



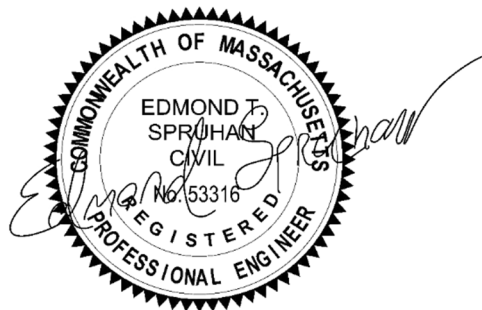
## SPRUHAN ENGINEERING

80 Jewett St Unit 01, Newton, MA 02458  
phone: 617-816-0722 email: edmond@spruhaneng.com

# STORMWATER MANAGEMENT REPORT

PROJECT:

**11 PARSONS STREET, NEWTON, MA.-**



Prepared by:  
Spruhan Engineering, P.C.  
March 12, 2025  
November 24, 2025 (R1)

## Contents

<b>1. Introduction.....</b>	<b>3</b>
<b>2. Existing Conditions.....</b>	<b>3</b>
2.1 Existing Topography and Drainage Infrastructure.....	4
<b>3. Proposed Conditions.....</b>	<b>4</b>
3.1 Project Description.....	4
3.2 Soil Information (Summary) .....	5
3.3 Infiltration System.....	6
3.4 Infiltration System for the Sump Pumps.....	7
3.5 Drawdown time (Time to empty) Calculations.....	7
3.6 Flowrate & volume of stormwater runoff summary. ....	8
3.7 Low Impact Development (LID).....	9
3.8 Total Suspended Solids (TSS) removal & Total Phosphorus (TP) reduction.....	11

### **Appendix A – HydroCAD Calculations**

### **Appendix B – Soil information (Full NRCS Report)**

### **Appendix C – Storm Water Operations & Maintenance Plan**

### **Appendix D – Precipitation Frequency Estimates for Newton (NOAA Atlas 14 Volume 10 V3)**

## 1. Introduction

Spruhan Engineering, P.C. (“Spruhan”) has prepared this Stormwater Management Report for the proposed development at **11 Parsons Street, Newton, Massachusetts** (the “Property”). The scope of the project proposes 3 units in this multi-family lot (the “Proposed Development”). The Property will also be improved with a driveway and landscaped areas.

In accordance with Section 29-148(C)(3) of the City of Newton Ordinances, the Proposed Development requires a “major stormwater management permit” because it will increase the amount of impervious surface at the Property by more than 1,000 square feet. Spruhan has designed the proposed stormwater management system to meet these standards.

## 2. Existing Conditions

The Property is a 17,678 square foot lot located on Parsons Avenue, between Wiswall Street and Watertown Street. The surrounding neighborhood is residential in character and abutting properties are improved by single-family or two-family dwellings. Table 1 provides a summary of the existing impervious, pervious, and landscaped areas at the Property.

<b>EXISTING AREAS</b>	
LOT AREA	17,678 S.F.
<b>IMPERVIOUS &amp; DEGRADED AREAS</b>	
BUILDING	1,256 S.F.
PORCH	627 S.F.
GRAVEL DRIVEWAY	376 S.F.
STONE WALLS	110 S.F.
PAVED WALKWAY	341 S.F.
BULKHEAD	28 S.F.
<b>TOTAL</b>	<b>2,738 S.F.</b>
<b>PERVIOUS &amp; DEGRADED AREAS</b>	
WOODEN STEPS & LANDING	47 S.F.
DIRT & STONE WALKWAY	52 S.F.
<b>TOTAL</b>	<b>99 S.F.</b>
LANDSCAPE	14,841 S.F.

*Table 1- Summary of the existing impervious, pervious and landscaped areas at the Property*

## 2.1 Existing Topography and Drainage Infrastructure

The Property has an approximate 6.5% slope that runs from the North (the right of the Property) to the South (the left of the Property). The Property does not have an existing drainage or infiltration system. Consequently, stormwater at the Property currently scours across the surface at grade.

### 3. Proposed Conditions

#### 3.1 Project Description

The scope of the proposed work involves developing the property with 3 units in this multi-family lot. Table 2 provides details on the proposed impervious, pervious, and landscaped areas at the Property.

<b>PROPOSED AREAS</b>	
LOT AREA	17,678 S.F.
<b>IMPERVIOUS &amp; DEGRADED AREAS</b>	
BUILDINGS	3,589 S.F.
COV. LANDING	70 S.F.
LANDING	34 S.F.
DRIVEWAY	1,015 S.F.
WALKWAYS & STEPS	318 S.F.
RETAINING WALLS	27 S.F.
<b>TOTAL</b>	<b>5,053 S.F.</b>
<b>PERVIOUS &amp; DEGRADED AREAS</b>	
WOODEN STEPS & LANDINGS	111 S.F.
<b>TOTAL</b>	<b>111 S.F.</b>
LANDSCAPE	12,514 S.F.

Table 2- Proposed impervious, pervious, and landscaped areas at the Property

### 3.2 Soil Information (Summary)

The NRCS Web Soil Survey shows one Map Unit inside our area of interest. This is listed next and the percentages of Area of Interest in the Map unit Legend Table:

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	0.2	100.0%
<b>Totals for Area of Interest</b>		<b>0.2</b>	<b>100.0%</b>

Map unit **626B** refers to **stratified gravel to very gravelly sand**, these soils have a Hydrological soil group “A”.

Also, 2 test pits were performed on the site and the hole logs showed **Gravelly Loamy Sand**; properties for such soils were applied to the HydroCAD software calculations and Drawdown time calculations as well.

Further detailed information is described in Appendix B.

DEEP OBSERVATION HOLE LOG												
DEEP OBSERVATION HOLE NUMBER:					TP-1	GROUND ELEVATION:					35.00	
Depth (in)	Horizon/ Layer	Matrix: Color-Moist	Redoximorphic Features			Texture (USDA)	Coarse Fragments (Percent by Volume)		Structure	Consistence (Moist)	Other	
			Depth (in)	Color	Percent		Gravel	Cobbles & Stones				
0-6 34.50	A	10YR 3 2	—	—	—	SANDY LOAM	<5	<5	MASSIVE	FRIABLE	—	
6-32 32.33	FILL	—	—	—	—	—	—	—	—	—	6"-14" ASH	
32-84 28.00	C	10YR 6 2	NONE	—	—	GRAVELLY LOAMY SAND	25	20	SINGLE GRAINED	LOOSE	—	
NOTES: 1. NO WEEPING OR STANDING WATER OBSERVED. 3. NO REFUSAL. 2. NO REDOX. OBSERVED. 4. LOGGED BY MATTHEW MUI, SE14259 ON 10/23/2024.												
DEEP OBSERVATION HOLE LOG												
DEEP OBSERVATION HOLE NUMBER:					TP-2	GROUND ELEVATION:					35.00	
Depth (in)	Horizon/ Layer	Matrix: Color-Moist	Redoximorphic Features			Texture (USDA)	Coarse Fragments (Percent by Volume)		Structure	Consistence (Moist)	Other	
			Depth (in)	Color	Percent		Gravel	Cobbles & Stones				
0-40 31.67	FILL / A	—	—	—	—	—	—	—	—	—	CONSISTING MOSTLY OF LOAM	
40-90 27.50	C	10YR 6 2	NONE	—	—	GRAVELLY LOAMY SAND	25	20	SINGLE GRAINED	LOOSE	MANY COBBLES	
NOTES: 1. NO WEEPING OR STANDING WATER OBSERVED. 3. NO REFUSAL. 2. NO REDOX. OBSERVED. 4. LOGGED BY MATTHEW MUI, SE14259 ON 10/23/2024.												

### 3.3 Infiltration System

The proposed infiltration system consists of one (01) set of Stormtech Chambers composed by 18 chambers, embedded in a crushed stone pit. The Calculations for such systems are shown next:

**Design Criteria:**

Proposed post-construction Impervious areas= 5,053 SF  
 Design for: 2" Rainstorm

**Total Storage Required:**

$$V_R = (2"/12) (5,053SF) = \underline{\underline{842 CF}}$$

**CAPACITY OF THE PROPOSED INFILTRATION SYSTEM FROM THE HYDROCAD MODEL**

System #1			
Volume	Invert	Avail.Storage	Storage Description
#1A	30.00'	790 cf	<b>11.00'W x 68.03'L x 3.75'H Field A</b> 2,806 cf Overall - 832 cf Embedded = 1,974 cf x 40.0% Voids
#2A	30.75'	832 cf	<b>ADS_StormTech DC-780 +Cap</b> x 18 Inside #1 Effective Size= 45.4"W x 30.0"H => 6.49 sf x 7.12'L = 46.2 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 18 Chambers in 2 Rows
		<b>1,622 cf</b>	<b>Total Available Storage</b>

Total Storage Provided (**1,622 CF**) > Total Storage Required (**840** CF/D)

The proposed infiltration system complies with the City of Newton Stormwater Management and Erosion Control Rules & Regulations, Section 5: Design Standards Part C.3.a page 6 of 17, where it states: “Stormwater management systems on new development sites shall be designed to: a) Retain the volume of runoff equivalent to, or greater than, two (2) inches multiplied by the total post-construction impervious surface area on the site...”

### 3.4 Infiltration System for the Sump Pumps

The proposed infiltration system to handle the groundwater from the precautionary sump pumps consists of one (01) set of Stormtech DC-780 Chambers embedded in a crushed stone pit, composed by a total of 2 chambers. This infiltration system is sized for the 10-year storm over the area of the basement.

The Calculations for such system are shown next:

	<b><u>Design Criteria:</u></b>
Proposed basement area=	2,221 SF
Design for:	10-year storm

#### **CAPACITY OF THE PROPOSED INFILTRATION SYSTEM FROM THE HYDROCAD MODEL**

System #2			
Volume	Invert	Avail.Storage	Storage Description
#1A	30.00'	281 cf	<b>10.08'W x 21.02'L x 3.75'H Field A</b> 795 cf Overall - 92 cf Embedded = 702 cf x 40.0% Voids
#2A	30.75'	92 cf	<b>ADS_StormTech DC-780 +Cap</b> x 2 Inside #1 Effective Size= 45.4"W x 30.0"H => 6.49 sf x 7.12'L = 46.2 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap
		<b>373 cf</b>	<b>Total Available Storage</b>

### 3.5 Drawdown time (Time to empty) Calculations.

$$Time = \frac{rv}{(k)(\text{Inf. System bottom Area})}$$

*rv = Storage capacity of the infiltration system.*

*k = Rawls rate based on soil texture class (2.41  $\frac{\text{in}}{\text{hr}}$  for Gravelly Loamy Sand*

#### System #1

$$\text{Time}_{\text{drawdown}} = (1622 \text{ cf}) / [(2.41 \text{ in/hr}) (1\text{ft}/12\text{in}) (748 \text{ sf})]$$

**Time = 10.80 hr < 72.00hr**

#### System #2 (System for the precautionary sump pumps)

$$\text{Time}_{\text{drawdown}} = (373 \text{ cf}) / [(2.41 \text{ in/hr}) (1\text{ft}/12\text{in}) (210 \text{ sf})]$$

**Time = 8.84hr < 72.00hr**

### 3.6 Flowrate & volume of stormwater runoff summary.

The proposed infiltration system designed for this site will control the runoff from the site and substantially improve drainage at the property.

HydroCAD was used to model the site for the existing and proposed conditions for the 2-year, 10-year, 25-year, and 100-year type III storm events based on The NOAA Atlas 14, Volume 10, Version 3, Rain Information for Newton Center, Massachusetts, USA.

Storm Event	Precipitation depths NOAA Atlas 14 (inches)	Precipitation depths used (inches)
2-Year	3.26	3.26
10-Year	5.13	5.13
25-Year	6.30	6.30
100-Year	8.10	8.78**

Table 3- Precipitation depths used for the HydroCAD analysis.

\*\*According to the City of Newton Stormwater Management and Erosion Control Rules & Regulations, Section 5: Design Standards Part B.6 page 5 of 17: “... the 100-year design storm is based on 8.78 inches of precipitation in 24 hours...”. In addition, Section 5: Design Standards Part C.2 page 6 of 17, states: “Projects shall comply with the Stormwater Standards of the most recent version of Massachusetts Stormwater Management Handbook (Handbook), and the City of Newton General Construction Detail Book and Streets Design Guide. Where an inconsistency exists between the Handbook and these Regulations, the stricter shall apply”.

Detailed HydroCAD calculations are included in Appendix A. Table 4, below, provides a summary of the existing and proposed conditions as they relate to flowrate and volume of stormwater runoff at the Property

SUMMARY TABLE				
Rainfall Event	Runoff Flow Rate (cfs)		Volume of Runoff (cf)	
	Existing	Proposed	Existing	Proposed
2-Year	0.00	0.00	121	1
10-Year	0.15	0.01	860	239
25-Year	0.39	0.07	1573	569
100-Year	1.07	0.39	3523	1578

### 3.7 Low Impact Development (LID)

Low Impact Development (LID) strategies use careful site design and decentralized stormwater management to reduce the environmental footprint of new growth and redevelopment. This approach improves water quality, minimizes the need for expensive pipe and pond stormwater systems, and creates more attractive developments.

The following strategies outline the LID methods that were implemented in this project:

1. **Use of Filter Mitts:**
  - a. Erosion control
  - b. Detains sediment, absorbs orders and degrades volatile organic compounds allows water by-pass, and is a food resource for beneficial microorganisms, which remediate by metabolizing wood preservatives, petroleum products, pesticides and both chlorinated and non-chlorinated hydrocarbons in stormwater runoff from reaching water resources, prevents erosion and silting on embankments parallel to creeks, lakes, and rivers, prevents erosion and turf loss on roadsides, hillsides, playing fields, and golf courses.
2. **Grass swales:** broad, open channels sown with erosion resistant and flood tolerant grasses.
  - a. Management Objectives:
    - i. Provide water quality treatment; remove suspended solids; heavy metals, trash.
    - ii. Reduce peak discharge rate and total runoff volume.
    - iii. Infiltrate water into the ground.
    - iv. Provide a location for snow storage.
3. **Infiltration Trenches and Dry Wells.** These are standard stormwater management structures that store water in the void space between crushed stone or gravel; the water slowly percolates downward into the subsoil.
  - a. Management Objectives:
    - i. Remove suspended solids, heavy metals trash, oil, and grease.
    - ii. Reduce peak discharge rate and total runoff volume.
    - iii. Provide modest infiltration and recharge.
    - iv. Provide snow storage areas.
4. **Grass Filter Strips** are low-angle vegetated slopes designed to treat sheet flow runoff from adjacent impervious areas.
  - a. Management Objectives:
    - i. Remove suspended solids, heavy metals, trash, oil, and grease.
    - ii. Reduce peak discharge rate and total runoff volume.
    - iii. Provide modest infiltration and recharge.
    - iv. Provide snow storage areas.
5. **Roadway and Parking Lot Design:**
  - a. Management Objectives:

- i. Remove suspended solids, heavy metals trash, oil, and grease.
- ii. Reduce peak discharge rate and total runoff volume.
- iii. Provide modest infiltration and recharge.
- iv. Provide snow storage areas.

6. Other LID Implementations:

- a. Shared Driveways
- b. Creating long flow paths over landscaped areas.

### **3.8 Total Suspended Solids (TSS) removal & Total Phosphorus (TP) reduction**

According to City of Newton Stormwater Management and Erosion Control Rules & Regulations, Section 5: Design Standards Part:

- C.3.c: Stormwater management systems on **new development** sites shall be designed to:
  - a) Remove 90% of the average annual load of Total Suspended Solids generated from the total post-construction impervious area on the site; and
  - b) Calculate the existing and proposed average annual Total Phosphorus (TP) load based on the land use(s) and demonstrate 60% reduction of the TP load generated from the total post-construction impervious surface area on the site: and
- C.4.c: Stormwater management systems on **redevelopment** sites shall be designed to:
  - a) Remove 80% of the average annual load of Total Suspended Solids generated from the total post-construction impervious area on the site; and
  - b) Calculate the existing and proposed average annual Total Phosphorus (TP) load based on the land use(s) and demonstrate 50% reduction of the TP load generated from the total post-construction impervious surface area on the site: and

Therefore, the Stormwater system has been designed to remove **85%** the average annual load of Total Suspended Solids (TSS) generated from the total post-construction impervious area on the site and achieve a total of **92.50%** reduction of the average annual Total Phosphorus (TP) load based generated from the total post-construction impervious surface area on the site.

Location:

TSS Removal Calculation Worksheet

B BMP <sup>1</sup>	C TSS Removal Rate <sup>1</sup>	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Infiltration Trench	0.80	1.00	0.80	0.20
Deep Sump and Hooded Catch Basin	0.25	0.20	0.05	0.15
	0.00	0.15	0.00	0.15
	0.00	0.15	0.00	0.15
	0.00	0.15	0.00	0.15

**Total TSS Removal =**

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project:

Date:

Prepared By:

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

### PHOSPHORUS LOADS / REDUCTIONS

**TP = A\*L**

**Where:**

- A = Total impervious area of post-development (acres)
- L = Load of a pollutant in pounds per acre per year.
- Ac = Captured impervious area of post-development (acres)

#### PRE-DEVELOPMENT PHOSPHORUS LOADING (Lpre)

Tppre = A\*L  
 Tppre = 0.0628 Acres X 1.96 lbs/acre/year  
 Tppre =

#### POST-DEVELOPMENT PHOSPHORUS LOADING (Lpost)

TPpost = A\*L  
 TPpost = 0.1160 Acres x 1.96 lbs/acre/year  
 TPpost =

#### REDUCED TP LOAD

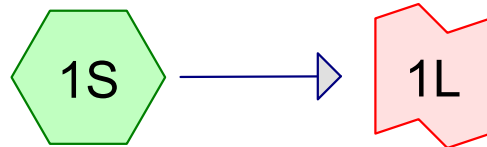
REDUCED TP = AC\*L  
 REDUCED TP = 0.1073 Acres x 1.96 lbs/acre/year  
 REDUCED TP =

#### TOTAL PHOSPHORUS REDUCTION % (TP)

TP RED. (%) =

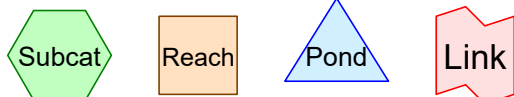
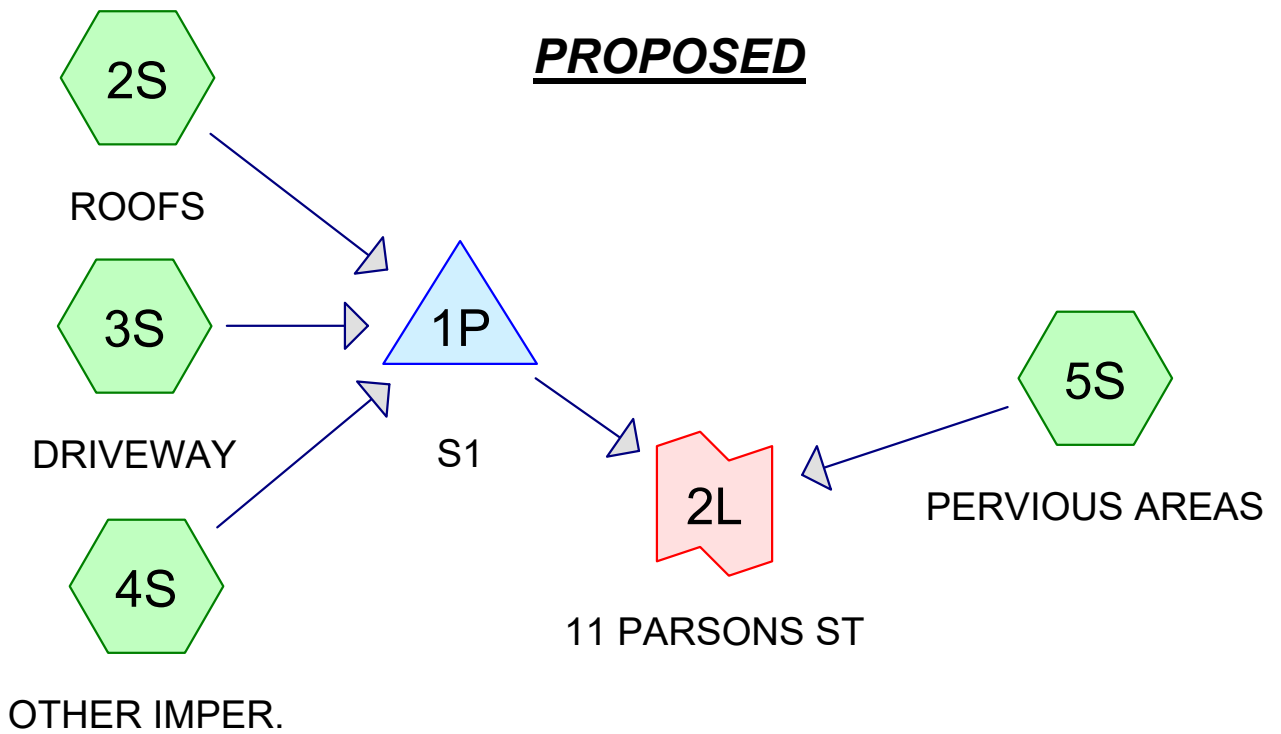
**Appendix A – HydroCAD Calculations**

**EXISTING**



EXISTING AREAS 11 PARSONS ST

**PROPOSED**



**Routing Diagram for 4 - HydroCAD R1**  
Prepared by SPRUHAN ENGINEERING, P.C.  
HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

#### 4 - HydroCAD R1

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

#### Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
27,565	39	>75% Grass cover, Good, HSG A (1S, 5S)
1,391	98	Paved parking, HSG A (1S, 3S)
5,542	98	Roofs, HSG A (1S, 2S)
858	98	Unconnected pavement, HSG A (1S, 4S)
<b>35,356</b>	<b>52</b>	<b>TOTAL AREA</b>

**4 - HydroCAD R1**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

**Soil Listing (all nodes)**

Area (sq-ft)	Soil Group	Subcatchment Numbers
35,356	HSG A	1S, 2S, 3S, 4S, 5S
0	HSG B	
0	HSG C	
0	HSG D	
0	Other	
<b>35,356</b>		<b>TOTAL AREA</b>

**4 - HydroCAD R1**

Prepared by SPRUHAN ENGINEERING, P.C.

**Ground Covers (all nodes)**

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Subcatchment Numbers
27,565	0	0	0	0	27,565	>75% Grass cover, Good	1S, 5S
1,391	0	0	0	0	1,391	Paved parking	1S, 3S
5,542	0	0	0	0	5,542	Roofs	1S, 2S
858	0	0	0	0	858	Unconnected pavement	1S, 4S
<b>35,356</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>35,356</b>	<b>TOTAL AREA</b>	

**4 - HydroCAD R1**

Type III 24-hr 2-Year Rainfall=3.26"

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

<b>Subcatchment 1S: EXISTING AREAS</b>	Runoff Area=17,678 sf 15.49% Impervious Runoff Depth=0.08" Tc=5.0 min UI Adjusted CN=47 Runoff=0.00 cfs 121 cf
<b>Subcatchment 2S: ROOFS</b>	Runoff Area=3,659 sf 100.00% Impervious Runoff Depth=3.03" Tc=5.0 min CN=98 Runoff=0.28 cfs 923 cf
<b>Subcatchment 3S: DRIVEWAY</b>	Runoff Area=1,015 sf 100.00% Impervious Runoff Depth=3.03" Tc=5.0 min CN=98 Runoff=0.08 cfs 256 cf
<b>Subcatchment 4S: OTHER IMPER.</b>	Runoff Area=379 sf 100.00% Impervious Runoff Depth=3.03" Tc=5.0 min CN=98 Runoff=0.03 cfs 96 cf
<b>Subcatchment 5S: PERVIOUS AREAS</b>	Runoff Area=12,625 sf 0.00% Impervious Runoff Depth=0.00" Tc=5.0 min CN=39 Runoff=0.00 cfs 1 cf
<b>Pond 1P: S1</b>	Peak Elev=31.03' Storage=388 cf Inflow=0.38 cfs 1,275 cf Outflow=0.05 cfs 1,275 cf
<b>Link 1L: 11 PARSONS ST</b>	Inflow=0.00 cfs 121 cf Primary=0.00 cfs 121 cf
<b>Link 2L: 11 PARSONS ST</b>	Inflow=0.00 cfs 1 cf Primary=0.00 cfs 1 cf
<b>Total Runoff Area = 35,356 sf Runoff Volume = 1,397 cf Average Runoff Depth = 0.47"</b>	
<b>77.96% Pervious = 27,565 sf 22.04% Impervious = 7,791 sf</b>	

**4 - HydroCAD R1**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

**Summary for Subcatchment 1S: EXISTING AREAS**

Runoff = 0.00 cfs @ 14.65 hrs, Volume= 121 cf, Depth= 0.08"

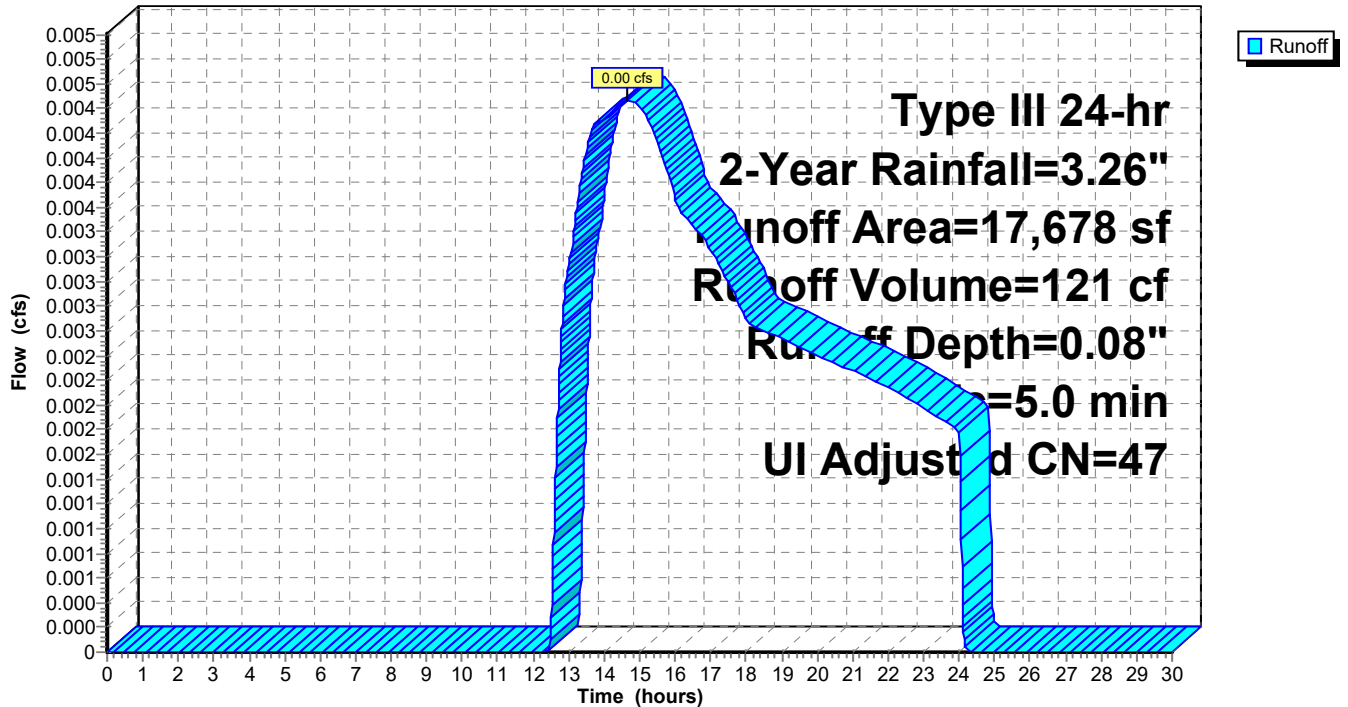
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-Year Rainfall=3.26"

Area (sf)	CN	Adj	Description
1,256	98		Roofs, HSG A
627	98		Roofs, HSG A
376	98		Paved parking, HSG A
110	98		Unconnected pavement, HSG A
* 341	98		Unconnected pavement, HSG A
* 28	98		Unconnected pavement, HSG A
47	39		>75% Grass cover, Good, HSG A
52	39		>75% Grass cover, Good, HSG A
14,841	39		>75% Grass cover, Good, HSG A
17,678	48	47	Weighted Average, UI Adjusted
14,940			84.51% Pervious Area
2,738			15.49% Impervious Area
479			17.49% Unconnected

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

**Subcatchment 1S: EXISTING AREAS**

**Hydrograph**



**4 - HydroCAD R1**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

**Summary for Subcatchment 2S: ROOFS**

Runoff = 0.28 cfs @ 12.07 hrs, Volume= 923 cf, Depth= 3.03"

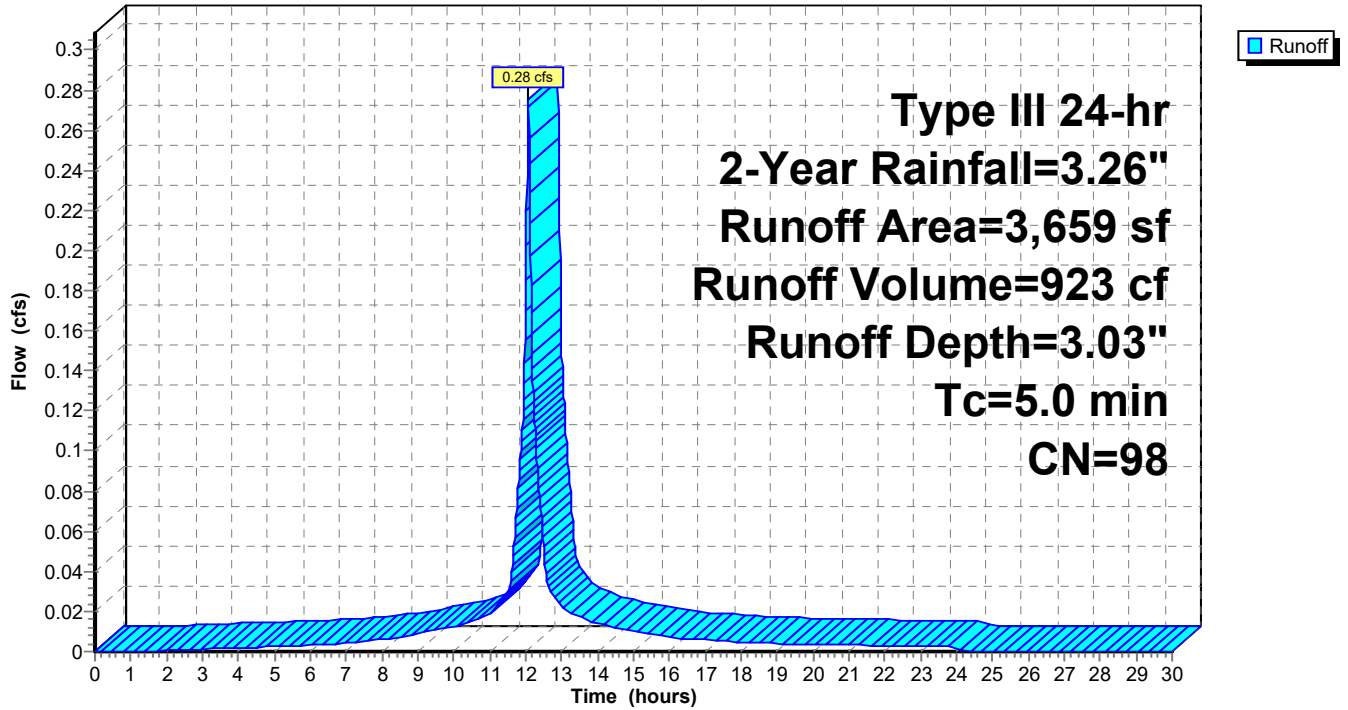
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-Year Rainfall=3.26"

Area (sf)	CN	Description
3,589	98	Roofs, HSG A
* 70	98	Roofs, HSG A
3,659	98	Weighted Average
3,659		100.00% Impervious Area

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

**Subcatchment 2S: ROOFS**

**Hydrograph**



**4 - HydroCAD R1**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

**Summary for Subcatchment 3S: DRIVEWAY**

Runoff = 0.08 cfs @ 12.07 hrs, Volume= 256 cf, Depth= 3.03"

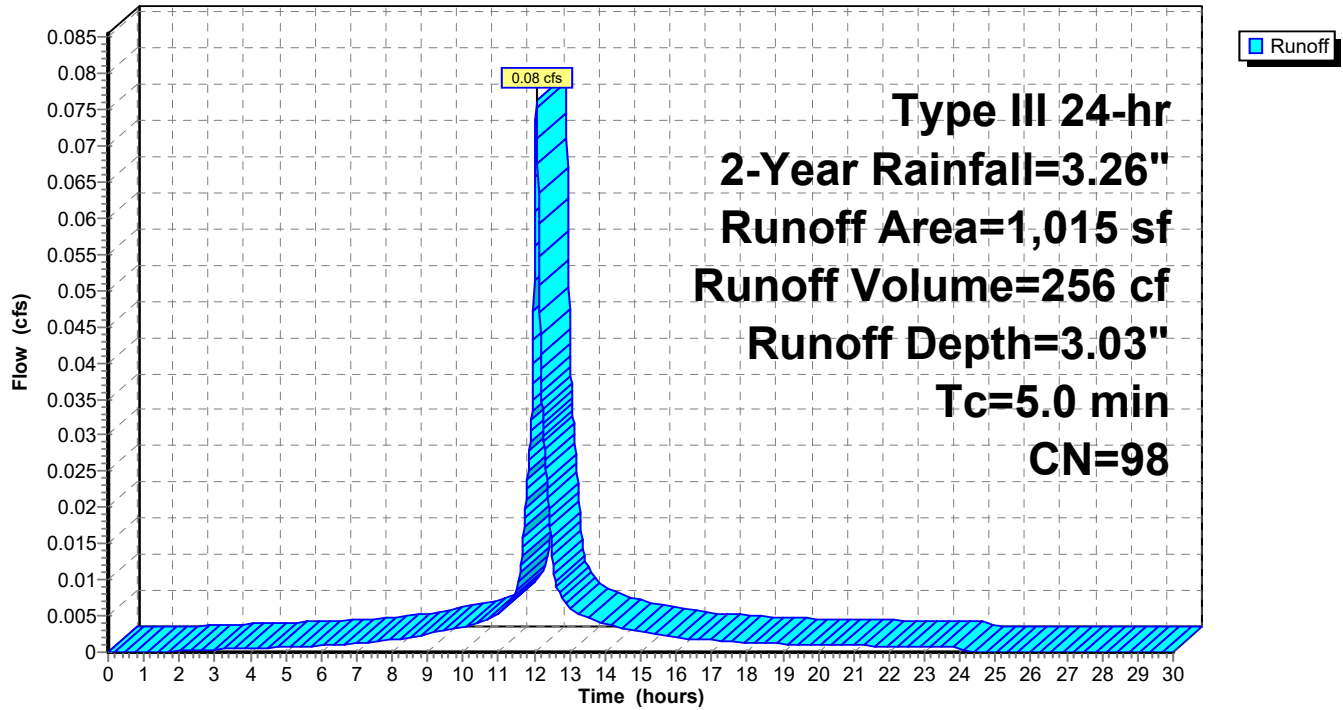
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-Year Rainfall=3.26"

Area (sf)	CN	Description
1,015	98	Paved parking, HSG A
1,015		100.00% Impervious Area

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

**Subcatchment 3S: DRIVEWAY**

**Hydrograph**



**4 - HydroCAD R1**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

**Summary for Subcatchment 4S: OTHER IMPER.**

Runoff = 0.03 cfs @ 12.07 hrs, Volume= 96 cf, Depth= 3.03"

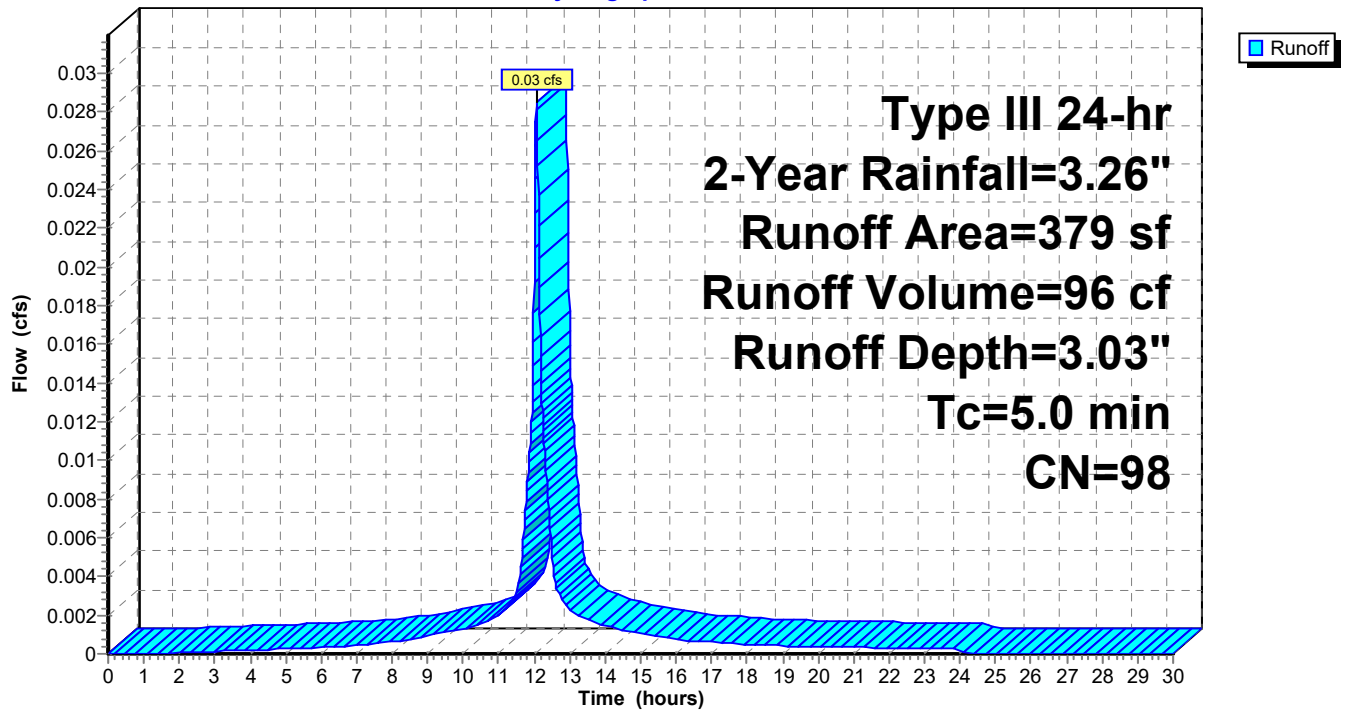
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-Year Rainfall=3.26"

Area (sf)	CN	Description
34	98	Unconnected pavement, HSG A
* 318	98	Unconnected pavement, HSG A
* 27	98	Unconnected pavement, HSG A
379	98	Weighted Average
379		100.00% Impervious Area
379		100.00% Unconnected

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

**Subcatchment 4S: OTHER IMPER.**

Hydrograph





**4 - HydroCAD R1**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

**Summary for Pond 1P: S1**

Inflow Area = 5,053 sf, 100.00% Impervious, Inflow Depth = 3.03" for 2-Year event  
 Inflow = 0.38 cfs @ 12.07 hrs, Volume= 1,275 cf  
 Outflow = 0.05 cfs @ 12.57 hrs, Volume= 1,275 cf, Atten= 87%, Lag= 29.9 min  
 Discarded = 0.05 cfs @ 12.57 hrs, Volume= 1,275 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 2  
 Peak Elev= 31.03' @ 12.57 hrs Surf.Area= 748 sf Storage= 388 cf

Plug-Flow detention time= 49.7 min calculated for 1,275 cf (100% of inflow)  
 Center-of-Mass det. time= 49.6 min ( 804.7 - 755.1 )

Volume	Invert	Avail.Storage	Storage Description
#1A	30.00'	790 cf	<b>11.00'W x 68.03'L x 3.75'H Field A</b> 2,806 cf Overall - 832 cf Embedded = 1,974 cf x 40.0% Voids
#2A	30.75'	832 cf	<b>ADS_StormTech DC-780 +Cap</b> x 18 Inside #1 Effective Size= 45.4"W x 30.0"H => 6.49 sf x 7.12'L = 46.2 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 18 Chambers in 2 Rows
		1,622 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	30.00'	<b>2.410 in/hr Exfiltration over Wetted area</b>

**Discarded OutFlow** Max=0.05 cfs @ 12.57 hrs HW=31.03' (Free Discharge)  
 ↑**-1=Exfiltration** (Exfiltration Controls 0.05 cfs)

**4 - HydroCAD R1**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

**Pond 1P: S1 - Chamber Wizard Field A**

**Chamber Model = ADS\_StormTech DC-780 +Cap (ADS StormTech® DC-780 with cap length)**

Effective Size= 45.4"W x 30.0"H => 6.49 sf x 7.12'L = 46.2 cf

Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

9 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 65.70' Row Length +14.0" End Stone x 2 = 68.03' Base Length

2 Rows x 51.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 11.00' Base Width

9.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.75' Field Height

18 Chambers x 46.2 cf = 832.3 cf Chamber Storage

2,806.2 cf Field - 832.3 cf Chambers = 1,973.9 cf Stone x 40.0% Voids = 789.6 cf Stone Storage

Chamber Storage + Stone Storage = 1,621.9 cf = 0.037 af

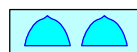
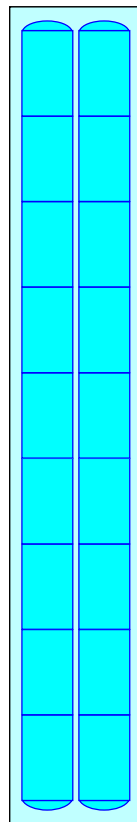
Overall Storage Efficiency = 57.8%

Overall System Size = 68.03' x 11.00' x 3.75'

18 Chambers

103.9 cy Field

73.1 cy Stone



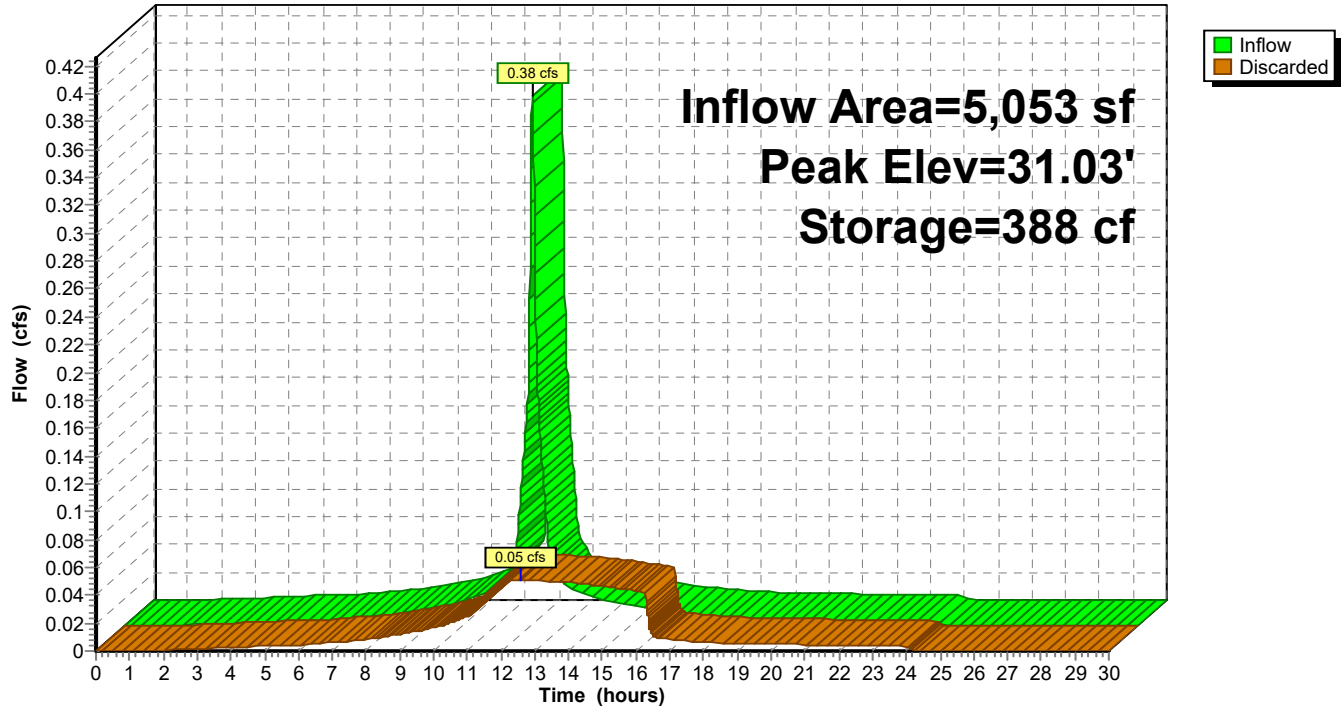
**4 - HydroCAD R1**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

**Pond 1P: S1**

**Hydrograph**



**4 - HydroCAD R1**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

**Stage-Discharge for Pond 1P: S1**

Elevation (feet)	Discarded (cfs)	Elevation (feet)	Discarded (cfs)	Elevation (feet)	Discarded (cfs)	Elevation (feet)	Discarded (cfs)
30.00	0.00	31.12	0.05	32.24	0.06	33.36	0.07
30.02	0.04	31.14	0.05	32.26	0.06	33.38	0.07
30.04	0.04	31.16	0.05	32.28	0.06	33.40	0.07
30.06	0.04	31.18	0.05	32.30	0.06	33.42	0.07
30.08	0.04	31.20	0.05	32.32	0.06	33.44	0.07
30.10	0.04	31.22	0.05	32.34	0.06	33.46	0.07
30.12	0.04	31.24	0.05	32.36	0.06	33.48	0.07
30.14	0.04	31.26	0.05	32.38	0.06	33.50	0.07
30.16	0.04	31.28	0.05	32.40	0.06	33.52	0.07
30.18	0.04	31.30	0.05	32.42	0.06	33.54	0.07
30.20	0.04	31.32	0.05	32.44	0.06	33.56	0.07
30.22	0.04	31.34	0.05	32.46	0.06	33.58	0.07
30.24	0.04	31.36	0.05	32.48	0.06	33.60	0.07
30.26	0.04	31.38	0.05	32.50	0.06	33.62	0.07
30.28	0.04	31.40	0.05	32.52	0.06	33.64	0.07
30.30	0.04	31.42	0.05	32.54	0.06	33.66	0.07
30.32	0.04	31.44	0.05	32.56	0.06	33.68	0.07
30.34	0.04	31.46	0.05	32.58	0.06	33.70	0.07
30.36	0.04	31.48	0.05	32.60	0.06	33.72	0.07
30.38	0.05	31.50	0.05	32.62	0.06	33.74	<b>0.07</b>
30.40	0.05	31.52	0.06	32.64	0.07		
30.42	0.05	31.54	0.06	32.66	0.07		
30.44	0.05	31.56	0.06	32.68	0.07		
30.46	0.05	31.58	0.06	32.70	0.07		
30.48	0.05	31.60	0.06	32.72	0.07		
30.50	0.05	31.62	0.06	32.74	0.07		
30.52	0.05	31.64	0.06	32.76	0.07		
30.54	0.05	31.66	0.06	32.78	0.07		
30.56	0.05	31.68	0.06	32.80	0.07		
30.58	0.05	31.70	0.06	32.82	0.07		
30.60	0.05	31.72	0.06	32.84	0.07		
30.62	0.05	31.74	0.06	32.86	0.07		
30.64	0.05	31.76	0.06	32.88	0.07		
30.66	0.05	31.78	0.06	32.90	0.07		
30.68	0.05	31.80	0.06	32.92	0.07		
30.70	0.05	31.82	0.06	32.94	0.07		
30.72	0.05	31.84	0.06	32.96	0.07		
30.74	0.05	31.86	0.06	32.98	0.07		
30.76	0.05	31.88	0.06	33.00	0.07		
30.78	0.05	31.90	0.06	33.02	0.07		
30.80	0.05	31.92	0.06	33.04	0.07		
30.82	0.05	31.94	0.06	33.06	0.07		
30.84	0.05	31.96	0.06	33.08	0.07		
30.86	0.05	31.98	0.06	33.10	0.07		
30.88	0.05	32.00	0.06	33.12	0.07		
30.90	0.05	32.02	0.06	33.14	0.07		
30.92	0.05	32.04	0.06	33.16	0.07		
30.94	0.05	32.06	0.06	33.18	0.07		
30.96	0.05	32.08	0.06	33.20	0.07		
30.98	0.05	32.10	0.06	33.22	0.07		
31.00	0.05	32.12	0.06	33.24	0.07		
31.02	0.05	32.14	0.06	33.26	0.07		
31.04	0.05	32.16	0.06	33.28	0.07		
31.06	0.05	32.18	0.06	33.30	0.07		
31.08	0.05	32.20	0.06	33.32	0.07		
31.10	0.05	32.22	0.06	33.34	0.07		

**4 - HydroCAD R1**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

**Stage-Area-Storage for Pond 1P: S1**

Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)
30.00	748	0	32.80	1,191	1,313
30.05	756	15	32.85	1,199	1,333
30.10	764	30	32.90	1,207	1,354
30.15	772	45	32.95	1,215	1,373
30.20	780	60	33.00	1,223	1,391
30.25	788	75	33.05	1,230	1,409
30.30	796	90	33.10	1,238	1,425
30.35	804	105	33.15	1,246	1,441
30.40	812	120	33.20	1,254	1,457
30.45	819	135	33.25	1,262	1,472
30.50	827	150	33.30	1,270	1,487
30.55	835	165	33.35	1,278	1,502
30.60	843	180	33.40	1,286	1,517
30.65	851	195	33.45	1,294	1,532
30.70	859	210	33.50	1,302	1,547
30.75	867	224	33.55	1,309	1,562
30.80	875	254	33.60	1,317	1,577
30.85	883	283	33.65	1,325	1,592
30.90	891	313	33.70	1,333	1,607
30.95	898	342	33.75	<b>1,341</b>	<b>1,622</b>
31.00	906	371			
31.05	914	400			
31.10	922	429			
31.15	930	458			
31.20	938	487			
31.25	946	516			
31.30	954	544			
31.35	962	573			
31.40	970	601			
31.45	978	629			
31.50	985	657			
31.55	993	685			
31.60	1,001	713			
31.65	1,009	740			
31.70	1,017	768			
31.75	1,025	795			
31.80	1,033	822			
31.85	1,041	849			
31.90	1,049	875			
31.95	1,057	902			
32.00	1,064	928			
32.05	1,072	954			
32.10	1,080	980			
32.15	1,088	1,006			
32.20	1,096	1,031			
32.25	1,104	1,057			
32.30	1,112	1,081			
32.35	1,120	1,106			
32.40	1,128	1,130			
32.45	1,136	1,155			
32.50	1,143	1,178			
32.55	1,151	1,202			
32.60	1,159	1,225			
32.65	1,167	1,247			
32.70	1,175	1,269			
32.75	1,183	1,291			

**4 - HydroCAD R1**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

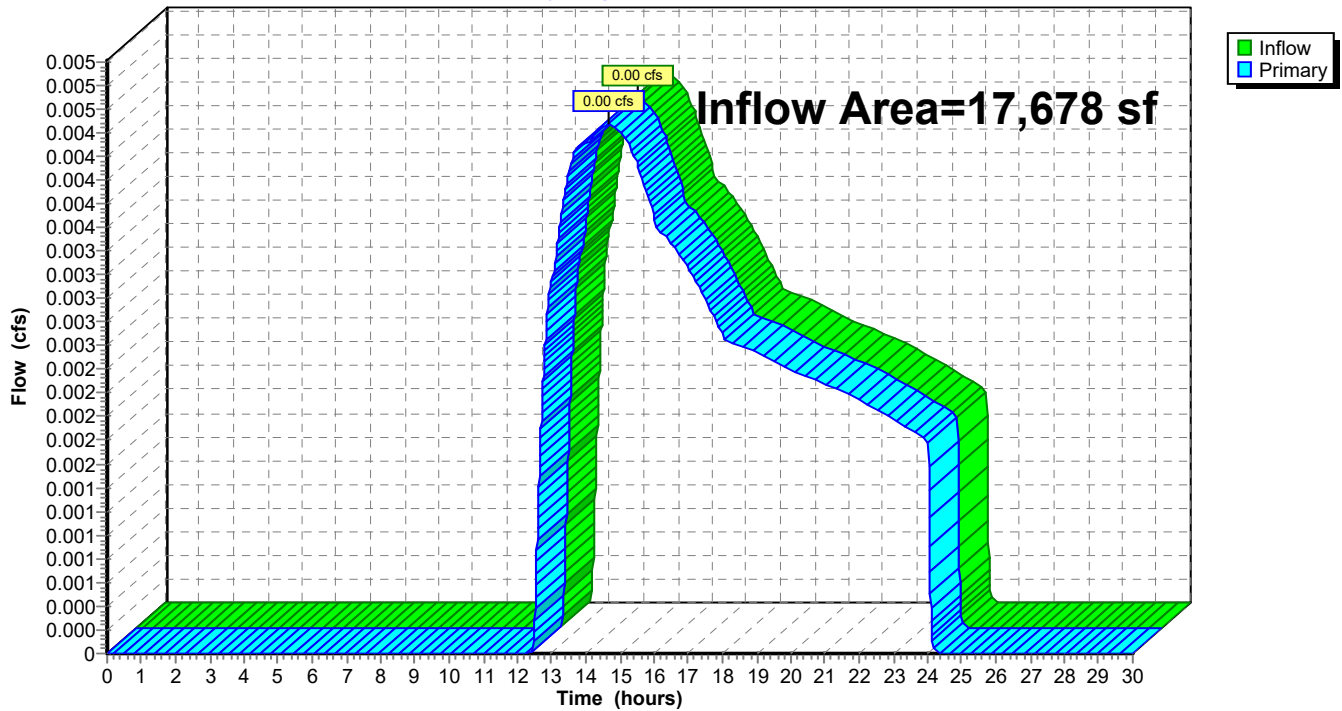
**Summary for Link 1L: 11 PARSONS ST**

Inflow Area = 17,678 sf, 15.49% Impervious, Inflow Depth = 0.08" for 2-Year event  
Inflow = 0.00 cfs @ 14.65 hrs, Volume= 121 cf  
Primary = 0.00 cfs @ 14.65 hrs, Volume= 121 cf, Atten=0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

**Link 1L: 11 PARSONS ST**

**Hydrograph**





**4 - HydroCAD R1**

Type III 24-hr 10-Year Rainfall=5.13"

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

<b>Subcatchment 1S: EXISTING AREAS</b>	Runoff Area=17,678 sf 15.49% Impervious Runoff Depth=0.58" Tc=5.0 min UI Adjusted CN=47 Runoff=0.15 cfs 860 cf
<b>Subcatchment 2S: ROOFS</b>	Runoff Area=3,659 sf 100.00% Impervious Runoff Depth=4.89" Tc=5.0 min CN=98 Runoff=0.44 cfs 1,492 cf
<b>Subcatchment 3S: DRIVEWAY</b>	Runoff Area=1,015 sf 100.00% Impervious Runoff Depth=4.89" Tc=5.0 min CN=98 Runoff=0.12 cfs 414 cf
<b>Subcatchment 4S: OTHER IMPER.</b>	Runoff Area=379 sf 100.00% Impervious Runoff Depth=4.89" Tc=5.0 min CN=98 Runoff=0.05 cfs 155 cf
<b>Subcatchment 5S: PERVIOUS AREAS</b>	Runoff Area=12,625 sf 0.00% Impervious Runoff Depth=0.23" Tc=5.0 min CN=39 Runoff=0.01 cfs 239 cf
<b>Pond 1P: S1</b>	Peak Elev=31.63' Storage=731 cf Inflow=0.60 cfs 2,060 cf Outflow=0.06 cfs 2,060 cf
<b>Link 1L: 11 PARSONS ST</b>	Inflow=0.15 cfs 860 cf Primary=0.15 cfs 860 cf
<b>Link 2L: 11 PARSONS ST</b>	Inflow=0.01 cfs 239 cf Primary=0.01 cfs 239 cf
<b>Total Runoff Area = 35,356 sf Runoff Volume = 3,160 cf Average Runoff Depth = 1.07"</b>	
<b>77.96% Pervious = 27,565 sf 22.04% Impervious = 7,791 sf</b>	

**4 - HydroCAD R1**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

**Summary for Subcatchment 1S: EXISTING AREAS**

Runoff = 0.15 cfs @ 12.12 hrs, Volume= 860 cf, Depth= 0.58"

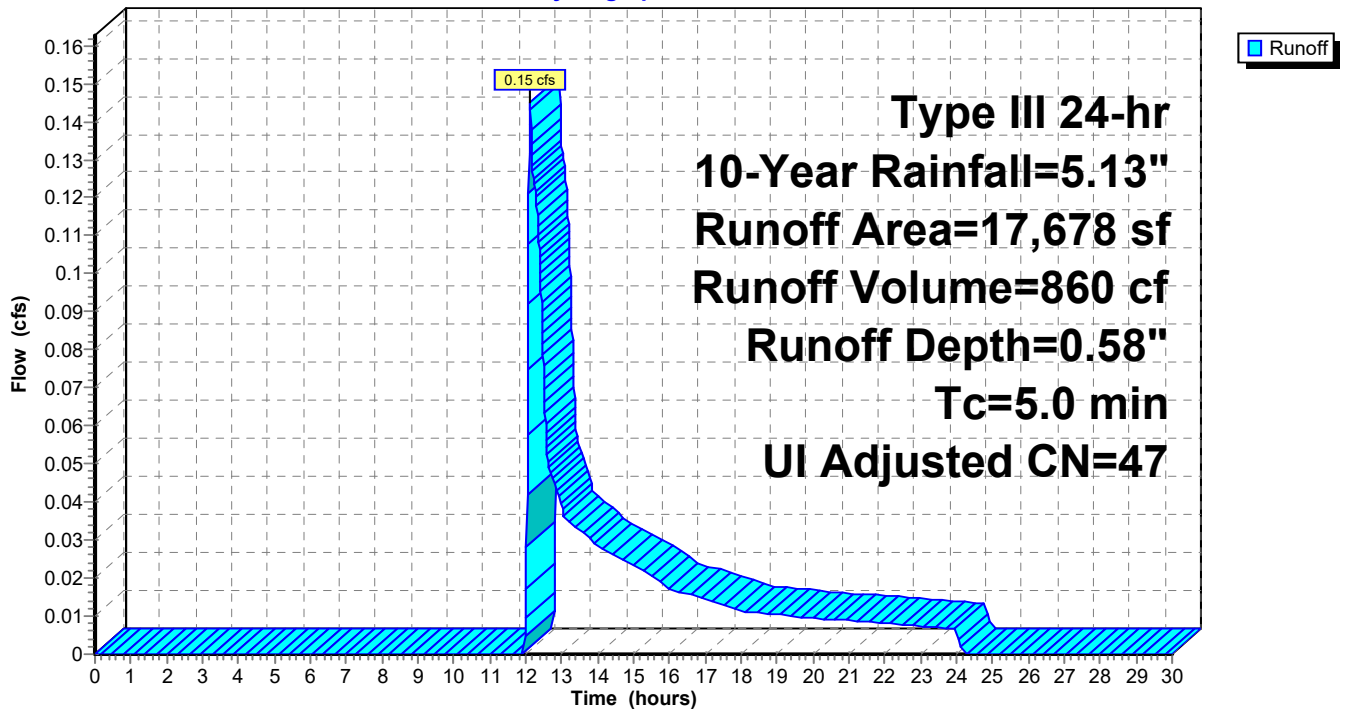
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 10-Year Rainfall=5.13"

Area (sf)	CN	Adj	Description
1,256	98		Roofs, HSG A
627	98		Roofs, HSG A
376	98		Paved parking, HSG A
110	98		Unconnected pavement, HSG A
* 341	98		Unconnected pavement, HSG A
* 28	98		Unconnected pavement, HSG A
47	39		>75% Grass cover, Good, HSG A
52	39		>75% Grass cover, Good, HSG A
14,841	39		>75% Grass cover, Good, HSG A
17,678	48	47	Weighted Average, UI Adjusted
14,940			84.51% Pervious Area
2,738			15.49% Impervious Area
479			17.49% Unconnected

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

**Subcatchment 1S: EXISTING AREAS**

**Hydrograph**



**4 - HydroCAD R1**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

**Summary for Subcatchment 2S: ROOFS**

Runoff = 0.44 cfs @ 12.07 hrs, Volume= 1,492 cf, Depth= 4.89"

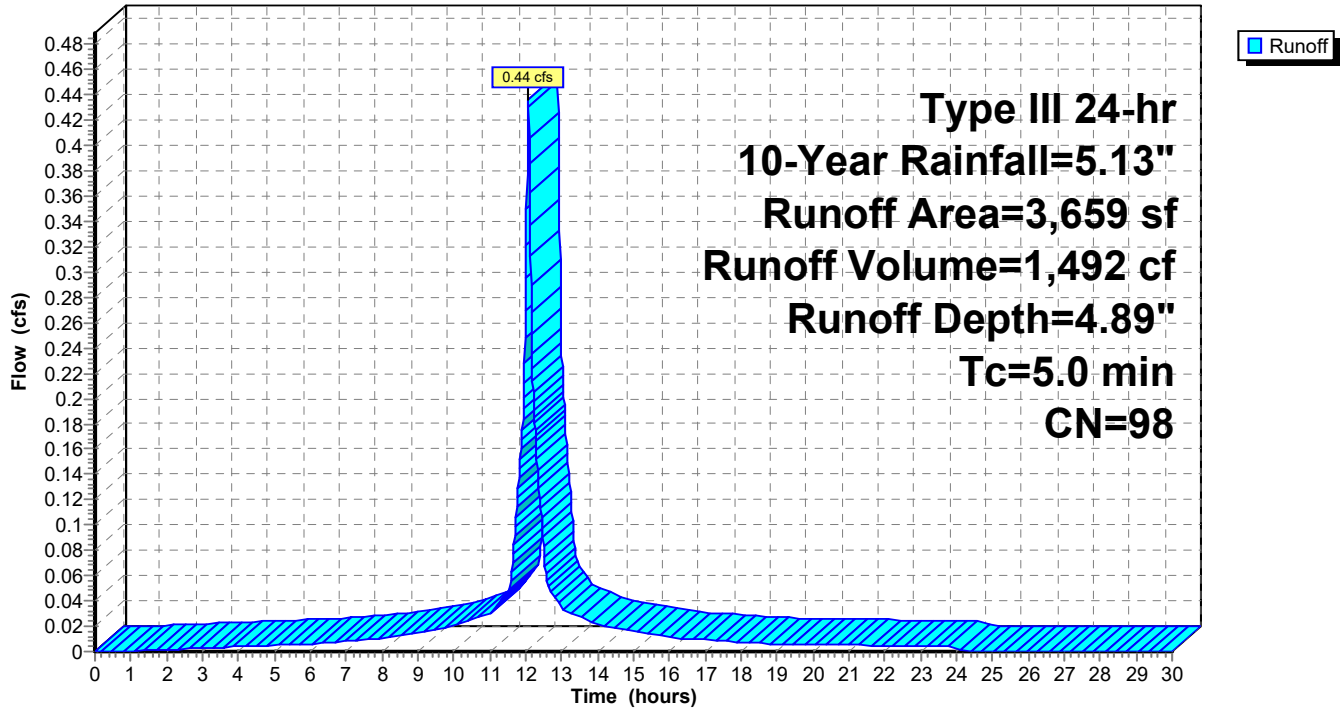
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 10-Year Rainfall=5.13"

Area (sf)	CN	Description
3,589	98	Roofs, HSG A
* 70	98	Roofs, HSG A
3,659	98	Weighted Average
3,659		100.00% Impervious Area

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

**Subcatchment 2S: ROOFS**

**Hydrograph**



**4 - HydroCAD R1**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

**Summary for Subcatchment 3S: DRIVEWAY**

Runoff = 0.12 cfs @ 12.07 hrs, Volume= 414 cf, Depth= 4.89"

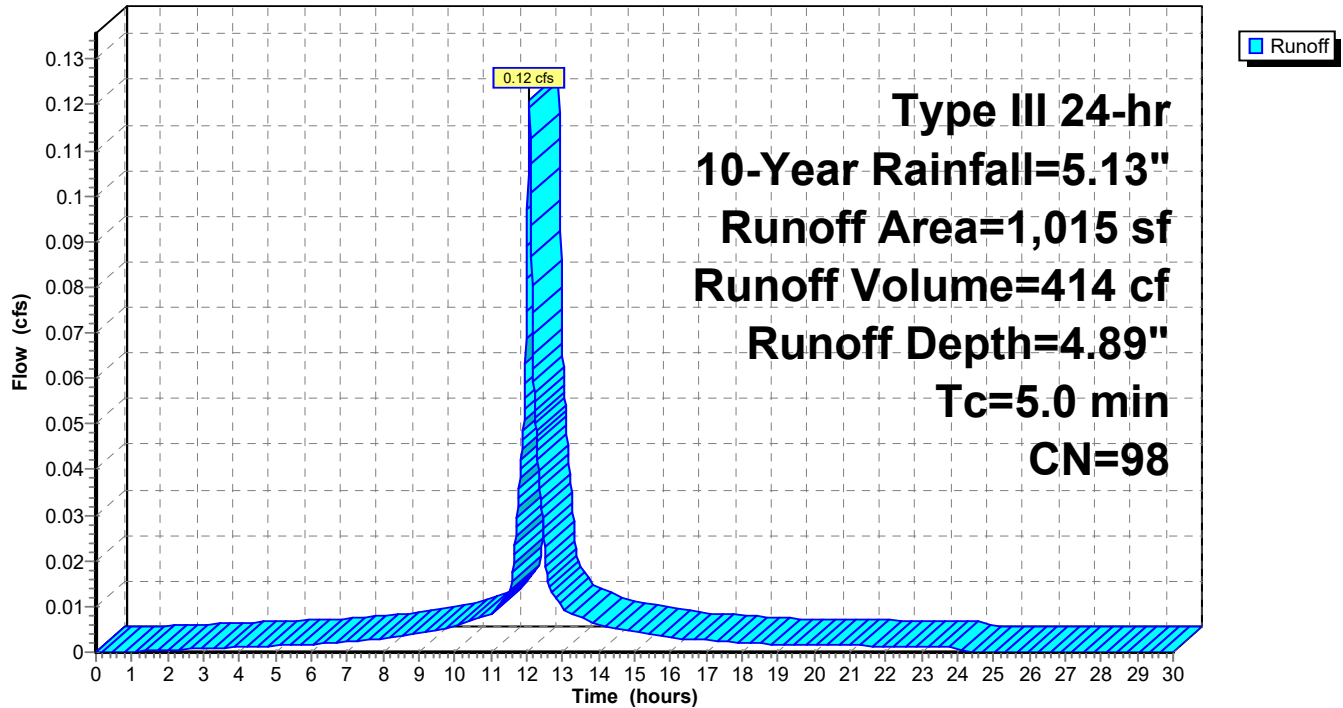
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 10-Year Rainfall=5.13"

Area (sf)	CN	Description
1,015	98	Paved parking, HSG A
1,015		100.00% Impervious Area

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

**Subcatchment 3S: DRIVEWAY**

**Hydrograph**



**4 - HydroCAD R1**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

**Summary for Subcatchment 4S: OTHER IMPER.**

Runoff = 0.05 cfs @ 12.07 hrs, Volume= 155 cf, Depth= 4.89"

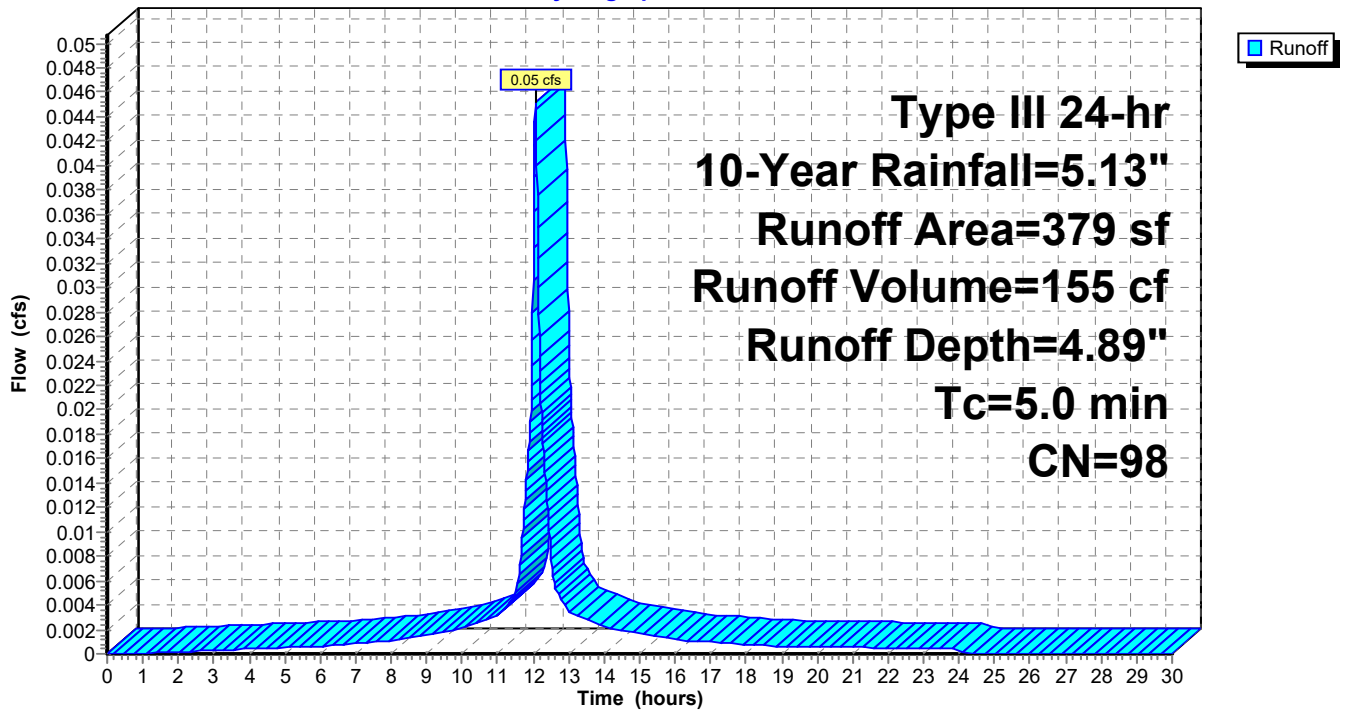
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-Year Rainfall=5.13"

	Area (sf)	CN	Description
	34	98	Unconnected pavement, HSG A
*	318	98	Unconnected pavement, HSG A
*	27	98	Unconnected pavement, HSG A
<hr/>			
	379	98	Weighted Average
	379		100.00% Impervious Area
	379		100.00% Unconnected

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

**Subcatchment 4S: OTHER IMPER.**

Hydrograph



**4 - HydroCAD R1**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

**Summary for Subcatchment 5S: PERVIOUS AREAS**

Runoff = 0.01 cfs @ 12.44 hrs, Volume= 239 cf, Depth= 0.23"

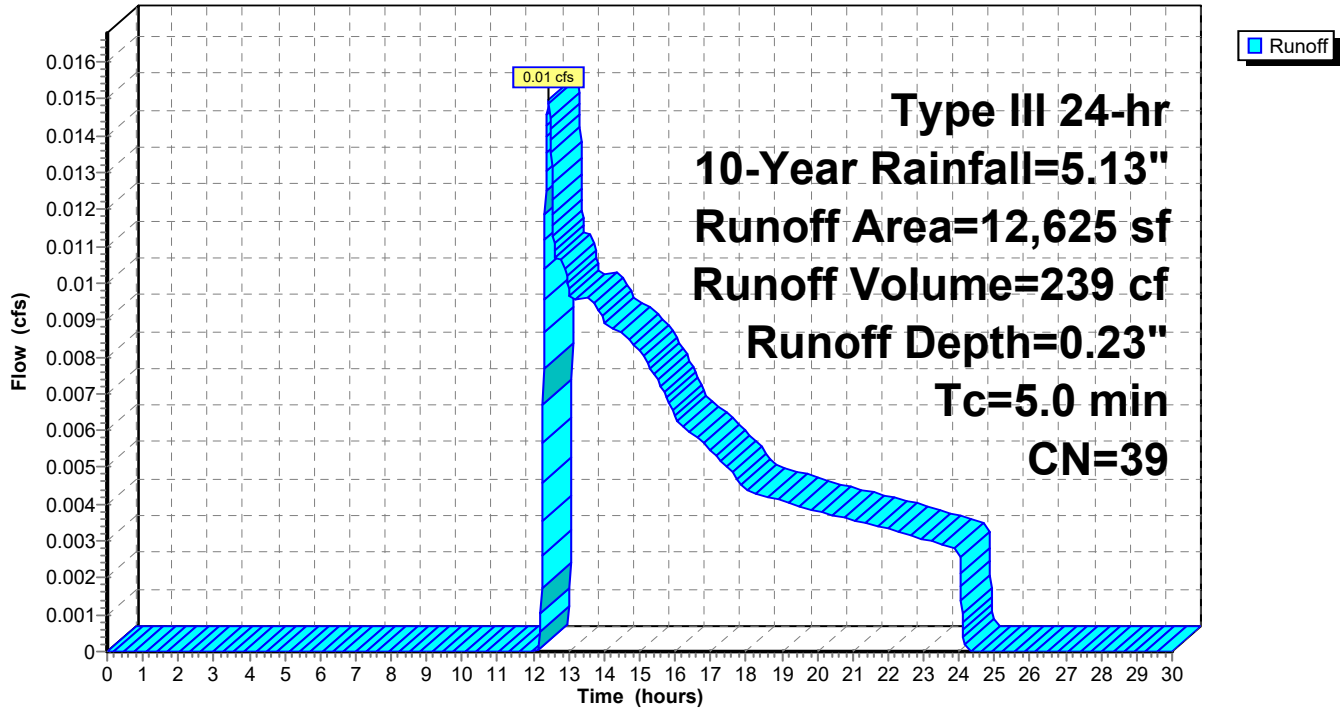
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 10-Year Rainfall=5.13"

Area (sf)	CN	Description
111	39	>75% Grass cover, Good, HSG A
12,514	39	>75% Grass cover, Good, HSG A
12,625	39	Weighted Average
12,625		100.00% Pervious Area

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

**Subcatchment 5S: PERVIOUS AREAS**

Hydrograph



**4 - HydroCAD R1**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

**Summary for Pond 1P: S1**

Inflow Area = 5,053 sf, 100.00% Impervious, Inflow Depth = 4.89" for 10-Year event  
 Inflow = 0.60 cfs @ 12.07 hrs, Volume= 2,060 cf  
 Outflow = 0.06 cfs @ 12.85 hrs, Volume= 2,060 cf, Atten= 91%, Lag= 46.9 min  
 Discarded = 0.06 cfs @ 12.85 hrs, Volume= 2,060 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 2  
 Peak Elev= 31.63' @ 12.85 hrs Surf.Area= 748 sf Storage= 731 cf

Plug-Flow detention time= 96.6 min calculated for 2,060 cf (100% of inflow)  
 Center-of-Mass det. time= 96.6 min ( 843.2 - 746.7 )

Volume	Invert	Avail.Storage	Storage Description
#1A	30.00'	790 cf	<b>11.00'W x 68.03'L x 3.75'H Field A</b> 2,806 cf Overall - 832 cf Embedded = 1,974 cf x 40.0% Voids
#2A	30.75'	832 cf	<b>ADS_StormTech DC-780 +Cap</b> x 18 Inside #1 Effective Size= 45.4"W x 30.0"H => 6.49 sf x 7.12'L = 46.2 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 18 Chambers in 2 Rows
		1,622 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	30.00'	<b>2.410 in/hr Exfiltration over Wetted area</b>

**Discarded OutFlow** Max=0.06 cfs @ 12.85 hrs HW=31.63' (Free Discharge)  
 ↑**-1=Exfiltration** (Exfiltration Controls 0.06 cfs)

**4 - HydroCAD R1**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

**Pond 1P: S1 - Chamber Wizard Field A**

**Chamber Model = ADS\_StormTech DC-780 +Cap (ADS StormTech® DC-780 with cap length)**

Effective Size= 45.4"W x 30.0"H => 6.49 sf x 7.12'L = 46.2 cf

Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

9 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 65.70' Row Length +14.0" End Stone x 2 = 68.03' Base Length

2 Rows x 51.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 11.00' Base Width

9.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.75' Field Height

18 Chambers x 46.2 cf = 832.3 cf Chamber Storage

2,806.2 cf Field - 832.3 cf Chambers = 1,973.9 cf Stone x 40.0% Voids = 789.6 cf Stone Storage

Chamber Storage + Stone Storage = 1,621.9 cf = 0.037 af

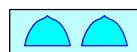
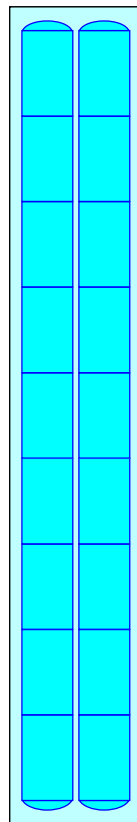
Overall Storage Efficiency = 57.8%

Overall System Size = 68.03' x 11.00' x 3.75'

18 Chambers

103.9 cy Field

73.1 cy Stone



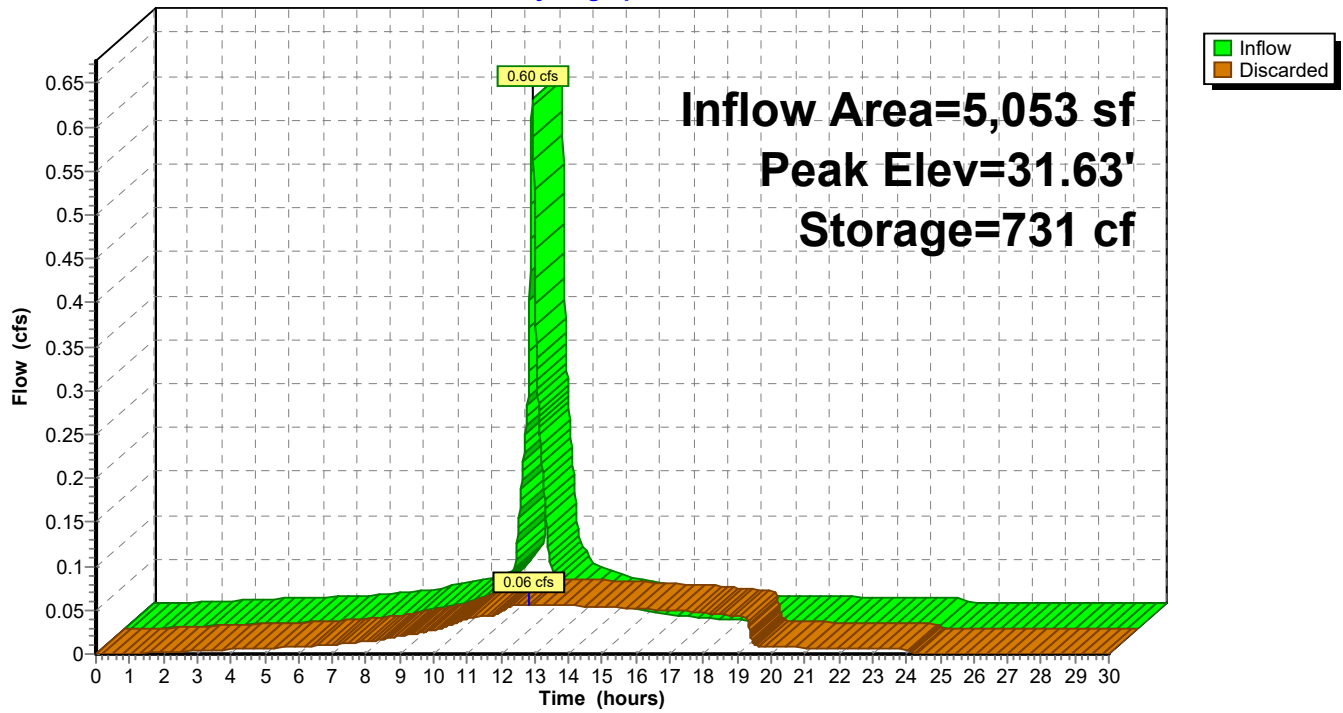
**4 - HydroCAD R1**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

**Pond 1P: S1**

Hydrograph



**4 - HydroCAD R1**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

**Stage-Discharge for Pond 1P: S1**

Elevation (feet)	Discarded (cfs)	Elevation (feet)	Discarded (cfs)	Elevation (feet)	Discarded (cfs)	Elevation (feet)	Discarded (cfs)
30.00	0.00	31.12	0.05	32.24	0.06	33.36	0.07
30.02	0.04	31.14	0.05	32.26	0.06	33.38	0.07
30.04	0.04	31.16	0.05	32.28	0.06	33.40	0.07
30.06	0.04	31.18	0.05	32.30	0.06	33.42	0.07
30.08	0.04	31.20	0.05	32.32	0.06	33.44	0.07
30.10	0.04	31.22	0.05	32.34	0.06	33.46	0.07
30.12	0.04	31.24	0.05	32.36	0.06	33.48	0.07
30.14	0.04	31.26	0.05	32.38	0.06	33.50	0.07
30.16	0.04	31.28	0.05	32.40	0.06	33.52	0.07
30.18	0.04	31.30	0.05	32.42	0.06	33.54	0.07
30.20	0.04	31.32	0.05	32.44	0.06	33.56	0.07
30.22	0.04	31.34	0.05	32.46	0.06	33.58	0.07
30.24	0.04	31.36	0.05	32.48	0.06	33.60	0.07
30.26	0.04	31.38	0.05	32.50	0.06	33.62	0.07
30.28	0.04	31.40	0.05	32.52	0.06	33.64	0.07
30.30	0.04	31.42	0.05	32.54	0.06	33.66	0.07
30.32	0.04	31.44	0.05	32.56	0.06	33.68	0.07
30.34	0.04	31.46	0.05	32.58	0.06	33.70	0.07
30.36	0.04	31.48	0.05	32.60	0.06	33.72	0.07
30.38	0.05	31.50	0.05	32.62	0.06	33.74	<b>0.07</b>
30.40	0.05	31.52	0.06	32.64	0.07		
30.42	0.05	31.54	0.06	32.66	0.07		
30.44	0.05	31.56	0.06	32.68	0.07		
30.46	0.05	31.58	0.06	32.70	0.07		
30.48	0.05	31.60	0.06	32.72	0.07		
30.50	0.05	31.62	0.06	32.74	0.07		
30.52	0.05	31.64	0.06	32.76	0.07		
30.54	0.05	31.66	0.06	32.78	0.07		
30.56	0.05	31.68	0.06	32.80	0.07		
30.58	0.05	31.70	0.06	32.82	0.07		
30.60	0.05	31.72	0.06	32.84	0.07		
30.62	0.05	31.74	0.06	32.86	0.07		
30.64	0.05	31.76	0.06	32.88	0.07		
30.66	0.05	31.78	0.06	32.90	0.07		
30.68	0.05	31.80	0.06	32.92	0.07		
30.70	0.05	31.82	0.06	32.94	0.07		
30.72	0.05	31.84	0.06	32.96	0.07		
30.74	0.05	31.86	0.06	32.98	0.07		
30.76	0.05	31.88	0.06	33.00	0.07		
30.78	0.05	31.90	0.06	33.02	0.07		
30.80	0.05	31.92	0.06	33.04	0.07		
30.82	0.05	31.94	0.06	33.06	0.07		
30.84	0.05	31.96	0.06	33.08	0.07		
30.86	0.05	31.98	0.06	33.10	0.07		
30.88	0.05	32.00	0.06	33.12	0.07		
30.90	0.05	32.02	0.06	33.14	0.07		
30.92	0.05	32.04	0.06	33.16	0.07		
30.94	0.05	32.06	0.06	33.18	0.07		
30.96	0.05	32.08	0.06	33.20	0.07		
30.98	0.05	32.10	0.06	33.22	0.07		
31.00	0.05	32.12	0.06	33.24	0.07		
31.02	0.05	32.14	0.06	33.26	0.07		
31.04	0.05	32.16	0.06	33.28	0.07		
31.06	0.05	32.18	0.06	33.30	0.07		
31.08	0.05	32.20	0.06	33.32	0.07		
31.10	0.05	32.22	0.06	33.34	0.07		

**4 - HydroCAD R1**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

**Stage-Area-Storage for Pond 1P: S1**

Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)
30.00	748	0	32.80	1,191	1,313
30.05	756	15	32.85	1,199	1,333
30.10	764	30	32.90	1,207	1,354
30.15	772	45	32.95	1,215	1,373
30.20	780	60	33.00	1,223	1,391
30.25	788	75	33.05	1,230	1,409
30.30	796	90	33.10	1,238	1,425
30.35	804	105	33.15	1,246	1,441
30.40	812	120	33.20	1,254	1,457
30.45	819	135	33.25	1,262	1,472
30.50	827	150	33.30	1,270	1,487
30.55	835	165	33.35	1,278	1,502
30.60	843	180	33.40	1,286	1,517
30.65	851	195	33.45	1,294	1,532
30.70	859	210	33.50	1,302	1,547
30.75	867	224	33.55	1,309	1,562
30.80	875	254	33.60	1,317	1,577
30.85	883	283	33.65	1,325	1,592
30.90	891	313	33.70	1,333	1,607
30.95	898	342	33.75	<b>1,341</b>	<b>1,622</b>
31.00	906	371			
31.05	914	400			
31.10	922	429			
31.15	930	458			
31.20	938	487			
31.25	946	516			
31.30	954	544			
31.35	962	573			
31.40	970	601			
31.45	978	629			
31.50	985	657			
31.55	993	685			
31.60	1,001	713			
31.65	1,009	740			
31.70	1,017	768			
31.75	1,025	795			
31.80	1,033	822			
31.85	1,041	849			
31.90	1,049	875			
31.95	1,057	902			
32.00	1,064	928			
32.05	1,072	954			
32.10	1,080	980			
32.15	1,088	1,006			
32.20	1,096	1,031			
32.25	1,104	1,057			
32.30	1,112	1,081			
32.35	1,120	1,106			
32.40	1,128	1,130			
32.45	1,136	1,155			
32.50	1,143	1,178			
32.55	1,151	1,202			
32.60	1,159	1,225			
32.65	1,167	1,247			
32.70	1,175	1,269			
32.75	1,183	1,291			

**4 - HydroCAD R1**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

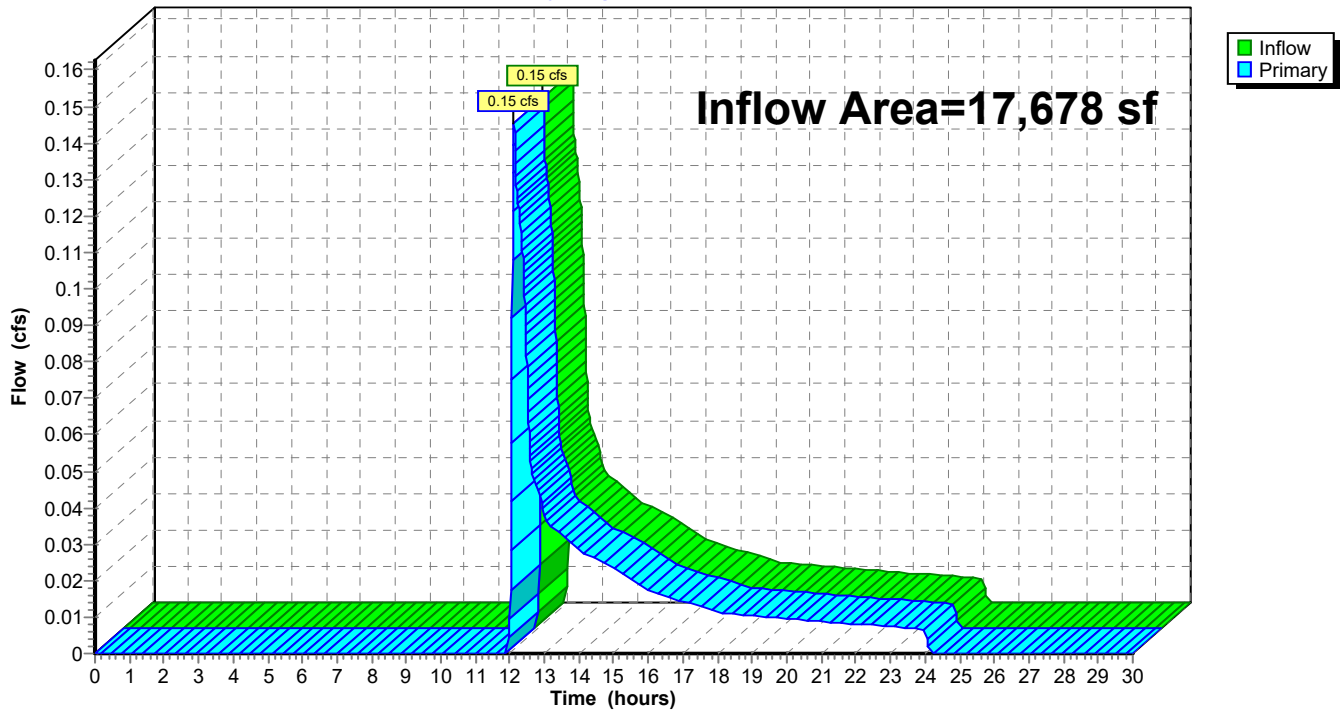
**Summary for Link 1L: 11 PARSONS ST**

Inflow Area = 17,678 sf, 15.49% Impervious, Inflow Depth = 0.58" for 10-Year event  
Inflow = 0.15 cfs @ 12.12 hrs, Volume= 860 cf  
Primary = 0.15 cfs @ 12.12 hrs, Volume= 860 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

**Link 1L: 11 PARSONS ST**

**Hydrograph**



### 4 - HydroCAD R1

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

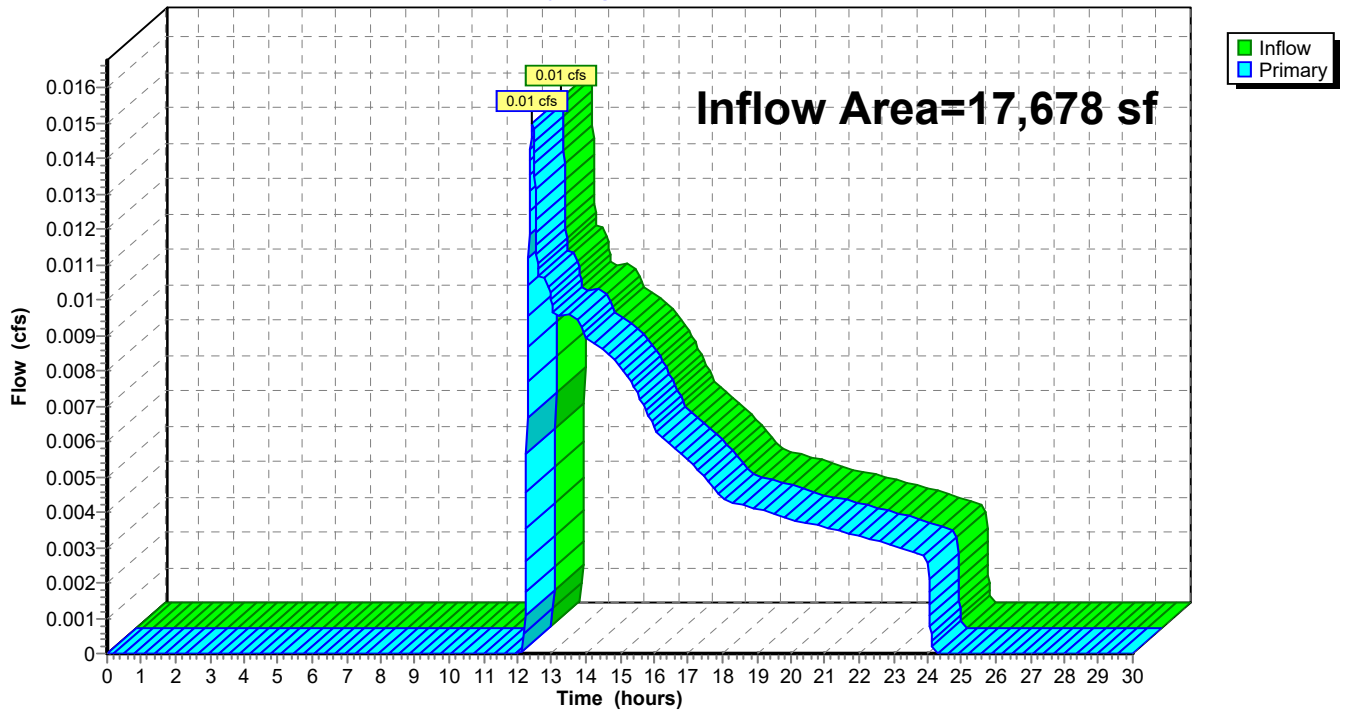
### Summary for Link 2L: 11 PARSONS ST

Inflow Area = 17,678 sf, 28.58% Impervious, Inflow Depth = 0.16" for 10-Year event  
Inflow = 0.01 cfs @ 12.44 hrs, Volume= 239 cf  
Primary = 0.01 cfs @ 12.44 hrs, Volume= 239 cf, Atten=0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

### Link 2L: 11 PARSONS ST

#### Hydrograph



**4 - HydroCAD R1**

Type III 24-hr 25-Year Rainfall=6.30"

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

<b>Subcatchment 1S: EXISTING AREAS</b>	Runoff Area=17,678 sf 15.49% Impervious Runoff Depth=1.07" Tc=5.0 min UI Adjusted CN=47 Runoff=0.39 cfs 1,573 cf
<b>Subcatchment 2S: ROOFS</b>	Runoff Area=3,659 sf 100.00% Impervious Runoff Depth=6.06" Tc=5.0 min CN=98 Runoff=0.54 cfs 1,848 cf
<b>Subcatchment 3S: DRIVEWAY</b>	Runoff Area=1,015 sf 100.00% Impervious Runoff Depth=6.06" Tc=5.0 min CN=98 Runoff=0.15 cfs 513 cf
<b>Subcatchment 4S: OTHER IMPER.</b>	Runoff Area=379 sf 100.00% Impervious Runoff Depth=6.06" Tc=5.0 min CN=98 Runoff=0.06 cfs 191 cf
<b>Subcatchment 5S: PERVIOUS AREAS</b>	Runoff Area=12,625 sf 0.00% Impervious Runoff Depth=0.53" Tc=5.0 min CN=39 Runoff=0.07 cfs 563 cf
<b>Pond 1P: S1</b>	Peak Elev=32.08' Storage=969 cf Inflow=0.74 cfs 2,552 cf Outflow=0.06 cfs 2,552 cf
<b>Link 1L: 11 PARSONS ST</b>	Inflow=0.39 cfs 1,573 cf Primary=0.39 cfs 1,573 cf
<b>Link 2L: 11 PARSONS ST</b>	Inflow=0.07 cfs 563 cf Primary=0.07 cfs 563 cf
<b>Total Runoff Area = 35,356 sf Runoff Volume = 4,688 cf Average Runoff Depth = 1.59"</b>	
<b>77.96% Pervious = 27,565 sf 22.04% Impervious = 7,791 sf</b>	

**4 - HydroCAD R1**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

**Summary for Subcatchment 1S: EXISTING AREAS**

Runoff = 0.39 cfs @ 12.10 hrs, Volume= 1,573 cf, Depth= 1.07"

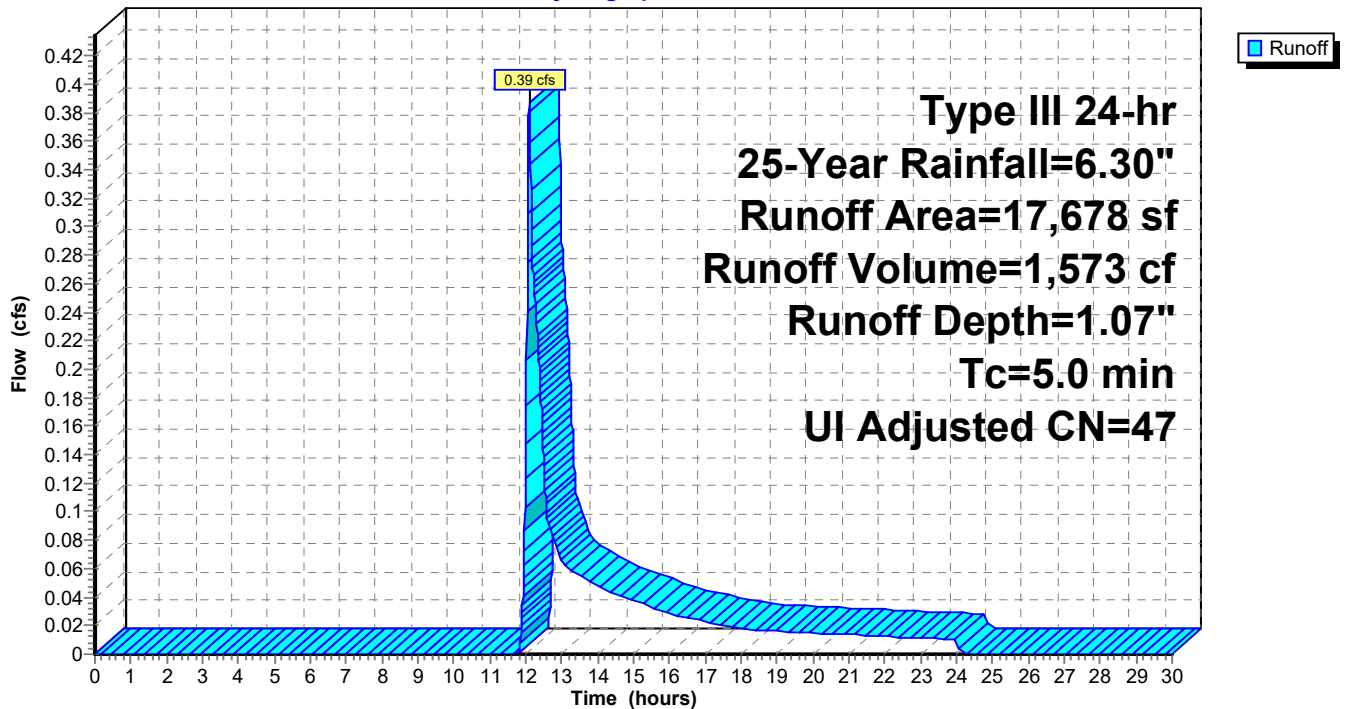
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 25-Year Rainfall=6.30"

Area (sf)	CN	Adj	Description
1,256	98		Roofs, HSG A
627	98		Roofs, HSG A
376	98		Paved parking, HSG A
110	98		Unconnected pavement, HSG A
* 341	98		Unconnected pavement, HSG A
* 28	98		Unconnected pavement, HSG A
47	39		>75% Grass cover, Good, HSG A
52	39		>75% Grass cover, Good, HSG A
14,841	39		>75% Grass cover, Good, HSG A
17,678	48	47	Weighted Average, UI Adjusted
14,940			84.51% Pervious Area
2,738			15.49% Impervious Area
479			17.49% Unconnected

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

**Subcatchment 1S: EXISTING AREAS**

Hydrograph



**4 - HydroCAD R1**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

**Summary for Subcatchment 2S: ROOFS**

Runoff = 0.54 cfs @ 12.07 hrs, Volume= 1,848 cf, Depth= 6.06"

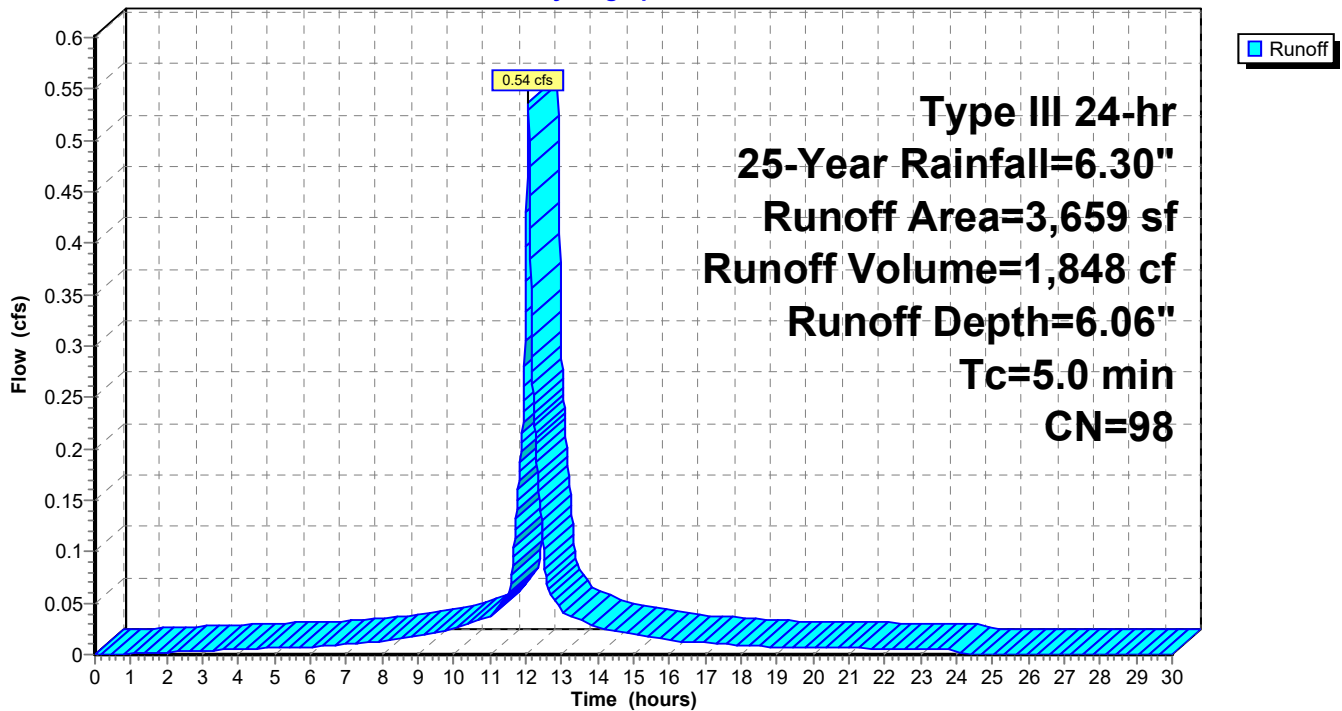
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 25-Year Rainfall=6.30"

Area (sf)	CN	Description
3,589	98	Roofs, HSG A
* 70	98	Roofs, HSG A
3,659	98	Weighted Average
3,659		100.00% Impervious Area

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

**Subcatchment 2S: ROOFS**

**Hydrograph**



**4 - HydroCAD R1**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

**Summary for Subcatchment 3S: DRIVEWAY**

Runoff = 0.15 cfs @ 12.07 hrs, Volume= 513 cf, Depth= 6.06"

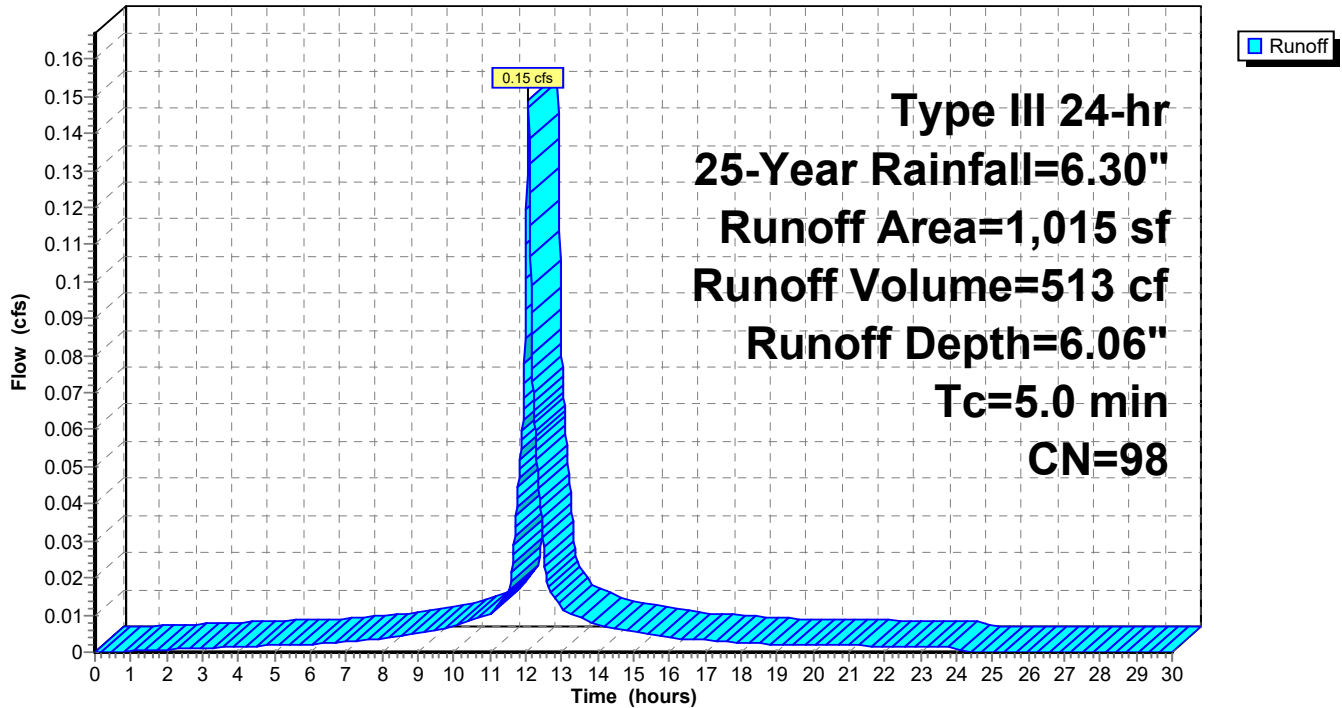
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 25-Year Rainfall=6.30"

Area (sf)	CN	Description
1,015	98	Paved parking, HSG A
1,015		100.00% Impervious Area

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

**Subcatchment 3S: DRIVEWAY**

**Hydrograph**



**4 - HydroCAD R1**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

**Summary for Subcatchment 4S: OTHER IMPER.**

Runoff = 0.06 cfs @ 12.07 hrs, Volume= 191 cf, Depth= 6.06"

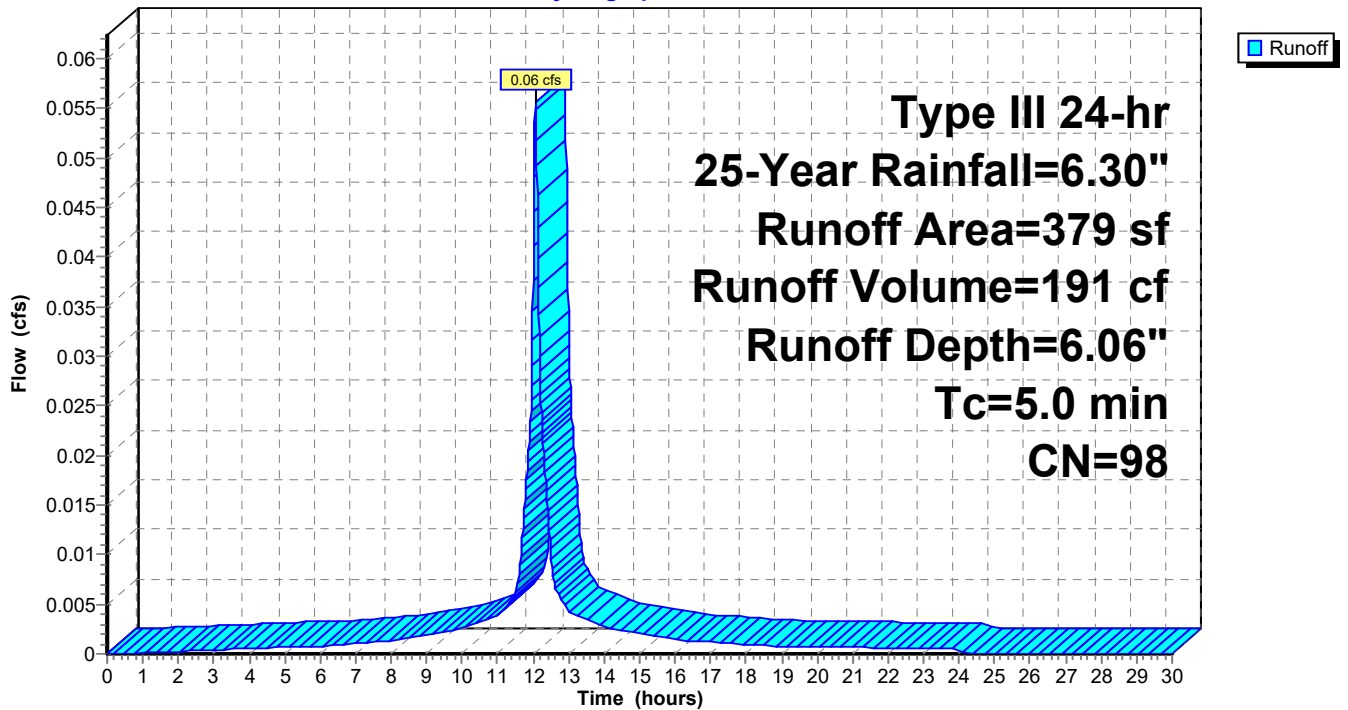
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 25-Year Rainfall=6.30"

Area (sf)	CN	Description
34	98	Unconnected pavement, HSG A
* 318	98	Unconnected pavement, HSG A
* 27	98	Unconnected pavement, HSG A
379	98	Weighted Average
379		100.00% Impervious Area
379		100.00% Unconnected

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

**Subcatchment 4S: OTHER IMPER.**

Hydrograph



**4 - HydroCAD R1**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

**Summary for Subcatchment 5S: PERVIOUS AREAS**

Runoff = 0.07 cfs @ 12.30 hrs, Volume= 563 cf, Depth= 0.53"

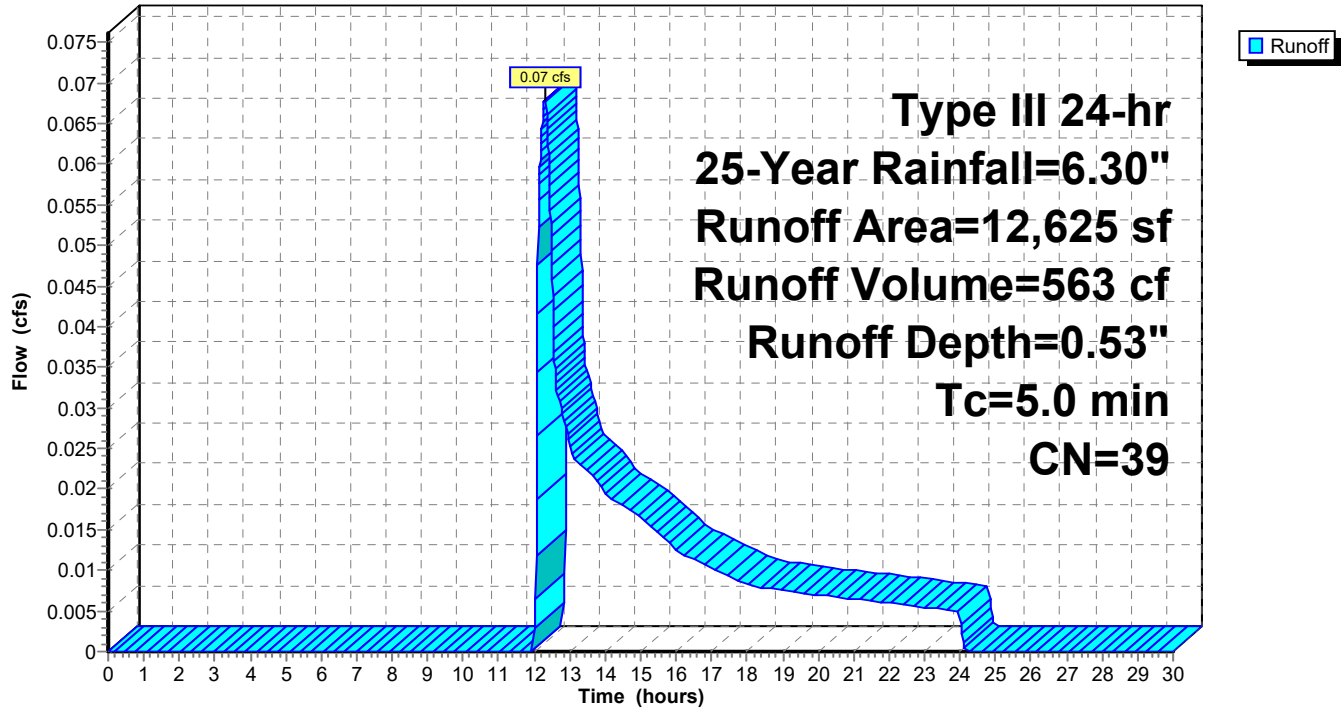
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 25-Year Rainfall=6.30"

Area (sf)	CN	Description
111	39	>75% Grass cover, Good, HSG A
12,514	39	>75% Grass cover, Good, HSG A
12,625	39	Weighted Average
12,625		100.00% Pervious Area

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

**Subcatchment 5S: PERVIOUS AREAS**

Hydrograph



**4 - HydroCAD R1**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

**Summary for Pond 1P: S1**

Inflow Area = 5,053 sf, 100.00% Impervious, Inflow Depth = 6.06" for 25-Year event  
 Inflow = 0.74 cfs @ 12.07 hrs, Volume= 2,552 cf  
 Outflow = 0.06 cfs @ 12.98 hrs, Volume= 2,552 cf, Atten= 92%, Lag= 54.8 min  
 Discarded = 0.06 cfs @ 12.98 hrs, Volume= 2,552 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 2  
 Peak Elev= 32.08' @ 12.98 hrs Surf.Area= 748 sf Storage= 969 cf

Plug-Flow detention time= 127.7 min calculated for 2,552 cf (100% of inflow)  
 Center-of-Mass det. time= 127.7 min ( 871.2 - 743.5 )

Volume	Invert	Avail.Storage	Storage Description
#1A	30.00'	790 cf	<b>11.00'W x 68.03'L x 3.75'H Field A</b> 2,806 cf Overall - 832 cf Embedded = 1,974 cf x 40.0% Voids
#2A	30.75'	832 cf	<b>ADS_StormTech DC-780 +Cap</b> x 18 Inside #1 Effective Size= 45.4"W x 30.0"H => 6.49 sf x 7.12'L = 46.2 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 18 Chambers in 2 Rows
		1,622 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	30.00'	<b>2.410 in/hr Exfiltration over Wetted area</b>

**Discarded OutFlow** Max=0.06 cfs @ 12.98 hrs HW=32.08' (Free Discharge)  
 ↑**-1=Exfiltration** (Exfiltration Controls 0.06 cfs)

**4 - HydroCAD R1**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

**Pond 1P: S1 - Chamber Wizard Field A**

**Chamber Model = ADS\_StormTech DC-780 +Cap (ADS StormTech® DC-780 with cap length)**

Effective Size= 45.4"W x 30.0"H => 6.49 sf x 7.12'L = 46.2 cf

Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

9 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 65.70' Row Length +14.0" End Stone x 2 = 68.03' Base Length

2 Rows x 51.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 11.00' Base Width

9.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.75' Field Height

18 Chambers x 46.2 cf = 832.3 cf Chamber Storage

2,806.2 cf Field - 832.3 cf Chambers = 1,973.9 cf Stone x 40.0% Voids = 789.6 cf Stone Storage

Chamber Storage + Stone Storage = 1,621.9 cf = 0.037 af

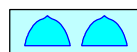
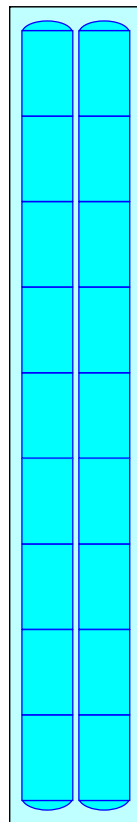
Overall Storage Efficiency = 57.8%

Overall System Size = 68.03' x 11.00' x 3.75'

18 Chambers

103.9 cy Field

73.1 cy Stone



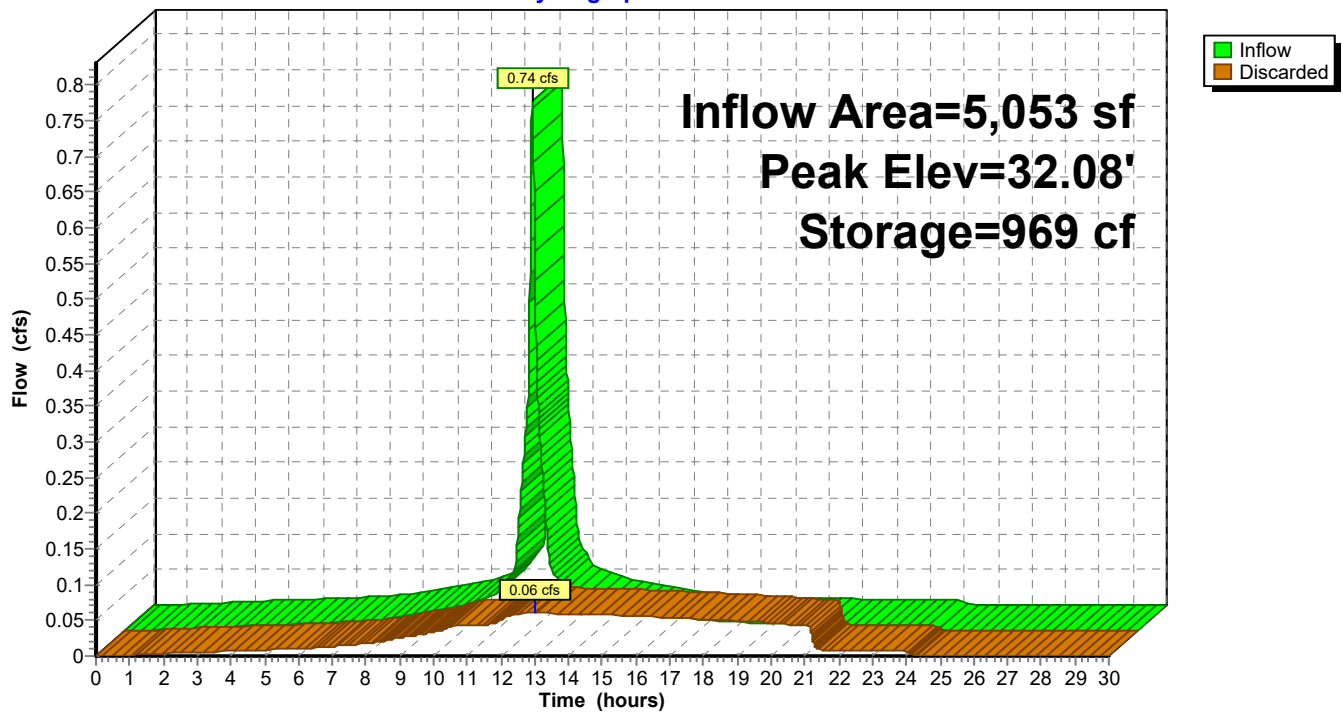
### 4 - HydroCAD R1

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

#### Pond 1P: S1

#### Hydrograph



**4 - HydroCAD R1**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

**Stage-Discharge for Pond 1P: S1**

Elevation (feet)	Discarded (cfs)	Elevation (feet)	Discarded (cfs)	Elevation (feet)	Discarded (cfs)	Elevation (feet)	Discarded (cfs)
30.00	0.00	31.12	0.05	32.24	0.06	33.36	0.07
30.02	0.04	31.14	0.05	32.26	0.06	33.38	0.07
30.04	0.04	31.16	0.05	32.28	0.06	33.40	0.07
30.06	0.04	31.18	0.05	32.30	0.06	33.42	0.07
30.08	0.04	31.20	0.05	32.32	0.06	33.44	0.07
30.10	0.04	31.22	0.05	32.34	0.06	33.46	0.07
30.12	0.04	31.24	0.05	32.36	0.06	33.48	0.07
30.14	0.04	31.26	0.05	32.38	0.06	33.50	0.07
30.16	0.04	31.28	0.05	32.40	0.06	33.52	0.07
30.18	0.04	31.30	0.05	32.42	0.06	33.54	0.07
30.20	0.04	31.32	0.05	32.44	0.06	33.56	0.07
30.22	0.04	31.34	0.05	32.46	0.06	33.58	0.07
30.24	0.04	31.36	0.05	32.48	0.06	33.60	0.07
30.26	0.04	31.38	0.05	32.50	0.06	33.62	0.07
30.28	0.04	31.40	0.05	32.52	0.06	33.64	0.07
30.30	0.04	31.42	0.05	32.54	0.06	33.66	0.07
30.32	0.04	31.44	0.05	32.56	0.06	33.68	0.07
30.34	0.04	31.46	0.05	32.58	0.06	33.70	0.07
30.36	0.04	31.48	0.05	32.60	0.06	33.72	0.07
30.38	0.05	31.50	0.05	32.62	0.06	33.74	<b>0.07</b>
30.40	0.05	31.52	0.06	32.64	0.07		
30.42	0.05	31.54	0.06	32.66	0.07		
30.44	0.05	31.56	0.06	32.68	0.07		
30.46	0.05	31.58	0.06	32.70	0.07		
30.48	0.05	31.60	0.06	32.72	0.07		
30.50	0.05	31.62	0.06	32.74	0.07		
30.52	0.05	31.64	0.06	32.76	0.07		
30.54	0.05	31.66	0.06	32.78	0.07		
30.56	0.05	31.68	0.06	32.80	0.07		
30.58	0.05	31.70	0.06	32.82	0.07		
30.60	0.05	31.72	0.06	32.84	0.07		
30.62	0.05	31.74	0.06	32.86	0.07		
30.64	0.05	31.76	0.06	32.88	0.07		
30.66	0.05	31.78	0.06	32.90	0.07		
30.68	0.05	31.80	0.06	32.92	0.07		
30.70	0.05	31.82	0.06	32.94	0.07		
30.72	0.05	31.84	0.06	32.96	0.07		
30.74	0.05	31.86	0.06	32.98	0.07		
30.76	0.05	31.88	0.06	33.00	0.07		
30.78	0.05	31.90	0.06	33.02	0.07		
30.80	0.05	31.92	0.06	33.04	0.07		
30.82	0.05	31.94	0.06	33.06	0.07		
30.84	0.05	31.96	0.06	33.08	0.07		
30.86	0.05	31.98	0.06	33.10	0.07		
30.88	0.05	32.00	0.06	33.12	0.07		
30.90	0.05	32.02	0.06	33.14	0.07		
30.92	0.05	32.04	0.06	33.16	0.07		
30.94	0.05	32.06	0.06	33.18	0.07		
30.96	0.05	32.08	0.06	33.20	0.07		
30.98	0.05	32.10	0.06	33.22	0.07		
31.00	0.05	32.12	0.06	33.24	0.07		
31.02	0.05	32.14	0.06	33.26	0.07		
31.04	0.05	32.16	0.06	33.28	0.07		
31.06	0.05	32.18	0.06	33.30	0.07		
31.08	0.05	32.20	0.06	33.32	0.07		
31.10	0.05	32.22	0.06	33.34	0.07		

**4 - HydroCAD R1**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

**Stage-Area-Storage for Pond 1P: S1**

Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)
30.00	748	0	32.80	1,191	1,313
30.05	756	15	32.85	1,199	1,333
30.10	764	30	32.90	1,207	1,354
30.15	772	45	32.95	1,215	1,373
30.20	780	60	33.00	1,223	1,391
30.25	788	75	33.05	1,230	1,409
30.30	796	90	33.10	1,238	1,425
30.35	804	105	33.15	1,246	1,441
30.40	812	120	33.20	1,254	1,457
30.45	819	135	33.25	1,262	1,472
30.50	827	150	33.30	1,270	1,487
30.55	835	165	33.35	1,278	1,502
30.60	843	180	33.40	1,286	1,517
30.65	851	195	33.45	1,294	1,532
30.70	859	210	33.50	1,302	1,547
30.75	867	224	33.55	1,309	1,562
30.80	875	254	33.60	1,317	1,577
30.85	883	283	33.65	1,325	1,592
30.90	891	313	33.70	1,333	1,607
30.95	898	342	33.75	<b>1,341</b>	<b>1,622</b>
31.00	906	371			
31.05	914	400			
31.10	922	429			
31.15	930	458			
31.20	938	487			
31.25	946	516			
31.30	954	544			
31.35	962	573			
31.40	970	601			
31.45	978	629			
31.50	985	657			
31.55	993	685			
31.60	1,001	713			
31.65	1,009	740			
31.70	1,017	768			
31.75	1,025	795			
31.80	1,033	822			
31.85	1,041	849			
31.90	1,049	875			
31.95	1,057	902			
32.00	1,064	928			
32.05	1,072	954			
32.10	1,080	980			
32.15	1,088	1,006			
32.20	1,096	1,031			
32.25	1,104	1,057			
32.30	1,112	1,081			
32.35	1,120	1,106			
32.40	1,128	1,130			
32.45	1,136	1,155			
32.50	1,143	1,178			
32.55	1,151	1,202			
32.60	1,159	1,225			
32.65	1,167	1,247			
32.70	1,175	1,269			
32.75	1,183	1,291			

**4 - HydroCAD R1**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

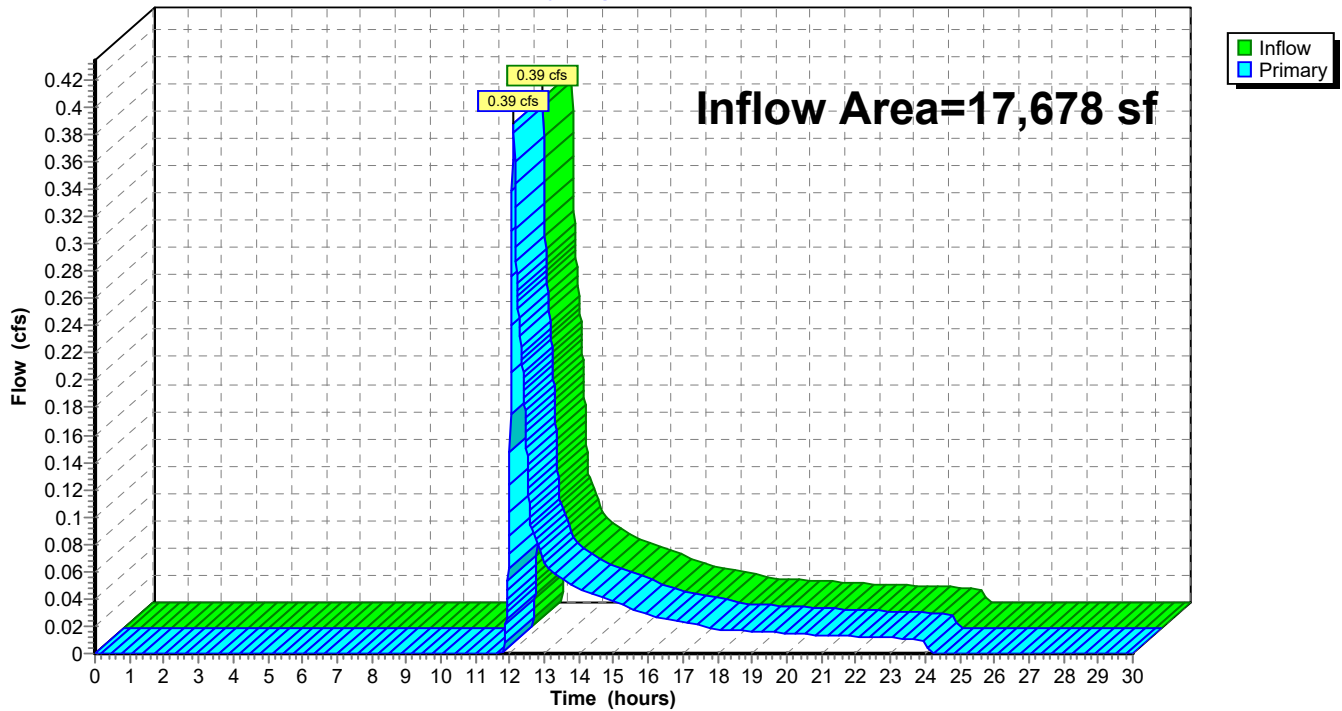
**Summary for Link 1L: 11 PARSONS ST**

Inflow Area = 17,678 sf, 15.49% Impervious, Inflow Depth = 1.07" for 25-Year event  
Inflow = 0.39 cfs @ 12.10 hrs, Volume= 1,573 cf  
Primary = 0.39 cfs @ 12.10 hrs, Volume= 1,573 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

**Link 1L: 11 PARSONS ST**

**Hydrograph**



**4 - HydroCAD R1**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

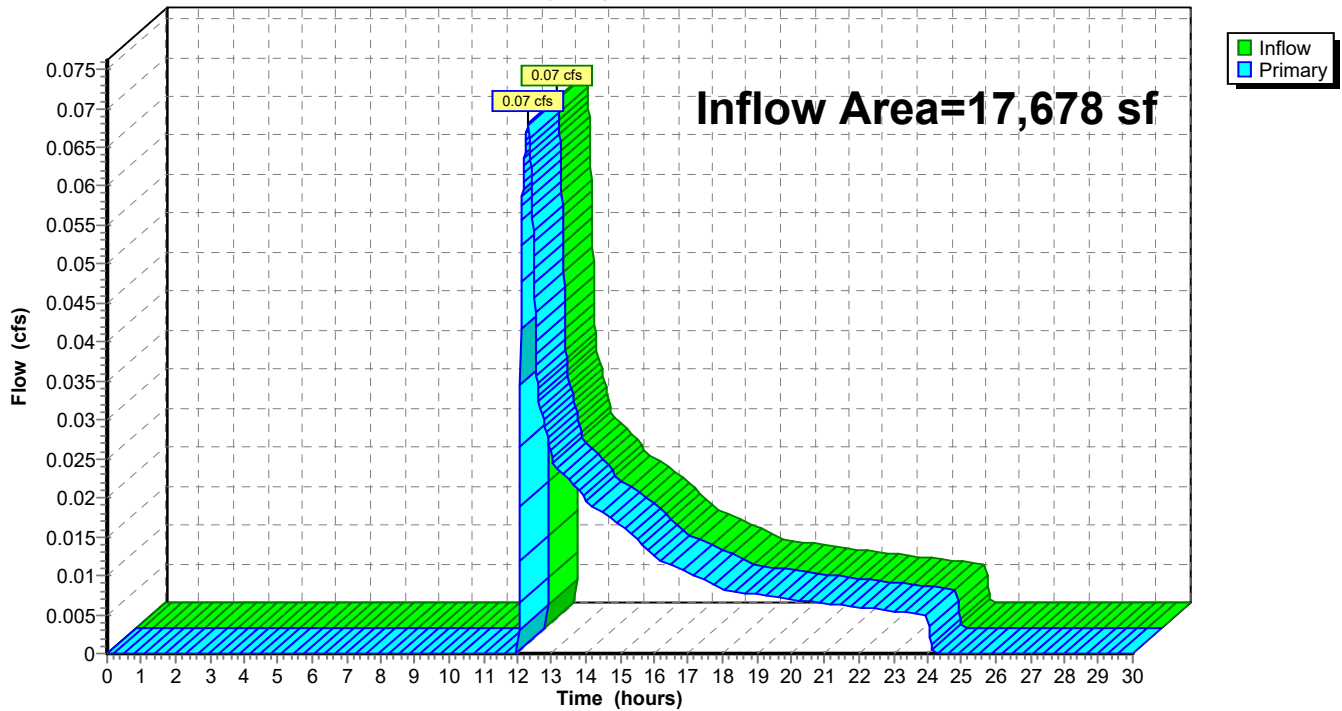
**Summary for Link 2L: 11 PARSONS ST**

Inflow Area = 17,678 sf, 28.58% Impervious, Inflow Depth = 0.38" for 25-Year event  
Inflow = 0.07 cfs @ 12.30 hrs, Volume= 563 cf  
Primary = 0.07 cfs @ 12.30 hrs, Volume= 563 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

**Link 2L: 11 PARSONS ST**

**Hydrograph**



**4 - HydroCAD R1**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

<b>Subcatchment 1S: EXISTING AREAS</b>	Runoff Area=17,678 sf 15.49% Impervious Runoff Depth=2.39" Tc=5.0 min UI Adjusted CN=47 Runoff=1.07 cfs 3,523 cf
<b>Subcatchment 2S: ROOFS</b>	Runoff Area=3,659 sf 100.00% Impervious Runoff Depth=8.54" Tc=5.0 min CN=98 Runoff=0.75 cfs 2,604 cf
<b>Subcatchment 3S: DRIVEWAY</b>	Runoff Area=1,015 sf 100.00% Impervious Runoff Depth=8.54" Tc=5.0 min CN=98 Runoff=0.21 cfs 722 cf
<b>Subcatchment 4S: OTHER IMPER.</b>	Runoff Area=379 sf 100.00% Impervious Runoff Depth=8.54" Tc=5.0 min CN=98 Runoff=0.08 cfs 270 cf
<b>Subcatchment 5S: PERVIOUS AREAS</b>	Runoff Area=12,625 sf 0.00% Impervious Runoff Depth=1.50" Tc=5.0 min CN=39 Runoff=0.39 cfs 1,578 cf
<b>Pond 1P: S1</b>	Peak Elev=33.38' Storage=1,512 cf Inflow=1.04 cfs 3,596 cf Outflow=0.07 cfs 3,596 cf
<b>Link 1L: 11 PARSONS ST</b>	Inflow=1.07 cfs 3,523 cf Primary=1.07 cfs 3,523 cf
<b>Link 2L: 11 PARSONS ST</b>	Inflow=0.39 cfs 1,578 cf Primary=0.39 cfs 1,578 cf
<b>Total Runoff Area = 35,356 sf Runoff Volume = 8,697 cf Average Runoff Depth = 2.95"</b>	
<b>77.96% Pervious = 27,565 sf 22.04% Impervious = 7,791 sf</b>	

**4 - HydroCAD R1**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

**Summary for Subcatchment 1S: EXISTING AREAS**

Runoff = 1.07 cfs @ 12.08 hrs, Volume= 3,523 cf, Depth= 2.39"

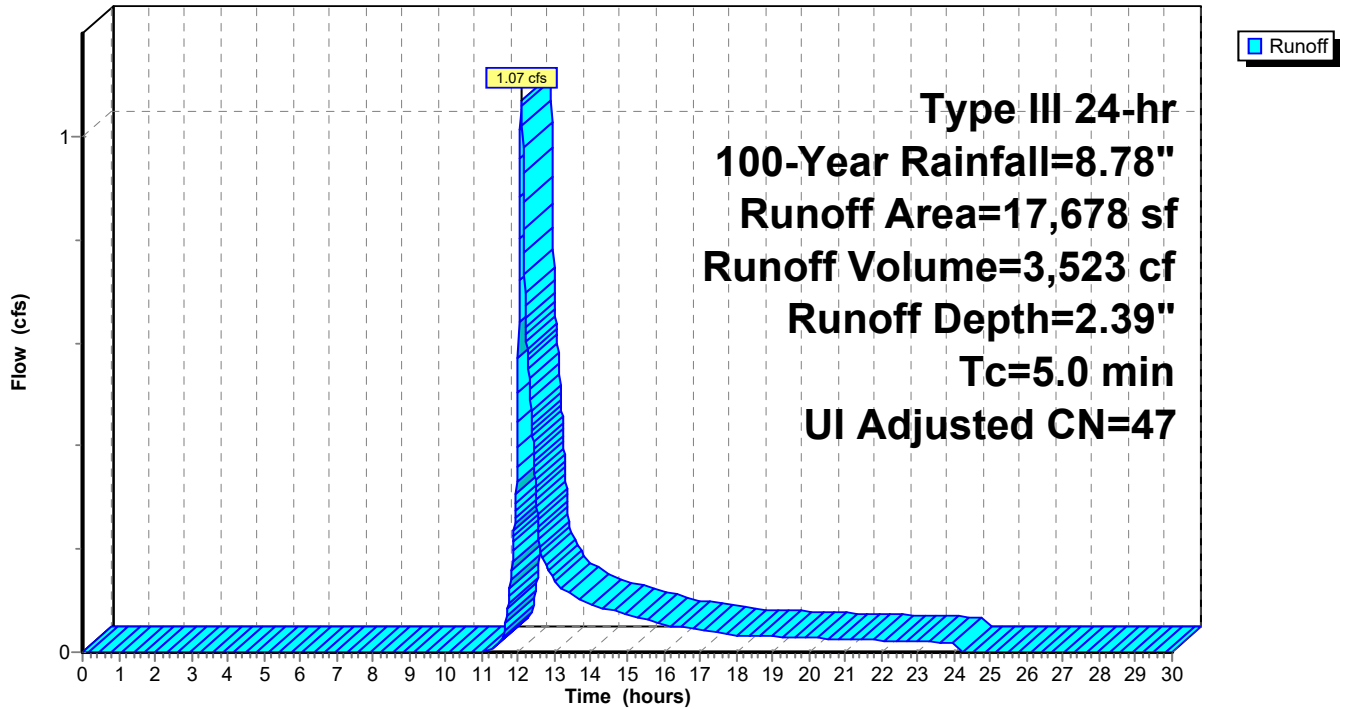
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-Year Rainfall=8.78"

Area (sf)	CN	Adj	Description
1,256	98		Roofs, HSG A
627	98		Roofs, HSG A
376	98		Paved parking, HSG A
110	98		Unconnected pavement, HSG A
* 341	98		Unconnected pavement, HSG A
* 28	98		Unconnected pavement, HSG A
47	39		>75% Grass cover, Good, HSG A
52	39		>75% Grass cover, Good, HSG A
14,841	39		>75% Grass cover, Good, HSG A
17,678	48	47	Weighted Average, UI Adjusted
14,940			84.51% Pervious Area
2,738			15.49% Impervious Area
479			17.49% Unconnected

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

**Subcatchment 1S: EXISTING AREAS**

Hydrograph



**4 - HydroCAD R1**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

**Summary for Subcatchment 2S: ROOFS**

Runoff = 0.75 cfs @ 12.07 hrs, Volume= 2,604 cf, Depth= 8.54"

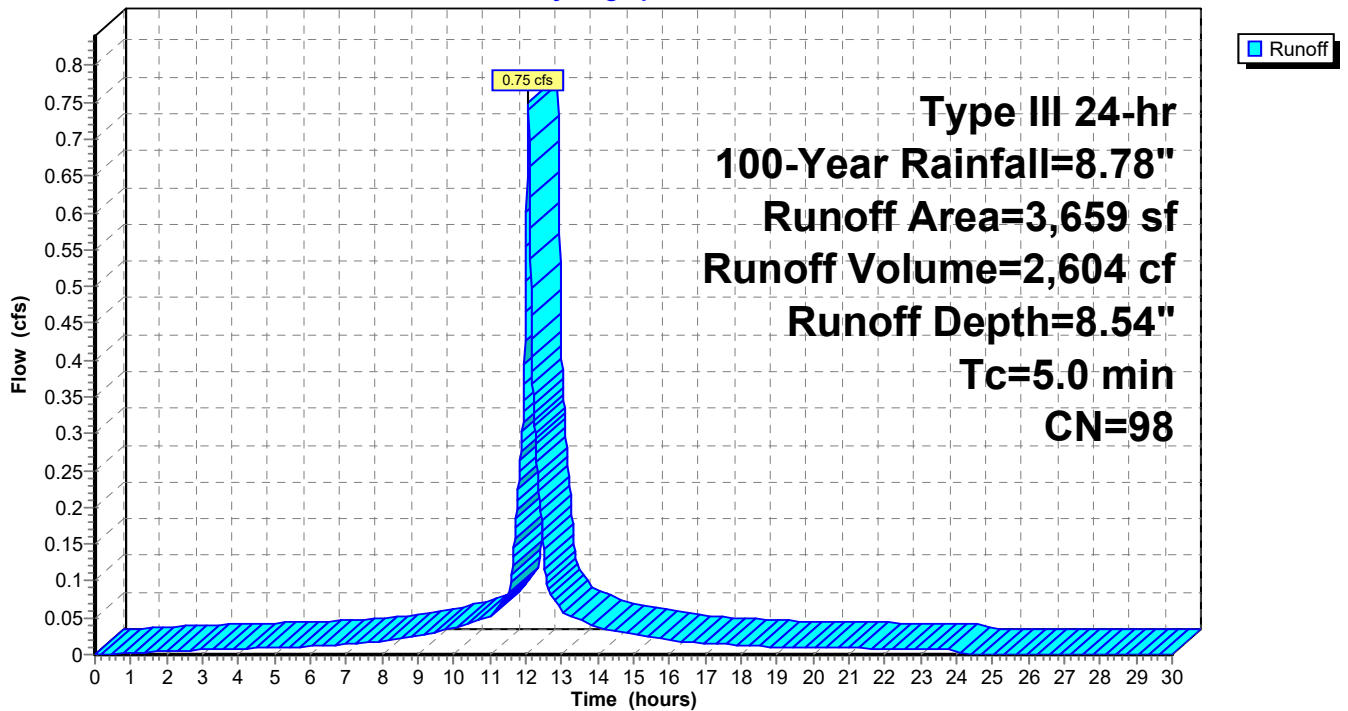
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-Year Rainfall=8.78"

Area (sf)	CN	Description
3,589	98	Roofs, HSG A
* 70	98	Roofs, HSG A
3,659	98	Weighted Average
3,659		100.00% Impervious Area

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

**Subcatchment 2S: ROOFS**

**Hydrograph**



**4 - HydroCAD R1**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

**Summary for Subcatchment 3S: DRIVEWAY**

Runoff = 0.21 cfs @ 12.07 hrs, Volume= 722 cf, Depth= 8.54"

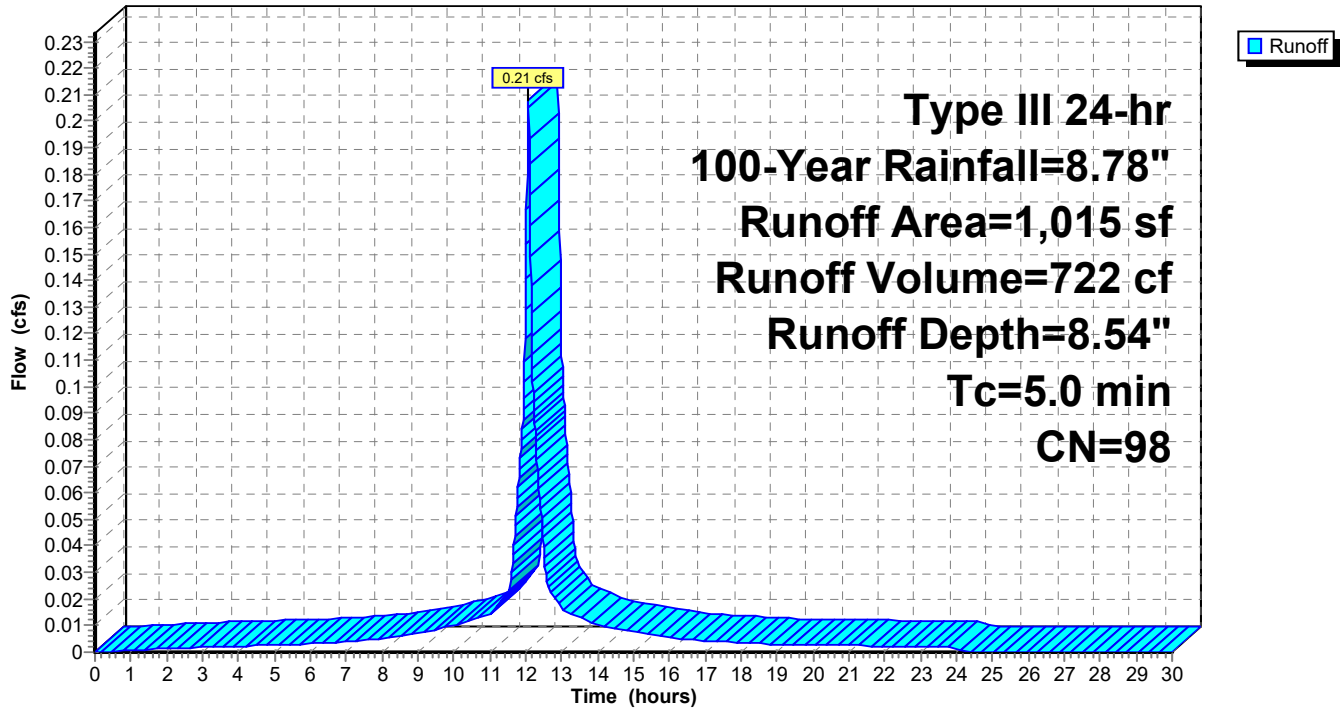
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-Year Rainfall=8.78"

Area (sf)	CN	Description
1,015	98	Paved parking, HSG A
1,015		100.00% Impervious Area

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

**Subcatchment 3S: DRIVEWAY**

**Hydrograph**



**4 - HydroCAD R1**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

**Summary for Subcatchment 4S: OTHER IMPER.**

Runoff = 0.08 cfs @ 12.07 hrs, Volume= 270 cf, Depth= 8.54"

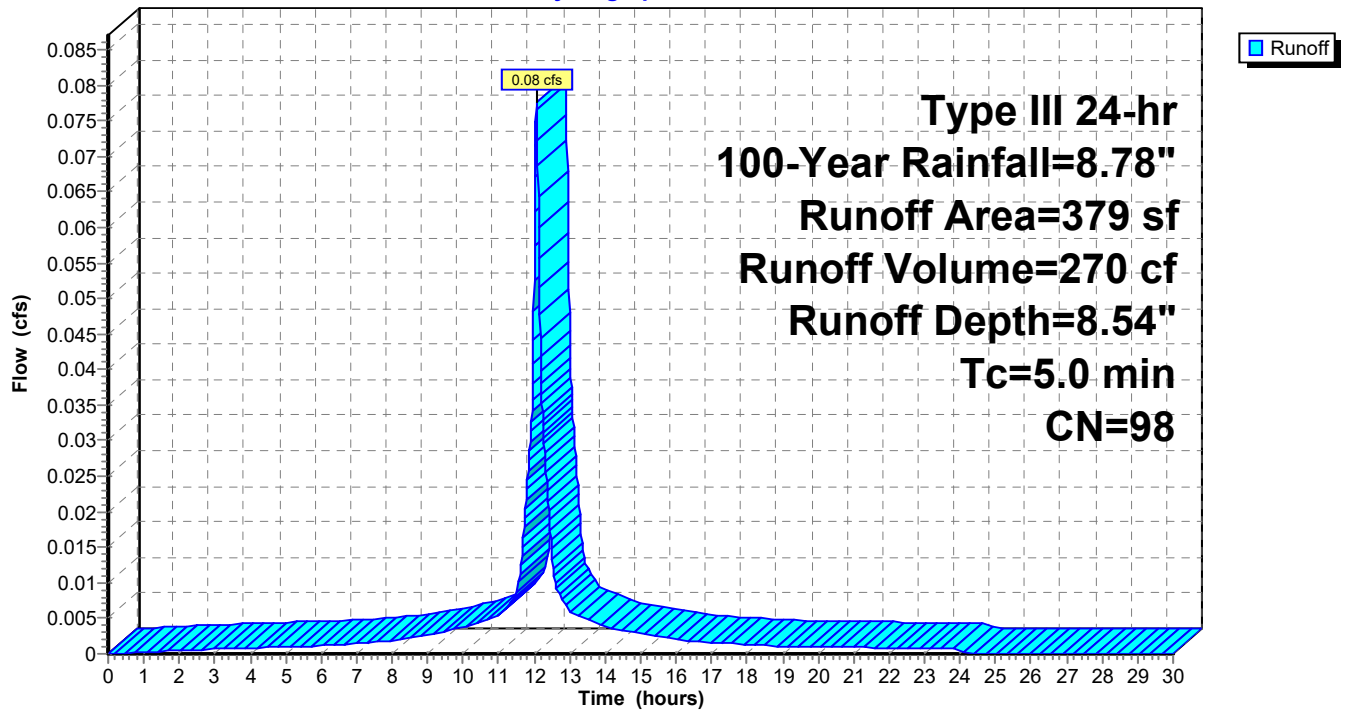
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-Year Rainfall=8.78"

Area (sf)	CN	Description
34	98	Unconnected pavement, HSG A
* 318	98	Unconnected pavement, HSG A
* 27	98	Unconnected pavement, HSG A
379	98	Weighted Average
379		100.00% Impervious Area
379		100.00% Unconnected

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

**Subcatchment 4S: OTHER IMPER.**

Hydrograph



**4 - HydroCAD R1**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

**Summary for Subcatchment 5S: PERVIOUS AREAS**

Runoff = 0.39 cfs @ 12.10 hrs, Volume= 1,578 cf, Depth= 1.50"

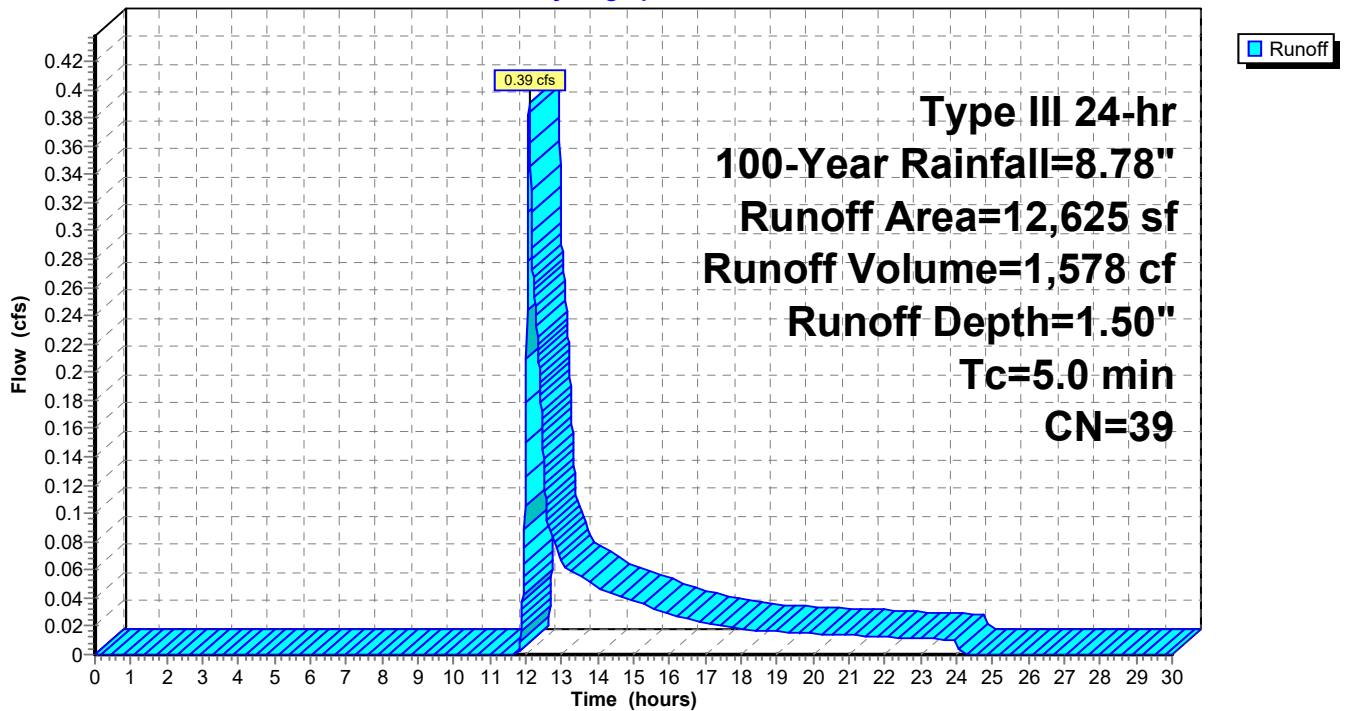
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-Year Rainfall=8.78"

Area (sf)	CN	Description
111	39	>75% Grass cover, Good, HSG A
12,514	39	>75% Grass cover, Good, HSG A
12,625	39	Weighted Average
12,625		100.00% Pervious Area

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

**Subcatchment 5S: PERVIOUS AREAS**

Hydrograph



**4 - HydroCAD R1**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

**Summary for Pond 1P: S1**

Inflow Area = 5,053 sf, 100.00% Impervious, Inflow Depth = 8.54" for 100-Year event  
 Inflow = 1.04 cfs @ 12.07 hrs, Volume= 3,596 cf  
 Outflow = 0.07 cfs @ 13.21 hrs, Volume= 3,596 cf, Atten= 93%, Lag= 68.5 min  
 Discarded = 0.07 cfs @ 13.21 hrs, Volume= 3,596 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 2  
 Peak Elev= 33.38' @ 13.21 hrs Surf.Area= 748 sf Storage= 1,512 cf

Plug-Flow detention time= 190.3 min calculated for 3,595 cf (100% of inflow)  
 Center-of-Mass det. time= 190.2 min ( 929.4 - 739.2 )

Volume	Invert	Avail.Storage	Storage Description
#1A	30.00'	790 cf	<b>11.00'W x 68.03'L x 3.75'H Field A</b> 2,806 cf Overall - 832 cf Embedded = 1,974 cf x 40.0% Voids
#2A	30.75'	832 cf	<b>ADS_StormTech DC-780 +Cap</b> x 18 Inside #1 Effective Size= 45.4"W x 30.0"H => 6.49 sf x 7.12'L = 46.2 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 18 Chambers in 2 Rows
		1,622 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	30.00'	<b>2.410 in/hr Exfiltration over Wetted area</b>

**Discarded OutFlow** Max=0.07 cfs @ 13.21 hrs HW=33.38' (Free Discharge)  
 ↑**-1=Exfiltration** (Exfiltration Controls 0.07 cfs)

**4 - HydroCAD R1**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

**Pond 1P: S1 - Chamber Wizard Field A**

**Chamber Model = ADS\_StormTech DC-780 +Cap (ADS StormTech® DC-780 with cap length)**

Effective Size= 45.4"W x 30.0"H => 6.49 sf x 7.12'L = 46.2 cf

Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

9 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 65.70' Row Length +14.0" End Stone x 2 = 68.03' Base Length

2 Rows x 51.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 11.00' Base Width

9.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.75' Field Height

18 Chambers x 46.2 cf = 832.3 cf Chamber Storage

2,806.2 cf Field - 832.3 cf Chambers = 1,973.9 cf Stone x 40.0% Voids = 789.6 cf Stone Storage

Chamber Storage + Stone Storage = 1,621.9 cf = 0.037 af

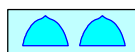
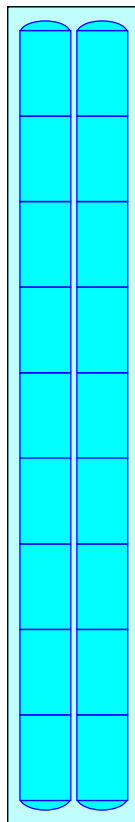
Overall Storage Efficiency = 57.8%

Overall System Size = 68.03' x 11.00' x 3.75'

18 Chambers

103.9 cy Field

73.1 cy Stone



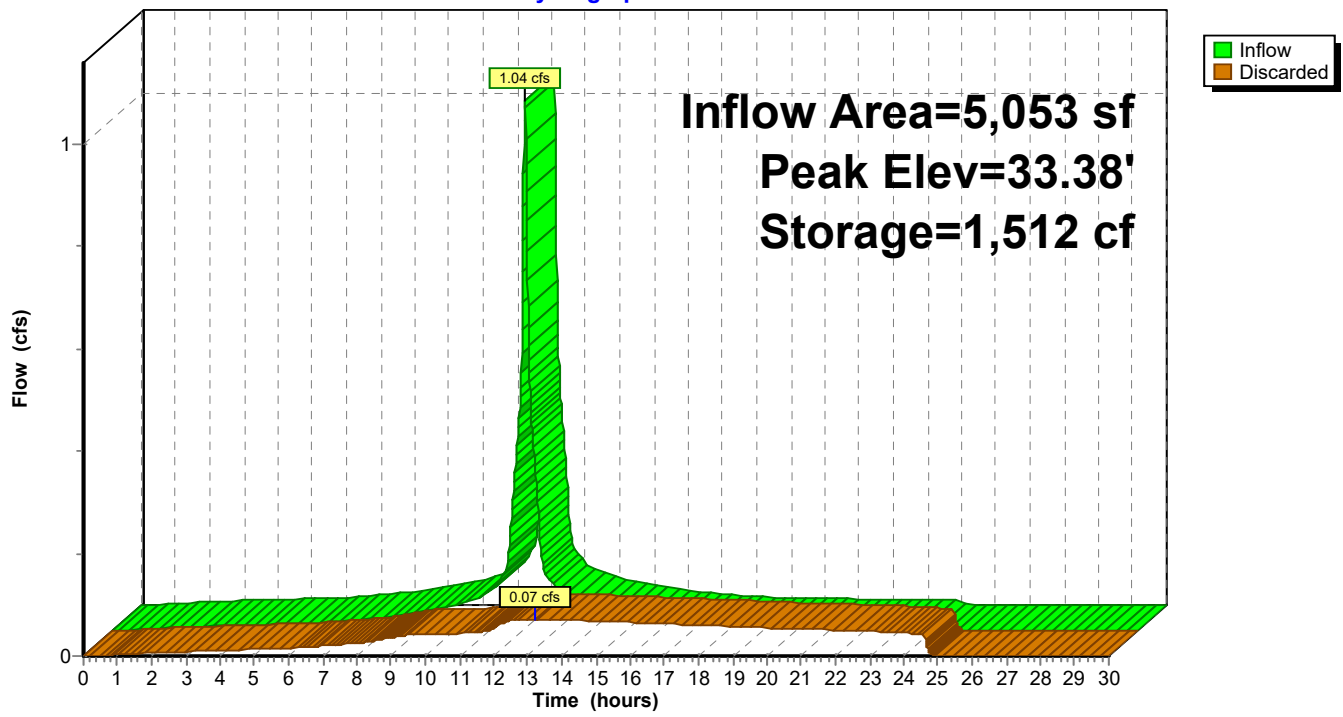
**4 - HydroCAD R1**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

**Pond 1P: S1**

**Hydrograph**



**4 - HydroCAD R1**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

**Stage-Discharge for Pond 1P: S1**

Elevation (feet)	Discarded (cfs)	Elevation (feet)	Discarded (cfs)	Elevation (feet)	Discarded (cfs)	Elevation (feet)	Discarded (cfs)
30.00	0.00	31.12	0.05	32.24	0.06	33.36	0.07
30.02	0.04	31.14	0.05	32.26	0.06	33.38	0.07
30.04	0.04	31.16	0.05	32.28	0.06	33.40	0.07
30.06	0.04	31.18	0.05	32.30	0.06	33.42	0.07
30.08	0.04	31.20	0.05	32.32	0.06	33.44	0.07
30.10	0.04	31.22	0.05	32.34	0.06	33.46	0.07
30.12	0.04	31.24	0.05	32.36	0.06	33.48	0.07
30.14	0.04	31.26	0.05	32.38	0.06	33.50	0.07
30.16	0.04	31.28	0.05	32.40	0.06	33.52	0.07
30.18	0.04	31.30	0.05	32.42	0.06	33.54	0.07
30.20	0.04	31.32	0.05	32.44	0.06	33.56	0.07
30.22	0.04	31.34	0.05	32.46	0.06	33.58	0.07
30.24	0.04	31.36	0.05	32.48	0.06	33.60	0.07
30.26	0.04	31.38	0.05	32.50	0.06	33.62	0.07
30.28	0.04	31.40	0.05	32.52	0.06	33.64	0.07
30.30	0.04	31.42	0.05	32.54	0.06	33.66	0.07
30.32	0.04	31.44	0.05	32.56	0.06	33.68	0.07
30.34	0.04	31.46	0.05	32.58	0.06	33.70	0.07
30.36	0.04	31.48	0.05	32.60	0.06	33.72	0.07
30.38	0.05	31.50	0.05	32.62	0.06	33.74	<b>0.07</b>
30.40	0.05	31.52	0.06	32.64	0.07		
30.42	0.05	31.54	0.06	32.66	0.07		
30.44	0.05	31.56	0.06	32.68	0.07		
30.46	0.05	31.58	0.06	32.70	0.07		
30.48	0.05	31.60	0.06	32.72	0.07		
30.50	0.05	31.62	0.06	32.74	0.07		
30.52	0.05	31.64	0.06	32.76	0.07		
30.54	0.05	31.66	0.06	32.78	0.07		
30.56	0.05	31.68	0.06	32.80	0.07		
30.58	0.05	31.70	0.06	32.82	0.07		
30.60	0.05	31.72	0.06	32.84	0.07		
30.62	0.05	31.74	0.06	32.86	0.07		
30.64	0.05	31.76	0.06	32.88	0.07		
30.66	0.05	31.78	0.06	32.90	0.07		
30.68	0.05	31.80	0.06	32.92	0.07		
30.70	0.05	31.82	0.06	32.94	0.07		
30.72	0.05	31.84	0.06	32.96	0.07		
30.74	0.05	31.86	0.06	32.98	0.07		
30.76	0.05	31.88	0.06	33.00	0.07		
30.78	0.05	31.90	0.06	33.02	0.07		
30.80	0.05	31.92	0.06	33.04	0.07		
30.82	0.05	31.94	0.06	33.06	0.07		
30.84	0.05	31.96	0.06	33.08	0.07		
30.86	0.05	31.98	0.06	33.10	0.07		
30.88	0.05	32.00	0.06	33.12	0.07		
30.90	0.05	32.02	0.06	33.14	0.07		
30.92	0.05	32.04	0.06	33.16	0.07		
30.94	0.05	32.06	0.06	33.18	0.07		
30.96	0.05	32.08	0.06	33.20	0.07		
30.98	0.05	32.10	0.06	33.22	0.07		
31.00	0.05	32.12	0.06	33.24	0.07		
31.02	0.05	32.14	0.06	33.26	0.07		
31.04	0.05	32.16	0.06	33.28	0.07		
31.06	0.05	32.18	0.06	33.30	0.07		
31.08	0.05	32.20	0.06	33.32	0.07		
31.10	0.05	32.22	0.06	33.34	0.07		

**4 - HydroCAD R1**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

**Stage-Area-Storage for Pond 1P: S1**

Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)
30.00	748	0	32.80	1,191	1,313
30.05	756	15	32.85	1,199	1,333
30.10	764	30	32.90	1,207	1,354
30.15	772	45	32.95	1,215	1,373
30.20	780	60	33.00	1,223	1,391
30.25	788	75	33.05	1,230	1,409
30.30	796	90	33.10	1,238	1,425
30.35	804	105	33.15	1,246	1,441
30.40	812	120	33.20	1,254	1,457
30.45	819	135	33.25	1,262	1,472
30.50	827	150	33.30	1,270	1,487
30.55	835	165	33.35	1,278	1,502
30.60	843	180	33.40	1,286	1,517
30.65	851	195	33.45	1,294	1,532
30.70	859	210	33.50	1,302	1,547
30.75	867	224	33.55	1,309	1,562
30.80	875	254	33.60	1,317	1,577
30.85	883	283	33.65	1,325	1,592
30.90	891	313	33.70	1,333	1,607
30.95	898	342	33.75	<b>1,341</b>	<b>1,622</b>
31.00	906	371			
31.05	914	400			
31.10	922	429			
31.15	930	458			
31.20	938	487			
31.25	946	516			
31.30	954	544			
31.35	962	573			
31.40	970	601			
31.45	978	629			
31.50	985	657			
31.55	993	685			
31.60	1,001	713			
31.65	1,009	740			
31.70	1,017	768			
31.75	1,025	795			
31.80	1,033	822			
31.85	1,041	849			
31.90	1,049	875			
31.95	1,057	902			
32.00	1,064	928			
32.05	1,072	954			
32.10	1,080	980			
32.15	1,088	1,006			
32.20	1,096	1,031			
32.25	1,104	1,057			
32.30	1,112	1,081			
32.35	1,120	1,106			
32.40	1,128	1,130			
32.45	1,136	1,155			
32.50	1,143	1,178			
32.55	1,151	1,202			
32.60	1,159	1,225			
32.65	1,167	1,247			
32.70	1,175	1,269			
32.75	1,183	1,291			

**4 - HydroCAD R1**

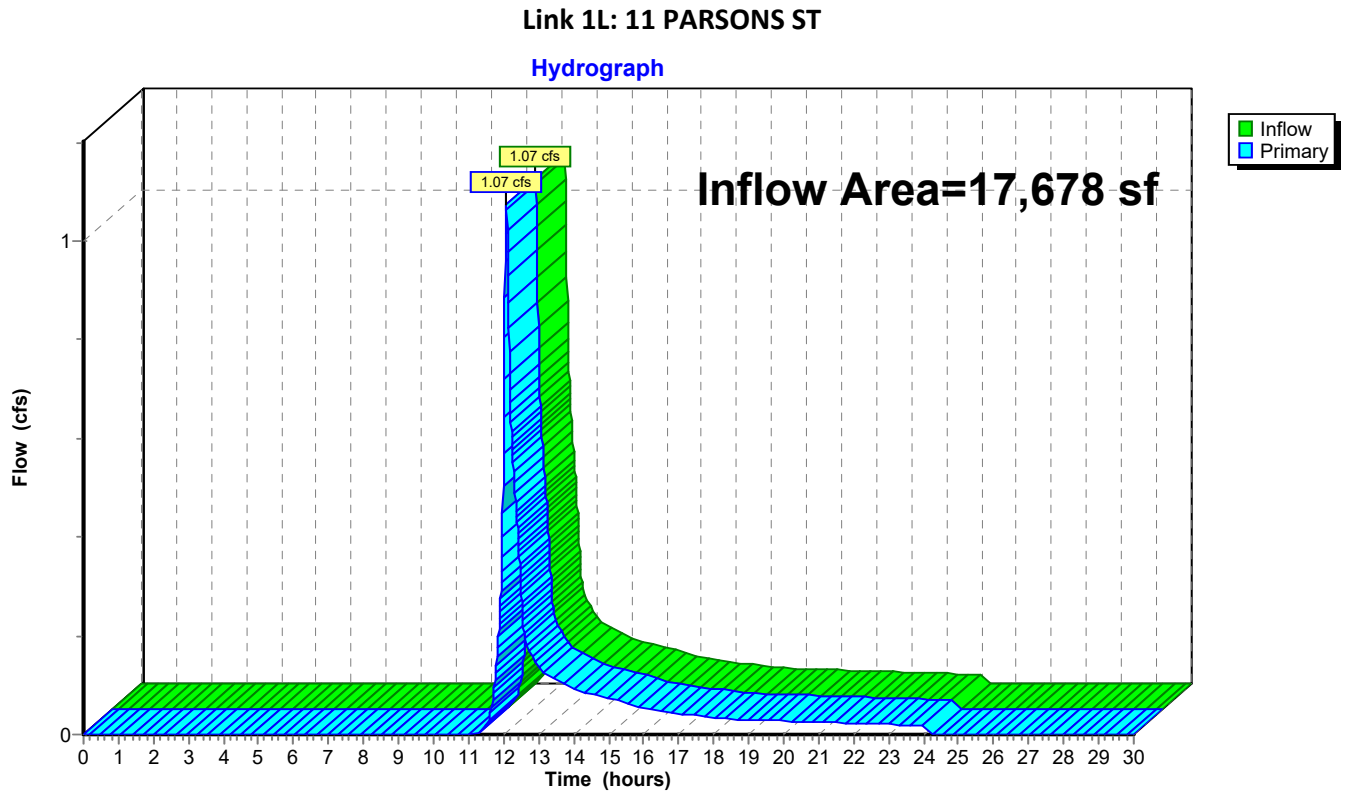
Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

**Summary for Link 1L: 11 PARSONS ST**

Inflow Area = 17,678 sf, 15.49% Impervious, Inflow Depth = 2.39" for 100-Year event  
Inflow = 1.07 cfs @ 12.08 hrs, Volume= 3,523 cf  
Primary = 1.07 cfs @ 12.08 hrs, Volume= 3,523 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs



**4 - HydroCAD R1**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

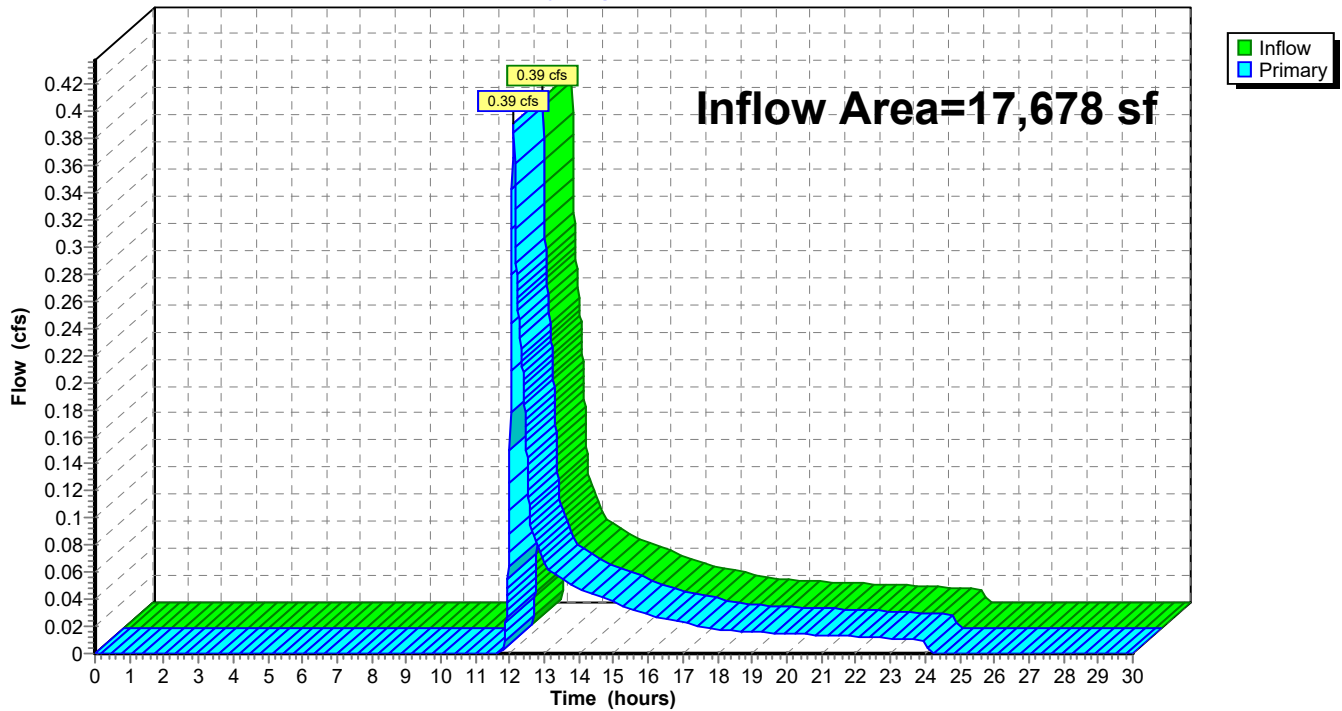
**Summary for Link 2L: 11 PARSONS ST**

Inflow Area = 17,678 sf, 28.58% Impervious, Inflow Depth = 1.07" for 100-Year event  
Inflow = 0.39 cfs @ 12.10 hrs, Volume= 1,578 cf  
Primary = 0.39 cfs @ 12.10 hrs, Volume= 1,578 cf, Atten= 0%, Lag= 0.0 min

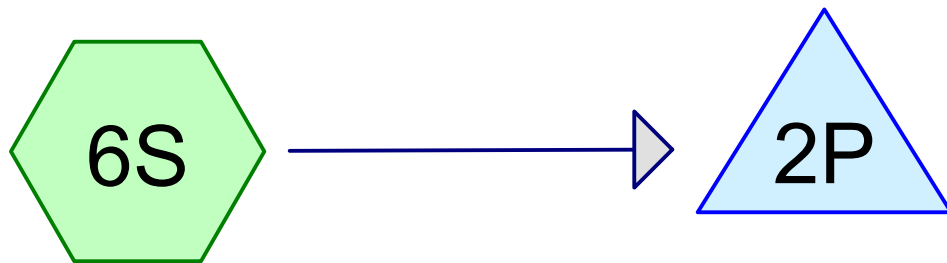
Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

**Link 2L: 11 PARSONS ST**

**Hydrograph**

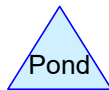
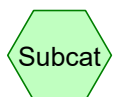


**INFILTRATION**  
**SYSTEM FOR**  
**PRECAUTIONARY**  
**SUMP PUMP**



BASEMENT AREA

S2 - PRECAUTIONARY  
SUMP PUMP



**4B - SUMP PUMP**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

**Area Listing (all nodes)**

Area (sq-ft)	CN	Description (subcatchment-numbers)
2,221	98	Roofs, HSG A (6S)
<b>2,221</b>	<b>98</b>	<b>TOTAL AREA</b>

**4B - SUMP PUMP**

Prepared by SPRUHAN ENGINEERING, P.C.

**Soil Listing (all nodes)**

Area (sq-ft)	Soil Group	Subcatchment Numbers
2,221	HSG A	6S
0	HSG B	
0	HSG C	
0	HSG D	
0	Other	
<b>2,221</b>		<b>TOTAL AREA</b>

**4B - SUMP PUMP**

Prepared by SPRUHAN ENGINEERING, P.C.

**Ground Covers (all nodes)**

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Subcatchment Numbers
2,221	0	0	0	0	2,221	Roofs	6S
<b>2,221</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>2,221</b>	<b>TOTAL</b>	
						<b>AREA</b>	

**4B - SUMP PUMP**

Type III 24-hr 10-Year Rainfall=5.13"

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment 6S: BASEMENT AREA**

Runoff Area=2,221 sf 100.00% Impervious Runoff Depth=4.89"  
Tc=5.0 min CN=98 Runoff=0.27 cfs 906 cf

**Pond 2P: S2 - PRECAUTIONARY SUMP PUMP**

Peak Elev=33.54' Storage=355 cf Inflow=0.27 cfs 906 cf  
Outflow=0.02 cfs 906 cf

**Total Runoff Area = 2,221 sf Runoff Volume = 906 cf Average Runoff Depth = 4.89"**  
**0.00% Pervious = 0 sf 100.00% Impervious = 2,221 sf**

**4B - SUMP PUMP**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

**Summary for Subcatchment 6S: BASEMENT AREA**

Runoff = 0.27 cfs @ 12.07 hrs, Volume= 906 cf, Depth= 4.89"

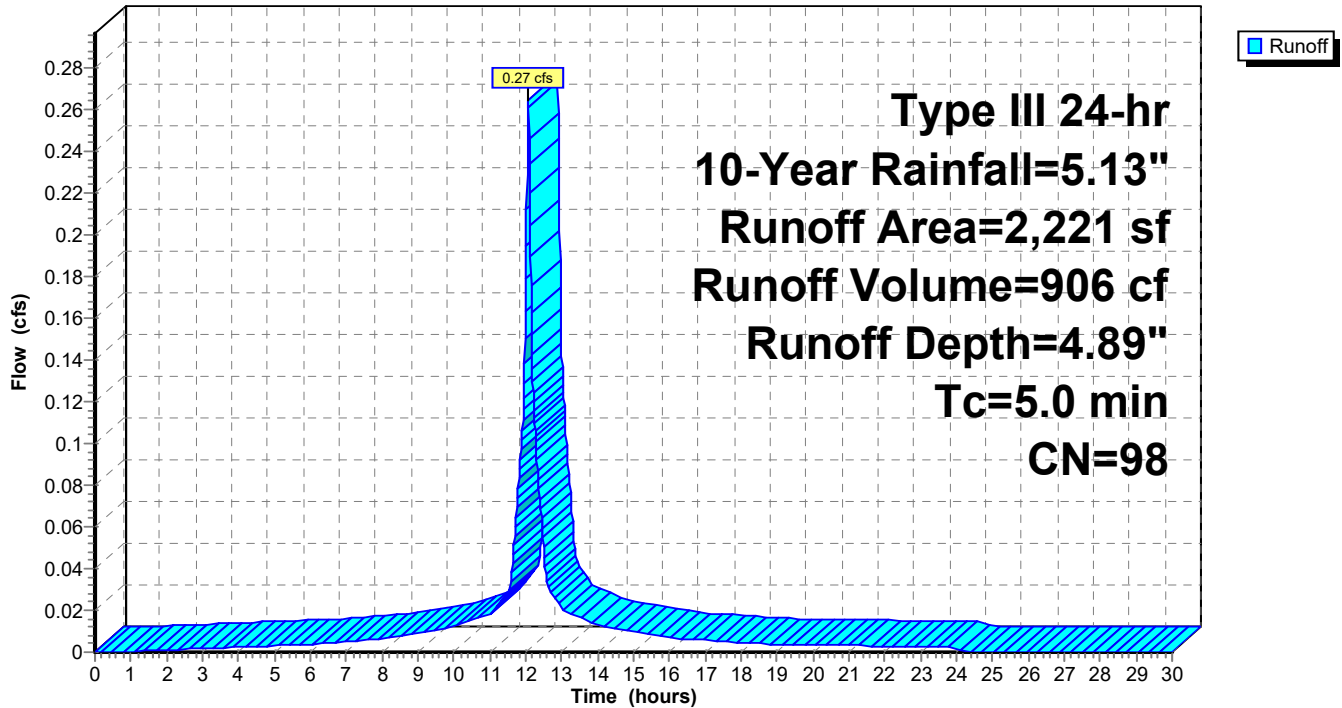
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 10-Year Rainfall=5.13"

Area (sf)	CN	Description
2,221	98	Roofs, HSG A
2,221		100.00% Impervious Area

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

**Subcatchment 6S: BASEMENT AREA**

Hydrograph



**4B - SUMP PUMP**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

**Summary for Pond 2P: S2 - PRECAUTIONARY SUMP PUMP**

Inflow Area = 2,221 sf, 100.00% Impervious, Inflow Depth = 4.89" for 10-Year event  
 Inflow = 0.27 cfs @ 12.07 hrs, Volume= 906 cf  
 Outflow = 0.02 cfs @ 12.87 hrs, Volume= 906 cf, Atten= 91%, Lag= 48.3 min  
 Discarded = 0.02 cfs @ 12.87 hrs, Volume= 906 cf

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 3  
 Peak Elev= 33.54' @ 12.87 hrs Surf.Area= 212 sf Storage= 355 cf

Plug-Flow detention time= 131.5 min calculated for 905 cf (100% of inflow)  
 Center-of-Mass det. time= 131.5 min ( 878.2 - 746.7 )

Volume	Invert	Avail.Storage	Storage Description
#1A	30.00'	281 cf	<b>10.08'W x 21.02'L x 3.75'H Field A</b> 795 cf Overall - 92 cf Embedded = 702 cf x 40.0% Voids
#2A	30.75'	92 cf	<b>ADS_StormTech DC-780 +Cap</b> x 2 Inside #1 Effective Size= 45.4"W x 30.0"H => 6.49 sf x 7.12'L = 46.2 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap
		373 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	30.00'	<b>2.410 in/hr Exfiltration over Wetted area</b>

**Discarded OutFlow** Max=0.02 cfs @ 12.87 hrs HW=33.54' (Free Discharge)  
 ↑**-1=Exfiltration** (Exfiltration Controls 0.02 cfs)

**4B - SUMP PUMP**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

**Pond 2P: S2 - PRECAUTIONARY SUMP PUMP - Chamber Wizard Field A**

**Chamber Model = ADS\_StormTech DC-780 +Cap (ADS StormTech® DC-780 with cap length)**

Effective Size= 45.4"W x 30.0"H => 6.49 sf x 7.12'L = 46.2 cf

Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

2 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 15.86' Row Length +31.0" End Stone x 2 = 21.02' Base Length

1 Rows x 51.0" Wide + 35.0" Side Stone x 2 = 10.08' Base Width

9.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.75' Field Height

2 Chambers x 46.2 cf = 92.5 cf Chamber Storage

794.9 cf Field - 92.5 cf Chambers = 702.5 cf Stone x 40.0% Voids = 281.0 cf Stone Storage

Chamber Storage + Stone Storage = 373.5 cf = 0.009 af

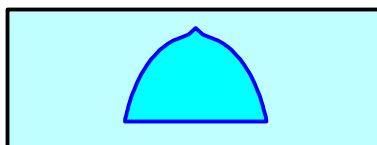
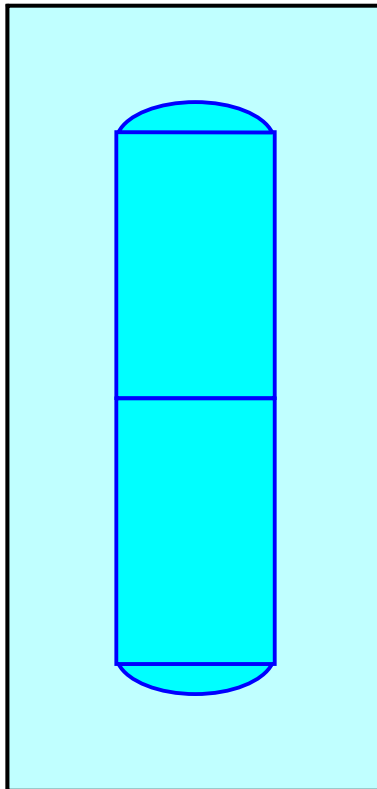
Overall Storage Efficiency = 47.0%

Overall System Size = 21.02' x 10.08' x 3.75'

2 Chambers

29.4 cy Field

26.0 cy Stone

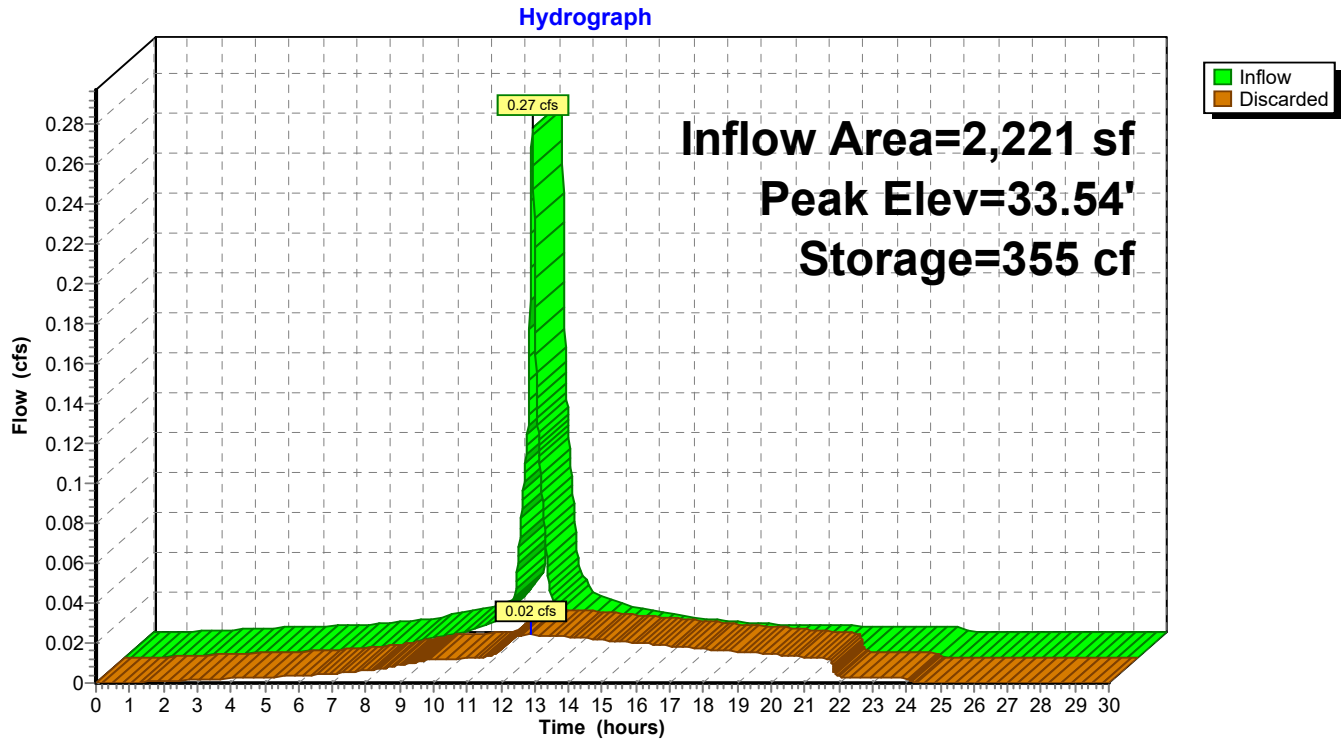


**4B - SUMP PUMP**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

**Pond 2P: S2 - PRECAUTIONARY SUMP PUMP**



**4B - SUMP PUMP**

Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

**Stage-Discharge for Pond 2P: S2 - PRECAUTIONARY SUMP PUMP**

Elevation (feet)	Discarded (cfs)	Elevation (feet)	Discarded (cfs)	Elevation (feet)	Discarded (cfs)	Elevation (feet)	Discarded (cfs)
30.00	0.00	31.12	0.02	32.24	0.02	33.36	0.02
30.02	0.01	31.14	0.02	32.26	0.02	33.38	0.02
30.04	0.01	31.16	0.02	32.28	0.02	33.40	0.02
30.06	0.01	31.18	0.02	32.30	0.02	33.42	0.02
30.08	0.01	31.20	0.02	32.32	0.02	33.44	0.02
30.10	0.01	31.22	0.02	32.34	0.02	33.46	0.02
30.12	0.01	31.24	0.02	32.36	0.02	33.48	0.02
30.14	0.01	31.26	0.02	32.38	0.02	33.50	0.02
30.16	0.01	31.28	0.02	32.40	0.02	33.52	0.02
30.18	0.01	31.30	0.02	32.42	0.02	33.54	0.02
30.20	0.01	31.32	0.02	32.44	0.02	33.56	0.02
30.22	0.01	31.34	0.02	32.46	0.02	33.58	0.02
30.24	0.01	31.36	0.02	32.48	0.02	33.60	0.02
30.26	0.01	31.38	0.02	32.50	0.02	33.62	0.02
30.28	0.01	31.40	0.02	32.52	0.02	33.64	0.02
30.30	0.01	31.42	0.02	32.54	0.02	33.66	0.02
30.32	0.01	31.44	0.02	32.56	0.02	33.68	0.02
30.34	0.01	31.46	0.02	32.58	0.02	33.70	0.02
30.36	0.01	31.48	0.02	32.60	0.02	33.72	0.02
30.38	0.01	31.50	0.02	32.62	0.02	33.74	<b>0.02</b>
30.40	0.01	31.52	0.02	32.64	0.02		
30.42	0.01	31.54	0.02	32.66	0.02		
30.44	0.01	31.56	0.02	32.68	0.02		
30.46	0.01	31.58	0.02	32.70	0.02		
30.48	0.01	31.60	0.02	32.72	0.02		
30.50	0.01	31.62	0.02	32.74	0.02		
30.52	0.01	31.64	0.02	32.76	0.02		
30.54	0.01	31.66	0.02	32.78	0.02		
30.56	0.01	31.68	0.02	32.80	0.02		
30.58	0.01	31.70	0.02	32.82	0.02		
30.60	0.01	31.72	0.02	32.84	0.02		
30.62	0.01	31.74	0.02	32.86	0.02		
30.64	0.01	31.76	0.02	32.88	0.02		
30.66	0.01	31.78	0.02	32.90	0.02		
30.68	0.01	31.80	0.02	32.92	0.02		
30.70	0.01	31.82	0.02	32.94	0.02		
30.72	0.01	31.84	0.02	32.96	0.02		
30.74	0.01	31.86	0.02	32.98	0.02		
30.76	0.01	31.88	0.02	33.00	0.02		
30.78	0.01	31.90	0.02	33.02	0.02		
30.80	0.01	31.92	0.02	33.04	0.02		
30.82	0.01	31.94	0.02	33.06	0.02		
30.84	0.01	31.96	0.02	33.08	0.02		
30.86	0.01	31.98	0.02	33.10	0.02		
30.88	0.01	32.00	0.02	33.12	0.02		
30.90	0.01	32.02	0.02	33.14	0.02		
30.92	0.02	32.04	0.02	33.16	0.02		
30.94	0.02	32.06	0.02	33.18	0.02		
30.96	0.02	32.08	0.02	33.20	0.02		
30.98	0.02	32.10	0.02	33.22	0.02		
31.00	0.02	32.12	0.02	33.24	0.02		
31.02	0.02	32.14	0.02	33.26	0.02		
31.04	0.02	32.16	0.02	33.28	0.02		
31.06	0.02	32.18	0.02	33.30	0.02		
31.08	0.02	32.20	0.02	33.32	0.02		
31.10	0.02	32.22	0.02	33.34	0.02		

**4B - SUMP PUMP**

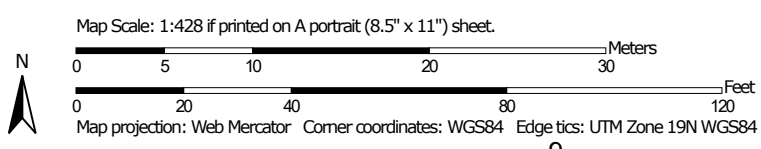
Prepared by SPRUHAN ENGINEERING, P.C.

HydroCAD® 10.00-25 s/n 09067 © 2019 HydroCAD Software Solutions LLC

**Stage-Area-Storage for Pond 2P: S2 - PRECAUTIONARY SUMP PUMP**


Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)
30.00	212	0	32.80	386	290
30.05	215	4	32.85	389	295
30.10	218	8	32.90	392	300
30.15	221	13	32.95	396	305
30.20	224	17	33.00	399	309
30.25	228	21	33.05	402	314
30.30	231	25	33.10	405	318
30.35	234	30	33.15	408	322
30.40	237	34	33.20	411	327
30.45	240	38	33.25	414	331
30.50	243	42	33.30	417	335
30.55	246	47	33.35	420	340
30.60	249	51	33.40	424	344
30.65	252	55	33.45	427	348
30.70	256	59	33.50	430	352
30.75	259	64	33.55	433	357
30.80	262	69	33.60	436	361
30.85	265	75	33.65	439	365
30.90	268	81	33.70	442	369
30.95	271	87	33.75	<b>445</b>	<b>373</b>
31.00	274	93			
31.05	277	99			
31.10	280	104			
31.15	284	110			
31.20	287	116			
31.25	290	122			
31.30	293	127			
31.35	296	133			
31.40	299	139			
31.45	302	145			
31.50	305	150			
31.55	308	156			
31.60	312	162			
31.65	315	167			
31.70	318	173			
31.75	321	178			
31.80	324	184			
31.85	327	190			
31.90	330	195			
31.95	333	201			
32.00	336	206			
32.05	340	212			
32.10	343	217			
32.15	346	223			
32.20	349	228			
32.25	352	233			
32.30	355	239			
32.35	358	244			
32.40	361	249			
32.45	364	255			
32.50	368	260			
32.55	371	265			
32.60	374	270			
32.65	377	275			
32.70	380	280			
32.75	383	285			

**Appendix B – Soil Information**




### MAP LEGEND

**Area of Interest (AOI)**

 Area of Interest (AOI)




















**Soils**







 Soil Map Unit Polygons

 Soil Map Unit Lines


 Soil Map Unit Points

**Special Point Features**






-  Blowout
-  Borrow Pit
-  Clay Spot
-  Closed Depression
-  Gravel Pit
-  Gravelly Spot
-  Landfill
-  Lava Flow
-  Marsh or swamp
-  Mine or Quarry
-  Miscellaneous Water
-  Perennial Water
-  Rock Outcrop
-  Saline Spot
-  Sandy Spot
-  Severely Eroded Spot
-  Sinkhole
-  Slide or Slip
-  Sodic Spot

-  Spoil Area
-  Stony Spot
-  Very Stony Spot
-  Wet Spot
-  Other
-  Special Line Features


**Water Features**

 Streams and Canals

**Transportation**

-  Rails
-  Interstate Highways
-  US Routes
-  Major Roads
-  Local Roads

**Background**

 Aerial Photography

### MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service  
 Web Soil Survey URL:  
 Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Middlesex County, Massachusetts  
 Survey Area Data: Version 24, Aug 27, 2024

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 22, 2022—Sep 1, 2023

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

## Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	0.5	100.0%
<b>Totals for Area of Interest</b>		<b>0.5</b>	<b>100.0%</b>

## Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

## Middlesex County, Massachusetts

### 626B—Merrimac-Urban land complex, 0 to 8 percent slopes

#### Map Unit Setting

*National map unit symbol:* 2tyr9

*Elevation:* 0 to 820 feet

*Mean annual precipitation:* 36 to 71 inches

*Mean annual air temperature:* 39 to 55 degrees F

*Frost-free period:* 140 to 250 days

*Farmland classification:* Not prime farmland

#### Map Unit Composition

*Merrimac and similar soils:* 45 percent

*Urban land:* 40 percent

*Minor components:* 15 percent

*Estimates are based on observations, descriptions, and transects of the mapunit.*

#### Description of Merrimac

##### Setting

*Landform:* Outwash plains, outwash terraces, moraines, eskers, kames

*Landform position (two-dimensional):* Summit, shoulder, backslope, footslope

*Landform position (three-dimensional):* Side slope, crest, riser, tread

*Down-slope shape:* Convex

*Across-slope shape:* Convex

*Parent material:* Loamy glaciofluvial deposits derived from granite, schist, and gneiss over sandy and gravelly glaciofluvial deposits derived from granite, schist, and gneiss

##### Typical profile

*Ap - 0 to 10 inches:* fine sandy loam

*Bw1 - 10 to 22 inches:* fine sandy loam

*Bw2 - 22 to 26 inches:* stratified gravel to gravelly loamy sand

*2C - 26 to 65 inches:* stratified gravel to very gravelly sand

##### Properties and qualities

*Slope:* 0 to 8 percent

*Depth to restrictive feature:* More than 80 inches

*Drainage class:* Somewhat excessively drained

*Runoff class:* Very low

*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to very high (1.42 to 99.90 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Calcium carbonate, maximum content:* 2 percent

*Maximum salinity:* Nonsaline (0.0 to 1.4 mmhos/cm)

*Sodium adsorption ratio, maximum:* 1.0

*Available water supply, 0 to 60 inches:* Low (about 4.6 inches)

##### Interpretive groups

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 2e

*Hydrologic Soil Group:* A

*Ecological site:* F144AY022MA - Dry Outwash  
*Hydric soil rating:* No

### **Description of Urban Land**

#### **Typical profile**

*M - 0 to 10 inches:* cemented material

#### **Properties and qualities**

*Slope:* 0 to 8 percent

*Depth to restrictive feature:* 0 inches to manufactured layer

*Runoff class:* Very high

*Capacity of the most limiting layer to transmit water (Ksat):* Very low (0.00 to 0.00 in/hr)

*Available water supply, 0 to 60 inches:* Very low (about 0.0 inches)

#### **Interpretive groups**

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 8

*Hydrologic Soil Group:* D

*Hydric soil rating:* Unranked

### **Minor Components**

#### **Hinckley**

*Percent of map unit:* 5 percent

*Landform:* Deltas, kames, eskers, outwash plains

*Landform position (two-dimensional):* Summit, shoulder, backslope

*Landform position (three-dimensional):* Head slope, nose slope, side slope, crest, rise

*Down-slope shape:* Convex

*Across-slope shape:* Convex, linear

*Hydric soil rating:* No

#### **Sudbury**

*Percent of map unit:* 5 percent

*Landform:* Deltas, terraces, outwash plains

*Landform position (two-dimensional):* Footslope

*Landform position (three-dimensional):* Tread, dip

*Down-slope shape:* Concave

*Across-slope shape:* Linear

*Hydric soil rating:* No

#### **Windsor**

*Percent of map unit:* 5 percent

*Landform:* Outwash terraces, dunes, outwash plains, deltas

*Landform position (three-dimensional):* Tread, riser

*Down-slope shape:* Linear, convex

*Across-slope shape:* Linear, convex

*Hydric soil rating:* No

## References

---

- American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.
- American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.
- Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.
- Federal Register. July 13, 1994. Changes in hydric soils of the United States.
- Federal Register. September 18, 2002. Hydric soils of the United States.
- Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.
- National Research Council. 1995. Wetlands: Characteristics and boundaries.
- Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. [http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2\\_054262](http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262)
- Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. [http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2\\_053577](http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577)
- Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. [http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2\\_053580](http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580)
- Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.
- United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.
- United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. [http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2\\_053374](http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374)
- United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. <http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084>

Custom Soil Resource Report

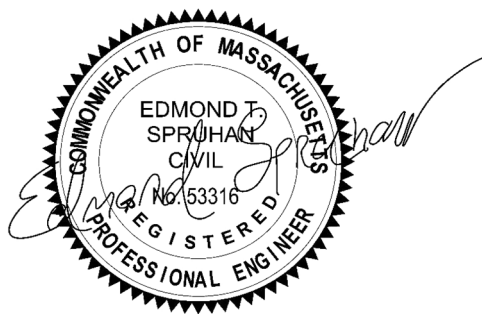
United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. [http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2\\_054242](http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242)

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. [http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2\\_053624](http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624)

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. [http://www.nrcs.usda.gov/Internet/FSE\\_DOCUMENTS/nrcs142p2\\_052290.pdf](http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf)

**Appendix C - Storm Water Operations & Maintenance Plan**

SPRUHAN ENGINEERING, P.C.  
OPERATIONS &  
MAINTENANCE PLAN  
11 PARSONS ST NEWTON MA.



**Prepared by: Spruhan Engineering, P.C.**  
**March 12, 2025**  
**November 24, 2025 (R1).**

## Operations & Maintenance Plan

### Introduction

The following Stormwater Operations & Maintenance plan is for **11 Parsons St., Newton, MA**. All erosion and sediment control measures to be used are to be constructed and installed according to the ‘Massachusetts Erosion and Sediment Control Guidelines for Urban and Sub-Urban Areas.’

The plan consists of the following elements:

- Owners’ information
- Operation and maintenance guidance – Pre and Post Construction
- Landscape installation and maintenance guidance
- Proposed inspection log

All erosion and sediment control measures must be installed prior to the commencement of any work. All sediment and erosion control measures shall remain in place until the entire site has been stabilized. The site is deemed stabilized when all landscaped areas have been loamed and seeded with vegetation having had the chance to establish itself. Any proposed paved areas shall have their binder course of pavement installed prior to the removal of these control measures.

The long-term operation and maintenance of a stormwater management system is as critical to its performance as its design and construction. Proper operation and maintenance ensure that the BMP will continue to remove pollutants effectively over the long-term, decreases the risk of re-suspending sediment; and therefore, improves water quality. Without proper maintenance, BMPs are likely to fail and no longer provide the necessary stormwater treatment.

The maintenance of the Drainage System is the exclusive responsibility of the Property Owner. Annual reports (example below) shall be submitted to the City Engineer every January for the prior year.

### Name and contact information:

**Manager:** \_\_\_\_\_

**Address:** \_\_\_\_\_

**Contact info:** \_\_\_\_\_

**Change on ownership:** The owner(s) of the stormwater management systems, with the exception of those associated with two-family dwellings, shall notify the Department of Public Works and Conservation Commission of changes in ownership or assignment of financial responsibility.

This plan is valid in perpetuity and any future property owners are solely responsible for the management of the stormwater system on-site in accordance with this O&M Plan.

## Operations & Maintenance

The following operations and maintenance plan has been developed in order to preserve the drainage infrastructure that will be constructed and to ensure the drainage and infiltration system continues to function as designed.

- **Before & During Construction Operation and Maintenance Plan:**

- Significant efforts shall be made to only disturb the minimum amount of area necessary to reduce potential erosion and sediment runoff. The control of dust in disturbed areas shall consist of at the least, wetting of disturbed soil or application of calcium chloride as required to minimize airborne dust.
- A stabilized construction entrance shall be installed to reduce the tracking of material onto the main road, &, if necessary, a wheel wash station put in place.
- Hay wattles shall be installed per the site plan to prevent sediment from being washed off site.
- All drainage structures shall be protected by filter fabric (or approved equal) to prevent sedimentation from entering the drainage system during the construction period.
- Driveway, pavement, and roadway (if required) areas shall be swept to remove sediments prior to introduction into the storm water management system.
- Drainage structures shall be inspected daily and cleaned as necessary of all sedimentation and construction materials during the construction period.
- The contractor is required to contact the engineer of record for drainage system inspection at least 72 hours prior to backfilling in order to receive inspection signoff.

- **Post Construction Operation and Maintenance Plan**

Once the construction is completed, it is the owner's responsibility to maintain the items outlined below to ensure the efficiency and integrity of the drainage systems. The post construction inspections shall take place at a minimum of once during the Spring (March-May), and a minimum of once during the fall (September – November) and after every major storm.

- **Pipes** shall be inspected on a minimum on a semi-annual basis. These inspections shall take place during the spring and fall months of the year. The inspector shall take note of any debris/sediment/clogging and shall document the condition of each structure. Based upon the observed condition, the inspector shall make recommendations if any further action is required.
- **All drainage structures, including manholes trench drains, area drains, cleanouts and catch basins**, shall be inspected four times per year and shall be cleaned of all sand, debris, and sediment four times per year or whenever the depth of deposits is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe in the basin.
- **Roof Gutters** shall be inspected annually and after major rain events. Remove leaves and sediment as necessary to allow rainwater to flow to system.

- **Storm-tech DC-780 Maintenance procedures:**
  - Storm-tech system shall be inspected at a minimum on a semi-annual basis, or after a major storm event.
  - Remove lid and cap from inspection ports which must be brought to finished grade.
  - Using a flashlight and stadia rod, measure the depth of sediment
  - If sediment is above 3” depth, then cleaning is required
  - A licensed professional shall provide cleanout/ flushing services of all sediment and debris via cleanouts and catch basins located per plans.
  - All caps and covers shall be replaced
- **Pump Station.**
  - **Maintenance Requirements:** The pump station will be inspected twice a year to determine if maintenance is required. In general, the inspections will follow the Inspection Checklist found in Attachment A, which include the following:
    - Check for unusual sounds from the pumps.
    - Check pump station control panel and indicator lights.
    - Check for float switch entanglement in the pump station.
    - Check for excessive movement of check valve arm on pump discharge header piping.
    - Check for leakage around pipe connection flanges/joints and valves and pump station walls.
    - Check for excessive sediment, debris, and/or trash within the box culvert and/or sump.
  - Maintenance of the pump station will occur as needed to ensure the pump station is performing properly. Additionally, **annual** maintenance of the pumps will be conducted, including:
    - Remove pumps from pump station and check motor bearings and seals per manufactures recommendations.
    - Check/lube pump and motor per manufactures recommendations.
    - Check bearing temperature.
    - Check shaft coupling.
    - Check shaft sleeve and oil seal.
    - Check stator housing, impeller, and zinc anodes.
    - Clean, wire brush corroded areas, and spot paint, as needed.

### **Other Activities:**

**Pavement Sweeping:** The paved areas shall be swept every quarter, so four (4) times per year.

**Lawn and Landscape Repairs:** The lawn and landscaped areas on the site shall be inspected in the spring and fall of each year and the areas shall be restabilized as needed by seeding as lawn or mulching landscaped areas.

An INSPECTION LOG example format is shown below on Table B.1. This must be filled every time an inspection or maintenance activity is performed on any element of the stormwater management on site, included but not limited to:

- Pretreatment devices.

11 PARSONS STREET, NEWTON, MA.

- Vegetation or filter media.
- Control structures.
- Embankments and slopes.
- Inlet and outlet channels and structures.
- Underground drainage.
- Sediment and debris accumulation in storage and forebay areas (including catch basins).
- Any nonstructural practices.
- Any other item that could affect the proper function of the stormwater management system

**FINAL IMPORTANT NOTES:**

- **PROVISIONS MUST EXIST ALLOWING THE CITY OF NEWTON OR ITS DESIGNEE TO ENTER THE PROPERTY AT REASONABLE TIMES AND IN A REASONABLE MANNER FOR THE PURPOSE OF INSPECTION.**
- **ANNUAL INSPECTION LOGS SHALL BE SUBMITTED TO THE DPW ENGINEERING DIVISION AS REQUIRED TO MAINTAIN CERTIFICATION OF COMPLIANCE UNDER NEWTON'S NPDES MS4 PERMIT.**

---

PROPERTY OWNER

## **ATTACHMENT A. LOG SHEET AND TABLES**

**OPERATION & MAINTENANCE PLAN  
LOG SHEET  
11 PARSONS ST., NEWTON, MA**

**INSPECTION REPORT:**

Inspection Firm: \_\_\_\_\_

Inspector's Name: \_\_\_\_\_ Date: \_\_\_\_\_

Components Inspected: \_\_\_\_\_

Signed: \_\_\_\_\_

**SYSTEM MAINTENANCE:**

Maintenance Firm: \_\_\_\_\_ Date: \_\_\_\_\_

Catch Basin Cleaned: Yes \_\_\_ No \_\_\_ Comments: \_\_\_\_\_  
\_\_\_\_\_

Manhole & Sumps Cleaned: Yes \_\_\_ No \_\_\_ Comments: \_\_\_\_\_  
\_\_\_\_\_

Drain Lines Inspected: Yes \_\_\_ No \_\_\_ Comments: \_\_\_\_\_  
\_\_\_\_\_

Stormwater unit System Cleaned: Yes \_\_\_ No \_\_\_ Comments: \_\_\_\_\_  
\_\_\_\_\_

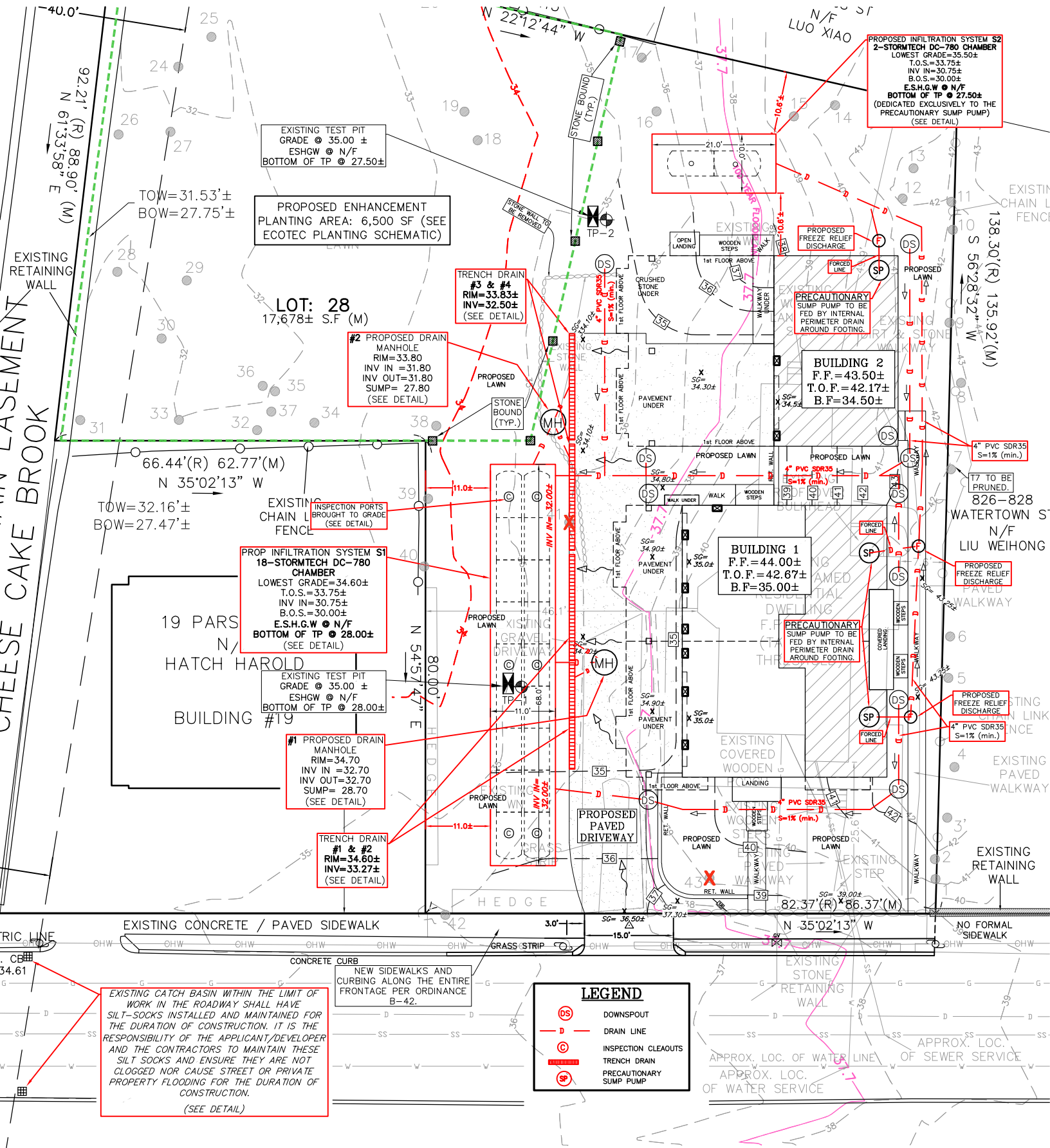
Estimate of Material Removed: \_\_\_\_\_

Other Comments: \_\_\_\_\_

Signed: \_\_\_\_\_



## **ATTACHMENT B. BMP MAP**



# BMP PLAN

**Appendix D**  
**Precipitation Frequency Estimates for Newton (NOAA Atlas 14 Volume 10 V3)**

11 PARSONS STREET, NEWTON, MA.

**NOAA Atlas 14, Volume 10, Version 3**  
**Location name: Newton Center, Massachusetts,**  
**USA\***



**Latitude: 42.3385°, Longitude: -71.2071°**

**Elevation: 96 ft\*\***

\* source: ESRI Maps

\*\* source: USGS



**POINT PRECIPITATION FREQUENCY ESTIMATES**

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

NOAA, National Weather Service, Silver Spring, Maryland

[PF tabular](#) | [PF graphical](#) | [Maps & aerials](#)

**PF tabular**

<b>PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)<sup>1</sup></b>										
<b>Duration</b>	<b>Average recurrence interval (years)</b>									
	<b>1</b>	<b>2</b>	<b>5</b>	<b>10</b>	<b>25</b>	<b>50</b>	<b>100</b>	<b>200</b>	<b>500</b>	<b>1000</b>
<b>5-min</b>	<b>0.302</b> (0.239-0.383)	<b>0.373</b> (0.294-0.473)	<b>0.489</b> (0.384-0.623)	<b>0.585</b> (0.457-0.750)	<b>0.717</b> (0.542-0.968)	<b>0.816</b> (0.604-1.13)	<b>0.921</b> (0.662-1.33)	<b>1.04</b> (0.705-1.54)	<b>1.23</b> (0.795-1.88)	<b>1.38</b> (0.872-2.16)
<b>10-min</b>	<b>0.428</b> (0.338-0.543)	<b>0.529</b> (0.417-0.671)	<b>0.693</b> (0.544-0.882)	<b>0.829</b> (0.647-1.06)	<b>1.02</b> (0.768-1.37)	<b>1.16</b> (0.856-1.60)	<b>1.30</b> (0.938-1.89)	<b>1.48</b> (0.999-2.18)	<b>1.74</b> (1.12-2.66)	<b>1.95</b> (1.24-3.06)
<b>15-min</b>	<b>0.504</b> (0.398-0.638)	<b>0.622</b> (0.490-0.789)	<b>0.815</b> (0.640-1.04)	<b>0.975</b> (0.762-1.25)	<b>1.20</b> (0.903-1.61)	<b>1.36</b> (1.01-1.88)	<b>1.54</b> (1.10-2.22)	<b>1.74</b> (1.18-2.57)	<b>2.04</b> (1.32-3.13)	<b>2.30</b> (1.45-3.60)
<b>30-min</b>	<b>0.687</b> (0.543-0.871)	<b>0.849</b> (0.669-1.08)	<b>1.11</b> (0.875-1.42)	<b>1.33</b> (1.04-1.71)	<b>1.63</b> (1.23-2.21)	<b>1.86</b> (1.38-2.57)	<b>2.10</b> (1.51-3.04)	<b>2.38</b> (1.61-3.52)	<b>2.81</b> (1.82-4.31)	<b>3.18</b> (2.01-4.97)
<b>60-min</b>	<b>0.871</b> (0.688-1.10)	<b>1.08</b> (0.848-1.36)	<b>1.41</b> (1.11-1.79)	<b>1.69</b> (1.32-2.16)	<b>2.07</b> (1.57-2.80)	<b>2.35</b> (1.74-3.26)	<b>2.66</b> (1.92-3.86)	<b>3.02</b> (2.04-4.46)	<b>3.58</b> (2.32-5.49)	<b>4.06</b> (2.57-6.35)
<b>2-hr</b>	<b>1.13</b> (0.900-1.43)	<b>1.40</b> (1.11-1.76)	<b>1.84</b> (1.45-2.32)	<b>2.20</b> (1.73-2.80)	<b>2.70</b> (2.06-3.63)	<b>3.07</b> (2.29-4.24)	<b>3.47</b> (2.53-5.03)	<b>3.97</b> (2.69-5.81)	<b>4.75</b> (3.09-7.22)	<b>5.43</b> (3.45-8.42)
<b>3-hr</b>	<b>1.32</b> (1.05-1.66)	<b>1.63</b> (1.30-2.05)	<b>2.14</b> (1.70-2.69)	<b>2.56</b> (2.02-3.24)	<b>3.14</b> (2.40-4.21)	<b>3.56</b> (2.67-4.91)	<b>4.03</b> (2.95-5.82)	<b>4.62</b> (3.13-6.72)	<b>5.54</b> (3.61-8.38)	<b>6.35</b> (4.04-9.79)
<b>6-hr</b>	<b>1.71</b> (1.37-2.13)	<b>2.10</b> (1.69-2.63)	<b>2.75</b> (2.20-3.44)	<b>3.28</b> (2.60-4.13)	<b>4.02</b> (3.09-5.34)	<b>4.56</b> (3.44-6.22)	<b>5.15</b> (3.78-7.37)	<b>5.89</b> (4.02-8.50)	<b>7.06</b> (4.61-10.6)	<b>8.07</b> (5.15-12.3)
<b>12-hr</b>	<b>2.18</b> (1.76-2.70)	<b>2.68</b> (2.16-3.32)	<b>3.48</b> (2.80-4.33)	<b>4.15</b> (3.32-5.19)	<b>5.07</b> (3.92-6.69)	<b>5.75</b> (4.36-7.78)	<b>6.49</b> (4.78-9.19)	<b>7.40</b> (5.07-10.6)	<b>8.81</b> (5.78-13.1)	<b>10.0</b> (6.42-15.2)
<b>24-hr</b>	<b>2.63</b> (2.14-3.23)	<b>3.26</b> (2.65-4.01)	<b>4.28</b> (3.46-5.29)	<b>5.13</b> (4.13-6.37)	<b>6.30</b> (4.90-8.26)	<b>7.16</b> (5.46-9.63)	<b>8.10</b> (6.01-11.4)	<b>9.28</b> (6.38-13.2)	<b>11.1</b> (7.31-16.3)	<b>12.7</b> (8.15-19.0)
<b>2-day</b>	<b>3.01</b> (2.46-3.67)	<b>3.79</b> (3.10-4.63)	<b>5.08</b> (4.14-6.23)	<b>6.14</b> (4.97-7.58)	<b>7.61</b> (5.96-9.93)	<b>8.68</b> (6.67-11.6)	<b>9.87</b> (7.40-13.9)	<b>11.4</b> (7.86-16.0)	<b>13.9</b> (9.16-20.2)	<b>16.1</b> (10.3-23.8)
<b>3-day</b>	<b>3.30</b> (2.71-4.02)	<b>4.15</b> (3.41-5.05)	<b>5.54</b> (4.53-6.77)	<b>6.69</b> (5.44-8.22)	<b>8.28</b> (6.52-10.8)	<b>9.44</b> (7.28-12.6)	<b>10.7</b> (8.07-15.0)	<b>12.4</b> (8.57-17.3)	<b>15.1</b> (10.0-21.9)	<b>17.5</b> (11.3-25.9)
<b>4-day</b>	<b>3.58</b> (2.95-4.34)	<b>4.46</b> (3.67-5.41)	<b>5.90</b> (4.83-7.18)	<b>7.09</b> (5.77-8.68)	<b>8.73</b> (6.89-11.3)	<b>9.93</b> (7.68-13.2)	<b>11.3</b> (8.49-15.7)	<b>13.0</b> (9.00-18.1)	<b>15.8</b> (10.5-22.8)	<b>18.3</b> (11.8-26.9)
<b>7-day</b>	<b>4.33</b> (3.59-5.22)	<b>5.25</b> (4.34-6.34)	<b>6.75</b> (5.56-8.17)	<b>7.99</b> (6.54-9.73)	<b>9.70</b> (7.68-12.5)	<b>10.9</b> (8.49-14.4)	<b>12.3</b> (9.32-17.0)	<b>14.1</b> (9.82-19.5)	<b>17.0</b> (11.3-24.3)	<b>19.6</b> (12.7-28.5)
<b>10-day</b>	<b>5.03</b> (4.18-6.04)	<b>5.97</b> (4.96-7.18)	<b>7.51</b> (6.21-9.06)	<b>8.78</b> (7.21-10.7)	<b>10.5</b> (8.36-13.4)	<b>11.8</b> (9.18-15.4)	<b>13.2</b> (9.98-18.1)	<b>15.0</b> (10.5-20.7)	<b>17.9</b> (11.9-25.4)	<b>20.4</b> (13.2-29.5)
<b>20-day</b>	<b>7.05</b> (5.90-8.42)	<b>8.07</b> (6.74-9.63)	<b>9.73</b> (8.10-11.7)	<b>11.1</b> (9.18-13.4)	<b>13.0</b> (10.3-16.3)	<b>14.4</b> (11.2-18.5)	<b>15.9</b> (11.9-21.2)	<b>17.6</b> (12.4-23.9)	<b>20.1</b> (13.5-28.3)	<b>22.2</b> (14.4-31.8)
<b>30-day</b>	<b>8.72</b> (7.33-10.4)	<b>9.79</b> (8.22-11.6)	<b>11.5</b> (9.64-13.8)	<b>13.0</b> (10.8-15.6)	<b>15.0</b> (11.9-18.7)	<b>16.5</b> (12.8-21.0)	<b>18.1</b> (13.5-23.7)	<b>19.7</b> (13.9-26.6)	<b>22.0</b> (14.8-30.6)	<b>23.7</b> (15.4-33.8)
<b>45-day</b>	<b>10.8</b> (9.11-12.8)	<b>11.9</b> (10.1-14.1)	<b>13.8</b> (11.6-16.4)	<b>15.3</b> (12.8-18.3)	<b>17.4</b> (13.9-21.5)	<b>19.1</b> (14.8-24.0)	<b>20.7</b> (15.4-26.7)	<b>22.3</b> (15.7-29.8)	<b>24.2</b> (16.4-33.6)	<b>25.7</b> (16.8-36.4)
<b>60-day</b>	<b>12.5</b> (10.6-14.8)	<b>13.7</b> (11.6-16.2)	<b>15.6</b> (13.2-18.5)	<b>17.2</b> (14.4-20.5)	<b>19.4</b> (15.5-23.9)	<b>21.2</b> (16.4-26.4)	<b>22.8</b> (16.9-29.2)	<b>24.3</b> (17.3-32.5)	<b>26.2</b> (17.7-36.2)	<b>27.5</b> (18.0-38.7)

<sup>1</sup> Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

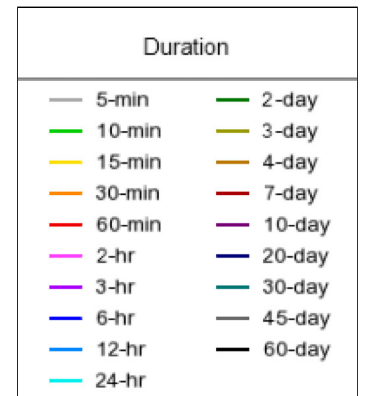
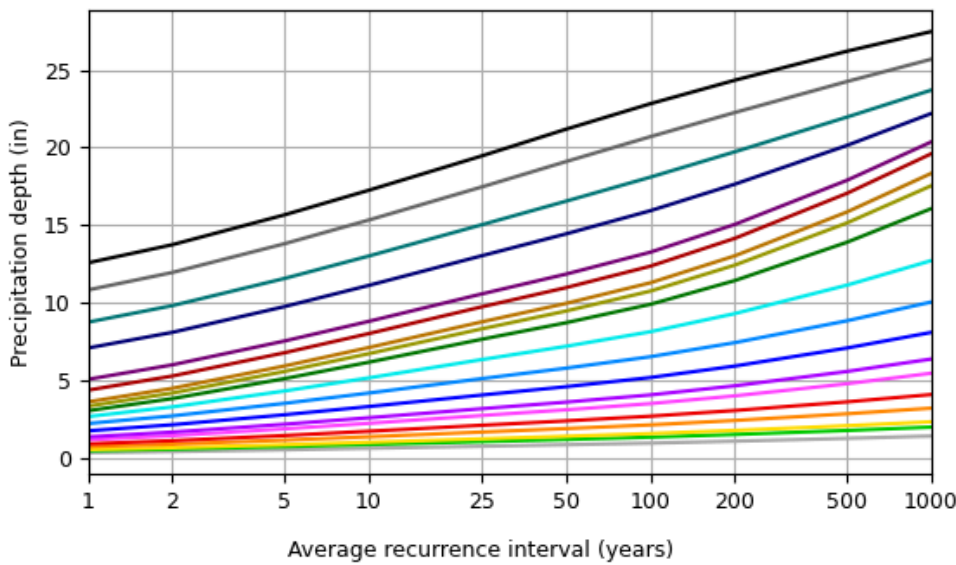
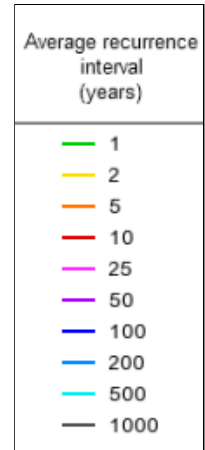
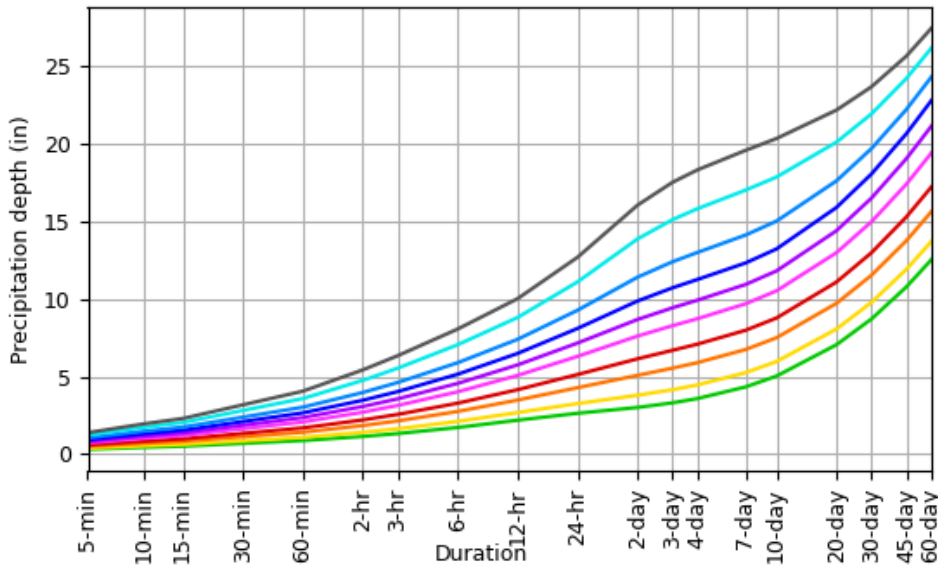
Please refer to NOAA Atlas 14 document for more information.

[Back to Top](#)

**PF graphical**

11 PARSONS STREET, NEWTON, MA.

### PDS-based depth-duration-frequency (DDF) curves Latitude: 42.3385°, Longitude: -71.2071°

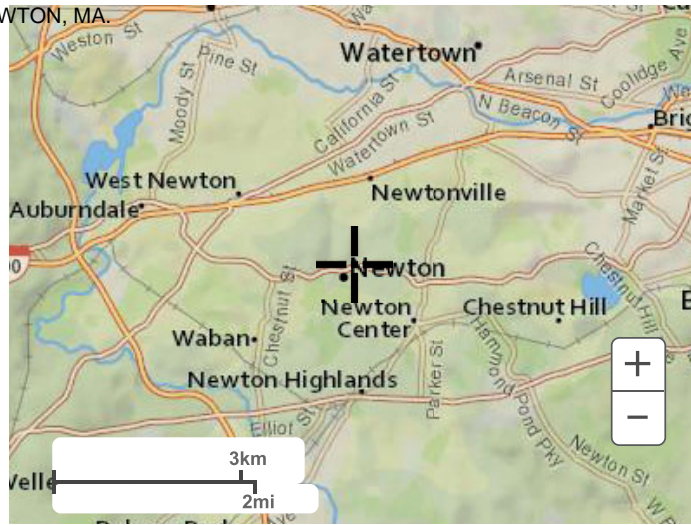


[Back to Top](#)

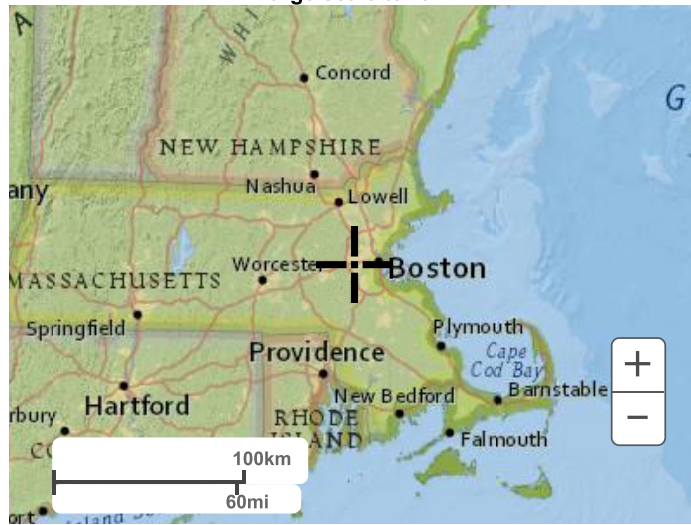
## Maps & aerials

Small scale terrain

11 PARSONS STREET, NEWTON, MA.



Large scale terrain

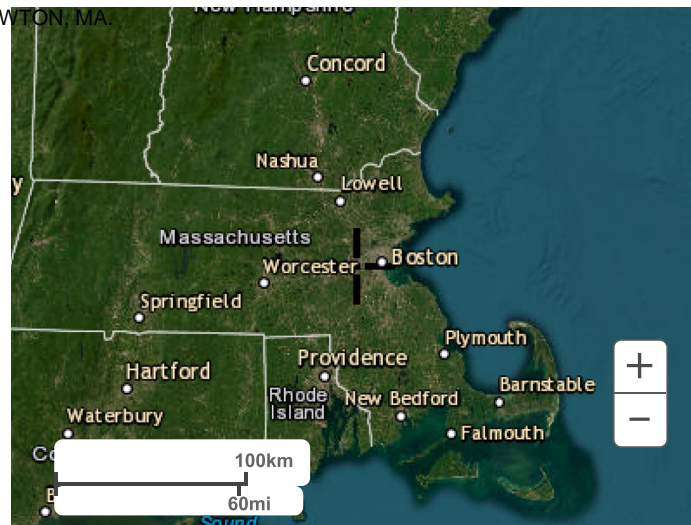


Large scale map



Large scale aerial

11 PARSONS STREET, NEWTON, MA.



[Back to Top](#)

---

[US Department of Commerce](#)  
[National Oceanic and Atmospheric Administration](#)  
[National Weather Service](#)  
[National Water Center](#)  
1325 East West Highway  
Silver Spring, MD 20910  
Questions?: [HDSC.Questions@noaa.gov](mailto:HDSC.Questions@noaa.gov)

[Disclaimer](#)