildings and parking areas. Vehicular access to the site will continue to be via the existing Lady Ellen Place. Similar to existing conditions, the site runoff will be towards the existing 450 mm municipal storm sewer.



Figure 4: Proposed Conditions Catchment Characteristics

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

- Roof storage on the two proposed buildings, controlled by WATTS Adjustable Flow Control Roof Drains (or equivalent)
- Grassed ditches

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;

- Roof storage with flow control roof drains
- Surface storage with inlet control devices (ICDs) (HYDROVEX or equivalent)
- Grass ditch

PCSWMM software has been used to model the behaviour of the proposed SWM system and determine its response under various storm events. The model was developed and tested in an iterative manner to determine the necessary storage volumes and flow control rates from the proposed site subcatchments.

The model was developed assuming that 80% and 77% of the building roofs A and B respectively is available for stormwater storage and the use of 19 fully exposed WATTS Adjustable Flow Control Roof Drains (or equivalent) for building A and 10 similar WATTS drains for building B. Outflow controls from each storage node were defined using outlets with appropriate head-discharge curves as defined using manufacture information provided in **Appendix D**.

Ponding areas with the relevant allowed depth at the proposed parking subcatchments were modeled using storage nodes with the appropriate stage-storage relationships. Outflow controls from each storage node were defined using the appropriate Hydrovex VHV head-discharge curve to maintain 100 year ponding depth under the allowed maximum depth. Specified Hydrovex models are shown in the following table.

Subcatchment	ICD
S_101	Hydrovex 75VHV-1
S_102	Hydrovex 75VHV-1
S_103	Hydrovex 100-VHV-1
S_104	Hydrovex 200-VHV-1
S_105	Hydrovex 75VHV-1
S_106	Hydrovex 75VHV-1
S_107	Hydrovex 100-VHV-1

A summary of the modeling results is provided in Table 2, detailed PCSWMM modeling results are provided in **Appendix B**.

**Table 2: PCSWMM Modeling Results**

<b>RETURN PERIOD (Years)</b>	<b>OUTFALL – UNCONTROLLED PRE DEV - TARGET RELEASE RATE (m<sup>3</sup>/sec)</b>	<b>OUTFALL - POST DEV 100 YEAR PEAK DISCHARGE (m<sup>3</sup>/sec)</b>
2	0.26	0.11
5	0.37	0.15
10	0.44	0.17
25	0.53	0.2
50	0.59	0.22
100	0.66	0.24

---

### 3.3 WATER QUALITY

WSP has requested the Rideau Valley Conservation authority (RVCA) to provide their requirements regarding the water quality control, however RVCA has not yet provided the required quality control measures, therefore post development quality control will be revised during the detailed design to address RVCA requirements.

It is assumed that runoff from the proposed rooftop 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. It should be noted that the typical sediment-generating activities are in areas with vehicular access, such as loading areas and parking areas. In the case of this development, the overall parking area is reduced and replaced with the roof areas of the proposed buildings. Therefore, the overall water quality leaving the site is considered to be improved upon existing conditions.

# 4 CONCLUSIONS

A stormwater management report has been prepared to support the feasibility study for the proposed development at 864 Lady Ellen Place in the City of Ottawa. The key points are summarized below.

## WATER QUALITY

It is assumed that runoff from the proposed rooftop 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. Further assessment will be made upon receiving RVCA requirements.

## WATER QUANTITY

Quantity control will be provided via roof storage on the two proposed buildings, allowed ponding depth in parking areas will be maintained by using ICDs at proposed catch basins, controlling post-development flows to pre-development levels for the 2- to 100-year storm events has been achieved.

# APPENDIX

# A

PRE-CONSULTATION  
MEETING MINUTES  
AND TECHNICAL  
COMMENTS

# APPENDIX

## **B** CALCULATIONS & PCSWMM OUTPUT



# APPENDIX

## C SUPPORTING DOCUMENTS





# APPENDIX

## **D** SUPPORTING DOCUMENTS



# APPENDIX

# A

PRE-CONSULTATION  
MEETING MINUTES  
AND TECHNICAL  
COMMENTS

# MEMO

Date:

To /  
Destinataire Craig Hamilton, Planner

From /  
Expéditeur Bruce Bramah, Project Manager, Infrastructure  
Approvals

**Pre-Application Consultation**  
**864 Lady Ellen Place, Ward #16**

File No. PC2022-0240

Subject /  
Objet \_\_\_\_\_,  
*Two new storage warehouses are proposed to  
be constructed that are one-storey and 4-  
storeys in height.*

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

- The original storm sewer within the easement was installed in 1959; no design sheet can be found for this. When the sewer was rehabilitated in 2012, there was no design sheet prepared..
- 1. The Servicing Study Guidelines for Development Applications are available at the following address: <https://ottawa.ca/en/planning-development-and-construction/developing-property/development-application-review-process/development-application-submission/guide-preparing-studies-and-plans#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](mailto: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:
- TSS requirements from the RVCA are pending at this time. Please contact the RVCA and provide the correspondence in the design brief.
  - i. The 2-yr storm event using the IDF information derived from the Meteorological Services of Canada rainfall data, taken from the MacDonald Cartier Airport, collected 1966 to 1997.
  - ii. The pre-development runoff coefficient or a maximum equivalent 'C' of 0.5, whichever is less (§ 8.3.7.3).
  - iii. A calculated time of concentration (Cannot be less than 10 minutes).
  - iv. Flows to the storm sewer in excess of the 2-year pre development storm release rate, up to and including the 100-year post development storm event, must be detained on site.
- Note: There may be area specific SWM Criteria that may apply. Check for any related SWM &/or Sub-watershed studies that may have been completed.
5. Deep Services (Storm, Sanitary & Water Supply)
- i. *Provide information on the monitoring manhole requirements – should be located in an accessible location on private property and outside of the easement (ie. Not in a parking area).*
  - ii. *Review provision of a high-level sewer.*
  - iii. *Provide information on the type of connection permitted*

Sewer connections to be made above the springline of the sewermain as per:

- a. Std Dwg S11.1 for flexible main sewers – *connections made using approved tee or wye fittings.*
  - b. Std Dwg S11 (For rigid main sewers) – *lateral must be less than 50% the diameter of the sewermain,*
  - c. 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,*
  - d. Connections to manholes permitted when the connection is to rigid main sewers where the lateral exceeds 50% the diameter of the sewermain. – Connect obvert to obvert with the outlet pipe unless pipes are a similar size.
  - e. *No submerged outlet connections.*
6. Water Boundary condition requests must include the location of the service and the expected loads required by the proposed development. Please provide the following information:
- i. Location of service
  - ii. Type of development and the amount of fire flow required (as per FUS, 2020).
  - iii. Average daily demand: \_\_\_ l/s.
  - iv. Maximum daily demand: \_\_\_ l/s.
  - v. Maximum hourly daily demand: \_\_\_ l/s.
7. MECP ECA Requirements

An MECP Environmental Compliance Approval (Input Application Type - Industrial Sewage Works or Municipal/Private Sewage Works) may be required for the proposed development based on the industrial zoning and multiple parcels of land. Please contact Ontario Ministry of the Environment and Climate Change, Ottawa District Office to arrange a pre-submission consultation:

For I/C/I applications: Emily Diamond  
 (613) 521-3450, ext. 238

[Emily.Diamond@ontario.ca](mailto:Emily.Diamond@ontario.ca)

8. 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.

9. Submission Requirements

– **SITE PLAN APPLICATION – Municipal servicing**

Legend:

The letter S indicates that the study or plan is required with application submission.

The letter M indicates that the study or plan may be required with application submission.

For information on preparing required studies and plans refer to:

<http://ottawa.ca/en/development-application-review-process-0/guide-preparing-studies-and-plans>

S/A	Number of copies	ENGINEERING		S/A	Number of copies
S	1	1. Site Servicing Plan	2. Assessment of Adequacy of Public Services / Site Servicing Study / Brief	S	1
S	1	3. Grade Control and Drainage Plan	4. Geotechnical Study / Slope Stability Study	S	1
	1	5. Composite Utility Plan	6. Groundwater Impact Study		1
	1	7. Servicing Options Report	8. Wellhead Protection Study		1
	1	9. Community Transportation Study and/or Transportation Impact Study / Brief	10. Erosion and Sediment Control Plan / Brief	S	1
S	1	11. Storm water Management Report / Brief	12. Hydro-geological and Terrain Analysis		1
M	1	13. Water main Analysis	14. Noise / Vibration Study		1
	1	15. Roadway Modification Design Plan	16. Confederation Line Proximity Study		1

Should you have any questions or require additional information, please contact me directly at (613) 580-2424, ext. 29686 or by email at [Bruce.Bramah@ottawa.ca](mailto:Bruce.Bramah@ottawa.ca).

Jadallah, Ayham

---

From: Bramah, Bruce <bruce.bramah@ottawa.ca>  
Sent: Thursday, November 17, 2022 8:50 AM  
To: Jadallah, Ayham  
Cc: Hamilton, Craig  
Subject: RE: 864 Lady Ellen Place: Emergency Overland Flow Outlet

Hi Ayham,

The intent is not to account for these flow in your SWM design, but to make sure it can safely cross the post development property. The image below shows the 24 ha drainage area coming from the west (location A). The drainage area from the South meeting at location B is 2.8 ha. This should be enough to come up with a rough idea of the peak overland flow.

Craig will be sending out all my engineering comments shortly. The quantity control shall be controlled to the 2 year pre development.



Development Review - South Branch  
City of Ottawa | Ville d'Ottawa  
110 Laurier Avenue West Ottawa, ON | 110, avenue. Laurier Ouest. Ottawa (Ontario) K1P 1J1  
613.580.2424 ext./poste 29686, [Bruce.Bramah@ottawa.ca](mailto:Bruce.Bramah@ottawa.ca)

---

From: Jadallah, Ayham <Ayham.Jadallah@wsp.com>  
Sent: November 15, 2022 9:13 AM  
To: Bramah, Bruce <bruce.bramah@ottawa.ca>  
Subject: FW: 864 Lady Ellen Place: Emergency Overland Flow Outlet

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Hi Bruce,

Just a kind reminder about the below request.

Thanks,

**Ayham Jadallah**, P.Eng, M.Eng  
Project Engineer



T+ 1 604-904-4660

---

From: Jadallah, Ayham  
Sent: Thursday, November 10, 2022 3:44 PM  
To: Bramah, Bruce <[bruce.bramah@ottawa.ca](mailto:bruce.bramah@ottawa.ca)>  
Cc: MacDonald, Jill <[Jill.MacDonald@wsp.com](mailto:Jill.MacDonald@wsp.com)>; De Santi, Nadia <[Nadia.De-Santi@wsp.com](mailto:Nadia.De-Santi@wsp.com)>; Follett, Chris <[Chris.Follett@wsp.com](mailto:Chris.Follett@wsp.com)>; Hamilton, Craig <[craig.hamilton@ottawa.ca](mailto:craig.hamilton@ottawa.ca)>; Yang, Winston <[Winston.Yang@wsp.com](mailto:Winston.Yang@wsp.com)>; Hind Barnieh <[hbarnieh@accesspd.ca](mailto:hbarnieh@accesspd.ca)>; Elisabeth Gebremedhin <[egebremedhin@accesspd.ca](mailto:egebremedhin@accesspd.ca)>  
Subject: RE: 864 Lady Ellen Place: Emergency Overland Flow Outlet

Hi Bruce,

Per the City's requirements, the contributing upstream parcels have to be considered in the SWM model, but the required datasets to carry out the study are not available, therefore can you provide the following requirements;

- Required study boundary
- Stormwater drainage As-Builts (shapefiles)
- Elevation data (contour or lidar) for the entire study area

Also can you please confirm that quantity control target is 100-yr to 2yr Pre-Development.

Thanks,

**Ayham Jadallah**, P.Eng, M.Eng  
Project Engineer



D+ 1 604-904-4660

---

From: Bramah, Bruce <[bruce.bramah@ottawa.ca](mailto:bruce.bramah@ottawa.ca)>  
Sent: Thursday, November 10, 2022 9:14 AM  
To: Yang, Winston <[Winston.Yang@wsp.com](mailto:Winston.Yang@wsp.com)>  
Cc: MacDonald, Jill <[Jill.MacDonald@wsp.com](mailto:Jill.MacDonald@wsp.com)>; De Santi, Nadia <[Nadia.De-Santi@wsp.com](mailto:Nadia.De-Santi@wsp.com)>; Follett, Chris <[Chris.Follett@wsp.com](mailto:Chris.Follett@wsp.com)>; Jadallah, Ayham <[Ayham.Jadallah@wsp.com](mailto:Ayham.Jadallah@wsp.com)>; Hamilton, Craig <[craig.hamilton@ottawa.ca](mailto:craig.hamilton@ottawa.ca)>; Hind Barnieh <[hbarnieh@accesspd.ca](mailto:hbarnieh@accesspd.ca)>; Elisabeth Gebremedhin <[egebremedhin@accesspd.ca](mailto:egebremedhin@accesspd.ca)>  
Subject: RE: 864 Lady Ellen Place: Emergency Overland Flow Outlet

Hi Winston,

The SWM strategy for this site should be for the entirety of the development area. The minor system should be designed with the use of surface storage only. The major system flows from upstream parcels will either drain through the minor system of the proposed site or will overland flow through the site to the northeast corner. The additional flows from adjacent properties do not need to be controlled.

Upon further review of the receiving storm sewers, this site will be controlled to the 2-year pre-development. All the engineering comments will be provided shortly to Craig.

If you have any further questions, I would be happy to set up a team's meeting or phone call to discuss next week.

Thank you,

**Bruce Bramah, EIT**

Project Manager

Planning, Real Estate and Economic Development Department / Direction générale de la planification, des biens immobiliers et du développement économique

Development Review - South Branch

City of Ottawa | Ville d'Ottawa

110 Laurier Avenue West Ottawa, ON | 110, avenue. Laurier Ouest. Ottawa (Ontario) K1P 1J1

613.580.2424 ext./poste 29686, [Bruce.Bramah@ottawa.ca](mailto:Bruce.Bramah@ottawa.ca)

---

From: Yang, Winston <[Winston.Yang@wsp.com](mailto:Winston.Yang@wsp.com)>  
Sent: November 09, 2022 9:54 AM  
To: Bramah, Bruce <[bruce.bramah@ottawa.ca](mailto:bruce.bramah@ottawa.ca)>  
Cc: MacDonald, Jill <[Jill.MacDonald@wsp.com](mailto:Jill.MacDonald@wsp.com)>; De Santi, Nadia <[nadia.de-santi@wsp.com](mailto:nadia.de-santi@wsp.com)>; Follett, Chris <[Chris.Follett@wsp.com](mailto:Chris.Follett@wsp.com)>; Jadallah, Ayham <[Ayham.Jadallah@wsp.com](mailto:Ayham.Jadallah@wsp.com)>; Hamilton, Craig <[craig.hamilton@ottawa.ca](mailto:craig.hamilton@ottawa.ca)>; Hind Barnieh <[hbarnieh@accesspd.ca](mailto:hbarnieh@accesspd.ca)>; Elisabeth Gebremedhin <[egebremedhin@accesspd.ca](mailto:egebremedhin@accesspd.ca)>  
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Importance: High

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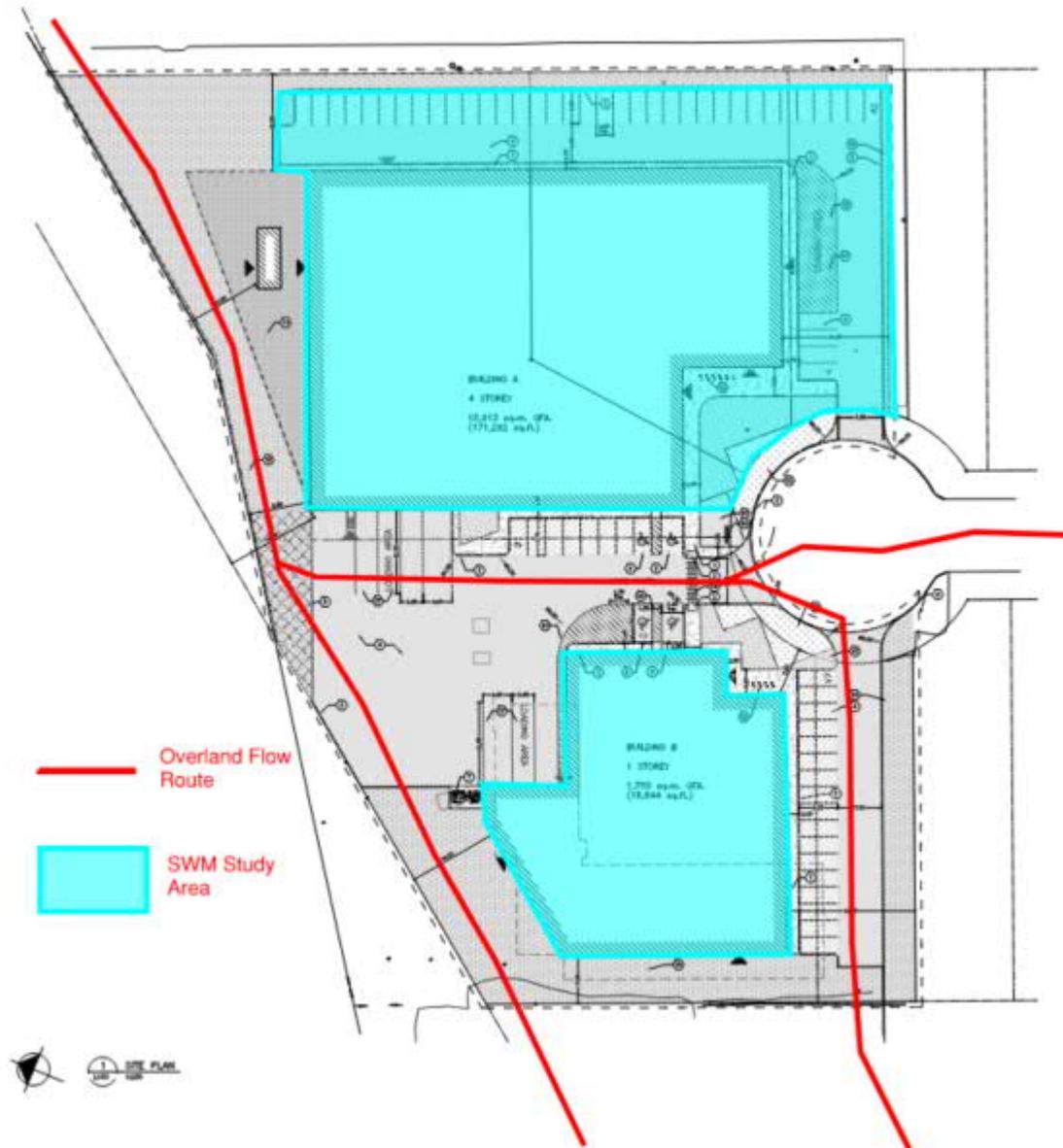
Thanks Bruce,

And I still have some concern regarding the SWM strategy for this site.

Since the subjected site is used as the overland flow route to convey the external surface runoff from upstream in multiple directions, Can the SWM study areas be limited to the highlighted in Cyan? Roof storage will be provided.

First, for SWM purpose, it is not feasible for the owner to over control external runoff that drains into the subjected site. The typical pre to post, control post 100 year to pre 5 year is not feasible for the entire site since the external runoff could not be by-passed.

The proposed parking lot and driving aisle will be used and maintained as the overland flow runway for the proposed and existing developments. It is not possible to separate the drainages that go down into the same sewer like existing.



Please take a look and feel free to confirm/comment the SWM study limit and strategy for this site.

Yours truly,

**Ding Bang (Winston) Yang, P.Eng., PMP**  
Senior Civil Engineer  
Infrastructure / Land Development & Municipal Engineering  
Ottawa



T+ 1 613-690-0538  
M+ 1 647-628-8108

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2611 Queensview Drive, Suite 300  
Ottawa, Ontario,  
K2B 8K2 Canada

[wsp.com](http://wsp.com)

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From: Bramah, Bruce <[bruce.bramah@ottawa.ca](mailto:bruce.bramah@ottawa.ca)>  
Sent: November 8, 2022 3:42 PM  
To: Yang, Winston <[Winston.Yang@wsp.com](mailto:Winston.Yang@wsp.com)>  
Cc: MacDonald, Jill <[Jill.MacDonald@wsp.com](mailto:Jill.MacDonald@wsp.com)>; De Santi, Nadia <[Nadia.De-Santi@wsp.com](mailto:Nadia.De-Santi@wsp.com)>; Follett, Chris <[Chris.Follett@wsp.com](mailto:Chris.Follett@wsp.com)>; Jadallah, Ayham <[Ayham.Jadallah@wsp.com](mailto:Ayham.Jadallah@wsp.com)>; Hamilton, Craig <[craig.hamilton@ottawa.ca](mailto:craig.hamilton@ottawa.ca)>; Hind Barnieh <[hbarnieh@accesspd.ca](mailto:hbarnieh@accesspd.ca)>; Elisabeth Gebremedhin <[egebremedhin@accesspd.ca](mailto:egebremedhin@accesspd.ca)>  
Subject: RE: 864 Lady Ellen Place: Emergency Overland Flow Outlet

Hi Winston,

I have brought this site up to our surface drainage group last week. The overland flow for the proposed development should match the existing condition which ultimately drains to the north east corner of the site. Please see the yellow below:



The MTO will be circulated upon submission to provide any comments, however, no concerns arose from the MTO circulation from the recently cancelled SPA for this site.

I am still waiting to hear back from our Infrastructure group regarding any future improvements to sewers within the existing easement. All my comments will be in the follow up email from Craig. If you have any further questions in the meantime, please feel free to reach out and we can set up a team meeting.

Thank you,

**Bruce Bramah, EIT**

Project Manager

Planning, Real Estate and Economic Development Department / Direction générale de la planification, des biens immobiliers et du développement économique

Development Review - South Branch

City of Ottawa | Ville d'Ottawa

110 Laurier Avenue West Ottawa, ON | 110, avenue. Laurier Ouest. Ottawa (Ontario) K1P 1J1

613.580.2424 ext./poste 29686, [Bruce.Bramah@ottawa.ca](mailto:Bruce.Bramah@ottawa.ca)

---

From: Yang, Winston <[Winston.Yang@wsp.com](mailto:Winston.Yang@wsp.com)>

Sent: November 08, 2022 11:48 AM

To: Bramah, Bruce <[bruce.bramah@ottawa.ca](mailto:bruce.bramah@ottawa.ca)>

Cc: MacDonald, Jill <[Jill.MacDonald@wsp.com](mailto:Jill.MacDonald@wsp.com)>; De Santi, Nadia <[nadia.de-santi@wsp.com](mailto:nadia.de-santi@wsp.com)>; Follett, Chris <[Chris.Follett@wsp.com](mailto:Chris.Follett@wsp.com)>; Jadallah, Ayham <[Ayham.Jadallah@wsp.com](mailto:Ayham.Jadallah@wsp.com)>; Hamilton, Craig <[craig.hamilton@ottawa.ca](mailto:craig.hamilton@ottawa.ca)>;

Hind Barnieh <[hbarnieh@accesspd.ca](mailto:hbarnieh@accesspd.ca)>; Elisabeth Gebremedhin <[egebremedhin@accesspd.ca](mailto:egebremedhin@accesspd.ca)>

Subject: RE: 864 Lady Ellen Place: Emergency Overland Flow Outlet

Importance: High

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Hi Bruce,

I would like to follow up with you regarding the emergency overland flow outlet for 864 Lady Ellen Place.

I was on site yesterday try to locate the overland flow drainage outlet. But I could not see any ditches or drainage culvert next to the north boundary adjacent to HWY 417.

And it seems like this site was built the way it is since the 60s while I am looking at the historical aerial image.

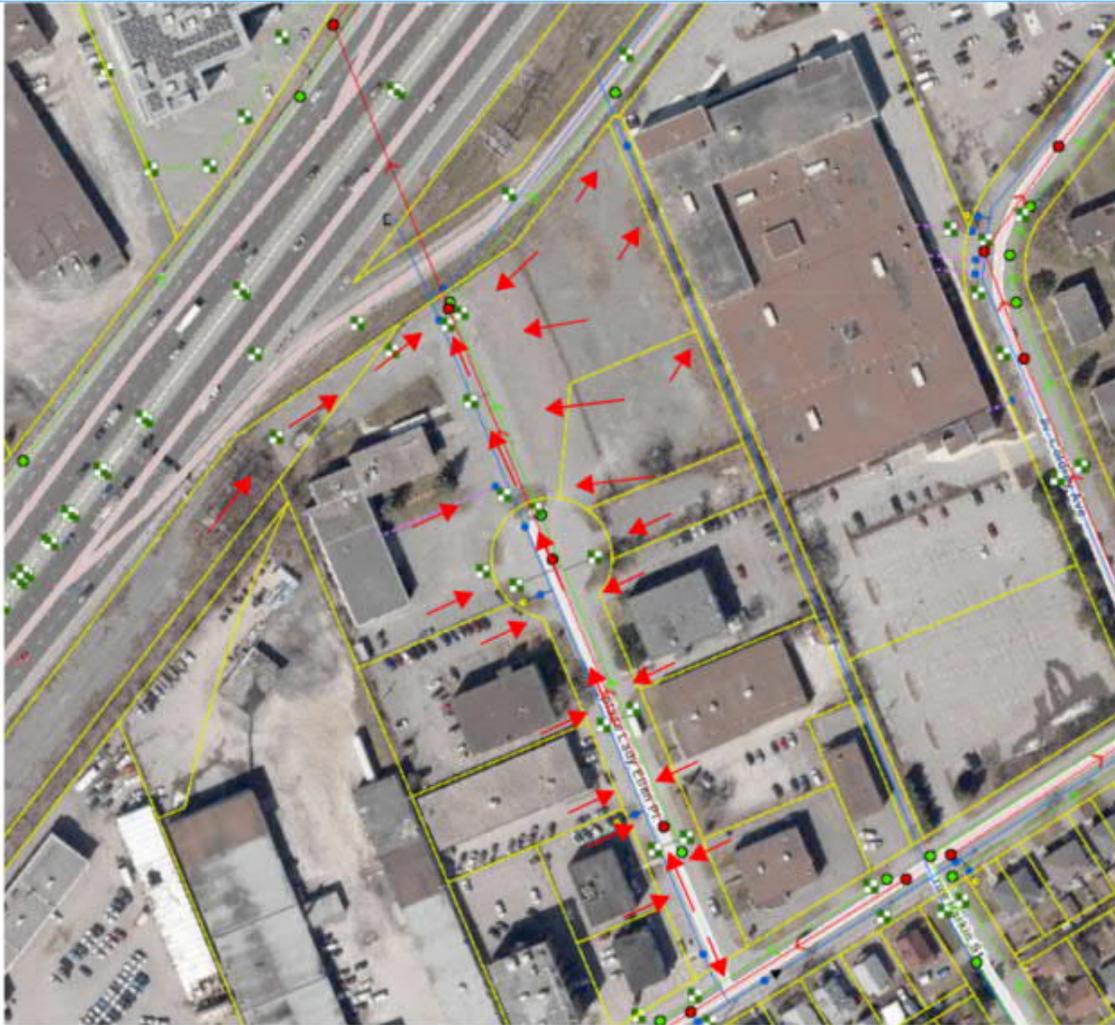
Base on the info from the survey and site observation, the overland flow from the upstream parcels will run down to the subjected site and be forced down to the minor system.

See below sketch for your reference. A site photo looking north from the Cul-de-sac is also attached for your reference.

Can you confirm or provide the emergency overland flow outlet for the subjected site? The missing emergency overland flow outlet for this site results in consequential impacts for the new development and existing developments upstream.

If you would like to discuss this issue and schedule a conference meeting, please do not hesitate to contact me.

Yours truly,



← OVERLAND FLOW



**Ding Bang (Winston) Yang, P.Eng., PMP**

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# APPENDIX

## **B** CALCULATIONS & PCSWMM OUTPUT

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.013)

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WARNING 03: negative offset ignored for Link C12  
 WARNING 03: negative offset ignored for Link C16\_3  
 WARNING 03: negative offset ignored for Link C16\_4  
 WARNING 03: negative offset ignored for Link C6\_2  
 WARNING 03: negative offset ignored for Link C7  
 WARNING 03: negative offset ignored for Link C8  
 WARNING 03: negative offset ignored for Link C8\_2

\*\*\*\*\*  
 Element Count  
 \*\*\*\*\*

Number of rain gages ..... 16  
 Number of subcatchments ... 16  
 Number of nodes ..... 47  
 Number of links ..... 46  
 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
S-101	0.09	45.00	95.00	2.0000	100yr_3hr_Chicago	S_101
S102	0.05	40.00	95.00	2.0000	100yr_3hr_Chicago	S_102
S-103	0.05	40.00	95.00	2.0000	100yr_3hr_Chicago	S_103
S-104	0.13	58.00	95.00	2.0000	100yr_3hr_Chicago	S_104
S-105	0.04	20.00	95.00	2.0000	100yr_3hr_Chicago	S_105
S-106	0.04	20.00	95.00	2.0000	100yr_3hr_Chicago	S_106
S-107	0.08	40.00	95.00	2.0000	100yr_3hr_Chicago	S_107
S-108	0.03	80.00	35.00	3.7910	100yr_3hr_Chicago	J7
S-109_1	0.03	35.00	35.00	3.5000	100yr_3hr_Chicago	J1
S-109_2	0.05	30.00	85.00	2.0000	100yr_3hr_Chicago	J4-2
S-109_3	0.08	60.00	50.00	3.5000	100yr_3hr_Chicago	J3
S-109_5	0.04	50.00	50.00	3.5000	100yr_3hr_Chicago	J4-1
S-110	0.00	30.00	25.00	3.5000	100yr_3hr_Chicago	S_111
S-111	0.08	45.00	80.00	2.0000	100yr_3hr_Chicago	S_111
S-Bldg-A	0.40	88.00	100.00	1.0000	100yr_3hr_Chicago	SU2
S-Bldg-B	0.18	45.00	100.00	1.0000	100yr_3hr_Chicago	SU1

\*\*\*\*\*

Node Summary

\*\*\*\*\*

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
CB01	JUNCTION	76.44	1.42	0.0	
CB03	JUNCTION	75.36	2.29	0.0	
CB04	JUNCTION	75.15	2.50	0.0	
CB05	JUNCTION	75.15	1.42	0.0	
CB2	JUNCTION	75.61	1.95	0.0	
EX_MHST65772	JUNCTION	74.15	2.18	0.0	

J1	JUNCTION	78.16	1.34	0.0
J10	JUNCTION	75.86	2.14	0.0
J11	JUNCTION	76.58	1.64	0.0
J13	JUNCTION	75.76	1.75	0.0
J14	JUNCTION	74.92	2.58	0.0
J15	JUNCTION	75.38	2.29	0.0
J2	JUNCTION	77.26	1.51	0.0
J20	JUNCTION	75.64	1.96	0.0
J21	JUNCTION	75.50	2.08	0.0
J22	JUNCTION	75.25	1.93	0.0
J24	JUNCTION	74.87	1.70	0.0
J25	JUNCTION	74.70	1.87	0.0
J26	JUNCTION	74.55	2.00	0.0
J3	JUNCTION	77.20	1.92	0.0
J4	JUNCTION	75.54	1.90	0.0
J4-1	JUNCTION	76.58	1.32	0.0
J4-2	JUNCTION	76.58	1.32	0.0
J5	JUNCTION	76.49	1.74	0.0
J6	JUNCTION	74.16	3.84	0.0
J7	JUNCTION	76.40	1.25	0.0
J8	JUNCTION	76.02	2.22	0.0
J9	JUNCTION	76.45	1.69	0.0
MHST66949	JUNCTION	75.58	1.90	0.0
MHST66950	JUNCTION	77.40	2.50	0.0
STMH100	JUNCTION	76.20	1.66	0.0
STMH101	JUNCTION	75.28	2.52	0.0
STMH1021	JUNCTION	74.72	2.67	0.0
STMH103	JUNCTION	74.62	2.90	0.0
STMH104	JUNCTION	74.35	2.97	0.0
STMH105	JUNCTION	74.22	2.58	0.0
MHST65789	OUTFALL	73.10	0.60	0.0
S_101	STORAGE	75.62	1.94	0.0
S_102	STORAGE	75.37	2.28	0.0
S_103	STORAGE	75.16	2.49	0.0
S_104	STORAGE	74.75	1.82	0.0
S_105	STORAGE	74.88	1.69	0.0
S_106	STORAGE	75.15	1.42	0.0
S_107	STORAGE	76.45	1.41	0.0
S_111	STORAGE	76.32	1.25	0.0
SU1	STORAGE	85.55	1.25	0.0
SU2	STORAGE	98.55	1.70	0.0

\*\*\*\*\*

Link Summary

\*\*\*\*\*

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	STMH104	STMH105	CONDUIT	10.2	0.4914	0.0130
C1_1	J22	J26	CONDUIT	38.6	1.8157	0.0130
C1_2	MHST66950	J13	CONDUIT	109.5	1.4984	0.0130
C1_3	J13	MHST66949	CONDUIT	10.6	1.5158	0.0130
C1_4	STMH105	EX_MHST65772	CONDUIT	1.8	3.4014	0.0130
C1_6	MHST66949	J4	CONDUIT	2.4	1.8278	0.0130
C1_7	J26	STMH105	CONDUIT	17.2	1.9222	0.0130
C1_8	J4	J22	CONDUIT	15.6	1.8410	0.0130
C10	CB04	J14	CONDUIT	5.6	1.0751	0.0100
C11	J8	J10	CONDUIT	10.6	1.0383	0.0130
C12	J10	MHST66949	CONDUIT	12.9	2.1754	0.0130
C13	CB01	STMH100	CONDUIT	23.4	1.3676	0.0130
C14	STMH100	J13	CONDUIT	24.1	0.9968	0.0130
C15	CB2	STMH101	CONDUIT	15.8	1.0129	0.0130
C16_2	J14	STMH1021	CONDUIT	29.4	0.4924	0.0130
C16_3	STMH101	J15	CONDUIT	30.1	-0.3390	0.0130
C16_4	J15	J14	CONDUIT	40.8	1.1206	0.0130
C17	STMH1021	STMH103	CONDUIT	7.0	0.5697	0.0130
C18	STMH103	STMH104	CONDUIT	49.0	0.4897	0.0130
C19	J20	J21	CONDUIT	10.0	0.9996	0.0130
C2	EX_MHST65772	MHST65789	CONDUIT	87.3	1.2022	0.0130
C20	J21	J22	CONDUIT	8.7	0.5724	0.0130
C21	CB05	J24	CONDUIT	16.8	1.0144	0.0130
C22	J24	J25	CONDUIT	21.8	0.5055	0.0130
C23	J25	J26	CONDUIT	8.4	0.5933	0.0130
C3	J1	J2	CONDUIT	40.0	0.7242	0.0350
C4	J2	J3	CONDUIT	24.8	2.7049	0.0350
C5	J3	J11	CONDUIT	63.8	0.9721	0.0350
C6	J7	STMH103	CONDUIT	21.1	2.1331	0.0130
C6_2	J11	J5	CONDUIT	11.6	0.7766	0.0350
C7	J6	EX_MHST65772	CONDUIT	2.3	0.8547	0.0100
C8	CB03	J15	CONDUIT	5.7	-0.2098	0.0100
C8_1	J9	J6	CONDUIT	33.9	2.5079	0.0350
C8_2	J5	J6	CONDUIT	6.1	1.1506	0.0350

C9	S_111	J4	CONDUIT	0.7	2.9511	0.0100
C9_1	J4-2	J7	CONDUIT	22.0	0.8183	0.0350
C9_4	J4-1	J9	CONDUIT	20.7	0.6295	0.0350
OL1	SU1	J20	OUTLET			
OL2	SU2	J8	OUTLET			
OL3	S_101	CB2	OUTLET			
OL4	S_102	CB03	OUTLET			
OL5	S_103	CB04	OUTLET			
OL6	S_104	J25	OUTLET			
OL7	S_105	J24	OUTLET			
OL8	S_106	CB05	OUTLET			
OL9	S_107	CB01	OUTLET			

\*\*\*\*\*  
Cross Section Summary  
\*\*\*\*\*

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	CIRCULAR	0.38	0.11	0.09	0.38	1	0.12
C1_1	CIRCULAR	0.45	0.16	0.11	0.45	1	0.38
C1_2	CIRCULAR	0.45	0.16	0.11	0.45	1	0.35
C1_3	CIRCULAR	0.45	0.16	0.11	0.45	1	0.35
C1_4	CIRCULAR	0.45	0.16	0.11	0.45	1	0.53
C1_6	CIRCULAR	0.45	0.16	0.11	0.45	1	0.39
C1_7	CIRCULAR	0.45	0.16	0.11	0.45	1	0.40
C1_8	CIRCULAR	0.45	0.16	0.11	0.45	1	0.39
C10	CIRCULAR	0.20	0.03	0.05	0.20	1	0.04
C11	CIRCULAR	0.20	0.03	0.05	0.20	1	0.03
C12	CIRCULAR	0.25	0.05	0.06	0.25	1	0.09
C13	CIRCULAR	0.20	0.03	0.05	0.20	1	0.04
C14	CIRCULAR	0.25	0.05	0.06	0.25	1	0.06
C15	CIRCULAR	0.20	0.03	0.05	0.20	1	0.03
C16_2	CIRCULAR	0.38	0.11	0.09	0.38	1	0.12
C16_3	CIRCULAR	0.38	0.11	0.09	0.38	1	0.10
C16_4	CIRCULAR	0.38	0.11	0.09	0.38	1	0.19
C17	CIRCULAR	1.00	0.79	0.25	1.00	1	1.81
C18	CIRCULAR	0.38	0.11	0.09	0.38	1	0.12
C19	CIRCULAR	0.20	0.03	0.05	0.20	1	0.03
C2	CIRCULAR	0.60	0.28	0.15	0.60	1	0.67

C20	CIRCULAR	0.25	0.05	0.06	0.25	1	0.04
C21	CIRCULAR	0.20	0.03	0.05	0.20	1	0.03
C22	CIRCULAR	0.20	0.03	0.05	0.20	1	0.02
C23	CIRCULAR	0.25	0.05	0.06	0.25	1	0.05
C3	TRAPEZOIDAL	0.50	0.75	0.24	3.00	1	0.70
C4	TRAPEZOIDAL	0.50	0.75	0.24	3.00	1	1.35
C5	TRAPEZOIDAL	0.50	0.75	0.24	3.00	1	0.81
C6	CIRCULAR	0.25	0.05	0.06	0.25	1	0.09
C6_2	TRAPEZOIDAL	0.50	0.75	0.24	3.00	1	0.72
C7	CIRCULAR	0.25	0.05	0.06	0.25	1	0.07
C8	CIRCULAR	0.20	0.03	0.05	0.20	1	0.02
C8_1	TRAPEZOIDAL	0.50	0.75	0.24	3.00	1	1.30
C8_2	TRAPEZOIDAL	0.50	0.75	0.24	3.00	1	0.88
C9	CIRCULAR	0.25	0.05	0.06	0.25	1	0.13
C9_1	TRAPEZOIDAL	0.50	0.75	0.24	3.00	1	0.74
C9_4	TRAPEZOIDAL	0.50	0.75	0.24	3.00	1	0.65

\*\*\*\*\*  
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

Surcharge Method ..... EXTRAN

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 .....	0.098	71.677
Evaporation Loss .....	0.000	0.000
Infiltration Loss .....	0.006	4.711
Surface Runoff .....	0.091	66.228
Final Storage .....	0.002	1.412
Continuity Error (%) .....	-0.942	

*****	Volume	Volume
Flow Routing Continuity	hectare-m	10^6 ltr
*****	-----	-----
Dry Weather Inflow .....	0.000	0.000
Wet Weather Inflow .....	0.091	0.907
Groundwater Inflow .....	0.000	0.000
RDII Inflow .....	0.000	0.000
External Inflow .....	0.000	0.000
External Outflow .....	0.081	0.808
Flooding Loss .....	0.009	0.089
Evaporation Loss .....	0.000	0.000
Exfiltration Loss .....	0.000	0.000
Initial Stored Volume ....	0.000	0.000
Final Stored Volume .....	0.001	0.012
Continuity Error (%) .....	-0.215	

\*\*\*\*\*

Highest Continuity Errors

\*\*\*\*\*

Node J2 (5.22%)

Node STMH101 (1.19%)

\*\*\*\*\*

Time-Step Critical Elements

\*\*\*\*\*

Link C9 (85.26%)

Link C1\_4 (10.58%)

\*\*\*\*\*

Highest Flow Instability Indexes

\*\*\*\*\*

Link OL1 (7)

Link OL2 (6)

\*\*\*\*\*

Routing Time Step Summary

\*\*\*\*\*

Minimum Time Step : 0.43 sec

Average Time Step : 0.53 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

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	Total	Total	Total	Total	Imperv	Perv	Total	Total
Peak Runoff								
Runoff Coeff	Precip	Runon	Evap	Infil	Runoff	Runoff	Runoff	Runoff

Subcatchment CMS	mm	mm	mm	mm	mm	mm	mm	10 <sup>6</sup> ltr
S-101 0.04 0.954	71.68	0.00	0.00	2.19	66.79	1.62	68.41	0.06
S102 0.02 0.954	71.68	0.00	0.00	2.19	66.71	1.63	68.35	0.03
S-103 0.02 0.954	71.68	0.00	0.00	2.19	66.71	1.63	68.35	0.03
S-104 0.06 0.955	71.68	0.00	0.00	2.19	66.81	1.62	68.43	0.09
S-105 0.02 0.954	71.68	0.00	0.00	2.19	66.79	1.62	68.41	0.03
S-106 0.02 0.954	71.68	0.00	0.00	2.19	66.79	1.62	68.41	0.03
S-107 0.04 0.954	71.68	0.00	0.00	2.19	66.79	1.62	68.41	0.05
S-108 0.01 0.632	71.68	0.00	0.00	28.54	24.61	20.71	45.32	0.01
S-109_1 0.01 0.617	71.68	0.00	0.00	28.70	24.57	19.65	44.23	0.01
S-109_2 0.02 0.898	71.68	0.00	0.00	6.60	59.71	4.69	64.40	0.03
S-109_3 0.04 0.698	71.68	0.00	0.00	22.12	35.09	14.94	50.03	0.04
S-109_5 0.02 0.710	71.68	0.00	0.00	22.02	35.10	15.81	50.91	0.02
S-111 0.04 0.869	71.68	0.00	0.00	8.82	56.20	6.12	62.31	0.05
S-Bldg-A 0.20 0.986	71.68	0.00	0.00	0.00	70.64	0.00	70.64	0.28
S-Bldg-B 0.09 0.985	71.68	0.00	0.00	0.00	70.61	0.00	70.61	0.13

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Node Depth Summary  
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Average Maximum Maximum Time of Max Reported  
Depth Depth HGL Occurrence Max Depth

Node	Type	Meters	Meters	Meters	days	hr:min	Meters
CB01	JUNCTION	0.12	0.18	76.62	0	01:02	0.18
CB03	JUNCTION	0.05	0.09	75.45	0	01:09	0.09
CB04	JUNCTION	0.03	0.09	75.24	0	01:06	0.09
CB05	JUNCTION	0.01	0.04	75.19	0	01:07	0.04
CB2	JUNCTION	0.03	0.06	75.67	0	00:57	0.06
EX_MHST65772	JUNCTION	0.08	0.25	74.40	0	01:11	0.24
J1	JUNCTION	0.02	0.13	78.29	0	01:10	0.13
J10	JUNCTION	0.06	0.10	75.96	0	01:34	0.10
J11	JUNCTION	0.03	0.18	76.76	0	01:11	0.18
J13	JUNCTION	0.02	0.06	75.82	0	01:19	0.06
J14	JUNCTION	0.03	0.11	75.04	0	01:12	0.11
J15	JUNCTION	0.02	0.05	75.44	0	01:11	0.05
J2	JUNCTION	0.57	0.70	77.96	0	01:11	0.70
J20	JUNCTION	0.06	0.11	75.75	0	01:26	0.11
J21	JUNCTION	0.05	0.10	75.60	0	01:27	0.10
J22	JUNCTION	0.07	0.12	75.37	0	01:22	0.12
J24	JUNCTION	0.04	0.14	75.01	0	01:10	0.14
J25	JUNCTION	0.09	0.30	75.00	0	01:10	0.30
J26	JUNCTION	0.07	0.17	74.72	0	01:11	0.16
J3	JUNCTION	0.03	0.17	77.37	0	01:10	0.17
J4	JUNCTION	0.06	0.10	75.64	0	01:22	0.10
J4-1	JUNCTION	0.03	0.15	76.73	0	01:10	0.15
J4-2	JUNCTION	0.04	0.15	76.73	0	01:10	0.15
J5	JUNCTION	0.04	0.16	76.65	0	01:11	0.16
J6	JUNCTION	0.07	0.25	74.41	0	01:11	0.25
J7	JUNCTION	0.02	0.11	76.51	0	01:10	0.11
J8	JUNCTION	0.08	0.14	76.16	0	01:31	0.14
J9	JUNCTION	0.02	0.10	76.55	0	01:10	0.10
MHST66949	JUNCTION	0.06	0.10	75.68	0	01:22	0.10
MHST66950	JUNCTION	0.00	0.00	77.40	0	00:00	0.00
STMH100	JUNCTION	0.02	0.07	76.27	0	01:03	0.07
STMH101	JUNCTION	0.12	0.16	75.44	0	01:08	0.16
STMH1021	JUNCTION	0.02	0.10	74.82	0	01:10	0.10
STMH103	JUNCTION	0.04	0.19	74.81	0	01:10	0.19
STMH104	JUNCTION	0.04	0.18	74.53	0	01:10	0.18
STMH105	JUNCTION	0.07	0.21	74.43	0	01:11	0.21
MHST65789	OUTFALL	0.08	0.25	73.35	0	01:11	0.24
S_101	STORAGE	0.51	1.94	77.56	0	00:55	1.94
S_102	STORAGE	0.39	2.28	77.65	0	01:02	2.28

S_103	STORAGE	0.26	2.49	77.65	0	01:06	2.49
S_104	STORAGE	0.30	1.82	76.57	0	01:05	1.82
S_105	STORAGE	0.28	1.69	76.57	0	01:02	1.69
S_106	STORAGE	0.24	1.42	76.57	0	01:01	1.42
S_107	STORAGE	0.35	1.41	77.86	0	01:02	1.41
S_111	STORAGE	0.02	0.03	76.35	0	01:31	0.03
SU1	STORAGE	0.05	0.12	85.67	0	01:26	0.12
SU2	STORAGE	0.06	0.12	98.67	0	01:31	0.12

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Node Inflow Summary  
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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
CB01	JUNCTION	0.000	0.011	0 01:02	0	0.0386	0.308
CB03	JUNCTION	0.000	0.004	0 01:02	0	0.0211	0.125
CB04	JUNCTION	0.000	0.016	0 01:06	0	0.0314	0.042
CB05	JUNCTION	0.000	0.003	0 01:01	0	0.0164	0.005
CB2	JUNCTION	0.000	0.004	0 00:55	0	0.0277	0.045
EX_MHST65772	JUNCTION	0.000	0.239	0 01:11	0	0.808	0.012
J1	JUNCTION	0.013	0.013	0 01:10	0.0133	0.0133	3.483
J10	JUNCTION	0.000	0.029	0 01:31	0	0.285	0.004
J11	JUNCTION	0.000	0.046	0 01:10	0	0.0524	0.325
J13	JUNCTION	0.000	0.011	0 01:03	0	0.0385	0.060
J14	JUNCTION	0.000	0.024	0 01:06	0	0.0797	0.009
J15	JUNCTION	0.000	0.008	0 01:06	0	0.0484	-0.026
J2	JUNCTION	0.000	0.013	0 01:10	0	0.0128	5.508
J20	JUNCTION	0.000	0.015	0 01:26	0	0.128	0.280
J21	JUNCTION	0.000	0.015	0 01:27	0	0.128	0.007
J22	JUNCTION	0.000	0.059	0 01:22	0	0.49	0.012
J24	JUNCTION	0.000	0.007	0 01:19	0	0.0335	-0.084
J25	JUNCTION	0.000	0.064	0 01:05	0	0.12	0.092
J26	JUNCTION	0.000	0.116	0 01:11	0	0.61	0.007
J3	JUNCTION	0.036	0.048	0 01:10	0.04	0.0522	-0.420
J4	JUNCTION	0.000	0.044	0 01:22	0	0.362	0.005

J4-1	JUNCTION	0.019	0.019	0	01:10	0.0204	0.0204	-0.157
J4-2	JUNCTION	0.024	0.024	0	01:10	0.0322	0.0322	-0.022
J5	JUNCTION	0.000	0.045	0	01:11	0	0.0522	0.030
J6	JUNCTION	0.000	0.063	0	01:11	0	0.0726	0.017
J7	JUNCTION	0.013	0.038	0	01:10	0.0136	0.0458	0.025
J8	JUNCTION	0.000	0.029	0	01:31	0	0.285	0.230
J9	JUNCTION	0.000	0.019	0	01:10	0	0.0204	0.194
MHST66949	JUNCTION	0.000	0.040	0	01:21	0	0.323	-0.008
MHST66950	JUNCTION	0.000	0.000	0	00:00	0	0	0.000 ltr
STMH100	JUNCTION	0.000	0.011	0	01:03	0	0.0385	0.004
STMH101	JUNCTION	0.000	0.004	0	00:57	0	0.0277	1.208
STMH1021	JUNCTION	0.000	0.024	0	01:12	0	0.0797	-0.025
STMH103	JUNCTION	0.000	0.061	0	01:10	0	0.126	0.022
STMH104	JUNCTION	0.000	0.061	0	01:10	0	0.126	0.003
STMH105	JUNCTION	0.000	0.176	0	01:11	0	0.735	0.003
MHST65789	OUTFALL	0.000	0.239	0	01:11	0	0.808	0.000
S_101	STORAGE	0.044	0.044	0	01:10	0.0616	0.0616	-0.001
S_102	STORAGE	0.025	0.025	0	01:10	0.0342	0.0342	0.017
S_103	STORAGE	0.025	0.025	0	01:10	0.0342	0.0342	0.012
S_104	STORAGE	0.064	0.064	0	01:10	0.089	0.089	0.010
S_105	STORAGE	0.020	0.020	0	01:10	0.0274	0.0274	0.003
S_106	STORAGE	0.020	0.020	0	01:10	0.0274	0.0274	-0.008
S_107	STORAGE	0.039	0.039	0	01:10	0.0547	0.0547	0.135
S_111	STORAGE	0.038	0.038	0	01:10	0.0499	0.0499	0.004
SU1	STORAGE	0.089	0.089	0	01:10	0.127	0.127	-1.073
SU2	STORAGE	0.198	0.198	0	01:10	0.283	0.283	-1.009

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Node Surcharge Summary  
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No nodes were surcharged.

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Node Flooding Summary  
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Flooding refers to all water that overflows a node, whether it ponds or not.

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Node	Hours Flooded	Maximum Rate CMS	Time of Max Occurrence days hr:min	Total Flood Volume 10^6 ltr	Maximum Ponded Depth Meters
S_101	0.77	0.040	0 01:10	0.034	0.000
S_102	0.36	0.020	0 01:10	0.013	0.000
S_103	0.11	0.009	0 01:10	0.003	0.000
S_104	0.09	0.007	0 01:10	0.002	0.000
S_105	0.36	0.016	0 01:10	0.010	0.000
S_106	0.37	0.016	0 01:10	0.011	0.000
S_107	0.30	0.028	0 01:10	0.016	0.000

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Storage Volume Summary  
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Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CMS
S_101	0.000	26	0	0	0.001	100	0 00:55	0.004
S_102	0.000	17	0	0	0.001	100	0 01:02	0.004
S_103	0.000	11	0	0	0.001	100	0 01:06	0.016
S_104	0.000	17	0	0	0.001	100	0 01:05	0.057
S_105	0.000	16	0	0	0.001	100	0 01:02	0.004
S_106	0.000	17	0	0	0.001	100	0 01:01	0.003
S_107	0.000	25	0	0	0.001	100	0 01:02	0.011
S_111	0.018	1	0	0	0.033	3	0 01:31	0.005
SU1	0.020	0	0	0	0.067	1	0 01:26	0.015
SU2	0.056	0	0	0	0.157	1	0 01:31	0.029

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Outfall Loading Summary  
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Flow	Avg	Max	Total
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Outfall Node	Freq Pcnt	Flow CMS	Flow CMS	Volume 10^6 ltr
MHST65789	96.44	0.041	0.239	0.808
System	96.44	0.041	0.239	0.808

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Link Flow Summary  
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Link	Type	Maximum  Flow  CMS	Time of Max Occurrence days hr:min	Maximum  Veloc  m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	0.061	0 01:10	1.15	0.50	0.49
C1_1	CONDUIT	0.059	0 01:22	1.60	0.15	0.31
C1_2	CONDUIT	0.000	0 00:00	0.00	0.00	0.06
C1_3	CONDUIT	0.011	0 01:19	0.97	0.03	0.15
C1_4	CONDUIT	0.176	0 01:11	2.33	0.33	0.50
C1_6	CONDUIT	0.040	0 01:22	1.48	0.10	0.22
C1_7	CONDUIT	0.115	0 01:11	1.87	0.29	0.42
C1_8	CONDUIT	0.044	0 01:22	1.45	0.11	0.25
C10	CONDUIT	0.016	0 01:06	1.29	0.35	0.41
C11	CONDUIT	0.029	0 01:31	1.19	0.85	0.71
C12	CONDUIT	0.029	0 01:31	1.68	0.33	0.39
C13	CONDUIT	0.011	0 01:03	1.07	0.30	0.38
C14	CONDUIT	0.011	0 01:03	0.94	0.19	0.30
C15	CONDUIT	0.004	0 00:57	0.71	0.12	0.24
C16_2	CONDUIT	0.024	0 01:12	0.87	0.20	0.30
C16_3	CONDUIT	0.004	0 01:36	0.16	0.04	0.29
C16_4	CONDUIT	0.008	0 01:11	0.64	0.05	0.22
C17	CONDUIT	0.024	0 01:11	0.79	0.01	0.11
C18	CONDUIT	0.061	0 01:10	1.14	0.50	0.49
C19	CONDUIT	0.015	0 01:27	1.02	0.46	0.48
C2	CONDUIT	0.239	0 01:11	2.18	0.35	0.41
C20	CONDUIT	0.015	0 01:27	0.84	0.33	0.39
C21	CONDUIT	0.003	0 01:07	0.68	0.10	0.22
C22	CONDUIT	0.008	0 01:13	0.63	0.34	0.82

C23	CONDUIT	0.064	0	01:10	1.38	1.40	0.90
C3	CONDUIT	0.013	0	01:10	0.36	0.02	0.22
C4	CONDUIT	0.013	0	01:11	0.26	0.01	0.26
C5	CONDUIT	0.046	0	01:10	0.51	0.06	0.35
C6	CONDUIT	0.037	0	01:10	1.70	0.43	0.46
C6_2	CONDUIT	0.045	0	01:11	0.52	0.06	0.34
C7	CONDUIT	0.063	0	01:11	1.28	0.88	0.97
C8	CONDUIT	0.004	0	01:02	0.49	0.22	0.33
C8_1	CONDUIT	0.018	0	01:10	0.62	0.01	0.20
C8_2	CONDUIT	0.045	0	01:11	0.67	0.05	0.30
C9	CONDUIT	0.005	0	01:31	1.30	0.04	0.13
C9_1	CONDUIT	0.024	0	01:10	0.46	0.03	0.26
C9_4	CONDUIT	0.019	0	01:10	0.40	0.03	0.25
OL1	DUMMY	0.015	0	01:26			
OL2	DUMMY	0.029	0	01:31			
OL3	DUMMY	0.004	0	00:55			
OL4	DUMMY	0.004	0	01:02			
OL5	DUMMY	0.016	0	01:06			
OL6	DUMMY	0.057	0	01:05			
OL7	DUMMY	0.004	0	01:02			
OL8	DUMMY	0.003	0	01:01			
OL9	DUMMY	0.011	0	01:02			

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Flow Classification Summary  
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Conduit	Adjusted /Actual Length	----- Fraction of Time in Flow Class -----								
		Up Dry	Down Dry	Sub Dry	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl	
C1	1.00	0.03	0.00	0.00	0.00	0.00	0.00	0.97	0.00	0.00
C1_1	1.00	0.03	0.00	0.00	0.00	0.97	0.00	0.00	0.91	0.00
C1_2	1.00	0.05	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C1_3	1.00	0.04	0.01	0.00	0.64	0.09	0.00	0.21	0.69	0.00
C1_4	1.00	0.03	0.00	0.00	0.00	0.64	0.00	0.32	0.03	0.00
C1_6	1.00	0.03	0.00	0.00	0.17	0.80	0.00	0.00	0.17	0.00
C1_7	1.00	0.03	0.00	0.00	0.00	0.97	0.00	0.00	0.12	0.00
C1_8	1.00	0.03	0.00	0.00	0.00	0.97	0.00	0.00	0.93	0.00

C10	1.00	0.05	0.00	0.00	0.00	0.00	0.00	0.95	0.00	0.00
C11	1.00	0.03	0.00	0.00	0.00	0.00	0.00	0.97	0.00	0.00
C12	1.00	0.03	0.00	0.00	0.00	0.97	0.00	0.00	0.13	0.00
C13	1.00	0.05	0.00	0.00	0.00	0.00	0.00	0.95	0.00	0.00
C14	1.00	0.05	0.00	0.00	0.00	0.00	0.00	0.95	0.00	0.00
C15	1.00	0.04	0.00	0.00	0.00	0.00	0.00	0.96	0.00	0.00
C16_2	1.00	0.04	0.00	0.00	0.00	0.00	0.00	0.96	0.00	0.00
C16_3	1.00	0.04	0.00	0.00	0.96	0.00	0.00	0.00	0.02	0.00
C16_4	1.00	0.04	0.00	0.00	0.95	0.01	0.00	0.00	0.91	0.00
C17	1.00	0.05	0.00	0.00	0.04	0.00	0.00	0.92	0.00	0.00
C18	1.00	0.03	0.00	0.00	0.00	0.00	0.00	0.97	0.00	0.00
C19	1.00	0.03	0.00	0.00	0.00	0.00	0.00	0.97	0.00	0.00
C2	1.00	0.03	0.00	0.00	0.00	0.96	0.00	0.00	0.30	0.00
C20	1.00	0.03	0.00	0.00	0.00	0.00	0.00	0.97	0.00	0.00
C21	1.00	0.03	0.00	0.00	0.00	0.00	0.00	0.97	0.00	0.00
C22	1.00	0.04	0.00	0.00	0.23	0.00	0.00	0.73	0.13	0.00
C23	1.00	0.04	0.00	0.00	0.00	0.00	0.00	0.96	0.00	0.00
C3	1.00	0.03	0.00	0.00	0.87	0.00	0.00	0.10	0.22	0.00
C4	1.00	0.03	0.09	0.00	0.88	0.00	0.00	0.00	0.83	0.00
C5	1.00	0.03	0.00	0.00	0.97	0.00	0.00	0.00	0.85	0.00
C6	1.00	0.03	0.00	0.00	0.00	0.00	0.00	0.97	0.00	0.00
C6_2	1.00	0.04	0.00	0.00	0.96	0.00	0.00	0.00	0.78	0.00
C7	1.00	0.03	0.01	0.00	0.96	0.00	0.01	0.00	0.15	0.00
C8	1.00	0.04	0.00	0.00	0.96	0.00	0.00	0.00	0.00	0.00
C8_1	1.00	0.04	0.00	0.00	0.00	0.00	0.00	0.96	0.00	0.00
C8_2	1.00	0.04	0.00	0.00	0.00	0.00	0.00	0.96	0.00	0.00
C9	1.00	0.04	0.00	0.00	0.00	0.00	0.00	0.96	0.00	0.00
C9_1	1.00	0.03	0.00	0.00	0.97	0.00	0.00	0.00	0.01	0.00
C9_4	1.00	0.03	0.00	0.00	0.97	0.00	0.00	0.00	0.46	0.00

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Conduit Surcharge Summary

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Conduit	Hours Full			Hours	
	Both Ends	Upstream	Dnstream	Above Normal	Capacity Limited
C22	0.01	0.01	0.13	0.01	0.01

C23                                    0.01            0.01            0.01            0.18            0.01

Analysis begun on: Fri Dec 16 15:46:25 2022  
Analysis ended on: Fri Dec 16 15:46:26 2022  
Total elapsed time: 00:00:01

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.013)

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Element Count

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Number of rain gages ..... 16  
 Number of subcatchments ... 2  
 Number of nodes ..... 9  
 Number of links ..... 8  
 Number of pollutants ..... 0  
 Number of land uses ..... 0

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Raingage Summary

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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
Building	0.13	80.00	100.00	1.0000	2yr_3hr_Chicago	EX_MHST65772
S1	1.23	160.00	90.00	3.0000	2yr_3hr_Chicago	EX_MHST65772

\*\*\*\*\*

Node Summary

\*\*\*\*\*

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
EX_MHST65772	JUNCTION	74.15	2.18	0.0	
J13	JUNCTION	75.76	1.75	0.0	
J22	JUNCTION	75.25	1.93	0.0	
J26	JUNCTION	74.55	2.00	0.0	
J4	JUNCTION	75.54	1.90	0.0	
MHST66949	JUNCTION	75.58	1.90	0.0	
MHST66950	JUNCTION	77.40	2.50	0.0	
STMH105	JUNCTION	74.22	2.58	0.0	
MHST65789	OUTFALL	73.10	0.60	0.0	

\*\*\*\*\*

Link Summary

\*\*\*\*\*

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1_1	J22	J26	CONDUIT	38.6	1.8157	0.0130
C1_2	MHST66950	J13	CONDUIT	109.5	1.4984	0.0100
C1_3	J13	MHST66949	CONDUIT	10.6	1.5158	0.0100
C1_4	STMH105	EX_MHST65772	CONDUIT	1.8	3.4014	0.0130
C1_6	MHST66949	J4	CONDUIT	2.4	1.8278	0.0130
C1_7	J26	STMH105	CONDUIT	17.2	1.9222	0.0130
C1_8	J4	J22	CONDUIT	15.6	1.8410	0.0130
C2	EX_MHST65772	MHST65789	CONDUIT	87.3	1.2022	0.0100

\*\*\*\*\*

Cross Section Summary

\*\*\*\*\*

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1_1	CIRCULAR	0.45	0.16	0.11	0.45	1	0.38
C1_2	CIRCULAR	0.45	0.16	0.11	0.45	1	0.45
C1_3	CIRCULAR	0.45	0.16	0.11	0.45	1	0.46
C1_4	CIRCULAR	0.45	0.16	0.11	0.45	1	0.53
C1_6	CIRCULAR	0.45	0.16	0.11	0.45	1	0.39
C1_7	CIRCULAR	0.45	0.16	0.11	0.45	1	0.40
C1_8	CIRCULAR	0.45	0.16	0.11	0.45	1	0.39
C2	CIRCULAR	0.60	0.28	0.15	0.60	1	0.88

\*\*\*\*\*

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

Surcharge Method ..... EXTRAN

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 hectare-m	Depth mm
*****		
Runoff Quantity Continuity		
*****		
Total Precipitation .....	0.043	31.860
Evaporation Loss .....	0.000	0.000
Infiltration Loss .....	0.004	2.876
Surface Runoff .....	0.038	27.798
Final Storage .....	0.002	1.443
Continuity Error (%) .....	-0.806	

	Volume hectare-m	Volume 10 <sup>6</sup> ltr
*****		
Flow Routing Continuity		
*****		
Dry Weather Inflow .....	0.000	0.000
Wet Weather Inflow .....	0.038	0.378
Groundwater Inflow .....	0.000	0.000
RDII Inflow .....	0.000	0.000
External Inflow .....	0.000	0.000
External Outflow .....	0.038	0.378
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	0.000
Continuity Error (%) .....	0.000	

\*\*\*\*\*  
 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  
 \*\*\*\*\*

Peak Runoff		Total	Total	Total	Total	Imperv	Perv	Total	Total
Runoff	Coeff	Precip	Runon	Evap	Infil	Runoff	Runoff	Runoff	Runoff
Subcatchment		mm	mm	mm	mm	mm	mm	mm	10 <sup>6</sup> ltr
CMS									
Building		31.86	0.00	0.00	0.00	30.49	0.00	30.49	0.04
0.03	0.957								
S1		31.86	0.00	0.00	3.18	27.50	0.01	27.51	0.34
0.23	0.864								

\*\*\*\*\*  
 Node Depth Summary  
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Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
EX_MHST65772	JUNCTION	0.04	0.23	74.38	0 01:10	0.23
J13	JUNCTION	0.00	0.00	75.76	0 00:00	0.00
J22	JUNCTION	0.00	0.00	75.25	0 00:00	0.00
J26	JUNCTION	0.00	0.00	74.55	0 00:00	0.00
J4	JUNCTION	0.00	0.00	75.54	0 00:00	0.00
MHST66949	JUNCTION	0.00	0.00	75.58	0 00:00	0.00
MHST66950	JUNCTION	0.00	0.00	77.40	0 00:00	0.00
STMH105	JUNCTION	0.01	0.16	74.38	0 01:10	0.16
MHST65789	OUTFALL	0.03	0.23	73.33	0 01:10	0.22

```

*****
Node Inflow Summary
*****

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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
EX_MHST65772	JUNCTION	0.263	0.263	0 01:10	0.378	0.378	0.007
J13	JUNCTION	0.000	0.000	0 00:00	0	0	0.000 ltr
J22	JUNCTION	0.000	0.000	0 00:00	0	0	0.000 ltr
J26	JUNCTION	0.000	0.000	0 00:00	0	0	0.000 ltr
J4	JUNCTION	0.000	0.000	0 00:00	0	0	0.000 ltr
MHST66949	JUNCTION	0.000	0.000	0 00:00	0	0	0.000 ltr
MHST66950	JUNCTION	0.000	0.000	0 00:00	0	0	0.000 ltr
STMH105	JUNCTION	0.000	0.001	0 01:00	0	0.000421	0.003
MHST65789	OUTFALL	0.000	0.262	0 01:10	0	0.378	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
MHST65789	89.42	0.020	0.262	0.378
System	89.42	0.020	0.262	0.378

\*\*\*\*\*  
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_1	CONDUIT	0.000	0 00:00	0.00	0.00	0.00
C1_2	CONDUIT	0.000	0 00:00	0.00	0.00	0.00
C1_3	CONDUIT	0.000	0 00:00	0.00	0.00	0.00
C1_4	CONDUIT	0.001	0 01:00	0.08	0.00	0.41
C1_6	CONDUIT	0.000	0 00:00	0.00	0.00	0.00
C1_7	CONDUIT	0.000	0 00:00	0.00	0.00	0.17
C1_8	CONDUIT	0.000	0 00:00	0.00	0.00	0.00

C2                            CONDUIT            0.262            0   01:10            2.70            0.30            0.38

\*\*\*\*\*  
 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	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C1_2	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C1_3	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C1_4	1.00	0.43	0.39	0.00	0.17	0.00	0.00	0.00	0.71	0.00
C1_6	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C1_7	1.00	0.83	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C1_8	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C2	1.00	0.10	0.00	0.00	0.00	0.90	0.00	0.00	0.25	0.00

\*\*\*\*\*  
 Conduit Surcharge Summary  
 \*\*\*\*\*

No conduits were surcharged.

Analysis begun on: Fri Dec 16 15:50:25 2022  
 Analysis ended on: Fri Dec 16 15:50:25 2022  
 Total elapsed time: < 1 sec

# APPENDIX

## C SUPPORTING DOCUMENTS





# VHV Vertical Vortex Flow Regulator

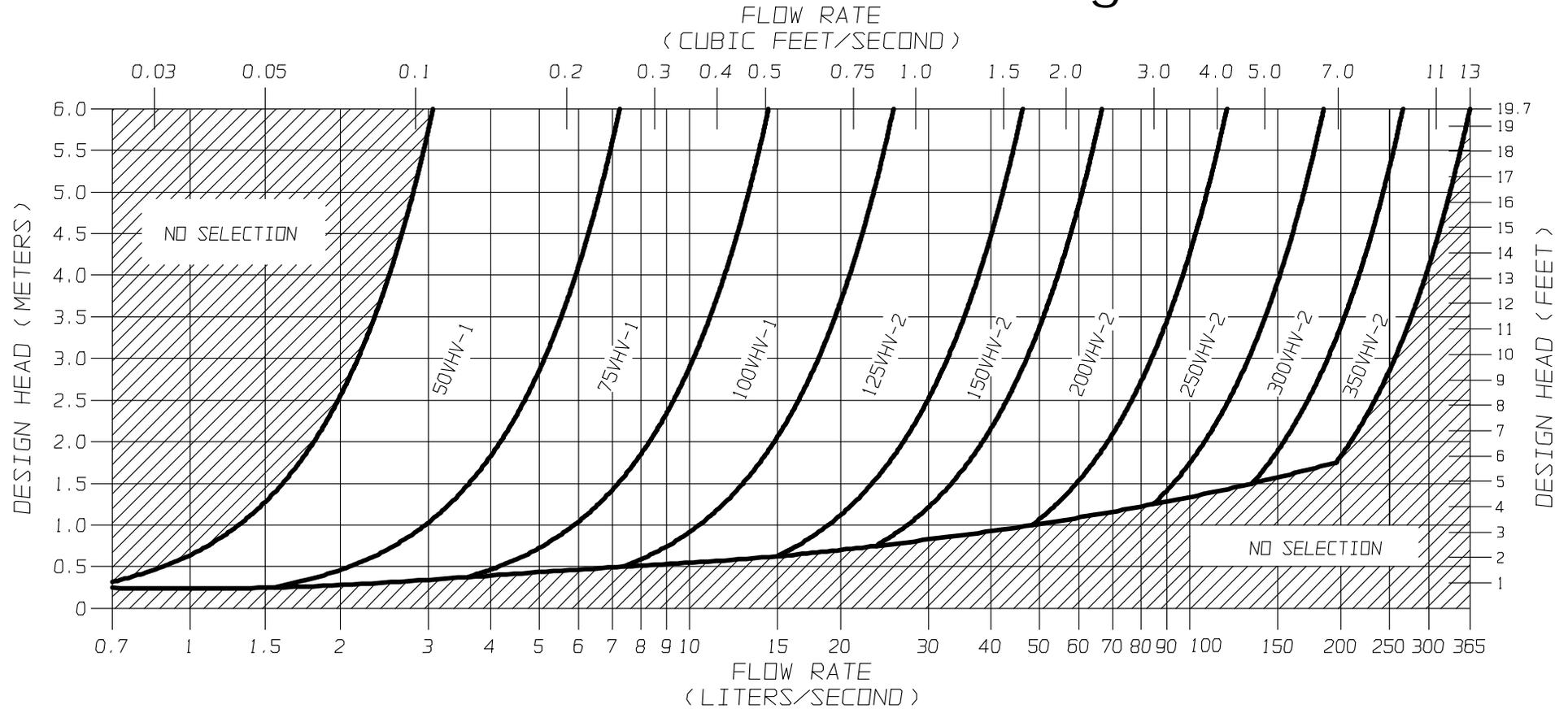


FIGURE 3 - VHV

**JOHN MEUNIER**



# SVHV Vertical Vortex Flow Regulator

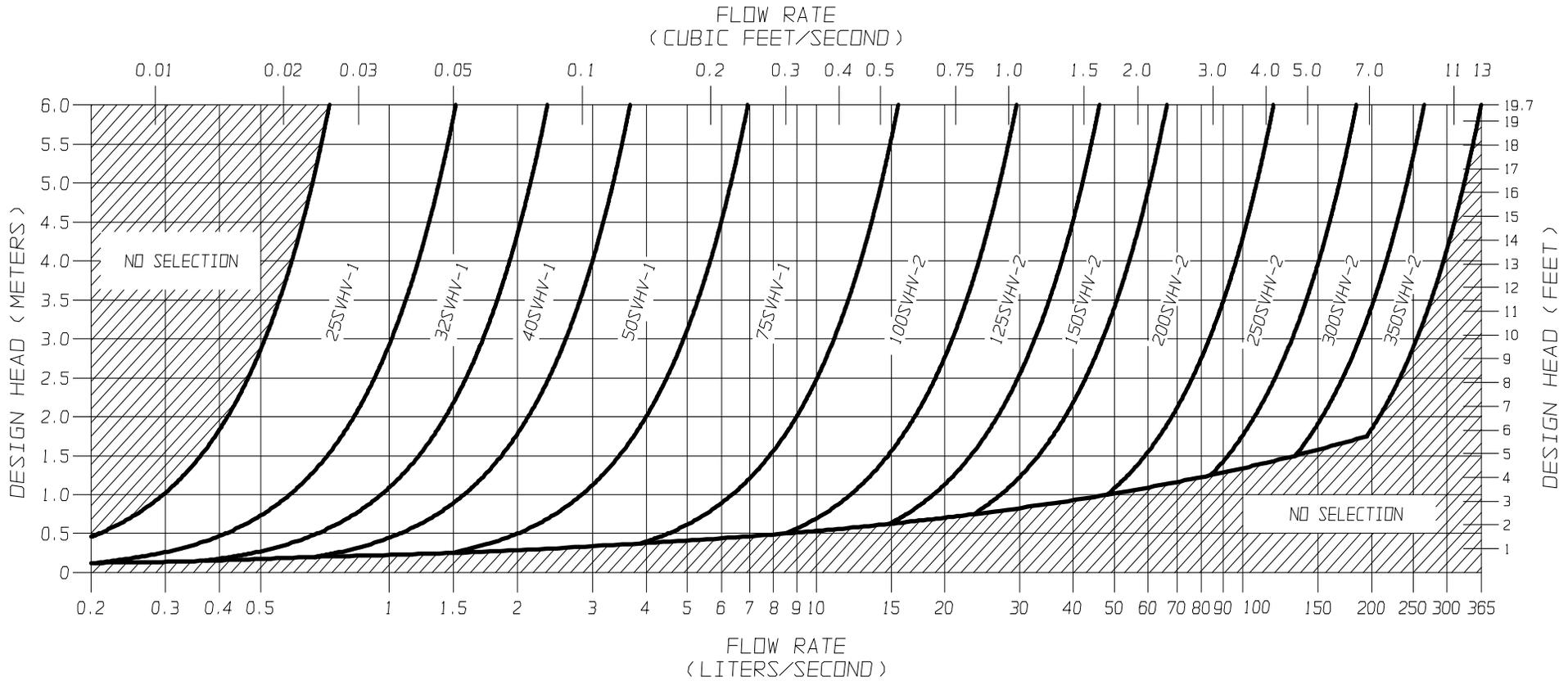


FIGURE 3 - SVHV

**JOHN MEUNIER**



# Adjustable Accutrol Weir

Tag: \_\_\_\_\_

## Adjustable Flow Control for Roof Drains

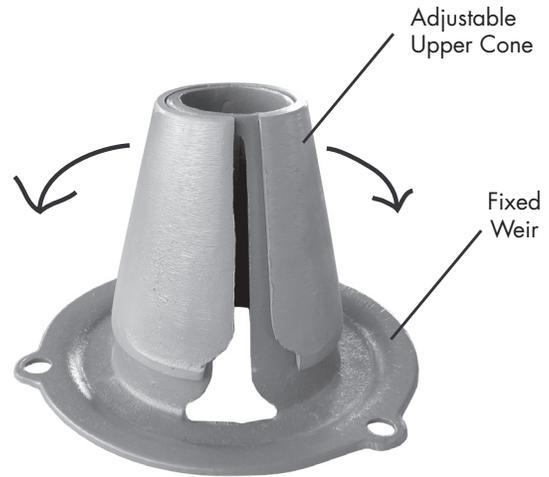
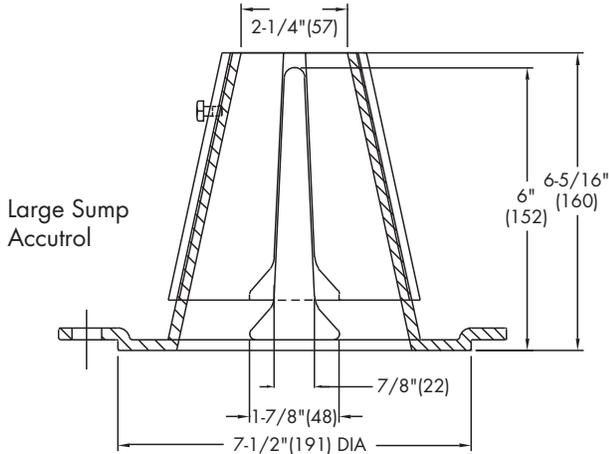
### ADJUSTABLE ACCUTROL (for Large Sump Roof Drains only)

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

#### EXAMPLE:

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

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



1/2 Weir Opening Exposed Shown Above

TABLE 1. Adjustable Accutrol Flow Rate Settings

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

Job Name \_\_\_\_\_  
 Job Location \_\_\_\_\_  
 Engineer \_\_\_\_\_

Contractor \_\_\_\_\_  
 Contractor's P.O. No. \_\_\_\_\_  
 Representative \_\_\_\_\_

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