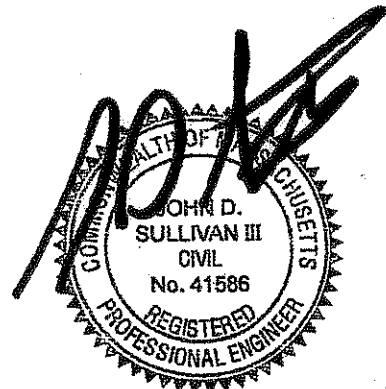


DRAINAGE ANALYSIS
For
"Our Lady of Mercy"
In
Belmont, Massachusetts

2009 AUG 18 PM 4: 04
COMMUNITY
DEVELOPMENT

August 12, 2009



8-12-09

Prepared For:

North Shore Construction & Development, Inc
215 Salem Street
Woburn, MA 01801

Project Summary – “Our Lady of Mercy” in Belmont, MA

This drainage analysis was conducted as part of the redevelopment of the Our Lady of Mercy properties located off of Belmont Street, Lawndale Street, and Oakley Road. The proposed redevelopment of these properties involve the construction of fifteen (15) townhouse units, two (2) single family houses, with associated driveways, walkways, patios, and limited site grading changes.

Overall, there is a 31.62% reduction in impervious surfaces when the properties are collectively evaluated (Existing Conditions vs. Proposed Conditions). There is a summary table provided on the proposed “Grading & Utility Plan” (sheet 5 of 20) in the plan set prepared by Sullivan Engineering Group, LLC with a revision date of August 12, 2009 detailing this reduction.

This report evaluates the predevelopment vs. postdevelopment scenario on the three separate parcels for the 100 year storm event (6.4 in/24hr).

The following is a summary of the HydroCAD results for the 100 year storm event:

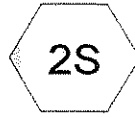
	Existing (cfs)	Postdevelopment (cfs)
Parcel A	4.33	3.70
Parcel C	1.70	0.95
Parcel D	2.13	1.66



Existing Parcel A



Total Existing Parcel A



Existing Parcel C



Total Ex. Parcel C



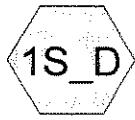
Existing Parcel D



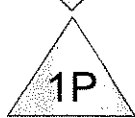
Total Existing Parcel D



Post Parcel A



Area to Drywell



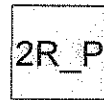
500 Gallon Drywell w/
48" stone surrounding



Total Post Parcel A



Post Parcel C



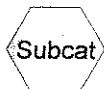
Total Post Parcel B



Post Parcel D



Total Post Parcel C



Drainage Diagram for Our Lady of Mercy

Prepared by Sullivan Engineering Group, LLC 8/12/2009
HydroCAD® 7.00 s/n 001433 © 1986-2003 Applied Microcomputer Systems

Our Lady of Mercy

Type III 24-hr 100 Yr Storm Event Rainfall=6.40"

Prepared by Sullivan Engineering Group, LLC

Page 2

HydroCAD® 7.00 s/n 001433 © 1986-2003 Applied Microcomputer Systems

8/12/2009

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 Parcel A

Runoff Area=37,419 sf Runoff Depth=4.20"
Tc=6.0 min CN=83 Runoff=4.33 cfs 0.301 af

Subcatchment 1S_D: Area to Drywell

Runoff Area=1,760 sf Runoff Depth=5.69"
Tc=5.0 min CN=98 Runoff=0.26 cfs 0.019 af

Subcatchment 1S_P: Post Parcel A

Runoff Area=35,659 sf Runoff Depth=3.68"
Tc=6.0 min CN=78 Runoff=3.69 cfs 0.251 af

Subcatchment 2S: Existing Parcel C

Runoff Area=13,169 sf Runoff Depth=4.84"
Tc=6.0 min CN=89 Runoff=1.70 cfs 0.122 af

Subcatchment 2S_P: Post Parcel C

Runoff Area=8,339 sf Runoff Depth=4.10"
Tc=6.0 min CN=82 Runoff=0.95 cfs 0.065 af

Subcatchment 3S: Existing Parcel D

Runoff Area=15,215 sf Runoff Depth=5.62"
Tc=6.0 min CN=97 Runoff=2.13 cfs 0.164 af

Subcatchment 3S_P: Post Parcel D

Runoff Area=15,215 sf Runoff Depth=3.29"
Tc=0.0 min CN=74 Runoff=1.66 cfs 0.096 af

Reach 1R: Total Existing Parcel A

Inflow=4.33 cfs 0.301 af
Outflow=4.33 cfs 0.301 af

Reach 1R_P: Total Post Parcel A

Inflow=3.70 cfs 0.265 af
Outflow=3.70 cfs 0.265 af

Reach 2R: Total Ex. Parcel C

Inflow=1.70 cfs 0.122 af
Outflow=1.70 cfs 0.122 af

Reach 2R_P: Total Post Parcel B

Inflow=0.95 cfs 0.065 af
Outflow=0.95 cfs 0.065 af

Reach 3R: Total Existing Parcel D

Inflow=2.13 cfs 0.164 af
Outflow=2.13 cfs 0.164 af

Reach 3R_P: Total Post Parcel C

Inflow=1.66 cfs 0.096 af
Outflow=1.66 cfs 0.096 af

Pond 1P: 500 Gallon Drywell w/ 48" stone surr

Peak Elev=89.59' Storage=389 cf Inflow=0.26 cfs 0.019 af
Outflow=0.01 cfs 0.014 af

Total Runoff Area = 2.910 ac Runoff Volume = 1.018 af Average Runoff Depth = 4.20"

Subcatchment 1S: Existing Parcel A

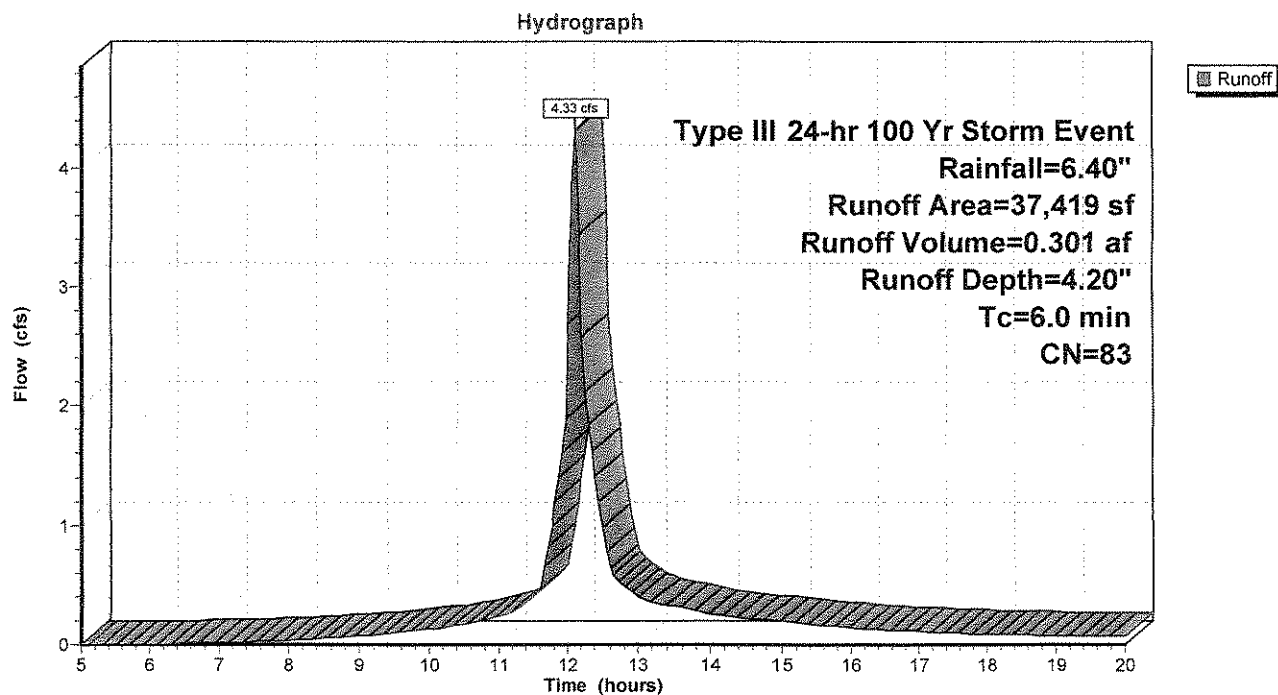
Runoff = 4.33 cfs @ 12.09 hrs, Volume= 0.301 af, Depth= 4.20"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100 Yr Storm Event Rainfall=6.40"

Area (sf)	CN	Description
17,632	98	Impervious Surfaces
19,787	69	50-75% Grass cover, Fair, HSG B
37,419	83	Weighted Average

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

Subcatchment 1S: Existing Parcel A



Subcatchment 1S_D: Area to Drywell

Runoff = 0.26 cfs @ 12.07 hrs, Volume= 0.019 af, Depth= 5.69"

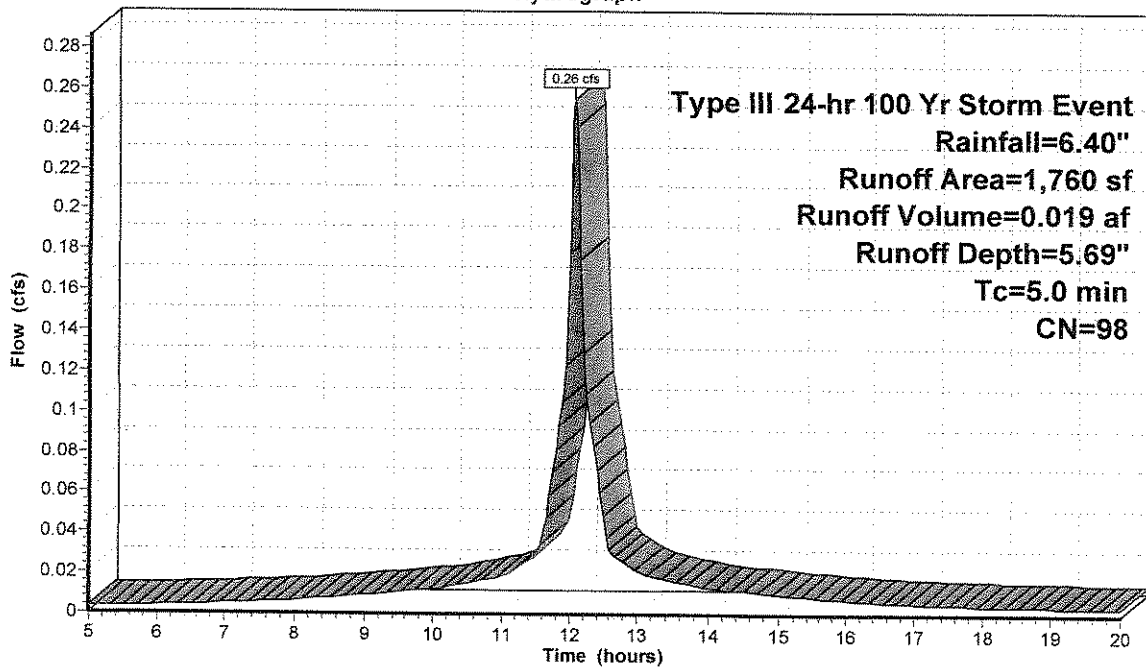
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100 Yr Storm Event Rainfall=6.40"

Area (sf)	CN	Description
1,760	98	Pavement/Berm

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

Subcatchment 1S_D: Area to Drywell

Hydrograph



Runoff

Subcatchment 1S_P: Post Parcel A

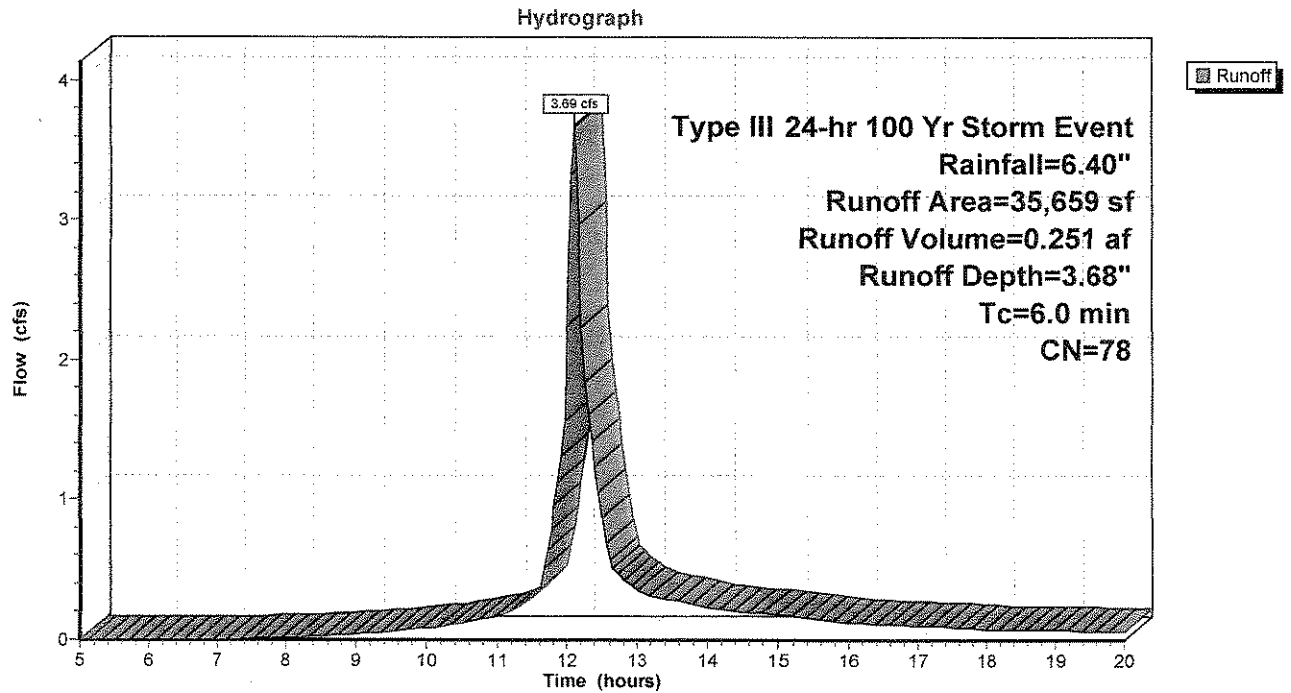
Runoff = 3.69 cfs @ 12.09 hrs, Volume= 0.251 af, Depth= 3.68"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100 Yr Storm Event Rainfall=6.40"

Area (sf)	CN	Description
16,507	98	Impervious Surfaces
19,152	61	>75% Grass cover, Good, HSG B
35,659	78	Weighted Average

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

Subcatchment 1S_P: Post Parcel A



Subcatchment 2S: Existing Parcel C

Runoff = 1.70 cfs @ 12.09 hrs, Volume= 0.122 af, Depth= 4.84"

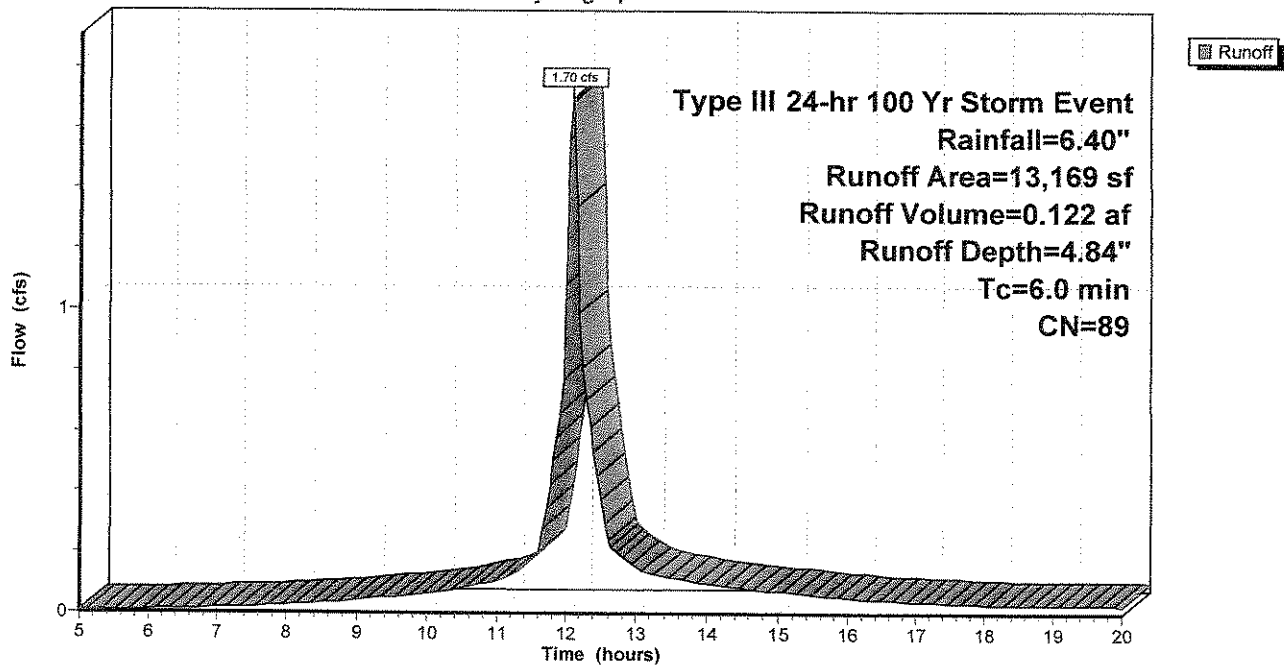
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100 Yr Storm Event Rainfall=6.40"

Area (sf)	CN	Description
9,176	98	Impervious Surfaces
3,993	69	50-75% Grass cover, Fair, HSG B
13,169	89	Weighted Average

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

Subcatchment 2S: Existing Parcel C

Hydrograph



Subcatchment 2S_P: Post Parcel C

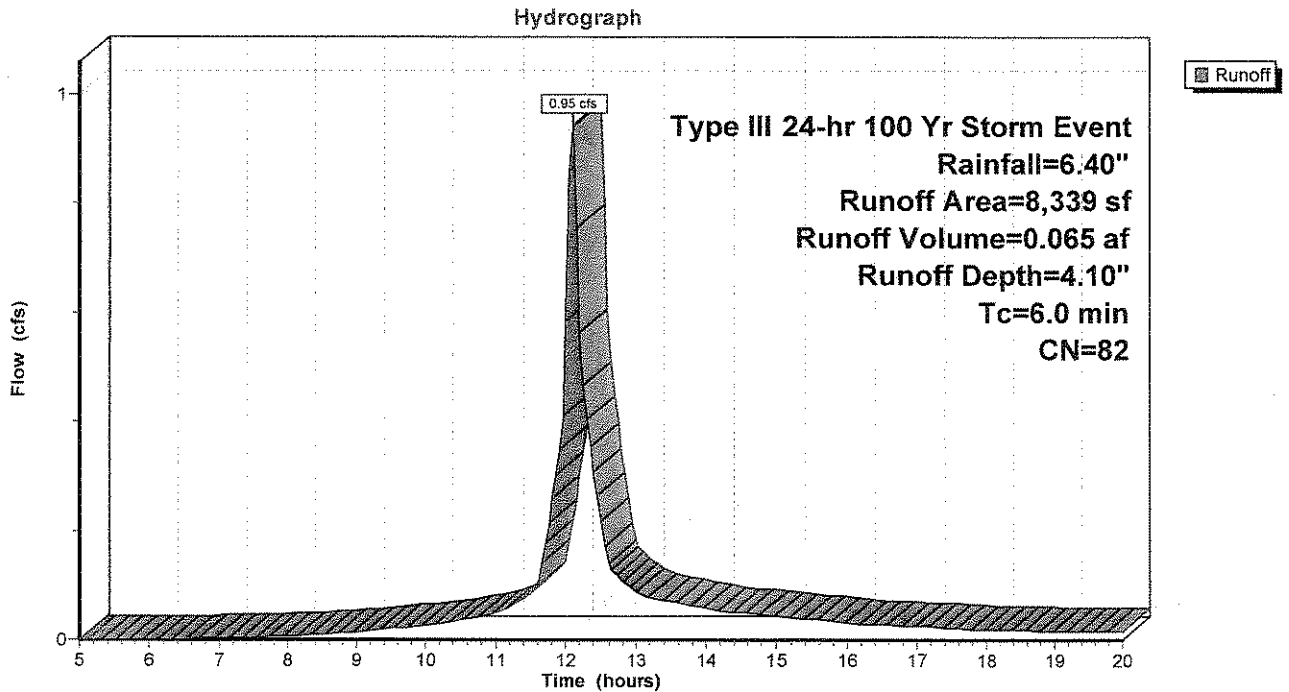
Runoff = 0.95 cfs @ 12.09 hrs, Volume= 0.065 af, Depth= 4.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100 Yr Storm Event Rainfall=6.40"

Area (sf)	CN	Description
4,629	98	Impervious Surfaces
3,710	61	>75% Grass cover, Good, HSG B
8,339	82	Weighted Average

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

Subcatchment 2S_P: Post Parcel C



Subcatchment 3S: Existing Parcel D

Runoff = 2.13 cfs @ 12.09 hrs, Volume= 0.164 af, Depth= 5.62"

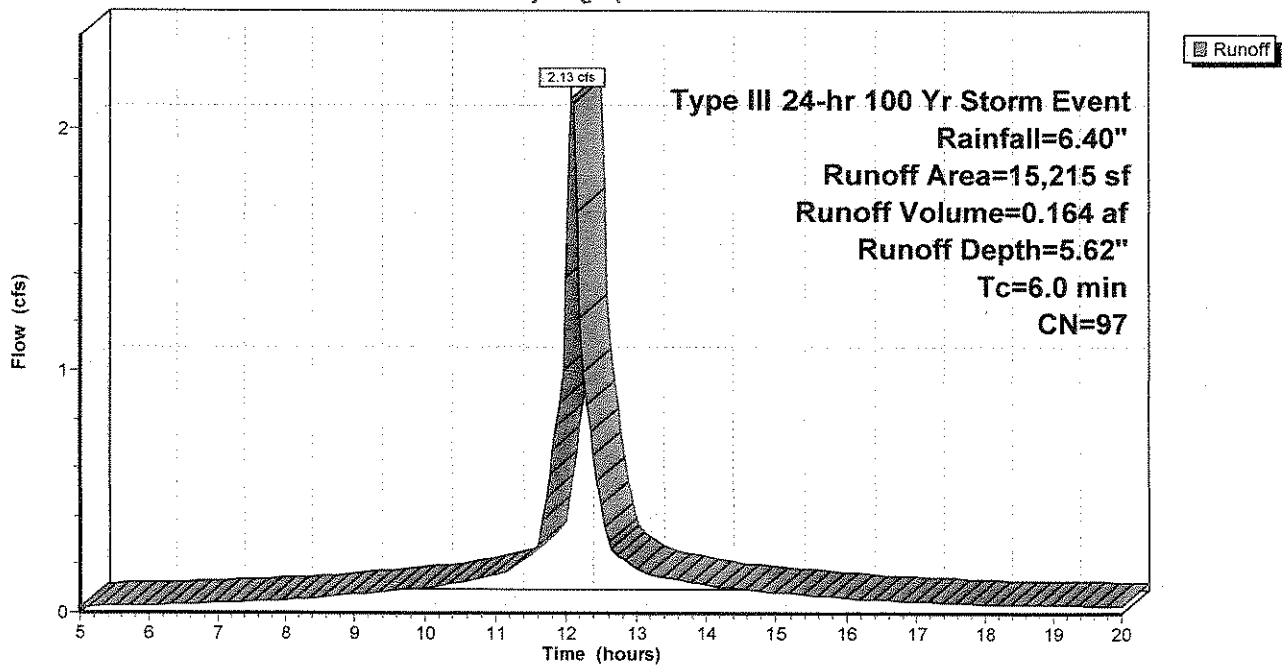
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100 Yr Storm Event Rainfall=6.40"

Area (sf)	CN	Description
14,652	98	Impervious Surfaces
563	69	50-75% Grass cover, Fair, HSG B
15,215	97	Weighted Average

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

Subcatchment 3S: Existing Parcel D

Hydrograph



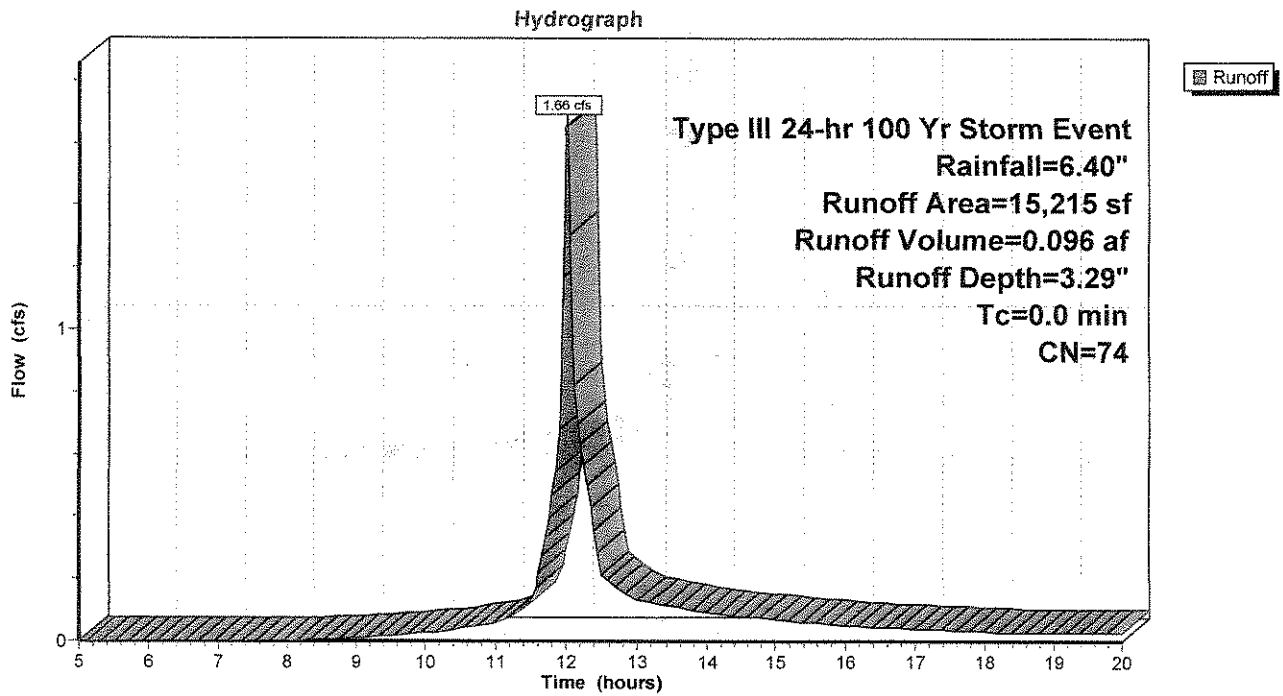
Subcatchment 3S_P: Post Parcel D

Runoff = 1.66 cfs @ 12.00 hrs, Volume= 0.096 af, Depth= 3.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Yr Storm Event Rainfall=6.40"

Area (sf)	CN	Description
5,454	98	Impervious Surfaces
9,761	61	>75% Grass cover, Good, HSG B
15,215	74	Weighted Average

Subcatchment 3S_P: Post Parcel D

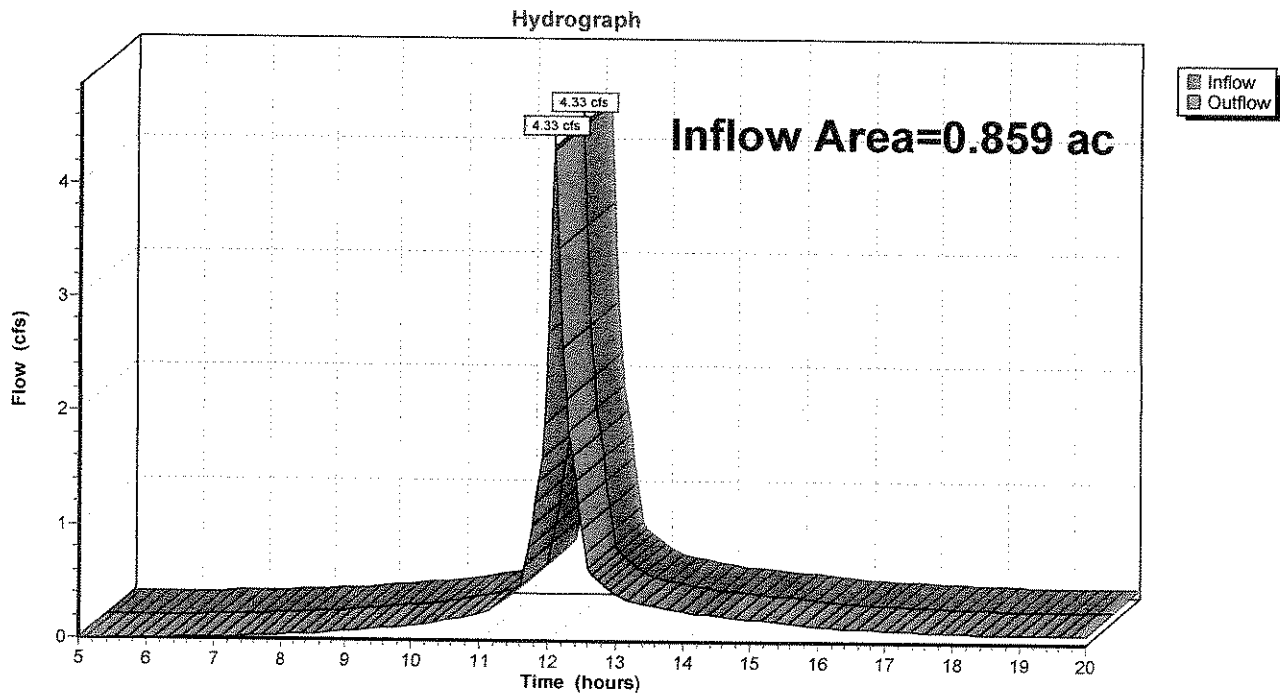


Reach 1R: Total Existing Parcel A

Inflow Area = 0.859 ac, Inflow Depth = 4.20" for 100 Yr Storm Event event
Inflow = 4.33 cfs @ 12.09 hrs, Volume= 0.301 af
Outflow = 4.33 cfs @ 12.09 hrs, Volume= 0.301 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach 1R: Total Existing Parcel A

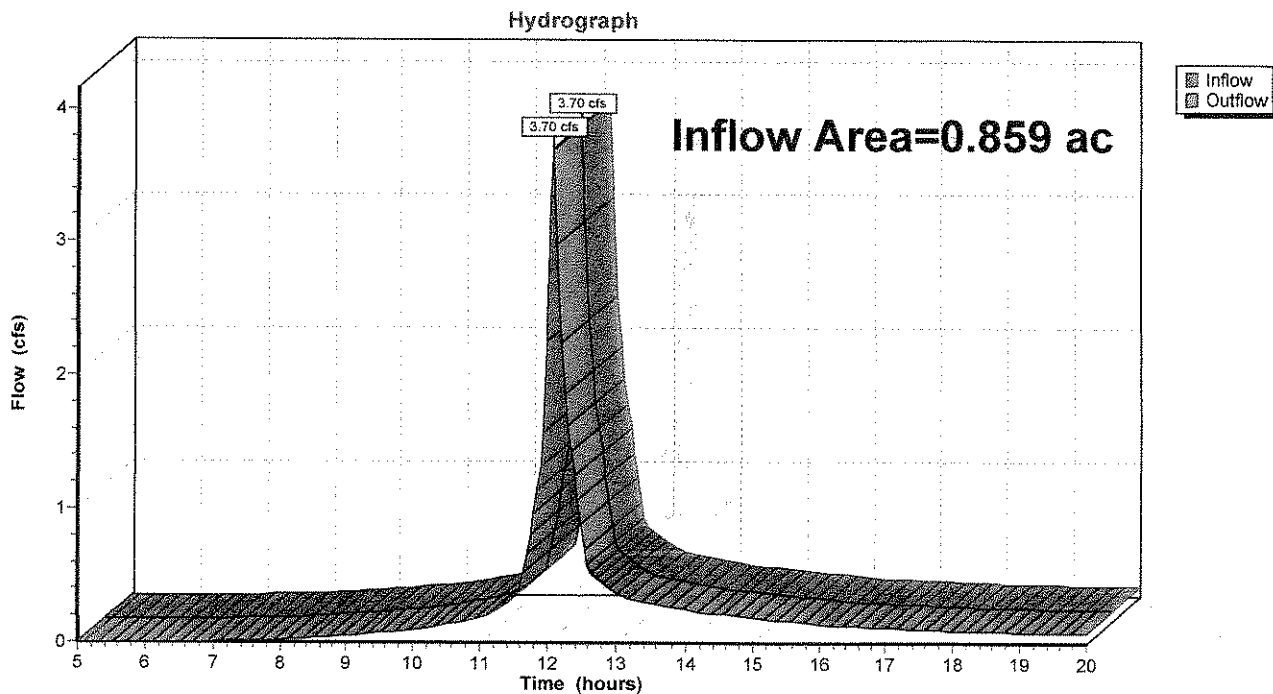


Reach 1R_P: Total Post Parcel A

Inflow Area = 0.859 ac, Inflow Depth = 3.70" for 100 Yr Storm Event event
Inflow = 3.70 cfs @ 12.09 hrs, Volume= 0.265 af
Outflow = 3.70 cfs @ 12.09 hrs, Volume= 0.265 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach 1R_P: Total Post Parcel A

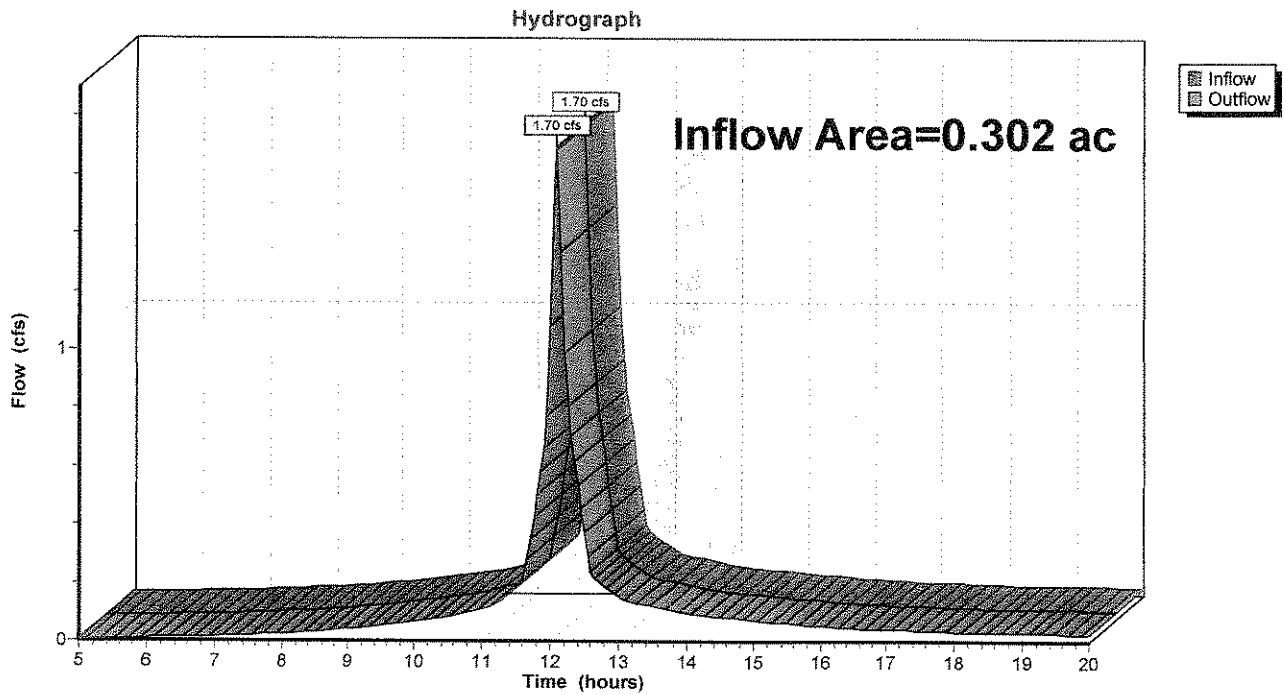


Reach 2R: Total Ex. Parcel C

Inflow Area = 0.302 ac, Inflow Depth = 4.84" for 100 Yr Storm Event event
Inflow = 1.70 cfs @ 12.09 hrs, Volume= 0.122 af
Outflow = 1.70 cfs @ 12.09 hrs, Volume= 0.122 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach 2R: Total Ex. Parcel C



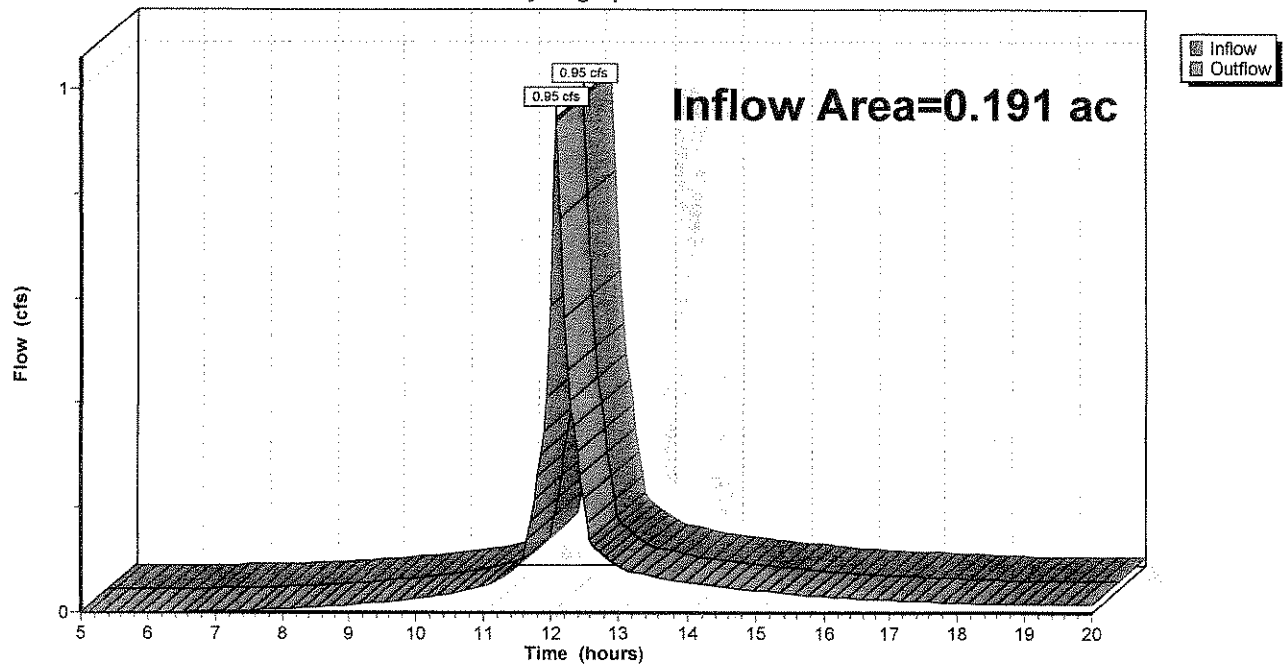
Reach 2R_P: Total Post Parcel B

Inflow Area = 0.191 ac, Inflow Depth = 4.10" for 100 Yr Storm Event event
Inflow = 0.95 cfs @ 12.09 hrs, Volume= 0.065 af
Outflow = 0.95 cfs @ 12.09 hrs, Volume= 0.065 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach 2R_P: Total Post Parcel B

Hydrograph

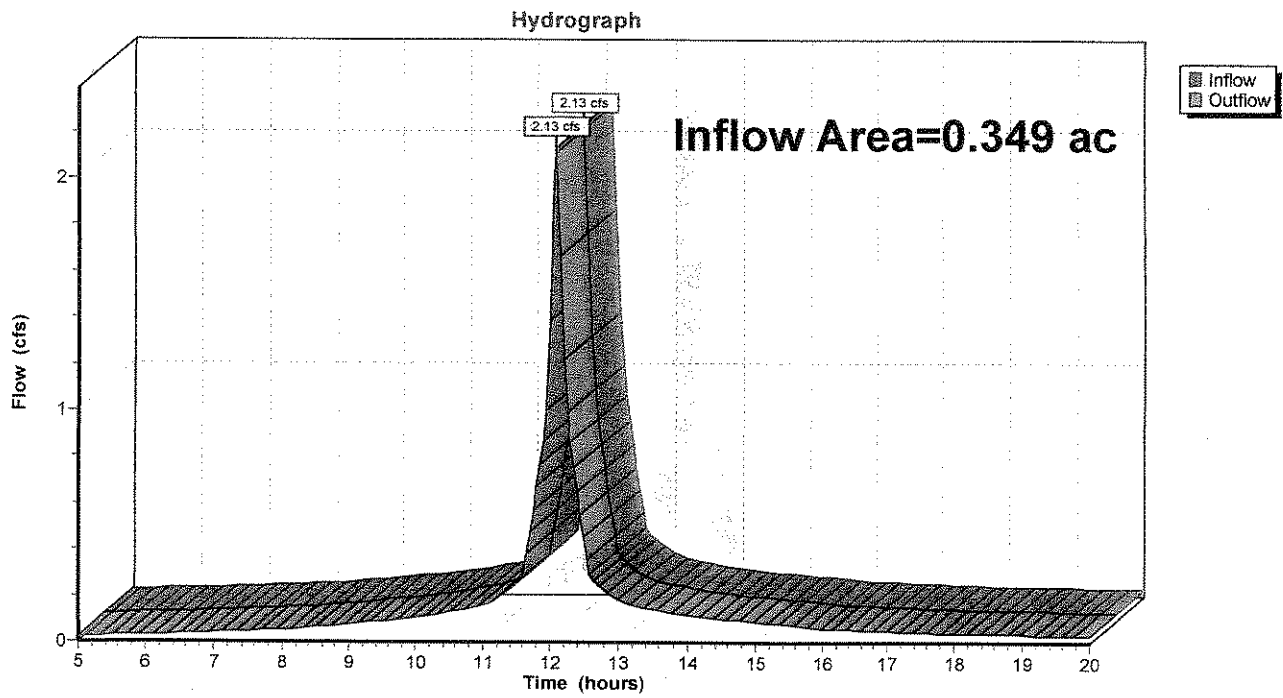


Reach 3R: Total Existing Parcel D

Inflow Area = 0.349 ac, Inflow Depth = 5.62" for 100 Yr Storm Event event
Inflow = 2.13 cfs @ 12.09 hrs, Volume= 0.164 af
Outflow = 2.13 cfs @ 12.09 hrs, Volume= 0.164 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach 3R: Total Existing Parcel D

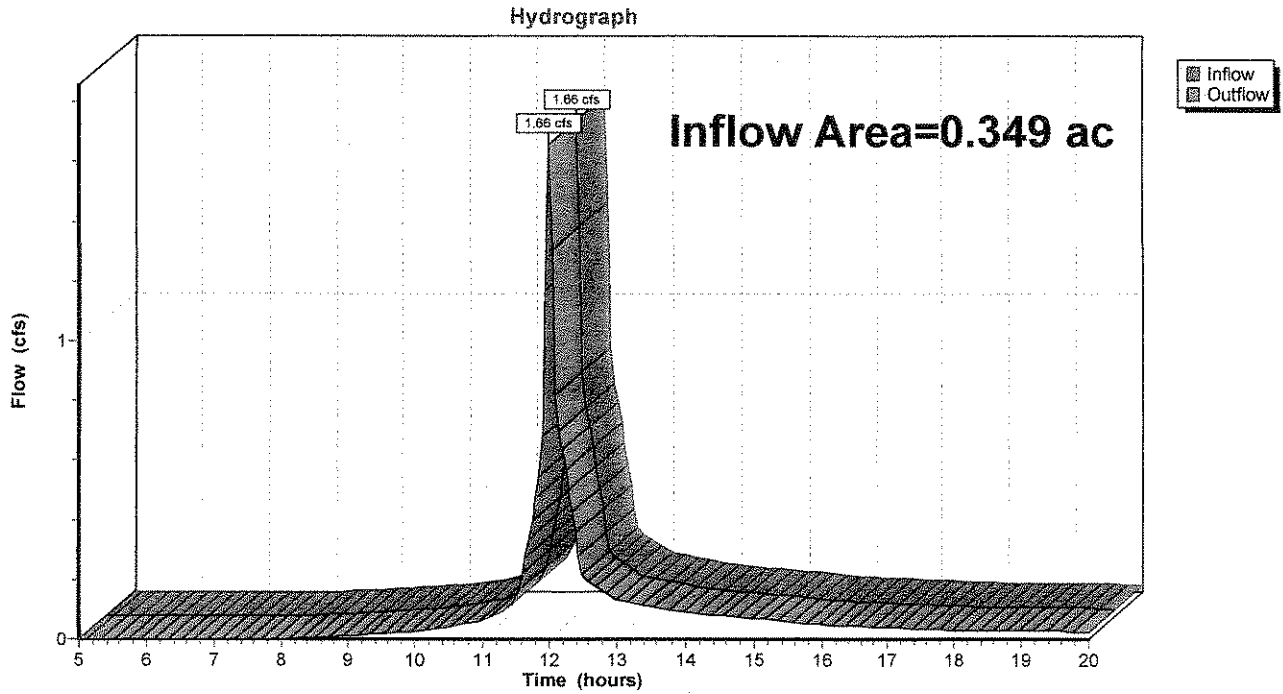


Reach 3R_P: Total Post Parcel C

Inflow Area = 0.349 ac, Inflow Depth = 3.29" for 100 Yr Storm Event event
Inflow = 1.66 cfs @ 12.00 hrs, Volume= 0.096 af
Outflow = 1.66 cfs @ 12.00 hrs, Volume= 0.096 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach 3R_P: Total Post Parcel C



Pond 1P: 500 Gallon Drywell w/ 48" stone surrounding

Drywell sized based on 20 MPI perc rate

Inflow Area =	0.040 ac,	Inflow Depth =	5.69"	for	100 Yr Storm Event event
Inflow =	0.26 cfs @	12.07 hrs,	Volume=	0.019 af	
Outflow =	0.01 cfs @	10.35 hrs,	Volume=	0.014 af,	Atten= 95%, Lag= 0.0 min
Primary =	0.01 cfs @	10.35 hrs,	Volume=	0.014 af	

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 89.59' @ 13.94 hrs Surf.Area= 196 sf Storage= 389 cf
 Plug-Flow detention time= 156.7 min calculated for 0.014 af (72% of inflow)
 Center-of-Mass det. time= 91.2 min (824.3 - 733.1)

#	Invert	Avail.Storage	Storage Description
1	85.33'	327 cf	14.00'W x 14.00'L x 4.67'H Prismatoid 915 cf Overall - 99 cf Embedded = 816 cf x 40.0% Voids
2	86.33'	99 cf	6.00'D x 3.50'H Vertical Cone/Cylinder Inside #1
		426 cf	Total Available Storage

#	Routing	Invert	Outlet Devices
1	Primary	0.00'	0.004160 fpm Exfiltration over entire Surface area

Primary OutFlow Max=0.01 cfs @ 10.35 hrs HW=85.38' (Free Discharge)
 ↑=Exfiltration (Exfiltration Controls 0.01 cfs)

Pond 1P: 500 Gallon Drywell w/ 48" stone surrounding

