Stormwater Management Report

Antares Solar Field

Grassy Hill Road & Walnut Hill Road
East Lyme, New London County, Connecticut

Prepared for Submission to:
Connecticut Siting Council

Date: October 9, 2012

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INTRODUCTION

The purpose of this report is to provide an analysis of the potential stormwater drainage impacts associated with the proposed Antares Solar Field project. The design is intended to be in full compliance with the State and Town regulations while taking prevailing site conditions and practical needs into account.

PROJECT DESCRIPTION

The site is currently occupied mostly by woods with light underbrush as well as gravel and dirt access driveways, a 2-story barn, building ruins, vegetated wetlands and natural stone walls. The site is proposed to be developed by constructing solar panel clusters that generate upwards of 6 megawatts (MW) of electricity as well as gravel access around the field with a proposed building and associated drainage structures and utilities.

Stormwater management for the proposed site consists of three new detention ponds and a leaky berm with outlet pipes at low points. Runoff will be discharged to either a tributary of Cranberry Meadow Brook southwest of the site or a separate tributary of Cranberry Meadow Brook southeast of the site. See Appendix A for a United States Geological Services (USGS) Site Location Map and Site Aerial Photo.

Slopes on the site range from approximately 2 to 25 percent, with a high elevation of approximately 333-feet at the north of the site and a low elevation of approximately 190-feet at the southwest of the site. Soils, taken from the National Resources Conservation Service (NRCS) Soil Survey Geographic (SSURGO) database for the State of Connecticut, dated March 31, 2011 are listed in Table 1. An NRCS Soil Survey Map is included in Appendix A.

Table 1
Soils Data

Map Symbol	Hydrologic Soil Group	Map Unit Name
2	D	Ridgebury fine sandy loam
3	D	Ridgebury, Leicester, and Whitman soils, extremely stony
17	D	Timakwa and Natchaug soils
29B	B	Agawam fine sandy loam, 3-8% slopes
32A	B	Haven and Enfield soils, 0-3% slopes
38C	A	Hinckley gravelly sandy loam, 3-15% slopes
38E	A	Hinckley gravelly sandy loam, 15-45% slopes
45A	C	Woodbridge fine sandy loam, 0-3% slopes
45B	C	Woodbridge fine sandy loam, 3-8% slopes
46B	C	Woodbridge fine sandy loam, 2-8% slopes, very stony
47C	C	Woodbridge fine sandy loam, 2-15% slopes, extremely stony

60D	B	Canton and Charlton soils, 15-25% slopes
73C	B	Charlton-Chatfield complex, 3-15% slopes, very rocky
73E	B	Charlton-Chatfield complex, 15-45% slopes, very rocky
75C	B	Hollis-Chatfield-Rock outcrop complex, 3-15% slopes
75E	B	Hollis-Chatfield-Rock outcrop complex, 15-45% slopes
84B	C	Paxton and Montauk fine sandy loams, 3-8% slopes
84C	C	Paxton and Montauk fine sandy loams, 8-15% slopes
85B	C	Paxton and Montauk fine sandy loams, 3-8% slopes, very stony
85C	C	Paxton and Montauk fine sandy loams, 8-15% slopes, very stony
86D	C	Paxton and Montauk fine sandy loams, 15-35% slopes, extremely stony
107	D	Limerick and Lim soils

The site is not located within the 100-year flood hazard area, according to the Federal Emergency Management Agency's (FEMA) Flood Insurance Rate Maps (FIRM) for New London County, effective date July 18, 2011. The site is located within Zone "X" which is delineated as "areas determined to be outside the 0.2% annual chance floodplain." A copy of the FEMA FIRM is included in Appendix A.

This report has been prepared in conjunction with the engineering design plans for the Antares Solar Field project, as prepared by BL Companies.

METHODOLOGY

Curve numbers were taken from Tables 2-2a and 2-2b of USDA TR-55, 2nd Edition, June 1986. A Type III storm distribution with an average antecedent moisture condition was used. Times of concentration were calculated using methods presented in the TR-55 Manual.

Peak flow rates were calculated using the software package HydroCAD, Version 7.10, with a time increment of 0.01 hours. The results can be found in Appendices B and C. Maps showing existing and proposed conditions drainage areas can be found in Appendix D. Rainfall depths of New London County were used for the calculation of peak flow rates and are listed in Table 2.

Table 2
Rainfall

Return Period	24-hr Rainfall Depth
2-year	3.40 inches
10-year	5.00 inches
100-year	7.10 inches

PRE-DEVELOPMENT HYDROLOGIC CONDITIONS

Based on pre-development drainage patterns, a 38.95 Acre (Ac) drainage area (Pre-Developed Drainage Area A) flows east and south from the ridge in the center of the site. Runoff from Drainage Area A then flows towards wetlands and into a tributary of Cranberry Meadow Brook (Discharge A). A 53.01 Ac drainage area (Pre-Developed Drainage Area B) that consists of the remaining site area as well as bordering property areas to the west of the site flows west and south from the ridge in the center of the site. Runoff from Drainage Area B then flows into Walnut Hill Road and eventually reaches a separate tributary from Discharge A of Cranberry Meadow Brook (Discharge B). Characteristics of these drainage areas are summarized in Table 3 and peak flows for all analyzed storms are summarized in Table 4. All calculation details may be found in Appendix B.

Table 3
Pre-Development Drainage Area Characteristics

Subwatershed ID	Area (ac)	Composite Curve Number (CN)	Time of Concentration (minutes)
Pre-Developed Drainage Area A	38.95	74	25.1
Pre-Developed Drainage Area B	53.01	74	34.1

Peak flows for all analyzed storms discharge to separate tributaries of Cranberry Meadow Brook and are summarized in Table 4; details may be found in Appendix B.

Table 4
Pre-Development Conditions Peak Flows

Analysis Point	Peak Flow (cfs)		
	2-yr	10-yr	50-yr
Discharge A	31.22	65.69	115.56
Discharge B	37.04	77.77	136.95

POST-DEVELOPMENT HYDROLOGIC CONDITIONS

The proposed storm management system will follow existing conditions with the exception of subdividing the drainage areas and routing through stormwater structures before discharging towards Discharge A and B, respectively.

Drainage Area A has been subdivided into 6 separate drainage areas. Post-Developed Drainage Areas A-1 and A-2 flow east from the ridge in the center of the site and into one of two new detention ponds. The detention ponds for Drainage Areas A-1 and A-2 will each have an outlet control structure and 12" outlet pipe. Post-Developed Drainage Areas A-3, A-4, and A-5 flow east from the ridge in the center of the site and into one of three low points along a new leaky berm. The leaky berm is a non-structural Best Management Practice (BMP) that consists of a 6" layer of crushed stone at the base with 1.5' of clean fill on top. The leaky berm will have three low points for each respective drainage area. Two low points will have a 4" outlet pipe and the third low point will have a catch basin and 12" outlet pipe. The outlets from Drainage Areas A-1 through A-5 will discharge into Post-Developed Drainage Area A-6. Drainage Area A-6 will then route runoff east and south to Discharge A to a tributary of Cranberry Meadow Brook.

Drainage Area B has been subdivided into 2 separate drainage areas. Post-Developed Drainage Area B-1 will flow south across the site and into a new detention pond. The detention pond for Drainage Area B-1 will have an outlet control structure and 12" outlet pipe. Post-Developed Drainage Area B-2 will mimic drainage patterns from the Pre-Developed Drainage Area B. Runoff will flow west and south towards Walnut Hill Road. Runoff from Drainage Areas B-1 and B-2 will converge southwest of the site at Discharge B.

Characteristics of the proposed drainage areas are summarized in Table 5.

Table 5
Post-Development Drainage Area Characteristics

Subwatershed ID	Area (ac)	Composite Curve Number (CN)	Time of Concentration (minutes)
Post-Developed Drainage Area A-1	5.23	75	15.5
Post-Developed Drainage Area A-2	5.33	75	15.5
Post-Developed Drainage Area A-3	6.10	75	18.7
Post-Developed Drainage Area A-4	5.85	75	19.7
Post-Developed Drainage Area A-5	7.58	75	17.8
Post-Developed Drainage Area A-6	10.21	74	24.0
Post-Developed Drainage Area B-1	2.90	76	13.0
Post-Developed Drainage Area B-2	48.76	74	34.1

Peak flows for all analyzed storms are treated for stormwater quantity and quality via one of three new detention ponds or the new leaky berm before being discharged to separate tributaries of Cranberry Meadow Brook. Those peak flows are summarized in Table 6; details may be found in Appendix C.

Table 6
Post-Development Conditions Peak Flows

Analysis Point	Peak Flow (cfs)		
	2-yr	10-yr	50-yr
Discharge A	30.24	61.46	105.65
Discharge B	35.91	74.25	129.39

SUMMARY & CONCLUSIONS

Peak discharge rates have been lessened from the pre-developed to post-developed site conditions by routing the disturbed site area through a treatment train of detention ponds and outlet structures or a leaky berm with outlet pipes. The flow rate will be lower before being discharged into each tributary of Cranberry Meadow Brook.

This report has been prepared to complement the submitted project plans as well as to represent the technical basis for the stormwater management system designs presented herein. In consideration of the overall project, we conclude that all technical drainage requirements and design parameters set forth by the Town of East Lyme and the State have been fully met. See Tables 7 and 8 for a summary of peak flows discharged at Discharges A and B, respectively.

Table 7
Summary of Peak Flows Discharged
At Discharge A

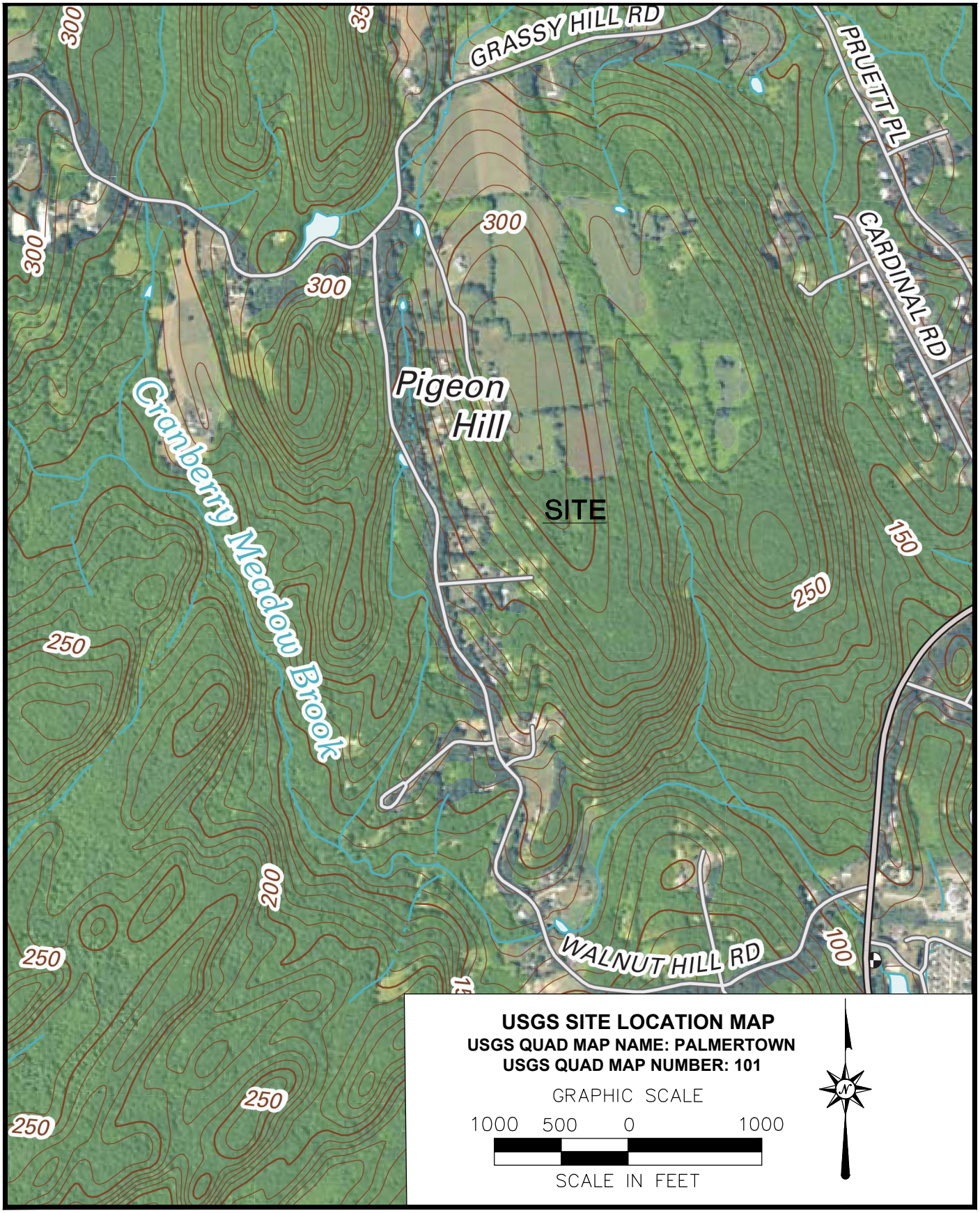
	Peak Flow (cfs)		
	2-yr	**10-yr**	**100-yr**
Pre-Development Conditions	31.22	65.69	115.56
Post-Development Conditions	30.24	61.46	105.65
Difference	-0.98	-4.23	-9.91

Table 8
Summary of Peak Flows Discharged
At Discharge B

	Peak Flow (cfs)		
	2-yr	**10-yr**	**100-yr**
Pre-Development Conditions	37.04	77.77	136.95
Post-Development Conditions	35.91	74.25	129.39
Difference	-1.13	-3.52	-7.56

APPENDIX A
LOCATION MAPS

Figure 1: USGS Site Location Map
Figure 2: Site Aerial Photo
Figure 3: NRCS Soil Survey Map
Figure 4: Flood Insurance Rate Map (FIRM), 09011C0336G, New London County, Connecticut



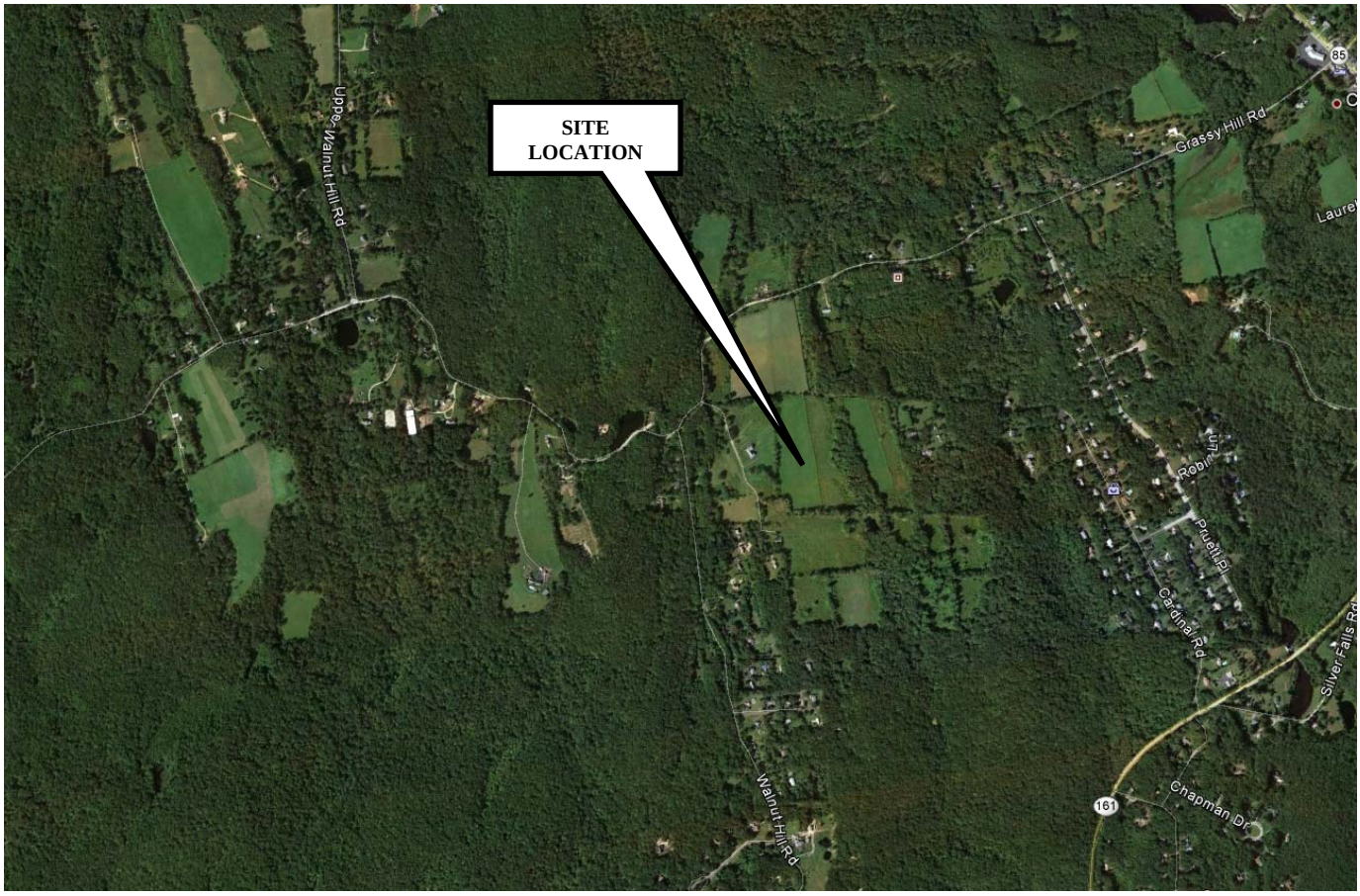
BL Companies

ANTARES SOLAR FIELD

GRASSY HILL ROAD AND WALNUT HILL ROAD
EAST LYME, CT

Designed	
Drawn	BKB
Checked	
Approved	
Scale	1"= 1000'
Project No.	06C1625G
Date	06/12/2012
CAD File	USGS

FIGURE 1

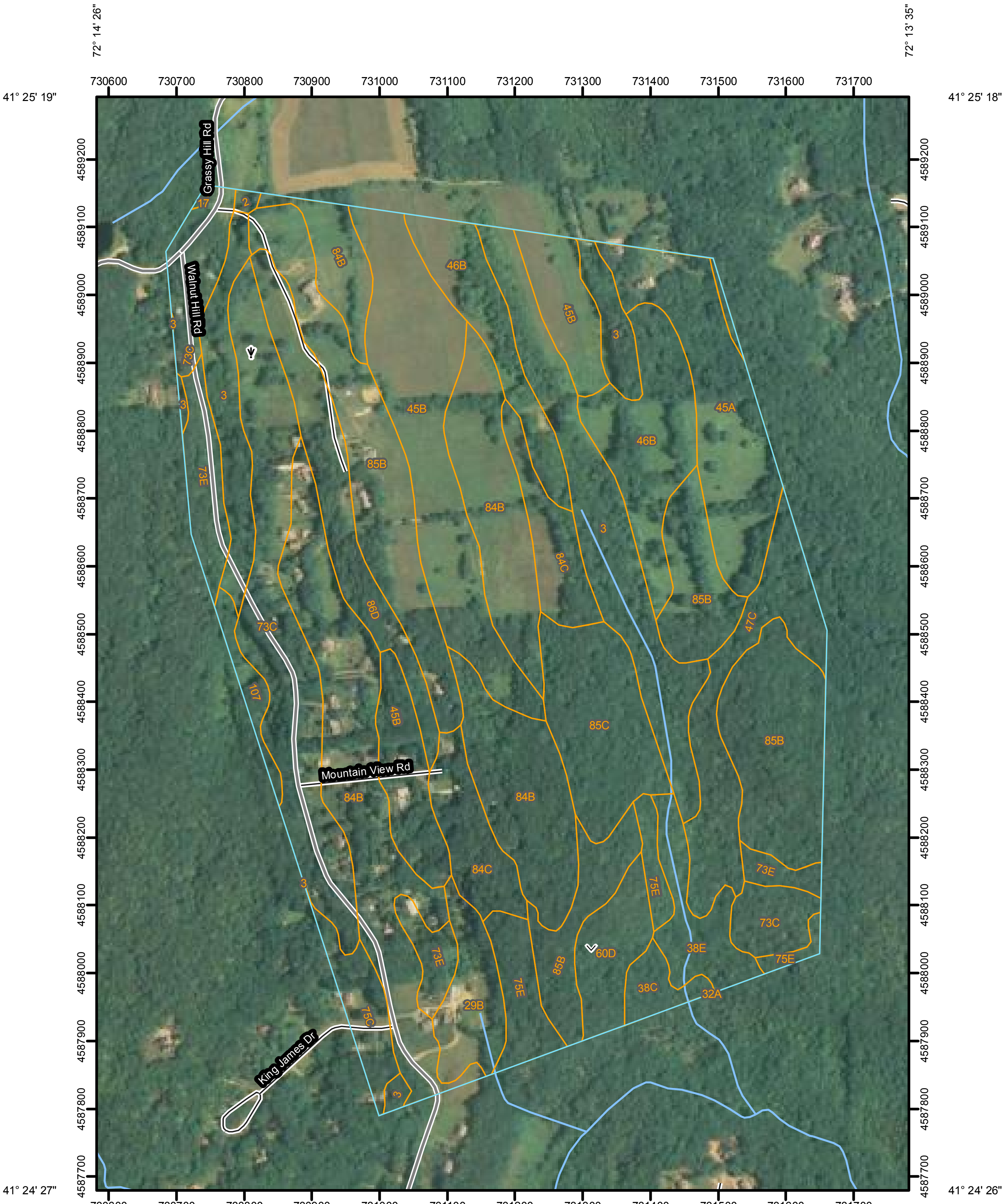


N

Figure 2: SITE AERIAL PHOTO
Antares Solar Subdivision
Grassy Hill Road and Walnut Hill Road
Town of East Lyme, New London County, Connecticut

BL Companies

Project No. 06C1625G


72° 14' 26"
72° 13' 35"
41° 25' 19"
41° 25' 18"
41° 24' 27"
41° 24' 26"
72° 14' 28"
72° 13' 37"
730600
730700
730800
730900
731000
731100
731200
731300
731400
731500
731600
731700
4589200
4589100
4589000
4588900
4588800
4588700
4588600
4588500
4588400
4588300
4588200
4588100
4588000
4587900
4587800
4587700
Grassy Hill Rd
Walnut Hill Rd
Mountain View Rd
King James Dr
17
2
84B
46B
45B
3
73C
45A
85B
84B
84C
86D
73C
107
45B
85C
47C
84B
84C
73E
75E
75C
29B
60D
38C
38E
32A
73C
75E

Map Scale: 1:7,700 if printed on A size (8.5" x 11") sheet.

N

Meters: 0, 50, 100, 200, 300

Feet: 0, 250, 500, 1,000, 1,500

FIGURE 3

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

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
- Gully
- Short Steep Slope
- Other

Political Features
- Cities

Water Features
- Streams and Canals

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

MAP INFORMATION

Map Scale: 1:7,700 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:12,000.

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 18N NAD83

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

Soil Survey Area: State of Connecticut
Survey Area Data: Version 10, Mar 31, 2011

Date(s) aerial images were photographed: 7/17/2006

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

State of Connecticut (CT600)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
2	Ridgebury fine sandy loam	0.3	0.1%
3	Ridgebury, Leicester, and Whitman soils, extremely stony	22.1	9.0%
17	Timakwa and Natchaug soils	0.1	0.0%
29B	Agawam fine sandy loam, 3 to 8 percent slopes	4.9	2.0%
32A	Haven and Enfield soils, 0 to 3 percent slopes	0.0	0.0%
38C	Hinckley gravelly sandy loam, 3 to 15 percent slopes	1.9	0.8%
38E	Hinckley gravelly sandy loam, 15 to 45 percent slopes	4.8	1.9%
45A	Woodbridge fine sandy loam, 0 to 3 percent slopes	12.6	5.2%
45B	Woodbridge fine sandy loam, 3 to 8 percent slopes	25.7	10.5%
46B	Woodbridge fine sandy loam, 2 to 8 percent slopes, very stony	15.6	6.4%
47C	Woodbridge fine sandy loam, 2 to 15 percent slopes, extremely stony	9.6	3.9%
60D	Canton and Charlton soils, 15 to 25 percent slopes	4.5	1.8%
73C	Charlton-Chatfield complex, 3 to 15 percent slopes, very rocky	23.5	9.6%
73E	Charlton-Chatfield complex, 15 to 45 percent slopes, very rocky	6.8	2.8%
75C	Hollis-Chatfield-Rock outcrop complex, 3 to 15 percent slopes	3.4	1.4%
75E	Hollis-Chatfield-Rock outcrop complex, 15 to 45 percent slopes	5.4	2.2%
84B	Paxton and Montauk fine sandy loams, 3 to 8 percent slopes	40.1	16.4%
84C	Paxton and Montauk fine sandy loams, 8 to 15 percent slopes	9.2	3.7%
85B	Paxton and Montauk fine sandy loams, 3 to 8 percent slopes, very stony	34.1	13.9%
85C	Paxton and Montauk fine sandy loams, 8 to 15 percent slopes, very stony	9.9	4.1%
86D	Paxton and Montauk fine sandy loams, 15 to 35 percent slopes, extremely stony	8.6	3.5%
107	Limerick and Lim soils	1.6	0.7%
Totals for Area of Interest		**244.6**	**100.0%**

RUSLE2 Related Attributes

This report summarizes those soil attributes used by the Revised Universal Soil Loss Equation Version 2 (RUSLE2) for the map units in the selected area. The report includes the map unit symbol, the component name, and the percent of the component in the map unit. Soil property data for each map unit component include the hydrologic soil group, erosion factors Kf for the surface horizon, erosion factor T, and the representative percentage of sand, silt, and clay in the surface horizon.

Report—RUSLE2 Related Attributes

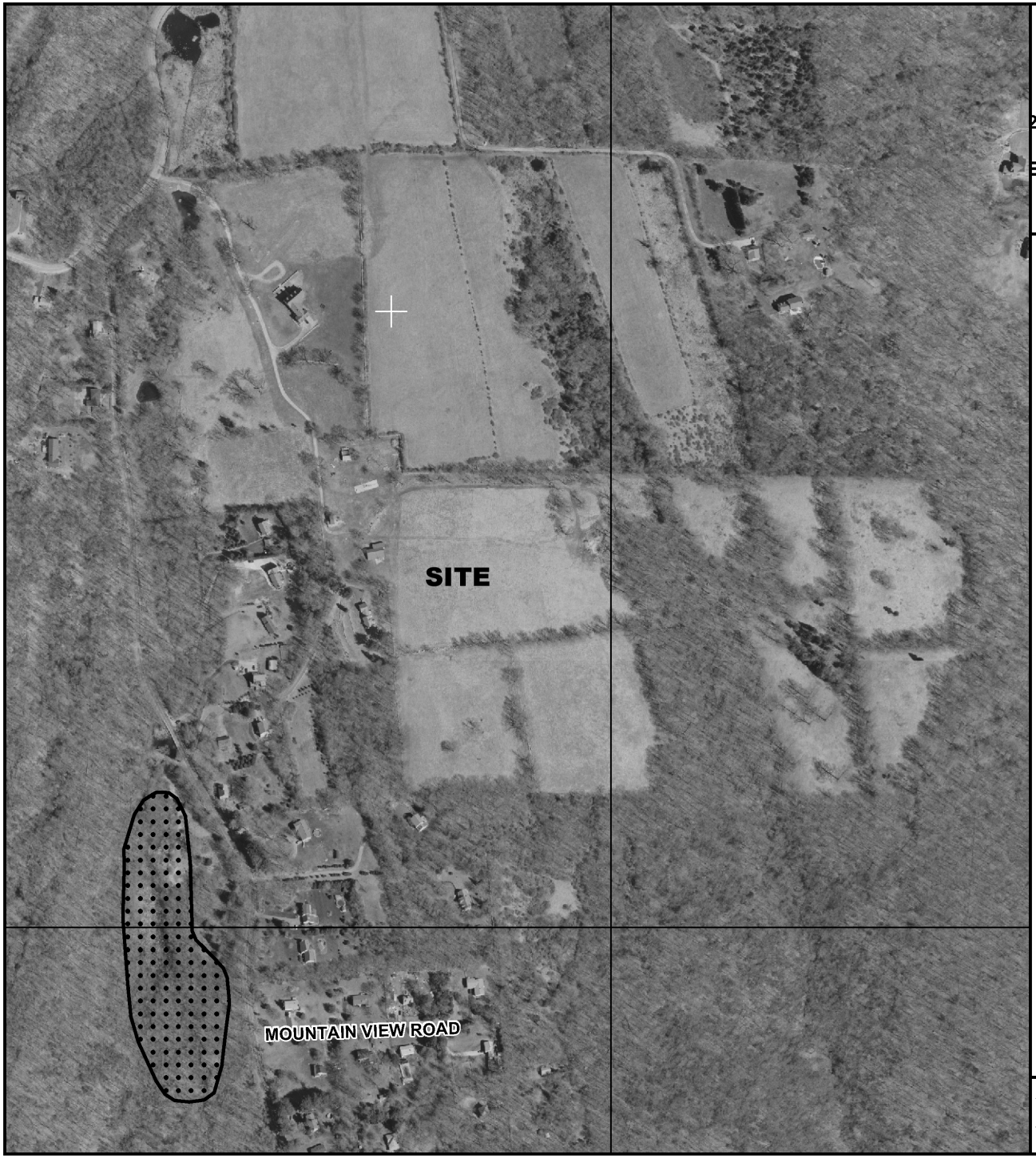
RUSLE2 Related Attributes– State of Connecticut								
Map symbol and soil name	Pct. of map unit	Slope length (ft)	Hydrologic group	Kf	T factor	Representative value		
						% Sand	% Silt	% Clay
2—Ridgebury fine sandy loam								
Ridgebury	80	125	D	.20	3	63.0	30.0	7.0
3—Ridgebury, Leicester, and Whitman soils, extremely stony								
Ridgebury	40	125	D	.20	3	63.0	30.0	7.0
Leicester	35	125	D	—	5	0.0	0.0	0.0
Whitman	15	125	D	—	2	0.0	0.0	0.0
17—Timakwa and Natchaug soils								
Timakwa	45	125	D	—	2	0.0	0.0	0.0
Natchaug	40	125	D	—	2	0.0	0.0	0.0
29B—Agawam fine sandy loam, 3 to 8 percent slopes								
Agawam	80	125	B	.32	3	62.0	31.0	7.0
32A—Haven and Enfield soils, 0 to 3 percent slopes								
Haven	60	125	B	.43	3	24.5	64.0	11.5
Enfield	25	125	B	—	3	0.0	0.0	0.0
38C—Hinckley gravelly sandy loam, 3 to 15 percent slopes								
Hinckley	80	125	A	.28	2	64.0	30.0	6.0
38E—Hinckley gravelly sandy loam, 15 to 45 percent slopes								
Hinckley	80	125	A	.28	2	64.0	30.0	6.0
45A—Woodbridge fine sandy loam, 0 to 3 percent slopes								
Woodbridge	80	174	C	.24	3	62.5	30.0	7.5

RUSLE2 Related Attributes– State of Connecticut								
Map symbol and soil name	Pct. of map unit	Slope length (ft)	Hydrologic group	Kf	T factor	Representative value		
						% Sand	% Silt	% Clay
45B—Woodbridge fine sandy loam, 3 to 8 percent slopes								
Woodbridge	80	174	C	.24	3	62.5	30.0	7.5
46B—Woodbridge fine sandy loam, 2 to 8 percent slopes, very stony								
Woodbridge	80	174	C	.24	3	62.5	30.0	7.5
47C—Woodbridge fine sandy loam, 2 to 15 percent slopes, extremely stony								
Woodbridge	80	174	C	.24	3	62.5	30.0	7.5
60D—Canton and Charlton soils, 15 to 25 percent slopes								
Canton	45	125	B	—	3	0.0	0.0	0.0
Charlton	35	125	B	.24	5	64.5	30.0	5.5
73C—Charlton-Chatfield complex, 3 to 15 percent slopes, very rocky								
Charlton	45	125	B	.24	5	64.5	30.0	5.5
Chatfield	30	125	B	.05	2	0.0	0.0	0.0
73E—Charlton-Chatfield complex, 15 to 45 percent slopes, very rocky								
Charlton	45	125	B	.24	5	64.5	30.0	5.5
Chatfield	30	125	B	.05	2	0.0	0.0	0.0
75C—Hollis-Chatfield-Rock outcrop complex, 3 to 15 percent slopes								
Hollis	35	125	D	—	1	0.0	0.0	0.0
Chatfield	30	125	B	.05	2	0.0	0.0	0.0
Rock outcrop	15	—	D	—	1	—	—	—
75E—Hollis-Chatfield-Rock outcrop complex, 15 to 45 percent slopes								
Hollis	35	125	D	—	1	0.0	0.0	0.0
Chatfield	30	125	B	.05	2	0.0	0.0	0.0
Rock outcrop	15	—	D	—	1	—	—	—
84B—Paxton and Montauk fine sandy loams, 3 to 8 percent slopes								
Paxton	55	174	C	.28	3	62.5	30.0	7.5
Montauk	30	174	C	.24	3	60.0	28.0	12.0

RUSLE2 Related Attributes– State of Connecticut								
Map symbol and soil name	Pct. of map unit	Slope length (ft)	Hydrologic group	Kf	T factor	Representative value		
						% Sand	% Silt	% Clay
84C—Paxton and Montauk fine sandy loams, 8 to 15 percent slopes								
Paxton	55	174	C	.28	3	62.5	30.0	7.5
Montauk	30	174	C	.24	3	60.0	28.0	12.0
85B—Paxton and Montauk fine sandy loams, 3 to 8 percent slopes, very stony								
Paxton	55	174	C	.28	3	62.5	30.0	7.5
Montauk	30	174	C	.24	3	60.0	28.0	12.0
85C—Paxton and Montauk fine sandy loams, 8 to 15 percent slopes, very stony								
Paxton	55	174	C	.28	3	62.5	30.0	7.5
Montauk	30	174	C	.24	3	60.0	28.0	12.0
86D—Paxton and Montauk fine sandy loams, 15 to 35 percent slopes, extremely stony								
Paxton	55	174	C	.28	3	62.5	30.0	7.5
Montauk	30	174	C	.24	3	60.0	28.0	12.0
107—Limerick and Lim soils								
Limerick	50	125	D	.49	5	34.0	58.0	8.0
Lim	30	125	D	.32	4	58.0	33.0	9.0

Data Source Information

Soil Survey Area: State of Connecticut
Survey Area Data: Version 10, Mar 31, 2011



MAP SCALE 1" = 500'

250 0 500 1000

FEET

METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0336G

FIRM

FLOOD INSURANCE RATE MAP

NEW LONDON COUNTY, CONNECTICUT

ALL JURISDICTIONS

PANEL 336 OF 554

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
EAST LYME, TOWN OF	090096	0336	G
MONTVILLE, TOWN OF	090099	0336	G
WATERFORD, TOWN OF	090107	0336	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
09011C0336G

EFFECTIVE DATE
JULY 18, 2011

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

FIGURE 4

LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A No Base Flood Elevations determined.

ZONE AE Base Flood Elevations determined.

ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.

ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.

ZONE AR Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.

ZONE A99 Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.

ZONE V Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.

ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

MAP SCALE 1" = 500'

250 0 500 1000

FEET

METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0336G

FIRM

FLOOD INSURANCE RATE MAP

NEW LONDON COUNTY, CONNECTICUT

ALL JURISDICTIONS

PANEL 336 OF 554

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
EAST LYME, TOWN OF	090096	0336	G
MONTVILLE, TOWN OF	090099	0336	G
WATERFORD, TOWN OF	090107	0336	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

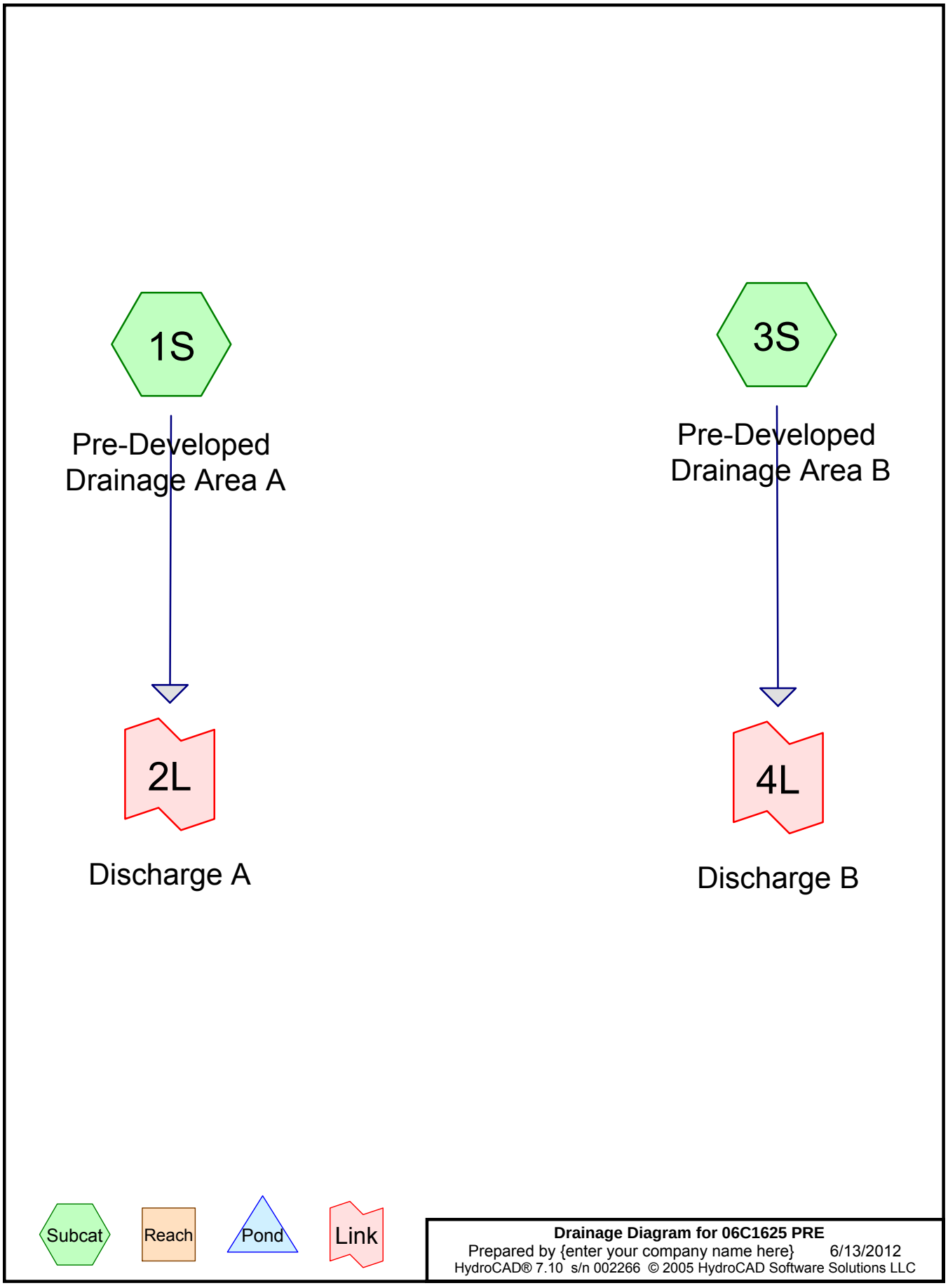
MAP NUMBER
09011C0336G

EFFECTIVE DATE
JULY 18, 2011

Federal Emergency Management Agency

APPENDIX B
PRE-DEVELOPMENT CONDITIONS

HydroCAD Reports: 2-, 10-, and 100-year storms



Drainage Diagram for 06C1625 PRE

Prepared by {enter your company name here} 6/13/2012

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Pre-Developed Drainage Area A Runoff Area=38.950 ac Runoff Depth>1.16"
Flow Length=1,723' Tc=25.1 min CN=74 Runoff=31.22 cfs 3.777 af

Subcatchment 3S: Pre-Developed Drainage Area B Runoff Area=53.010 ac Runoff Depth>1.16"
Flow Length=2,339' Tc=34.1 min CN=74 Runoff=37.04 cfs 5.128 af

Link 2L: Discharge A Inflow=31.22 cfs 3.777 af
Primary=31.22 cfs 3.777 af

Link 4L: Discharge B Inflow=37.04 cfs 5.128 af
Primary=37.04 cfs 5.128 af

Total Runoff Area = 91.960 ac Runoff Volume = 8.905 af Average Runoff Depth = 1.16"

Subcatchment 1S: Pre-Developed Drainage Area A

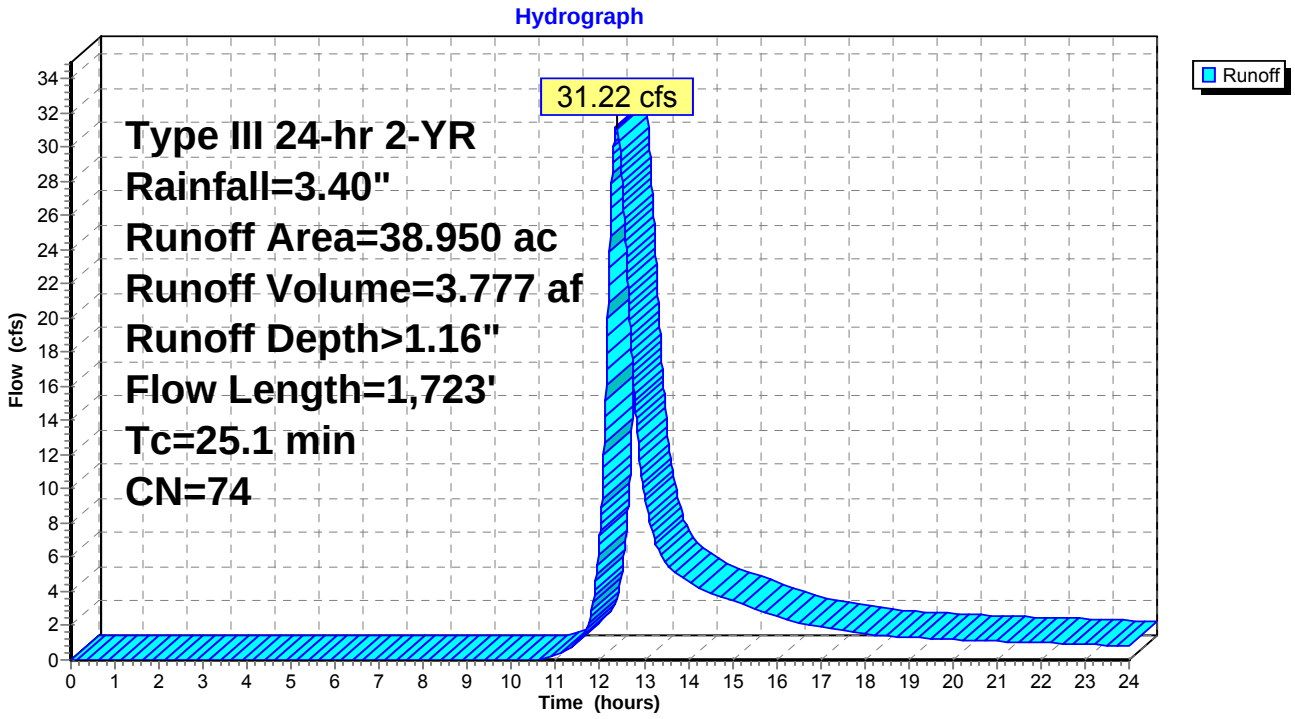
Runoff = 31.22 cfs @ 12.38 hrs, Volume= 3.777 af, Depth> 1.16"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.40"

Area (ac)	CN	Description
8.000	72	Woods/grass comb., Good, HSG C
0.100	98	Paved parking & roofs
30.850	74	>75% Grass cover, Good, HSG C
38.950	74	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.6	100	0.0700	0.1		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.40"
12.0	1,256	0.0622	1.7		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.5	367	0.0289	12.9	543.40	**Channel Flow,** Area= 42.0 sf Perim= 17.5' r= 2.40' n= 0.035 Earth, dense weeds
25.1	1,723	Total			

Subcatchment 1S: Pre-Developed Drainage Area A



Subcatchment 3S: Pre-Developed Drainage Area B

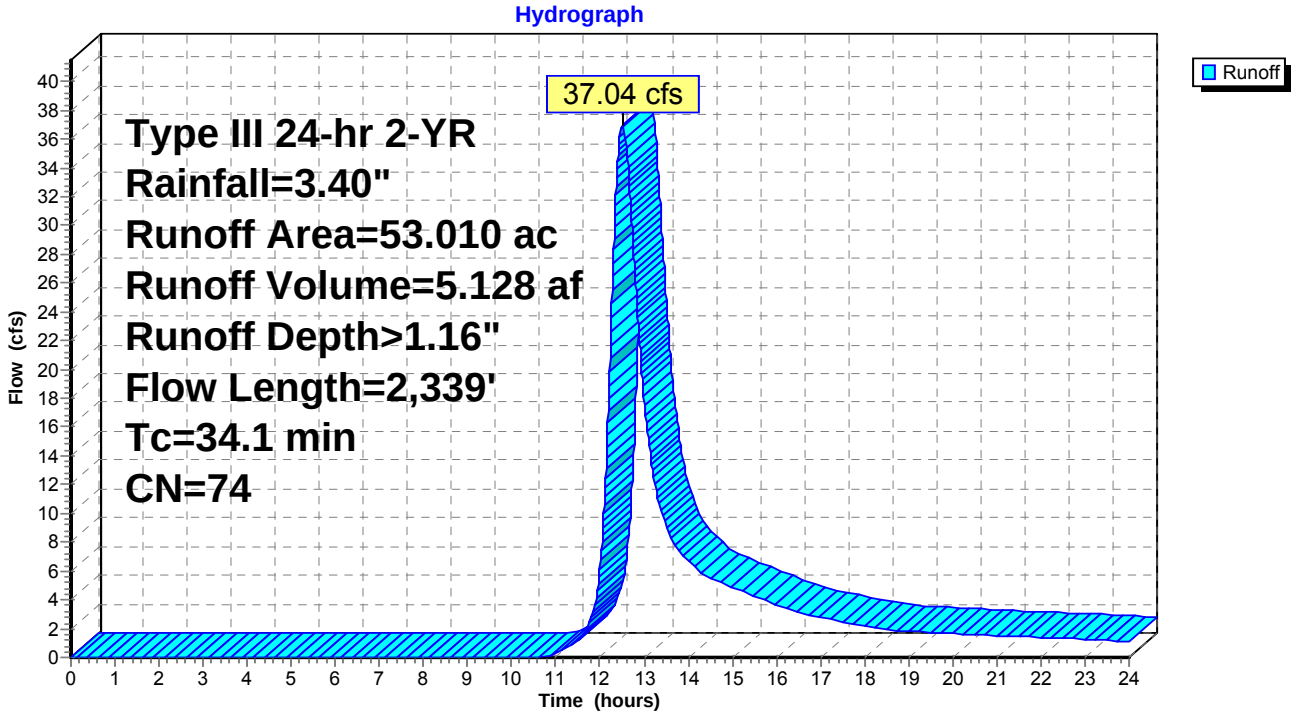
Runoff = 37.04 cfs @ 12.51 hrs, Volume= 5.128 af, Depth> 1.16"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.40"

Area (ac)	CN	Description
1.590	98	Paved parking & roofs
31.800	72	Woods/grass comb., Good, HSG C
19.620	74	>75% Grass cover, Good, HSG C
53.010	74	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.0	200	0.0700	0.2		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.40"
5.3	537	0.1155	1.7		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
6.8	1,602	0.0374	3.9		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
34.1	2,339	Total			

Subcatchment 3S: Pre-Developed Drainage Area B

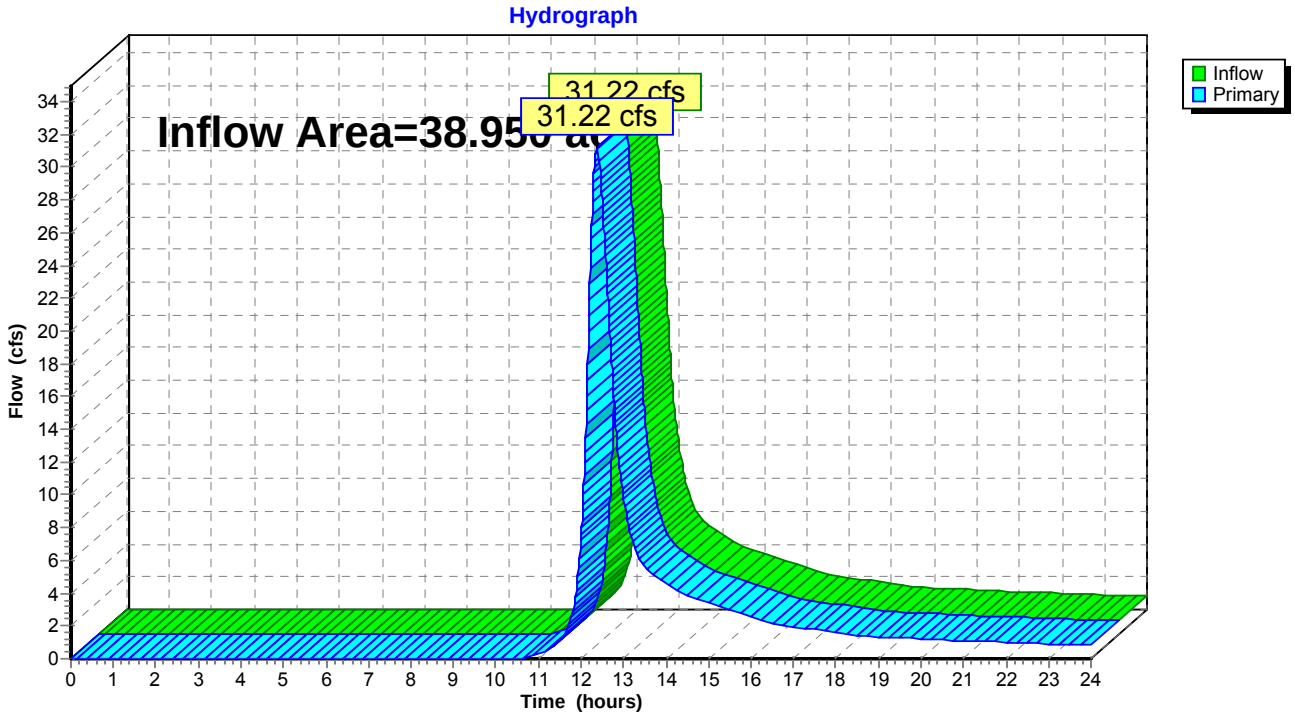


Link 2L: Discharge A

Inflow Area = 38.950 ac, Inflow Depth > 1.16" for 2-YR event
Inflow = 31.22 cfs @ 12.38 hrs, Volume= 3.777 af
Primary = 31.22 cfs @ 12.38 hrs, Volume= 3.777 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 2L: Discharge A

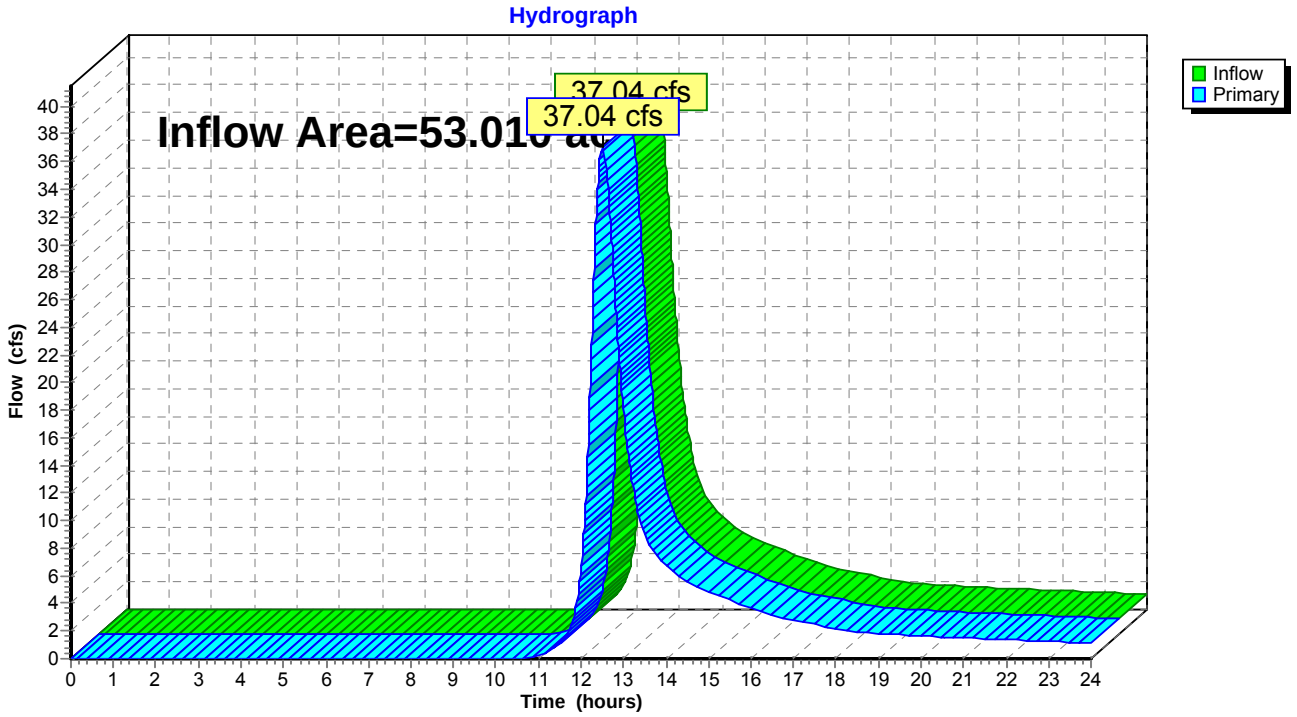


Link 4L: Discharge B

Inflow Area = 53.010 ac, Inflow Depth > 1.16" for 2-YR event
Inflow = 37.04 cfs @ 12.51 hrs, Volume= 5.128 af
Primary = 37.04 cfs @ 12.51 hrs, Volume= 5.128 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 4L: Discharge B



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Pre-Developed Drainage Area A Runoff Area=38.950 ac Runoff Depth>2.35"
Flow Length=1,723' Tc=25.1 min CN=74 Runoff=65.69 cfs 7.631 af

Subcatchment 3S: Pre-Developed Drainage Area B Runoff Area=53.010 ac Runoff Depth>2.35"
Flow Length=2,339' Tc=34.1 min CN=74 Runoff=77.77 cfs 10.363 af

Link 2L: Discharge A Inflow=65.69 cfs 7.631 af
Primary=65.69 cfs 7.631 af

Link 4L: Discharge B Inflow=77.77 cfs 10.363 af
Primary=77.77 cfs 10.363 af

Total Runoff Area = 91.960 ac Runoff Volume = 17.993 af Average Runoff Depth = 2.35"

Subcatchment 1S: Pre-Developed Drainage Area A

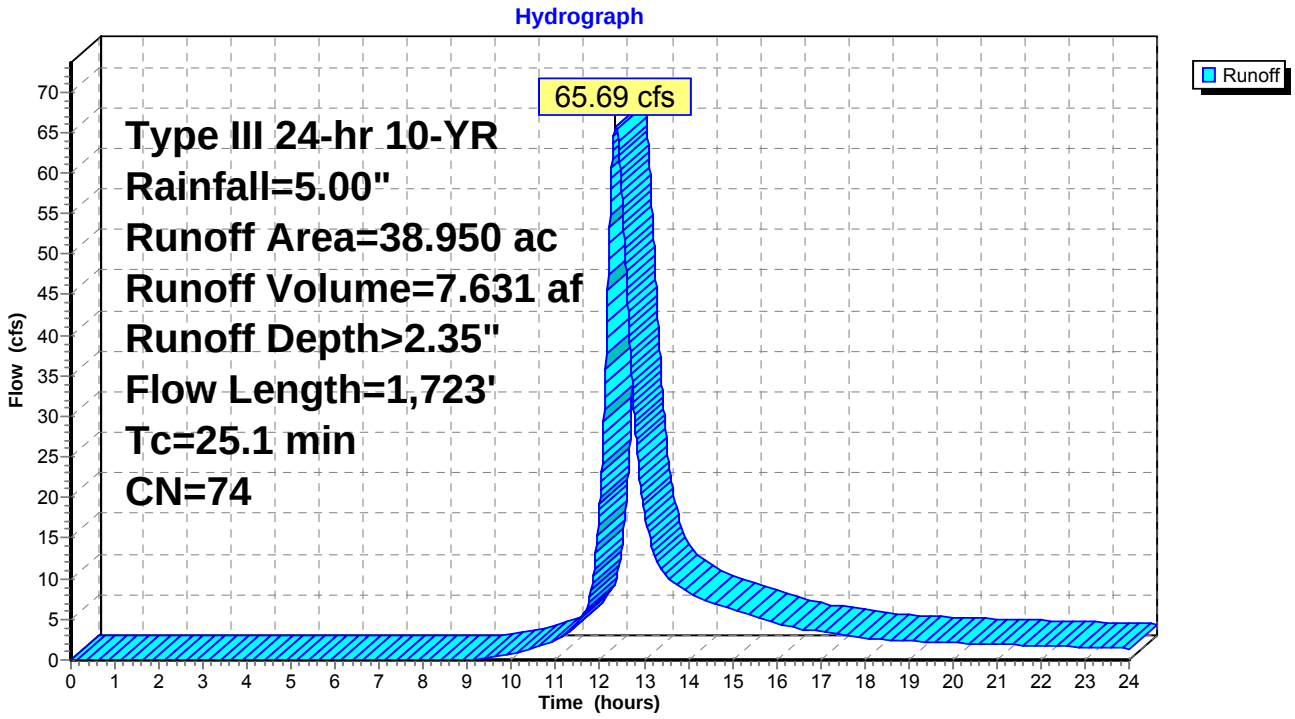
Runoff = 65.69 cfs @ 12.36 hrs, Volume= 7.631 af, Depth> 2.35"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=5.00"

Area (ac)	CN	Description
8.000	72	Woods/grass comb., Good, HSG C
0.100	98	Paved parking & roofs
30.850	74	>75% Grass cover, Good, HSG C
38.950	74	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.6	100	0.0700	0.1		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.40"
12.0	1,256	0.0622	1.7		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.5	367	0.0289	12.9	543.40	**Channel Flow,** Area= 42.0 sf Perim= 17.5' r= 2.40' n= 0.035 Earth, dense weeds
25.1	1,723	Total			

Subcatchment 1S: Pre-Developed Drainage Area A



Subcatchment 3S: Pre-Developed Drainage Area B

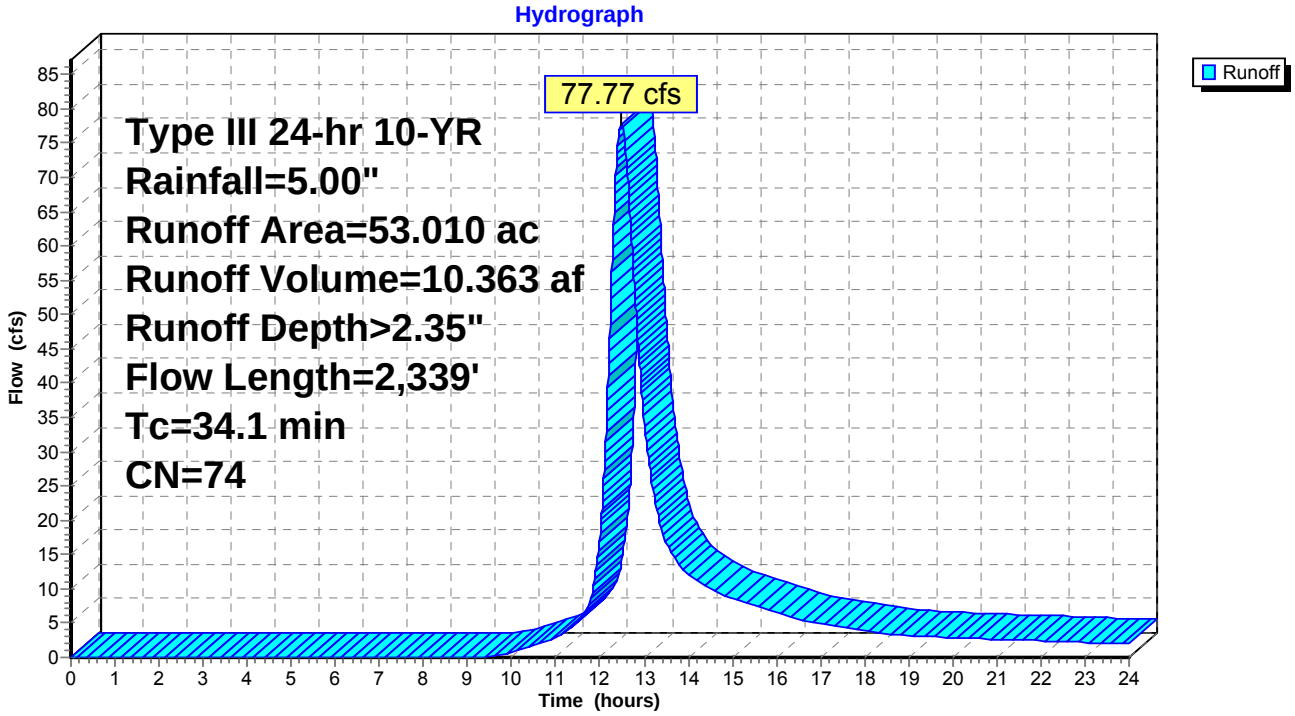
Runoff = 77.77 cfs @ 12.47 hrs, Volume= 10.363 af, Depth> 2.35"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=5.00"

Area (ac)	CN	Description
1.590	98	Paved parking & roofs
31.800	72	Woods/grass comb., Good, HSG C
19.620	74	>75% Grass cover, Good, HSG C
53.010	74	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.0	200	0.0700	0.2		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.40"
5.3	537	0.1155	1.7		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
6.8	1,602	0.0374	3.9		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
34.1	2,339	Total			

Subcatchment 3S: Pre-Developed Drainage Area B

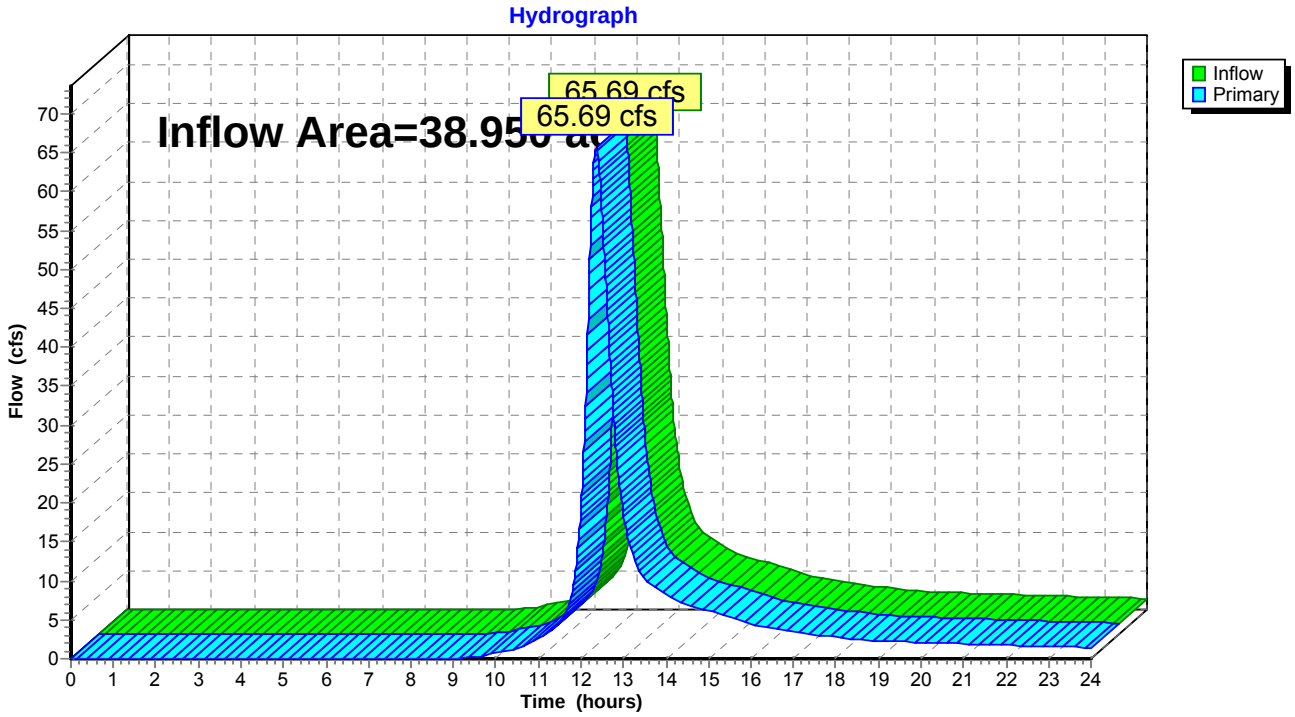


Link 2L: Discharge A

Inflow Area = 38.950 ac, Inflow Depth > 2.35" for 10-YR event
Inflow = 65.69 cfs @ 12.36 hrs, Volume= 7.631 af
Primary = 65.69 cfs @ 12.36 hrs, Volume= 7.631 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 2L: Discharge A

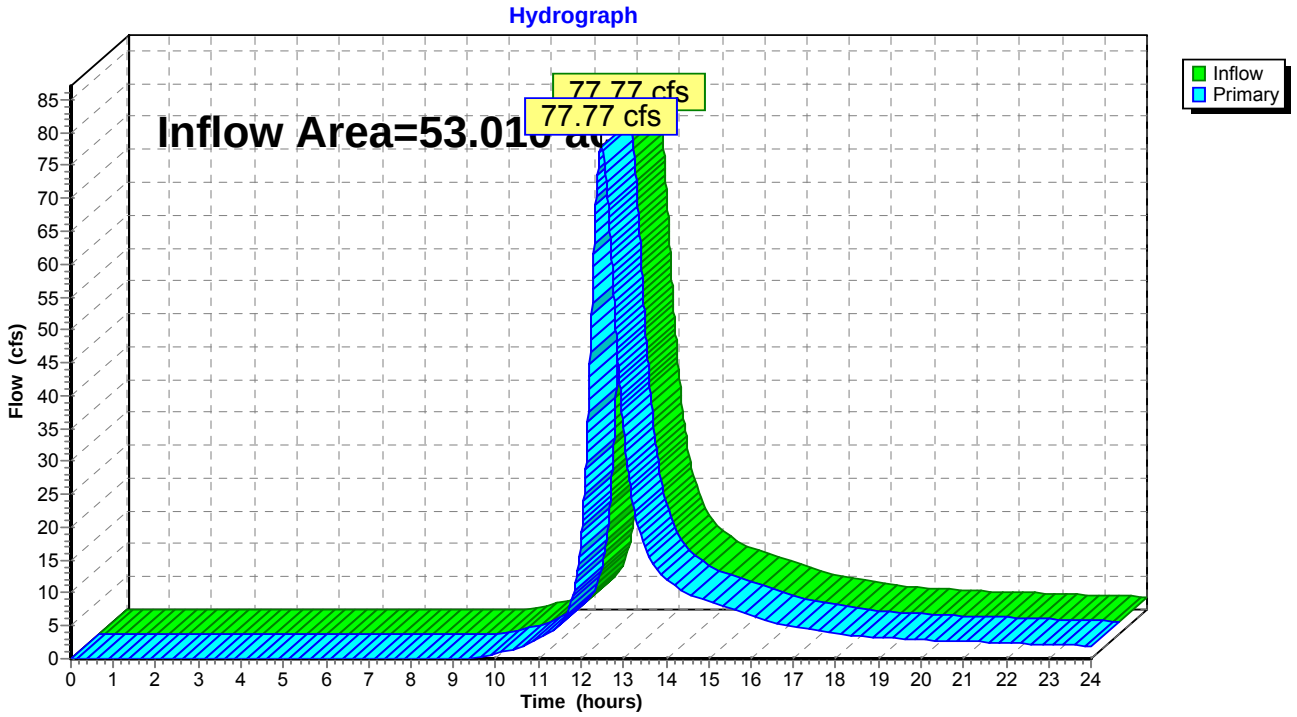


Link 4L: Discharge B

Inflow Area = 53.010 ac, Inflow Depth > 2.35" for 10-YR event
Inflow = 77.77 cfs @ 12.47 hrs, Volume= 10.363 af
Primary = 77.77 cfs @ 12.47 hrs, Volume= 10.363 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 4L: Discharge B



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Pre-Developed Drainage Area A Runoff Area=38.950 ac Runoff Depth>4.11"
Flow Length=1,723' Tc=25.1 min CN=74 Runoff=115.56 cfs 13.336 af

Subcatchment 3S: Pre-Developed Drainage Area B Runoff Area=53.010 ac Runoff Depth>4.10"
Flow Length=2,339' Tc=34.1 min CN=74 Runoff=136.95 cfs 18.115 af

Link 2L: Discharge A Inflow=115.56 cfs 13.336 af
Primary=115.56 cfs 13.336 af

Link 4L: Discharge B Inflow=136.95 cfs 18.115 af
Primary=136.95 cfs 18.115 af

Total Runoff Area = 91.960 ac Runoff Volume = 31.450 af Average Runoff Depth = 4.10"

Subcatchment 1S: Pre-Developed Drainage Area A

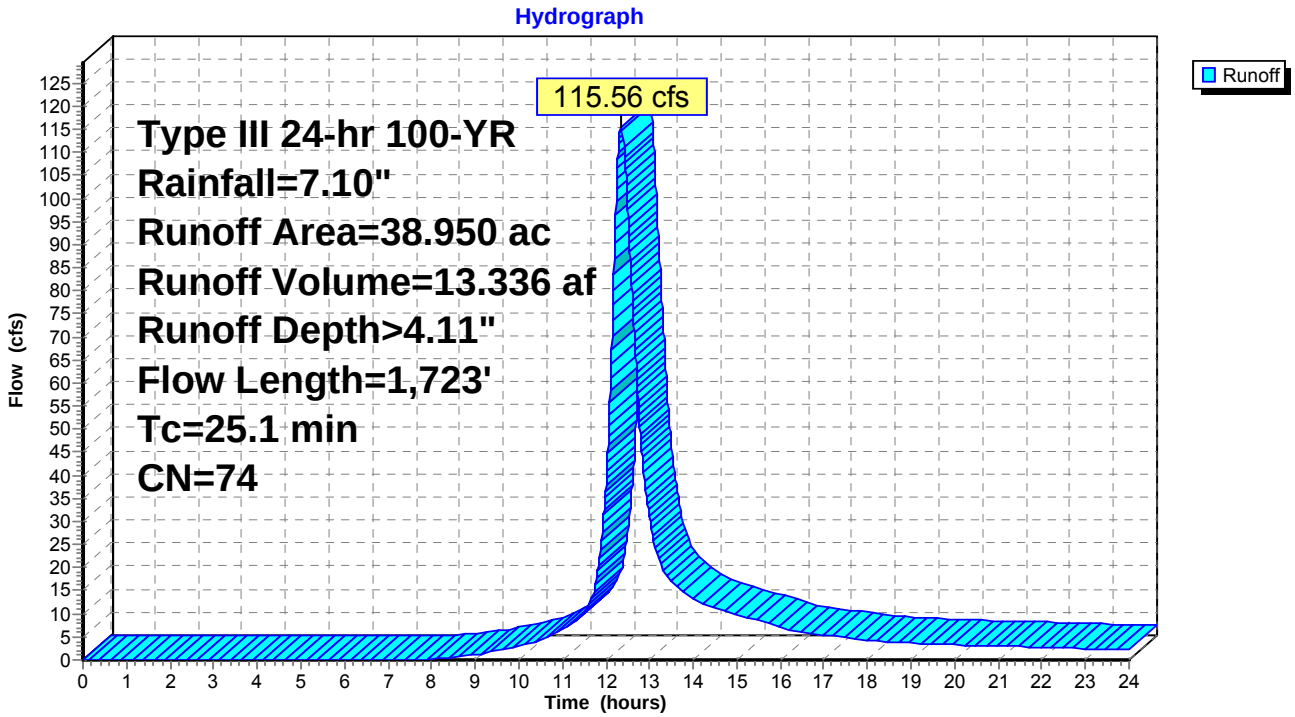
Runoff = 115.56 cfs @ 12.35 hrs, Volume= 13.336 af, Depth> 4.11"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=7.10"

Area (ac)	CN	Description
8.000	72	Woods/grass comb., Good, HSG C
0.100	98	Paved parking & roofs
30.850	74	>75% Grass cover, Good, HSG C
38.950	74	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.6	100	0.0700	0.1		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.40"
12.0	1,256	0.0622	1.7		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.5	367	0.0289	12.9	543.40	**Channel Flow,** Area= 42.0 sf Perim= 17.5' r= 2.40' n= 0.035 Earth, dense weeds
25.1	1,723	Total			

Subcatchment 1S: Pre-Developed Drainage Area A



Subcatchment 3S: Pre-Developed Drainage Area B

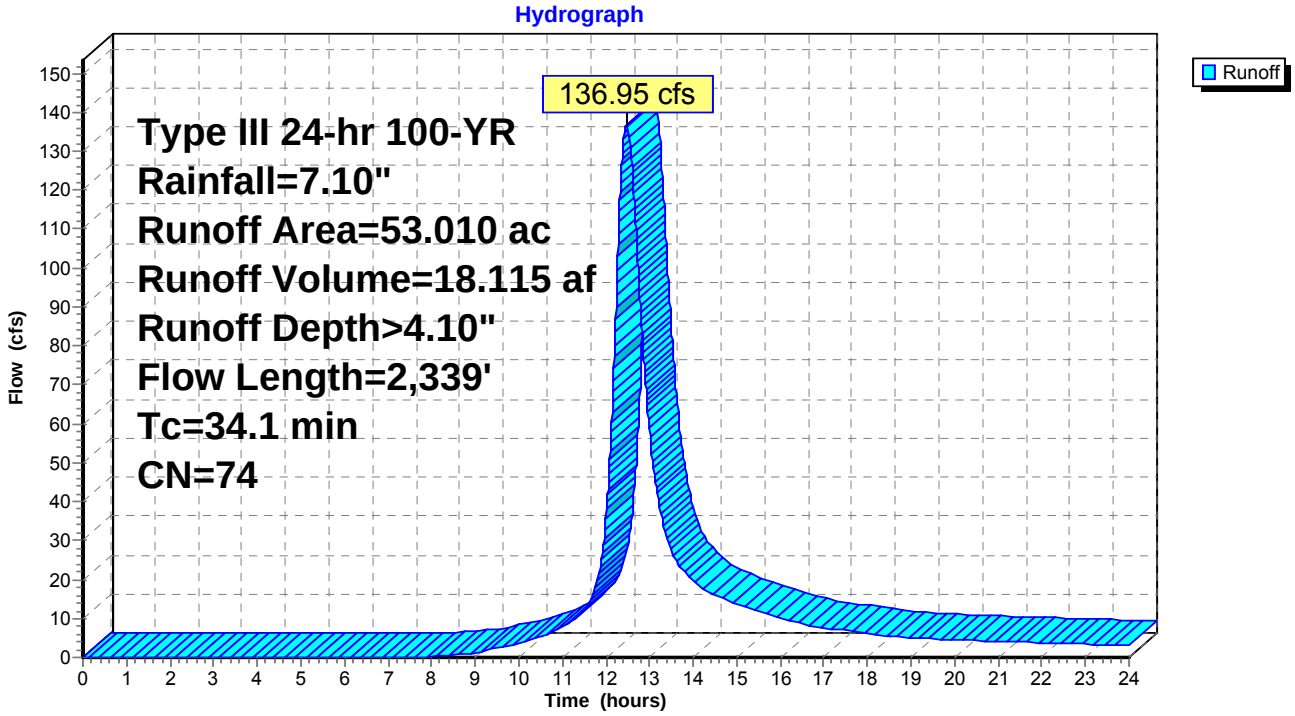
Runoff = 136.95 cfs @ 12.47 hrs, Volume= 18.115 af, Depth> 4.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=7.10"

Area (ac)	CN	Description
1.590	98	Paved parking & roofs
31.800	72	Woods/grass comb., Good, HSG C
19.620	74	>75% Grass cover, Good, HSG C
53.010	74	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.0	200	0.0700	0.2		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.40"
5.3	537	0.1155	1.7		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
6.8	1,602	0.0374	3.9		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
34.1	2,339	Total			

Subcatchment 3S: Pre-Developed Drainage Area B

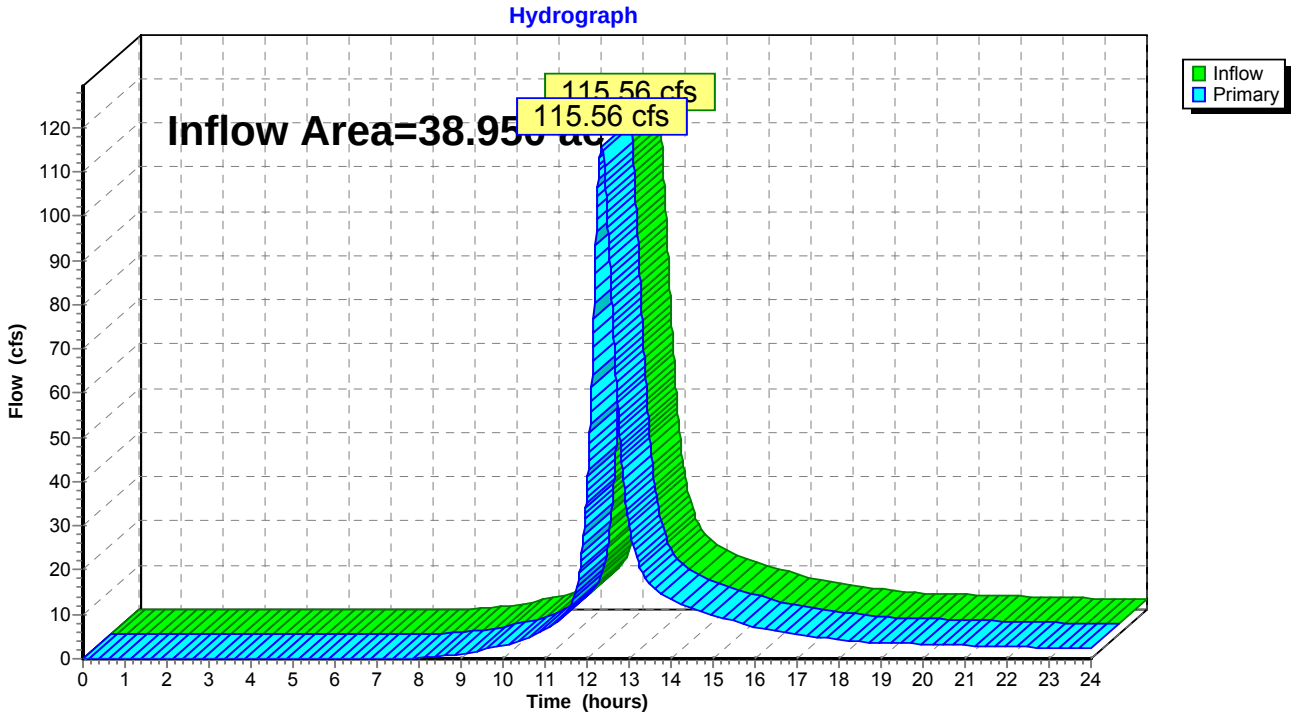


Link 2L: Discharge A

Inflow Area = 38.950 ac, Inflow Depth > 4.11" for 100-YR event
Inflow = 115.56 cfs @ 12.35 hrs, Volume= 13.336 af
Primary = 115.56 cfs @ 12.35 hrs, Volume= 13.336 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 2L: Discharge A

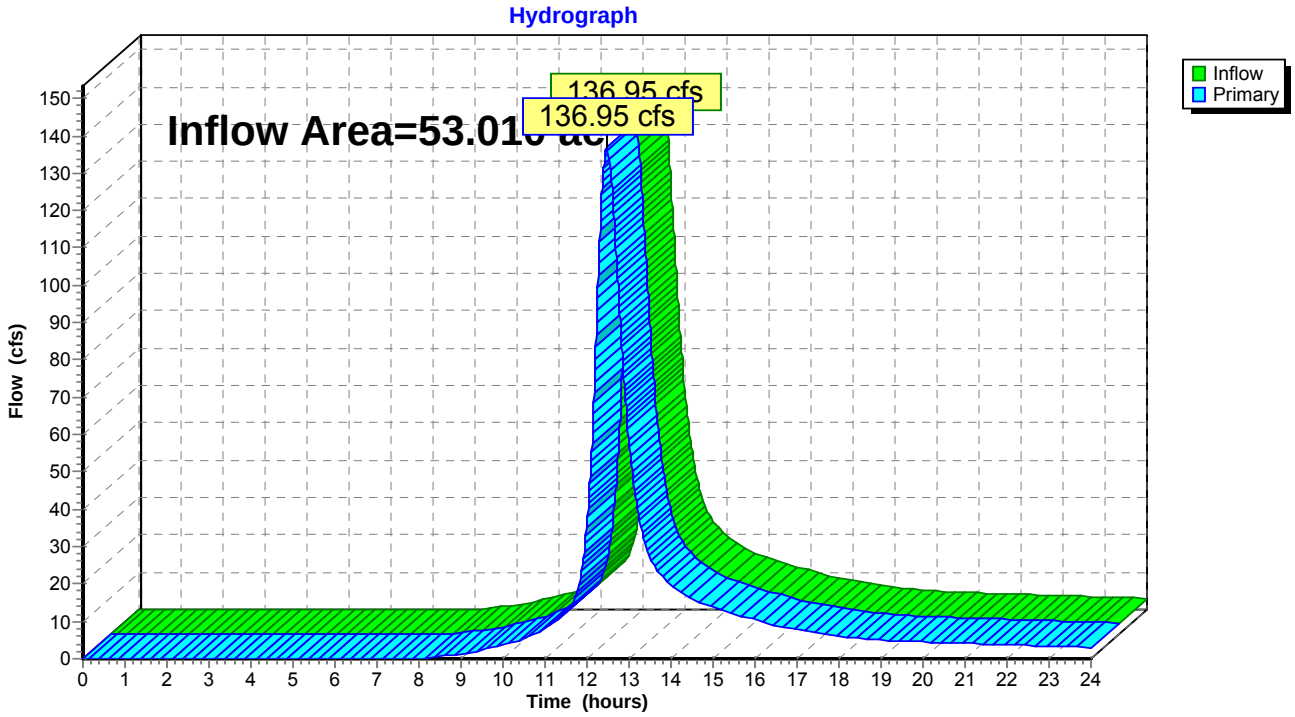


Link 4L: Discharge B

Inflow Area = 53.010 ac, Inflow Depth > 4.10" for 100-YR event
Inflow = 136.95 cfs @ 12.47 hrs, Volume= 18.115 af
Primary = 136.95 cfs @ 12.47 hrs, Volume= 18.115 af, Atten= 0%, Lag= 0.0 min

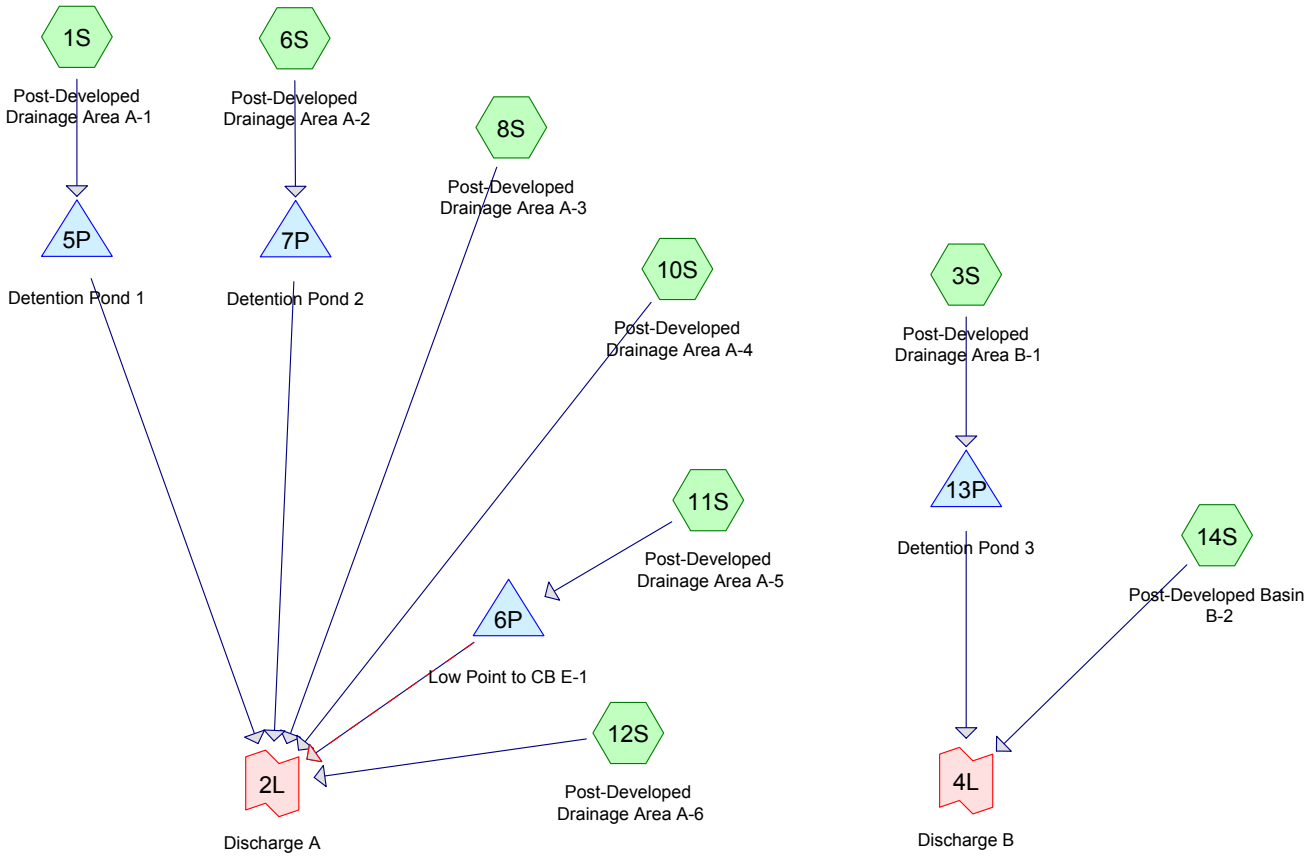
Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 4L: Discharge B



APPENDIX C
POST-DEVELOPMENT CONDITIONS

HydroCAD Reports: 2-, 10-, and 100-year storms



Subcat Reach Pond Link

Drainage Diagram for 06C1625 POST

Prepared by {enter your company name here} 6/13/2012

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Post-Developed Drainage Area A-1 Runoff Area=5.230 ac Runoff Depth>1.23"
Flow Length=651' Tc=15.5 min CN=75 Runoff=5.41 cfs 0.535 af

Subcatchment 3S: Post-Developed Drainage Area B-1 Runoff Area=2.900 ac Runoff Depth>1.29"
Flow Length=666' Tc=13.0 min CN=76 Runoff=3.40 cfs 0.312 af

Subcatchment 6S: Post-Developed Drainage Area A-2 Runoff Area=5.330 ac Runoff Depth>1.23"
Flow Length=658' Tc=15.5 min CN=75 Runoff=5.52 cfs 0.545 af

Subcatchment 8S: Post-Developed Drainage Area A-3 Runoff Area=6.100 ac Runoff Depth>1.23"
Flow Length=953' Tc=18.7 min CN=75 Runoff=5.87 cfs 0.623 af

Subcatchment 10S: Post-Developed Drainage Area A-4 Runoff Area=5.850 ac Runoff Depth>1.23"
Flow Length=1,050' Tc=19.7 min CN=75 Runoff=5.51 cfs 0.597 af

Subcatchment 11S: Post-Developed Drainage Area A-5 Runoff Area=7.580 ac Runoff Depth>1.23"
Flow Length=868' Tc=17.8 min CN=75 Runoff=7.43 cfs 0.774 af

Subcatchment 12S: Post-Developed Drainage Area A-6 Runoff Area=10.210 ac Runoff Depth>1.16"
Flow Length=1,609' Tc=24.0 min CN=74 Runoff=8.35 cfs 0.990 af

Subcatchment 14S: Post-Developed Basin B-2 Runoff Area=48.760 ac Runoff Depth>1.16"
Tc=34.1 min CN=74 Runoff=34.07 cfs 4.716 af

Pond 5P: Detention Pond 1 Peak Elev=290.38' Storage=6,914 cf Inflow=5.41 cfs 0.535 af
Outflow=2.75 cfs 0.527 af

Pond 6P: Low Point to CB E-1 Peak Elev=264.81' Storage=616 cf Inflow=7.43 cfs 0.774 af
Primary=6.51 cfs 0.774 af Secondary=0.00 cfs 0.000 af Outflow=6.51 cfs 0.774 af

Pond 7P: Detention Pond 2 Peak Elev=286.43' Storage=4,270 cf Inflow=5.52 cfs 0.545 af
Outflow=3.96 cfs 0.545 af

Pond 13P: Detention Pond 3 Peak Elev=280.77' Storage=2,265 cf Inflow=3.40 cfs 0.312 af
Outflow=1.85 cfs 0.311 af

Link 2L: Discharge A Inflow=30.24 cfs 4.057 af
Primary=30.24 cfs 4.057 af

Link 4L: Discharge B Inflow=35.91 cfs 5.028 af
Primary=35.91 cfs 5.028 af

Total Runoff Area = 91.960 ac Runoff Volume = 9.093 af Average Runoff Depth = 1.19"

Subcatchment 1S: Post-Developed Drainage Area A-1

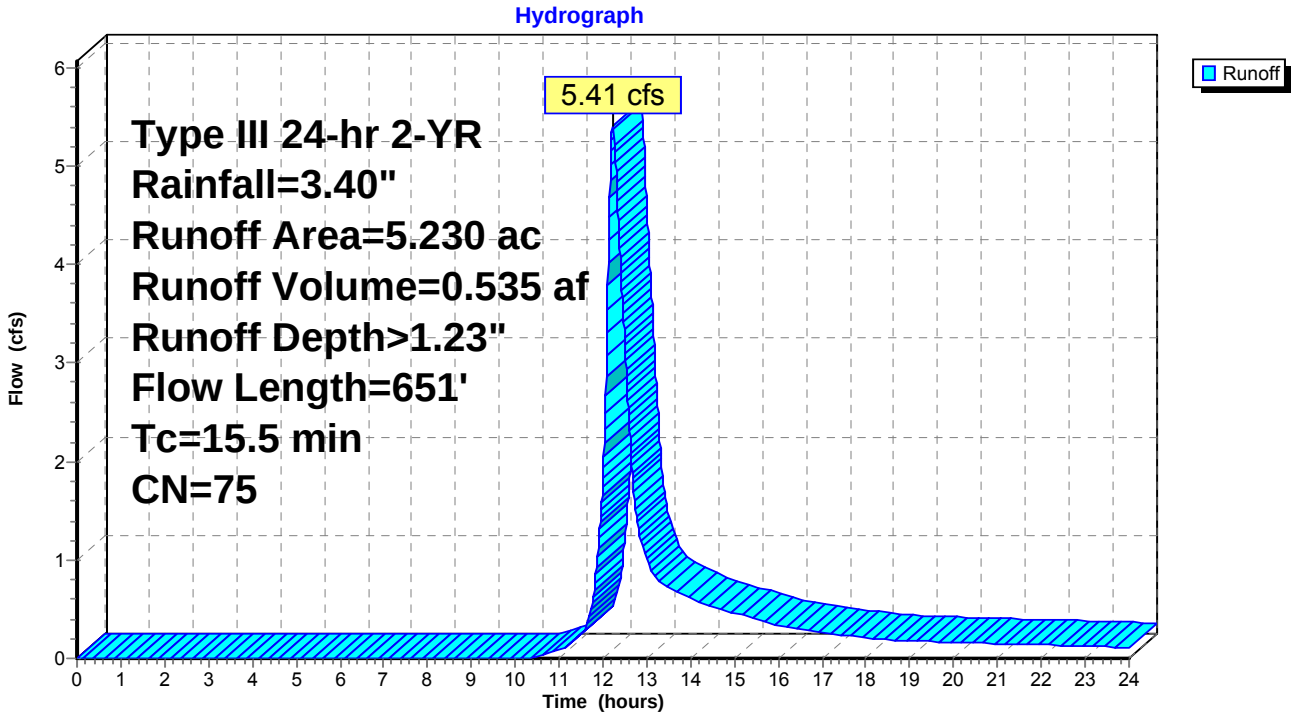
Runoff = 5.41 cfs @ 12.22 hrs, Volume= 0.535 af, Depth> 1.23"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.40"

Area (ac)	CN	Description
0.130	72	Woods/grass comb., Good, HSG C
0.350	89	Gravel roads, HSG C
4.750	74	>75% Grass cover, Good, HSG C
5.230	75	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	100	0.0500	0.2		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.40"
5.9	551	0.0500	1.6		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
15.5	651	Total			

Subcatchment 1S: Post-Developed Drainage Area A-1



Subcatchment 3S: Post-Developed Drainage Area B-1

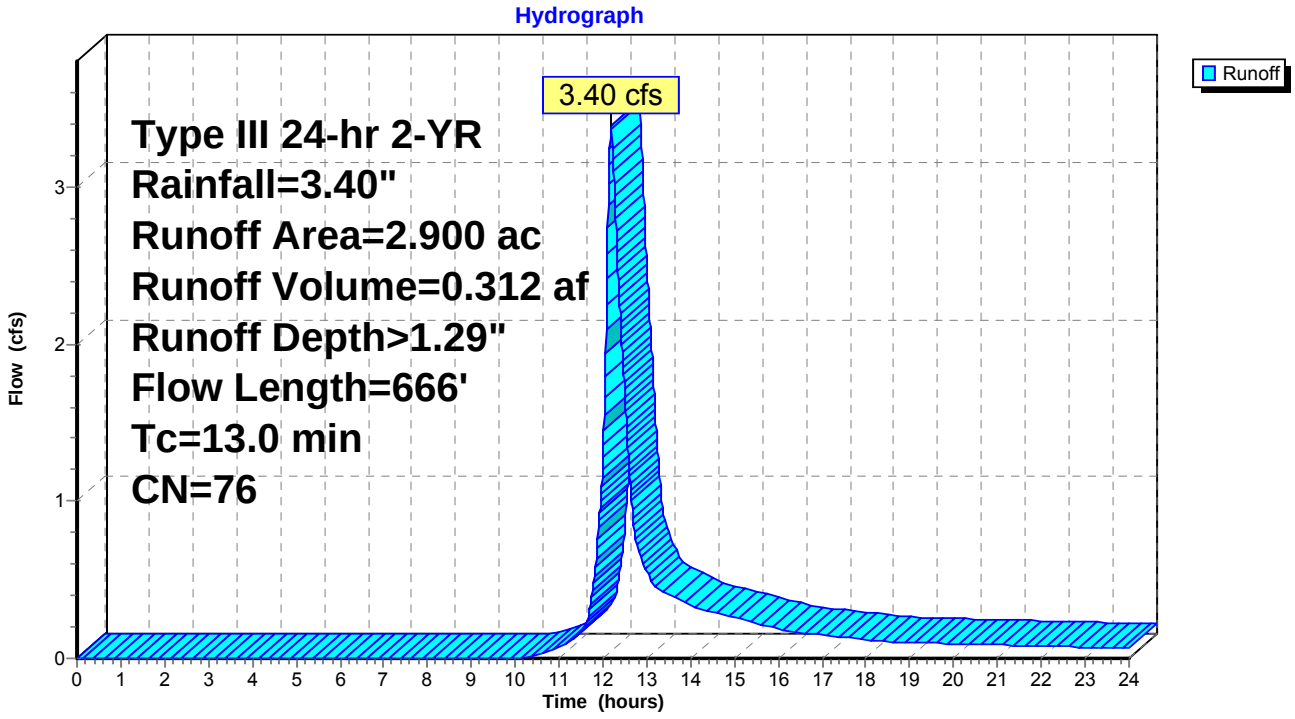
Runoff = 3.40 cfs @ 12.19 hrs, Volume= 0.312 af, Depth> 1.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.40"

Area (ac)	CN	Description
0.040	98	Paved parking & roofs
0.400	89	Gravel roads, HSG C
2.460	74	>75% Grass cover, Good, HSG C
2.900	76	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	100	0.0500	0.2		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.40"
3.4	566	0.0350	2.8		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
13.0	666	Total			

Subcatchment 3S: Post-Developed Drainage Area B-1



Subcatchment 6S: Post-Developed Drainage Area A-2

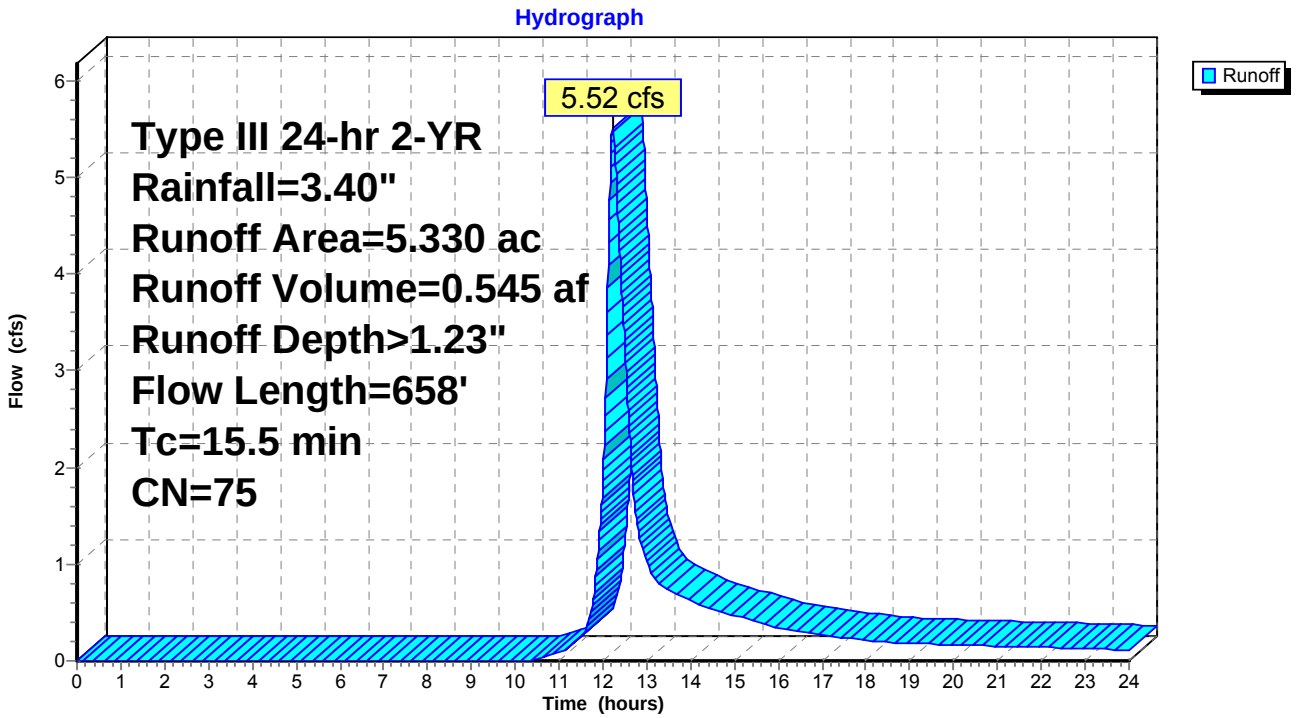
Runoff = 5.52 cfs @ 12.22 hrs, Volume= 0.545 af, Depth> 1.23"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.40"

Area (ac)	CN	Description
0.300	89	Gravel roads, HSG C
5.030	74	>75% Grass cover, Good, HSG C
5.330	75	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	100	0.0500	0.2		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.40"
5.9	558	0.0500	1.6		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
15.5	658	Total			

Subcatchment 6S: Post-Developed Drainage Area A-2



Subcatchment 8S: Post-Developed Drainage Area A-3

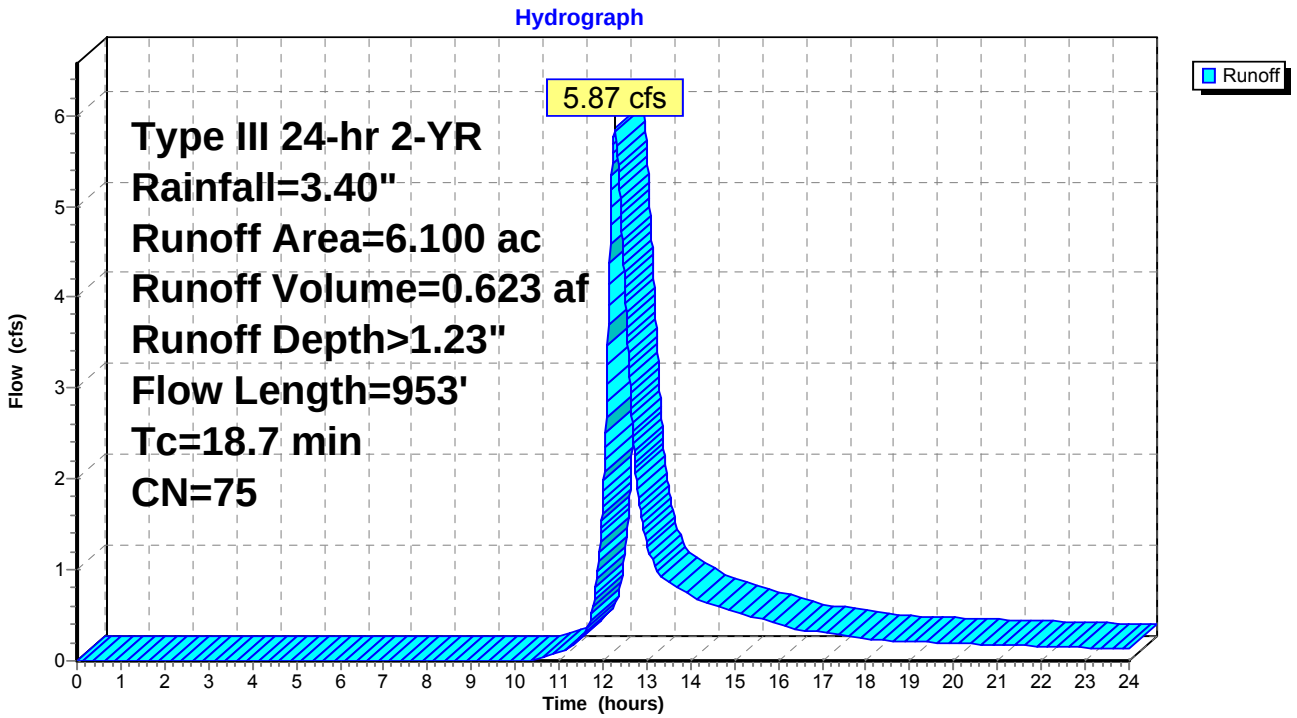
Runoff = 5.87 cfs @ 12.28 hrs, Volume= 0.623 af, Depth> 1.23"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.40"

Area (ac)	CN	Description
0.310	89	Gravel roads, HSG C
5.790	74	>75% Grass cover, Good, HSG C
6.100	75	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	100	0.0500	0.2		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.40"
9.1	853	0.0500	1.6		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
18.7	953	Total			

Subcatchment 8S: Post-Developed Drainage Area A-3



Subcatchment 10S: Post-Developed Drainage Area A-4

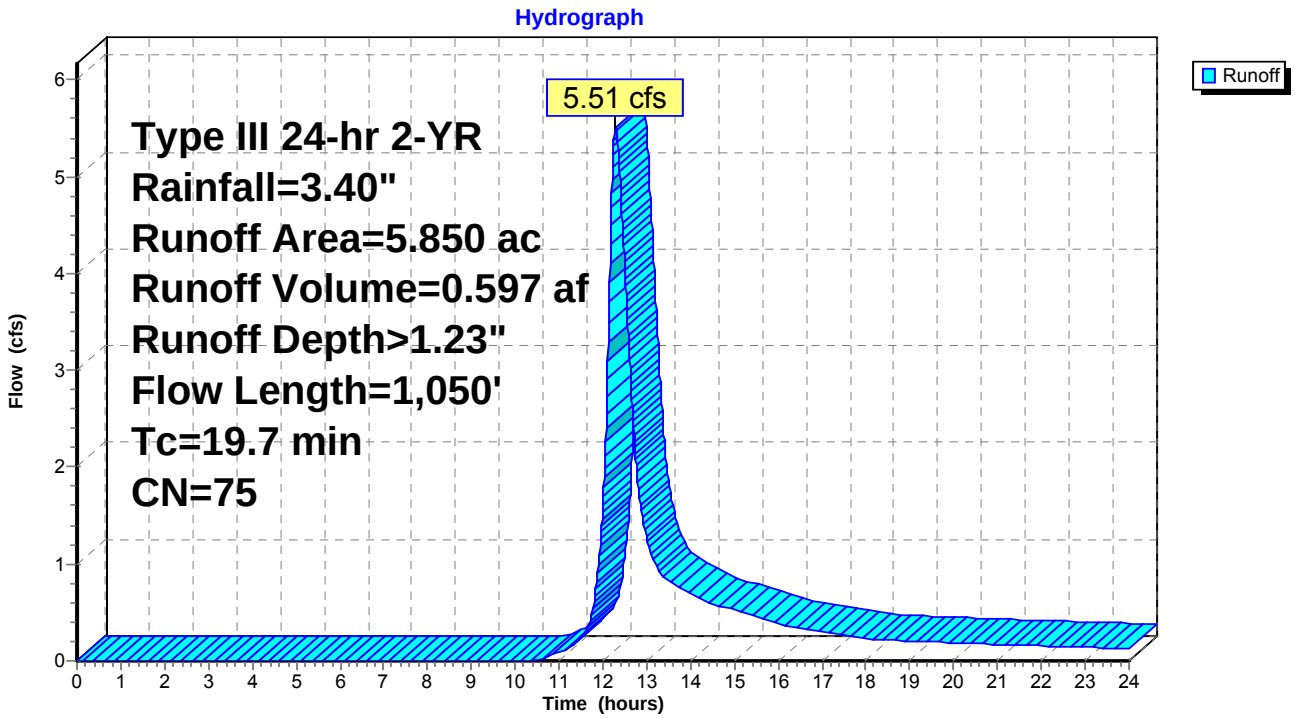
Runoff = 5.51 cfs @ 12.28 hrs, Volume= 0.597 af, Depth> 1.23"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.40"

Area (ac)	CN	Description
0.530	89	Gravel roads, HSG C
5.320	74	>75% Grass cover, Good, HSG C
5.850	75	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	100	0.0500	0.2		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.40"
10.1	950	0.0500	1.6		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
19.7	1,050	Total			

Subcatchment 10S: Post-Developed Drainage Area A-4



Subcatchment 11S: Post-Developed Drainage Area A-5

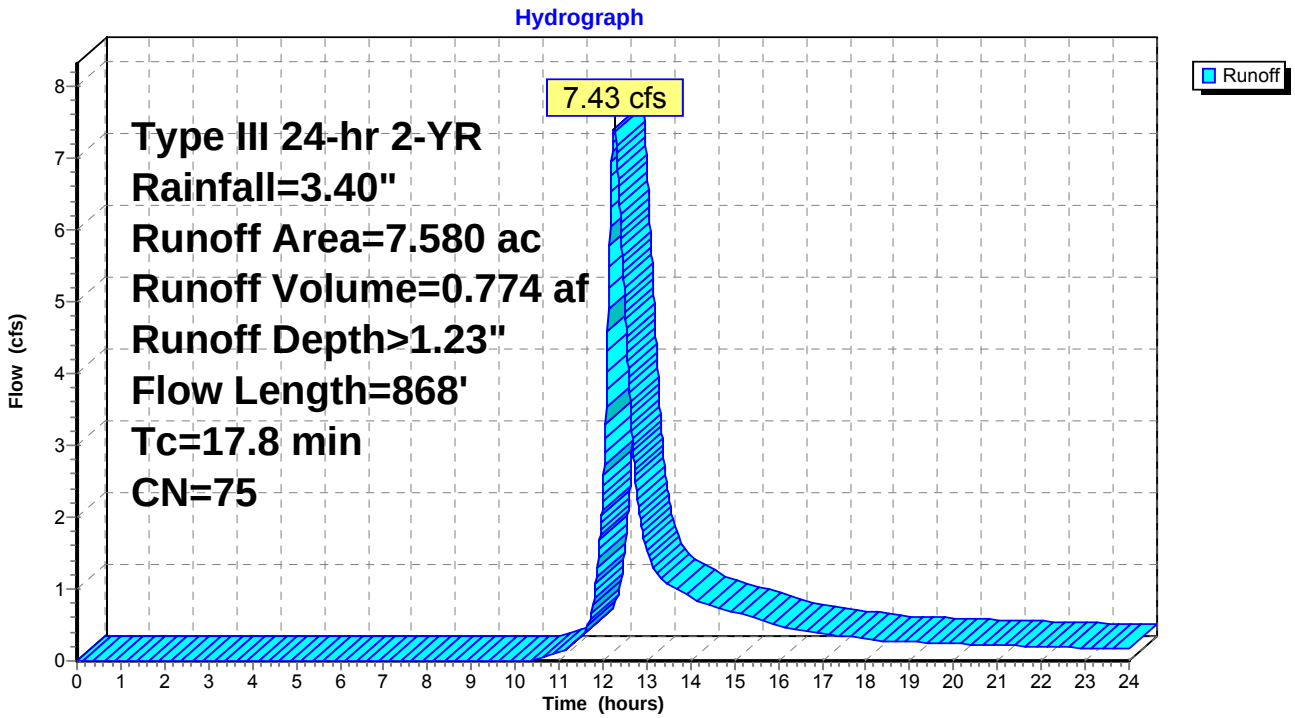
Runoff = 7.43 cfs @ 12.26 hrs, Volume= 0.774 af, Depth> 1.23"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.40"

Area (ac)	CN	Description
0.530	89	Gravel roads, HSG C
7.050	74	>75% Grass cover, Good, HSG C
7.580	75	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	100	0.0500	0.2		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.40"
8.2	768	0.0500	1.6		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
17.8	868	Total			

Subcatchment 11S: Post-Developed Drainage Area A-5



Subcatchment 12S: Post-Developed Drainage Area A-6

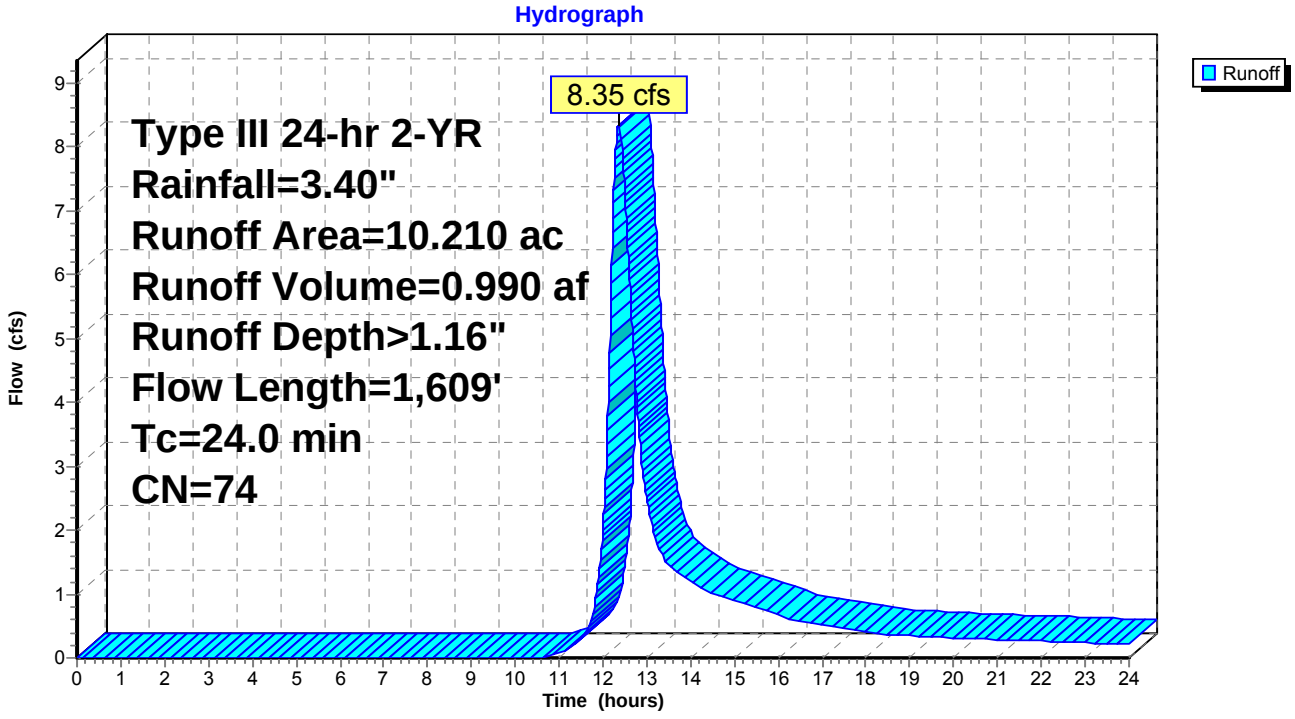
Runoff = 8.35 cfs @ 12.35 hrs, Volume= 0.990 af, Depth> 1.16"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.40"

Area (ac)	CN	Description
2.550	72	Woods/grass comb., Good, HSG C
7.660	74	>75% Grass cover, Good, HSG C
10.210	74	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.7	100	0.0125	0.1		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.40"
5.8	350	0.0400	1.0		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.5	1,159	0.0289	12.9	543.40	**Channel Flow,** Area= 42.0 sf Perim= 17.5' r= 2.40' n= 0.035
24.0	1,609	Total			

Subcatchment 12S: Post-Developed Drainage Area A-6



Subcatchment 14S: Post-Developed Basin B-2

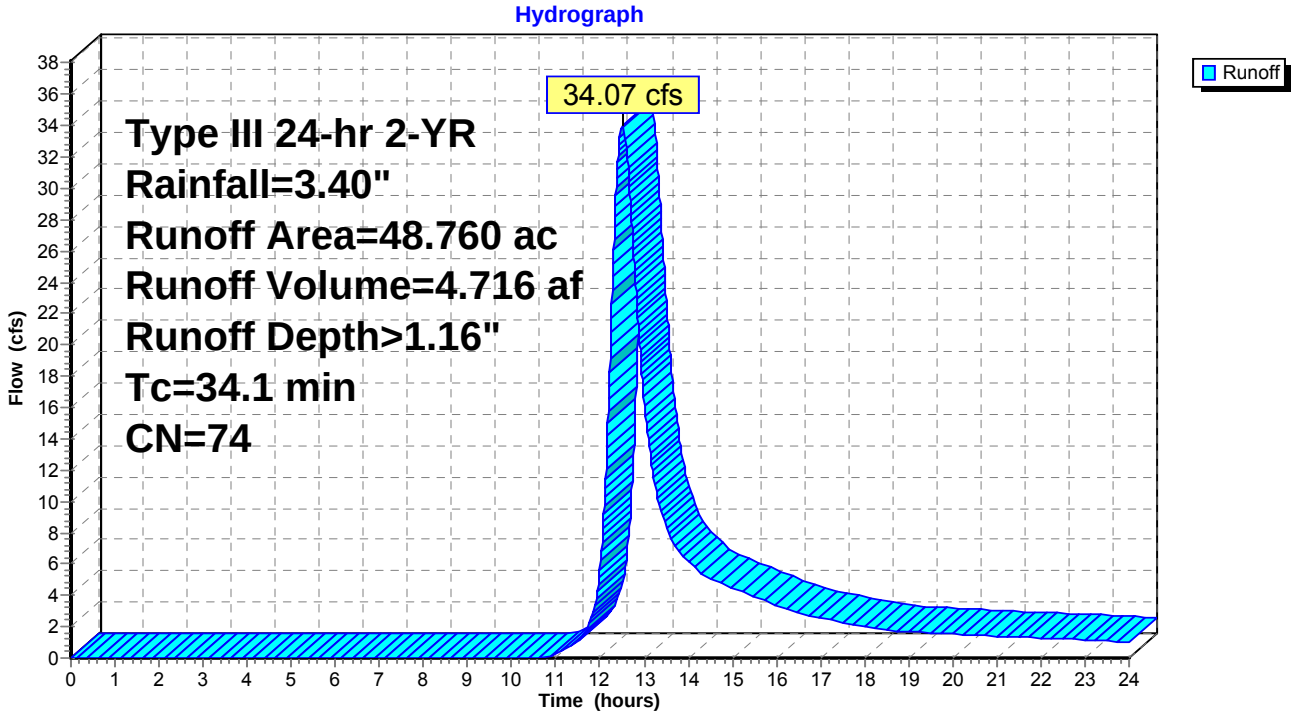
Runoff = 34.07 cfs @ 12.51 hrs, Volume= 4.716 af, Depth> 1.16"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.40"

Area (ac)	CN	Description
1.500	98	Paved parking & roofs
27.550	72	Woods/grass comb., Good, HSG C
19.710	74	>75% Grass cover, Good, HSG C
48.760	74	Weighted Average

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

Subcatchment 14S: Post-Developed Basin B-2



Pond 5P: Detention Pond 1

Inflow Area = 5.230 ac, Inflow Depth > 1.23" for 2-YR event
Inflow = 5.41 cfs @ 12.22 hrs, Volume= 0.535 af
Outflow = 2.75 cfs @ 12.55 hrs, Volume= 0.527 af, Atten= 49%, Lag= 19.8 min
Primary = 2.75 cfs @ 12.55 hrs, Volume= 0.527 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 290.38' @ 12.55 hrs Surf.Area= 4,129 sf Storage= 6,914 cf
Plug-Flow detention time= 117.0 min calculated for 0.527 af (99% of inflow)
Center-of-Mass det. time= 109.4 min (971.1 - 861.7)

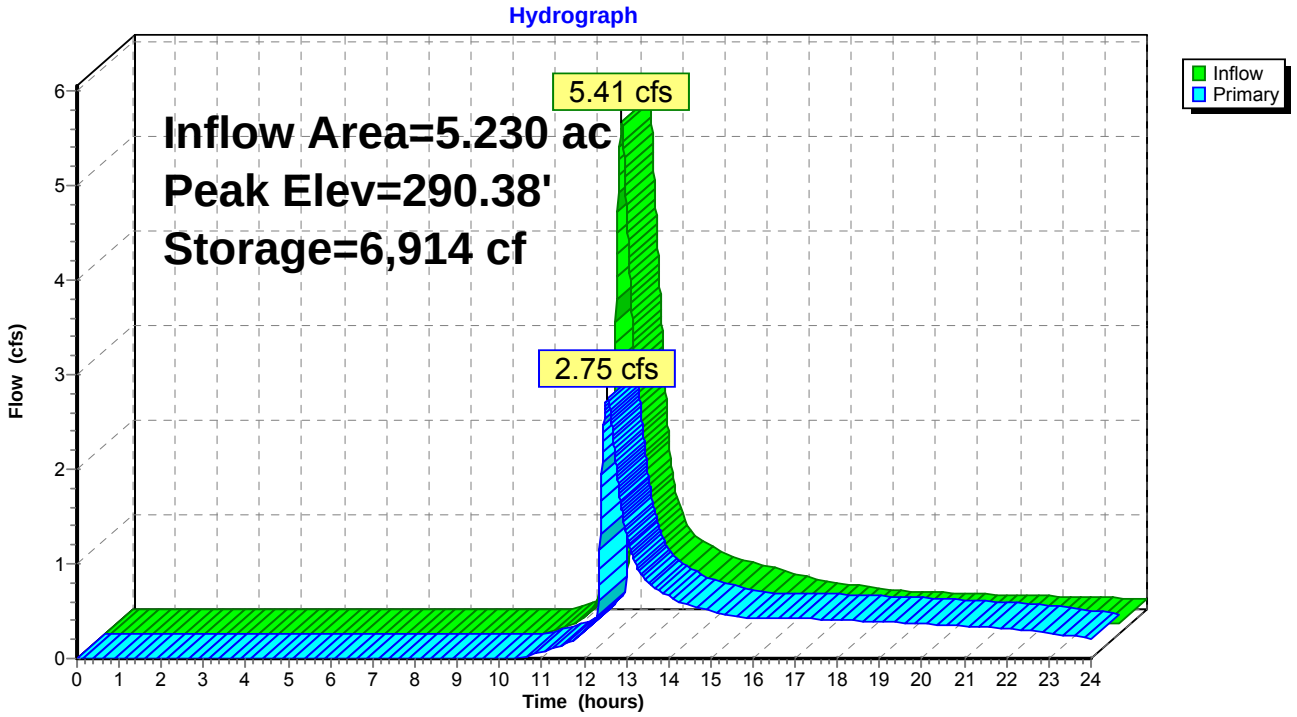
Volume	Invert	Avail.Storage	Storage Description
#1	286.50'	37,334 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
286.50	0	0	0
288.00	1,136	852	852
290.00	3,487	4,623	5,475
292.00	6,887	10,374	15,849
294.00	11,385	18,272	34,121
294.25	14,317	3,213	37,334

Device	Routing	Invert	Outlet Devices
#1	Primary	286.50'	**12.0" x 56.0' long Culvert** CPP, mitered to conform to fill, Ke= 0.700 Outlet Invert= 286.00' S= 0.0089 '/' Cc= 0.900 n= 0.010 PVC, smooth interior
#2	Device 1	286.50'	**3.0" Vert. Orifice** C= 0.600
#3	Device 1	290.00'	**3.0' long x 1.5' high Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Device 1	293.25'	**4.00' x 4.00' Horiz. CB Grate** Limited to weir flow C= 0.600

Primary OutFlow Max=2.75 cfs @ 12.55 hrs HW=290.38' (Free Discharge)
└**1=Culvert** (Passes 2.75 cfs of 6.13 cfs potential flow)
  ├**2=Orifice** (Orifice Controls 0.46 cfs @ 9.3 fps)
  ├**3=Sharp-Crested Rectangular Weir** (Weir Controls 2.29 cfs @ 2.1 fps)
  └**4=CB Grate** (Controls 0.00 cfs)

Pond 5P: Detention Pond 1



Pond 6P: Low Point to CB E-1

Inflow Area = 7.580 ac, Inflow Depth > 1.23" for 2-YR event
Inflow = 7.43 cfs @ 12.26 hrs, Volume= 0.774 af
Outflow = 6.51 cfs @ 12.37 hrs, Volume= 0.774 af, Atten= 12%, Lag= 6.6 min
Primary = 6.51 cfs @ 12.37 hrs, Volume= 0.774 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 264.81' @ 12.37 hrs Surf.Area= 1,172 sf Storage= 616 cf
Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.3 min (863.8 - 863.5)

Volume	Invert	Avail.Storage	Storage Description
#1	263.50'	12,952 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

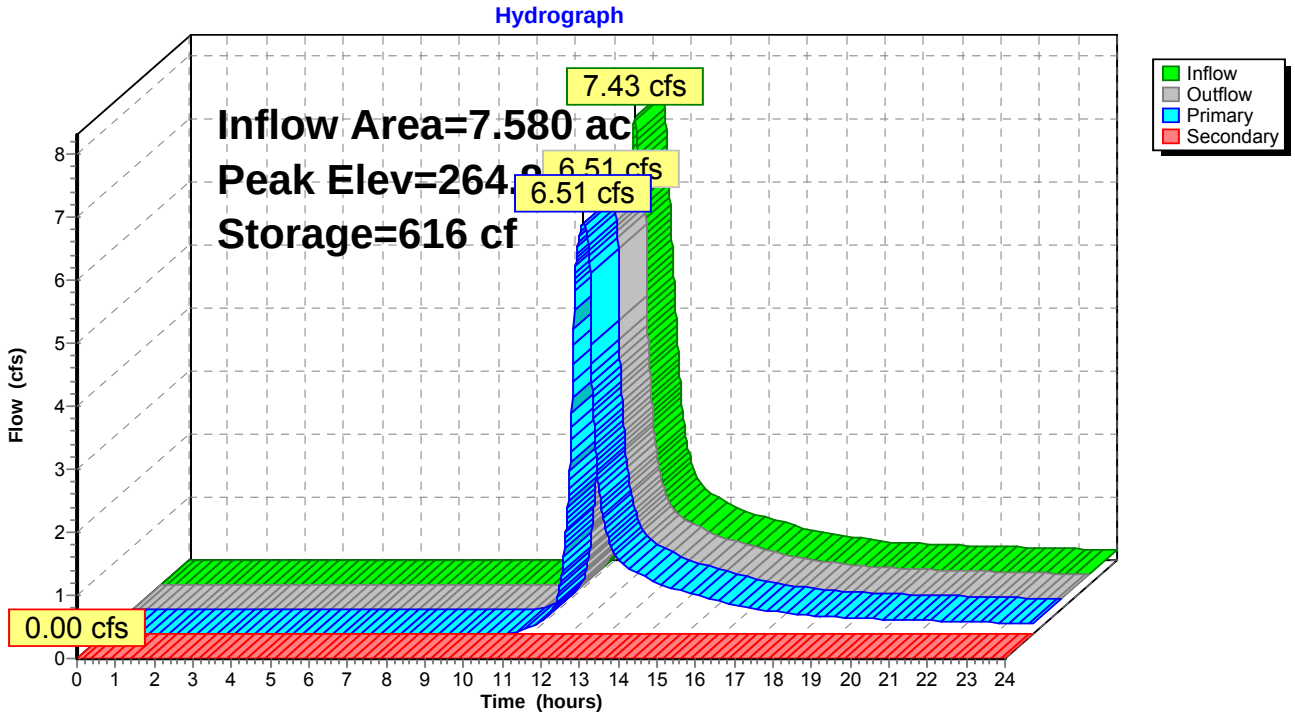
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
263.50	0	0	0
264.00	220	55	55
266.00	2,584	2,804	2,859
268.00	5,873	8,457	11,316
268.25	7,213	1,636	12,952

Device	Routing	Invert	Outlet Devices
#1	Primary	260.50'	**12.0" x 45.0' long Culvert** CPP, mitered to conform to fill, Ke= 0.700 Outlet Invert= 260.00' S= 0.0111 '/' Cc= 0.900 n= 0.010 PVC, smooth interior
#2	Device 1	263.50'	**4.00' x 4.00' Horiz. CB Grate** Limited to weir flow C= 0.600
#3	Secondary	268.45'	**138.0' long x 1.7' high Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=6.51 cfs @ 12.37 hrs HW=264.81' (Free Discharge)
└**1=Culvert** (Inlet Controls 6.51 cfs @ 8.3 fps)
└**2=CB Grate** (Passes 6.51 cfs of 78.03 cfs potential flow)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=263.50' (Free Discharge)
└**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 6P: Low Point to CB E-1



Pond 7P: Detention Pond 2

Inflow Area = 5.330 ac, Inflow Depth > 1.23" for 2-YR event
Inflow = 5.52 cfs @ 12.22 hrs, Volume= 0.545 af
Outflow = 3.96 cfs @ 12.41 hrs, Volume= 0.545 af, Atten= 28%, Lag= 11.4 min
Primary = 3.96 cfs @ 12.41 hrs, Volume= 0.545 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 286.43' @ 12.41 hrs Surf.Area= 2,908 sf Storage= 4,270 cf
Plug-Flow detention time= 20.9 min calculated for 0.545 af (100% of inflow)
Center-of-Mass det. time= 20.5 min (882.2 - 861.7)

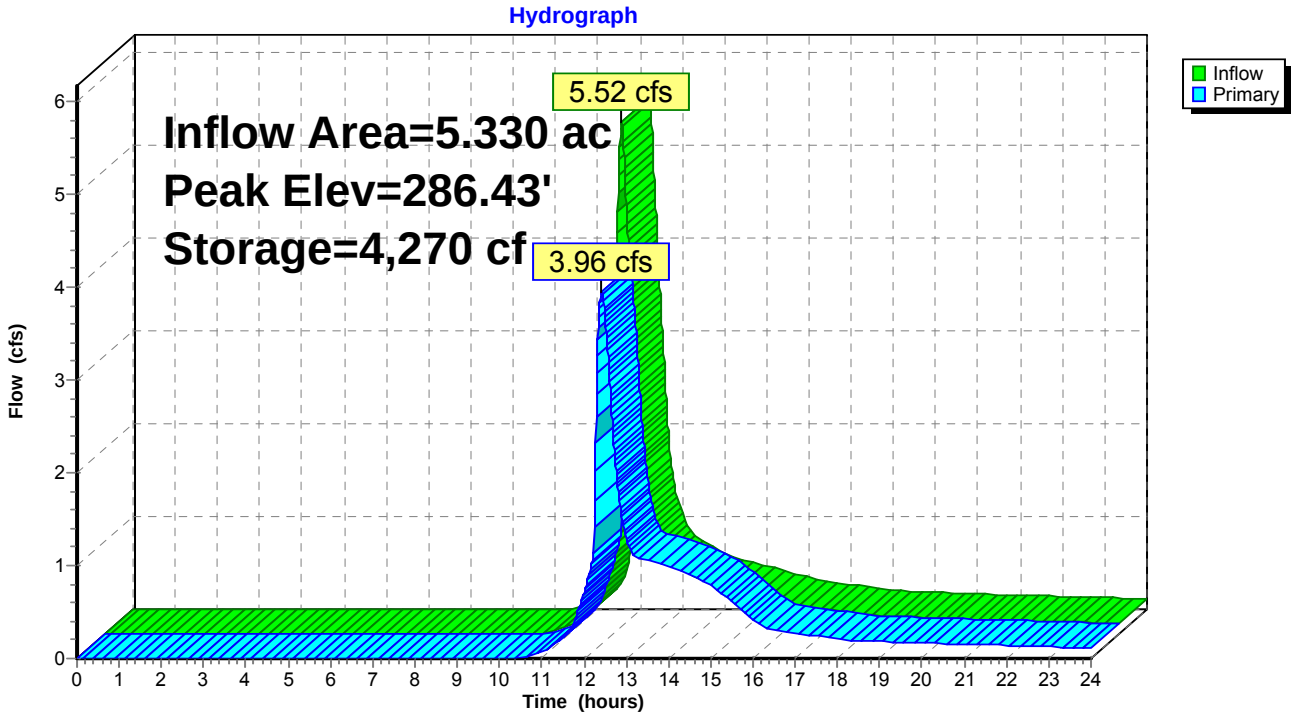
Volume	Invert	Avail.Storage	Storage Description
#1	283.00'	28,282 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
283.00	0	0	0
284.00	584	292	292
286.00	2,272	2,856	3,148
288.00	5,206	7,478	10,626
290.00	9,269	14,475	25,101
290.30	11,939	3,181	28,282

Device	Routing	Invert	Outlet Devices
#1	Primary	283.00'	**12.0" x 54.0' long Culvert** CPP, mitered to conform to fill, Ke= 0.700 Outlet Invert= 282.00' S= 0.0185 '/' Cc= 0.900 n= 0.010 PVC, smooth interior
#2	Device 1	283.00'	**5.0" Vert. Orifice** C= 0.600
#3	Device 1	286.00'	**3.0' long x 2.5' high Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Device 1	289.30'	**4.00' x 4.00' Horiz. CB Grate** Limited to weir flow C= 0.600

Primary OutFlow Max=3.95 cfs @ 12.41 hrs HW=286.43' (Free Discharge)
└**1=Culvert** (Passes 3.95 cfs of 5.71 cfs potential flow)
  ├**2=Orifice** (Orifice Controls 1.18 cfs @ 8.6 fps)
  ├**3=Sharp-Crested Rectangular Weir** (Weir Controls 2.77 cfs @ 2.2 fps)
  └**4=CB Grate** (Controls 0.00 cfs)

Pond 7P: Detention Pond 2



Pond 13P: Detention Pond 3

Inflow Area = 2.900 ac, Inflow Depth > 1.29" for 2-YR event
Inflow = 3.40 cfs @ 12.19 hrs, Volume= 0.312 af
Outflow = 1.85 cfs @ 12.46 hrs, Volume= 0.311 af, Atten= 46%, Lag= 16.5 min
Primary = 1.85 cfs @ 12.46 hrs, Volume= 0.311 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 280.77' @ 12.46 hrs Surf.Area= 2,656 sf Storage= 2,265 cf
Plug-Flow detention time= 11.2 min calculated for 0.311 af (100% of inflow)
Center-of-Mass det. time= 10.6 min (867.3 - 856.7)

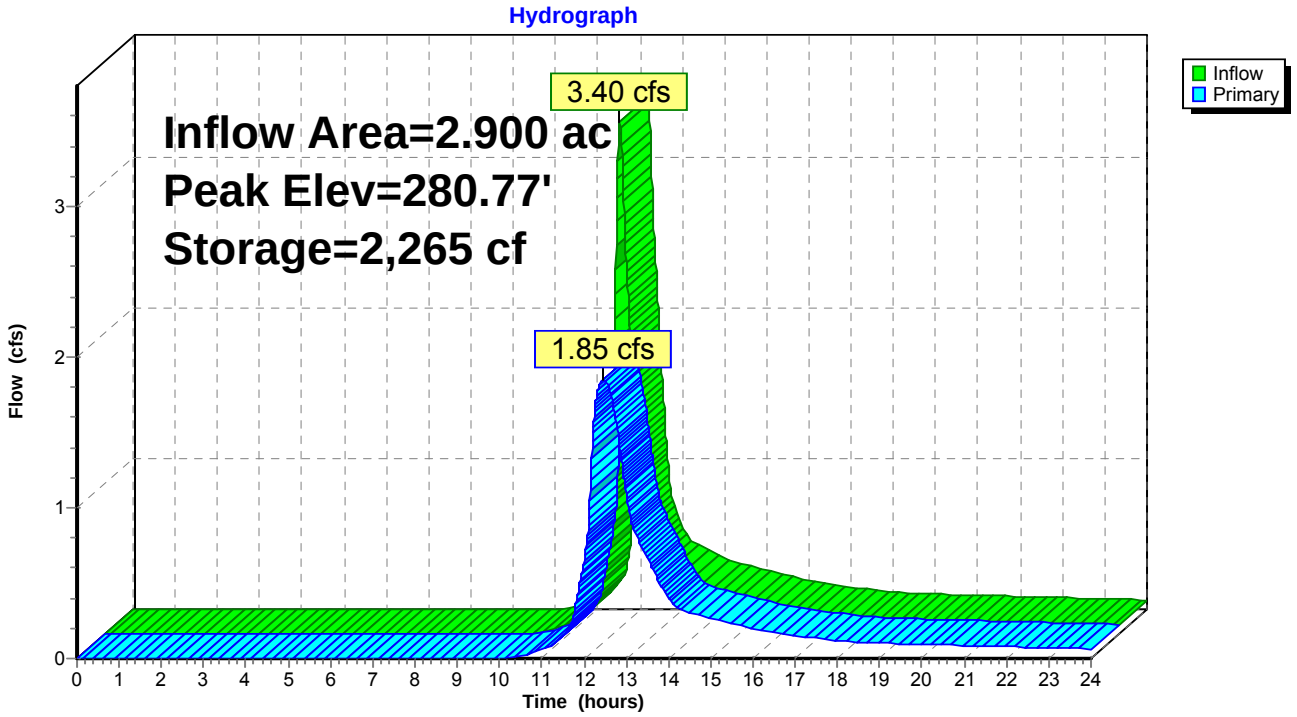
Volume	Invert	Avail.Storage	Storage Description
#1	279.00'	21,504 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
279.00	0	0	0
280.00	1,400	700	700
282.00	4,654	6,054	6,754
284.00	7,900	12,554	19,308
284.25	9,664	2,196	21,504

Device	Routing	Invert	Outlet Devices
#1	Primary	279.00'	**12.0" x 122.0' long Culvert** CPP, mitered to conform to fill, Ke= 0.700 Outlet Invert= 278.00' S= 0.0082 '/' Cc= 0.900 n= 0.010 PVC, smooth interior
#2	Device 1	279.00'	**6.0" Vert. Orifice** C= 0.600
#3	Device 1	280.00'	**6.0" Vert. Orifice** C= 0.600
#4	Device 1	283.12'	**4.00' x 4.00' Horiz. CB Grate** Limited to weir flow C= 0.600

Primary OutFlow Max=1.85 cfs @ 12.46 hrs HW=280.77' (Free Discharge)
└**1=Culvert** (Passes 1.85 cfs of 3.76 cfs potential flow)
  ├**2=Orifice** (Orifice Controls 1.17 cfs @ 5.9 fps)
  ├**3=Orifice** (Orifice Controls 0.68 cfs @ 3.5 fps)
  └**4=CB Grate** (Controls 0.00 cfs)

Pond 13P: Detention Pond 3

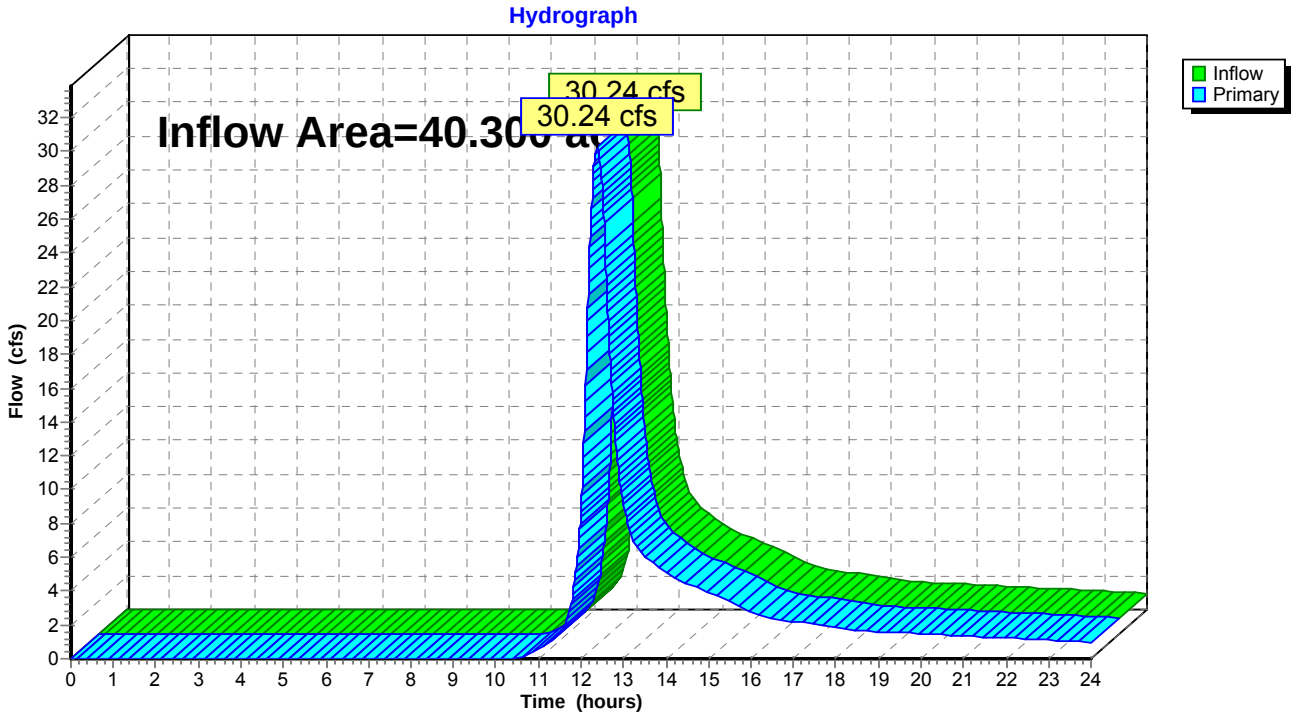


Link 2L: Discharge A

Inflow Area = 40.300 ac, Inflow Depth > 1.21" for 2-YR event
Inflow = 30.24 cfs @ 12.38 hrs, Volume= 4.057 af
Primary = 30.24 cfs @ 12.38 hrs, Volume= 4.057 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 2L: Discharge A

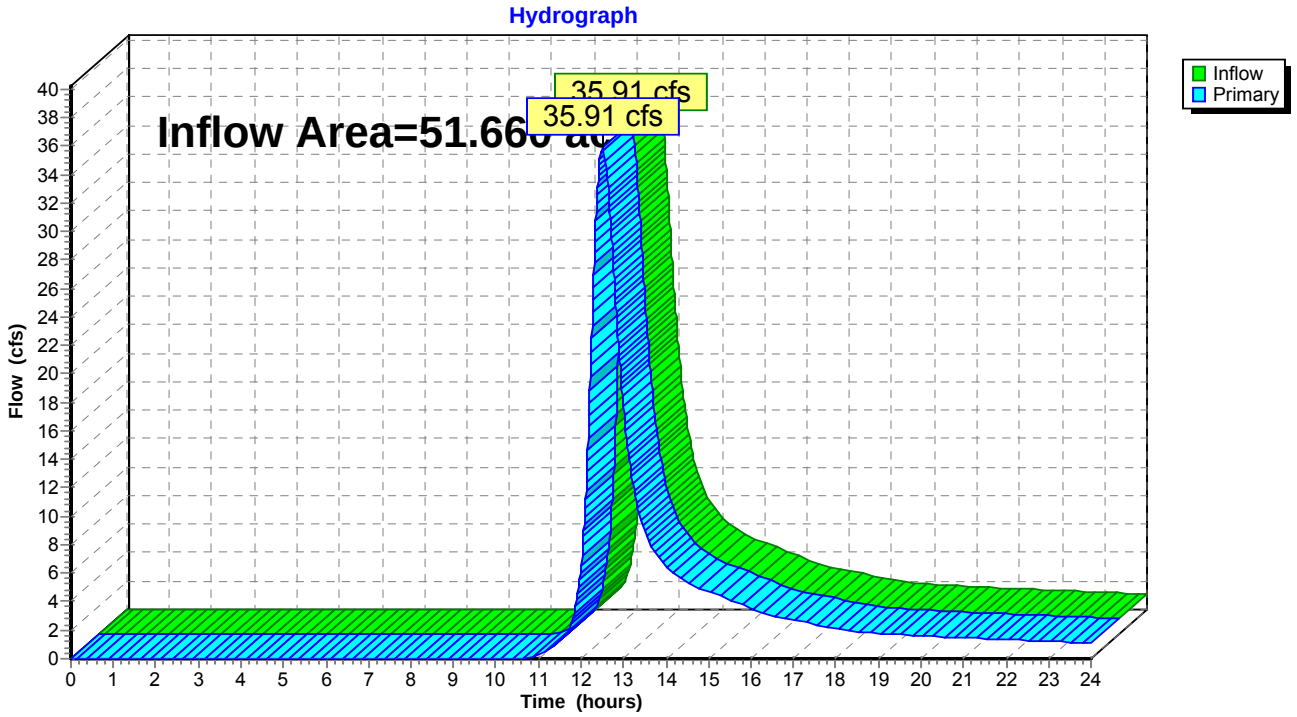


Link 4L: Discharge B

Inflow Area = 51.660 ac, Inflow Depth > 1.17" for 2-YR event
Inflow = 35.91 cfs @ 12.51 hrs, Volume= 5.028 af
Primary = 35.91 cfs @ 12.51 hrs, Volume= 5.028 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 4L: Discharge B



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Post-Developed Drainage Area A-1 Runoff Area=5.230 ac Runoff Depth>2.44"
Flow Length=651' Tc=15.5 min CN=75 Runoff=11.18 cfs 1.064 af

Subcatchment 3S: Post-Developed Drainage Area B-1 Runoff Area=2.900 ac Runoff Depth>2.53"
Flow Length=666' Tc=13.0 min CN=76 Runoff=6.87 cfs 0.611 af

Subcatchment 6S: Post-Developed Drainage Area A-2 Runoff Area=5.330 ac Runoff Depth>2.44"
Flow Length=658' Tc=15.5 min CN=75 Runoff=11.39 cfs 1.084 af

Subcatchment 8S: Post-Developed Drainage Area A-3 Runoff Area=6.100 ac Runoff Depth>2.44"
Flow Length=953' Tc=18.7 min CN=75 Runoff=12.07 cfs 1.240 af

Subcatchment 10S: Post-Developed Drainage Area A-4 Runoff Area=5.850 ac Runoff Depth>2.44"
Flow Length=1,050' Tc=19.7 min CN=75 Runoff=11.36 cfs 1.189 af

Subcatchment 11S: Post-Developed Drainage Area A-5 Runoff Area=7.580 ac Runoff Depth>2.44"
Flow Length=868' Tc=17.8 min CN=75 Runoff=15.32 cfs 1.541 af

Subcatchment 12S: Post-Developed Drainage Area A-6 Runoff Area=10.210 ac Runoff Depth>2.35"
Flow Length=1,609' Tc=24.0 min CN=74 Runoff=17.55 cfs 2.001 af

Subcatchment 14S: Post-Developed Basin B-2 Runoff Area=48.760 ac Runoff Depth>2.35"
Tc=34.1 min CN=74 Runoff=71.53 cfs 9.532 af

Pond 5P: Detention Pond 1 Peak Elev=291.14' Storage=10,562 cf Inflow=11.18 cfs 1.064 af
Outflow=6.79 cfs 1.010 af

Pond 6P: Low Point to CB E-1 Peak Elev=267.38' Storage=8,014 cf Inflow=15.32 cfs 1.541 af
Primary=8.43 cfs 1.539 af Secondary=0.00 cfs 0.000 af Outflow=8.43 cfs 1.539 af

Pond 7P: Detention Pond 2 Peak Elev=287.54' Storage=8,381 cf Inflow=11.39 cfs 1.084 af
Outflow=6.71 cfs 1.084 af

Pond 13P: Detention Pond 3 Peak Elev=281.86' Storage=6,101 cf Inflow=6.87 cfs 0.611 af
Outflow=2.72 cfs 0.610 af

Link 2L: Discharge A Inflow=61.46 cfs 8.063 af
Primary=61.46 cfs 8.063 af

Link 4L: Discharge B Inflow=74.25 cfs 10.142 af
Primary=74.25 cfs 10.142 af

Total Runoff Area = 91.960 ac Runoff Volume = 18.262 af Average Runoff Depth = 2.38"

Subcatchment 1S: Post-Developed Drainage Area A-1

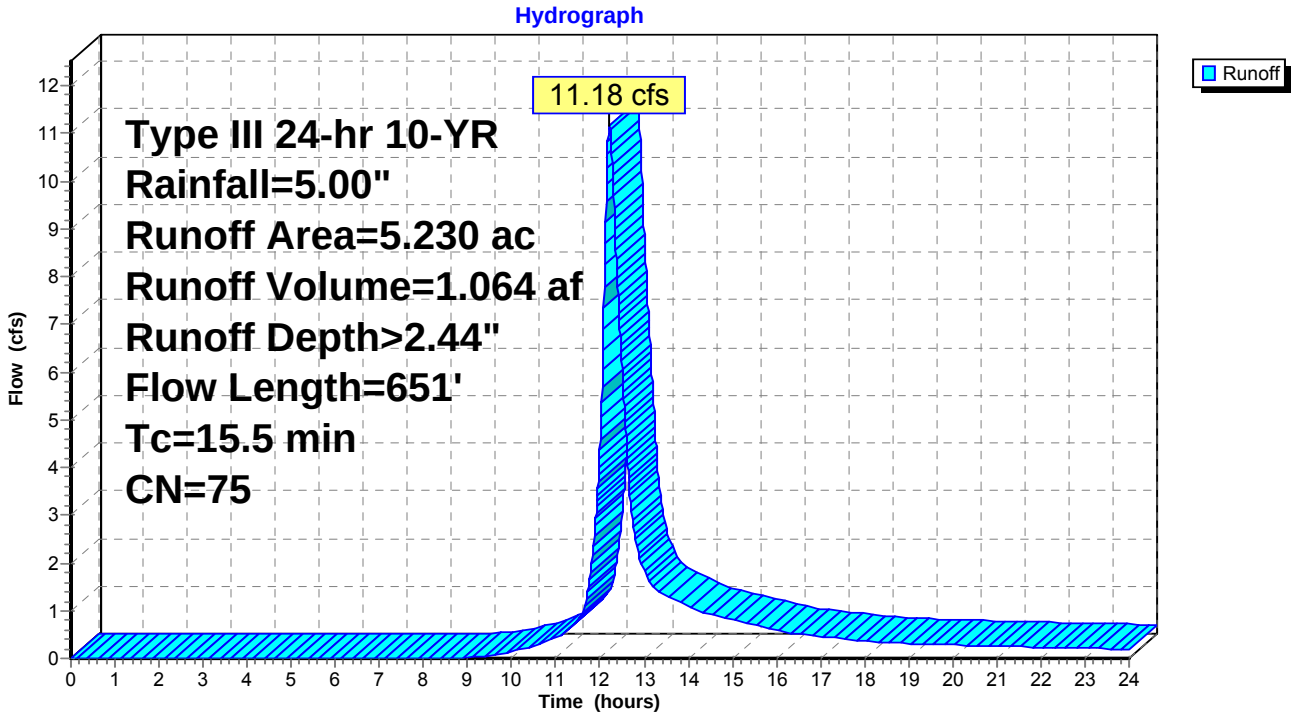
Runoff = 11.18 cfs @ 12.21 hrs, Volume= 1.064 af, Depth> 2.44"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=5.00"

Area (ac)	CN	Description
0.130	72	Woods/grass comb., Good, HSG C
0.350	89	Gravel roads, HSG C
4.750	74	>75% Grass cover, Good, HSG C
5.230	75	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	100	0.0500	0.2		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.40"
5.9	551	0.0500	1.6		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
15.5	651	Total			

Subcatchment 1S: Post-Developed Drainage Area A-1



Subcatchment 3S: Post-Developed Drainage Area B-1

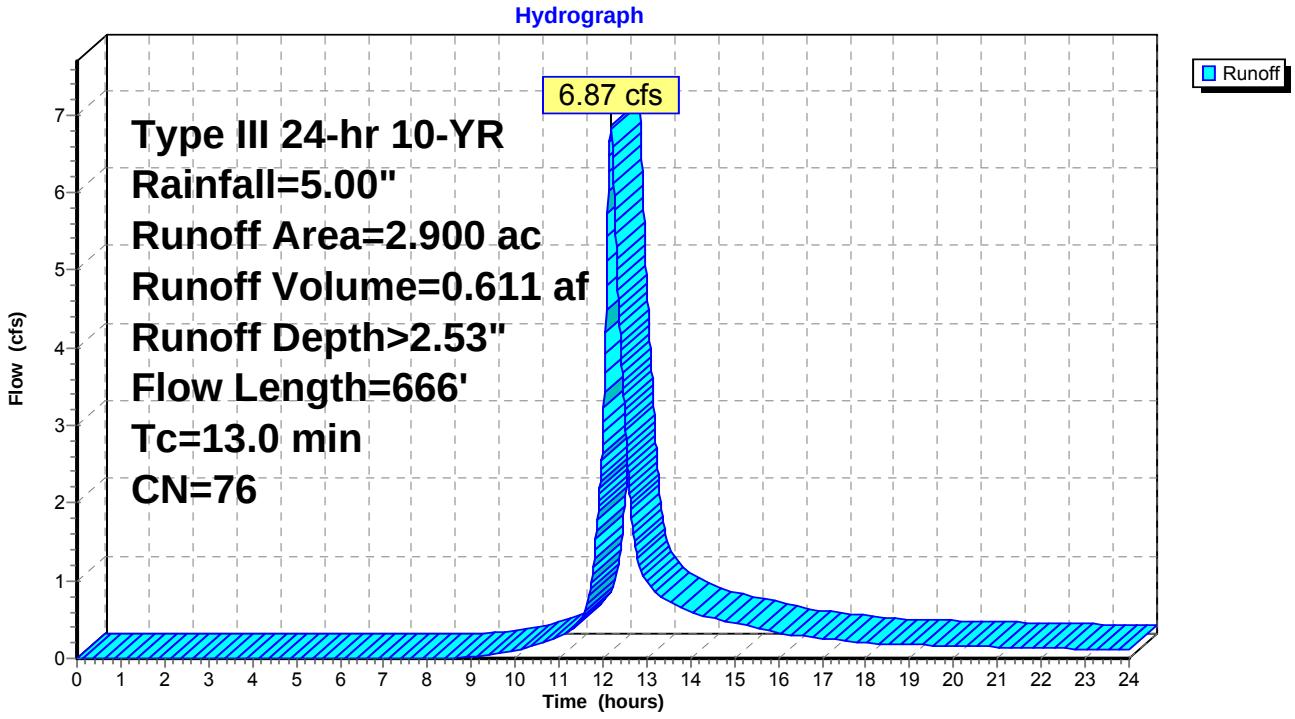
Runoff = 6.87 cfs @ 12.18 hrs, Volume= 0.611 af, Depth> 2.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=5.00"

Area (ac)	CN	Description
0.040	98	Paved parking & roofs
0.400	89	Gravel roads, HSG C
2.460	74	>75% Grass cover, Good, HSG C
2.900	76	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	100	0.0500	0.2		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.40"
3.4	566	0.0350	2.8		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
13.0	666	Total			

Subcatchment 3S: Post-Developed Drainage Area B-1



Subcatchment 6S: Post-Developed Drainage Area A-2

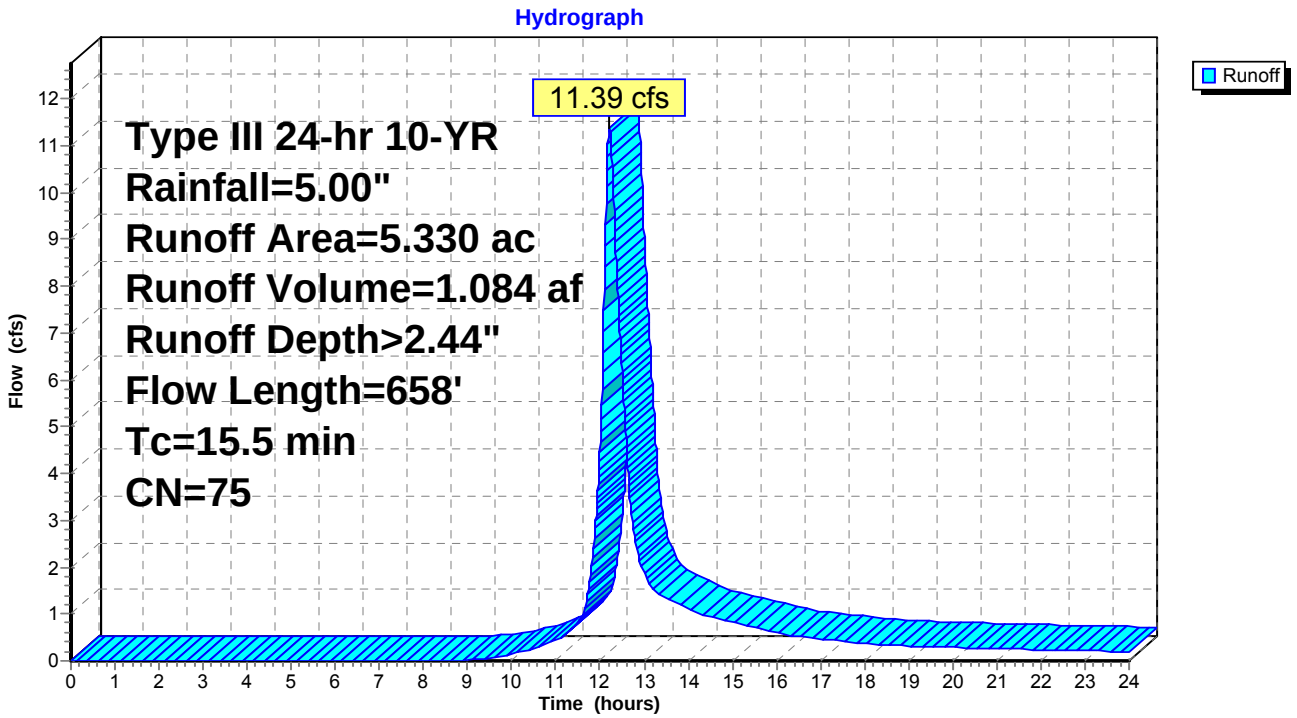
Runoff = 11.39 cfs @ 12.21 hrs, Volume= 1.084 af, Depth> 2.44"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=5.00"

Area (ac)	CN	Description
0.300	89	Gravel roads, HSG C
5.030	74	>75% Grass cover, Good, HSG C
5.330	75	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	100	0.0500	0.2		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.40"
5.9	558	0.0500	1.6		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
15.5	658	Total			

Subcatchment 6S: Post-Developed Drainage Area A-2



Subcatchment 8S: Post-Developed Drainage Area A-3

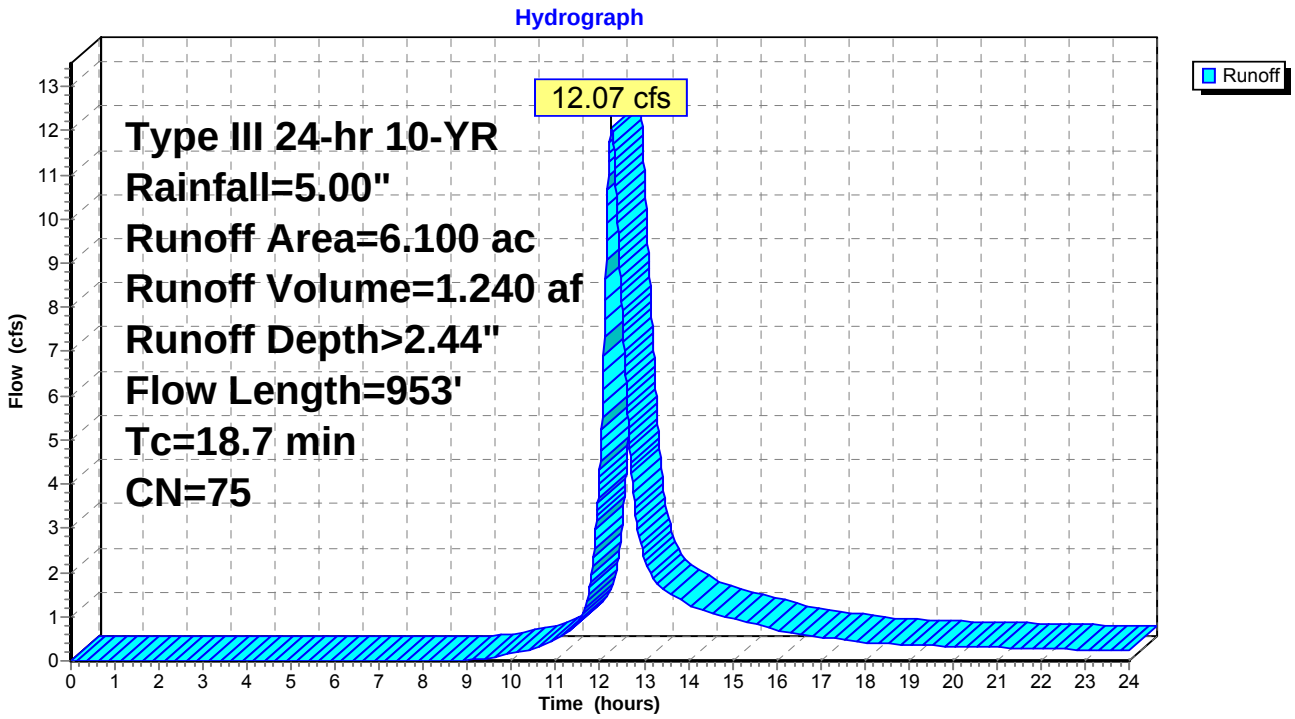
Runoff = 12.07 cfs @ 12.26 hrs, Volume= 1.240 af, Depth> 2.44"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=5.00"

Area (ac)	CN	Description
0.310	89	Gravel roads, HSG C
5.790	74	>75% Grass cover, Good, HSG C
6.100	75	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	100	0.0500	0.2		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.40"
9.1	853	0.0500	1.6		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
18.7	953	Total			

Subcatchment 8S: Post-Developed Drainage Area A-3



Subcatchment 10S: Post-Developed Drainage Area A-4

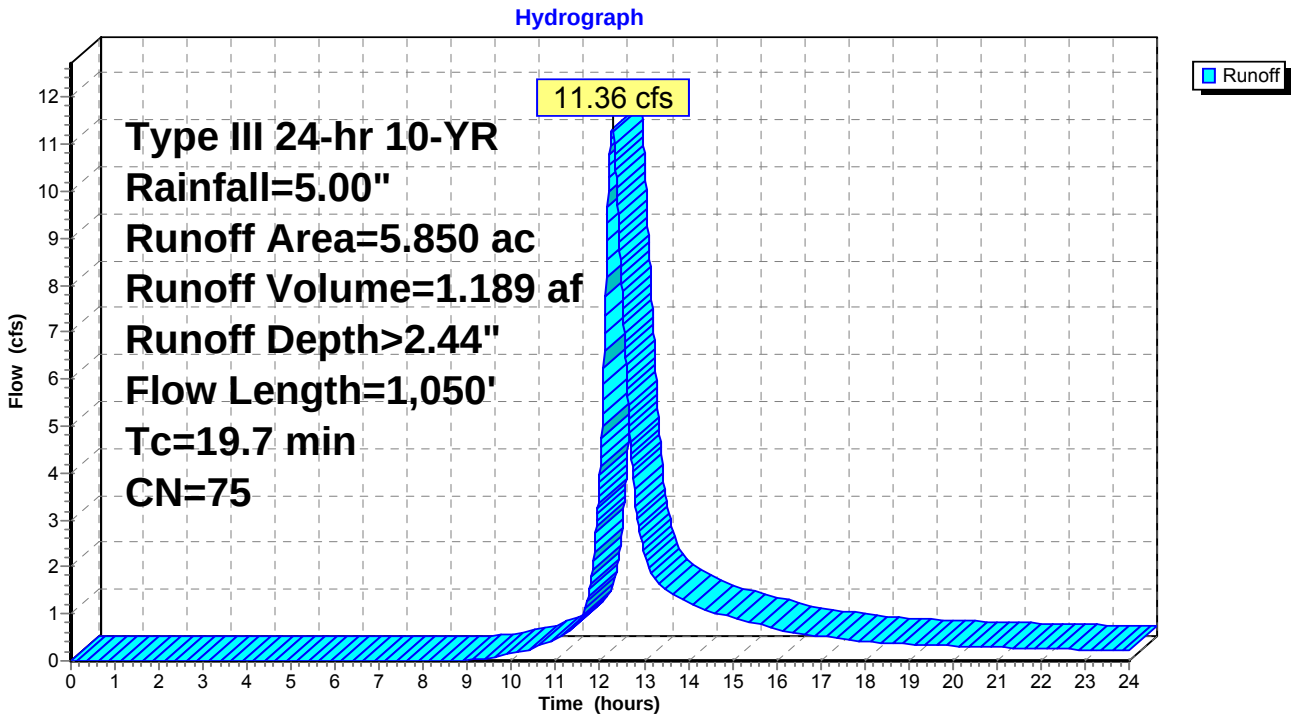
Runoff = 11.36 cfs @ 12.28 hrs, Volume= 1.189 af, Depth> 2.44"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=5.00"

Area (ac)	CN	Description
0.530	89	Gravel roads, HSG C
5.320	74	>75% Grass cover, Good, HSG C
5.850	75	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	100	0.0500	0.2		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.40"
10.1	950	0.0500	1.6		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
19.7	1,050	Total			

Subcatchment 10S: Post-Developed Drainage Area A-4



Subcatchment 11S: Post-Developed Drainage Area A-5

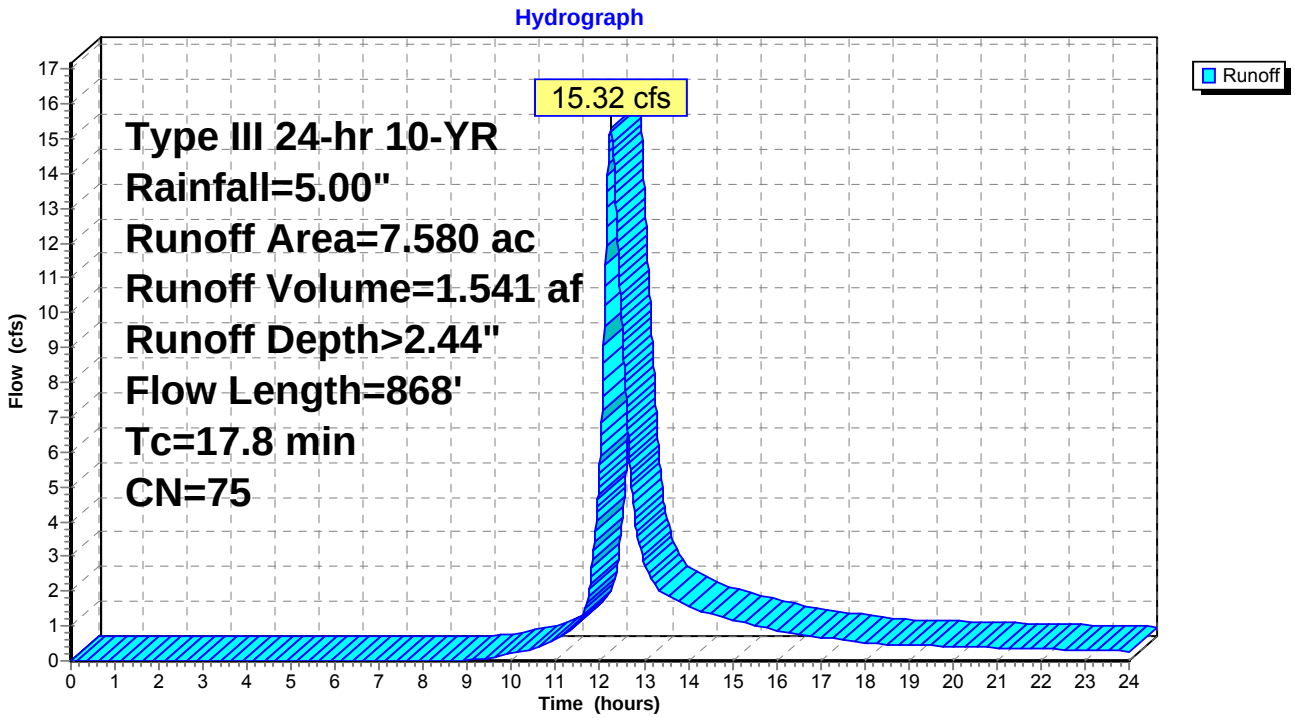
Runoff = 15.32 cfs @ 12.25 hrs, Volume= 1.541 af, Depth> 2.44"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=5.00"

Area (ac)	CN	Description
0.530	89	Gravel roads, HSG C
7.050	74	>75% Grass cover, Good, HSG C
7.580	75	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	100	0.0500	0.2		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.40"
8.2	768	0.0500	1.6		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
17.8	868	Total			

Subcatchment 11S: Post-Developed Drainage Area A-5



Subcatchment 12S: Post-Developed Drainage Area A-6

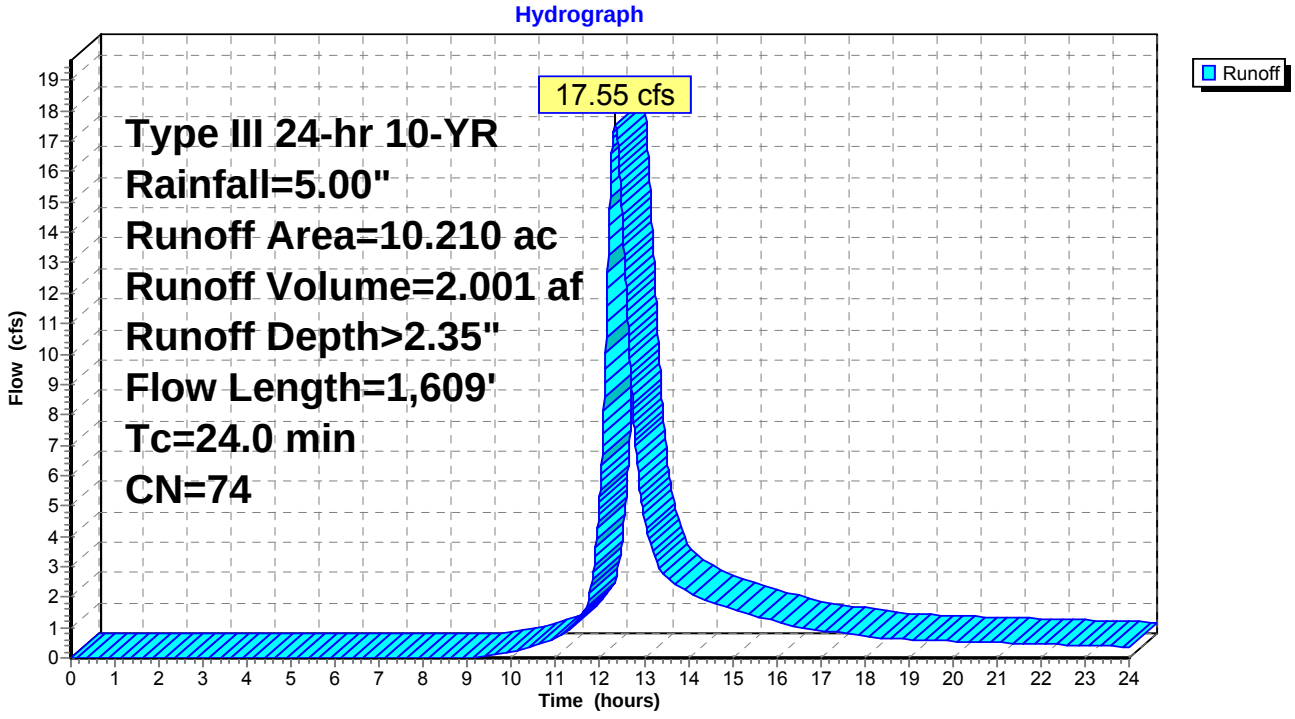
Runoff = 17.55 cfs @ 12.35 hrs, Volume= 2.001 af, Depth> 2.35"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=5.00"

Area (ac)	CN	Description
2.550	72	Woods/grass comb., Good, HSG C
7.660	74	>75% Grass cover, Good, HSG C
10.210	74	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.7	100	0.0125	0.1		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.40"
5.8	350	0.0400	1.0		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.5	1,159	0.0289	12.9	543.40	**Channel Flow,** Area= 42.0 sf Perim= 17.5' r= 2.40' n= 0.035
24.0	1,609	Total			

Subcatchment 12S: Post-Developed Drainage Area A-6



Subcatchment 14S: Post-Developed Basin B-2

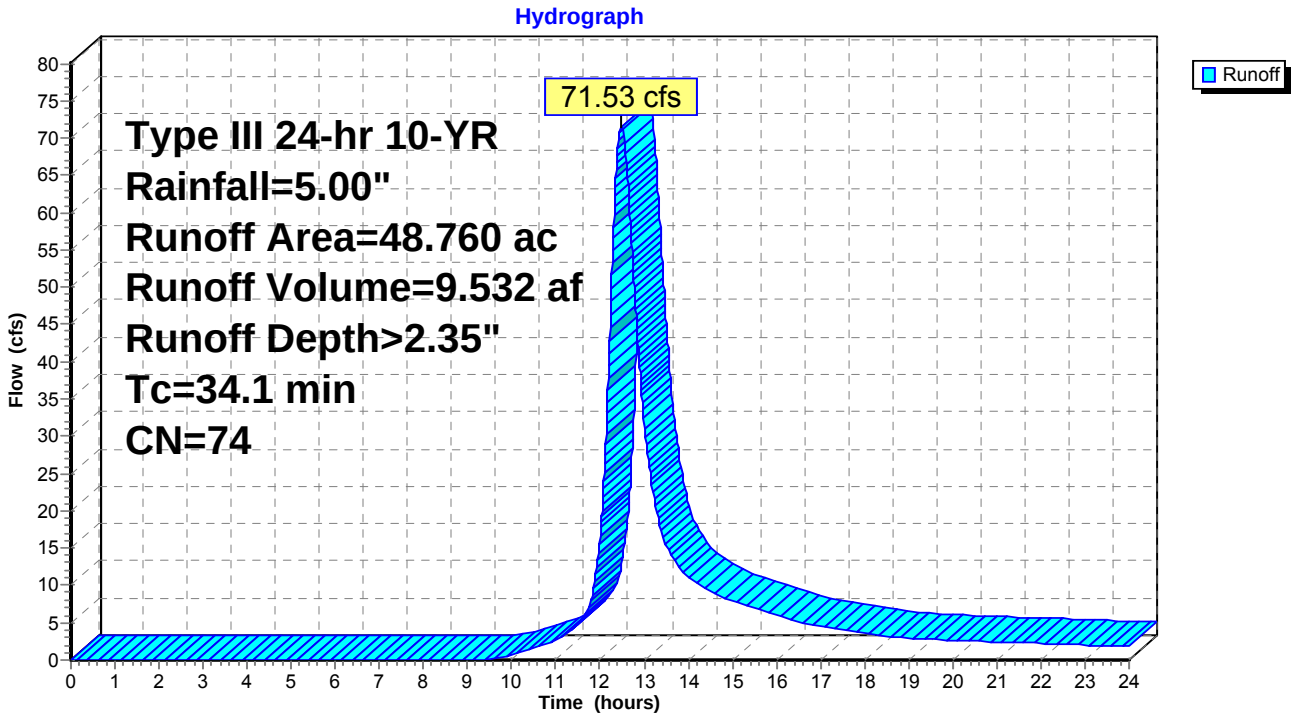
Runoff = 71.53 cfs @ 12.47 hrs, Volume= 9.532 af, Depth> 2.35"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=5.00"

Area (ac)	CN	Description
1.500	98	Paved parking & roofs
27.550	72	Woods/grass comb., Good, HSG C
19.710	74	>75% Grass cover, Good, HSG C
48.760	74	Weighted Average

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

Subcatchment 14S: Post-Developed Basin B-2



Pond 5P: Detention Pond 1

Inflow Area = 5.230 ac, Inflow Depth > 2.44" for 10-YR event
Inflow = 11.18 cfs @ 12.21 hrs, Volume= 1.064 af
Outflow = 6.79 cfs @ 12.46 hrs, Volume= 1.010 af, Atten= 39%, Lag= 14.6 min
Primary = 6.79 cfs @ 12.46 hrs, Volume= 1.010 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 291.14' @ 12.46 hrs Surf.Area= 5,427 sf Storage= 10,562 cf
Plug-Flow detention time= 81.3 min calculated for 1.010 af (95% of inflow)
Center-of-Mass det. time= 54.4 min (896.1 - 841.6)

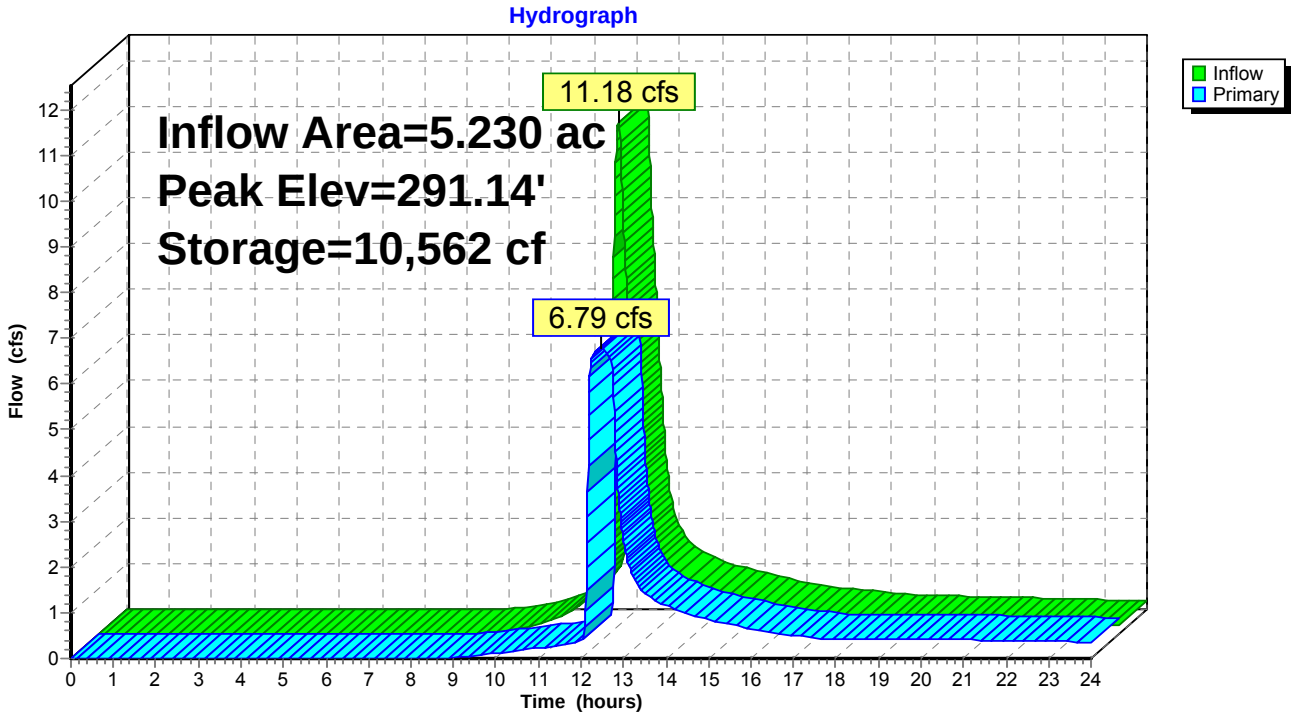
Volume	Invert	Avail.Storage	Storage Description
#1	286.50'	37,334 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
286.50	0	0	0
288.00	1,136	852	852
290.00	3,487	4,623	5,475
292.00	6,887	10,374	15,849
294.00	11,385	18,272	34,121
294.25	14,317	3,213	37,334

Device	Routing	Invert	Outlet Devices
#1	Primary	286.50'	**12.0" x 56.0' long Culvert** CPP, mitered to conform to fill, Ke= 0.700 Outlet Invert= 286.00' S= 0.0089 '/' Cc= 0.900 n= 0.010 PVC, smooth interior
#2	Device 1	286.50'	**3.0" Vert. Orifice** C= 0.600
#3	Device 1	290.00'	**3.0' long x 1.5' high Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Device 1	293.25'	**4.00' x 4.00' Horiz. CB Grate** Limited to weir flow C= 0.600

Primary OutFlow Max=6.79 cfs @ 12.46 hrs HW=291.14' (Free Discharge)
└**1=Culvert** (Inlet Controls 6.79 cfs @ 8.6 fps)
  ├**2=Orifice** (Passes < 0.50 cfs potential flow)
  ├**3=Sharp-Crested Rectangular Weir** (Passes < 12.08 cfs potential flow)
  └**4=CB Grate** (Controls 0.00 cfs)

Pond 5P: Detention Pond 1



Pond 6P: Low Point to CB E-1

Inflow Area = 7.580 ac, Inflow Depth > 2.44" for 10-YR event
Inflow = 15.32 cfs @ 12.25 hrs, Volume= 1.541 af
Outflow = 8.43 cfs @ 12.55 hrs, Volume= 1.539 af, Atten= 45%, Lag= 18.3 min
Primary = 8.43 cfs @ 12.55 hrs, Volume= 1.539 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 267.38' @ 12.55 hrs Surf.Area= 4,861 sf Storage= 8,014 cf
Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 4.7 min (848.2 - 843.5)

Volume	Invert	Avail.Storage	Storage Description
#1	263.50'	12,952 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

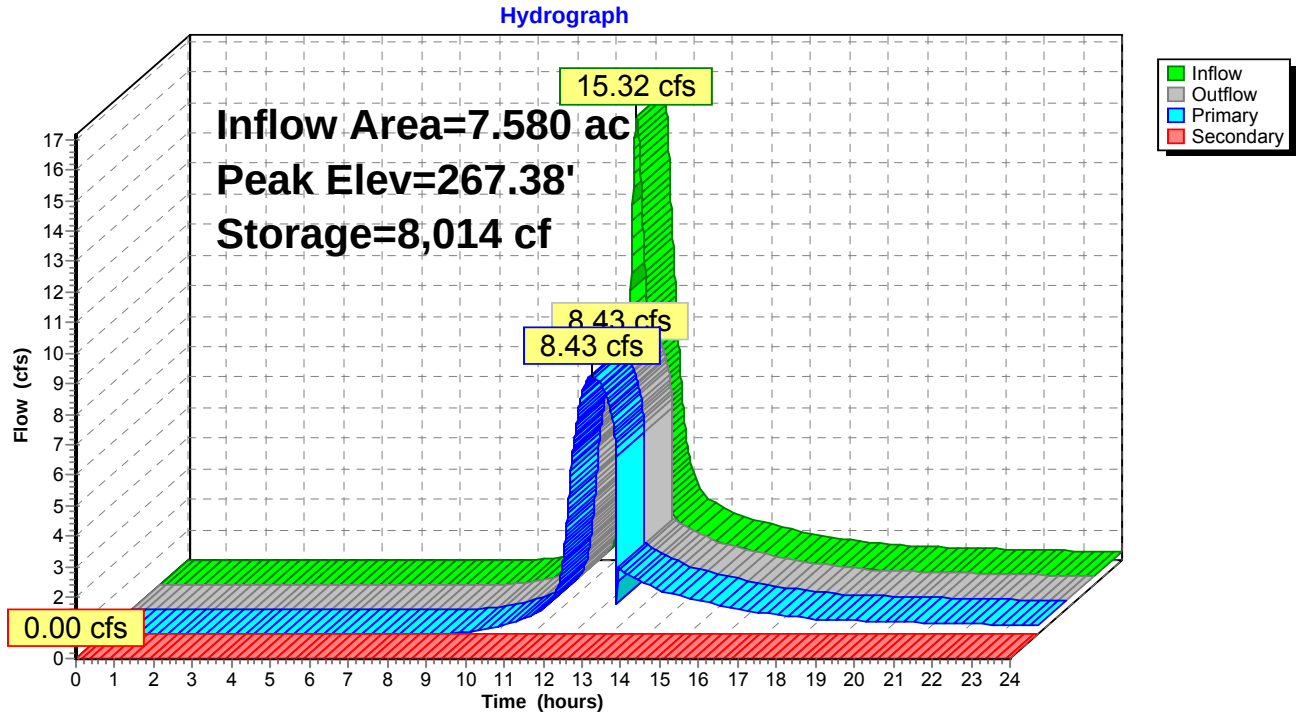
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
263.50	0	0	0
264.00	220	55	55
266.00	2,584	2,804	2,859
268.00	5,873	8,457	11,316
268.25	7,213	1,636	12,952

Device	Routing	Invert	Outlet Devices
#1	Primary	260.50'	**12.0" x 45.0' long Culvert** CPP, mitered to conform to fill, Ke= 0.700 Outlet Invert= 260.00' S= 0.0111 '/' Cc= 0.900 n= 0.010 PVC, smooth interior
#2	Device 1	263.50'	**4.00' x 4.00' Horiz. CB Grate** Limited to weir flow C= 0.600
#3	Secondary	268.45'	**138.0' long x 1.7' high Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=8.43 cfs @ 12.55 hrs HW=267.38' (Free Discharge)
└**1=Culvert** (Inlet Controls 8.43 cfs @ 10.7 fps)
└**2=CB Grate** (Passes 8.43 cfs of 151.84 cfs potential flow)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=263.50' (Free Discharge)
└**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 6P: Low Point to CB E-1



Pond 7P: Detention Pond 2

Inflow Area = 5.330 ac, Inflow Depth > 2.44" for 10-YR event
Inflow = 11.39 cfs @ 12.21 hrs, Volume= 1.084 af
Outflow = 6.71 cfs @ 12.47 hrs, Volume= 1.084 af, Atten= 41%, Lag= 15.4 min
Primary = 6.71 cfs @ 12.47 hrs, Volume= 1.084 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 287.54' @ 12.47 hrs Surf.Area= 4,530 sf Storage= 8,381 cf
Plug-Flow detention time= 21.7 min calculated for 1.084 af (100% of inflow)
Center-of-Mass det. time= 21.3 min (863.0 - 841.6)

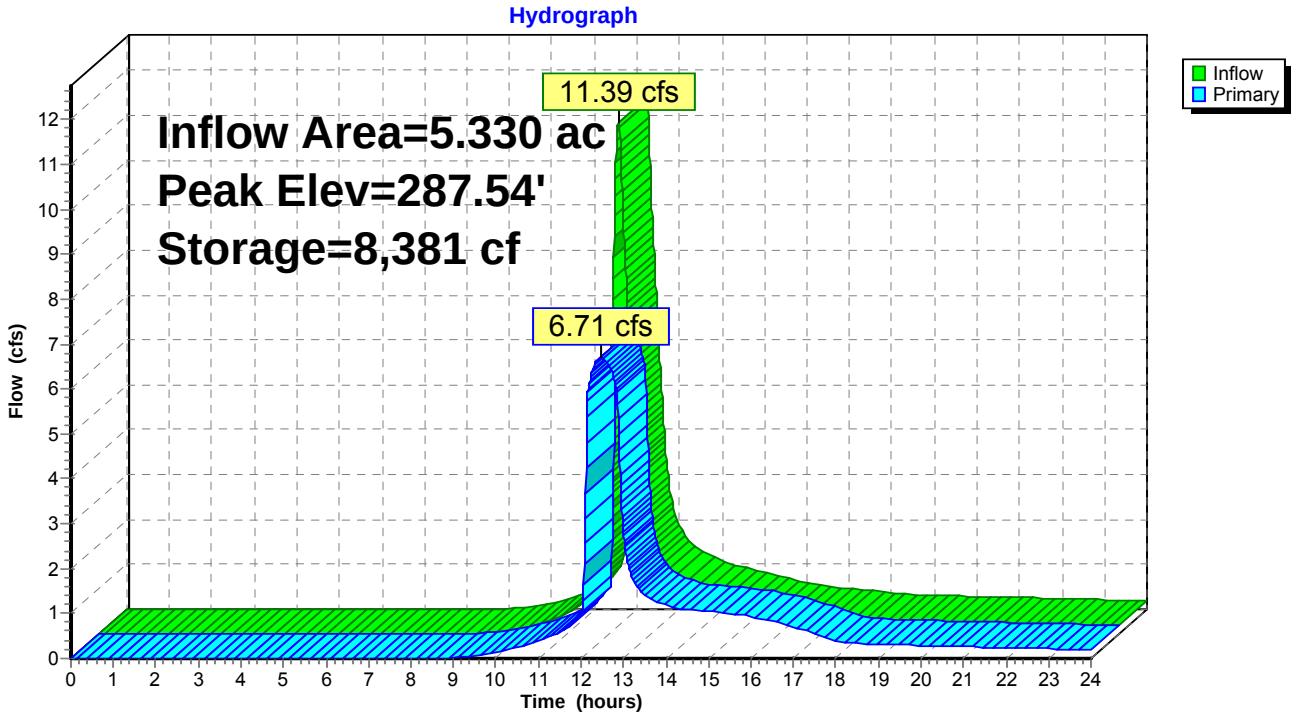
Volume	Invert	Avail.Storage	Storage Description
#1	283.00'	28,282 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
283.00	0	0	0
284.00	584	292	292
286.00	2,272	2,856	3,148
288.00	5,206	7,478	10,626
290.00	9,269	14,475	25,101
290.30	11,939	3,181	28,282

Device	Routing	Invert	Outlet Devices
#1	Primary	283.00'	**12.0" x 54.0' long Culvert** CPP, mitered to conform to fill, Ke= 0.700 Outlet Invert= 282.00' S= 0.0185 '/' Cc= 0.900 n= 0.010 PVC, smooth interior
#2	Device 1	283.00'	**5.0" Vert. Orifice** C= 0.600
#3	Device 1	286.00'	**3.0' long x 2.5' high Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Device 1	289.30'	**4.00' x 4.00' Horiz. CB Grate** Limited to weir flow C= 0.600

Primary OutFlow Max=6.71 cfs @ 12.47 hrs HW=287.54' (Free Discharge)
└**1=Culvert** (Inlet Controls 6.71 cfs @ 8.5 fps)
  ├**2=Orifice** (Passes < 1.37 cfs potential flow)
  ├**3=Sharp-Crested Rectangular Weir** (Passes < 18.07 cfs potential flow)
  └**4=CB Grate** (Controls 0.00 cfs)

Pond 7P: Detention Pond 2



Pond 13P: Detention Pond 3

Inflow Area = 2.900 ac, Inflow Depth > 2.53" for 10-YR event
Inflow = 6.87 cfs @ 12.18 hrs, Volume= 0.611 af
Outflow = 2.72 cfs @ 12.54 hrs, Volume= 0.610 af, Atten= 60%, Lag= 21.7 min
Primary = 2.72 cfs @ 12.54 hrs, Volume= 0.610 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 281.86' @ 12.54 hrs Surf.Area= 4,420 sf Storage= 6,101 cf
Plug-Flow detention time= 18.7 min calculated for 0.610 af (100% of inflow)
Center-of-Mass det. time= 18.1 min (855.2 - 837.1)

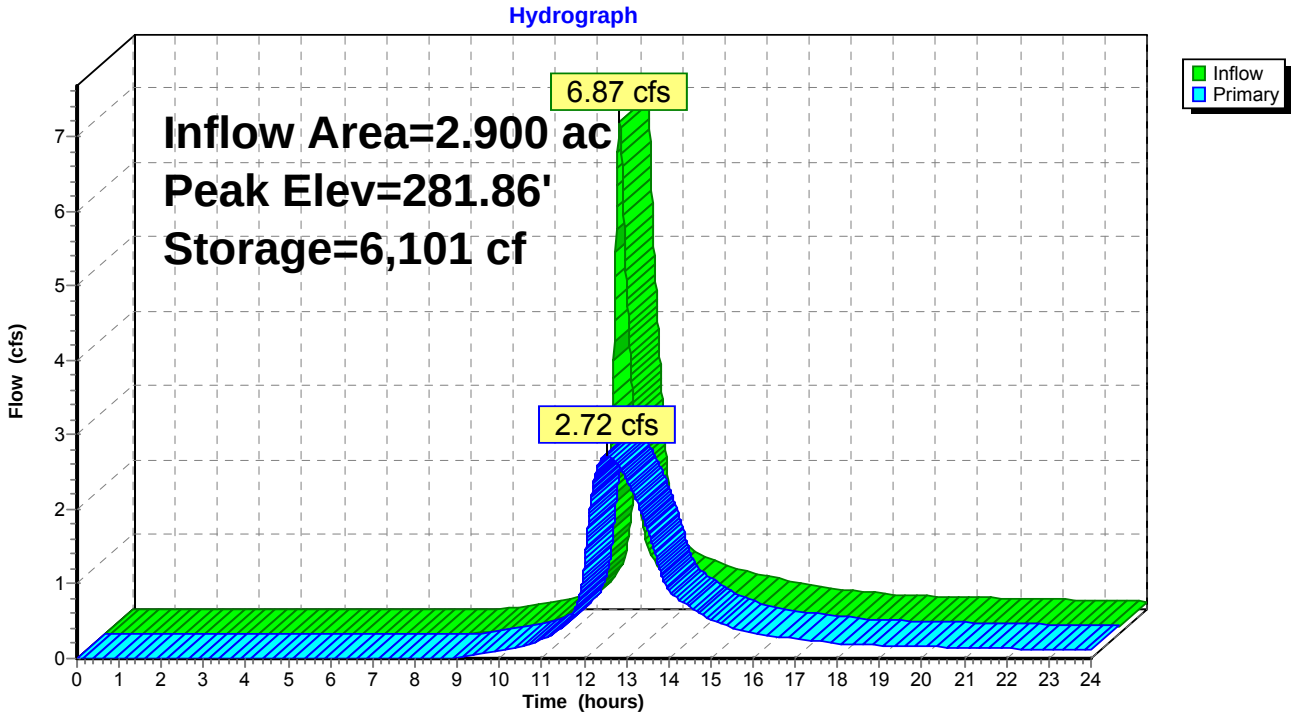
Volume	Invert	Avail.Storage	Storage Description
#1	279.00'	21,504 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
279.00	0	0	0
280.00	1,400	700	700
282.00	4,654	6,054	6,754
284.00	7,900	12,554	19,308
284.25	9,664	2,196	21,504

Device	Routing	Invert	Outlet Devices
#1	Primary	279.00'	**12.0" x 122.0' long Culvert** CPP, mitered to conform to fill, Ke= 0.700 Outlet Invert= 278.00' S= 0.0082 '/' Cc= 0.900 n= 0.010 PVC, smooth interior
#2	Device 1	279.00'	**6.0" Vert. Orifice** C= 0.600
#3	Device 1	280.00'	**6.0" Vert. Orifice** C= 0.600
#4	Device 1	283.12'	**4.00' x 4.00' Horiz. CB Grate** Limited to weir flow C= 0.600

Primary OutFlow Max=2.72 cfs @ 12.54 hrs HW=281.86' (Free Discharge)
└**1=Culvert** (Passes 2.72 cfs of 5.12 cfs potential flow)
  ├**2=Orifice** (Orifice Controls 1.53 cfs @ 7.8 fps)
  ├**3=Orifice** (Orifice Controls 1.20 cfs @ 6.1 fps)
  └**4=CB Grate** (Controls 0.00 cfs)

Pond 13P: Detention Pond 3

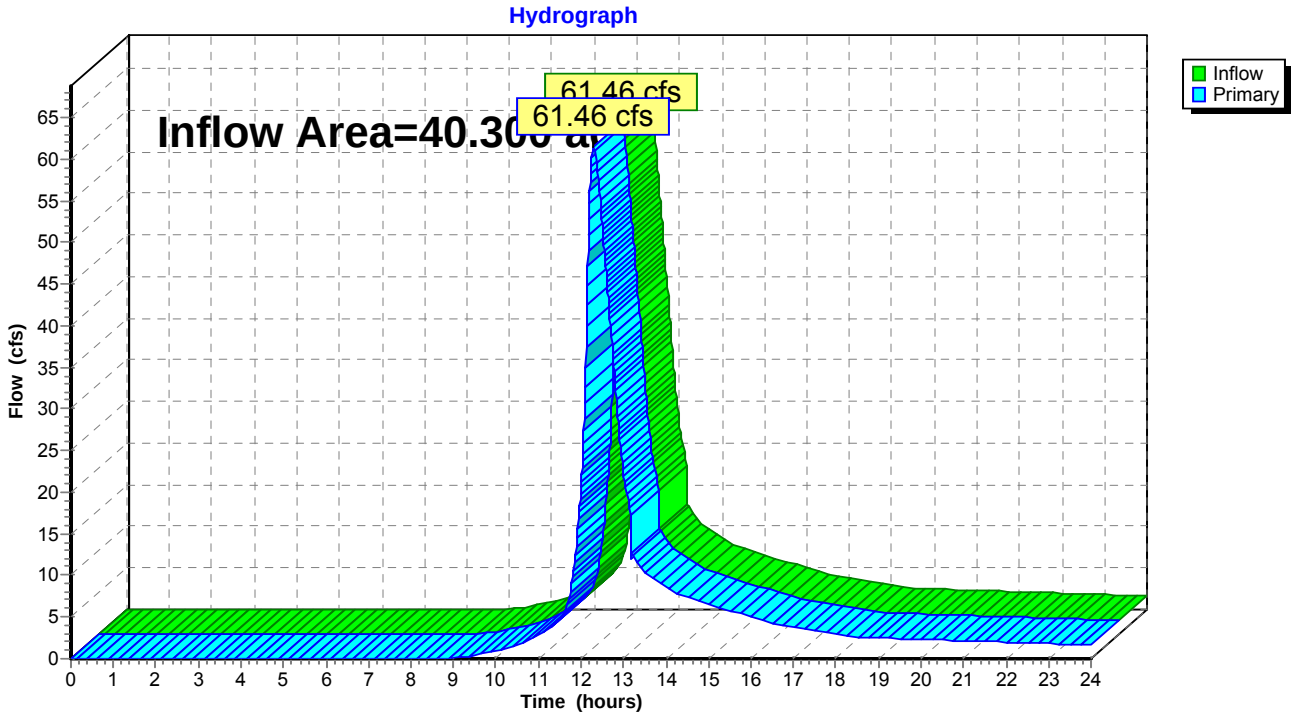


Link 2L: Discharge A

Inflow Area = 40.300 ac, Inflow Depth > 2.40" for 10-YR event
Inflow = 61.46 cfs @ 12.30 hrs, Volume= 8.063 af
Primary = 61.46 cfs @ 12.30 hrs, Volume= 8.063 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 2L: Discharge A

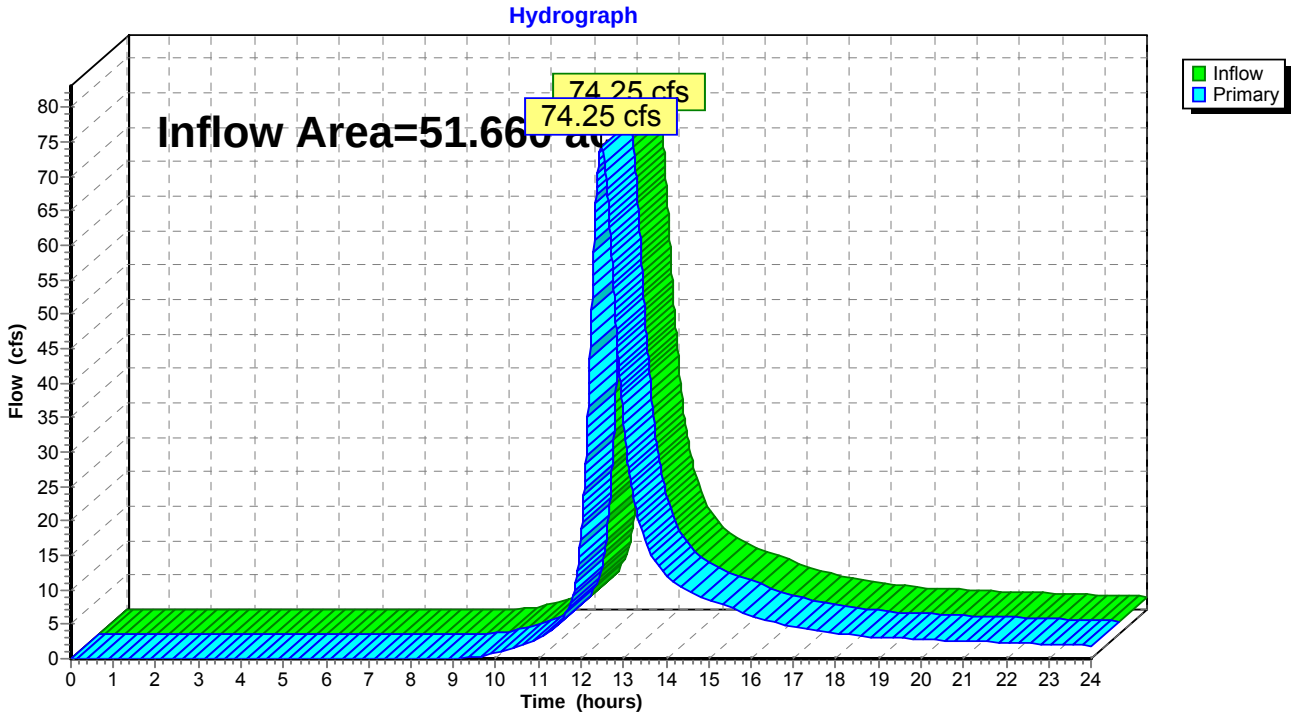


Link 4L: Discharge B

Inflow Area = 51.660 ac, Inflow Depth > 2.36" for 10-YR event
Inflow = 74.25 cfs @ 12.47 hrs, Volume= 10.142 af
Primary = 74.25 cfs @ 12.47 hrs, Volume= 10.142 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 4L: Discharge B



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Post-Developed Drainage Area A-1 Runoff Area=5.230 ac Runoff Depth>4.22"
Flow Length=651' Tc=15.5 min CN=75 Runoff=19.44 cfs 1.841 af

Subcatchment 3S: Post-Developed Drainage Area B-1 Runoff Area=2.900 ac Runoff Depth>4.34"
Flow Length=666' Tc=13.0 min CN=76 Runoff=11.80 cfs 1.048 af

Subcatchment 6S: Post-Developed Drainage Area A-2 Runoff Area=5.330 ac Runoff Depth>4.22"
Flow Length=658' Tc=15.5 min CN=75 Runoff=19.81 cfs 1.877 af

Subcatchment 8S: Post-Developed Drainage Area A-3 Runoff Area=6.100 ac Runoff Depth>4.22"
Flow Length=953' Tc=18.7 min CN=75 Runoff=20.99 cfs 2.146 af

Subcatchment 10S: Post-Developed Drainage Area A-4 Runoff Area=5.850 ac Runoff Depth>4.22"
Flow Length=1,050' Tc=19.7 min CN=75 Runoff=19.73 cfs 2.058 af

Subcatchment 11S: Post-Developed Drainage Area A-5 Runoff Area=7.580 ac Runoff Depth>4.22"
Flow Length=868' Tc=17.8 min CN=75 Runoff=26.67 cfs 2.667 af

Subcatchment 12S: Post-Developed Drainage Area A-6 Runoff Area=10.210 ac Runoff Depth>4.11"
Flow Length=1,609' Tc=24.0 min CN=74 Runoff=30.84 cfs 3.496 af

Subcatchment 14S: Post-Developed Basin B-2 Runoff Area=48.760 ac Runoff Depth>4.10"
Tc=34.1 min CN=74 Runoff=125.97 cfs 16.662 af

Pond 5P: Detention Pond 1 Peak Elev=292.73' Storage=21,511 cf Inflow=19.44 cfs 1.841 af
Outflow=7.99 cfs 1.737 af

Pond 6P: Low Point to CB E-1 Peak Elev=268.52' Storage=12,952 cf Inflow=26.67 cfs 2.667 af
Primary=9.15 cfs 2.389 af Secondary=10.79 cfs 0.089 af Outflow=19.97 cfs 2.477 af

Pond 7P: Detention Pond 2 Peak Elev=289.30' Storage=19,111 cf Inflow=19.81 cfs 1.877 af
Outflow=8.04 cfs 1.875 af

Pond 13P: Detention Pond 3 Peak Elev=283.12' Storage=12,985 cf Inflow=11.80 cfs 1.048 af
Outflow=3.46 cfs 1.047 af

Link 2L: Discharge A Inflow=105.65 cfs 13.790 af
Primary=105.65 cfs 13.790 af

Link 4L: Discharge B Inflow=129.39 cfs 17.709 af
Primary=129.39 cfs 17.709 af

Total Runoff Area = 91.960 ac Runoff Volume = 31.796 af Average Runoff Depth = 4.15"

Subcatchment 1S: Post-Developed Drainage Area A-1

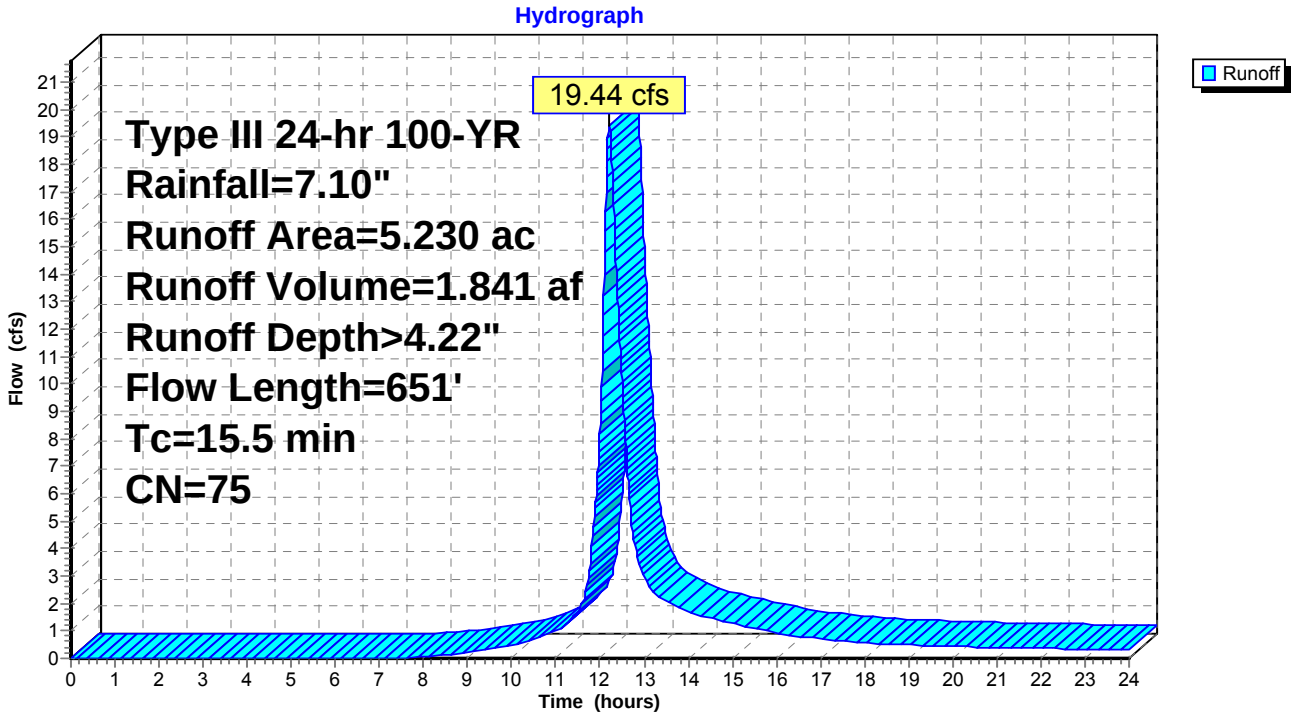
Runoff = 19.44 cfs @ 12.21 hrs, Volume= 1.841 af, Depth> 4.22"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=7.10"

Area (ac)	CN	Description
0.130	72	Woods/grass comb., Good, HSG C
0.350	89	Gravel roads, HSG C
4.750	74	>75% Grass cover, Good, HSG C
5.230	75	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	100	0.0500	0.2		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.40"
5.9	551	0.0500	1.6		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
15.5	651	Total			

Subcatchment 1S: Post-Developed Drainage Area A-1



Subcatchment 3S: Post-Developed Drainage Area B-1

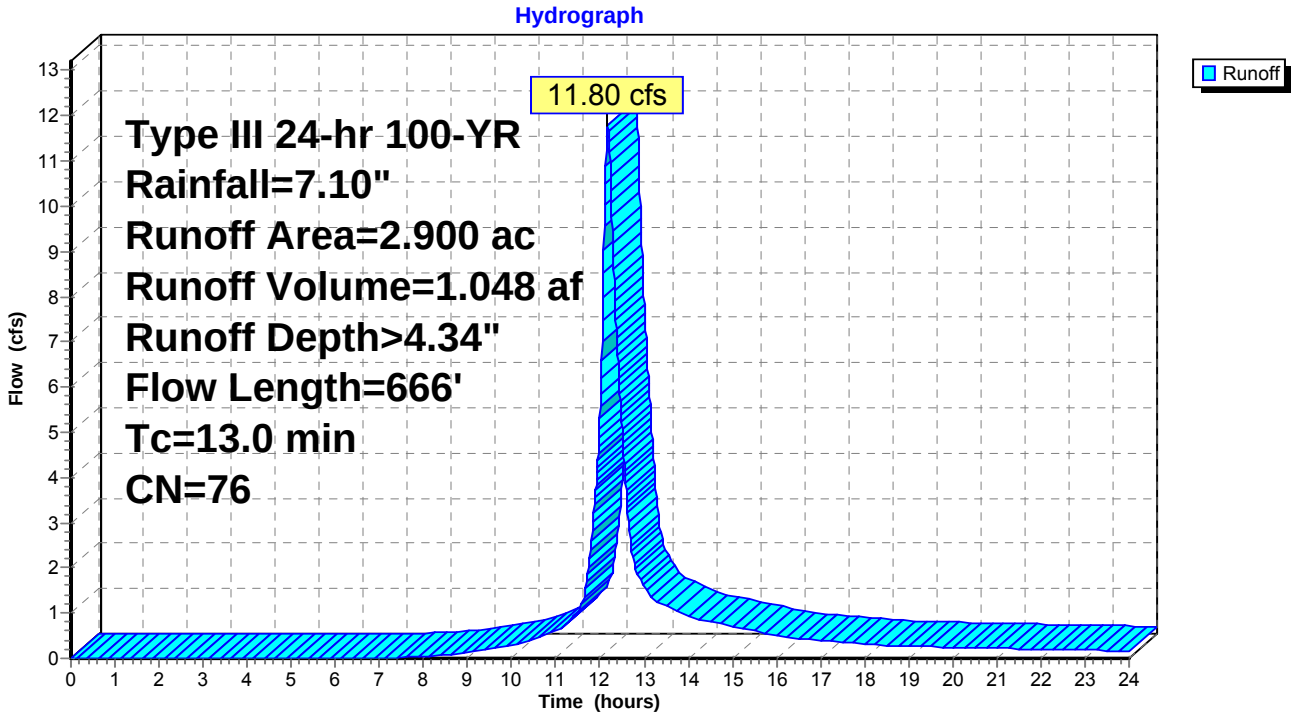
Runoff = 11.80 cfs @ 12.18 hrs, Volume= 1.048 af, Depth> 4.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=7.10"

Area (ac)	CN	Description
0.040	98	Paved parking & roofs
0.400	89	Gravel roads, HSG C
2.460	74	>75% Grass cover, Good, HSG C
2.900	76	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	100	0.0500	0.2		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.40"
3.4	566	0.0350	2.8		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
13.0	666	Total			

Subcatchment 3S: Post-Developed Drainage Area B-1



Subcatchment 6S: Post-Developed Drainage Area A-2

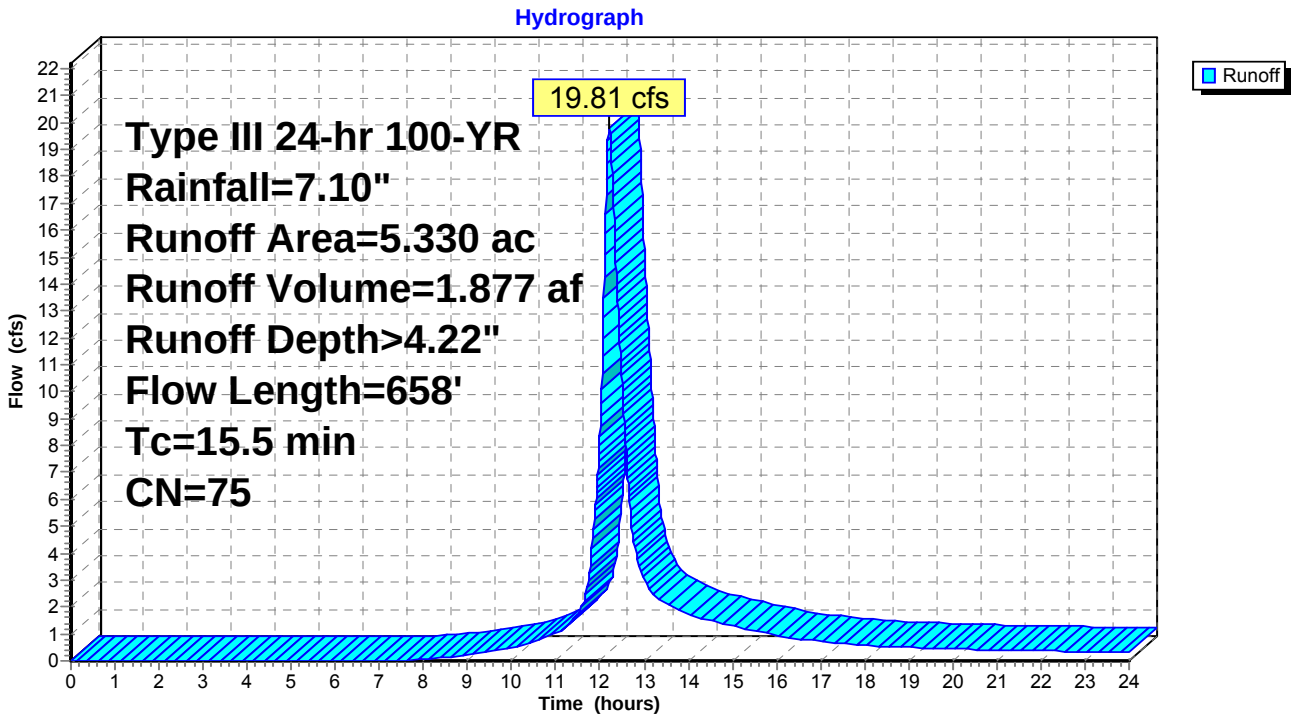
Runoff = 19.81 cfs @ 12.21 hrs, Volume= 1.877 af, Depth> 4.22"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=7.10"

Area (ac)	CN	Description
0.300	89	Gravel roads, HSG C
5.030	74	>75% Grass cover, Good, HSG C
5.330	75	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	100	0.0500	0.2		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.40"
5.9	558	0.0500	1.6		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
15.5	658	Total			

Subcatchment 6S: Post-Developed Drainage Area A-2



Subcatchment 8S: Post-Developed Drainage Area A-3

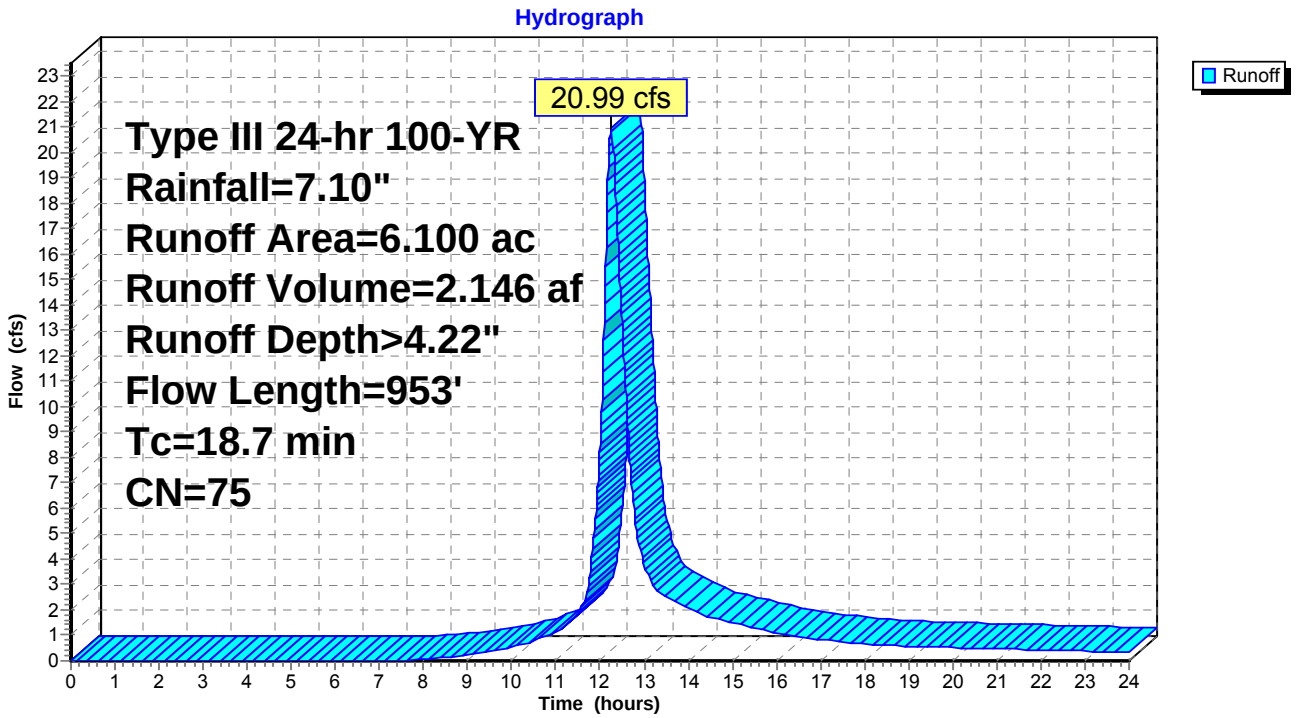
Runoff = 20.99 cfs @ 12.26 hrs, Volume= 2.146 af, Depth> 4.22"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=7.10"

Area (ac)	CN	Description
0.310	89	Gravel roads, HSG C
5.790	74	>75% Grass cover, Good, HSG C
6.100	75	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	100	0.0500	0.2		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.40"
9.1	853	0.0500	1.6		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
18.7	953	Total			

Subcatchment 8S: Post-Developed Drainage Area A-3



Subcatchment 10S: Post-Developed Drainage Area A-4

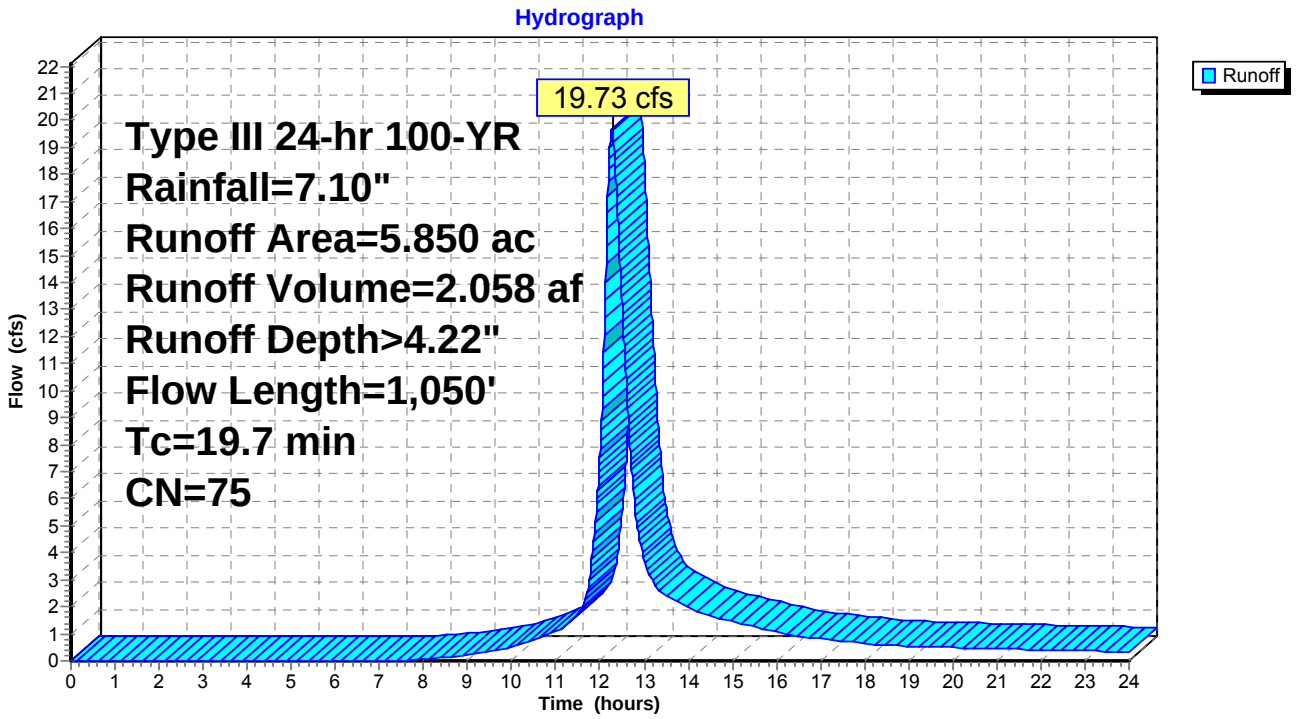
Runoff = 19.73 cfs @ 12.28 hrs, Volume= 2.058 af, Depth> 4.22"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=7.10"

Area (ac)	CN	Description
0.530	89	Gravel roads, HSG C
5.320	74	>75% Grass cover, Good, HSG C
5.850	75	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	100	0.0500	0.2		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.40"
10.1	950	0.0500	1.6		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
19.7	1,050	Total			

Subcatchment 10S: Post-Developed Drainage Area A-4



Subcatchment 11S: Post-Developed Drainage Area A-5

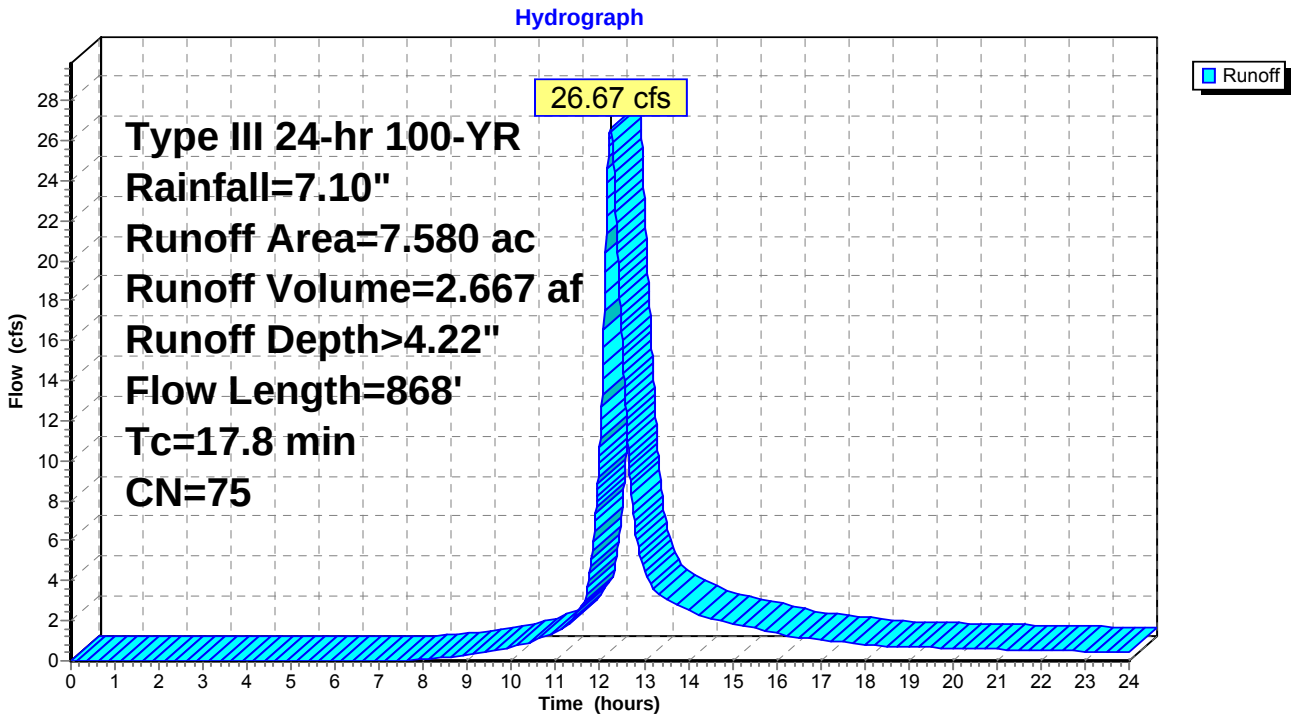
Runoff = 26.67 cfs @ 12.24 hrs, Volume= 2.667 af, Depth> 4.22"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=7.10"

Area (ac)	CN	Description
0.530	89	Gravel roads, HSG C
7.050	74	>75% Grass cover, Good, HSG C
7.580	75	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	100	0.0500	0.2		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.40"
8.2	768	0.0500	1.6		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
17.8	868	Total			

Subcatchment 11S: Post-Developed Drainage Area A-5



Subcatchment 12S: Post-Developed Drainage Area A-6

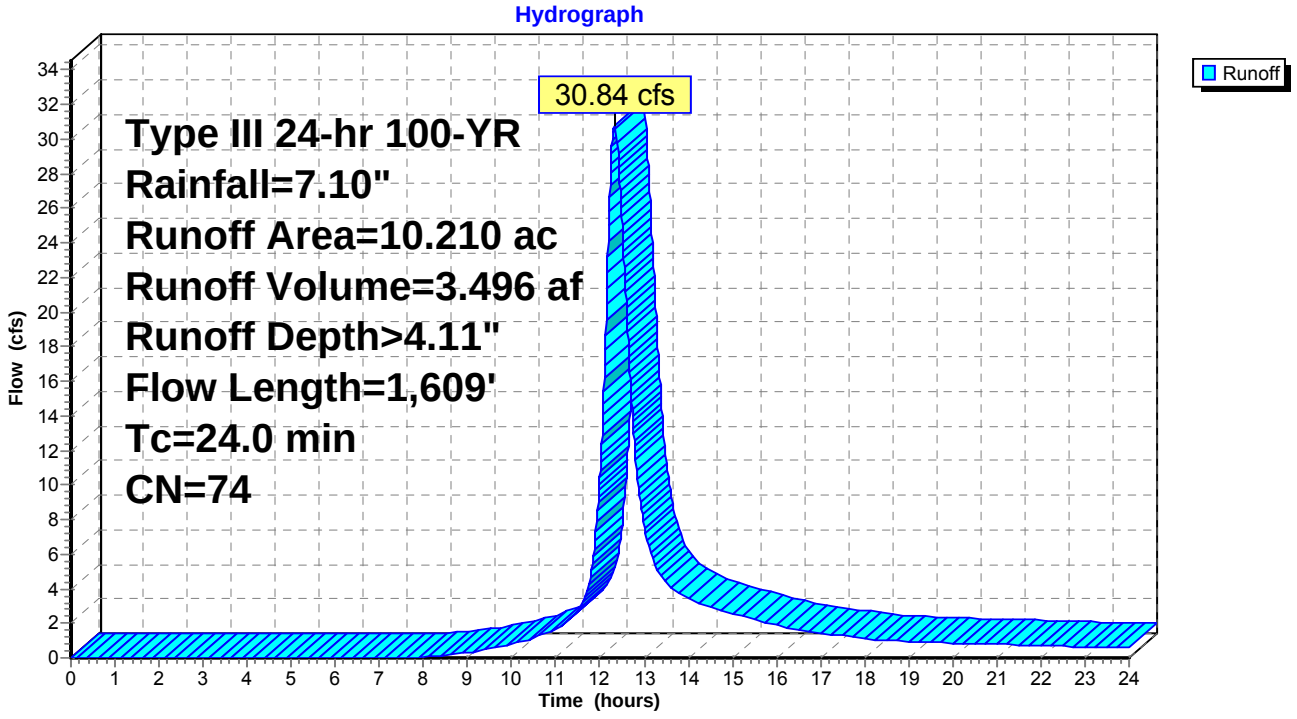
Runoff = 30.84 cfs @ 12.34 hrs, Volume= 3.496 af, Depth> 4.11"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=7.10"

Area (ac)	CN	Description
2.550	72	Woods/grass comb., Good, HSG C
7.660	74	>75% Grass cover, Good, HSG C
10.210	74	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.7	100	0.0125	0.1		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.40"
5.8	350	0.0400	1.0		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.5	1,159	0.0289	12.9	543.40	**Channel Flow,** Area= 42.0 sf Perim= 17.5' r= 2.40' n= 0.035
24.0	1,609	Total			

Subcatchment 12S: Post-Developed Drainage Area A-6



Subcatchment 14S: Post-Developed Basin B-2

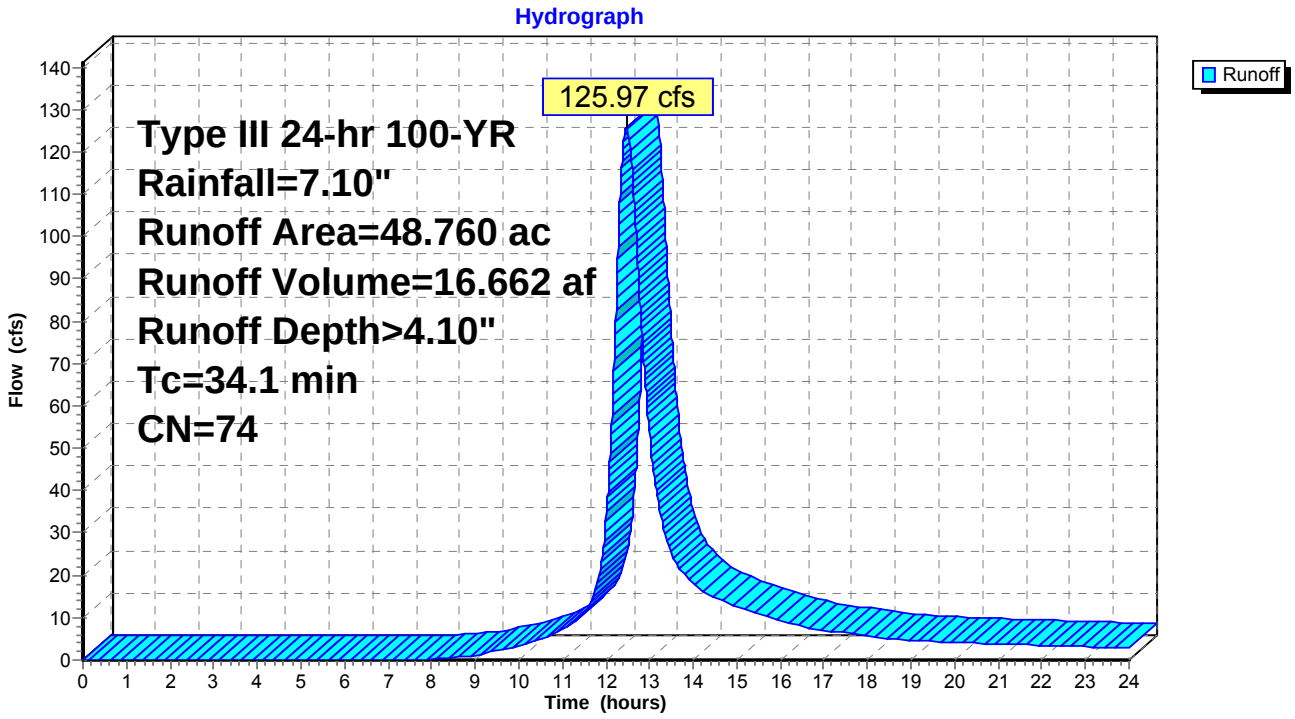
Runoff = 125.97 cfs @ 12.47 hrs, Volume= 16.662 af, Depth> 4.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=7.10"

Area (ac)	CN	Description
1.500	98	Paved parking & roofs
27.550	72	Woods/grass comb., Good, HSG C
19.710	74	>75% Grass cover, Good, HSG C
48.760	74	Weighted Average

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

Subcatchment 14S: Post-Developed Basin B-2



Pond 5P: Detention Pond 1

Inflow Area = 5.230 ac, Inflow Depth > 4.22" for 100-YR event
Inflow = 19.44 cfs @ 12.21 hrs, Volume= 1.841 af
Outflow = 7.99 cfs @ 12.58 hrs, Volume= 1.737 af, Atten= 59%, Lag= 22.0 min
Primary = 7.99 cfs @ 12.58 hrs, Volume= 1.737 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 292.73' @ 12.58 hrs Surf.Area= 8,538 sf Storage= 21,511 cf
Plug-Flow detention time= 63.6 min calculated for 1.736 af (94% of inflow)
Center-of-Mass det. time= 33.6 min (859.6 - 826.0)

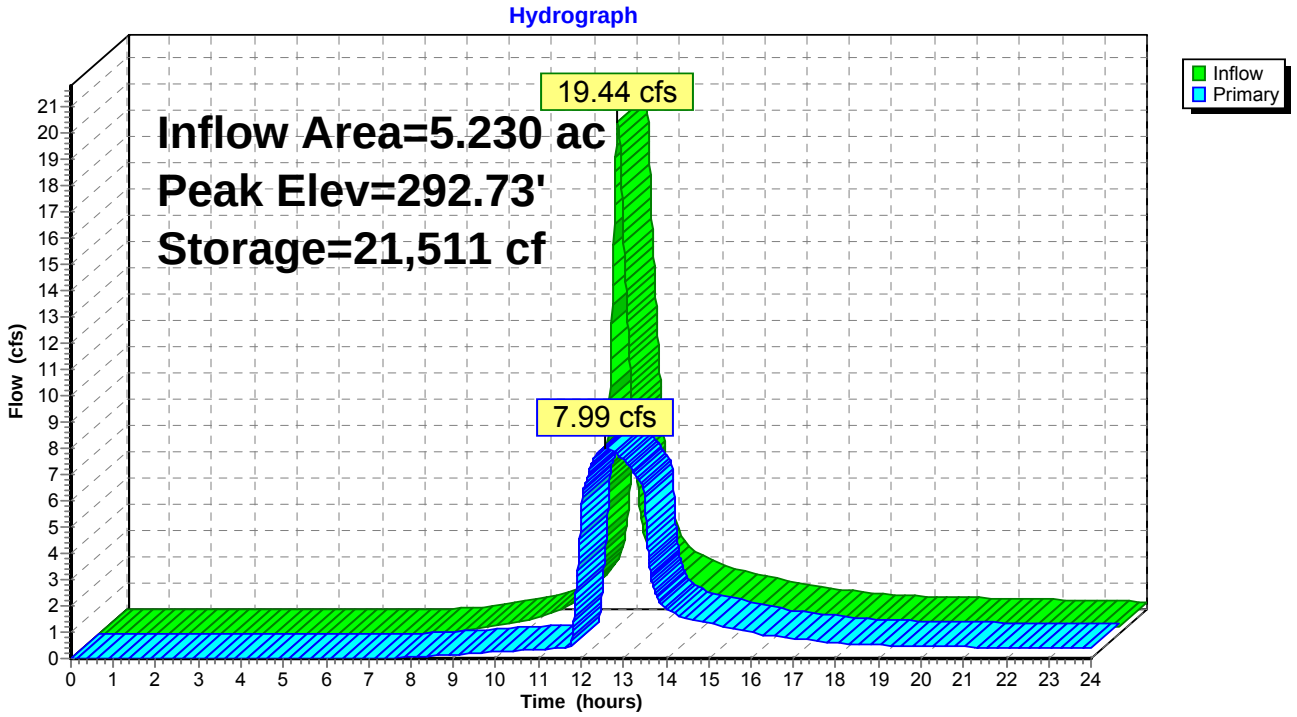
Volume	Invert	Avail.Storage	Storage Description
#1	286.50'	37,334 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
286.50	0	0	0
288.00	1,136	852	852
290.00	3,487	4,623	5,475
292.00	6,887	10,374	15,849
294.00	11,385	18,272	34,121
294.25	14,317	3,213	37,334

Device	Routing	Invert	Outlet Devices
#1	Primary	286.50'	**12.0" x 56.0' long Culvert** CPP, mitered to conform to fill, Ke= 0.700 Outlet Invert= 286.00' S= 0.0089 '/' Cc= 0.900 n= 0.010 PVC, smooth interior
#2	Device 1	286.50'	**3.0" Vert. Orifice** C= 0.600
#3	Device 1	290.00'	**3.0' long x 1.5' high Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Device 1	293.25'	**4.00' x 4.00' Horiz. CB Grate** Limited to weir flow C= 0.600

Primary OutFlow Max=7.99 cfs @ 12.58 hrs HW=292.73' (Free Discharge)
└**1=Culvert** (Inlet Controls 7.99 cfs @ 10.2 fps)
  ├**2=Orifice** (Passes < 0.58 cfs potential flow)
  ├**3=Sharp-Crested Rectangular Weir** (Passes < 44.35 cfs potential flow)
  └**4=CB Grate** (Controls 0.00 cfs)

Pond 5P: Detention Pond 1



Pond 6P: Low Point to CB E-1

Inflow Area = 7.580 ac, Inflow Depth > 4.22" for 100-YR event
Inflow = 26.67 cfs @ 12.24 hrs, Volume= 2.667 af
Outflow = 19.97 cfs @ 12.28 hrs, Volume= 2.477 af, Atten= 25%, Lag= 2.6 min
Primary = 9.15 cfs @ 12.28 hrs, Volume= 2.389 af
Secondary = 10.79 cfs @ 12.28 hrs, Volume= 0.089 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 268.52' @ 12.28 hrs Surf.Area= 7,213 sf Storage= 12,952 cf
Plug-Flow detention time= 50.4 min calculated for 2.477 af (93% of inflow)
Center-of-Mass det. time= 14.0 min (841.9 - 827.9)

Volume	Invert	Avail.Storage	Storage Description
#1	263.50'	12,952 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

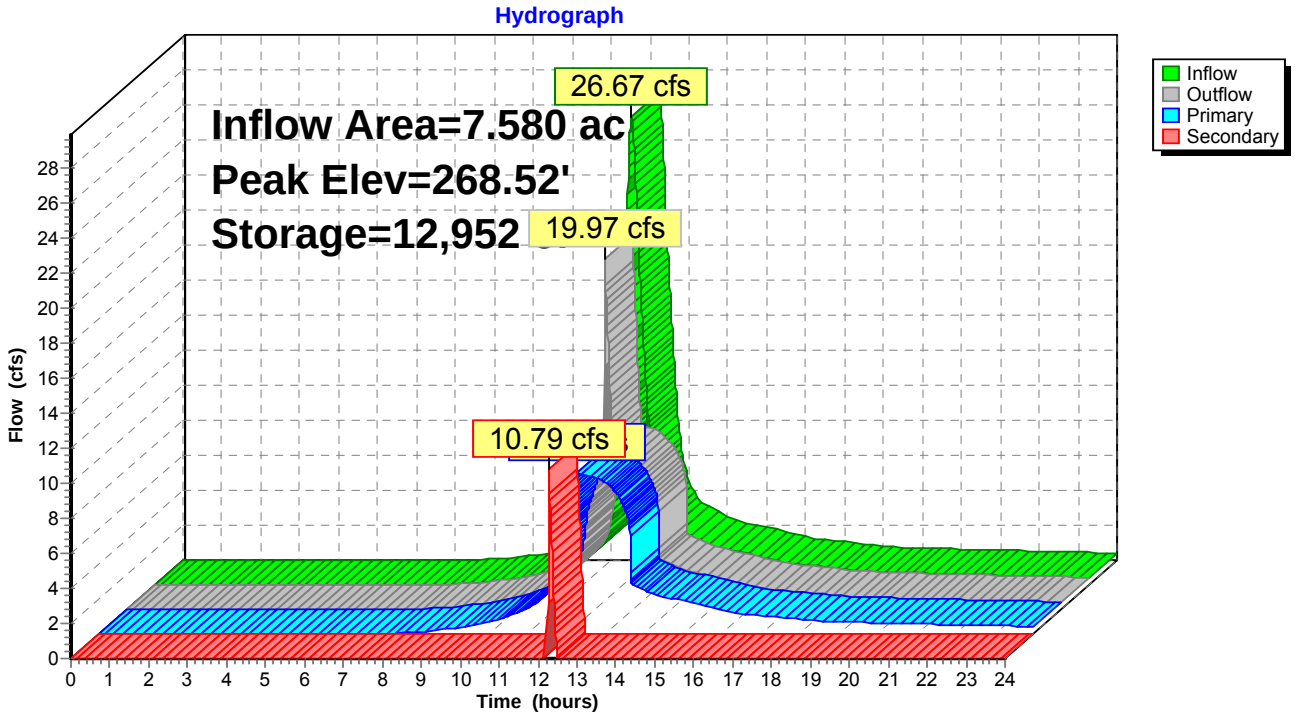
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
263.50	0	0	0
264.00	220	55	55
266.00	2,584	2,804	2,859
268.00	5,873	8,457	11,316
268.25	7,213	1,636	12,952

Device	Routing	Invert	Outlet Devices
#1	Primary	260.50'	**12.0" x 45.0' long Culvert** CPP, mitered to conform to fill, Ke= 0.700 Outlet Invert= 260.00' S= 0.0111 '/' Cc= 0.900 n= 0.010 PVC, smooth interior
#2	Device 1	263.50'	**4.00' x 4.00' Horiz. CB Grate** Limited to weir flow C= 0.600
#3	Secondary	268.45'	**138.0' long x 1.7' high Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=9.15 cfs @ 12.28 hrs HW=268.52' (Free Discharge)
└**1=Culvert** (Inlet Controls 9.15 cfs @ 11.7 fps)
└**2=CB Grate** (Passes 9.15 cfs of 172.70 cfs potential flow)

Secondary OutFlow Max=9.15 cfs @ 12.28 hrs HW=268.52' (Free Discharge)
└**3=Sharp-Crested Rectangular Weir** (Weir Controls 9.15 cfs @ 0.9 fps)

Pond 6P: Low Point to CB E-1



Pond 7P: Detention Pond 2

Inflow Area = 5.330 ac, Inflow Depth > 4.22" for 100-YR event
Inflow = 19.81 cfs @ 12.21 hrs, Volume= 1.877 af
Outflow = 8.04 cfs @ 12.58 hrs, Volume= 1.875 af, Atten= 59%, Lag= 22.2 min
Primary = 8.04 cfs @ 12.58 hrs, Volume= 1.875 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 289.30' @ 12.58 hrs Surf.Area= 7,847 sf Storage= 19,111 cf
Plug-Flow detention time= 27.1 min calculated for 1.875 af (100% of inflow)
Center-of-Mass det. time= 26.7 min (852.7 - 826.0)

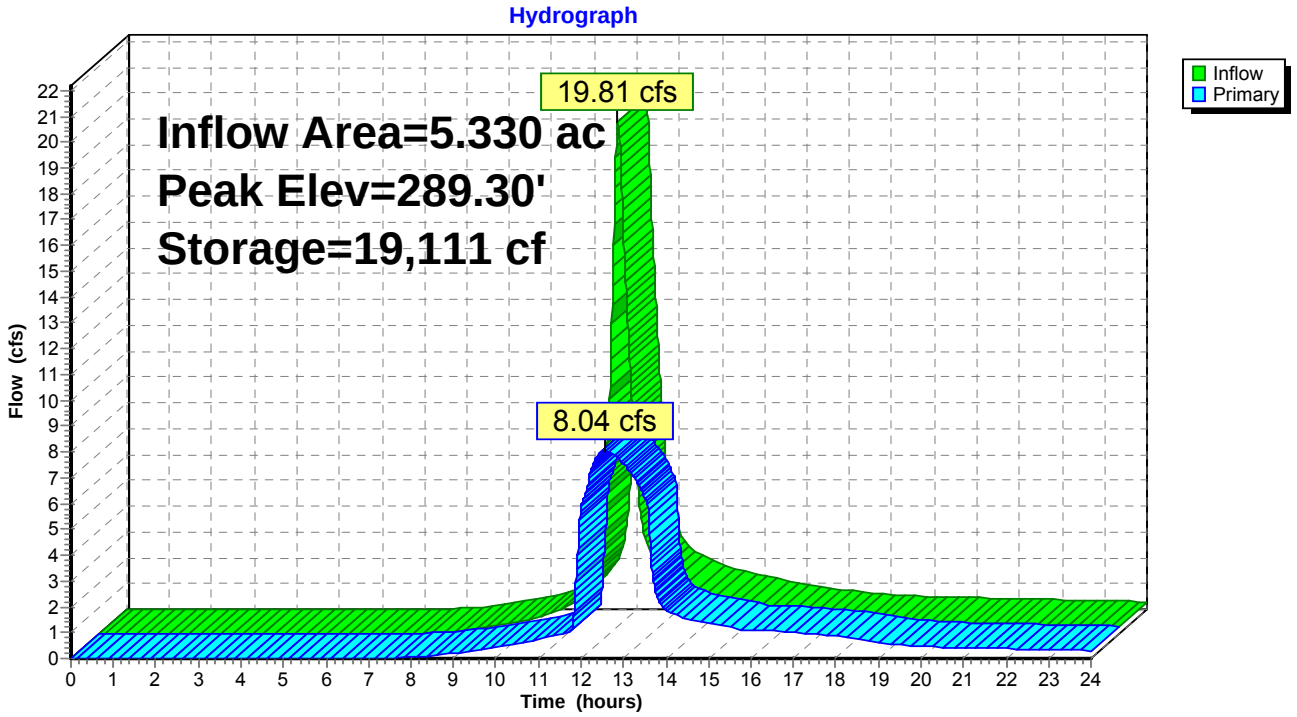
Volume	Invert	Avail.Storage	Storage Description
#1	283.00'	28,282 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
283.00	0	0	0
284.00	584	292	292
286.00	2,272	2,856	3,148
288.00	5,206	7,478	10,626
290.00	9,269	14,475	25,101
290.30	11,939	3,181	28,282

Device	Routing	Invert	Outlet Devices
#1	Primary	283.00'	**12.0" x 54.0' long Culvert** CPP, mitered to conform to fill, Ke= 0.700 Outlet Invert= 282.00' S= 0.0185 '/' Cc= 0.900 n= 0.010 PVC, smooth interior
#2	Device 1	283.00'	**5.0" Vert. Orifice** C= 0.600
#3	Device 1	286.00'	**3.0' long x 2.5' high Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Device 1	289.30'	**4.00' x 4.00' Horiz. CB Grate** Limited to weir flow C= 0.600

Primary OutFlow Max=8.04 cfs @ 12.58 hrs HW=289.30' (Free Discharge)
└**1=Culvert** (Inlet Controls 8.04 cfs @ 10.2 fps)
  ├**2=Orifice** (Passes < 1.62 cfs potential flow)
  ├**3=Sharp-Crested Rectangular Weir** (Passes < 53.28 cfs potential flow)
  └**4=CB Grate** (Passes < 0.00 cfs potential flow)

Pond 7P: Detention Pond 2



Pond 13P: Detention Pond 3

Inflow Area = 2.900 ac, Inflow Depth > 4.34" for 100-YR event
Inflow = 11.80 cfs @ 12.18 hrs, Volume= 1.048 af
Outflow = 3.46 cfs @ 12.61 hrs, Volume= 1.047 af, Atten= 71%, Lag= 25.9 min
Primary = 3.46 cfs @ 12.61 hrs, Volume= 1.047 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 283.12' @ 12.61 hrs Surf.Area= 6,472 sf Storage= 12,985 cf
Plug-Flow detention time= 30.8 min calculated for 1.047 af (100% of inflow)
Center-of-Mass det. time= 30.2 min (851.9 - 821.8)

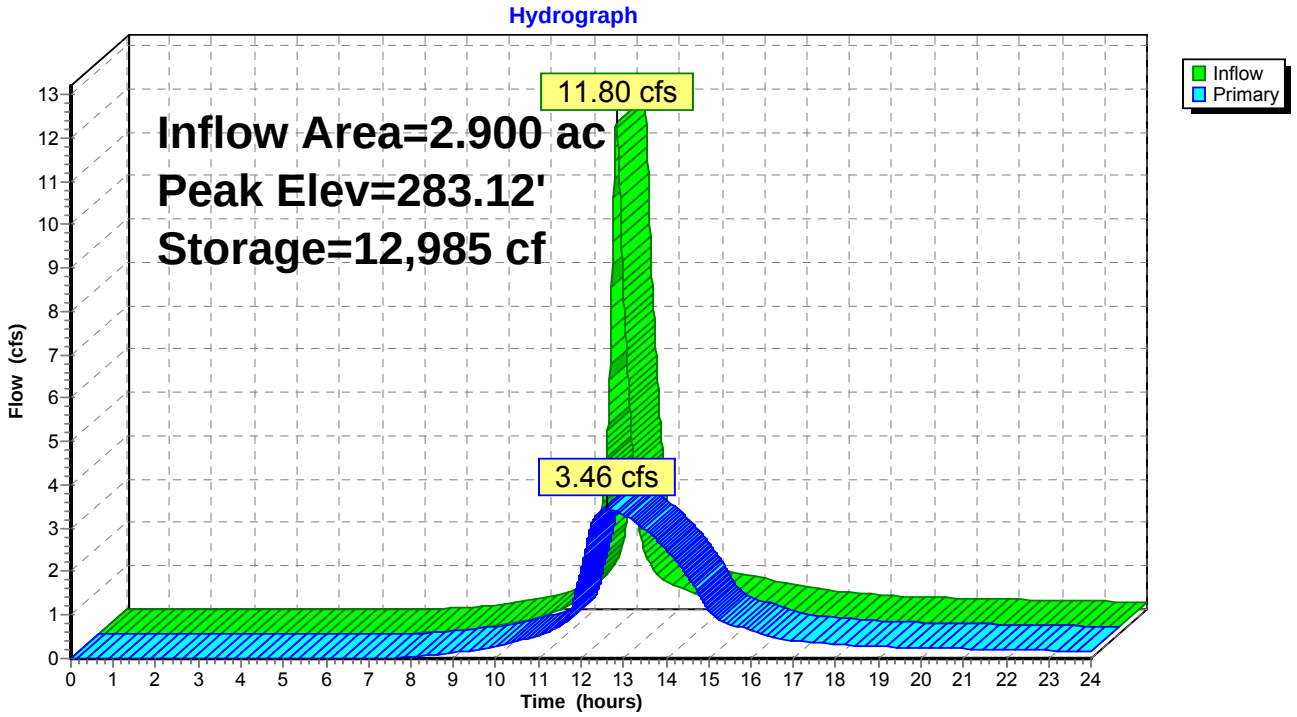
Volume	Invert	Avail.Storage	Storage Description
#1	279.00'	21,504 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
279.00	0	0	0
280.00	1,400	700	700
282.00	4,654	6,054	6,754
284.00	7,900	12,554	19,308
284.25	9,664	2,196	21,504

Device	Routing	Invert	Outlet Devices
#1	Primary	279.00'	**12.0" x 122.0' long Culvert** CPP, mitered to conform to fill, Ke= 0.700 Outlet Invert= 278.00' S= 0.0082 '/' Cc= 0.900 n= 0.010 PVC, smooth interior
#2	Device 1	279.00'	**6.0" Vert. Orifice** C= 0.600
#3	Device 1	280.00'	**6.0" Vert. Orifice** C= 0.600
#4	Device 1	283.12'	**4.00' x 4.00' Horiz. CB Grate** Limited to weir flow C= 0.600

Primary OutFlow Max=3.46 cfs @ 12.61 hrs HW=283.12' (Free Discharge)
└**1=Culvert** (Passes 3.46 cfs of 6.35 cfs potential flow)
  ├**2=Orifice** (Orifice Controls 1.86 cfs @ 9.5 fps)
  ├**3=Orifice** (Orifice Controls 1.60 cfs @ 8.2 fps)
  └**4=CB Grate** (Weir Controls 0.00 cfs)

Pond 13P: Detention Pond 3

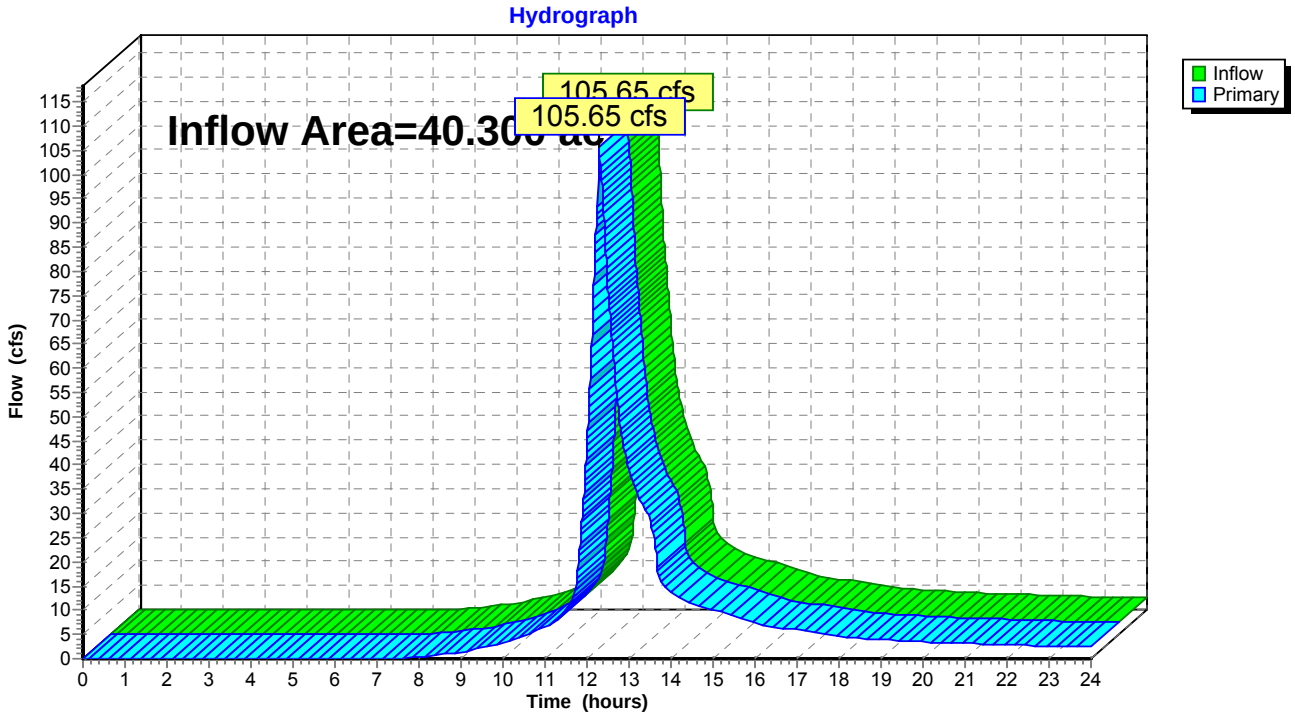


Link 2L: Discharge A

Inflow Area = 40.300 ac, Inflow Depth > 4.11" for 100-YR event
Inflow = 105.65 cfs @ 12.28 hrs, Volume= 13.790 af
Primary = 105.65 cfs @ 12.28 hrs, Volume= 13.790 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 2L: Discharge A

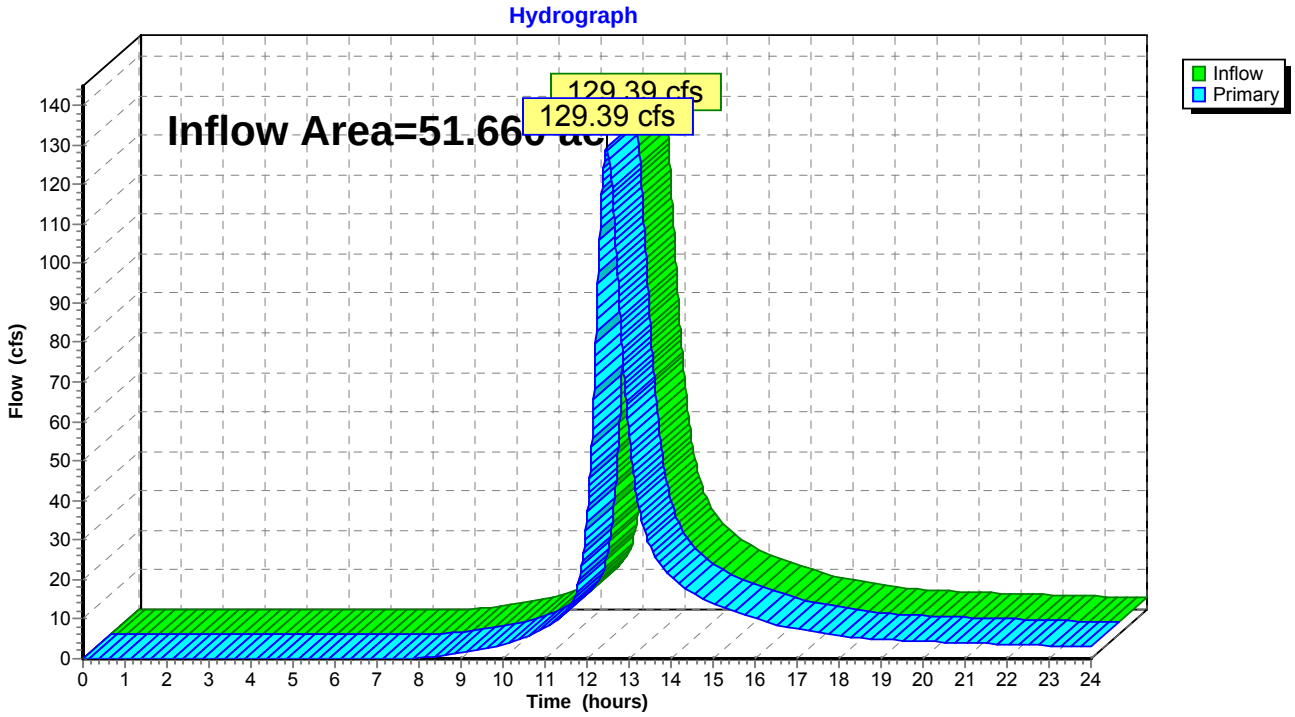


Link 4L: Discharge B

Inflow Area = 51.660 ac, Inflow Depth > 4.11" for 100-YR event
Inflow = 129.39 cfs @ 12.47 hrs, Volume= 17.709 af
Primary = 129.39 cfs @ 12.47 hrs, Volume= 17.709 af, Atten= 0%, Lag= 0.0 min

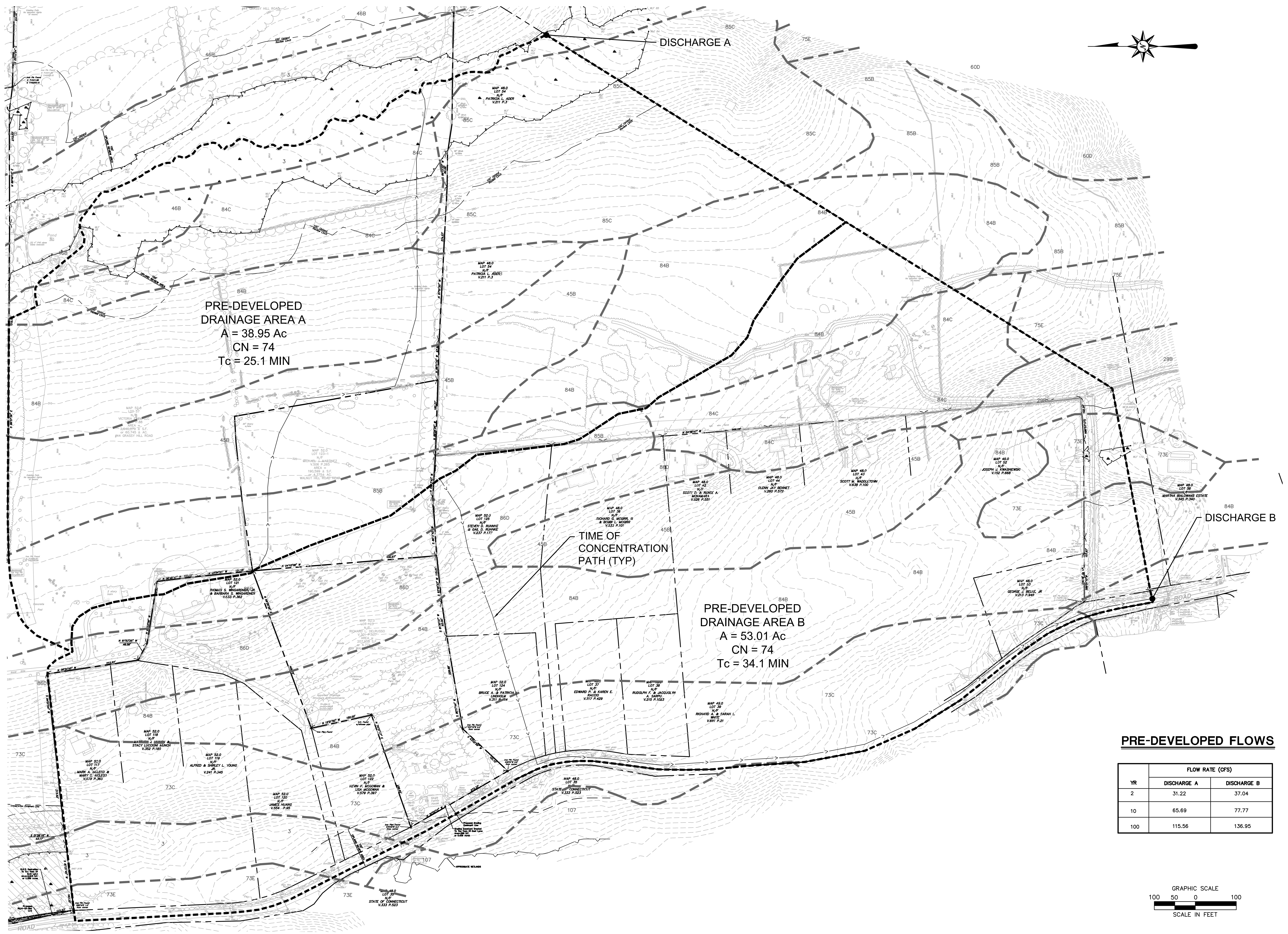
Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 4L: Discharge B



APPENDIX D
MAPS

ED-1 Existing Drainage Map
PD-1 Proposed Drainage Map
GU-0 Overall Grading, Drainage, and Utilities Plan



PRE-DEVELOPED FLOWS

YR	FLOW RATE (CFS)	
	DISCHARGE A	DISCHARGE B
2	31.22	37.04
10	65.69	77.77
100	115.56	136.95

GRAPHIC SCALE
100 50 0 100
SCALE IN FEET

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(203) 630-2615 Fax

ANTARES SOLAR FIELD
GRASSY HILL RD AND WALNUT HILL RD
EAST LYME, CONNECTICUT

REVISIONS
No. Date Desc.

Designed BKB
Drawn BKB
Checked RBG
Approved
Scale 1"=100'
Project No. 06C1625-G
Date 10/09/12
CAD File: ED06C1625G01

Title
EXISTING DRAINAGE MAP

Sheet No.
ED-1

Xref (s): XY06C162502 ; XC06C162500 ; XC06C162501 ; XC06C162502 ; BD06C1625G01

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Layout: ED-1 24x36 100sc

DISCHARGE A

POST-DEVELOPED
DRAINAGE AREA A-6
A = 10.21 Ac
CN = 74
Tc = 24.0 MIN

POST-DEVELOPED
DRAINAGE AREA A-5
A = 7.58 Ac
CN = 75
Tc = 17.8 MIN

POST-DEVELOPED
DRAINAGE AREA A-4
A = 5.85 Ac
CN = 75
Tc = 19.7 MIN

POST-DEVELOPED
DRAINAGE AREA B-1
A = 2.90 Ac
CN = 76
Tc = 13.0 MIN

POST-DEVELOPED
DRAINAGE AREA A-1
A = 5.23 Ac
CN = 75
Tc = 15.5 MIN

POST-DEVELOPED
DRAINAGE AREA A-2
A = 5.33 Ac
CN = 75
Tc = 15.5 MIN

POST-DEVELOPED
DRAINAGE AREA A-3
A = 6.10 Ac
CN = 75
Tc = 18.7 MIN

POST-DEVELOPED
DRAINAGE AREA B-2
A = 48.76 Ac
CN = 74
Tc = 34.1 MIN

TIME OF
CONCENTRATION
PATH (TYP)

DISCHARGE B

POST-DEVELOPED FLOWS

YR	FLOW RATE (CFS)	
	DISCHARGE A	DISCHARGE B
2	30.24	35.91
10	61.46	74.25
100	105.65	129.39

GRAPHIC SCALE
100 50 0 100
SCALE IN FEET

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(203) 630-2615 Fax

ANTARES SOLAR FIELD
GRASSY HILL RD AND WALNUT HILL RD
EAST LYME, CONNECTICUT

REVISIONS
No. Date Desc.

Designed	BKB
Drawn	BKB
Checked	RBG
Approved	
Scale	1"=100'
Project No.	06C1625-G
Date	10/09/12

CAD File: PD06C1625G01

Title
PROPOSED
DRAINAGE
MAP

Sheet No.
PD-1

Xref (s): ; XY06C1625G2 ; XC06C1625G01 ; XC06C1625G00 ; XC06C1625G02 ; XC06C1625G01 ; BD06C1625G01

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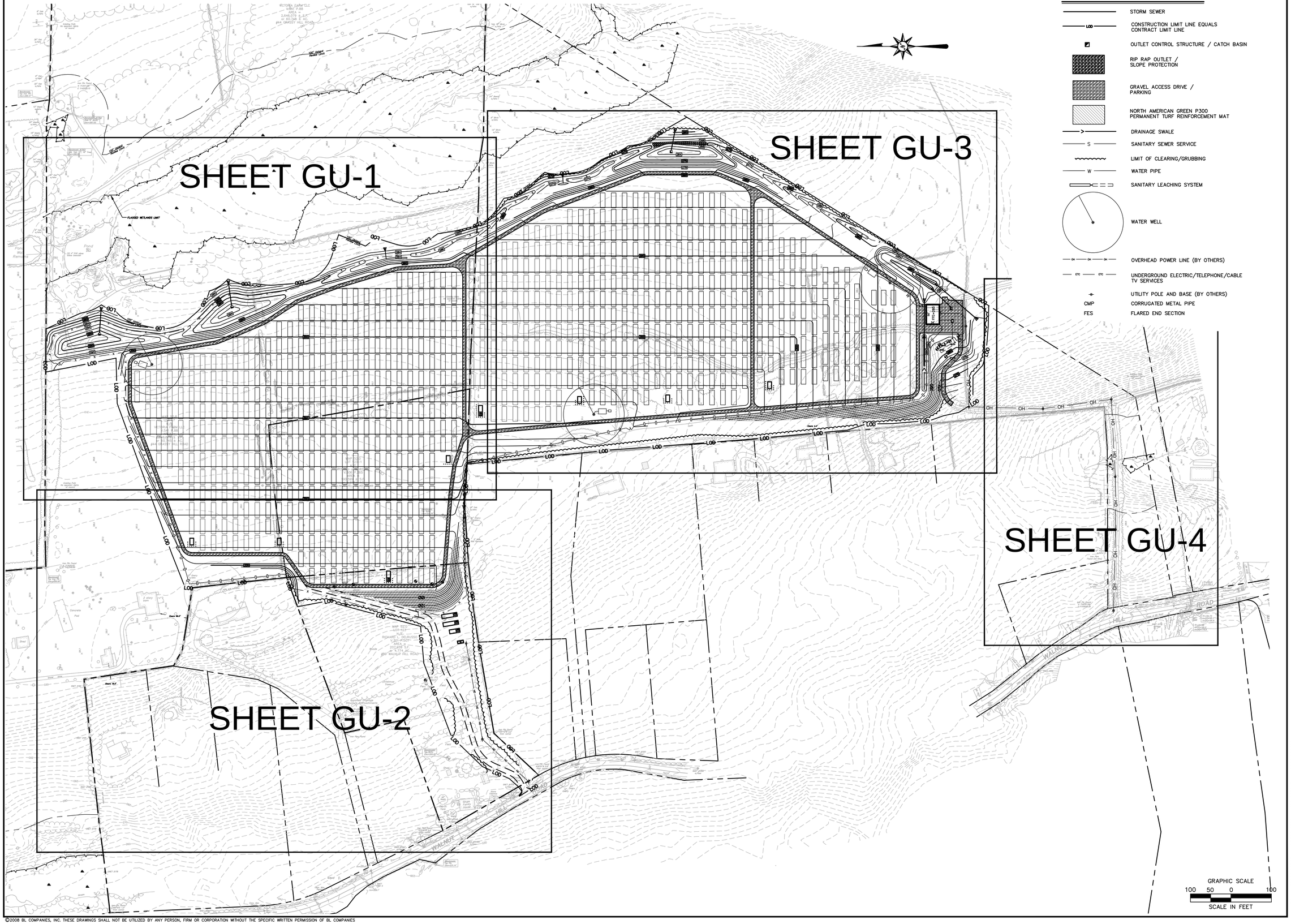

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ANTARES SOLAR FIELD
GRASSY HILL RD AND WALNUT HILL RD
EAST LYME, CONNECTICUT

REVISIONS
No. Date Desc.

Designed	BKB
Drawn	BKB
Checked	RBG
Approved	
Scale	1"=100'
Project No.	06C1625-G
Date	10/09/12

CAD File: GU06C1625G01

Title
OVERALL GRADING, DRAINAGE, & UTILITIES PLAN

Sheet No.
GU-0

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APPENDIX E
OPERATIONS AND MAINTENANCE PLAN

Appendix F:
Operations and Maintenance Plan

Antares Solar Field
East Lyme, Connecticut

Prepared For Submission To:
Connecticut Siting Council

October 9, 2012

BL Project Number: 11C3908

Prepared For:
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General Overview

The project, located southeast of the intersection of Grassy Hill Road and Walnut Hill Road, is proposed to be developed by constructing solar panel clusters that generate upwards of 6MW of electricity as well as gravel access around the field with a proposed building and associated drainage structures and utilities. The site demolition that will occur includes removal of existing trees, building foundations, stone walls, and fence.

No work is proposed within the adjacent 100' upland review area and no new stormwater discharge locations are proposed. The disturbed site area will be treated for water quality and quantity before being discharged to one of two existing discharge locations.

The site is not located within the 100-year flood hazard area, according to the Federal Emergency Management Agency's (FEMA) Flood Insurance Rate Maps (FIRM) for New London County, effective date July 18, 2011. The site is located within Zone "X" which is delineated as "areas determined to be outside the 0.2% annual chance floodplain."

The following Operations and Maintenance Plan was prepared specifically for this proposed solar field in the Town of East Lyme, Connecticut

Purpose & Goals

The purpose of this Manual is to ensure that the stormwater BMP components are operated in accordance with all approvals and permits. The primary goal is to inform all the property managers about how the system operates and what maintenance items are necessary to protect downstream wetlands and watercourses. The secondary goal is to provide a practical, efficient means of maintenance planning and record keeping to verify permit compliance.

Responsible Parties

Greenskies Renewable Energy, LLC will be responsible for implementing the Plan on the entire property. The party will be responsible for overseeing the maintenance of the entire solar field.

List of Permits & Special Conditions

The project will receive a number of permits, which may contain special conditions that require compliance by the owners and maintenance contractors. These permits may include the following:

- Connecticut Siting Council Approval
- Connecticut General Permit for the Discharge of Stormwater Associated with Construction Activity

Maintenance Logs and Checklists

Greenskies Renewable Energy, LLC will keep a record of all maintenance procedures performed, date of inspection/ cleanings, etc. Copies of inspection reports and maintenance records shall be kept on site in the manager's offices once they are established.

Forms

The following forms will be developed for annual maintenance. Copies of the forms will be kept on-site as part of the Storm Water Management Plan.

- Annual Checklist
- Quarterly Checklist
- Monthly Checklist

Employee Training

All necessary Greenskies Renewable Energy, LLC employees will take part in an employee-training program, with annual updates, to ensure that the employees charged with maintaining the BMP's do so in accordance with the approved permit conditions. All employees that have maintenance duties will be adequately informed of their responsibilities. All sub-contractors (Vactor, snowplowing, etc.) will be informed of special requirements and responsibilities.

Spill Control

Greenskies Renewable Energy, LLC will have a spill control program. That program will be updated annually and incorporated into the employee-training program.

Storm Water Management

System Components

The storm water management system has several components that are shown on the Overall Grading, Drainage, and Utilities Plan (GU-0), and they perform various functions in treating storm water runoff:

Catch Basins are inlets, which trap road sand and floatable debris prior to draining through the storm sewer system. The catch basins (CBs) are equipped with 2' deep sumps, and hoods over the outlet pipes.

Catch Basins and Outlet Protection

Greenskies Renewable Energy, LLC is responsible for cleaning the catch basins and outlet protection on the property. A Connecticut licensed hauler shall clean the sumps, and dispose of removed sand legally. As part of the hauling contract, the hauler shall notify Greenskies Renewable Energy, LLC in writing where the material is being disposed.

Each catch basin shall be inspected every four months, with one inspection occurring during the month of April. Any debris occurring within one foot from the bottom of each sump shall be removed by Vacuum "Vactor" type of maintenance equipment.

During the inspection of each of the catch basin sumps, the hoods (where provided) on each of the outlet pipes shall also be observed. In the event that a hood is damaged or off the hanger, it shall be reset or repaired.

Detention Ponds

The detention ponds shall be inspected every six months in the months of April and October. The inspection shall follow the maintenance list below. The detention basin shall be inspected, maintained and cleaned periodically (if required) during construction, and at the end of construction once the vegetation is fully stabilized.

For the first year of operation following construction, inspect the detention basin each month for the months of January, February, March and April, and once every four months thereafter. After the first year of operation, the detention basin shall be inspected a minimum of two times yearly with one inspection occurring in the month of April. Any accumulations found to be occurring within one foot of the inlet orifice shall be removed from the detention basin and properly disposed off-site. Also, any floating material discovered during inspections shall be removed from the basin.

A detailed maintenance logbook shall be kept for each detention ponds. Information is to include, but not be limited to, the date of inspection, record of sediment depth, condition of the inlet pipe, condition of orifice, condition of outlet control structure, observation of any floatables, and date of cleaning performed.

Regular inspection/maintenance for the detention ponds includes the following items:

- checking that the storm inlet into the detention pond is clear and functioning properly,
- checking that the outlet control structure is clear and the outlet is functioning properly,
- checking that the outlet channel from the pond is clear and not eroding,
- removing paper and debris from inside of pond,
- mowing the crest of the basin for maintenance access,
- removing invasive plant species from wetland marsh in bottom of pond,
- checking slopes for any dips or settlement that might indicate seepage,

The bottom of the detention ponds are planted as a marsh for additional filtering, and will not normally be mowed. The sides of the ponds will be maintained as a meadow. The crest of the ponds will be mowed periodically for maintenance access.

Leaky Berm

The leaky berm shall be checked for and cleaned of trash, excessive sediment, other debris and erosion on a monthly basis. Check the outlet pipes and verify they are clear of debris and functioning properly. A detailed maintenance logbook shall be kept with information including, but not limited to, the date of inspection, record of grit depth, condition of vegetation, observation of any floatables, and date of cleaning performed.

Swales

Grassed drainage swales shall be checked for and cleaned of trash, excessive sediment, other debris and erosion on a monthly basis. Maintain the swales as meadow during growing season. A detailed maintenance logbook shall be kept with information including, but not limited to, the date of inspection, record of grit depth, condition of vegetation, observation of any floatables, and date of cleaning performed.

Site Maintenance

Landscaping

The management company retained by Greenskies Renewable Energy, LLC will maintain landscaped areas. Normally the landscaping maintenance will consist of mowing lawns, raking leaves, etc. The lawn areas, once established, will be maintained at a typical height of 3 ½". This will allow the grass to be maintained with minimal impact from weeds and/or pests. The low-maintenance areas will be maintained as a meadow or allowed to revert back to natural conditions.

Topsoil, brush, leaves, clippings, woodchips, mulch, equipment, and other material shall be stored off site.

Maintaining Native Vegetation

Existing vegetation around the perimeter of the development will be maintained in its native condition. No clearing, grading, stockpiling, storage, or development will occur in these areas.