REPORT

FINAL

DRAINAGE INVESTIGATION FOR STORMWATER CONTROL WITH GREEN ROOF

361-373-JFK Blvd
Bayonne, NJ

FOR
Bayonne Planning Board

Prepared By:

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Introduction

Presented herein are the results of the drainage investigation conducted for the proposed new multi family house located at 361-373-JFK Blvd. The purpose of the investigation was to explore the pre and post development site conditions for rain runoff conditions. This study addresses pre-existing conditions, and the final post developed site conditions. In order to determine the necessary BMP requirements for the post development, the design used hydraulic software methods to achieve the post developed rain runoff storm-water requirements for the project site.

Project Description

The existing lot of 17498 sf had 100% site existing pervious coverage with weeds and vegetation covering most of the entire lot. The proposed construction has full increase in the imperious coverage a total of 96% for the new building to 16,853SF. The proposed runoff shall collect water in an ADS piping detention with an overflow weir and orifice at the exit to the street sanitary system. See attached plans for reference.

Existing Site Runoff Characteristics

The existing site had no detention of runoff from the site. All water on site flowed to the sidewalk gutters, then to the corner catch basins. The flows were moderate since the site did not have any major slopes.

During a significant storm event the existing site conditions did not contain the rain fall and flows onto Avenue C. The rain flows from a higher elevation and the flow continues onto the existing concrete front area to the street gutter.

Engineering Recommendations for (BMP) Best Management Practice

Proposed Site Characteristics

The proposed building is to be situated on the street with other residential building. The existing site pervious covers 100% of the lot. The proposed design has fulfilled the criteria set by the Bayonne MUA checklist. The new house criteria since our post

is equal to the pre-construction conditions. The placement of storage tanks will decrease the 2, 10, 25 and 100 yr. storm events are individually less than the precondition. Since the site was equal impervious area. This detention system allows for full storage up to a 2 yr. event and REDUCES flow during higher rain events. .The pipes will be placed under the garage floor with outlet and inlet tanks at the building's face

GREEN ROOF Design

Green Roof Composition:

The green roof comprise (top to bottom) actual vegetation, growing medium; filter fabric, drainage layer, root barrier, water proofing system, leak detection system and the roof structure. Vegetation: The criteria for selection of vegetation is to tolerate a broad range of conditions including, weather, water depth and inundation, high wind speed, temperature fluctuation, amount of direct sun light, presence or absence of surrounding structures, roof slope, architectural features etc. The selected plant species are native in nature to reflect healthy plant community for the available sunlight. The plant selection will be discussed with the reviewing agency. Growing Medium: The growing medium affects the ability of the installation to support vegetation, retain stormwater, and provide heat and noise insulation for the building; and is a crucial design parameter. The growing medium is selected to be (80 t0 90%) lightweight and to retain sufficient water to sustain vegetation. The growing medium is comprises lightweight aggregate, (10 to 20%) of stable organic matter, have sufficient permeability to prevent ponding or logging The selected medium should have low turbidity, suspended solids and carbon to decrease pollution in the discharge form the roof. The growing medium is selected to have sufficient water storage capacity. The recommended permeability of the growing medium is at least 1-inch per hour as per ASTM E2399, the pH value range is between 6 and 8.5. The fine particles (10%) should be less than 0.002 inches or greater than 0.47 inches. Filter Fabric: A filter fabric is to be installed below the planting media with sufficient density to support the growing medium and permit root penetration.

Drainage Layer: The drainage layer is a non-carbonate, coarser granular material resistant to freeze and thaw cycles and possess hydraulic conductivity greater than the growing medium.

Roof Barrier: A roof barrier is provided to ensure that the roots of the vegetation does not damage the roof structure and does not interfere with the root's access to water.

Water Proofing System: A waterproofing system is included to ensure that water does not damage the roof or leak into the building. The impermeable root barrier may act as the waterproofing system. Leak Detection: Location of physical leak detection systems will depend on the manufacturer's specifications and shall be placed

accordingly. A flood test is not recommended, as it is insufficient for detecting small leaks. Electronic leak detection and moisture monitoring systems are recommended.

Roof Slope: The roof is relatively flat with pitch for positive drainage towards the drainage outlet. Environmental Protection: The green roof must be protected against the wind erosion. The vegetation must be established quickly especially around the perimeter and corners of the roof. Temporary erosion protection, such as mats or mesh, must be provided until mature plant cover is established. If erosion becomes an issue, permanent stabilization must be installed. All stabilization measures must be included in the maintenance plan. Safety: All green roofs must be designed to safely convey overflows, up to and including the 100-year storm, to downstream drainage systems. The design of any overflow structure must be sufficient to provide safe and stable discharge of stormwater in the event of an overflow. Safe and stable discharge minimizes the possibility of adverse impacts, including erosion and flooding in down-gradient areas. All drains and scuppers must be protected to prevent clogging; one such method is a gravel apron, as shown in the image below.

Vegetated Areas: · Bi-weekly inspections are required when establishing/restoring vegetation. · A minimum of one inspection during the growing season and one inspection during the non-growing season is required to ensure the health, density and diversity of the vegetation. Additional inspections are required after major weather events, such as but not limited to, high wind events and lightning strikes. · Trimming of the vegetation must be performed on a regular schedule based on specific site conditions. · Vegetative cover must be maintained at 85%; damage in excess of 50% must be immediately addressed through replanting in accordance with the original specifications. · Vegetated areas must be inspected at least once annually for erosion, scour and unwanted growth; any unwanted growth must be removed with minimum disruption to the remaining vegetation. · All use of fertilizers, pesticides, mechanical treatments and other means to ensure optimum vegetation must not compromise the intended purpose of the green roof.

Drain Time: · Water ponding on the surface and the drainage layer of green roofs must fully drain within 72 hours; ponding in excess of 72 hours may render the green roof ineffective and may result in anaerobic conditions, odor and both water quality and mosquito breeding issues.

GREEN ROOF Calculations:

Calculation of runoff retention of the proposed Green Roof:

- **ROOF TOP GARDEN STORAGE CAPACITY: Using the above formula s generated by NJ storm best storm water management**
- 6” min depth of green roof
- Vegetation min of 20% 1-7 mm pumice 60% 4-10 mm pumice 20% composted pine bark fines

$$S_v = \frac{SA\ x\ [(d\ x\ \eta_1)+(DL\ x\ \eta_2)]}{12\ in/ft}, \text{ where:}$$

S_v = storage volume (cf)
SA = green roof area (sf)
d = media depth (in)
η_1 = available water capacity for runoff retention
DL = drainage layer depth (in)
η_2 = drainage layer field capacity

SA = Proposed Green Roof Area = 5758 SF

d = 6-inches
ɳ1 = 0.231 [Refer to the Table attached from NJ Stormwater Best Management Manual April - 2021
DL = 6-inches
ɳ2 = 0.349 [Refer to the Table attached from NJ Stormwater Best Management Manual April - 2021

SV = 722.6

Calculation of discharged runoff volume from the roof area for 2, 10 and 100-year storms for Impervious Roof:
Reference Technical Release-55 (TR-55) NRCS Methodology
Discharged Runoff Volumes by NRCS TR-55 without Green Roof (NRCS Computer Software Hydrology Studio Version 2021 3.0.20)

CN=98, A=0.09 acres, Tc = 6 Minutes
Vol $_{2\text{-Year}}$ = 3528ft^3
Vol $_{10\text{-Year}}$ = 5749ft^3
Vol $_{100\text{-Year}}$ = 9234ft^3
Discharged runoff Volume = Runoff Volumes – Storage Volume
For 2-Year = 2806

For 10-Year = 5027

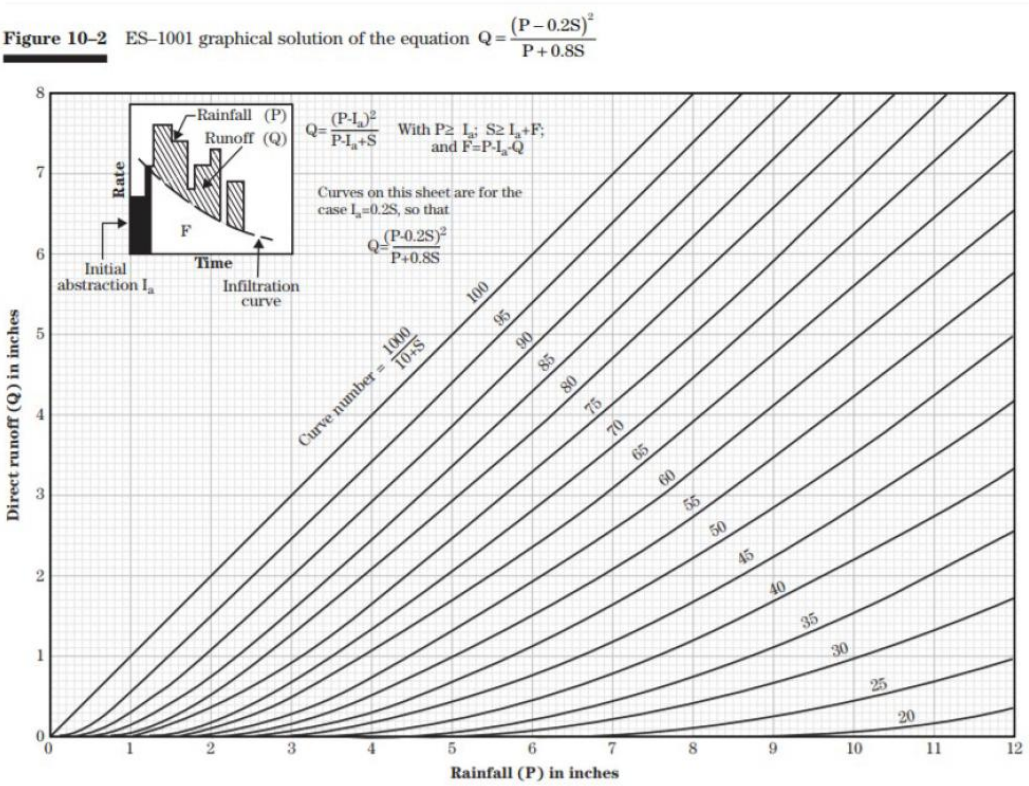
For 100-Year = 8515

Calculation of Direct Runoff Depth:
The direct runoff depth, ◌̊, is calculated by dividing the discharged runoff volume by the roof area, yielding

$$Q = \frac{reduced\ runoff\ volume\ (cf)\ x\ 12\ in/ft}{green\ roof\ area\ (sf)}$$

the following results:
$Q_{2\text{-Year Depth}}$ = 2806/15909 = 2.11
$Q_{10\text{-Year Depth}}$ = 5027/15909 = 3.79
$Q_{2\text{-Year Depth}}$ = 8515/15909 = 6.422

From NRCS Methodology for two, 10 and 100-year design storm the rainfall precipitation depths are
P_2 = 3.33
P_{10} = 4.99
P_{100} = 8.15



Adjusted CN [Figure 10-2 NJ Best Management Practice Manual 2021]
$CN_{2\text{-Year}}$ = 88
$CN_{10\text{-Year}}$ = 87
$CN_{100\text{-Year}}$ = 84

Calculation of Peak Flow rates by Adjusted Curve Number:

The peak flow rates per adjusted Curve Number as per (NRCS Computer Software Hydrology Studio
Version 2021 3.0.20)

Time of concentration: [N.J.A.C 7:8-2.4(g)4 for sheet flow and Equation 15-8 NEH 630

n = Manning's coefficient = 0.24 ref; Table 15-1 630 (NEH) and as per NJ Best Management Practices Manual 2021
L = Length of sheet flow 55 feet as per the location of discharge drain on the roof

P_2 = 2-Year, 24 hour rainfall (inches) = 3.33 in (Figure 5-8) NJ Stormwater BMP Manual April. 2021)

S = Slope of land surface, ft/ft = 0.010 as per architectural plans for a flat roof consider a pitch of 6- inch in 50 ft.

T_t = Travel time (hours)

Time of concentration (Green Roof) for 2 –Year = 11.45 minutes

Time of concentration (Green Roof) for 10 –Year = 9.2 minutes

Time of concentration for 100–Year = 7.44Minutes

Consider Average Time of Concentration as 9.35inutes

Consider Minimum Time of Concentration as 6 minutes for concrete roof.

Strom event	ADJUSTED CN	Discharged Runoff Vol-Green Roof (ft_3)	Peak Flow cfs
2 year	88	3528	0.23
10 year	87	5749	0.61
100 year	84	9234	1.63

Compare these results with that from an impervious roof:
(NRCS Computer Software Hydrology Studio Version 2021 3.0.20)
CN = 98, Tc = 6 Min

Strom event	ADJUSTED CN	Discharged Runoff Vol-Green Roof (af)	Peak Flow cfs
2 year	98	0.87af	1.34
10 year	98	0.137af	2.00
100 year	98	0.212	3.2

Pre-Construction Surface Runoff for two, 10 and 100-Year Storms
Vacant lot approximately 16187 sq.ft.
Pre-construction Drainage Computation:

Rational formula Q=C x i x A
Where:
Q = the surface runoff in cubic feet per second (ft_3/sec)
C = the coefficient of surface runoff
A = the area in acres
i = the rainfall intensity in in/hour
Consider 'C' as 0.3 for the pre-developed condition as the undeveloped land with vegetative cover.
Consider 2-year, 10-year and 100-year design storms for stormwater quantity estimation.

Time of concentration [N.J.A.C 7:8-2.4(g)4 for sheet flow and Equation 15-8 NEH 630

n = Manning's coefficient = 0.40 ref; Table 15-1 630 (NEH)

L = Length of sheet flow 10 feet (630 (NEH)

P_2 = 2-Year, 24 hour rainfall (inches) = 3.33 in (Figure 5-8) NJ Stormwater BMP Manual April. 2021)

S = Slope of land surface, ft/ft = 0.099 as per site plan with topographic survey.

T_t = Travel time (hours)

$T_{t\text{-}2\text{-}year\ Pre}$ = 0.0287 hours = 1.74 minutes.

Pre-Construction Peak Flow by NRCS:

The peak flow rates as per (Rational Method) Computer Software Hydrology Studio Version 2021 3.0.20

Storm Event	Peak Runoff Vol-Vacant Lot (aft)	Peak Flow (ft_3/sec)
2	0.089	1.36
10	0.134	2.04
100	0.216	3.26

Rational Method Hydrology
Pre-Construction Peak Flow by:

CN = 98 for asphalt and garages and homes >95%

Storm Event	Peak Runoff Vol-Vacant Lot (ft_3)	Peak Flow (ft_3/sec)
2	**0.045**	**0.54**
10	**0.064**	**0.77**
100	**0.092**	**1.11**

Design Hydrology for On-Site for drainage pipes in the garage

The hydraulic analysis for the area focused on design the detention facility to meet the required hydrograph based Bayonne MUA requirements. See appendix for the hydraulic study calculations.

The permanent hydraulic and water quality features below have been designed, and the existing features checked on site for this project's work. This section contains the calculations and analyses needed to size detention pipes. Calculations were performed by hydrocad Software by Bentley Systems which include uniform flow spreadsheets, Hydraulic Grade Line (HGL) computations and layouts, software printouts, etc.

The Design Hydrology Software included:

- Analyze post developed conditions and pond sizes for 2, 10, and 100 years storm events.
- Compute outlet rating curves, pond infiltration, pond detention time, and analyzes the channel.
- Compute outlet rating curves, pond infiltration, pond detention time, and analyzes the channel
- Minium storage for storm detention must comply with a Rainfall data collected from the Department of Commerce Precipitation Frequency Data. BASED ON NJDEP REQUIREMENTS FOR A DESIGN STORM OF 2" RAINFALL IN 60 minutes WITHOUT DISCHARGING TO THE STREET.
  Volume 16853sf ***of property impervious area * 2in/hr/12"/ft = 2808cf of storage required.***

240lf of 3'-0".ft dia. ADS solid piping is equivalent to 2683 cf of storage
PLUS ROOF GARDEN runoff in Q added to the detention
see hydrocad summary results

- Computed Hydrographs for multiple events, and routes them through multiple reaches and ponds.
- Accurate basin maps(s) prepared showing onsite, offsite contributing areas, Tc routes, for existing and developed conditions

- Time of concentration correctly calculated (Tc=max, sheet flow + channel/pipe flow). Minimum Tc=10 min.
- Appropriate methods used to calculate flow rates (rational method, Stormshed, & multiple regression)

Each feature together with calculations is provided in Appendix.

The control practices outlined here are designed to decrease rain event runoff impact.

Table 1 - Pre/Post Runoff Table

Point in Question (PIQ) Pre/Post Storm water Runoff for Property				
Storm Event	Existing Conditions (5S) Q, CFS	Proposed Conditions (5S to 14r) Q, CFS	Change, Q CFS	% reduction
2	1.36	0.00/ with orrifce 0.27	-1.36	100%
10	2.04	0.82	-1.22	62%
100	3.26	1.36	-1.9	52%

Conclusion

The existing site conditions of the site were substandard and don't effectively recharge precipitation due to impervious surface. The new building shall detain the water in a collected pond roof top and detention system on grade before allowing the water to flow through the weir at a slow rate of discharge. The proposed residential/commercial building occupies the entire lot with limited rear and side yard green. A preconstruction and post construction hydraulic and hydrologic (H&H) analysis is done to meet the requirements of N.J.A.C 7:8, New Jersey Best Management Practices Manual April 202, and Jersey City MUA Stormwater Ordinance and other documents and standards as mentioned in the design references; and utilizing NRCS Computer Software Hydrology Studio **Version 2021 3.0.20. The recent NJDEP amendments for N.J.A.C 7:8 to maximize** green infrastructure compared to Low Impact Development (LID) Strategies and use of non-structural best management practices. The proposed green roof justifies the NJDEP amendments for the stormwater management. Drainage computations are done for the preconstruction site condition for the vacant lot and compared with the post

construction development. The post construction drainage computations are done for the roof drainage with green roof to establish the volume of water and surface runoff reduction achieved by the proposed green roof and concrete tank. As depicted in the drainage calculations, the post construction peak flows are less than the preconstruction peak flows.

The proposed site improvements will decrease the water runoff from the site for a 2yr storm event and moderately for higher rain events the contractor/owner for properly maintains of the system and will be responsible to adequately slope detention piping to the weir exit. The proposed final site conditions do reflect the current NJ DEP stormwater Standards for the BMP.

EXISTING DRAINAGE CALCULATIONS

METHOD: NRCS

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Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2 Yr	Type III 24-hr		Default	24.00	1	3.30	2
2	10 Yr	Type III 24-hr		Default	24.00	1	4.90	2
3	25 Yr	Type III 24-hr		Default	24.00	1	5.90	2
4	100 Yr	Type III 24-hr		Default	24.00	1	7.80	2

Summary for Subcatchment 5S: EXISTING SITE RUNOFF

Exsiting Drainage area

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

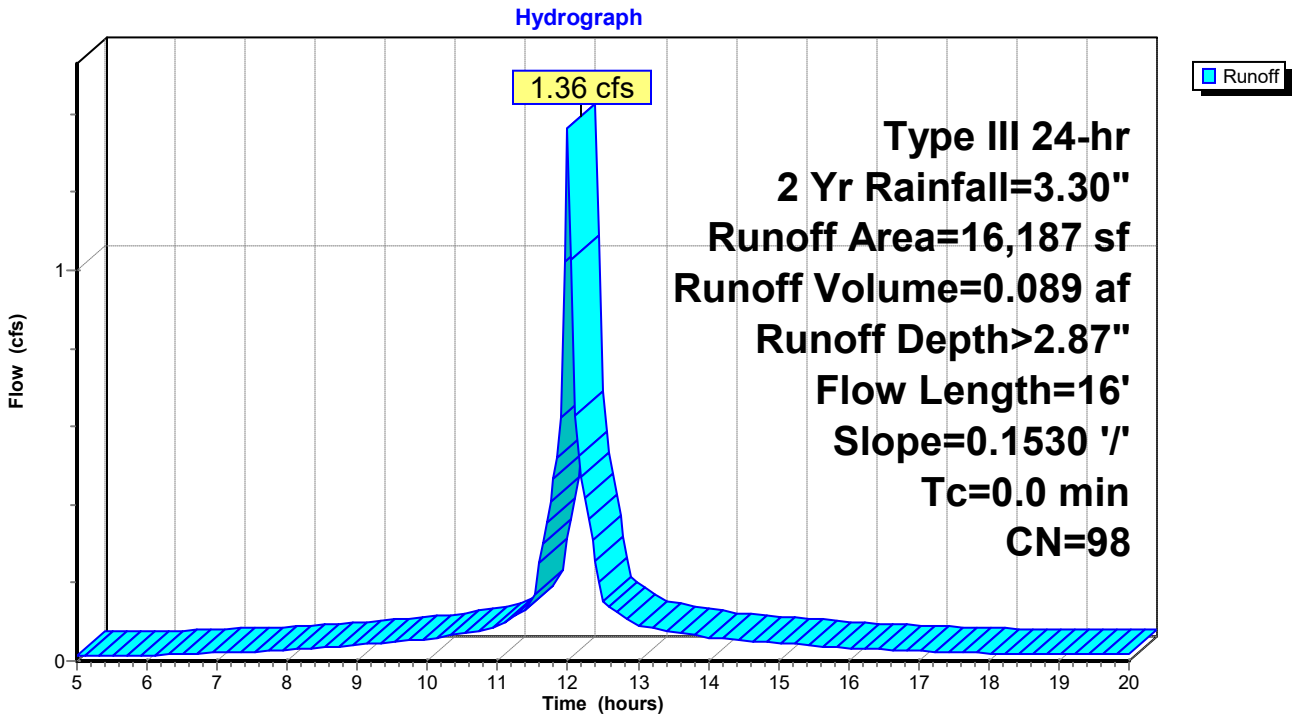
Runoff = 1.36 cfs @ 12.00 hrs, Volume= 0.089 af, Depth> 2.87"
Routed to nonexistent node 2P

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Yr Rainfall=3.30"

Area (sf)	CN	Description
16,187	98	Water Surface, 0% imp, HSG A
16,187		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	16	0.1530	7.94		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps

Subcatchment 5S: EXISTING SITE RUNOFF



Summary for Subcatchment 5S: EXISTING SITE RUNOFF

Exsiting Drainage area

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

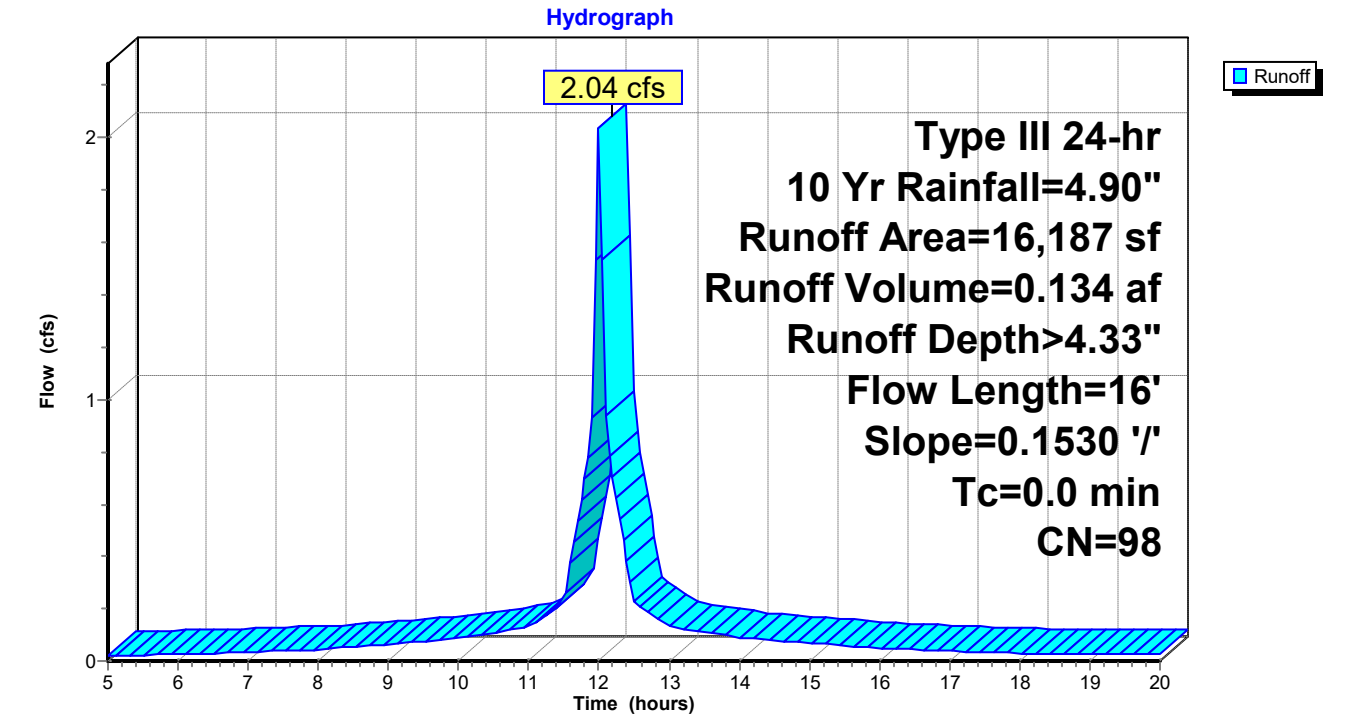
Runoff = 2.04 cfs @ 12.00 hrs, Volume= 0.134 af, Depth> 4.33"
Routed to nonexistent node 2P

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Yr Rainfall=4.90"

Area (sf)	CN	Description
16,187	98	Water Surface, 0% imp, HSG A
16,187		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	16	0.1530	7.94		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps

Subcatchment 5S: EXISTING SITE RUNOFF



Summary for Subcatchment 5S: EXISTING SITE RUNOFF

Exsiting Drainage area

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

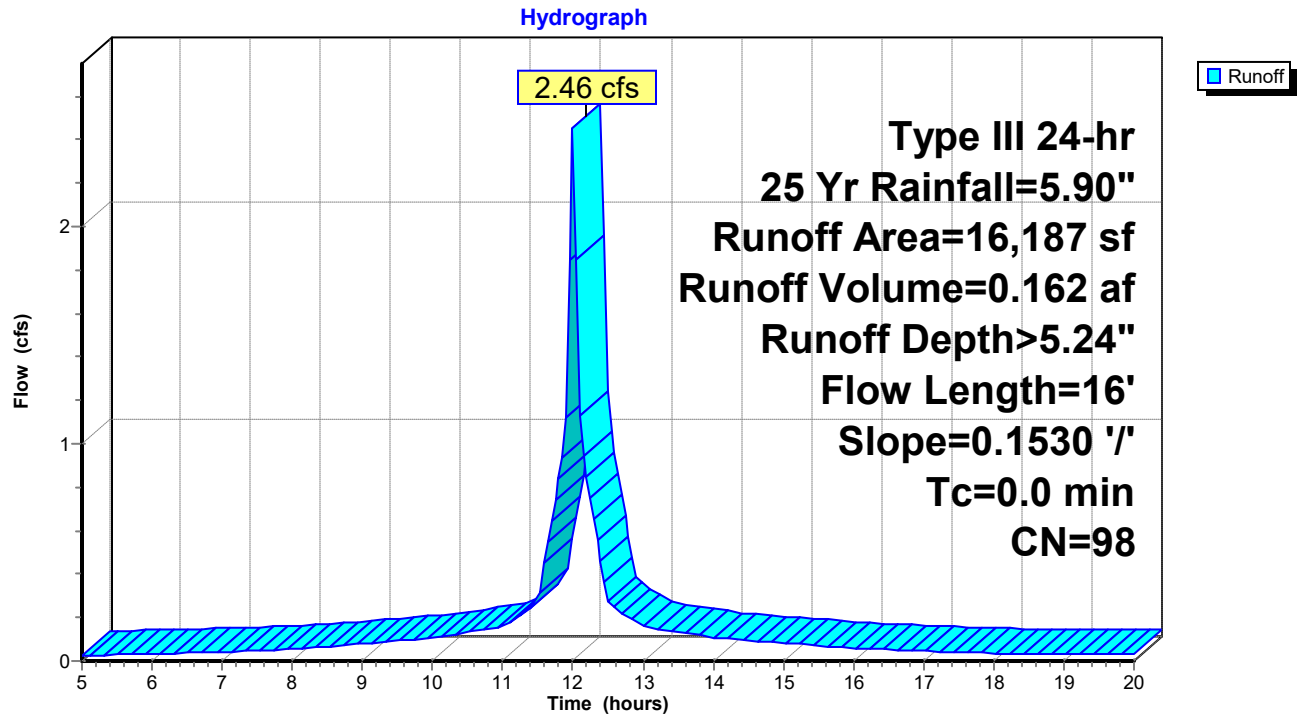
Runoff = 2.46 cfs @ 12.00 hrs, Volume= 0.162 af, Depth> 5.24"
Routed to nonexistent node 2P

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Yr Rainfall=5.90"

Area (sf)	CN	Description
16,187	98	Water Surface, 0% imp, HSG A
16,187		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	16	0.1530	7.94		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps

Subcatchment 5S: EXISTING SITE RUNOFF



Summary for Subcatchment 5S: EXISTING SITE RUNOFF

Exsiting Drainage area

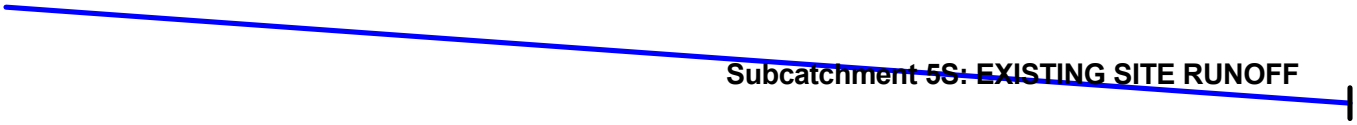
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 3.26 cfs @ 12.00 hrs, Volume= 0.216 af, Depth> 6.96"
Routed to nonexistent node 2P

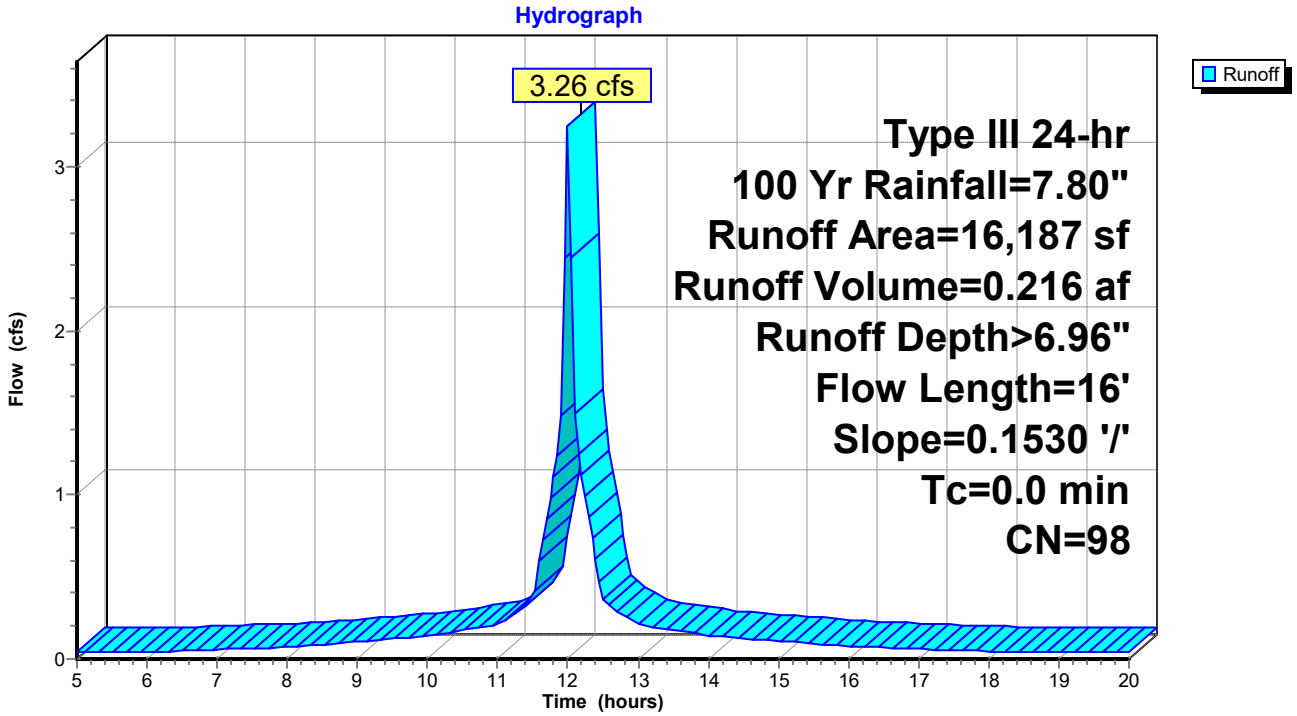
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Yr Rainfall=7.80"

Area (sf)	CN	Description
16,187	98	Water Surface, 0% imp, HSG A
16,187		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	16	0.1530	7.94		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps



Subcatchment 5S: EXISTING SITE RUNOFF



EXISTING DRAINAGE CALCULATIONS

METHOD: RATIONAL

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Bayonne, NJ

Summary for Subcatchment 5S: EXISTING SITE RUNOFF

Exsiting Drainage area

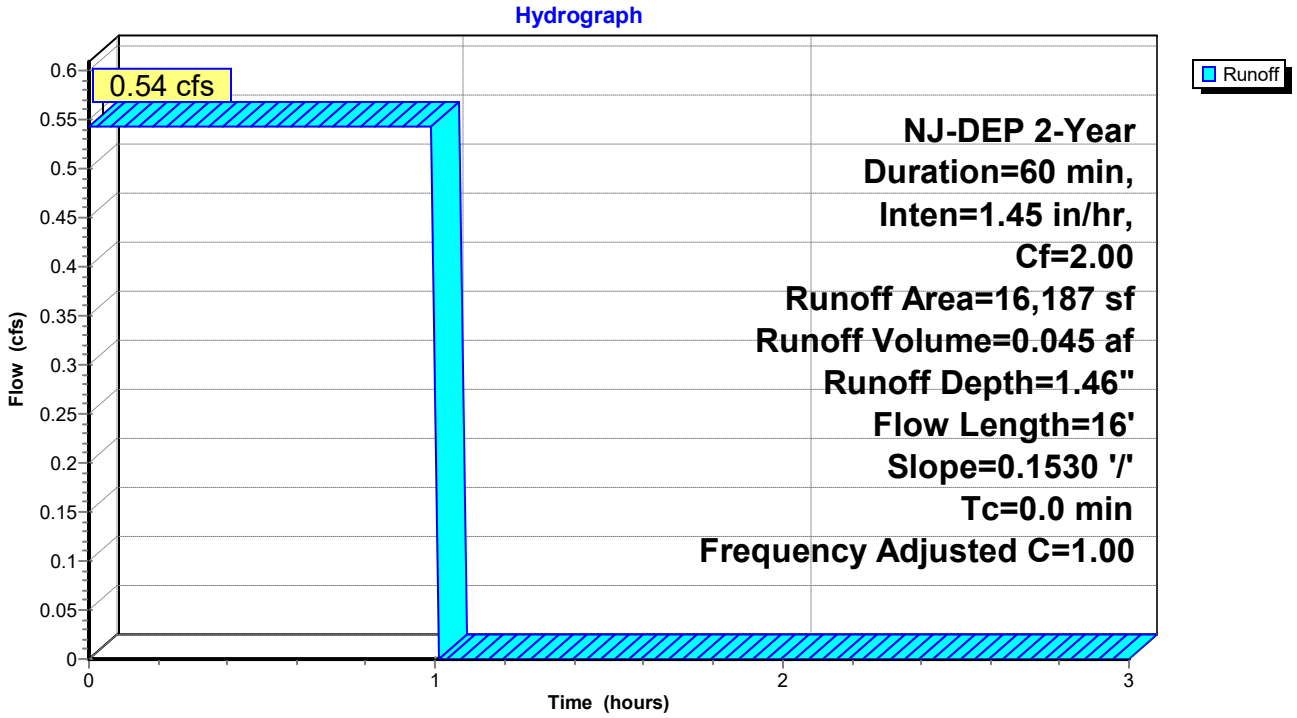
Runoff = 0.54 cfs @ 0.00 hrs, Volume= 0.045 af, Depth= 1.46"
Routed to nonexistent node 2P

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
NJ-DEP 2-Year Duration=60 min, Inten=1.45 in/hr, Cf=2.00

Area (sf)	C	Adj	Description
16,187	0.99		Water Surface, 0% imp, HSG A
16,187	0.99	1.00	Weighted Average, Frequency Adjusted
16,187			100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	16	0.1530	7.94		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps

Subcatchment 5S: EXISTING SITE RUNOFF



Summary for Subcatchment 5S: EXISTING SITE RUNOFF

Exsiting Drainage area

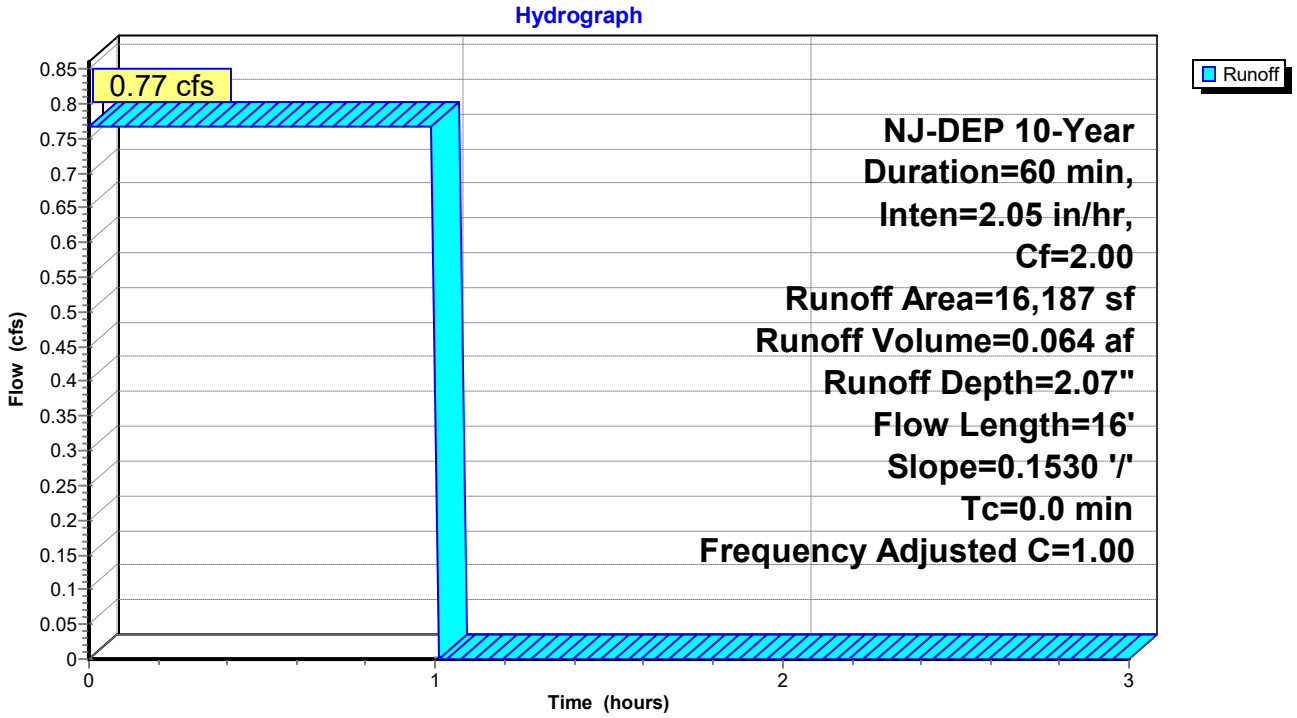
Runoff = 0.77 cfs @ 0.00 hrs, Volume= 0.064 af, Depth= 2.07"
Routed to nonexistent node 2P

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
NJ-DEP 10-Year Duration=60 min, Inten=2.05 in/hr, Cf=2.00

Area (sf)	C	Adj	Description
16,187	0.99		Water Surface, 0% imp, HSG A
16,187	0.99	1.00	Weighted Average, Frequency Adjusted
16,187			100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	16	0.1530	7.94		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps

Subcatchment 5S: EXISTING SITE RUNOFF



Summary for Subcatchment 5S: EXISTING SITE RUNOFF

Exsiting Drainage area

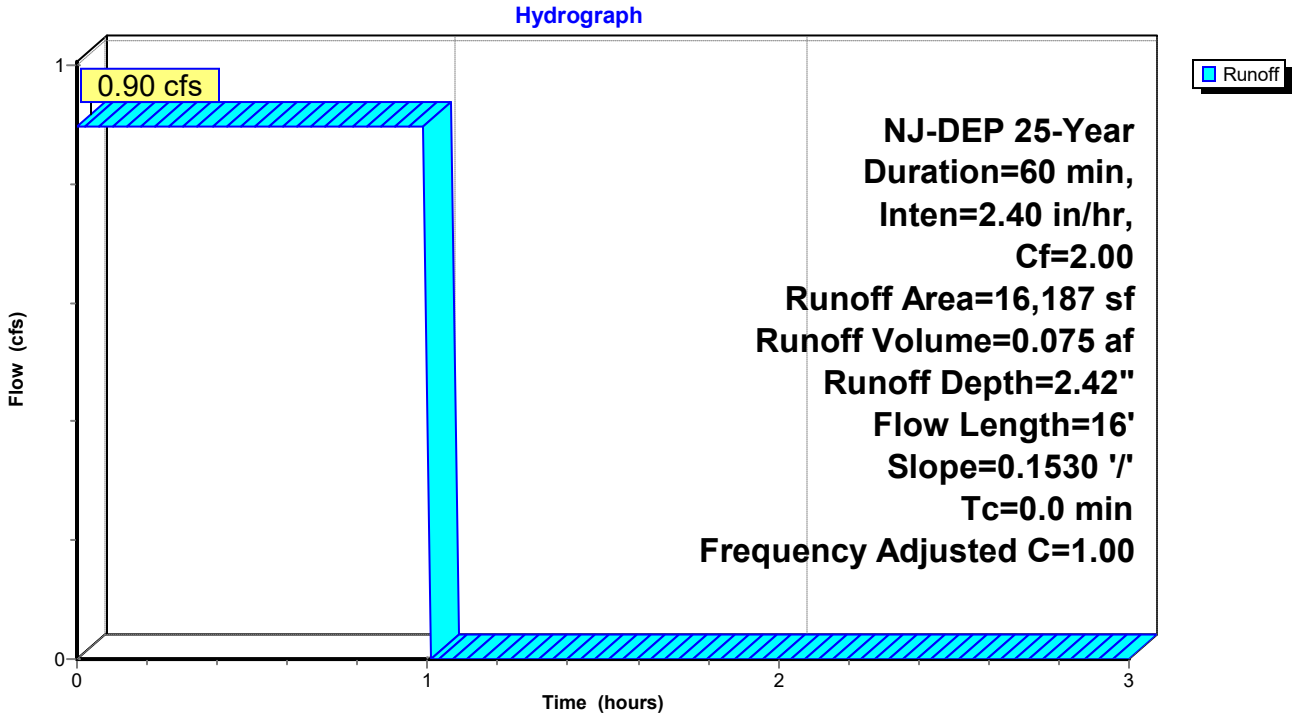
Runoff = 0.90 cfs @ 0.00 hrs, Volume= 0.075 af, Depth= 2.42"
Routed to nonexistent node 2P

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
NJ-DEP 25-Year Duration=60 min, Inten=2.40 in/hr, Cf=2.00

Area (sf)	C	Adj	Description
16,187	0.99		Water Surface, 0% imp, HSG A
16,187	0.99	1.00	Weighted Average, Frequency Adjusted
16,187			100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	16	0.1530	7.94		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps

Subcatchment 5S: EXISTING SITE RUNOFF



Summary for Subcatchment 5S: EXISTING SITE RUNOFF

Exsiting Drainage area

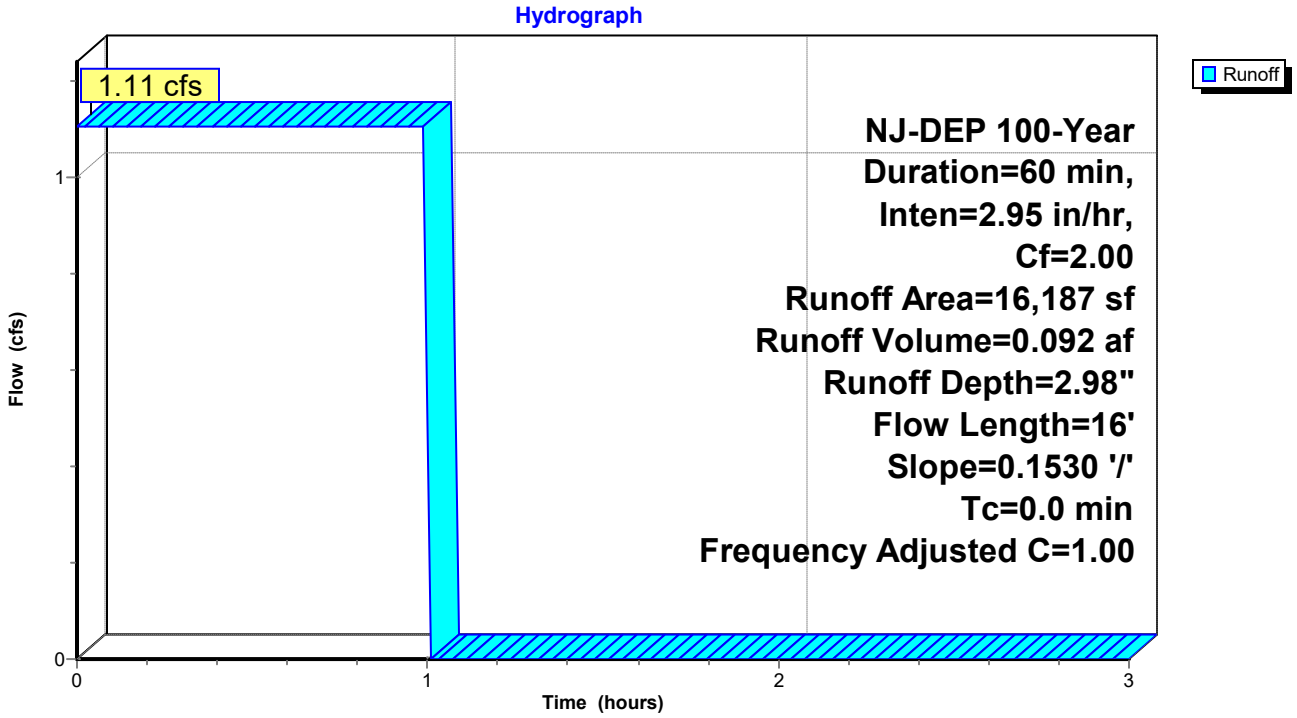
Runoff = 1.11 cfs @ 0.00 hrs, Volume= 0.092 af, Depth= 2.98"
Routed to nonexistent node 2P

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
NJ-DEP 100-Year Duration=60 min, Inten=2.95 in/hr, Cf=2.00

Area (sf)	C	Adj	Description
16,187	0.99		Water Surface, 0% imp, HSG A
16,187	0.99	1.00	Weighted Average, Frequency Adjusted
16,187			100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	16	0.1530	7.94		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps

Subcatchment 5S: EXISTING SITE RUNOFF



PROPOSED DRAINAGE CALCULATIONS WITH NO GREEN ROOF

361-373-JFK Blvd
Bayonne, NJ

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	1 Yr	Type III 24-hr		Default	24.00	1	2.80	2
2	2 Yr	Type III 24-hr		Default	24.00	1	3.30	2
3	10 Yr	Type III 24-hr		Default	24.00	1	4.90	2
4	25 Yr	Type III 24-hr		Default	24.00	1	5.90	2
5	100 Yr	Type III 24-hr		Default	24.00	1	7.80	2

Summary for Subcatchment 5S: propsoed roof SITE RUNOFF-total-no green roof

Exsiting Drainage area

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

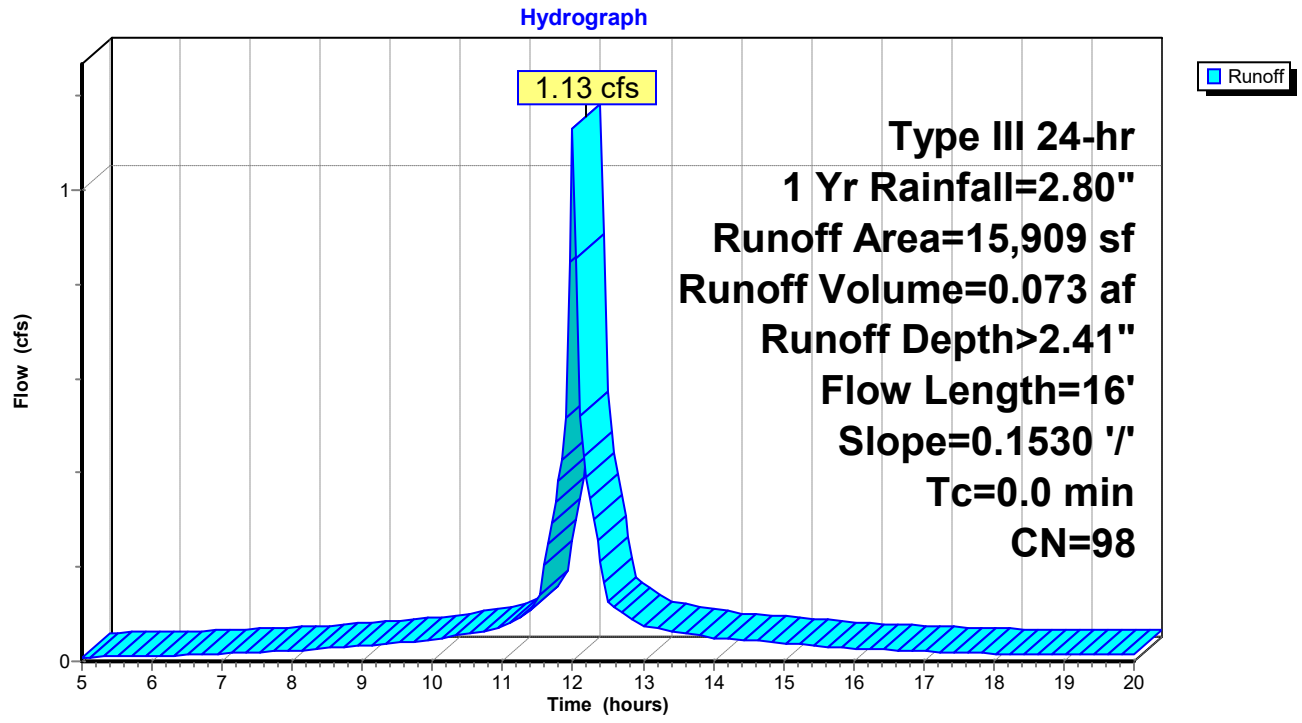
Runoff = 1.13 cfs @ 12.00 hrs, Volume= 0.073 af, Depth> 2.41"
Routed to nonexistent node 2P

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 1 Yr Rainfall=2.80"

Area (sf)	CN	Description
15,909	98	Water Surface, 0% imp, HSG A
15,909		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	16	0.1530	7.94		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps

Subcatchment 5S: propsoed roof SITE RUNOFF-total-no green roof



Summary for Subcatchment 5S: propsoed roof SITE RUNOFF-total-no green roof

Exsiting Drainage area

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

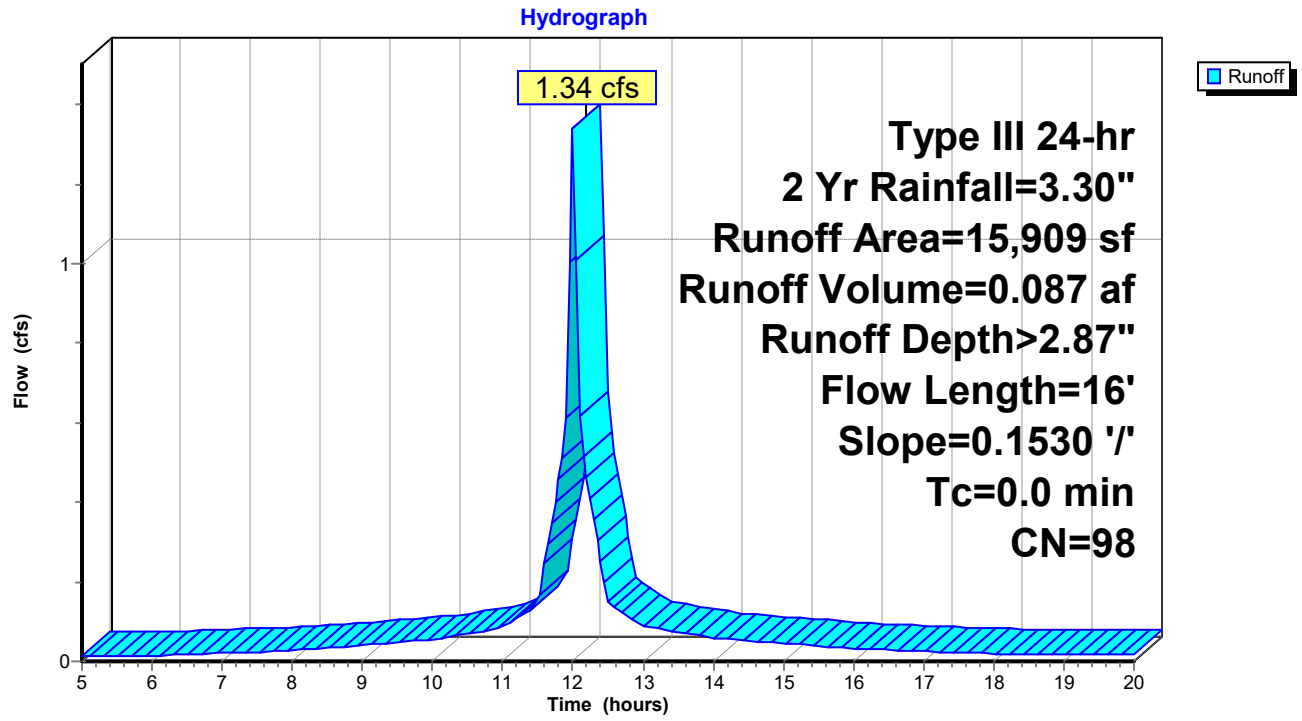
Runoff = 1.34 cfs @ 12.00 hrs, Volume= 0.087 af, Depth> 2.87"
Routed to nonexistent node 2P

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Yr Rainfall=3.30"

Area (sf)	CN	Description
15,909	98	Water Surface, 0% imp, HSG A
15,909		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	16	0.1530	7.94		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps

Subcatchment 5S: propsoed roof SITE RUNOFF-total-no green roof



Summary for Subcatchment 5S: propsoed roof SITE RUNOFF-total-no green roof

Exsiting Drainage area

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

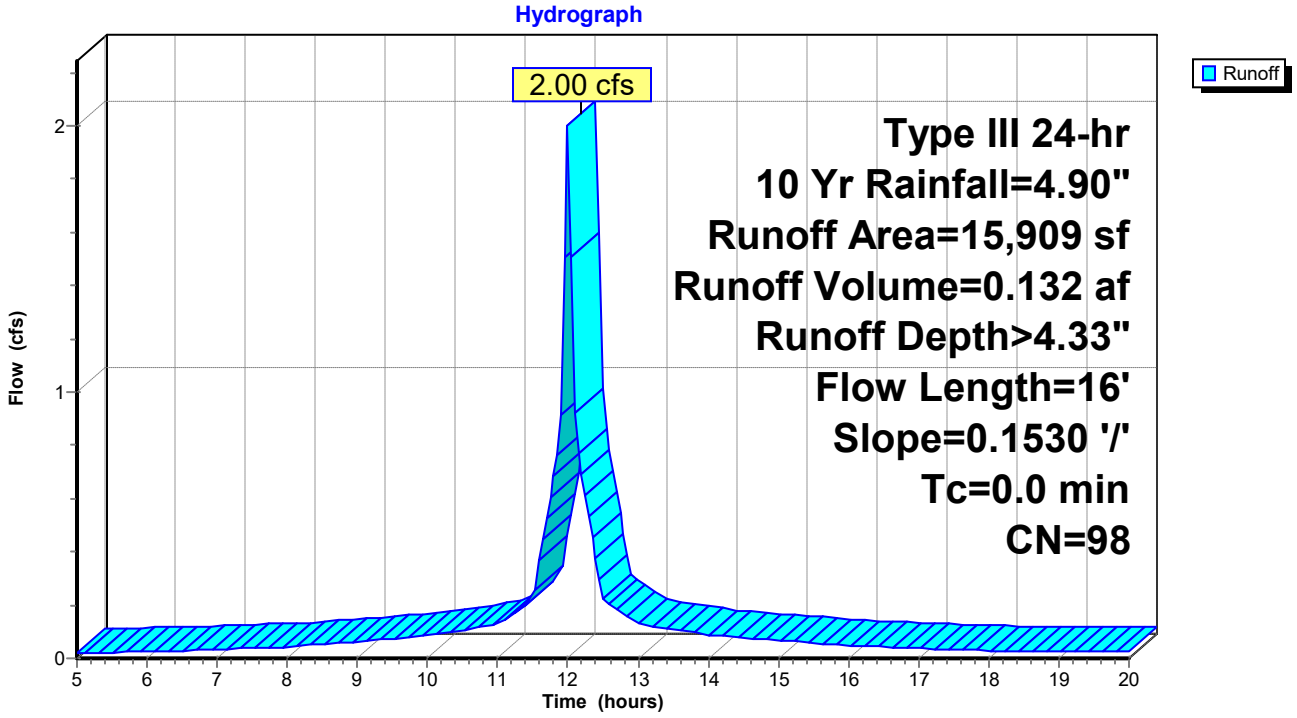
Runoff = 2.00 cfs @ 12.00 hrs, Volume= 0.132 af, Depth> 4.33"
Routed to nonexistent node 2P

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Yr Rainfall=4.90"

Area (sf)	CN	Description
15,909	98	Water Surface, 0% imp, HSG A
15,909		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	16	0.1530	7.94		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps

Subcatchment 5S: propsoed roof SITE RUNOFF-total-no green roof



Summary for Subcatchment 5S: propsoed roof SITE RUNOFF-total-no green roof

Exsiting Drainage area

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

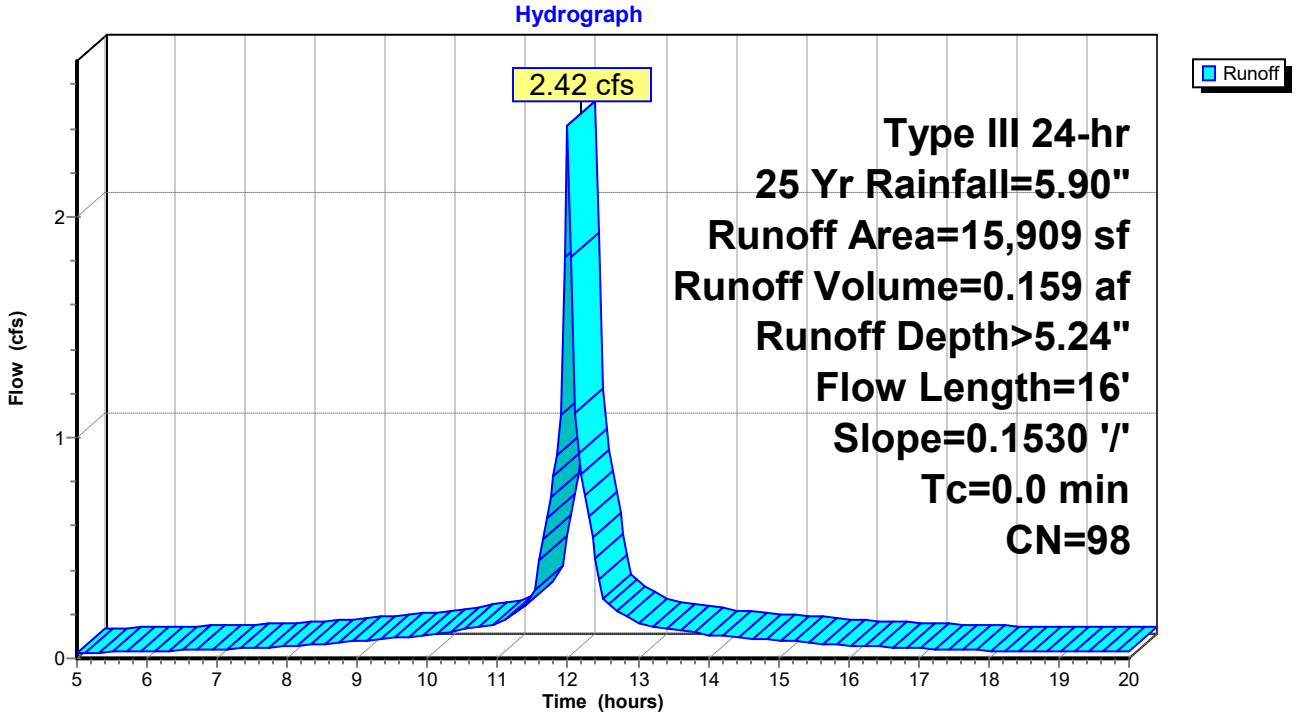
Runoff = 2.42 cfs @ 12.00 hrs, Volume= 0.159 af, Depth> 5.24"
Routed to nonexistent node 2P

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Yr Rainfall=5.90"

Area (sf)	CN	Description
15,909	98	Water Surface, 0% imp, HSG A
15,909		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	16	0.1530	7.94		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps

Subcatchment 5S: propsoed roof SITE RUNOFF-total-no green roof



Summary for Subcatchment 5S: propsoed roof SITE RUNOFF-total-no green roof

Exsiting Drainage area

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

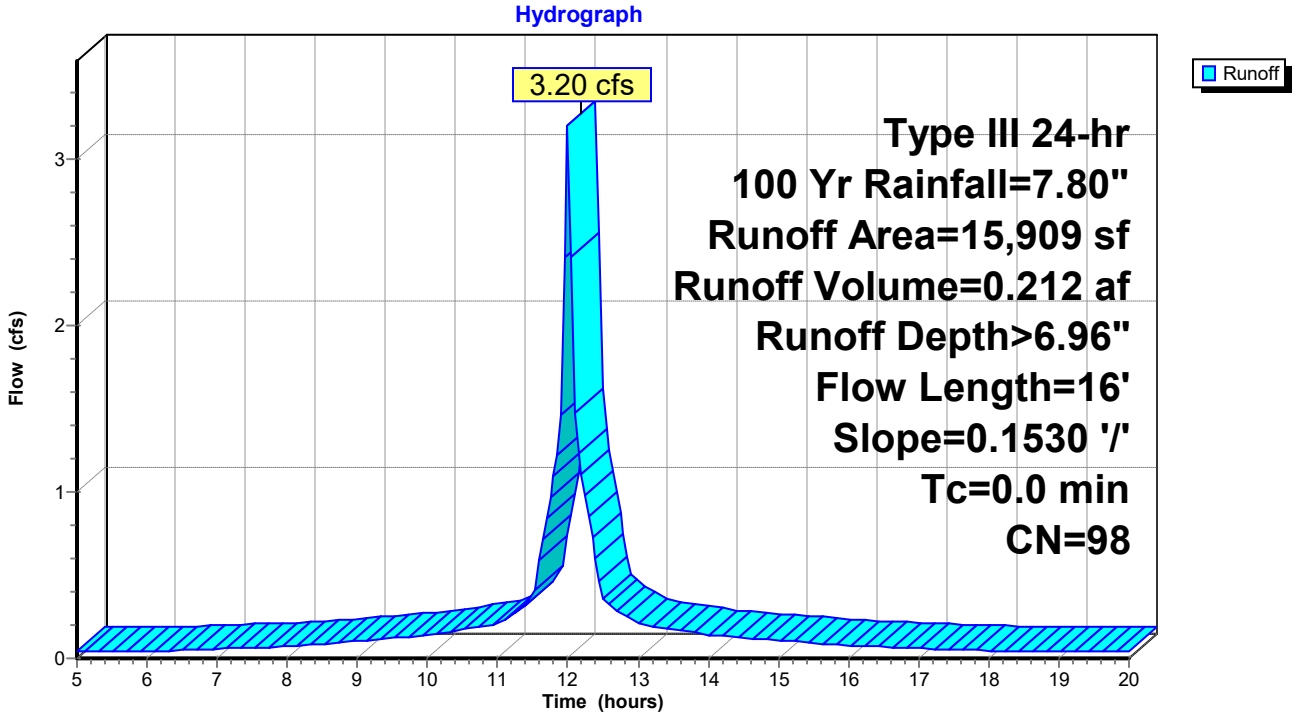
Runoff = 3.20 cfs @ 12.00 hrs, Volume= 0.212 af, Depth> 6.96"
Routed to nonexistent node 2P

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Yr Rainfall=7.80"

Area (sf)	CN	Description
15,909	98	Water Surface, 0% imp, HSG A
15,909		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	16	0.1530	7.94		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps

Subcatchment 5S: propsoed roof SITE RUNOFF-total-no green roof



PROPOSED DRAINAGE
CALCULATIONS WITH GREEN ROOF

361-373-JFK Blvd
Bayonne, NJ

Summary for Subcatchment 5S: EXISTING SITE RUNOFF

Exsiting Drainage area

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

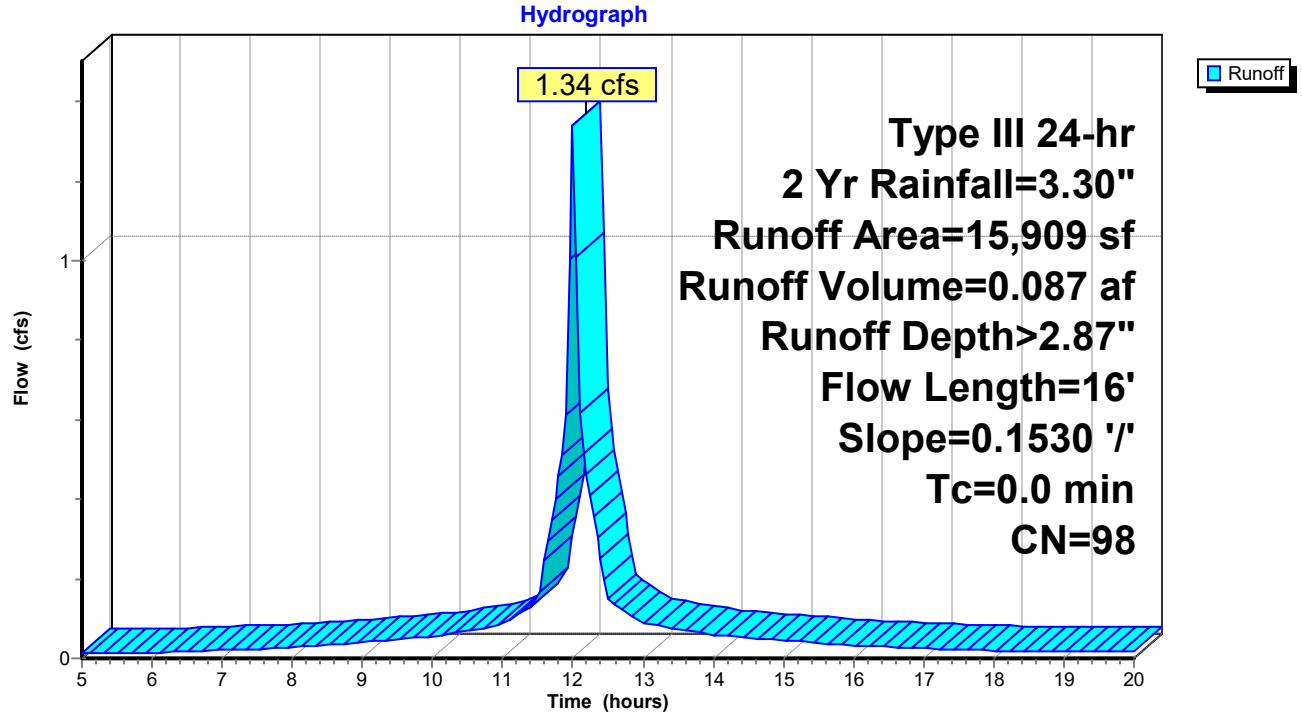
Runoff = 1.34 cfs @ 12.00 hrs, Volume= 0.087 af, Depth> 2.87"
Routed to nonexistent node 2P

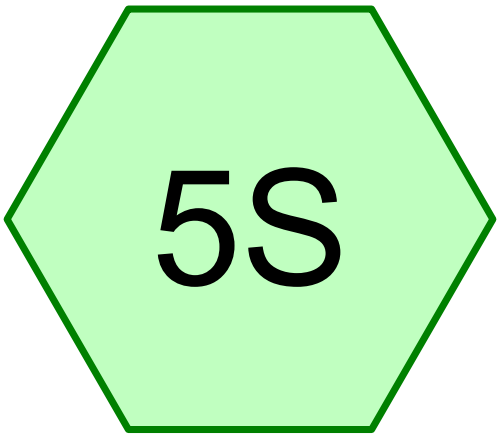
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Yr Rainfall=3.30"

Area (sf)	CN	Description
15,909	98	Water Surface, 0% imp, HSG A
15,909		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	16	0.1530	7.94		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps

Subcatchment 5S: EXISTING SITE RUNOFF





GREEN ROOF 2YR SITE RUNOFF

Subcat Reach Pond Link

Routing Diagram for 373-kennedy-greenroof-10
Prepared by OEA, Printed 10/18/2026
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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.132	87	Water Surface, 0% imp, HSG A (5S)
0.132	**87**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.132	HSG A	5S
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.000	Other	
0.132		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.132	0.000	0.000	0.000	0.000	0.132	Water Surface, 0% imp	5S
0.132	**0.000**	**0.000**	**0.000**	**0.000**	**0.132**	**TOTAL AREA**	

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 5S: GREEN ROOF 2YR SITE Runoff Area=5,749 sf 0.00% Impervious Runoff Depth>3.28"
Flow Length=16' Slope=0.1530 '/' Tc=0.0 min CN=87 Runoff=0.61 cfs 0.036 af

Total Runoff Area = 0.132 ac Runoff Volume = 0.036 af Average Runoff Depth = 3.28"
100.00% Pervious = 0.132 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 5S: GREEN ROOF 2YR SITE RUNOFF

Exsiting Drainage area

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.61 cfs @ 12.00 hrs, Volume= 0.036 af, Depth> 3.28"
Routed to nonexistent node 2P

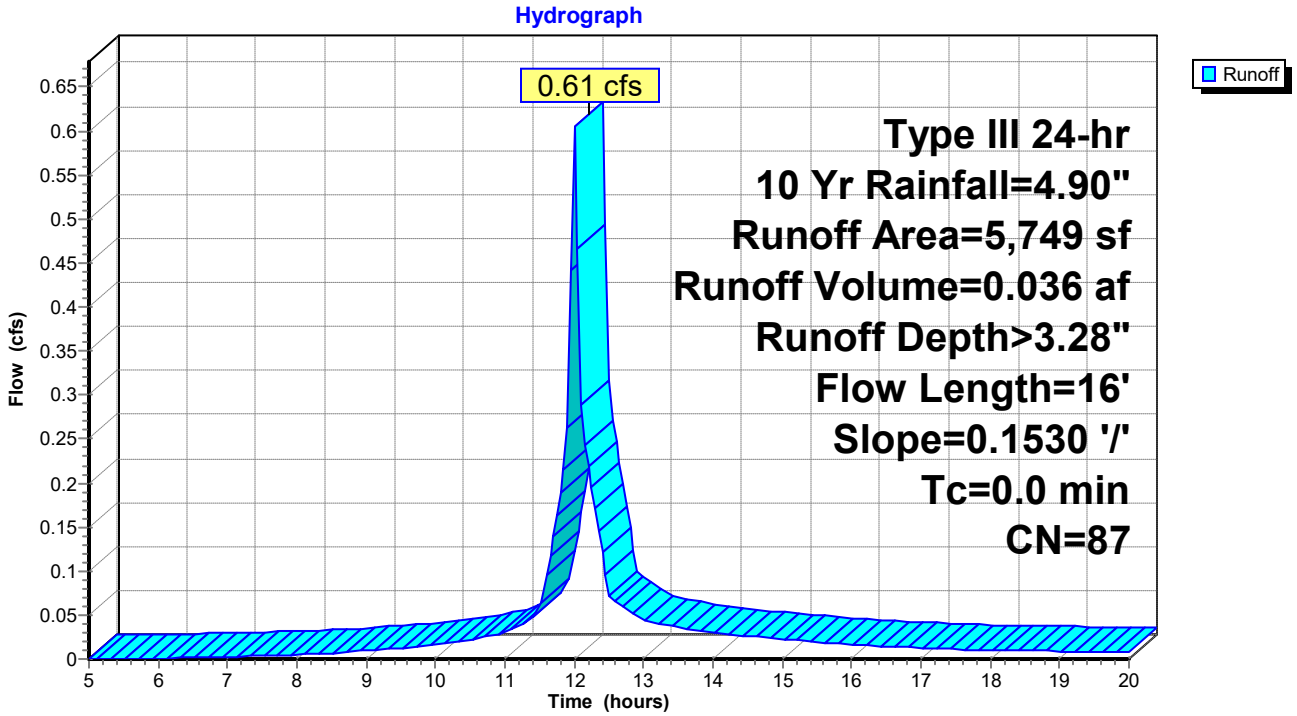
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Yr Rainfall=4.90"

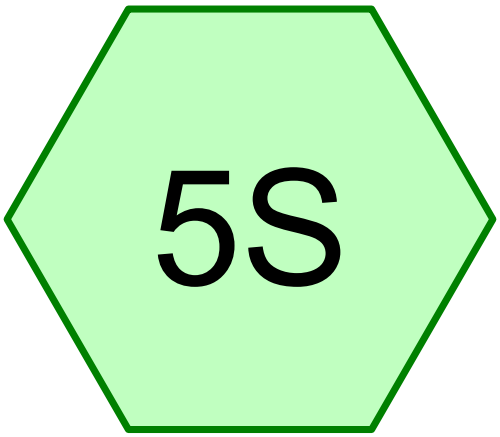
	Area (sf)	CN	Description
*	5,749	87	Water Surface, 0% imp, HSG A
	5,749		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	16	0.1530	7.94		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps

Subcatchment 5S: GREEN ROOF 2YR SITE RUNOFF

Subcatchment 5S: GREEN ROOF 2YR SITE RUNOFF





GREEN ROOF 100YR SITE RUNOFF

Subcat Reach Pond Link

Routing Diagram for 373-kennedy-greenroof-100
Prepared by OEA, Printed 10/18/2026
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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.212	84	Water Surface, 0% imp, HSG A (5S)
0.212	**84**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.212	HSG A	5S
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.000	Other	
0.212		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.212	0.000	0.000	0.000	0.000	0.212	Water Surface, 0% imp	5S
0.212	**0.000**	**0.000**	**0.000**	**0.000**	**0.212**	**TOTAL AREA**	

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 5S: GREEN ROOF 100YR Runoff Area=9,234 sf 0.00% Impervious Runoff Depth>5.58"
Flow Length=16' Slope=0.1530 '/' Tc=0.0 min CN=84 Runoff=1.63 cfs 0.099 af

Total Runoff Area = 0.212 ac Runoff Volume = 0.099 af Average Runoff Depth = 5.58"
100.00% Pervious = 0.212 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 5S: GREEN ROOF 100YR SITE RUNOFF

Exsiting Drainage area

[46] Hint: Tc=0 (Instant runoff peak depends on dt)

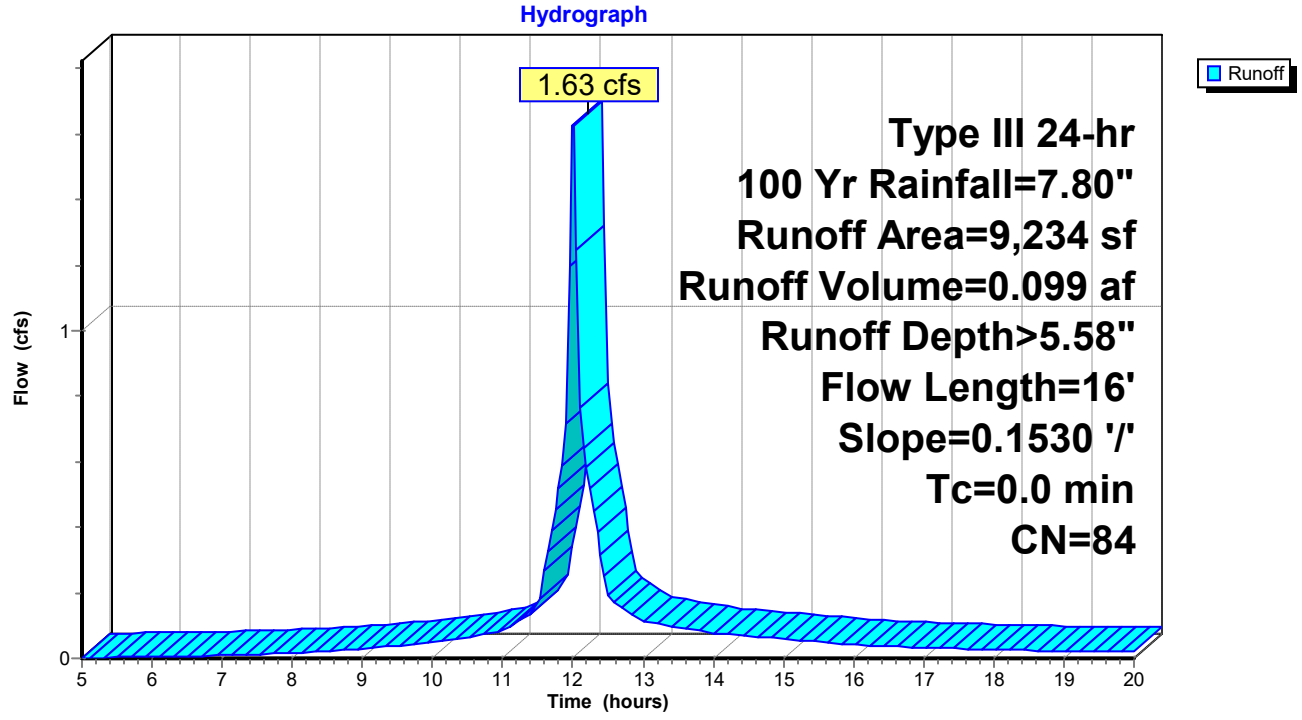
Runoff = 1.63 cfs @ 12.00 hrs, Volume= 0.099 af, Depth> 5.58"
Routed to nonexistent node 2P

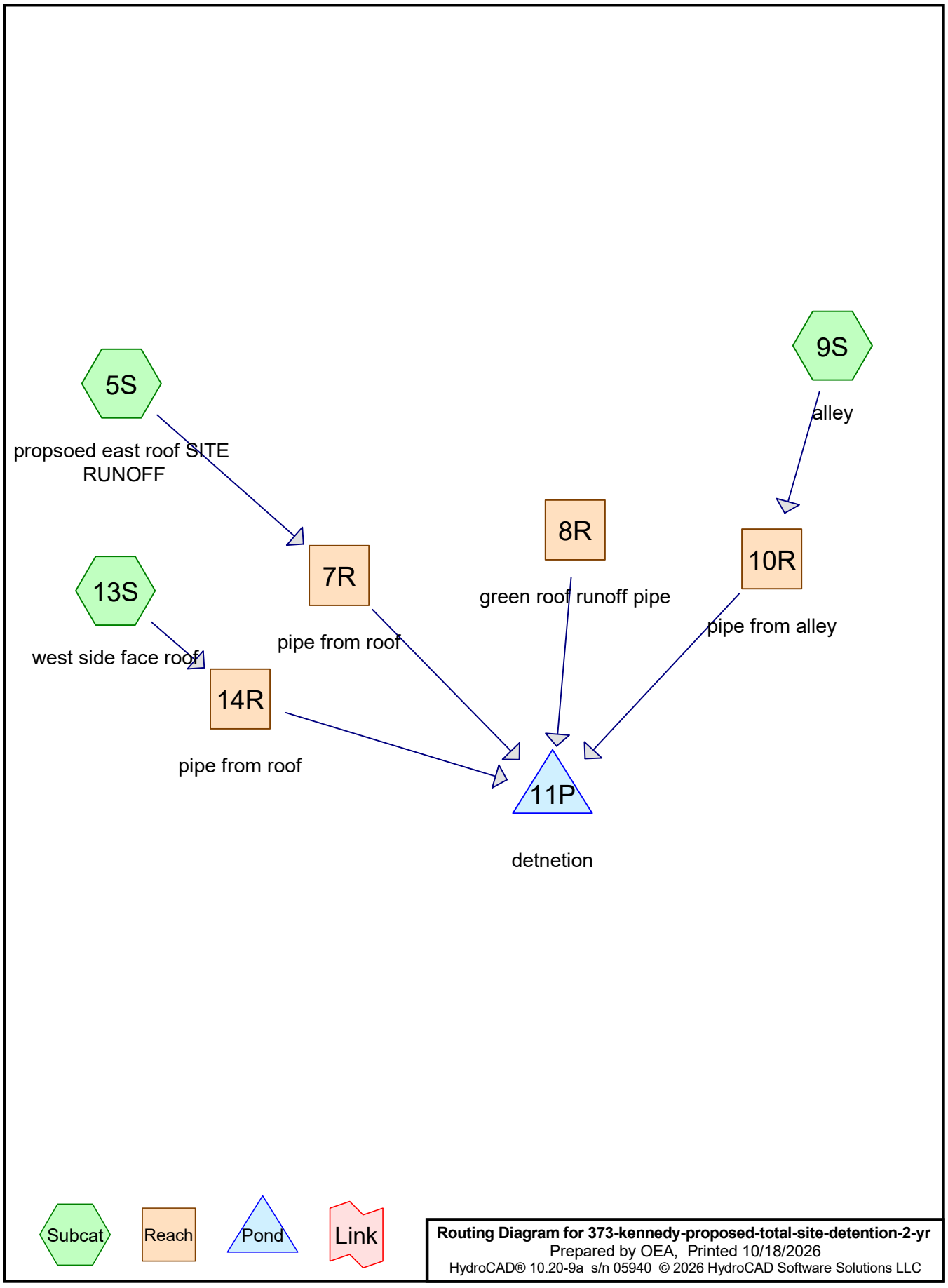
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Yr Rainfall=7.80"

	Area (sf)	CN	Description
*	9,234	84	Water Surface, 0% imp, HSG A
	9,234		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.0	16	0.1530	7.94		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps

Subcatchment 5S: GREEN ROOF 100YR SITE RUNOFF





Routing Diagram for 373-kennedy-proposed-total-site-detention-2-yr
Prepared by OEA, Printed 10/18/2026
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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.096	98	Water Surface, 0% imp, HSG A (5S)
0.006	67	grass (9S)
0.012	98	water surface hga A (13S)
0.114	**96**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.096	HSG A	5S
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.018	Other	9S, 13S
0.114		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.096	0.000	0.000	0.000	0.000	0.096	Water Surface, 0% imp	5S
0.000	0.000	0.000	0.000	0.006	0.006	grass	9S
0.000	0.000	0.000	0.000	0.012	0.012	water surface hga A	13S
0.096	**0.000**	**0.000**	**0.000**	**0.018**	**0.114**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)	Node Name
1	7R	100.70	100.30	115.0	0.0035	0.010	0.0	4.0	0.0	
2	8R	100.90	100.20	145.0	0.0048	0.010	0.0	8.0	0.0	
3	10R	100.99	100.60	121.0	0.0032	0.010	0.0	4.0	0.0	
4	14R	100.98	100.30	123.0	0.0055	0.010	0.0	4.0	0.0	

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 5S: propsoed east roof SITE Runoff Area=4,164 sf 0.00% Impervious Runoff Depth>2.87"
Flow Length=116' Slope=0.1530 '/' Tc=6.0 min CN=98 Runoff=0.30 cfs 0.023 af

Subcatchment 9S: alley Runoff Area=0.006 ac 0.00% Impervious Runoff Depth>0.67"
Tc=0.0 min CN=67 Runoff=0.01 cfs 0.000 af

Subcatchment 13S: west side face roof Runoff Area=0.012 ac 100.00% Impervious Runoff Depth>2.87"
Tc=0.0 min CN=98 Runoff=0.04 cfs 0.003 af

Reach 7R: pipe from roof Avg. Flow Depth=0.33' Max Vel=1.90 fps Inflow=0.30 cfs 0.023 af
4.0" Round Pipe n=0.010 L=115.0' S=0.0035 '/' Capacity=0.15 cfs Outflow=0.15 cfs 0.023 af

Reach 8R: green roof runoff pipe Avg. Flow Depth=0.22' Max Vel=2.58 fps Inflow=0.23 cfs 0.286 af
8.0" Round Pipe n=0.010 L=145.0' S=0.0048 '/' Capacity=1.09 cfs Outflow=0.26 cfs 0.286 af

Reach 10R: pipe from alley Avg. Flow Depth=0.04' Max Vel=0.74 fps Inflow=0.01 cfs 0.000 af
4.0" Round Pipe n=0.010 L=121.0' S=0.0032 '/' Capacity=0.14 cfs Outflow=0.00 cfs 0.000 af

Reach 14R: pipe from roof Avg. Flow Depth=0.11' Max Vel=1.70 fps Inflow=0.04 cfs 0.003 af
4.0" Round Pipe n=0.010 L=123.0' S=0.0055 '/' Capacity=0.18 cfs Outflow=0.04 cfs 0.003 af

Pond 11P: detnetion Peak Elev=99.38' Storage=0.029 af Inflow=0.42 cfs 0.312 af
Primary=0.00 cfs 0.000 af Secondary=0.27 cfs 0.292 af Outflow=0.27 cfs 0.292 af

Total Runoff Area = 0.114 ac Runoff Volume = 0.026 af Average Runoff Depth = 2.75"
89.44% Pervious = 0.102 ac 10.56% Impervious = 0.012 ac

Summary for Subcatchment 5S: propsoed east roof SITE RUNOFF

Exsiting Drainage area

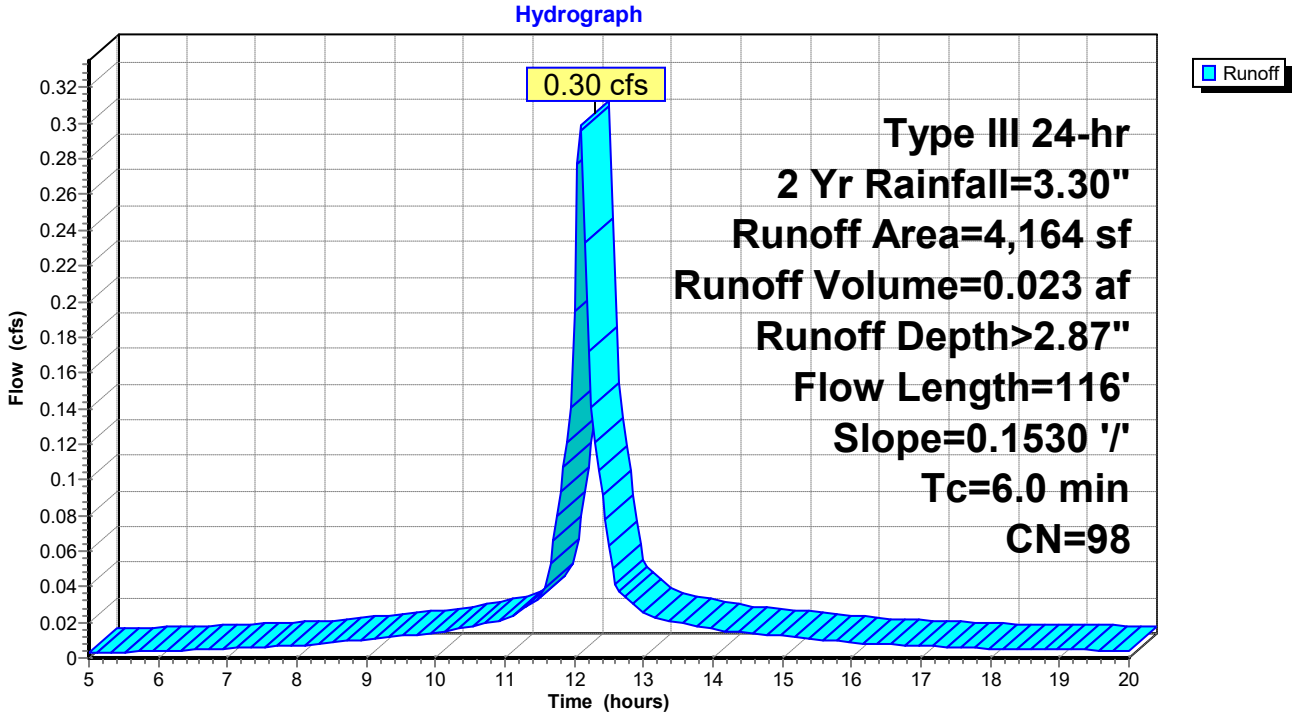
Runoff = 0.30 cfs @ 12.09 hrs, Volume= 0.023 af, Depth> 2.87"
Routed to Reach 7R : pipe from roof

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Yr Rainfall=3.30"

Area (sf)	CN	Description
4,164	98	Water Surface, 0% imp, HSG A
4,164		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	116	0.1530	7.94		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.2	116	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 5S: propsoed east roof SITE RUNOFF



Summary for Subcatchment 9S: alley

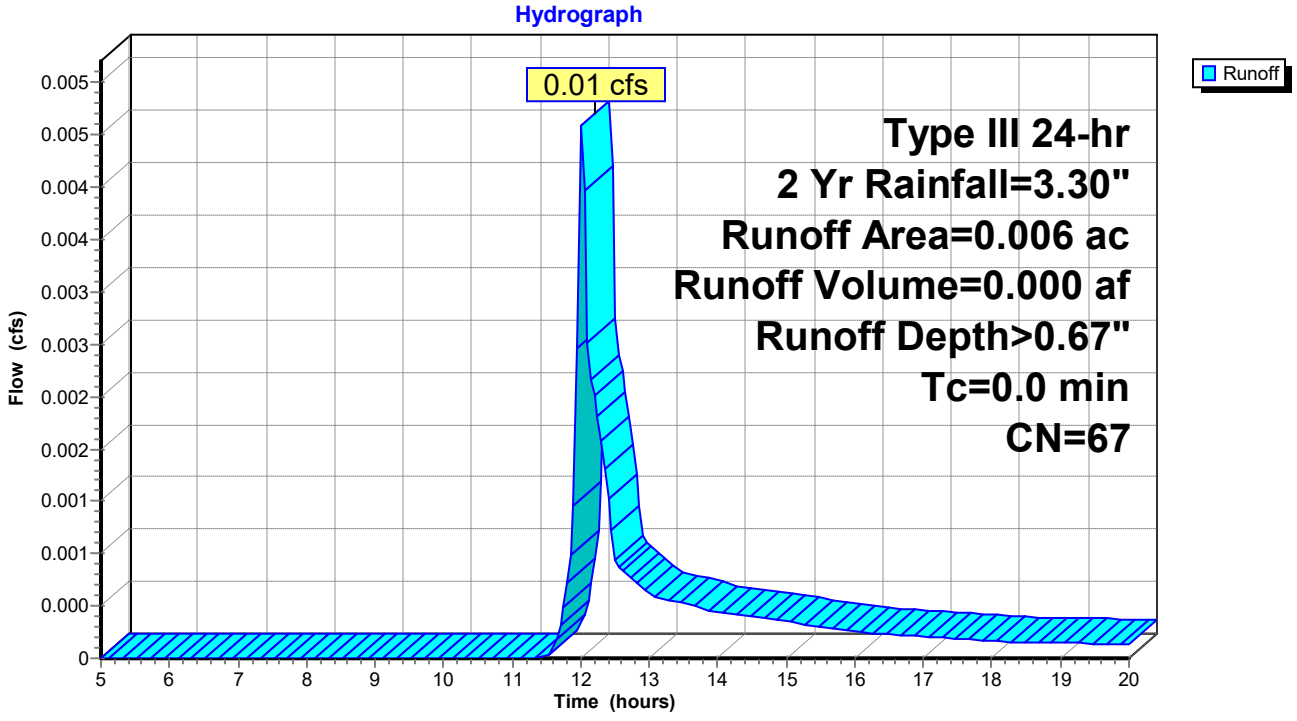
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.01 cfs @ 12.01 hrs, Volume= 0.000 af, Depth> 0.67"
Routed to Reach 10R : pipe from alley

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Yr Rainfall=3.30"

	Area (ac)	CN	Description
*	0.006	67	grass
	0.006		100.00% Pervious Area

Subcatchment 9S: alley



Summary for Subcatchment 13S: west side face roof

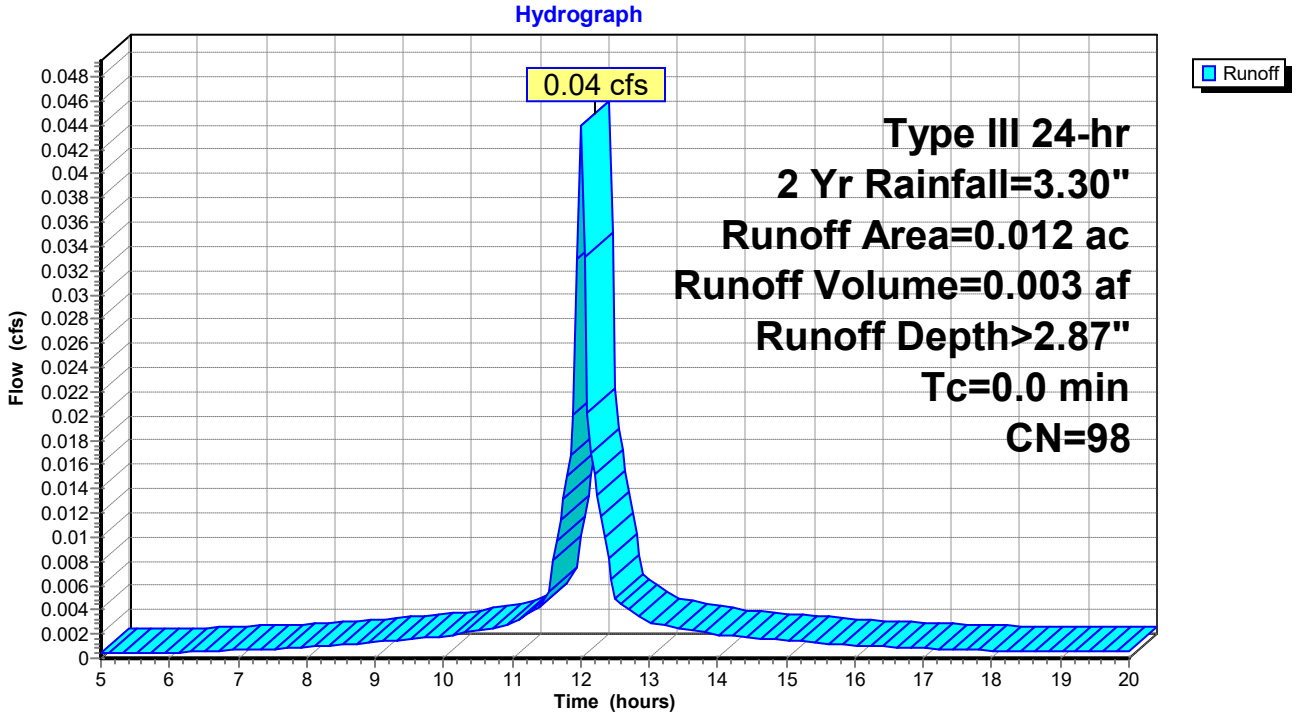
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.04 cfs @ 12.00 hrs, Volume= 0.003 af, Depth> 2.87"
Routed to Reach 14R : pipe from roof

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Yr Rainfall=3.30"

	Area (ac)	CN	Description
*	0.012	98	water surface hga A
	0.012		100.00% Impervious Area

Subcatchment 13S: west side face roof



Summary for Reach 7R: pipe from roof

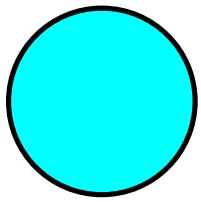
[52] Hint: Inlet/Outlet conditions not evaluated
[82] Warning: Early inflow requires earlier time span
[55] Hint: Peak inflow is 205% of Manning's capacity
[76] Warning: Detained 0.002 af (Pond w/culvert advised)

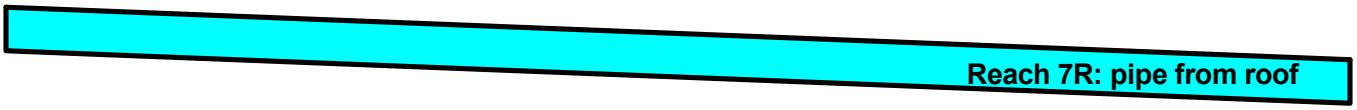
Inflow Area = 0.096 ac, 0.00% Impervious, Inflow Depth > 2.87" for 2 Yr event
Inflow = 0.30 cfs @ 12.09 hrs, Volume= 0.023 af
Outflow = 0.15 cfs @ 12.00 hrs, Volume= 0.023 af, Atten= 51%, Lag= 0.0 min
Routed to Pond 11P : detnetion

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.90 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 0.98 fps, Avg. Travel Time= 2.0 min

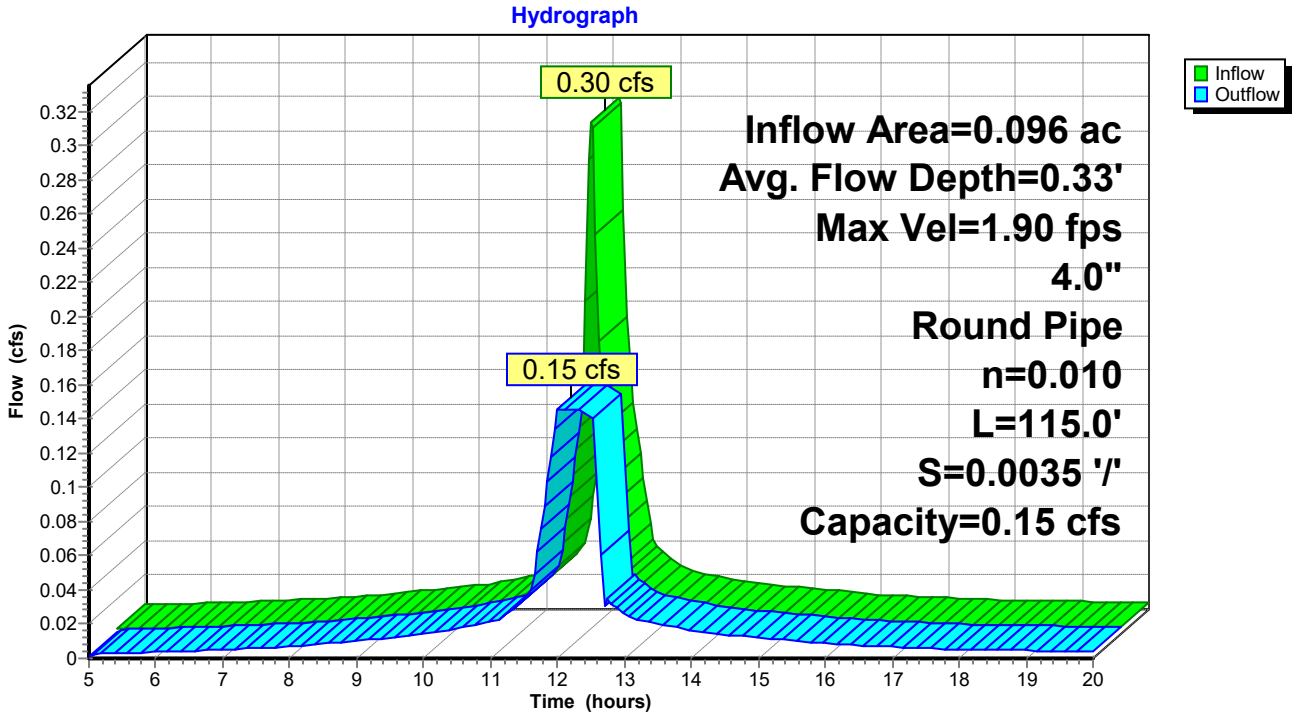
Peak Storage= 10 cf @ 12.00 hrs
Average Depth at Peak Storage= 0.33' , Surface Width= 0.00'
Bank-Full Depth= 0.33' Flow Area= 0.1 sf, Capacity= 0.15 cfs

4.0" Round Pipe
n= 0.010 PVC, smooth interior
Length= 115.0' Slope= 0.0035 '/'
Inlet Invert= 100.70', Outlet Invert= 100.30'

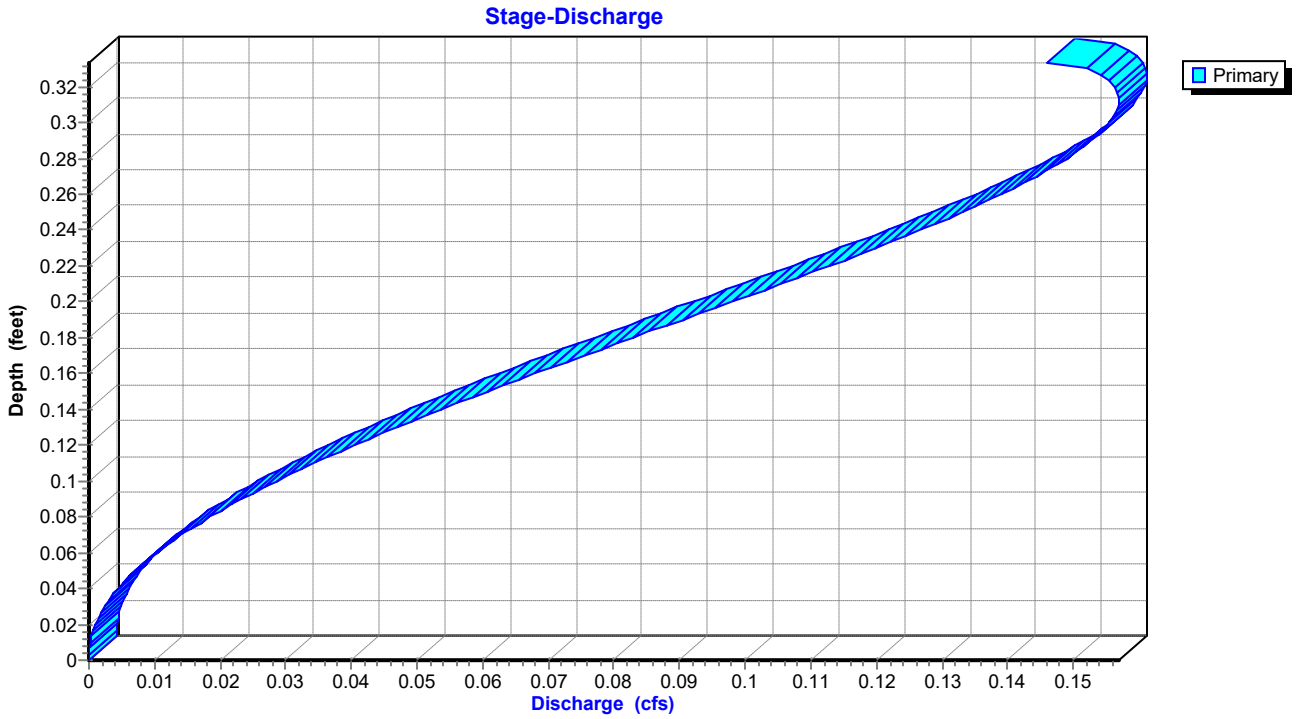




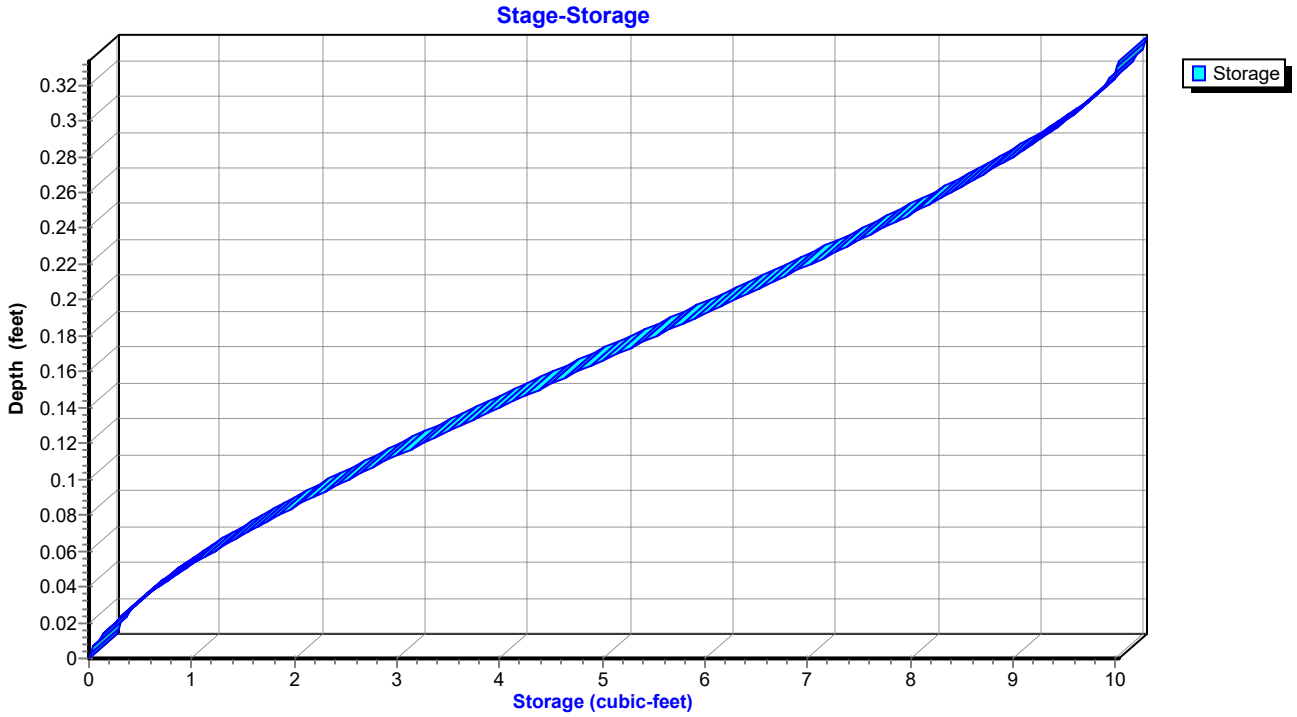
Reach 7R: pipe from roof



Reach 7R: pipe from roof



Reach 7R: pipe from roof



Summary for Reach 8R: green roof runoff pipe

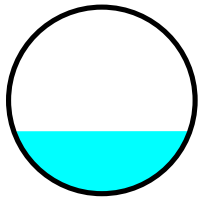
[52] Hint: Inlet/Outlet conditions not evaluated
[90] Warning: Qout>Qin may require smaller dt or Finer Routing

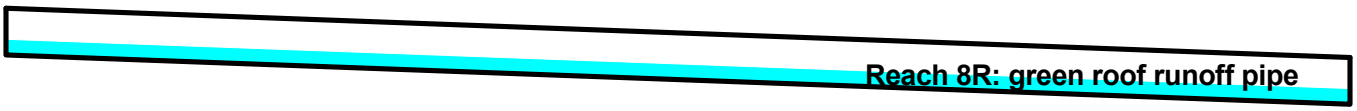
Inflow = 0.23 cfs @ 5.00 hrs, Volume= 0.286 af, Incl. 0.23 cfs Base Flow
Outflow = 0.26 cfs @ 5.05 hrs, Volume= 0.286 af, Atten= 0%, Lag= 3.0 min
Routed to Pond 11P : detnetion

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.58 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 2.48 fps, Avg. Travel Time= 1.0 min

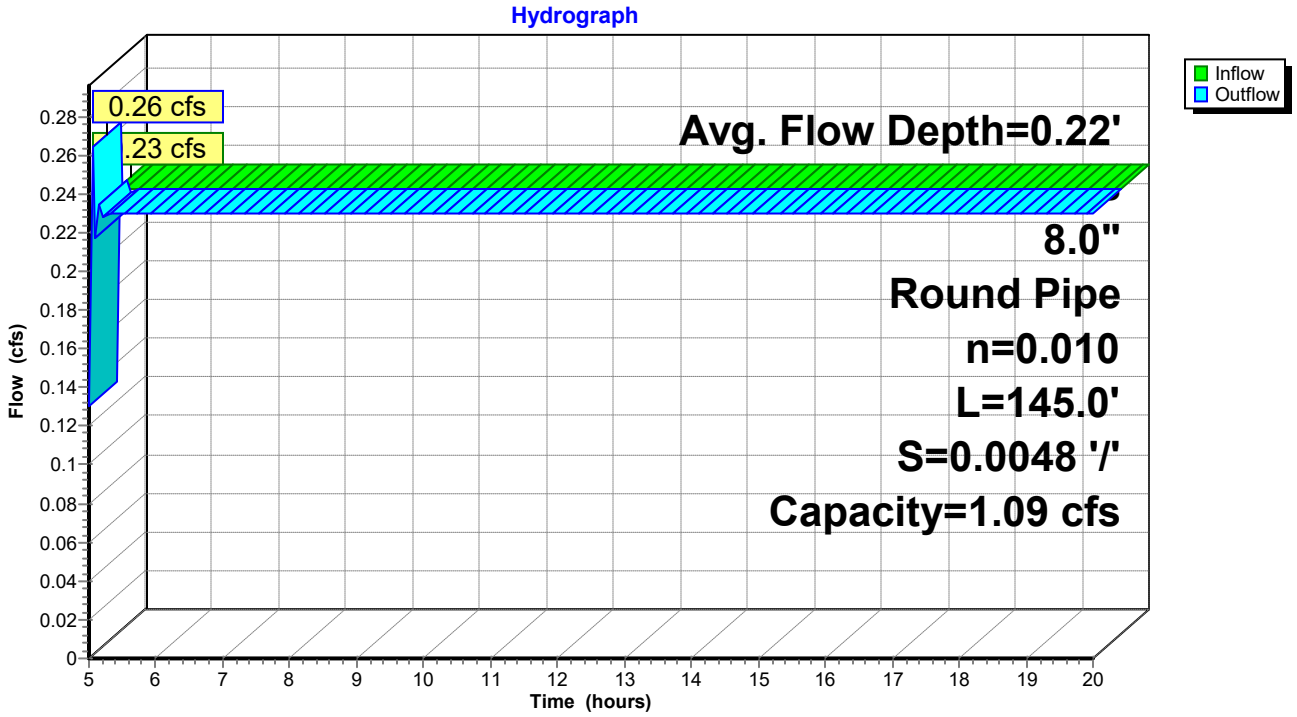
Peak Storage= 15 cf @ 5.05 hrs
Average Depth at Peak Storage= 0.22' , Surface Width= 0.63'
Bank-Full Depth= 0.67' Flow Area= 0.3 sf, Capacity= 1.09 cfs

8.0" Round Pipe
n= 0.010 PVC, smooth interior
Length= 145.0' Slope= 0.0048 '/'
Inlet Invert= 100.90', Outlet Invert= 100.20'

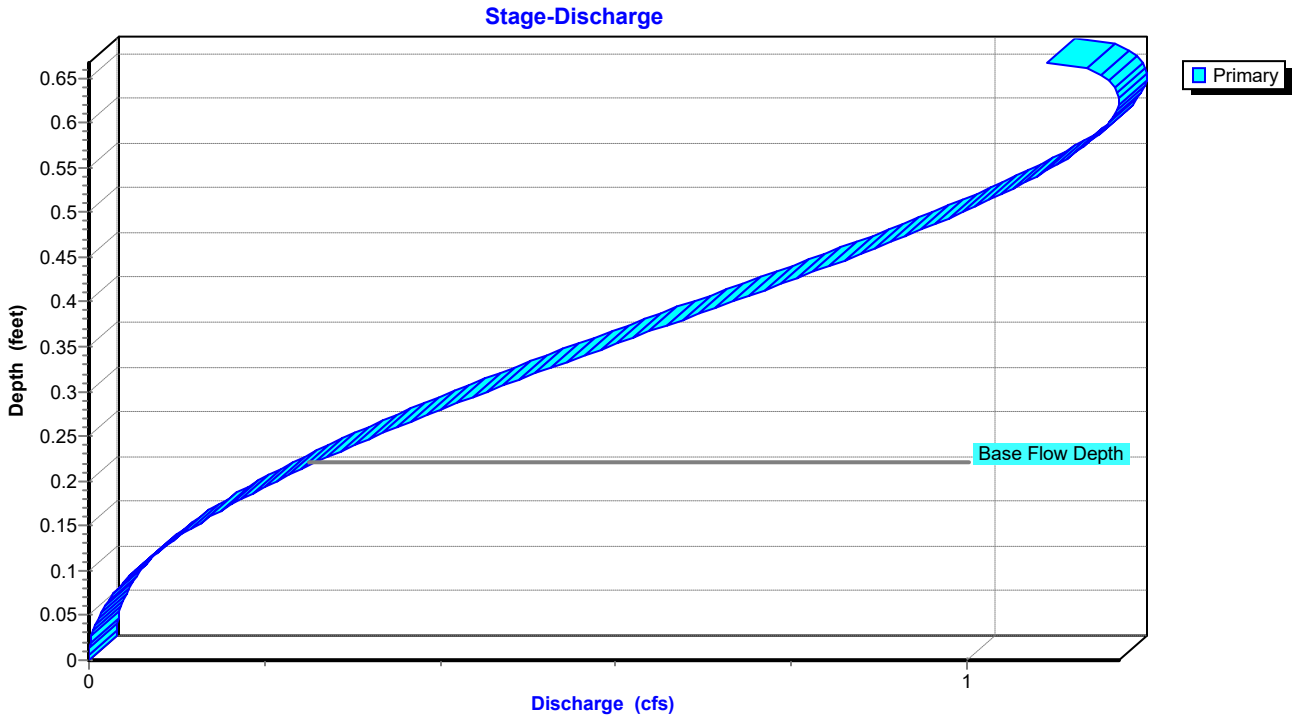




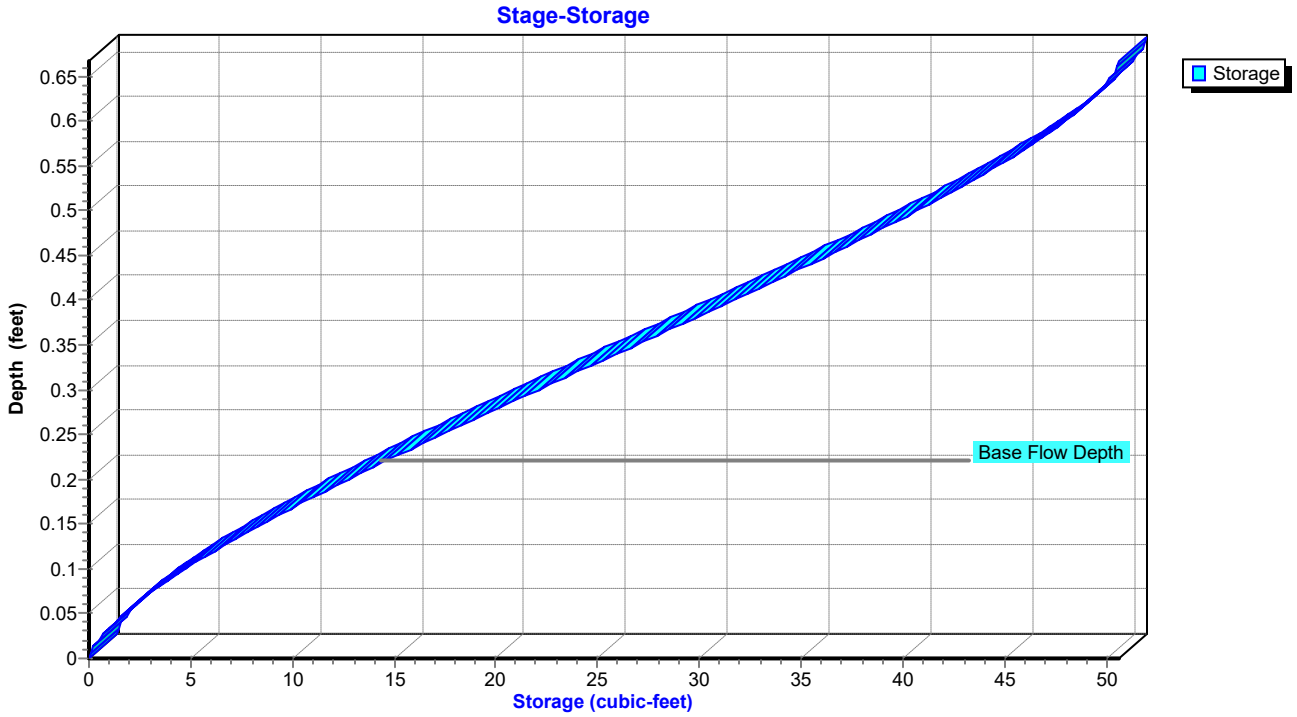
Reach 8R: green roof runoff pipe



Reach 8R: green roof runoff pipe



Reach 8R: green roof runoff pipe



Summary for Reach 10R: pipe from alley

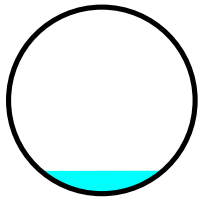
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 0.006 ac, 0.00% Impervious, Inflow Depth > 0.67" for 2 Yr event
Inflow = 0.01 cfs @ 12.01 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 12.05 hrs, Volume= 0.000 af, Atten= 10%, Lag= 2.4 min
Routed to Pond 11P : detnetion

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.74 fps, Min. Travel Time= 2.7 min
Avg. Velocity = 0.34 fps, Avg. Travel Time= 5.9 min

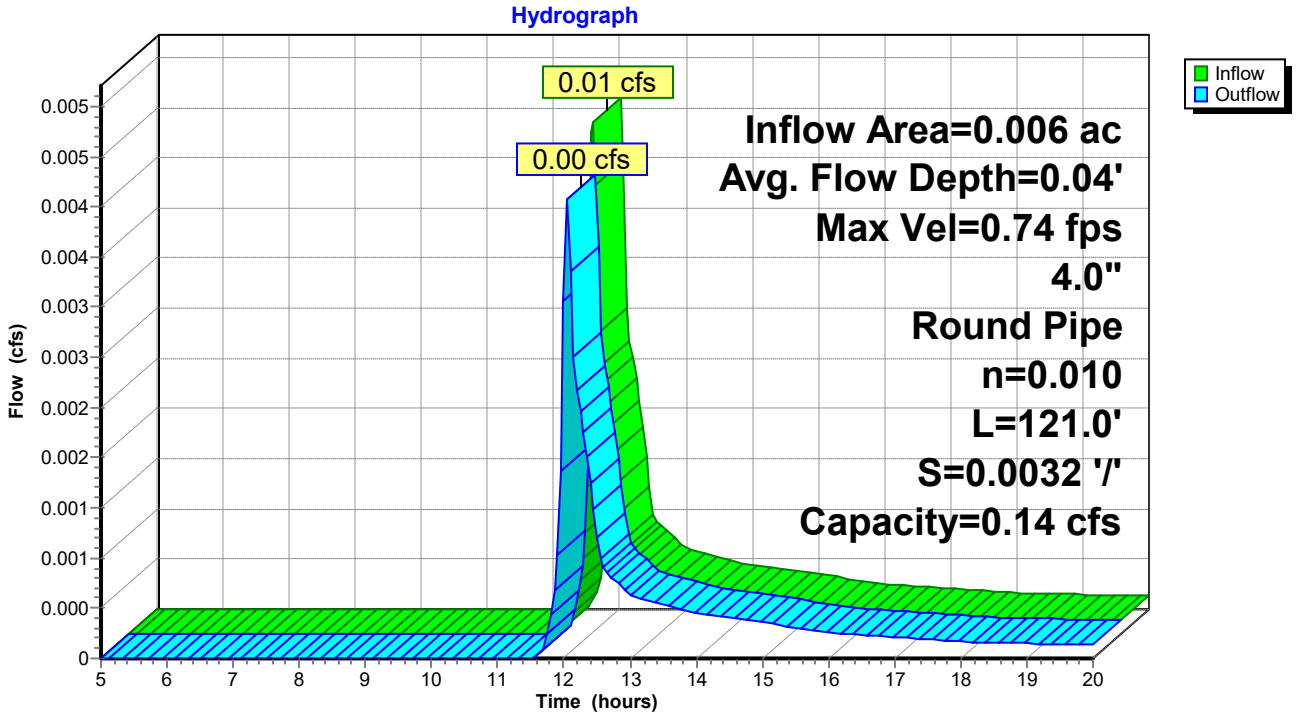
Peak Storage= 1 cf @ 12.05 hrs
Average Depth at Peak Storage= 0.04' , Surface Width= 0.22'
Bank-Full Depth= 0.33' Flow Area= 0.1 sf, Capacity= 0.14 cfs

4.0" Round Pipe
n= 0.010 PVC, smooth interior
Length= 121.0' Slope= 0.0032 '/'
Inlet Invert= 100.99', Outlet Invert= 100.60'

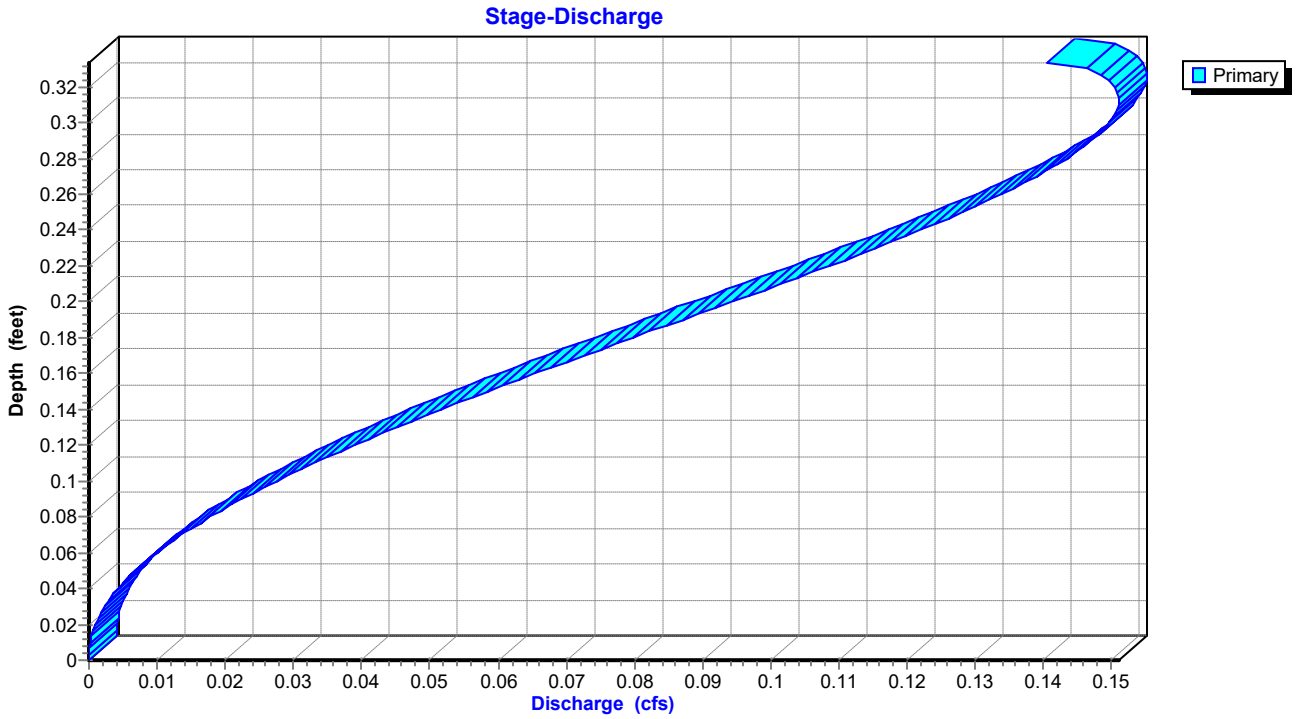




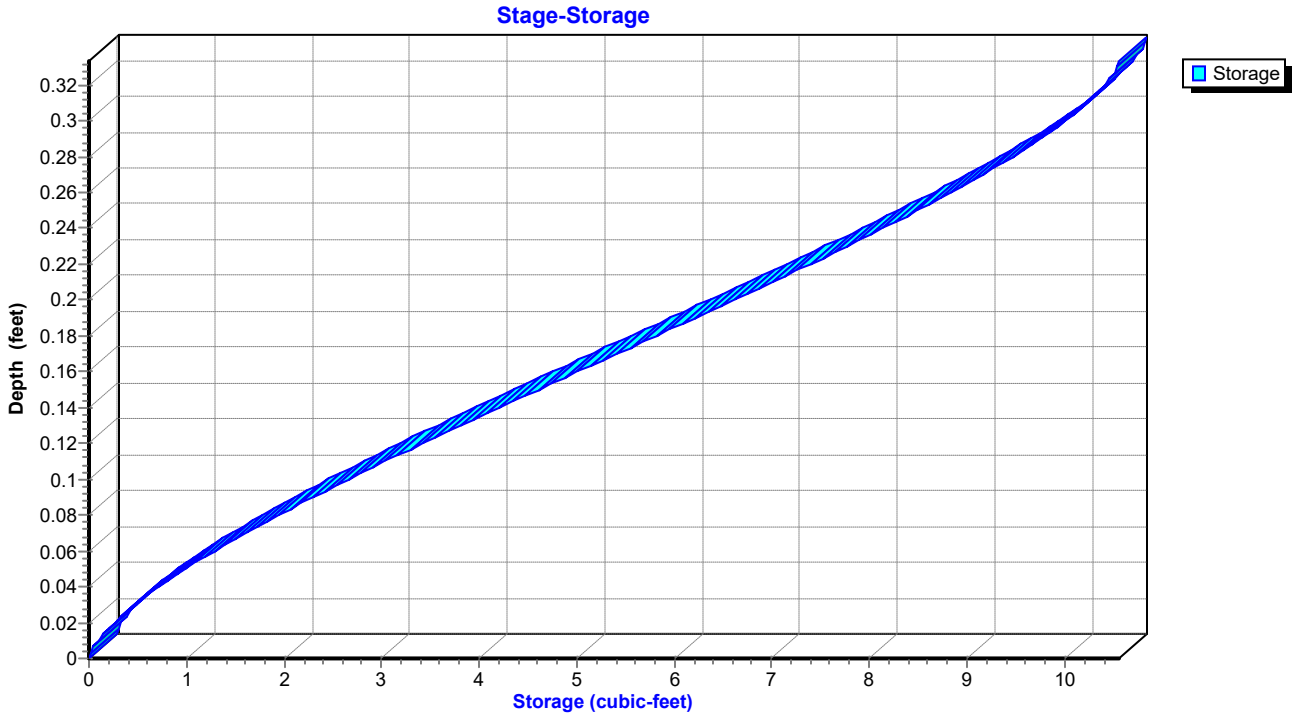
Reach 10R: pipe from alley



Reach 10R: pipe from alley



Reach 10R: pipe from alley



Summary for Reach 14R: pipe from roof

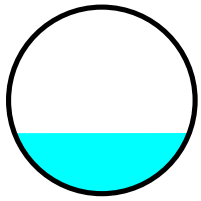
[52] Hint: Inlet/Outlet conditions not evaluated
[82] Warning: Early inflow requires earlier time span

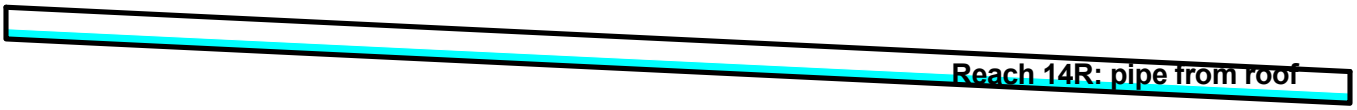
Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth > 2.87" for 2 Yr event
Inflow = 0.04 cfs @ 12.00 hrs, Volume= 0.003 af
Outflow = 0.04 cfs @ 12.02 hrs, Volume= 0.003 af, Atten= 5%, Lag= 0.9 min
Routed to Pond 11P : detnetion

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.70 fps, Min. Travel Time= 1.2 min
Avg. Velocity = 0.63 fps, Avg. Travel Time= 3.2 min

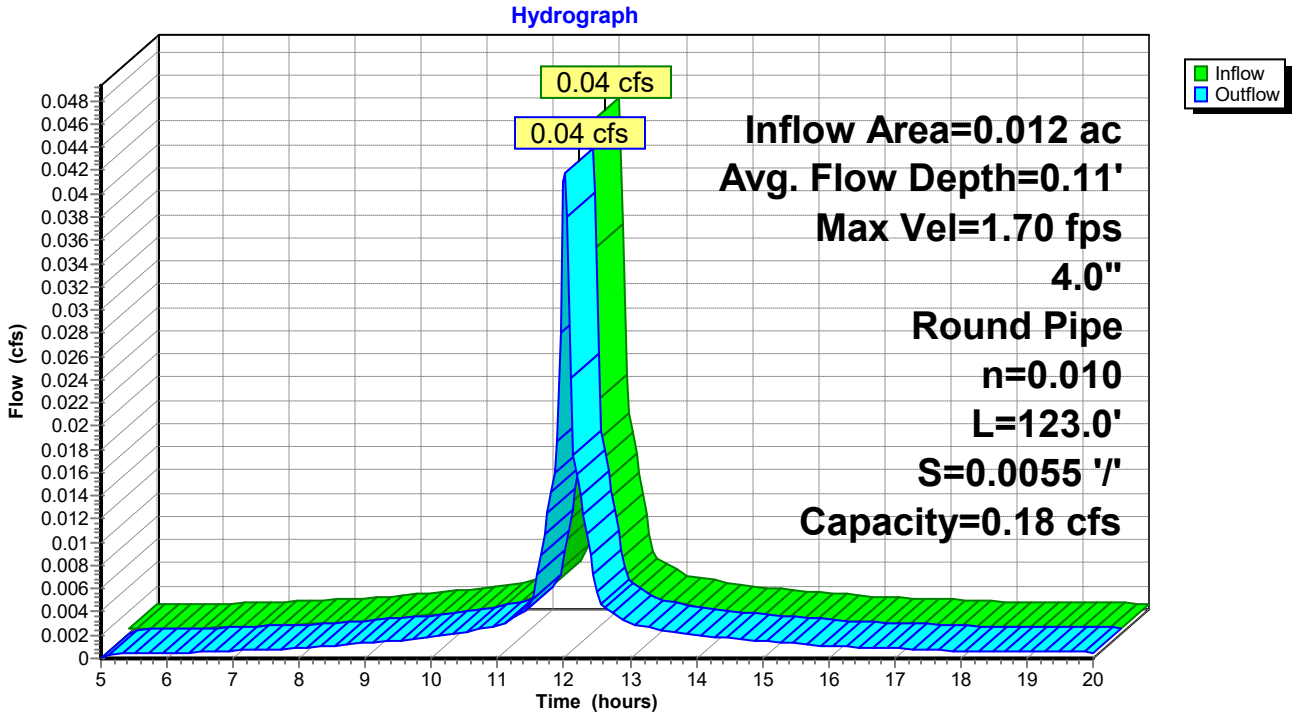
Peak Storage= 3 cf @ 12.02 hrs
Average Depth at Peak Storage= 0.11' , Surface Width= 0.31'
Bank-Full Depth= 0.33' Flow Area= 0.1 sf, Capacity= 0.18 cfs

4.0" Round Pipe
n= 0.010 PVC, smooth interior
Length= 123.0' Slope= 0.0055 '/'
Inlet Invert= 100.98', Outlet Invert= 100.30'

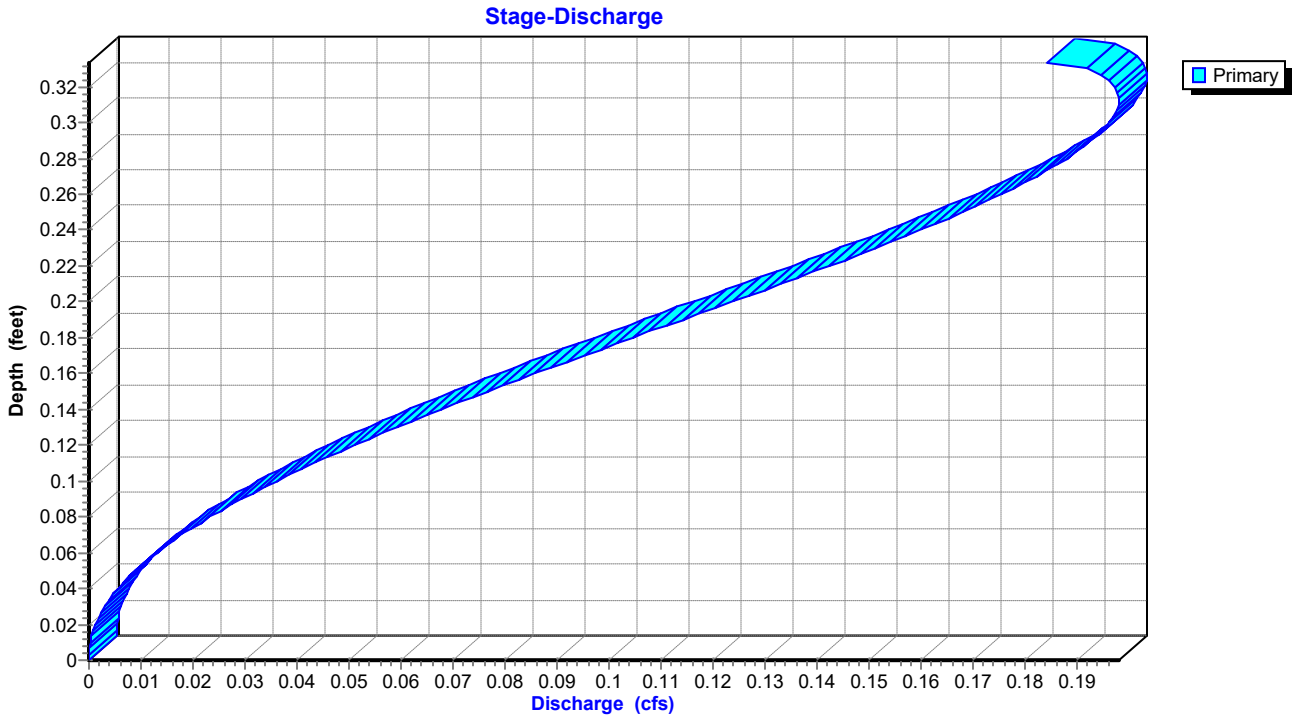




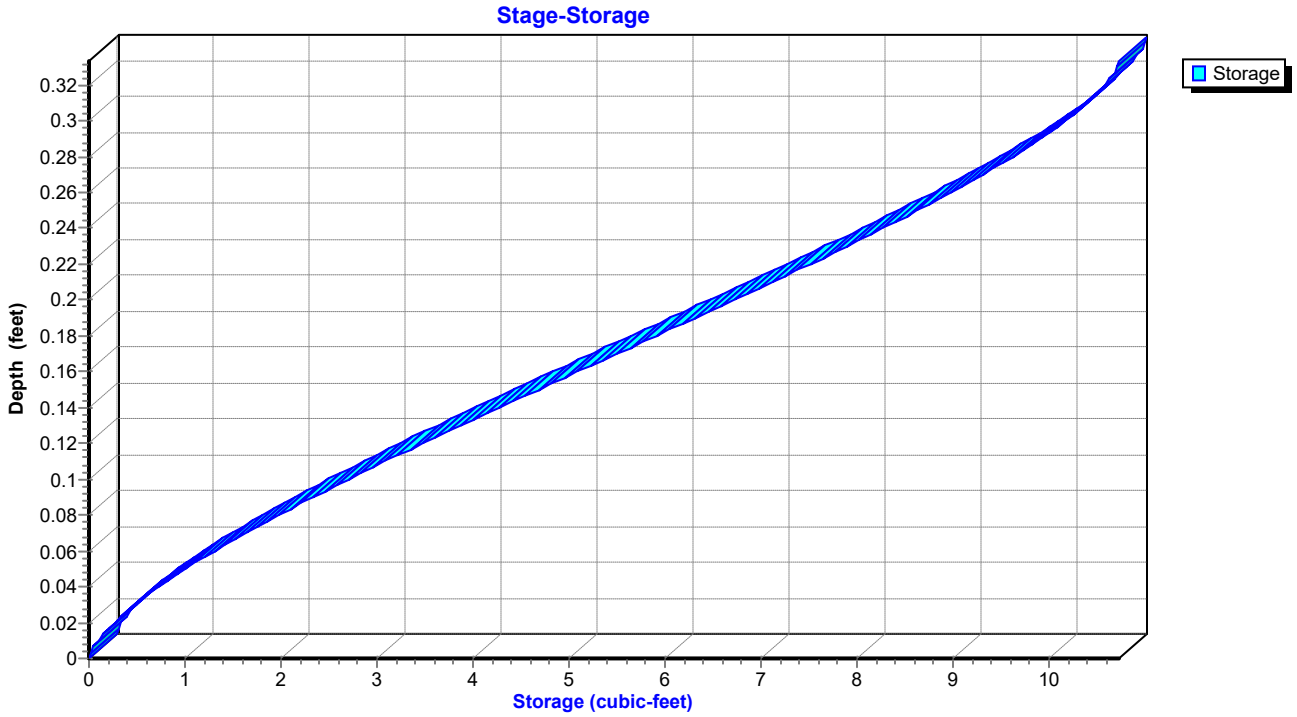
Reach 14R: pipe from roof



Reach 14R: pipe from roof



Reach 14R: pipe from roof



Summary for Pond 11P: detnetion

[82] Warning: Early inflow requires earlier time span
[44] Hint: Outlet device #2 is below defined storage

Inflow Area = 0.114 ac, 10.56% Impervious, Inflow Depth > 32.94" for 2 Yr event
Inflow = 0.42 cfs @ 12.02 hrs, Volume= 0.312 af
Outflow = 0.27 cfs @ 12.71 hrs, Volume= 0.292 af, Atten= 36%, Lag= 41.6 min
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af
Secondary = 0.27 cfs @ 12.71 hrs, Volume= 0.292 af

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 99.38' @ 12.71 hrs Surf.Area= 0.015 ac Storage= 0.029 af

Plug-Flow detention time= 54.9 min calculated for 0.292 af (94% of inflow)
Center-of-Mass det. time= 25.7 min (775.5 - 749.8)

Volume	Invert	Avail.Storage	Storage Description
#1	97.20'	0.039 af	**36.0" Round Pipe Storage** L= 240.0' S= 0.0010 '/'

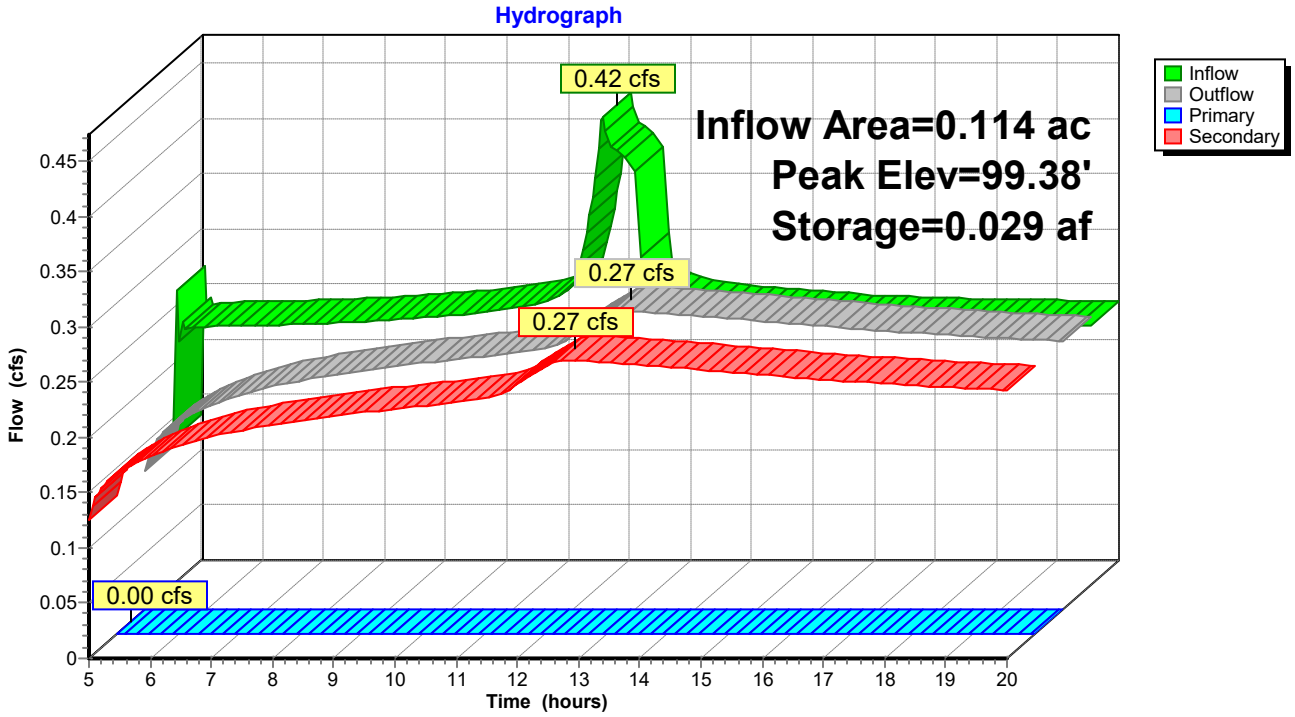
Device	Routing	Invert	Outlet Devices
#1	Primary	99.50'	**2.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Secondary	96.57'	**2.5" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=97.25' (Free Discharge)
└**1=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

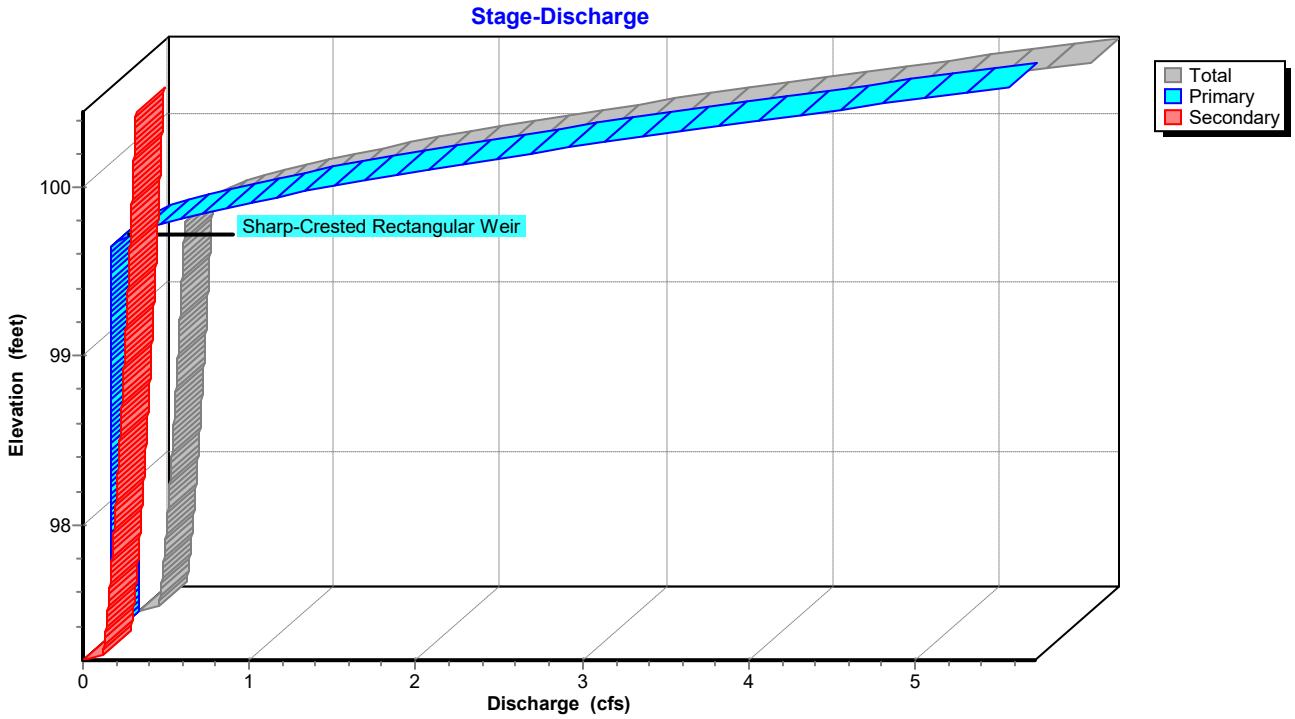
Secondary OutFlow Max=0.27 cfs @ 12.71 hrs HW=99.38' (Free Discharge)
└**2=Orifice/Grate** (Orifice Controls 0.27 cfs @ 7.92 fps)



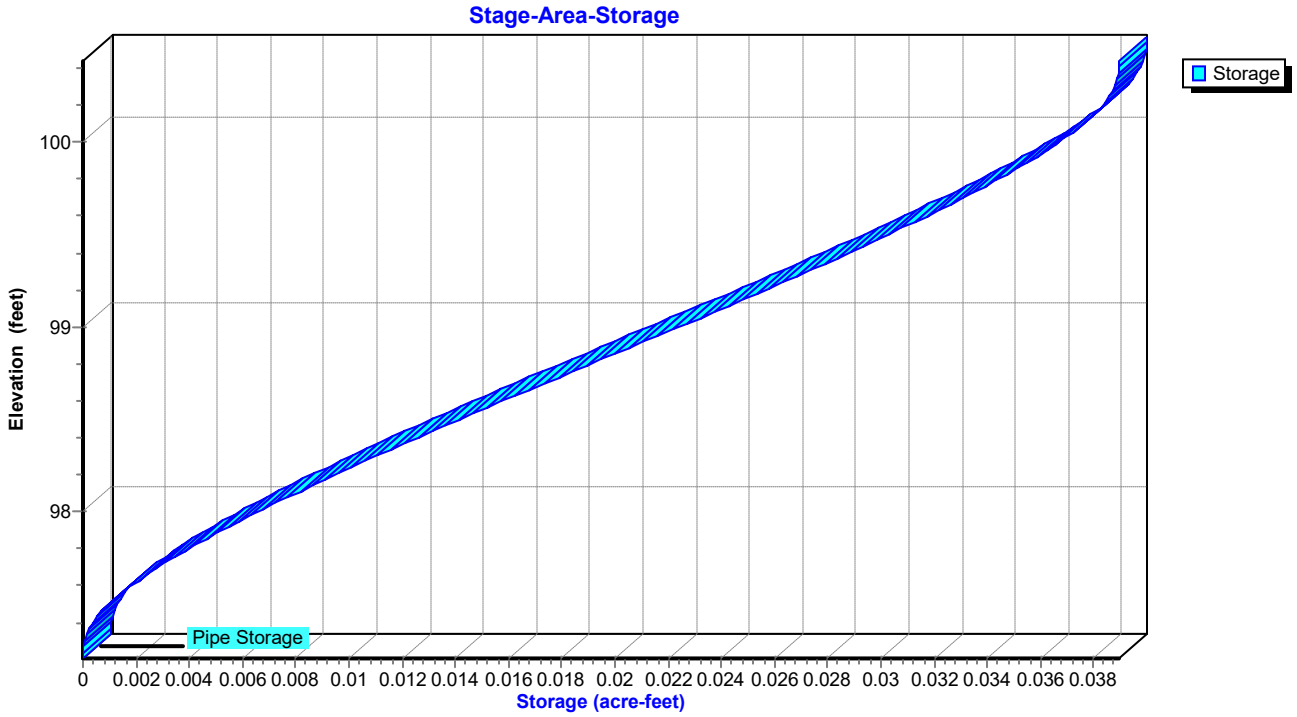
Pond 11P: detnetion

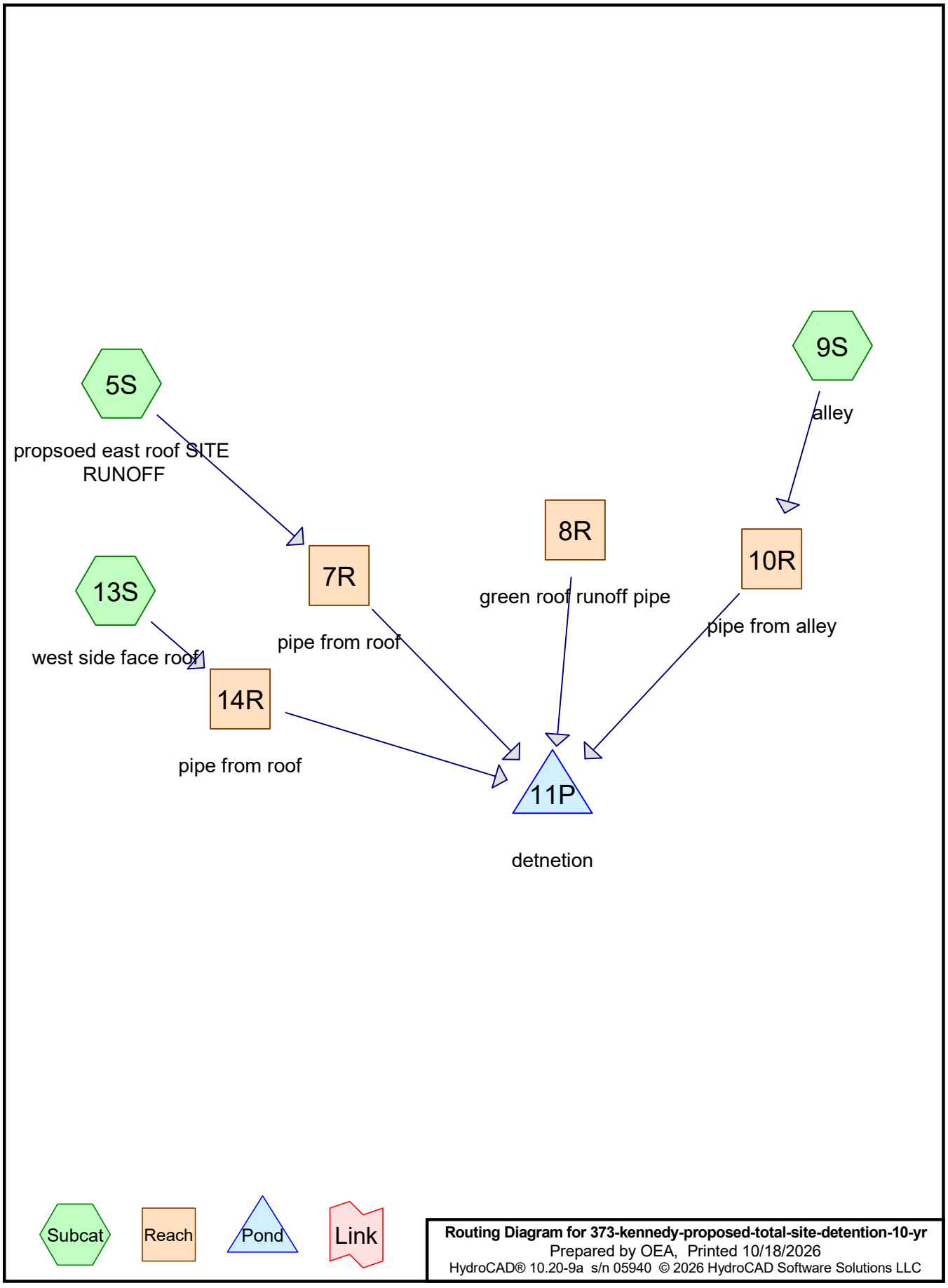


Pond 11P: detnetion



Pond 11P: detnetion





Routing Diagram for 373-kennedy-proposed-total-site-detention-10-yr
Prepared by OEA, Printed 10/18/2026
HydroCAD® 10.20-9a s/n 05940 © 2026 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.096	98	Water Surface, 0% imp, HSG A (5S)
0.006	67	grass (9S)
0.012	98	water surface hga A (13S)
0.114	**96**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.096	HSG A	5S
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.018	Other	9S, 13S
0.114		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.096	0.000	0.000	0.000	0.000	0.096	Water Surface, 0% imp	5S
0.000	0.000	0.000	0.000	0.006	0.006	grass	9S
0.000	0.000	0.000	0.000	0.012	0.012	water surface hga A	13S
0.096	**0.000**	**0.000**	**0.000**	**0.018**	**0.114**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)	Node Name
1	7R	100.70	100.30	115.0	0.0035	0.010	0.0	4.0	0.0	
2	8R	100.90	100.20	145.0	0.0048	0.010	0.0	8.0	0.0	
3	10R	100.99	100.60	121.0	0.0032	0.010	0.0	4.0	0.0	
4	14R	100.98	100.30	123.0	0.0055	0.010	0.0	4.0	0.0	

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 5S: propsoed east roof SITE Runoff Area=4,164 sf 0.00% Impervious Runoff Depth>4.33"
Flow Length=116' Slope=0.1530 '/' Tc=6.0 min CN=98 Runoff=0.45 cfs 0.034 af

Subcatchment 9S: alley Runoff Area=0.006 ac 0.00% Impervious Runoff Depth>1.59"
Tc=0.0 min CN=67 Runoff=0.01 cfs 0.001 af

Subcatchment 13S: west side face roof Runoff Area=0.012 ac 100.00% Impervious Runoff Depth>4.33"
Tc=0.0 min CN=98 Runoff=0.07 cfs 0.004 af

Reach 7R: pipe from roof Avg. Flow Depth=0.33' Max Vel=1.90 fps Inflow=0.45 cfs 0.034 af
4.0" Round Pipe n=0.010 L=115.0' S=0.0035 '/' Capacity=0.15 cfs Outflow=0.15 cfs 0.034 af

Reach 8R: green roof runoff pipe Avg. Flow Depth=0.39' Max Vel=3.33 fps Inflow=0.61 cfs 0.759 af
8.0" Round Pipe n=0.010 L=145.0' S=0.0048 '/' Capacity=1.09 cfs Outflow=0.71 cfs 0.758 af

Reach 10R: pipe from alley Avg. Flow Depth=0.07' Max Vel=0.99 fps Inflow=0.01 cfs 0.001 af
4.0" Round Pipe n=0.010 L=121.0' S=0.0032 '/' Capacity=0.14 cfs Outflow=0.01 cfs 0.001 af

Reach 14R: pipe from roof Avg. Flow Depth=0.13' Max Vel=1.90 fps Inflow=0.07 cfs 0.004 af
4.0" Round Pipe n=0.010 L=123.0' S=0.0055 '/' Capacity=0.18 cfs Outflow=0.06 cfs 0.004 af

Pond 11P: detnetion Peak Elev=99.69' Storage=0.033 af Inflow=0.83 cfs 0.798 af
Primary=0.54 cfs 0.418 af Secondary=0.29 cfs 0.347 af Outflow=0.82 cfs 0.765 af

Total Runoff Area = 0.114 ac Runoff Volume = 0.040 af Average Runoff Depth = 4.18"
89.44% Pervious = 0.102 ac 10.56% Impervious = 0.012 ac

Summary for Subcatchment 5S: propsoed east roof SITE RUNOFF

Exsiting Drainage area

Runoff = 0.45 cfs @ 12.09 hrs, Volume= 0.034 af, Depth> 4.33"
Routed to Reach 7R : pipe from roof

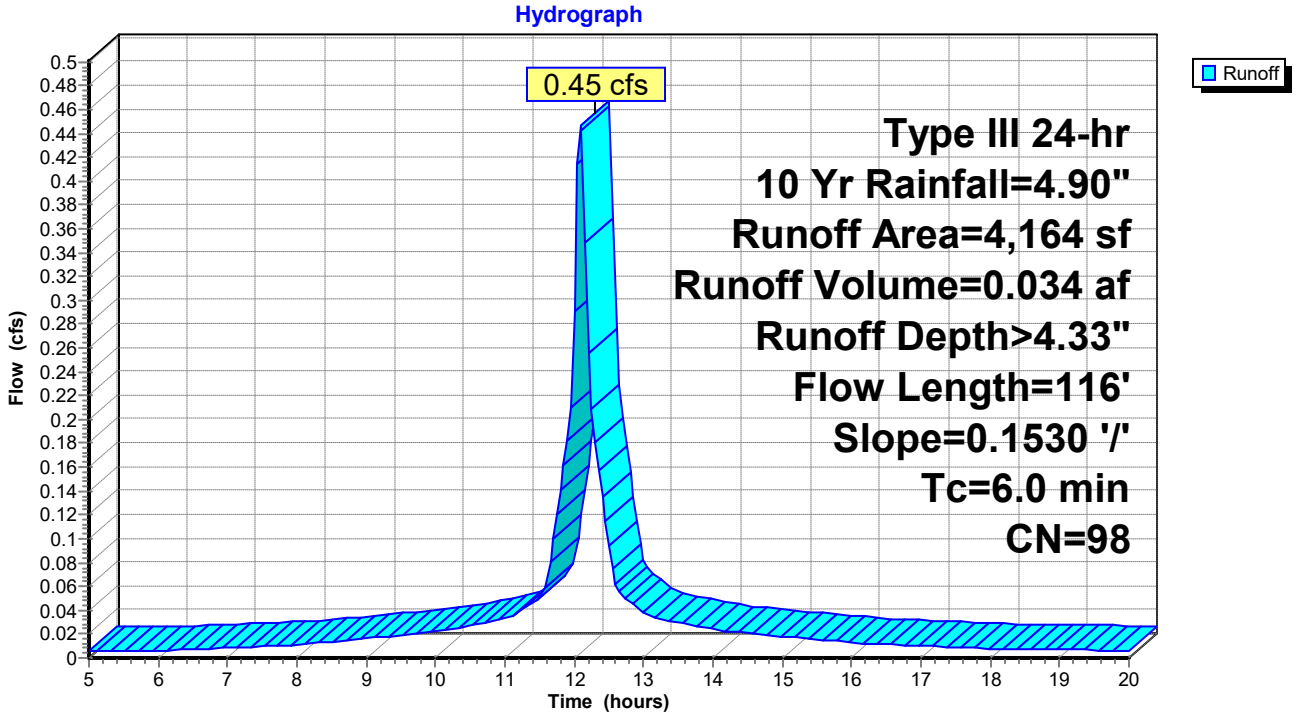
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Yr Rainfall=4.90"

Area (sf)	CN	Description
4,164	98	Water Surface, 0% imp, HSG A
4,164		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	116	0.1530	7.94		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.2	116	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 5S: propsoed east roof SITE RUNOFF

Subcatchment 5S: propsoed east roof SITE RUNOFF



Summary for Subcatchment 9S: alley

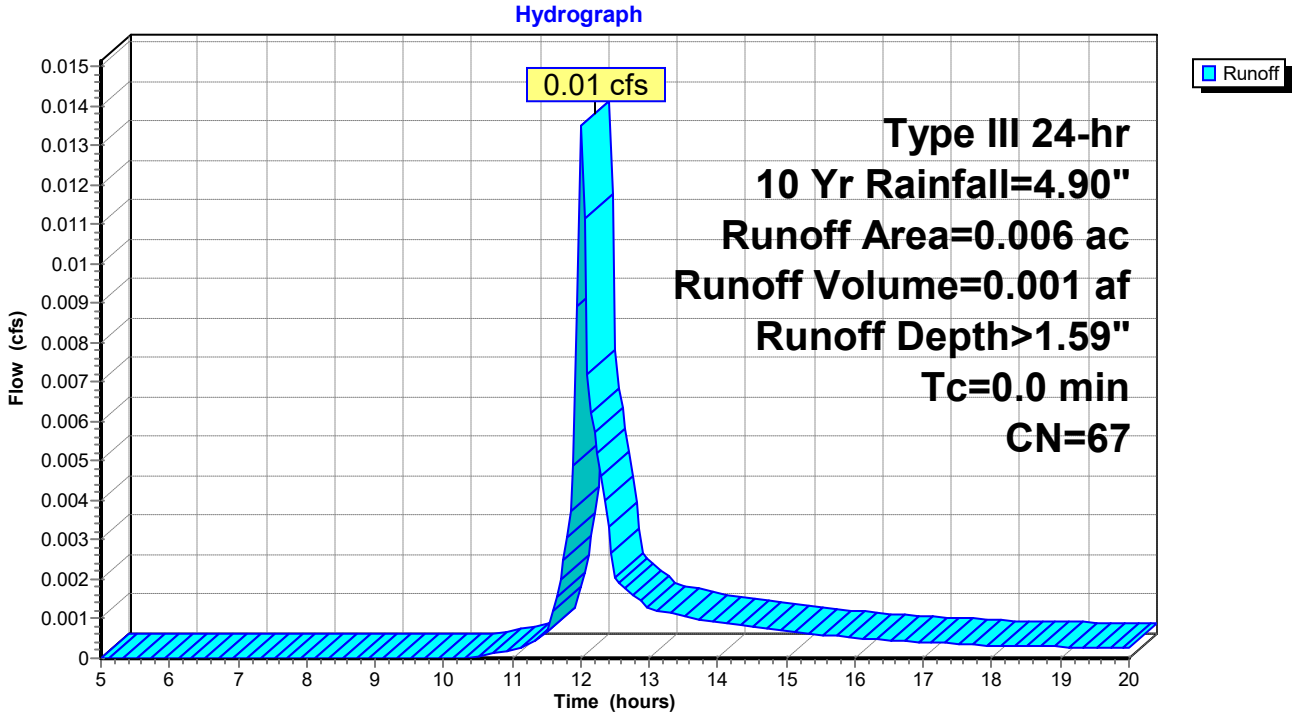
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.01 cfs @ 12.01 hrs, Volume= 0.001 af, Depth> 1.59"
Routed to Reach 10R : pipe from alley

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Yr Rainfall=4.90"

	Area (ac)	CN	Description
*	0.006	67	grass
	0.006		100.00% Pervious Area

Subcatchment 9S: alley



Summary for Subcatchment 13S: west side face roof

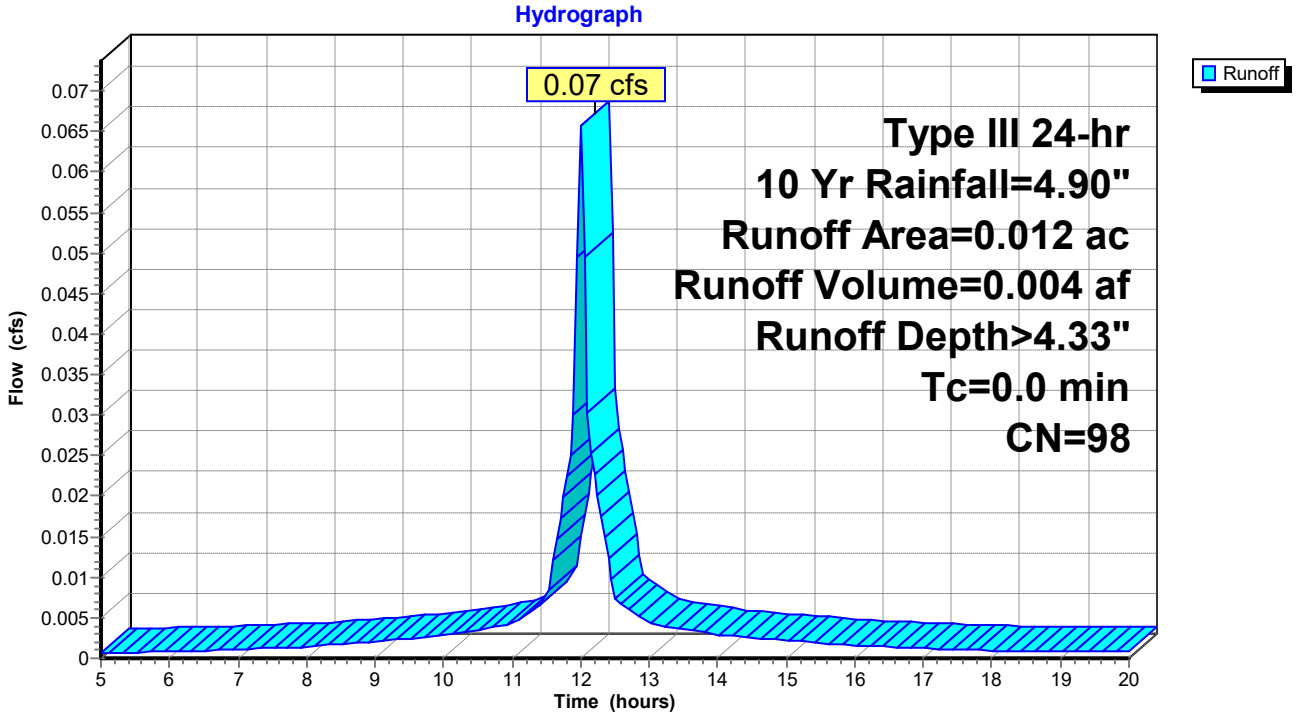
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.07 cfs @ 12.00 hrs, Volume= 0.004 af, Depth> 4.33"
Routed to Reach 14R : pipe from roof

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Yr Rainfall=4.90"

	Area (ac)	CN	Description
*	0.012	98	water surface hga A
	0.012		100.00% Impervious Area

Subcatchment 13S: west side face roof



Summary for Reach 7R: pipe from roof

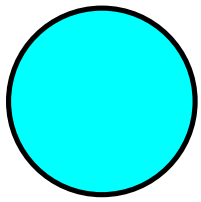
[52] Hint: Inlet/Outlet conditions not evaluated
[82] Warning: Early inflow requires earlier time span
[55] Hint: Peak inflow is 307% of Manning's capacity
[76] Warning: Detained 0.005 af (Pond w/culvert advised)

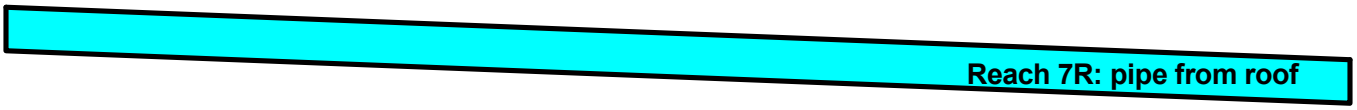
Inflow Area = 0.096 ac, 0.00% Impervious, Inflow Depth > 4.33" for 10 Yr event
Inflow = 0.45 cfs @ 12.09 hrs, Volume= 0.034 af
Outflow = 0.15 cfs @ 11.86 hrs, Volume= 0.034 af, Atten= 65%, Lag= 0.0 min
Routed to Pond 11P : detnetion

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.90 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 1.11 fps, Avg. Travel Time= 1.7 min

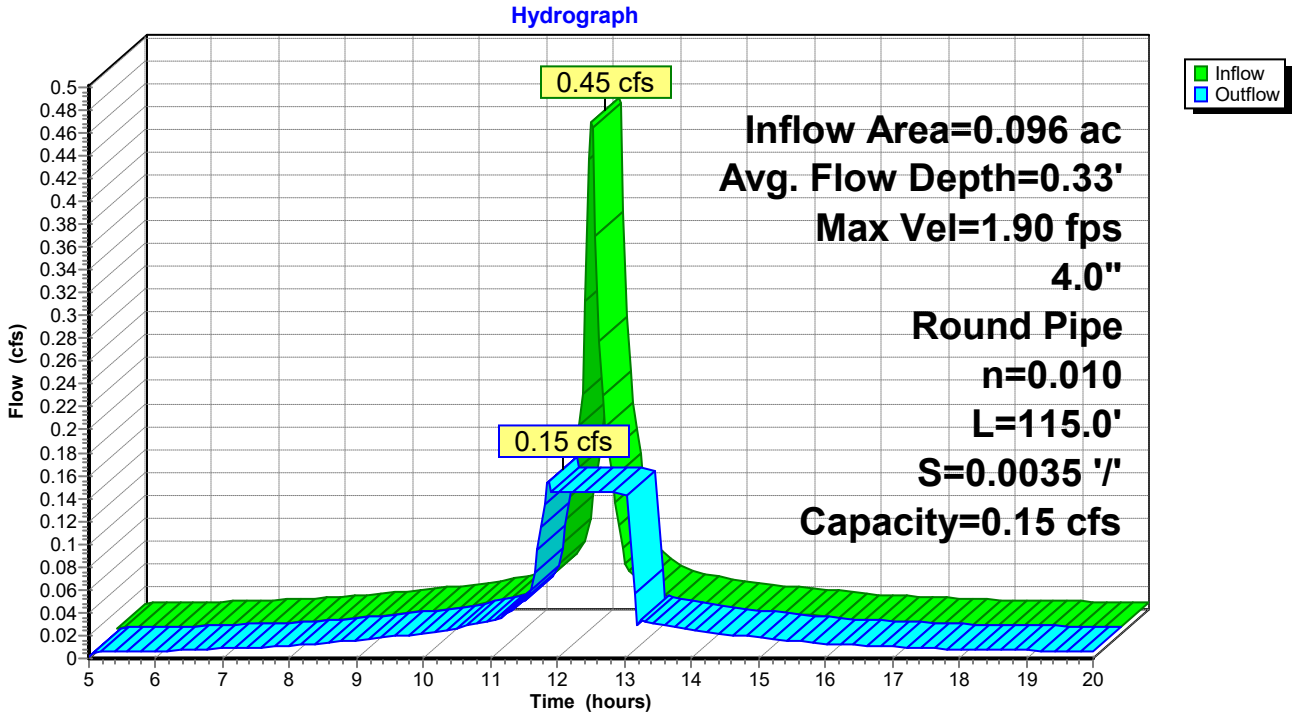
Peak Storage= 10 cf @ 11.90 hrs
Average Depth at Peak Storage= 0.33' , Surface Width= 0.00'
Bank-Full Depth= 0.33' Flow Area= 0.1 sf, Capacity= 0.15 cfs

4.0" Round Pipe
n= 0.010 PVC, smooth interior
Length= 115.0' Slope= 0.0035 '/'
Inlet Invert= 100.70', Outlet Invert= 100.30'

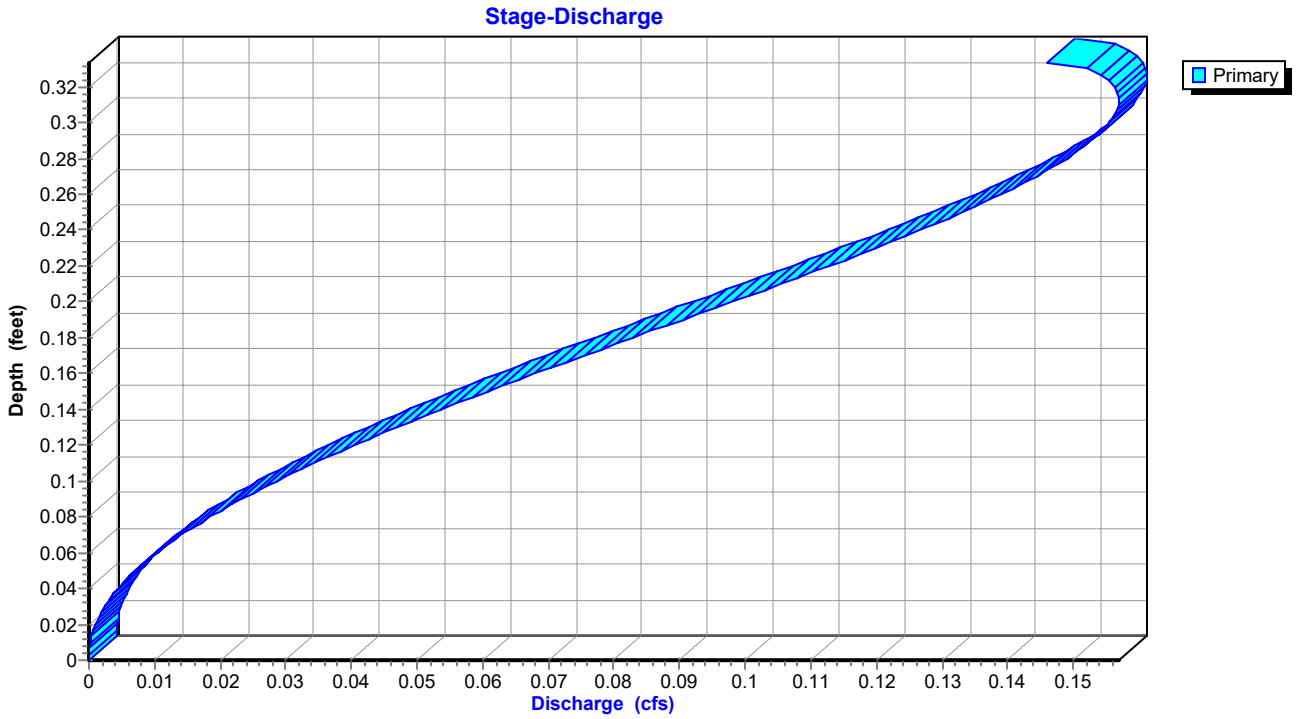




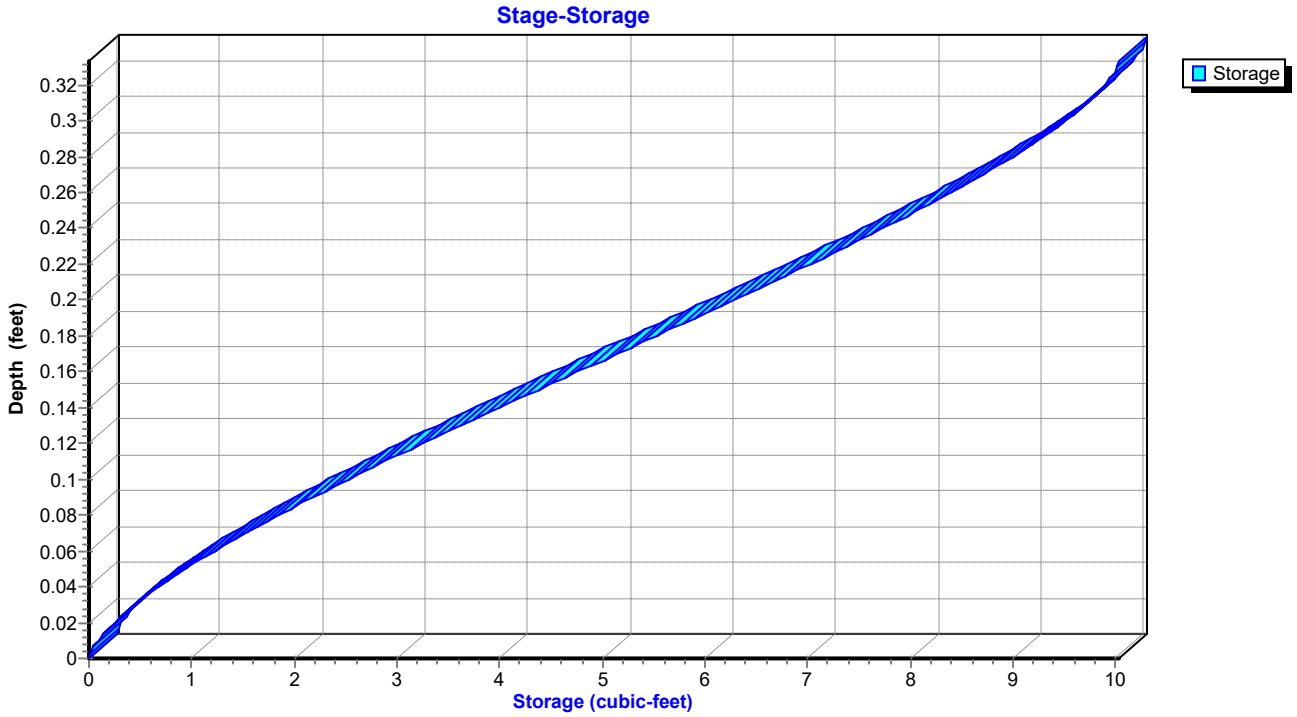
Reach 7R: pipe from roof



Reach 7R: pipe from roof



Reach 7R: pipe from roof



Summary for Reach 8R: green roof runoff pipe

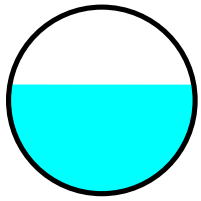
[52] Hint: Inlet/Outlet conditions not evaluated
[90] Warning: Qout>Qin may require smaller dt or Finer Routing

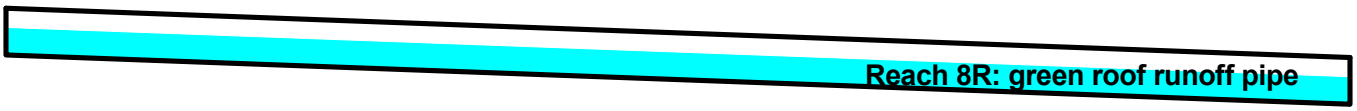
Inflow = 0.61 cfs @ 5.00 hrs, Volume= 0.759 af, Incl. 0.61 cfs Base Flow
Outflow = 0.71 cfs @ 5.05 hrs, Volume= 0.758 af, Atten= 0%, Lag= 3.0 min
Routed to Pond 11P : detnetion

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.33 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 3.21 fps, Avg. Travel Time= 0.8 min

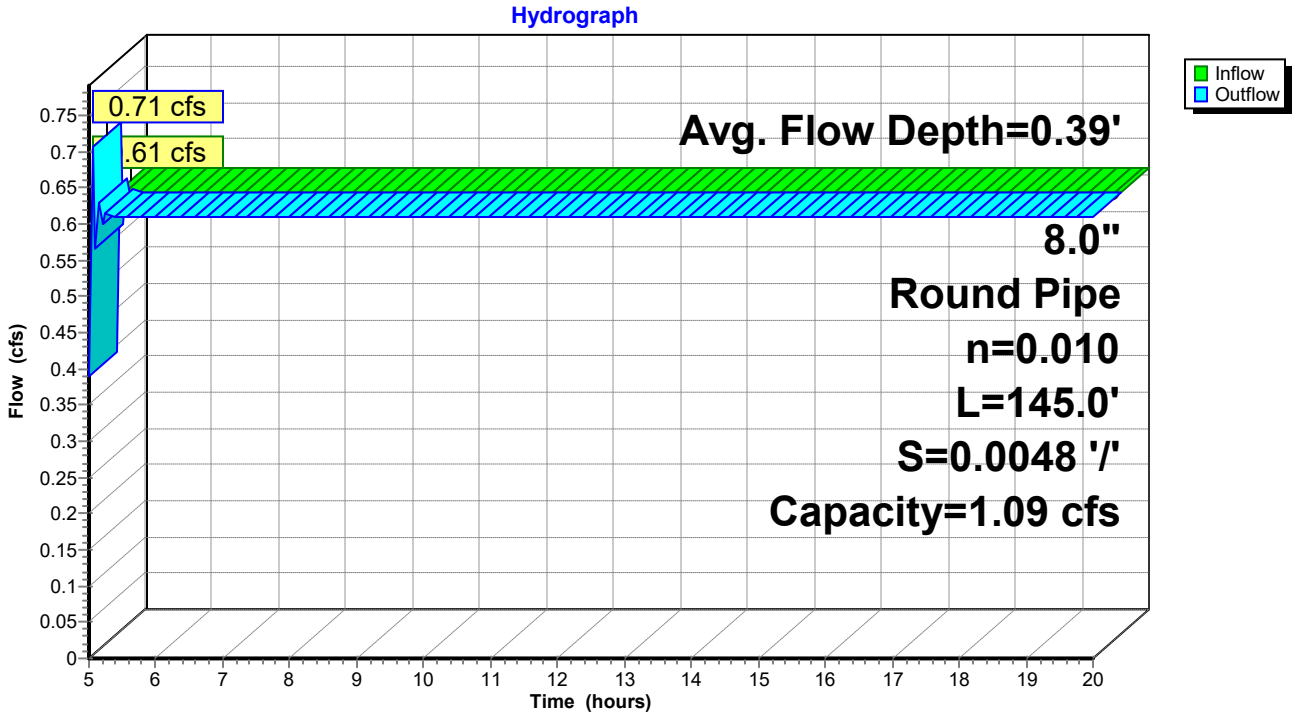
Peak Storage= 31 cf @ 5.05 hrs
Average Depth at Peak Storage= 0.39' , Surface Width= 0.66'
Bank-Full Depth= 0.67' Flow Area= 0.3 sf, Capacity= 1.09 cfs

8.0" Round Pipe
n= 0.010 PVC, smooth interior
Length= 145.0' Slope= 0.0048 '/'
Inlet Invert= 100.90', Outlet Invert= 100.20'

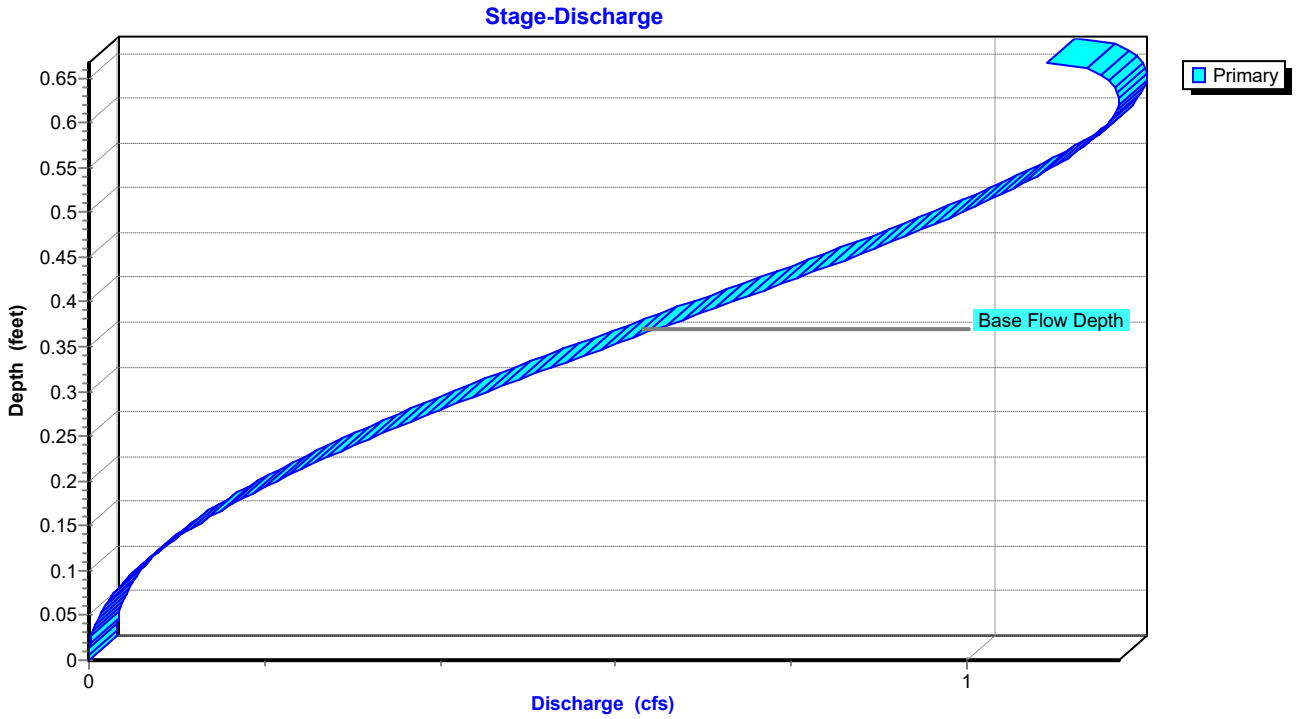




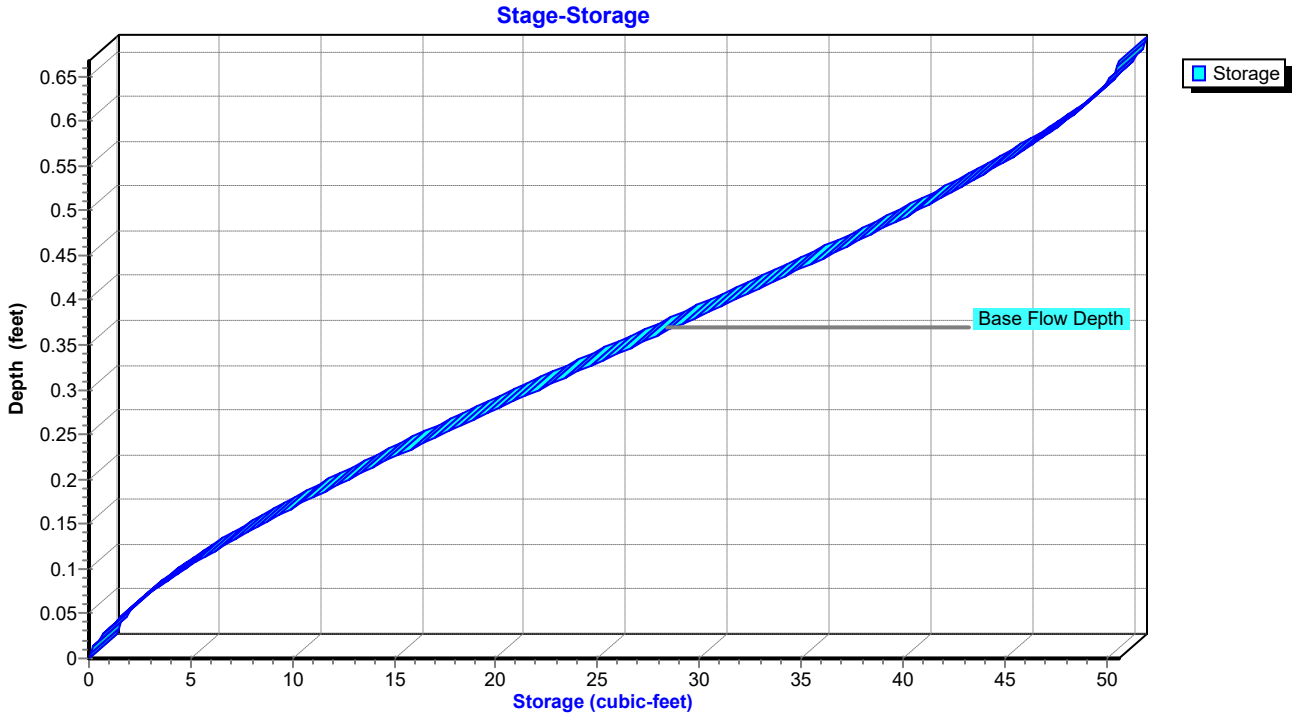
Reach 8R: green roof runoff pipe



Reach 8R: green roof runoff pipe



Reach 8R: green roof runoff pipe



Summary for Reach 10R: pipe from alley

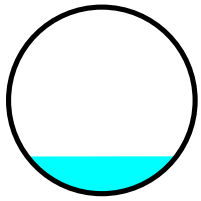
[52] Hint: Inlet/Outlet conditions not evaluated

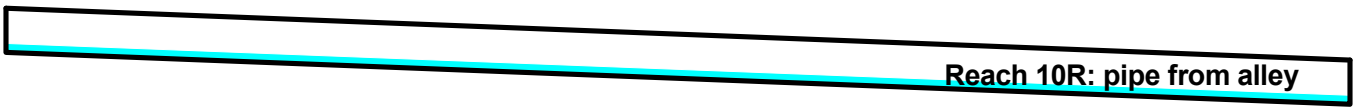
Inflow Area = 0.006 ac, 0.00% Impervious, Inflow Depth > 1.59" for 10 Yr event
Inflow = 0.01 cfs @ 12.01 hrs, Volume= 0.001 af
Outflow = 0.01 cfs @ 12.04 hrs, Volume= 0.001 af, Atten= 8%, Lag= 1.9 min
Routed to Pond 11P : detnetion

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.99 fps, Min. Travel Time= 2.0 min
Avg. Velocity = 0.41 fps, Avg. Travel Time= 4.9 min

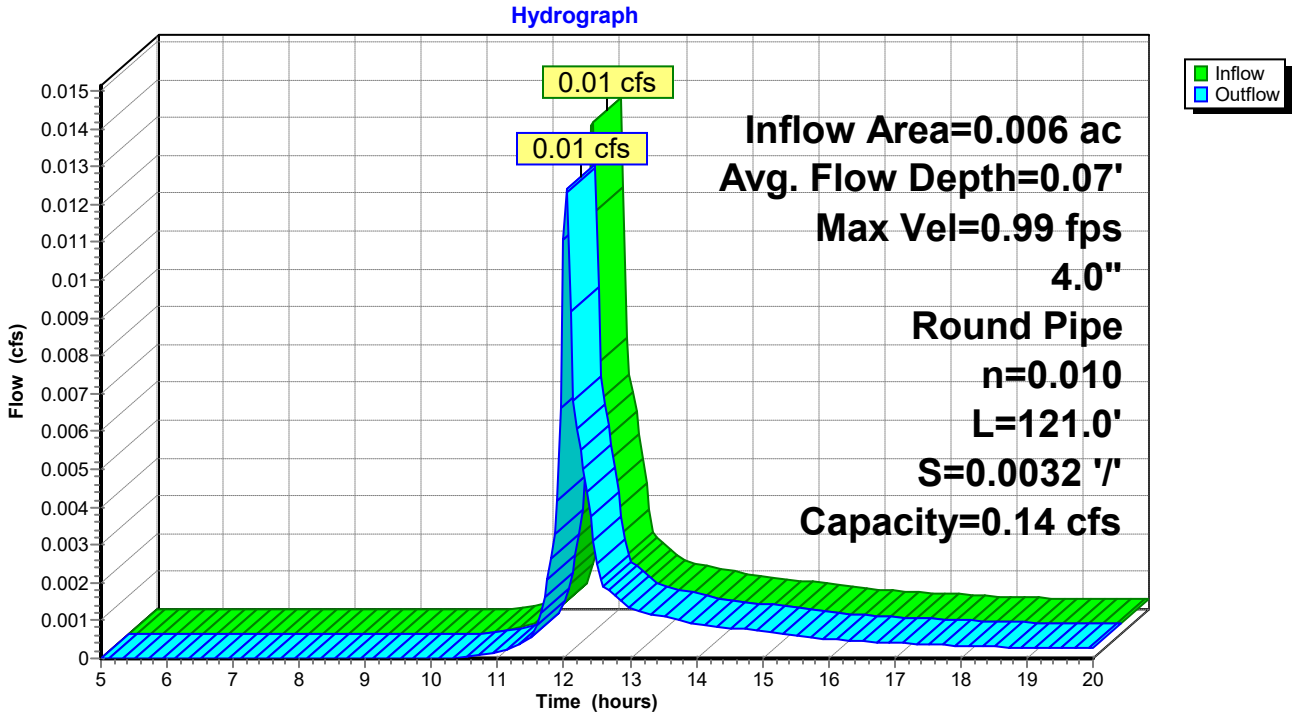
Peak Storage= 2 cf @ 12.04 hrs
Average Depth at Peak Storage= 0.07' , Surface Width= 0.27'
Bank-Full Depth= 0.33' Flow Area= 0.1 sf, Capacity= 0.14 cfs

4.0" Round Pipe
n= 0.010 PVC, smooth interior
Length= 121.0' Slope= 0.0032 '/'
Inlet Invert= 100.99', Outlet Invert= 100.60'

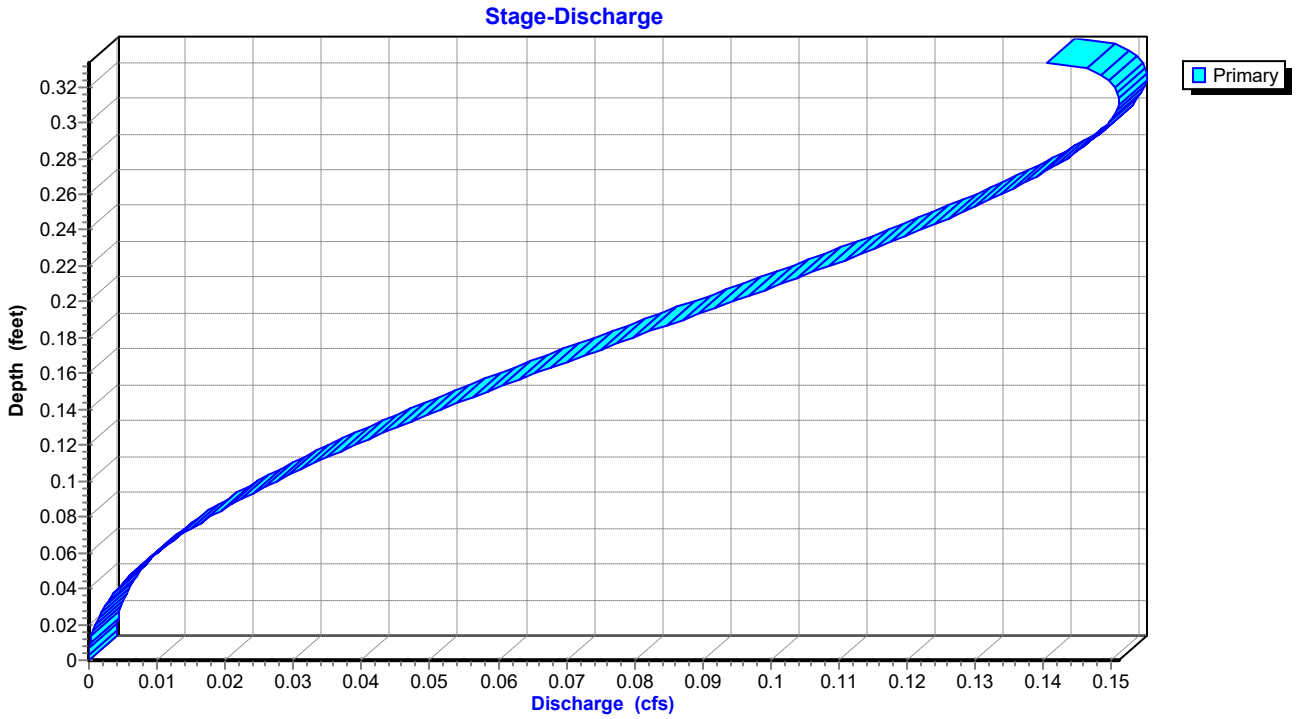




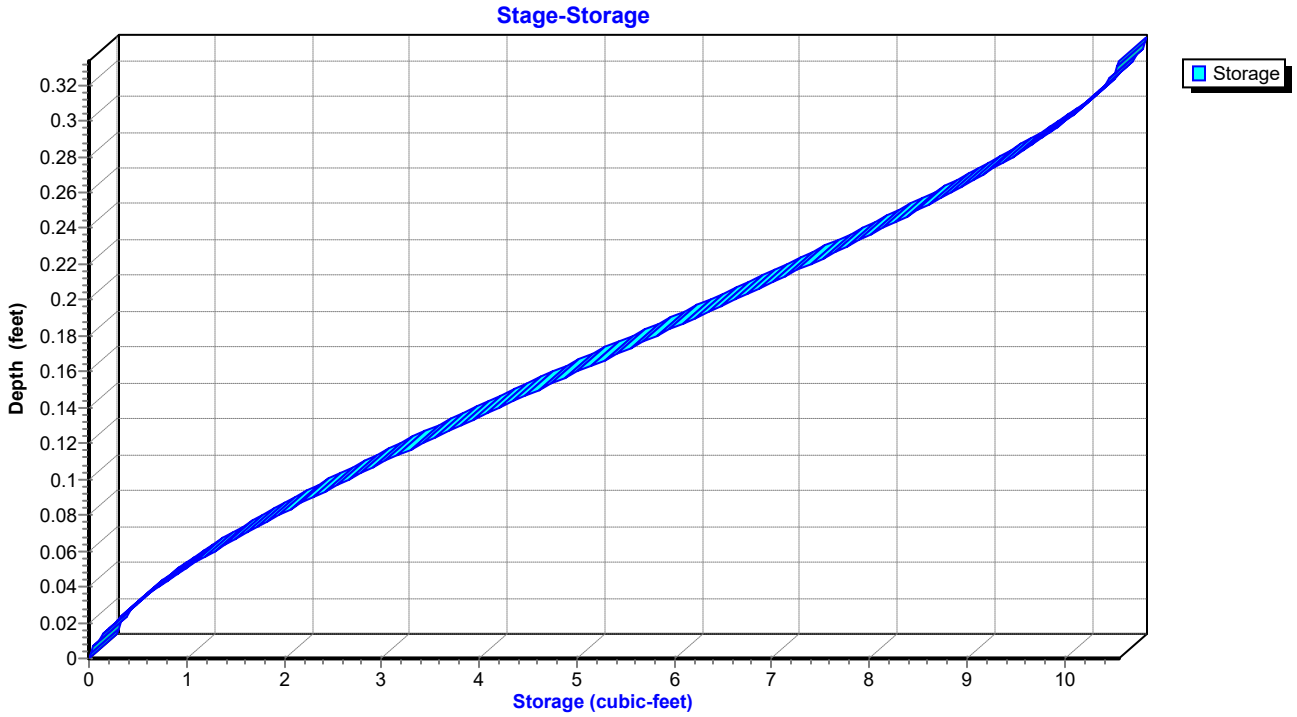
Reach 10R: pipe from alley



Reach 10R: pipe from alley



Reach 10R: pipe from alley



Summary for Reach 14R: pipe from roof

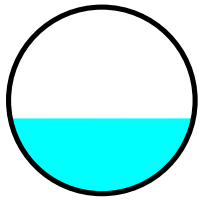
[52] Hint: Inlet/Outlet conditions not evaluated
[82] Warning: Early inflow requires earlier time span

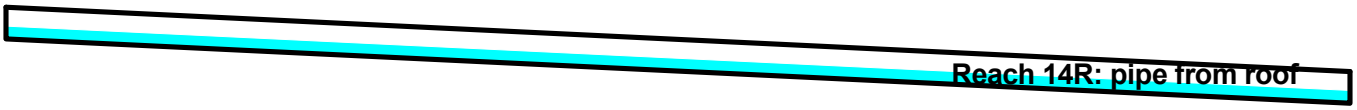
Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth > 4.33" for 10 Yr event
Inflow = 0.07 cfs @ 12.00 hrs, Volume= 0.004 af
Outflow = 0.06 cfs @ 12.01 hrs, Volume= 0.004 af, Atten= 4%, Lag= 0.8 min
Routed to Pond 11P : detnetion

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.90 fps, Min. Travel Time= 1.1 min
Avg. Velocity = 0.72 fps, Avg. Travel Time= 2.9 min

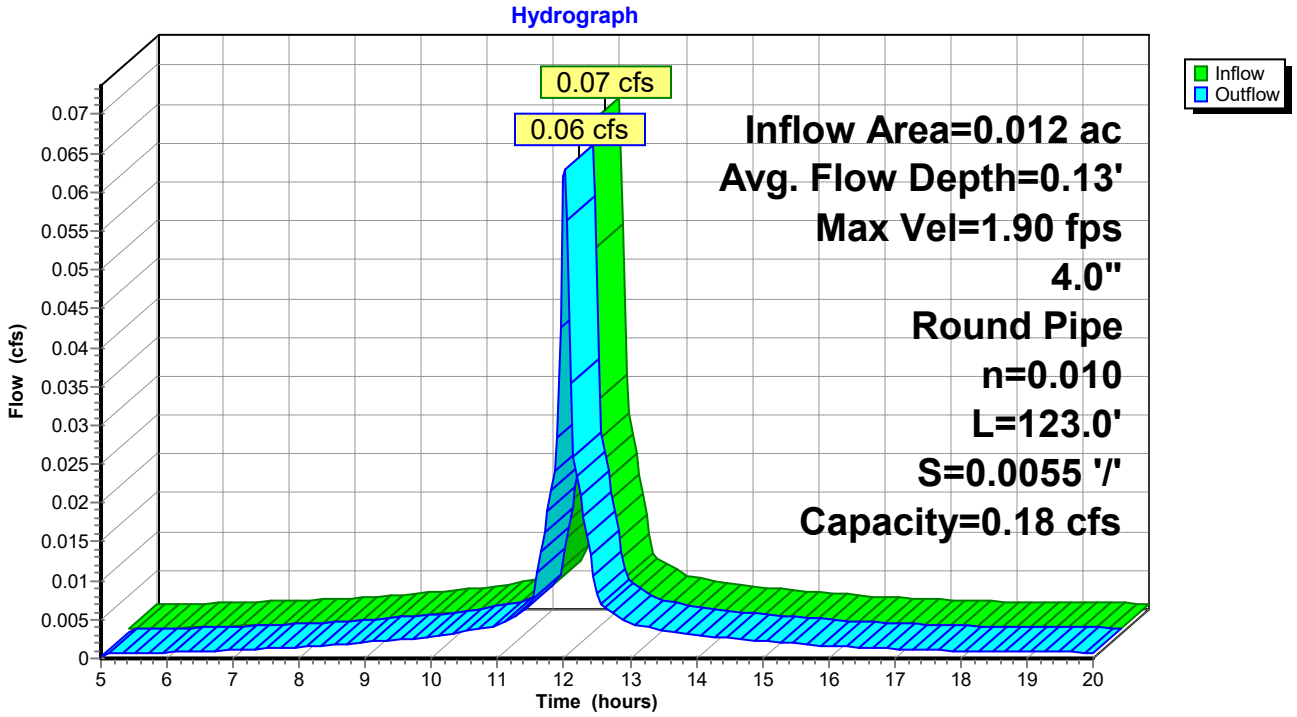
Peak Storage= 4 cf @ 12.01 hrs
Average Depth at Peak Storage= 0.13' , Surface Width= 0.33'
Bank-Full Depth= 0.33' Flow Area= 0.1 sf, Capacity= 0.18 cfs

4.0" Round Pipe
n= 0.010 PVC, smooth interior
Length= 123.0' Slope= 0.0055 '/'
Inlet Invert= 100.98', Outlet Invert= 100.30'

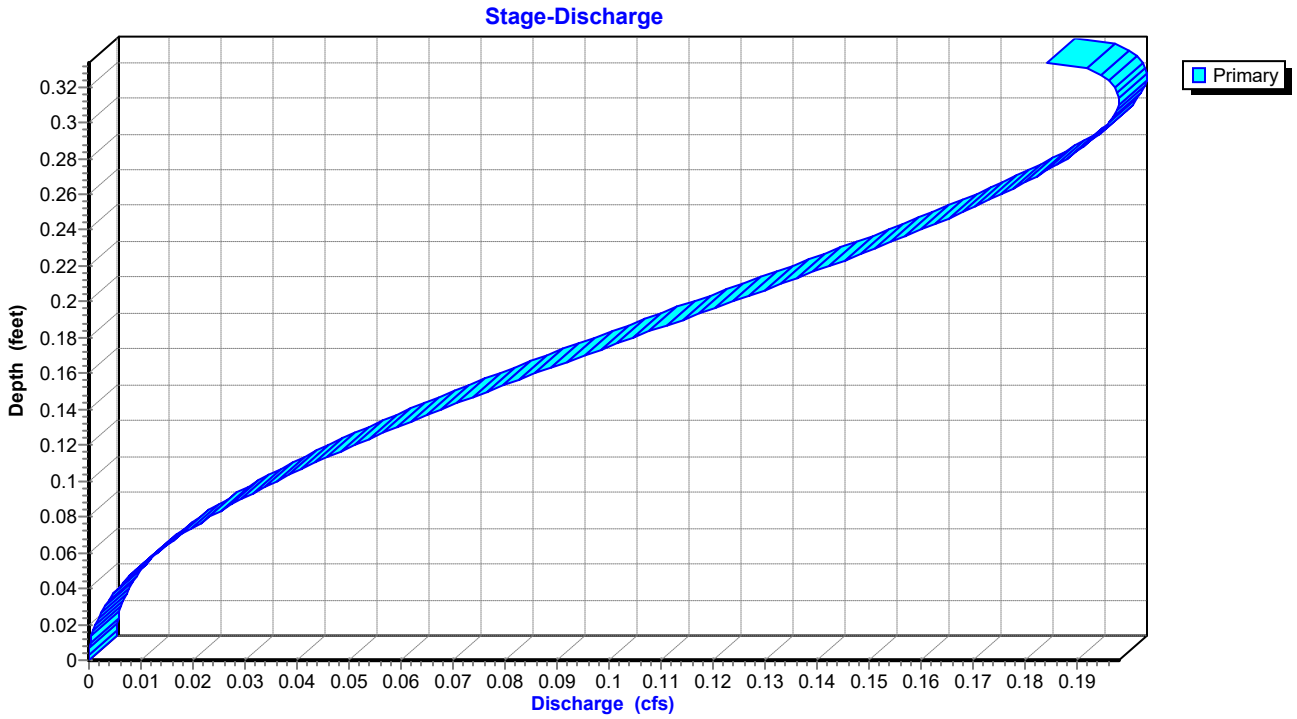




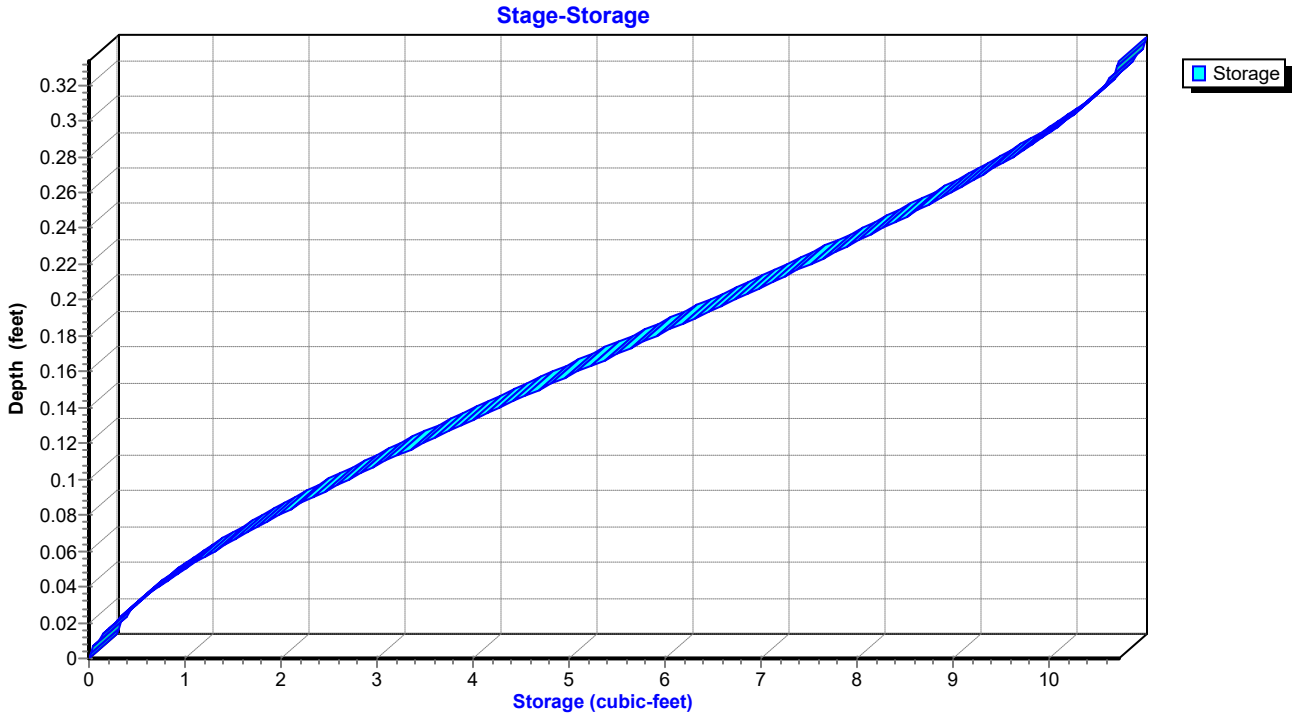
Reach 14R: pipe from roof



Reach 14R: pipe from roof



Reach 14R: pipe from roof



Summary for Pond 11P: detnetion

[82] Warning: Early inflow requires earlier time span
[44] Hint: Outlet device #2 is below defined storage

Inflow Area = 0.114 ac, 10.56% Impervious, Inflow Depth > 84.27" for 10 Yr event
Inflow = 0.83 cfs @ 12.02 hrs, Volume= 0.798 af
Outflow = 0.82 cfs @ 12.05 hrs, Volume= 0.765 af, Atten= 1%, Lag= 2.2 min
Primary = 0.54 cfs @ 12.05 hrs, Volume= 0.418 af
Secondary = 0.29 cfs @ 12.05 hrs, Volume= 0.347 af

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 99.69' @ 12.05 hrs Surf.Area= 0.013 ac Storage= 0.033 af

Plug-Flow detention time= 36.8 min calculated for 0.765 af (96% of inflow)
Center-of-Mass det. time= 17.9 min (767.9 - 750.0)

Volume	Invert	Avail.Storage	Storage Description
#1	97.20'	0.039 af	**36.0" Round Pipe Storage** L= 240.0' S= 0.0010 '/'

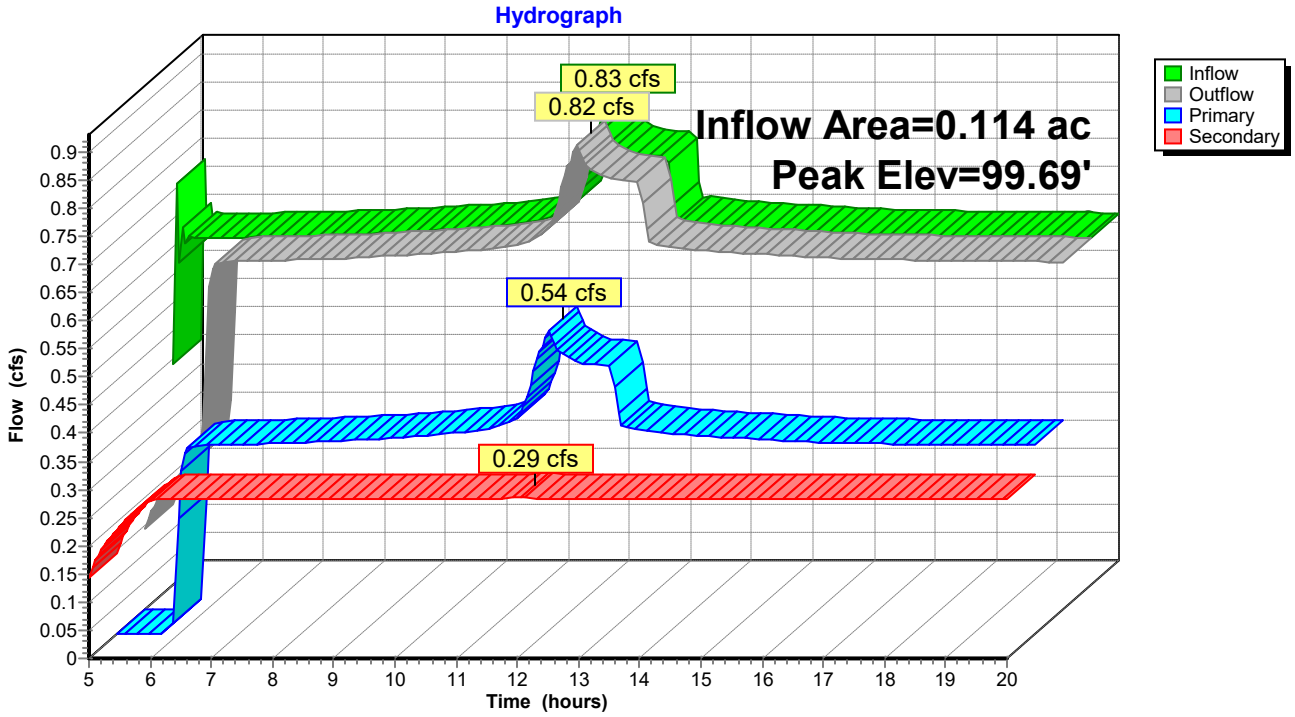
Device	Routing	Invert	Outlet Devices
#1	Primary	99.50'	**2.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Secondary	96.57'	**2.5" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.54 cfs @ 12.05 hrs HW=99.69' (Free Discharge)
└**1=Sharp-Crested Rectangular Weir** (Weir Controls 0.54 cfs @ 1.43 fps)

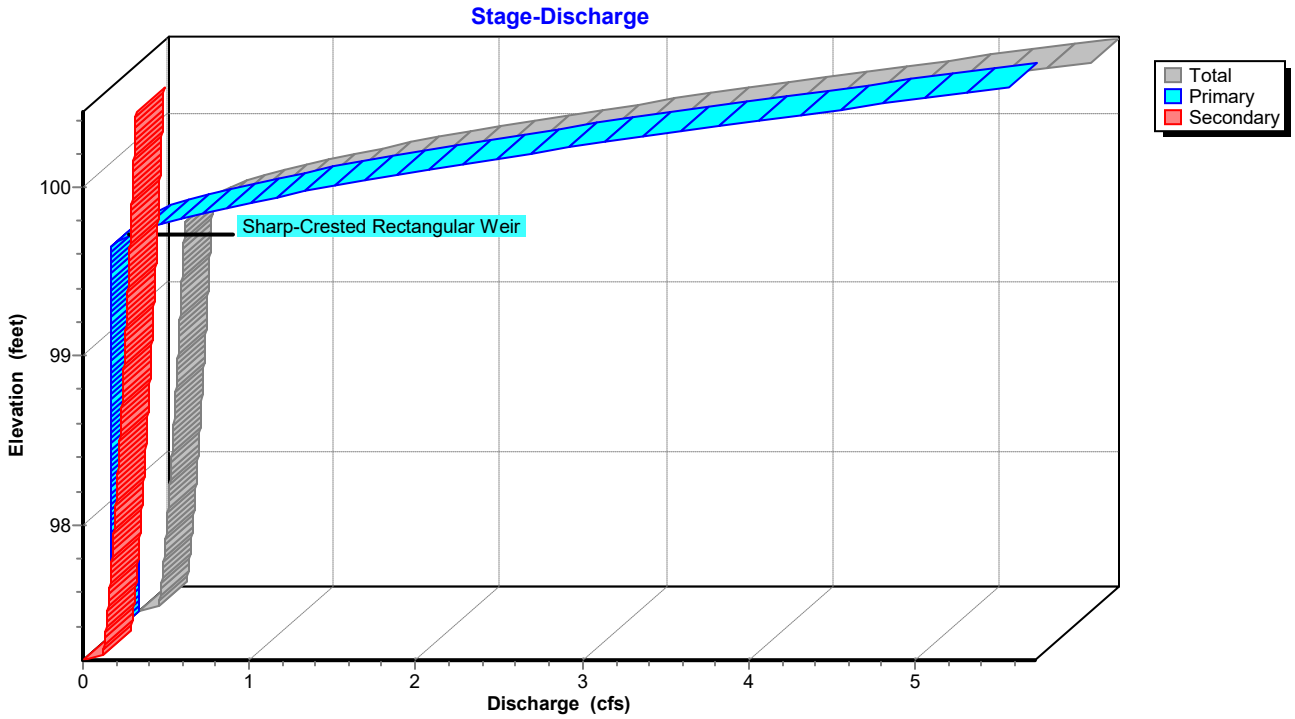
Secondary OutFlow Max=0.29 cfs @ 12.05 hrs HW=99.69' (Free Discharge)
└**2=Orifice/Grate** (Orifice Controls 0.29 cfs @ 8.36 fps)



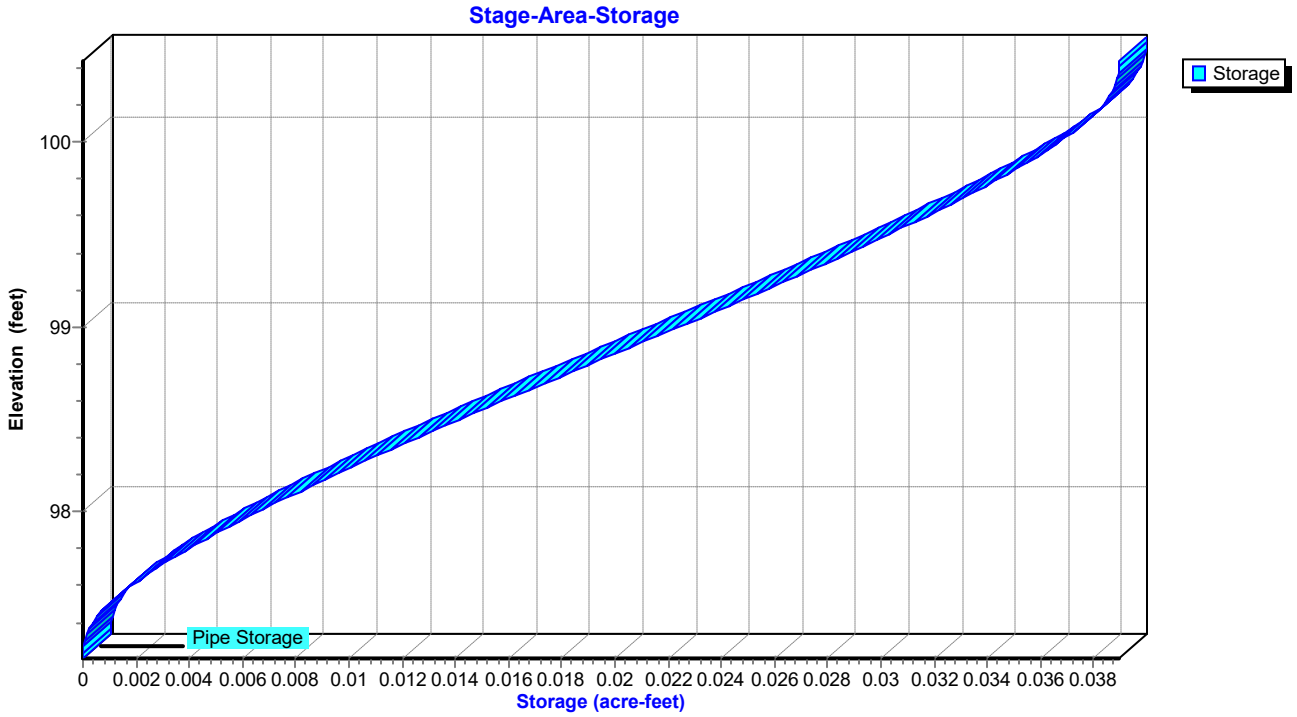
Pond 11P: detnetion

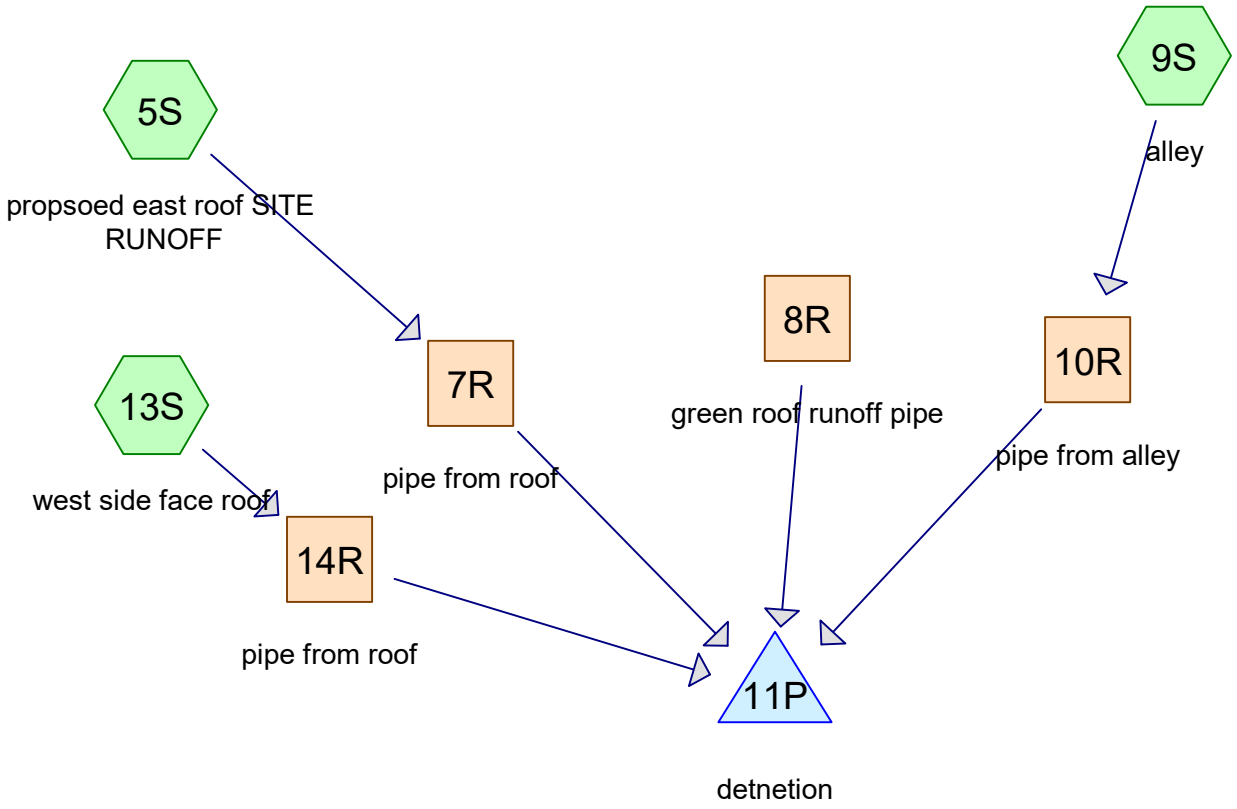


Pond 11P: detnetion



Pond 11P: detnetion





Subcat Reach Pond Link

Routing Diagram for 373-kennedy-proposed-total-site-detention-100-yr
Prepared by OEA, Printed 10/18/2026
HydroCAD® 10.20-9a s/n 05940 © 2026 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.096	98	Water Surface, 0% imp, HSG A (5S)
0.006	67	grass (9S)
0.012	98	water surface hga A (13S)
0.114	**96**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.096	HSG A	5S
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.018	Other	9S, 13S
0.114		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.096	0.000	0.000	0.000	0.000	0.096	Water Surface, 0% imp	5S
0.000	0.000	0.000	0.000	0.006	0.006	grass	9S
0.000	0.000	0.000	0.000	0.012	0.012	water surface hga A	13S
0.096	**0.000**	**0.000**	**0.000**	**0.018**	**0.114**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)	Node Name
1	7R	100.70	100.30	115.0	0.0035	0.010	0.0	4.0	0.0	
2	8R	100.90	100.20	145.0	0.0048	0.010	0.0	8.0	0.0	
3	10R	100.99	100.60	121.0	0.0032	0.010	0.0	4.0	0.0	
4	14R	100.98	100.30	123.0	0.0055	0.010	0.0	4.0	0.0	

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 5S: propsoed east roof SITE Runoff Area=4,164 sf 0.00% Impervious Runoff Depth>6.96"
Flow Length=116' Slope=0.1530 '/' Tc=6.0 min CN=98 Runoff=0.71 cfs 0.055 af

Subcatchment 9S: alley Runoff Area=0.006 ac 0.00% Impervious Runoff Depth>3.68"
Tc=0.0 min CN=67 Runoff=0.03 cfs 0.002 af

Subcatchment 13S: west side face roof Runoff Area=0.012 ac 100.00% Impervious Runoff Depth>6.96"
Tc=0.0 min CN=98 Runoff=0.11 cfs 0.007 af

Reach 7R: pipe from roof Avg. Flow Depth=0.33' Max Vel=1.90 fps Inflow=0.71 cfs 0.055 af
4.0" Round Pipe n=0.010 L=115.0' S=0.0035 '/' Capacity=0.15 cfs Outflow=0.15 cfs 0.055 af

Reach 8R: green roof runoff pipe Avg. Flow Depth=0.67' Max Vel=3.56 fps Inflow=1.63 cfs 2.027 af
8.0" Round Pipe n=0.010 L=145.0' S=0.0048 '/' Capacity=1.09 cfs Outflow=1.12 cfs 1.358 af

Reach 10R: pipe from alley Avg. Flow Depth=0.10' Max Vel=1.26 fps Inflow=0.03 cfs 0.002 af
4.0" Round Pipe n=0.010 L=121.0' S=0.0032 '/' Capacity=0.14 cfs Outflow=0.03 cfs 0.002 af

Reach 14R: pipe from roof Avg. Flow Depth=0.18' Max Vel=2.15 fps Inflow=0.11 cfs 0.007 af
4.0" Round Pipe n=0.010 L=123.0' S=0.0055 '/' Capacity=0.18 cfs Outflow=0.10 cfs 0.007 af

Pond 11P: detnetion Peak Elev=99.81' Storage=0.034 af Inflow=1.37 cfs 1.422 af
Primary=1.07 cfs 1.032 af Secondary=0.29 cfs 0.356 af Outflow=1.36 cfs 1.388 af

Total Runoff Area = 0.114 ac Runoff Volume = 0.064 af Average Runoff Depth = 6.79"
89.44% Pervious = 0.102 ac 10.56% Impervious = 0.012 ac

Summary for Subcatchment 5S: propsoed east roof SITE RUNOFF

Exsiting Drainage area

Runoff = 0.71 cfs @ 12.09 hrs, Volume= 0.055 af, Depth> 6.96"
Routed to Reach 7R : pipe from roof

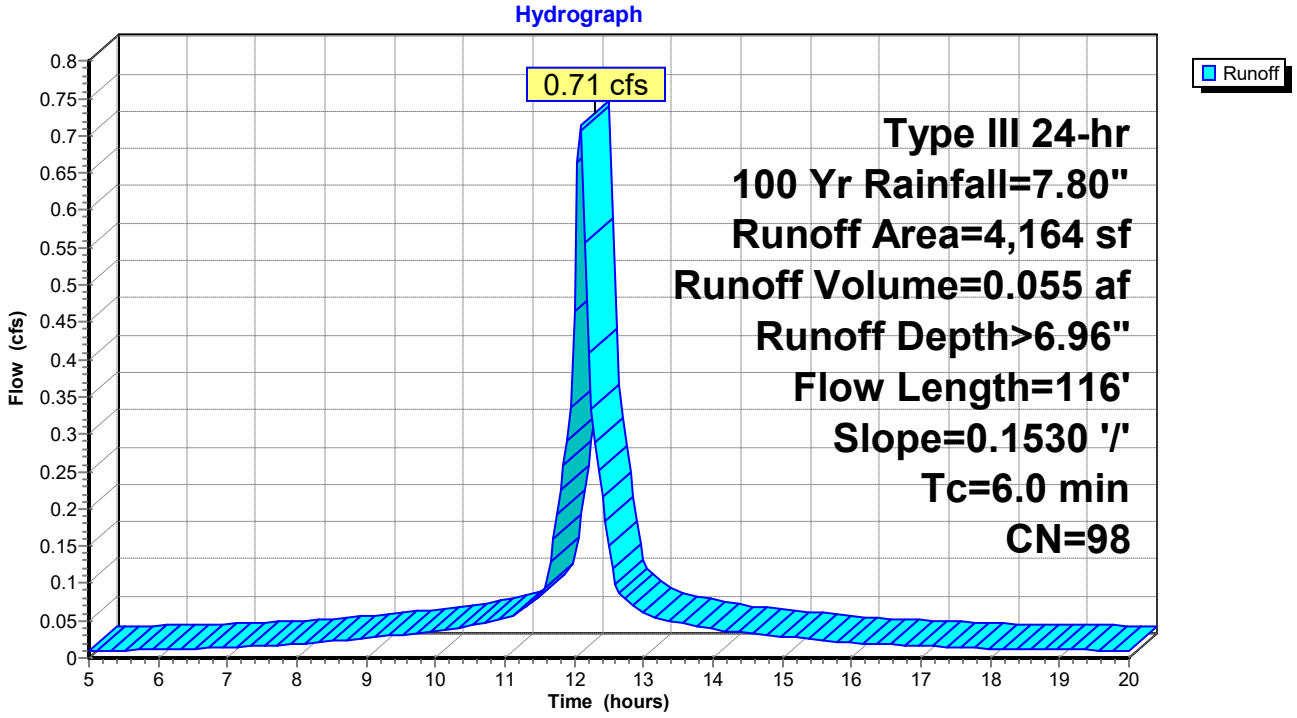
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Yr Rainfall=7.80"

Area (sf)	CN	Description
4,164	98	Water Surface, 0% imp, HSG A
4,164		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	116	0.1530	7.94		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.2	116	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 5S: propsoed east roof SITE RUNOFF

Subcatchment 5S: propsoed east roof SITE RUNOFF



Summary for Subcatchment 9S: alley

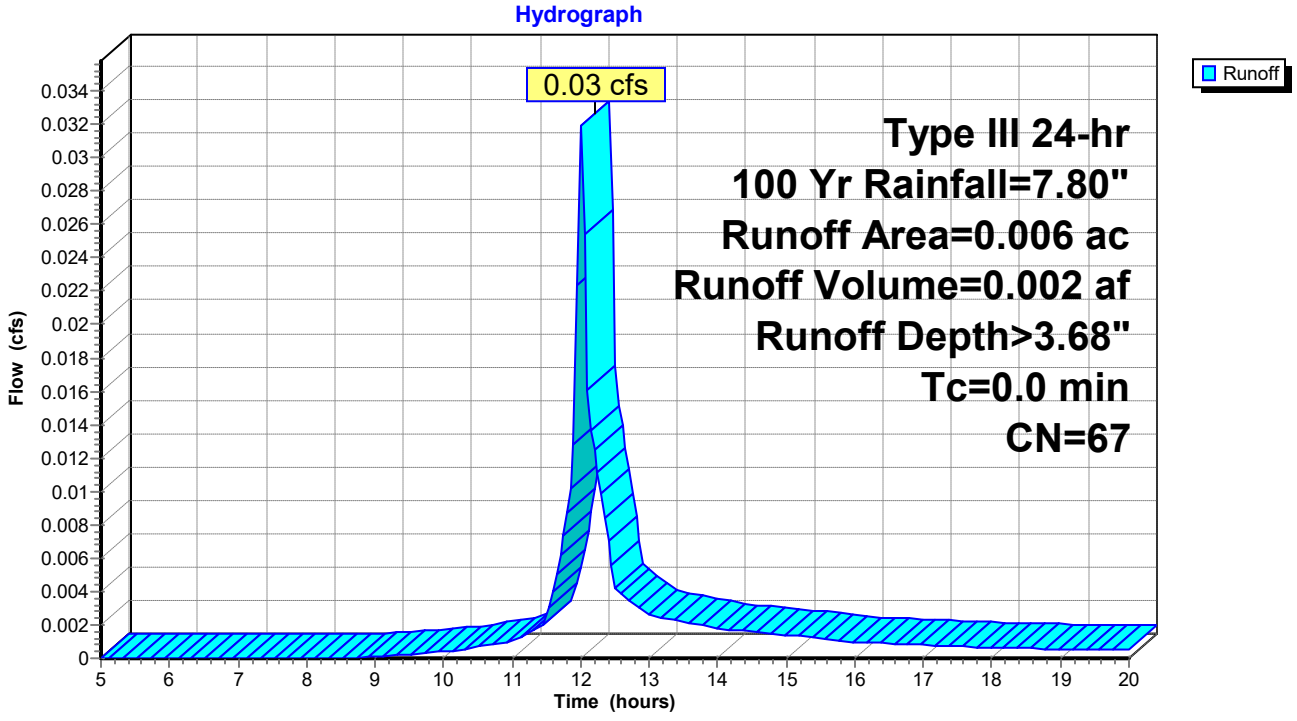
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.03 cfs @ 12.00 hrs, Volume= 0.002 af, Depth> 3.68"
Routed to Reach 10R : pipe from alley

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Yr Rainfall=7.80"

	Area (ac)	CN	Description
*	0.006	67	grass
	0.006		100.00% Pervious Area

Subcatchment 9S: alley



Summary for Subcatchment 13S: west side face roof

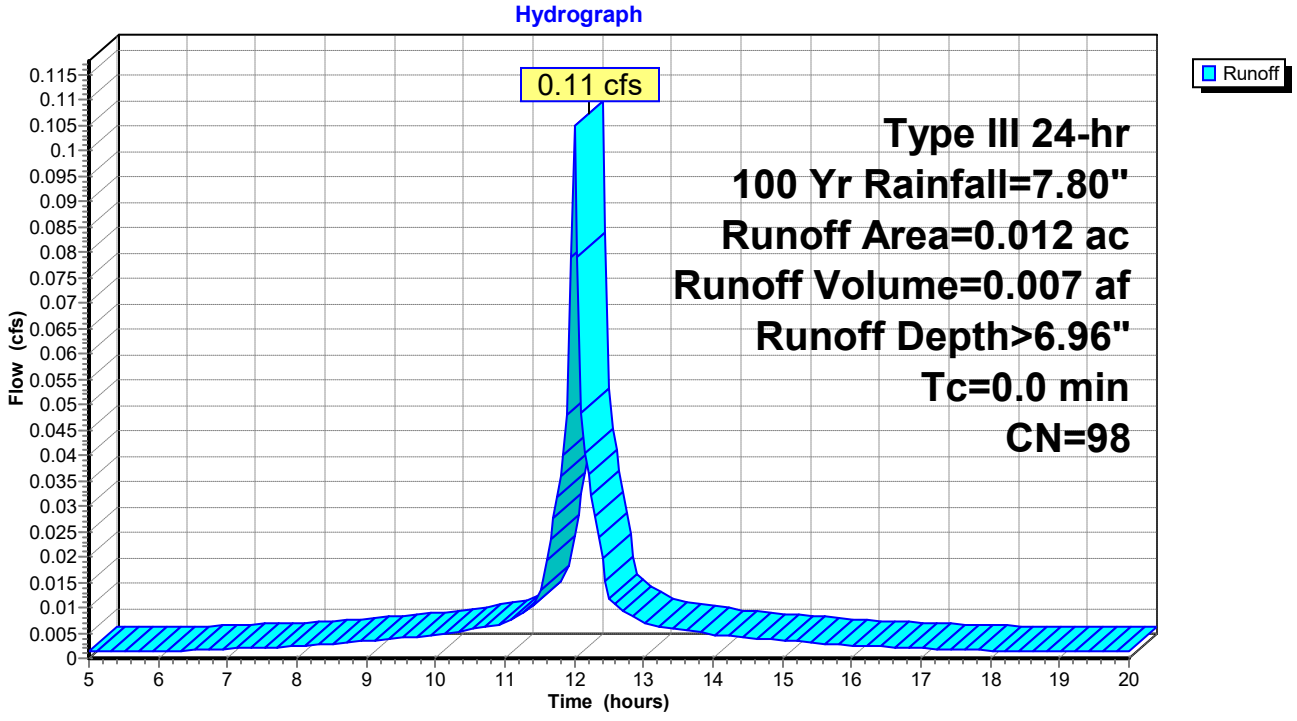
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 0.11 cfs @ 12.00 hrs, Volume= 0.007 af, Depth> 6.96"
Routed to Reach 14R : pipe from roof

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Yr Rainfall=7.80"

	Area (ac)	CN	Description
*	0.012	98	water surface hga A
	0.012		100.00% Impervious Area

Subcatchment 13S: west side face roof



Summary for Reach 7R: pipe from roof

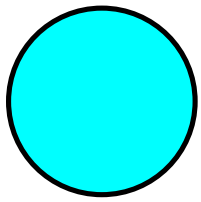
[52] Hint: Inlet/Outlet conditions not evaluated
[82] Warning: Early inflow requires earlier time span
[55] Hint: Peak inflow is 490% of Manning's capacity
[76] Warning: Detained 0.013 af (Pond w/culvert advised)

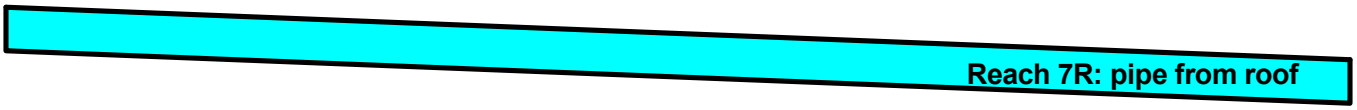
Inflow Area = 0.096 ac, 0.00% Impervious, Inflow Depth > 6.96" for 100 Yr event
Inflow = 0.71 cfs @ 12.09 hrs, Volume= 0.055 af
Outflow = 0.15 cfs @ 11.72 hrs, Volume= 0.055 af, Atten= 79%, Lag= 0.0 min
Routed to Pond 11P : detnetion

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.90 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 1.26 fps, Avg. Travel Time= 1.5 min

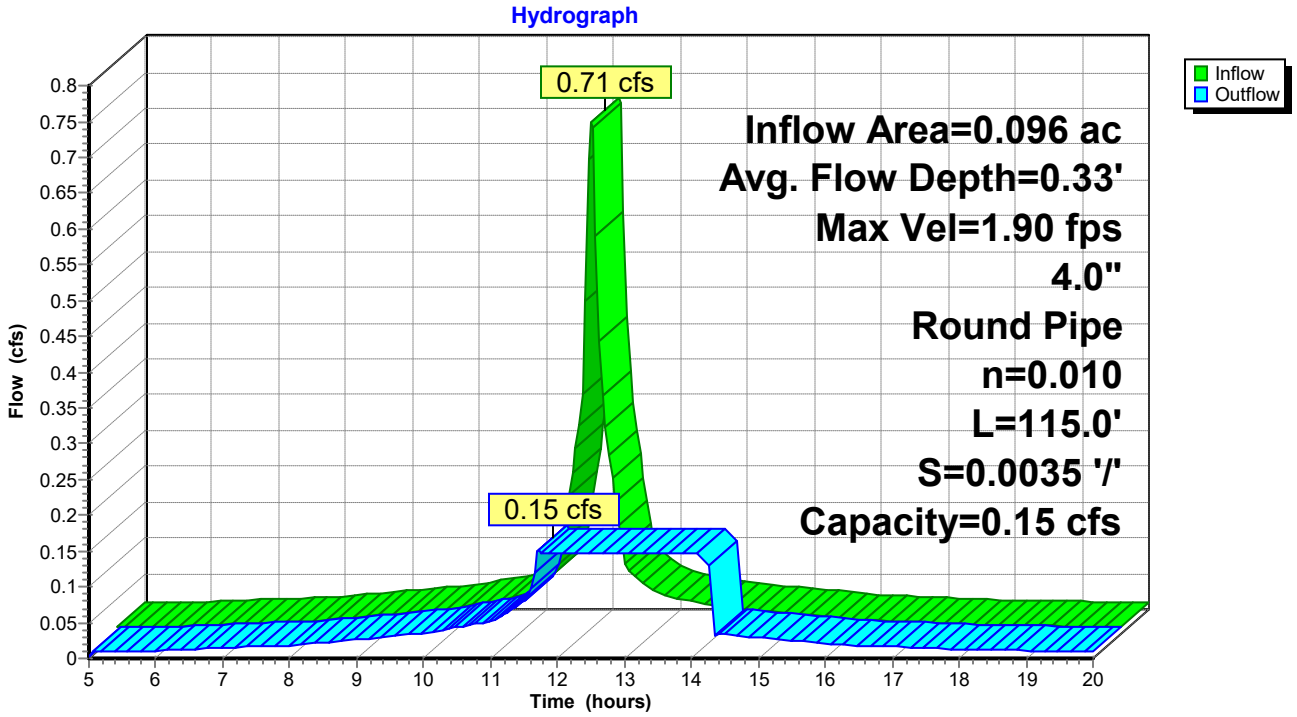
Peak Storage= 10 cf @ 11.75 hrs
Average Depth at Peak Storage= 0.33' , Surface Width= 0.00'
Bank-Full Depth= 0.33' Flow Area= 0.1 sf, Capacity= 0.15 cfs

4.0" Round Pipe
n= 0.010 PVC, smooth interior
Length= 115.0' Slope= 0.0035 '/'
Inlet Invert= 100.70', Outlet Invert= 100.30'

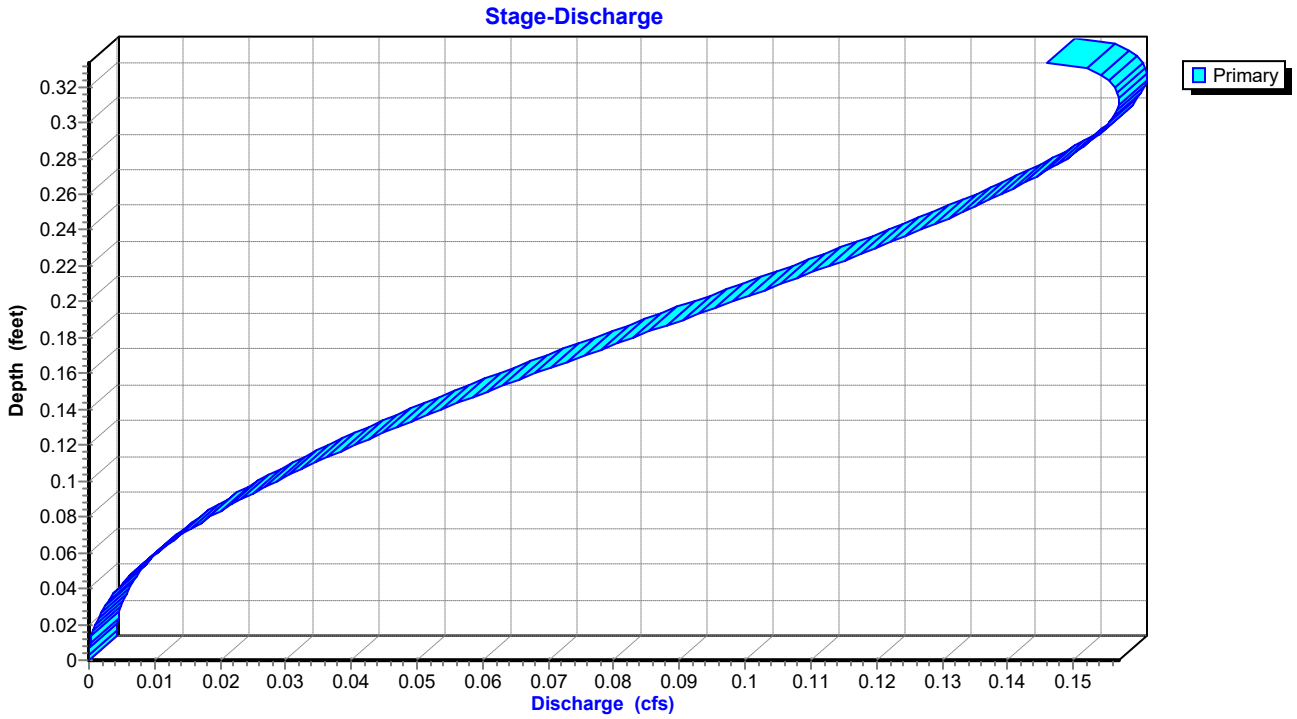




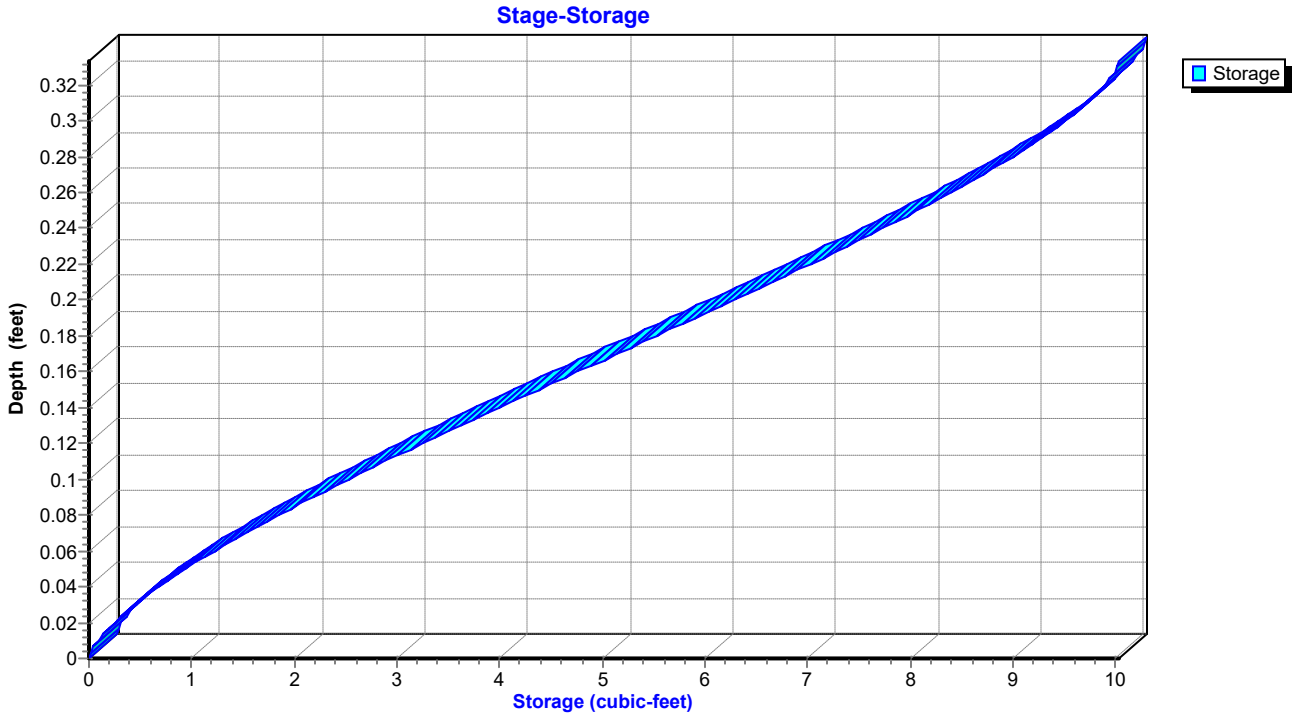
Reach 7R: pipe from roof



Reach 7R: pipe from roof



Reach 7R: pipe from roof



Summary for Reach 8R: green roof runoff pipe

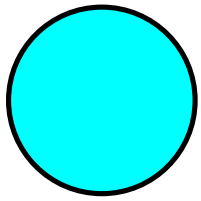
[52] Hint: Inlet/Outlet conditions not evaluated
[55] Hint: Peak inflow is 149% of Manning's capacity
[76] Warning: Detained 0.668 af (Pond w/culvert advised)

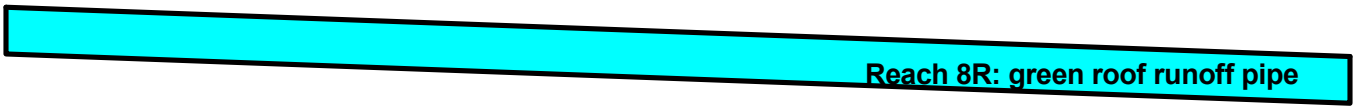
Inflow = 1.63 cfs @ 5.00 hrs, Volume= 2.027 af, Incl. 1.63 cfs Base Flow
Outflow = 1.12 cfs @ 5.00 hrs, Volume= 1.358 af, Atten= 31%, Lag= 0.0 min
Routed to Pond 11P : detnetion

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.56 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 3.13 fps, Avg. Travel Time= 0.8 min

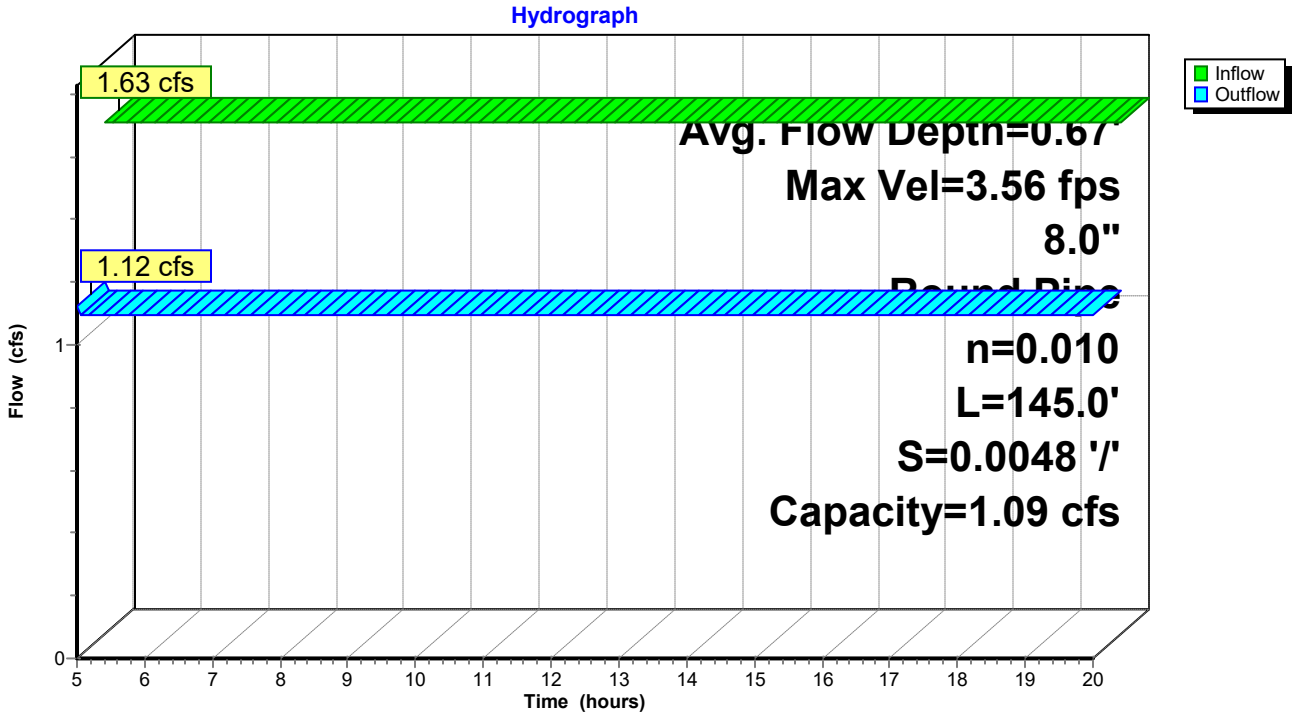
Peak Storage= 51 cf @ 5.05 hrs
Average Depth at Peak Storage= 0.67'
Bank-Full Depth= 0.67' Flow Area= 0.3 sf, Capacity= 1.09 cfs

8.0" Round Pipe
n= 0.010 PVC, smooth interior
Length= 145.0' Slope= 0.0048 '/'
Inlet Invert= 100.90', Outlet Invert= 100.20'

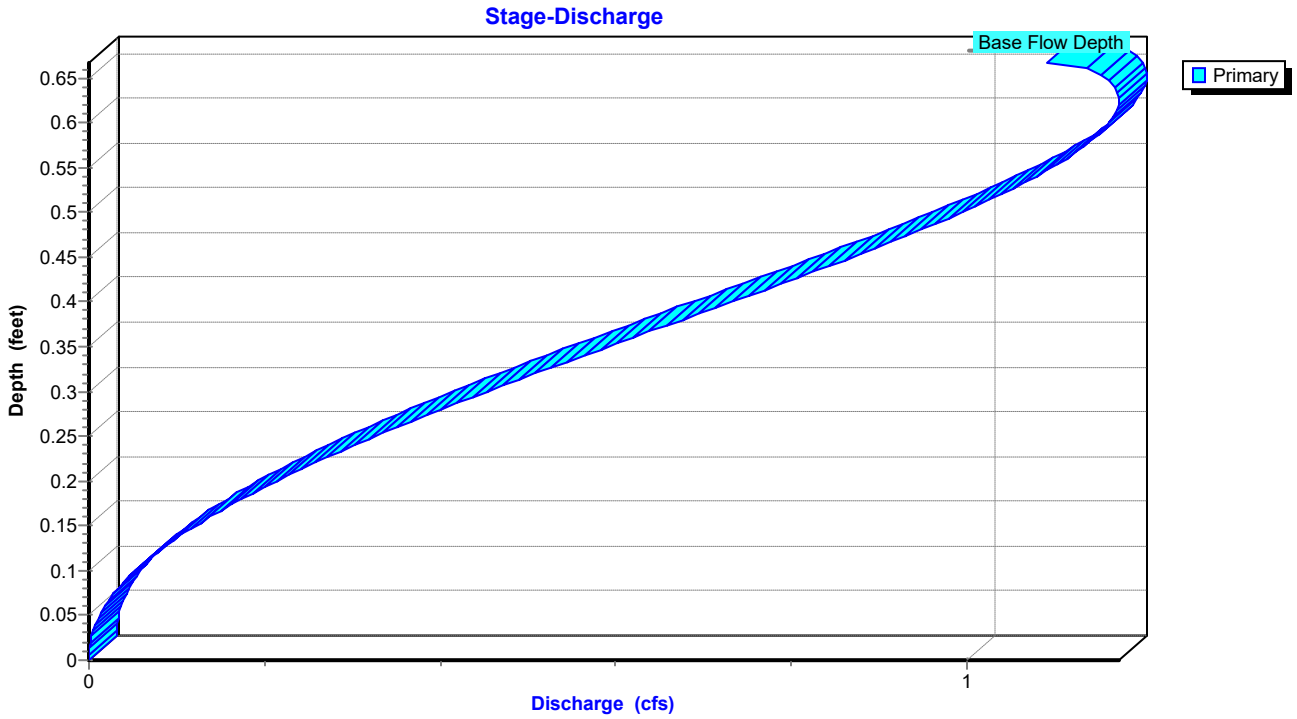




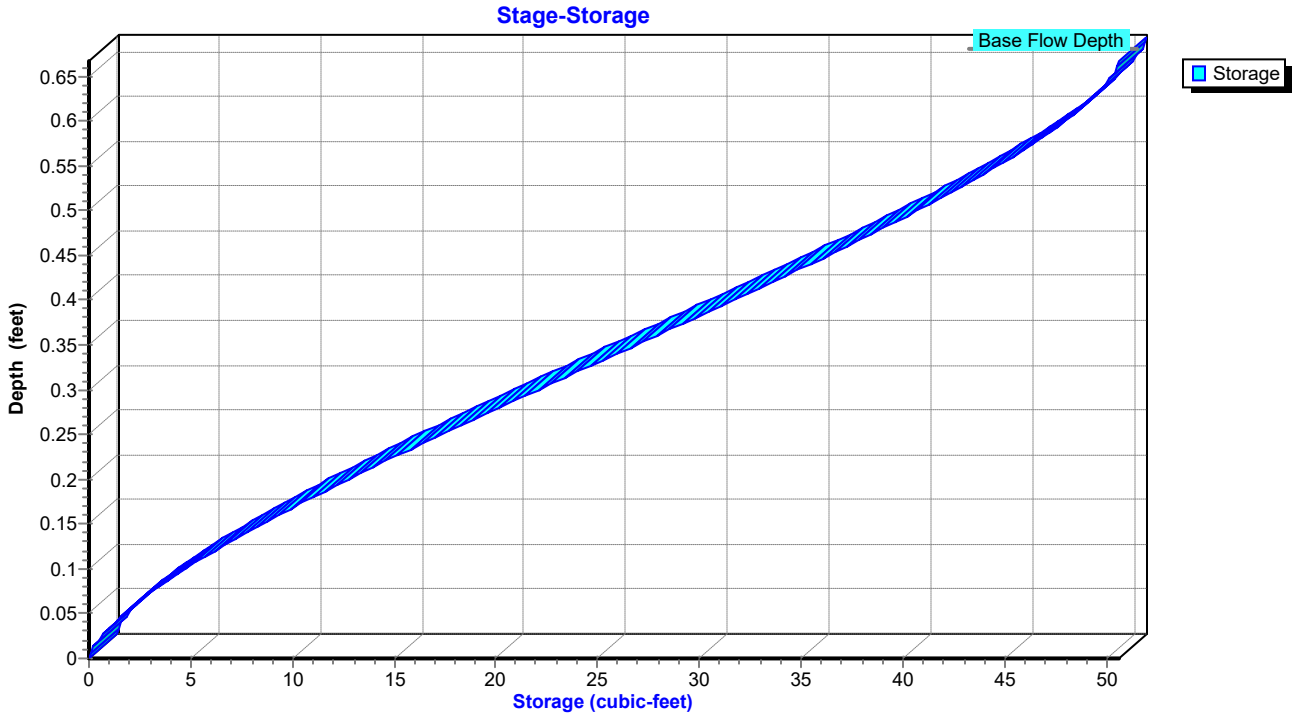
Reach 8R: green roof runoff pipe



Reach 8R: green roof runoff pipe



Reach 8R: green roof runoff pipe



Summary for Reach 10R: pipe from alley

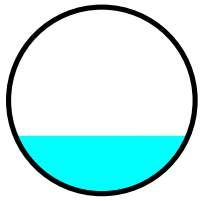
[52] Hint: Inlet/Outlet conditions not evaluated

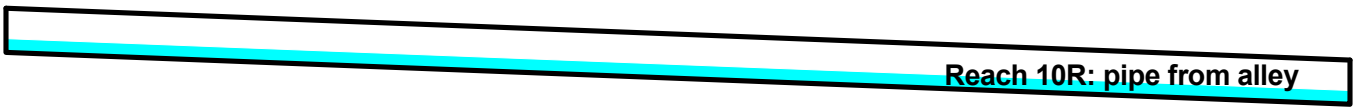
Inflow Area = 0.006 ac, 0.00% Impervious, Inflow Depth > 3.68" for 100 Yr event
Inflow = 0.03 cfs @ 12.00 hrs, Volume= 0.002 af
Outflow = 0.03 cfs @ 12.03 hrs, Volume= 0.002 af, Atten= 7%, Lag= 1.4 min
Routed to Pond 11P : detnetion

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.26 fps, Min. Travel Time= 1.6 min
Avg. Velocity = 0.49 fps, Avg. Travel Time= 4.1 min

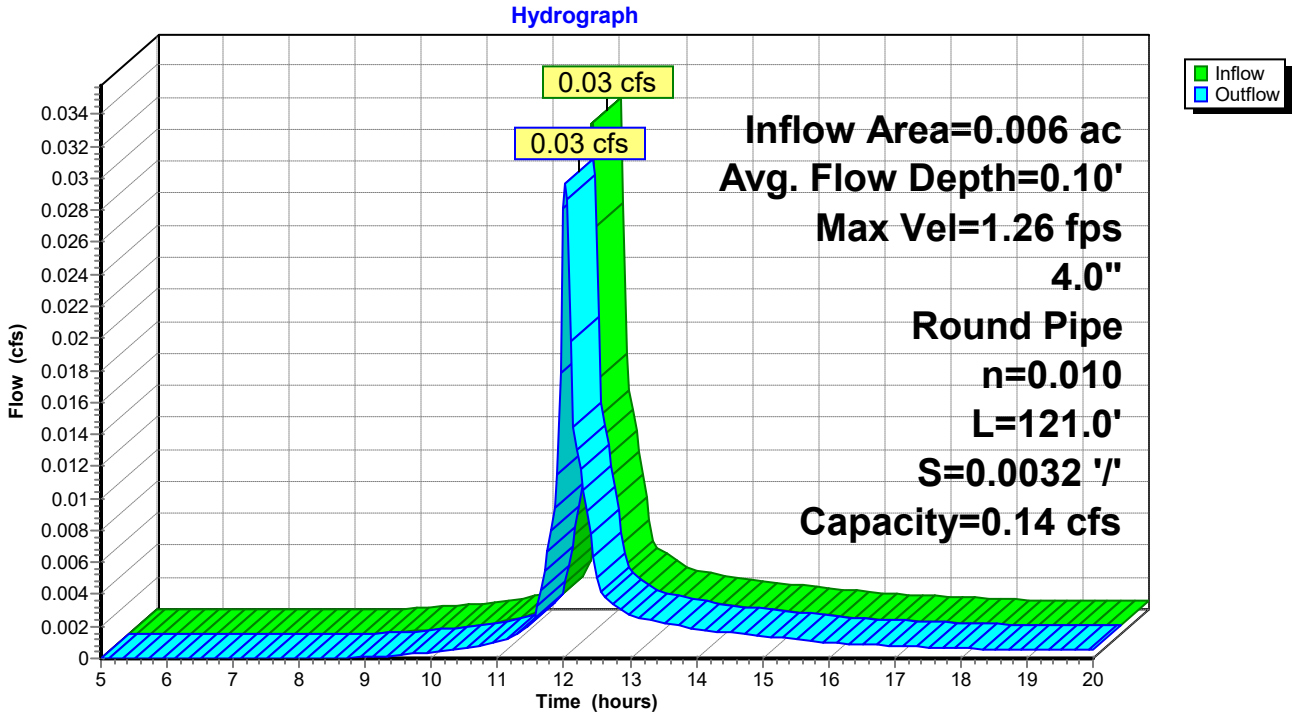
Peak Storage= 3 cf @ 12.03 hrs
Average Depth at Peak Storage= 0.10' , Surface Width= 0.31'
Bank-Full Depth= 0.33' Flow Area= 0.1 sf, Capacity= 0.14 cfs

4.0" Round Pipe
n= 0.010 PVC, smooth interior
Length= 121.0' Slope= 0.0032 '/'
Inlet Invert= 100.99', Outlet Invert= 100.60'

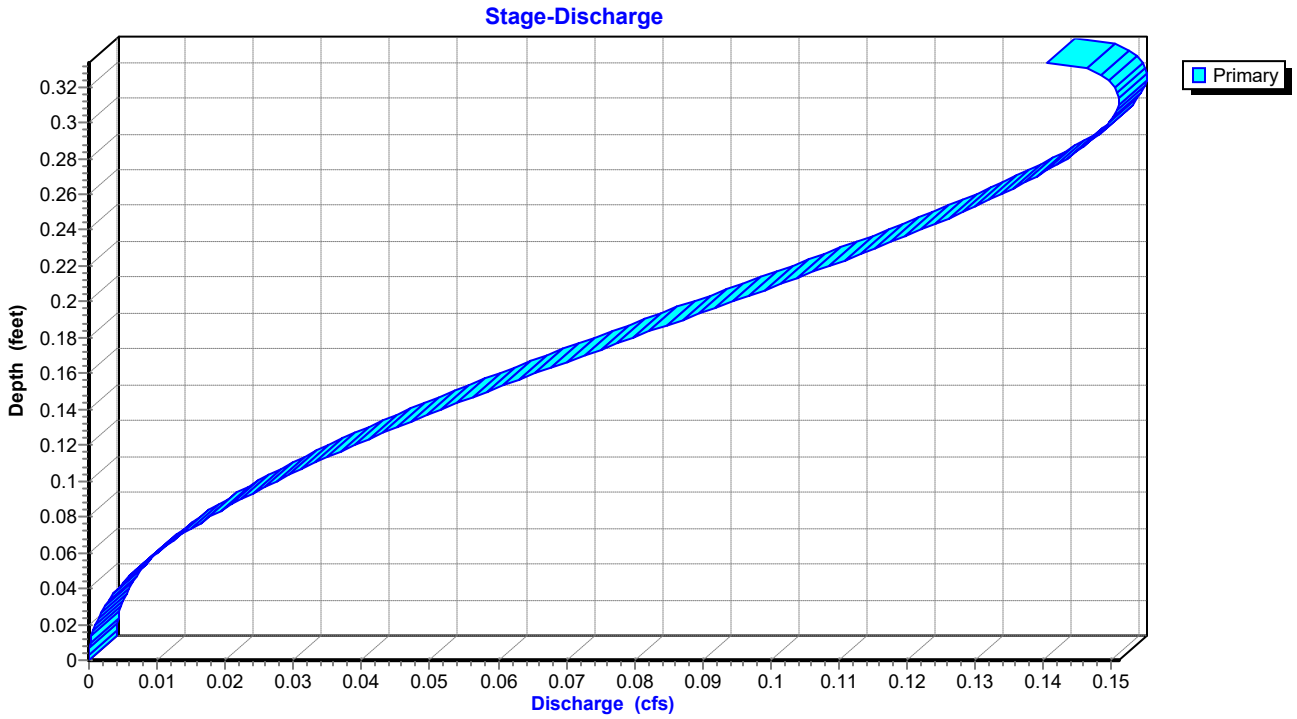




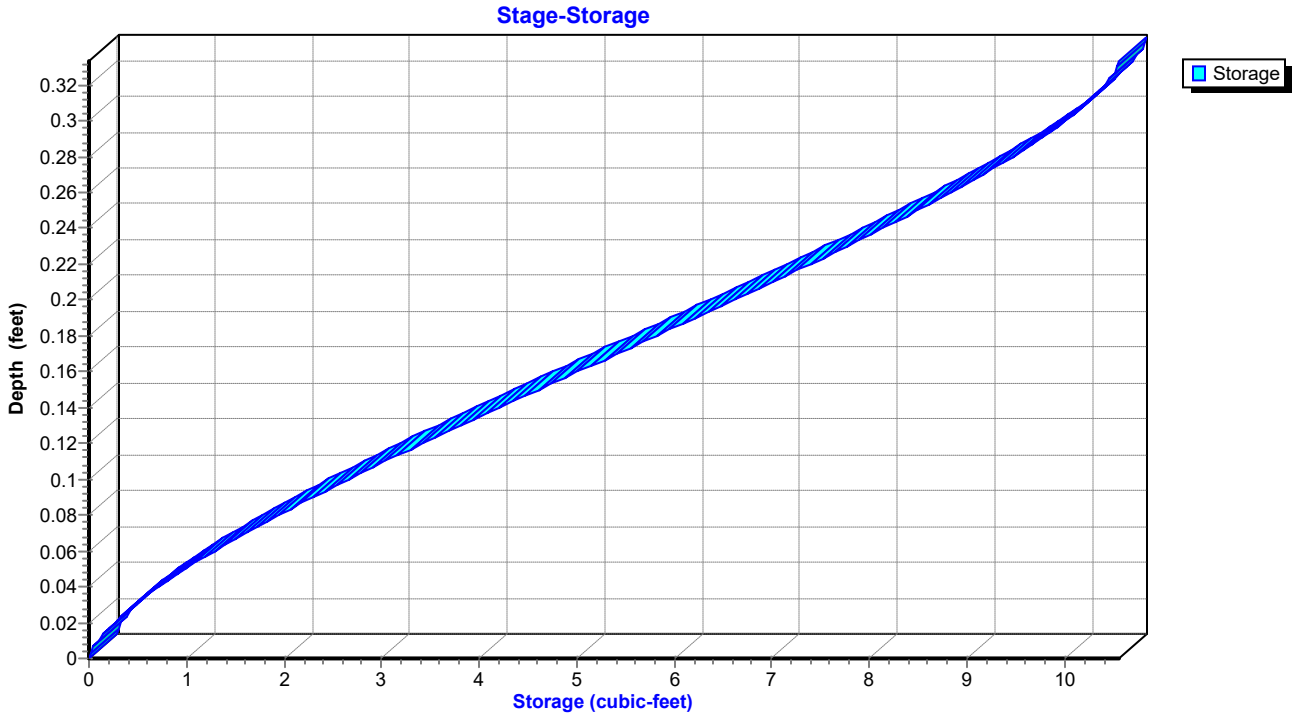
Reach 10R: pipe from alley



Reach 10R: pipe from alley



Reach 10R: pipe from alley



Summary for Reach 14R: pipe from roof

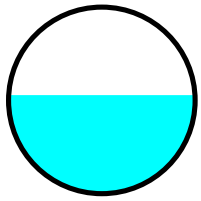
[52] Hint: Inlet/Outlet conditions not evaluated
[82] Warning: Early inflow requires earlier time span

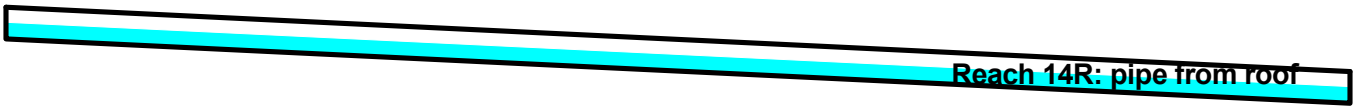
Inflow Area = 0.012 ac,100.00% Impervious, Inflow Depth > 6.96" for 100 Yr event
Inflow = 0.11 cfs @ 12.00 hrs, Volume= 0.007 af
Outflow = 0.10 cfs @ 12.01 hrs, Volume= 0.007 af, Atten= 4%, Lag= 0.7 min
Routed to Pond 11P : detnetion

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.15 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 0.83 fps, Avg. Travel Time= 2.5 min

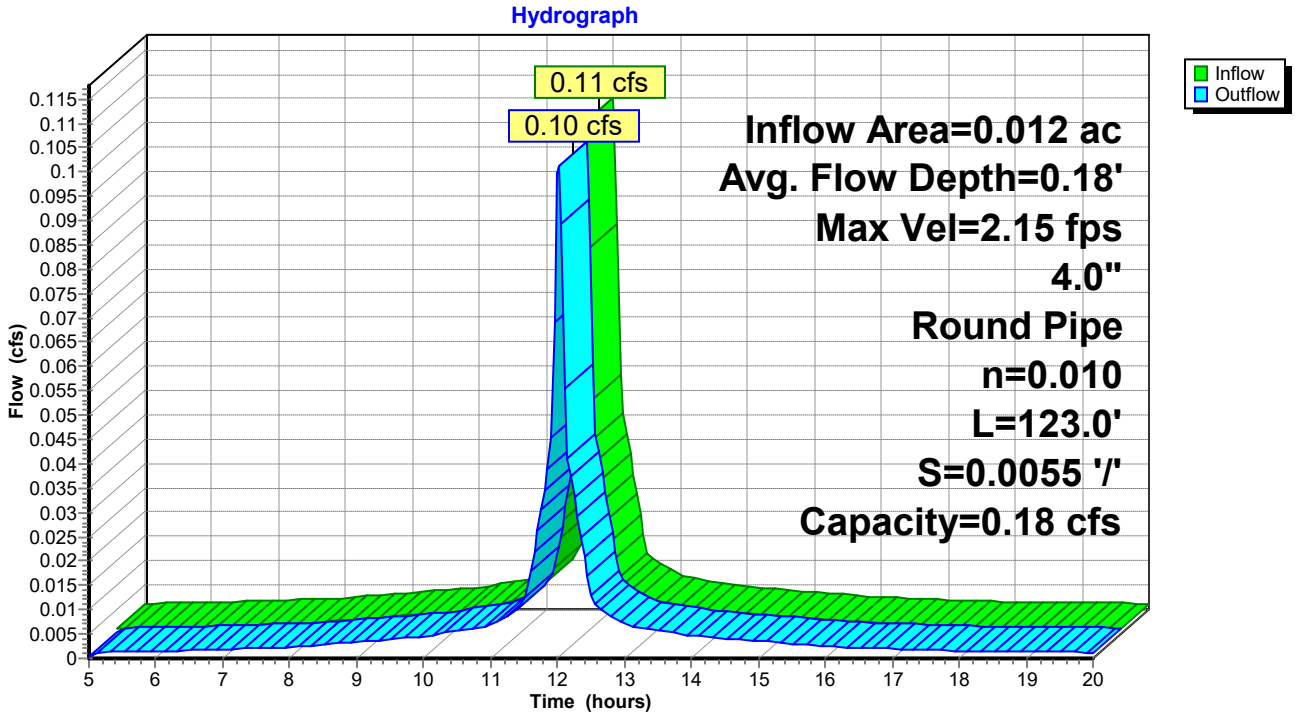
Peak Storage= 6 cf @ 12.01 hrs
Average Depth at Peak Storage= 0.18' , Surface Width= 0.33'
Bank-Full Depth= 0.33' Flow Area= 0.1 sf, Capacity= 0.18 cfs

4.0" Round Pipe
n= 0.010 PVC, smooth interior
Length= 123.0' Slope= 0.0055 '/'
Inlet Invert= 100.98', Outlet Invert= 100.30'

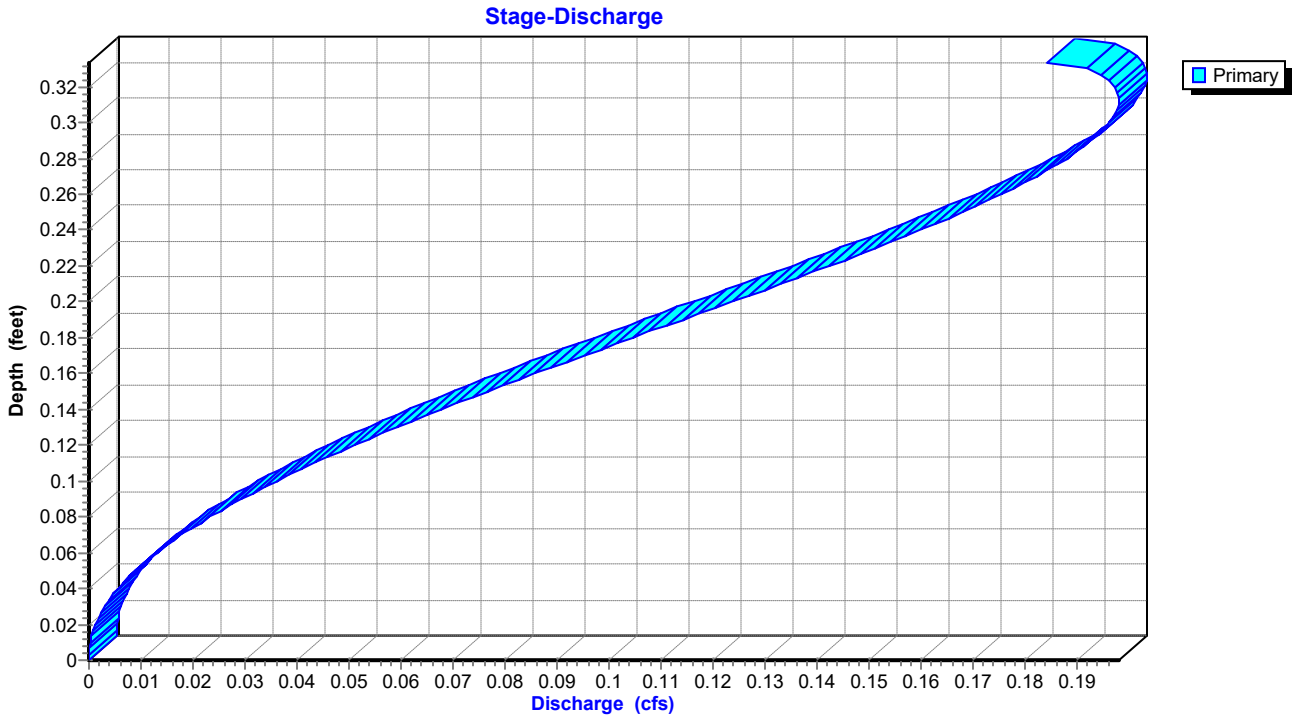




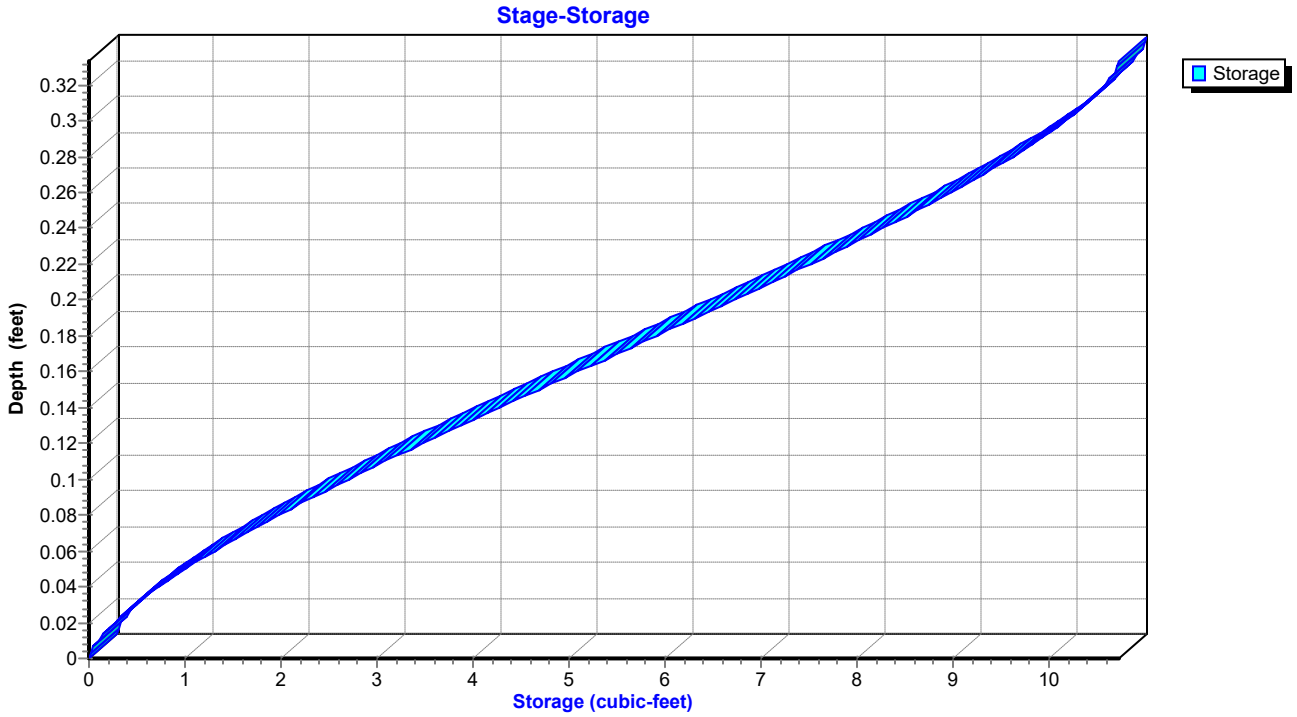
Reach 14R: pipe from roof



Reach 14R: pipe from roof



Reach 14R: pipe from roof



Summary for Pond 11P: detnetion

[82] Warning: Early inflow requires earlier time span
[44] Hint: Outlet device #2 is below defined storage

Inflow Area = 0.114 ac, 10.56% Impervious, Inflow Depth >150.22" for 100 Yr event
Inflow = 1.37 cfs @ 12.02 hrs, Volume= 1.422 af
Outflow = 1.36 cfs @ 12.05 hrs, Volume= 1.388 af, Atten= 1%, Lag= 1.9 min
Primary = 1.07 cfs @ 12.05 hrs, Volume= 1.032 af
Secondary = 0.29 cfs @ 12.05 hrs, Volume= 0.356 af

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 99.81' @ 12.05 hrs Surf.Area= 0.012 ac Storage= 0.034 af

Plug-Flow detention time= 22.8 min calculated for 1.386 af (97% of inflow)
Center-of-Mass det. time= 10.7 min (760.8 - 750.1)

Volume	Invert	Avail.Storage	Storage Description
#1	97.20'	0.039 af	**36.0" Round Pipe Storage** L= 240.0' S= 0.0010 '/'

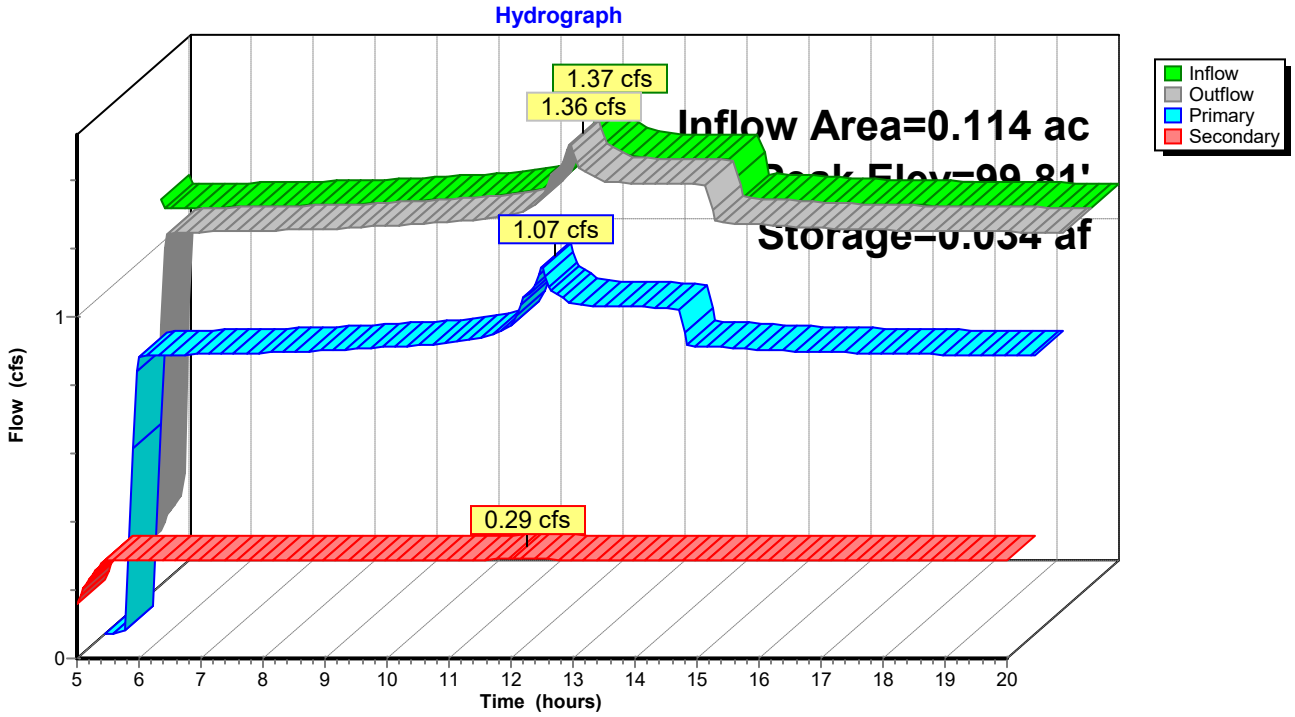
Device	Routing	Invert	Outlet Devices
#1	Primary	99.50'	**2.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Secondary	96.57'	**2.5" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.07 cfs @ 12.05 hrs HW=99.80' (Free Discharge)
└**1=Sharp-Crested Rectangular Weir** (Weir Controls 1.07 cfs @ 1.81 fps)

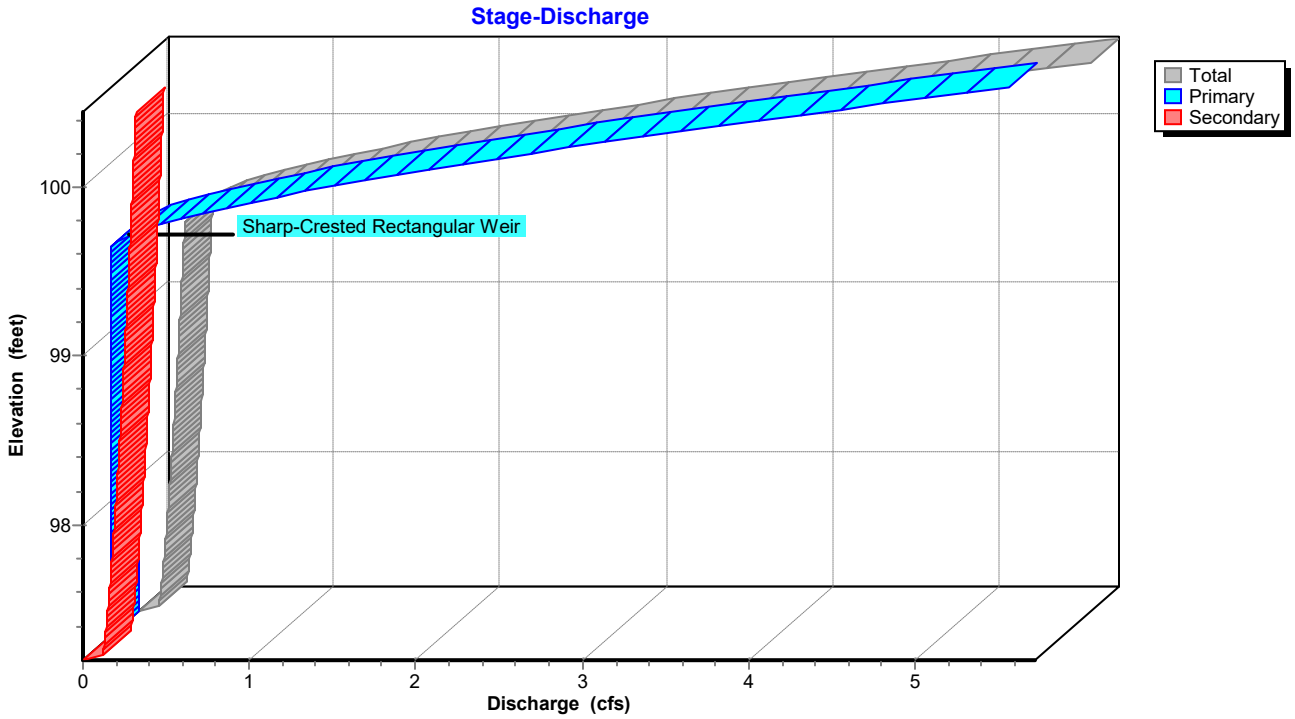
Secondary OutFlow Max=0.29 cfs @ 12.05 hrs HW=99.80' (Free Discharge)
└**2=Orifice/Grate** (Orifice Controls 0.29 cfs @ 8.52 fps)



Pond 11P: detnetion



Pond 11P: detnetion



Pond 11P: detnetion

