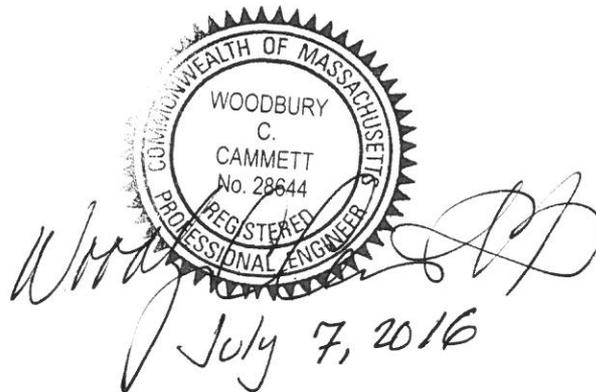


Woodbury C. Cammett, PE MA, NH
Robert B. Blanchette, PE, SIT
Robert E. Smith, PLS MA, NH
Denis Hamel, CPESC
Emily Fredette, EIT

Consulting Engineers and Land Surveyors

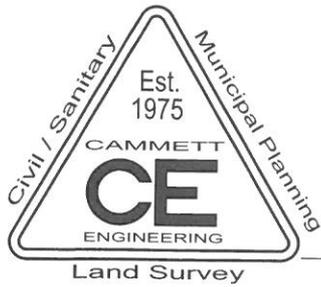
**SPECIAL PERMIT APPLICATION
HANNAH & SEAN STELLMACH
31 NEWTON ROAD
MAP 33, PARCEL 32
AMESBURY, MA. 01913**



**Prepared By:
W. C. Cammett Engineering, Inc.
297 Elm Street
Amesbury, Ma. 01913**

Job#: 16025

W.C. Cammett Engineering, Inc.
297 Elm Street ▲ Amesbury, Massachusetts 01913
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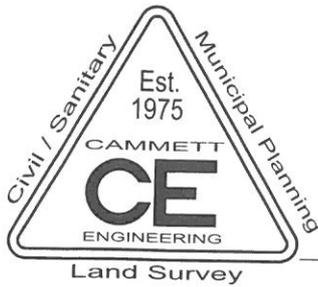


Woodbury C. Cammett, PE MA, NH
Robert B. Blanchette, PE, SIT
Robert E. Smith, PLS MA, NH
Denis Hamel, CPESC
Emily Fredette, EIT

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TABLE OF CONTENTS

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| • STORMWATER REPORT AND CALCULATIONS | |
| • STORMWATER OPERATION & MAINTENANCE PLAN | |



Woodbury C. Cammett, PE MA, NH
Robert B. Blanchette, PE, SIT
Robert E. Smith, PLS MA, NH
Denis Hamel, CPESC
Emily Fredette, EIT

Consulting Engineers and Land Surveyors

July 8, 2016

Planning Board
Town Hall
Amesbury, MA. 01913

RE: Special Permit Application
Hannah & Sean Stellmach
31 Newton Road
Amesbury, MA. 01913

Dear Board Members,

On behalf of our clients, Hannah and Sean Stellmach, we are hereby submitting this application for Special Permit in the Water Resources Protection District as required under the Amesbury Zoning Bylaw Section XIV(I)(B)(7) for any new construction. The applicant proposes the construction of a single family dwelling. The following documents are submitted as part of the application package:

- Application for Special Permit
- Site Plan prepared by W. C. Cammett Engineering, Inc. dated 7/8/16
- Certified List of Abutters
- Application Fee \$500 and Abutter Notification Fee \$9.80

If the Board requires additional information or has any questions regarding this application, please contact our office.

Sincerely,
W.C. Cammett Engineering, Inc.

Robert Blanchette, P.E.



Amesbury

PLANNING BOARD

Town Hall

APPLICATION FOR SPECIAL PERMIT

Date June 22, 2016
Name Hannah & Sean Stellmach
Address 23 Spindletree Road Amesbury, MA 01913

Title Reference - Book 32149 Page 424

Application is hereby made for a special permit under the requirements of Section V, Paragraph D of the Amesbury Zoning Bylaw.

Premises affected are situated on 31 Newton Road Street, Amesbury, Massachusetts, and on Map # 33, Lot # 32 of the Assessor's Map.

1. Type of Special Permit Required: Section XIV(I)(B)(7) for any new construction
2. Zoning District: R80
3. Has there been any previous appeal or permit on this property: No
If yes, explain: _____
4. Lot Size: 1.95 AC
5. Size of Building(s) existing or proposed: Proposed single family dwelling approx. 1720 SF
6. Occupancy of Use, existing /proposed: Existing - undeveloped / Proposed - single family dwelling
7. Is site plan review required: No
8. Is Subdivision Control Law approval required: No

9. Other permits required: Board of Health Disposal Works Construction Permit - Obtained
10. Description of proposed work/use: The proposed used is a single family dwelling including driveway, septic system, stormwater management, and underground utilities.
11. Principal Points upon which application is based: The proposed work requires the approval of the Planning Board since the proposed construction requires a special permit within the Water Resources Protection District. Stormwater is being managed to the greatest extent possible to match pre-development conditions.



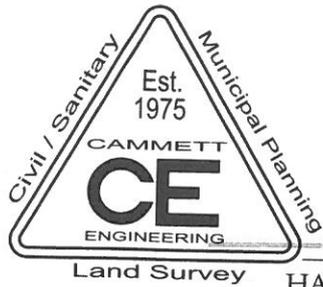
 Signature of Applicant



 Owner (if not Applicant)

Filing Fee: \$500.00 plus \$100 per lot (CAD, Cluster) or \$50 per dwelling unit (Multi-Family)
 Received: _____
 Distributed: _____
 Hearing: _____

Application must be filed with sixteen (16) sets of plans, a list of abutters, and a Building Inspector refusal; If site plan approval or subdivision control law approval is necessary, sixteen (16) sets of plans shall be submitted. One copy of completed plan on (1) diskette.



Woodbury C. Cammett, PE MA, NH
Robert B. Blanchette, PE, SIT
Robert E. Smith, PLS MA, NH
Denis Hamel, CPESC
Emily Fredette, EIT

Consulting Engineers and Land Surveyors

HANNAH S HORTON
SEAN A STELLMACH
30 GLEN DEVIN STREET
AMESBSURY, MA 01913

53-7150/2113

789

DATE July 1st 2016

© DELUXE © deluxe.com/checks

PAY TO City of Amesbury \$ 500.00
THE ORDER OF Five hundred dollars and 00/100 DOLLARS

Security Features Included. Details on Back.



The NEWBURYPORT BANK
The Newburyport Five Cents Savings Bank
Newburyport, Mass.

MEMO 31 Newton Rd. Special Permit

[Signature] NP

⑆ 211371502⑆ 0913 602 9⑈ 0789

SPECIALTY BLUE

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297 Elm Street ▲ Amesbury, Massachusetts 01913
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Amesbury

Community & Economic Development
Planning – Conservation – Appeals
Tel: (978) 388-8110
Fax: (978) 388-6727

62 Friend Street
Second Floor
Amesbury, MA 01913

ABUTTER NOTIFICATION POSTAGE FEES

The following is the formula used for determining the postage costs for each application:

Number of Certified Abutters
(including applicant and representative)

$$\underline{10} \times .98 = \underline{9.80}$$

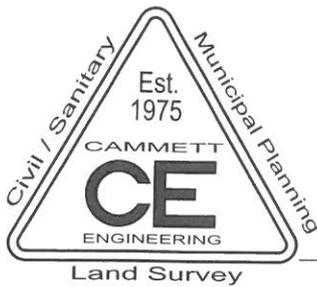
TOTAL AMOUNT OWED FOR POSTAGE:

\$ 9.80

Please remit a check payable to the **City of Amesbury** for the total amount owed for postage. Also, please be advised that your postage fee must be paid prior to you being scheduled for a meeting date.

NOTE: Postage fee subject to change with postage increase.

Effective date: 02/27/2009
Revised: January 2014



Woodbury C. Cammett, PE MA, NH
Robert B. Blanchette, PE, SIT
Robert E. Smith, PLS MA, NH
Denis Hamel, CPESC
Emily Fredette, EIT

Consulting Engineers and Land Surveyors

PROJECT DESCRIPTION

The Project Site (The "Site") is located at 31 Newton Road, Amesbury, MA.

The Site consists of an undeveloped parcel of approximately 1.95 acres situated in the R-80 Zoning District and the Water Resources Protection District.

The proposed project is the construction of a single family dwelling, including driveway, and stormwater management. The proposed development will utilize infiltration trenches, sediment forebay and infiltration basin to maintain pre-development stormwater patterns and water quality to the greatest extent possible. As required under Section XIV(I)B(7)(1), for lots occupied by single family dwellings, the site design incorporates natural drainage patterns and vegetation in order to maintain pre-development stormwater patterns and water quality to the greatest extent possible by routing stormwater runoff from rooftops, driveways and other impervious surfaces into infiltration trenches, sediment forebay and infiltration basin. Only 4.5% of the lot coverage will be impervious surfaces.

FINDINGS REQUIRED – SECTION X.J.5a-g

- a. The use requested is listed in the Table of Use Regulations as a special permit in the district for which the application is made.

The use requested for construction of a single family dwelling is permitted, not requiring a special permit in the R-80 district in the Table of Use Regulations. However, the special permit is required for new construction in the Water Resources Protection District under Section XIV(I)(B)(7).

- b. The requested use is essential and/or desirable to the public convenience or welfare.

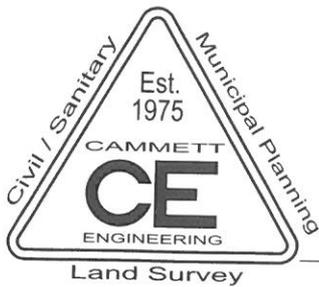
The end use as a single family dwelling is a low density use and consistent with surrounding uses.

- c. The requested use will not create undue traffic congestion or unduly impair pedestrian safety.

The end use as a single family dwelling will not create undue traffic congestion or impair pedestrian safety. The increase in traffic is minimal and there are no sidewalks on Newton Road.

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d. The requested use will not overload any public water, drainage, or sewer system or any other municipal system to such an extent that the requested use or any developed use in the immediate area or in any other area of Town will be unduly subjected to hazards affecting health, safety, or the general welfare.

The end use as a single family dwelling will not overload any public utility. The proposed use has a minimal impact on the public systems.

e. Any special regulations for the use set forth in Section XI of this Bylaw are fulfilled.

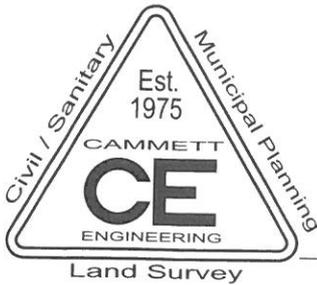
The single family dwelling meets the requirements of Section XIV(I)(B)(7)(1). Stormwater recharge is attained through site design that incorporates natural drainage patterns and vegetation in order to maintain pre-development stormwater flows and water quality to the greatest extent possible. The stormwater from the rooftop is diverted underground to infiltration trenches where groundwater recharge and infiltration will be maximized. The stormwater from the driveway is routed to a sediment forebay leading to a wet basin which promotes TSS removal. Only 4.5% of the lot will be covered with impervious surfaces.

f. The requested use will not impair the integrity or character of the district or adjoining districts nor be detrimental to the health or welfare.

The end use as a single family dwelling will not impair the integrity of the district. The single family dwelling is a low density use and consistent with surrounding uses.

g. The requested use will not by its addition to a neighborhood cause an excess of that particular use that could be detrimental to the character to said neighborhood.

The end use as a single family dwelling will not cause an excess of that particular use that could be detrimental to the character of the neighborhood. The construction is consistent with surrounding single family house lots and the lot is a similar size as many of the surrounding single family house lots, providing for a low density use.



Woodbury C. Cammett, PE MA, NH
Robert B. Blanchette, PE, SIT
Robert E. Smith, PLS MA, NH
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Emily Fredette, EIT

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FINDINGS REQUIRED-SECTION XIV(J)4A.

- A. In no way, during construction or thereafter, adversely affect the existing or potential quality or quantity of water that is available in the water resource protection district.

The use has been designed to incorporate measures to promote treatment and recharge of stormwater runoff to mitigate any negative impacts.

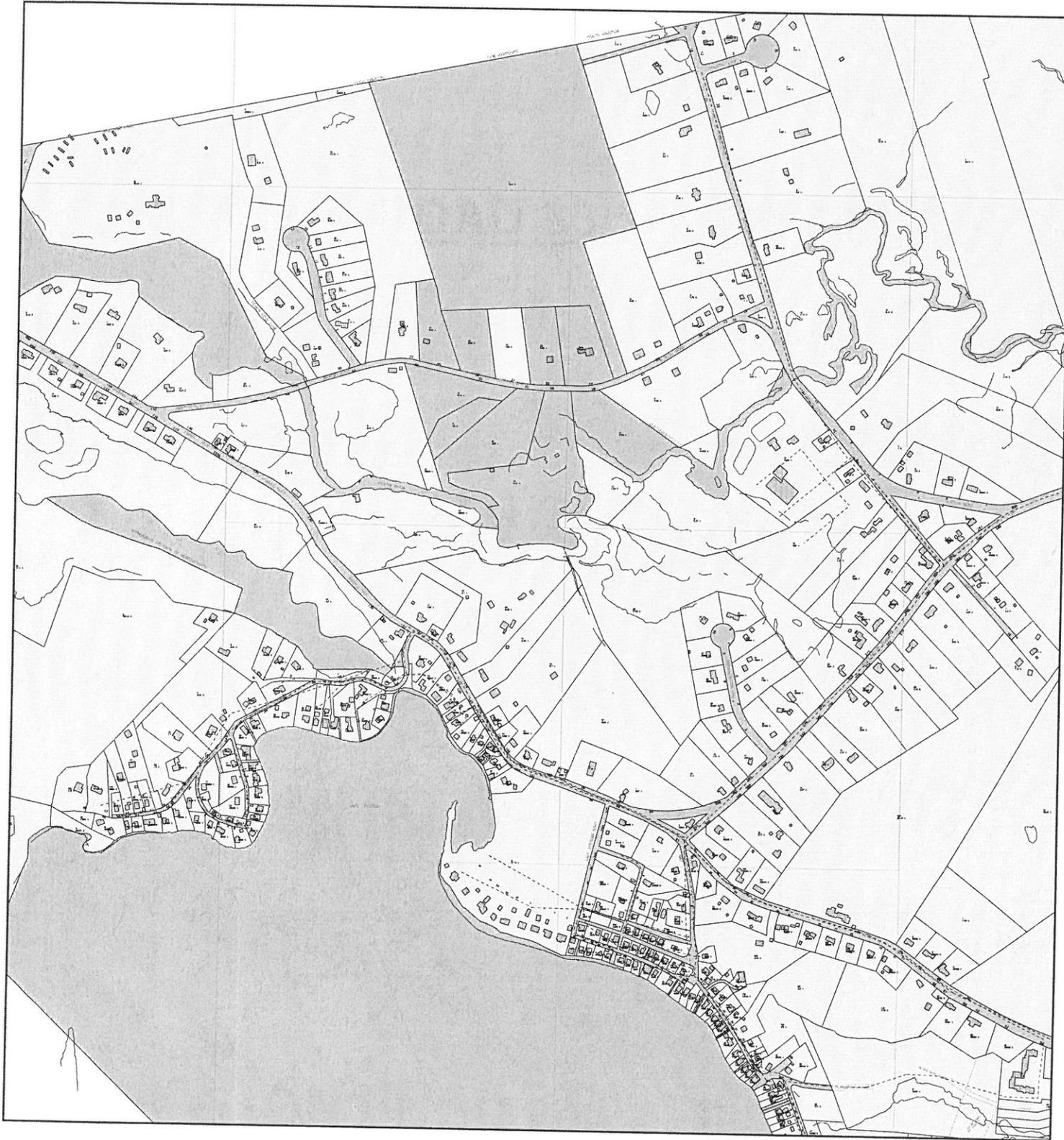
- B. Be designed to avoid substantial disturbance of soils, topography, drainage, vegetation and other water related natural characteristics of the site to be developed, in adherence to the practices outlined in "Guidelines for Soil and Water Conservation in Urbanizing Areas of Massachusetts"(USDA Soil Conservation Services, October 1977)(as amended).

The site has been designed to minimize impervious surfaces, land disturbance and vegetation removal in order to maximize preservation of existing natural features to the greatest extent practicable.

W.C. Cammett Engineering, Inc.

297 Elm Street ▲ Amesbury, Massachusetts 01913
Telephone: (978) 388-2157 ▲ Fax: (978) 388-0428
www.cammett.com

31 NEWTON ROAD 33/32 300 FT



Information on this Map is
Compiled and Maintained for
Assessing Purposes Only

GEOGRAPHIC INFORMATION SYSTEM
VISION APPRAISAL TECHNOLOGY



**ABUTTERS LISTING for 31 NEWTON RD 33/32 300 FT
AMESBURY, MA**

| AV PID | Map | Lot | Unit | Location | Owner's Name | Co_Owner's Name | Address | City | ST Zip | Book/Page |
|-----------|-----|-----|------|----------------|--------------------------------|--------------------------|--------------------|----------|----------|-------------|
| 5416 | 34 | 1 | | 25.5 NEWTON RD | EATON KEVIN S | | 22 NEWTON RD | AMESBURY | MA 01913 | 32835 / 579 |
| 5459 | 34 | 9 | | 26 NEWTON RD | AMESBURY CITY OF | | TOWN HALL | AMESBURY | MA 01913 | 06099/0546 |
| 101799 | 34 | 24 | | 27 NEWTON RD | CAROL L EATON ITEVOCABLE TRUST | RONALD A & KEVIN S EATON | (TRUS 27 NEWTON RD | AMESBURY | MA 01913 | 32835 / 575 |
| 5460 | 33 | 14 | | 28 NEWTON RD | AMESBURY CITY OF | WATER DEPT | TOWN HALL | AMESBURY | MA 01913 | |
| 101798 | 33 | 33 | | 29 NEWTON RD | EATON RONALD A | | 29 NEWTON RD | AMESBURY | MA 01913 | 18240 / 82 |
| 5461 | 33 | 15 | | 30 NEWTON RD | AMESBURY CITY OF | | TOWN HALL | AMESBURY | MA 01913 | 06099/0544 |
| 5407 | 33 | 10 | | 32 NEWTON RD | AMESBURY CITY OF | | TOWN HALL | AMESBURY | MA 01913 | 13094/0134 |
| 101796 | 33 | 31 | | 33 NEWTON RD | EATON KEVIN S | | 22 NEWTON RD | AMESBURY | MA 01913 | 32839 / 583 |
| 5462 | 33 | 11 | | 34 NEWTON RD | AMESBURY CITY OF | WATER DEPT | TOWN HALL | AMESBURY | MA 01913 | 12800 / 249 |
| 5435 | 33 | 17 | | 35 NEWTON RD | SIMMONS JAMES E JR | PATRICIA LEE SIMMONS T/E | PO BOX 138 | AMESBURY | MA 01913 | 32444 / 595 |

Parcel Count: 10

THE BOARD OF ASSESSORS OF THE TOWN OF
AMESBURY, MA HEREBY CERTIFIES THAT THIS
LIST OF ABUTTERS IS THE MOST RECENT
APPLICABLE TAX LIST AS REQUIRED BY CHAPTER
40A, SECTION 11 OF THE MASSACHUSETTS
GENERAL LAWS AS AMENDED

[Handwritten Signature]
11/11/20 20:11/11

5416
EATON KEVIN S
22 NEWTON RD
AMESBURY, MA 01913

5459
AMESBURY CITY OF
TOWN HALL
AMESBURY, MA 01913

101799
CAROL L EATON ITEVOCABLE TRUST
RONALD A & KEVIN S EATON
27 NEWTON RD
AMESBURY, MA 01913

5460
AMESBURY CITY OF
WATER DEPT
TOWN HALL
AMESBURY, MA 01913

101798
EATON RONALD A
29 NEWTON RD
AMESBURY, MA 01913

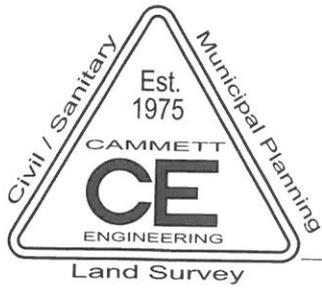
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AMESBURY CITY OF
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AMESBURY, MA 01913

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TOWN HALL
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101796
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AMESBURY CITY OF
WATER DEPT
TOWN HALL
AMESBURY, MA 01913

5435
SIMMONS JAMES E JR
PATRICIA LEE SIMMONS T/E
PO BOX 138
AMESBURY, MA 01913



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Robert B. Blanchette, PE, SIT
Robert E. Smith, PLS MA, NH
Denis Hamel, CPESC
Emily Fredette, EIT

Consulting Engineers and Land Surveyors

APPENDICIES

W.C. Cammett Engineering, Inc.
297 Elm Street ▲ Amesbury, Massachusetts 01913
Telephone: (978) 388-2157 ▲ Fax: (978) 388-0428
www.cammett.com

Stormwater Report & Calculations

Project #16025

**31 Newton Road
Amesbury, Ma.**

W.C. Cammett Engineering, Inc.
297 Elm Street - Amesbury, MA

July 2016

STORMWATER REPORT

Site Description

General

The 1.95± acre parcel is located at 31 Newton Road in Amesbury, Massachusetts. The parcel lies within R-80 zoning district and Water Resource Protection overlay district. The site, located at the base of Rings Hill, is covered by mostly woods and thick meadow. Existing slopes on the site are steep. The slopes begin at the street around 10% and increase to 20%+ moving uphill away from the street. Soils on the parcel are comprised of Hinckley loamy sand and Paxton fine sandy loam, very stony, which can be classified as hydrologic soil group A and group C, respectively. Refer to the Pre-Development Drainage Plan for a more detailed description of existing conditions.

Pre-Development Drainage Conditions

The site consists of one subcatchment area. Subcatchment-E1 is an overland flow tributary to the south that collects in a drainage ditch that runs parallel to the road. Runoff collected in the ditch flows from west to east and is then routed through a 12-inch diameter culvert that leads south under Newton Road, where it empties on the opposite side. Refer to the Pre-Development Drainage Plan and calculations for a more detailed description of subcatchment data.

Project Description

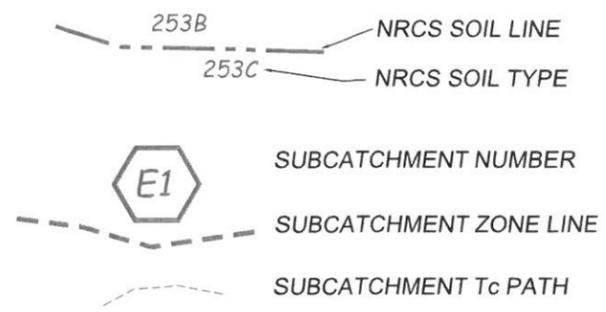
Proposed Site Enhancements

The proposed enhancements on the parcel include a 1,720 sf dwelling, 2,633 sf paved driveway, a sediment forebay, wet basin, and a subsurface infiltration basin. The total increase in impervious area is 3,833 square feet. Refer to the Post-Development Drainage Plan for more detail of the proposed work.

Post-Development Drainage Conditions

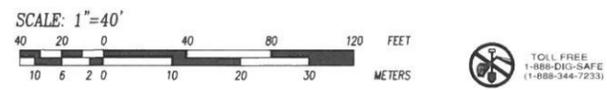
The proposed development which is creating impervious area on-site will be treated using a sediment forebay, wet basin, and a subsurface infiltration basin. A subsurface infiltration basin will be constructed to collect runoff from the impervious roof area of the proposed dwelling. A sediment forebay and wet basin will be constructed to collect runoff from the impervious surface of the proposed driveway. The forebay provides pretreatment by facilitating the gravity separation of suspended solids in the runoff before delivery to the wet basin. The wet basin additionally treats the stormwater by allowing sediments to settle in the permanent pool of water, as well as provides dry storage capacity to control peak discharge rates. The remainder of the property will be a combination of lawn area and existing woods. Refer to the Post-Development Drainage Plan and calculations for a more detailed description of subcatchment data.

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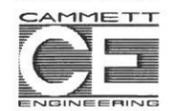


SOILS DATA

- 253D HINKLEY LOAMY SAND
15-25% SLOPES
HYDROLOGIC GROUP - A
- 306D PAXTON FINE SANDY LOAM
15-25% SLOPES
VERY STONY
HYDROLOGIC GROUP - C



FOR REGISTRY USE ONLY



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 LAND SURVEYORS SINCE 1975
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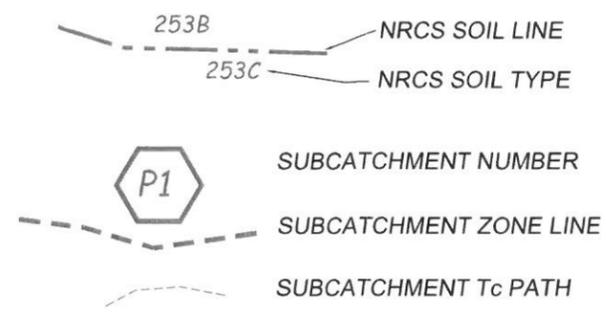
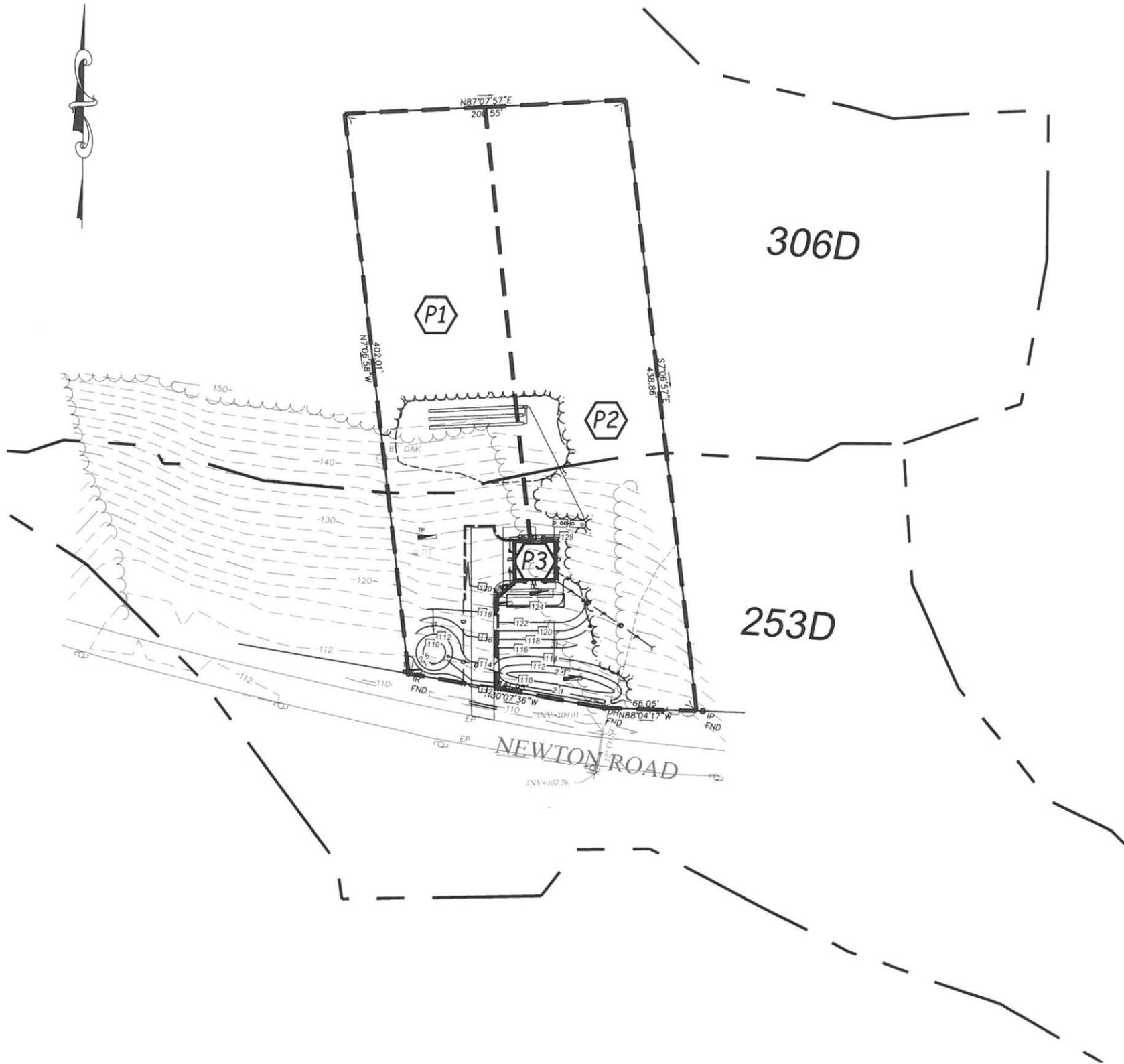
Sheet Title:
PRE-DEVELOPMENT DRAINAGE PLAN
 Project Title:
Special Permit
 31 Newton Road
 Amesbury, MA 01913
 Essex County

Applicant/Owner:
Hannah & Sean Stellmach
 23 Spindletree Road
 Amesbury, MA 01913

| REVISION | | | |
|----------|------|-------------|----|
| NO. | DATE | DESCRIPTION | BY |
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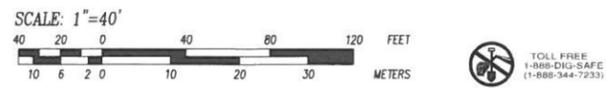
Date: _____
 PROJ. MGR: R. BLANCHETTE
 FIELD: M. MICHAUD / J. SALVAGGIO
 DESIGN: R. BLANCHETTE
 DRAWN: N. KOCH
 CHECKED: W. CAMMETT
 DATE: 7/5/16
 FILE: 16025 PRE-DEVELOPMENT.DWG
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 JOB #: 16025

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SOILS DATA

- 253D HINKLEY LOAMY SAND
15-25% SLOPES
HYDROLOGIC GROUP - A
- 306D PAXTON FINE SANDY LOAM
15-25% SLOPES
VERY STONY
HYDROLOGIC GROUP - C



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Sheet Title:
POST-DEVELOPMENT DRAINAGE PLAN
 Project Title:
Special Permit
 31 Newton Road
 Amesbury, MA 01913
 Essex County

Applicant/Owner:
Hannah & Sean Stellmach
 23 Spindletree Road
 Amesbury, MA 01913

| REVISION | | | |
|----------|------|-------------|----|
| NO. | DATE | DESCRIPTION | BY |
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Date: _____
 PROJ. MGR.: R. BLANCHETTE
 FIELD: M. MICHAUD / J. SALVAGGIO
 DESIGN: R. BLANCHETTE
 DRAWN: N. KOCH
 CHECKED: W. CAMMETT
 DATE: 7/5/16
 FILE: 16025 POST-DEVELOPMENT.DWG
 FBK:
 JOB #: 16025

ATTACHMENT TO CHECKLIST FOR STORMWATER REPORT

Sean and Hannah Stellmach
31 Newton Road
Amesbury, MA 01913

Standard 1: No New Untreated Discharges

This project does not involve the creation of any untreated stormwater discharge. The discharge from the driveway will be directed to the sediment forebay and wet basin.

Standard 2: Peak Rate Attenuation

Peak rate attenuation is provided through the use of the wet basin and subsurface infiltration basin. These measures will mitigate peak flow rates in the developed condition. The post-developed runoff rates remain similar to the rate found in existing site conditions to the maximum extent practical. See Summary Tables 1-3.

Table 1: Comparison of Peak Runoff - 2 Year Storm

| Site Condition Drainage Zone | Pre-Development (cfs) | Post-Development (cfs) |
|---------------------------------|--------------------------|---------------------------|
| Sub-1 | 0.00 | 0.00 |

Table 2: Comparison of Peak Runoff - 10 Year Storm

| Site Condition Drainage Zone | Pre-Development (cfs) | Post-Development (cfs) |
|---------------------------------|--------------------------|---------------------------|
| Sub-1 | 0.06 | 0.04 |

Table 3: Comparison of Peak Runoff - 100 Year Storm

| Site Condition Drainage Zone | Pre-Development (cfs) | Post-Development (cfs) |
|---------------------------------|--------------------------|---------------------------|
| Sub-1 | 0.62 | 0.64 |

Standard 3: Recharge

The post-developed site will have a total impervious area of 3,833 sf. The recharge volume required for this area will be fulfilled using a subsurface infiltration basin that will collect runoff from the impervious roof area of the proposed dwelling. Please see HydroCAD report for volumes.

Required Recharge Volume – HSG A Soil 0.60 – in

| | | |
|----------------|-------------------------|-------------------|
| Paved Driveway | 2,633 sf x 0.60 – in/12 | = 131.6 cf |
| Roof Area | 1,200 sf x 0.60 – in/12 | = 60.0 cf |
| TOTAL | | = 191.6 cf |

Recharge Volume Provided

Subsurface Infiltration Basin (See HydroCad report) = **261.4 cf**

261.4 cf provided > 191.6 cf required

Standard 4: Water Quality

W_{QV} = Water Quality Volume

I = total impervious area (including rooftop)

D = Required Water Quality Volume

$$W_{QV} = D \times I$$

D = 1.0" for discharges near or to other areas. I = .088 ac

$$W_{QV} = (1.0") \times (I \text{ Ac.}) = \underline{0.088} \text{ Ac.-in.}$$

$$\text{convert to Ac.-Ft.} = \underline{0.007} \text{ Ac.-Ft.}$$

Forebay provides: 0.016 Ac.-Ft.

Location: | 31 Newton Road, Amesbury, MA

TSS Removal Calculation Worksheet

| B BMP ¹ | C TSS Removal Rate ¹ | D Starting TSS Load* | E Amount Removed (C*D) | F Remaining Load (D-E) |
|-----------------------|---------------------------------------|----------------------------|------------------------------|------------------------------|
| Sediment Forebay | 0.25 | 1.00 | 0.25 | 0.75 |
| Wet Basin | 0.80 | 0.75 | 0.60 | 0.15 |
| | 0.00 | 0.15 | 0.00 | 0.15 |
| | 0.00 | 0.15 | 0.00 | 0.15 |
| | 0.00 | 0.15 | 0.00 | 0.15 |

Total TSS Removal =

| |
|-----|
| 85% |
|-----|

Project:
Prepared By:
Date:

Hannah & Sean Stellmach

N. Koch
7.1.2016

*Equals remaining load from previous BMP (E) which enters the BMP

Standard 5: LUHPPL's

This project is not a use that generates higher potential pollutant loads.

Standard 6: Critical Areas

This project does not discharge to any critical area.

Standard 7: Redevelopment

This project is not a redevelopment project.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan (CPPPESC Plan)

A Stormwater Pollution Prevention Plan (SWPPP) is not required due to disturbance equaling less than one acre of land.

Standard 9: Operation and Maintenance Plan

Refer to the attached Operation and Maintenance Plan.

Standard 10: Prohibition of Illicit Discharges

An illicit discharge statement is provided.

All illicit discharges to the stormwater management system are prohibited. These discharges include, but are not limited to, wastewater, stormwater contaminated by contact with process waste, raw materials, toxic pollutants, hazardous substances, oil, or grease. To my knowledge, there are no existing illicit discharges on the site.

I, Sean + Hannah Stelmach, hereby certify that I have read and understand that any illicit discharge to the stormwater management system is prohibited.

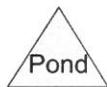
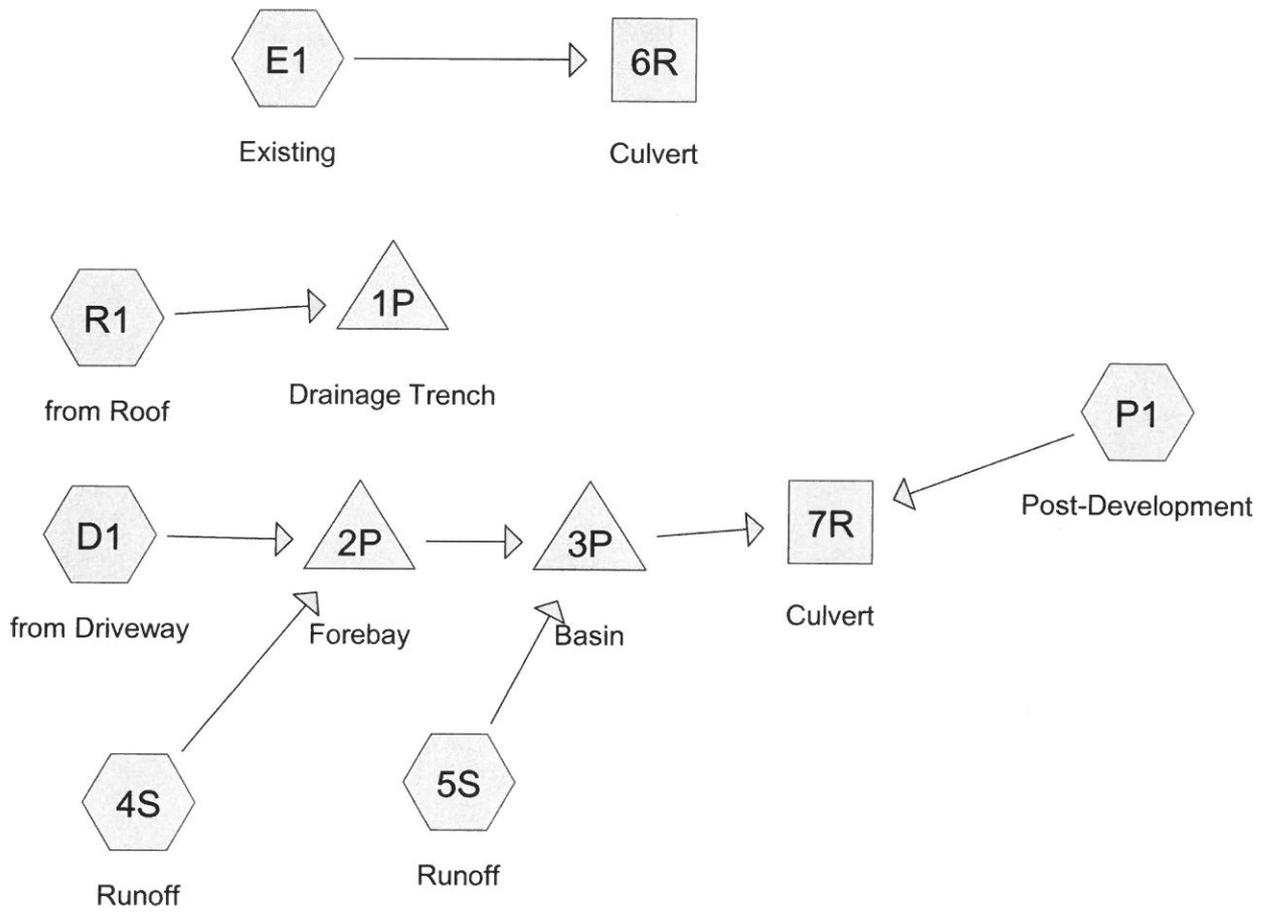
 Signature

6/30/16 Date

STORMWATER SUMMARY

Existing stormwater runoff drainage patterns will be generally unchanged under post-development conditions. Runoff water from the site will be diverted into a sediment forebay and basin to allow for water quality standards to be met and to maximize infiltration to attenuate to the increase in impervious surfaces and change in ground cover from meadow and woods to lawn. Post-development stormwater flows for the 2, 10 and 100-year storm events will remain the same or less than existing stormwater flows.

HydroCAD Calculations



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Page 2

Area Listing (all nodes)

| Area (acres) | CN | Description (subcatchment-numbers) |
|-----------------|-----------|--|
| 0.166 | 39 | >75% Grass cover, Good, HSG A (4S, 5S) |
| 1.123 | 30 | Meadow, non-grazed, HSG A (4S, 5S, E1, P1) |
| 0.217 | 71 | Meadow, non-grazed, HSG C (4S, E1) |
| 0.088 | 98 | Paved parking, HSG A (D1, P1, R1) |
| 0.271 | 30 | Woods, Good, HSG A (E1) |
| 0.386 | 70 | Woods, Good, HSG C (5S, E1, P1) |
| 2.251 | 44 | TOTAL AREA |

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Soil Listing (all nodes)

| Area (acres) | Soil Group | Subcatchment Numbers |
|-----------------|---------------|-------------------------|
| 1.648 | HSG A | 4S, 5S, D1, E1, P1, R1 |
| 0.000 | HSG B | |
| 0.602 | HSG C | 4S, 5S, E1, P1 |
| 0.000 | HSG D | |
| 0.000 | Other | |
| 2.251 | | TOTAL AREA |

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Ground Covers (all nodes)

| HSG-A (acres) | HSG-B (acres) | HSG-C (acres) | HSG-D (acres) | Other (acres) | Total (acres) | Ground Cover | Subcatchment Numbers |
|------------------|------------------|------------------|------------------|------------------|------------------|------------------------|-------------------------|
| 0.166 | 0.000 | 0.000 | 0.000 | 0.000 | 0.166 | >75% Grass cover, Good | 4S, 5S |
| 1.123 | 0.000 | 0.217 | 0.000 | 0.000 | 1.340 | Meadow, non-grazed | 4S, 5S, E1, P1 |
| 0.088 | 0.000 | 0.000 | 0.000 | 0.000 | 0.088 | Paved parking | D1, P1, R1 |
| 0.271 | 0.000 | 0.386 | 0.000 | 0.000 | 0.657 | Woods, Good | 5S, E1, P1 |
| 1.648 | 0.000 | 0.602 | 0.000 | 0.000 | 2.251 | TOTAL AREA | |

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Pipe Listing (all nodes)

| Line# | Node Number | In-Invert (feet) | Out-Invert (feet) | Length (feet) | Slope (ft/ft) | n | Diam/Width (inches) | Height (inches) | Inside-Fill (inches) |
|-------|-------------|------------------|-------------------|---------------|---------------|-------|---------------------|-----------------|----------------------|
| 1 | 6R | 109.00 | 107.80 | 30.0 | 0.0400 | 0.010 | 12.0 | 0.0 | 0.0 |
| 2 | 7R | 109.00 | 107.80 | 30.0 | 0.0400 | 0.010 | 12.0 | 0.0 | 0.0 |
| 3 | 1P | 124.00 | 123.00 | 100.0 | 0.0100 | 0.010 | 4.0 | 0.0 | 0.0 |

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Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

| | |
|--|--|
| Subcatchment 4S: Runoff | Runoff Area=12,317 sf 0.00% Impervious Runoff Depth>0.15" Tc=0.0 min CN=52 Runoff=0.01 cfs 0.004 af |
| Subcatchment 5S: Runoff | Runoff Area=21,735 sf 0.00% Impervious Runoff Depth>0.03" Tc=0.0 min CN=45 Runoff=0.00 cfs 0.001 af |
| Subcatchment D1: from Driveway | Runoff Area=2,260 sf 100.00% Impervious Runoff Depth>2.87" Tc=6.0 min CN=98 Runoff=0.15 cfs 0.012 af |
| Subcatchment E1: Existing | Runoff Area=49,019 sf 0.00% Impervious Runoff Depth>0.00" Flow Length=145' Tc=6.0 min CN=41 Runoff=0.00 cfs 0.000 af |
| Subcatchment P1: Post-Development | Runoff Area=11,507 sf 3.24% Impervious Runoff Depth=0.00" Flow Length=145' Tc=6.0 min CN=33 Runoff=0.00 cfs 0.000 af |
| Subcatchment R1: from Roof | Runoff Area=1,200 sf 100.00% Impervious Runoff Depth>2.87" Tc=6.0 min CN=98 Runoff=0.08 cfs 0.007 af |
| Reach 6R: Culvert | Avg. Flow Depth=0.01' Max Vel=1.05 fps Inflow=0.00 cfs 0.000 af 12.0" Round Pipe n=0.010 L=30.0' S=0.0400 ' Capacity=9.26 cfs Outflow=0.00 cfs 0.000 af |
| Reach 7R: Culvert | Avg. Flow Depth=0.00' Max Vel=0.00 fps Inflow=0.00 cfs 0.000 af 12.0" Round Pipe n=0.010 L=30.0' S=0.0400 ' Capacity=9.26 cfs Outflow=0.00 cfs 0.000 af |
| Pond 1P: Drainage Trench | Peak Elev=123.53' Storage=0.001 af Inflow=0.08 cfs 0.007 af Discarded=0.02 cfs 0.007 af Primary=0.00 cfs 0.000 af Outflow=0.02 cfs 0.007 af |
| Pond 2P: Forebay | Peak Elev=111.51' Storage=494 cf Inflow=0.15 cfs 0.016 af Outflow=0.01 cfs 0.005 af |
| Pond 3P: Basin | Peak Elev=110.84' Storage=564 cf Inflow=0.01 cfs 0.006 af Outflow=0.00 cfs 0.000 af |

Total Runoff Area = 2.251 ac Runoff Volume = 0.024 af Average Runoff Depth = 0.13"
96.09% Pervious = 2.163 ac 3.91% Impervious = 0.088 ac

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Summary for Subcatchment 4S: Runoff

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

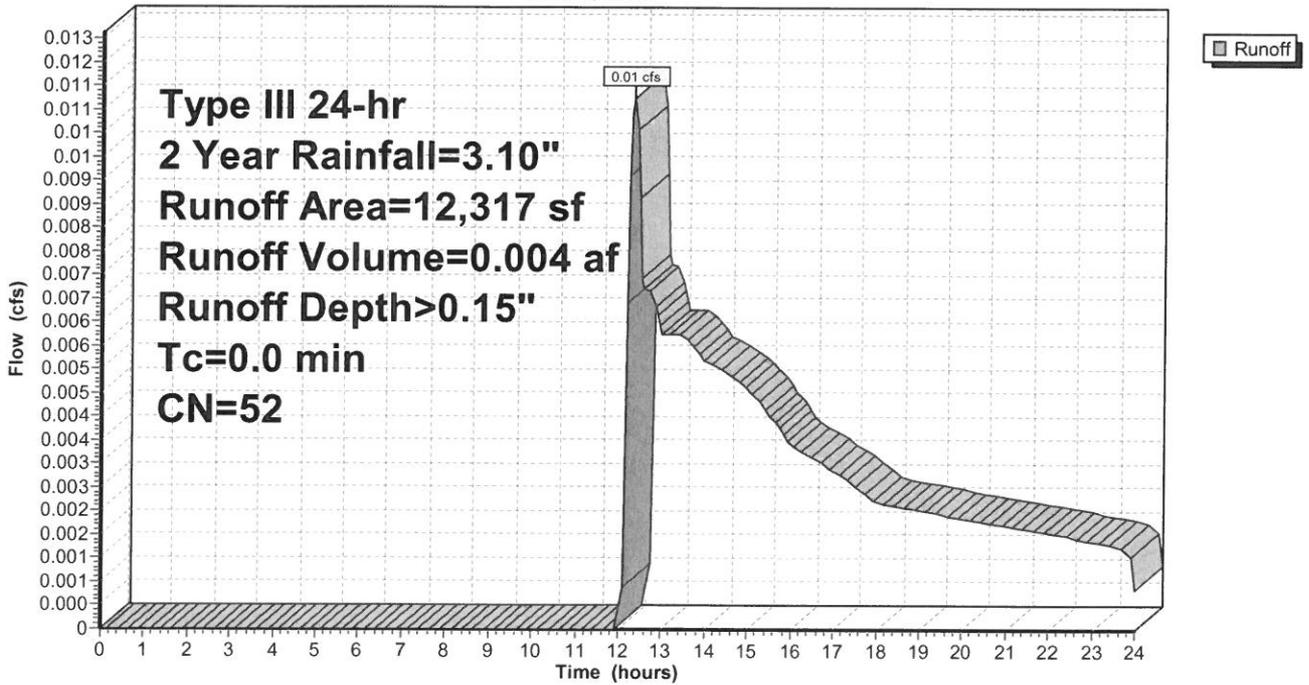
Runoff = 0.01 cfs @ 12.34 hrs, Volume= 0.004 af, Depth> 0.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.10"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 3,726 | 30 | Meadow, non-grazed, HSG A |
| 5,860 | 71 | Meadow, non-grazed, HSG C |
| 2,731 | 39 | >75% Grass cover, Good, HSG A |
| 12,317 | 52 | Weighted Average |
| 12,317 | | 100.00% Pervious Area |

Subcatchment 4S: Runoff

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Summary for Subcatchment D1: from Driveway

Runoff = 0.15 cfs @ 12.09 hrs, Volume= 0.012 af, Depth> 2.87"

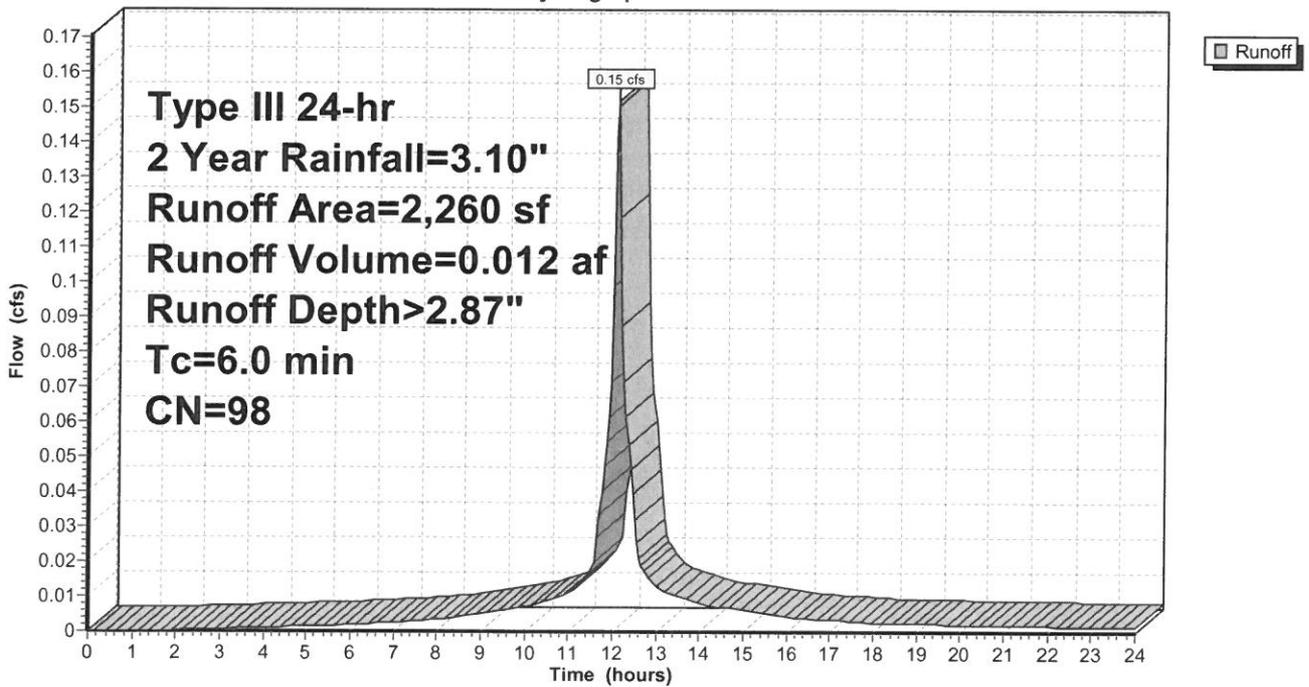
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.10"

| Area (sf) | CN | Description |
|-----------|----|-------------------------|
| 2,260 | 98 | Paved parking, HSG A |
| 2,260 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------|
| 6.0 | | | | | Direct Entry, |

Subcatchment D1: from Driveway

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Summary for Subcatchment E1: Existing

[73] Warning: Peak may fall outside time span

Runoff = 0.00 cfs @ 23.77 hrs, Volume= 0.000 af, Depth> 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.10"

| Area (sf) | CN | Description |
|-----------|----|---------------------------|
| 11,821 | 30 | Woods, Good, HSG A |
| 24,080 | 30 | Meadow, non-grazed, HSG A |
| 3,578 | 71 | Meadow, non-grazed, HSG C |
| 9,540 | 70 | Woods, Good, HSG C |
| 49,019 | 41 | Weighted Average |
| 49,019 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|--|-------------------|----------------|--|
| 3.3 | 50 | 0.1950 | 0.25 | | Sheet Flow, first 50 Grass: Dense n= 0.240 P2= 3.10" |
| 0.1 | 45 | 0.1950 | 7.11 | | Shallow Concentrated Flow, Unpaved Kv= 16.1 fps |
| 0.1 | 50 | 0.1540 | 6.32 | | Shallow Concentrated Flow, Unpaved Kv= 16.1 fps |
| 3.5 | 145 | Total, Increased to minimum Tc = 6.0 min | | | |

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Summary for Subcatchment P1: Post-Development

[45] Hint: Runoff=Zero

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

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.10"

| Area (sf) | CN | Description |
|-----------|----|---------------------------|
| 373 | 98 | Paved parking, HSG A |
| 10,871 | 30 | Meadow, non-grazed, HSG A |
| 263 | 70 | Woods, Good, HSG C |
| 11,507 | 33 | Weighted Average |
| 11,134 | | 96.76% Pervious Area |
| 373 | | 3.24% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|--|-------------------|----------------|--|
| 3.3 | 50 | 0.1950 | 0.25 | | Sheet Flow, first 50 Grass: Dense n= 0.240 P2= 3.10" |
| 0.1 | 45 | 0.1950 | 7.11 | | Shallow Concentrated Flow, Unpaved Kv= 16.1 fps |
| 0.1 | 50 | 0.1540 | 6.32 | | Shallow Concentrated Flow, Unpaved Kv= 16.1 fps |
| 3.5 | 145 | Total, Increased to minimum Tc = 6.0 min | | | |

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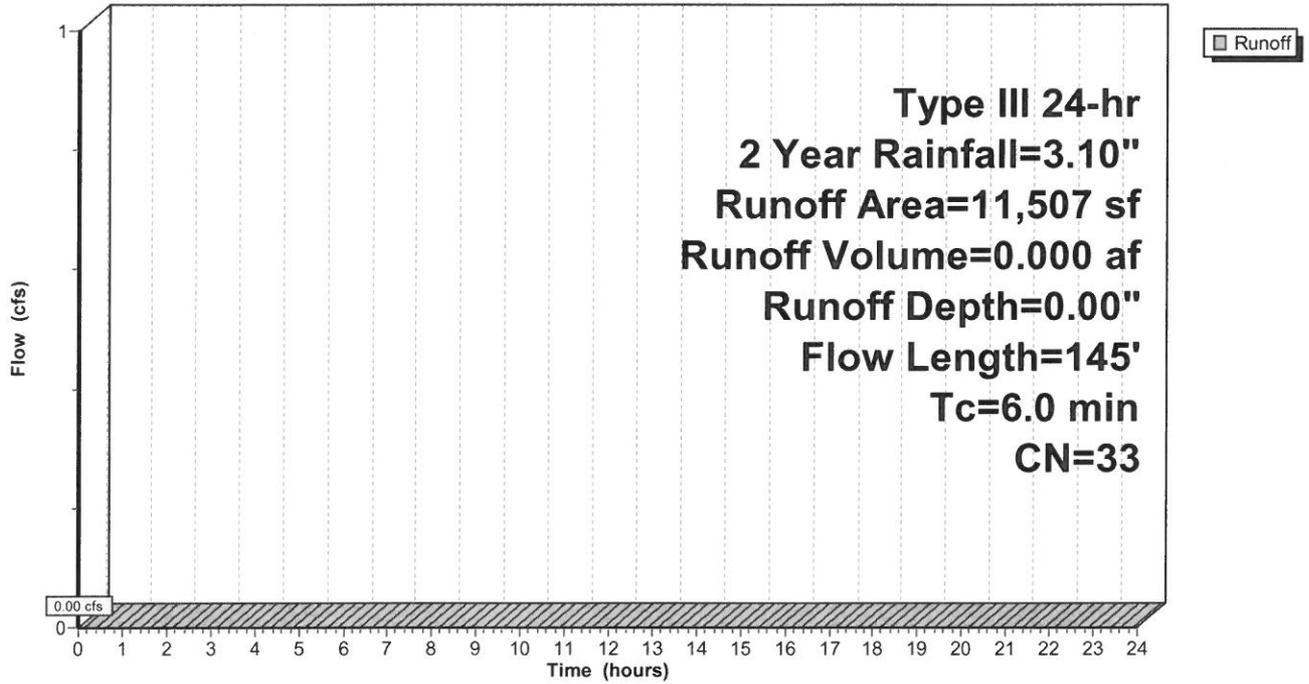
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Subcatchment P1: Post-Development

Hydrograph



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Summary for Subcatchment R1: from Roof

Runoff = 0.08 cfs @ 12.09 hrs, Volume= 0.007 af, Depth> 2.87"

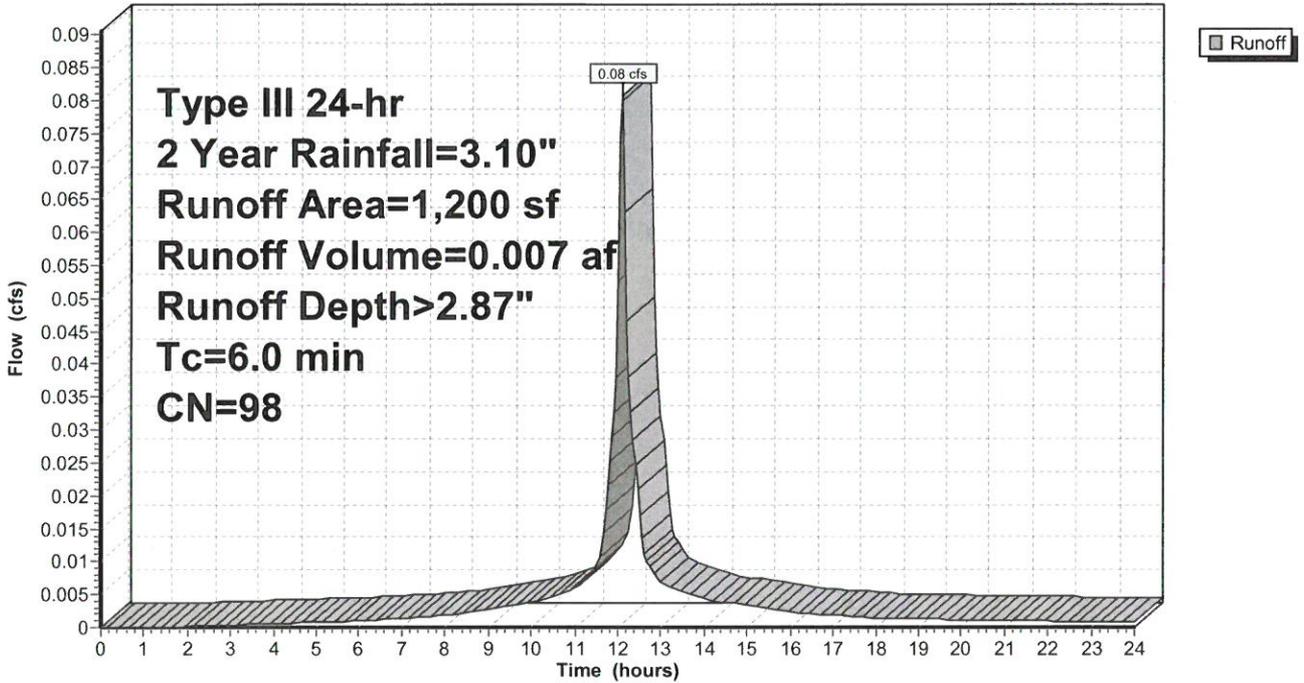
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Rainfall=3.10"

| Area (sf) | CN | Description |
|-----------|----|-------------------------|
| 1,200 | 98 | Paved parking, HSG A |
| 1,200 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------|
| 6.0 | | | | | Direct Entry, |

Subcatchment R1: from Roof

Hydrograph



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Summary for Reach 6R: Culvert

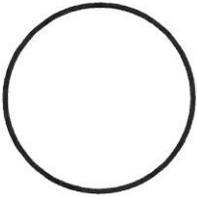
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 1.125 ac, 0.00% Impervious, Inflow Depth > 0.00" for 2 Year event
Inflow = 0.00 cfs @ 23.77 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 23.78 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.05 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 1.05 fps, Avg. Travel Time= 0.5 min

Peak Storage= 0 cf @ 23.78 hrs
Average Depth at Peak Storage= 0.01'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 9.26 cfs

12.0" Round Pipe
n= 0.010 PVC, smooth interior
Length= 30.0' Slope= 0.0400 '/'
Inlet Invert= 109.00', Outlet Invert= 107.80'



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Summary for Reach 7R: Culvert

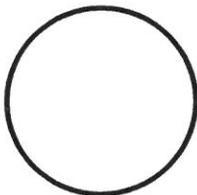
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 1.098 ac, 5.51% Impervious, Inflow Depth = 0.00" for 2 Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 9.26 cfs

12.0" Round Pipe
n= 0.010 PVC, smooth interior
Length= 30.0' Slope= 0.0400 '/'
Inlet Invert= 109.00', Outlet Invert= 107.80'



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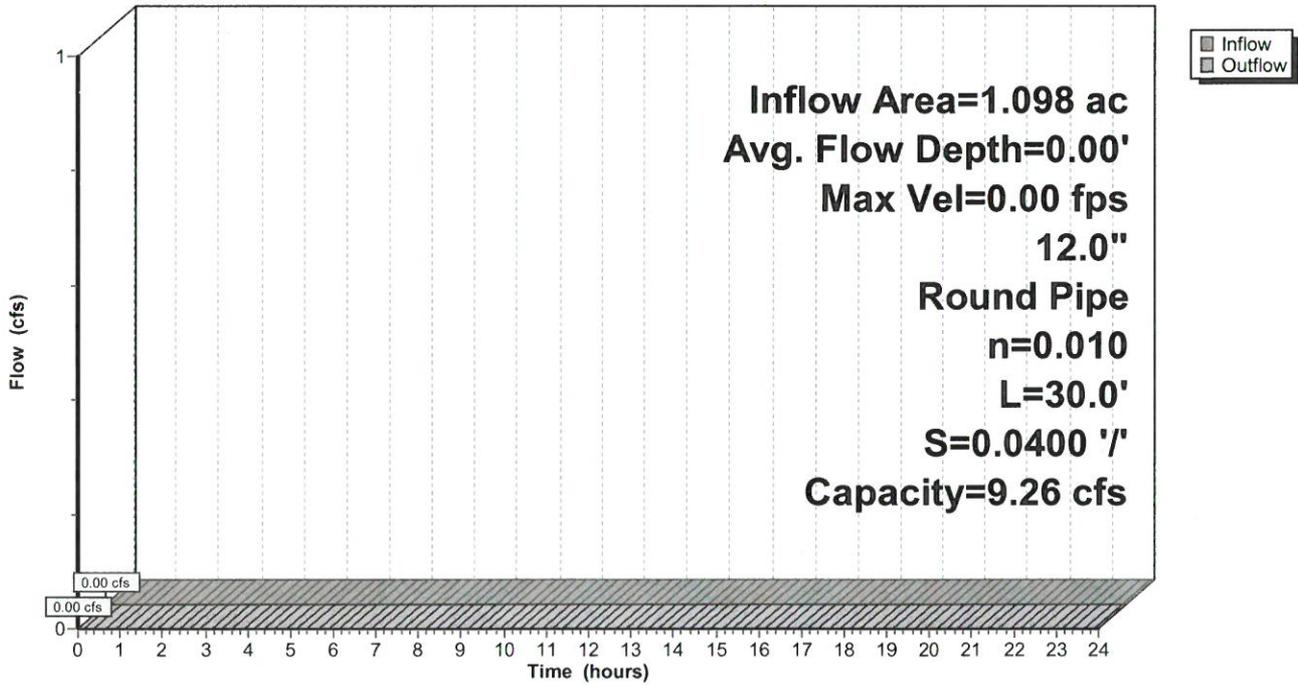
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Reach 7R: Culvert

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Summary for Pond 1P: Drainage Trench

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=98)

Inflow Area = 0.028 ac, 100.00% Impervious, Inflow Depth > 2.87" for 2 Year event
 Inflow = 0.08 cfs @ 12.09 hrs, Volume= 0.007 af
 Outflow = 0.02 cfs @ 12.44 hrs, Volume= 0.007 af, Atten= 73%, Lag= 21.3 min
 Discarded = 0.02 cfs @ 12.44 hrs, Volume= 0.007 af
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Peak Elev= 123.53' @ 12.44 hrs Surf.Area= 0.006 ac Storage= 0.001 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 14.6 min (771.3 - 756.6)

| Volume | Invert | Avail.Storage | Storage Description |
|--------|---------|---------------|---|
| #1A | 123.00' | 0.004 af | 6.78'W x 41.33'L x 1.88'H Field A 0.012 af Overall - 0.003 af Embedded = 0.009 af x 40.0% Voids |
| #2A | 123.33' | 0.002 af | ADS N-12 12 x 6 Inside #1 Inside= 12.2"W x 12.2"H => 0.81 sf x 20.00'L = 16.2 cf Outside= 14.5"W x 14.5"H => 1.05 sf x 20.00'L = 20.9 cf 3 Rows of 2 Chambers |
| | | 0.006 af | Total Available Storage |

Storage Group A created with Chamber Wizard

| Device | Routing | Invert | Outlet Devices |
|--------|-----------|---------|--|
| #1 | Primary | 124.00' | 4.0" Round Culvert L= 100.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 124.00' / 123.00' S= 0.0100 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.09 sf |
| #2 | Discarded | 123.00' | 2.410 in/hr Exfiltration over Wetted area Conductivity to Groundwater Elevation = 120.00' |

Discarded OutFlow Max=0.02 cfs @ 12.44 hrs HW=123.53' (Free Discharge)
 ↳ **2=Exfiltration** (Controls 0.02 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=123.00' (Free Discharge)
 ↳ **1=Culvert** (Controls 0.00 cfs)

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Pond 1P: Drainage Trench - Chamber Wizard Field A

Chamber Model = ADS N-12 12 (ADS N-12® Pipe)

Inside= 12.2"W x 12.2"H => 0.81 sf x 20.00'L = 16.2 cf

Outside= 14.5"W x 14.5"H => 1.05 sf x 20.00'L = 20.9 cf

14.5" Wide + 10.9" Spacing = 25.4" C-C Row Spacing

2 Chambers/Row x 20.00' Long = 40.00' Row Length +8.0" End Stone x 2 = 41.33' Base Length

3 Rows x 14.5" Wide + 10.9" Spacing x 2 + 8.0" Side Stone x 2 = 6.78' Base Width

4.0" Base + 14.5" Chamber Height + 4.0" Cover = 1.88' Field Height

6 Chambers x 16.2 cf = 97.2 cf Chamber Storage

6 Chambers x 20.9 cf = 125.6 cf Displacement

525.3 cf Field - 125.6 cf Chambers = 399.7 cf Stone x 40.0% Voids = 159.9 cf Stone Storage

Chamber Storage + Stone Storage = 257.1 cf = 0.006 af

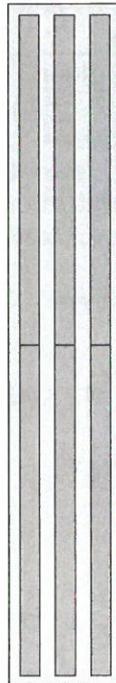
Overall Storage Efficiency = 48.9%

Overall System Size = 41.33' x 6.78' x 1.88'

6 Chambers

19.5 cy Field

14.8 cy Stone



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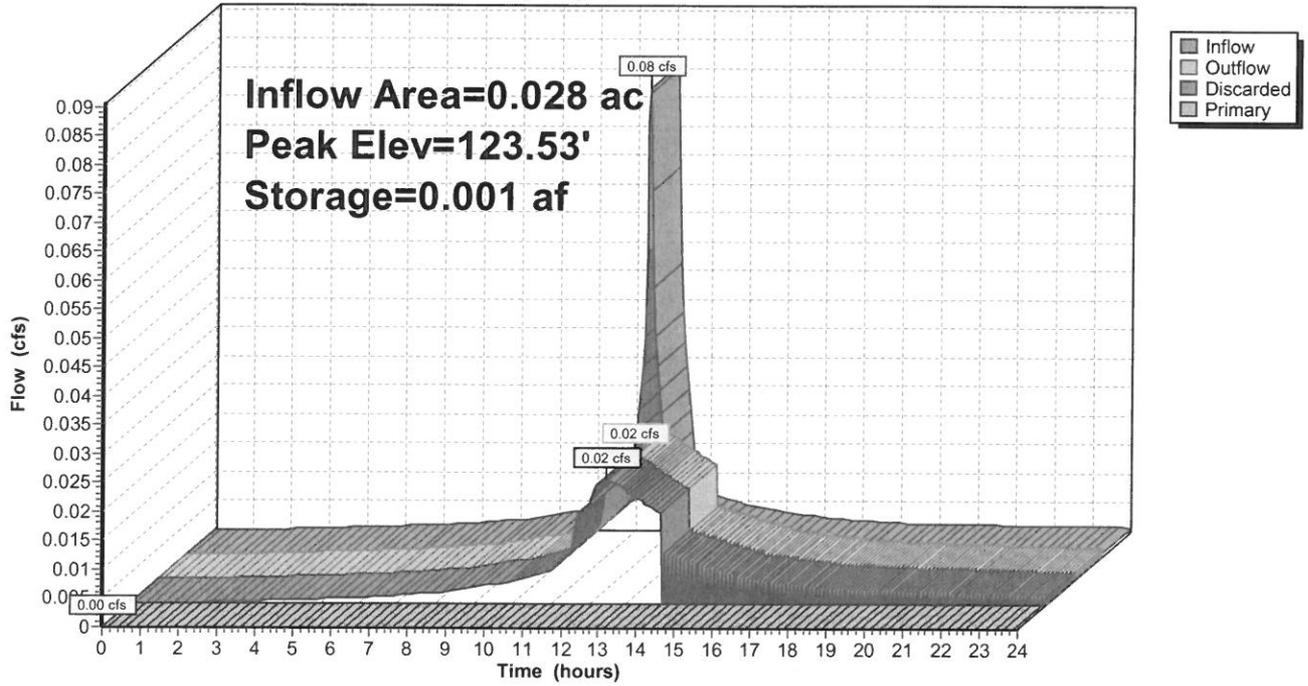
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Pond 1P: Drainage Trench

Hydrograph



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Summary for Pond 2P: Forebay

Inflow Area = 0.335 ac, 15.50% Impervious, Inflow Depth > 0.57" for 2 Year event
 Inflow = 0.15 cfs @ 12.09 hrs, Volume= 0.016 af
 Outflow = 0.01 cfs @ 14.74 hrs, Volume= 0.005 af, Atten= 92%, Lag= 158.9 min
 Primary = 0.01 cfs @ 14.74 hrs, Volume= 0.005 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Peak Elev= 111.51' @ 14.74 hrs Surf.Area= 451 sf Storage= 494 cf

Plug-Flow detention time= 482.3 min calculated for 0.005 af (29% of inflow)
 Center-of-Mass det. time= 277.9 min (1,086.0 - 808.1)

| Volume | Invert | Avail.Storage | Storage Description |
|--------|---------|---------------|--|
| #1 | 110.00' | 1,022 cf | Custom Stage Data (Prismatic) Listed below (Recalc) |

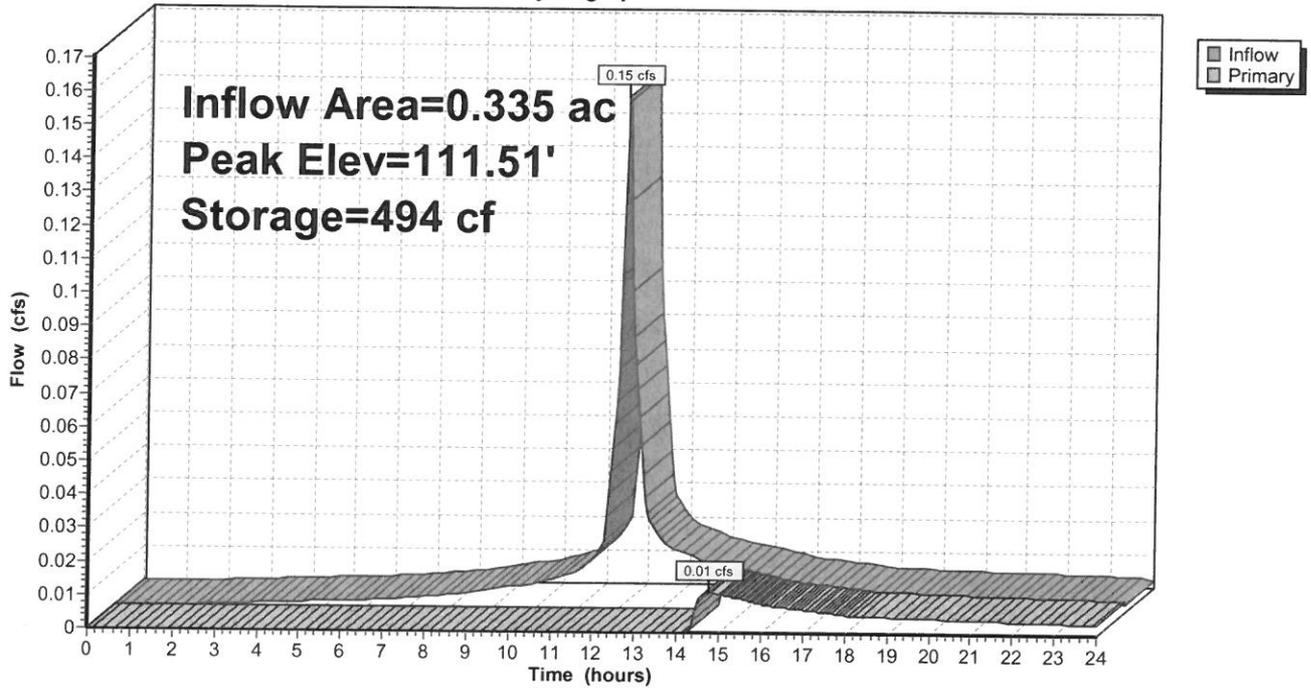
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---------------------|----------------------|---------------------------|---------------------------|
| 110.00 | 201 | 0 | 0 |
| 112.00 | 531 | 732 | 732 |
| 112.50 | 627 | 290 | 1,022 |

| Device | Routing | Invert | Outlet Devices |
|--------|---------|---------|---|
| #1 | Primary | 111.50' | 8.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads |

Primary OutFlow Max=0.01 cfs @ 14.74 hrs HW=111.51' TW=110.53' (Dynamic Tailwater)
 ↑**1=Orifice/Grate** (Weir Controls 0.01 cfs @ 0.39 fps)

Pond 2P: Forebay

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Summary for Pond 3P: Basin

Inflow Area = 0.834 ac, 6.22% Impervious, Inflow Depth > 0.09" for 2 Year event
 Inflow = 0.01 cfs @ 14.77 hrs, Volume= 0.006 af
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Starting Elev= 110.50' Surf.Area= 708 sf Storage= 299 cf
 Peak Elev= 110.84' @ 24.00 hrs Surf.Area= 855 sf Storage= 564 cf (264 cf above start)
 Flood Elev= 112.50' Surf.Area= 1,578 sf Storage= 2,585 cf (2,285 cf above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
 Center-of-Mass det. time= (not calculated: no outflow)

| Volume | Invert | Avail.Storage | Storage Description |
|--------|---------|---------------|--|
| #1 | 110.00' | 2,585 cf | Custom Stage Data (Prismatic) Listed below (Recalc) |

| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---------------------|----------------------|---------------------------|---------------------------|
| 110.00 | 490 | 0 | 0 |
| 112.00 | 1,360 | 1,850 | 1,850 |
| 112.50 | 1,578 | 735 | 2,585 |

| Device | Routing | Invert | Outlet Devices |
|--------|---------|---------|--|
| #1 | Primary | 111.50' | 4.0' long x 2.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32 |

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=110.50' TW=109.00' (Dynamic Tailwater)
 ↑1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

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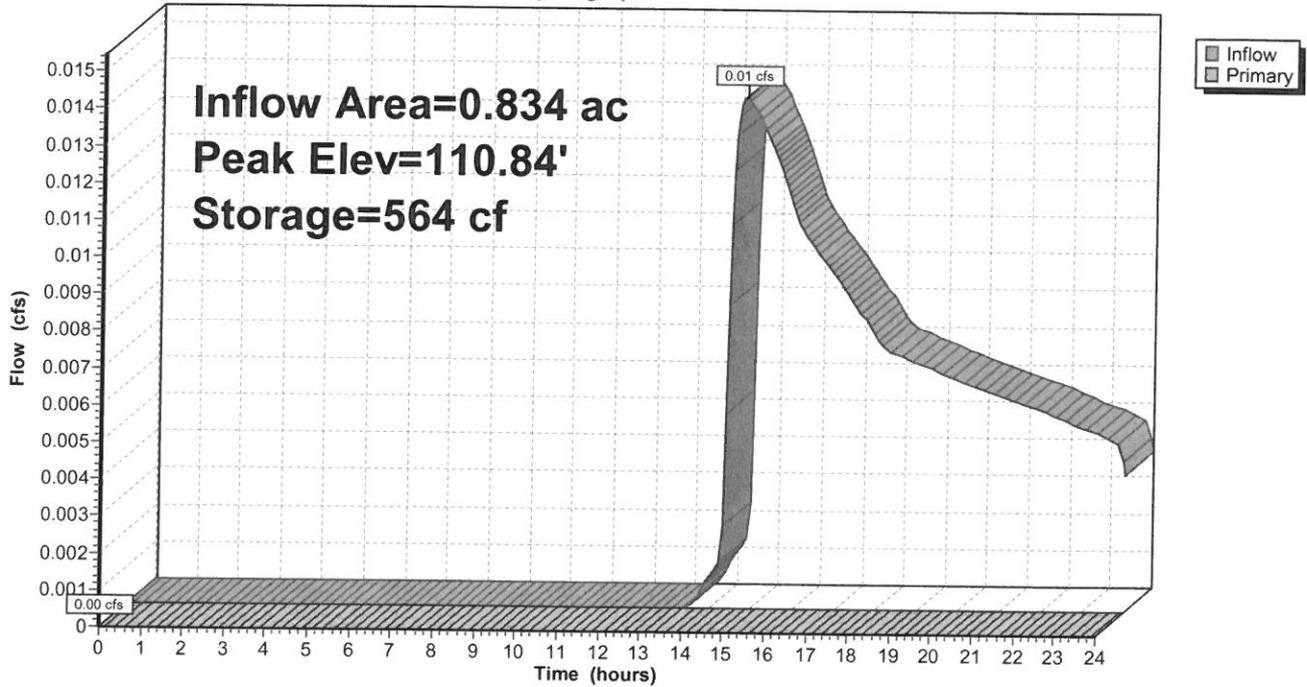
31 Newton Road
Type III 24-hr 2 Year Rainfall=3.10"

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Pond 3P: Basin

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Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

| | |
|--|--|
| Subcatchment 4S: Runoff | Runoff Area=12,317 sf 0.00% Impervious Runoff Depth>0.69" Tc=0.0 min CN=52 Runoff=0.17 cfs 0.016 af |
| Subcatchment 5S: Runoff | Runoff Area=21,735 sf 0.00% Impervious Runoff Depth>0.37" Tc=0.0 min CN=45 Runoff=0.08 cfs 0.015 af |
| Subcatchment D1: from Driveway | Runoff Area=2,260 sf 100.00% Impervious Runoff Depth>4.51" Tc=6.0 min CN=98 Runoff=0.24 cfs 0.020 af |
| Subcatchment E1: Existing | Runoff Area=49,019 sf 0.00% Impervious Runoff Depth>0.21" Flow Length=145' Tc=6.0 min CN=41 Runoff=0.06 cfs 0.020 af |
| Subcatchment P1: Post-Development | Runoff Area=11,507 sf 3.24% Impervious Runoff Depth>0.02" Flow Length=145' Tc=6.0 min CN=33 Runoff=0.00 cfs 0.000 af |
| Subcatchment R1: from Roof | Runoff Area=1,200 sf 100.00% Impervious Runoff Depth>4.51" Tc=6.0 min CN=98 Runoff=0.12 cfs 0.010 af |
| Reach 6R: Culvert | Avg. Flow Depth=0.06' Max Vel=3.27 fps Inflow=0.06 cfs 0.020 af 12.0" Round Pipe n=0.010 L=30.0' S=0.0400 '/' Capacity=9.26 cfs Outflow=0.06 cfs 0.020 af |
| Reach 7R: Culvert | Avg. Flow Depth=0.05' Max Vel=3.04 fps Inflow=0.04 cfs 0.019 af 12.0" Round Pipe n=0.010 L=30.0' S=0.0400 '/' Capacity=9.26 cfs Outflow=0.04 cfs 0.019 af |
| Pond 1P: Drainage Trench | Peak Elev=123.87' Storage=0.003 af Inflow=0.12 cfs 0.010 af Discarded=0.03 cfs 0.010 af Primary=0.00 cfs 0.000 af Outflow=0.03 cfs 0.010 af |
| Pond 2P: Forebay | Peak Elev=111.61' Storage=539 cf Inflow=0.39 cfs 0.036 af Outflow=0.26 cfs 0.025 af |
| Pond 3P: Basin | Peak Elev=111.53' Storage=1,255 cf Inflow=0.33 cfs 0.040 af Outflow=0.04 cfs 0.018 af |

Total Runoff Area = 2.251 ac Runoff Volume = 0.082 af Average Runoff Depth = 0.44"
96.09% Pervious = 2.163 ac 3.91% Impervious = 0.088 ac

Summary for Subcatchment 4S: Runoff

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

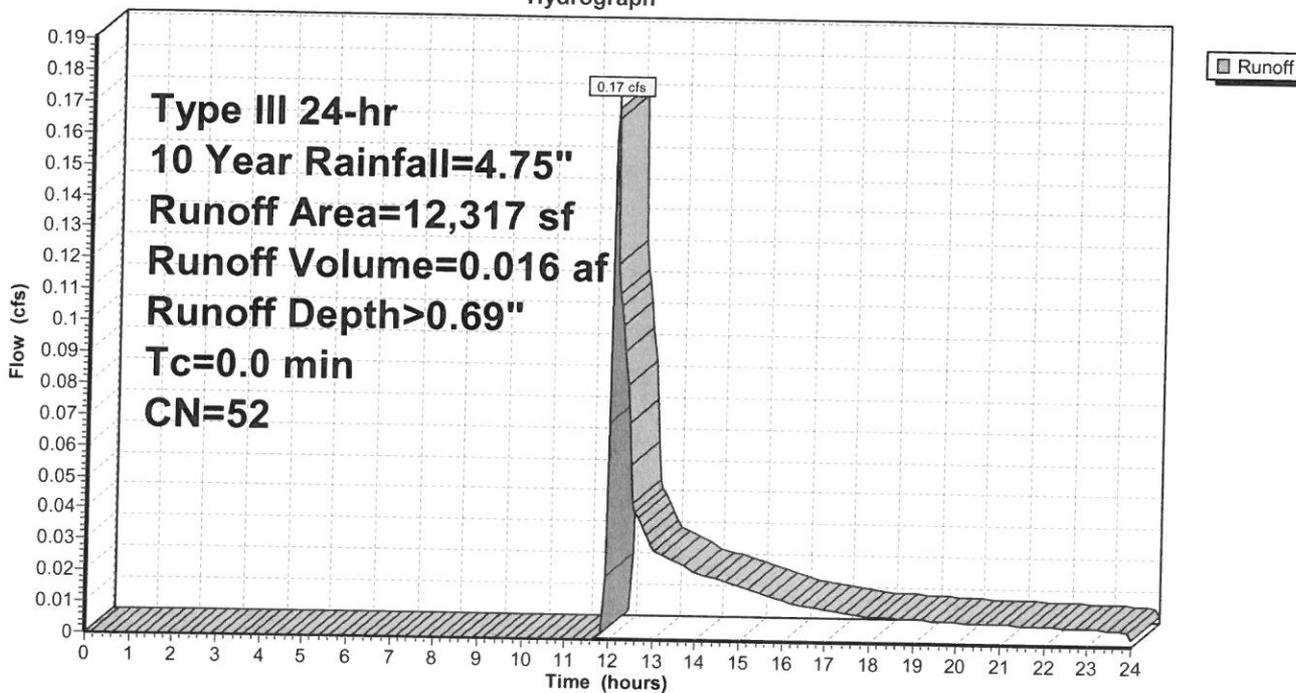
Runoff = 0.17 cfs @ 12.03 hrs, Volume= 0.016 af, Depth> 0.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=4.75"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 3,726 | 30 | Meadow, non-grazed, HSG A |
| 5,860 | 71 | Meadow, non-grazed, HSG C |
| 2,731 | 39 | >75% Grass cover, Good, HSG A |
| 12,317 | 52 | Weighted Average |
| 12,317 | | 100.00% Pervious Area |

Subcatchment 4S: Runoff

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Summary for Subcatchment 5S: Runoff

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

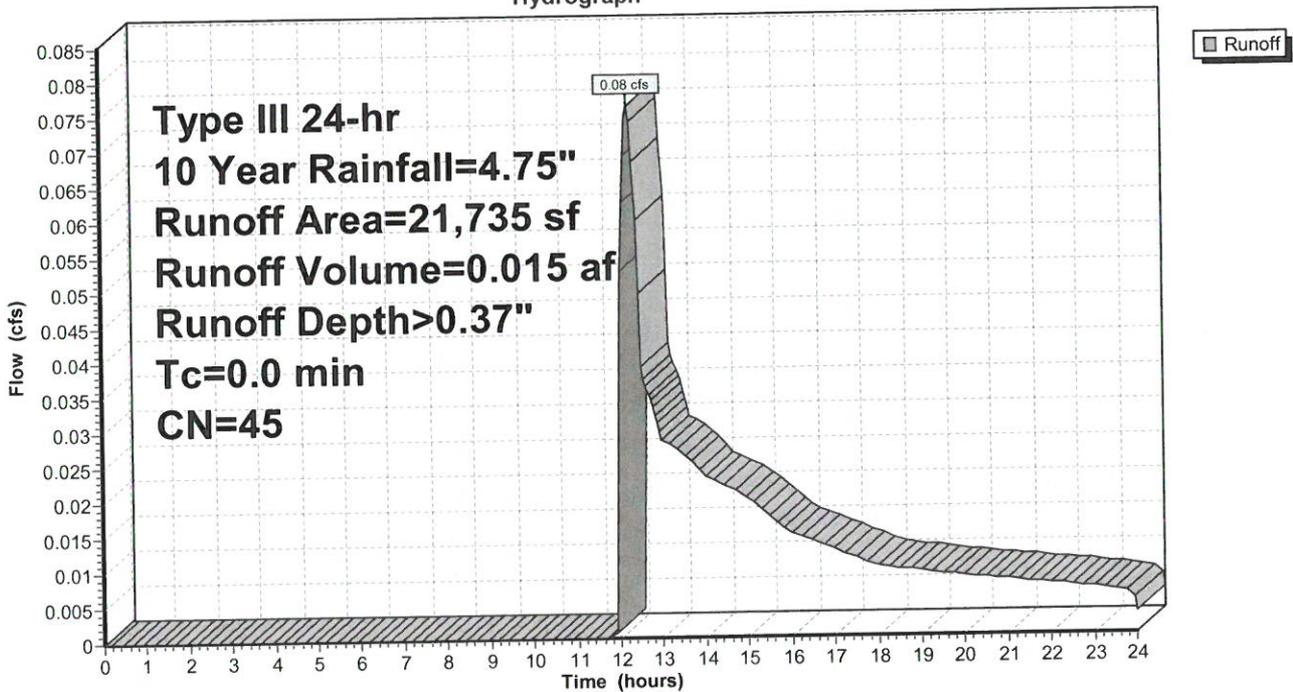
Runoff = 0.08 cfs @ 12.24 hrs, Volume= 0.015 af, Depth> 0.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=4.75"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 6,999 | 70 | Woods, Good, HSG C |
| 10,251 | 30 | Meadow, non-grazed, HSG A |
| 4,485 | 39 | >75% Grass cover, Good, HSG A |
| 21,735 | 45 | Weighted Average |
| 21,735 | | 100.00% Pervious Area |

Subcatchment 5S: Runoff

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Summary for Subcatchment D1: from Driveway

Runoff = 0.24 cfs @ 12.09 hrs, Volume= 0.020 af, Depth> 4.51"

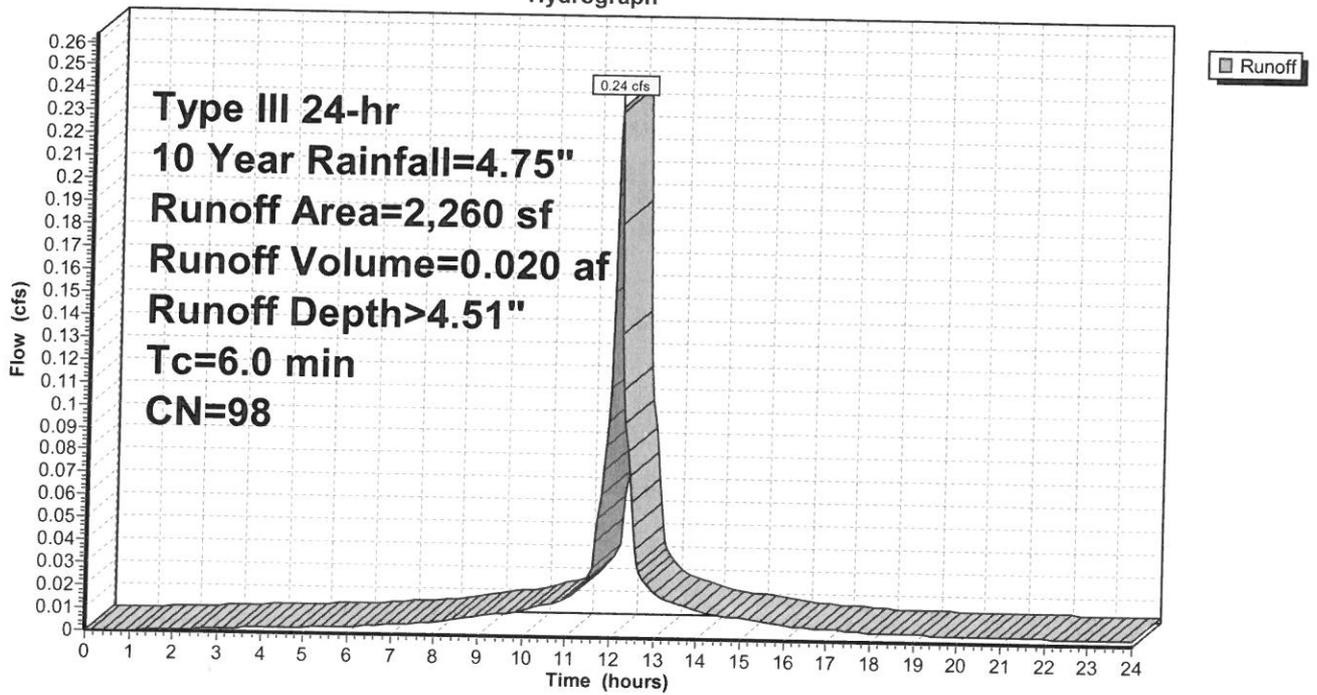
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=4.75"

| Area (sf) | CN | Description |
|-----------|----|-------------------------|
| 2,260 | 98 | Paved parking, HSG A |
| 2,260 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------|
| 6.0 | | | | | Direct Entry, |

Subcatchment D1: from Driveway

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Type III 24-hr 10 Year Rainfall=4.75"

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Summary for Subcatchment E1: Existing

Runoff = 0.06 cfs @ 12.45 hrs, Volume= 0.020 af, Depth> 0.21"

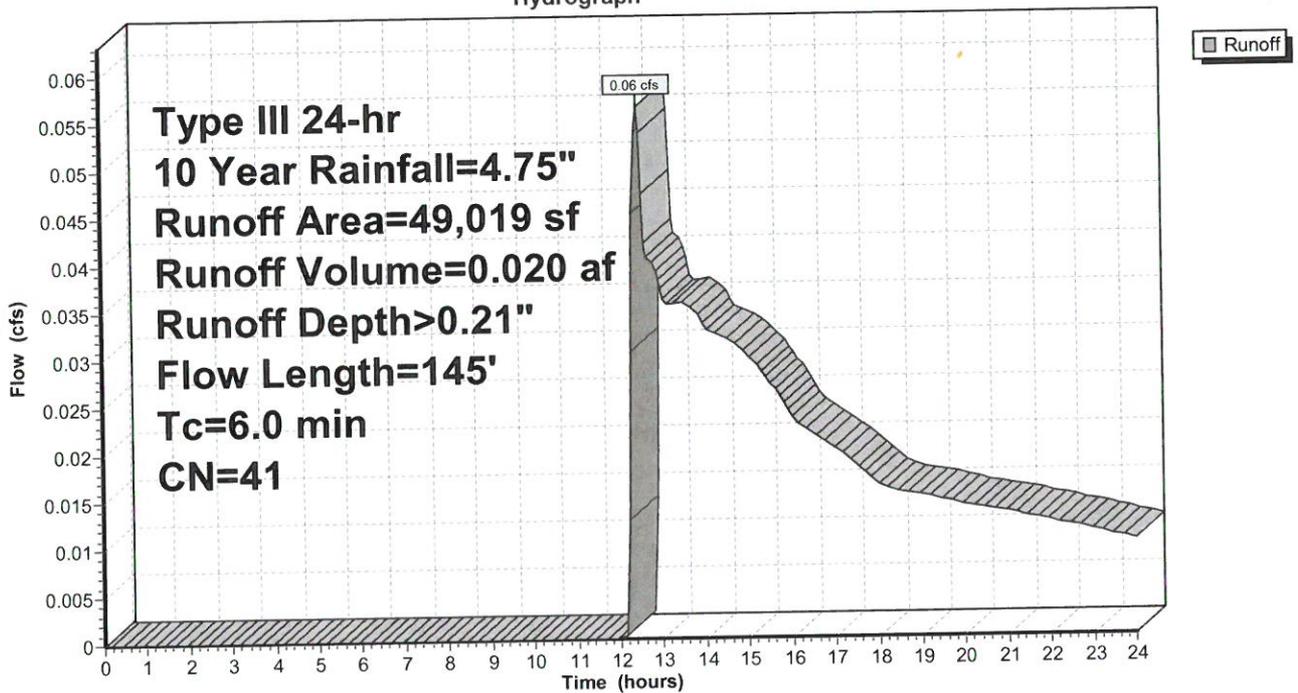
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=4.75"

| Area (sf) | CN | Description |
|-----------|----|---------------------------|
| 11,821 | 30 | Woods, Good, HSG A |
| 24,080 | 30 | Meadow, non-grazed, HSG A |
| 3,578 | 71 | Meadow, non-grazed, HSG C |
| 9,540 | 70 | Woods, Good, HSG C |
| 49,019 | 41 | Weighted Average |
| 49,019 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|--|-------------------|----------------|--|
| 3.3 | 50 | 0.1950 | 0.25 | | Sheet Flow, first 50 Grass: Dense n= 0.240 P2= 3.10" |
| 0.1 | 45 | 0.1950 | 7.11 | | Shallow Concentrated Flow, Unpaved Kv= 16.1 fps |
| 0.1 | 50 | 0.1540 | 6.32 | | Shallow Concentrated Flow, Unpaved Kv= 16.1 fps |
| 3.5 | 145 | Total, Increased to minimum Tc = 6.0 min | | | |

Subcatchment E1: Existing

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Summary for Subcatchment P1: Post-Development

Runoff = 0.00 cfs @ 21.23 hrs, Volume= 0.000 af, Depth> 0.02"

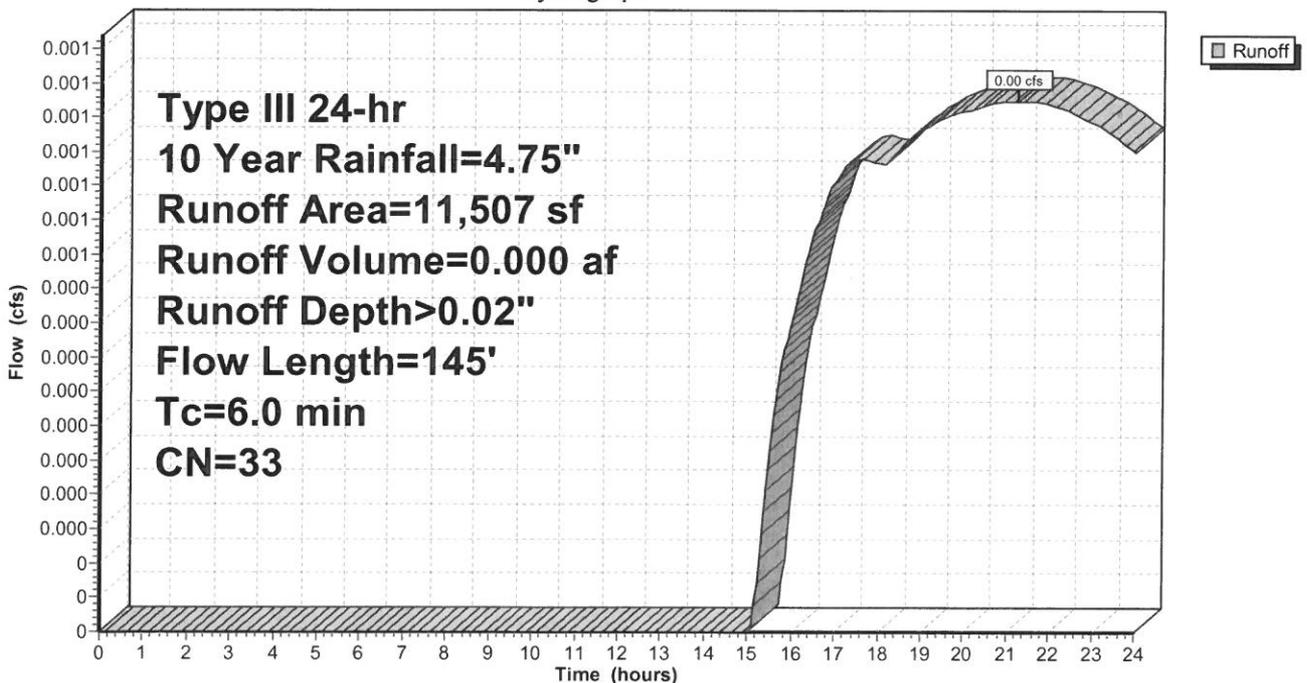
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=4.75"

| Area (sf) | CN | Description |
|-----------|----|---------------------------|
| 373 | 98 | Paved parking, HSG A |
| 10,871 | 30 | Meadow, non-grazed, HSG A |
| 263 | 70 | Woods, Good, HSG C |
| 11,507 | 33 | Weighted Average |
| 11,134 | | 96.76% Pervious Area |
| 373 | | 3.24% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|--|-------------------|----------------|--|
| 3.3 | 50 | 0.1950 | 0.25 | | Sheet Flow, first 50 Grass: Dense n= 0.240 P2= 3.10" |
| 0.1 | 45 | 0.1950 | 7.11 | | Shallow Concentrated Flow, Unpaved Kv= 16.1 fps |
| 0.1 | 50 | 0.1540 | 6.32 | | Shallow Concentrated Flow, Unpaved Kv= 16.1 fps |
| 3.5 | 145 | Total, Increased to minimum Tc = 6.0 min | | | |

Subcatchment P1: Post-Development

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Summary for Subcatchment R1: from Roof

Runoff = 0.12 cfs @ 12.09 hrs, Volume= 0.010 af, Depth> 4.51"

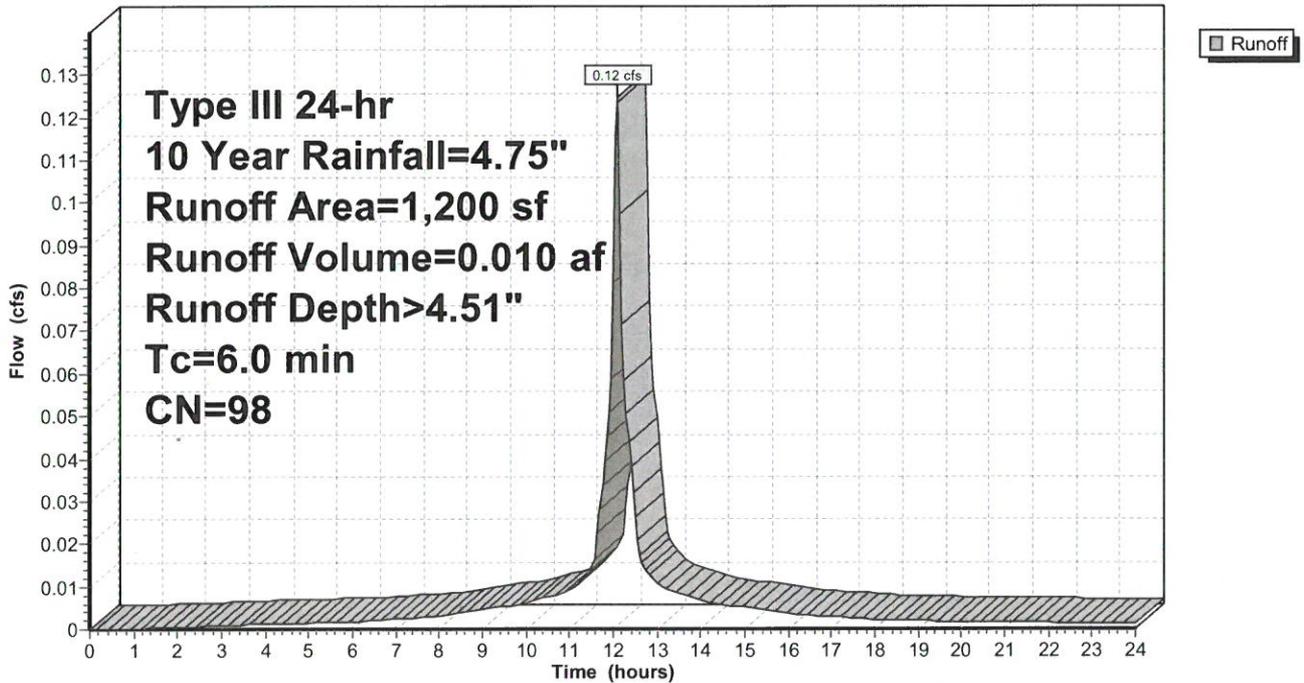
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=4.75"

| Area (sf) | CN | Description |
|-----------|----|-------------------------|
| 1,200 | 98 | Paved parking, HSG A |
| 1,200 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------|
| 6.0 | | | | | Direct Entry, |

Subcatchment R1: from Roof

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Summary for Reach 6R: Culvert

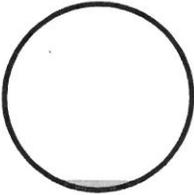
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 1.125 ac, 0.00% Impervious, Inflow Depth > 0.21" for 10 Year event
Inflow = 0.06 cfs @ 12.45 hrs, Volume= 0.020 af
Outflow = 0.06 cfs @ 12.45 hrs, Volume= 0.020 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.27 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.36 fps, Avg. Travel Time= 0.2 min

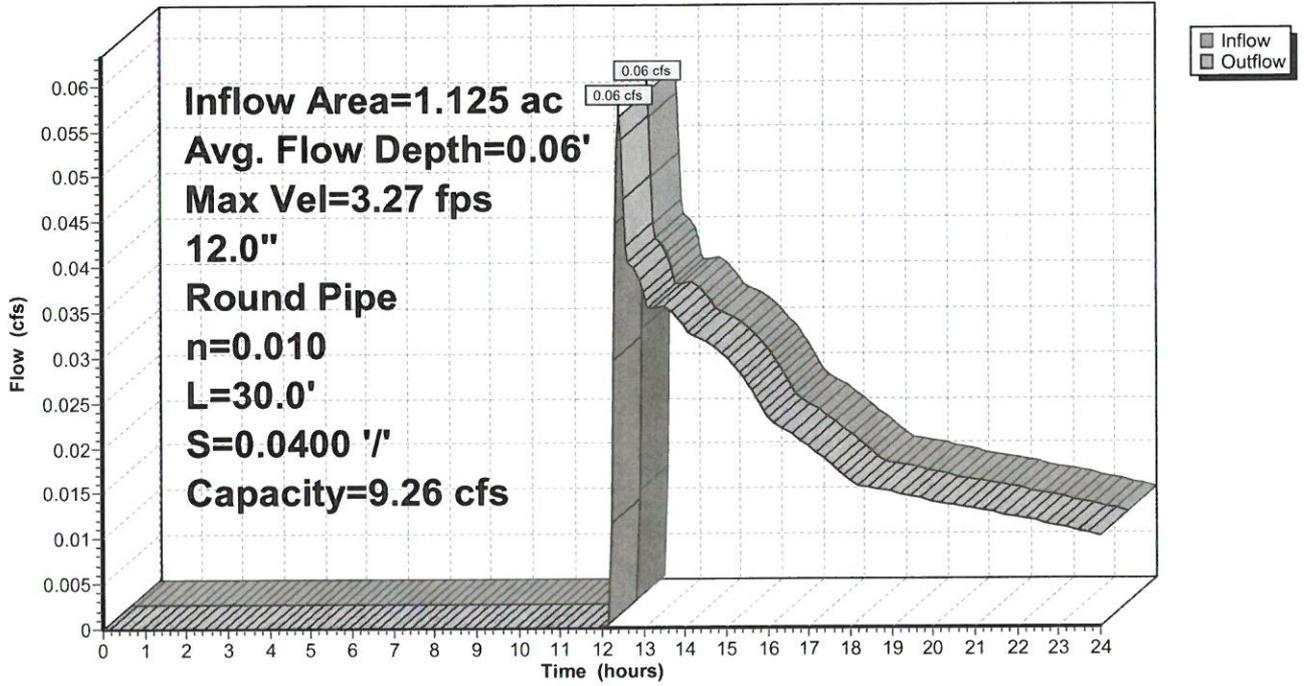
Peak Storage= 1 cf @ 12.45 hrs
Average Depth at Peak Storage= 0.06'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 9.26 cfs

12.0" Round Pipe
n= 0.010 PVC, smooth interior
Length= 30.0' Slope= 0.0400 '/'
Inlet Invert= 109.00', Outlet Invert= 107.80'



Reach 6R: Culvert

Hydrograph



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Summary for Reach 7R: Culvert

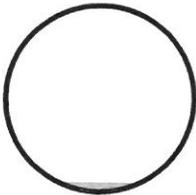
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 1.098 ac, 5.51% Impervious, Inflow Depth > 0.20" for 10 Year event
Inflow = 0.04 cfs @ 15.22 hrs, Volume= 0.019 af
Outflow = 0.04 cfs @ 15.21 hrs, Volume= 0.019 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.04 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.49 fps, Avg. Travel Time= 0.2 min

Peak Storage= 0 cf @ 15.21 hrs
Average Depth at Peak Storage= 0.05'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 9.26 cfs

12.0" Round Pipe
n= 0.010 PVC, smooth interior
Length= 30.0' Slope= 0.0400 '/'
Inlet Invert= 109.00', Outlet Invert= 107.80'



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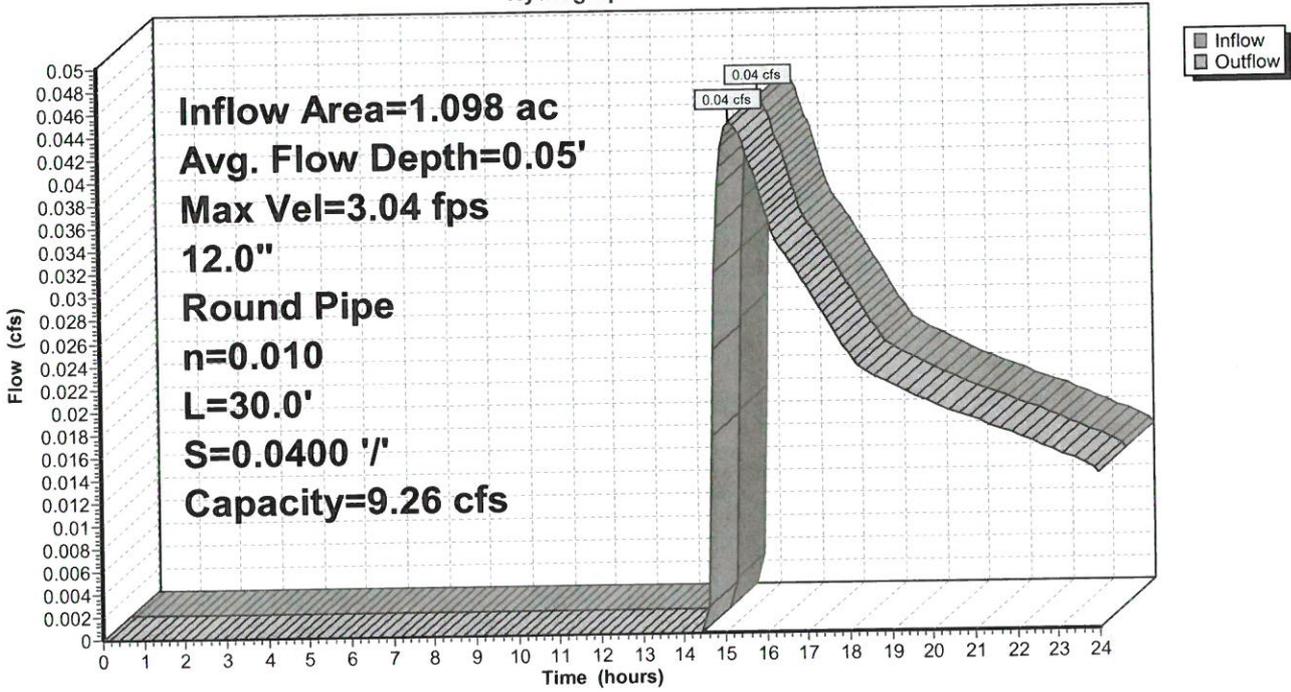
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Reach 7R: Culvert

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Summary for Pond 1P: Drainage Trench

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=86)

Inflow Area = 0.028 ac, 100.00% Impervious, Inflow Depth > 4.51" for 10 Year event
 Inflow = 0.12 cfs @ 12.09 hrs, Volume= 0.010 af
 Outflow = 0.03 cfs @ 12.51 hrs, Volume= 0.010 af, Atten= 80%, Lag= 25.4 min
 Discarded = 0.03 cfs @ 12.51 hrs, Volume= 0.010 af
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Peak Elev= 123.87' @ 12.51 hrs Surf.Area= 0.006 ac Storage= 0.003 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 27.2 min (775.6 - 748.5)

| Volume | Invert | Avail.Storage | Storage Description |
|--------|---------|---------------|--|
| #1A | 123.00' | 0.004 af | 6.78'W x 41.33'L x 1.88'H Field A |
| #2A | 123.33' | 0.002 af | 0.012 af Overall - 0.003 af Embedded = 0.009 af x 40.0% Voids ADS N-12 12 x 6 Inside #1 Inside= 12.2"W x 12.2"H => 0.81 sf x 20.00'L = 16.2 cf Outside= 14.5"W x 14.5"H => 1.05 sf x 20.00'L = 20.9 cf 3 Rows of 2 Chambers |
| | | 0.006 af | Total Available Storage |

Storage Group A created with Chamber Wizard

| Device | Routing | Invert | Outlet Devices |
|--------|-----------|---------|--|
| #1 | Primary | 124.00' | 4.0" Round Culvert L= 100.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 124.00' / 123.00' S= 0.0100 ' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.09 sf |
| #2 | Discarded | 123.00' | 2.410 in/hr Exfiltration over Wetted area Conductivity to Groundwater Elevation = 120.00' |

Discarded OutFlow Max=0.03 cfs @ 12.51 hrs HW=123.87' (Free Discharge)
 ↑2=Exfiltration (Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=123.00' (Free Discharge)
 ↑1=Culvert (Controls 0.00 cfs)

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Pond 1P: Drainage Trench - Chamber Wizard Field A

Chamber Model = ADS N-12 12 (ADS N-12® Pipe)

Inside= 12.2"W x 12.2"H => 0.81 sf x 20.00'L = 16.2 cf

Outside= 14.5"W x 14.5"H => 1.05 sf x 20.00'L = 20.9 cf

14.5" Wide + 10.9" Spacing = 25.4" C-C Row Spacing

2 Chambers/Row x 20.00' Long = 40.00' Row Length +8.0" End Stone x 2 = 41.33' Base Length

3 Rows x 14.5" Wide + 10.9" Spacing x 2 + 8.0" Side Stone x 2 = 6.78' Base Width

4.0" Base + 14.5" Chamber Height + 4.0" Cover = 1.88' Field Height

6 Chambers x 16.2 cf = 97.2 cf Chamber Storage

6 Chambers x 20.9 cf = 125.6 cf Displacement

525.3 cf Field - 125.6 cf Chambers = 399.7 cf Stone x 40.0% Voids = 159.9 cf Stone Storage

Chamber Storage + Stone Storage = 257.1 cf = 0.006 af

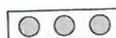
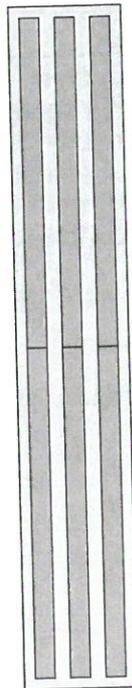
Overall Storage Efficiency = 48.9%

Overall System Size = 41.33' x 6.78' x 1.88'

6 Chambers

19.5 cy Field

14.8 cy Stone



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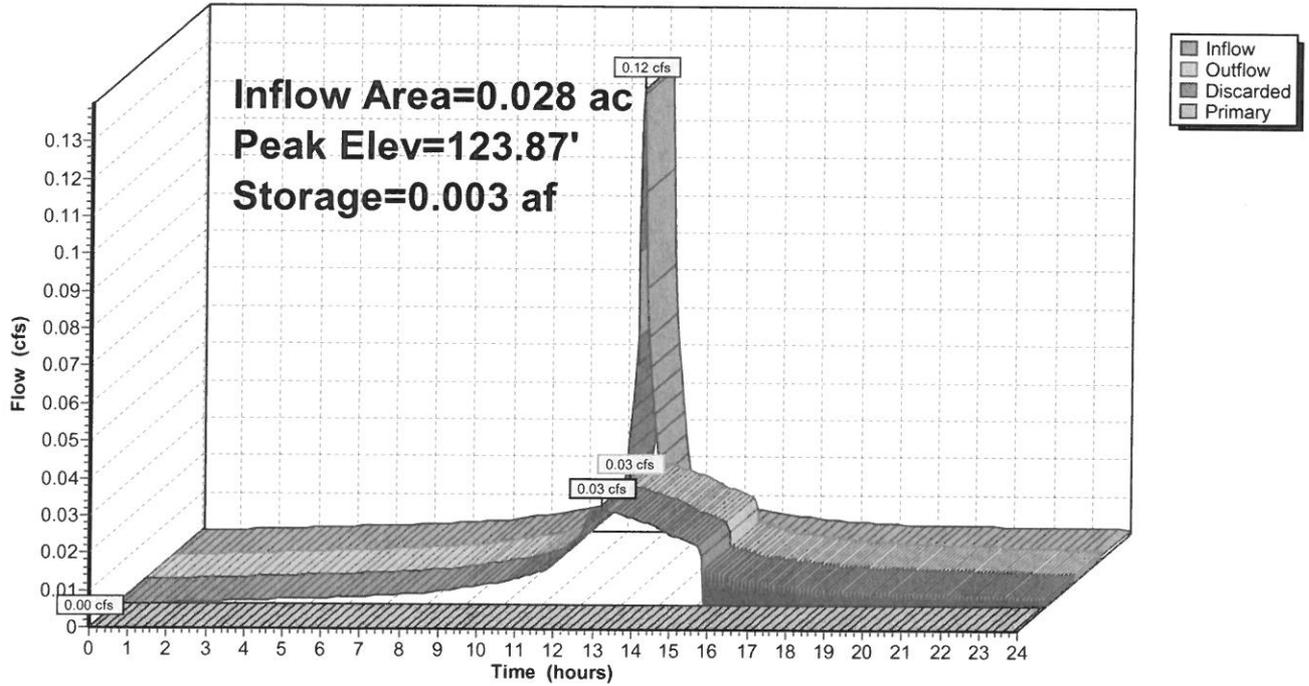
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Pond 1P: Drainage Trench

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Summary for Pond 2P: Forebay

Inflow Area = 0.335 ac, 15.50% Impervious, Inflow Depth > 1.29" for 10 Year event
 Inflow = 0.39 cfs @ 12.06 hrs, Volume= 0.036 af
 Outflow = 0.26 cfs @ 12.21 hrs, Volume= 0.025 af, Atten= 33%, Lag= 8.8 min
 Primary = 0.26 cfs @ 12.21 hrs, Volume= 0.025 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Peak Elev= 111.61' @ 12.21 hrs Surf.Area= 467 sf Storage= 539 cf

Plug-Flow detention time= 204.5 min calculated for 0.024 af (68% of inflow)
 Center-of-Mass det. time= 89.8 min (910.1 - 820.2)

| Volume | Invert | Avail.Storage | Storage Description |
|--------|---------|---------------|--|
| #1 | 110.00' | 1,022 cf | Custom Stage Data (Prismatic) Listed below (Recalc) |

| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---------------------|----------------------|---------------------------|---------------------------|
| 110.00 | 201 | 0 | 0 |
| 112.00 | 531 | 732 | 732 |
| 112.50 | 627 | 290 | 1,022 |

| Device | Routing | Invert | Outlet Devices |
|--------|---------|---------|---|
| #1 | Primary | 111.50' | 8.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads |

Primary OutFlow Max=0.25 cfs @ 12.21 hrs HW=111.61' TW=110.65' (Dynamic Tailwater)
 ↑ **1=Orifice/Grate** (Weir Controls 0.25 cfs @ 1.09 fps)

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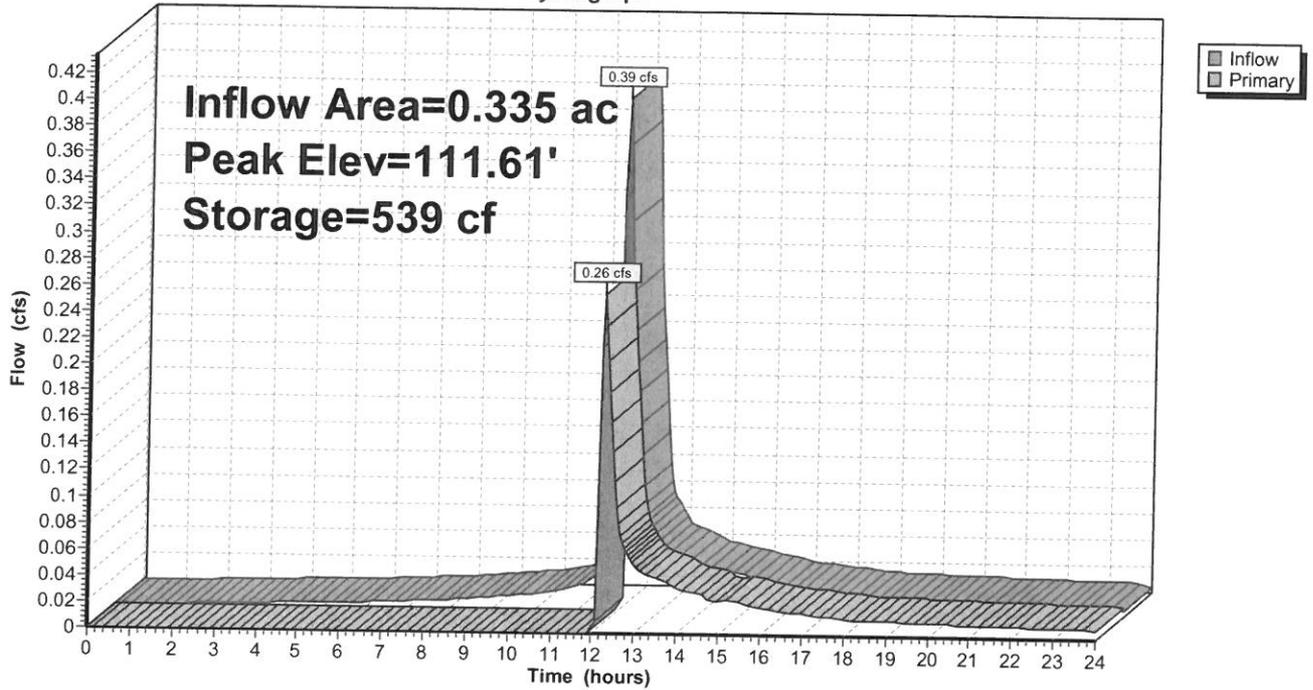
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Pond 2P: Forebay

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Summary for Pond 3P: Basin

Inflow Area = 0.834 ac, 6.22% Impervious, Inflow Depth > 0.57" for 10 Year event
 Inflow = 0.33 cfs @ 12.21 hrs, Volume= 0.040 af
 Outflow = 0.04 cfs @ 15.21 hrs, Volume= 0.018 af, Atten= 87%, Lag= 180.1 min
 Primary = 0.04 cfs @ 15.21 hrs, Volume= 0.018 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Starting Elev= 110.50' Surf.Area= 708 sf Storage= 299 cf
 Peak Elev= 111.53' @ 15.21 hrs Surf.Area= 1,154 sf Storage= 1,255 cf (956 cf above start)
 Flood Elev= 112.50' Surf.Area= 1,578 sf Storage= 2,585 cf (2,285 cf above start)

Plug-Flow detention time= 460.9 min calculated for 0.011 af (29% of inflow)
 Center-of-Mass det. time= 179.3 min (1,105.1 - 925.8)

| Volume | Invert | Avail.Storage | Storage Description |
|------------------|-------------------|------------------------|--|
| #1 | 110.00' | 2,585 cf | Custom Stage Data (Prismatic) Listed below (Recalc) |
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
| 110.00 | 490 | 0 | 0 |
| 112.00 | 1,360 | 1,850 | 1,850 |
| 112.50 | 1,578 | 735 | 2,585 |

| Device | Routing | Invert | Outlet Devices |
|--------|---------|---------|--|
| #1 | Primary | 111.50' | 4.0' long x 2.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32 |

Primary OutFlow Max=0.04 cfs @ 15.21 hrs HW=111.53' TW=109.05' (Dynamic Tailwater)
 ↳1=Broad-Crested Rectangular Weir (Weir Controls 0.04 cfs @ 0.42 fps)

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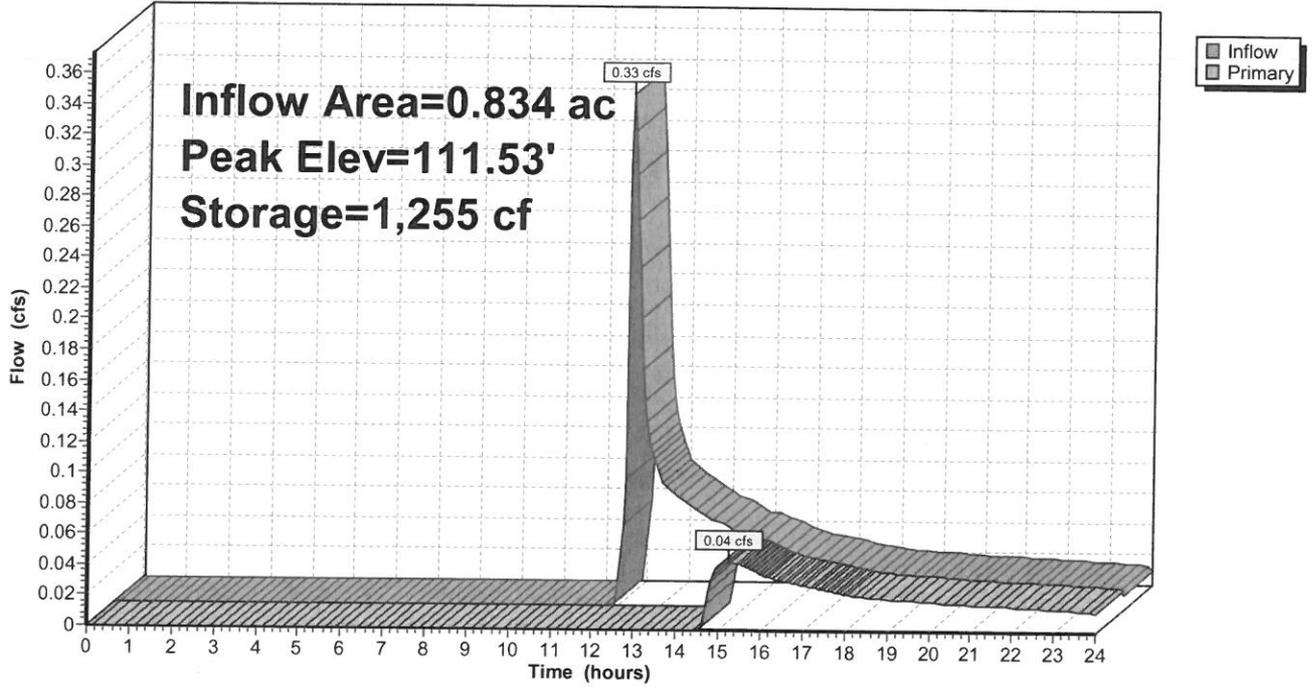
31 Newton Road
Type III 24-hr 10 Year Rainfall=4.75"

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Pond 3P: Basin

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Type III 24-hr 100 Year Rainfall=6.85"

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Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

| | |
|--|--|
| Subcatchment 4S: Runoff | Runoff Area=12,317 sf 0.00% Impervious Runoff Depth>1.76" Tc=0.0 min CN=52 Runoff=0.60 cfs 0.041 af |
| Subcatchment 5S: Runoff | Runoff Area=21,735 sf 0.00% Impervious Runoff Depth>1.17" Tc=0.0 min CN=45 Runoff=0.58 cfs 0.049 af |
| Subcatchment D1: from Driveway | Runoff Area=2,260 sf 100.00% Impervious Runoff Depth>6.61" Tc=6.0 min CN=98 Runoff=0.34 cfs 0.029 af |
| Subcatchment E1: Existing | Runoff Area=49,019 sf 0.00% Impervious Runoff Depth>0.86" Flow Length=145' Tc=6.0 min CN=41 Runoff=0.62 cfs 0.080 af |
| Subcatchment P1: Post-Development | Runoff Area=11,507 sf 3.24% Impervious Runoff Depth>0.34" Flow Length=145' Tc=6.0 min CN=33 Runoff=0.02 cfs 0.007 af |
| Subcatchment R1: from Roof | Runoff Area=1,200 sf 100.00% Impervious Runoff Depth>6.61" Tc=6.0 min CN=98 Runoff=0.18 cfs 0.015 af |
| Reach 6R: Culvert | Avg. Flow Depth=0.18' Max Vel=6.71 fps Inflow=0.62 cfs 0.080 af 12.0" Round Pipe n=0.010 L=30.0' S=0.0400 '/' Capacity=9.26 cfs Outflow=0.62 cfs 0.080 af |
| Reach 7R: Culvert | Avg. Flow Depth=0.18' Max Vel=6.77 fps Inflow=0.65 cfs 0.093 af 12.0" Round Pipe n=0.010 L=30.0' S=0.0400 '/' Capacity=9.26 cfs Outflow=0.64 cfs 0.093 af |
| Pond 1P: Drainage Trench | Peak Elev=124.13' Storage=0.004 af Inflow=0.18 cfs 0.015 af Discarded=0.03 cfs 0.014 af Primary=0.04 cfs 0.001 af Outflow=0.07 cfs 0.015 af |
| Pond 2P: Forebay | Peak Elev=111.74' Storage=601 cf Inflow=0.84 cfs 0.070 af Outflow=0.82 cfs 0.059 af |
| Pond 3P: Basin | Peak Elev=111.66' Storage=1,410 cf Inflow=1.35 cfs 0.107 af Outflow=0.63 cfs 0.085 af |

Total Runoff Area = 2.251 ac Runoff Volume = 0.222 af Average Runoff Depth = 1.18"
96.09% Pervious = 2.163 ac 3.91% Impervious = 0.088 ac

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Summary for Subcatchment 4S: Runoff

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

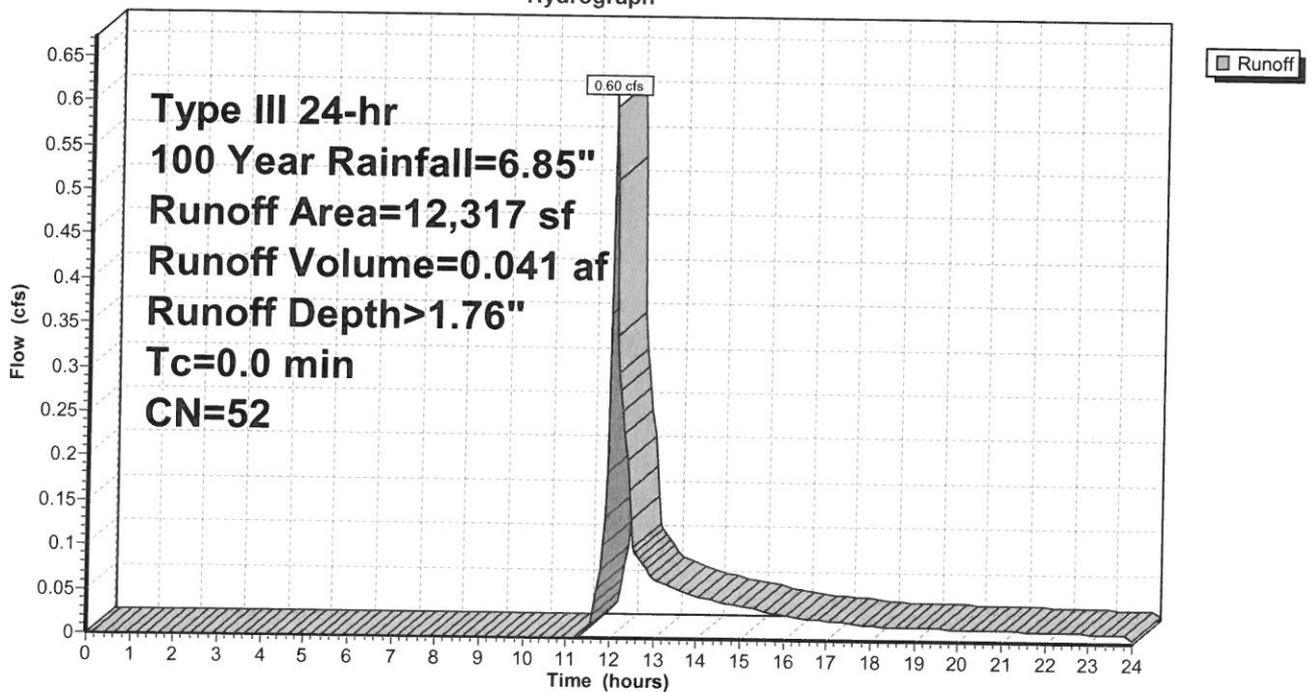
Runoff = 0.60 cfs @ 12.01 hrs, Volume= 0.041 af, Depth> 1.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Rainfall=6.85"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 3,726 | 30 | Meadow, non-grazed, HSG A |
| 5,860 | 71 | Meadow, non-grazed, HSG C |
| 2,731 | 39 | >75% Grass cover, Good, HSG A |
| 12,317 | 52 | Weighted Average |
| 12,317 | | 100.00% Pervious Area |

Subcatchment 4S: Runoff

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Summary for Subcatchment 5S: Runoff

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

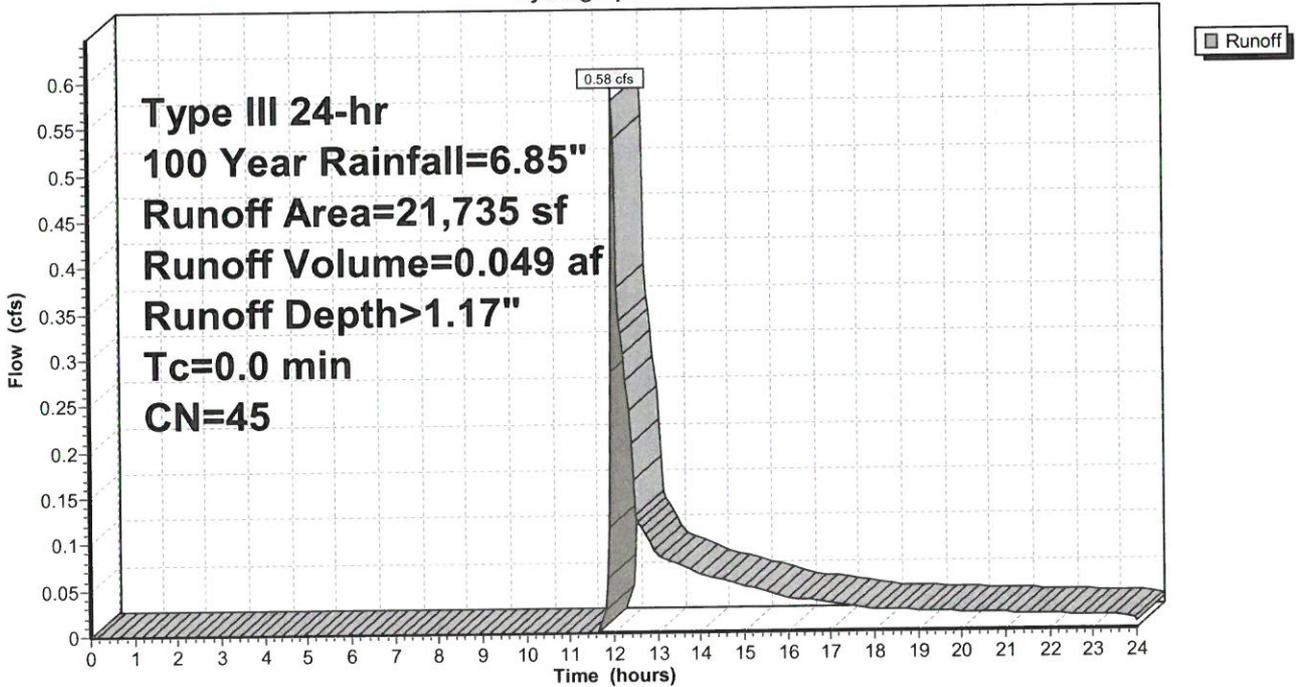
Runoff = 0.58 cfs @ 12.02 hrs, Volume= 0.049 af, Depth> 1.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Rainfall=6.85"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 6,999 | 70 | Woods, Good, HSG C |
| 10,251 | 30 | Meadow, non-grazed, HSG A |
| 4,485 | 39 | >75% Grass cover, Good, HSG A |
| 21,735 | 45 | Weighted Average |
| 21,735 | | 100.00% Pervious Area |

Subcatchment 5S: Runoff

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Summary for Subcatchment D1: from Driveway

Runoff = 0.34 cfs @ 12.09 hrs, Volume= 0.029 af, Depth> 6.61"

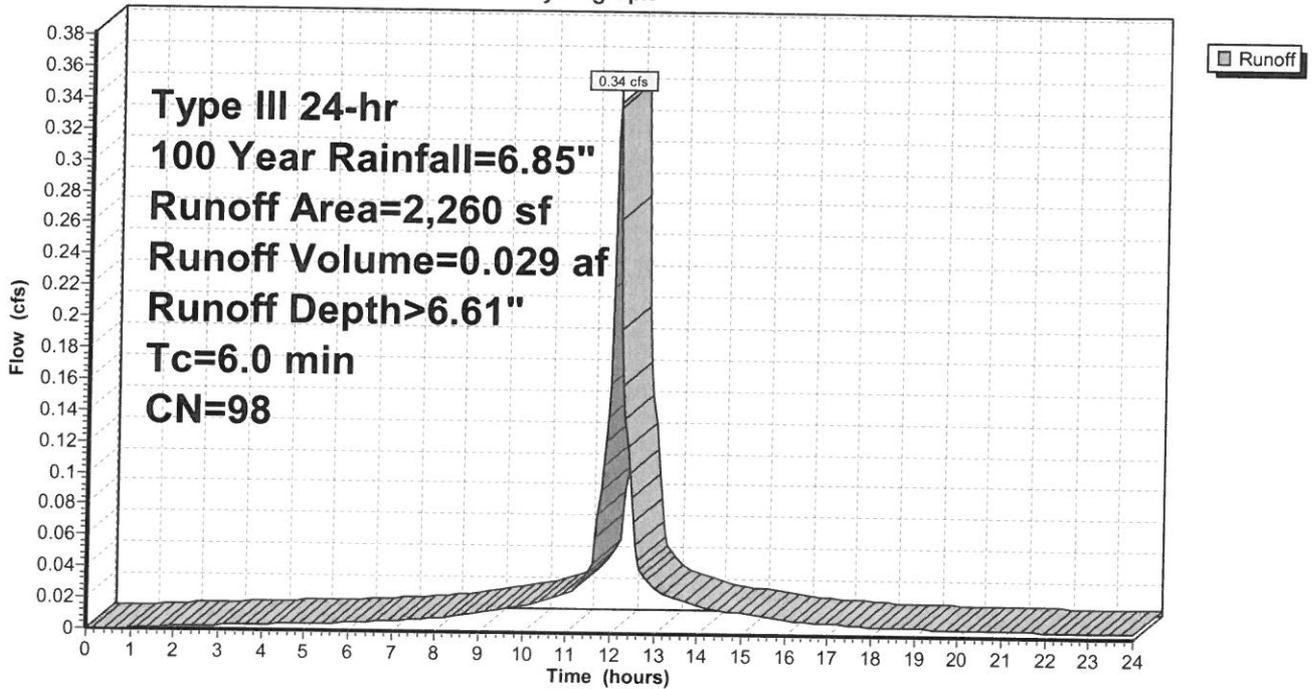
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Rainfall=6.85"

| Area (sf) | CN | Description |
|-----------|----|-------------------------|
| 2,260 | 98 | Paved parking, HSG A |
| 2,260 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------|
| 6.0 | | | | | Direct Entry, |

Subcatchment D1: from Driveway

Hydrograph



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Type III 24-hr 100 Year Rainfall=6.85"

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Summary for Subcatchment E1: Existing

Runoff = 0.62 cfs @ 12.14 hrs, Volume= 0.080 af, Depth> 0.86"

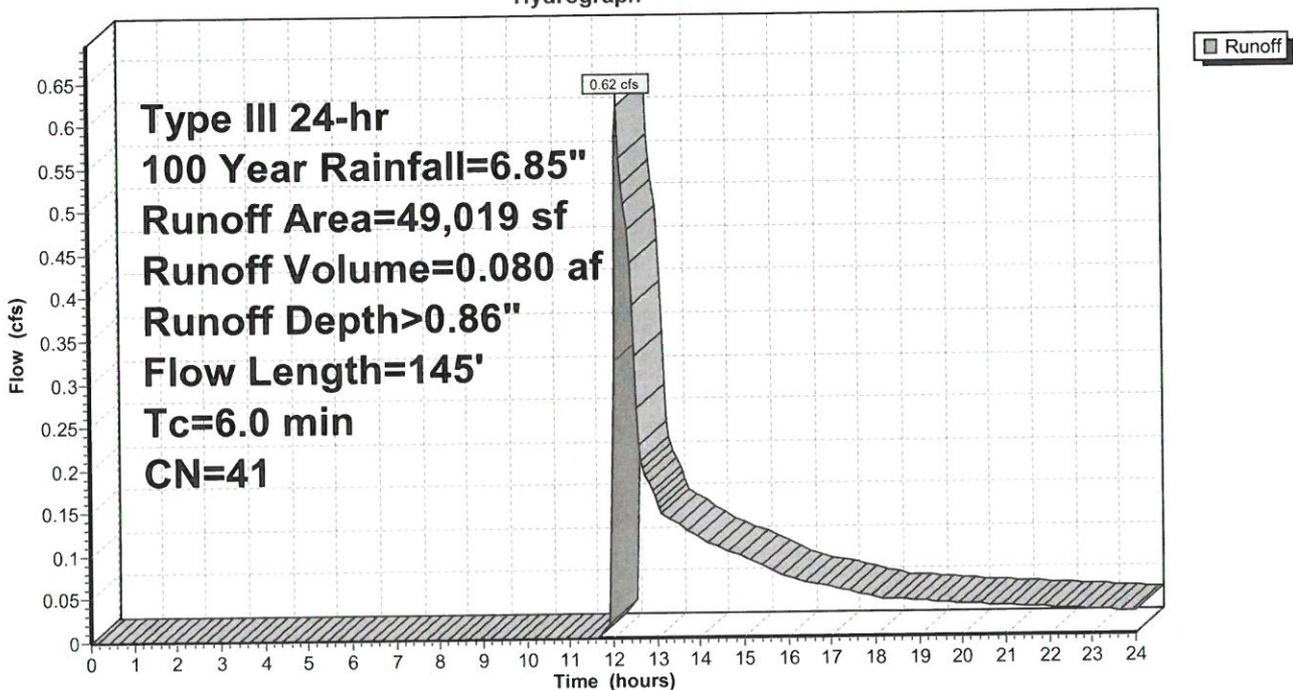
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Rainfall=6.85"

| Area (sf) | CN | Description |
|-----------|----|---------------------------|
| 11,821 | 30 | Woods, Good, HSG A |
| 24,080 | 30 | Meadow, non-grazed, HSG A |
| 3,578 | 71 | Meadow, non-grazed, HSG C |
| 9,540 | 70 | Woods, Good, HSG C |
| 49,019 | 41 | Weighted Average |
| 49,019 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|--|-------------------|----------------|--|
| 3.3 | 50 | 0.1950 | 0.25 | | Sheet Flow, first 50 Grass: Dense n= 0.240 P2= 3.10" |
| 0.1 | 45 | 0.1950 | 7.11 | | Shallow Concentrated Flow, Unpaved Kv= 16.1 fps |
| 0.1 | 50 | 0.1540 | 6.32 | | Shallow Concentrated Flow, Unpaved Kv= 16.1 fps |
| 3.5 | 145 | Total, Increased to minimum Tc = 6.0 min | | | |

Subcatchment E1: Existing

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Summary for Subcatchment P1: Post-Development

Runoff = 0.02 cfs @ 12.43 hrs, Volume= 0.007 af, Depth> 0.34"

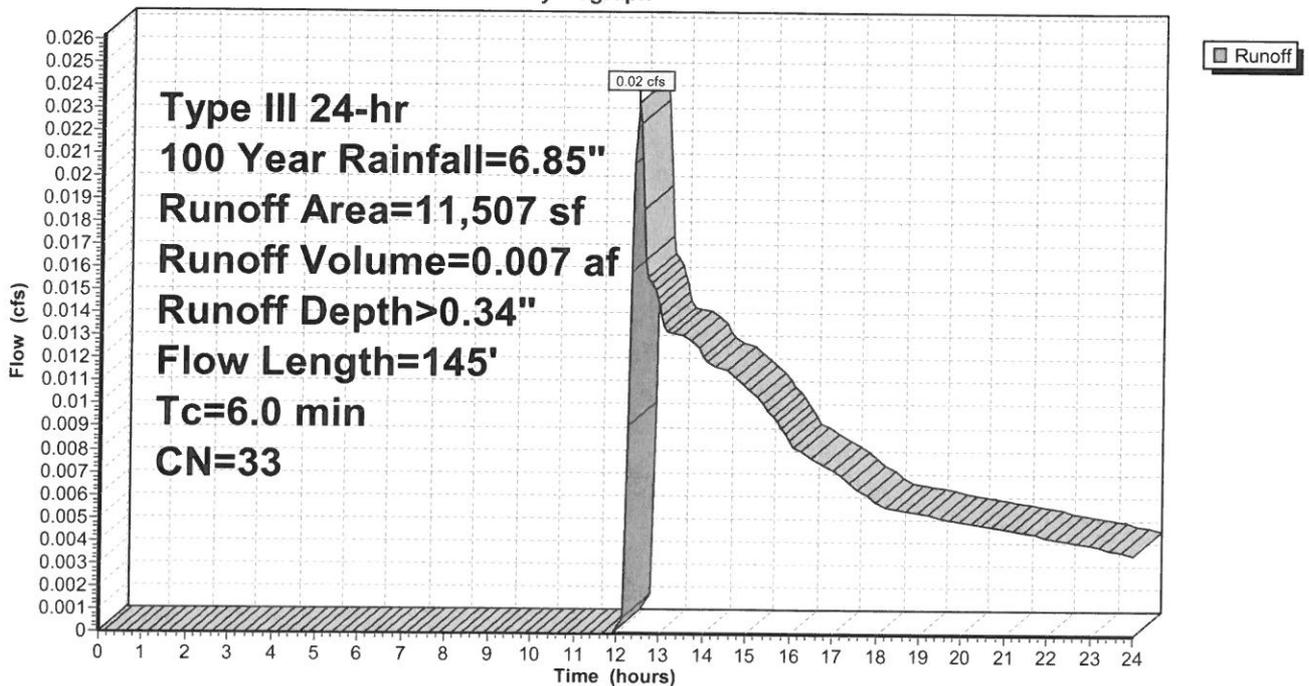
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Rainfall=6.85"

| Area (sf) | CN | Description |
|-----------|----|---------------------------|
| 373 | 98 | Paved parking, HSG A |
| 10,871 | 30 | Meadow, non-grazed, HSG A |
| 263 | 70 | Woods, Good, HSG C |
| 11,507 | 33 | Weighted Average |
| 11,134 | | 96.76% Pervious Area |
| 373 | | 3.24% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|--|-------------------|----------------|--|
| 3.3 | 50 | 0.1950 | 0.25 | | Sheet Flow, first 50 Grass: Dense n= 0.240 P2= 3.10" |
| 0.1 | 45 | 0.1950 | 7.11 | | Shallow Concentrated Flow, Unpaved Kv= 16.1 fps |
| 0.1 | 50 | 0.1540 | 6.32 | | Shallow Concentrated Flow, Unpaved Kv= 16.1 fps |
| 3.5 | 145 | Total, Increased to minimum Tc = 6.0 min | | | |

Subcatchment P1: Post-Development

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Summary for Subcatchment R1: from Roof

Runoff = 0.18 cfs @ 12.09 hrs, Volume= 0.015 af, Depth> 6.61"

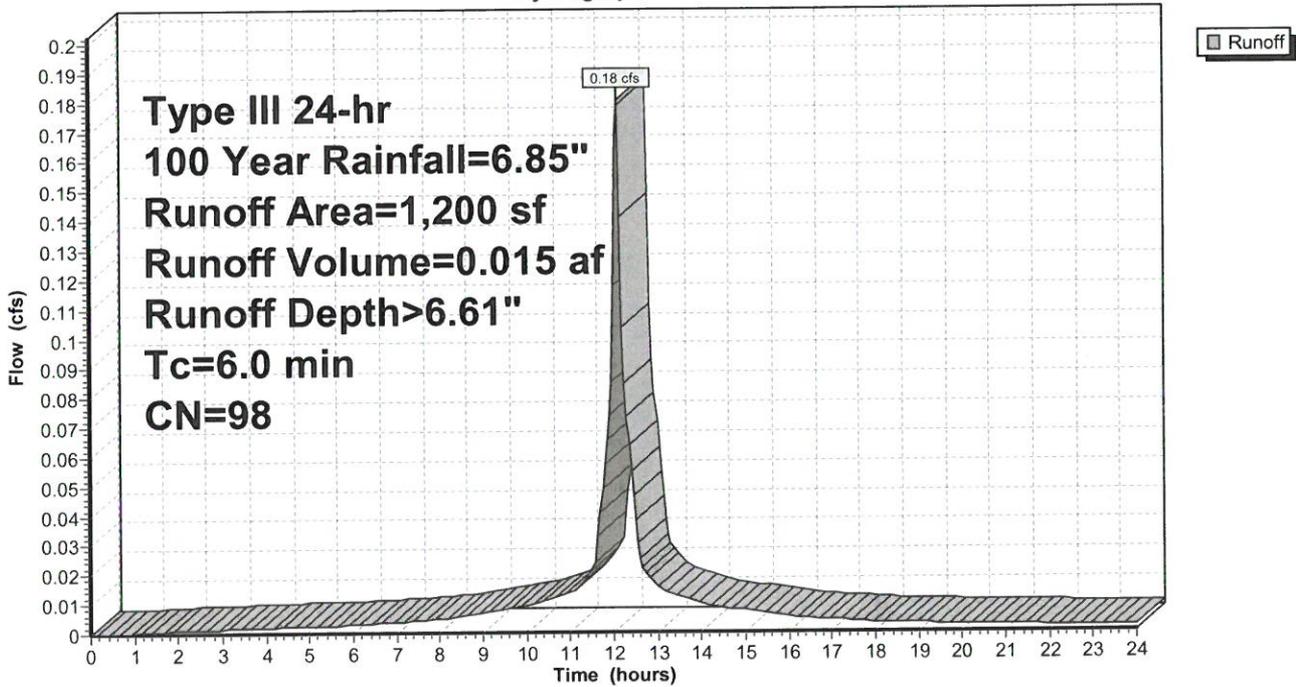
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Rainfall=6.85"

| Area (sf) | CN | Description |
|-----------|----|-------------------------|
| 1,200 | 98 | Paved parking, HSG A |
| 1,200 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------|
| 6.0 | | | | | Direct Entry, |

Subcatchment R1: from Roof

Hydrograph



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Summary for Reach 6R: Culvert

[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 1.125 ac, 0.00% Impervious, Inflow Depth > 0.86" for 100 Year event
Inflow = 0.62 cfs @ 12.14 hrs, Volume= 0.080 af
Outflow = 0.62 cfs @ 12.14 hrs, Volume= 0.080 af, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.71 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 3.38 fps, Avg. Travel Time= 0.1 min

Peak Storage= 3 cf @ 12.14 hrs
Average Depth at Peak Storage= 0.18'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 9.26 cfs

12.0" Round Pipe
n= 0.010 PVC, smooth interior
Length= 30.0' Slope= 0.0400 '/'
Inlet Invert= 109.00', Outlet Invert= 107.80'



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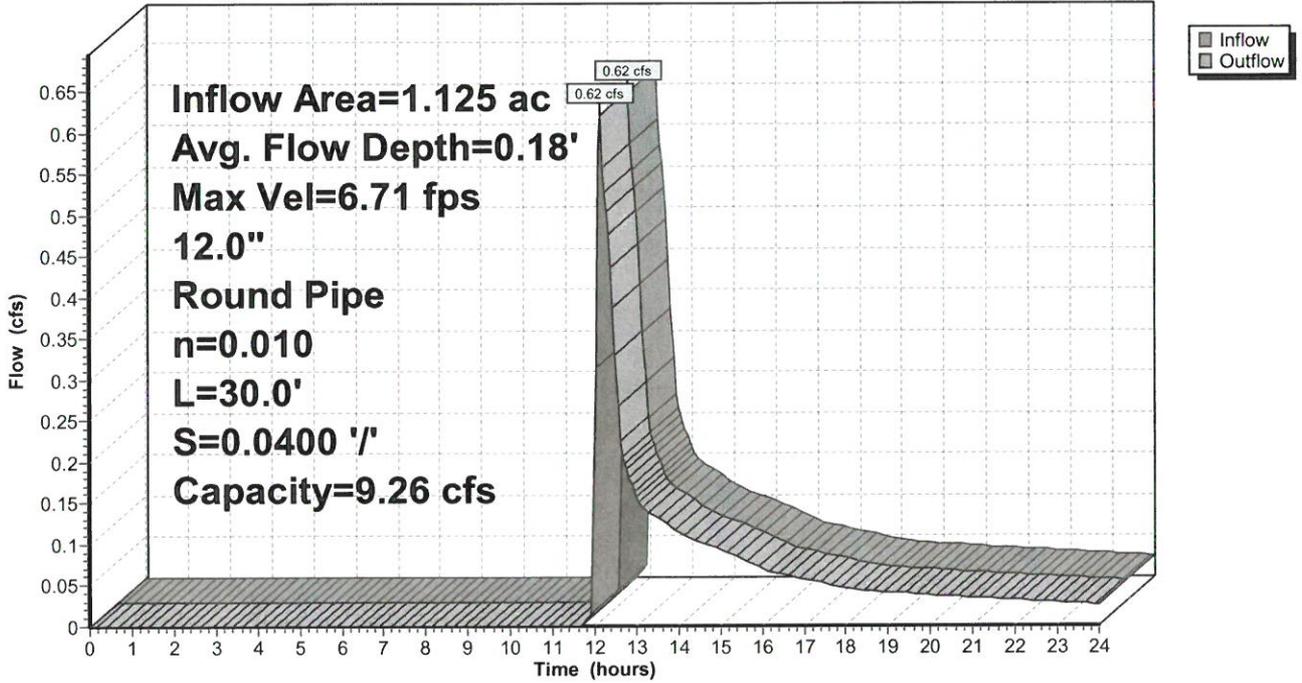
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Reach 6R: Culvert

Hydrograph



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Summary for Reach 7R: Culvert

[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 1.098 ac, 5.51% Impervious, Inflow Depth > 1.01" for 100 Year event
Inflow = 0.65 cfs @ 12.30 hrs, Volume= 0.093 af
Outflow = 0.64 cfs @ 12.25 hrs, Volume= 0.093 af, Atten= 1%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.77 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 3.56 fps, Avg. Travel Time= 0.1 min

Peak Storage= 3 cf @ 12.25 hrs
Average Depth at Peak Storage= 0.18'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 9.26 cfs

12.0" Round Pipe
n= 0.010 PVC, smooth interior
Length= 30.0' Slope= 0.0400 '/'
Inlet Invert= 109.00', Outlet Invert= 107.80'



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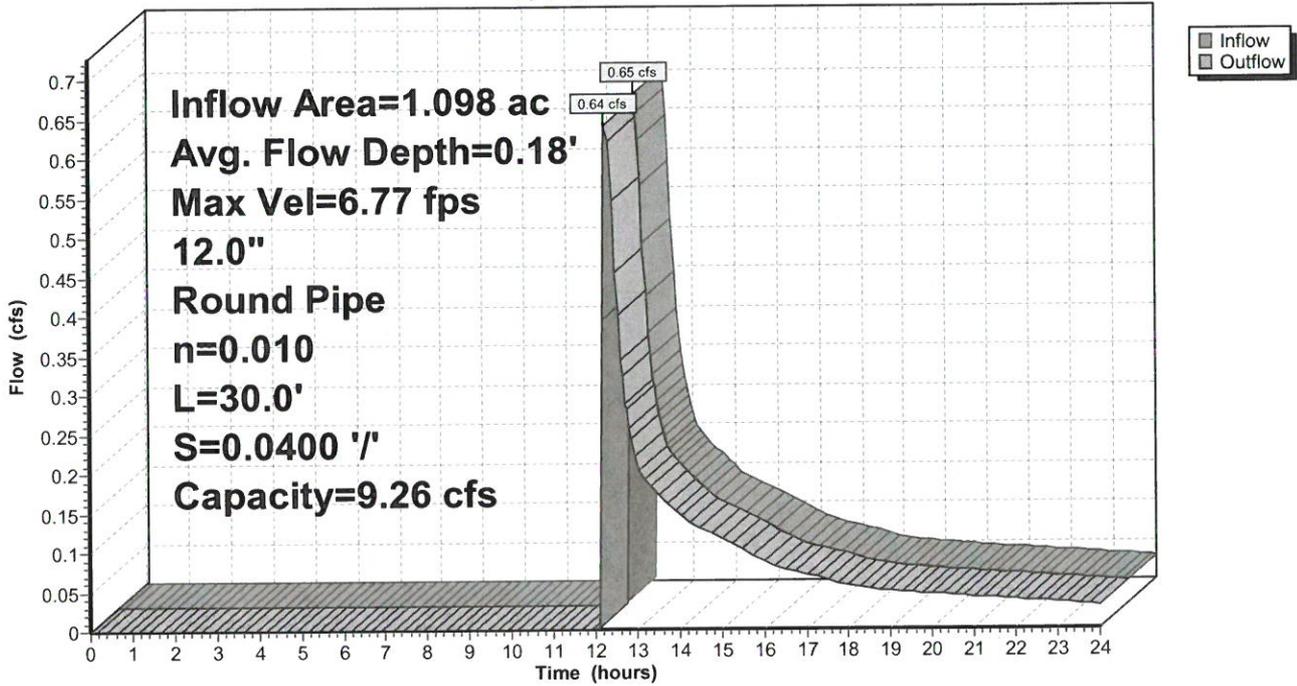
31 Newton Road
Type III 24-hr 100 Year Rainfall=6.85"

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Reach 7R: Culvert

Hydrograph



Summary for Pond 1P: Drainage Trench

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=77)

Inflow Area = 0.028 ac, 100.00% Impervious, Inflow Depth > 6.61" for 100 Year event
 Inflow = 0.18 cfs @ 12.09 hrs, Volume= 0.015 af
 Outflow = 0.07 cfs @ 12.32 hrs, Volume= 0.015 af, Atten= 62%, Lag= 14.3 min
 Discarded = 0.03 cfs @ 12.32 hrs, Volume= 0.014 af
 Primary = 0.04 cfs @ 12.32 hrs, Volume= 0.001 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Peak Elev= 124.13' @ 12.32 hrs Surf.Area= 0.006 ac Storage= 0.004 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 32.4 min (775.3 - 742.8)

| Volume | Invert | Avail.Storage | Storage Description |
|--------|---------|---------------|---|
| #1A | 123.00' | 0.004 af | 6.78'W x 41.33'L x 1.88'H Field A 0.012 af Overall - 0.003 af Embedded = 0.009 af x 40.0% Voids |
| #2A | 123.33' | 0.002 af | ADS N-12 12 x 6 Inside #1 Inside= 12.2"W x 12.2"H => 0.81 sf x 20.00'L = 16.2 cf Outside= 14.5"W x 14.5"H => 1.05 sf x 20.00'L = 20.9 cf 3 Rows of 2 Chambers |
| | | 0.006 af | Total Available Storage |

Storage Group A created with Chamber Wizard

| Device | Routing | Invert | Outlet Devices |
|--------|-----------|---------|---|
| #1 | Primary | 124.00' | 4.0" Round Culvert L= 100.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 124.00' / 123.00' S= 0.0100 '/ Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.09 sf |
| #2 | Discarded | 123.00' | 2.410 in/hr Exfiltration over Wetted area Conductivity to Groundwater Elevation = 120.00' |

Discarded OutFlow Max=0.03 cfs @ 12.32 hrs HW=124.13' (Free Discharge)
 ↳ **2=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=0.04 cfs @ 12.32 hrs HW=124.13' (Free Discharge)
 ↳ **1=Culvert** (Inlet Controls 0.04 cfs @ 1.24 fps)

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Pond 1P: Drainage Trench - Chamber Wizard Field A

Chamber Model = ADS N-12 12 (ADS N-12® Pipe)

Inside= 12.2"W x 12.2"H => 0.81 sf x 20.00'L = 16.2 cf

Outside= 14.5"W x 14.5"H => 1.05 sf x 20.00'L = 20.9 cf

14.5" Wide + 10.9" Spacing = 25.4" C-C Row Spacing

2 Chambers/Row x 20.00' Long = 40.00' Row Length +8.0" End Stone x 2 = 41.33' Base Length

3 Rows x 14.5" Wide + 10.9" Spacing x 2 + 8.0" Side Stone x 2 = 6.78' Base Width

4.0" Base + 14.5" Chamber Height + 4.0" Cover = 1.88' Field Height

6 Chambers x 16.2 cf = 97.2 cf Chamber Storage

6 Chambers x 20.9 cf = 125.6 cf Displacement

525.3 cf Field - 125.6 cf Chambers = 399.7 cf Stone x 40.0% Voids = 159.9 cf Stone Storage

Chamber Storage + Stone Storage = 257.1 cf = 0.006 af

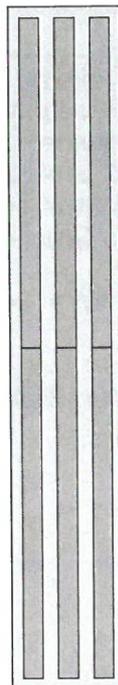
Overall Storage Efficiency = 48.9%

Overall System Size = 41.33' x 6.78' x 1.88'

6 Chambers

19.5 cy Field

14.8 cy Stone



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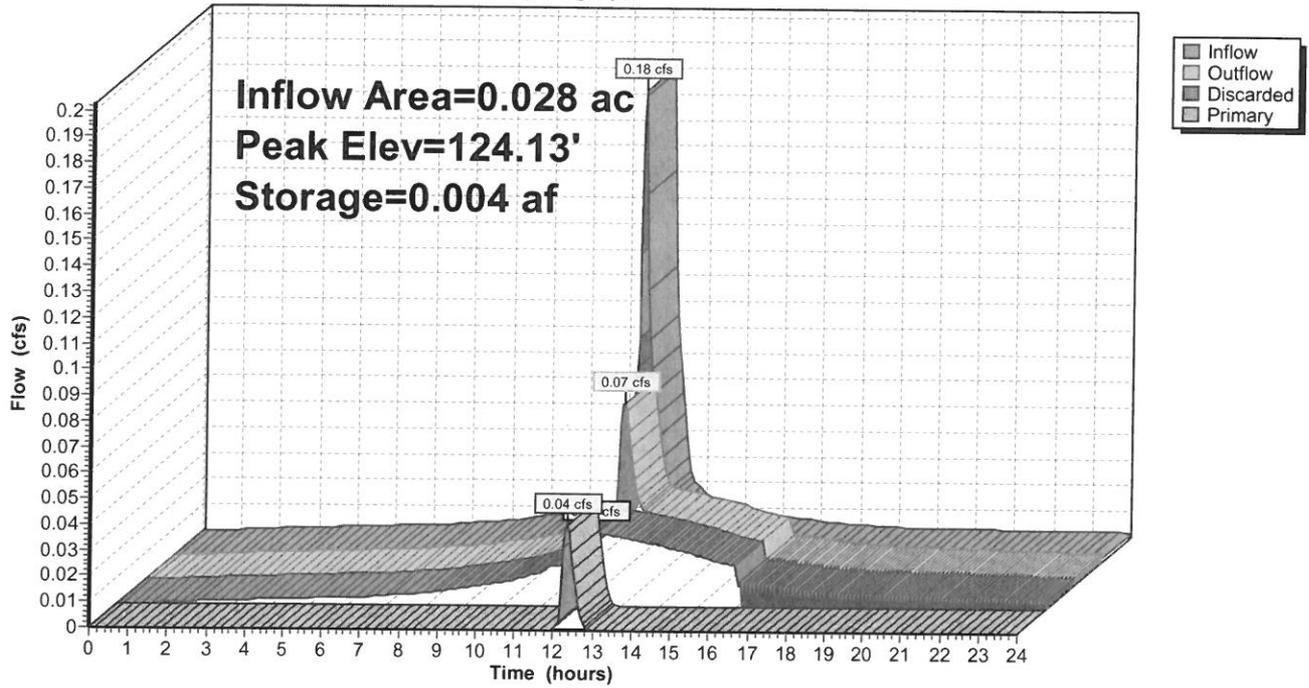
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Pond 1P: Drainage Trench

Hydrograph



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Summary for Pond 2P: Forebay

Inflow Area = 0.335 ac, 15.50% Impervious, Inflow Depth > 2.51" for 100 Year event
 Inflow = 0.84 cfs @ 12.03 hrs, Volume= 0.070 af
 Outflow = 0.82 cfs @ 12.06 hrs, Volume= 0.059 af, Atten= 3%, Lag= 1.9 min
 Primary = 0.82 cfs @ 12.06 hrs, Volume= 0.059 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Peak Elev= 111.74' @ 12.06 hrs Surf.Area= 489 sf Storage= 601 cf

Plug-Flow detention time= 122.2 min calculated for 0.058 af (84% of inflow)
 Center-of-Mass det. time= 50.1 min (868.6 - 818.5)

| Volume | Invert | Avail.Storage | Storage Description |
|--------|---------|---------------|--|
| #1 | 110.00' | 1,022 cf | Custom Stage Data (Prismatic) Listed below (Recalc) |

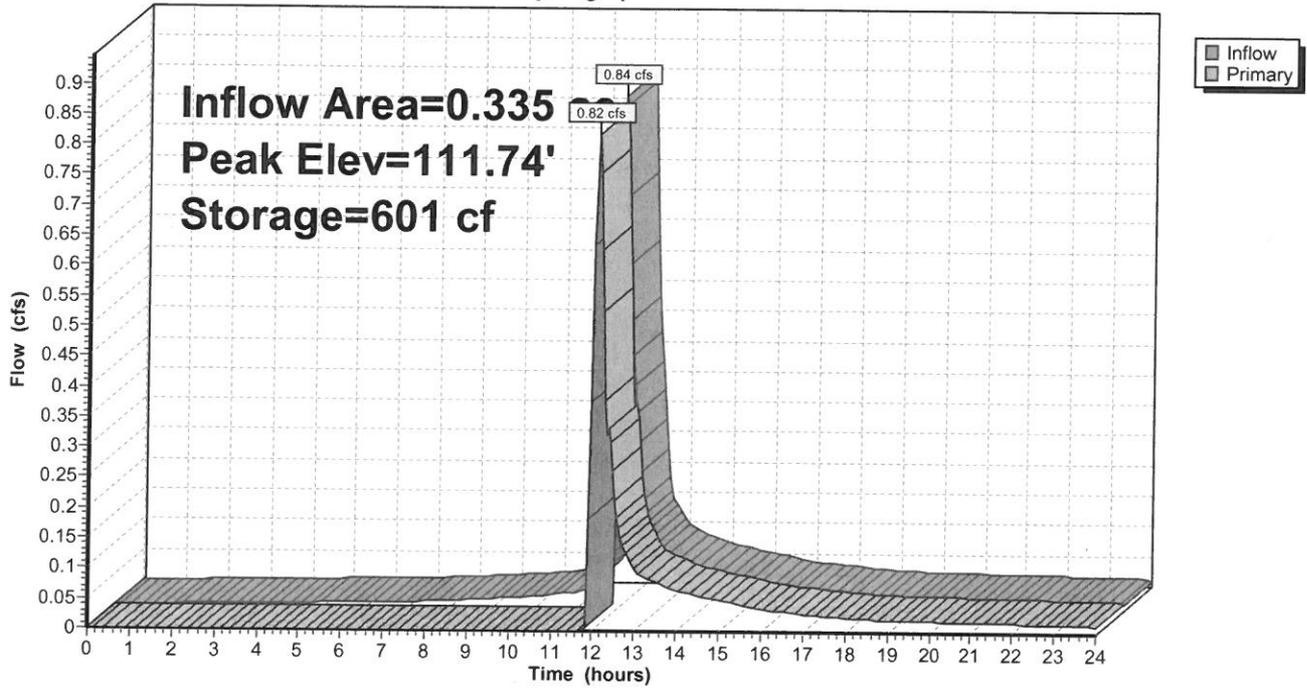
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---------------------|----------------------|---------------------------|---------------------------|
| 110.00 | 201 | 0 | 0 |
| 112.00 | 531 | 732 | 732 |
| 112.50 | 627 | 290 | 1,022 |

| Device | Routing | Invert | Outlet Devices |
|--------|---------|---------|---|
| #1 | Primary | 111.50' | 8.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads |

Primary OutFlow Max=0.80 cfs @ 12.06 hrs HW=111.74' TW=111.18' (Dynamic Tailwater)
 ↑ **1=Orifice/Grate** (Weir Controls 0.80 cfs @ 1.60 fps)

Pond 2P: Forebay

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Summary for Pond 3P: Basin

Inflow Area = 0.834 ac, 6.22% Impervious, Inflow Depth > 1.54" for 100 Year event
 Inflow = 1.35 cfs @ 12.05 hrs, Volume= 0.107 af
 Outflow = 0.63 cfs @ 12.29 hrs, Volume= 0.085 af, Atten= 53%, Lag= 14.6 min
 Primary = 0.63 cfs @ 12.29 hrs, Volume= 0.085 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Starting Elev= 110.50' Surf.Area= 708 sf Storage= 299 cf
 Peak Elev= 111.66' @ 12.29 hrs Surf.Area= 1,211 sf Storage= 1,410 cf (1,110 cf above start)
 Flood Elev= 112.50' Surf.Area= 1,578 sf Storage= 2,585 cf (2,285 cf above start)

Plug-Flow detention time= 163.0 min calculated for 0.079 af (73% of inflow)
 Center-of-Mass det. time= 45.0 min (925.9 - 881.0)

| Volume | Invert | Avail.Storage | Storage Description |
|---------------------|----------------------|---------------------------|--|
| #1 | 110.00' | 2,585 cf | Custom Stage Data (Prismatic) Listed below (Recalc) |
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
| 110.00 | 490 | 0 | 0 |
| 112.00 | 1,360 | 1,850 | 1,850 |
| 112.50 | 1,578 | 735 | 2,585 |

| Device | Routing | Invert | Outlet Devices |
|--------|---------|---------|--|
| #1 | Primary | 111.50' | 4.0' long x 2.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32 |

Primary OutFlow Max=0.63 cfs @ 12.29 hrs HW=111.66' TW=109.18' (Dynamic Tailwater)
 ↑ **1=Broad-Crested Rectangular Weir** (Weir Controls 0.63 cfs @ 1.01 fps)

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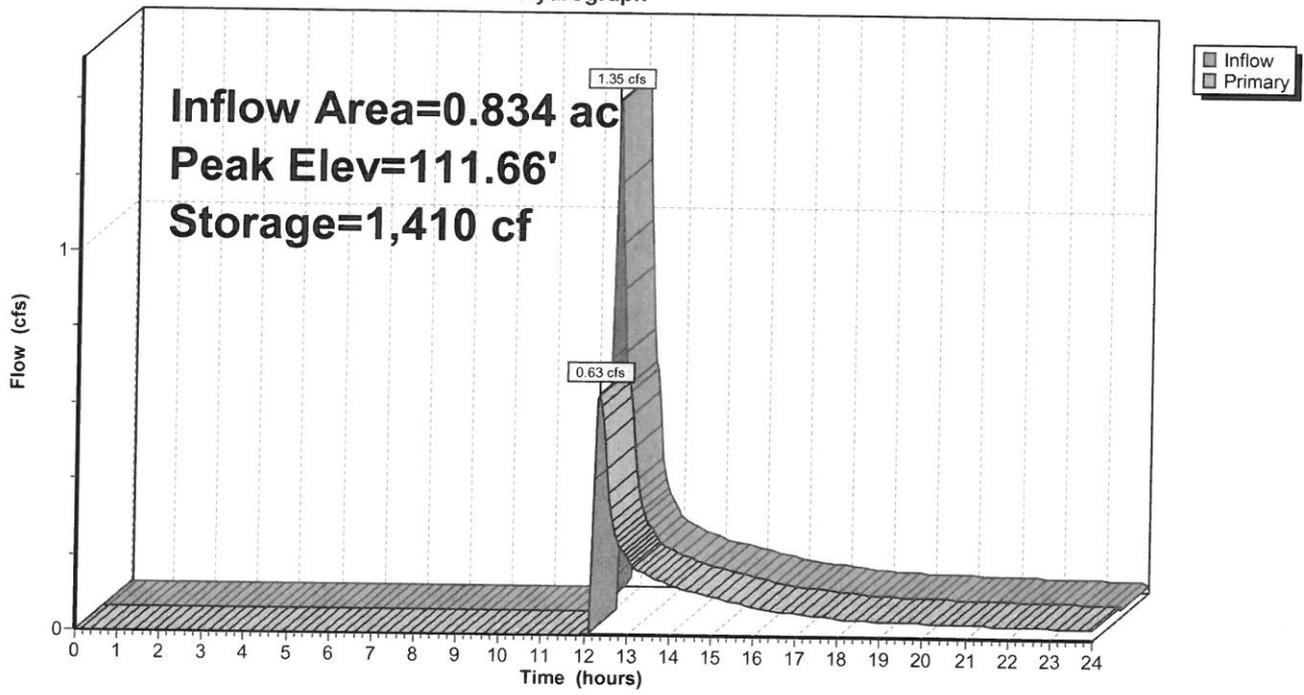
31 Newton Road
Type III 24-hr 100 Year Rainfall=6.85"

Printed 7/1/2016

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Pond 3P: Basin

Hydrograph



Stormwater Operation & Maintenance Plan

Project #16025

**31 Newton Road
Amesbury, Ma.**

W.C. Cammett Engineering, Inc.
297 Elm Street - Amesbury, MA

July 2016

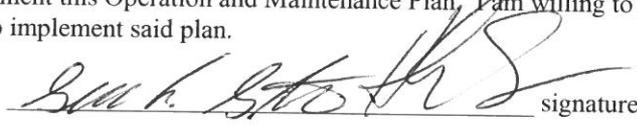
**OPERATION AND MAINTENANCE PLAN
FOR THE STORMWATER MANAGEMENT
FACILITIES**

July 2016

Owner and Responsible Party for Drainage utilities, located on locus property, Operation and Maintenance Plan after completion of project:

**Sean and Hanna Stellmach
31 Newton Road**

I Sean + Hanna Stellmach hereby certify that I have read and understand the requirements of and will implement this Operation and Maintenance Plan. I am willing to provide the necessary financial backing to implement said plan.

 signature 6/30/16 date

Schedule for Inspection and Maintenance:

This inspection and maintenance schedule has been prepared to ensure that the proposed Stormwater Management Facility functions as designed according to the Stormwater Management Policy issued by the Massachusetts Department of Environmental Protection. The Policy defines Stormwater Management Standards as guidelines for stormwater management. The Standards address water quality and quantity using non-structural measures, site planning, and Best Management Practices or BMP's. An inspection and maintenance schedule is necessary for the BMP's to continue to function properly and as designed.

During construction, stormwater management facilities will be inspected at least once bi-weekly and after every rainfall event of 0.5 in. or more. Stormwater Management Facility will be cleaned/maintained as required based upon inspection. The cleaning and maintenance of all BMP's during construction includes removing sediment, replacing or repairing any damaged structure or pipe, and ensuring that soil erosion is kept to a minimum. The owner will be responsible for inspection and maintenance during construction.

All disturbed areas and slopes shall be loamed and seeded. If grass does not sufficiently cover the disturbed areas or dies, additional seeding shall be conducted to properly vegetate the disturbed areas.

After construction is complete and the site has been stabilized, the following BMP maintenance schedule is proposed.

BMP: Subsurface Infiltration Basin

Inspections should be performed at a minimum of once per year or after major rainfall events if necessary. Cleaning should be done at the discretion of the owner to maintain proper storage and flow.

The following is the recommended procedure to inspect system in service:

- 1) Locate the riser section of the retention/detention system. The riser will typically be 24" in diameter or larger.
- 2) Remove the lid from the riser.
- 3) Measure the sediment buildup at each riser and cleanout location. Only certified confined space entry personnel having appropriate equipment should be permitted to enter the retention/detention System.
- 4) Inspect each manifold, all laterals, and outlet pipes for sediment build up, obstructions, or other problems. Obstructions should be removed at this time.
- 5) If measured sediment build up is between 5% - 20% of the pipe diameter, cleaning should be considered; if sediment build up exceeds 20%, cleaning should be performed at the earliest opportunity. A thorough cleaning of the system (manifolds and laterals) shall be performed by either manual methods or by a vacuum truck.

BMP: Sediment Forebay

The sediment forebay should be inspected monthly and cleaned out at least four times per year or when sediment depth is between 3 to 6 inches. After removing the sediment, replace any vegetation damaged during the clean-out by either reseeding or resodding. Make sure selected grasses are able to withstand periodic inundation under water and drought-tolerant during the summer.

When mowing grasses, keep the grass height no greater than 6 inches. Set mower blades no lower than 3 to 4 inches. Check for signs of rilling and gullyng and repair as needed. Remove trash and debris at the same time.

BMP: **Wet Basin**

The basin should be inspected at least once a year to ensure they are operating as designed.

Potential problems to check include:

- Subsidence, erosion, cracking or tree growth on embankment
- Damage to emergency spillway
- Sediment accumulation
- Erosion within the basin and banks
- Emergence of invasive species

Make any necessary repairs immediately.

At least twice a year, mow the upper-stage, side slopes, embankment and emergency spillway. At this time, also check for any trash and debris and remove it. Remove sediment from the basin as necessary, and at least once every 10 years.

INSPECTION AND MAINTENANCE CHECKLIST
For
31 Newton Road

| ITEM | DATE OF INSPECTION AND REQUIRED MAINTENANCE | MAINTENANCE TO BE PROVIDED / COMMENT | DATE MAINTENANCE COMPLETE |
|-------------------------------|---|--------------------------------------|---------------------------|
| Subsurface Infiltration Basin | | | |
| Sediment Forebay | | | |
| Infiltration Basin | | | |

Inspected By: _____ Date: _____

