Atlantic
DESIGN ENGINEERS, INC.

Letter of Transmittal

To: Breeka Lí Goodlander
Franklin Conservation Commission
355 East Central Street
Franklin, MA 02038

Date: 11-10-2023
Project #: 3328.00
Project: Upper Union Solar Project

We are sending you:

✓ Enclosed __ Under separate cover

Via:

__ Direct from printer __Taxi
__ Messenger __ Mail

The following items:

___Prints ___ Sepias __Tracings ____ Reports ____ Shop Drawings __Original Drawings
___Mylar ___ Linen __Specifications ___ Samples ___ Other

Description:

Nine (9) copies of full size Revised Site Plans dated November 10, 2023
Nine (9) copies Response to BETA Notice of Intent Peer Review Comments by Atlantic dated November 10, 2023
Nine (9) copies Response to MassDEP Comments by Atlantic dated November 10, 2023
Nine (9) copies Response to Peer Review Comments by Goddard Consulting LLC dated November 13, 2023
Nine (9) copies Request for Newly Required Variances by Goddard Consulting LLC dated November 14, 2023
Nine (9) copies Wetland Replication Plan by Goddard Consulting LLC dated November 14, 2023
Nine (9) copies Functions and Characteristic Statement by Goddard Consulting LLC dated November 15, 2023
Nine (9) copies Buffer Zone Mitigation Plan by Goddard Consulting LLC dated November 13, 2023
Nine (9) copies StreamStats Report by Goddard Consulting LLC dated November 13, 2023
One (1) copy Stormwater Addendum #1 By Atlantic dated November 10, 2023

Remarks:

Signed: Richard J. Tabaczynski, P.E.

Copy to: _____

P.O. Box 1051
Sandwich, MA 02563
(508) 888-9282 · FAX 888-5859
email: ade@atlanticcompanies.com
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RESPONSE TO BETA NOI PEER REVIEW COMMENTS

DESIGN ENGINEERS, INC.

November 10, 2023

Breeka Lí Goodlander, Agent
Town of Franklin Conservation Commission
355 East Central Street
Franklin, MA 02038

RE: Response to BETA Notice of Intent Peer Review Comments, August 18, 2023
Upper Union Solar Project – Franklin, MA
ADE Job #3328.00
DEP File #CE 159-1281

Dear Ms. Goodlander:

This response letter addresses the comments made in the BETA Notice of Intent Peer Review Comments Letter dated August 18, 2023, for above-referenced project. Please note the peer review comments are italicized, and our responses follow in bold text:

ADMINISTRATIVE AND PLAN COMMENTS

The plan set (as identified above) is missing information and requires additional information for clarity.

Table 1. NOI Plan

NOI Plan Requirements	*Yes*	*No*
Scale of 40'=1" or larger	☐	
North Arrow (with reference)	☐	
Topographic contours (2' intervals)	☐	
Existing Conditions Topography (with source and date of survey)	☐	
Proposed Topography	☐	
Existing and Proposed Vegetation	☐	
Existing Structures and Improvements	☐	
Resource Areas and Buffer Zones labeled	☐	
Location of Erosion Controls	☐	
Details of Proposed Structures	☐	
Construction Sequence and Schedule		✓ *(See comment A2)*
Registered PLS Stamp (Existing Condition Plans Only)		✓ *(See comment A3)*
Assessors' Reference	✓	
Abutting Property Assessors' Reference	✓	
Survey Benchmark	✓	
Accurate Plan Scale	✓	

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PLAN AND GENERAL COMMENTS

A1. As of August 18, 2023, MassDEP has not issued a file number.

The DEP file number is CE 159-1281.

A2. Provide a Construction Schedule and Sequence in the plan notes as required under Section 7.18.1.14. of the Bylaw.

Refer to the Construction Sequence and Schedule by Atlantic Design Engineers, Inc. dated 11/10/2023.

A3. The Existing Conditions Plans must be stamped by a Professional Land Surveyor registered in the state of Massachusetts.

The revised existing conditions plan sheets are stamped by a PLS.

A4. The NOI narrative references a total of 31,676 sf of alteration proposed within the Buffer Zones to local and state jurisdictional Resource Areas; however, the Resource Area Impact Summary Form references a total of 33,923 sf of Buffer Zone alteration. The Applicant should clarify the correct square footage of proposed impact to Buffer Zone.

The square footage of impact to Buffer Zone was revised due to additional wetlands found and site design changes. It is provided on the revised site plans.

A5. Provide a note stating who performed the wetland delineation and when it occurred.

This note is provided on Sheet 2 of the revised site plans.

WETLAND RESOURCE AREAS AND REGULATORY REVIEW

BETA conducted an onsite review and completed a regulatory review of the submitted documents and plans, focusing on compliance with Resource Area definitions and Performance Standards set forth in the Act and the Bylaw. The Project Narrative states that proposed work will only occur within Buffer Zone; however, it appears that impacts to IVW will be required to construct the Project as designed (Comment W6). The Project is subject to the MassDEP Stormwater Standards and a review of compliance with these Standards is being completed by BETA as part of the Planning Board review process.

The NOI application includes narrative information describing the Project and the proposed impacts within the Buffer Zone. However, impacts to the IVW that BETA observed in the field will require quantification by the Applicant, as well as demonstration of the Avoid/Minimize/Mitigate sequencing. Mitigation measures presently include use of erosion controls, installation of Stormwater Best Management Practices (BMP's), and Buffer Zone restoration. It is recommended that the Applicant review the Resource Area boundary comments presented in this letter to determine if

any modifications to the Bylaw Variance request or the proposed Buffer Zone mitigation plan are required. In addition, any revised materials should include all materials required under the Bylaw including a construction sequencing plan and a functions and characteristics statement.

Additional information is required to describe the effects of the work on the interests of the Act and the Bylaw, including demonstration of compliance with the Massachusetts Stormwater Management Standards, demonstration of compliance with the Bylaw, and reassessment of Resource Area boundaries.

Refer to Goddard Associates Response to Peer Review Comments.

RESOURCE AREA AND BOUNDARY COMMENTS

BETA conducted a Site visit on August 9, 2023 to assess existing conditions and to review Resource Area delineations, focusing on the definitions and methodologies referenced under the Act and the Bylaw. Review of Resource Area delineations was limited to locations where the delineated boundary was within, or may be within, 100 feet of the Limit of Work (LOW) and located within the subject Site.

W1. BETA concurs with the identification of the B-Series as an IVW Subject to Protection under the Bylaw.

No response necessary

W2. To verify the conclusions made in the Vernal Pool Evaluation, BETA reviewed the B-Series IVW for Vernal Pool indicators. During the Site visit, little to no standing water was observed within the B- Series IVW. Although the time BETA's assessment is not seasonally appropriate for an evaluation of the presence of Vernal Pool species, BETA does concur that there was insufficient evidence to support ponding at a depth sufficient to support Vernal Pool species common to this region. No other areas at the Site were observed to meet the criteria for a Vernal Pool.

No response necessary

W3. Hydric soil meeting the criteria for Hydric Soil Indicator F6 Redox Dark Surface and hydrophytic vegetation including spotted joe-pye weed, smooth arrowwood (Viburnum dentatum) and sensitive fern were observed approximately 5-10 feet upgradient of flag B-26.

The wetland boundary and flagging were revised in the field and are shown on the revised site plans. Refer to Goddard Associates Response to Peer Review Comments.

W4. Hydric soil meeting the criteria for Hydric Soil Indicator F6 Redox Dark

Surface[1] and hydrophytic vegetation including royal fern (Osmunda regalis), sensitive fern (Onoclea sensibilis), spotted joe- pye weed (Eutrochium maculatum), and purple loosestrife (Lythrum salicaria) were observed approximately 5-10 feet upgradient of flags A36-A38.

The wetland boundary and flagging were revised in the field and are shown on the revised site plans. Refer to Goddard Associates Response to Peer Review Comments.

W5. *Hydric soil meeting the criteria for Hydric Soil Indicator F6 Redox Dark Surface and hydrophytic vegetation including royal fern, sensitive fern, and cinnamon fern (Osmundastrum cinnamomeum) were observed 5-10 feet upgradient of flags A46 to A49.*

The wetland boundary and flagging were revised in the field and are shown on the revised site plans. Refer to Goddard Associates Response to Peer Review Comments.

W6. *Hydric soil indicators consisting of a depleted matrix under a thick, dark A horizon within 12" of the surface and hydrophytic vegetation including highbush blueberry (Vaccinium corymbosum), royal fern, cinnamon fern, and silky dogwood (Cornus amomum) were observed north of an existing stone wall and east of the existing stockpile. Based on BETA's observations, the Applicant should re-evaluate this area and flag the boundaries of additional Areas Subject to Protection under the Act and/or Bylaw.*

The wetland boundary and flagging were revised in the field and are shown on the revised site plans. Refer to Goddard Associates Response to Peer Review Comments.

W7. *Channelized flow along a hydraulic gradient was observed interior of the A Series wetland. This channel is not depicted on the Project plans but is described within the Wetland Border Report and depicted on Figure 1 of the Report. Based on BETA's observations, the channelized flow meets the definition of a stream with protected Bank and Land Under Water (LUW). This stream is not mapped on the most recent USGS maps; however, the Applicant should provide proof of the stream's status as intermittent using the StreamStats method identified in 310 CMR 10.58 (2)(a)1.c.i.*

Refer to Goddard Associates Response to Peer Review Comments.

CONSTRUCTION COMMENTS

W8. Material storage and laydown areas should be depicted on the Project plans and located outside of jurisdictional areas.

Material storage and laydown areas are shown outside of jurisdictional areas on the revised site plans.

W9. A swale with haybale check dams is proposed along the Site access roadway. The Applicant should clarify if this is intended to be a construction-period stormwater control, and BETA recommends that the haybales be replaced with straw to avoid the spread of non-native plant species.

The haybale check dams have been replaced with stone check dams in the revised site plans.

W10. The NOI narrative indicates that compost filter tubes and/or silt fence will be used as an erosion control measure. Silt fence is not a permitted erosion control measure in the Town of Franklin (Pg. 13 of Town of Franklin Best Development Practices Guidebook). BETA defers to the Commission regarding the use of silt fence.

The silt fence is proposed only in conjunction with the compost filter tubes as a double erosion control measure. This has been clarified on the plans.

W11. The project as currently depicted will disturb more than (1) one acre of land which will require preparation of a Stormwater Pollution Prevention Plan (SWPPP) and filing of a Notice of Intent with the EPA.

Acknowledged

MITIGATION COMMENTS

The Applicant proposed an approximately 617 sf mitigation area to offset approximately 308 sf of impact within the locally protected 25-foot No Disturb Buffer Zone associated with installation of a portion of the gravel access road and associated grading.

W12. The proposed mitigation is located within an existing unvegetated cart path. The path is well- defined, and the lack of vegetation may indicate soil compaction that could make establishment of the proposed plantings difficult. The Applicant should include a protocol within the Buffer Zone Mitigation Plan for use if the existing soil is compacted. Spreading a layer of loam of an undetermined thickness may not be a suitable planting medium if the underlying soil is compacted and/or unsuitable for planting. This protocol should also include a range of depths of loam that will be used dependent on soil conditions.

Refer to Goddard Associates Response to Peer Review Comments.

W13. Organic material (i.e. leaf litter) removed during preparation of the mitigation area for planting should be saved if feasible and spread within the mitigation area to increase organic content of the soil.

Refer to Goddard Associates Response to Peer Review Comments.

W14. BETA defers to the Commission to determine if the proposed mitigation is sufficient to offset the proposed impact to the Buffer Zone Resource Area pursuant to Section 7.11 of the Bylaw.

Acknowledged

WPA PERFORMANCE STANDARDS COMMENTS

The Project does not propose any work within Resource Areas Subject to Protection under the Act; however, the Project does propose work within Buffer Zone and local Buffer Zone Resource Areas.

BYLAW REGULATORY COMMENTS

W15. The following materials must be submitted per the submission requirements of the Bylaw Regulations:

a. *A Construction Sequence and Schedule (Section 7.15); and*

Refer to the Construction Sequence and Schedule by Atlantic Design Engineers, Inc. dated 11/10/2023.

b. *A complete Functions and Characteristics Statement (Section 7.10.1).*

c. **Refer to Goddard Associates Response to Peer Review Comments.**

W16. The Applicant has requested a Variance per Section 5 of the Bylaw Regulations for work within the 0-25 No Disturb Buffer Zone. BETA defers to the Commission for approval of the requested Variance.

Acknowledged

W17. Portions of the proposed gravel access road and Site fencing are proposed within the 25-50 Buffer Zone. BETA defers to the Commission regarding classification of the access road as a structure per Section 4.3.1 of the Bylaw Regulations and the requirement of an associated Variance request.

Acknowledged

STORMWATER MANAGEMENT

Stormwater management features proposed include the construction of a stormwater detention basin along the northerly edge of the access driveway at the western edge of the easement, a second detention basin at the far easterly edge of the parcel, and an infiltration trench and deep sump catch basin at the entrance. The two detention basins will capture stormwater runoff from the arrays and the gravel roadway. A catch basin is proposed at the Site entrance which will discharge to a subsurface infiltration trench beneath the driveway. Outfalls from this basin are proposed to convey captured stormwater runoff to the east. The remainder of the Site will generally follow pre-development flow patterns with no stormwater BMPs proposed.

A review of the Project's compliance with the Massachusetts Stormwater Management Standards and the applicable local Regulations was issued to the Planning Board on August 4, 2023. Currently, the Project does not fully comply with the Massachusetts Stormwater Standards, and revisions to the design are required to comply with the Standards.

Acknowledged

Please call us at (508) 888-9282 if you should have any questions.

Sincerely,

ATLANTIC DESIGN ENGINEERS, INC.

Richard J. Tabaczynski, P.E.
Vice President

RESPONSE TO MASSDEP COMMENTS

Atlantic
DESIGN ENGINEERS, INC.

November 10, 2023

Mr. Gregory Rondeau, Chairman
Franklin Planning Board
355 East Central Street
Franklin, MA 02038

RE: Response to MassDEP Comments, October 20, 2023
Upper Union Solar Project – Franklin, MA
ADE Job #3328.00
DEP File #CE 159-1281

Dear Mr. Rondeau:

This response letter addresses the comments made in the MassDEP's e-mail dated October 20, 2023 for above-referenced project. Please note the MassDEP's comments are italicized, and our responses follow in bold text:

The applicant should confirm that the detention basin will drain within 72 hours of precipitation events. The Cultec infiltration system should be clearly labelled on the Site Plans, and the applicant should verify that there is adequate separation (>4' or >2' with mounding calculations) between the bottom of the system and mean annual high groundwater.

Basin drawdown calculations are included in the Miscellaneous Calculations section of the Drainage Addendum. The Cultec chambers are labelled and clarified on the revised Site Plans, Sheet 6. The soil evaluated test pits confirmed adequate separation to groundwater.

A seed mix comprised of a diversity of native herbaceous species, sufficient topsoil, and infrequent mowing are recommended beneath the array.

The revised Site Plans indicate all areas disturbed due to solar construction to be planted with seed mix designed in accordance with the Town of Franklin Best Development Practices Guidebook along with a minimum of 6" of topsoil. Mowing is anticipated to be limited to twice a year.

Many solar arrays in Massachusetts experience erosion problems during construction. Phasing of the project, extra erosion control measures, and frequent monitoring are recommended to prevent erosion problems, particularly in areas with steep slopes, stony soils, or where panel configurations can cause gullies to form at the driplines.

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Additional intermediate rows of erosion control measures are provided on the revised Site Plans and erosion control notes have been added to instruct the contractor to limit the time of exposed soil prior to stabilization.

Please call us at (508) 888-9282 if you should have any questions.

Sincerely,

ATLANTIC DESIGN ENGINEERS, INC.

Richard J. Tabaczynski, P.E.
Vice President

CC: VS Union Solar Smart, LLC

RESPONSE TO PEER REVIEW COMMENTS – GODDARD CONSULTING

November 13, 2023

Franklin Conservation Commission
355 E Central Street
Franklin, MA 02038

Re: Response to Peer Review Comments for NOI
Upper Union Solar Project, Franklin, MA

Dear Franklin Conservation Commission,

Goddard Consulting, LLC, (Goddard) is pleased to submit this response letter on behalf of Colleen DeBenedetto (the Applicant) to provide responses to the project review comments issued by BETA Group in regard to the Notice of Intent (NOI) filed for 0 Upper Union Street, Franklin, MA (Map 319, Lot 9). This letter is a supplemental response to the response letter submitted by Atlantic Design Engineers, titled "Response to BETA Notice of Intent Peer Review Comments" and dated November 10, 2023. The purpose of this letter is to supplement Atlantic's letter and provide responses to all remaining comments pertinent to Goddard's work on the site.

On August 18, 2023, BETA Group issued a formal peer review letter of the Notice of Intent before the Conservation Commission for 0 Upper Union Street. Atlantic Design Engineers have provided responses to all comments regarding site design, construction, and stormwater. All comments pertaining to wetland resource areas were referenced to be responded to by Goddard Consulting. Goddard has provided responses to each comment at this time, and a revised site plan set is included with the submittal.

Table 1: BETA Group Peer Review Comment Responses

Comments Issued 8/18/2023 by BETA Group	Goddard Consulting Responses issued 11/13/2023
W3. Hydric soil meeting the criteria for Hydric Soil Indicator F6 Redox Dark Surface and hydrophytic vegetation including spotted joe-pye weed, smooth arrowwood (Viburnum dentatum) and sensitive fern were observed approximately 5-10 feet upgradient of flag B-26.	Goddard Consulting, Breeka Lí Goodlander, and Jonathan Niro of BETA Group visited the site together on September 28, 2023, to review the existing wetland delineation per the attached comment. On the site walk, Goddard agreed with the BETA comment that both soils meeting the criteria for a hydric soil as well as a predominance of wetland vegetation were located upgradient of flag GC B26. Two new flags, GC B26-1 and GC B26-2 were hung upgradient of the existing delineation. These flags were agreed upon in the field, surveyed, and added to the new site plan.
W4. Hydric soil meeting the criteria for Hydric Soil Indicator F6 Redox Dark Surface1 and hydrophytic vegetation including royal fern (Osmunda regalis), sensitive fern (Onoclea sensibilis), spotted joe- pye weed (Eutrochium maculatum), and purple loosestrife (Lythrum salicaria) were observed approximately 5-10 feet upgradient of flags A36-A38.	Goddard Consulting, Breeka Lí Goodlander, and Jonathan Niro of BETA Group visited the site together on September 28, 2023, to review the existing wetland delineation per the attached comment. On the site walk, Goddard and BETA reached an agreement that the soils upgradient of the existing delineation did not meet the criteria to be considered a wetland soil. The delineation was agreed upon to remain in place.
W5. Hydric soil meeting the criteria for Hydric Soil Indicator F6 Redox Dark Surface and hydrophytic	Goddard Consulting, Breeka Lí Goodlander, and Jonathan Niro of BETA Group visited the site together on September 28, 2023, to

vegetation including royal fern, sensitive fern, and cinnamon fern (Osmundastrum cinnamomeum) were observed 5-10 feet upgradient of flags A46 to A49.	review the existing wetland delineation per the attached comment. On the site walk, Goddard agreed with the BETA comment that both soils meeting the criteria for a hydric soil as well as a predominance of wetland vegetation were located upgradient of the existing delineation above A46 to A49. Flags GC A46 to A48 were removed in the field. New wetland flags GC A46R, GC A47R, GC A47-1, GC A48R, and GC A48-1 were hung in the field upgradient of the old flags. These flags were agreed upon in the field, surveyed, and added to the new site plan.
W6. Hydric soil indicators consisting of a depleted matrix under a thick, dark A horizon within 12" of the surface and hydrophytic vegetation including highbush blueberry (Vaccinium corymbosum), royal fern, cinnamon fern, and silky dogwood (Cornus amomum) were observed north of an existing stone wall and east of the existing stockpile. Based on BETA's observations, the Applicant should re-evaluate this area and flag the boundaries of additional Areas Subject to Protection under the Act and/or Bylaw.	Goddard Consulting, Breeka Lí Goodlander, and Jonathan Niro of BETA Group visited the site together on September 28, 2023, to review the existing wetland delineation per the attached comment. On the site walk, Goddard and BETA located the area in question. The area was identified as an isolated vegetated wetland jurisdictional under the local bylaw. As such, the area was flagged with series GC I1 to GC I15. These flags were agreed upon in the field, surveyed, and added to the new site plan.
W7. Channelized flow along a hydraulic gradient was observed interior of the A Series wetland. This channel is not depicted on the Project plans but is described within the Wetland Border Report and depicted on Figure 1 of the Report. Based on BETA's observations, the channelized flow meets the definition of a stream with protected Bank and Land Under Water (LUW). This stream is not mapped on the most recent USGS maps; however, the Applicant should provide proof of the stream's status as intermittent using the StreamStats method identified in 310 CMR 10.58 (2)(a)1.c.i.	Goddard agrees that there in an intermittent stream with channelized flow internal of the A-Series wetland. As the area is not proposed to be impacted, no delineation of the area was deemed necessary. However, to document the area as intermittent, Goddard has attached a StreamStats documentation of the area. The viable sampling point was significantly downstream of the site, however still yields an intermittent stream documentation, with a 99% flow duration of .00174, and a drainage area of .17 square miles.
W12. The proposed mitigation is located within an existing unvegetated cart path. The path is well- defined, and the lack of vegetation may indicate soil compaction that could make establishment of the proposed plantings difficult. The Applicant should include a protocol within the Buffer Zone Mitigation Plan for use if the existing soil is compacted. Spreading a layer of loam of an undetermined thickness may not be a suitable planting medium if the underlying soil is compacted and/or unsuitable for planting. This protocol should also include a range of depths of loam that will be used dependent on soil conditions.	Goddard Consulting has revised the original restoration plan with a date of 11/13/2023 to address the attached comment. In this revised plan, Goddard added a section discussing the potential for compacted soils, and how to ensure proper planting substrate if encountered.
W13. Organic material (i.e. leaf litter) removed during preparation of the mitigation area for planting should be saved if feasible and spread within the mitigation area to increase organic content of the soil.	Goddard agrees with the attached comment. Materials such as leaf litter, logs, and rocks will be saved and placed over the final restoration area. This will assist in the organic content of the soil, while also creating microhabitats along the previously barren path.

W15B. The following materials must be submitted per the submission requirements of the Bylaw Regulations: b. A complete Functions and Characteristics Statement (Section 7.10.1).	In accordance with the local bylaw, Goddard has submitted a Functions and Characteristics Statement dated 11/13/ as part of this supplemental submittal.

As outlined in the table above, the following documents are attached to this supplemental submittal:

- *Buffer Zone Mitigation Plan,* Goddard Consulting LLC. REV. 11/13/2023
- *StreamStats Analysis.* Accessed by Goddard Consulting LLC on 11/13/2023
- *Functions and Characteristics Statement,* Goddard Consulting LLC. 11/13/2023

As of 11/13/2023, it is Goddard's opinion that all remaining comments from the site's peer review have been adequately addressed and all necessary materials have been submitted. If you have any questions, please do not hesitate to reach out.

Sincerely,

Goddard Consulting, LLC
Andrew Thibault
Andrew Thibault, WPIT, WSA
Environmental Scientist

CC: Mass DEP – CERO - Wetlands Division, 8 New Bond Street, Worcester, MA 01606

REQUEST FOR NEWLY REQUIRED VARIANCES - GODDARD CONSULTING LLC

GODDARD CONSULTING
Strategic Ecological Consulting

November 14, 2023

Franklin Conservation Commission
355 E. Central Street
Franklin, MA 02038

Re: Request for Newly Required Variances – 0 Upper Union Street, Franklin MA (Map: 319, Parcel: 9)

Dear Franklin Conservation Commission,

On behalf of VS Union Solar Smart, LLC (the applicant), Goddard Consulting, LLC (representative) is hereby submitting this request for two newly required variances for the proposed solar array and associated stormwater management currently before the conservation commission at 0 Upper Union Street, Franklin MA (Map: 319, Parcel: 9). This request is a supplement to the Notice of Intent application submitted concurrently as required by the local wetlands bylaw and regulations. Site constraints, including the existing power easement through the site, provide difficulty to take additional mitigation measures on the lot.

As noted in the attached supplemental submittal packet, alterations to the wetland delineation were made in September of 2023 during the peer review process. Most notably, an isolated vegetated wetland jurisdictional under the local bylaw was delineated with GC I1 – GC I15 in the northern portions of the site, within the proposed solar array. Additionally, the B-Series isolated vegetated wetland had two wetland flags hung upgradient of the prior delineation in the area of the proposed roadway, flags GC B26-1 and GC B26-2. These additional flags led to an increase in the encroachment of the 25-foot no disturb zone as outlined in the local bylaw.

1.0 Waiver Request for Fill and Replication of the GC I-Series Isolated Vegetated Wetland

As outlined above, during the peer review process in the fall of 2023, an isolated vegetated wetland jurisdictional under the local bylaw was delineated with GC I1 – GC I15 in the northern portions of the site, within the proposed solar array. This locally regulated IVW measures 1647 SF. The area is characterized by a slight break in topography forming a shallow depressional area. Rock below the surface leads to poor drainage and a high-water table. The area supports native wetland vegetation (highbush blueberry, silky dogwood, northern arrowwood, black tupelo, sedges, and ferns) and contains hydric soils. The area's topography does not show signs of potential functionality as a vernal pool, and so the area has been classified as a bylaw regulated isolated vegetated wetland.

The isolated vegetated wetland falls completely within the southern portion of the solar array as designed. The proposed solar array measures roughly 2.21 acres. As outlined in the below alternatives analysis, multiple lot constraints create difficulty for the array to be moved to other locations on-site or downsized within its footprint. The lot follows a narrow, constricted shape for much of its reach until widening in its northern portion. Additionally, a power line easement sits within the center of the lot that cannot have the project proposed within. As such, the solar array has been sized and laid out in the only viable area on the subject parcel that would allow for proper sizing and orientation to meet the goals of the project.

To comply with all regulatory requirements under the local bylaw, full replication is proposed at a 2:1 ratio for the proposed filling of the IVW. A detailed wetland replication plan has been submitted by Goddard Consulting LLC to create a 3294 SF replication area off of BVW flags GC A14 to GC A21. The area is designed to meet all local requirements, as well as to replicate as similar conditions as possible to that of the lost isolated wetland.

The local bylaw states the following:

To prevent wetlands loss, the Commission shall require applicants to avoid wetlands alteration wherever feasible; shall minimize wetlands alteration; and, where alteration is unavoidable, shall require full mitigation. The Commission may authorize or require replication of wetlands as a form of mitigation, but only with adequate security, professional design and monitoring to assure success, because of the high likelihood of failure of replication.

To comply with the above excerpt from the local bylaw, the variance requested for this work is strictly to allow for the fill of the IVW to take place, with the approval of the 3294 SF replication area proposed. It is the opinion of Goddard that the alteration in this situation is unavoidable due to the lot constraints and the required size and layout of the solar array. To demonstrate compliance, Goddard has submitted a wetland replication plan containing design protocols to ensure a high likelihood of success. The plan requires revegetation and success within two years, or the work will be redone to ensure success of the area is achieved. Goddard believes the above standard has been met, and respectfully requests a variance to fill the isolated wetland and replicate at a 2:1 ratio.

Below is a table summarizing potential alternatives to the proposed work.

Summary of Alternatives

Alternative option	Impact to wetland resources and buffer zone	Mitigation	Cost
Alternative 1: No change to existing conditions	No impacts to buffer zone or wetland resources.	None required. Project would not include restoration of compacted areas	No cost, but applicant is unable to develop land as needed. Renewable energy supply would not occur as no project to create it as such.
Alternative 2: Scale back proposed solar array around Isolated Wetland	Buffer Zone to existing IVW would be impacted, but no wetland replication would occur as mitigation.	Project would provide significantly scaled-back mitigation with no 2:1 wetland replication/creation.	Project cost would likely be too high for the small solar array output, and this alterative would not be viable. Renewable energy supply would be unlikely to be pursued and created in this alternative as well.
Alternative 3: Current proposal	Impacts to buffer zone and IVW onsite as described.	Project replicates lost IVW at a 2:1 ratio, creating 1647 SF of additional wetland area on-site. Mitigation of the cart path remains proposed as well.	Current design is most costly but meets the needs of the applicant. It is the only alternative where the end result (sizing and layout of array) creates a viable project for the applicant to pursue. It is the only alternative that will result in renewable energy supply to be created as a result.

2.0 Waiver Request for Relief from Additional Mitigation Requirements

As outlined above, during the peer review process in the fall of 2023, the B-Series isolated vegetated wetland had two wetland flags hung upgradient of the prior delineation in the area of the proposed roadway, flags GC B26-1 and GC B26-2. These flags were hung after a site walk between Goddard Consulting, BETA Group, and Breeka Lí Goodlander where Goddard Consulting agreed there were hydric soils and a predominance of wetland vegetation above the existing delineation. These additional flags led to an increase in the encroachment of the 25-foot local no disturb zone as outlined in the local bylaw. Originally, the encroachment into the 25-foot local no disturb zone measured 308 square feet. It was discovered that by shifting the layout of the project around an unvegetated cart path, 617 square feet of mitigation could be proposed by loosening the soils and revegetating this cart path to meet a 2:1 ratio between mitigation to encroachment within the 25-foot no disturb zone.

However, now that the delineation has been expanded in the "pinch point" area of the roadway, the encroachments to the 25-foot no disturb zone total 773 SF (excluding the already existing roadway through the area). As a result, opportunities for additional mitigation were explored around the site to provide restoration for the increase in the encroachment. However, the site is subject to multiple constraints that prevent the opportunity for additional mitigation. The power easement running through the site is considered to be the only disturbed area on the lot where mitigation could occur. However, mitigation in this area is discouraged because the easement is not guaranteed to be unimpacted in perpetuity, and restoration taken may be impacted in the future. Outside of the easement, the lot is forested and undeveloped, and therefore opportunities for mitigation are limited. The only opportunity for mitigation is the unvegetated cart path outside of the limit of work. The remainder of the areas are undisturbed.

As a result, it is Goddard's opinion that the applicant has made efforts to provide mitigation to the extent that the lot constraints and easement issues allow. A variance is requested for relief from additional mitigation requirements, with the reasoning that mitigation has been provided on the lot to the extent allowable.

3.0 Conclusion

In summary, based on the above analysis with each variance request, Goddard believes that adverse impacts to wetland resources and buffer zones have been avoided to the greatest extent practicable, and mitigation has been provided for the work to the extent allowable on the lot. In kind wetland replication at a ratio of 2:1 will be performed for complete mitigation for the required IVW fill. The 617 SF of mitigation for the cart path remains proposed, and additional documentation on the lot constraints for further mitigation has been provided. Goddard respectfully requests that the Franklin Conservation Commission issue a variance for both requested items as part of the ongoing permitting for the Upper Union Street Solar Project.

Sincerely,

Goddard Consulting, LLC

Andrew Thibault

Andrew Thibault, WPIT, WSA
Environmental Scientist

WETLAND REPLICATION PLAN – GODDARD CONSULTING, LLC

November 14, 2023

WETLAND REPLICATION PLAN
0 Upper Union Street Solar

0 Upper Union Street
Franklin, MA
Map 319, Lot 9

PURPOSE:
CONSTRUCTION DOCUMENT

PREPARED FOR:
VS Union Solar Smart, LLC
24941 Dana Point Harbor
Dana Point, CA 92629

All construction work discussed in this document shall be supervised by a qualified wetland scientist with a minimum of five years' experience.

Table of Contents:

I. EXISTING ISOLATED VEGETATED WETLAND

The subject parcel is a primarily forested site located at 1056 Upper Union Street Franklin MA (Map 319, Lot 9). The lot comprises approximately 6.21 acres and consists of natural wooded area with a maintained power line easement running through its center. A bordering vegetated wetland (BVW) system with an internal intermittent stream is present in the southeastern corner of the parcel. There are two locally jurisdictional isolated vegetated wetlands (IVW) located in the southwestern and central portions of the lot.

The northernmost Isolated Vegetated Wetland was discovered during the peer review process in the fall of 2023, and subsequently added to all site documents. The area measures approximately 1647 square feet and lies within the proposed solar field. The location of the IVW is such that the project is not viable to be redesigned due to the loss of required panels, and so the area is proposed to be filled and replicated at a 2:1 ratio. To ensure in-kind replication, the native tree and shrub species found within the IVW are to be proposed within the replication area.

II. WETLAND REPLICATION AREA

References: See Site Plans approved

A. LOCATION:

The proposed replication area measures 3294 SF and is located adjacent to wetland flags A14 to A21. The proposed roadway will allow machinery to reach the existing walking trails, allowing for streamlined access to the wetland replication area without disturbing areas outside of the approved limit of work. The project involves 1647 SF of fill of a bylaw jurisdictional IVW for the proposed solar panels. The proposed 3294 SF wetland replication area allows for a 2:1 ratio of wetland fill to replication meeting all local performance standards. Double sets of erosion controls will be installed along the limit of work to ensure adequate protection to the adjacent wetland resource area.

The location of the replication was selected for the following reasons:

- The area can easily be accessed by the proposed roadway. The roadway will bring machinery to meet the existing cart path, bringing machinery to the area with minimal impact. As a result, very few shrubs and brush will be removed or trampled to reach the Wetland Replication Area.

- The replication area directly abuts an existing BVW with similar vegetation and soil conditions as the impact area.
- The area within the forest was desirable for wetland replication due to the shade from surrounding large trees which will keep the wetland environment at a natural, cool temperature.
- The nearby topography of the uplands is a slight incline from the wetlands. Therefore, only 1-2 feet of grading will need to occur to reach desirable depths for necessary hydric soil conditions.
- The close proximity to BVW will allow the replication area to blend into a similar landscape provided nearby.
- This location allows the replicated wetland to fulfill more functions and values on a greater scale than the existing IVW, particularly in the sense of flood control due to its greater size and mild slope. The BVW replication area will provide protection of the following benefits: public or private water supply, ground water supply, flood control, storm damage prevention, prevention of pollution, and plant or wildlife habitat.
- Alternative areas were discussed throughout the property, but none provided the same benefits as the current proposed area. Access would not have been as easy, and the benefits of the surrounding landscape would not nearly be as beneficial as the extended BVW proposed. Further proximity to BVW and lack of shade from overstory canopy trees would have led to a less successful and desirable environment for a wetland replication area.

The following steps may be completed congruently to ensure transplanted vegetation is immediately planted.

B. GENERAL INSTALLATION PROCEDURES:

Supervision: All work within the replication area shall be supervised by a qualified wetland scientist with a minimum of five years' experience. Wetland scientist shall submit qualification for approval by the Conservation Commission prior to the commencement of work that requires supervision. The supervisor shall submit monitoring reports to the Conservation Commission as described below. Reports shall contain details of all work performed and photographs of completed conditions.

Timing: Work shall take place ideally when the wetland impact area is not saturated. If necessary, a dewatering plan shall be approved by the Conservation Commission. The construction and installation of the replication area should be accomplished during the spring or fall growing seasons (between April 16 and May 31 or between September 16 and October 30). Planting during these periods is highly recommended. The replication area grading is advised not to commence unless the contractor can guarantee completion of the work within the replication area within the same season.

Step 1: Stake Limits of Work, Confirm Wetland Flags in Place & Install ECB – At Replication Area

Staking out limits of work and confirmation of wetland flags are planned for the replication areas. Erosion control barriers shall then be installed in the form of staked siltation fence and mulch sock (or similar invasive-free barrier) placed at the limit of work for the replication area. Two sets are proposed for increased protection against erosion. These will remain in place and be maintained until the areas are completely stabilized and then may be removed after approval of the Conservation Commission. Wetland scientist shall have authority to require additional erosion control measures if deemed necessary.

Step 2a: Identify Shrubs, Woody Debris, and Boulders to be re-used in Replication Area

The wetland scientist shall identify and flag any native wetland shrubs within the replication area and the IVW impact area that may be dug up and stockpiled for use as additional plantings in the replication area. Any flagged specimens shall be removed and stockpiled in a designated area outside the replication area. Any large woody debris (rotting logs and tree stumps), moss covered boulders/rocks, ferns (royal fern, sensitive fern, cinnamon fern), and other ground cover shall also be identified and flagged for stockpiling and subsequent addition to the replication area. Wetland trees that lie or stand along the edge of the replication area may be preserved at the discretion of the wetland scientist.

Step 2b: Remove Trees and Vegetation

Once flagged trees, shrubs and woody debris specimens have all been removed and stockpiled, clear and remove all remaining vegetation within the replication areas in preparation for excavation and grading.

Step 3: Excavation of Wetland Soils at IVW Impact Area

Prior to any soil excavation, a storage area for soil and leaf litter shall be prepared; soil shall not be stored in buffer zone. Topsoil, leaf litter, and subsoil shall be stockpiled separately. Wetland soils from the IVW impact area will be excavated and transported to the replication area. The soils immediately surrounding the IVW impact area will also be transplanted to the replication area and will be placed along the inner border of the replication area to create a natural transition from upland to wetland soils.

Step 4: Excavation of Replication Area

An excavator or backhoe shall remove existing soils up to the edge of the proposed replication area boundary, to a depth at which redoximorphic features become visible in the C-horizon at the soil surface and at least one foot below proposed final grade, all of which shall be supervised and directed by the wetland scientist. Final grading will range from 439 feet to 440 feet as favorable hydrological conditions are reached. The general topography around the areas is a slight incline, so it is expected groundwater will be reached at the desired depths. Topsoil and subsoil shall be removed from the area for re-use elsewhere in the project site or removed from the site. Subsoil of the C-horizon shall be loosened prior to Step 5 to ensure soils aren't compacted prior to topsoil placement.

Step 5: Final Grading of Replication Area

Upon removal of existing soils down to the proper depth (as determined by the wetland scientist), the organic soil from the IVW impacts area will be placed within the replication area. If soils from the impact area are not sufficient, supplemental soils shall be imported, sourced from composted organic materials, and shall consist of a 50:50 mix of loam and organic material with an organic content between 12 and 20%. Topsoil shall be placed within the replication area to a depth 6-12" and even with the surrounding proposed elevation on design plan, to be determined by the supervising wetland scientist. Final grade shall be confirmed to be proper by the wetland scientist prior to plantings. Placement of soil shall be such that no equipment drives over or compacts placed soils. Final grading will result in micro relief of pits and mounds. Topography will create areas that pool and flood during heavy rain events and also see water near the surface during the wet season.

Step 6: Place Woody Debris and Boulders

Woody debris, stags, and moss-covered boulders currently lay on site in the proposed replication area. These shall be preserved and randomly placed throughout the replication area to provide cover for wildlife.

Step 7: Planting

Selected species, especially ferns, grasses and sedges, may be transplanted from the IVW impact area into the replication areas provided that the time of year and duration of plants' time out of soil is appropriate for survival of transplants. Precise citing of plants may be determined by the wetland scientist in the field prior to installation. All plantings (reference the planting list from section C) shall be distributed randomly throughout the area; trees spaced at 10-15' on center; shrubs spaced at 6-12' on center. Shrubs shall be planted in clumps of 3 the same species. As a rule, plants of the same species will be placed in groupings that more closely mimic natural conditions. Trees shall be planted on mounds and shrubs in depressions. Stockpiled shrubs will be placed first. All other plantings will be removed from burlap sacks, wire cages and plastic containers prior to planting. Each plant will have it roots loosened prior to planting to encourage root growth away from the planting bulb. Leaf litter shall be spread throughout area if available. Wetland seed mix shall be scattered evenly by hand throughout the replication area. Once all work is complete an erosion control barrier will be installed to enclose the replication area on the access side of the replication area.

Step 8: Erosion Controls Removal

Once the replication areas are stable, a request shall be submitted to the Conservation Commission to remove the erosion controls around the wetland replication areas. Upon approval of stabilization, erosion controls shall be removed promptly, and any significant disturbance shall be seeded with a wetland seed mix as specified in section C.

Step 9: Replication Monitoring

a. **Seasonal monitoring reports** shall be prepared for the replication areas by a qualified wetland scientist for a period of 2 additional years after installation or every year until a COC is issued by the Franklin Conservation Commission. This monitoring program will consist of early summer and early fall inspections and will include photographs and details about the vitality of the replication areas. Monitoring reports shall be submitted to the Commission by November 15th of each year. Monitoring reports shall describe, using narratives, plans, and color photographs, the physical characteristics of the replication areas with respect to stability, soil characteristics (i.e. horizons, depths, texture, percent gravel and rock, organic matter, Munsell hue, value and chroma, consistence and evidence of hydrologic influence), survival of vegetation and plant mortality, aerial extent and distribution, species diversity and vertical stratification (i.e. herb, shrub and tree layers). Invasive species will be documented if present, monitored and removed.

b. **At least 75% of the surface area** of the replication areas shall be re-established with indigenous plant species within two growing seasons. If the replication areas does not meet the 75% re-vegetation requirement by the end of the second growing season after installation, the Applicant shall submit a remediation plan to the Commission for approval that will achieve replication goals, under the supervision of a Wetland Specialist. This plan must include an analysis of why the areas have not successfully re-vegetated and how the Applicant intends to resolve the problem.

C. PLANTING LIST:

Proposed Plantings for Replication Area 1 (3294 s.f.)

Common Name	Scientific Name	Number	Size
Trees (n= 15)*			
Red Maple (FAC)	*Acer rubrum*	6	4-5’
American Elm (FAC)	*Ulmus americana*	3	4-5’
Tupelo	*Nyssa sylvatica*	3	4-5’
American Hornbeam	*Carpinus caroliniana*	3	4-5’
Shrubs (n=33)*			
Highbush Blueberry (FACW)	*Vaccinium corymbosum*	6	3 gal. pot
Winterberry (FACW)**	*Ilex verticillata*	6	3 gal. pot
Silky Dogwood (FACW)	*Cornus amomu*	12	3 gal. pot
Northern Arrowwood	*Viburnum recognitum*	9	3 gal. pot
Seed Mix			
New England Wetland Plants WETMIX or equivalent*	Replication area	1	2 lbs
New England Wetland Plants CONSERVATION SEEDMIX or equivalent*	Disturbed areas around replication area and access.	1	1 lbs

*Planting species and seedmixes may be substituted with Conservation Commission approval with similar native species with the same wetland indicator status if certain species are unavailable.
**Winterberry shall be planted at a ratio of at least 1 male to 5 females and shall not exceed a 1:1 male to female ratio.

D. CONCLUSIONS

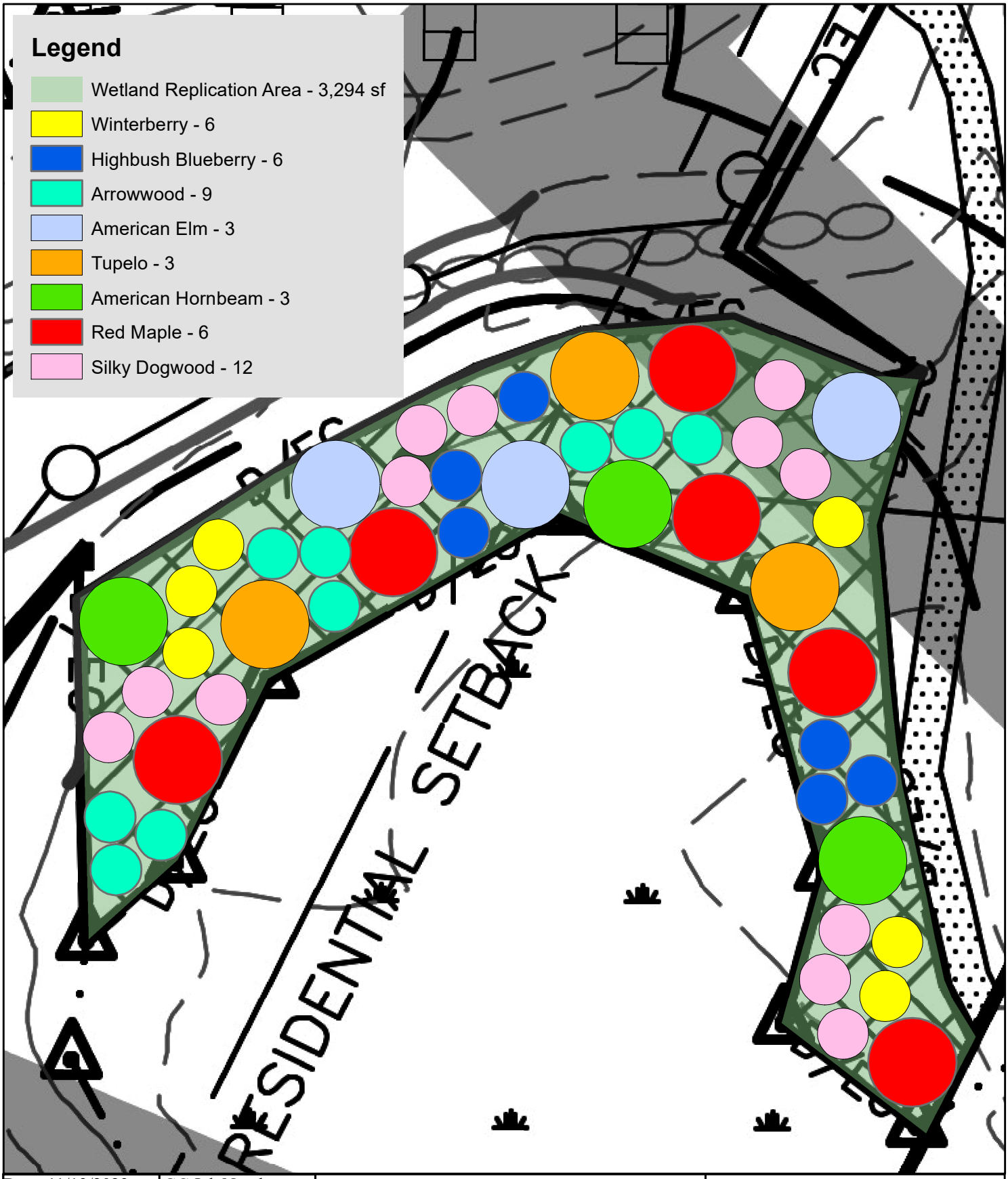
The IVW impact area will be mitigated at a ratio of 2:1 with the final replication area. All local, state and federal statutory interests and performance standards have been protected and will be met by the project, as described above. The wetland replication plan has been designed to replicate the environmental attributes of the Isolated Wetland as closely as possible with the BVW replication, and to meet or exceed the benefits to local wildlife. The native trees and shrubs found growing within the IVW are proposed within the replication area for even greater species diversity. Stockpiled shrubs and soils will be transported and used within the replication area.

Sincerely,

Goddard Consulting, LLC

Andrew Thibault

Andrew Thibault, WPIT, WSA
Environmental Scientist



Date: 11/13/2023	GC Job Number: 101-083	Wetland Replication Area Planting Plan	0 5 10 Feet
GODDARD CONSULTING Strategic Ecological Consulting		1056 Upper Union Street Franklin, MA	1 in = 15 ft Map: 319, Lot: 9 N W E S

FUNCTIONS AND CHARACTIVERSTICS STATEMENT – GODDARD CONSULTING LLC

November 15, 2023

Franklin Conservation Commission
355 E. Central Street
Franklin, MA 02038

Re: Notice of Intent – 0 Upper Union Street, Franklin, MA (Map: 319, Parcel: 9)

Dear Franklin Conservation Commission,

1.0 REGULATORY COMPLIANCE WITH FRANKLIN'S WETLANDS PROTECTION BYLAW

1.1 FUNCTIONS AND CHARACTERISTICS STATEMENT – PROJECT COMPLIANCE

In accordance with §7.10.1 of the Town of Franklin Conservation Commission Regulations, please find below a summary of the proposed project's impacts on the functions and characteristics of floodplains and wetlands. It is Goddard's opinion that the project will have no significant individual or cumulative adverse effects on these functions and characteristics.

1. **Public Water Supplies** – The nearest public well is located about 0.5 miles from the subject site to the North. Route 495 runs between the parcel and the existing well. No adverse effects are anticipated to public water supplies.

2. **Private Water Supplies** – According to MassDEP's Well Drilling Database, the nearest private well that could be identified is located at 875 Upper Union Street, approximately 500 feet away from the nearest work area. This distance is significantly greater than any setbacks for wells identified in MassDEP's Private Well Guidelines.

3. **Groundwater** – Five test pits were performed on the site. From mottling within the soil C-Layers, Estimated Seasonal High Groundwater onsite is anticipated at approximately 40" – 74" below the soil surface. The infiltration basins have been designed accordingly to ensure proper infiltration occurs. The bottom elevation of basin 2P is proposed at 455, and the bottom elevation for basin 6P is proposed at 404.

4. **Flood Control** – No work of any kind is proposed in any FEMA Flood Zones. Compensatory storage is not required to be addressed.

5. **Erosion and Sedimentation** – Erosion and sedimentation controls including entrenched silt fencing, curlex sediment logs, and stone construction entrance will be in place and maintained in good condition throughout construction activities. Double erosion controls are proposed along areas of significant excavation, such as the wetland replication area. Erosion control mats are proposed and will be implemented where necessary.

6. **Storm Damage Prevention** – The proposed stormwater management system has been designed to handle the 2-, 10-, 25- and 100-year return periods for Franklin (see Existing Stormwater Report by Atlantic Design Engineers). The attached stormwater report demonstrates compliance with pre and post runoff rates for each respective storm event. In addition, the system will attenuate peak rates of runoff, resulting in less damaging stormwater runoff for the site and surrounding areas.

7. **Water Quality** – There are no surface waters associated with the IVWs onsite. The BVW system has an interally flowing intermittent stream that moves water to additional wetland systems during high-water periods. Grading proposed on the site , to the extent feasible, be kept to follow the existing contours to mimic existing runoff patterns,

outside of areas within the array that presently exceed 20%. Stormwater runoff from portions of the proposed development area will be directed to ditches and swales, delivering water to detention basins to prevent direct discharge of untreated stormwater to any wetland resource areas or offsite. The design of the proposed stormwater management system is such that there shall be no increase in peak flows resulting from development of the site.

8. **Water Pollution Control** – During construction, erosion and sediment controls, typically in the form of entrenched silt fence and sediment logs, will minimize any potential water pollution. Double erosion controls are proposed along areas of significant excavation, such as the wetland replication area. The proposed stormwater management system has been designed deto handle the 2-, 10-, 25- and 100-year storms, with no increases in peak runoff rates for the site. Vegetated swales deliver stormwater to on-site detention basins. As such, no biological pollution is expected to occur as a result of construction activities or post-construction use of the site.

9. **Fisheries** – No work is proposed adjacent to ponds, perennial streams, or any other fishery habitats.

10. **Shellfish** - Not applicable in Franklin, inland resource areas only.

11. **Wildlife Habitat** – In Goddard's opinion, the natural community present on the site within the work area, as described in MassWildlife's Classification of the Natural Communities of Massachusetts, should be classified as a White Pine – Oak Forest. This type of natural community is assigned an SRank of S5, which means it is "demonstrably secure in Massachusetts" and is "common, widespread, and abundant."

According to MassWildlife's BioMap, the work area is not considered either Core Habitat (areas that are critical for the long-term persistence of rare species, exemplary natural communities, and resilient ecosystems) or Critical Natural Landscape (large landscape blocks that are minimally impacted by development and buffers to core habitats and coastal areas).

12. **Rare Species Habitat (including rare plant species)** – No rare species are mapped on or near the project site. The nearest Estimated Habitat of Rare Wildlife or Priority Habitat of Rare Species is approximately 1.7 miles from the site, PH 770 in Wrentham, MA. There are no mapped potential or certified vernal pools onsite. The nearest mapped potential vernal pools are mapped 150 feet off-site to the east, and 200 feet off-site to the north.

13. **Agriculture** – The project site is not located in proximity to any agricultural operations. One soil unit mapped on site (Woodbridge fine sandy loam, 0 to 8 percent slopes, 310B) is considered prime farmland by the NRCS Soil Survey. However, much of this is located within the existing power easement. The remainder of the on-site soils, (Woodbridge fine sandy loam, 0 to 8 percent slopes, extremely stony - 312B, Charlton-Hollis Rock Outcrop Complexes, 103C & 103D) are not mapped as prime farmland soils.

14. **Aquaculture** – There are no aquaculture operations on or near the project site.

15. **Recreation** – Neither active nor passive recreational uses will be impacted by construction activities or post-construction conditions on the site. The work area does not contain any playing fields, walking paths, swimming areas, or other recreational areas. Its position within a power easement makes it a poor location for recreation of any kind.

1.2 I SERIES ISOLATED VEGETATED WETLAND – BYLAW COMPLIANCE

Due to the location of the I-Series Isolated Vegetated Wetland, the project would not be viable to work around the area due to the significant loss of solar panels that would occur. As such, the I-series Isolated Wetland is proposed to be filled and replicated to assist with the project design and maintain a viable project with the site. As a resource area subject to the local bylaw is proposed to be filled and replicated, compliance with the local bylaw is demonstrated below.

According to Chapter 181, Section 8, paragraph 2 of the local bylaw,

To prevent wetlands loss, the Commission shall require applicants to avoid wetlands alteration wherever feasible; shall minimize wetlands alteration; and, where alteration is unavoidable, shall require full mitigation. The Commission may authorize or require replication of wetlands as a form of mitigation, but only with adequate security, professional design and monitoring to assure success, because of the high likelihood of failure of replication.

Impacts to wetland resource areas have been avoided on the site wherever feasible. The construction of the roadway has been designed to utilize narrow upland portions to avoid unnecessary wetland alteraions. No impacts to BVW are proposed with the project. However, due to the location of the GC I-Series Isolated Wetland within the suitable work area, filling and relocating the isolated wetland is required to achieve the project goals. Avoidance of the area would not produce a solar array that would meet the project goals or create a viable project. To ensure proper replication of the area is achieved, the Isolated Vegetated wetland is proposed to be filled at a 2:1 ratio to ensure a net increase to wetland cover is achieved with post-construction conditions. Goddard has submitted a wetland replication plan with a similar and even greater species diversity than that of the lost isolated wetland. The plan outlines all necessary steps and includes the supervision of a wetland scientist to ensure the correct design and likelihood of success of the replicated wetland.

According to Section 5 of the Franklin Conservation Commission Regulations, the conservation commission may grant a variance if they find that it is necessary to request the work outlined in the variance request, and that the proposed work will not result in adverse effects to the interests outlined in the local bylaw. For compliance purposes, the variance procedure is outlined below:

5. TOWN OF FRANKLIN CONSERVATION COMMISSION REGULATIONS - VARIANCE PROCEDURE

5.1. The Commission may grant a variance from these regulations upon a showing by the applicant that any proposed work, or its natural and consequential impacts and effects, will not have any adverse affect upon any of the interests protected in Chapter 181 of the Town of Franklin Wetlands Protection Bylaw. It shall be the responsibility of the applicant to provide the Commission, in writing, with any and all information, which the Commission may request, in order to enable the Commission to ascertain such adverse effects. The failure of the applicant to furnish any information, which has been requested, shall result in the denial of a request for a variance pursuant to the applicable subsection of this regulation.

5.2. The Commission may grant a variance from these regulations when it is necessary to avoid so restricting the use of the property as to constitute an unconstitutional taking without compensation. If the Commission receives an application for a variance pursuant to an applicable subsection of the regulation, the Commission may request an opinion from the Town Counsel as to whether the application of these regulations to a particular project will result in such a taking without compensation.

5.3. Variance process: To request a variance, the applicant shall submit a variance request in writing at the time of the application for the Notice of Intent or Request for Determination of Applicability. The request shall explain why the variance is needed and shall describe in detail how the project can be completed without significant adverse impacts on the functions and characteristics of the resource area. Such detail must include, but is not limited to, an alternatives analysis.

As part of this supplemental submittal, all supporting documentation has been provided, including an alternatives analysis, as outlined above. A variance request has been submitted to the conservation commission for the required isolated wetland fill and 2:1 replication.

In accordance with the Town of Franklin Conservation Commission Regulations, please find below a summary of the proposed project's impacts on the functions and values being served by the GC I-Series Isolated Wetland. It is Goddard's opinion that the project as designed will have no significant individual or cumulative adverse effects on these functions and values by providing proper mitigation for each characteristic.

1.3 I SERIES ISOLATED VEGETATED WETLAND – FUNCTIONS & VALUES

Table 1: Functions and Values Analysis & Mitigation

Functions & Values Performed by the GC I-Series Isolated Wetland (1647 SF)	Functions & Values Mitigated by the Proposed Wetland Replication Area (3294 SF)
1. Wildlife Habitat As a 1647 Square Foot Isolated Wetland, the area delineated by the GC I-Series qualifies a small wetland habitat. As such, the area contains native wetland plant species that provide foraging and pollinator habitat for local wildlife. Species dominant within this habitat area consist of highbush blueberry, silky dogwood, northern arrowwood, black tupelo, sedges, and wetland ferns. Highbush blueberry, silky dogwood, arrowwood, and black tupelo all provide both pollinator habitat as well as food sources through berry production. In addition, black tupelo is considered an excellent tree for cavity/den habitat, as dead trees can stand in place for long periods of time. Sedges provide soil stabilization, insect habitat, and foraging through seed production. Native ferns provide soil stabilization, shading, and microhabitats.	1. Wildlife Habitat The proposed wetland replication area measures 3294 Square Feet, a 2:1 replication ratio to the required fill. The area is proposed to connect to an existing, established BVW, where the soils and hydrology match that of the lost area. Wetland soils from the isolated wetland will be re-used within the replication area to ensure the organic topsoil matches that of the lost area. All species located within the lost IVW are proposed to be planted within the replication area. Sedges and ferns from the IVW are proposed to be dug and relocated into the wetland replication area. The planting plan includes highbush blueberry, silky dogwood, northern arrowwood, black tupelo to maintain the pollinator and foraging habitat provided within the IVW. The plan also adds additional wetland species for an even greater species diversity, proposing American elm, American hornbeam, winterberry, and red maple. In addition to the habitat and foraging already referenced, the greater species diversity is proposed to add additional benefits not originally found within the isolated wetland.

	Winterberries hang on the shrubs late into the season, and often provide an additional food source during times of scarcity. The addition of winterberry prolongs the seasons in which the areas provide benefits to wildlife. The American hornbeam provides significant grazing and nesting habitat. Red maples, a staple in forested wetland habitat, provide edible seeds, buds, flowers, and twigs. American elm provides additional habitat to birds and insects, and like the black tupelo, is a cavity nesting tree. As the replication area is proposed at a 2:1 ratio, significant plantings can be proposed. The area will be planted with 15 native trees and 33 native shrubs, in addition to a native seedmix providing diversity within the understory. It is the opinion of Goddard that the wetland replication plan has been designed to replicate and exceed all wildlife benefits from the proposed fill of the GC I-Series IVW.
2. Flood Control Wetlands provide flood control through a number of ways. The breaks in topography allow for the collection and slowing of water movement, and native wetland species provide significant water uptake and water filtration. On the subject site, the 1647 SF isolated wetland assists in flood control by providing a shallow break in topography in a surrounding upland forest. Snow melt, rain, and surface runoff slowly pitch into the isolated wetland, where native wetland species provide water uptake and filtration. This wetland is a shallow slope, and does not provide significant volumes of flood storage. The topography does not allow for such volumes of surface water to act as vernal pool habitat or to qualify for Isolated Land Subject to Flooding (ILSF).	2. Flood Control The proposed wetland replication area measures 3294 Square Feet, a 2:1 replication ratio to the required fill. The area is proposed to connect to an existing, established BVW system that provides the same flood control benefits of the lost IVW, on a larger scale. The A-series BVW system follows a slow pitch off of the existing upland forest, where snow melt, rain, and surface runoff enter a shallow BVW system. Similar to the IVW, the grade of the area does not flood to the extent of providing vernal pool habitat, but instead disperses the water through a shallow wetland system, infiltrating and being filtered through native wetland vegetation. As the area is significantly larger, the flood control volume created by the 2:1 replication area exceeds that of the lost IVW. In addition, stormwater management swales and basins are proposed within the work area adjacent to the location of the existing IVW. The water runoff generated from the proposed project will be handled within the area, and therefore no additional runoff rates are anticipated from the project.

3. Storm Damage Prevention In addition to flood control, in many of the same ways, wetlands help prevent storm damage prevention by temporarily storing runoff through the topographical breaks. The native vegetation further slows the movement of water down and provides some water uptake. On the subject site, the 1647 SF isolated wetland assists in prevention of storm damage by providing a shallow break in topography in the surrounding upland forest. During heavy storms, water follows the natural topography toward the IVW. This helps prevent erosion or sedimentation into nearby areas. The storm damage prevention of the IVW is limited due to its small size. The shallow topography change does not allow significant water to be stored within the area.	3. Storm Damage Prevention The proposed wetland replication area measures 3294 Square Feet, a 2:1 replication ratio to the required fill. The area is proposed to connect to an existing, established BVW system that provides the same storm damage prevention of the lost IVW, on a larger scale. The A-series BVW system follows a slow pitch off of the existing upland forest, where runoff enters a large shallow BVW system. Water here becomes spread out and slowed down as it infiltrates into the ground. The A-Series BVW has a permanent outlet, unlike the GC I-Series IVW. An intermittent stream continues down the slope off the site, toward additional wetland systems. This allows for more runoff to be managed by the large BVW system. Additionally, the creation of a 3294 SF replication area expands the storm damage prevention capabilities of the BVW. Runoff would first pass through the replication area, slowing before reaching the existing wetland limits and internal intermittent stream. The 2:1 replication to fill ratio enhances the level of storm damage prevention of the site.

In summary, Goddard Consulting believes that the proposed project will not have any adverse impacts on the interests protected by the Town of Franklin's Wetlands Protection Bylaw. The proposed project meets all regulatory compliance standards identified therein and has proposed mitigation for its impacts. The breakdown above has been submitted to provide additional information to the commission on the vitality of the proposed replication area, and to ensure all functions and values of lost resource areas are adequately mitigated as part of the project.

Please feel free to contact us if you have any questions about this Notice of Intent supplemental submission.

Sincerely,

Goddard Consulting, LLC

Andrew Thibault

Andrew Thibault, WPIT, WSA
Environmental Scientist

BUFFER ZONE MITIGATION PLAN – GODDARD CONSULTING LLC

REV. 11/13/2023

Buffer Zone Mitigation Plan

for

1056 Upper Union Street
Franklin MA, 02038
Map 319, Lot 9

ADDRESSED TO:
Franklin Conservation Commission
Franklin Municipal Building
355 E Central Street
Franklin, MA 02038

PREPARED FOR:
Atlantic Design Engineers, Inc.
39 Pleasant Street
Sagamore, MA 02561

PREPARED BY:
Goddard Consulting, LLC
291 Main Street, Suite 8
Northborough, MA 01532

Table of Contents:

A. EXISTING CONDITIONS:

The subject parcel is a primarily forested site located at 1056 Upper Union Street Franklin MA (Map 319, Lot 9). The lot comprises approximately 6.21 acres and consists of natural wooded area with a maintained power line easement running through its center. A bordering vegetated wetland (BVW) system with an internal intermittent stream is present in the southeastern corner of the parcel. There are two locally jurisdictional isolated vegetated wetlands (IVW) located in the southwestern and central portions of the lot.

B. PROPOSED CONDITIONS:

The proposed project consists of the installation of a solar farm in the northeastern portion of the parcel, and associated access road and utilities. Due to site constraints regarding access, the access road is proposed in the small gap between the BVW and IVW onsite. Originally, this resulted in the disturbance of approximately 308 square feet of the 25' No Disturb Zone associated with these two wetland resources. As mitigation for this disturbance, 617 square feet of mitigation (2:1 ratio) was proposed by selecting an unvegetated cart path area to revegate and restore. This mitigation area will be located in the area of a footpath that is devoid of vegetation. This area was selected because it is the only area within the buffer zone that is not already vegetated with native species, as the lot is primarily forested and undeveloped. Plant quantities were determined based on MassDEP plant spacing guidelines.

As of November of 2023, the site's delineation has been modified to include all changes outlined during the peer review process. A greater area of the pinch point falls within the 25-Foot No Disturb Zone as the delineation was expanded. With the updated delineation, the site's required access now will impact 773 SF of the 25-Foot No Disturb Zone. As the lot is forested and undeveloped, the only area viable for restoration is the unvegetated cart path. This area remains proposed as restoration, however no additional areas can be selected to meet mitigation requirements as the lot is forested and undisturbed. The only remaining disturbed areas consist of the site's power line easement that is not able to be worked in. As such, a waiver request has been submitted as relief from the mitigation requirements that are unable to be met due to lot constraints.

Photo 1: View of footpath to be restored as mitigation.

C. GENERAL INSTALLATION PROCEDURES:

Supervision: All work within the mitigation area shall be supervised by a qualified wetland scientist with a minimum of five years' experience. Wetland scientist shall submit qualification for approval by the Conservation Commission prior to the commencement of work that requires supervision. The supervisor shall submit monitoring reports to the Conservation Commission as described below. Reports shall contain details of all work performed and photographs of completed conditions.

Timing: The installation of the plantings should be accomplished during the spring or fall growing seasons (between April 16 and May 31 or between September 16 and October 30).

Step 1: Identify Shrubs, Woody Debris, and Boulders to be re-used in Enhancement Area
The wetland scientist shall identify and flag any native wetland shrubs within the enhancement area that are to remain in place in the enhancement area. Trees that lie or stand along the edge of the enhancement area may be preserved at the discretion of the wetland scientist. Woody debris and boulders to be removed from the work area will be moved to the mitigation area to provide additional habitat features.

Step 2: Loosening of Compacted Soils
As the area to be planted is a historic cart path, soils within the planting area may be compacted. The wetland scientist shall inspect the soils in the field prior to the installation of the proposed plantings. If existing soils are not considered to be compacted and are considered suitable for planting, the area will be hand raked to loosen the soil, and 12" of clean loam will be spread over the area before planting. If soils are found to be too compacted for planting, soils will be excavated down beyond the compacted areas (approximately 1-2 feet is anticipated, more if needed) and the matching depth of clean loam will be spread over the area to provide a

viable planting surface that blends the area into the surrounding grade. Project wetland scientist will oversee the soil excavation to ensure proper planting substrates are created.

Step 3: Loaming and Planting

Loam will be spread over the enhancement area. Soils will be spread by hand raking only. Plantings will be installed according to the plan and immediately seeded with New England Wetland Plants Conservation Mix to stabilize the soils. Precise siting of plants may be determined by the wetland scientist in the field prior to installation. All plantings (reference the planting list from section C) shall be distributed randomly throughout the area; shrubs spaced at 8' on center. All plantings will be removed from burlap sacks, wire cages and plastic containers prior to planting. Each plant will have it roots loosened prior to planting to encourage root growth away from the planting bulb. Leaf litter shall be spread throughout area if available. Conservation seed mix shall be scattered evenly by hand throughout the enhancement area.

Step 3: Monitoring

a. **Seasonal monitoring reports** shall be prepared for the enhancement area by a qualified wetland scientist for a period of 2 additional years after installation or every year until a COC is issued by the Franklin Conservation Commission. This monitoring program will consist of early summer and early fall inspections and will include photographs and details about the vitality of the enhancement area. Monitoring reports shall be submitted to the Commission by November 15th of each year. Monitoring reports shall describe, using narratives, plans, and color photographs, the physical characteristics of the enhancement area with respect to stability, survival of vegetation and plant mortality, aerial extent and distribution, species diversity and vertical stratification (i.e. herb, shrub and tree layers).

b. **At least 75% of the surface area** of the enhancement area shall be re-established with indigenous plant species within two growing seasons. If the enhancement area does not meet the 75% re-vegetation requirement by the end of the second growing season after installation, the Applicant shall submit a remediation plan to the Commission for approval that will achieve enhancement goals, under the supervision of a Wetland Specialist. This plan must include an analysis of why the areas have not successfully re-vegetated and how the Applicant intends to resolve the problem.

D. PLANTING LIST:

Proposed Plantings for Buffer Zone Mitigation Area (617 s.f.)

Common Name	Scientific Name	Indicator Status	Number	Size
Shrubs/Trees (n=11)*				
Red Maple	*Acer rubrum*	FAC	3	2-3'
Witch Hazel	*Hammamelis virginiana*	FACU	4	1-2 gal. pot
Black Chokeberry	*Aronia melanocarpa*	FAC	4	1-2 gal. pot
Seed Mix				
New England Wetland Plants Conservation/Wildlife Seed Mix or equivalent	Various	FACW, FAC, FACU, UPL	1	0.5 pounds

*Planting species and seed mixes may be substituted with Conservation Commission approval with similar native species with the same wetland indicator status if certain species are unavailable.

E. CONCLUSIONS

The proposed mitigation area will revegetate the only unvegetated area on-site outside of the existing easement. The mitigation plantings will provide wildlife value in the form of added habitat as well as providing a food source in an area previously not providing benefits to wildlife. All state and federal statutory interests and performance standards have been protected and will be met by the project, as described above. A waiver request is being submitted for relief from the additional mitigation requirements, as the natural state of the lot does not contain additional areas able to be used for mitigation.

Sincerely,
Goddard Consulting, LLC

Chris Frattaroli
Wetland Scientist

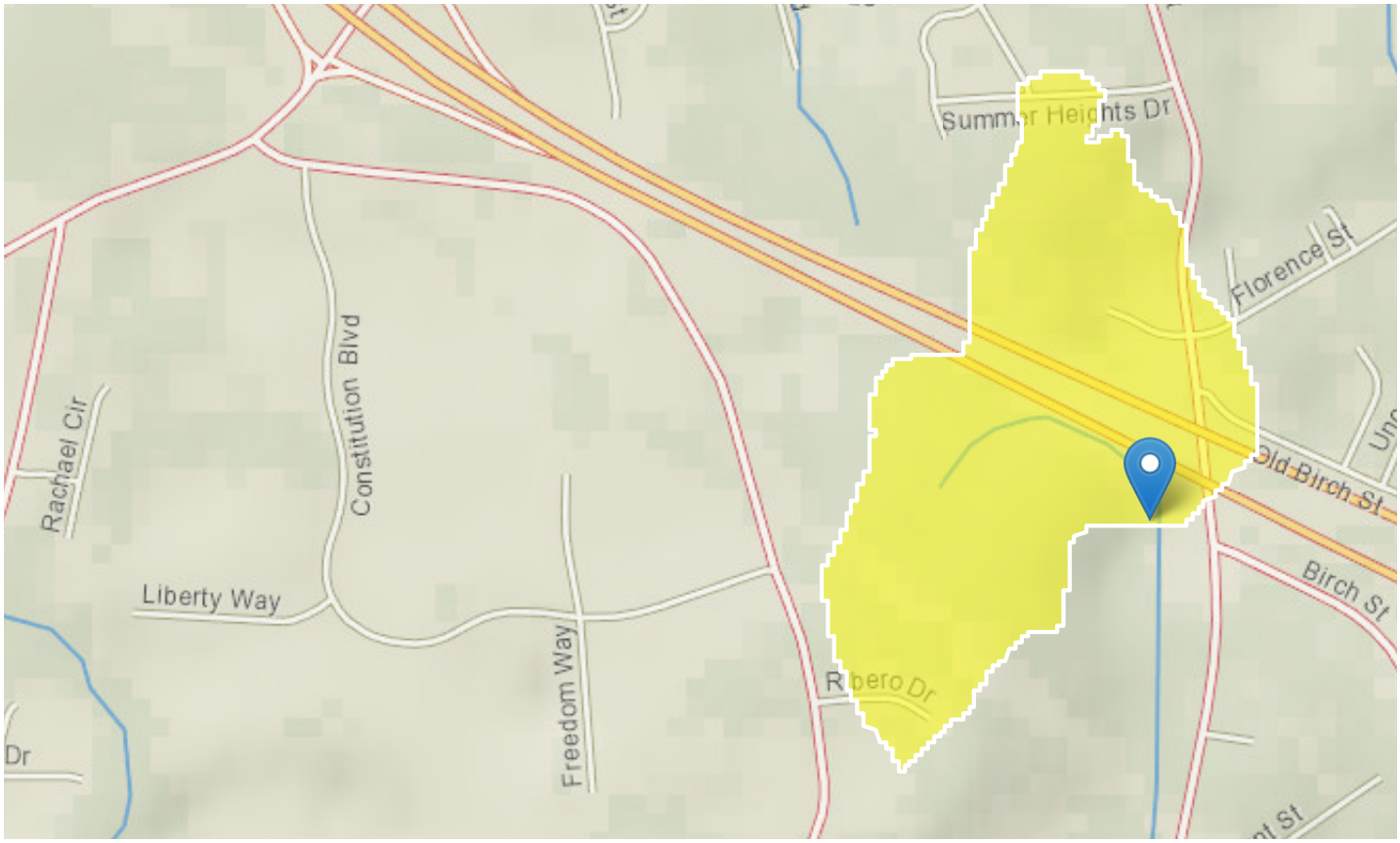
Andrew Thibault

Andrew Thibault, WPIT, WSA
Environmental Scientist

STREAMSTATS REPORT – GODDARD CONSULTING, LLC

StreamStats Report

Region ID:	MA
Workspace ID:	MA20231113183016180000
Clicked Point (Latitude, Longitude):	42.05700, -71.38495
Time:	2023-11-13 13:30:38 -0500



Collapse All

Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
BSLDEM250	Mean basin slope computed from 1:250K DEM	4.265	percent
DRFTPERSTR	Area of stratified drift per unit of stream length	0	square mile per mile
DRNAREA	Area that drains to a point on a stream	0.17	square miles
MAREGION	Region of Massachusetts 0 for Eastern 1 for Western	0	dimensionless

Flow-Duration Statistics

Flow-Duration Statistics Parameters [Statewide Low Flow WRIR00 4135]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.17	square miles	1.61	149
DRFTPERSTR	Stratified Drift per Stream Length	0	square mile per mile	0	1.29
MAREGION	Massachusetts Region	0	dimensionless	0	1
BSLDEM250	Mean Basin Slope from 250K DEM	4.265	percent	0.32	24.6

Flow-Duration Statistics Disclaimers [Statewide Low Flow WRIR00 4135]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors.

Flow-Duration Statistics Flow Report [Statewide Low Flow WRIR00 4135]

Statistic	Value	Unit
50 Percent Duration	0.157	ft^3/s
60 Percent Duration	0.0894	ft^3/s
70 Percent Duration	0.0401	ft^3/s
75 Percent Duration	0.0278	ft^3/s
80 Percent Duration	0.0207	ft^3/s
85 Percent Duration	0.014	ft^3/s
90 Percent Duration	0.00892	ft^3/s
95 Percent Duration	0.00457	ft^3/s
98 Percent Duration	0.00266	ft^3/s
99 Percent Duration	0.00174	ft^3/s

Flow-Duration Statistics Citations

Ries, K.G., III,2000, Methods for estimating low-flow statistics for Massachusetts streams: U.S. Geological Survey Water Resources Investigations Report 00-4135, 81 p. (http://pubs.usgs.gov/wri/wri004135/)

Application Version: 4.18.1

StreamStats Services Version: 1.2.22

NSS Services Version: 2.2.1

STORMWATER ADDENDUM #1

DESIGN ENGINEERS, INC.

STORMWATER
ADDENDUM #1
For
Upper Union Solar Project
0 Upper Union Street
Franklin, Massachusetts

Prepared for:

VS Union Solar Smart, LLC
24941 Dana Point Harbor
Dana Point, California 92629

Prepared by:

Atlantic Design Engineers, Inc.
P.O. Box 1051
Sandwich, Massachusetts 02563

November 10, 2023
ADE Project No. 3328.00

TABLE OF CONTENTS

APPENDICES

1.0 SUMMARY

This Addendum #1 to the original stormwater report dated 6/19/23 addresses the stormwater/drainage-related comments from the BETA Group, Inc review letters dated 8/3/23 and 8/18/23, the Massachusetts Department of Environmental Protection (MassDEP) review letter dated 10/20/23, and the Town Engineer review letter dated 8/7/23.

The following is a summary of the revisions incorporated into this Stormwater Report Addendum #1:

- Provide soil evaluation test pit logs completed by Zenith Consulting Engineers LLC on 10/11/23.
- Revised Water Quality, Recharge, TSS Removal, and Stormwater Basin/Infiltration Trench Drawn calculations.
- Revised CN values and Tc calculations provided within the revised Pre and Post Development HydroCAD Calculations
- Revised Pre and Post-development watershed plans
- Provide Pre and Post-development volume and revised Pre and Post-development runoff rate comparison table
- Revised Post-Construction Long Term Stormwater O&M Plan as follows:
    - Provide owner's signature line;
    - Indicated stormwater system owner following construction;
    - Indicated party or parties responsible for maintenance;
    - Provided BMP location map;
    - Indicated catch basin should be inspected four times per year;
    - Indicated regular inspection and maintenance of drip edges;
    - Provided owner's signature line on illicit discharge compliance statement;
- Provide Best Management Practices (BMP) Location Map

2.0 PRE & POST-DEVELOPMENT RUNOFF RATE AND VOLUME COMPARISON TABLE

Design Point #DP 1 – Offsite West				
Storm Event	***Pre-Development***		***Post-Development***	
	Runoff Rate	*Volume*	*Runoff Rate*	*Volume*
2-year	0.98 cfs	3,622 cf	0.97 cfs	3,603 cf
10-year	2.22 cfs	7,899 cf	2.02 cfs	7,365 cf
25-year	3.30 cfs	11,691 cf	2.91 cfs	10,609 cf
100-year	5.63 cfs	20,101 cf	4.77 cfs	17,670 cf

Design Point # DP 2 – Offsite North				
Storm Event	***Pre-Development***		***Post-Development***	
	Runoff Rate	*Volume*	*Runoff Rate*	*Volume*
2-year	1.24 cfs	4,502 cf	0.37 cfs	1,248 cf
10-year	2.97 cfs	10,173 cf	0.78 cfs	2,591 cf
25-year	4.49 cfs	15,275 cf	1.13 cfs	3,758 cf
100-year	7.82 cfs	26,711 cf	1.87 cfs	6,307 cf

Design Point # DP 3 – Offsite West Wetland				
Storm Event	***Pre-Development***		***Post-Development***	
	Runoff Rate	*Volume*	*Runoff Rate*	*Volume*
2-year	1.38 cfs	4,048 cf	1.18 cfs	4,019 cf
10-year	2.84 cfs	8,275 cf	2.41 cfs	8,092 cf
25-year	4.06 cfs	11,921 cf	3.43 cfs	11,582 cf
100-year	6.63 cfs	19, 854 cf	5.57 cfs	19,144 cf

Design Point # DP 4 – Offsite East Wetland				
Storm Event	***Pre-Development***		***Post-Development***	
	Runoff Rate	*Volume*	*Runoff Rate*	*Volume*
2-year	0.98 cfs	3,176 cf	0.78 cfs	3,130 cf
10-year	2.22 cfs	6,927 cf	1.75 cfs	6,713 cf
25-year	3.29 cfs	10,253 cf	2.58 cfs	9,866 cf
100-year	5.60 cfs	17,628 cf	4.35 cfs	16,824 cf

Design Point # DP 5 – Offsite Northwest				
Storm Event	***Pre-Development***		***Post-Development***	
	Runoff Rate	*Volume*	*Runoff Rate*	*Volume*
2-year	0.00 cfs	0 cf	0.00 cfs	5 cf
10-year	0.02 cfs	694 cf	0.01 cfs	310 cf
25-year	0.14 cfs	2,311 cf	0.11 cfs	827 cf
100-year	1.34 cfs	7,871 cf	0.72 cfs	2,445 cf

Design Point # DP 6 – Offsite East				
Storm Event	***Pre-Development***		***Post-Development***	
	Runoff Rate	*Volume*	*Runoff Rate*	*Volume*
2-year	0.02 cfs	548 cf	0.13 cfs	566 cf
10-year	0.40 cfs	2,860 cf	0.41 cfs	1,484 cf
25-year	1.09 cfs	5,586 cf	0.68 cfs	3,361 cf
100-year	2.99 cfs	12,875 cf	1.28 cfs	4,411 cf

APPENDIX A

Soil Evaluation Test Pit Logs

On-Site Review
Form 11 & 12
Franklin, Massachusetts

Site Address/Parcel ID **0 Upper Union Street** Owner Name VS Union Solar Smart, LLC
New Construction ☒ Upgrade ☐ Repair ☐
Soil Survey Available? Yes ☒ No ☐ Source NRCS Web Soil Survey Soil Map Unit 312B
Soil Name Woodbridge Fine Sandy Loam Parent Material Coarse Loamy Lodgement Till Landform Ground Moraines
Land Use Lawn Slope (%) 0-8 Surface Stones None Vegetation Grass
Current Water Resource Conditions (USGS): Date: 10/11/2023 Range: Normal

Deep Hole Number **TP-1** Date 10/11/2023 Time 8:00 am Weather Cloudy 55°
Distance From: Open Water Body 400'+ Drainage Way 100'+ Wetlands 100'+
Property Line 10'+ Drinking Water Well 100'+ Other None
Unsuitable Material Present? Yes☐ No ☒ If Yes: Disturbed Soil ☐ Fill Material ☐ Bedrock ☐
Groundwater Observed? Yes ☐ No ☒ If Yes: Depth to Weeping None Depth to Standing None
Estimated Depth to High Groundwater Mottles @74"

SOIL LOG					
Depth (in)	Soil Horizon/ Layer	Soil Texture	Soil Color (Munsell)	Mottles	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0-8	O/A	Sandy Loam	10YR 3/2		
8-34	B	Sandy Loam	10YR 5/6		
34-108	C	Loamy Sand	2.5Y 5/2	74"	

Soil Survey Available? Yes ☒ No ☐ Source NRCS Web Soil Survey Soil Map Unit 310B
Soil Name Woodbridge Fine Sandy Loam Parent Material Coarse Loamy Lodgement Till Landform Ground Moraines
Land Use Lawn Slope (%) 3-8 Surface Stones None Vegetation Grass
Current Water Resource Conditions (USGS): Date: 10/11/2023 Range: Normal

Deep Hole Number **TP-2** Date 10/11/2023 Time 8:00 am Weather Cloudy 55°
Distance From: Open Water Body 400'+ Drainage Way 100'+ Wetlands 100'+
Property Line 10'+ Drinking Water Well 100'+ Other None
Unsuitable Material Present? Yes☐ No ☒ If Yes: Disturbed Soil ☐ Fill Material ☐ Bedrock ☐
Groundwater Observed? Yes ☐ No ☒ If Yes: Depth to Weeping None Depth to Standing None
Estimated Depth to High Groundwater Mottles @ 70"

SOIL LOG					
Depth (in)	Soil Horizon/ Layer	Soil Texture	Soil Color (Munsell)	Mottles	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0-8	O/A	Sandy Loam	10YR 3/2		
8-32	B	Sandy Loam	10YR 5/6		
32-94	C	Loamy Sand	2.5Y 5/2	70"	Refusal

On-Site Review
Form 11 & 12

Deep Hole Number **TP-3** Date 10/11/2023 Time 8:00 am Weather Cloudy 55°
Distance From: Open Water Body 400'+ Drainage Way 100'+ Wetlands 100'+
Property Line 10'+ Drinking Water Well 100'+ Other None
Unsuitable Material Present? Yes☐ No ☒ If Yes: Disturbed Soil ☐ Fill Material ☐ Bedrock ☐
Groundwater Observed? Yes ☐ No ☒ If Yes: Depth to Weeping None Depth to Standing None
Estimated Depth to High Groundwater Mottles @60"

SOIL LOG					
Depth (in)	Soil Horizon/ Layer	Soil Texture	Soil Color (Munsell)	Mottles	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0-12	O/A	Sandy Loam	10YR 3/2		
12-38	B	Sandy Loam	10YR 5/6		
38-56	C1	Loamy Sand	2.5Y 5/2		
56-74	C2d	Sandy Loam	2.5Y 5/3	60"	
74-122	C3	Medium Coarse Sand	2.5Y 5/4		

Deep Hole Number **TP-4** Date 10/11/2023 Time 8:00 am Weather Cloudy 45°
Distance From: Open Water Body 400'+ Drainage Way 100'+ Wetlands 100'+
Property Line 10'+ Drinking Water Well 100'+ Other None
Unsuitable Material Present? Yes☐ No ☒ If Yes: Disturbed Soil ☐ Fill Material ☐ Bedrock ☐
Groundwater Observed? Yes ☐ No ☒ If Yes: Depth to Weeping None Depth to Standing None
Estimated Depth to High Groundwater Mottles @50"

SOIL LOG					
Depth (in)	Soil Horizon/ Layer	Soil Texture	Soil Color (Munsell)	Mottles	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0-10	O/A	Sandy Loam	10YR 3/2		
10-32	B	Sandy Loam	10YR 5/8		
32-76	C	Loamy Sand	2.5Y 5/6	50"	

Deep Hole Number **TP-5** Date 10/11/2023 Time 8:00 am Weather Cloudy 45°
Distance From: Open Water Body 400'+ Drainage Way 100'+ Wetlands 100'+
Property Line 10'+ Drinking Water Well 100'+ Other None
Unsuitable Material Present? Yes☐ No ☒ If Yes: Disturbed Soil ☐ Fill Material ☐ Bedrock ☐
Groundwater Observed? Yes ☐ No ☒ If Yes: Depth to Weeping None Depth to Standing None
Estimated Depth to High Groundwater Mottles @40"

SOIL LOG					
Depth (in)	Soil Horizon/ Layer	Soil Texture	Soil Color (Munsell)	Mottles	Other (Structure, Stones, Boulders, Consistency, % Gravel)
0-8	O/A	Sandy Loam	10YR 3/2		
8-34	B	Sandy Loam	10YR 5/8		
34-84	C	Loamy Sand	2.5Y 5/6	40"	Refusal

On-Site Review
Form 11 & 12

Witnessed By: No witness

Performed By: Nyle Zager SE2781 Exp. 6/30/2025

Signature _____ Date 10-17-23

PERCOLATION TEST	
Date: 10/11/2023	Time: 9:04 am
Deep Hole Number	NONE
Depth of Perc.	
Start Pre-Soak	
End Pre-Soak	
Time at 12"	
Time at 9"	
Time at 6"	
Time (9"-6")	
Rate (Min./Inch)	

3 Main St Lakeville, MA Tel# 508-947-4208

APPENDIX B

Miscellaneous Calculations

Drawdown Calculations

Design Engineer:	Atlantic Design Engineers, Inc.	Job No.:	3328.00
Project Name:	Upper Union Solar Project	Calc'd By:	BJR
Location:	0 Upper Union Street, Franklin, MA	Date:	11/10/2023

Time Drawdown (Tdd)=Rv/[(K)(A)]

Rv = Storage Volume
K = Saturated Hydraulic Conductivity
A = Bottom Area of Basin

Rv calculated in HydroCAD based on 100yr design storm

Proposed Stormwater Basin 2P	Infiltration Rate	2.41	in/hr		
	Bottom Area =	4,039		sq ft	
	Storage Volume (Rv)=	15,057			
	Time to Drawdown (Tdd)=	15,057 / [(2.41 / 12) (4,039)]			
	Time to Drawdown (Tdd)=	19		**hrs <72 hrs - Requirement Met**	
Proposed Stormwater Basin 6P	Infiltration Rate	2.41	in/hr		
	Bottom Area =	1,593		sq ft	
	Storage Volume (Rv)=	16,011			
	Time to Drawdown (Tdd)=	16,011 / [(2.41 / 12) (1,593)]			
	Time to Drawdown (Tdd)=	50		**hrs <72 hrs - Requirement Met**	
Proposed Infiltration Trench	Infiltration Rate	2.41	in/hr		
	Bottom Area =	140		sq ft	
	Storage Volume (Rv)=	56			
	Time to Drawdown (Tdd)=	56 / [(2.41 / 12) (140)]			
	Time to Drawdown (Tdd)=	2		**hrs <72 hrs - Requirement Met**	

Required Recharge Volume

Design Engineer:	Atlantic Design Engineers, Inc	Job No.:	3328.00
Project Name:	Upper Union Solar Project	Calc'd By:	BJR
Location:	0 Upper Union Street, Franklin, MA	Original Date:	6/19/2023
		Revised Date:	11/10/2023

The groundwater recharge volume is required for the proposed asphalt **impervious area.**

Rv = (F) (Aimp)
Rv = Required Recharge Volume
Aimp= Impervious Area on site
F = Target Depth Factor: 0.25 inch for C soils

Required Recharge

Total New Impervious Area =	1,137 sf	
Required Recharge Volume (Rv)=	1,137 *0.25"* (1/12)=	**24 cf**
Recharge Volume Provided		
Cultec C-100HD Subsurface System	(2) Cultec C-100HD Chambers w/ Stone (See HydroCAD Calcs)	**153** cf
Proposed Volume Provided in Sub-Surface Systems=		**153 cf**

Total Required Recharge Volume on Site= 24 cf

Proposed Recharge Volume Provided in Subsurface System= 153 cf

153 > 24

Standard is Met

Required Recharge Volume

Design Engineer:	Atlantic Design Engineers, Inc	Job No.:	3328.00
Project Name:	Upper Union Solar Project	Calc'd By:	BJR
Location:	0 Upper Union Street, Franklin, MA	Original Date:	6/19/2023
		Revision Date:	11/10/2023

The groundwater recharge volume is required for the proposed equipment pad **impervious area.**

Rv = (F) (Aimp)
Rv = Required Recharge Volume
Aimp= Impervious Area on site
F = Target Depth Factor: 0.6 inch for A soils

Infiltration Trench (140 SF x 1'D @ 40% Voids)

Total New Impervious Area =	640 sf	
Required Recharge Volume (Rv)=	640 *0.6"* (1/12)=	**32 cf**
Recharge Volume Provided		
Infiltration Trench	140 SF*1 FT *(40%)=	**56 cf**
Proposed Volume Provided in Infiltration Trench=		**56 cf**

Total Required Recharge Volume on Site=	**32 cf**
Proposed Recharge Volume Provided in Infiltration Trench=	**56 cf**

56 > 32

Standard is Met

TSS REMOVAL CALCULATION SHEET

Design Engineer:	Atlantic Design Engineers, Inc	Job No.:	3328.00
Project Name:	Upper Union Solar Project	Calc'd By:	BR
Location:	0 Upper Union Street, Franklin, MA	Date:	11/10/2023

Paved Driveway Section (80% Treatment Requirement)

BMP	Removal Rate	Starting TSS Load	TSS Removed	Remaining Load
Deep Sump Catch Basins	25%	100.0%	25%	75.0%
Subsurface Infiltration (Cultec HD-100)	80%	75.0%	60%	15.0%
Total Removed			**85%**	

Water Quality Calulation Sheet*

Design Engineer:	Atlantic Design Engineers, Inc	Job No.:	3328.00
Project Name:	Upper Union Solar Project	Calc'd By:	BJR
Location:	0 Upper Union Street, Franklin, MA	Original Date:	6/19/2023
		Revision Date:	11/10/2023

The required water quality treatment volume is calculated as follows:

Vwq = (Dwq)*(Aimp)
Vwq =Required Water Quality Volume
Dwq =Water Quality Depth * **1"**
Aimp=Area of Impervious

Subcatchment Area: 1S

Total Impervious Area for the Subcatchment=	1,137	sf			
Water Quality Volume Required (Vwq)=	1,137		* 1" * (1/12)=	95	cf
Volume Provided via Cultec 100HD=			(4 CHAMBER) Cultec C-100HD Chambers w/ Stone (See HydroCAD Calcs)	153	cf
Volume Required=	94.8		<	153	**Water Quality Volume is met**

Subcatchment Area: 6A

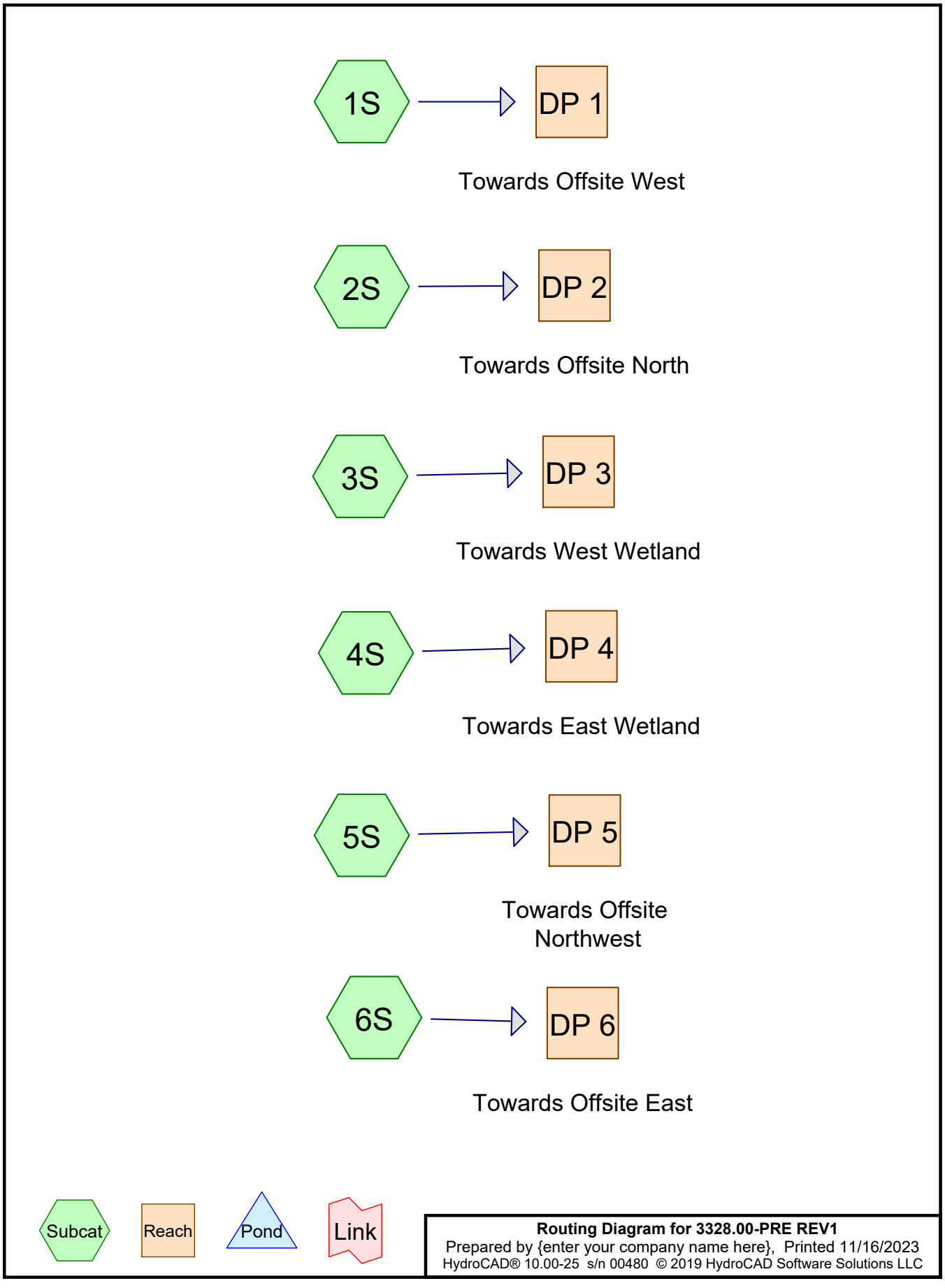
Total Impervious Area for the Subcatchment=	640	sf			
Water Quality Volume Required (Vwq)=	640		* 1" * (1/12)=	53	cf
Volume Provided via Infiltration Trench=			140 SF*1"*(40%)	56	cf
Volume Required=	53.3		<	56	**Water Quality Volume is met**

Total Impervious Area on the Site=	1,777	sf
Total Volume Quality Required=	148	cf
Total Volume Provided=	209	cf

* The purpose of these calculations is to show compliance with the Town of Franklin Stormwater Management Bylaw Chapter 153, specifically Section153-16.B.(1).(a)

APPENDIX C

Revised Pre and Post Development HydroCAD Calculations



Routing Diagram for 3328.00-PRE REV1

Prepared by {enter your company name here}, Printed 11/16/2023

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
36,001	74	>75% Grass cover, Good, HSG C (1S, 2S)
45,039	77	Brush, Poor, HSG C (3S, 4S)
2,000	96	Gravel surface, HSG C (3S, 4S)
3,337	98	Roofs, HSG C (1S, 2S)
91,346	30	Woods, Good, HSG A (5S, 6S)
135,937	70	Woods, Good, HSG C (1S, 2S, 3S, 4S, 5S, 6S)
313,660	**60**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
91,346	HSG A	5S, 6S
0	HSG B	
222,314	HSG C	1S, 2S, 3S, 4S, 5S, 6S
0	HSG D	
0	Other	
313,660		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Sub Num
0	0	36,001	0	0	36,001	>75% Grass cover, Good	
0	0	45,039	0	0	45,039	Brush, Poor	
0	0	2,000	0	0	2,000	Gravel surface	
0	0	3,337	0	0	3,337	Roofs	
91,346	0	135,937	0	0	227,283	Woods, Good	
91,346	**0**	**222,314**	**0**	**0**	**313,660**	**TOTAL AREA**	

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Runoff Area=43,659 sf 4.43% Impervious Runoff Depth=1.00"
Flow Length=329' Tc=11.4 min CN=73 Runoff=0.98 cfs 3,622 cf

Subcatchment 2S: Runoff Area=60,694 sf 2.31% Impervious Runoff Depth=0.89"
Flow Length=325' Tc=10.3 min CN=71 Runoff=1.24 cfs 4,502 cf

Subcatchment 3S: Runoff Area=39,622 sf 0.00% Impervious Runoff Depth=1.23"
Flow Length=182' Tc=9.1 min CN=77 Runoff=1.23 cfs 4,048 cf

Subcatchment 4S: Runoff Area=38,286 sf 0.00% Impervious Runoff Depth=1.00"
Flow Length=122' Tc=8.2 min CN=73 Runoff=0.98 cfs 3,176 cf

Subcatchment 5S: Runoff Area=72,775 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=357' Tc=15.1 min CN=37 Runoff=0.00 cfs 0 cf

Subcatchment 6S: Runoff Area=58,624 sf 0.00% Impervious Runoff Depth=0.11"
Flow Length=427' Tc=15.7 min CN=49 Runoff=0.02 cfs 548 cf

Reach DP 1: Towards Offsite West Inflow=0.98 cfs 3,622 cf
Outflow=0.98 cfs 3,622 cf

Reach DP 2: Towards Offsite North Inflow=1.24 cfs 4,502 cf
Outflow=1.24 cfs 4,502 cf

Reach DP 3: Towards West Wetland Inflow=1.23 cfs 4,048 cf
Outflow=1.23 cfs 4,048 cf

Reach DP 4: Towards East Wetland Inflow=0.98 cfs 3,176 cf
Outflow=0.98 cfs 3,176 cf

Reach DP 5: Towards Offsite Northwest Inflow=0.00 cfs 0 cf
Outflow=0.00 cfs 0 cf

Reach DP 6: Towards Offsite East Inflow=0.02 cfs 548 cf
Outflow=0.02 cfs 548 cf

Total Runoff Area = 313,660 sf Runoff Volume = 15,898 cf Average Runoff Depth = 0.61"
98.94% Pervious = 310,323 sf 1.06% Impervious = 3,337 sf

Summary for Subcatchment 1S:

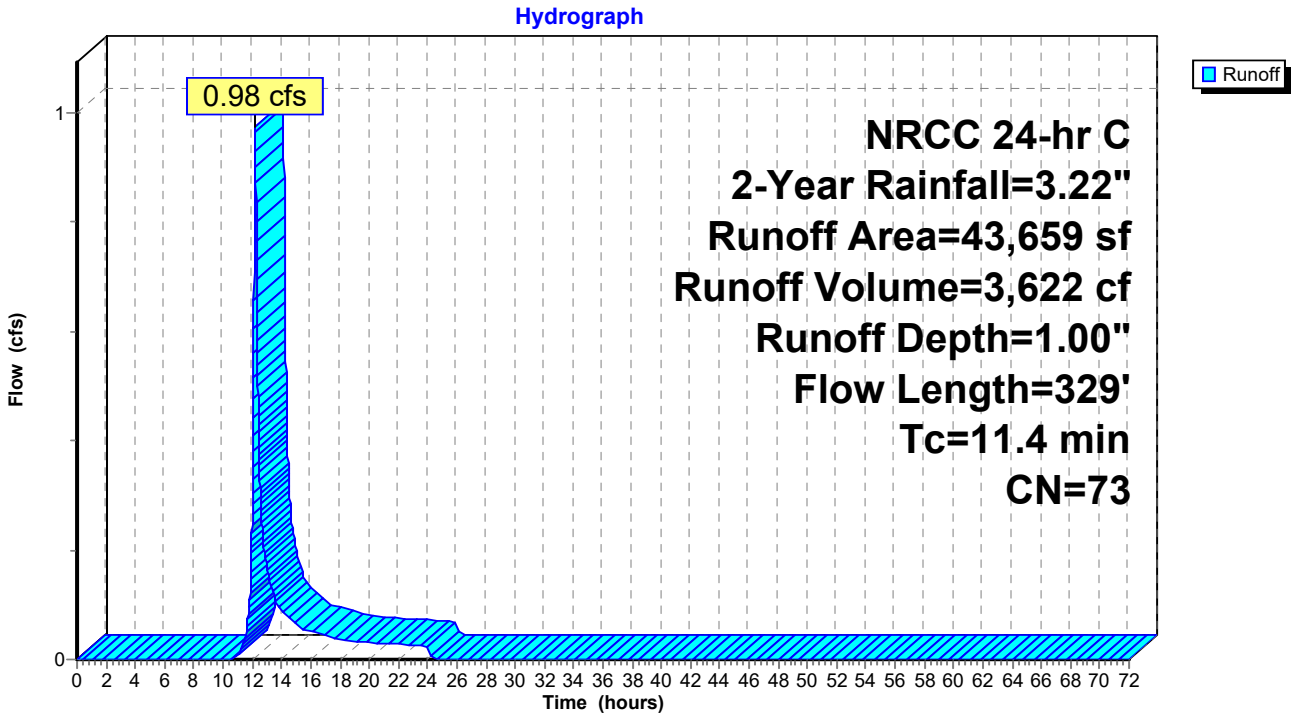
Runoff = 0.98 cfs @ 12.20 hrs, Volume= 3,622 cf, Depth= 1.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 2-Year Rainfall=3.22"

Area (sf)	CN	Description
18,229	70	Woods, Good, HSG C
1,932	98	Roofs, HSG C
23,498	74	>75% Grass cover, Good, HSG C
43,659	73	Weighted Average
41,727		95.57% Pervious Area
1,932		4.43% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	50	0.0280	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.44"
0.3	22	0.0320	1.25		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.4	257	0.0180	0.67		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
11.4	329	Total			

Subcatchment 1S:



Summary for Subcatchment 2S:

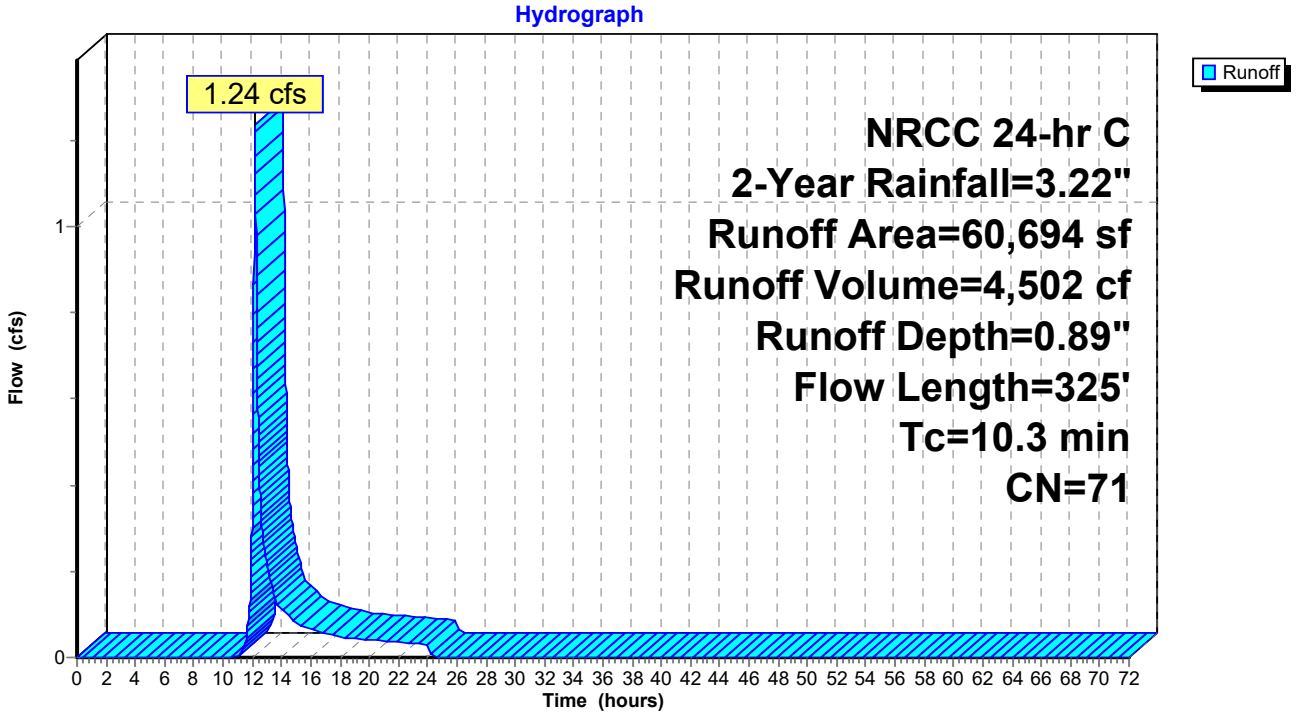
Runoff = 1.24 cfs @ 12.19 hrs, Volume= 4,502 cf, Depth= 0.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 2-Year Rainfall=3.22"

Area (sf)	CN	Description
12,503	74	>75% Grass cover, Good, HSG C
1,405	98	Roofs, HSG C
46,786	70	Woods, Good, HSG C
60,694	71	Weighted Average
59,289		97.69% Pervious Area
1,405		2.31% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	50	0.0540	0.23		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.44"
0.2	13	0.0310	1.23		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.5	262	0.0180	0.67		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
10.3	325	Total			

Subcatchment 2S:



Summary for Subcatchment 3S:

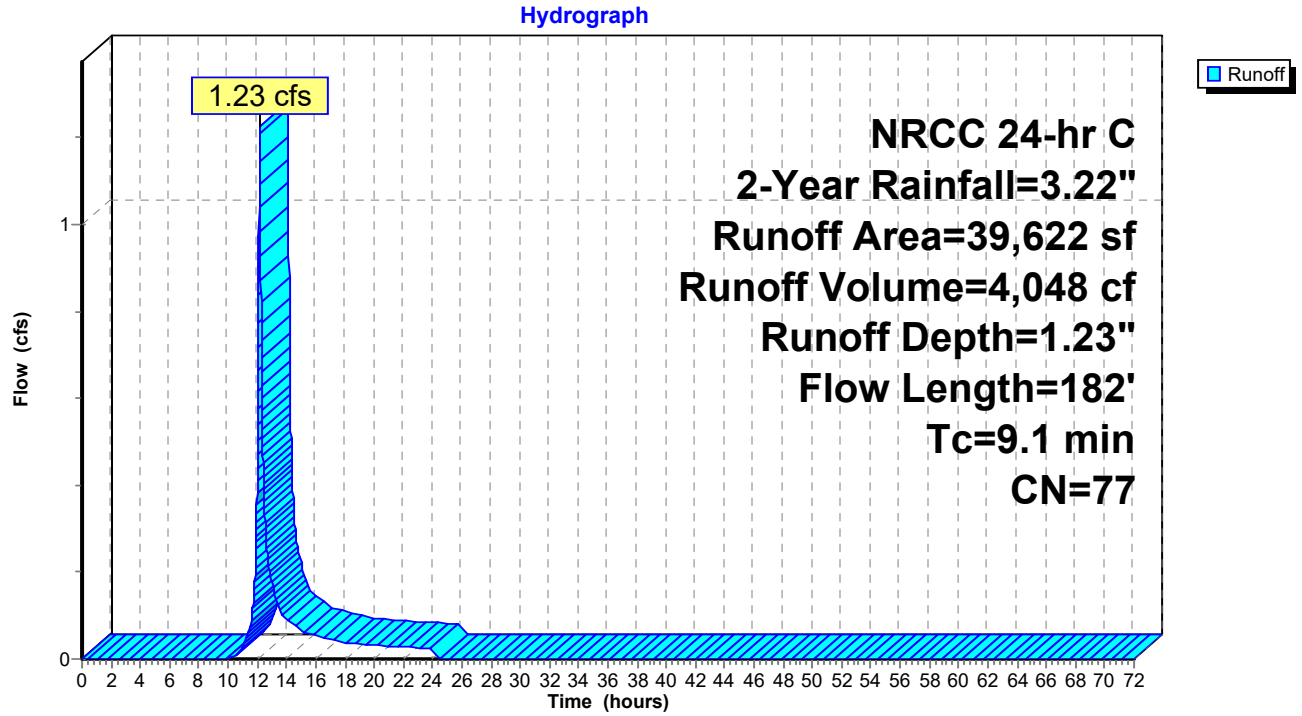
Runoff = 1.23 cfs @ 12.17 hrs, Volume= 4,048 cf, Depth= 1.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 2-Year Rainfall=3.22"

Area (sf)	CN	Description
6,096	70	Woods, Good, HSG C
1,627	96	Gravel surface, HSG C
31,899	77	Brush, Poor, HSG C
39,622	77	Weighted Average
39,622		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	50	0.0548	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.44"
0.9	102	0.0768	1.94		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	11	0.0400	3.22		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.2	19	0.0536	1.62		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
9.1	182	Total			

Subcatchment 3S:



Summary for Subcatchment 4S:

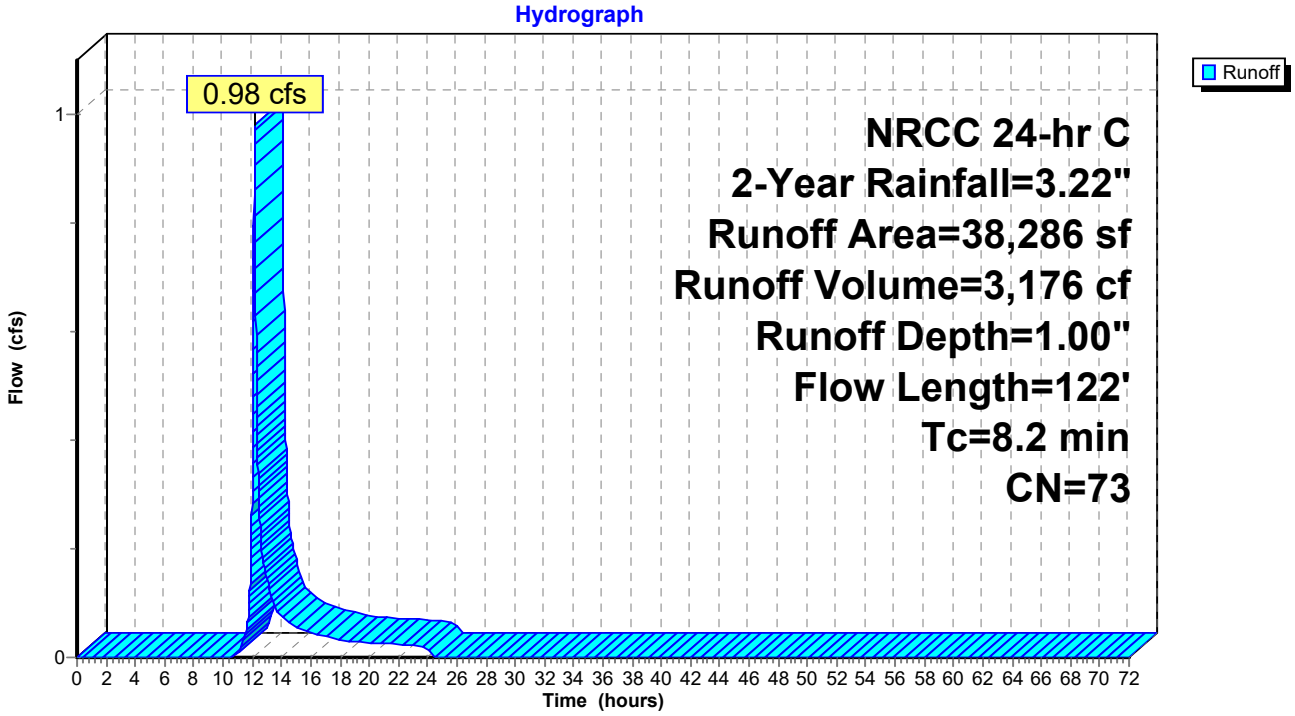
Runoff = 0.98 cfs @ 12.16 hrs, Volume= 3,176 cf, Depth= 1.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 2-Year Rainfall=3.22"

Area (sf)	CN	Description
13,140	77	Brush, Poor, HSG C
17,055	70	Woods, Good, HSG C
373	96	Gravel surface, HSG C
7,718	70	Woods, Good, HSG C
38,286	73	Weighted Average
38,286		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.5	50	0.0640	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.44"
0.7	72	0.1350	1.84		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
8.2	122	Total			

Subcatchment 4S:



Summary for Subcatchment 5S:

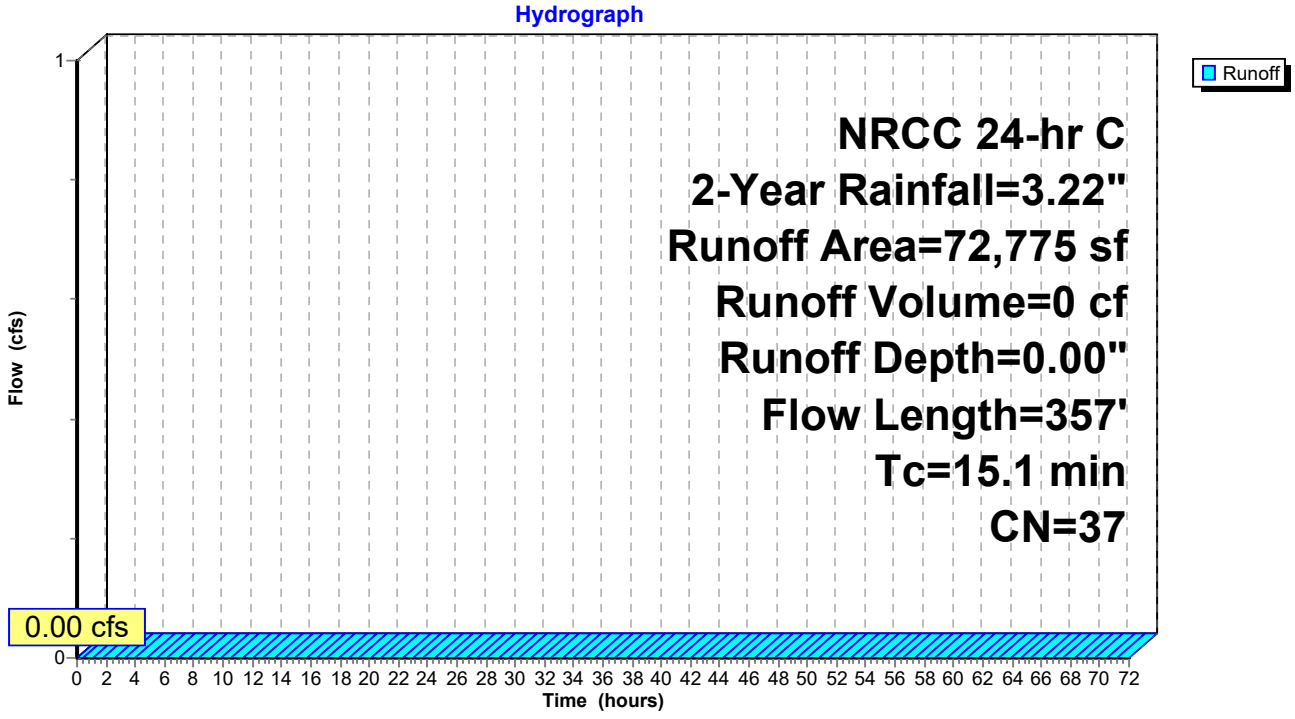
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 2-Year Rainfall=3.22"

Area (sf)	CN	Description
9,331	70	Woods, Good, HSG C
60,443	30	Woods, Good, HSG A
3,001	70	Woods, Good, HSG C
72,775	37	Weighted Average
72,775		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	50	0.0200	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.44"
3.2	307	0.1050	1.62		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
15.1	357	Total			

Subcatchment 5S:



Summary for Subcatchment 6S:

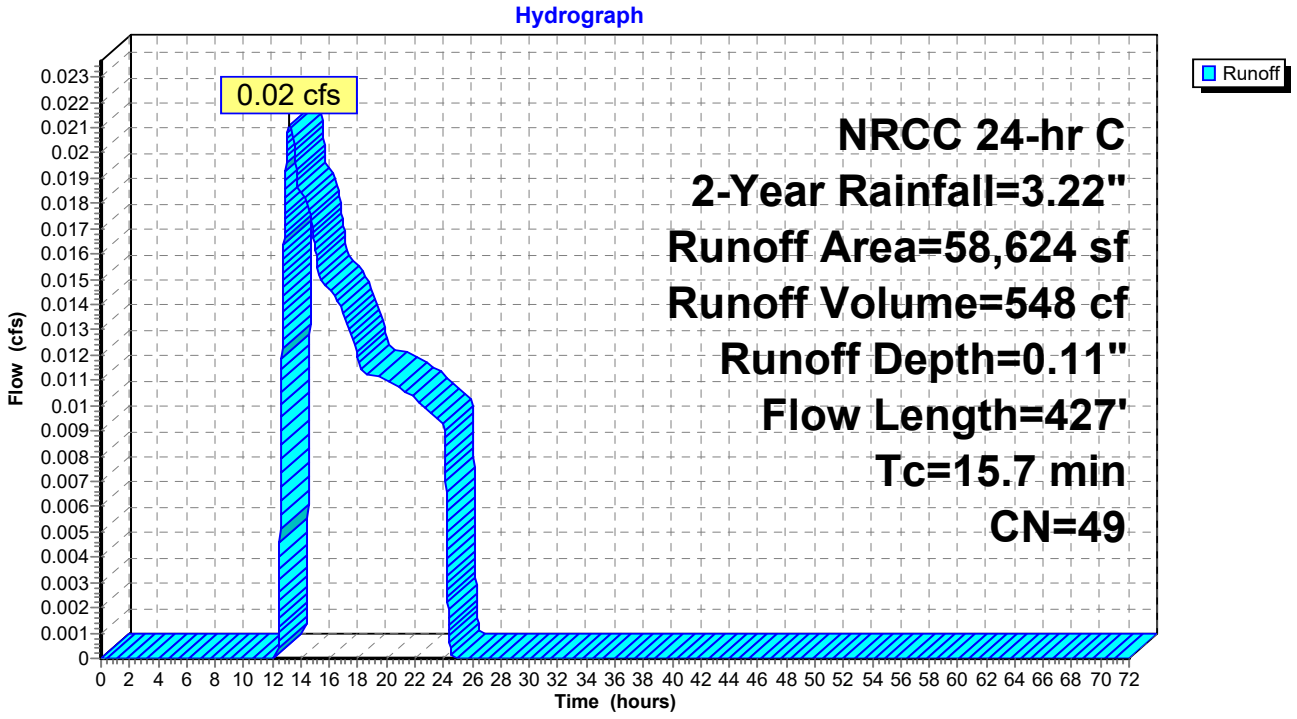
Runoff = 0.02 cfs @ 13.21 hrs, Volume= 548 cf, Depth= 0.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 2-Year Rainfall=3.22"

Area (sf)	CN	Description
30,903	30	Woods, Good, HSG A
27,721	70	Woods, Good, HSG C
58,624	49	Weighted Average
58,624		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	50	0.0200	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.44"
3.8	377	0.1120	1.67		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
15.7	427	Total			

Subcatchment 6S:

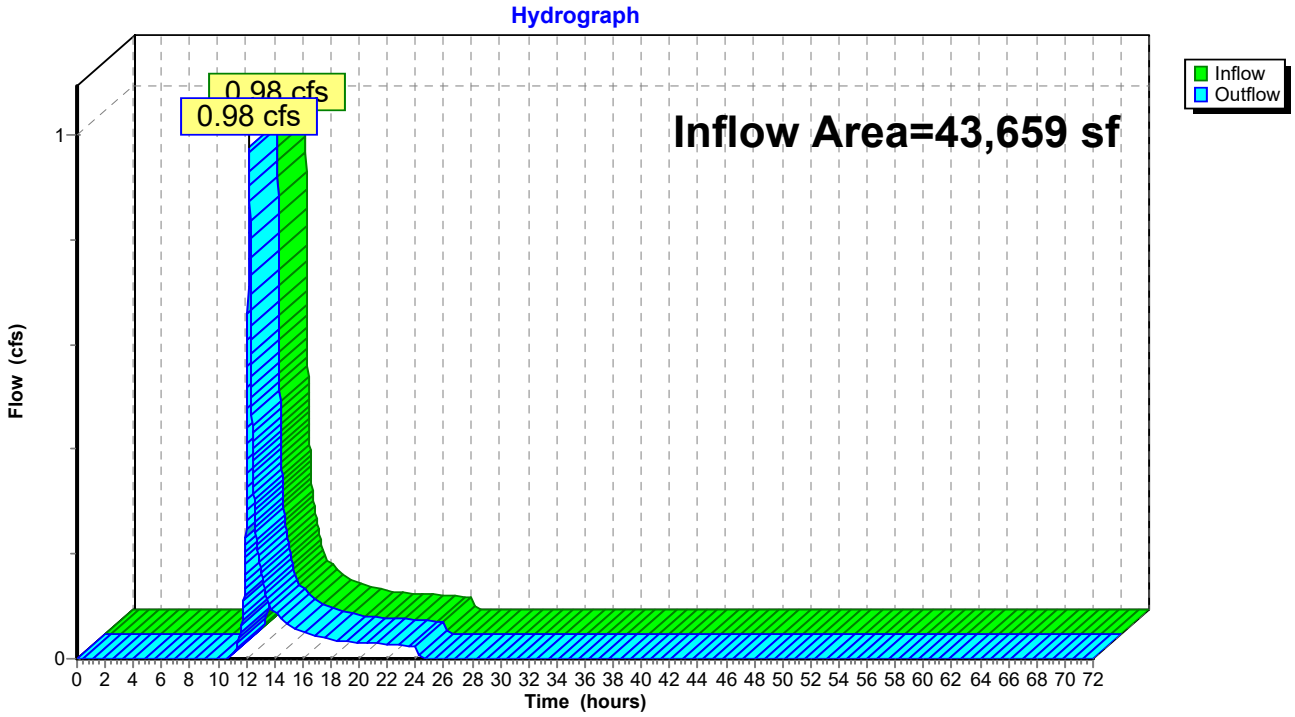


Summary for Reach DP 1: Towards Offsite West

Inflow Area = 43,659 sf, 4.43% Impervious, Inflow Depth = 1.00" for 2-Year event
Inflow = 0.98 cfs @ 12.20 hrs, Volume= 3,622 cf
Outflow = 0.98 cfs @ 12.20 hrs, Volume= 3,622 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 1: Towards Offsite West

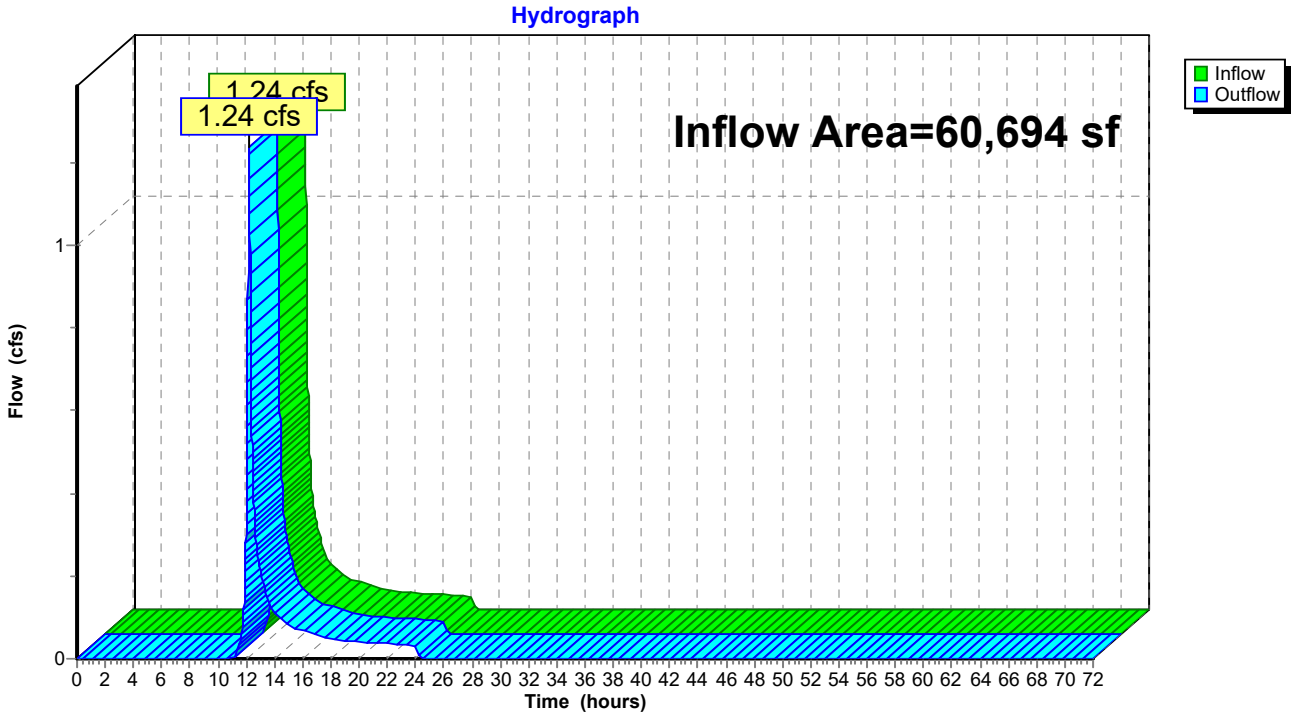


Summary for Reach DP 2: Towards Offsite North

Inflow Area = 60,694 sf, 2.31% Impervious, Inflow Depth = 0.89" for 2-Year event
Inflow = 1.24 cfs @ 12.19 hrs, Volume= 4,502 cf
Outflow = 1.24 cfs @ 12.19 hrs, Volume= 4,502 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 2: Towards Offsite North

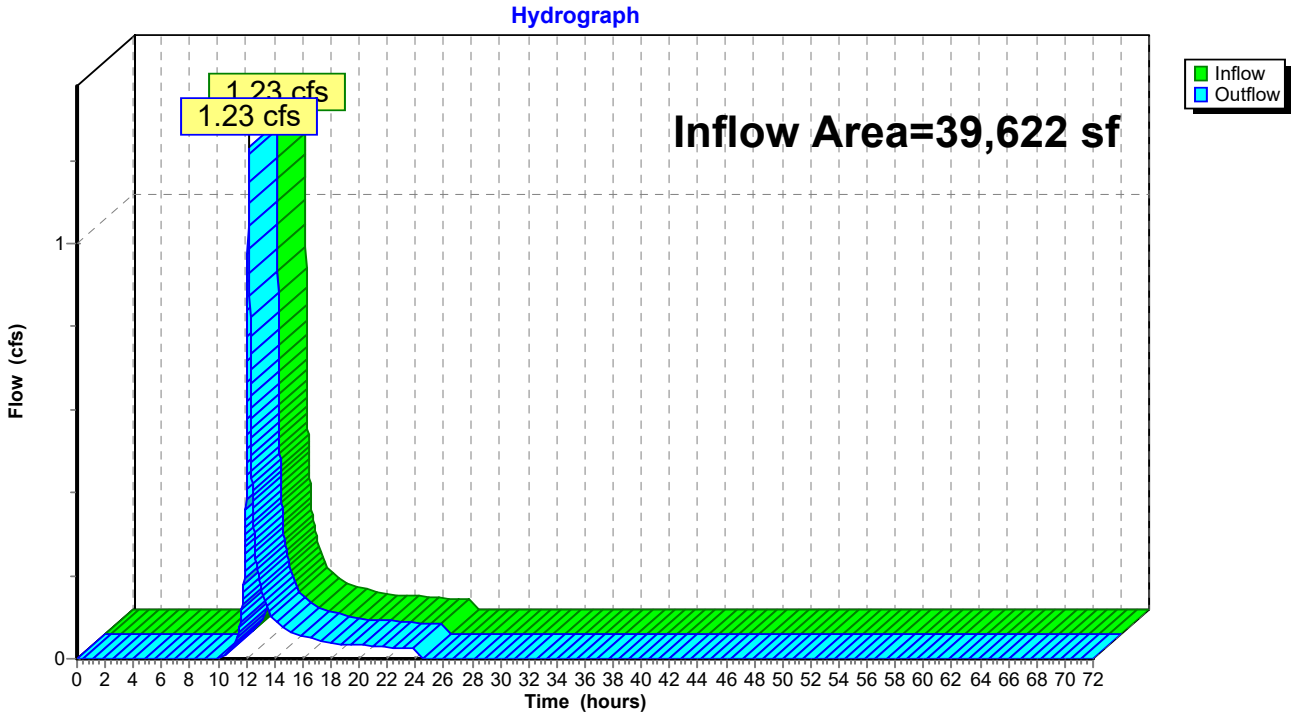


Summary for Reach DP 3: Towards West Wetland

Inflow Area = 39,622 sf, 0.00% Impervious, Inflow Depth = 1.23" for 2-Year event
Inflow = 1.23 cfs @ 12.17 hrs, Volume= 4,048 cf
Outflow = 1.23 cfs @ 12.17 hrs, Volume= 4,048 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 3: Towards West Wetland

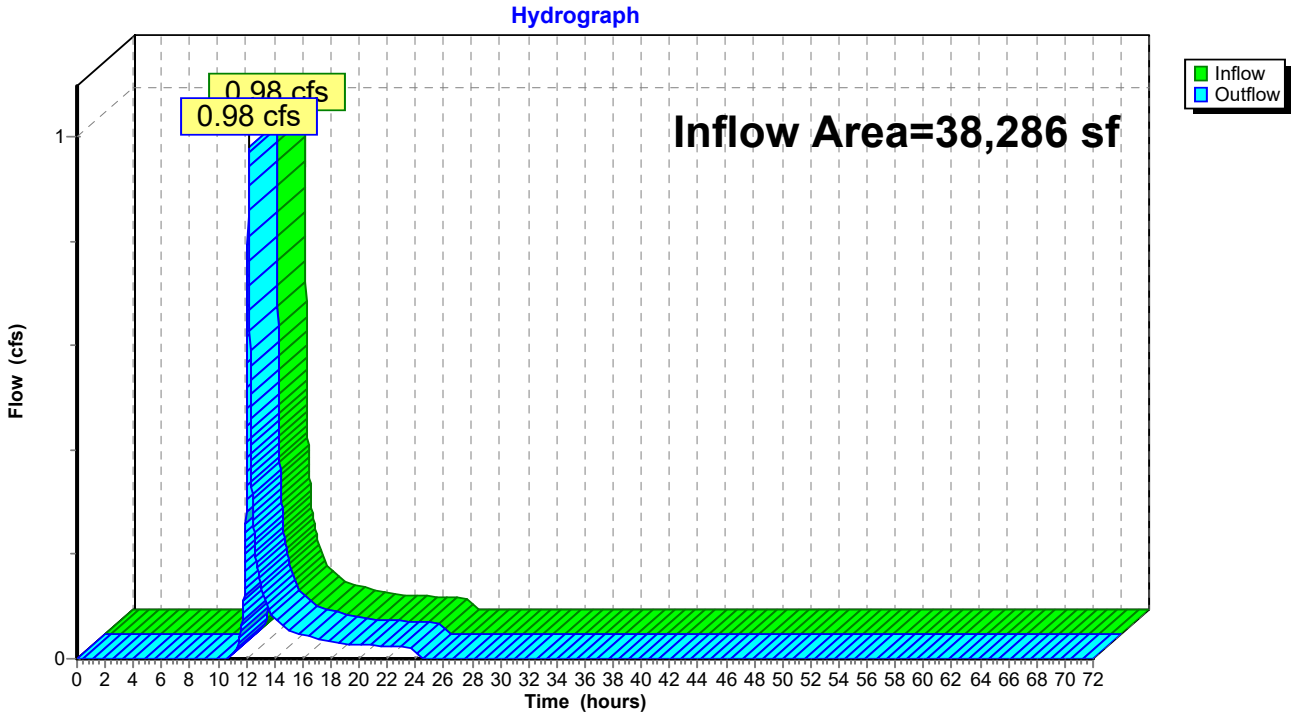


Summary for Reach DP 4: Towards East Wetland

Inflow Area = 38,286 sf, 0.00% Impervious, Inflow Depth = 1.00" for 2-Year event
Inflow = 0.98 cfs @ 12.16 hrs, Volume= 3,176 cf
Outflow = 0.98 cfs @ 12.16 hrs, Volume= 3,176 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 4: Towards East Wetland

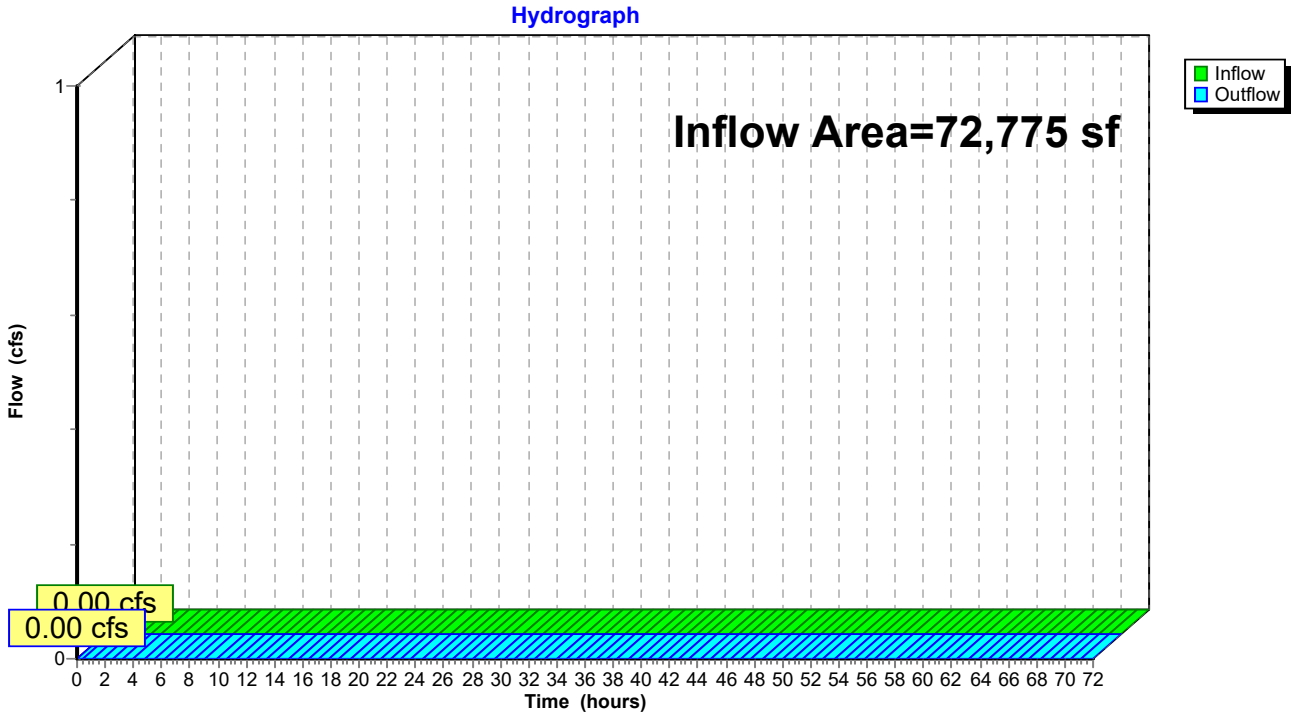


Summary for Reach DP 5: Towards Offsite Northwest

Inflow Area = 72,775 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 5: Towards Offsite Northwest

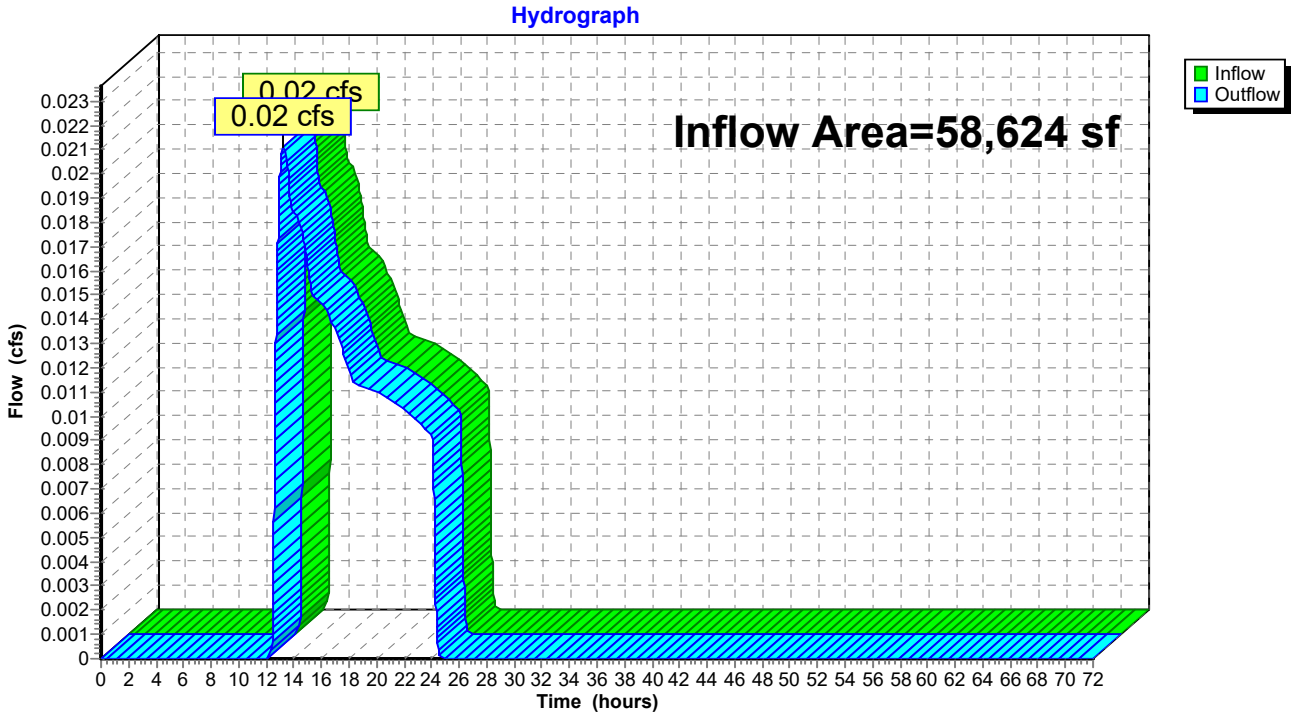


Summary for Reach DP 6: Towards Offsite East

Inflow Area = 58,624 sf, 0.00% Impervious, Inflow Depth = 0.11" for 2-Year event
Inflow = 0.02 cfs @ 13.21 hrs, Volume= 548 cf
Outflow = 0.02 cfs @ 13.21 hrs, Volume= 548 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 6: Towards Offsite East



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Runoff Area=43,659 sf 4.43% Impervious Runoff Depth=2.17"
Flow Length=329' Tc=11.4 min CN=73 Runoff=2.22 cfs 7,899 cf

Subcatchment 2S: Runoff Area=60,694 sf 2.31% Impervious Runoff Depth=2.01"
Flow Length=325' Tc=10.3 min CN=71 Runoff=2.97 cfs 10,173 cf

Subcatchment 3S: Runoff Area=39,622 sf 0.00% Impervious Runoff Depth=2.51"
Flow Length=182' Tc=9.1 min CN=77 Runoff=2.55 cfs 8,275 cf

Subcatchment 4S: Runoff Area=38,286 sf 0.00% Impervious Runoff Depth=2.17"
Flow Length=122' Tc=8.2 min CN=73 Runoff=2.22 cfs 6,927 cf

Subcatchment 5S: Runoff Area=72,775 sf 0.00% Impervious Runoff Depth=0.11"
Flow Length=357' Tc=15.1 min CN=37 Runoff=0.02 cfs 694 cf

Subcatchment 6S: Runoff Area=58,624 sf 0.00% Impervious Runoff Depth=0.59"
Flow Length=427' Tc=15.7 min CN=49 Runoff=0.40 cfs 2,860 cf

Reach DP 1: Towards Offsite West Inflow=2.22 cfs 7,899 cf
Outflow=2.22 cfs 7,899 cf

Reach DP 2: Towards Offsite North Inflow=2.97 cfs 10,173 cf
Outflow=2.97 cfs 10,173 cf

Reach DP 3: Towards West Wetland Inflow=2.55 cfs 8,275 cf
Outflow=2.55 cfs 8,275 cf

Reach DP 4: Towards East Wetland Inflow=2.22 cfs 6,927 cf
Outflow=2.22 cfs 6,927 cf

Reach DP 5: Towards Offsite Northwest Inflow=0.02 cfs 694 cf
Outflow=0.02 cfs 694 cf

Reach DP 6: Towards Offsite East Inflow=0.40 cfs 2,860 cf
Outflow=0.40 cfs 2,860 cf

Total Runoff Area = 313,660 sf Runoff Volume = 36,829 cf Average Runoff Depth = 1.41"
98.94% Pervious = 310,323 sf 1.06% Impervious = 3,337 sf

Summary for Subcatchment 1S:

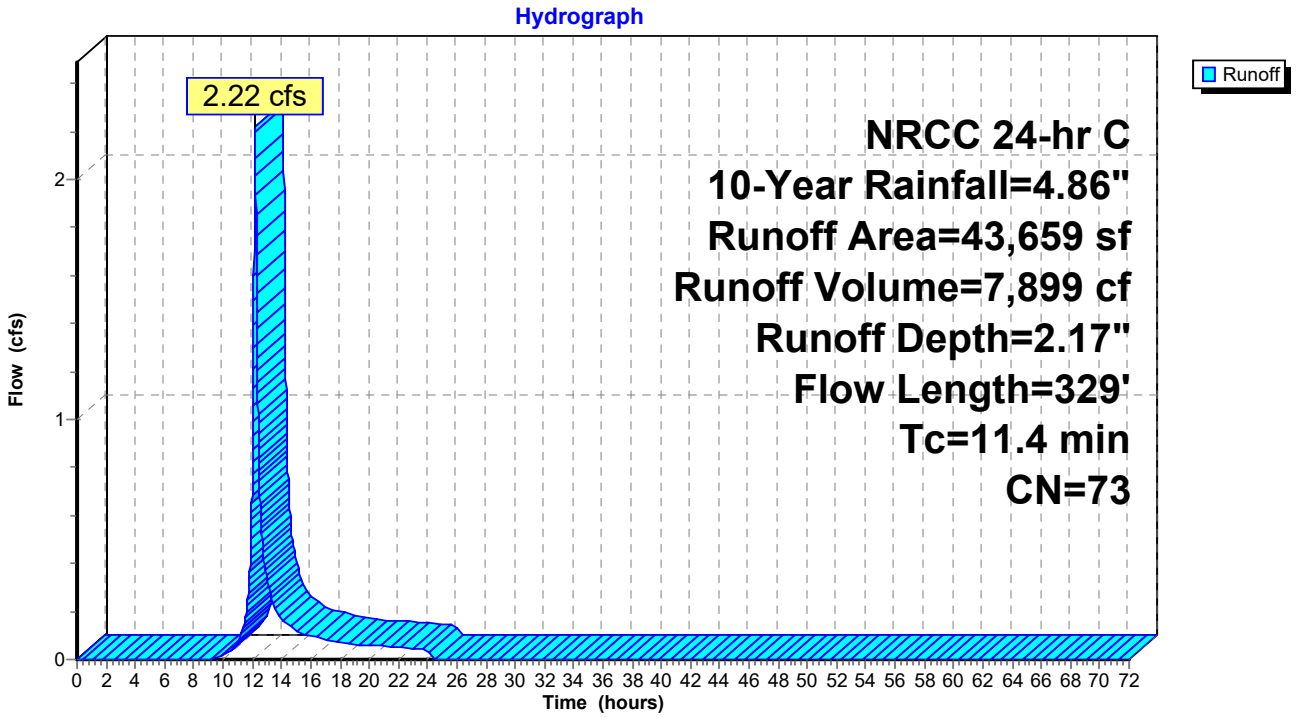
Runoff = 2.22 cfs @ 12.19 hrs, Volume= 7,899 cf, Depth= 2.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 10-Year Rainfall=4.86"

Area (sf)	CN	Description
18,229	70	Woods, Good, HSG C
1,932	98	Roofs, HSG C
23,498	74	>75% Grass cover, Good, HSG C
43,659	73	Weighted Average
41,727		95.57% Pervious Area
1,932		4.43% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	50	0.0280	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.44"
0.3	22	0.0320	1.25		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.4	257	0.0180	0.67		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
11.4	329	Total			

Subcatchment 1S:



Summary for Subcatchment 2S:

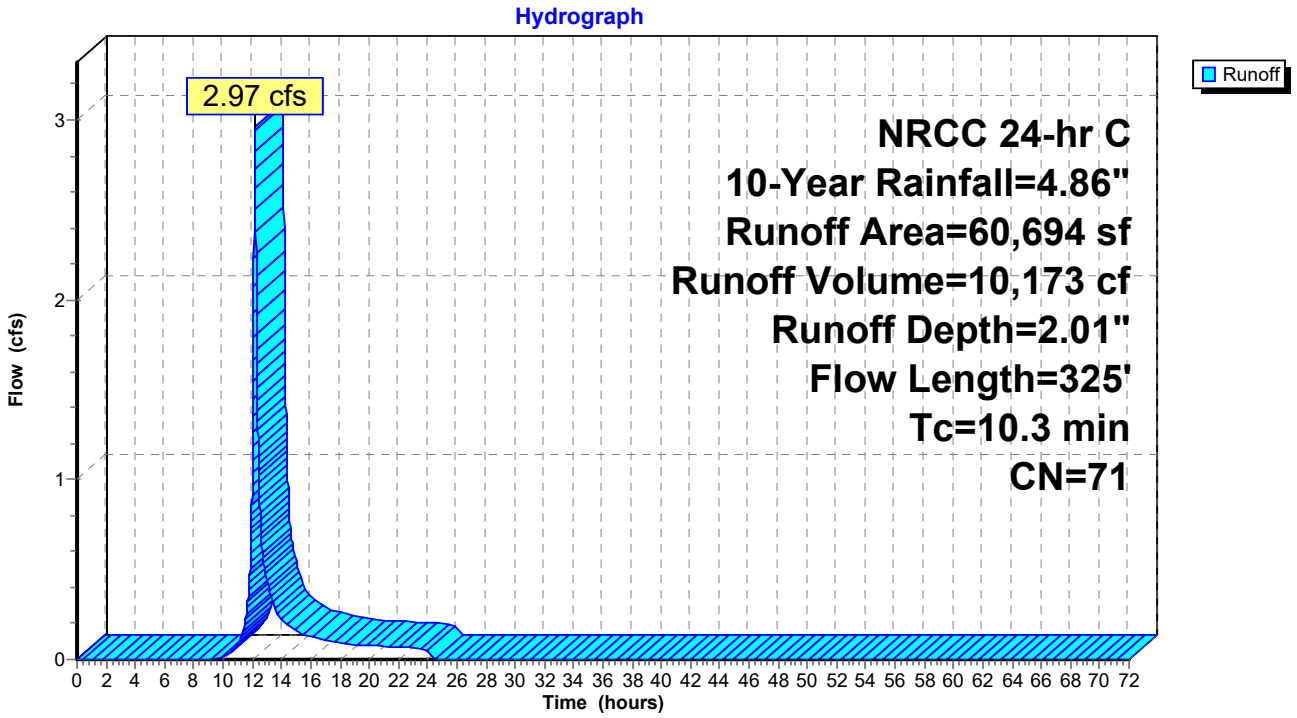
Runoff = 2.97 cfs @ 12.18 hrs, Volume= 10,173 cf, Depth= 2.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 10-Year Rainfall=4.86"

Area (sf)	CN	Description
12,503	74	>75% Grass cover, Good, HSG C
1,405	98	Roofs, HSG C
46,786	70	Woods, Good, HSG C
60,694	71	Weighted Average
59,289		97.69% Pervious Area
1,405		2.31% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	50	0.0540	0.23		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.44"
0.2	13	0.0310	1.23		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.5	262	0.0180	0.67		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
10.3	325	Total			

Subcatchment 2S:



Summary for Subcatchment 3S:

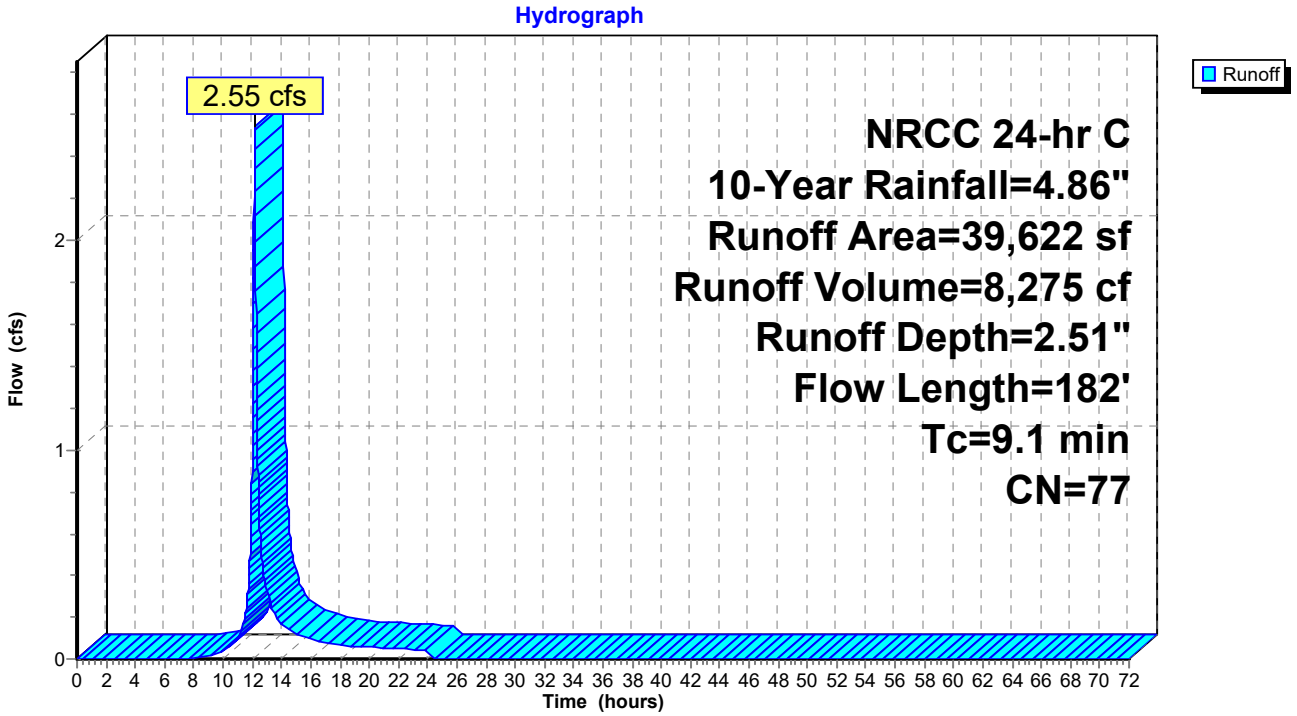
Runoff = 2.55 cfs @ 12.16 hrs, Volume= 8,275 cf, Depth= 2.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 10-Year Rainfall=4.86"

Area (sf)	CN	Description
6,096	70	Woods, Good, HSG C
1,627	96	Gravel surface, HSG C
31,899	77	Brush, Poor, HSG C
39,622	77	Weighted Average
39,622		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	50	0.0548	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.44"
0.9	102	0.0768	1.94		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	11	0.0400	3.22		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.2	19	0.0536	1.62		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
9.1	182	Total			

Subcatchment 3S:



Summary for Subcatchment 4S:

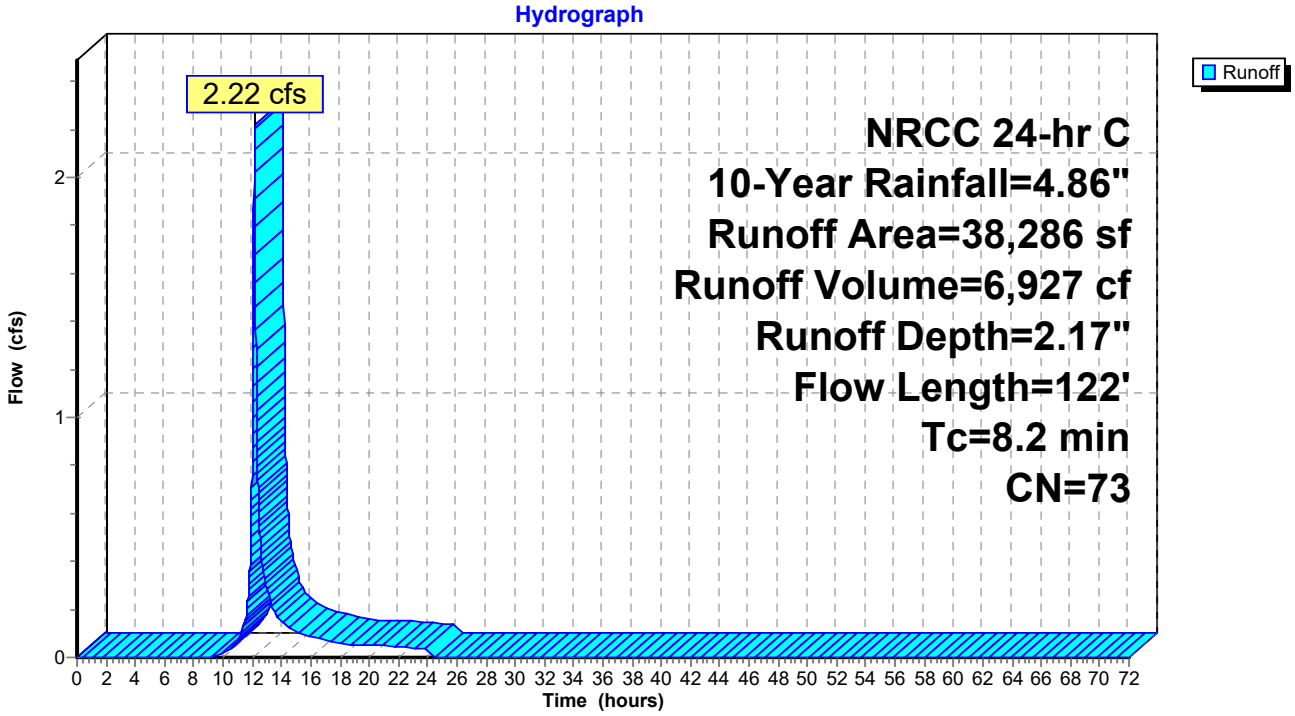
Runoff = 2.22 cfs @ 12.16 hrs, Volume= 6,927 cf, Depth= 2.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 10-Year Rainfall=4.86"

Area (sf)	CN	Description
13,140	77	Brush, Poor, HSG C
17,055	70	Woods, Good, HSG C
373	96	Gravel surface, HSG C
7,718	70	Woods, Good, HSG C
38,286	73	Weighted Average
38,286		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.5	50	0.0640	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.44"
0.7	72	0.1350	1.84		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
8.2	122	Total			

Subcatchment 4S:



Summary for Subcatchment 5S:

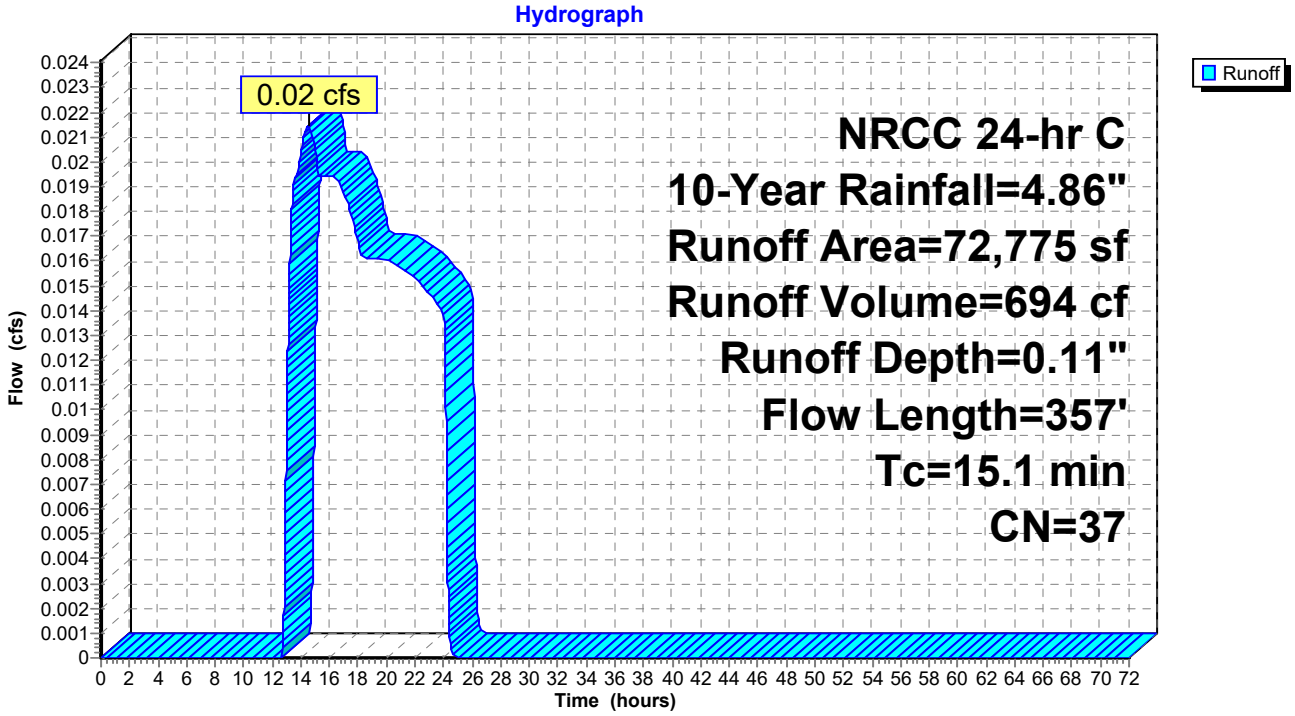
Runoff = 0.02 cfs @ 14.51 hrs, Volume= 694 cf, Depth= 0.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 10-Year Rainfall=4.86"

Area (sf)	CN	Description
9,331	70	Woods, Good, HSG C
60,443	30	Woods, Good, HSG A
3,001	70	Woods, Good, HSG C
72,775	37	Weighted Average
72,775		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	50	0.0200	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.44"
3.2	307	0.1050	1.62		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
15.1	357	Total			

Subcatchment 5S:



Summary for Subcatchment 6S:

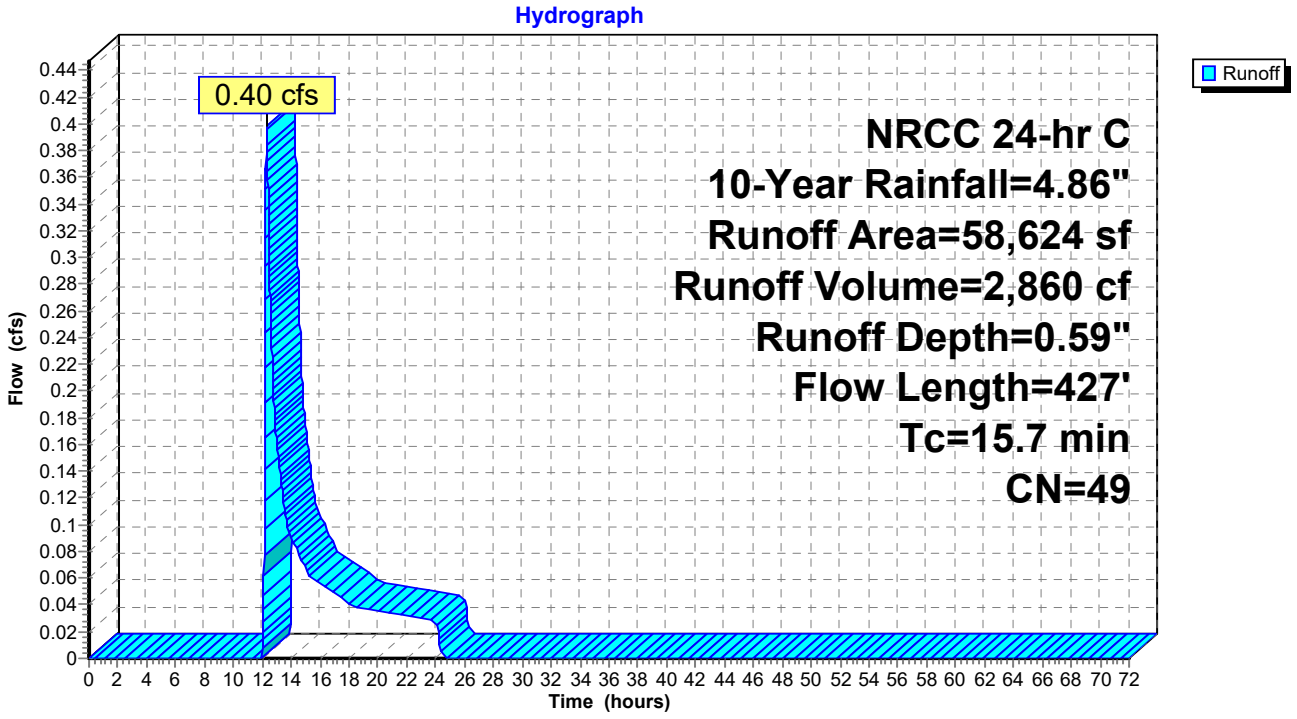
Runoff = 0.40 cfs @ 12.30 hrs, Volume= 2,860 cf, Depth= 0.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 10-Year Rainfall=4.86"

Area (sf)	CN	Description
30,903	30	Woods, Good, HSG A
27,721	70	Woods, Good, HSG C
58,624	49	Weighted Average
58,624		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	50	0.0200	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.44"
3.8	377	0.1120	1.67		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
15.7	427	Total			

Subcatchment 6S:

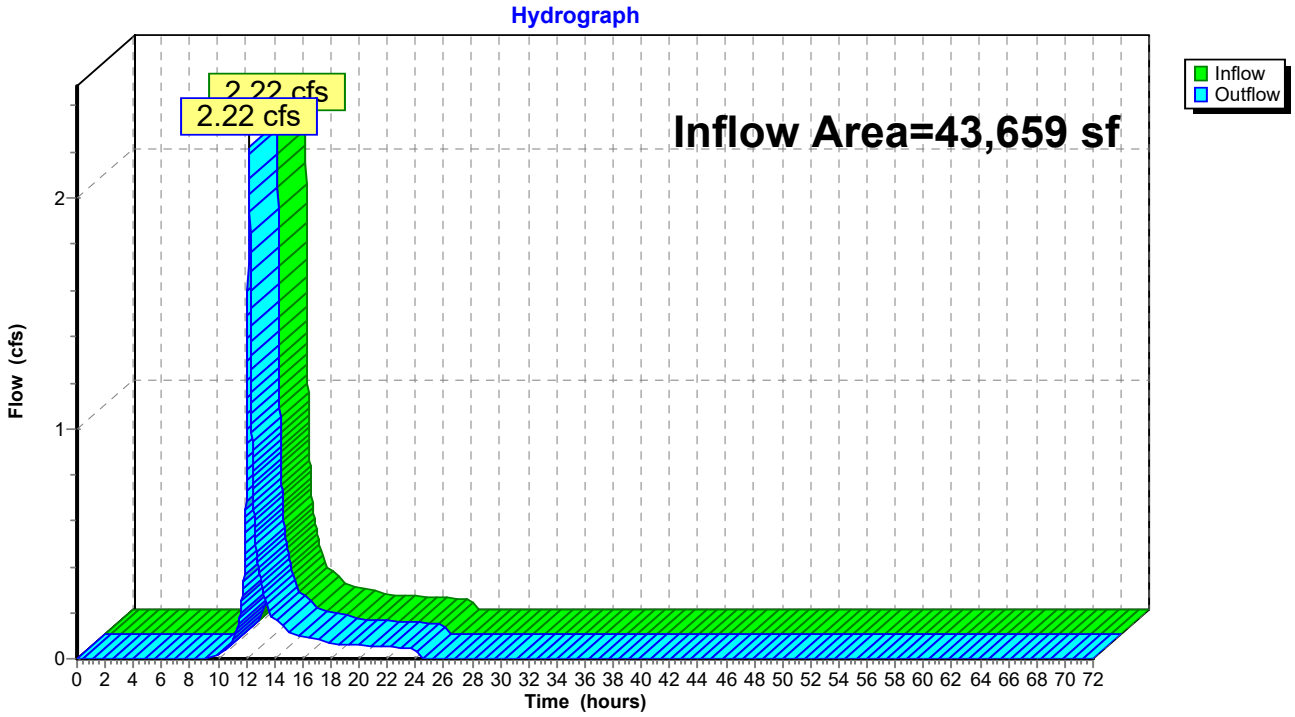


Summary for Reach DP 1: Towards Offsite West

Inflow Area = 43,659 sf, 4.43% Impervious, Inflow Depth = 2.17" for 10-Year event
Inflow = 2.22 cfs @ 12.19 hrs, Volume= 7,899 cf
Outflow = 2.22 cfs @ 12.19 hrs, Volume= 7,899 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 1: Towards Offsite West

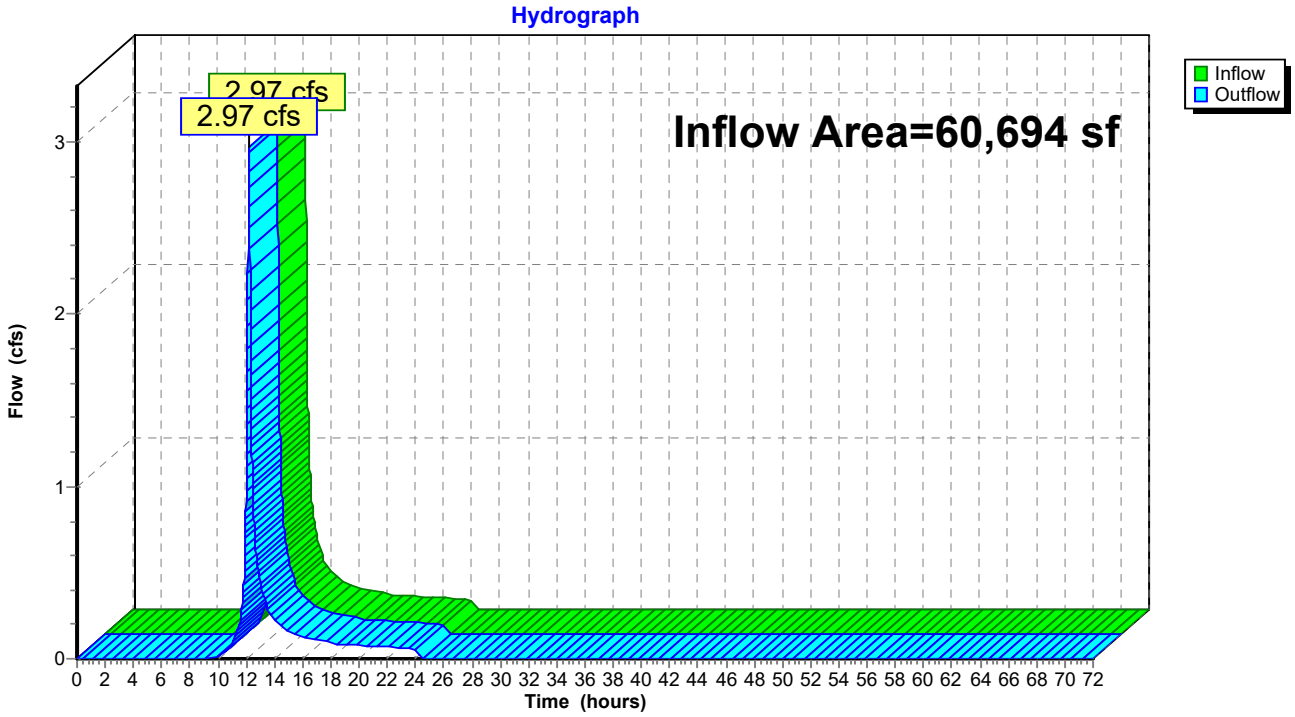


Summary for Reach DP 2: Towards Offsite North

Inflow Area = 60,694 sf, 2.31% Impervious, Inflow Depth = 2.01" for 10-Year event
Inflow = 2.97 cfs @ 12.18 hrs, Volume= 10,173 cf
Outflow = 2.97 cfs @ 12.18 hrs, Volume= 10,173 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 2: Towards Offsite North

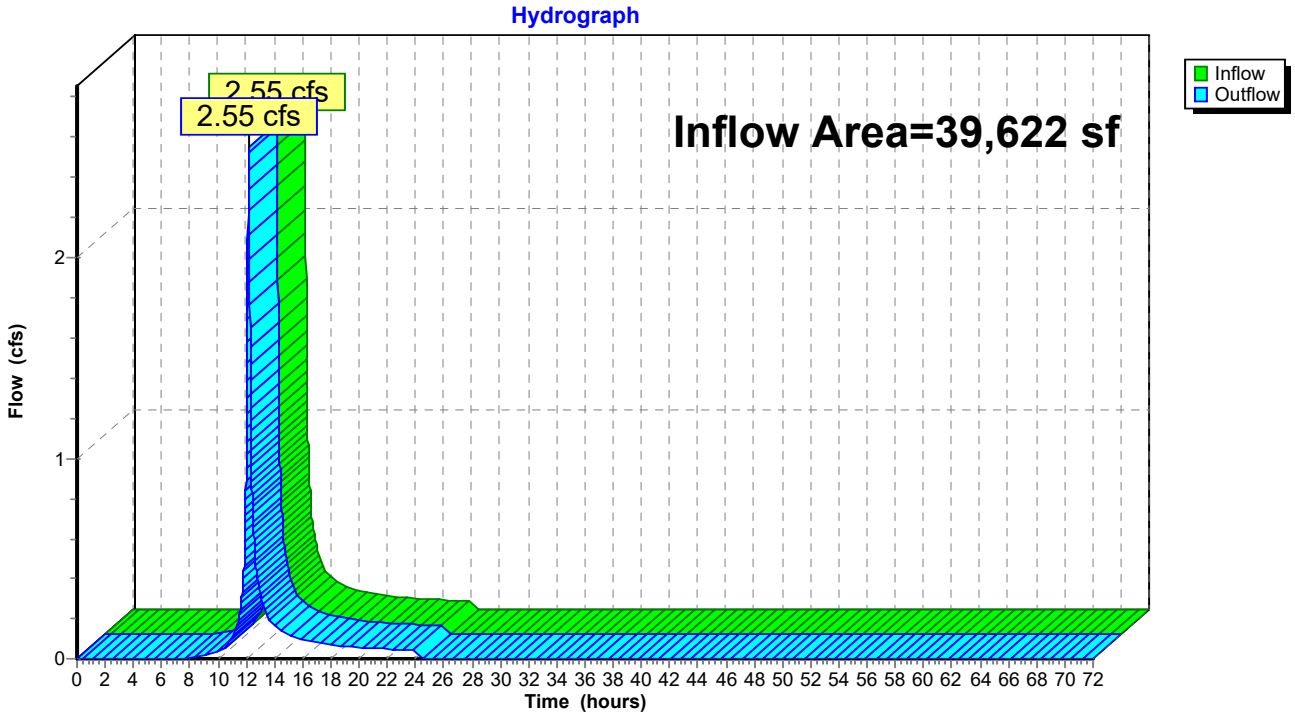


Summary for Reach DP 3: Towards West Wetland

Inflow Area = 39,622 sf, 0.00% Impervious, Inflow Depth = 2.51" for 10-Year event
Inflow = 2.55 cfs @ 12.16 hrs, Volume= 8,275 cf
Outflow = 2.55 cfs @ 12.16 hrs, Volume= 8,275 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 3: Towards West Wetland

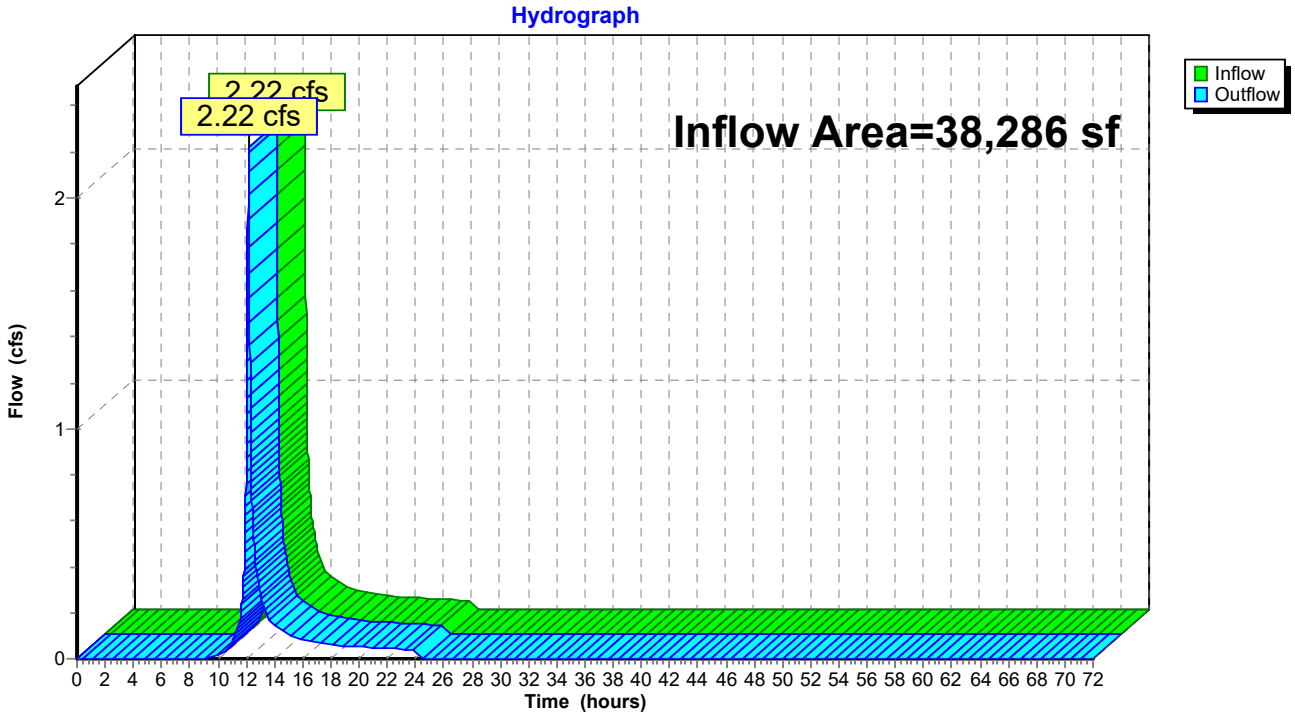


Summary for Reach DP 4: Towards East Wetland

Inflow Area = 38,286 sf, 0.00% Impervious, Inflow Depth = 2.17" for 10-Year event
Inflow = 2.22 cfs @ 12.16 hrs, Volume= 6,927 cf
Outflow = 2.22 cfs @ 12.16 hrs, Volume= 6,927 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 4: Towards East Wetland

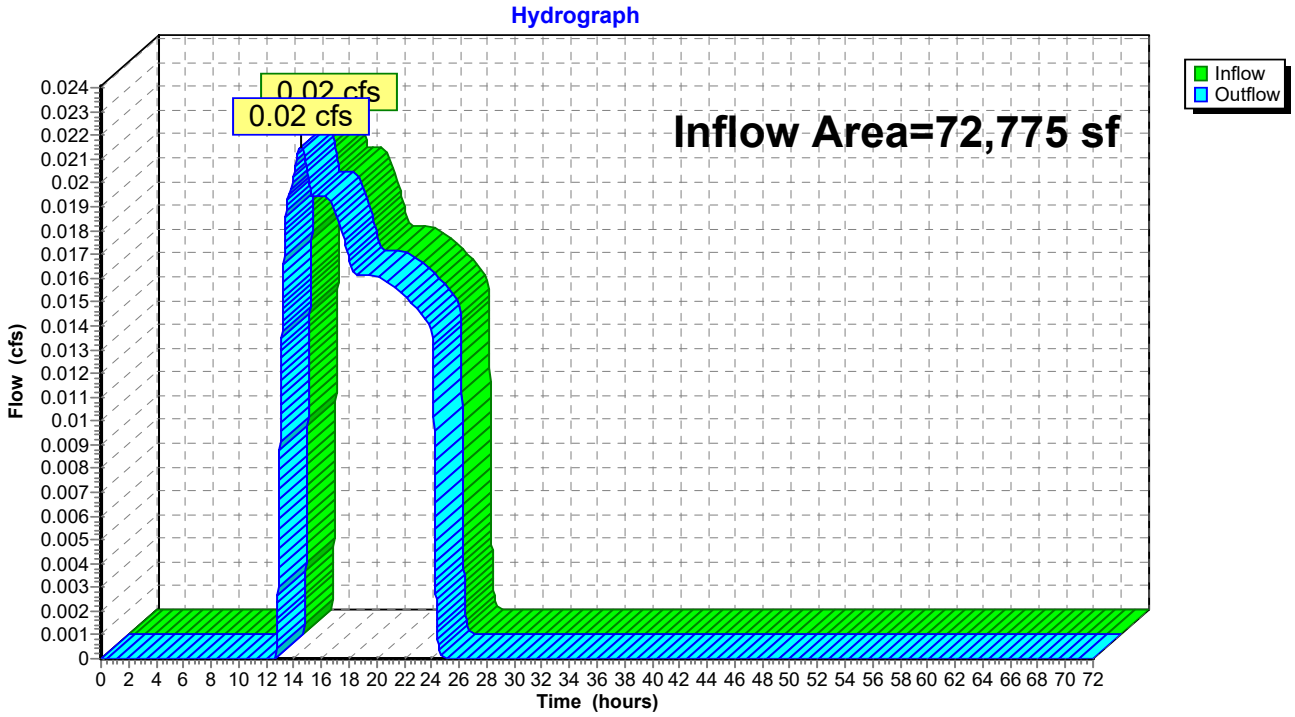


Summary for Reach DP 5: Towards Offsite Northwest

Inflow Area = 72,775 sf, 0.00% Impervious, Inflow Depth = 0.11" for 10-Year event
Inflow = 0.02 cfs @ 14.51 hrs, Volume= 694 cf
Outflow = 0.02 cfs @ 14.51 hrs, Volume= 694 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 5: Towards Offsite Northwest

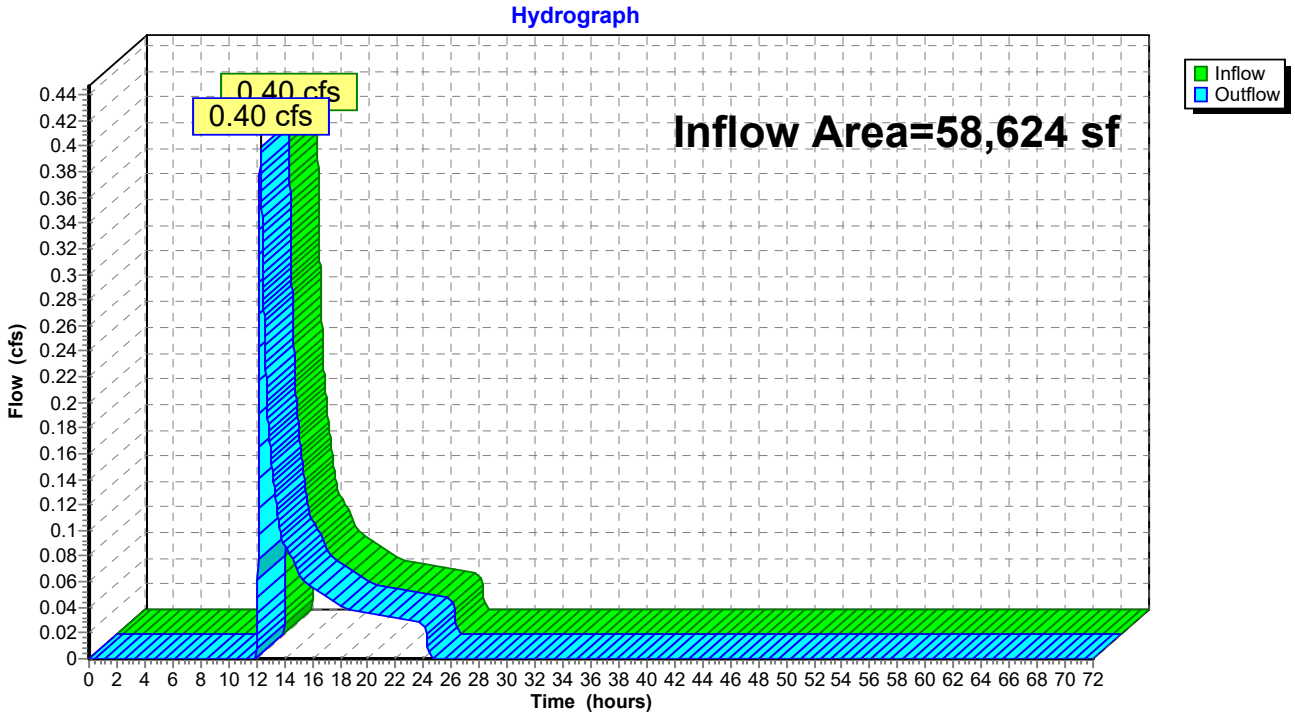


Summary for Reach DP 6: Towards Offsite East

Inflow Area = 58,624 sf, 0.00% Impervious, Inflow Depth = 0.59" for 10-Year event
Inflow = 0.40 cfs @ 12.30 hrs, Volume= 2,860 cf
Outflow = 0.40 cfs @ 12.30 hrs, Volume= 2,860 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 6: Towards Offsite East



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Runoff Area=43,659 sf 4.43% Impervious Runoff Depth=3.21"
Flow Length=329' Tc=11.4 min CN=73 Runoff=3.30 cfs 11,691 cf

Subcatchment 2S: Runoff Area=60,694 sf 2.31% Impervious Runoff Depth=3.02"
Flow Length=325' Tc=10.3 min CN=71 Runoff=4.49 cfs 15,275 cf

Subcatchment 3S: Runoff Area=39,622 sf 0.00% Impervious Runoff Depth=3.61"
Flow Length=182' Tc=9.1 min CN=77 Runoff=3.66 cfs 11,921 cf

Subcatchment 4S: Runoff Area=38,286 sf 0.00% Impervious Runoff Depth=3.21"
Flow Length=122' Tc=8.2 min CN=73 Runoff=3.29 cfs 10,253 cf

Subcatchment 5S: Runoff Area=72,775 sf 0.00% Impervious Runoff Depth=0.38"
Flow Length=357' Tc=15.1 min CN=37 Runoff=0.14 cfs 2,311 cf

Subcatchment 6S: Runoff Area=58,624 sf 0.00% Impervious Runoff Depth=1.14"
Flow Length=427' Tc=15.7 min CN=49 Runoff=1.09 cfs 5,586 cf

Reach DP 1: Towards Offsite West Inflow=3.30 cfs 11,691 cf
Outflow=3.30 cfs 11,691 cf

Reach DP 2: Towards Offsite North Inflow=4.49 cfs 15,275 cf
Outflow=4.49 cfs 15,275 cf

Reach DP 3: Towards West Wetland Inflow=3.66 cfs 11,921 cf
Outflow=3.66 cfs 11,921 cf

Reach DP 4: Towards East Wetland Inflow=3.29 cfs 10,253 cf
Outflow=3.29 cfs 10,253 cf

Reach DP 5: Towards Offsite Northwest Inflow=0.14 cfs 2,311 cf
Outflow=0.14 cfs 2,311 cf

Reach DP 6: Towards Offsite East Inflow=1.09 cfs 5,586 cf
Outflow=1.09 cfs 5,586 cf

Total Runoff Area = 313,660 sf Runoff Volume = 57,036 cf Average Runoff Depth = 2.18"
98.94% Pervious = 310,323 sf 1.06% Impervious = 3,337 sf

Summary for Subcatchment 1S:

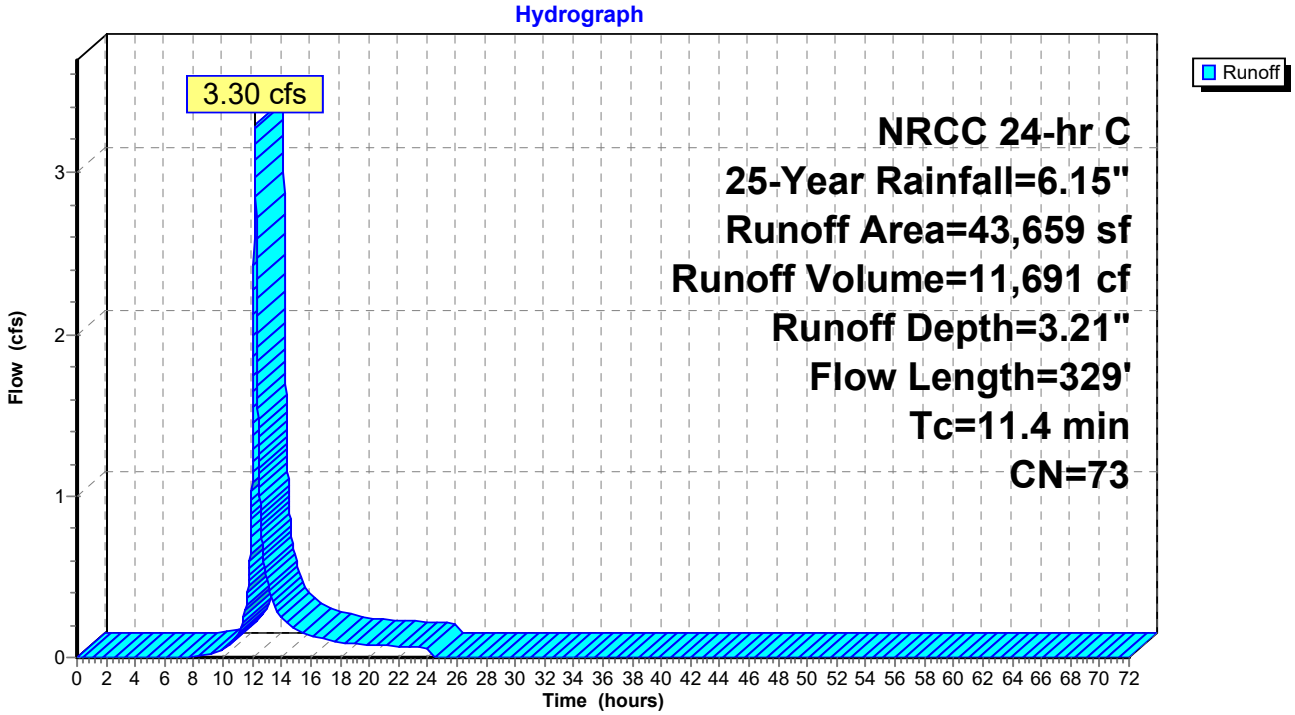
Runoff = 3.30 cfs @ 12.19 hrs, Volume= 11,691 cf, Depth= 3.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 25-Year Rainfall=6.15"

Area (sf)	CN	Description
18,229	70	Woods, Good, HSG C
1,932	98	Roofs, HSG C
23,498	74	>75% Grass cover, Good, HSG C
43,659	73	Weighted Average
41,727		95.57% Pervious Area
1,932		4.43% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	50	0.0280	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.44"
0.3	22	0.0320	1.25		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.4	257	0.0180	0.67		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
11.4	329	Total			

Subcatchment 1S:



Summary for Subcatchment 2S:

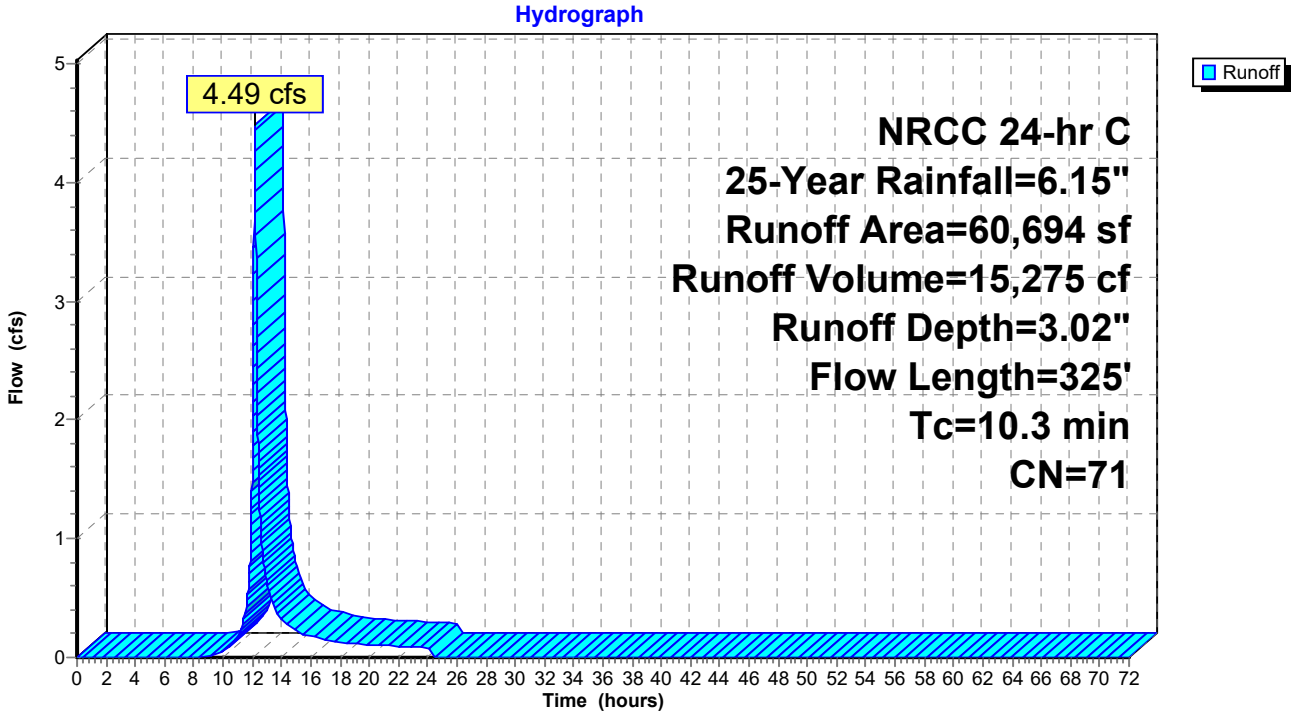
Runoff = 4.49 cfs @ 12.18 hrs, Volume= 15,275 cf, Depth= 3.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 25-Year Rainfall=6.15"

Area (sf)	CN	Description
12,503	74	>75% Grass cover, Good, HSG C
1,405	98	Roofs, HSG C
46,786	70	Woods, Good, HSG C
60,694	71	Weighted Average
59,289		97.69% Pervious Area
1,405		2.31% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	50	0.0540	0.23		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.44"
0.2	13	0.0310	1.23		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.5	262	0.0180	0.67		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
10.3	325	Total			

Subcatchment 2S:



Summary for Subcatchment 3S:

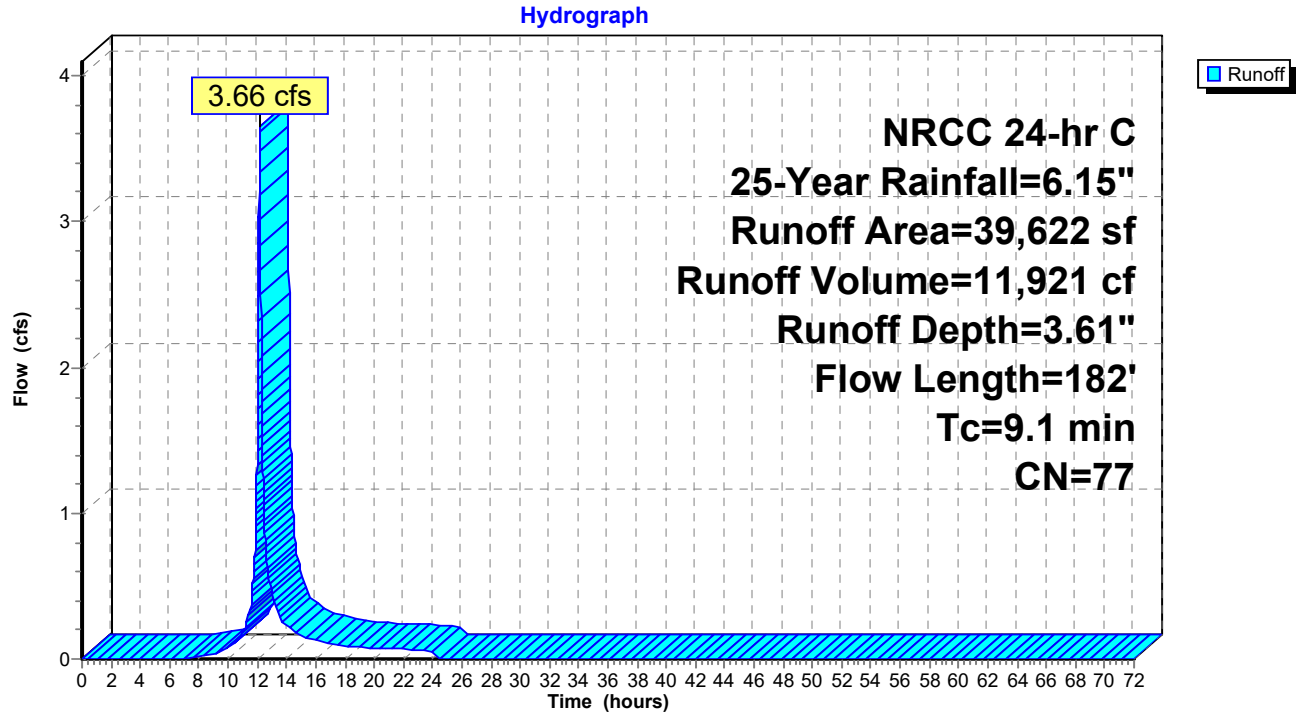
Runoff = 3.66 cfs @ 12.16 hrs, Volume= 11,921 cf, Depth= 3.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 25-Year Rainfall=6.15"

Area (sf)	CN	Description
6,096	70	Woods, Good, HSG C
1,627	96	Gravel surface, HSG C
31,899	77	Brush, Poor, HSG C
39,622	77	Weighted Average
39,622		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	50	0.0548	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.44"
0.9	102	0.0768	1.94		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	11	0.0400	3.22		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.2	19	0.0536	1.62		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
9.1	182	Total			

Subcatchment 3S:



Summary for Subcatchment 4S:

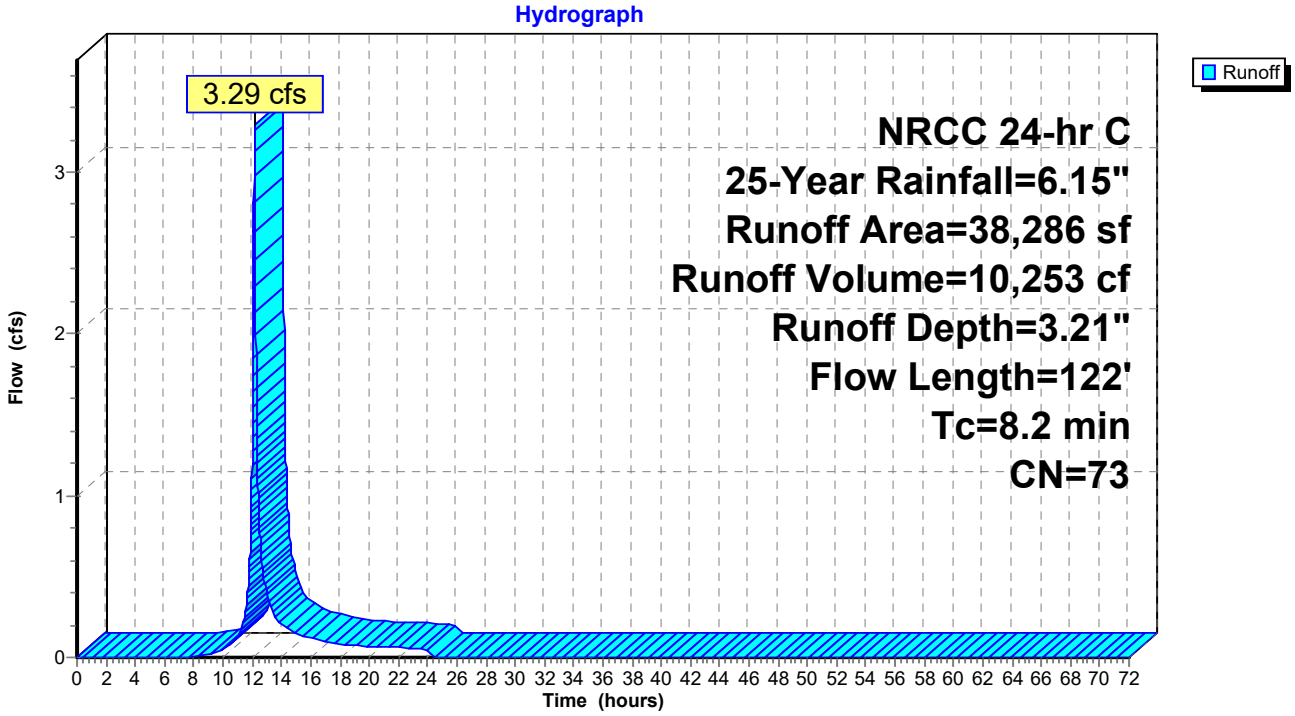
Runoff = 3.29 cfs @ 12.16 hrs, Volume= 10,253 cf, Depth= 3.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 25-Year Rainfall=6.15"

Area (sf)	CN	Description
13,140	77	Brush, Poor, HSG C
17,055	70	Woods, Good, HSG C
373	96	Gravel surface, HSG C
7,718	70	Woods, Good, HSG C
38,286	73	Weighted Average
38,286		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.5	50	0.0640	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.44"
0.7	72	0.1350	1.84		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
8.2	122	Total			

Subcatchment 4S:



Summary for Subcatchment 5S:

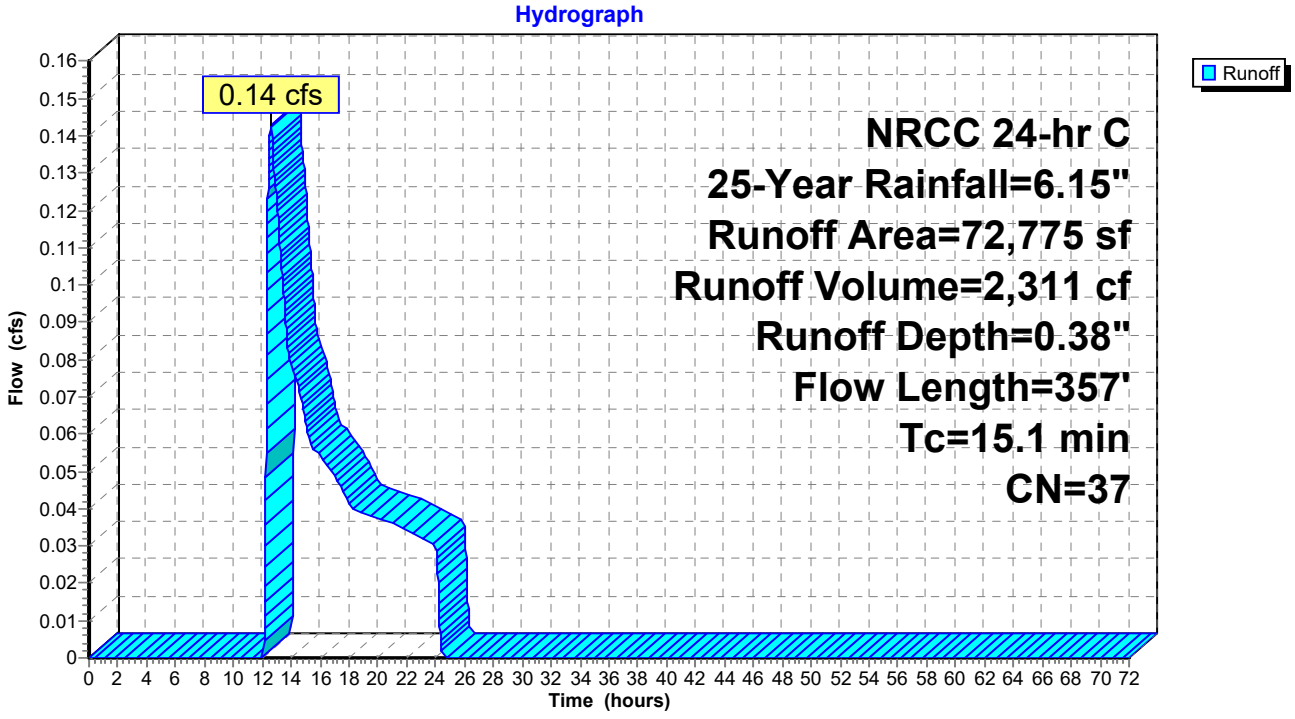
Runoff = 0.14 cfs @ 12.60 hrs, Volume= 2,311 cf, Depth= 0.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 25-Year Rainfall=6.15"

Area (sf)	CN	Description
9,331	70	Woods, Good, HSG C
60,443	30	Woods, Good, HSG A
3,001	70	Woods, Good, HSG C
72,775	37	Weighted Average
72,775		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	50	0.0200	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.44"
3.2	307	0.1050	1.62		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
15.1	357	Total			

Subcatchment 5S:



Summary for Subcatchment 6S:

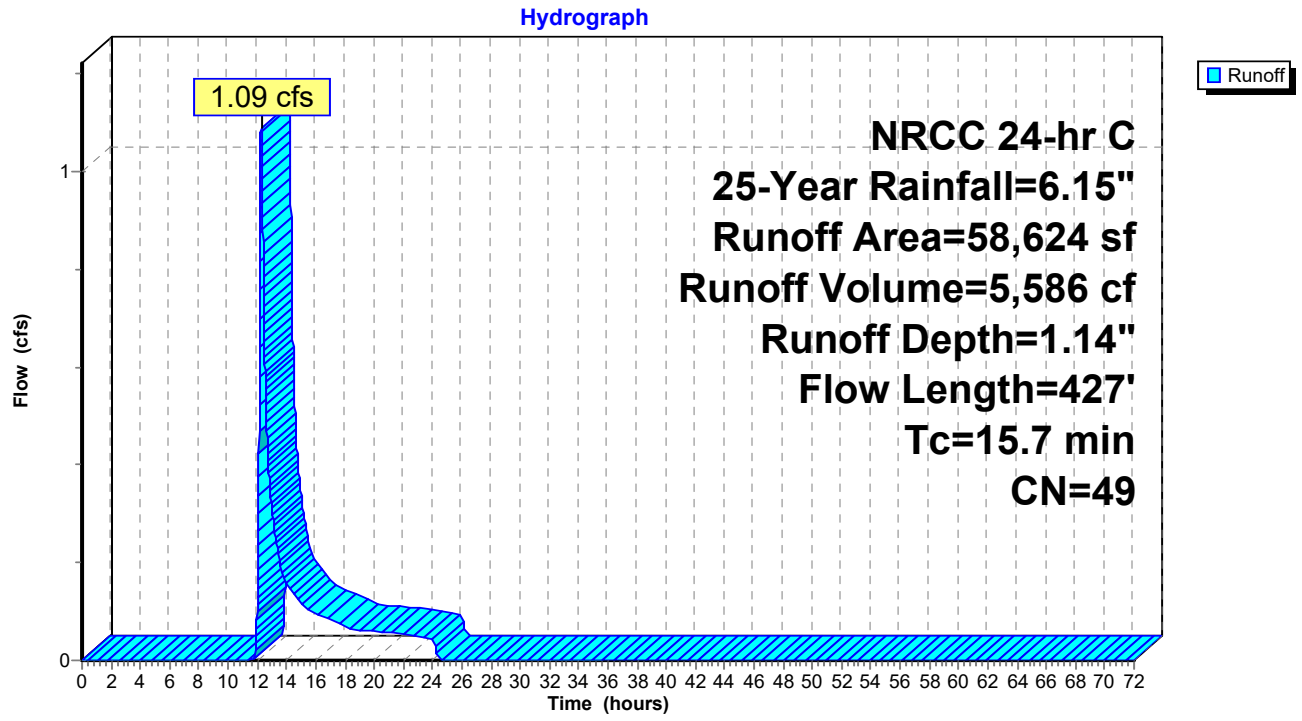
Runoff = 1.09 cfs @ 12.27 hrs, Volume= 5,586 cf, Depth= 1.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 25-Year Rainfall=6.15"

Area (sf)	CN	Description
30,903	30	Woods, Good, HSG A
27,721	70	Woods, Good, HSG C
58,624	49	Weighted Average
58,624		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	50	0.0200	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.44"
3.8	377	0.1120	1.67		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
15.7	427	Total			

Subcatchment 6S:

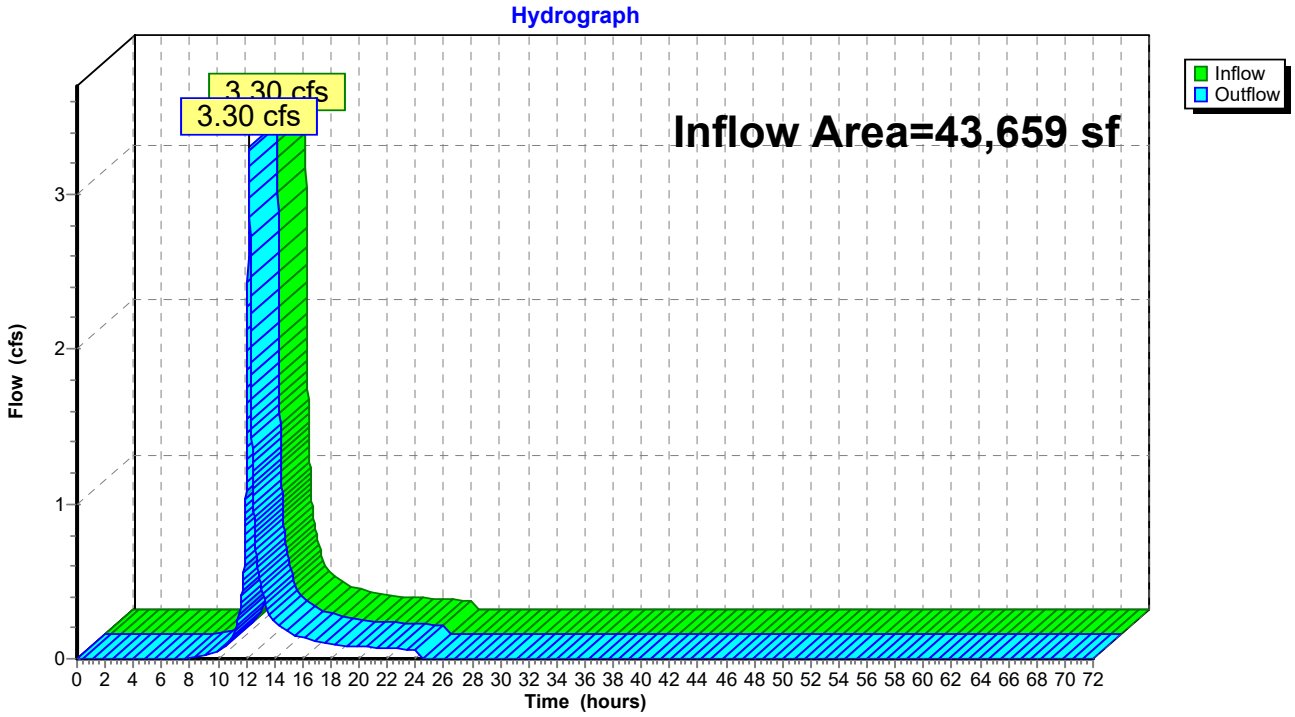


Summary for Reach DP 1: Towards Offsite West

Inflow Area = 43,659 sf, 4.43% Impervious, Inflow Depth = 3.21" for 25-Year event
Inflow = 3.30 cfs @ 12.19 hrs, Volume= 11,691 cf
Outflow = 3.30 cfs @ 12.19 hrs, Volume= 11,691 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 1: Towards Offsite West

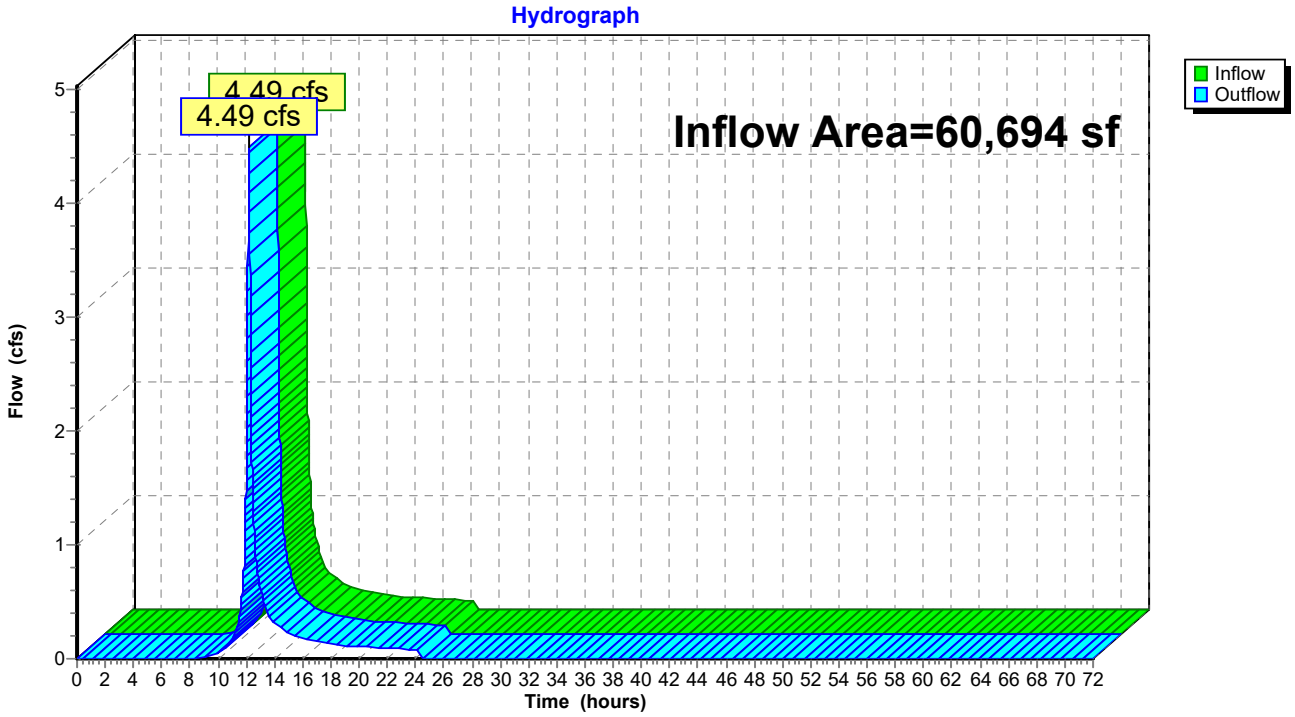


Summary for Reach DP 2: Towards Offsite North

Inflow Area = 60,694 sf, 2.31% Impervious, Inflow Depth = 3.02" for 25-Year event
Inflow = 4.49 cfs @ 12.18 hrs, Volume= 15,275 cf
Outflow = 4.49 cfs @ 12.18 hrs, Volume= 15,275 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 2: Towards Offsite North

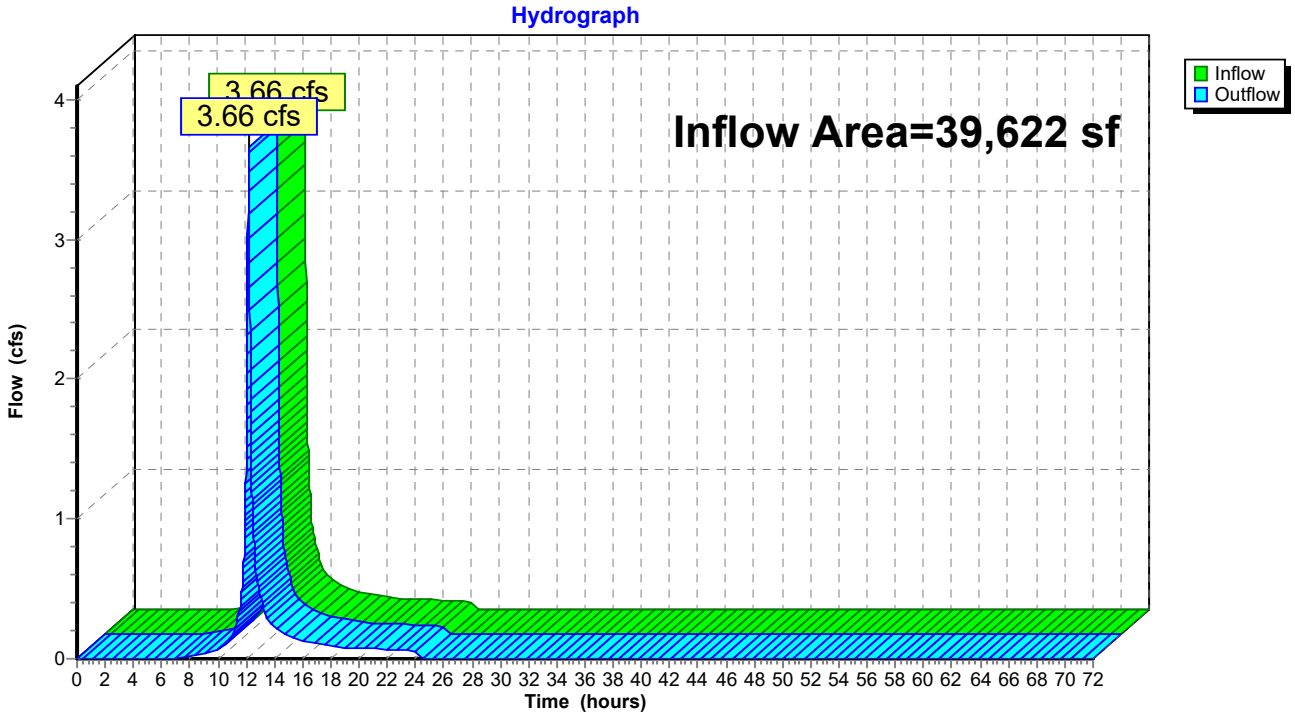


Summary for Reach DP 3: Towards West Wetland

Inflow Area = 39,622 sf, 0.00% Impervious, Inflow Depth = 3.61" for 25-Year event
Inflow = 3.66 cfs @ 12.16 hrs, Volume= 11,921 cf
Outflow = 3.66 cfs @ 12.16 hrs, Volume= 11,921 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 3: Towards West Wetland

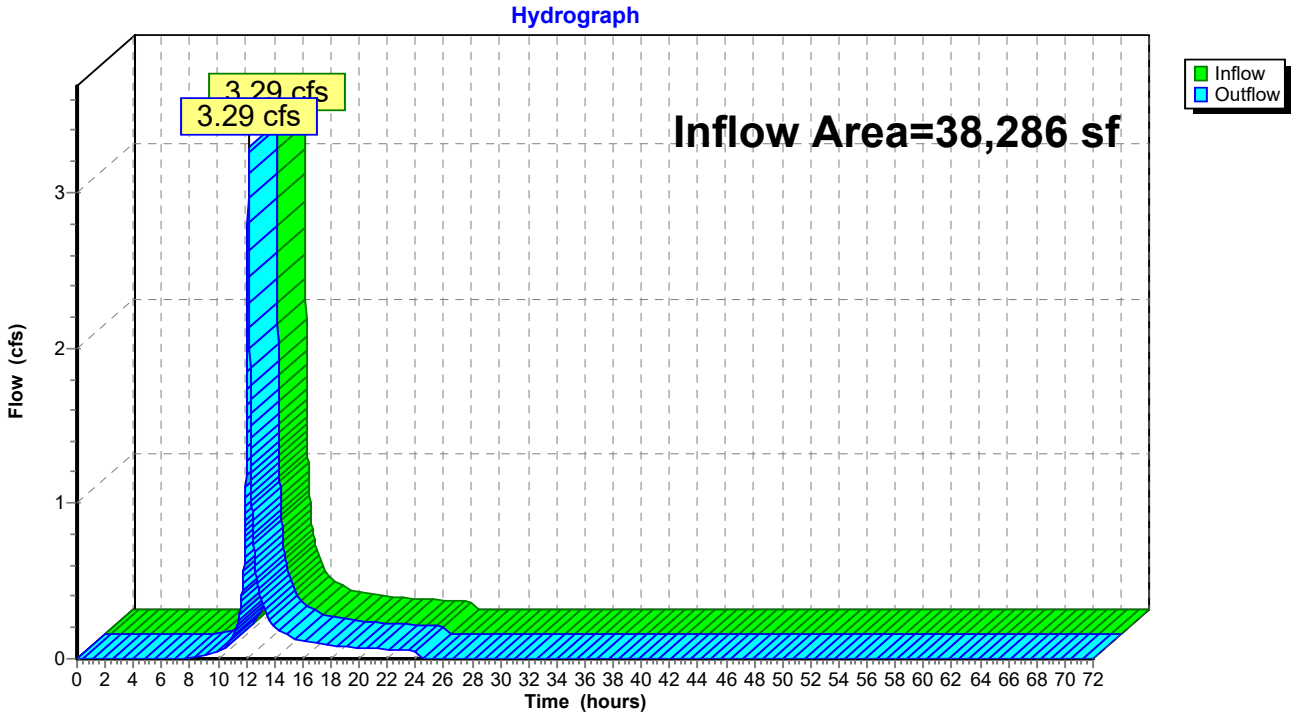


Summary for Reach DP 4: Towards East Wetland

Inflow Area = 38,286 sf, 0.00% Impervious, Inflow Depth = 3.21" for 25-Year event
Inflow = 3.29 cfs @ 12.16 hrs, Volume= 10,253 cf
Outflow = 3.29 cfs @ 12.16 hrs, Volume= 10,253 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 4: Towards East Wetland

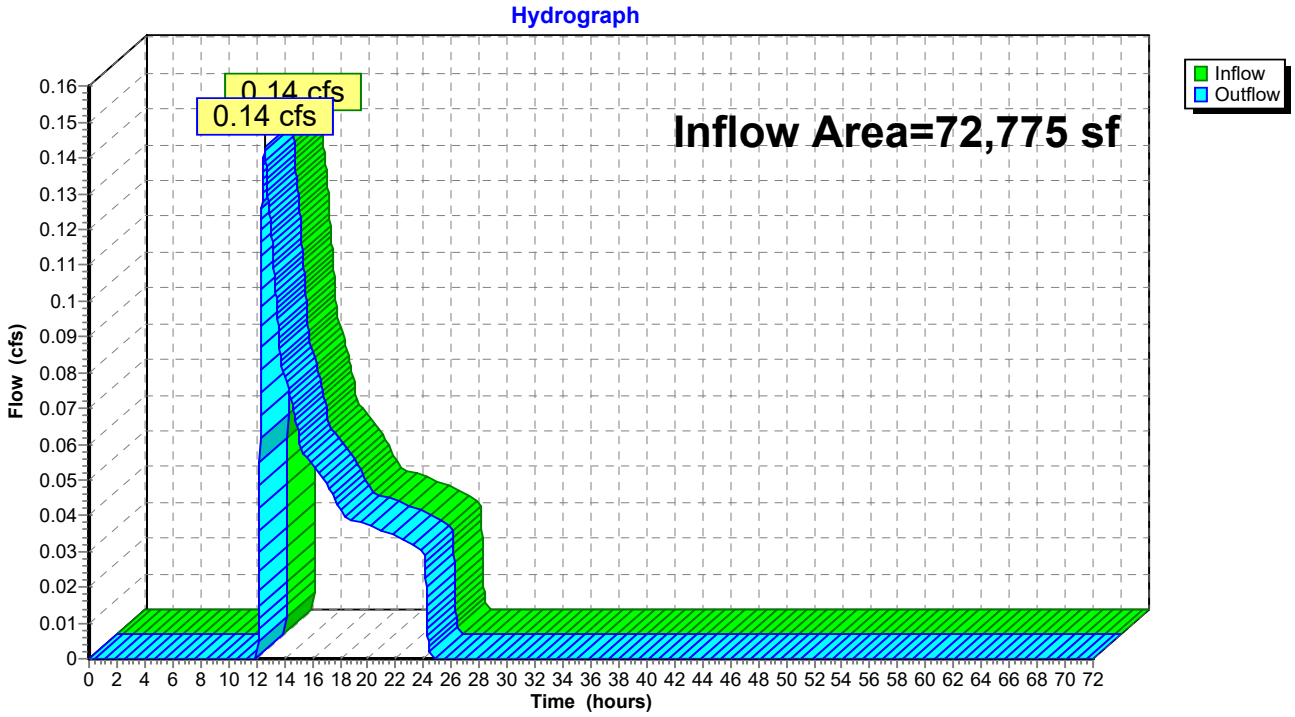


Summary for Reach DP 5: Towards Offsite Northwest

Inflow Area = 72,775 sf, 0.00% Impervious, Inflow Depth = 0.38" for 25-Year event
Inflow = 0.14 cfs @ 12.60 hrs, Volume= 2,311 cf
Outflow = 0.14 cfs @ 12.60 hrs, Volume= 2,311 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 5: Towards Offsite Northwest

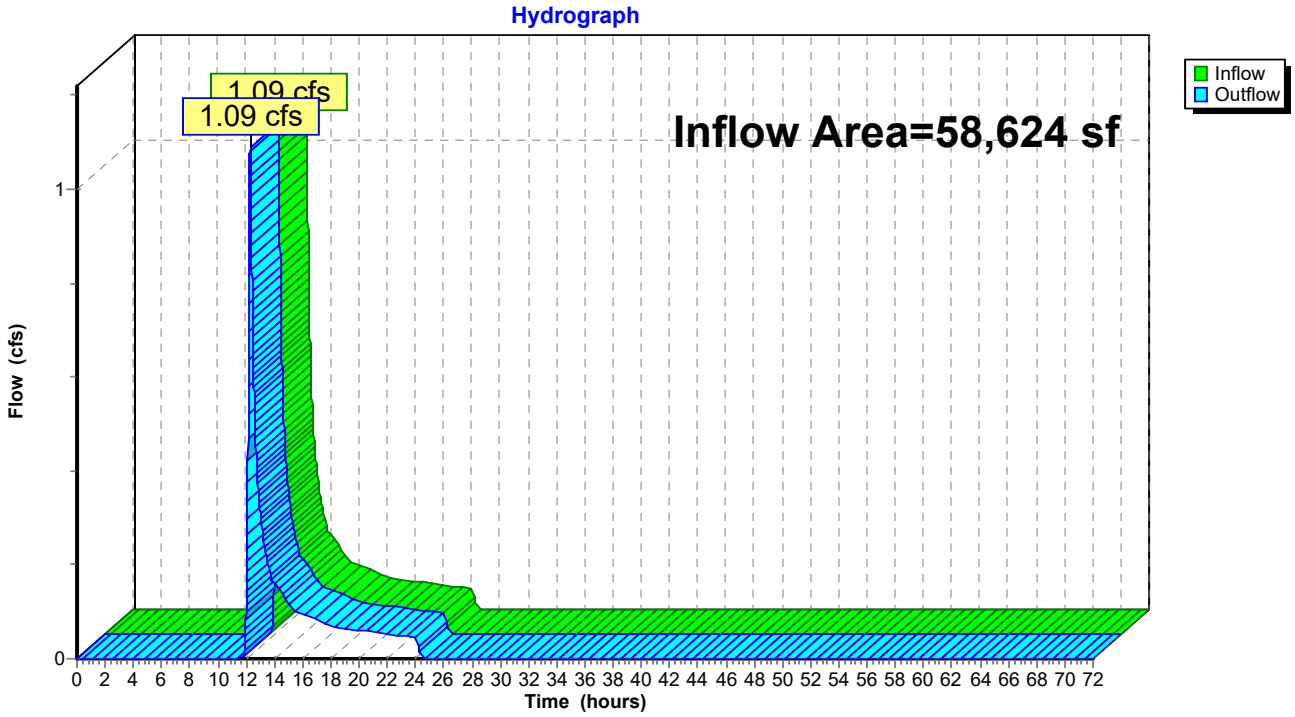


Summary for Reach DP 6: Towards Offsite East

Inflow Area = 58,624 sf, 0.00% Impervious, Inflow Depth = 1.14" for 25-Year event
Inflow = 1.09 cfs @ 12.27 hrs, Volume= 5,586 cf
Outflow = 1.09 cfs @ 12.27 hrs, Volume= 5,586 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 6: Towards Offsite East



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Runoff Area=43,659 sf 4.43% Impervious Runoff Depth=5.53"
Flow Length=329' Tc=11.4 min CN=73 Runoff=5.63 cfs 20,101 cf

Subcatchment 2S: Runoff Area=60,694 sf 2.31% Impervious Runoff Depth=5.28"
Flow Length=325' Tc=10.3 min CN=71 Runoff=7.82 cfs 26,711 cf

Subcatchment 3S: Runoff Area=39,622 sf 0.00% Impervious Runoff Depth=6.01"
Flow Length=182' Tc=9.1 min CN=77 Runoff=5.99 cfs 19,854 cf

Subcatchment 4S: Runoff Area=38,286 sf 0.00% Impervious Runoff Depth=5.53"
Flow Length=122' Tc=8.2 min CN=73 Runoff=5.60 cfs 17,628 cf

Subcatchment 5S: Runoff Area=72,775 sf 0.00% Impervious Runoff Depth=1.30"
Flow Length=357' Tc=15.1 min CN=37 Runoff=1.34 cfs 7,871 cf

Subcatchment 6S: Runoff Area=58,624 sf 0.00% Impervious Runoff Depth=2.64"
Flow Length=427' Tc=15.7 min CN=49 Runoff=2.99 cfs 12,875 cf

Reach DP 1: Towards Offsite West Inflow=5.63 cfs 20,101 cf
Outflow=5.63 cfs 20,101 cf

Reach DP 2: Towards Offsite North Inflow=7.82 cfs 26,711 cf
Outflow=7.82 cfs 26,711 cf

Reach DP 3: Towards West Wetland Inflow=5.99 cfs 19,854 cf
Outflow=5.99 cfs 19,854 cf

Reach DP 4: Towards East Wetland Inflow=5.60 cfs 17,628 cf
Outflow=5.60 cfs 17,628 cf

Reach DP 5: Towards Offsite Northwest Inflow=1.34 cfs 7,871 cf
Outflow=1.34 cfs 7,871 cf

Reach DP 6: Towards Offsite East Inflow=2.99 cfs 12,875 cf
Outflow=2.99 cfs 12,875 cf

Total Runoff Area = 313,660 sf Runoff Volume = 105,040 cf Average Runoff Depth = 4.02"
98.94% Pervious = 310,323 sf 1.06% Impervious = 3,337 sf

Summary for Subcatchment 1S:

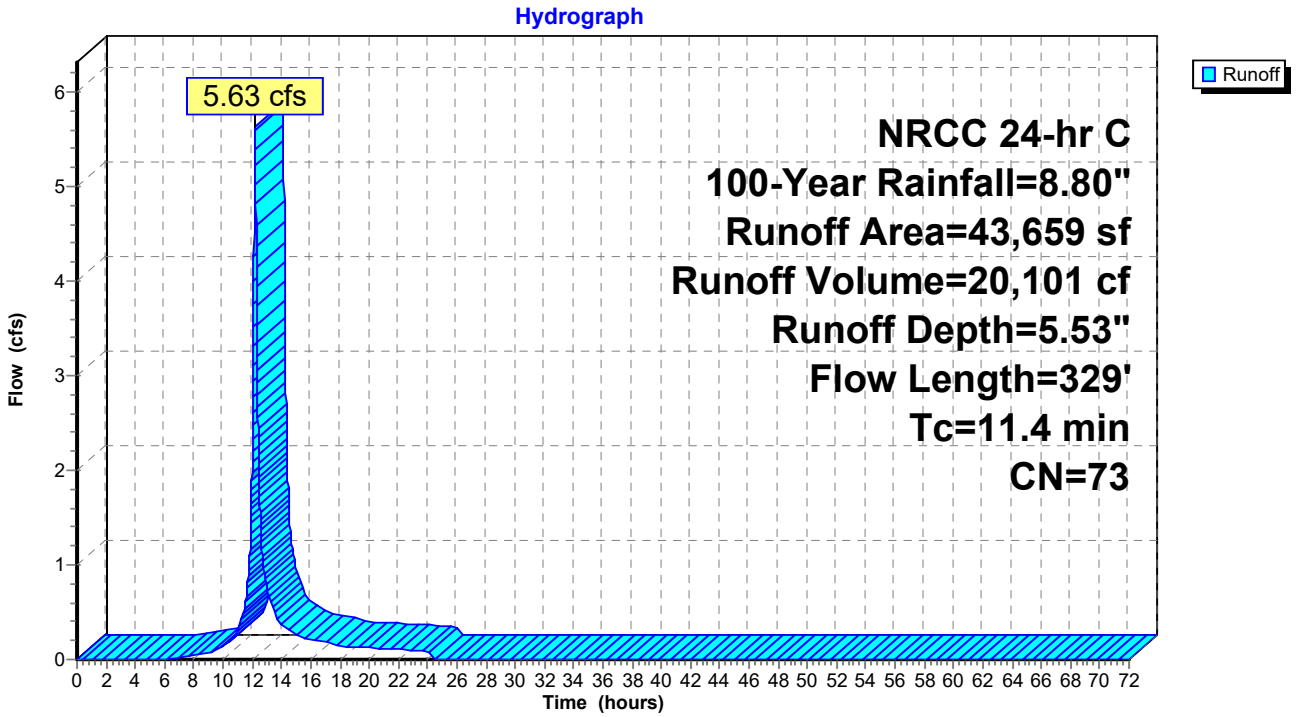
Runoff = 5.63 cfs @ 12.19 hrs, Volume= 20,101 cf, Depth= 5.53"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 100-Year Rainfall=8.80"

Area (sf)	CN	Description
18,229	70	Woods, Good, HSG C
1,932	98	Roofs, HSG C
23,498	74	>75% Grass cover, Good, HSG C
43,659	73	Weighted Average
41,727		95.57% Pervious Area
1,932		4.43% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	50	0.0280	0.18		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.44"
0.3	22	0.0320	1.25		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.4	257	0.0180	0.67		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
11.4	329	Total			

Subcatchment 1S:



Summary for Subcatchment 2S:

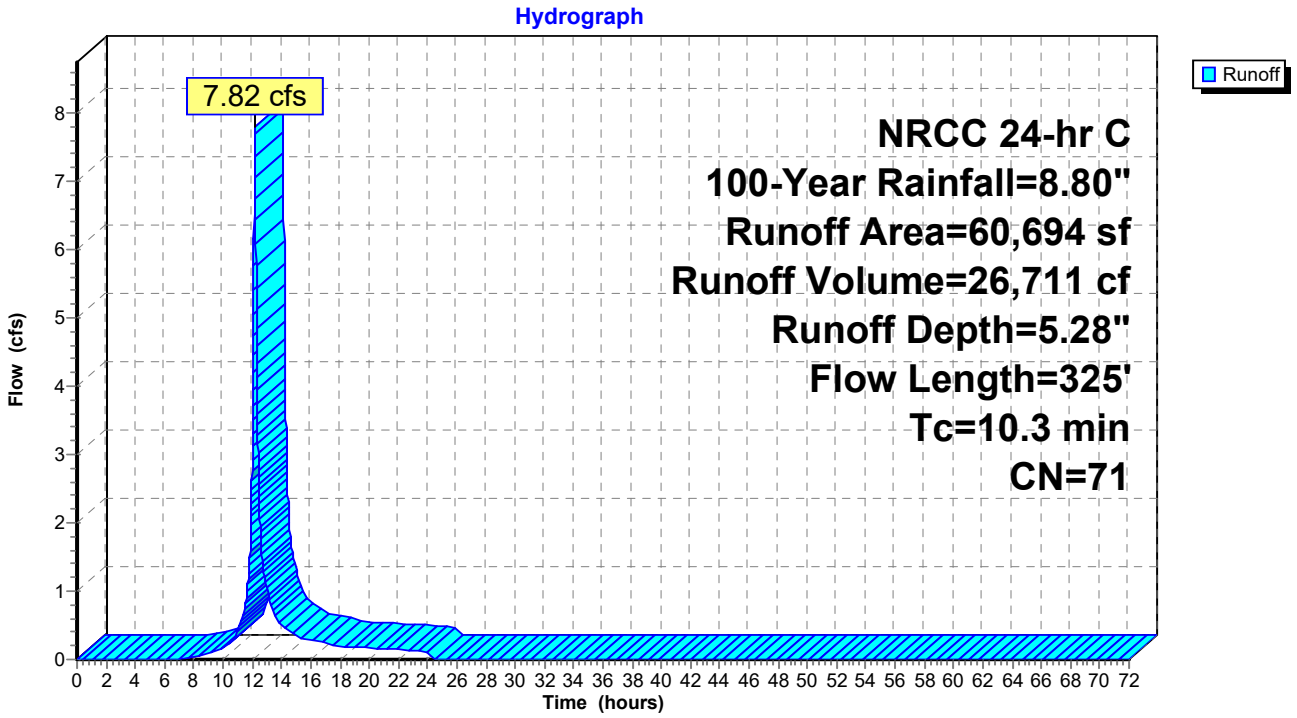
Runoff = 7.82 cfs @ 12.18 hrs, Volume= 26,711 cf, Depth= 5.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 100-Year Rainfall=8.80"

Area (sf)	CN	Description
12,503	74	>75% Grass cover, Good, HSG C
1,405	98	Roofs, HSG C
46,786	70	Woods, Good, HSG C
60,694	71	Weighted Average
59,289		97.69% Pervious Area
1,405		2.31% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	50	0.0540	0.23		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.44"
0.2	13	0.0310	1.23		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.5	262	0.0180	0.67		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
10.3	325	Total			

Subcatchment 2S:



Summary for Subcatchment 3S:

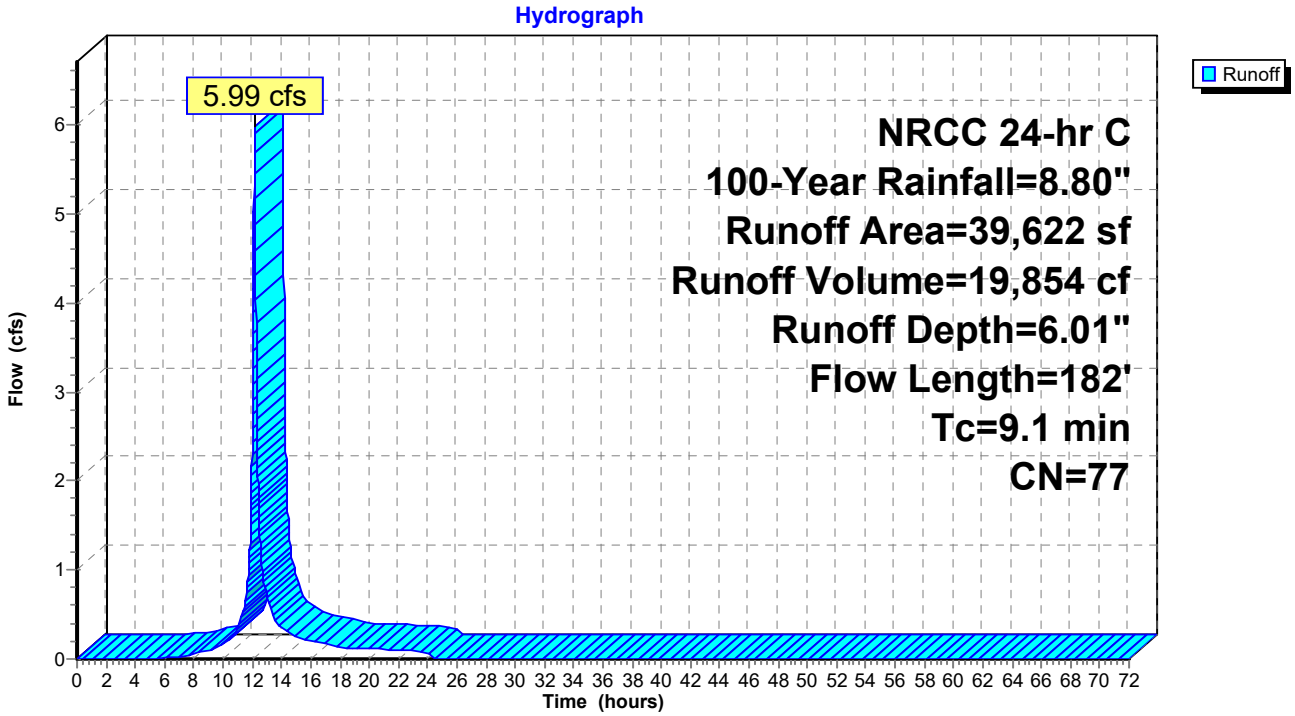
Runoff = 5.99 cfs @ 12.16 hrs, Volume= 19,854 cf, Depth= 6.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 100-Year Rainfall=8.80"

Area (sf)	CN	Description
6,096	70	Woods, Good, HSG C
1,627	96	Gravel surface, HSG C
31,899	77	Brush, Poor, HSG C
39,622	77	Weighted Average
39,622		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	50	0.0548	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.44"
0.9	102	0.0768	1.94		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	11	0.0400	3.22		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.2	19	0.0536	1.62		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
9.1	182	Total			

Subcatchment 3S:



Summary for Subcatchment 4S:

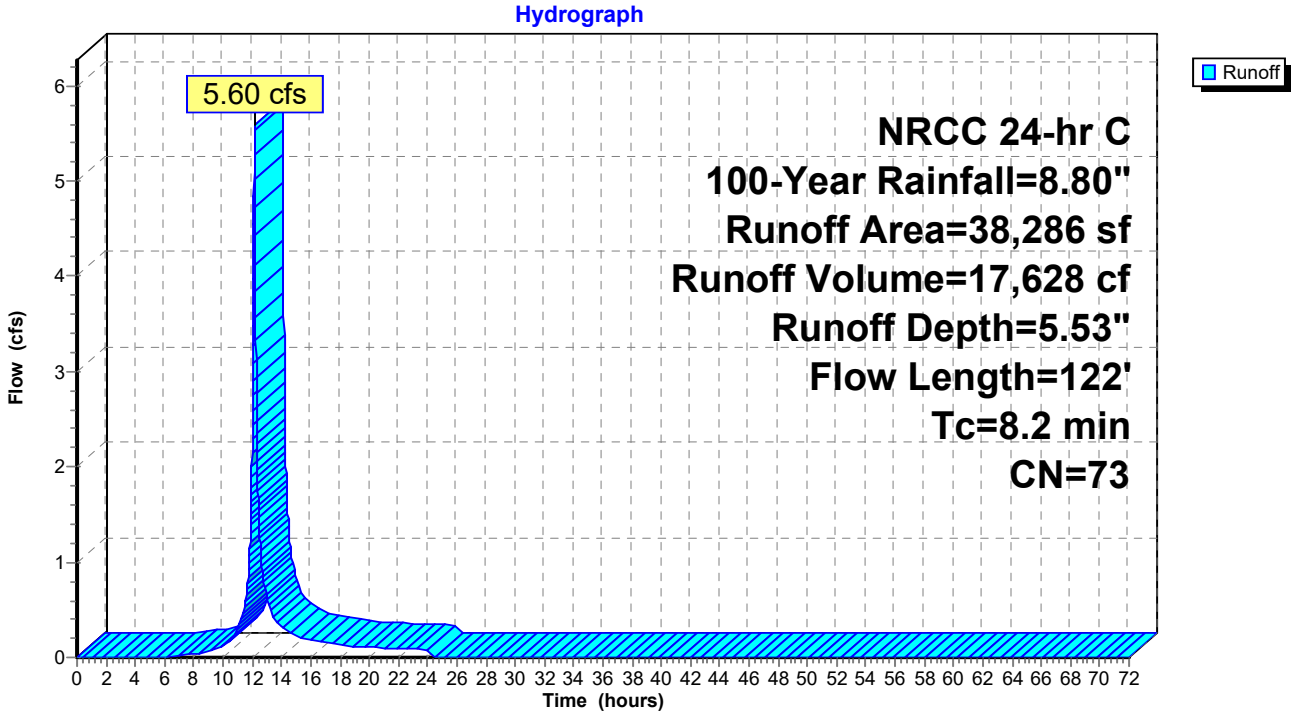
Runoff = 5.60 cfs @ 12.15 hrs, Volume= 17,628 cf, Depth= 5.53"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 100-Year Rainfall=8.80"

Area (sf)	CN	Description
13,140	77	Brush, Poor, HSG C
17,055	70	Woods, Good, HSG C
373	96	Gravel surface, HSG C
7,718	70	Woods, Good, HSG C
38,286	73	Weighted Average
38,286		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.5	50	0.0640	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.44"
0.7	72	0.1350	1.84		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
8.2	122	Total			

Subcatchment 4S:



Summary for Subcatchment 5S:

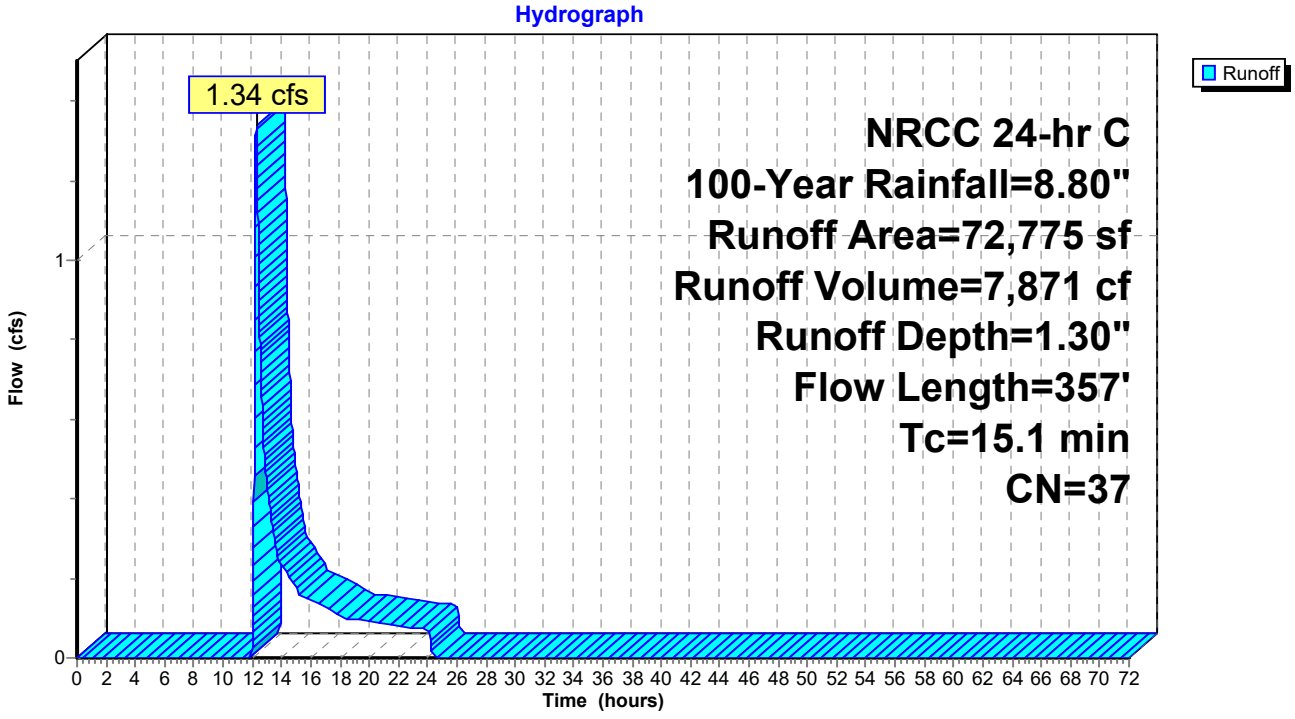
Runoff = 1.34 cfs @ 12.28 hrs, Volume= 7,871 cf, Depth= 1.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 100-Year Rainfall=8.80"

Area (sf)	CN	Description
9,331	70	Woods, Good, HSG C
60,443	30	Woods, Good, HSG A
3,001	70	Woods, Good, HSG C
72,775	37	Weighted Average
72,775		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	50	0.0200	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.44"
3.2	307	0.1050	1.62		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
15.1	357	Total			

Subcatchment 5S:



Summary for Subcatchment 6S:

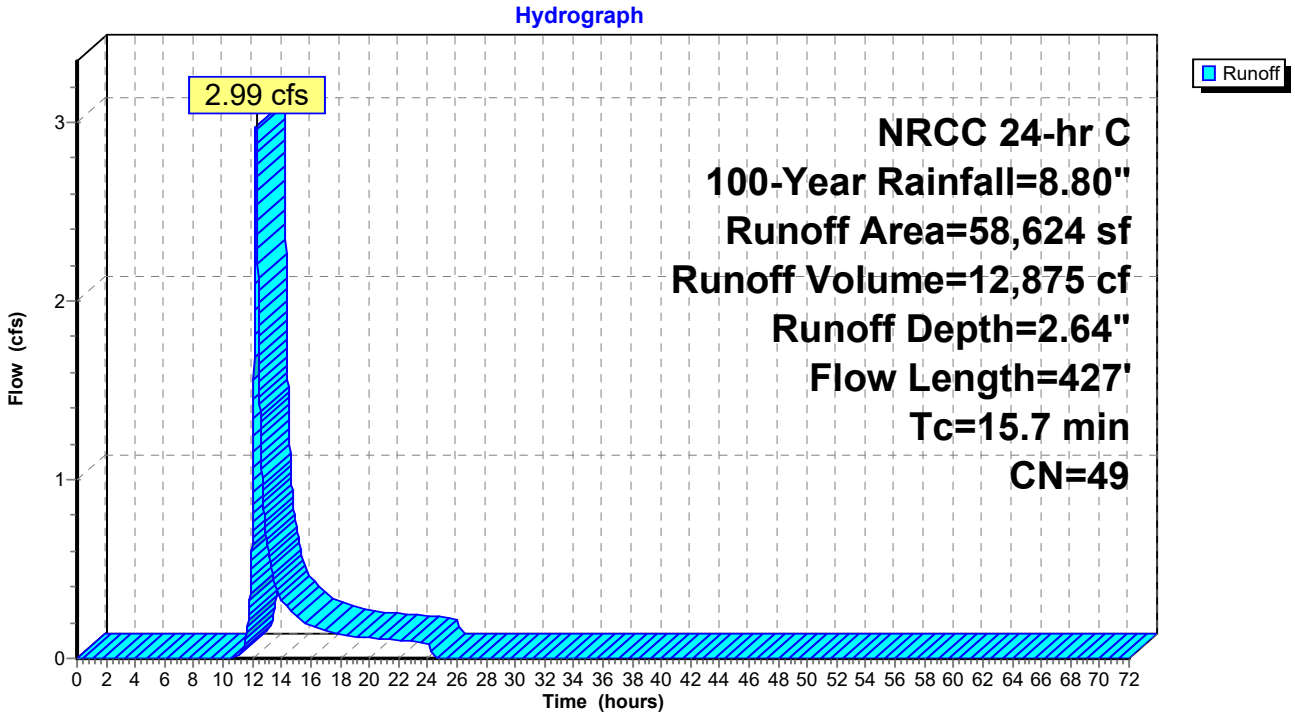
Runoff = 2.99 cfs @ 12.26 hrs, Volume= 12,875 cf, Depth= 2.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 100-Year Rainfall=8.80"

Area (sf)	CN	Description
30,903	30	Woods, Good, HSG A
27,721	70	Woods, Good, HSG C
58,624	49	Weighted Average
58,624		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	50	0.0200	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.44"
3.8	377	0.1120	1.67		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
15.7	427	Total			

Subcatchment 6S:

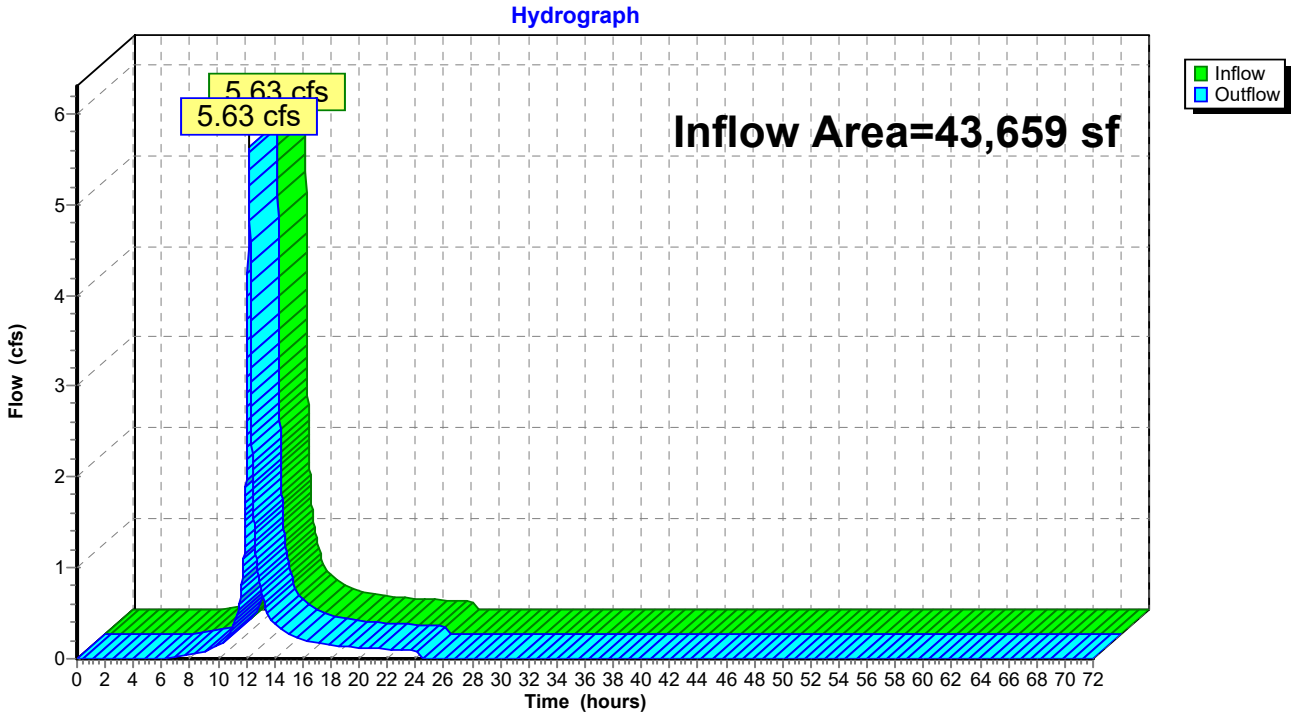


Summary for Reach DP 1: Towards Offsite West

Inflow Area = 43,659 sf, 4.43% Impervious, Inflow Depth = 5.53" for 100-Year event
Inflow = 5.63 cfs @ 12.19 hrs, Volume= 20,101 cf
Outflow = 5.63 cfs @ 12.19 hrs, Volume= 20,101 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 1: Towards Offsite West

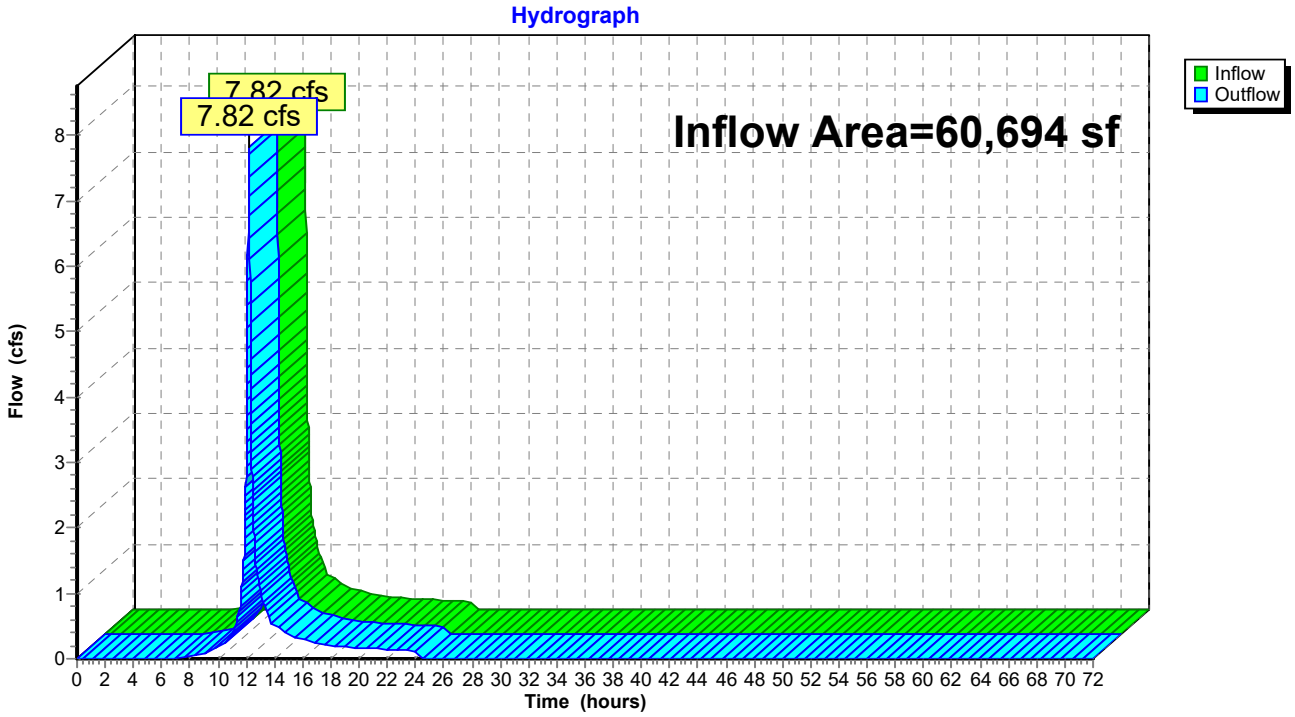


Summary for Reach DP 2: Towards Offsite North

Inflow Area = 60,694 sf, 2.31% Impervious, Inflow Depth = 5.28" for 100-Year event
Inflow = 7.82 cfs @ 12.18 hrs, Volume= 26,711 cf
Outflow = 7.82 cfs @ 12.18 hrs, Volume= 26,711 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 2: Towards Offsite North

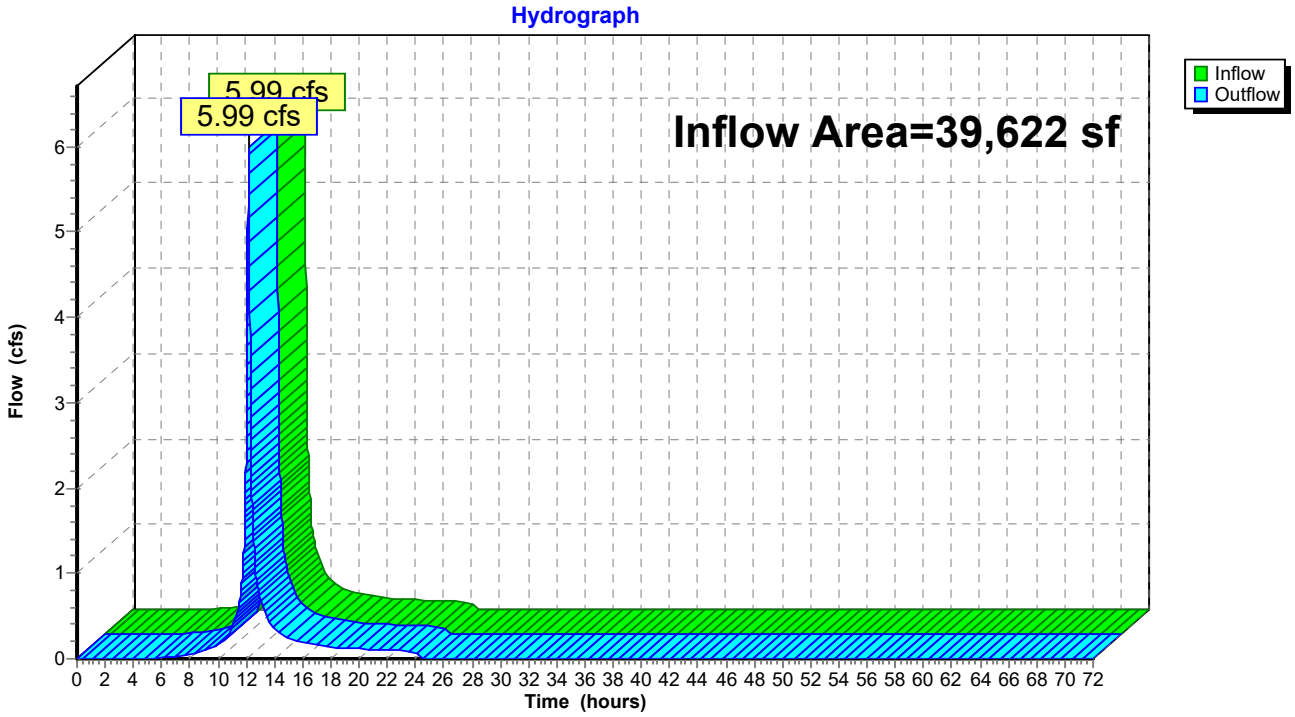


Summary for Reach DP 3: Towards West Wetland

Inflow Area = 39,622 sf, 0.00% Impervious, Inflow Depth = 6.01" for 100-Year event
Inflow = 5.99 cfs @ 12.16 hrs, Volume= 19,854 cf
Outflow = 5.99 cfs @ 12.16 hrs, Volume= 19,854 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 3: Towards West Wetland

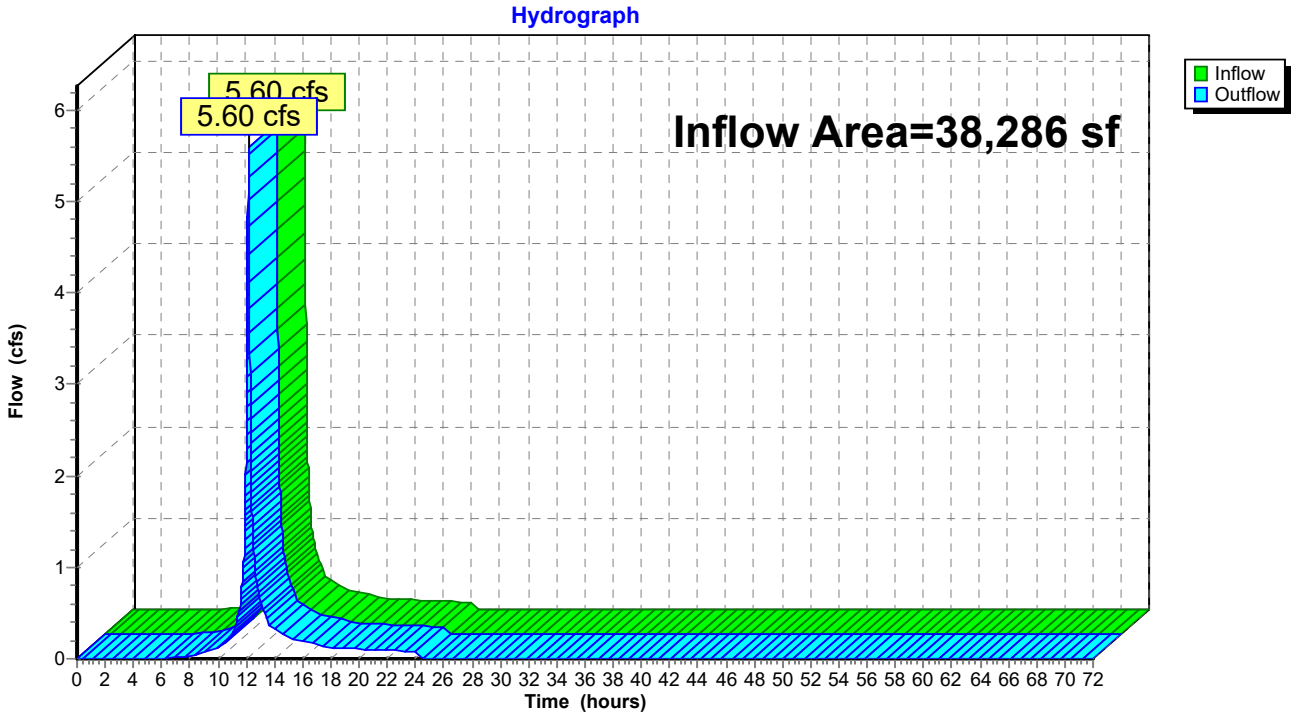


Summary for Reach DP 4: Towards East Wetland

Inflow Area = 38,286 sf, 0.00% Impervious, Inflow Depth = 5.53" for 100-Year event
Inflow = 5.60 cfs @ 12.15 hrs, Volume= 17,628 cf
Outflow = 5.60 cfs @ 12.15 hrs, Volume= 17,628 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 4: Towards East Wetland

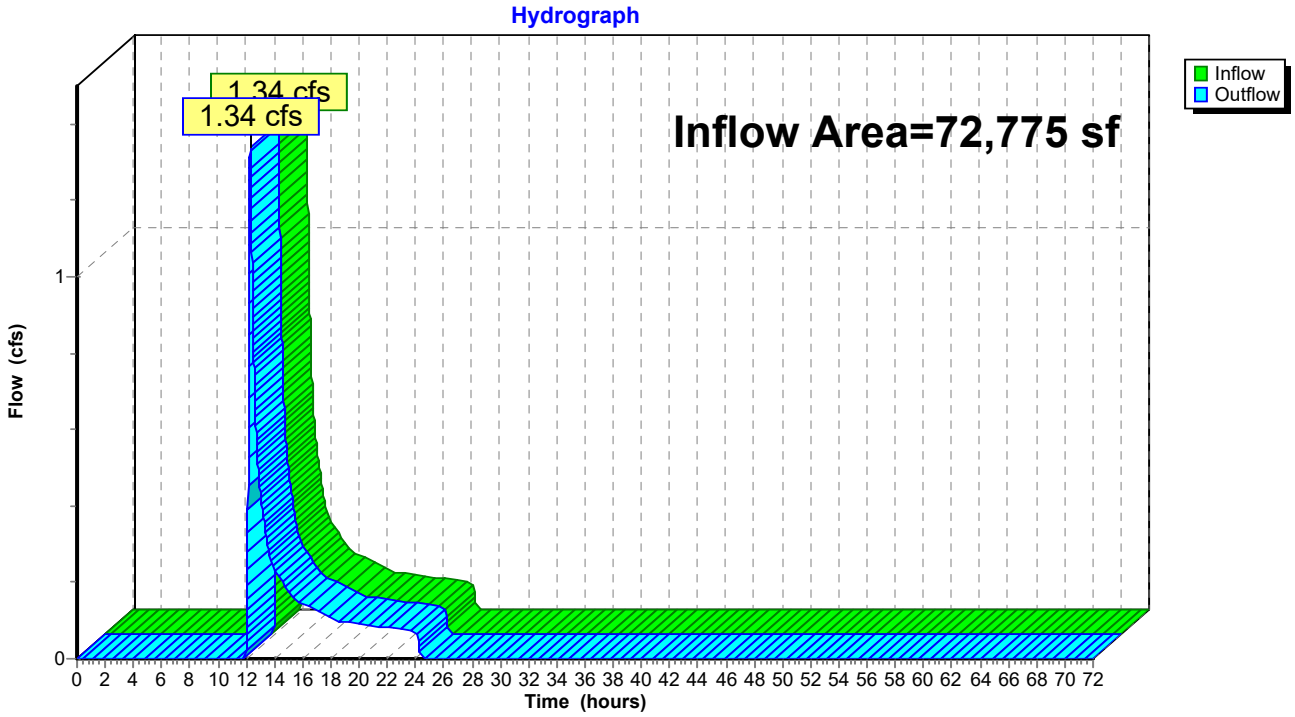


Summary for Reach DP 5: Towards Offsite Northwest

Inflow Area = 72,775 sf, 0.00% Impervious, Inflow Depth = 1.30" for 100-Year event
Inflow = 1.34 cfs @ 12.28 hrs, Volume= 7,871 cf
Outflow = 1.34 cfs @ 12.28 hrs, Volume= 7,871 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 5: Towards Offsite Northwest

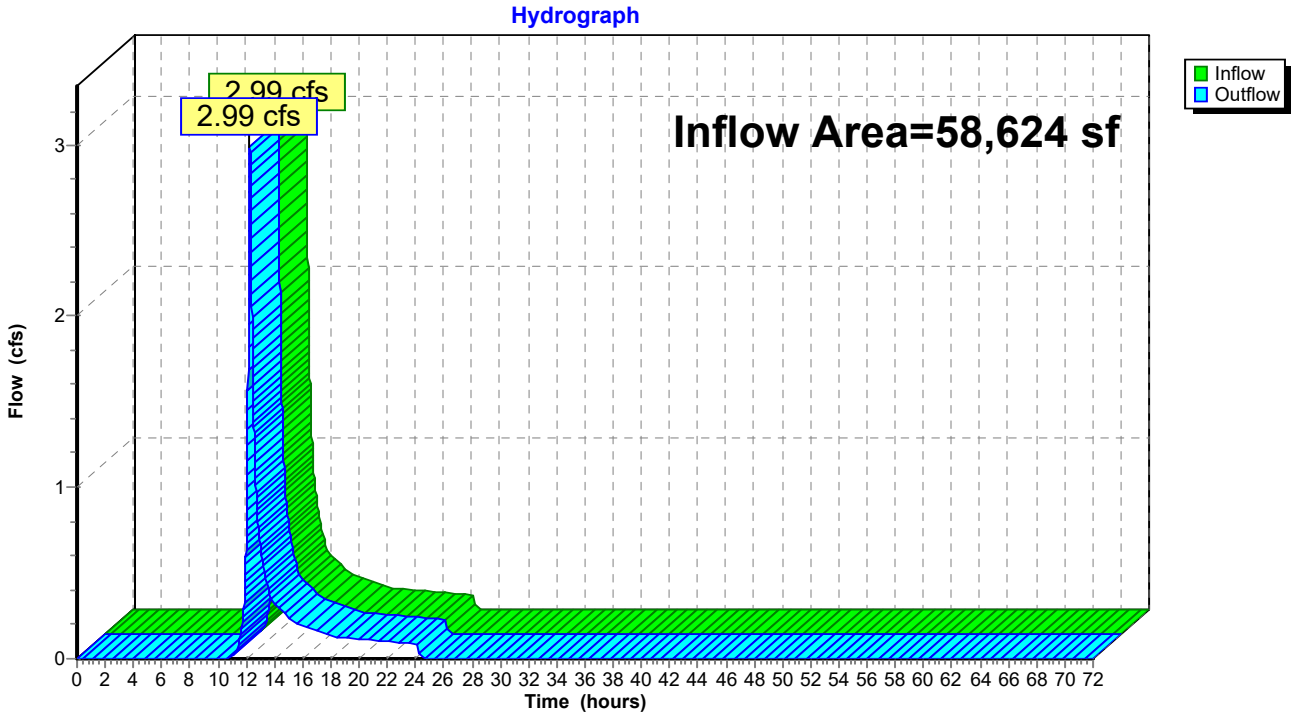


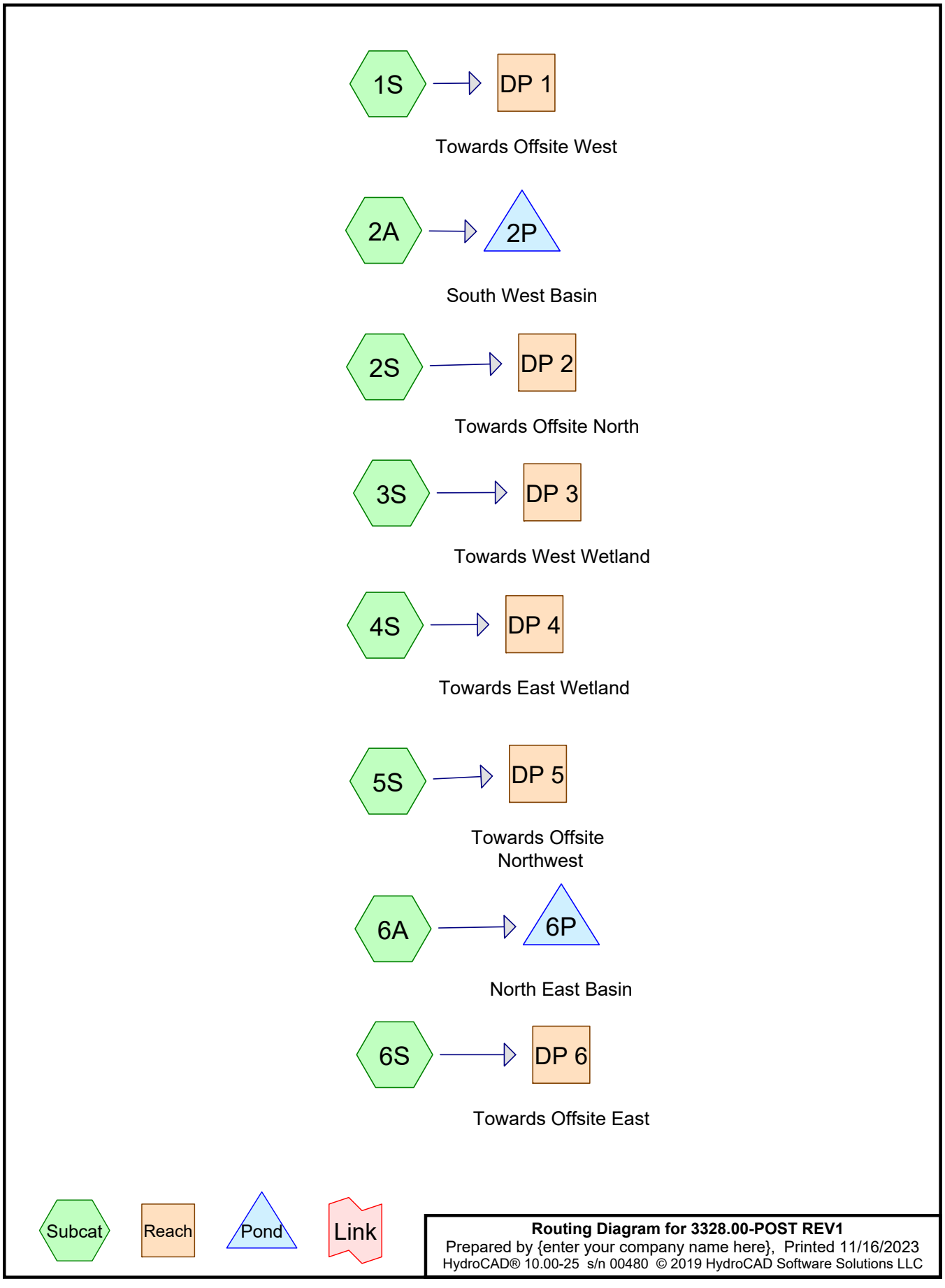
Summary for Reach DP 6: Towards Offsite East

Inflow Area = 58,624 sf, 0.00% Impervious, Inflow Depth = 2.64" for 100-Year event
Inflow = 2.99 cfs @ 12.26 hrs, Volume= 12,875 cf
Outflow = 2.99 cfs @ 12.26 hrs, Volume= 12,875 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 6: Towards Offsite East





Routing Diagram for 3328.00-POST REV1

Prepared by {enter your company name here}, Printed 11/16/2023

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
82,152	39	>75% Grass cover, Good, HSG A (5S, 6A, 6S)
80,895	74	>75% Grass cover, Good, HSG C (1S, 2A, 5S, 6A, 6S)
47,408	77	Brush, Poor, HSG C (2S, 3S, 4S)
3,251	96	Gravel surface, HSG A (6A)
22,853	96	Gravel surface, HSG C (1S, 2A, 2S, 3S, 4S, 6A)
1,137	98	Paved parking, HSG C (1S)
3,364	98	Roofs, HSG C (1S, 2A)
640	98	Unconnected pavement, HSG C (6A)
5,880	30	Woods, Good, HSG A (5S, 6A, 6S)
66,080	70	Woods, Good, HSG C (1S, 2A, 2S, 3S, 4S, 5S, 6A, 6S)
313,660	**66**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
91,283	HSG A	5S, 6A, 6S
0	HSG B	
222,377	HSG C	1S, 2A, 2S, 3S, 4S, 5S, 6A, 6S
0	HSG D	
0	Other	
313,660		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Sub Num
82,152	0	80,895	0	0	163,047	>75% Grass cover, Good	
0	0	47,408	0	0	47,408	Brush, Poor	
3,251	0	22,853	0	0	26,104	Gravel surface	
0	0	1,137	0	0	1,137	Paved parking	
0	0	3,364	0	0	3,364	Roofs	
0	0	640	0	0	640	Unconnected pavement	
5,880	0	66,080	0	0	71,960	Woods, Good	
91,283	**0**	**222,377**	**0**	**0**	**313,660**	**TOTAL AREA**	

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Runoff Area=35,263 sf 9.29% Impervious Runoff Depth=1.23"
Flow Length=303' Tc=12.2 min CN=77 Runoff=0.97 cfs 3,603 cf

Subcatchment 2A: Runoff Area=55,890 sf 2.19% Impervious Runoff Depth=1.23"
Flow Length=240' Tc=6.4 min CN=77 Runoff=1.95 cfs 5,711 cf

Subcatchment 2S: Runoff Area=12,847 sf 0.00% Impervious Runoff Depth=1.17"
Flow Length=225' Tc=9.7 min CN=76 Runoff=0.37 cfs 1,248 cf

Subcatchment 3S: Runoff Area=37,446 sf 0.00% Impervious Runoff Depth=1.29"
Flow Length=191' Tc=10.0 min CN=78 Runoff=1.18 cfs 4,019 cf

Subcatchment 4S: Runoff Area=35,752 sf 0.00% Impervious Runoff Depth=1.05"
Flow Length=151' Tc=13.8 min CN=74 Runoff=0.78 cfs 3,130 cf

Subcatchment 5S: Runoff Area=18,143 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=299' Tc=6.0 min CN=40 Runoff=0.00 cfs 5 cf

Subcatchment 6A: Runoff Area=106,367 sf 0.60% Impervious Runoff Depth=0.20"
Flow Length=472' Tc=11.1 min CN=53 Runoff=0.12 cfs 1,798 cf

Subcatchment 6S: Runoff Area=11,952 sf 0.00% Impervious Runoff Depth=0.57"
Flow Length=314' Tc=10.6 min CN=64 Runoff=0.13 cfs 566 cf

Reach DP 1: Towards Offsite West Inflow=0.97 cfs 3,603 cf
Outflow=0.97 cfs 3,603 cf

Reach DP 2: Towards Offsite North Inflow=0.37 cfs 1,248 cf
Outflow=0.37 cfs 1,248 cf

Reach DP 3: Towards West Wetland Inflow=1.18 cfs 4,019 cf
Outflow=1.18 cfs 4,019 cf

Reach DP 4: Towards East Wetland Inflow=0.78 cfs 3,130 cf
Outflow=0.78 cfs 3,130 cf

Reach DP 5: Towards Offsite Northwest Inflow=0.00 cfs 5 cf
Outflow=0.00 cfs 5 cf

Reach DP 6: Towards Offsite East Inflow=0.13 cfs 566 cf
Outflow=0.13 cfs 566 cf

Pond 2P: South West Basin Peak Elev=455.41' Storage=1,742 cf Inflow=1.95 cfs 5,711 cf
Outflow=0.25 cfs 5,711 cf

Pond 6P: North East Basin Peak Elev=404.06' Storage=94 cf Inflow=0.12 cfs 1,798 cf
Outflow=0.09 cfs 1,798 cf

Total Runoff Area = 313,660 sf Runoff Volume = 20,081 cf Average Runoff Depth = 0.77"
98.36% Pervious = 308,519 sf 1.64% Impervious = 5,141 sf

Summary for Subcatchment 1S:

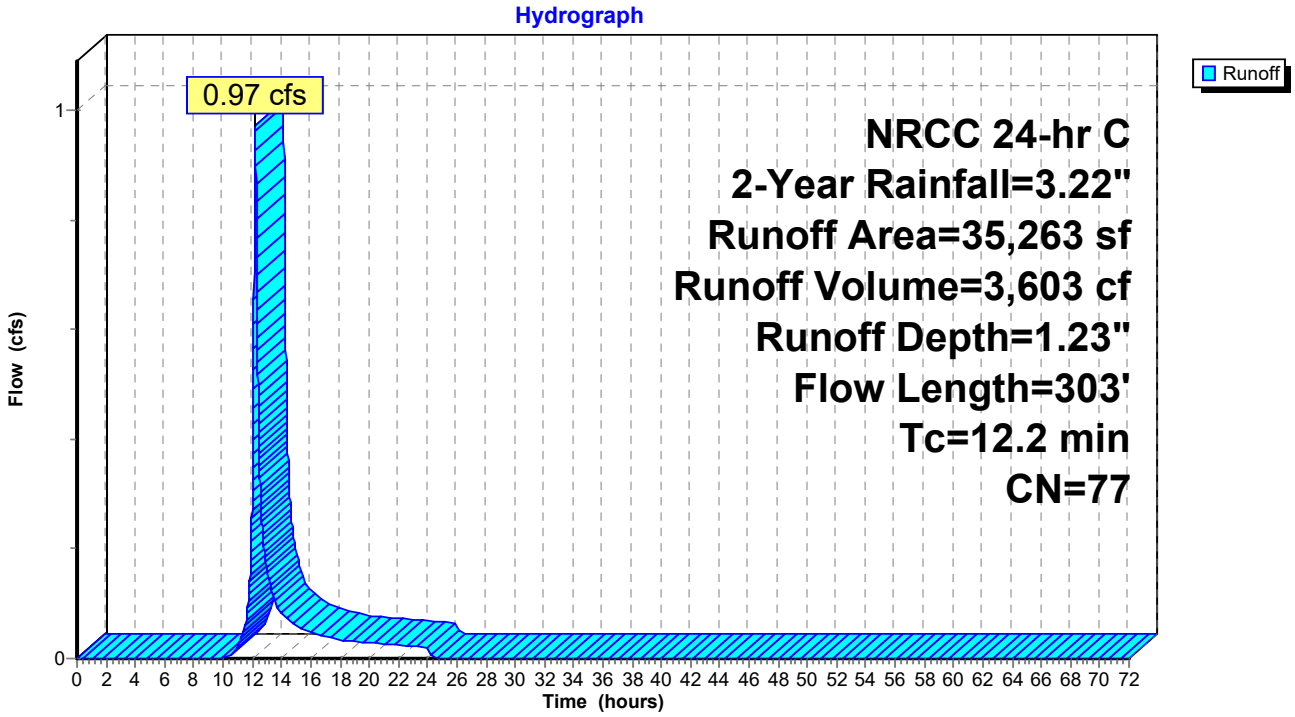
Runoff = 0.97 cfs @ 12.21 hrs, Volume= 3,603 cf, Depth= 1.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 2-Year Rainfall=3.22"

Area (sf)	CN	Description
5,731	70	Woods, Good, HSG C
2,138	98	Roofs, HSG C
24,414	74	>75% Grass cover, Good, HSG C
1,843	96	Gravel surface, HSG C
1,137	98	Paved parking, HSG C
35,263	77	Weighted Average
31,988		90.71% Pervious Area
3,275		9.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.4	50	0.0340	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.44"
0.8	47	0.0213	1.02		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
2.9	123	0.0203	0.71		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.1	31	0.0484	3.54		**Shallow Concentrated Flow, Gravel Road** Unpaved Kv= 16.1 fps
4.0	52	0.0019	0.22		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
12.2	303	Total			

Subcatchment 1S:



Summary for Subcatchment 2A:

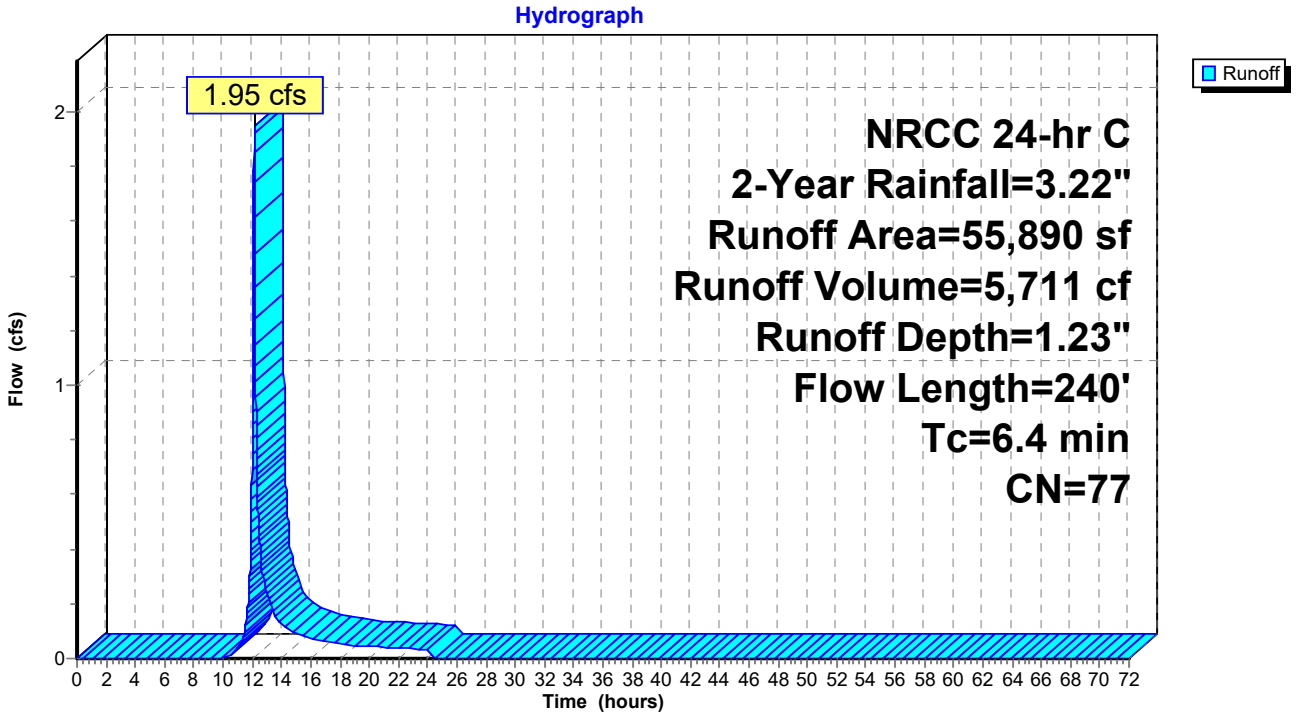
Runoff = 1.95 cfs @ 12.14 hrs, Volume= 5,711 cf, Depth= 1.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 2-Year Rainfall=3.22"

Area (sf)	CN	Description
30,811	74	>75% Grass cover, Good, HSG C
1,226	98	Roofs, HSG C
15,725	70	Woods, Good, HSG C
8,128	96	Gravel surface, HSG C
55,890	77	Weighted Average
54,664		97.81% Pervious Area
1,226		2.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	50	0.0540	0.23		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.44"
0.2	13	0.0310	1.23		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.2	71	0.0366	0.96		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.2	28	0.0321	2.88		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.2	78	0.0256	1.12		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.4	240	Total			

Subcatchment 2A:



Summary for Subcatchment 2S:

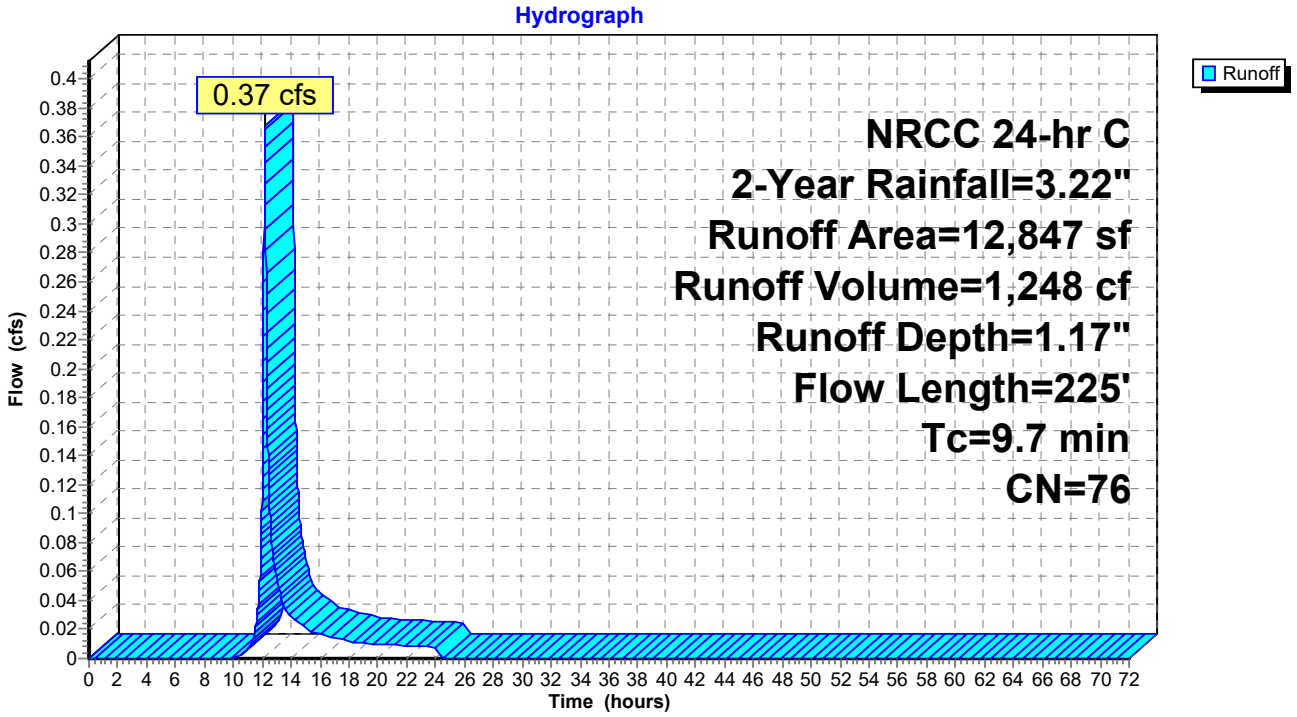
Runoff = 0.37 cfs @ 12.17 hrs, Volume= 1,248 cf, Depth= 1.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 2-Year Rainfall=3.22"

Area (sf)	CN	Description
5,793	70	Woods, Good, HSG C
5,770	77	Brush, Poor, HSG C
1,284	96	Gravel surface, HSG C
12,847	76	Weighted Average
12,847		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.6	50	0.0880	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.44"
0.1	19	0.0256	2.58		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.2	10	0.0102	0.71		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.2	46	0.0176	0.66		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.9	59	0.0273	1.16		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.4	20	0.0251	0.79		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.3	21	0.0239	1.08		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
9.7	225	Total			

Subcatchment 2S:



Summary for Subcatchment 3S:

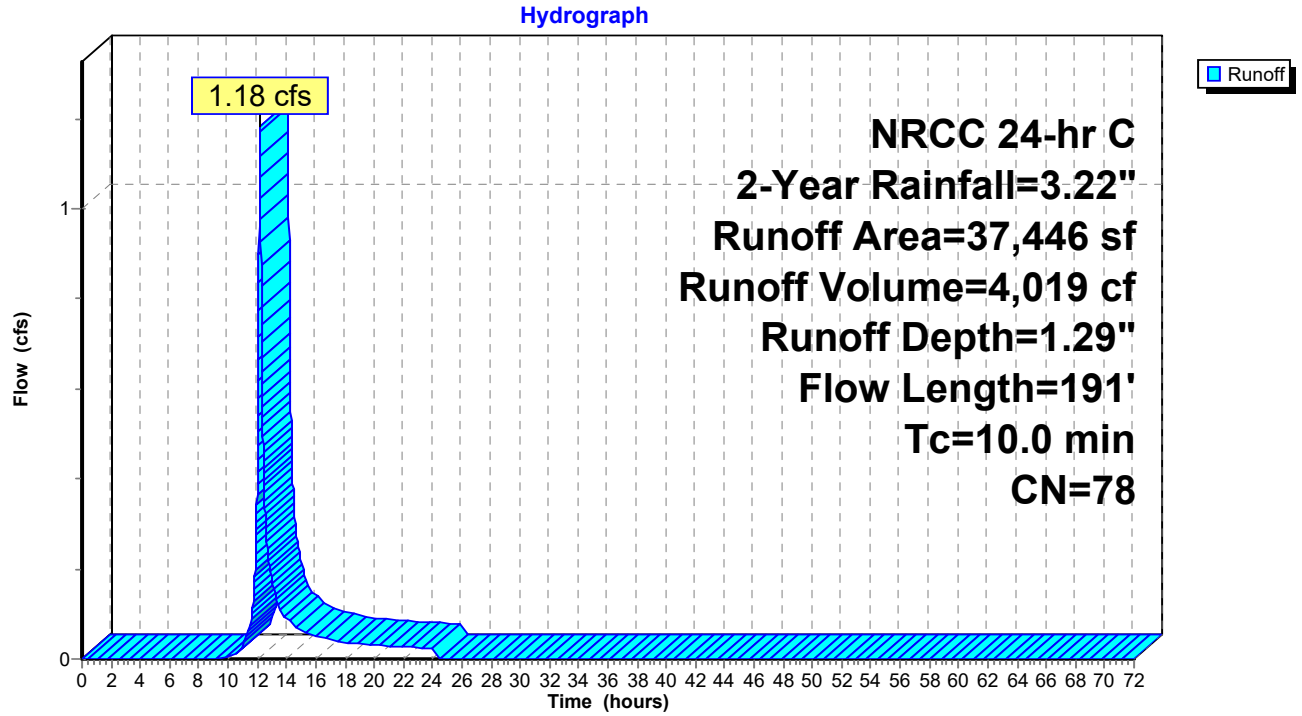
Runoff = 1.18 cfs @ 12.18 hrs, Volume= 4,019 cf, Depth= 1.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 2-Year Rainfall=3.22"

Area (sf)	CN	Description
4,935	70	Woods, Good, HSG C
28,511	77	Brush, Poor, HSG C
4,000	96	Gravel surface, HSG C
37,446	78	Weighted Average
37,446		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	50	0.0440	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.44"
1.0	111	0.0731	1.89		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	11	0.0400	3.22		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.2	19	0.0536	1.62		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
10.0	191	Total			

Subcatchment 3S:



Summary for Subcatchment 4S:

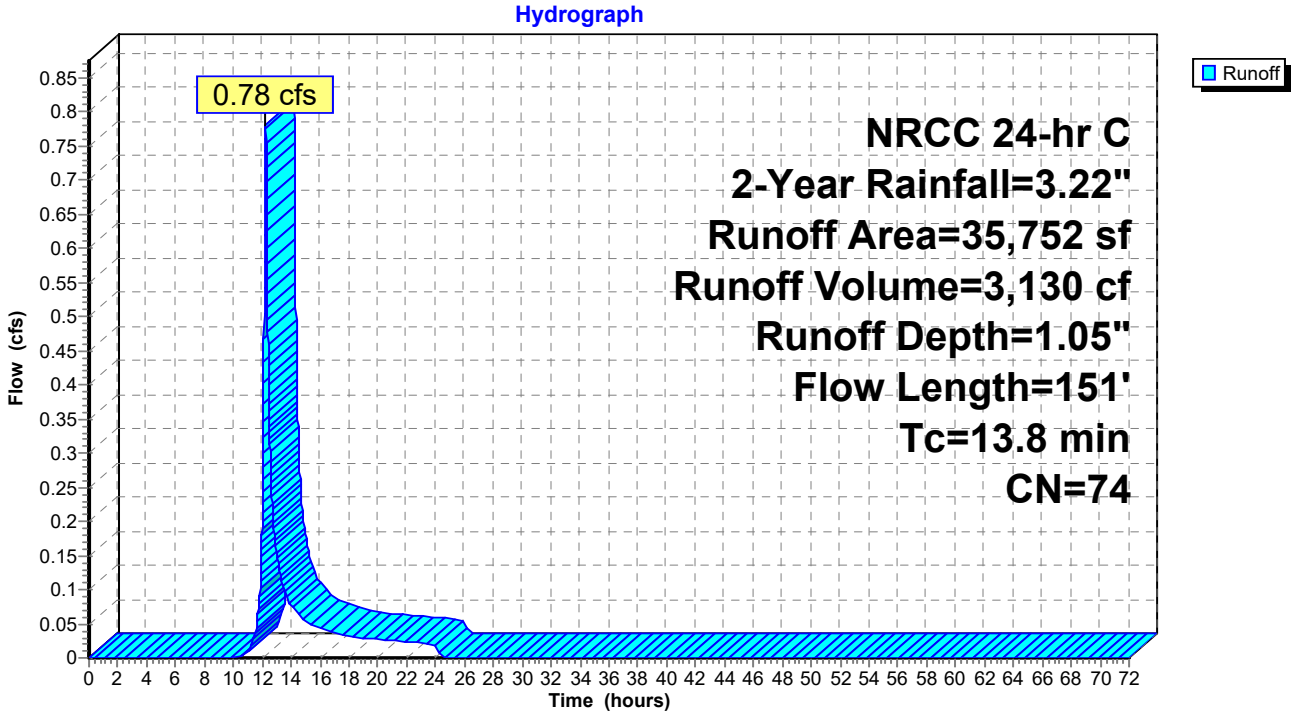
Runoff = 0.78 cfs @ 12.22 hrs, Volume= 3,130 cf, Depth= 1.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 2-Year Rainfall=3.22"

Area (sf)	CN	Description
19,992	70	Woods, Good, HSG C
13,127	77	Brush, Poor, HSG C
2,633	96	Gravel surface, HSG C
35,752	74	Weighted Average
35,752		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.0	50	0.0160	0.06		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.44"
0.8	101	0.0974	2.18		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
13.8	151	Total			

Subcatchment 4S:



Summary for Subcatchment 5S:

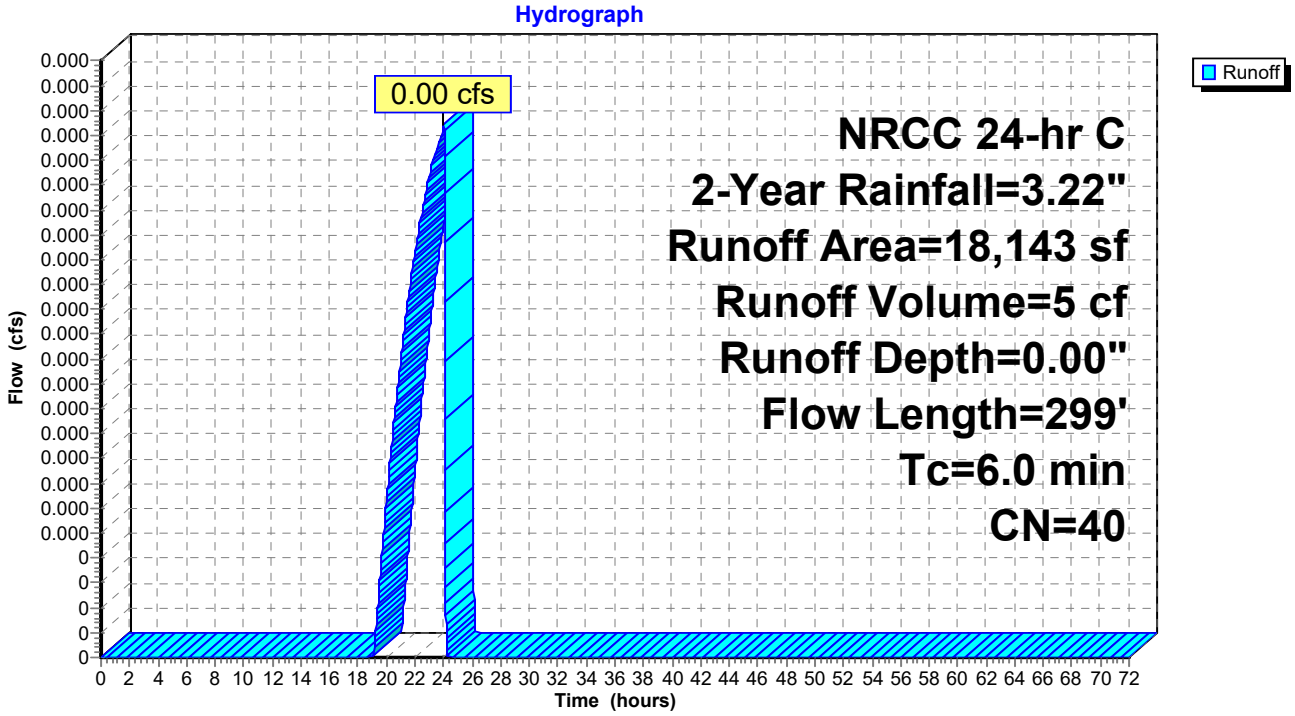
Runoff = 0.00 cfs @ 24.01 hrs, Volume= 5 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 2-Year Rainfall=3.22"

Area (sf)	CN	Description
574	70	Woods, Good, HSG C
1,112	74	>75% Grass cover, Good, HSG C
4,232	30	Woods, Good, HSG A
12,225	39	>75% Grass cover, Good, HSG A
18,143	40	Weighted Average
18,143		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.8	50	0.1040	0.30		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.44"
0.9	193	0.0629	3.76		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.5	56	0.1470	1.92		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
4.2	299	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 5S:



Summary for Subcatchment 6A:

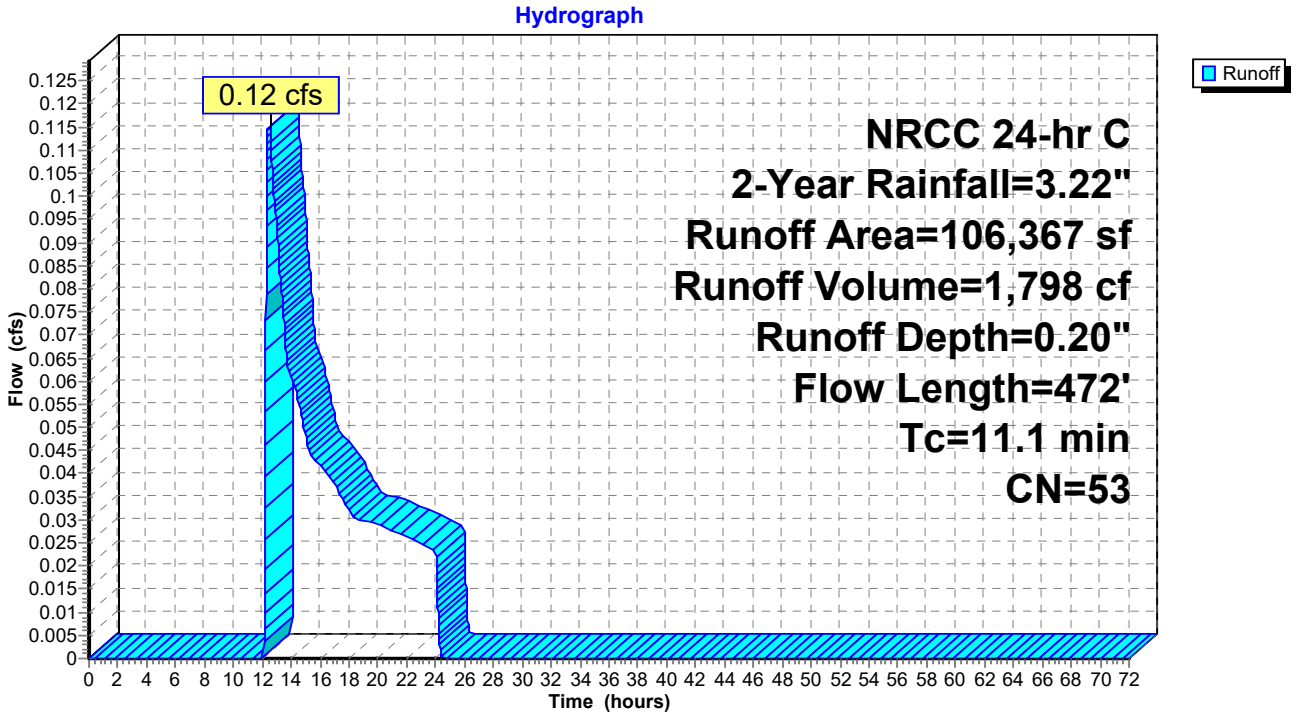
Runoff = 0.12 cfs @ 12.57 hrs, Volume= 1,798 cf, Depth= 0.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 2-Year Rainfall=3.22"

Area (sf)	CN	Description
7,811	70	Woods, Good, HSG C
20,625	74	>75% Grass cover, Good, HSG C
4,965	96	Gravel surface, HSG C
640	98	Unconnected pavement, HSG C
746	30	Woods, Good, HSG A
68,329	39	>75% Grass cover, Good, HSG A
3,251	96	Gravel surface, HSG A
106,367	53	Weighted Average
105,727		99.40% Pervious Area
640		0.60% Impervious Area
640		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	50	0.0200	0.11		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.44"
1.8	238	0.1042	2.26		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
1.4	184	0.0914	2.16	22.30	**Trap/Vee/Rect Channel Flow,** Bot.W=4.00' D=1.00' Z= 5.6 & 7.0 '/' Top.W=16.60' n= 0.150 Sheet flow over Short Grass
11.1	472	Total			

Subcatchment 6A:



Summary for Subcatchment 6S:

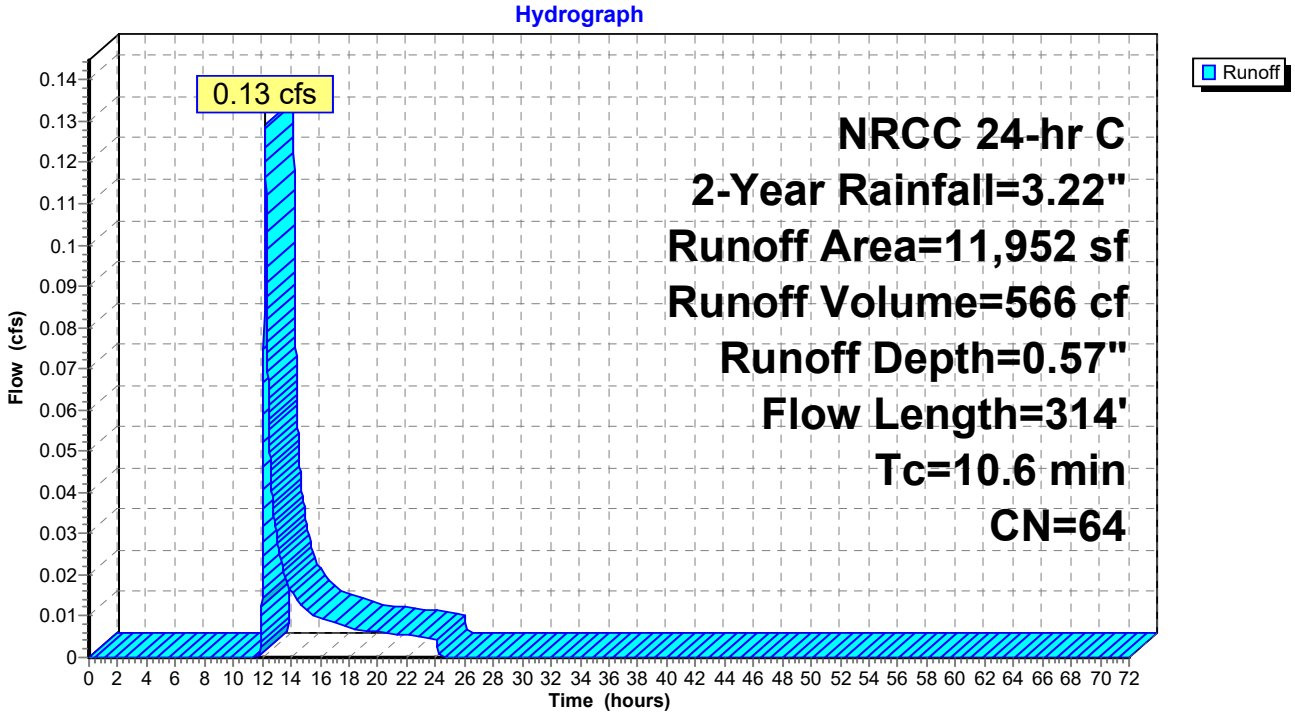
Runoff = 0.13 cfs @ 12.20 hrs, Volume= 566 cf, Depth= 0.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 2-Year Rainfall=3.22"

Area (sf)	CN	Description
5,519	70	Woods, Good, HSG C
3,933	74	>75% Grass cover, Good, HSG C
902	30	Woods, Good, HSG A
1,598	39	>75% Grass cover, Good, HSG A
11,952	64	Weighted Average
11,952		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.7	50	0.0600	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.44"
1.9	150	0.0690	1.31		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.0	114	0.1496	1.93		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
10.6	314	Total			

Subcatchment 6S:

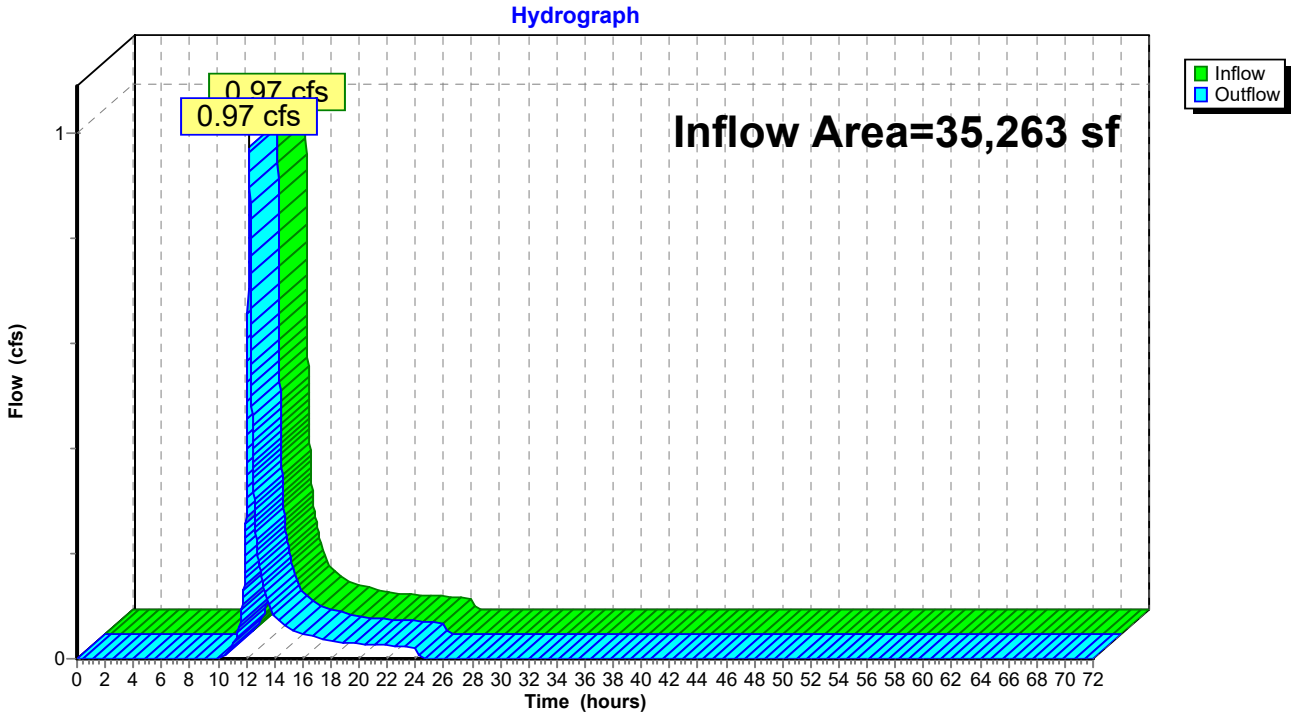


Summary for Reach DP 1: Towards Offsite West

Inflow Area = 35,263 sf, 9.29% Impervious, Inflow Depth = 1.23" for 2-Year event
Inflow = 0.97 cfs @ 12.21 hrs, Volume= 3,603 cf
Outflow = 0.97 cfs @ 12.21 hrs, Volume= 3,603 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 1: Towards Offsite West

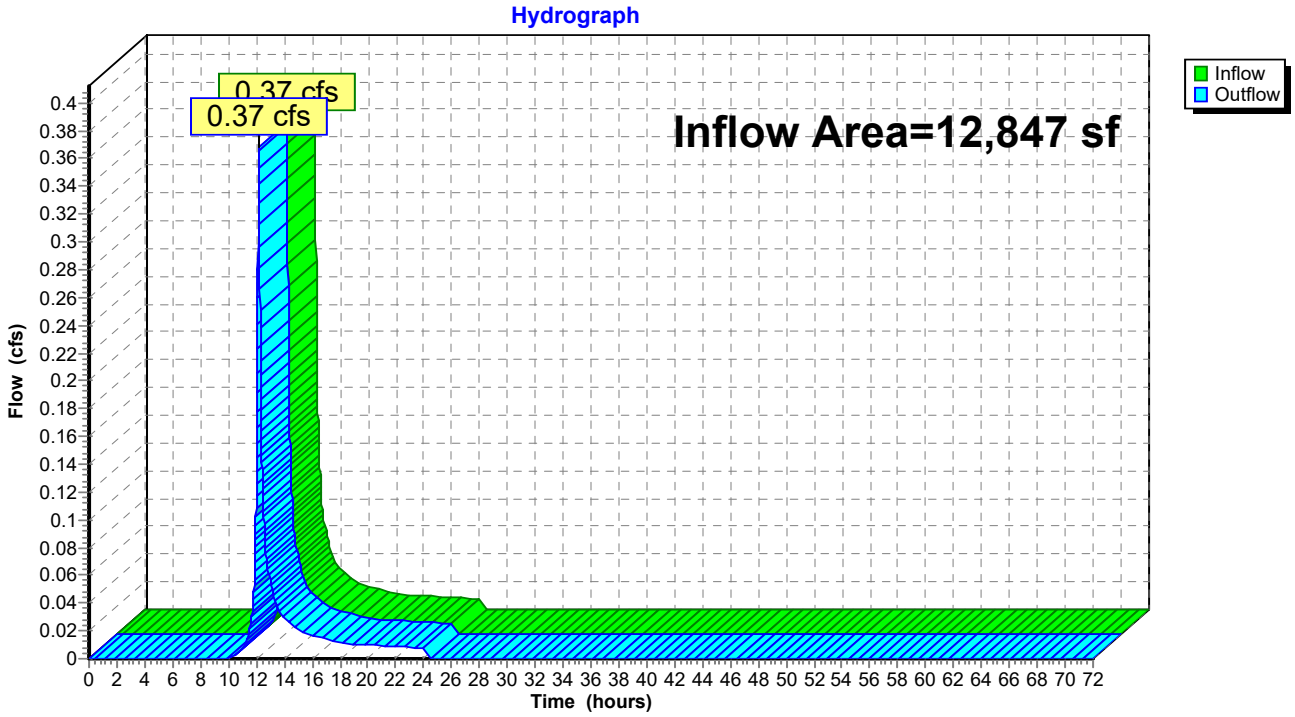


Summary for Reach DP 2: Towards Offsite North

Inflow Area = 12,847 sf, 0.00% Impervious, Inflow Depth = 1.17" for 2-Year event
Inflow = 0.37 cfs @ 12.17 hrs, Volume= 1,248 cf
Outflow = 0.37 cfs @ 12.17 hrs, Volume= 1,248 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 2: Towards Offsite North

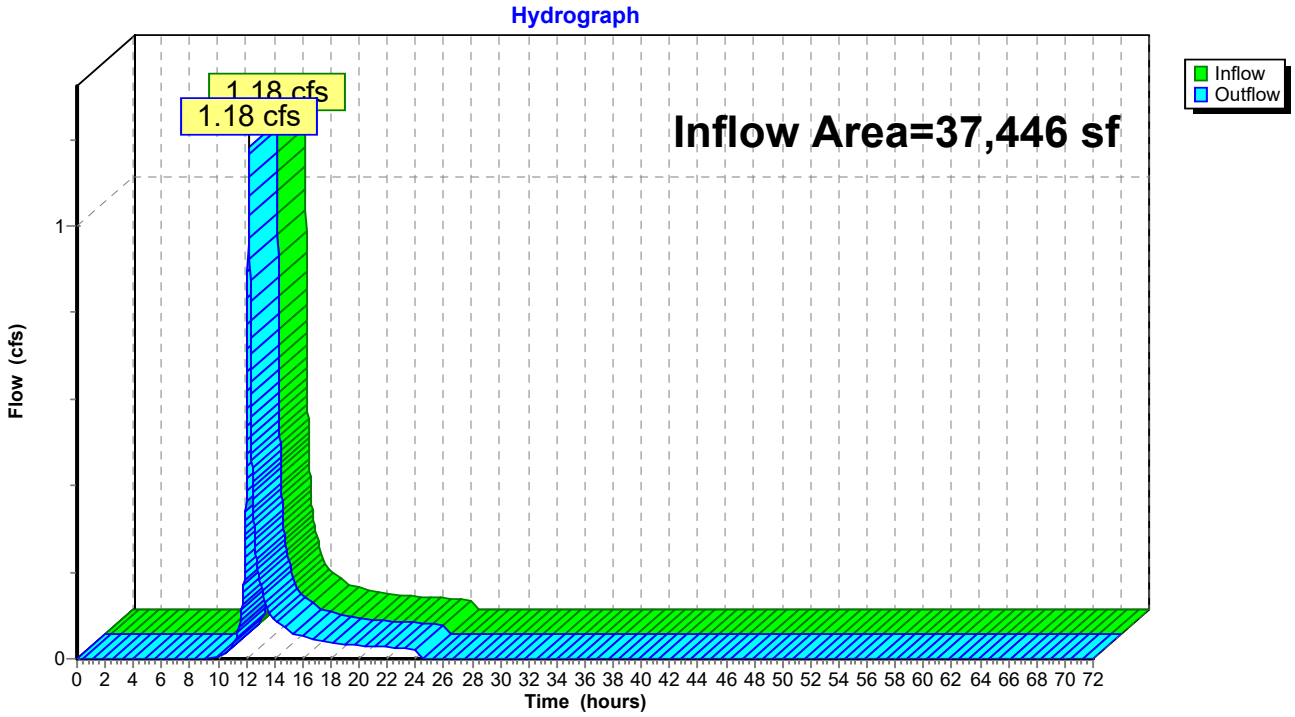


Summary for Reach DP 3: Towards West Wetland

Inflow Area = 37,446 sf, 0.00% Impervious, Inflow Depth = 1.29" for 2-Year event
Inflow = 1.18 cfs @ 12.18 hrs, Volume= 4,019 cf
Outflow = 1.18 cfs @ 12.18 hrs, Volume= 4,019 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 3: Towards West Wetland

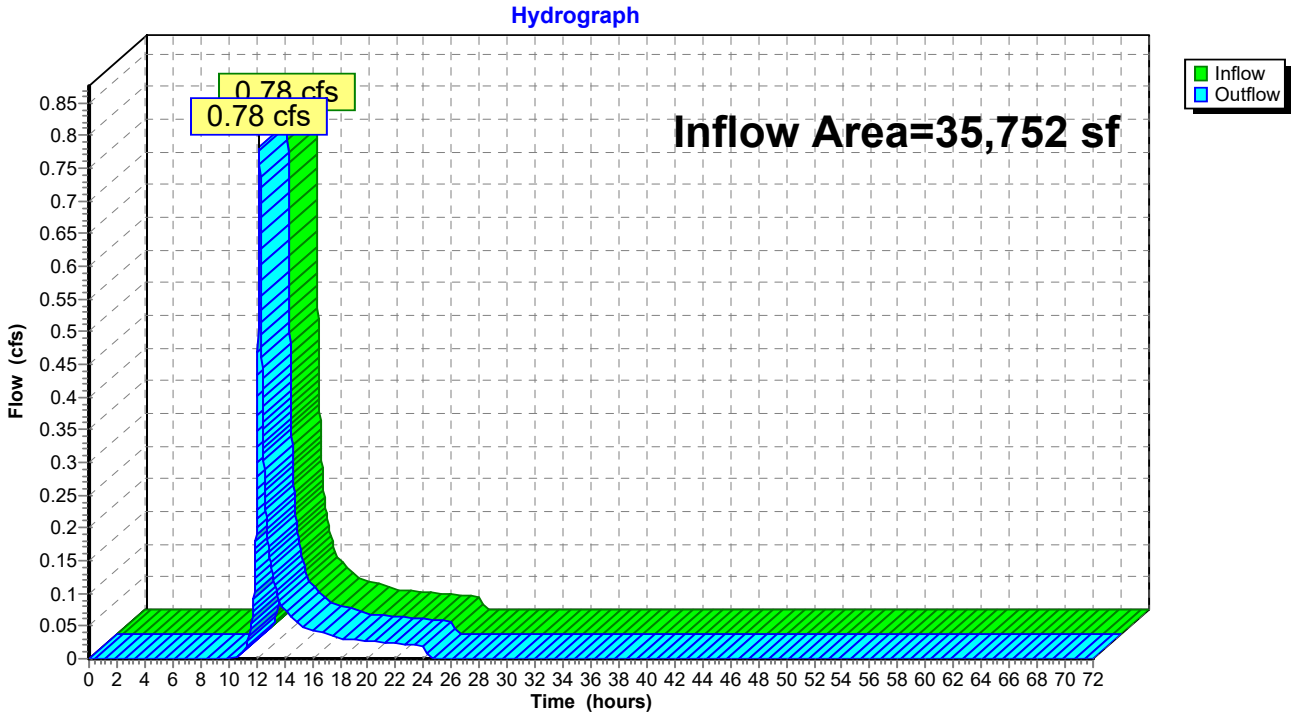


Summary for Reach DP 4: Towards East Wetland

Inflow Area = 35,752 sf, 0.00% Impervious, Inflow Depth = 1.05" for 2-Year event
Inflow = 0.78 cfs @ 12.22 hrs, Volume= 3,130 cf
Outflow = 0.78 cfs @ 12.22 hrs, Volume= 3,130 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 4: Towards East Wetland

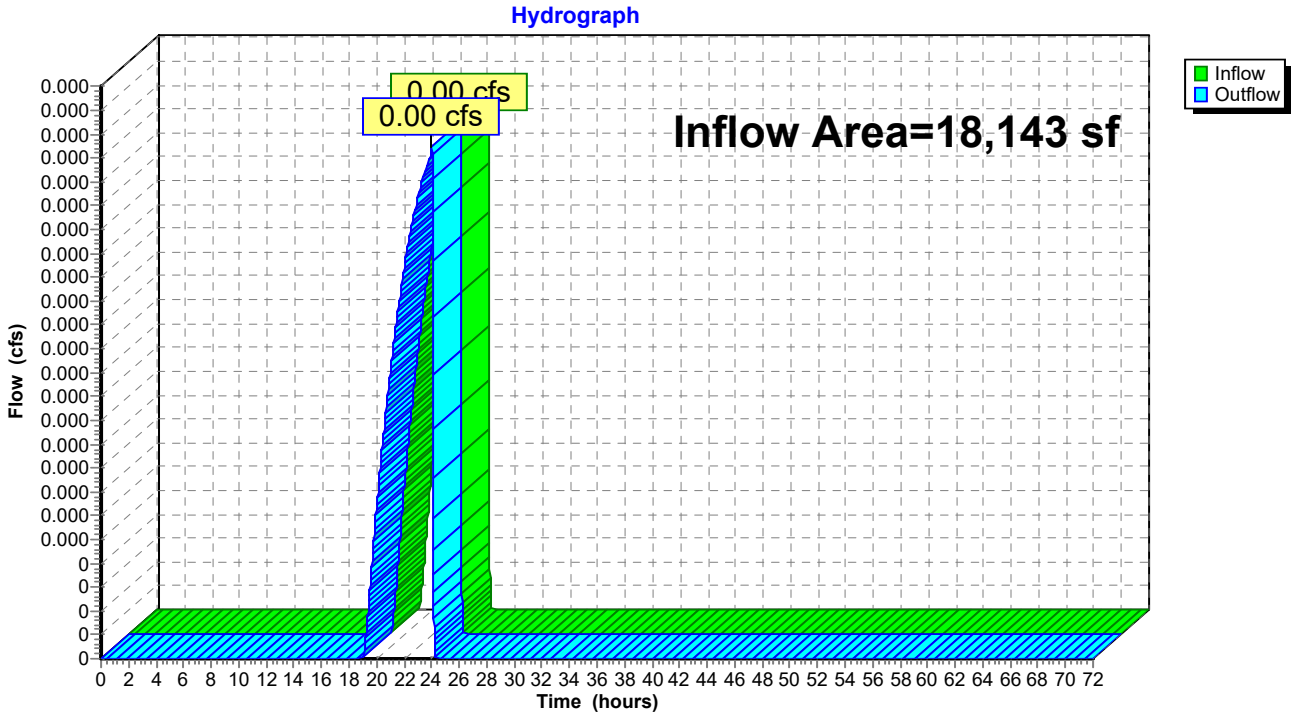


Summary for Reach DP 5: Towards Offsite Northwest

Inflow Area = 18,143 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 24.01 hrs, Volume= 5 cf
Outflow = 0.00 cfs @ 24.01 hrs, Volume= 5 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 5: Towards Offsite Northwest

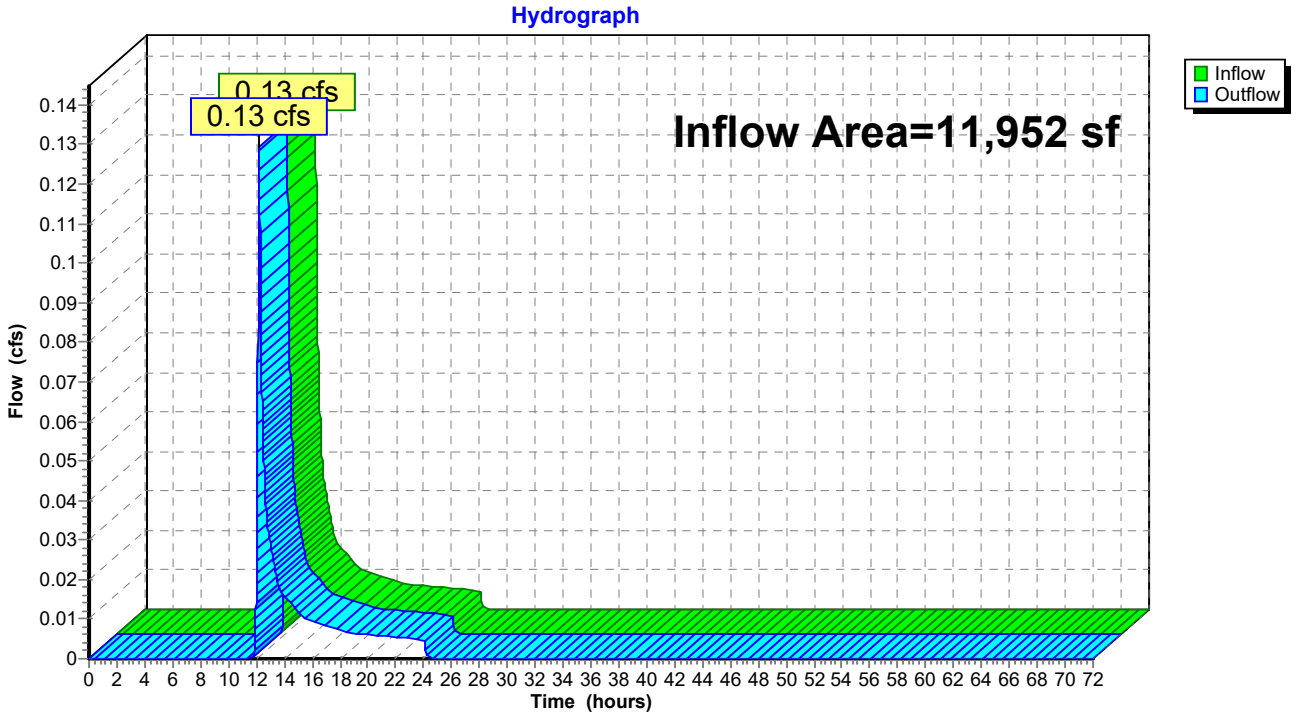


Summary for Reach DP 6: Towards Offsite East

Inflow Area = 11,952 sf, 0.00% Impervious, Inflow Depth = 0.57" for 2-Year event
Inflow = 0.13 cfs @ 12.20 hrs, Volume= 566 cf
Outflow = 0.13 cfs @ 12.20 hrs, Volume= 566 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 6: Towards Offsite East



Summary for Pond 2P: South West Basin

Inflow Area = 55,890 sf, 2.19% Impervious, Inflow Depth = 1.23" for 2-Year event
Inflow = 1.95 cfs @ 12.14 hrs, Volume= 5,711 cf
Outflow = 0.25 cfs @ 12.98 hrs, Volume= 5,711 cf, Atten= 87%, Lag= 50.4 min
Discarded = 0.25 cfs @ 12.98 hrs, Volume= 5,711 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 455.41' @ 12.98 hrs Surf.Area= 4,401 sf Storage= 1,742 cf

Plug-Flow detention time= 57.3 min calculated for 5,710 cf (100% of inflow)
Center-of-Mass det. time= 57.3 min (921.7 - 864.4)

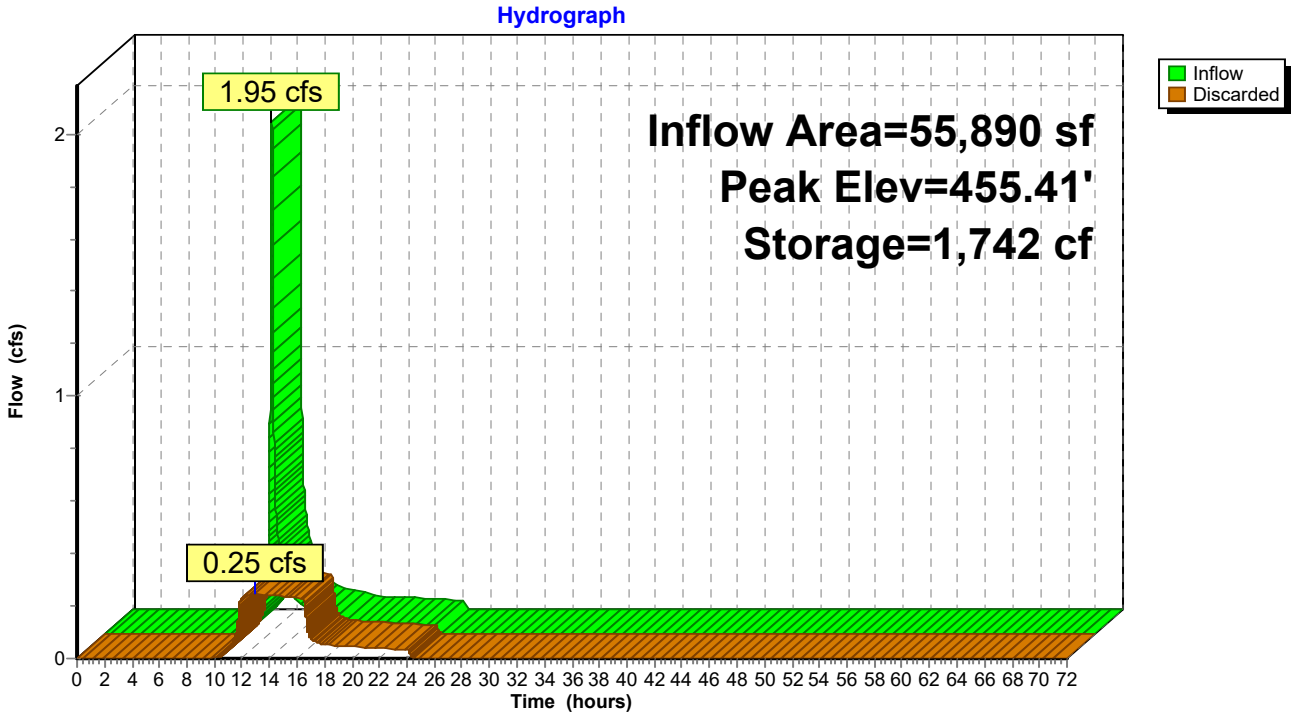
Volume	Invert	Avail.Storage	Storage Description
#1	455.00'	16,306 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
455.00	4,039	0	0	4,039
456.00	4,943	4,483	4,483	4,974
457.00	5,904	5,416	9,900	5,969
458.00	6,922	6,406	16,306	7,026

Device	Routing	Invert	Outlet Devices
#1	Discarded	455.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.25 cfs @ 12.98 hrs HW=455.41' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.25 cfs)

Pond 2P: South West Basin



Summary for Pond 6P: North East Basin

Inflow Area = 106,367 sf, 0.60% Impervious, Inflow Depth = 0.20" for 2-Year event
Inflow = 0.12 cfs @ 12.57 hrs, Volume= 1,798 cf
Outflow = 0.09 cfs @ 13.07 hrs, Volume= 1,798 cf, Atten= 21%, Lag= 30.1 min
Discarded = 0.09 cfs @ 13.07 hrs, Volume= 1,798 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 404.06' @ 13.07 hrs Surf.Area= 1,633 sf Storage= 94 cf

Plug-Flow detention time= 15.0 min calculated for 1,798 cf (100% of inflow)
Center-of-Mass det. time= 15.0 min (1,014.6 - 999.6)

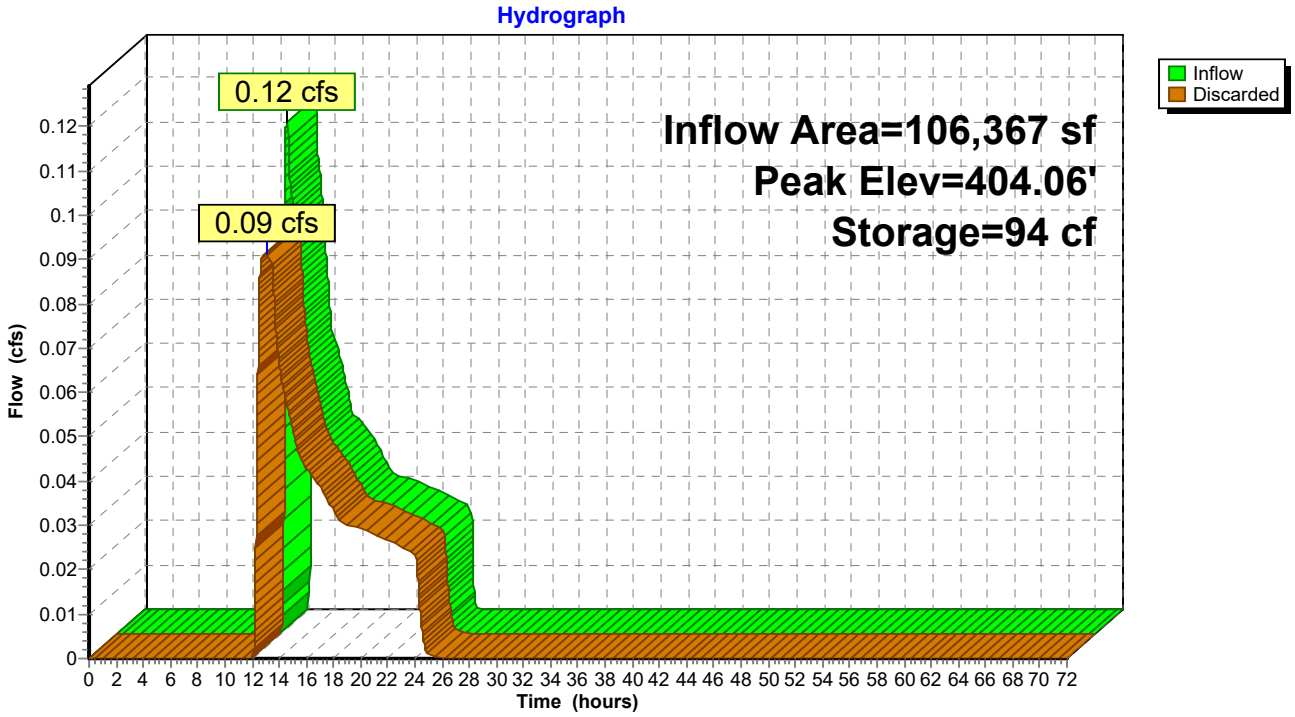
Volume	Invert	Avail.Storage	Storage Description
#1	404.00'	18,479 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
404.00	1,593	178.0	0	0	1,593
405.00	2,352	203.0	1,960	1,960	2,375
406.00	3,120	229.0	2,727	4,687	3,294
407.00	3,995	256.0	3,548	8,236	4,364
408.00	5,102	285.0	4,537	12,773	5,641
409.00	6,333	315.0	5,706	18,479	7,105

Device	Routing	Invert	Outlet Devices
#1	Discarded	404.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.09 cfs @ 13.07 hrs HW=404.06' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.09 cfs)

Pond 6P: North East Basin



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Runoff Area=35,263 sf 9.29% Impervious Runoff Depth=2.51"
Flow Length=303' Tc=12.2 min CN=77 Runoff=2.02 cfs 7,365 cf

Subcatchment 2A: Runoff Area=55,890 sf 2.19% Impervious Runoff Depth=2.51"
Flow Length=240' Tc=6.4 min CN=77 Runoff=4.02 cfs 11,673 cf

Subcatchment 2S: Runoff Area=12,847 sf 0.00% Impervious Runoff Depth=2.42"
Flow Length=225' Tc=9.7 min CN=76 Runoff=0.78 cfs 2,591 cf

Subcatchment 3S: Runoff Area=37,446 sf 0.00% Impervious Runoff Depth=2.59"
Flow Length=191' Tc=10.0 min CN=78 Runoff=2.41 cfs 8,092 cf

Subcatchment 4S: Runoff Area=35,752 sf 0.00% Impervious Runoff Depth=2.25"
Flow Length=151' Tc=13.8 min CN=74 Runoff=1.75 cfs 6,713 cf

Subcatchment 5S: Runoff Area=18,143 sf 0.00% Impervious Runoff Depth=0.21"
Flow Length=299' Tc=6.0 min CN=40 Runoff=0.01 cfs 310 cf

Subcatchment 6A: Runoff Area=106,367 sf 0.60% Impervious Runoff Depth=0.80"
Flow Length=472' Tc=11.1 min CN=53 Runoff=1.51 cfs 7,063 cf

Subcatchment 6S: Runoff Area=11,952 sf 0.00% Impervious Runoff Depth=1.49"
Flow Length=314' Tc=10.6 min CN=64 Runoff=0.41 cfs 1,484 cf

Reach DP 1: Towards Offsite West Inflow=2.02 cfs 7,365 cf
Outflow=2.02 cfs 7,365 cf

Reach DP 2: Towards Offsite North Inflow=0.78 cfs 2,591 cf
Outflow=0.78 cfs 2,591 cf

Reach DP 3: Towards West Wetland Inflow=2.41 cfs 8,092 cf
Outflow=2.41 cfs 8,092 cf

Reach DP 4: Towards East Wetland Inflow=1.75 cfs 6,713 cf
Outflow=1.75 cfs 6,713 cf

Reach DP 5: Towards Offsite Northwest Inflow=0.01 cfs 310 cf
Outflow=0.01 cfs 310 cf

Reach DP 6: Towards Offsite East Inflow=0.41 cfs 1,484 cf
Outflow=0.41 cfs 1,484 cf

Pond 2P: South West Basin Peak Elev=456.08' Storage=4,901 cf Inflow=4.02 cfs 11,673 cf
Outflow=0.28 cfs 11,673 cf

Pond 6P: North East Basin Peak Elev=405.31' Storage=2,728 cf Inflow=1.51 cfs 7,063 cf
Outflow=0.14 cfs 7,063 cf

Total Runoff Area = 313,660 sf Runoff Volume = 45,293 cf Average Runoff Depth = 1.73"
98.36% Pervious = 308,519 sf 1.64% Impervious = 5,141 sf

Summary for Subcatchment 1S:

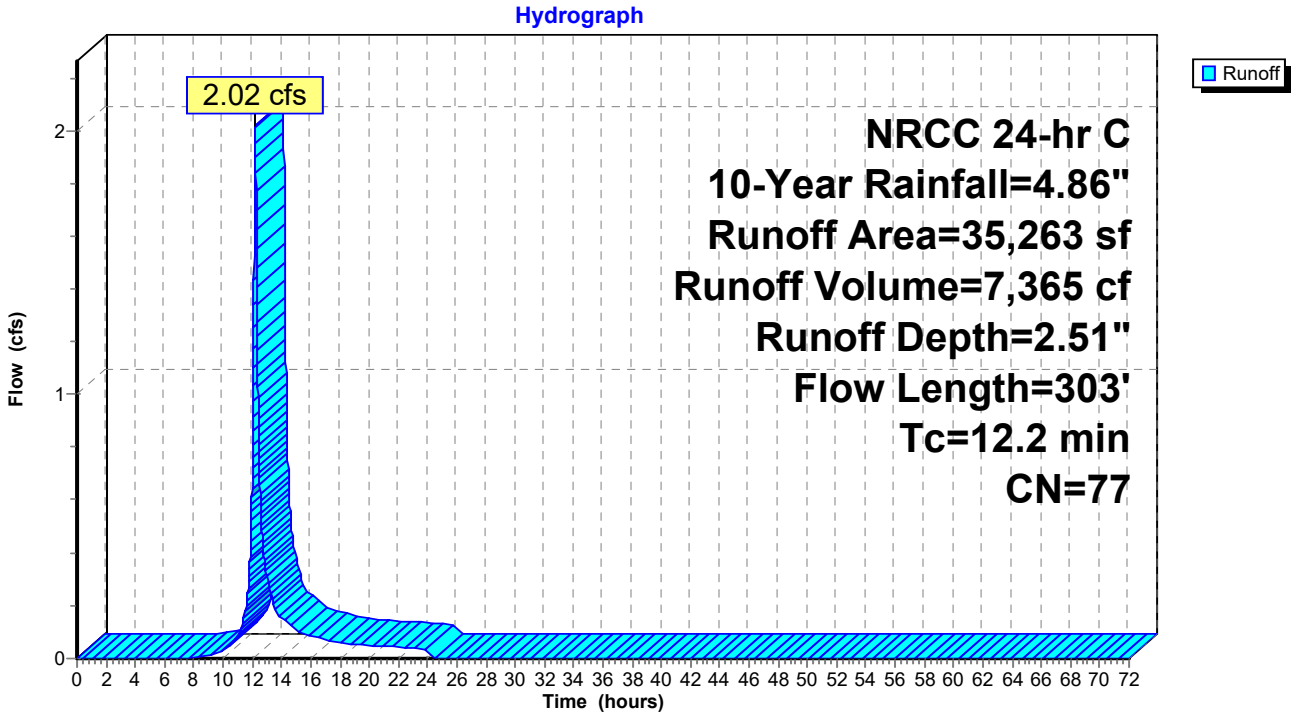
Runoff = 2.02 cfs @ 12.20 hrs, Volume= 7,365 cf, Depth= 2.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 10-Year Rainfall=4.86"

Area (sf)	CN	Description
5,731	70	Woods, Good, HSG C
2,138	98	Roofs, HSG C
24,414	74	>75% Grass cover, Good, HSG C
1,843	96	Gravel surface, HSG C
1,137	98	Paved parking, HSG C
35,263	77	Weighted Average
31,988		90.71% Pervious Area
3,275		9.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.4	50	0.0340	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.44"
0.8	47	0.0213	1.02		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
2.9	123	0.0203	0.71		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.1	31	0.0484	3.54		**Shallow Concentrated Flow, Gravel Road** Unpaved Kv= 16.1 fps
4.0	52	0.0019	0.22		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
12.2	303	Total			

Subcatchment 1S:



Summary for Subcatchment 2A:

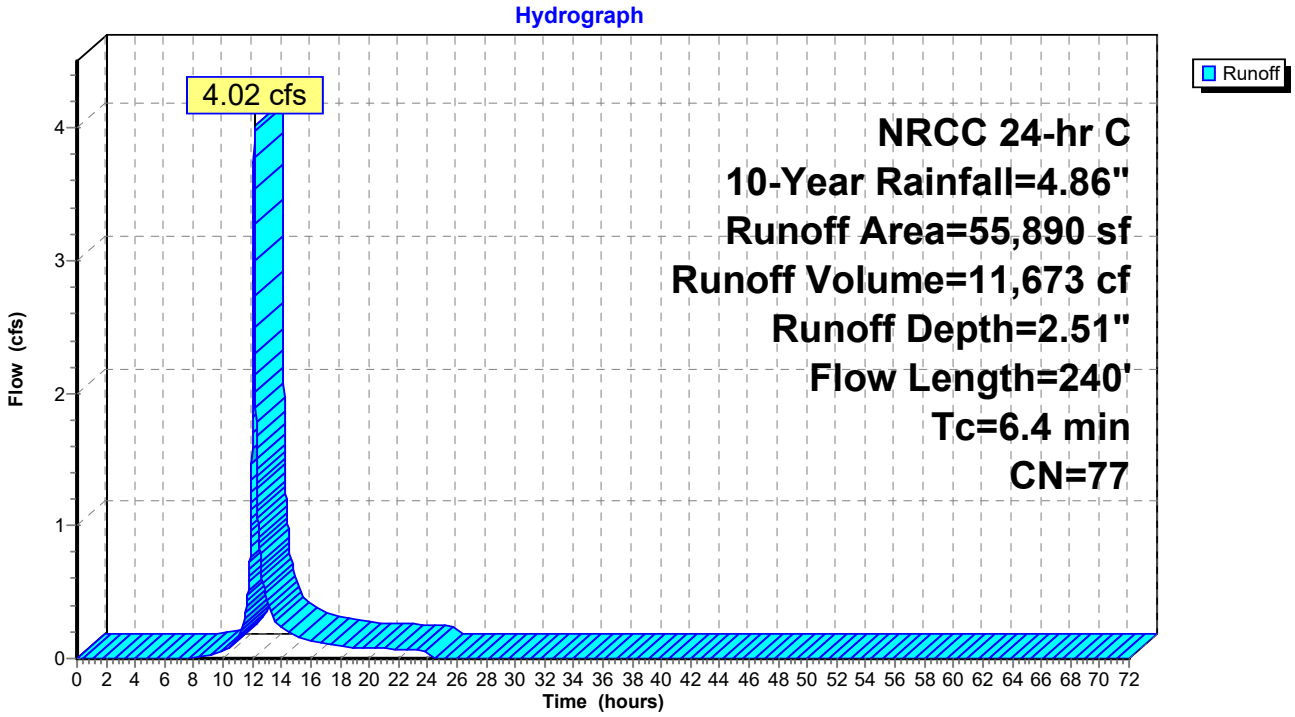
Runoff = 4.02 cfs @ 12.14 hrs, Volume= 11,673 cf, Depth= 2.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 10-Year Rainfall=4.86"

Area (sf)	CN	Description
30,811	74	>75% Grass cover, Good, HSG C
1,226	98	Roofs, HSG C
15,725	70	Woods, Good, HSG C
8,128	96	Gravel surface, HSG C
55,890	77	Weighted Average
54,664		97.81% Pervious Area
1,226		2.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	50	0.0540	0.23		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.44"
0.2	13	0.0310	1.23		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.2	71	0.0366	0.96		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.2	28	0.0321	2.88		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.2	78	0.0256	1.12		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.4	240	Total			

Subcatchment 2A:



Summary for Subcatchment 2S:

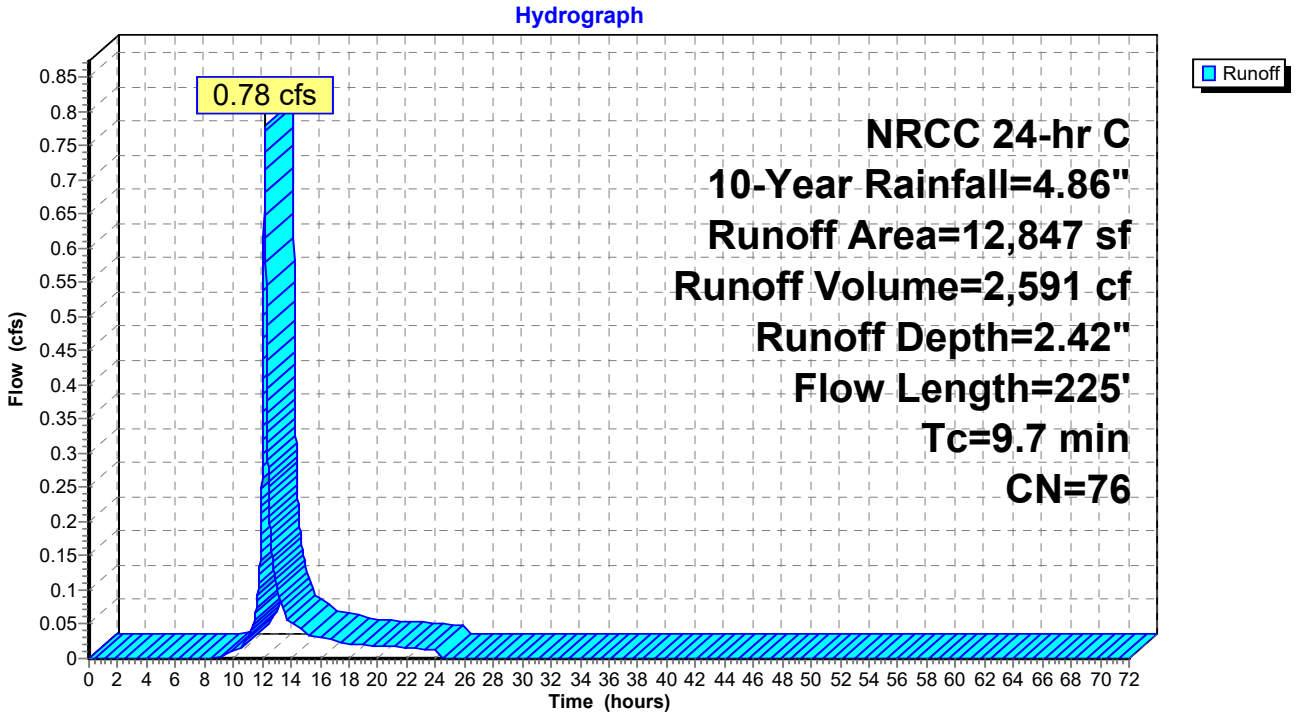
Runoff = 0.78 cfs @ 12.17 hrs, Volume= 2,591 cf, Depth= 2.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 10-Year Rainfall=4.86"

Area (sf)	CN	Description
5,793	70	Woods, Good, HSG C
5,770	77	Brush, Poor, HSG C
1,284	96	Gravel surface, HSG C
12,847	76	Weighted Average
12,847		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.6	50	0.0880	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.44"
0.1	19	0.0256	2.58		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.2	10	0.0102	0.71		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.2	46	0.0176	0.66		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.9	59	0.0273	1.16		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.4	20	0.0251	0.79		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.3	21	0.0239	1.08		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
9.7	225	Total			

Subcatchment 2S:



Summary for Subcatchment 3S:

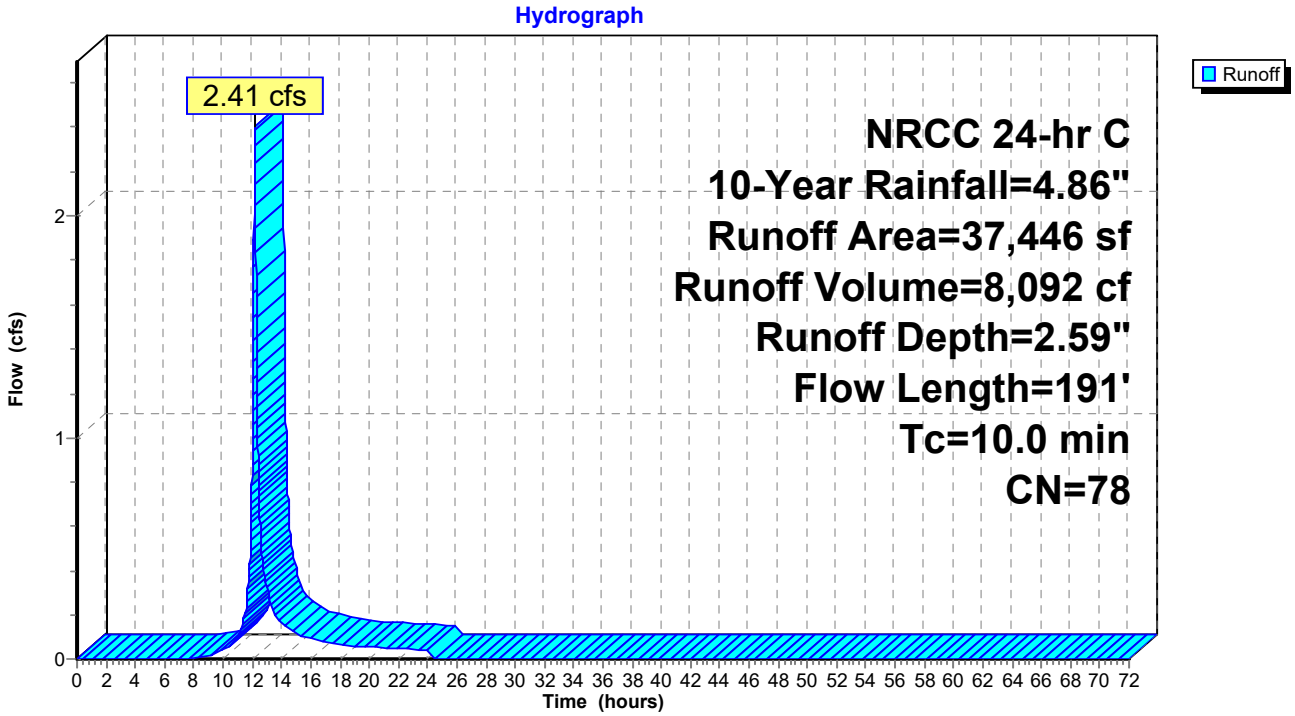
Runoff = 2.41 cfs @ 12.17 hrs, Volume= 8,092 cf, Depth= 2.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 10-Year Rainfall=4.86"

Area (sf)	CN	Description
4,935	70	Woods, Good, HSG C
28,511	77	Brush, Poor, HSG C
4,000	96	Gravel surface, HSG C
37,446	78	Weighted Average
37,446		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	50	0.0440	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.44"
1.0	111	0.0731	1.89		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	11	0.0400	3.22		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.2	19	0.0536	1.62		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
10.0	191	Total			

Subcatchment 3S:



Summary for Subcatchment 4S:

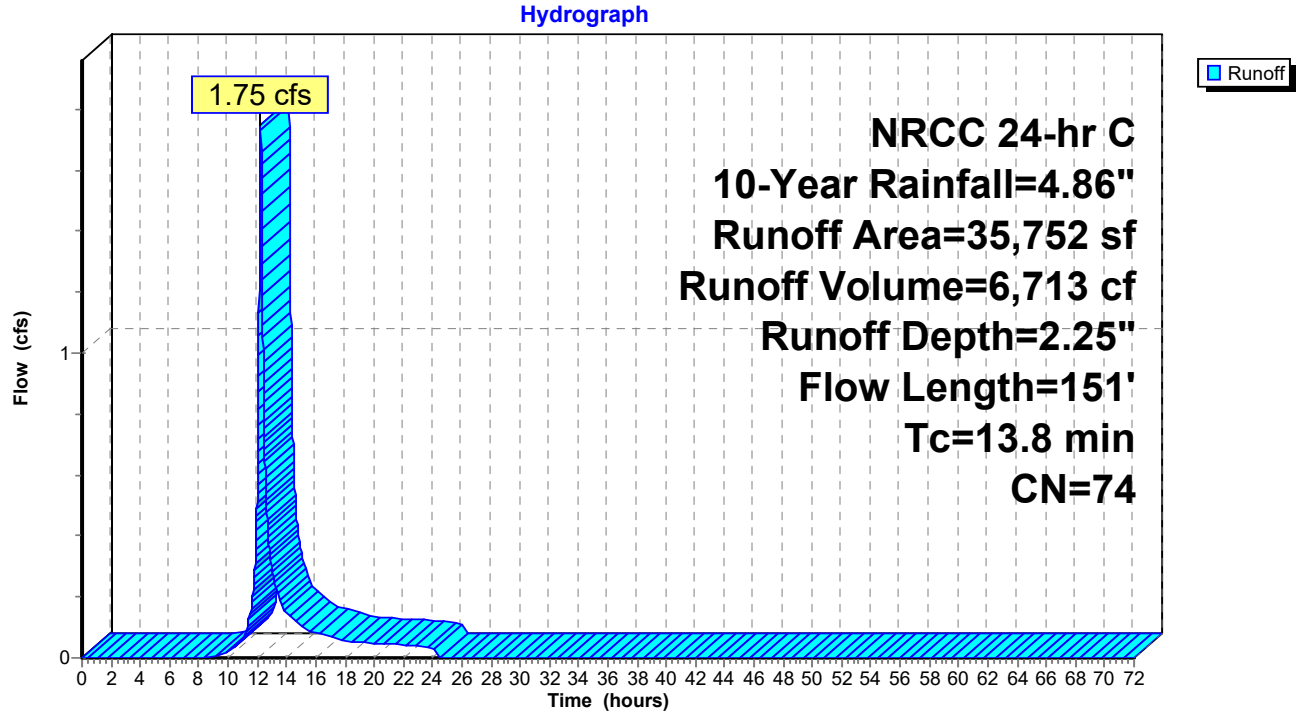
Runoff = 1.75 cfs @ 12.22 hrs, Volume= 6,713 cf, Depth= 2.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 10-Year Rainfall=4.86"

Area (sf)	CN	Description
19,992	70	Woods, Good, HSG C
13,127	77	Brush, Poor, HSG C
2,633	96	Gravel surface, HSG C
35,752	74	Weighted Average
35,752		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.0	50	0.0160	0.06		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.44"
0.8	101	0.0974	2.18		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
13.8	151	Total			

Subcatchment 4S:



Summary for Subcatchment 5S:

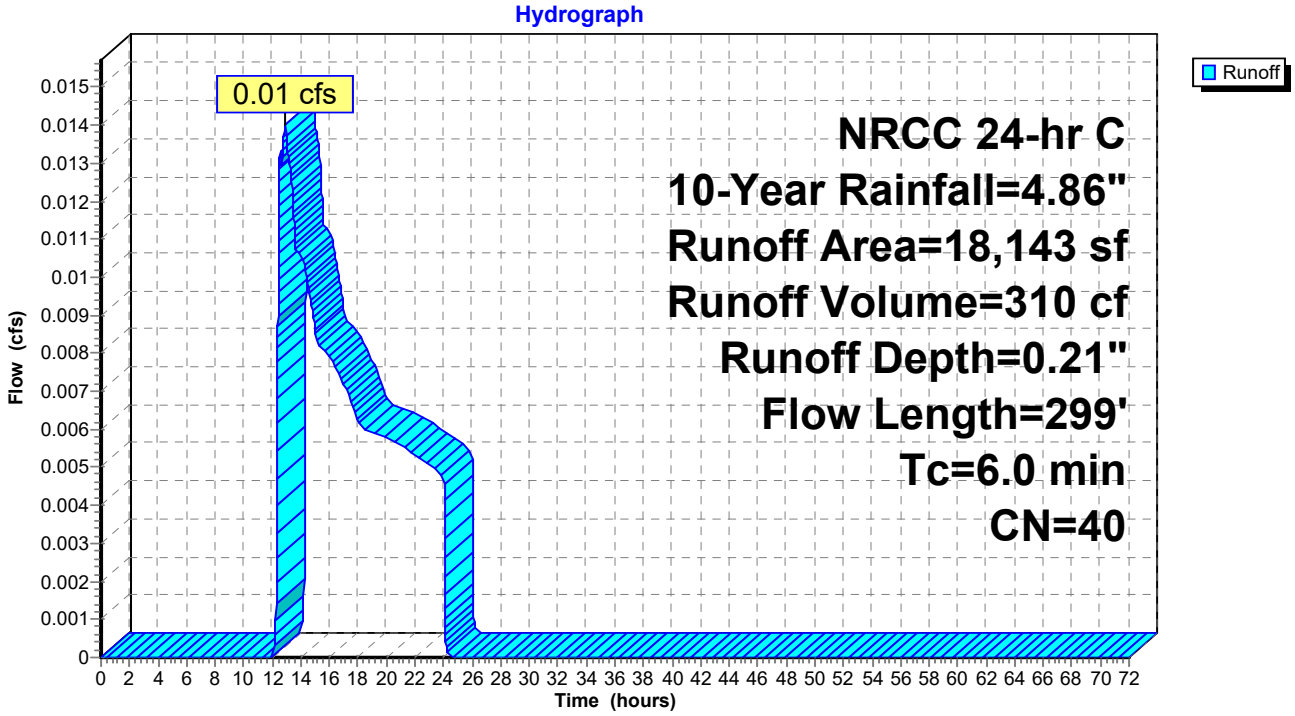
Runoff = 0.01 cfs @ 12.94 hrs, Volume= 310 cf, Depth= 0.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 10-Year Rainfall=4.86"

Area (sf)	CN	Description
574	70	Woods, Good, HSG C
1,112	74	>75% Grass cover, Good, HSG C
4,232	30	Woods, Good, HSG A
12,225	39	>75% Grass cover, Good, HSG A
18,143	40	Weighted Average
18,143		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.8	50	0.1040	0.30		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.44"
0.9	193	0.0629	3.76		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.5	56	0.1470	1.92		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
4.2	299	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 5S:



Summary for Subcatchment 6A:

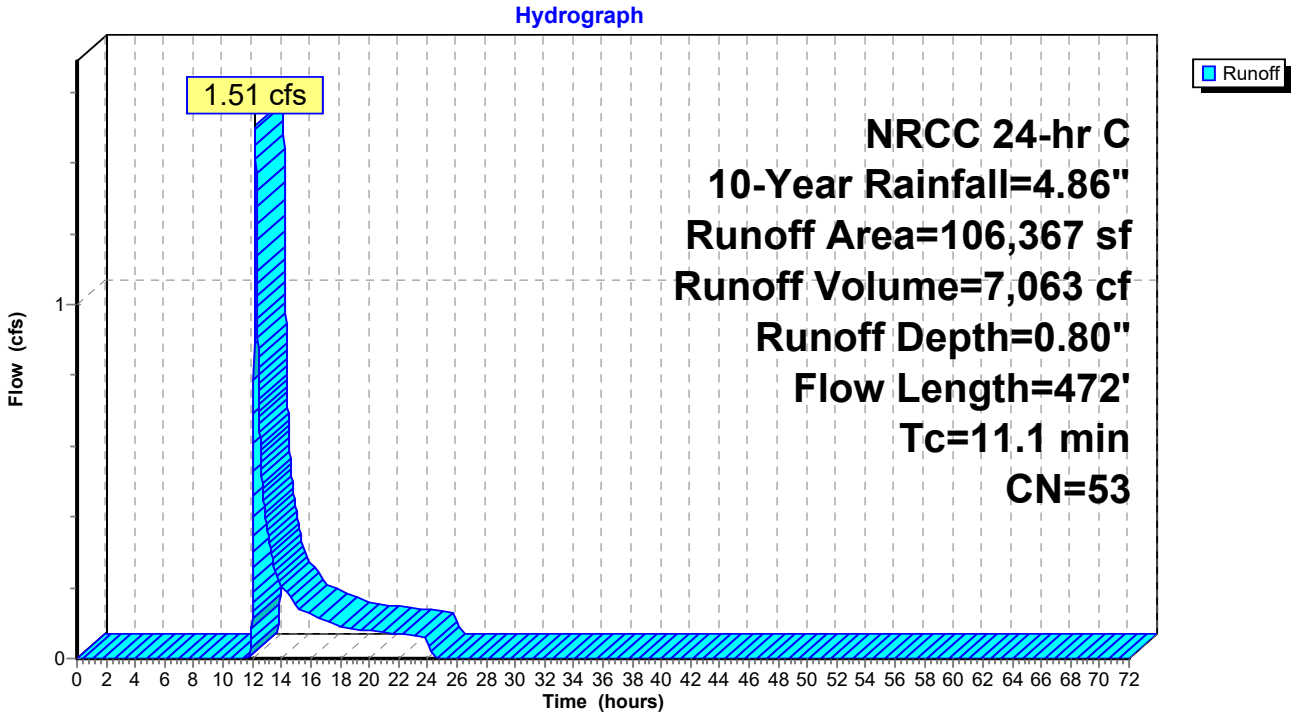
Runoff = 1.51 cfs @ 12.21 hrs, Volume= 7,063 cf, Depth= 0.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 10-Year Rainfall=4.86"

Area (sf)	CN	Description
7,811	70	Woods, Good, HSG C
20,625	74	>75% Grass cover, Good, HSG C
4,965	96	Gravel surface, HSG C
640	98	Unconnected pavement, HSG C
746	30	Woods, Good, HSG A
68,329	39	>75% Grass cover, Good, HSG A
3,251	96	Gravel surface, HSG A
106,367	53	Weighted Average
105,727		99.40% Pervious Area
640		0.60% Impervious Area
640		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	50	0.0200	0.11		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.44"
1.8	238	0.1042	2.26		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
1.4	184	0.0914	2.16	22.30	**Trap/Vee/Rect Channel Flow,** Bot.W=4.00' D=1.00' Z= 5.6 & 7.0 '/' Top.W=16.60' n= 0.150 Sheet flow over Short Grass
11.1	472	Total			

Subcatchment 6A:



Summary for Subcatchment 6S:

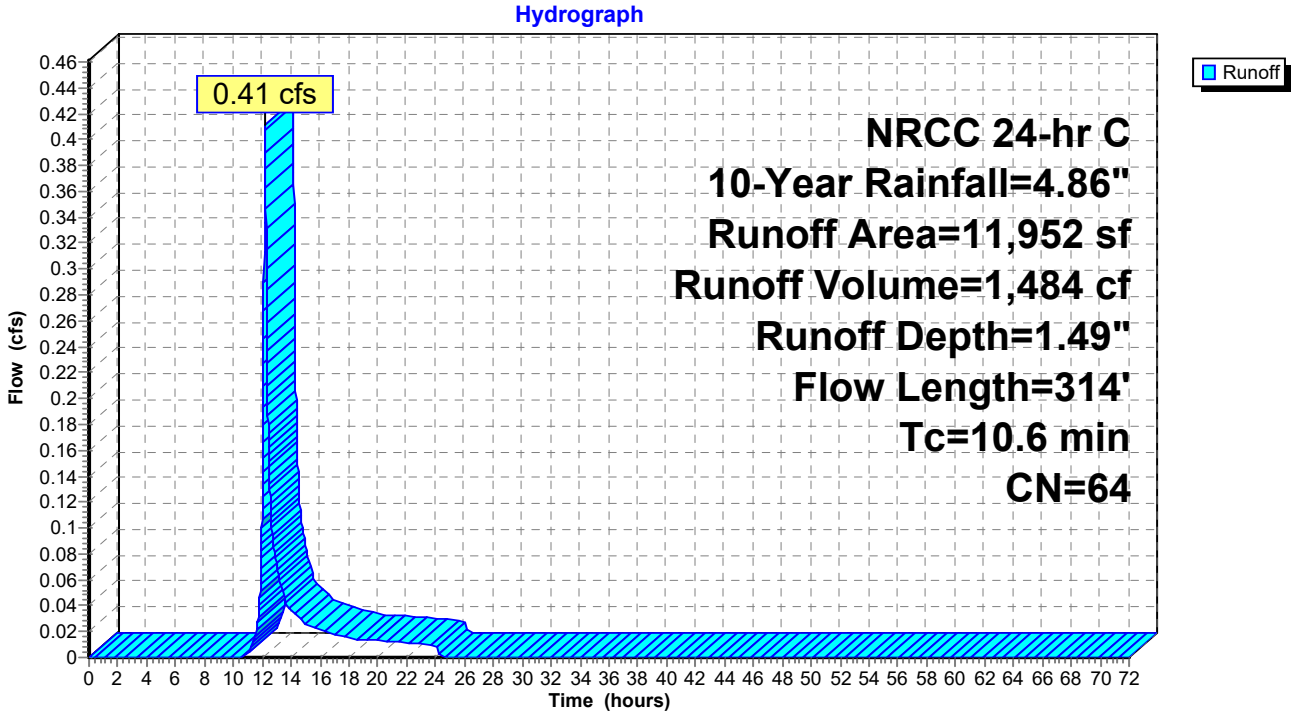
Runoff = 0.41 cfs @ 12.19 hrs, Volume= 1,484 cf, Depth= 1.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 10-Year Rainfall=4.86"

Area (sf)	CN	Description
5,519	70	Woods, Good, HSG C
3,933	74	>75% Grass cover, Good, HSG C
902	30	Woods, Good, HSG A
1,598	39	>75% Grass cover, Good, HSG A
11,952	64	Weighted Average
11,952		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.7	50	0.0600	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.44"
1.9	150	0.0690	1.31		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.0	114	0.1496	1.93		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
10.6	314	Total			

Subcatchment 6S:

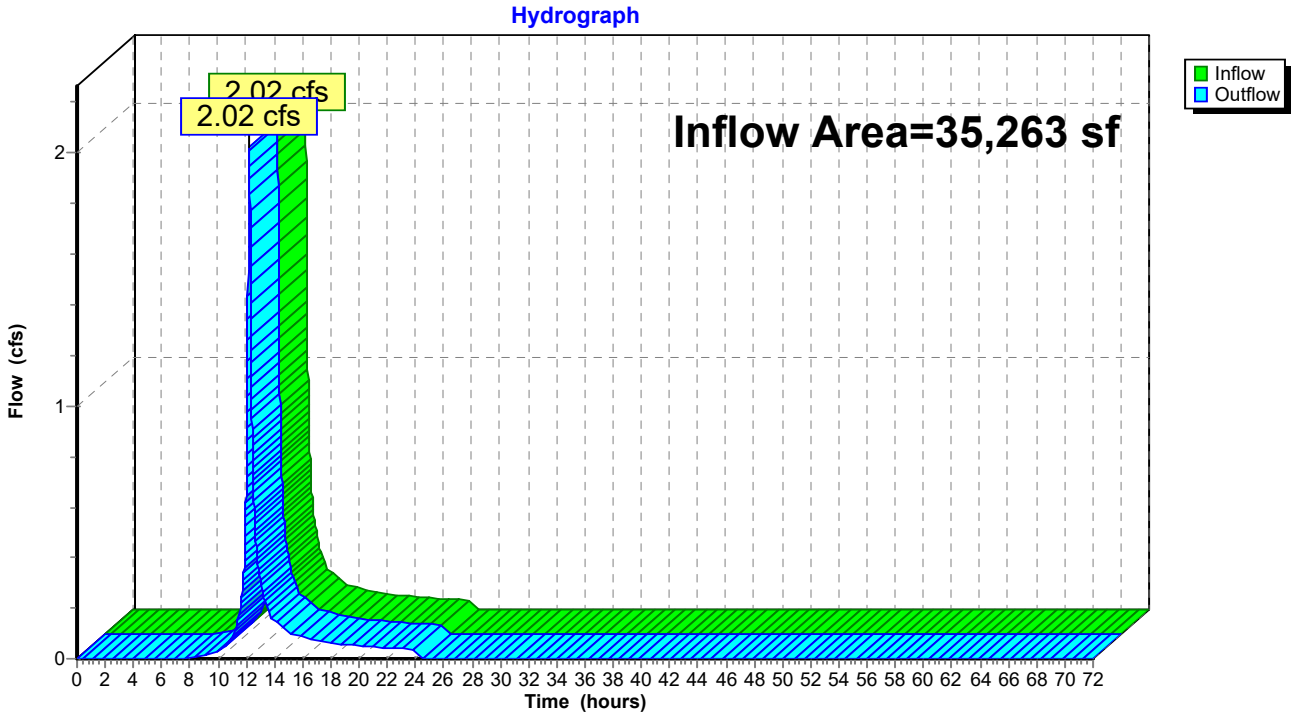


Summary for Reach DP 1: Towards Offsite West

Inflow Area = 35,263 sf, 9.29% Impervious, Inflow Depth = 2.51" for 10-Year event
Inflow = 2.02 cfs @ 12.20 hrs, Volume= 7,365 cf
Outflow = 2.02 cfs @ 12.20 hrs, Volume= 7,365 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 1: Towards Offsite West

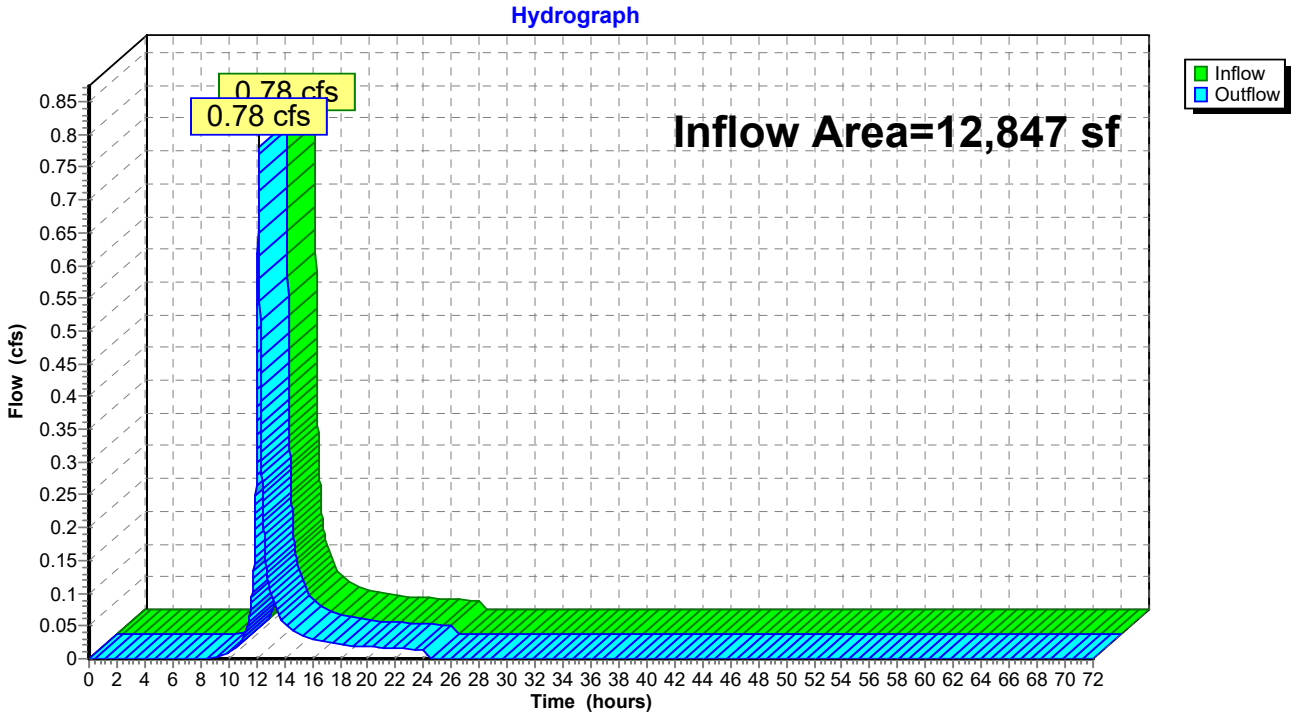


Summary for Reach DP 2: Towards Offsite North

Inflow Area = 12,847 sf, 0.00% Impervious, Inflow Depth = 2.42" for 10-Year event
Inflow = 0.78 cfs @ 12.17 hrs, Volume= 2,591 cf
Outflow = 0.78 cfs @ 12.17 hrs, Volume= 2,591 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 2: Towards Offsite North

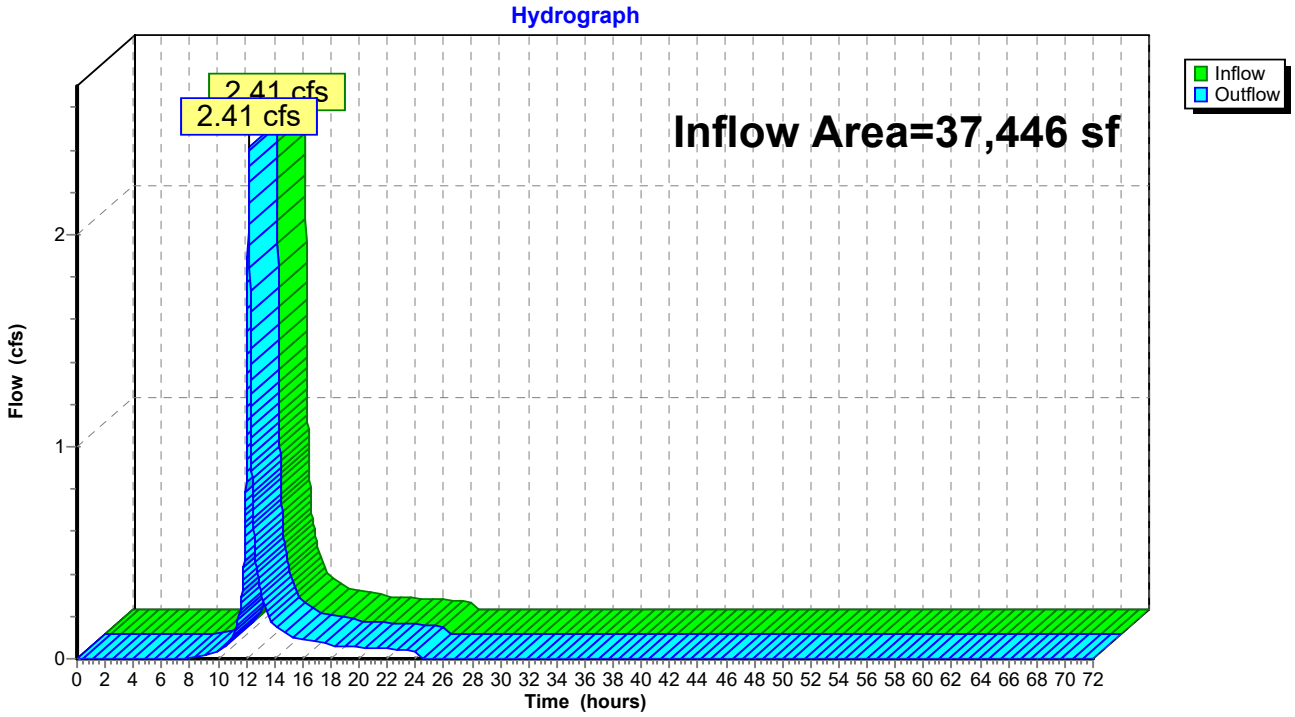


Summary for Reach DP 3: Towards West Wetland

Inflow Area = 37,446 sf, 0.00% Impervious, Inflow Depth = 2.59" for 10-Year event
Inflow = 2.41 cfs @ 12.17 hrs, Volume= 8,092 cf
Outflow = 2.41 cfs @ 12.17 hrs, Volume= 8,092 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 3: Towards West Wetland

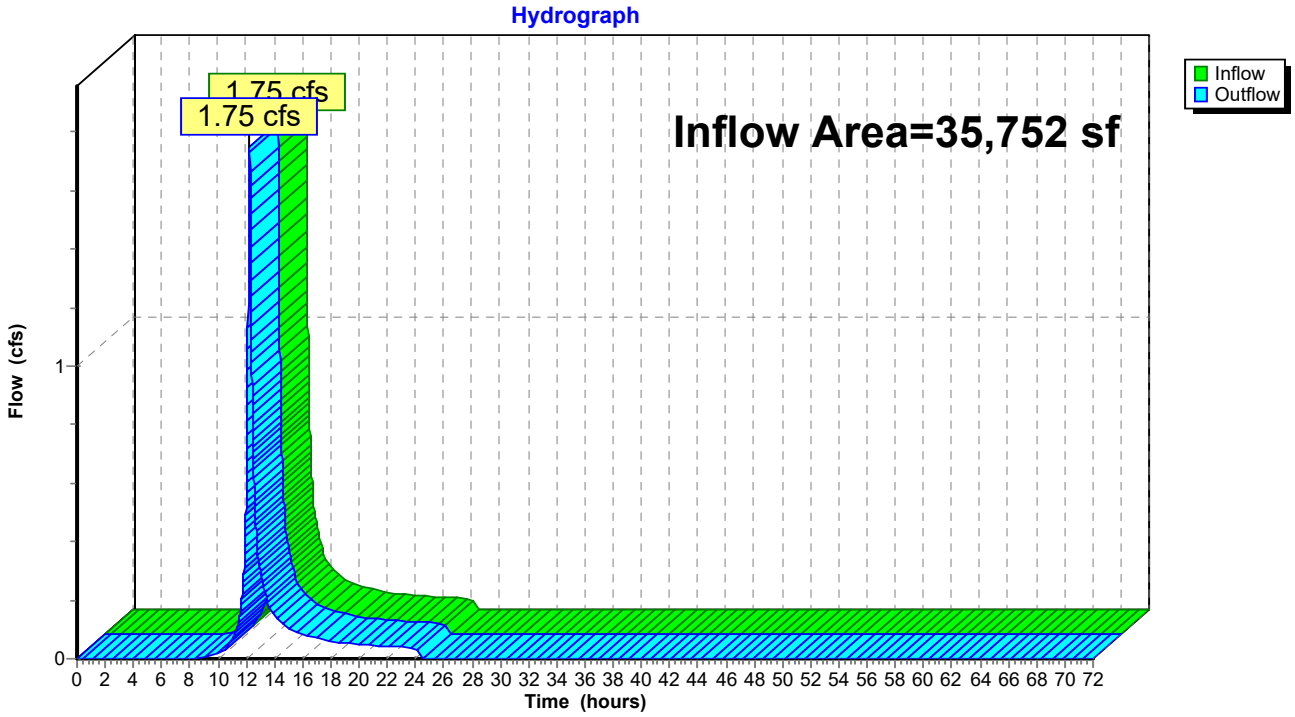


Summary for Reach DP 4: Towards East Wetland

Inflow Area = 35,752 sf, 0.00% Impervious, Inflow Depth = 2.25" for 10-Year event
Inflow = 1.75 cfs @ 12.22 hrs, Volume= 6,713 cf
Outflow = 1.75 cfs @ 12.22 hrs, Volume= 6,713 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 4: Towards East Wetland

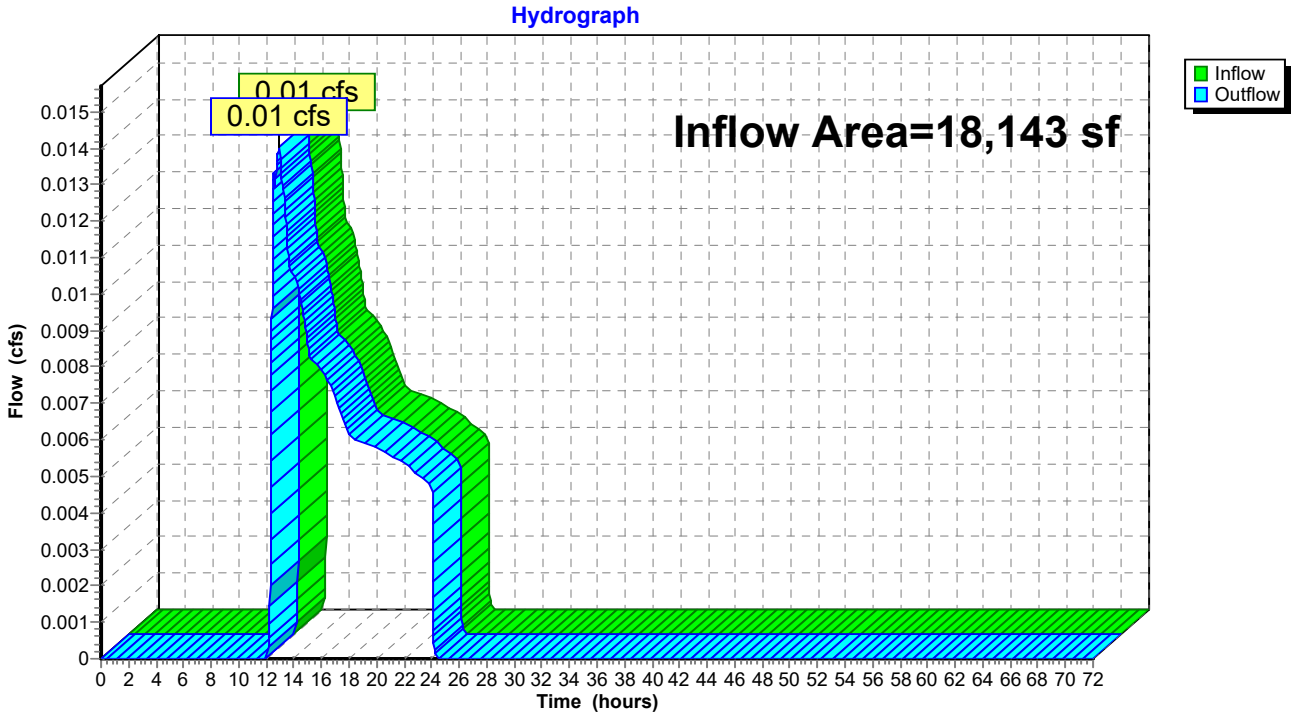


Summary for Reach DP 5: Towards Offsite Northwest

Inflow Area = 18,143 sf, 0.00% Impervious, Inflow Depth = 0.21" for 10-Year event
Inflow = 0.01 cfs @ 12.94 hrs, Volume= 310 cf
Outflow = 0.01 cfs @ 12.94 hrs, Volume= 310 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 5: Towards Offsite Northwest

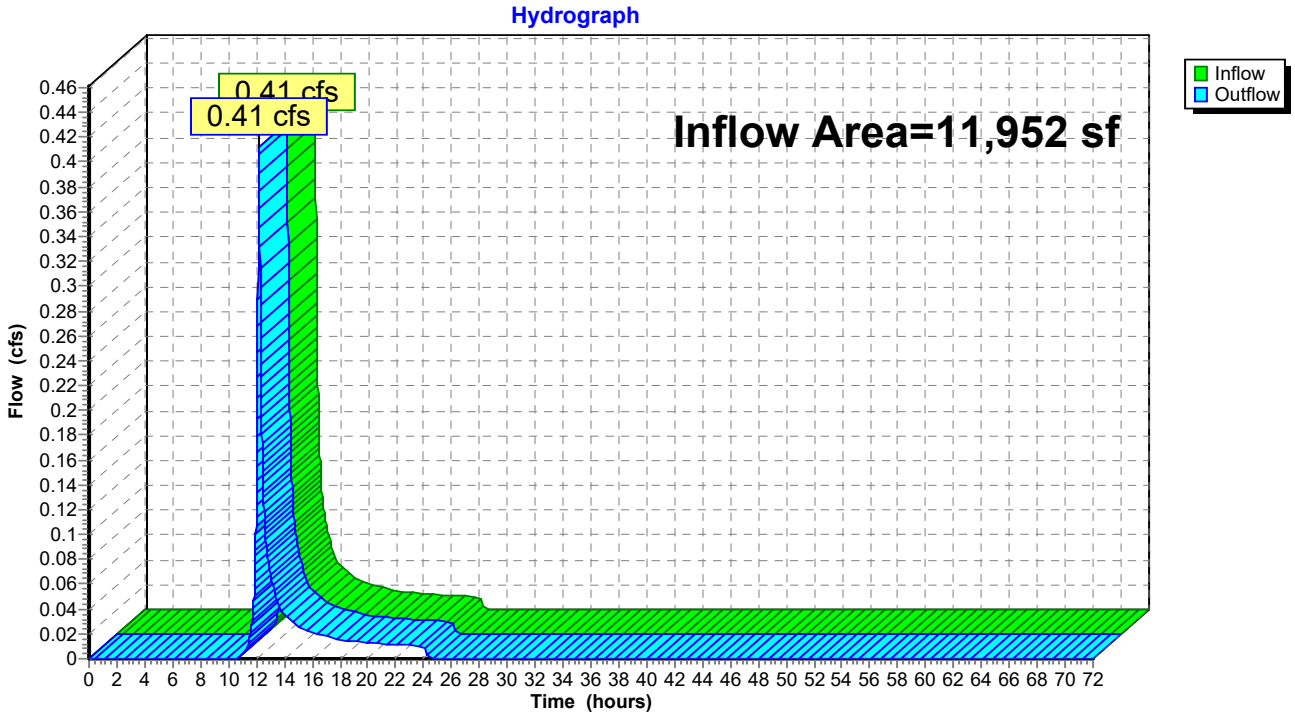


Summary for Reach DP 6: Towards Offsite East

Inflow Area = 11,952 sf, 0.00% Impervious, Inflow Depth = 1.49" for 10-Year event
Inflow = 0.41 cfs @ 12.19 hrs, Volume= 1,484 cf
Outflow = 0.41 cfs @ 12.19 hrs, Volume= 1,484 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 6: Towards Offsite East



Summary for Pond 2P: South West Basin

Inflow Area = 55,890 sf, 2.19% Impervious, Inflow Depth = 2.51" for 10-Year event
Inflow = 4.02 cfs @ 12.14 hrs, Volume= 11,673 cf
Outflow = 0.28 cfs @ 13.57 hrs, Volume= 11,673 cf, Atten= 93%, Lag= 85.7 min
Discarded = 0.28 cfs @ 13.57 hrs, Volume= 11,673 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 456.08' @ 13.57 hrs Surf.Area= 5,020 sf Storage= 4,901 cf

Plug-Flow detention time= 168.2 min calculated for 11,671 cf (100% of inflow)
Center-of-Mass det. time= 168.2 min (1,009.6 - 841.4)

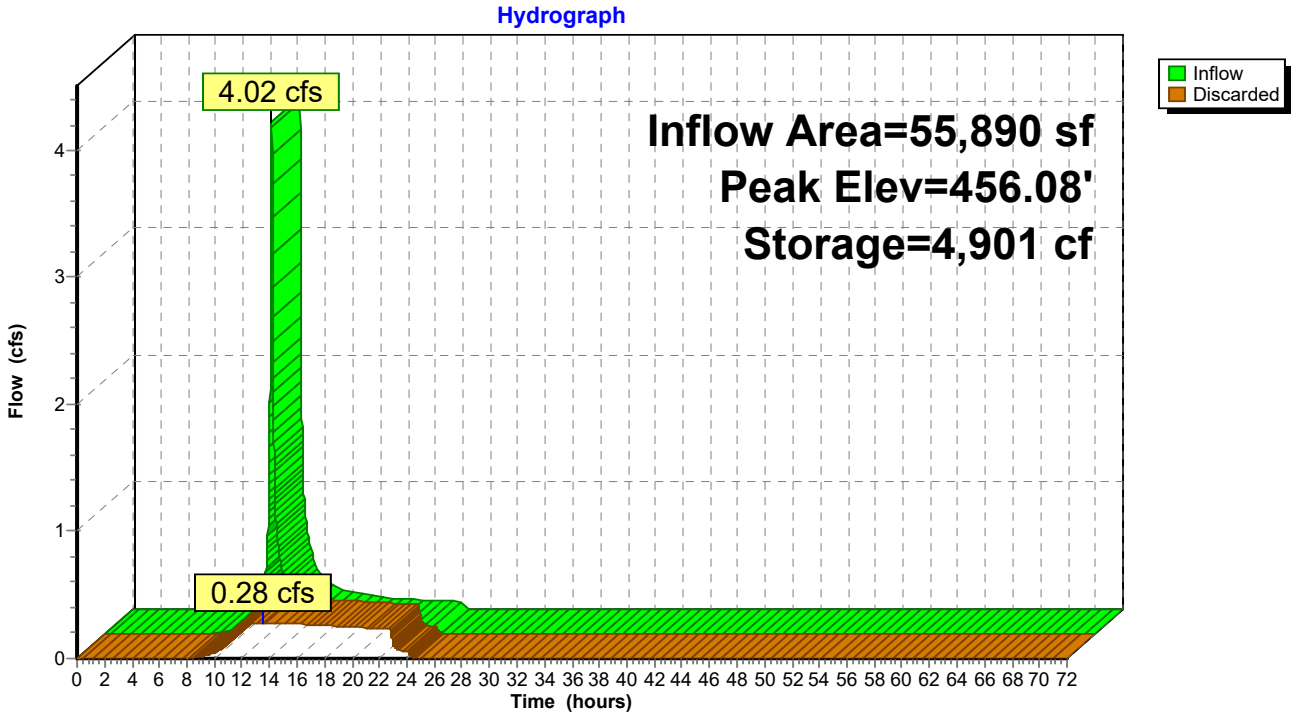
Volume	Invert	Avail.Storage	Storage Description
#1	455.00'	16,306 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
455.00	4,039	0	0	4,039
456.00	4,943	4,483	4,483	4,974
457.00	5,904	5,416	9,900	5,969
458.00	6,922	6,406	16,306	7,026

Device	Routing	Invert	Outlet Devices
#1	Discarded	455.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.28 cfs @ 13.57 hrs HW=456.08' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.28 cfs)

Pond 2P: South West Basin



Summary for Pond 6P: North East Basin

Inflow Area = 106,367 sf, 0.60% Impervious, Inflow Depth = 0.80" for 10-Year event
Inflow = 1.51 cfs @ 12.21 hrs, Volume= 7,063 cf
Outflow = 0.14 cfs @ 15.09 hrs, Volume= 7,063 cf, Atten= 90%, Lag= 172.9 min
Discarded = 0.14 cfs @ 15.09 hrs, Volume= 7,063 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 405.31' @ 15.09 hrs Surf.Area= 2,580 sf Storage= 2,728 cf

Plug-Flow detention time= 235.4 min calculated for 7,062 cf (100% of inflow)
Center-of-Mass det. time= 235.4 min (1,160.8 - 925.3)

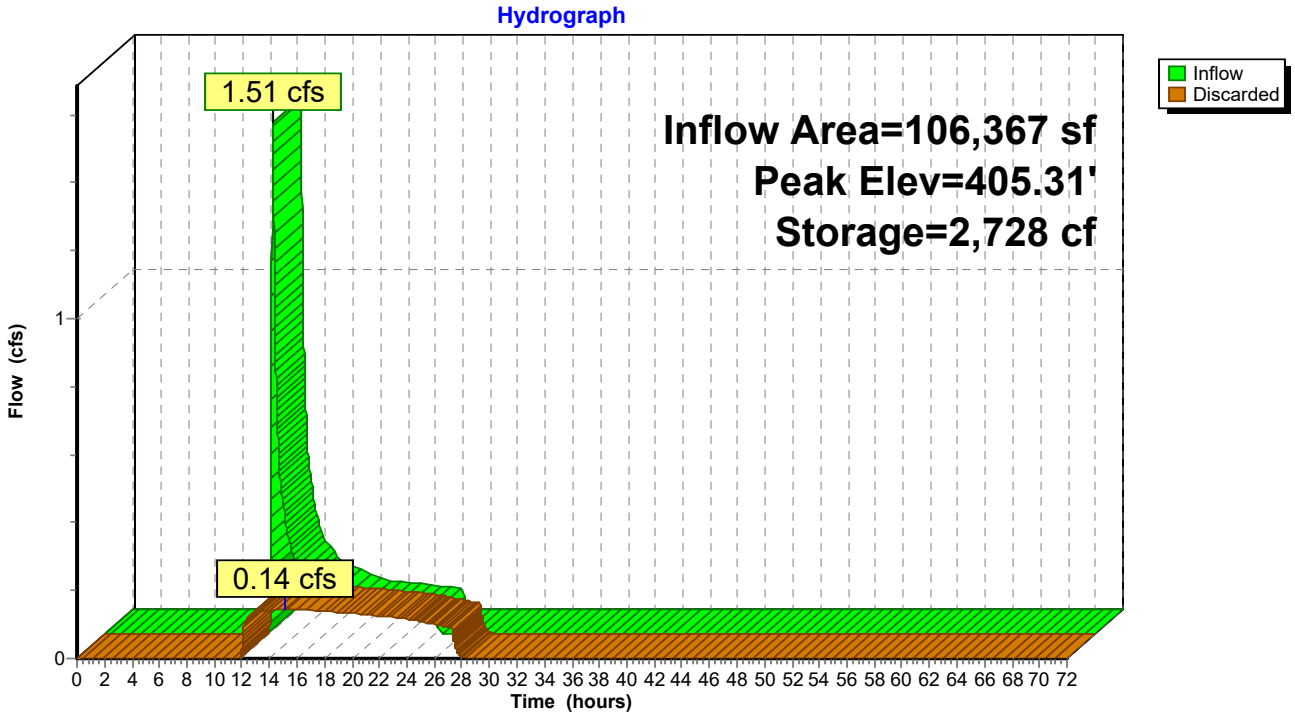
Volume	Invert	Avail.Storage	Storage Description
#1	404.00'	18,479 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
404.00	1,593	178.0	0	0	1,593
405.00	2,352	203.0	1,960	1,960	2,375
406.00	3,120	229.0	2,727	4,687	3,294
407.00	3,995	256.0	3,548	8,236	4,364
408.00	5,102	285.0	4,537	12,773	5,641
409.00	6,333	315.0	5,706	18,479	7,105

Device	Routing	Invert	Outlet Devices
#1	Discarded	404.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.14 cfs @ 15.09 hrs HW=405.31' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.14 cfs)

Pond 6P: North East Basin



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Runoff Area=35,263 sf 9.29% Impervious Runoff Depth=3.61"
Flow Length=303' Tc=12.2 min CN=77 Runoff=2.91 cfs 10,609 cf

Subcatchment 2A: Runoff Area=55,890 sf 2.19% Impervious Runoff Depth=3.61"
Flow Length=240' Tc=6.4 min CN=77 Runoff=5.76 cfs 16,815 cf

Subcatchment 2S: Runoff Area=12,847 sf 0.00% Impervious Runoff Depth=3.51"
Flow Length=225' Tc=9.7 min CN=76 Runoff=1.13 cfs 3,758 cf

Subcatchment 3S: Runoff Area=37,446 sf 0.00% Impervious Runoff Depth=3.71"
Flow Length=191' Tc=10.0 min CN=78 Runoff=3.43 cfs 11,582 cf

Subcatchment 4S: Runoff Area=35,752 sf 0.00% Impervious Runoff Depth=3.31"
Flow Length=151' Tc=13.8 min CN=74 Runoff=2.58 cfs 9,866 cf

Subcatchment 5S: Runoff Area=18,143 sf 0.00% Impervious Runoff Depth=0.55"
Flow Length=299' Tc=6.0 min CN=40 Runoff=0.11 cfs 827 cf

Subcatchment 6A: Runoff Area=106,367 sf 0.60% Impervious Runoff Depth=1.45"
Flow Length=472' Tc=11.1 min CN=53 Runoff=3.25 cfs 12,818 cf

Subcatchment 6S: Runoff Area=11,952 sf 0.00% Impervious Runoff Depth=2.37"
Flow Length=314' Tc=10.6 min CN=64 Runoff=0.68 cfs 2,361 cf

Reach DP 1: Towards Offsite West Inflow=2.91 cfs 10,609 cf
Outflow=2.91 cfs 10,609 cf

Reach DP 2: Towards Offsite North Inflow=1.13 cfs 3,758 cf
Outflow=1.13 cfs 3,758 cf

Reach DP 3: Towards West Wetland Inflow=3.43 cfs 11,582 cf
Outflow=3.43 cfs 11,582 cf

Reach DP 4: Towards East Wetland Inflow=2.58 cfs 9,866 cf
Outflow=2.58 cfs 9,866 cf

Reach DP 5: Towards Offsite Northwest Inflow=0.11 cfs 827 cf
Outflow=0.11 cfs 827 cf

Reach DP 6: Towards Offsite East Inflow=0.68 cfs 2,361 cf
Outflow=0.68 cfs 2,361 cf

Pond 2P: South West Basin Peak Elev=456.66' Storage=7,933 cf Inflow=5.76 cfs 16,815 cf
Outflow=0.31 cfs 16,815 cf

Pond 6P: North East Basin Peak Elev=406.48' Storage=6,286 cf Inflow=3.25 cfs 12,818 cf
Outflow=0.20 cfs 12,818 cf

Total Runoff Area = 313,660 sf Runoff Volume = 68,637 cf Average Runoff Depth = 2.63"
98.36% Pervious = 308,519 sf 1.64% Impervious = 5,141 sf

Summary for Subcatchment 1S:

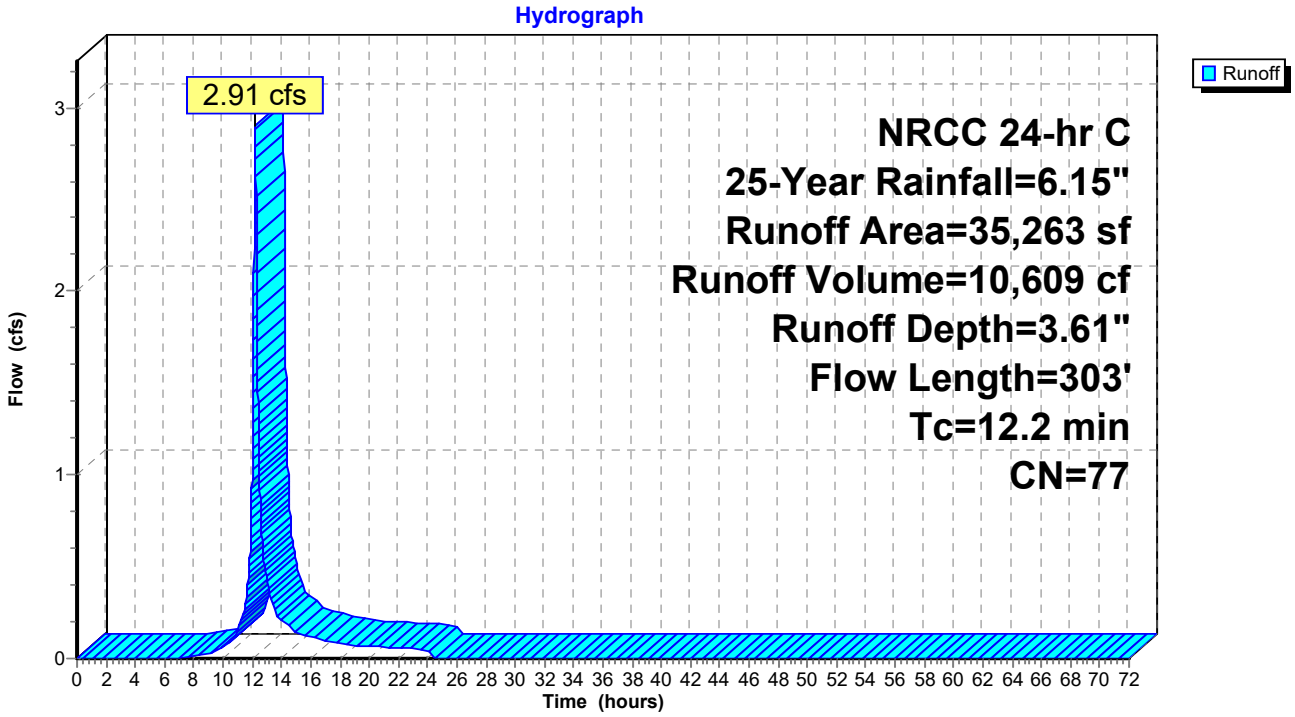
Runoff = 2.91 cfs @ 12.20 hrs, Volume= 10,609 cf, Depth= 3.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 25-Year Rainfall=6.15"

Area (sf)	CN	Description
5,731	70	Woods, Good, HSG C
2,138	98	Roofs, HSG C
24,414	74	>75% Grass cover, Good, HSG C
1,843	96	Gravel surface, HSG C
1,137	98	Paved parking, HSG C
35,263	77	Weighted Average
31,988		90.71% Pervious Area
3,275		9.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.4	50	0.0340	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.44"
0.8	47	0.0213	1.02		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
2.9	123	0.0203	0.71		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.1	31	0.0484	3.54		**Shallow Concentrated Flow, Gravel Road** Unpaved Kv= 16.1 fps
4.0	52	0.0019	0.22		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
12.2	303	Total			

Subcatchment 1S:



Summary for Subcatchment 2A:

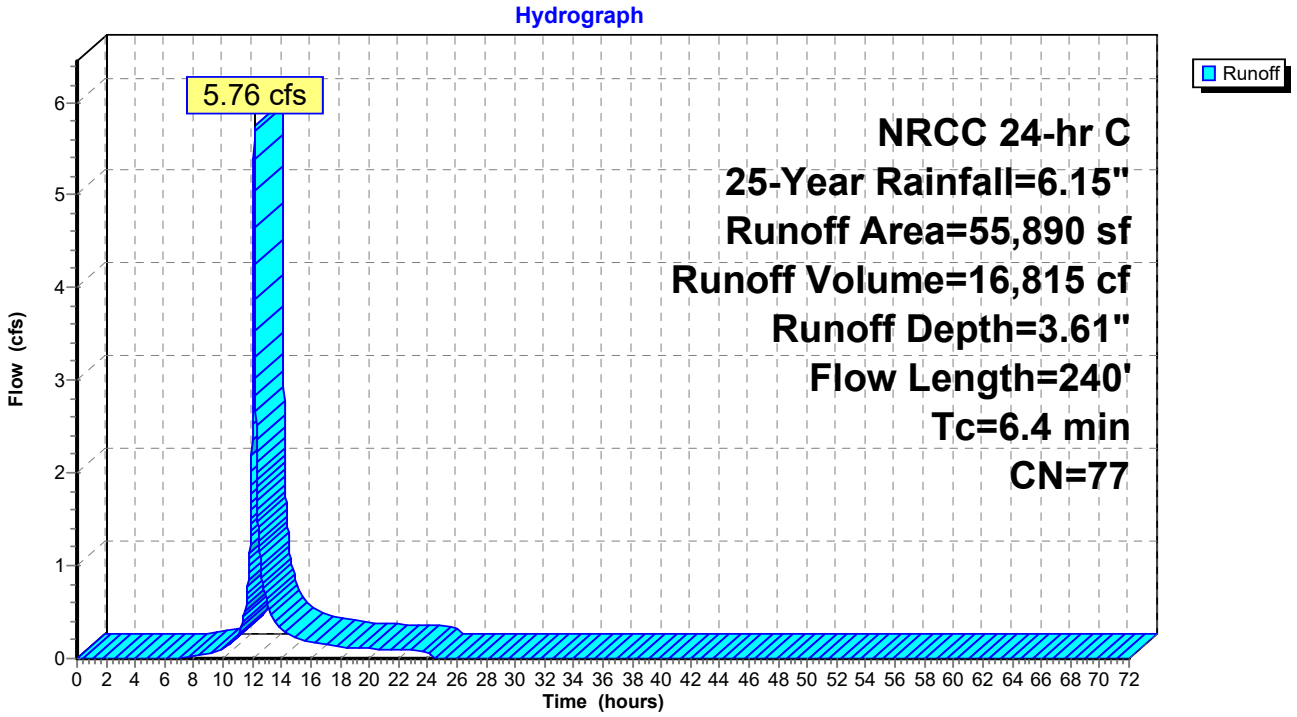
Runoff = 5.76 cfs @ 12.14 hrs, Volume= 16,815 cf, Depth= 3.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 25-Year Rainfall=6.15"

Area (sf)	CN	Description
30,811	74	>75% Grass cover, Good, HSG C
1,226	98	Roofs, HSG C
15,725	70	Woods, Good, HSG C
8,128	96	Gravel surface, HSG C
55,890	77	Weighted Average
54,664		97.81% Pervious Area
1,226		2.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	50	0.0540	0.23		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.44"
0.2	13	0.0310	1.23		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.2	71	0.0366	0.96		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.2	28	0.0321	2.88		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.2	78	0.0256	1.12		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.4	240	Total			

Subcatchment 2A:



Summary for Subcatchment 2S:

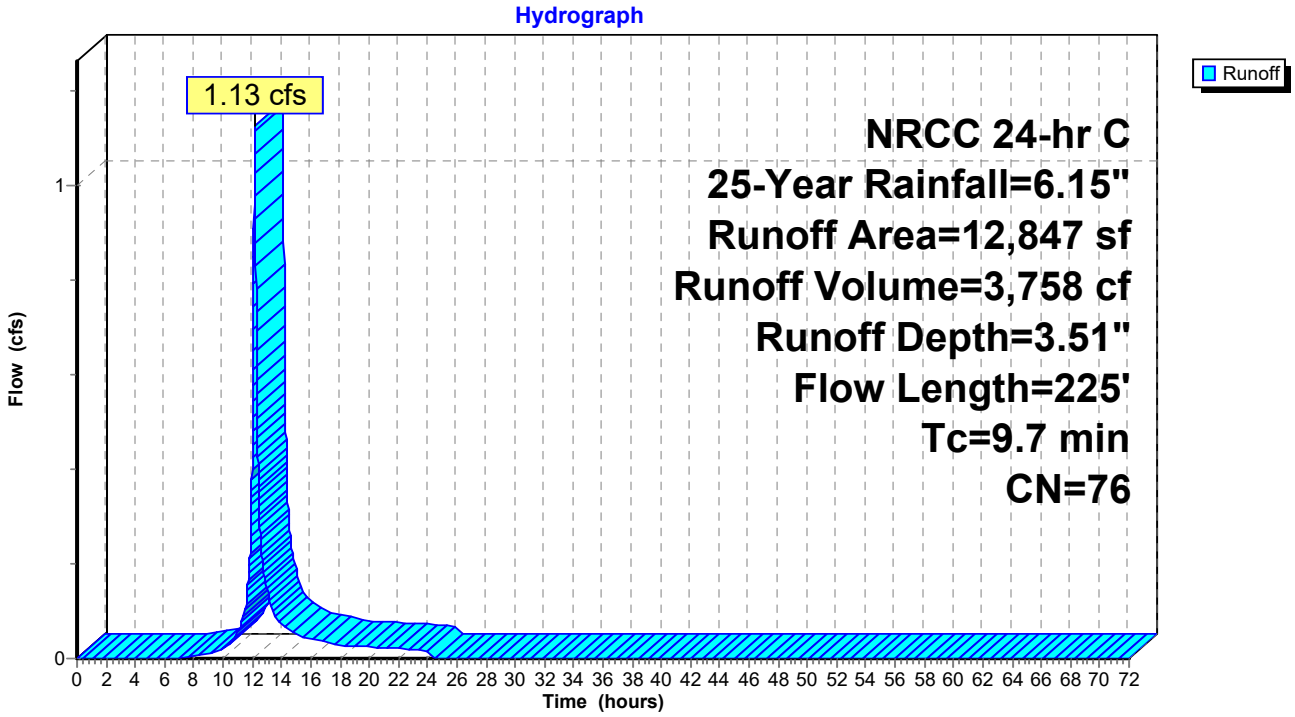
Runoff = 1.13 cfs @ 12.17 hrs, Volume= 3,758 cf, Depth= 3.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 25-Year Rainfall=6.15"

Area (sf)	CN	Description
5,793	70	Woods, Good, HSG C
5,770	77	Brush, Poor, HSG C
1,284	96	Gravel surface, HSG C
12,847	76	Weighted Average
12,847		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.6	50	0.0880	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.44"
0.1	19	0.0256	2.58		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.2	10	0.0102	0.71		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.2	46	0.0176	0.66		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.9	59	0.0273	1.16		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.4	20	0.0251	0.79		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.3	21	0.0239	1.08		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
9.7	225	Total			

Subcatchment 2S:



Summary for Subcatchment 3S:

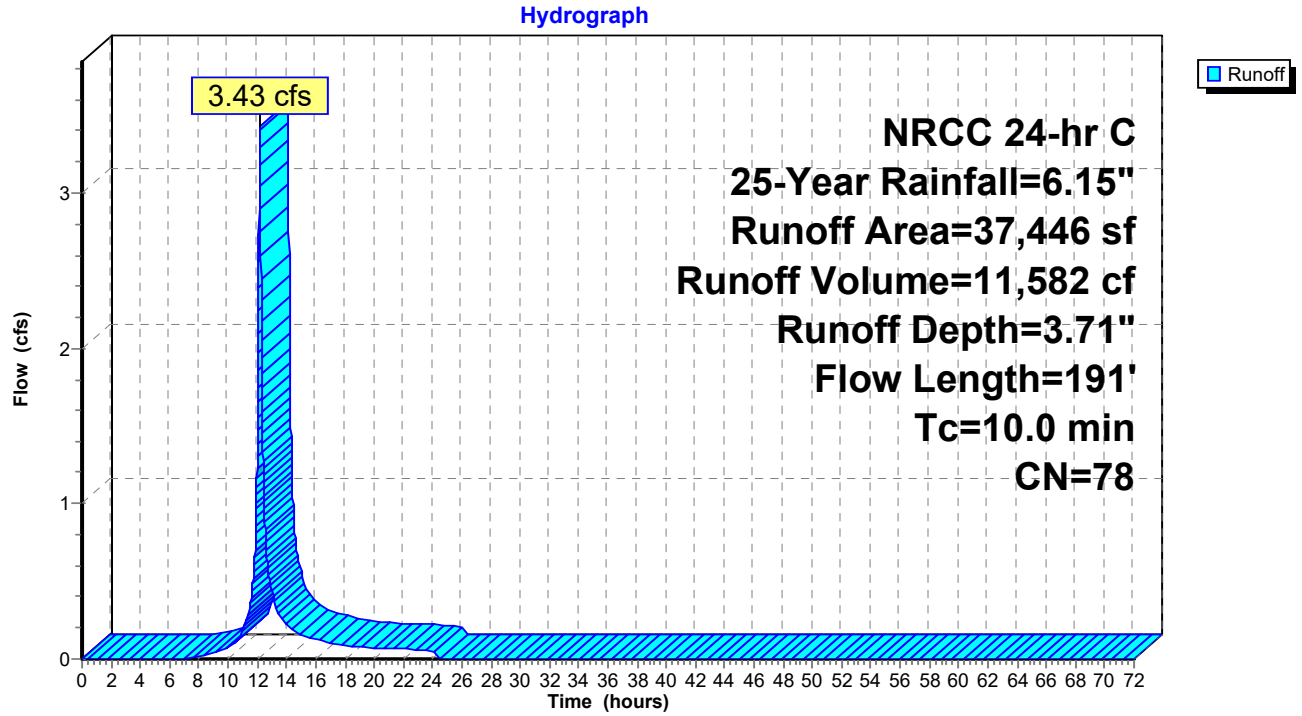
Runoff = 3.43 cfs @ 12.17 hrs, Volume= 11,582 cf, Depth= 3.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 25-Year Rainfall=6.15"

Area (sf)	CN	Description
4,935	70	Woods, Good, HSG C
28,511	77	Brush, Poor, HSG C
4,000	96	Gravel surface, HSG C
37,446	78	Weighted Average
37,446		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	50	0.0440	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.44"
1.0	111	0.0731	1.89		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	11	0.0400	3.22		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.2	19	0.0536	1.62		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
10.0	191	Total			

Subcatchment 3S:



Summary for Subcatchment 4S:

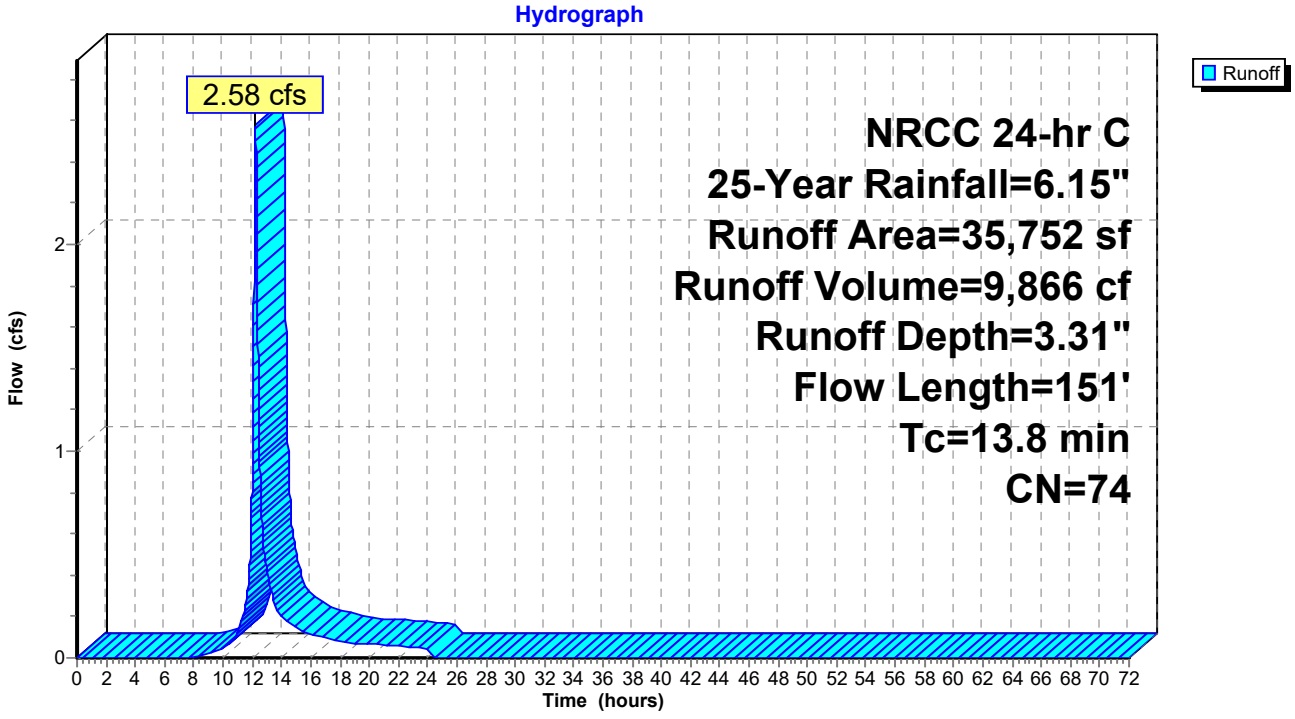
Runoff = 2.58 cfs @ 12.22 hrs, Volume= 9,866 cf, Depth= 3.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 25-Year Rainfall=6.15"

Area (sf)	CN	Description
19,992	70	Woods, Good, HSG C
13,127	77	Brush, Poor, HSG C
2,633	96	Gravel surface, HSG C
35,752	74	Weighted Average
35,752		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.0	50	0.0160	0.06		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.44"
0.8	101	0.0974	2.18		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
13.8	151	Total			

Subcatchment 4S:



Summary for Subcatchment 5S:

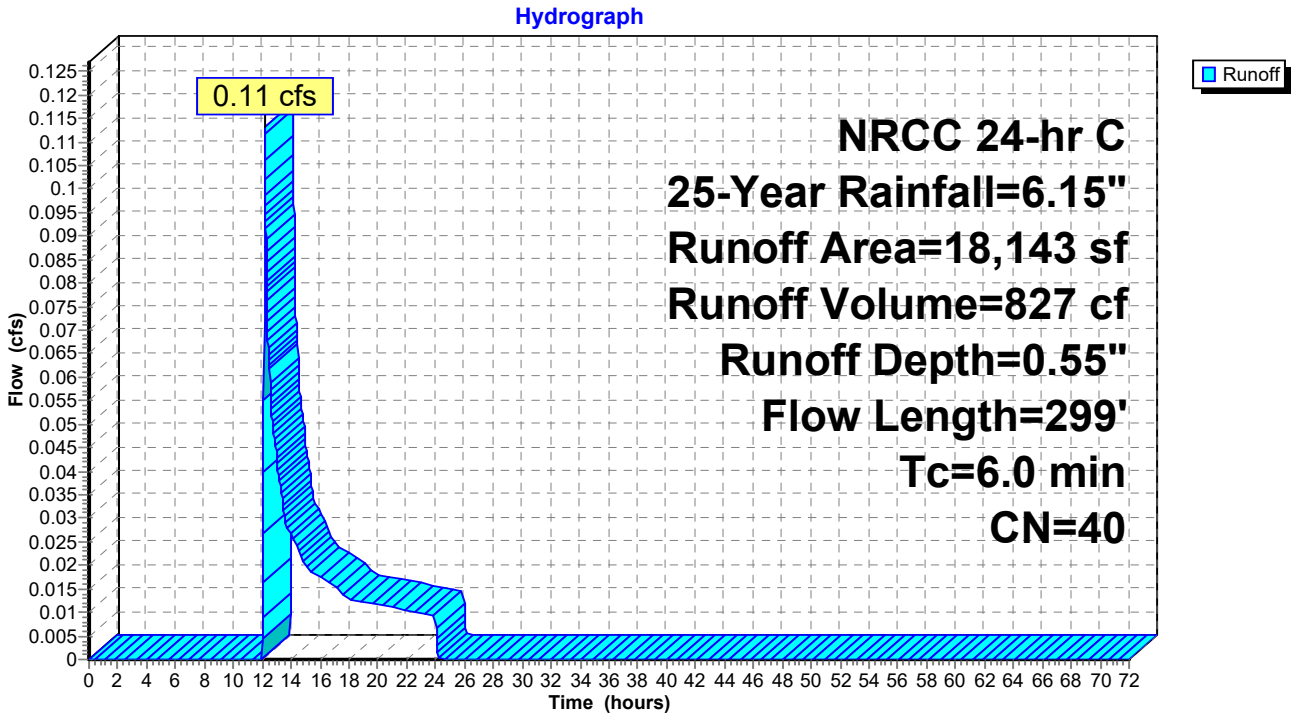
Runoff = 0.11 cfs @ 12.16 hrs, Volume= 827 cf, Depth= 0.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 25-Year Rainfall=6.15"

Area (sf)	CN	Description
574	70	Woods, Good, HSG C
1,112	74	>75% Grass cover, Good, HSG C
4,232	30	Woods, Good, HSG A
12,225	39	>75% Grass cover, Good, HSG A
18,143	40	Weighted Average
18,143		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.8	50	0.1040	0.30		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.44"
0.9	193	0.0629	3.76		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.5	56	0.1470	1.92		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
4.2	299	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 5S:



Summary for Subcatchment 6A:

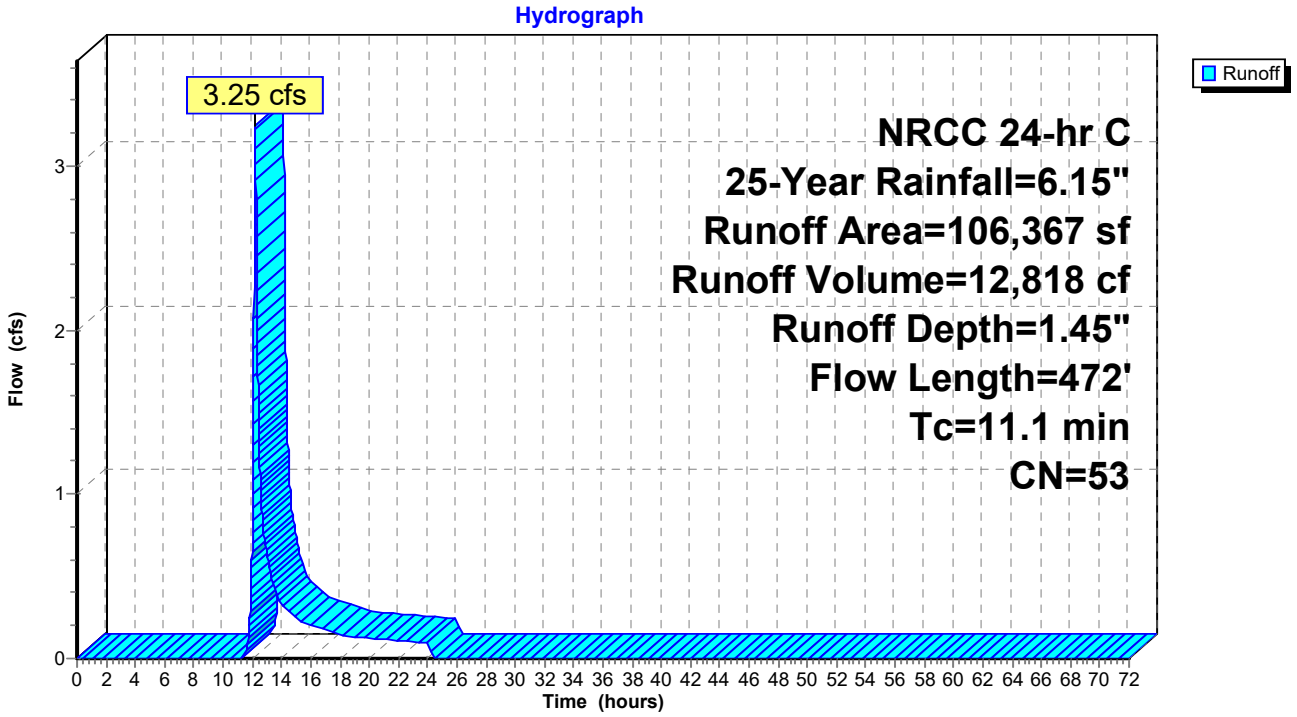
Runoff = 3.25 cfs @ 12.20 hrs, Volume= 12,818 cf, Depth= 1.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 25-Year Rainfall=6.15"

Area (sf)	CN	Description
7,811	70	Woods, Good, HSG C
20,625	74	>75% Grass cover, Good, HSG C
4,965	96	Gravel surface, HSG C
640	98	Unconnected pavement, HSG C
746	30	Woods, Good, HSG A
68,329	39	>75% Grass cover, Good, HSG A
3,251	96	Gravel surface, HSG A
106,367	53	Weighted Average
105,727		99.40% Pervious Area
640		0.60% Impervious Area
640		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	50	0.0200	0.11		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.44"
1.8	238	0.1042	2.26		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
1.4	184	0.0914	2.16	22.30	**Trap/Vee/Rect Channel Flow,** Bot.W=4.00' D=1.00' Z= 5.6 & 7.0 '/' Top.W=16.60' n= 0.150 Sheet flow over Short Grass
11.1	472	Total			

Subcatchment 6A:



Summary for Subcatchment 6S:

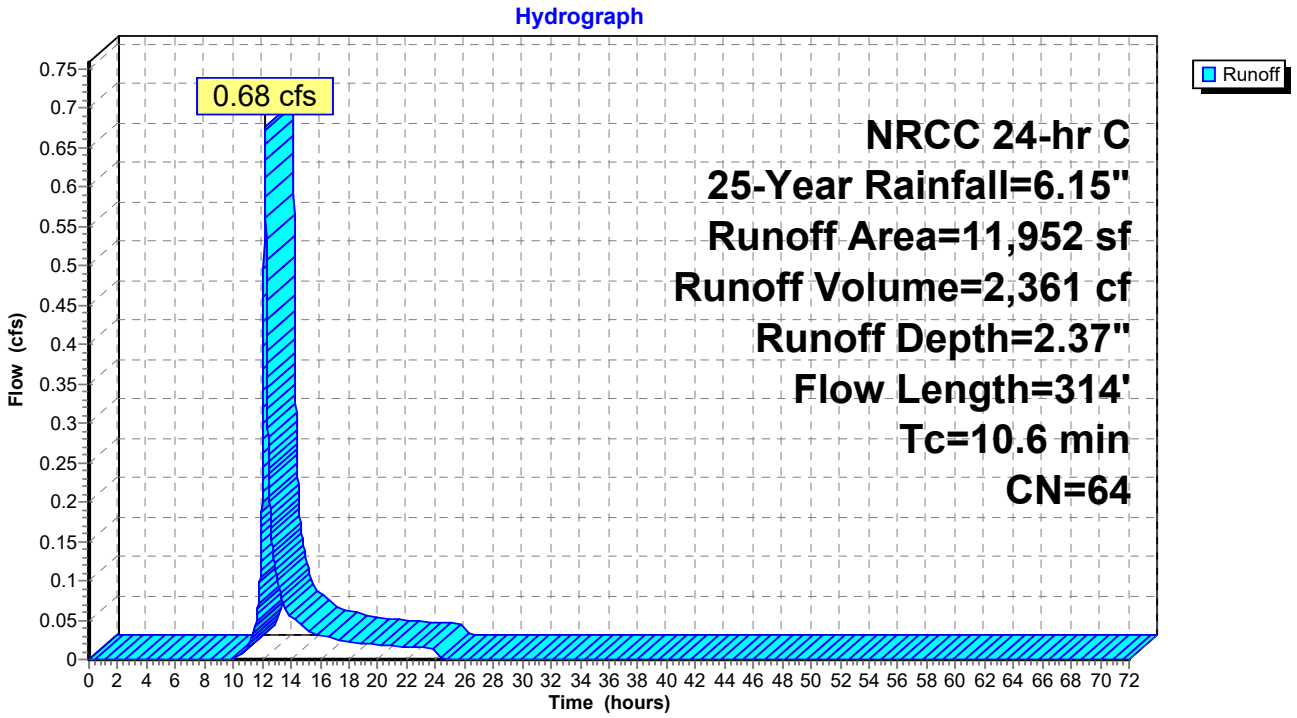
Runoff = 0.68 cfs @ 12.19 hrs, Volume= 2,361 cf, Depth= 2.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 25-Year Rainfall=6.15"

Area (sf)	CN	Description
5,519	70	Woods, Good, HSG C
3,933	74	>75% Grass cover, Good, HSG C
902	30	Woods, Good, HSG A
1,598	39	>75% Grass cover, Good, HSG A
11,952	64	Weighted Average
11,952		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.7	50	0.0600	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.44"
1.9	150	0.0690	1.31		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.0	114	0.1496	1.93		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
10.6	314	Total			

Subcatchment 6S:

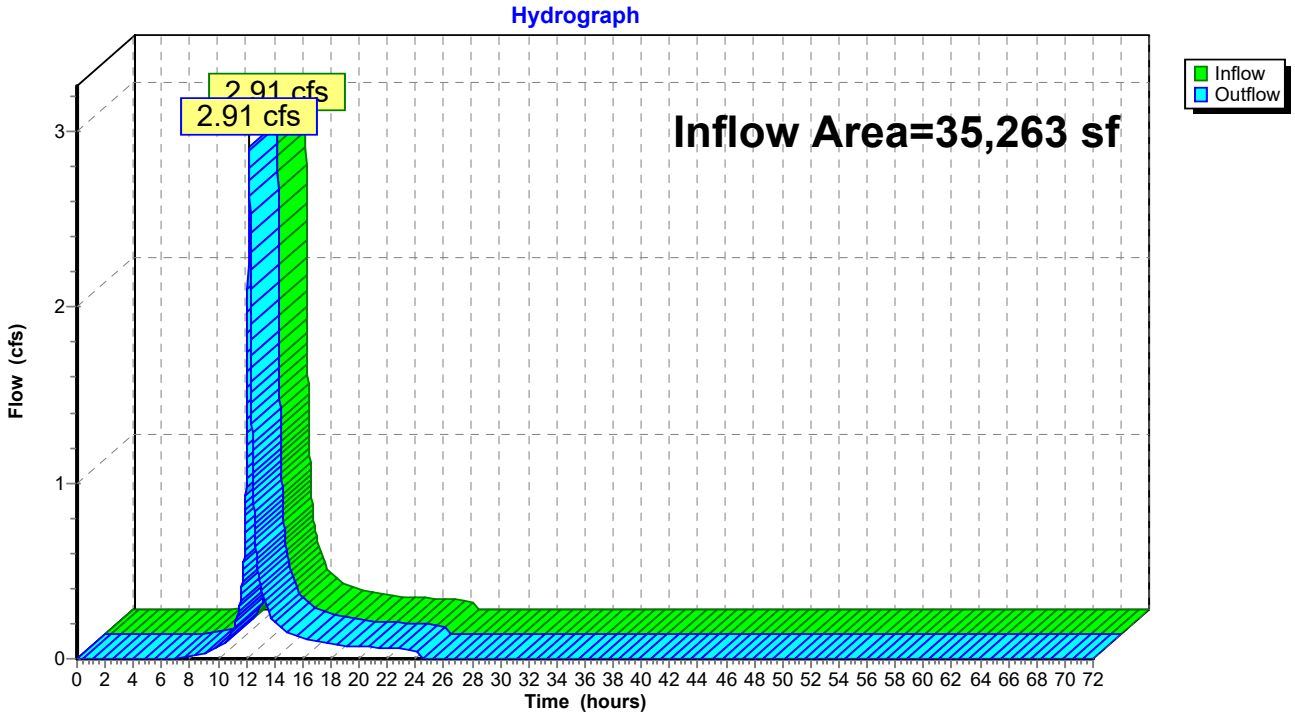


Summary for Reach DP 1: Towards Offsite West

Inflow Area = 35,263 sf, 9.29% Impervious, Inflow Depth = 3.61" for 25-Year event
Inflow = 2.91 cfs @ 12.20 hrs, Volume= 10,609 cf
Outflow = 2.91 cfs @ 12.20 hrs, Volume= 10,609 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 1: Towards Offsite West

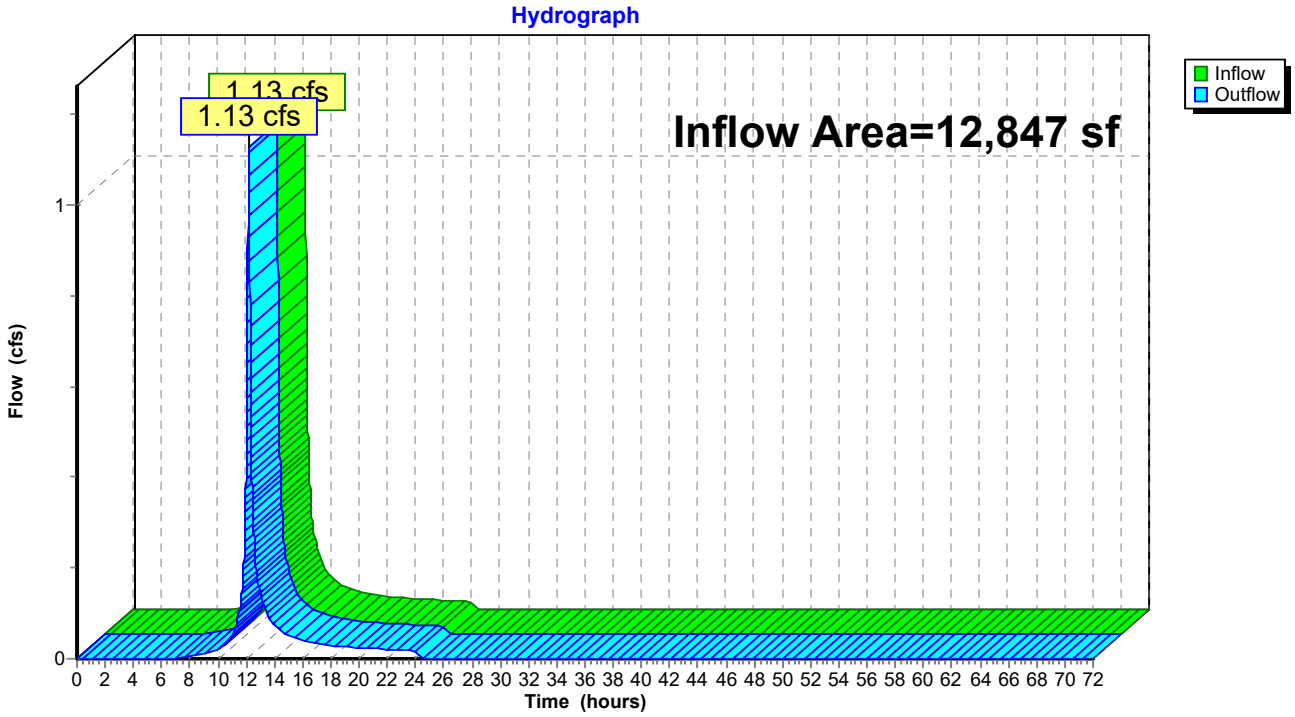


Summary for Reach DP 2: Towards Offsite North

Inflow Area = 12,847 sf, 0.00% Impervious, Inflow Depth = 3.51" for 25-Year event
Inflow = 1.13 cfs @ 12.17 hrs, Volume= 3,758 cf
Outflow = 1.13 cfs @ 12.17 hrs, Volume= 3,758 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 2: Towards Offsite North

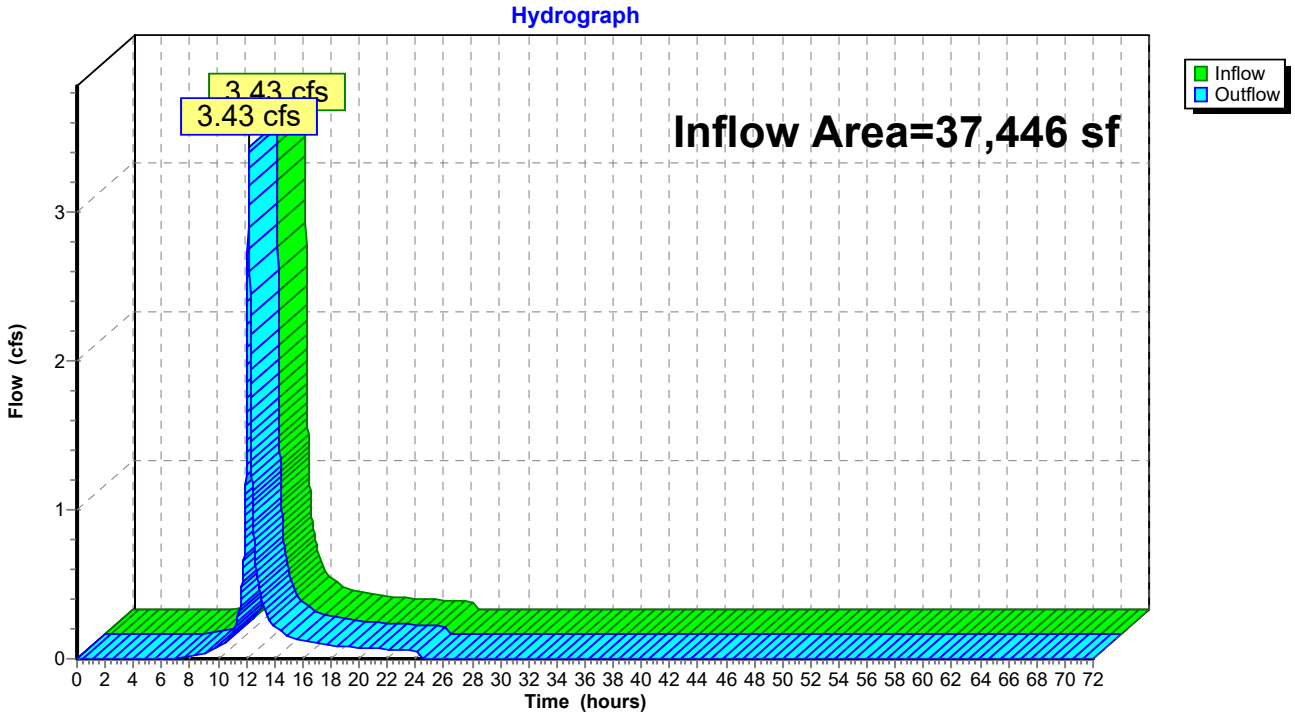


Summary for Reach DP 3: Towards West Wetland

Inflow Area = 37,446 sf, 0.00% Impervious, Inflow Depth = 3.71" for 25-Year event
Inflow = 3.43 cfs @ 12.17 hrs, Volume= 11,582 cf
Outflow = 3.43 cfs @ 12.17 hrs, Volume= 11,582 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 3: Towards West Wetland

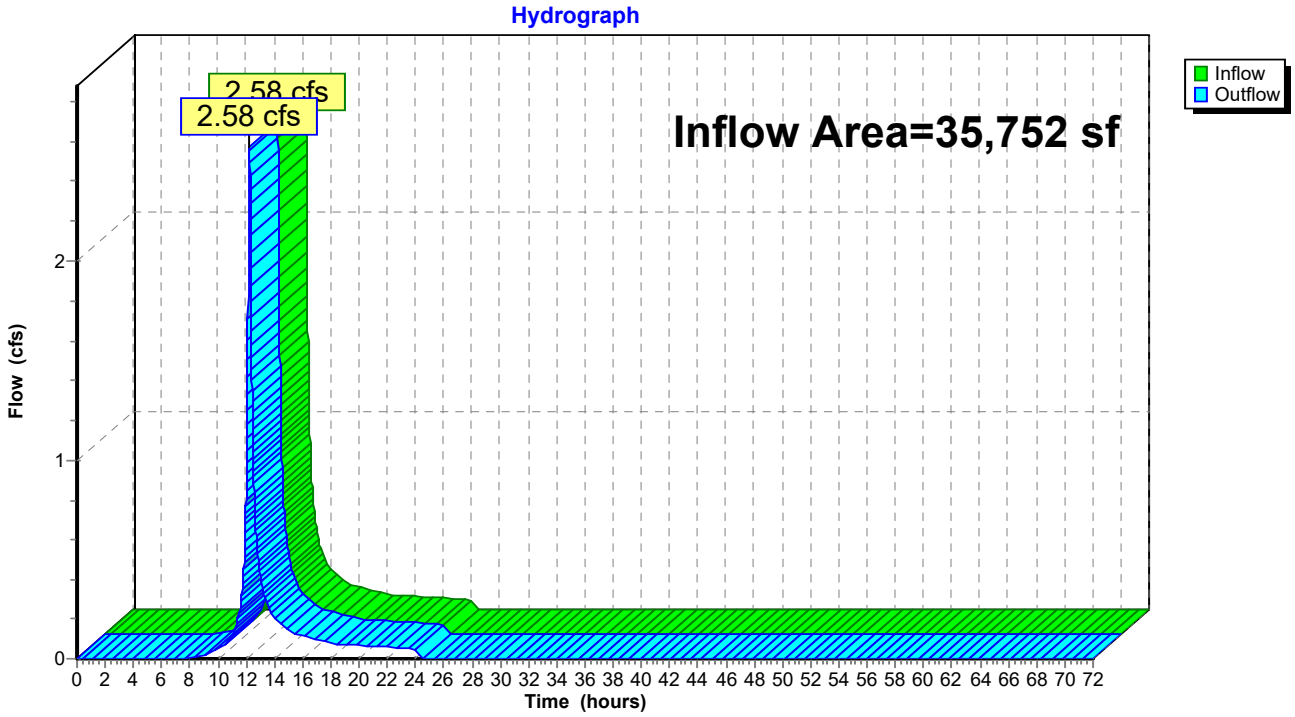


Summary for Reach DP 4: Towards East Wetland

Inflow Area = 35,752 sf, 0.00% Impervious, Inflow Depth = 3.31" for 25-Year event
Inflow = 2.58 cfs @ 12.22 hrs, Volume= 9,866 cf
Outflow = 2.58 cfs @ 12.22 hrs, Volume= 9,866 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 4: Towards East Wetland

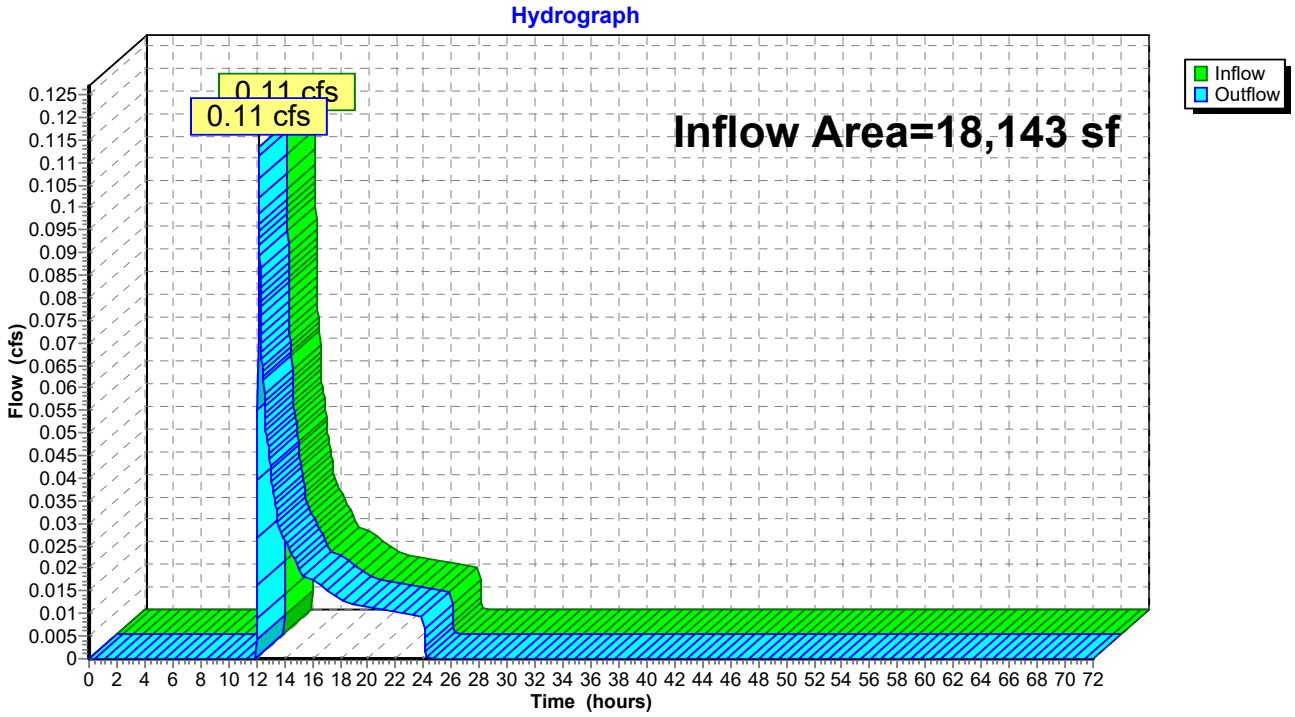


Summary for Reach DP 5: Towards Offsite Northwest

Inflow Area = 18,143 sf, 0.00% Impervious, Inflow Depth = 0.55" for 25-Year event
Inflow = 0.11 cfs @ 12.16 hrs, Volume= 827 cf
Outflow = 0.11 cfs @ 12.16 hrs, Volume= 827 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 5: Towards Offsite Northwest

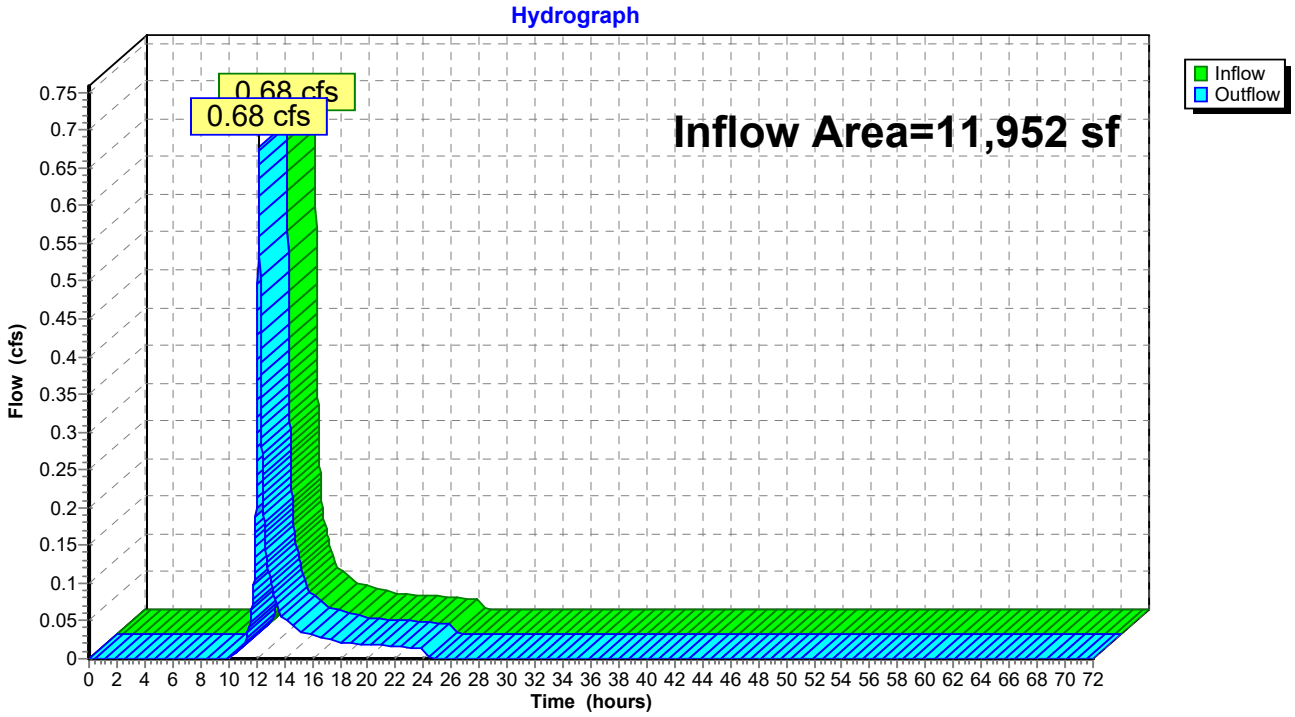


Summary for Reach DP 6: Towards Offsite East

Inflow Area = 11,952 sf, 0.00% Impervious, Inflow Depth = 2.37" for 25-Year event
Inflow = 0.68 cfs @ 12.19 hrs, Volume= 2,361 cf
Outflow = 0.68 cfs @ 12.19 hrs, Volume= 2,361 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 6: Towards Offsite East



Summary for Pond 2P: South West Basin

Inflow Area = 55,890 sf, 2.19% Impervious, Inflow Depth = 3.61" for 25-Year event
Inflow = 5.76 cfs @ 12.14 hrs, Volume= 16,815 cf
Outflow = 0.31 cfs @ 14.08 hrs, Volume= 16,815 cf, Atten= 95%, Lag= 116.8 min
Discarded = 0.31 cfs @ 14.08 hrs, Volume= 16,815 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 456.66' @ 14.08 hrs Surf.Area= 5,565 sf Storage= 7,933 cf

Plug-Flow detention time= 264.7 min calculated for 16,813 cf (100% of inflow)
Center-of-Mass det. time= 264.7 min (1,094.6 - 829.9)

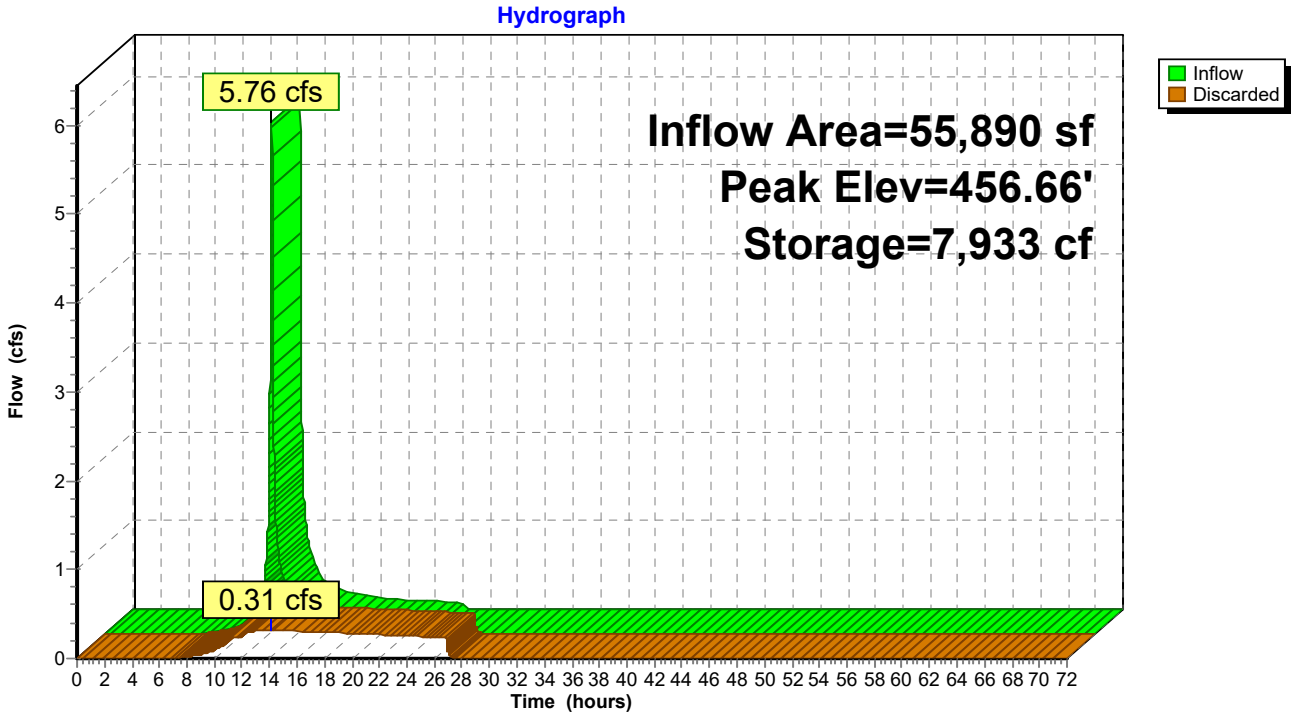
Volume	Invert	Avail.Storage	Storage Description
#1	455.00'	16,306 cf	**Custom Stage Data (Conic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
455.00	4,039	0	0	4,039
456.00	4,943	4,483	4,483	4,974
457.00	5,904	5,416	9,900	5,969
458.00	6,922	6,406	16,306	7,026

Device	Routing	Invert	Outlet Devices
#1	Discarded	455.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.31 cfs @ 14.08 hrs HW=456.66' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.31 cfs)

Pond 2P: South West Basin



Summary for Pond 6P: North East Basin

Inflow Area = 106,367 sf, 0.60% Impervious, Inflow Depth = 1.45" for 25-Year event
Inflow = 3.25 cfs @ 12.20 hrs, Volume= 12,818 cf
Outflow = 0.20 cfs @ 16.17 hrs, Volume= 12,818 cf, Atten= 94%, Lag= 238.5 min
Discarded = 0.20 cfs @ 16.17 hrs, Volume= 12,818 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 406.48' @ 16.17 hrs Surf.Area= 3,528 sf Storage= 6,286 cf

Plug-Flow detention time= 407.6 min calculated for 12,817 cf (100% of inflow)
Center-of-Mass det. time= 407.6 min (1,308.6 - 901.0)

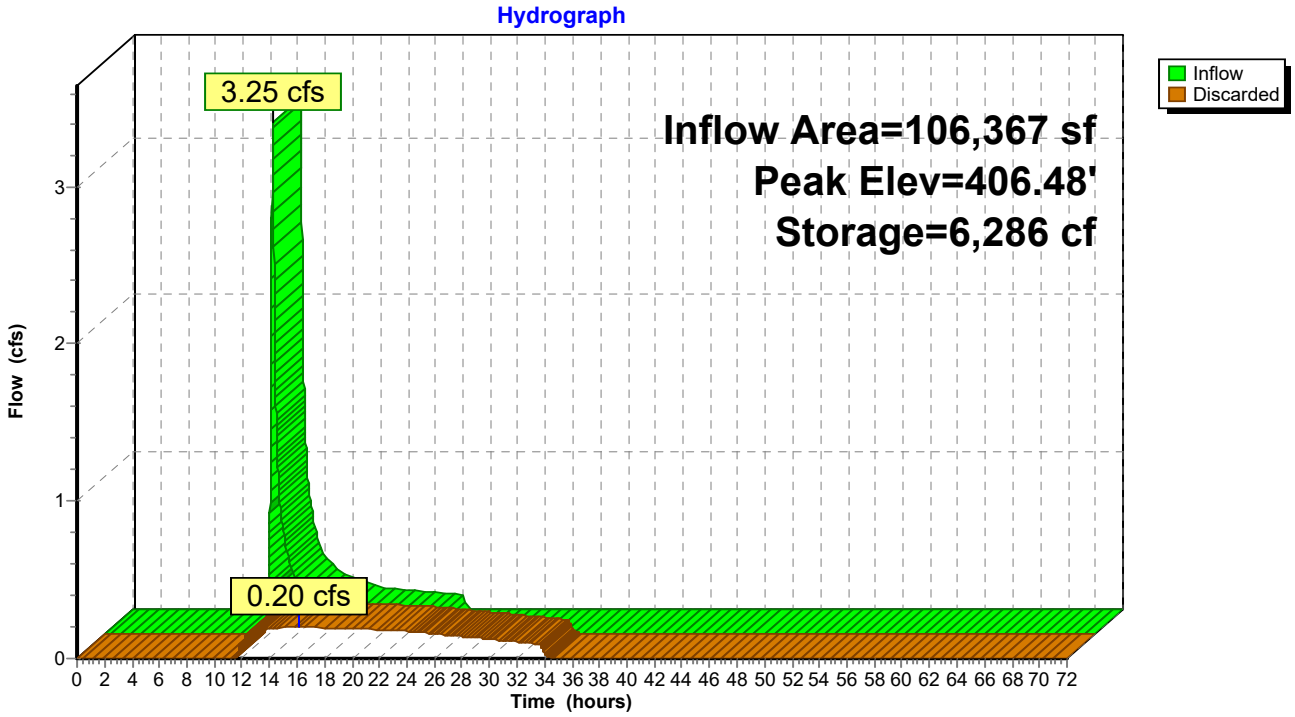
Volume	Invert	Avail.Storage	Storage Description
#1	404.00'	18,479 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
404.00	1,593	178.0	0	0	1,593
405.00	2,352	203.0	1,960	1,960	2,375
406.00	3,120	229.0	2,727	4,687	3,294
407.00	3,995	256.0	3,548	8,236	4,364
408.00	5,102	285.0	4,537	12,773	5,641
409.00	6,333	315.0	5,706	18,479	7,105

Device	Routing	Invert	Outlet Devices
#1	Discarded	404.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.20 cfs @ 16.17 hrs HW=406.48' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.20 cfs)

Pond 6P: North East Basin



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Runoff Area=35,263 sf 9.29% Impervious Runoff Depth=6.01"
Flow Length=303' Tc=12.2 min CN=77 Runoff=4.77 cfs 17,670 cf

Subcatchment 2A: Runoff Area=55,890 sf 2.19% Impervious Runoff Depth=6.01"
Flow Length=240' Tc=6.4 min CN=77 Runoff=9.40 cfs 28,005 cf

Subcatchment 2S: Runoff Area=12,847 sf 0.00% Impervious Runoff Depth=5.89"
Flow Length=225' Tc=9.7 min CN=76 Runoff=1.87 cfs 6,307 cf

Subcatchment 3S: Runoff Area=37,446 sf 0.00% Impervious Runoff Depth=6.13"
Flow Length=191' Tc=10.0 min CN=78 Runoff=5.57 cfs 19,144 cf

Subcatchment 4S: Runoff Area=35,752 sf 0.00% Impervious Runoff Depth=5.65"
Flow Length=151' Tc=13.8 min CN=74 Runoff=4.35 cfs 16,824 cf

Subcatchment 5S: Runoff Area=18,143 sf 0.00% Impervious Runoff Depth=1.62"
Flow Length=299' Tc=6.0 min CN=40 Runoff=0.72 cfs 2,445 cf

Subcatchment 6A: Runoff Area=106,367 sf 0.60% Impervious Runoff Depth=3.11"
Flow Length=472' Tc=11.1 min CN=53 Runoff=7.65 cfs 27,533 cf

Subcatchment 6S: Runoff Area=11,952 sf 0.00% Impervious Runoff Depth=4.43"
Flow Length=314' Tc=10.6 min CN=64 Runoff=1.28 cfs 4,411 cf

Reach DP 1: Towards Offsite West Inflow=4.77 cfs 17,670 cf
Outflow=4.77 cfs 17,670 cf

Reach DP 2: Towards Offsite North Inflow=1.87 cfs 6,307 cf
Outflow=1.87 cfs 6,307 cf

Reach DP 3: Towards West Wetland Inflow=5.57 cfs 19,144 cf
Outflow=5.57 cfs 19,144 cf

Reach DP 4: Towards East Wetland Inflow=4.35 cfs 16,824 cf
Outflow=4.35 cfs 16,824 cf

Reach DP 5: Towards Offsite Northwest Inflow=0.72 cfs 2,445 cf
Outflow=0.72 cfs 2,445 cf

Reach DP 6: Towards Offsite East Inflow=1.28 cfs 4,411 cf
Outflow=1.28 cfs 4,411 cf

Pond 2P: South West Basin Peak Elev=457.82' Storage=15,057 cf Inflow=9.40 cfs 28,005 cf
Outflow=0.38 cfs 28,005 cf

Pond 6P: North East Basin Peak Elev=408.59' Storage=16,011 cf Inflow=7.65 cfs 27,533 cf
Outflow=0.32 cfs 27,533 cf

Total Runoff Area = 313,660 sf Runoff Volume = 122,339 cf Average Runoff Depth = 4.68"
98.36% Pervious = 308,519 sf 1.64% Impervious = 5,141 sf

Summary for Subcatchment 1S:

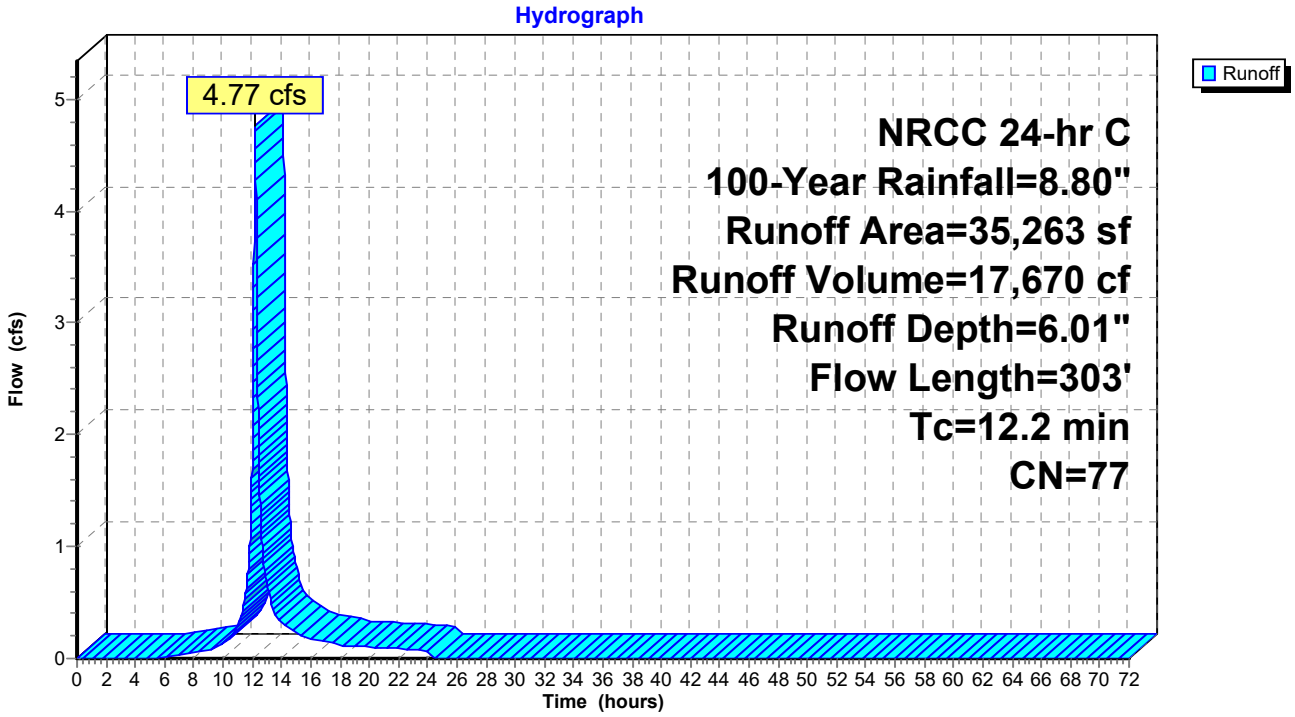
Runoff = 4.77 cfs @ 12.20 hrs, Volume= 17,670 cf, Depth= 6.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 100-Year Rainfall=8.80"

Area (sf)	CN	Description
5,731	70	Woods, Good, HSG C
2,138	98	Roofs, HSG C
24,414	74	>75% Grass cover, Good, HSG C
1,843	96	Gravel surface, HSG C
1,137	98	Paved parking, HSG C
35,263	77	Weighted Average
31,988		90.71% Pervious Area
3,275		9.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.4	50	0.0340	0.19		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.44"
0.8	47	0.0213	1.02		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
2.9	123	0.0203	0.71		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
0.1	31	0.0484	3.54		**Shallow Concentrated Flow, Gravel Road** Unpaved Kv= 16.1 fps
4.0	52	0.0019	0.22		**Shallow Concentrated Flow, Woods** Woodland Kv= 5.0 fps
12.2	303	Total			

Subcatchment 1S:



Summary for Subcatchment 2A:

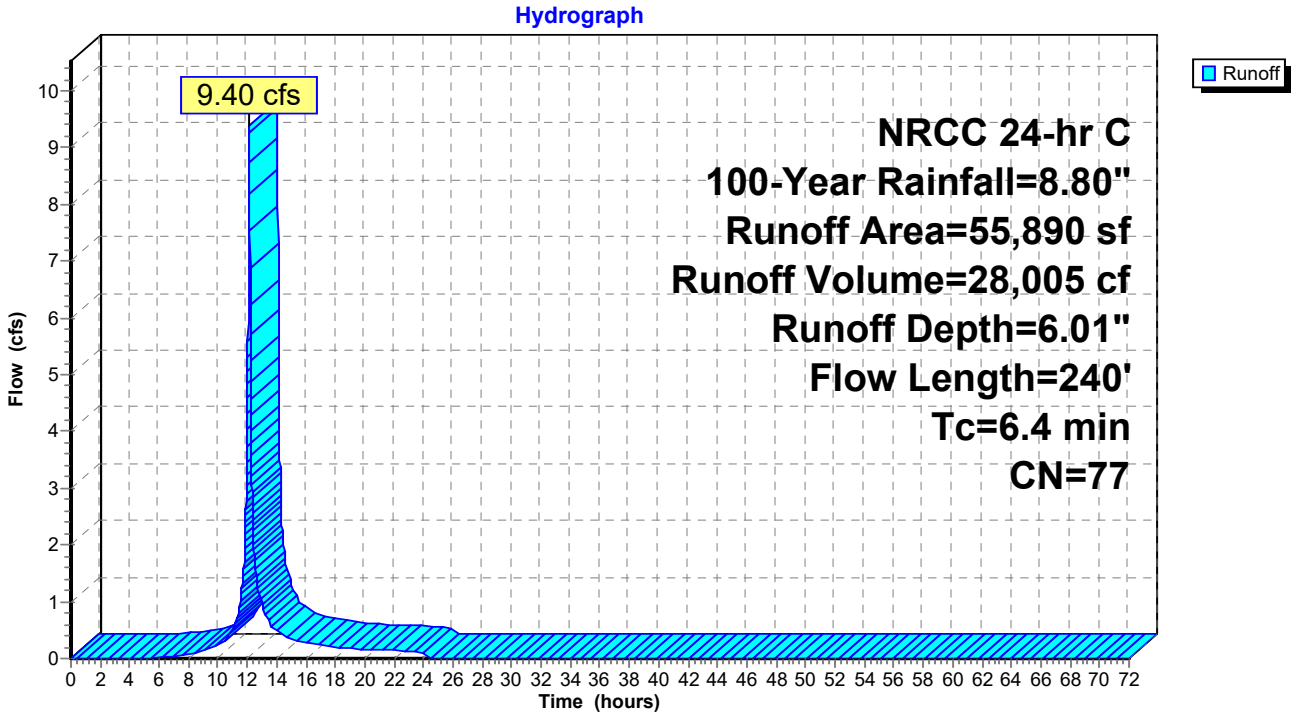
Runoff = 9.40 cfs @ 12.14 hrs, Volume= 28,005 cf, Depth= 6.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 100-Year Rainfall=8.80"

Area (sf)	CN	Description
30,811	74	>75% Grass cover, Good, HSG C
1,226	98	Roofs, HSG C
15,725	70	Woods, Good, HSG C
8,128	96	Gravel surface, HSG C
55,890	77	Weighted Average
54,664		97.81% Pervious Area
1,226		2.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	50	0.0540	0.23		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.44"
0.2	13	0.0310	1.23		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.2	71	0.0366	0.96		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.2	28	0.0321	2.88		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.2	78	0.0256	1.12		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.4	240	Total			

Subcatchment 2A:



Summary for Subcatchment 2S:

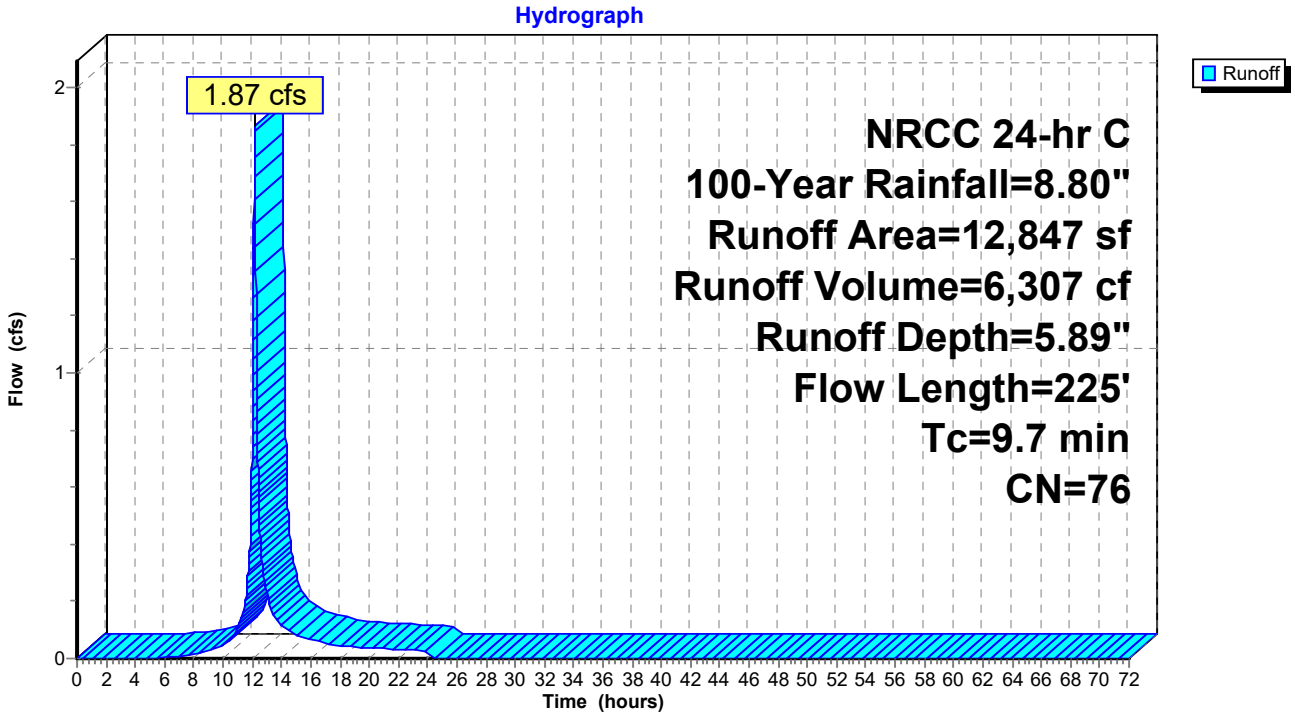
Runoff = 1.87 cfs @ 12.17 hrs, Volume= 6,307 cf, Depth= 5.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 100-Year Rainfall=8.80"

Area (sf)	CN	Description
5,793	70	Woods, Good, HSG C
5,770	77	Brush, Poor, HSG C
1,284	96	Gravel surface, HSG C
12,847	76	Weighted Average
12,847		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.6	50	0.0880	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.44"
0.1	19	0.0256	2.58		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.2	10	0.0102	0.71		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.2	46	0.0176	0.66		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.9	59	0.0273	1.16		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.4	20	0.0251	0.79		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.3	21	0.0239	1.08		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
9.7	225	Total			

Subcatchment 2S:



Summary for Subcatchment 3S:

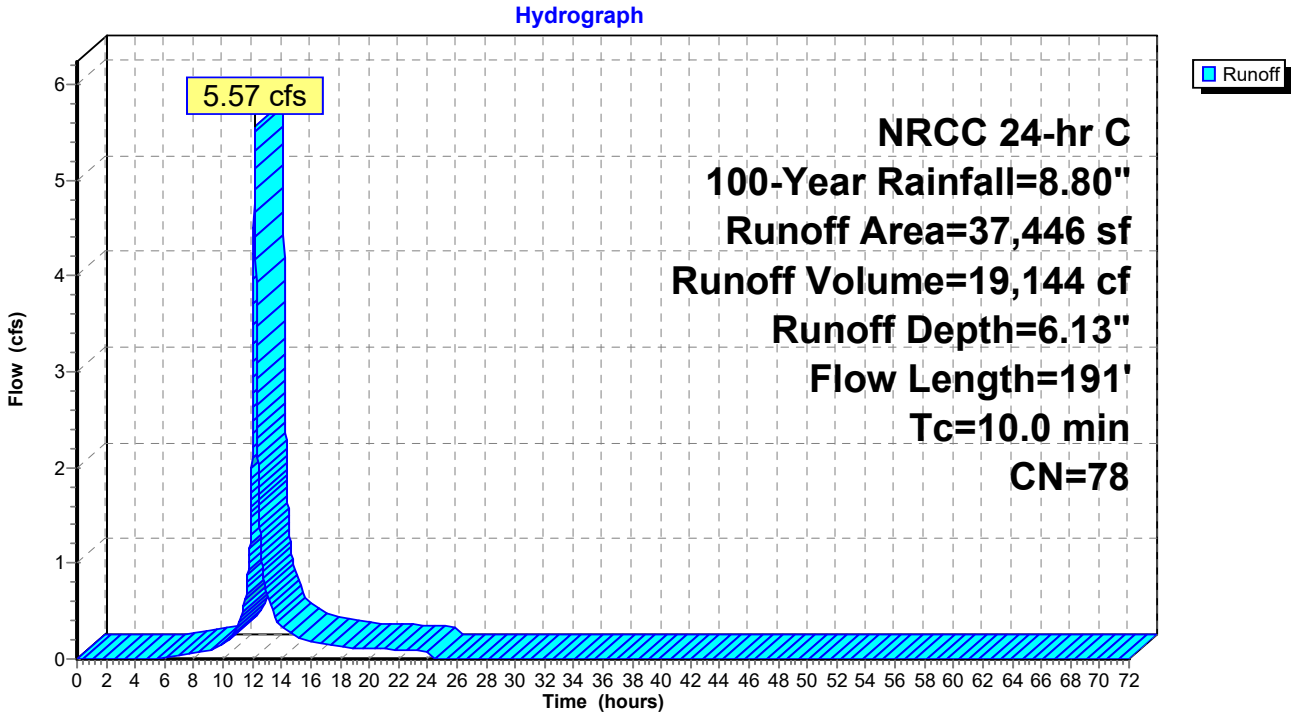
Runoff = 5.57 cfs @ 12.17 hrs, Volume= 19,144 cf, Depth= 6.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 100-Year Rainfall=8.80"

Area (sf)	CN	Description
4,935	70	Woods, Good, HSG C
28,511	77	Brush, Poor, HSG C
4,000	96	Gravel surface, HSG C
37,446	78	Weighted Average
37,446		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	50	0.0440	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.44"
1.0	111	0.0731	1.89		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	11	0.0400	3.22		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.2	19	0.0536	1.62		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
10.0	191	Total			

Subcatchment 3S:



Summary for Subcatchment 4S:

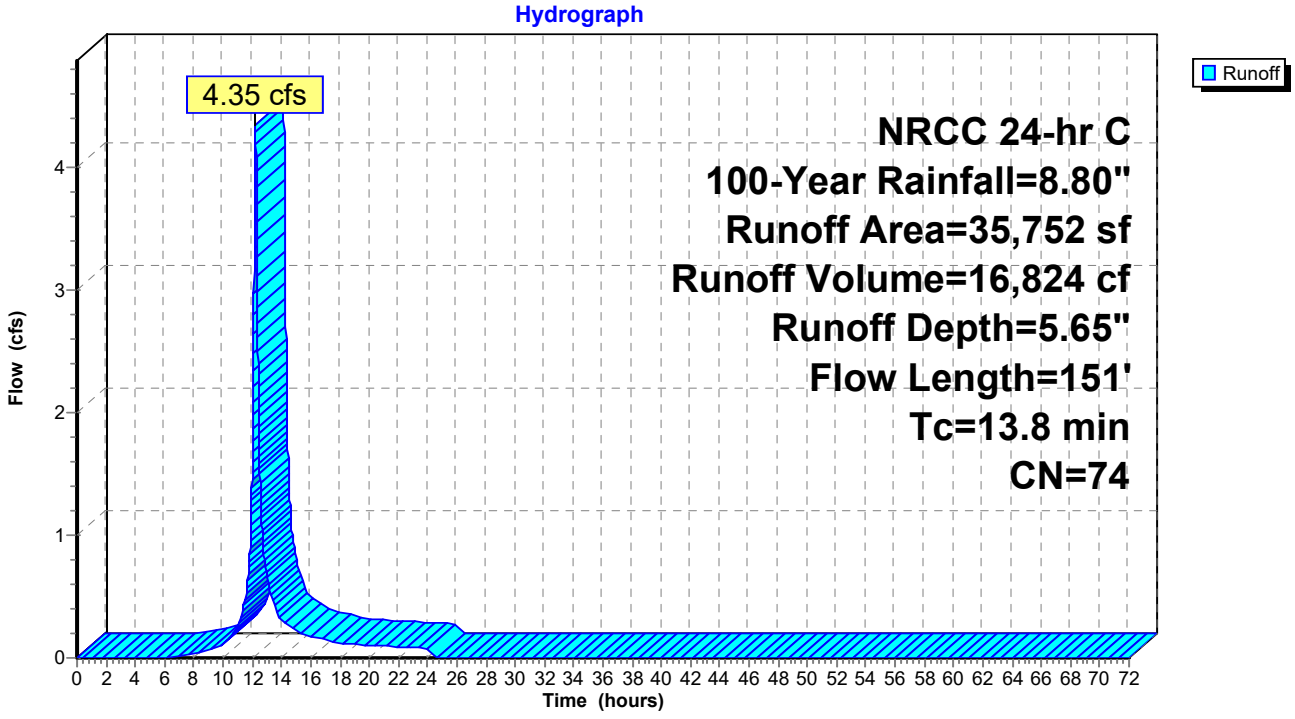
Runoff = 4.35 cfs @ 12.22 hrs, Volume= 16,824 cf, Depth= 5.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 100-Year Rainfall=8.80"

Area (sf)	CN	Description
19,992	70	Woods, Good, HSG C
13,127	77	Brush, Poor, HSG C
2,633	96	Gravel surface, HSG C
35,752	74	Weighted Average
35,752		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.0	50	0.0160	0.06		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.44"
0.8	101	0.0974	2.18		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
13.8	151	Total			

Subcatchment 4S:



Summary for Subcatchment 5S:

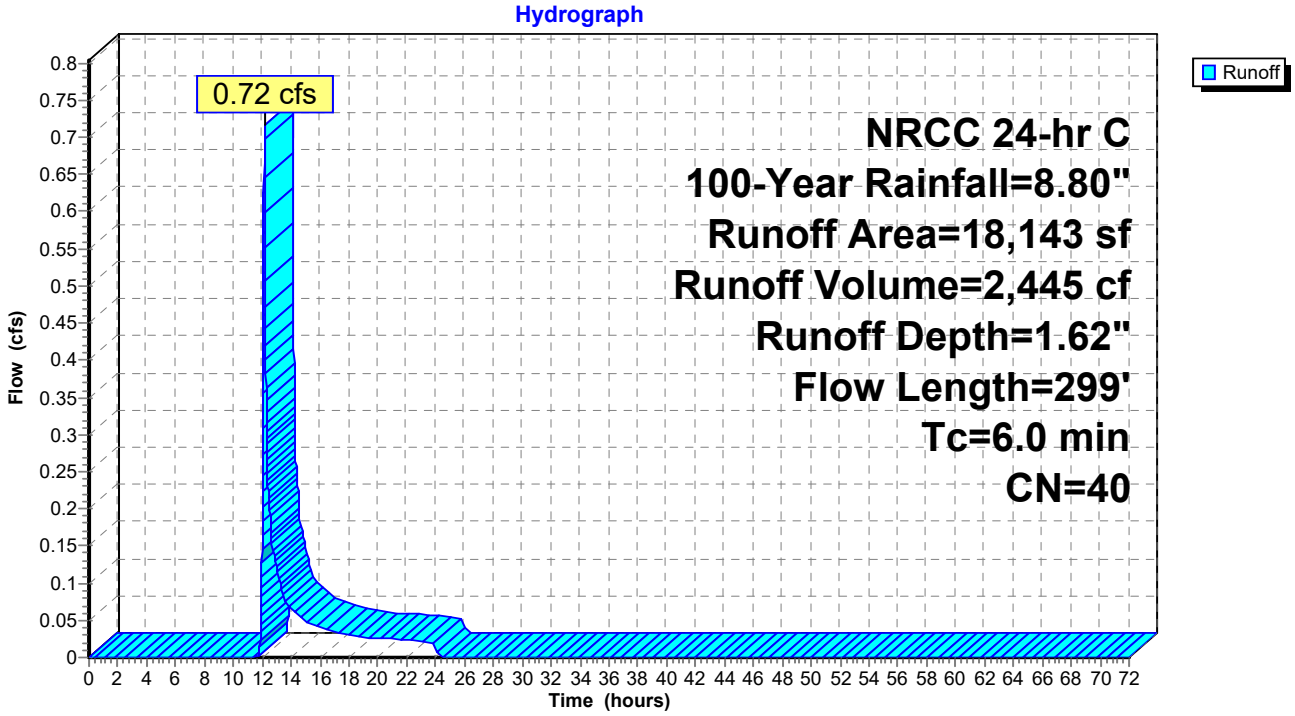
Runoff = 0.72 cfs @ 12.14 hrs, Volume= 2,445 cf, Depth= 1.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 100-Year Rainfall=8.80"

Area (sf)	CN	Description
574	70	Woods, Good, HSG C
1,112	74	>75% Grass cover, Good, HSG C
4,232	30	Woods, Good, HSG A
12,225	39	>75% Grass cover, Good, HSG A
18,143	40	Weighted Average
18,143		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.8	50	0.1040	0.30		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.44"
0.9	193	0.0629	3.76		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.5	56	0.1470	1.92		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
4.2	299	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 5S:



Summary for Subcatchment 6A:

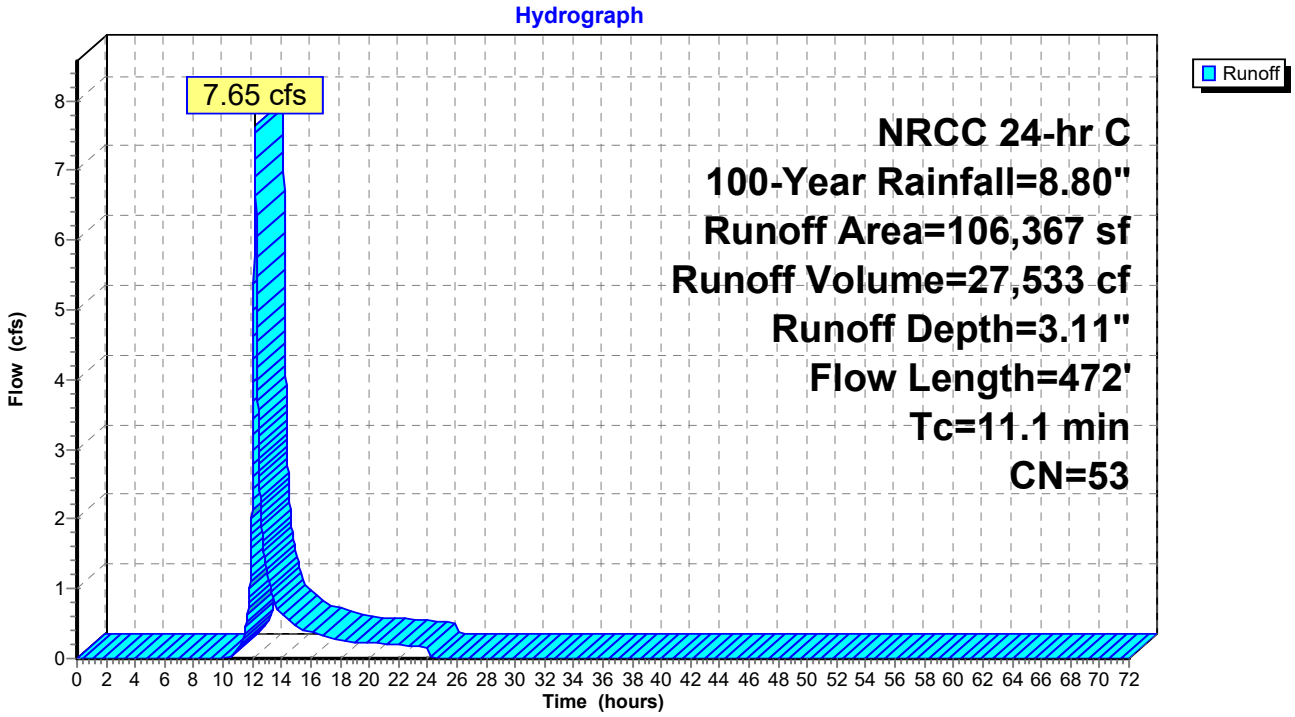
Runoff = 7.65 cfs @ 12.19 hrs, Volume= 27,533 cf, Depth= 3.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 100-Year Rainfall=8.80"

Area (sf)	CN	Description
7,811	70	Woods, Good, HSG C
20,625	74	>75% Grass cover, Good, HSG C
4,965	96	Gravel surface, HSG C
640	98	Unconnected pavement, HSG C
746	30	Woods, Good, HSG A
68,329	39	>75% Grass cover, Good, HSG A
3,251	96	Gravel surface, HSG A
106,367	53	Weighted Average
105,727		99.40% Pervious Area
640		0.60% Impervious Area
640		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	50	0.0200	0.11		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.44"
1.8	238	0.1042	2.26		**Shallow Concentrated Flow, Grass** Short Grass Pasture Kv= 7.0 fps
1.4	184	0.0914	2.16	22.30	**Trap/Vee/Rect Channel Flow,** Bot.W=4.00' D=1.00' Z= 5.6 & 7.0 '/' Top.W=16.60' n= 0.150 Sheet flow over Short Grass
11.1	472	Total			

Subcatchment 6A:



Summary for Subcatchment 6S:

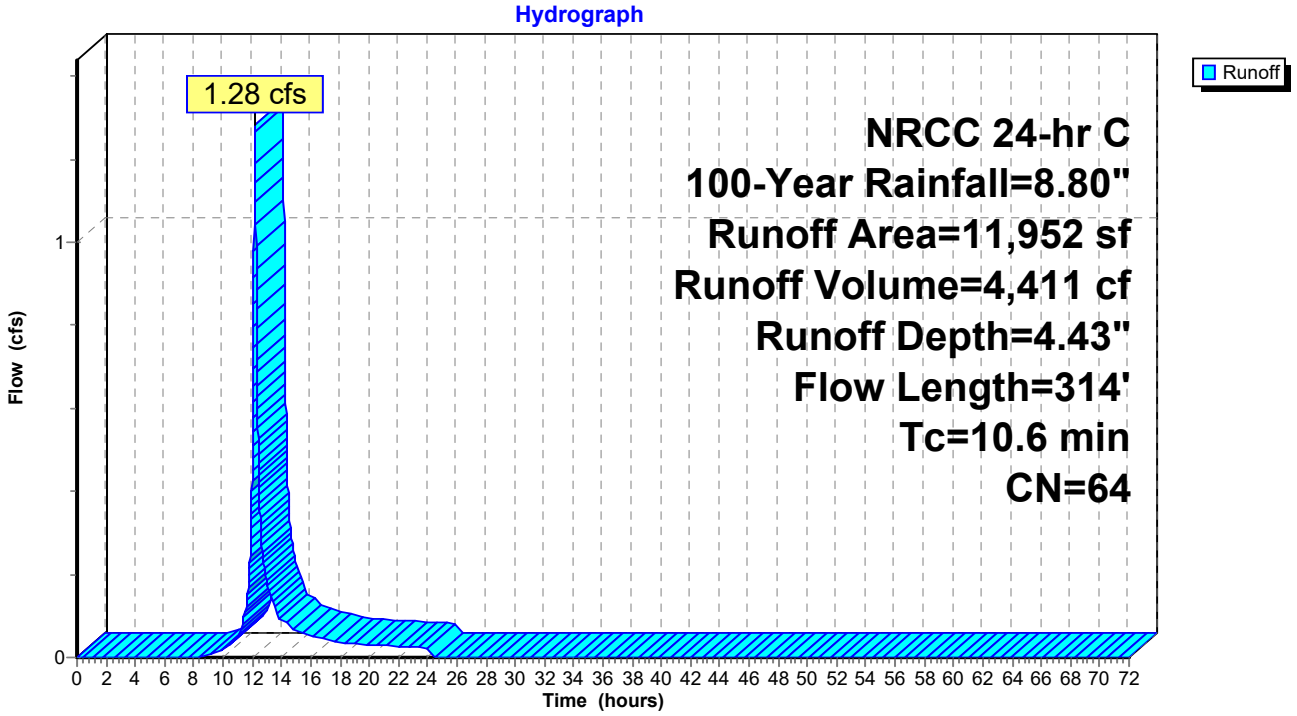
Runoff = 1.28 cfs @ 12.18 hrs, Volume= 4,411 cf, Depth= 4.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 100-Year Rainfall=8.80"

Area (sf)	CN	Description
5,519	70	Woods, Good, HSG C
3,933	74	>75% Grass cover, Good, HSG C
902	30	Woods, Good, HSG A
1,598	39	>75% Grass cover, Good, HSG A
11,952	64	Weighted Average
11,952		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.7	50	0.0600	0.11		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.44"
1.9	150	0.0690	1.31		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.0	114	0.1496	1.93		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
10.6	314	Total			

Subcatchment 6S:

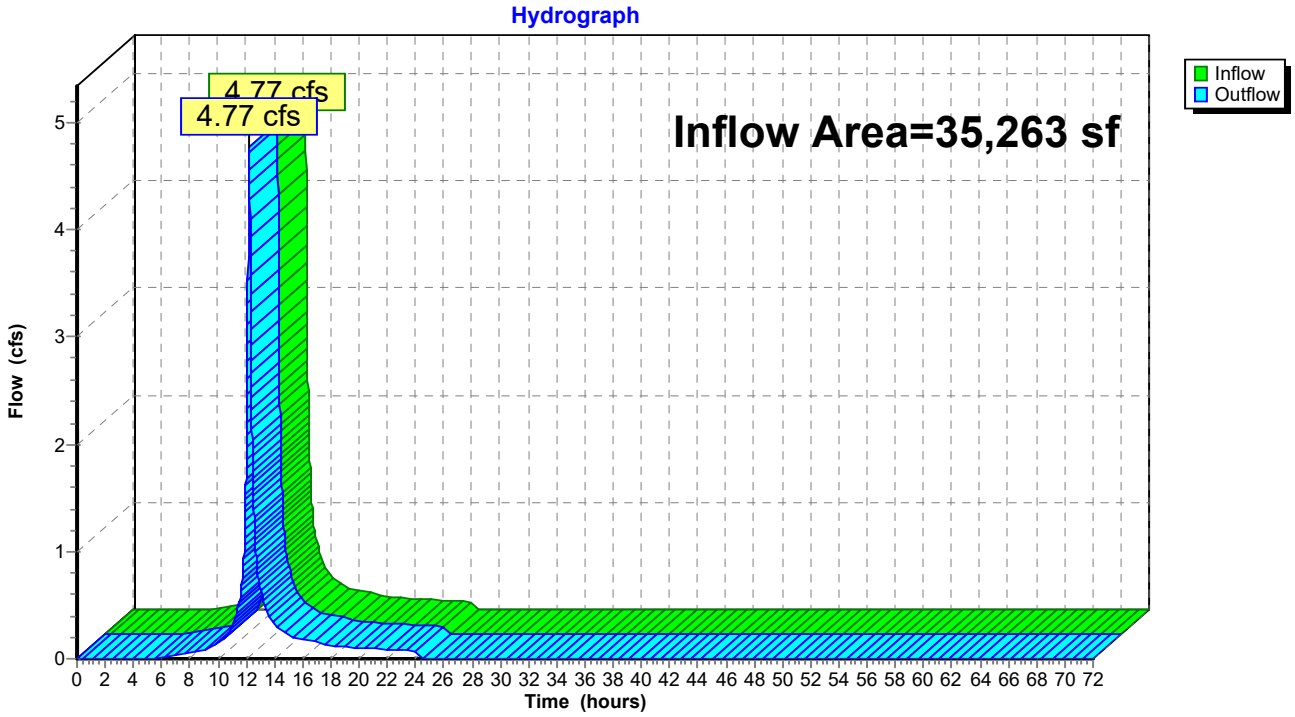


Summary for Reach DP 1: Towards Offsite West

Inflow Area = 35,263 sf, 9.29% Impervious, Inflow Depth = 6.01" for 100-Year event
Inflow = 4.77 cfs @ 12.20 hrs, Volume= 17,670 cf
Outflow = 4.77 cfs @ 12.20 hrs, Volume= 17,670 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 1: Towards Offsite West

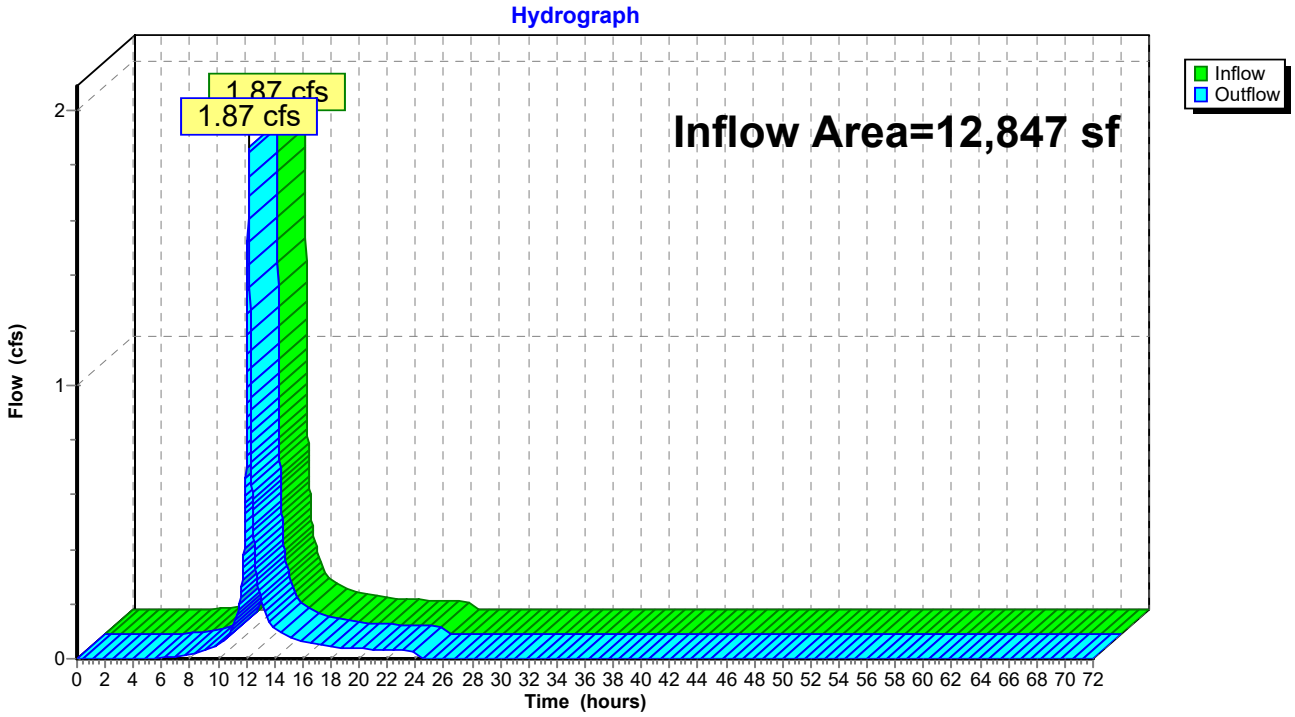


Summary for Reach DP 2: Towards Offsite North

Inflow Area = 12,847 sf, 0.00% Impervious, Inflow Depth = 5.89" for 100-Year event
Inflow = 1.87 cfs @ 12.17 hrs, Volume= 6,307 cf
Outflow = 1.87 cfs @ 12.17 hrs, Volume= 6,307 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 2: Towards Offsite North

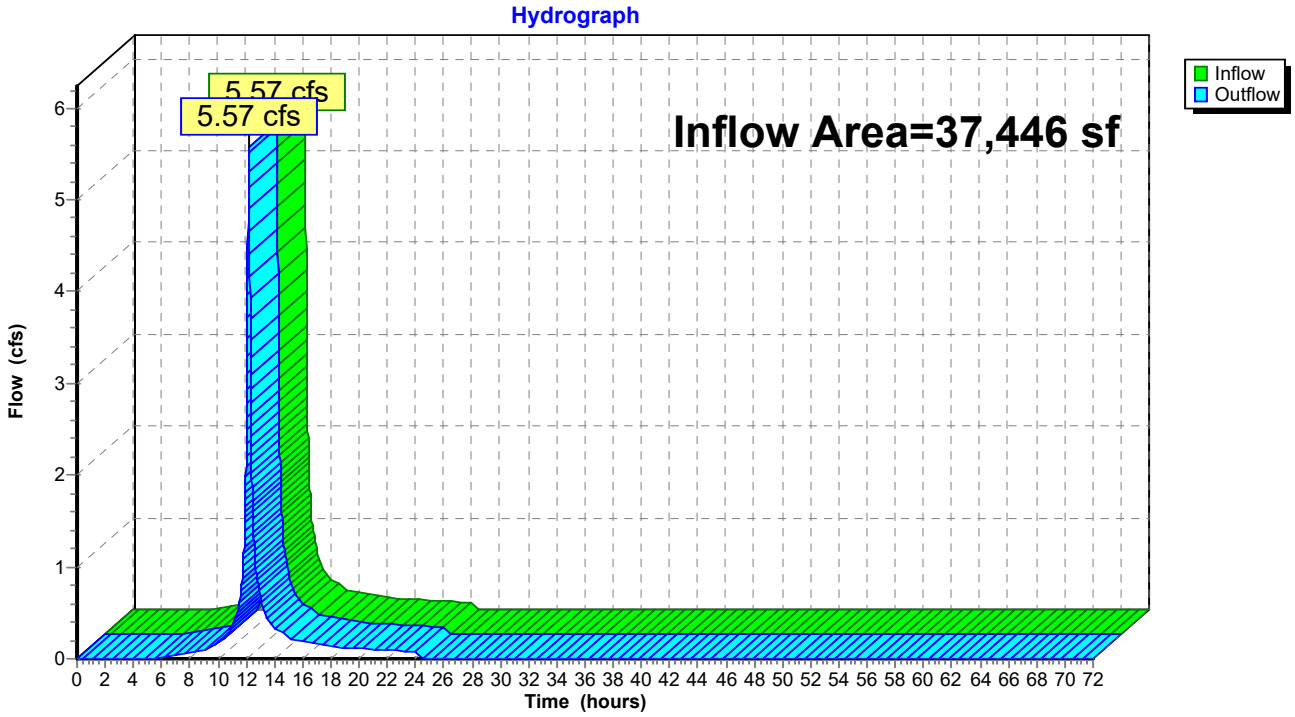


Summary for Reach DP 3: Towards West Wetland

Inflow Area = 37,446 sf, 0.00% Impervious, Inflow Depth = 6.13" for 100-Year event
Inflow = 5.57 cfs @ 12.17 hrs, Volume= 19,144 cf
Outflow = 5.57 cfs @ 12.17 hrs, Volume= 19,144 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 3: Towards West Wetland

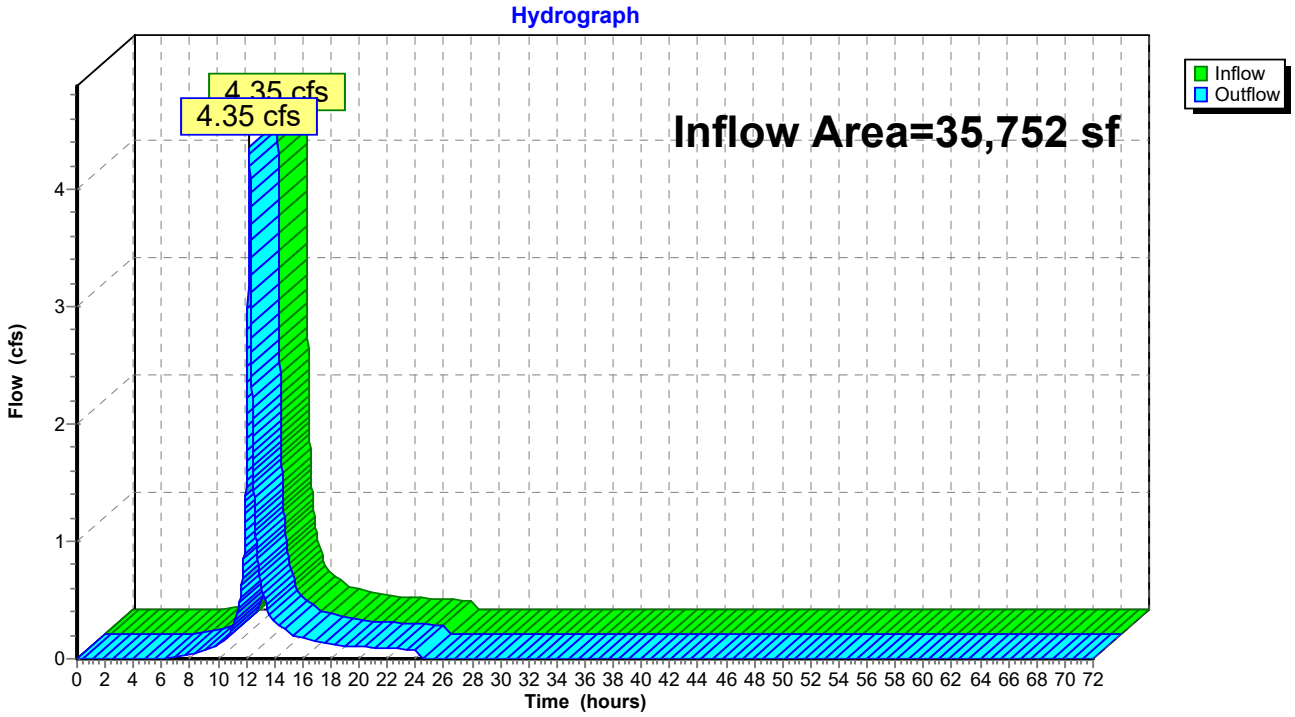


Summary for Reach DP 4: Towards East Wetland

Inflow Area = 35,752 sf, 0.00% Impervious, Inflow Depth = 5.65" for 100-Year event
Inflow = 4.35 cfs @ 12.22 hrs, Volume= 16,824 cf
Outflow = 4.35 cfs @ 12.22 hrs, Volume= 16,824 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 4: Towards East Wetland

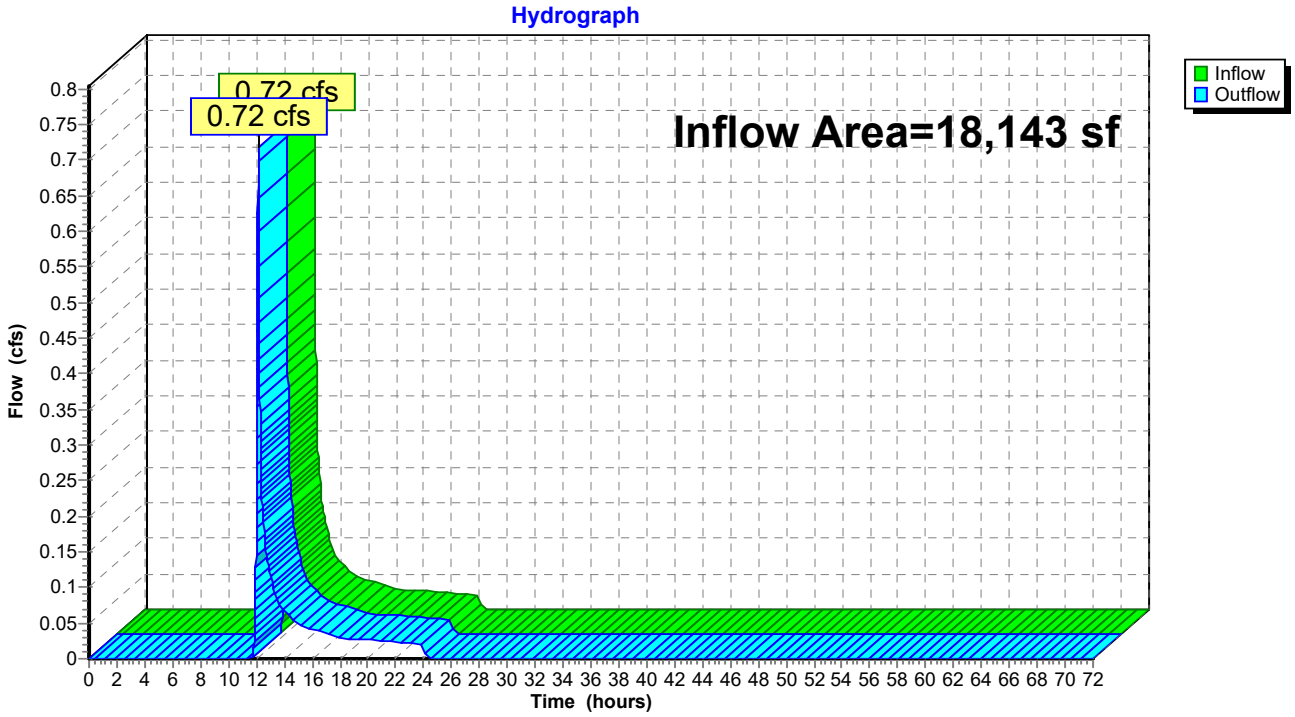


Summary for Reach DP 5: Towards Offsite Northwest

Inflow Area = 18,143 sf, 0.00% Impervious, Inflow Depth = 1.62" for 100-Year event
Inflow = 0.72 cfs @ 12.14 hrs, Volume= 2,445 cf
Outflow = 0.72 cfs @ 12.14 hrs, Volume= 2,445 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 5: Towards Offsite Northwest

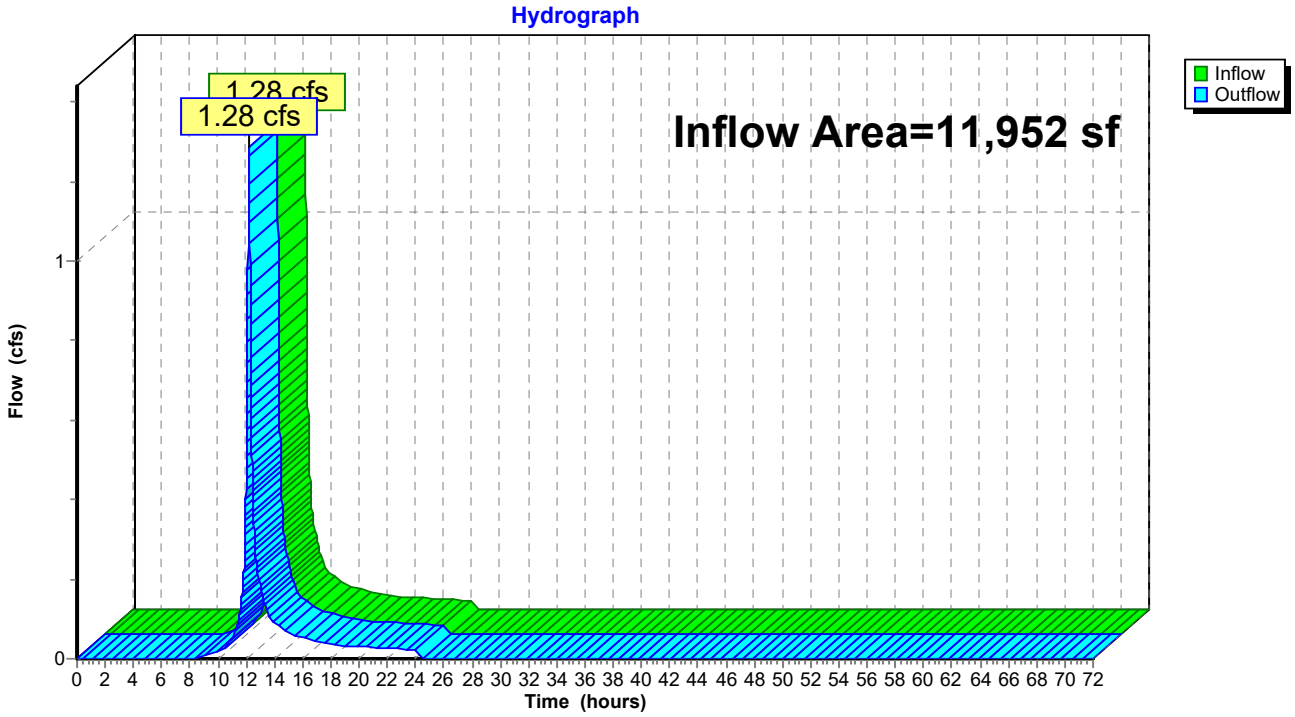


Summary for Reach DP 6: Towards Offsite East

Inflow Area = 11,952 sf, 0.00% Impervious, Inflow Depth = 4.43" for 100-Year event
Inflow = 1.28 cfs @ 12.18 hrs, Volume= 4,411 cf
Outflow = 1.28 cfs @ 12.18 hrs, Volume= 4,411 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach DP 6: Towards Offsite East



Summary for Pond 2P: South West Basin

Inflow Area = 55,890 sf, 2.19% Impervious, Inflow Depth = 6.01" for 100-Year event
Inflow = 9.40 cfs @ 12.14 hrs, Volume= 28,005 cf
Outflow = 0.38 cfs @ 14.77 hrs, Volume= 28,005 cf, Atten= 96%, Lag= 157.9 min
Discarded = 0.38 cfs @ 14.77 hrs, Volume= 28,005 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 457.82' @ 14.77 hrs Surf.Area= 6,730 sf Storage= 15,057 cf

Plug-Flow detention time= 430.8 min calculated for 28,001 cf (100% of inflow)
Center-of-Mass det. time= 430.9 min (1,244.6 - 813.8)

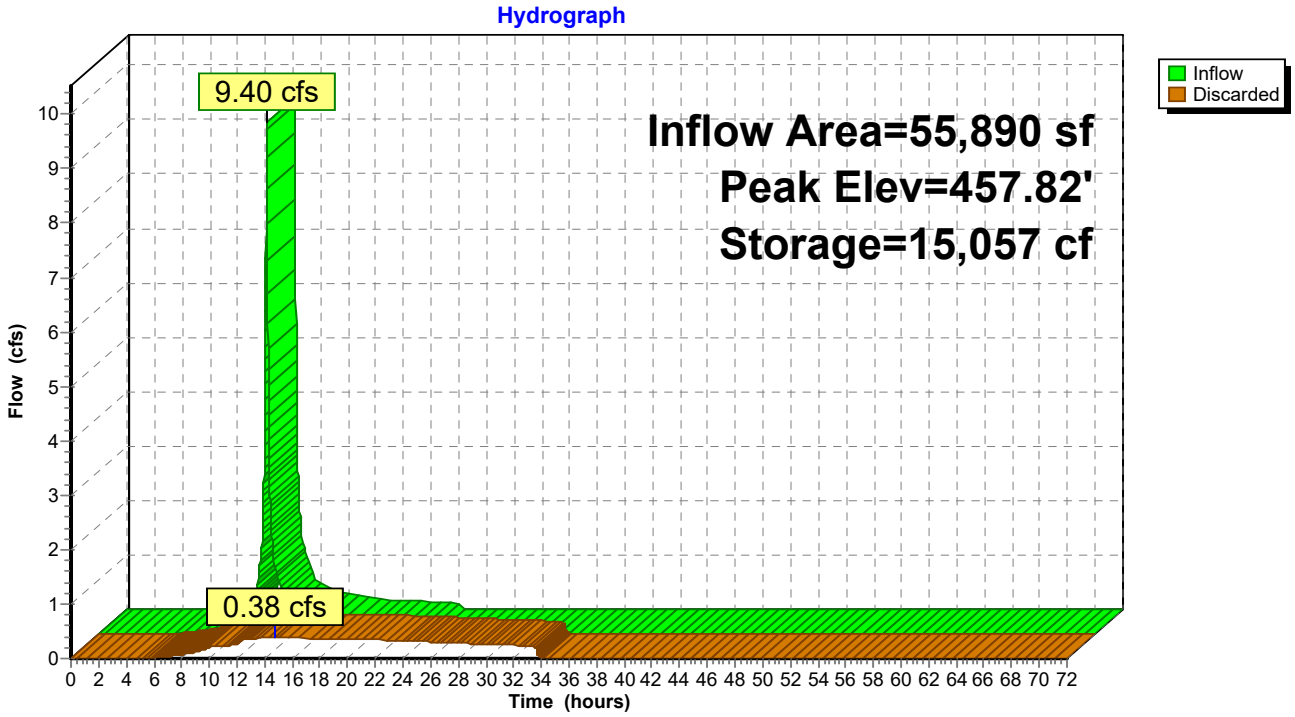
Volume	Invert	Avail.Storage	Storage Description
#1	455.00'	16,306 cf	**Custom Stage Data (Conic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
455.00	4,039	0	0	4,039
456.00	4,943	4,483	4,483	4,974
457.00	5,904	5,416	9,900	5,969
458.00	6,922	6,406	16,306	7,026

Device	Routing	Invert	Outlet Devices
#1	Discarded	455.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.38 cfs @ 14.77 hrs HW=457.82' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.38 cfs)

Pond 2P: South West Basin



Summary for Pond 6P: North East Basin

Inflow Area = 106,367 sf, 0.60% Impervious, Inflow Depth = 3.11" for 100-Year event
Inflow = 7.65 cfs @ 12.19 hrs, Volume= 27,533 cf
Outflow = 0.32 cfs @ 16.92 hrs, Volume= 27,533 cf, Atten= 96%, Lag= 283.7 min
Discarded = 0.32 cfs @ 16.92 hrs, Volume= 27,533 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 408.59' @ 16.92 hrs Surf.Area= 5,817 sf Storage= 16,011 cf

Plug-Flow detention time= 640.4 min calculated for 27,529 cf (100% of inflow)
Center-of-Mass det. time= 640.4 min (1,514.5 - 874.0)

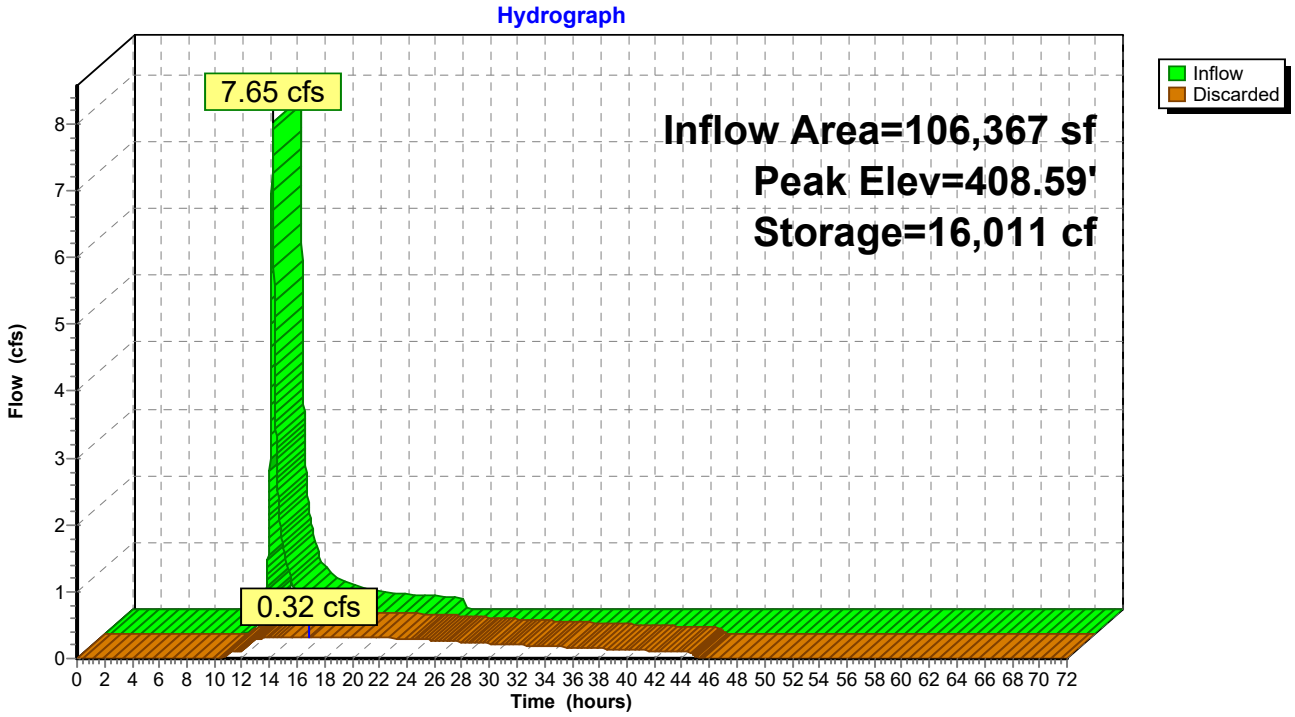
Volume	Invert	Avail.Storage	Storage Description
#1	404.00'	18,479 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

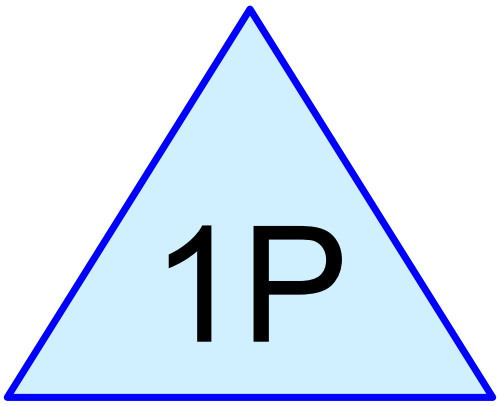
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
404.00	1,593	178.0	0	0	1,593
405.00	2,352	203.0	1,960	1,960	2,375
406.00	3,120	229.0	2,727	4,687	3,294
407.00	3,995	256.0	3,548	8,236	4,364
408.00	5,102	285.0	4,537	12,773	5,641
409.00	6,333	315.0	5,706	18,479	7,105

Device	Routing	Invert	Outlet Devices
#1	Discarded	404.00'	**2.410 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.32 cfs @ 16.92 hrs HW=408.59' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.32 cfs)

Pond 6P: North East Basin





Cultec 100-HD

Subcat Reach Pond Link

Routing Diagram for 3328.00 CULTEC
Prepared by {enter your company name here}, Printed 11/16/2023

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 Stor-Ind+Trans method - Pond routing by Stor-Ind method

Pond 1P: Cultec 100-HD Peak Elev=0.00' Storage=0 cf

Summary for Pond 1P: Cultec 100-HD

Volume	Invert	Avail.Storage	Storage Description
#1A	0.00'	95 cf	**8.25'W x 17.50'L x 2.04'H Field A** 295 cf Overall - 58 cf Embedded = 237 cf x 40.0% Voids
#2A	0.50'	58 cf	**Cultec C-100HD** x 4 Inside #1 Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap Row Length Adjustment= +0.50' x 1.86 sf x 2 rows
		153 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Pond 1P: Cultec 100-HD - Chamber Wizard Field A

Chamber Model = Cultec C-100HD (Cultec Contactor® 100HD)
Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf
Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap
Row Length Adjustment= +0.50' x 1.86 sf x 2 rows

36.0" Wide + 3.0" Spacing = 39.0" C-C Row Spacing

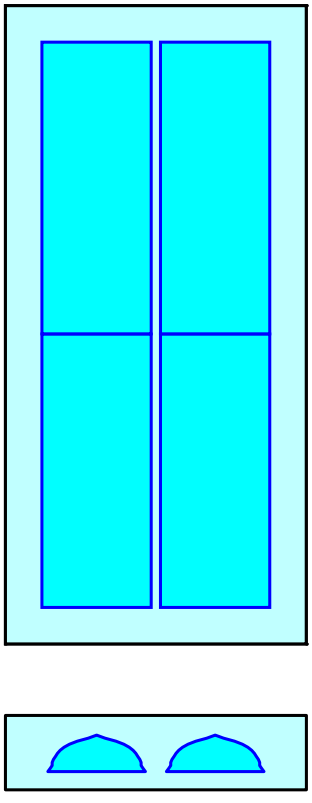
2 Chambers/Row x 7.50' Long +0.50' Row Adjustment = 15.50' Row Length +12.0" End Stone x 2 = 17.50' Base Length
2 Rows x 36.0" Wide + 3.0" Spacing x 1 + 12.0" Side Stone x 2 = 8.25' Base Width
6.0" Base + 12.5" Chamber Height + 6.0" Cover = 2.04' Field Height

4 Chambers x 14.0 cf +0.50' Row Adjustment x 1.86 sf x 2 Rows = 57.7 cf Chamber Storage

294.8 cf Field - 57.7 cf Chambers = 237.1 cf Stone x 40.0% Voids = 94.8 cf Stone Storage

Chamber Storage + Stone Storage = 152.5 cf = 0.004 af
Overall Storage Efficiency = 51.7%
Overall System Size = 17.50' x 8.25' x 2.04'

4 Chambers
10.9 cy Field
8.8 cy Stone



APPENDIX D

Revised Pre and Post Development Watershed Plans

FILE: 3328-WSHD-REV1

Atlantic® DESIGN ENGINEERS, INC.
P.O. Box 1051, Sandwich, MA 02563 (508) 888 – 9282

Designed by : ______
Drawn by : ______
Checked by : ______
Survey chk. by : ______
Approved by : ______

SCALE
SCALE 1" = 40'
0 10 20 40 80

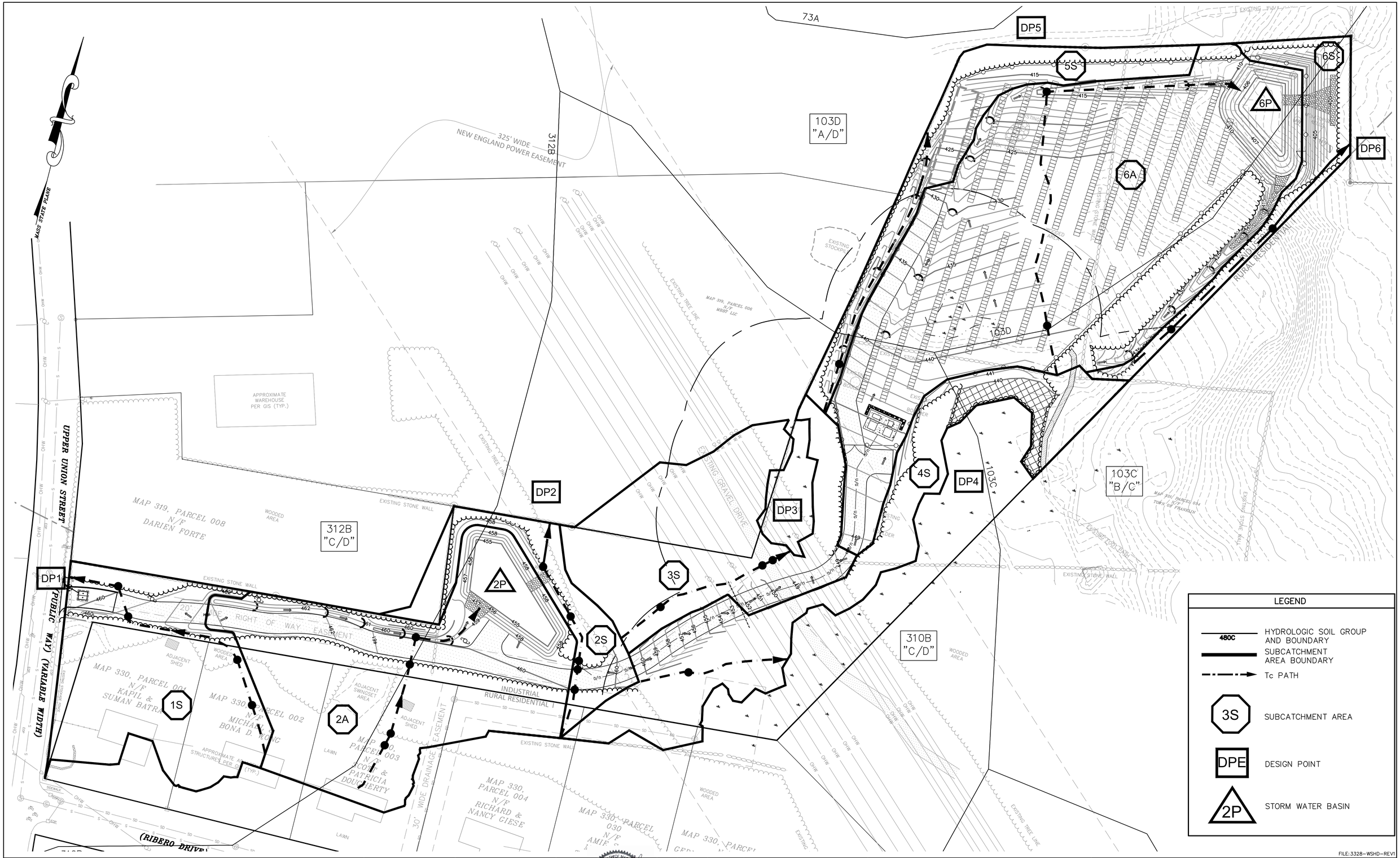
DATE

NO.	BY	DATE	REVISION
1	BJR	11/10/23	PEER REVIEW/TOWN COMMENTS

APPLICANT:
VS UNION SOLAR SMART, LLC
24941 DANA POINT HARBOR
DANA POINT, CA 92629

PRE DEVELOPMENT WATERSHED PLAN
FOR
UPPER UNION SOLAR PROJECT
FRANKLIN, MA
JUNE 19, 2023

Sheet 1 of 2
JOB NUMBER 3328.00



FILE:3328-WSHD-REV1

Atlantic® DESIGN ENGINEERS, INC.
P.O. Box 1051, Sandwich, MA 02563 (508) 888 – 9282

Designed by :
Drawn by :
Checked by :
Survey chk. by :
Approved by :

SCALE
SCALE 1" = 40'
0 10 20 40 80

RICHARD J. TABACZYNSKI CIVIL No. 33748 REGISTERED PROFESSIONAL ENGINEER COMMONWEALTH OF MASSACHUSETTS

DATE

NO.	BY	DATE	REVISION
1	BJR	11/10/23	PEER REVIEW/TOWN COMMENTS

APPLICANT:
VS UNION SOLAR SMART, LLC
24941 DANA POINT HARBOR
DANA POINT, CA 92629

POST DEVELOPMENT WATERSHED PLAN
FOR
UPPER UNION SOLAR PROJECT
FRANKLIN, MA
JUNE 19, 2023

Sheet 2 of 2
JOB NUMBER 3328.00

APPENDIX E

Revised O&M Plan

Upper Union Solar Project
At
0 Upper Union Street – Franklin, MA
Post-Construction Long Term Stormwater Operation & Maintenance Plan
Revised November 10, 2023
ADE Job #3328.00

A. GENERAL NOTES

1. Upon completion of construction, the operation and maintenance of all components of the stormwater management system will be the responsibility (financially and otherwise) of the system owner (responsible party):

System Owner
VS Union Solar Smart, LLC
24941 Dana Point Harbor
Dana Point, California 92629

Signature: *John T. Harrington* **Date 11.15.23**

2. The responsible party shall file an inspection report with the Town of Franklin DPW following each site inspection as recommended in the Operation & Maintenance (O&M) Schedule. The inspection report shall identify the date of inspection, name, and contact number of responsible party, specific structures inspected, specific maintenance and/or repairs required and general observations. Any deficiencies noted in the inspection report shall be corrected to the Town of Franklin's DPW's satisfaction.

3. Disposal of accumulated sediment and hydrocarbons to be in accordance with the applicable local, state, and federal guidelines and regulations.

4. There shall be no illicit discharge of any waste or waste water into the stormwater management system. The maintenance of the facility shall be undertaken in such a manner as to prevent any discharge of waste or waste water into the stormwater management system. Any waste oil or other waste products generated during the maintenance shall be properly disposed of offsite.

5. The Town will be notified of changes in project ownership or assignment of operation and maintenance financial responsibility.

6. The maintenance schedule in this operation and maintenance (O&M) Plan will only be amended by mutual agreement of the Town and the responsible party. Amendments will be made in writing and signed by the responsible party.

7. There shall be regular inspection and maintenance of drip edges to mitigate creation of rills and gullies.

8. There shall be no illicit discharge of any waste or waste water into the stormwater management system. The maintenance of the facility shall be undertaken in such a manner as to prevent any discharge of waste or waste water into stormwater management system. Any waste products generated during maintenance shall be properly disposed of off-site.

System Owner
VS Union Solar Smart, LLC
24941 Dana Point Harbor
Dana Point, California 92629

Signature: *John T. Harrington* **Date: 11.15.23**

B. STORMWATER SYSTEM/BMPS

Erosion control barriers:
Until the site is fully stabilized, erosion control barriers (sediment log, straw wattles, silt fence, etc.) should be inspected immediately after major storm events (2" or greater). Sediment deposits must be removed when the level of deposition reaches approximately one-half the height of the barrier. Repair/replace any sections of erosion control barriers that are damaged and install additional rows of barriers if needed.

Deep Sump Hooded Catch Basins:
Inspect after every major storm event (2" or greater) for the first few months after construction and at least four times per year thereafter. Inspect for clogged grates or pipes and excessive accumulation of sediment and trash. Remove accumulation of leaves or debris over grate inlets as needed throughout the year. Clean sumps when sediment reaches 24".

Sub-surface Infiltration System:
Inspect after every major storm event (2" or greater) for the first few months after construction to ensure proper stabilization and function. Thereafter, inspect at least twice per year during wet weather to ensure the system is draining properly. Check for accumulation of sediment and ponding water. If ponding water is visible inside the system for several days after a storm event, notify the engineer for possible remedial measures. Remove sediment as necessary during construction, while the system is dry, and at least every five years after construction.

Stone Check Dams:
Inspect after every major storm event (2" or greater) for the first few months after construction to ensure proper stabilization and function. Thereafter inspect twice per year at a minimum, for erosion, excessive accumulation of sediment, signs of failure, excessive weed/vegetation growth, and trash. Repair eroded spots immediately after inspection. Accumulated sediment shall be removed at least once a year or before it exceeds 0.5 ft. in depth, whichever occurs first.

Grassed swales:
Inspect after every major storm event (2" or greater) for the first few months after construction and at least twice per year thereafter. Repair eroded spots immediately after inspection. Additional inspections should be scheduled during the first few months to ensure that the vegetation in the channels is established adequately. Accumulated sediment shall be removed at least once a year or before it exceeds 0.5' in depth, whichever occurs first. Swales shall be mowed as needed. Clippings to be removed from swales, areas immediately up-gradient and properly disposed of.

Street Sweeping:
All paved areas should be swept two times per year, once during the late spring and once during the late fall seasons after construction.

Stone Infiltration Trench:
Inspect after every major storm event (2" or greater) for the first few months after construction and at least twice per year thereafter during wet weather to ensure the system is working properly. Check for accumulation of sediment, debris, weed growth and leaf litter and clean out as required, including replacement of top layer of stone.

Infiltration Basins:
Inspect after every major storm event (2" or greater) for the first few months after construction to ensure proper stabilization and function, thereafter inspect at least twice per year during wet weather to ensure the system is draining properly. Check for accumulation of sediment and ponding of water. If ponding water is visible inside the basin for several days after a storm event, notify the engineer for possible remedial measures. Remove sediment as necessary during construction, while the system is dry, and at least every 5 years after construction.

Rip-rap Aprons/Spillways/Level Spreaders:
Inspect after every major storm event (2" or greater) for the first few months after construction to ensure proper stabilization and function. Thereafter inspect twice per year at a minimum, for erosion, excessive accumulation of sediment, signs of failure, excessive weed/vegetation growth, and trash. Repair eroded spots immediately after inspection. Accumulated sediment shall be removed at least once a year or before it exceeds 0.5 ft. in depth, whichever occurs first.

Panel Drip Edges:
Inspect below panel drip edges, after every major storm event (2" or greater) for the first few months after construction and at least twice per year thereafter. Look for formation of eroded channels, rills and gulley's, particularly on newly constructed slopes. Repair and/or re-seed any areas that are eroded or not stabilized immediately after inspection.

C. ESTIMATED ANNUAL BUDGET

The estimated annual budget for the activities required in this Post-Construction Long Term Stormwater Operation and Maintenance Plan is $2,000.00.

D. SAMPLE OPERATION AND MAINTENANCE LOG (Next Page)

SAMPLE OPERATION AND MAINTENANCE LOG

UPPER UNION SOLAR PROJECT - FRANKLIN, MASSACHUSETTS

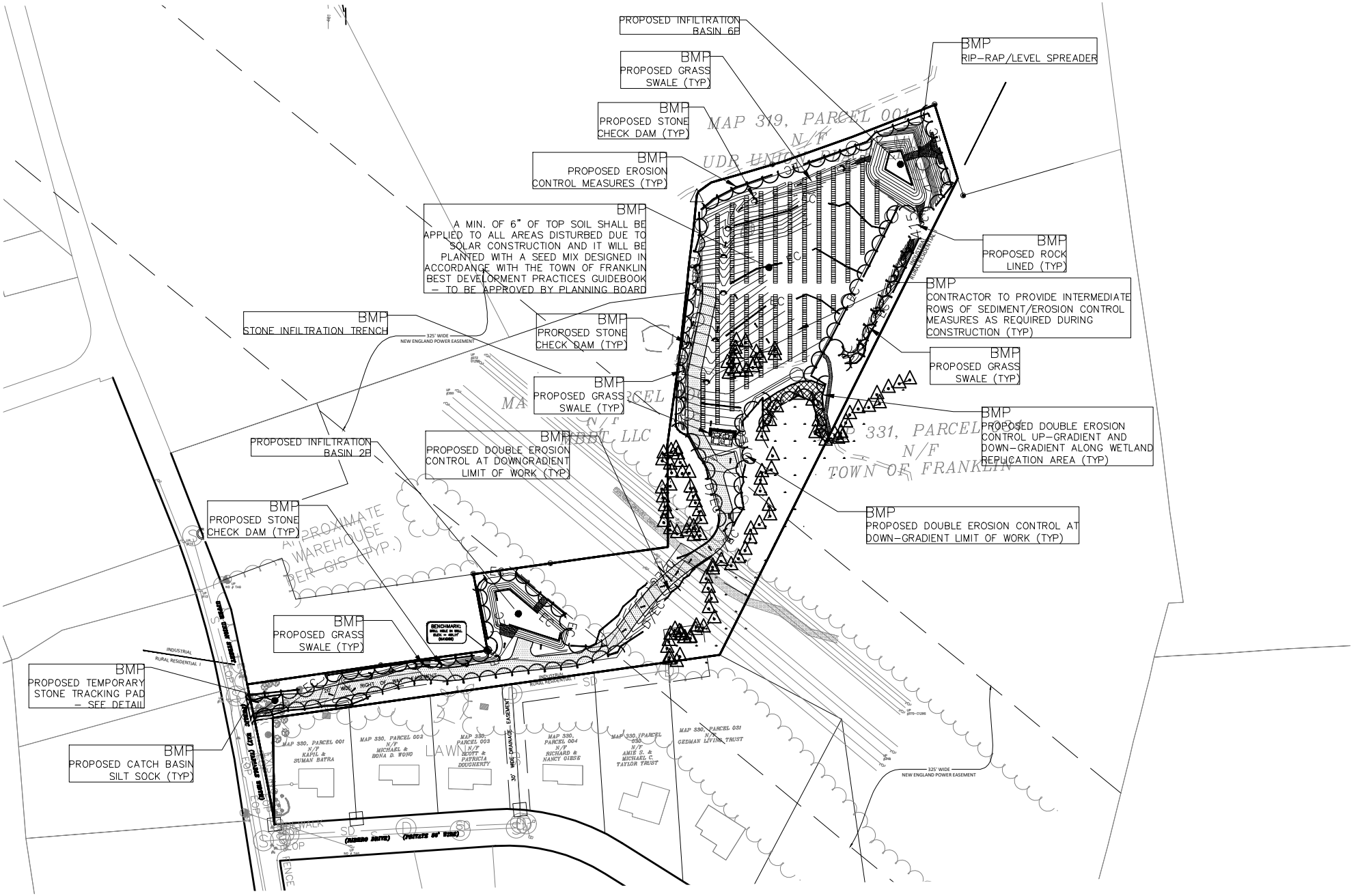
POST-CONSTRUCTION LONG TERM STORMWATER OPERATION & MAINTENANCE PLAN

Date: _____ **Personnel Present:** _____
_____
Inspectors Name: _____
Inspectors Contact Information: _____
_____
_____
Signature: _____

O&M ITEM:	**COMMENTS, CORRECTIVE ACTION NEEDED, AND NOTES:**
Erosion Control Barriers	
Deep Sump Hooded Catch Basins	
Sub-Surface Infiltration System	
Grassed Swales	
Street Sweeping	
Stone Infiltration Trench	
Infiltration Basins	
Outlet Pipes and Flared End Sections/Headwalls	
Rip-rap Aprons/Spillways/Level Spreaders	
Stone Check Dams	

APPENDIX F

BMP Location Map



BMP Locations
Upper Union Solar Project
0 Upper Union Street, franklin, MA
Scale: 1"=200'

Atlantic DESIGN ENGINEERS, INC.
P.O. Box 1051 Sandwich, MA 02563 tel. (508) 888-9282 fax. (508) 888-5859