# STORMWATER CALCULATIONS & REPORT

## Project

**50 Mattakeesett Street,**
**Pembroke, MA 02359**
**Assessor's Parcel C9-23E**
**Proposed Storage Units**

## Owner

**JPC / Pembroke Realty Trust**
**137 Washington Street**
**Norwell, MA 02061**

## Applicant

**Mike Bulman**
**P.O. Box 20**
**Scituate, MA 02066**

***Date: December 26, 2018***
***Prepared by:***


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*Registered Professional Engineers,*
*Project Managers & Environmental Consultants*

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COMMONWEALTH OF MASSACHUSETTS
JEFFREY M. HASSETT
CIVIL
No. 49293
REGISTERED PROFESSIONAL ENGINEER

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# Project Narrative
## 50 Mattakeesett Street
## Pembroke, Massachusetts

**Project Summary**

The project proponent proposes to construct two new storage unit buildings at 50 Mattakeesett Street, Pembroke, MA. The property is shown as Pembroke Assessor's Parcel C9-23E and is approximately 1.5 acres. The property has frontage on Mattakeesett Street and is abutted by developed residential properties. The property slopes to the southwest, northwest, and northeast towards the abutting residential properties.

The proposed stormwater system is comprised of an infiltration basin and a roof drywell system. The systems will provide groundwater recharge, treatment of pavement runoff and control the rates and volumes of runoff.

The work proposed by this project is described as constructing two new storage unit buildings and associated driveway, grading, lawn, landscaping and stormwater mitigation. The disturbed areas will be restored and stabilized with the proposed buildings, driveways, and lawn surfaces.

**Pre-Development Condition**

The site is currently comprised of an office building, paved parking lot, concrete walkway, woods, lawn and landscaped areas. The property currently has a stormwater system consisting of catch basins and leaching pits located in corners of the parking lot.

Soil information was obtained from the Soils Conservation Services (SCS) Survey of Plymouth County, Massachusetts and on-site soil testing. Based on SCS Soils Mapping the soils are classified as "427B – Newfields fine sandy loam, 3 to 8 percent slopes" (Hydrologic Soil Group B).

**Post-Development Condition**

In the post-development condition stormwater analysis, the same watershed areas were analyzed for the purpose of analyzing the rates and volumes of runoff from the proposed new storage unit buildings, and driveways. The proposed stormwater system is comprised of an infiltration basin to capture runoff from the proposed driveway and a roof drywell system to capture runoff from the roofs of the proposed storage unit buildings. The system will provide groundwater recharge, treatment of driveway runoff and control the rates and volumes of runoff. Refer to Watershed Delineation Plan WS-2 for a delineation of post-development drainage subareas. The design points for the post-development design condition correspond to the design points for the pre-development design condition and are shown on Plans WS-1 and WS-2.

The stormwater management system was designed to be in compliance with the DEP Stormwater Management Policy to the extent practicable.

**Erosion and Siltation Control**

The following are mitigating measures that will be employed to ensure that impacts to wetland interests protected under the Wetlands Protection Act are minimized to the extent possible.

Erosion and Sedimentation Control

The potential for temporary impacts to wetlands due to erosion and migration of sediments into adjacent wetlands will be mitigated by adherence to basic erosion control practices. These include:

1. Install staked mulch sock and/or silt fence (as directed by Conservation Agent) at the upland edge of the limit of work as shown on the Site Plan. This erosion control barrier shall be installed prior to earthwork at the site. An additional stockpile of siltation fence, and stakes will be stored on site for use in repairing the erosion control barrier as needed. Inspections of the erosion control barrier shall be made weekly and after all significant rainfall events.
2. Clearly define the limits of work in the field in order to minimize the extent of clearing and soil disturbance.
3. Regrade, loam and seed exposed soil areas immediately following construction.

## SUMMARY OF STORMWATER STANDARDS 1 – 10
## (50 Mattakeesett Street, Pembroke, MA)

**Standard #1: *No new stormwater conveyances (i.e. outfalls)…***

The project complies as it does not propose any new stormwater outfalls. Stormwater in the existing and proposed conditions flows overland in a southwesterly direction towards the abutting properties. It is the intent of the proposed design to follow the natural/existing conditions stormwater flow paths to the extent practicable. Proposed roof runoff will be directed to a roof drywell system and the driveway runoff will be directed to an infiltration basin.

**Standard #2: *Post-Development peak discharge rates do not exceed pre-development rates…***

The project has been designed to mitigate peak rates and volumes of runoff. See below for calculations of the runoff discharges and volumes for the 2, 10 and 100-yr. storm events.

**Peak Discharge Rates (cfs):**

Design Point #1:

| | 2-Yr. | 10-Yr. | 100-Yr. |
|---|---|---|---|
| Pre-Development | 0.65 | 1.72 | 4.78 |
| Post-Development | 0.45 | 1.51 | 4.61 |

Design Point #3:

| | 2-Yr. | 10-Yr. | 100-Yr. |
|---|---|---|---|
| Pre-Development | 0.35 | 0.82 | 2.11 |
| Post-Development | 0.35 | 0.81 | 2.04 |

**Volume of Runoff (ac-ft.):**

Design Point #1:

| | 2-Yr. | 10-Yr. | 100-Yr. |
|---|---|---|---|
| Pre-Development | 0.060 | 0.141 | 0.379 |
| Post-Development | 0.040 | 0.117 | 0.350 |

Design Point #3:

| | 2-Yr. | 10-Yr. | 100-Yr. |
|---|---|---|---|
| Pre-Development | 0.034 | 0.075 | 0.190 |
| Post-Development | 0.034 | 0.074 | 0.184 |

**Standard #3: *Loss of annual recharge to groundwater shall be eliminated…***

There is no loss of annual recharge to groundwater because the project proposes an infiltration basin and system of roof drywell chambers designed to infiltrate runoff.

Recharge Volume = 0.35 inches of runoff X Increased Impervious Area** (Hydrologic Soil Group B)

The redevelopment results in 7,678 s.f. of impervious roof and driveway area.

*Therefore* Minimum Recharge Volume = 0.35 in. x 7,678 s .f. X (1 ft./12 in.) = 224 c.f. (min.)

PROVIDED RECHARGE = 2000 c.f.
(Provided within the infiltration basin from bottom to the spillway and within the roof drywell system)
– see HydroCAD results in Appendix C)

**Standard #4: *Stormwater management systems...shall remove 80% of the average... TSS....***

Requirement: Provide 80% TSS Removal of the Water Quality Volume.

Water Quality Volume (WQV) = 0.5 inches of runoff X new driveway impervious areas*

*Therefore:* Minimum WQV = 0.5 inches X 3,980 s.f. X (1 ft./12 in.) = 166 c.f. (min.)

PROVIDED = 1,699 c.f.
(Provided within the infiltration basin – see HydroCAD results in Appendix C)

**Total impervious area for Std. 4 Calculation is not required to include roof runoff, as roof runoff is considered clean and free of suspended solids (non-metal roof is proposed).*

**Standard #5: Stormwater discharges from Land Uses with Higher Potential Pollutant Loads**

Not applicable. An office building is not a land use with higher potential pollutant loads.

**Standard #6: Stormwater discharges to critical areas...**

Not applicable. The property is not an ACEC.

**Standard #7: A redevelopment project is required to meet standards....only to the extent practicable**

The project is considered to be a partial redevelopment. The project has been designed to comply with all standards.

**Standard #8: Erosion & Sedimental Control Plan**

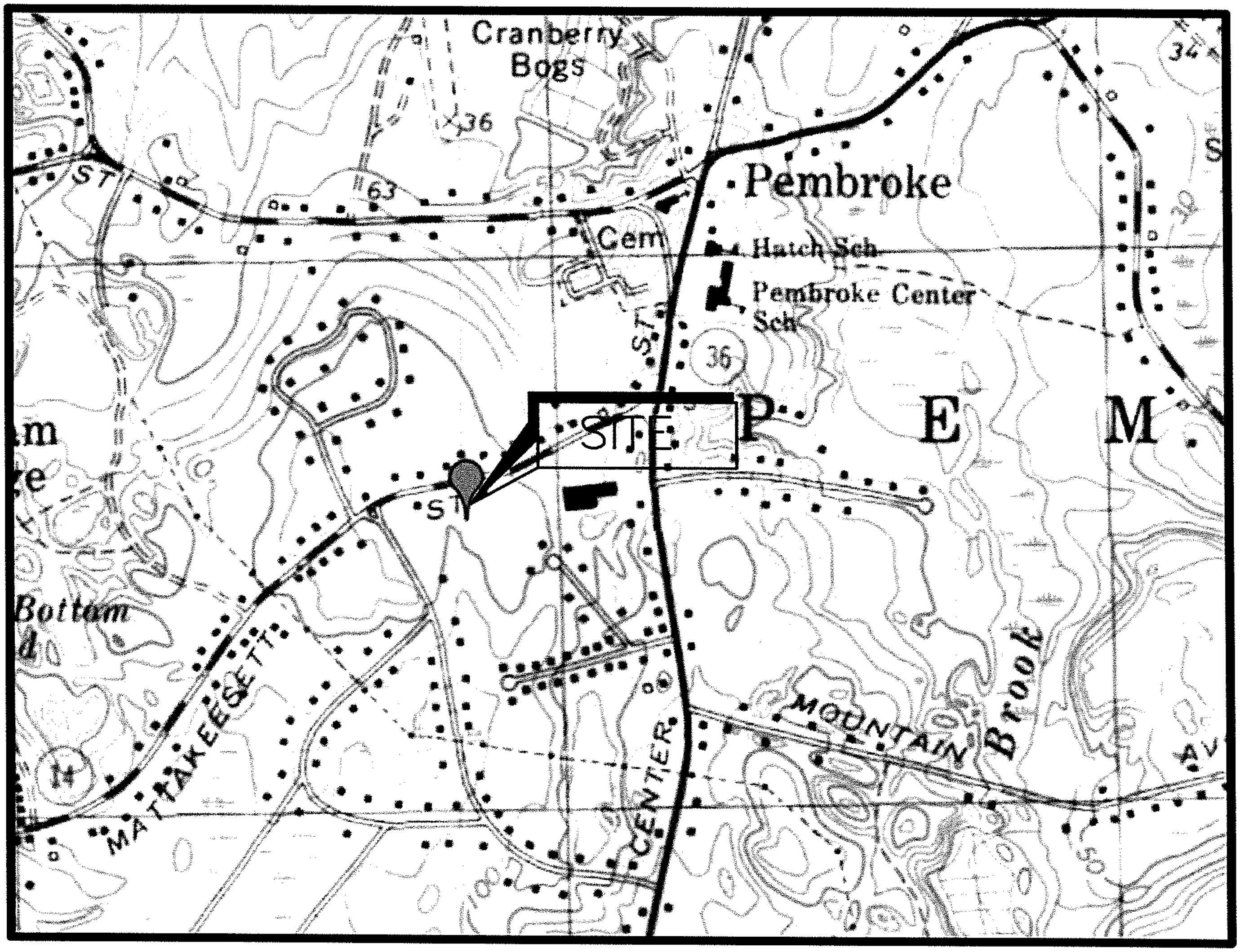
An Erosion & Sedimentation Control plan is submitted in Appendix A of this report.

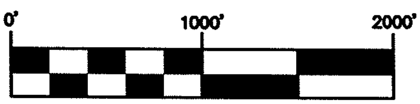
**Standard #9: A Long Term Operation & Maintenance Plan shall be developed...**

A Post-Construction Operation & Maintenance Plan is submitted in Appendix A of this report.

**Standard #10: All illicit discharges to the stormwater management system are prohibited.**

An illicit discharge compliance statement is submitted in Appendix A of this report.




SCALE: 1" = 1000'

U.S. GEOLOGICAL SURVEY
7.5 X 15 MINUTE SERIES

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FIGURE – 1

# USGS LOCUS MAP
## 50 MATTAKEESETT STREET
## PEMBROKE, MASSACHUSETTS


0' 200' 400'

SCALE: 1" = 200'

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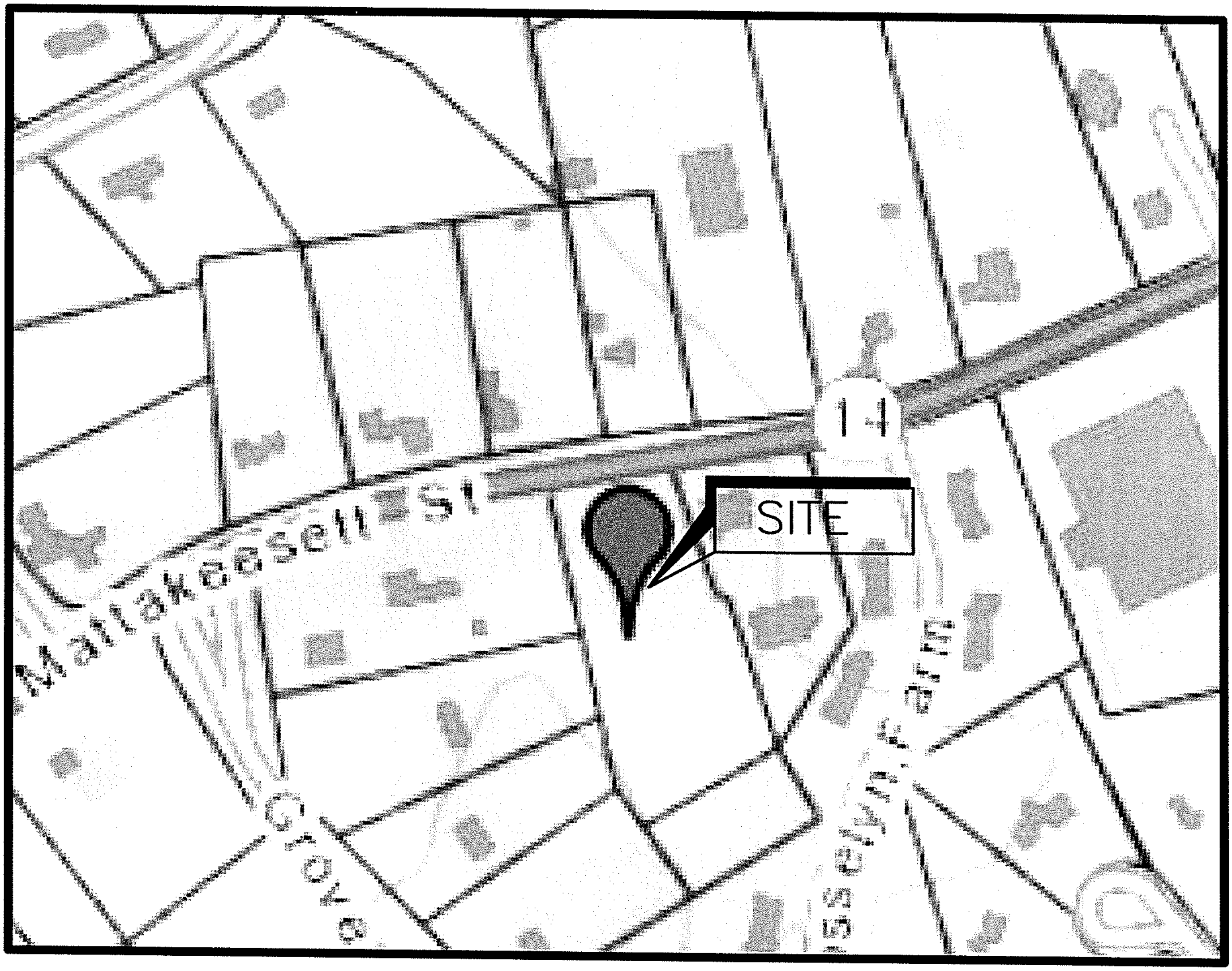
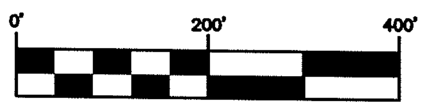
FIGURE – 2

# FEMA FLOOD MAP
## 50 MATTAKEESETT STREET
## PEMBROKE, MASSACHUSETTS




SCALE: 1" = 200'

NATURAL HERITAGE & ENDANGERED SPECIES ATLAS
MASS GIS


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FIGURE – 3

# NHESP MAP
## 50 MATTAKEESETT STREET
## PEMBROKE, MASSACHUSETTS


0' 200' 400'

SCALE: 1" = 200'

SCS SOILS MAP

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FIGURE - 4

# SCS SOILS MAP
## 50 MATTAKEESETT STREET
## PEMBROKE, MASSACHUSETTS

## APPENDIX A

- Const. Phase Stormwater Management Plan
- Construction Phase Erosion Control Maintenance Schedule & Checklist
- Post-Development Operation & Maintenance Plan & Long-Term Operation & Maintenance
- Stormceptor Owner's Manual
- Illicit Discharge Compliance Statement
- Storage Volume Calculation

# Construction Phase Operation & Maintenance Plan
# Best Management Practices
## 50 Mattakeesett Street
## Pembroke, MA

**Responsible Parties & Contact Information:**

Owner:

JPC / Pembroke Realty Trust
137 Washington Street
Norwell, MA 02061
781-659-7273

Contractor:

______________________________
______________________________
______________________________
______________________________

**Inspection & Record Keeping:**

The responsible party shall maintain an operation and maintenance log during construction to control construction-related impacts, including erosion, sedimentation and other pollutant sources and land disturbance activities.

The anticipated time to complete this project is twelve months. The responsible party shall inspect the construction site at least once every 14 calendar days and within 24 hours of a storm event of ½ inch or greater. Inspections shall be performed until the site is fully stabilized and the temporary sedimentation controls have been removed. The inspector shall inspect each measure to determine if it was installed/performed correctly. The inspector shall also determine if the measures have been damaged and if so the corrective action.

The log shall kept on-site at all times and shall be made available to MassDEP and the Conservation Commission upon request. Member and agents of MassDEP and the Conservation Commission shall be allowed to enter and inspect the premises to evaluate and ensure that the responsible party complies with the Operation and Maintenance Plan requirements for each BMP.

**Operation & Maintenance:**

Land disturbance activities for this project include constructing the proposed storage unit buildings and associated driveways, grading, lawn, landscaping and stormwater systems. During land disturbance and construction activities, project proponents must implement controls that prevent erosion, control sediment movement, and stabilize exposed soils to prevent pollutants from moving offsite. Construction activities increase the potential for erosion and sedimentation at a site which may adversely impact wetland resource areas. To prevent this impact, the following conditions shall be imposed to control erosion and sedimentation:

**Stabilization Practices:** Disturbed areas shall be stabilized and protected as soon as practicable. Disturbed areas shall be stabilized when construction activity in the area has ceased for more than 14 days unless not feasible due to snow cover or if construction activities will resume within 21 days after construction temporarily ceased. Stabilization measures include the following:

- Temporary seeding
- Geotextiles
- Mulching and Netting
- Permanent seeding

# Construction Phase: Erosion Control Maintenance Schedule & Checklist

## Construction Practices

| Best Management Practice | Inspection Frequency (1) | Date Inspected | Inspector | Minimum Maintenance and Key Items to Check (1) | Cleaning/Repair Needed: ☐yes ☐no (List Items) | Date of Cleaning/ Repair | Performed by |
|---|---|---|---|---|---|---|---|
| Construction Site Stabilization | Weekly | | | 1. Construction Site Stabilization Inspection/ Maintenance, temporary seeding, mulching etc.<br><br>Disturbed areas shall be stabilized when construction activity in the area has ceased for more than 14 days | | | |
| Erosion Barrier | Bi-Weekly | | | 1 Remove accumulated silt.<br>2 Repair rips / bulges. | | | |
| Mulching & Netting | Bi-Weekly | | | 1. Mulch Maintenance | | | |
| Land Grading | Weekly | | | 1. Check for washouts and/or gullies.<br>2. Check for accumulated silt. | | | |
| Permanent Seeding | Bi-Weekly | | | 1. Permanent Seeding Inspection/ Maintenance | | | |
| | | | | | | | |
| | | | | | | | |

**Stormwater Control Manager** ______________________________

# Long-Term Operation & Maintenance Plan
# Best Management Practices
## 50 Mattakeesett Street
## Pembroke, MA

**Responsible Parties & Contact Information:**

Owner:

JPC/Pembroke Realty Trust
137 Washington Street
Norwell, MA 02061
781-659-7273

**Record Keeping:**

The responsible party shall maintain an operation and maintenance log for a minimum of three years prior including inspections, repairs, replacement and disposal. The log shall be kept on-site at all times.

The log shall be made available to MassDEP and the Conservation Commission upon request. Members and agents of MassDEP and the Town shall be allowed to enter and inspect the premises to evaluate and ensure that the responsible party complies with the Operation and Maintenance Plan requirements for each BMP.

**Operation & Maintenance:**

In order to maintain the integrity of the stormwater management system, frequent inspections and maintenance shall be performed by the owner. The BMPs require continuous inspections and maintenance in order to function properly. The BMPs should be inspected and maintained as specified and after all major storm events.

**Gutter & Downspout Systems** shall be inspected quarterly. Material observed within any gutter or downspout shall be removed and disposed of in accordance with all applicable local, state and federal regulations. Inspect for signs of overflow to the surcharge pipe. It is recommended that "gutter guards" be installed on the roof gutter system to prevent leaves and tree debris from entering the subsurface system.

**Infiltration Basin** shall be checked for infiltrative capacity on a quarterly basis and after any significant rainfall event. Trash, leaves, branches, etc. shall be removed from basin and channel areas. Silt, sand and sediment, if significant accumulation occurs, shall be removed by hand annually. Material shall be removed and disposed of in accordance with all applicable local, states and federal regulations. Care shall be taken to maintain vegetation growth within a basin. Grass shall be cut and weeds and brush removed or trimmed at regular intervals during the growing season. Reseeding and weed control may need to be performed periodically to maintain healthy, dense vegetation and maintain the pollutant removal efficiency of the basin. Any slope erosion within the basins shall be stabilized and repaired as soon as practical. Mowing shall be performed frequently enough to keep the vegetation in vigorous condition and to control encroachment of weeds and woody vegetation, however it should not be mowed too closely so as to reduce the filtering effect. Mowing shall be performed with a bag attachment to prevent the compaction of cut grass and occur at a minimum of two times per year. The basins shall be monitored immediately after each two year storm event to verify that they fully drain within a 72-hour period. If it is found that the basin is not sufficiently drained, the basin shall be inspected by a Professional Engineer and the underlying gravel layer should be removed and replaced as overseen by a Professional Engineer.

Important items to check during inspection include: signs of differential settlement, cracking, erosion, leakage in the embankments, tree growth on the embankments, condition of riprap, sediment accumulation and the health of the turf.

**Roof Drywells** shall be checked for infiltrative capacity on a quarterly basis and after any significant rainfall event. Additional inspections should be scheduled during the first few months to make sure that the chambers are exfiltrating within 72 hours of all storms. It is recommended that "gutter guards" be installed on the roof gutter system to prevent leaves and tree debris from entering the subsurface system. Material observed within any roof drywell shall be removed and disposed of in accordance with all applicable local, states and federal regulations.

**Stormceptor** Owner's Manual is attached to this report.

**Anticipated Operation and Maintenance Cost:**
The annual anticipated operation and maintenance cost is approximately $1,500.00.

**Project Location: 50 Mattakeesett Street, Pembroke, MA**

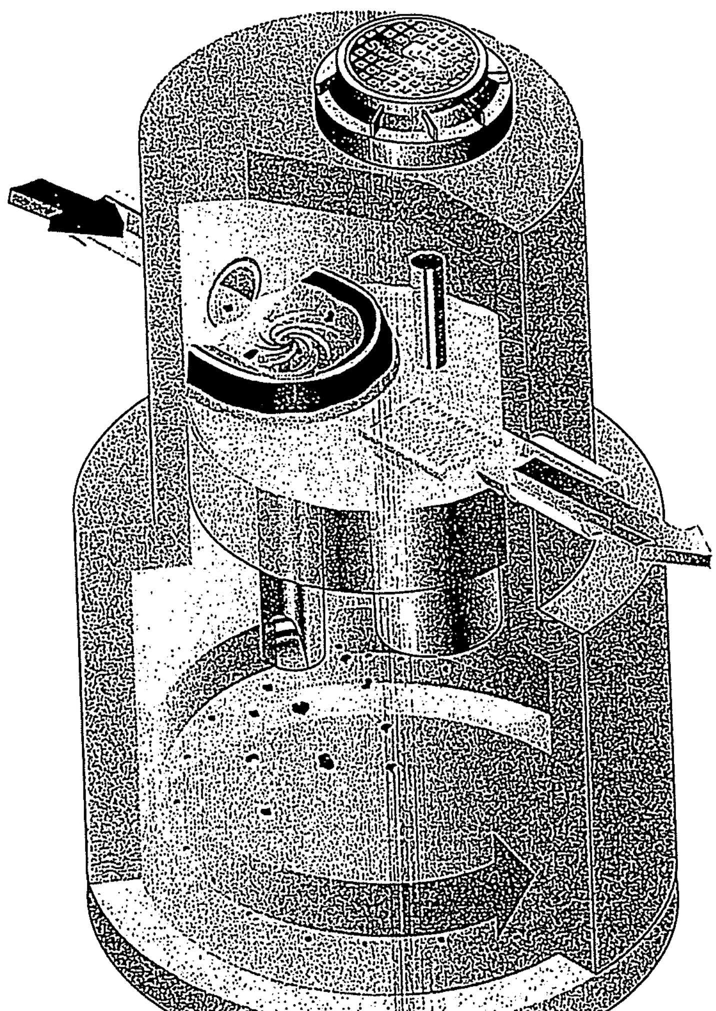
**Stormwater Management – Post Construction Phase**

**Best Management Practices – Inspection Schedule and Evaluation Checklist**

## Long Term Practices

| Best Management Practice | Inspection Frequency (1) | Date Inspected | Inspector | Minimum Maintenance and Key Items to Check (1) | Cleaning/Repair Needed: ☐yes ☐no (List Items) | Date of Cleaning/ Repair | Performed by |
|---|---|---|---|---|---|---|---|
| Driveway Sweeping | Monthly | | | Sweep & Remove any accumulated sediment | | | |
| Gutter and Downspout System | Quarterly | | | Remove material in gutters and downspouts.<br>Install gutter guards.<br>Inspect for signs of overflow to surcharge. | | | |
| Infiltration Basin | Quarterly | | | Check infiltrative capacity.<br>Remove sediment, trash and debris.<br>Repair erosion and scour.<br>Mow Grass | | | |
| Roof Drywell System | Quarterly | | | Inspect for infiltrative capacity<br>Repair erosion or scour | | | |
| Stormceptor | Monthly | | | Inspect and clean outlets<br>Twice per year – remove sediment, trash and debris with vacuum truck. | | | |

# Stormceptor®
# Owner's Manual



Stormceptor is protected by one or more of the following patents:

Canadian Patent No. 2,137,942
Canadian Patent No. 2,175,277
Canadian Patent No. 2,180,305
Canadian Patent No. 2,180,338
Canadian Patent No. 2,206,338
Canadian Patent No. 2,327,768
U.S. Patent No. 5,753,115
U.S. Patent No. 5,849,181
U.S. Patent No. 6,068,765
U.S. Patent No. 6,371,690
U.S. Patent No. 7,582,216
U.S. Patent No. 7,666,303
Australia Patent No. 693.164
Australia Patent No. 707,133
Australia Patent No. 729,096
Australia Patent No. 779,401
Australia Patent No. 2008,279,378
Australia Patent No. 2008,288,900
Indonesia Patent No. 0007058
Japan Patent No. 3581233
Japan Patent No. 9-11476
Korean Patent No. 0519212
Malaysia Patent No. 118987
New Zealand Patent No. 314,646
New Zealand Patent No. 583,008
New Zealand Patent No. 583,583
South African Patent No. 2010/00682
South African Patent No. 2010/01796
Other Patents Pending

## Table of Contents

Congratulations!

Your selection of a Stormceptor® means that you have chosen the most recognized and efficient stormwater oil/sediment separator available for protecting the environment. Stormceptor is a pollution control device often referred to as a "Hydrodynamic Separator (HDS)" or an "Oil Grit Separator (OGS)", engineered to remove and retain pollutants from stormwater runoff to protect our lakes, rivers and streams from the harmful effects of non-point source pollution.

## 1 – Stormceptor Overview

Stormceptor is a patented stormwater quality structure most often utilized as a treatment component of the underground storm drain network for stormwater pollution prevention. Stormceptor is designed to remove sediment, total suspended solids (TSS), other pollutants attached to sediment, hydrocarbons and free oil from stormwater runoff. Collectively the Stormceptor provides spill protection and prevents non-point source pollution from entering downstream waterways.

**Key benefits of Stormceptor include:**

- Removes sediment, suspended solids, debris, nutrients, heavy metals, and hydrocarbons (oil and grease) from runoff and snowmelt.
- Will not scour or re-suspend trapped pollutants.
- Provides sediment and oil storage.
- Provides spill control for accidents, commercial and industrial developments.
- Easy to inspect and maintain (vacuum truck).
- "STORMCEPTOR" is *clearly* marked on the access cover (excluding inlet designs).
- Relatively small footprint.
- 3rd Party tested and independently verified.
- Dedicated team of experts available to provide support.

**Model Types:**

- STC (Standard)
- STF (Fiberglass)
- EOS (Extended Oil Storage)
- OSR (Oil and Sand Removal)
- MAX (Custom designed unit, specific to site)

**Configuration Types:**

- Inlet unit (accommodates inlet flow entry, and multi-pipe entry)
- In-Line (accommodates multi-pipe entry)
- Submerged Unit (accommodates the site's tailwater conditions)
- Series Unit (combines treatment in two systems)

## Please Maintain Your Stormceptor

To ensure long-term environmental protection through continued performance as originally designed for your site, **Stormceptor must be maintained**, as any stormwater treatment practice does. The need for maintenance is determined through inspection of the Stormceptor. Procedures for inspection are provided within this document. Maintenance of the Stormceptor is performed from the surface via vacuum truck.

If you require information about Stormceptor, or assistance in finding resources to facilitate inspections or maintenance of your Stormceptor please call your local Stormceptor Licensee or Imbrium® Systems.

## 2 – Stormceptor Operation & Components

Stormceptor is a flexibly designed underground stormwater quality treatment device that is unparalleled in its effectiveness for pollutant capture and retention using patented flow separation technology.

Stormceptor creates a non-turbulent treatment environment below the insert platform within the system. The insert diverts water into the lower chamber, allowing free oils and debris to rise, and sediment to settle under relatively low velocity conditions. These pollutants are trapped and stored below the insert and protected from large runoff events for later removal during the maintenance procedure.

With thousands of units operating worldwide, Stormceptor delivers reliable protection every day, in every storm. The patented Stormceptor design prohibits the scour and release of captured pollutants, ensuring superior water quality treatment and protection during even the most extreme storm events. Stormceptor's proven performance is backed by the longest record of lab and field verification in the industry.

*Stormceptor Schematic and Component Functions*

Below are schematics of two common Stormceptor configurations with key components identified and their functions briefly described.

**Figure 1.** Inline Stormceptor

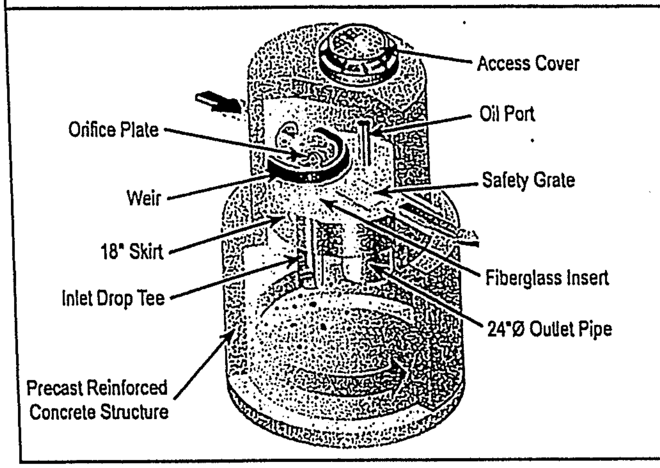
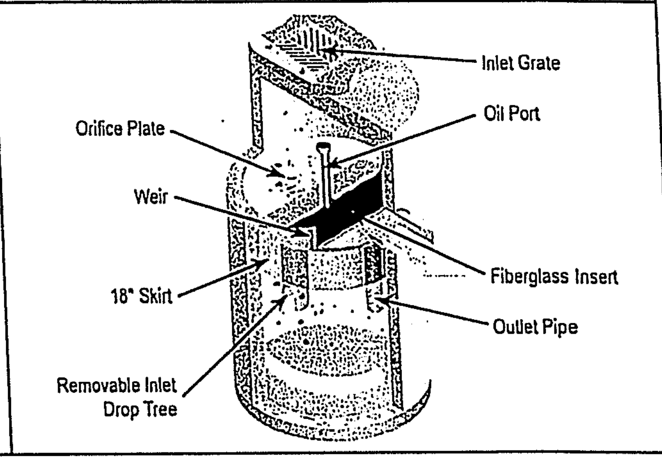



**Figure 2.** Inlet Stormceptor




- **Manhole access cover** – provides access to the subsurface components
- **Precast reinforced concrete structure** – provides the vessel's watertight structural support
- **Fiberglass insert** – separates vessel into upper and lower chambers
- **Weir** – directs incoming stormwater and oil spills into the lower chamber
- **Orifice plate** – prevents scour of accumulated pollutants
- **Inlet drop tee** – conveys stormwater into the lower chamber
- **Fiberglass skirt** – provides double-wall containment of hydrocarbons
- **Outlet riser pipe** – conveys treated water to the upper chamber; primary vacuum line access port for sediment removal
- **Oil inspection port** – primary access for measuring oil depth and oil removal
- **Safety grate** – safety measure to cover riser pipe in the event of manned entry into vessel

## 3 – Stormceptor Identification

Stormceptor is available in both precast concrete and fiberglass vessels, with precast concrete often being the dominant material of construction.

In the Stormceptor, a patented, engineered fiberglass insert separates the structure into an upper chamber and lower chamber. The lower chamber will remain full of water, as this is where the pollutants are sequestered for later removal. Multiple Stormceptor model (STC, OSR, EOS, MAX and STF) configurations exist, each to be inspected and maintained in a similar fashion.

Each unit is easily identifiable as a Stormceptor by the trade name "Stormceptor" embossed on each access cover at the surface. To determine the location of "inlet" Stormceptor units with horizontal catch basin inlet, look down into the grate as the Stormceptor insert will be visible. The name "Stormceptor" is not embossed on inlet models due to the variability of inlet grates used/ approved across North America.

Once the location of the Stormceptor is determined, the model number may be identified by comparing the measured depth from the fiberglass insert level at the outlet pipe's invert (water level) to the bottom of the tank using **Table 1**.

In addition, starting in 1996 a metal serial number tag containing the model number has been affixed to the inside of the unit, on the fiberglass insert. If the unit does not have a serial number, or if there is any uncertainty regarding the size of the unit using depth measurements, please contact your local Stormceptor Representative for assistance.

### *Sizes/Models*

Typical general dimensions and capacities of the standard precast STC, EOS & OSR Stormceptor models in both USA and Canada/International (excluding South East Asia and Australia) are provided in **Tables 1 and 2.** Typical rim to invert measurements are provided later in this document. The total depth for cleaning will be the sum of the depth from outlet pipe invert (generally the water level) to rim (grade) and the depth from outlet pipe invert to the precast bottom of the unit. Note that depths and capacities may vary slightly between regions.

**Table 1A. (US) Stormceptor Dimensions – Insert to Base of Structure**

| STC Model | Insert to Base (in.) |
|---|---|
| 450 | 60 |
| 900 | 55 |
| 1200 | 71 |
| 1800 | 105 |
| 2400 | 94 |
| 3600 | 134 |
| 4800 | 128 |
| 6000 | 150 |
| 7200 | 134 |
| 11000* | 128 |
| 13000* | 150 |
| 16000* | 134 |

| EOS Model | Insert to Base (in.) |
|---|---|
| 4-175 | 60 |
| 9-365 | 55 |
| 12-590 | 71 |
| 18-1000 | 105 |
| 24-1400 | 94 |
| 36-1700 | 134 |
| 48-2000 | 128 |
| 60-2500 | 150 |
| 72-3400 | 134 |
| 110-5000* | 128 |
| 130-6000* | 150 |
| 160-7800* | 134 |

| OSR Model | Insert to Base (in.) |
|---|---|
| 65 | 60 |
| 140 | 55 |
| | |
| | |
| 250 | 94 |
| | |
| 390 | 128 |
| | |
| 560 | 134 |
| 780* | 128 |
| | |
| 1125* | 134 |

| Typical STF m (in.) |
|---|
| 1.5 (60) |
| 1.5 (61) |
| 1.8 (73) |
| 2.9 (115) |
| 2.3 (89) |
| 3.2 (127) |
| 2.9 (113) |
| 3.5 (138) |
| 3.3 (128) |

*Notes:*

1. *Depth Below Pipe Inlet Invert to the Bottom of Base Slab can vary slightly by manufacturing facility, and can be modified to accommodate specific site designs, pollutant loads or site conditions. Contact your local representative for assistance.*

**Consist of two chamber structures in series.*

## Table 1B. (CA & Int'l) Stormceptor Dimensions – Insert to Base of Structure

| STC Model | Insert to Base (m) | EOS Model | Insert to Base (m) | OSR Model | Insert to Base (m) | Typical STF m (in.) |
|---|---|---|---|---|---|---|
| 300 | 1.5 | 300 | 1.5 | 300 | 1.7 | 1.5 (60) |
| 750 | 1.5 | 750 | 1.5 | 750 | 1.6 | 1.5 (61) |
| 1000 | 1.8 | 1000 | 1.8 | | | 1.8 (73) |
| 1500 | 2.8 | | | | | 2.9 (115) |
| 2000 | 2.8 | 2000 | 2.8 | 2000 | 2.6 | 2.3 (89) |
| 3000 | 3.7 | 3000 | 3.7 | | | 3.2 (127) |
| 4000 | 3.4 | 4000 | 3.4 | 4000 | 3.6 | 2.9 (113) |
| 5000 | 4.0 | 5000 | 4.0 | | | 3.5 (138) |
| 6000 | 3.7 | 6000 | 3.7 | 6000 | 3.7 | 3.3 (128) |
| 9000* | 3.4 | 9000* | 3.4 | 9000* | 3.6 | |
| 11000* | 4.0 | 10000* | 4.0 | | | |
| 14000* | 3.7 | 14000* | 3.7 | 14000* | 3.7 | |

*Notes:*

1. *Depth Below Pipe Inlet Invert to the Bottom of Base Slab can vary slightly by manufacturing facility, and can be modified to accommodate specific site designs, pollutant loads or site conditions. Contact your local representative for assistance.*

**Consist of two chamber structures in series.*

## Table 2A. (US) Storage Capacities

| STC Model | Hydrocarbon Storage Capacity gal | Sediment Capacity ft³ | EOS Model | Hydrocarbon Storage Capacity gal | OSR Model | Hydrocarbon Storage Capacity gal | Sediment Capacity ft³ |
|---|---|---|---|---|---|---|---|
| 450 | 86 | 46 | 4-175 | 175 | 065 | 115 | 46 |
| 900 | 251 | 89 | 9-365 | 365 | 140 | 233 | 58 |
| 1200 | 251 | 127 | 12-590 | 591 | | | |
| 1800 | 251 | 207 | 18-1000 | 1198 | | | |
| 2400 | 840 | 205 | 24-1400 | 1457 | 250 | 792 | 156 |
| 3600 | 840 | 373 | 36-1700 | 1773 | | | |
| 4800 | 909 | 543 | 48-2000 | 2005 | 390 | 1233 | 465 |
| 6000 | 909 | 687 | 60-2500 | 2514 | | | |
| 7200 | 1059 | 839 | 72-3400 | 3418 | 560 | 1384 | 690 |
| 11000* | 2797 | 1089 | 110-5000* | 5023 | 780* | 2430 | 930 |
| 13000* | 2797 | 1374 | 130-6000* | 6041 | | | |
| 16000* | 3055 | 1677 | 160-7800* | 7850 | 1125* | 2689 | 1378 |

*Notes:*

1. *Hydrocarbon & Sediment capacities can be modified to accommodate specific site design requirements, contact your local representative for assistance.*

**Consist of two chamber structures in series.*

## Table 2B. (CA & Int'l) Storage Capacities

| STC Model | Hydrocarbon Storage Capacity L | Sediment Capacity L | EOS Model | Hydrocarbon Storage Capacity L | OSR Model | Hydrocarbon Storage Capacity L | Sediment Capacity L |
|---|---|---|---|---|---|---|---|
| 300 | 300 | 1450 | 300 | 662 | 300 | 300 | 1500 |
| 750 | 915 | 3000 | 750 | 1380 | 750 | 900 | 3000 |
| 1000 | 915 | 3800 | 1000 | 2235 | | | |
| 1500 | 915 | 6205 | | | | | |
| 2000 | 2890 | 7700 | 2000 | 5515 | 2000 | 2790 | 7700 |
| 3000 | 2890 | 11965 | 3000 | 6710 | | | |
| 4000 | 3360 | 16490 | 4000 | 7585 | 4000 | 4700 | 22200 |
| 5000 | 3360 | 20940 | 5000 | 9515 | | | |
| 6000 | 3930 | 26945 | 6000 | 12940 | 6000 | 5200 | 26900 |
| 9000* | 10555 | 32980 | 9000* | 19010 | 9000* | 9300 | 33000 |
| 11000* | 10555 | 37415 | 10000* | 22865 | | | |
| 14000* | 11700 | 53890 | 14000* | 29715 | 14000* | 10500 | 53900 |

*Notes:*

1. *Hydrocarbon & Sediment capacities can be modified to accommodate specific site design requirements, contact your local representative for assistance.*

**Consist of two chamber structures in series.*

## 4 – Stormceptor Inspection & Maintenance

Regular inspection and maintenance is a proven, cost-effective way to maximize water resource protection for all stormwater pollution control practices, and is required to insure proper functioning of the Stormceptor. Both inspection and maintenance of the Stormceptor is easily performed from the surface. Stormceptor's patented technology has no moving parts, simplifying the inspection and maintenance process.

Please refer to the following information and guidelines before conducting inspection and maintenance activities.

### *When is inspection needed?*

- Post-construction inspection is required prior to putting the Stormceptor into service.
- Routine inspections are recommended during the first year of operation to accurately assess the sediment accumulation.
- Inspection frequency in subsequent years is based on the maintenance plan developed in the first year.
- Inspections should also be performed immediately after oil, fuel, or other chemical spills.

### *When is maintenance cleaning needed?*

- For optimum performance, the unit should be cleaned out once the sediment depth reaches the recommended maintenance sediment depth, which is approximately 15% of the unit's total storage capacity (see **Table 2**). The frequency should be adjusted based on historical inspection results due to variable site pollutant loading.

- Sediment removal is easier when removed on a regular basis at or prior to the recommended maintenance sediment depths, as sediment build-up can compact making removal more difficult.
- The unit should be cleaned out immediately after an oil, fuel or chemical spill.

***What conditions can compromise Stormceptor performance?***

- If construction sediment and debris is not removed prior to activating the Stormceptor unit, maintenance frequency may be reduced.
- If the system is not maintained regularly and fills with sediment and debris beyond the capacity as indicated in **Table 2**, pollutant removal efficiency may be reduced.
- If an oil spill(s) exceeds the oil capacity of the system, subsequent spills may not be captured.
- If debris clogs the inlet of the system, removal efficiency of sediment and hydrocarbons may be reduced.
- If a downstream blockage occurs, a backwater condition may occur for the Stormceptor and removal efficiency of sediment and hydrocarbons may be reduced.

***What training is required?***

The Stormceptor is to be inspected and maintained by professional vacuum cleaning service providers with experience in the maintenance of underground tanks, sewers and catch basins. For typical inspection and maintenance activities, no specific supplemental training is required for the Stormceptor. Information provided within this Manual (provided to the site owner) contains sufficient guidance to maintain the system properly.

In unusual circumstances, such as if a damaged component needs replacement or some other condition requires manned entry into the vessel, confined space entry procedures must be followed. Only professional maintenance service providers trained in these procedures should enter the vessel. Service provider companies typically have personnel who are trained and certified in confined space entry procedures according to local, state, and federal standards.

***What equipment is typically required for inspection?***

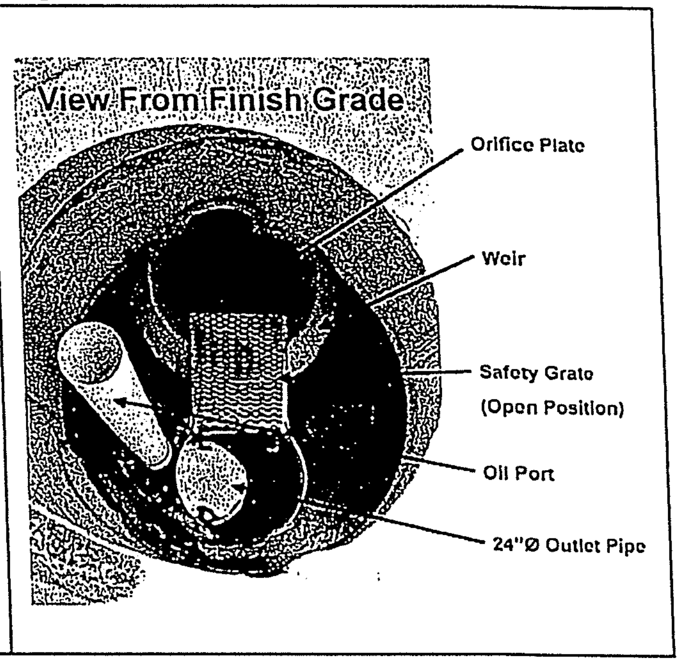
- Manhole access cover lifting tool
- Oil dipstick / Sediment probe with ball valve (typically ¾-inch to 1-inch diameter)
- Flashlight
- Camera
- Data log / Inspection Report
- Safety cones and caution tape
- Hard hat, safety shoes, safety glasses, and chemical-resistant gloves

## Recommended Stormceptor Inspection Procedure:

- Stormceptor is to be inspected from grade through a standard surface manhole access cover.
- Sediment and oil depth inspections are performed with a sediment probe and oil dipstick.
- Oil depth is measured through the oil inspection port, either a 4-inch (100 mm) or 6-inch (150 mm) diameter port.
- Sediment depth can be measured through the oil inspection port or the 24-inch (610 mm) diameter outlet riser pipe.
- Inspections also involve a visual inspection of the internal components of the system.

Figure 3.

Figure 4.




***What equipment is typically required for maintenance?***

- Vacuum truck equipped with water hose and jet nozzle
- Small pump and tubing for oil removal
- Manhole access cover lifting tool
- Oil dipstick / Sediment probe with ball valve (typically ¾-inch to 1-inch diameter)
- Flashlight
- Camera
- Data log / Inspection Report
- Safety cones
- Hard hats, safety shoes, safety glasses, chemical-resistant gloves, and hearing protection for service providers
- Gas analyzer, respiratory gear, and safety harness for specially trained personnel if confined space entry is required

## Recommended Stormceptor Maintenance Procedure

Maintenance of Stormceptor is performed using a vacuum truck.

No entry into the unit is required for maintenance. ***DO NOT ENTER THE STORMCEPTOR CHAMBER*** unless you have the proper personal safety equipment, have been trained and are qualified to enter a confined space, as identified by local Occupational Safety and Health Regulations (e.g. 29 CFR 1910.146 or Canada Occupational Safety and Health Regulations – SOR/86-304). Without the proper equipment, training and permit, entry into confined spaces can result in serious bodily harm and potentially death. Consult local, provincial, and/or state regulations to determine the requirements for confined space entry. Be aware, and take precaution that the Stormceptor fiberglass insert may be slippery. In addition, be aware that some units do not have a safety grate to cover the outlet riser pipe that leads to the submerged, lower chamber.

- Ideally maintenance should be conducted during dry weather conditions when no flow is entering the unit.
- Stormceptor is to be maintained through a standard surface manhole access cover.
- Insert the oil dipstick into the oil inspection port. If oil is present, pump off the oil layer into separate containment using a small pump and tubing.
- Maintenance cleaning of accumulated sediment is performed with a vacuum truck.
  - For 6-ft (1800 mm) diameter models and larger, the vacuum hose is inserted into the lower chamber via the 24-inch (610 mm) outlet riser pipe.
  - For 4-ft (1200 mm) diameter model, the removable drop tee is lifted out, and the vacuum hose is inserted into the lower chamber via the 12-inch (305 mm) drop tee hole.

**Figure 5.**

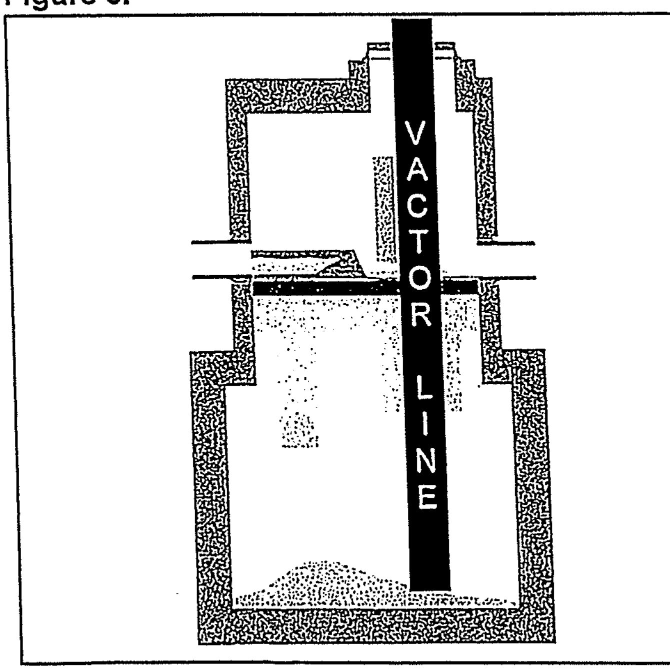
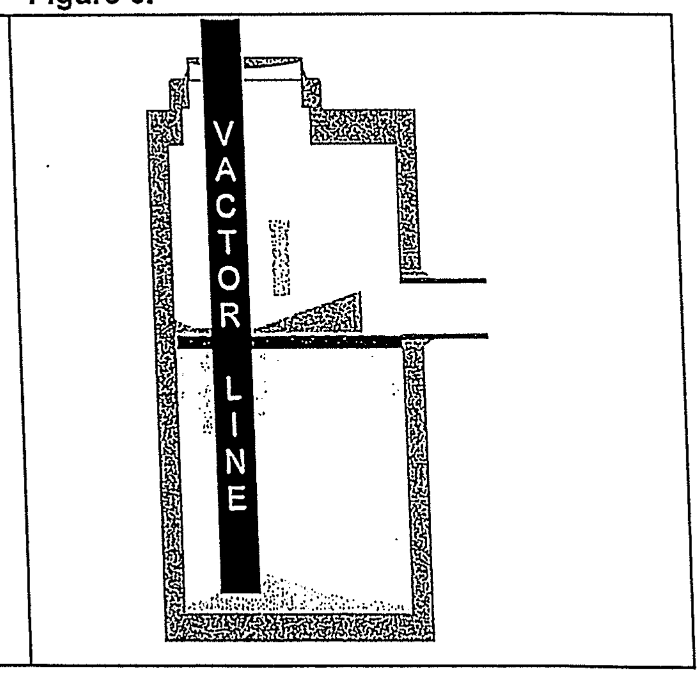



**Figure 6.**



- Using the vacuum hose, decant the water from the lower chamber into a separate containment tank or to the sanitary sewer, if permitted by the local regulating authority.
- Remove the sediment sludge from the bottom of the unit using the vacuum hose. For large Stormceptor units, a flexible hose is often connected to the primary vacuum line for ease of movement in the lower chamber.
- Units that have not been maintained regularly, have surpassed the maximum recommended sediment capacity, or contain damaged components may require manned entry by trained personnel using safe and proper confined space entry procedures.

Figure 7.

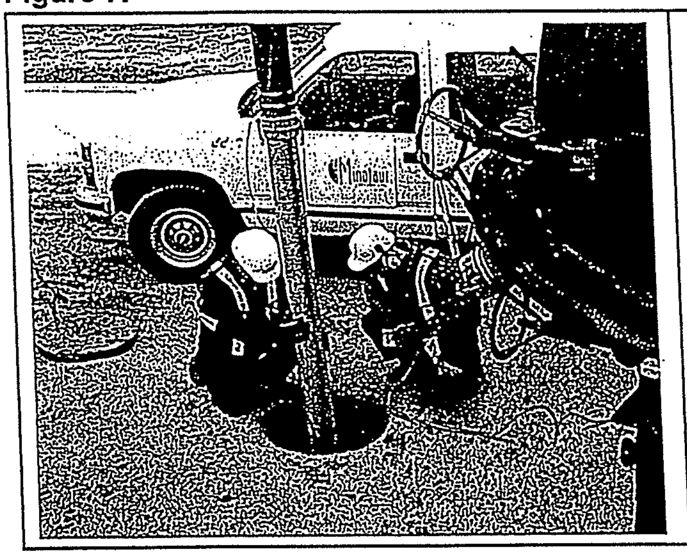
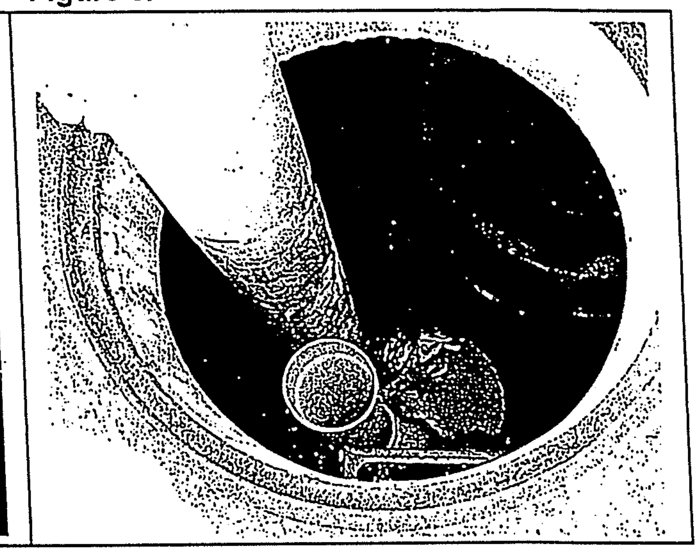


Figure 8.



*A maintenance worker stationed at the above ground surface uses a vacuum hose to evacuate water, sediment, and debris from the system.*

### *What is required for proper disposal?*

The requirements for the disposal of material removed from Stormceptor units are similar to that of any other stormwater treatment Best Management Practices (BMP). Local guidelines should be consulted prior to disposal of the separator contents. In most areas the sediment, once dewatered, can be disposed of in a sanitary landfill. It is not anticipated that the sediment would be classified as hazardous waste. This could be site and pollutant dependent. In some cases, approval from the disposal facility operator/agency may be required.

### *What about oil spills?*

Stormceptor is often implemented in areas where there is high potential for oil, fuel or other hydrocarbon or chemical spills. Stormceptor units should be cleaned immediately after a spill occurs by a licensed liquid waste hauler. You should also notify the appropriate regulatory agencies as required in the event of a spill.

### *What if I see an oil rainbow or sheen at the Stormceptor outlet?*

With a steady influx of water with high concentrations of oil, a sheen may be noticeable at the Stormceptor outlet. This may occur because a hydrocarbon rainbow or sheen can be seen at very small oil concentrations (< 10 ppm). Stormceptor is effective at removing 95% of free oil, and the appearance of a sheen at the outlet with high influent oil concentrations does not mean that the unit is not working to this level of removal. In addition, if the influent oil is emulsified, the Stormceptor will not be able to remove it. The Stormceptor is designed for free oil removal and not emulsified or dissolved oil conditions.

### *What factors affect the costs involved with inspection/maintenance?*

The Vacuum Service Industry for stormwater drainage and sewer systems is a well-established sector of the service industry that cleans underground tanks, sewers and catch basins. Costs to clean Stormceptor units will vary. Inspection and maintenance costs are most often based on unit size, the number of units on a site, sediment/oil/hazardous material loads, transportation distances, tipping fees, disposal requirements and other local regulations.

### *What factors predict maintenance frequency?*

Maintenance frequency will vary with the amount of pollution on your site (number of hydrocarbon spills, amount of sediment, site activity and use, etc.). It is recommended that the frequency of maintenance be increased or reduced based on local conditions. If the sediment load is high from an unstable site or sediment loads transported from upstream catchments, maintenance may be required semi-annually. Conversely once a site has stabilized, maintenance may be required less frequently (for example: two to seven year, site and situation dependent). Maintenance should be performed immediately after an oil spill or once the sediment depth in Stormceptor reaches the value specified in **Table 3** based on the unit size.

**Table 3A. (US) Recommended Sediment Depths Indicating Maintenance**

| STC Model | Maintenance Sediment depth (in) | EOS Model | Maintenance Sediment depth (in) | Oil Storage Depth (in) | OSR Model | Maintenance Sediment depth (in) |
|---|---|---|---|---|---|---|
| 450 | 8 | 4-175 | 9 | 24 | 065 | 8 |
| 900 | 8 | 9-365 | 9 | 24 | 140 | 8 |
| 1200 | 10 | 12-590 | 11 | 39 | | |
| 1800 | 15 | | | | | |
| 2400 | 12 | 24-1400 | 14 | 68 | 250 | 12 |
| 3600 | 17 | 36-1700 | 19 | 79 | | |
| 4800 | 15 | 48-2000 | 16 | 68 | 390 | 17 |
| 6000 | 18 | 60-2500 | 20 | 79 | | |
| 7200 | 15 | 72-3400 | 17 | 79 | 560 | 17 |
| 11000* | 17 | 110-5000* | 16 | 68 | 780* | 17 |
| 13000* | 20 | 130-6000* | 20 | 79 | | |
| 16000* | 17 | 160-7800* | 17 | 79 | 1125* | 17 |

*Note:*

1. *The values above are for typical standard units.*

**Per structure.*

## Table 3B. (CA & Int'l) Recommended Sediment Depths Indicating Maintenance

| STC Model | Maintenance Sediment depth (mm) | EOS Model | Maintenance Sediment depth (mm) | Oil Storage Depth (mm) | OSR Model | Maintenance Sediment depth (mm) |
|---|---|---|---|---|---|---|
| 300 | 225 | 300 | 225 | 610 | 300 | 200 |
| 750 | 230 | 750 | 230 | 610 | 750 | 200 |
| 1000 | 275 | 1000 | 275 | 990 | | |
| 1500 | 400 | | | | | |
| 2000 | 350 | 2000 | 350 | 1727 | 2000 | 300 |
| 3000 | 475 | 3000 | 475 | 2006 | | |
| 4000 | 400 | 4000 | 400 | 1727 | 4000 | 375 |
| 5000 | 500 | 5000 | 500 | 2006 | | |
| 6000 | 425 | 6000 | 425 | 2006 | 6000 | 375 |
| 9000* | 400 | 9000* | 400 | 1727 | 9000* | 425 |
| 11000* | 500 | 10000* | 500 | 2006 | | |
| 14000* | 425 | 14000* | 425 | 2006 | 14000* | 425 |

*Note:*

1. *The values above are for typical standard units.*

**Per structure.*

### *Replacement parts*

Since there are no moving parts during operation in a Stormceptor, broken, damaged, or worn parts are not typically encountered. Therefore, inspection and maintenance activities are generally focused on pollutant removal. However, if replacements parts are necessary, they may be purchased by contacting your local Stormceptor Representative, or Imbrium Systems.

**The benefits of regular inspection and maintenance are many – from ensuring maximum operation efficiency, to keeping maintenance costs low, to the continued protection of natural waterways – and provide the key to Stormceptor's long and effective service life.**

### Stormceptor Inspection and Maintenance Log

Stormceptor Model No: ______________________________

Allowable Sediment Depth: ______________________________

Serial Number: ______________________________

Installation Date: ______________________________

Location Description of Unit: ______________________________

Other Comments: ______________________________

## Contact Information

Questions regarding the Stormceptor can be addressed by contacting your area Stormceptor Licensee, Imbrium Systems, or visit our website at www.stormceptor.com.

**Stormceptor Licensees:**

CANADA

Lafarge Canada Inc.
www.lafargepipe.com
403-292-9502 / 1-888-422-4022 — Calgary, AB
780-468-5910 — Edmonton, AB
204-958-6348 — Winnipeg, MB, NW. ON, SK

Langley Concrete Group
www.langleyconcretegroup.com
604-502-5236 — BC

Hanson Pipe & Precast Inc.
www.hansonpipeandprecast.com
519-622-7574 / 1-888-888-3222 — ON

Lécuyer et Fils Ltée.
www.lecuyerbeton.com
450-454-3928 / 1-800-561-0970 — QC

Strescon Limited
www.strescon.com
902-494-7400 — NS, NF
506-633-8877 — NB, PE

UNITED STATES

Rinker Materials
www.rinkerstormceptor.com
1-800-909-7763

AUSTRALIA & SOUTHEAST ASIA, including New Zealand & Japan

Humes Water Solutions
www.humes.com.au
+61 7 3364 2894

**Imbrium Systems Inc. & Imbrium Systems LLC**

| | |
|---|---|
| Canada | 1-416-960-9900 / 1-800-565-4801 |
| United States | 1-301-279-8827 / 1-888-279-8826 |
| International | +1-416-960-9900 / +1-301-279-8827 |
| Email | info@imbriumsystems.com |

www.imbriumsystems.com
www.stormceptor.com

December 26, 2018

TO: Town of Pembroke
Conservation Commission
100 Center Street, Town Hall
Pembroke, MA 02359

RE: 50 Mattakeesett Street, Pembroke, MA

To Members of the Commission:

This letter is a statement that to the best of my knowledge, no illicit discharges currently exist or are being considered by me to the stormwater management system. An illicit discharge is any discharge that is not composed entirely of stormwater.

Applicant's Representative

MORSE ENGINEERING CO., INC.
19 Union Street, P.O. Box 92
Scituate, MA 02066
(781) 545-0895

JOB 50 MATTAKEESETT STREET

SHEET NO. ______ OF ______

CALCULATED BY ______ DATE ______

CHECKED BY ______ DATE ______

SCALE ______

STORAGE VOLUME

EXISTING RUNOFF VOLUME = 0.379 ac.-ft. (SUB-1)

PROPOSED RUNOFF VOLUME = 0.221 ac-ft. (SUB-1A) + 0.203 ac.-ft. (SUB-1B) + 0.067 ac.-ft (SUB-1C)

= 0.491 ac.-ft

$\Sigma$ = + 0.112 ac-ft

= + 4879 C.F.

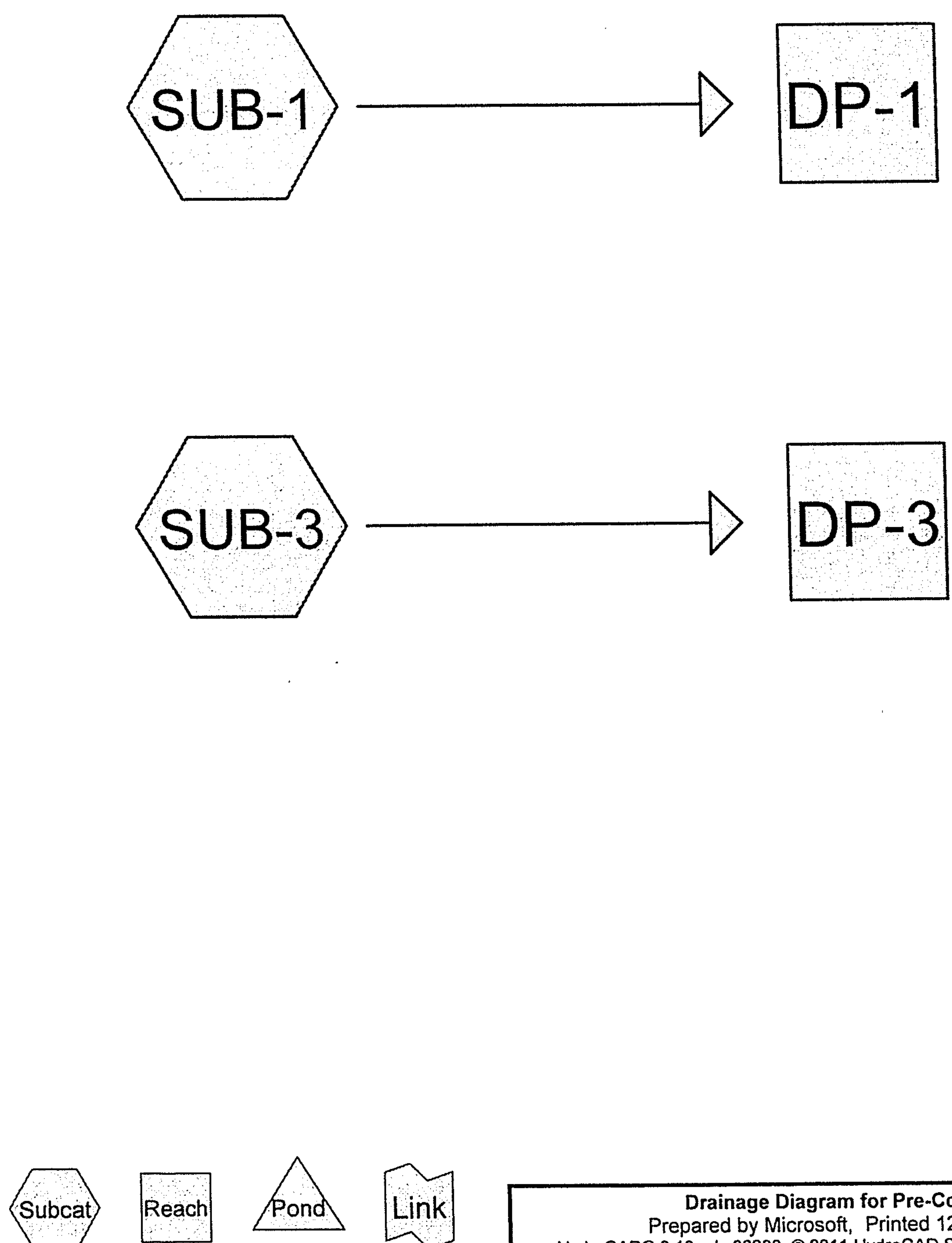
STORAGE VOLUME REQUIRED = 7,101 C.F. (BASIN) + 980 C.F. (DRYWELL)

= 8,081 C.F.

= > 150 %

## APPENDIX B

- Pre-Development HydroCAD Analysis
- Post-Development HydroCAD Analysis




**Drainage Diagram for Pre-Cornell**
Prepared by Microsoft, Printed 12/26/2018
HydroCAD® 9.10 s/n 06290 © 2011 HydroCAD Software Solutions LLC

## Area Listing (all nodes)

| Area (acres) | CN | Description (subcatchment-numbers) |
|---|---|---|
| 0.825 | 60 | Woods, Fair, HSG B (SUB-1, SUB-3) |
| 0.207 | 61 | >75% Grass cover, Good, HSG B (SUB-1, SUB-3) |
| 0.024 | 98 | Concrete (SUB-1, SUB-3) |
| 0.222 | 98 | Pavement (SUB-1, SUB-3) |
| 0.052 | 98 | Roof (SUB-1, SUB-3) |
| **1.329** | 69 | **TOTAL AREA** |

## Soil Listing (all nodes)

| Area (acres) | Soil Group | Subcatchment Numbers |
|---|---|---|
| 0.000 | HSG A | |
| 1.032 | HSG B | SUB-1, SUB-3 |
| 0.000 | HSG C | |
| 0.000 | HSG D | |
| 0.297 | Other | SUB-1, SUB-3 |
| **1.329** | | **TOTAL AREA** |

Time span=0.00-24.00 hrs, dt=0.02 hrs, 1201 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment SUB-1:** Runoff Area=39,737 sf 19.43% Impervious Runoff Depth>0.79"
Flow Length=180' Tc=9.2 min CN=67 Runoff=0.65 cfs 0.060 af

**Subcatchment SUB-3:** Runoff Area=18,134 sf 28.77% Impervious Runoff Depth>0.99"
Flow Length=190' Tc=13.5 min CN=71 Runoff=0.35 cfs 0.034 af

**Reach DP-1:** Inflow=0.65 cfs 0.060 af
Outflow=0.65 cfs 0.060 af

**Reach DP-3:** Inflow=0.35 cfs 0.034 af
Outflow=0.35 cfs 0.034 af

**Total Runoff Area = 1.329 ac Runoff Volume = 0.094 af Average Runoff Depth = 0.85"**
**77.65% Pervious = 1.032 ac 22.35% Impervious = 0.297 ac**

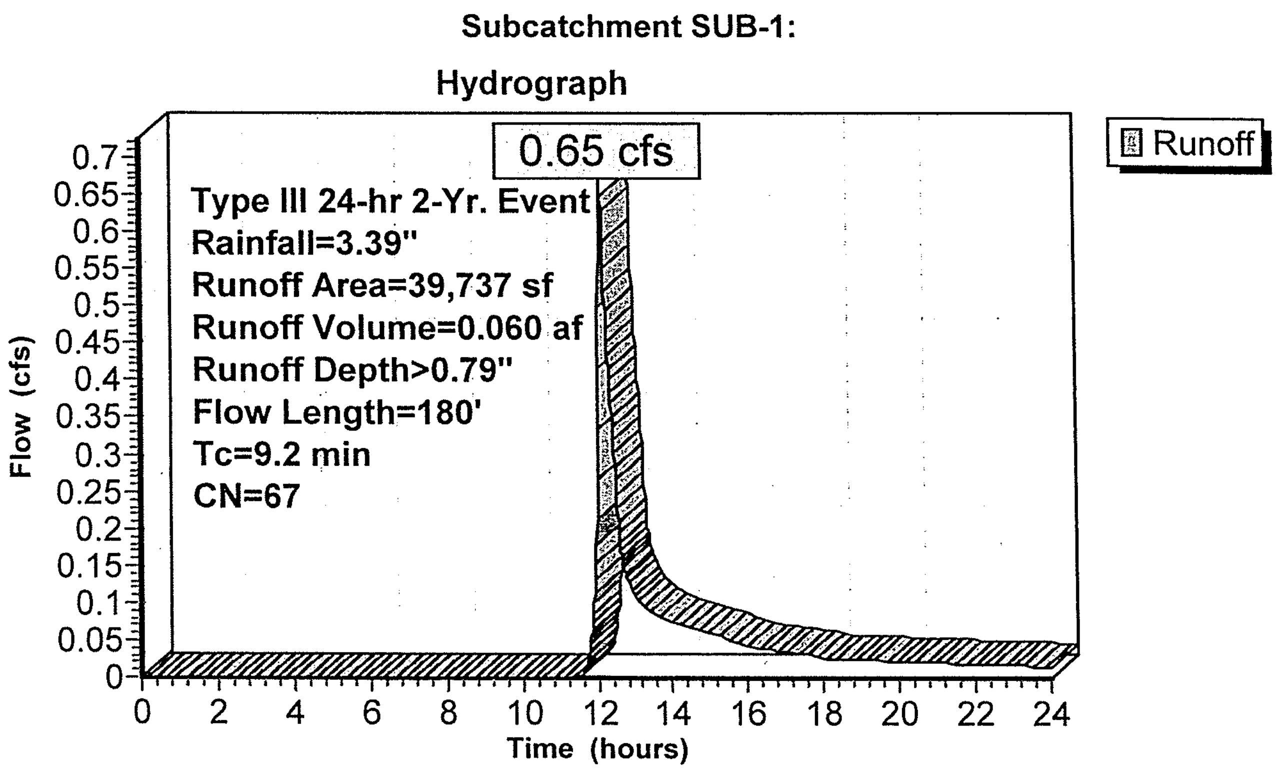
## Summary for Subcatchment SUB-1:

Runoff = 0.65 cfs @ 12.15 hrs, Volume= 0.060 af, Depth> 0.79"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-Yr. Event Rainfall=3.39"

| | Area (sf) | CN | Description |
|---|---|---|---|
| | 30,309 | 60 | Woods, Fair, HSG B |
| * | 6,468 | 98 | Pavement |
| * | 462 | 98 | Concrete |
| | 1,709 | 61 | >75% Grass cover, Good, HSG B |
| * | 789 | 98 | Roof |
| | 39,737 | 67 | Weighted Average |
| | 32,018 | | 80.57% Pervious Area |
| | 7,719 | | 19.43% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 8.5 | 50 | 0.0500 | 0.10 | | **Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20" |
| 0.7 | 130 | 0.0347 | 3.00 | | **Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps |
| 9.2 | 180 | Total | | | |



## Summary for Subcatchment SUB-3:

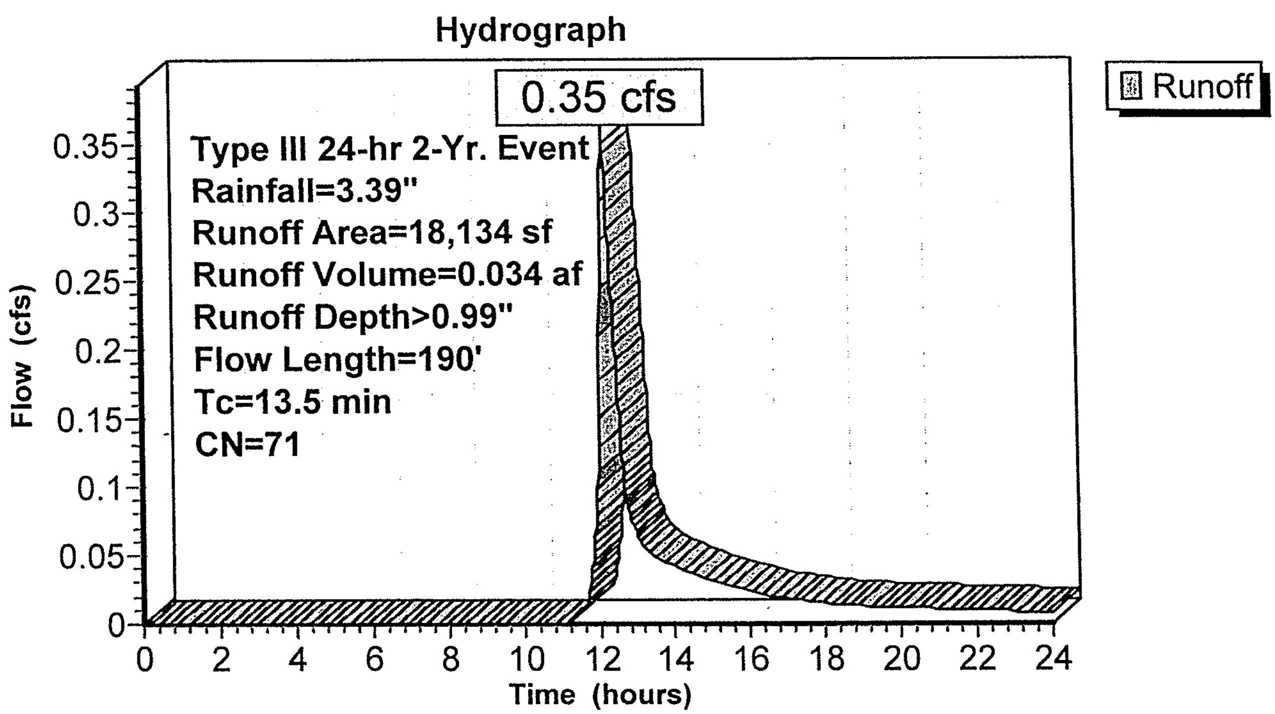
Runoff = 0.35 cfs @ 12.20 hrs, Volume= 0.034 af, Depth> 0.99"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-Yr. Event Rainfall=3.39"

| | Area (sf) | CN | Description |
|---|---|---|---|
| | 5,621 | 60 | Woods, Fair, HSG B |
| * | 3,184 | 98 | Pavement |
| * | 567 | 98 | Concrete |
| | 7,296 | 61 | >75% Grass cover, Good, HSG B |
| * | 1,466 | 98 | Roof |
| | 18,134 | 71 | Weighted Average |
| | 12,917 | | 71.23% Pervious Area |
| | 5,217 | | 28.77% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 12.3 | 50 | 0.0200 | 0.07 | | **Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20" |
| 1.2 | 140 | 0.0140 | 1.90 | | **Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps |
| 13.5 | 190 | Total | | | |

### Subcatchment SUB-3:



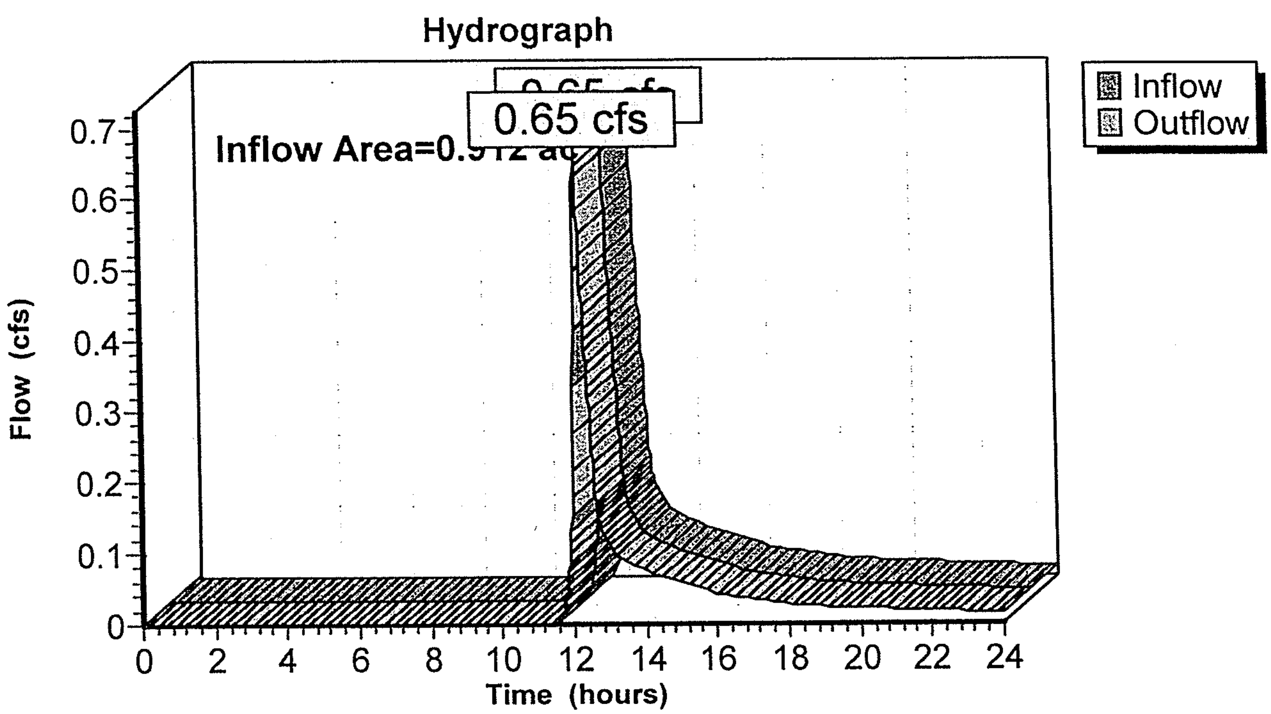
## Summary for Reach DP-1:

[40] Hint: Not Described (Outflow=Inflow)

| | | | | |
|---|---|---|---|---|
| Inflow Area = | 0.912 ac, | 19.43% Impervious, Inflow Depth > | 0.79" | for 2-Yr. Event event |
| Inflow = | 0.65 cfs @ | 12.15 hrs, Volume= | 0.060 af | |
| Outflow = | 0.65 cfs @ | 12.15 hrs, Volume= | 0.060 af, Atten= 0%, Lag= 0.0 min | |

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

### Reach DP-1:



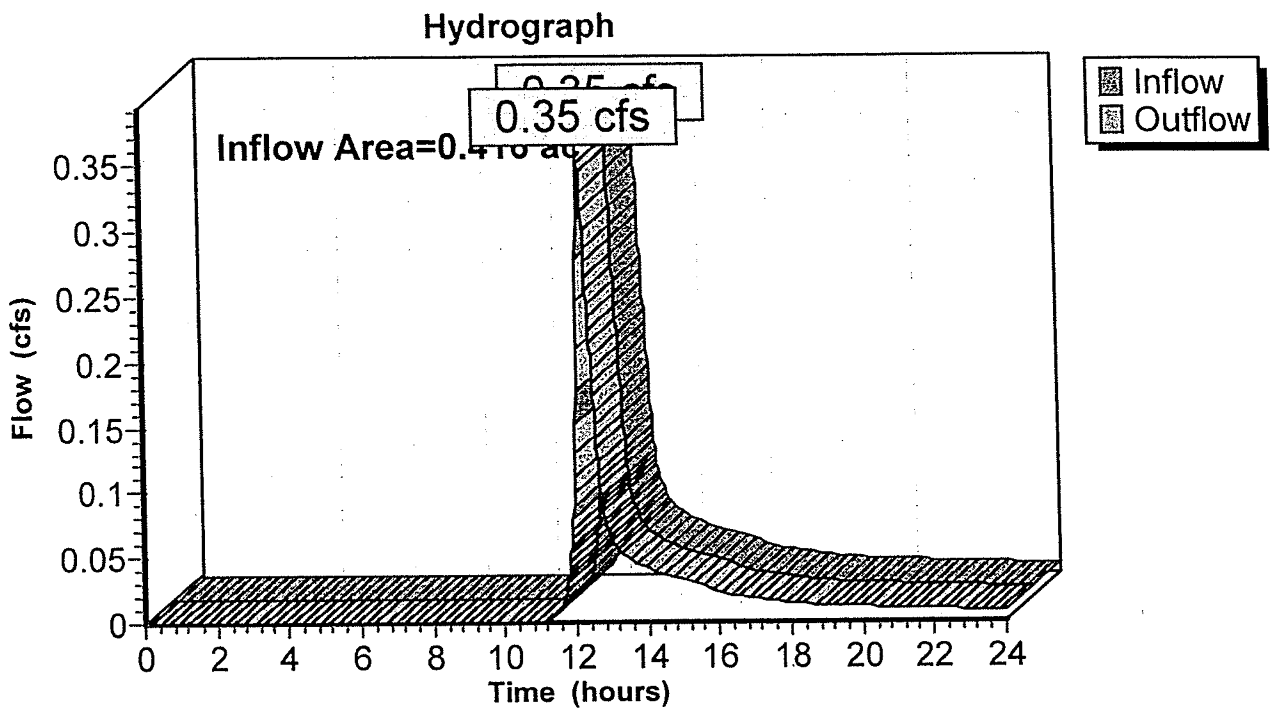
## Summary for Reach DP-3:

[40] Hint: Not Described (Outflow=Inflow)

| | | | | | |
|---|---|---|---|---|---|
| Inflow Area = | 0.416 ac, | 28.77% Impervious, | Inflow Depth > 0.99" | for 2-Yr. Event event | |
| Inflow = | 0.35 cfs @ | 12.20 hrs, | Volume= | 0.034 af | |
| Outflow = | 0.35 cfs @ | 12.20 hrs, | Volume= | 0.034 af, | Atten= 0%, Lag= 0.0 min |

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

### Reach DP-3:



Time span=0.00-24.00 hrs, dt=0.02 hrs, 1201 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment SUB-1:** Runoff Area=39,737 sf 19.43% Impervious Runoff Depth>1.85"
Flow Length=180' Tc=9.2 min CN=67 Runoff=1.72 cfs 0.141 af

**Subcatchment SUB-3:** Runoff Area=18,134 sf 28.77% Impervious Runoff Depth>2.17"
Flow Length=190' Tc=13.5 min CN=71 Runoff=0.82 cfs 0.075 af

**Reach DP-1:** Inflow=1.72 cfs 0.141 af
Outflow=1.72 cfs 0.141 af

**Reach DP-3:** Inflow=0.82 cfs 0.075 af
Outflow=0.82 cfs 0.075 af

**Total Runoff Area = 1.329 ac Runoff Volume = 0.216 af Average Runoff Depth = 1.95"**
**77.65% Pervious = 1.032 ac 22.35% Impervious = 0.297 ac**

## Summary for Subcatchment SUB-1:

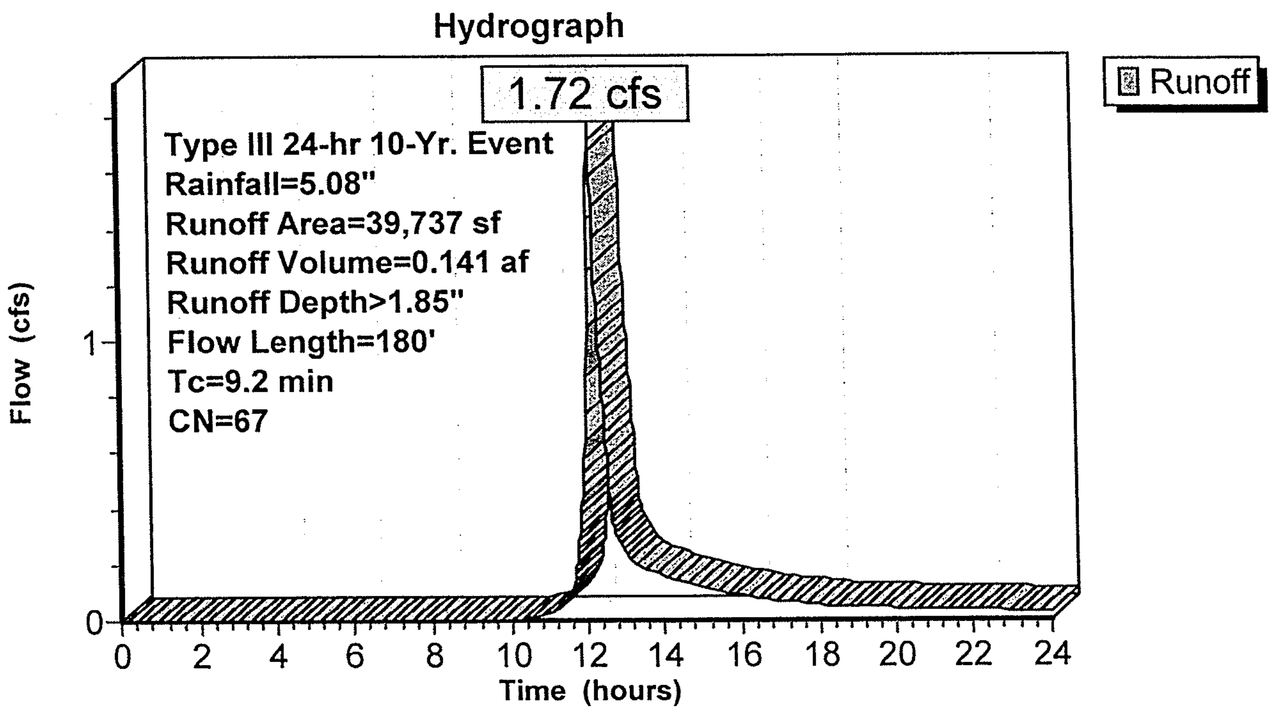
Runoff = 1.72 cfs @ 12.14 hrs, Volume= 0.141 af, Depth> 1.85"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-Yr. Event Rainfall=5.08"

| | Area (sf) | CN | Description |
|---|---|---|---|
| | 30,309 | 60 | Woods, Fair, HSG B |
| * | 6,468 | 98 | Pavement |
| * | 462 | 98 | Concrete |
| | 1,709 | 61 | >75% Grass cover, Good, HSG B |
| * | 789 | 98 | Roof |
| | 39,737 | 67 | Weighted Average |
| | 32,018 | | 80.57% Pervious Area |
| | 7,719 | | 19.43% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 8.5 | 50 | 0.0500 | 0.10 | | **Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20" |
| 0.7 | 130 | 0.0347 | 3.00 | | **Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps |
| 9.2 | 180 | Total | | | |

### Subcatchment SUB-1:



## Summary for Subcatchment SUB-3:

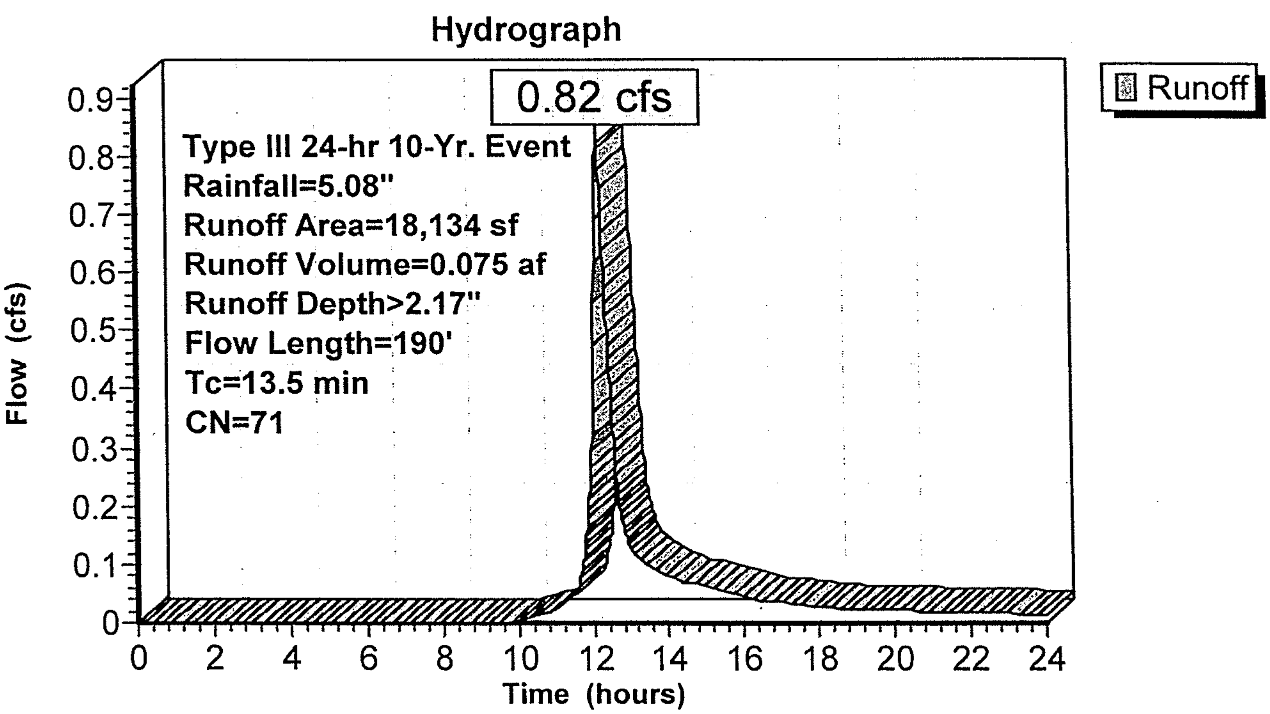
Runoff = 0.82 cfs @ 12.19 hrs, Volume= 0.075 af, Depth> 2.17"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-Yr. Event Rainfall=5.08"

| | Area (sf) | CN | Description |
|---|---|---|---|
| | 5,621 | 60 | Woods, Fair, HSG B |
| * | 3,184 | 98 | Pavement |
| * | 567 | 98 | Concrete |
| | 7,296 | 61 | >75% Grass cover, Good, HSG B |
| * | 1,466 | 98 | Roof |
| | 18,134 | 71 | Weighted Average |
| | 12,917 | | 71.23% Pervious Area |
| | 5,217 | | 28.77% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 12.3 | 50 | 0.0200 | 0.07 | | **Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20" |
| 1.2 | 140 | 0.0140 | 1.90 | | **Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps |
| 13.5 | 190 | Total | | | |

### Subcatchment SUB-3:

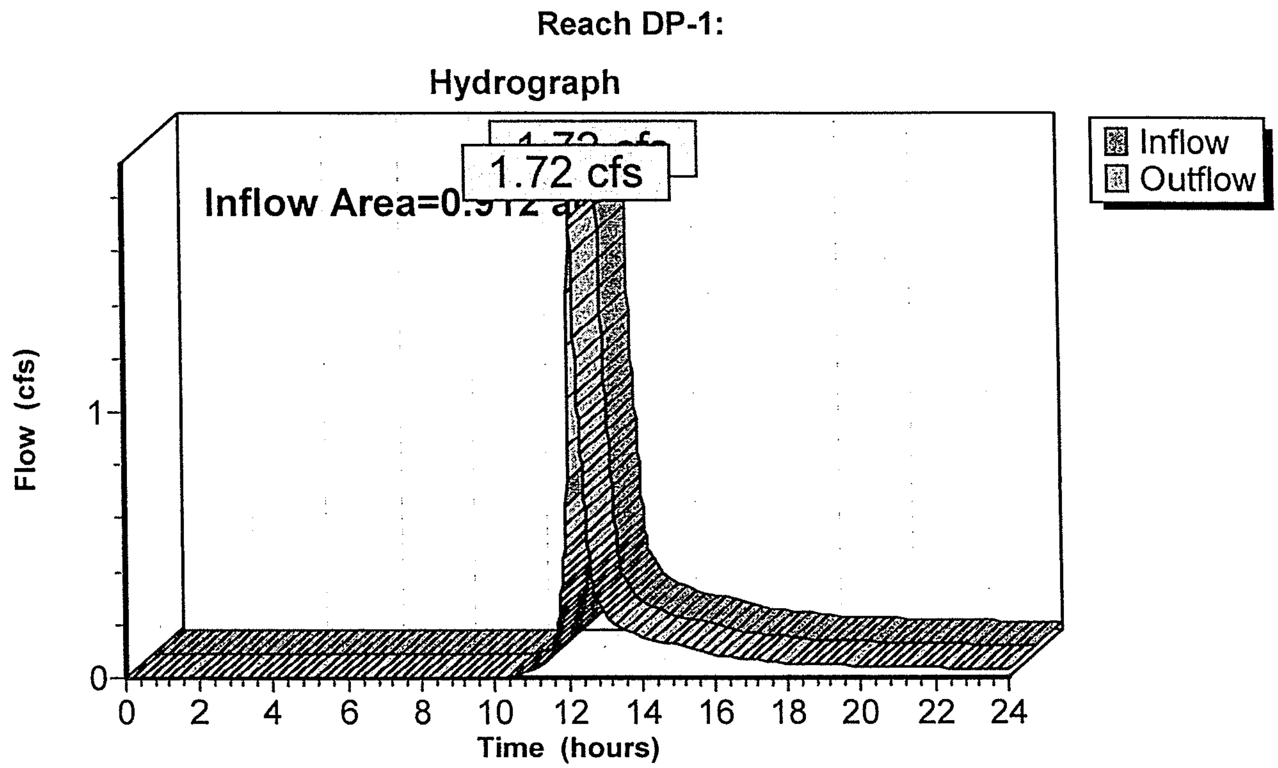


## Summary for Reach DP-1:

[40] Hint: Not Described (Outflow=Inflow)

| | | | | |
|---|---|---|---|---|
| Inflow Area = | 0.912 ac, | 19.43% Impervious, | Inflow Depth > 1.85" | for 10-Yr. Event event |
| Inflow = | 1.72 cfs @ | 12.14 hrs, Volume= | 0.141 af | |
| Outflow = | 1.72 cfs @ | 12.14 hrs, Volume= | 0.141 af, Atten= 0%, Lag= 0.0 min | |

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs



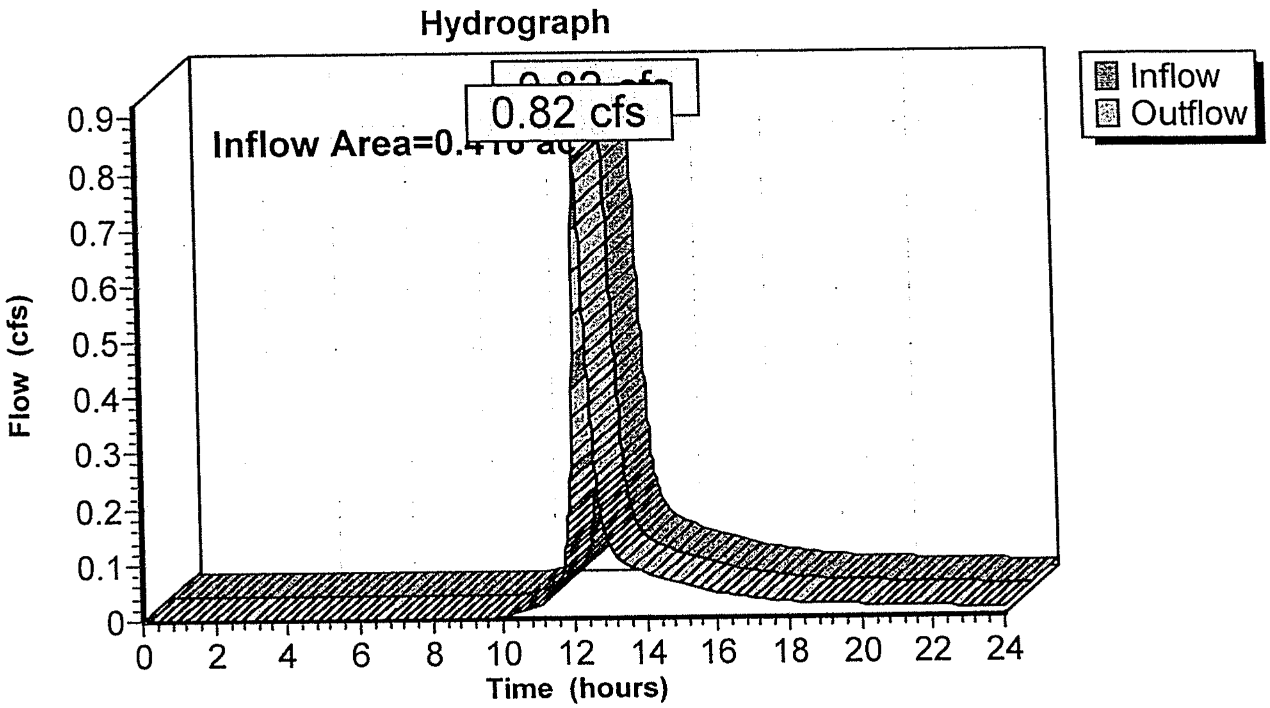
## Summary for Reach DP-3:

[40] Hint: Not Described (Outflow=Inflow)

| | | | |
|---|---|---|---|
| Inflow Area = | 0.416 ac, 28.77% Impervious, | Inflow Depth > 2.17" | for 10-Yr. Event event |
| Inflow = | 0.82 cfs @ 12.19 hrs, Volume= | 0.075 af | |
| Outflow = | 0.82 cfs @ 12.19 hrs, Volume= | 0.075 af, Atten= 0%, Lag= 0.0 min | |

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

### Reach DP-3:



Time span=0.00-24.00 hrs, dt=0.02 hrs, 1201 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment SUB-1:** Runoff Area=39,737 sf 19.43% Impervious Runoff Depth>4.99"
Flow Length=180' Tc=9.2 min CN=67 Runoff=4.78 cfs 0.379 af

**Subcatchment SUB-3:** Runoff Area=18,134 sf 28.77% Impervious Runoff Depth>5.48"
Flow Length=190' Tc=13.5 min CN=71 Runoff=2.11 cfs 0.190 af

**Reach DP-1:** Inflow=4.78 cfs 0.379 af
Outflow=4.78 cfs 0.379 af

**Reach DP-3:** Inflow=2.11 cfs 0.190 af
Outflow=2.11 cfs 0.190 af

**Total Runoff Area = 1.329 ac Runoff Volume = 0.569 af Average Runoff Depth = 5.14"**
**77.65% Pervious = 1.032 ac 22.35% Impervious = 0.297 ac**

## Summary for Subcatchment SUB-1:

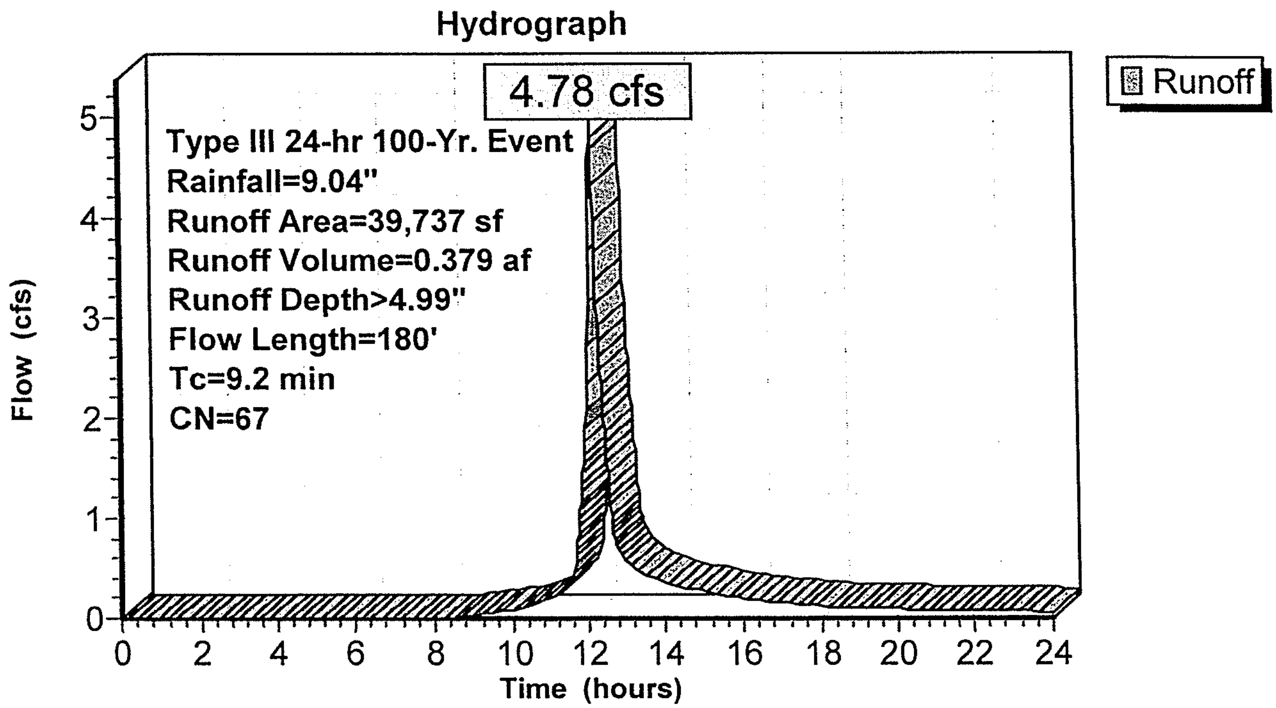
Runoff = 4.78 cfs @ 12.13 hrs, Volume= 0.379 af, Depth> 4.99"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-Yr. Event Rainfall=9.04"

| | Area (sf) | CN | Description |
|---|---|---|---|
| | 30,309 | 60 | Woods, Fair, HSG B |
| * | 6,468 | 98 | Pavement |
| * | 462 | 98 | Concrete |
| | 1,709 | 61 | >75% Grass cover, Good, HSG B |
| * | 789 | 98 | Roof |
| | 39,737 | 67 | Weighted Average |
| | 32,018 | | 80.57% Pervious Area |
| | 7,719 | | 19.43% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 8.5 | 50 | 0.0500 | 0.10 | | **Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20" |
| 0.7 | 130 | 0.0347 | 3.00 | | **Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps |
| 9.2 | 180 | Total | | | |

### Subcatchment SUB-1:



## Summary for Subcatchment SUB-3:

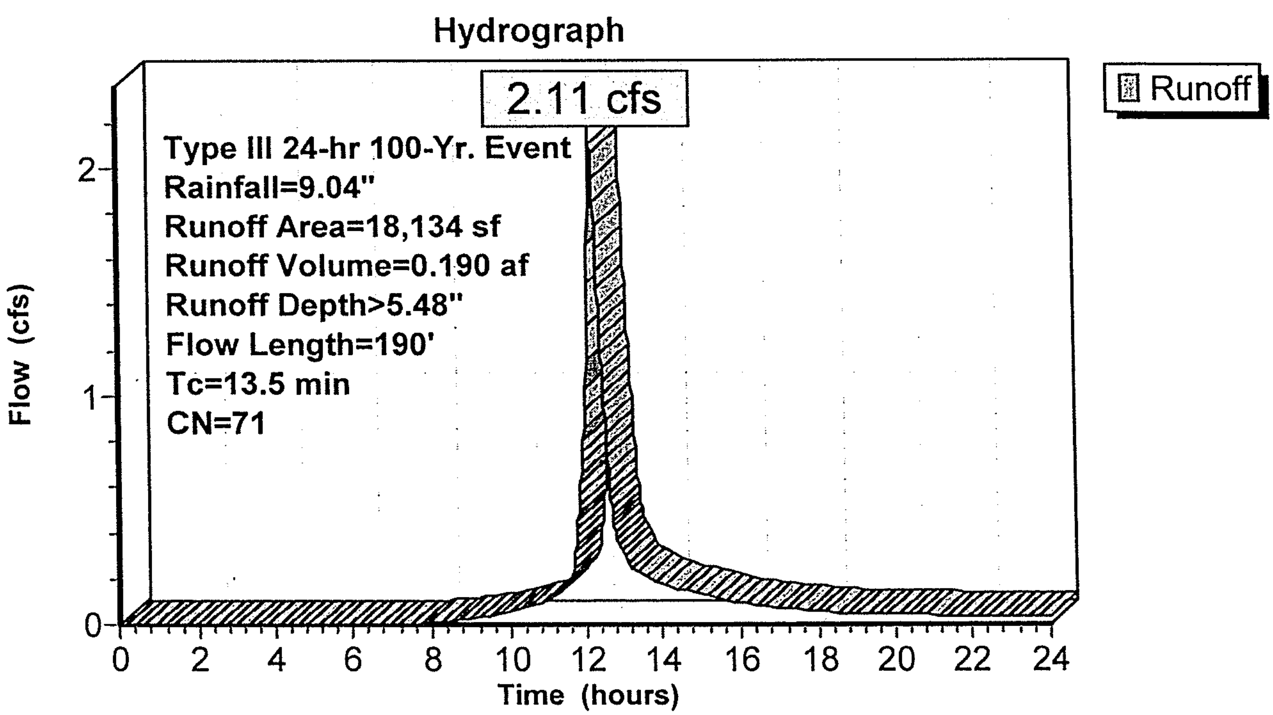
Runoff = 2.11 cfs @ 12.18 hrs, Volume= 0.190 af, Depth> 5.48"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-Yr. Event Rainfall=9.04"

| | Area (sf) | CN | Description |
|---|---|---|---|
| | 5,621 | 60 | Woods, Fair, HSG B |
| * | 3,184 | 98 | Pavement |
| * | 567 | 98 | Concrete |
| | 7,296 | 61 | >75% Grass cover, Good, HSG B |
| * | 1,466 | 98 | Roof |
| | 18,134 | 71 | Weighted Average |
| | 12,917 | | 71.23% Pervious Area |
| | 5,217 | | 28.77% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 12.3 | 50 | 0.0200 | 0.07 | | **Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20" |
| 1.2 | 140 | 0.0140 | 1.90 | | **Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps |
| 13.5 | 190 | Total | | | |

### Subcatchment SUB-3:



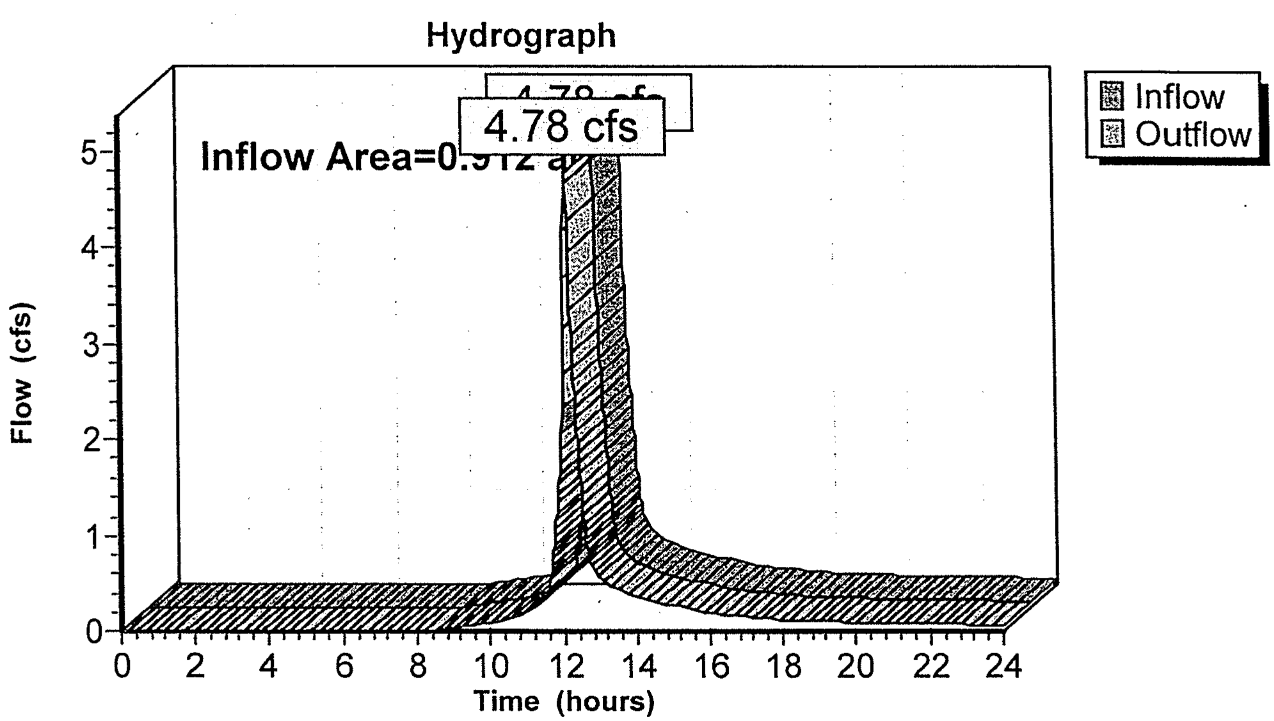
## Summary for Reach DP-1:

[40] Hint: Not Described (Outflow=Inflow)

| | | | | |
|---|---|---|---|---|
| Inflow Area = | 0.912 ac, 19.43% Impervious, | Inflow Depth > 4.99" | for 100-Yr. Event event | |
| Inflow = | 4.78 cfs @ 12.13 hrs, | Volume= | 0.379 af | |
| Outflow = | 4.78 cfs @ 12.13 hrs, | Volume= | 0.379 af, | Atten= 0%, Lag= 0.0 min |

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

### Reach DP-1:



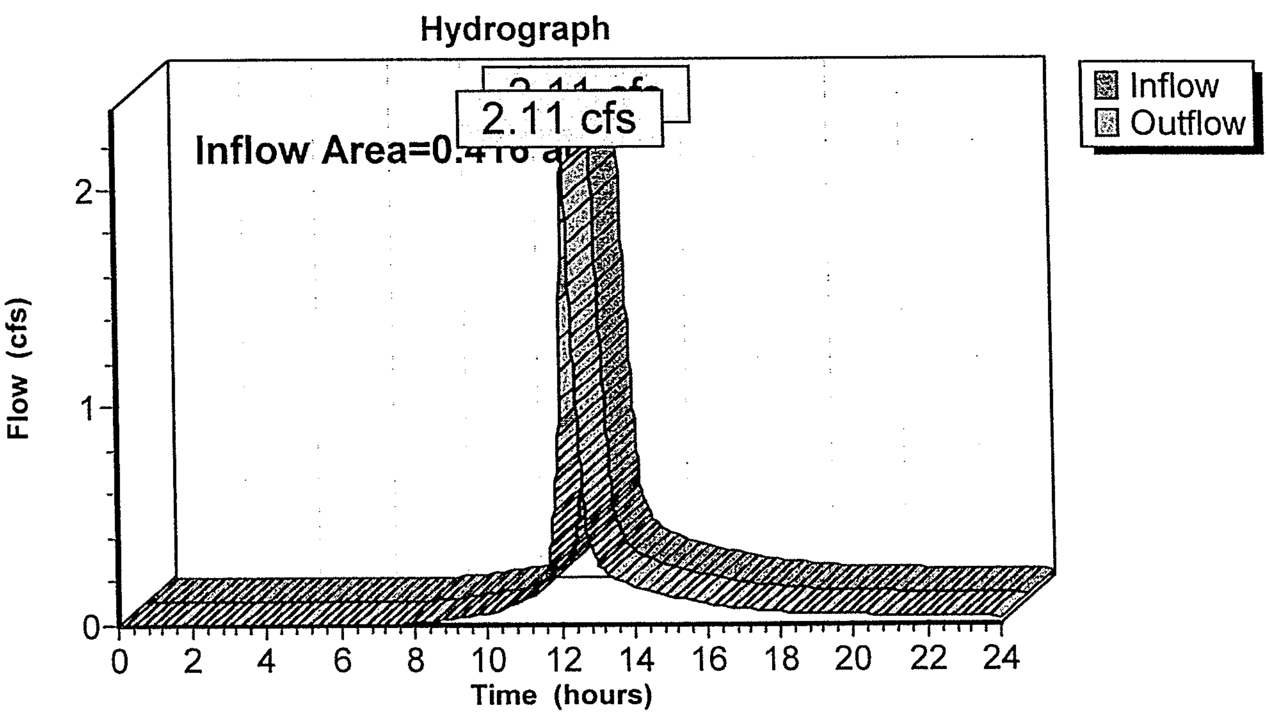
## Summary for Reach DP-3:

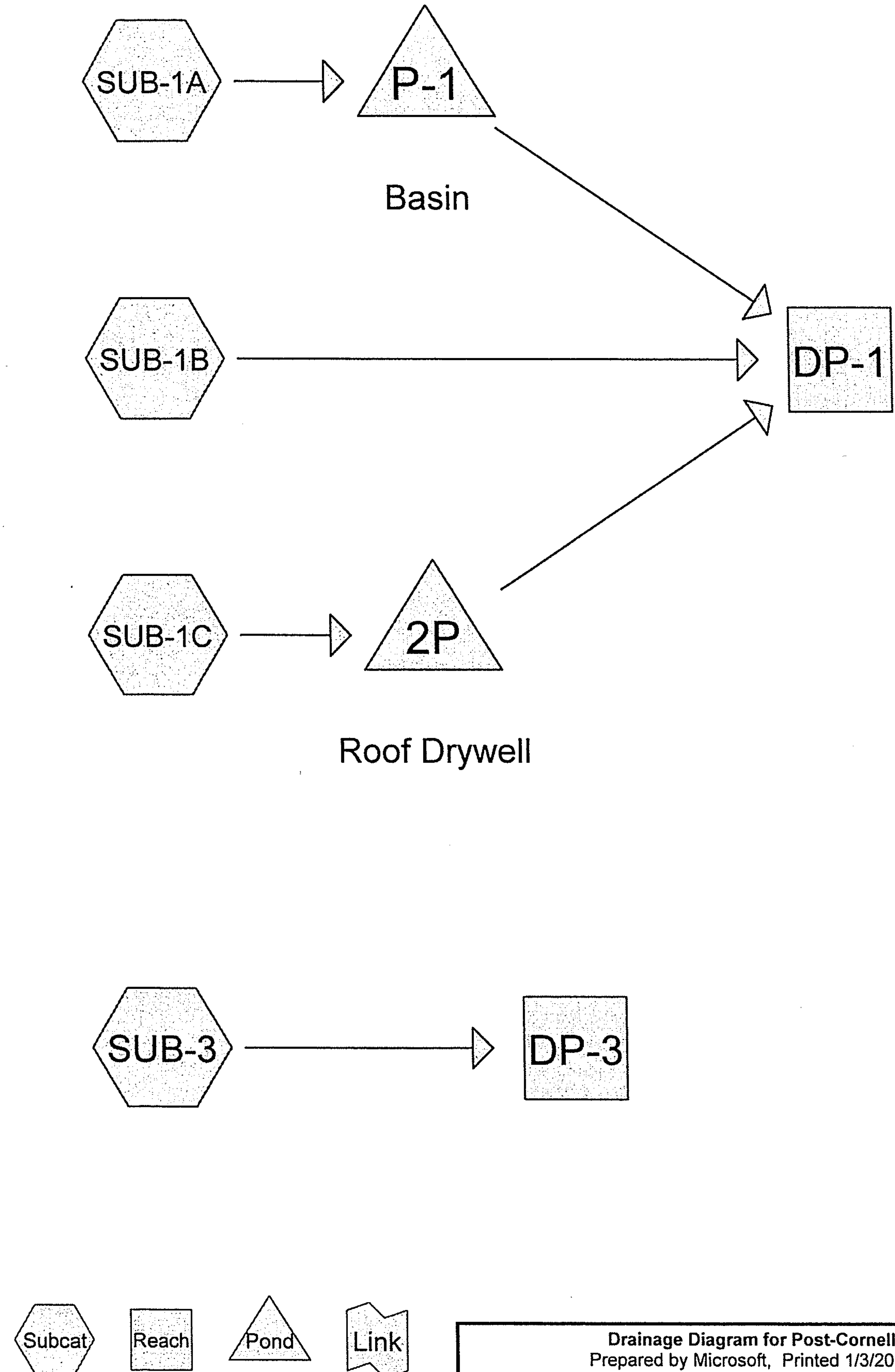
[40] Hint: Not Described (Outflow=Inflow)

| | | |
|---|---|---|
| Inflow Area = | 0.416 ac, 28.77% Impervious, Inflow Depth > 5.48" | for 100-Yr. Event event |
| Inflow = | 2.11 cfs @ 12.18 hrs, Volume= | 0.190 af |
| Outflow = | 2.11 cfs @ 12.18 hrs, Volume= | 0.190 af, Atten= 0%, Lag= 0.0 min |

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

### Reach DP-3:






**Drainage Diagram for Post-Cornell**
Prepared by Microsoft, Printed 1/3/2019
HydroCAD® 9.10 s/n 06290 © 2011 HydroCAD Software Solutions LLC

## Area Listing (all nodes)

| Area (acres) | CN | Description (subcatchment-numbers) |
|---|---|---|
| 0.314 | 60 | Woods, Fair, HSG B (SUB-1A, SUB-1B, SUB-3) |
| 0.422 | 61 | >75% Grass cover, Good, HSG B (SUB-1A, SUB-1B, SUB-3) |
| 0.121 | 82 | Gravel (SUB-1A) |
| 0.024 | 98 | Concrete (SUB-1B, SUB-3) |
| 0.306 | 98 | Pavement (SUB-1A, SUB-1B, SUB-3) |
| 0.144 | 98 | Roof (SUB-1B, SUB-1C, SUB-3) |
| **1.330** | 76 | **TOTAL AREA** |

## Soil Listing (all nodes)

| Area (acres) | Soil Group | Subcatchment Numbers |
|---|---|---|
| 0.000 | HSG A | |
| 0.736 | HSG B | SUB-1A, SUB-1B, SUB-3 |
| 0.000 | HSG C | |
| 0.000 | HSG D | |
| 0.594 | Other | SUB-1A, SUB-1B, SUB-1C, SUB-3 |
| **1.330** | | **TOTAL AREA** |

Time span=0.00-24.00 hrs, dt=0.02 hrs, 1201 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment SUB-1A:** Runoff Area=17,838 sf 32.37% Impervious Runoff Depth>1.48"
Flow Length=180' Tc=9.2 min CN=79 Runoff=0.63 cfs 0.050 af

**Subcatchment SUB-1B:** Runoff Area=18,930 sf 29.68% Impervious Runoff Depth>1.05"
Flow Length=180' Tc=9.2 min CN=72 Runoff=0.45 cfs 0.038 af

**Subcatchment SUB-1C:** Runoff Area=4,000 sf 100.00% Impervious Runoff Depth>3.15"
Tc=6.0 min CN=98 Runoff=0.30 cfs 0.024 af

**Subcatchment SUB-3:** Runoff Area=17,151 sf 30.42% Impervious Runoff Depth>1.05"
Flow Length=190' Tc=13.5 min CN=72 Runoff=0.35 cfs 0.034 af

**Reach DP-1:** Inflow=0.45 cfs 0.040 af
Outflow=0.45 cfs 0.040 af

**Reach DP-3:** Inflow=0.35 cfs 0.034 af
Outflow=0.35 cfs 0.034 af

**Pond 2P: Roof Drywell** Peak Elev=94.51' Storage=398 cf Inflow=0.30 cfs 0.024 af
Discarded=0.02 cfs 0.024 af Primary=0.00 cfs 0.000 af Outflow=0.02 cfs 0.024 af

**Pond P-1: Basin** Peak Elev=93.10' Storage=742 cf Inflow=0.63 cfs 0.050 af
Discarded=0.09 cfs 0.049 af Primary=0.05 cfs 0.002 af Outflow=0.14 cfs 0.050 af

**Total Runoff Area = 1.330 ac Runoff Volume = 0.147 af Average Runoff Depth = 1.33"**
**64.41% Pervious = 0.856 ac 35.59% Impervious = 0.473 ac**

## Summary for Subcatchment SUB-1A:

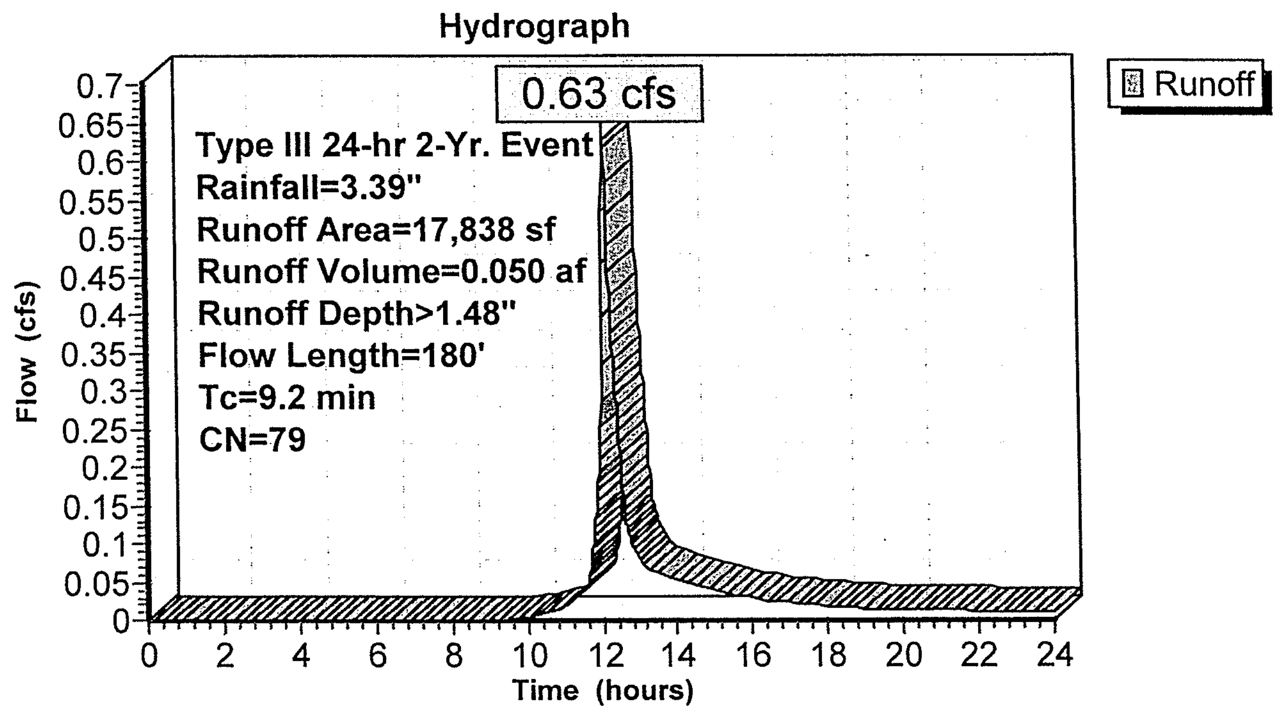
Runoff = 0.63 cfs @ 12.13 hrs, Volume= 0.050 af, Depth> 1.48"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-Yr. Event Rainfall=3.39"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 5,775 | 98 | Pavement |
| | 4,821 | 61 | >75% Grass cover, Good, HSG B |
| | 1,984 | 60 | Woods, Fair, HSG B |
| * | 5,258 | 82 | Gravel |
| | 17,838 | 79 | Weighted Average |
| | 12,063 | | 67.63% Pervious Area |
| | 5,775 | | 32.37% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 8.5 | 50 | 0.0500 | 0.10 | | **Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20" |
| 0.7 | 130 | 0.0347 | 3.00 | | **Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps |
| 9.2 | 180 | Total | | | |

### Subcatchment SUB-1A:



## Summary for Subcatchment SUB-1B:

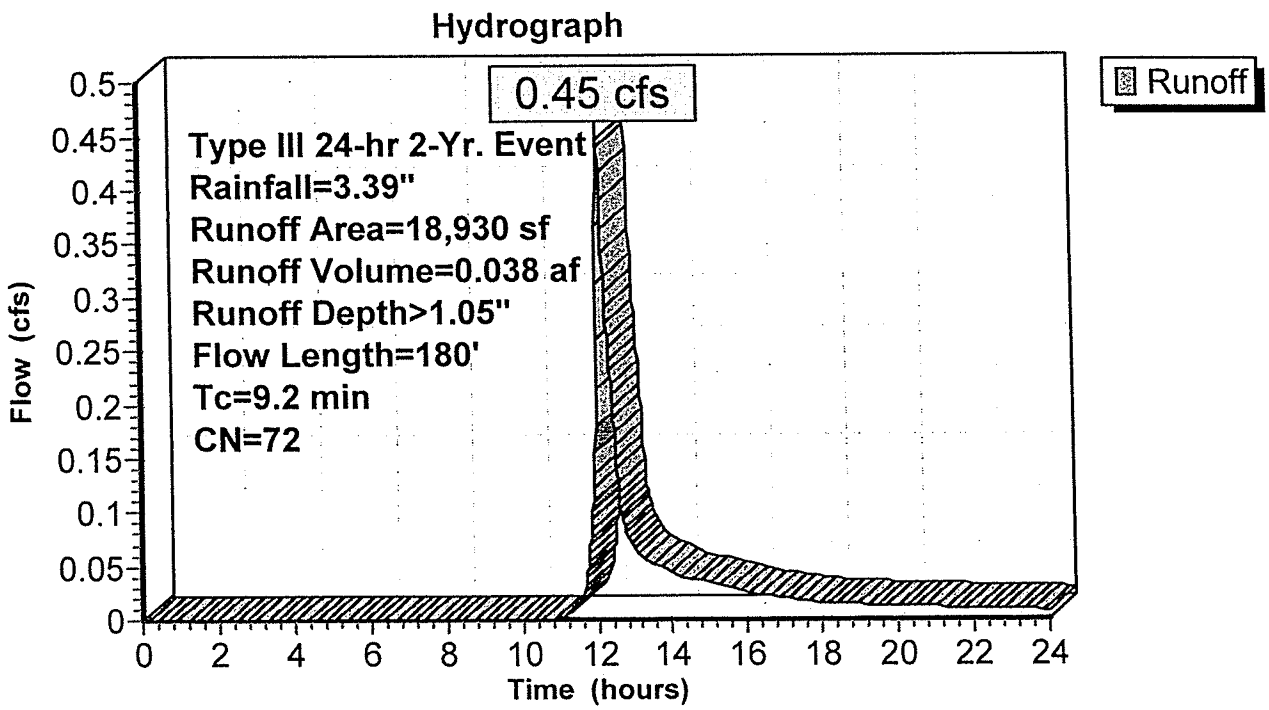
Runoff = 0.45 cfs @ 12.14 hrs, Volume= 0.038 af, Depth> 1.05"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-Yr. Event Rainfall=3.39"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 789 | 98 | Roof |
| * | 4,368 | 98 | Pavement |
| * | 462 | 98 | Concrete |
| | 6,270 | 61 | >75% Grass cover, Good, HSG B |
| | 7,041 | 60 | Woods, Fair, HSG B |
| | 18,930 | 72 | Weighted Average |
| | 13,311 | | 70.32% Pervious Area |
| | 5,619 | | 29.68% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 8.5 | 50 | 0.0500 | 0.10 | | **Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20" |
| 0.7 | 130 | 0.0347 | 3.00 | | **Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps |
| 9.2 | 180 | Total | | | |

## Subcatchment SUB-1B:



## Summary for Subcatchment SUB-1C:

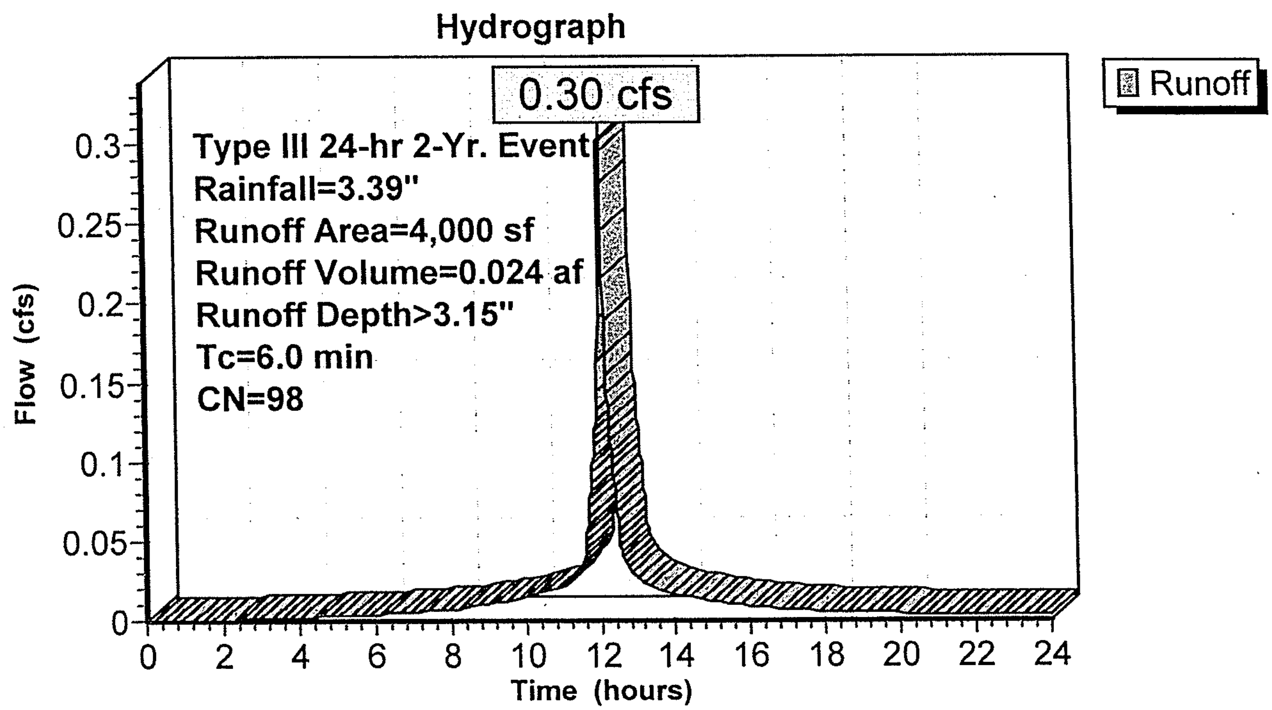
Runoff = 0.30 cfs @ 12.08 hrs, Volume= 0.024 af, Depth> 3.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-Yr. Event Rainfall=3.39"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 4,000 | 98 | Roof |
| | 4,000 | | 100.00% Impervious Area |

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

### Subcatchment SUB-1C:



## Summary for Subcatchment SUB-3:

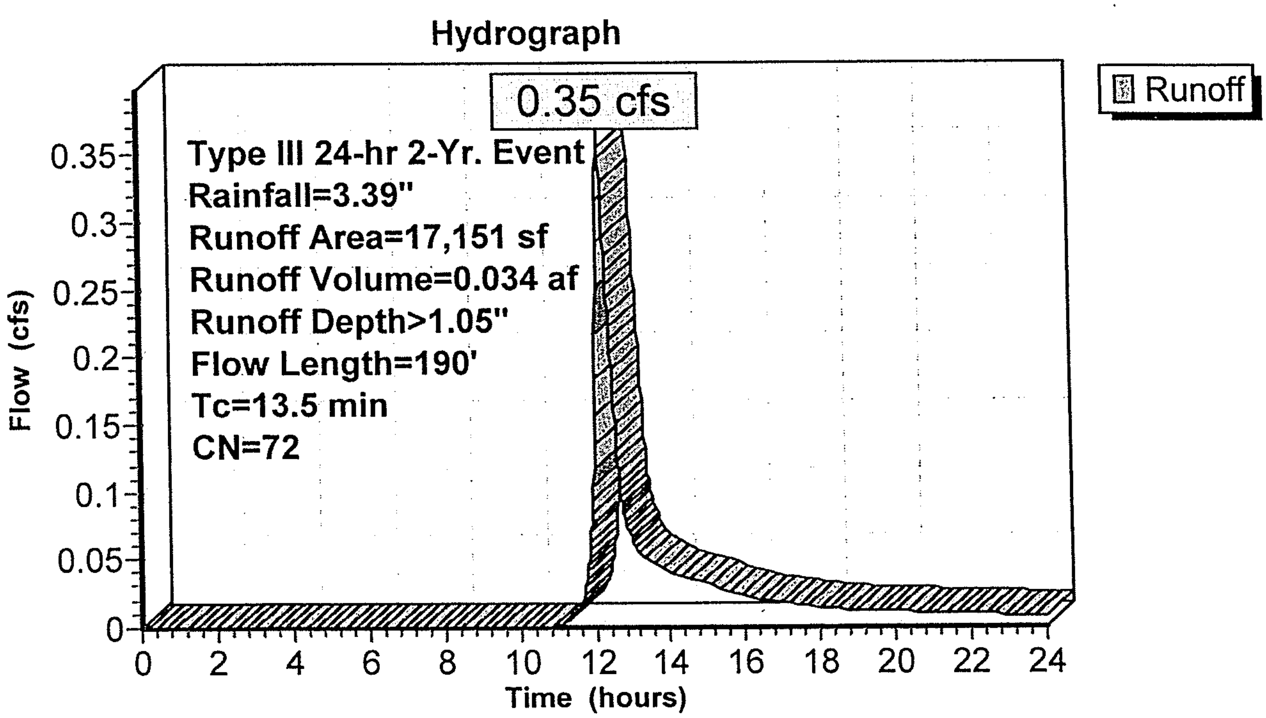
Runoff = 0.35 cfs @ 12.20 hrs, Volume= 0.034 af, Depth> 1.05"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 2-Yr. Event Rainfall=3.39"

| | Area (sf) | CN | Description |
|---|---|---|---|
| | 4,638 | 60 | Woods, Fair, HSG B |
| * | 3,184 | 98 | Pavement |
| * | 567 | 98 | Concrete |
| | 7,296 | 61 | >75% Grass cover, Good, HSG B |
| * | 1,466 | 98 | Roof |
| | 17,151 | 72 | Weighted Average |
| | 11,934 | | 69.58% Pervious Area |
| | 5,217 | | 30.42% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 12.3 | 50 | 0.0200 | 0.07 | | **Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20" |
| 1.2 | 140 | 0.0140 | 1.90 | | **Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps |
| 13.5 | 190 | Total | | | |

### Subcatchment SUB-3:



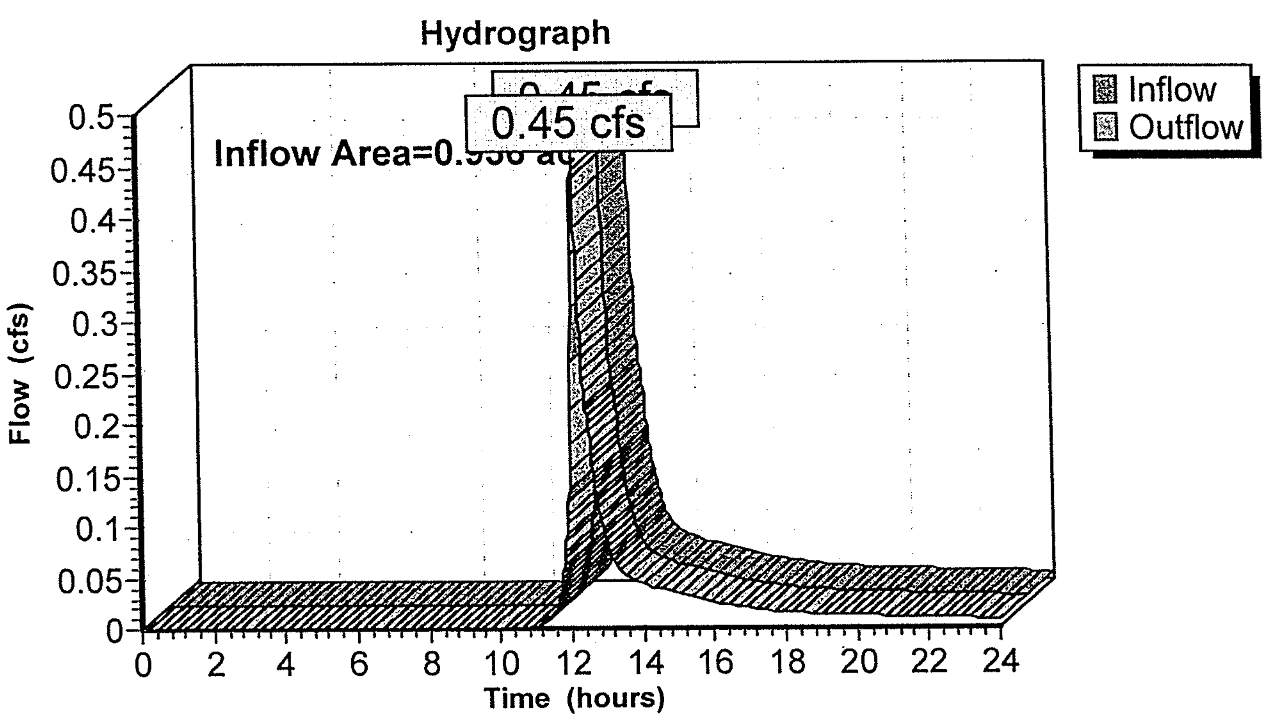
## Summary for Reach DP-1:

[40] Hint: Not Described (Outflow=Inflow)

| | | | | |
|---|---|---|---|---|
| Inflow Area = | 0.936 ac, 37.76% Impervious, | Inflow Depth > 0.51" | for 2-Yr. Event event | |
| Inflow = | 0.45 cfs @ 12.14 hrs, | Volume= | 0.040 af | |
| Outflow = | 0.45 cfs @ 12.14 hrs, | Volume= | 0.040 af, | Atten= 0%, Lag= 0.0 min |

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

**Reach DP-1:**



## Summary for Reach DP-3:

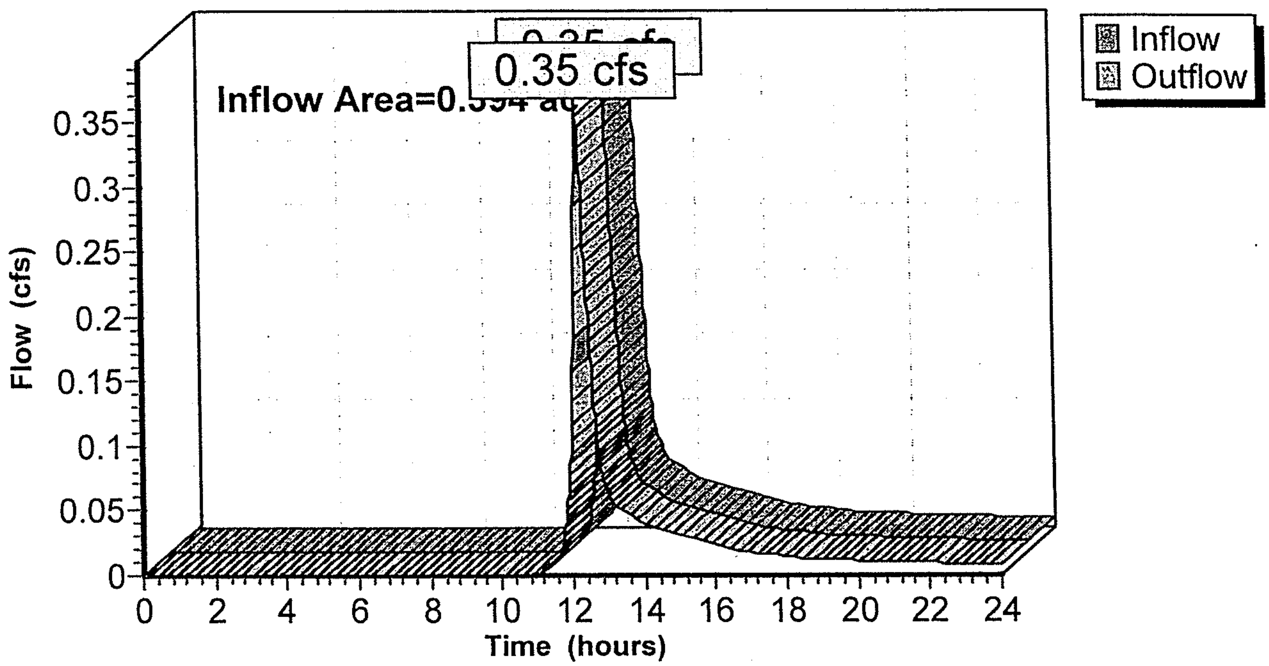
[40] Hint: Not Described (Outflow=Inflow)

| | | | | |
|---|---|---|---|---|
| Inflow Area = | 0.394 ac, 30.42% Impervious, | Inflow Depth > 1.05" | for 2-Yr. Event event | |
| Inflow = | 0.35 cfs @ | 12.20 hrs, Volume= | 0.034 af | |
| Outflow = | 0.35 cfs @ | 12.20 hrs, Volume= | 0.034 af, | Atten= 0%, Lag= 0.0 min |

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

**Reach DP-3:**

**Hydrograph**



## Summary for Pond 2P: Roof Drywell

[87] Warning: Oscillations may require Finer Routing or smaller dt

```
Inflow Area =     0.092 ac,100.00% Impervious, Inflow Depth >  3.15"   for 2-Yr. Event event
Inflow     =      0.30 cfs @  12.08 hrs, Volume=         0.024 af
Outflow    =      0.02 cfs @  11.38 hrs, Volume=         0.024 af, Atten= 93%, Lag= 0.0 min
Discarded  =      0.02 cfs @  11.38 hrs, Volume=         0.024 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= 0.02 hrs
Peak Elev= 94.51' @ 13.20 hrs Surf.Area= 395 sf Storage= 398 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 133.6 min ( 888.3 - 754.7 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 93.42' | 301 cf | **Chambers** Listed below Inside #2 |
| #2 | 92.92' | 271 cf | **Stone Backfill (Prismatic)** Listed below (Recalc)<br>980 cf Overall - 301 cf Embedded = 679 cf x 40.0% Voids |
| | | 572 cf | Total Available Storage |

| Elevation (feet) | Cum.Store (cubic-feet) |
|---|---|
| 93.42 | 0 |
| 94.75 | 301 |

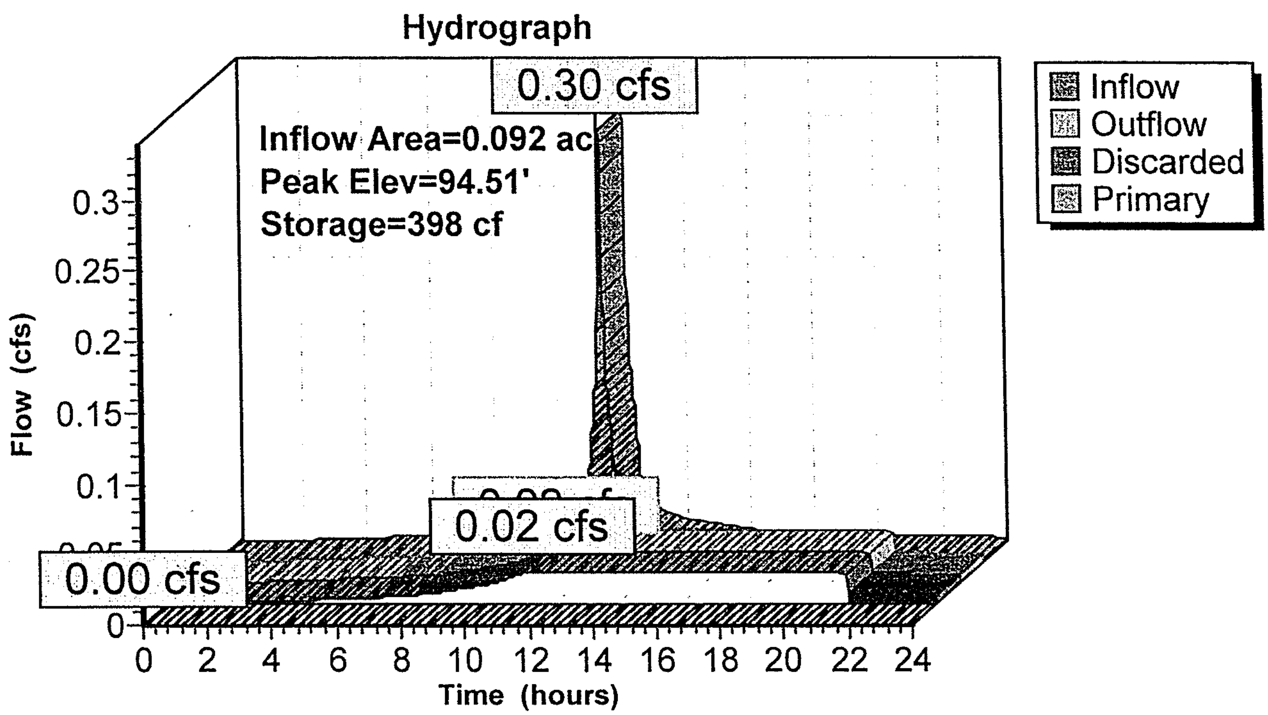
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 92.92 | 395 | 0 | 0 |
| 93.92 | 395 | 395 | 395 |
| 95.40 | 395 | 585 | 980 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Discarded | 92.92' | **2.410 in/hr Exfiltration over Surface area** |
| #2 | Primary | 94.75' | **4.0" Horiz. Orifice/Grate X 2.00** C= 0.600<br>Limited to weir flow at low heads |

**Discarded OutFlow** Max=0.02 cfs @ 11.38 hrs HW=92.95' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=92.92' TW=0.00' (Dynamic Tailwater)
↑—**2=Orifice/Grate** ( Controls 0.00 cfs)

## Pond 2P: Roof Drywell



## Summary for Pond P-1: Basin

[87] Warning: Oscillations may require Finer Routing or smaller dt

Inflow Area = 0.410 ac, 32.37% Impervious, Inflow Depth > 1.48" for 2-Yr. Event event
Inflow = 0.63 cfs @ 12.13 hrs, Volume= 0.050 af
Outflow = 0.14 cfs @ 12.62 hrs, Volume= 0.050 af, Atten= 78%, Lag= 29.0 min
Discarded = 0.09 cfs @ 12.62 hrs, Volume= 0.049 af
Primary = 0.05 cfs @ 12.62 hrs, Volume= 0.002 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Peak Elev= 93.10' @ 12.62 hrs Surf.Area= 1,580 sf Storage= 742 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 72.6 min ( 917.3 - 844.7 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 91.60' | 2,841 cf | **Custom Stage Data (Prismatic)** Listed below (Recalc)<br>7,101 cf Overall x 40.0% Voids |

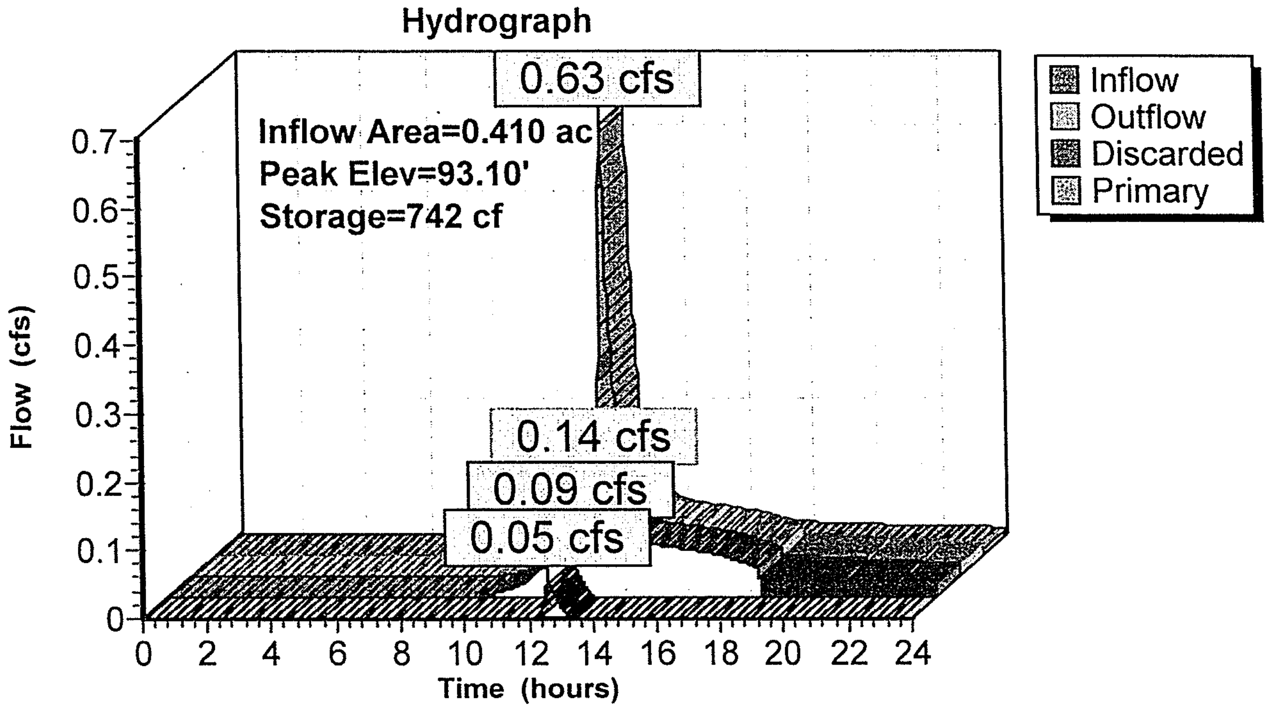
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 91.60 | 757 | 0 | 0 |
| 92.00 | 1,116 | 375 | 375 |
| 93.00 | 1,533 | 1,325 | 1,699 |
| 94.00 | 2,006 | 1,770 | 3,469 |
| 95.60 | 2,535 | 3,633 | 7,101 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Discarded | 91.60' | **2.410 in/hr Exfiltration over Surface area** |
| #2 | Primary | 93.00' | **0.5' long x 1.60' rise Sharp-Crested Rectangular Weir**<br>2 End Contraction(s) |
| #3 | Primary | 94.60' | **6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) |

**Discarded OutFlow** Max=0.09 cfs @ 12.62 hrs HW=93.10' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.09 cfs)

**Primary OutFlow** Max=0.05 cfs @ 12.62 hrs HW=93.10' TW=0.00' (Dynamic Tailwater)
├─**2=Sharp-Crested Rectangular Weir** (Weir Controls 0.05 cfs @ 1.03 fps)
└─**3=Sharp-Crested Rectangular Weir** ( Controls 0.00 cfs)

## Pond P-1: Basin



Time span=0.00-24.00 hrs, dt=0.02 hrs, 1201 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment SUB-1A:** Runoff Area=17,838 sf 32.37% Impervious Runoff Depth>2.87"
Flow Length=180' Tc=9.2 min CN=79 Runoff=1.23 cfs 0.098 af

**Subcatchment SUB-1B:** Runoff Area=18,930 sf 29.68% Impervious Runoff Depth>2.26"
Flow Length=180' Tc=9.2 min CN=72 Runoff=1.02 cfs 0.082 af

**Subcatchment SUB-1C:** Runoff Area=4,000 sf 100.00% Impervious Runoff Depth>4.84"
Tc=6.0 min CN=98 Runoff=0.46 cfs 0.037 af

**Subcatchment SUB-3:** Runoff Area=17,151 sf 30.42% Impervious Runoff Depth>2.25"
Flow Length=190' Tc=13.5 min CN=72 Runoff=0.81 cfs 0.074 af

**Reach DP-1:** Inflow=1.51 cfs 0.117 af
Outflow=1.51 cfs 0.117 af

**Reach DP-3:** Inflow=0.81 cfs 0.074 af
Outflow=0.81 cfs 0.074 af

**Pond 2P: Roof Drywell** Peak Elev=94.85' Storage=485 cf Inflow=0.46 cfs 0.037 af
Discarded=0.02 cfs 0.031 af Primary=0.22 cfs 0.006 af Outflow=0.24 cfs 0.037 af

**Pond P-1: Basin** Peak Elev=93.60' Storage=1,079 cf Inflow=1.23 cfs 0.098 af
Discarded=0.10 cfs 0.069 af Primary=0.57 cfs 0.029 af Outflow=0.67 cfs 0.098 af

**Total Runoff Area = 1.330 ac Runoff Volume = 0.290 af Average Runoff Depth = 2.62"**
**64.41% Pervious = 0.856 ac 35.59% Impervious = 0.473 ac**

## Summary for Subcatchment SUB-1A:

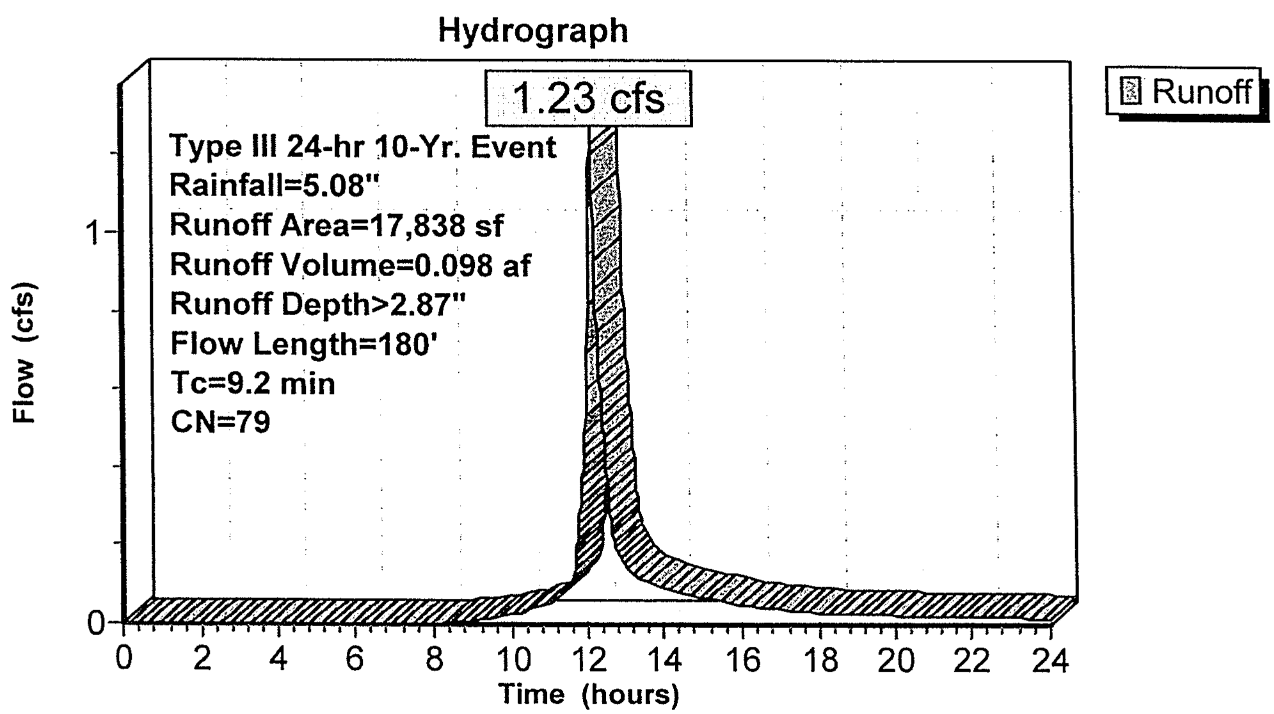
Runoff = 1.23 cfs @ 12.13 hrs, Volume= 0.098 af, Depth> 2.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-Yr. Event Rainfall=5.08"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 5,775 | 98 | Pavement |
| | 4,821 | 61 | >75% Grass cover, Good, HSG B |
| | 1,984 | 60 | Woods, Fair, HSG B |
| * | 5,258 | 82 | Gravel |
| | 17,838 | 79 | Weighted Average |
| | 12,063 | | 67.63% Pervious Area |
| | 5,775 | | 32.37% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 8.5 | 50 | 0.0500 | 0.10 | | **Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20" |
| 0.7 | 130 | 0.0347 | 3.00 | | **Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps |
| 9.2 | 180 | Total | | | |

### Subcatchment SUB-1A:



## Summary for Subcatchment SUB-1B:

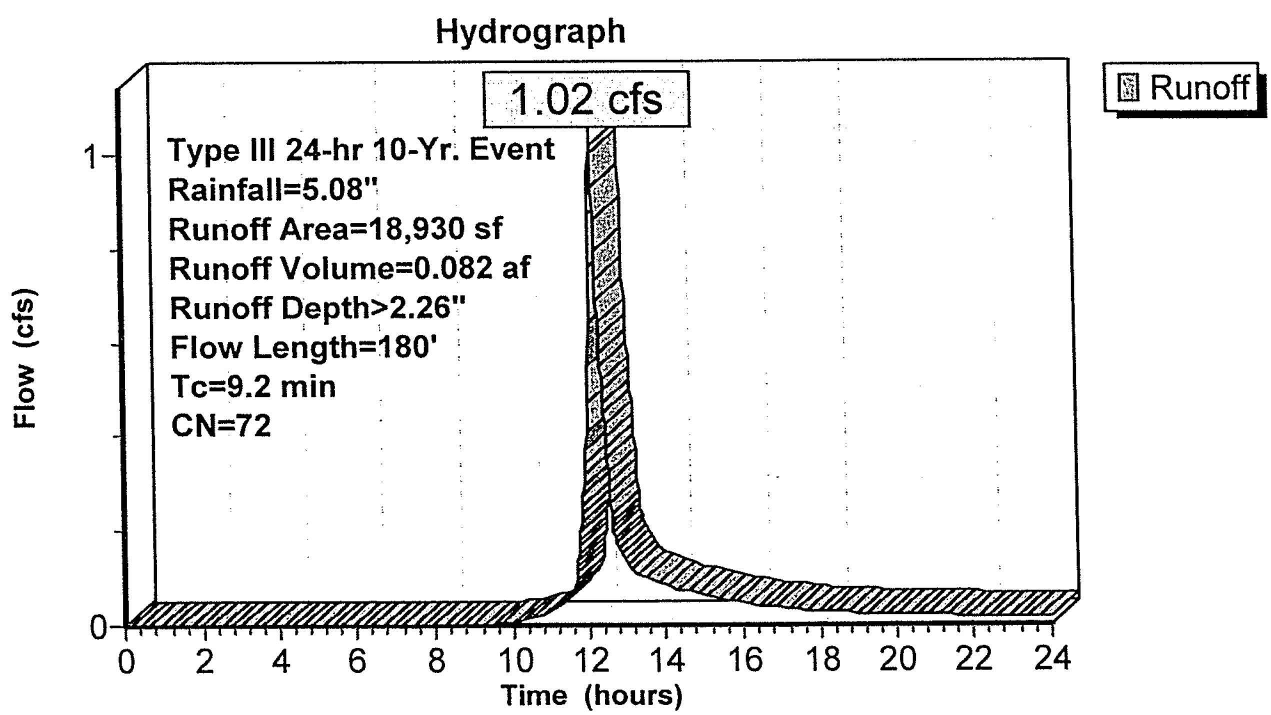
Runoff = 1.02 cfs @ 12.13 hrs, Volume= 0.082 af, Depth> 2.26"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-Yr. Event Rainfall=5.08"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 789 | 98 | Roof |
| * | 4,368 | 98 | Pavement |
| * | 462 | 98 | Concrete |
| | 6,270 | 61 | >75% Grass cover, Good, HSG B |
| | 7,041 | 60 | Woods, Fair, HSG B |
| | 18,930 | 72 | Weighted Average |
| | 13,311 | | 70.32% Pervious Area |
| | 5,619 | | 29.68% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 8.5 | 50 | 0.0500 | 0.10 | | **Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20" |
| 0.7 | 130 | 0.0347 | 3.00 | | **Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps |
| 9.2 | 180 | Total | | | |

## Subcatchment SUB-1B:



## Summary for Subcatchment SUB-1C:

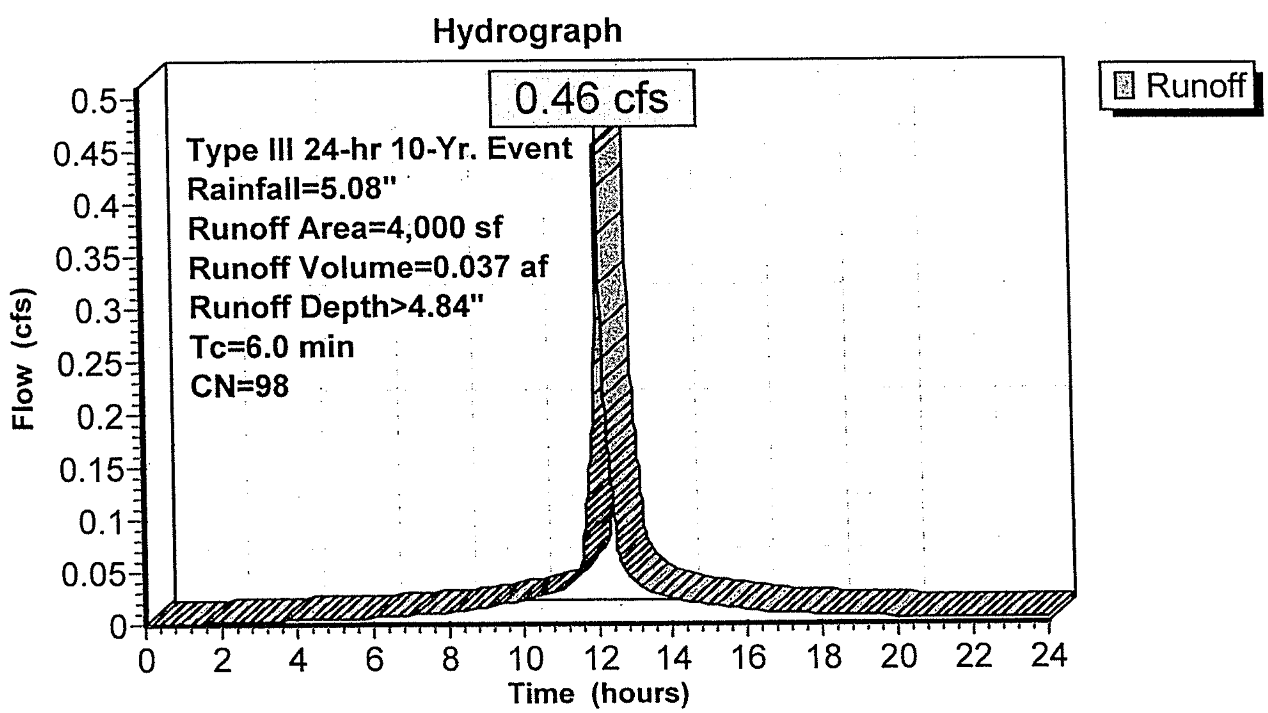
Runoff = 0.46 cfs @ 12.08 hrs, Volume= 0.037 af, Depth> 4.84"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-Yr. Event Rainfall=5.08"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 4,000 | 98 | Roof |
| | 4,000 | | 100.00% Impervious Area |

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

### Subcatchment SUB-1C:



## Summary for Subcatchment SUB-3:

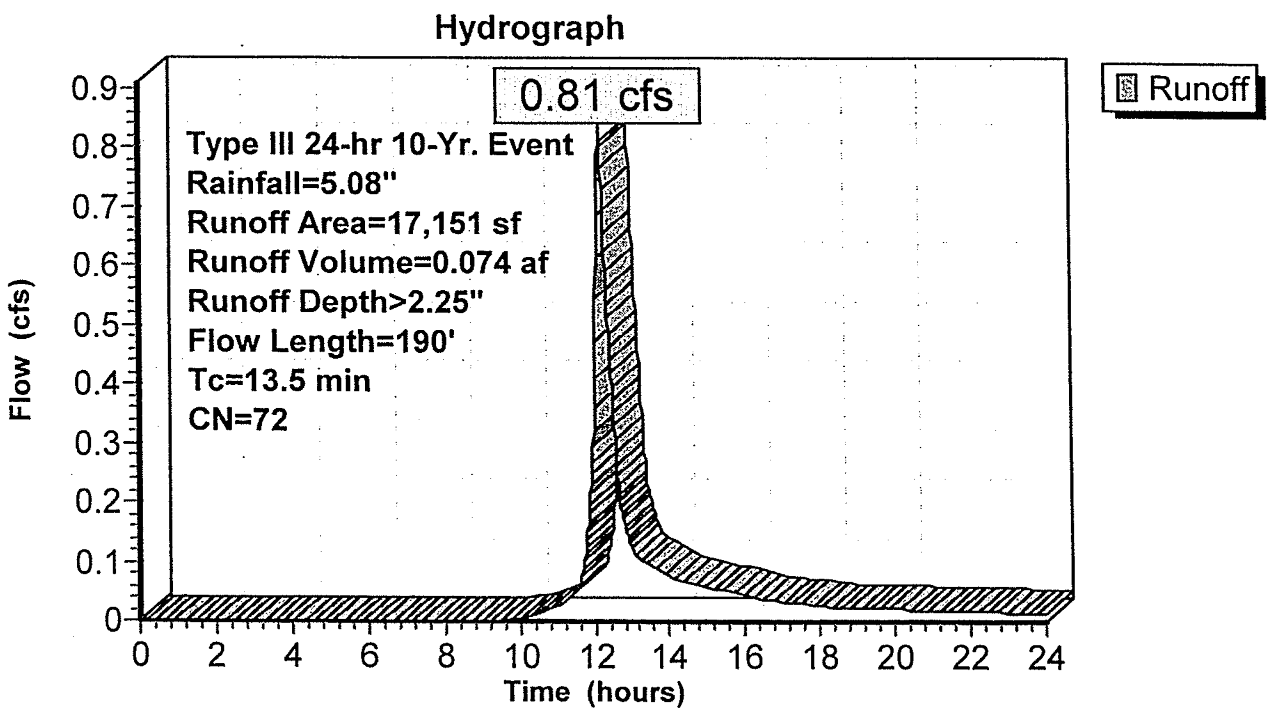
Runoff = 0.81 cfs @ 12.19 hrs, Volume= 0.074 af, Depth> 2.25"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 10-Yr. Event Rainfall=5.08"

| | Area (sf) | CN | Description |
|---|---|---|---|
| | 4,638 | 60 | Woods, Fair, HSG B |
| * | 3,184 | 98 | Pavement |
| * | 567 | 98 | Concrete |
| | 7,296 | 61 | >75% Grass cover, Good, HSG B |
| * | 1,466 | 98 | Roof |
| | 17,151 | 72 | Weighted Average |
| | 11,934 | | 69.58% Pervious Area |
| | 5,217 | | 30.42% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 12.3 | 50 | 0.0200 | 0.07 | | **Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20" |
| 1.2 | 140 | 0.0140 | 1.90 | | **Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps |
| 13.5 | 190 | Total | | | |

## Subcatchment SUB-3:



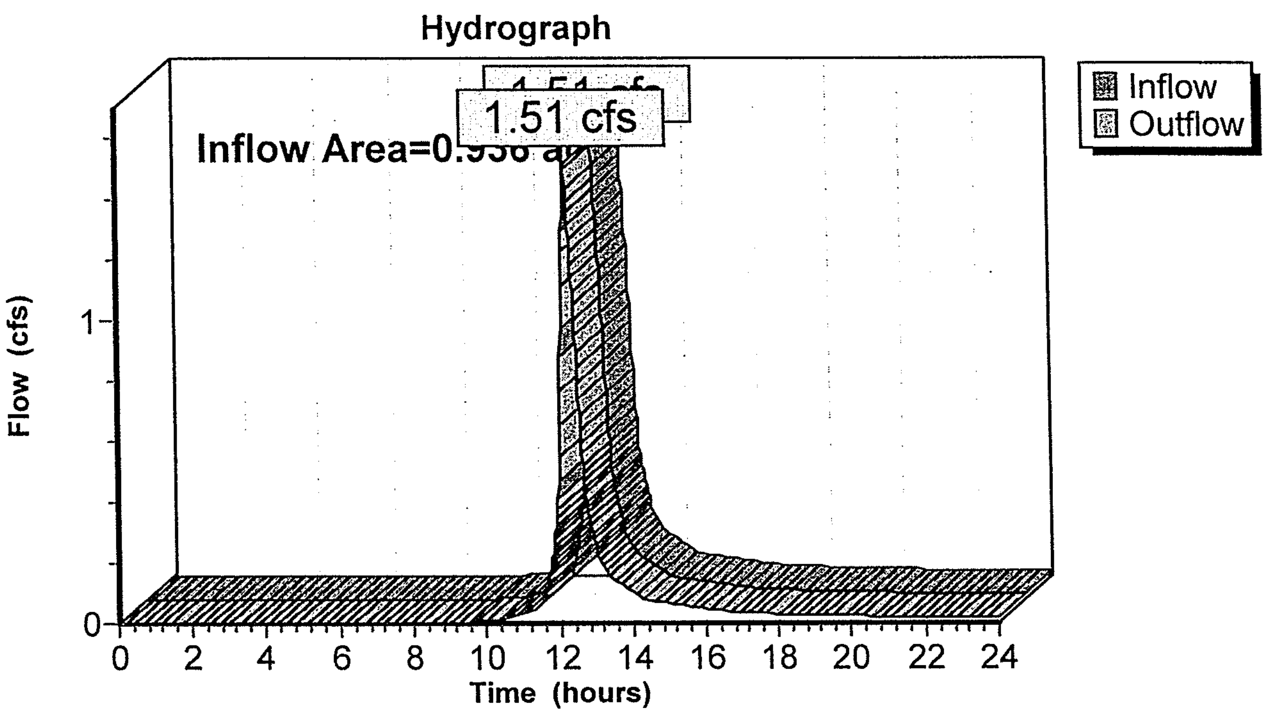
## Summary for Reach DP-1:

[40] Hint: Not Described (Outflow=Inflow)

| | | | |
|---|---|---|---|
| Inflow Area = | 0.936 ac, 37.76% Impervious, Inflow Depth > 1.50" | for 10-Yr. Event event | |
| Inflow = | 1.51 cfs @ 12.21 hrs, Volume= | 0.117 af | |
| Outflow = | 1.51 cfs @ 12.21 hrs, Volume= | 0.117 af, Atten= 0%, Lag= 0.0 min | |

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

### Reach DP-1:



## Summary for Reach DP-3:

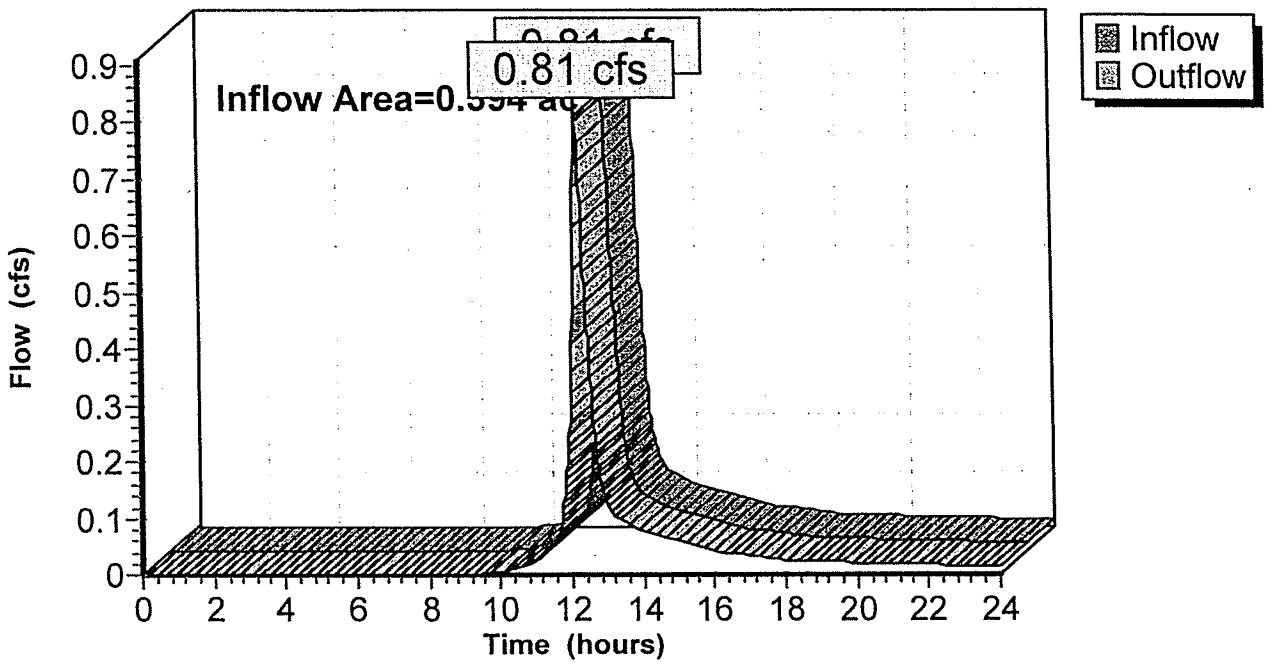
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.394 ac, 30.42% Impervious, Inflow Depth > 2.25" for 10-Yr. Event event
Inflow = 0.81 cfs @ 12.19 hrs, Volume= 0.074 af
Outflow = 0.81 cfs @ 12.19 hrs, Volume= 0.074 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

**Reach DP-3:**

**Hydrograph**



## Summary for Pond 2P: Roof Drywell

| | | | |
|---|---|---|---|
| Inflow Area = | 0.092 ac,100.00% Impervious, Inflow Depth > 4.84" for 10-Yr. Event event | | |
| Inflow = | 0.46 cfs @ 12.08 hrs, Volume= | 0.037 af | |
| Outflow = | 0.24 cfs @ 12.22 hrs, Volume= | 0.037 af, | Atten= 48%, Lag= 8.5 min |
| Discarded = | 0.02 cfs @ 10.52 hrs, Volume= | 0.031 af | |
| Primary = | 0.22 cfs @ 12.22 hrs, Volume= | 0.006 af | |

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Peak Elev= 94.85' @ 12.22 hrs Surf.Area= 395 sf Storage= 485 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 142.4 min ( 889.6 - 747.2 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 93.42' | 301 cf | **Chambers** Listed below Inside #2 |
| #2 | 92.92' | 271 cf | **Stone Backfill (Prismatic)** Listed below (Recalc)<br>980 cf Overall - 301 cf Embedded = 679 cf x 40.0% Voids |
| | | 572 cf | Total Available Storage |

| Elevation (feet) | Cum.Store (cubic-feet) |
|---|---|
| 93.42 | 0 |
| 94.75 | 301 |

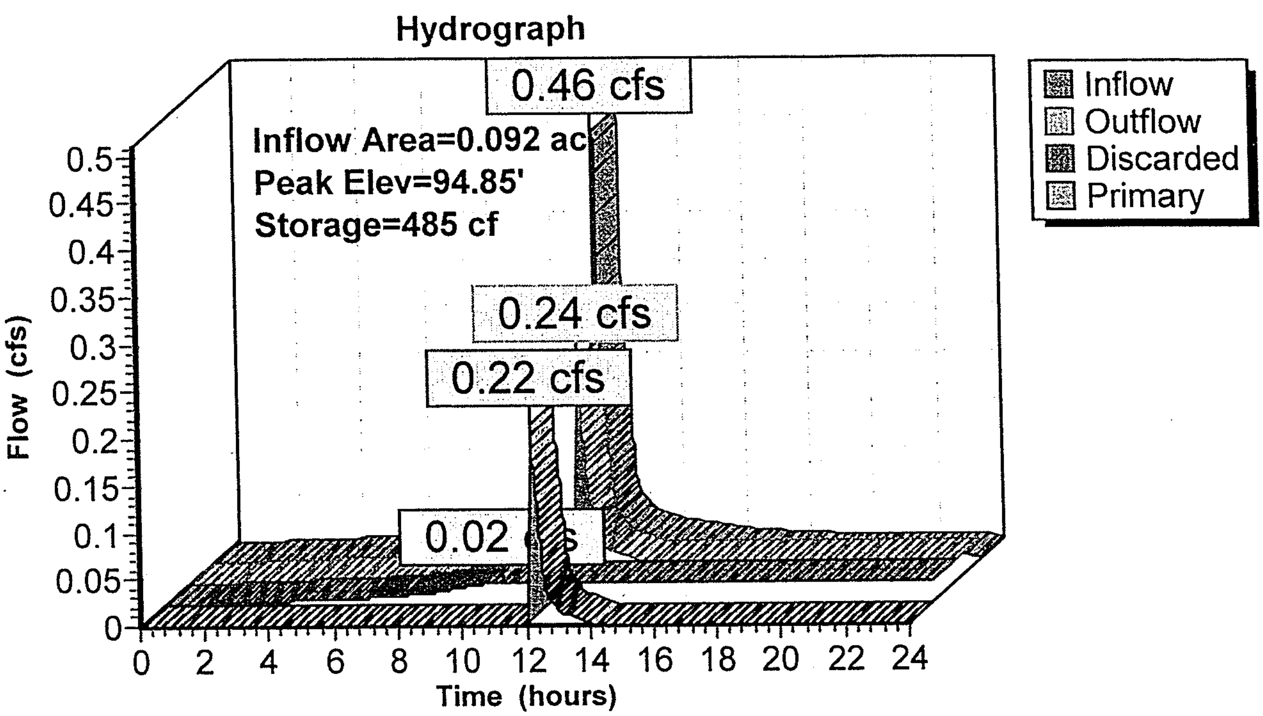
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 92.92 | 395 | 0 | 0 |
| 93.92 | 395 | 395 | 395 |
| 95.40 | 395 | 585 | 980 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Discarded | 92.92' | **2.410 in/hr Exfiltration over Surface area** |
| #2 | Primary | 94.75' | **4.0" Horiz. Orifice/Grate X 2.00** C= 0.600<br>Limited to weir flow at low heads |

**Discarded OutFlow** Max=0.02 cfs @ 10.52 hrs HW=92.95' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

**Primary OutFlow** Max=0.21 cfs @ 12.22 hrs HW=94.85' TW=0.00' (Dynamic Tailwater)
↑—**2=Orifice/Grate** (Weir Controls 0.21 cfs @ 1.03 fps)

## Pond 2P: Roof Drywell



## Summary for Pond P-1: Basin

| | | | | |
|---|---|---|---|---|
| Inflow Area = | 0.410 ac, | 32.37% Impervious, | Inflow Depth > 2.87" | for 10-Yr. Event event |
| Inflow = | 1.23 cfs @ | 12.13 hrs, Volume= | 0.098 af | |
| Outflow = | 0.67 cfs @ | 12.32 hrs, Volume= | 0.098 af, Atten= 45%, Lag= 11.2 min | |
| Discarded = | 0.10 cfs @ | 12.32 hrs, Volume= | 0.069 af | |
| Primary = | 0.57 cfs @ | 12.32 hrs, Volume= | 0.029 af | |

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Peak Elev= 93.60' @ 12.32 hrs Surf.Area= 1,815 sf Storage= 1,079 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 60.2 min ( 885.9 - 825.7 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 91.60' | 2,841 cf | **Custom Stage Data (Prismatic)** Listed below (Recalc)<br>7,101 cf Overall x 40.0% Voids |

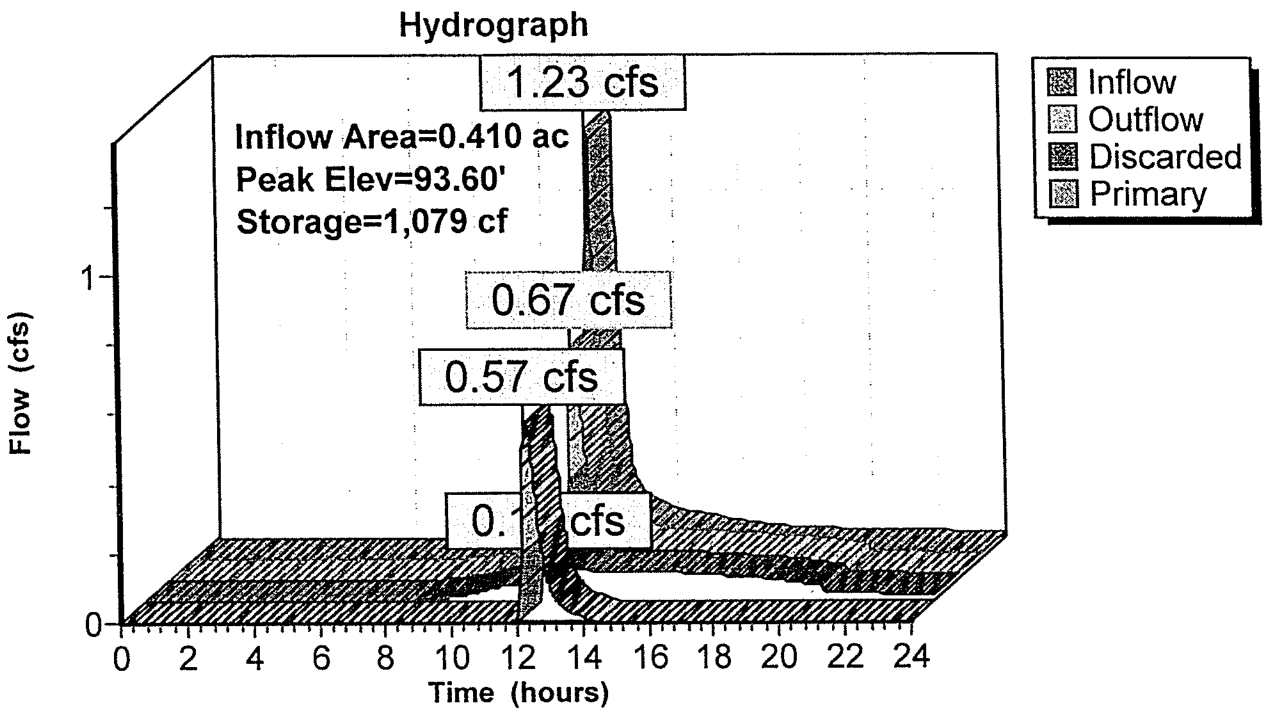
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 91.60 | 757 | 0 | 0 |
| 92.00 | 1,116 | 375 | 375 |
| 93.00 | 1,533 | 1,325 | 1,699 |
| 94.00 | 2,006 | 1,770 | 3,469 |
| 95.60 | 2,535 | 3,633 | 7,101 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Discarded | 91.60' | **2.410 in/hr Exfiltration over Surface area** |
| #2 | Primary | 93.00' | **0.5' long x 1.60' rise Sharp-Crested Rectangular Weir**<br>2 End Contraction(s) |
| #3 | Primary | 94.60' | **6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) |

**Discarded OutFlow** Max=0.10 cfs @ 12.32 hrs HW=93.60' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.10 cfs)

**Primary OutFlow** Max=0.57 cfs @ 12.32 hrs HW=93.60' TW=0.00' (Dynamic Tailwater)
├─**2=Sharp-Crested Rectangular Weir** (Weir Controls 0.57 cfs @ 2.52 fps)
└─**3=Sharp-Crested Rectangular Weir** ( Controls 0.00 cfs)

## Pond P-1: Basin



Time span=0.00-24.00 hrs, dt=0.02 hrs, 1201 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment SUB-1A:** Runoff Area=17,838 sf 32.37% Impervious Runoff Depth>6.47"
Flow Length=180' Tc=9.2 min CN=79 Runoff=2.74 cfs 0.221 af

**Subcatchment SUB-1B:** Runoff Area=18,930 sf 29.68% Impervious Runoff Depth>5.61"
Flow Length=180' Tc=9.2 min CN=72 Runoff=2.56 cfs 0.203 af

**Subcatchment SUB-1C:** Runoff Area=4,000 sf 100.00% Impervious Runoff Depth>8.79"
Tc=6.0 min CN=98 Runoff=0.81 cfs 0.067 af

**Subcatchment SUB-3:** Runoff Area=17,151 sf 30.42% Impervious Runoff Depth>5.60"
Flow Length=190' Tc=13.5 min CN=72 Runoff=2.04 cfs 0.184 af

**Reach DP-1:** Inflow=4.61 cfs 0.350 af
Outflow=4.61 cfs 0.350 af

**Reach DP-3:** Inflow=2.04 cfs 0.184 af
Outflow=2.04 cfs 0.184 af

**Pond 2P: Roof Drywell** Peak Elev=95.39' Storage=571 cf Inflow=0.81 cfs 0.067 af
Discarded=0.02 cfs 0.035 af Primary=0.67 cfs 0.028 af Outflow=0.69 cfs 0.063 af

**Pond P-1: Basin** Peak Elev=94.64' Storage=1,925 cf Inflow=2.74 cfs 0.221 af
Discarded=0.12 cfs 0.101 af Primary=1.84 cfs 0.119 af Outflow=1.97 cfs 0.220 af

**Total Runoff Area = 1.330 ac Runoff Volume = 0.675 af Average Runoff Depth = 6.09"**
**64.41% Pervious = 0.856 ac 35.59% Impervious = 0.473 ac**

## Summary for Subcatchment SUB-1A:

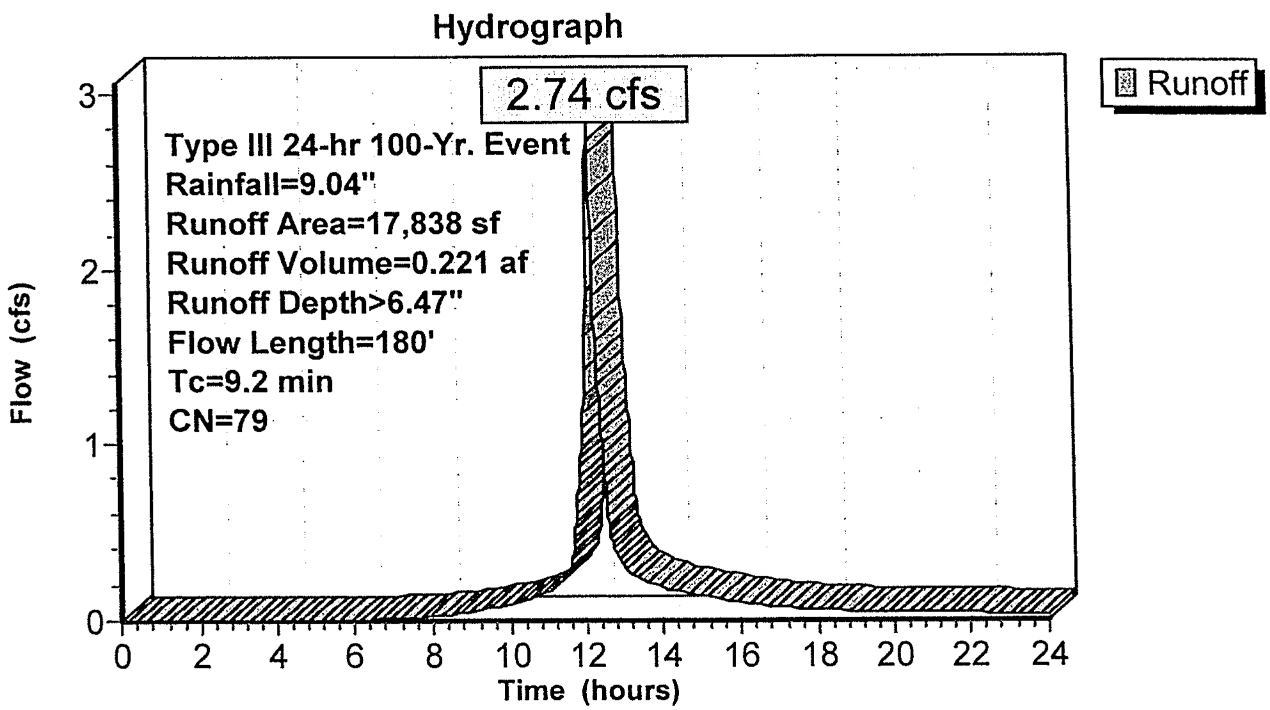
Runoff = 2.74 cfs @ 12.13 hrs, Volume= 0.221 af, Depth> 6.47"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-Yr. Event Rainfall=9.04"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 5,775 | 98 | Pavement |
| | 4,821 | 61 | >75% Grass cover, Good, HSG B |
| | 1,984 | 60 | Woods, Fair, HSG B |
| * | 5,258 | 82 | Gravel |
| | 17,838 | 79 | Weighted Average |
| | 12,063 | | 67.63% Pervious Area |
| | 5,775 | | 32.37% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 8.5 | 50 | 0.0500 | 0.10 | | **Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20" |
| 0.7 | 130 | 0.0347 | 3.00 | | **Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps |
| 9.2 | 180 | Total | | | |

### Subcatchment SUB-1A:



## Summary for Subcatchment SUB-1B:

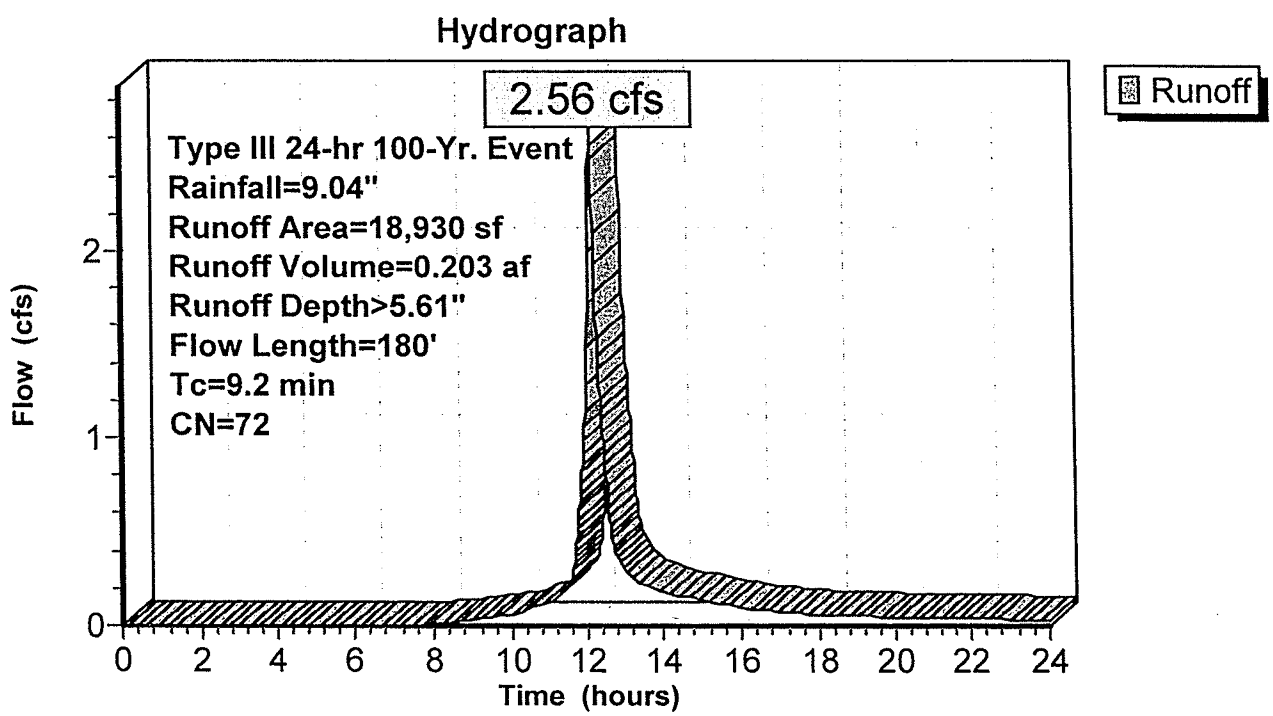
Runoff = 2.56 cfs @ 12.13 hrs, Volume= 0.203 af, Depth> 5.61"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-Yr. Event Rainfall=9.04"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 789 | 98 | Roof |
| * | 4,368 | 98 | Pavement |
| * | 462 | 98 | Concrete |
| | 6,270 | 61 | >75% Grass cover, Good, HSG B |
| | 7,041 | 60 | Woods, Fair, HSG B |
| | 18,930 | 72 | Weighted Average |
| | 13,311 | | 70.32% Pervious Area |
| | 5,619 | | 29.68% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 8.5 | 50 | 0.0500 | 0.10 | | **Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20" |
| 0.7 | 130 | 0.0347 | 3.00 | | **Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps |
| 9.2 | 180 | Total | | | |

### Subcatchment SUB-1B:



## Summary for Subcatchment SUB-1C:

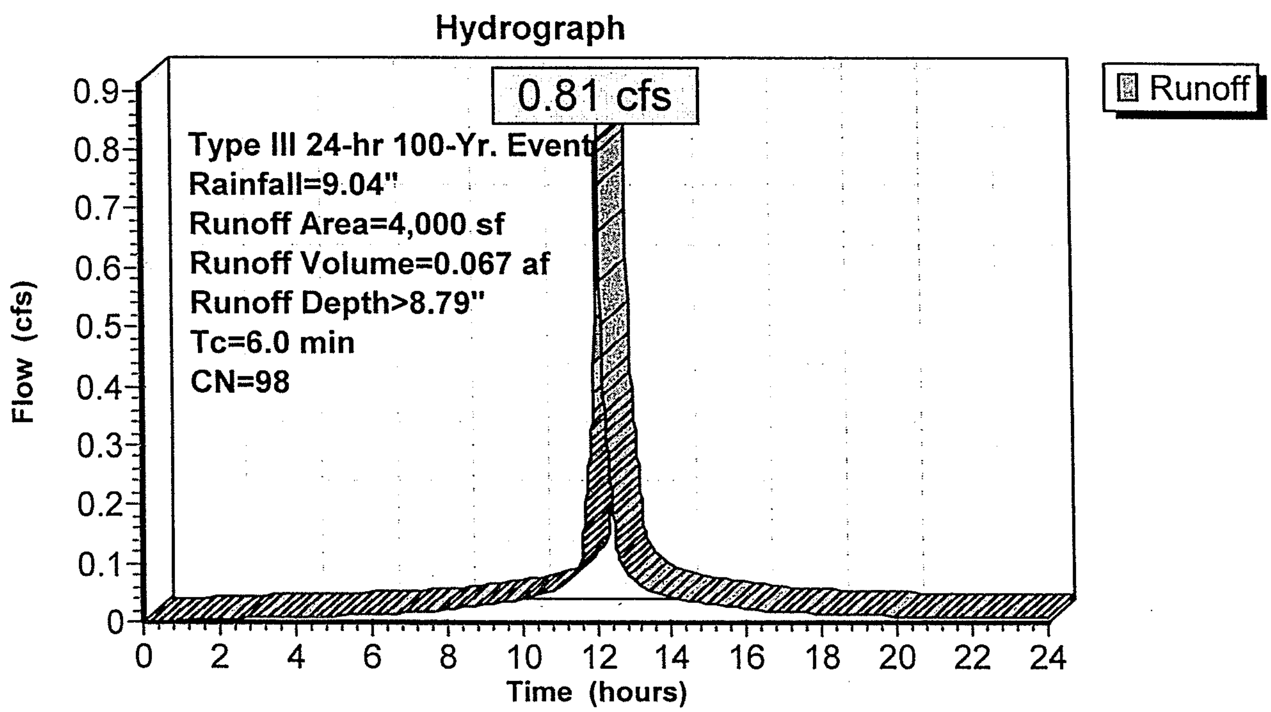
Runoff = 0.81 cfs @ 12.08 hrs, Volume= 0.067 af, Depth> 8.79"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-Yr. Event Rainfall=9.04"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 4,000 | 98 | Roof |
| | 4,000 | | 100.00% Impervious Area |

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

### Subcatchment SUB-1C:



## Summary for Subcatchment SUB-3:

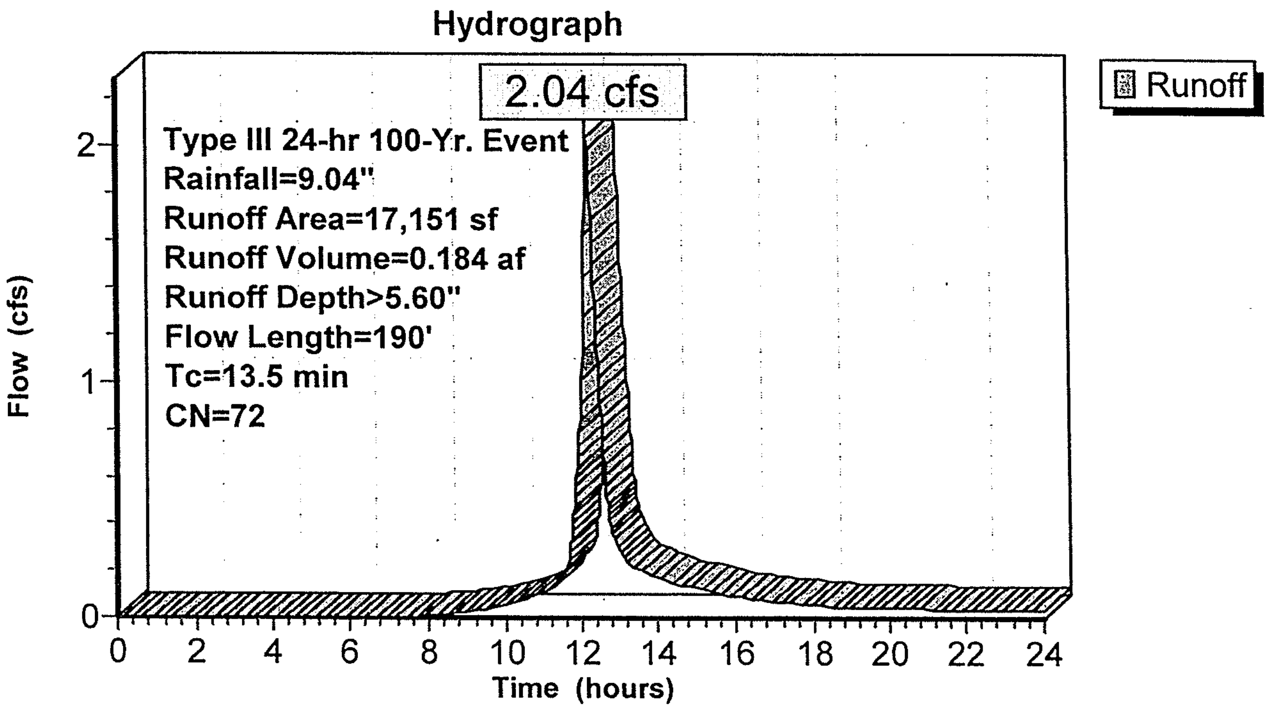
Runoff = 2.04 cfs @ 12.18 hrs, Volume= 0.184 af, Depth> 5.60"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Type III 24-hr 100-Yr. Event Rainfall=9.04"

| | Area (sf) | CN | Description |
|---|---|---|---|
| | 4,638 | 60 | Woods, Fair, HSG B |
| * | 3,184 | 98 | Pavement |
| * | 567 | 98 | Concrete |
| | 7,296 | 61 | >75% Grass cover, Good, HSG B |
| * | 1,466 | 98 | Roof |
| | 17,151 | 72 | Weighted Average |
| | 11,934 | | 69.58% Pervious Area |
| | 5,217 | | 30.42% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 12.3 | 50 | 0.0200 | 0.07 | | **Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20" |
| 1.2 | 140 | 0.0140 | 1.90 | | **Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps |
| 13.5 | 190 | Total | | | |

### Subcatchment SUB-3:

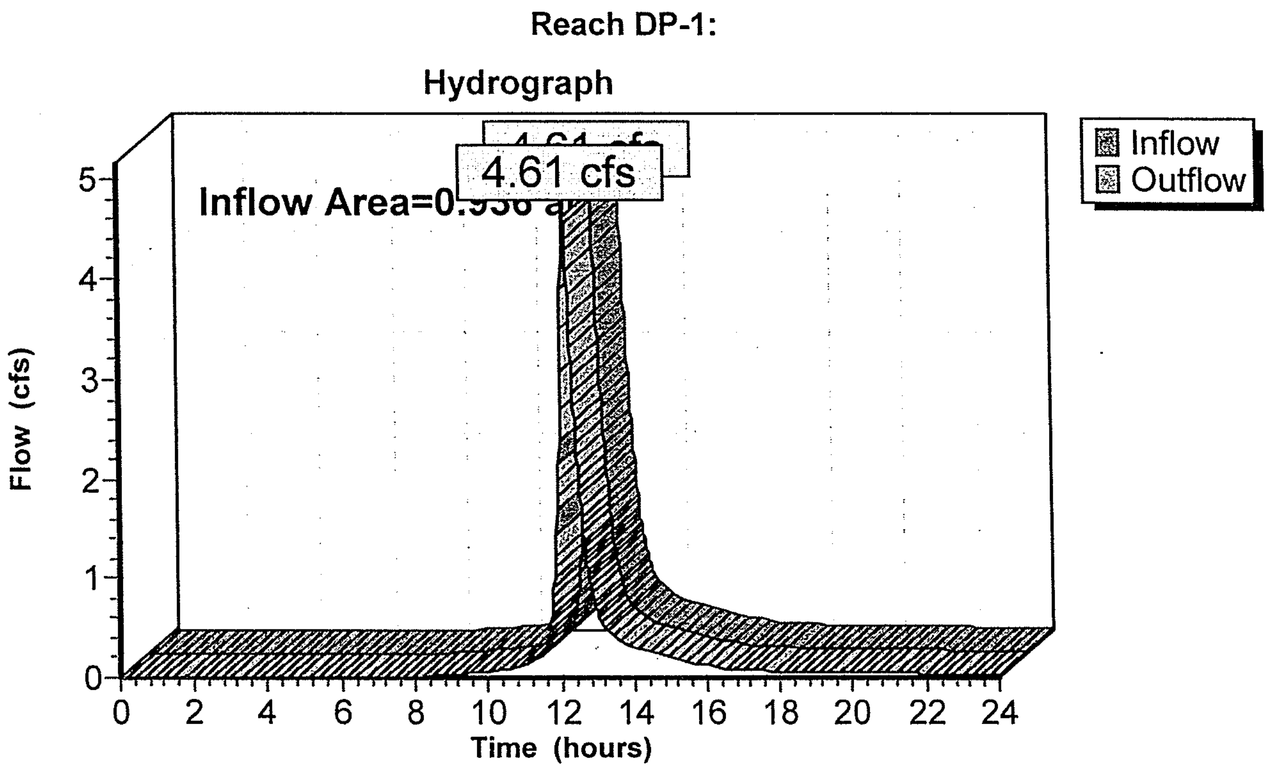


## Summary for Reach DP-1:

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.936 ac, 37.76% Impervious, Inflow Depth > 4.48" for 100-Yr. Event event
Inflow = 4.61 cfs @ 12.15 hrs, Volume= 0.350 af
Outflow = 4.61 cfs @ 12.15 hrs, Volume= 0.350 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs

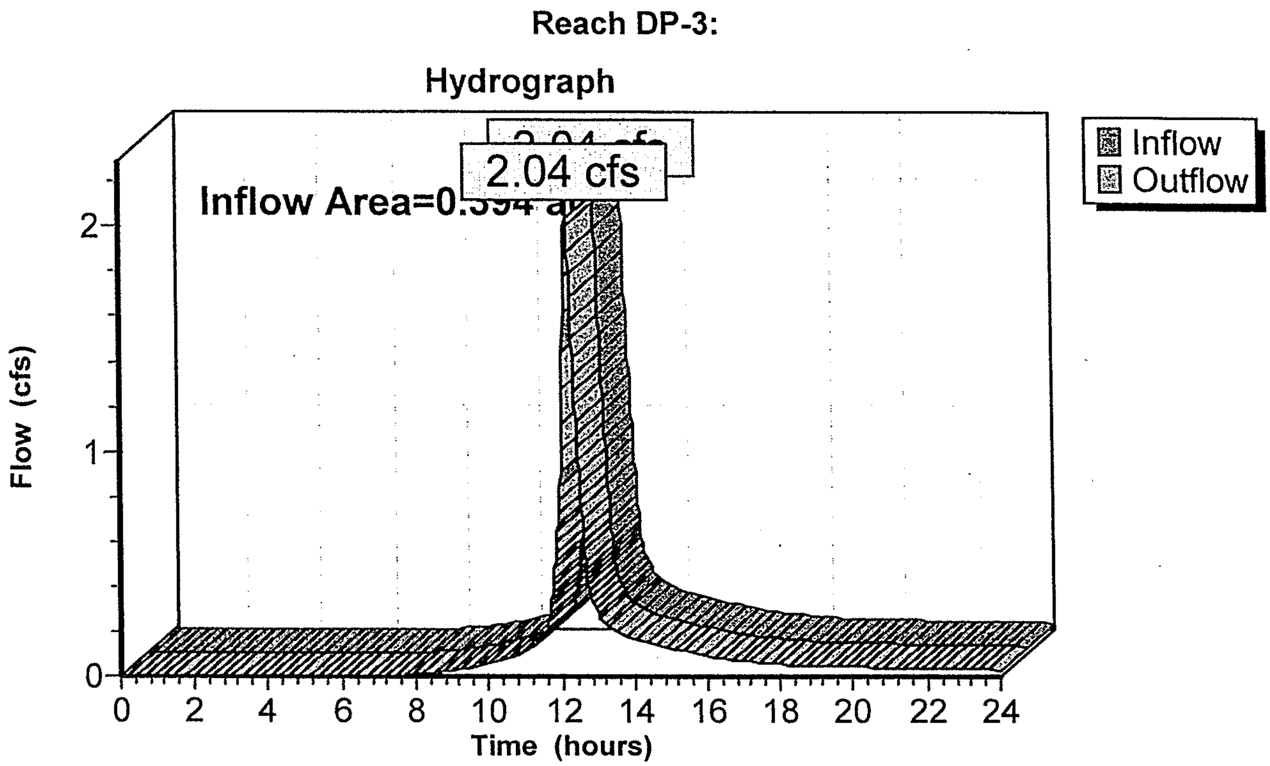


## Summary for Reach DP-3:

[40] Hint: Not Described (Outflow=Inflow)

| | | | | |
|---|---|---|---|---|
| Inflow Area = | 0.394 ac, 30.42% Impervious, | Inflow Depth > | 5.60" | for 100-Yr. Event event |
| Inflow = | 2.04 cfs @ 12.18 hrs, | Volume= | 0.184 af | |
| Outflow = | 2.04 cfs @ 12.18 hrs, | Volume= | 0.184 af, | Atten= 0%, Lag= 0.0 min |

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs



## Summary for Pond 2P: Roof Drywell

| | | | |
|---|---|---|---|
| Inflow Area = | 0.092 ac,100.00% Impervious, Inflow Depth > 8.79" | for 100-Yr. Event event | |
| Inflow = | 0.81 cfs @ 12.08 hrs, Volume= | 0.067 af | |
| Outflow = | 0.69 cfs @ 12.13 hrs, Volume= | 0.063 af, | Atten= 15%, Lag= 2.9 min |
| Discarded = | 0.02 cfs @ 8.66 hrs, Volume= | 0.035 af | |
| Primary = | 0.67 cfs @ 12.13 hrs, Volume= | 0.028 af | |

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Peak Elev= 95.39' @ 12.13 hrs Surf.Area= 395 sf Storage= 571 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 66.6 min ( 805.9 - 739.2 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 93.42' | 301 cf | **Chambers** Listed below Inside #2 |
| #2 | 92.92' | 271 cf | **Stone Backfill (Prismatic)** Listed below (Recalc)<br>980 cf Overall - 301 cf Embedded = 679 cf x 40.0% Voids |
| | | 572 cf | Total Available Storage |

| Elevation (feet) | Cum.Store (cubic-feet) |
|---|---|
| 93.42 | 0 |
| 94.75 | 301 |

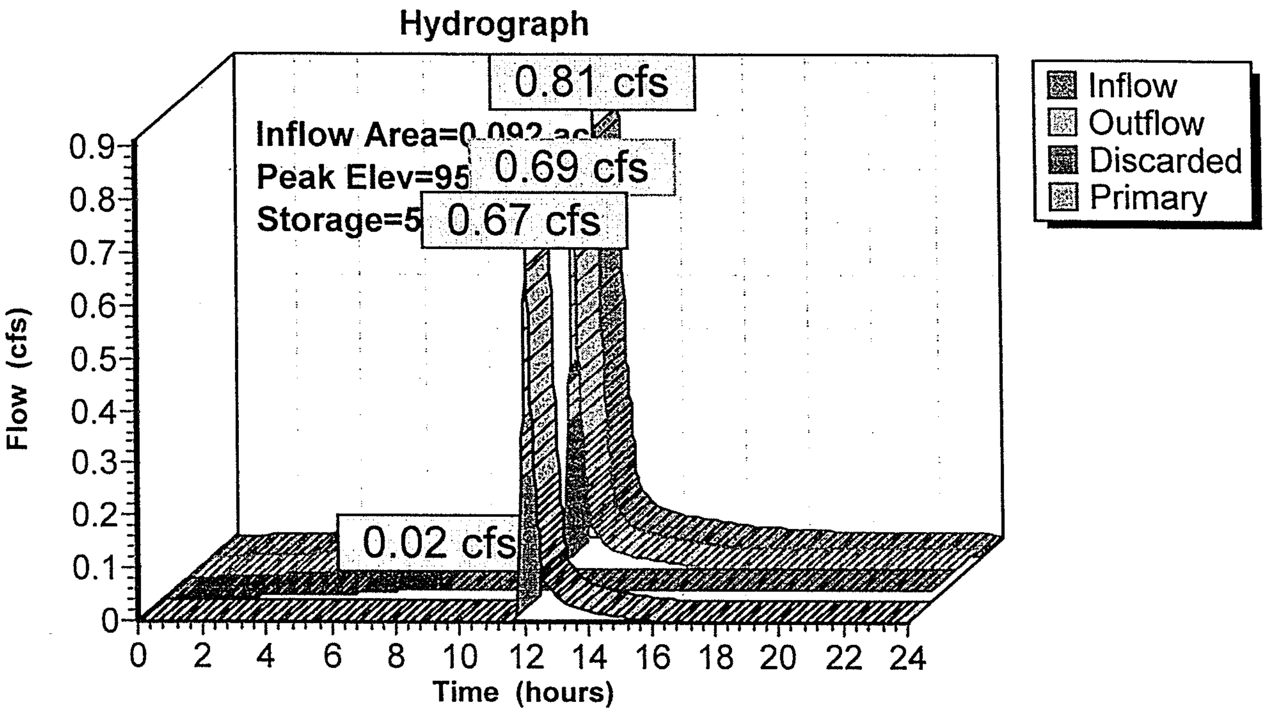
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 92.92 | 395 | 0 | 0 |
| 93.92 | 395 | 395 | 395 |
| 95.40 | 395 | 585 | 980 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Discarded | 92.92' | **2.410 in/hr Exfiltration over Surface area** |
| #2 | Primary | 94.75' | **4.0" Horiz. Orifice/Grate X 2.00** C= 0.600<br>Limited to weir flow at low heads |

**Discarded OutFlow** Max=0.02 cfs @ 8.66 hrs HW=92.95' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

**Primary OutFlow** Max=0.67 cfs @ 12.13 hrs HW=95.39' TW=0.00' (Dynamic Tailwater)
↑—**2=Orifice/Grate** (Orifice Controls 0.67 cfs @ 3.84 fps)

**Pond 2P: Roof Drywell**



## Summary for Pond P-1: Basin

Inflow Area = 0.410 ac, 32.37% Impervious, Inflow Depth > 6.47" for 100-Yr. Event event
Inflow = 2.74 cfs @ 12.13 hrs, Volume= 0.221 af
Outflow = 1.97 cfs @ 12.23 hrs, Volume= 0.220 af, Atten= 28%, Lag= 6.1 min
Discarded = 0.12 cfs @ 12.23 hrs, Volume= 0.101 af
Primary = 1.84 cfs @ 12.23 hrs, Volume= 0.119 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.02 hrs
Peak Elev= 94.64' @ 12.23 hrs Surf.Area= 2,217 sf Storage= 1,925 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 46.3 min ( 848.9 - 802.6 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 91.60' | 2,841 cf | **Custom Stage Data (Prismatic)** Listed below (Recalc)<br>7,101 cf Overall x 40.0% Voids |

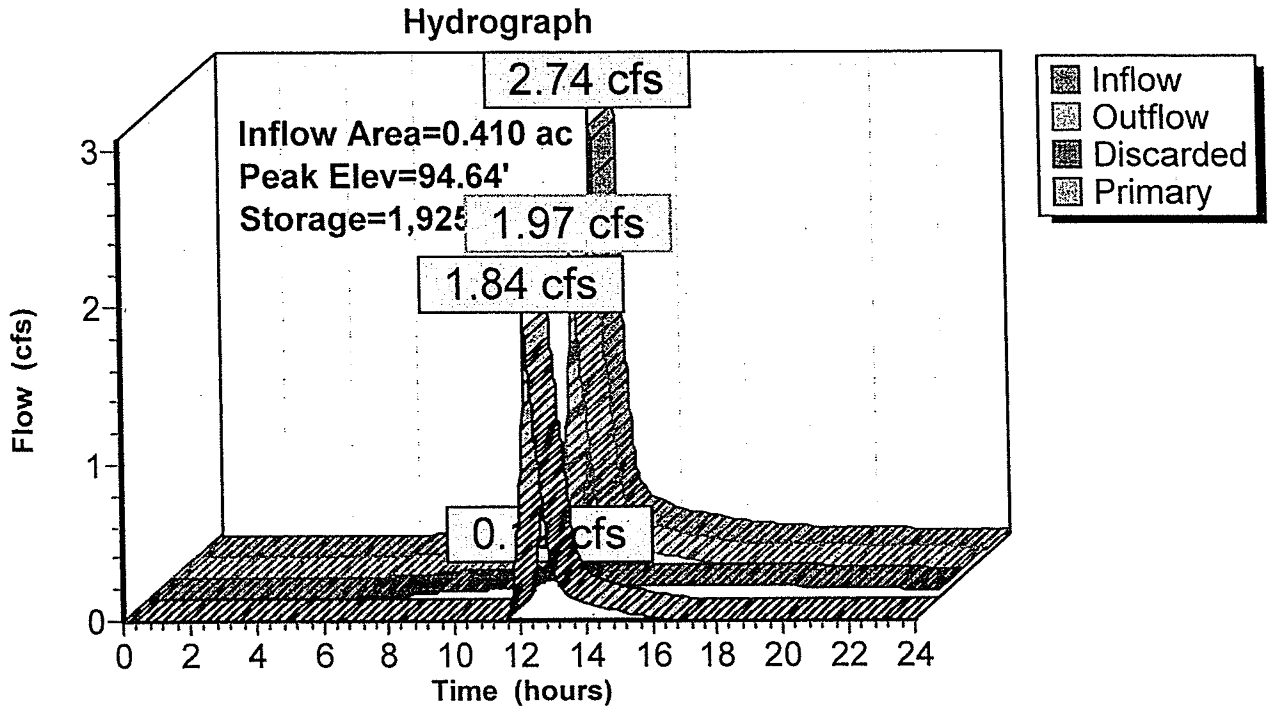
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 91.60 | 757 | 0 | 0 |
| 92.00 | 1,116 | 375 | 375 |
| 93.00 | 1,533 | 1,325 | 1,699 |
| 94.00 | 2,006 | 1,770 | 3,469 |
| 95.60 | 2,535 | 3,633 | 7,101 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Discarded | 91.60' | **2.410 in/hr Exfiltration over Surface area** |
| #2 | Primary | 93.00' | **0.5' long x 1.60' rise Sharp-Crested Rectangular Weir**<br>2 End Contraction(s) |
| #3 | Primary | 94.60' | **6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s) |

**Discarded OutFlow** Max=0.12 cfs @ 12.23 hrs HW=94.63' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.12 cfs)

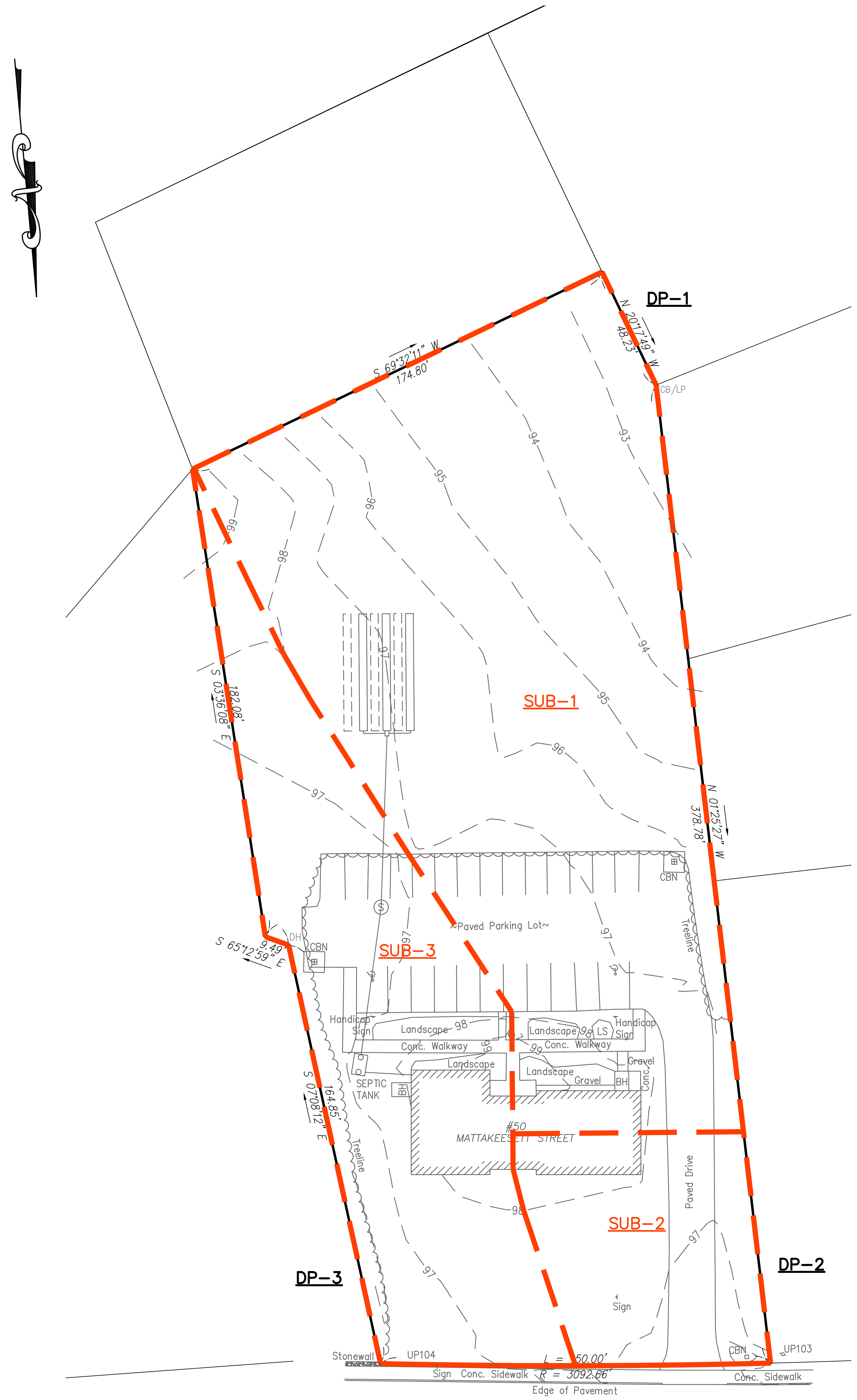
**Primary OutFlow** Max=1.83 cfs @ 12.23 hrs HW=94.63' TW=0.00' (Dynamic Tailwater)
├─**2=Sharp-Crested Rectangular Weir** (Orifice Controls 1.70 cfs @ 4.26 fps)
└─**3=Sharp-Crested Rectangular Weir** (Weir Controls 0.13 cfs @ 0.61 fps)

## Pond P-1: Basin



**PLANS**

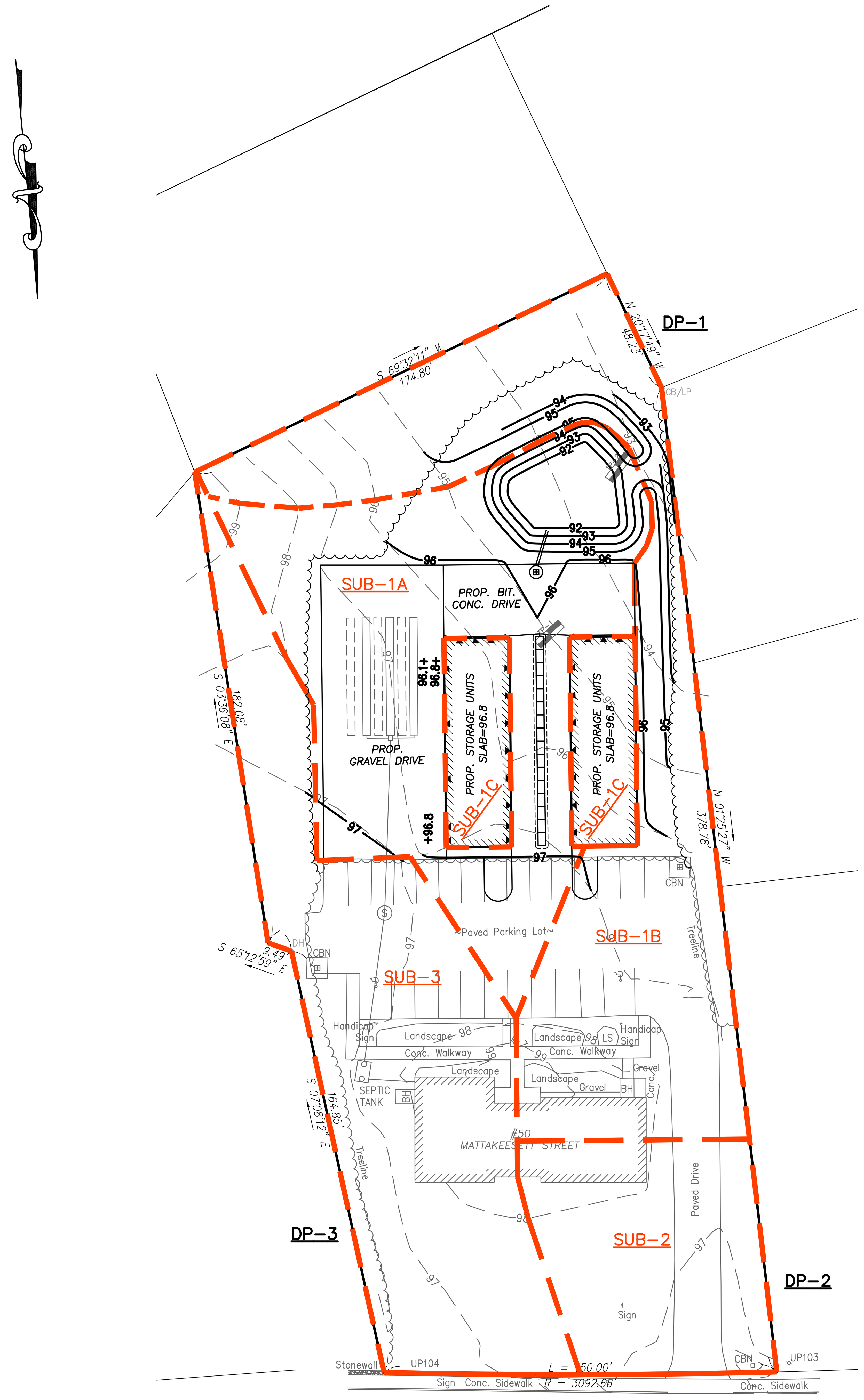
- Watershed Delineation Plan (WS-1 & WS-2)




MATTAKEESETT STREET
(PUBLIC - 45' WIDE)

PRE-DEVELOPMENT WATERSHED
SCALE: 1" = 30'

SITE LAYOUT
SCALE: 1" = 30'




MATTAKEESETT STREET
(PUBLIC - 45' WIDE)

POST-DEVELOPMENT WATERSHED
SCALE: 1" = 30'

| REV. | DATE | DESCRIPTION | BY |
| --- | --- | --- | --- |
| | | | |

ENGINEERED BY:
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COMMONWEALTH OF MASSACHUSETTS
JEFFREY M. HASSETT
CIVIL
No. 49293
REGISTERED PROFESSIONAL ENGINEER

PROJECT: PROPOSED SITE PLAN
50 MATTAKEESETT STREET
(ASSESSOR'S PARCEL: C9-23E)
PEMBROKE, MASSACHUSETTS 02359

DESIGN: JDG
JOB NO: 18-288
DATE: 12/26/18
REV: -
SHEET: 1 OF 1

PREPARED FOR: MIKE BULMAN
P.O. BOX 20
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PLAN TITLE: WATERSHED PLANS