STORMWATER MANAGEMENT REPORT

for

PROPOSED MIXED-USE DEVELOPMENT

located at

160 FIRST AVENUE
BLOCK 101, LOT 4.01

in the

BOROUGH OF ATLANTIC HIGHLANDS
MONMOUTH COUNTY, NJ

has been prepared for

KALIAN MANAGEMENT LLC

2 HENESSEY BOULEVARD, SUITE 1
ATLANTIC HIGHLANDS, NJ 07716

on

January 30, 2023
Last Revised November 03, 2023

InSite Project No. 22-756-10

Patrick R. Ward, PE, PP
NJPE #50790

InSite Engineering, LLC
1955 Route 34, Suite 1A • Wall, NJ 07719
732-531-7100 (ph) • 732-531-7344 (fx) • InSite@InSiteEng.net • www.InSiteEng.net
Licensed in NJ, PA, DE, NY, CT, NC, DC, & CO

TABLE OF CONTENTS

APPENDICES

1 INTRODUCTION

The subject property is known and designated as Block 101, Lot 4.01 as shown on Tax Map #22 of the Borough of Atlantic Highlands. The existing site encompasses 19,905 SF (approximately 0.46 acres). The Preliminary and Final Major Site Plan and Stormwater Management Report have been prepared by this office on behalf of the Applicant, Kalian Management, LLC.

2 PROJECT SCOPE

The site is located on the northeastern corner of First Avenue and East Garfield Avenue, in the Borough of Atlantic Highlands. It is bound to the south by East Garfield Avenue with an office building beyond; to the west by First Avenue with existing commercial buildings beyond; to the north by a new mixed-use development; and to the east by a vacant lot. The site is located within the CBD (Commercial Business District) Zone as indicated on the Borough's zoning map. The lot is currently developed with a liquor store use. The site has a high point of 22.98 located at the northeast property corner and a low point of 18.57 located at the southwest driveway entrance. The existing grade is gentle sloping at an overall rate of approximately 3% from southeast to northwest.

The Applicant is proposing to develop the property with a four-story, 12,700 square foot residential/retail building with associated parking. Additional improvements include supplemental lighting and landscaping measures around the proposed parking facilities. A permeable asphalt paving system will be used to infiltrate and offset the runoff generated by the minor increase in impervious surfaces.

3 BASIS OF COMPARISON

The rules and regulations of the Borough of Atlantic Highlands mimic the NJDEP stormwater regulations. This project falls under the Borough's and State's definition of a minor development which states that projects not generating one or more acres of land disturbance or one quarter or more acres of impervious surface are exempt. Therefore, water quality and recharge BMP's are not required as a part of this application. However, with the development of the residential/retail building and the increase in impervious area, stormwater runoff rates and volumes will increase.

The Borough of Atlantic Highlands requires stormwater management to mitigate the increased runoff generated by the development. The summary below and attached calculations will show how the proposed permeable asphalt system is adequate to handle any extra runoff generated by the proposed development.

4 METHODOLOGY & DESIGN

The pre- and post-development stormwater runoff calculations follow the methodology outlined in Soil Conservation Service Technical Release No.'s 55 and 20 (TR-55 and TR-20). The data to support these calculations was obtained from field survey data, the applicable USGS mapping for the site, and the applicable Soil Survey for the site. The calculations were performed using HydroCAD 10.10-7a.

Prior to the design, a detailed soils investigation was performed on the property by Whitestone Associates, Inc. Soil permeability testing was performed on soil to determine infiltration rates. A factor of safety of two (2) is applied to the lower limits of the soils permeability results to determine the design infiltration rate. The results of these test ratings are included with detailed soil profile logs as an appendix to this report.

Under existing conditions all runoff generated on site flows to the south and western property lines, where it is collected in the municipal right-of-way via sheet flow. Under proposed conditions all roof area and parking area is collected and conveyed to the recharge pipe to infiltrate the increase in runoff for the 25-year storm event.

Runoff generated by the roof is conveyed through an six (6") inch PVC exterior downspout collection system and into the storage system via E-inlets in the parking area and 6" perforated pvc. A summary analysis of the existing and proposed flow rates which leave the site are summarized as follows:

InSite Engineering, LLC
1955 Route 34, Suite 1A • Wall, NJ 07719
732-531-7100 (ph) • 732-531-7344 (fx) • InSite@InSiteEng.net • www.InSiteEng.net
Licensed in NJ, PA, DE, NY, CT, NC, DC, & CO

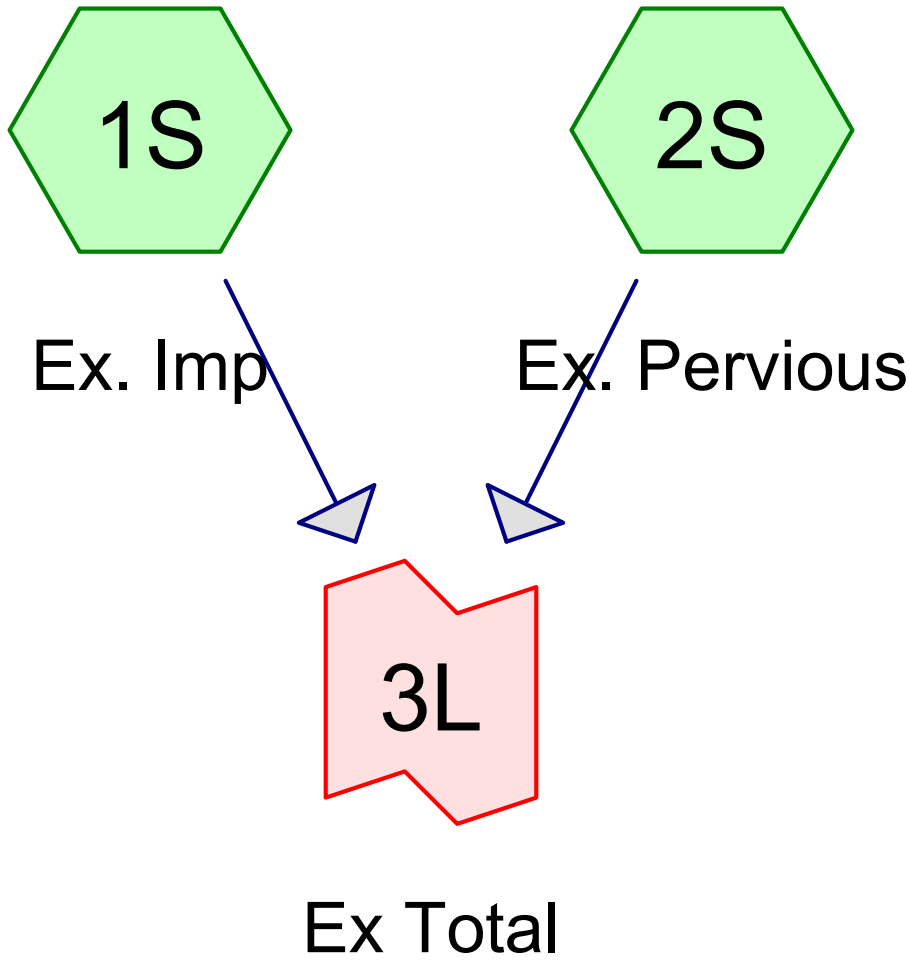
Storm Event	Existing Conditions	Proposed Conditions
2-Year	1.83 cfs	0.26 cfs
10-Year	2.86 cfs	0.41 cfs
25-Year	3.55 cfs	0.51 cfs
100-Year	4.91 cfs	0.73 cfs

5 CONCLUSION

As indicated within the attached calculations and described above, the peak run-off rates for the two-, 10-, 25- and 100-year storm event will decrease from existing to proposed conditions. Therefore, the proposed development is not anticipated to have adverse hydrologic impacts on the subject property or surrounding community.

APPENDICES

A. EXISTING CONDITIONS RUNOFF CALCULATIONS



Subcat Reach Pond Link

Routing Diagram for r4 Monmouth County
Prepared by Insite Engineering, LLC, Printed 11/8/2023

Summary for Subcatchment 1S: Ex. Imp

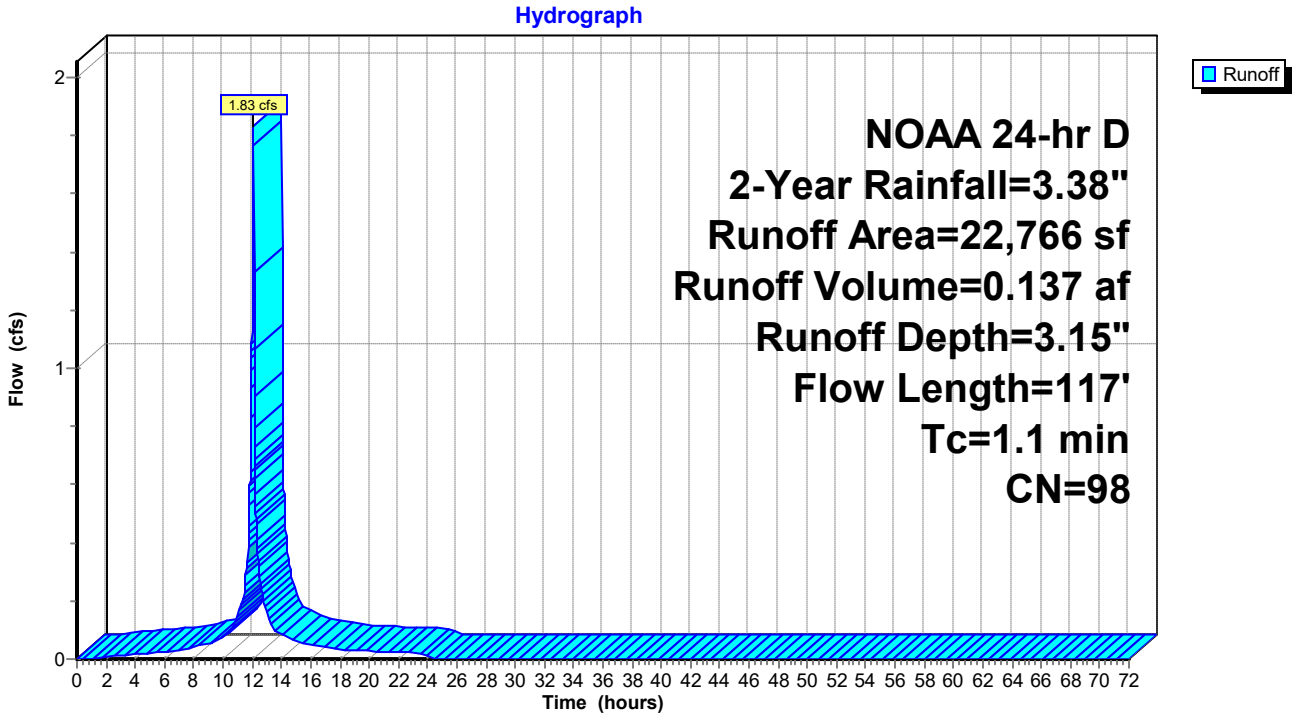
Runoff = 1.83 cfs @ 12.10 hrs, Volume= 0.137 af, Depth= 3.15"
Routed to Link 3L : Ex Total

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 2-Year Rainfall=3.38"

Area (sf)	CN	Description
22,766	98	Paved parking, HSG A
22,766		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	100	0.0285	1.63		**Sheet Flow, 22.30-19.45** Smooth surfaces n= 0.011 P2= 3.40"
0.1	17	0.0353	3.81		**Shallow Concentrated Flow, 19.45-18.85** Paved Kv= 20.3 fps
1.1	117	Total			

Subcatchment 1S: Ex. Imp



Summary for Subcatchment 2S: Ex. Pervious

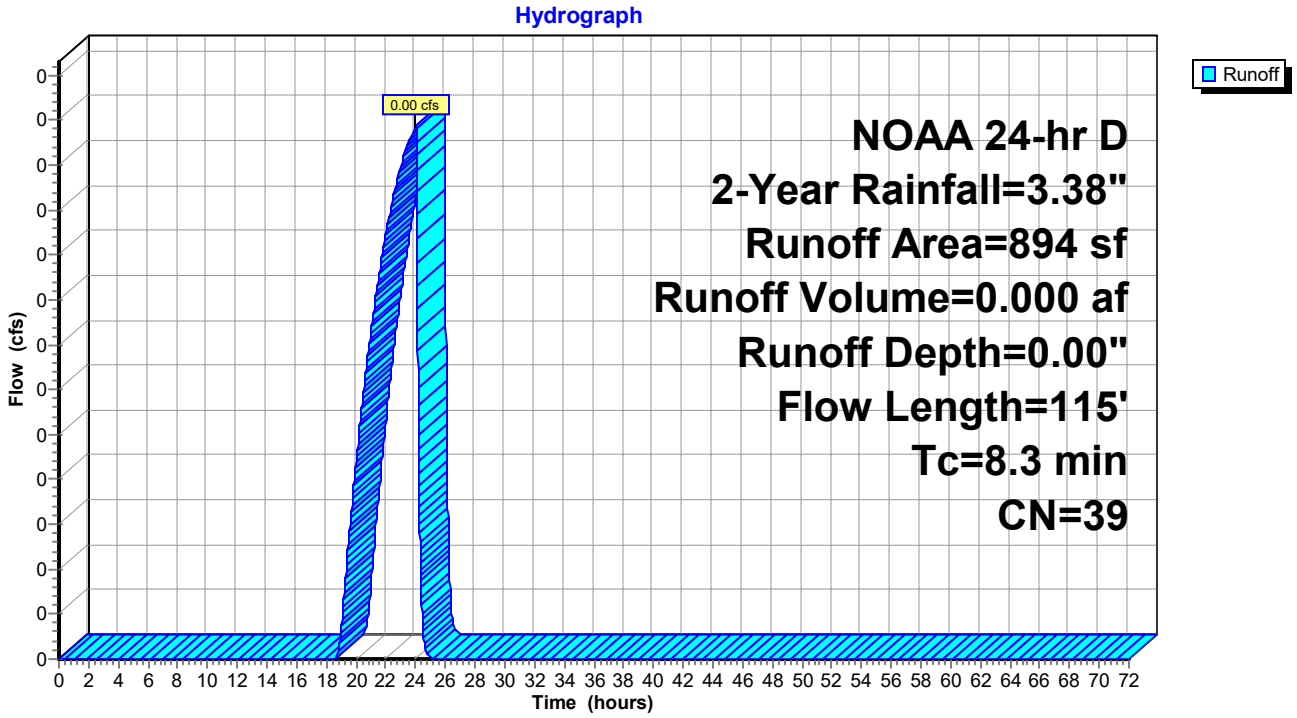
Runoff = 0.00 cfs @ 24.01 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Link 3L : Ex Total

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 2-Year Rainfall=3.38"

Area (sf)	CN	Description
894	39	>75% Grass cover, Good, HSG A
894		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	100	0.0293	0.20		**Sheet Flow, 23.00-20.07** Grass: Short n= 0.150 P2= 3.40"
0.1	15	0.0680	4.20		**Shallow Concentrated Flow, 20.07-19.05** Unpaved Kv= 16.1 fps
8.3	115	Total			

Subcatchment 2S: Ex. Pervious

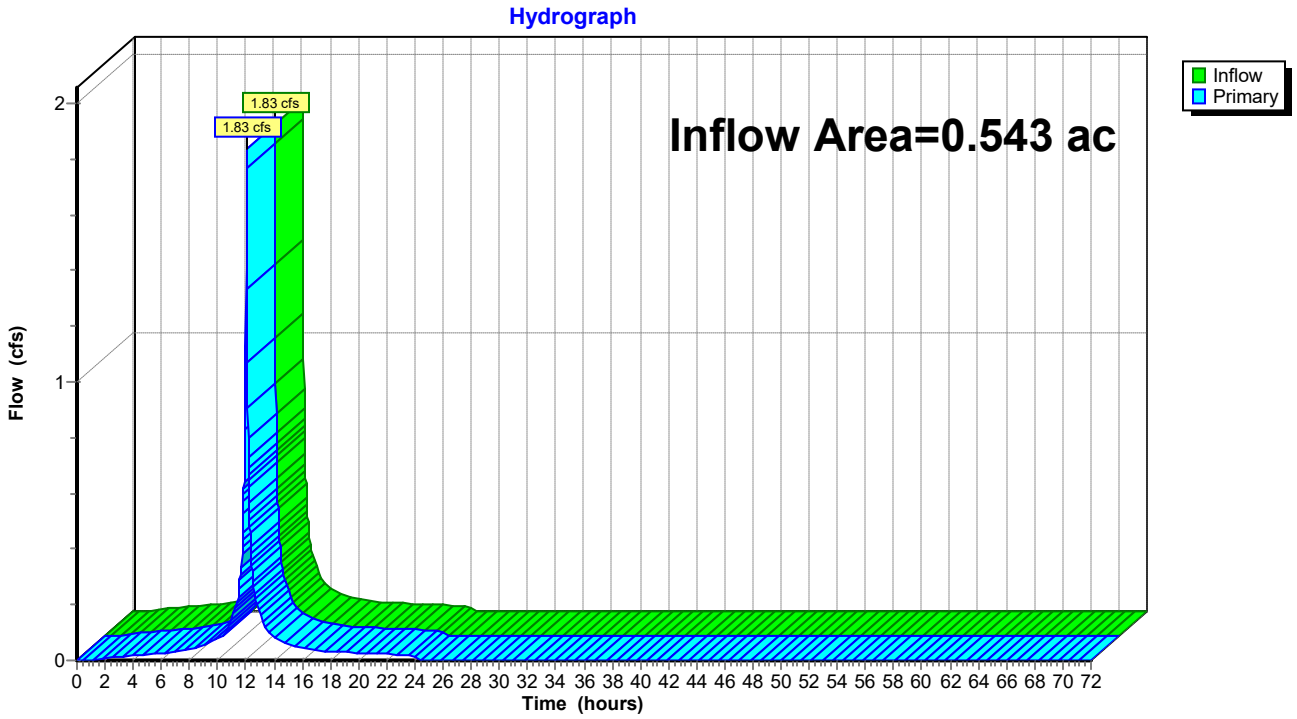


Summary for Link 3L: Ex Total

Inflow Area = 0.543 ac, 96.22% Impervious, Inflow Depth = 3.03" for 2-Year event
Inflow = 1.83 cfs @ 12.10 hrs, Volume= 0.137 af
Primary = 1.83 cfs @ 12.10 hrs, Volume= 0.137 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link 3L: Ex Total



Summary for Subcatchment 1S: Ex. Imp

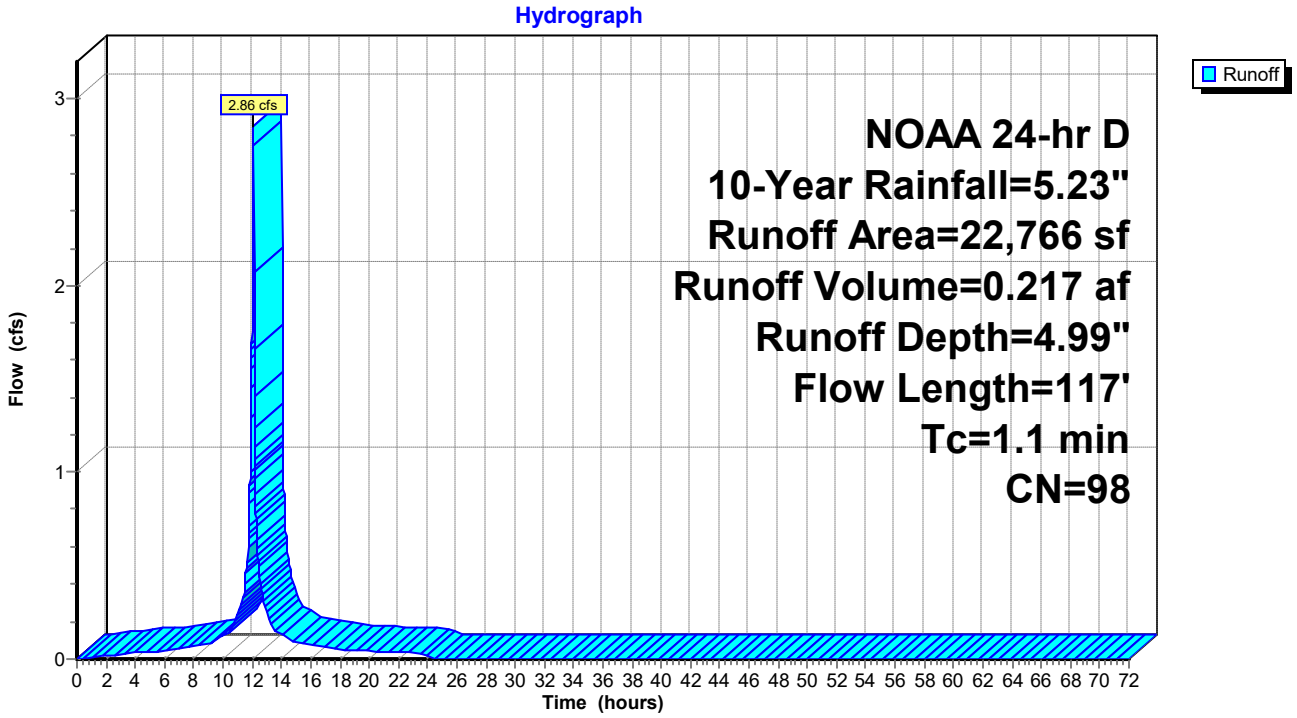
Runoff = 2.86 cfs @ 12.10 hrs, Volume= 0.217 af, Depth= 4.99"
Routed to Link 3L : Ex Total

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 10-Year Rainfall=5.23"

Area (sf)	CN	Description
22,766	98	Paved parking, HSG A
22,766		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	100	0.0285	1.63		**Sheet Flow, 22.30-19.45** Smooth surfaces n= 0.011 P2= 3.40"
0.1	17	0.0353	3.81		**Shallow Concentrated Flow, 19.45-18.85** Paved Kv= 20.3 fps
1.1	117	Total			

Subcatchment 1S: Ex. Imp



Summary for Subcatchment 2S: Ex. Pervious

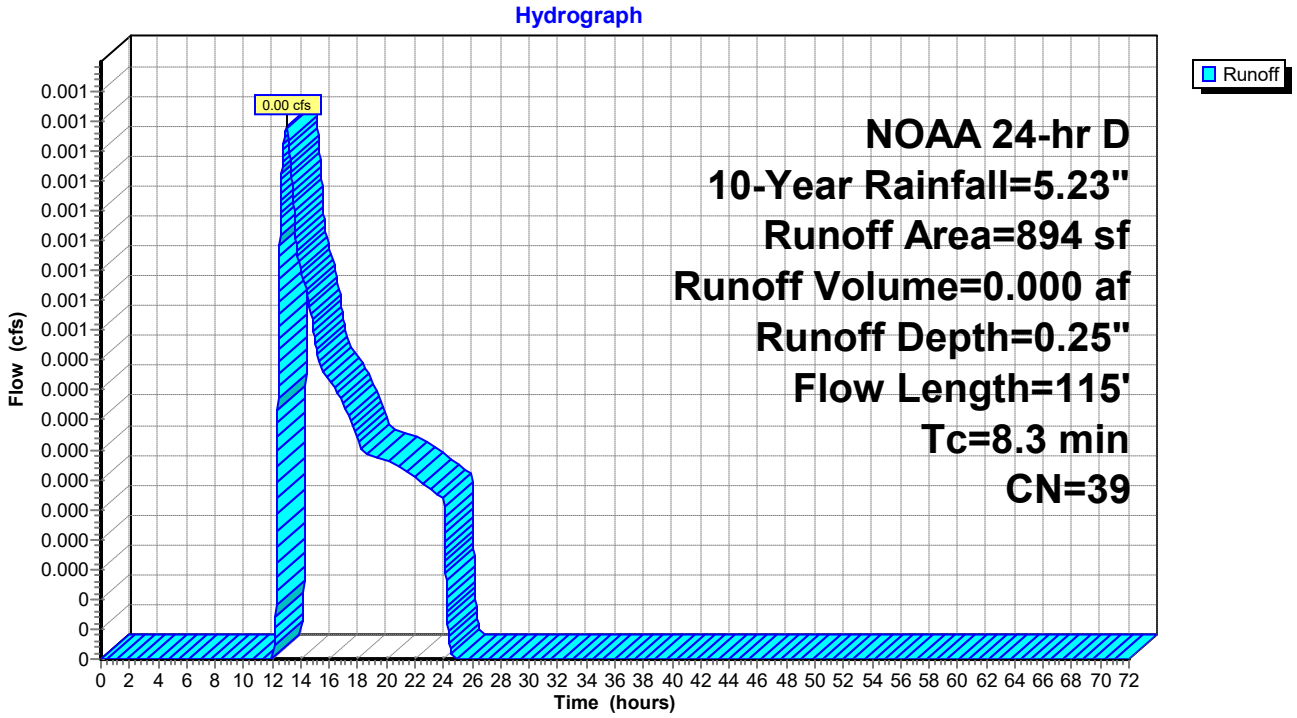
Runoff = 0.00 cfs @ 12.96 hrs, Volume= 0.000 af, Depth= 0.25"
Routed to Link 3L : Ex Total

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 10-Year Rainfall=5.23"

Area (sf)	CN	Description
894	39	>75% Grass cover, Good, HSG A
894		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	100	0.0293	0.20		**Sheet Flow, 23.00-20.07** Grass: Short n= 0.150 P2= 3.40"
0.1	15	0.0680	4.20		**Shallow Concentrated Flow, 20.07-19.05** Unpaved Kv= 16.1 fps
8.3	115	Total			

Subcatchment 2S: Ex. Pervious

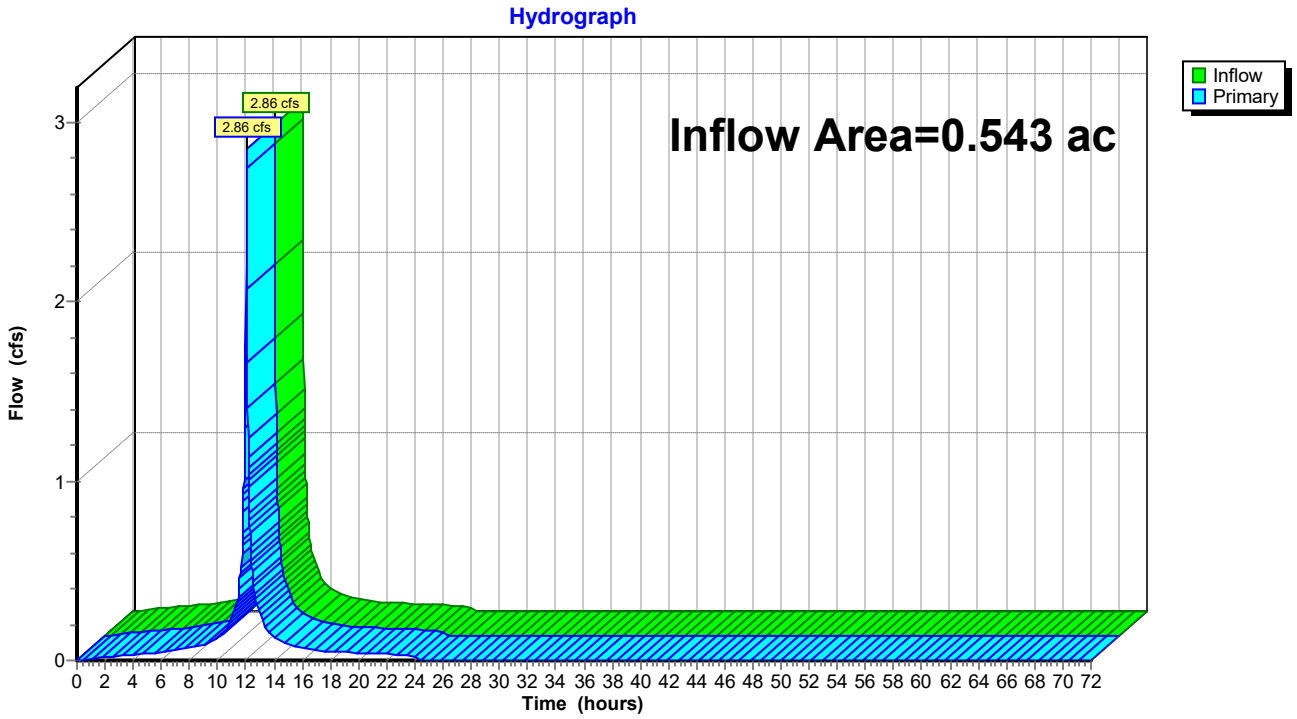


Summary for Link 3L: Ex Total

Inflow Area = 0.543 ac, 96.22% Impervious, Inflow Depth = 4.81" for 10-Year event
Inflow = 2.86 cfs @ 12.10 hrs, Volume= 0.218 af
Primary = 2.86 cfs @ 12.10 hrs, Volume= 0.218 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link 3L: Ex Total



Summary for Subcatchment 1S: Ex. Imp

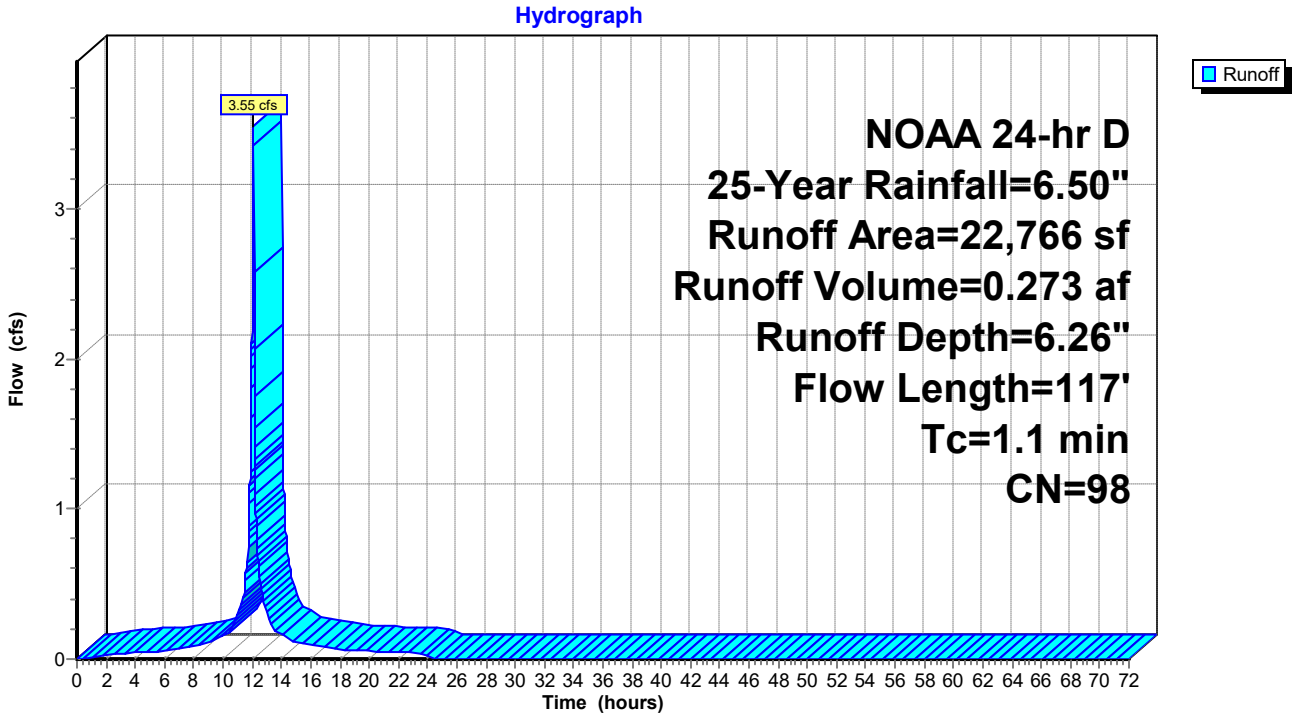
Runoff = 3.55 cfs @ 12.10 hrs, Volume= 0.273 af, Depth= 6.26"
Routed to Link 3L : Ex Total

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 25-Year Rainfall=6.50"

Area (sf)	CN	Description
22,766	98	Paved parking, HSG A
22,766		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	100	0.0285	1.63		**Sheet Flow, 22.30-19.45** Smooth surfaces n= 0.011 P2= 3.40"
0.1	17	0.0353	3.81		**Shallow Concentrated Flow, 19.45-18.85** Paved Kv= 20.3 fps
1.1	117	Total			

Subcatchment 1S: Ex. Imp



Summary for Subcatchment 2S: Ex. Pervious

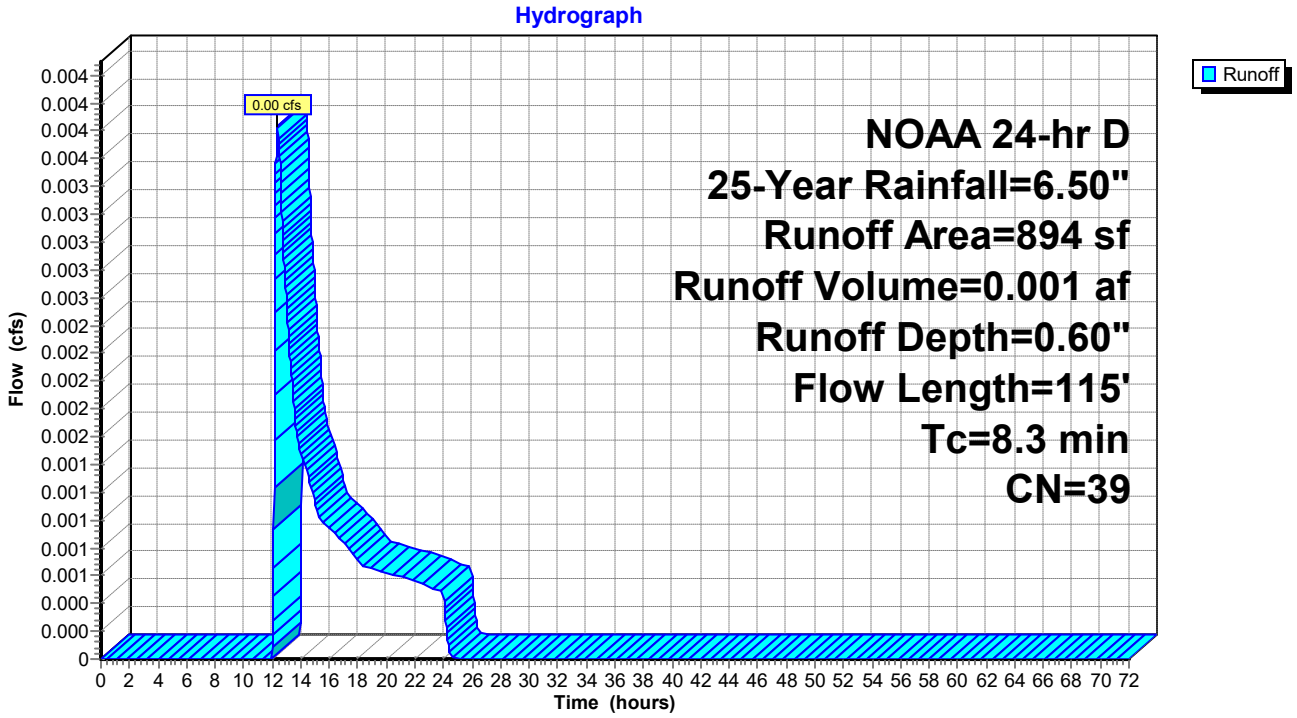
Runoff = 0.00 cfs @ 12.36 hrs, Volume= 0.001 af, Depth= 0.60"
Routed to Link 3L : Ex Total

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 25-Year Rainfall=6.50"

Area (sf)	CN	Description
894	39	>75% Grass cover, Good, HSG A
894		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	100	0.0293	0.20		**Sheet Flow, 23.00-20.07** Grass: Short n= 0.150 P2= 3.40"
0.1	15	0.0680	4.20		**Shallow Concentrated Flow, 20.07-19.05** Unpaved Kv= 16.1 fps
8.3	115	Total			

Subcatchment 2S: Ex. Pervious

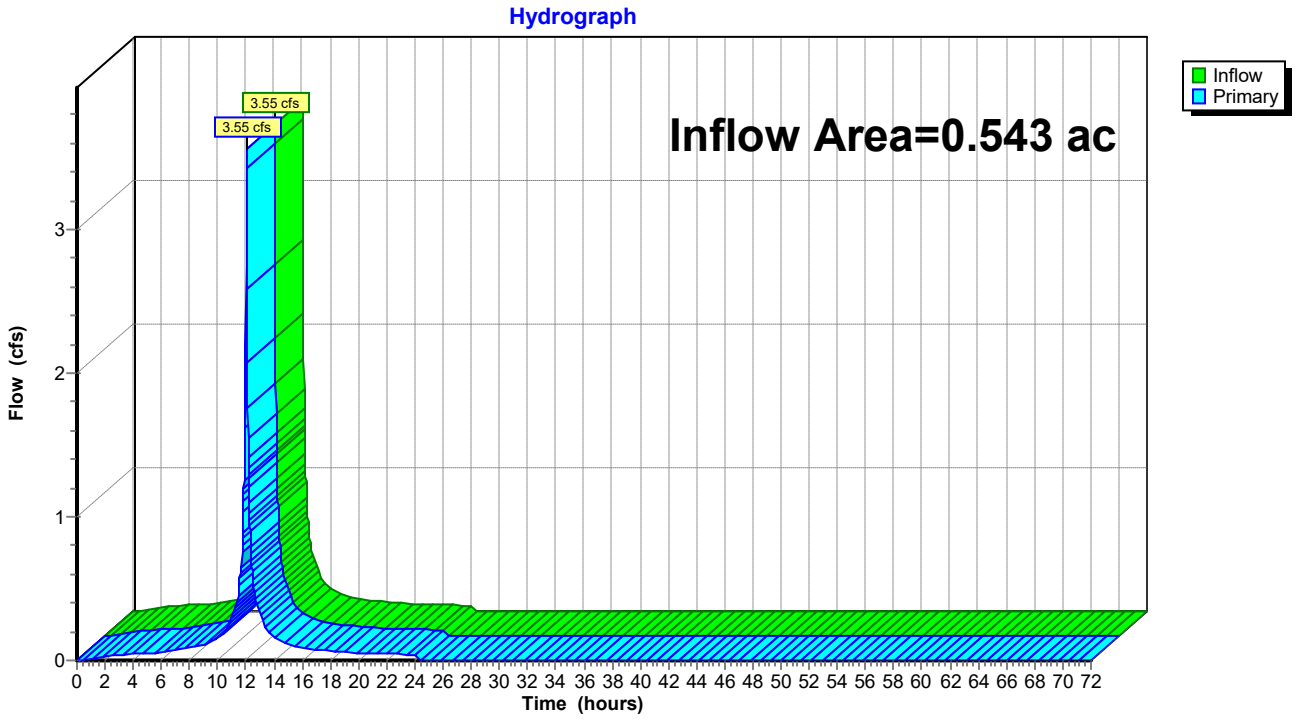


Summary for Link 3L: Ex Total

Inflow Area = 0.543 ac, 96.22% Impervious, Inflow Depth = 6.05" for 25-Year event
Inflow = 3.55 cfs @ 12.10 hrs, Volume= 0.274 af
Primary = 3.55 cfs @ 12.10 hrs, Volume= 0.274 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link 3L: Ex Total



Summary for Subcatchment 1S: Ex. Imp

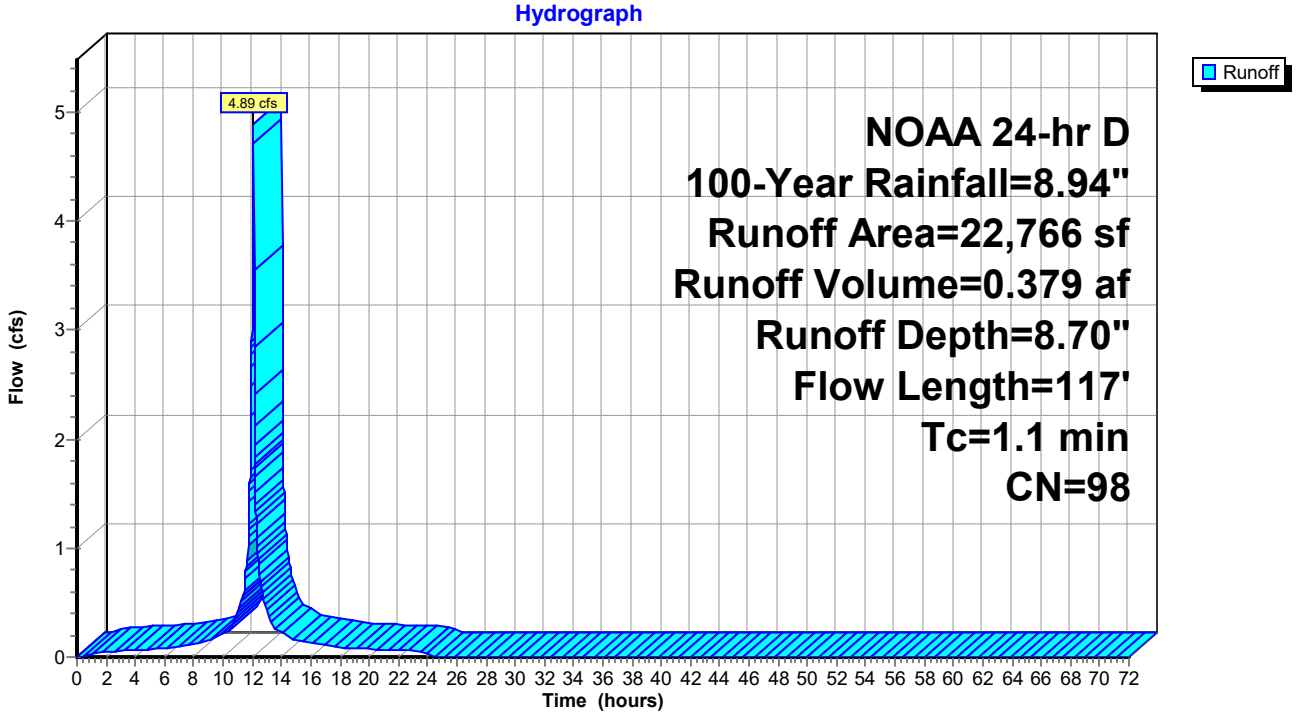
Runoff = 4.89 cfs @ 12.10 hrs, Volume= 0.379 af, Depth= 8.70"
Routed to Link 3L : Ex Total

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 100-Year Rainfall=8.94"

Area (sf)	CN	Description
22,766	98	Paved parking, HSG A
22,766		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	100	0.0285	1.63		**Sheet Flow, 22.30-19.45** Smooth surfaces n= 0.011 P2= 3.40"
0.1	17	0.0353	3.81		**Shallow Concentrated Flow, 19.45-18.85** Paved Kv= 20.3 fps
1.1	117	Total			

Subcatchment 1S: Ex. Imp



Summary for Subcatchment 2S: Ex. Pervious

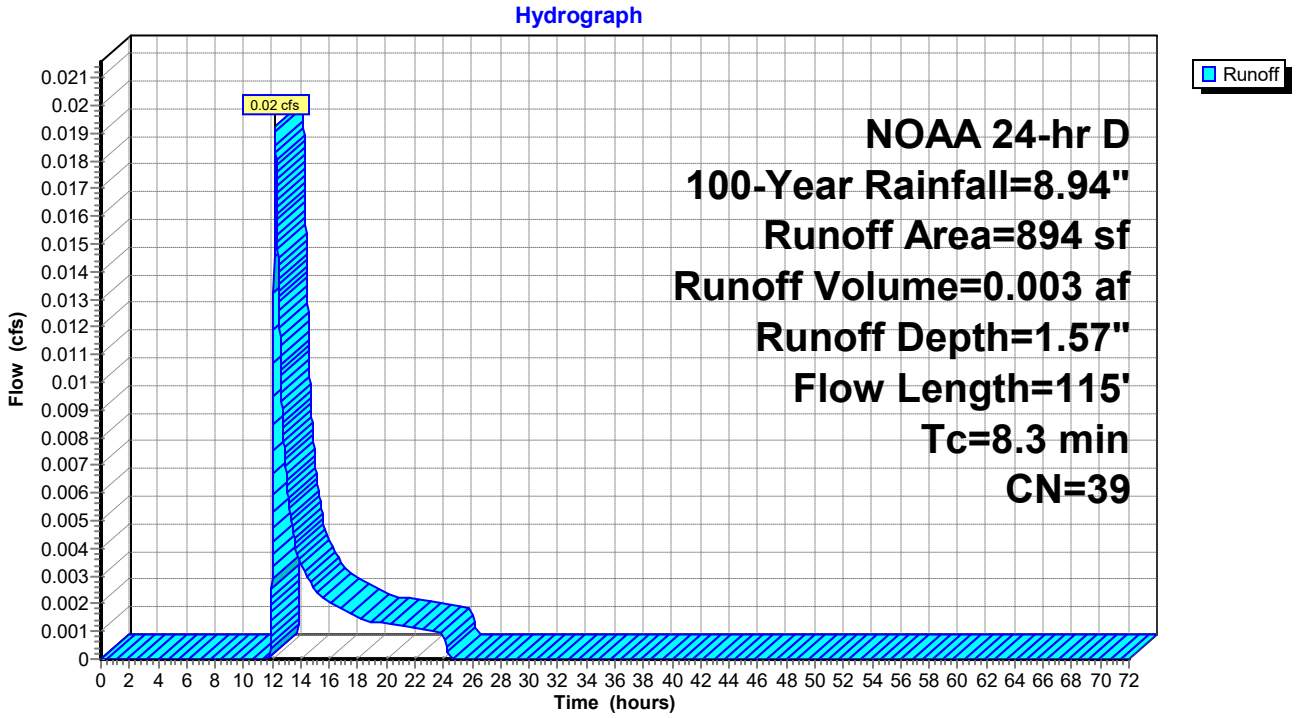
Runoff = 0.02 cfs @ 12.19 hrs, Volume= 0.003 af, Depth= 1.57"
Routed to Link 3L : Ex Total

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 100-Year Rainfall=8.94"

Area (sf)	CN	Description
894	39	>75% Grass cover, Good, HSG A
894		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	100	0.0293	0.20		**Sheet Flow, 23.00-20.07** Grass: Short n= 0.150 P2= 3.40"
0.1	15	0.0680	4.20		**Shallow Concentrated Flow, 20.07-19.05** Unpaved Kv= 16.1 fps
8.3	115	Total			

Subcatchment 2S: Ex. Pervious

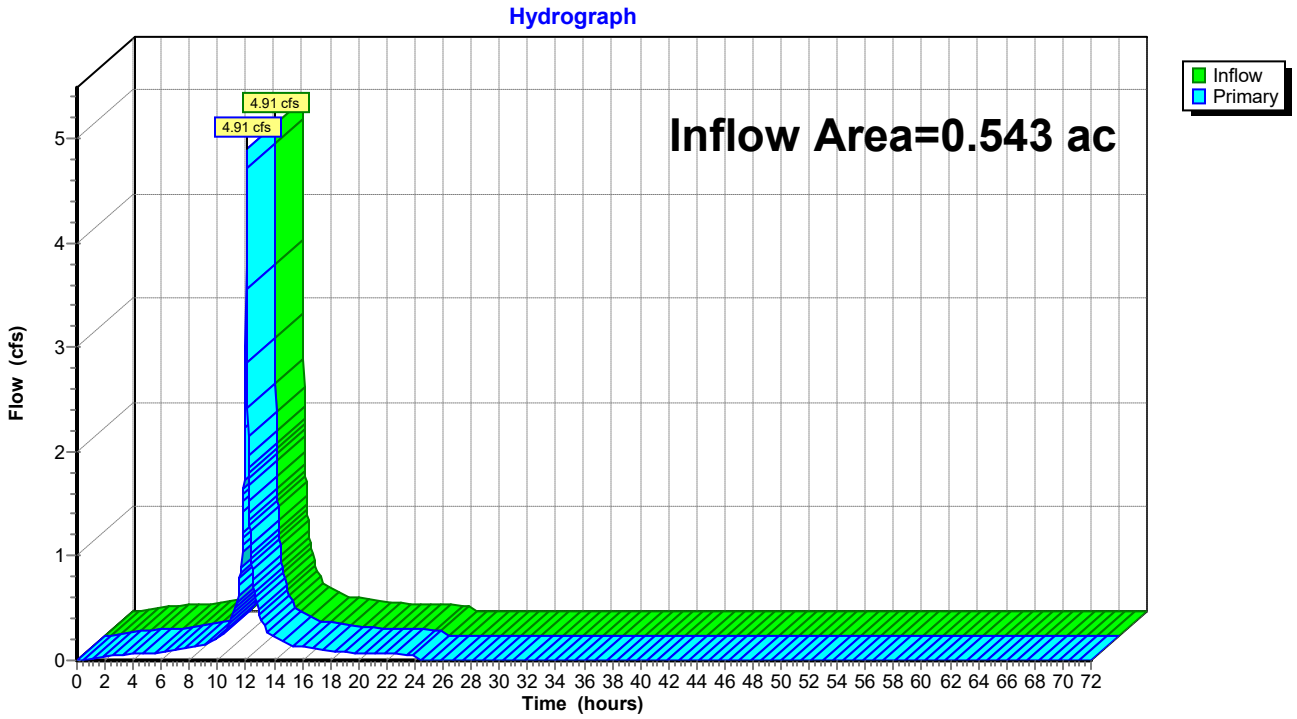


Summary for Link 3L: Ex Total

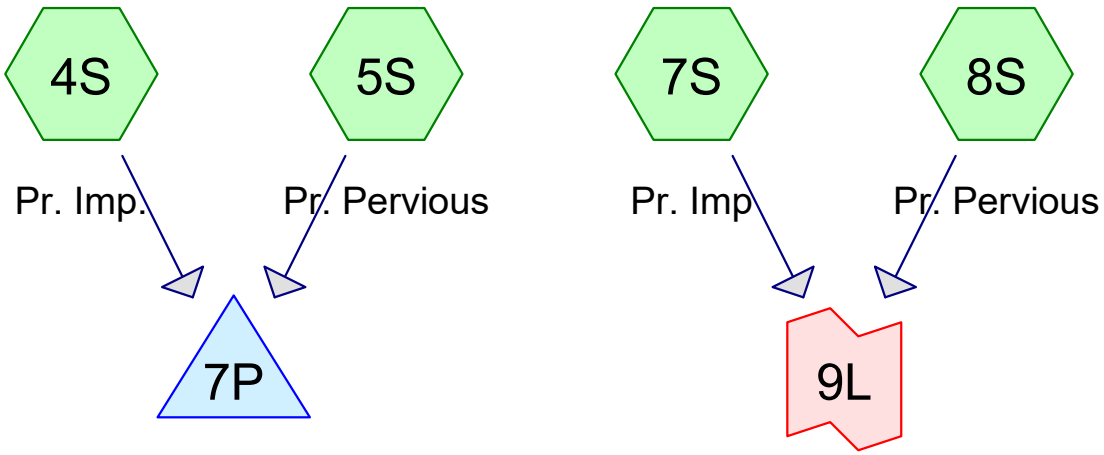
Inflow Area = 0.543 ac, 96.22% Impervious, Inflow Depth = 8.43" for 100-Year event
Inflow = 4.91 cfs @ 12.10 hrs, Volume= 0.382 af
Primary = 4.91 cfs @ 12.10 hrs, Volume= 0.382 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link 3L: Ex Total



B. PROPOSED CONDITIONS RUNOFF CALCULATIONS



Subcat Reach Pond Link

Routing Diagram for r4 Monmouth County
Prepared by Insite Engineering, LLC, Printed 11/8/2023

Summary for Subcatchment 4S: Pr. Imp.

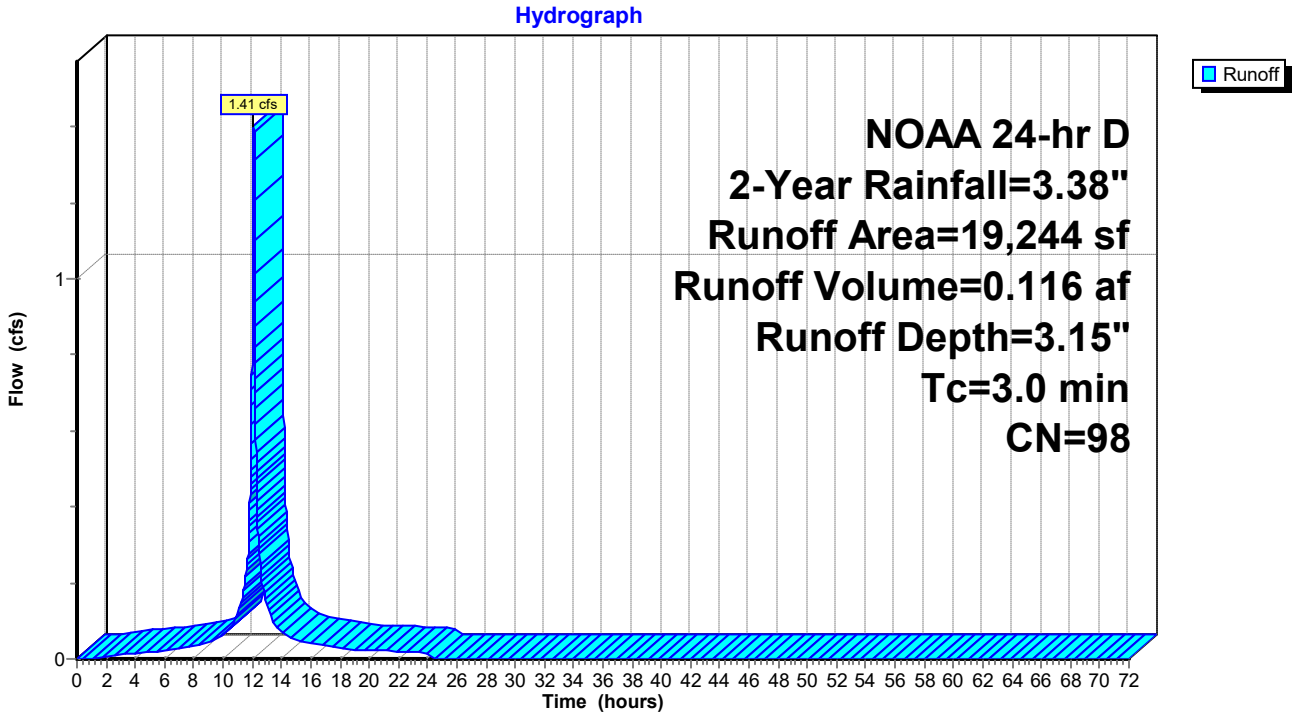
Runoff = 1.41 cfs @ 12.11 hrs, Volume= 0.116 af, Depth= 3.15"
Routed to Pond 7P : Permeable Pavement

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 2-Year Rainfall=3.38"

Area (sf)	CN	Description
19,244	98	Paved parking, HSG A
19,244		100.00% Impervious Area

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

Subcatchment 4S: Pr. Imp.



Summary for Subcatchment 5S: Pr. Pervious

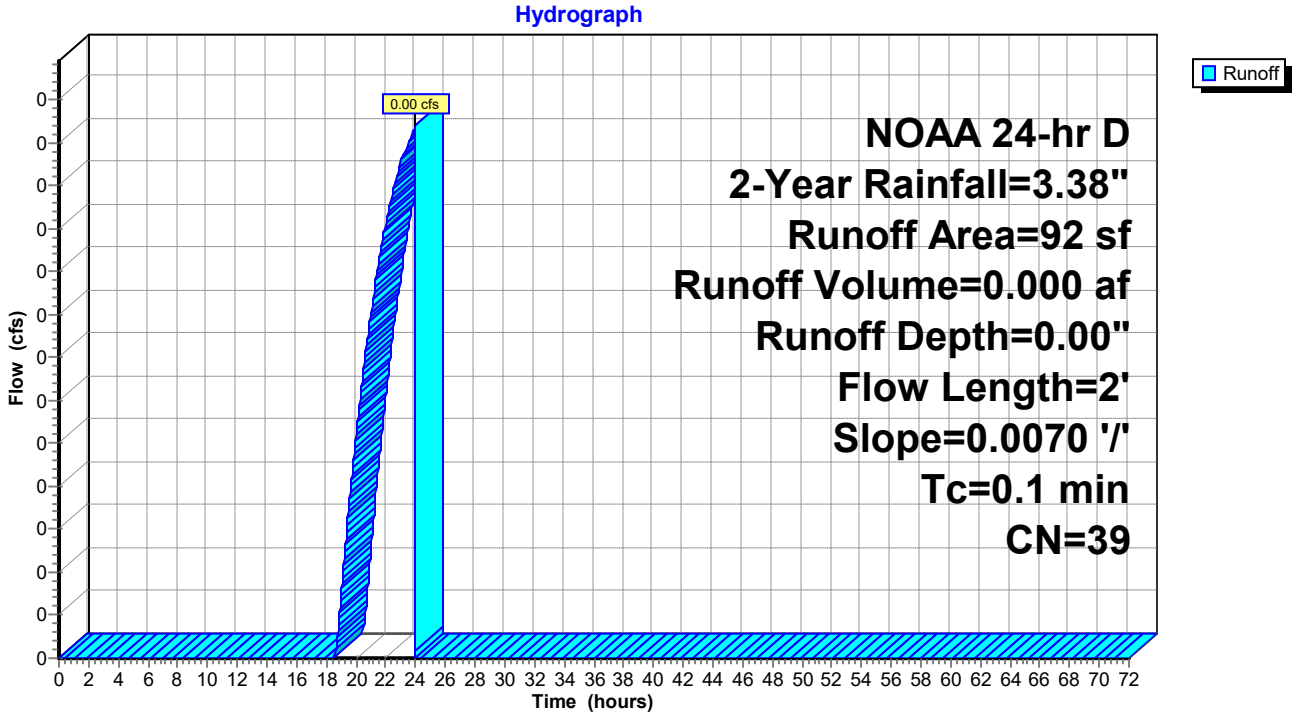
Runoff = 0.00 cfs @ 23.99 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Pond 7P : Permeable Pavement

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 2-Year Rainfall=3.38"

Area (sf)	CN	Description
92	39	>75% Grass cover, Good, HSG A
92		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	2	0.0070	0.43		**Sheet Flow, 20.08-19.94** Smooth surfaces n= 0.011 P2= 3.40"

Subcatchment 5S: Pr. Pervious



Summary for Subcatchment 7S: Pr. Imp

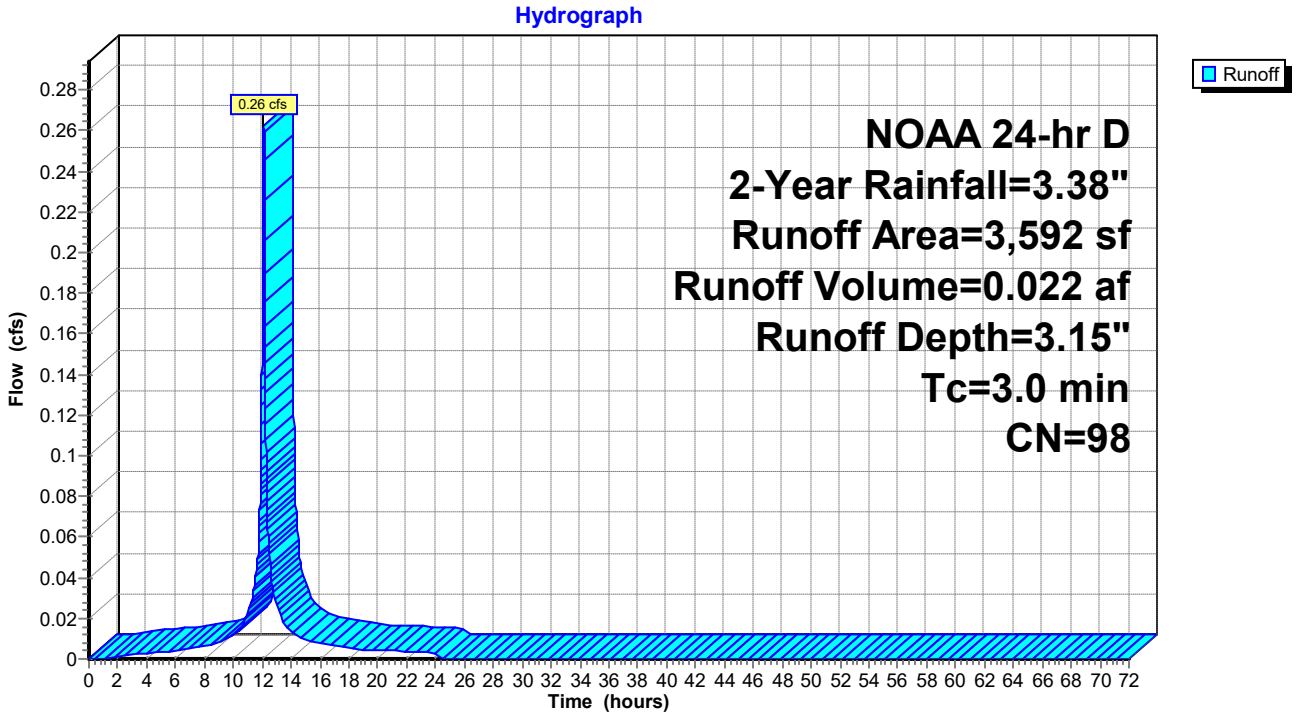
Runoff = 0.26 cfs @ 12.11 hrs, Volume= 0.022 af, Depth= 3.15"
Routed to Link 9L : Unattenuated Total

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 2-Year Rainfall=3.38"

Area (sf)	CN	Description
3,592	98	Paved parking, HSG A
3,592		100.00% Impervious Area

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

Subcatchment 7S: Pr. Imp



Summary for Subcatchment 8S: Pr. Pervious

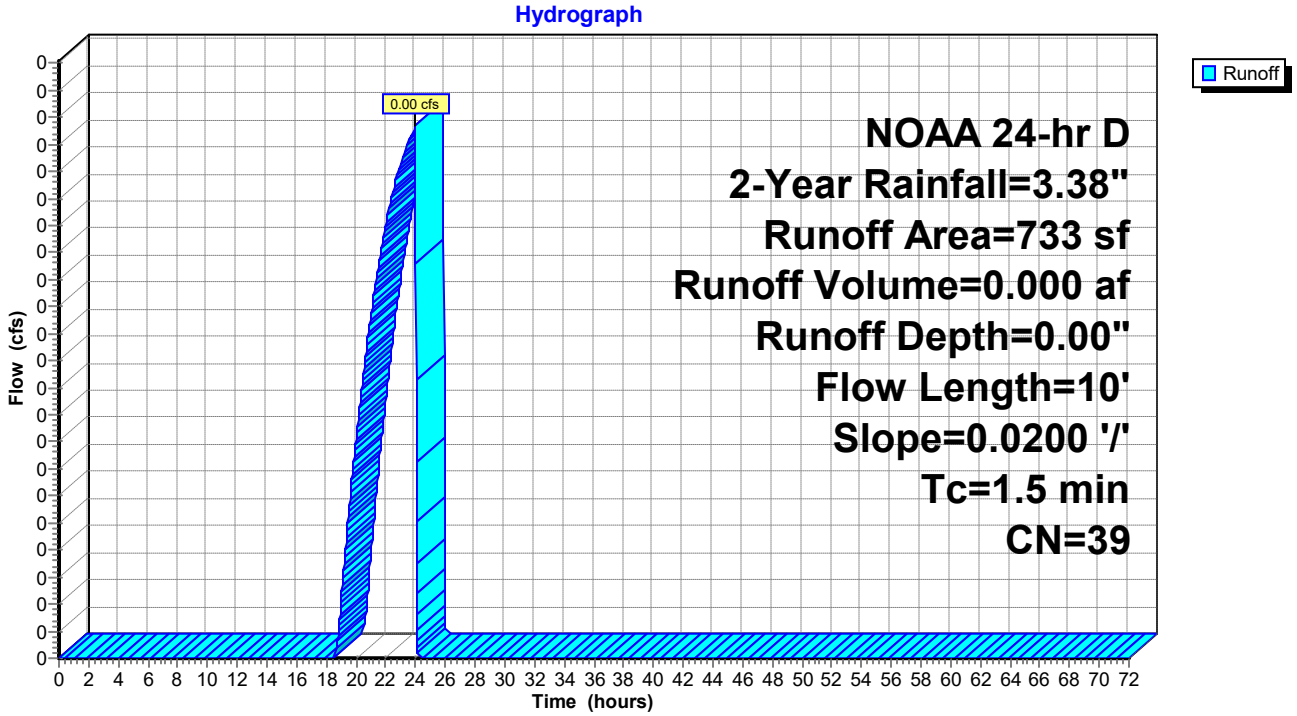
Runoff = 0.00 cfs @ 24.00 hrs, Volume= 0.000 af, Depth= 0.00"
Routed to Link 9L : Unattenuated Total

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 2-Year Rainfall=3.38"

Area (sf)	CN	Description
733	39	>75% Grass cover, Good, HSG A
733		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	10	0.0200	0.11		**Sheet Flow, 18.65-18.58** Grass: Short n= 0.150 P2= 3.40"

Subcatchment 8S: Pr. Pervious



Summary for Pond 7P: Permeable Pavement

Inflow Area = 0.444 ac, 99.52% Impervious, Inflow Depth = 3.13" for 2-Year event
Inflow = 1.41 cfs @ 12.11 hrs, Volume= 0.116 af
Outflow = 1.40 cfs @ 12.12 hrs, Volume= 0.116 af, Atten= 0%, Lag= 0.3 min
Discarded = 1.40 cfs @ 12.12 hrs, Volume= 0.116 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 18.52' @ 12.12 hrs Surf.Area= 6,886 sf Storage= 24 cf

Plug-Flow detention time= 0.3 min calculated for 0.116 af (100% of inflow)
Center-of-Mass det. time= 0.3 min (756.5 - 756.2)

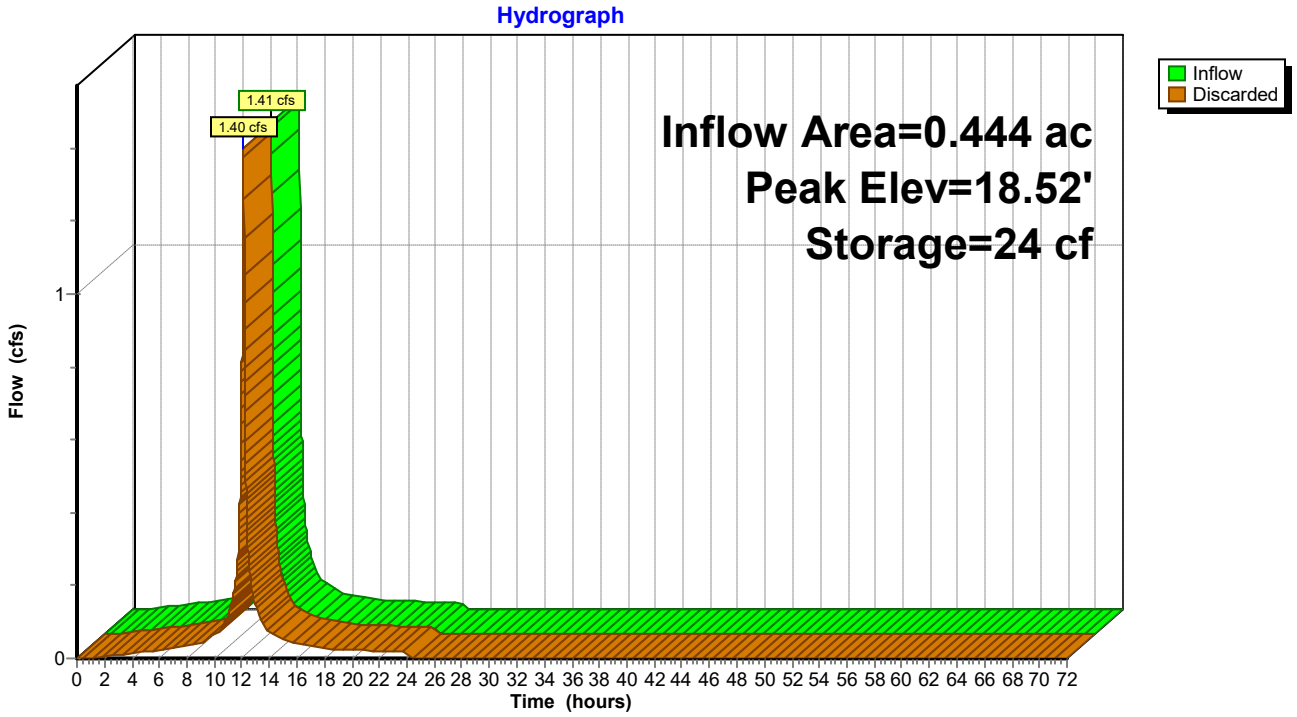
Volume	Invert	Avail.Storage	Storage Description
#1	18.51'	2,726 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 6,886 cf Overall - 71 cf Embedded = 6,815 cf x 40.0% Voids
#2	18.76'	59 cf	**6.0" Round Pipe Storage** x 6 Inside #1 L= 50.0' 71 cf Overall - 0.3" Wall Thickness = 59 cf
		2,785 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
18.51	6,886	0	0
19.51	6,886	6,886	6,886

Device	Routing	Invert	Outlet Devices
#1	Discarded	18.51'	**10.000 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=1.59 cfs @ 12.12 hrs HW=18.52' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 1.59 cfs)

Pond 7P: Permeable Pavement

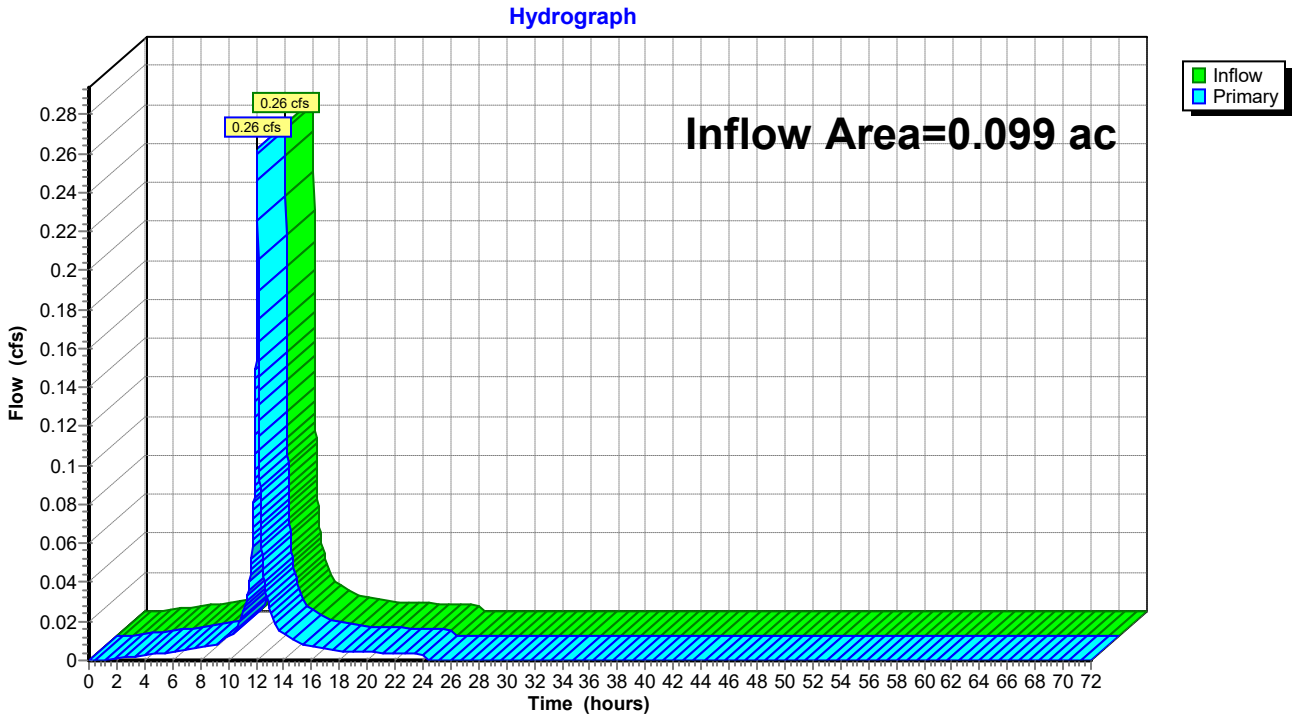


Summary for Link 9L: Unattenuated Total

Inflow Area = 0.099 ac, 83.05% Impervious, Inflow Depth = 2.61" for 2-Year event
Inflow = 0.26 cfs @ 12.11 hrs, Volume= 0.022 af
Primary = 0.26 cfs @ 12.11 hrs, Volume= 0.022 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link 9L: Unattenuated Total



Summary for Subcatchment 4S: Pr. Imp.

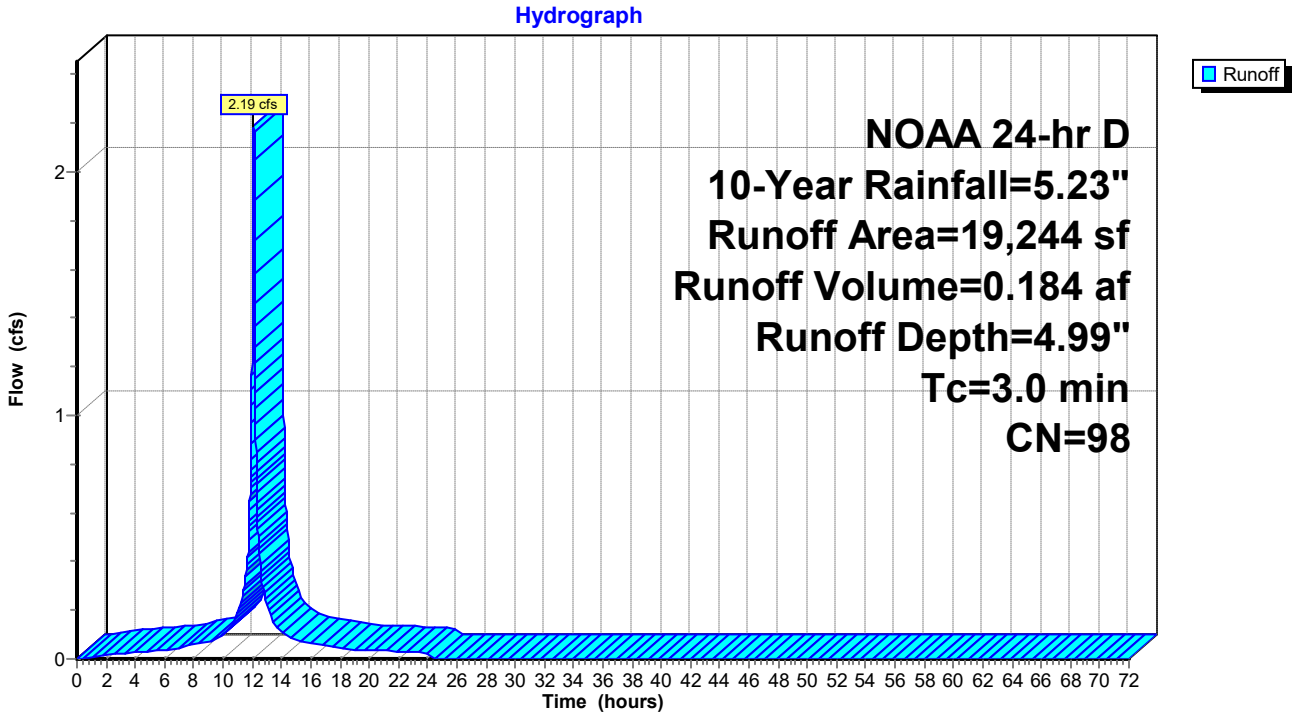
Runoff = 2.19 cfs @ 12.11 hrs, Volume= 0.184 af, Depth= 4.99"
Routed to Pond 7P : Permeable Pavement

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 10-Year Rainfall=5.23"

Area (sf)	CN	Description
19,244	98	Paved parking, HSG A
19,244		100.00% Impervious Area

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

Subcatchment 4S: Pr. Imp.



Summary for Subcatchment 5S: Pr. Pervious

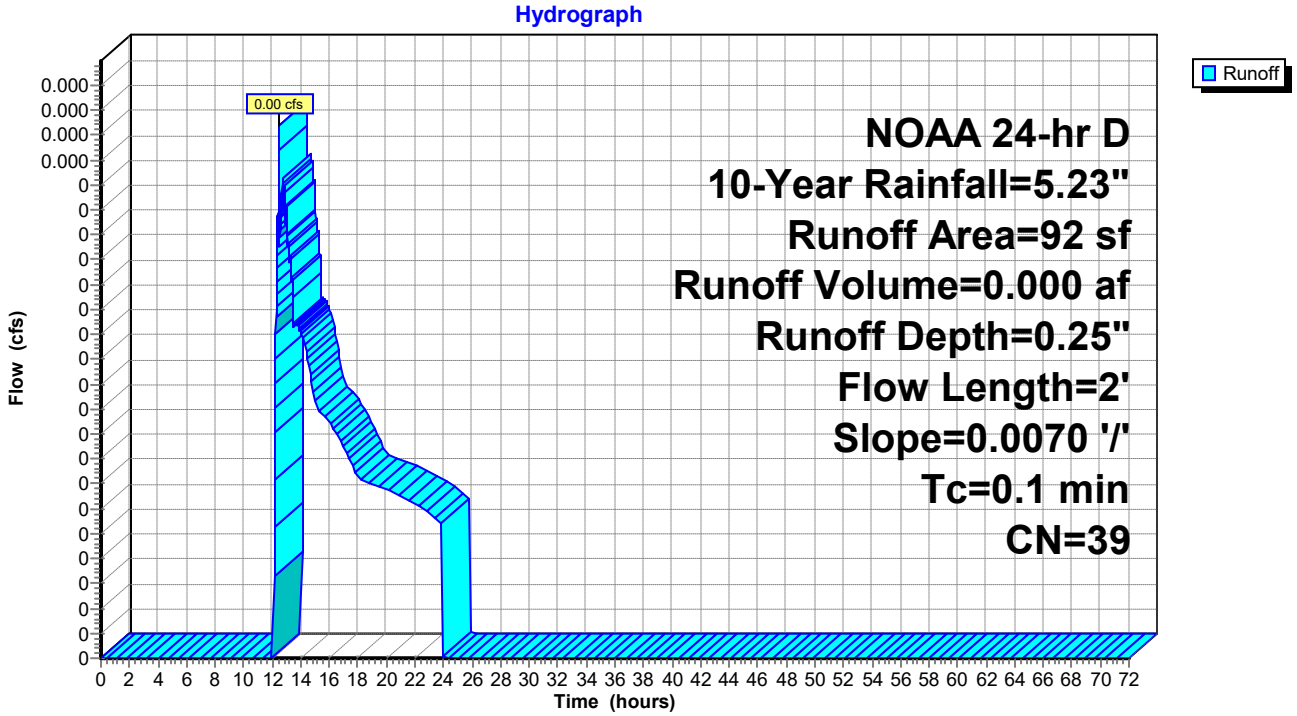
Runoff = 0.00 cfs @ 12.49 hrs, Volume= 0.000 af, Depth= 0.25"
Routed to Pond 7P : Permeable Pavement

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 10-Year Rainfall=5.23"

Area (sf)	CN	Description
92	39	>75% Grass cover, Good, HSG A
92		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	2	0.0070	0.43		**Sheet Flow, 20.08-19.94** Smooth surfaces n= 0.011 P2= 3.40"

Subcatchment 5S: Pr. Pervious



Summary for Subcatchment 7S: Pr. Imp

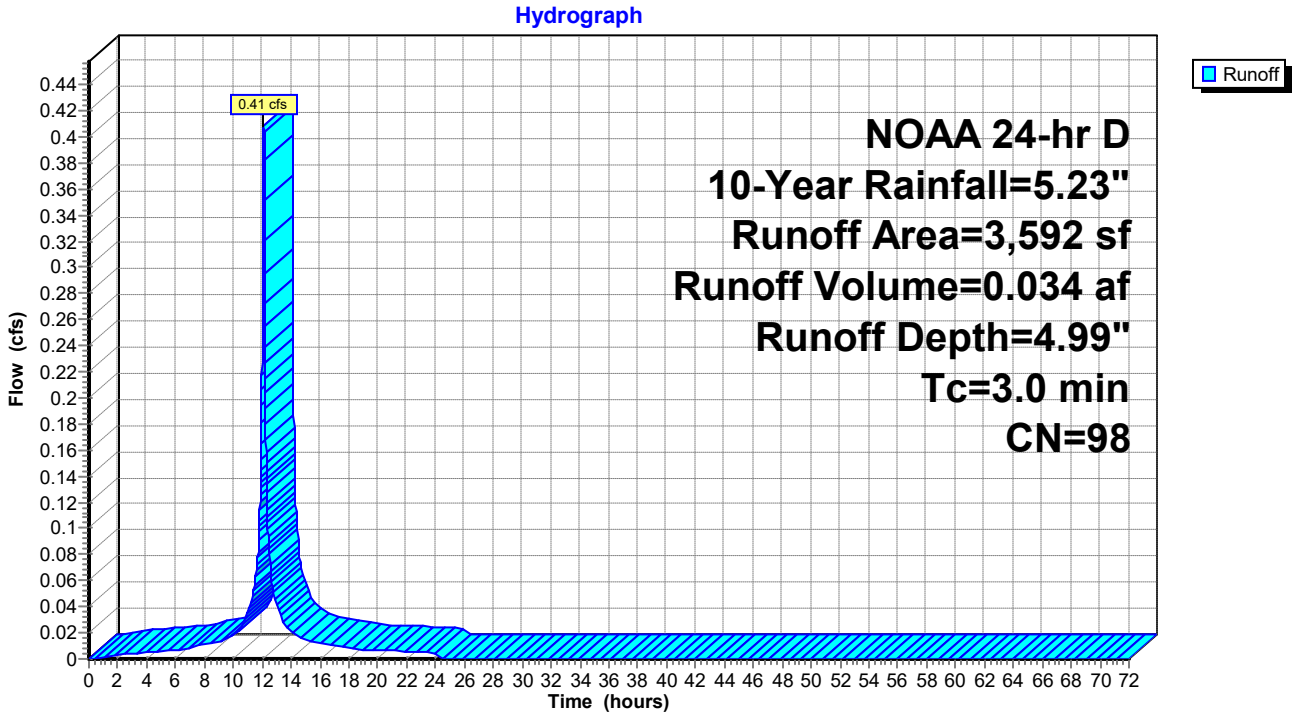
Runoff = 0.41 cfs @ 12.11 hrs, Volume= 0.034 af, Depth= 4.99"
Routed to Link 9L : Unattenuated Total

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 10-Year Rainfall=5.23"

Area (sf)	CN	Description
3,592	98	Paved parking, HSG A
3,592		100.00% Impervious Area

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

Subcatchment 7S: Pr. Imp



Summary for Subcatchment 8S: Pr. Pervious

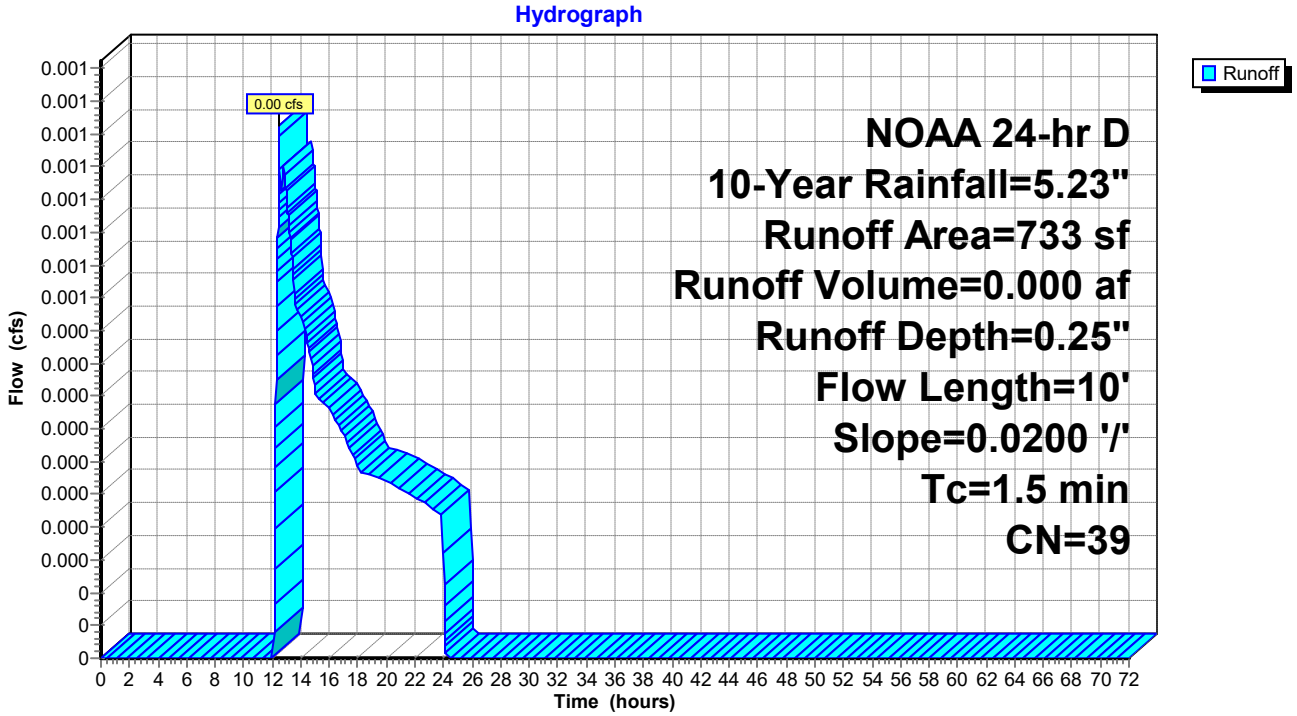
Runoff = 0.00 cfs @ 12.51 hrs, Volume= 0.000 af, Depth= 0.25"
Routed to Link 9L : Unattenuated Total

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 10-Year Rainfall=5.23"

Area (sf)	CN	Description
733	39	>75% Grass cover, Good, HSG A
733		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	10	0.0200	0.11		**Sheet Flow, 18.65-18.58** Grass: Short n= 0.150 P2= 3.40"

Subcatchment 8S: Pr. Pervious



Summary for Pond 7P: Permeable Pavement

Inflow Area = 0.444 ac, 99.52% Impervious, Inflow Depth = 4.97" for 10-Year event
Inflow = 2.19 cfs @ 12.11 hrs, Volume= 0.184 af
Outflow = 1.59 cfs @ 12.05 hrs, Volume= 0.184 af, Atten= 27%, Lag= 0.0 min
Discarded = 1.59 cfs @ 12.05 hrs, Volume= 0.184 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 18.58' @ 12.16 hrs Surf.Area= 6,886 sf Storage= 183 cf

Plug-Flow detention time= 0.4 min calculated for 0.184 af (100% of inflow)
Center-of-Mass det. time= 0.4 min (748.0 - 747.6)

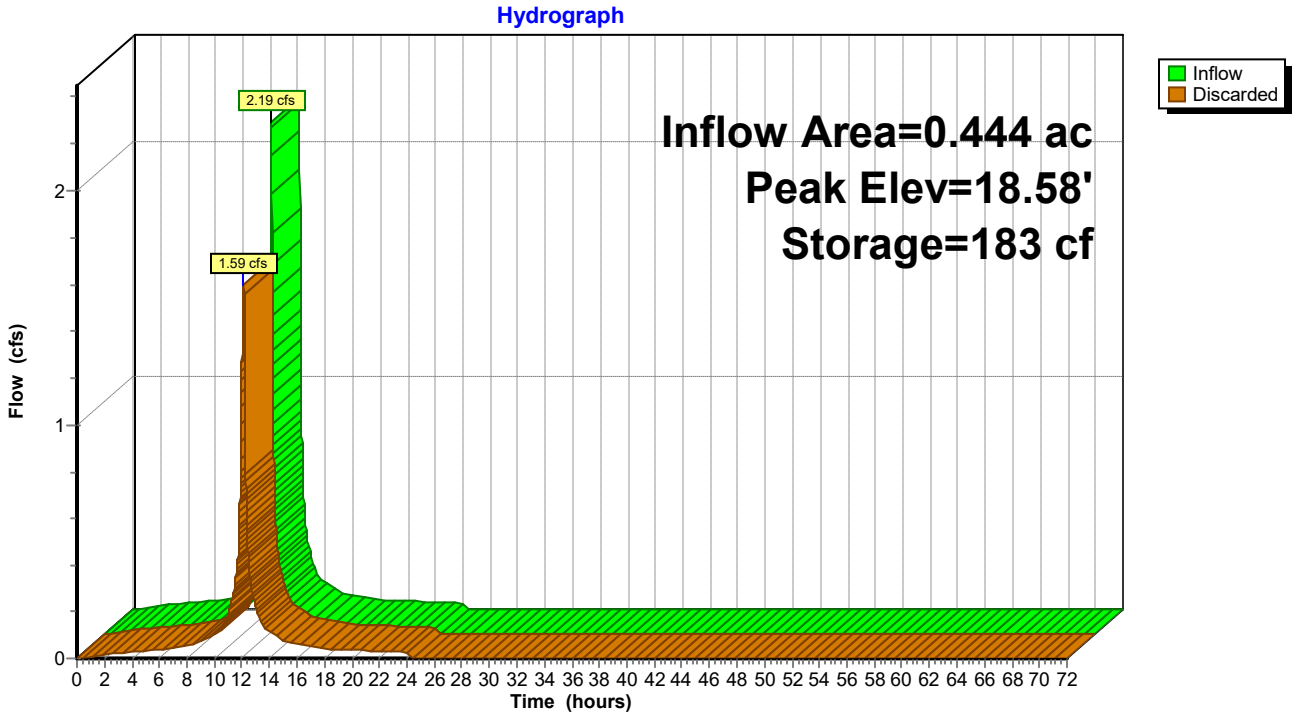
Volume	Invert	Avail.Storage	Storage Description
#1	18.51'	2,726 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 6,886 cf Overall - 71 cf Embedded = 6,815 cf x 40.0% Voids
#2	18.76'	59 cf	**6.0" Round Pipe Storage** x 6 Inside #1 L= 50.0' 71 cf Overall - 0.3" Wall Thickness = 59 cf
		2,785 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
18.51	6,886	0	0
19.51	6,886	6,886	6,886

Device	Routing	Invert	Outlet Devices
#1	Discarded	18.51'	**10.000 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=1.59 cfs @ 12.05 hrs HW=18.52' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 1.59 cfs)

Pond 7P: Permeable Pavement

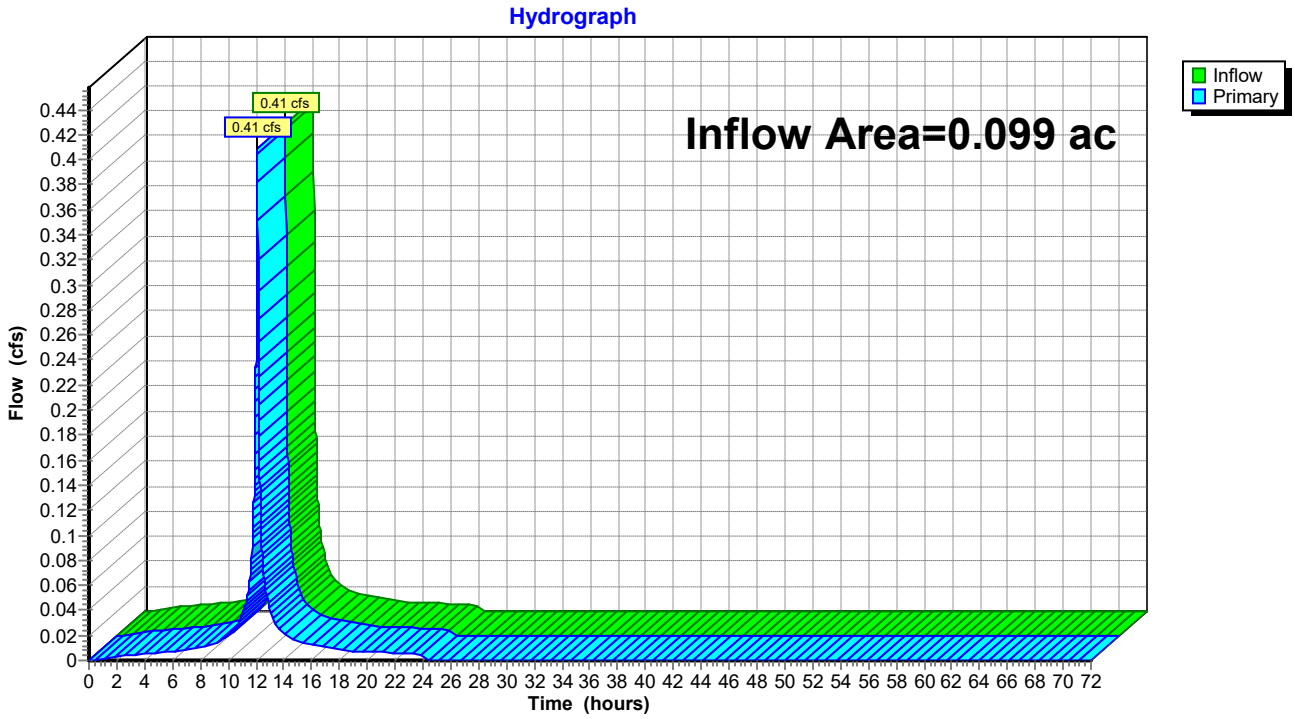


Summary for Link 9L: Unattenuated Total

Inflow Area = 0.099 ac, 83.05% Impervious, Inflow Depth = 4.19" for 10-Year event
Inflow = 0.41 cfs @ 12.11 hrs, Volume= 0.035 af
Primary = 0.41 cfs @ 12.11 hrs, Volume= 0.035 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link 9L: Unattenuated Total



Summary for Subcatchment 4S: Pr. Imp.

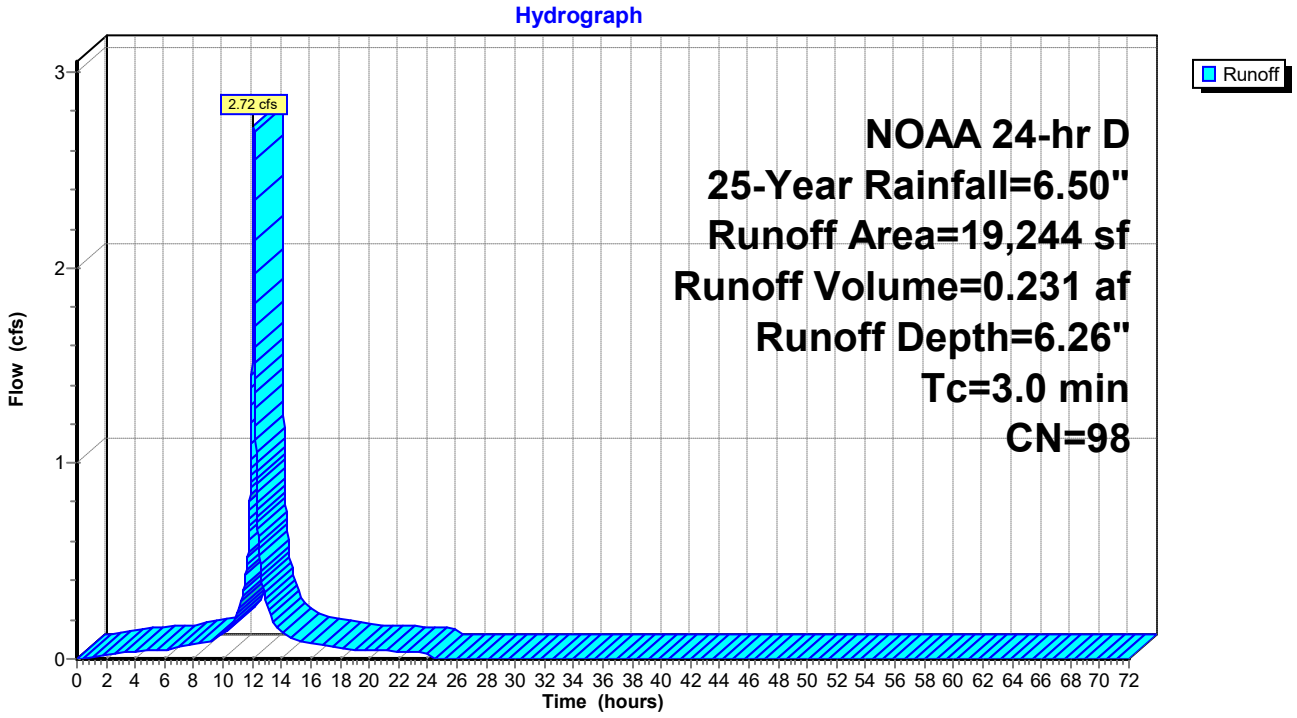
Runoff = 2.72 cfs @ 12.11 hrs, Volume= 0.231 af, Depth= 6.26"
Routed to Pond 7P : Permeable Pavement

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 25-Year Rainfall=6.50"

Area (sf)	CN	Description
19,244	98	Paved parking, HSG A
19,244		100.00% Impervious Area

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

Subcatchment 4S: Pr. Imp.



Summary for Subcatchment 5S: Pr. Pervious

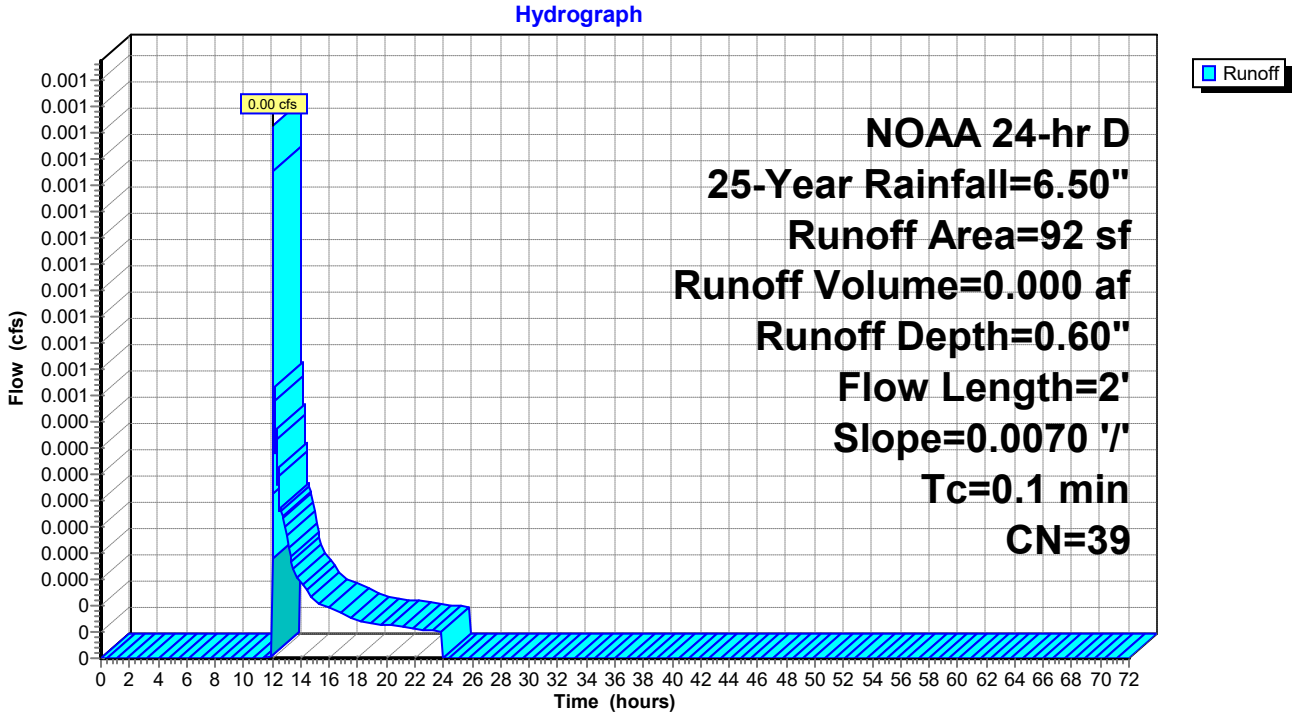
Runoff = 0.00 cfs @ 12.09 hrs, Volume= 0.000 af, Depth= 0.60"
Routed to Pond 7P : Permeable Pavement

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 25-Year Rainfall=6.50"

Area (sf)	CN	Description
92	39	>75% Grass cover, Good, HSG A
92		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	2	0.0070	0.43		**Sheet Flow, 20.08-19.94** Smooth surfaces n= 0.011 P2= 3.40"

Subcatchment 5S: Pr. Pervious



Summary for Subcatchment 7S: Pr. Imp

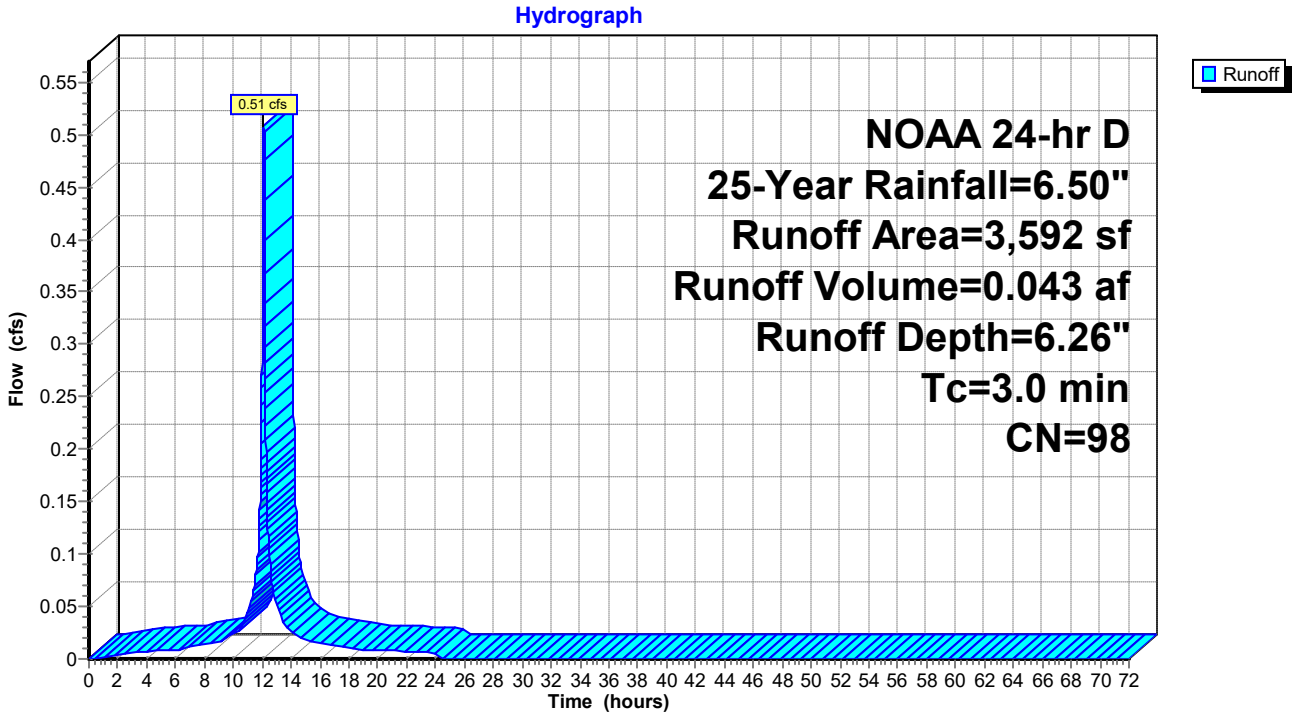
Runoff = 0.51 cfs @ 12.11 hrs, Volume= 0.043 af, Depth= 6.26"
Routed to Link 9L : Unattenuated Total

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 25-Year Rainfall=6.50"

Area (sf)	CN	Description
3,592	98	Paved parking, HSG A
3,592		100.00% Impervious Area

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

Subcatchment 7S: Pr. Imp



Summary for Subcatchment 8S: Pr. Pervious

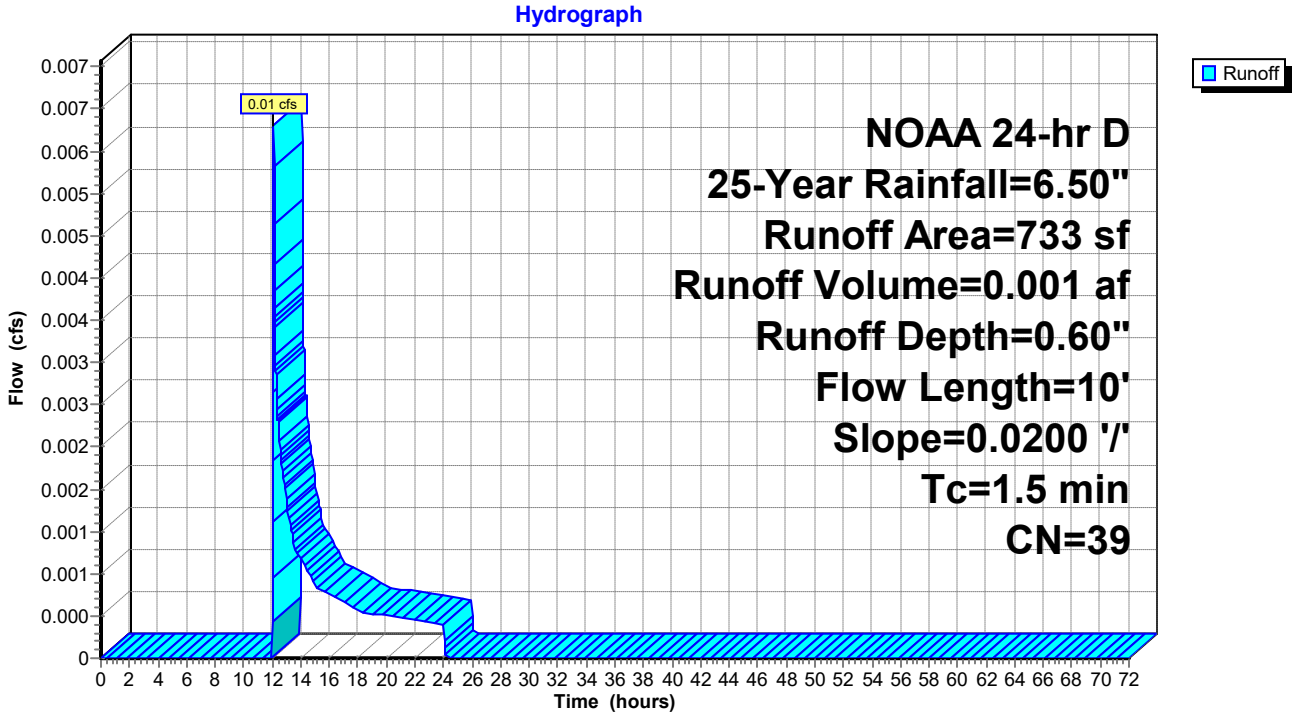
Runoff = 0.01 cfs @ 12.11 hrs, Volume= 0.001 af, Depth= 0.60"
Routed to Link 9L : Unattenuated Total

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 25-Year Rainfall=6.50"

Area (sf)	CN	Description
733	39	>75% Grass cover, Good, HSG A
733		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	10	0.0200	0.11		**Sheet Flow, 18.65-18.58** Grass: Short n= 0.150 P2= 3.40"

Subcatchment 8S: Pr. Pervious



Summary for Pond 7P: Permeable Pavement

Inflow Area = 0.444 ac, 99.52% Impervious, Inflow Depth = 6.23" for 25-Year event
Inflow = 2.73 cfs @ 12.11 hrs, Volume= 0.231 af
Outflow = 1.59 cfs @ 12.01 hrs, Volume= 0.231 af, Atten= 42%, Lag= 0.0 min
Discarded = 1.59 cfs @ 12.01 hrs, Volume= 0.231 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 18.67' @ 12.19 hrs Surf.Area= 6,886 sf Storage= 432 cf

Plug-Flow detention time= 0.8 min calculated for 0.231 af (100% of inflow)
Center-of-Mass det. time= 0.8 min (744.9 - 744.1)

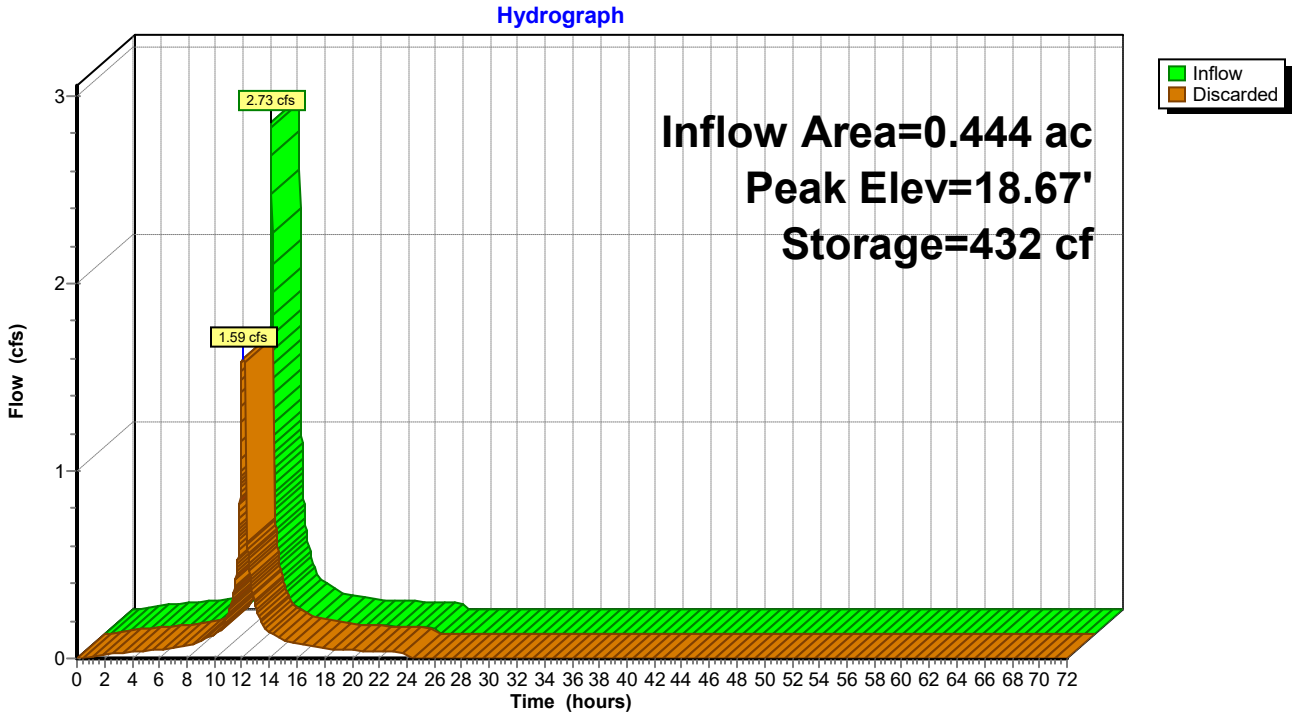
Volume	Invert	Avail.Storage	Storage Description
#1	18.51'	2,726 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 6,886 cf Overall - 71 cf Embedded = 6,815 cf x 40.0% Voids
#2	18.76'	59 cf	**6.0" Round Pipe Storage** x 6 Inside #1 L= 50.0' 71 cf Overall - 0.3" Wall Thickness = 59 cf
		2,785 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
18.51	6,886	0	0
19.51	6,886	6,886	6,886

Device	Routing	Invert	Outlet Devices
#1	Discarded	18.51'	**10.000 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=1.59 cfs @ 12.01 hrs HW=18.52' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 1.59 cfs)

Pond 7P: Permeable Pavement

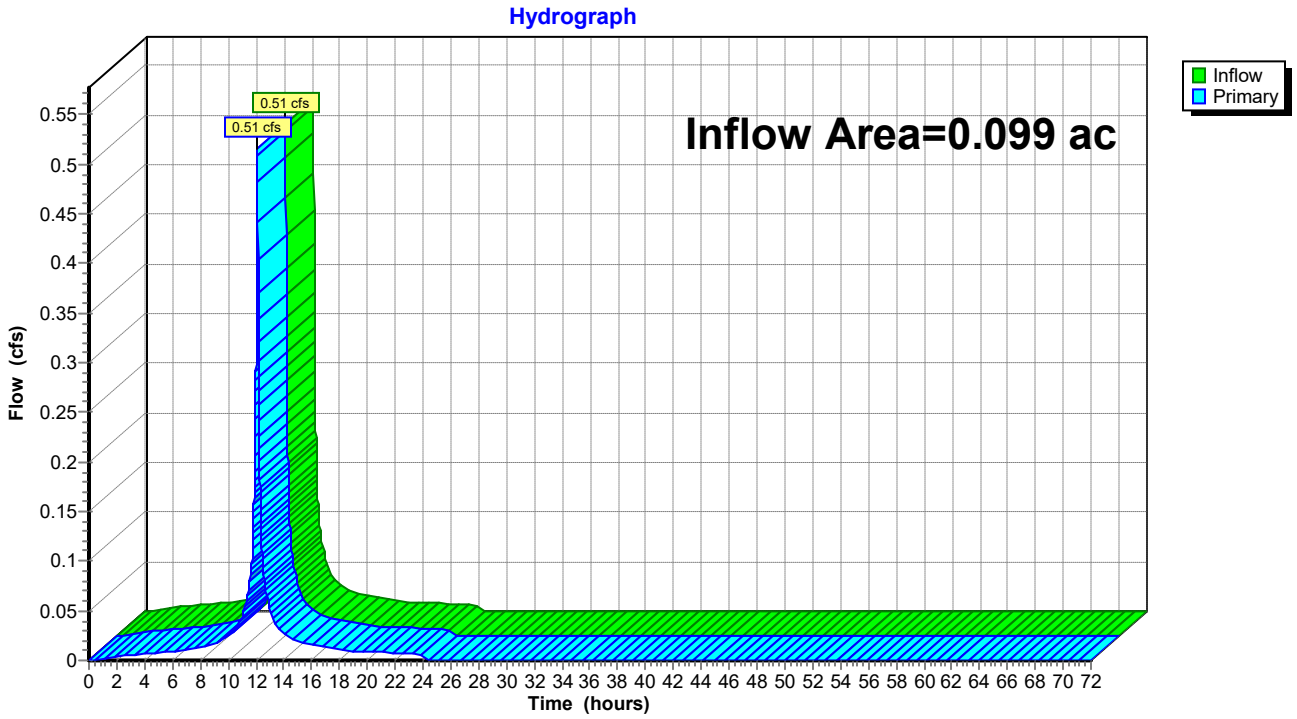


Summary for Link 9L: Unattenuated Total

Inflow Area = 0.099 ac, 83.05% Impervious, Inflow Depth = 5.30" for 25-Year event
Inflow = 0.51 cfs @ 12.11 hrs, Volume= 0.044 af
Primary = 0.51 cfs @ 12.11 hrs, Volume= 0.044 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link 9L: Unattenuated Total



Summary for Subcatchment 4S: Pr. Imp.

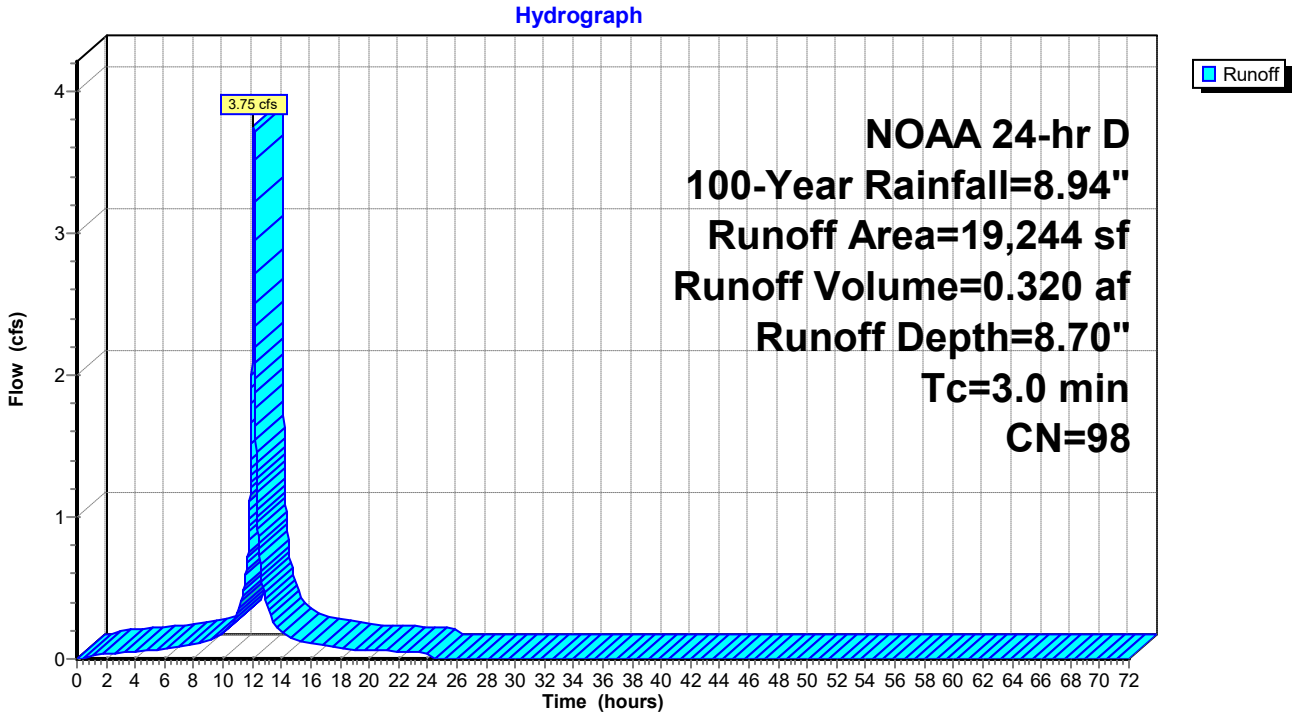
Runoff = 3.75 cfs @ 12.11 hrs, Volume= 0.320 af, Depth= 8.70"
Routed to Pond 7P : Permeable Pavement

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 100-Year Rainfall=8.94"

Area (sf)	CN	Description
19,244	98	Paved parking, HSG A
19,244		100.00% Impervious Area

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

Subcatchment 4S: Pr. Imp.



Summary for Subcatchment 5S: Pr. Pervious

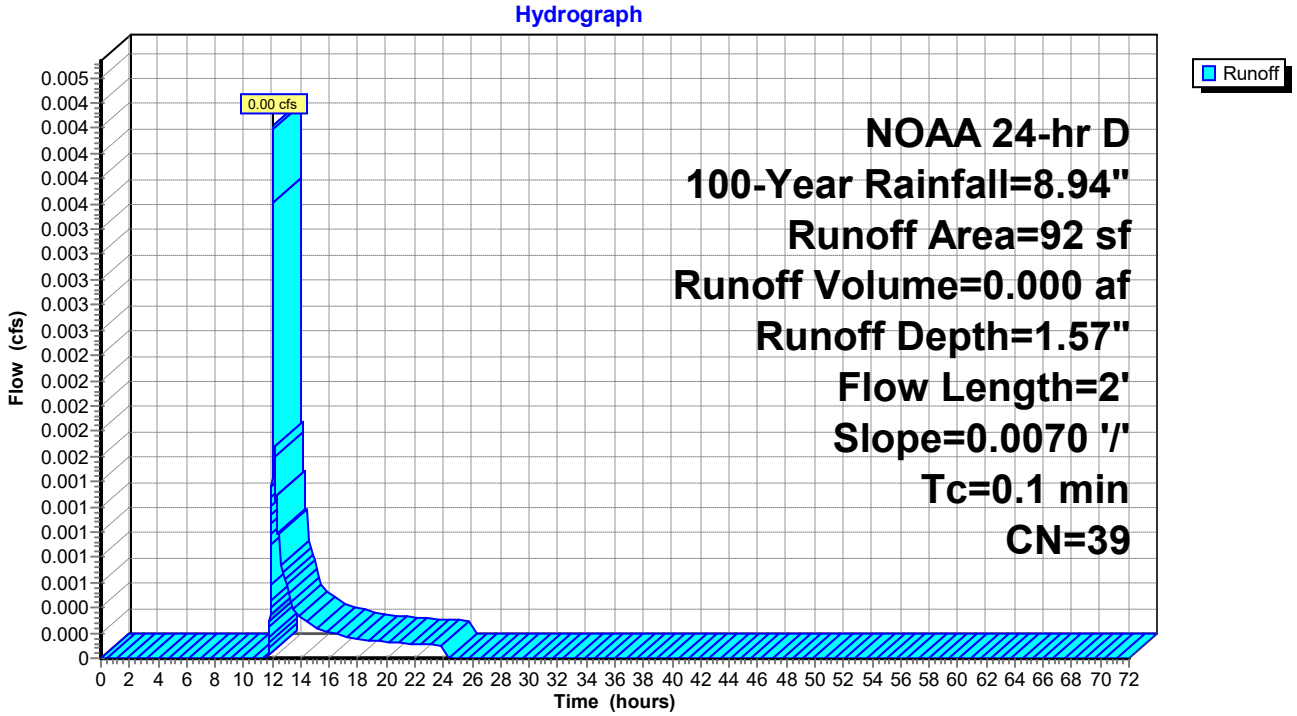
Runoff = 0.00 cfs @ 12.09 hrs, Volume= 0.000 af, Depth= 1.57"
Routed to Pond 7P : Permeable Pavement

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 100-Year Rainfall=8.94"

Area (sf)	CN	Description
92	39	>75% Grass cover, Good, HSG A
92		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	2	0.0070	0.43		**Sheet Flow, 20.08-19.94** Smooth surfaces n= 0.011 P2= 3.40"

Subcatchment 5S: Pr. Pervious



Summary for Subcatchment 7S: Pr. Imp

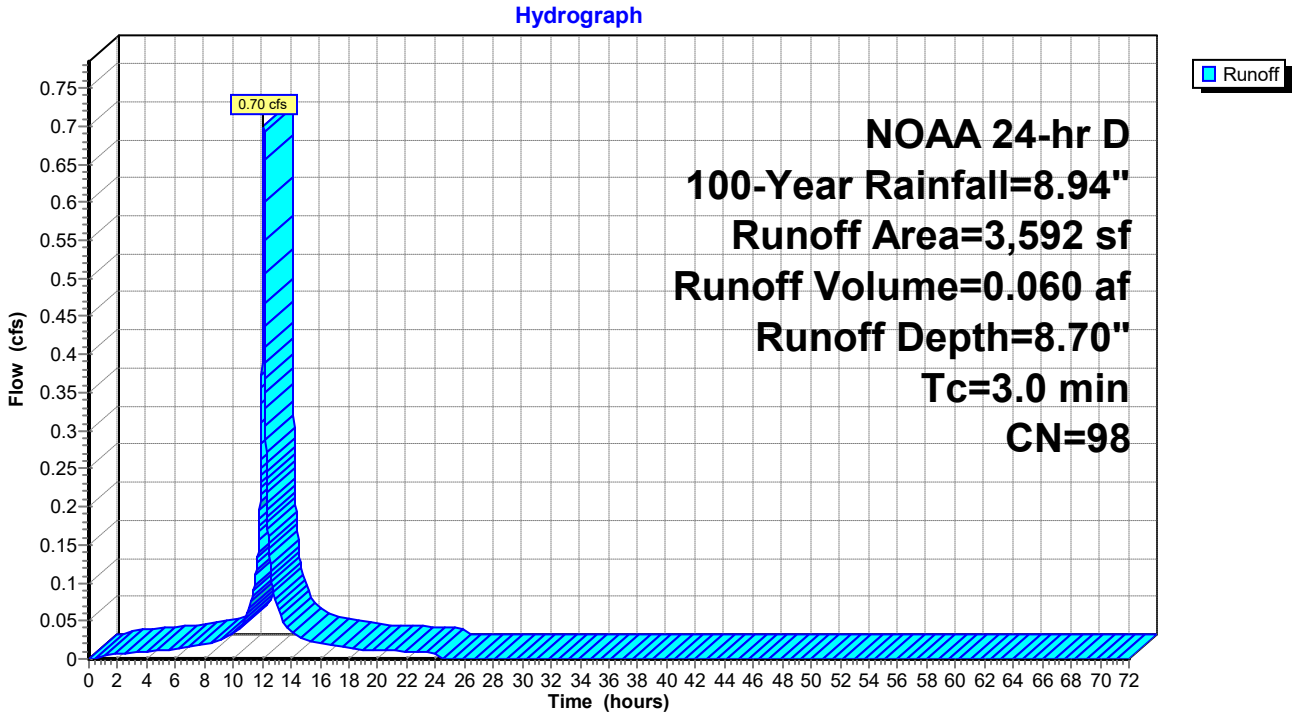
Runoff = 0.70 cfs @ 12.11 hrs, Volume= 0.060 af, Depth= 8.70"
Routed to Link 9L : Unattenuated Total

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 100-Year Rainfall=8.94"

Area (sf)	CN	Description
3,592	98	Paved parking, HSG A
3,592		100.00% Impervious Area

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

Subcatchment 7S: Pr. Imp



Summary for Subcatchment 8S: Pr. Pervious

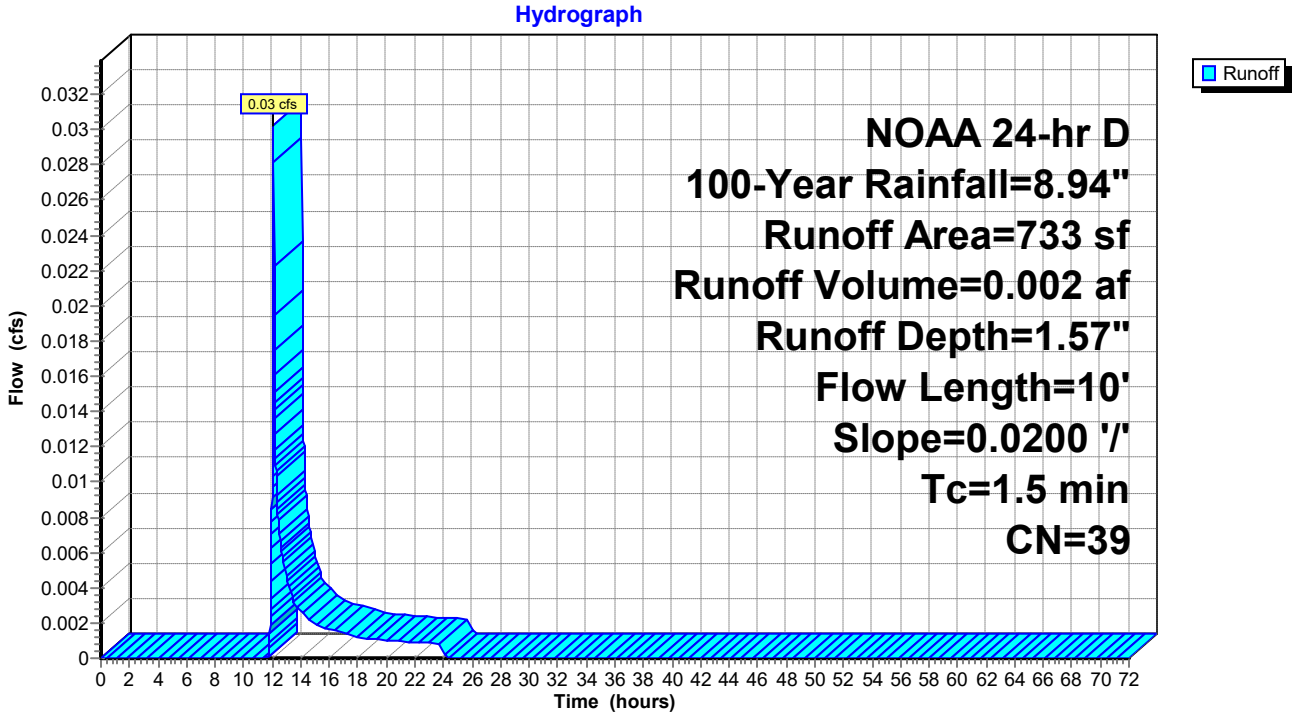
Runoff = 0.03 cfs @ 12.11 hrs, Volume= 0.002 af, Depth= 1.57"
Routed to Link 9L : Unattenuated Total

Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 100-Year Rainfall=8.94"

Area (sf)	CN	Description
733	39	>75% Grass cover, Good, HSG A
733		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	10	0.0200	0.11		**Sheet Flow, 18.65-18.58** Grass: Short n= 0.150 P2= 3.40"

Subcatchment 8S: Pr. Pervious



Summary for Pond 7P: Permeable Pavement

Inflow Area = 0.444 ac, 99.52% Impervious, Inflow Depth = 8.67" for 100-Year event
Inflow = 3.76 cfs @ 12.11 hrs, Volume= 0.321 af
Outflow = 1.59 cfs @ 11.94 hrs, Volume= 0.321 af, Atten= 58%, Lag= 0.0 min
Discarded = 1.59 cfs @ 11.94 hrs, Volume= 0.321 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 18.92' @ 12.25 hrs Surf.Area= 6,886 sf Storage= 1,141 cf

Plug-Flow detention time= 2.2 min calculated for 0.321 af (100% of inflow)
Center-of-Mass det. time= 2.2 min (742.0 - 739.8)

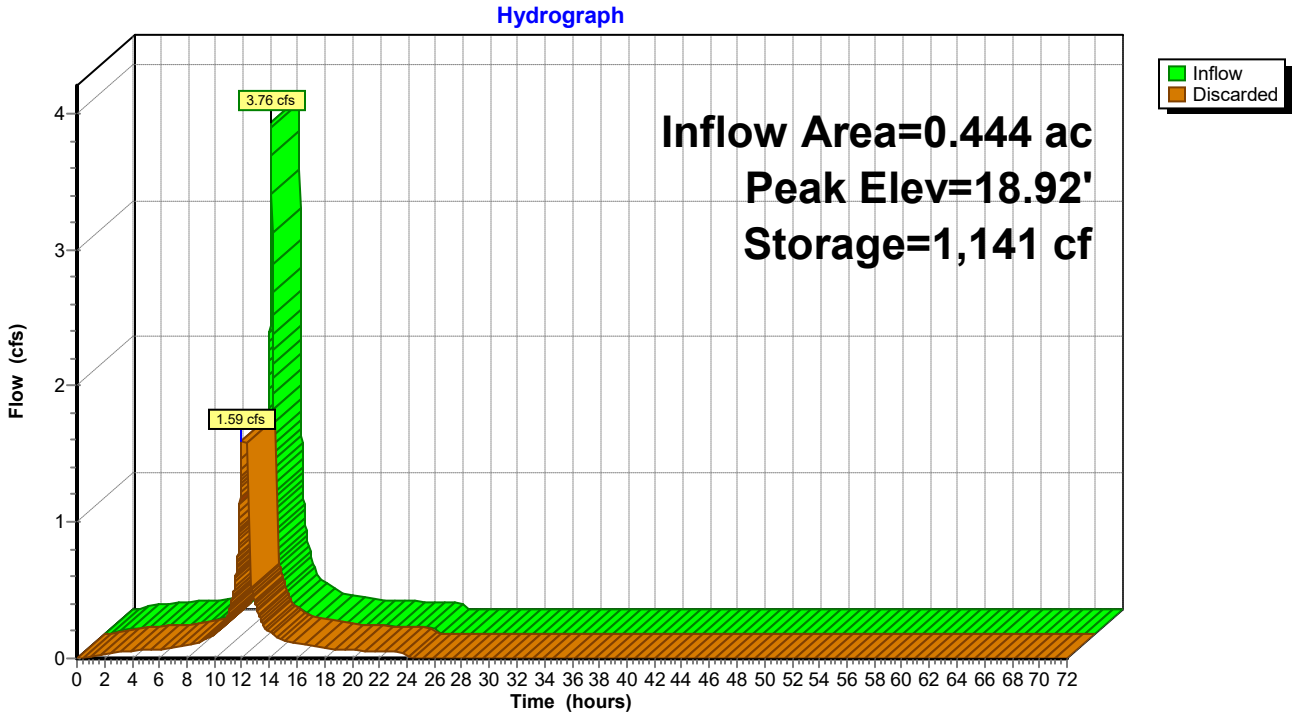
Volume	Invert	Avail.Storage	Storage Description
#1	18.51'	2,726 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 6,886 cf Overall - 71 cf Embedded = 6,815 cf x 40.0% Voids
#2	18.76'	59 cf	**6.0" Round Pipe Storage** x 6 Inside #1 L= 50.0' 71 cf Overall - 0.3" Wall Thickness = 59 cf
		2,785 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
18.51	6,886	0	0
19.51	6,886	6,886	6,886

Device	Routing	Invert	Outlet Devices
#1	Discarded	18.51'	**10.000 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=1.59 cfs @ 11.94 hrs HW=18.52' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 1.59 cfs)

Pond 7P: Permeable Pavement

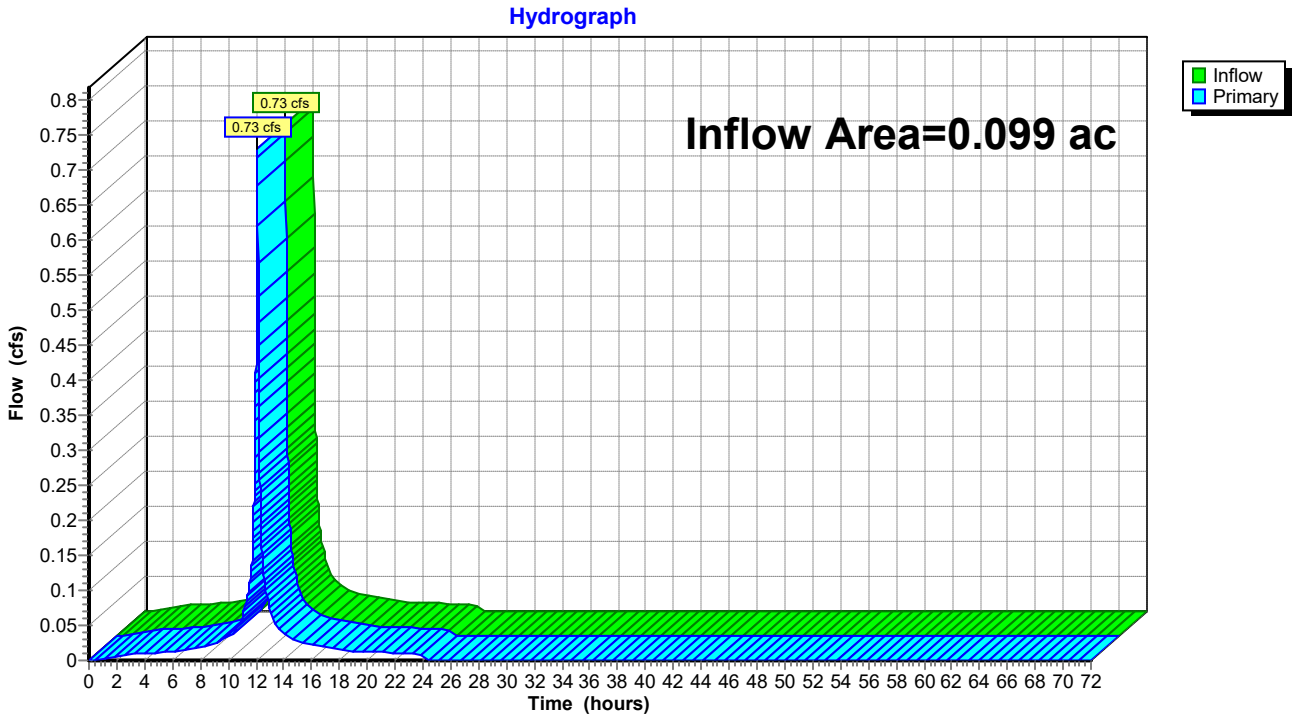


Summary for Link 9L: Unattenuated Total

Inflow Area = 0.099 ac, 83.05% Impervious, Inflow Depth = 7.49" for 100-Year event
Inflow = 0.73 cfs @ 12.11 hrs, Volume= 0.062 af
Primary = 0.73 cfs @ 12.11 hrs, Volume= 0.062 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link 9L: Unattenuated Total



C. GEOTECHNICAL INFORMATION

WHITESTONE
An Employee-Owned Company

1959 HIGHWAY 34
BUILDING A, SUITE 102
WALL, NJ 07719
732.592.2101
whitestoneassoc.com

December 13, 2022

via InSite Engineering, LLC

KALIAN COMPANIES
Two Hennessey Boulevard
Suite One
Atlantic Highlands, New Jersey 07716

Attention: Mr. Patrick Kalian
President & CEO

Regarding: STORMWATER MANAGEMENT AREA EVALUATION
PROPOSED MIXED-USE BUILDING
160 FIRST AVENUE
BLOCK 101, LOT 4.01
ATLANTIC HIGHLANDS, MONMOUTH COUNTY, NEW JERSEY
WHITESTONE PROJECT NO.: GS2219785.000

Dear Mr. Kalian:

Whitestone Associates, Inc. (Whitestone) is pleased to submit this *Stormwater Management* (SWM) *Area Evaluation* report in support of the proposed site improvements referenced above. This report is based on preliminary project information provided InSite Engineering, LLC (InSite) including the June 23, 2022 *Boundary and Topographic Survey*, correspondence with InSite, and available internet aerial photography.

1.0 PROJECT DESCRIPTION

The subject site located at 160 First Avenue (Block 101, Lot 4.01) in Atlantic Highlands, Monmouth County, New Jersey currently houses a commercial building with associated pavements, landscaped areas, and utilities.

The proposed redevelopment will include demolition of the existing site structures and construction of an approximately 12,100-square feet (footprint), four-story mixed-use development with a new SWM facility and pavements. Based on information provided by InSite, the proposed SWM facilities will be situated up to four feet below existing site grades. Due to site access restrictions, soil borings were conducted in lieu of test pits.

2.0 FIELD INVESTIGATION

The investigation and infiltration testing were conducted in general accordance with standards presented in the *New Jersey Stormwater Best Management Practices Manual* (BMP Manual). Specifically, the investigation included drilling six soil borings (identified as B-1 through B-6), and conducting six in-situ

infiltration tests adjacent to the soil boring locations (identified as I-1 through I-6) within proposed SWM locations provided by InSite. The subsurface tests were conducted in the presence of a Whitestone engineer who conducted field tests, recorded visual classifications, and collected samples of the various strata encountered. The tests were located in the field using normal taping procedures and estimated right angles. These locations are presumed to be accurate within a few feet. The subsurface tests were terminated at an approximate depth of 12 feet below ground surface (fbgs). The infiltration test locations are shown on the *Testing Location Plan* included as Figure 1. Detailed descriptions of the subsurface conditions encountered are presented on the enclosed *Records of Subsurface Exploration* included in Appendix A and infiltration test results are provided in Appendix B.

2.0 SUMMARY OF FINDINGS

Subsurface Profile: The subsurface conditions encountered at and below the proposed level of infiltration included natural coastal plains deposits consisting of United States Department of Agriculture (USDA) classifications loamy sand and sand with various amounts of gravel. The natural soils were encountered to a maximum explored depth of 12.0 fbgs.

Estimated Seasonal High Groundwater Levels & Infiltration Test Results: The methods used in determining the seasonal high groundwater level include evaluating the soil morphology within a test excavation and identifying irregular spots or blotches of different colors or minerals unlike that of the surrounding soil (mottles). A summary of the estimated seasonal high groundwater observations as well as tested soil hydraulic conductivity results associated with the supplemental investigation are included in the following table.

INFILTRATION/PERMEABILITY TEST SUMMARY				
Infiltration Test No. @ Boring No.	**ESHGW (fbgs/NAVD 88)**	**USDA Classification @ Test Depth**	**Field Tested Infiltration Test Results**	
			Depth (fbgs/NAVD 88)	**Infiltration Rate (in/hour)**
I-1 @ B-1	11.0 / 11.0	Sand	4.0 / 18.0	> 20
I-2 @ B-2	11.5 / 10.5	Sand	4.0 / 18.0	> 20
I-3 @ B-3	11.0 / 11.0	Sand	4.0 / 18.0	> 20
I-4 @ B-4	11.5 / 10.5	Sand	4.0 / 18.0	> 20
I-5 @ B-5	11.0 / 10.0	Sand	4.0 / 17.0	> 20
I-6 @ B-6	11.0 / 10.0	Sand	4.0 / 17.0	> 20

NE: not encountered within the depth explored; NAVD 88: North American Vertical Datum of 1988

Tested Soil Infiltration Rates: In-situ infiltration tests were conducted at the anticipated levels of infiltration within the proposed SWM areas in conformance with methodologies detailed in the *New Jersey Stormwater Best Practices Manual*. In-situ infiltration testing indicated infiltration rates greater than 20 inches per hour (iph). In-situ infiltration test results associated with the investigation are provided in Appendix B, *Record of Subsurface Exploration* are included in Appendix A.

3.0 CLOSING

Whitestone appreciates the opportunity to be of service to Kalian Companies. Please contact us with any questions or comments regarding the information herein.

Sincerely,

WHITESTONE ASSOCIATES, INC.

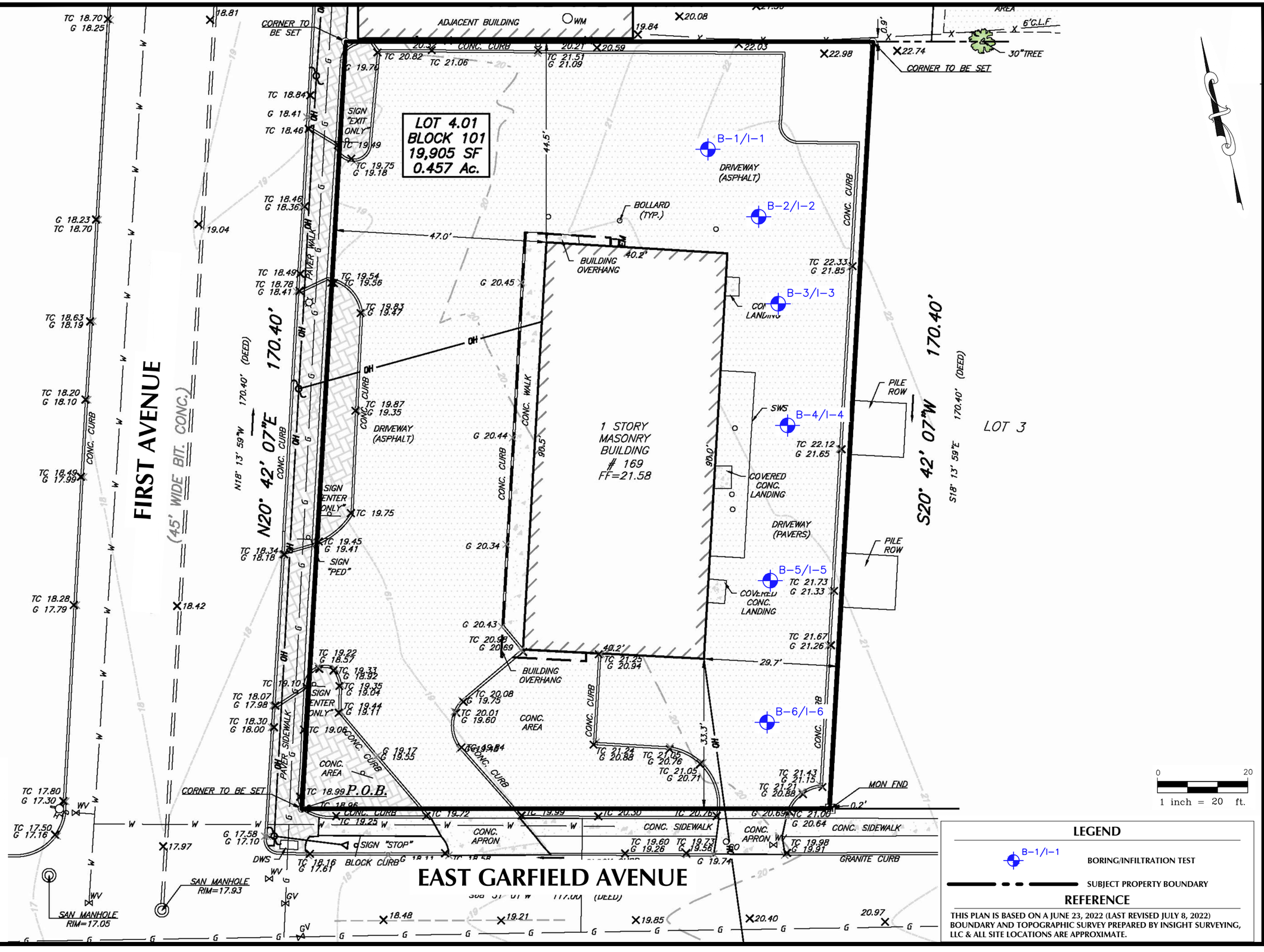
Kyle J. Kopacz, P.E.
Associate

Laurence W. Keller, P.E.
Vice President

CN/rs L:\Job Folders\2022\2219785GS\Reports and Submittals\19785 SWM.docx
Enclosures

WHITESTONE

FIGURE 1
Testing Location Plan



LEGEND

B-1/I-1 — BORING/INFILTRATION TEST

SUBJECT PROPERTY BOUNDARY

REFERENCE

THIS PLAN IS BASED ON A JUNE 23, 2022 (LAST REVISED JULY 8, 2022) BOUNDARY AND TOPOGRAPHIC SURVEY PREPARED BY INSIGHT SURVEYING, LLC & ALL SITE LOCATIONS ARE APPROXIMATE.

WHITESTONE
An Employee-Owned Company
1959 HIGHWAY 34 BUILDING A, UNIT 102 WALL, NJ 07719
732-592-2101 WHITESTONEASSOC.COM

DRAWING TITLE: **TEST LOCATION PLAN**

CLIENT: **KALIAN COMPANIES**

PROJECT: PROPOSED MIXED-USE BUILDING
160 FIRST AVENUE
ATLANTIC HIGHLANDS, MONMOUTH COUNTY, NJ

PROJECT #:	GS2219785.000
DESIGNED BY: GR	PROJ. MGR.: KK
DATE: 12/9/22	FIGURE: 1
SCALE: 1" = 20'	

L:\Job Folders\2022\2219785GS\Drawings and Plans\GS2219785.000 TLP.dwg

WHITESTONE

APPENDIX A
Records of Subsurface Exploration

WHITESTONE

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-1

Page 1 of 1

Project:	Proposed Mixed-Use Building	**WAI Project No.:**	GS2219785.000
Location:	160 First Avenue (Block 101, Lot 4.01); Atlantic Highlands, Monmouth County, NJ	**Client:**	Kalian Companies

Surface Elevation:	± 22.0 feet	**Date Started:**	12/1/2022		**Water Depth (feet bgs)**	**Elevation (feet)**	**Cave-In Depth (feet bgs)** / **Elevation (feet)**
Termination Depth:	12.0 feet bgs	**Date Completed:**	12/1/2022				
Proposed Location:	SWM	**Logged By:**	TJ	**During:**	11.0	11.0	**At Completion:** 5.0 / 17.0
Drill / Test Method:	HSA / SPT	**Contractor:**	BW	**At Completion:**	12.0	10.0	
		Equipment:	CME-55	**24 Hours:**	---	---	**ESHGW:** 11.0 / 11.0

SAMPLE INFORMATION						DEPTH	STRATA	DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)			
						0.0	PAVEMENT	4" Asphalt with 6" Gravel Subbase	
						0.8	COASTAL PLAIN DEPOSITS		
2 - 4	S-1		6 - 9 - 8 - 8	16	17			Brownish-Yellow (10YR 6/6) LOAMY SAND; No Coarse Fragments; Moist; Weak Granular Structure; Friable; No Roots (SM)	
						4.0			
4 - 6	S-2		6 - 6 - 8 - 8	19	14	5.0		Brownish-Yellow (10YR 6/6) SAND; No Coarse Fragments; Moist; Weak Granular Structure; Friable; No Roots (SP)	
6 - 8	S-3		6 - 8 - 11 - 11	13	19			As Above (SP)	
8 - 10	S-4		11 - 17 - 20 - 20	15	37			As Above (SP)	
						10.0			
10 - 12	S-5		20 - 24 - 25 - 29	10	49			As Above, <5% Gravel, Wet (SP)	
						12.0			
								Boring Log B-1 Terminated at a Depth of 12.0 Feet Below Ground Surface	
						15.0			
						20.0			
						25.0			

NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched, ESHGW = Estimated Seasonal High Groundwater

WHITESTONE

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-2

Page 1 of 1

Project:	Proposed Mixed-Use Building	**WAI Project No.:**	GS2219785.000
Location:	160 First Avenue (Block 101, Lot 4.01); Atlantic Highlands, Monmouth County, NJ	**Client:**	Kalian Companies

Surface Elevation:	± 22.0 feet	**Date Started:**	12/1/2022		**Water Depth (feet bgs)**	**Elevation (feet)**	**Cave-In Depth (feet bgs)** / **Elevation (feet)**
Termination Depth:	12.0 feet bgs	**Date Completed:**	12/1/2022				
Proposed Location:	SWM	**Logged By:**	TJ	**During:**	11.5	10.5	**At Completion:** 5.0 / 17.0
Drill / Test Method:	HSA / SPT	**Contractor:**	BW	**At Completion:**	12.0	10.0	
		Equipment:	CME-55	**24 Hours:**	---	---	**ESHGW:** 11.5 / 10.5

SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						0.0				
							PAVEMENT		4" Asphalt with 6" Gravel Subbase	
						0.8	COASTAL PLAIN DEPOSITS			
2 - 4	S-1		4 - 5 - 5 - 7	18	10				Brownish-Yellow (10YR 6/6) LOAMY SAND; No Coarse Fragments; Moist; Weak Granular Structure; Friable; No Roots (SM)	
						4.0				
4 - 6	S-2		6 - 8 - 8 - 11	20	16	5.0			Brownish-Yellow (10YR 6/6) SAND; No Coarse Fragments; Moist; Weak Granular Structure; Friable; No Roots (SP)	
6 - 8	S-3		9 - 10 - 15 - 16	18	25				As Above (SP)	
8 - 10	S-4		11 - 16 - 20 - 23	15	36				As Above (SP)	
						10.0				
10 - 12	S-5		15 - 16 - 11 - 15	12	27	12.0			As Above, Brownish-Yellow (10-YR 6/6), Wet (SP)	
									Boring Log B-2 Terminated at a Depth of 12.0 Feet Below Ground Surface	
						15.0				
						20.0				
						25.0				

NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched, ESHGW = Estimated Seasonal High Groundwater

WHITESTONE

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-3

Project:	Proposed Mixed-Use Building	**WAI Project No.:**	GS2219785.000
Location:	160 First Avenue (Block 101, Lot 4.01); Atlantic Highlands, Monmouth County, NJ	**Client:**	Kalian Companies

				Water Depth (feet bgs) | Elevation (feet)	Cave-In Depth (feet bgs) | Elevation (feet)
Surface Elevation:	± 22.0 feet	**Date Started:**	12/1/2022		
Termination Depth:	12.0 feet bgs	**Date Completed:**	12/1/2022		
Proposed Location:	SWM	**Logged By:**	TJ	**During:** 11.0 | 11.0	**At Completion:** 6.0 | 16.0
Drill / Test Method:	HSA / SPT	**Contractor:**	BW	**At Completion:** 11.0 | 11.0	
		Equipment:	CME-55	**24 Hours:** --- | ---	**ESHGW:** 11.0 | 11.0

SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						0.0	PAVEMENT		4" Asphalt with 6" Gravel Subbase	
						0.8	COASTAL PLAIN DEPOSITS			
2 - 4	S-1	X	9 - 12 - 9 - 7	18	21				Brownish-Yellow (10YR 6/6) LOAMY SAND; No Coarse Fragments; Moist; Weak Granular Structure; Friable; No Roots (SM)	
						4.0				
4 - 6	S-2	X	7 - 6 - 6 - 7	19	12	5.0			Brownish-Yellow (10YR 6/6) SAND; No Coarse Fragments; Moist; Weak Granular Structure; Friable; No Roots (SP)	
6 - 8	S-3	X	7 - 8 - 8 - 10	13	16				As Above (SP)	
8 - 10	S-4	X	9 - 12 - 12 - 15	16	24				As Above (SP)	
						10.0				
10 - 12	S-5	X	15 - 16 - 15 - 11	17	31				As Above (SP)	
						12.0				
									Boring Log B-3 Terminated at a Depth of 12.0 Feet Below Ground Surface	
						15.0				
						20.0				
						25.0				

NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched, ESHGW = Estimated Seasonal High Groundwater

WHITESTONE

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-4

Project:	Proposed Mixed-Use Building	**WAI Project No.:**	GS2219785.000
Location:	160 First Avenue (Block 101, Lot 4.01); Atlantic Highlands, Monmouth County, NJ	**Client:**	Kalian Companies

Surface Elevation:	± 22.0 feet	**Date Started:**	12/1/2022		**Water Depth (feet bgs)**	**Elevation (feet)**	**Cave-In Depth (feet bgs)** / **Elevation (feet)**
Termination Depth:	12.0 feet bgs	**Date Completed:**	12/1/2022				
Proposed Location:	SWM	**Logged By:**	TJ	**During:**	11.5	10.5	**At Completion:** 8.0 / 14.0
Drill / Test Method:	HSA / SPT	**Contractor:**	BW	**At Completion:**	11.5	10.5	
		Equipment:	CME-55	**24 Hours:**	---	---	**ESHGW:** 11.5 / 10.5

SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						0.0	PAVEMENT		4" Asphalt with 6" Gravel Subbase	
						0.8	COASTAL PLAIN DEPOSITS			
2 - 4	S-1		8 - 9 - 12 - 10	16	21				Brownish-Yellow (10YR 6/6) SAND; No Coarse Fragments; Moist; Weak Granular Structure; Friable; No Roots (SP)	
4 - 6	S-2		10 - 11 - 12 - 12	15	23	5.0			As Above (SP)	
6 - 8	S-3		10 - 9 - 11 - 14	20	20				As Above (SP)	
8 - 10	S-4		13 - 17 - 20 - 20	20	37	10.0			As Above, Dense (SP)	
10 - 12	S-5		15 - 19 - 17 - 16	20	36	12.0			As Above, <5% Gravel, Wet (SP)	
						15.0			Boring Log B-4 Terminated at a Depth of 12.0 Feet Below Ground Surface	
						20.0				
						25.0				

NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched, ESHGW = Estimated Seasonal High Groundwater

RECORD OF SUBSURFACE EXPLORATION

WHITESTONE

Boring No.: B-5

Project:	Proposed Mixed-Use Building	**WAI Project No.:**	GS2219785.000
Location:	160 First Avenue (Block 101, Lot 4.01); Atlantic Highlands, Monmouth County, NJ	**Client:**	Kalian Companies

Surface Elevation:	± 21.0 feet	**Date Started:**	12/1/2022		**Water Depth (feet bgs) | Elevation (feet)**		**Cave-In Depth (feet bgs) | Elevation (feet)**
Termination Depth:	12.0 feet bgs	**Date Completed:**	12/1/2022				
Proposed Location:	SWM	**Logged By:**	TJ	**During:**	11.0 | 10.0	**At Completion:**	7.0 | 14.0
Drill / Test Method:	HSA / SPT	**Contractor:**	BW	**At Completion:**	11.0 | 10.0		
		Equipment:	CME-55	**24 Hours:**	--- | ---	**ESHGW:**	11.0 | 10.0

SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						0.0				
							PAVEMENT		5" Asphalt with 6" Gravel Subbase	
						0.9	COASTAL PLAIN DEPOSITS			
2 - 4	S-1		6 - 9 - 6 - 7	18	15				Brownish-Yellow (10YR 6/6) LOAMY SAND; No Coarse Fragments; Moist; Weak Granular Structure; Friable; No Roots (SM)	
						4.0				
4 - 6	S-2		6 - 5 - 6 - 6	14	11	5.0			Brownish-Yellow (10YR 6/6) SAND; No Coarse Fragments; Moist; Weak Granular Structure; Friable; No Roots (SP)	
6 - 8	S-3		5 - 5 - 6 - 6	16	11				As Above (SP)	
8 - 10	S-4		8 - 13 - 16 - 25	15	29				As Above (SP)	
						10.0				
10 - 12	S-5		25 - 21 - 19 - 19	16	40				As Above, 20% Gravel, Wet (SP)	
						12.0				
									Boring Log B-5 Terminated at a Depth of 12.0 Feet Below Ground Surface	
						15.0				
						20.0				
						25.0				

NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched, ESHGW = Estimated Seasonal High Groundwater

WHITESTONE

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-6

Page 1 of 1

Project:	Proposed Mixed-Use Building	**WAI Project No.:**	GS2219785.000
Location:	160 First Avenue (Block 101, Lot 4.01); Atlantic Highlands, Monmouth County, NJ	**Client:**	Kalian Companies

Surface Elevation:	± 21.0 feet	**Date Started:**	12/1/2022		**Water Depth (feet bgs) | Elevation (feet)**		**Cave-In Depth (feet bgs) | Elevation (feet)**
Termination Depth:	12.0 feet bgs	**Date Completed:**	12/1/2022				
Proposed Location:	SWM	**Logged By:**	TJ	**During:**	11.0 | 10.0	**At Completion:**	5.0 | 16.0
Drill / Test Method:	HSA / SPT	**Contractor:**	BW	**At Completion:**	11.0 | 10.0		
		Equipment:	CME-55	**24 Hours:**	--- | ---	**ESHGW:**	11.0 | 10.0

SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						0.0	PAVEMENT		4" Asphalt with 6" Gravel Subbase	
						0.8	COASTAL PLAIN DEPOSITS			
2 - 4	S-1		6 - 8 - 6 - 6	18	14				Brownish-Yellow (10YR 6/6) LOAMY SAND; No Coarse Fragments; Moist; Weak Granular Structure; Friable; No Roots (SM)	
						4.0				
4 - 6	S-2		6 - 5 - 6 - 6	16	11	5.0			Brownish-Yellow (10YR 6/6) SAND; No Coarse Fragments; Moist; Weak Granular Structure; Friable; No Roots (SP)	
6 - 8	S-3		6 - 8 - 8 - 12	11	16				As Above (SP)	
8 - 10	S-4		12 - 10 - 10 - 9	12	20				As Above (SP)	
						10.0				
10 - 12	S-5		9 - 10 - 12 - 11	15	22				As Above, Wet (SP)	
						12.0				
									Boring Log B-6 Terminated at a Depth of 12.0 Feet Below Ground Surface	
						15.0				
						20.0				
						25.0				

NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched, ESHGW = Estimated Seasonal High Groundwater

WHITESTONE

APPENDIX B
Infiltration Test Results

WHITESTONE

INFILTRATION TEST

Client: Kalian Companies

Test Hole No.: I-1@B-1

Project: Proposed Mixed-Use Building

Date: 12/1/2022

Location: 160 First Avenue
(Block 101, Lot 4.01)
Atlantic Highlands, Monmouth Co., NJ

Weather: Clear

Surface Elevation: 22.00

File No. GS2219785.000

Test Depth (Feet): 4.00

Field Engineer: TJ

Test Depth (Elevation): 18.00

Reading No.	Time		Water Level Reading (inches)		Water Level Fall (Inches)	Time Interval (Hours)	Rate of Flow (Inches/Hour)
	Start	Finish	Start	Finish			
PS	8:55	9:07	6.0	0.0	6.0	0.2	>20.0
1	9:09	9:15	6.0	3.0	3.0	0.1	>20.0
2	9:15	9:21	6.0	3.0	3.0	0.1	>20.0
3	9:21	9:27	6.0	3.0	3.0	0.1	>20.0

Remarks: Field i = >20.0 in/hr

NOTES: PS = Pre Soak; NS = Not Surveyed

WHITESTONE

INFILTRATION TEST

Client: Kalian Companies

Test Hole No.: I-2@B-2

Project: Proposed Mixed-Use Building

Date: 12/1/2022

Location: 160 First Avenue
(Block 101, Lot 4.01)
Atlantic Highlands, Monmouth Co., NJ

Weather: Clear

Surface Elevation: 22.00

File No. GS2219785.000

Test Depth (Feet): 4.00

Field Engineer: TJ

Test Depth (Elevation): 18.00

Reading No.	Time		Water Level Reading (inches)		Water Level Fall (Inches)	Time Interval (Hours)	Rate of Flow (Inches/Hour)
	Start	Finish	Start	Finish			
PS	8:31	8:39	6.0	0.0	6.0	0.133	>20.0
1	8:40	8:49	6.0	0.0	6.0	0.15	>20.0
2	8:49	8:58	6.0	0.0	6.0	0.15	>20.0
3	8:58	9:07	6.0	0.0	6.0	0.15	>20.0

Remarks: Field *i* = >20.0 in/hr

NOTES: PS = Pre Soak; NS = Not Surveyed

WHITESTONE

INFILTRATION TEST

Client: Kalian Companies

Test Hole No.: I-3@B-3

Project: Proposed Mixed-Use Building

Date: 12/1/2022

Location: 160 First Avenue
(Block 101, Lot 4.01)
Atlantic Highlands, Monmouth Co., NJ

Weather: Clear

Surface Elevation: 22.00

File No. GS2219785.000

Test Depth (Feet): 4.00

Field Engineer: TJ

Test Depth (Elevation): 18.00

Reading No.	Time		Water Level Reading (inches)		Water Level Fall (Inches)	Time Interval (Hours)	Rate of Flow (Inches/Hour)
	Start	Finish	Start	Finish			
PS	9:35	9:50	6.0	0.0	6.0	0.2	>20.0
1	9:50	9:59	6.0	3.0	3.0	0.15	20.0
2	10:00	10:09	6.0	3.0	3.0	0.15	20.0
3	10:09	10:18	6.0	3.0	3.0	0.15	20.0

Remarks: Field *i* = 20.0 in/hr

NOTES: PS = Pre Soak; NS = Not Surveyed

WHITESTONE

INFILTRATION TEST

Client: Kalian Companies

Test Hole No.: I-4@B-4

Project: Proposed Mixed-Use Building

Date: 12/1/2022

Location: 160 First Avenue
(Block 101, Lot 4.01)
Atlantic Highlands, Monmouth Co., NJ

Weather: Clear

Surface Elevation: 22.00

File No. GS2219785.000

Test Depth (Feet): 4.00

Field Engineer: TJ

Test Depth (Elevation): 18.00

Reading No.	Time		Water Level Reading (inches)		Water Level Fall (Inches)	Time Interval (Hours)	Rate of Flow (Inches/Hour)
	Start	Finish	Start	Finish			
PS	11:55	12:02	6.0	0.0	6.0	0.117	>20.0
1	12:02	12:12	6.0	0.0	6.0	0.167	>20.0
2	12:12	12:22	6.0	0.0	6.0	0.167	>20.0
3	12:22	12:32	6.0	0.0	6.0	0.167	>20.0

Remarks: Field i = >20.0 in/hr

NOTES: PS = Pre Soak; NS = Not Surveyed

WHITESTONE

INFILTRATION TEST

Client: Kalian Companies

Test Hole No.: I-5@B-5

Project: Proposed Mixed-Use Building

Date: 12/1/2022

Location: 160 First Avenue
(Block 101, Lot 4.01)
Atlantic Highlands, Monmouth Co., NJ

Weather: Clear

Surface Elevation: 21.00

File No. GS2219785.000

Test Depth (Feet): 4.00

Field Engineer: TJ

Test Depth (Elevation): 17.00

Reading No.	Time		Water Level Reading (inches)		Water Level Fall (Inches)	Time Interval (Hours)	Rate of Flow (Inches/Hour)
	Start	Finish	Start	Finish			
PS	12:20	12:34	6.0	0.0	6.0	0.23	>20.0
1	12:34	12:42	6.0	3.0	3.0	0.13	>20.0
2	12:42	12:50	6.0	3.0	3.0	0.13	>20.0
3	12:50	12:58	6.0	3.0	3.0	0.13	>20.0

Remarks: Field *i* = >20.0 in/hr

NOTES: PS = Pre Soak; NS = Not Surveyed

WHITESTONE

INFILTRATION TEST

Client: Kalian Companies

Test Hole No.: I-6@B-6

Project: Proposed Mixed-Use Building

Date: 12/1/2022

Location: 160 First Avenue
(Block 101, Lot 4.01)
Atlantic Highlands, Monmouth Co., NJ

Weather: Clear

Surface Elevation: 21.00

File No. GS2219785.000

Test Depth (Feet): 4.00

Field Engineer: TJ

Test Depth (Elevation): 17.00

Reading No.	Time		Water Level Reading (inches)		Water Level Fall (Inches)	Time Interval (Hours)	Rate of Flow (Inches/Hour)
	Start	Finish	Start	Finish			
PS	1:00	1:15	6.0	0.0	6.0	0.25	>20.0
1	1:15	1:24	6.0	3.0	3.0	0.15	20.00
2	1:24	1:33	6.0	3.0	3.0	0.15	20.00
3	1:33	1:42	6.0	3.0	3.0	0.15	20.00

Remarks: Field *i* = 20.0 in/hr

NOTES: PS = Pre Soak; NS = Not Surveyed

WHITESTONE

APPENDIX C
Supplemental Information (USCS, Terms & Symbols)

WHITESTONE
An Employee-Owned Company

1959 HIGHWAY 34
BUILDING A, SUITE 102
WALL, NJ 07719
732.592.2101
whitestoneassoc.com

UNIFIED SOIL CLASSIFICATION SYSTEM

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
			GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SAND AND SANDY SOILS	CLEAN SAND (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
			SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
			SC	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMITS LESS THAN 50	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMITS GREATER THAN 50	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS			PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS FOR SAMPLES WITH 5% TO 12% FINES

GRADATION*

% FINER BY WEIGHT	
TRACE	1% TO 10%
LITTLE	10% TO 20%
SOME	20% TO 35%
AND	35% TO 50%

COMPACTNESS*
Sand and/or Gravel

RELATIVE DENSITY	
LOOSE	0% TO 40%
MEDIUM DENSE	40% TO 70%
DENSE	70% TO 90%
VERY DENSE	90% TO 100%

CONSISTENCY*
Clay and/or Silt

RANGE OF SHEARING STRENGTH IN POUNDS PER SQUARE FOOT	
VERY SOFT	LESS THAN 250
SOFT	250 TO 500
MEDIUM	500 TO 1000
STIFF	1000 TO 2000
VERY STIFF	2000 TO 4000
HARD	GREATER THAN 4000

** VALUES ARE FROM LABORATORY OR FIELD TEST DATA, WHERE APPLICABLE. WHEN NO TESTING WAS PERFORMED, VALUES ARE ESTIMATED.*

Other Office Locations:

WARREN, NJ 908.668.7777 | CHALFONT, PA 215.712.2700 | SOUTHBOROUGH, MA 508.485.0755 | ROCKY HILL, CT 860.726.7889 | PHILADELPHIA, PA 215.848.2323 | BEDFORD, NH 603.514.2230 | TAMPA, FL 813.851.0690 | MIAMI, FL 786.783.6966

Environmental & Geotechnical Engineers & Consultants

WHITESTONE
An Employee-Owned Company

1959 HIGHWAY 34
BUILDING A, SUITE 102
WALL, NJ 07719
732.592.2101
whitestoneassoc.com

GEOTECHNICAL TERMS AND SYMBOLS

SAMPLE IDENTIFICATION

The Unified Soil Classification System is used to identify the soil unless otherwise noted.

SOIL PROPERTY SYMBOLS

N: Standard Penetration Value: Blows per ft. of a 140 lb. hammer falling 30" on a 2" O.D. split-spoon.
Qu: Unconfined compressive strength, TSF.
Qp: Penetrometer value, unconfined compressive strength, TSF.
Mc: Moisture content, %.
LL: Liquid limit, %.
PI: Plasticity index, %.
δd: Natural dry density, PCF.
▼: Apparent groundwater level at time noted after completion of boring.

DRILLING AND SAMPLING SYMBOLS

NE: Not Encountered (Groundwater was not encountered).
SS: Split-Spoon - 1 ⅜" I.D., 2" O.D., except where noted.
ST: Shelby Tube - 3" O.D., except where noted.
AU: Auger Sample.
OB: Diamond Bit.
CB: Carbide Bit
WS: Washed Sample.

RELATIVE DENSITY AND CONSISTENCY CLASSIFICATION

Term (Non-Cohesive Soils)	Standard Penetration Resistance
Very Loose	0-4
Loose	4-10
Medium Dense	10-30
Dense	30-50
Very Dense	Over 50

Term (Cohesive Soils)	Qu (TSF)
Very Soft	0 - 0.25
Soft	0.25 - 0.50
Firm (Medium)	0.50 - 1.00
Stiff	1.00 - 2.00
Very Stiff	2.00 - 4.00
Hard	4.00+

PARTICLE SIZE

Boulders	8 in.+	Coarse Sand	5mm-0.6mm	Silt	0.074mm-0.005mm
Cobbles	8 in.-3 in.	Medium Sand	0.6mm-0.2mm	Clay	-0.005mm
Gravel	3 in.-5mm	Fine Sand	0.2mm-0.074mm		

Other Office Locations:

WARREN, NJ 908.668.7777 | CHALFONT, PA 215.712.2700 | SOUTHBOROUGH, MA 508.485.0755 | ROCKY HILL, CT 860.726.7889 | PHILADELPHIA, PA 215.848.2323 | BEDFORD, NH 603.514.2230 | TAMPA, FL 813.851.0690 | MIAMI, FL 786.783.6966

D. 72 HOUR DRAIN DOWN

Hydrograph for Pond 7P: Permeable Pavement

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Discarded (cfs)
0.00	0.00	0	18.51	0.00
2.00	0.04	1	18.51	0.04
4.00	0.05	1	18.51	0.05
6.00	0.07	1	18.51	0.07
8.00	0.10	2	18.51	0.10
10.00	0.18	3	18.51	**0.18**
12.00	**2.21**	**111**	**18.55**	**1.59**
14.00	**0.19**	**3**	**18.51**	0.19
16.00	0.11	2	18.51	0.11
18.00	0.07	1	18.51	0.07
20.00	0.06	1	18.51	0.06
22.00	0.05	1	18.51	0.05
24.00	0.04	1	18.51	0.04
26.00	0.00	0	18.51	0.00
28.00	0.00	0	18.51	0.00
30.00	0.00	0	18.51	0.00
32.00	0.00	0	18.51	0.00
34.00	0.00	0	18.51	0.00
36.00	0.00	0	18.51	0.00
38.00	0.00	0	18.51	0.00
40.00	0.00	0	18.51	0.00
42.00	0.00	0	18.51	0.00
44.00	0.00	0	18.51	0.00
46.00	0.00	0	18.51	0.00
48.00	0.00	0	18.51	0.00
50.00	0.00	0	18.51	0.00
52.00	0.00	0	18.51	0.00
54.00	0.00	0	18.51	0.00
56.00	0.00	0	18.51	0.00
58.00	0.00	0	18.51	0.00
60.00	0.00	0	18.51	0.00
62.00	0.00	0	18.51	0.00
64.00	0.00	0	18.51	0.00
66.00	0.00	0	18.51	0.00
68.00	0.00	0	18.51	0.00
70.00	0.00	0	18.51	0.00
72.00	0.00	0	18.51	0.00

E. GROUNDWATER MOUNDING ANALYSIS

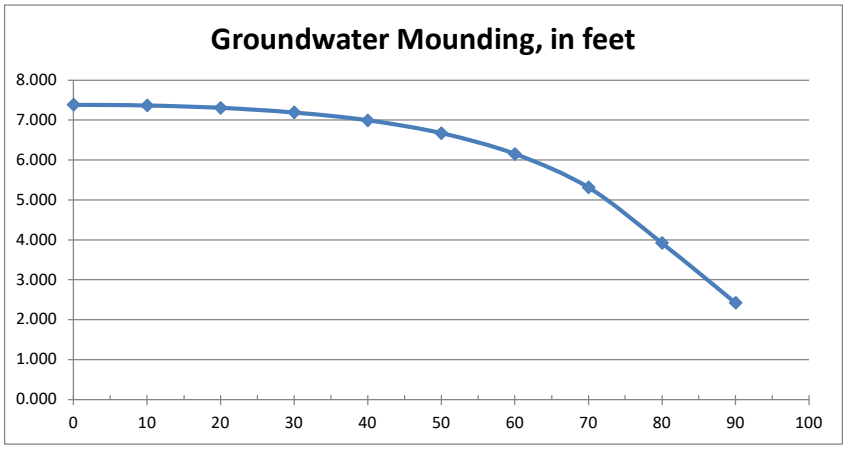
Input Values

10.00	*R*	Recharge rate (permeability rate) (in/hr)
0.150	Sy	Specific yield, Sy (dimensionless) default value is 0.15; max value is 0.2 provided that a lab test data is submitted
50.00	Kh	Horizontal hydraulic conductivity (in/hr) Kh = 5xRecharge Rate (R) in the coastal plain; Kh=R outside the coastal plain
80.000	x	1/2 length of basin (x direction, in feet)
20.000	y	1/2 width of basin (y direction, in feet)
2.44	t	Duration of infiltration period (hours)
10.00	hi(0)	Initial thickness of saturated zone (feet)

17.383	h(max)	Maximum thickness of saturated zone (beneath center of basin at end of infiltration period)
7.383	Δh(max)	Maximum groundwater mounding (beneath center of basin at end of infiltration period)

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
7.383	0
7.365	10
7.306	20
7.191	30
6.994	40
6.670	50
6.150	60
5.310	70
3.921	80
2.420	90

Re-Calculate Now



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

F. DRAINAGE AREA MAPS