

February 19, 2013

Matt Nazar, Planner  
Susan Redmond, Assistant Planner  
Augusta Planning Board  
City Center Plaza  
16 Cony Road  
Augusta, Maine 04330



Re: CARA/Lacrosse Field stormwater analysis

Dear Matt/Susan,

CARA is proposing to construct a 57 space gravel parking lot along the existing grassed playfield area of the Lacrosse complex. Drainage from the parking lot is designed to flow into a proposed filter pond downslope from the parking area. The filter pond will provide detention for the expected increase in permeability (grass to gravel land use) and also provide required water quality enhancements by filtering through the ponds filtering media prior to discharge into the adjacent stream. It is anticipated that this projects' site infrastructure will be constructed during this 2013 construction season.

#### **Existing Site Conditions**

The site proposed for new parking lot construction is currently grassed playfield area. The topography of the proposed developed site is shown at a one-half foot contour interval as surveyed by a physical topographic survey. The slope of the property varies from 1% along the flatter areas to 5% along the steeper slopes adjacent to the stream.

#### **Adjacent Areas**

Adjacent areas and land uses are similar in nature to that being proposed. The area currently supports playing field activities and parking lots. The northern portion of the site abuts residential

housing. The western portion of the site is undeveloped woods.

### Stormwater Analysis

We have plainmetered the existing condition land use area, which consists of a grassed surface. The predevelopment condition total is 34,600 square feet. We have calculated existing runoff rates for the 2/10/25 year storm events to be 0.66/1.45/1.89 cfs.

We have performed a similar calculation for the proposed condition. We have plainmetered the proposed condition land use area, which consists of 17,600 sf of gravel parking, 12,000 sf of grass cover, and 5,000 sf filter media/grass surface. The post development condition total is 34,600 square feet. We have calculated proposed runoff rates for the 2/10/25 year storm events to be 0.28/0.71/0.95 cfs, which is approximately half of the existing flow rate. There should be no downstream impacts from this project.

### Water quality

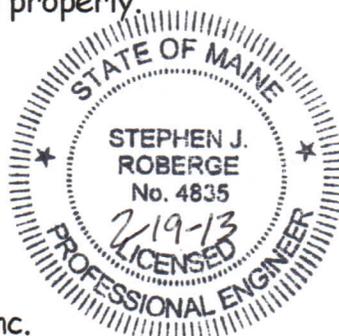
We have provided calculations depicting the required sizing for the filter pond treatment area. A filter pond treatment facility will enhance the water quality of a watershed area by infiltrating water through a filter media and granular envelope and capturing this water in underdrains located under the pond prior to discharge. As can be seen from those calculations, this filter pond greatly exceeds the minimum requirements for treatment.

Please feel free to contact me if you have any questions concerning the calculations of stormwater from this project. It is important to note that proper erosion control and revegetation of disturbed areas is essential for the proper operation of the stormwater facilities. Maintenance of the field areas and careful attention to the cleanliness of the parking area must be a top priority in order for the system to function properly.

Sincerely yours,



Stephen Roberge, PE  
for SJR Engineering Inc.







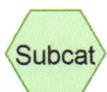
Existing Lacrosse Field



New Parking area to  
filter pond



Filter Pond



# Lacrosse field ExistingProposed conditions

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## Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.115	39	>75% Grass cover, Good, HSG A (2S)
1.070	74	>75% Grass cover, Good, HSG C (1S,2S)
0.404	76	Gravel parking, HSG A (2S)
<b>1.589</b>		<b>TOTAL AREA</b>

# Lacrosse field ExistingProposed conditions

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## Soil Listing (all nodes)

Area (acres)	Soil Goup	Subcatchment Numbers
0.519	HSG A	2S
0.000	HSG B	
1.070	HSG C	1S, 2S
0.000	HSG D	
0.000	Other	
<b>1.589</b>		<b>TOTAL AREA</b>

**Lacrosse field ExistingProposed condition Type III 24-hr 2 Year Storm Event Rainfall=3.00"**

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points

Runoff by SCS TR-20 method, UH=SCS

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

**Subcatchment 1S: Existing Lacrosse Field** Runoff Area=34,600 sf 0.00% Impervious Runoff Depth>0.82"  
Flow Length=180' Slope=0.0500 '/ Tc=11.2 min CN=74 Runoff=0.66 cfs 0.055 af

**Subcatchment 2S: New Parking area to filter** Runoff Area=34,600 sf 0.00% Impervious Runoff Depth>0.63"  
Flow Length=280' Tc=40.1 min CN=70 Runoff=0.28 cfs 0.042 af

**Pond 3P: Filter Pond** Peak Elev=0.01' Storage=73 cf Inflow=0.28 cfs 0.042 af  
Discarded=0.28 cfs 0.042 af Primary=0.00 cfs 0.000 af Outflow=0.28 cfs 0.042 af

**Total Runoff Area = 1.589 ac Runoff Volume = 0.096 af Average Runoff Depth = 0.73"**  
**100.00% Pervious = 1.589 ac 0.00% Impervious = 0.000 ac**

**Summary for Subcatchment 1S: Existing Lacrosse Field**

Runoff = 0.66 cfs @ 12.17 hrs, Volume= 0.055 af, Depth> 0.82"

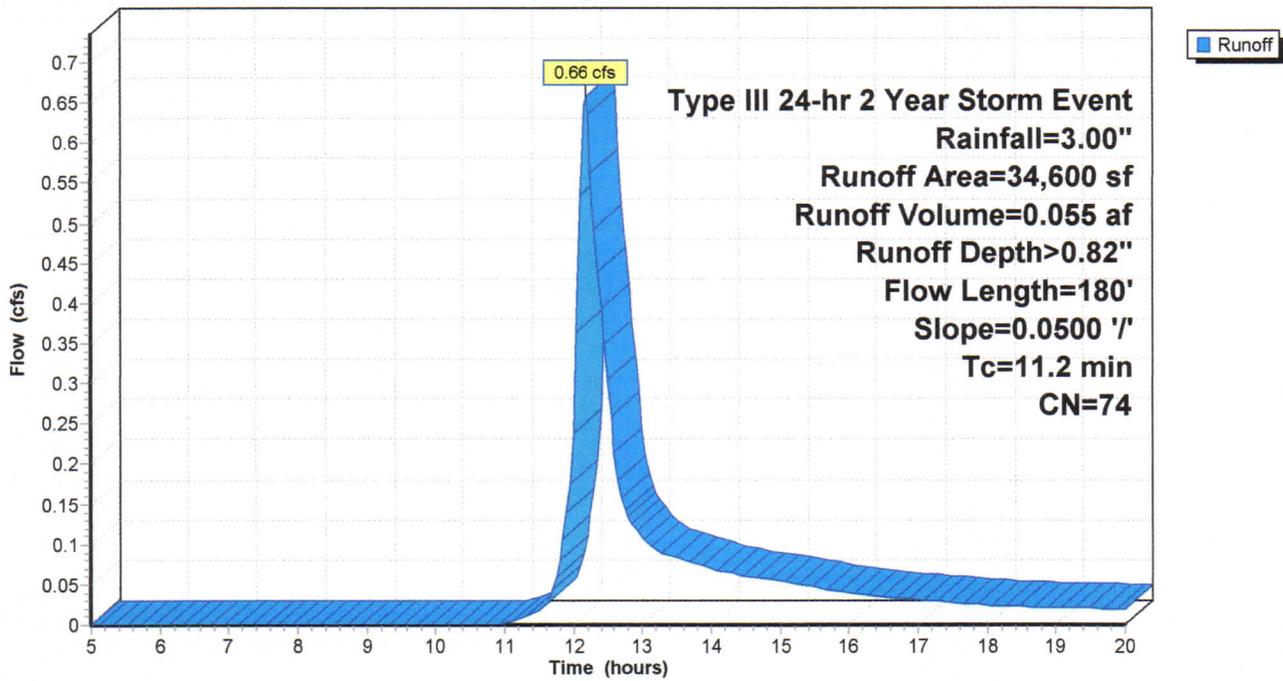
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 Type III 24-hr 2 Year Storm Event Rainfall=3.00"

Area (sf)	CN	Description
34,600	74	>75% Grass cover, Good, HSG C
34,600		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	180	0.0500	0.27		Sheet Flow, Grass: Short n= 0.150 P2= 3.00"

**Subcatchment 1S: Existing Lacrosse Field**

Hydrograph



**Summary for Subcatchment 2S: New Parking area to filter pond**

Runoff = 0.28 cfs @ 12.63 hrs, Volume= 0.042 af, Depth> 0.63"

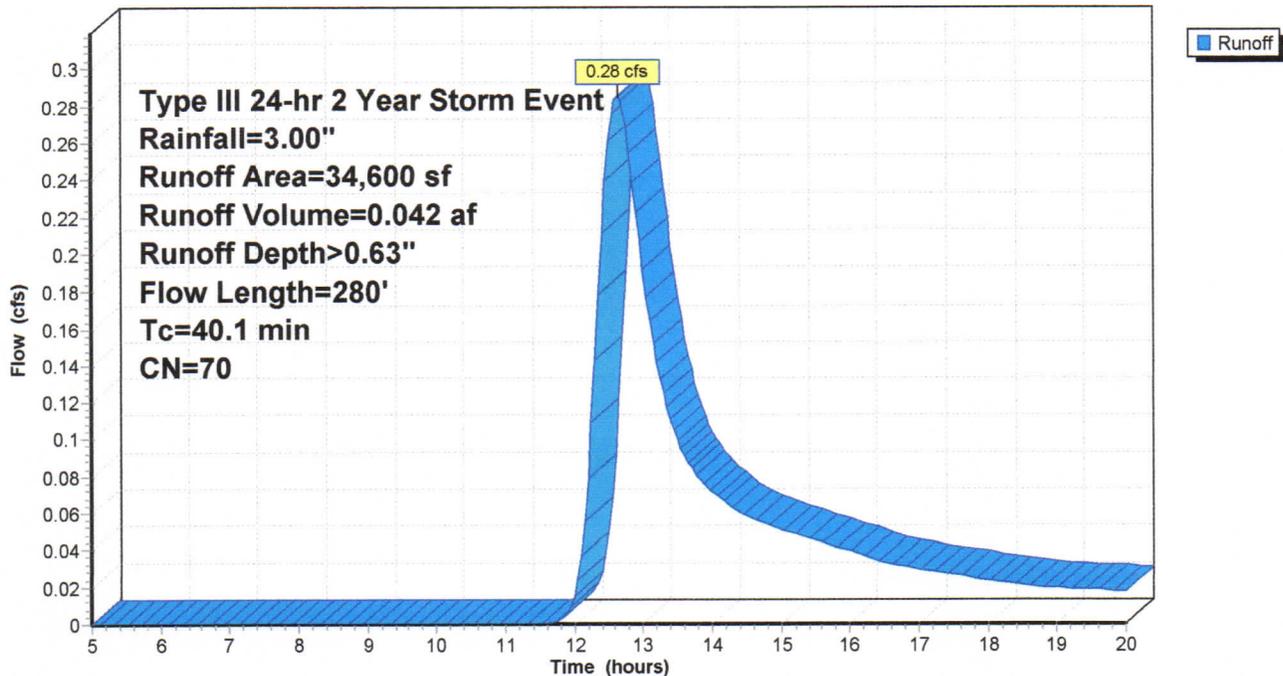
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 Type III 24-hr 2 Year Storm Event Rainfall=3.00"

Area (sf)	CN	Description
* 17,600	76	Gravel parking, HSG A
12,000	74	>75% Grass cover, Good, HSG C
5,000	39	>75% Grass cover, Good, HSG A
34,600	70	Weighted Average
34,600		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.4	100	0.0100	0.12		Sheet Flow, Grass: Short n= 0.150 P2= 3.00"
1.0	80	0.0200	1.27		Sheet Flow, Smooth surfaces n= 0.011 P2= 3.00"
25.7	100	0.0050	0.06		Sheet Flow, Grass: Dense n= 0.240 P2= 3.00"
40.1	280	Total			

**Subcatchment 2S: New Parking area to filter pond**

Hydrograph



**Summary for Pond 3P: Filter Pond**

Inflow Area = 0.794 ac, 0.00% Impervious, Inflow Depth > 0.63" for 2 Year Storm Event event  
 Inflow = 0.28 cfs @ 12.63 hrs, Volume= 0.042 af  
 Outflow = 0.28 cfs @ 12.71 hrs, Volume= 0.042 af, Atten= 2%, Lag= 4.5 min  
 Discarded = 0.28 cfs @ 12.71 hrs, Volume= 0.042 af  
 Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 Peak Elev= 0.01' @ 12.71 hrs Surf.Area= 5,005 sf Storage= 73 cf

Plug-Flow detention time=4.4 min calculated for 0.042 af (99% of inflow)  
 Center-of-Mass det. time= 3.5 min ( 860.6 - 857.2 )

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	7,875 cf	<b>Custom Stage Data (Prismatic) Listed below (Recalc)</b>
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
0.00	5,000	0	0
1.50	5,500	7,875	7,875

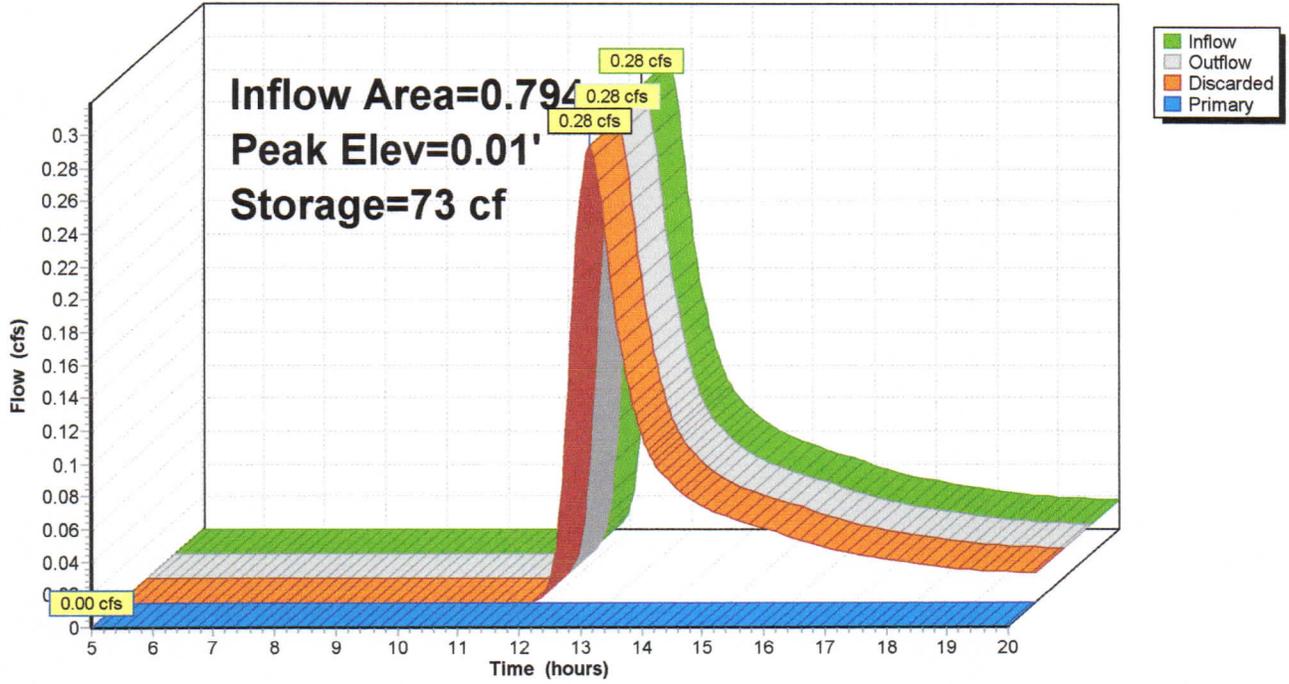
Device	Routing	Invert	Outlet Devices
#1	Primary	1.50'	<b>10.0' long x 6.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83
#2	Discarded	0.00'	<b>2.470 in/hr Exfiltration over Surface area</b>

**Discarded OutFlow** Max=0.29 cfs @ 12.71 hrs HW=0.01' (Free Discharge)  
 ↑**2=Exfiltration** (Exfiltration Controls 0.29 cfs)

**Primary OutFlow** Max=0.00 cfs @ 5.00 hrs HW=0.00' (Free Discharge)  
 ↑**1=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

### Pond 3P: Filter Pond

Hydrograph



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points  
Runoff by SCS TR-20 method, UH=SCS  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment 1S: Existing Lacrosse Field** Runoff Area=34,600 sf 0.00% Impervious Runoff Depth>1.75"  
Flow Length=180' Slope=0.0500 '/ Tc=11.2 min CN=74 Runoff=1.45 cfs 0.116 af

**Subcatchment 2S: New Parking area to filter** Runoff Area=34,600 sf 0.00% Impervious Runoff Depth>1.45"  
Flow Length=280' Tc=40.1 min CN=70 Runoff=0.71 cfs 0.096 af

**Pond 3P: Filter Pond** Peak Elev=0.19' Storage=935 cf Inflow=0.71 cfs 0.096 af  
Discarded=0.29 cfs 0.096 af Primary=0.00 cfs 0.000 af Outflow=0.29 cfs 0.096 af

**Total Runoff Area = 1.589 ac Runoff Volume = 0.211 af Average Runoff Depth = 1.60"**  
**100.00% Pervious = 1.589 ac 0.00% Impervious = 0.000 ac**

**Summary for Subcatchment 1S: Existing Lacrosse Field**

Runoff = 1.45 cfs @ 12.16 hrs, Volume= 0.116 af, Depth> 1.75"

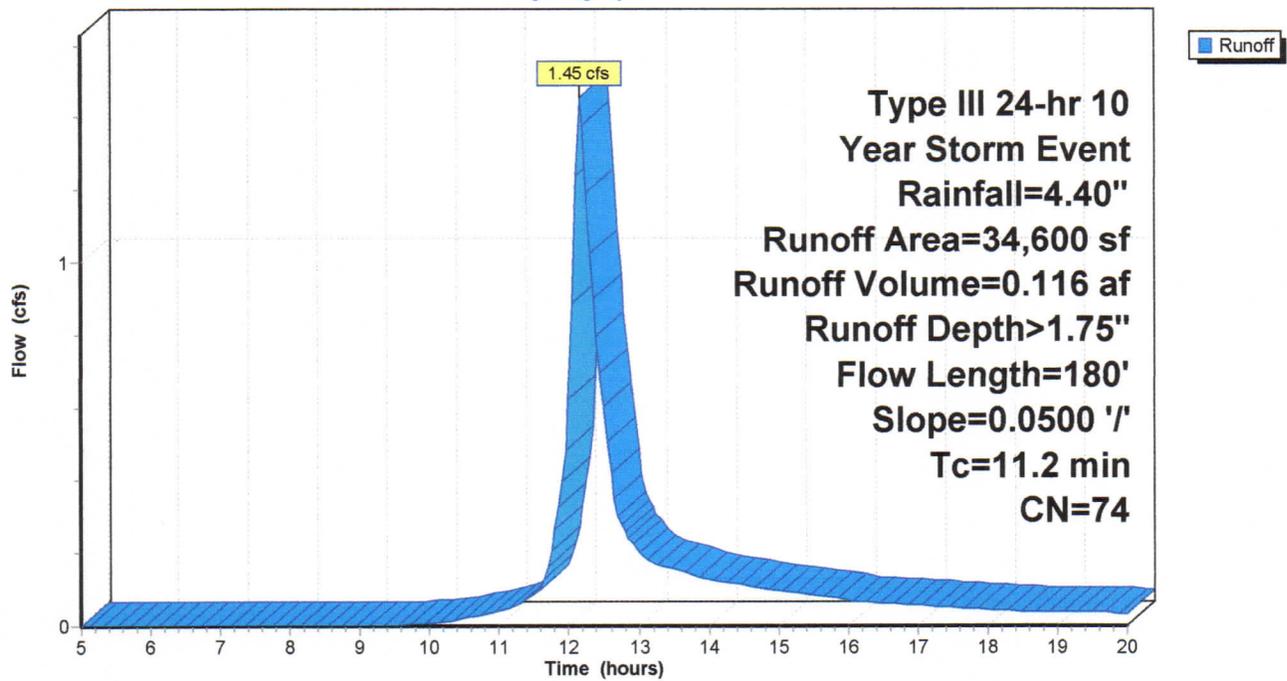
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 Type III 24-hr 10 Year Storm Event Rainfall=4.40"

Area (sf)	CN	Description
34,600	74	>75% Grass cover, Good, HSG C
34,600		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	180	0.0500	0.27		Sheet Flow, Grass: Short n= 0.150 P2= 3.00"

**Subcatchment 1S: Existing Lacrosse Field**

Hydrograph



**Summary for Subcatchment 2S: New Parking area to filter pond**

Runoff = 0.71 cfs @ 12.59 hrs, Volume= 0.096 af, Depth> 1.45"

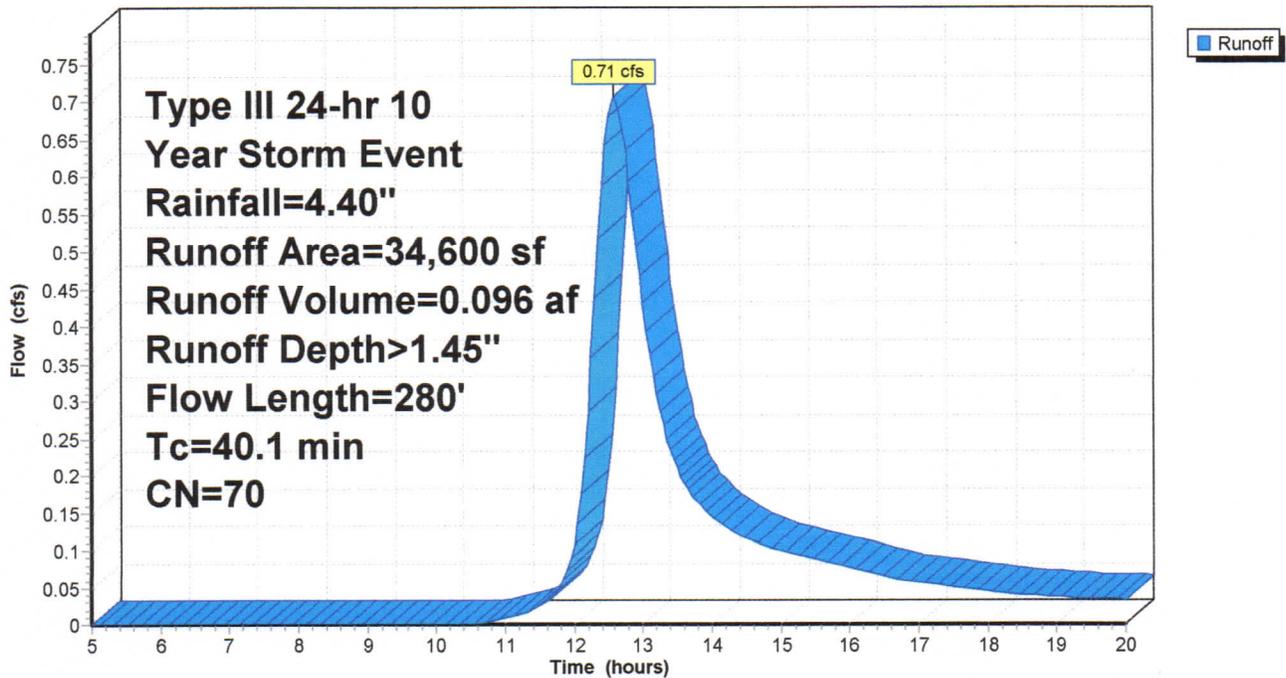
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 Type III 24-hr 10 Year Storm Event Rainfall=4.40"

Area (sf)	CN	Description
* 17,600	76	Gravel parking, HSG A
12,000	74	>75% Grass cover, Good, HSG C
5,000	39	>75% Grass cover, Good, HSG A
34,600	70	Weighted Average
34,600		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.4	100	0.0100	0.12		Sheet Flow, Grass: Short n= 0.150 P2= 3.00"
1.0	80	0.0200	1.27		Sheet Flow, Smooth surfaces n= 0.011 P2= 3.00"
25.7	100	0.0050	0.06		Sheet Flow, Grass: Dense n= 0.240 P2= 3.00"
40.1	280	Total			

**Subcatchment 2S: New Parking area to filter pond**

Hydrograph



**Summary for Pond 3P: Filter Pond**

Inflow Area = 0.794 ac, 0.00% Impervious, Inflow Depth > 1.45" for 10 Year Storm Event event  
 Inflow = 0.71 cfs @ 12.59 hrs, Volume= 0.096 af  
 Outflow = 0.29 cfs @ 13.24 hrs, Volume= 0.096 af, Atten= 59%, Lag= 39.2 min  
 Discarded = 0.29 cfs @ 13.24 hrs, Volume= 0.096 af  
 Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 Peak Elev= 0.19' @ 13.24 hrs Surf.Area= 5,062 sf Storage= 935 cf

Plug-Flow detention time=24.5 min calculated for 0.095 af (99% of inflow)  
 Center-of-Mass det. time= 23.7 min ( 862.6 - 838.9 )

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	7,875 cf	<b>Custom Stage Data (Prismatic) Listed below (Recalc)</b>
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
0.00	5,000	0	0
1.50	5,500	7,875	7,875

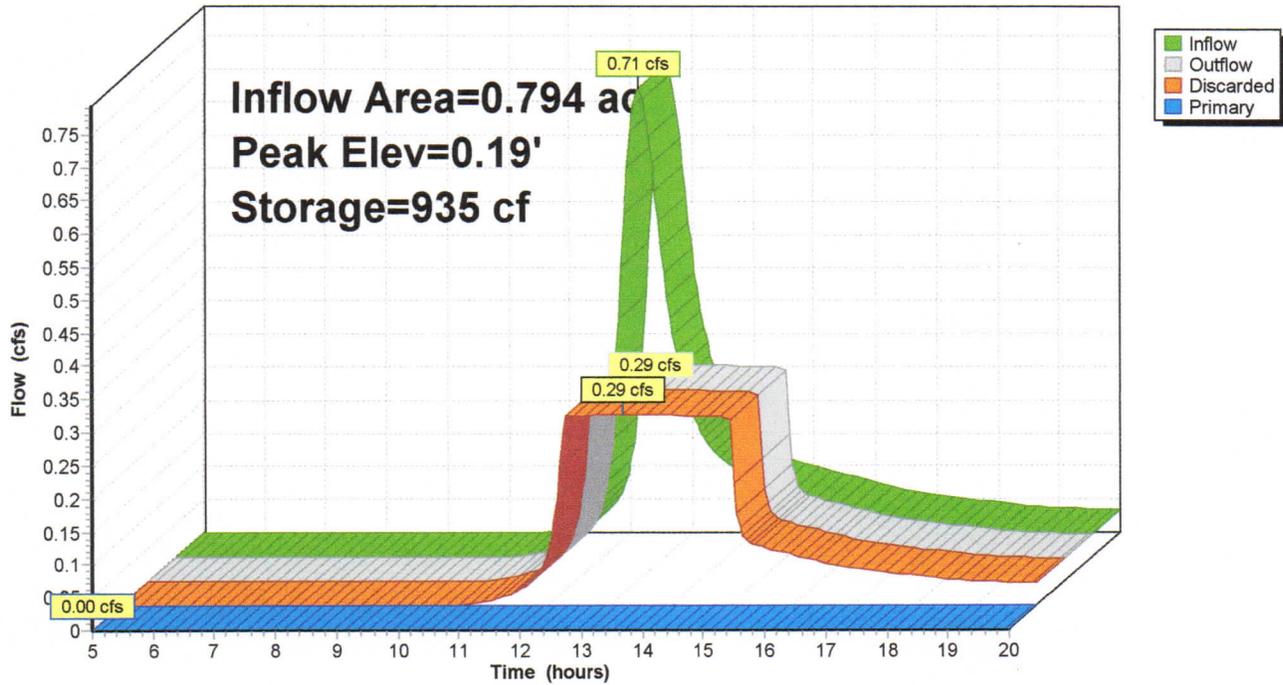
Device	Routing	Invert	Outlet Devices
#1	Primary	1.50'	<b>10.0' long x 6.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83
#2	Discarded	0.00'	<b>2.470 in/hr Exfiltration over Surface area</b>

**Discarded OutFlow** Max=0.29 cfs @ 13.24 hrs HW=0.19' (Free Discharge)  
 ↑**2=Exfiltration** (Exfiltration Controls 0.29 cfs)

**Primary OutFlow** Max=0.00 cfs @ 5.00 hrs HW=0.00' (Free Discharge)  
 ↑**1=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

### Pond 3P: Filter Pond

Hydrograph



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points

Runoff by SCS TR-20 method, UH=SCS

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

**Subcatchment 1S: Existing Lacrosse Field** Runoff Area=34,600 sf 0.00% Impervious Runoff Depth>2.26"  
Flow Length=180' Slope=0.0500 '/ Tc=11.2 min CN=74 Runoff=1.89 cfs 0.150 af

**Subcatchment 2S: New Parking area to filter** Runoff Area=34,600 sf 0.00% Impervious Runoff Depth>1.92"  
Flow Length=280' Tc=40.1 min CN=70 Runoff=0.95 cfs 0.127 af

**Pond 3P: Filter Pond** Peak Elev=0.32' Storage=1,627 cf Inflow=0.95 cfs 0.127 af  
Discarded=0.29 cfs 0.127 af Primary=0.00 cfs 0.000 af Outflow=0.29 cfs 0.127 af

**Total Runoff Area = 1.589 ac Runoff Volume = 0.277 af Average Runoff Depth = 2.09"**  
**100.00% Pervious = 1.589 ac 0.00% Impervious = 0.000 ac**

**Summary for Subcatchment 1S: Existing Lacrosse Field**

Runoff = 1.89 cfs @ 12.16 hrs, Volume= 0.150 af, Depth> 2.26"

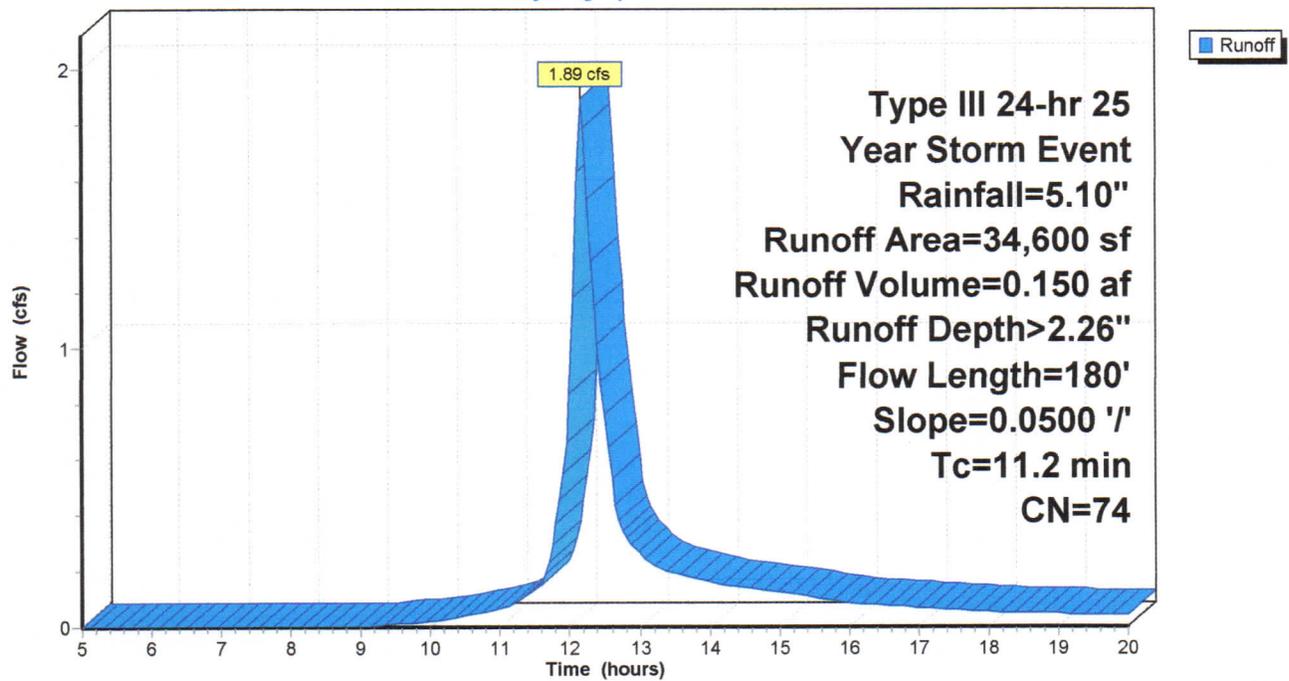
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 Type III 24-hr 25 Year Storm Event Rainfall=5.10"

Area (sf)	CN	Description
34,600	74	>75% Grass cover, Good, HSG C
34,600		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	180	0.0500	0.27		Sheet Flow, Grass: Short n= 0.150 P2= 3.00"

**Subcatchment 1S: Existing Lacrosse Field**

Hydrograph



**Summary for Subcatchment 2S: New Parking area to filter pond**

Runoff = 0.95 cfs @ 12.58 hrs, Volume= 0.127 af, Depth> 1.92"

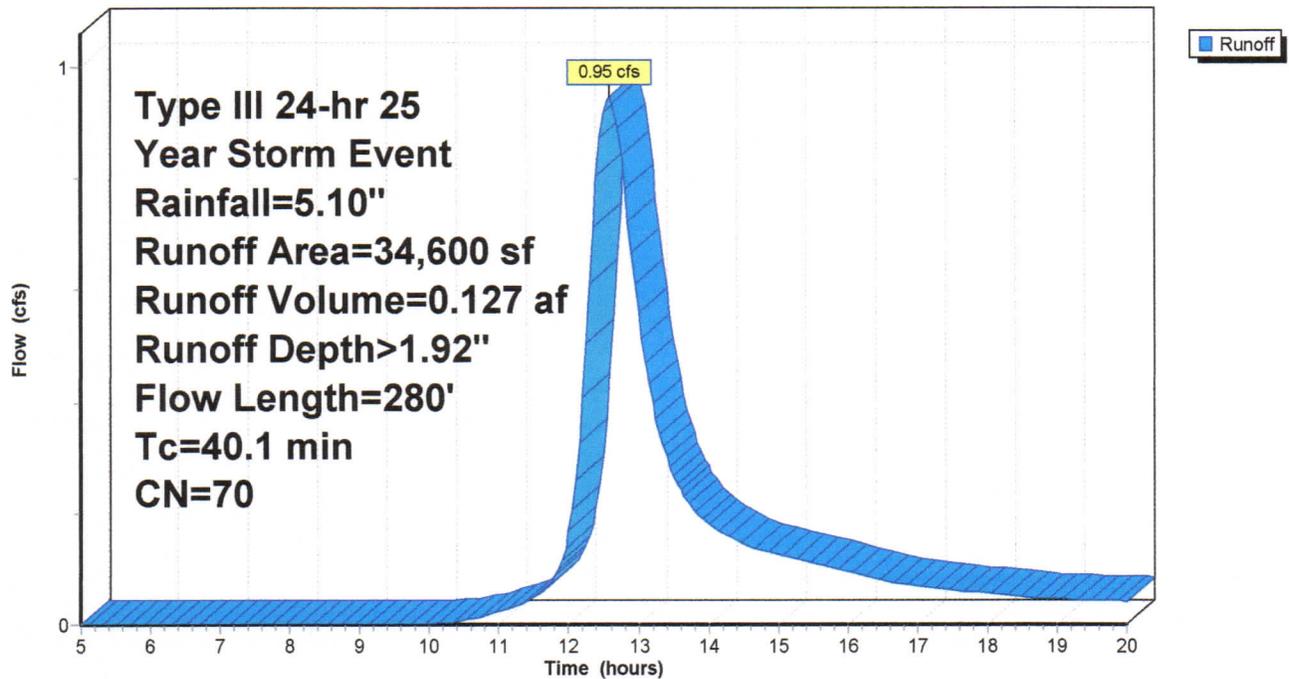
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 Type III 24-hr 25 Year Storm Event Rainfall=5.10"

Area (sf)	CN	Description
* 17,600	76	Gravel parking, HSG A
12,000	74	>75% Grass cover, Good, HSG C
5,000	39	>75% Grass cover, Good, HSG A
34,600	70	Weighted Average
34,600		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.4	100	0.0100	0.12		Sheet Flow, Grass: Short n= 0.150 P2= 3.00"
1.0	80	0.0200	1.27		Sheet Flow, Smooth surfaces n= 0.011 P2= 3.00"
25.7	100	0.0050	0.06		Sheet Flow, Grass: Dense n= 0.240 P2= 3.00"
40.1	280	Total			

**Subcatchment 2S: New Parking area to filter pond**

Hydrograph



**Summary for Pond 3P: Filter Pond**

Inflow Area = 0.794 ac, 0.00% Impervious, Inflow Depth > 1.92" for 25 Year Storm Event event  
 Inflow = 0.95 cfs @ 12.58 hrs, Volume= 0.127 af  
 Outflow = 0.29 cfs @ 13.43 hrs, Volume= 0.127 af, Atten= 69%, Lag= 50.7 min  
 Discarded = 0.29 cfs @ 13.43 hrs, Volume= 0.127 af  
 Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs  
 Peak Elev= 0.32' @ 13.43 hrs Surf.Area= 5,107 sf Storage= 1,627 cf

Plug-Flow detention time=46.3 min calculated for 0.127 af (100% of inflow)  
 Center-of-Mass det. time= 45.6 min ( 878.5 - 832.9 )

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	7,875 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
0.00	5,000	0	0
1.50	5,500	7,875	7,875

Device	Routing	Invert	Outlet Devices
#1	Primary	1.50'	<b>10.0' long x 6.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83
#2	Discarded	0.00'	<b>2.470 in/hr Exfiltration over Surface area</b>

**Discarded OutFlow** Max=0.29 cfs @ 13.43 hrs HW=0.32' (Free Discharge)  
 ↳2=Exfiltration (Exfiltration Controls 0.29 cfs)

**Primary OutFlow** Max=0.00 cfs @ 5.00 hrs HW=0.00' (Free Discharge)  
 ↳1=Broad-Crested Rectangular Weir ( Controls 0.00 cfs)

### Pond 3P: Filter Pond

#### Hydrograph

