Storm Water Management

&

Erosion Control Narrative

For

Hot Springs Warehouse

3106 Berlin Drive

La Crosse, WI 54603

Prepared By

Makepeace Engineering, LLC

1.0 Introduction

A. Project Description

Makepeace Engineering is assisting Wieser Brothers in site design, which includes the stormwater management and erosion control, for a project at 3106 Berlin Drive within the City of La Crosse.

The project consists of office space, warehouse space, loading dock, biofilter, rain garden, parking lot and other necessary improvements.

B. Pre-Construction Site

The project site is located within La Crosse County Tax Parcel 17-10687-90. The projects will disturb an area of approximately 2.7 acres. The existing site is approximately 100% pervious and contains a stormwater easement along the southern property line.

2.0 Requirements

The project will disturb 2.7 acres. As such, it is subject to requirements of the City of La Crosse stormwater ordinance, including post-construction performance standards. In addition, it is subject to the Wisconsin Department of Natural Resources Construction (WDNR) General Permit.

3.0 Erosion Control Plan

A. Management Practices

Erosion and sediment control best management practices are shown on the plans and will be installed and maintained as indicated below in accordance with WDNR Technical Standards.

- Technical Standard 1056 Silt Fence
- Technical Standard 1058 Mulching for Construction Sites
- Technical Standard 1059 Seeding
- Technical Standard 1052 Non-channel Erosion Mat
- Technical Standard 1053 Channel Erosion Mat
- Technical Standard 1062 Ditch Checks
- Technical Standard 1063 Sediment Trap
- Technical Standard 1057 Trackout Control Practices
- Technical Standard 1060 Storm Drain Inlet protection for Construction Sites

B. Sequence of Work

1. Install silt fence, and sediment barriers prior to any land disturbance.

2. Mass grading for parking lot, building area, impervious areas, bio-infiltration device, and rain garden.
3. Disturb only as much soil as is necessary to complete construction. Preserve as much vegetation as possible.
4. Temporary erosion control seeding and mulch will be placed on disturbed areas which will not be disturbed again for a period of more than 14 days.
5. Temporary erosion control seeding, mulch, and silt fence will be used on stockpiles which will exist for more than seven days.
6. Post-construction bmp's construction sequencing will follow Section 4A below.
7. Grade site as construction progresses.
8. Properly dispose of construction waste.
9. Re-vegetate each phase as construction for that phase is completed.
10. Continuously clean up off-site sediment deposits.
11. Inspect erosion and sediment control practices weekly, and within 24 hours following a rainfall of 0.5 inches or greater. Written documentation of each inspection shall be maintained at the construction site and shall include the time, date, and location of inspection, the phase of land disturbance at the construction site, person conducting the inspection, assessment of control practices, and a description of any erosion or sediment control measure installation or maintenance performed in response to the inspection.
12. Remove tracking pad once construction is completed.
13. Remove all sediment barriers once construction is completed and the site is at least 70% re-vegetated.

4.0 Storm Water Management Plan

A. Post-Construction Site

The post construction site will consist of one building, one biofilter, one rain garden, a swale, and a concrete parking lot.

Storm water from the building and a large portion of the northwest corner of the property will drain to the north and be caught by a swale. The swale travels from west to east and discharges into a rain garden for storage and treatment. The area directly adjacent to the loading dock will also drain east to the rain garden. The rain garden will have a weir that discharges water to the east during large storm events.

Storm water from the parking lot and paved area will drain to the south. This runoff will directly drain into the bio-infiltration device area. Storm water in the bio-infiltration device will discharge into the nearby municipal storm sewer manhole. In the largest rain events, water will discharge over the sidewalk and into the right-of-way and to the municipal storm sewer system.

The site will have a breakdown of approximately 44% impervious and 56% pervious compared to the pre-construction breakdown of 0% impervious and 100% pervious.

B. Post-Construction Performance Requirements

The proposed site is zoned planned development. As such, the site is subject to the following post-construction performance standards under the city of La Crosse ordinance chapter 105 section 61:

- 80% TSS for new development
- 2-year 24-hour peak runoff discharge
- 10-year 24-hour peak runoff discharge

Due to the native soils on site having a design infiltration rate of approximately 0.13 inches per hour, the site is exempt from infiltration requirements. In addition to the above, the following requirements are needed to satisfy the WDNR:

- 1-year, 24-hour peak runoff discharge

C. Modelling Results

1. TSS Reduction & INFILTRATION

Stormwater for building, loading dock, and northwest corner of the parcel drains to a swale which runs west to east and outlets to a rain garden. The parking and pavement of the site drains south and west to a bio-infiltration device.

WinSLAMM v10.4.1 was used to model pollutant loading and reduction and indicates 82% solids reduction will be achieved with the device size and location shown on the plans. The rain file modeled was the 1981 rain file from Madison, Wisconsin.

2. Peak Flow Control

Peak flow values were modeled in HydroCAD 10.00-26. Existing pervious areas were assigned a curve number of 61, as per the City of La Crosse Municipal Code. Post-construction contains a rain garden, bio-infiltration device, and a grassed swale. The results are as follows:

Storm Event	Existing Site	Proposed Site
1-Year	0.4	0.32
2-Year	0.85	0.46
10-Year	3.4	3.03

D. Sequence of Work

1. Install erosion control measurements.
2. Construct project including rough grading.
3. Side slopes will be no steeper than 2H:1V on biofilter side slopes, and 3H:1V everywhere else on the site.
4. Once construction is completed and the site is stabilized, excavate rain garden and bio-infiltration devices to subgrade. Remove accumulated sediment if needed.
5. Install engineered soil and plantings in accordance with construction details.

E. Long-Term Maintenance

1. Water plants as necessary during the first growing season.
2. Water as needed after first growing season.
3. Treat diseased vegetation as needed.
4. Inspect soil and repair eroded areas as needed.
5. Remove litter and debris monthly.
6. Remove accumulated sediment as needed to allow proper function.
7. Make repairs as needed when performance is compromised.

DECLARATION OF CONDITIONS, COVENANTS AND RESTRICTIONS FOR MAINTENANCE OF STORMWATER MANAGEMENT MEASURES

This space is reserved for recording data

Return to:

City of La Crosse
Engineering Department
400 La Crosse Street
La Crosse, Wisconsin 54601

RECITALS:

A. Hutaige LLC
is the owner of parcel in the City of La Crosse at the following address:
3106 Berlin Drive
more particularly described on Exhibit A attached hereto ("Property").

B. Owner desires to construct buildings and/or parking facilities on the Property in accordance with certain plans and specifications approved by the City.

C. The City requires Owner to record this Declaration regarding maintenance of stormwater management measures to be located on the Property. Owner agrees to maintain the stormwater management measures and to grant to the City the rights set forth below.

NOW, THEREFORE, in consideration of the declarations herein and other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the owner agrees as follows:

Tax Parcel No.: 17-10687-090

1. Maintenance. Owner and its successors and assigns shall be responsible to repair and maintain the stormwater management measures located on the Property in good condition and in working order and such that the measures comply with the approved plans on file with the City Engineer. Said maintenance shall be at the Owner's sole cost and expense. Owner will conduct such maintenance or repair work in accordance with all applicable laws, codes, regulations, and similar requirements, and pursuant to the Maintenance Provisions attached hereto as Exhibit B.

2. Easement to City. If Owner fails to maintain the stormwater management measures as required in Section 1, then City shall have the right, after providing Owner with written notice of the maintenance issue ("Maintenance Notice") and thirty (30) days to comply with the City's maintenance request, to enter the Property in order to conduct the maintenance specified in the Maintenance Notice. City will conduct such maintenance work in accordance with all applicable laws, codes, regulations, and similar requirements and will not unreasonably interfere with Owner's use of the Property. All costs and expenses incurred by the City in conducting such maintenance may be charged to the owner of the Property by placing the amount on the tax roll for the Property as a special charge in accordance with Section 66.0627, Wis. Stats.

3. Term/Termination. The term of this Agreement shall commence on the date that this Agreement is filed of record with the Register of Deeds Office for La Crosse County, Wisconsin, and except as otherwise herein specifically provided, shall continue in perpetuity. Notwithstanding the foregoing, this Agreement may be terminated by recording with the Register of Deeds Office for La Crosse County, Wisconsin, a written instrument of termination signed by the City and all of the then-owners of the Property.

4. Miscellaneous.

(a) Notices. Any notice, request or demand required or permitted under this Agreement shall be in writing and shall be deemed given when personally served or three (3) days after the same has been deposited with the United States Post Office, registered or certified mail, return receipt requested, postage prepaid and addressed as follows:

If to Owner:
Hutaige LLC
N10972 Timberwolf Ln
Trempealeau, WI 54661

If to City:
City of La Crosse
Engineering Department
400 La Crosse Street
La Crosse, WI 54601
Attention: City Engineer

Any party may change its address for the receipt of notice by written notice to the other.

(b) Governing Law. This Agreement shall be governed and construed in accordance with the laws of the State of Wisconsin.

(c) Amendments or Further Agreements to be in Writing. This Agreement may not be modified in whole or in part unless such agreement is in writing and signed by all parties bound hereby.

(d) Covenants Running with the Land. All of the easements, restrictions, covenants and agreements set forth in this Agreement are intended to be and shall be construed as covenants running with the land, binding upon, inuring to the benefit of, and enforceable by the parties hereto and their respective successors and assigns.

(e) Partial Invalidity. If any provisions, or portions thereof, of this Agreement or the application thereof to any person or circumstance shall, to any extent, be invalid or unenforceable, the remainder of this Agreement, or the application of such provision, or portion thereof, to any other persons or circumstances shall not be affected thereby and each provision of this Agreement shall be valid and enforceable to the fullest extent permitted by law.

IN WITNESS WHEREOF, we have hereunto set our hands and seals this _____ day of _____, 20_____.

_____ _____

STATE OF WISCONSIN)
COUNTY OF LA CROSSE) SS

Personally came before me this _____ day of _____, 20_____, the above named _____, to me known to be the person(s) who executed the foregoing instrument and acknowledged the same.

_____
NOTARY PUBLIC

My Commission Expires:_____

Drafted by: City of La Crosse
Engineering Department
400 La Crosse Street
La Crosse, Wisconsin 54601

EXHIBIT A

Legal Description

La Crosse International Business Park Lot 9 Subject to Easement in Document Number 1462796

EXHIBIT B
Maintenance Provisions

All components of the storm water system shall be inspected at least semi-annually in early Spring and early Autumn. Repairs will be made whenever the performance of a storm water feature is compromised. Inspection and repairs shall be made as follows:

Storm Pipes
When storm pipes become blocked, preventing the flow, pipes shall be cleaned with a higher velocity jetter to clear the obstruction.

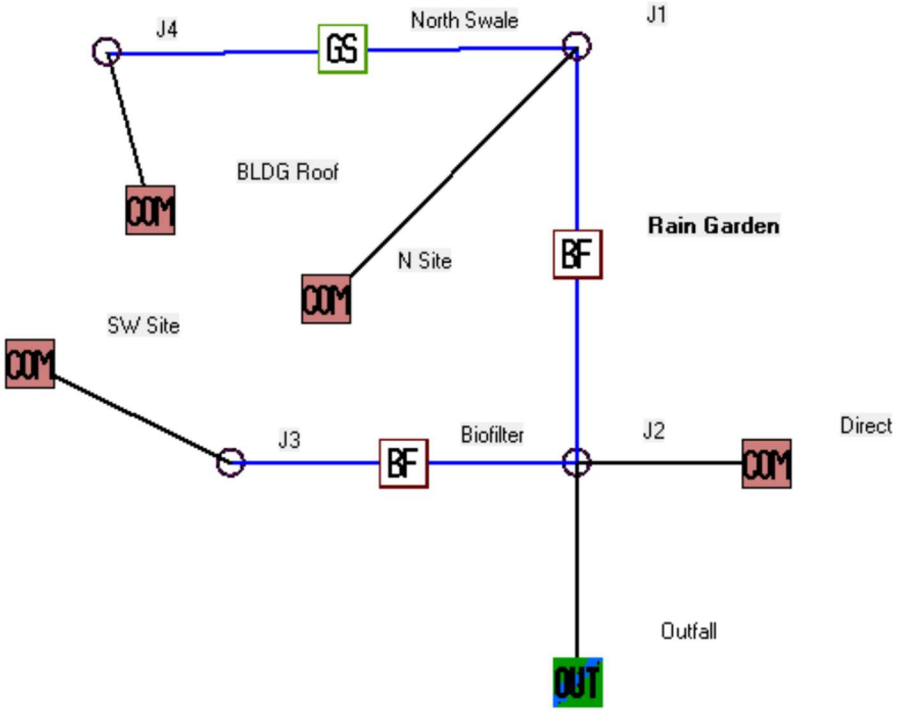
Rain Garden
Water rain garden a minimum of weekly for the first three months after installation. Inspect rani garden a minimum of three times per growing season. Remove any nuisance or invasive plants, and note any issues with excess moisture, soil erosion, berm settling, or potential failure of any component of the rain garden. Remove excessive dead plant material annually, and replace dead plants in the case of significant losses. Stabilize eroding soil. Repair any damage or settling of the berm that may affect ponding area and/or proper discharge of water from the device. If the rain garden retains surface water for greater than 72 hours, remove established turf and replace with fresh soil and deep-rooted native plant species. Avoid using the rain garden as a snow storage area.

Bio-infiltration Device
Water plantings at least weekly during first three months of establishment. Inspect planting area at least annually. Maintenance is required when standing water is visible 48 hours after a rainfall event. Maintenance shall consist of removal of all sediment and sub-cutting to a depth of two feet. The subcut material shall be disposed of and replaced with a mix of 70-85% sand and 15-30% compost, and finished with three inches shredded wood mulch. The bed shall be replanted with native perennial plugs (seeding not allowed) placed 12” on center. In the spring of each year, dead vegetation shall be removed to allow for new growth. Twice per growing season, the planting bed shall be weeded and mulch replenished.

Hot Springs Warehouse Project

MODELING SUMMARY

February, 2025



Data file name: \\wdmycloud\Public\Makepeace Engineering\2 Clients\Not Uploaded\Wieser Brothers\Hot Springs\SLAMM\3106 Berlin Dr.mdb
WinSLAMM Version 10.4.0
Rain file name: C:\WinSLAMM Files\Rain Files\WisReg - Madison WI 1981.RAN
Particulate Solids Concentration file name: C:\WinSLAMM Files\v10.1 WI_AVG01.pscx
Runoff Coefficient file name: C:\WinSLAMM Files\WI_SL06 Dec06.rsvx
Residential Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Institutional Street Delivery file name: C:\WinSLAMM Files\WI_Com Inst Indust Dec06.std
Commercial Street Delivery file name: C:\WinSLAMM Files\WI_Com Inst Indust Dec06.std
Industrial Street Delivery file name: C:\WinSLAMM Files\WI_Com Inst Indust Dec06.std
Other Urban Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Freeway Street Delivery file name: C:\WinSLAMM Files\Freeway Dec06.std
Apply Street Delivery Files to Adjust the After Event Load Street Dirt Mass Balance: False
Pollutant Relative Concentration file name: C:\WinSLAMM Files\WI_GEO03.ppdx
Source Area PSD and Peak to Average Flow Ratio File: C:\WinSLAMM Files\NURP Source Area PSD Files.csv
Cost Data file name:
If Other Device Pollutant Load Reduction Values = 1, Off-site Pollutant Loads are Removed from Pollutant Load % Reduction calculations
Seed for random number generator: -42
Study period starting date: 01/01/81 Study period ending date: 12/31/81
Start of Winter Season: 12/02 End of Winter Season: 03/12
Date: 02-17-2025 Time: 16:38:57
Site information:

Pre-Development Area Description	Pre-Development Area (ac)	Pre-Development CN
Undeveloped	2.730	61
Total Area (ac)/Composite CN	2.730	61

LU# 1 - Commercial: N Site Total area (ac): 0.230
  31 - Sidewalks 1: 0.005 ac. Connected Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
  45 - Large Landscaped Areas 1: 0.225 ac. Normal Silty Source Area PSD File: C:\WinSLAMM Files\NURP.cpz

LU# 2 - Commercial: BLDG Roof Total area (ac): 0.678
  1 - Roofs 1: 0.550 ac. Pitched Connected Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
  45 - Large Landscaped Areas 1: 0.128 ac. Normal Silty Source Area PSD File: C:\WinSLAMM Files\NURP.cpz

LU# 3 - Commercial: SW Site Total area (ac): 1.121
  13 - Paved Parking 1: 0.564 ac. Connected Source Area PSD File: C:\WinSLAMM Files\NURP.cpz

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     31 - Sidewalks 1:  0.020 ac.    Connected    Source Area PSD File: C:\WinSLAMM
Files\NURP.cpz
     45 - Large Landscaped Areas 1:  0.537 ac.    Normal Silty    Source Area PSD
File: C:\WinSLAMM Files\NURP.cpz

LU# 4 - Commercial:  Direct     Total area (ac):  0.182
     25 - Driveways 1:  0.023 ac.    Connected    Source Area PSD File: C:\WinSLAMM
Files\NURP.cpz
     45 - Large Landscaped Areas 1:  0.159 ac.    Normal Silty    Source Area PSD
File: C:\WinSLAMM Files\NURP.cpz


      Control Practice 1:  Biofilter CP# 1 (DS) - Rain Garden
         1.  Top area (square feet) =  3626
         2.  Bottom aea (square feet) =  2250
         3.  Depth (ft):   2
         4.  Biofilter width (ft) - for Cost Purposes Only:   10
         5.  Infiltration rate (in/hr) =  0.13
         6.  Random infiltration rate generation?  No
         7.  Infiltration rate fraction (side):   0.001
         8.  Infiltration rate fraction (bottom):   1
         9.  Depth of biofilter that is rock filled (ft) 0
         10.  Porosity of rock filled volume =  0
         11.  Engineered soil infiltration rate:   0
         12.  Engineered soil depth (ft) =  0
         13.  Engineered soil porosity =  0
         14. Percent solids reduction due to flow through engineered soil =  0
         15. Biofilter peak to average flow ratio =  3.8
         16. Number of biofiltration control devices =  1
         17. Particle size distribution file:  Not needed - calculated by program
         18. Initial water surface elevation (ft):   0
         Soil Data                        Soil Type Fraction in Eng. Soil
         Biofilter Outlet/Discharge Characteristics:
             Outlet type:  Broad Crested Weir
                     1.  Weir crest length (ft):   5
                     2.  Weir crest width (ft):   5
                     3.  Height of datum to bottom of weir opening:   1.67

      Control Practice 2:  Biofilter CP# 2 (DS) - Biofilter
         1.  Top area (square feet) =  8280
         2.  Bottom aea (square feet) =  1500
         3.  Depth (ft):   3.5
         4.  Biofilter width (ft) - for Cost Purposes Only:   10
         5.  Infiltration rate (in/hr) =  0.13
         6.  Random infiltration rate generation?  No
         7.  Infiltration rate fraction (side):   0.001
         8.  Infiltration rate fraction (bottom):   1
         9.  Depth of biofilter that is rock filled (ft) 0
         10.  Porosity of rock filled volume =  0
         11.  Engineered soil infiltration rate:   3.6
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12. Engineered soil depth (ft) = 2
13. Engineered soil porosity = 0.27
14. Percent solids reduction due to flow through engineered soil = 80
15. Biofilter peak to average flow ratio = 3.8
16. Number of biofiltration control devices = 1
17. Particle size distribution file: Not needed - calculated by program
18. Initial water surface elevation (ft): 0
Soil Data Soil Type Fraction in Eng. Soil
User-Defined Soil Type 1.000
Biofilter Outlet/Discharge Characteristics:
Outlet type: Broad Crested Weir
1. Weir crest length (ft): 5
2. Weir crest width (ft): 5
3. Height of datum to bottom of weir opening: 3.25
Outlet type: Vertical Stand Pipe
1. Stand pipe diameter (ft): 0.5
2. Stand pipe height above datum (ft): 2.8
Outlet type: Drain Tile/Underdrain
1. Underdrain outlet diameter (ft): 0.5
2. Invert elevation above datum (ft): 0
3. Number of underdrain outlets: 2

Control Practice 3: Grass Swale CP# 1 (DS) - North Swale
Total drainage area (acres)= 0.678
Fraction of drainage area served by swales (ac) = 1.00
Swale density (ft/ac) = 460.00
Total swale length (ft) = 253
Average swale length to outlet (ft)= 95
Typical bottom width (ft) = 0.1
Typical swale side slope (_H:1V) = 3.0
Typical longitudinal slope (ft.H/ft.V) = 0.001
Swale retardance factor: C
Typical grass height (in) = 6.0
Swale dynamic infiltration rate (in/hr)= 0.150
Typical swale depth (ft) for cost analysis (optional) = 0.0
Particle size distribution file name: Not needed - calculated by program
Use total swale length instead of swale density for infiltration calculations: True

SLAMM for Windows Version 10.4.0

Data file name: \\wdmycloud\Public\Makepeace Engineering\2 Clients\Not Uploaded\Wieser Brothers\Hot Springs\SLAMM\3106 Berlin Dr.mdb
Data file description:
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Particulate Solids Concentration file name: C:\WinSLAMM Files\v10.1 WI_AVG01.pscx
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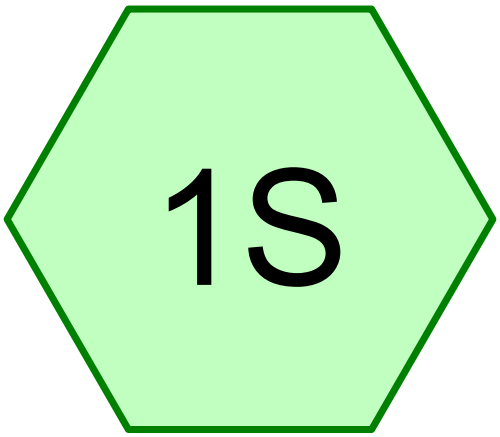
Residential Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Institutional Street Delivery file name: C:\WinSLAMM Files\WI_Com Inst Indust Dec06.std
Commercial Street Delivery file name: C:\WinSLAMM Files\WI_Com Inst Indust Dec06.std
Industrial Street Delivery file name: C:\WinSLAMM Files\WI_Com Inst Indust Dec06.std
Other Urban Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Freeway Street Delivery file name: C:\WinSLAMM Files\Freeway Dec06.std
Pollutant Relative Concentration file name: C:\WinSLAMM Files\WI_GEO03.ppdx
Start of Winter Season: 12/02 End of Winter Season: 03/12
Model Run Start Date: 01/01/81 Model Run End Date: 12/31/81
Date of run: 02-17-2025 Time of run: 16:38:29
Total Area Modeled (acres): 2.211
Years in Model Run: 1.00

	Runoff Volume (cu ft)	Percent Runoff Volume Reduction	Particulate Solids Conc. (mg/L)	Particulate Solids Yield (lbs)	Percent Particulate Solids Reduction
Total of all Land Uses without Controls:	105759	-	87.09	575.0	-
Outfall Total with Controls:	44331	58.08%	37.08	102.6	82.16%
Annualized Total After Outfall Controls:	44452			102.9	



Existing Site

Subcat Reach Pond Link

Routing Diagram for Ex Site 3106 Berlin
Prepared by HP, Printed 2/6/2025

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
2.730	61	Pasture/grassland/range, Good, HSG B (1S)
2.730	**61**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
2.730	HSG B	1S
0.000	HSG C	
0.000	HSG D	
0.000	Other	
2.730		**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
0.000	2.730	0.000	0.000	0.000	2.730	Pasture/grassland/range, Good	1S
0.000	**2.730**	**0.000**	**0.000**	**0.000**	**2.730**	**TOTAL AREA**	

Time span=5.00-28.00 hrs, dt=0.05 hrs, 461 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Existing Site Runoff Area=118,919 sf 0.00% Impervious Runoff Depth=0.23"
Flow Length=239' Tc=14.3 min CN=61 Runoff=0.40 cfs 0.052 af

Total Runoff Area = 2.730 ac Runoff Volume = 0.052 af Average Runoff Depth = 0.23"
100.00% Pervious = 2.730 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: Existing Site

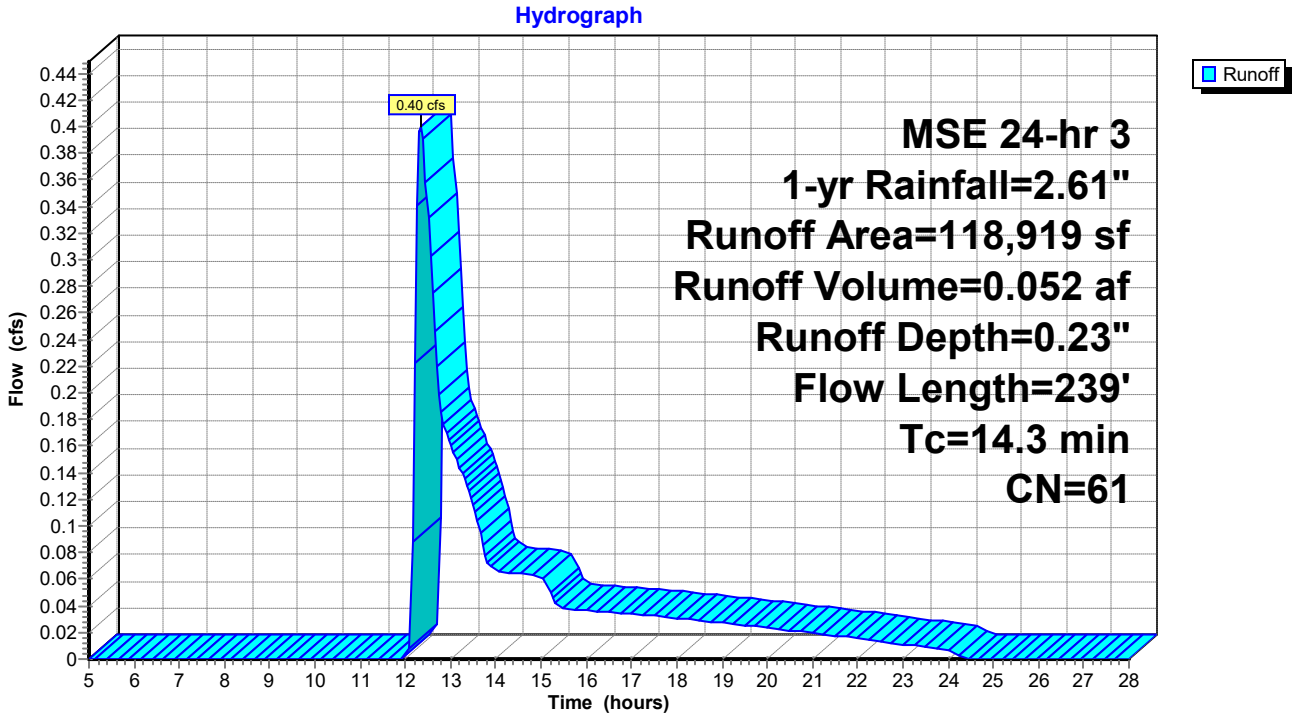
Runoff = 0.40 cfs @ 12.33 hrs, Volume= 0.052 af, Depth= 0.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 5.00-28.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 1-yr Rainfall=2.61"

Area (sf)	CN	Description
118,919	61	Pasture/grassland/range, Good, HSG B
118,919		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.1	196	0.0253	0.23		**Sheet Flow, Sheet Flow** Range n= 0.130 P2= 3.01"
0.2	43	0.2097	3.21		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
14.3	239	Total			

Subcatchment 1S: Existing Site



Time span=5.00-28.00 hrs, dt=0.05 hrs, 461 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Existing Site Runoff Area=118,919 sf 0.00% Impervious Runoff Depth=0.37"
Flow Length=239' Tc=14.3 min CN=61 Runoff=0.85 cfs 0.084 af

Total Runoff Area = 2.730 ac Runoff Volume = 0.084 af Average Runoff Depth = 0.37"
100.00% Pervious = 2.730 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: Existing Site

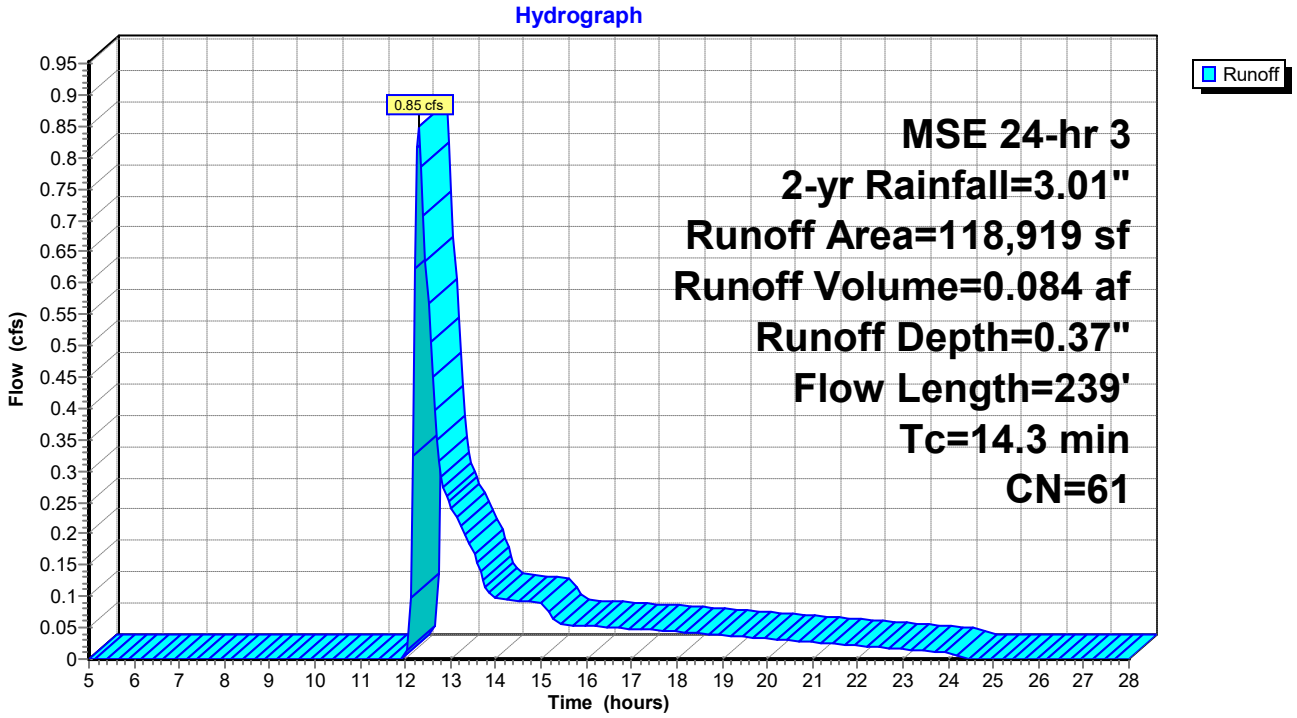
Runoff = 0.85 cfs @ 12.29 hrs, Volume= 0.084 af, Depth= 0.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 5.00-28.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 2-yr Rainfall=3.01"

Area (sf)	CN	Description
118,919	61	Pasture/grassland/range, Good, HSG B
118,919		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.1	196	0.0253	0.23		**Sheet Flow, Sheet Flow** Range n= 0.130 P2= 3.01"
0.2	43	0.2097	3.21		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
14.3	239	Total			

Subcatchment 1S: Existing Site



Time span=5.00-28.00 hrs, dt=0.05 hrs, 461 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Existing Site Runoff Area=118,919 sf 0.00% Impervious Runoff Depth=1.06"
Flow Length=239' Tc=14.3 min CN=61 Runoff=3.40 cfs 0.240 af

Total Runoff Area = 2.730 ac Runoff Volume = 0.240 af Average Runoff Depth = 1.06"
100.00% Pervious = 2.730 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: Existing Site

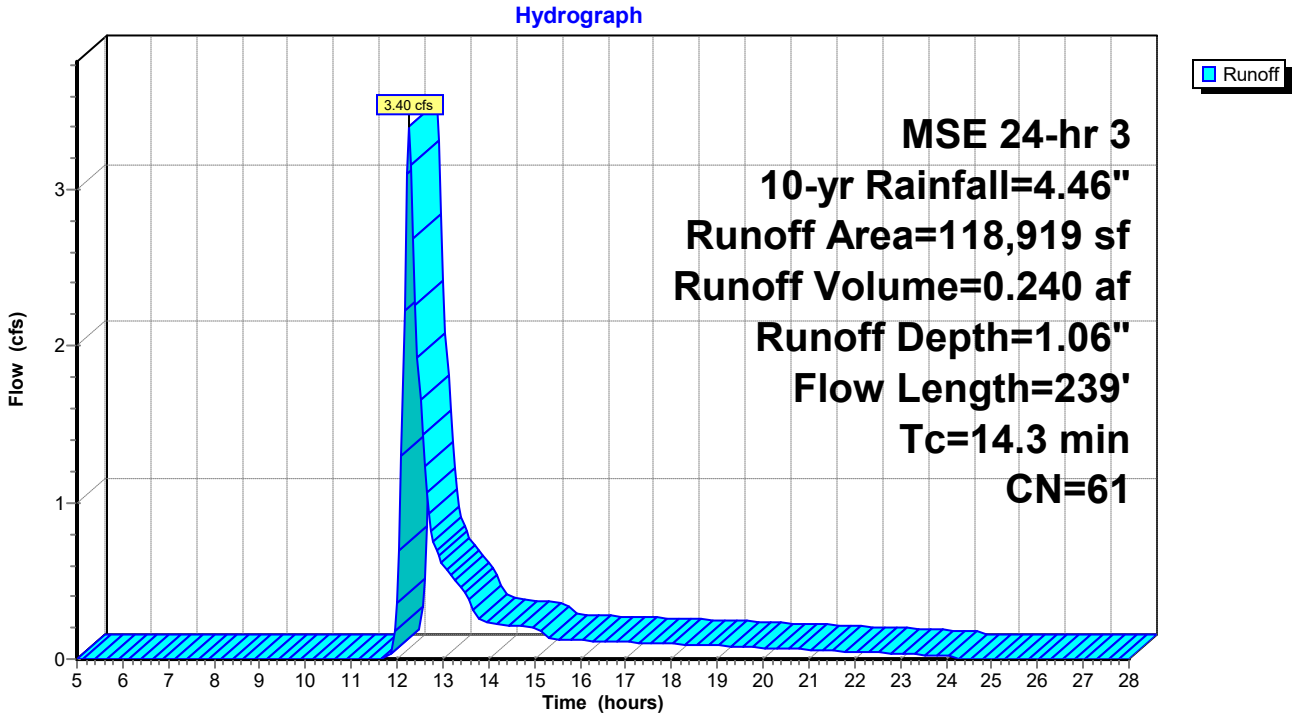
Runoff = 3.40 cfs @ 12.25 hrs, Volume= 0.240 af, Depth= 1.06"

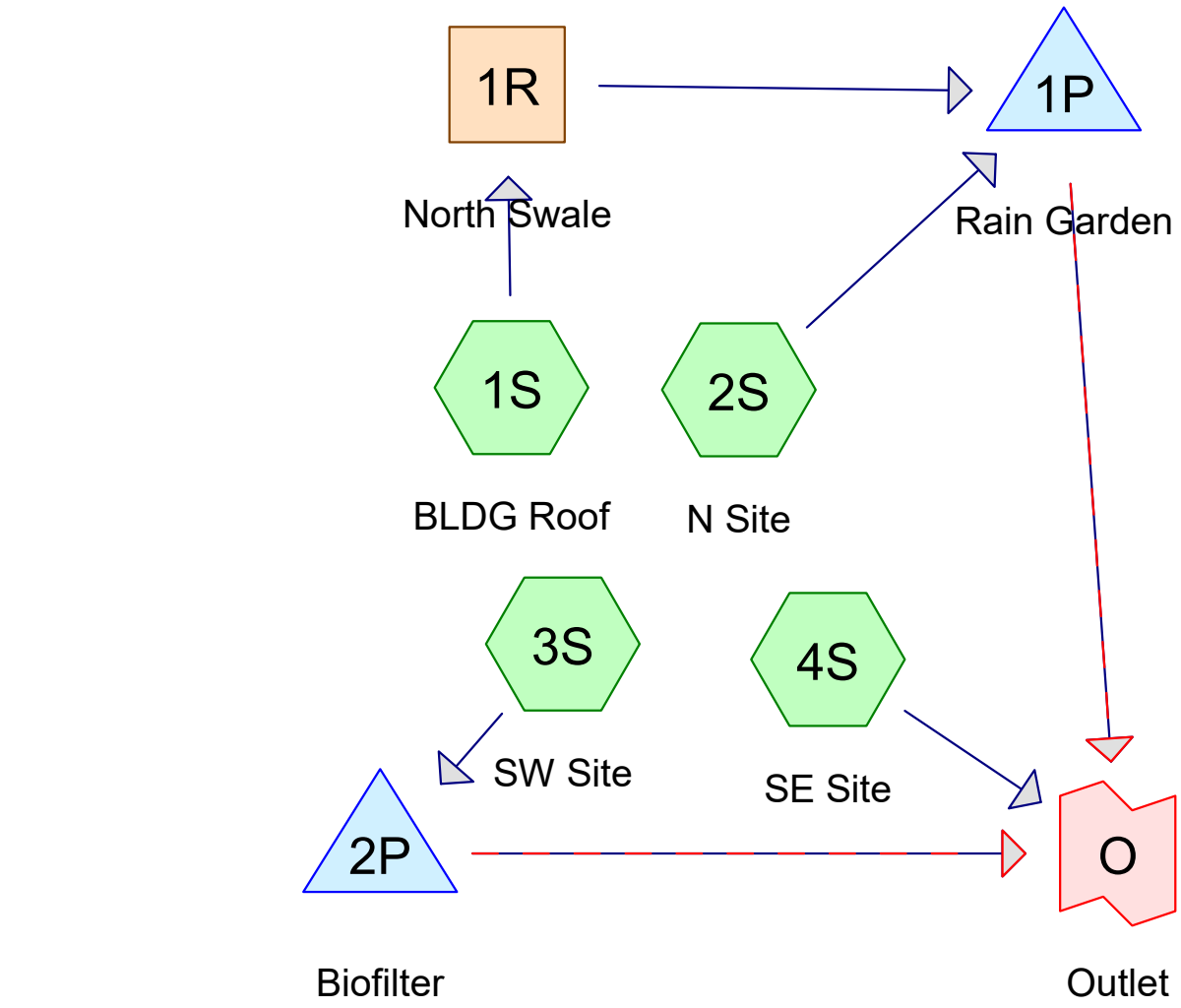
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 5.00-28.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 10-yr Rainfall=4.46"

Area (sf)	CN	Description
118,919	61	Pasture/grassland/range, Good, HSG B
118,919		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.1	196	0.0253	0.23		**Sheet Flow, Sheet Flow** Range n= 0.130 P2= 3.01"
0.2	43	0.2097	3.21		**Shallow Concentrated Flow, Shallow Concentrated** Short Grass Pasture Kv= 7.0 fps
14.3	239	Total			

Subcatchment 1S: Existing Site





Subcat Reach Pond Link

Routing Diagram for Pro Site 3106 Berlin
Prepared by HP, Printed 2/17/2025

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.049	61	>75% Grass cover, Good, HSG B (1S, 2S, 3S, 4S)
0.023	98	Loading Dock, HSG B (4S)
0.564	98	Paved parking, HSG B (3S)
0.025	98	Sidewalk, HSG B (2S, 3S)
0.550	98	Unconnected roofs, HSG B (1S)
2.211	**80**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
2.211	HSG B	1S, 2S, 3S, 4S
0.000	HSG C	
0.000	HSG D	
0.000	Other	
2.211		**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
0.000	1.049	0.000	0.000	0.000	1.049	>75% Grass cover, Good	1S, 2S, 3S, 4S
0.000	0.023	0.000	0.000	0.000	0.023	Loading Dock	4S
0.000	0.564	0.000	0.000	0.000	0.564	Paved parking	3S
0.000	0.025	0.000	0.000	0.000	0.025	Sidewalk	2S, 3S
0.000	0.550	0.000	0.000	0.000	0.550	Unconnected roofs	1S
0.000	**2.211**	**0.000**	**0.000**	**0.000**	**2.211**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	2P	727.00	722.78	50.0	0.0844	0.010	12.0	0.0	0.0

Time span=2.00-28.00 hrs, dt=0.05 hrs, 521 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: BLDG Roof Runoff Area=29,534 sf 81.12% Impervious Runoff Depth=1.97"
Flow Length=128' Slope=0.5000 '/' Tc=0.4 min CN=WQ Runoff=2.36 cfs 0.112 af

Subcatchment 2S: N Site Runoff Area=10,019 sf 2.18% Impervious Runoff Depth=0.28"
Flow Length=363' Tc=5.2 min CN=WQ Runoff=0.07 cfs 0.005 af

Subcatchment 3S: SW Site Runoff Area=48,831 sf 52.10% Impervious Runoff Depth=1.35"
Flow Length=291' Tc=3.3 min CN=WQ Runoff=2.52 cfs 0.126 af

Subcatchment 4S: SE Site Runoff Area=7,928 sf 12.64% Impervious Runoff Depth=0.50"
Flow Length=202' Slope=0.0280 '/' Tc=1.8 min CN=WQ Runoff=0.14 cfs 0.008 af

Reach 1R: North Swale Avg. Flow Depth=0.54' Max Vel=2.48 fps Inflow=2.36 cfs 0.112 af
n=0.025 L=253.0' S=0.0111 '/' Capacity=11.41 cfs Outflow=2.17 cfs 0.112 af

Pond 1P: Rain Garden Peak Elev=724.61' Storage=4,464 cf Inflow=2.20 cfs 0.117 af
Discarded=0.01 cfs 0.018 af Primary=0.00 cfs 0.000 af Outflow=0.01 cfs 0.018 af

Pond 2P: Biofilter Peak Elev=729.78' Storage=2,982 cf Inflow=2.52 cfs 0.126 af
Discarded=0.01 cfs 0.013 af Primary=0.26 cfs 0.105 af Secondary=0.00 cfs 0.000 af Outflow=0.28 cfs 0.118 af

Link O: Outlet Inflow=0.32 cfs 0.113 af
Primary=0.32 cfs 0.113 af

Total Runoff Area = 2.211 ac Runoff Volume = 0.251 af Average Runoff Depth = 1.36"
47.44% Pervious = 1.049 ac 52.56% Impervious = 1.162 ac

Summary for Subcatchment 1S: BLDG Roof

[49] Hint: Tc<2dt may require smaller dt

Runoff = 2.36 cfs @ 12.05 hrs, Volume= 0.112 af, Depth= 1.97"

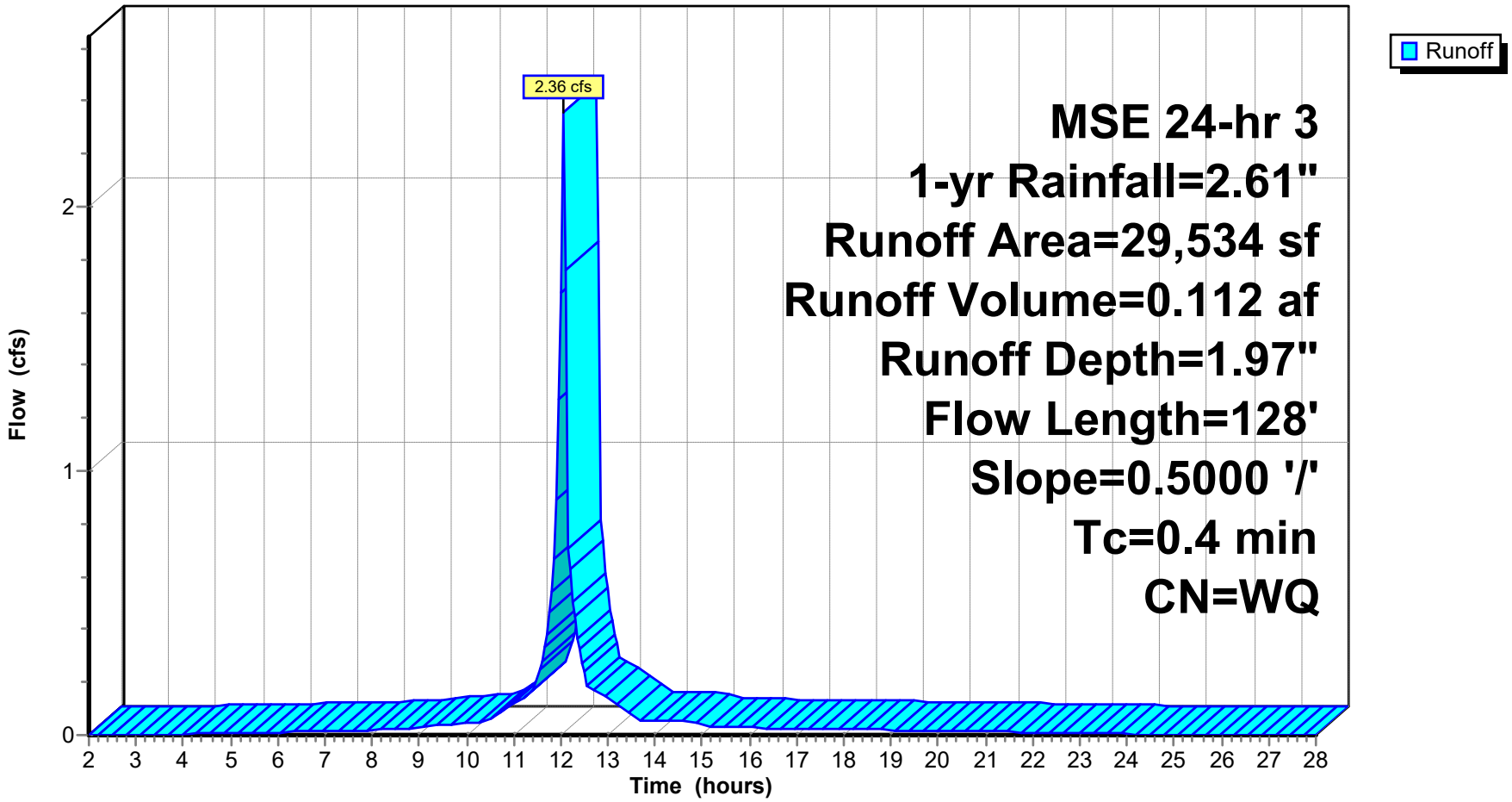
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 2.00-28.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 1-yr Rainfall=2.61"

Area (sf)	CN	Description
23,958	98	Unconnected roofs, HSG B
5,576	61	>75% Grass cover, Good, HSG B
29,534		Weighted Average
5,576		18.88% Pervious Area
23,958		81.12% Impervious Area
23,958		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	128	0.5000	5.08		**Sheet Flow, Roof** Smooth surfaces n= 0.011 P2= 3.01"

Subcatchment 1S: BLDG Roof

Hydrograph



Summary for Subcatchment 2S: N Site

[49] Hint: Tc<2dt may require smaller dt

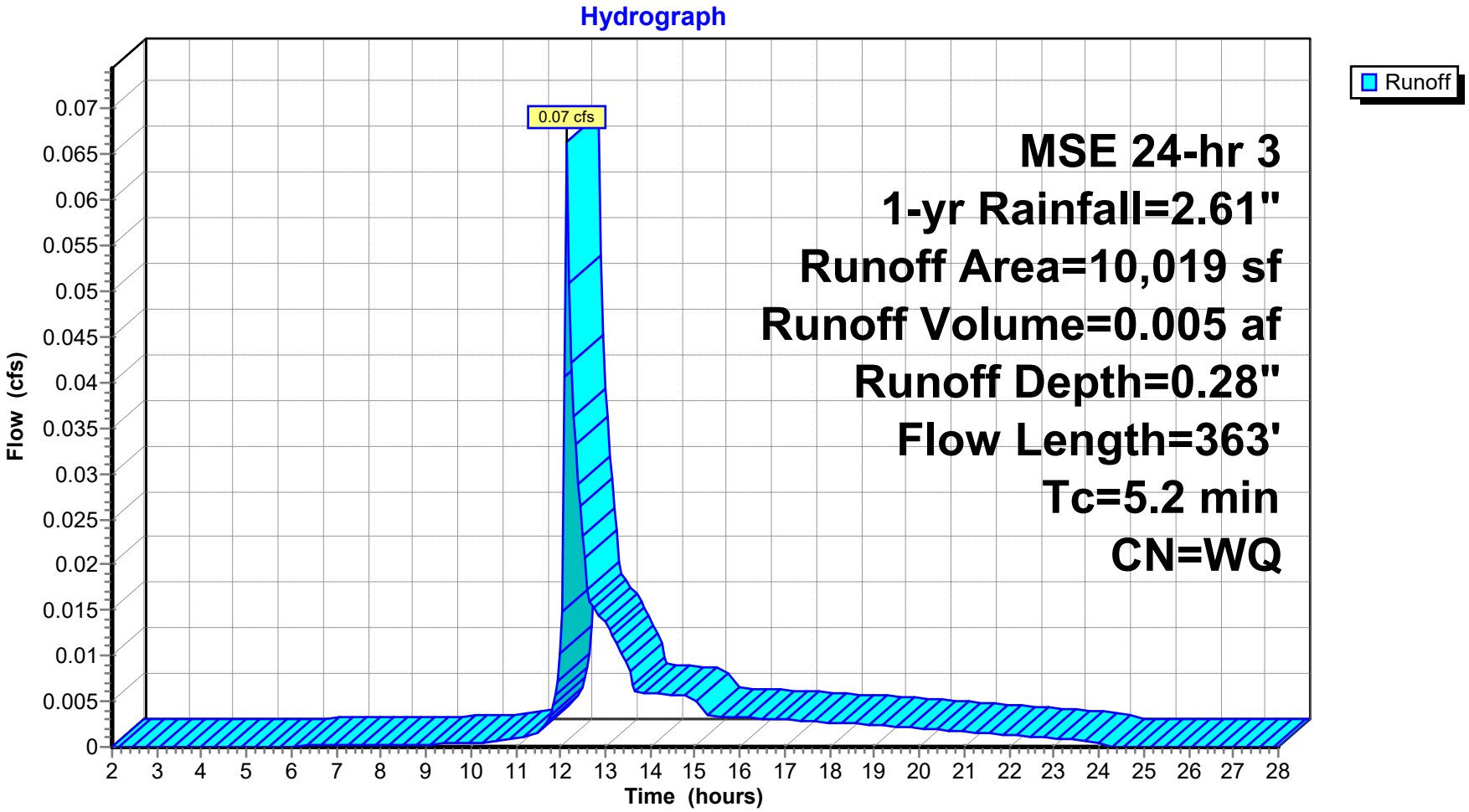
Runoff = 0.07 cfs @ 12.16 hrs, Volume= 0.005 af, Depth= 0.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 2.00-28.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 1-yr Rainfall=2.61"

	Area (sf)	CN	Description
	9,801	61	>75% Grass cover, Good, HSG B
*	218	98	Sidewalk, HSG B
	10,019		Weighted Average
	9,801		97.82% Pervious Area
	218		2.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	8	0.0200	0.10		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.01"
3.9	355	0.0100	1.50		**Shallow Concentrated Flow, Shallow Concentrated** Grassed Waterway Kv= 15.0 fps
5.2	363	Total			

Subcatchment 2S: N Site



Summary for Subcatchment 3S: SW Site

[49] Hint: Tc<2dt may require smaller dt

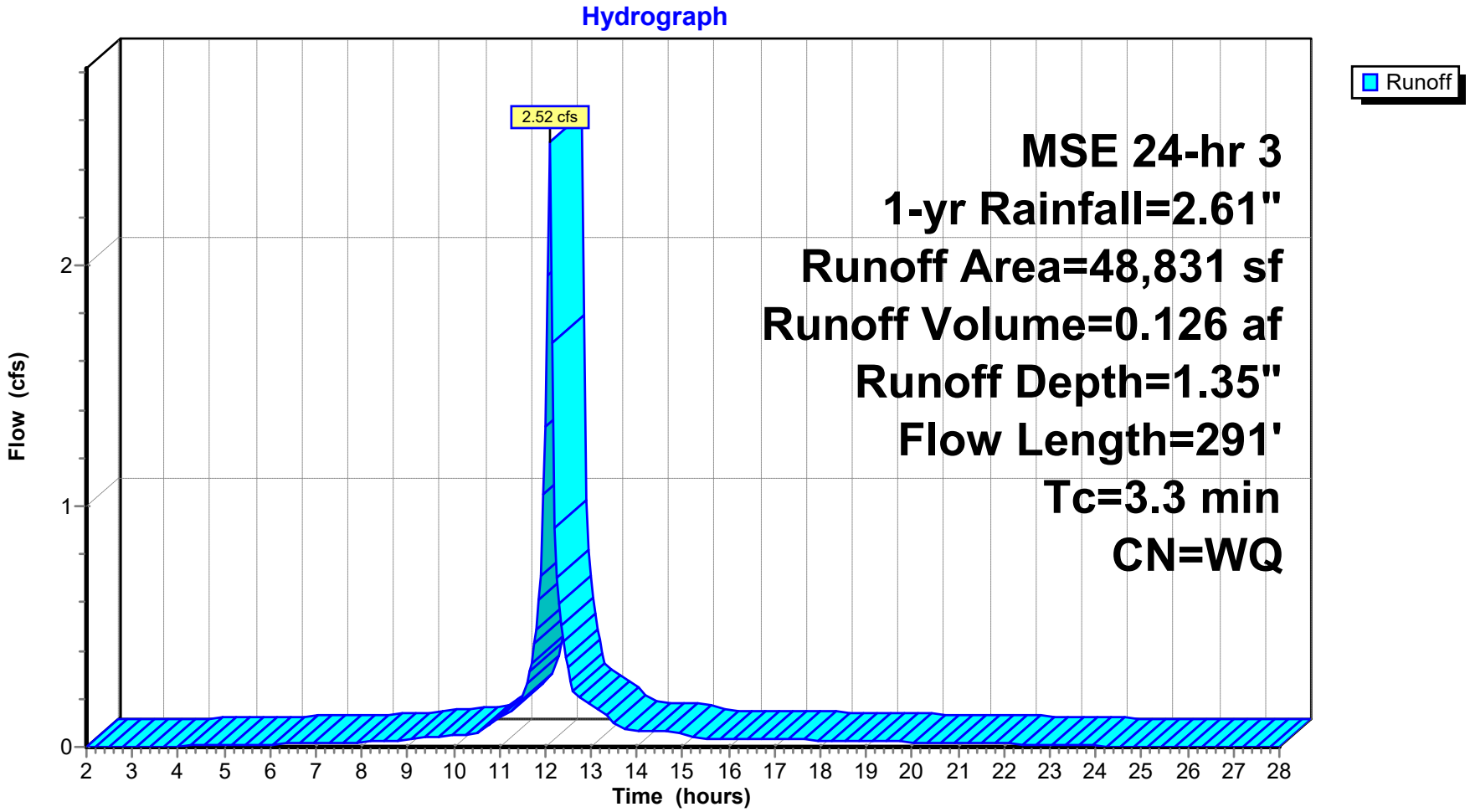
Runoff = 2.52 cfs @ 12.09 hrs, Volume= 0.126 af, Depth= 1.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 2.00-28.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 1-yr Rainfall=2.61"

	Area (sf)	CN	Description
	24,568	98	Paved parking, HSG B
	23,392	61	>75% Grass cover, Good, HSG B
*	871	98	Sidewalk, HSG B
	48,831		Weighted Average
	23,392		47.90% Pervious Area
	25,439		52.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	96	0.0280	1.51		**Sheet Flow, Parking**
					Smooth surfaces n= 0.011 P2= 3.01"
2.2	195	0.0100	1.50		**Shallow Concentrated Flow, Pervious**
					Grassed Waterway Kv= 15.0 fps
3.3	291	Total			

Subcatchment 3S: SW Site



Summary for Subcatchment 4S: SE Site

[49] Hint: Tc<2dt may require smaller dt

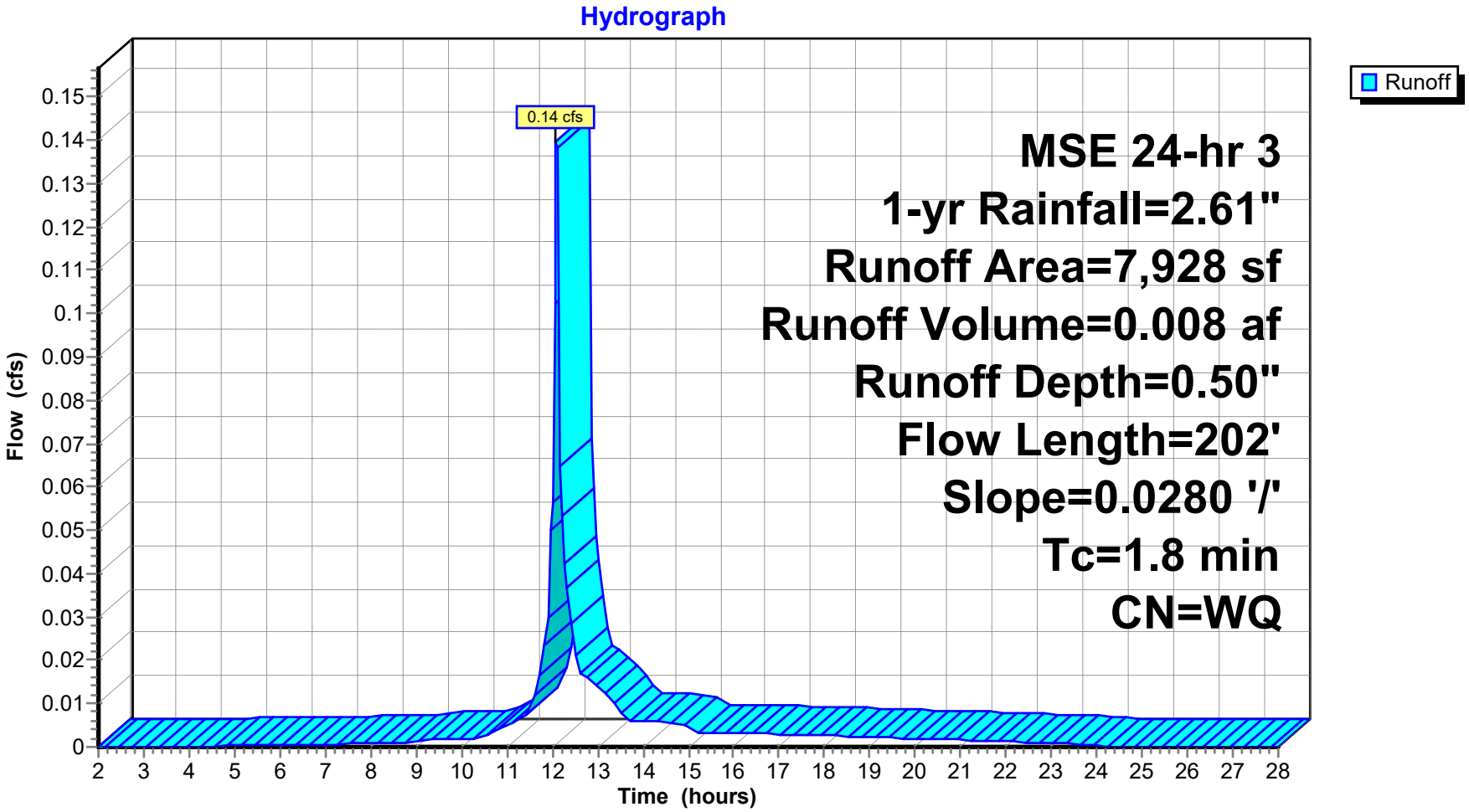
Runoff = 0.14 cfs @ 12.09 hrs, Volume= 0.008 af, Depth= 0.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 2.00-28.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 1-yr Rainfall=2.61"

	Area (sf)	CN	Description
*	1,002	98	Loading Dock, HSG B
	6,926	61	>75% Grass cover, Good, HSG B
	7,928		Weighted Average
	6,926		87.36% Pervious Area
	1,002		12.64% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	96	0.0280	1.51		**Sheet Flow, Parking** Smooth surfaces n= 0.011 P2= 3.01"
0.7	106	0.0280	2.51		**Shallow Concentrated Flow, Pervious** Grassed Waterway Kv= 15.0 fps
1.8	202	Total			

Subcatchment 4S: SE Site



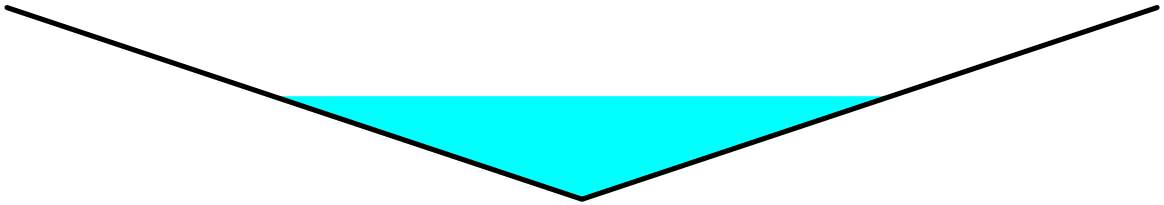
Summary for Reach 1R: North Swale

Inflow Area = 0.678 ac, 81.12% Impervious, Inflow Depth = 1.97" for 1-yr event
Inflow = 2.36 cfs @ 12.05 hrs, Volume= 0.112 af
Outflow = 2.17 cfs @ 12.08 hrs, Volume= 0.112 af, Atten= 8%, Lag= 1.4 min

Routing by Dyn-Stor-Ind method, Time Span= 2.00-28.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.48 fps, Min. Travel Time= 1.7 min
Avg. Velocity = 0.81 fps, Avg. Travel Time= 5.2 min

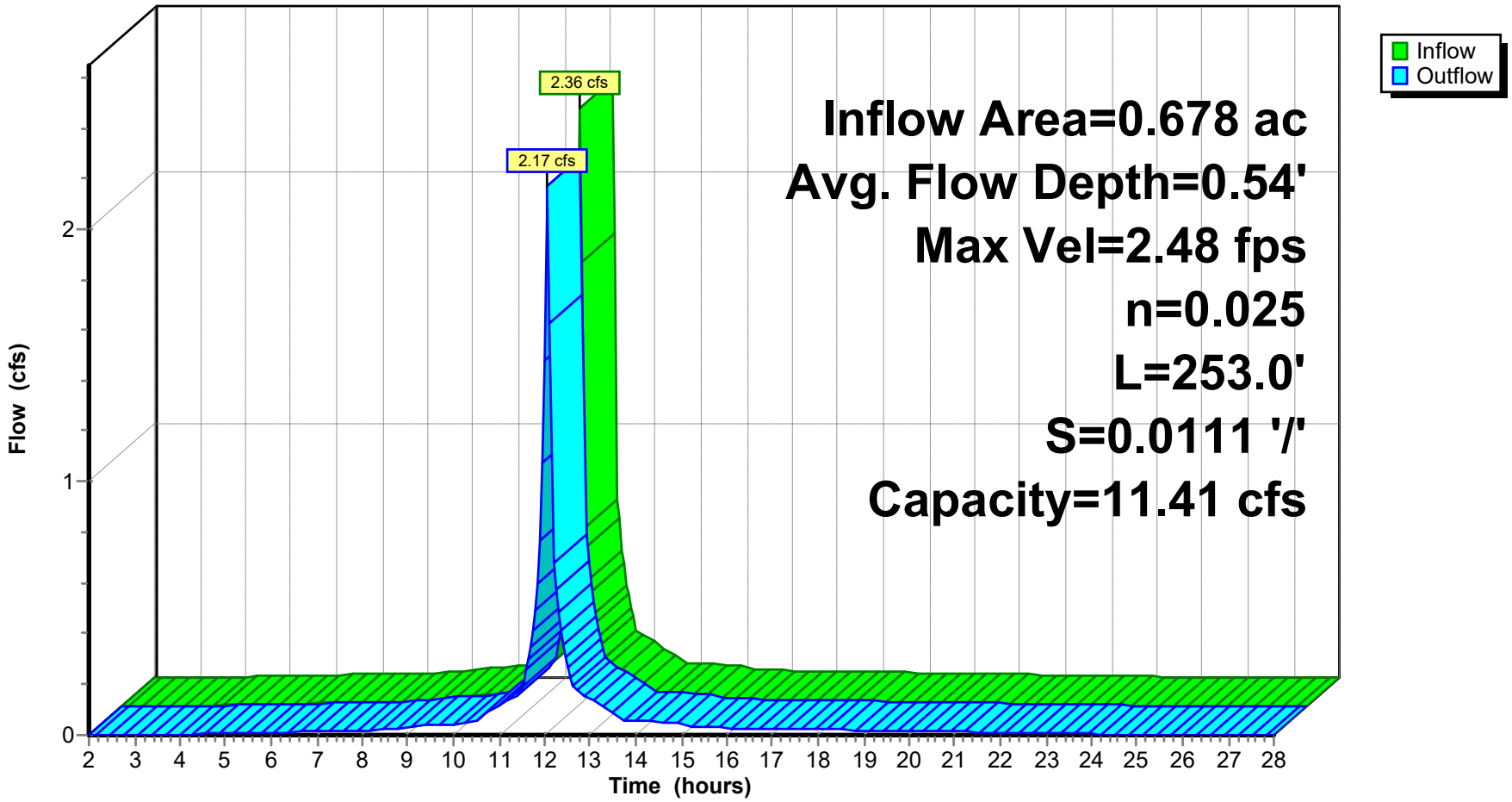
Peak Storage= 219 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.54'
Bank-Full Depth= 1.00' Flow Area= 3.0 sf, Capacity= 11.41 cfs

0.00' x 1.00' deep channel, n= 0.025 Earth, grassed & winding
Side Slope Z-value= 3.0 '/' Top Width= 6.00'
Length= 253.0' Slope= 0.0111 '/'
Inlet Invert= 734.50', Outlet Invert= 731.70'



Reach 1R: North Swale

Hydrograph



Summary for Pond 1P: Rain Garden

Inflow Area = 0.908 ac, 61.12% Impervious, Inflow Depth = 1.54" for 1-yr event
Inflow = 2.20 cfs @ 12.08 hrs, Volume= 0.117 af
Outflow = 0.01 cfs @ 22.22 hrs, Volume= 0.018 af, Atten= 100%, Lag= 608.4 min
Discarded = 0.01 cfs @ 22.22 hrs, Volume= 0.018 af
Primary = 0.00 cfs @ 2.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 2.00-28.00 hrs, dt= 0.05 hrs
Peak Elev= 724.61' @ 22.22 hrs Surf.Area= 3,332 sf Storage= 4,464 cf

Plug-Flow detention time= 475.7 min calculated for 0.018 af (16% of inflow)
Center-of-Mass det. time= 285.7 min (1,047.1 - 761.4)

Volume	Invert	Avail.Storage	Storage Description
#1	723.00'	5,822 cf	**Custom Stage Data (Pyramidal)** Listed below (Recalc)

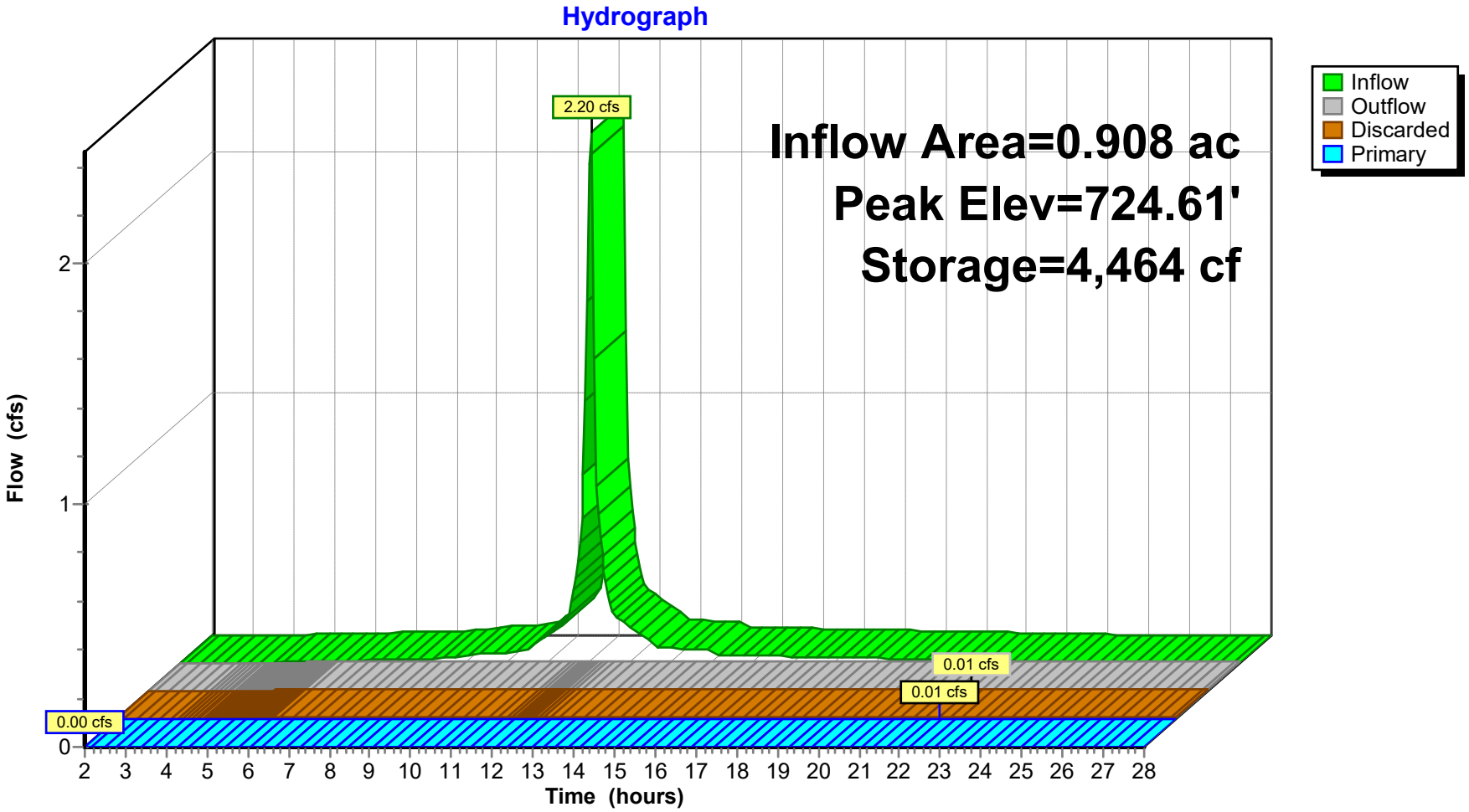
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
723.00	2,250	0	0	2,250
725.00	3,626	5,822	5,822	3,692

Device	Routing	Invert	Outlet Devices
#1	Discarded	723.00'	**0.130 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 704.00' Phase-In= 0.01'
#2	Primary	724.67'	**Outlet Weir, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 0.21 Width (feet) 0.00 34.00

Discarded OutFlow Max=0.01 cfs @ 22.22 hrs HW=724.61' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 2.00 hrs HW=723.00' TW=0.00' (Dynamic Tailwater)
↑—**2=Outlet Weir** (Controls 0.00 cfs)

Pond 1P: Rain Garden



Summary for Pond 2P: Biofilter

Inflow Area = 1.121 ac, 52.10% Impervious, Inflow Depth = 1.35" for 1-yr event
Inflow = 2.52 cfs @ 12.09 hrs, Volume= 0.126 af
Outflow = 0.28 cfs @ 12.55 hrs, Volume= 0.118 af, Atten= 89%, Lag= 27.3 min
Discarded = 0.01 cfs @ 12.55 hrs, Volume= 0.013 af
Primary = 0.26 cfs @ 12.55 hrs, Volume= 0.105 af
Secondary = 0.00 cfs @ 2.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 2.00-28.00 hrs, dt= 0.05 hrs
Peak Elev= 729.78' @ 12.55 hrs Surf.Area= 4,332 sf Storage= 2,982 cf

Plug-Flow detention time= 203.8 min calculated for 0.118 af (94% of inflow)
Center-of-Mass det. time= 174.4 min (938.5 - 764.1)

Volume	Invert	Avail.Storage	Storage Description
#1	727.00'	7,462 cf	**Custom Stage Data (Pyramidal)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
727.00	1,500	0.0	0	0	1,500
729.00	1,500	27.0	810	810	1,810
730.50	8,280	100.0	6,652	7,462	8,601

Device	Routing	Invert	Outlet Devices
#1	Discarded	727.00'	**0.130 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 704.00' Phase-In= 0.01'
#2	Primary	727.00'	**12.0" Round 12" STM** L= 50.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 727.00' / 722.78' S= 0.0844 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf
#3	Device 2	727.02'	**3.600 in/hr Underdrains over Wetted area above 727.02'** Excluded Wetted area = 1,503 sf Phase-In= 0.01'
#4	Device 2	729.80'	**6.0" Horiz. 6" Standpipe** C= 0.600 Limited to weir flow at low heads
#5	Secondary	730.25'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79

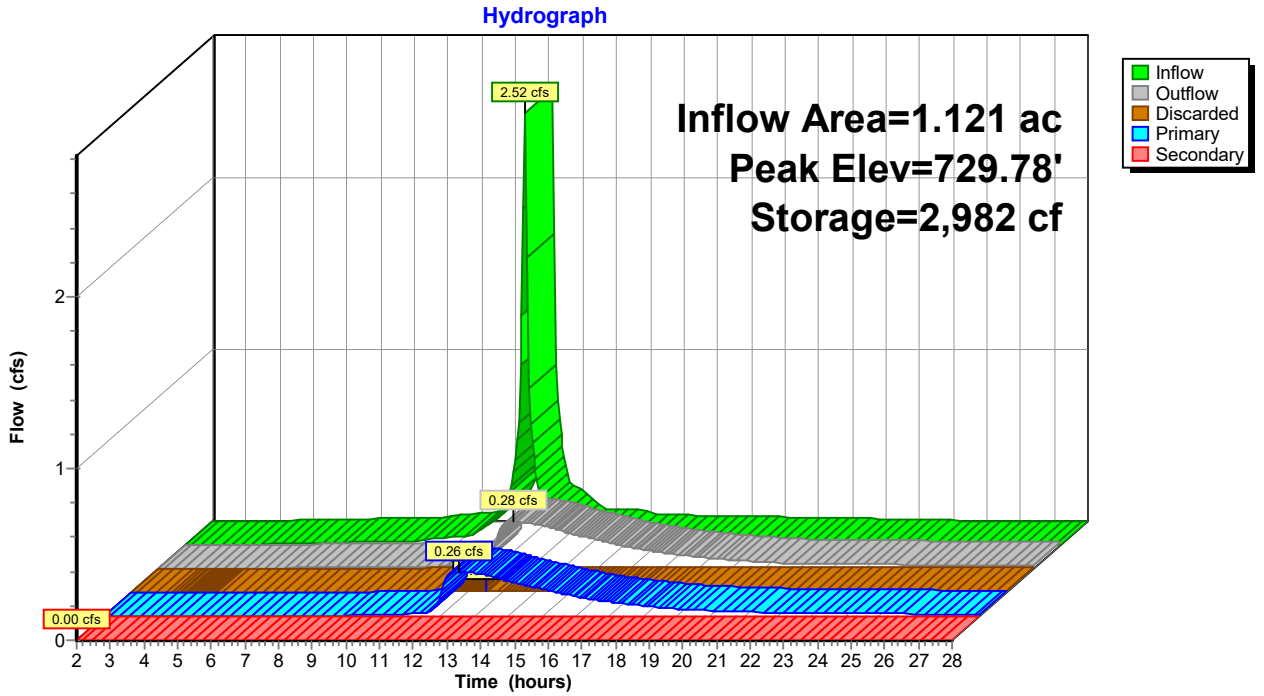
2.88

Discarded OutFlow Max=0.01 cfs @ 12.55 hrs HW=729.78' (Free Discharge)
└**1=Exfiltration** (Controls 0.01 cfs)

Primary OutFlow Max=0.26 cfs @ 12.55 hrs HW=729.78' TW=0.00' (Dynamic Tailwater)
└**2=12" STM** (Passes 0.26 cfs of 5.71 cfs potential flow)
  └**3=Underdrains** (Exfiltration Controls 0.26 cfs)
  └**4=6" Standpipe** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 2.00 hrs HW=727.00' TW=0.00' (Dynamic Tailwater)
└**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 2P: Biofilter

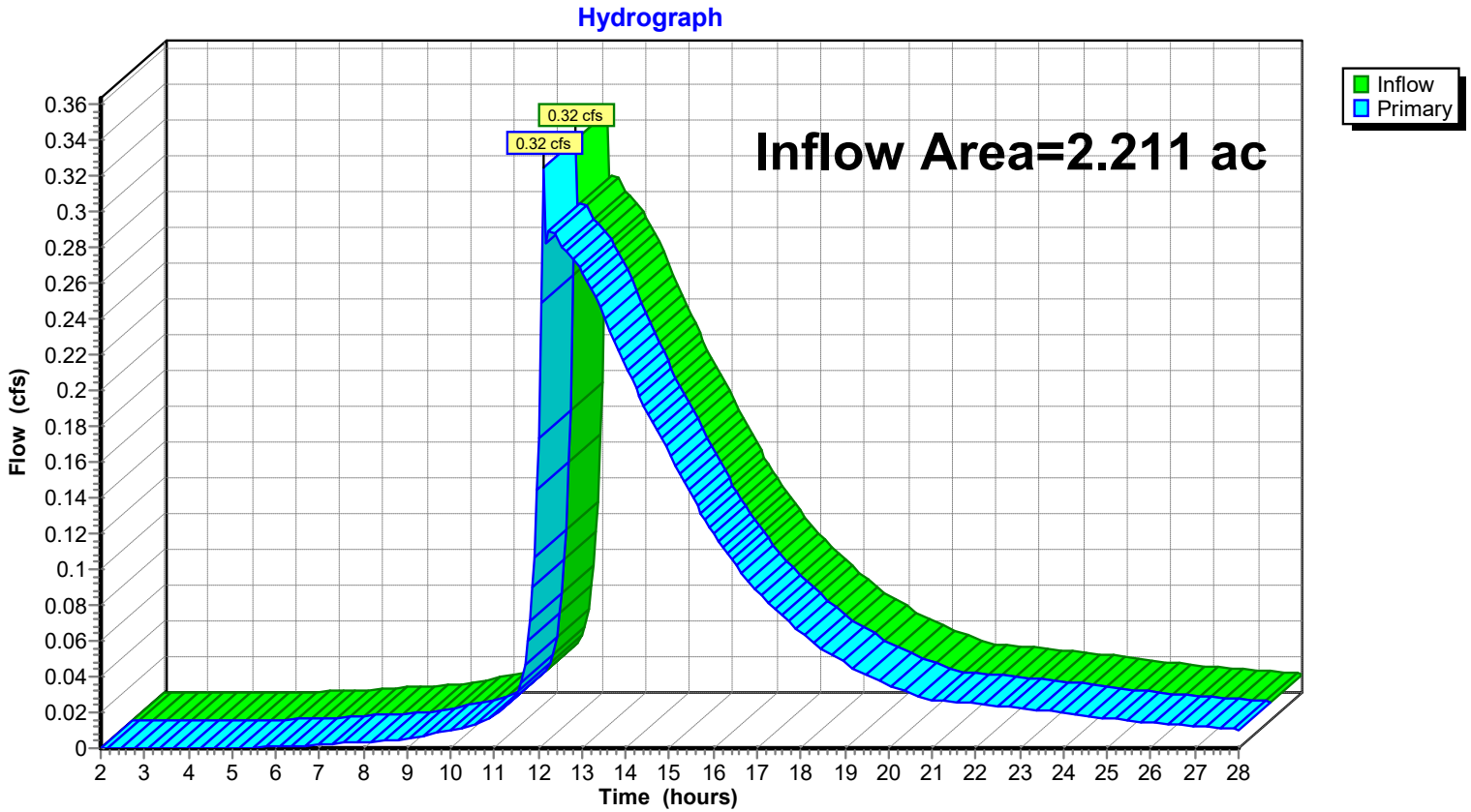


Summary for Link O: Outlet

Inflow Area = 2.211 ac, 52.56% Impervious, Inflow Depth > 0.61" for 1-yr event
Inflow = 0.32 cfs @ 12.11 hrs, Volume= 0.113 af
Primary = 0.32 cfs @ 12.11 hrs, Volume= 0.113 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 2.00-28.00 hrs, dt= 0.05 hrs

Link O: Outlet



Time span=2.00-28.00 hrs, dt=0.05 hrs, 521 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: BLDG Roof Runoff Area=29,534 sf 81.12% Impervious Runoff Depth=2.32"
Flow Length=128' Slope=0.5000 '/' Tc=0.4 min CN=WQ Runoff=2.77 cfs 0.131 af

Subcatchment 2S: N Site Runoff Area=10,019 sf 2.18% Impervious Runoff Depth=0.42"
Flow Length=363' Tc=5.2 min CN=WQ Runoff=0.13 cfs 0.008 af

Subcatchment 3S: SW Site Runoff Area=48,831 sf 52.10% Impervious Runoff Depth=1.62"
Flow Length=291' Tc=3.3 min CN=WQ Runoff=3.06 cfs 0.152 af

Subcatchment 4S: SE Site Runoff Area=7,928 sf 12.64% Impervious Runoff Depth=0.67"
Flow Length=202' Slope=0.0280 '/' Tc=1.8 min CN=WQ Runoff=0.21 cfs 0.010 af

Reach 1R: North Swale Avg. Flow Depth=0.57' Max Vel=2.58 fps Inflow=2.77 cfs 0.131 af
n=0.025 L=253.0' S=0.0111 '/' Capacity=11.41 cfs Outflow=2.55 cfs 0.131 af

Pond 1P: Rain Garden Peak Elev=724.71' Storage=4,792 cf Inflow=2.62 cfs 0.139 af
Discarded=0.01 cfs 0.019 af Primary=0.06 cfs 0.016 af Outflow=0.07 cfs 0.035 af

Pond 2P: Biofilter Peak Elev=729.88' Storage=3,462 cf Inflow=3.06 cfs 0.152 af
Discarded=0.02 cfs 0.014 af Primary=0.42 cfs 0.129 af Secondary=0.00 cfs 0.000 af Outflow=0.44 cfs 0.143 af

Link O: Outlet Inflow=0.46 cfs 0.156 af
Primary=0.46 cfs 0.156 af

Total Runoff Area = 2.211 ac Runoff Volume = 0.301 af Average Runoff Depth = 1.64"
47.44% Pervious = 1.049 ac 52.56% Impervious = 1.162 ac

Summary for Subcatchment 1S: BLDG Roof

[49] Hint: Tc<2dt may require smaller dt

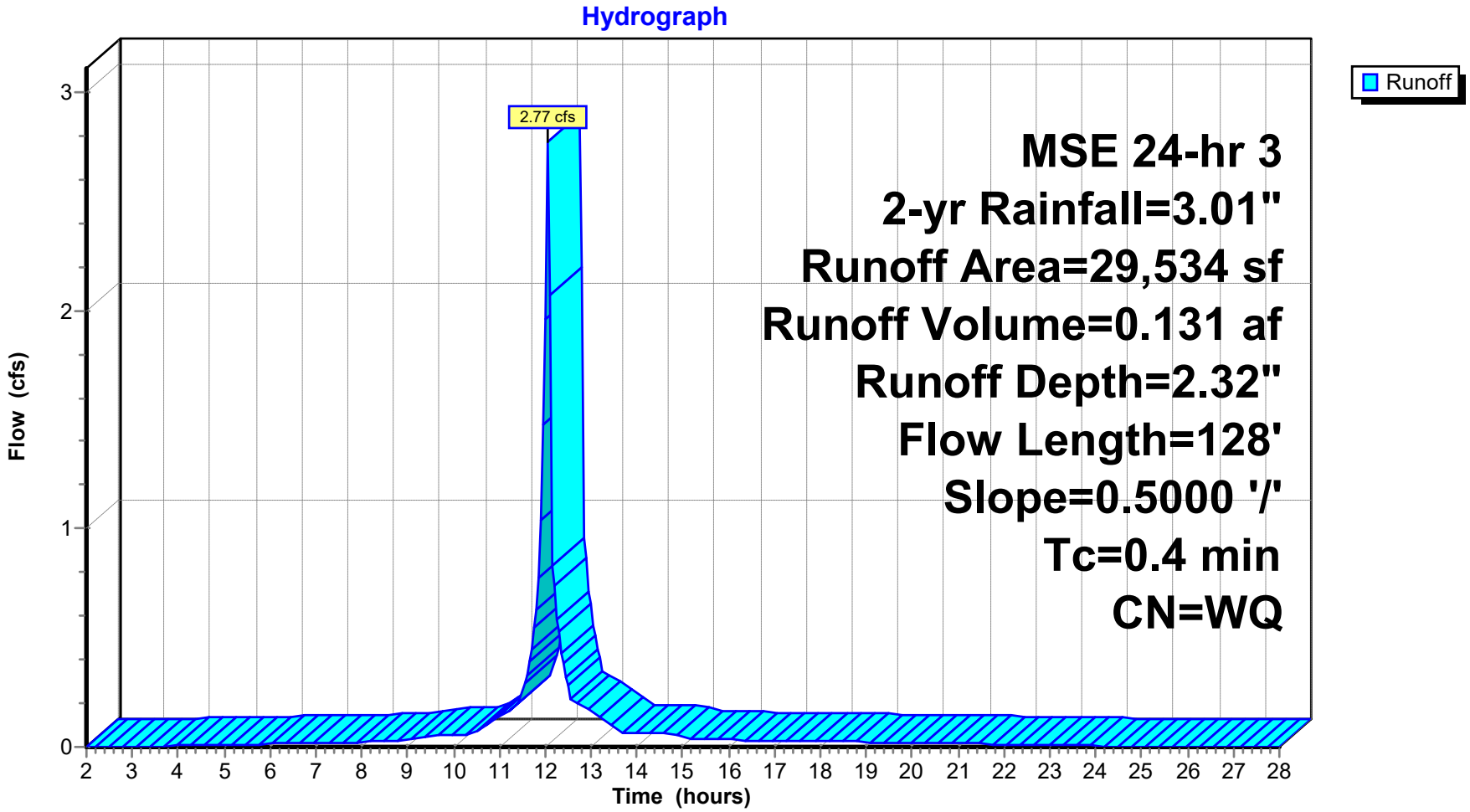
Runoff = 2.77 cfs @ 12.05 hrs, Volume= 0.131 af, Depth= 2.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 2.00-28.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 2-yr Rainfall=3.01"

Area (sf)	CN	Description
23,958	98	Unconnected roofs, HSG B
5,576	61	>75% Grass cover, Good, HSG B
29,534		Weighted Average
5,576		18.88% Pervious Area
23,958		81.12% Impervious Area
23,958		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	128	0.5000	5.08		**Sheet Flow, Roof** Smooth surfaces n= 0.011 P2= 3.01"

Subcatchment 1S: BLDG Roof



Summary for Subcatchment 2S: N Site

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.13 cfs @ 12.15 hrs, Volume= 0.008 af, Depth= 0.42"

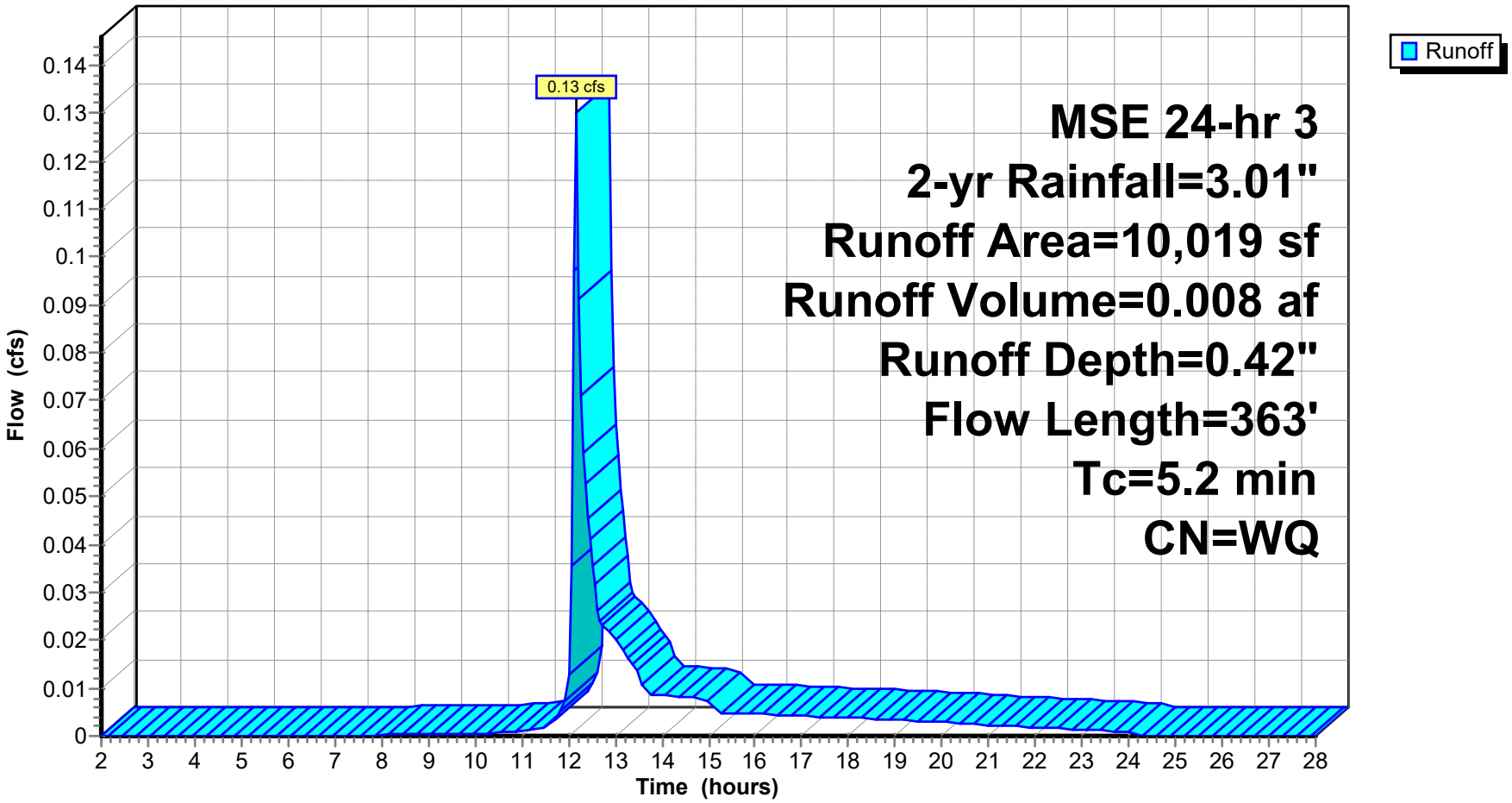
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 2.00-28.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 2-yr Rainfall=3.01"

	Area (sf)	CN	Description
	9,801	61	>75% Grass cover, Good, HSG B
*	218	98	Sidewalk, HSG B
	10,019		Weighted Average
	9,801		97.82% Pervious Area
	218		2.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	8	0.0200	0.10		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.01"
3.9	355	0.0100	1.50		**Shallow Concentrated Flow, Shallow Concentrated** Grassed Waterway Kv= 15.0 fps
5.2	363	Total			

Subcatchment 2S: N Site

Hydrograph



Summary for Subcatchment 3S: SW Site

[49] Hint: Tc<2dt may require smaller dt

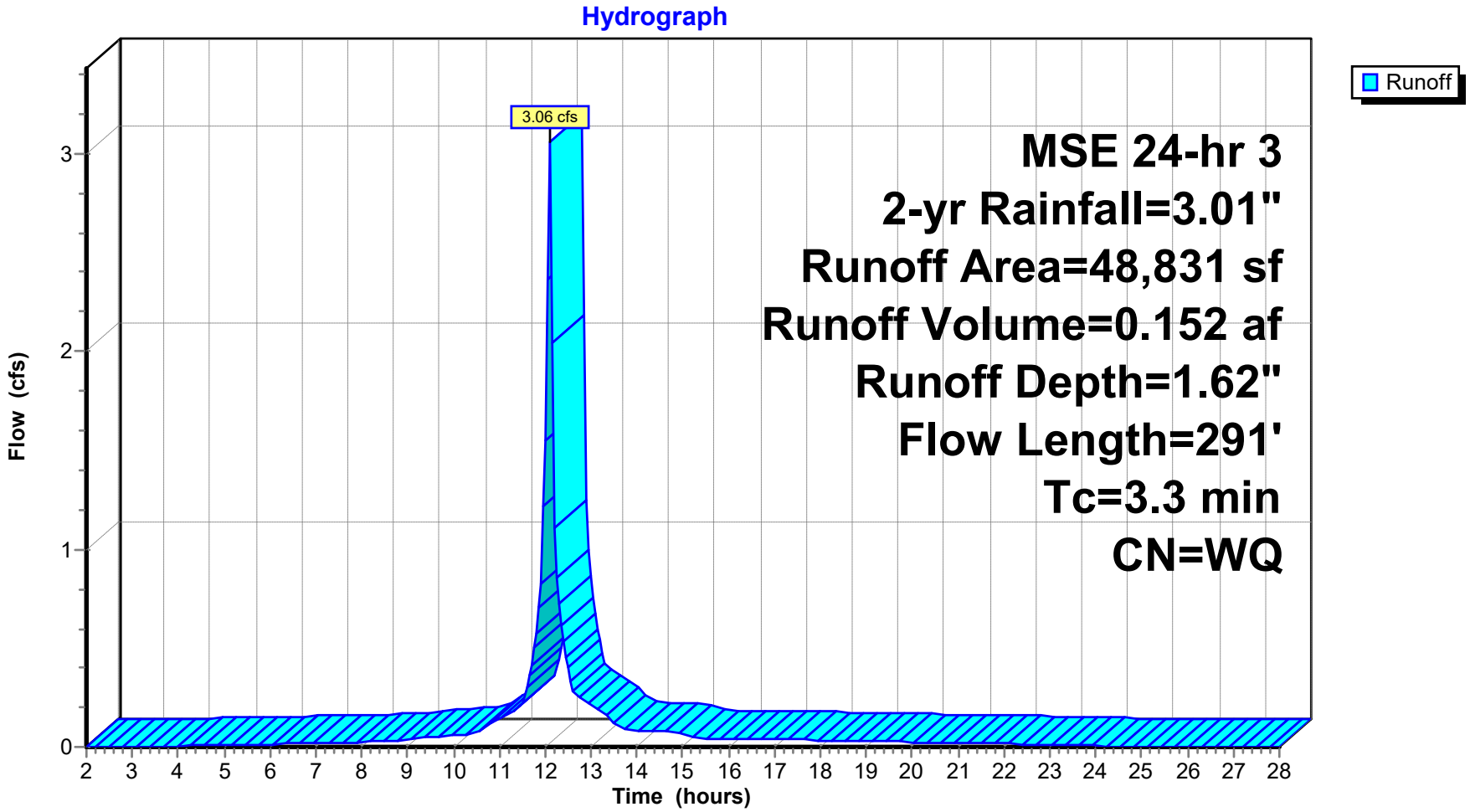
Runoff = 3.06 cfs @ 12.10 hrs, Volume= 0.152 af, Depth= 1.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 2.00-28.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 2-yr Rainfall=3.01"

	Area (sf)	CN	Description
	24,568	98	Paved parking, HSG B
	23,392	61	>75% Grass cover, Good, HSG B
*	871	98	Sidewalk, HSG B
	48,831		Weighted Average
	23,392		47.90% Pervious Area
	25,439		52.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	96	0.0280	1.51		**Sheet Flow, Parking**
					Smooth surfaces n= 0.011 P2= 3.01"
2.2	195	0.0100	1.50		**Shallow Concentrated Flow, Pervious**
					Grassed Waterway Kv= 15.0 fps
3.3	291	Total			

Subcatchment 3S: SW Site



Summary for Subcatchment 4S: SE Site

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.21 cfs @ 12.09 hrs, Volume= 0.010 af, Depth= 0.67"

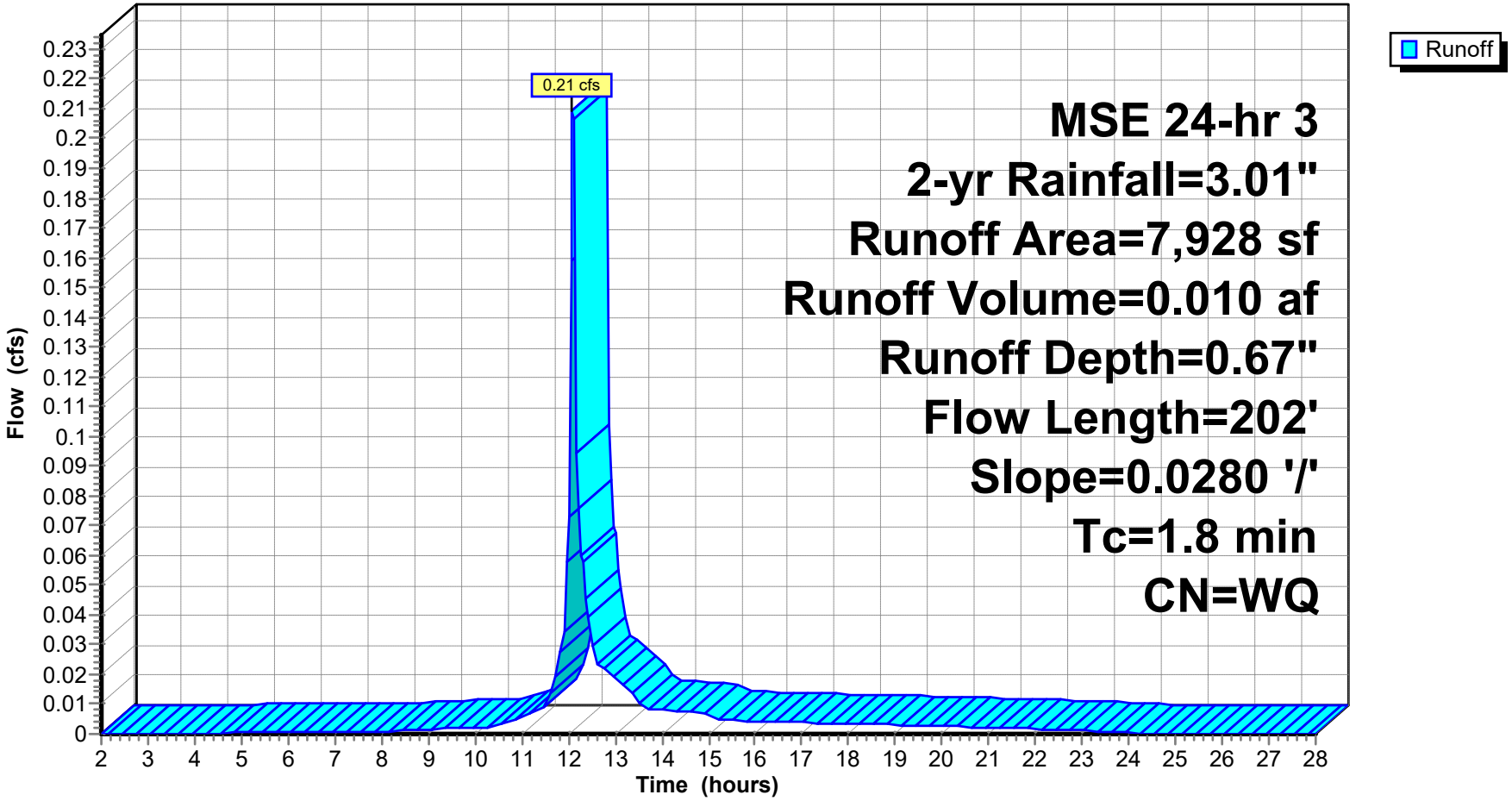
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 2.00-28.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 2-yr Rainfall=3.01"

	Area (sf)	CN	Description
*	1,002	98	Loading Dock, HSG B
	6,926	61	>75% Grass cover, Good, HSG B
	7,928		Weighted Average
	6,926		87.36% Pervious Area
	1,002		12.64% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	96	0.0280	1.51		**Sheet Flow, Parking**
					Smooth surfaces n= 0.011 P2= 3.01"
0.7	106	0.0280	2.51		**Shallow Concentrated Flow, Pervious**
					Grassed Waterway Kv= 15.0 fps
1.8	202	Total			

Subcatchment 4S: SE Site

Hydrograph



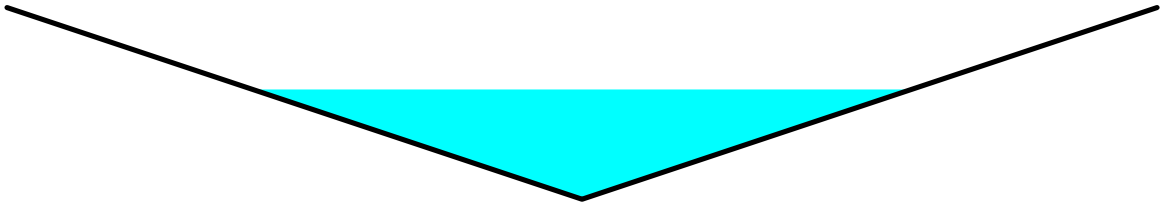
Summary for Reach 1R: North Swale

Inflow Area = 0.678 ac, 81.12% Impervious, Inflow Depth = 2.32" for 2-yr event
Inflow = 2.77 cfs @ 12.05 hrs, Volume= 0.131 af
Outflow = 2.55 cfs @ 12.08 hrs, Volume= 0.131 af, Atten= 8%, Lag= 1.4 min

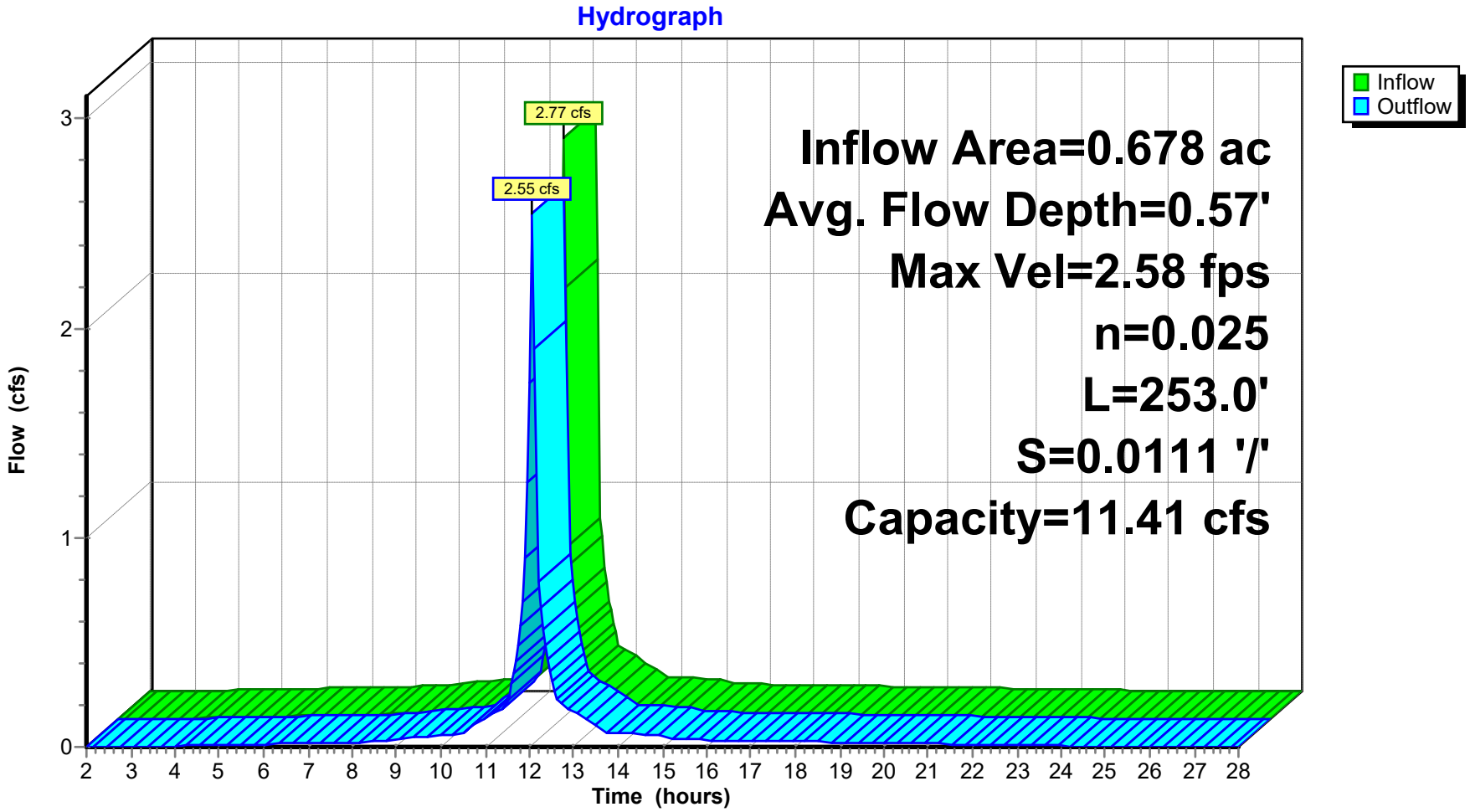
Routing by Dyn-Stor-Ind method, Time Span= 2.00-28.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.58 fps, Min. Travel Time= 1.6 min
Avg. Velocity = 0.84 fps, Avg. Travel Time= 5.0 min

Peak Storage= 247 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.57'
Bank-Full Depth= 1.00' Flow Area= 3.0 sf, Capacity= 11.41 cfs

0.00' x 1.00' deep channel, n= 0.025 Earth, grassed & winding
Side Slope Z-value= 3.0 '/' Top Width= 6.00'
Length= 253.0' Slope= 0.0111 '/'
Inlet Invert= 734.50', Outlet Invert= 731.70'



Reach 1R: North Swale



Summary for Pond 1P: Rain Garden

Inflow Area = 0.908 ac, 61.12% Impervious, Inflow Depth = 1.84" for 2-yr event
Inflow = 2.62 cfs @ 12.08 hrs, Volume= 0.139 af
Outflow = 0.07 cfs @ 14.83 hrs, Volume= 0.035 af, Atten= 97%, Lag= 165.0 min
Discarded = 0.01 cfs @ 14.83 hrs, Volume= 0.019 af
Primary = 0.06 cfs @ 14.83 hrs, Volume= 0.016 af

Routing by Dyn-Stor-Ind method, Time Span= 2.00-28.00 hrs, dt= 0.05 hrs
Peak Elev= 724.71' @ 14.83 hrs Surf.Area= 3,404 sf Storage= 4,792 cf

Plug-Flow detention time= 410.8 min calculated for 0.035 af (25% of inflow)
Center-of-Mass det. time= 266.5 min (1,026.9 - 760.4)

Volume	Invert	Avail.Storage	Storage Description
#1	723.00'	5,822 cf	**Custom Stage Data (Pyramidal)** Listed below (Recalc)

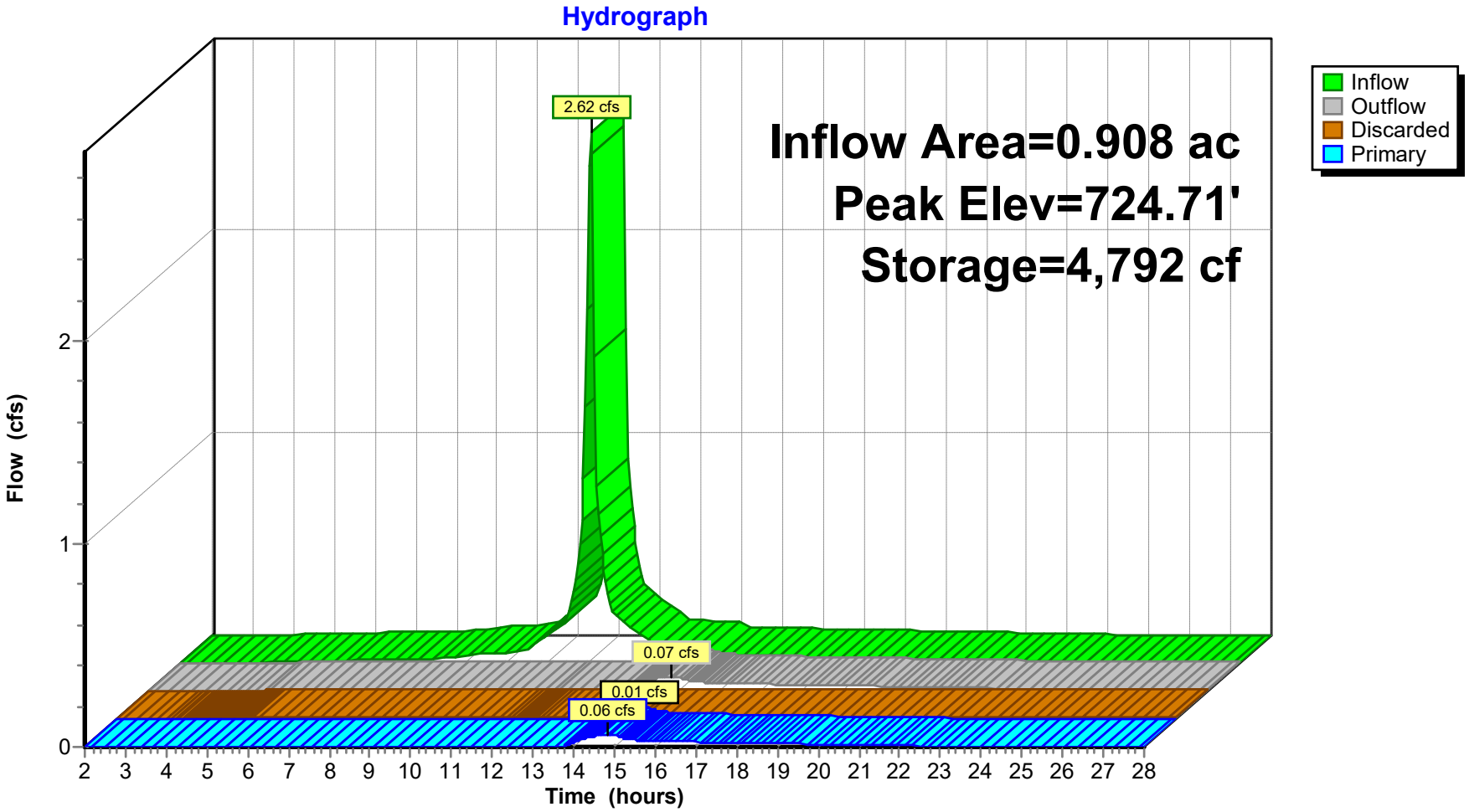
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
723.00	2,250	0	0	2,250
725.00	3,626	5,822	5,822	3,692

Device	Routing	Invert	Outlet Devices
#1	Discarded	723.00'	**0.130 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 704.00' Phase-In= 0.01'
#2	Primary	724.67'	**Outlet Weir, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 0.21 Width (feet) 0.00 34.00

Discarded OutFlow Max=0.01 cfs @ 14.83 hrs HW=724.71' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.01 cfs)

Primary OutFlow Max=0.06 cfs @ 14.83 hrs HW=724.71' TW=0.00' (Dynamic Tailwater)
↑—**2=Outlet Weir** (Weir Controls 0.06 cfs @ 0.50 fps)

Pond 1P: Rain Garden



Summary for Pond 2P: Biofilter

Inflow Area = 1.121 ac, 52.10% Impervious, Inflow Depth = 1.62" for 2-yr event
Inflow = 3.06 cfs @ 12.10 hrs, Volume= 0.152 af
Outflow = 0.44 cfs @ 12.47 hrs, Volume= 0.143 af, Atten= 86%, Lag= 22.2 min
Discarded = 0.02 cfs @ 12.47 hrs, Volume= 0.014 af
Primary = 0.42 cfs @ 12.47 hrs, Volume= 0.129 af
Secondary = 0.00 cfs @ 2.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 2.00-28.00 hrs, dt= 0.05 hrs
Peak Elev= 729.88' @ 12.47 hrs Surf.Area= 4,827 sf Storage= 3,462 cf

Plug-Flow detention time= 191.9 min calculated for 0.143 af (95% of inflow)
Center-of-Mass det. time= 163.9 min (927.6 - 763.7)

Volume	Invert	Avail.Storage	Storage Description
#1	727.00'	7,462 cf	**Custom Stage Data (Pyramidal)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
727.00	1,500	0.0	0	0	1,500
729.00	1,500	27.0	810	810	1,810
730.50	8,280	100.0	6,652	7,462	8,601

Device	Routing	Invert	Outlet Devices
#1	Discarded	727.00'	**0.130 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 704.00' Phase-In= 0.01'
#2	Primary	727.00'	**12.0" Round 12" STM** L= 50.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 727.00' / 722.78' S= 0.0844 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf
#3	Device 2	727.02'	**3.600 in/hr Underdrains over Wetted area above 727.02'** Excluded Wetted area = 1,503 sf Phase-In= 0.01'
#4	Device 2	729.80'	**6.0" Horiz. 6" Standpipe** C= 0.600 Limited to weir flow at low heads
#5	Secondary	730.25'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79

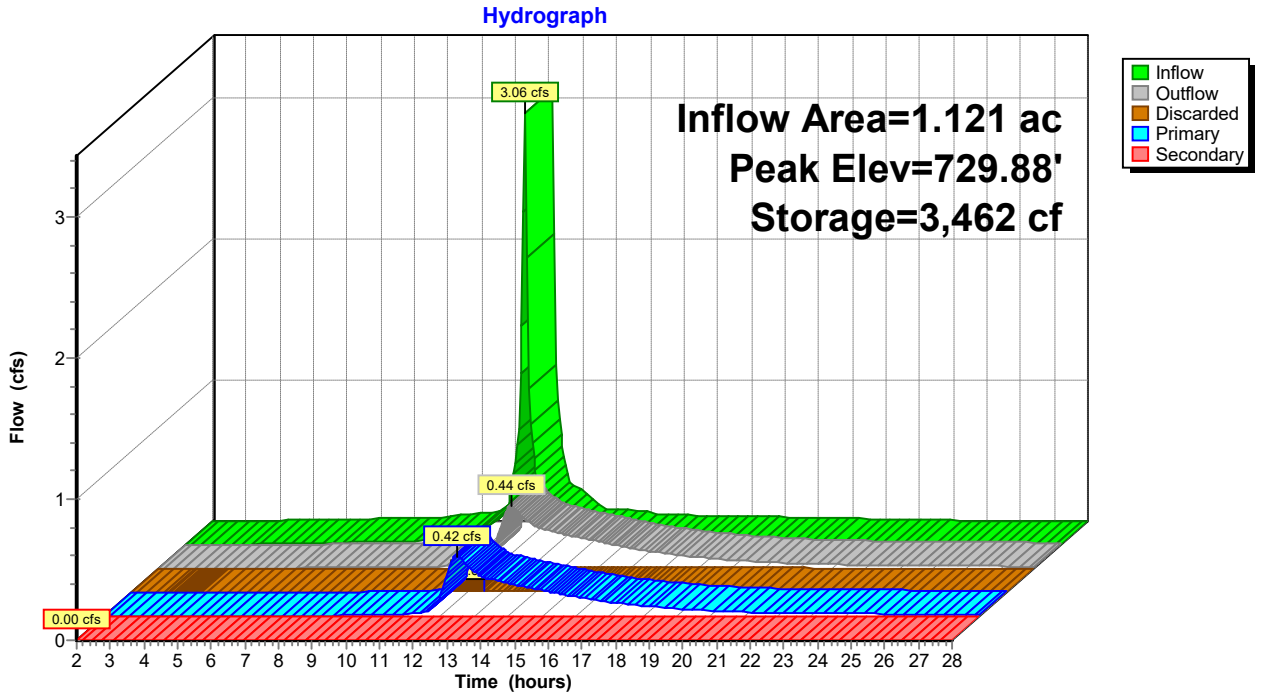
2.88

Discarded OutFlow Max=0.02 cfs @ 12.47 hrs HW=729.88' (Free Discharge)
└**1=Exfiltration** (Controls 0.02 cfs)

Primary OutFlow Max=0.42 cfs @ 12.47 hrs HW=729.88' TW=0.00' (Dynamic Tailwater)
└**2=12" STM** (Passes 0.42 cfs of 5.84 cfs potential flow)
└**3=Underdrains** (Exfiltration Controls 0.30 cfs)
└**4=6" Standpipe** (Weir Controls 0.12 cfs @ 0.94 fps)

Secondary OutFlow Max=0.00 cfs @ 2.00 hrs HW=727.00' TW=0.00' (Dynamic Tailwater)
└**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 2P: Biofilter

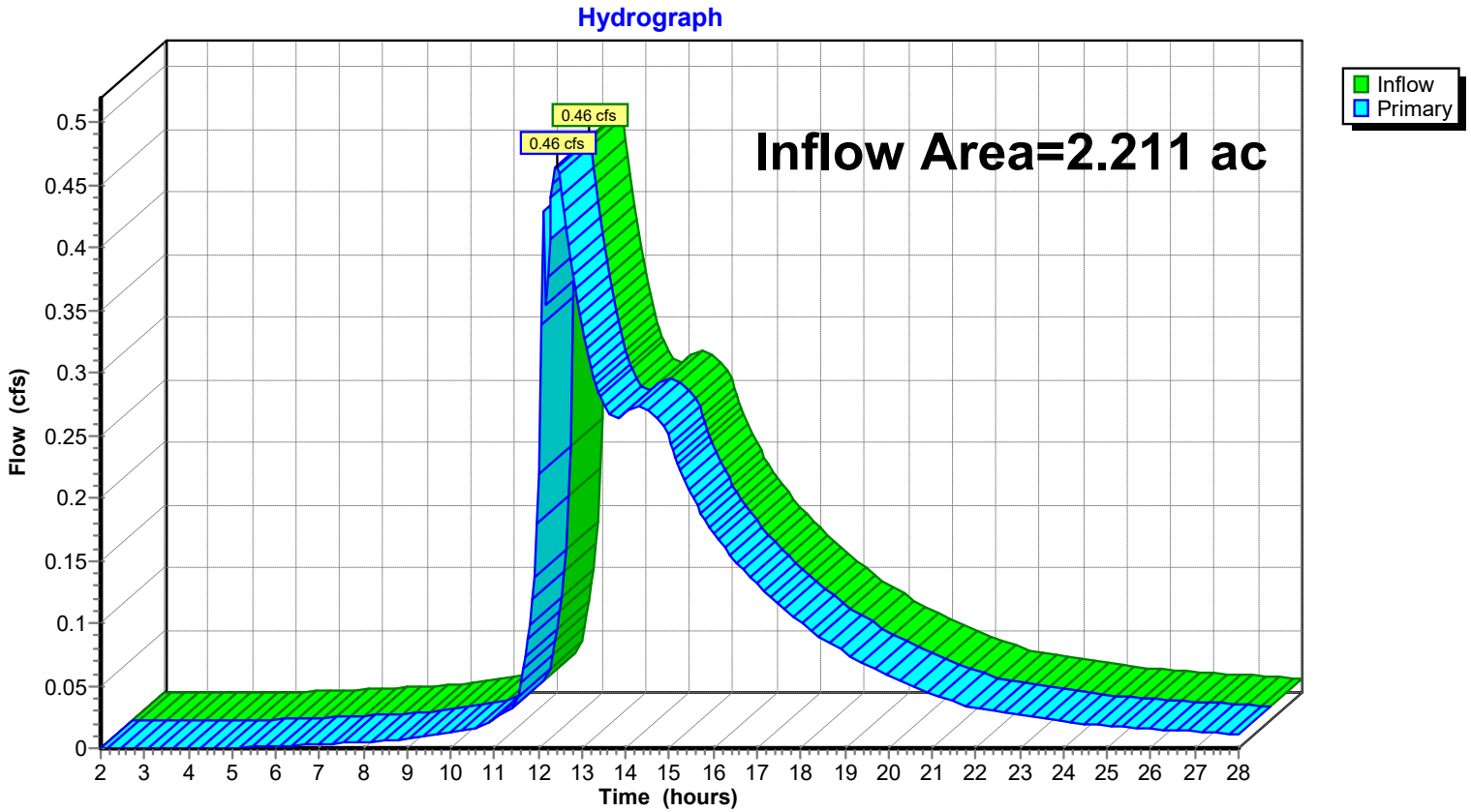


Summary for Link O: Outlet

Inflow Area = 2.211 ac, 52.56% Impervious, Inflow Depth > 0.84" for 2-yr event
Inflow = 0.46 cfs @ 12.41 hrs, Volume= 0.156 af
Primary = 0.46 cfs @ 12.41 hrs, Volume= 0.156 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 2.00-28.00 hrs, dt= 0.05 hrs

Link O: Outlet



Time span=2.00-28.00 hrs, dt=0.05 hrs, 521 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: BLDG Roof Runoff Area=29,534 sf 81.12% Impervious Runoff Depth=3.63"
Flow Length=128' Slope=0.5000 '/' Tc=0.4 min CN=WQ Runoff=4.31 cfs 0.205 af

Subcatchment 2S: N Site Runoff Area=10,019 sf 2.18% Impervious Runoff Depth=1.13"
Flow Length=363' Tc=5.2 min CN=WQ Runoff=0.44 cfs 0.022 af

Subcatchment 3S: SW Site Runoff Area=48,831 sf 52.10% Impervious Runoff Depth=2.71"
Flow Length=291' Tc=3.3 min CN=WQ Runoff=5.25 cfs 0.253 af

Subcatchment 4S: SE Site Runoff Area=7,928 sf 12.64% Impervious Runoff Depth=1.46"
Flow Length=202' Slope=0.0280 '/' Tc=1.8 min CN=WQ Runoff=0.52 cfs 0.022 af

Reach 1R: North Swale Avg. Flow Depth=0.67' Max Vel=2.89 fps Inflow=4.31 cfs 0.205 af
n=0.025 L=253.0' S=0.0111 '/' Capacity=11.41 cfs Outflow=3.92 cfs 0.205 af

Pond 1P: Rain Garden Peak Elev=724.82' Storage=5,184 cf Inflow=4.31 cfs 0.226 af
Discarded=0.01 cfs 0.020 af Primary=1.87 cfs 0.102 af Outflow=1.88 cfs 0.122 af

Pond 2P: Biofilter Peak Elev=730.19' Storage=5,175 cf Inflow=5.25 cfs 0.253 af
Discarded=0.02 cfs 0.016 af Primary=1.03 cfs 0.226 af Secondary=0.00 cfs 0.000 af Outflow=1.05 cfs 0.243 af

Link O: Outlet Inflow=3.03 cfs 0.351 af
Primary=3.03 cfs 0.351 af

Total Runoff Area = 2.211 ac Runoff Volume = 0.501 af Average Runoff Depth = 2.72"
47.44% Pervious = 1.049 ac 52.56% Impervious = 1.162 ac

Summary for Subcatchment 1S: BLDG Roof

[49] Hint: Tc<2dt may require smaller dt

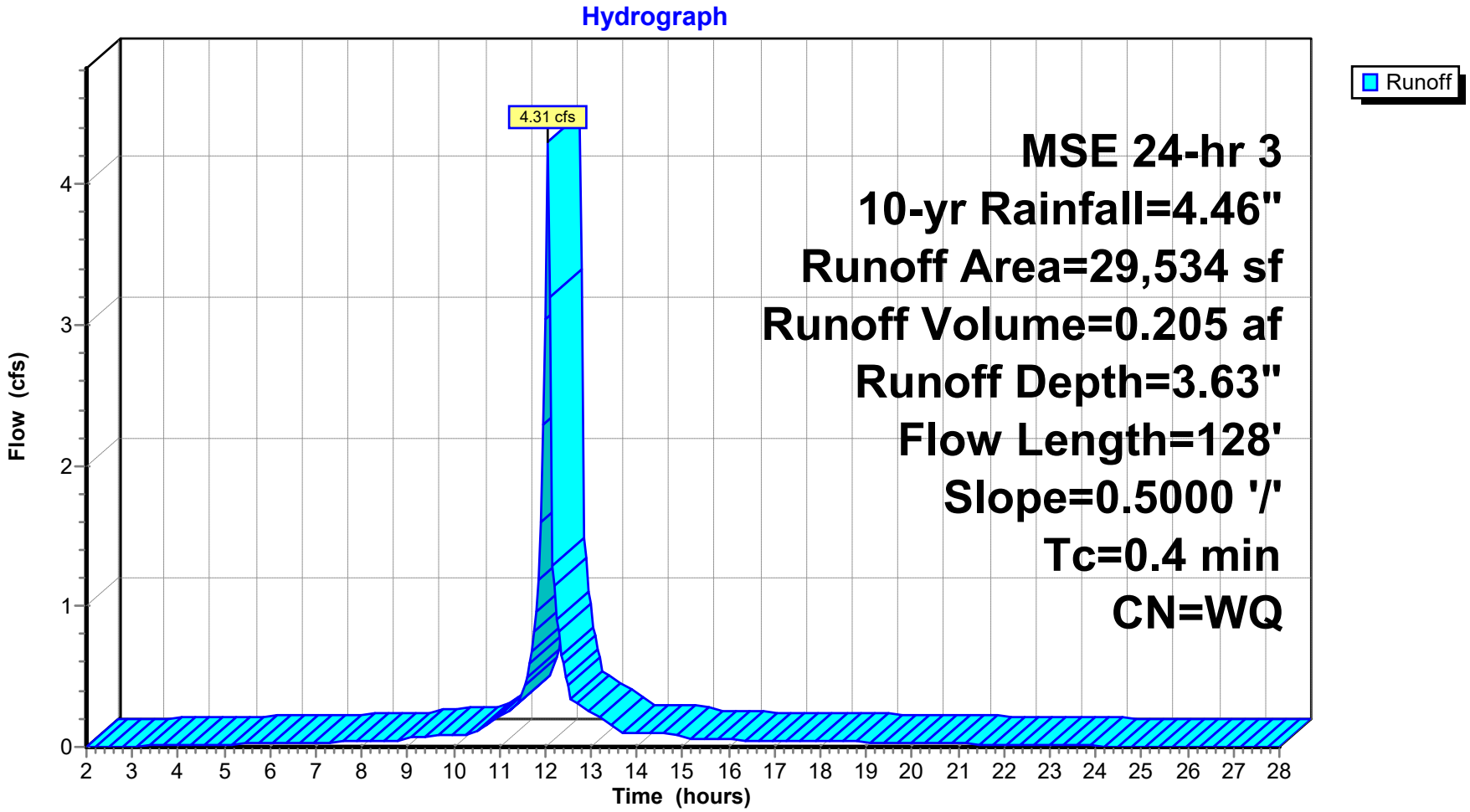
Runoff = 4.31 cfs @ 12.05 hrs, Volume= 0.205 af, Depth= 3.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 2.00-28.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 10-yr Rainfall=4.46"

Area (sf)	CN	Description
23,958	98	Unconnected roofs, HSG B
5,576	61	>75% Grass cover, Good, HSG B
29,534		Weighted Average
5,576		18.88% Pervious Area
23,958		81.12% Impervious Area
23,958		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	128	0.5000	5.08		**Sheet Flow, Roof** Smooth surfaces n= 0.011 P2= 3.01"

Subcatchment 1S: BLDG Roof



Summary for Subcatchment 2S: N Site

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.44 cfs @ 12.13 hrs, Volume= 0.022 af, Depth= 1.13"

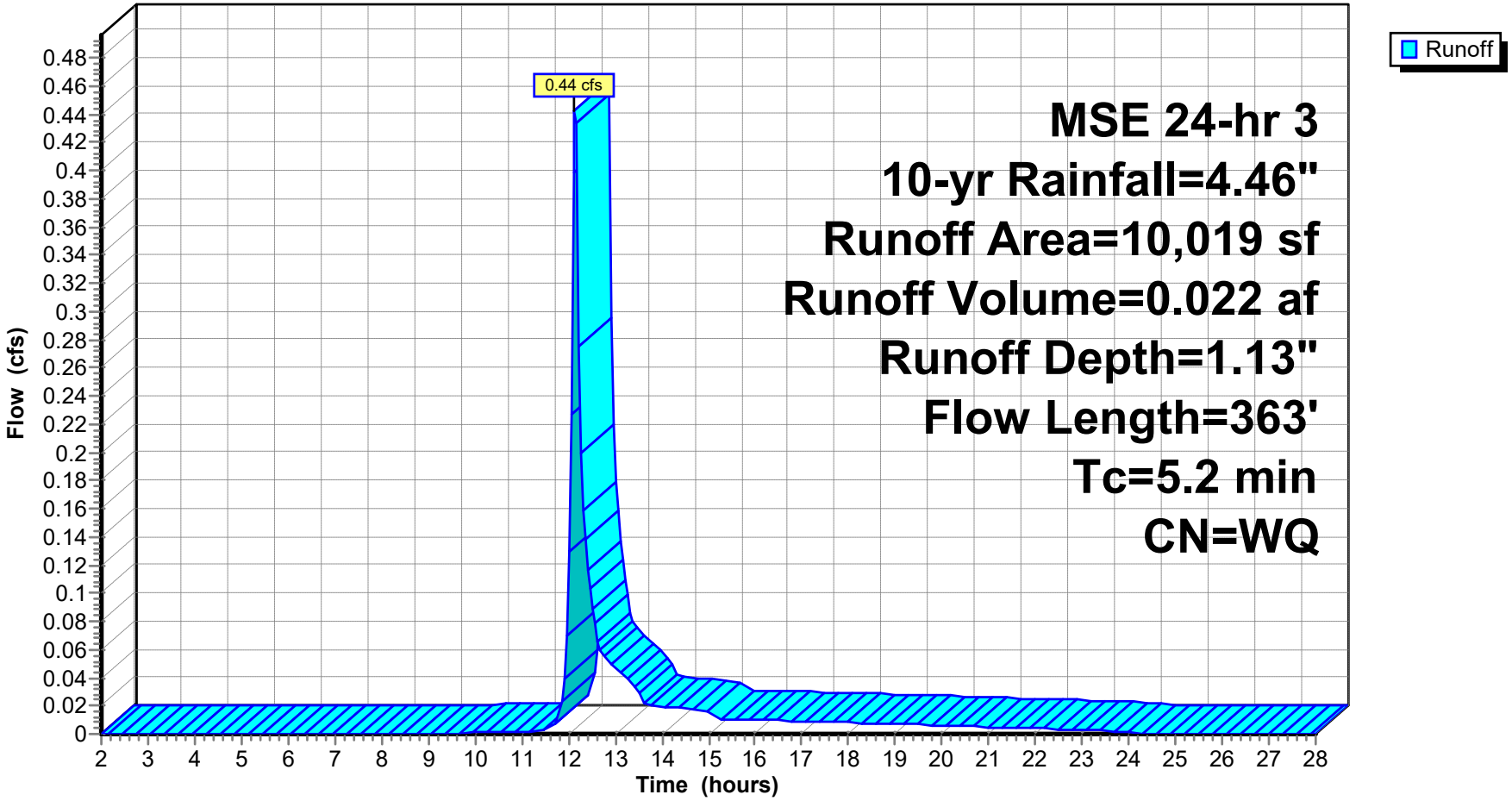
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 2.00-28.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 10-yr Rainfall=4.46"

	Area (sf)	CN	Description
	9,801	61	>75% Grass cover, Good, HSG B
*	218	98	Sidewalk, HSG B
	10,019		Weighted Average
	9,801		97.82% Pervious Area
	218		2.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	8	0.0200	0.10		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.01"
3.9	355	0.0100	1.50		**Shallow Concentrated Flow, Shallow Concentrated** Grassed Waterway Kv= 15.0 fps
5.2	363	Total			

Subcatchment 2S: N Site

Hydrograph



Summary for Subcatchment 3S: SW Site

[49] Hint: Tc<2dt may require smaller dt

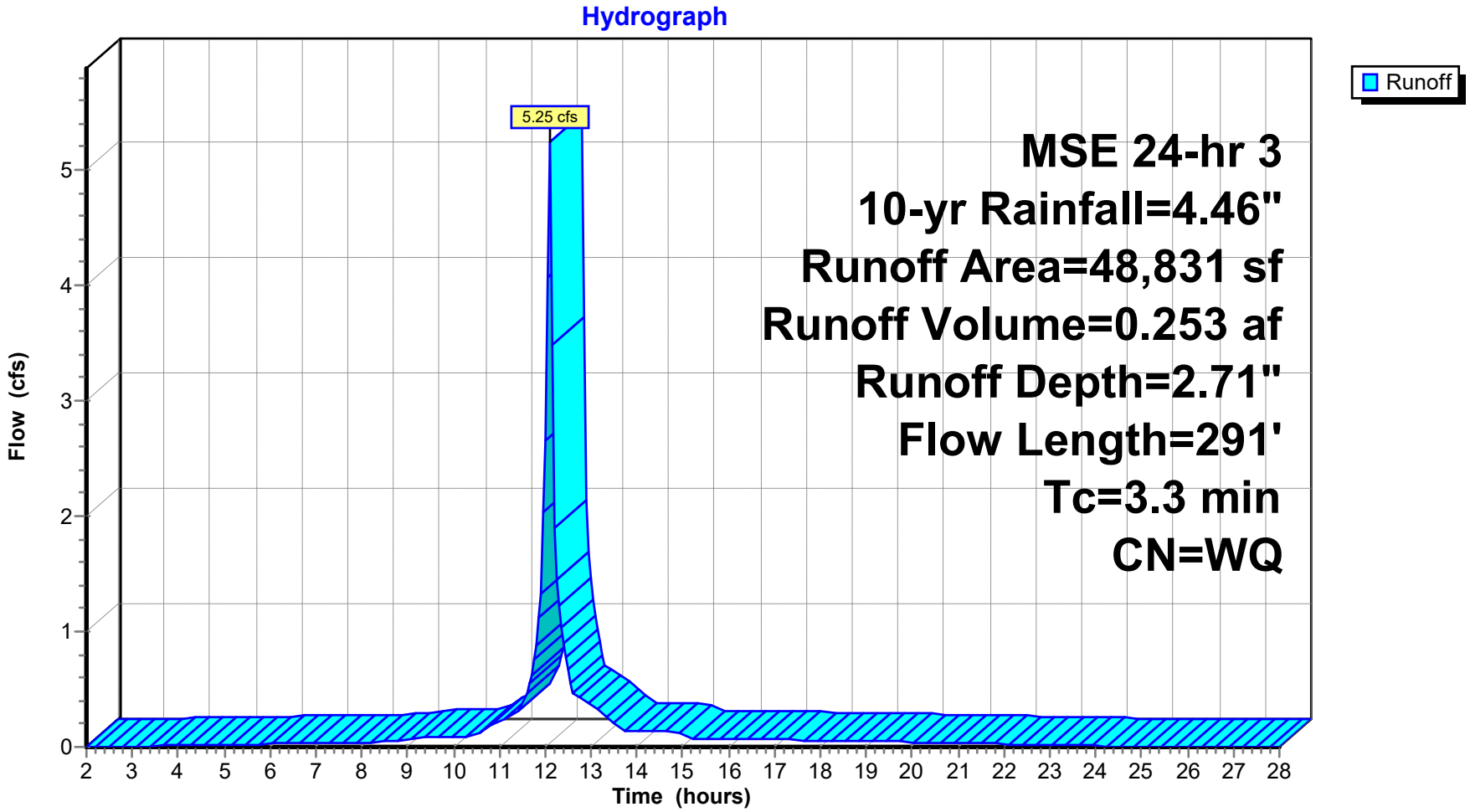
Runoff = 5.25 cfs @ 12.10 hrs, Volume= 0.253 af, Depth= 2.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 2.00-28.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 10-yr Rainfall=4.46"

	Area (sf)	CN	Description
	24,568	98	Paved parking, HSG B
	23,392	61	>75% Grass cover, Good, HSG B
*	871	98	Sidewalk, HSG B
	48,831		Weighted Average
	23,392		47.90% Pervious Area
	25,439		52.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	96	0.0280	1.51		**Sheet Flow, Parking**
					Smooth surfaces n= 0.011 P2= 3.01"
2.2	195	0.0100	1.50		**Shallow Concentrated Flow, Pervious**
					Grassed Waterway Kv= 15.0 fps
3.3	291	Total			

Subcatchment 3S: SW Site



Summary for Subcatchment 4S: SE Site

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.52 cfs @ 12.09 hrs, Volume= 0.022 af, Depth= 1.46"

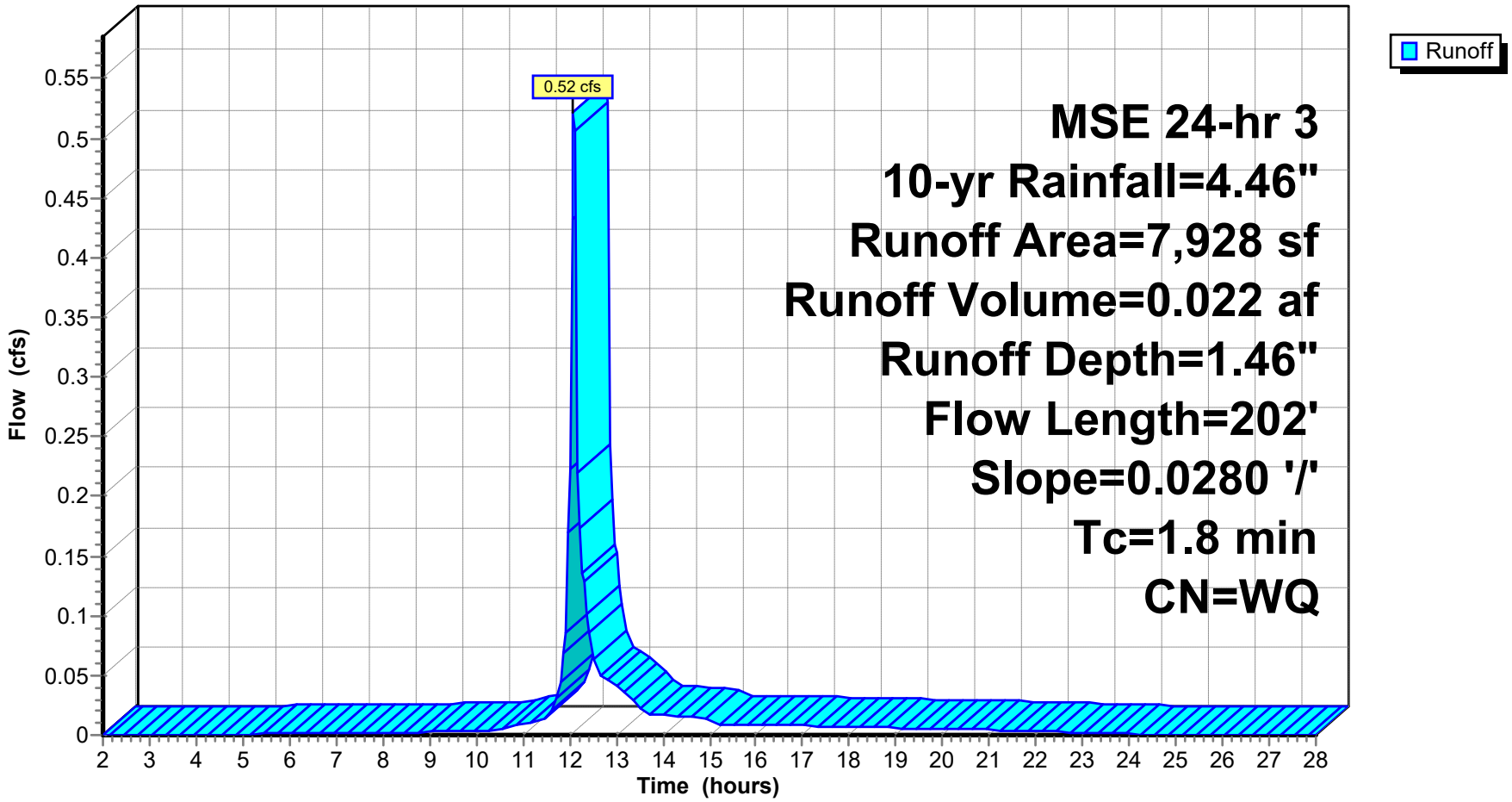
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 2.00-28.00 hrs, dt= 0.05 hrs
MSE 24-hr 3 10-yr Rainfall=4.46"

	Area (sf)	CN	Description
*	1,002	98	Loading Dock, HSG B
	6,926	61	>75% Grass cover, Good, HSG B
	7,928		Weighted Average
	6,926		87.36% Pervious Area
	1,002		12.64% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	96	0.0280	1.51		**Sheet Flow, Parking**
					Smooth surfaces n= 0.011 P2= 3.01"
0.7	106	0.0280	2.51		**Shallow Concentrated Flow, Pervious**
					Grassed Waterway Kv= 15.0 fps
1.8	202	Total			

Subcatchment 4S: SE Site

Hydrograph



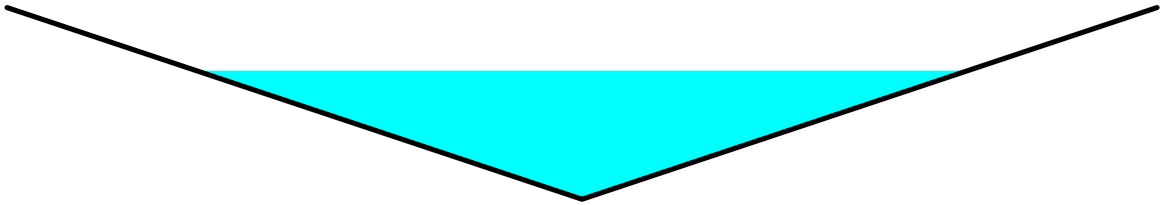
Summary for Reach 1R: North Swale

Inflow Area = 0.678 ac, 81.12% Impervious, Inflow Depth = 3.63" for 10-yr event
Inflow = 4.31 cfs @ 12.05 hrs, Volume= 0.205 af
Outflow = 3.92 cfs @ 12.07 hrs, Volume= 0.205 af, Atten= 9%, Lag= 1.2 min

Routing by Dyn-Stor-Ind method, Time Span= 2.00-28.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.89 fps, Min. Travel Time= 1.5 min
Avg. Velocity = 0.93 fps, Avg. Travel Time= 4.5 min

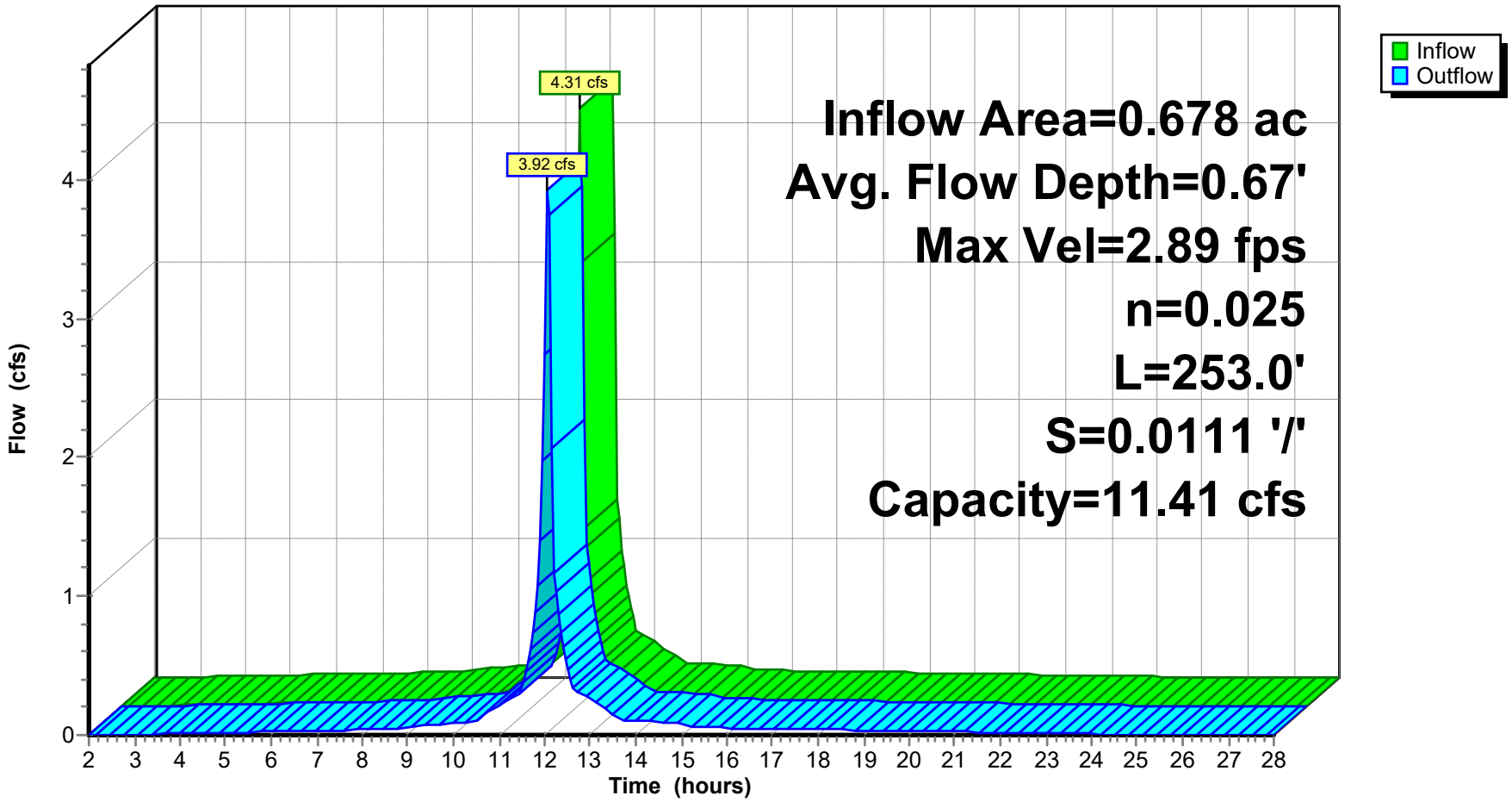
Peak Storage= 341 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.67'
Bank-Full Depth= 1.00' Flow Area= 3.0 sf, Capacity= 11.41 cfs

0.00' x 1.00' deep channel, n= 0.025 Earth, grassed & winding
Side Slope Z-value= 3.0 '/' Top Width= 6.00'
Length= 253.0' Slope= 0.0111 '/'
Inlet Invert= 734.50', Outlet Invert= 731.70'



Reach 1R: North Swale

Hydrograph



Summary for Pond 1P: Rain Garden

Inflow Area = 0.908 ac, 61.12% Impervious, Inflow Depth = 2.99" for 10-yr event
Inflow = 4.31 cfs @ 12.08 hrs, Volume= 0.226 af
Outflow = 1.88 cfs @ 12.20 hrs, Volume= 0.122 af, Atten= 56%, Lag= 7.4 min
Discarded = 0.01 cfs @ 12.20 hrs, Volume= 0.020 af
Primary = 1.87 cfs @ 12.20 hrs, Volume= 0.102 af

Routing by Dyn-Stor-Ind method, Time Span= 2.00-28.00 hrs, dt= 0.05 hrs
Peak Elev= 724.82' @ 12.20 hrs Surf.Area= 3,489 sf Storage= 5,184 cf

Plug-Flow detention time= 202.1 min calculated for 0.122 af (54% of inflow)
Center-of-Mass det. time= 112.4 min (870.1 - 757.7)

Volume	Invert	Avail.Storage	Storage Description
#1	723.00'	5,822 cf	**Custom Stage Data (Pyramidal)** Listed below (Recalc)

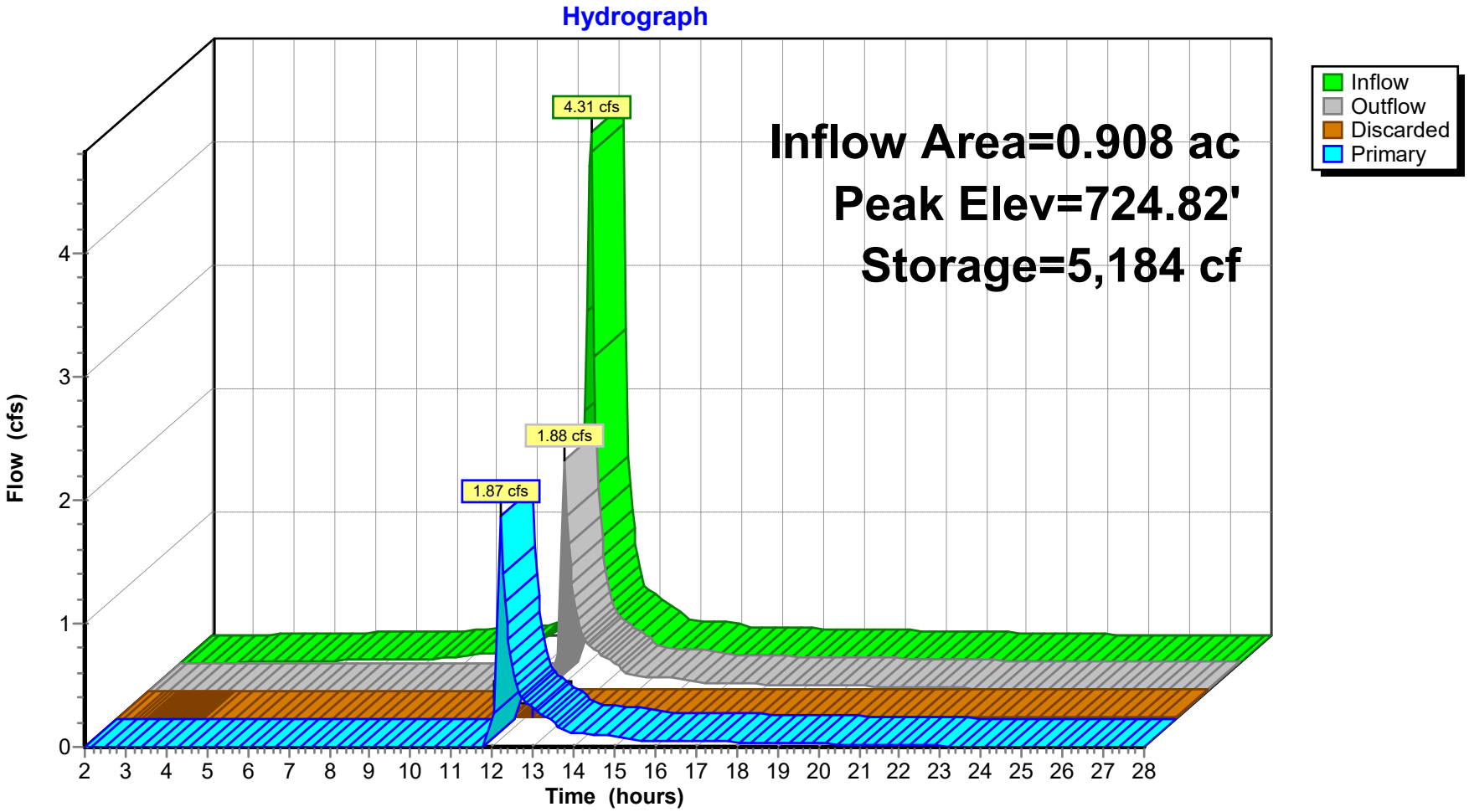
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
723.00	2,250	0	0	2,250
725.00	3,626	5,822	5,822	3,692

Device	Routing	Invert	Outlet Devices
#1	Discarded	723.00'	**0.130 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 704.00' Phase-In= 0.01'
#2	Primary	724.67'	**Outlet Weir, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 0.21 Width (feet) 0.00 34.00

Discarded OutFlow Max=0.01 cfs @ 12.20 hrs HW=724.82' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.01 cfs)

Primary OutFlow Max=1.86 cfs @ 12.20 hrs HW=724.82' TW=0.00' (Dynamic Tailwater)
↑—**2=Outlet Weir** (Weir Controls 1.86 cfs @ 1.02 fps)

Pond 1P: Rain Garden



Summary for Pond 2P: Biofilter

Inflow Area = 1.121 ac, 52.10% Impervious, Inflow Depth = 2.71" for 10-yr event
Inflow = 5.25 cfs @ 12.10 hrs, Volume= 0.253 af
Outflow = 1.05 cfs @ 12.35 hrs, Volume= 0.243 af, Atten= 80%, Lag= 15.4 min
Discarded = 0.02 cfs @ 12.35 hrs, Volume= 0.016 af
Primary = 1.03 cfs @ 12.35 hrs, Volume= 0.226 af
Secondary = 0.00 cfs @ 2.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 2.00-28.00 hrs, dt= 0.05 hrs
Peak Elev= 730.19' @ 12.35 hrs Surf.Area= 6,419 sf Storage= 5,175 cf

Plug-Flow detention time= 149.8 min calculated for 0.243 af (96% of inflow)
Center-of-Mass det. time= 128.4 min (890.6 - 762.2)

Volume	Invert	Avail.Storage	Storage Description
#1	727.00'	7,462 cf	**Custom Stage Data (Pyramidal)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
727.00	1,500	0.0	0	0	1,500
729.00	1,500	27.0	810	810	1,810
730.50	8,280	100.0	6,652	7,462	8,601

Device	Routing	Invert	Outlet Devices
#1	Discarded	727.00'	**0.130 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 704.00' Phase-In= 0.01'
#2	Primary	727.00'	**12.0" Round 12" STM** L= 50.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 727.00' / 722.78' S= 0.0844 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf
#3	Device 2	727.02'	**3.600 in/hr Underdrains over Wetted area above 727.02'** Excluded Wetted area = 1,503 sf Phase-In= 0.01'
#4	Device 2	729.80'	**6.0" Horiz. 6" Standpipe** C= 0.600 Limited to weir flow at low heads
#5	Secondary	730.25'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79

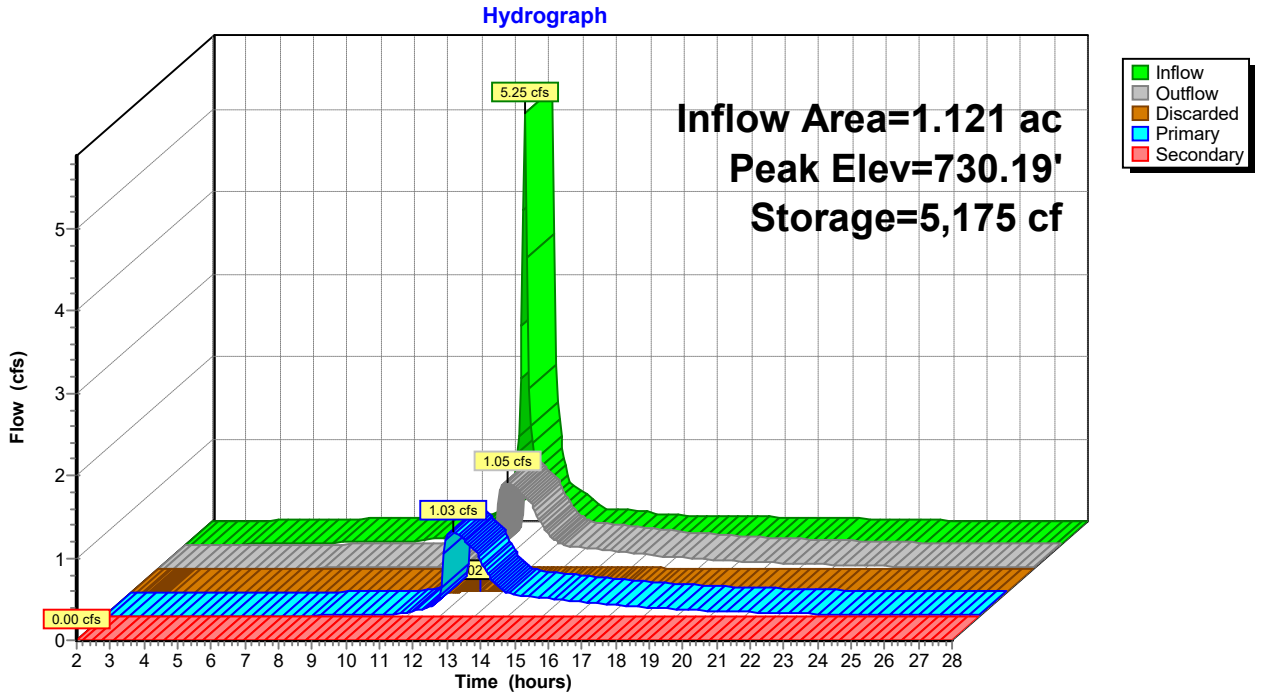
2.88

Discarded OutFlow Max=0.02 cfs @ 12.35 hrs HW=730.19' (Free Discharge)
└**1=Exfiltration** (Controls 0.02 cfs)

Primary OutFlow Max=1.02 cfs @ 12.35 hrs HW=730.19' TW=0.00' (Dynamic Tailwater)
└**2=12" STM** (Passes 1.02 cfs of 6.20 cfs potential flow)
  └**3=Underdrains** (Exfiltration Controls 0.44 cfs)
  └**4=6" Standpipe** (Orifice Controls 0.59 cfs @ 3.00 fps)

Secondary OutFlow Max=0.00 cfs @ 2.00 hrs HW=727.00' TW=0.00' (Dynamic Tailwater)
└**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 2P: Biofilter



Summary for Link O: Outlet

Inflow Area = 2.211 ac, 52.56% Impervious, Inflow Depth > 1.90" for 10-yr event
Inflow = 3.03 cfs @ 12.20 hrs, Volume= 0.351 af
Primary = 3.03 cfs @ 12.20 hrs, Volume= 0.351 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 2.00-28.00 hrs, dt= 0.05 hrs

Link O: Outlet