

# STORMWATER MANAGEMENT REPORT

*For a*

## **PROPOSED MIXED-USE BUILDING**

**BLOCK 59; LOTS 9-11, 12 (TM #11)**

**BOROUGH OF BRADLEY BEACH  
MONMOUTH COUNTY, NJ**

*Prepared for:*

**301 MAIN STREET HOLDINGS, LLC**  
PO Box 185  
Glen Rock, NJ 07452

**March 12, 2020**



**Patrick R. Ward, PE, PP**  
**NJPE 24GE09079000**  
**NJPP 33LI00626800**

**InSite Engineering, LLC**

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Our office is submitting this drainage report on behalf of the Applicant, 301 Main Street Holdings, LLC, who are proposing to construct a mixed-use building at the above referenced property. The applicant is seeking to amend a prior site plan approval from 2015.

### **Project Description**

The subject development consists of two parcels designated as Block 59, Lots 9 through 11 and Block 59, Lot 12 as shown on Tax Map Sheet #11 of the Borough of Bradley Beach. They are located on the northwest corner of Third Avenue and Main Street (NJ State Route 71), within the Borough's General Business West (GBW) Zone. The properties are bound to the north and west by residential uses. Commercial uses exist across Main Street and Third Avenue. An unnamed alley right-of-way bisects the two tracts.

Lots 9, 10, and 11 was previously developed with an existing two and one-half story frame building on the southeast corner which was utilized as Giamano's Ristorante. Associated improvements included parking areas to the west and north, concrete patio and dumpster areas, and a bocce ball court along Third Avenue. The property was almost entirely covered with impervious surface (95.9%) with the only open area consisting of a grass strip along the northern property line. Lot 12 was previously utilized as residential property, with a pair of two-story dwellings. Associated improvements to this use included concrete and brick walkways, planters, and a single shed. Existing impervious coverage on Lot 12 is 31.4%.

The previous applicant sought approval to demolish all of the existing structures/improvements on both properties and construct a new mixed use building with associated improvements. The current applicant is seeking approval for a new four-story building which will be situated entirely on Lots 9, 10, and 11 with a commercial use on the first floor and residential apartments on floors two through four. Thirty (30) units are proposed. Parking areas will be located both on Lots 9-11 and Lot 12 in order to serve the use. The parking area on Lots 9-11 will be located under the proposed building and will be accessed by two new driveways opening onto Third Avenue and Main Street. The parking area on Lot 12 will open onto Third Avenue only, but will have a shared drive aisle with Lots 9-11. Other appurtenant features to the proposed development will include concrete curb and walkway areas, trash enclosure areas, landscaping measures, and building signage.

As a result of the development, onsite impervious coverage will decrease on Lots 9-11, but increase on Lot 12, resulting in a total net increase in impervious coverage for the development. This increase in impervious coverage dictates that stormwater peak release rates will also increase and will therefore need to be mitigated. The proposed method of offsetting the increase in stormwater runoff is an underground infiltration system proposed under the drive aisle of the Lot 12 parking area. Detailed descriptions of this mitigation technique, as well as supporting calculations, are contained herein.

## **Methodology & Design**

The existing topography of the site consists of a ridge running from north to south through Lots 9, 10, & 11. Runoff from the eastern third of the development flows southeasterly toward the State right-of-way (Main Street) while runoff from the western two-thirds flows southwesterly toward the municipal right-of-way (Third Avenue). All runoff flowing within the Main Street right-of-way eventually combines with runoff entering the Third Avenue right-of-way, where the total flow continues down Third Avenue. As such, the hydrologic point of analysis is the southwestern corner of the development.

In the post development hydrologic condition, effectively all of the runoff tributary to the State right-of-way will be eliminated. This is due to the fact that the new mixed-use building will comprise almost the entirety of Lots 9, 10, 11. The only proposed runoff tributary to Main Street is generated over a small entrance which is significantly smaller in size to the original drainage area. The existing versus proposed hydrology of this area is quantified below. Stormwater hydrographs generated using the HydroCAD 10.0 analysis software, as well as Drainage Area Maps, are included at end of this report for ease of reference:

### **Existing Versus Proposed Flow Rates to Main Street (NJ State Route 71)**

<b>Storm Frequency</b>	<b>Existing Conditions (cfs)</b>	<b>Proposed Conditions (cfs)</b>	<b>Reduction (%)</b>
2-Year	0.53	0.00	100.0
10-Year	0.82	0.00	100.0
100-Year	1.41	0.01	99.3

Stormwater generated over the roof of the proposed building will be collected via an 8" PVC downspout collection system, majority of which will discharge into a diversion manhole located within the Lot 12 parking area. The diversion manhole will direct runoff into an infiltration system consisting of Terre Arch™ precast concrete storage units within a stone field. The diversion manhole is fitted with a weir set at the top elevation of the system to ensure that it fills to one hundred (100%) percent capacity, forcing all stored runoff to infiltrate through the bottom stone back into the soil. Runoff from rainfall events exceeding the capacity of the system flows over the weir and is conveyed, via 15" RCP conduit, towards a 'B' inlet within Third Avenue. The inlet will contain an open bottomed stone sump to allow runoff to infiltrate into the native soil. Runoff from even higher intensity rainfall events, which exceeds the capacity of the system, conduit, and inlet, will trigger the inlet grate and continue to flow overland down Third Avenue. For maintenance and emergency situations, the diversion manhole is also fitted with a 2.5" orifice within the weir wall. This orifice will remain covered under normal operation, however, it can be opened to allow the system to drain should infiltrative abilities become compromised. A portion of the roof deck (400 square feet) will be discharged directly to grade in the parking lot. Please refer to the accompanying Site Plan for a layout and construction details of all items referred to above.

The system has been implemented to store and infiltrate roof runoff in order to offset the peak flow increase after construction. The following table compares predevelopment versus post development rates tributary to the point of analysis:

**Existing Versus Proposed Flow Rates (Total Site)**

<b>Storm Frequency</b>	<b>Existing Conditions (cfs)</b>	<b>Proposed Conditions (cfs)</b>	<b>Reduction (%)</b>
2-Year	1.40	0.54	61.4
10-Year	2.16	0.83	61.6
100-Year	3.84	3.79	1.3

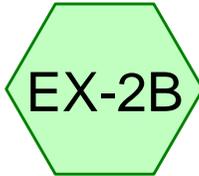
**Conclusion**

In summary, the proposed development will increase the amount of runoff generated on site due to the addition of the mixed use building and parking areas. However, the implementation of the infiltration system will mitigate any potential adverse hydrologic effects by providing the necessary storage to offset the volume and runoff increase. Redirection of the proposed roof area will also effectively eliminate flows tributary to the State right-of-way.

## **PRE-DEVELOPMENT HYDROGRAPHS (STATE ROUTE 71)**



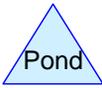
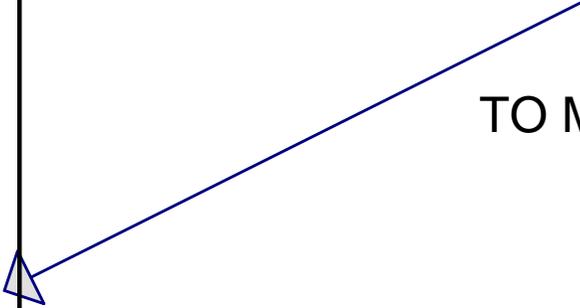
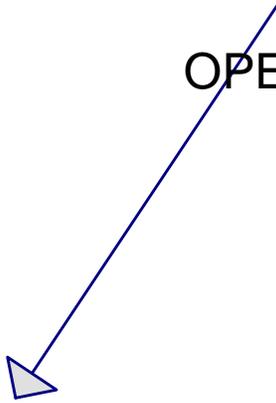
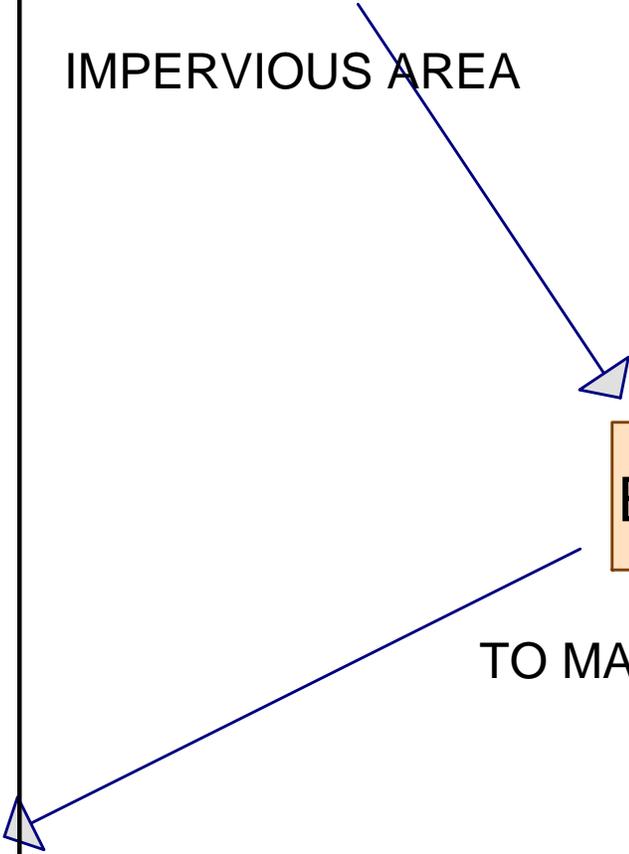
IMPERVIOUS AREA



OPEN SPACE



TO MAIN STREET



## SWM Analysis

Prepared by InSite Engineering, LLC

HydroCAD® 10.00-24 s/n 03018 © 2018 HydroCAD Software Solutions LLC

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### Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.008	39	>75% Grass cover, Good, HSG A (EX-2B)
0.183	98	Unconnected impervious, HSG A (EX-2A)
<b>0.191</b>	<b>96</b>	<b>TOTAL AREA</b>

# SWM Analysis

Prepared by InSite Engineering, LLC

HydroCAD® 10.00-24 s/n 03018 © 2018 HydroCAD Software Solutions LLC

Type III 24-hr 2-Year Rainfall=3.40"

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## Summary for Subcatchment EX-2A: IMPERVIOUS AREA

Runoff = 0.53 cfs @ 12.13 hrs, Volume= 0.048 af, Depth= 3.17"

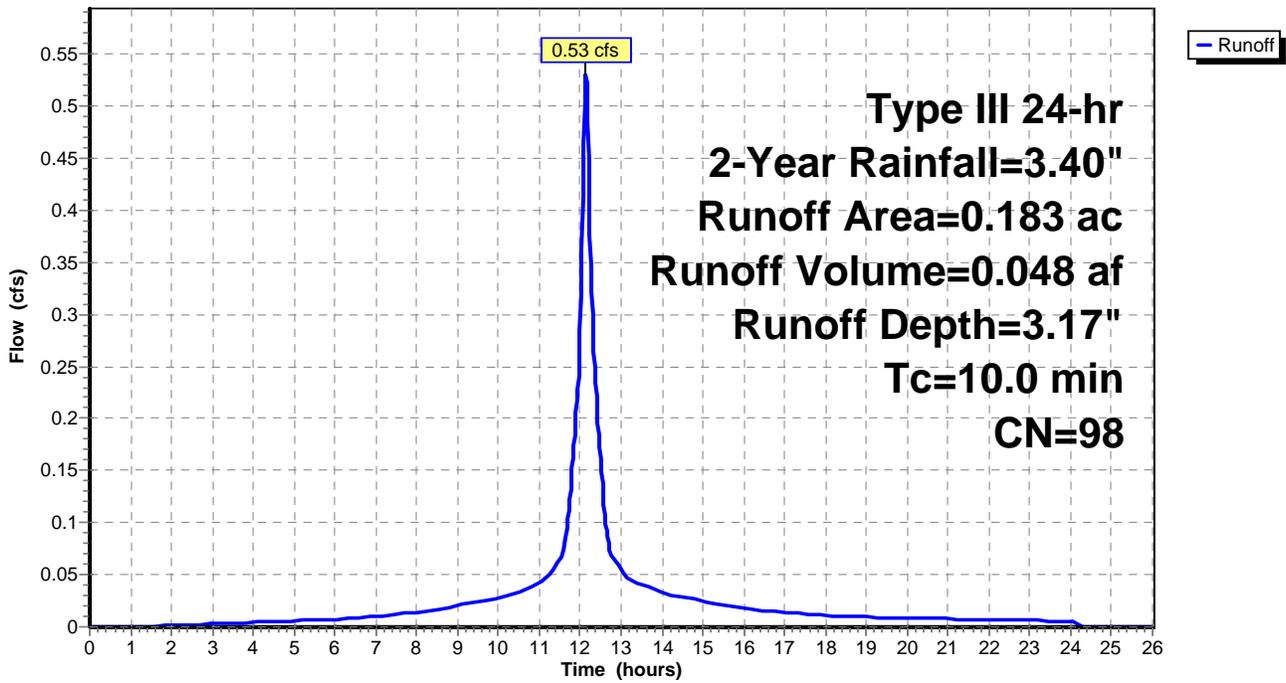
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs  
Type III 24-hr 2-Year Rainfall=3.40"

Area (ac)	CN	Description
* 0.183	98	Unconnected impervious, HSG A
0.183		100.00% Impervious Area
0.183		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry, MIN Tc

## Subcatchment EX-2A: IMPERVIOUS AREA

Hydrograph



# SWM Analysis

Prepared by InSite Engineering, LLC

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Type III 24-hr 2-Year Rainfall=3.40"

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## Summary for Subcatchment EX-2B: OPEN SPACE

Runoff = 0.00 cfs @ 23.50 hrs, Volume= 0.000 af, Depth= 0.00"

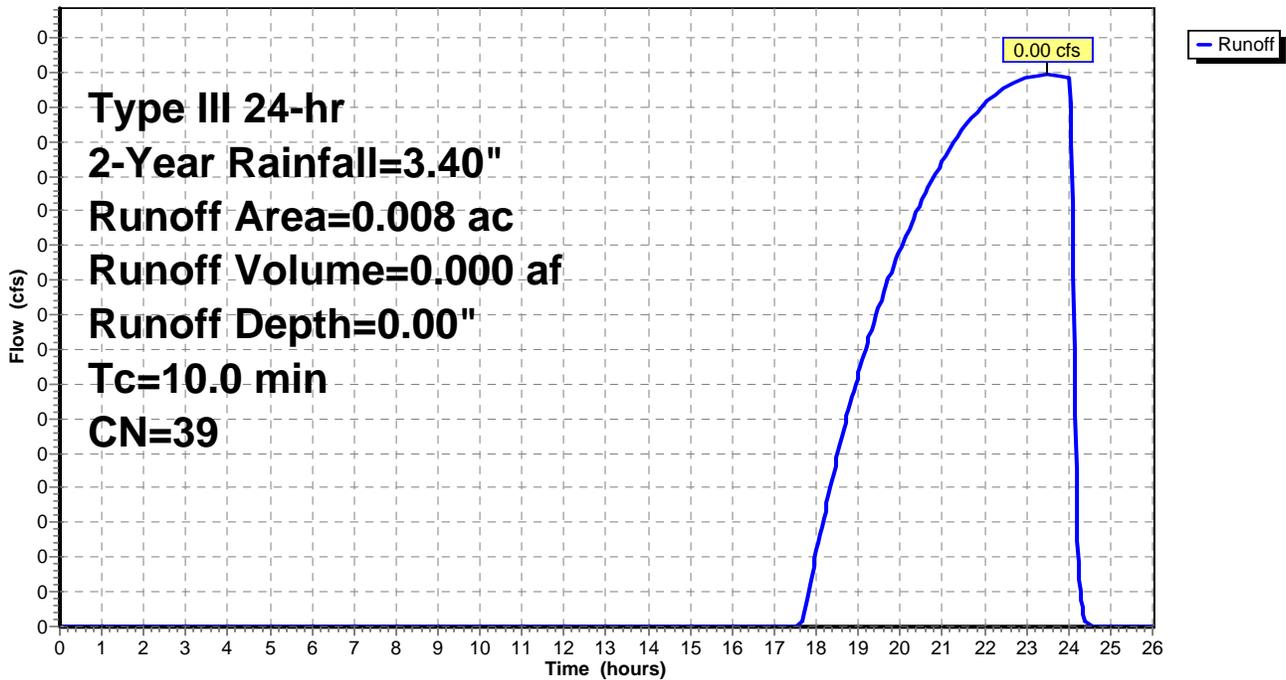
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs  
Type III 24-hr 2-Year Rainfall=3.40"

Area (ac)	CN	Description
0.008	39	>75% Grass cover, Good, HSG A
0.008		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry, MIN Tc

## Subcatchment EX-2B: OPEN SPACE

Hydrograph



# SWM Analysis

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Type III 24-hr 2-Year Rainfall=3.40"

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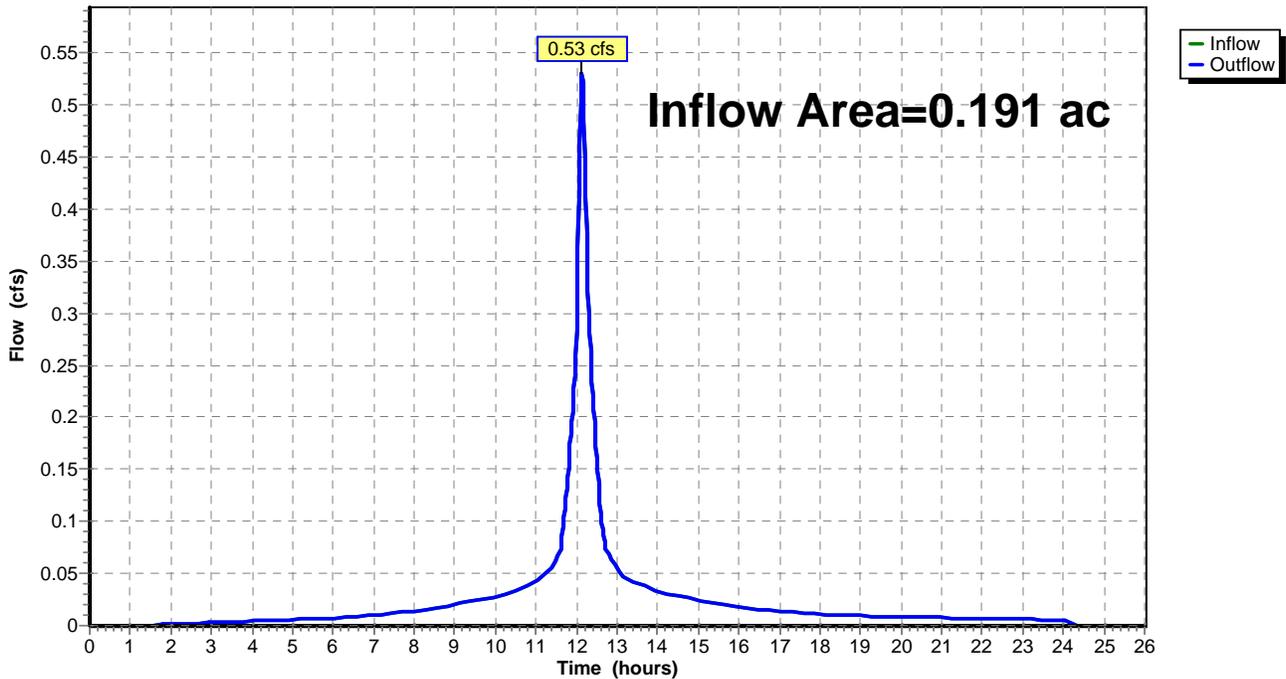
## Summary for Reach EX-2: TO MAIN STREET

Inflow Area = 0.191 ac, 95.81% Impervious, Inflow Depth = 3.03" for 2-Year event  
Inflow = 0.53 cfs @ 12.13 hrs, Volume= 0.048 af  
Outflow = 0.53 cfs @ 12.13 hrs, Volume= 0.048 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs

## Reach EX-2: TO MAIN STREET

Hydrograph



# SWM Analysis

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Type III 24-hr 10-Year Rainfall=5.20"

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## Summary for Subcatchment EX-2A: IMPERVIOUS AREA

Runoff = 0.82 cfs @ 12.13 hrs, Volume= 0.076 af, Depth= 4.96"

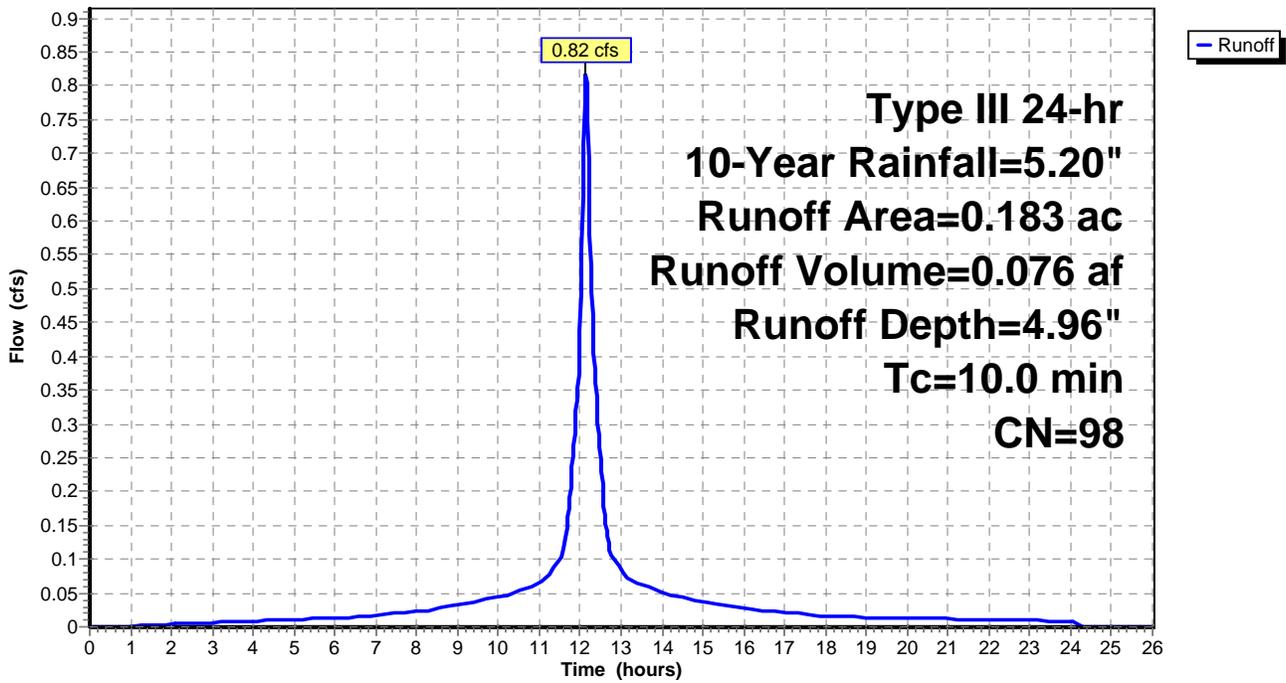
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs  
Type III 24-hr 10-Year Rainfall=5.20"

Area (ac)	CN	Description
* 0.183	98	Unconnected impervious, HSG A
0.183		100.00% Impervious Area
0.183		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry, MIN Tc

## Subcatchment EX-2A: IMPERVIOUS AREA

Hydrograph



# SWM Analysis

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Type III 24-hr 10-Year Rainfall=5.20"

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## Summary for Subcatchment EX-2B: OPEN SPACE

Runoff = 0.00 cfs @ 12.50 hrs, Volume= 0.000 af, Depth= 0.24"

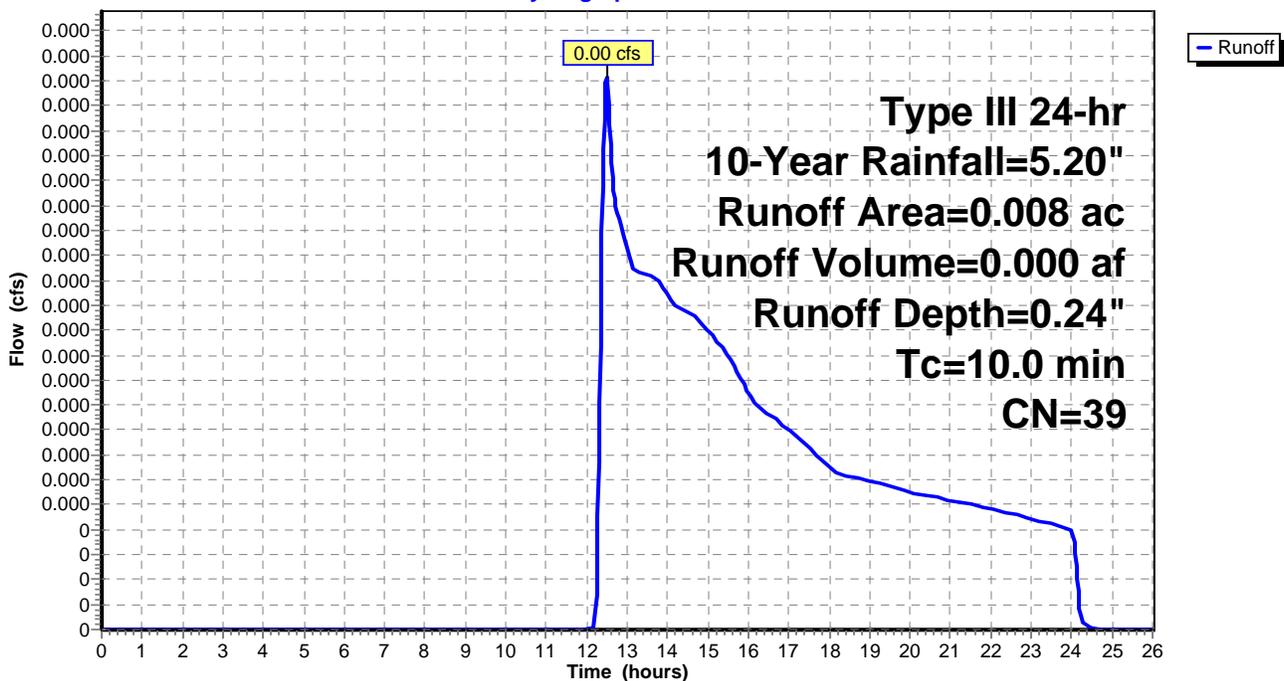
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs  
Type III 24-hr 10-Year Rainfall=5.20"

Area (ac)	CN	Description
0.008	39	>75% Grass cover, Good, HSG A
0.008		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry, MIN Tc

## Subcatchment EX-2B: OPEN SPACE

Hydrograph



# SWM Analysis

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Type III 24-hr 10-Year Rainfall=5.20"

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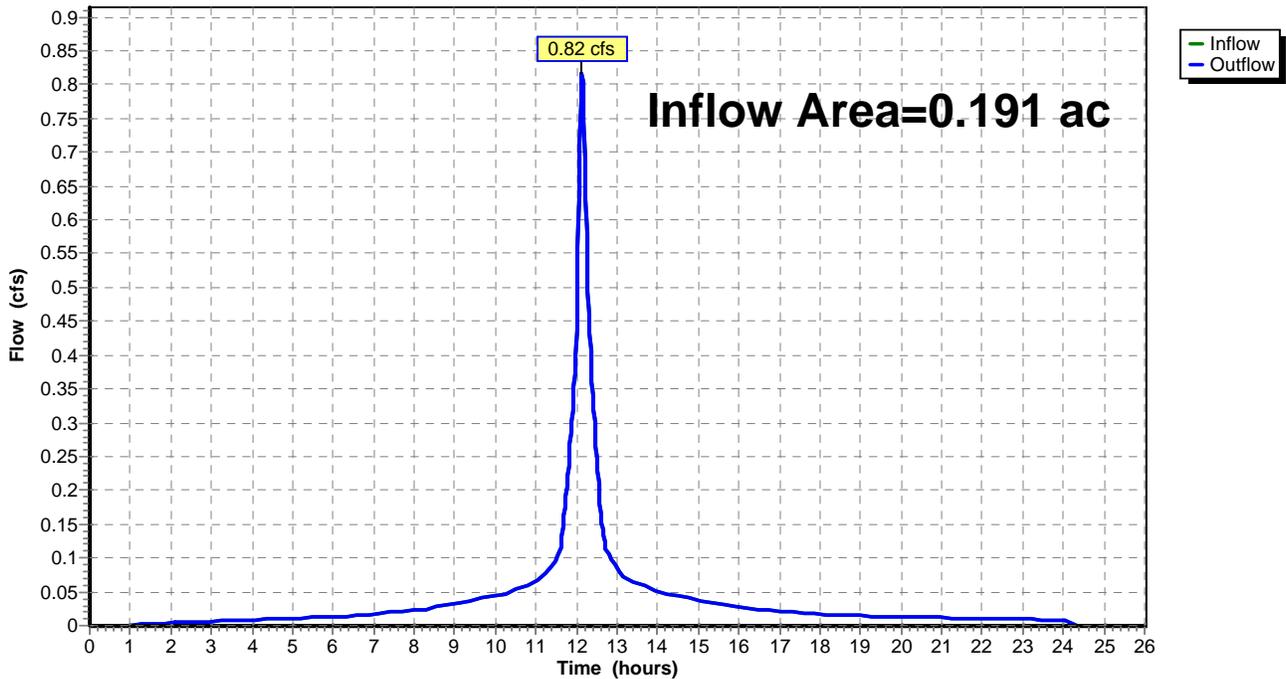
## Summary for Reach EX-2: TO MAIN STREET

Inflow Area = 0.191 ac, 95.81% Impervious, Inflow Depth = 4.77" for 10-Year event  
Inflow = 0.82 cfs @ 12.13 hrs, Volume= 0.076 af  
Outflow = 0.82 cfs @ 12.13 hrs, Volume= 0.076 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs

## Reach EX-2: TO MAIN STREET

Hydrograph



# SWM Analysis

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Type III 24-hr 100-Year Rainfall=8.90"

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## Summary for Subcatchment EX-2A: IMPERVIOUS AREA

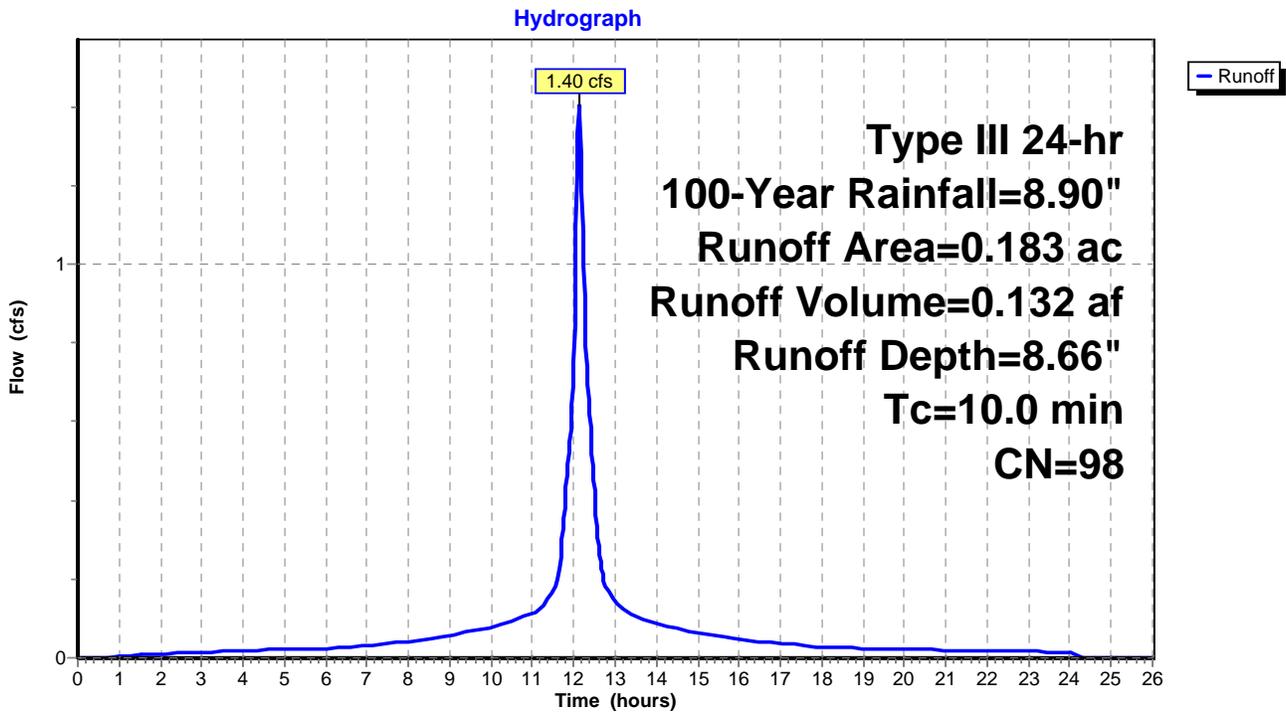
Runoff = 1.40 cfs @ 12.13 hrs, Volume= 0.132 af, Depth= 8.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs  
Type III 24-hr 100-Year Rainfall=8.90"

Area (ac)	CN	Description
* 0.183	98	Unconnected impervious, HSG A
0.183		100.00% Impervious Area
0.183		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry, MIN Tc

## Subcatchment EX-2A: IMPERVIOUS AREA



# SWM Analysis

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Type III 24-hr 100-Year Rainfall=8.90"

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## Summary for Subcatchment EX-2B: OPEN SPACE

Runoff = 0.01 cfs @ 12.17 hrs, Volume= 0.001 af, Depth= 1.56"

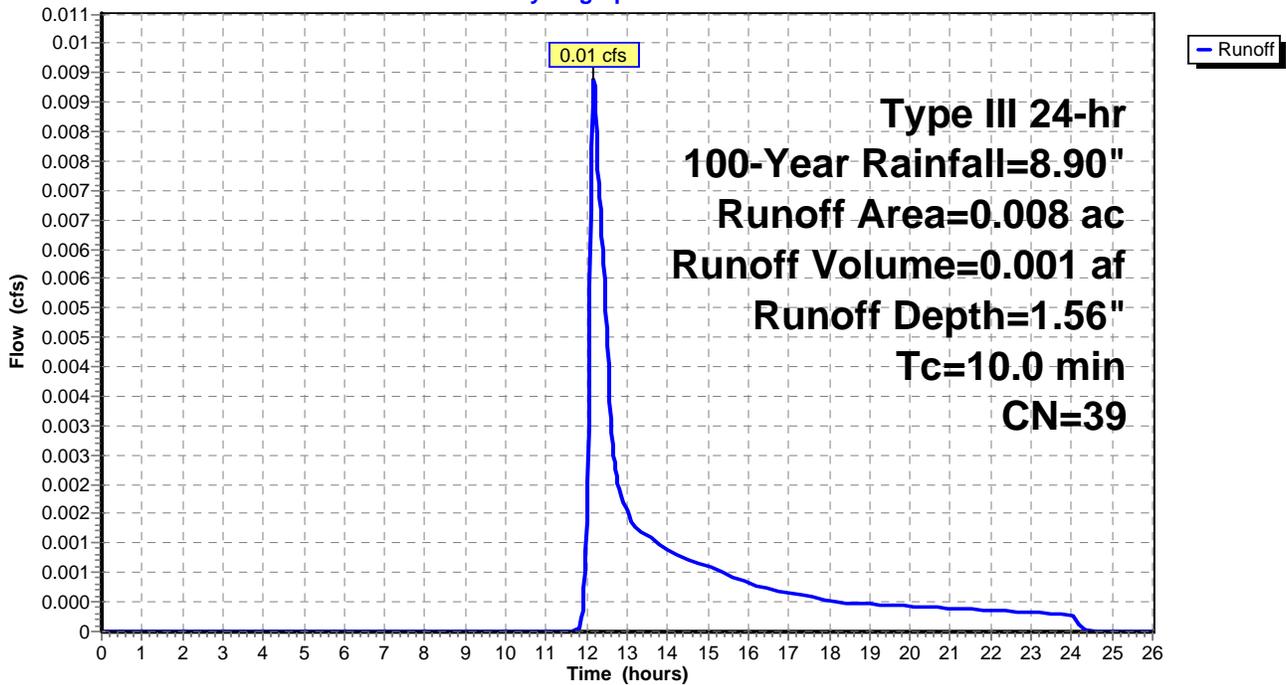
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs  
Type III 24-hr 100-Year Rainfall=8.90"

Area (ac)	CN	Description
0.008	39	>75% Grass cover, Good, HSG A
0.008		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry, MIN Tc

## Subcatchment EX-2B: OPEN SPACE

Hydrograph



# SWM Analysis

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Type III 24-hr 100-Year Rainfall=8.90"

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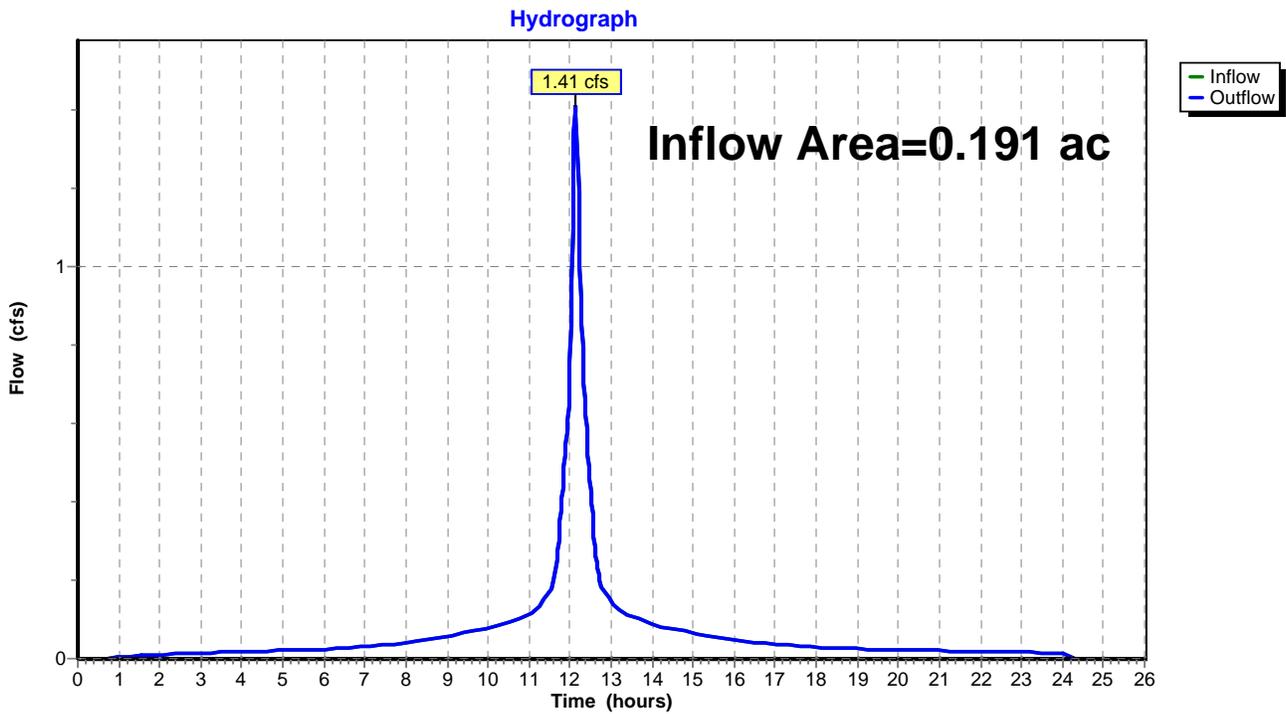
Page 11

## Summary for Reach EX-2: TO MAIN STREET

Inflow Area = 0.191 ac, 95.81% Impervious, Inflow Depth = 8.36" for 100-Year event  
Inflow = 1.41 cfs @ 12.13 hrs, Volume= 0.133 af  
Outflow = 1.41 cfs @ 12.13 hrs, Volume= 0.133 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs

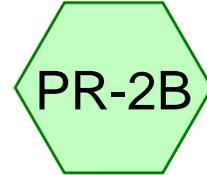
## Reach EX-2: TO MAIN STREET



## **POST DEVELOPMENT HYDROGRAPHS (STATE ROUTE 71)**



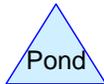
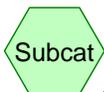
UNDETAINED TO MAIN STREET (OPEN SPACE)



UNDETAINED TO MAIN STREET (IMPERVIOUS)



TO MAIN STREET



## SWM Analysis

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### Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.001	98	Unconnected impervious, HSG A (PR-2B)
<b>0.001</b>	<b>98</b>	<b>TOTAL AREA</b>

# SWM Analysis

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Type III 24-hr 2-Year Rainfall=3.40"

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## Summary for Subcatchment PR-2A: UNDETAINED TO MAIN STREET (OPEN SPACE)

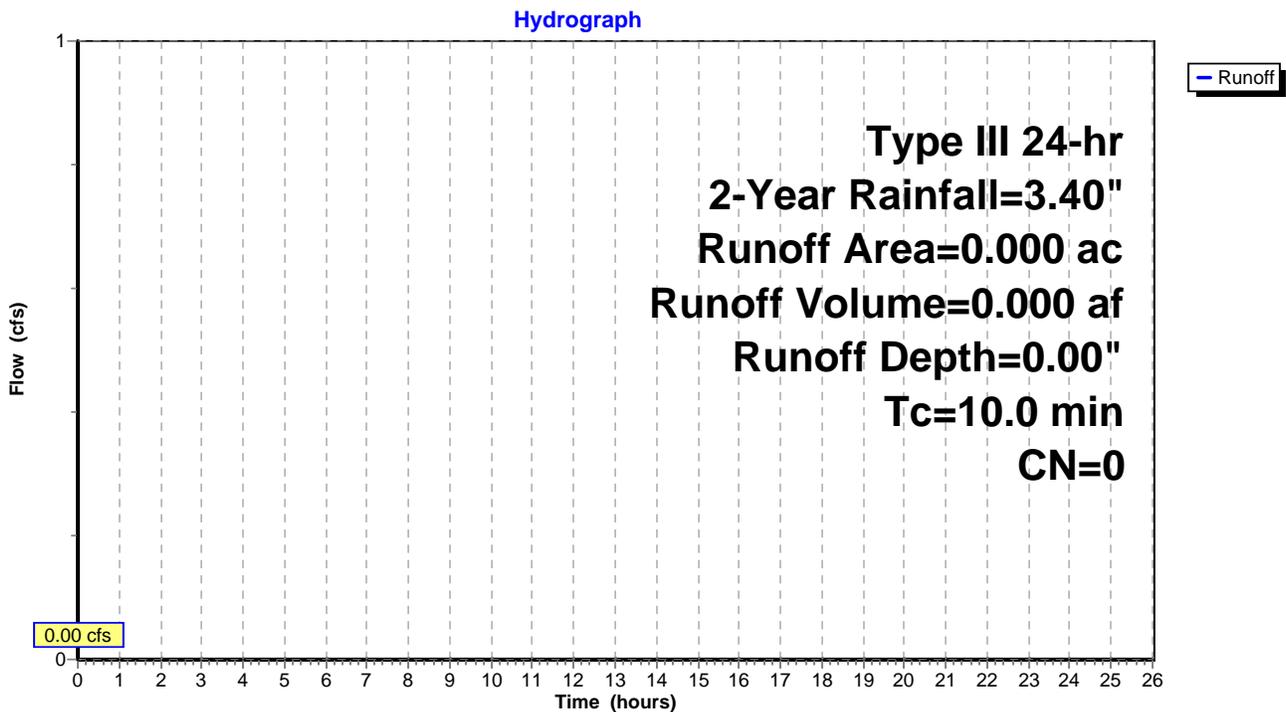
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs  
Type III 24-hr 2-Year Rainfall=3.40"

Area (ac)	CN	Description
0.000	39	>75% Grass cover, Good, HSG A

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry, MIN Tc

## Subcatchment PR-2A: UNDETAINED TO MAIN STREET (OPEN SPACE)





# SWM Analysis

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Type III 24-hr 2-Year Rainfall=3.40"

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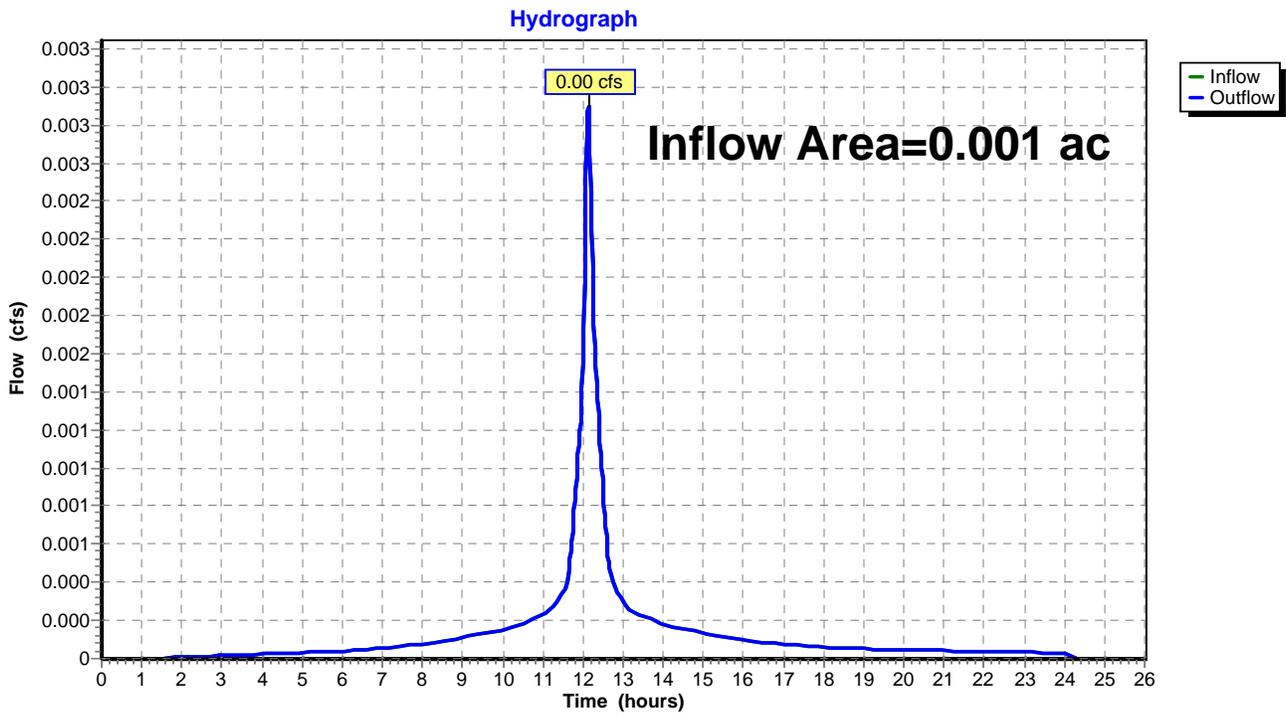
Page 5

## Summary for Reach PR-2: TO MAIN STREET

Inflow Area = 0.001 ac, 100.00% Impervious, Inflow Depth = 3.17" for 2-Year event  
Inflow = 0.00 cfs @ 12.13 hrs, Volume= 0.000 af  
Outflow = 0.00 cfs @ 12.13 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs

## Reach PR-2: TO MAIN STREET



# SWM Analysis

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Type III 24-hr 10-Year Rainfall=5.20"

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## Summary for Subcatchment PR-2A: UNDETAINED TO MAIN STREET (OPEN SPACE)

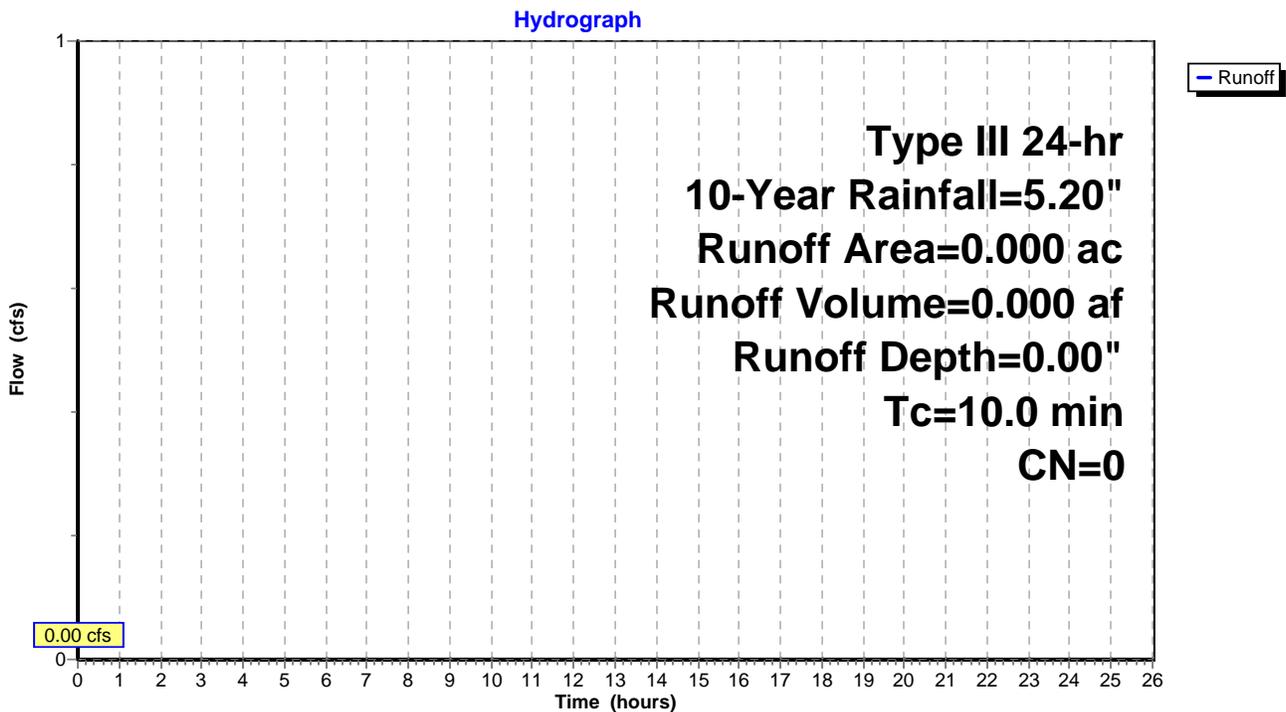
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs  
Type III 24-hr 10-Year Rainfall=5.20"

Area (ac)	CN	Description
0.000	39	>75% Grass cover, Good, HSG A

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry, MIN Tc

## Subcatchment PR-2A: UNDETAINED TO MAIN STREET (OPEN SPACE)



# SWM Analysis

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Type III 24-hr 10-Year Rainfall=5.20"

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## Summary for Subcatchment PR-2B: UNDETAINED TO MAIN STREET (IMPERVIOUS)

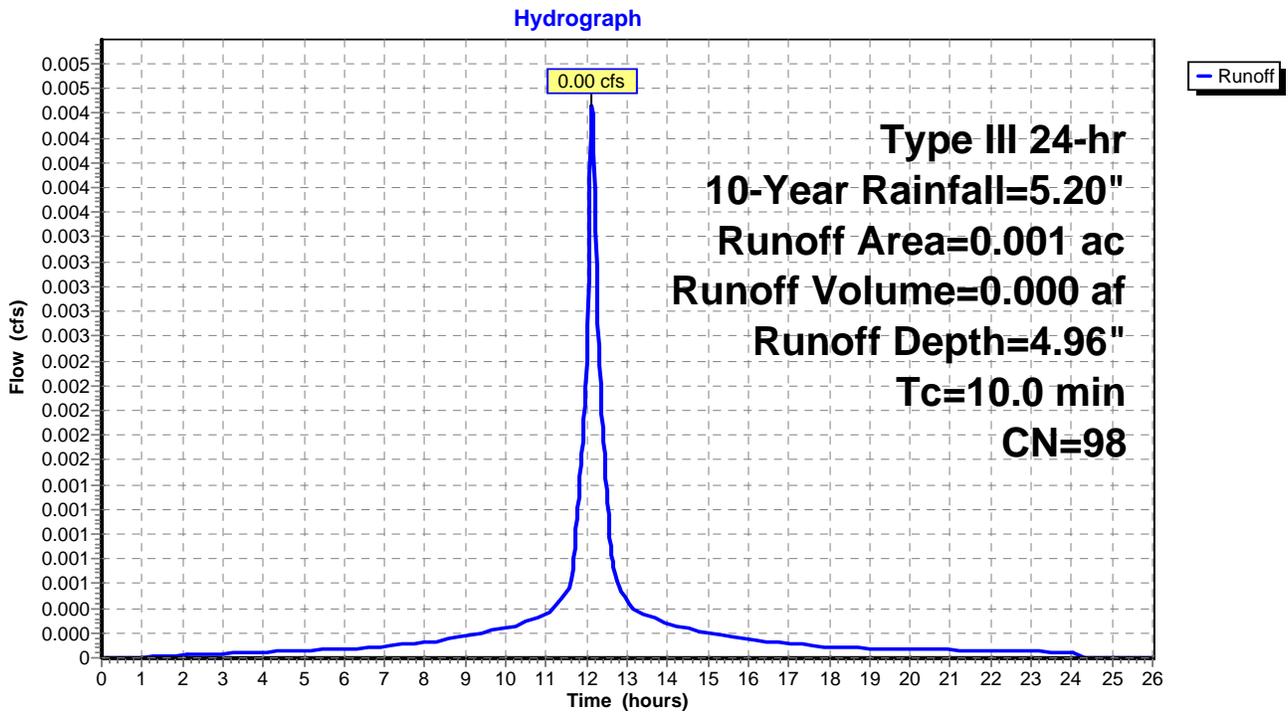
Runoff = 0.00 cfs @ 12.13 hrs, Volume= 0.000 af, Depth= 4.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs  
Type III 24-hr 10-Year Rainfall=5.20"

Area (ac)	CN	Description
* 0.001	98	Unconnected impervious, HSG A
0.001		100.00% Impervious Area
0.001		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry, MIN Tc

## Subcatchment PR-2B: UNDETAINED TO MAIN STREET (IMPERVIOUS)



# SWM Analysis

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Type III 24-hr 10-Year Rainfall=5.20"

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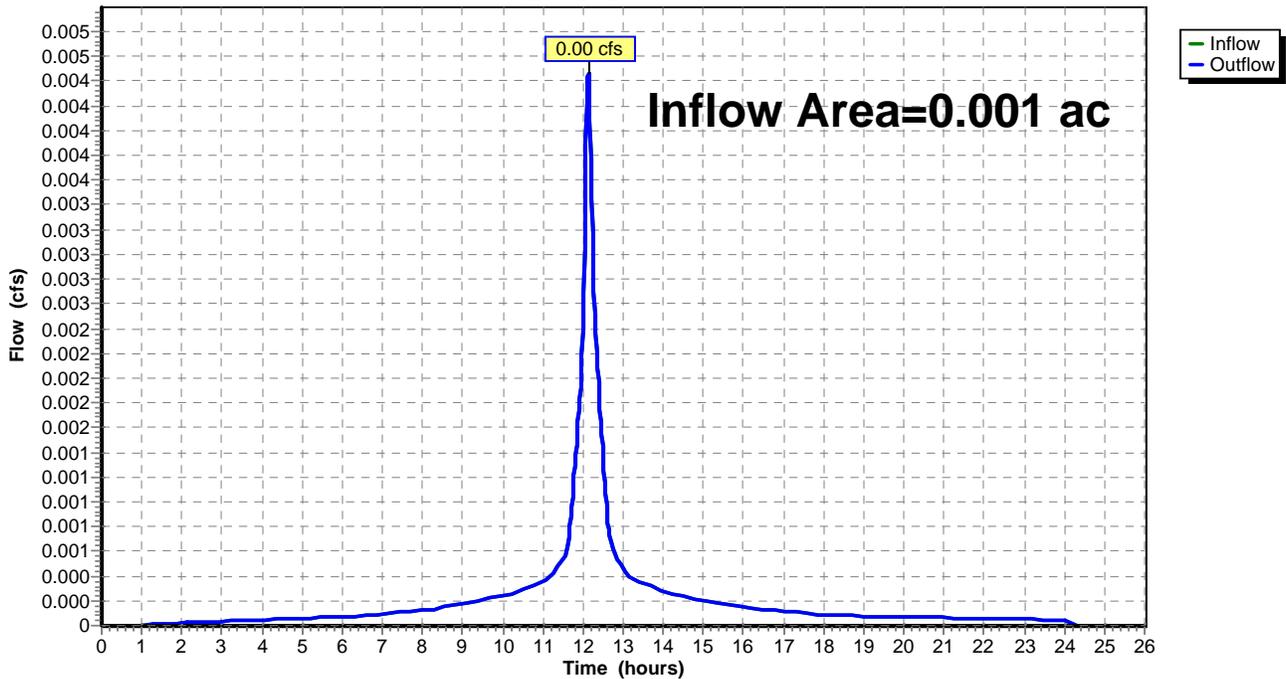
## Summary for Reach PR-2: TO MAIN STREET

Inflow Area = 0.001 ac, 100.00% Impervious, Inflow Depth = 4.96" for 10-Year event  
Inflow = 0.00 cfs @ 12.13 hrs, Volume= 0.000 af  
Outflow = 0.00 cfs @ 12.13 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs

## Reach PR-2: TO MAIN STREET

Hydrograph



# SWM Analysis

Prepared by InSite Engineering, LLC

HydroCAD® 10.00-24 s/n 03018 © 2018 HydroCAD Software Solutions LLC

Type III 24-hr 100-Year Rainfall=8.90"

Printed 3/12/2020

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## Summary for Subcatchment PR-2A: UNDETAINED TO MAIN STREET (OPEN SPACE)

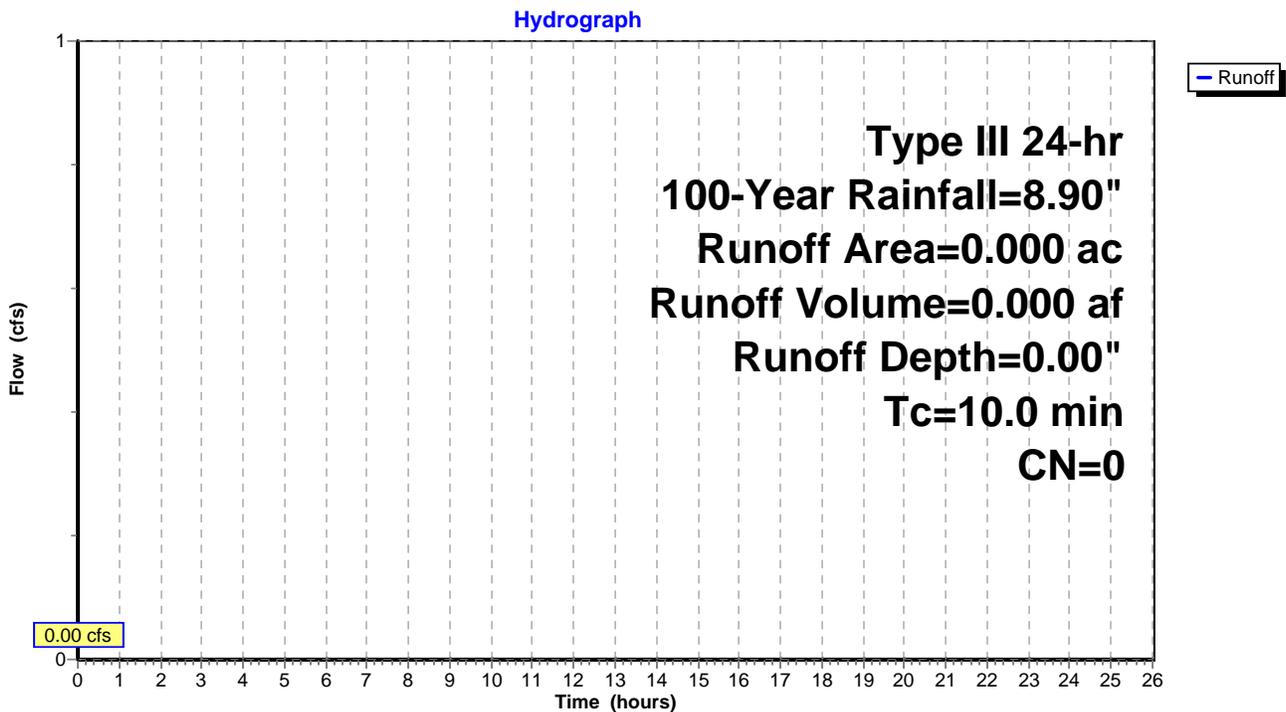
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs  
Type III 24-hr 100-Year Rainfall=8.90"

Area (ac)	CN	Description
0.000	39	>75% Grass cover, Good, HSG A

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry, MIN Tc

## Subcatchment PR-2A: UNDETAINED TO MAIN STREET (OPEN SPACE)



# SWM Analysis

Prepared by InSite Engineering, LLC

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Type III 24-hr 100-Year Rainfall=8.90"

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## Summary for Subcatchment PR-2B: UNDETAINED TO MAIN STREET (IMPERVIOUS)

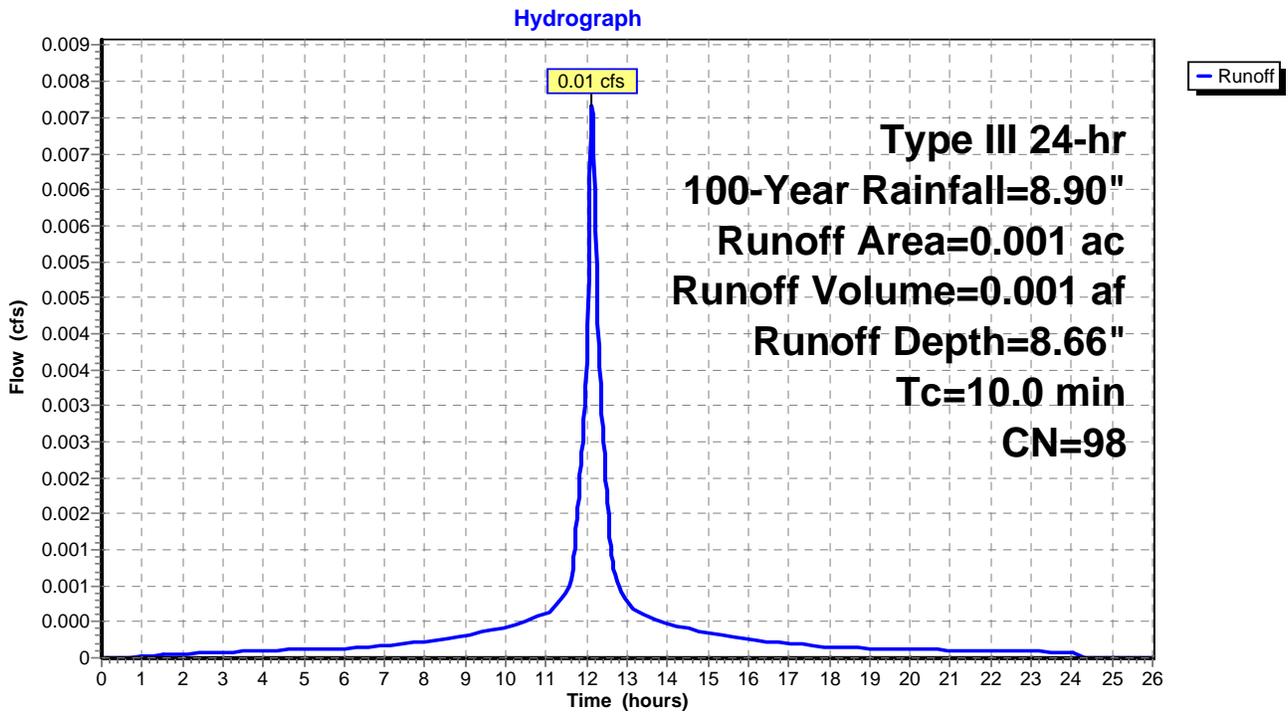
Runoff = 0.01 cfs @ 12.13 hrs, Volume= 0.001 af, Depth= 8.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs  
Type III 24-hr 100-Year Rainfall=8.90"

Area (ac)	CN	Description
* 0.001	98	Unconnected impervious, HSG A
0.001		100.00% Impervious Area
0.001		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry, MIN Tc

## Subcatchment PR-2B: UNDETAINED TO MAIN STREET (IMPERVIOUS)



# SWM Analysis

Prepared by InSite Engineering, LLC

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Type III 24-hr 100-Year Rainfall=8.90"

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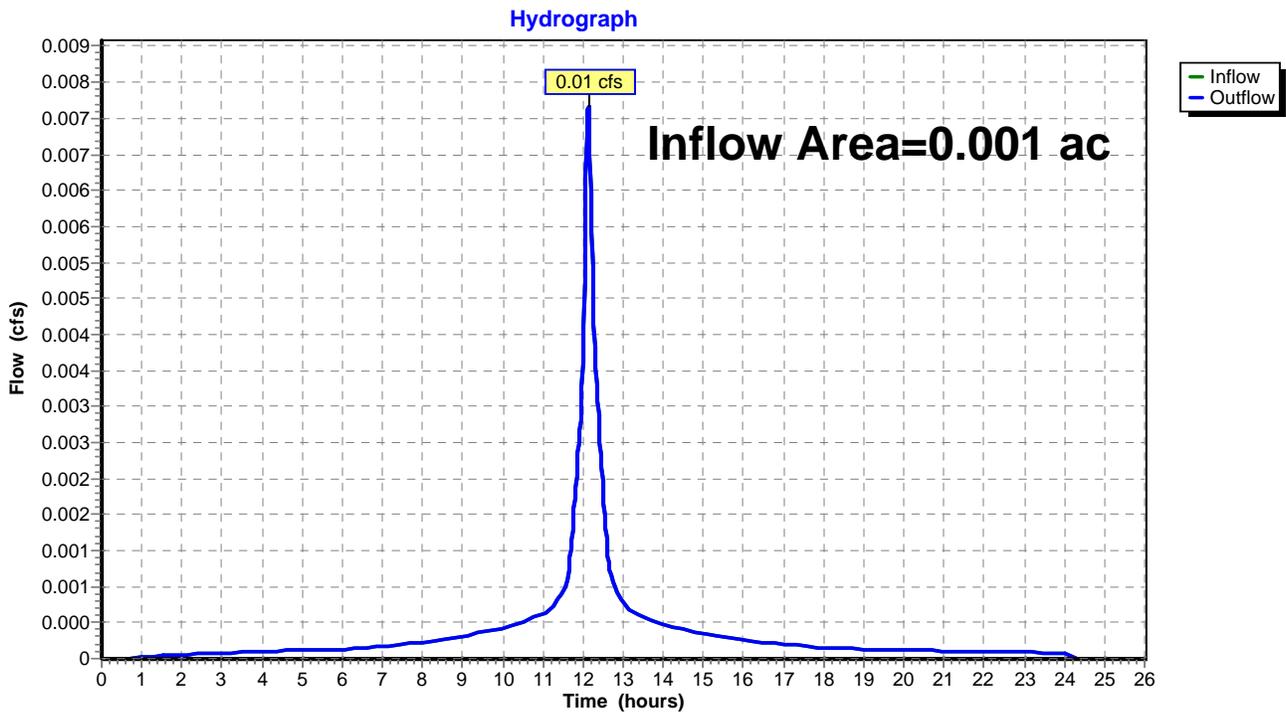
Page 11

## Summary for Reach PR-2: TO MAIN STREET

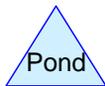
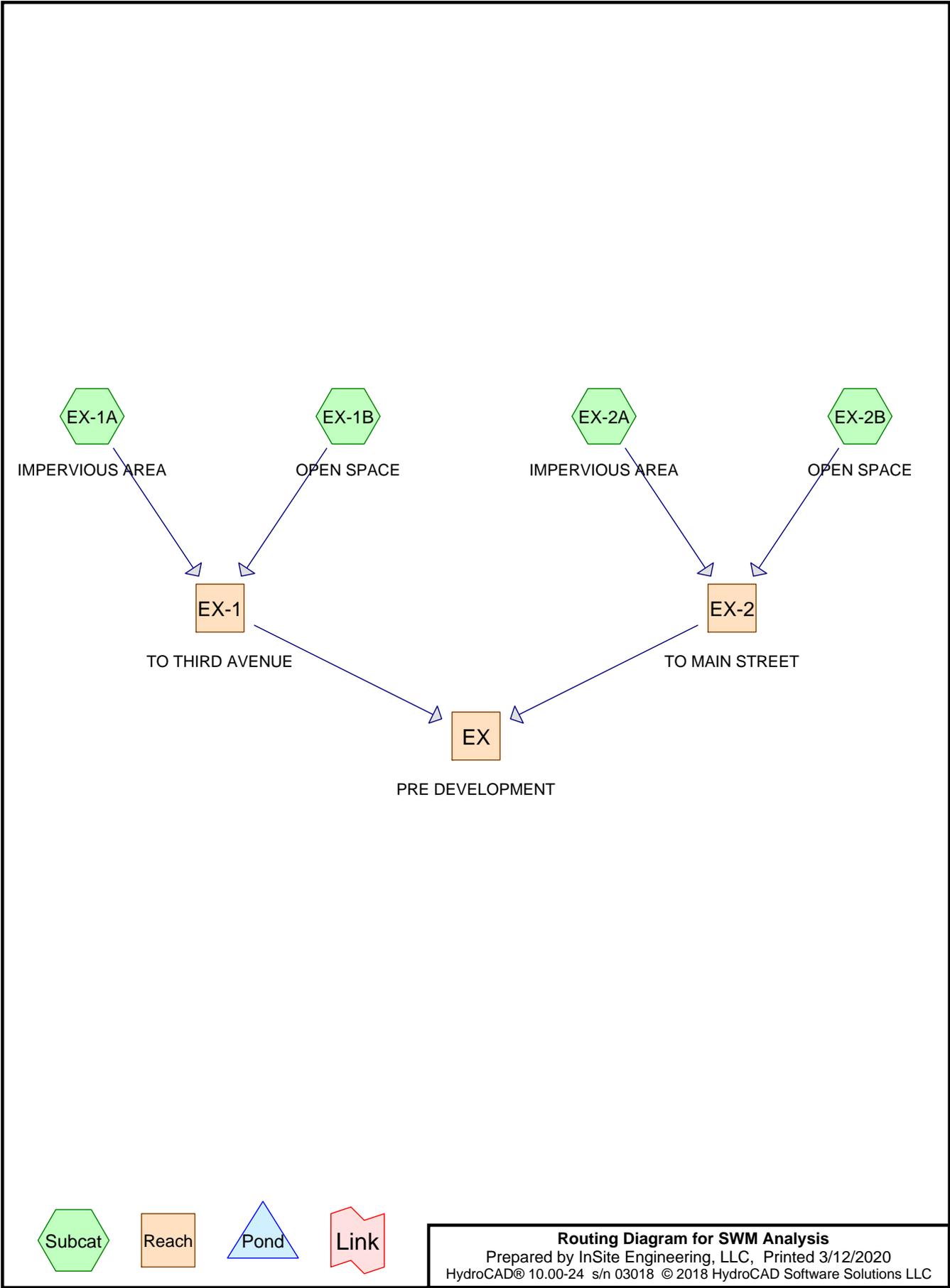
Inflow Area = 0.001 ac, 100.00% Impervious, Inflow Depth = 8.66" for 100-Year event  
Inflow = 0.01 cfs @ 12.13 hrs, Volume= 0.001 af  
Outflow = 0.01 cfs @ 12.13 hrs, Volume= 0.001 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs

## Reach PR-2: TO MAIN STREET



## **PRE-DEVELOPMENT HYDROGRAPHS (OVERALL SITE)**



## SWM Analysis

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### Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.121	39	>75% Grass cover, Good, HSG A (EX-1B, EX-2B)
0.483	98	Unconnected impervious, HSG A (EX-1A, EX-2A)
<b>0.604</b>	<b>86</b>	<b>TOTAL AREA</b>

# SWM Analysis

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Type III 24-hr 2-Year Rainfall=3.40"

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## Summary for Subcatchment EX-1A: IMPERVIOUS AREA

Runoff = 0.87 cfs @ 12.13 hrs, Volume= 0.079 af, Depth= 3.17"

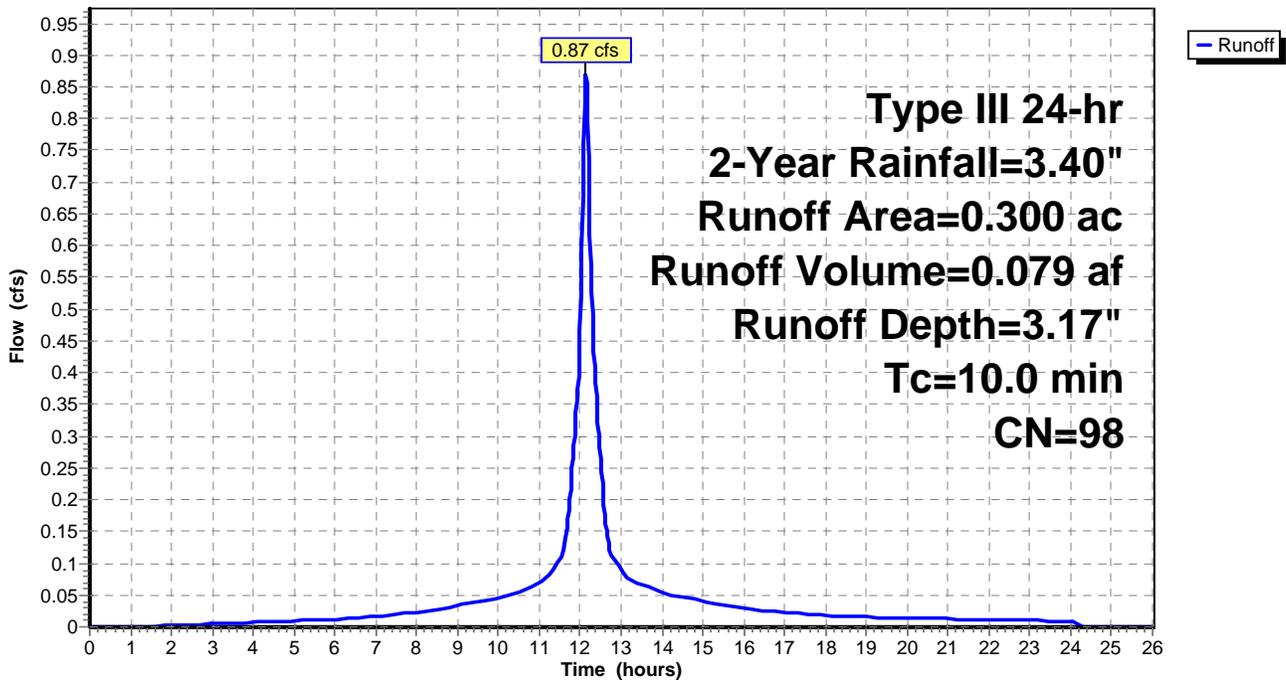
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs  
Type III 24-hr 2-Year Rainfall=3.40"

Area (ac)	CN	Description
* 0.300	98	Unconnected impervious, HSG A
0.300		100.00% Impervious Area
0.300		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry, MIN Tc

## Subcatchment EX-1A: IMPERVIOUS AREA

Hydrograph





# SWM Analysis

Prepared by InSite Engineering, LLC

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Type III 24-hr 2-Year Rainfall=3.40"

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## Summary for Subcatchment EX-2A: IMPERVIOUS AREA

Runoff = 0.53 cfs @ 12.13 hrs, Volume= 0.048 af, Depth= 3.17"

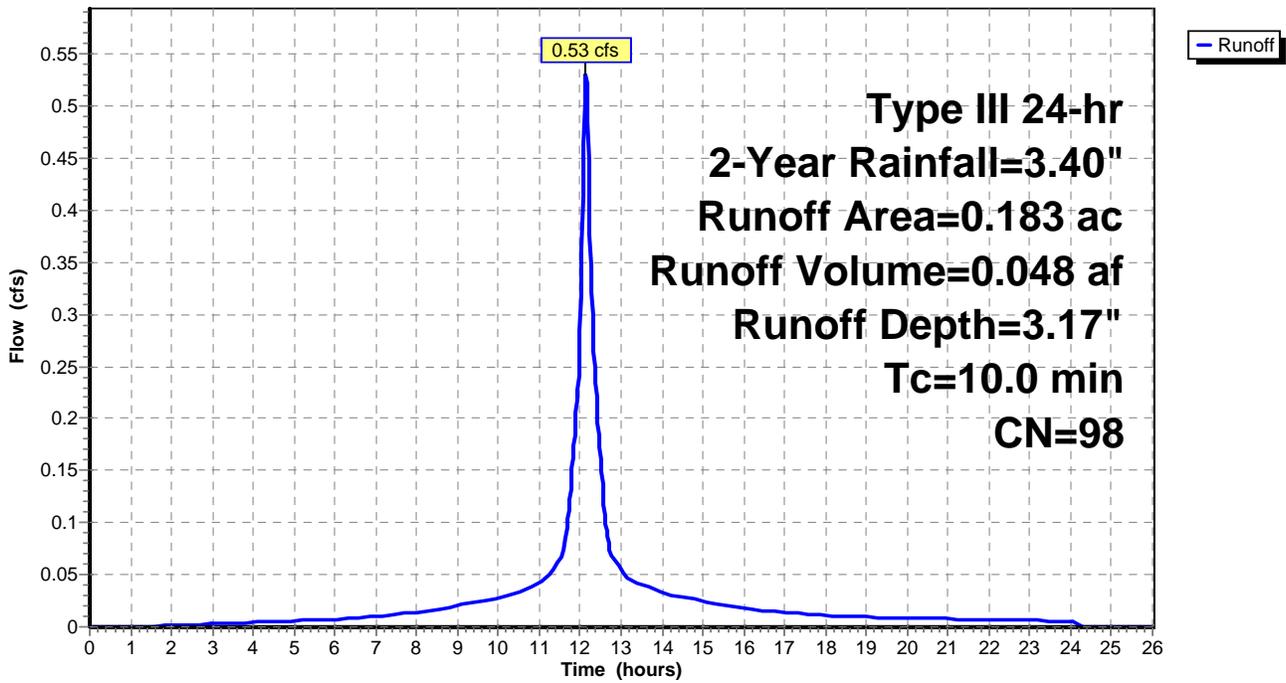
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs  
Type III 24-hr 2-Year Rainfall=3.40"

Area (ac)	CN	Description
* 0.183	98	Unconnected impervious, HSG A
0.183		100.00% Impervious Area
0.183		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry, MIN Tc

## Subcatchment EX-2A: IMPERVIOUS AREA

Hydrograph



# SWM Analysis

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Type III 24-hr 2-Year Rainfall=3.40"

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## Summary for Subcatchment EX-2B: OPEN SPACE

Runoff = 0.00 cfs @ 23.50 hrs, Volume= 0.000 af, Depth= 0.00"

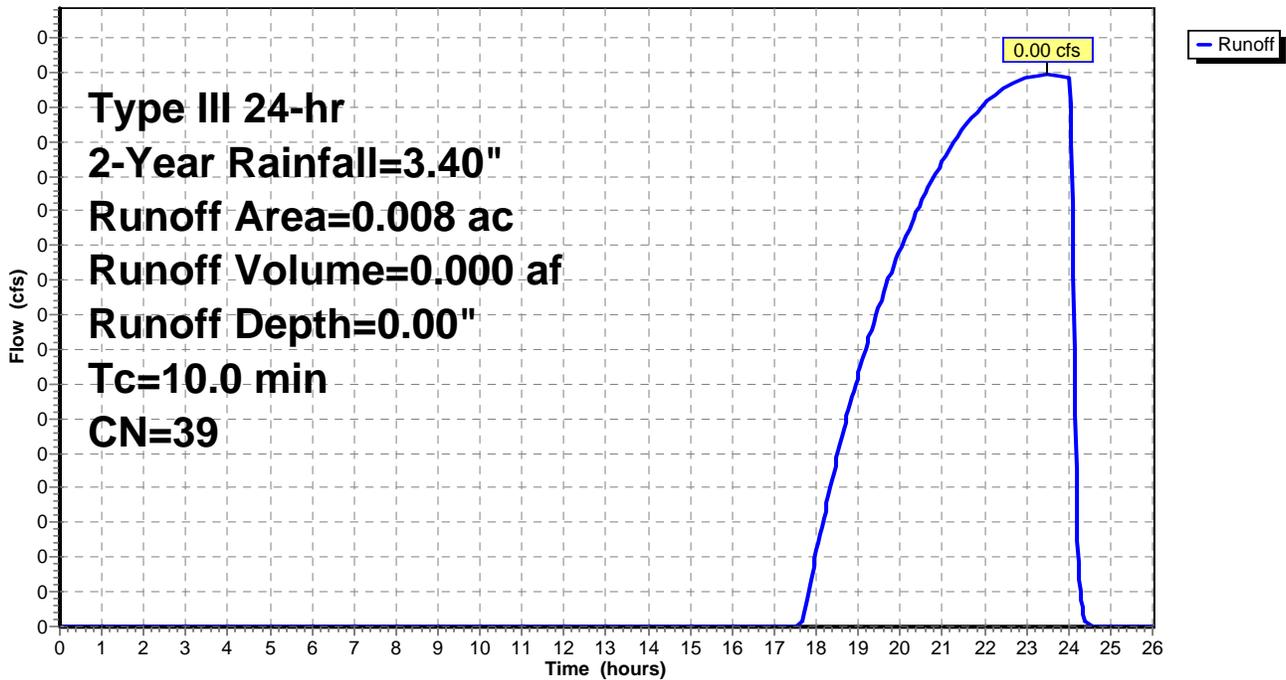
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs  
Type III 24-hr 2-Year Rainfall=3.40"

Area (ac)	CN	Description
0.008	39	>75% Grass cover, Good, HSG A
0.008		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry, MIN Tc

## Subcatchment EX-2B: OPEN SPACE

Hydrograph



**SWM Analysis**

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Type III 24-hr 2-Year Rainfall=3.40"

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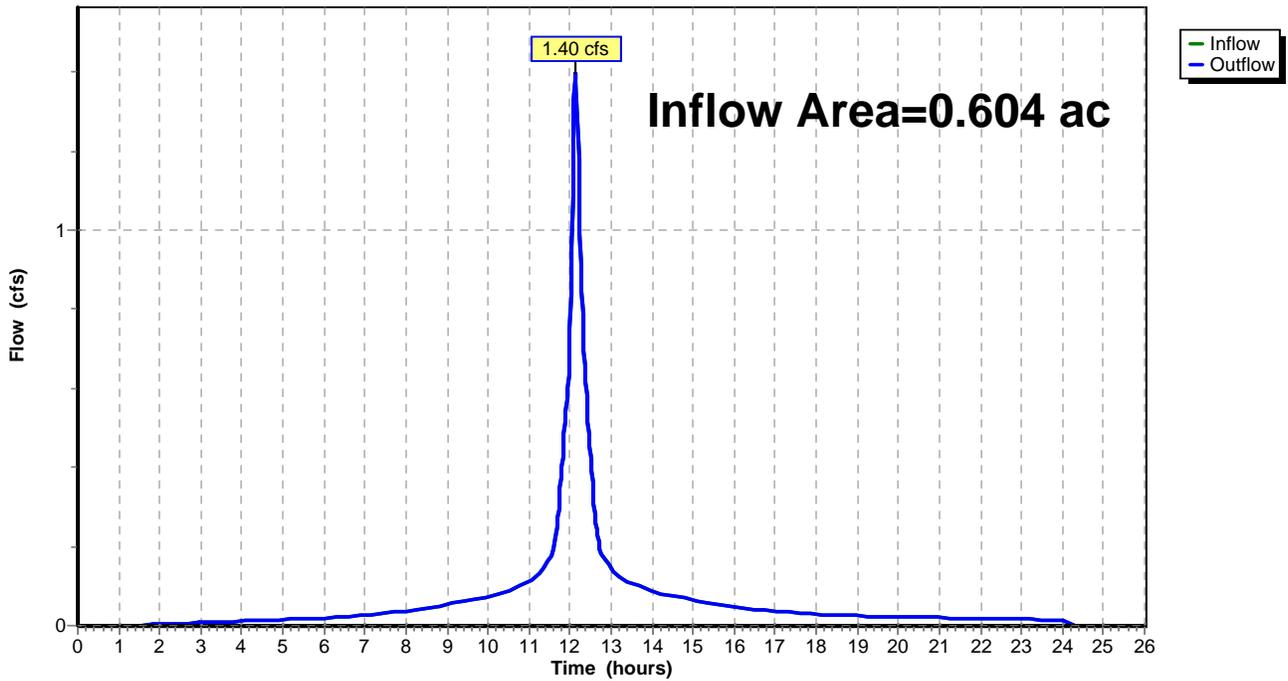
**Summary for Reach EX: PRE DEVELOPMENT**

Inflow Area = 0.604 ac, 79.97% Impervious, Inflow Depth = 2.53" for 2-Year event  
Inflow = 1.40 cfs @ 12.13 hrs, Volume= 0.128 af  
Outflow = 1.40 cfs @ 12.13 hrs, Volume= 0.128 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs

**Reach EX: PRE DEVELOPMENT**

Hydrograph



# SWM Analysis

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Type III 24-hr 2-Year Rainfall=3.40"

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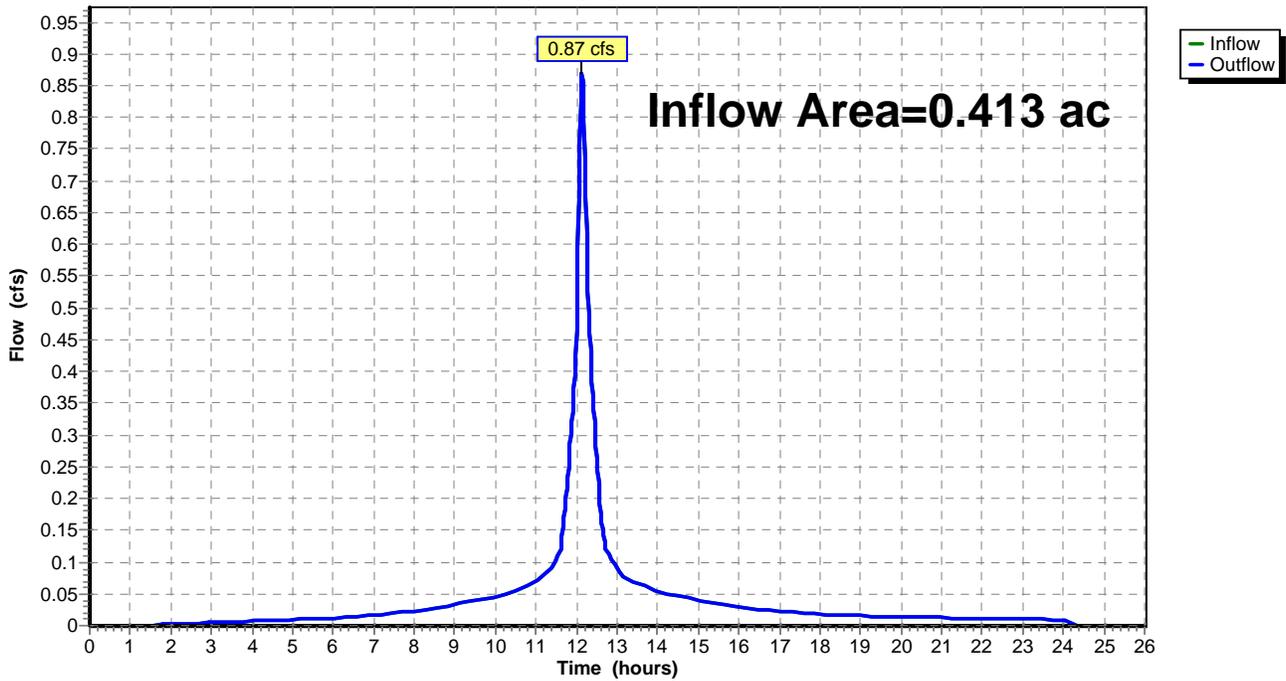
## Summary for Reach EX-1: TO THIRD AVENUE

Inflow Area = 0.413 ac, 72.64% Impervious, Inflow Depth = 2.30" for 2-Year event  
Inflow = 0.87 cfs @ 12.13 hrs, Volume= 0.079 af  
Outflow = 0.87 cfs @ 12.13 hrs, Volume= 0.079 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs

## Reach EX-1: TO THIRD AVENUE

Hydrograph



# SWM Analysis

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Type III 24-hr 2-Year Rainfall=3.40"

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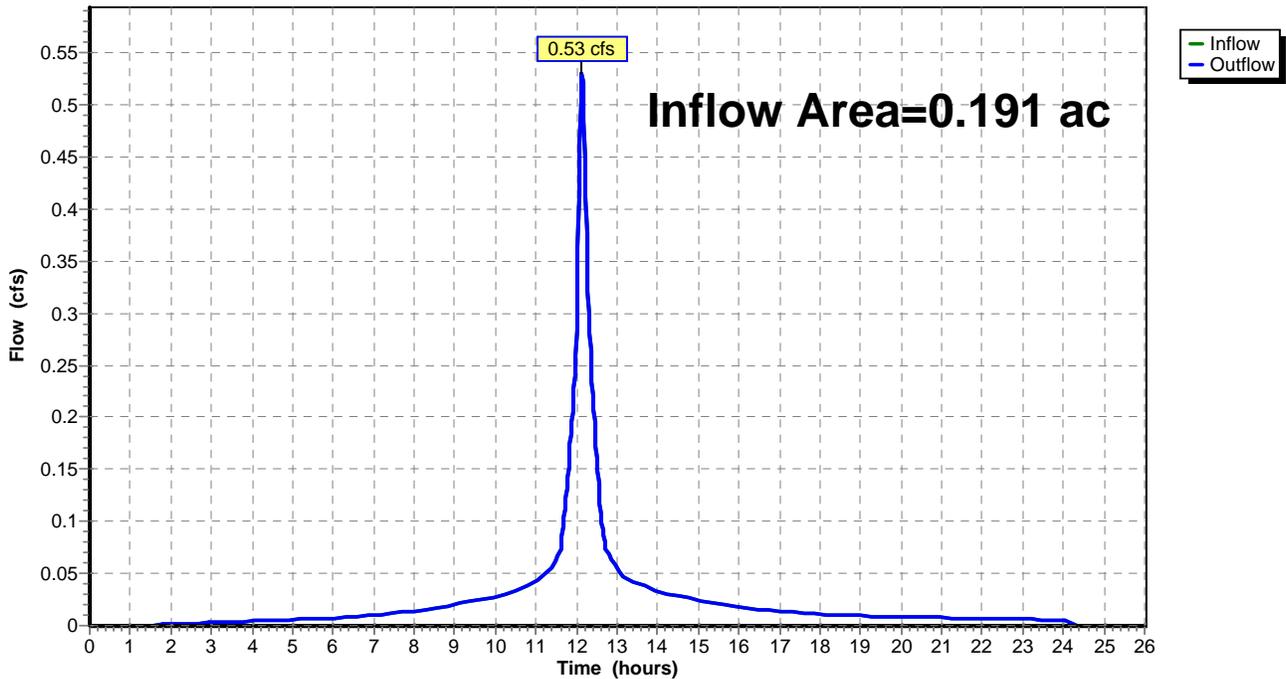
## Summary for Reach EX-2: TO MAIN STREET

Inflow Area = 0.191 ac, 95.81% Impervious, Inflow Depth = 3.03" for 2-Year event  
Inflow = 0.53 cfs @ 12.13 hrs, Volume= 0.048 af  
Outflow = 0.53 cfs @ 12.13 hrs, Volume= 0.048 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs

## Reach EX-2: TO MAIN STREET

Hydrograph



**SWM Analysis**

Prepared by InSite Engineering, LLC

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Type III 24-hr 10-Year Rainfall=5.20"

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**Summary for Subcatchment EX-1A: IMPERVIOUS AREA**

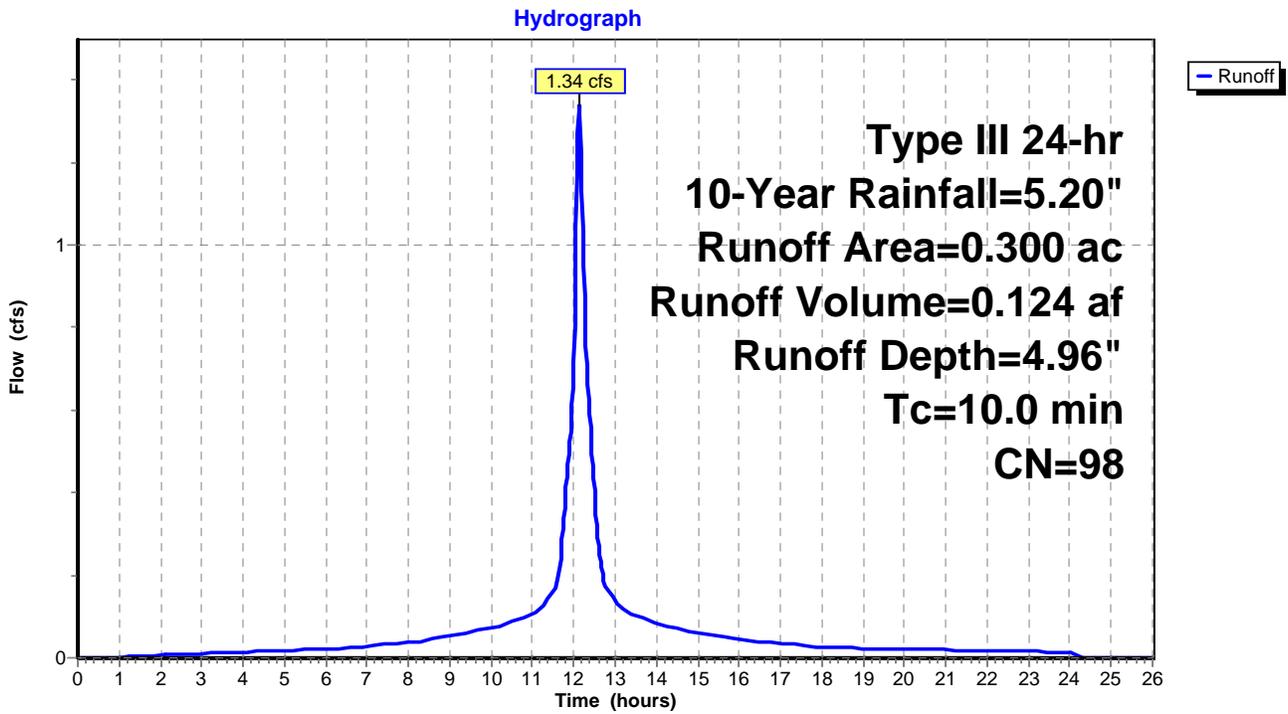
Runoff = 1.34 cfs @ 12.13 hrs, Volume= 0.124 af, Depth= 4.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs  
Type III 24-hr 10-Year Rainfall=5.20"

Area (ac)	CN	Description
* 0.300	98	Unconnected impervious, HSG A
0.300		100.00% Impervious Area
0.300		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry, MIN Tc

**Subcatchment EX-1A: IMPERVIOUS AREA**



# SWM Analysis

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Type III 24-hr 10-Year Rainfall=5.20"

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## Summary for Subcatchment EX-1B: OPEN SPACE

Runoff = 0.01 cfs @ 12.50 hrs, Volume= 0.002 af, Depth= 0.24"

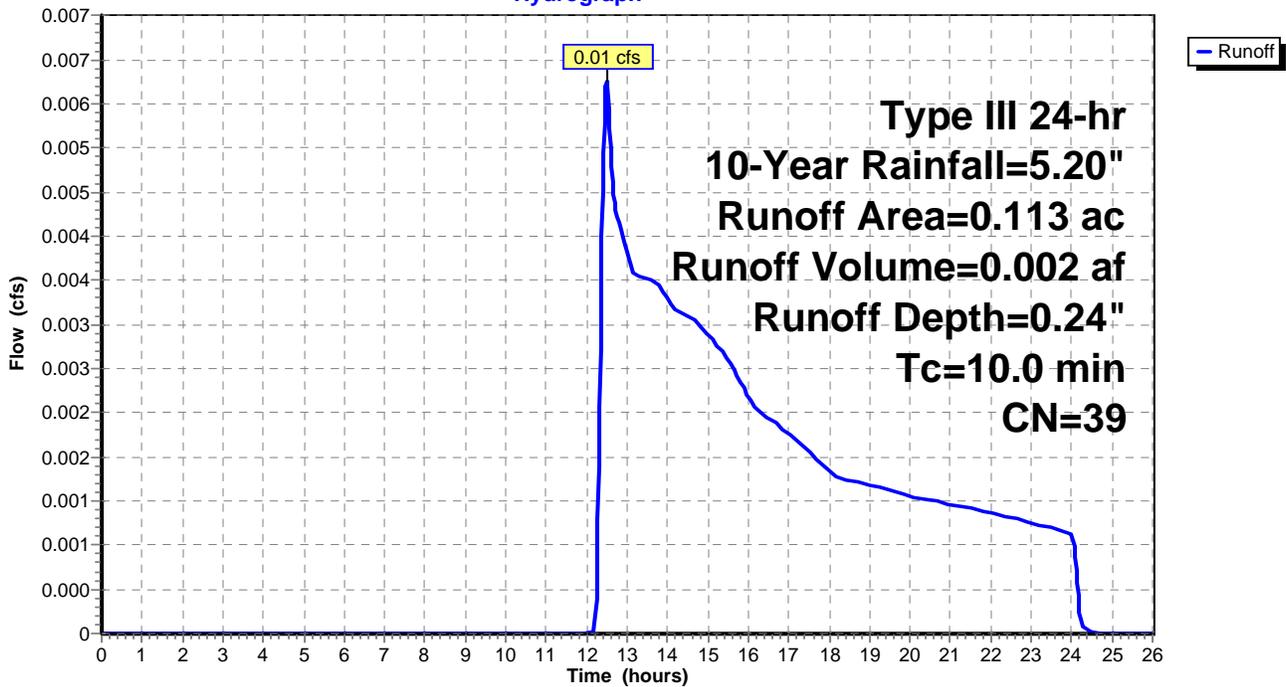
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs  
Type III 24-hr 10-Year Rainfall=5.20"

Area (ac)	CN	Description
0.113	39	>75% Grass cover, Good, HSG A
0.113		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry, MIN Tc

## Subcatchment EX-1B: OPEN SPACE

Hydrograph



# SWM Analysis

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Type III 24-hr 10-Year Rainfall=5.20"

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## Summary for Subcatchment EX-2A: IMPERVIOUS AREA

Runoff = 0.82 cfs @ 12.13 hrs, Volume= 0.076 af, Depth= 4.96"

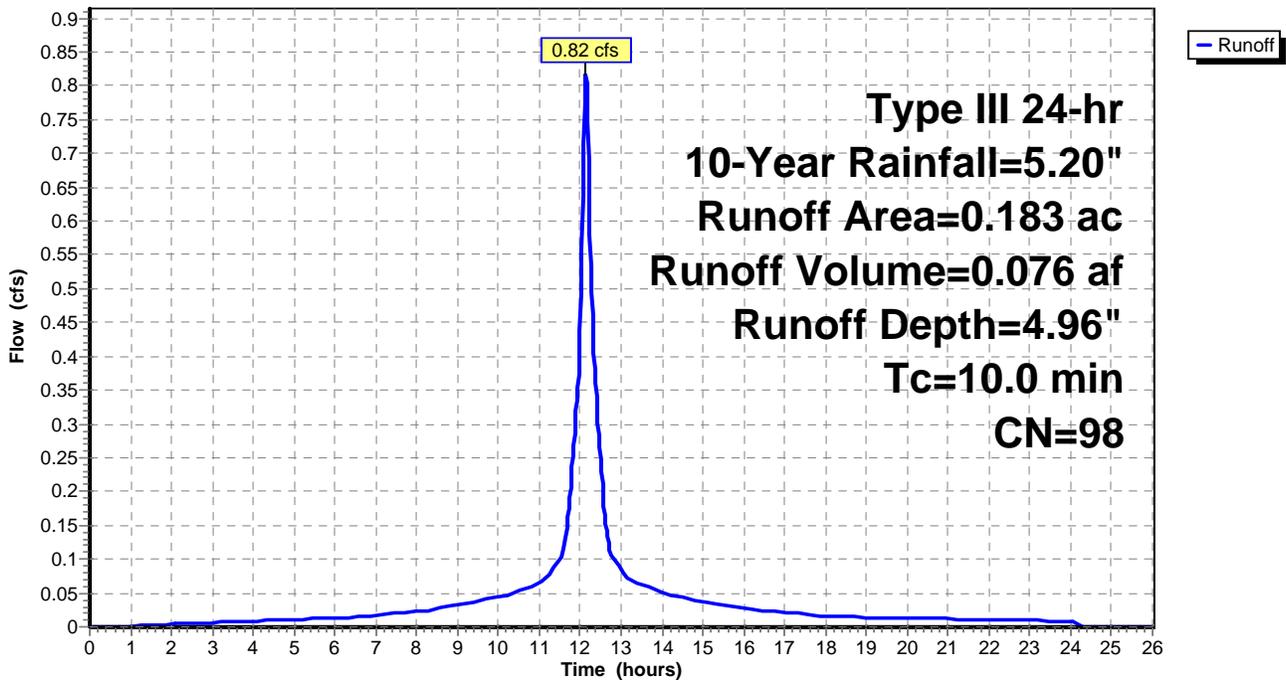
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs  
Type III 24-hr 10-Year Rainfall=5.20"

Area (ac)	CN	Description
* 0.183	98	Unconnected impervious, HSG A
0.183		100.00% Impervious Area
0.183		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry, MIN Tc

## Subcatchment EX-2A: IMPERVIOUS AREA

Hydrograph





# SWM Analysis

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Type III 24-hr 10-Year Rainfall=5.20"

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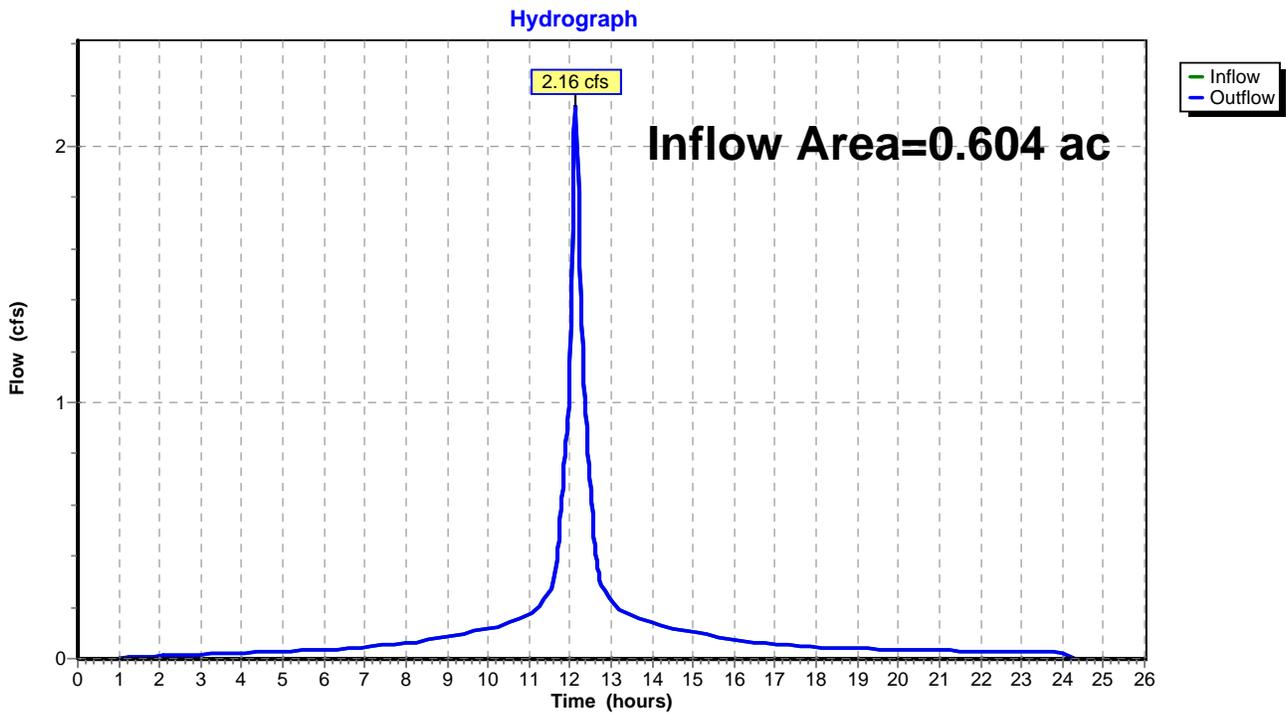
Page 14

## Summary for Reach EX: PRE DEVELOPMENT

Inflow Area = 0.604 ac, 79.97% Impervious, Inflow Depth = 4.02" for 10-Year event  
Inflow = 2.16 cfs @ 12.13 hrs, Volume= 0.202 af  
Outflow = 2.16 cfs @ 12.13 hrs, Volume= 0.202 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs

## Reach EX: PRE DEVELOPMENT



# SWM Analysis

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Type III 24-hr 10-Year Rainfall=5.20"

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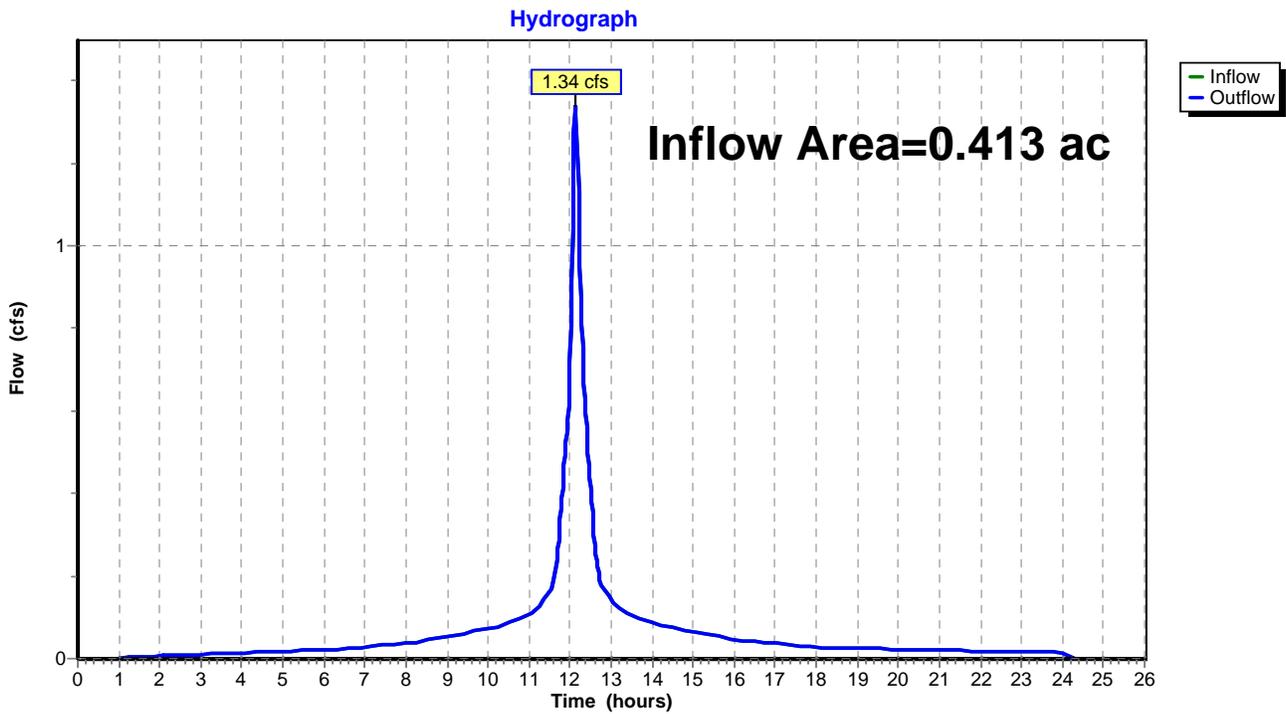
Page 15

## Summary for Reach EX-1: TO THIRD AVENUE

Inflow Area = 0.413 ac, 72.64% Impervious, Inflow Depth = 3.67" for 10-Year event  
Inflow = 1.34 cfs @ 12.13 hrs, Volume= 0.126 af  
Outflow = 1.34 cfs @ 12.13 hrs, Volume= 0.126 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs

## Reach EX-1: TO THIRD AVENUE



# SWM Analysis

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Type III 24-hr 10-Year Rainfall=5.20"

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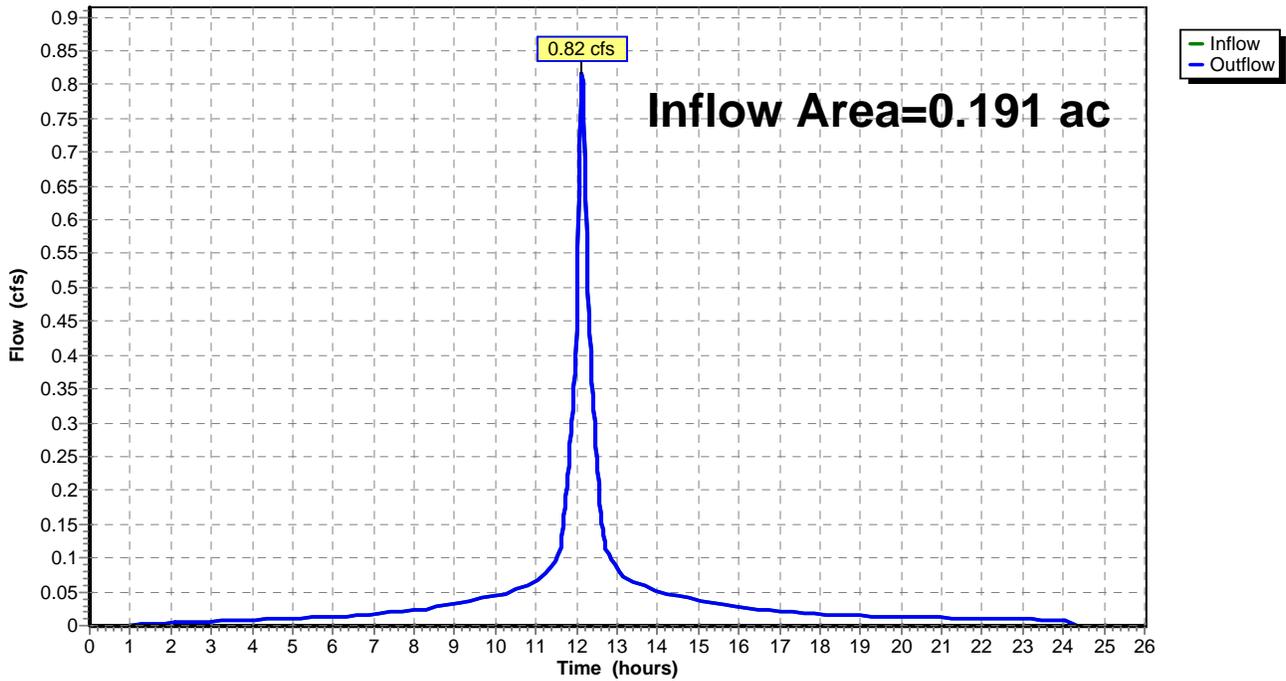
## Summary for Reach EX-2: TO MAIN STREET

Inflow Area = 0.191 ac, 95.81% Impervious, Inflow Depth = 4.77" for 10-Year event  
Inflow = 0.82 cfs @ 12.13 hrs, Volume= 0.076 af  
Outflow = 0.82 cfs @ 12.13 hrs, Volume= 0.076 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs

## Reach EX-2: TO MAIN STREET

Hydrograph



**SWM Analysis**

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Type III 24-hr 100-Year Rainfall=8.90"

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**Summary for Subcatchment EX-1A: IMPERVIOUS AREA**

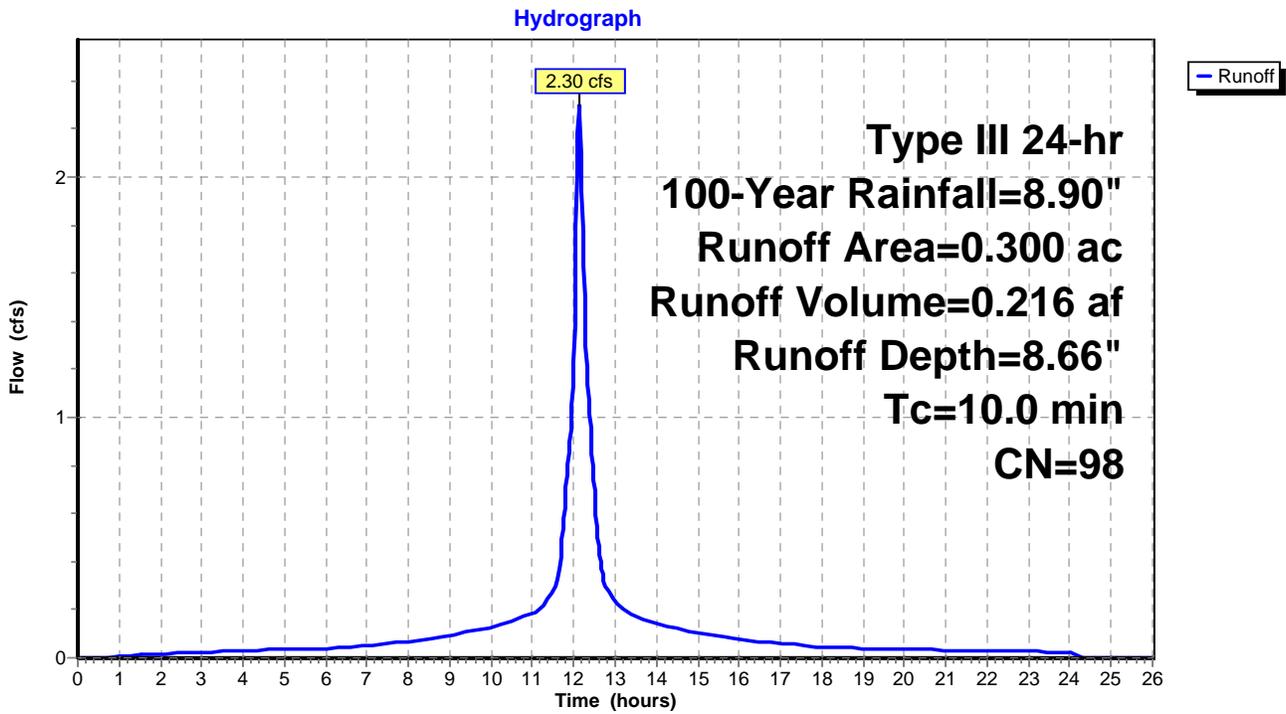
Runoff = 2.30 cfs @ 12.13 hrs, Volume= 0.216 af, Depth= 8.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs  
Type III 24-hr 100-Year Rainfall=8.90"

Area (ac)	CN	Description
* 0.300	98	Unconnected impervious, HSG A
0.300		100.00% Impervious Area
0.300		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry, MIN Tc

**Subcatchment EX-1A: IMPERVIOUS AREA**



# SWM Analysis

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Type III 24-hr 100-Year Rainfall=8.90"

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## Summary for Subcatchment EX-1B: OPEN SPACE

Runoff = 0.13 cfs @ 12.17 hrs, Volume= 0.015 af, Depth= 1.56"

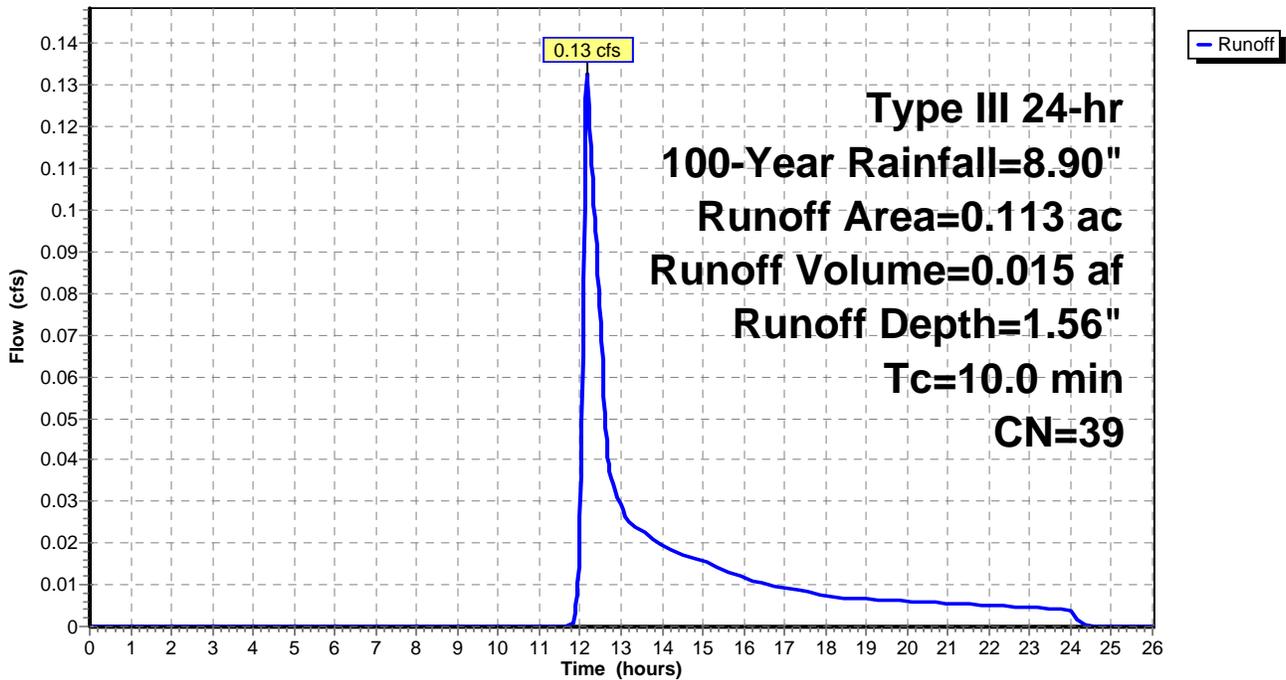
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs  
Type III 24-hr 100-Year Rainfall=8.90"

Area (ac)	CN	Description
0.113	39	>75% Grass cover, Good, HSG A
0.113		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry, MIN Tc

## Subcatchment EX-1B: OPEN SPACE

Hydrograph



# SWM Analysis

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Type III 24-hr 100-Year Rainfall=8.90"

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## Summary for Subcatchment EX-2A: IMPERVIOUS AREA

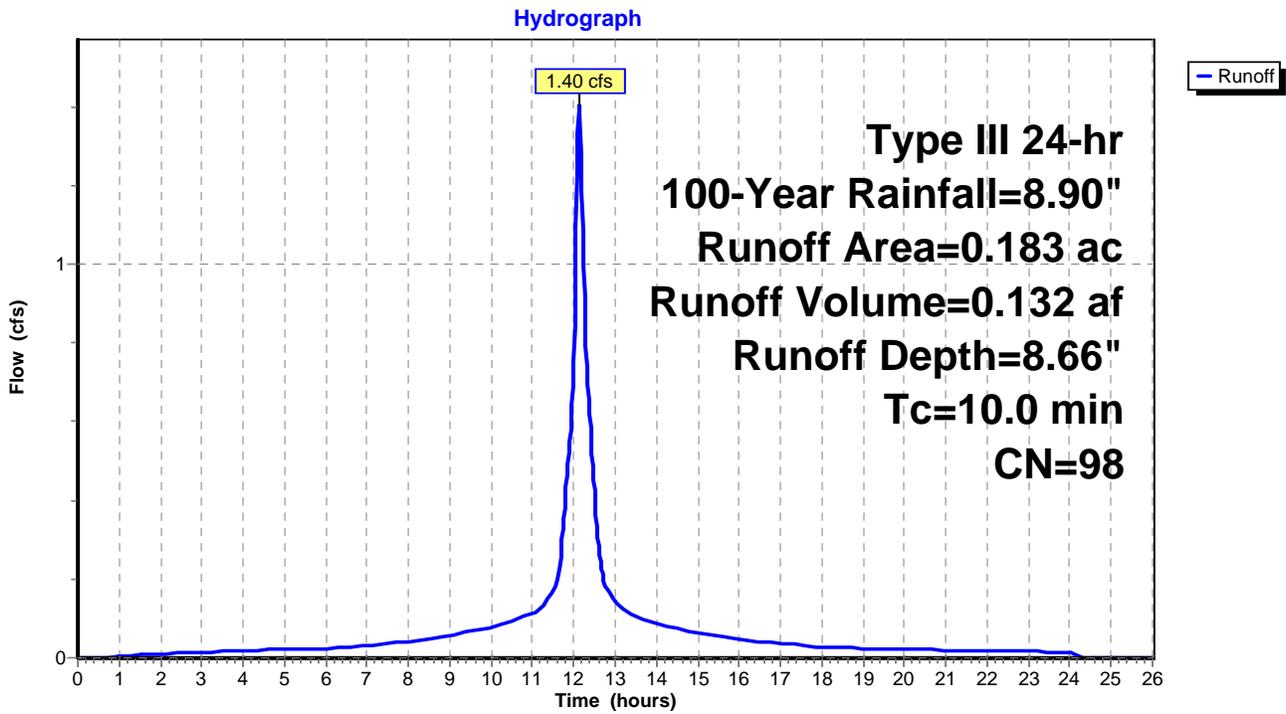
Runoff = 1.40 cfs @ 12.13 hrs, Volume= 0.132 af, Depth= 8.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs  
Type III 24-hr 100-Year Rainfall=8.90"

Area (ac)	CN	Description
* 0.183	98	Unconnected impervious, HSG A
0.183		100.00% Impervious Area
0.183		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry, MIN Tc

## Subcatchment EX-2A: IMPERVIOUS AREA



# SWM Analysis

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Type III 24-hr 100-Year Rainfall=8.90"

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## Summary for Subcatchment EX-2B: OPEN SPACE

Runoff = 0.01 cfs @ 12.17 hrs, Volume= 0.001 af, Depth= 1.56"

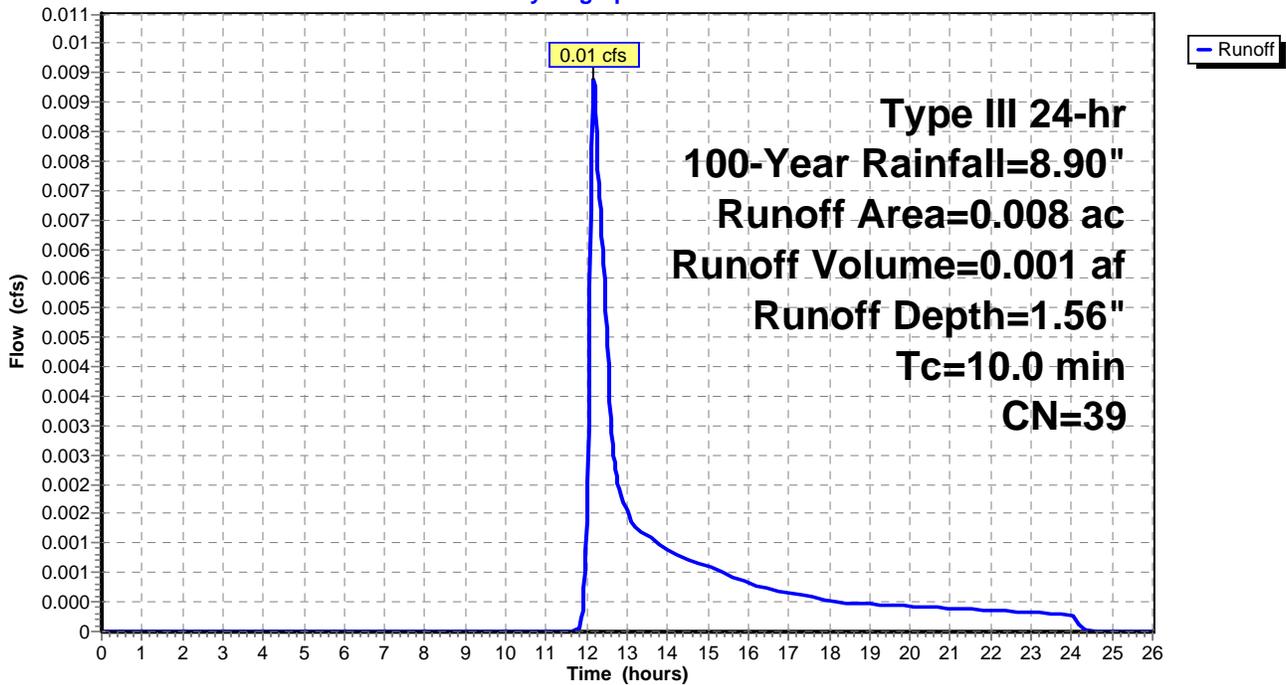
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs  
Type III 24-hr 100-Year Rainfall=8.90"

Area (ac)	CN	Description
0.008	39	>75% Grass cover, Good, HSG A
0.008		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry, MIN Tc

## Subcatchment EX-2B: OPEN SPACE

Hydrograph



# SWM Analysis

Prepared by InSite Engineering, LLC

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Type III 24-hr 100-Year Rainfall=8.90"

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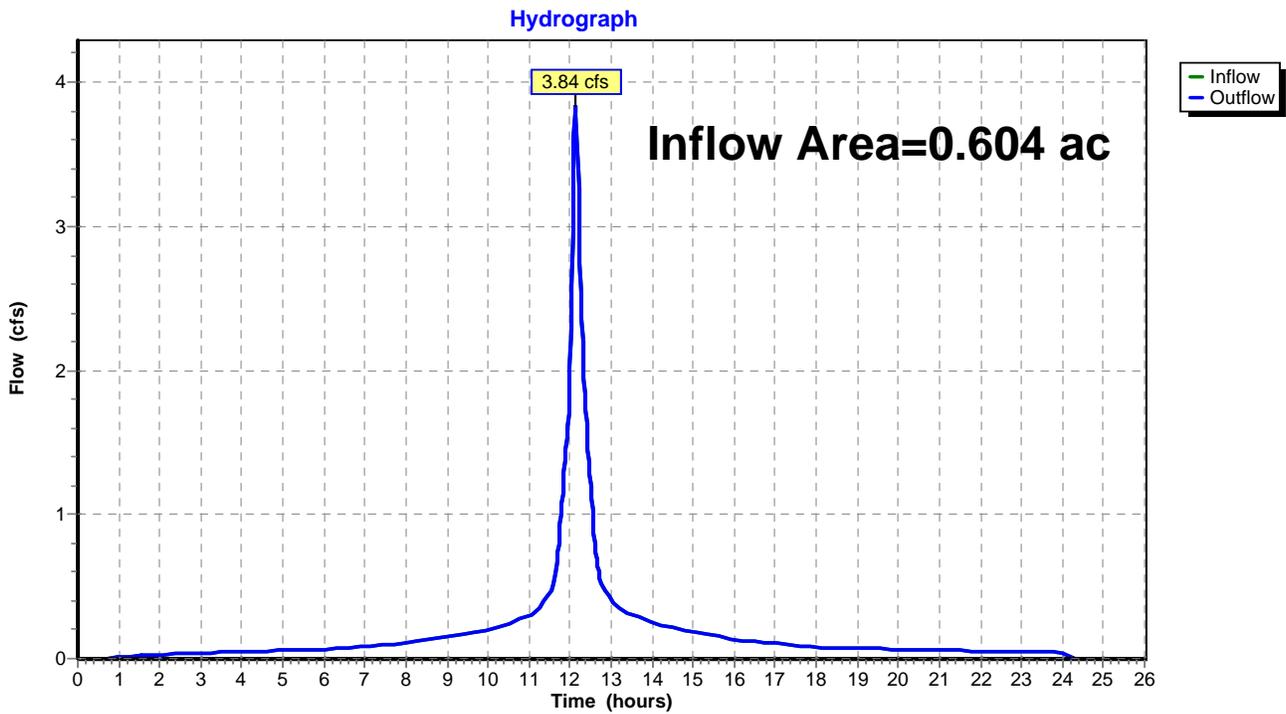
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## Summary for Reach EX: PRE DEVELOPMENT

Inflow Area = 0.604 ac, 79.97% Impervious, Inflow Depth = 7.24" for 100-Year event  
Inflow = 3.84 cfs @ 12.13 hrs, Volume= 0.364 af  
Outflow = 3.84 cfs @ 12.13 hrs, Volume= 0.364 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs

## Reach EX: PRE DEVELOPMENT



# SWM Analysis

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Type III 24-hr 100-Year Rainfall=8.90"

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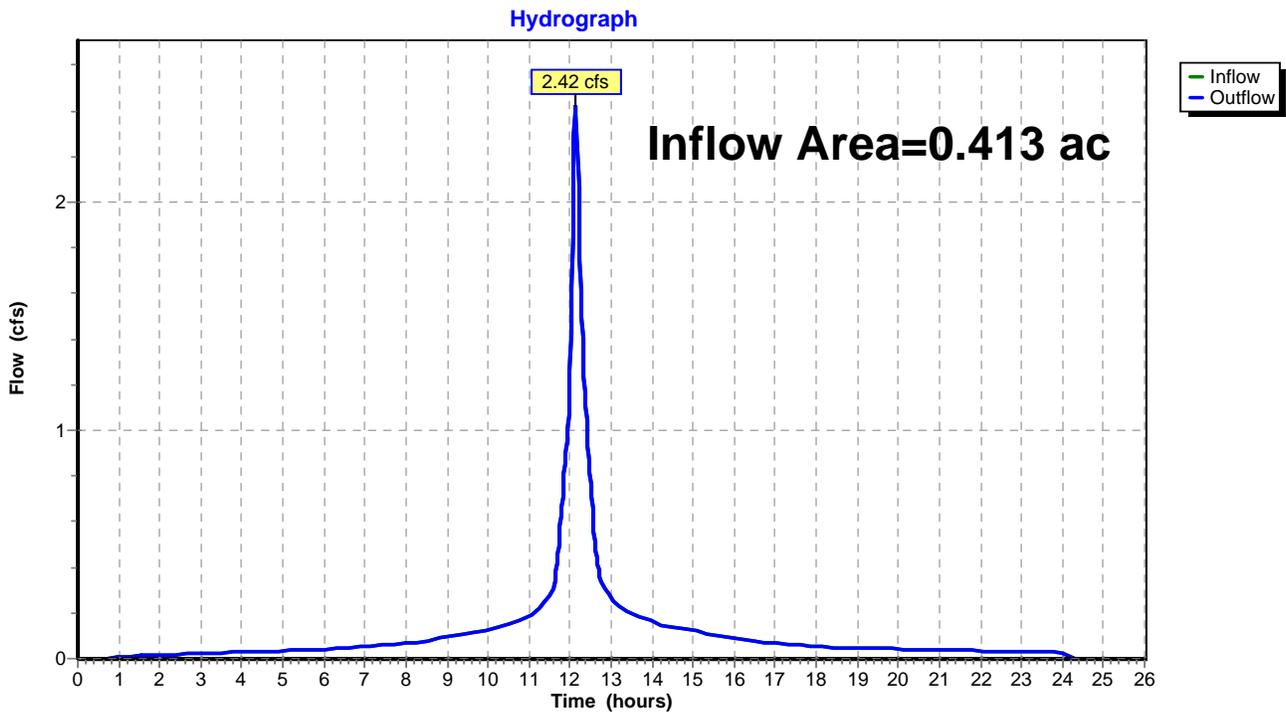
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## Summary for Reach EX-1: TO THIRD AVENUE

Inflow Area = 0.413 ac, 72.64% Impervious, Inflow Depth = 6.72" for 100-Year event  
Inflow = 2.42 cfs @ 12.14 hrs, Volume= 0.231 af  
Outflow = 2.42 cfs @ 12.14 hrs, Volume= 0.231 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs

## Reach EX-1: TO THIRD AVENUE



# SWM Analysis

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Type III 24-hr 100-Year Rainfall=8.90"

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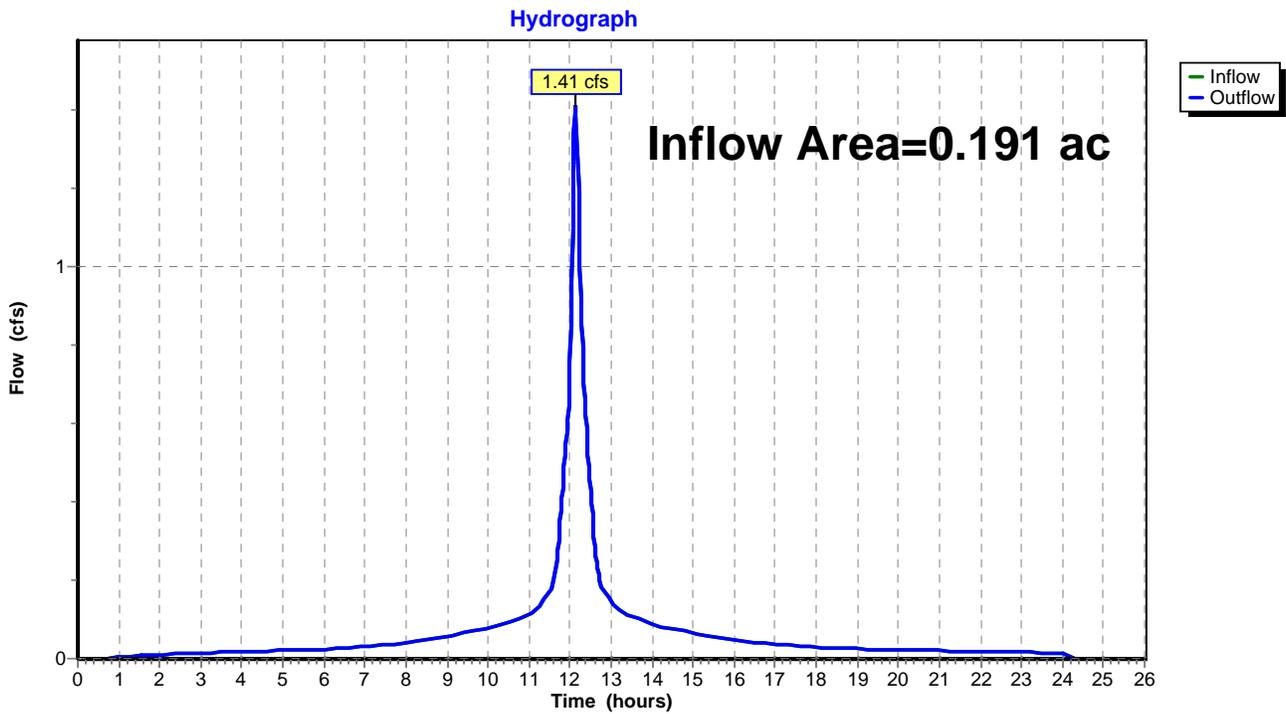
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## Summary for Reach EX-2: TO MAIN STREET

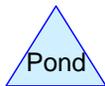
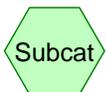
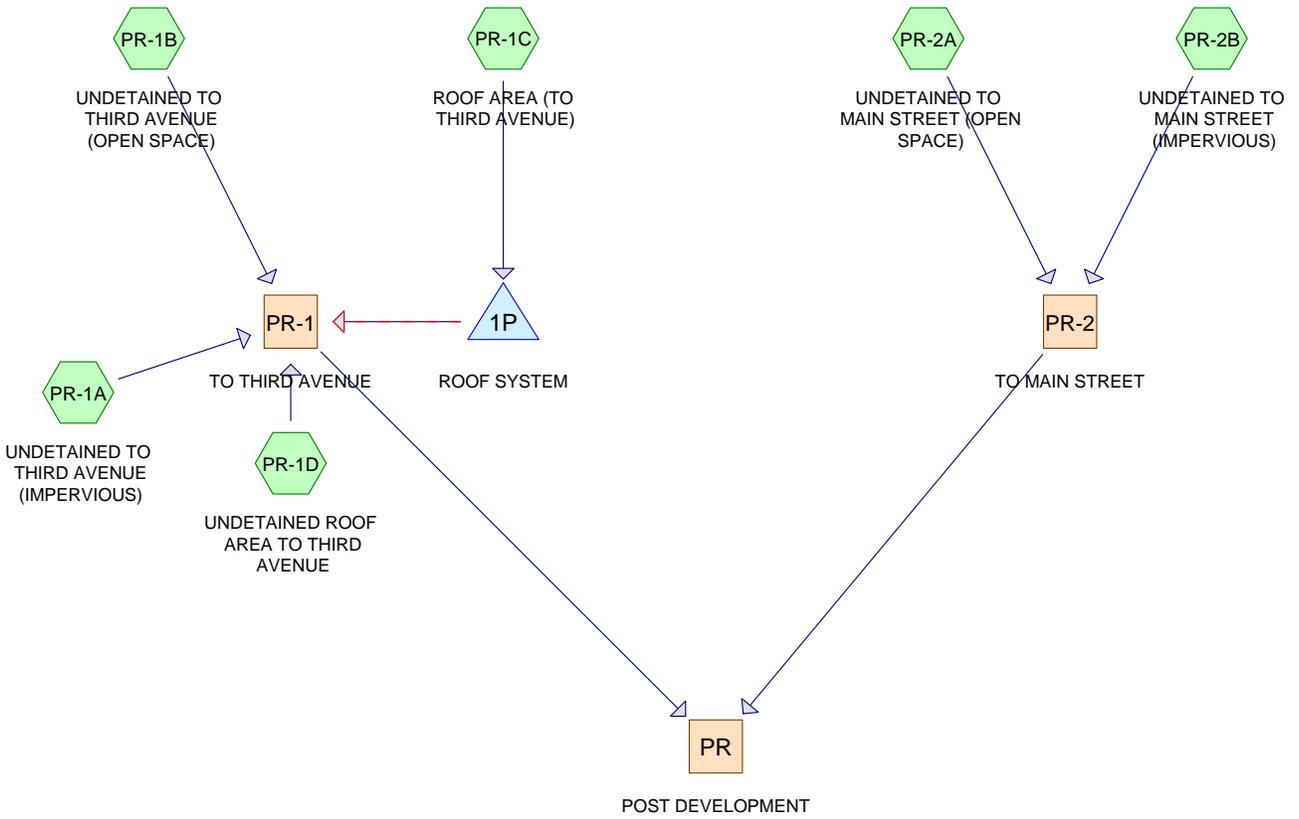
Inflow Area = 0.191 ac, 95.81% Impervious, Inflow Depth = 8.36" for 100-Year event  
Inflow = 1.41 cfs @ 12.13 hrs, Volume= 0.133 af  
Outflow = 1.41 cfs @ 12.13 hrs, Volume= 0.133 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs

## Reach EX-2: TO MAIN STREET



## **POST DEVELOPMENT HYDROGRAPHS (OVERALL SITE)**



## SWM Analysis

Prepared by InSite Engineering, LLC  
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Page 2

### Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.041	39	>75% Grass cover, Good, HSG A (PR-1B)
0.377	98	Roofs, HSG A (PR-1C)
0.177	98	Unconnected impervious, HSG A (PR-1A, PR-2B)
0.009	98	Unconnected roofs, HSG A (PR-1D)
<b>0.604</b>	<b>94</b>	<b>TOTAL AREA</b>

# SWM Analysis

Prepared by InSite Engineering, LLC

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Type III 24-hr 2-Year Rainfall=3.40"

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## Summary for Subcatchment PR-1A: UNDETAINED TO THIRD AVENUE (IMPERVIOUS)

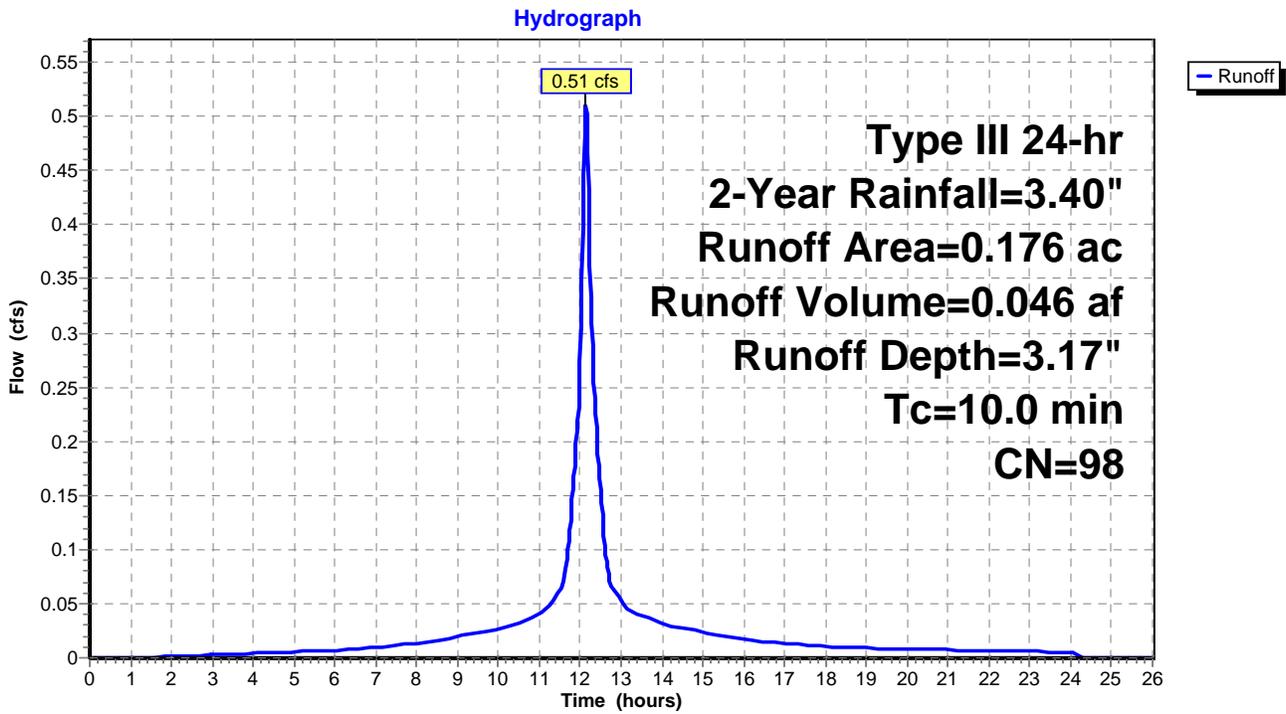
Runoff = 0.51 cfs @ 12.13 hrs, Volume= 0.046 af, Depth= 3.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs  
Type III 24-hr 2-Year Rainfall=3.40"

Area (ac)	CN	Description
* 0.176	98	Unconnected impervious, HSG A
0.176		100.00% Impervious Area
0.176		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry, MIN Tc

## Subcatchment PR-1A: UNDETAINED TO THIRD AVENUE (IMPERVIOUS)



**SWM Analysis**

Prepared by InSite Engineering, LLC

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Type III 24-hr 2-Year Rainfall=3.40"

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**Summary for Subcatchment PR-1B: UNDETAINED TO THIRD AVENUE (OPEN SPACE)**

Runoff = 0.00 cfs @ 23.50 hrs, Volume= 0.000 af, Depth= 0.00"

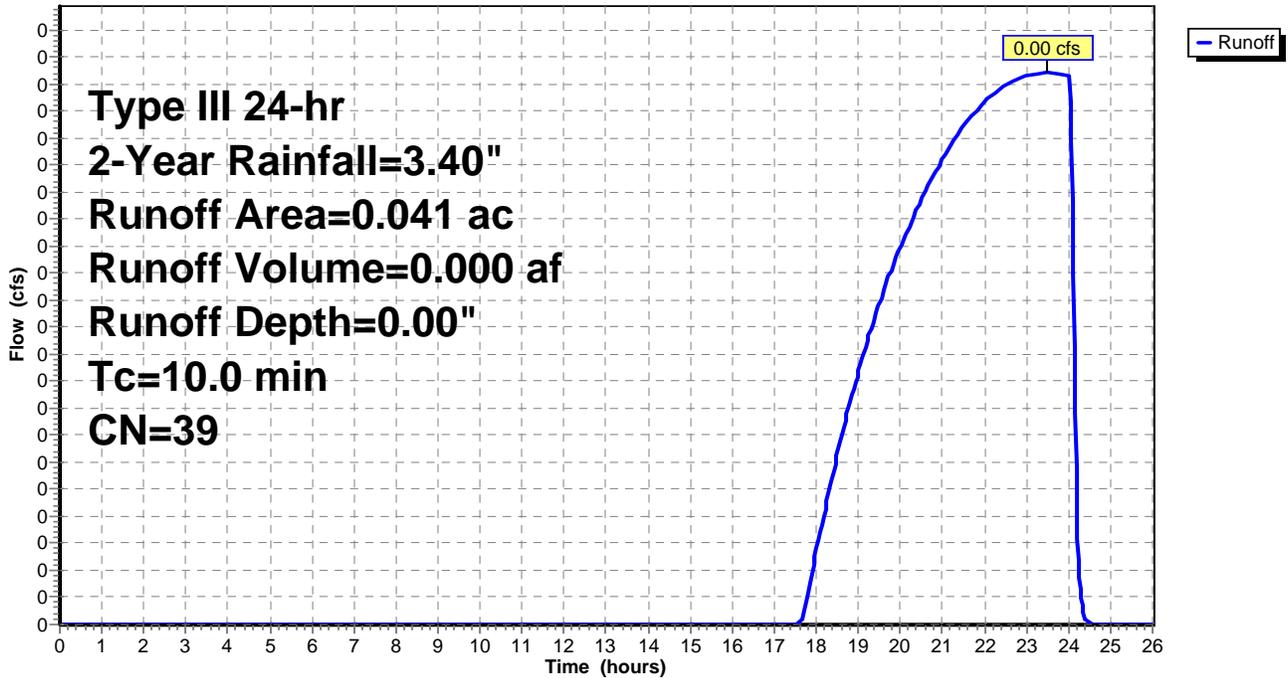
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs  
Type III 24-hr 2-Year Rainfall=3.40"

Area (ac)	CN	Description
0.041	39	>75% Grass cover, Good, HSG A
0.041		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry, MIN Tc

**Subcatchment PR-1B: UNDETAINED TO THIRD AVENUE (OPEN SPACE)**

Hydrograph



# SWM Analysis

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Type III 24-hr 2-Year Rainfall=3.40"

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## Summary for Subcatchment PR-1C: ROOF AREA (TO THIRD AVENUE)

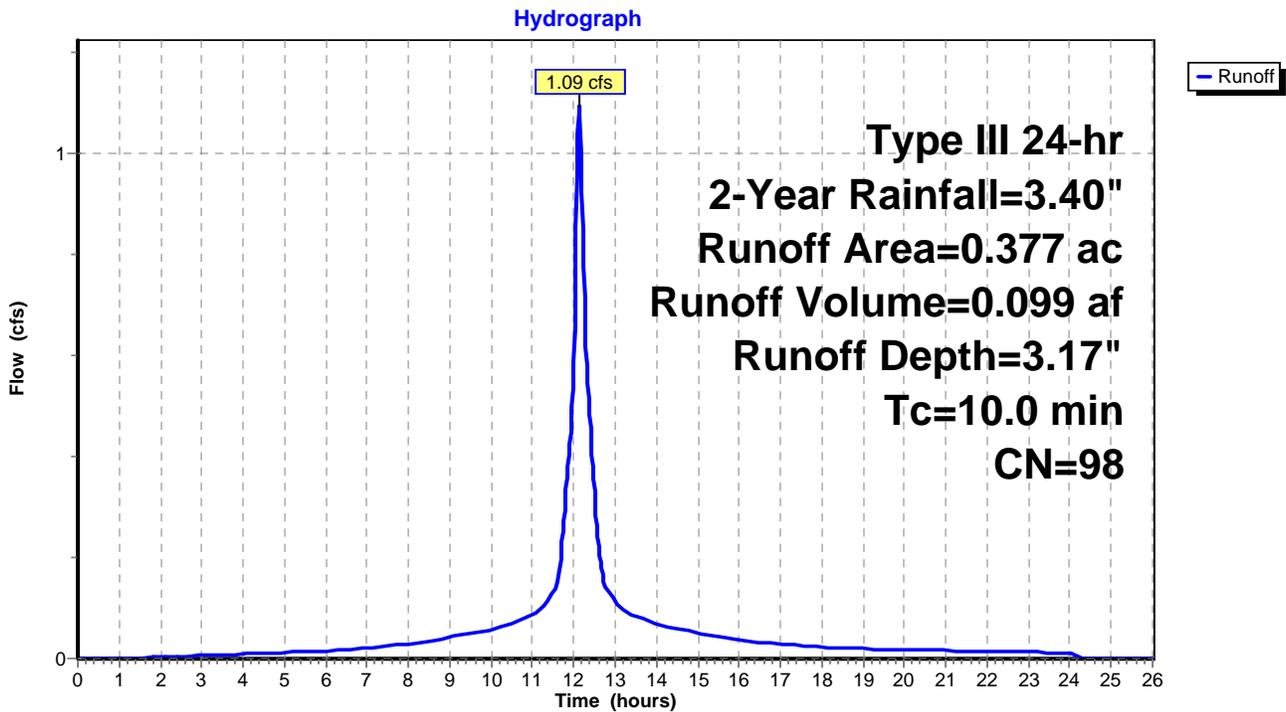
Runoff = 1.09 cfs @ 12.13 hrs, Volume= 0.099 af, Depth= 3.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs  
Type III 24-hr 2-Year Rainfall=3.40"

Area (ac)	CN	Description
0.377	98	Roofs, HSG A
0.377		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry, MIN Tc

## Subcatchment PR-1C: ROOF AREA (TO THIRD AVENUE)



# SWM Analysis

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Type III 24-hr 2-Year Rainfall=3.40"

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## Summary for Subcatchment PR-1D: UNDETAINED ROOF AREA TO THIRD AVENUE

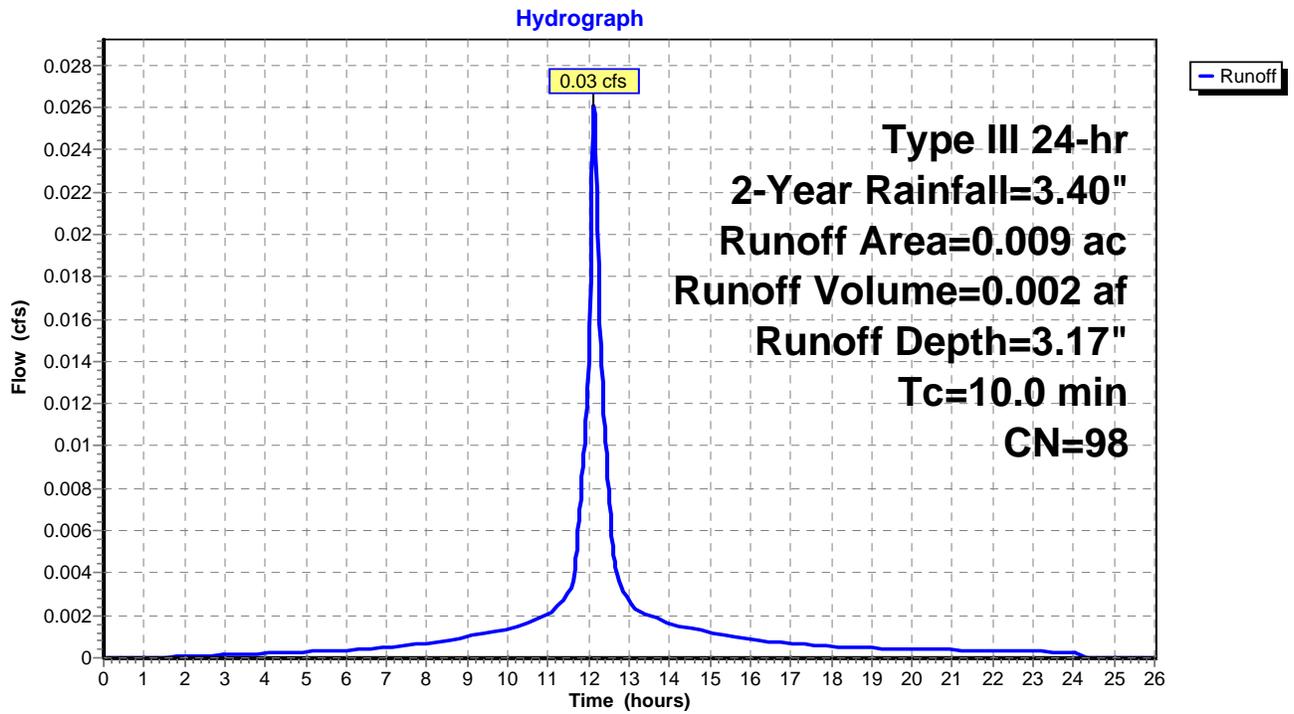
Runoff = 0.03 cfs @ 12.13 hrs, Volume= 0.002 af, Depth= 3.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs  
Type III 24-hr 2-Year Rainfall=3.40"

Area (ac)	CN	Description
0.009	98	Unconnected roofs, HSG A
0.009		100.00% Impervious Area
0.009		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry,

## Subcatchment PR-1D: UNDETAINED ROOF AREA TO THIRD AVENUE



# SWM Analysis

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Type III 24-hr 2-Year Rainfall=3.40"

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## Summary for Subcatchment PR-2A: UNDETAINED TO MAIN STREET (OPEN SPACE)

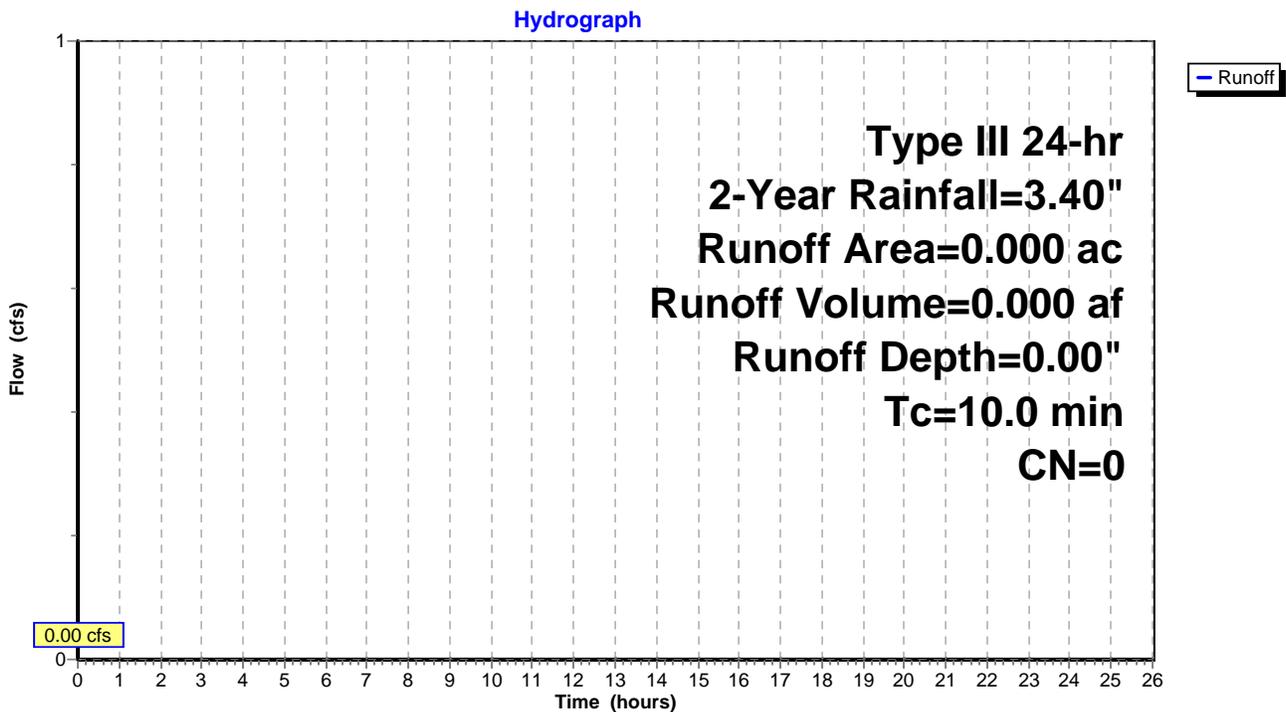
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs  
Type III 24-hr 2-Year Rainfall=3.40"

Area (ac)	CN	Description
0.000	39	>75% Grass cover, Good, HSG A

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry, MIN Tc

## Subcatchment PR-2A: UNDETAINED TO MAIN STREET (OPEN SPACE)



# SWM Analysis

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Type III 24-hr 2-Year Rainfall=3.40"

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## Summary for Subcatchment PR-2B: UNDETAINED TO MAIN STREET (IMPERVIOUS)

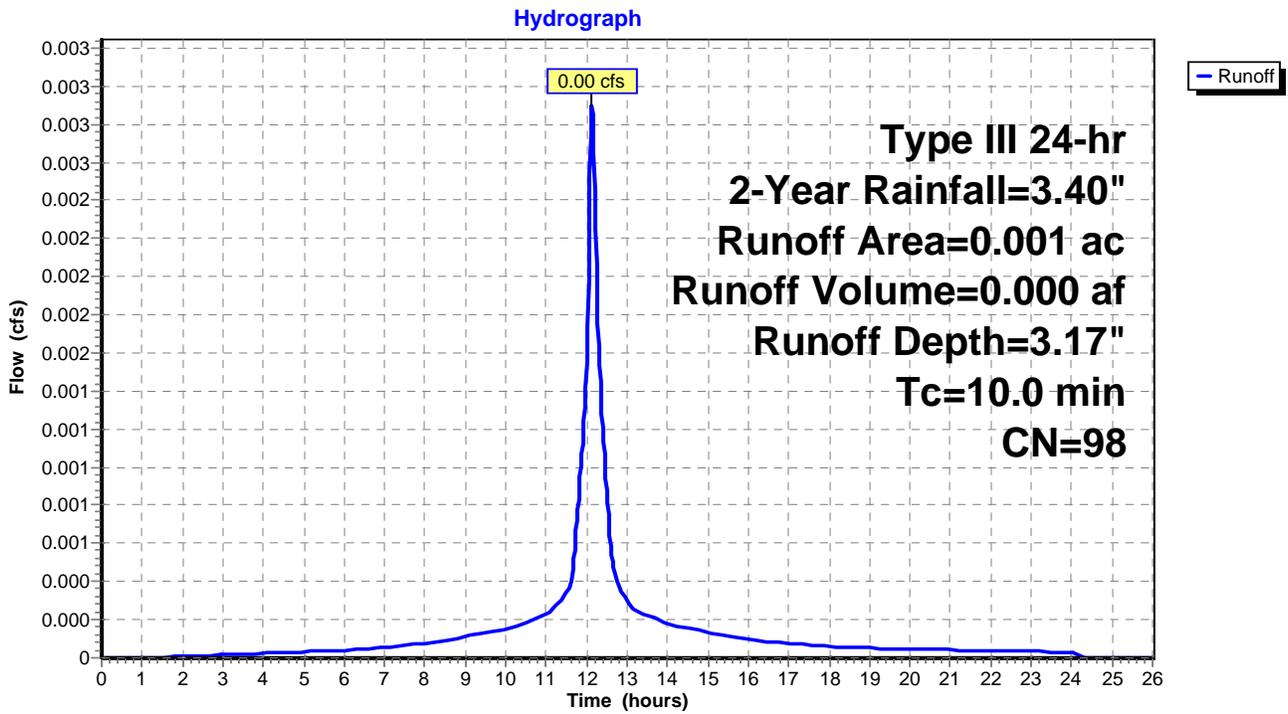
Runoff = 0.00 cfs @ 12.13 hrs, Volume= 0.000 af, Depth= 3.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs  
Type III 24-hr 2-Year Rainfall=3.40"

Area (ac)	CN	Description
* 0.001	98	Unconnected impervious, HSG A
0.001		100.00% Impervious Area
0.001		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry, MIN Tc

## Subcatchment PR-2B: UNDETAINED TO MAIN STREET (IMPERVIOUS)



# SWM Analysis

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Type III 24-hr 2-Year Rainfall=3.40"

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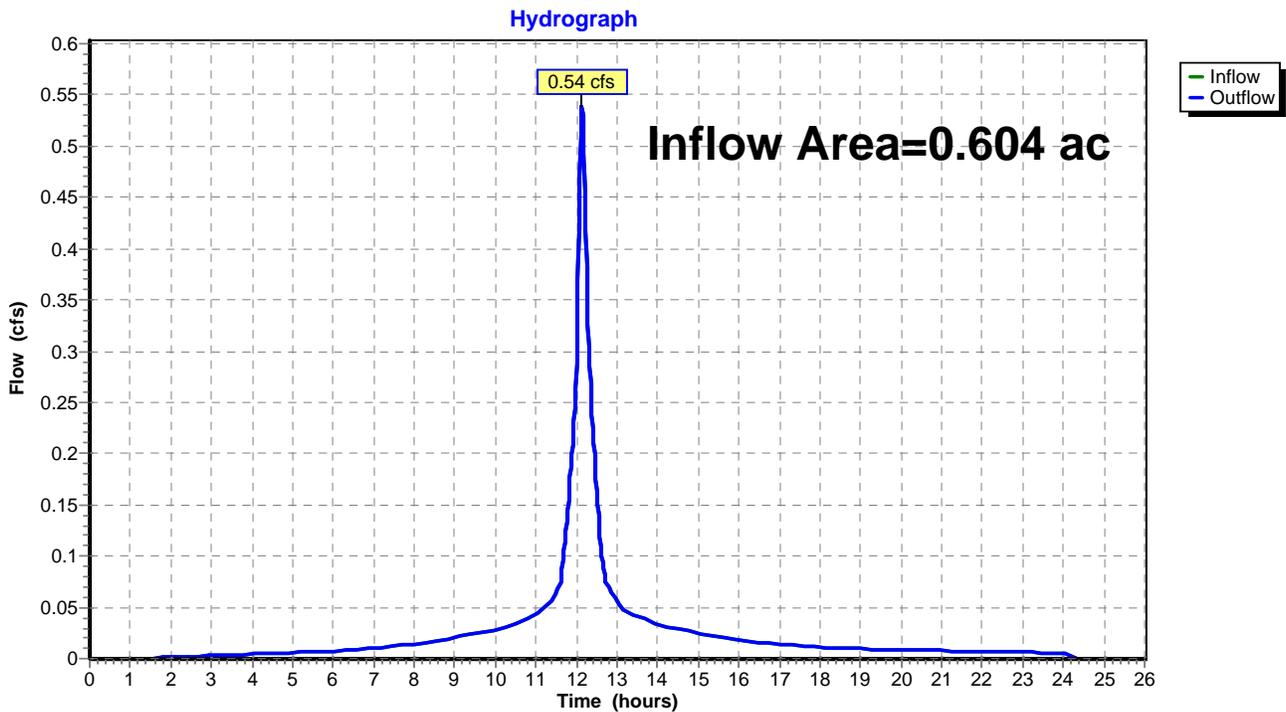
Page 9

## Summary for Reach PR: POST DEVELOPMENT

Inflow Area = 0.604 ac, 93.21% Impervious, Inflow Depth = 0.98" for 2-Year event  
Inflow = 0.54 cfs @ 12.13 hrs, Volume= 0.049 af  
Outflow = 0.54 cfs @ 12.13 hrs, Volume= 0.049 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs

## Reach PR: POST DEVELOPMENT



# SWM Analysis

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Type III 24-hr 2-Year Rainfall=3.40"

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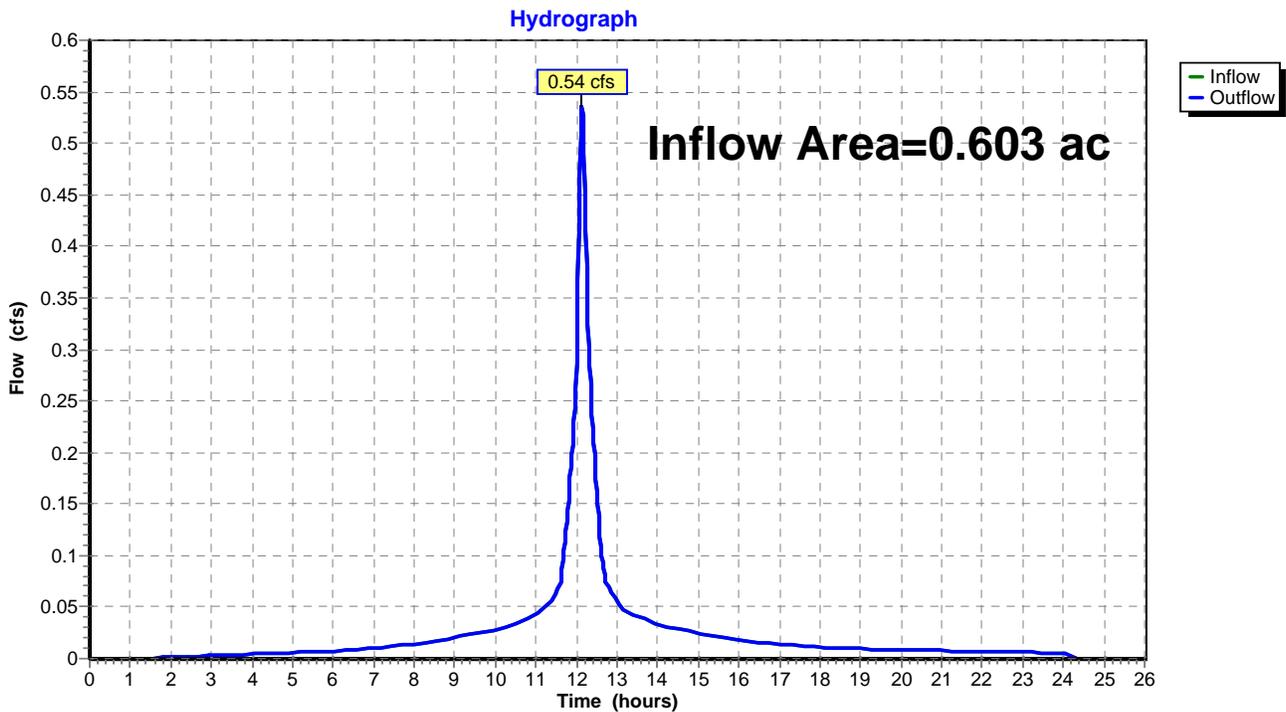
Page 10

## Summary for Reach PR-1: TO THIRD AVENUE

Inflow Area = 0.603 ac, 93.20% Impervious, Inflow Depth = 0.97" for 2-Year event  
Inflow = 0.54 cfs @ 12.13 hrs, Volume= 0.049 af  
Outflow = 0.54 cfs @ 12.13 hrs, Volume= 0.049 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs

## Reach PR-1: TO THIRD AVENUE



# SWM Analysis

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Type III 24-hr 2-Year Rainfall=3.40"

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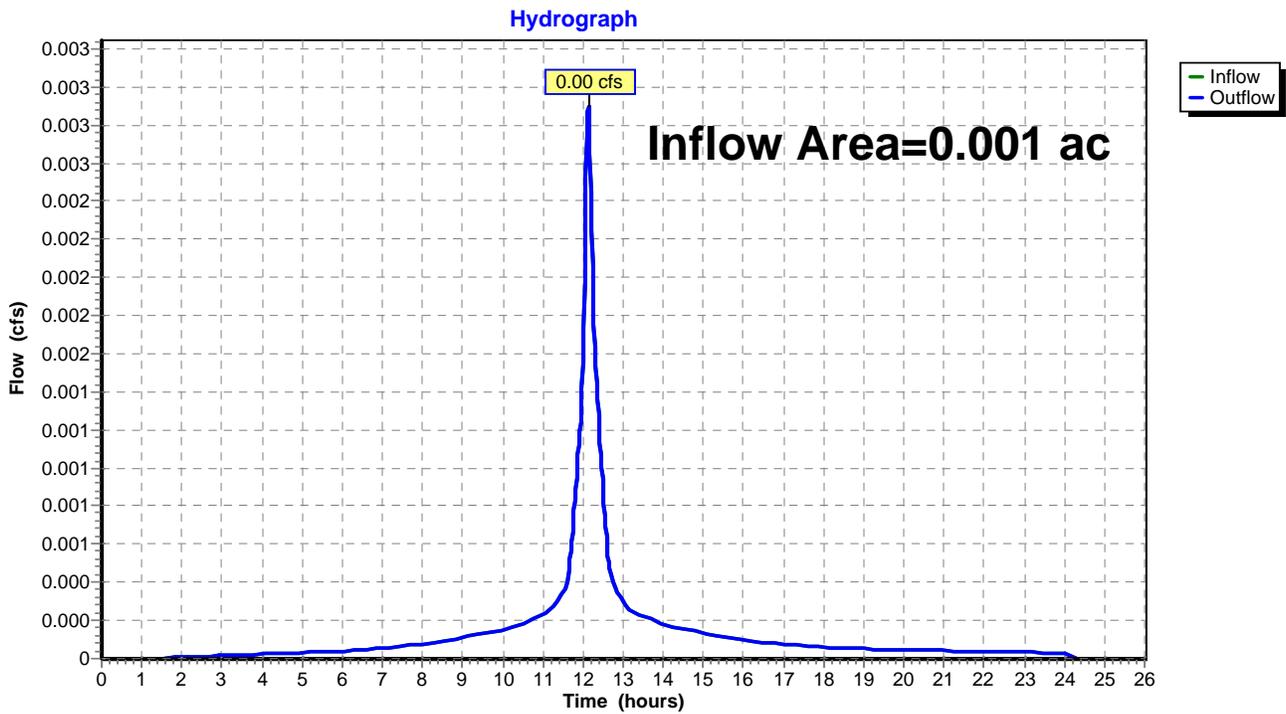
Page 11

## Summary for Reach PR-2: TO MAIN STREET

Inflow Area = 0.001 ac, 100.00% Impervious, Inflow Depth = 3.17" for 2-Year event  
Inflow = 0.00 cfs @ 12.13 hrs, Volume= 0.000 af  
Outflow = 0.00 cfs @ 12.13 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs

## Reach PR-2: TO MAIN STREET



# SWM Analysis

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Type III 24-hr 2-Year Rainfall=3.40"

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## Summary for Pond 1P: ROOF SYSTEM

Inflow Area = 0.377 ac, 100.00% Impervious, Inflow Depth = 3.17" for 2-Year event  
 Inflow = 1.09 cfs @ 12.13 hrs, Volume= 0.099 af  
 Outflow = 0.10 cfs @ 11.34 hrs, Volume= 0.099 af, Atten= 91%, Lag= 0.0 min  
 Discarded = 0.10 cfs @ 11.34 hrs, Volume= 0.099 af  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs / 2  
 Peak Elev= 19.55' @ 13.16 hrs Surf.Area= 1,386 sf Storage= 1,657 cf

Plug-Flow detention time= 130.7 min calculated for 0.099 af (100% of inflow)  
 Center-of-Mass det. time= 130.6 min ( 889.5 - 758.9 )

Volume	Invert	Avail.Storage	Storage Description
#1A	17.84'	891 cf	<b>21.00'W x 66.00'L x 3.50'H Field A</b> 4,851 cf Overall - 2,624 cf Embedded = 2,227 cf x 40.0% Voids
#2A	18.34'	1,888 cf	<b>Terre Hill Arch 26</b> x 8 Inside #1 Inside= 207.9"W x 27.0"H => 29.49 sf x 8.00'L = 236.0 cf Outside= 228.0"W x 34.0"H => 41.00 sf x 8.00'L = 328.0 cf
#3	18.34'	35 cf	<b>8.0" Round MANIFOLD SYSTEM</b> -Impervious L= 100.0' S= 0.0100 '/'
#4	19.34'	12 cf	<b>0.50'D x 10.00'H VERTICAL DOWNSPOUTS</b> x 6 -Impervious
		2,825 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	17.84'	<b>3.000 in/hr EXFILTRATION over Surface area</b>
#2	Primary	18.34'	<b>15.0" Round 15" RCP OUT</b> L= 39.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 18.34' / 18.10' S= 0.0062 '/' Cc= 0.900 n= 0.015 Concrete sewer w/manholes & inlets, Flow Area= 1.23 sf
#3	Device 2	21.34'	<b>4.0' long 4' DIVERSION WEIR</b> 2 End Contraction(s)
#4	Secondary	23.00'	<b>6.0" Vert. DOWNSPOUT OVERFLOWS X 6.00</b> C= 0.600

**Discarded OutFlow** Max=0.10 cfs @ 11.34 hrs HW=17.96' (Free Discharge)

↑**1=EXFILTRATION** (Exfiltration Controls 0.10 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=17.84' (Free Discharge)

↑**2=15" RCP OUT** ( Controls 0.00 cfs)

↑**3=4' DIVERSION WEIR** ( Controls 0.00 cfs)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=17.84' (Free Discharge)

↑**4=DOWNSPOUT OVERFLOWS** ( Controls 0.00 cfs)

# SWM Analysis

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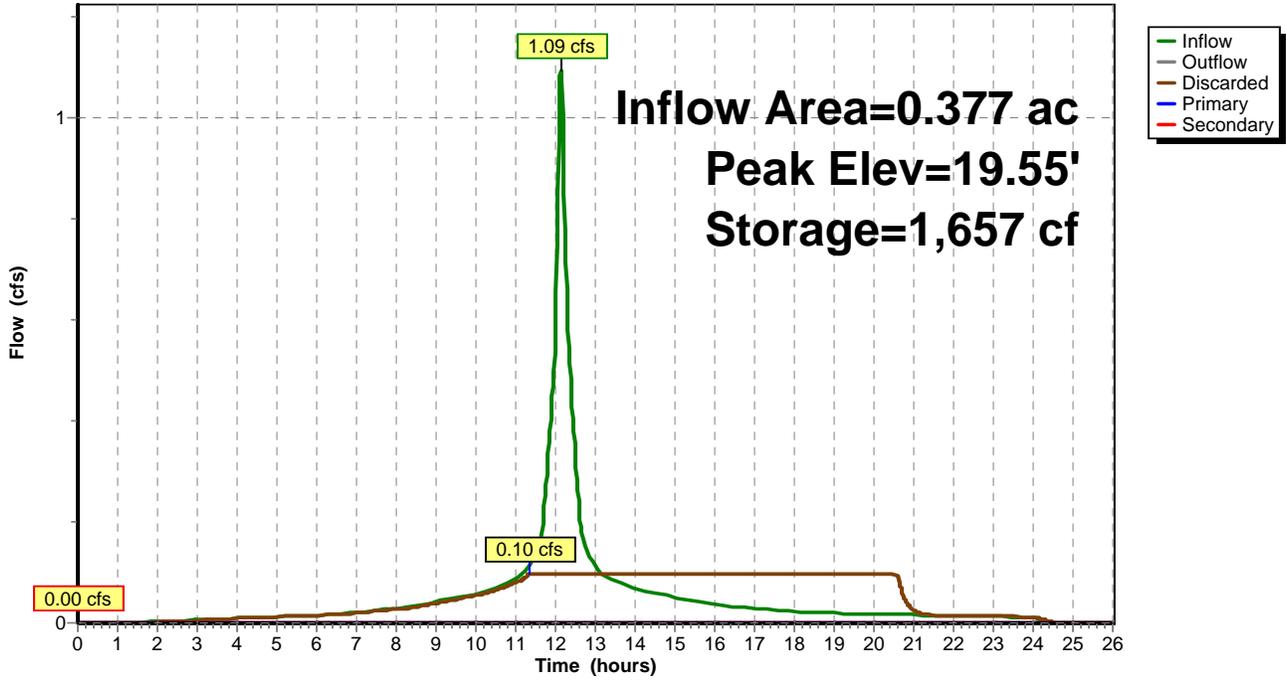
Type III 24-hr 2-Year Rainfall=3.40"

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## Pond 1P: ROOF SYSTEM

Hydrograph



# SWM Analysis

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Type III 24-hr 10-Year Rainfall=5.20"

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## Summary for Subcatchment PR-1A: UNDETAINED TO THIRD AVENUE (IMPERVIOUS)

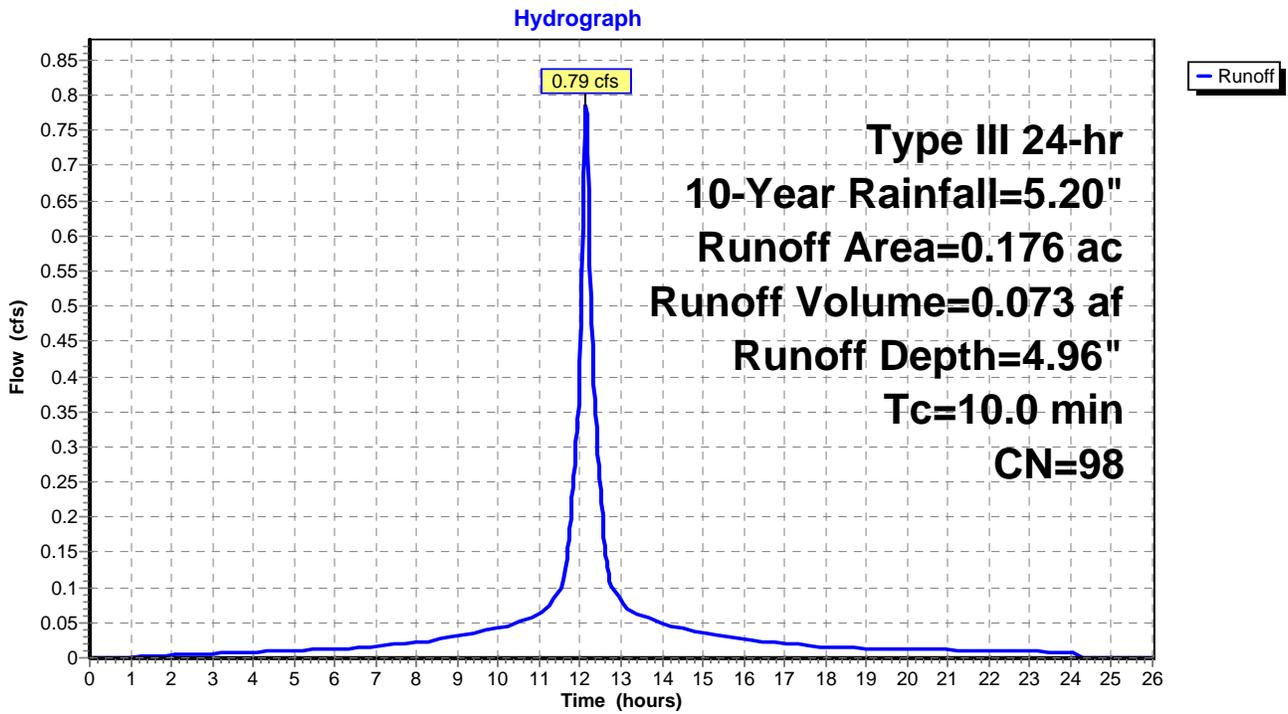
Runoff = 0.79 cfs @ 12.13 hrs, Volume= 0.073 af, Depth= 4.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs  
Type III 24-hr 10-Year Rainfall=5.20"

Area (ac)	CN	Description
* 0.176	98	Unconnected impervious, HSG A
0.176		100.00% Impervious Area
0.176		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry, MIN Tc

## Subcatchment PR-1A: UNDETAINED TO THIRD AVENUE (IMPERVIOUS)



# SWM Analysis

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Type III 24-hr 10-Year Rainfall=5.20"

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## Summary for Subcatchment PR-1B: UNDETAINED TO THIRD AVENUE (OPEN SPACE)

Runoff = 0.00 cfs @ 12.50 hrs, Volume= 0.001 af, Depth= 0.24"

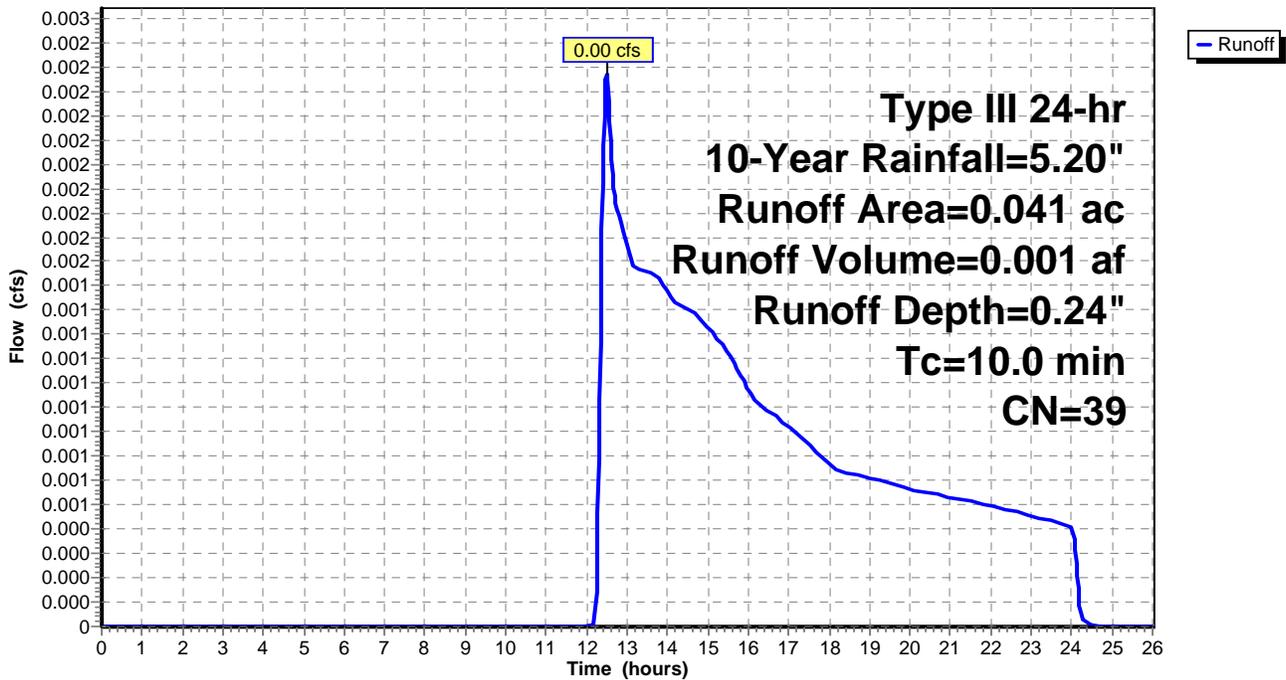
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs  
Type III 24-hr 10-Year Rainfall=5.20"

Area (ac)	CN	Description
0.041	39	>75% Grass cover, Good, HSG A
0.041		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry, MIN Tc

## Subcatchment PR-1B: UNDETAINED TO THIRD AVENUE (OPEN SPACE)

Hydrograph



# SWM Analysis

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Type III 24-hr 10-Year Rainfall=5.20"

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## Summary for Subcatchment PR-1C: ROOF AREA (TO THIRD AVENUE)

Runoff = 1.68 cfs @ 12.13 hrs, Volume= 0.156 af, Depth= 4.96"

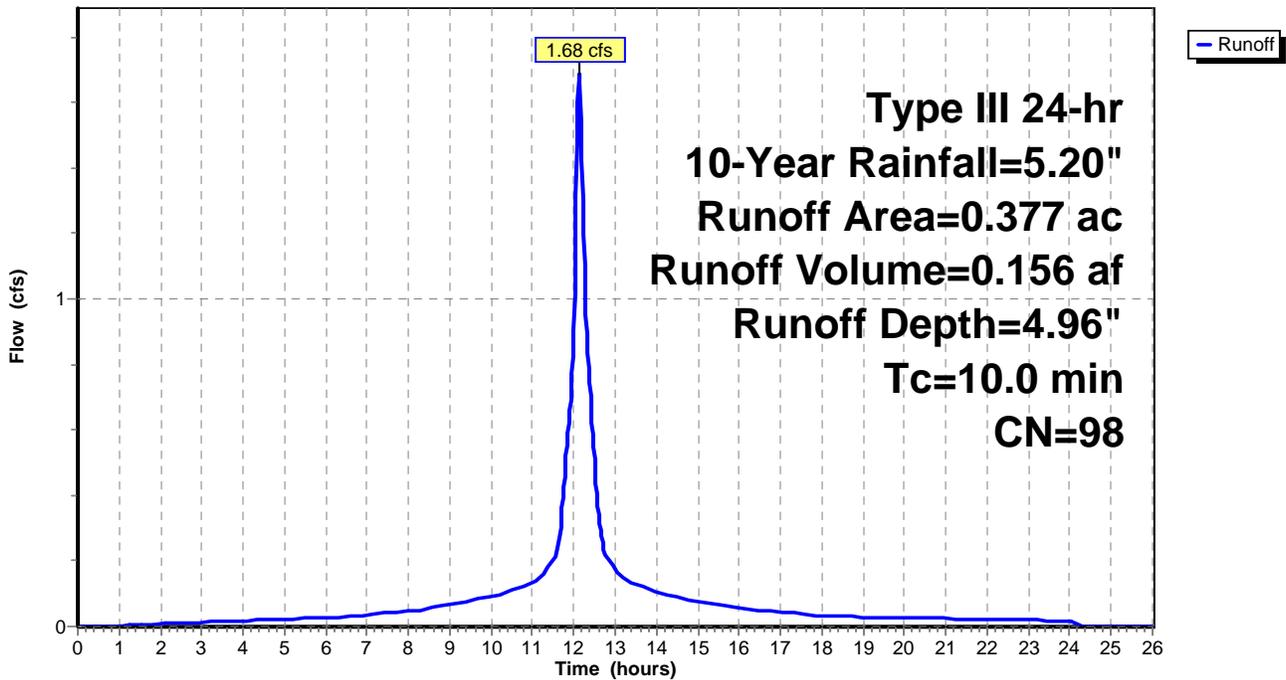
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs  
Type III 24-hr 10-Year Rainfall=5.20"

Area (ac)	CN	Description
0.377	98	Roofs, HSG A
0.377		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry, MIN Tc

## Subcatchment PR-1C: ROOF AREA (TO THIRD AVENUE)

Hydrograph



# SWM Analysis

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Type III 24-hr 10-Year Rainfall=5.20"

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## Summary for Subcatchment PR-1D: UNDETAINED ROOF AREA TO THIRD AVENUE

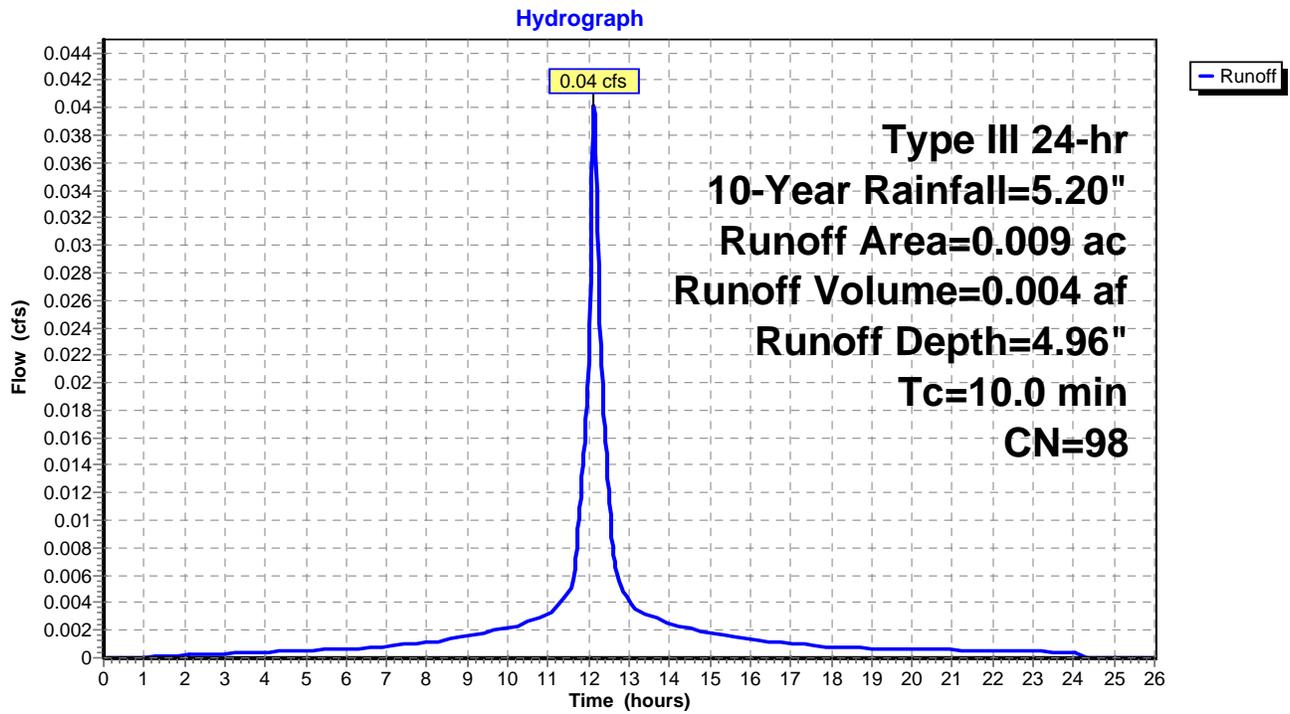
Runoff = 0.04 cfs @ 12.13 hrs, Volume= 0.004 af, Depth= 4.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs  
Type III 24-hr 10-Year Rainfall=5.20"

Area (ac)	CN	Description
0.009	98	Unconnected roofs, HSG A
0.009		100.00% Impervious Area
0.009		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry,

## Subcatchment PR-1D: UNDETAINED ROOF AREA TO THIRD AVENUE



# SWM Analysis

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Type III 24-hr 10-Year Rainfall=5.20"

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## Summary for Subcatchment PR-2A: UNDETAINED TO MAIN STREET (OPEN SPACE)

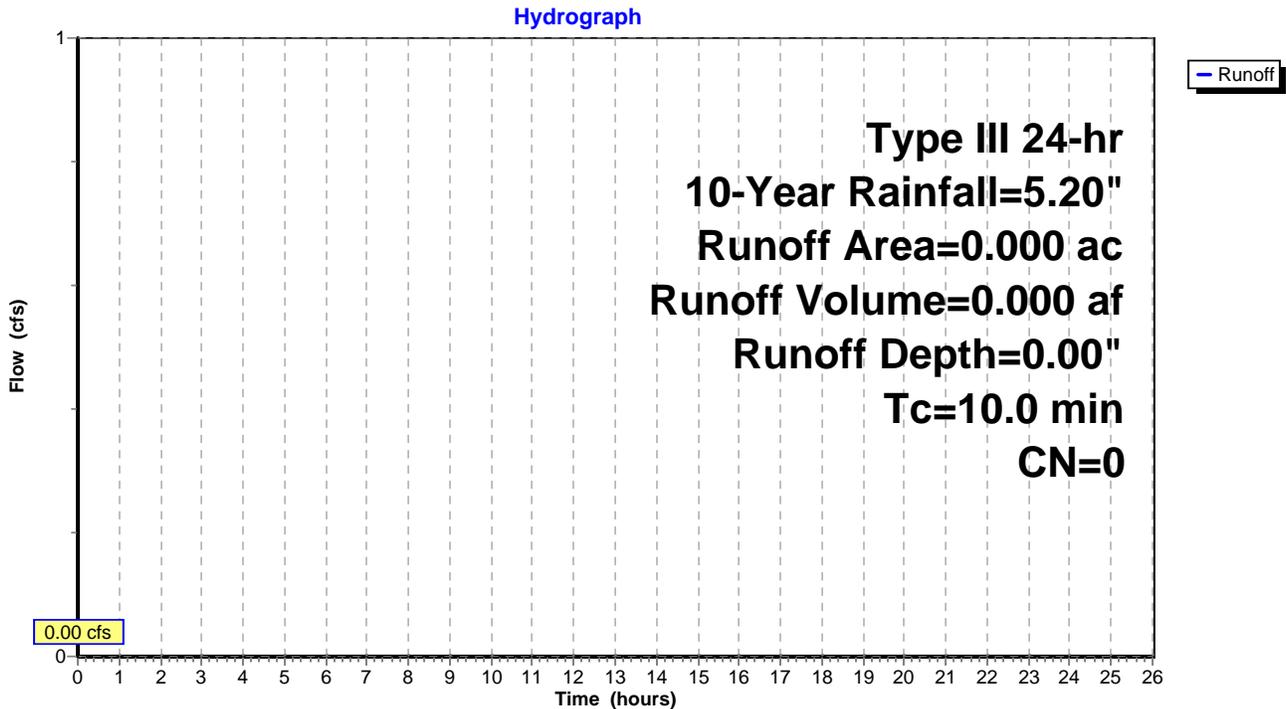
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs  
Type III 24-hr 10-Year Rainfall=5.20"

Area (ac)	CN	Description
0.000	39	>75% Grass cover, Good, HSG A

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry, MIN Tc

## Subcatchment PR-2A: UNDETAINED TO MAIN STREET (OPEN SPACE)



# SWM Analysis

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Type III 24-hr 10-Year Rainfall=5.20"

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## Summary for Subcatchment PR-2B: UNDETAINED TO MAIN STREET (IMPERVIOUS)

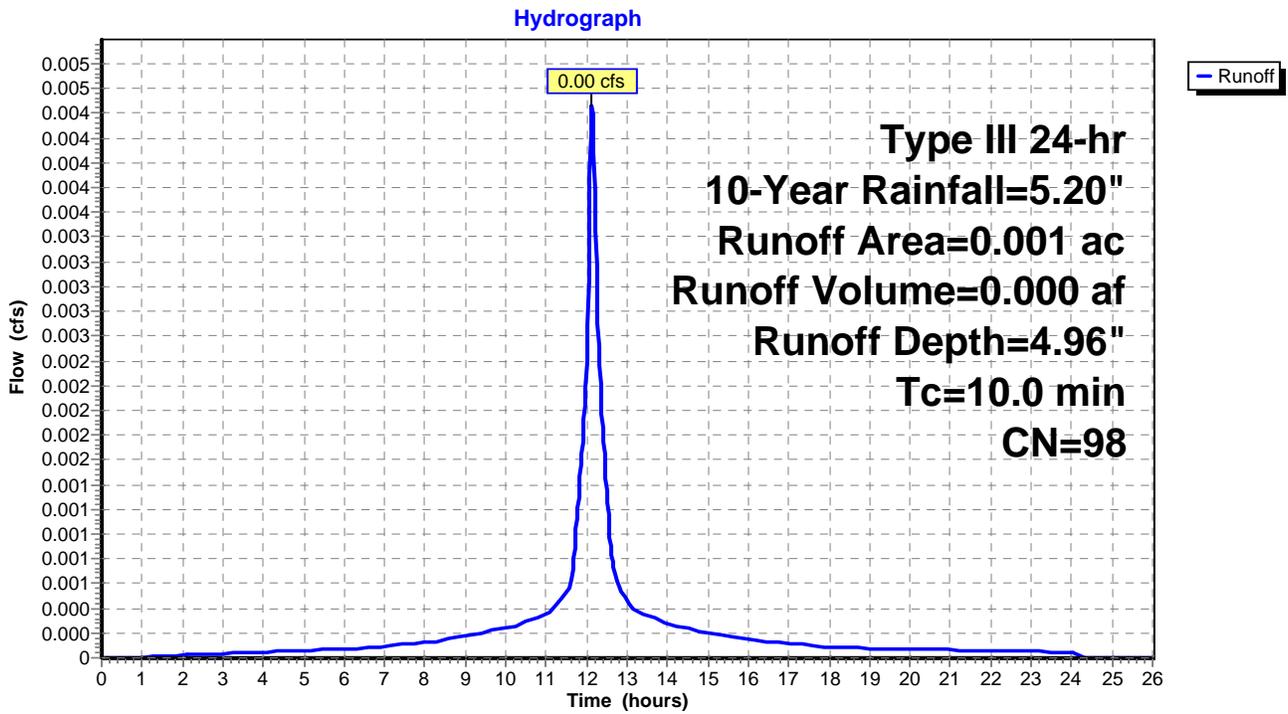
Runoff = 0.00 cfs @ 12.13 hrs, Volume= 0.000 af, Depth= 4.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs  
Type III 24-hr 10-Year Rainfall=5.20"

Area (ac)	CN	Description
* 0.001	98	Unconnected impervious, HSG A
0.001		100.00% Impervious Area
0.001		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry, MIN Tc

## Subcatchment PR-2B: UNDETAINED TO MAIN STREET (IMPERVIOUS)



# SWM Analysis

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Type III 24-hr 10-Year Rainfall=5.20"

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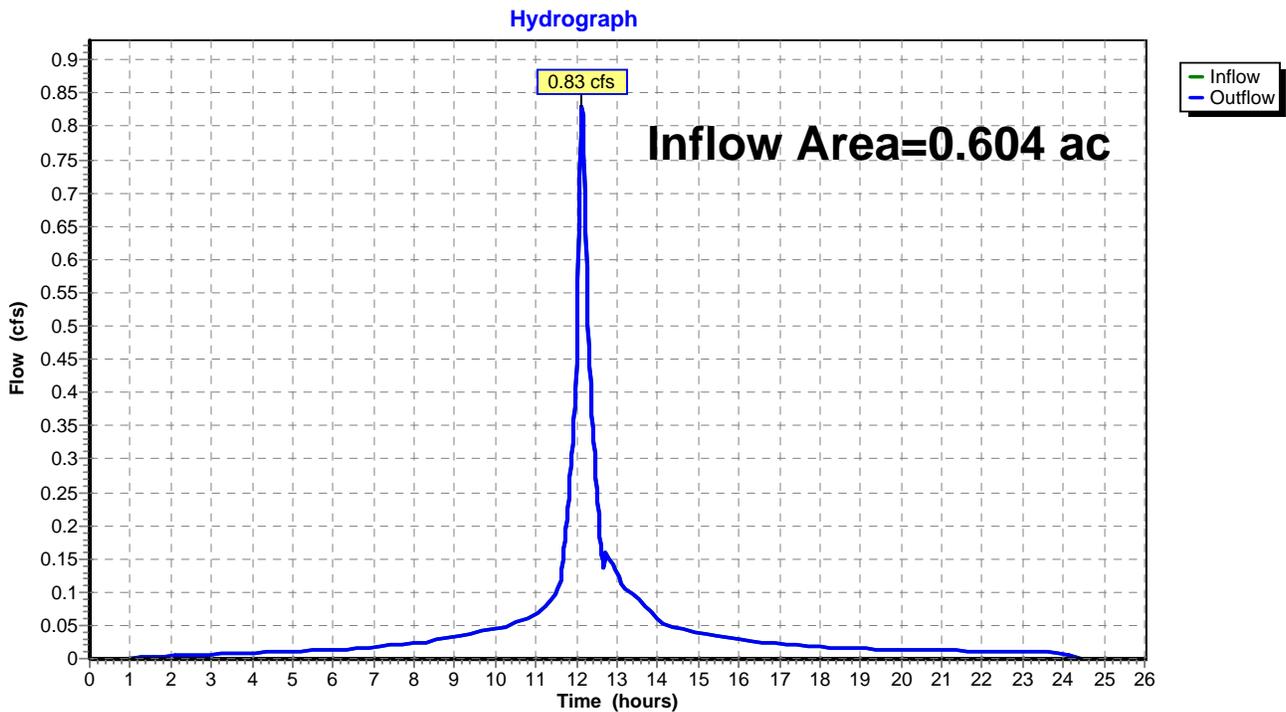
Page 20

## Summary for Reach PR: POST DEVELOPMENT

Inflow Area = 0.604 ac, 93.21% Impervious, Inflow Depth = 1.61" for 10-Year event  
Inflow = 0.83 cfs @ 12.13 hrs, Volume= 0.081 af  
Outflow = 0.83 cfs @ 12.13 hrs, Volume= 0.081 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs

## Reach PR: POST DEVELOPMENT



# SWM Analysis

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Type III 24-hr 10-Year Rainfall=5.20"

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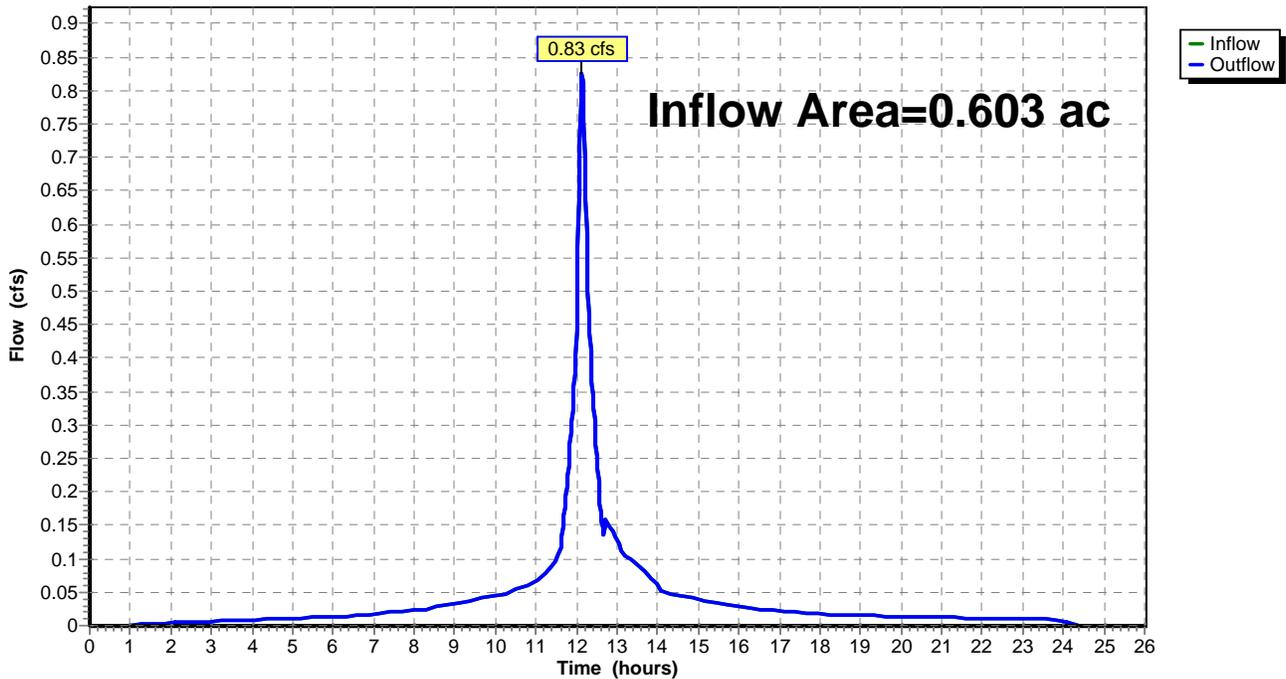
## Summary for Reach PR-1: TO THIRD AVENUE

Inflow Area = 0.603 ac, 93.20% Impervious, Inflow Depth = 1.60" for 10-Year event  
Inflow = 0.83 cfs @ 12.13 hrs, Volume= 0.081 af  
Outflow = 0.83 cfs @ 12.13 hrs, Volume= 0.081 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs

## Reach PR-1: TO THIRD AVENUE

Hydrograph



# SWM Analysis

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Type III 24-hr 10-Year Rainfall=5.20"

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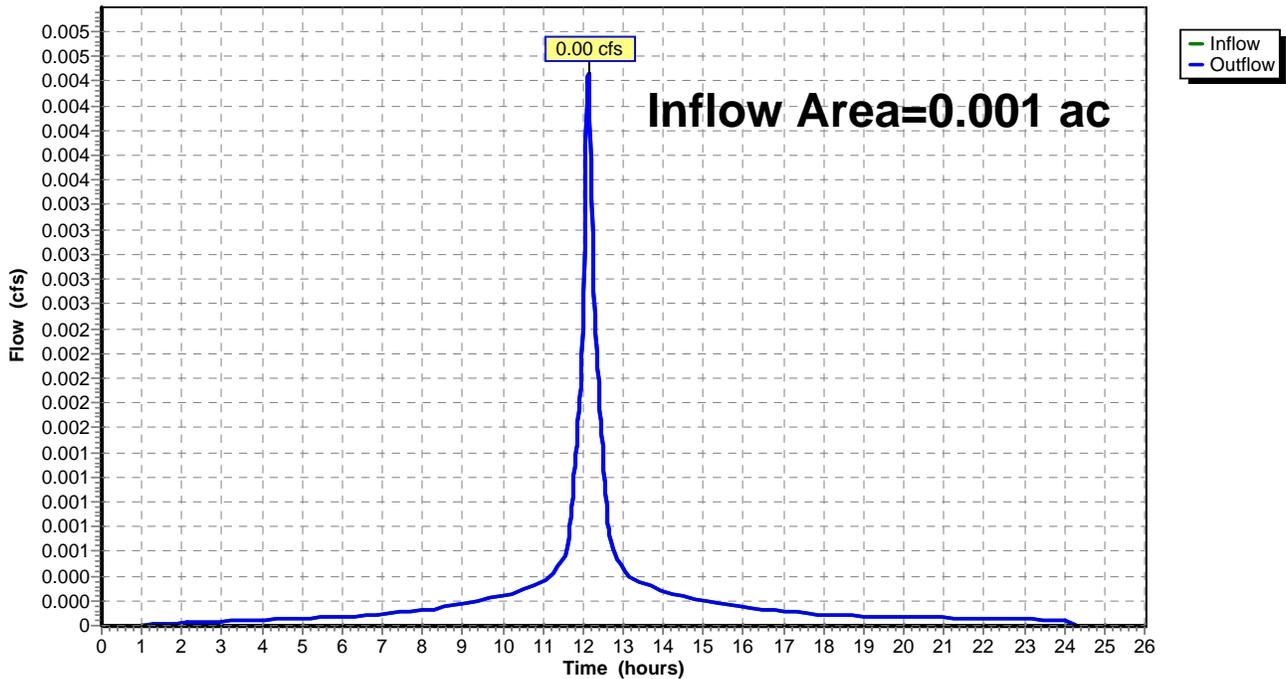
## Summary for Reach PR-2: TO MAIN STREET

Inflow Area = 0.001 ac, 100.00% Impervious, Inflow Depth = 4.96" for 10-Year event  
Inflow = 0.00 cfs @ 12.13 hrs, Volume= 0.000 af  
Outflow = 0.00 cfs @ 12.13 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs

## Reach PR-2: TO MAIN STREET

Hydrograph



# SWM Analysis

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Type III 24-hr 10-Year Rainfall=5.20"

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## Summary for Pond 1P: ROOF SYSTEM

Inflow Area = 0.377 ac, 100.00% Impervious, Inflow Depth = 4.96" for 10-Year event  
 Inflow = 1.68 cfs @ 12.13 hrs, Volume= 0.156 af  
 Outflow = 0.14 cfs @ 12.90 hrs, Volume= 0.152 af, Atten= 92%, Lag= 46.0 min  
 Discarded = 0.10 cfs @ 10.36 hrs, Volume= 0.149 af  
 Primary = 0.04 cfs @ 12.90 hrs, Volume= 0.003 af  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs / 2  
 Peak Elev= 21.35' @ 12.90 hrs Surf.Area= 1,386 sf Storage= 2,816 cf

Plug-Flow detention time= 246.7 min calculated for 0.152 af (98% of inflow)  
 Center-of-Mass det. time= 231.5 min ( 982.6 - 751.1 )

Volume	Invert	Avail.Storage	Storage Description
#1A	17.84'	891 cf	<b>21.00'W x 66.00'L x 3.50'H Field A</b> 4,851 cf Overall - 2,624 cf Embedded = 2,227 cf x 40.0% Voids
#2A	18.34'	1,888 cf	<b>Terre Hill Arch 26</b> x 8 Inside #1 Inside= 207.9"W x 27.0"H => 29.49 sf x 8.00'L = 236.0 cf Outside= 228.0"W x 34.0"H => 41.00 sf x 8.00'L = 328.0 cf
#3	18.34'	35 cf	<b>8.0" Round MANIFOLD SYSTEM</b> -Impervious L= 100.0' S= 0.0100 '/'
#4	19.34'	12 cf	<b>0.50'D x 10.00'H VERTICAL DOWNSPOUTS</b> x 6 -Impervious
		2,825 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	17.84'	<b>3.000 in/hr EXFILTRATION over Surface area</b>
#2	Primary	18.34'	<b>15.0" Round 15" RCP OUT</b> L= 39.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 18.34' / 18.10' S= 0.0062 '/ Cc= 0.900 n= 0.015 Concrete sewer w/manholes & inlets, Flow Area= 1.23 sf
#3	Device 2	21.34'	<b>4.0' long 4' DIVERSION WEIR</b> 2 End Contraction(s)
#4	Secondary	23.00'	<b>6.0" Vert. DOWNSPOUT OVERFLOWS X 6.00</b> C= 0.600

**Discarded OutFlow** Max=0.10 cfs @ 10.36 hrs HW=17.96' (Free Discharge)

↑**1=EXFILTRATION** (Exfiltration Controls 0.10 cfs)

**Primary OutFlow** Max=0.02 cfs @ 12.90 hrs HW=21.35' (Free Discharge)

↑**2=15" RCP OUT** (Passes 0.02 cfs of 8.47 cfs potential flow)

↑**3=4' DIVERSION WEIR** (Weir Controls 0.02 cfs @ 0.38 fps)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=17.84' (Free Discharge)

↑**4=DOWNSPOUT OVERFLOWS** ( Controls 0.00 cfs)

**SWM Analysis**

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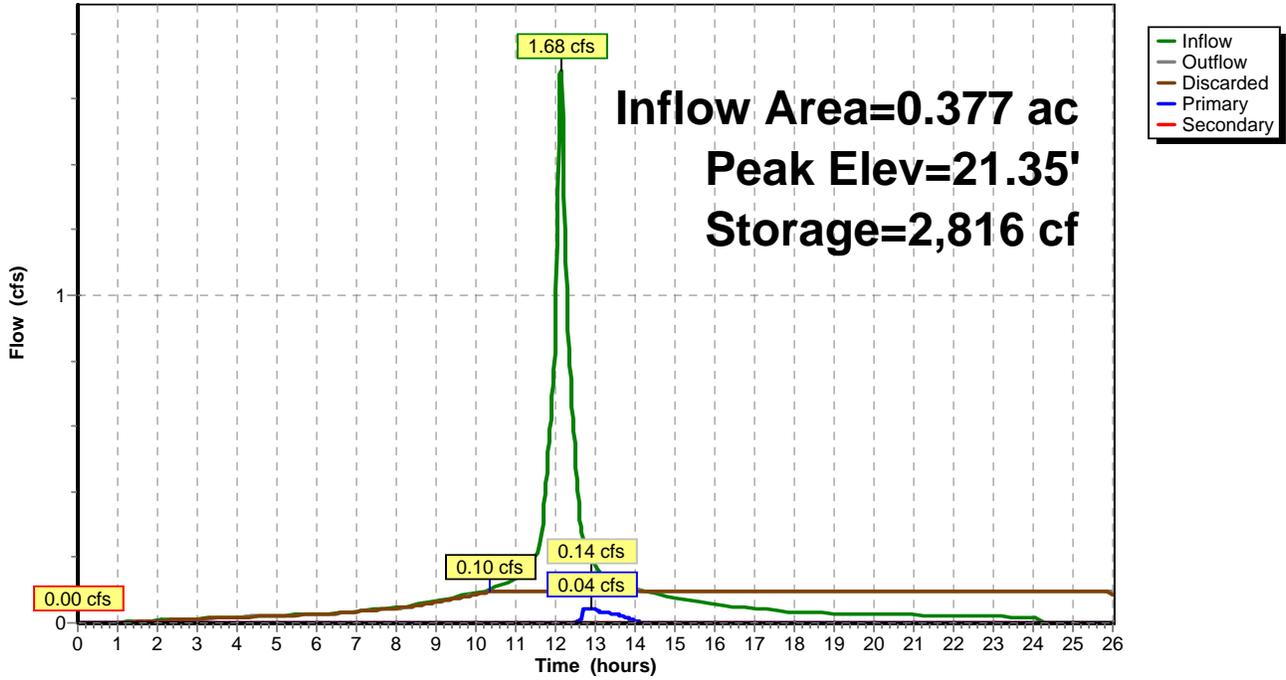
Type III 24-hr 10-Year Rainfall=5.20"

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**Pond 1P: ROOF SYSTEM**

Hydrograph



# SWM Analysis

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## Summary for Subcatchment PR-1A: UNDETAINED TO THIRD AVENUE (IMPERVIOUS)

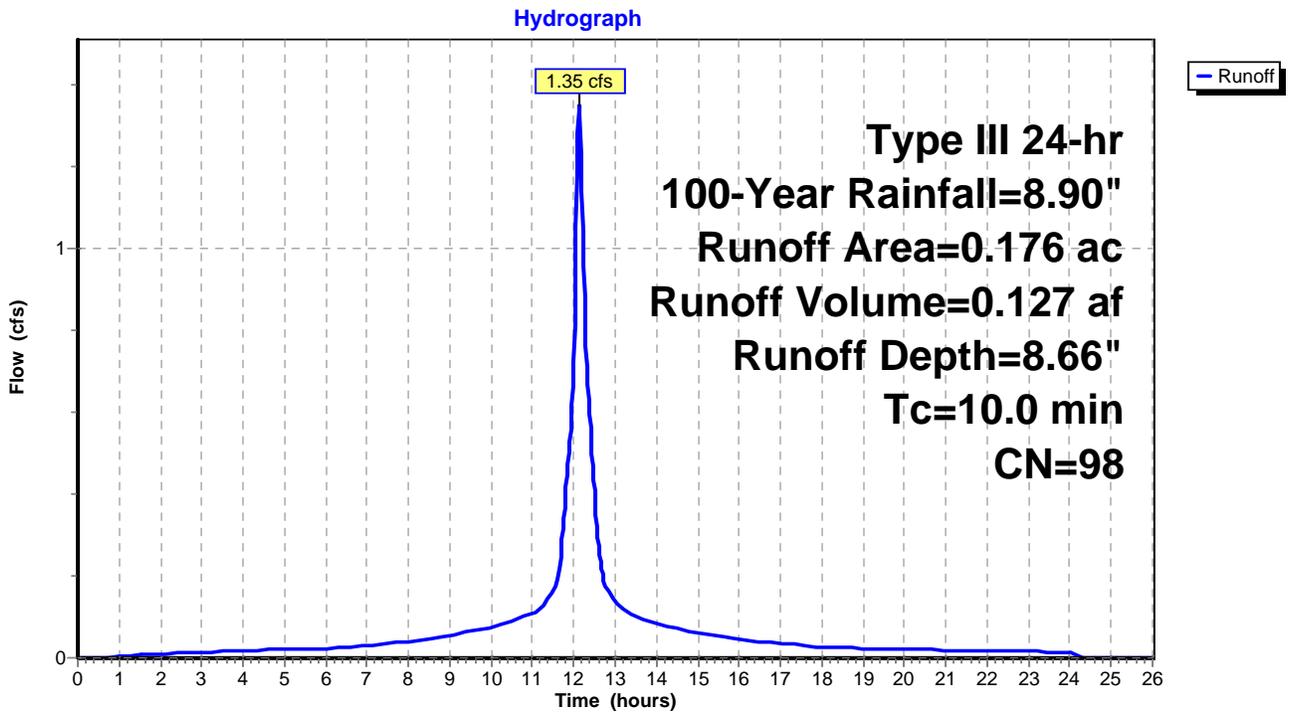
Runoff = 1.35 cfs @ 12.13 hrs, Volume= 0.127 af, Depth= 8.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs  
Type III 24-hr 100-Year Rainfall=8.90"

Area (ac)	CN	Description
* 0.176	98	Unconnected impervious, HSG A
0.176		100.00% Impervious Area
0.176		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry, MIN Tc

## Subcatchment PR-1A: UNDETAINED TO THIRD AVENUE (IMPERVIOUS)



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## Summary for Subcatchment PR-1B: UNDETAINED TO THIRD AVENUE (OPEN SPACE)

Runoff = 0.05 cfs @ 12.17 hrs, Volume= 0.005 af, Depth= 1.56"

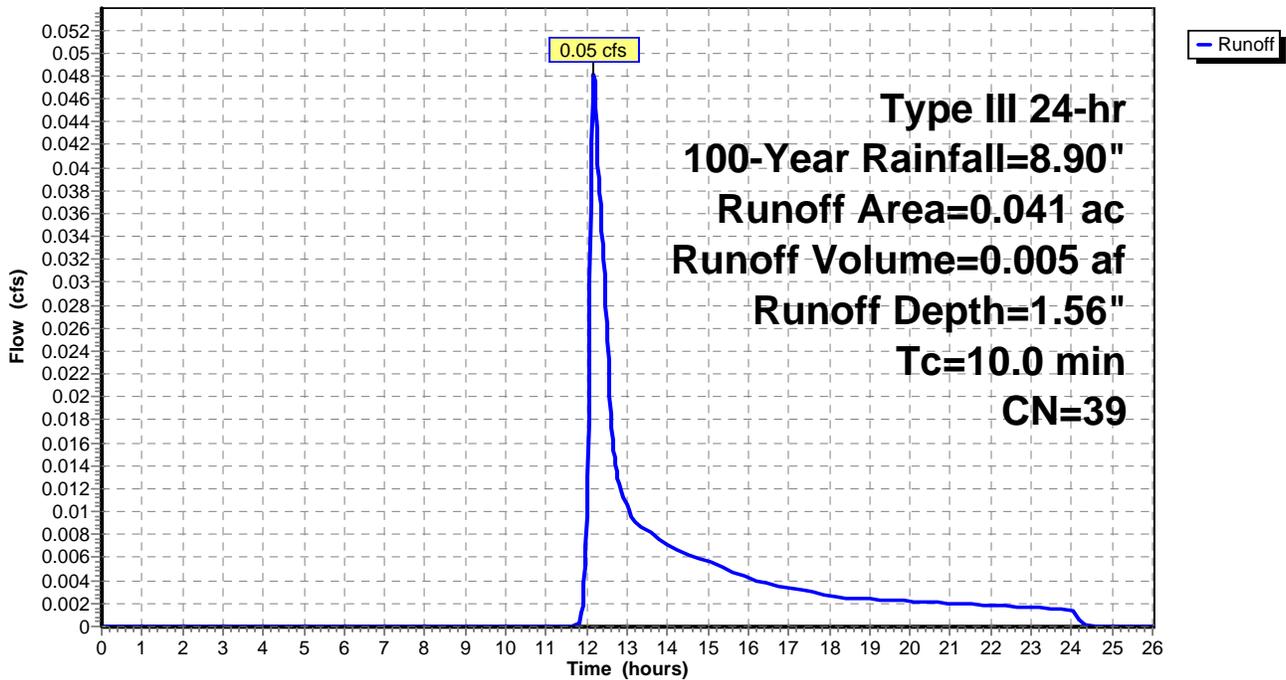
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs  
Type III 24-hr 100-Year Rainfall=8.90"

Area (ac)	CN	Description
0.041	39	>75% Grass cover, Good, HSG A
0.041		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry, MIN Tc

## Subcatchment PR-1B: UNDETAINED TO THIRD AVENUE (OPEN SPACE)

Hydrograph



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Type III 24-hr 100-Year Rainfall=8.90"

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## Summary for Subcatchment PR-1C: ROOF AREA (TO THIRD AVENUE)

Runoff = 2.89 cfs @ 12.13 hrs, Volume= 0.272 af, Depth= 8.66"

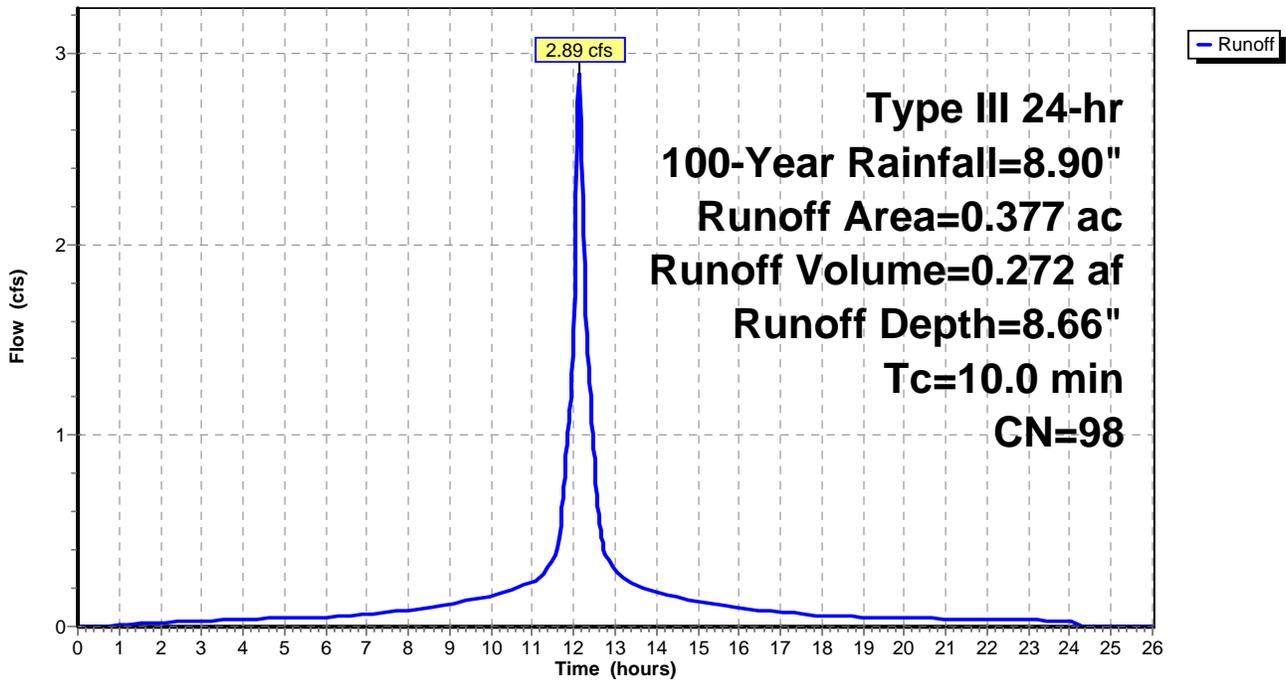
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs  
Type III 24-hr 100-Year Rainfall=8.90"

Area (ac)	CN	Description
0.377	98	Roofs, HSG A
0.377		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry, MIN Tc

## Subcatchment PR-1C: ROOF AREA (TO THIRD AVENUE)

Hydrograph



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Type III 24-hr 100-Year Rainfall=8.90"

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## Summary for Subcatchment PR-1D: UNDETAINED ROOF AREA TO THIRD AVENUE

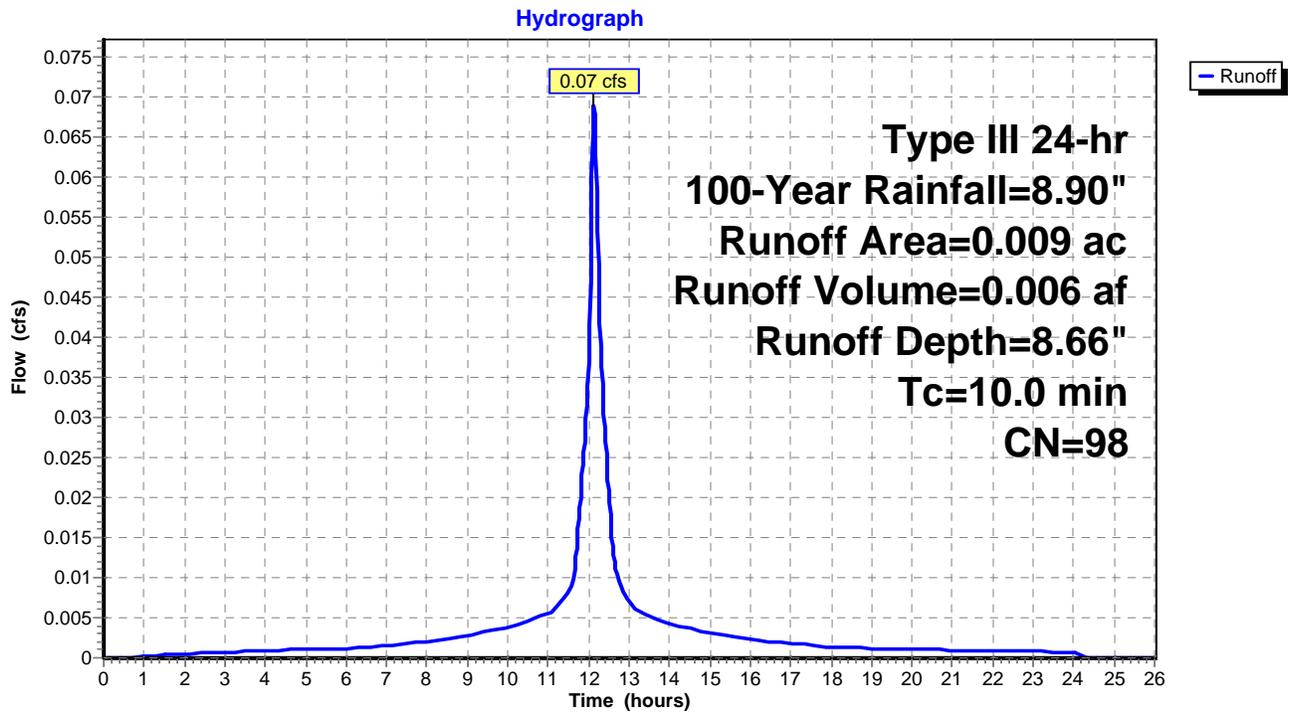
Runoff = 0.07 cfs @ 12.13 hrs, Volume= 0.006 af, Depth= 8.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs  
Type III 24-hr 100-Year Rainfall=8.90"

Area (ac)	CN	Description
0.009	98	Unconnected roofs, HSG A
0.009		100.00% Impervious Area
0.009		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry,

## Subcatchment PR-1D: UNDETAINED ROOF AREA TO THIRD AVENUE



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## Summary for Subcatchment PR-2A: UNDETAINED TO MAIN STREET (OPEN SPACE)

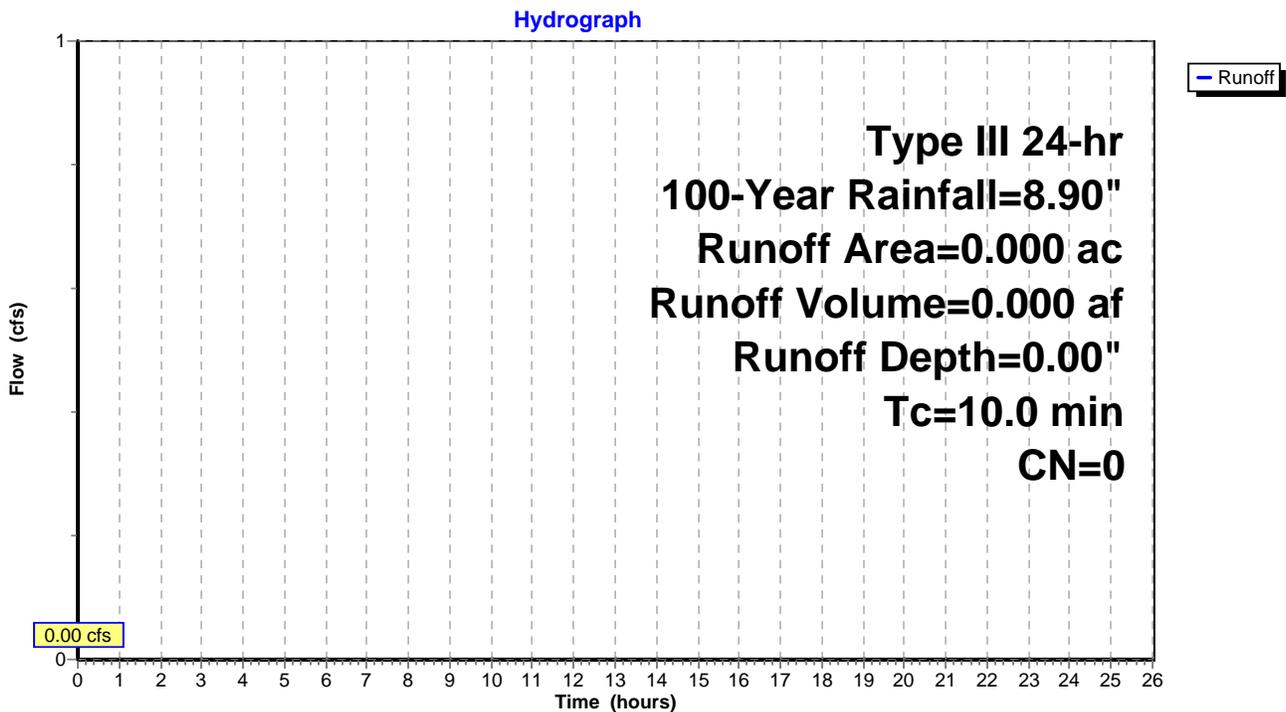
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs  
Type III 24-hr 100-Year Rainfall=8.90"

Area (ac)	CN	Description
0.000	39	>75% Grass cover, Good, HSG A

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry, MIN Tc

## Subcatchment PR-2A: UNDETAINED TO MAIN STREET (OPEN SPACE)



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## Summary for Subcatchment PR-2B: UNDETAINED TO MAIN STREET (IMPERVIOUS)

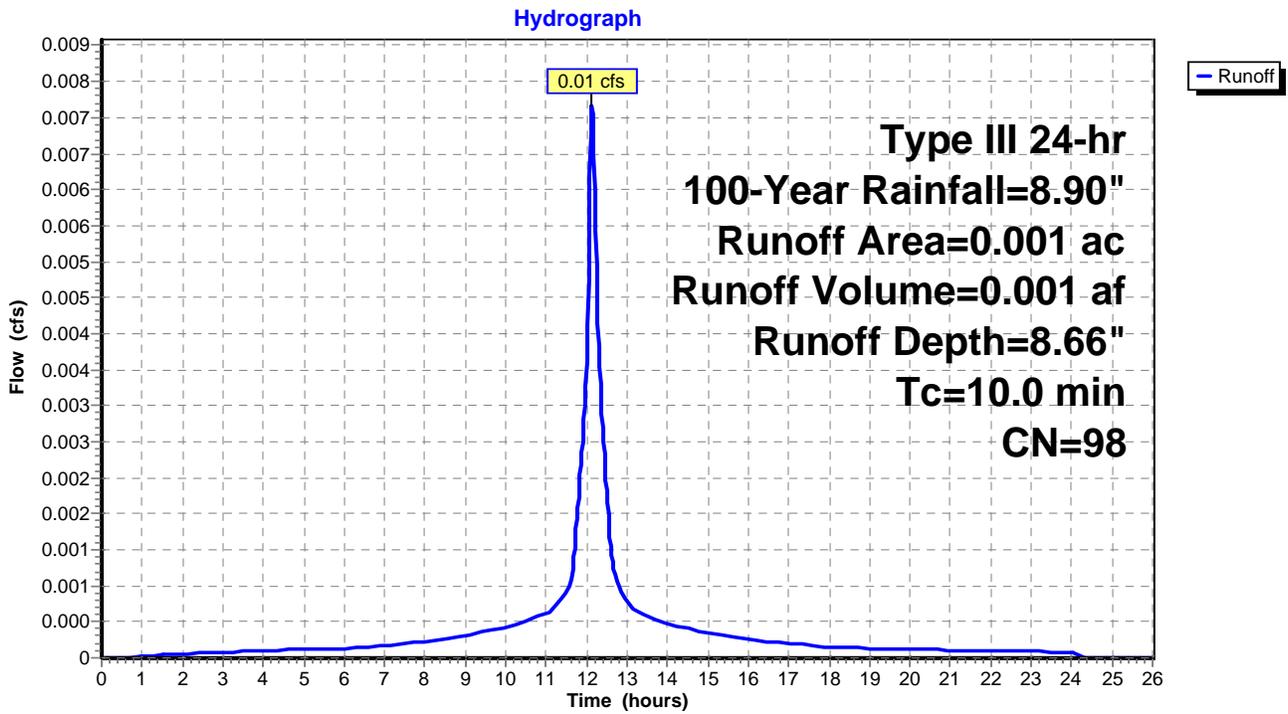
Runoff = 0.01 cfs @ 12.13 hrs, Volume= 0.001 af, Depth= 8.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs  
Type III 24-hr 100-Year Rainfall=8.90"

Area (ac)	CN	Description
* 0.001	98	Unconnected impervious, HSG A
0.001		100.00% Impervious Area
0.001		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					Direct Entry, MIN Tc

## Subcatchment PR-2B: UNDETAINED TO MAIN STREET (IMPERVIOUS)



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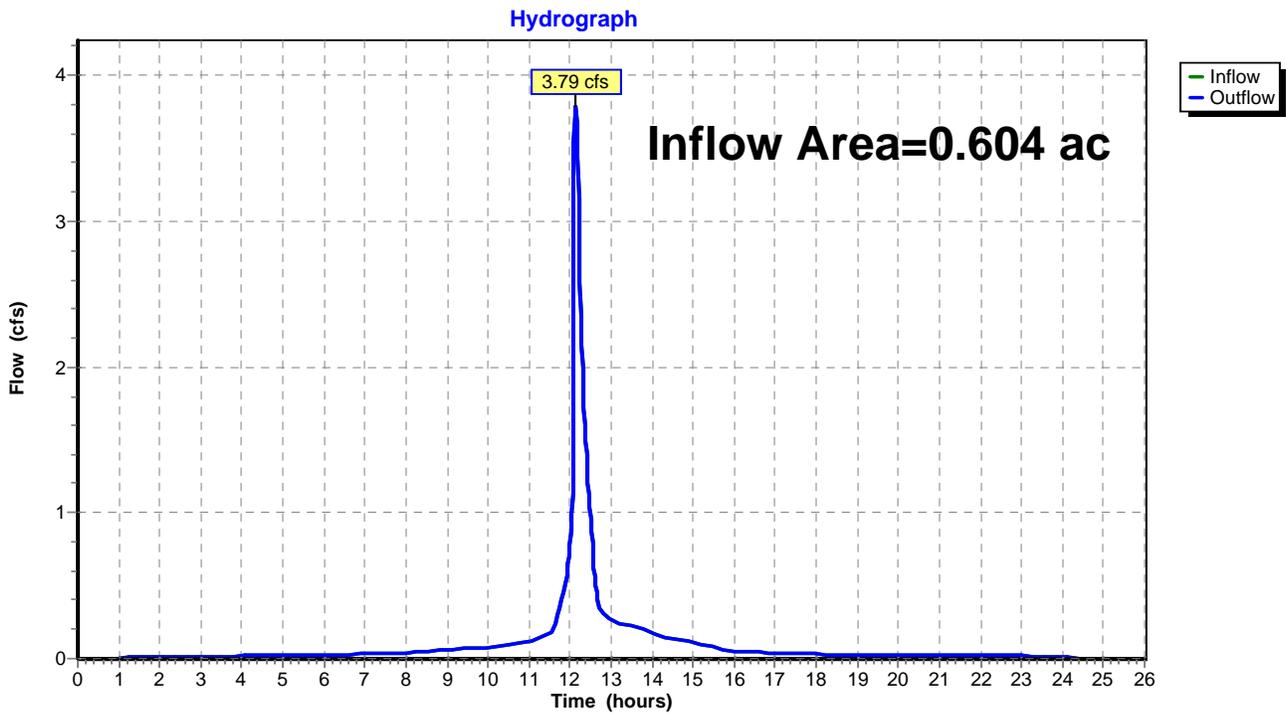
Page 31

## Summary for Reach PR: POST DEVELOPMENT

Inflow Area = 0.604 ac, 93.21% Impervious, Inflow Depth = 4.11" for 100-Year event  
Inflow = 3.79 cfs @ 12.14 hrs, Volume= 0.207 af  
Outflow = 3.79 cfs @ 12.14 hrs, Volume= 0.207 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs

## Reach PR: POST DEVELOPMENT



# SWM Analysis

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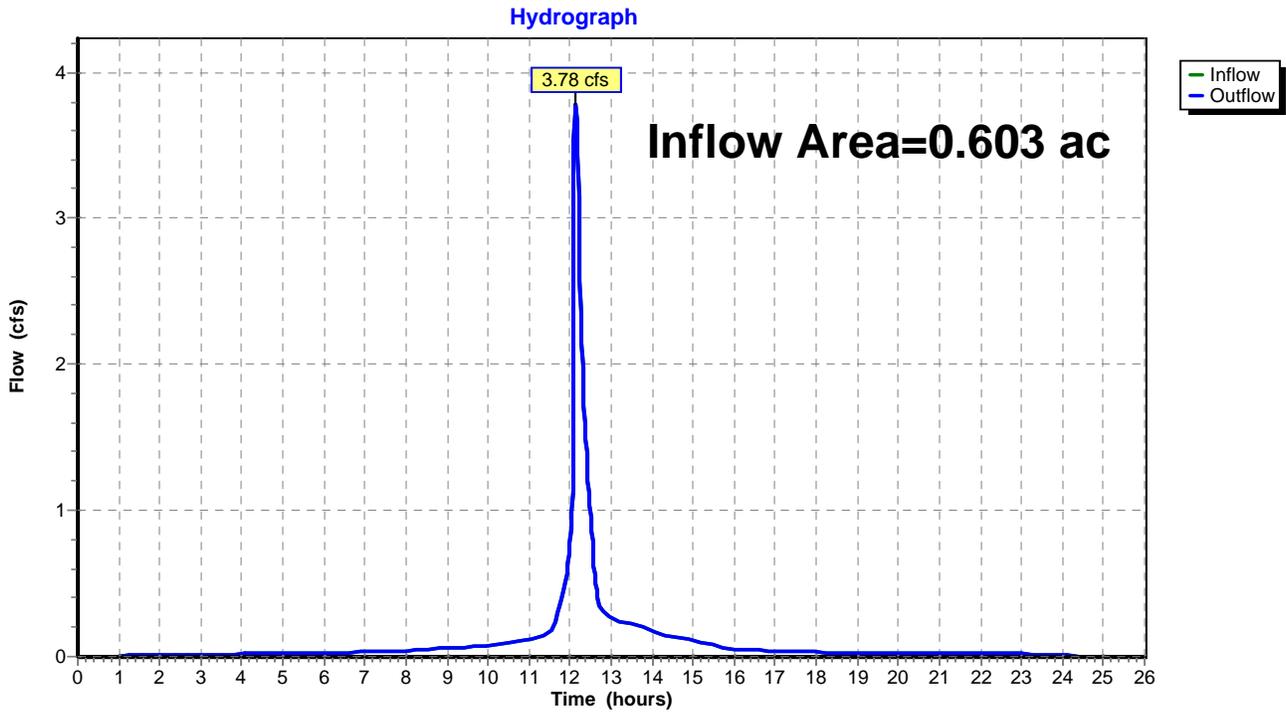
Page 32

## Summary for Reach PR-1: TO THIRD AVENUE

Inflow Area = 0.603 ac, 93.20% Impervious, Inflow Depth = 4.10" for 100-Year event  
Inflow = 3.78 cfs @ 12.14 hrs, Volume= 0.206 af  
Outflow = 3.78 cfs @ 12.14 hrs, Volume= 0.206 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs

## Reach PR-1: TO THIRD AVENUE



# SWM Analysis

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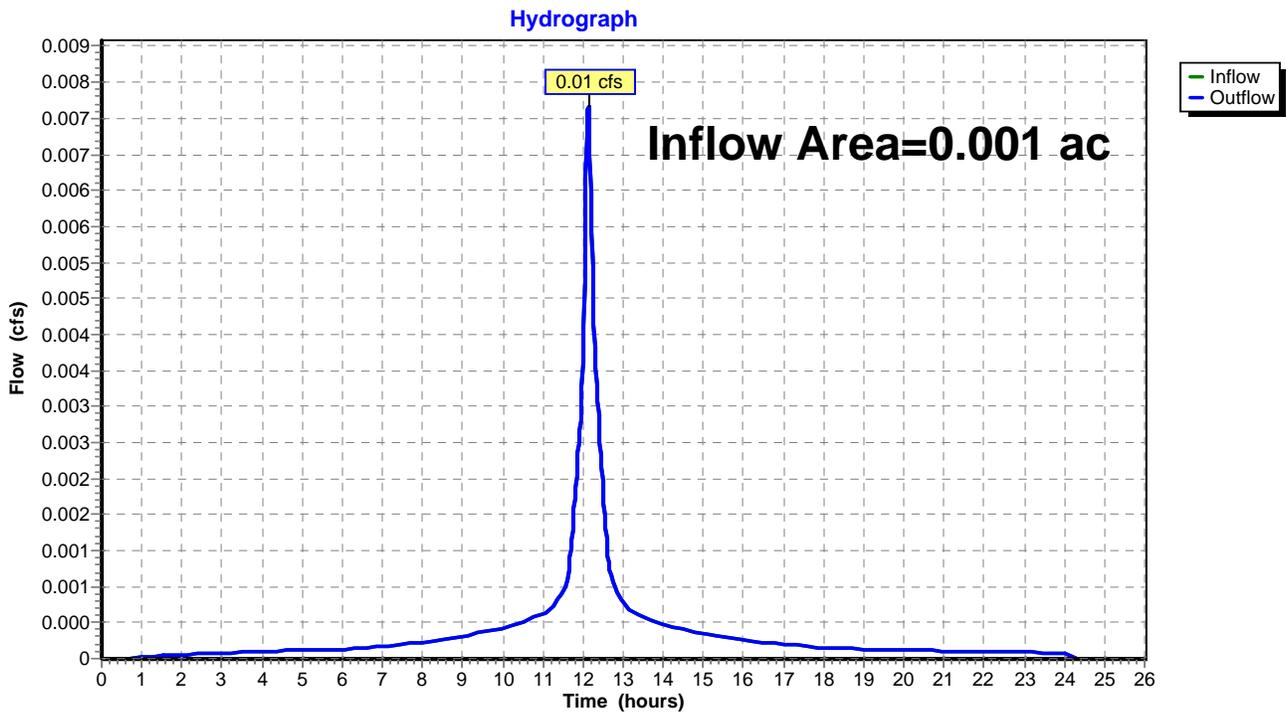
Page 33

## Summary for Reach PR-2: TO MAIN STREET

Inflow Area = 0.001 ac, 100.00% Impervious, Inflow Depth = 8.66" for 100-Year event  
Inflow = 0.01 cfs @ 12.13 hrs, Volume= 0.001 af  
Outflow = 0.01 cfs @ 12.13 hrs, Volume= 0.001 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs

## Reach PR-2: TO MAIN STREET



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## Summary for Pond 1P: ROOF SYSTEM

Inflow Area = 0.377 ac, 100.00% Impervious, Inflow Depth = 8.66" for 100-Year event  
 Inflow = 2.89 cfs @ 12.13 hrs, Volume= 0.272 af  
 Outflow = 2.41 cfs @ 12.14 hrs, Volume= 0.233 af, Atten= 16%, Lag= 0.1 min  
 Discarded = 0.10 cfs @ 8.62 hrs, Volume= 0.166 af  
 Primary = 2.32 cfs @ 12.14 hrs, Volume= 0.067 af  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-26.00 hrs, dt= 0.02 hrs / 2  
 Peak Elev= 21.66' @ 12.14 hrs Surf.Area= 1,386 sf Storage= 2,816 cf

Plug-Flow detention time= 197.4 min calculated for 0.233 af (86% of inflow)  
 Center-of-Mass det. time= 133.8 min ( 877.4 - 743.6 )

Volume	Invert	Avail.Storage	Storage Description
#1A	17.84'	891 cf	<b>21.00'W x 66.00'L x 3.50'H Field A</b> 4,851 cf Overall - 2,624 cf Embedded = 2,227 cf x 40.0% Voids
#2A	18.34'	1,888 cf	<b>Terre Hill Arch 26</b> x 8 Inside #1 Inside= 207.9"W x 27.0"H => 29.49 sf x 8.00'L = 236.0 cf Outside= 228.0"W x 34.0"H => 41.00 sf x 8.00'L = 328.0 cf
#3	18.34'	35 cf	<b>8.0" Round MANIFOLD SYSTEM</b> -Impervious L= 100.0' S= 0.0100 '/'
#4	19.34'	12 cf	<b>0.50'D x 10.00'H VERTICAL DOWNSPOUTS</b> x 6 -Impervious
		2,825 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	17.84'	<b>3.000 in/hr EXFILTRATION over Surface area</b>
#2	Primary	18.34'	<b>15.0" Round 15" RCP OUT</b> L= 39.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 18.34' / 18.10' S= 0.0062 '/' Cc= 0.900 n= 0.015 Concrete sewer w/manholes & inlets, Flow Area= 1.23 sf
#3	Device 2	21.34'	<b>4.0' long 4' DIVERSION WEIR</b> 2 End Contraction(s)
#4	Secondary	23.00'	<b>6.0" Vert. DOWNSPOUT OVERFLOWS X 6.00</b> C= 0.600

**Discarded OutFlow** Max=0.10 cfs @ 8.62 hrs HW=17.96' (Free Discharge)

↑**1=EXFILTRATION** (Exfiltration Controls 0.10 cfs)

**Primary OutFlow** Max=2.29 cfs @ 12.14 hrs HW=21.66' (Free Discharge)

↑**2=15" RCP OUT** (Passes 2.29 cfs of 9.08 cfs potential flow)

↑**3=4' DIVERSION WEIR** (Weir Controls 2.29 cfs @ 1.84 fps)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=17.84' (Free Discharge)

↑**4=DOWNSPOUT OVERFLOWS** ( Controls 0.00 cfs)

# SWM Analysis

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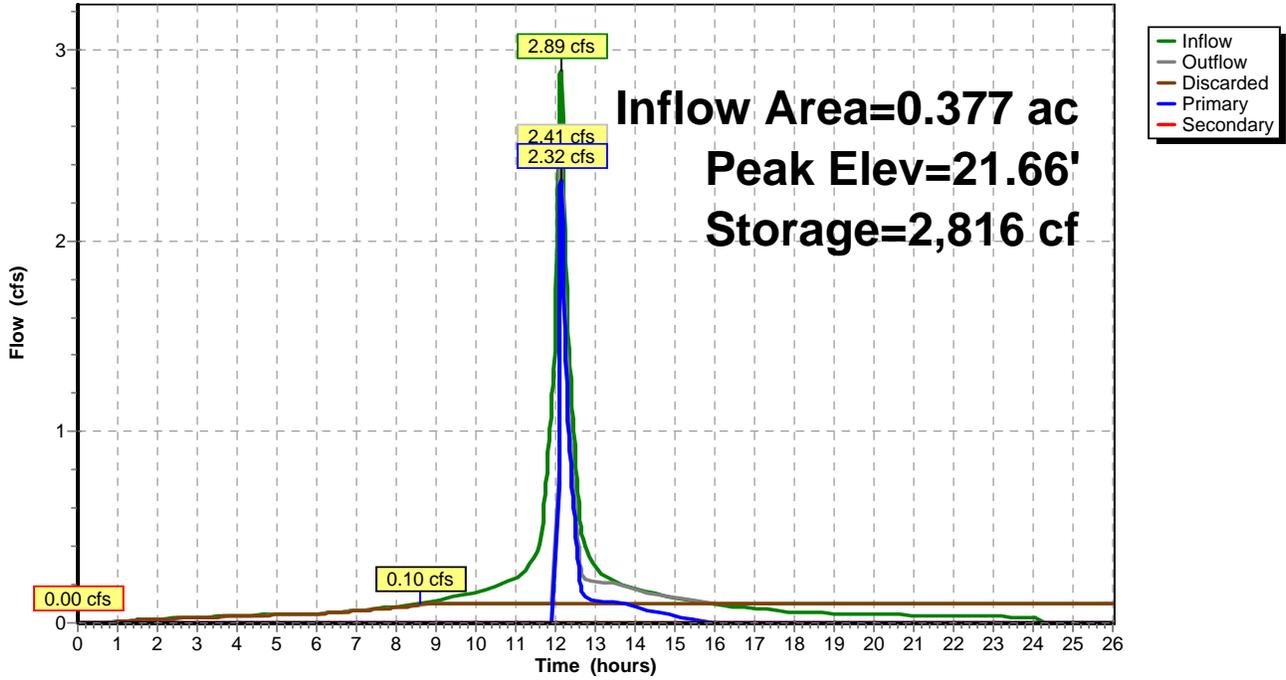
Type III 24-hr 100-Year Rainfall=8.90"

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## Pond 1P: ROOF SYSTEM

Hydrograph



## **OPERATIONS AND MAINTENANCE MANUAL**

## **1.0 INTRODUCTION**

The New Jersey Department of Environmental Protection Stormwater Management Rules require that a Maintenance Plan be developed for all of the stormwater management measures incorporated into the design of a development. The proposed mixed-use building on the southeast corner of Main Street (State Route 71) and Third Avenue in Bradley Beach is a Site Plan containing a new building footprint and parking areas. The stormwater management measure proposed for this site is a Terre Arch infiltration system under the Lot 12 parking area.

All inspection and maintenance tasks and procedures must be performed in accordance with all applicable Municipal, County, State and Federal Regulations. Particular attention is drawn to the Manual on Uniform Traffic Control Devices and to Title 29 of the Code of Federal Regulations (CFR), Part 1926 – Safety and Health Regulations for Construction and all other applicable Occupational Safety and Health Administration (OSHA) Guidelines.

## **2.0 FACILITY/OWNER INFORMATION**

Facility:           Mixed-Use Building  
                      301 Main Street & 704 ½ Third Avenue  
                      Borough of Bradley Beach, Monmouth County, NJ

Applicant:       301 Main Street Holdings, LLC  
                      PO Box 185  
                      Glen Rock, NJ 07452

## **3.0 MAINTENANCE REQUIREMENTS FOR STORM SEWER SYSTEM**

The inlets and conveyance components of the Stormwater Management System must be kept clear of leaves and debris to ensure proper function of the entire system and to prevent local ponding, loss of water quality function and long term deterioration of the system.

Maintenance of the inlets and pipe conveyance system should be performed as follows:

- The inlets should be cleared and inspected at least four (4) times annually and after each major storm event.
- Inlet grates should be inspected and cleared of leaves and debris on a weekly basis in association with general landscape maintenance.
- Inlet structures should be inspected yearly during dry conditions for structural integrity including grates, ladder rungs, grouting at pipe connections, and concrete (spalling, cracking, etc.)

- Removal of any silt, gravel leaves, trash and debris that has collected on the surface of the pavement, drains and/or within the drainage structures. Removal can be accomplished using a mechanical vacuum, system or manually. Manual removal would require gloves, a shovel, broom and a garbage can, gaining access where necessary by lifting the grate/manhole cover with a pik-axe or crowbar and climbing down a ladder into the structure. Care should be taken to wear bright colored reflective clothing. Construction cones and a flag person shall be required to block vehicles from travelling in any area being maintained.
- Any trees, shrubs and grasses in the vicinity of the storm drainage components shall be kept pruned and trimmed so that access to these structures can be made for inspection and maintenance purposes.

For outlet structures, special attention should be given to the removal of floating debris (leaves, paper, trash, branches, and other manmade and natural materials), which can clog the outlet devices. If N-Eco curb pieces are installed at each inlet and properly maintained, the amount of floating debris making its way to the outlet structures of underground detention basins will be reduced. The benefits of debris removal include:

- Reducing the chance of clogging in the outlet structures and other facility components.
- Reducing potential mosquito breeding habitats
- Improving facility performance.

Maintenance for the outlet structures shall be performed as follows:

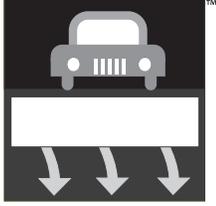
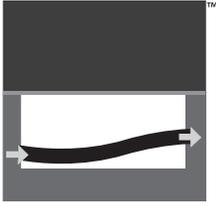
- The outlet structures are to be cleared and inspected after each major storm.
- The outlet structures are to be cleared and inspected each quarter regardless of storm activity.
- The outlet structures are to be inspected once per year during dry conditions for structural integrity including bolt/nut connections, trash racks and concrete (spalling, cracking, etc.)

Cost: Labor – 4 man-hours

Approximate cost (Labor/Material) - \$400 per service

#### **4.0 MAINTENANCE REQUIREMENTS FOR THE UNDERGROUND INFILTRATION SYSTEM**

The following pages present the operations and maintenance guidelines for the Terre Arch System incorporated into the project's Stormwater Management Plan. These guidelines are as provided from the manufacturer (Contech Engineered Solutions) and are reprinted here for inclusion in this manual. This office takes no responsibility for the content of same. Any and all questions regarding these guidelines should be directed to the manufacturer.



**CONTECH**<sup>®</sup>  
ENGINEERED SOLUTIONS

**Terre Arch**<sup>™</sup>  
**Inspection and  
Maintenance Guide**



URBANGREEN<sup>®</sup> 

## Safety

Before entering into any storm sewer or underground retention/detention system, check to make sure all OSHA and local safety regulations and guidelines are observed during the maintenance process. Hard hats, safety glasses, steel-toed boots and any other appropriate personal protective equipment shall be worn at all times.

## Inspection Frequency

Inspections are recommended at a minimum annually. The first year of operation may require more frequent inspections. Frequency of inspections will vary significantly on the local site conditions. An individual inspection schedule should be established for each site.

## Inspections

Inspection is the key to effective maintenance, and is easily performed. Inspections may need to be performed more often in the winter months in climates where sanding operations may lead to rapid sediment accumulations, or in equipment washdown areas. It is very useful to keep a record of each inspection. A sample inspection log is included for your use.

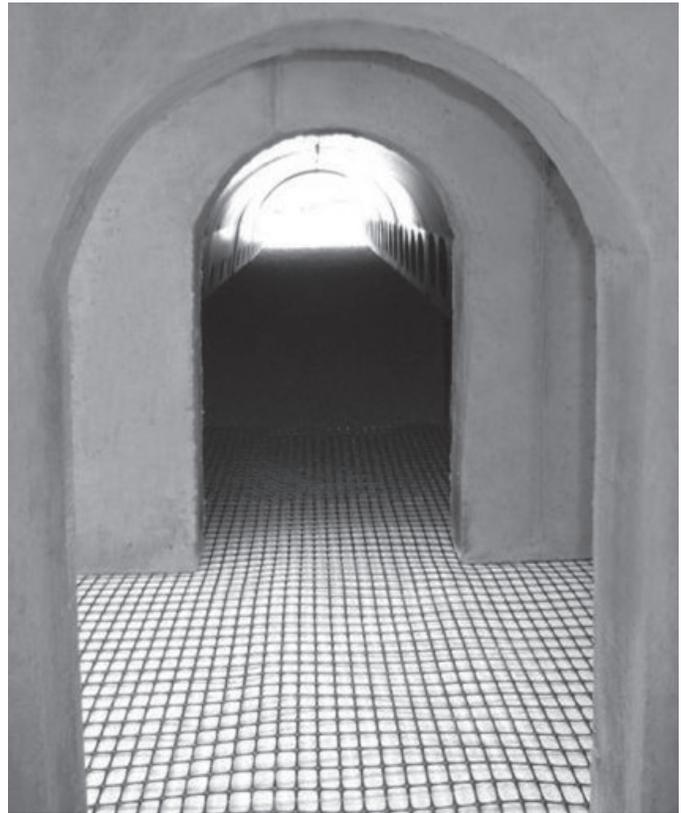
The entire treatment train should be inspected and maintained. The treatment train may consist of an upstream sump manhole, or pre-treatment HDS device. Inspections should start at the upstream device and continue downstream to the discharge orifice if incorporated into the arch system.

### Pre-Treatment Device Inspection

Inspection and maintenance procedures provided by the manufacturer should be followed for pre-treatment systems such as a CDS<sup>®</sup>, Vortechs<sup>®</sup>, VortSentry<sup>®</sup> or VortSentry<sup>®</sup> HS. Expected pollutants will be floatable trash, sediment, oil and grease. Pre-treatment devices are recommended for all detention/retention devices regardless of type.

### Distribution Manifold Inspection

The distribution manifold spreads the incoming flows into the various rows of arches. The majority of sediment will be captured in the distribution manifold, due to the lower velocities induced which allows the particles to settle out.



A distribution manifold is typically located at one end of every row of arches. Inspection can be done through manhole access and visually inspecting the distribution manifold. When the depth of sediment accumulates over 4 inches (102 mm), cleanout is recommended.

### Visual Inspection

Maintenance or further investigation may be required if any of the following conditions exist:

- Evidence of an unusual amount of silt and soil build-up on the surface
- Clogged outlet drainpipe
- System does not drain to the elevation of the lowest pipe in dry conditions
- Evidence of potholes or sinkholes

## Maintenance

Underground stormwater retention/detention systems should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on site activities rather than the size or configuration of the system. If accumulated silt is interfering with the operation of the detention system (i.e.: blocking outlet pipes or deposits significantly reduce the storage capacity of the system) it should be removed.

It is easiest to maintain a system when there is no flow entering. For this reason, cleanout should be scheduled during dry weather.

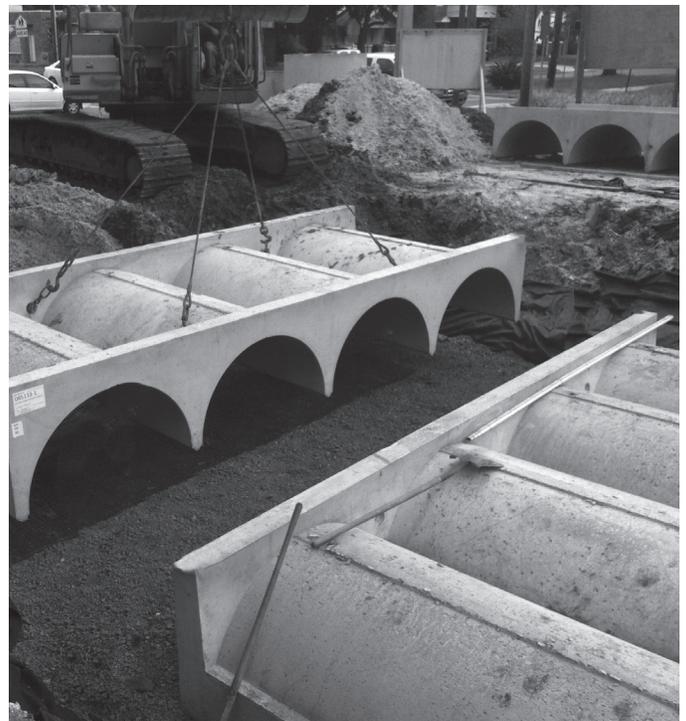
It is important to block the outlet pipe from the system prior to maintenance to limit the potential for pollutants to be flushed downstream.

A vacuum truck or other similar devices can be used to remove sediment from the treatment train and distribution manifold. Starting upstream, maintain manholes with sumps and any pre-treatment devices (following manufacturer recommended procedures). Once maintenance is complete, replace all caps, lids and covers. It is important to document maintenance events on the Inspection and Maintenance Log.

### Terre Arch Row Maintenance

If maintenance to the arch rows is required, a JetVac truck utilizing a high pressure nozzle (sledge dredging tool) with rear facing jets will be required. Insert the nozzle from the distribution manifold into the arch row through the opening. Turn the water feed hose on and feed the supply hose until the nozzle has reached the end of the arch row. Withdraw the nozzle slowly.

The tool will backflush the arch row forcing debris into the distribution manifold. Use the stringer vacuum hose to remove the sediments and debris from the distribution manifold. Multiple passes may be required to fully cleanout the arch row. Use caution to minimize movement of stone bedding at the arch invert while performing this task; relevel stone as needed. Vacuum out the distribution manifold and remove all debris that may be clogging the outlet pipe.



# Inspection & Maintenance Log Sample Template

Terre Arch			Location	
Date	Depth of Sediment	Accumulated Trash	Name of Inspector	Maintenance Performed/Notes



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**The product(s) described may be protected by one or more of the following US patents:  
7,798,747; 7,828,496**

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## **5.0 MAINTENANCE LOGS:**

Proof of these inspections is the responsibility of the property owner. Inspection/Maintenance Logs shall be submitted to the Municipal Engineer annually, and copies of these reports must be kept onsite and made available for inspection by the Municipality if requested. Inspections should be a part of the standard operating procedure.

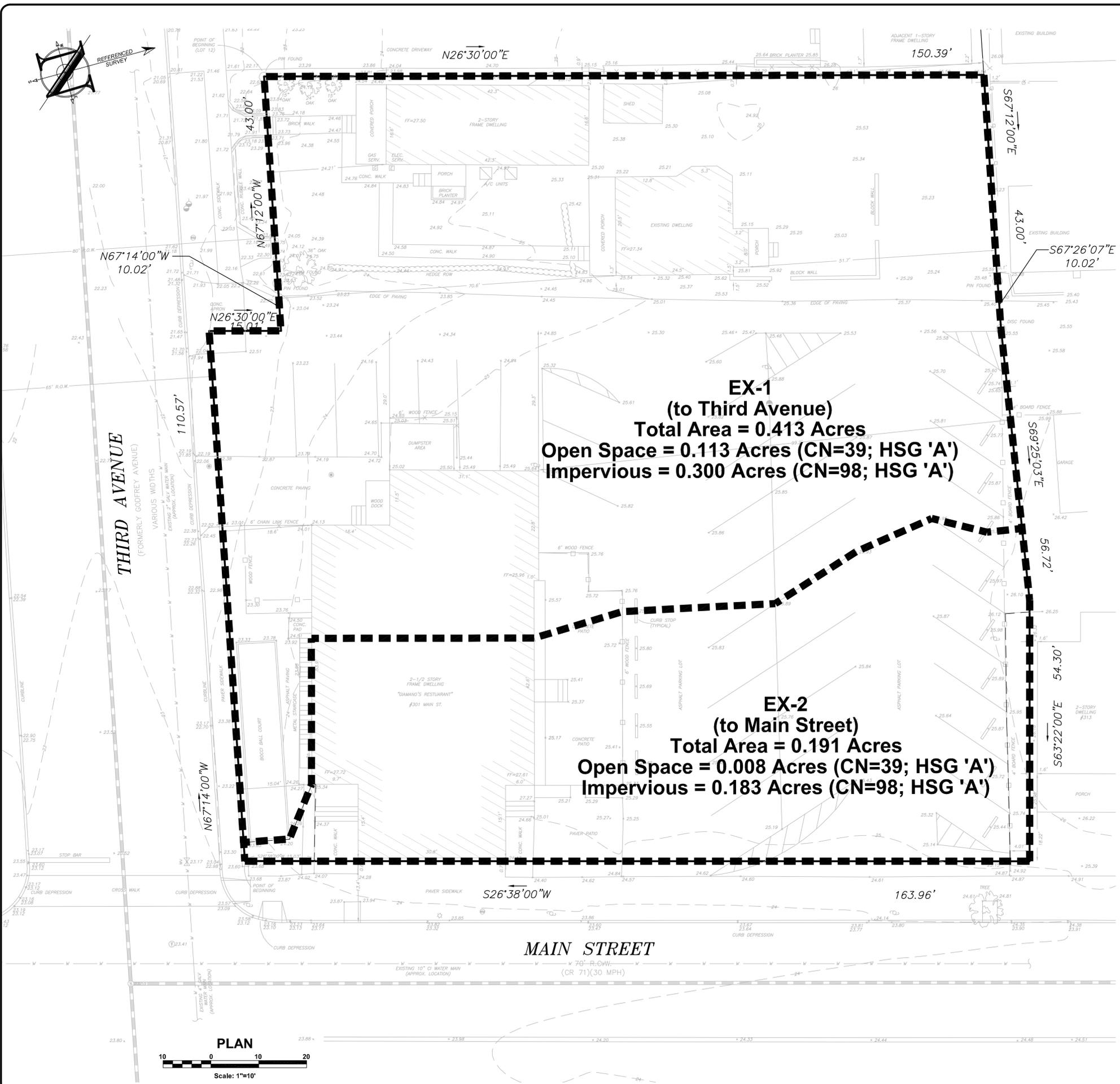
The maintenance logs shall include the following information:

- 1 – The name of the person(s) performing the maintenance.
- 2 – The date that the maintenance was performed.
- 3 – The location of the maintenance.
- 4 – A clear description of the type of maintenance performed.
- 5 – Any observations and comments

An example is attached.

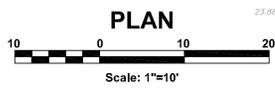


## **PRE-DEVELOPMENT DRAINAGE AREA MAP**



**EX-1  
(to Third Avenue)**  
**Total Area = 0.413 Acres**  
**Open Space = 0.113 Acres (CN=39; HSG 'A')**  
**Impervious = 0.300 Acres (CN=98; HSG 'A')**

**EX-2  
(to Main Street)**  
**Total Area = 0.191 Acres**  
**Open Space = 0.008 Acres (CN=39; HSG 'A')**  
**Impervious = 0.183 Acres (CN=98; HSG 'A')**



**NOTE:**  
 UNLESS OTHERWISE NOTED, A MINIMUM TIME OF  
 CONCENTRATION OF 10 MINS HAS BEEN USED FOR ALL AREAS

**PROJECT INFORMATION**

**PROPOSED  
 MIXED-USE  
 BUILDING**

**PROJECT LOCATION:** TAX MAP SHEET #11  
 BLOCK 59, LOTS 9-11; 301 MAIN STREET  
 BOROUGH OF BRADLEY BEACH,  
 MONMOUTH COUNTY, NJ

**OWNER:**  
**301 MAIN STREET HOLDINGS, LLC**  
 PO BOX 185  
 GLEN ROCK, 07452  
 Ph (201) 914-7094

**APPLICANT:**  
**301 MAIN STREET HOLDINGS, LLC**  
 PO BOX 185  
 GLEN ROCK, 07452  
 Ph (201) 914-7094

**APPLICANT'S PROFESSIONALS**

**ATTORNEY:**  
**MICHAEL A. BRUNO, ESQ.**  
**GIORDANO, HALLERAN & CIESLA, PC**  
 125 HALF MILE ROAD, SUITE 300  
 RED BANK, NJ 07701

**ARCHITECT:**  
**MONTEFORTE ARCHITECTURAL STUDIO**  
 733 ROUTE 35, SUITE C  
 OCEAN, NJ 07712

**SURVEYOR:**  
**FRD SURVEYING, LLC**  
 136 GOLF VIEW BOULEVARD  
 TOMS RIVER, NJ 08753



**CALL BEFORE YOU DIG!**  
 NJ ONE CALL...800-272-1000  
 (NJ One Call is not a guarantee)

ELECTRIC	RED
GAS	ORANGE
COMMUNICATION / TV	YELLOW
SEWER	GREEN
TEMP. SURVEY MARKERS	MAGENTA
PROPOSED EXCAVATION	WHITE



InSite Engineering, LLC  
 CERTIFICATE OF AUTHORIZATION: 24GA28083200  
 1913 ATLANTIC AVENUE, SUITE F4, WALL, NJ 08736  
 732-531-7100 (PH) 732-531-7344 (FAX)  
 InSite@InSiteEng.net www.InSiteEng.net

LICENSED IN: NEW JERSEY, NEW YORK, PENNSYLVANIA  
 DELAWARE, CONNECTICUT, NORTH CAROLINA  
 COLORADO, & DISTRICT OF COLUMBIA

**CAUTION:** IF THIS DOCUMENT DOES NOT CONTAIN THE SIGNATURE  
 AND RAISED SEAL OF THE PROFESSIONAL, IT IS NOT AN ORIGINAL  
 AND MAY HAVE BEEN ALTERED

**Patrick R. Ward, PE, PP**  
 NJPE 24GE09079000 NJPP 33L100626800

**REVISIONS**

Rev. #	Date	Comment

0 03/12/20 INITIAL RELEASE  
 SCALE: AS SHOWN DESIGNED BY: PRW  
 DATE: 03/12/20 DRAWN BY: TJJ  
 JOB #: 20-1356-01 CHECKED BY: PRW  
 CAD ID: 20-1356-01 R0 AMENDED

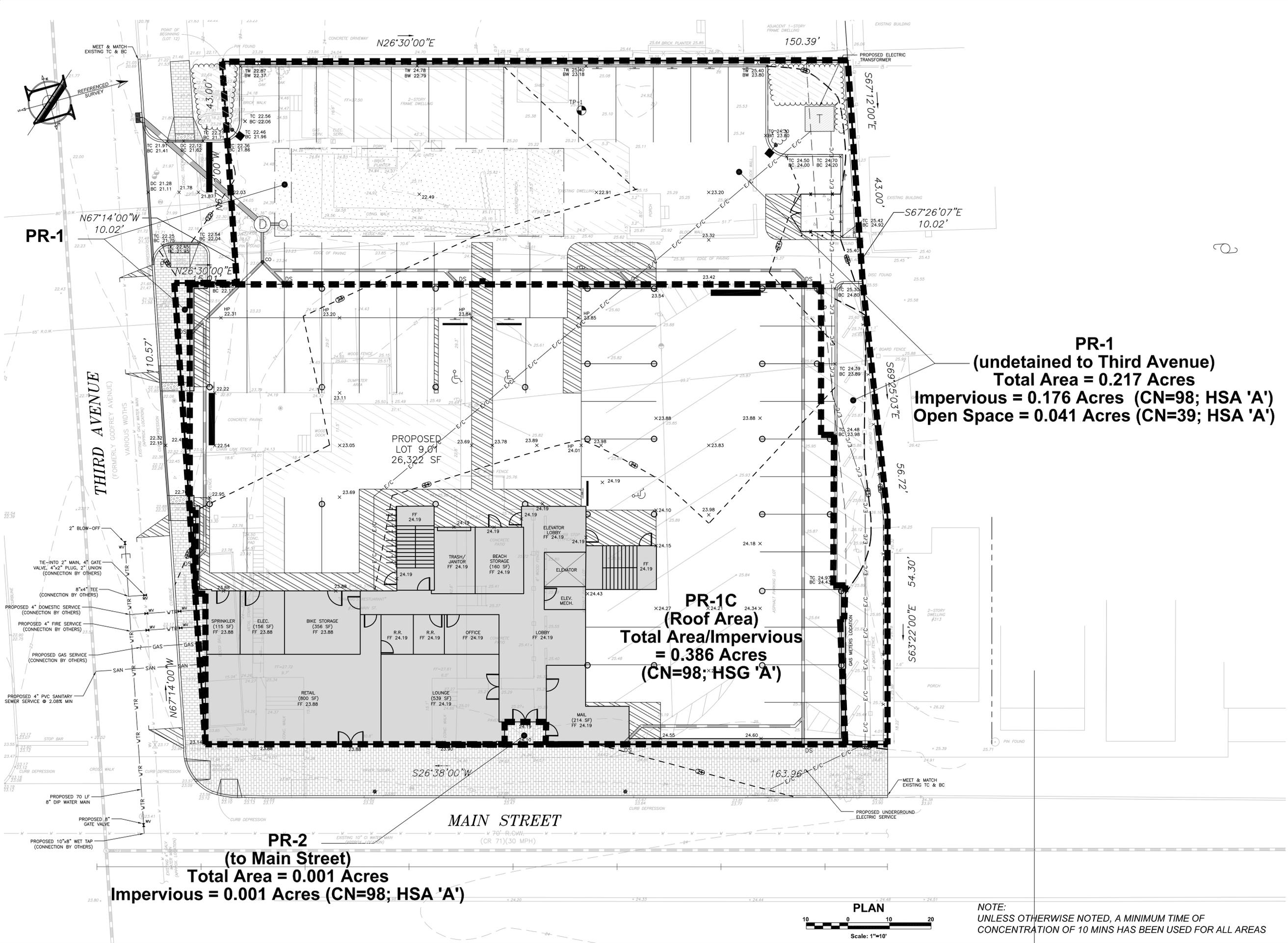
NOT FOR CONSTRUCTION  
 FOR CONSTRUCTION

**PLAN INFORMATION**

**AMENDED PRELIMINARY &  
 FINAL MAJOR SITE PLAN**

**SHEET TITLE:**  
**EXISTING DRAINAGE  
 AREA MAP**

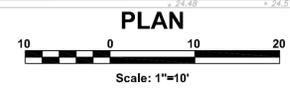
## **POST DEVELOPMENT DRAINAGE AREA MAP**



**PR-1**  
 (undetained to Third Avenue)  
 Total Area = 0.217 Acres  
 Impervious = 0.176 Acres (CN=98; HSA 'A')  
 Open Space = 0.041 Acres (CN=39; HSA 'A')

**PR-1C**  
 (Roof Area)  
 Total Area/Impervious  
 = 0.386 Acres  
 (CN=98; HSG 'A')

**PR-2**  
 (to Main Street)  
 Total Area = 0.001 Acres  
 Impervious = 0.001 Acres (CN=98; HSA 'A')



**NOTE:**  
 UNLESS OTHERWISE NOTED, A MINIMUM TIME OF  
 CONCENTRATION OF 10 MINS HAS BEEN USED FOR ALL AREAS

**PROJECT INFORMATION**

**PROPOSED MIXED-USE BUILDING**

**PROJECT LOCATION:** TAX MAP SHEET #11  
 BLOCK 59, LOTS 9-11, 301 MAIN STREET  
 BLOCK 59, LOT 12, 704 1/2 THIRD AVENUE  
 BOROUGH OF BRADLEY BEACH,  
 MONMOUTH COUNTY, NJ

**OWNER:**  
**301 MAIN STREET HOLDINGS, LLC**  
 PO BOX 185  
 GLEN ROCK, 07452  
 Ph (201) 914-7094

**APPLICANT:**  
**301 MAIN STREET HOLDINGS, LLC**  
 PO BOX 185  
 GLEN ROCK, 07452  
 Ph (201) 914-7094

**APPLICANT'S PROFESSIONALS**

**ATTORNEY:**  
 MICHAEL A. BRUNO, ESQ.  
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 125 HALF MILE ROAD, SUITE 300  
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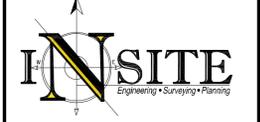
**ARCHITECT:**  
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 733 ROUTE 35, SUITE C  
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**SURVEYOR:**  
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DATE: 03/12/20 DRAWN BY: TJJ

JOB #: 20-1356-01 CHECKED BY: PRW

CAD ID: 20-1356-01 R0 AMENDED

NOT FOR CONSTRUCTION APPROVED BY:

**PLAN INFORMATION**

DRAWING TITLE:  
 AMENDED PRELIMINARY &  
 FINAL MAJOR SITE PLAN

SHEET TITLE:  
 PROPOSED DRAINAGE  
 AREA MAP

SHEET NO:  
 1 OF 1