Georgia Department of Transportation

MS4 Infeasibility Report for

Reconstruction of the Existing Interchange at I-95 and SR 21 to a Diverging Diamond Interchange

PI No. 0012722

Chatham County

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Executive Summary

In January 2012, the Georgia Department of Natural Resources Environmental Protection Division (EPD) issued Georgia Department of Transportation's (GDOT's) first Municipal Separate Storm Sewer System (MS4) Permit (General National Pollutant Discharge Elimination System [NPDES] Permit No. GAR041000) (Permit) for discharges from its MS4 designated areas.

The Permit regulates new and existing point source discharges of stormwater from roadways owned and operated by GDOT to waters of the State of Georgia. The Reconstruction of the existing interchange at I-95 and SR21 project must meet the requirements of the Permit, which include incorporating permanent water quality control and detention measures (best management practices [BMPs]) into the design where appropriate, where those BMPs have not been determined to be infeasible based on the infeasibility criteria identified in Section 1.4 of the GDOT Guidelines for Design of Post-Construction BMPs (GDOT Guidelines) issued February 22, 2013, and where required in accordance with the GDOT Guidelines.

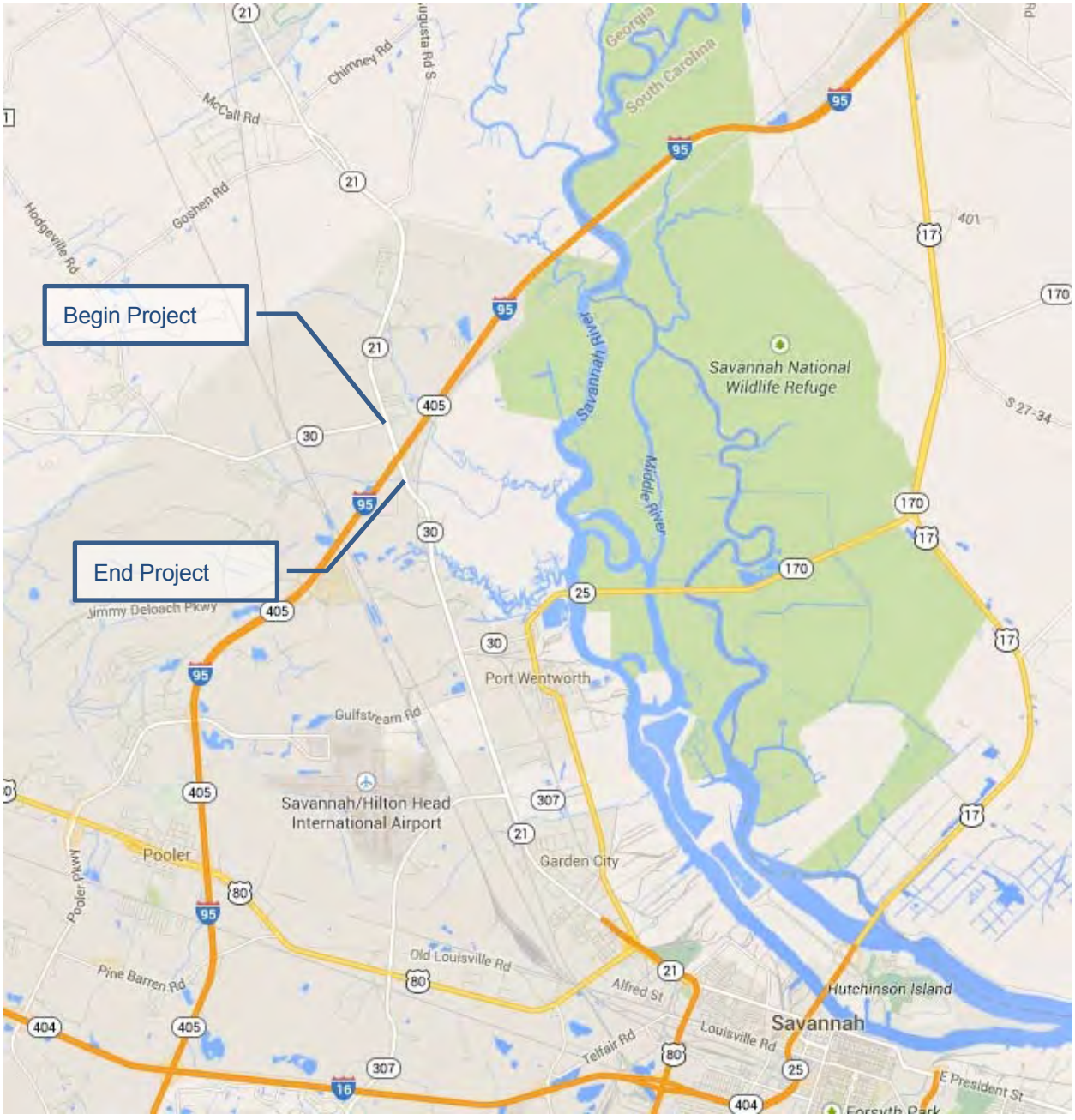
Project Description

State Route 21 in Chatham County was identified for corridor improvements and minor interchange improvements. This proposed project was presented to and approved by the Operational Improvement Committee. In the interest of accelerated and efficient delivery, the project was approved for Design-Build delivery on January 28, 2014.

SR 21 is an urban principal arterial that connects downtown Savannah to the northern suburban areas in Effingham County. Currently, SR 21 consists of two through lanes and one right turn auxiliary lane each direction with a grass median. The SR 21/I-95 interchange is a conventional diamond interchange with two through travel lanes and one turn lane in each direction on the arterial mainline and dual left turns and a right turn lane on the ramp terminals. The exit ramp intersections are controlled by traffic signals that are coordinated with the intersection of SR 30 to the north.

The Office of Traffic Operations performed an engineering study of the interchange to determine if a diverging diamond interchange (DDI) configuration would improve operations along SR 21. The proposed DDI consists of three through lanes and one turn lane in each direction of SR 21 under the I-95 overpass. The additional lane from the SR 21 at the interchange will terminate as a left turn only lane at SR 30 to the north and a right turn only lane at Hendley Road to the south. The project will use the existing grass median/shoulder to connect the lanes from the DDI on the north and south side of the interchange. A capacity analysis concluded that the DDI reconfiguration will improve operations at the interchange in the short term over a 10 year project life, reducing the intersection delay and travel times from the ramps and along the SR 21 mainline. These improvements will also increase the operational efficiency of the intersection, by reducing the potential for queuing on the I-95 mainline.

PROJECT LOCATION MAP



Design Methodology

Water Quality Volume (WQv)

The Water Quality Volume is the volume of stormwater runoff required to treat the first 1.2 inches of rainfall for the removal of 80% of the average annual post-development total suspended solids. The 1.2-inch criterion is considered the 85th percentile event according to the Georgia Stormwater Management Manual and is sufficient for a majority of storm events to achieve the 80% reduction goal.

Channel Protection Volume (CPv)

The Channel Protection Volume is the volume of stormwater runoff generated by the 1-year, 24-hour rainfall event. The purpose of the Channel Protection Volume is to protect downstream channels from runoff generated by additional impervious surfaces and shall be detained for at least 24 hours. Additionally, erosion prevention measures such as energy dissipation and velocity control will be provided at all outfalls to help protect the downstream channel. Where possible, the stream buffer will be preserved to minimize impacts to the stability of the channel bank.

Overland Flood Protection Volume (QP25)

The Overland Flood Protection Volume is the volume of stormwater runoff generated by the 25-year, 24-hour rainfall event. The purpose of the Overland Flood Protection Volume is to ensure that the post-development peak discharge does not exceed pre-development peak discharge. If the post-development peak volume is greater than the pre-development peak volume, the volume will be detained to release at pre-development levels. The detention is to ensure that the channel banks will be protected from an increase in the magnitude of runoff.

Extreme Flood Protection Volume (Qf)

The Extreme Flood Protection Volume is the volume of stormwater runoff generated by the 100-year, 24-hour rainfall event. Extreme Flood Protection Volume shall be provided such that downstream flooding is not exacerbated by the increase in impervious area.

Project and Outfall Level Exclusions

MS4 post-construction storm water requirements that involve the design and installation of post-construction BMPs can be excluded from the project entirely if one of the “Project Level Exclusions” is claimed. If a project does not qualify for a Project Level Exclusion, specific outfall drainage areas within a project may qualify for an “Outfall Level Exclusion” (specific only to an area of the project). Both Project Level and Outfall Level Exclusions are defined below:

Project Level Exclusions

1. Roadways that are not owned or operated (maintained) by GDOT may not require post-construction BMPs. Coordinate with the appropriate local government or entity to determine storm water management requirements.

2. The project location is not within an MS4 area.

3. Maintenance and safety improvement projects whereby the sites are not connected and the individual site disturbs less than one acre. This includes projects such as repaving, shoulder building, fiber optic line installation, sign addition, and sound barrier installation.

4. Projects that have their environmental documents approved or right-of-way plans submitted for approval on or before June 30th, 2012.

5. Road projects that disturb less than 1 acre or for site development projects that add less than 5,000 ft2 of impervious area.

Outfall Level Exclusions

1. Cases where the project would require an existing roadway alignment change solely to allow for BMPs. This exclusion applies only to existing roadway alignment changes that would create a safety concern. A written explanation of the safety concern(s) must be included with the post-construction storm water report for all uses of this exclusion.

2. Instances where the installation of post-construction BMPs would require the re-alignment and/or piping of a stream.

3. When a project would impact existing vegetated stream buffers or wetlands solely for the purposes of installing BMPs. See state requirements for additional information on stream buffers.

4. Where storm water discharges from the project site are designed to exit the right-of-way as sheet flow (non-point source discharges). Sheet flow should be designed in a manner to ensure that the flow will not cause instability, erosion, or flooding. The designer should determine if this is possible by visiting the site prior to design, and providing a written explanation with supporting evidence for this drainage area.

5. As stated in section 4.2.5.1(a) of the GDOT MS4 permit, “Storm water runoff that must be treated does not apply to flows that originate outside of GDOT’s right-of-way or diverted flows from undisturbed areas.” If feasible, direct all offsite storm water around the project site to the cross drain or stream such that it does not combine with storm water from the project’s impervious surfaces or conveyance systems. This redirection allows the BMPs to only treat or detain the storm water that originates from GDOT’s site, and storm water that originates off-site to pass through the right of way unimpeded.

6. As stated in section 4.2.5.1(a) of the GDOT MS4 permit, for outfalls along linear roadway projects whereby the net impervious surface area within that outfall's drainage area has been reduced or remains the same as pre-developed conditions, post-construction storm water requirements will not apply. Special consideration from the Department may be given to those projects with a minimal increase in impervious area. In such cases, the designer will be required to provide supporting calculations showing that the increase in storm water runoff and/or volume required to be treated for water quality is negligible with respect to the drainage area in question.

For this project, no project level exclusions can be utilized. However, outfall level exclusions #3 and #6 will be used as a first level exclusionary criterion before infeasibility criteria are examined.

Infeasibility Criteria

There are ten criteria for determining Infeasibility of Post-Construction Stormwater Management Design on State Routes:

1. The cost of construction of the BMP equals or exceeds 10% of the combined cost of the right-of-way, construction, and utilities of the project area draining to the outfall in question.

2. The project is delayed by 90 days or more due to the implementation of post-construction BMPs.

3. The use of BMPs will impact threatened or endangered species habitat.

4. The use of BMPs will significantly damage a community resource such as a historical area, park, wildlife refuge, nature trail, or school facilities.

5. The use of BMPs will displace a business or residence.

6. Implementation of the BMP would result in the violation of a federal or state law.

7. The project has shallow bedrock, contaminated soils, high groundwater, utilities, or underground facilities and avoidance or relocation cost of the utility equals the cost of the BMP.

8. The soil hydraulic conductivity (K) is less than 10^{-4} centimeter/second (while 10^{-5} centimeter/second is the absolute lower limit) when considering infiltration BMPs.

9. The site is too small to infiltrate the necessary volume.

10. The site does not allow for gravity flow to the appropriate BMP.

Best Management Practices

In addition to the above criteria, an appropriate BMP must be available for construction. Current GDOT policy allows 10 BMPs for post-construction stormwater management.

	Treatment Parameters				
BMP	WQv	TSS Removal	CPv	QP25	Qf
Filter Strip	Yes	60%	No	No	No
Grass Channel	Yes	50%	No	No	No
Enhanced Swale	Yes	80%	In some Situations	No	No
Infiltration Trench	Yes	80%	In some Situations	No	No
Sand Filter	Yes	80%	In some Situations	No	No
Dry Detention Basin	Yes	65%	Yes	Yes	Yes
Wet Detention Pond	Yes	80%	Yes	Yes	Yes
Stormwater Wetland	Yes	80%	Yes	Yes	Yes
Bioslope	Yes	95%	No	No	No
Bioretention Area	Yes	85%	In some Situations	No	No
Open Graded Friction Coarse	No	50%	No	No	No

TSS = Total Suspended Solids

Certain BMPs do not provide all treatment required and would have to be used in a “treatment train.”

Results/Conclusions

This project includes seven drainage areas. Each drainage area is evaluated for BMP installation and any applicable outfall exclusions.

Project MS4 Requirements and Feasibility Summary Chart

	Applicable MS4 Requirements					Feasibility		
Drainage Area	WQv	CPv	Qp25	Qf	Outfall Level Exclusion	Feasible	Infeasibility Criteria	BMP Selected
DA1					Yes #6	N/A	N/A	None
DA2	X	X			No	Yes	N/A	Wet Enhanced Swale
DA3	X	X			No	Yes	N/A	Wet Enhanced Swale
DA4					Yes #6	N/A	N/A	None
DA5	X	X			No	Yes	N/A	Wet Enhanced Swale
DA6a					Yes #3	N/A	N/A	None
DA6b					Yes #3	N/A	N/A	None
DA6c					Yes #6	N/A	N/A	None
DA6d					Yes #3	N/A	N/A	None
DA6e	X	X			No	Yes	N/A	Grass Channel & Dry Detention Pond
DA7	X	X	X	X	No	No	#2	None

Drainage Basin	Appendix A Drainage Map	Appendix J Plan Sheet
1	21-001	13-003,13-004
2	21-001	13-003, 14-001
3	21-001	13-002,13-003, 14-001
4	21-001	13-002, 14-001
5	21-001	13-002, 14-002
6	21-001	13-001,13-002, 13-003
7	21-001	13-003, 13-004, 13-005, 14-002

Drainage Area 1

Drainage Area 1 is located on the west quadrant of the interchange along SR 21 from STA.142+00 to 165+50 LT. This drainage area outfalls, at STA.165+00 LT, into a buffered stream that runs parallel to Piedmont Avenue.

Physical Parameters of Drainage Area 1

Drainage Area 1 (Pre)	**Area (ac)**	**CN**
Roadway Impervious	2.77	98
Fair Condition Grass (Soil Group C)	0.51	79
Total	**5.18**	**95.05**

Drainage Area 1 (Post)	**Area (ac)**	**CN**
Roadway Impervious	2.77	98
Fair Condition Grass (Soil Group C)	0.51	79
Total	**5.18**	**95.05**

Conclusion:

Since, there is no change in impervious area in pre and post conditions outfall level exclusion #6 is used for Drainage Area 1.

Outfall level exclusion #6. As stated in section 4.2.5.1(a) of the GDOT MS4 permit, for outfalls along linear roadway projects whereby the net impervious surface area within that outfall's drainage area has been reduced or remains the same as pre-developed conditions, post-construction storm water requirements will not apply. Special consideration from the Department may be given to those projects with a minimal increase in impervious area. In such cases, the designer will be required to provide supporting calculations showing that the increase in storm water runoff and/or volume required to be treated for water quality is negligible with respect to the drainage area in question.

Drainage Area 2

Drainage Area 2 is located on the west quadrant of the interchange along the south bound entrance ramp from STA.132+00 LT to 142+00 LT approximately. This drainage area flows into a buffered wetland that begins at STA.129+00 LT and flows south.

Physical Parameters of Drainage Area 2

Drainage Area 2 (Pre)	**Area (ac)**	**CN**
Roadway Impervious	0.51	98
Fair Condition Grass (Soil Group C)	1.37	79
Total	**1.88**	**84.15**

Drainage Area 2 (Post)	**Area (ac)**	**CN**
Roadway Impervious	0.61	98
Fair Condition Grass (Soil Group C)	1.27	79
Total	**1.88**	**85.16**

Water Quality Volume

Total Drainage Area (Acres)	1.88
Pre-Developed Impervious Area (Acres)	0.51
Post-Developed Impervious Area (Acres)	0.61
Pre-Developed % Impervious	27.13%
Post-Developed % Impervious	32.45%
Runoff Coefficient Rv (Rvpost-Rvpre)	0.048

Design Volumes	Cubic Feet
Required WQv	393
Required CPv	573

Design Flows	Q25(cfs)	Q100(cfs)
Pre	13.50	17.51
Post	13.69	17.70

The addition of the small area (0.1 acres) of new paving increases the 25-year storm and the 100-year storm by 0.19 cfs which is less than a 2% increase for both storms. The downstream drainage system for this basin was analyzed and no adverse impact will occur due to the increase in flow rate. Qp25 and Qp100 attenuation will not be provided for this drainage area.

BMP Evaluation for Drainage Area 2

Filter Strip – The typical section for this project is a rural section. The current design does not require the acquisition of additional right of way. The additional shoulder width would require the acquisition of additional right of way and would be determined to be infeasible under infeasibility criteria #2; the project would be delayed by 90 days or more due to the implementation of post-construction BMPs. **The filter strip is not an appropriate BMP for this project.**

Grass Channel – The typical section for this project is a rural section. Since the grass channel does not provide the required 80% TSS removal a wet enhanced swale can be installed in approximately the same foot print and will provide the required TSS removal. **The grass channel is not an appropriate BMP for this project.**

Infiltration Trench – As indicated in the soil descriptions in Appendix D, the soil infiltration rate is less than 0.5 inch/hour and there is a high water table. Soils with an infiltration rate greater than 0.5 inch/hour would be considered acceptable for sanitary drain fields. All soils in the project area are rated as very limited. All information shown in Appendix D was collected from the National Resource Conservation Service Web Soil Survey. **The infiltration trench is not an appropriate BMP for this project.**

Sand Filter – The sand filter has high construction maintenance cost and would be considered after a bioretention area did not work. The area required for the sand filter would exceed the existing right of way in this drainage area. The required acquisition of additional right of way would be determined to be infeasible under infeasibility criteria #2; the project would be delayed by 90 days or more due to the implementation of post-construction BMPs. **The sand filter is not an appropriate BMP for this project.**

Dry Detention Basin – The dry detention basin can be built to provide the channel protection volume and can control the overland flood protection. However, since it only provided 65% TSS removal an additional treatment method would have to be provided. Due to the limited right of way in this area the pond could not be constructed inside the existing right of way**. The dry detention pond is not an appropriate BMP for this project.**

Wet Detention Pond – The drainage area for Drainage Area 2 is less than 10 acres; therefore, **the wet detention pond is not an appropriate BMP for this project.**

Stormwater Wetlands – The drainage area for Drainage Area 2 is less than 25 acres; therefore, **the stormwater wetland is not an appropriate BMP for this project.**

Bioslope – The bioslope requires more area and is more expensive to construct than the wet enhanced swale. **The bioslope is not an appropriate BMP for this project.**

Bioretention Areas – The bioretention area has high construction and maintenance cost and would be considered if other, more compact BMP's did not work. The area required for the bioretention area would exceed the existing right of way in this drainage area. The required acquisition of additional right of way would be determined to be infeasible under infeasibility criteria #2; the project would be delayed by 90 days or more due to the implementation of post-construction BMPs. **The bioretention area is not an appropriate BMP for this project.**

Enhanced Swales – A wet enhanced swale was sited and analyzed for Drainage Area 2. The swale can be located in the existing ditch northwest of the ramp. Based on the combined required water quality volume and channel protection volume of 966 cubic feet, an average depth of 1 foot, and a 6-foot bottom width, a 97-foot-long wet enhanced swale will be required. The existing ditch is very flat (less than 1% slope) and wider than 6 feet.

Infeasibility Criteria	BMP									
	Filter Strip	Grass Channel	Infiltration Trench	Sand Filter	Dry Detention Basin	Wet Detention Basin	Stormwater Wetlands	Bioslope	Bioretention Areas	Enhanced Swales
1 – Construction Cost										
2 – Project Delay	X			X					X	
3 – T/E Species										
4 – Community Resource										
5 – Business or Residence										
6 – Federal or State Law										
7 – Site Conditions										
8 – Soil										
9 – Small Site										
10 – Gravity Flow										

The cost of constructing the wet enhanced swale and the construction cost for the portion of the project contained in this drainage area was calculated. It was determined that the swale is considered feasible under Infeasibility Criteria #1 since the BMP will cost less than 10% of the roadway construction cost. Detailed construction costs and right of way estimates are included in Appendix E.

	Proposed Project Cost	Additional MS4 Cost Cost
Earthwork	$27,903	$1,500
Erosion control	$19,481	$500
Signing and Marking	$10,998	$0
Roadway Items	$453,401	$0
Right of Way	$0	$0
Utilities	$25,589.15	$0
Landscaping for Enhanced Swale		$5,820*
Check Dams		$1,000
Control Structure		$4,000
Total	**$537,372**	**$12,820**
Total Increase	**2.39%**	

*Cost was assumed to be $60 per linear foot.

Providing water quality treatment and channel protection for Drainage Area 2 is feasible.

Drainage Area 3

Drainage Area 3 is located on the west quadrant of the interchange between SB entrance Ramp and I-95 from STA.135+15 to 141+50 RT approximately. This drainage area outfalls into a cross drain under the ramp at STA.135+23 RT.

Physical Parameters of Drainage Area 3

Drainage Area 3 (Pre)	**Area (ac)**	**CN**
Roadway Impervious	1.15	98
Fair Condition Grass (Soil Group C)	1.85	79
Total	**3.00**	**86.28**

Drainage Area 3 (Post)	**Area (ac)**	**CN**
Roadway Impervious	1.35	98
Fair Condition Grass (Soil Group C)	1.65	79
Total	**3.00**	**87.55**

Water Quality Volume

Total Drainage Area (Acres)	3.00
Pre-Developed Impervious Area (Acres)	1.15
Post-Developed Impervious Area (Acres)	1.35
Pre-Developed % Impervious	38.33%
Post-Developed % Impervious	45.00%
Runoff Coefficient Rv (Rvpost-Rvpre)	0.060

Design Volumes	Cubic Feet
Required WQv	785
Required CPv	1220

Design Flows	Q25(cfs)	Q100(cfs)
Pre	25.19	32.44
Post	25.59	32.81

The addition of the small area (0.2 acres) of new paving increases the 25-year storm by 0.4 cfs (1.15% increase) and the 100-year storm by 0.37 cfs (1.15% increase). The downstream drainage system for this basin was analyzed and no adverse impact will occur due to the increase in flow rate. Qp25 and Qp100 attenuation will not be provided for this drainage area.

BMP Evaluation for Drainage Area 3

Filter Strip – The typical section for this project is a rural section. The current design does not require the acquisition of additional right of way. The additional shoulder width would require the acquisition of additional right of way and would be determined to be infeasible under infeasibility criteria #2; the project would be delayed by 90 days or more due to the implementation of post-construction BMPs. **The filter strip is not an appropriate BMP for this project.**

Grass Channel – The typical section for this project is a rural section. Since the grass channel does not provide the required 80% TSS removal a wet enhanced swale can be installed in approximately the same foot print and will provide the required TSS removal. **The grass channel is not an appropriate BMP for this project.**

Infiltration Trench – As indicated in the soil descriptions in Appendix D, the soil infiltration rate is less than 0.5 inch/hour and there is a high water table. Soils with an infiltration rate greater than 0.5 inch/hour would be considered acceptable for sanitary drain fields. All soils in the project area are rated as very limited. All information shown in Appendix D was collected from the National Resource Conservation Service Web Soil Survey. **The infiltration trench is not an appropriate BMP for this project.**

Sand Filter – The sand filter has high construction maintenance cost and would be considered after a bioretention area did not work. The area required for the sand filter would exceed the existing right of way in this drainage area. The required acquisition of additional right of way would be determined to be infeasible under infeasibility criteria #2; the project would be delayed by 90 days or more due to the implementation of post-construction BMPs. **The sand filter is not an appropriate BMP for this project.**

Dry Detention Basin – The dry detention basin can be built to provide the channel protection volume and can control the overland flood protection. However, since it only provided 65% TSS removal an additional treatment method would have to be provided. Due to the limited right of way in this area the pond could not be constructed inside the existing right of way**. The dry detention pond is not an appropriate BMP for this project.**

Wet Detention Pond – The drainage area for Drainage Area 3 is less than 10 acres; therefore, **the wet detention pond is not an appropriate BMP for this project.**

Stormwater Wetlands – The drainage area for Drainage Area 3 is less than 25 acres; therefore, **the stormwater wetland is not an appropriate BMP for this project.**

Bioslope – The bioslope requires more area and is more expensive to construct than the wet enhanced swale. **The bioslope is not an appropriate BMP for this project.**

Bioretention Areas – The bioretention area has high construction and maintenance cost and would be considered if other, more compact BMP's did not work. The area required for the bioretention area would exceed the existing right of way in this drainage area. The required acquisition of additional right of way would be determined to be infeasible under infeasibility criteria #2; the project would be delayed by 90 days or more due to the implementation of post-construction BMPs. **The bioretention area is not an appropriate BMP for this project.**

Enhanced Swales – A wet enhanced swale was sited and analyzed for Drainage Area 3. The swale can be located in the existing ditch south of the ramp. Based on the combined required water quality volume and channel protection volume of 2004 cubic feet, an average depth of 1 foot, and an 8-foot bottom width, a 167-foot-long wet enhanced swale will be required. The existing ditch is flat, less than 2% slope. 3 check dams will be used to maintain the volume of the swale.

Infeasibility Criteria	BMP									
	Filter Strip	Grass Channel	Infiltration Trench	Sand Filter	Dry Detention Basin	Wet Detention Basin	Stormwater Wetlands	Bioslope	Bioretention Areas	Enhanced Swales
1 – Construction Cost										
2 – Project Delay	X			X					X	
3 – T/E Species										
4 – Community Resource										
5 – Business or Residence										
6 – Federal or State Law										
7 – Site Conditions										
8 – Soil										
9 – Small Site										
10 – Gravity Flow										

The cost of constructing the wet enhanced swale and the construction cost for the portion of the project contained in this drainage area was calculated. It was determined that the swale is considered feasible under Infeasibility Criteria #1 since the BMP will cost less than 10% of the roadway construction cost. Detailed construction costs and right of way estimates are included in Appendix F.

	Proposed Project Cost	Additional MS4 Cost Cost
Earthwork	$12,480	$2,500
Erosion control	$6,301	$750
Signing and Marking	$8,608	$0
Roadway Items	$196,677	$0
Right of Way	$0	$0
Utilities	$11,203.28	$0
Landscaping for Enhanced Swale		$10,020*
Check Dams		$1,500
Control Structure		$4,000
Total	**$235,269**	**$18,770**
Total Increase	**7.98%**	

*Cost was assumed to be $60 per linear foot.

Providing water quality treatment and channel protection for Drainage Area 3 is feasible.

Drainage Area 4

Drainage Area 4 is located on the west quadrant of the interchange between SB entrance Ramp and I-95 from STA.129+00 to 135+00 RT approximately. This drainage area outfalls into a cross drain under the ramp at STA.135+23 RT.

Physical Parameters of Drainage Area 4

Drainage Area 4 (Pre)	**Area (ac)**	**CN**
Roadway Impervious	0.84	98
Fair Condition Grass (Soil Group C)	1.07	79
Total	**1.91**	**87.36**

Drainage Area 4 (Post)	**Area (ac)**	**CN**
Roadway Impervious	0.84	98
Fair Condition Grass (Soil Group C)	1.07	79
Total	**1.91**	**87.36**

Conclusion:

Since, there is no change in impervious area in pre and post conditions outfall level exclusion #6 is used for Drainage Area 1.

Outfall level exclusion #6. As stated in section 4.2.5.1(a) of the GDOT MS4 permit, for outfalls along linear roadway projects whereby the net impervious surface area within that outfall's drainage area has been reduced or remains the same as pre-developed conditions, post-construction storm water requirements will not apply. Special consideration from the Department may be given to those projects with a minimal increase in impervious area. In such cases, the designer will be required to provide supporting calculations showing that the increase in storm water runoff and/or volume required to be treated for water quality is negligible with respect to the drainage area in question.

Drainage Area 5

Drainage Area 5 is located on the southwest quadrant of the interchange and encompasses the NB exit ramp and I-95 from STA.1004+00 to 1016+00 RT approximately. This drainage area outfalls into a cross drain under the NB exit ramp at STA.105+50 RT.

Physical Parameters of Drainage Area 5

Drainage Area 5 (Pre)	**Area (ac)**	**CN**
Roadway Impervious	3.88	98
Fair Condition Grass (Soil Group C)	4.26	79
Total	**8.14**	**88.06**

Drainage Area 5 (Post)	**Area (ac)**	**CN**
Roadway Impervious	4.26	98
Fair Condition Grass (Soil Group C)	3.88	79
Total	**8.14**	**88.94**

Water Quality Volume

Total Drainage Area (Acres)	8.14
Pre-Developed Impervious Area (Acres)	3.88
Post-Developed Impervious Area (Acres)	4.26
Pre-Developed % Impervious	47.67%
Post-Developed % Impervious	52.33%
Runoff Coefficient Rv (Rvpost-Rvpre)	0.042

Design Volumes	Cubic Feet
Required WQv	1490
Required CPv	2365

Design Flows	Q25(cfs)	Q100(cfs)
Pre	60.98	78.05
Post	61.64	78.56

The addition of the small area (0.38 acres) of new paving increases the 25-year storm by 0.66 cfs (1.08% increase) and the 100-year storm by 0.51 cfs (0.65% increase). The downstream drainage system for this basin was analyzed and no adverse impact will occur due to the increase in flow rate. Qp25 and Qp100 attenuation will not be provided for this drainage area.

BMP Evaluation for Drainage Area 5

Filter Strip – The typical section for this project is a rural section. The current design does not require the acquisition of additional right of way. The additional shoulder width would require the acquisition of additional right of way and would be determined to be infeasible under infeasibility criteria #2; the project would be delayed by 90 days or more due to the implementation of post-construction BMPs. **The filter strip is not an appropriate BMP for this project.**

Grass Channel – The typical section for this project is a rural section. Since the grass channel does not provide the required 80% TSS removal a wet enhanced swale can be installed in approximately the same foot print and will provide the required TSS removal. **The grass channel is not an appropriate BMP for this project.**

Infiltration Trench – As indicated in the soil descriptions in Appendix D, the soil infiltration rate is less than 0.5 inch/hour and there is a high water table. Soils with an infiltration rate greater than 0.5 inch/hour would be considered acceptable for sanitary drain fields. All soils in the project area are rated as very limited. All information shown in Appendix D was collected from the National Resource Conservation Service Web Soil Survey. **The infiltration trench is not an appropriate BMP for this project.**

Sand Filter – The sand filter has high construction maintenance cost and would be considered after a bioretention area did not work. The area required for the sand filter would exceed the existing right of way in this drainage area. The required acquisition of additional right of way would be determined to be infeasible under infeasibility criteria #2; the project would be delayed by 90 days or more due to the implementation of post-construction BMPs. **The sand filter is not an appropriate BMP for this project.**

Dry Detention Basin – The dry detention basin can be built to provide the channel protection volume and can control the overland flood protection. However, since it only provided 65% TSS removal an additional treatment method would have to be provided. Due to the limited right of way in this area the pond could not be constructed inside the existing right of way**. The dry detention pond is not an appropriate BMP for this project.**

Wet Detention Pond – The drainage area for Drainage Area 5 is less than 10 acres; therefore, **the wet detention pond is not an appropriate BMP for this project.**

Stormwater Wetlands – The drainage area for Drainage Area 5 is less than 25 acres; therefore, **the stormwater wetland is not an appropriate BMP for this project.**

Bioslope – The bioslope requires more area and is more expensive to construct than the wet enhanced swale. **The bioslope is not an appropriate BMP for this project.**

Bioretention Areas – The bioretention area has high construction and maintenance cost and would be considered if other, more compact BMP's did not work. The area required for the bioretention area would exceed the existing right of way in this drainage area. The required acquisition of additional right of way would be determined to be infeasible under infeasibility criteria #2; the project would be delayed by 90 days or more due to the implementation of post-construction BMPs. **The bioretention area is not an appropriate BMP for this project.**

Enhanced Swales – A wet enhanced swale was sited and analyzed for Drainage Area 5. The swale can be located in the existing ditch south of the ramp. Based on the combined required water quality volume and channel protection volume of 3855 cubic feet, an average depth of 1 foot, and a 10-foot bottom width, a 275-foot-long wet enhanced swale will be required. The existing ditch is flat, less than 1% slope. 6 check dams will be used to maintain the volume of the swale.

Infeasibility Criteria	BMP									
	Filter Strip	Grass Channel	Infiltration Trench	Sand Filter	Dry Detention Basin	Wet Detention Basin	Stormwater Wetlands	Bioslope	Bioretention Areas	Enhanced Swales
1 – Construction Cost										
2 – Project Delay	X			X					X	
3 – T/E Species										
4 – Community Resource										
5 – Business or Residence										
6 – Federal or State Law										
7 – Site Conditions										
8 – Soil										
9 – Small Site										
10 – Gravity Flow										

The cost of constructing the wet enhanced swale and the construction cost for the portion of the project contained in this drainage area was calculated. It was determined that the swale is considered feasible under Infeasibility Criteria #1 since the BMP will cost less than 10% of the roadway construction cost. Detailed construction costs and right of way estimates are included in Appendix G.

	Proposed Project Cost	Additional MS4 Cost Cost
Earthwork	$23,647	$3,000
Erosion control	$14,075	$1,000
Signing and Marking	$10,338	$0
Roadway Items	$381,886	$0
Right of Way	$0	$0
Utilities	$ 21,497.31	$0
Landscaping for Enhanced Swale		$16,500*
Check Dams		$3,000
Control Structure		$4,000
Total	**$451,444**	**$27,500**
Total Increase	**6.09%**	

*Cost was assumed to be $60 per linear foot.

Providing water quality treatment and channel protection for Drainage Area 5 is feasible.

Drainage Area 6a

Drainage Area 6a is located on the southeast quadrant of the interchange, SR21 from STA.117+00 to 121+00 RT approximately. This drainage area outfalls into Little Hearst Branch at STA.121+00 RT.

Physical Parameters of Drainage Area 6a

Drainage Area 6a (Pre)	**Area (ac)**	**CN**
Roadway Impervious	1.33	98
Fair Condition Grass (Soil Group C)	1.59	79
Total	**2.92**	**87.65**

Drainage Area 6a (Post)	**Area (ac)**	**CN**
Roadway Impervious	1.34	98
Fair Condition Grass (Soil Group C)	1.58	79
Total	**2.92**	**87.72**

Conclusion:

Per the project typicals in the Concept Report, the additional pavement will drain across the existing travel lanes toward the outside shoulder. A stream is present the complete distance downstream of the additional impervious area runoff. Any BMP installation will impact the stream, therefore, outfall level exclusion #3 is used for Drainage Area 6a.

Outfall level exclusion #3. When a project would impact existing vegetated stream buffers or wetlands solely for the purposes of installing BMPs. See state requirements for additional information on stream buffers.

Drainage Area 6b

Drainage Area 6b is located on the southeast quadrant of the interchange, SR21 from STA.117+00 to 121+50 LT approximately. This drainage area outfalls into Little Hearst Branch at STA.121+50 LT.

Physical Parameters of Drainage Area 6b

Drainage Area 6b (Pre)	**Area (ac)**	**CN**
Roadway Impervious	0.47	98
Fair Condition Grass (Soil Group C)	1.73	79
Total	**2.20**	**83.06**

Drainage Area 6b (Post)	**Area (ac)**	**CN**
Roadway Impervious	0.48	98
Fair Condition Grass (Soil Group C)	1.72	79
Total	**2.20**	**83.15**

Conclusion:

Per the project typicals in the Concept Report, the additional pavement will drain across the existing travel lanes toward the outside shoulder. A wetland and a stream are present the complete distance downstream of the additional impervious area runoff. Any BMP installation will impact the wetland and stream, therefore, outfall level exclusion #3 is used for Drainage Area 6b.

Outfall level exclusion #3. When a project would impact existing vegetated stream buffers or wetlands solely for the purposes of installing BMPs. See state requirements for additional information on stream buffers.

Drainage Area 6c

Drainage Area 6c is located on the southeast quadrant of the interchange and encompasses the median, SR21 from STA.119+00 to 126+50 approximately. This drainage area outfalls into Little Hearst Branch at STA.121+00 RT.

Physical Parameters of Drainage Area 6c

Drainage Area 6c (Pre)	**Area (ac)**	**CN**
Roadway Impervious	0.05	98
Fair Condition Grass (Soil Group C)	0.39	79
Total	**0.44**	**81.16**

Drainage Area 6c (Post)	**Area (ac)**	**CN**
Roadway Impervious	0.05	98
Fair Condition Grass (Soil Group C)	0.39	79
Total	**0.44**	**81.16**

Conclusion:

Since, there is no change in impervious area in pre and post conditions outfall level exclusion #6 is used for Drainage Area 6c.

Outfall level exclusion #6. As stated in section 4.2.5.1(a) of the GDOT MS4 permit, for outfalls along linear roadway projects whereby the net impervious surface area within that outfall's drainage area has been reduced or remains the same as pre-developed conditions, post-construction storm water requirements will not apply. Special consideration from the Department may be given to those projects with a minimal increase in impervious area. In such cases, the designer will be required to provide supporting calculations showing that the increase in storm water runoff and/or volume required to be treated for water quality is negligible with respect to the drainage area in question.

Drainage Area 6d

Drainage Area 6d is located on the southeast quadrant of the interchange, SR21 from STA.121+50 to 133+00 LT approximately. This drainage area outfalls into a wetland of Little Hearst Branch at STA.123+00 LT.

Physical Parameters of Drainage Area 6d

Drainage Area 6d (Pre)	**Area (ac)**	**CN**
Roadway Impervious	1.81	98
Fair Condition Grass (Soil Group C)	1.71	79
Total	**3.52**	**88.77**

Drainage Area 6d (Post)	**Area (ac)**	**CN**
Roadway Impervious	1.96	98
Fair Condition Grass (Soil Group C)	1.56	79
Total	**3.52**	**89.58**

Conclusion:

Per the project typicals in the Concept Report, the additional pavement will drain across the existing travel lanes toward the outside shoulder. Wetlands are present the complete distance downstream of the additional impervious area runoff. Any BMP installation will impact the wetlands, therefore, outfall level exclusion #3 is used for Drainage Area 6d.

Outfall level exclusion #3. When a project would impact existing vegetated stream buffers or wetlands solely for the purposes of installing BMPs. See state requirements for additional information on stream buffers.

Drainage Area 6e

Drainage Area 6e is located on the southeast quadrant of the interchange and encompasses the NB entrance ramp, I-95 from STA.1016+00 to 1025+00 RT and SR21 from STA.117+00 to 138+50 RT approximately. This drainage area outfalls into Little Hearst Branch at STA.121+00 RT.

Physical Parameters of Drainage Area 6e

Drainage Area 6e (Pre)	**Area (ac)**	**CN**
Roadway Impervious	6.05	98
Fair Condition Grass (Soil Group C)	6.67	79
Total	**12.72**	**88.04**

Drainage Area 6e (Post)	**Area (ac)**	**CN**
Roadway Impervious	6.72	98
Fair Condition Grass (Soil Group C)	6.00	79
Total	**12.72**	**89.04**

Water Quality Volume

Total Drainage Area (Acres)	12.72
Pre-Developed Impervious Area (Acres)	6.05
Post-Developed Impervious Area (Acres)	6.72
Pre-Developed % Impervious	47.56%
Post-Developed % Impervious	52.83%
Runoff Coefficient Rv (Rvpost-Rvpre)	0.047

Design Volumes	Cubic Feet
Required WQv	2627
Required CPv	4202

Design Flows	Q25(cfs)	Q100(cfs)
Pre	64.29	82.47
Post	64.93	83.01

The addition of the small area (0.67 acres) of new paving increases the 25-year storm by 0.64 cfs (1.00% increase) and the 100-year storm by 0.54 cfs (0.65% increase). Little Hearst Branch has a drainage area larger than 5 square miles at the outfall. Qp25 and Qp100 attenuation will not be provided for this drainage area.

BMP Evaluation for Drainage Area 6e

Filter Strip – The typical section for this project is a rural section. The current design does not require the acquisition of additional right of way. The additional shoulder width would require the acquisition of additional right of way and would be determined to be infeasible under infeasibility criteria #2; the project would be delayed by 90 days or more due to the implementation of post-construction BMPs. **The filter strip is not an appropriate BMP for this project.**

Infiltration Trench – As indicated in the soil descriptions in Appendix D, the soil infiltration rate is less than 0.5 inch/hour and there is a high water table. Soils with an infiltration rate greater than 0.5 inch/hour would be considered acceptable for sanitary drain fields. All soils in the project area are rated as very limited. All information shown in Appendix D was collected from the National Resource Conservation Service Web Soil Survey. **The infiltration trench is not an appropriate BMP for this project.**

Sand Filter – The drainage area for Drainage Area 6e is too large to utilize a sand filter. Therefore, **the sand filter is not an appropriate BMP for this project.**

Wet Detention Pond – A wet detention pond would be considered if other, more compact BMPs did not work. **The wet detention pond is not an appropriate BMP for this project.**

Stormwater Wetlands – The drainage area for Drainage Area 6e is less than 25 acres; therefore, **the stormwater wetland is not an appropriate BMP for this project.**

Bioslope – The bioslope requires more area and is more expensive to construct than the wet enhanced swale. **The bioslope is not an appropriate BMP for this project.**

Enhanced Swales – The drainage area for Drainage Area 6e is more than 5 acres. Therefore, **the enhanced swale is not an appropriate BMP for this project.**

Bioretention Areas – The drainage area for Drainage Area 6e is more than 5 acres. Therefore, **the bioretention area is not an appropriate BMP for this project.**

A combination of a dry detention pond located near the outfall into Little Hearst Branch and grass channels in the existing ditches and grassed medians can be used to provide the water quality and channel protection volumes for this drainage area. The combination produces an 82.5% TSS removal. (50% from the grass channels and 32.5% from the dry detention basin) Per current GDOT policy one half of the provided water quality volume can be used as channel protection volume. This results in a total volume required in the dry detention pond of 5,516 cubic feet. Using a 4 foot deep pond with 1.5 feet of freeboard above the treatment volume, a pond with an inside dimension of approximately 20'x70' will be required. With side slope construction the pond will easily fit inside the existing right of way while avoiding wetland and stream buffers near the outfall.

Infeasibility Criteria	BMP									
	Filter Strip	Grass Channel	Infiltration Trench	Sand Filter	Dry Detention Basin	Wet Detention Basin	Stormwater Wetlands	Bioslope	Bioretention Areas	Enhanced Swales
1 – Construction Cost										
2 – Project Delay	X									
3 – T/E Species										
4 – Community Resource										
5 – Business or Residence										
6 – Federal or State Law										
7 – Site Conditions										
8 – Soil										
9 – Small Site										
10 – Gravity Flow										

The cost of constructing the dry detention and the construction cost for the portion of the project contained in this drainage area was calculated. It was determined that the swale is considered feasible under Infeasibility Criteria #1 since the BMP will cost less than 10% of the roadway construction cost. Detailed construction costs and right of way estimates are included in Appendix H.

	Proposed Project Cost	Additional MS4 Cost Cost
Earthwork	$38,755	$25,000
Erosion control	$26,173	$4,000
Signing and Marking	$144,560	$0
Roadway Items	$626,287	$0
Right of Way	$0	$0
Utilities	$41,788.76	$0
Grass Swale Construction		$6,000
Control Structure		$15,000
Total	**$877,564**	**$50,000**
Total Increase	**5.70%**	

*Cost was assumed to be $60 per linear foot.

Providing water quality treatment and channel protection for Drainage Area 6e is feasible.

Drainage Area 7

Drainage Area 7 is located on the northeast quadrant of the interchange and encompasses the SB exist ramp, I-95 from STA.1016+00 to 1031+50 LT and SR21 from STA.138+00 to 166+00 RT approximately. This drainage area outfalls into a cross drain at STA.149+50 RT.

Physical Parameters of Drainage Area 7

Drainage Area 6 (Pre)	**Area (ac)**	**CN**
Roadway Impervious	10.66	98
Fair Condition Grass (Soil Group C)	10.01	79
Total	**20.67**	**88.80**

Drainage Area 6 (Post)	**Area (ac)**	**CN**
Roadway Impervious	11.76	98
Fair Condition Grass (Soil Group C)	8.91	79
Total	**20.67**	**89.81**

Water Quality Volume

Total Drainage Area (Acres)	20.67
Pre-Developed Impervious Area (Acres)	10.66
Post-Developed Impervious Area (Acres)	11.76
Pre-Developed % Impervious	51.57%
Post-Developed % Impervious	56.89%
Runoff Coefficient Rv (Rvpost-Rvpre)	0.048

Design Volumes	Cubic Feet
Required WQv	4313
Required CPv	7053

Design Flows	Q25(cfs)	Q100(cfs)
Pre	137.98	176.32
Post	139.48	177.92

The addition of the area (1.10 acres) of new paving increases the 25-year storm by 1.50 cfs (1.09% increase) and the 100-year storm by 1.60 cfs (0.91% increase). The downstream drainage system for this basin was analyzed and no adverse impact will occur due to the increase in flow rate. Qp25 and Qp100 attenuation will not be provided for this drainage area.

BMP Evaluation for Drainage Area 7

Filter Strip – The typical section for this project is a rural section. The current design does not require the acquisition of additional right of way. The additional shoulder width would require the acquisition of additional right of way and would be determined to be infeasible under infeasibility criteria #2; the project would be delayed by 90 days or more due to the implementation of post-construction BMPs. In addition, to meet the required TSS removal, the filter strip would have to be used in conjunction with another BMP. **The filter strip is not an appropriate BMP for this project.**

Grass Channel – The typical section for this project is a rural section. Since the grass channel does not provide the required 80% TSS removal a wet enhanced swale can be installed in approximately the same foot print and will provide the required TSS removal. **The grass channel is not an appropriate BMP for this project.**

Infiltration Trench – As indicated in the soil descriptions in Appendix D, the soil infiltration rate is less than 0.5 inch/hour and there is a high water table. Soils with an infiltration rate greater than 0.5 inch/hour would be considered acceptable for sanitary drain fields. All soils in the project area are rated as very limited. All information shown in Appendix D was collected from the National Resource Conservation Service Web Soil Survey. **The infiltration trench is not an appropriate BMP for this project.**

Sand Filter – The drainage area for Drainage Area 7 is too large to utilize a sand filter. Therefore, **the sand filter is not an appropriate BMP for this project.**

Dry Detention Basin – The dry detention basin can be built to provide the channel protection volume and can control the overland flood protection. However, since it only provided 65% TSS removal an additional treatment method would have to be provided. Due to the limited right of way in this area the pond and the additional control methods could not be constructed inside the existing right of way**. The dry detention pond is not an appropriate BMP for this project.**

Wet Detention Pond – A wet detention pond was investigated for this drainage basin. While the drainage area is of sufficient size to maintain the wet detention pond, the outfall of for this drainage basin is only 4.5 feet below the roadway. Maintaining a 3 foot deep permanent pool and 1 foot of free board will only leave 0.5 feet of vertical space to accommodate the volume required. The foot print of the pond would be 18,400 square feet. This amount of area does not exist within the existing right of way (see figure in Appendix I). The wet detention pond would be infeasible under criteria #2, increases the project schedule more than 90 days, since no other right of way has to be acquired for the project. Therefore, **the wet detention pond is not an appropriate BMP for this project.**

Stormwater Wetlands – The drainage area for Drainage Area 7 is less than 25 acres; therefore, **the stormwater wetland is not an appropriate BMP for this project.**

Bioslope – The bioslope, with a media width of 4 feet installed in the roadway embankment, would result in the underdrain pipe below the bottom of ditch elevation, not allowing the underdrain pipe system to tie into the existing drainage structures. Therefore, **the bioslope is not an appropriate BMP for this project.**

Enhanced Swales – The drainage area for Drainage Area 7 is more than 5 acres. While the drainage area could be subdivided into smaller areas, the new pavement areas flow into a limited median. Therefore, **the enhanced swale is not an appropriate BMP for this project.**

Bioretention Areas – The drainage area for Drainage Area 7 is more than 5 acres. Therefore, **the bioretention area is not an appropriate BMP for this project.**

Infeasibility Criteria	BMP									
	Filter Strip	Grass Channel	Infiltration Trench	Sand Filter	Dry Detention Basin	Wet Detention Basin	Stormwater Wetlands	Bioslope	Bioretention Areas	Enhanced Swales
1 – Construction Cost										
2 – Project Delay	X					X				
3 – T/E Species										
4 – Community Resource										
5 – Business or Residence										
6 – Federal or State Law										
7 – Site Conditions										
8 – Soil										
9 – Small Site										
10 – Gravity Flow										

The filter strip was considered but due to the need to combine with another BMP to meet required TSS removal and the additional shoulder width, the footprint was larger than the wet detention pond; therefore, the wet detention pond was studied. **Providing water quality treatment and channel protection for Drainage Area 7 is not feasible.**

Appendix A – Drainage Area Map

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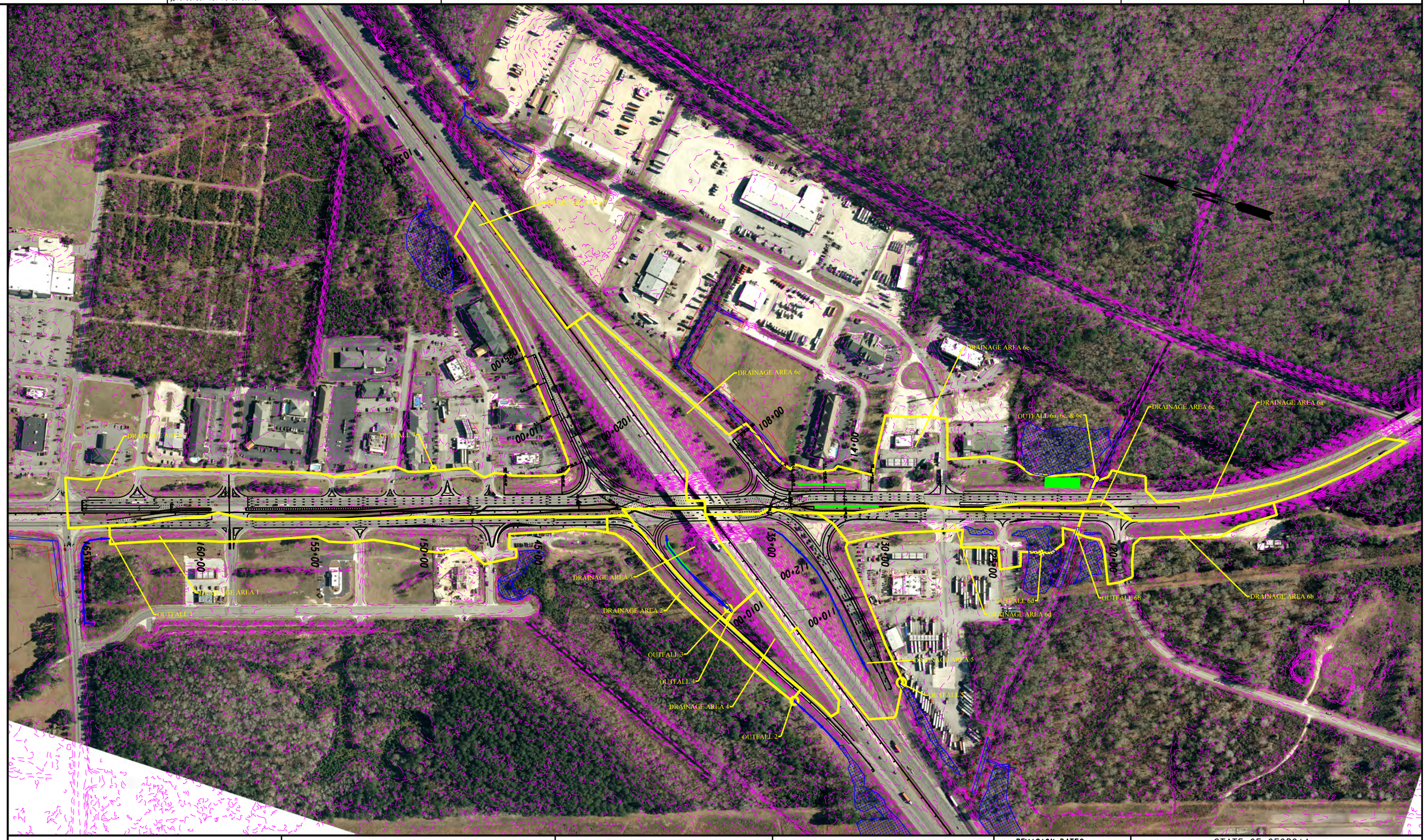


PROPERTY AND EXISTING R/W LINE	—— ℄ ———
REQUIRED R/W LINE	———
CONSTRUCTION LIMITS	—C— F—
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES	
EASEMENT FOR CONSTR OF SLOPES	
EASEMENT FOR CONSTR OF DRIVES	

BEGIN LIMIT OF ACCESS	BLA
END LIMIT OF ACCESS	ELA
LIMIT OF ACCESS	—◦◦◦—
REQ'D R/W & LIMIT OF ACCESS	—|||—

REVISION DATES		

STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION

OFFICE:

DRAINAGE AREA MAP

SR 21 AT I-95 DDI

DRAWING No. 21-001

12/14/2012 GPLN

Appendix B - Water Quality and Channel Protection Calculations

Water Quality and Channel Protection Storage Design

ARCADIS

Project Name	I-95@SR21 DDI
Project Number	12722
Date	12/7/2014
Design By:	
Structure No.	
Drainage Area	DA1

Water Quality Volume Calculations

Site Area	5.180	acres	
Post-development Impervious Area Increase	0.000	acres	
Percent Impervious (I) Pre	53.47%		
Percent Impervious (I) Post	53.47%		
Runoff Coefficient Rv (Rvpost-Rvpre)	0.000		
Rainfall Depth (P)	1.2 inches		
Calculated Treatment Volume (WQ_v)	0.00 acre/ft		0.00 cuft
Required Treatment Volume (WQ_v) **(Post Volume - Pre Volume)**			**0.00 cuft**
Provided Treatment Volume (WQ_v) **- From Hydraflow**			

Channel Protection Volume Calculations

1yr 24hr CP Required Treatment Volume (Cp_v) **- From Hydraflow (Post - Pre)**	**0.00**	**cuft**
1yr 24hr CP Provided Treatment Volume (Cp_v) **- From Hydraflow**		**cuft**

Formulas

$$R_v = 0.05 + (0.009)(I)$$

$$WQ_v = 1.2 * R_v * A / 12$$

Required channel protection volume = Total Pre-development CPv for basin - Total Pre-development CPv for basin) * (sub-basin percentage)

Water Quality and Channel Protection Storage Design

ARCADIS

Project Name	I-95@SR21 DDI
Project Number	12722
Date	12/7/2014
Design By:	
Structure No.	
Drainage Area	DA2

Water Quality Volume Calculations

Site Area	1.880	acres	
Post-development Impervious Area Increase	0.100	acres	
Percent Impervious (I) Pre	27.13%		
Percent Impervious (I) Post	32.45%		
Runoff Coefficient Rv (Rvpost-Rvpre)	0.048		
Rainfall Depth (P)	1.2 inches		
Calculated Treatment Volume (WQ_v)	0.009 acre/ft		393. cuft
Required Treatment Volume (WQ_v) **(Post Volume - Pre Volume)**			**393. cuft**
Provided Treatment Volume (WQ_v) **- From Hydraflow**			

Channel Protection Volume Calculations

1yr 24hr CP Required Treatment Volume (Cp_v) **- From Hydraflow (Post - Pre)**	**573.00**	**cuft**
1yr 24hr CP Provided Treatment Volume (Cp_v) **- From Hydraflow**		**cuft**

Formulas

$$R_v = 0.05 + (0.009)(I)$$

$$WQ_v = 1.2 * R_v * A / 12$$

Required channel protection volume = Total Pre-development CPv for basin - Total Pre-development CPv for basin) * (sub-basin percentage)

Water Quality and Channel Protection Storage Design

ARCADIS

Project Name	I-95@SR21 DDI
Project Number	12722
Date	12/7/2014
Design By:	
Structure No.	
Drainage Area	DA3

Water Quality Volume Calculations

Site Area	3.000	acres	
Post-development Impervious Area Increase	0.200	acres	
Percent Impervious (I) Pre	38.33%		
Percent Impervious (I) Post	45.00%		
Runoff Coefficient Rv (Rvpost-Rvpre)	0.060		
Rainfall Depth (P)	1.2 inches		
Calculated Treatment Volume (WQ_v)	0.018 acre/ft		785 cuft
Required Treatment Volume (WQ_v) **(Post Volume - Pre Volume)**			**785 cuft**
Provided Treatment Volume (WQ_v) **- From Hydraflow**			

Channel Protection Volume Calculations

1yr 24hr CP Required Treatment Volume (Cp_v) **- From Hydraflow (Post - Pre)**	**1,220.00**	**cuft**
1yr 24hr CP Provided Treatment Volume (Cp_v) **- From Hydraflow**		**cuft**

Formulas

$$R_v = 0.05 + (0.009)(I)$$

$$WQ_v = 1.2 * R_v * A / 12$$

Required channel protection volume = Total Pre-development CPv for basin - Total Pre-development CPv for basin) * (sub-basin percentage)

Water Quality and Channel Protection Storage Design

ARCADIS

Project Name	I-95@SR21 DDI
Project Number	12722
Date	12/7/2014
Design By:	
Structure No.	
Drainage Area	DA4

Water Quality Volume Calculations

Site Area	1.910	acres	
Post-development Impervious Area Increase	0.000	acres	
Percent Impervious (I) Pre	43.98%		
Percent Impervious (I) Post	43.98%		
Runoff Coefficient Rv (Rvpost-Rvpre)	0.000		
Rainfall Depth (P)	1.2 inches		
Calculated Treatment Volume (WQ_v)	0.000 acre/ft		0 cuft
Required Treatment Volume (WQ_v) **(Post Volume - Pre Volume)**			**0 cuft**
Provided Treatment Volume (WQ_v) **- From Hydraflow**			

Channel Protection Volume Calculations

1yr 24hr CP Required Treatment Volume (Cp_v) **- From Hydraflow (Post - Pre)**	**0.00**	**cuft**
1yr 24hr CP Provided Treatment Volume (Cp_v) **- From Hydraflow**		**cuft**

Formulas

$$R_v = 0.05 + (0.009)(I)$$

$$WQ_v = 1.2 * R_v * A/12$$

Required channel protection volume = Total Pre-development CPv for basin - Total Pre-development CPv for basin) * (sub-basin percentage)

Water Quality and Channel Protection Storage Design

ARCADIS

Project Name	I-95@SR21 DDI
Project Number	12722
Date	12/7/2014
Design By:	
Structure No.	
Drainage Area	DA5

Water Quality Volume Calculations

Site Area	8.140	acres	
Post-development Impervious Area Increase	0.380	acres	
Percent Impervious (I) Pre	47.67%		
Percent Impervious (I) Post	52.33%		
Runoff Coefficient Rv (Rvpost-Rvpre)	0.042		
Rainfall Depth (P)	1.2 inches		
Calculated Treatment Volume (WQ_v)	0.034 acre/ft		1,490 cuft
Required Treatment Volume (WQ_v) **(Post Volume - Pre Volume)**			**1,490 cuft**
Provided Treatment Volume (WQ_v) **- From Hydraflow**			

Channel Protection Volume Calculations

1yr 24hr CP Required Treatment Volume (Cp_v) **- From Hydraflow (Post - Pre)**	**2,365.00**	**cuft**
1yr 24hr CP Provided Treatment Volume (Cp_v) **- From Hydraflow**		**cuft**

Formulas

$$R_v = 0.05 + (0.009)(I)$$

$$WQ_v = 1.2 * R_v * A / 12$$

Required channel protection volume = Total Pre-development CPv for basin - Total Pre-development CPv for basin) * (sub-basin percentage)

Water Quality and Channel Protection Storage Design

ARCADIS

Project Name	I-95@SR21 DDI
Project Number	12722
Date	2/12/2015
Design By:	
Structure No.	
Drainage Area	DA6a

Water Quality Volume Calculations

Site Area	2.920	acres	
Post-development Impervious Area Increase	0.010	acres	
Percent Impervious (I) Pre	45.55%		
Percent Impervious (I) Post	45.89%		
Runoff Coefficient Rv (Rvpost-Rvpre)	0.003		
Rainfall Depth (P)	1.2 inches		
Calculated Treatment Volume (WQ_v)	0.001 acre/ft		40 cuft
Required Treatment Volume (WQ_v) **(Post Volume - Pre Volume)**			**40 cuft**
Provided Treatment Volume (WQ_v) **- From Hydraflow**			

Channel Protection Volume Calculations

1yr 24hr CP Required Treatment Volume (Cp_v) **- From Hydraflow (Post - Pre)**	**74.00**	**cuft**
1yr 24hr CP Provided Treatment Volume (Cp_v) **- From Hydraflow**		**cuft**

Formulas

$$R_v = 0.05 + (0.009)(I)$$

$$WQ_v = 1.2 * R_v * A / 12$$

Required channel protection volume = Total Pre-development CPv for basin - Total Pre-development CPv for basin) * (sub-basin percentage)

Water Quality and Channel Protection Storage Design

ARCADIS

Project Name	I-95@SR21 DDI
Project Number	12722
Date	2/12/2015
Design By:	
Structure No.	
Drainage Area	DA6b

Water Quality Volume Calculations

Site Area	2.200	acres	
Post-development Impervious Area Increase	0.010	acres	
Percent Impervious (I) Pre	21.36%		
Percent Impervious (I) Post	21.82%		
Runoff Coefficient Rv (Rvpost-Rvpre)	0.004		
Rainfall Depth (P)	1.2 inches		
Calculated Treatment Volume (WQ_v)	0.001 acre/ft		40 cuft
Required Treatment Volume (WQ_v) **(Post Volume - Pre Volume)**			**40 cuft**
Provided Treatment Volume (WQ_v) **- From Hydraflow**			

Channel Protection Volume Calculations

1yr 24hr CP Required Treatment Volume (Cp_v) **- From Hydraflow (Post - Pre)**	**55.00**	**cuft**
1yr 24hr CP Provided Treatment Volume (Cp_v) **- From Hydraflow**		**cuft**

Formulas

$$R_v = 0.05 + (0.009)(I)$$

$$WQ_v = 1.2 * R_v * A / 12$$

Required channel protection volume = Total Pre-development CPv for basin - Total Pre-development CPv for basin) * (sub-basin percentage)

Water Quality and Channel Protection Storage Design

ARCADIS

Project Name	I-95@SR21 DDI
Project Number	12722
Date	2/12/2015
Design By:	
Structure No.	
Drainage Area	DA6c

Water Quality Volume Calculations

Site Area	0.440	acres	
Post-development Impervious Area Increase	0.000	acres	
Percent Impervious (I) Pre	11.36%		
Percent Impervious (I) Post	11.36%		
Runoff Coefficient Rv (Rvpost-Rvpre)	0.000		
Rainfall Depth (P)	1.2 inches		
Calculated Treatment Volume (WQ_v)	0.000 acre/ft		0 cuft
Required Treatment Volume (WQ_v) **(Post Volume - Pre Volume)**			**0 cuft**
Provided Treatment Volume (WQ_v) **- From Hydraflow**			

Channel Protection Volume Calculations

1yr 24hr CP Required Treatment Volume (Cp_v) **- From Hydraflow (Post - Pre)**	**0.00**	**cuft**
1yr 24hr CP Provided Treatment Volume (Cp_v) **- From Hydraflow**		**cuft**

Formulas

$$R_v = 0.05 + (0.009)(I)$$

$$WQ_v = 1.2 * R_v * A / 12$$

Required channel protection volume = Total Pre-development CPv for basin - Total Pre-development CPv for basin) * (sub-basin percentage)

Water Quality and Channel Protection Storage Design

ARCADIS

Project Name	I-95@SR21 DDI
Project Number	12722
Date	2/12/2015
Design By:	
Structure No.	
Drainage Area	DA6d

Water Quality Volume Calculations

Site Area	3.520	acres	
Post-development Impervious Area Increase	0.150	acres	
Percent Impervious (I) Pre	51.42%		
Percent Impervious (I) Post	55.68%		
Runoff Coefficient Rv (Rvpost-Rvpre)	0.038		
Rainfall Depth (P)	1.2 inches		
Calculated Treatment Volume (WQ_v)	0.014 acre/ft		589 cuft
Required Treatment Volume (WQ_v) **(Post Volume - Pre Volume)**			**589 cuft**
Provided Treatment Volume (WQ_v) **- From Hydraflow**			

Channel Protection Volume Calculations

1yr 24hr CP Required Treatment Volume (Cp_v) **- From Hydraflow (Post - Pre)**	**946.00**	**cuft**
1yr 24hr CP Provided Treatment Volume (Cp_v) **- From Hydraflow**		**cuft**

Formulas

$$R_v = 0.05 + (0.009)(I)$$

$$WQ_v = 1.2 * R_v * A / 12$$

Required channel protection volume = Total Pre-development CPv for basin - Total Pre-development CPv for basin) * (sub-basin percentage)

Water Quality and Channel Protection Storage Design

ARCADIS

Project Name	I-95@SR21 DDI
Project Number	12722
Date	2/12/2015
Design By:	
Structure No.	
Drainage Area	DA6e

Water Quality Volume Calculations

Site Area	12.720	acres	
Post-development Impervious Area Increase	0.670	acres	
Percent Impervious (I) Pre	47.56%		
Percent Impervious (I) Post	52.83%		
Runoff Coefficient Rv (Rvpost-Rvpre)	0.047		
Rainfall Depth (P)	1.2 inches		
Calculated Treatment Volume (WQ_v)	0.060 acre/ft		2,627 cuft
Required Treatment Volume (WQ_v) **(Post Volume - Pre Volume)**			**2,627 cuft**
Provided Treatment Volume (WQ_v) **- From Hydraflow**			

Channel Protection Volume Calculations

1yr 24hr CP Required Treatment Volume (Cp_v) **- From Hydraflow (Post - Pre)**	**4,202.00**	**cuft**
1yr 24hr CP Provided Treatment Volume (Cp_v) **- From Hydraflow**		**cuft**

Formulas

$$R_v = 0.05 + (0.009)(I)$$

$$WQ_v = 1.2 * R_v * A / 12$$

Required channel protection volume = Total Pre-development CPv for basin - Total Pre-development CPv for basin) * (sub-basin percentage)

Water Quality and Channel Protection Storage Design

ARCADIS

Project Name	I-95@SR21 DDI
Project Number	12722
Date	12/7/2014
Design By:	
Structure No.	
Drainage Area	DA7

Water Quality Volume Calculations

Site Area	20.670	acres	
Post-development Impervious Area Increase	1.100	acres	
Percent Impervious (I) Pre	51.57%		
Percent Impervious (I) Post	56.89%		
Runoff Coefficient Rv (Rvpost-Rvpre)	0.048		
Rainfall Depth (P)	1.2 inches		
Calculated Treatment Volume (WQ_v)	0.099 acre/ft		4,313 cuft
Required Treatment Volume (WQ_v) **(Post Volume - Pre Volume)**			**4,313 cuft**
Provided Treatment Volume (WQ_v) **- From Hydraflow**			

Channel Protection Volume Calculations

1yr 24hr CP Required Treatment Volume (Cp_v) **- From Hydraflow (Post - Pre)**	**7,053.00**	**cuft**
1yr 24hr CP Provided Treatment Volume (Cp_v) **- From Hydraflow**		**cuft**

Formulas

$$R_v = 0.05 + (0.009)(I)$$

$$WQ_v = 1.2 * R_v * A / 12$$

Required channel protection volume = Total Pre-development CPv for basin - Total Pre-development CPv for basin) * (sub-basin percentage)

Appendix C - Hydrographs

1. 1-Year Storm
2. 25-Year Storm
3. 100-Year Storm

Project Description

File Name ..... Pre-Post Hydrographs - DA6 Subareas.SPF
Description .....
I-95@SR21 DDI P.I.0012722

Project Options

Flow Units ..... CFS
Elevation Type ..... Elevation
Hydrology Method ..... SCS TR-55
Time of Concentration (TOC) Method ..... SCS TR-55
Link Routing Method ..... Kinematic Wave
Enable Overflow Ponding at Nodes ..... YES
Skip Steady State Analysis Time Periods .... NO

Analysis Options

Start Analysis On	Nov 13, 2014	00:00:00
End Analysis On	Nov 14, 2014	00:00:00
Start Reporting On	Nov 13, 2014	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins.....	24
Nodes.....	12
Junctions	0
Outfalls	12
Flow Diversions	0
Inlets	0
Storage Nodes	0
Links.....	0
Channels	0
Pipes	0
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1		Time Series	1-Year Storm	Cumulative	inches	Georgia	Chatham	1	3.70	SCS Type II 24-hr

Subbasin Summary

SN	Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ft³)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	DA6a-Post	2.92	87.72	3.70	2.43	25725.23	9.70	0 00:10:00
2	DA6a-Pre	2.92	87.65	3.70	2.42	25651.03	9.67	0 00:10:00
3	DA6b-Post	2.20	83.15	3.70	2.04	16291.44	5.78	0 00:13:25
4	DA6b-Pre	2.20	83.06	3.70	2.03	16235.54	5.77	0 00:13:25
5	DA6c-Post	0.44	81.16	3.70	1.88	3009.12	1.03	0 00:15:04
6	DA6c-Pre	0.44	81.16	3.70	1.88	3009.12	1.03	0 00:15:04
7	DA6d-Post	3.52	89.58	3.70	2.60	33170.65	12.40	0 00:10:00
8	DA6d-Pre	3.52	88.77	3.70	2.52	32225.11	12.09	0 00:10:00
9	DA6e-Post	12.72	89.04	3.70	2.55	117557.99	25.60	0 00:35:30
10	DA6e-Pre	12.72	88.04	3.70	2.46	113356.19	24.77	0 00:35:30
11	Drainage Area 1-Post	5.18	89.16	3.70	2.56	48080.30	12.21	0 00:27:27
12	Drainage Area 1-Pre	5.18	89.16	3.70	2.56	48080.30	12.21	0 00:27:27
13	Drainage Area 2-Post	1.88	85.16	3.70	2.21	15047.80	5.03	0 00:15:49
14	Drainage Area 2-Pre	1.88	84.15	3.70	2.12	14474.55	4.85	0 00:15:49
15	Drainage Area 3-Post	3.00	87.55	3.70	2.41	26266.68	9.92	0 00:10:00
16	Drainage Area 3-Pre	3.00	86.28	3.70	2.30	25047.00	9.50	0 00:10:00
17	Drainage Area 4-Post	1.91	87.36	3.70	2.40	16605.25	6.26	0 00:10:00
18	Drainage Area 4-Pre	1.91	87.36	3.70	2.40	16605.25	6.26	0 00:10:00
19	Drainage Area 5 - Post	8.14	88.94	3.70	2.54	74963.79	24.55	0 00:16:09
20	Drainage Area 5 - Pre	8.14	88.06	3.70	2.46	72599.93	23.89	0 00:16:09
21	Drainage Area 6 - Post	21.80	88.21	3.70	2.47	195540.12	55.68	0 00:22:19
22	Drainage Area 6 - Pre	21.80	87.48	3.70	2.41	190317.28	54.40	0 00:22:19
23	Drainage Area 7 - Post	20.67	89.81	3.70	2.62	196434.05	56.37	0 00:21:40
24	Drainage Area 7 - Pre	20.67	88.80	3.70	2.52	189381.03	54.69	0 00:21:40

Subbasin Hydrology

Subbasin : Drainage Area 1-Post

Input Data

Area (ac) 5.18
Weighted Curve Number 89.16
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	2.77	C	98.00
50 - 75% grass cover, Fair	2.41	C	79.00
Composite Area & Weighted CN	5.18		89.16

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.011	0.00	0.00
Flow Length (ft) :	115	0.00	0.00
Slope (%) :	0.4	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.7	0.00	0.00
Velocity (ft/sec) :	0.90	0.00	0.00
Computed Flow Time (min) :	2.13	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	1550	0.00	0.00
Slope (%) :	0.4	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.02	0.00	0.00
Computed Flow Time (min) :	25.33	0.00	0.00

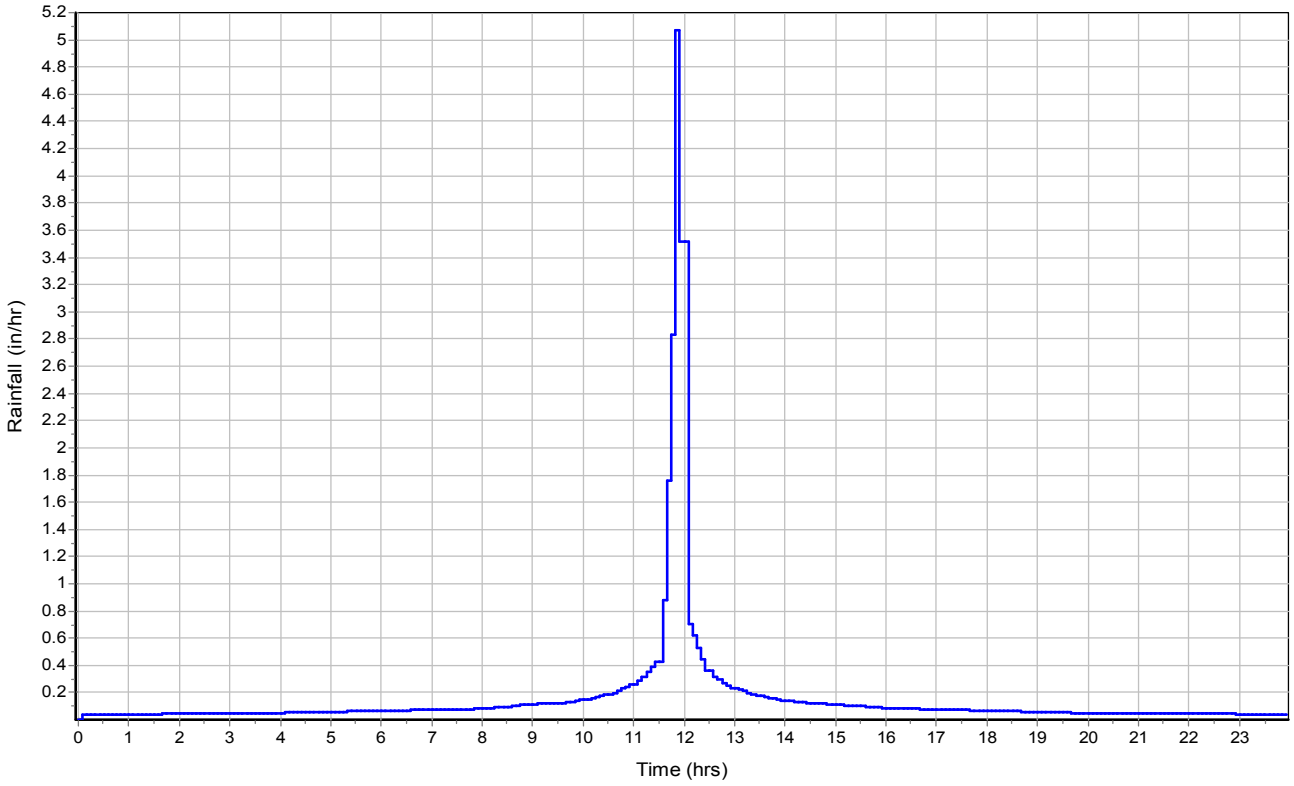
Total TOC (min) 27.46

Subbasin Runoff Results

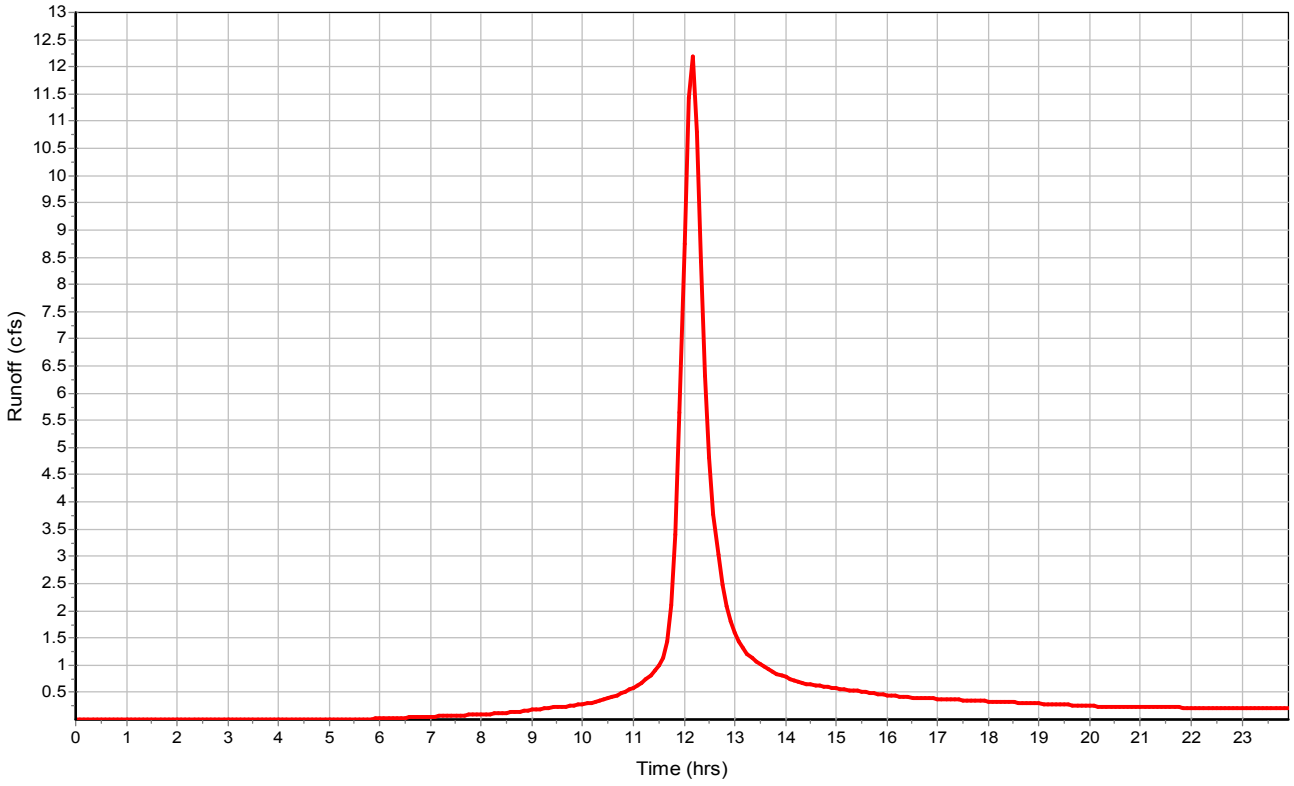
Total Rainfall (in)	3.70
Total Runoff (in)	2.56
Peak Runoff (cfs)	12.21
Weighted Curve Number	89.16
Time of Concentration (days hh:mm:ss)	0 00:27:28

Subbasin : Drainage Area 1-Post

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage Area 1-Pre

Input Data

Area (ac)	5.18
Weighted Curve Number	89.16
Rain Gage ID	Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	2.77	C	98.00
50 - 75% grass cover, Fair	2.41	C	79.00
Composite Area & Weighted CN	5.18		89.16

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.011	0.00	0.00
Flow Length (ft) :	115	0.00	0.00
Slope (%) :	0.4	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.7	0.00	0.00
Velocity (ft/sec) :	0.90	0.00	0.00
Computed Flow Time (min) :	2.13	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	1550	0.00	0.00
Slope (%) :	0.4	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.02	0.00	0.00
Computed Flow Time (min) :	25.33	0.00	0.00

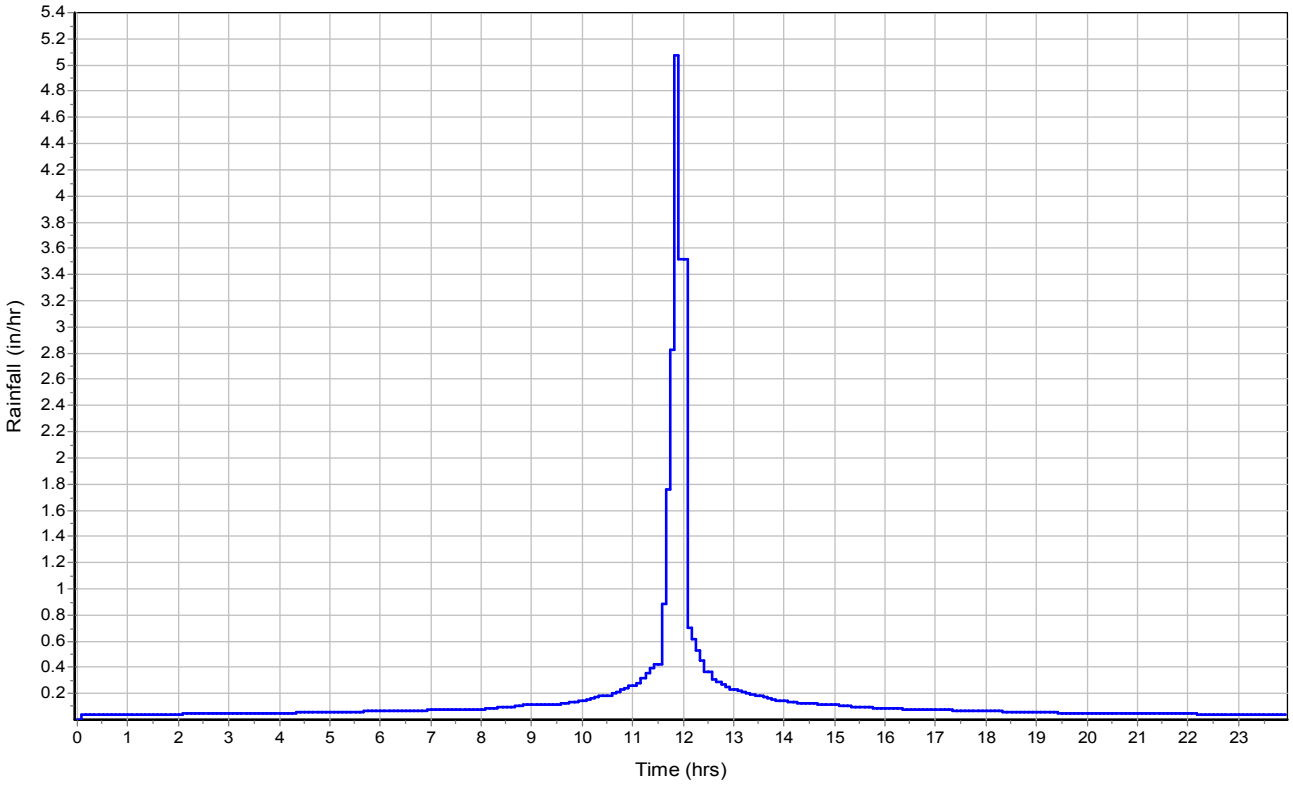
Total TOC (min) 27.46

Subbasin Runoff Results

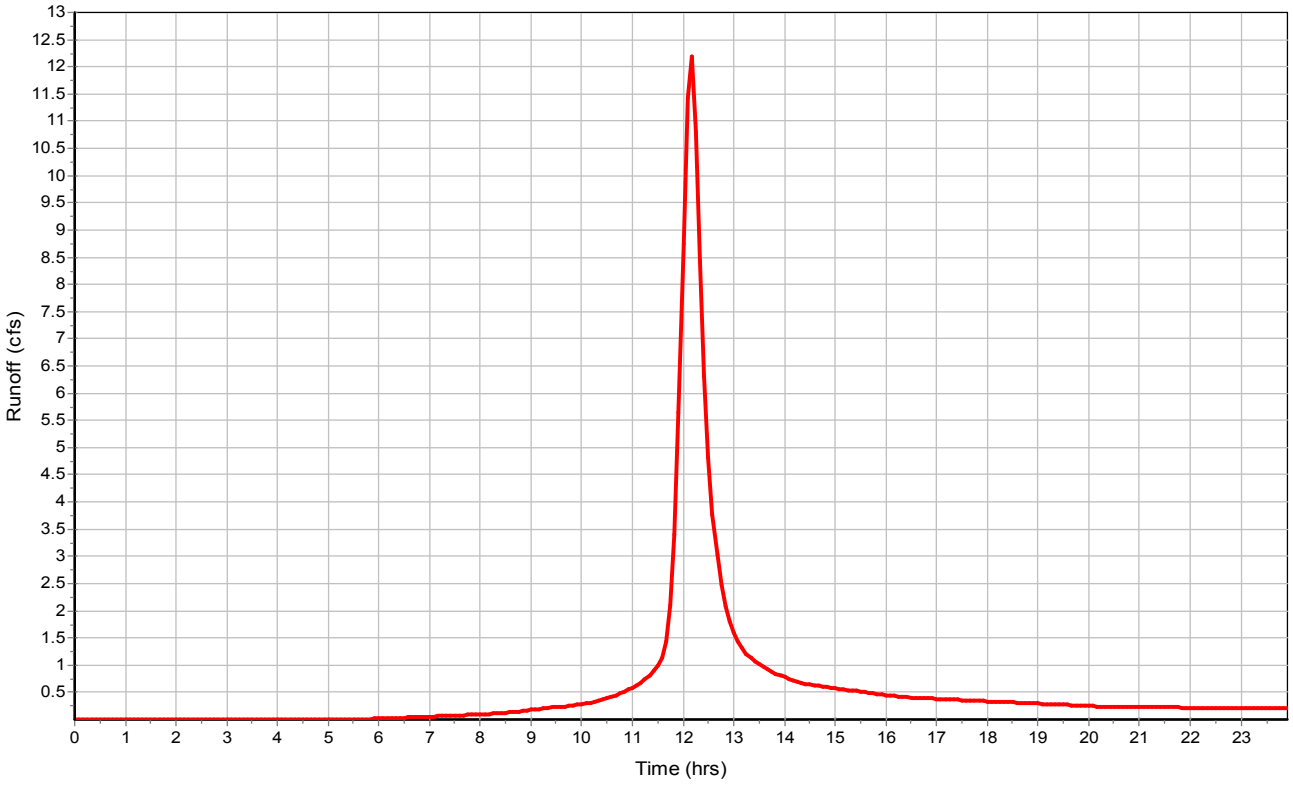
Total Rainfall (in)	3.70
Total Runoff (in)	2.56
Peak Runoff (cfs)	12.21
Weighted Curve Number	89.16
Time of Concentration (days hh:mm:ss)	0 00:27:28

Subbasin : Drainage Area 1-Pre

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage Area 2-Post

Input Data

Area (ac) 1.88
Weighted Curve Number 85.16
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.61	C	98.00
50 - 75% grass cover, Fair	1.27	C	79.00
Composite Area & Weighted CN	1.88		85.16

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.011	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	2.5	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.7	0.00	0.00
Velocity (ft/sec) :	1.82	0.00	0.00
Computed Flow Time (min) :	0.91	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	1020	0.00	0.00
Slope (%) :	0.5	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.14	0.00	0.00
Computed Flow Time (min) :	14.91	0.00	0.00

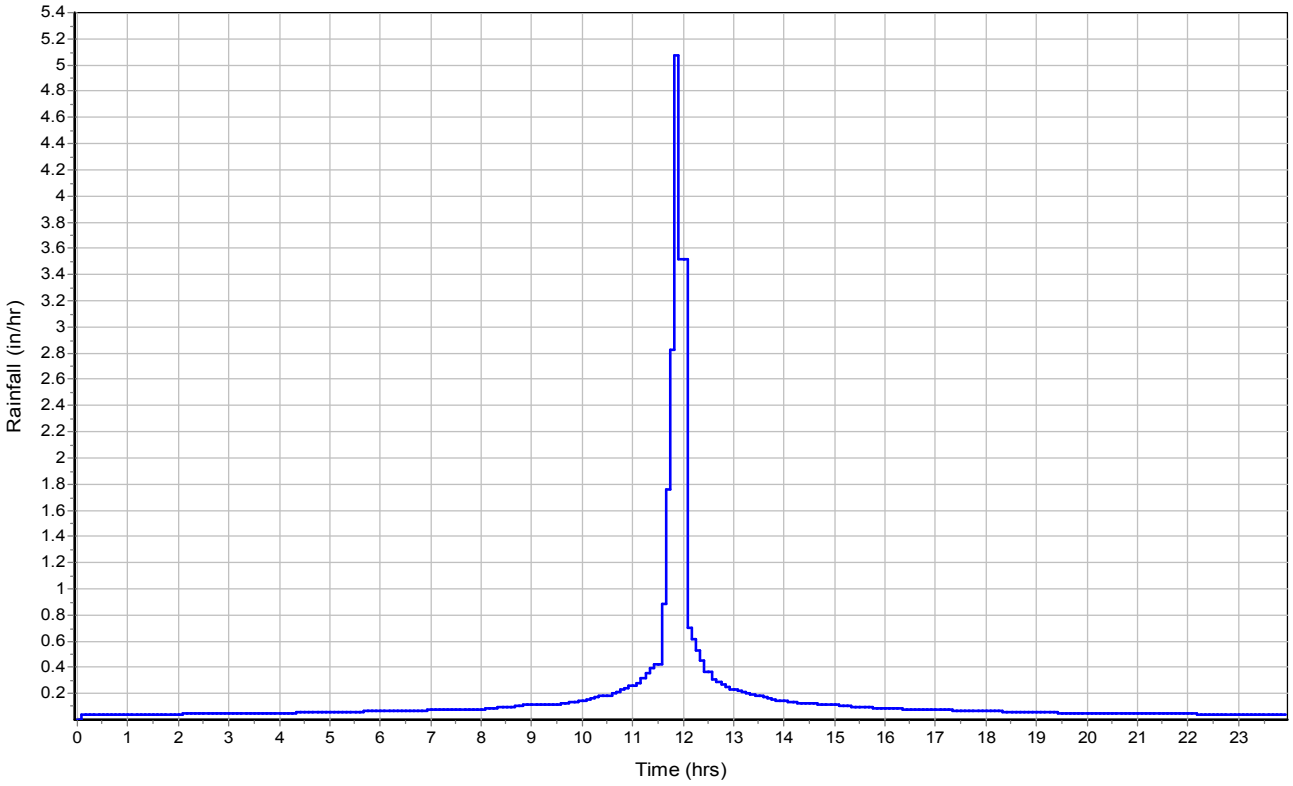
Total TOC (min) 15.83

Subbasin Runoff Results

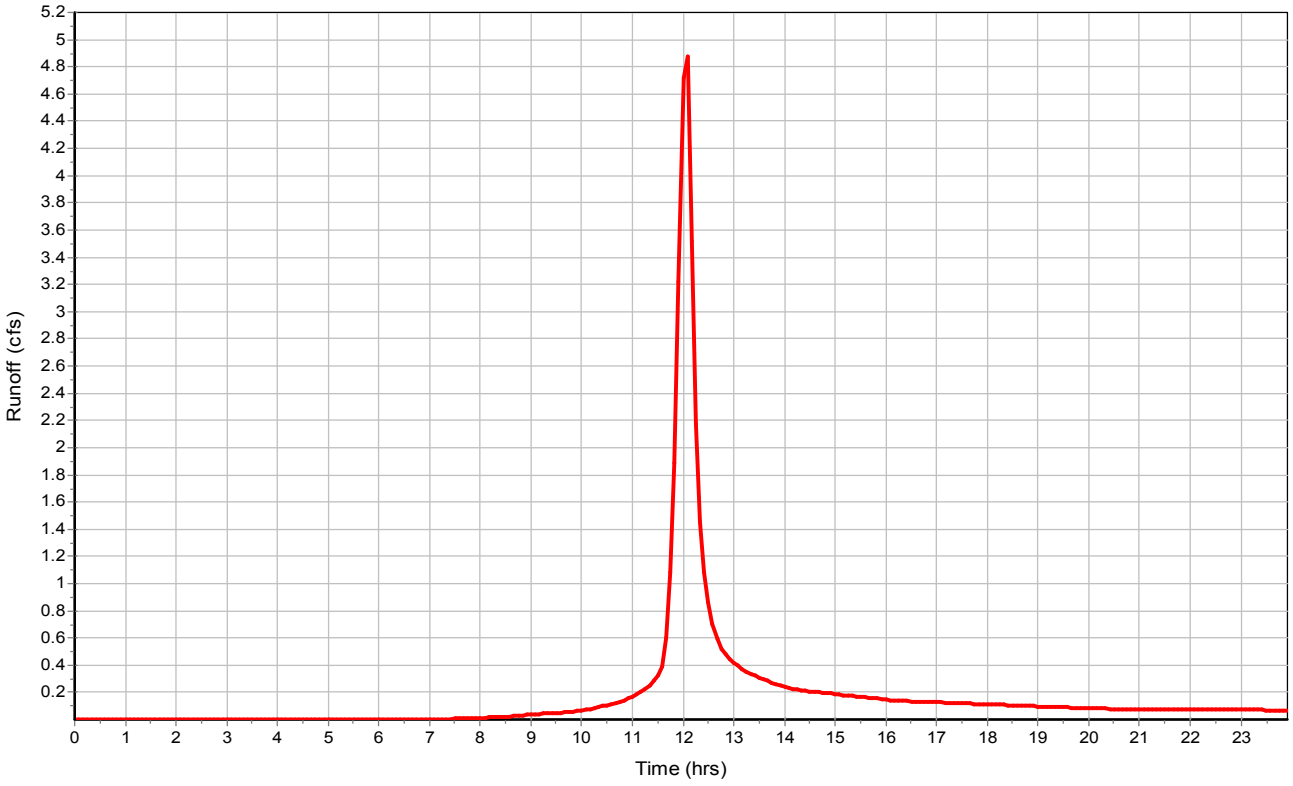
Total Rainfall (in) 3.70
Total Runoff (in) 2.21
Peak Runoff (cfs) 5.03
Weighted Curve Number 85.16
Time of Concentration (days hh:mm:ss) 0 00:15:50

Subbasin : Drainage Area 2-Post

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage Area 2-Pre

Input Data

Area (ac)	1.88
Weighted Curve Number	84.15
Rain Gage ID	Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.51	C	98.00
50 - 75% grass cover, Fair	1.37	C	79.00
Composite Area & Weighted CN	1.88		84.15

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.011	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	2.5	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.7	0.00	0.00
Velocity (ft/sec) :	1.82	0.00	0.00
Computed Flow Time (min) :	0.91	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	1020	0.00	0.00
Slope (%) :	0.5	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.14	0.00	0.00
Computed Flow Time (min) :	14.91	0.00	0.00

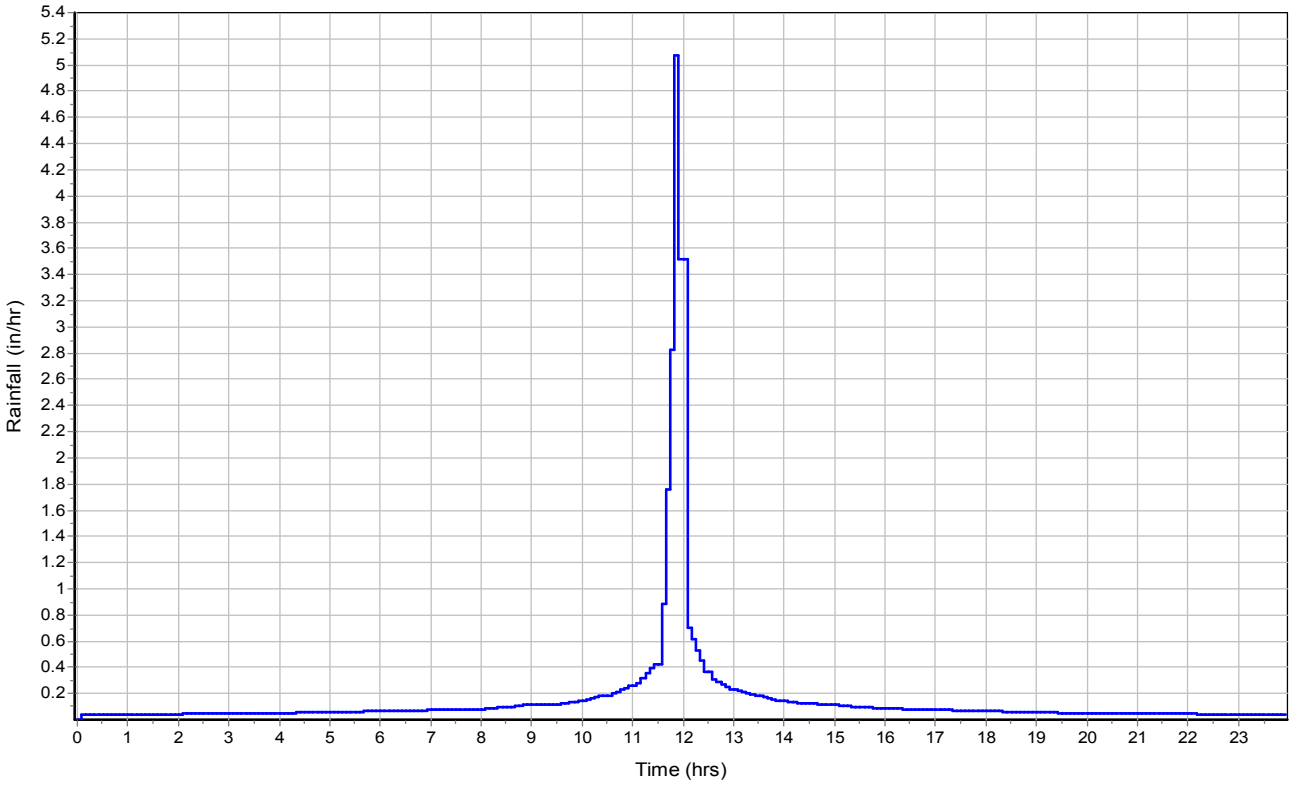
Total TOC (min) 15.83

Subbasin Runoff Results

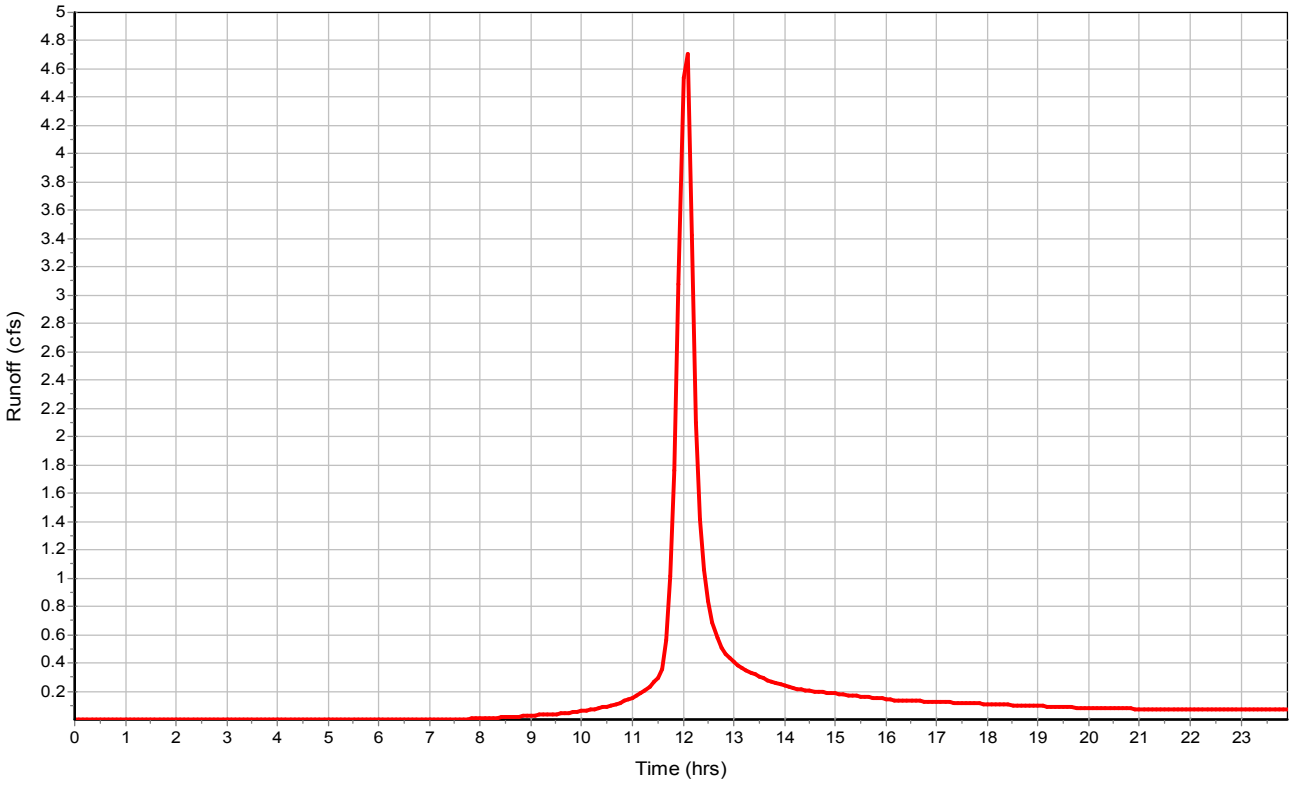
Total Rainfall (in)	3.70
Total Runoff (in)	2.12
Peak Runoff (cfs)	4.85
Weighted Curve Number	84.15
Time of Concentration (days hh:mm:ss)	0 00:15:50

Subbasin : Drainage Area 2-Pre

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage Area 3-Post

Input Data

Area (ac)	3.00
Weighted Curve Number	87.55
Rain Gage ID	Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	1.35	C	98.00
50 - 75% grass cover, Fair	1.65	C	79.00
Composite Area & Weighted CN	3.00		87.55

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.011	0.00	0.00
Flow Length (ft) :	250	0.00	0.00
Slope (%) :	1.6	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.7	0.00	0.00
Velocity (ft/sec) :	1.83	0.00	0.00
Computed Flow Time (min) :	2.28	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	400	0.00	0.00
Slope (%) :	0.9	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.53	0.00	0.00
Computed Flow Time (min) :	4.36	0.00	0.00

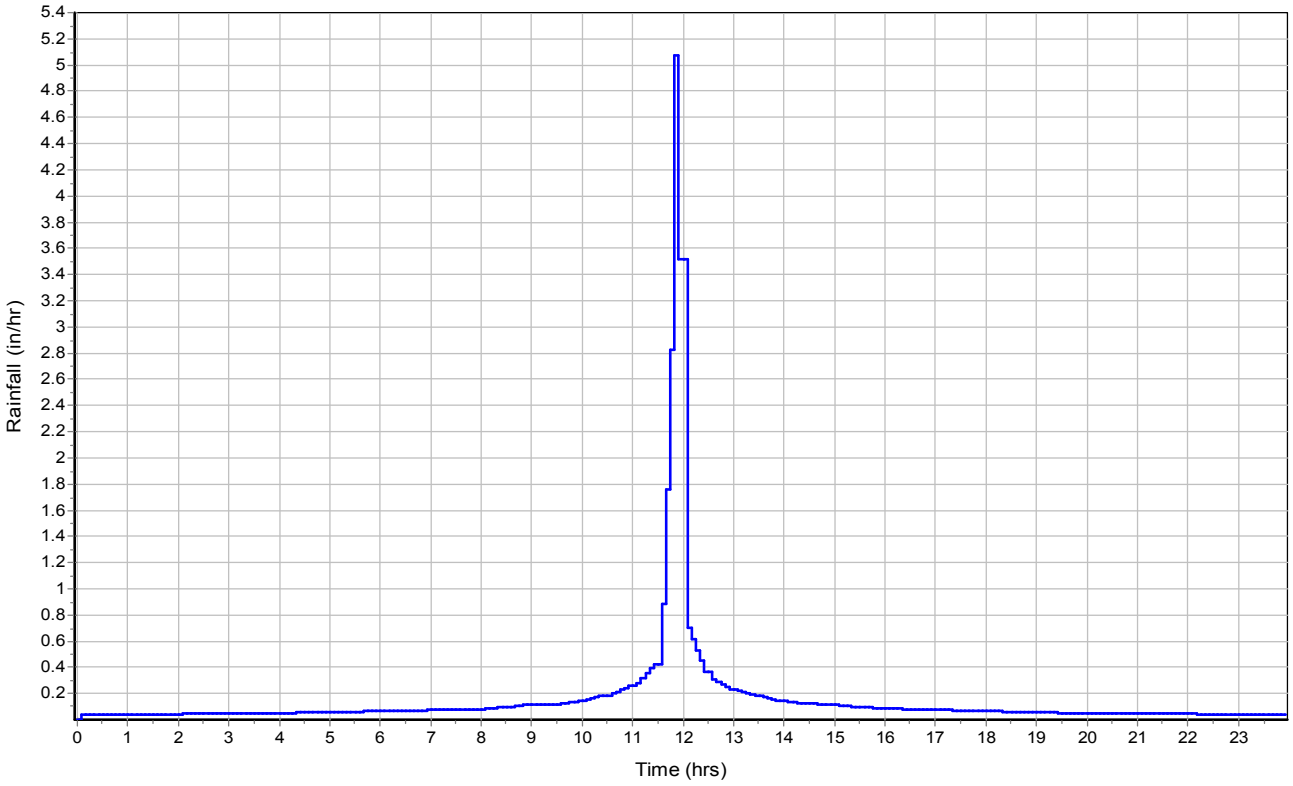
Total TOC (min) 6.63

Subbasin Runoff Results

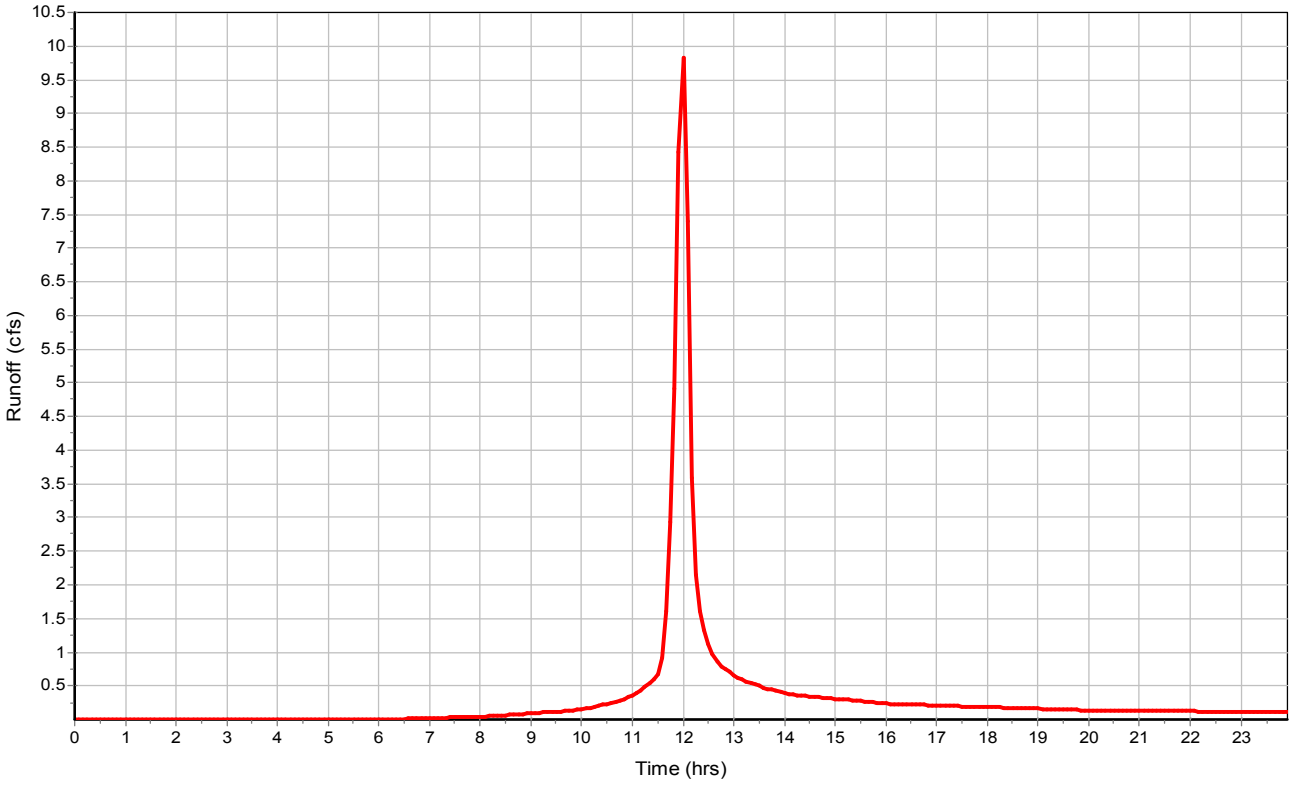
Total Rainfall (in)	3.70
Total Runoff (in)	2.41
Peak Runoff (cfs)	9.92
Weighted Curve Number	87.55
Time of Concentration (days hh:mm:ss)	0 00:06:38

Subbasin : Drainage Area 3-Post

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage Area 3-Pre

Input Data

Area (ac)	3.00
Weighted Curve Number	86.28
Rain Gage ID	Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	1.15	C	98.00
50 - 75% grass cover, Fair	1.85	C	79.00
Composite Area & Weighted CN	3.00		86.28

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.011	0.00	0.00
Flow Length (ft) :	250	0.00	0.00
Slope (%) :	1.6	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.7	0.00	0.00
Velocity (ft/sec) :	1.83	0.00	0.00
Computed Flow Time (min) :	2.28	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	400	0.00	0.00
Slope (%) :	0.9	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.53	0.00	0.00
Computed Flow Time (min) :	4.36	0.00	0.00

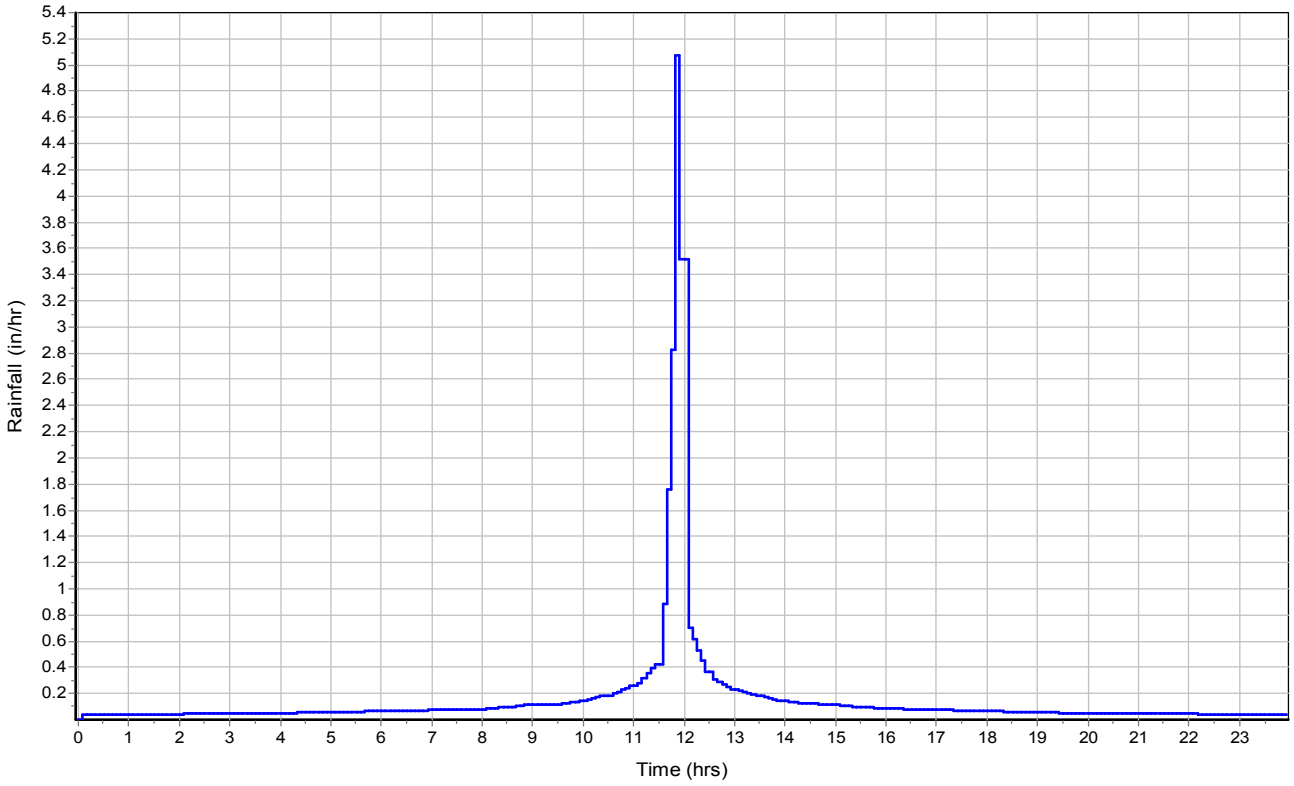
Total TOC (min) 6.63

Subbasin Runoff Results

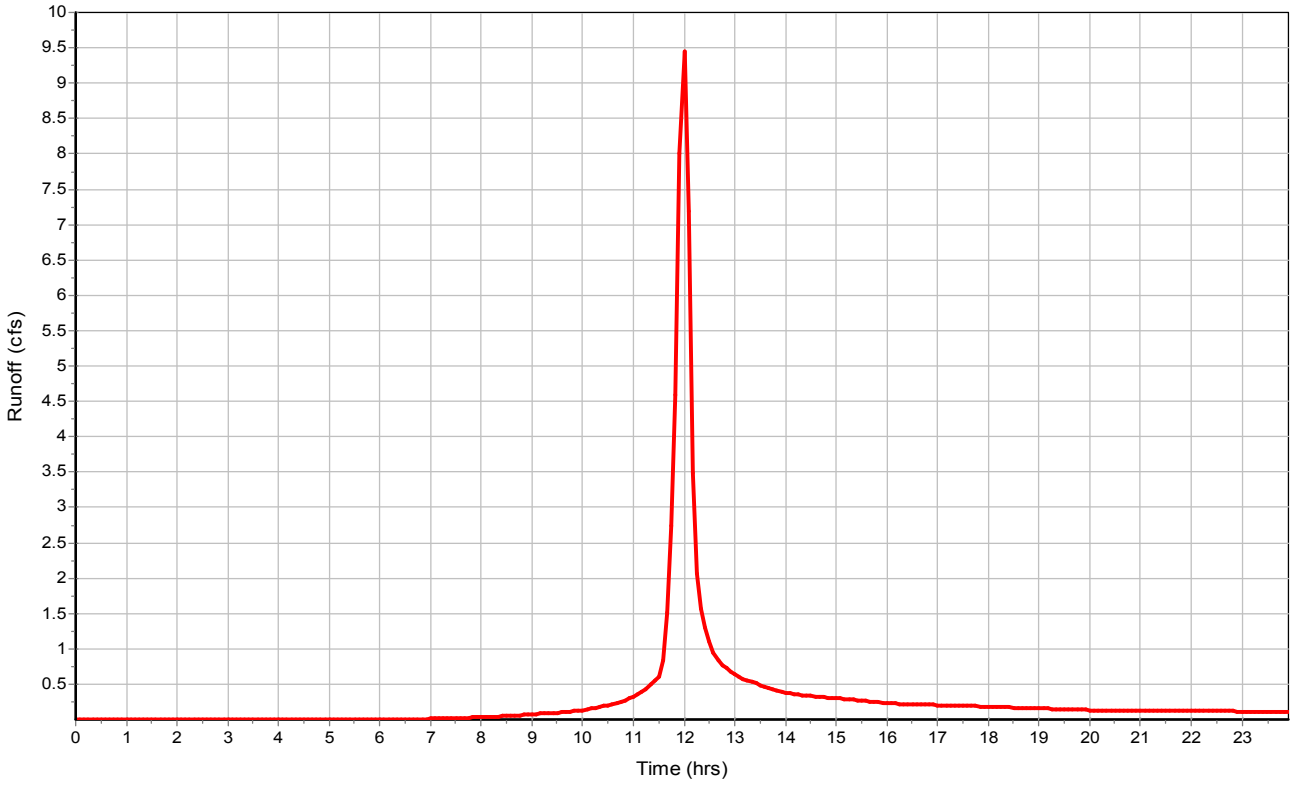
Total Rainfall (in)	3.70
Total Runoff (in)	2.30
Peak Runoff (cfs)	9.50
Weighted Curve Number	86.28
Time of Concentration (days hh:mm:ss)	0 00:06:38

Subbasin : Drainage Area 3-Pre

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage Area 4-Post

Input Data

Area (ac) 1.91
Weighted Curve Number 87.36
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.84	C	98.00
50 - 75% grass cover, Fair	1.07	C	79.00
Composite Area & Weighted CN	1.91		87.36

Time of Concentration

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	573	0.00	0.00
Slope (%) :	1.6	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	2.04	0.00	0.00
Computed Flow Time (min) :	4.68	0.00	0.00

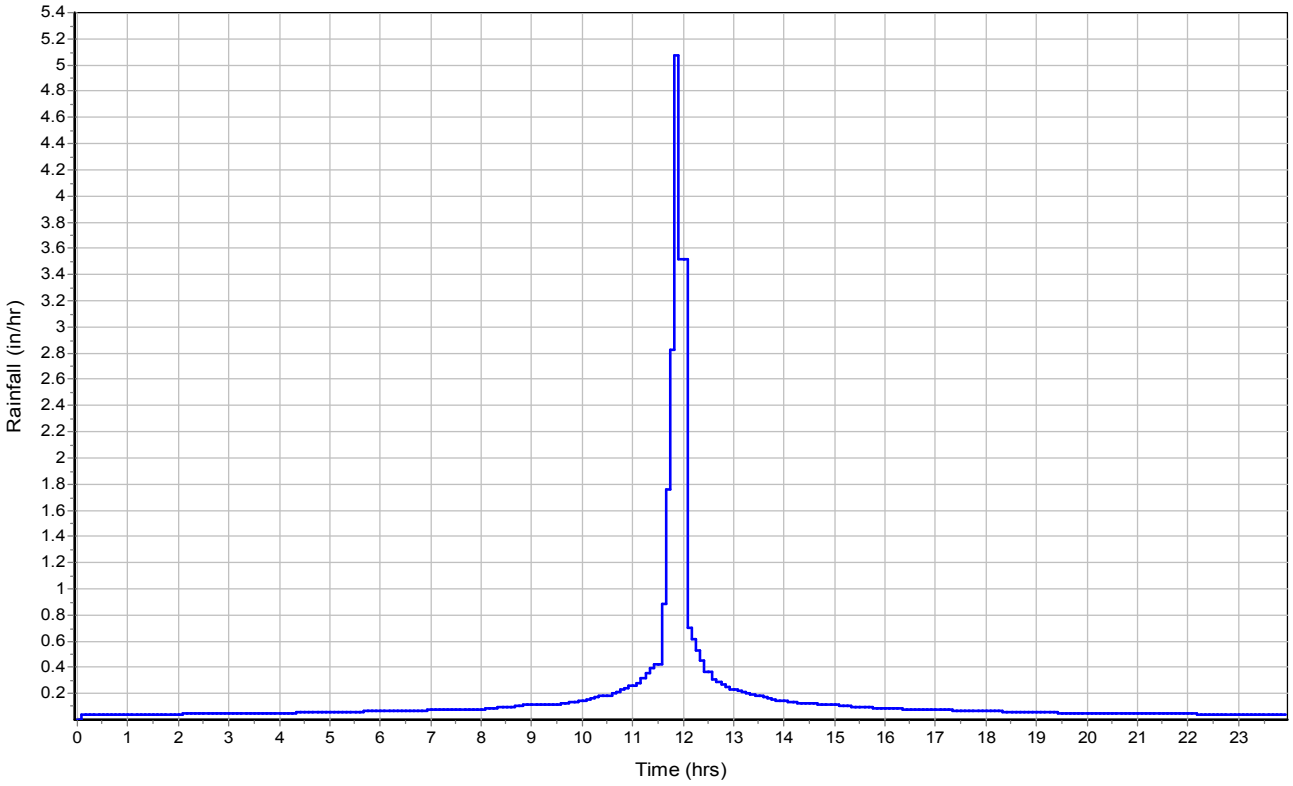
Total TOC (min) 4.68

Subbasin Runoff Results

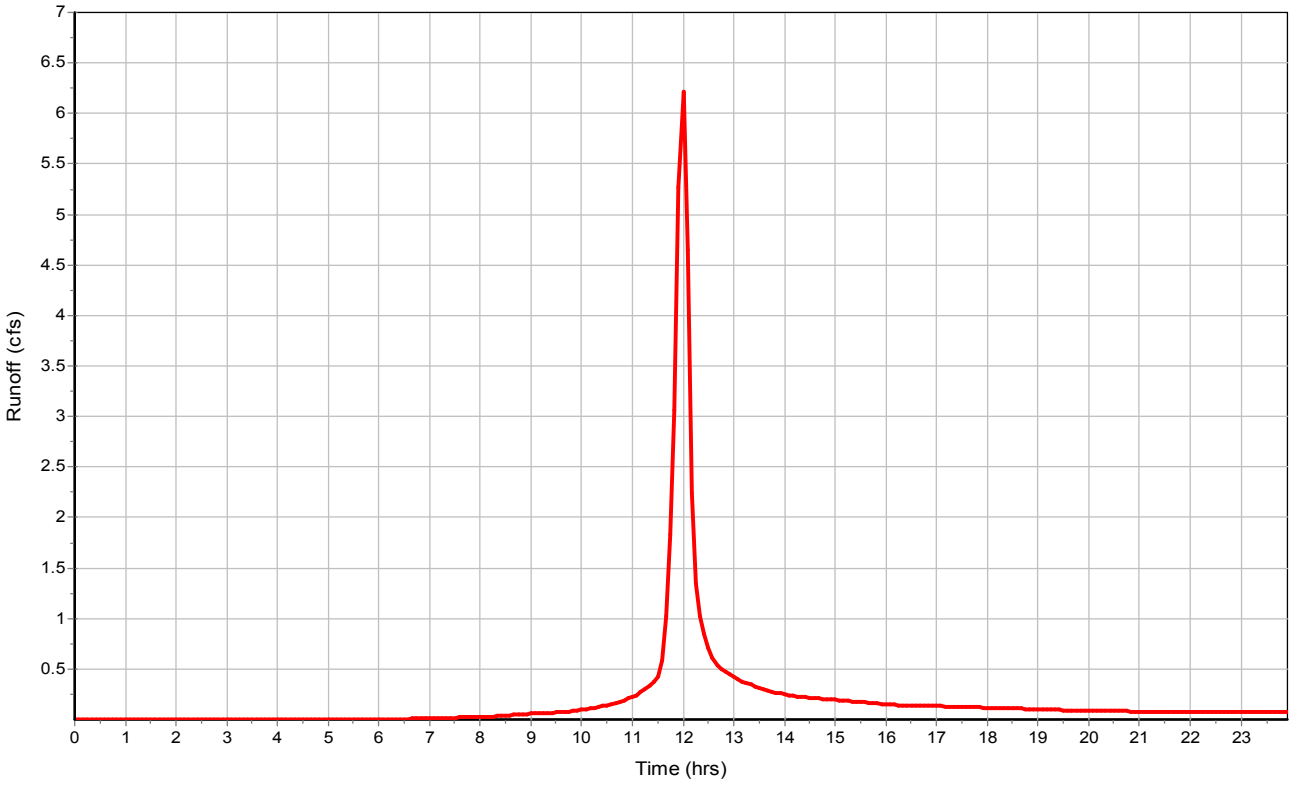
Total Rainfall (in) 3.70
Total Runoff (in) 2.40
Peak Runoff (cfs) 6.26
Weighted Curve Number 87.36
Time of Concentration (days hh:mm:ss) 0 00:04:41

Subbasin : Drainage Area 4-Post

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage Area 4-Pre

Input Data

Area (ac) 1.91
Weighted Curve Number 87.36
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved roads with curbs & sewers	0.84	C	98.00
50 - 75% grass cover, Fair	1.07	C	79.00
Composite Area & Weighted CN	1.91		87.36

Time of Concentration

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	573	0.00	0.00
Slope (%) :	1.6	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	2.04	0.00	0.00
Computed Flow Time (min) :	4.68	0.00	0.00

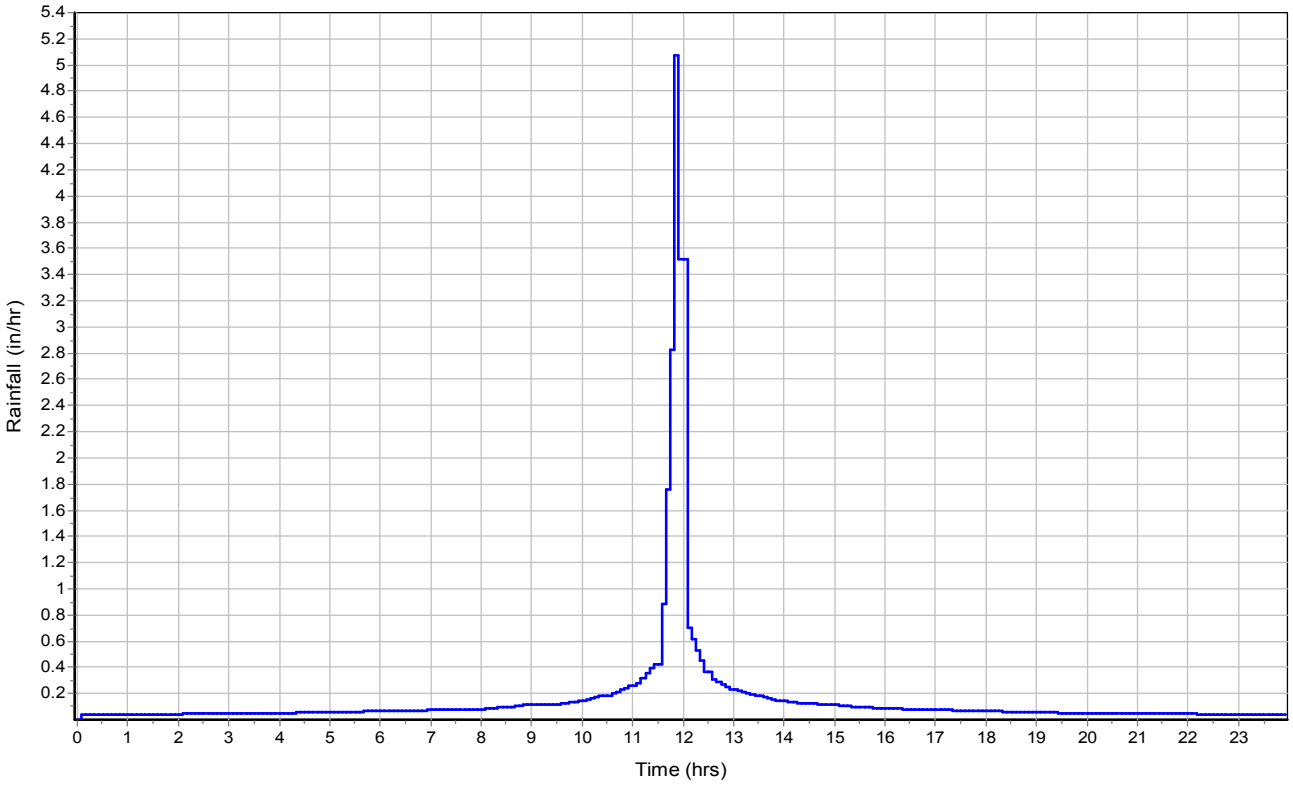
Total TOC (min) 4.68

Subbasin Runoff Results

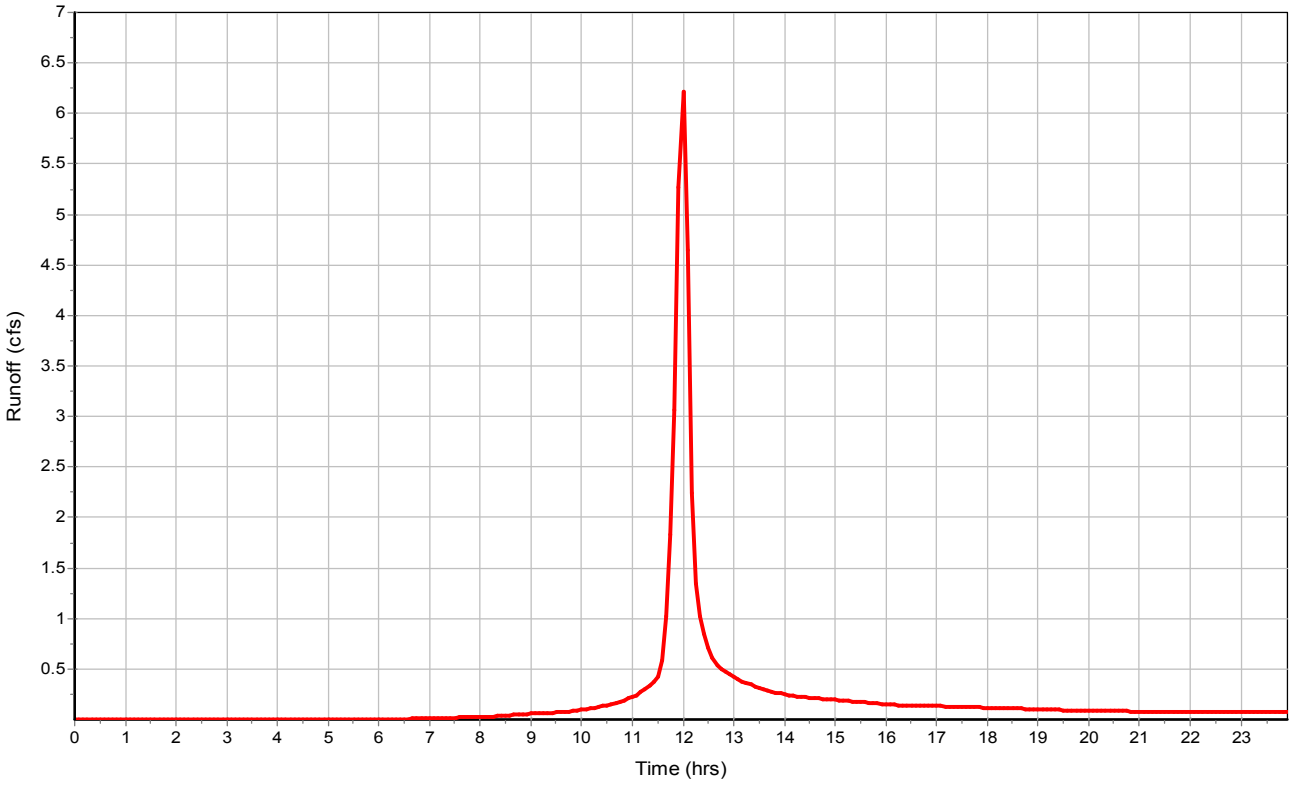
Total Rainfall (in) 3.70
Total Runoff (in) 2.40
Peak Runoff (cfs) 6.26
Weighted Curve Number 87.36
Time of Concentration (days hh:mm:ss) 0 00:04:41

Subbasin : Drainage Area 4-Pre

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage Area 5 - Post

Input Data

Area (ac)	8.14
Weighted Curve Number	88.94
Rain Gage ID	Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	4.26	C	98.00
50 - 75% grass cover, Fair	3.88	C	79.00
Composite Area & Weighted CN	8.14		88.94

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.15	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	1.1	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.70	0.00	0.00
Velocity (ft/sec) :	0.16	0.00	0.00
Computed Flow Time (min) :	10.27	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	700	0.00	0.00
Slope (%) :	1.5	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.98	0.00	0.00
Computed Flow Time (min) :	5.89	0.00	0.00

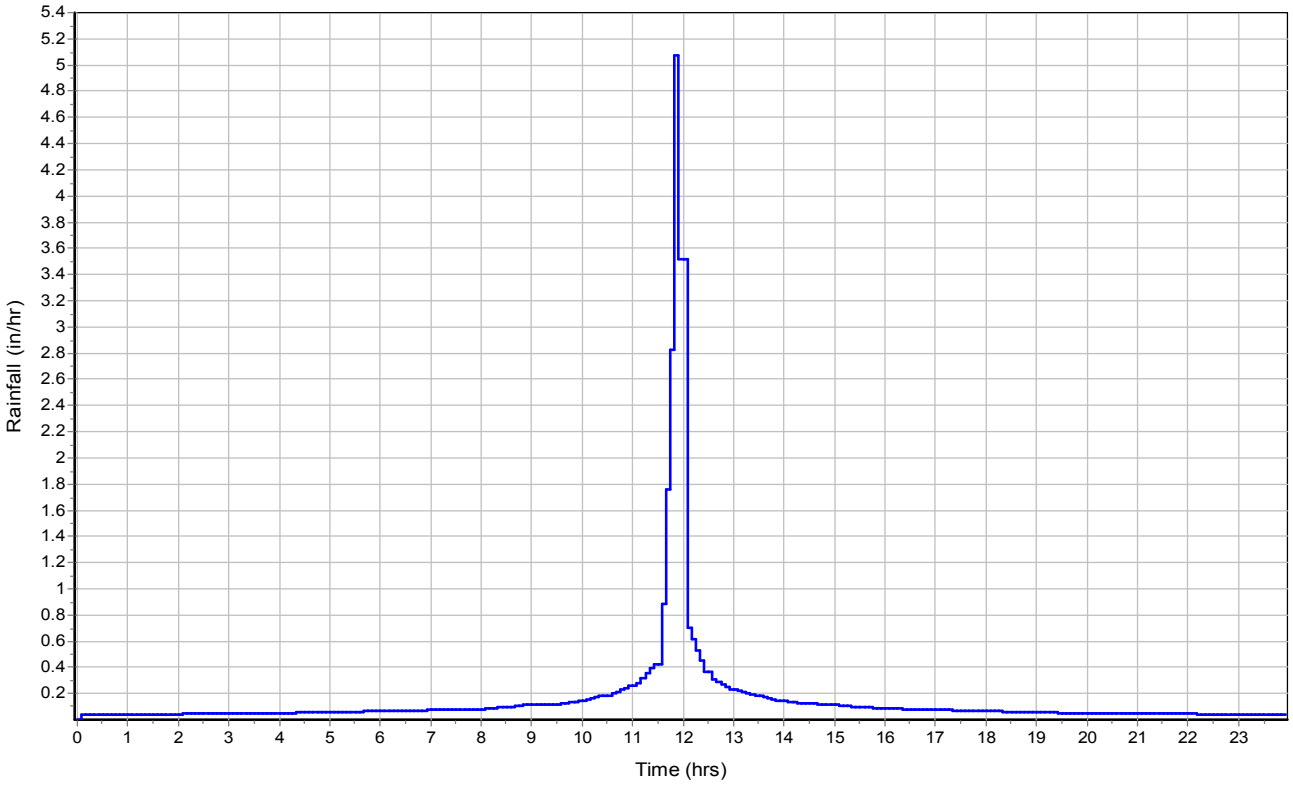
Total TOC (min) 16.16

Subbasin Runoff Results

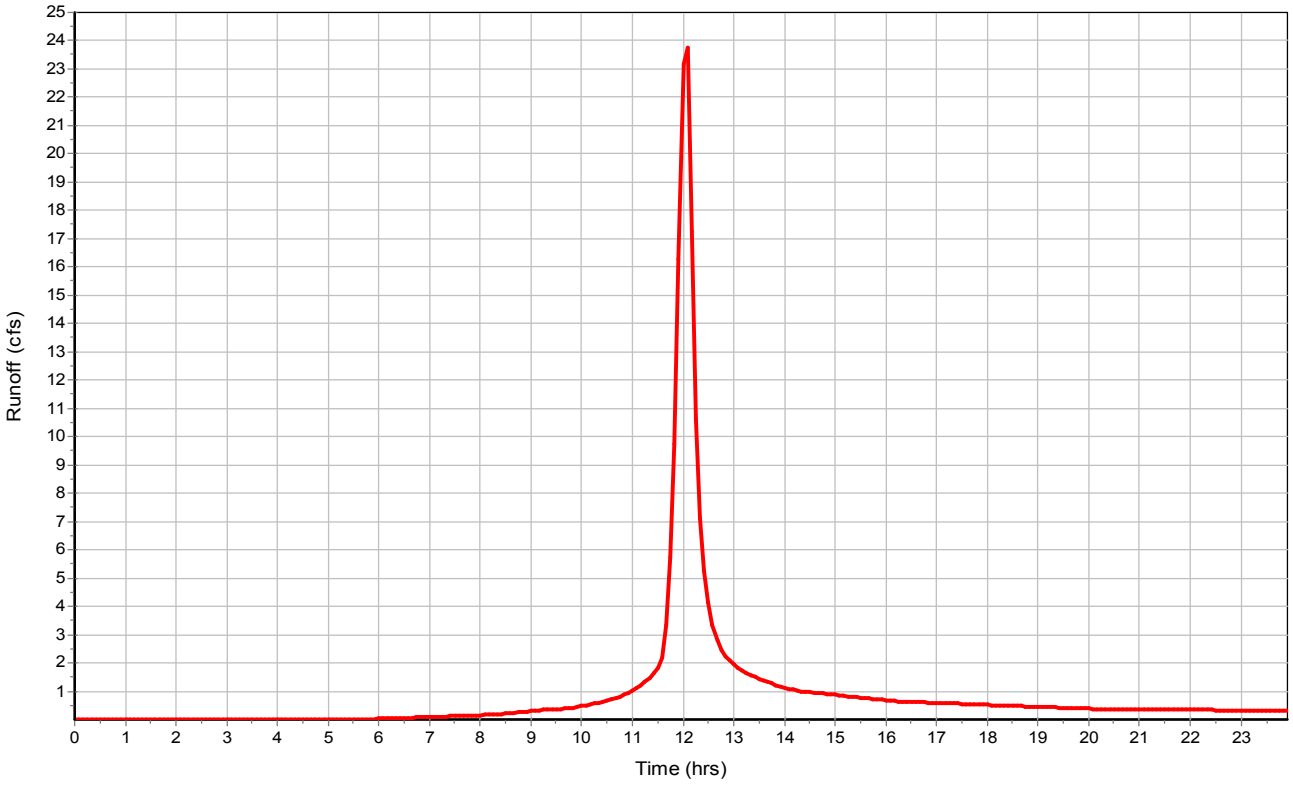
Total Rainfall (in)	3.70
Total Runoff (in)	2.54
Peak Runoff (cfs)	24.55
Weighted Curve Number	88.94
Time of Concentration (days hh:mm:ss)	0 00:16:10

Subbasin : Drainage Area 5 - Post

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage Area 5 - Pre

Input Data

Area (ac)	8.14
Weighted Curve Number	88.06
Rain Gage ID	Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	3.88	C	98.00
50 - 75% grass cover, Fair	4.26	C	79.00
Composite Area & Weighted CN	8.14		88.06

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.15	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	1.1	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.70	0.00	0.00
Velocity (ft/sec) :	0.16	0.00	0.00
Computed Flow Time (min) :	10.27	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	700	0.00	0.00
Slope (%) :	1.5	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.98	0.00	0.00
Computed Flow Time (min) :	5.89	0.00	0.00

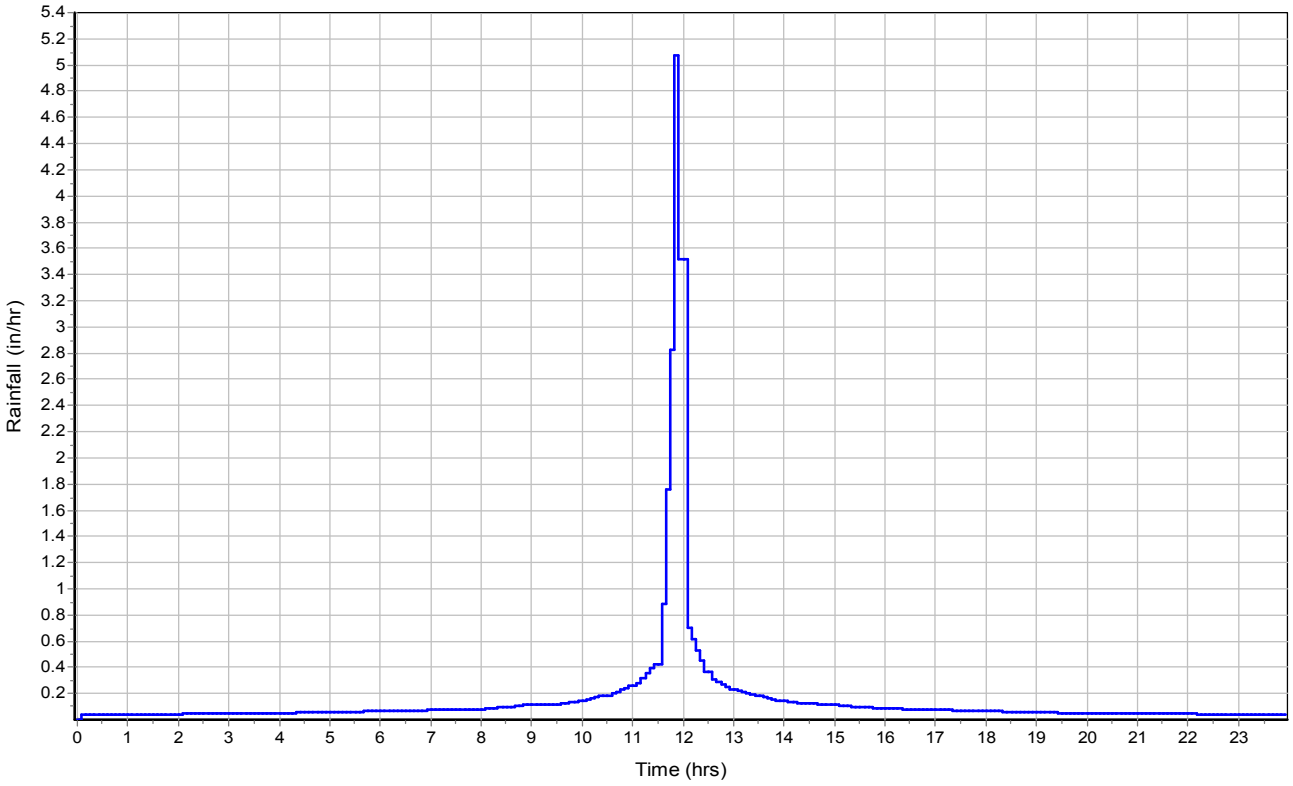
Total TOC (min) 16.16

Subbasin Runoff Results

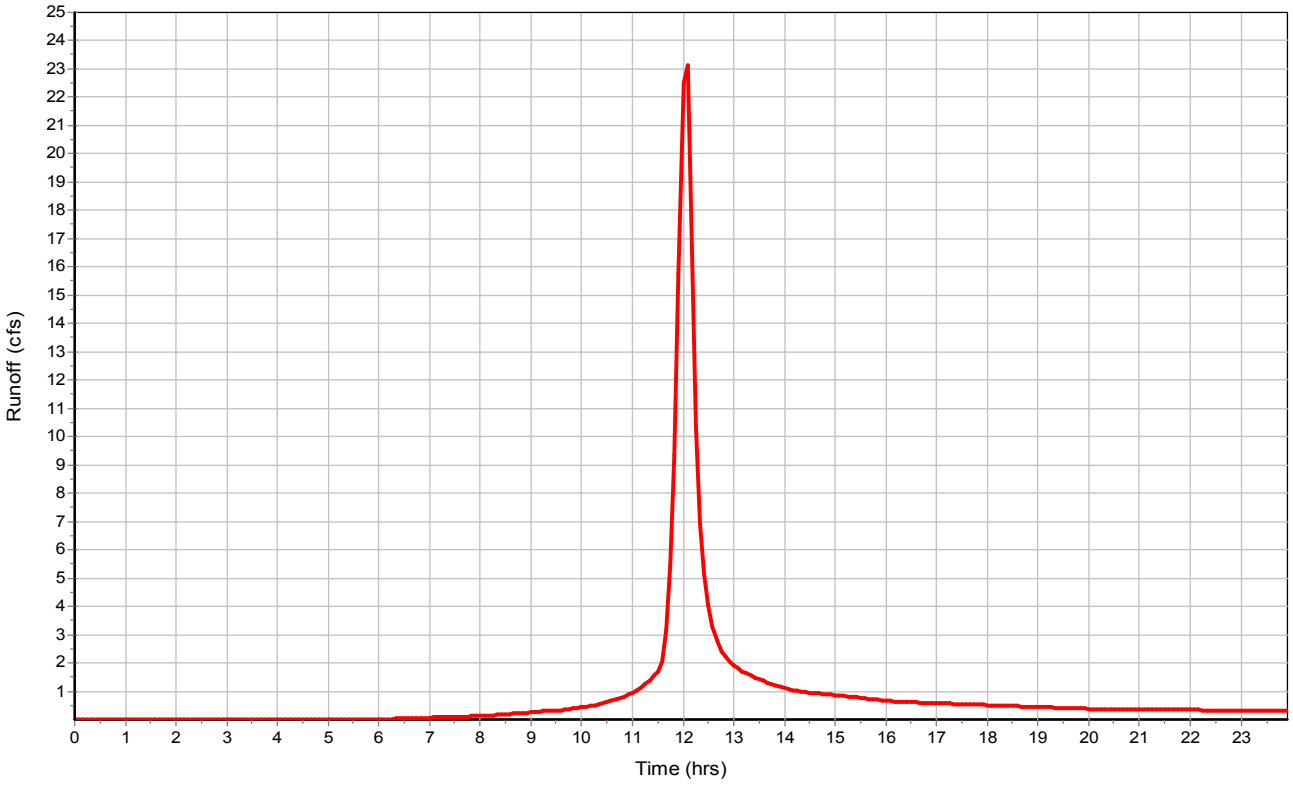
Total Rainfall (in)	3.70
Total Runoff (in)	2.46
Peak Runoff (cfs)	23.89
Weighted Curve Number	88.06
Time of Concentration (days hh:mm:ss)	0 00:16:10

Subbasin : Drainage Area 5 - Pre

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin Hydrology

Subbasin : DA6a-Post

Input Data

Area (ac) 2.92
Weighted Curve Number 87.72
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	1.34	C	98.00
50 - 75% grass cover, Fair	1.58	C	79.00
Composite Area & Weighted CN	2.92		87.72

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.011	0.00	0.00
Flow Length (ft) :	75	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.70	0.00	0.00
Velocity (ft/sec) :	1.57	0.00	0.00
Computed Flow Time (min) :	0.79	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	1400	0.00	0.00
Slope (%) :	3	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	2.79	0.00	0.00
Computed Flow Time (min) :	8.36	0.00	0.00

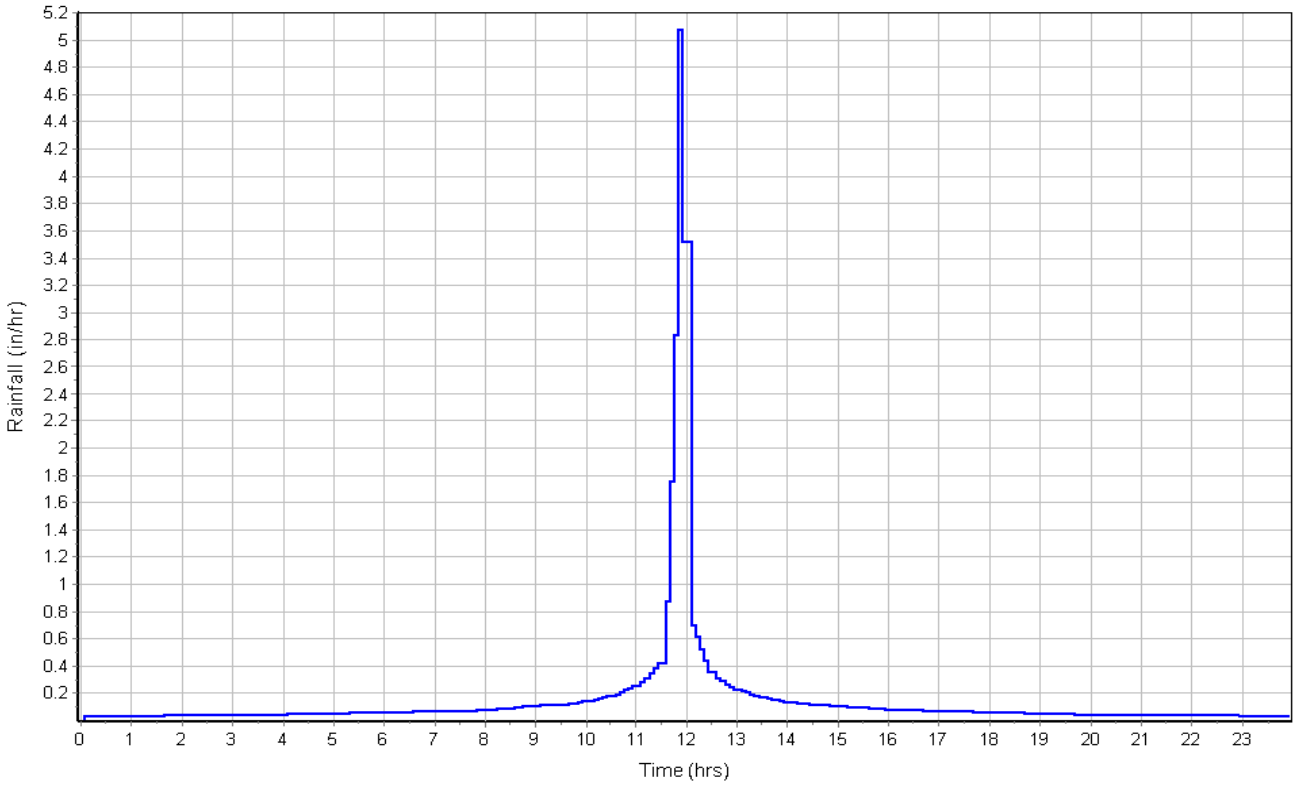
Total TOC (min) 9.16

Subbasin Runoff Results

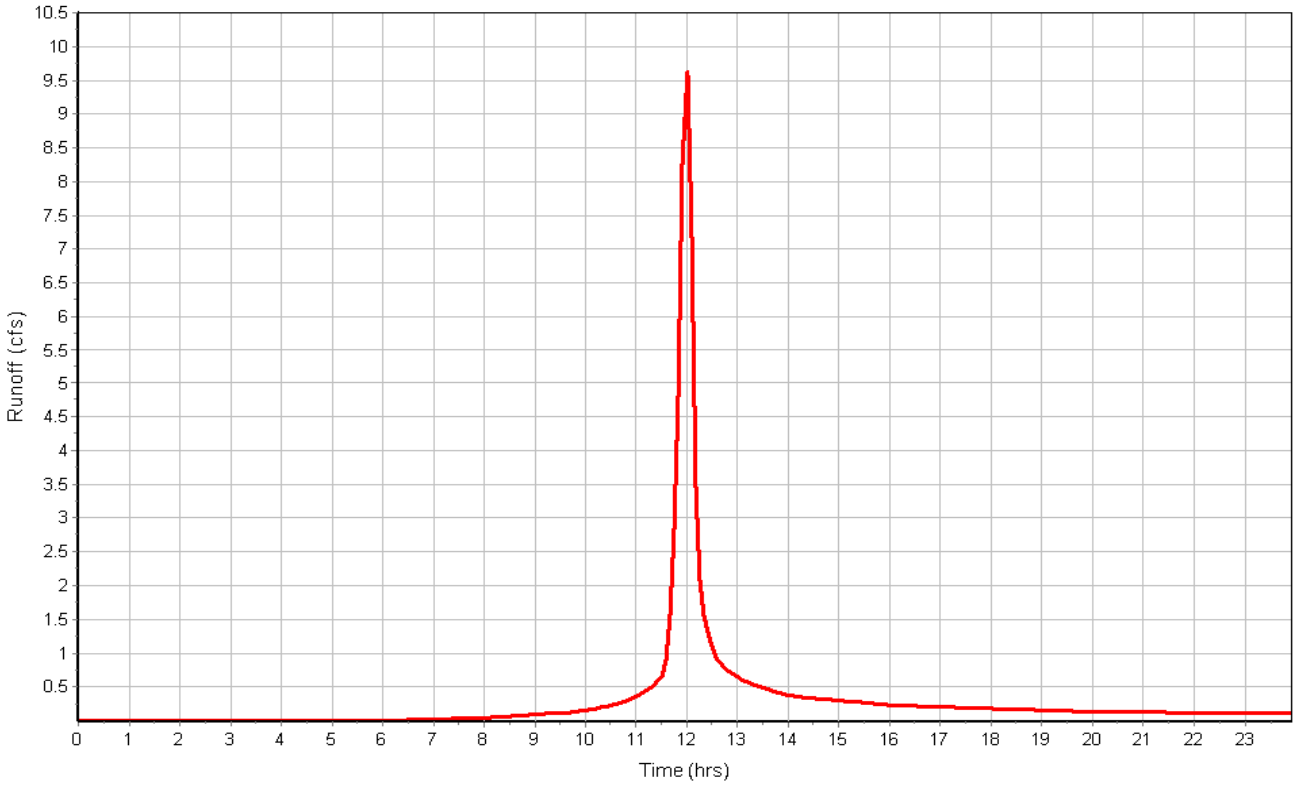
Total Rainfall (in)	3.70
Total Runoff (in)	2.43
Peak Runoff (cfs)	9.70
Weighted Curve Number	87.72
Time of Concentration (days hh:mm:ss)	0 00:09:10

Subbasin : DA6a-Post

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : DA6a-Pre

Input Data

Area (ac) 2.92
Weighted Curve Number 87.65
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	1.33	C	98.00
50 - 75% grass cover, Fair	1.59	C	79.00
Composite Area & Weighted CN	2.92		87.65

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.011	0.00	0.00
Flow Length (ft) :	75	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.70	0.00	0.00
Velocity (ft/sec) :	1.57	0.00	0.00
Computed Flow Time (min) :	0.79	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	1400	0.00	0.00
Slope (%) :	3	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	2.79	0.00	0.00
Computed Flow Time (min) :	8.36	0.00	0.00

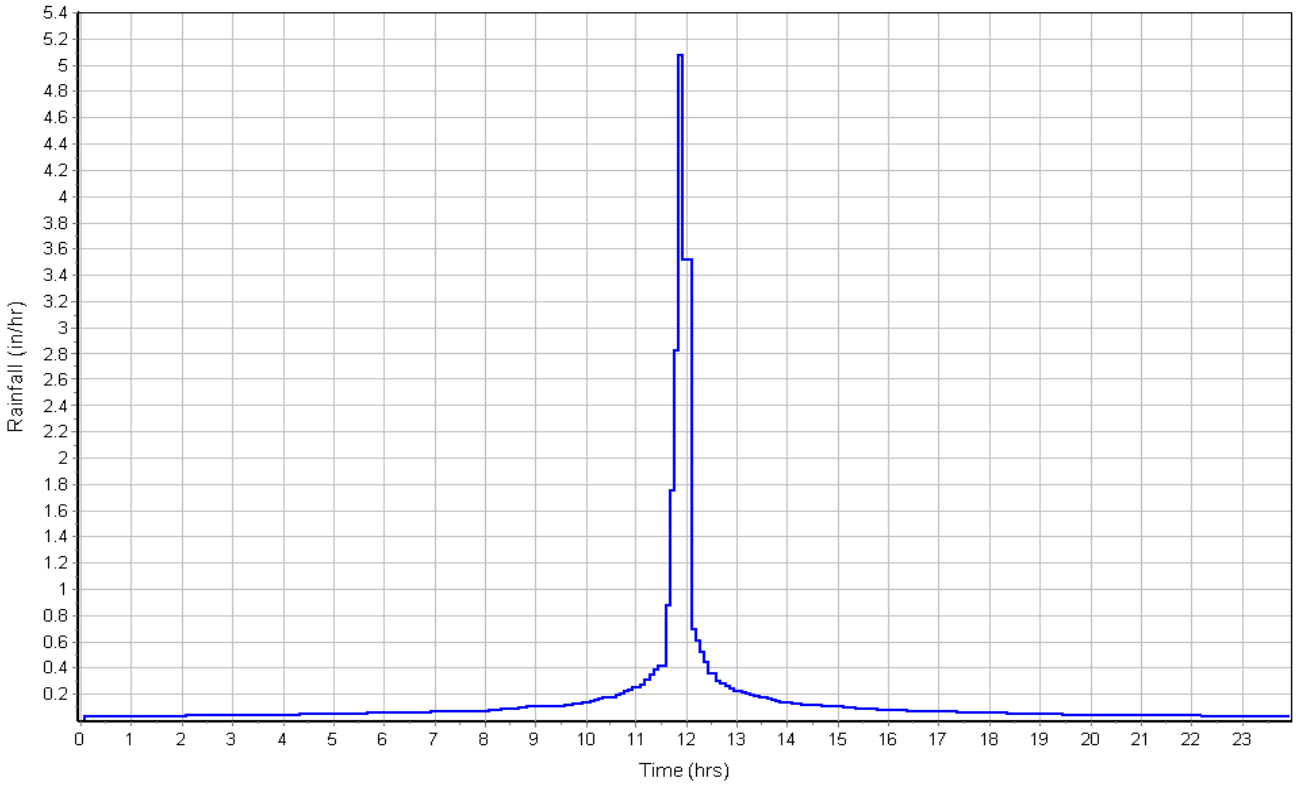
Total TOC (min) 9.16

Subbasin Runoff Results

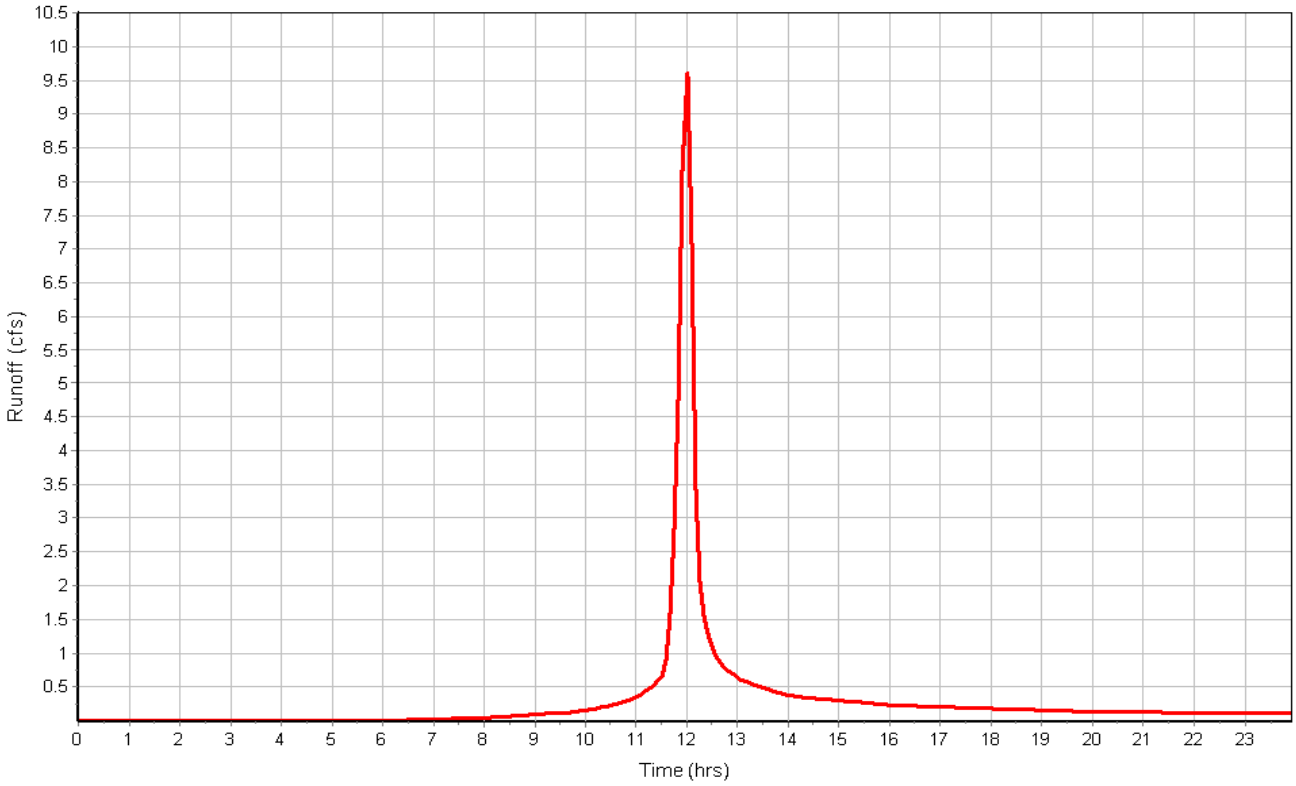
Total Rainfall (in) 3.70
Total Runoff (in) 2.42
Peak Runoff (cfs) 9.67
Weighted Curve Number 87.65
Time of Concentration (days hh:mm:ss) 0 00:09:10

Subbasin : DA6a-Pre

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : DA6b-Post

Input Data

Area (ac) 2.20
Weighted Curve Number 83.15
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.48	C	98.00
50 - 75% grass cover, Fair	1.72	C	79.00
Composite Area & Weighted CN	2.20		83.15

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.4	0.00	0.00
Flow Length (ft) :	55	0.00	0.00
Slope (%) :	33	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.70	0.00	0.00
Velocity (ft/sec) :	0.26	0.00	0.00
Computed Flow Time (min) :	3.58	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	850	0.00	0.00
Slope (%) :	0.8	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.44	0.00	0.00
Computed Flow Time (min) :	9.84	0.00	0.00

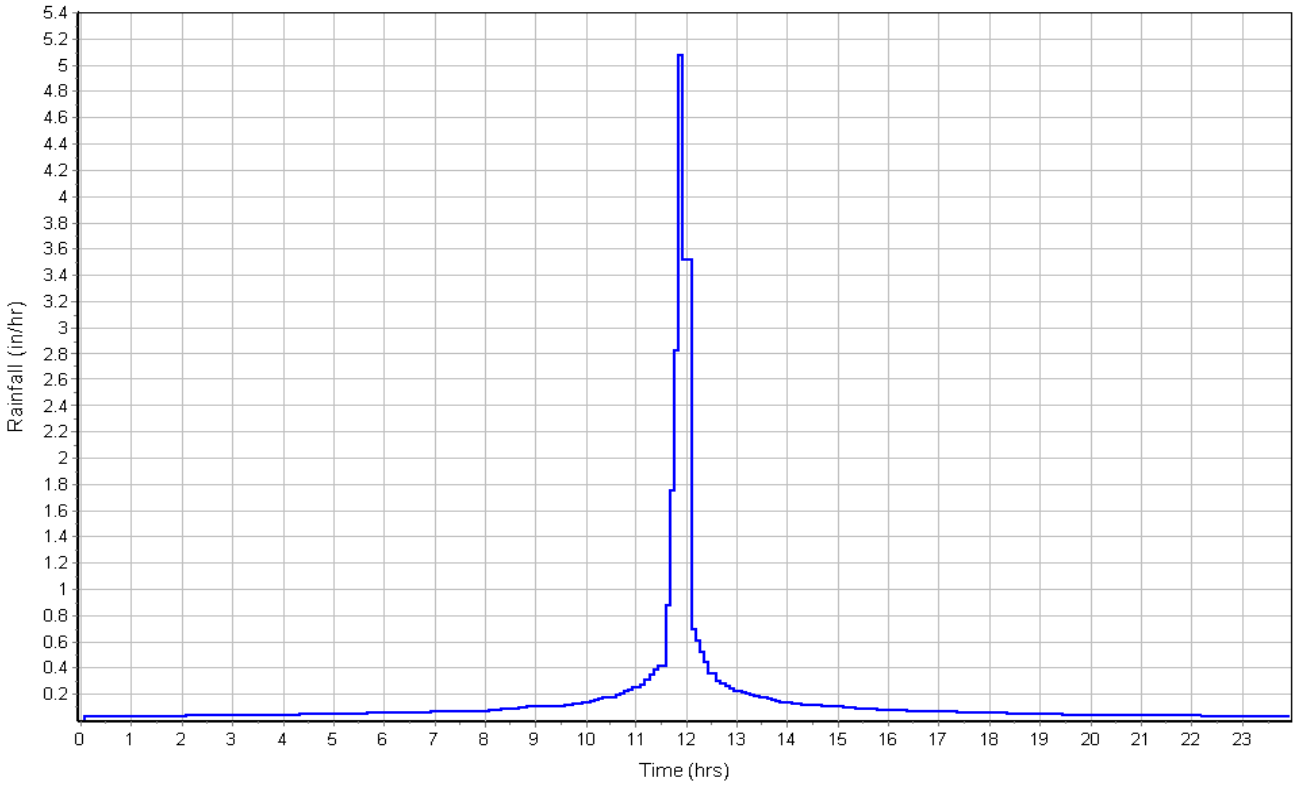
Total TOC (min) 13.42

Subbasin Runoff Results

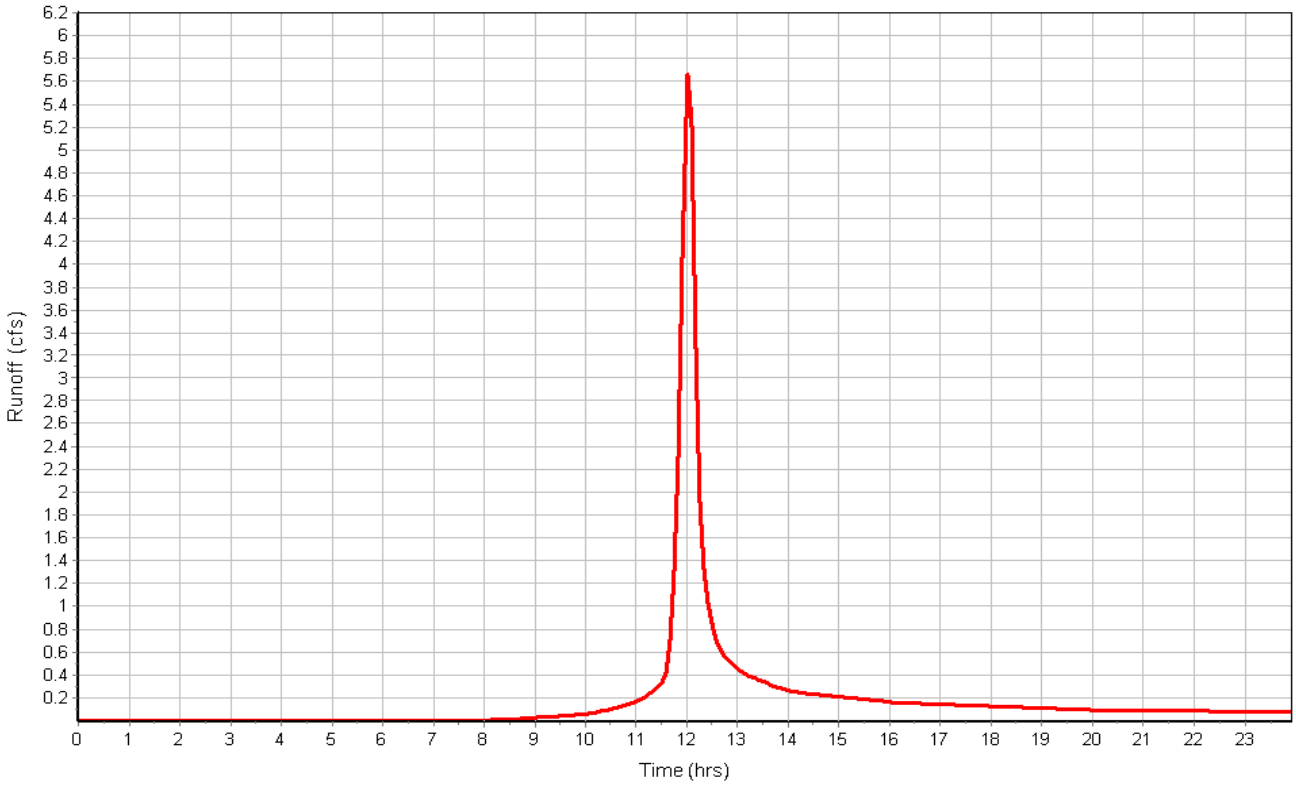
Total Rainfall (in) 3.70
Total Runoff (in) 2.04
Peak Runoff (cfs) 5.78
Weighted Curve Number 83.15
Time of Concentration (days hh:mm:ss) 0 00:13:25

Subbasin : DA6b-Post

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : DA6b-Pre

Input Data

Area (ac)	2.20
Weighted Curve Number	83.06
Rain Gage ID	Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.47	C	98.00
50 - 75% grass cover, Fair	1.73	C	79.00
Composite Area & Weighted CN	2.20		83.06

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.4	0.00	0.00
Flow Length (ft) :	55	0.00	0.00
Slope (%) :	33	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.70	0.00	0.00
Velocity (ft/sec) :	0.26	0.00	0.00
Computed Flow Time (min) :	3.58	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	850	0.00	0.00
Slope (%) :	0.8	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.44	0.00	0.00
Computed Flow Time (min) :	9.84	0.00	0.00

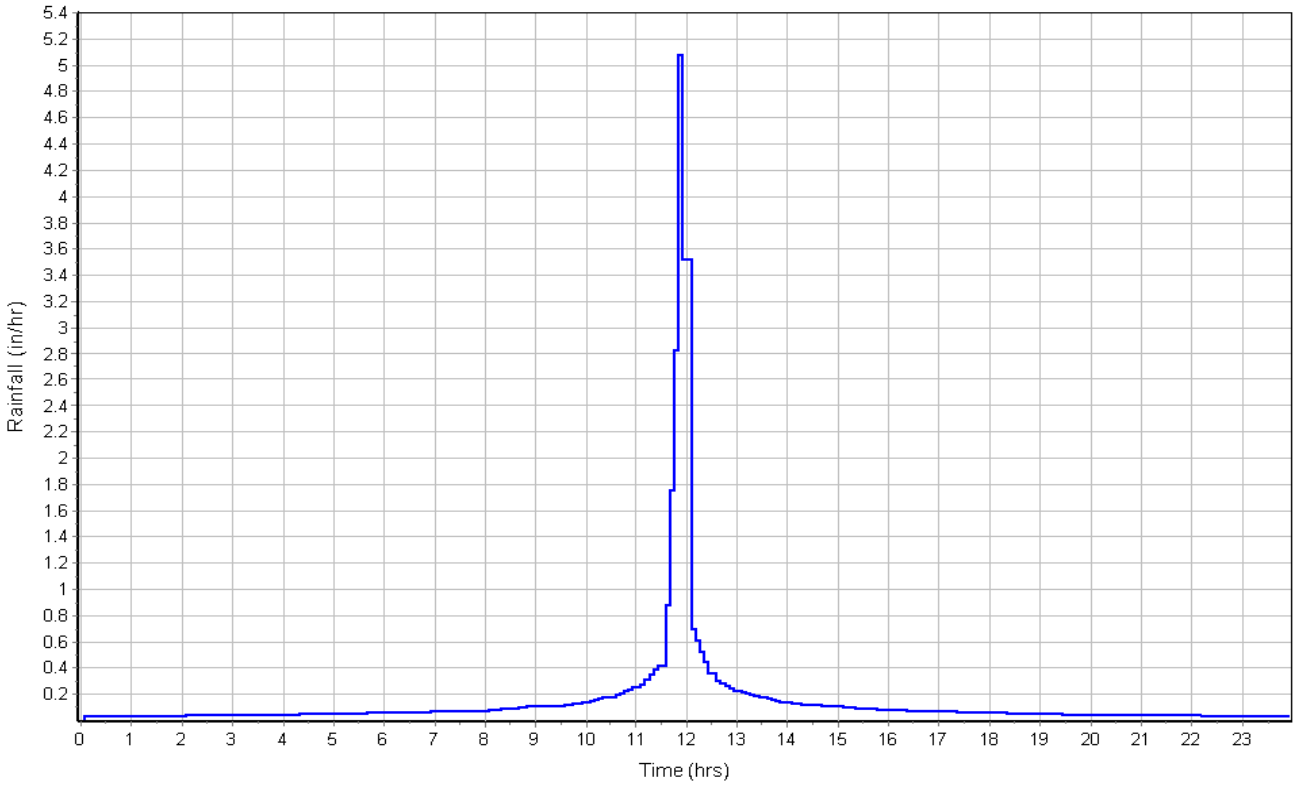
Total TOC (min) 13.42

Subbasin Runoff Results

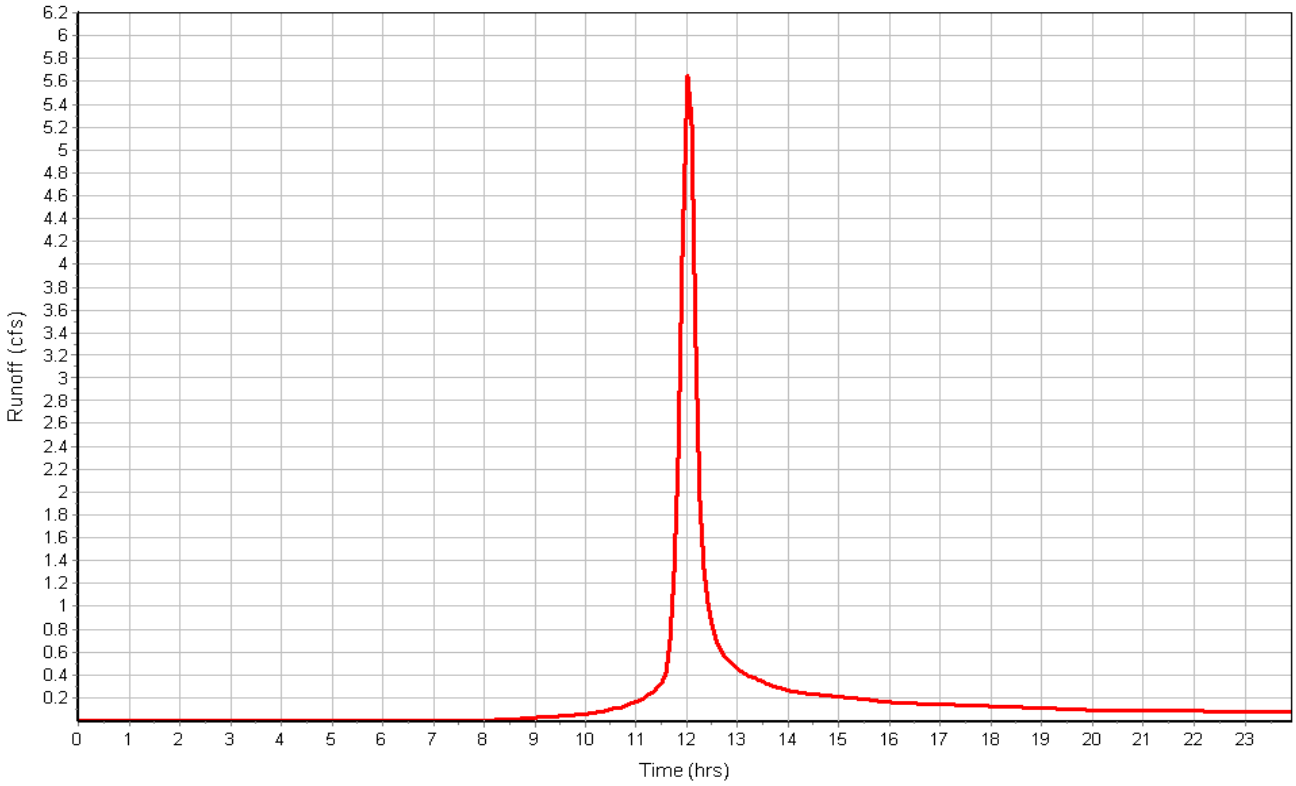
Total Rainfall (in)	3.70
Total Runoff (in)	2.03
Peak Runoff (cfs)	5.77
Weighted Curve Number	83.06
Time of Concentration (days hh:mm:ss)	0 00:13:25

Subbasin : DA6b-Pre

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : DA6c-Post

Input Data

Area (ac) 0.44
Weighted Curve Number 81.16
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.05	C	98.00
50 - 75% grass cover, Fair	0.39	C	79.00
Composite Area & Weighted CN	0.44		81.16

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.15	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	1	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.70	0.00	0.00
Velocity (ft/sec) :	0.16	0.00	0.00
Computed Flow Time (min) :	10.67	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	330	0.00	0.00
Slope (%) :	0.6	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.25	0.00	0.00
Computed Flow Time (min) :	4.40	0.00	0.00

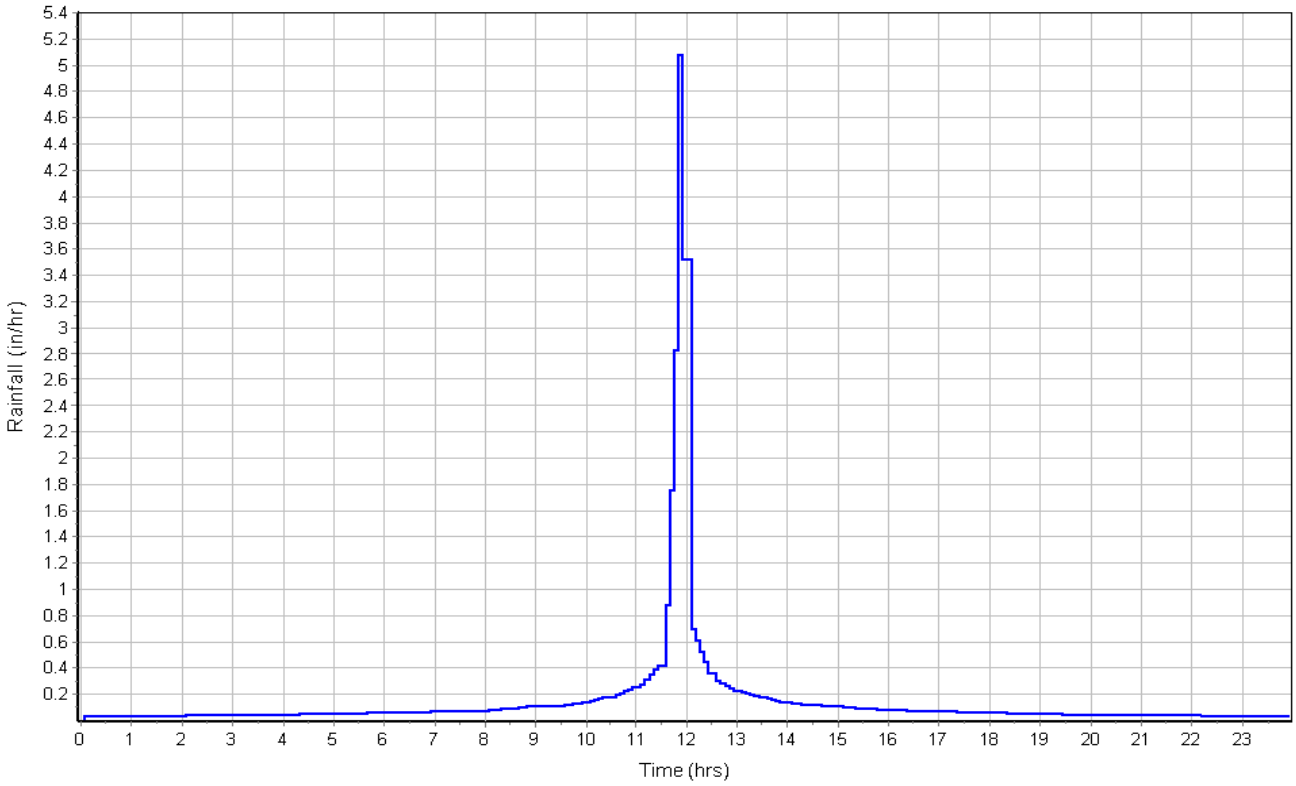
Total TOC (min) 15.07

Subbasin Runoff Results

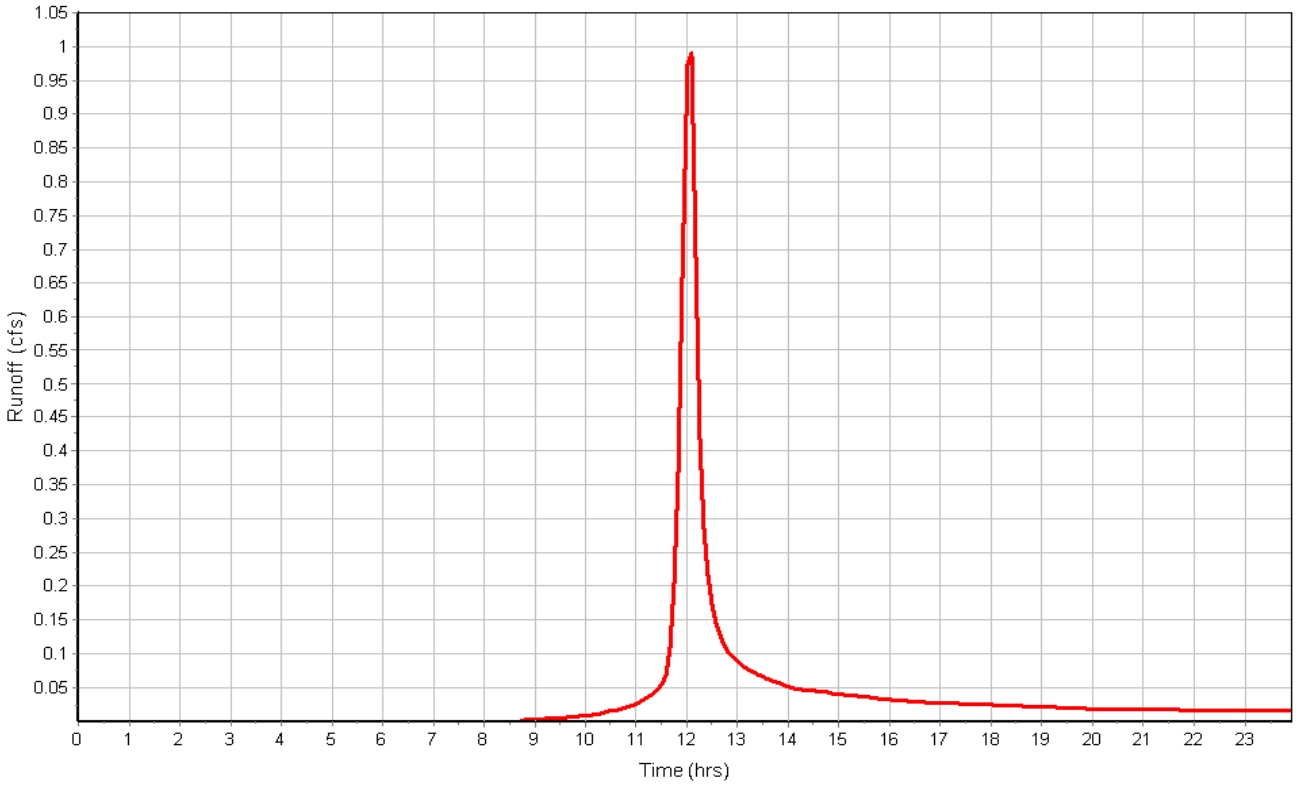
Total Rainfall (in) 3.70
Total Runoff (in) 1.88
Peak Runoff (cfs) 1.03
Weighted Curve Number 81.16
Time of Concentration (days hh:mm:ss) 0 00:15:04

Subbasin : DA6c-Post

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : DA6c-Pre

Input Data

Area (ac) 0.44
Weighted Curve Number 81.16
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.05	C	98.00
50 - 75% grass cover, Fair	0.39	C	79.00
Composite Area & Weighted CN	0.44		81.16

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.15	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	1	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.70	0.00	0.00
Velocity (ft/sec) :	0.16	0.00	0.00
Computed Flow Time (min) :	10.67	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	330	0.00	0.00
Slope (%) :	0.6	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.25	0.00	0.00
Computed Flow Time (min) :	4.40	0.00	0.00

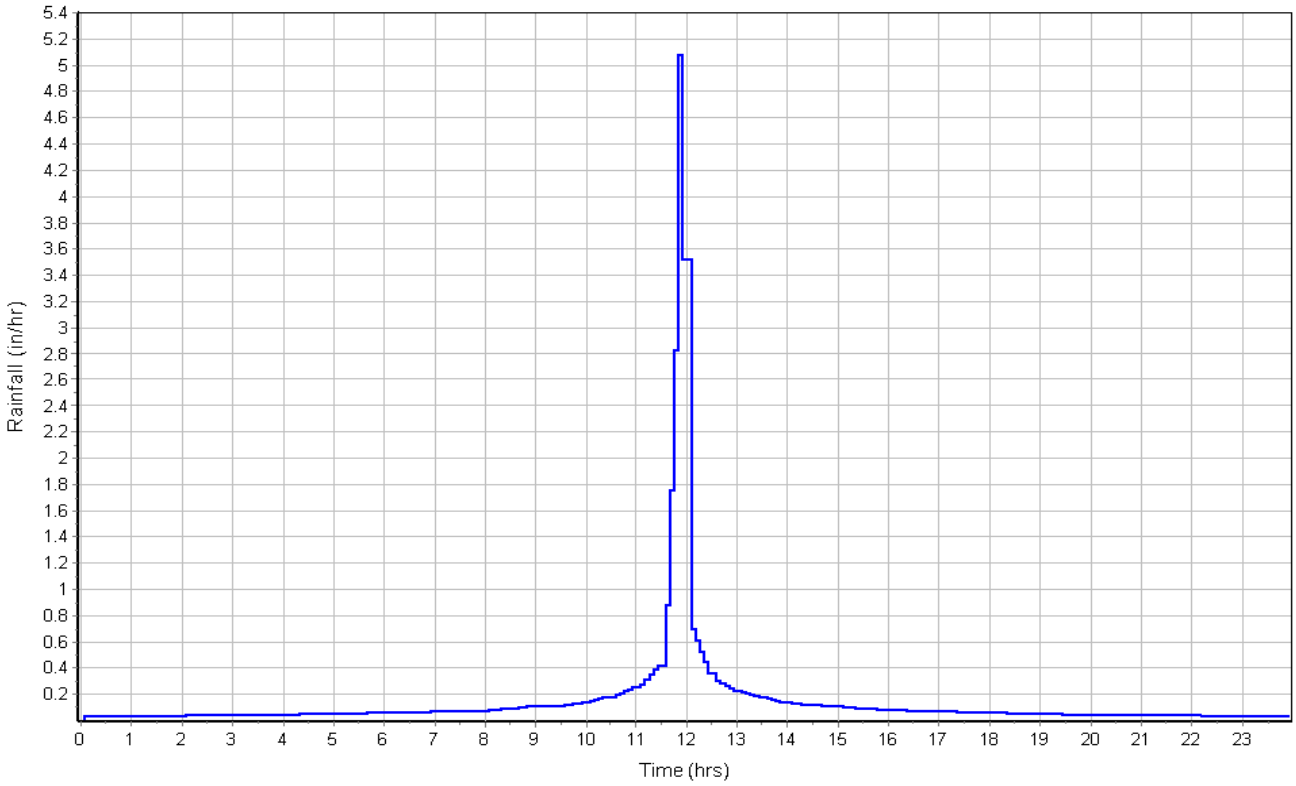
Total TOC (min) 15.07

Subbasin Runoff Results

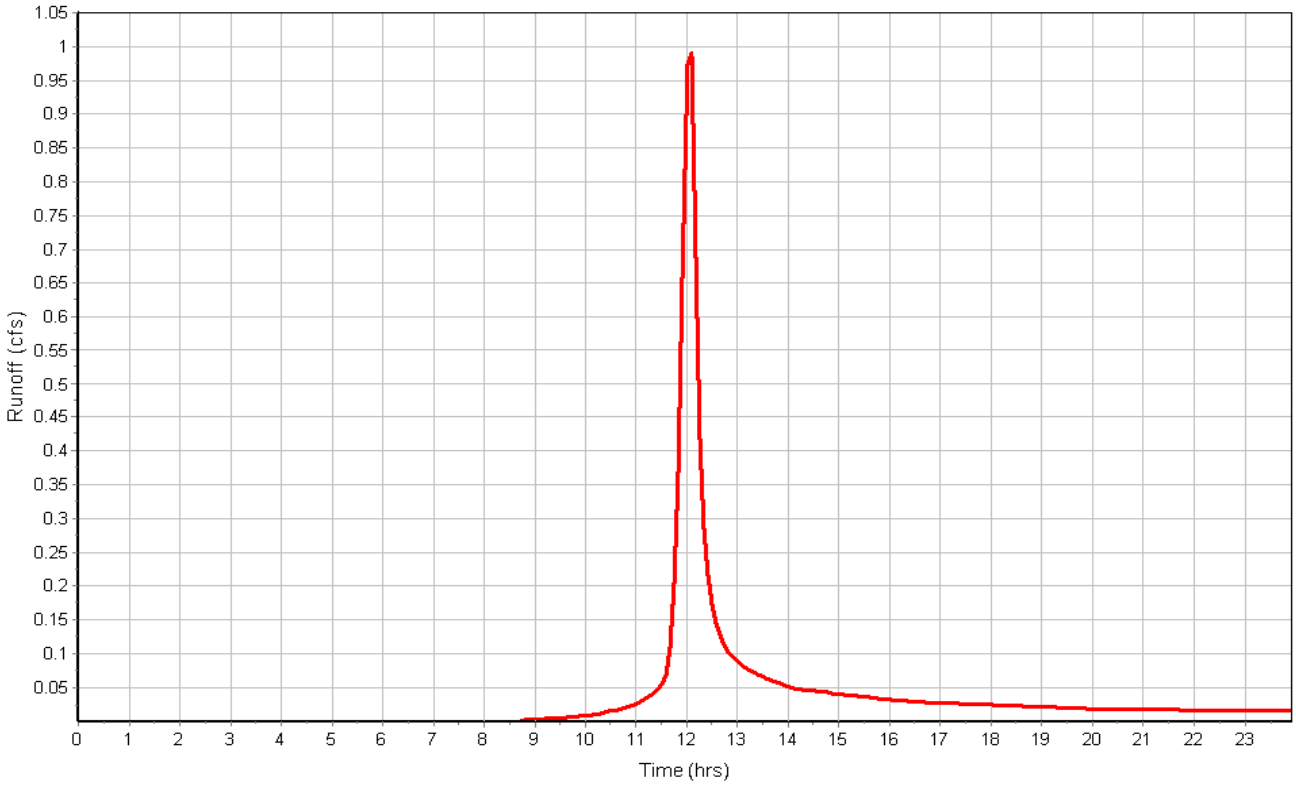
Total Rainfall (in) 3.70
Total Runoff (in) 1.88
Peak Runoff (cfs) 1.03
Weighted Curve Number 81.16
Time of Concentration (days hh:mm:ss) 0 00:15:04

Subbasin : DA6c-Pre

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : DA6d-Post

Input Data

Area (ac) 3.52
Weighted Curve Number 89.58
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	1.96	C	98.00
50 - 75% grass cover, Fair	1.56	C	79.00
Composite Area & Weighted CN	3.52		89.58

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.011	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.70	0.00	0.00
Velocity (ft/sec) :	1.67	0.00	0.00
Computed Flow Time (min) :	1.00	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	900	0.00	0.00
Slope (%) :	2	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	2.28	0.00	0.00
Computed Flow Time (min) :	6.58	0.00	0.00

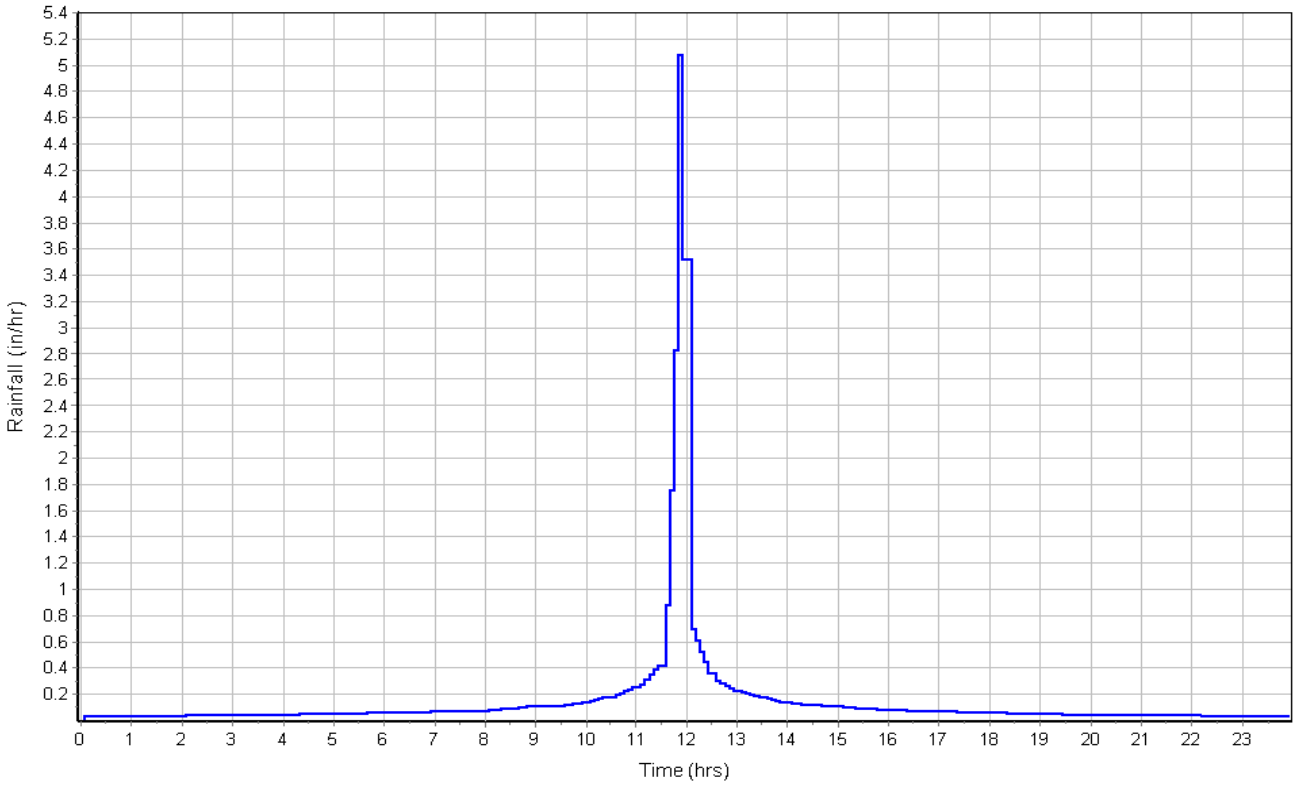
Total TOC (min) 7.58

Subbasin Runoff Results

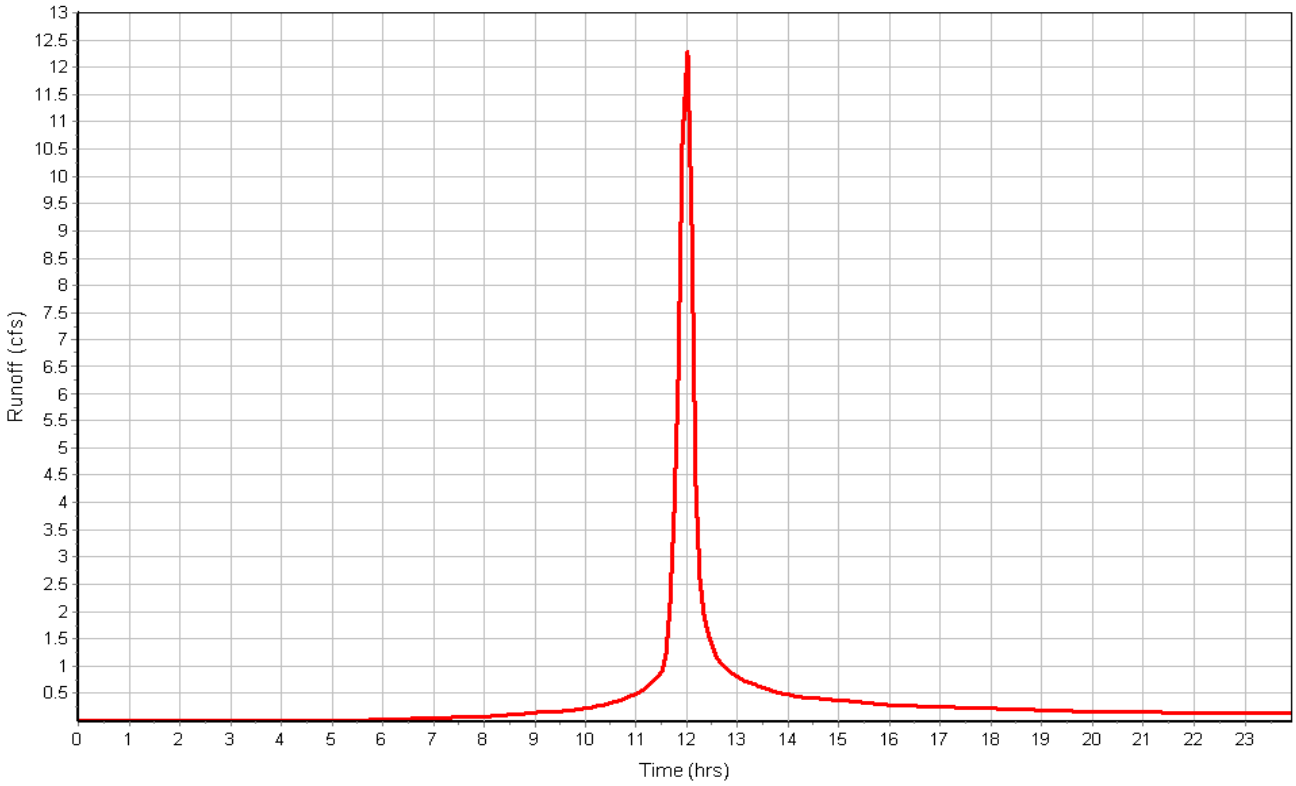
Total Rainfall (in) 3.70
Total Runoff (in) 2.60
Peak Runoff (cfs) 12.40
Weighted Curve Number 89.58
Time of Concentration (days hh:mm:ss) 0 00:07:35

Subbasin : DA6d-Post

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : DA6d-Pre

Input Data

Area (ac) 3.52
Weighted Curve Number 88.77
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	1.81	C	98.00
50 - 75% grass cover, Fair	1.71	C	79.00
Composite Area & Weighted CN	3.52		88.77

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.011	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.70	0.00	0.00
Velocity (ft/sec) :	1.67	0.00	0.00
Computed Flow Time (min) :	1.00	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	900	0.00	0.00
Slope (%) :	2	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	2.28	0.00	0.00
Computed Flow Time (min) :	6.58	0.00	0.00

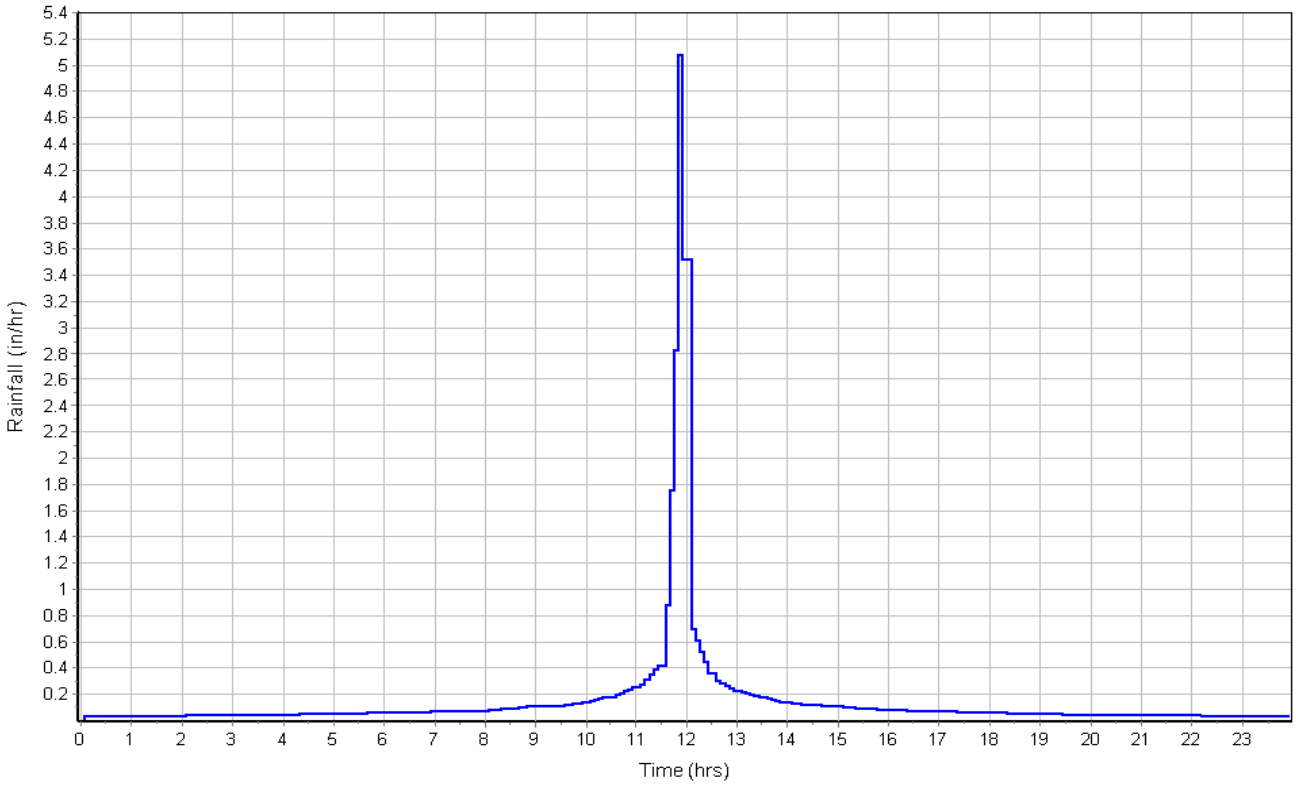
Total TOC (min) 7.58

Subbasin Runoff Results

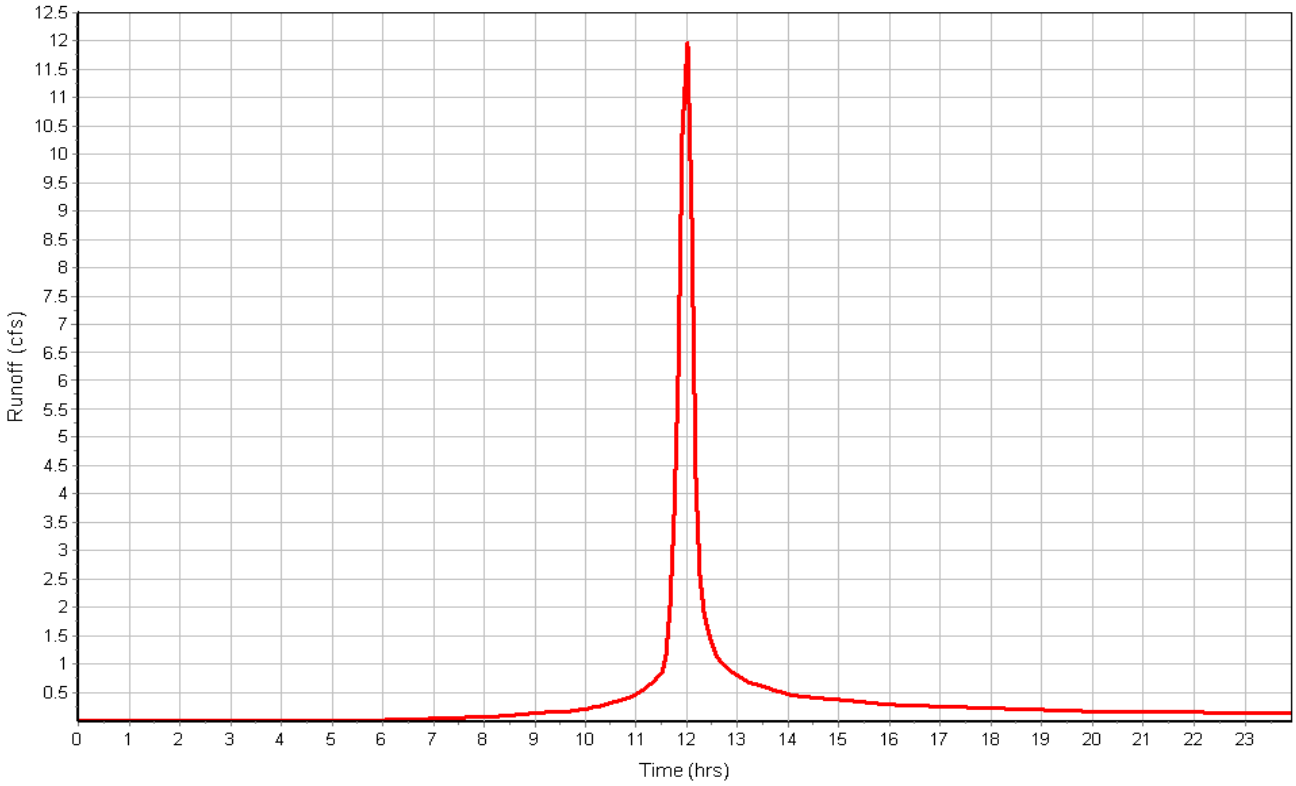
Total Rainfall (in) 3.70
Total Runoff (in) 2.52
Peak Runoff (cfs) 12.09
Weighted Curve Number 88.77
Time of Concentration (days hh:mm:ss) 0 00:07:35

Subbasin : DA6d-Pre

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : DA6e-Post

Input Data

Area (ac) 12.72
Weighted Curve Number 89.04
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	6.72	C	98.00
50 - 75% grass cover, Fair	6.00	C	79.00
Composite Area & Weighted CN	12.72		89.04

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.15	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	1	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.70	0.00	0.00
Velocity (ft/sec) :	0.16	0.00	0.00
Computed Flow Time (min) :	10.67	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	2400	0.00	0.00
Slope (%) :	1	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.61	0.00	0.00
Computed Flow Time (min) :	24.84	0.00	0.00

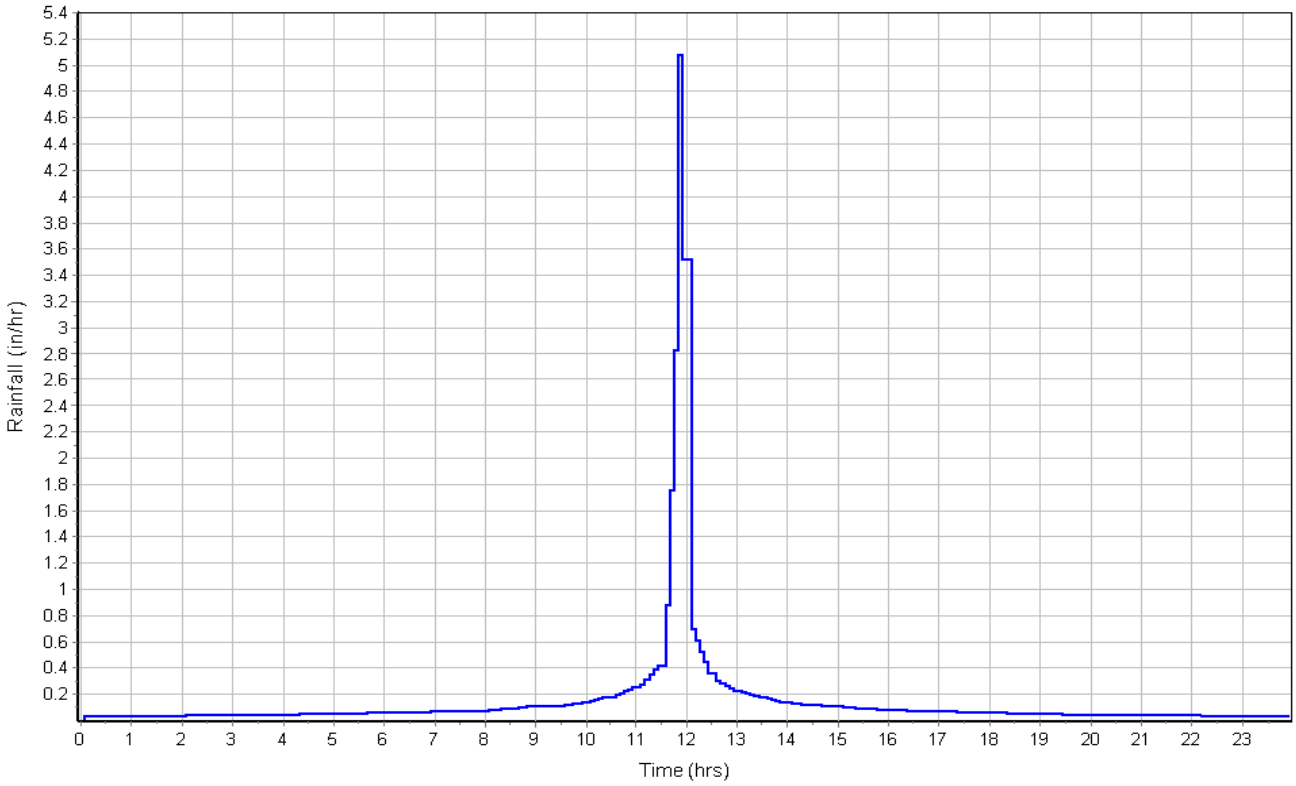
Total TOC (min) 35.51

Subbasin Runoff Results

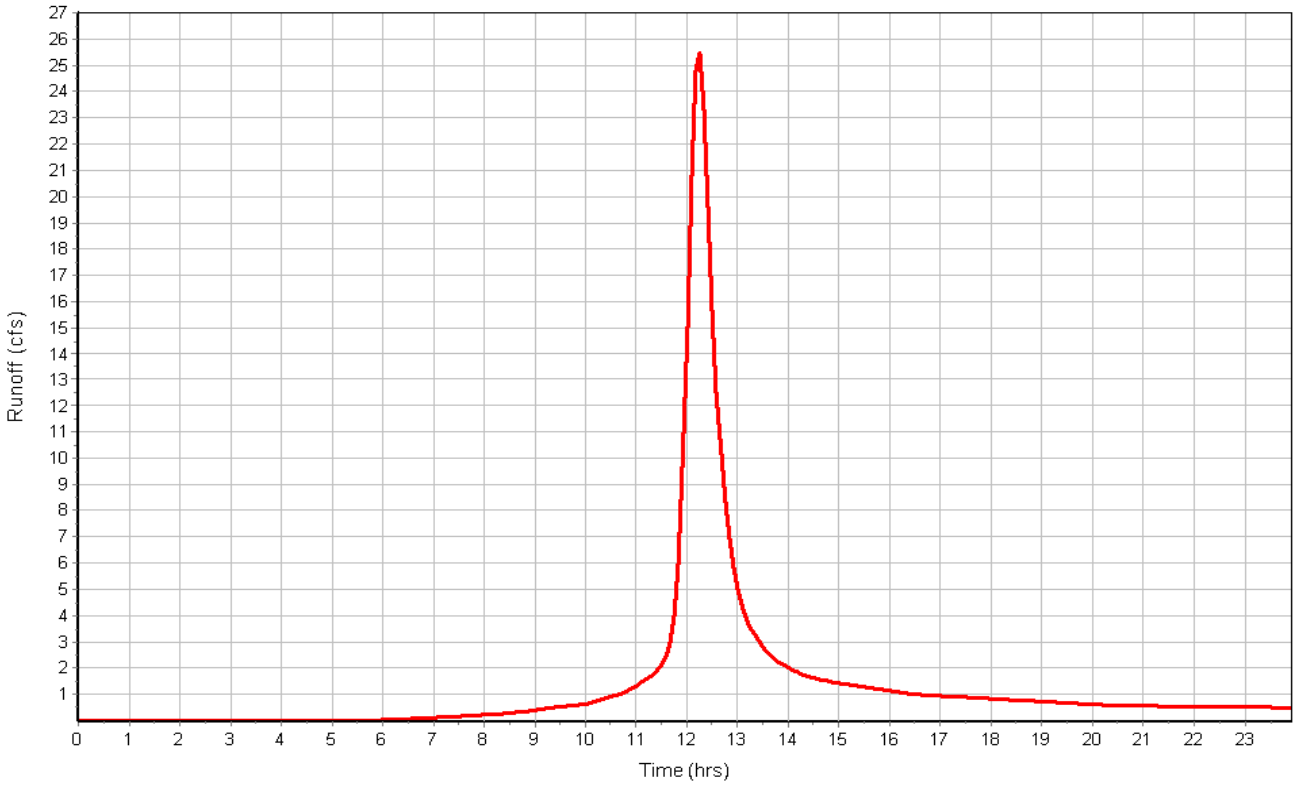
Total Rainfall (in) 3.70
Total Runoff (in) 2.55
Peak Runoff (cfs) 25.60
Weighted Curve Number 89.04
Time of Concentration (days hh:mm:ss) 0 00:35:31

Subbasin : DA6e-Post

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : DA6e-Pre

Input Data

Area (ac)	12.72
Weighted Curve Number	88.04
Rain Gage ID	Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	6.05	C	98.00
50 - 75% grass cover, Fair	6.67	C	79.00
Composite Area & Weighted CN	12.72		88.04

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.15	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	1	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.70	0.00	0.00
Velocity (ft/sec) :	0.16	0.00	0.00
Computed Flow Time (min) :	10.67	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	2400	0.00	0.00
Slope (%) :	1	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.61	0.00	0.00
Computed Flow Time (min) :	24.84	0.00	0.00

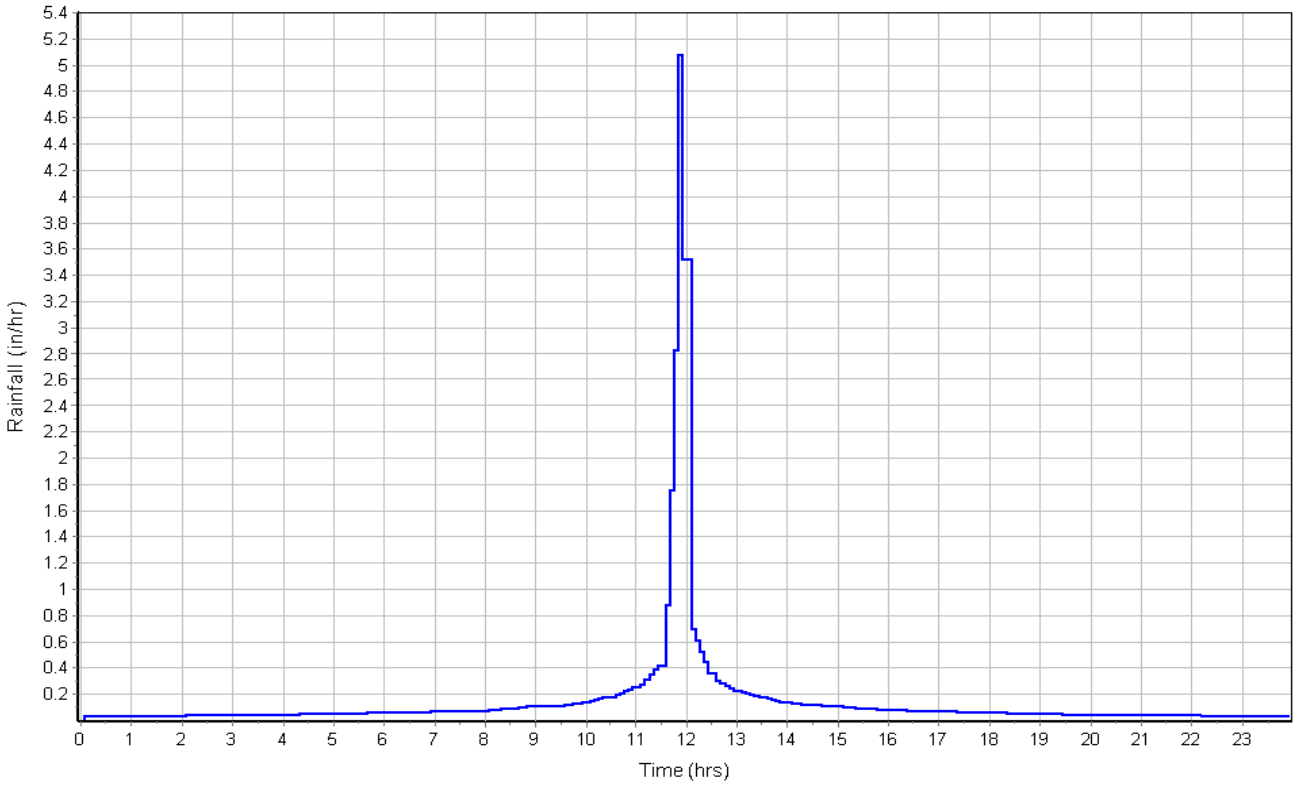
Total TOC (min) 35.51

Subbasin Runoff Results

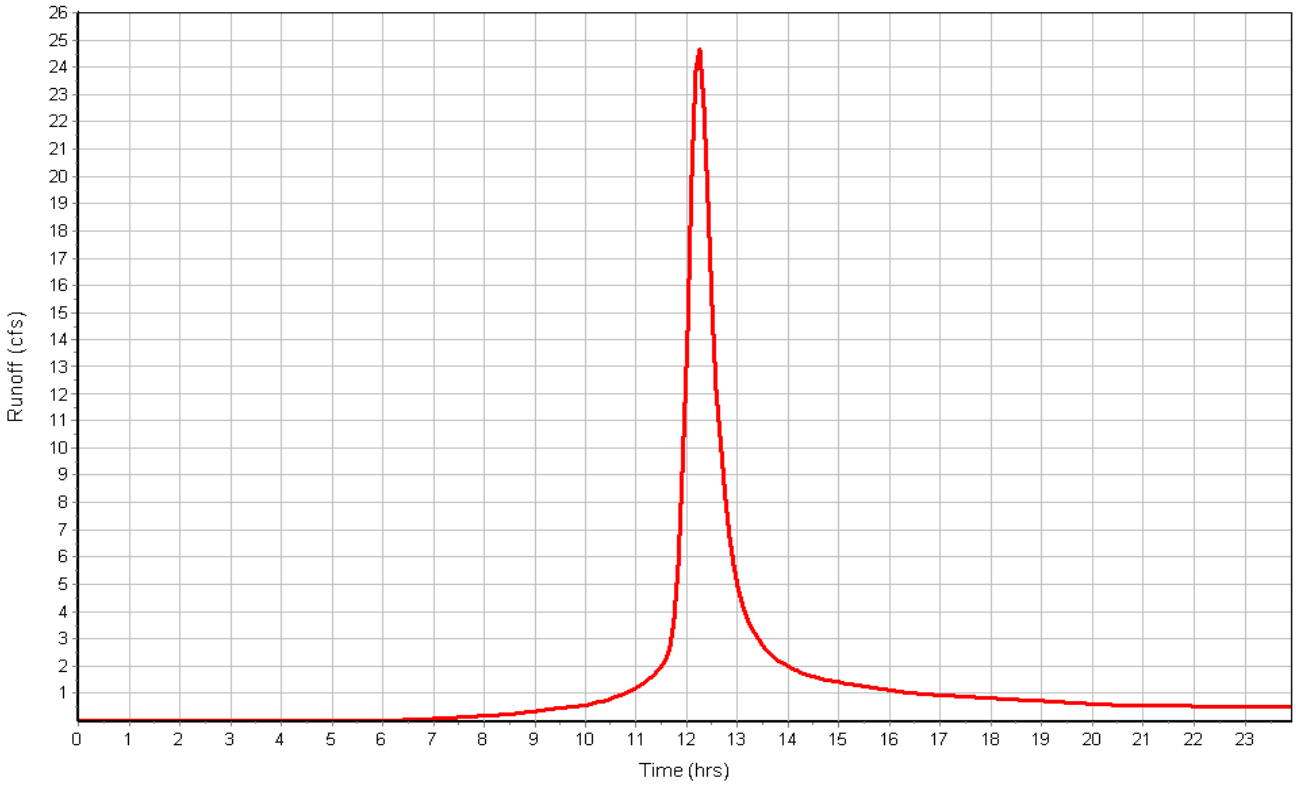
Total Rainfall (in)	3.70
Total Runoff (in)	2.46
Peak Runoff (cfs)	24.77
Weighted Curve Number	88.04
Time of Concentration (days hh:mm:ss)	0 00:35:31

Subbasin : DA6e-Pre

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage Area 7 - Post

Input Data

Area (ac) 20.67
Weighted Curve Number 89.81
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	11.76	C	98.00
50 - 75% grass cover, Fair	8.91	C	79.00
Composite Area & Weighted CN	20.67		89.81

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.15	0.00	0.00
Flow Length (ft) :	200	0.00	0.00
Slope (%) :	1.5	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.70	0.00	0.00
Velocity (ft/sec) :	0.21	0.00	0.00
Computed Flow Time (min) :	15.79	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	900	0.00	0.00
Slope (%) :	2.5	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	2.55	0.00	0.00
Computed Flow Time (min) :	5.88	0.00	0.00

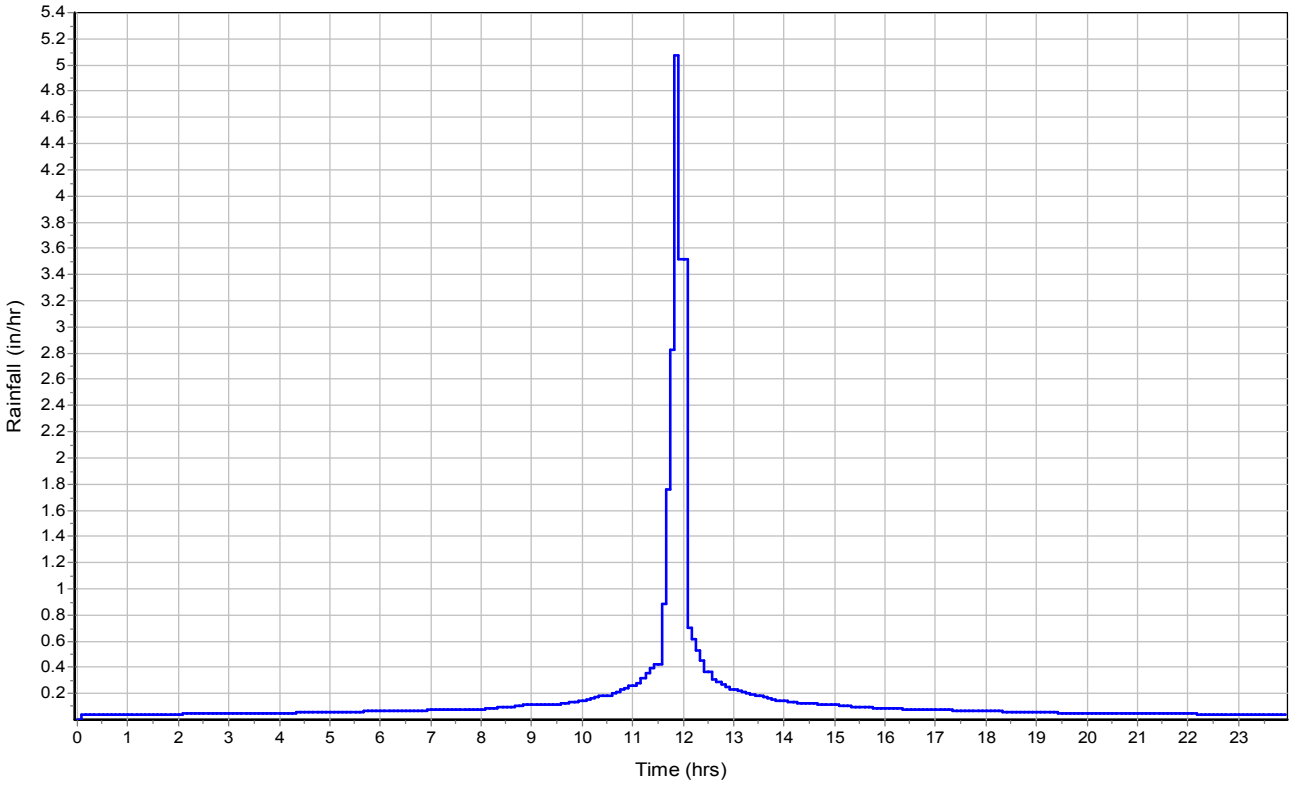
Total TOC (min) 21.68

Subbasin Runoff Results

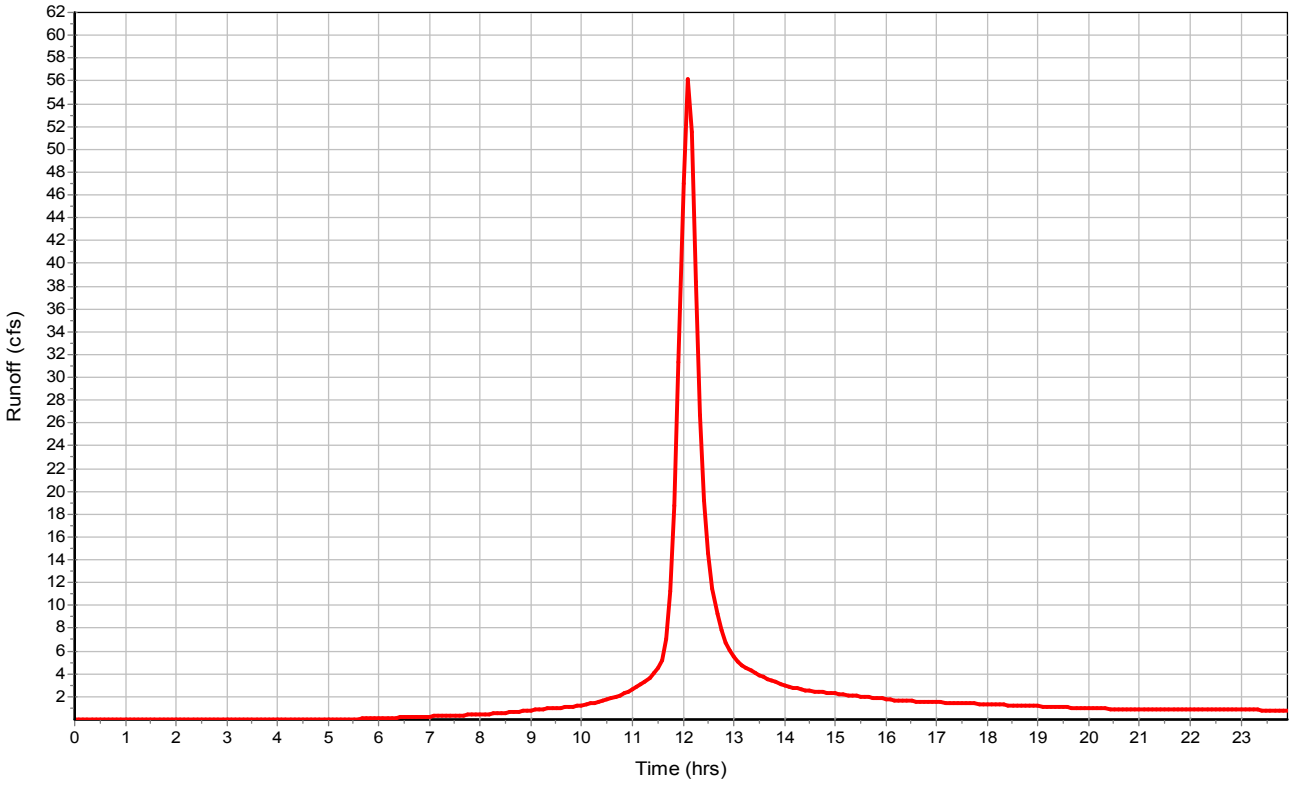
Total Rainfall (in) 3.70
Total Runoff (in) 2.62
Peak Runoff (cfs) 56.37
Weighted Curve Number 89.81
Time of Concentration (days hh:mm:ss) 0 00:21:41

Subbasin : Drainage Area 7 - Post

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage Area 7 - Pre

Input Data

Area (ac)	20.67
Weighted Curve Number	88.80
Rain Gage ID	Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	10.66	C	98.00
50 - 75% grass cover, Fair	10.01	C	79.00
Composite Area & Weighted CN	20.67		88.80

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.15	0.00	0.00
Flow Length (ft) :	200	0.00	0.00
Slope (%) :	1.5	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.70	0.00	0.00
Velocity (ft/sec) :	0.21	0.00	0.00
Computed Flow Time (min) :	15.79	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	900	0.00	0.00
Slope (%) :	2.5	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	2.55	0.00	0.00
Computed Flow Time (min) :	5.88	0.00	0.00

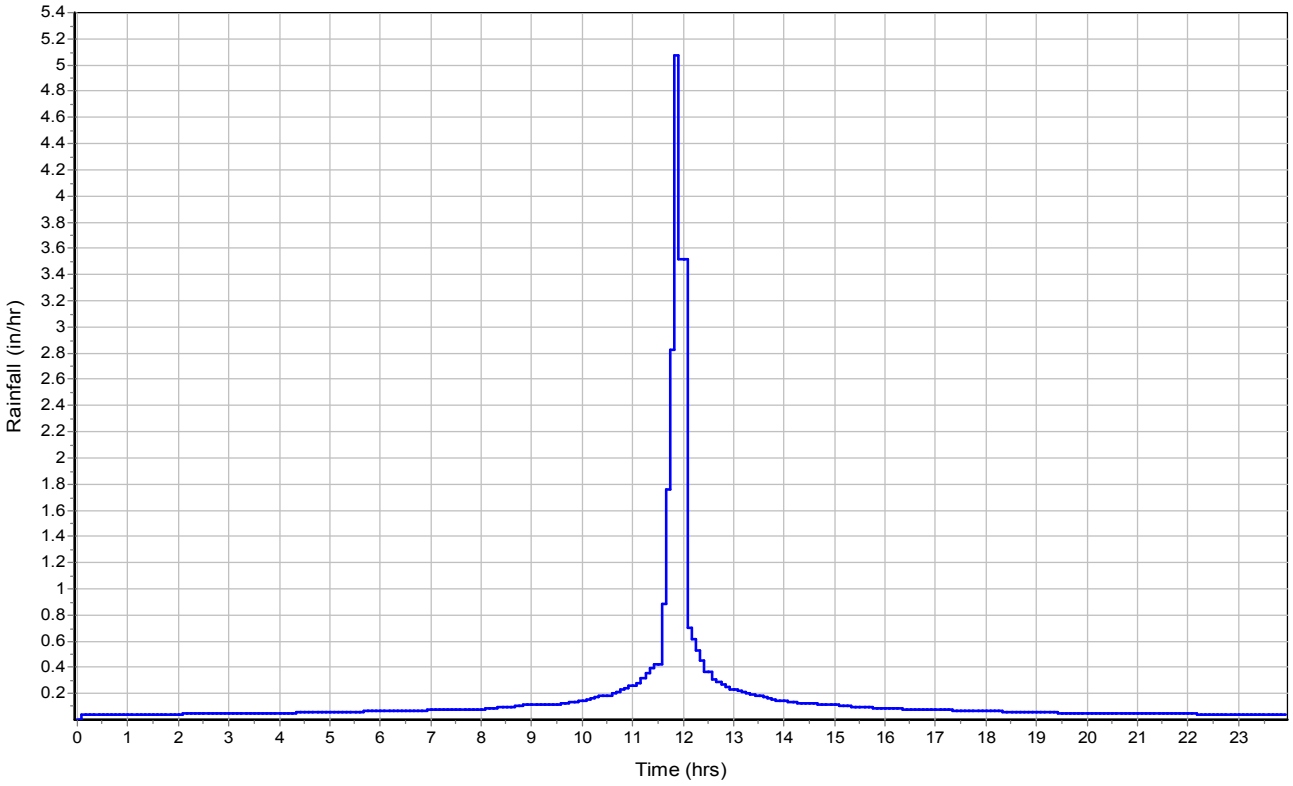
Total TOC (min) 21.68

Subbasin Runoff Results

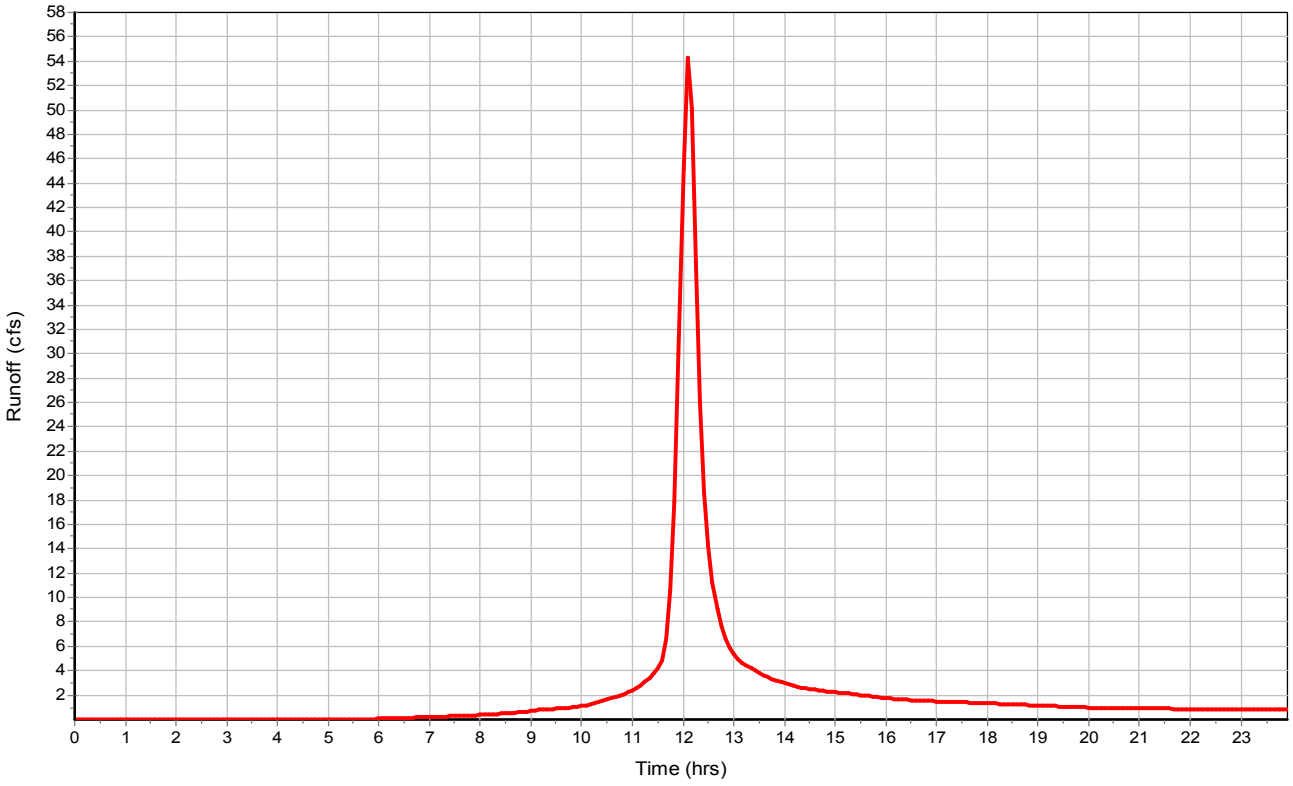
Total Rainfall (in)	3.70
Total Runoff (in)	2.52
Peak Runoff (cfs)	54.69
Weighted Curve Number	88.80
Time of Concentration (days hh:mm:ss)	0 00:21:41

Subbasin : Drainage Area 7 - Pre

Rainfall Intensity Graph



Runoff Hydrograph



Project Description

File Name ..... Pre-Post Hydrographs - DA6 Subareas.SPF
Description .....
I-95@SR21 DDI P.I.0012722

Project Options

Flow Units ..... CFS
Elevation Type ..... Elevation
Hydrology Method ..... SCS TR-55
Time of Concentration (TOC) Method ..... SCS TR-55
Link Routing Method ..... Kinematic Wave
Enable Overflow Ponding at Nodes ..... YES
Skip Steady State Analysis Time Periods ..... NO

Analysis Options

Start Analysis On ..... Nov 13, 2014 00:00:00
End Analysis On ..... Nov 14, 2014 00:00:00
Start Reporting On ..... Nov 13, 2014 00:00:00
Antecedent Dry Days ..... 0 days
Runoff (Dry Weather) Time Step ..... 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step ..... 0 00:05:00 days hh:mm:ss
Reporting Time Step ..... 0 00:05:00 days hh:mm:ss
Routing Time Step ..... 30 seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins	24
Nodes	12
Junctions	0
Outfalls	12
Flow Diversions	0
Inlets	0
Storage Nodes	0
Links	0
Channels	0
Pipes	0
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1		Time Series	25-Year Storm	Cumulative	inches	Georgia	Chatham	25	8.00	SCS Type II 24-hr

Subbasin Summary

SN	Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ft^3)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	DA6a-Post	2.92	87.72	8.00	6.54	69268.39	24.93	0 00:10:00
2	DA6a-Pre	2.92	87.65	8.00	6.53	69183.59	24.93	0 00:10:00
3	DA6b-Post	2.20	83.15	8.00	6.00	47876.07	16.43	0 00:13:25
4	DA6b-Pre	2.20	83.06	8.00	5.98	47788.23	16.40	0 00:13:25
5	DA6c-Post	0.44	81.16	8.00	5.76	9201.47	3.07	0 00:15:04
6	DA6c-Pre	0.44	81.16	8.00	5.76	9201.47	3.07	0 00:15:04
7	DA6d-Post	3.52	89.58	8.00	6.76	86325.47	30.70	0 00:10:00
8	DA6d-Pre	3.52	88.77	8.00	6.66	85086.04	30.45	0 00:10:00
9	DA6e-Post	12.72	89.04	8.00	6.69	308993.74	64.93	0 00:35:30
10	DA6e-Pre	12.72	88.04	8.00	6.57	303499.09	64.29	0 00:35:30
11	Drainage Area 1-Post	5.18	89.16	8.00	6.71	126095.61	30.77	0 00:27:27
12	Drainage Area 1-Pre	5.18	89.16	8.00	6.71	126095.61	30.77	0 00:27:27
13	Drainage Area 2-Post	1.88	85.16	8.00	6.23	42529.66	13.69	0 00:15:49
14	Drainage Area 2-Pre	1.88	84.15	8.00	6.11	41717.56	13.50	0 00:15:49
15	Drainage Area 3-Post	3.00	87.55	8.00	6.52	70948.35	25.59	0 00:10:00
16	Drainage Area 3-Pre	3.00	86.28	8.00	6.36	69303.96	25.19	0 00:10:00
17	Drainage Area 4-Post	1.91	87.36	8.00	6.49	45010.99	16.23	0 00:10:00
18	Drainage Area 4-Pre	1.91	87.36	8.00	6.49	45010.99	16.23	0 00:10:00
19	Drainage Area 5 - Post	8.14	88.94	8.00	6.68	197381.98	61.64	0 00:16:09
20	Drainage Area 5 - Pre	8.14	88.06	8.00	6.58	194279.42	60.98	0 00:16:09
21	Drainage Area 6 - Post	21.80	88.21	8.00	6.59	521730.48	142.55	0 00:22:19
22	Drainage Area 6 - Pre	21.80	87.48	8.00	6.51	514924.96	141.46	0 00:22:19
23	Drainage Area 7 - Post	20.67	89.81	8.00	6.78	508942.76	139.48	0 00:21:40
24	Drainage Area 7 - Pre	20.67	88.80	8.00	6.66	499938.90	137.98	0 00:21:40

Subbasin Hydrology

Subbasin : Drainage Area 1-Post

Input Data

Area (ac) 5.18
Weighted Curve Number 89.16
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	2.77	C	98.00
50 - 75% grass cover, Fair	2.41	C	79.00
Composite Area & Weighted CN	5.18		89.16

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.011	0.00	0.00
Flow Length (ft) :	115	0.00	0.00
Slope (%) :	0.4	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.7	0.00	0.00
Velocity (ft/sec) :	0.90	0.00	0.00
Computed Flow Time (min) :	2.13	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	1550	0.00	0.00
Slope (%) :	0.4	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.02	0.00	0.00
Computed Flow Time (min) :	25.33	0.00	0.00

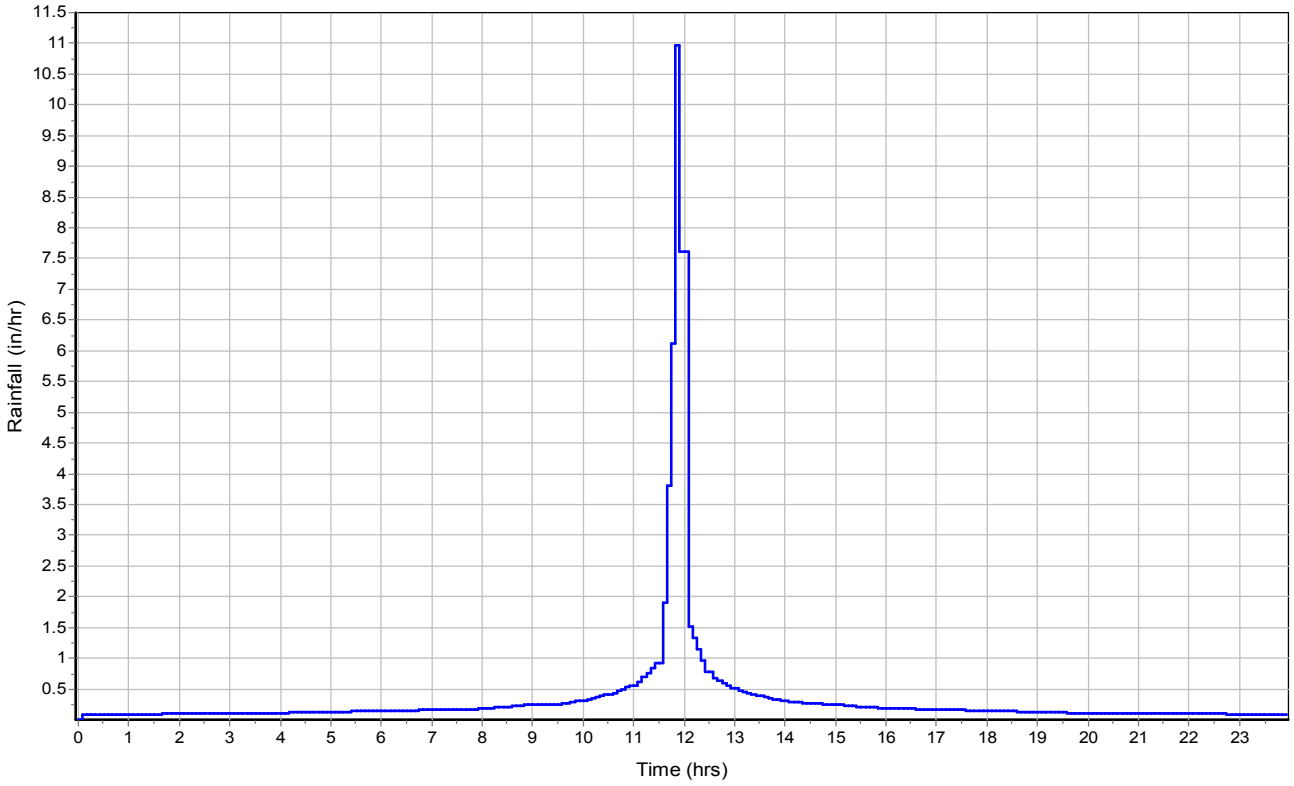
Total TOC (min) 27.46

Subbasin Runoff Results

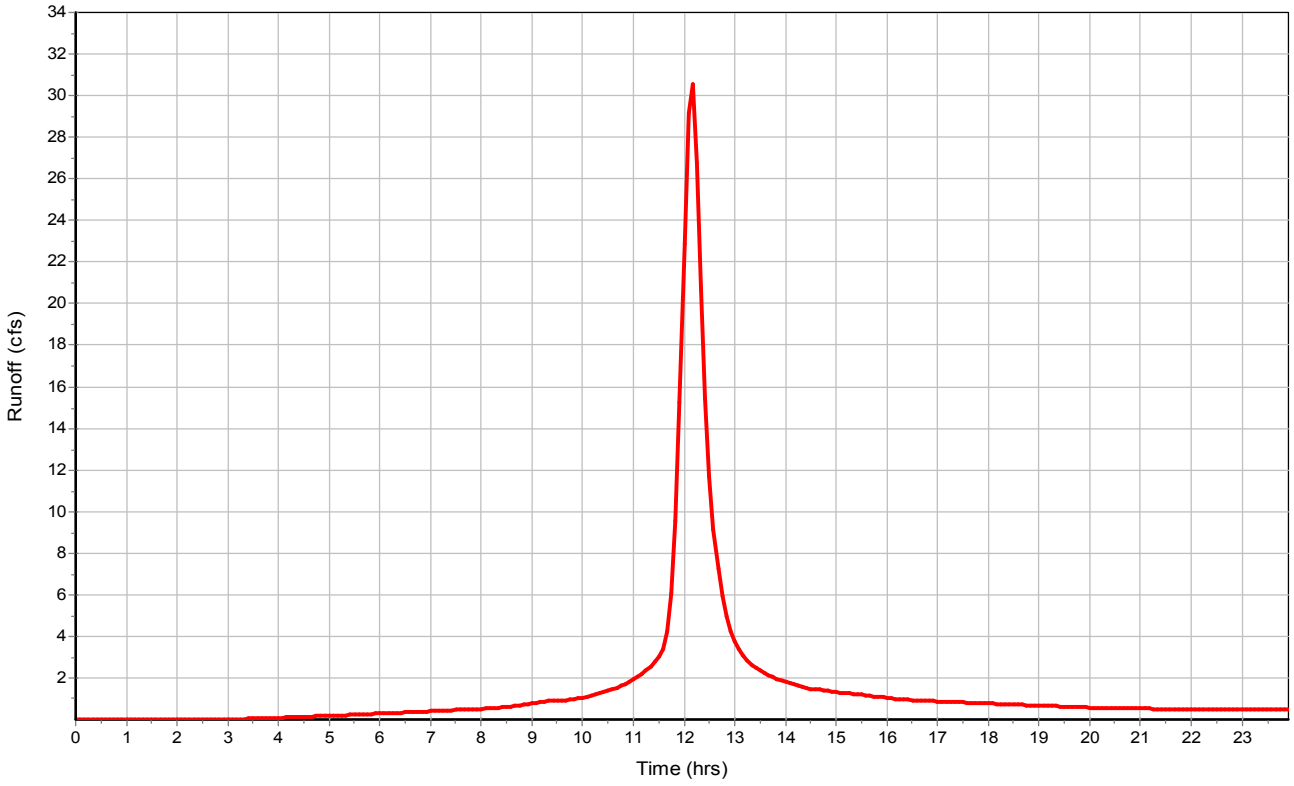
Total Rainfall (in)	8.00
Total Runoff (in)	6.71
Peak Runoff (cfs)	30.77
Weighted Curve Number	89.16
Time of Concentration (days hh:mm:ss)	0 00:27:28

Subbasin : Drainage Area 1-Post

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage Area 1-Pre

Input Data

Area (ac)	5.18
Weighted Curve Number	89.16
Rain Gage ID	Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	2.77	C	98.00
50 - 75% grass cover, Fair	2.41	C	79.00
Composite Area & Weighted CN	5.18		89.16

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.011	0.00	0.00
Flow Length (ft) :	115	0.00	0.00
Slope (%) :	0.4	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.7	0.00	0.00
Velocity (ft/sec) :	0.90	0.00	0.00
Computed Flow Time (min) :	2.13	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	1550	0.00	0.00
Slope (%) :	0.4	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.02	0.00	0.00
Computed Flow Time (min) :	25.33	0.00	0.00

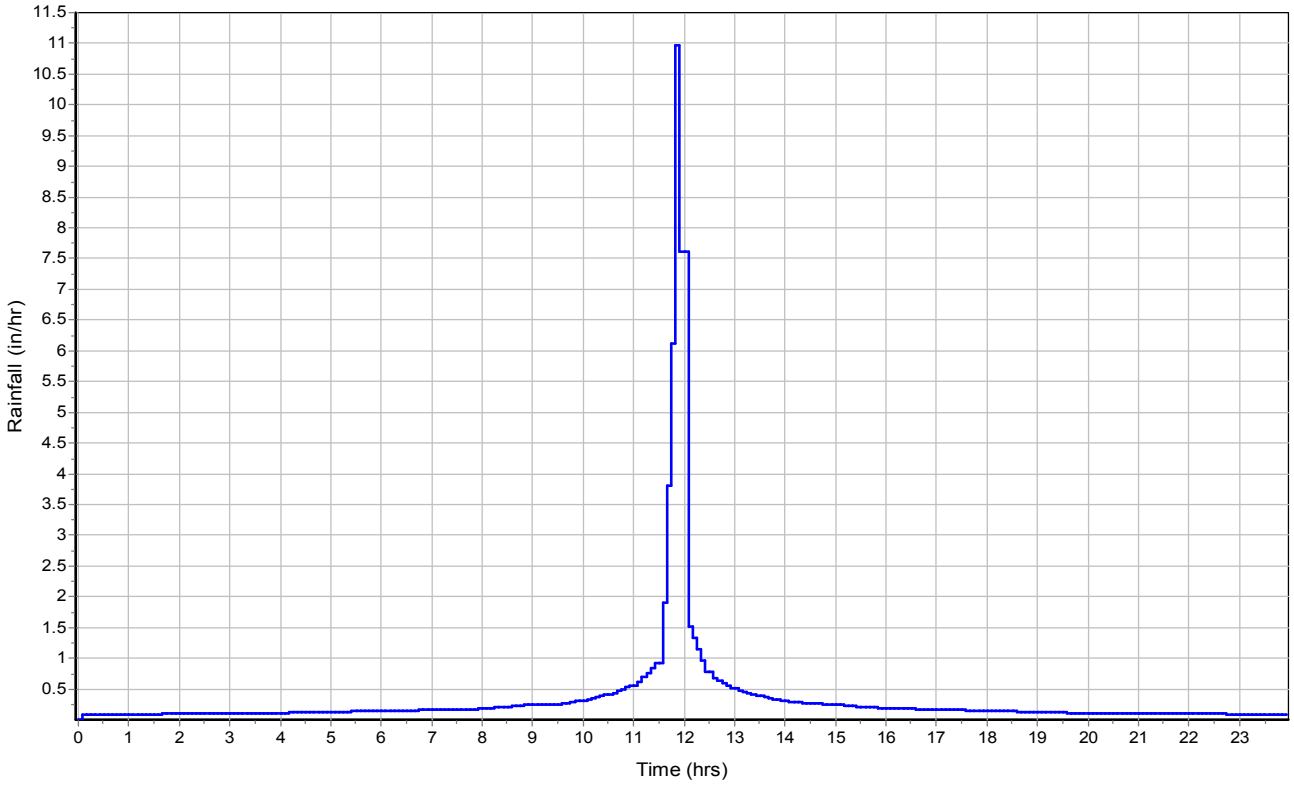
Total TOC (min) 27.46

Subbasin Runoff Results

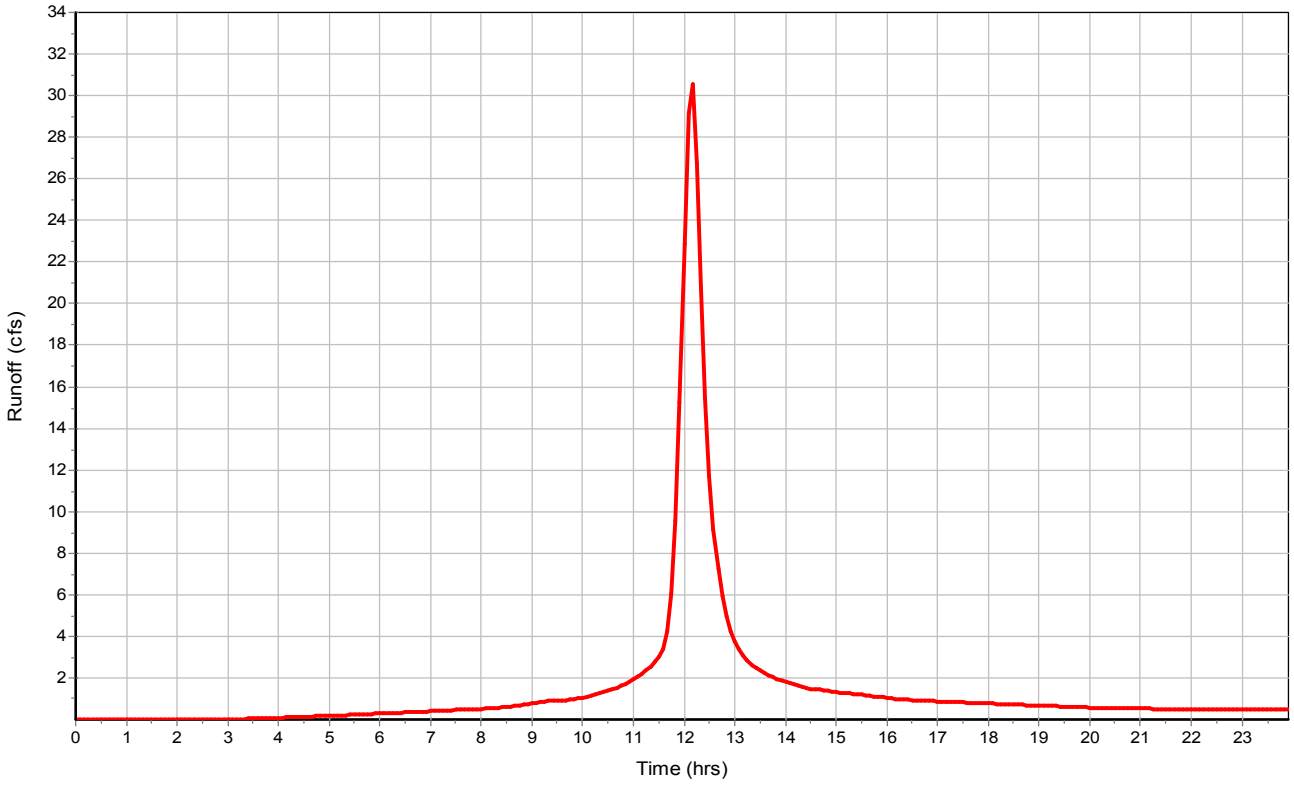
Total Rainfall (in)	8.00
Total Runoff (in)	6.71
Peak Runoff (cfs)	30.77
Weighted Curve Number	89.16
Time of Concentration (days hh:mm:ss)	0 00:27:28

Subbasin : Drainage Area 1-Pre

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage Area 2-Post

Input Data

Area (ac) 1.88
Weighted Curve Number 85.16
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.61	C	98.00
50 - 75% grass cover, Fair	1.27	C	79.00
Composite Area & Weighted CN	1.88		85.16

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.011	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	2.5	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.7	0.00	0.00
Velocity (ft/sec) :	1.82	0.00	0.00
Computed Flow Time (min) :	0.91	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	1020	0.00	0.00
Slope (%) :	0.5	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.14	0.00	0.00
Computed Flow Time (min) :	14.91	0.00	0.00

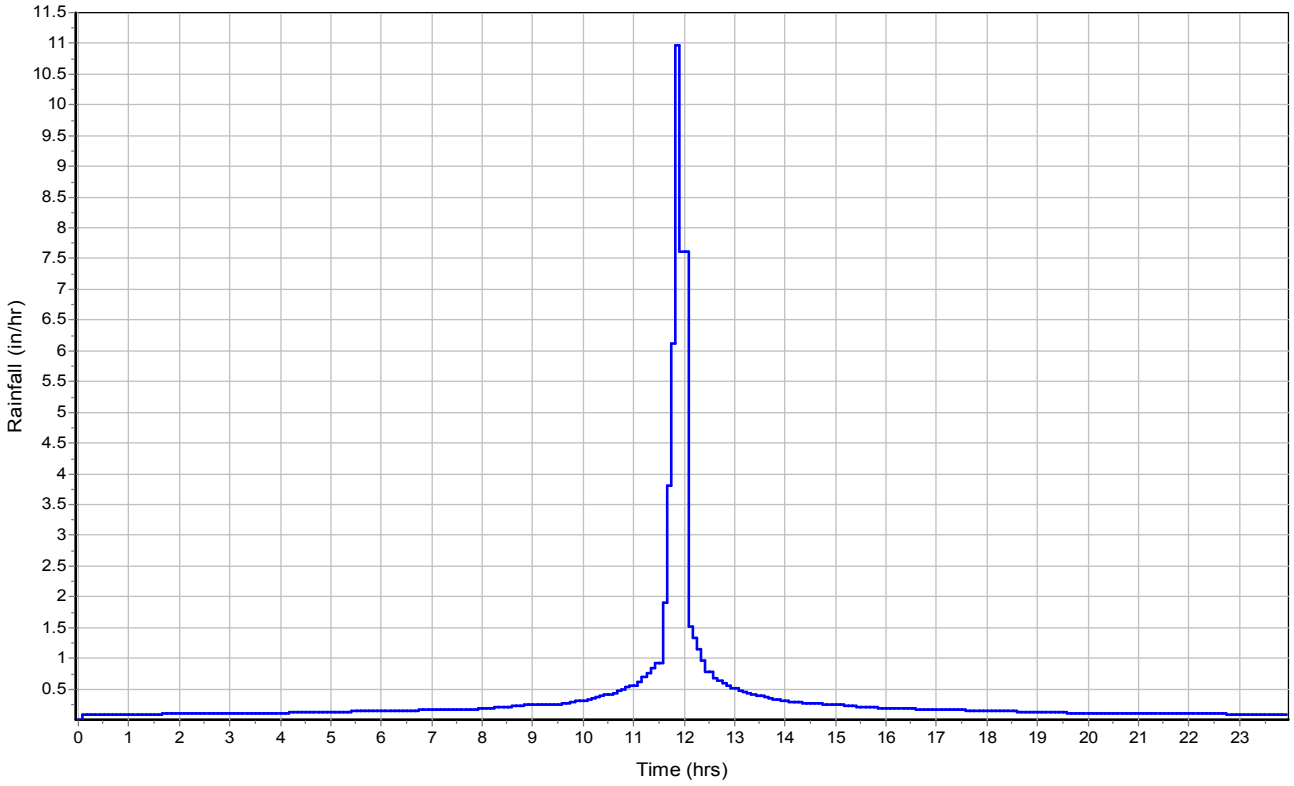
Total TOC (min) 15.83

Subbasin Runoff Results

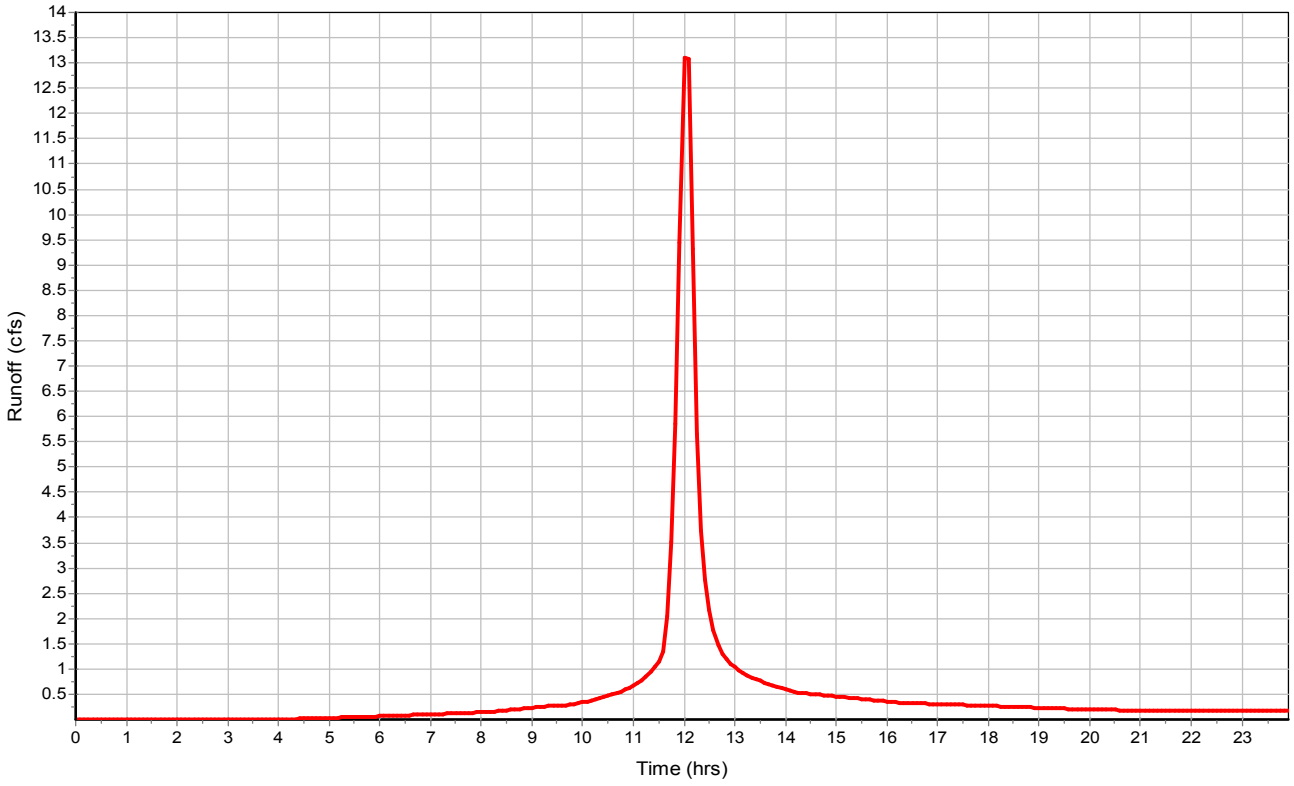
Total Rainfall (in) 8.00
Total Runoff (in) 6.23
Peak Runoff (cfs) 13.69
Weighted Curve Number 85.16
Time of Concentration (days hh:mm:ss) 0 00:15:50

Subbasin : Drainage Area 2-Post

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage Area 2-Pre

Input Data

Area (ac)	1.88
Weighted Curve Number	84.15
Rain Gage ID	Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.51	C	98.00
50 - 75% grass cover, Fair	1.37	C	79.00
Composite Area & Weighted CN	1.88		84.15

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.011	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	2.5	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.7	0.00	0.00
Velocity (ft/sec) :	1.82	0.00	0.00
Computed Flow Time (min) :	0.91	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	1020	0.00	0.00
Slope (%) :	0.5	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.14	0.00	0.00
Computed Flow Time (min) :	14.91	0.00	0.00

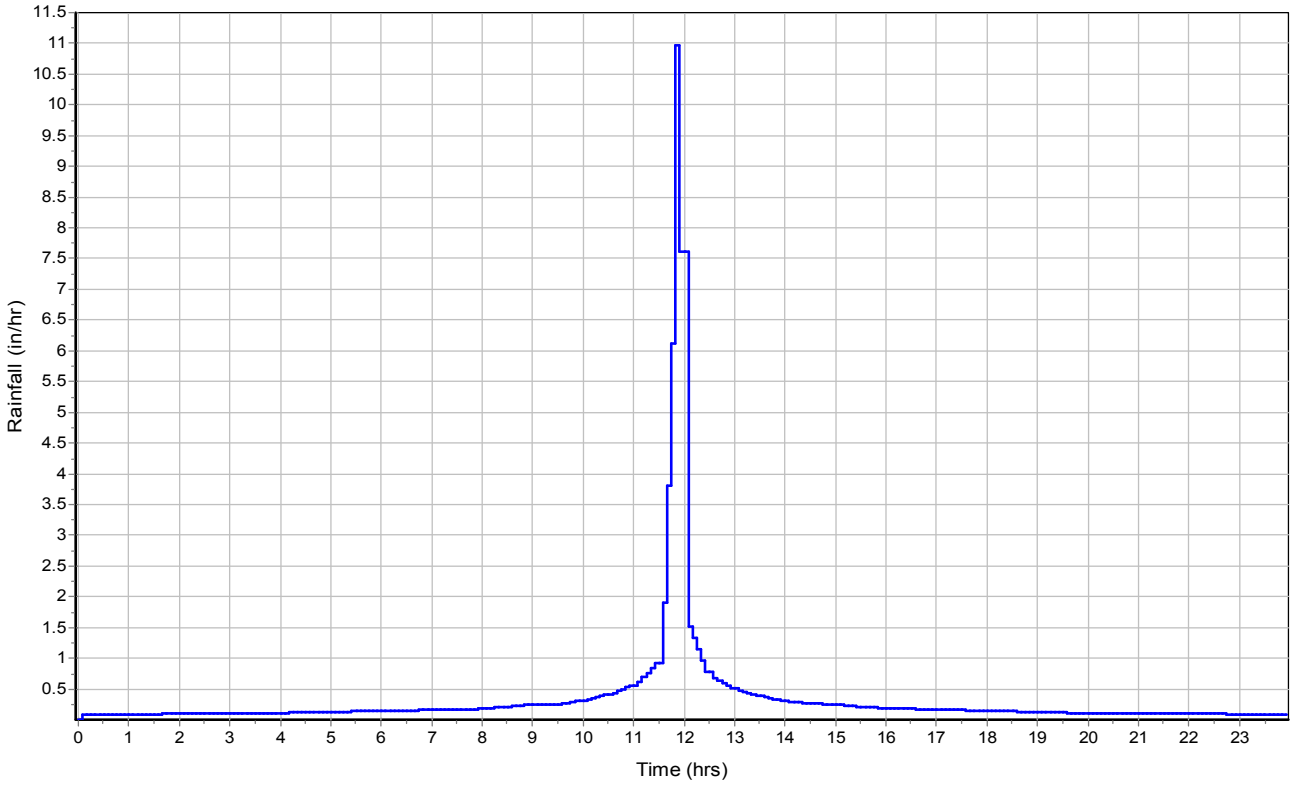
Total TOC (min) 15.83

Subbasin Runoff Results

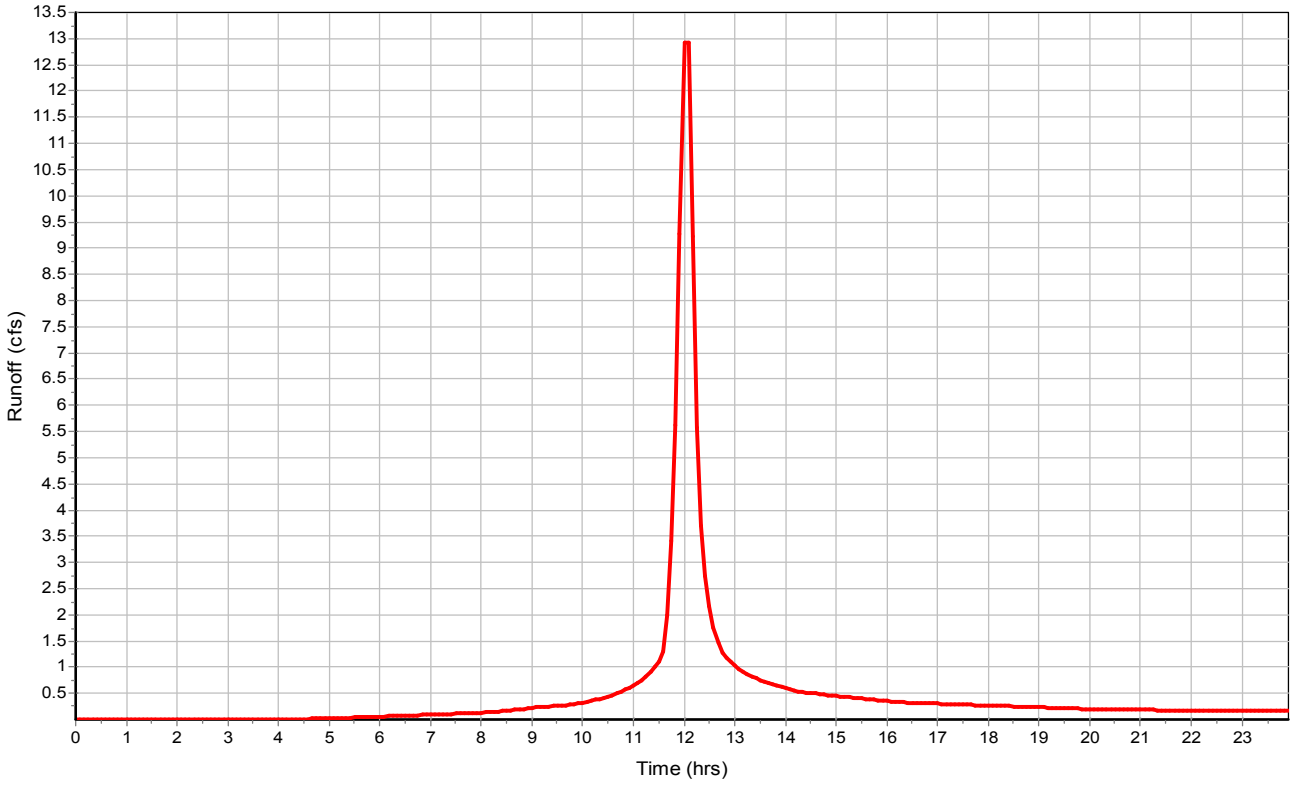
Total Rainfall (in)	8.00
Total Runoff (in)	6.11
Peak Runoff (cfs)	13.50
Weighted Curve Number	84.15
Time of Concentration (days hh:mm:ss)	0 00:15:50

Subbasin : Drainage Area 2-Pre

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage Area 3-Post

Input Data

Area (ac) 3.00
Weighted Curve Number 87.55
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	1.35	C	98.00
50 - 75% grass cover, Fair	1.65	C	79.00
Composite Area & Weighted CN	3.00		87.55

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.011	0.00	0.00
Flow Length (ft) :	250	0.00	0.00
Slope (%) :	1.6	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.7	0.00	0.00
Velocity (ft/sec) :	1.83	0.00	0.00
Computed Flow Time (min) :	2.28	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	400	0.00	0.00
Slope (%) :	0.9	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.53	0.00	0.00
Computed Flow Time (min) :	4.36	0.00	0.00

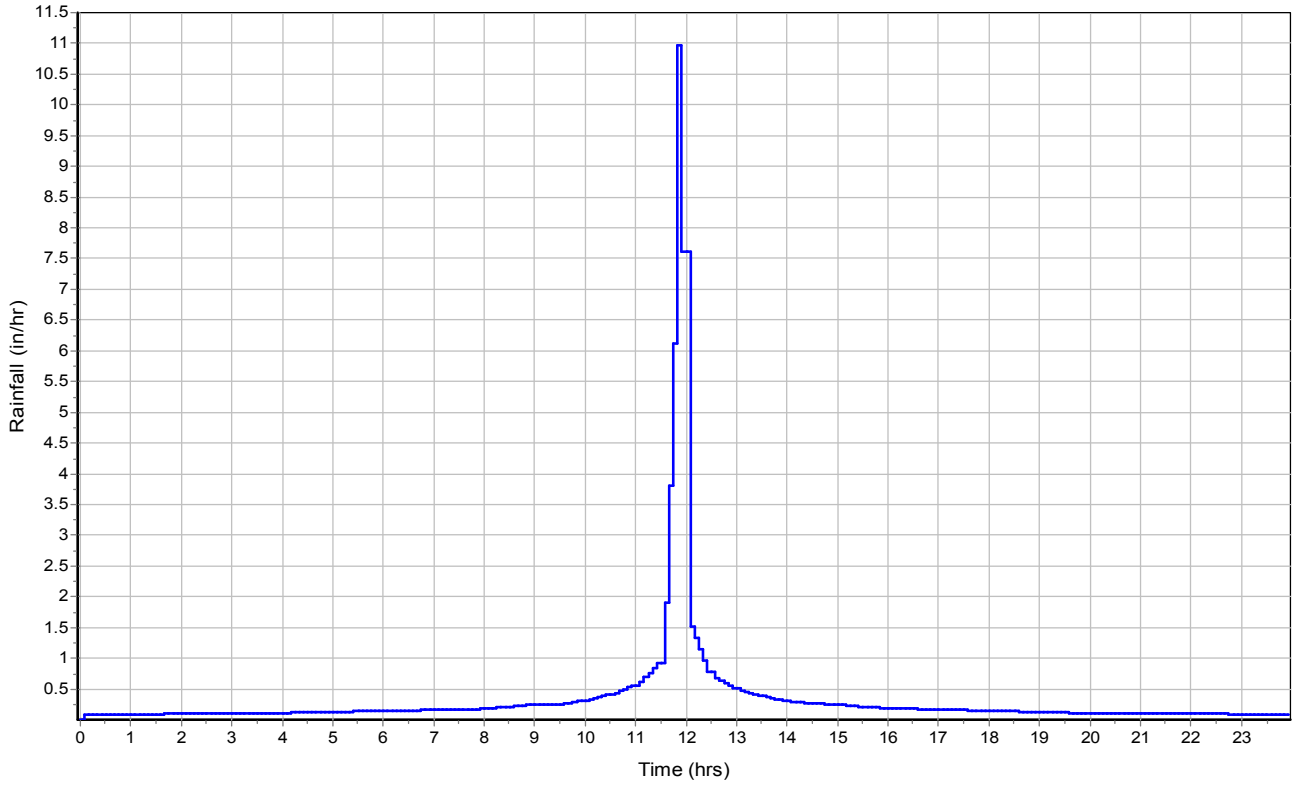
Total TOC (min) 6.63

Subbasin Runoff Results

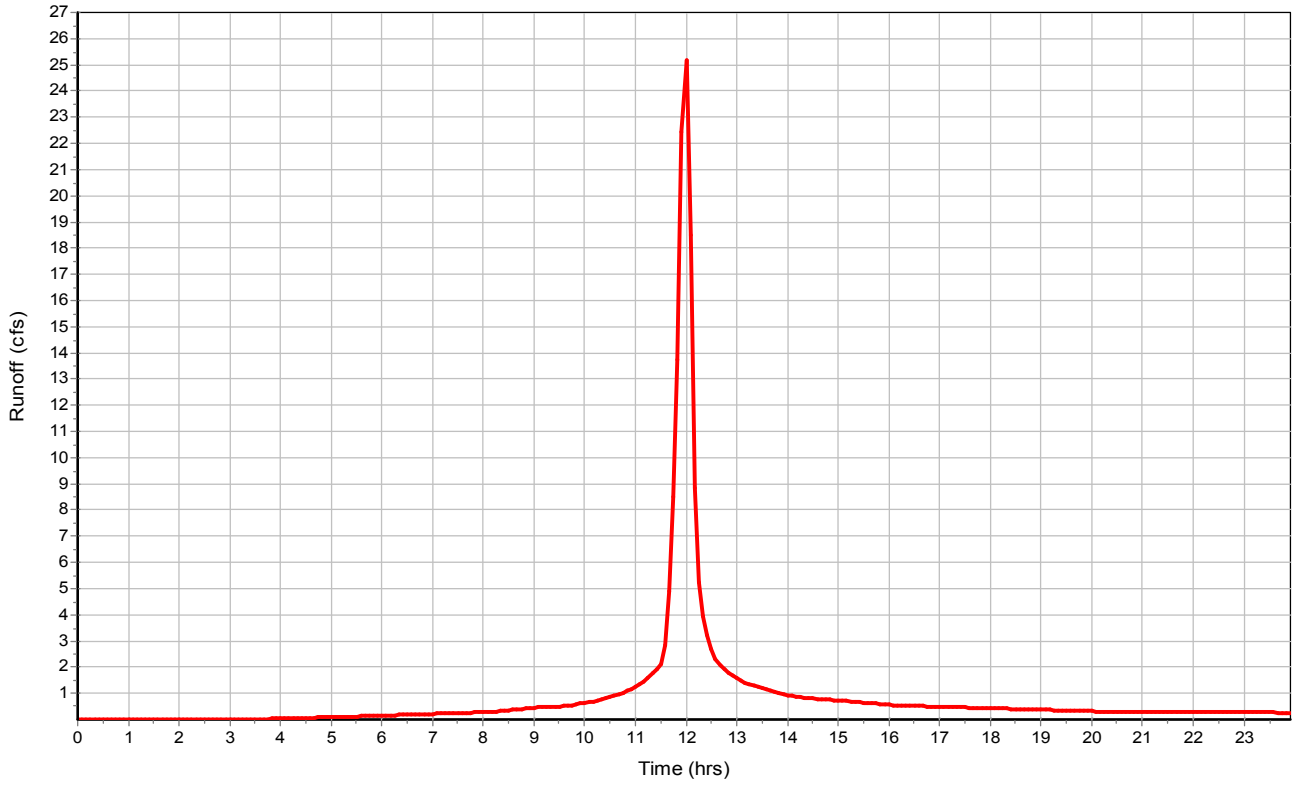
Total Rainfall (in) 8.00
Total Runoff (in) 6.52
Peak Runoff (cfs) 25.59
Weighted Curve Number 87.55
Time of Concentration (days hh:mm:ss) 0 00:06:38

Subbasin : Drainage Area 3-Post

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage Area 3-Pre

Input Data

Area (ac)	3.00
Weighted Curve Number	86.28
Rain Gage ID	Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	1.15	C	98.00
50 - 75% grass cover, Fair	1.85	C	79.00
Composite Area & Weighted CN	3.00		86.28

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.011	0.00	0.00
Flow Length (ft) :	250	0.00	0.00
Slope (%) :	1.6	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.7	0.00	0.00
Velocity (ft/sec) :	1.83	0.00	0.00
Computed Flow Time (min) :	2.28	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	400	0.00	0.00
Slope (%) :	0.9	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.53	0.00	0.00
Computed Flow Time (min) :	4.36	0.00	0.00

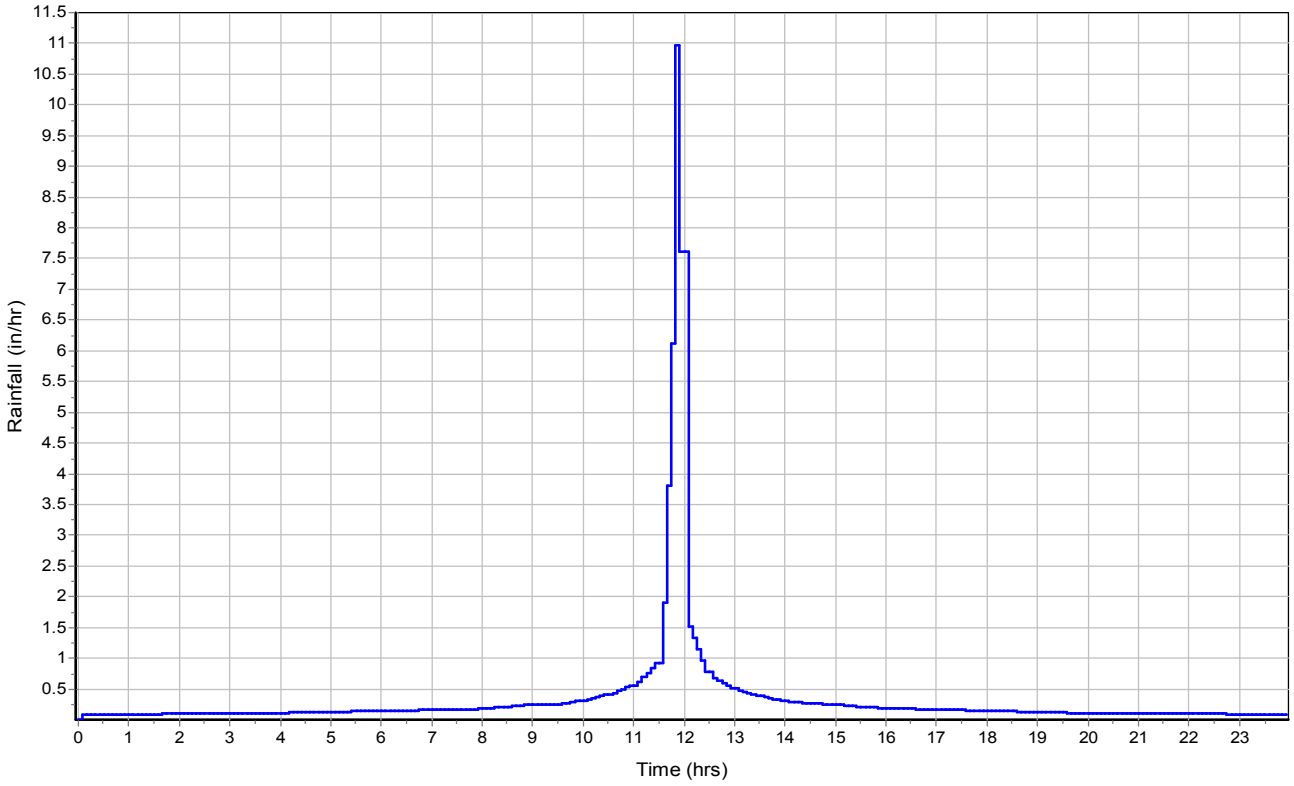
Total TOC (min) 6.63

Subbasin Runoff Results

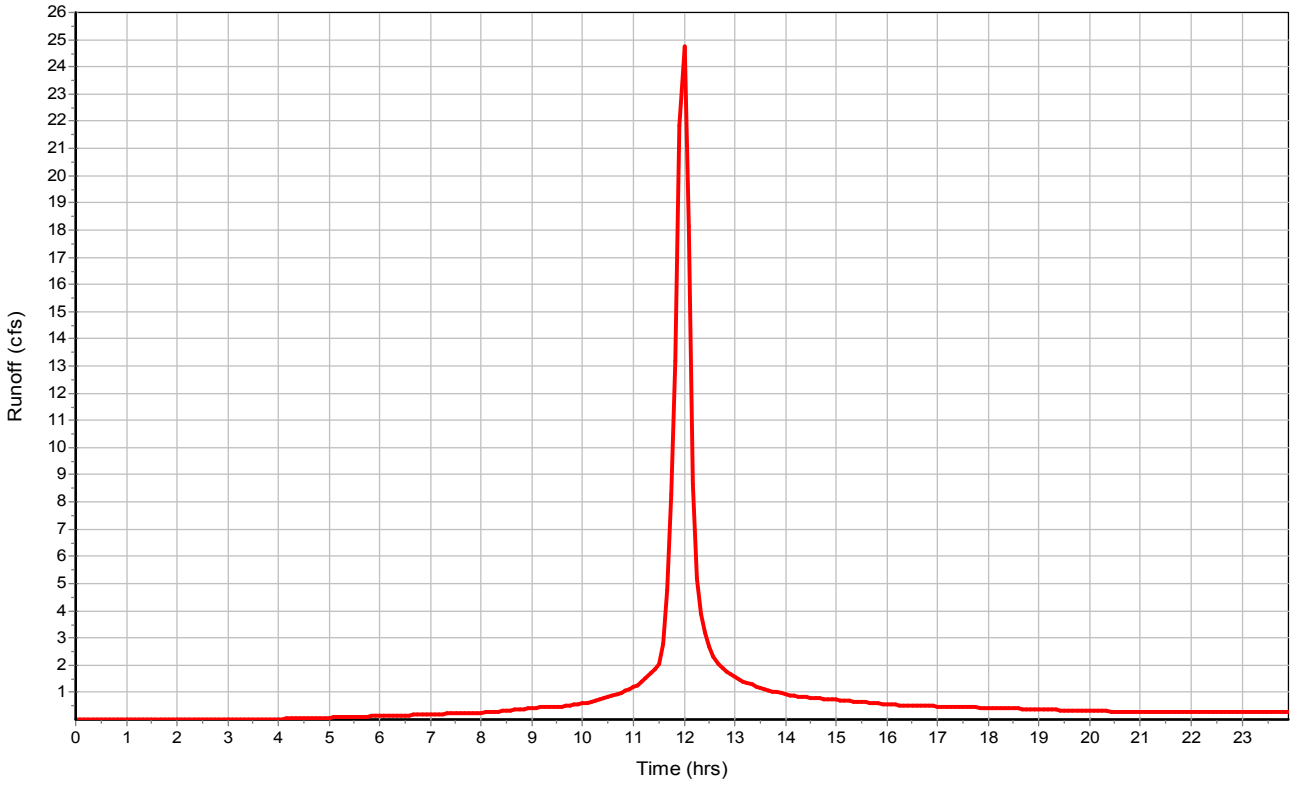
Total Rainfall (in)	8.00
Total Runoff (in)	6.36
Peak Runoff (cfs)	25.19
Weighted Curve Number	86.28
Time of Concentration (days hh:mm:ss)	0 00:06:38

Subbasin : Drainage Area 3-Pre

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage Area 4-Post

Input Data

Area (ac) 1.91
Weighted Curve Number 87.36
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.84	C	98.00
50 - 75% grass cover, Fair	1.07	C	79.00
Composite Area & Weighted CN	1.91		87.36

Time of Concentration

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	573	0.00	0.00
Slope (%) :	1.6	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	2.04	0.00	0.00
Computed Flow Time (min) :	4.68	0.00	0.00

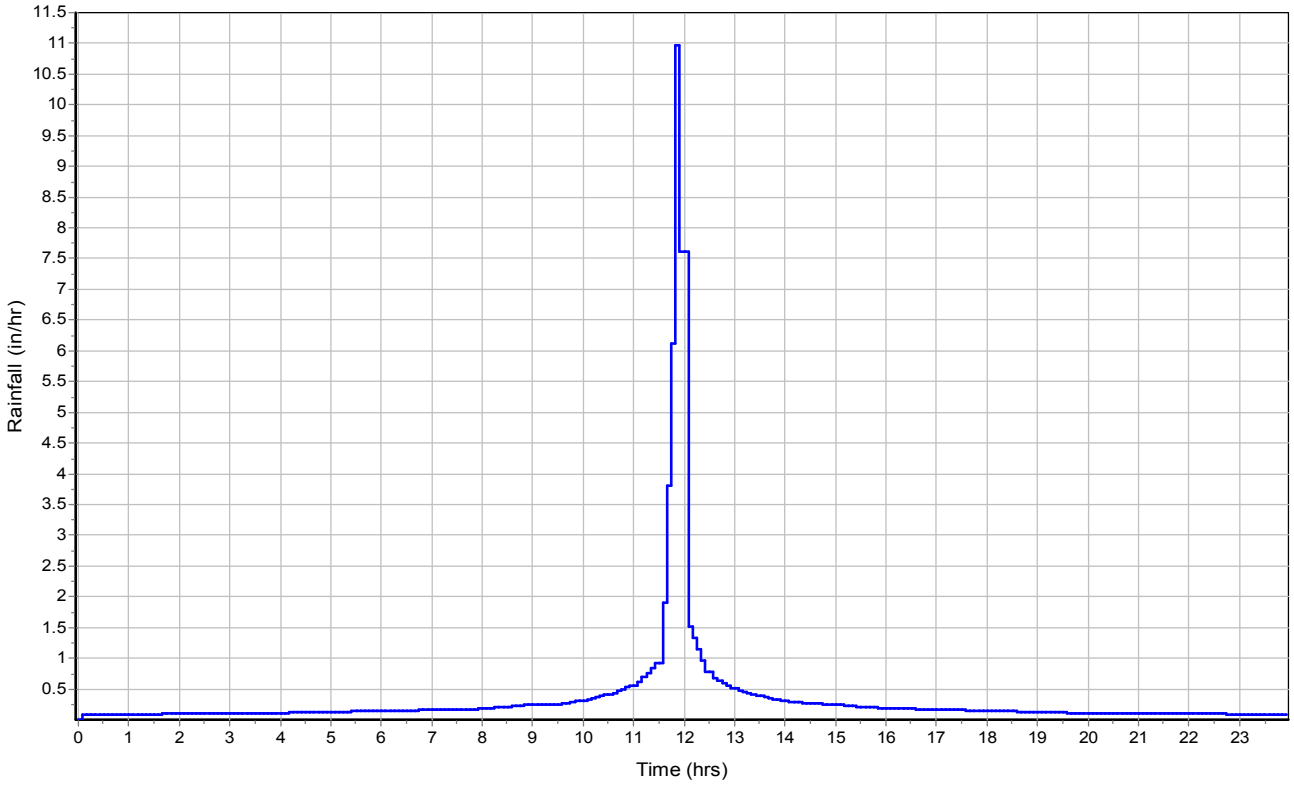
Total TOC (min) 4.68

Subbasin Runoff Results

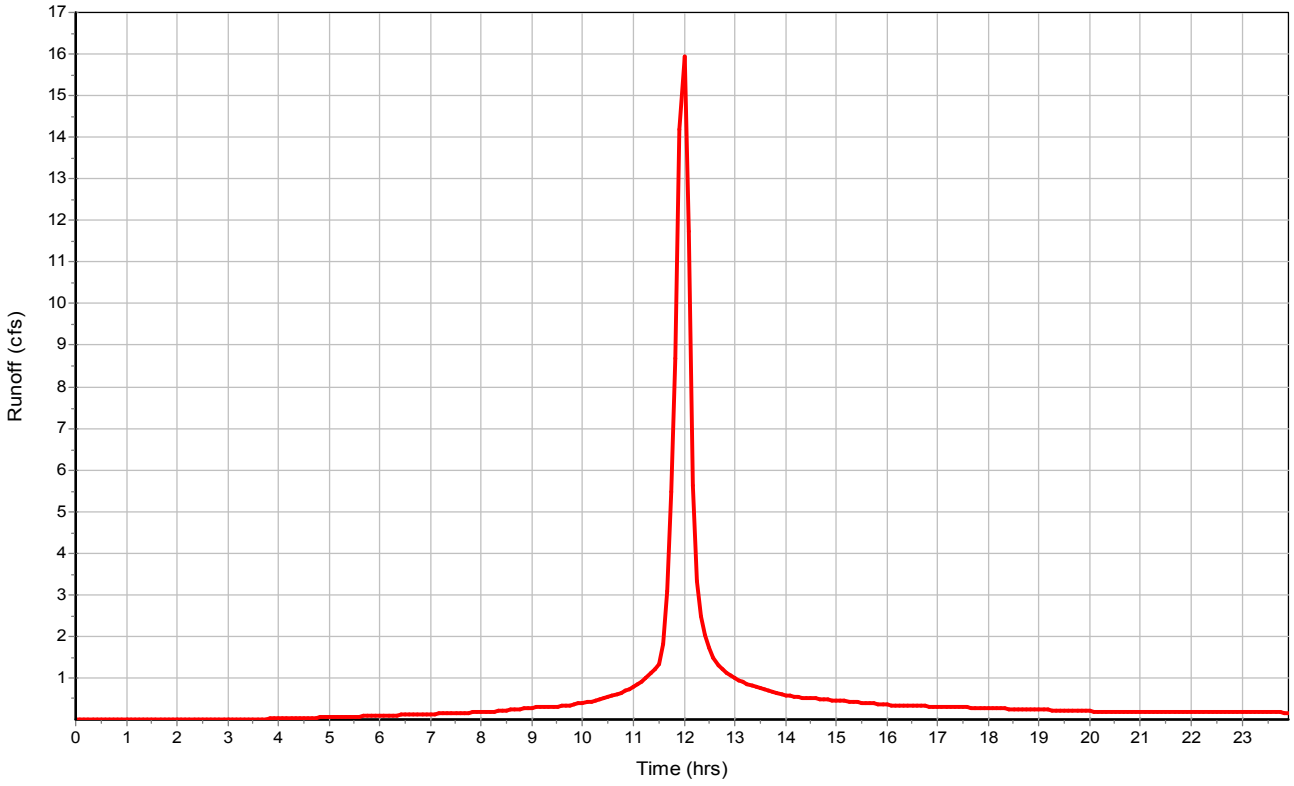
Total Rainfall (in) 8.00
Total Runoff (in) 6.49
Peak Runoff (cfs) 16.23
Weighted Curve Number 87.36
Time of Concentration (days hh:mm:ss) 0 00:04:41

Subbasin : Drainage Area 4-Post

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage Area 4-Pre

Input Data

Area (ac) 1.91
Weighted Curve Number 87.36
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved roads with curbs & sewers	0.84	C	98.00
50 - 75% grass cover, Fair	1.07	C	79.00
Composite Area & Weighted CN	1.91		87.36

Time of Concentration

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	573	0.00	0.00
Slope (%) :	1.6	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	2.04	0.00	0.00
Computed Flow Time (min) :	4.68	0.00	0.00

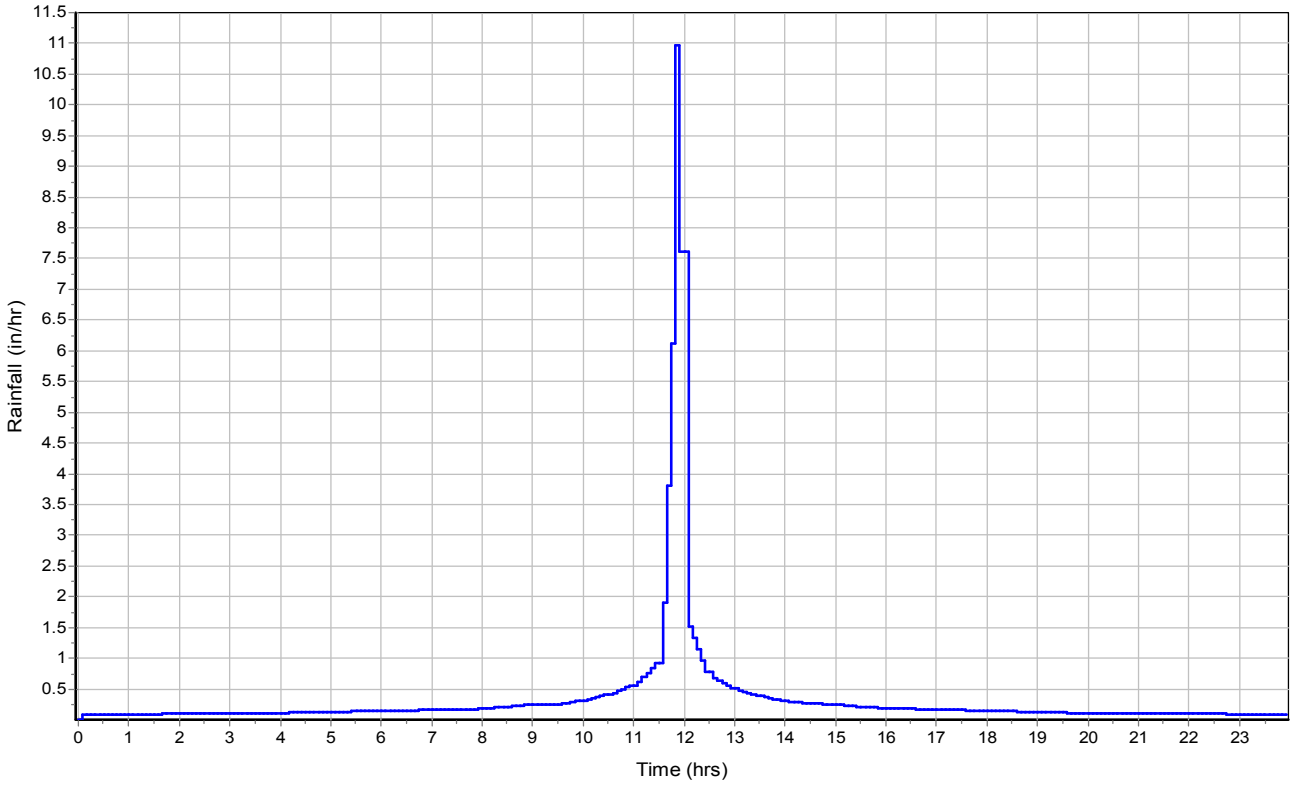
Total TOC (min) 4.68

Subbasin Runoff Results

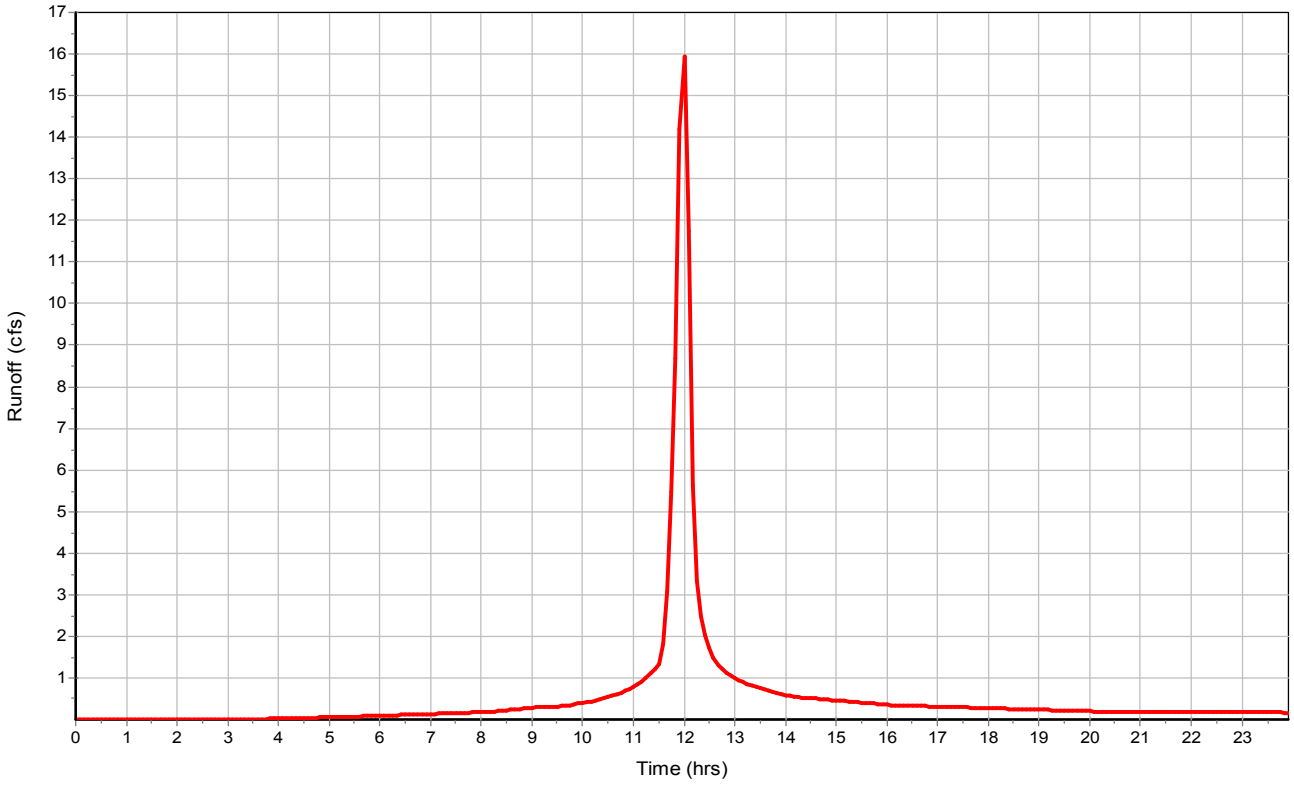
Total Rainfall (in) 8.00
Total Runoff (in) 6.49
Peak Runoff (cfs) 16.23
Weighted Curve Number 87.36
Time of Concentration (days hh:mm:ss) 0 00:04:41

Subbasin : Drainage Area 4-Pre

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage Area 5 - Post

Input Data

Area (ac)	8.14
Weighted Curve Number	88.94
Rain Gage ID	Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	4.26	C	98.00
50 - 75% grass cover, Fair	3.88	C	79.00
Composite Area & Weighted CN	8.14		88.94

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.15	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	1.1	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.70	0.00	0.00
Velocity (ft/sec) :	0.16	0.00	0.00
Computed Flow Time (min) :	10.27	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	700	0.00	0.00
Slope (%) :	1.5	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.98	0.00	0.00
Computed Flow Time (min) :	5.89	0.00	0.00

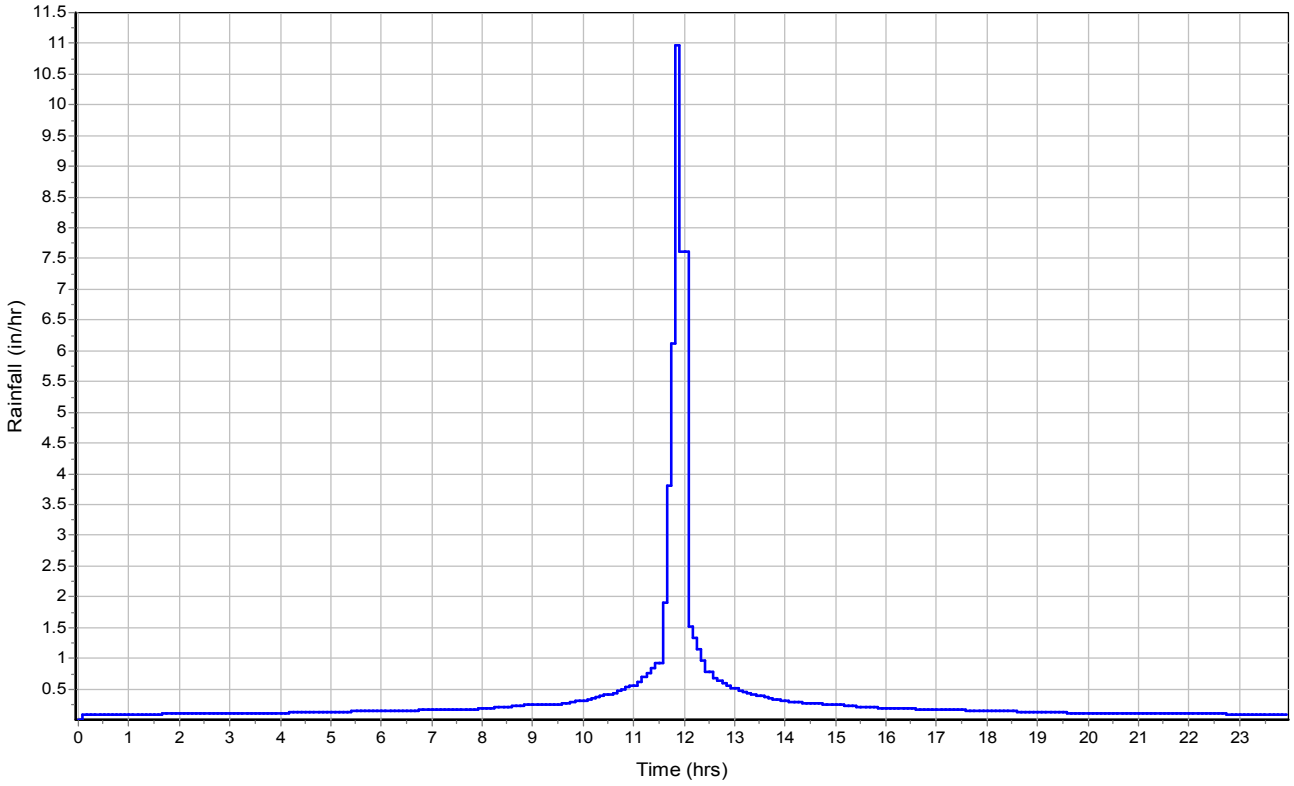
Total TOC (min) 16.16

Subbasin Runoff Results

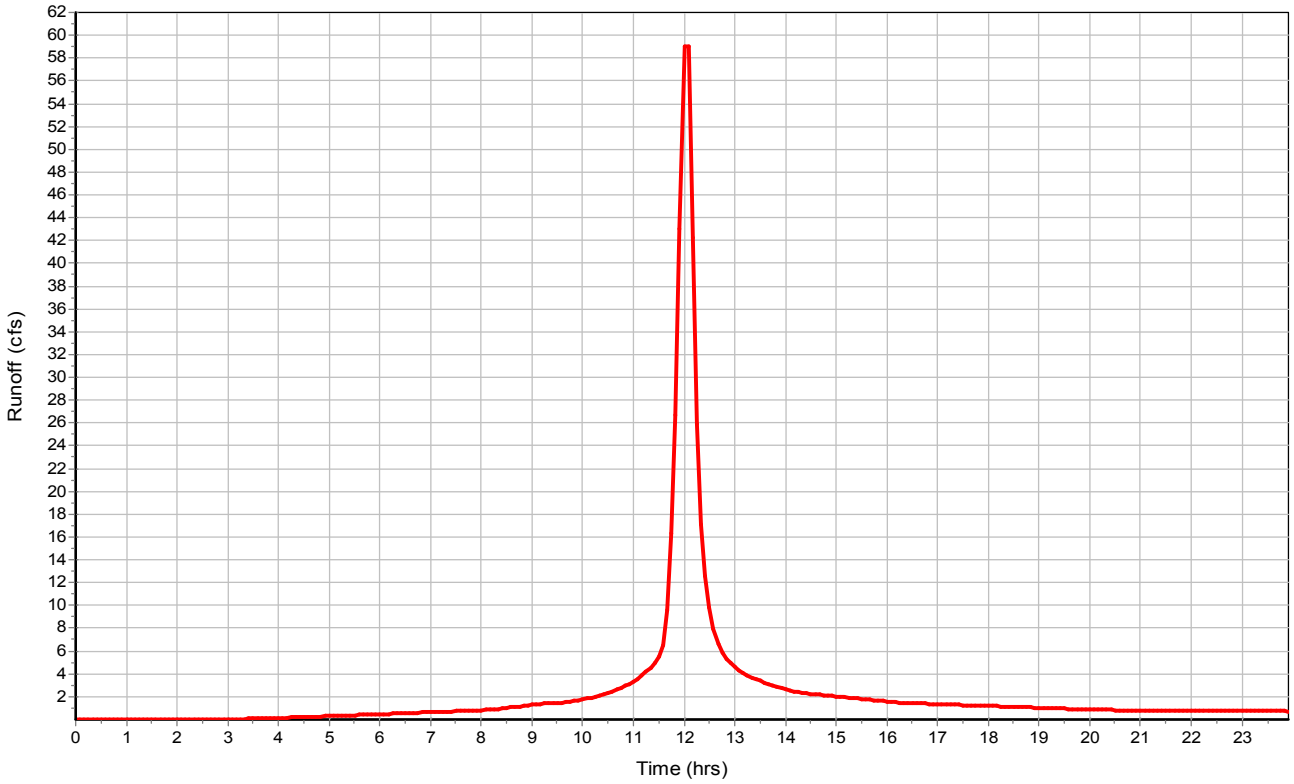
Total Rainfall (in)	8.00
Total Runoff (in)	6.68
Peak Runoff (cfs)	61.64
Weighted Curve Number	88.94
Time of Concentration (days hh:mm:ss)	0 00:16:10

Subbasin : Drainage Area 5 - Post

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage Area 5 - Pre

Input Data

Area (ac)	8.14
Weighted Curve Number	88.06
Rain Gage ID	Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	3.88	C	98.00
50 - 75% grass cover, Fair	4.26	C	79.00
Composite Area & Weighted CN	8.14		88.06

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.15	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	1.1	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.70	0.00	0.00
Velocity (ft/sec) :	0.16	0.00	0.00
Computed Flow Time (min) :	10.27	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	700	0.00	0.00
Slope (%) :	1.5	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.98	0.00	0.00
Computed Flow Time (min) :	5.89	0.00	0.00

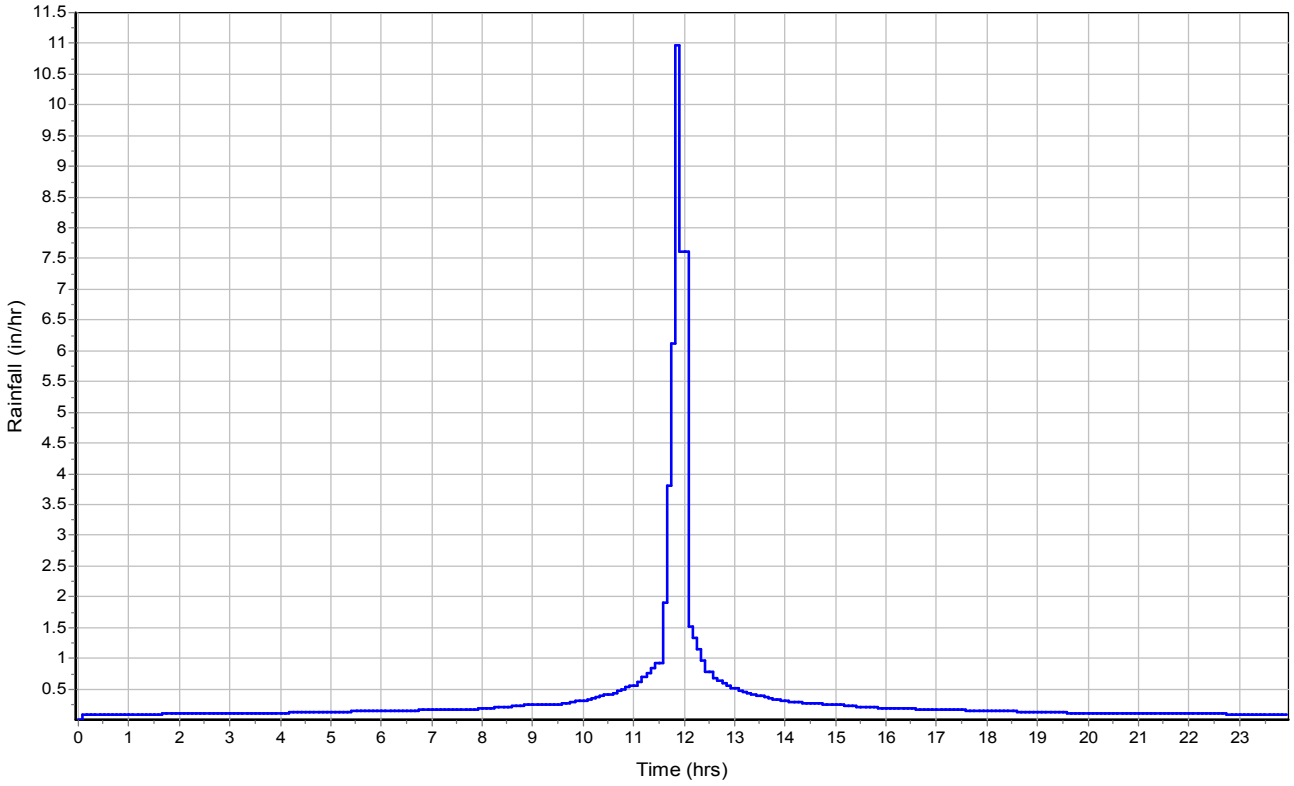
Total TOC (min) 16.16

Subbasin Runoff Results

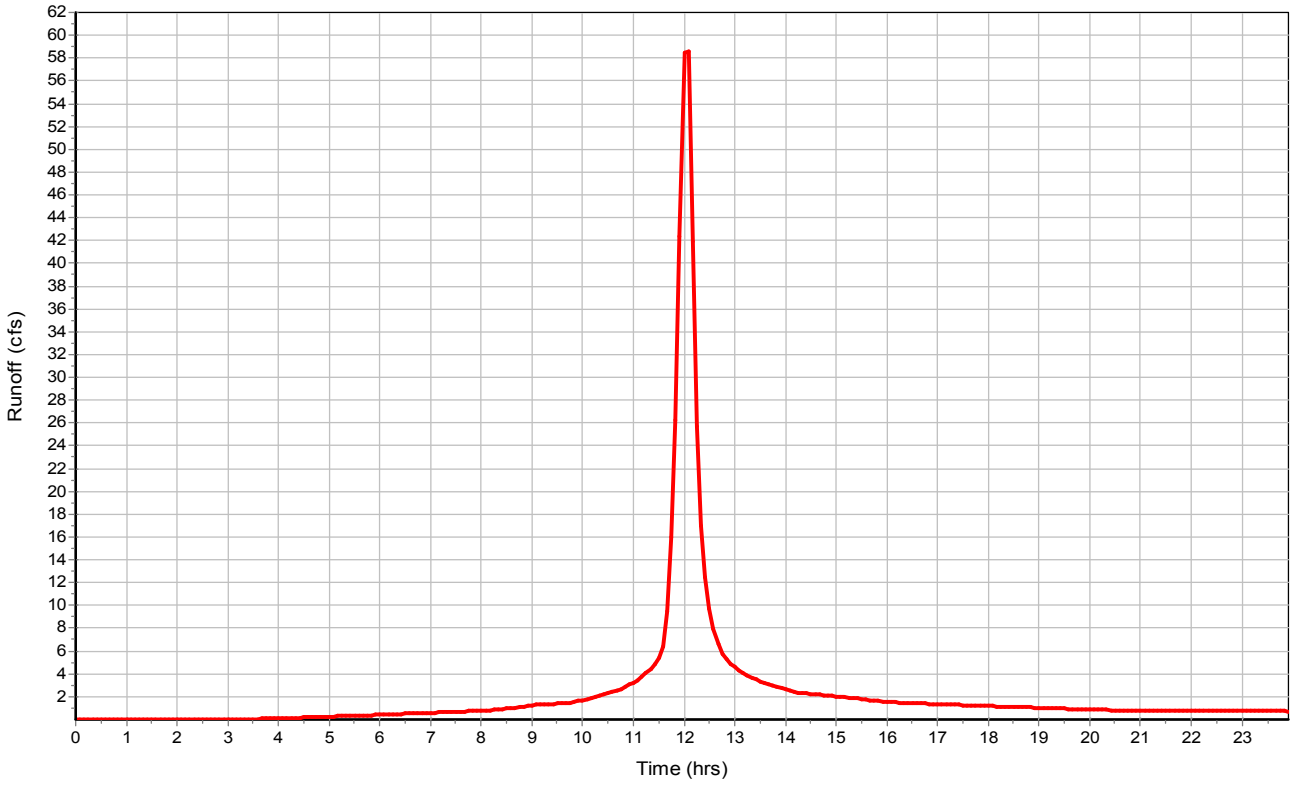
Total Rainfall (in)	8.00
Total Runoff (in)	6.58
Peak Runoff (cfs)	60.98
Weighted Curve Number	88.06
Time of Concentration (days hh:mm:ss)	0 00:16:10

Subbasin : Drainage Area 5 - Pre

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin Hydrology

Subbasin : DA6a-Post

Input Data

Area (ac) 2.92
Weighted Curve Number 87.72
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	1.34	C	98.00
50 - 75% grass cover, Fair	1.58	C	79.00
Composite Area & Weighted CN	2.92		87.72

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.011	0.00	0.00
Flow Length (ft) :	75	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.70	0.00	0.00
Velocity (ft/sec) :	1.57	0.00	0.00
Computed Flow Time (min) :	0.79	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	1400	0.00	0.00
Slope (%) :	3	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	2.79	0.00	0.00
Computed Flow Time (min) :	8.36	0.00	0.00

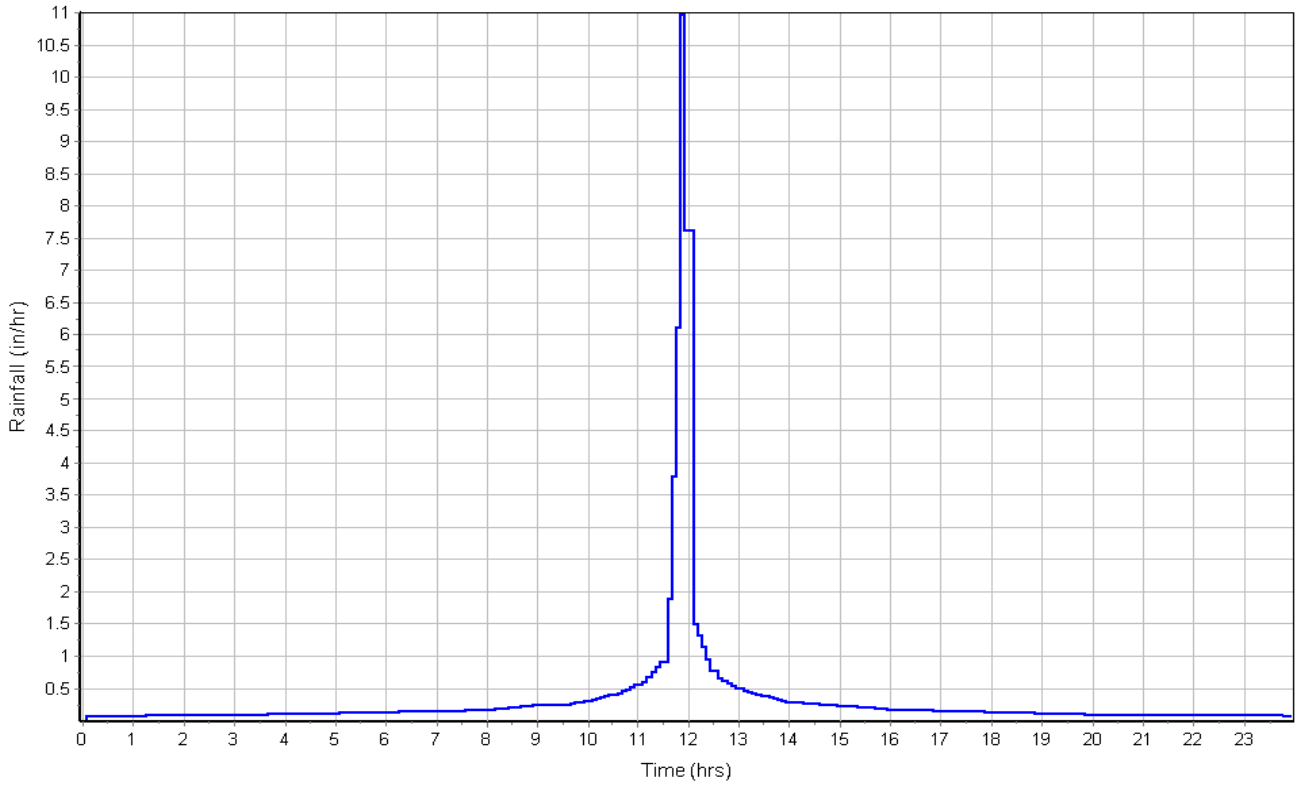
Total TOC (min) 9.16

Subbasin Runoff Results

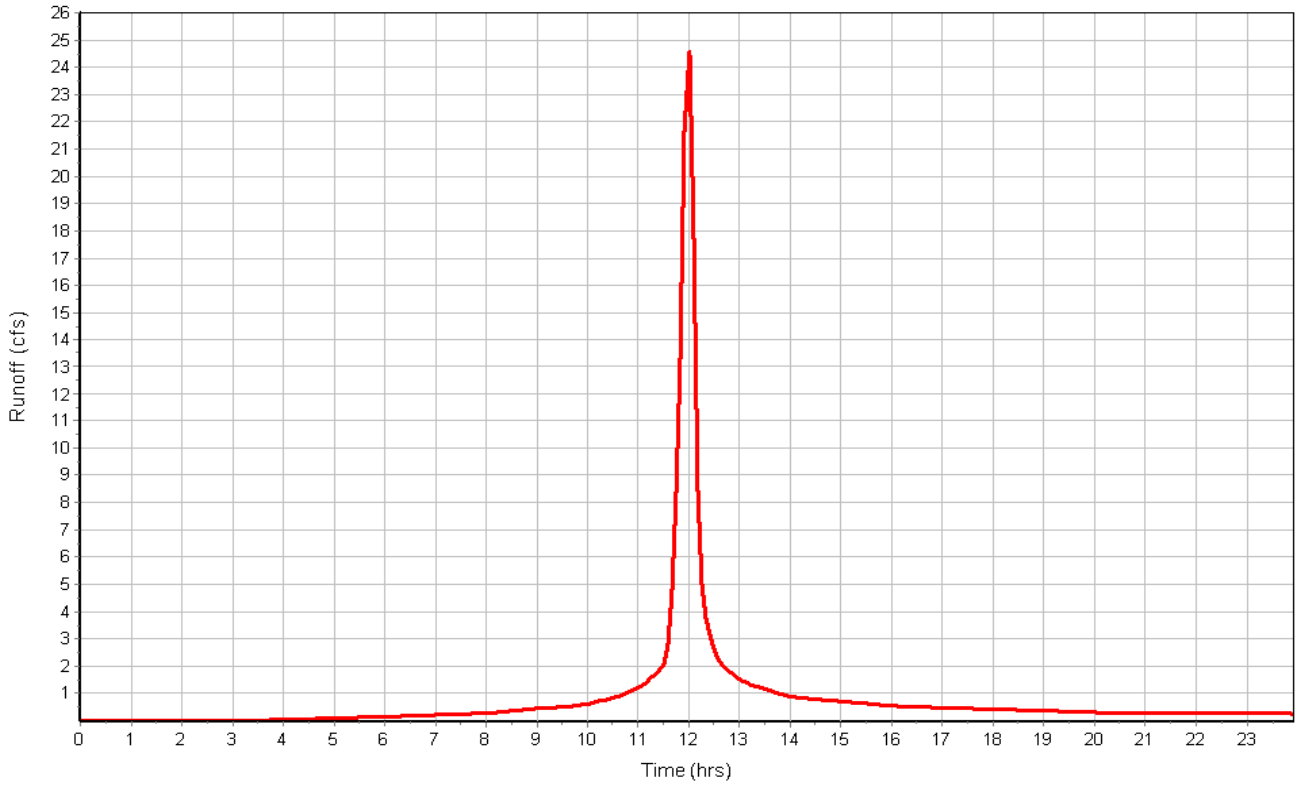
Total Rainfall (in)	8.00
Total Runoff (in)	6.54
Peak Runoff (cfs)	24.93
Weighted Curve Number	87.72
Time of Concentration (days hh:mm:ss)	0 00:09:10

Subbasin : DA6a-Post

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : DA6a-Pre

Input Data

Area (ac)	2.92
Weighted Curve Number	87.65
Rain Gage ID	Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	1.33	C	98.00
50 - 75% grass cover, Fair	1.59	C	79.00
Composite Area & Weighted CN	2.92		87.65

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.011	0.00	0.00
Flow Length (ft) :	75	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.70	0.00	0.00
Velocity (ft/sec) :	1.57	0.00	0.00
Computed Flow Time (min) :	0.79	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	1400	0.00	0.00
Slope (%) :	3	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	2.79	0.00	0.00
Computed Flow Time (min) :	8.36	0.00	0.00

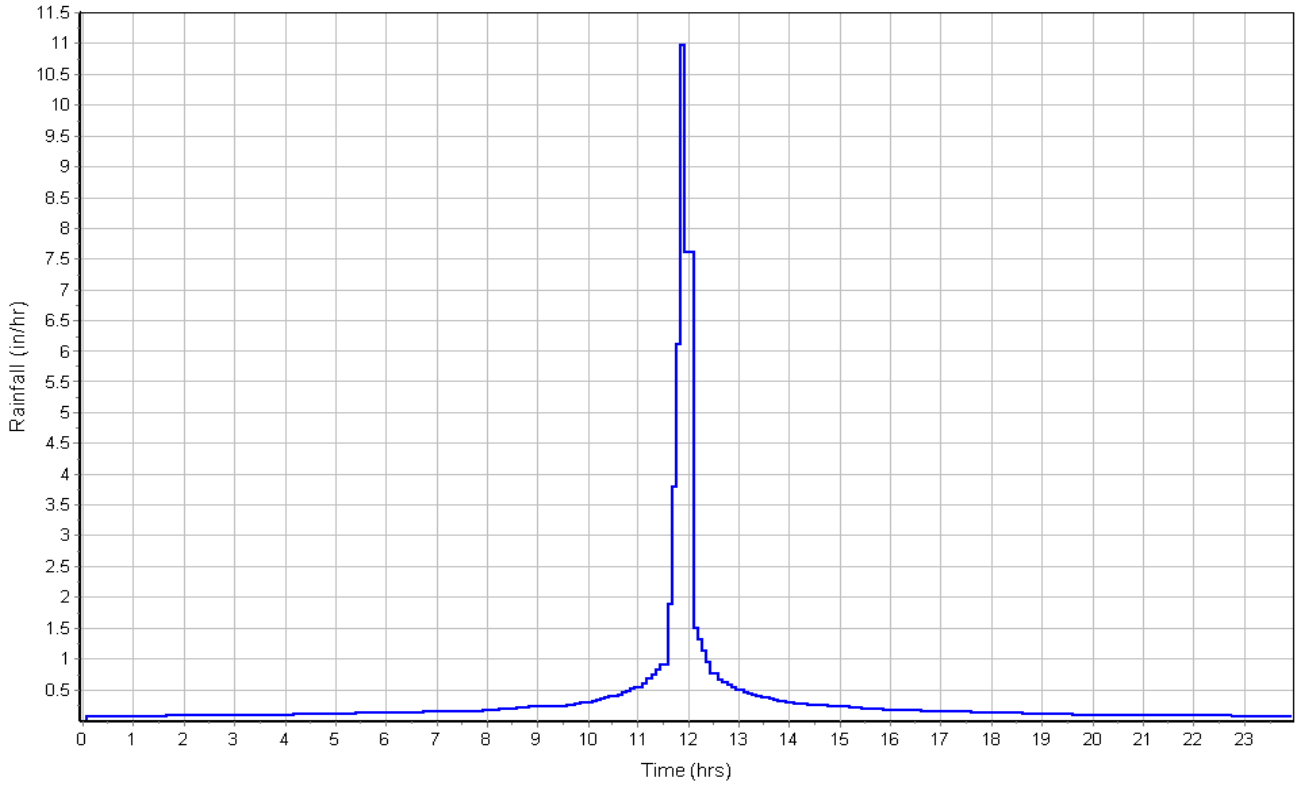
Total TOC (min) 9.16

Subbasin Runoff Results

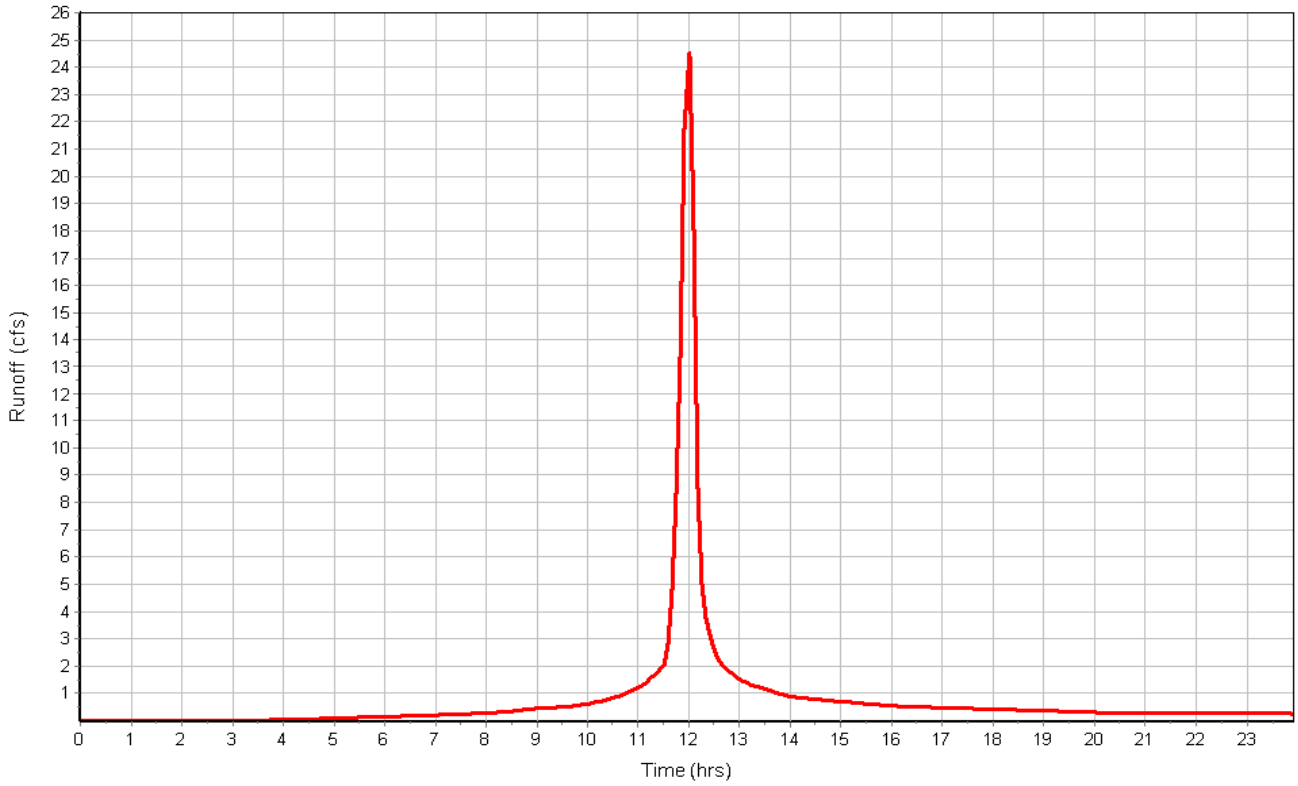
Total Rainfall (in)	8.00
Total Runoff (in)	6.53
Peak Runoff (cfs)	24.93
Weighted Curve Number	87.65
Time of Concentration (days hh:mm:ss)	0 00:09:10

Subbasin : DA6a-Pre

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : DA6b-Post

Input Data

Area (ac) 2.20
Weighted Curve Number 83.15
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.48	C	98.00
50 - 75% grass cover, Fair	1.72	C	79.00
Composite Area & Weighted CN	2.20		83.15

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.4	0.00	0.00
Flow Length (ft) :	55	0.00	0.00
Slope (%) :	33	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.70	0.00	0.00
Velocity (ft/sec) :	0.26	0.00	0.00
Computed Flow Time (min) :	3.58	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	850	0.00	0.00
Slope (%) :	0.8	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.44	0.00	0.00
Computed Flow Time (min) :	9.84	0.00	0.00

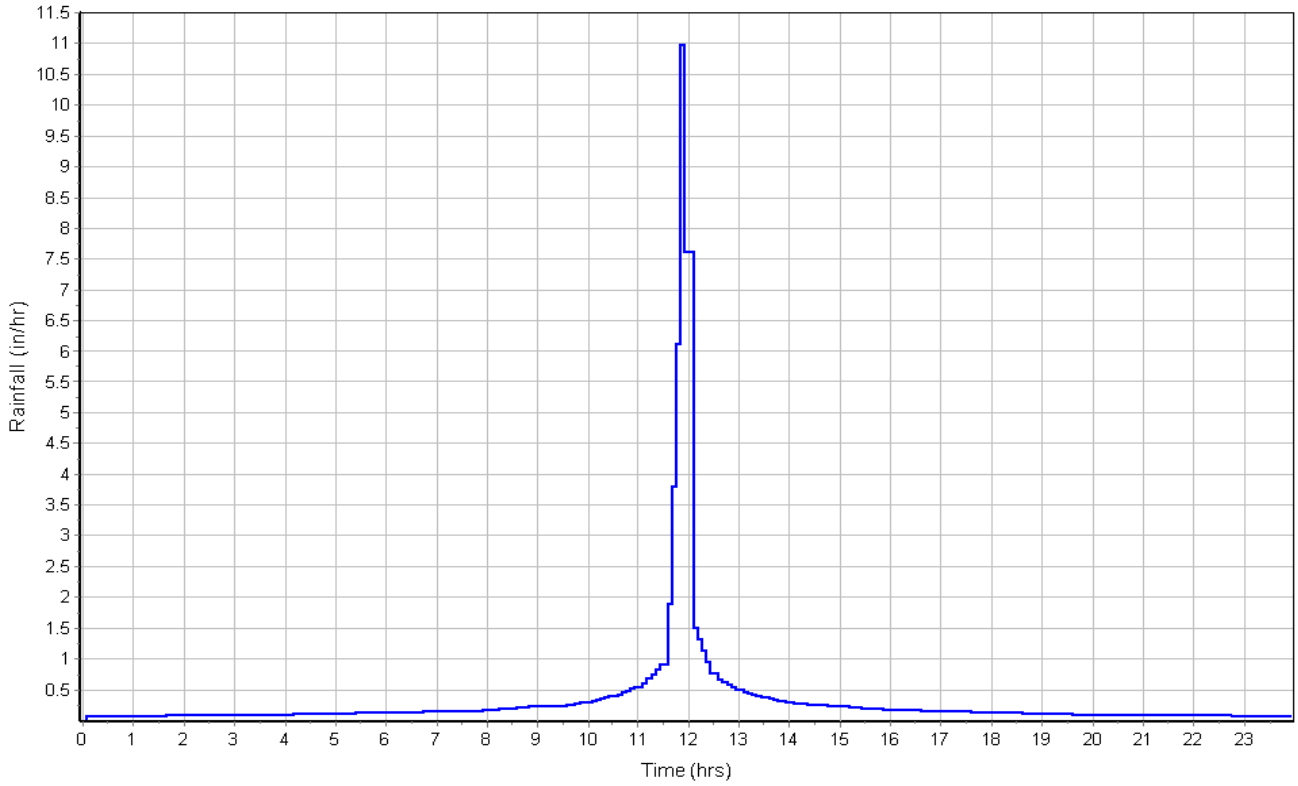
Total TOC (min) 13.42

Subbasin Runoff Results

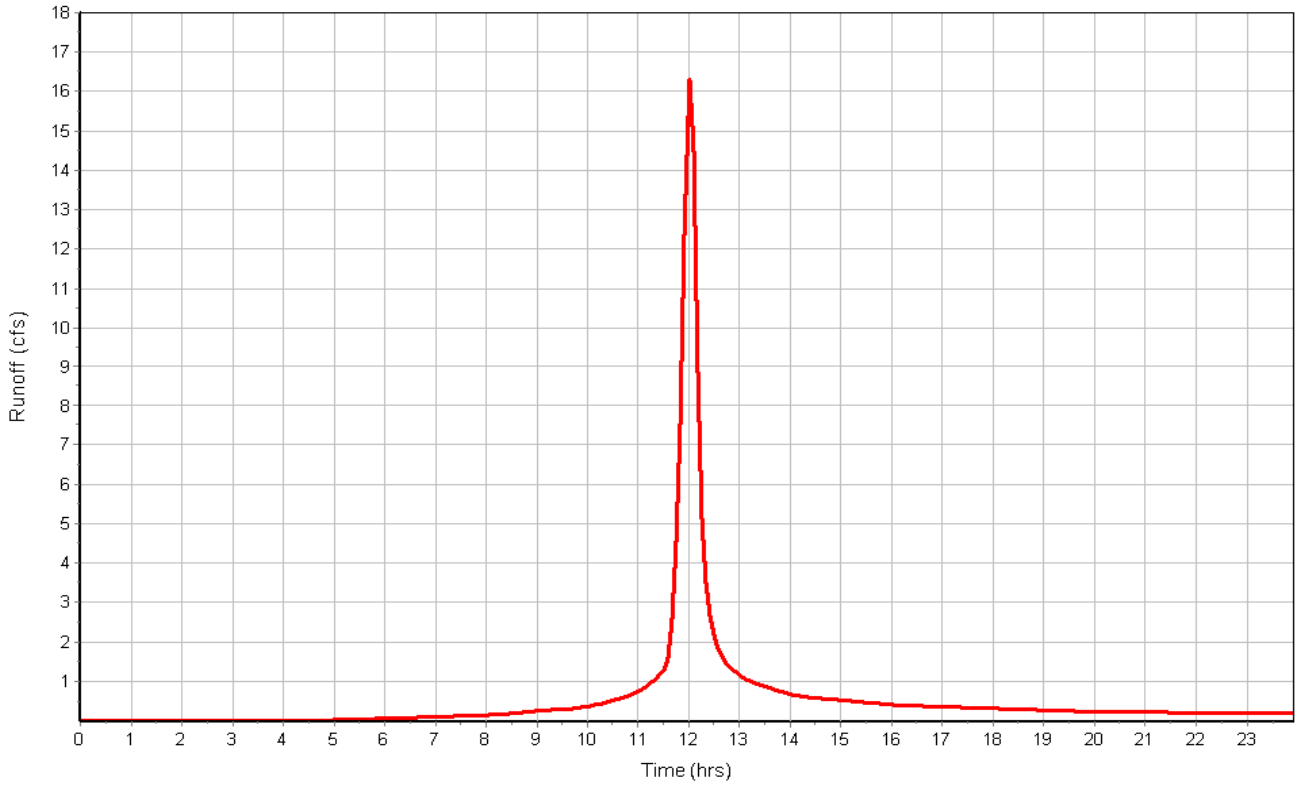
Total Rainfall (in) 8.00
Total Runoff (in) 6.00
Peak Runoff (cfs) 16.43
Weighted Curve Number 83.15
Time of Concentration (days hh:mm:ss) 0 00:13:25

Subbasin : DA6b-Post

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : DA6b-Pre

Input Data

Area (ac) 2.20
Weighted Curve Number 83.06
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.47	C	98.00
50 - 75% grass cover, Fair	1.73	C	79.00
Composite Area & Weighted CN	2.20		83.06

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.4	0.00	0.00
Flow Length (ft) :	55	0.00	0.00
Slope (%) :	33	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.70	0.00	0.00
Velocity (ft/sec) :	0.26	0.00	0.00
Computed Flow Time (min) :	3.58	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	850	0.00	0.00
Slope (%) :	0.8	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.44	0.00	0.00
Computed Flow Time (min) :	9.84	0.00	0.00

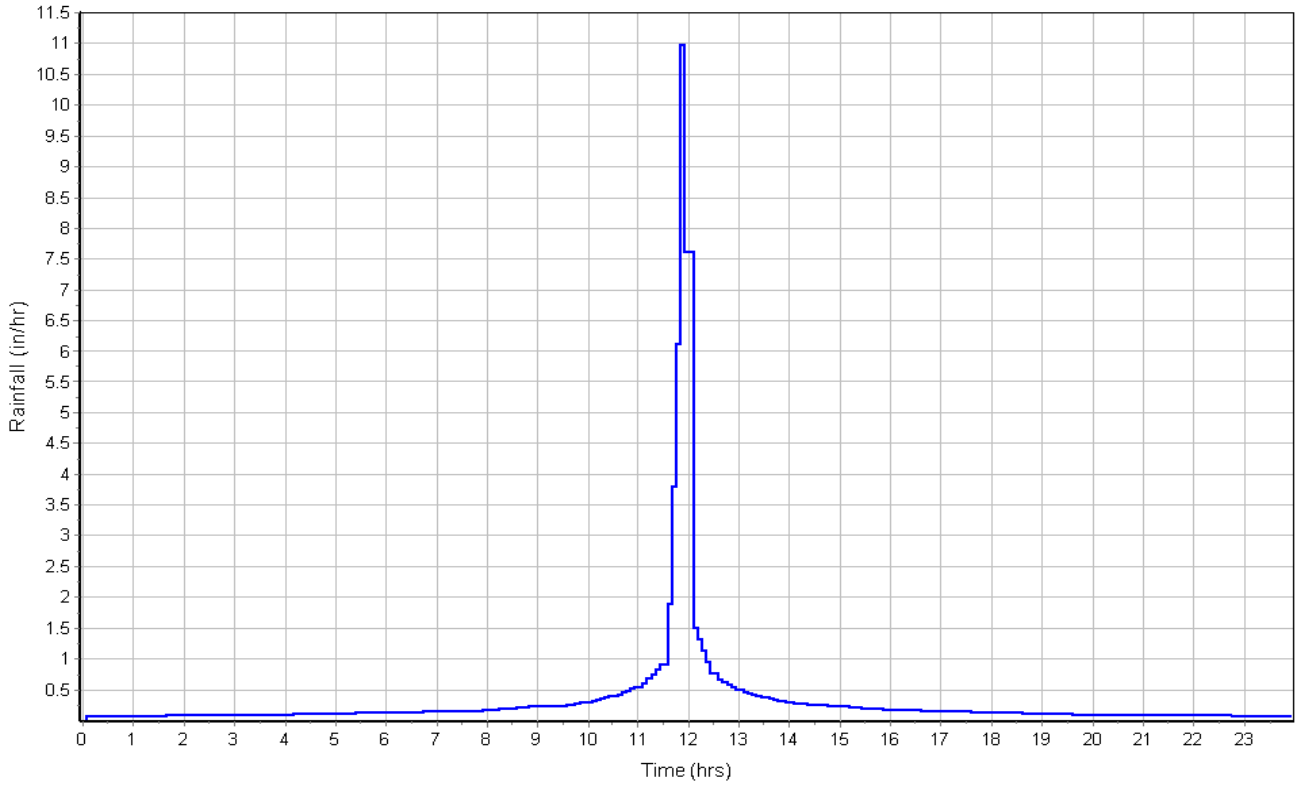
Total TOC (min) 13.42

Subbasin Runoff Results

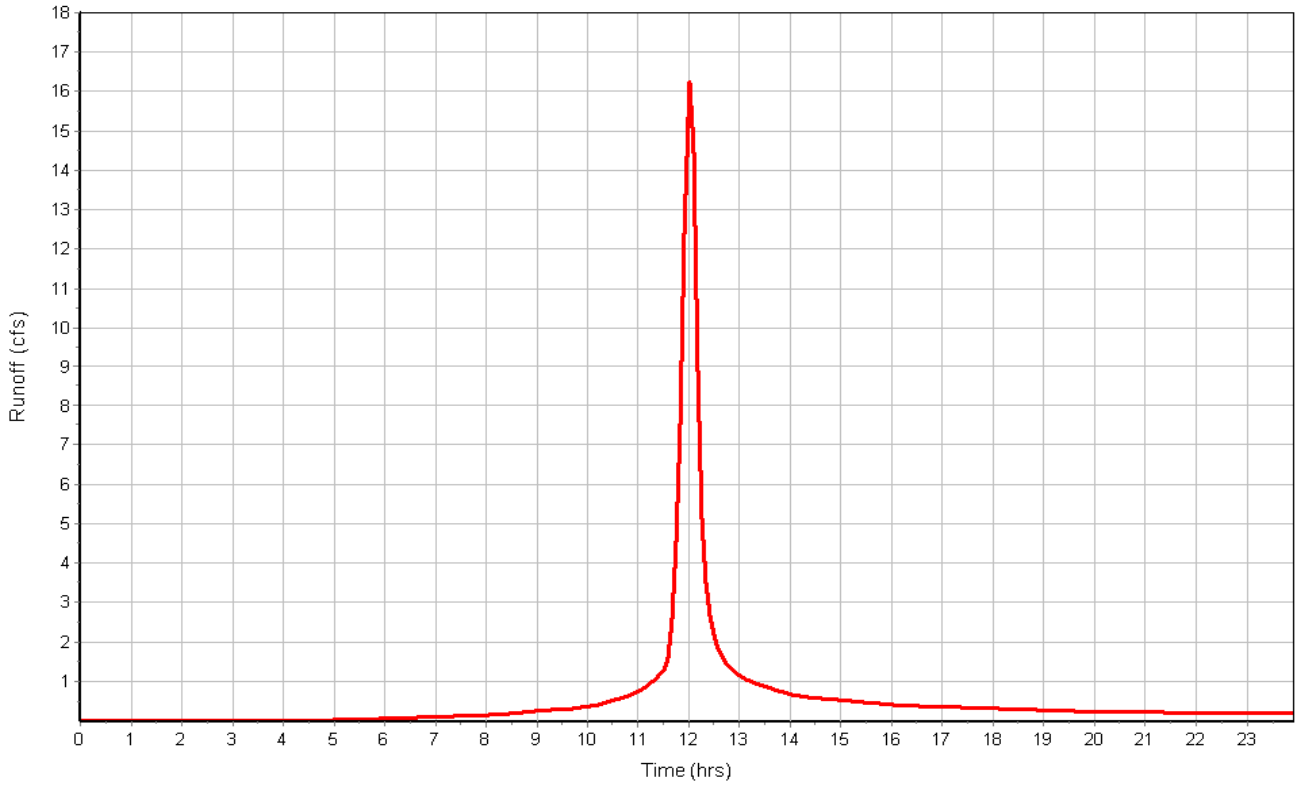
Total Rainfall (in) 8.00
Total Runoff (in) 5.98
Peak Runoff (cfs) 16.40
Weighted Curve Number 83.06
Time of Concentration (days hh:mm:ss) 0 00:13:25

Subbasin : DA6b-Pre

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : DA6c-Post

Input Data

Area (ac) 0.44
Weighted Curve Number 81.16
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.05	C	98.00
50 - 75% grass cover, Fair	0.39	C	79.00
Composite Area & Weighted CN	0.44		81.16

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.15	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	1	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.70	0.00	0.00
Velocity (ft/sec) :	0.16	0.00	0.00
Computed Flow Time (min) :	10.67	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	330	0.00	0.00
Slope (%) :	0.6	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.25	0.00	0.00
Computed Flow Time (min) :	4.40	0.00	0.00

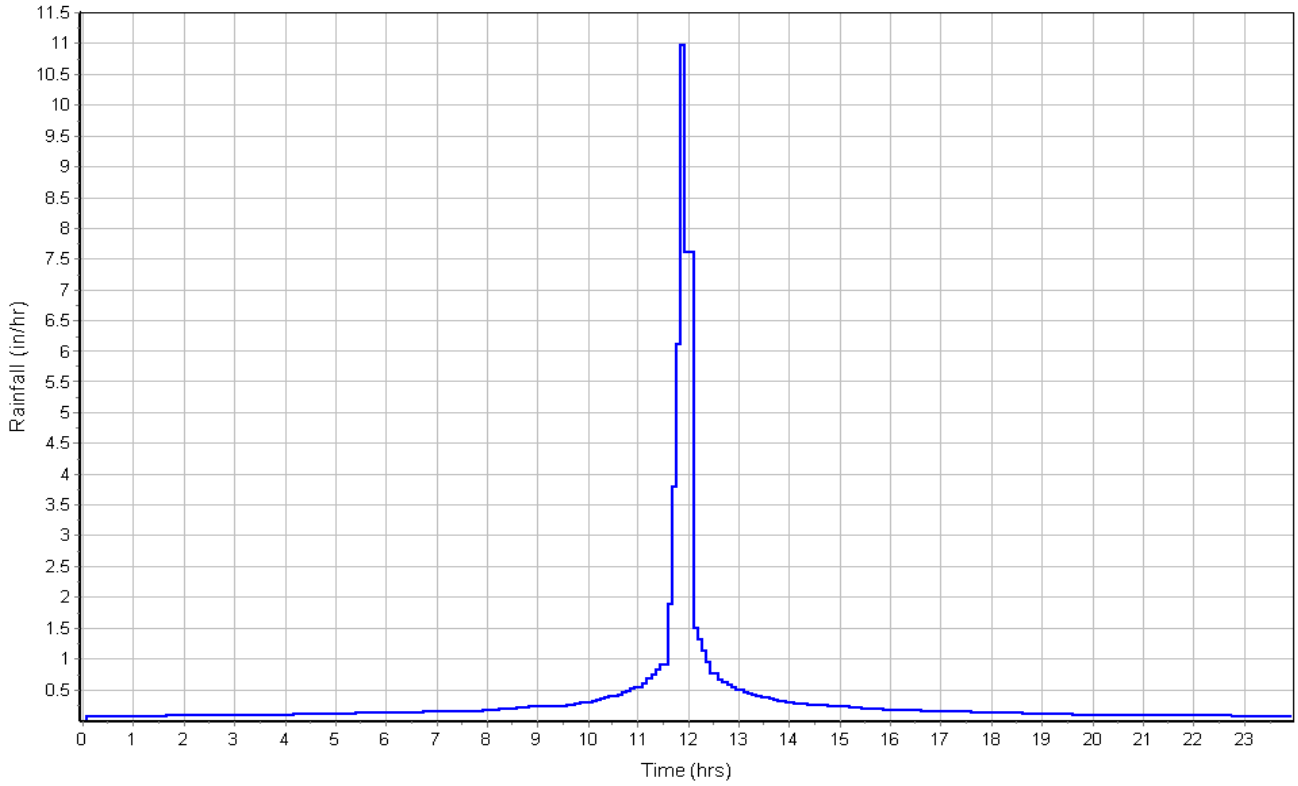
Total TOC (min) 15.07

Subbasin Runoff Results

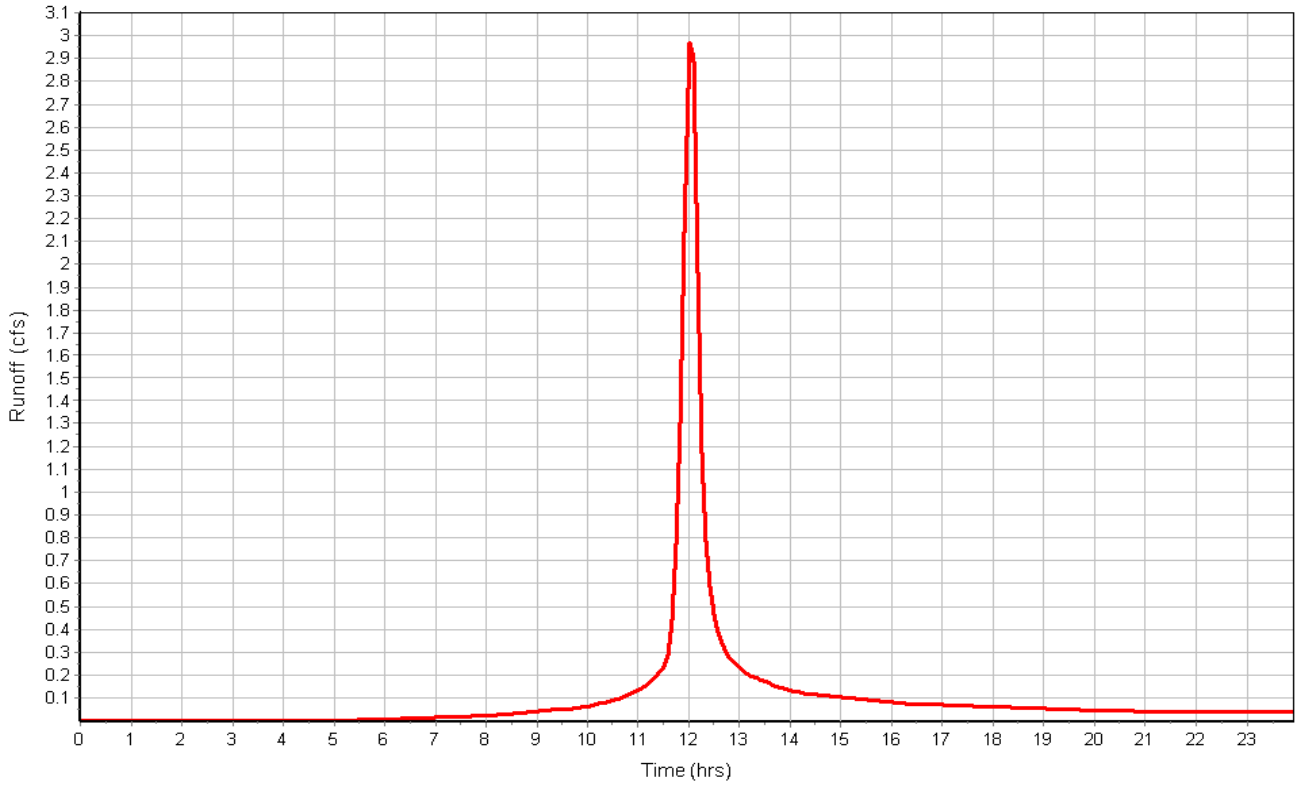
Total Rainfall (in) 8.00
Total Runoff (in) 5.76
Peak Runoff (cfs) 3.07
Weighted Curve Number 81.16
Time of Concentration (days hh:mm:ss) 0 00:15:04

Subbasin : DA6c-Post

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : DA6c-Pre

Input Data

Area (ac) 0.44
Weighted Curve Number 81.16
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.05	C	98.00
50 - 75% grass cover, Fair	0.39	C	79.00
Composite Area & Weighted CN	0.44		81.16

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.15	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	1	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.70	0.00	0.00
Velocity (ft/sec) :	0.16	0.00	0.00
Computed Flow Time (min) :	10.67	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	330	0.00	0.00
Slope (%) :	0.6	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.25	0.00	0.00
Computed Flow Time (min) :	4.40	0.00	0.00

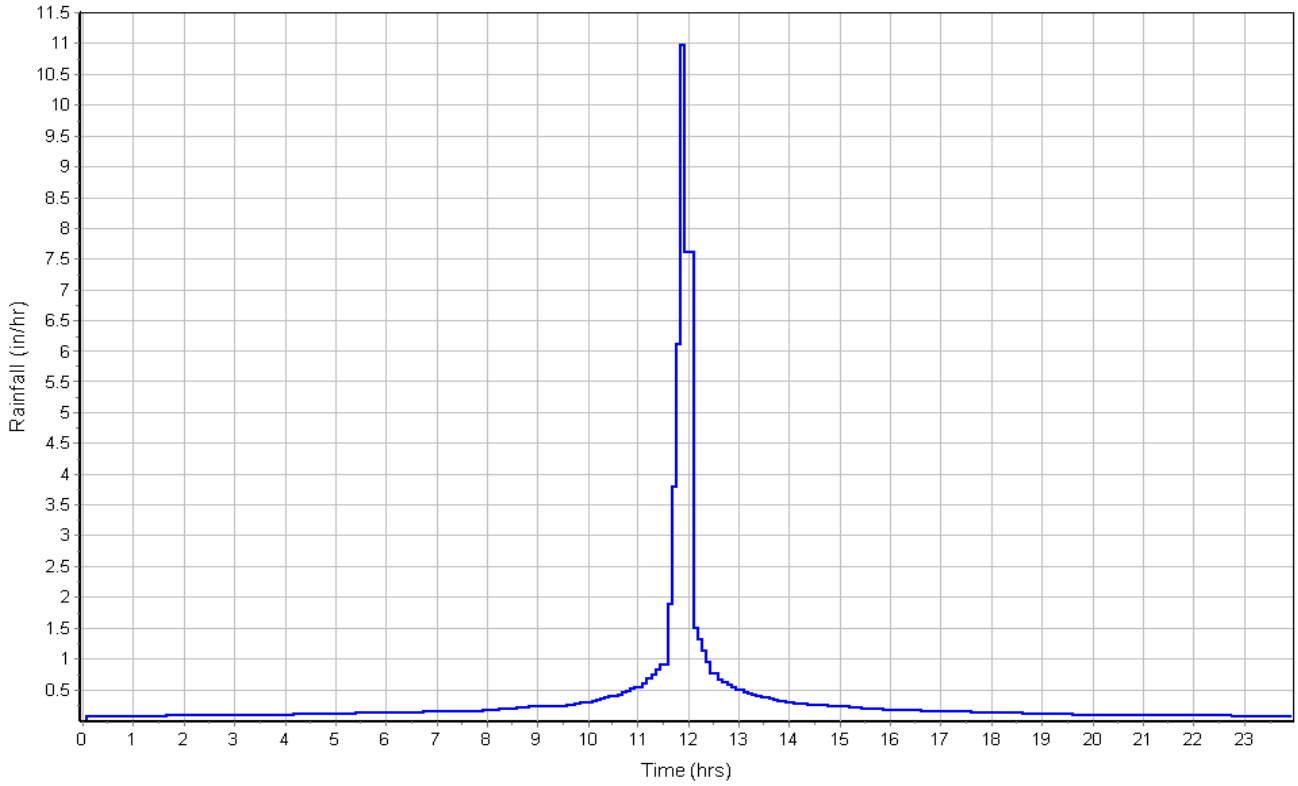
Total TOC (min) 15.07

Subbasin Runoff Results

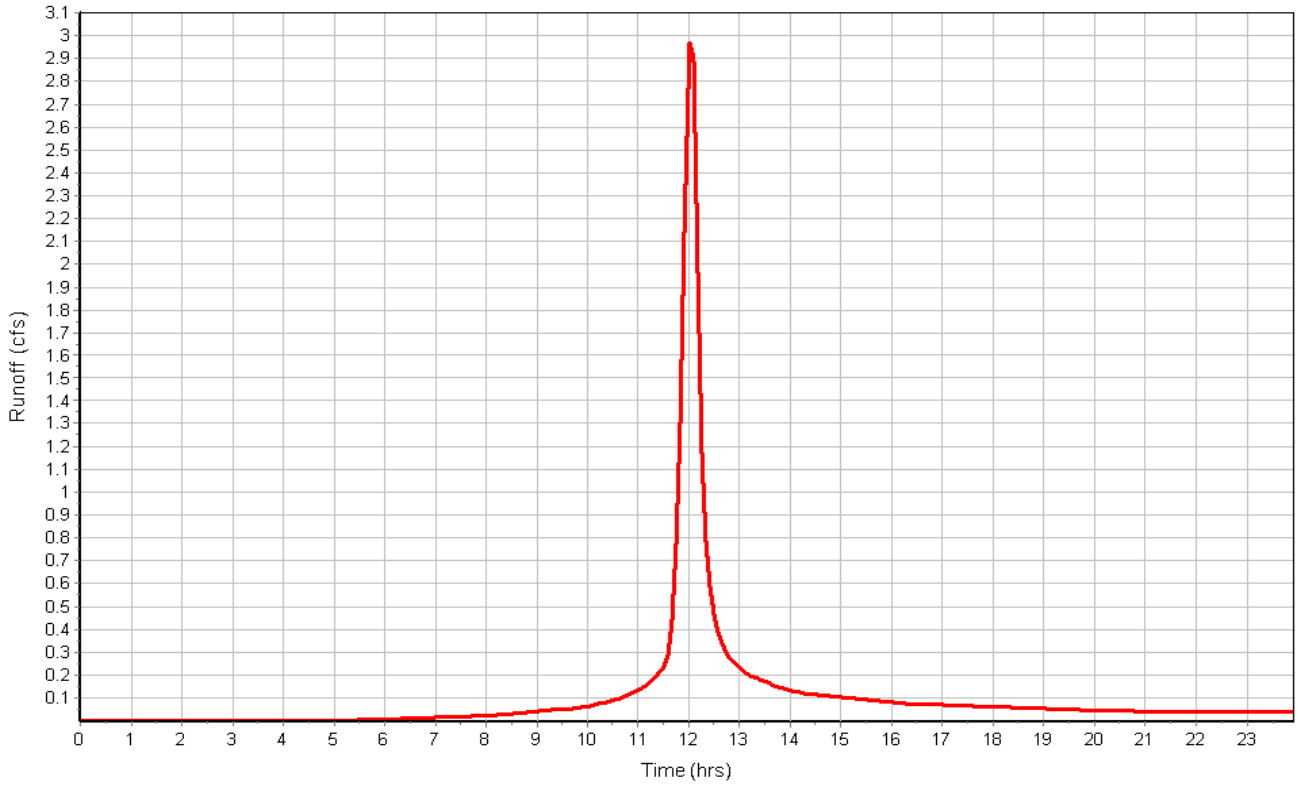
Total Rainfall (in) 8.00
Total Runoff (in) 5.76
Peak Runoff (cfs) 3.07
Weighted Curve Number 81.16
Time of Concentration (days hh:mm:ss) 0 00:15:04

Subbasin : DA6c-Pre

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : DA6d-Post

Input Data

Area (ac) 3.52
Weighted Curve Number 89.58
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	1.96	C	98.00
50 - 75% grass cover, Fair	1.56	C	79.00
Composite Area & Weighted CN	3.52		89.58

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.011	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.70	0.00	0.00
Velocity (ft/sec) :	1.67	0.00	0.00
Computed Flow Time (min) :	1.00	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	900	0.00	0.00
Slope (%) :	2	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	2.28	0.00	0.00
Computed Flow Time (min) :	6.58	0.00	0.00

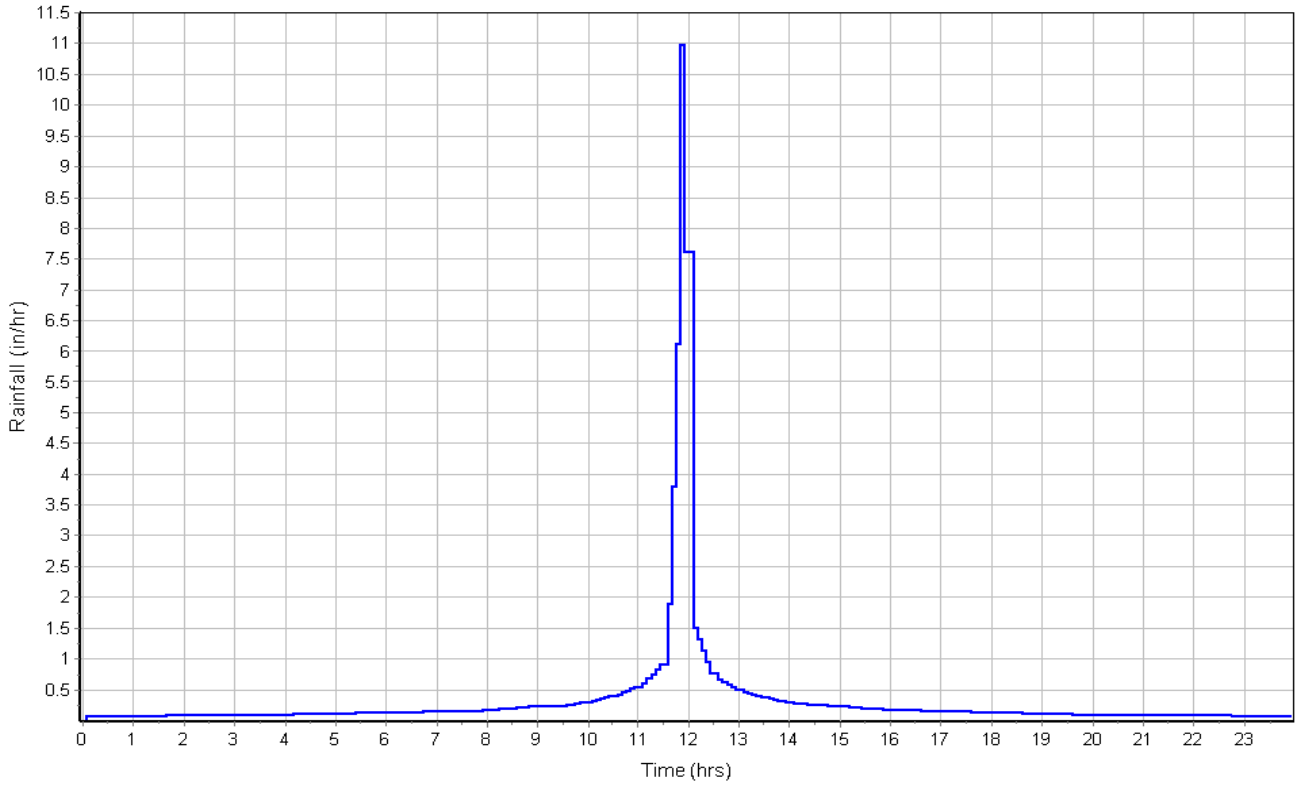
Total TOC (min) 7.58

Subbasin Runoff Results

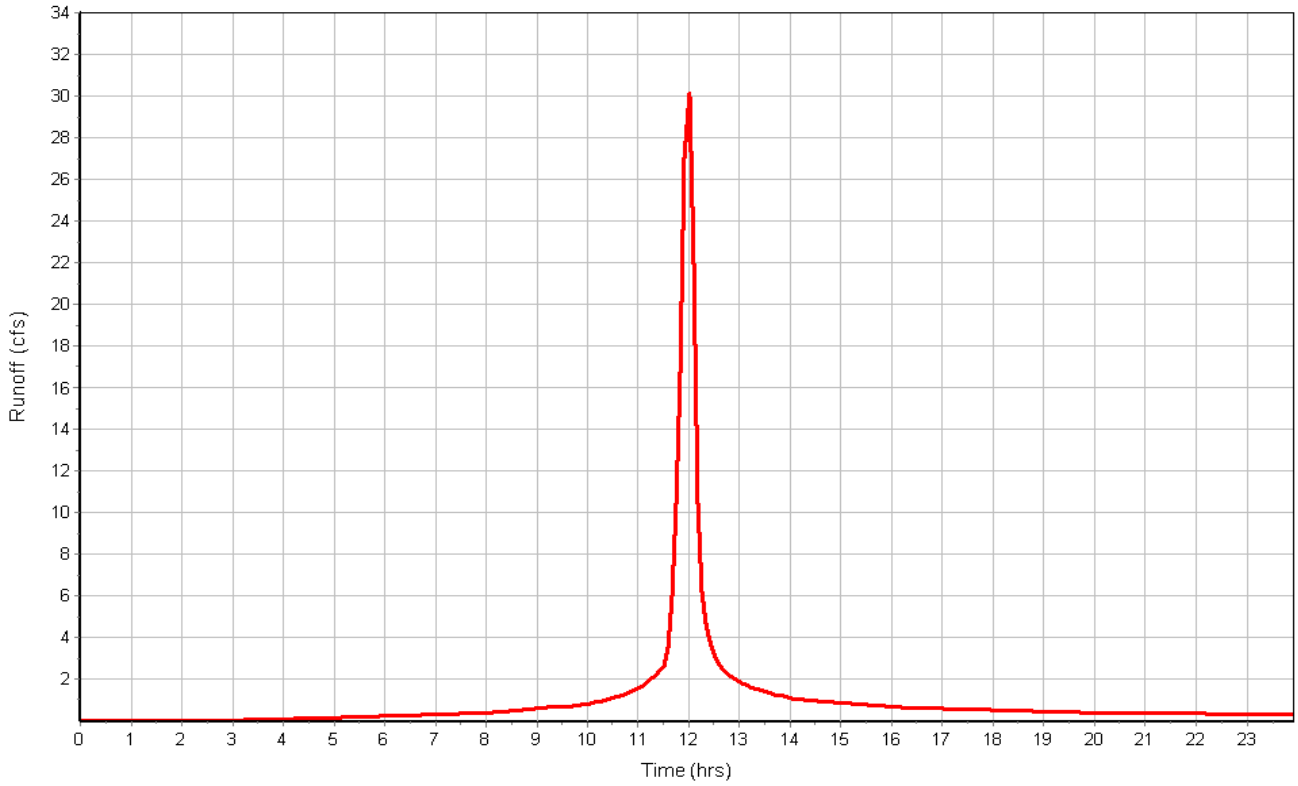
Total Rainfall (in) 8.00
Total Runoff (in) 6.76
Peak Runoff (cfs) 30.70
Weighted Curve Number 89.58
Time of Concentration (days hh:mm:ss) 0 00:07:35

Subbasin : DA6d-Post

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : DA6d-Pre

Input Data

Area (ac) 3.52
Weighted Curve Number 88.77
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	1.81	C	98.00
50 - 75% grass cover, Fair	1.71	C	79.00
Composite Area & Weighted CN	3.52		88.77

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.011	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.70	0.00	0.00
Velocity (ft/sec) :	1.67	0.00	0.00
Computed Flow Time (min) :	1.00	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	900	0.00	0.00
Slope (%) :	2	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	2.28	0.00	0.00
Computed Flow Time (min) :	6.58	0.00	0.00

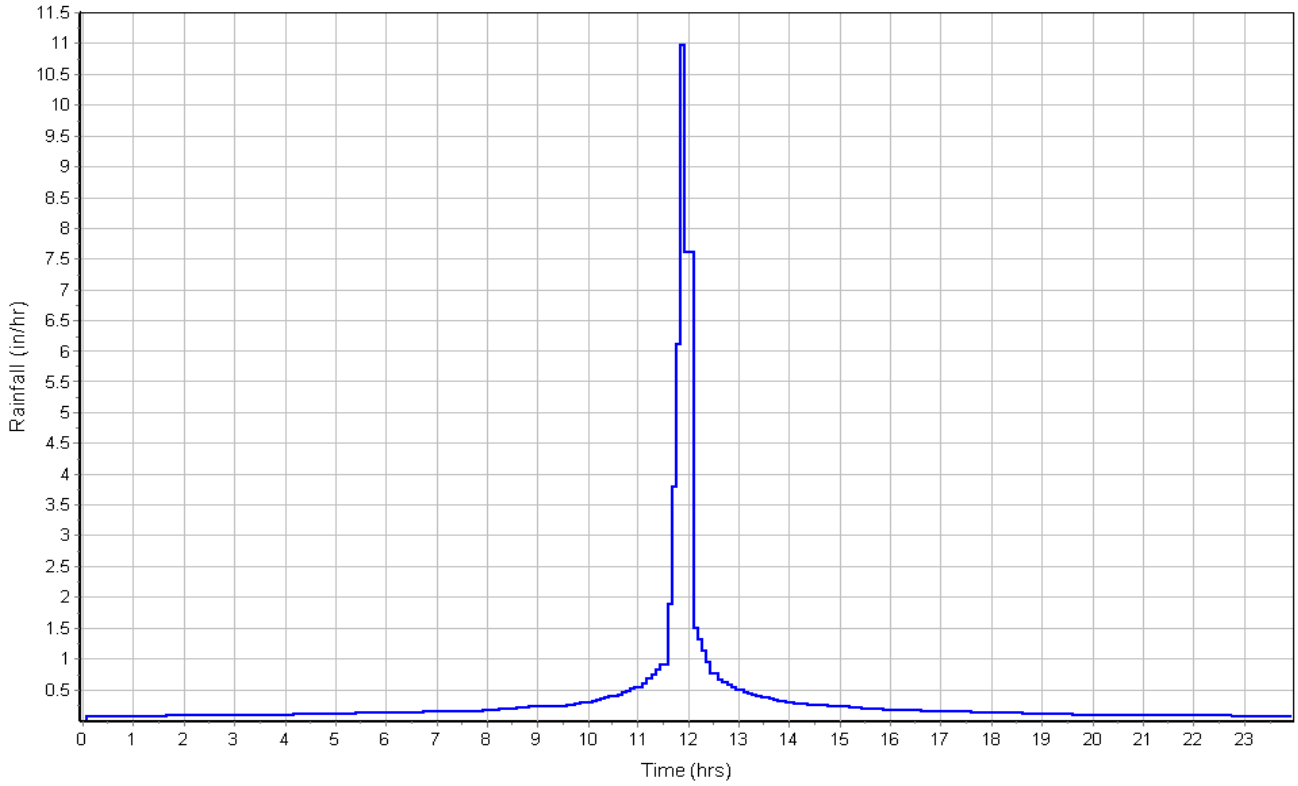
Total TOC (min) 7.58

Subbasin Runoff Results

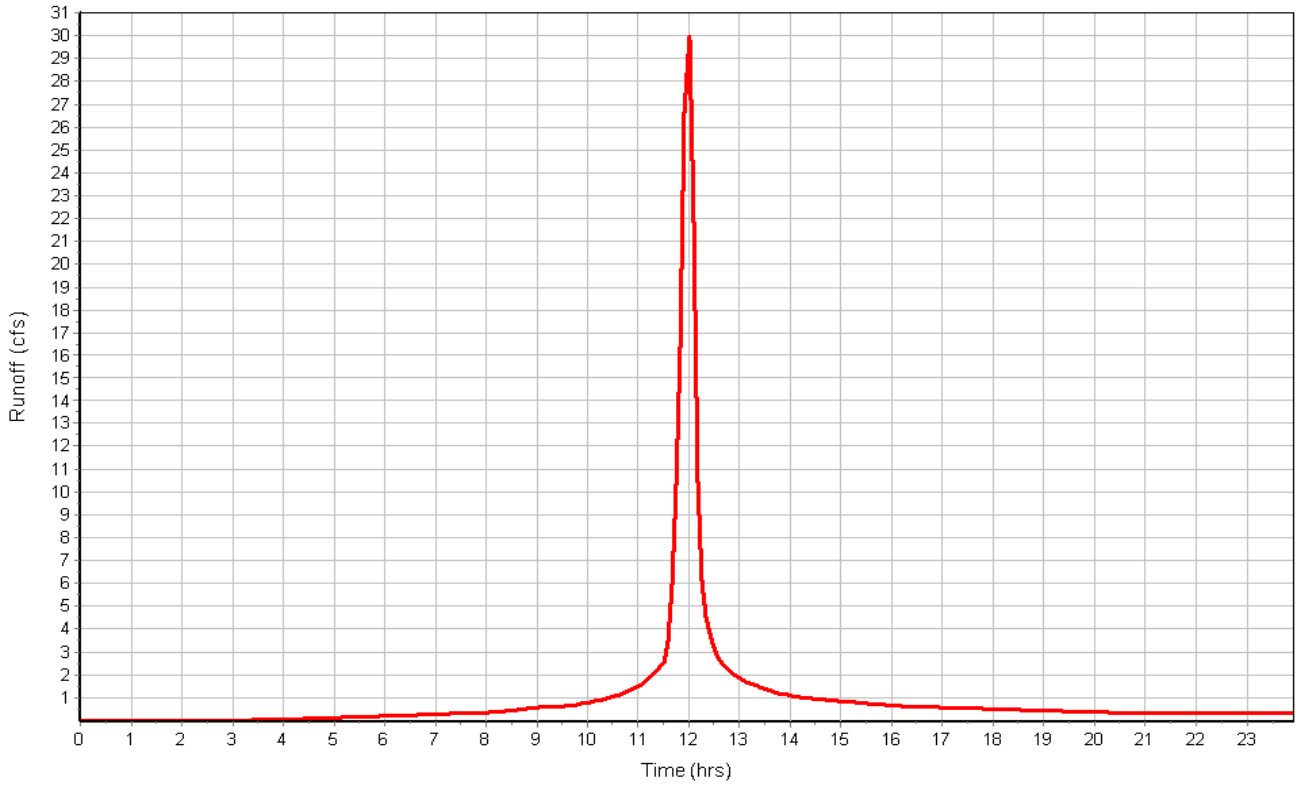
Total Rainfall (in) 8.00
Total Runoff (in) 6.66
Peak Runoff (cfs) 30.45
Weighted Curve Number 88.77
Time of Concentration (days hh:mm:ss) 0 00:07:35

Subbasin : DA6d-Pre

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : DA6e-Post

Input Data

Area (ac) 12.72
Weighted Curve Number 89.04
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	6.72	C	98.00
50 - 75% grass cover, Fair	6.00	C	79.00
Composite Area & Weighted CN	12.72		89.04

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.15	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	1	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.70	0.00	0.00
Velocity (ft/sec) :	0.16	0.00	0.00
Computed Flow Time (min) :	10.67	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	2400	0.00	0.00
Slope (%) :	1	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.61	0.00	0.00
Computed Flow Time (min) :	24.84	0.00	0.00

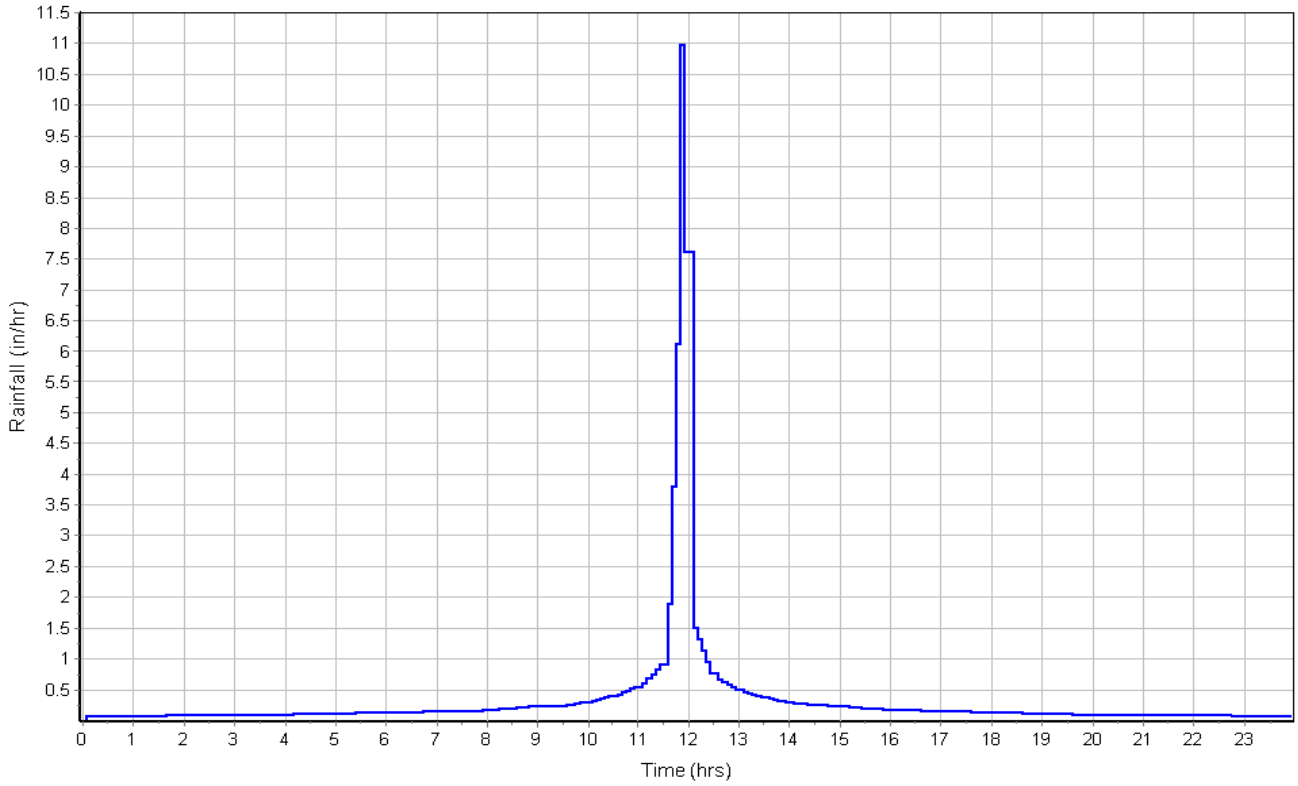
Total TOC (min) 35.51

Subbasin Runoff Results

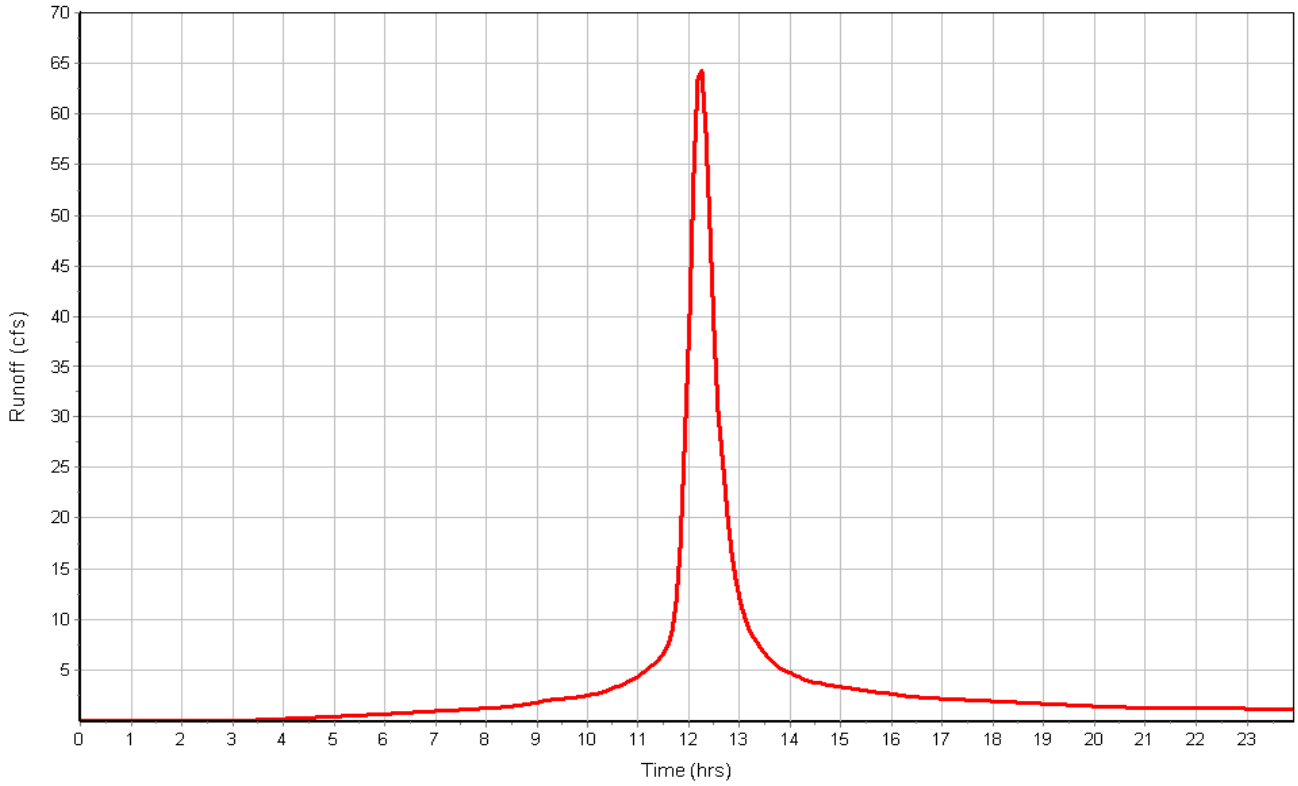
Total Rainfall (in) 8.00
Total Runoff (in) 6.69
Peak Runoff (cfs) 64.93
Weighted Curve Number 89.04
Time of Concentration (days hh:mm:ss) 0 00:35:31

Subbasin : DA6e-Post

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : DA6e-Pre

Input Data

Area (ac) 12.72
Weighted Curve Number 88.04
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	6.05	C	98.00
50 - 75% grass cover, Fair	6.67	C	79.00
Composite Area & Weighted CN	12.72		88.04

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.15	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	1	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.70	0.00	0.00
Velocity (ft/sec) :	0.16	0.00	0.00
Computed Flow Time (min) :	10.67	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	2400	0.00	0.00
Slope (%) :	1	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.61	0.00	0.00
Computed Flow Time (min) :	24.84	0.00	0.00

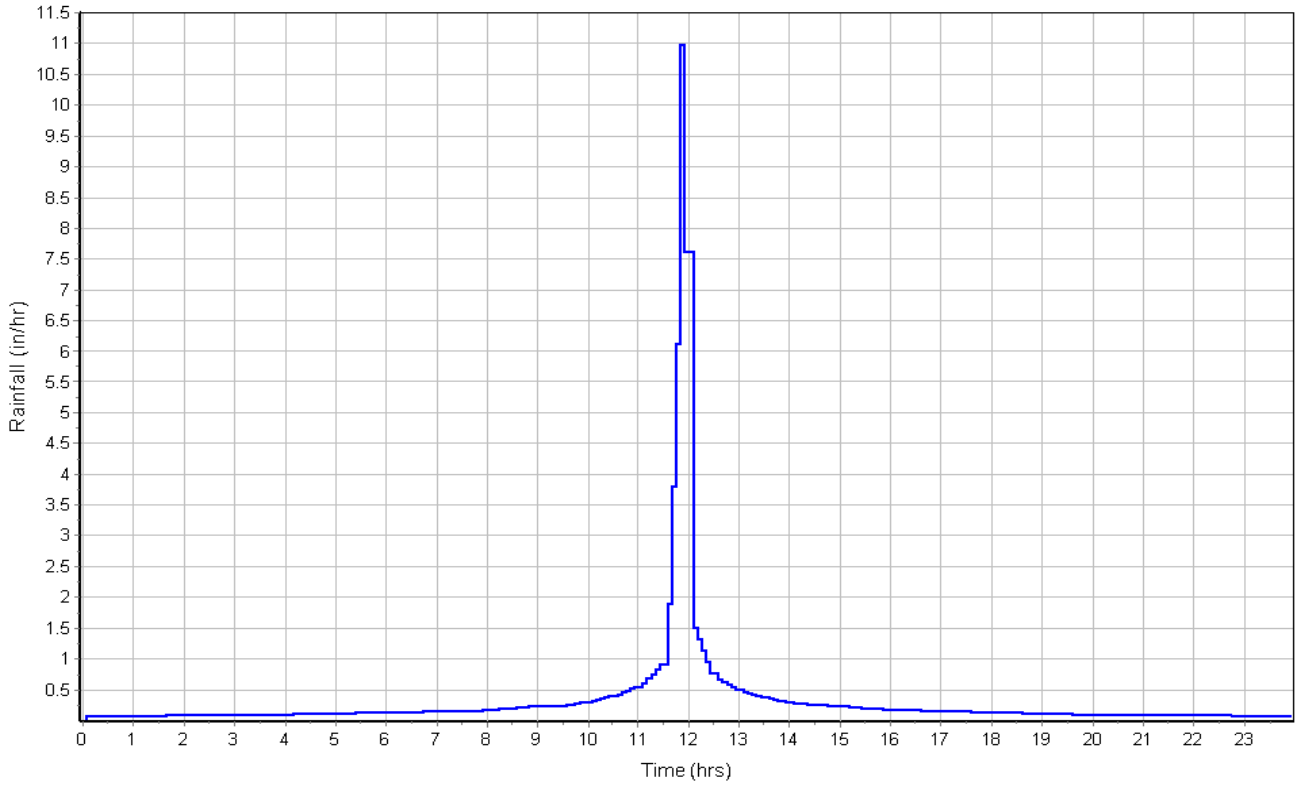
Total TOC (min) 35.51

Subbasin Runoff Results

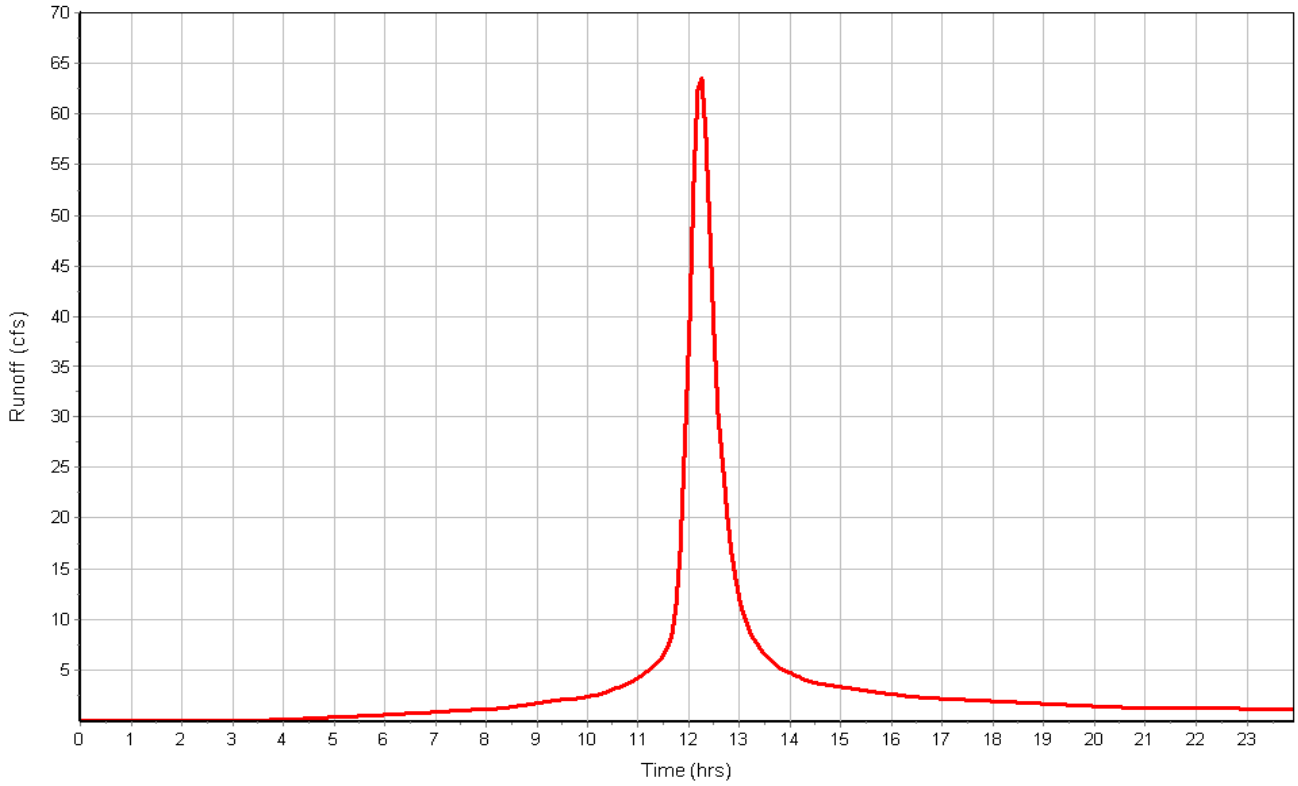
Total Rainfall (in) 8.00
Total Runoff (in) 6.57
Peak Runoff (cfs) 64.29
Weighted Curve Number 88.04
Time of Concentration (days hh:mm:ss) 0 00:35:31

Subbasin : DA6e-Pre

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage Area 7 - Post

Input Data

Area (ac)	20.67
Weighted Curve Number	89.81
Rain Gage ID	Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	11.76	C	98.00
50 - 75% grass cover, Fair	8.91	C	79.00
Composite Area & Weighted CN	20.67		89.81

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.15	0.00	0.00
Flow Length (ft) :	200	0.00	0.00
Slope (%) :	1.5	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.70	0.00	0.00
Velocity (ft/sec) :	0.21	0.00	0.00
Computed Flow Time (min) :	15.79	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	900	0.00	0.00
Slope (%) :	2.5	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	2.55	0.00	0.00
Computed Flow Time (min) :	5.88	0.00	0.00

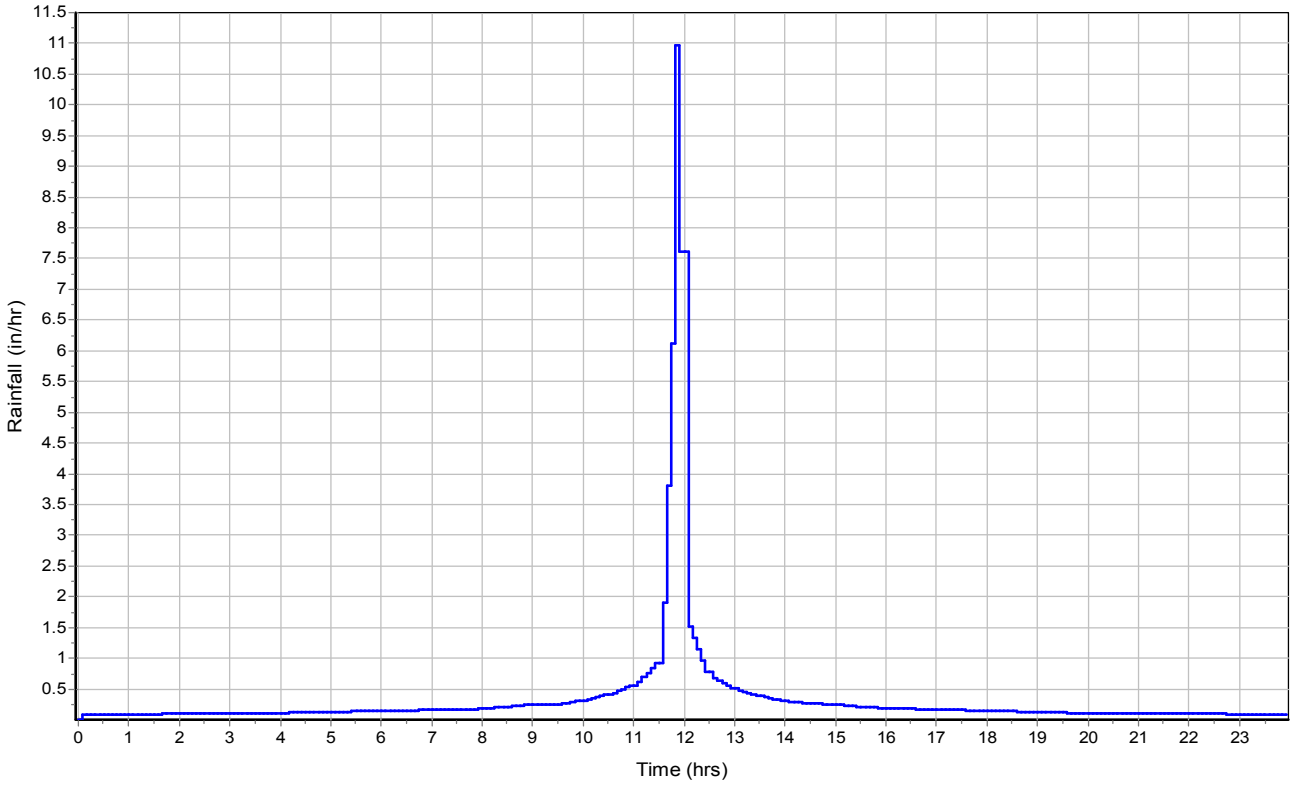
Total TOC (min) 21.68

Subbasin Runoff Results

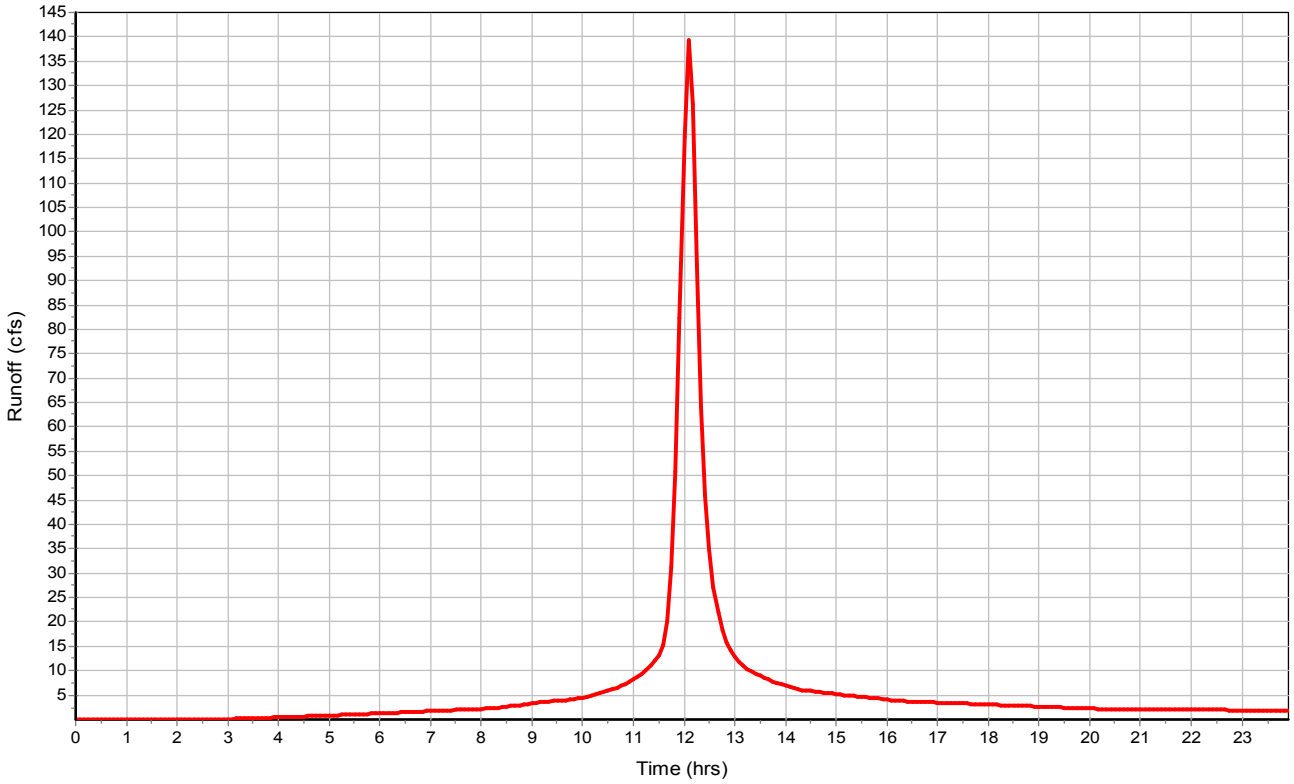
Total Rainfall (in)	8.00
Total Runoff (in)	6.78
Peak Runoff (cfs)	139.48
Weighted Curve Number	89.81
Time of Concentration (days hh:mm:ss)	0 00:21:41

Subbasin : Drainage Area 7 - Post

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage Area 7 - Pre

Input Data

Area (ac)	20.67
Weighted Curve Number	88.80
Rain Gage ID	Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	10.66	C	98.00
50 - 75% grass cover, Fair	10.01	C	79.00
Composite Area & Weighted CN	20.67		88.80

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.15	0.00	0.00
Flow Length (ft) :	200	0.00	0.00
Slope (%) :	1.5	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.70	0.00	0.00
Velocity (ft/sec) :	0.21	0.00	0.00
Computed Flow Time (min) :	15.79	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	900	0.00	0.00
Slope (%) :	2.5	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	2.55	0.00	0.00
Computed Flow Time (min) :	5.88	0.00	0.00

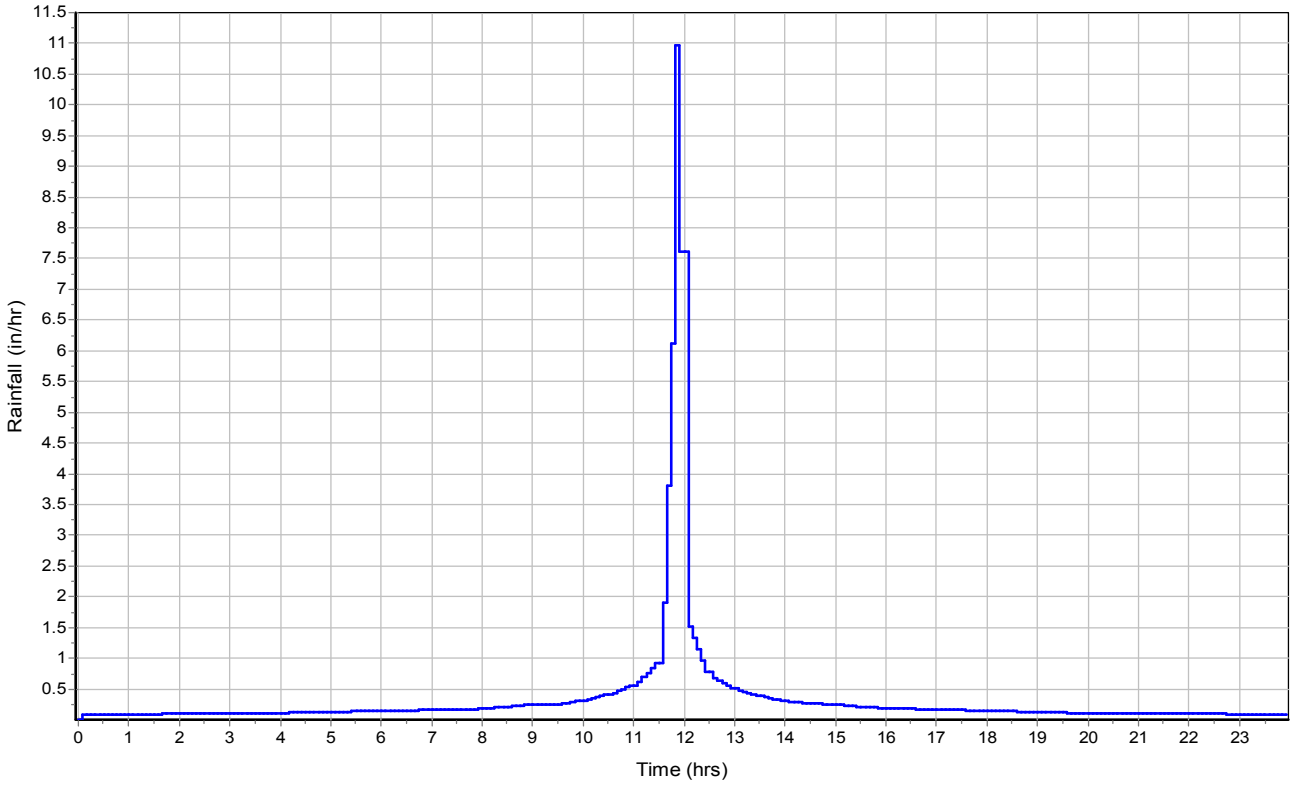
Total TOC (min) 21.68

Subbasin Runoff Results

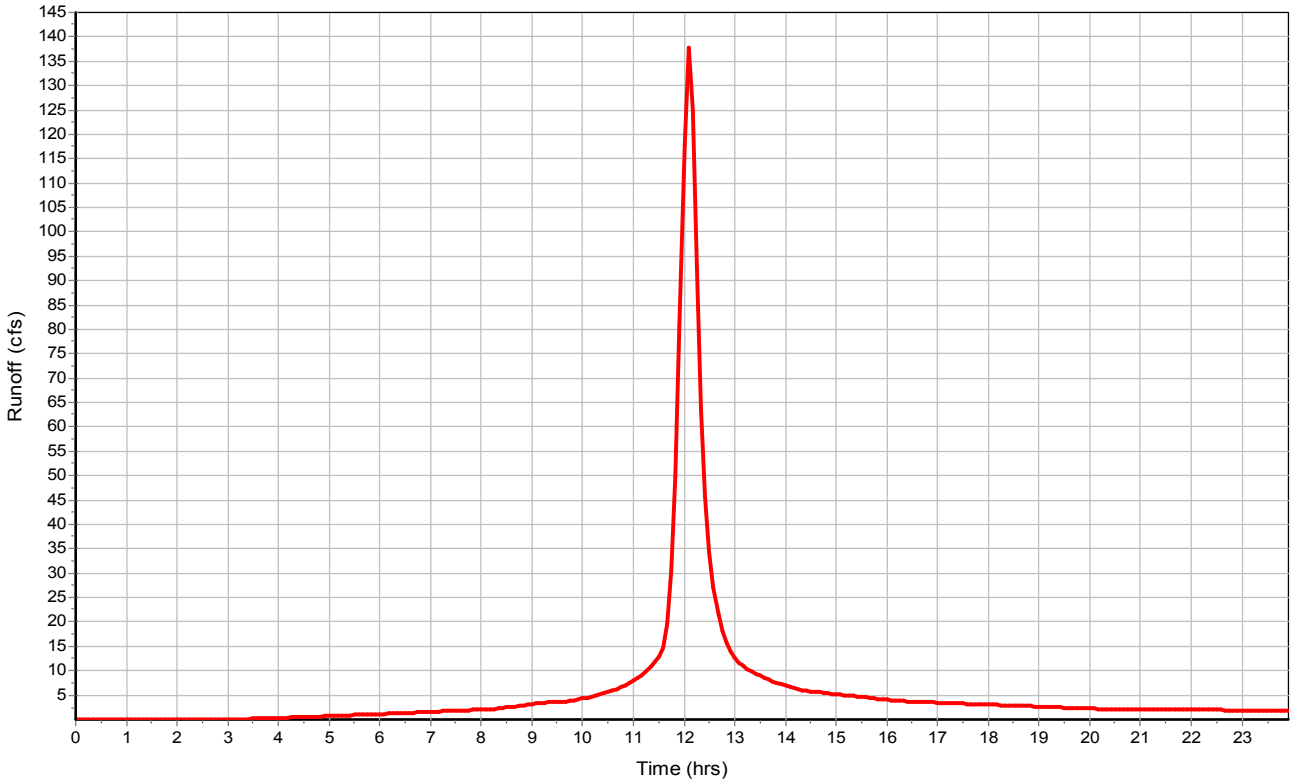
Total Rainfall (in)	8.00
Total Runoff (in)	6.66
Peak Runoff (cfs)	137.98
Weighted Curve Number	88.80
Time of Concentration (days hh:mm:ss)	0 00:21:41

Subbasin : Drainage Area 7 - Pre

Rainfall Intensity Graph



Runoff Hydrograph



Project Description

File Name	Pre-Post Hydrographs - DA6 Subareas.SPF
Description	
	I-95@SR21 DDI P.I.0012722

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	SCS TR-55
Time of Concentration (TOC) Method	SCS TR-55
Link Routing Method	Kinematic Wave
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	NO

Analysis Options

Start Analysis On	Nov 13, 2014	00:00:00
End Analysis On	Nov 14, 2014	00:00:00
Start Reporting On	Nov 13, 2014	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins	24
Nodes	12
Junctions	0
Outfalls	12
Flow Diversions	0
Inlets	0
Storage Nodes	0
Links	0
Channels	0
Pipes	0
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1		Time Series	100-Year Storm	Cumulative	inches	Georgia	Chatham	100	10.00	SCS Type II 24-hr

Subbasin Summary

SN	Subbasin ID	Area (ac)	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ft^3)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	DA6a-Post	2.92	87.72	10.00	8.50	90054.21	31.93	0 00:10:00
2	DA6a-Pre	2.92	87.65	10.00	8.49	89969.41	31.93	0 00:10:00
3	DA6b-Post	2.20	83.15	10.00	7.92	63265.09	21.39	0 00:13:25
4	DA6b-Pre	2.20	83.06	10.00	7.91	63169.26	21.35	0 00:13:25
5	DA6c-Post	0.44	81.16	10.00	7.67	12247.33	4.04	0 00:15:04
6	DA6c-Pre	0.44	81.16	10.00	7.67	12247.33	4.04	0 00:15:04
7	DA6d-Post	3.52	89.58	10.00	8.73	111522.90	39.11	0 00:10:00
8	DA6d-Pre	3.52	88.77	10.00	8.63	110232.36	38.87	0 00:10:00
9	DA6e-Post	12.72	89.04	10.00	8.66	399909.57	83.01	0 00:35:30
10	DA6e-Pre	12.72	88.04	10.00	8.54	394137.87	82.47	0 00:35:30
11	Drainage Area 1-Post	5.18	89.16	10.00	8.68	163138.31	39.33	0 00:27:27
12	Drainage Area 1-Pre	5.18	89.16	10.00	8.68	163138.31	39.33	0 00:27:27
13	Drainage Area 2-Post	1.88	85.16	10.00	8.18	55789.47	17.70	0 00:15:49
14	Drainage Area 2-Pre	1.88	84.15	10.00	8.05	54922.77	17.51	0 00:15:49
15	Drainage Area 3-Post	3.00	87.55	10.00	8.48	92292.75	32.81	0 00:10:00
16	Drainage Area 3-Pre	3.00	86.28	10.00	8.32	90561.24	32.44	0 00:10:00
17	Drainage Area 4-Post	1.91	87.36	10.00	8.45	58593.32	20.80	0 00:10:00
18	Drainage Area 4-Pre	1.91	87.36	10.00	8.45	58593.32	20.80	0 00:10:00
19	Drainage Area 5 - Post	8.14	88.94	10.00	8.65	255532.84	78.56	0 00:16:09
20	Drainage Area 5 - Pre	8.14	88.06	10.00	8.54	252312.09	78.05	0 00:16:09
21	Drainage Area 6 - Post	21.80	88.21	10.00	8.56	677149.67	182.78	0 00:22:19
22	Drainage Area 6 - Pre	21.80	87.48	10.00	8.47	669948.47	181.27	0 00:22:19
23	Drainage Area 7 - Post	20.67	89.81	10.00	8.76	656981.09	177.92	0 00:21:40
24	Drainage Area 7 - Pre	20.67	88.80	10.00	8.63	647602.08	176.32	0 00:21:40

Subbasin Hydrology

Subbasin : Drainage Area 1-Post

Input Data

Area (ac) 5.18
Weighted Curve Number 89.16
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	2.77	C	98.00
50 - 75% grass cover, Fair	2.41	C	79.00
Composite Area & Weighted CN	5.18		89.16

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.011	0.00	0.00
Flow Length (ft) :	115	0.00	0.00
Slope (%) :	0.4	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.7	0.00	0.00
Velocity (ft/sec) :	0.90	0.00	0.00
Computed Flow Time (min) :	2.13	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	1550	0.00	0.00
Slope (%) :	0.4	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.02	0.00	0.00
Computed Flow Time (min) :	25.33	0.00	0.00

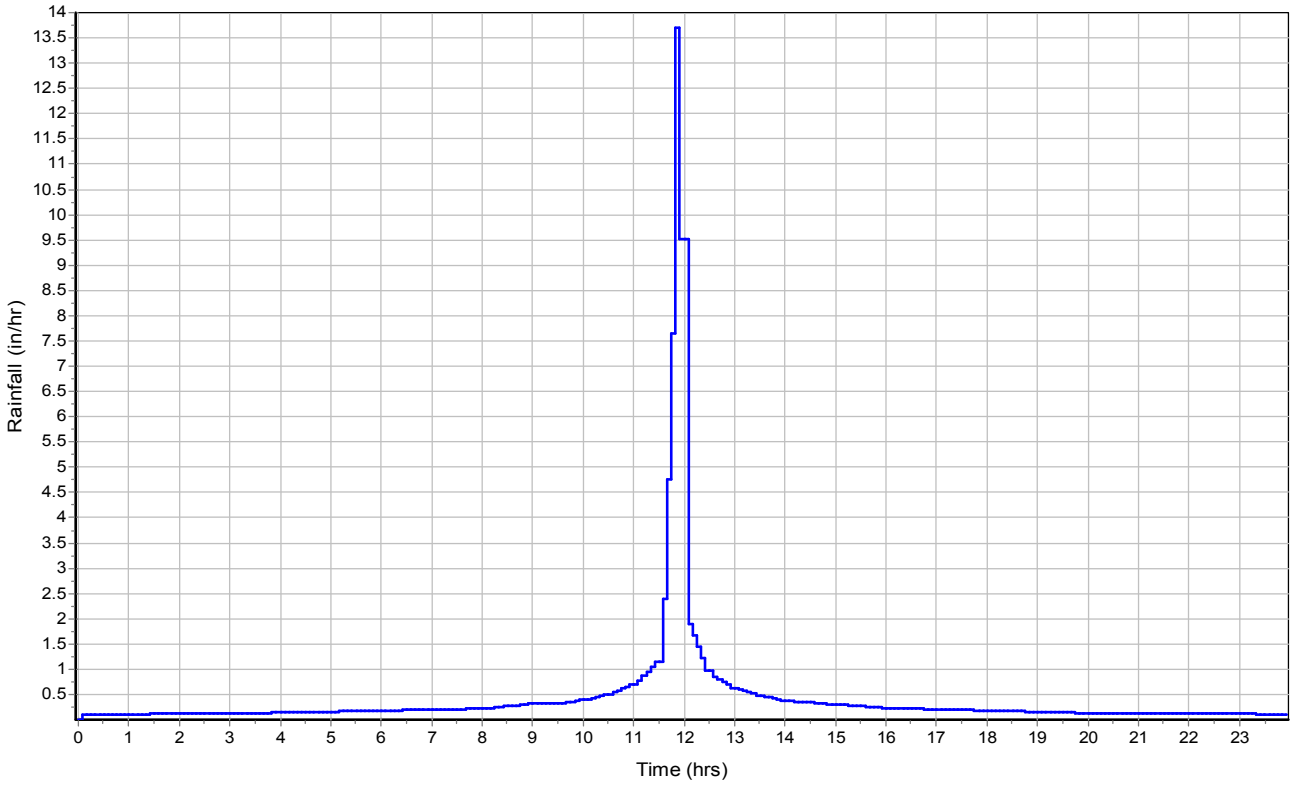
Total TOC (min) 27.46

Subbasin Runoff Results

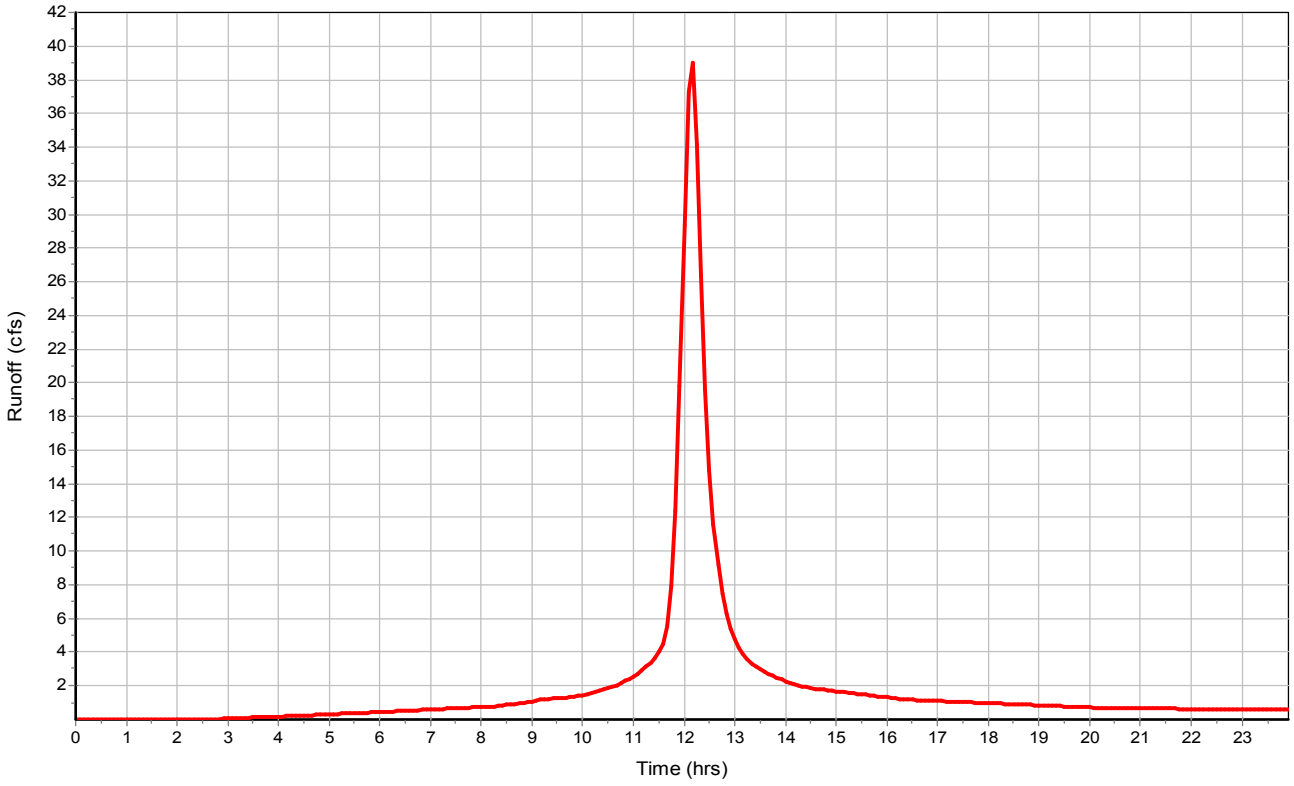
Total Rainfall (in)	10.00
Total Runoff (in)	8.68
Peak Runoff (cfs)	39.33
Weighted Curve Number	89.16
Time of Concentration (days hh:mm:ss)	0 00:27:28

Subbasin : Drainage Area 1-Post

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage Area 1-Pre

Input Data

Area (ac) 5.18
Weighted Curve Number 89.16
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	2.77	C	98.00
50 - 75% grass cover, Fair	2.41	C	79.00
Composite Area & Weighted CN	5.18		89.16

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.011	0.00	0.00
Flow Length (ft) :	115	0.00	0.00
Slope (%) :	0.4	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.7	0.00	0.00
Velocity (ft/sec) :	0.90	0.00	0.00
Computed Flow Time (min) :	2.13	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	1550	0.00	0.00
Slope (%) :	0.4	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.02	0.00	0.00
Computed Flow Time (min) :	25.33	0.00	0.00

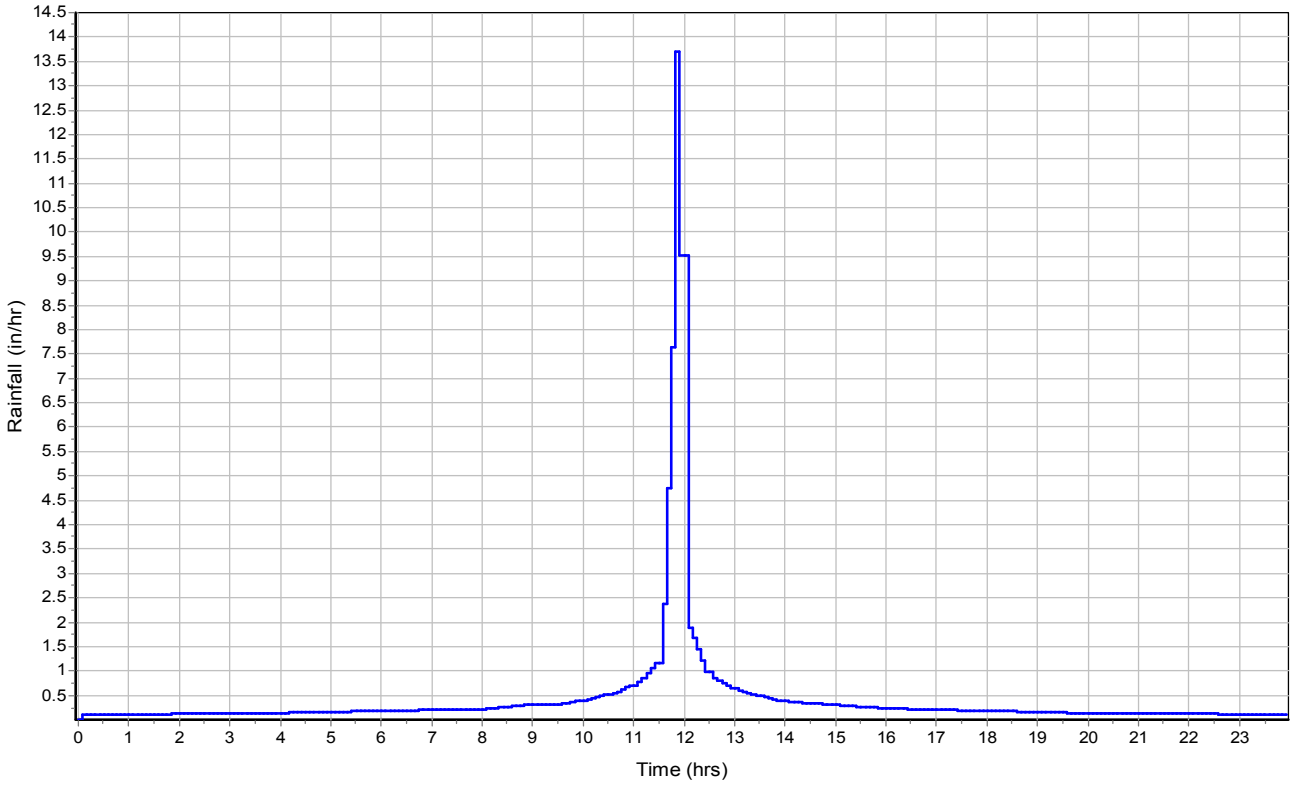
Total TOC (min) 27.46

Subbasin Runoff Results

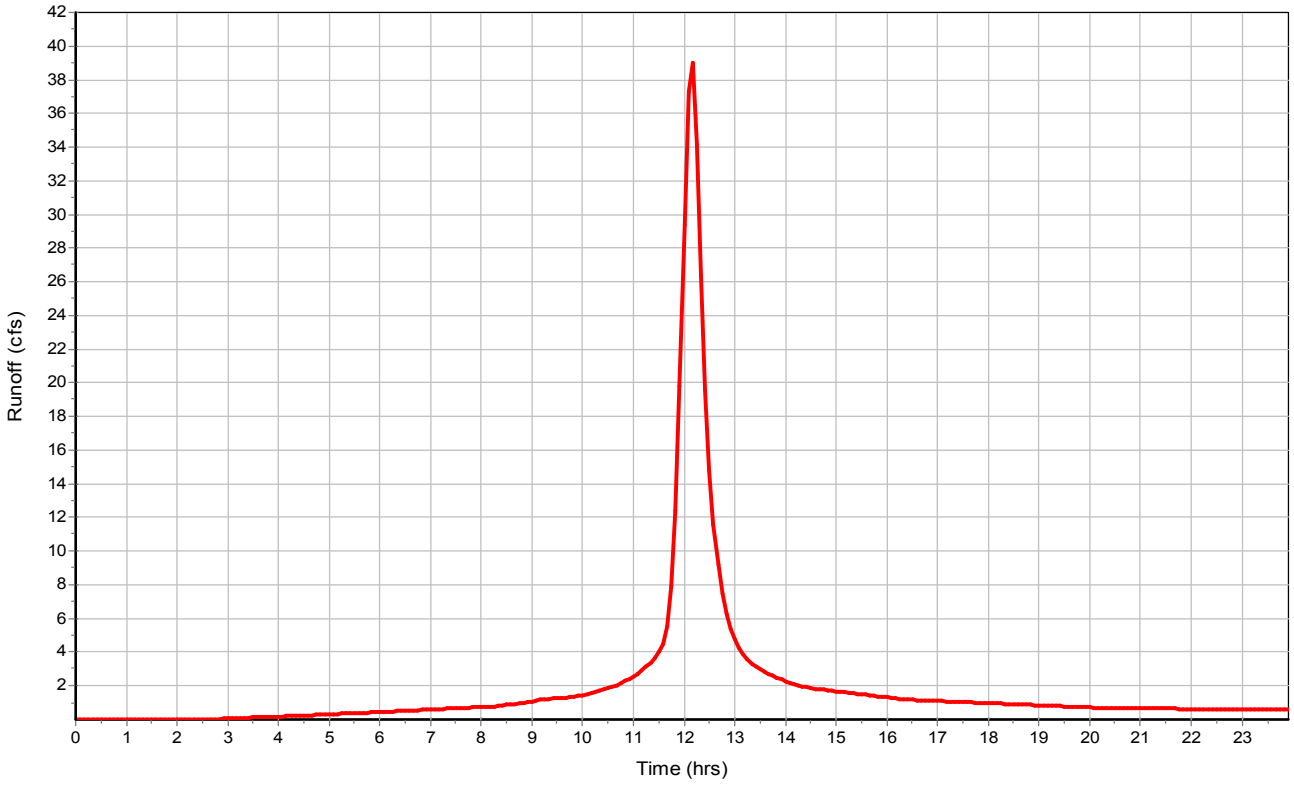
Total Rainfall (in) 10.00
Total Runoff (in) 8.68
Peak Runoff (cfs) 39.33
Weighted Curve Number 89.16
Time of Concentration (days hh:mm:ss) 0 00:27:28

Subbasin : Drainage Area 1-Pre

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage Area 2-Post

Input Data

Area (ac)	1.88
Weighted Curve Number	85.16
Rain Gage ID	Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.61	C	98.00
50 - 75% grass cover, Fair	1.27	C	79.00
Composite Area & Weighted CN	1.88		85.16

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.011	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	2.5	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.7	0.00	0.00
Velocity (ft/sec) :	1.82	0.00	0.00
Computed Flow Time (min) :	0.91	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	1020	0.00	0.00
Slope (%) :	0.5	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.14	0.00	0.00
Computed Flow Time (min) :	14.91	0.00	0.00

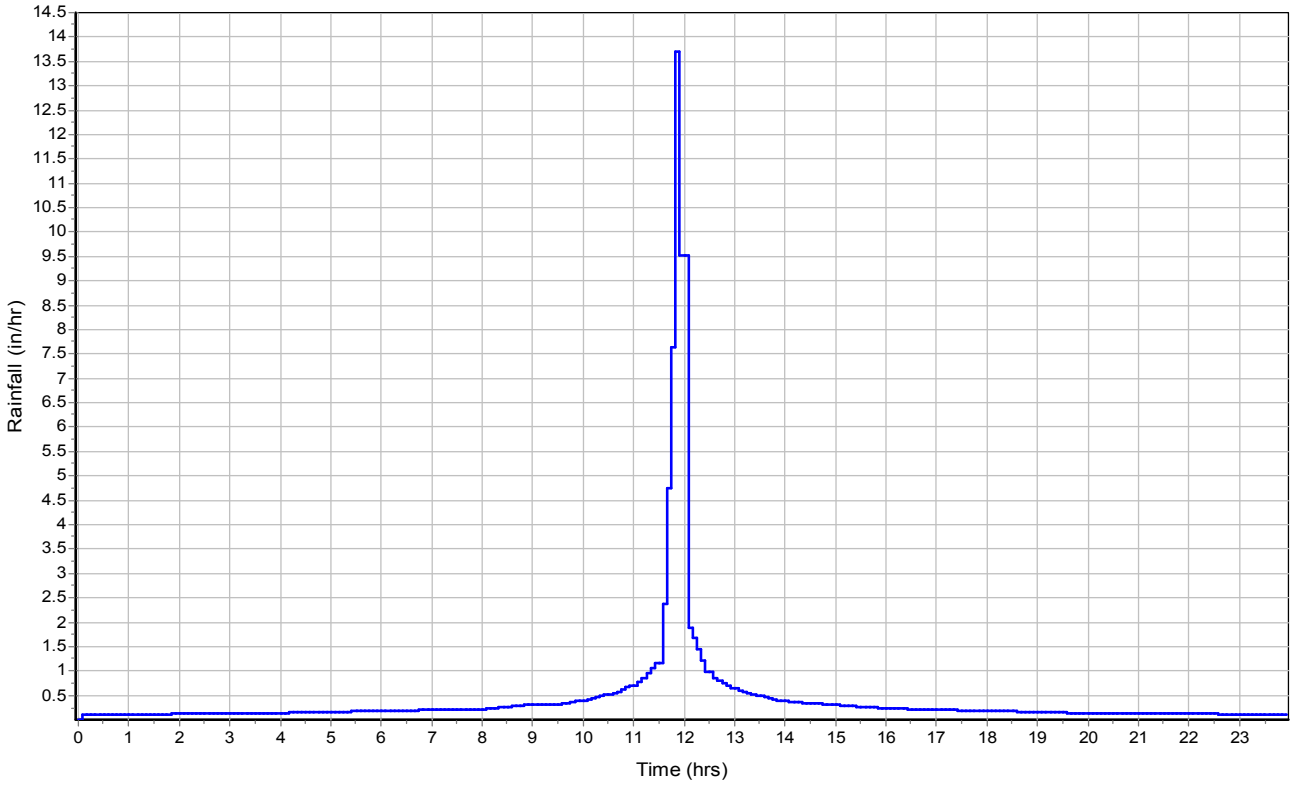
Total TOC (min) 15.83

Subbasin Runoff Results

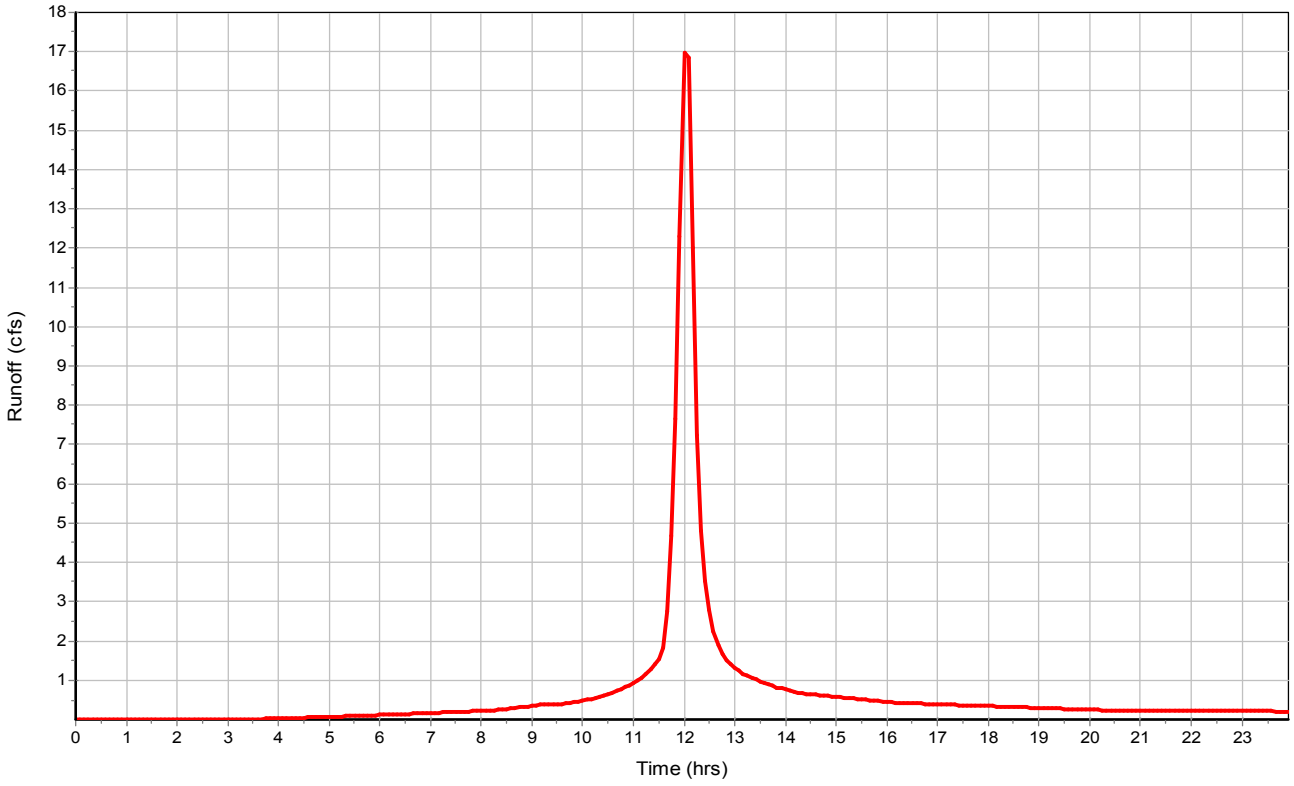
Total Rainfall (in)	10.00
Total Runoff (in)	8.18
Peak Runoff (cfs)	17.70
Weighted Curve Number	85.16
Time of Concentration (days hh:mm:ss)	0 00:15:50

Subbasin : Drainage Area 2-Post

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage Area 2-Pre

Input Data

Area (ac)	1.88
Weighted Curve Number	84.15
Rain Gage ID	Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.51	C	98.00
50 - 75% grass cover, Fair	1.37	C	79.00
Composite Area & Weighted CN	1.88		84.15

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.011	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	2.5	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.7	0.00	0.00
Velocity (ft/sec) :	1.82	0.00	0.00
Computed Flow Time (min) :	0.91	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	1020	0.00	0.00
Slope (%) :	0.5	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.14	0.00	0.00
Computed Flow Time (min) :	14.91	0.00	0.00

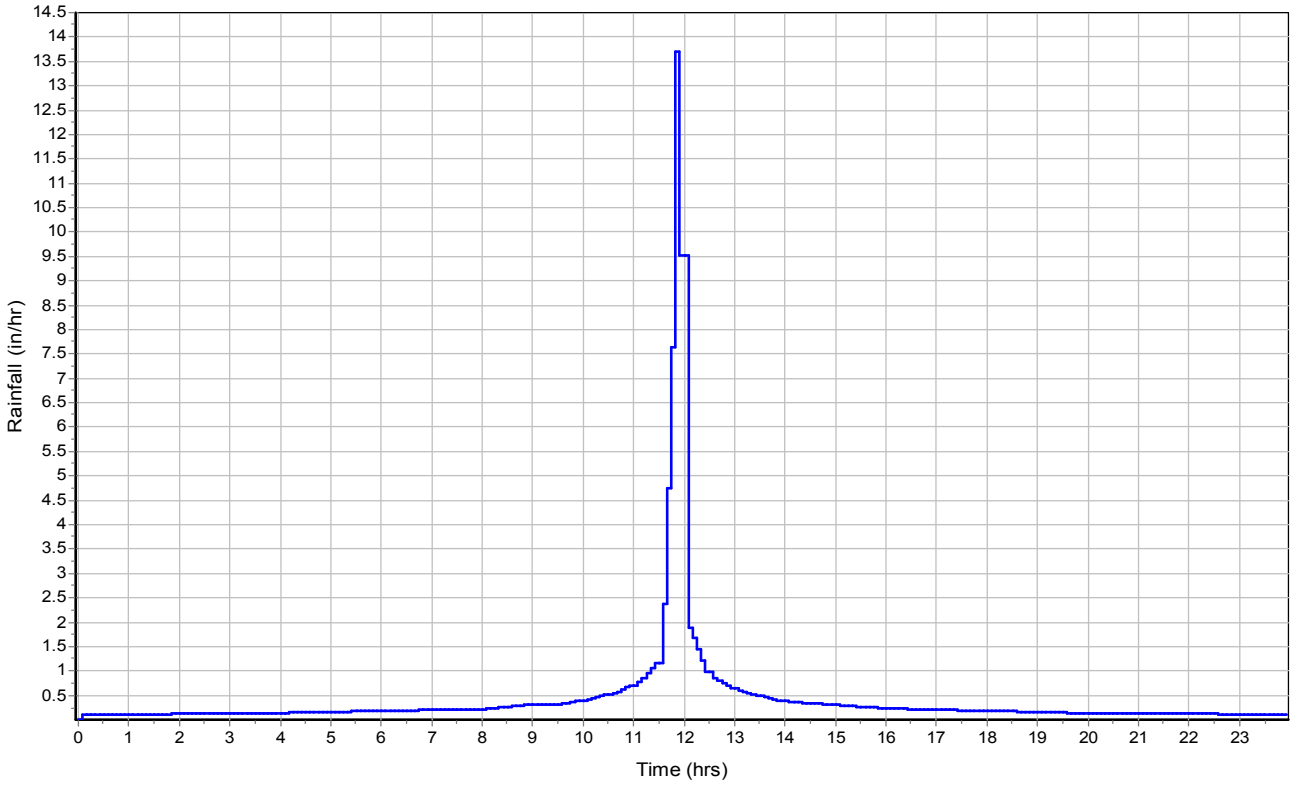
Total TOC (min) 15.83

Subbasin Runoff Results

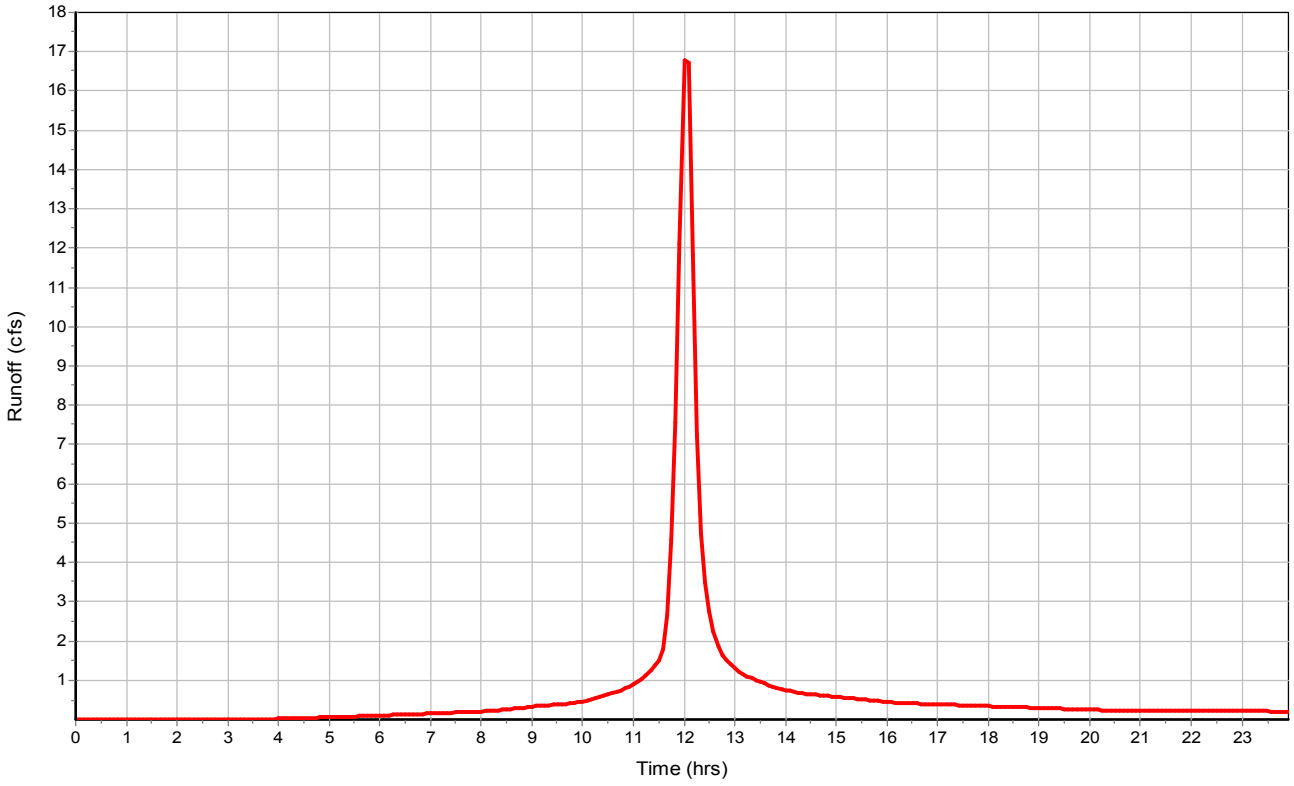
Total Rainfall (in)	10.00
Total Runoff (in)	8.05
Peak Runoff (cfs)	17.51
Weighted Curve Number	84.15
Time of Concentration (days hh:mm:ss)	0 00:15:50

Subbasin : Drainage Area 2-Pre

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage Area 3-Post

Input Data

Area (ac) 3.00
Weighted Curve Number 87.55
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	1.35	C	98.00
50 - 75% grass cover, Fair	1.65	C	79.00
Composite Area & Weighted CN	3.00		87.55

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.011	0.00	0.00
Flow Length (ft) :	250	0.00	0.00
Slope (%) :	1.6	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.7	0.00	0.00
Velocity (ft/sec) :	1.83	0.00	0.00
Computed Flow Time (min) :	2.28	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	400	0.00	0.00
Slope (%) :	0.9	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.53	0.00	0.00
Computed Flow Time (min) :	4.36	0.00	0.00

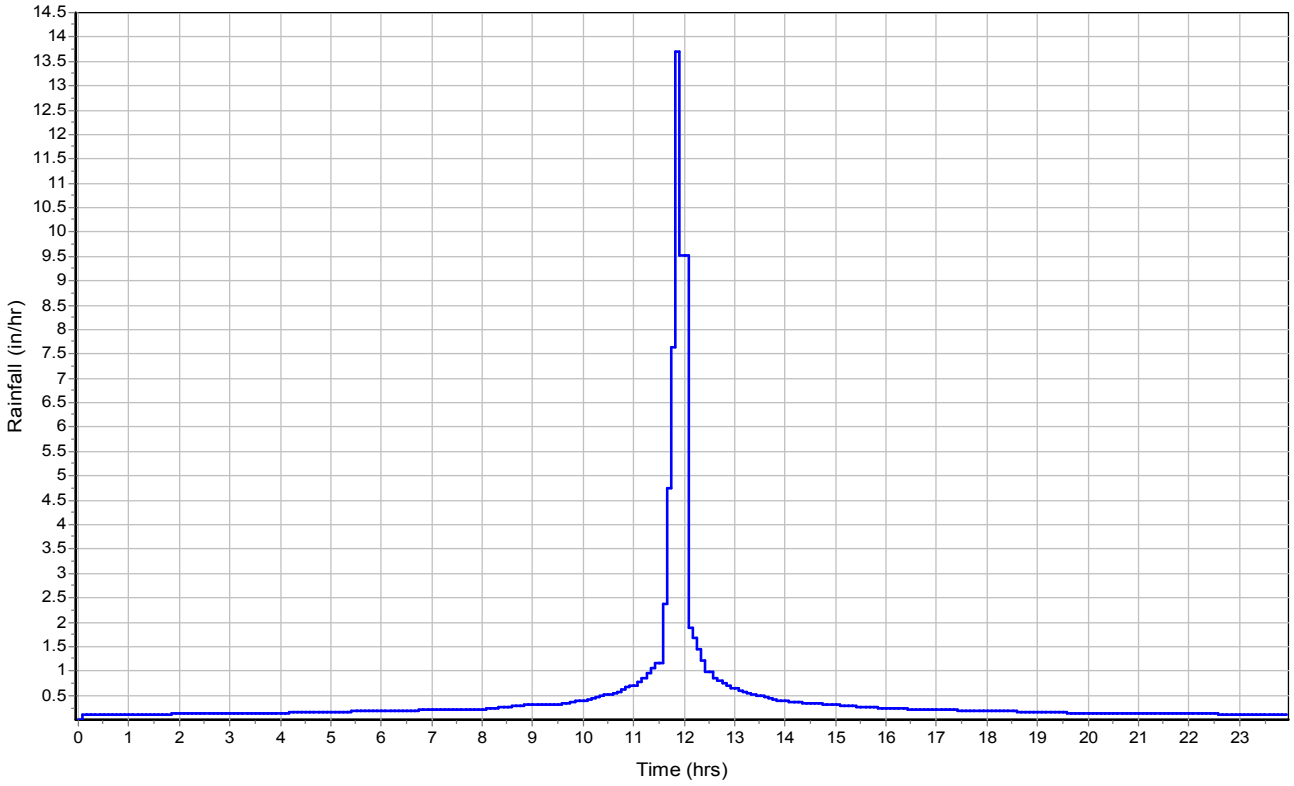
Total TOC (min) 6.63

Subbasin Runoff Results

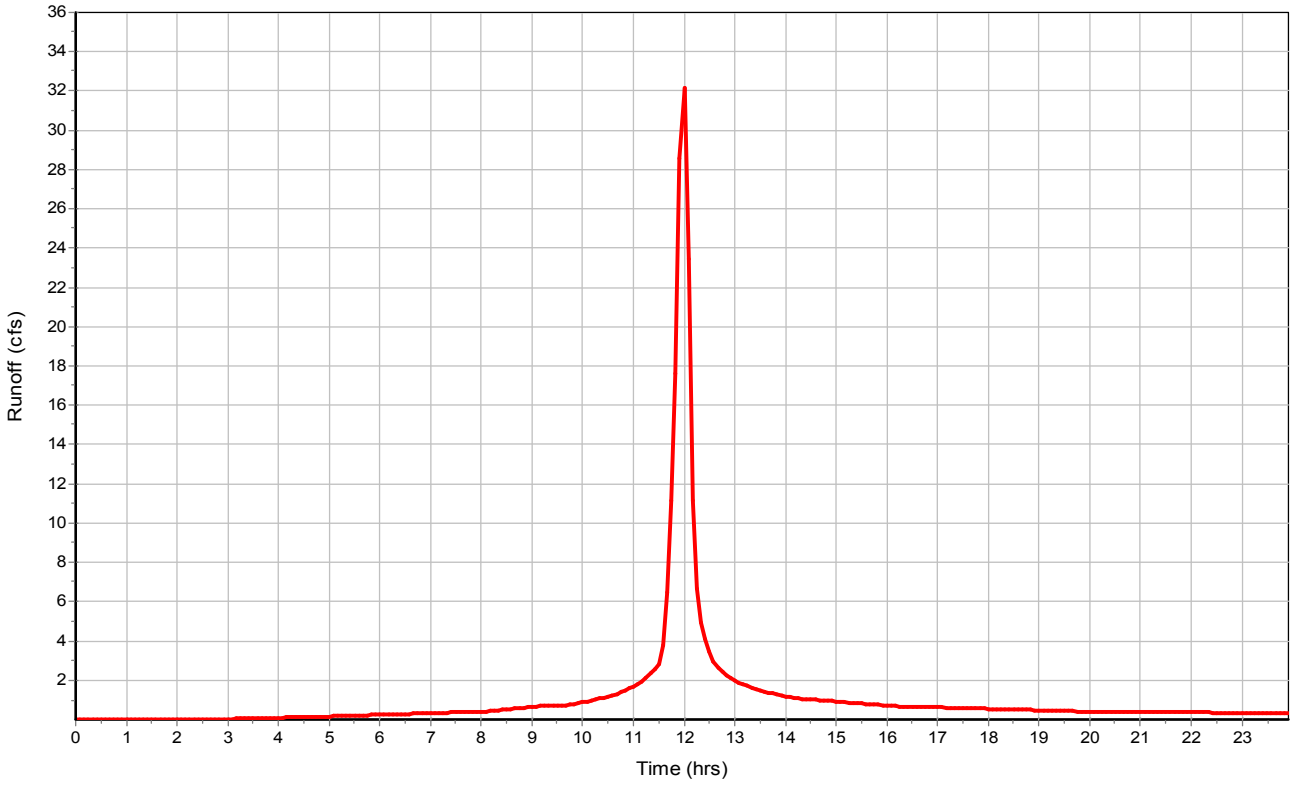
Total Rainfall (in) 10.00
Total Runoff (in) 8.48
Peak Runoff (cfs) 32.81
Weighted Curve Number 87.55
Time of Concentration (days hh:mm:ss) 0 00:06:38

Subbasin : Drainage Area 3-Post

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage Area 3-Pre

Input Data

Area (ac)	3.00
Weighted Curve Number	86.28
Rain Gage ID	Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	1.15	C	98.00
50 - 75% grass cover, Fair	1.85	C	79.00
Composite Area & Weighted CN	3.00		86.28

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.011	0.00	0.00
Flow Length (ft) :	250	0.00	0.00
Slope (%) :	1.6	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.7	0.00	0.00
Velocity (ft/sec) :	1.83	0.00	0.00
Computed Flow Time (min) :	2.28	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	400	0.00	0.00
Slope (%) :	0.9	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.53	0.00	0.00
Computed Flow Time (min) :	4.36	0.00	0.00

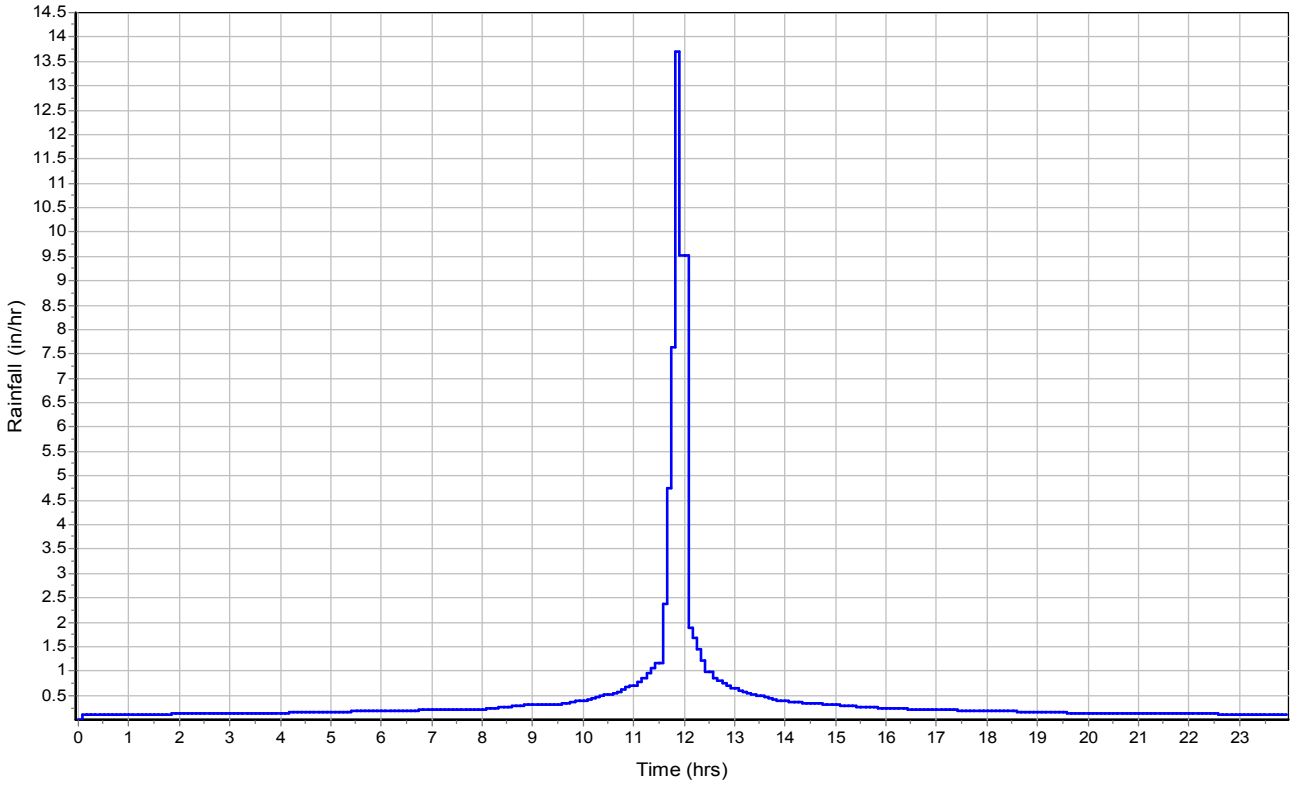
Total TOC (min) 6.63

Subbasin Runoff Results

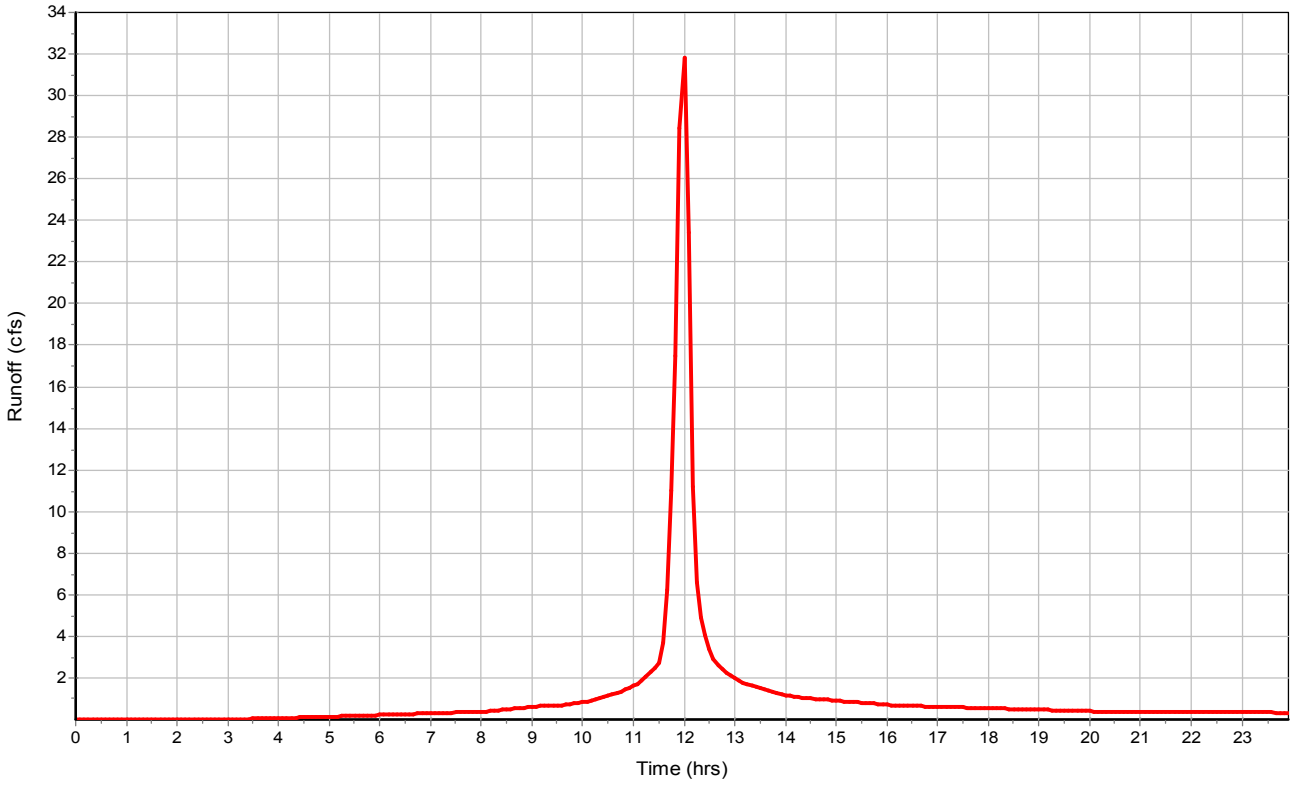
Total Rainfall (in)	10.00
Total Runoff (in)	8.32
Peak Runoff (cfs)	32.44
Weighted Curve Number	86.28
Time of Concentration (days hh:mm:ss)	0 00:06:38

Subbasin : Drainage Area 3-Pre

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage Area 4-Post

Input Data

Area (ac) 1.91
Weighted Curve Number 87.36
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.84	C	98.00
50 - 75% grass cover, Fair	1.07	C	79.00
Composite Area & Weighted CN	1.91		87.36

Time of Concentration

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	573	0.00	0.00
Slope (%) :	1.6	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	2.04	0.00	0.00
Computed Flow Time (min) :	4.68	0.00	0.00

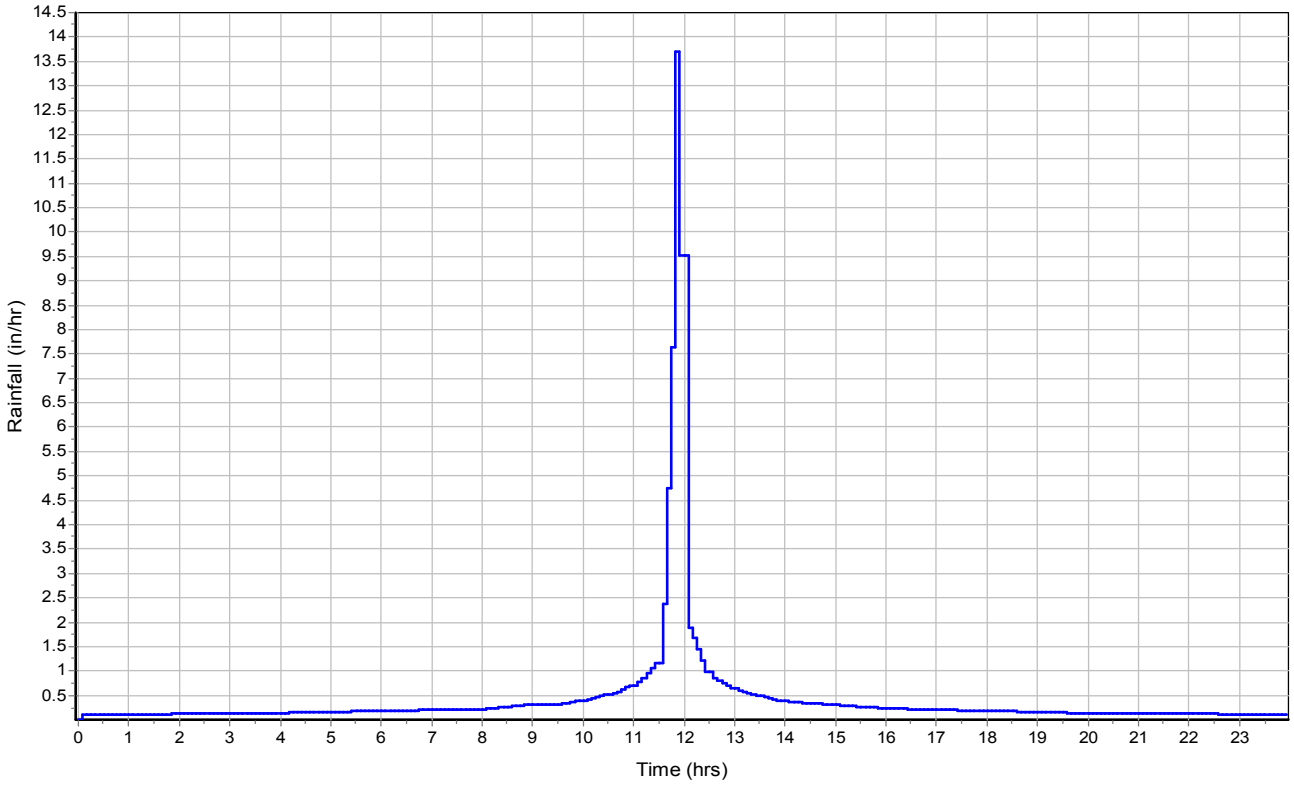
Total TOC (min) 4.68

Subbasin Runoff Results

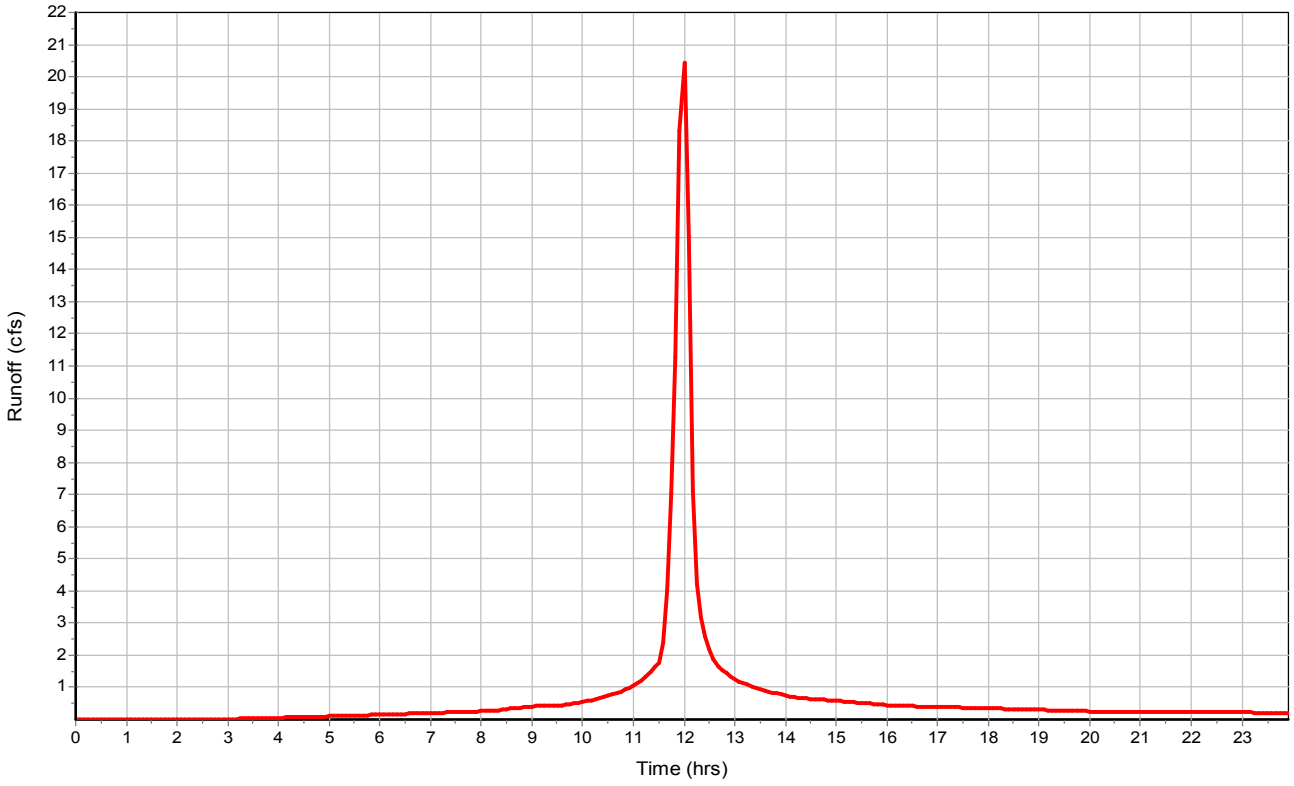
Total Rainfall (in) 10.00
Total Runoff (in) 8.45
Peak Runoff (cfs) 20.80
Weighted Curve Number 87.36
Time of Concentration (days hh:mm:ss) 0 00:04:41

Subbasin : Drainage Area 4-Post

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage Area 4-Pre

Input Data

Area (ac) 1.91
Weighted Curve Number 87.36
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved roads with curbs & sewers	0.84	C	98.00
50 - 75% grass cover, Fair	1.07	C	79.00
Composite Area & Weighted CN	1.91		87.36

Time of Concentration

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	573	0.00	0.00
Slope (%) :	1.6	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	2.04	0.00	0.00
Computed Flow Time (min) :	4.68	0.00	0.00

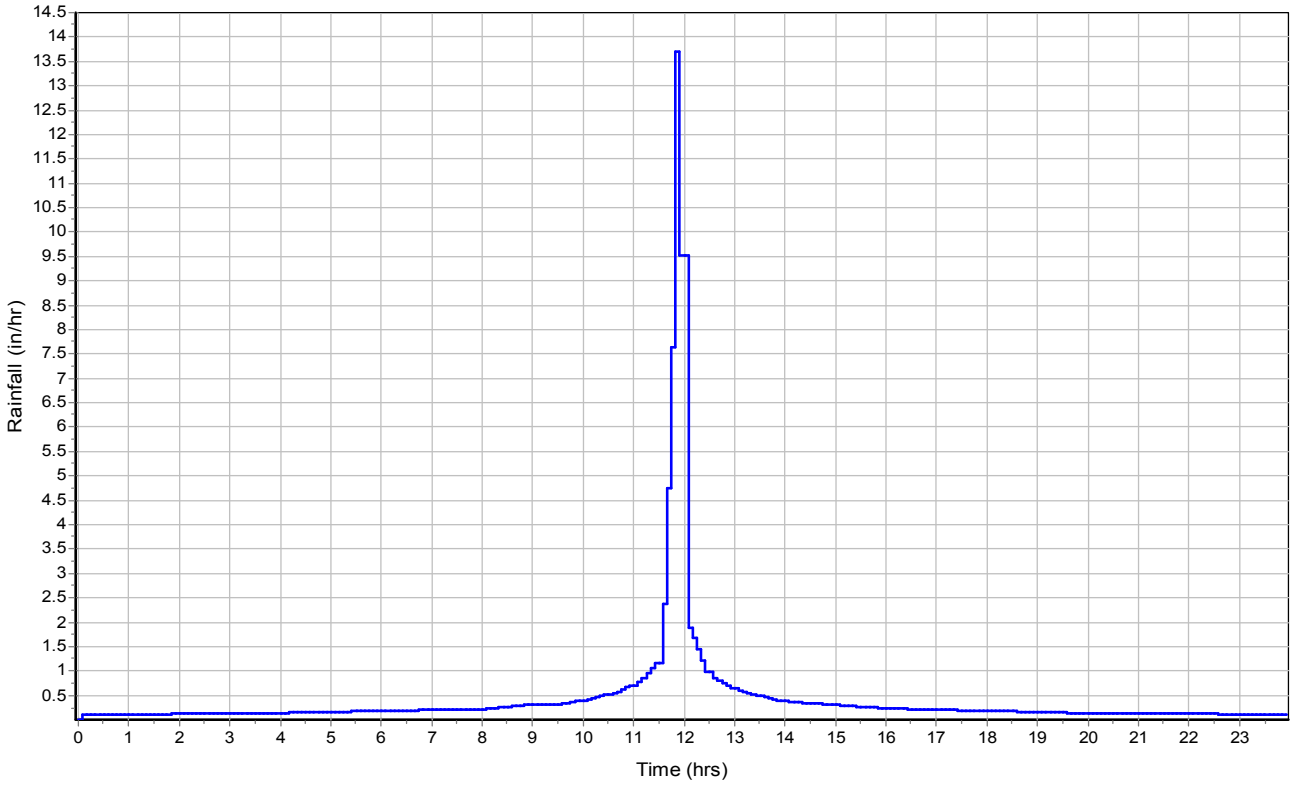
Total TOC (min) 4.68

Subbasin Runoff Results

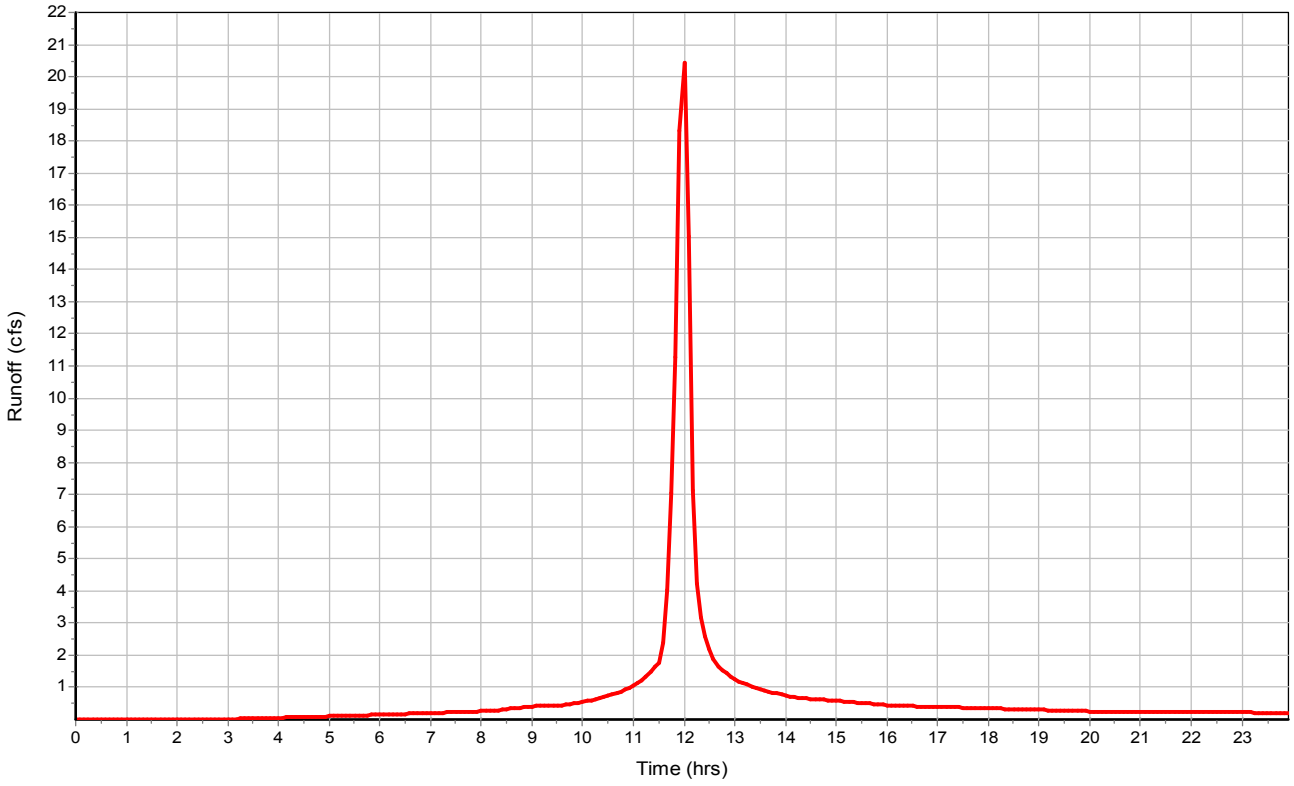
Total Rainfall (in) 10.00
Total Runoff (in) 8.45
Peak Runoff (cfs) 20.80
Weighted Curve Number 87.36
Time of Concentration (days hh:mm:ss) 0 00:04:41

Subbasin : Drainage Area 4-Pre

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage Area 5 - Post

Input Data

Area (ac)	8.14
Weighted Curve Number	88.94
Rain Gage ID	Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	4.26	C	98.00
50 - 75% grass cover, Fair	3.88	C	79.00
Composite Area & Weighted CN	8.14		88.94

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.15	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	1.1	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.70	0.00	0.00
Velocity (ft/sec) :	0.16	0.00	0.00
Computed Flow Time (min) :	10.27	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	700	0.00	0.00
Slope (%) :	1.5	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.98	0.00	0.00
Computed Flow Time (min) :	5.89	0.00	0.00

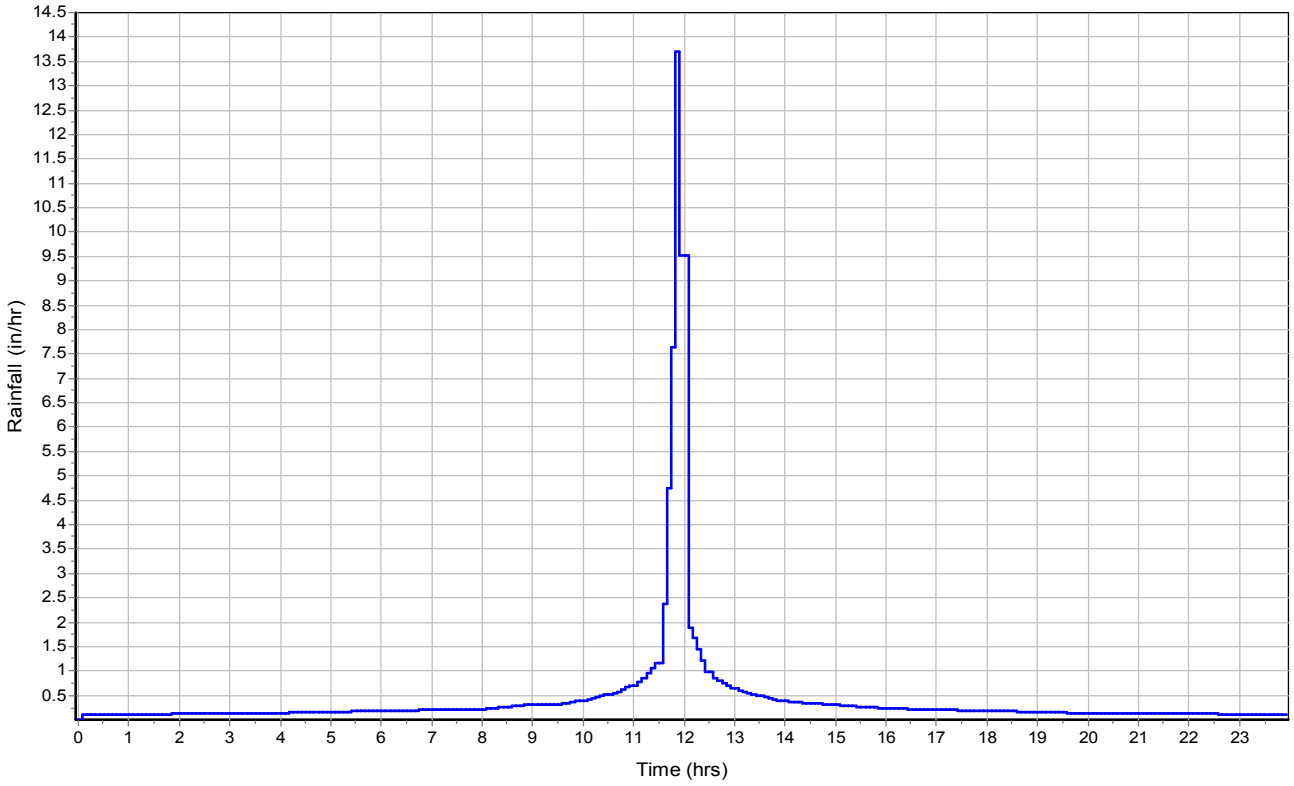
Total TOC (min) 16.16

Subbasin Runoff Results

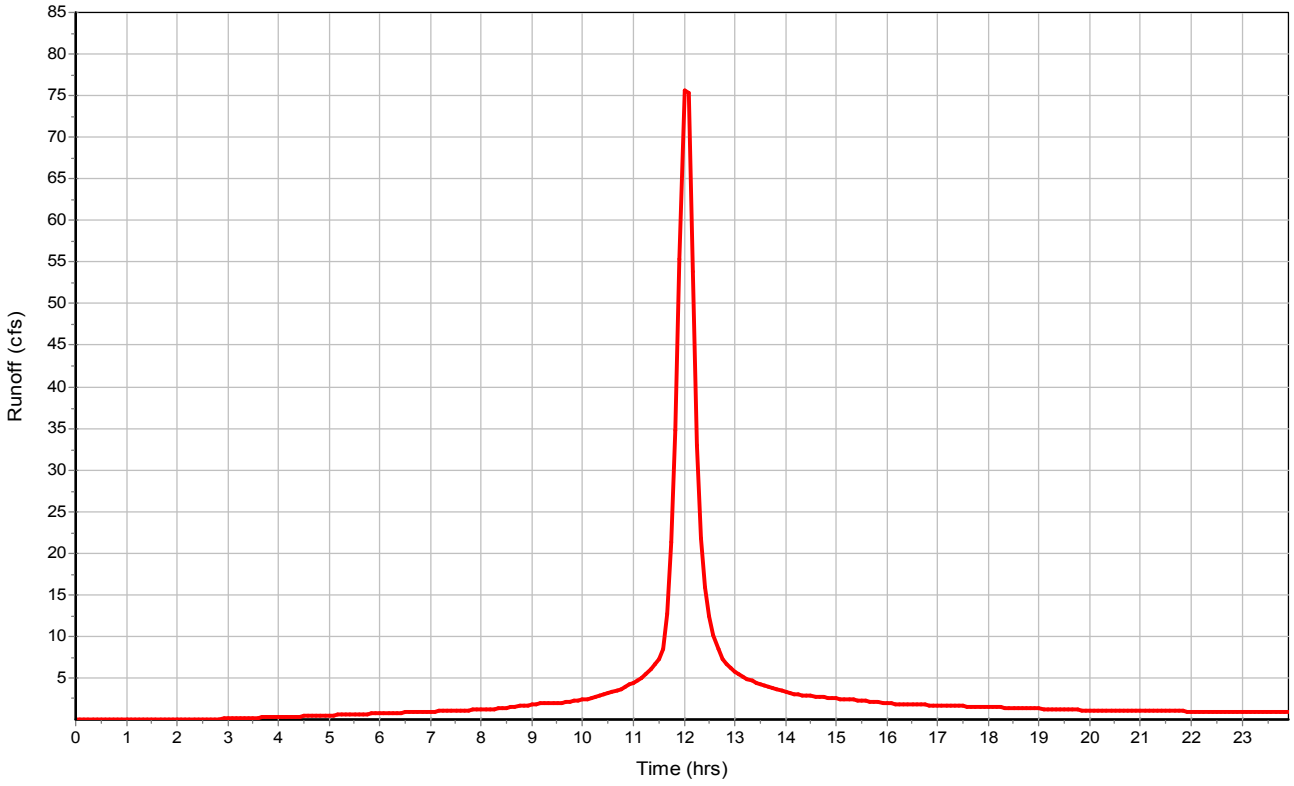
Total Rainfall (in)	10.00
Total Runoff (in)	8.65
Peak Runoff (cfs)	78.56
Weighted Curve Number	88.94
Time of Concentration (days hh:mm:ss)	0 00:16:10

Subbasin : Drainage Area 5 - Post

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage Area 5 - Pre

Input Data

Area (ac)	8.14
Weighted Curve Number	88.06
Rain Gage ID	Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	3.88	C	98.00
50 - 75% grass cover, Fair	4.26	C	79.00
Composite Area & Weighted CN	8.14		88.06

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.15	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	1.1	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.70	0.00	0.00
Velocity (ft/sec) :	0.16	0.00	0.00
Computed Flow Time (min) :	10.27	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	700	0.00	0.00
Slope (%) :	1.5	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.98	0.00	0.00
Computed Flow Time (min) :	5.89	0.00	0.00

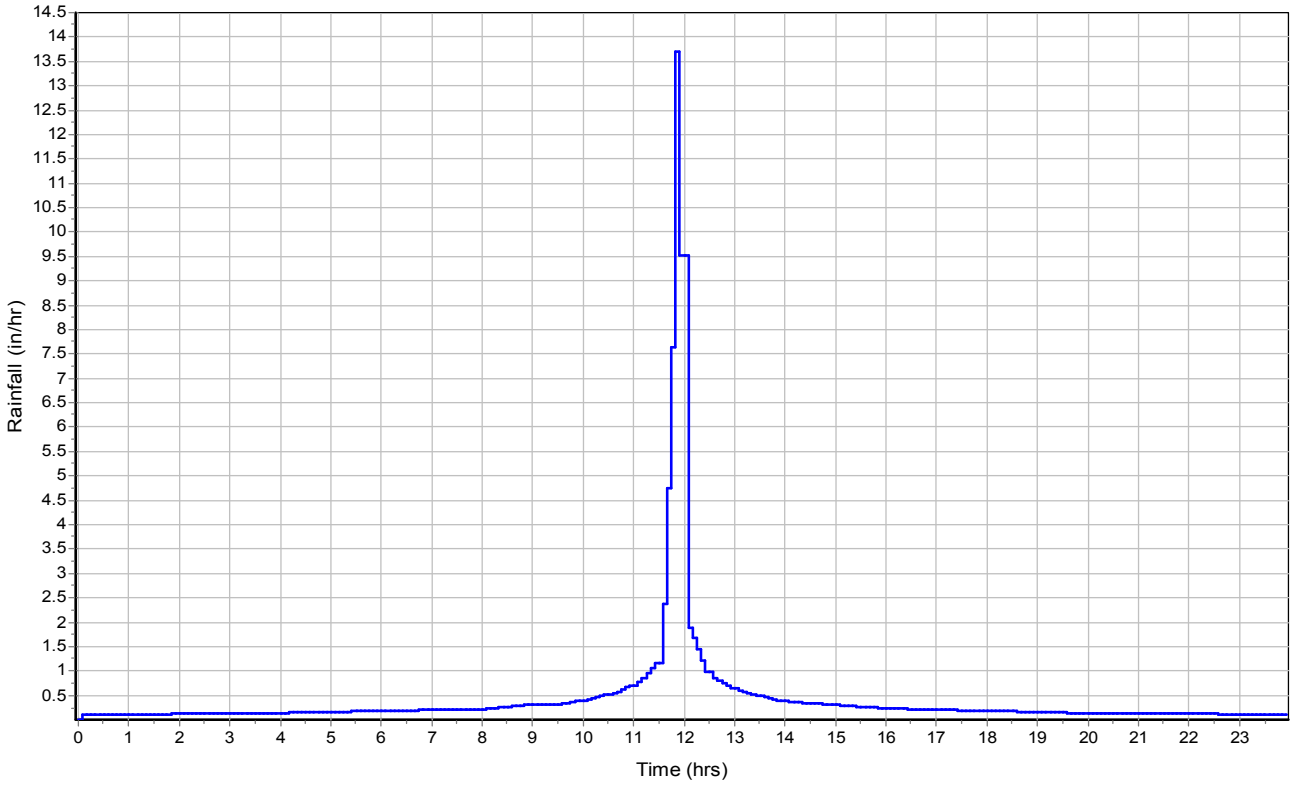
Total TOC (min) 16.16

Subbasin Runoff Results

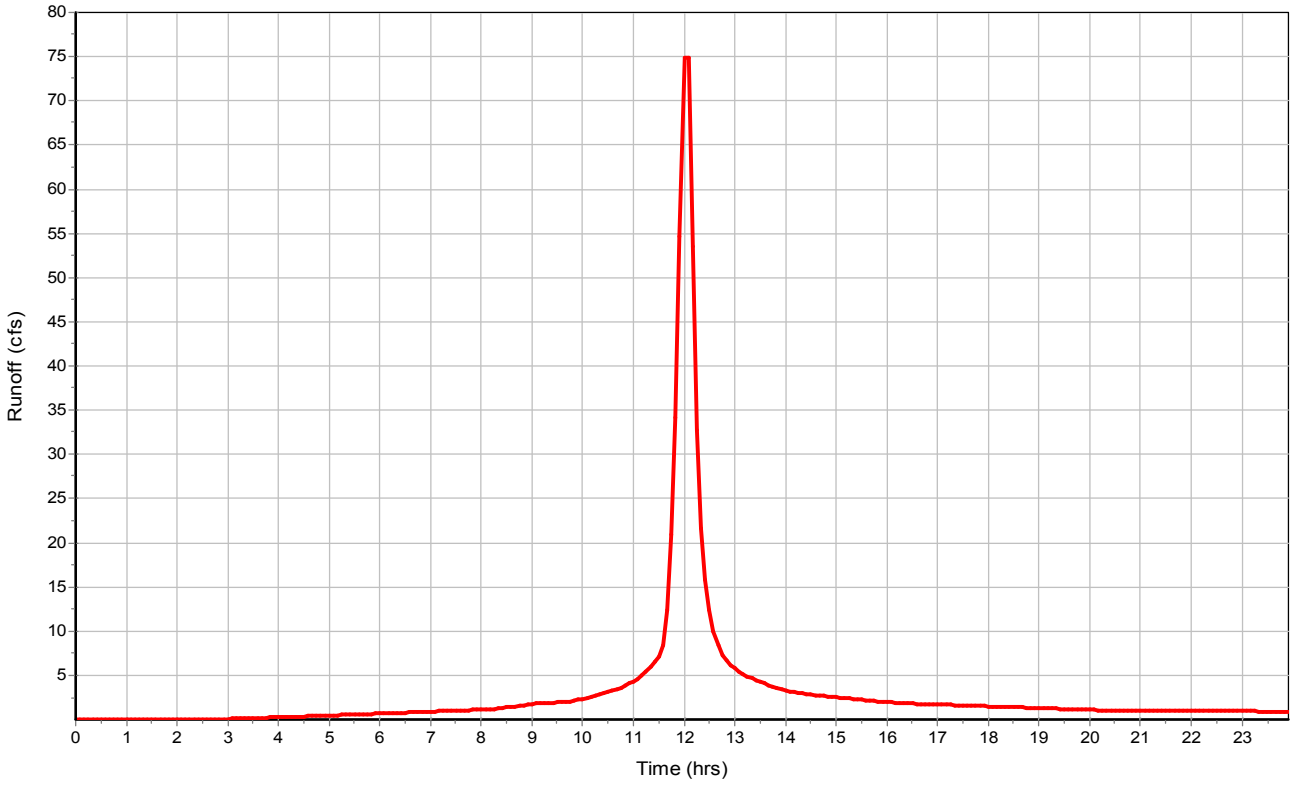
Total Rainfall (in)	10.00
Total Runoff (in)	8.54
Peak Runoff (cfs)	78.05
Weighted Curve Number	88.06
Time of Concentration (days hh:mm:ss)	0 00:16:10

Subbasin : Drainage Area 5 - Pre

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin Hydrology

Subbasin : DA6a-Post

Input Data

Area (ac) 2.92
Weighted Curve Number 87.72
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	1.34	C	98.00
50 - 75% grass cover, Fair	1.58	C	79.00
Composite Area & Weighted CN	2.92		87.72

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.011	0.00	0.00
Flow Length (ft) :	75	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.70	0.00	0.00
Velocity (ft/sec) :	1.57	0.00	0.00
Computed Flow Time (min) :	0.79	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	1400	0.00	0.00
Slope (%) :	3	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	2.79	0.00	0.00
Computed Flow Time (min) :	8.36	0.00	0.00

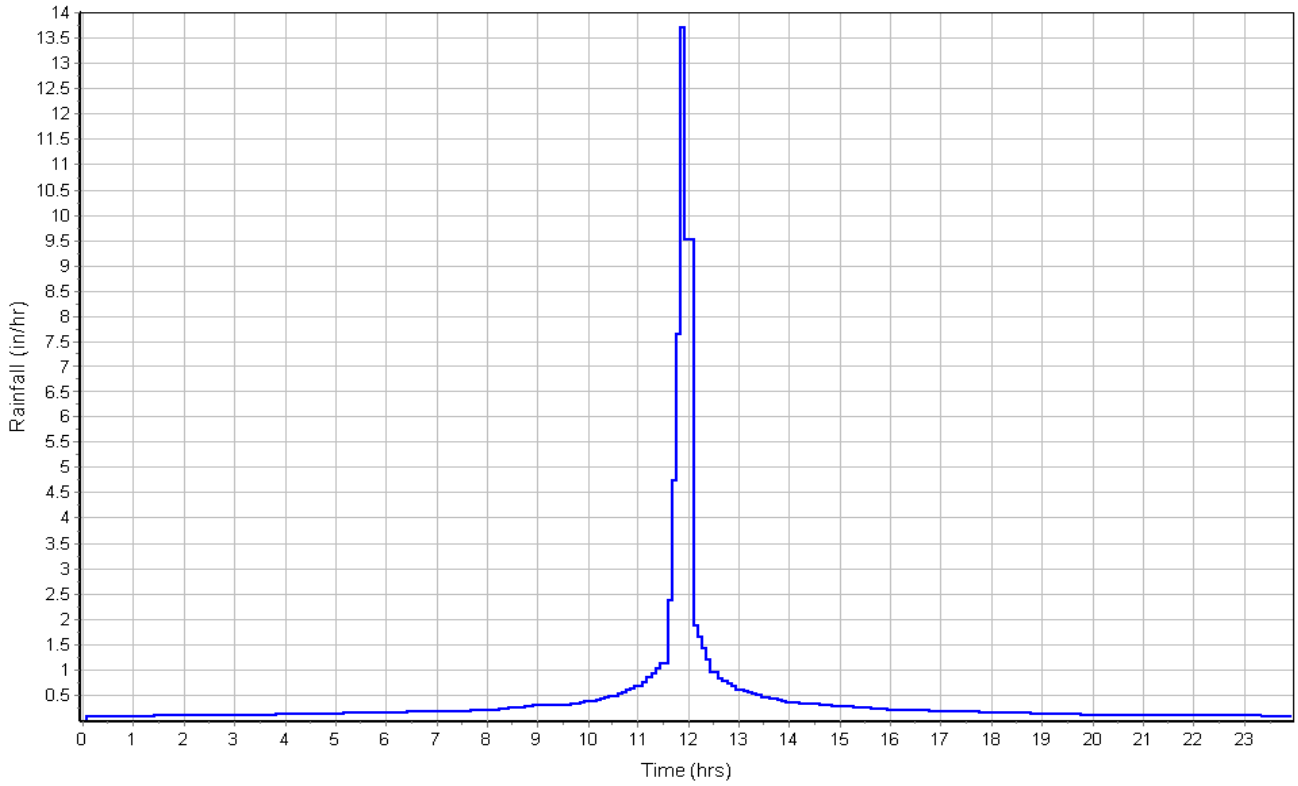
Total TOC (min) 9.16

Subbasin Runoff Results

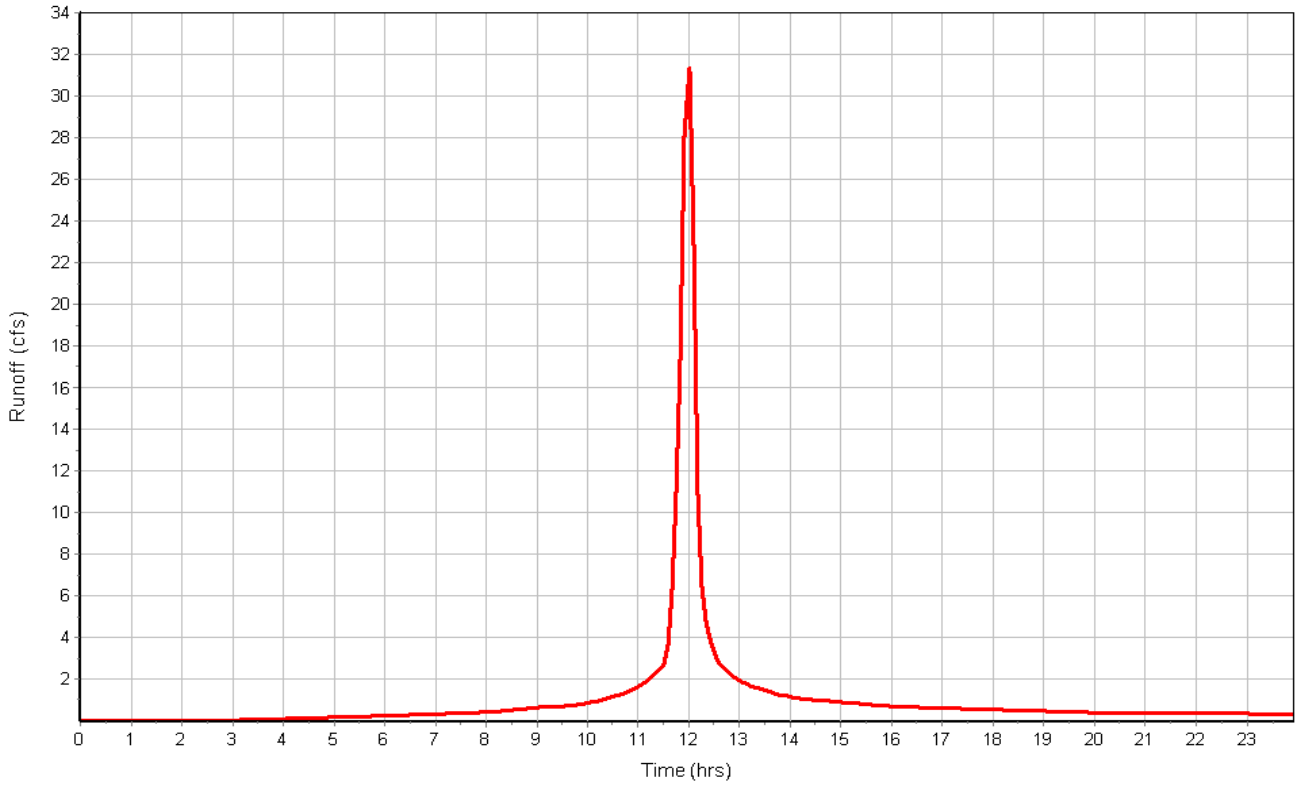
Total Rainfall (in)	10.00
Total Runoff (in)	8.50
Peak Runoff (cfs)	31.93
Weighted Curve Number	87.72
Time of Concentration (days hh:mm:ss)	0 00:09:10

Subbasin : DA6a-Post

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : DA6a-Pre

Input Data

Area (ac) 2.92
Weighted Curve Number 87.65
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	1.33	C	98.00
50 - 75% grass cover, Fair	1.59	C	79.00
Composite Area & Weighted CN	2.92		87.65

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.011	0.00	0.00
Flow Length (ft) :	75	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.70	0.00	0.00
Velocity (ft/sec) :	1.57	0.00	0.00
Computed Flow Time (min) :	0.79	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	1400	0.00	0.00
Slope (%) :	3	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	2.79	0.00	0.00
Computed Flow Time (min) :	8.36	0.00	0.00

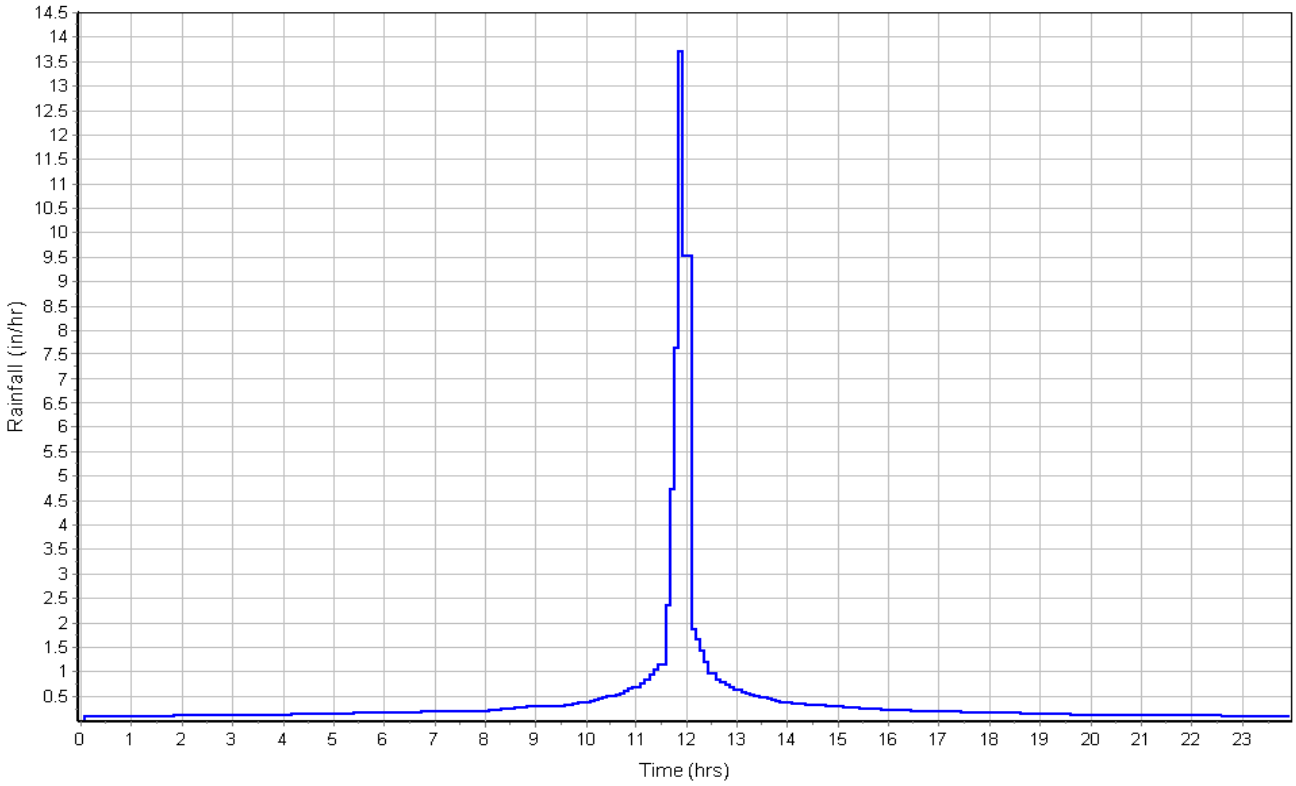
Total TOC (min) 9.16

Subbasin Runoff Results

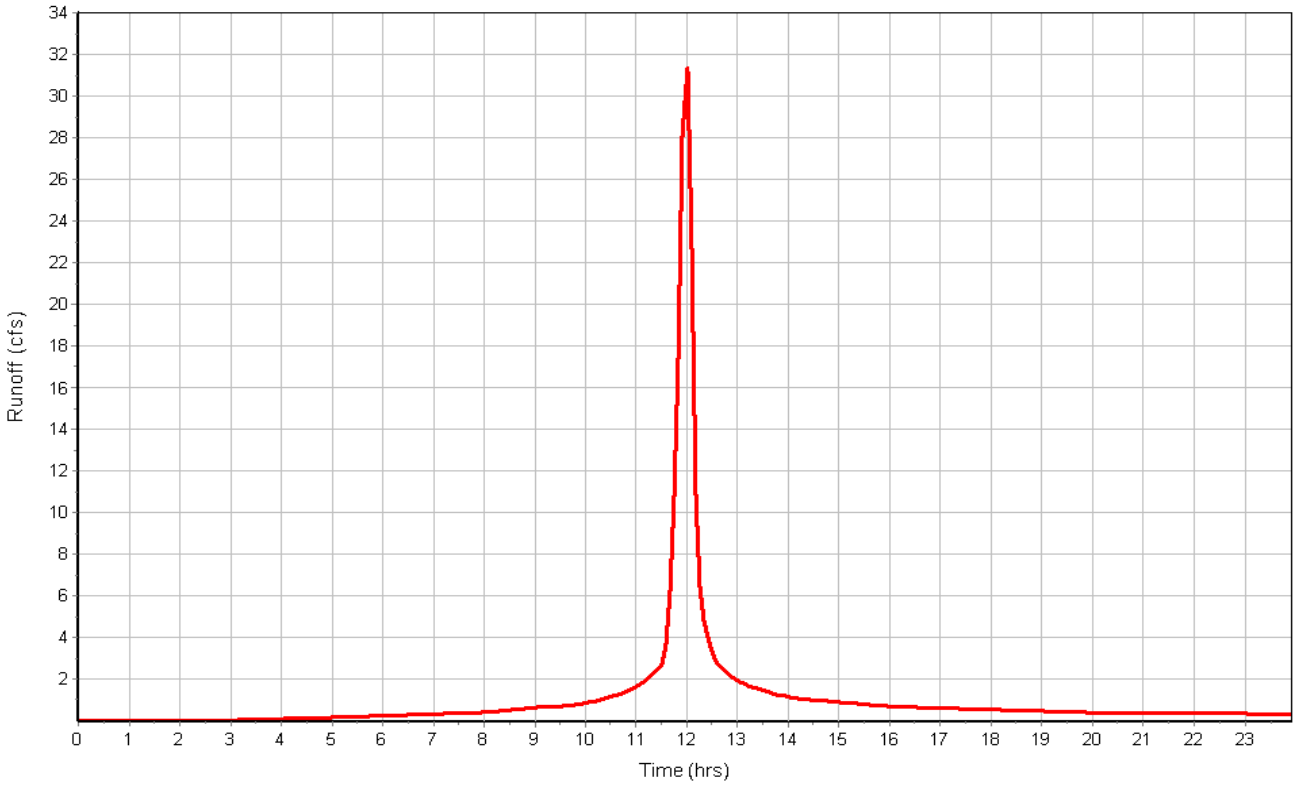
Total Rainfall (in) 10.00
Total Runoff (in) 8.49
Peak Runoff (cfs) 31.93
Weighted Curve Number 87.65
Time of Concentration (days hh:mm:ss) 0 00:09:10

Subbasin : DA6a-Pre

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : DA6b-Post

Input Data

Area (ac) 2.20
Weighted Curve Number 83.15
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.48	C	98.00
50 - 75% grass cover, Fair	1.72	C	79.00
Composite Area & Weighted CN	2.20		83.15

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.4	0.00	0.00
Flow Length (ft) :	55	0.00	0.00
Slope (%) :	33	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.70	0.00	0.00
Velocity (ft/sec) :	0.26	0.00	0.00
Computed Flow Time (min) :	3.58	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	850	0.00	0.00
Slope (%) :	0.8	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.44	0.00	0.00
Computed Flow Time (min) :	9.84	0.00	0.00

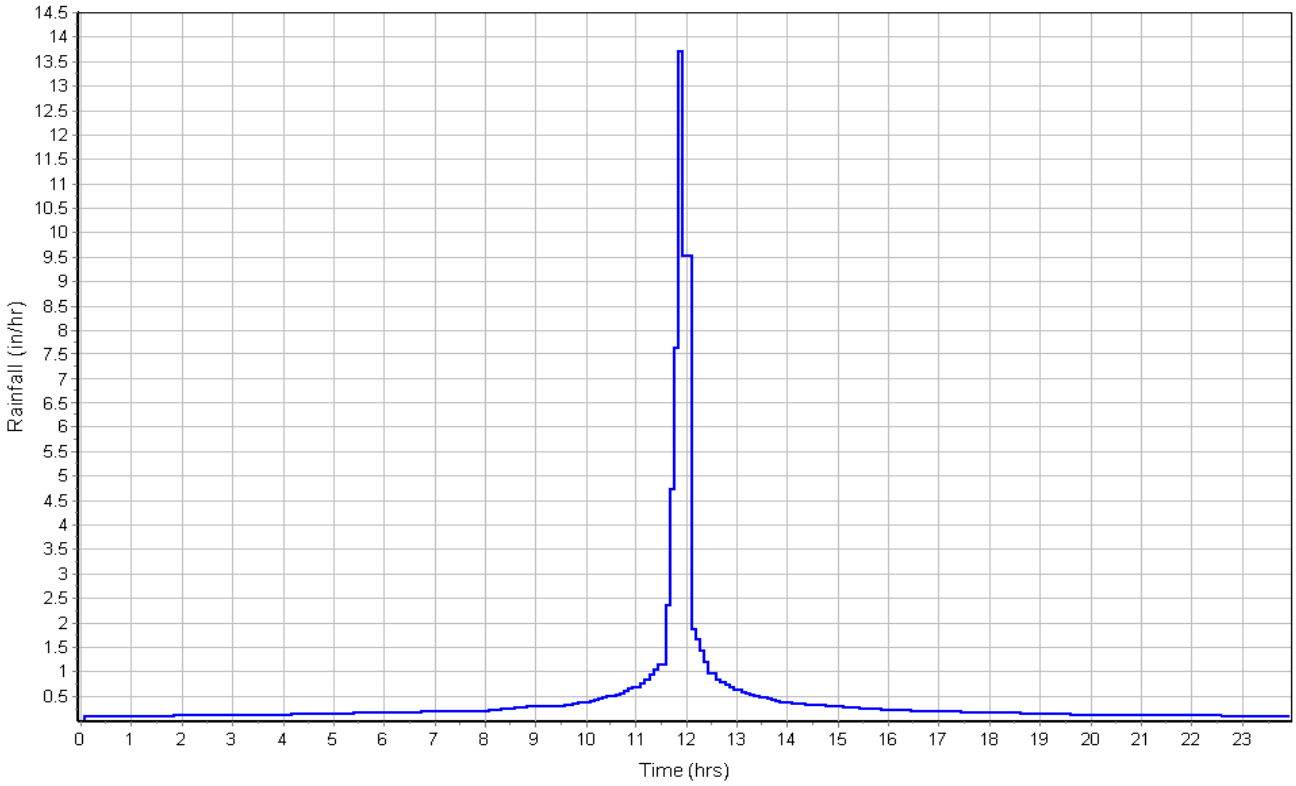
Total TOC (min) 13.42

Subbasin Runoff Results

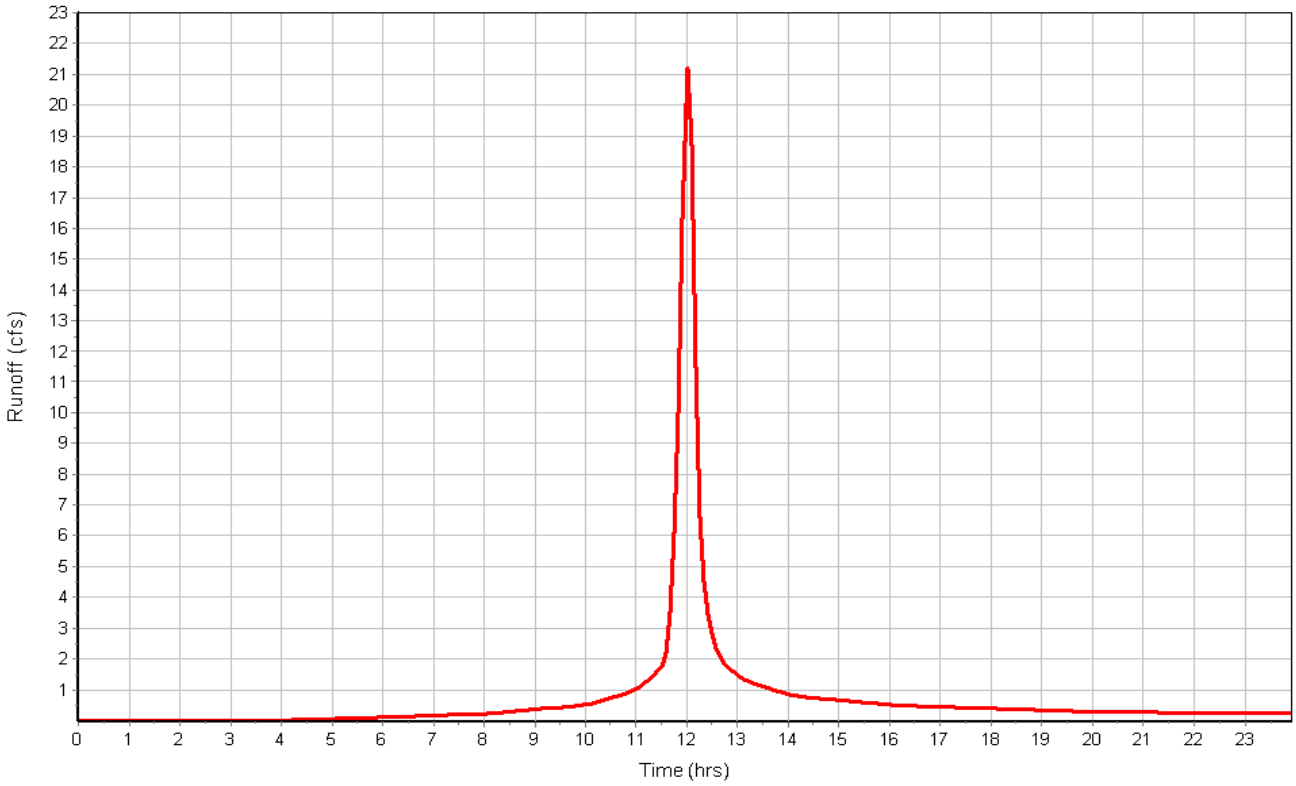
Total Rainfall (in) 10.00
Total Runoff (in) 7.92
Peak Runoff (cfs) 21.39
Weighted Curve Number 83.15
Time of Concentration (days hh:mm:ss) 0 00:13:25

Subbasin : DA6b-Post

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : DA6b-Pre

Input Data

Area (ac) 2.20
Weighted Curve Number 83.06
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.47	C	98.00
50 - 75% grass cover, Fair	1.73	C	79.00
Composite Area & Weighted CN	2.20		83.06

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.4	0.00	0.00
Flow Length (ft) :	55	0.00	0.00
Slope (%) :	33	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.70	0.00	0.00
Velocity (ft/sec) :	0.26	0.00	0.00
Computed Flow Time (min) :	3.58	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	850	0.00	0.00
Slope (%) :	0.8	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.44	0.00	0.00
Computed Flow Time (min) :	9.84	0.00	0.00

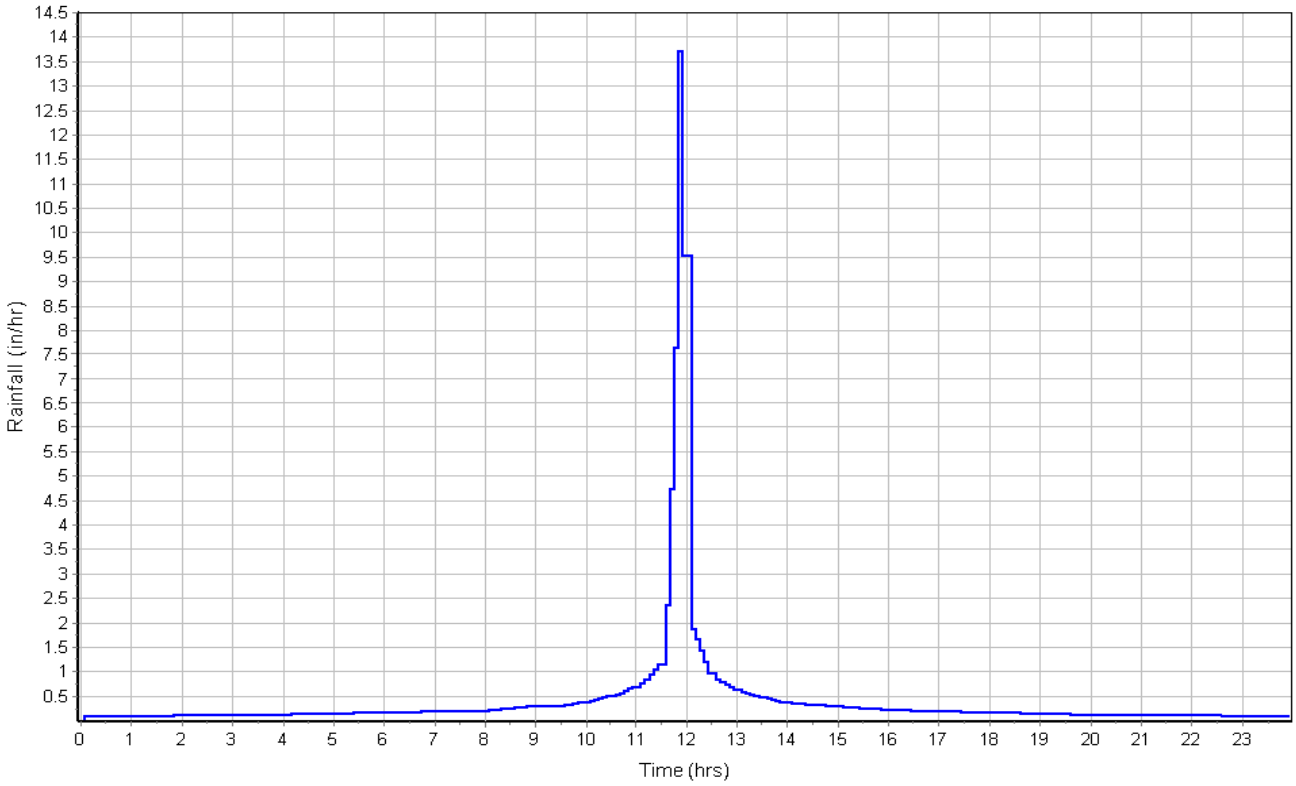
Total TOC (min) 13.42

Subbasin Runoff Results

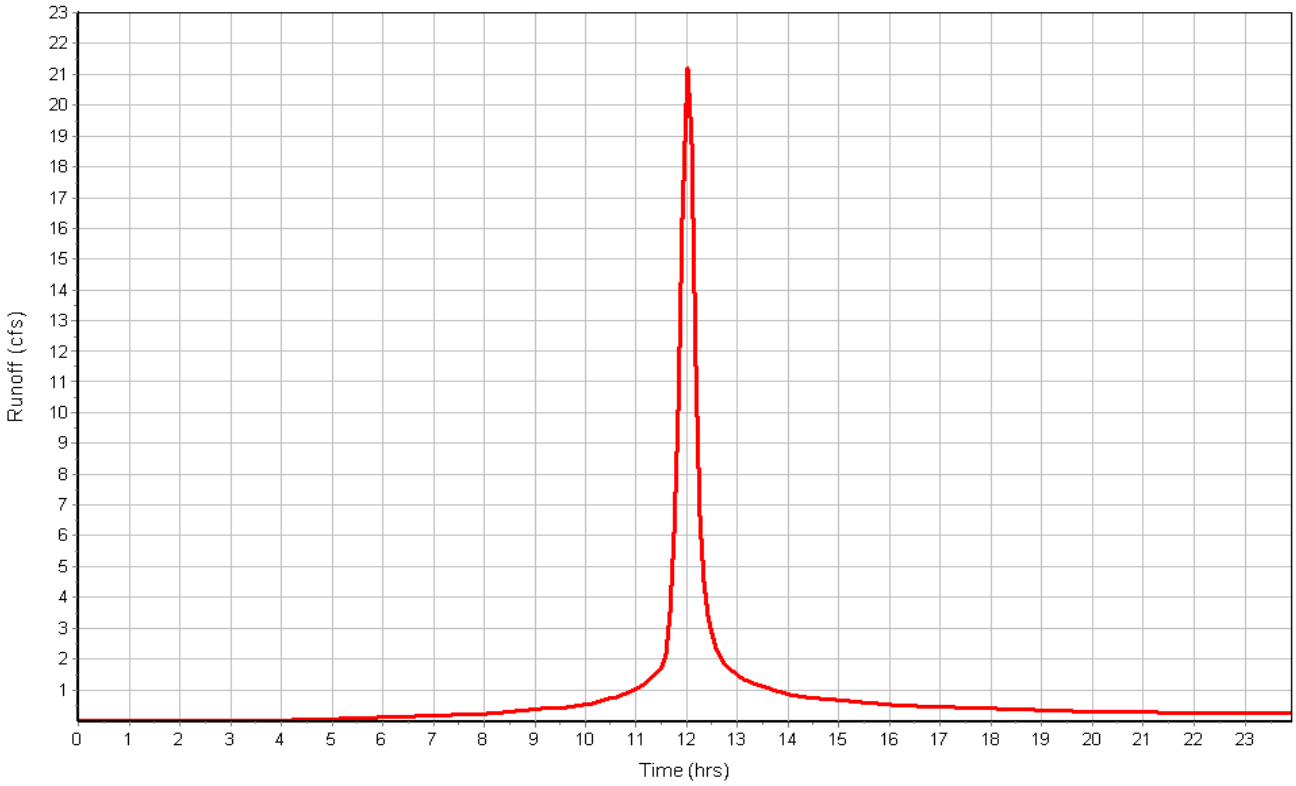
Total Rainfall (in) 10.00
Total Runoff (in) 7.91
Peak Runoff (cfs) 21.35
Weighted Curve Number 83.06
Time of Concentration (days hh:mm:ss) 0 00:13:25

Subbasin : DA6b-Pre

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : DA6c-Post

Input Data

Area (ac) 0.44
Weighted Curve Number 81.16
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.05	C	98.00
50 - 75% grass cover, Fair	0.39	C	79.00
Composite Area & Weighted CN	0.44		81.16

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.15	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	1	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.70	0.00	0.00
Velocity (ft/sec) :	0.16	0.00	0.00
Computed Flow Time (min) :	10.67	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	330	0.00	0.00
Slope (%) :	0.6	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.25	0.00	0.00
Computed Flow Time (min) :	4.40	0.00	0.00

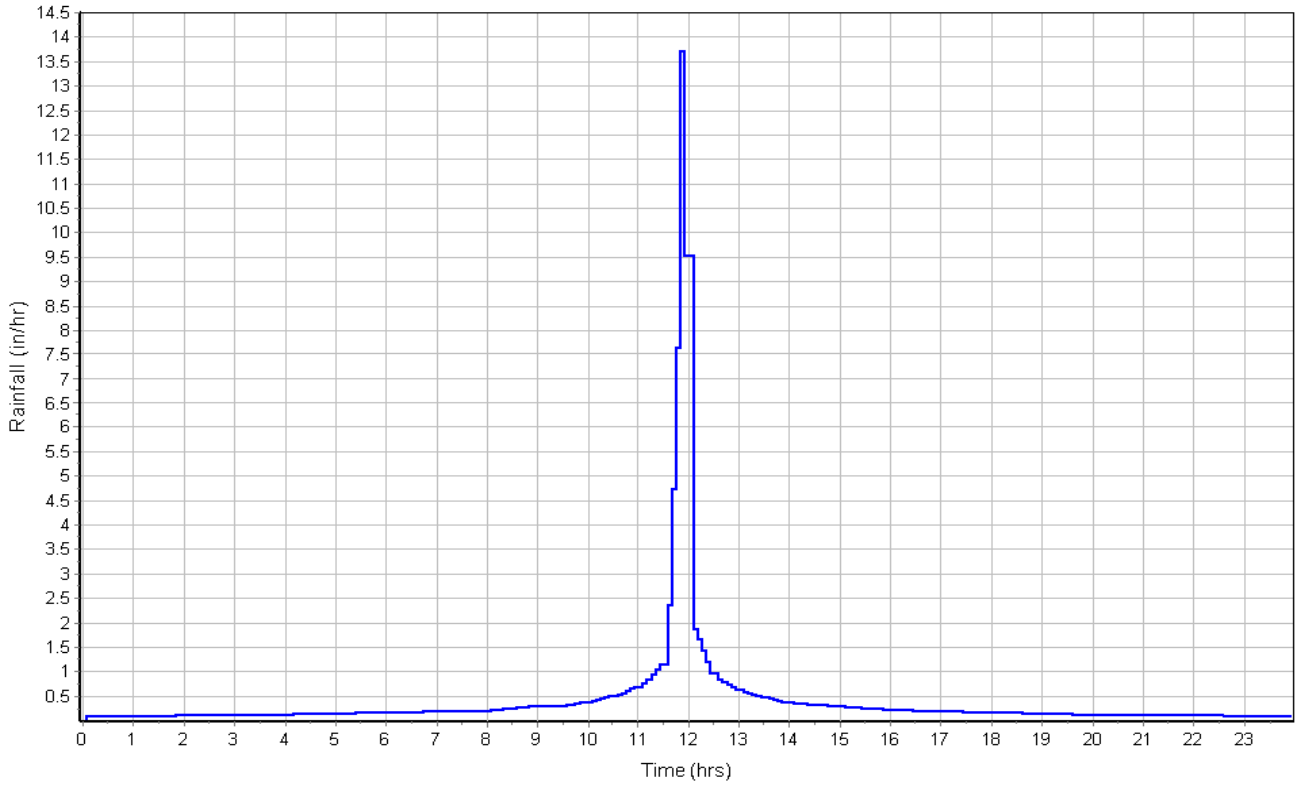
Total TOC (min) 15.07

Subbasin Runoff Results

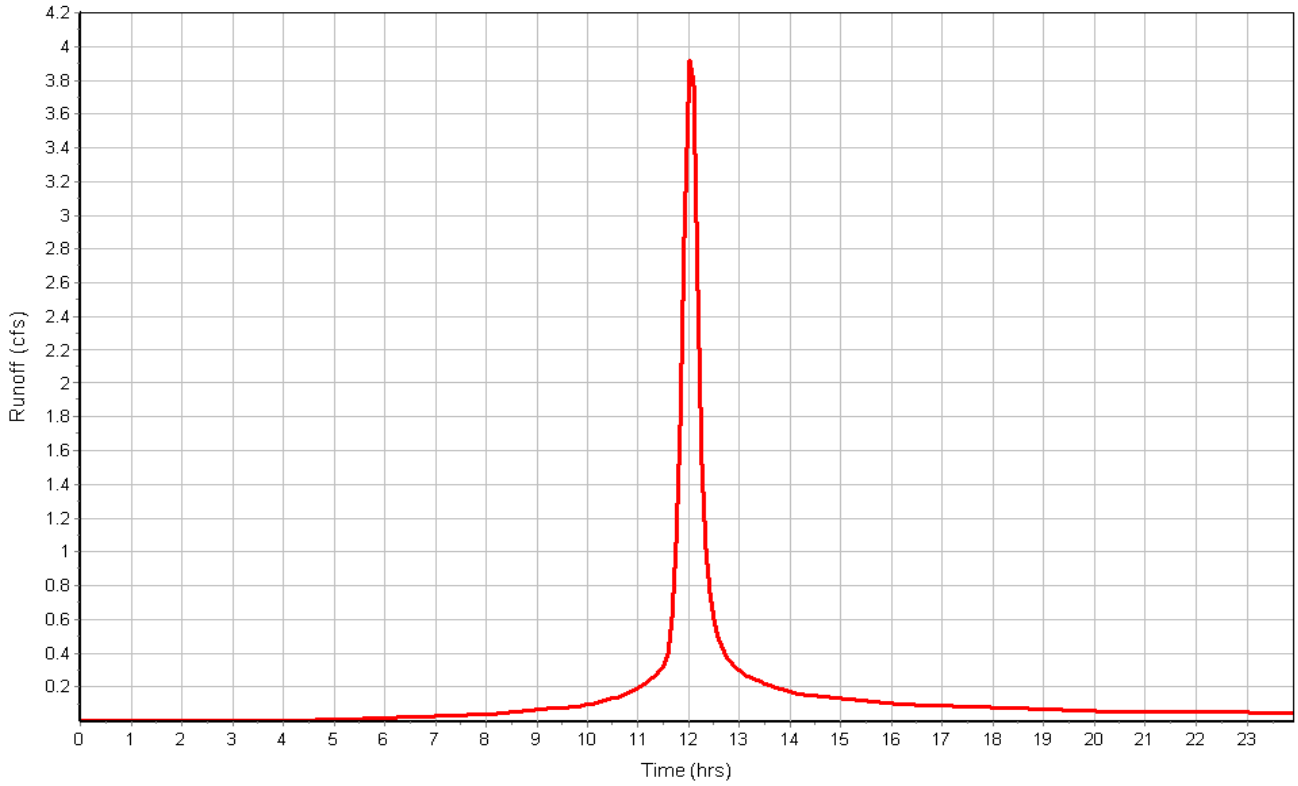
Total Rainfall (in) 10.00
Total Runoff (in) 7.67
Peak Runoff (cfs) 4.04
Weighted Curve Number 81.16
Time of Concentration (days hh:mm:ss) 0 00:15:04

Subbasin : DA6c-Post

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : DA6c-Pre

Input Data

Area (ac) 0.44
Weighted Curve Number 81.16
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	0.05	C	98.00
50 - 75% grass cover, Fair	0.39	C	79.00
Composite Area & Weighted CN	0.44		81.16

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.15	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	1	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.70	0.00	0.00
Velocity (ft/sec) :	0.16	0.00	0.00
Computed Flow Time (min) :	10.67	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	330	0.00	0.00
Slope (%) :	0.6	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.25	0.00	0.00
Computed Flow Time (min) :	4.40	0.00	0.00

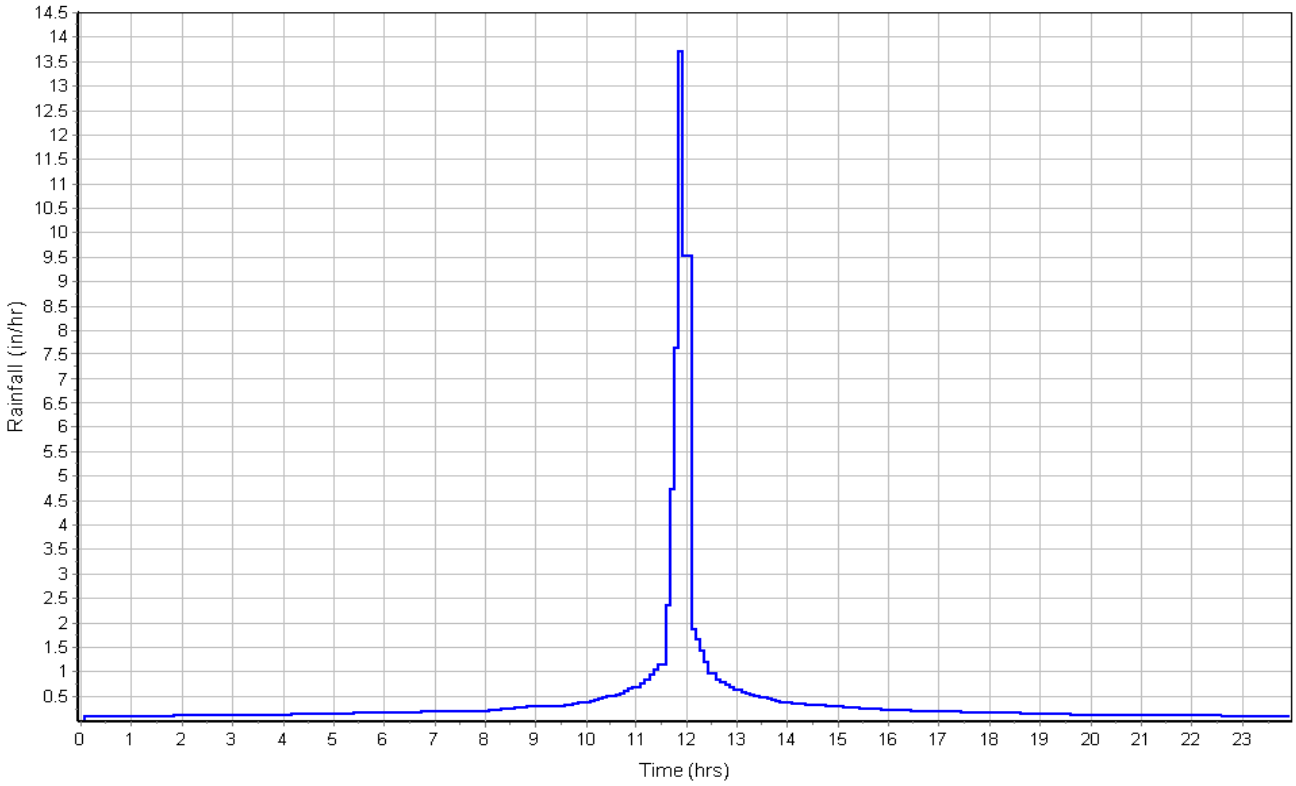
Total TOC (min) 15.07

Subbasin Runoff Results

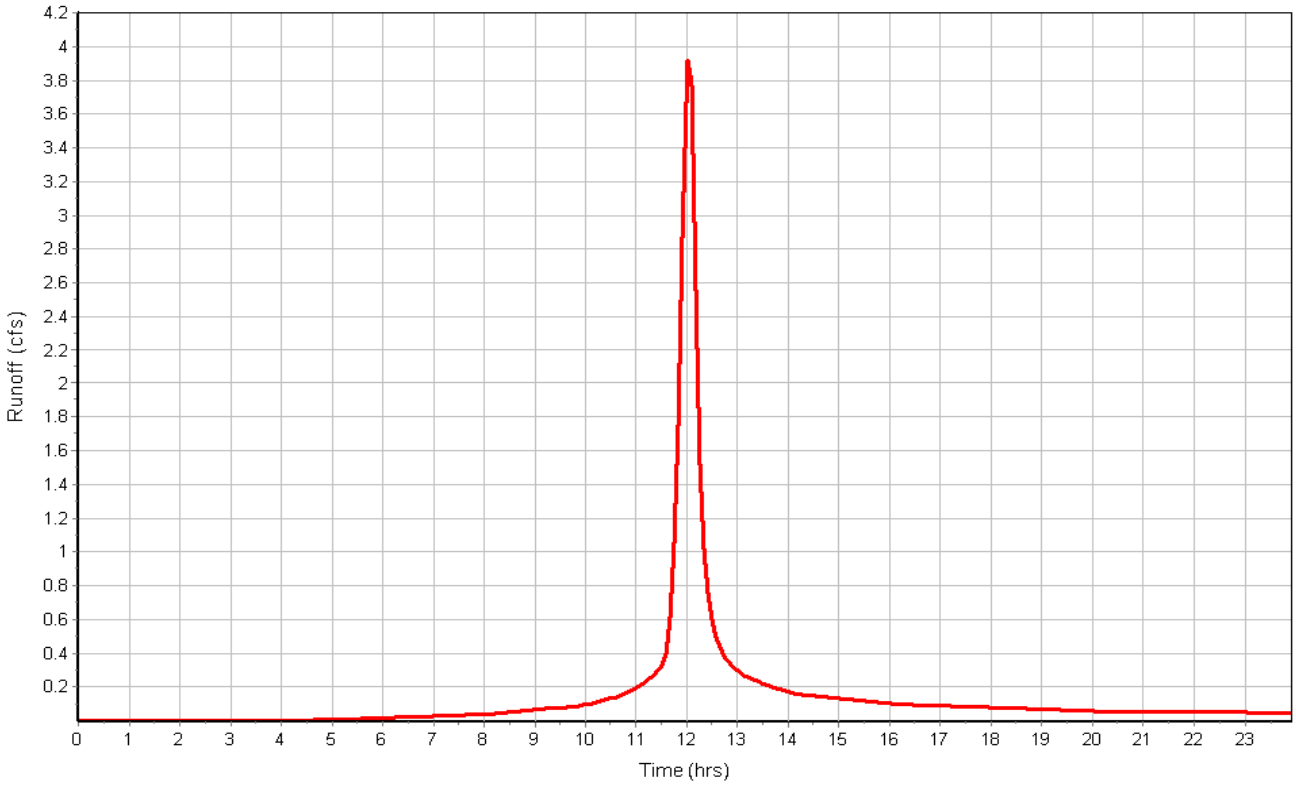
Total Rainfall (in) 10.00
Total Runoff (in) 7.67
Peak Runoff (cfs) 4.04
Weighted Curve Number 81.16
Time of Concentration (days hh:mm:ss) 0 00:15:04

Subbasin : DA6c-Pre

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : DA6d-Post

Input Data

Area (ac) 3.52
Weighted Curve Number 89.58
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	1.96	C	98.00
50 - 75% grass cover, Fair	1.56	C	79.00
Composite Area & Weighted CN	3.52		89.58

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.011	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.70	0.00	0.00
Velocity (ft/sec) :	1.67	0.00	0.00
Computed Flow Time (min) :	1.00	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	900	0.00	0.00
Slope (%) :	2	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	2.28	0.00	0.00
Computed Flow Time (min) :	6.58	0.00	0.00

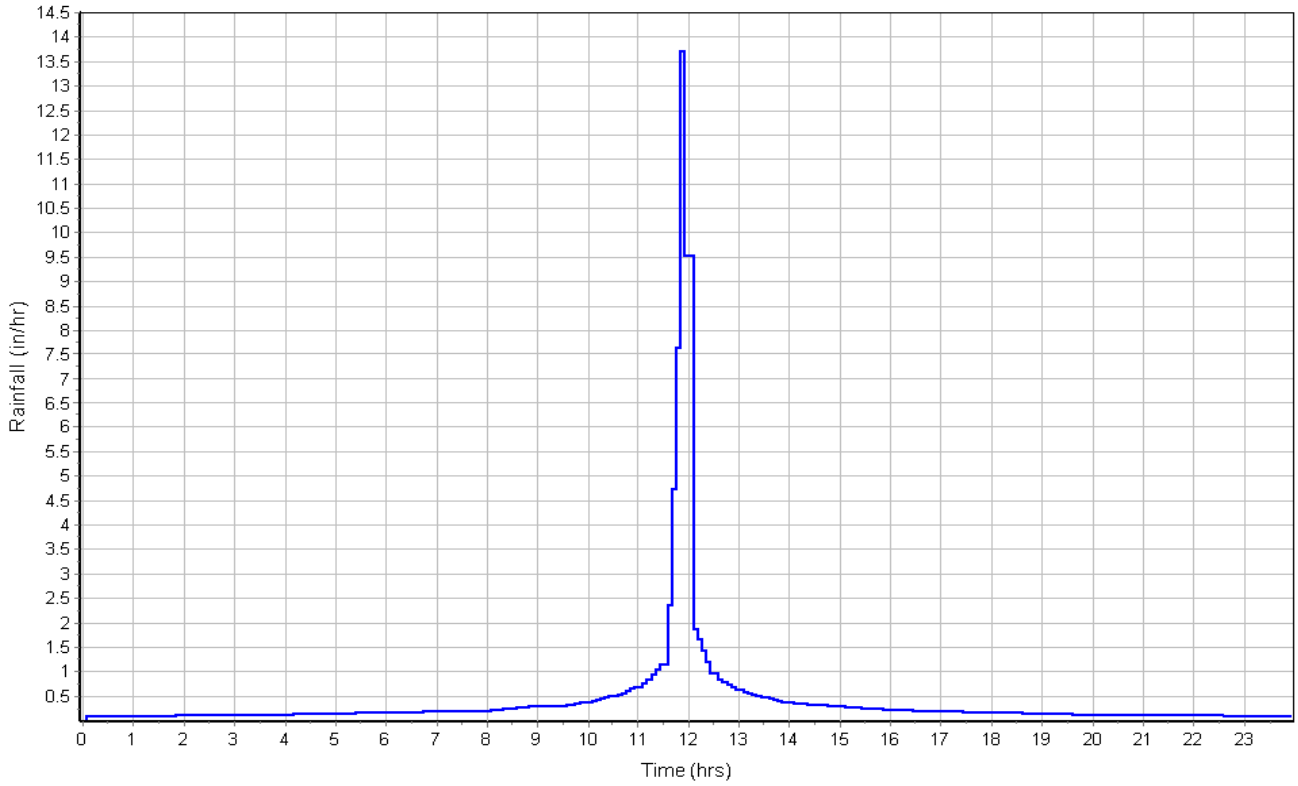
Total TOC (min) 7.58

Subbasin Runoff Results

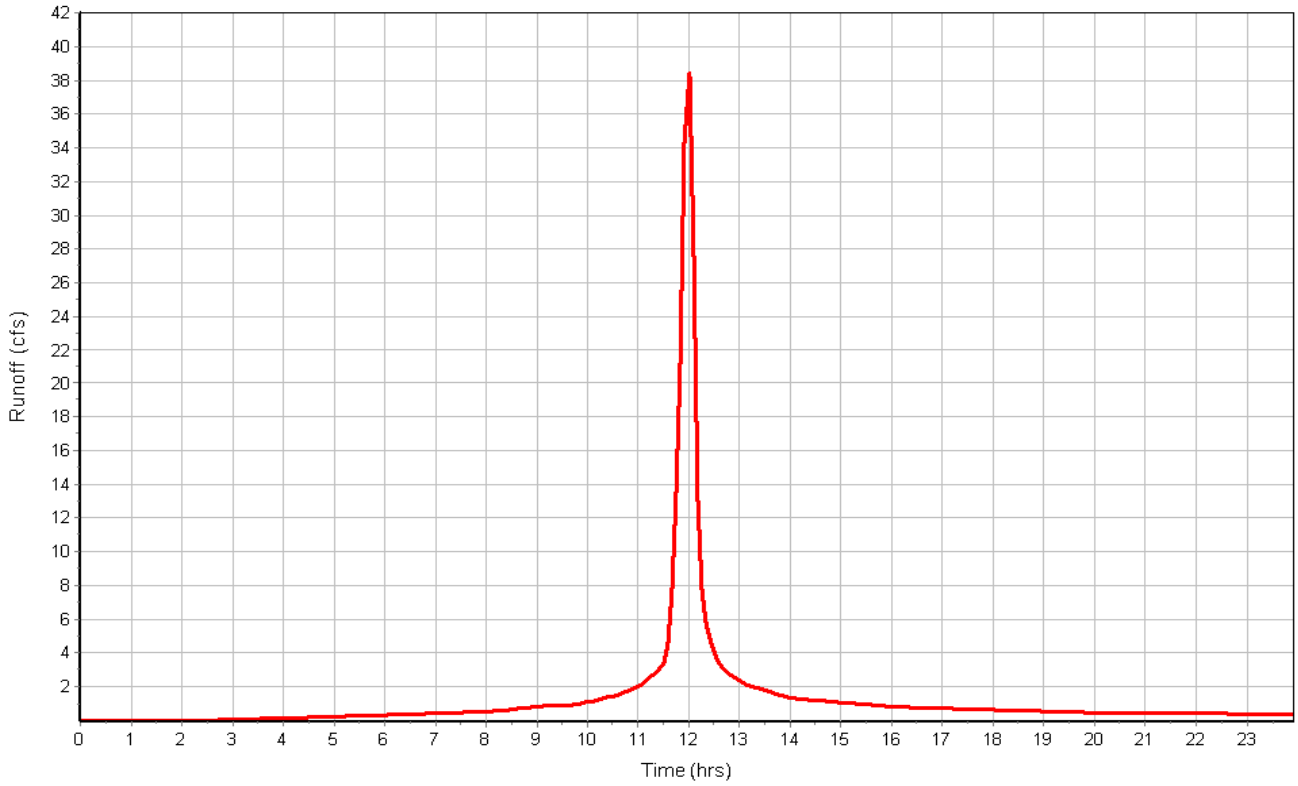
Total Rainfall (in) 10.00
Total Runoff (in) 8.73
Peak Runoff (cfs) 39.11
Weighted Curve Number 89.58
Time of Concentration (days hh:mm:ss) 0 00:07:35

Subbasin : DA6d-Post

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : DA6d-Pre

Input Data

Area (ac) 3.52
Weighted Curve Number 88.77
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	1.81	C	98.00
50 - 75% grass cover, Fair	1.71	C	79.00
Composite Area & Weighted CN	3.52		88.77

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.011	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.70	0.00	0.00
Velocity (ft/sec) :	1.67	0.00	0.00
Computed Flow Time (min) :	1.00	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	900	0.00	0.00
Slope (%) :	2	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	2.28	0.00	0.00
Computed Flow Time (min) :	6.58	0.00	0.00

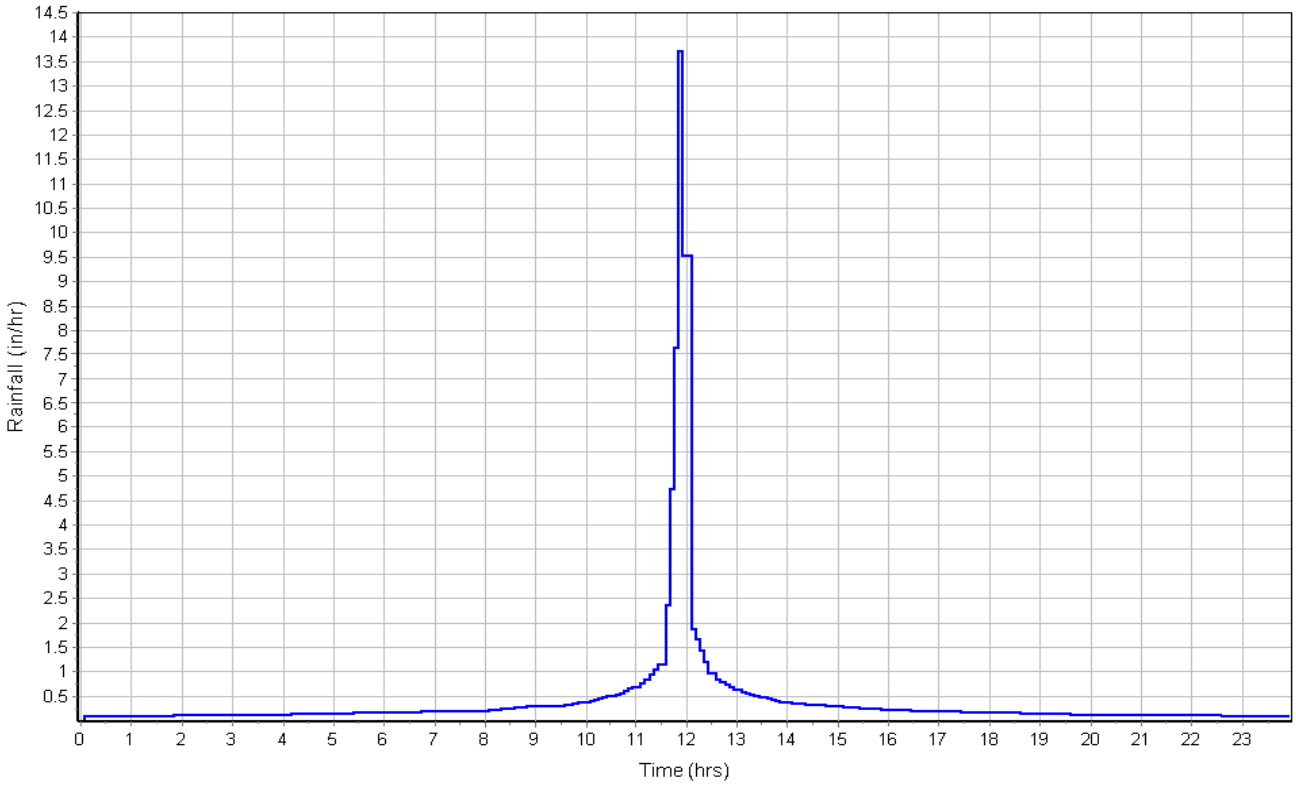
Total TOC (min) 7.58

Subbasin Runoff Results

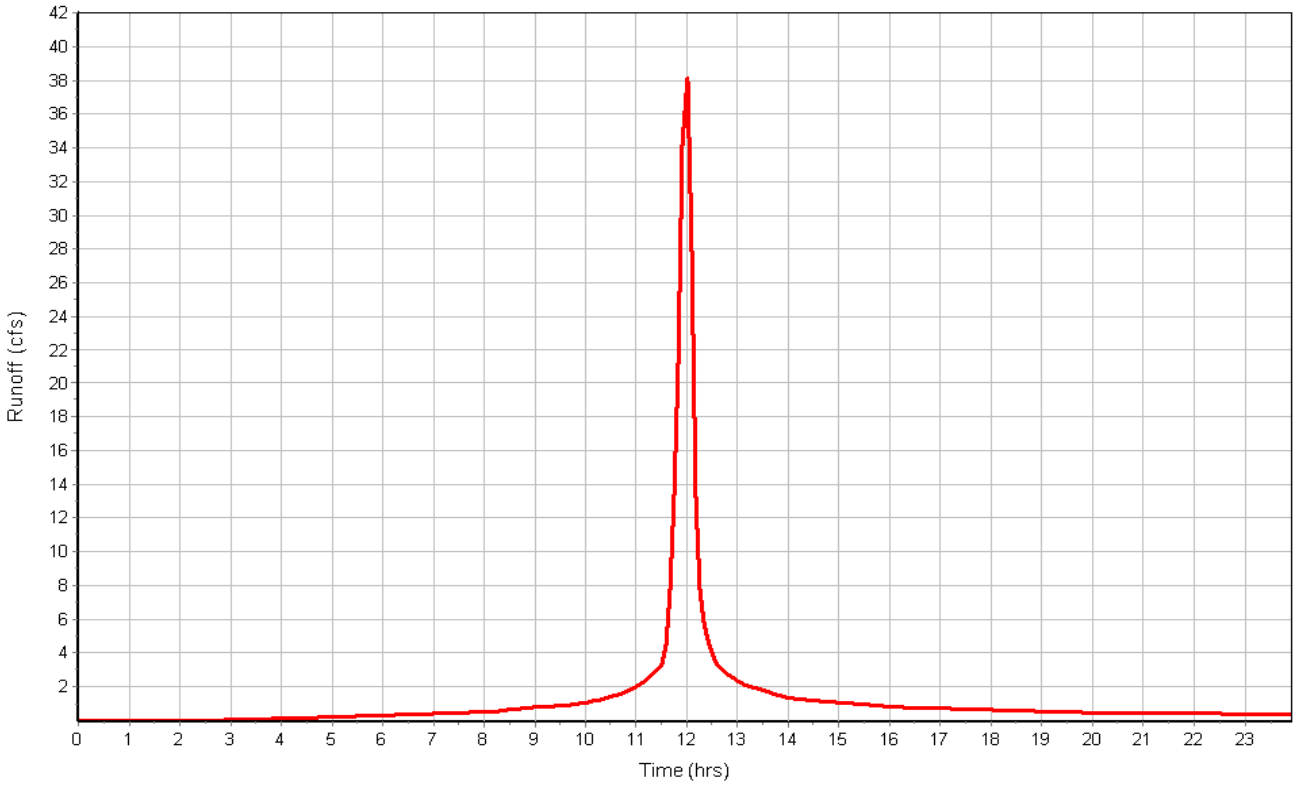
Total Rainfall (in) 10.00
Total Runoff (in) 8.63
Peak Runoff (cfs) 38.87
Weighted Curve Number 88.77
Time of Concentration (days hh:mm:ss) 0 00:07:35

Subbasin : DA6d-Pre

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : DA6e-Post

Input Data

Area (ac) 12.72
Weighted Curve Number 89.04
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	6.72	C	98.00
50 - 75% grass cover, Fair	6.00	C	79.00
Composite Area & Weighted CN	12.72		89.04

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.15	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	1	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.70	0.00	0.00
Velocity (ft/sec) :	0.16	0.00	0.00
Computed Flow Time (min) :	10.67	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	2400	0.00	0.00
Slope (%) :	1	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.61	0.00	0.00
Computed Flow Time (min) :	24.84	0.00	0.00

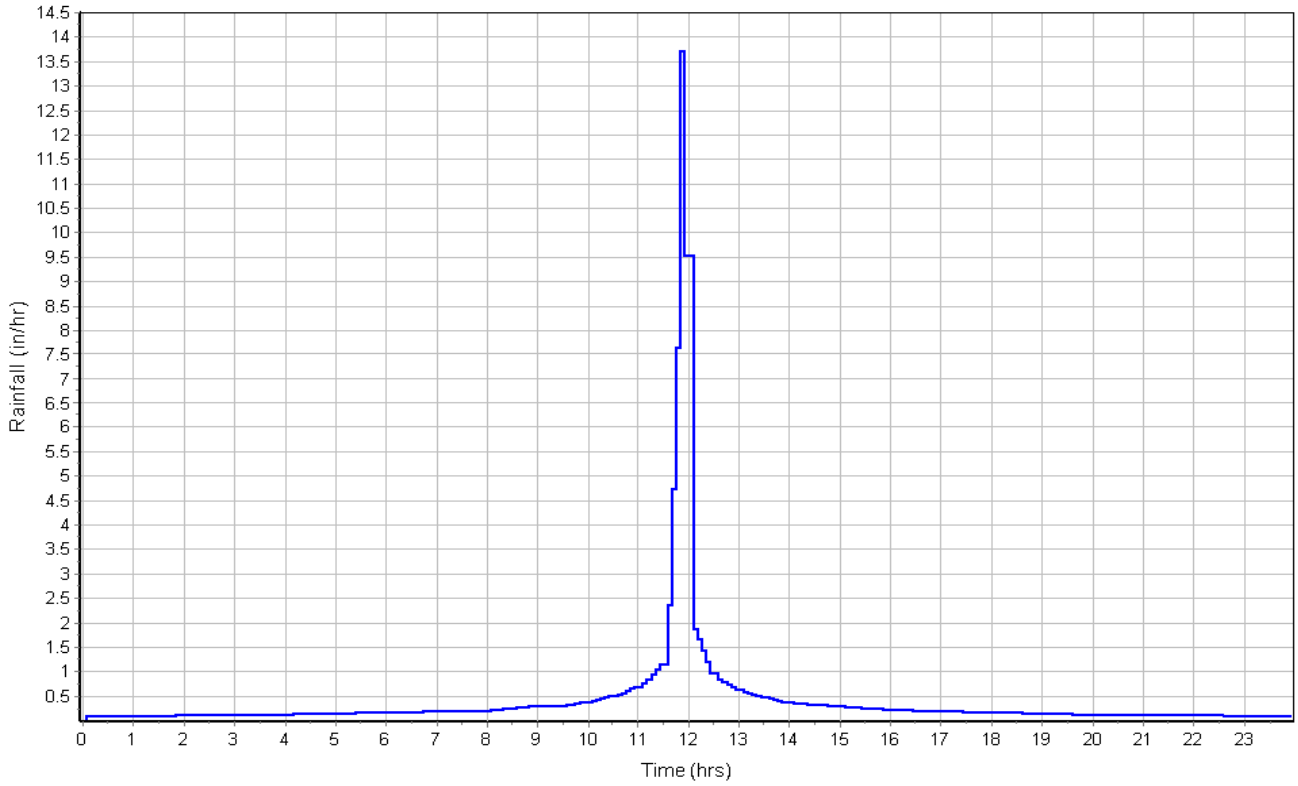
Total TOC (min) 35.51

Subbasin Runoff Results

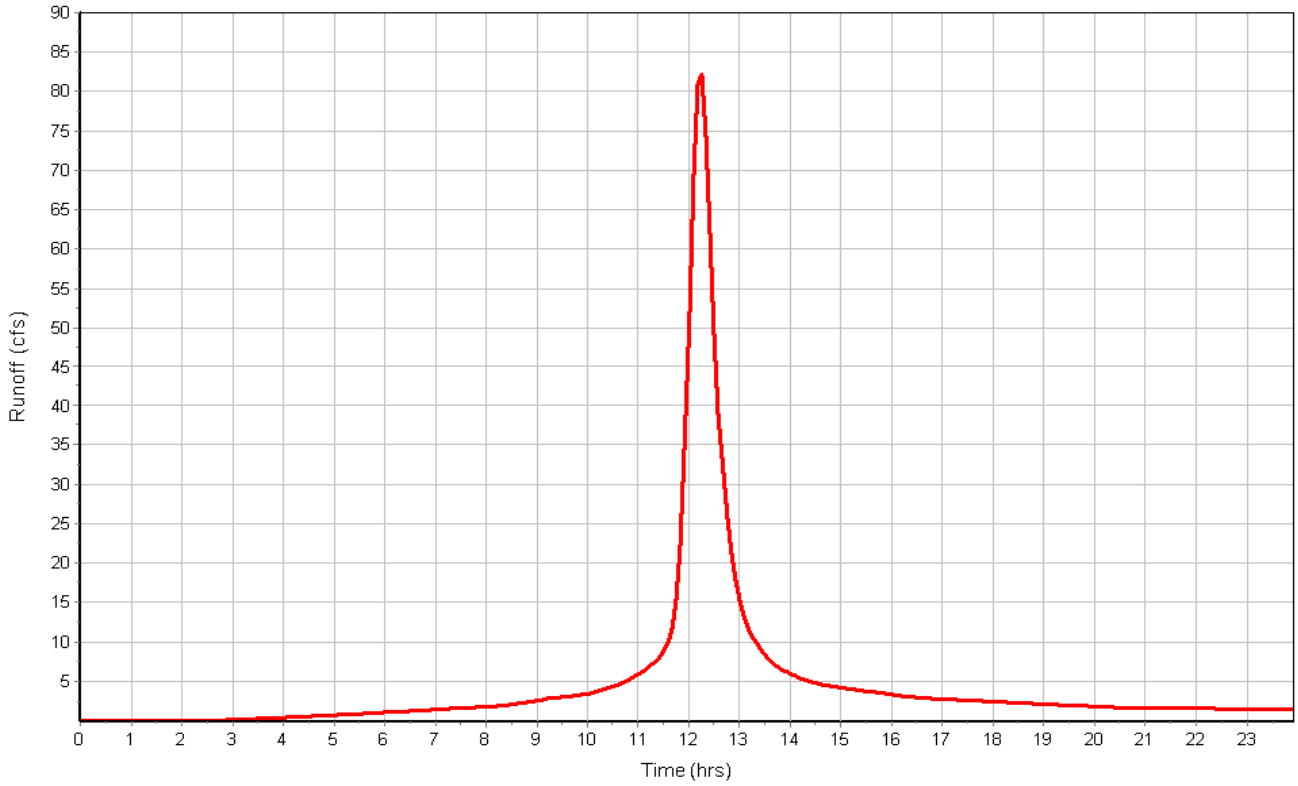
Total Rainfall (in) 10.00
Total Runoff (in) 8.66
Peak Runoff (cfs) 83.01
Weighted Curve Number 89.04
Time of Concentration (days hh:mm:ss) 0 00:35:31

Subbasin : DA6e-Post

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : DA6e-Pre

Input Data

Area (ac) 12.72
Weighted Curve Number 88.04
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	6.05	C	98.00
50 - 75% grass cover, Fair	6.67	C	79.00
Composite Area & Weighted CN	12.72		88.04

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.15	0.00	0.00
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	1	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.70	0.00	0.00
Velocity (ft/sec) :	0.16	0.00	0.00
Computed Flow Time (min) :	10.67	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	2400	0.00	0.00
Slope (%) :	1	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	1.61	0.00	0.00
Computed Flow Time (min) :	24.84	0.00	0.00

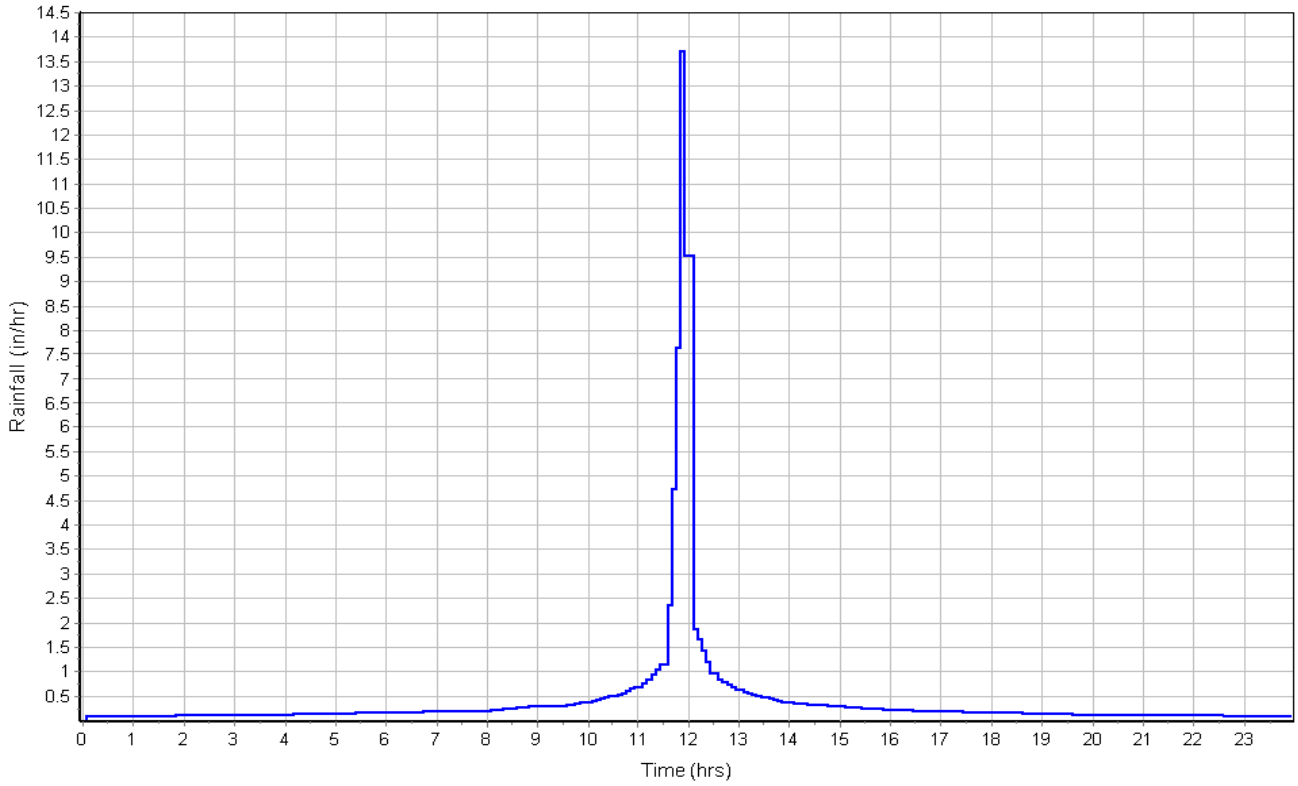
Total TOC (min) 35.51

Subbasin Runoff Results

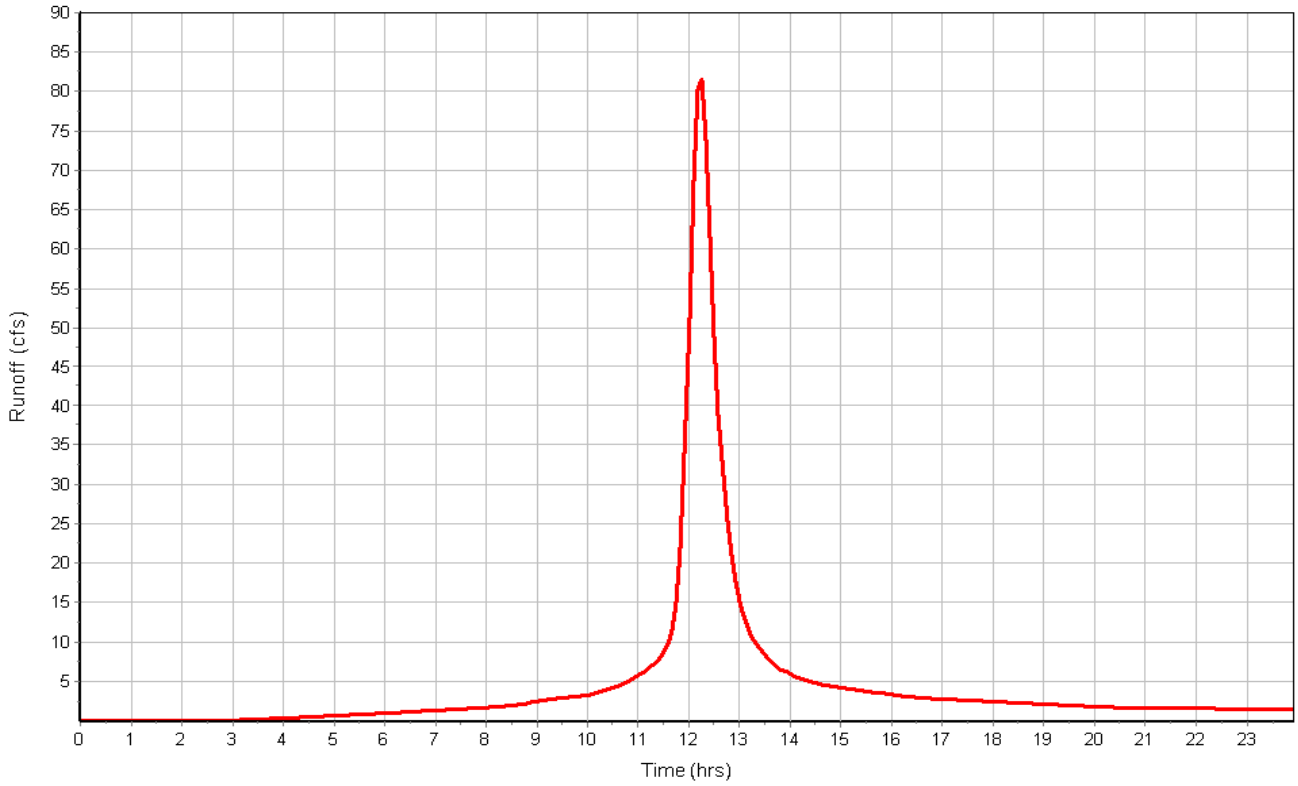
Total Rainfall (in) 10.00
Total Runoff (in) 8.54
Peak Runoff (cfs) 82.47
Weighted Curve Number 88.04
Time of Concentration (days hh:mm:ss) 0 00:35:31

Subbasin : DA6e-Pre

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage Area 7 - Post

Input Data

Area (ac)	20.67
Weighted Curve Number	89.81
Rain Gage ID	Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	11.76	C	98.00
50 - 75% grass cover, Fair	8.91	C	79.00
Composite Area & Weighted CN	20.67		89.81

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.15	0.00	0.00
Flow Length (ft) :	200	0.00	0.00
Slope (%) :	1.5	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.70	0.00	0.00
Velocity (ft/sec) :	0.21	0.00	0.00
Computed Flow Time (min) :	15.79	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	900	0.00	0.00
Slope (%) :	2.5	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	2.55	0.00	0.00
Computed Flow Time (min) :	5.88	0.00	0.00

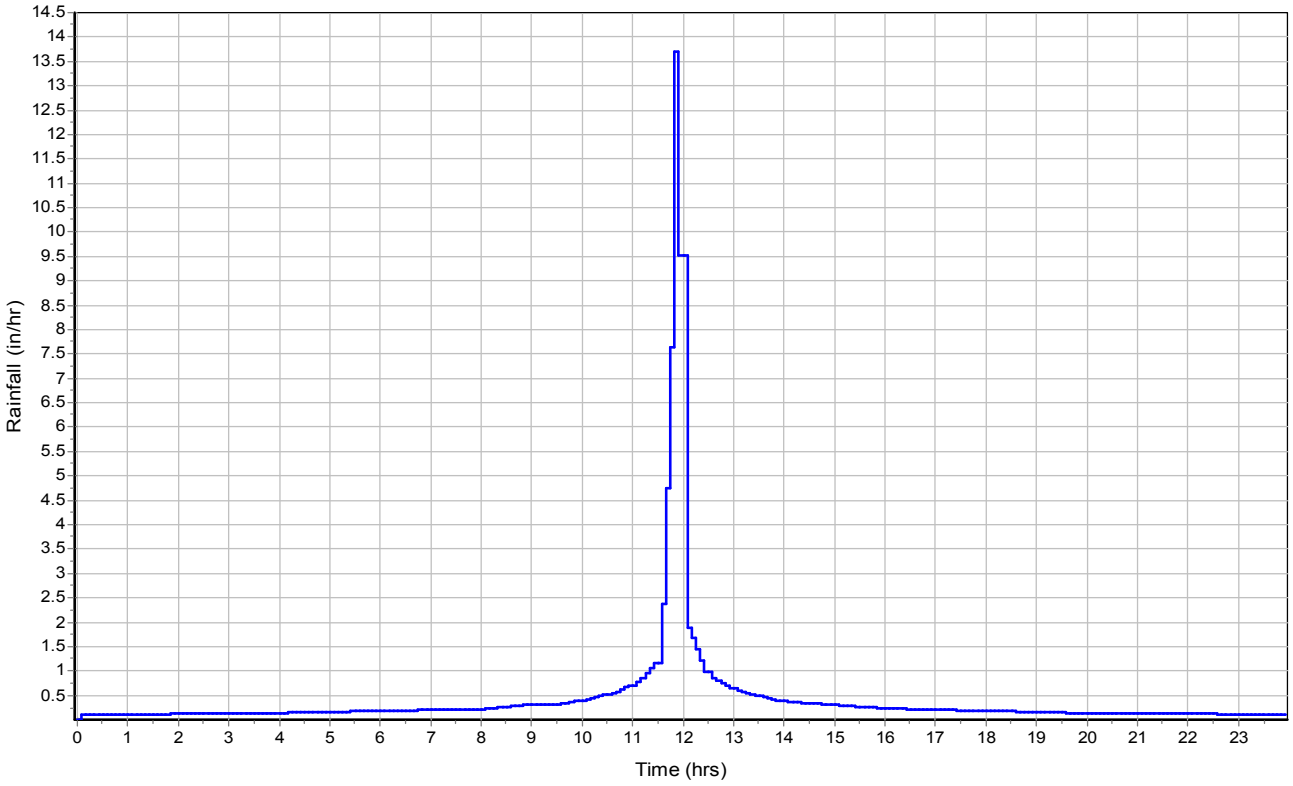
Total TOC (min) 21.68

Subbasin Runoff Results

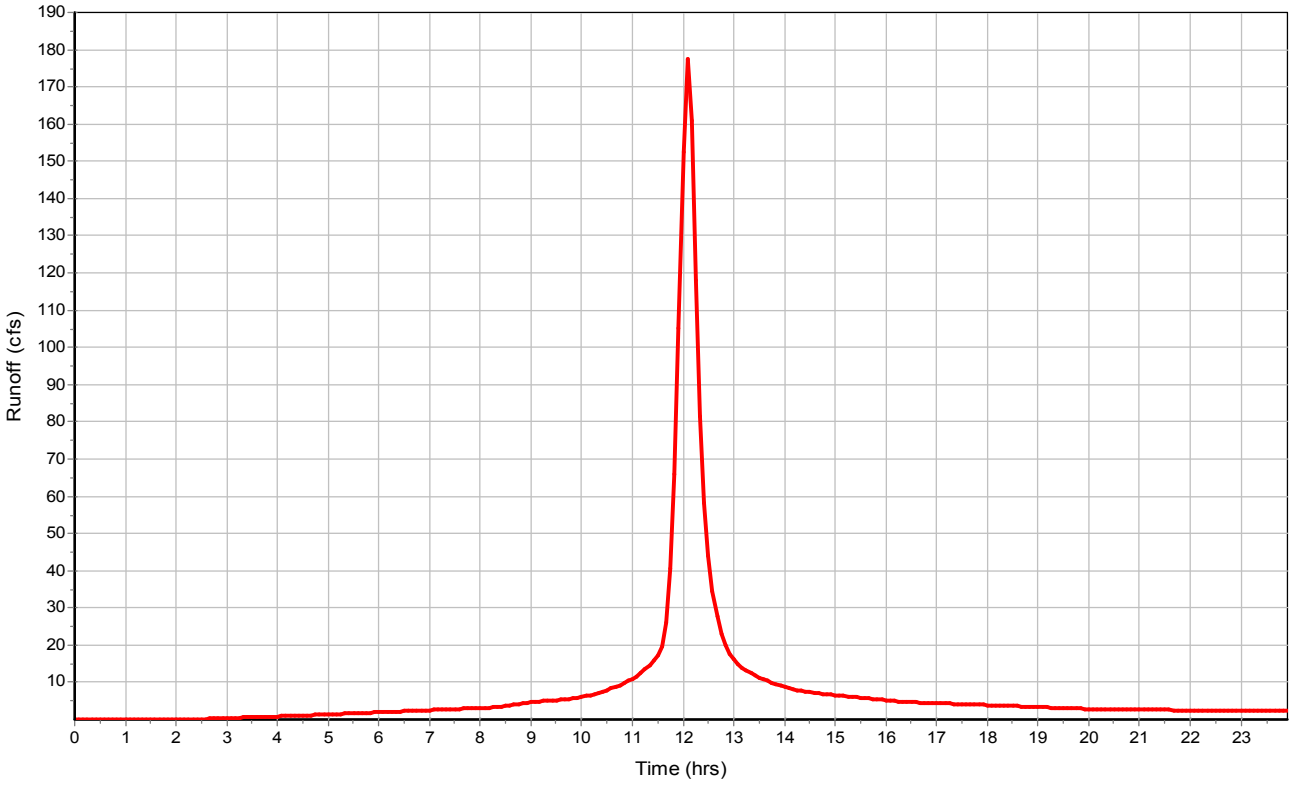
Total Rainfall (in)	10.00
Total Runoff (in)	8.76
Peak Runoff (cfs)	177.92
Weighted Curve Number	89.81
Time of Concentration (days hh:mm:ss)	0 00:21:41

Subbasin : Drainage Area 7 - Post

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : Drainage Area 7 - Pre

Input Data

Area (ac)	20.67
Weighted Curve Number	88.80
Rain Gage ID	Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Paved parking & roofs	10.66	C	98.00
50 - 75% grass cover, Fair	10.01	C	79.00
Composite Area & Weighted CN	20.67		88.80

Time of Concentration

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	.15	0.00	0.00
Flow Length (ft) :	200	0.00	0.00
Slope (%) :	1.5	0.00	0.00
2 yr, 24 hr Rainfall (in) :	4.70	0.00	0.00
Velocity (ft/sec) :	0.21	0.00	0.00
Computed Flow Time (min) :	15.79	0.00	0.00

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	900	0.00	0.00
Slope (%) :	2.5	0.00	0.00
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	2.55	0.00	0.00
Computed Flow Time (min) :	5.88	0.00	0.00

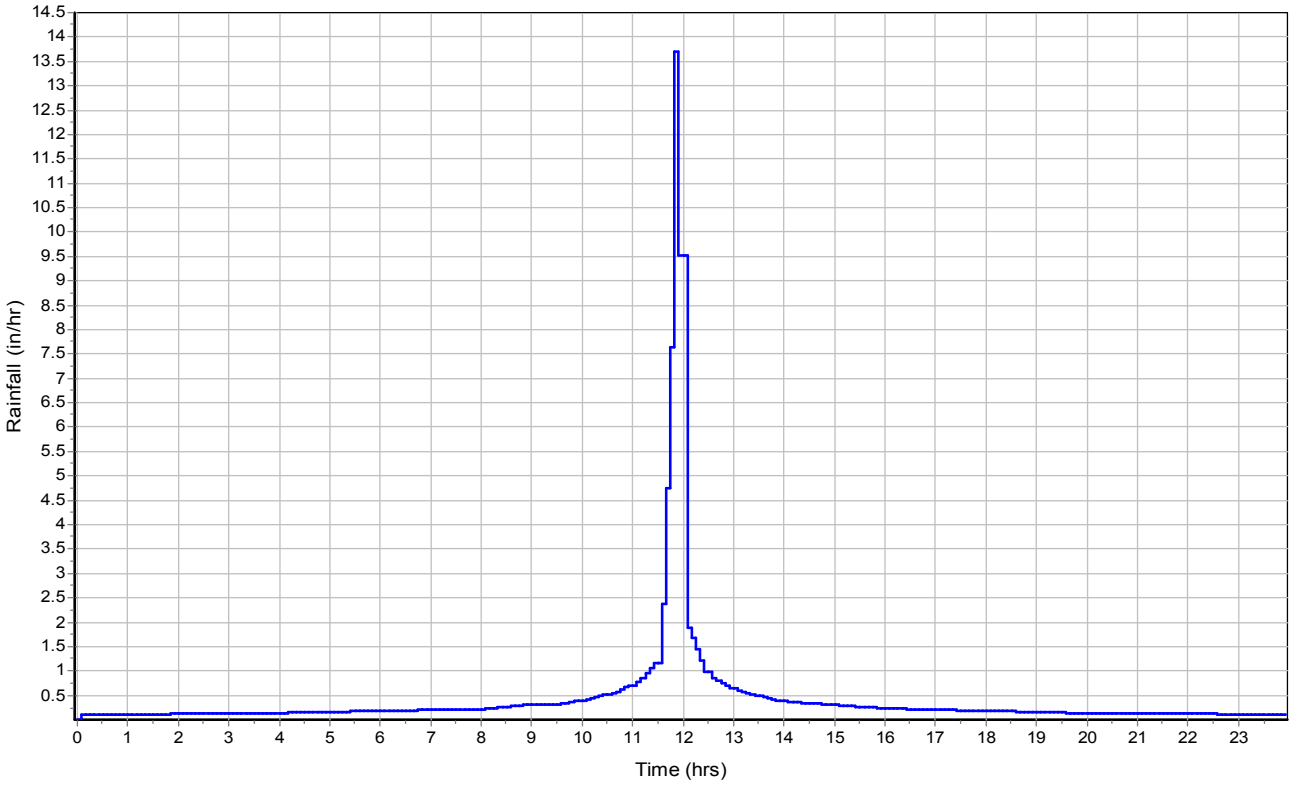
Total TOC (min) 21.68

Subbasin Runoff Results

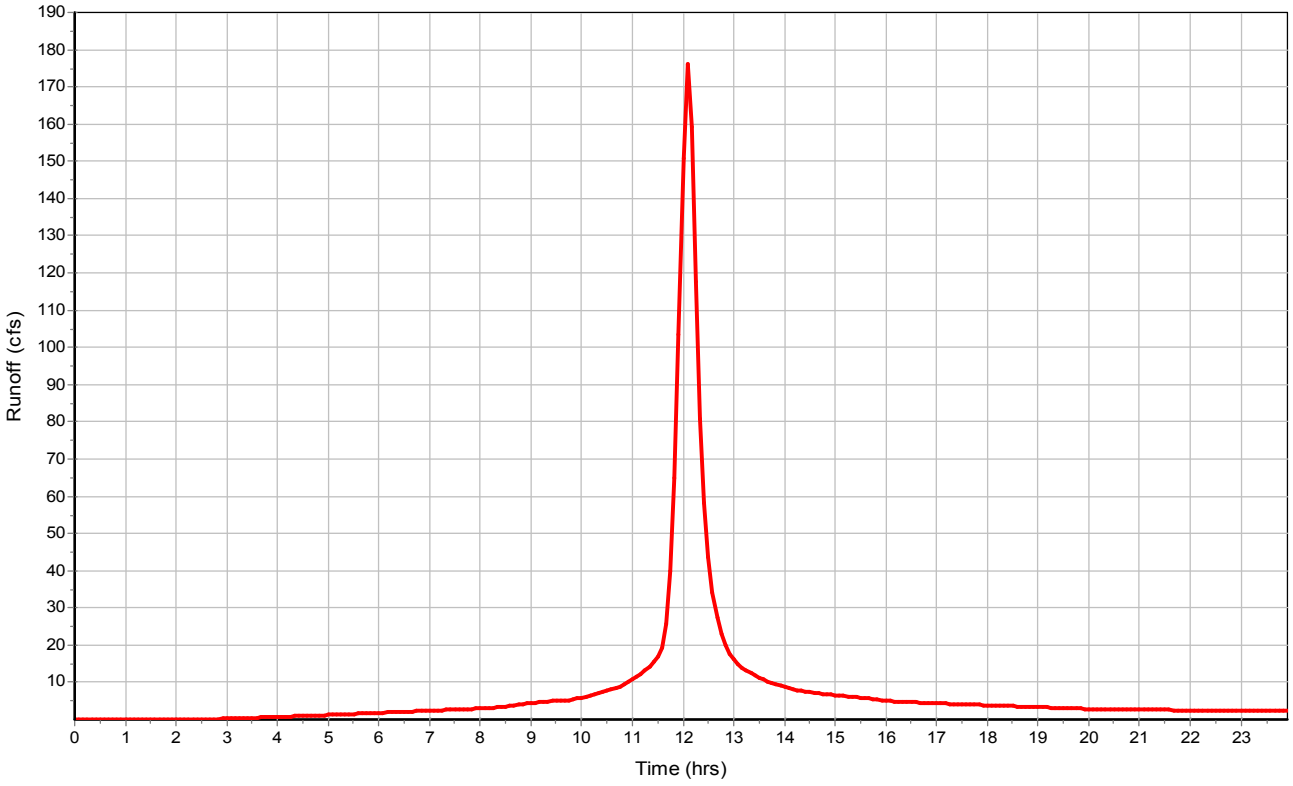
Total Rainfall (in)	10.00
Total Runoff (in)	8.63
Peak Runoff (cfs)	176.32
Weighted Curve Number	88.80
Time of Concentration (days hh:mm:ss)	0 00:21:41

Subbasin : Drainage Area 7 - Pre

Rainfall Intensity Graph



Runoff Hydrograph



Appendix D – Soil Information

All information shown in Appendix D was collected from the National Resource Conservation Service Web Soil Survey.

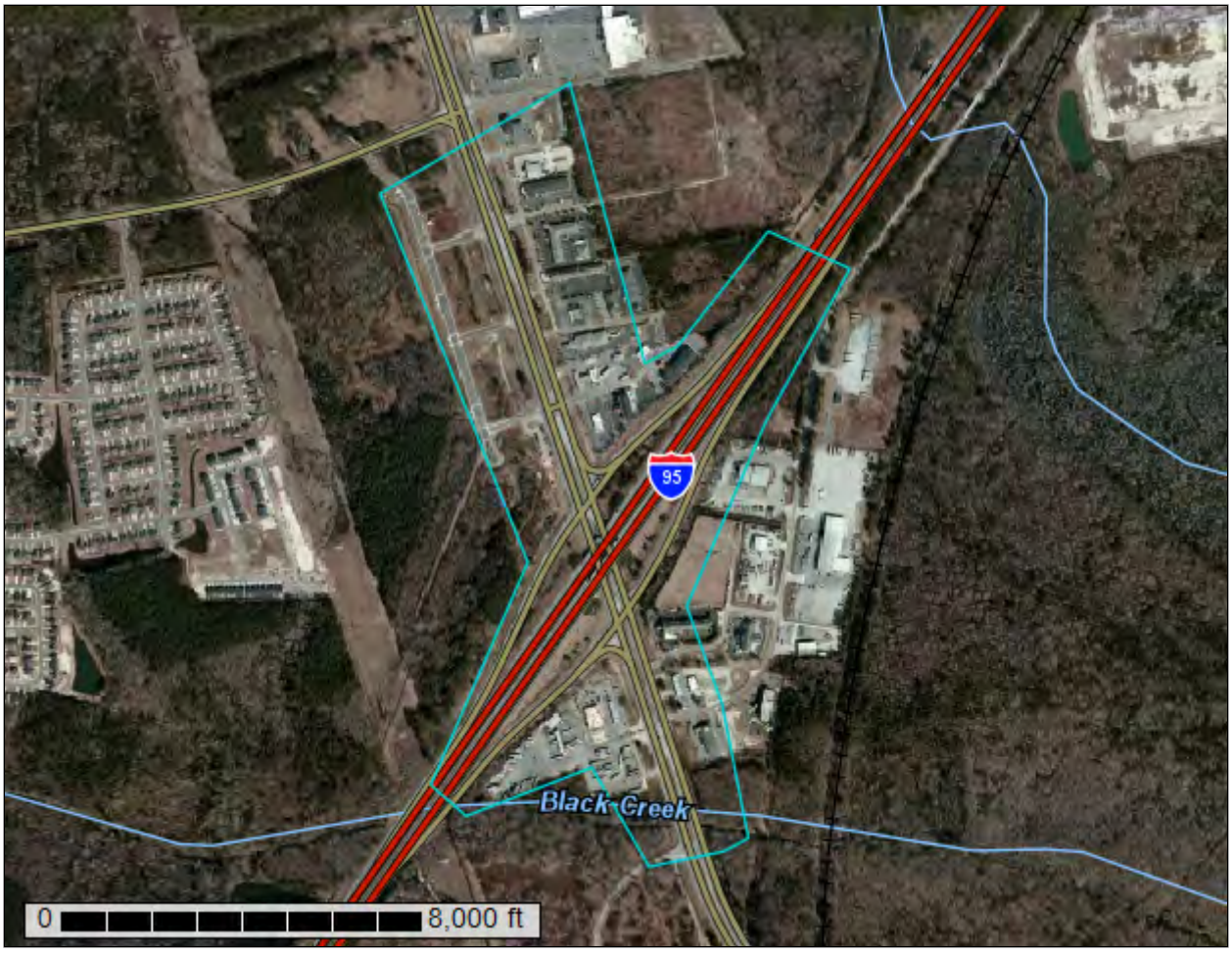
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Bryan and Chatham Counties, Georgia



December 7, 2014

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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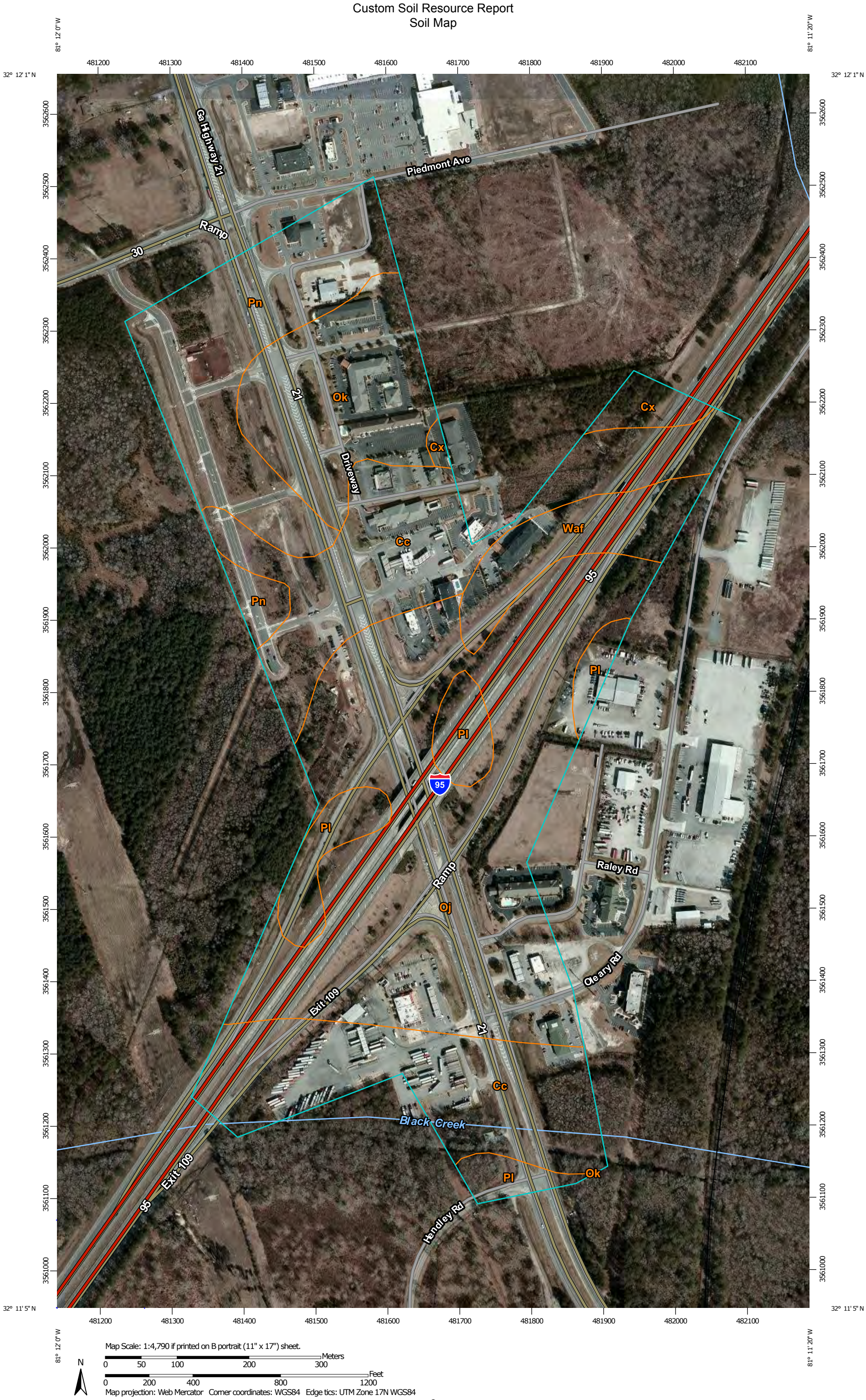
Contents

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:4,790 if printed on B portrait (11" x 17") sheet.

Meters: 0 50 100 200 300

Feet: 0 200 400 800 1200

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

MAP LEGEND

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

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Bryan and Chatham Counties, Georgia
Survey Area Data: Version 9, Sep 17, 2014

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

Date(s) aerial images were photographed: Mar 1, 2010—Apr 18, 2011

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

Bryan and Chatham Counties, Georgia (GA613)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
Cc	Cape Fear soils	38.5	26.8%
Cx	Craven loamy fine sand	2.3	1.6%
Oj	Ocilla complex	51.0	35.6%
Ok	Ogeechee loamy fine sand	14.6	10.2%
Pl	Pelham loamy sand	9.0	6.3%
Pn	Pooler fine sandy loam	20.7	14.4%
Waf	Wahee sandy loam	7.3	5.1%
Totals for Area of Interest		**143.4**	**100.0%**

Map Unit Descriptions

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

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

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

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

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

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

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

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

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

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

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

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

Bryan and Chatham Counties, Georgia

Cc—Cape Fear soils

Map Unit Setting

National map unit symbol: 46g5
Mean annual precipitation: 44 to 52 inches
Mean annual air temperature: 64 to 70 degrees F
Frost-free period: 230 to 290 days
Farmland classification: Not prime farmland

Map Unit Composition

Cape fear and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cape Fear

Setting

Landform: Depressions, drainageways
Down-slope shape: Concave, linear
Across-slope shape: Concave
Parent material: Marine deposits

Typical profile

H1 - 0 to 16 inches: loam
H2 - 16 to 52 inches: clay
H3 - 52 to 62 inches: loamy fine sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Very poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: Rare
Frequency of ponding: None
Available water storage in profile: High (about 9.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: C/D

Cx—Craven loamy fine sand

Map Unit Setting

National map unit symbol: 46gb
Elevation: 20 to 450 feet
Mean annual precipitation: 44 to 52 inches
Mean annual air temperature: 64 to 70 degrees F

Frost-free period: 230 to 290 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Craven and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Craven

Setting

Landform: Interfluves
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Marine deposits

Typical profile

H1 - 0 to 13 inches: loamy fine sand
H2 - 13 to 48 inches: sandy clay
H3 - 48 to 58 inches: sandy clay loam
H4 - 58 to 80 inches: sandy clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 18 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C

Minor Components

Pelham

Percent of map unit: 5 percent
Landform: Depressions, flats
Landform position (three-dimensional): Dip
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear

Oj—Ocilla complex

Map Unit Setting

National map unit symbol: 46gt

Elevation: 10 to 450 feet
Mean annual precipitation: 44 to 52 inches
Mean annual air temperature: 64 to 70 degrees F
Frost-free period: 230 to 290 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Ocilla and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ocilla

Setting

Landform: Interfluves
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Marine deposits

Typical profile

H1 - 0 to 28 inches: loamy fine sand
H2 - 28 to 59 inches: sandy clay loam
H3 - 59 to 67 inches: sandy clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: About 12 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 5.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: B/D
Ecological site: Loamy rise, moderately wet (R153AY001GA)

Minor Components

Ellabelle

Percent of map unit: 3 percent
Landform: Drainageways, depressions
Down-slope shape: Linear, concave
Across-slope shape: Concave

Pelham

Percent of map unit: 2 percent
Landform: Depressions, flats
Landform position (three-dimensional): Dip
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear

Ok—Ogeechee loamy fine sand

Map Unit Setting

National map unit symbol: 46gw
Elevation: 10 to 50 feet
Mean annual precipitation: 44 to 52 inches
Mean annual air temperature: 64 to 70 degrees F
Frost-free period: 230 to 290 days
Farmland classification: Not prime farmland

Map Unit Composition

Ogeechee and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ogeechee

Setting

Landform: Depressions, drainageways, flats
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Parent material: Marine deposits

Typical profile

H1 - 0 to 8 inches: loamy fine sand
H2 - 8 to 23 inches: sandy clay loam
H3 - 23 to 42 inches: sandy clay
H4 - 42 to 60 inches: sandy clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: B/D

Pl—Pelham loamy sand

Map Unit Setting

National map unit symbol: 46h0
Elevation: 20 to 450 feet
Mean annual precipitation: 44 to 52 inches
Mean annual air temperature: 64 to 70 degrees F
Frost-free period: 230 to 290 days
Farmland classification: Not prime farmland

Map Unit Composition

Pelham and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pelham

Setting

Landform: Flats, drainageways, depressions
Landform position (three-dimensional): Dip
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Parent material: Marine deposits

Typical profile

H1 - 0 to 27 inches: loamy sand
H2 - 27 to 56 inches: sandy clay loam
H3 - 56 to 68 inches: sandy clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Available water storage in profile: Low (about 5.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D

Pn—Pooler fine sandy loam

Map Unit Setting

National map unit symbol: 46h1
Elevation: 20 to 100 feet
Mean annual precipitation: 44 to 52 inches
Mean annual air temperature: 64 to 70 degrees F
Frost-free period: 230 to 290 days
Farmland classification: Not prime farmland

Map Unit Composition

Pooler and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pooler

Setting

Landform: Depressions, flats
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Parent material: Marine deposits

Typical profile

H1 - 0 to 6 inches: fine sandy loam
H2 - 6 to 12 inches: sandy clay loam
H3 - 12 to 52 inches: clay
H4 - 52 to 72 inches: sandy clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 8.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: C/D

Waf—Wahee sandy loam

Map Unit Setting

National map unit symbol: 46h6
Elevation: 20 to 450 feet
Mean annual precipitation: 44 to 52 inches
Mean annual air temperature: 64 to 70 degrees F
Frost-free period: 230 to 290 days
Farmland classification: Not prime farmland

Map Unit Composition

Wahee and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wahee

Setting

Landform: Interfluves
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Marine deposits

Typical profile

H1 - 0 to 11 inches: sandy loam
H2 - 11 to 56 inches: clay
H3 - 56 to 65 inches: sandy clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 9.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C/D

Minor Components

Pooler

Percent of map unit: 5 percent
Landform: Depressions, flats
Landform position (three-dimensional): Talf
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear

Appendix E

Plans and Cost Estimate Drainage Area 2

4. BMP Location Map
5. Detailed Proposed Project Cost Estimate
6. Additional MS4 Cost Estimate

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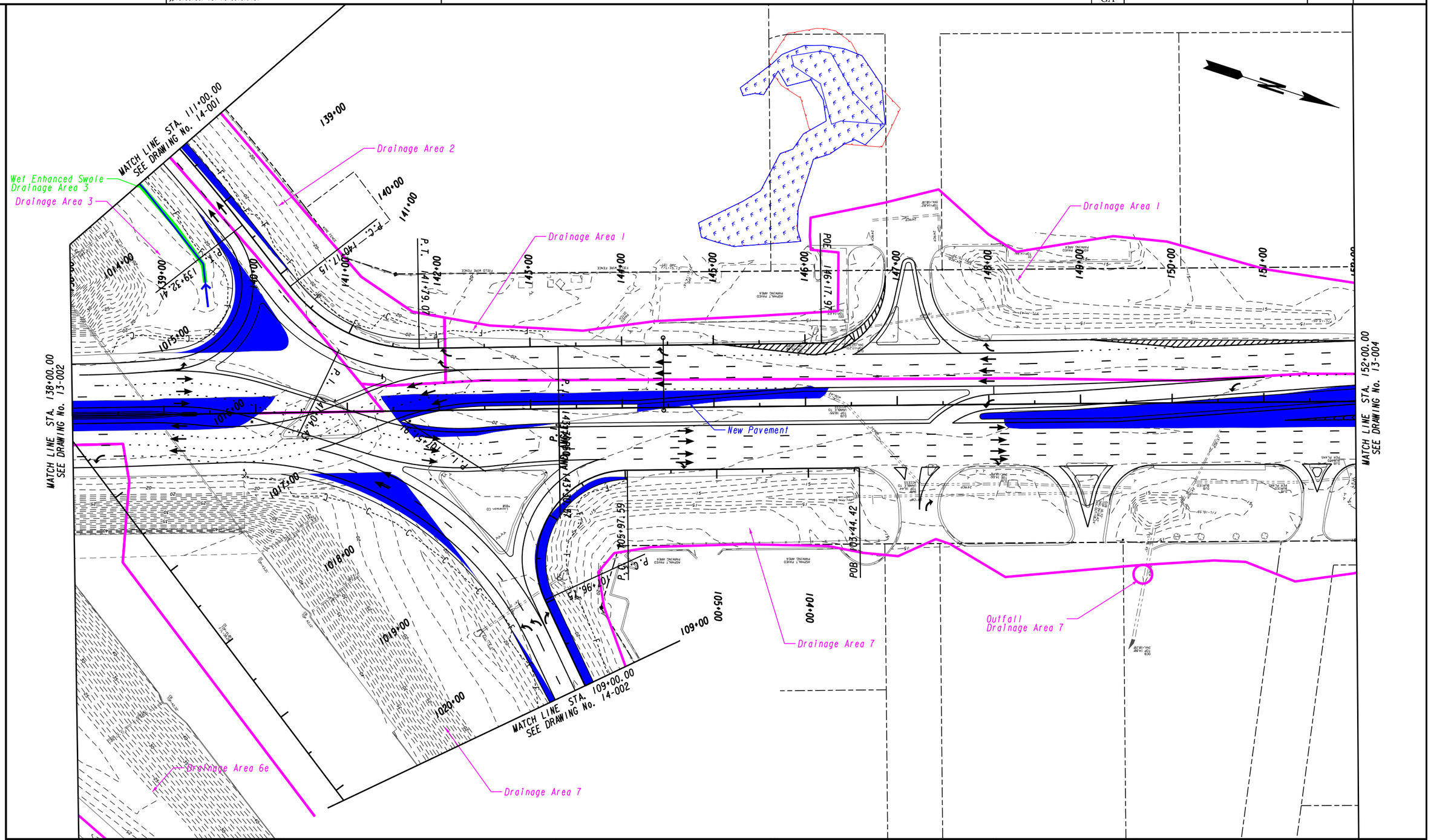

PROPERTY AND EXISTING R/W LINE	——P——
REQUIRED R/W LINE	
CONSTRUCTION LIMITS	——C—— F——
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES	
EASEMENT FOR CONSTR OF SLOPES	
EASEMENT FOR CONSTR OF DRIVES	

BEGIN LIMIT OF ACCESS	BLA
END LIMIT OF ACCESS	ELA
LIMIT OF ACCESS	
REQ'D R/W & LIMIT OF ACCESS	

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OFFICE:

MAINLINE PLAN

SR 21 AT I-95 DDI

DRAWING No.
13-003

12/14/2012 GPLN

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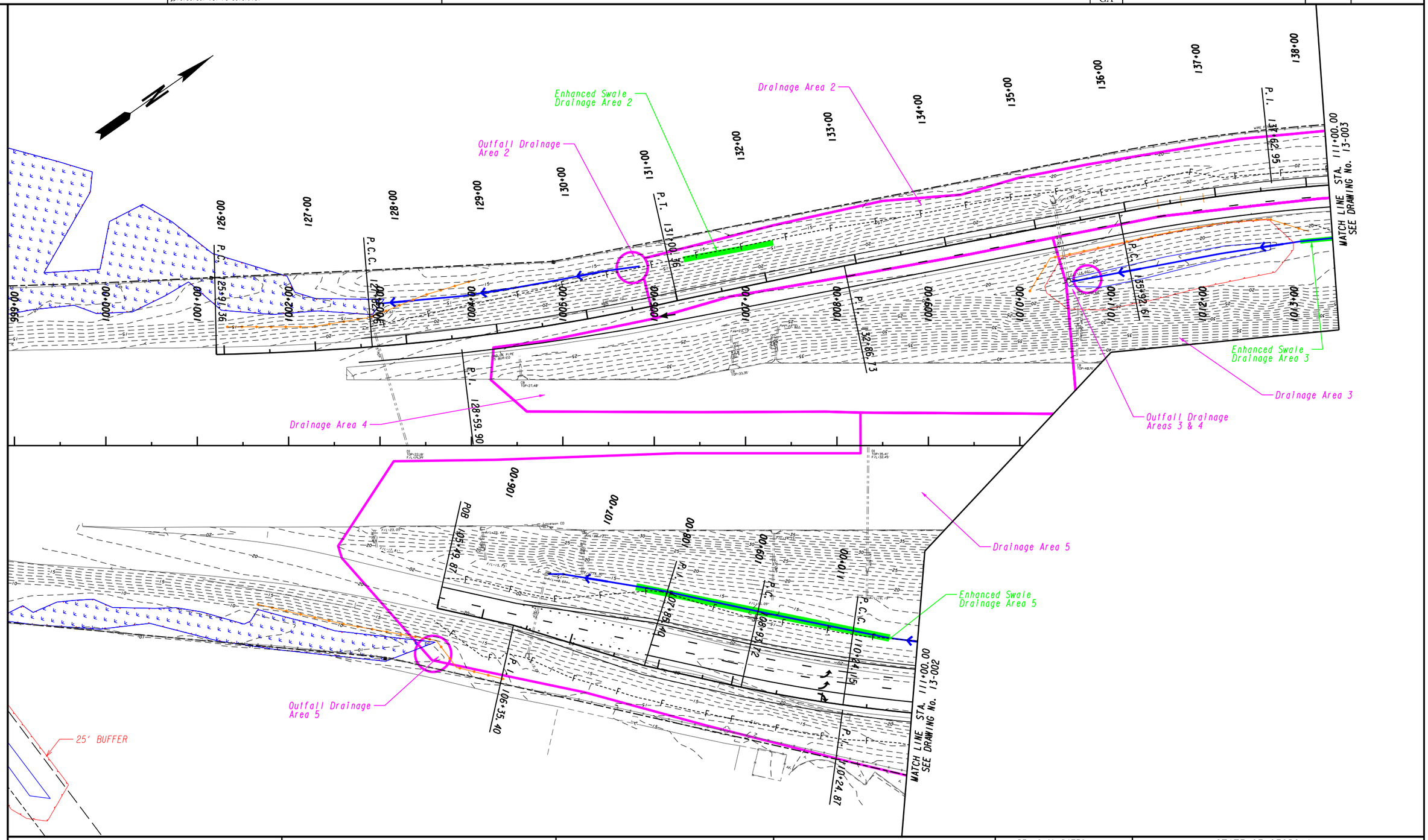

PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS

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DEPARTMENT OF TRANSPORTATION
OFFICE:

CROSSROAD PLAN

SR 21 AT I-95 DDI

DRAWING No. 14-001

12/14/2012 GPLN

CONSTRUCTION COST ESTIMATE

Project: SR 21 from SR 30 to I-95 including DDI
Project No.: 0012722
County: Chatham
Basin: Drainage Area 2

Prepared by: ARCADIS
Last Modified: December 5, 2014

ITEM NO.	ITEM	UNIT	QUANTITY	UNIT PRICE	COST
	ROADWAY ITEMS				
150-1000	TRAFFIC CONTROL -	LS	LUMP	$20,000.00	$2,790.33
201-1500	CLEARING & GRUBBING -	LS	LUMP	$60,000.00	$8,370.99
210-0100	GRADING COMPLETE -	LS	LUMP	$200,000.00	$27,903.31
310-1101	GR AGGR BASE CRS, INCL MATL	TN	1172	$20.47	$23,990.84
310-5060	GR AGGR BASE CRS, 6 INCH, INCL MATL	SY	123	$11.68	$1,436.64
318-3000	AGGR SURF CRS	TN		$22.92	
402-1802	RECYCLED ASPH CONC PATCHING, INCL BITUM MATL & H LIME	TN	114	$91.32	$10,410.48
402-1812	RECYCLED ASPH CONC LEVELING, INCL BITUM MATL & H LIME	TN	614	$67.32	$41,334.48
402-3121	RECYCLED ASPH CONC 25 MM SUPERPAVE, GP 1 OR 2, INCL BITUM	TN	558	$62.68	$34,975.44
402-3600	RECYCLED ASPH CONC 12.5 MM, SMA, GP 2 ONLY, INCLPOLYMER-MODIFIED BITUM MATL &	TN	1353	$130.00	$175,890.00
402-3190	RECYCLED ASPH CONC 19 MM SUPERPAVE, GP 1 OR 2,INCL BITUM	TN	237	$60.47	$14,331.39
413-1000	BITUM TACK COAT	GL	851	$1.93	$1,642.43
432-5010	MILL ASPH CONC PVMT, VARIABLE DEPTH	SY	10310	$1.61	$16,599.10
441-0748	CONCRETE MEDIAN, 6 IN	SY	1228	$58.33	$71,629.24
441-6022	CONC CURB & GUTTER, 6 IN X 30 IN, TP 2	LF	1172	$16.74	$19,619.28
500-3101	CLASS A CONCRETE	CY		$376.75	
500-9999	CLASS B CONC, BASE OR PVMT WIDENING	CY	11	$213.67	$2,350.37
621-4070	CONCRETE SIDE BARRIER, TYPE 7C	LF	106	$72.14	$7,646.84
634-1200	RIGHT OF WAY MARKERS	EA		$104.68	
641-1100	GUARDRAIL, TP T	LF		$42.77	
641-1200	GUARDRAIL, TP W	LF		$15.47	
641-5001	GUARDRAIL ANCHORAGE, TP 1	EA		$622.69	
641-5006	GUARDRAIL ANCHORAGE, TP 6	EA		$362.12	
641-5012	GUARDRAIL ANCHORAGE, TP 12	EA		$1,856.51	
648-1350	IMPACT ATTENUATOR UNIT, TYPE P -	EA		$18,145.71	
	DRAINAGE ITEMS				
441-0303	CONC SPILLWAY, TP 3	EA		$2,298.82	
550-1180	STORM DRAIN PIPE, 18 IN, H 1-10	LF	28	$40.16	$1,124.48
550-1240	STORM DRAIN PIPE, 24 IN, H 1-10	LF	7	$43.94	$307.58
550-1300	STORM DRAIN PIPE, 30 IN, H 1-10	LF		$62.78	
550-1360	STORM DRAIN PIPE, 36 IN, H 1-10	LF		$75.50	
550-4218	FLARED END SECTION 18 IN, STORM DRAIN	EA	1	$647.45	$647.45
550-4224	FLARED END SECTION 24 IN, STORM DRAIN	EA	1	$777.06	$777.06
550-4236	FLARED END SECTION 36 IN, STORM DRAIN	EA		$1,285.66	
573-2006	UNDDR PIPE INCL DRAINAGE AGGR, 6 IN	LF		$12.73	
603-2182	STN DUMPED RIP RAP, TP 3, 24 IN	SY	14	$50.05	$700.70
603-7000	PLASTIC FILTER FABRIC	SY	14	$5.24	$73.36
611-3000	RECONSTR CATCH BASIN, GROUP 1	EA		$2,974.95	
611-3010	RECONSTR DROP INLET, GROUP 1	EA		$1,125.64	
611-3030	RECONSTR STORM SEW MANHOLE, TYPE 1	EA		$2,937.54	
611-8000	ADJUST CATCH BASIN TO GRADE	EA		$2,069.48	
668-1100	CATCH BASIN, GP 1	EA	1	$2,612.83	$2,612.83
668-1110	CATCH BASIN, GP 1, ADDL DEPTH	LF	1	$292.04	$292.04
668-2100	DROP INLET, GP 1	EA	1	$2,506.71	$2,506.71
668-2110	DROP INLET, GP 1, ADDL DEPTH	LF	1	$340.69	$340.69
668-4300	STORM SEWER MANHOLE, TP 1	EA		$2,346.99	
668-4311	STORM SEWER MANHOLE, TP 1, ADDL DEPTH, CL 1	LF		$332.65	
668-5000	JUNCTION BOX	EA		$2,321.35	

231-1250	MISCELLANEOUS CONSTRUCTION, UNPAVED ROADS, STREETS AND DRIVEWAYS - ENHA	EA	1	$11,000.00	$11,000.00
	EROSION CONTROL ITEMS				
163-0232	TEMPORARY GRASSING	AC	0.28	$542.55	$151.39
163-0240	MULCH	TN	6.70	$205.32	$1,374.99
163-0300	CONSTRUCTION EXIT	EA	1	$1,853.38	$1,853.38
163-0503	CONSTRUCT AND REMOVE SILT CONTROL GATE, TP 3	EA	1	$535.03	$535.03
163-0527	CONSTRUCT AND REMOVE RIP RAP CHECK DAMS,	EA	1	$595.15	$595.15
163-0550	CONSTRUCT AND REMOVE INLET SEDIMENT TRAP	EA	3	$202.98	$608.94
165-0030	MAINTENANCE OF TEMPORARY SILT FENCE, TP C	LF	738	$1.28	$944.64
165-0041	MAINTENANCE OF CHECK DAMS - ALL TYPES	LF	1	$132.23	$132.23
165-0087	MAINTENANCE OF SILT CONTROL GATE, TP 3	EA	1	$132.23	$132.23
165-0101	MAINTENANCE OF CONSTRUCTION EXIT	EA	1	$512.02	$512.02
165-0105	MAINTENANCE OF INLET SEDIMENT TRAP	EA	3	$86.90	$260.70
167-1000	WATER QUALITY MONITORING AND SAMPLING	EA	1	$1,035.68	$1,035.68
167-1500	WATER QUALITY INSPECTIONS	MO	3	$993.55	$2,980.65
171-0030	TEMPORARY SILT FENCE, TYPE C	LF	1475	$3.82	$5,634.50
643-8200	BARRIER FENCE (ORANGE), 4 FT	LF	164	$2.92	$478.88
700-6910	PERMANENT GRASSING	AC	1	$960.36	$960.36
700-7000	AGRICULTURAL LIME	TN	2	$51.73	$103.46
700-8000	FERTILIZER MIXED GRADE	TN	1	$292.10	$292.10
700-8100	FERTILIZER NITROGEN CONTENT	LB	28	$2.36	$66.08
716-2000	EROSION CONTROL MATS, SLOPES	SY	837	$0.99	$828.63
	SIGNING, MARKING, AND SIGNAL ITEMS				
636-1020	HIGHWAY SIGNS, TP 1 MATL, REFL SHEETING, TP 3	SF	14	$19.00	$266.00
636-1033	HIGHWAY SIGNS, TP 1 MATL, REFL SHEETING, TP 9	SF	14	$17.73	$248.22
636-1041	HIGHWAY SIGNS, TP 2 MATL, REFL SHEETING, TP 9	SF	8	$33.95	$271.60
636-2070	GALV STEEL POSTS, TP 7	LF	42	$9.70	$407.40
639-3004	STEEL STRAIN POLE, TP IV	EA		$5,000.00	
647-1000	TRAFFIC SIGNAL INSTALLATION NO -	LS		$95,000.00	
647-1000	TRAFFIC SIGNAL INSTALLATION NO -	LS		$95,000.00	
653-0110	THERMOPLASTIC PVMT MARKING, ARROW, TP 1	EA	2	$74.21	$148.42
653-0120	THERMOPLASTIC PVMT MARKING, ARROW, TP 2	EA	3	$90.00	$270.00
653-1501	THERMOPLASTIC SOLID TRAF STRIPE, 5 IN, WHITE	LF	1681	$0.42	$706.02
653-1502	THERMOPLASTIC SOLID TRAF STRIPE, 5 IN, YELLOW	LF	1465	$0.44	$644.60
653-1704	THERMOPLASTIC SOLID TRAF STRIPE, 24 IN, WHITE	LF	5	$5.57	$27.85
653-1804	THERMOPLASTIC SOLID TRAF STRIPE, 8 IN, WHITE	LF	20	$2.03	$40.60
653-3501	THERMOPLASTIC SKIP TRAF STRIPE, 5 IN, WHITE	GLF	2947	$0.28	$825.16
653-6004	THERMOPLASTIC TRAF STRIPING, WHITE	SY	70	$3.50	$245.00
653-6006	THERMOPLASTIC TRAF STRIPING, YELLOW	SY	21	$3.22	$67.62
654-1001	RAISED PVMT MARKERS TP 1	EA	37	$3.14	$116.18
682-6233	CONDUIT, NONMETL, TP 3, 2 IN	LF		$8.83	
935-1114	OUTSIDE PLANT FIBER OPTIC CABLE, LOOSE TUBE, SINGLE	LF		$2.30	
935-1511	OUTSIDE PLANT FIBER OPTIC CABLE, DROP, SINGLE MODE,	LF		$2.30	
935-3104	FIBER OPTIC CLOSURE, UNDERGROUND, 36 FIBER	EA		$700.00	
935-3501	FIBER OPTIC CLOSURE, FDC (WALL MOUNTED),	EA		$375.00	
935-4010	FIBER OPTIC SPLICE, FUSION	EA		$29.59	
935-5050	FIBER OPTIC PATCH CORD, SM	EA		$107.54	
936-1001	CCTV SYSTEM, TYPE B	EA		$2,000.00	
939-2305	FIELD SWITCH, TYPE C	EA	2	$1,856.60	$3,713.20
939-4040	TYPE D CABINET	EA	2	$1,500.00	$3,000.00

Subtotal Construction Cost		**511,782.97**
Reimbursable Utilities 5%	$	25,589.15
Total Construction Cost	**$**	**537,372.12**

Right-of-way	$	-
Grand Total Project Cost	**$**	**537,372.12**

Appendix F

Plans and Cost Estimate Drainage Area 3

1. BMP Location Map
2. Detailed Proposed Project Cost Estimate
3. Additional MS4 Cost Estimate

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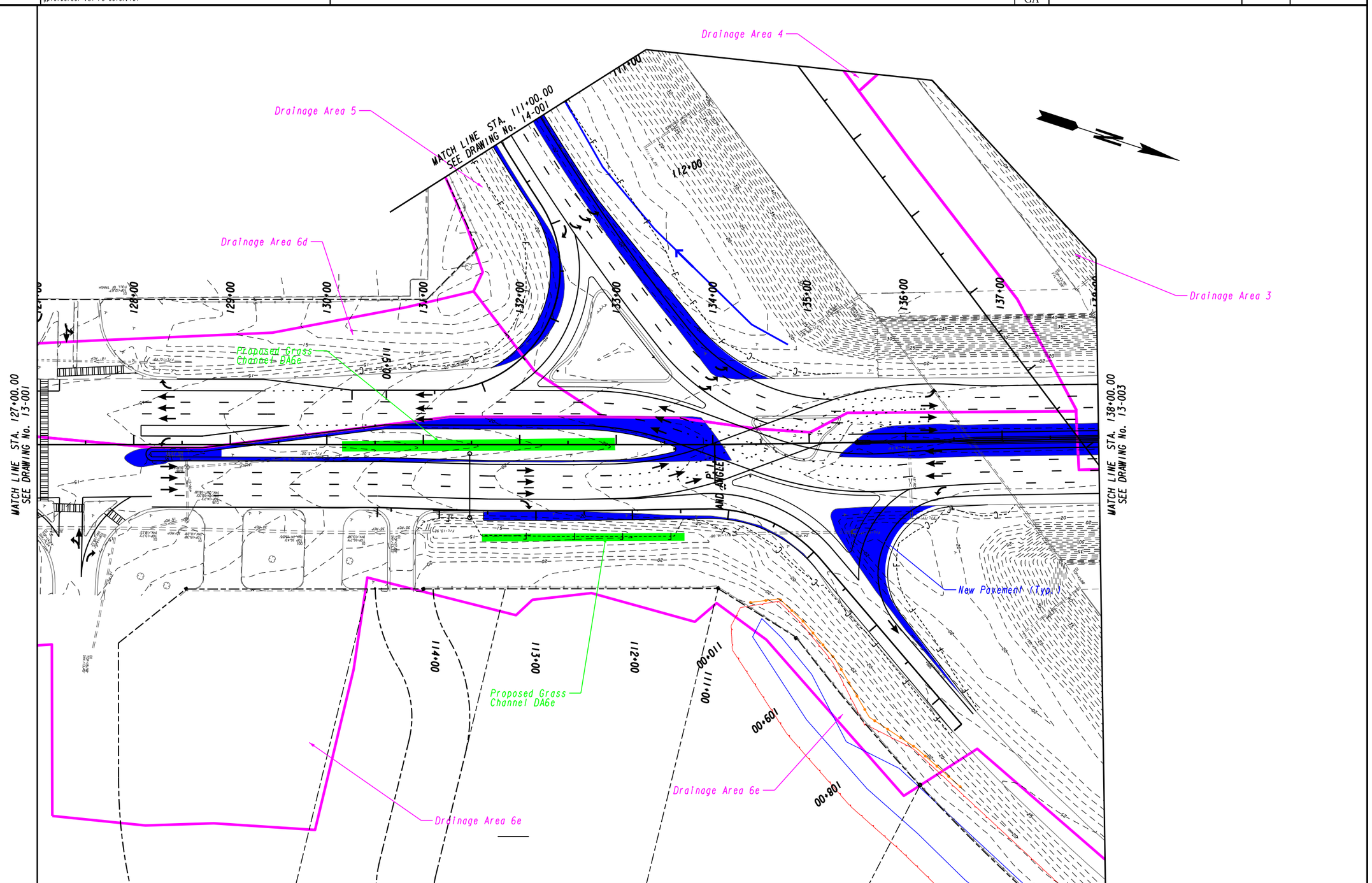

PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS

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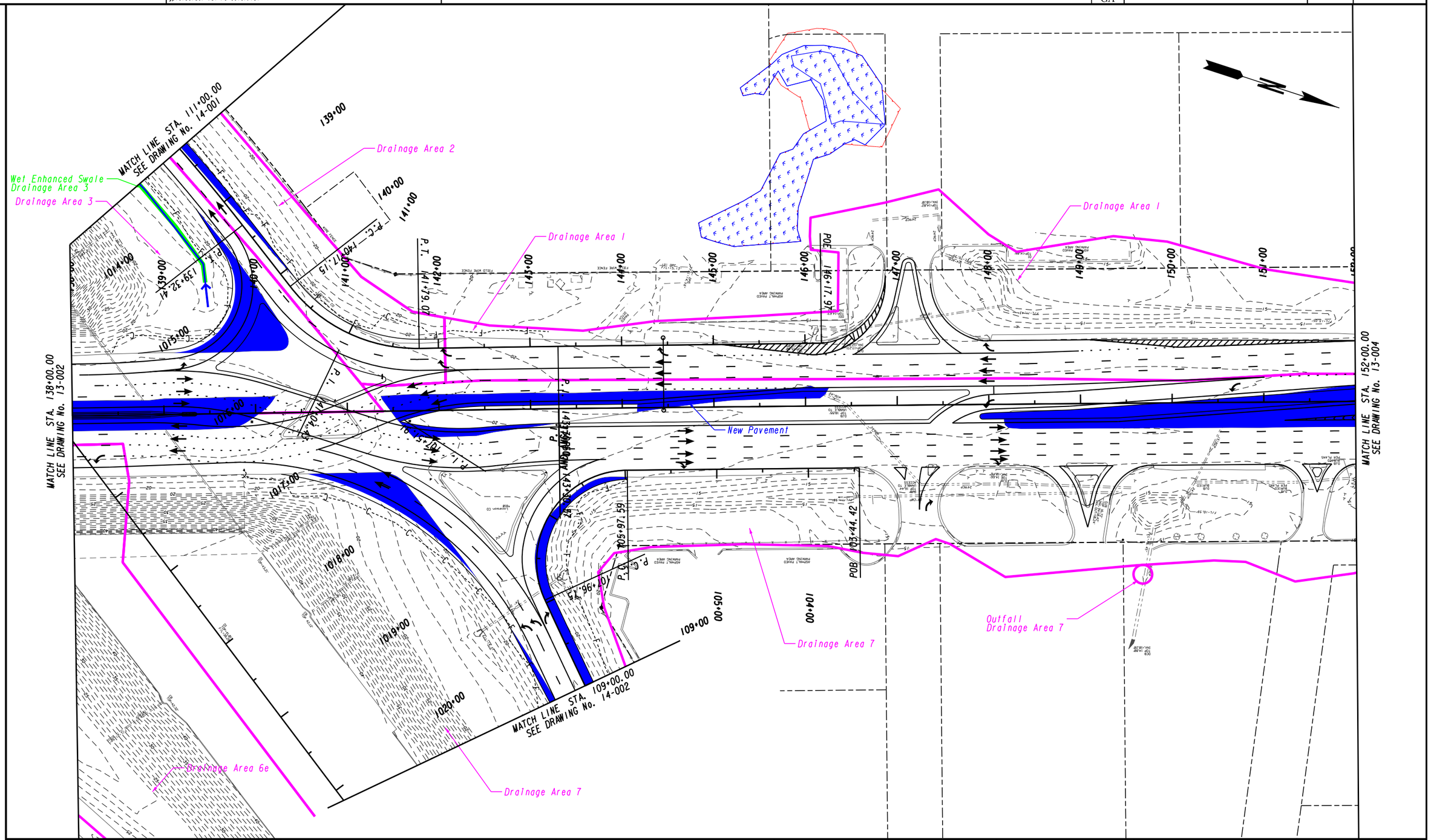

PROPERTY AND EXISTING R/W LINE	——P——
REQUIRED R/W LINE	
CONSTRUCTION LIMITS	——C—— F——
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES	
EASEMENT FOR CONSTR OF SLOPES	
EASEMENT FOR CONSTR OF DRIVES	

BEGIN LIMIT OF ACCESS	BLA
END LIMIT OF ACCESS	ELA
LIMIT OF ACCESS	
REQ'D R/W & LIMIT OF ACCESS	

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13-003

12/14/2012 GPLN

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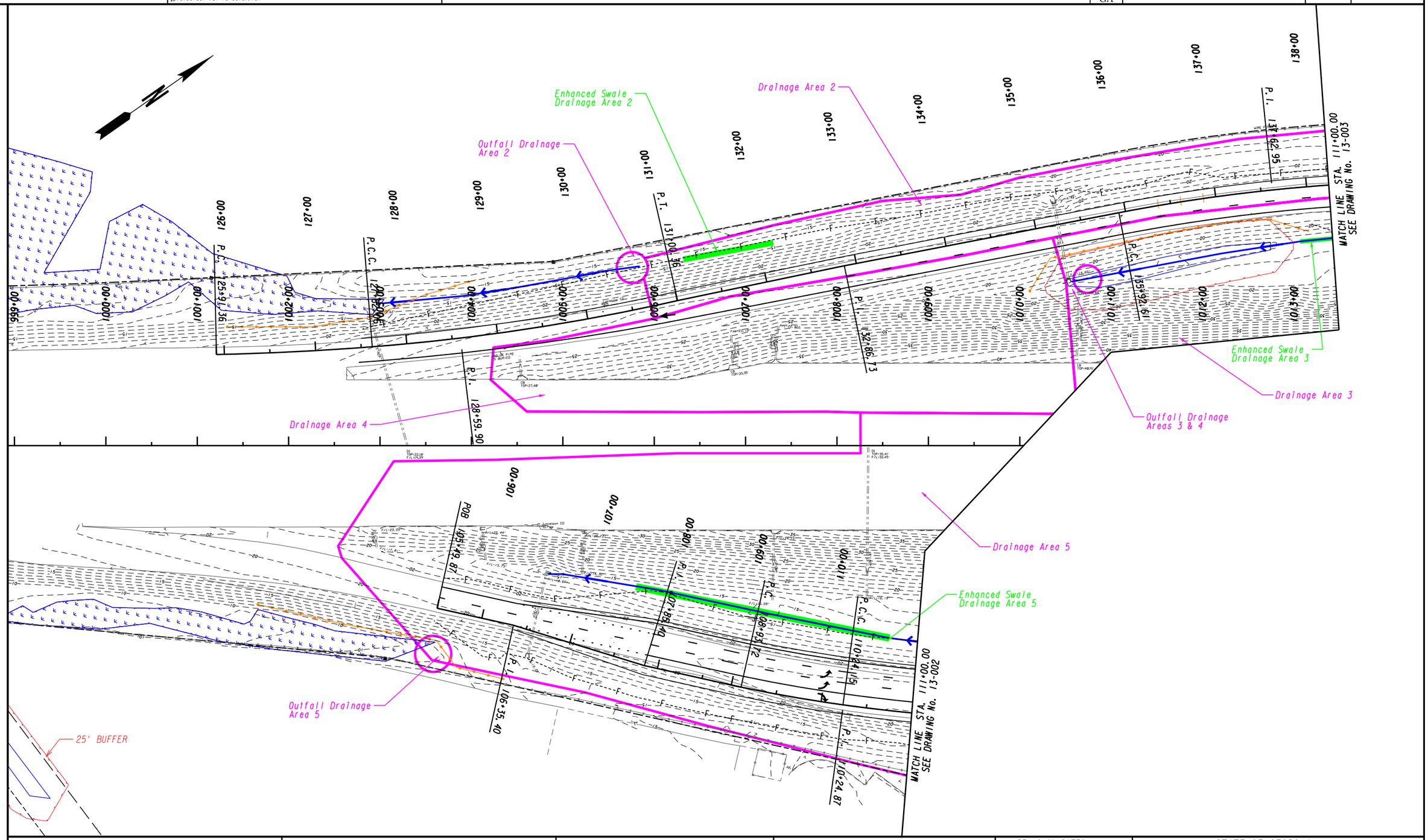

PROPERTY AND EXISTING R/W LINE
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BEGIN LIMIT OF ACCESS.....BLA
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LIMIT OF ACCESS
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DEPARTMENT OF TRANSPORTATION
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CROSSROAD PLAN

SR 21 AT I-95 DDI

DRAWING No. 14-001

12/14/2012 GPLN

CONSTRUCTION COST ESTIMATE

Project: SR 21 from SR 30 to I-95 including DDI
Project No.: 0012722
County: Chatham
Basin: Drainage Area 3

Prepared by: ARCADIS
Last Modified: December 5, 2014

ITEM NO.	ITEM	UNIT	QUANTITY	UNIT PRICE	COST
	ROADWAY ITEMS				
150-1000	TRAFFIC CONTROL -	LS	LUMP	$20,000.00	$1,248.03
201-1500	CLEARING & GRUBBING -	LS	LUMP	$60,000.00	$3,744.09
210-0100	GRADING COMPLETE -	LS	LUMP	$200,000.00	$12,480.29
310-1101	GR AGGR BASE CRS, INCL MATL	TN	524	$20.47	$10,726.28
310-5060	GR AGGR BASE CRS, 6 INCH, INCL MATL	SY	55	$11.68	$642.40
318-3000	AGGR SURF CRS	TN		$22.92	
402-1802	RECYCLED ASPH CONC PATCHING, INCL BITUM MATL & H LIME	TN	51	$91.32	$4,657.32
402-1812	RECYCLED ASPH CONC LEVELING, INCL BITUM MATL & H LIME	TN	275	$67.32	$18,513.00
402-3121	RECYCLED ASPH CONC 25 MM SUPERPAVE, GP 1 OR 2, INCL BITUM	TN	250	$62.68	$15,670.00
402-3600	RECYCLED ASPH CONC 12.5 MM, SMA, GP 2 ONLY, INCLPOLYMER-MODIFIED BITUM MATL &	TN	605	$130.00	$78,650.00
402-3190	RECYCLED ASPH CONC 19 MM SUPERPAVE, GP 1 OR 2,INCL BITUM	TN	106	$60.47	$6,409.82
413-1000	BITUM TACK COAT	GL	381	$1.93	$735.33
432-5010	MILL ASPH CONC PVMT, VARIABLE DEPTH	SY	4611	$1.61	$7,423.71
441-0748	CONCRETE MEDIAN, 6 IN	SY	549	$58.33	$32,023.17
441-6022	CONC CURB & GUTTER, 6 IN X 30 IN, TP 2	LF	524	$16.74	$8,771.76
500-3101	CLASS A CONCRETE	CY		$376.75	
500-9999	CLASS B CONC, BASE OR PVMT WIDENING	CY	5	$213.67	$1,068.35
621-4070	CONCRETE SIDE BARRIER, TYPE 7C	LF	47	$72.14	$3,390.58
634-1200	RIGHT OF WAY MARKERS	EA		$104.68	
641-1100	GUARDRAIL, TP T	LF		$42.77	
641-1200	GUARDRAIL, TP W	LF		$15.47	
641-5001	GUARDRAIL ANCHORAGE, TP 1	EA		$622.69	
641-5006	GUARDRAIL ANCHORAGE, TP 6	EA		$362.12	
641-5012	GUARDRAIL ANCHORAGE, TP 12	EA		$1,856.51	
648-1350	IMPACT ATTENUATOR UNIT, TYPE P -	EA		$18,145.71	
	DRAINAGE ITEMS				
441-0303	CONC SPILLWAY, TP 3	EA		$2,298.82	
550-1180	STORM DRAIN PIPE, 18 IN, H 1-10	LF	12	$40.16	$481.92
550-1240	STORM DRAIN PIPE, 24 IN, H 1-10	LF	3	$43.94	$131.82
550-1300	STORM DRAIN PIPE, 30 IN, H 1-10	LF		$62.78	
550-1360	STORM DRAIN PIPE, 36 IN, H 1-10	LF		$75.50	
550-4218	FLARED END SECTION 18 IN, STORM DRAIN	EA	1	$647.45	$647.45
550-4224	FLARED END SECTION 24 IN, STORM DRAIN	EA	1	$777.06	$777.06
550-4236	FLARED END SECTION 36 IN, STORM DRAIN	EA		$1,285.66	
573-2006	UNDDR PIPE INCL DRAINAGE AGGR, 6 IN	LF		$12.73	
603-2182	STN DUMPED RIP RAP, TP 3, 24 IN	SY	6	$50.05	$300.30
603-7000	PLASTIC FILTER FABRIC	SY	6	$5.24	$31.44
611-3000	RECONSTR CATCH BASIN, GROUP 1	EA		$2,974.95	
611-3010	RECONSTR DROP INLET, GROUP 1	EA		$1,125.64	
611-3030	RECONSTR STORM SEW MANHOLE, TYPE 1	EA		$2,937.54	
611-8000	ADJUST CATCH BASIN TO GRADE	EA		$2,069.48	
668-1100	CATCH BASIN, GP 1	EA		$2,612.83	
668-1110	CATCH BASIN, GP 1, ADDL DEPTH	LF	1	$292.04	$292.04
668-2100	DROP INLET, GP 1	EA		$2,506.71	
668-2110	DROP INLET, GP 1, ADDL DEPTH	LF	1	$340.69	$340.69
668-4300	STORM SEWER MANHOLE, TP 1	EA		$2,346.99	
668-4311	STORM SEWER MANHOLE, TP 1, ADDL DEPTH, CL 1	LF		$332.65	

668-5000	JUNCTION BOX	EA		$2,321.35	
231-1250	MISCELLANEOUS CONSTRUCTION, UNPAVED ROADS, STREETS AND DRIVEWAYS - ENHA	EA		$11,000.00	
	EROSION CONTROL ITEMS				
163-0232	TEMPORARY GRASSING	AC	0.12	$542.55	$67.71
163-0240	MULCH	TN	3.00	$205.32	$614.99
163-0300	CONSTRUCTION EXIT	EA		$1,853.38	
163-0503	CONSTRUCT AND REMOVE SILT CONTROL GATE, TP 3	EA		$535.03	
163-0527	CONSTRUCT AND REMOVE RIP RAP CHECK DAMS,	EA	1	$595.15	$595.15
163-0550	CONSTRUCT AND REMOVE INLET SEDIMENT TRAP	EA	1	$202.98	$202.98
165-0030	MAINTENANCE OF TEMPORARY SILT FENCE, TP C	LF	330	$1.28	$422.40
165-0041	MAINTENANCE OF CHECK DAMS - ALL TYPES	LF	1	$132.23	$132.23
165-0087	MAINTENANCE OF SILT CONTROL GATE, TP 3	EA		$132.23	
165-0101	MAINTENANCE OF CONSTRUCTION EXIT	EA		$512.02	
165-0105	MAINTENANCE OF INLET SEDIMENT TRAP	EA	1	$86.90	$86.90
167-1000	WATER QUALITY MONITORING AND SAMPLING	EA		$1,035.68	
167-1500	WATER QUALITY INSPECTIONS	MO	1	$993.55	$993.55
171-0030	TEMPORARY SILT FENCE, TYPE C	LF	660	$3.82	$2,521.20
643-8200	BARRIER FENCE (ORANGE), 4 FT	LF	73	$2.92	$213.16
700-6910	PERMANENT GRASSING	AC		$960.36	
700-7000	AGRICULTURAL LIME	TN	1	$51.73	$51.73
700-8000	FERTILIZER MIXED GRADE	TN		$292.10	
700-8100	FERTILIZER NITROGEN CONTENT	LB	12	$2.36	$28.32
716-2000	EROSION CONTROL MATS, SLOPES	SY	374	$0.99	$370.26
	SIGNING, MARKING, AND SIGNAL ITEMS				
636-1020	HIGHWAY SIGNS, TP 1 MATL, REFL SHEETING, TP 3	SF	6	$19.00	$114.00
636-1033	HIGHWAY SIGNS, TP 1 MATL, REFL SHEETING, TP 9	SF	6	$17.73	$106.38
636-1041	HIGHWAY SIGNS, TP 2 MATL, REFL SHEETING, TP 9	SF	4	$33.95	$135.80
636-2070	GALV STEEL POSTS, TP 7	LF	19	$9.70	$184.30
639-3004	STEEL STRAIN POLE, TP IV	EA		$5,000.00	
647-1000	TRAFFIC SIGNAL INSTALLATION NO -	LS		$95,000.00	
647-1000	TRAFFIC SIGNAL INSTALLATION NO -	LS		$95,000.00	
653-0110	THERMOPLASTIC PVMT MARKING, ARROW, TP 1	EA	1	$74.21	$74.21
653-0120	THERMOPLASTIC PVMT MARKING, ARROW, TP 2	EA	1	$90.00	$90.00
653-1501	THERMOPLASTIC SOLID TRAF STRIPE, 5 IN, WHITE	LF	752	$0.42	$315.84
653-1502	THERMOPLASTIC SOLID TRAF STRIPE, 5 IN, YELLOW	LF	655	$0.44	$288.20
653-1704	THERMOPLASTIC SOLID TRAF STRIPE, 24 IN, WHITE	LF	2	$5.57	$11.14
653-1804	THERMOPLASTIC SOLID TRAF STRIPE, 8 IN, WHITE	LF	9	$2.03	$18.27
653-3501	THERMOPLASTIC SKIP TRAF STRIPE, 5 IN, WHITE	GLF	1318	$0.28	$369.04
653-6004	THERMOPLASTIC TRAF STRIPING, WHITE	SY	31	$3.50	$108.50
653-6006	THERMOPLASTIC TRAF STRIPING, YELLOW	SY	9	$3.22	$28.98
654-1001	RAISED PVMT MARKERS TP 1	EA	16	$3.14	$50.24
682-6233	CONDUIT, NONMETL, TP 3, 2 IN	LF		$8.83	
935-1114	OUTSIDE PLANT FIBER OPTIC CABLE, LOOSE TUBE, SINGLE	LF		$2.30	
935-1511	OUTSIDE PLANT FIBER OPTIC CABLE, DROP, SINGLE MODE,	LF		$2.30	
935-3104	FIBER OPTIC CLOSURE, UNDERGROUND, 36 FIBER	EA		$700.00	
935-3501	FIBER OPTIC CLOSURE, FDC (WALL MOUNTED),	EA		$375.00	
935-4010	FIBER OPTIC SPLICE, FUSION	EA		$29.59	
935-5050	FIBER OPTIC PATCH CORD, SM	EA		$107.54	
936-1001	CCTV SYSTEM, TYPE B	EA		$2,000.00	
939-2305	FIELD SWITCH, TYPE C	EA	2	$1,856.60	$3,713.20
939-4040	TYPE D CABINET	EA	2	$1,500.00	$3,000.00

Subtotal Construction Cost		**224,065.53**
Reimbursable Utilities 5%	$	11,203.28
Total Construction Cost	**$**	**235,268.81**

Grand Total Project Cost	**$**	**235,268.81**

Appendix G

Plans and Cost Estimate Drainage Area 5

1. BMP Location Map
2. Detailed Proposed Project Cost Estimate
3. Additional MS4 Cost Estimate

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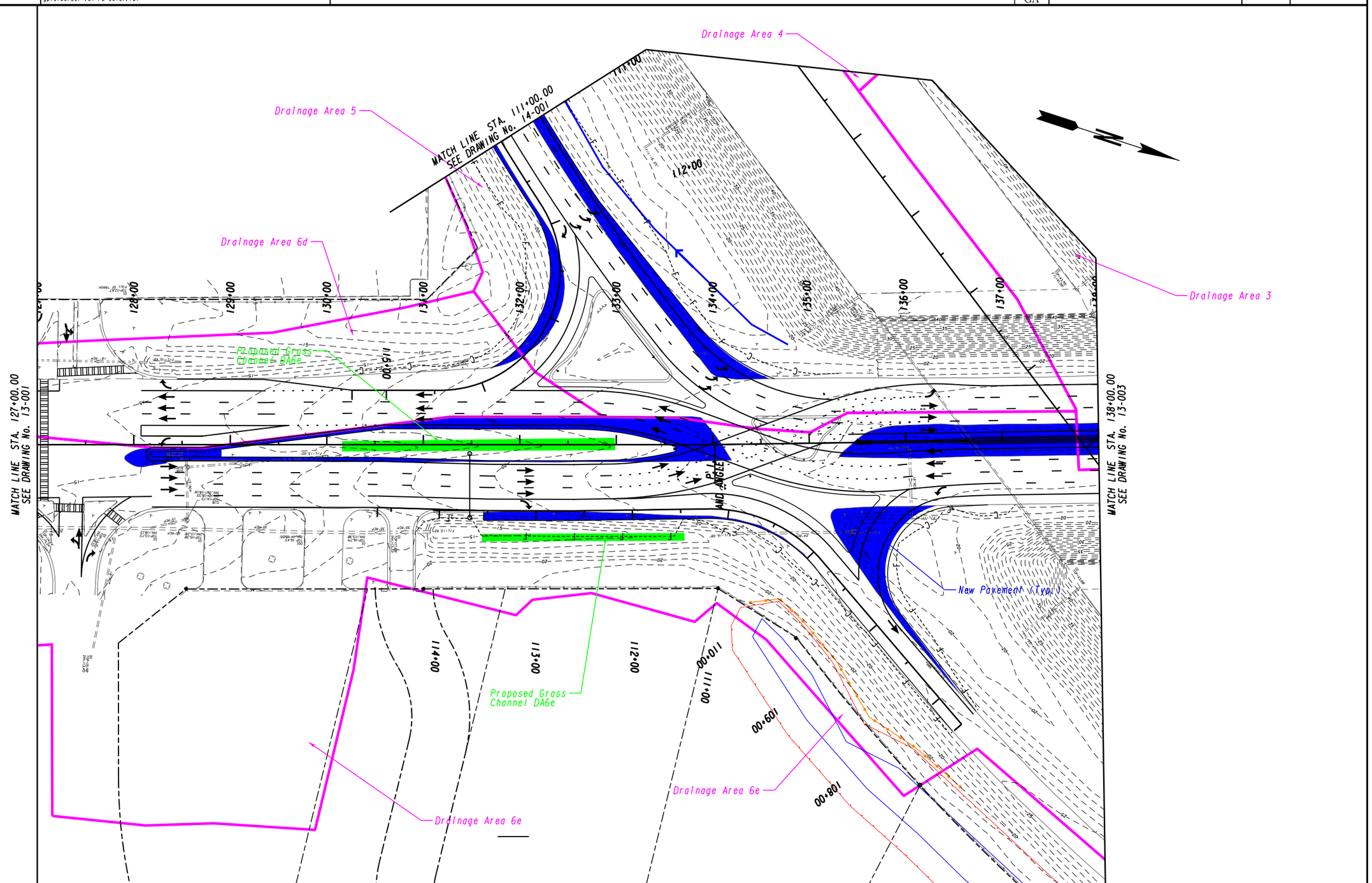

PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS

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SCALE IN FEET
0 50 100 200

REVISION DATES

STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION
OFFICE:

MAINLINE PLAN

SR 21 AT I-95 DDI

DRAWING No. 13-002

12/14/2012 GPLN

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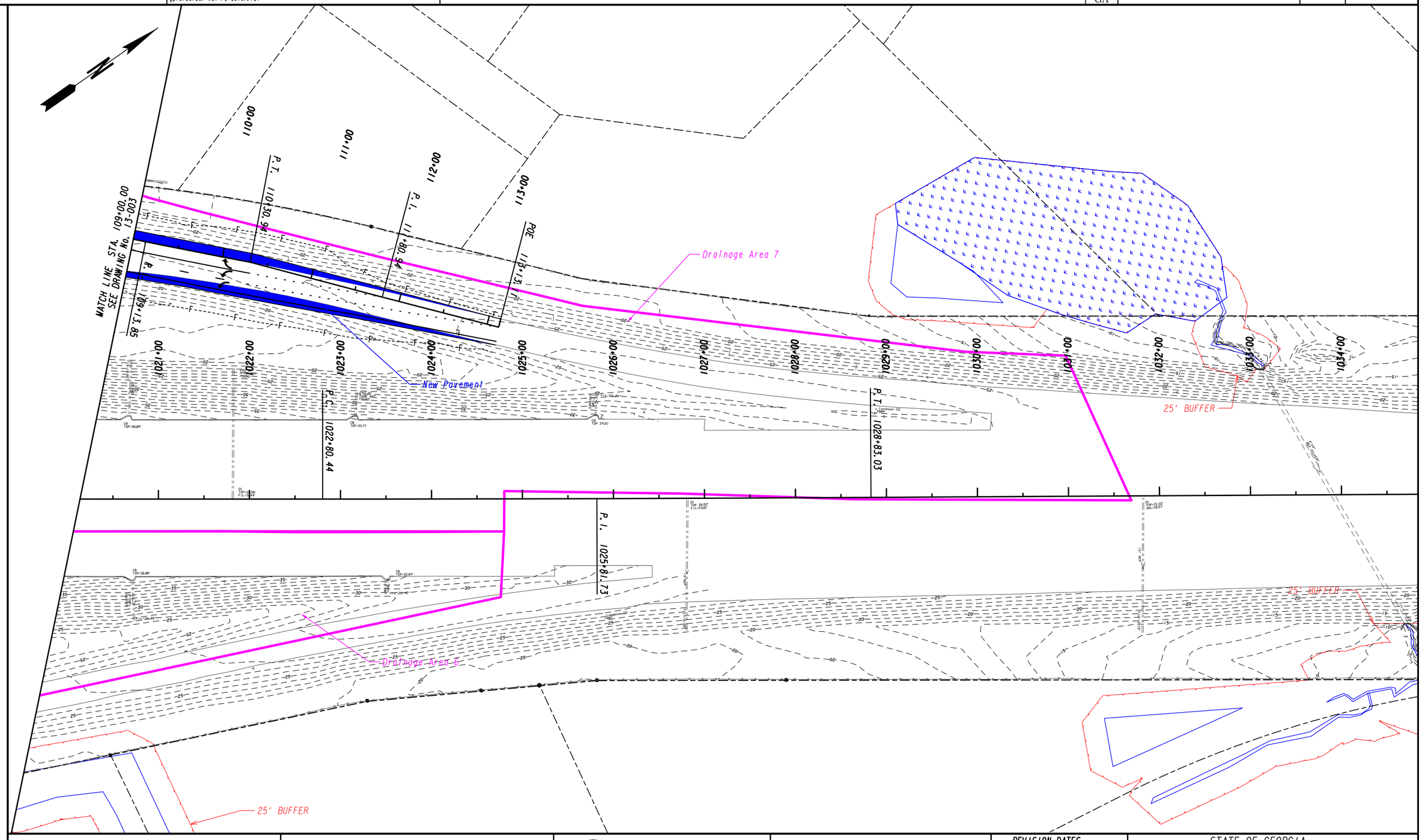

PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS

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SCALE IN FEET
0 50 100 200

REVISION DATES

STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION
OFFICE:

CROSSROAD PLAN

SR 21 AT I-95 DDI

DRAWING No. 14-002

12/14/2012 GPLN

CONSTRUCTION COST ESTIMATE

Project: SR 21 from SR 30 to I-95 including DDI
Project No.: 0012722
County: Chatham
Basin: Drainage Area 5

Prepared by: ARCADIS
Last Modified: December 5, 2014

ITEM NO.	ITEM	UNIT	QUANTITY	UNIT PRICE	COST
	ROADWAY ITEMS				
150-1000	TRAFFIC CONTROL -	LS	LUMP	$20,000.00	$2,364.69
201-1500	CLEARING & GRUBBING -	LS	LUMP	$60,000.00	$7,094.06
210-0100	GRADING COMPLETE -	LS	LUMP	$200,000.00	$23,646.87
310-1101	GR AGGR BASE CRS, INCL MATL	TN	993	$20.47	$20,326.71
310-5060	GR AGGR BASE CRS, 6 INCH, INCL MATL	SY	104	$11.68	$1,214.72
318-3000	AGGR SURF CRS	TN		$22.92	
402-1802	RECYCLED ASPH CONC PATCHING, INCL BITUM MATL & H LIME	TN	97	$91.32	$8,858.04
402-1812	RECYCLED ASPH CONC LEVELING, INCL BITUM MATL & H LIME	TN	520	$67.32	$35,006.40
402-3121	RECYCLED ASPH CONC 25 MM SUPERPAVE, GP 1 OR 2, INCL BITUM	TN	473	$62.68	$29,647.64
402-3600	RECYCLED ASPH CONC 12.5 MM, SMA, GP 2 ONLY, INCLPOLYMER-MODIFIED BITUM MATL &	TN	1147	$130.00	$149,110.00
402-3190	RECYCLED ASPH CONC 19 MM SUPERPAVE, GP 1 OR 2,INCL BITUM	TN	201	$60.47	$12,154.47
413-1000	BITUM TACK COAT	GL	721	$1.93	$1,391.53
432-5010	MILL ASPH CONC PVMT, VARIABLE DEPTH	SY	8738	$1.61	$14,068.18
441-0748	CONCRETE MEDIAN, 6 IN	SY	1040	$58.33	$60,663.20
441-6022	CONC CURB & GUTTER, 6 IN X 30 IN, TP 2	LF	993	$16.74	$16,622.82
500-3101	CLASS A CONCRETE	CY		$376.75	
500-9999	CLASS B CONC, BASE OR PVMT WIDENING	CY	9	$213.67	$1,923.03
621-4070	CONCRETE SIDE BARRIER, TYPE 7C	LF	90	$72.14	$6,492.60
634-1200	RIGHT OF WAY MARKERS	EA		$104.68	
641-1100	GUARDRAIL, TP T	LF		$42.77	
641-1200	GUARDRAIL, TP W	LF		$15.47	
641-5001	GUARDRAIL ANCHORAGE, TP 1	EA		$622.69	
641-5006	GUARDRAIL ANCHORAGE, TP 6	EA		$362.12	
641-5012	GUARDRAIL ANCHORAGE, TP 12	EA		$1,856.51	
648-1350	IMPACT ATTENUATOR UNIT, TYPE P -	EA		$18,145.71	
	DRAINAGE ITEMS				
441-0303	CONC SPILLWAY, TP 3	EA		$2,298.82	
550-1180	STORM DRAIN PIPE, 18 IN, H 1-10	LF	24	$40.16	$963.84
550-1240	STORM DRAIN PIPE, 24 IN, H 1-10	LF	6	$43.94	$263.64
550-1300	STORM DRAIN PIPE, 30 IN, H 1-10	LF		$62.78	
550-1360	STORM DRAIN PIPE, 36 IN, H 1-10	LF		$75.50	
550-4218	FLARED END SECTION 18 IN, STORM DRAIN	EA	1	$647.45	$647.45
550-4224	FLARED END SECTION 24 IN, STORM DRAIN	EA	1	$777.06	$777.06
550-4236	FLARED END SECTION 36 IN, STORM DRAIN	EA		$1,285.66	
573-2006	UNDDR PIPE INCL DRAINAGE AGGR, 6 IN	LF		$12.73	
603-2182	STN DUMPED RIP RAP, TP 3, 24 IN	SY	12	$50.05	$600.60
603-7000	PLASTIC FILTER FABRIC	SY	12	$5.24	$62.88
611-3000	RECONSTR CATCH BASIN, GROUP 1	EA		$2,974.95	
611-3010	RECONSTR DROP INLET, GROUP 1	EA		$1,125.64	
611-3030	RECONSTR STORM SEW MANHOLE, TYPE 1	EA		$2,937.54	
611-8000	ADJUST CATCH BASIN TO GRADE	EA		$2,069.48	
668-1100	CATCH BASIN, GP 1	EA		$2,612.83	
668-1110	CATCH BASIN, GP 1, ADDL DEPTH	LF	1	$292.04	$292.04
668-2100	DROP INLET, GP 1	EA		$2,506.71	
668-2110	DROP INLET, GP 1, ADDL DEPTH	LF	1	$340.69	$340.69
668-4300	STORM SEWER MANHOLE, TP 1	EA		$2,346.99	
668-4311	STORM SEWER MANHOLE, TP 1, ADDL DEPTH, CL 1	LF		$332.65	

668-5000	JUNCTION BOX	EA		$2,321.35	
231-1250	MISCELLANEOUS CONSTRUCTION, UNPAVED ROADS, STREETS AND DRIVEWAYS - ENHA	EA	1	$11,000.00	$11,000.00
	EROSION CONTROL ITEMS				
163-0232	TEMPORARY GRASSING	AC	0.24	$542.55	$128.30
163-0240	MULCH	TN	5.68	$205.32	$1,165.24
163-0300	CONSTRUCTION EXIT	EA		$1,853.38	
163-0503	CONSTRUCT AND REMOVE SILT CONTROL GATE, TP 3	EA	1	$535.03	$535.03
163-0527	CONSTRUCT AND REMOVE RIP RAP CHECK DAMS,	EA	1	$595.15	$595.15
163-0550	CONSTRUCT AND REMOVE INLET SEDIMENT TRAP	EA	2	$202.98	$405.96
165-0030	MAINTENANCE OF TEMPORARY SILT FENCE, TP C	LF	625	$1.28	$800.00
165-0041	MAINTENANCE OF CHECK DAMS - ALL TYPES	LF	1	$132.23	$132.23
165-0087	MAINTENANCE OF SILT CONTROL GATE, TP 3	EA	1	$132.23	$132.23
165-0101	MAINTENANCE OF CONSTRUCTION EXIT	EA		$512.02	
165-0105	MAINTENANCE OF INLET SEDIMENT TRAP	EA	2	$86.90	$173.80
167-1000	WATER QUALITY MONITORING AND SAMPLING	EA	1	$1,035.68	$1,035.68
167-1500	WATER QUALITY INSPECTIONS	MO	3	$993.55	$2,980.65
171-0030	TEMPORARY SILT FENCE, TYPE C	LF	1250	$3.82	$4,775.00
643-8200	BARRIER FENCE (ORANGE), 4 FT	LF	139	$2.92	$405.88
700-6910	PERMANENT GRASSING	AC		$960.36	
700-7000	AGRICULTURAL LIME	TN	1	$51.73	$51.73
700-8000	FERTILIZER MIXED GRADE	TN		$292.10	
700-8100	FERTILIZER NITROGEN CONTENT	LB	24	$2.36	$56.64
716-2000	EROSION CONTROL MATS, SLOPES	SY	709	$0.99	$701.91
	SIGNING, MARKING, AND SIGNAL ITEMS				
636-1020	HIGHWAY SIGNS, TP 1 MATL, REFL SHEETING, TP 3	SF	12	$19.00	$228.00
636-1033	HIGHWAY SIGNS, TP 1 MATL, REFL SHEETING, TP 9	SF	12	$17.73	$212.76
636-1041	HIGHWAY SIGNS, TP 2 MATL, REFL SHEETING, TP 9	SF	7	$33.95	$237.65
636-2070	GALV STEEL POSTS, TP 7	LF	35	$9.70	$339.50
639-3004	STEEL STRAIN POLE, TP IV	EA		$5,000.00	
647-1000	TRAFFIC SIGNAL INSTALLATION NO -	LS		$95,000.00	
647-1000	TRAFFIC SIGNAL INSTALLATION NO -	LS		$95,000.00	
653-0110	THERMOPLASTIC PVMT MARKING, ARROW, TP 1	EA	1	$74.21	$74.21
653-0120	THERMOPLASTIC PVMT MARKING, ARROW, TP 2	EA	3	$90.00	$270.00
653-1501	THERMOPLASTIC SOLID TRAF STRIPE, 5 IN, WHITE	LF	1425	$0.42	$598.50
653-1502	THERMOPLASTIC SOLID TRAF STRIPE, 5 IN, YELLOW	LF	1241	$0.44	$546.04
653-1704	THERMOPLASTIC SOLID TRAF STRIPE, 24 IN, WHITE	LF	4	$5.57	$22.28
653-1804	THERMOPLASTIC SOLID TRAF STRIPE, 8 IN, WHITE	LF	17	$2.03	$34.51
653-3501	THERMOPLASTIC SKIP TRAF STRIPE, 5 IN, WHITE	GLF	2497	$0.28	$699.16
653-6004	THERMOPLASTIC TRAF STRIPING, WHITE	SY	59	$3.50	$206.50
653-6006	THERMOPLASTIC TRAF STRIPING, YELLOW	SY	18	$3.22	$57.96
654-1001	RAISED PVMT MARKERS TP 1	EA	31	$3.14	$97.34
682-6233	CONDUIT, NONMETL, TP 3, 2 IN	LF		$8.83	
935-1114	OUTSIDE PLANT FIBER OPTIC CABLE, LOOSE TUBE, SINGLE	LF		$2.30	
935-1511	OUTSIDE PLANT FIBER OPTIC CABLE, DROP, SINGLE MODE,	LF		$2.30	
935-3104	FIBER OPTIC CLOSURE, UNDERGROUND, 36 FIBER	EA		$700.00	
935-3501	FIBER OPTIC CLOSURE, FDC (WALL MOUNTED),	EA		$375.00	
935-4010	FIBER OPTIC SPLICE, FUSION	EA		$29.59	
935-5050	FIBER OPTIC PATCH CORD, SM	EA		$107.54	
936-1001	CCTV SYSTEM, TYPE B	EA		$2,000.00	
939-2305	FIELD SWITCH, TYPE C	EA	2	$1,856.60	$3,713.20
939-4040	TYPE D CABINET	EA	2	$1,500.00	$3,000.00

Subtotal Construction Cost		**429,946.20**
Reimbursable Utilities 5%	$	21,497.31
Total Construction Cost	**$**	**451,443.51**

Grand Total Project Cost	**$**	**451,443.51**

Appendix H

Plans and Cost Estimate Drainage Area 6

1. BMP Location Map
2. Detailed Proposed Project Cost Estimate
3. Additional MS4 Cost Estimate

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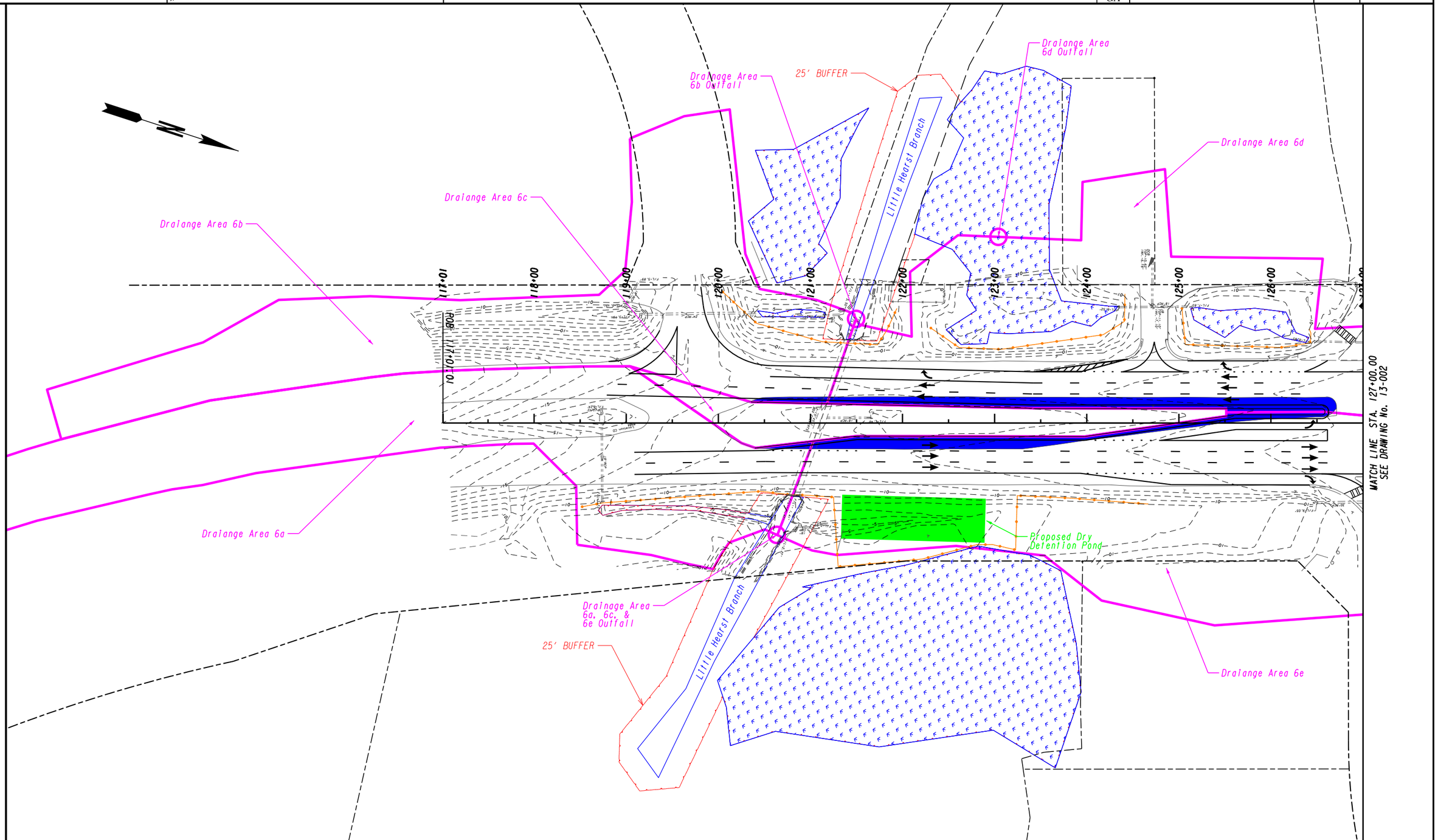

PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS

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SCALE IN FEET
0 50 100 200

REVISION DATES		

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SR 21 AT I-95 DDI

DRAWING No. 13-001

12/14/2012 GPLN

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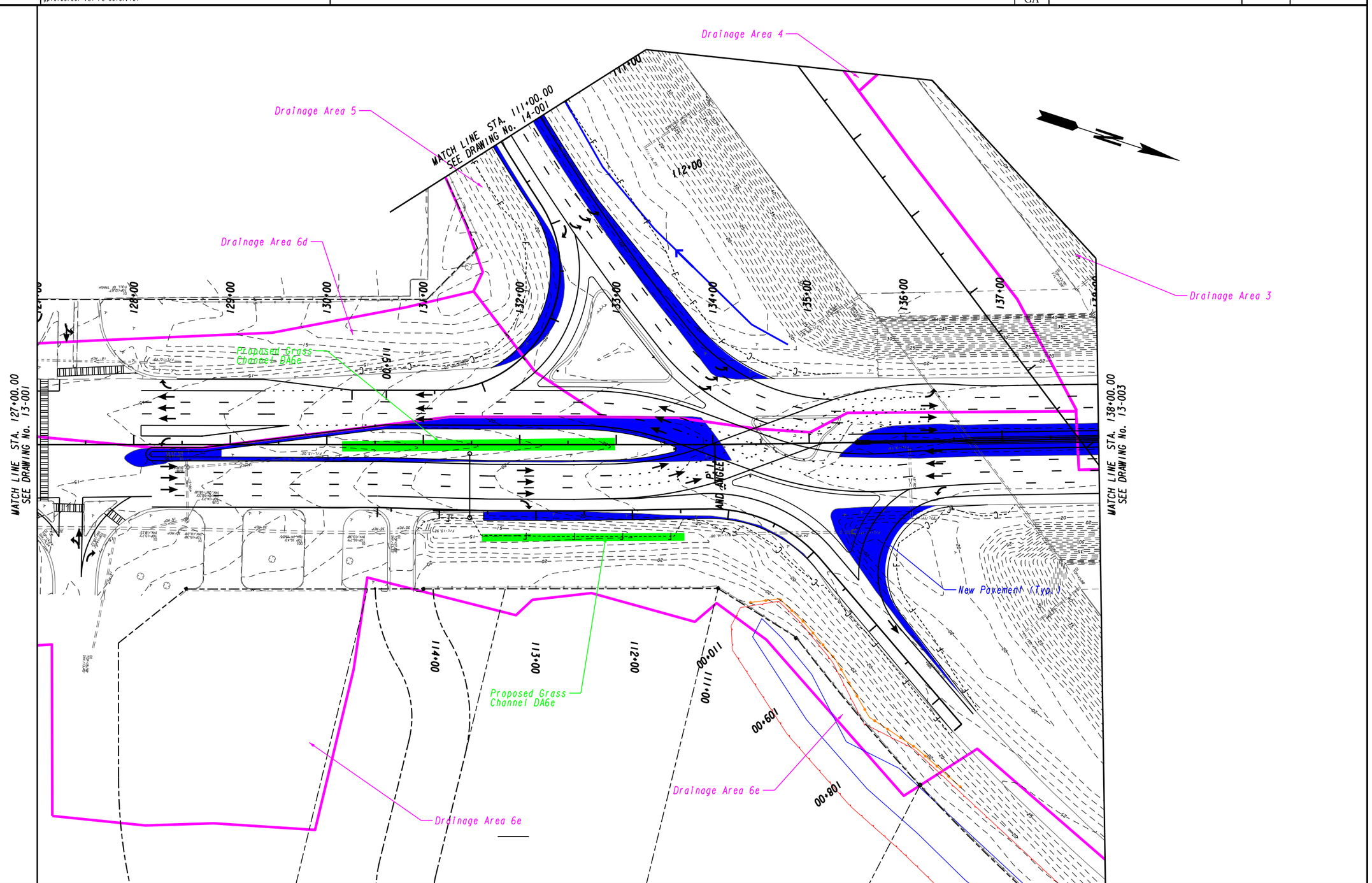

PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS

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REVISION DATES

STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION
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SR 21 AT I-95 DDI

DRAWING No. 13-002

12/14/2012 GPLN

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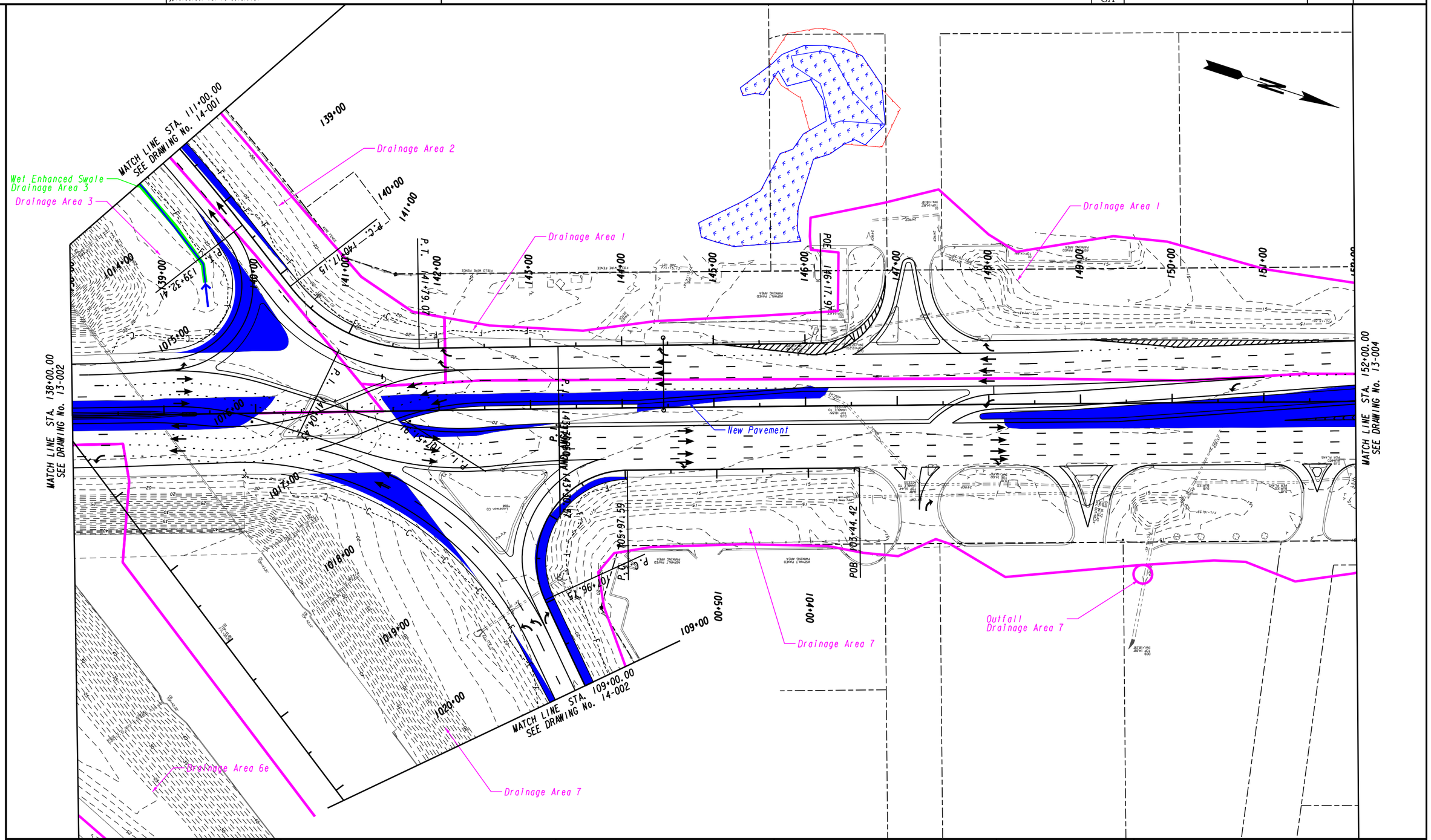

PROPERTY AND EXISTING R/W LINE	——P——
REQUIRED R/W LINE	
CONSTRUCTION LIMITS	——C—— F——
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES	
EASEMENT FOR CONSTR OF SLOPES	
EASEMENT FOR CONSTR OF DRIVES	

BEGIN LIMIT OF ACCESS	BLA
END LIMIT OF ACCESS	ELA
LIMIT OF ACCESS	
REQ'D R/W & LIMIT OF ACCESS	

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SCALE IN FEET
0 50 100 200

REVISION DATES

STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION

OFFICE:

MAINLINE PLAN

SR 21 AT I-95 DDI

DRAWING No.
13-003

12/14/2012 GPLN

CONSTRUCTION COST ESTIMATE

Project: SR 21 from SR 30 to I-95 including DDI
Project No.: 0012722
County: Chatham
Basin: Drainage Area 6

Prepared by: ARCADIS
Last Modified: December 5, 2014

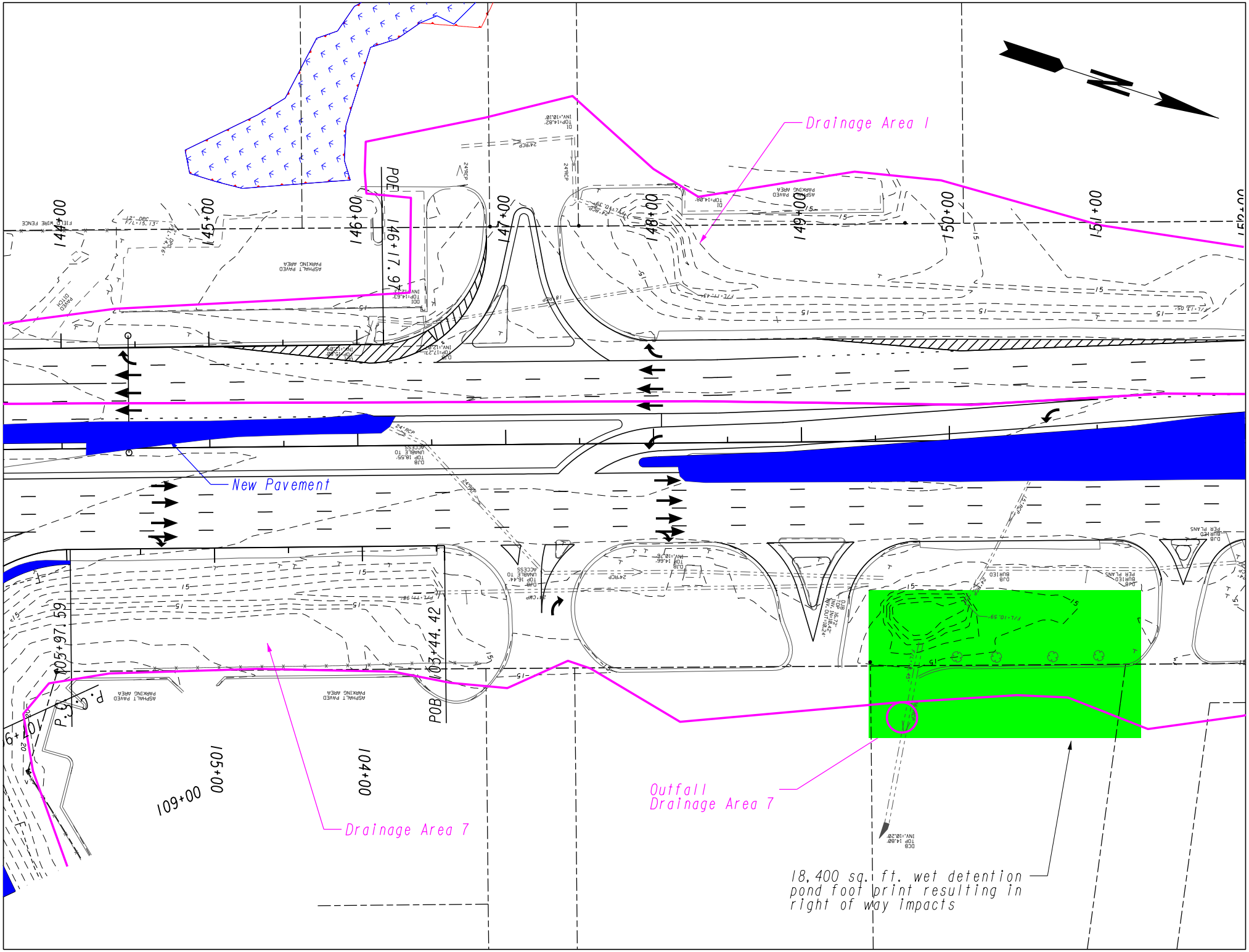
ITEM NO.	ITEM	UNIT	QUANTITY	UNIT PRICE	COST
	ROADWAY ITEMS				
150-1000	TRAFFIC CONTROL -	LS	LUMP	$20,000.00	$3,875.46
201-1500	CLEARING & GRUBBING -	LS	LUMP	$60,000.00	$11,626.38
210-0100	GRADING COMPLETE -	LS	LUMP	$200,000.00	$38,754.60
310-1101	GR AGGR BASE CRS, INCL MATL	TN	1628	$20.47	$33,325.16
310-5060	GR AGGR BASE CRS, 6 INCH, INCL MATL	SY	171	$11.68	$1,997.28
318-3000	AGGR SURF CRS	TN		$22.92	
402-1802	RECYCLED ASPH CONC PATCHING, INCL BITUM MATL & H LIME	TN	159	$91.32	$14,519.88
402-1812	RECYCLED ASPH CONC LEVELING, INCL BITUM MATL & H LIME	TN	853	$67.32	$57,423.96
402-3121	RECYCLED ASPH CONC 25 MM SUPERPAVE, GP 1 OR 2, INCL BITUM	TN	775	$62.68	$48,577.00
402-3600	RECYCLED ASPH CONC 12.5 MM, SMA, GP 2 ONLY, INCLPOLYMER-MODIFIED BITUM MATL &	TN	1880	$130.00	$244,400.00
402-3190	RECYCLED ASPH CONC 19 MM SUPERPAVE, GP 1 OR 2,INCL BITUM	TN	329	$60.47	$19,894.63
413-1000	BITUM TACK COAT	GL	1182	$1.93	$2,281.26
432-5010	MILL ASPH CONC PVMT, VARIABLE DEPTH	SY	14320	$1.61	$23,055.20
441-0748	CONCRETE MEDIAN, 6 IN	SY	1705	$58.33	$99,452.65
441-6022	CONC CURB & GUTTER, 6 IN X 30 IN, TP 2	LF	1628	$16.74	$27,252.72
500-3101	CLASS A CONCRETE	CY		$376.75	
500-9999	CLASS B CONC, BASE OR PVMT WIDENING	CY	16	$213.67	$3,418.72
621-4070	CONCRETE SIDE BARRIER, TYPE 7C	LF	147	$72.14	$10,604.58
634-1200	RIGHT OF WAY MARKERS	EA		$104.68	
641-1100	GUARDRAIL, TP T	LF		$42.77	
641-1200	GUARDRAIL, TP W	LF		$15.47	
641-5001	GUARDRAIL ANCHORAGE, TP 1	EA		$622.69	
641-5006	GUARDRAIL ANCHORAGE, TP 6	EA		$362.12	
641-5012	GUARDRAIL ANCHORAGE, TP 12	EA		$1,856.51	
648-1350	IMPACT ATTENUATOR UNIT, TYPE P -	EA		$18,145.71	
	DRAINAGE ITEMS				
441-0303	CONC SPILLWAY, TP 3	EA		$2,298.82	
550-1180	STORM DRAIN PIPE, 18 IN, H 1-10	LF	39	$40.16	$1,566.24
550-1240	STORM DRAIN PIPE, 24 IN, H 1-10	LF	10	$43.94	$439.40
550-1300	STORM DRAIN PIPE, 30 IN, H 1-10	LF		$62.78	
550-1360	STORM DRAIN PIPE, 36 IN, H 1-10	LF		$75.50	
550-4218	FLARED END SECTION 18 IN, STORM DRAIN	EA	2	$647.45	$1,294.90
550-4224	FLARED END SECTION 24 IN, STORM DRAIN	EA	1	$777.06	$777.06
550-4236	FLARED END SECTION 36 IN, STORM DRAIN	EA		$1,285.66	
573-2006	UNDDR PIPE INCL DRAINAGE AGGR, 6 IN	LF		$12.73	
603-2182	STN DUMPED RIP RAP, TP 3, 24 IN	SY	19	$50.05	$950.95
603-7000	PLASTIC FILTER FABRIC	SY	19	$5.24	$99.56
611-3000	RECONSTR CATCH BASIN, GROUP 1	EA		$2,974.95	
611-3010	RECONSTR DROP INLET, GROUP 1	EA		$1,125.64	
611-3030	RECONSTR STORM SEW MANHOLE, TYPE 1	EA		$2,937.54	
611-8000	ADJUST CATCH BASIN TO GRADE	EA	1	$2,069.48	$2,069.48
668-1100	CATCH BASIN, GP 1	EA	1	$2,612.83	$2,612.83
668-1110	CATCH BASIN, GP 1, ADDL DEPTH	LF	2	$292.04	$584.08
668-2100	DROP INLET, GP 1	EA	1	$2,506.71	$2,506.71
668-2110	DROP INLET, GP 1, ADDL DEPTH	LF	2	$340.69	$681.38
668-4300	STORM SEWER MANHOLE, TP 1	EA		$2,346.99	
668-4311	STORM SEWER MANHOLE, TP 1, ADDL DEPTH, CL 1	LF		$332.65	

668-5000	JUNCTION BOX	EA		$2,321.35	
231-1250	MISCELLANEOUS CONSTRUCTION, UNPAVED ROADS, STREETS AND DRIVEWAYS - ENHA	EA	1	$11,000.00	$11,000.00
	EROSION CONTROL ITEMS				
163-0232	TEMPORARY GRASSING	AC	0.39	$542.55	$210.26
163-0240	MULCH	TN	9.30	$205.32	$1,909.70
163-0300	CONSTRUCTION EXIT	EA	1	$1,853.38	$1,853.38
163-0503	CONSTRUCT AND REMOVE SILT CONTROL GATE, TP 3	EA	1	$535.03	$535.03
163-0527	CONSTRUCT AND REMOVE RIP RAP CHECK DAMS,	EA	2	$595.15	$1,190.30
163-0550	CONSTRUCT AND REMOVE INLET SEDIMENT TRAP	EA	4	$202.98	$811.92
165-0030	MAINTENANCE OF TEMPORARY SILT FENCE, TP C	LF	1024	$1.28	$1,310.72
165-0041	MAINTENANCE OF CHECK DAMS - ALL TYPES	LF	2	$132.23	$264.46
165-0087	MAINTENANCE OF SILT CONTROL GATE, TP 3	EA	1	$132.23	$132.23
165-0101	MAINTENANCE OF CONSTRUCTION EXIT	EA	1	$512.02	$512.02
165-0105	MAINTENANCE OF INLET SEDIMENT TRAP	EA	4	$86.90	$347.60
167-1000	WATER QUALITY MONITORING AND SAMPLING	EA	1	$1,035.68	$1,035.68
167-1500	WATER QUALITY INSPECTIONS	MO	5	$993.55	$4,967.75
171-0030	TEMPORARY SILT FENCE, TYPE C	LF	2049	$3.82	$7,827.18
643-8200	BARRIER FENCE (ORANGE), 4 FT	LF	228	$2.92	$665.76
700-6910	PERMANENT GRASSING	AC	1	$960.36	$960.36
700-7000	AGRICULTURAL LIME	TN	2	$51.73	$103.46
700-8000	FERTILIZER MIXED GRADE	TN	1	$292.10	$292.10
700-8100	FERTILIZER NITROGEN CONTENT	LB	39	$2.36	$92.04
716-2000	EROSION CONTROL MATS, SLOPES	SY	1163	$0.99	$1,151.37
	SIGNING, MARKING, AND SIGNAL ITEMS				
636-1020	HIGHWAY SIGNS, TP 1 MATL, REFL SHEETING, TP 3	SF	19	$19.00	$361.00
636-1033	HIGHWAY SIGNS, TP 1 MATL, REFL SHEETING, TP 9	SF	19	$17.73	$336.87
636-1041	HIGHWAY SIGNS, TP 2 MATL, REFL SHEETING, TP 9	SF	12	$33.95	$407.40
636-2070	GALV STEEL POSTS, TP 7	LF	58	$9.70	$562.60
639-3004	STEEL STRAIN POLE, TP IV	EA	4	$5,000.00	$20,000.00
647-1000	TRAFFIC SIGNAL INSTALLATION NO -	LS		$95,000.00	
647-1000	TRAFFIC SIGNAL INSTALLATION NO -	LS	1	$95,000.00	$95,000.00
653-0110	THERMOPLASTIC PVMT MARKING, ARROW, TP 1	EA	2	$74.21	$148.42
653-0120	THERMOPLASTIC PVMT MARKING, ARROW, TP 2	EA	4	$90.00	$360.00
653-1501	THERMOPLASTIC SOLID TRAF STRIPE, 5 IN, WHITE	LF	2335	$0.42	$980.70
653-1502	THERMOPLASTIC SOLID TRAF STRIPE, 5 IN, YELLOW	LF	2035	$0.44	$895.40
653-1704	THERMOPLASTIC SOLID TRAF STRIPE, 24 IN, WHITE	LF	7	$5.57	$38.99
653-1804	THERMOPLASTIC SOLID TRAF STRIPE, 8 IN, WHITE	LF	28	$2.03	$56.84
653-3501	THERMOPLASTIC SKIP TRAF STRIPE, 5 IN, WHITE	GLF	4092	$0.28	$1,145.76
653-6004	THERMOPLASTIC TRAF STRIPING, WHITE	SY	97	$3.50	$339.50
653-6006	THERMOPLASTIC TRAF STRIPING, YELLOW	SY	29	$3.22	$93.38
654-1001	RAISED PVMT MARKERS TP 1	EA	51	$3.14	$160.14
682-6233	CONDUIT, NONMETL, TP 3, 2 IN	LF	1064	$8.83	$9,395.12
935-1114	OUTSIDE PLANT FIBER OPTIC CABLE, LOOSE TUBE, SINGLE	LF	2640	$2.30	$6,072.00
935-1511	OUTSIDE PLANT FIBER OPTIC CABLE, DROP, SINGLE MODE,	LF	210	$2.30	$483.00
935-3104	FIBER OPTIC CLOSURE, UNDERGROUND, 36 FIBER	EA	1	$700.00	$700.00
935-3501	FIBER OPTIC CLOSURE, FDC (WALL MOUNTED),	EA	1	$375.00	$375.00
935-4010	FIBER OPTIC SPLICE, FUSION	EA	40	$29.59	$1,183.60
935-5050	FIBER OPTIC PATCH CORD, SM	EA	1	$107.54	$107.54
936-1001	CCTV SYSTEM, TYPE B	EA	1	$2,000.00	$2,000.00
939-2305	FIELD SWITCH, TYPE C	EA	1	$1,856.60	$1,856.60
939-4040	TYPE D CABINET	EA	1	$1,500.00	$1,500.00

Subtotal Construction Cost		**835,775.25**
Reimbursable Utilities 5%	$	41,788.76
Total Construction Cost	**$**	**877,564.02**

Grand Total Project Cost	**$**	**877,564.02**

Appendix I – Drainage Area 7 Infeasibility Figure


Drainage Area 1
New Pavement
Drainage Area 7
Outfall
Drainage Area 7
18,400 sq. ft. wet detention pond foot print resulting in right of way impacts
POE 146+17.97
POB 103+44.42
105+97.59
144+00
145+00
146+00
147+00
148+00
149+00
150+00
151+00
104+00
105+00

Appendix J – Costing Plans

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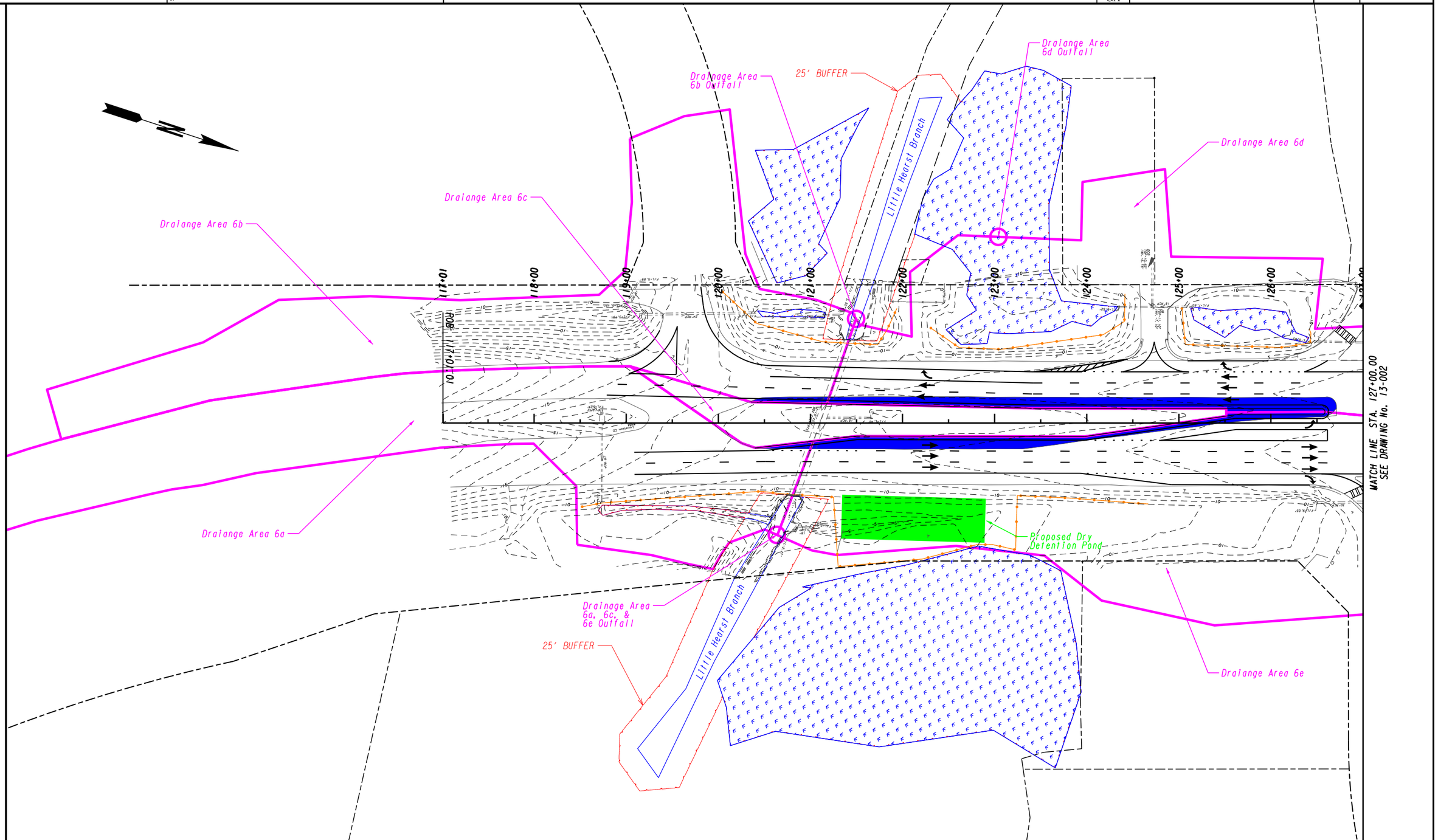

PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

BEGIN LIMIT OF ACCESS.....BLA
END LIMIT OF ACCESS.....ELA
LIMIT OF ACCESS
REQ'D R/W & LIMIT OF ACCESS

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SCALE IN FEET
0 50 100 200

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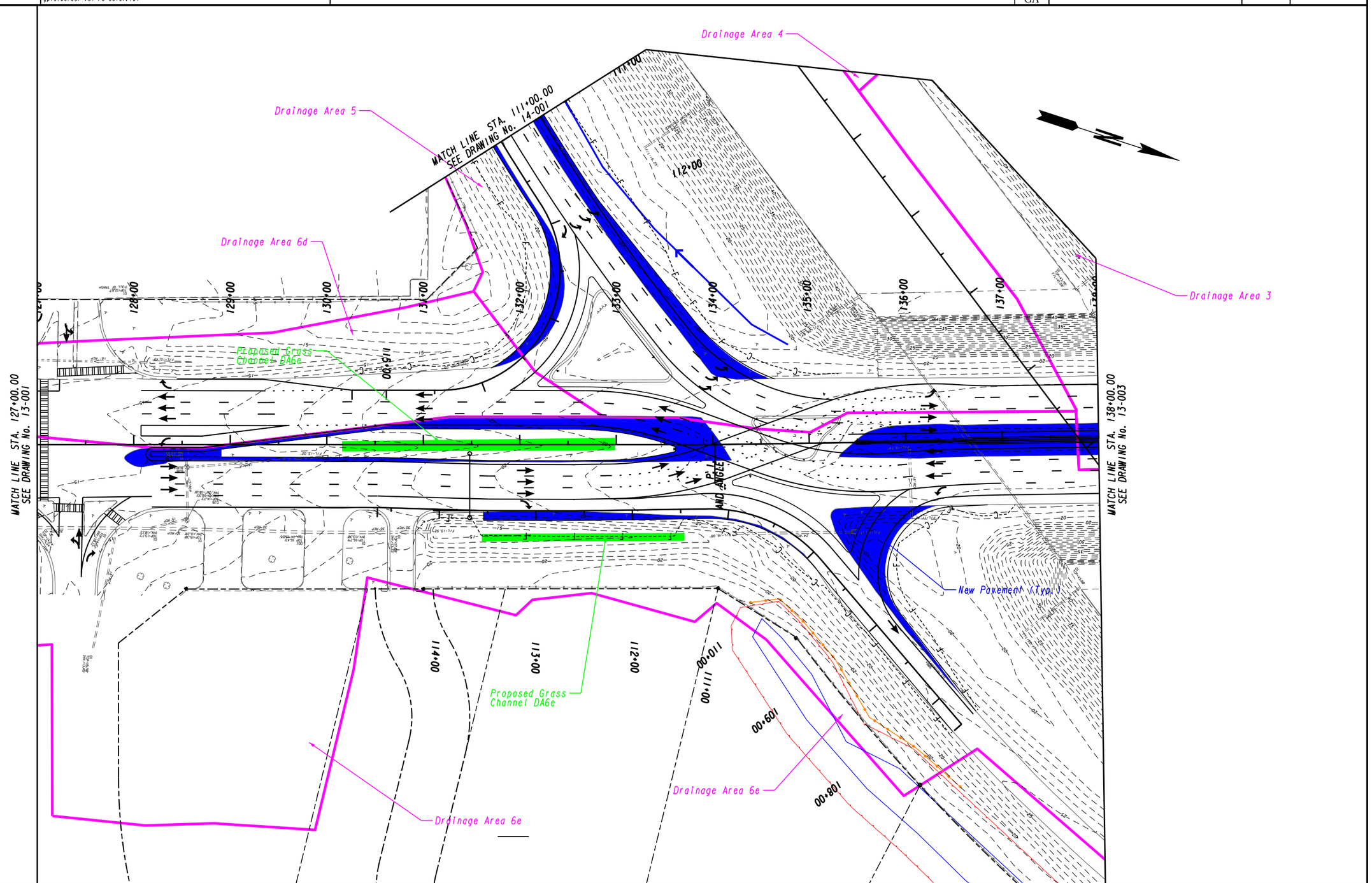

PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

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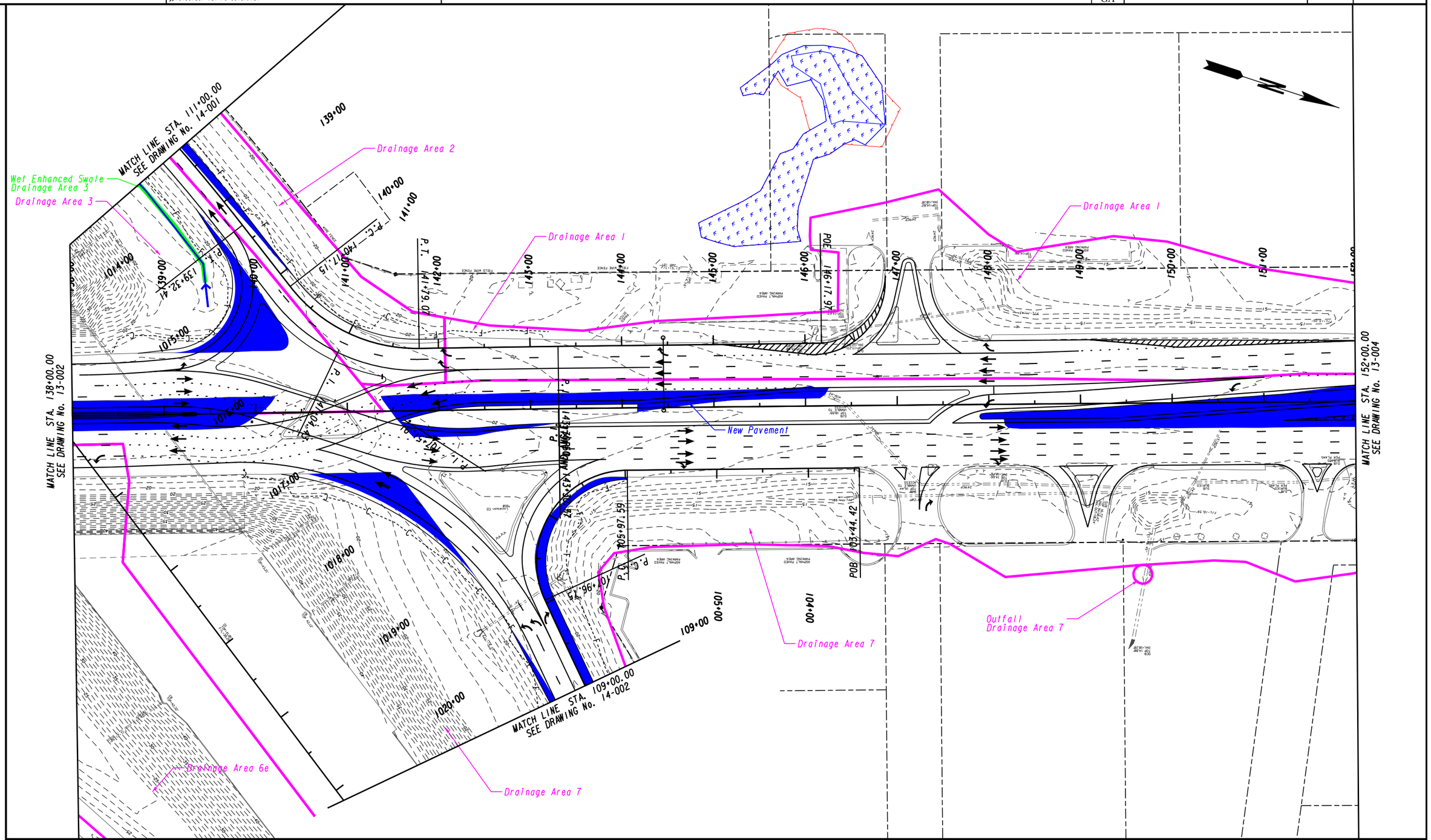

PROPERTY AND EXISTING R/W LINE	——P——
REQUIRED R/W LINE	
CONSTRUCTION LIMITS	——C—— F——
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES	
EASEMENT FOR CONSTR OF SLOPES	
EASEMENT FOR CONSTR OF DRIVES	

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REQ'D R/W & LIMIT OF ACCESS	

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MATCH LINE STA. 152+00.00
SEE DRAWING No. 13-003

MATCH LINE STA. 165+00.00
SEE DRAWING No. 13-005

Drainage Area 1

Drainage Area 1

Outfall Drainage Area 1

25' BUFFER

152+25.27

P.I. 161+94.56

New Pavement

Drainage Area 7

Drainage Area 7

Drainage Area 7

PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
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EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

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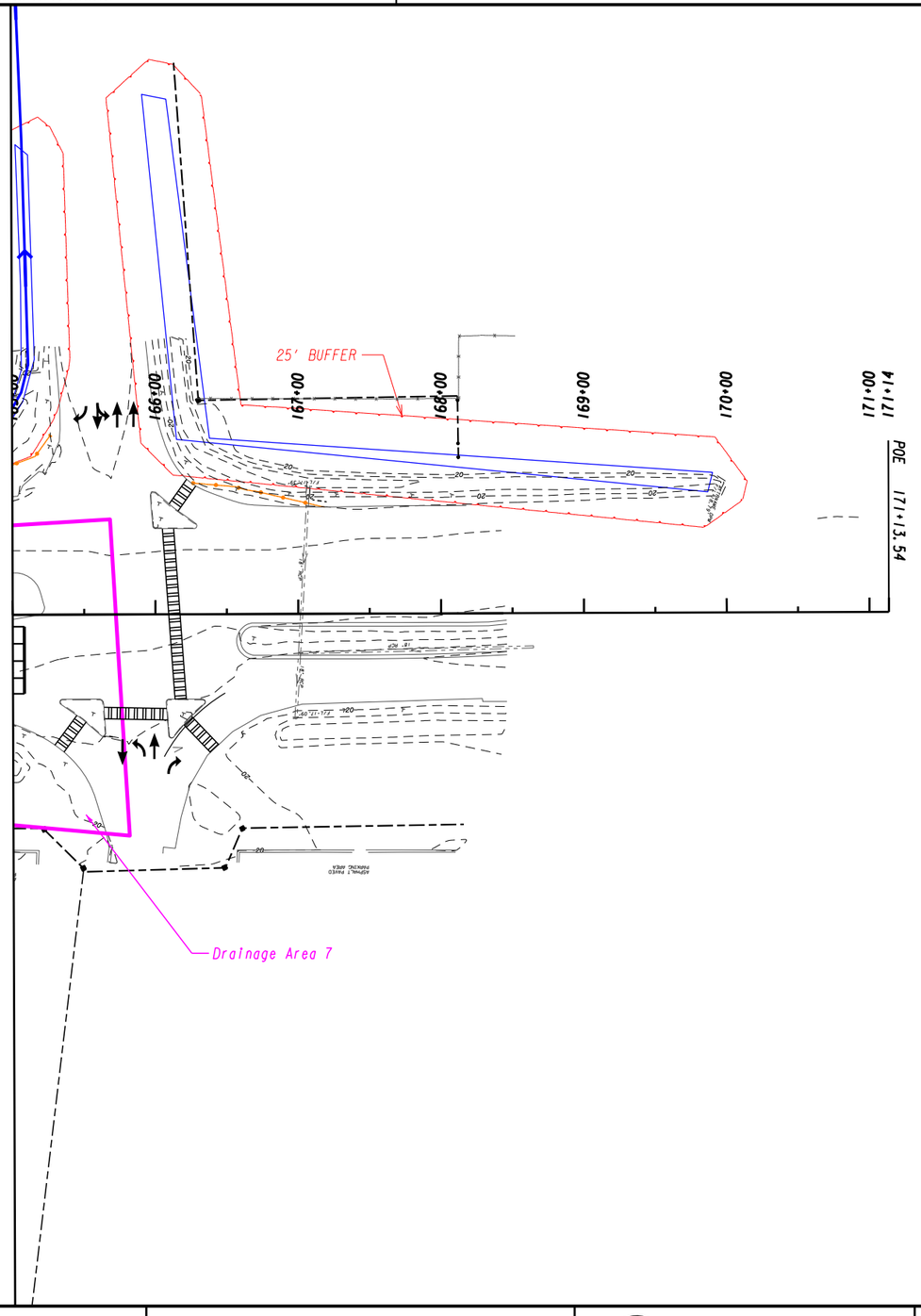

PROPERTY AND EXISTING R/W LINE
REQUIRED R/W LINE
CONSTRUCTION LIMITS
EASEMENT FOR CONSTR & MAINTENANCE OF SLOPES
EASEMENT FOR CONSTR OF SLOPES
EASEMENT FOR CONSTR OF DRIVES

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REQ'D R/W & LIMIT OF ACCESS

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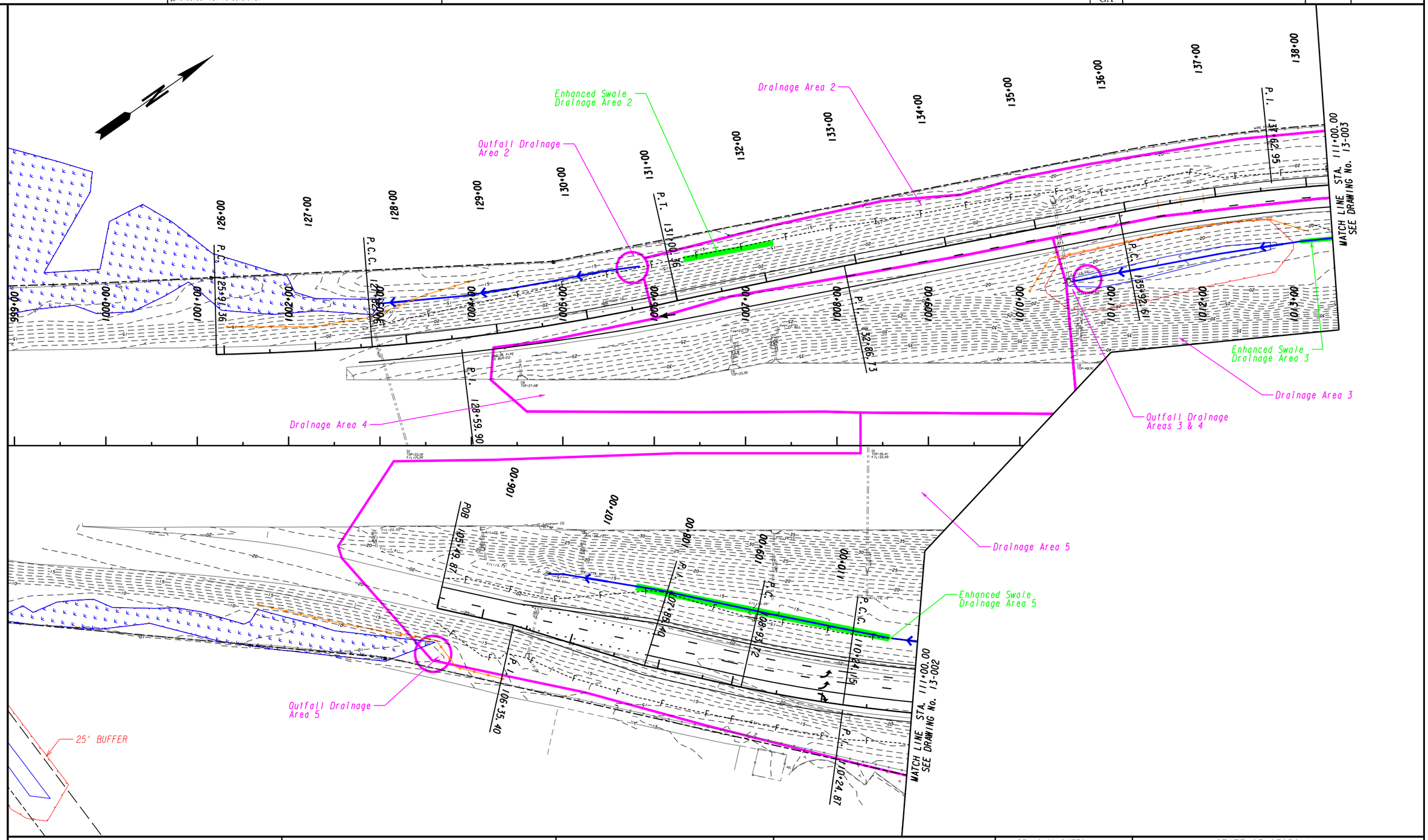

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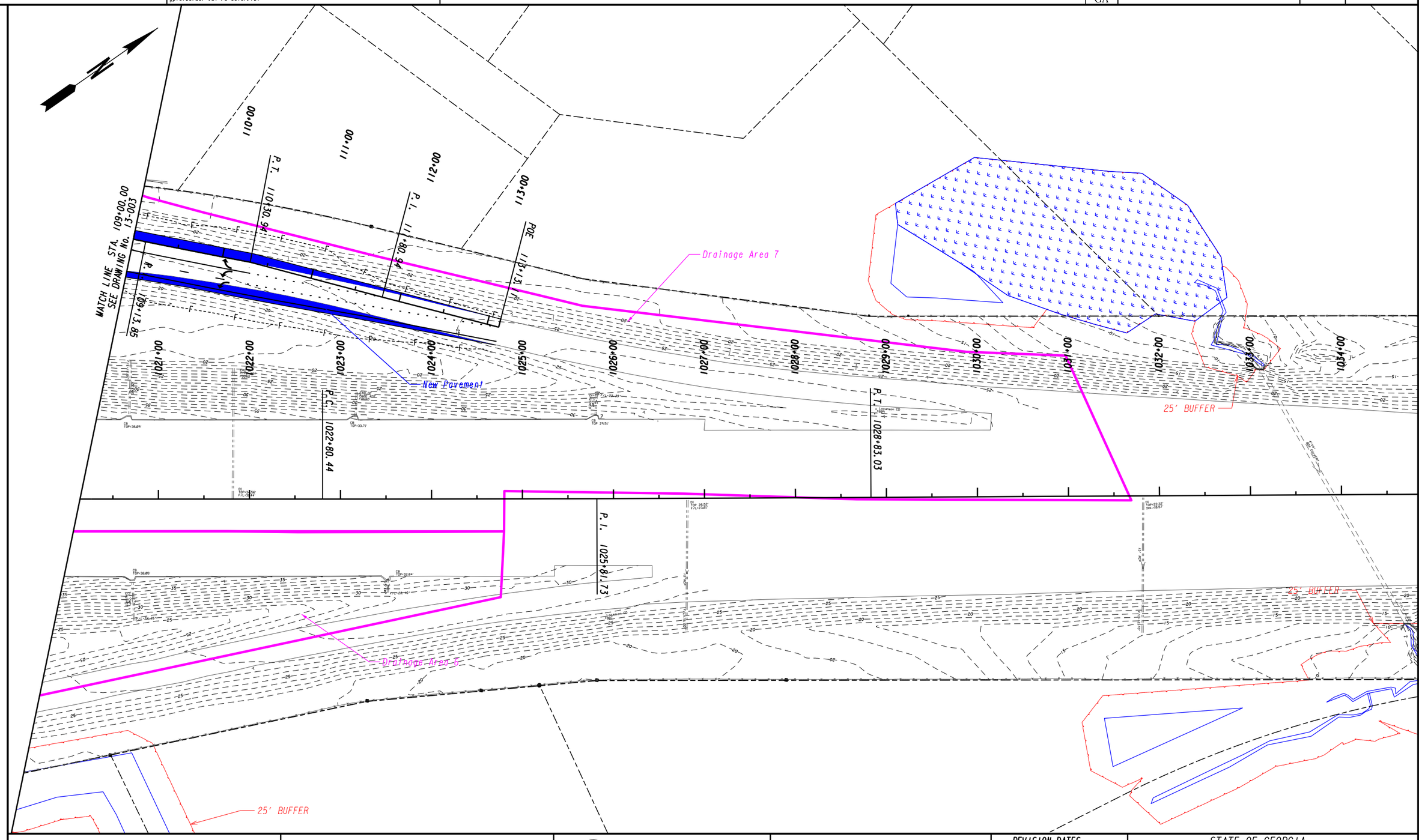

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EASEMENT FOR CONSTR OF SLOPES
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