

STORMWATER REPORT

**160 Bare Hill Road
Boxford/Topsfield, Massachusetts**

September 19, 2023

Applicant:
Lee Katz & Cameron Mayer
160 Bare Hill Road
Boxford, MA 01921

Prepared By
Williams & Sparages, LLC
189 North Main Street, Suite 101
Middleton, MA 01949
Ph: 978-539-8088
Fax: 978-539-8200
www.wsengineers.com

W&S Project Data

BOXF-0110A
SPbarehill#160.dwg
EXISTING.hcp
PROPOSED.hcp
p:\BOXF-0110A(160 Bare Hill Road)\drainage\stormwater_report.docx



Project Narrative

The subject property is located at 160 Bare Hill Road in Boxford & Topsfield located within the Boxford Residence-Agricultural Zoning District and the Topsfield IRA Zoning District. It is currently occupied by a three (3) bedroom house, barn, paved driveway and lawn areas. A majority of the parcel to the north of the existing dwelling is undeveloped and covered with trees both deciduous and coniferous.

The proposal is to construct a Barn, Paddock, Ring and Arena for horseback riding which will be accessed by a twelve-foot (12') wide gravel driveway with two small cul-de-sacs for vehicular access. The proposal also calls for gravel maintenance driveways running alongside the barn, paddock, ring and arena for maintenance and upkeep. A proposed area for manure stockpile is shown at the end of the gravel maintenance road. The applicant proposes to clear an area to the north of said proposed structures in order to provide areas for riding and pasture of the animals which are shown on the accompanying plans. The total amount of clearing amounts to approximately 6.1 acres out of the 12.5-acre parcel.

Peak Rate Runoff Tables

There are two (2) points of comparison that were selected for this. Comparison location 1L represents all surficial flows from within the limit of the watershed analysis flowing towards the wetlands to the southeast and Comparison location 2L represents the surficial flows to the wetlands to the north. Link 3L show below is the summary of both comparison locations to ensure that the total flow from within the limit of the watershed analysis in any direction is reduced in the post-construction condition. It is also important to note that there are three (3) isolated areas located in the area of proposed meadow that are topographic low points and act as stormwater management areas.

Examining the following Peak Rate/Volume of Runoff and Basin Performance table, the proposed stormwater management system is effective for mitigating the peak flow rates from the limit of watershed analysis for the 2-year, 10-year, 25-year, 50-year and 100-year storm events using the NOAA-14 Atlas Point Precipitation Frequency Estimates in order to be conservative. See attached tables.

Runoff Comparison Tables

Table 1.0: Total Peak Rate of Runoff Comparison Location 3L					
Description	2 Year	10 Year	25 Year	50 Year	100 Year
Existing Peak Rate of Runoff (cfs)	0.0	0.13	0.67	1.54	3.14
Proposed Peak Rate of Runoff (cfs)	0.0	0.01	0.07	0.19	1.59
Difference	0	-0.12	-0.60	-1.35	-1.55

Table 1.1: Total Peak Volume of Runoff Comparison Location 3L					
Description	2 Year	10 Year	25 Year	50 Year	100 Year
Existing Peak Volume of Runoff (cf)	9	3,693	11,068	18,891	25,597
Proposed Peak Volume of Runoff (cf)	0	344	1,979	4,046	10,132
Difference	-9	-3,349	9,089	-14,845	-15,465

Table 2.0: Peak Rate of Runoff to Wetlands to Southeast Comparison Location 1L					
Description	2 Year	10 Year	25 Year	50 Year	100 Year
Existing Peak Rate of Runoff (cfs)	0.0	0.13	0.67	1.47	2.74
Proposed Peak Rate of Runoff (cfs)	0.0	0.01	0.06	0.15	1.34
Difference	0	-0.12	-0.61	-1.32	-1.40

Table 2.1: Peak Volume Runoff to Wetlands to Southeast Comparison Location 1L					
Description	2 Year	10 Year	25 Year	50 Year	100 Year
Existing Peak Volume of Runoff (cf)	9	3,595	9,870	16,180	24,598
Proposed Peak Volume of Runoff (cf)	0	246	781	14,845	5,133
Difference	-9	-3,349	9,089	-14,845	-1,465

Table 3.0: Peak Rate of Runoff to Wetlands to North | Comparison Location 2L

Description	2 Year	10 Year	25 Year	50 Year	100 Year
Existing Peak Rate of Runoff (cfs)	0.0	0.01	0.04	0.10	0.39
Proposed Peak Rate of Runoff (cfs)	0.0	0.01	0.04	0.10	0.39
Difference	0	0	0	0	0

Table 3.1: Peak Volume Runoff to Wetlands to North | Comparison Location 2L

Description	2 Year	10 Year	25 Year	50 Year	100 Year
Existing Peak Volume of Runoff (cf)	0	98	1,199	2,712	4,999
Proposed Peak Volume of Runoff (cf)	0	98	1,199	2,712	4,999
Difference	0	0	0	0	0

Table 4.0: Stormwater Management Area 1P | Infiltration Basin Performance Table

24 Hour Type III Storm event	Peak Rate of Inflow (cfs)	Peak Rates of Outflow (cfs)				Peak Water Level (ft)
		Total (cfs)	Exfiltration (cfs)		6'L Spillway (cfs)	
2 year	0.01	0.01	0.01		0.0	87.00
10 year	0.20	0.11	0.11		0.0	87.24
25 year	0.50	0.16	0.16		0.0	88.07
50 year	0.80	0.21	0.21		0.0	88.71
100 year	1.19	0.26	0.26		0.0	89.39

Table 4.1: Stormwater Management Area 2P | Infiltration Basin Performance Table

24 Hour Type III Storm event	Peak Rate of Inflow (cfs)	Peak Rates of Outflow (cfs)				Peak Water Level (ft)
		Total (cfs)	Exfiltration (cfs)		6'L Spillway (cfs)	
2 year	0.02	0.02	0.02		0.0	84.00
10 year	0.53	0.38	0.38		0.0	84.07
25 year	1.58	0.50	0.50		0.0	84.96
50 year	2.68	0.62	0.62		0.0	85.79
100 year	4.18	1.93	0.72		1.22	86.19

Drawdown Within 72 Hours:

$$T_{\text{drawdown}} = [R_v \text{ total} / (K)(\text{Bottom Area})]$$

Stormwater Management Area 1P

$R_{v\ 1P} = 2,159 \text{ ft}^3$ (use peak volume for 100 yr storm in order to be conservative)

$K = 8.27 \text{ in/hr}$ (Rawls Rate)

Bottom Area = 510 ft^2

$$T_{\text{drawdown}} = 2,159 / [(8.27)(510)/12] = 6.1 \text{ hours} < 72 \text{ hours}$$

Stormwater Management Area 2P

$R_{v\ 2P} = 6,025 \text{ ft}^3$ (use peak volume for 100 yr storm in order to be conservative)

$K = 8.27 \text{ in/hr}$ (Rawls Rate)

Bottom Area = 1950 ft^2

$$T_{\text{drawdown}} = 6025 / [(8.27)(1950)/12] = 4.5 \text{ hours} < 72 \text{ hours}$$

Recharge Volume:

$$R_v \text{ required} = (\text{Impervious Area}) (F)$$

Site consists of Hydrologic Soils Group A: $F_c = 0.60 \text{ in.}$

Site Impervious Area Draining to Recharge Facilities:

Stormwater Management Area 1P

$A_{\text{imp A soils}} = 2,160 \text{ ft}^2$ (Proposed Barn)

$$R_v \text{ required} = [(2160) (0.60)/12] = 108 \text{ ft}^3$$

$R_v \text{ provided} = 3,060 \text{ ft}^3$ Provided below the spillway; Therefore Okay

Stormwater Management Area 2P

There is no proposed impervious area tributary to Pond 2P; Therefore N.A.

Water Quality Volume:

$$V_{\text{wq required}} = (A_{\text{imp}})(D_{\text{wq}})$$

$$D_{\text{WQ}} = 0.5 \text{ in}$$

Stormwater Management Area 1P

$$V_{\text{wq required}} = [(0) (0.5)/12] = 0 \text{ ft}^3$$

Exempt from this requirement, roof runoff only considered clean by DEP for certain types

Stormwater Management Area 2P- Stormwater Management Area for driveway & front yard

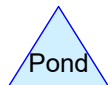
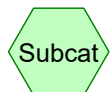
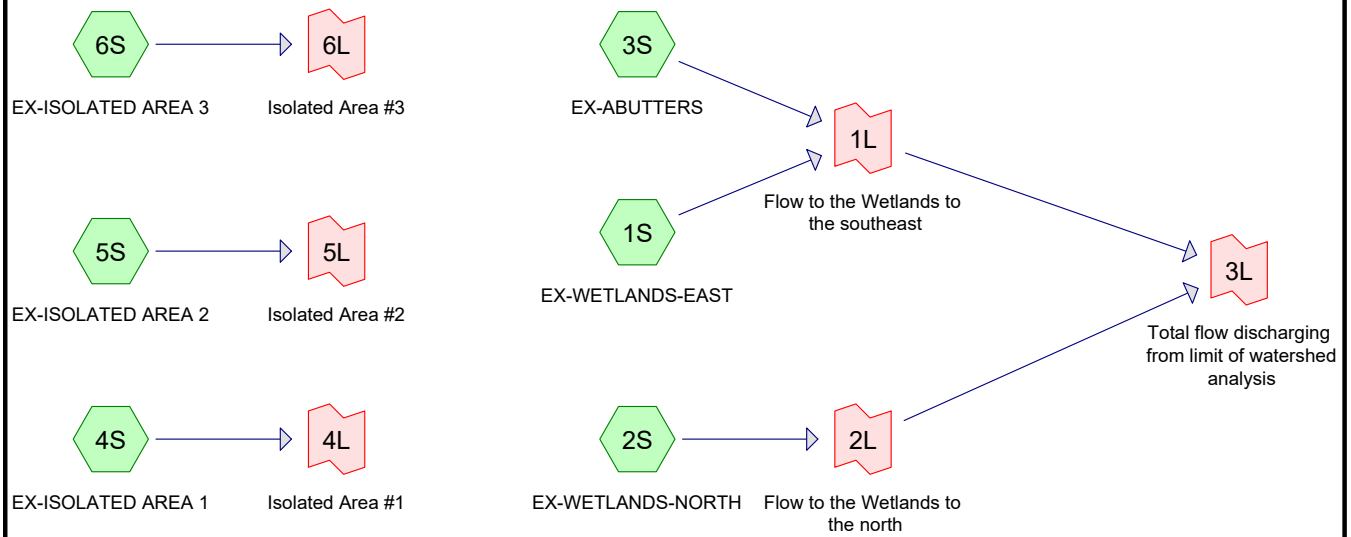
There is no proposed impervious area tributary to Pond 2P; Therefore N.A.

HydroCAD Data



Existing Condition





EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 2

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-yr	Type III 24-hr		Default	24.00	1	3.24	2
2	10-yr	Type III 24-hr		Default	24.00	1	5.12	2
3	25-yr	Type III 24-hr		Default	24.00	1	6.29	2
4	50-yr	Type III 24-hr		Default	24.00	1	7.15	2
5	100-yr	Type III 24-hr		Default	24.00	1	8.10	2

EXISTING

Type III 24-hr 2-yr Rainfall=3.24"

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 3

Summary for Subcatchment 1S: EX-WETLANDS-EAST

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"
 Routed to Link 1L : Flow to the Wetlands to the southeast

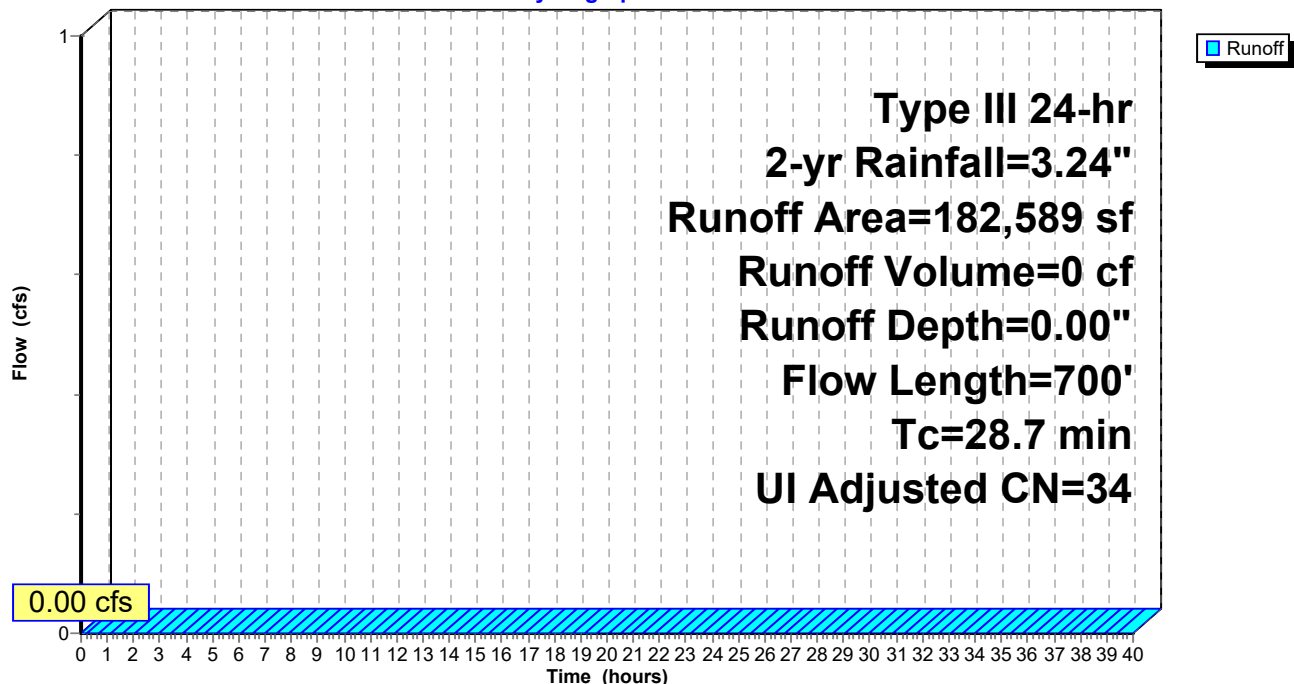
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-yr Rainfall=3.24"

Area (sf)	CN	Adj	Description
3,200	98		Unconnected roofs, HSG A
5,000	98		Paved parking, HSG A
40,000	39		>75% Grass cover, Good, HSG A
134,389	30		Woods, Good, HSG A
182,589	35	34	Weighted Average, UI Adjusted
174,389			95.51% Pervious Area
8,200			4.49% Impervious Area
3,200			39.02% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.2	50	0.0100	0.05		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
12.5	650	0.0300	0.87		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
28.7	700	Total			

Subcatchment 1S: EX-WETLANDS-EAST

Hydrograph



EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 4

Summary for Subcatchment 2S: EX-WETLANDS-NORTH

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"
 Routed to Link 2L : Flow to the Wetlands to the north

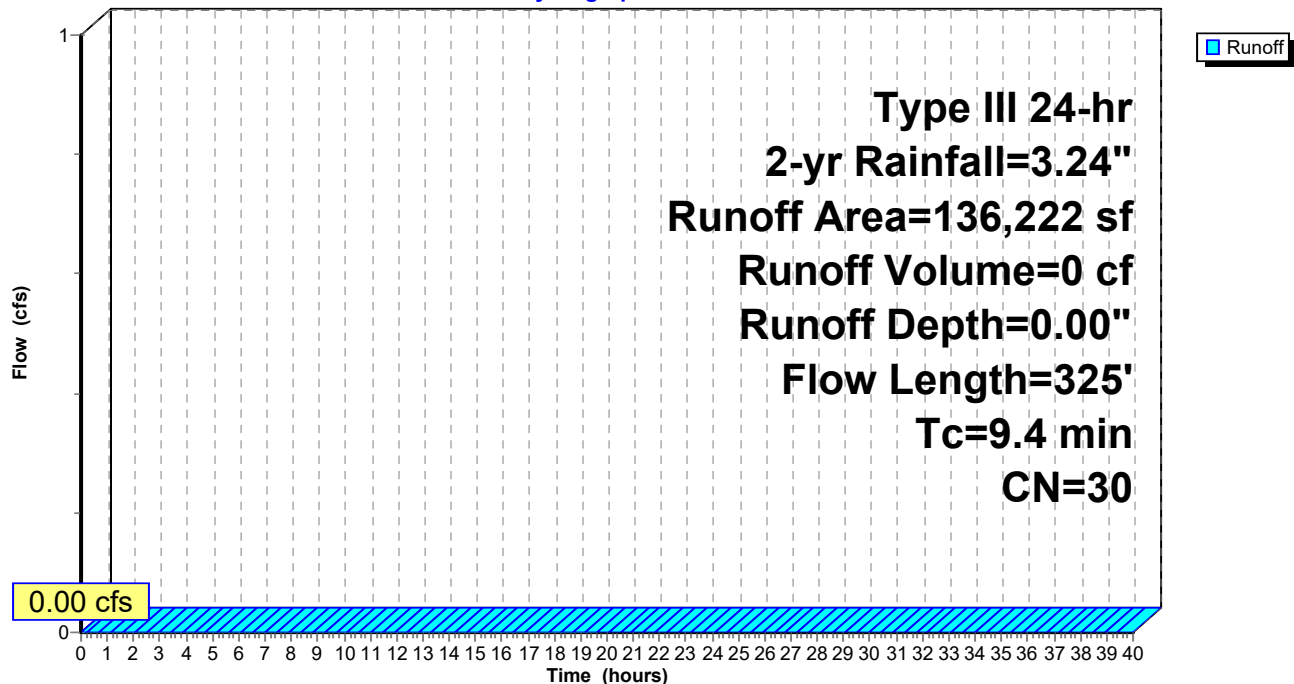
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-yr Rainfall=3.24"

Area (sf)	CN	Description
136,222	30	Woods, Good, HSG A
136,222		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0800	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
2.4	275	0.1500	1.94		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
9.4	325	Total			

Subcatchment 2S: EX-WETLANDS-NORTH

Hydrograph



EXISTING*Type III 24-hr 2-yr Rainfall=3.24"*

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 5

Summary for Subcatchment 3S: EX-ABUTTERS

Runoff = 0.00 cfs @ 24.02 hrs, Volume= 9 cf, Depth= 0.00"
 Routed to Link 1L : Flow to the Wetlands to the southeast

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-yr Rainfall=3.24"

Area (sf)	CN	Adj	Description
5,000	98		Unconnected roofs, HSG A
5,000	98		Paved parking, HSG A
5,000	61		>75% Grass cover, Good, HSG B
55,000	39		>75% Grass cover, Good, HSG A
61,524	30		Woods, Good, HSG A
131,524	40	39	Weighted Average, UI Adjusted
121,524			92.40% Pervious Area
10,000			7.60% Impervious Area
5,000			50.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0800	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
8.7	450	0.0300	0.87		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
15.7	500	Total			

EXISTING

Prepared by Williams & Sparages

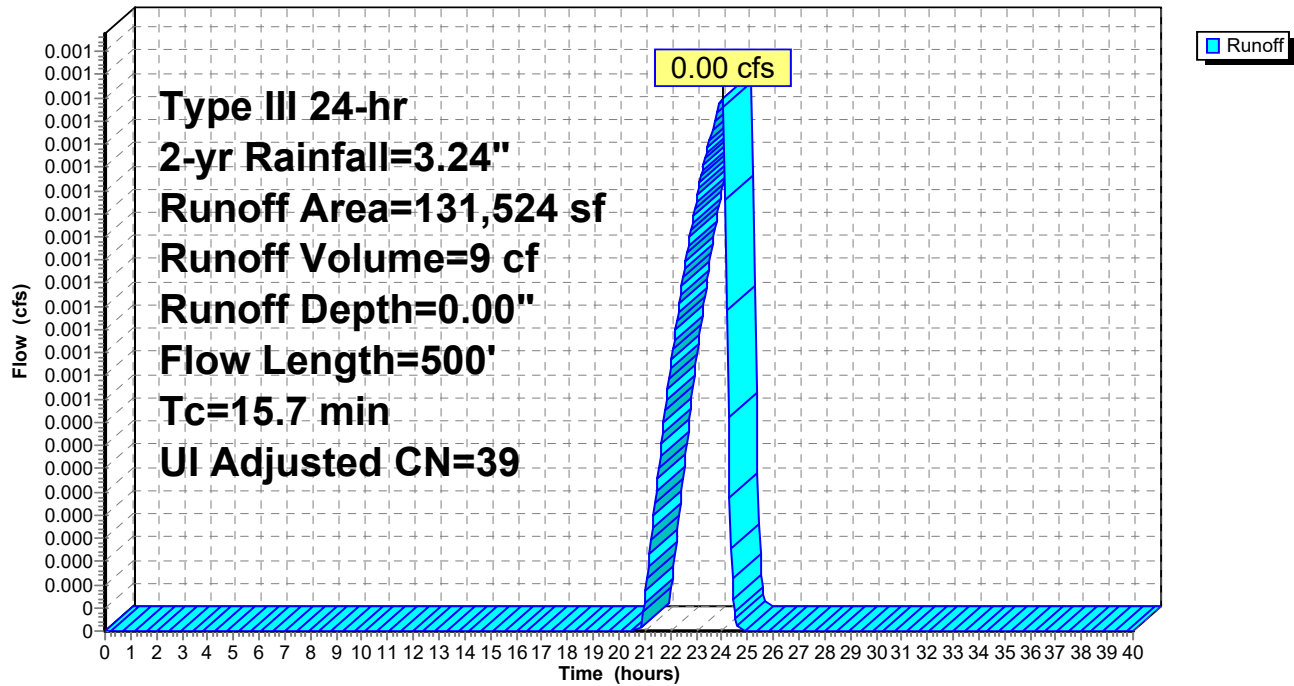
Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 6

Subcatchment 3S: EX-ABUTTERS

Hydrograph



EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 7

Summary for Subcatchment 4S: EX-ISOLATED AREA 1

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"
 Routed to Link 4L : Isolated Area #1

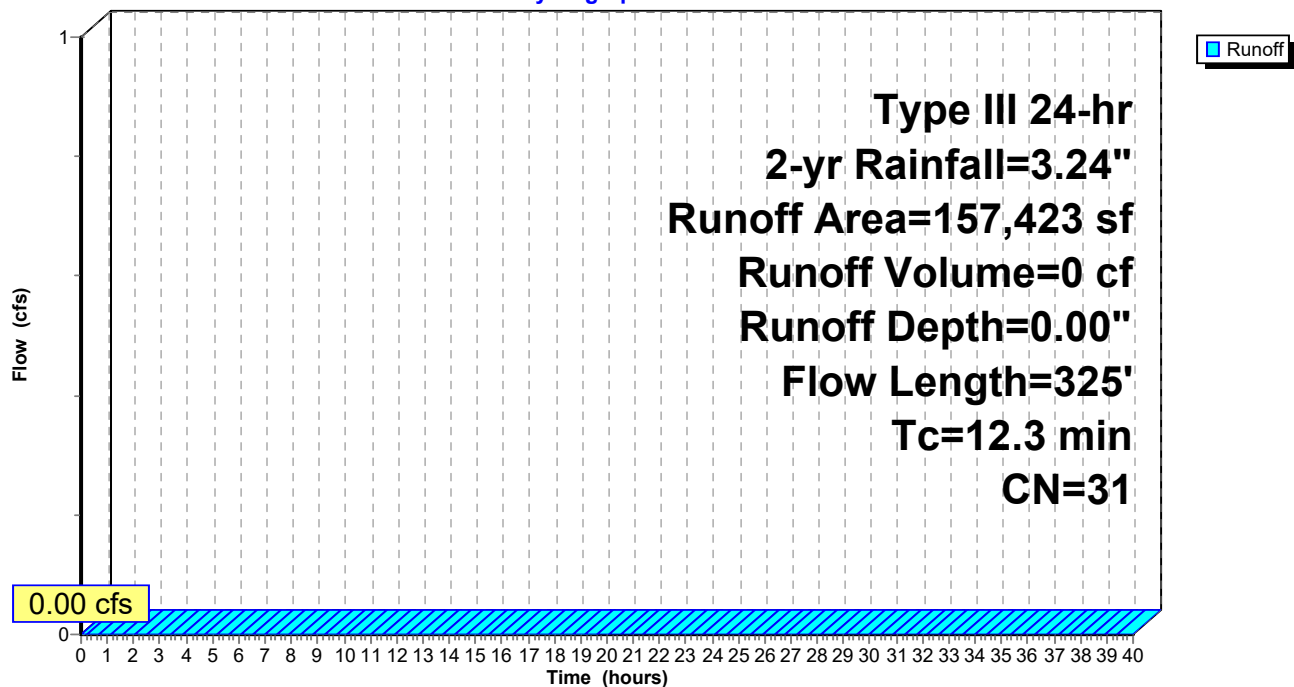
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-yr Rainfall=3.24"

Area (sf)	CN	Description
153,803	30	Woods, Good, HSG A
3,620	55	Woods, Good, HSG B
157,423	31	Weighted Average
157,423		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0800	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
5.3	275	0.0300	0.87		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
12.3	325	Total			

Subcatchment 4S: EX-ISOLATED AREA 1

Hydrograph



EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 8

Summary for Subcatchment 5S: EX-ISOLATED AREA 2

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"
 Routed to Link 5L : Isolated Area #2

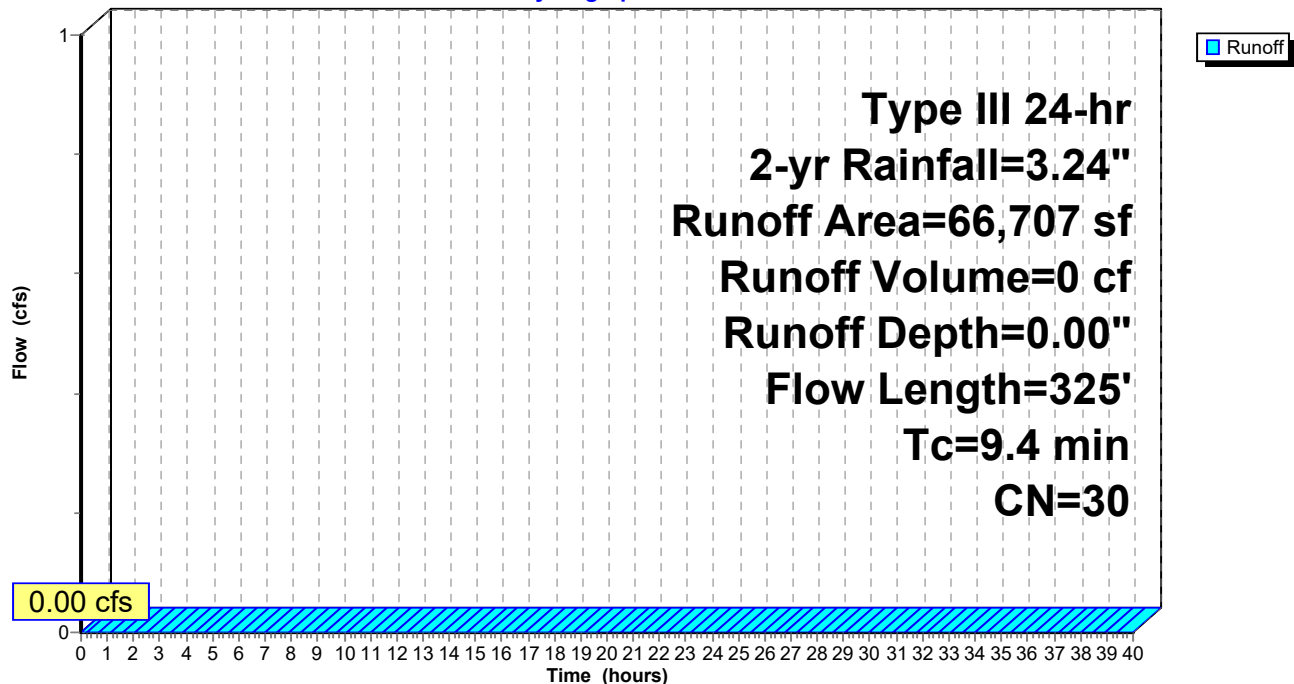
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-yr Rainfall=3.24"

Area (sf)	CN	Description
66,707	30	Woods, Good, HSG A
66,707		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0800	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
2.4	275	0.1500	1.94		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
9.4	325	Total			

Subcatchment 5S: EX-ISOLATED AREA 2

Hydrograph



EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 9

Summary for Subcatchment 6S: EX-ISOLATED AREA 3

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"
 Routed to Link 6L : Isolated Area #3

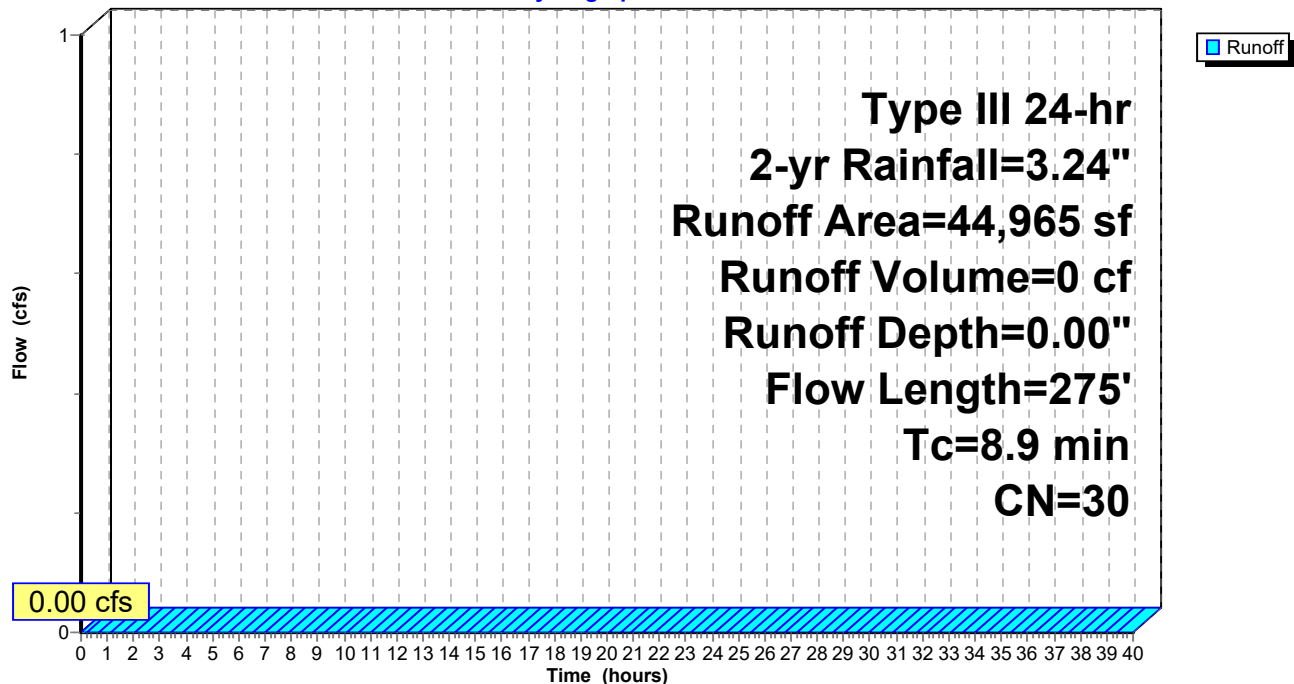
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-yr Rainfall=3.24"

Area (sf)	CN	Description
44,965	30	Woods, Good, HSG A
44,965		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0800	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
1.9	225	0.1500	1.94		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
8.9	275	Total			

Subcatchment 6S: EX-ISOLATED AREA 3

Hydrograph



EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

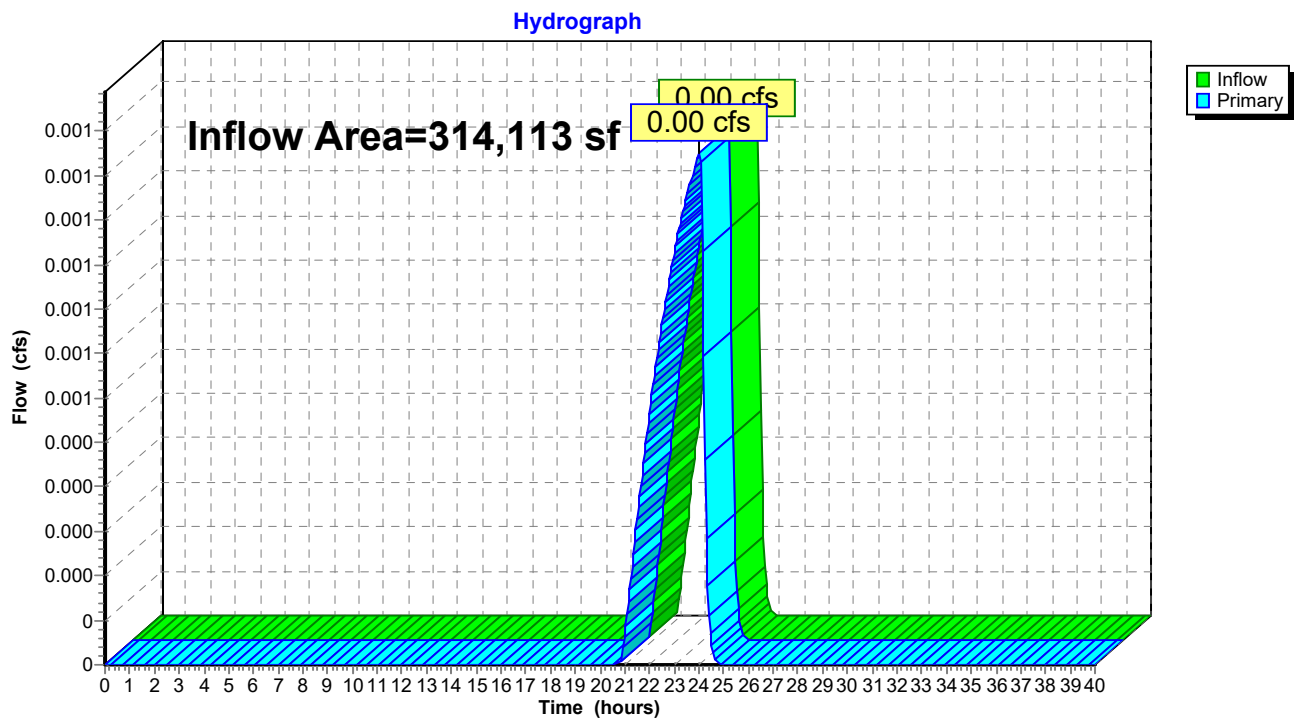
HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 10

Summary for Link 1L: Flow to the Wetlands to the southeast

Inflow Area = 314,113 sf, 5.79% Impervious, Inflow Depth = 0.00" for 2-yr event
Inflow = 0.00 cfs @ 24.02 hrs, Volume= 9 cf
Primary = 0.00 cfs @ 24.02 hrs, Volume= 9 cf, Atten= 0%, Lag= 0.0 min
Routed to Link 3L : Total flow discharging from limit of watershed analysis

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 1L: Flow to the Wetlands to the southeast

EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

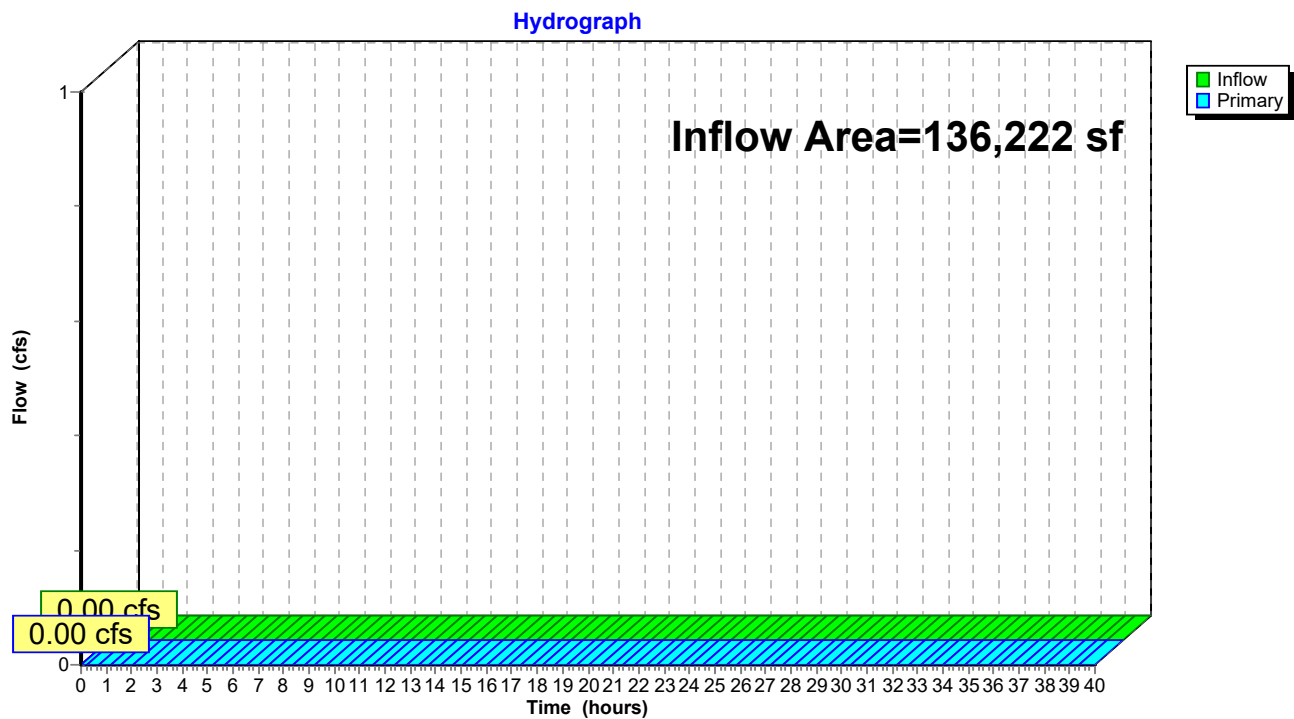
HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 11

Summary for Link 2L: Flow to the Wetlands to the north

Inflow Area = 136,222 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-yr event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min
Routed to Link 3L : Total flow discharging from limit of watershed analysis

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 2L: Flow to the Wetlands to the north

EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

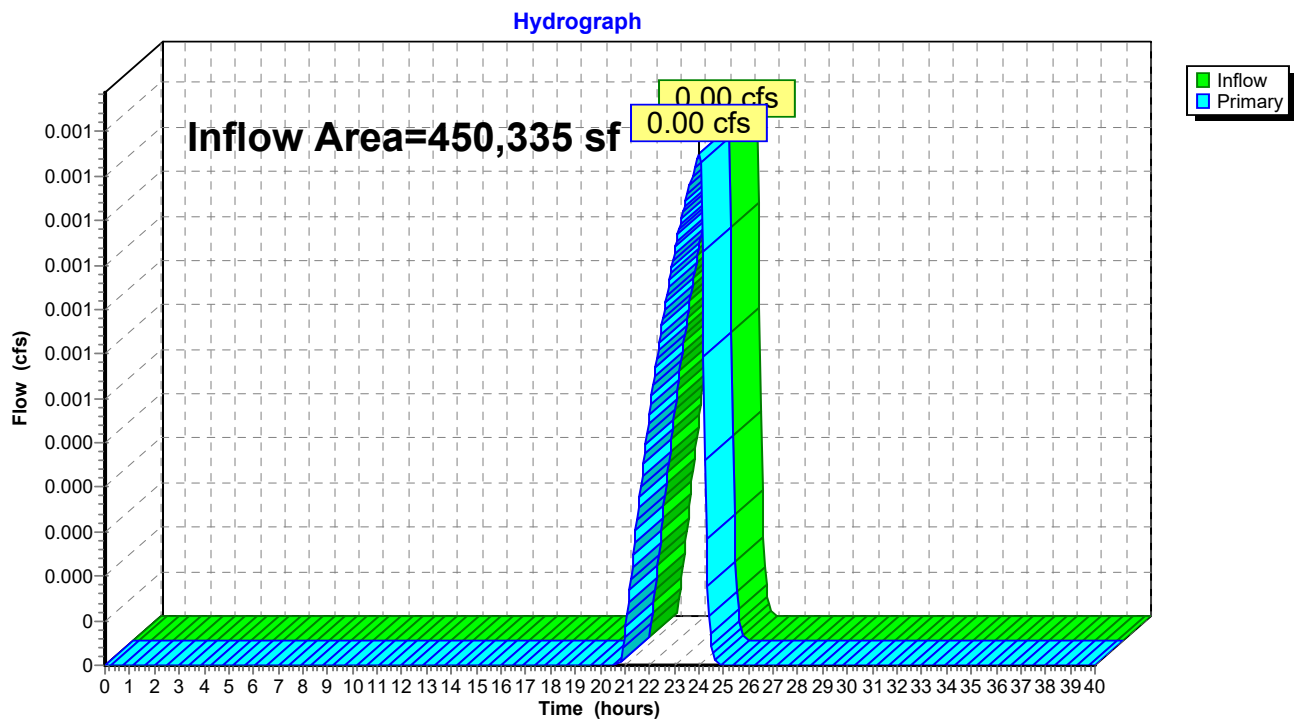
HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 12

Summary for Link 3L: Total flow discharging from limit of watershed analysis

Inflow Area = 450,335 sf, 4.04% Impervious, Inflow Depth = 0.00" for 2-yr event
 Inflow = 0.00 cfs @ 24.02 hrs, Volume= 9 cf
 Primary = 0.00 cfs @ 24.02 hrs, Volume= 9 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 3L: Total flow discharging from limit of watershed analysis

EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 13

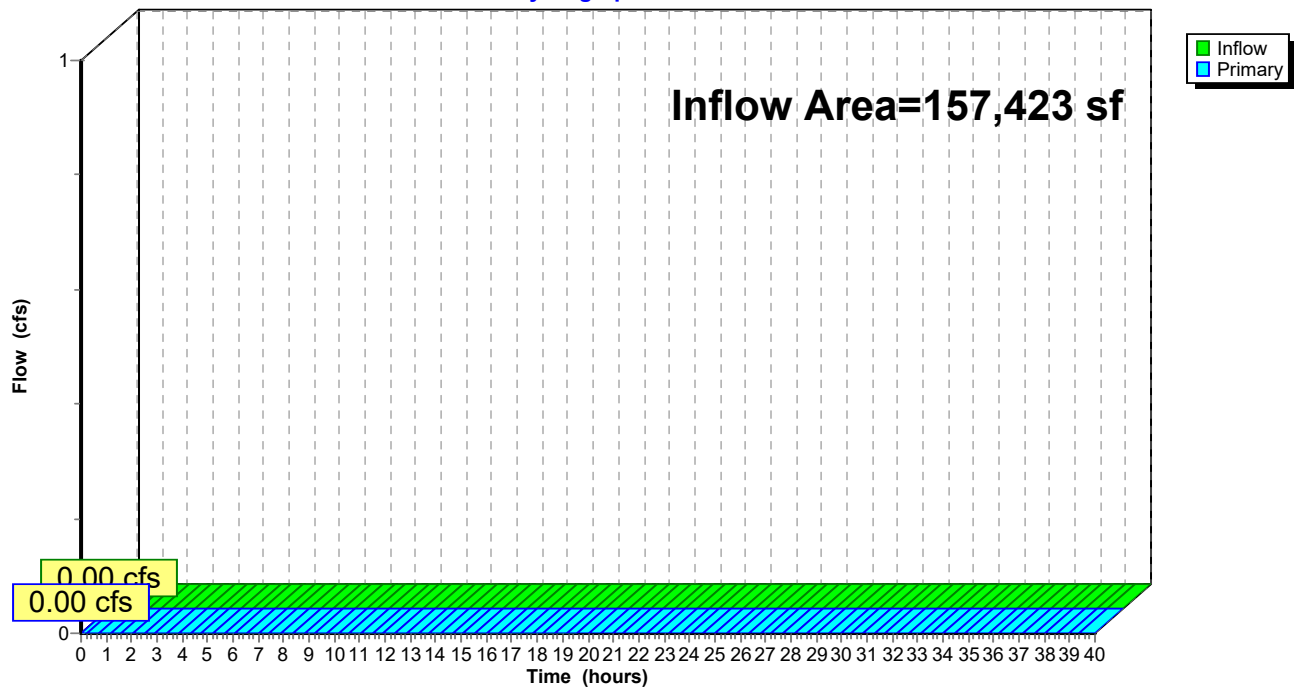
Summary for Link 4L: Isolated Area #1

Inflow Area = 157,423 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-yr event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 4L: Isolated Area #1

Hydrograph



EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 14

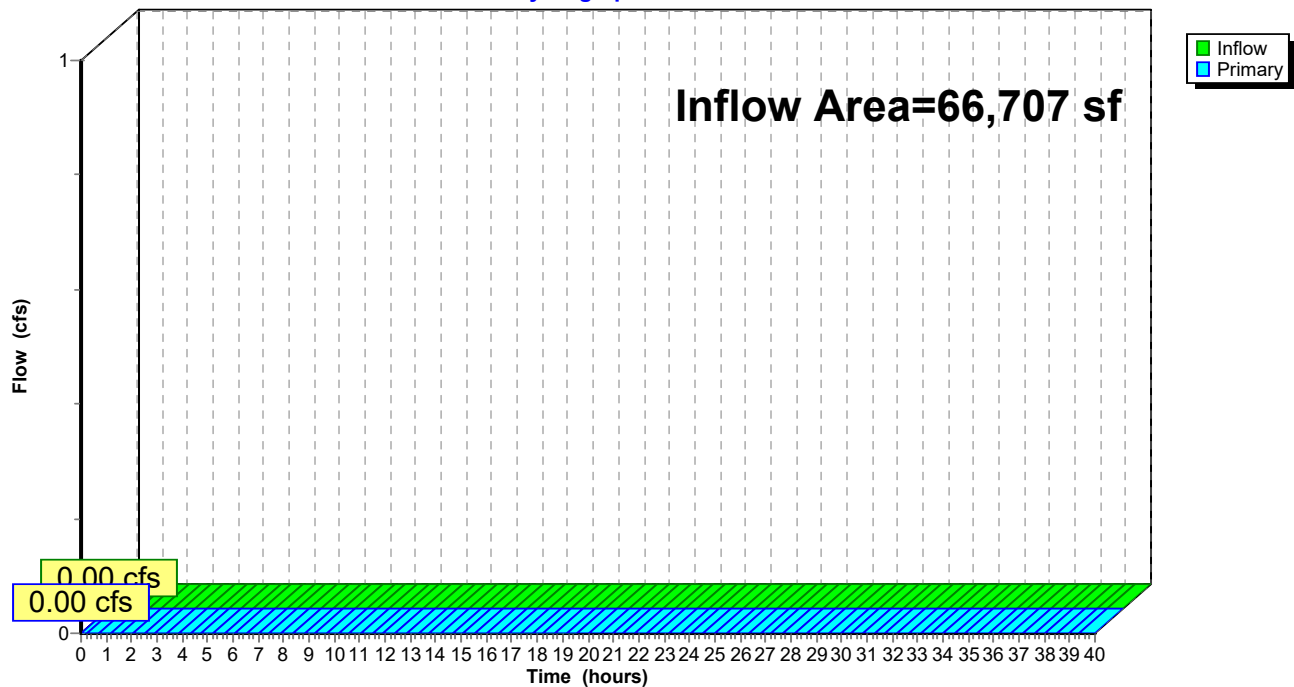
Summary for Link 5L: Isolated Area #2

Inflow Area = 66,707 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-yr event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 5L: Isolated Area #2

Hydrograph



EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 15

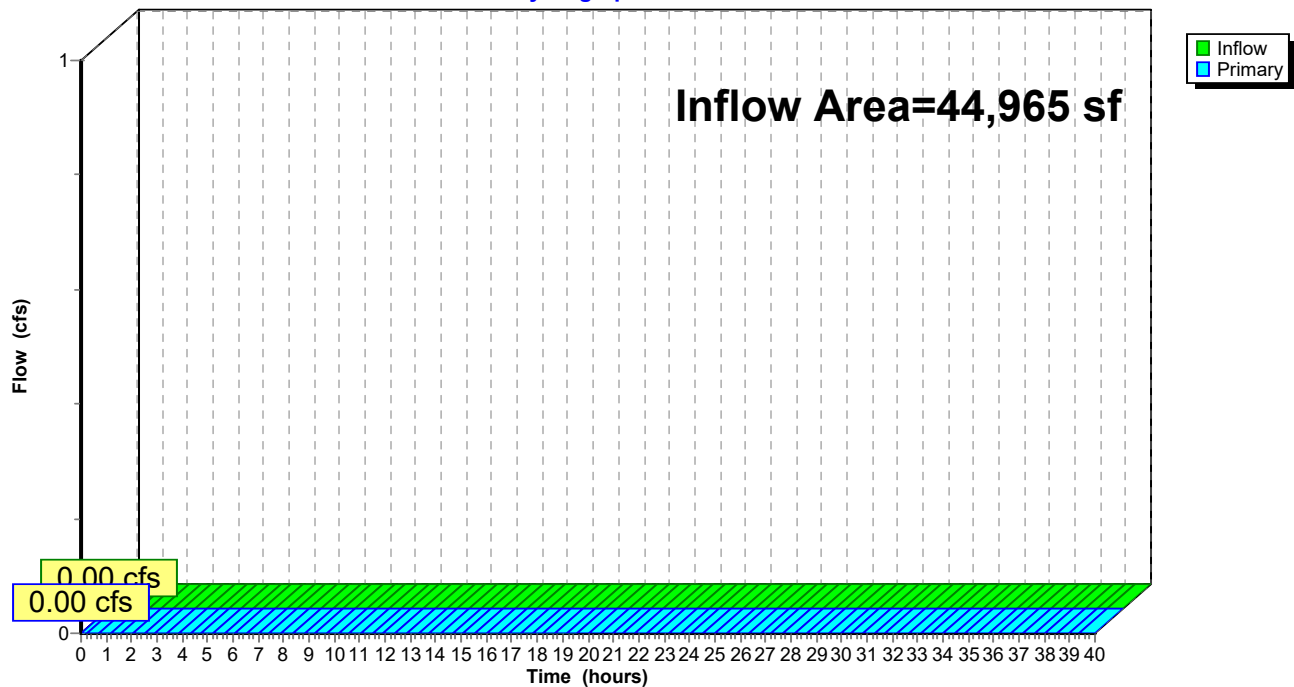
Summary for Link 6L: Isolated Area #3

Inflow Area = 44,965 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-yr event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 6L: Isolated Area #3

Hydrograph



EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 16

Summary for Subcatchment 1S: EX-WETLANDS-EAST

Runoff = 0.04 cfs @ 15.65 hrs, Volume= 1,129 cf, Depth= 0.07"
 Routed to Link 1L : Flow to the Wetlands to the southeast

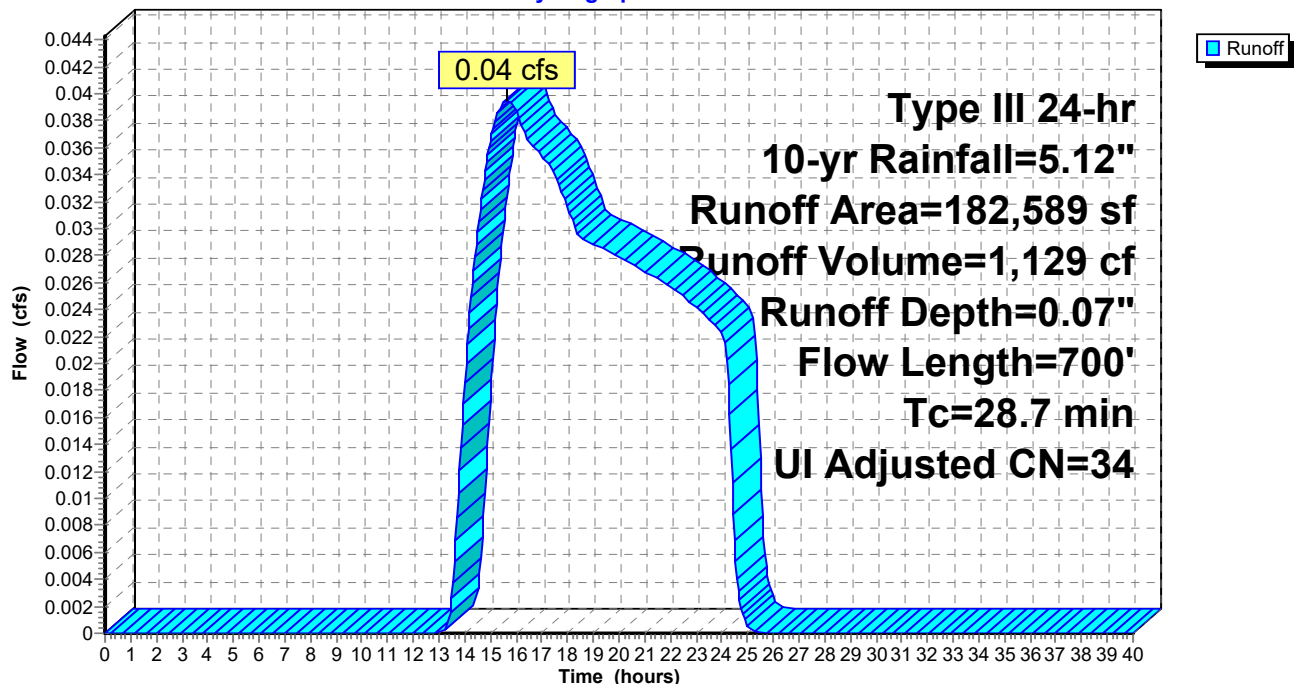
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-yr Rainfall=5.12"

Area (sf)	CN	Adj	Description
3,200	98		Unconnected roofs, HSG A
5,000	98		Paved parking, HSG A
40,000	39		>75% Grass cover, Good, HSG A
134,389	30		Woods, Good, HSG A
182,589	35	34	Weighted Average, UI Adjusted
174,389			95.51% Pervious Area
8,200			4.49% Impervious Area
3,200			39.02% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.2	50	0.0100	0.05		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
12.5	650	0.0300	0.87		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
28.7	700	Total			

Subcatchment 1S: EX-WETLANDS-EAST

Hydrograph



EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 17

Summary for Subcatchment 2S: EX-WETLANDS-NORTH

Runoff = 0.01 cfs @ 23.18 hrs, Volume= 98 cf, Depth= 0.01"
 Routed to Link 2L : Flow to the Wetlands to the north

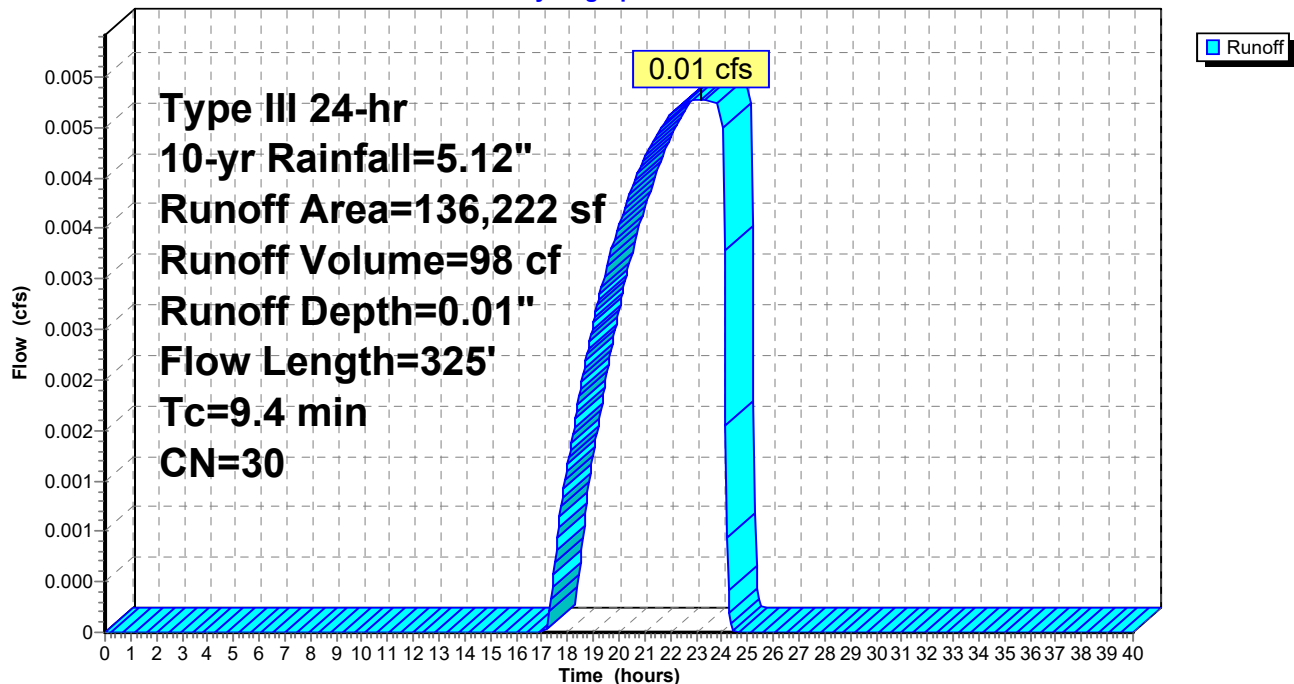
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-yr Rainfall=5.12"

Area (sf)	CN	Description
136,222	30	Woods, Good, HSG A
136,222		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0800	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
2.4	275	0.1500	1.94		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
9.4	325	Total			

Subcatchment 2S: EX-WETLANDS-NORTH

Hydrograph



EXISTING

Type III 24-hr 10-yr Rainfall=5.12"

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 18

Summary for Subcatchment 3S: EX-ABUTTERS

Runoff = 0.13 cfs @ 12.61 hrs, Volume= 2,466 cf, Depth= 0.22"
 Routed to Link 1L : Flow to the Wetlands to the southeast

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-yr Rainfall=5.12"

Area (sf)	CN	Adj	Description		
5,000	98		Unconnected roofs, HSG A		
5,000	98		Paved parking, HSG A		
5,000	61		>75% Grass cover, Good, HSG B		
55,000	39		>75% Grass cover, Good, HSG A		
61,524	30		Woods, Good, HSG A		
131,524	40	39	Weighted Average, UI Adjusted		
121,524			92.40% Pervious Area		
10,000			7.60% Impervious Area		
5,000			50.00% Unconnected		
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0800	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
8.7	450	0.0300	0.87		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
15.7	500	Total			

EXISTING

Prepared by Williams & Sparages

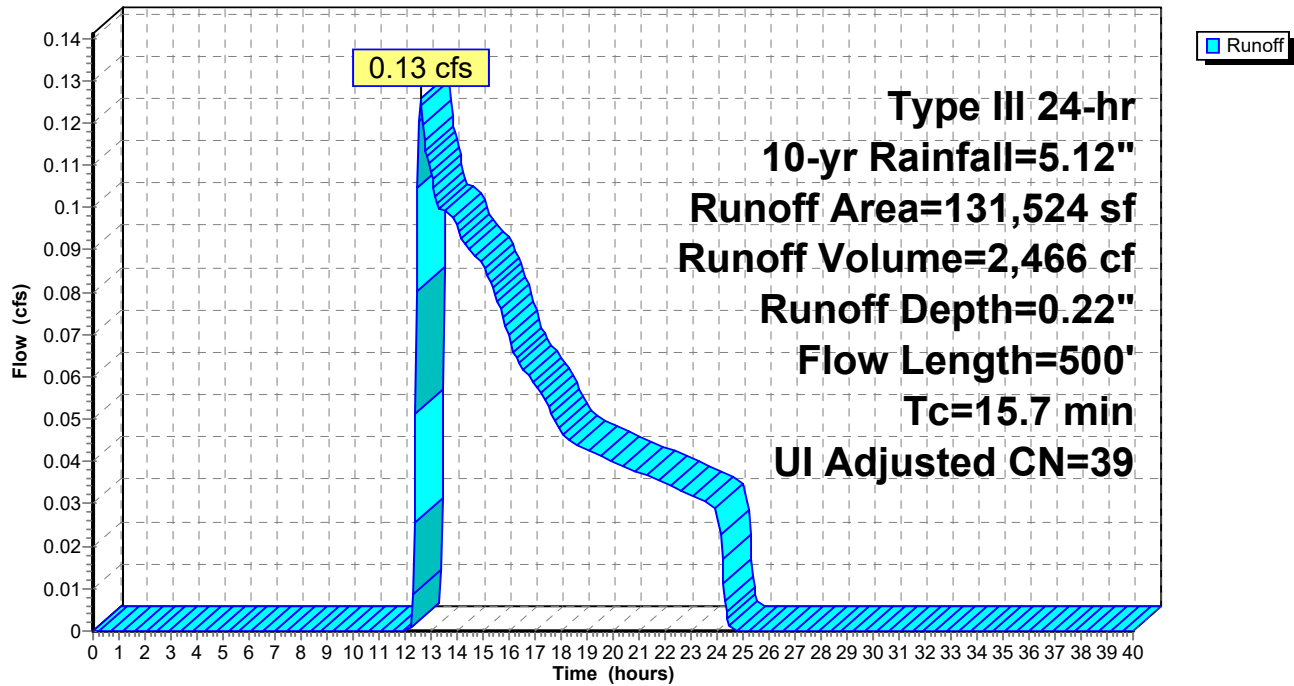
Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 19

Subcatchment 3S: EX-ABUTTERS

Hydrograph



EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 20

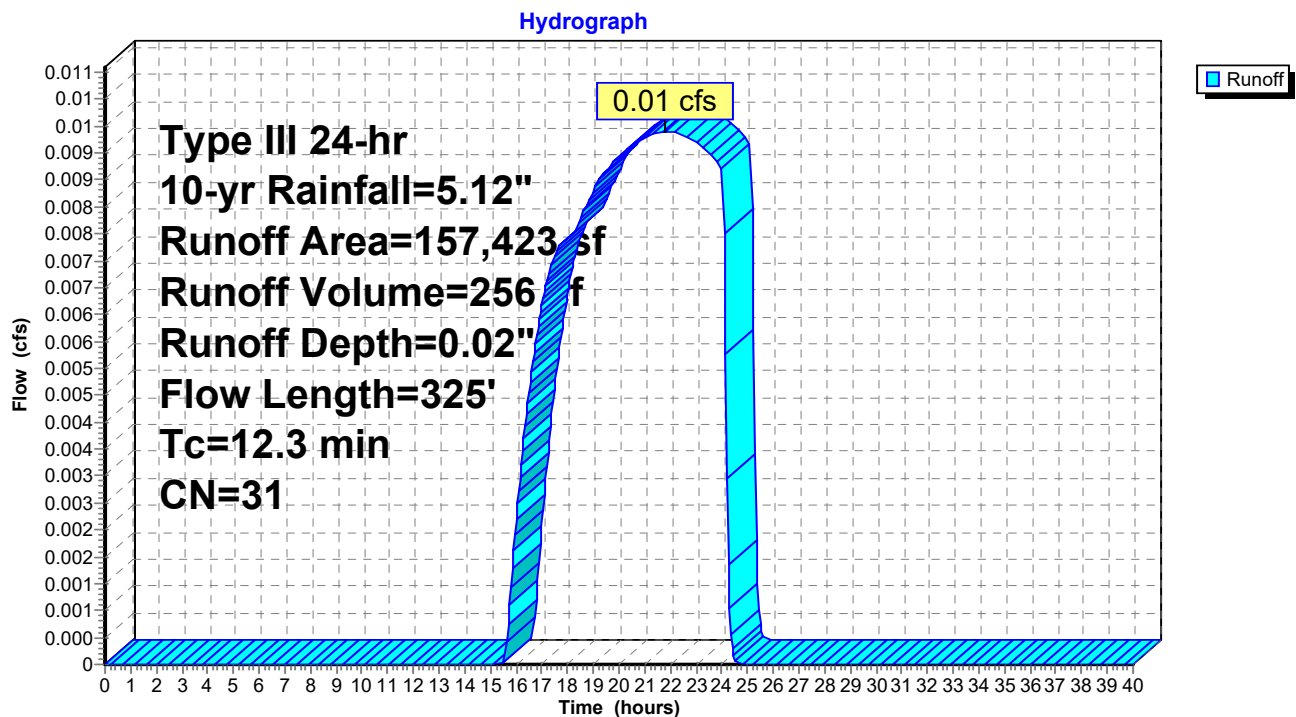
Summary for Subcatchment 4S: EX-ISOLATED AREA 1

Runoff = 0.01 cfs @ 21.78 hrs, Volume= 256 cf, Depth= 0.02"
 Routed to Link 4L : Isolated Area #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-yr Rainfall=5.12"

Area (sf)	CN	Description
153,803	30	Woods, Good, HSG A
3,620	55	Woods, Good, HSG B
157,423	31	Weighted Average
157,423		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0800	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
5.3	275	0.0300	0.87		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
12.3	325	Total			

Subcatchment 4S: EX-ISOLATED AREA 1

EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 21

Summary for Subcatchment 5S: EX-ISOLATED AREA 2

Runoff = 0.00 cfs @ 23.18 hrs, Volume= 48 cf, Depth= 0.01"
 Routed to Link 5L : Isolated Area #2

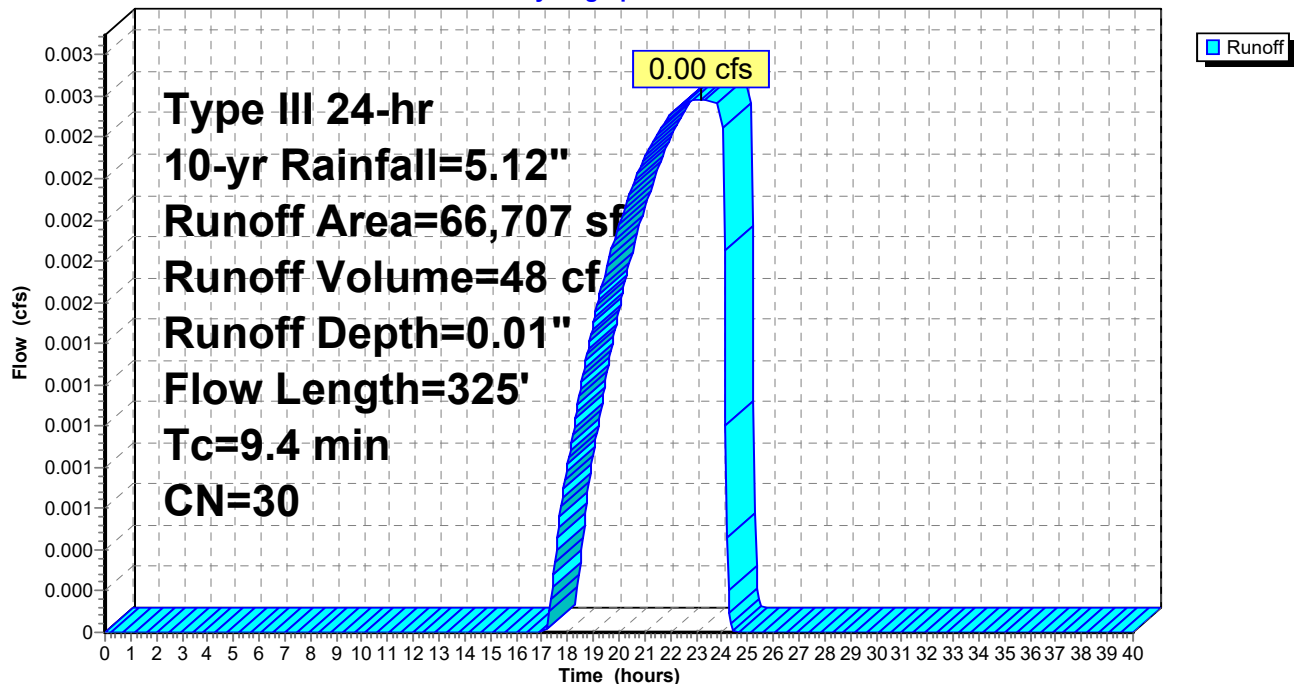
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-yr Rainfall=5.12"

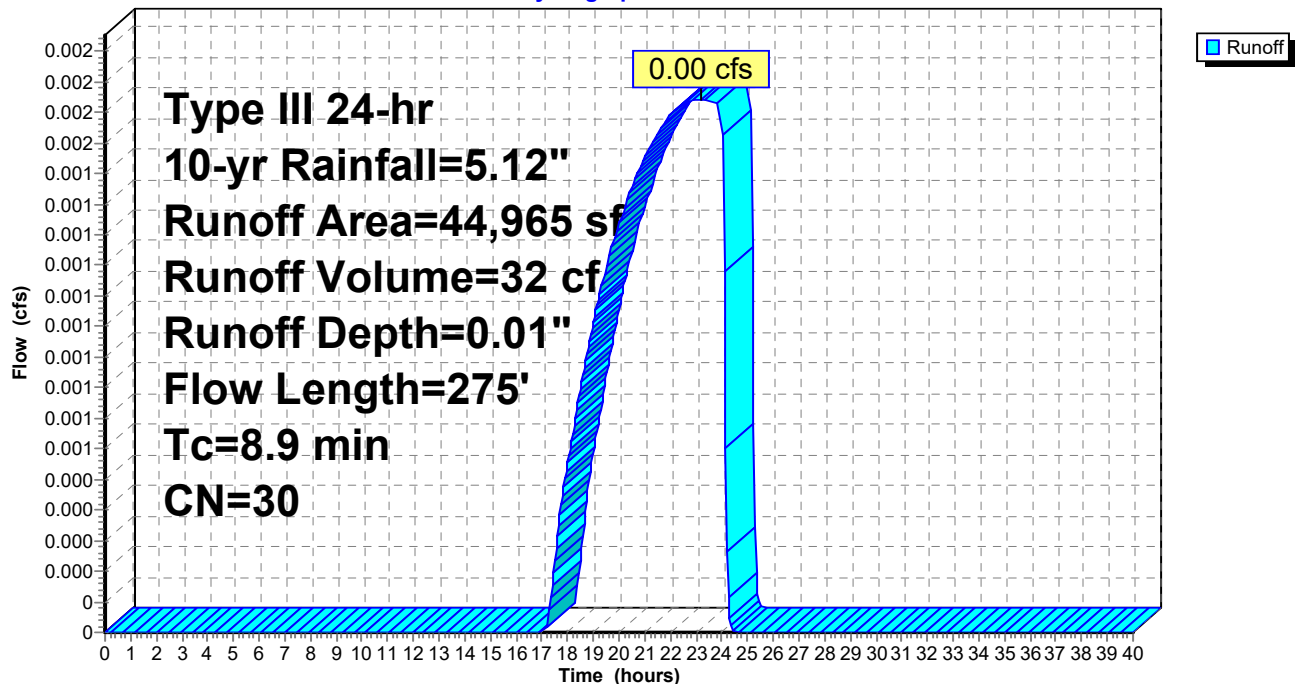
Area (sf)	CN	Description
66,707	30	Woods, Good, HSG A
66,707		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0800	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
2.4	275	0.1500	1.94		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
9.4	325	Total			

Subcatchment 5S: EX-ISOLATED AREA 2

Hydrograph





EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

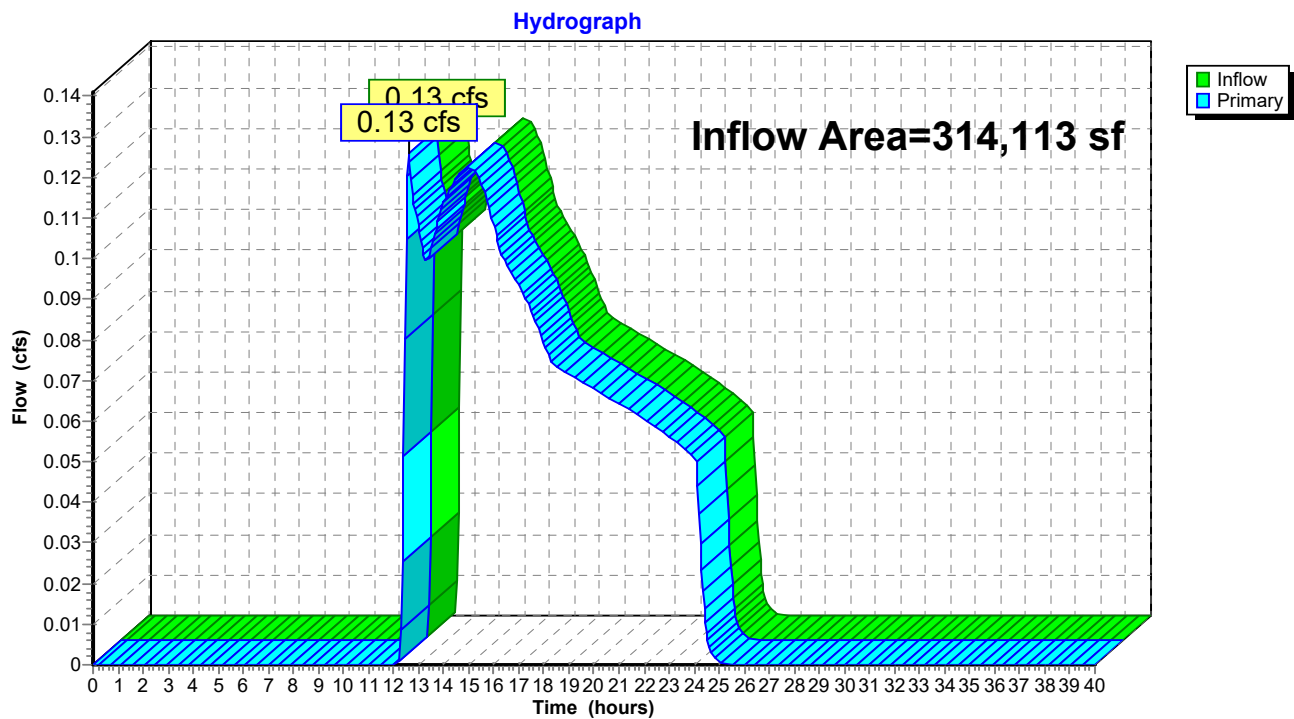
HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 23

Summary for Link 1L: Flow to the Wetlands to the southeast

Inflow Area = 314,113 sf, 5.79% Impervious, Inflow Depth = 0.14" for 10-yr event
Inflow = 0.13 cfs @ 12.61 hrs, Volume= 3,595 cf
Primary = 0.13 cfs @ 12.61 hrs, Volume= 3,595 cf, Atten= 0%, Lag= 0.0 min
Routed to Link 3L : Total flow discharging from limit of watershed analysis

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 1L: Flow to the Wetlands to the southeast

EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

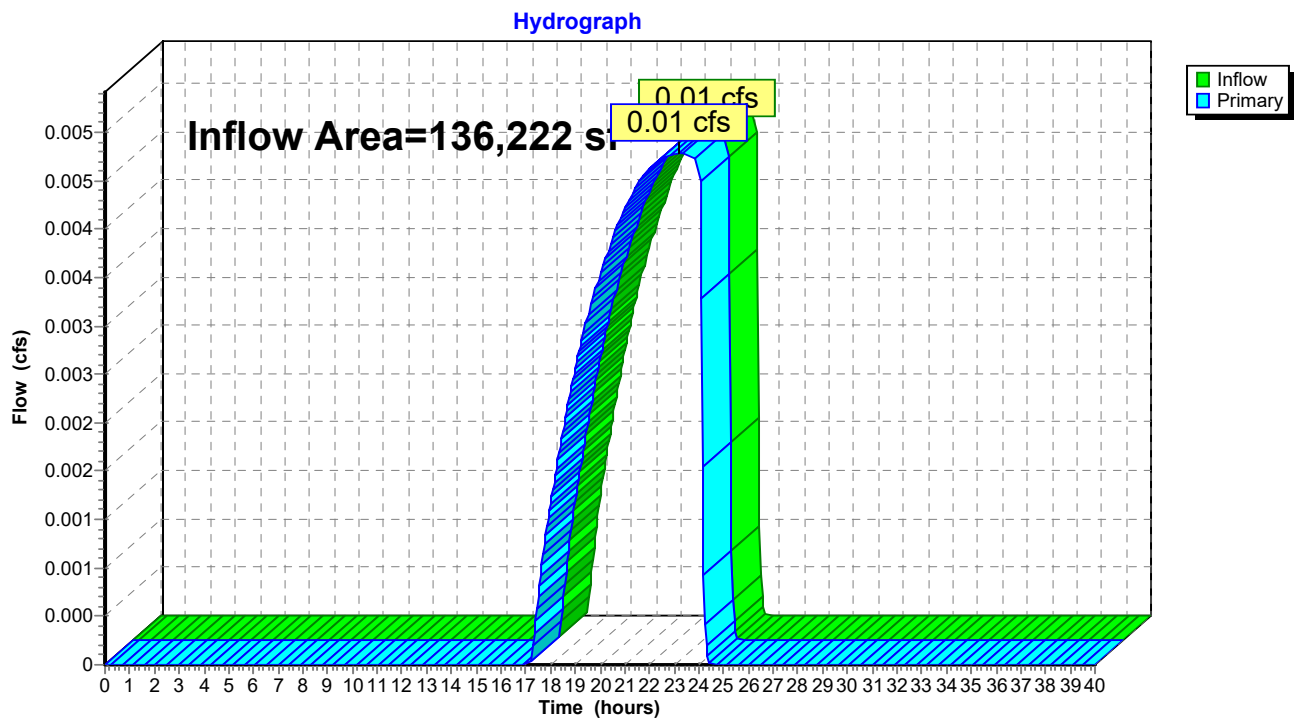
HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 24

Summary for Link 2L: Flow to the Wetlands to the north

Inflow Area = 136,222 sf, 0.00% Impervious, Inflow Depth = 0.01" for 10-yr event
Inflow = 0.01 cfs @ 23.18 hrs, Volume= 98 cf
Primary = 0.01 cfs @ 23.18 hrs, Volume= 98 cf, Atten= 0%, Lag= 0.0 min
Routed to Link 3L : Total flow discharging from limit of watershed analysis

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 2L: Flow to the Wetlands to the north

EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

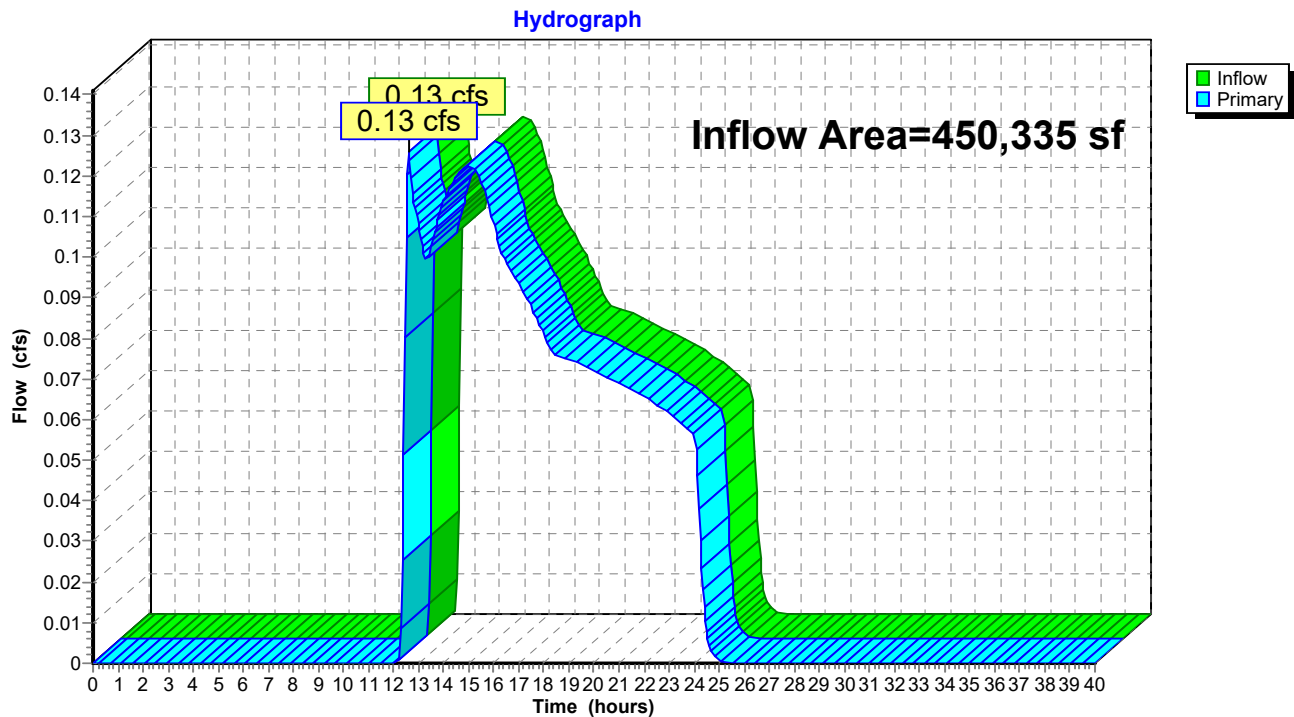
HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 25

Summary for Link 3L: Total flow discharging from limit of watershed analysis

Inflow Area = 450,335 sf, 4.04% Impervious, Inflow Depth = 0.10" for 10-yr event
Inflow = 0.13 cfs @ 12.61 hrs, Volume= 3,693 cf
Primary = 0.13 cfs @ 12.61 hrs, Volume= 3,693 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 3L: Total flow discharging from limit of watershed analysis

EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

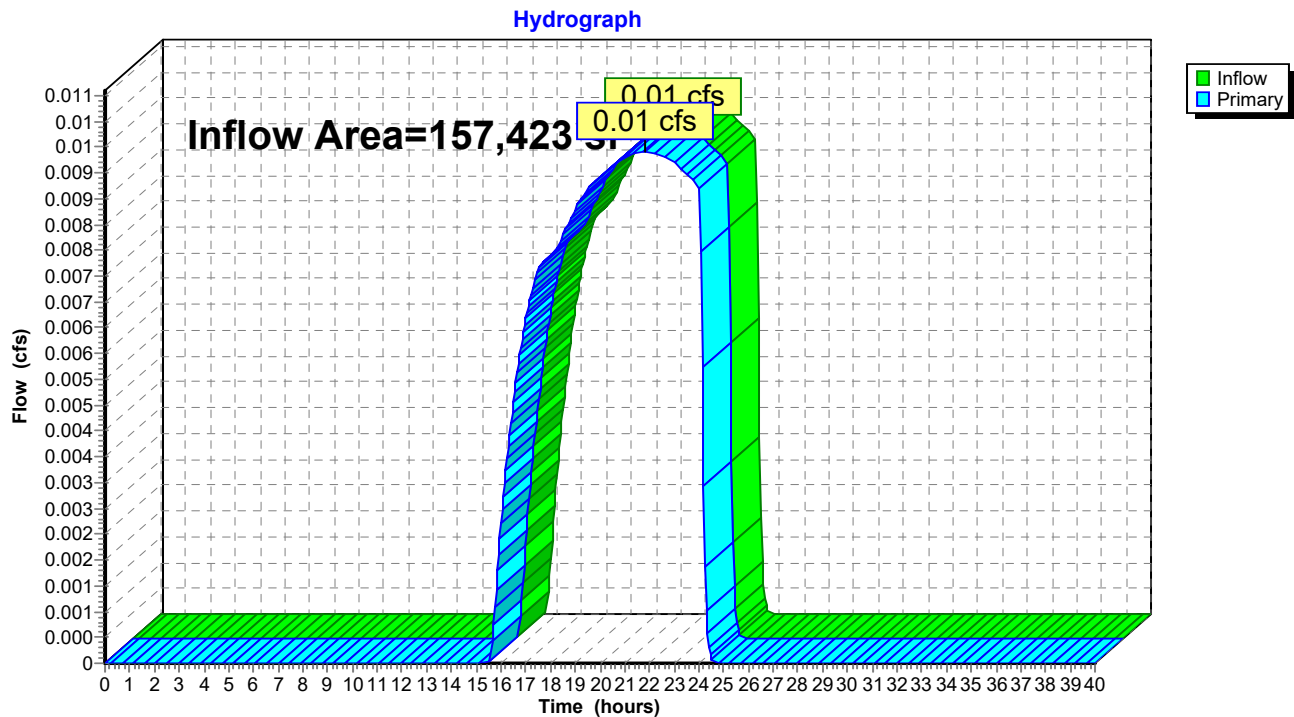
HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 26

Summary for Link 4L: Isolated Area #1

Inflow Area = 157,423 sf, 0.00% Impervious, Inflow Depth = 0.02" for 10-yr event
Inflow = 0.01 cfs @ 21.78 hrs, Volume= 256 cf
Primary = 0.01 cfs @ 21.78 hrs, Volume= 256 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 4L: Isolated Area #1

EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

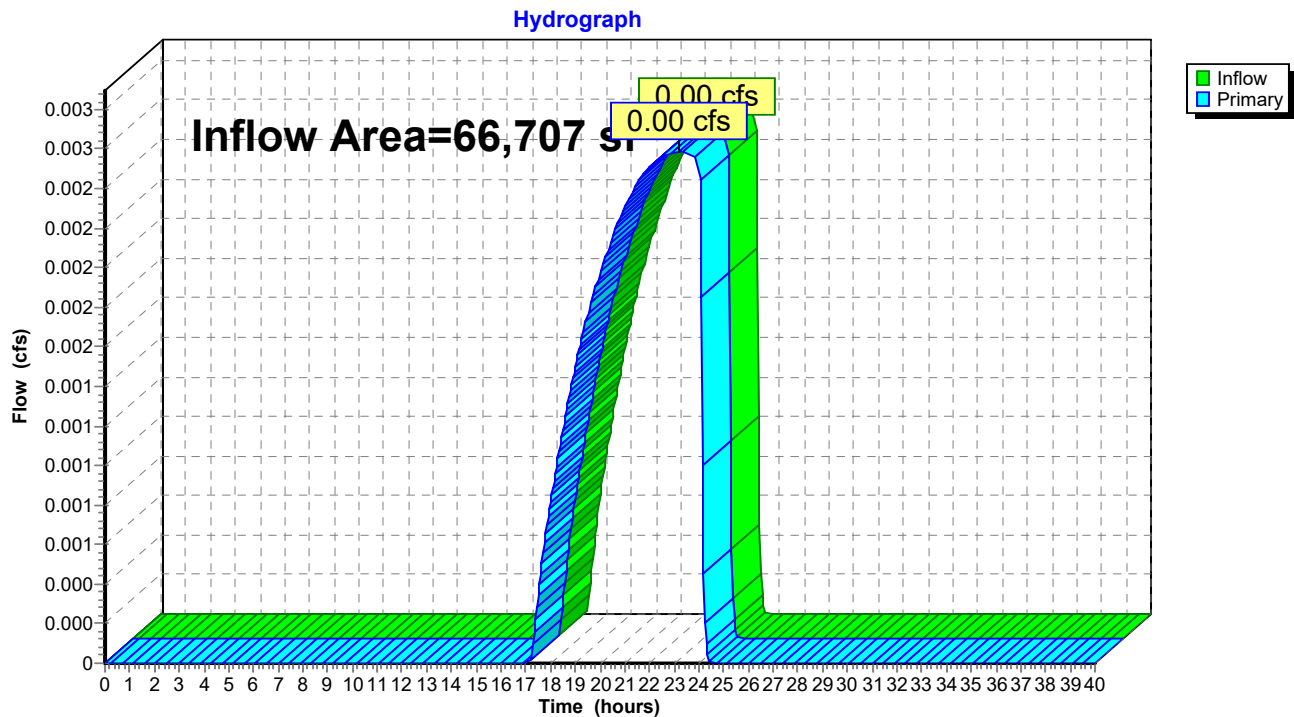
HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 27

Summary for Link 5L: Isolated Area #2

Inflow Area = 66,707 sf, 0.00% Impervious, Inflow Depth = 0.01" for 10-yr event
Inflow = 0.00 cfs @ 23.18 hrs, Volume= 48 cf
Primary = 0.00 cfs @ 23.18 hrs, Volume= 48 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 5L: Isolated Area #2

EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

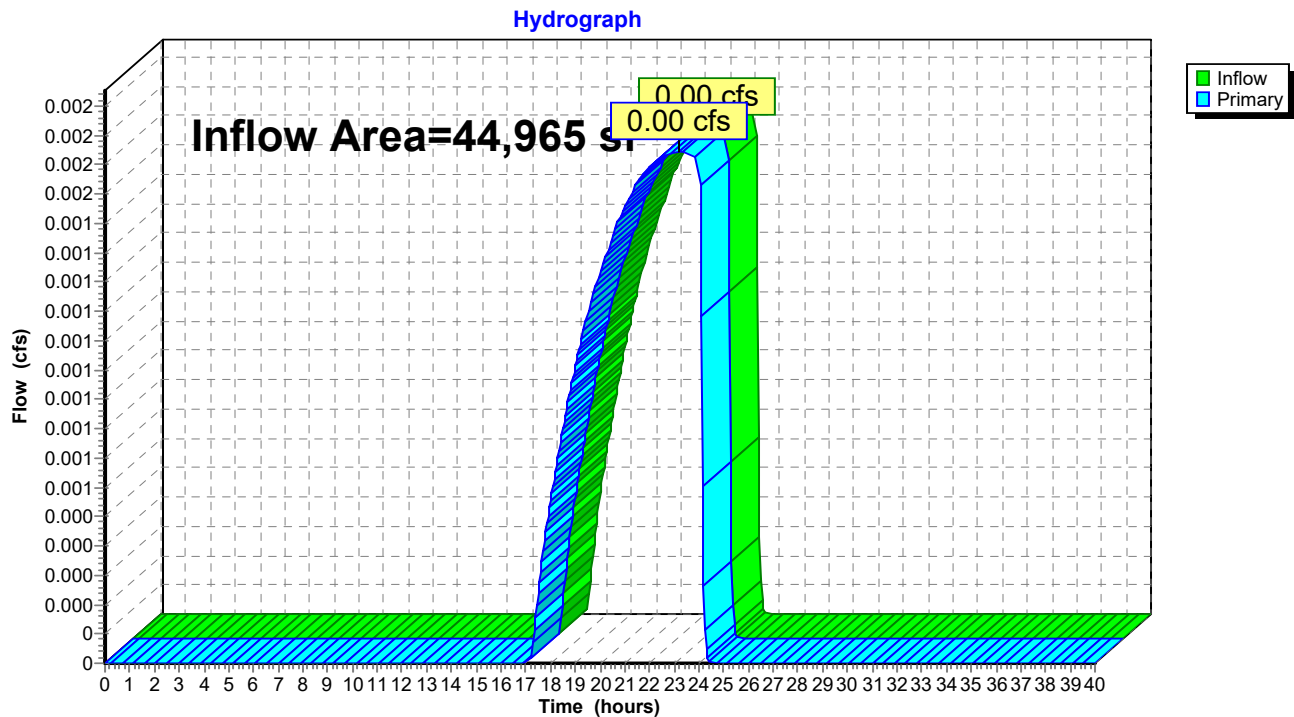
HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 28

Summary for Link 6L: Isolated Area #3

Inflow Area = 44,965 sf, 0.00% Impervious, Inflow Depth = 0.01" for 10-yr event
Inflow = 0.00 cfs @ 23.15 hrs, Volume= 32 cf
Primary = 0.00 cfs @ 23.15 hrs, Volume= 32 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 6L: Isolated Area #3

EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 29

Summary for Subcatchment 1S: EX-WETLANDS-EAST

Runoff = 0.17 cfs @ 13.07 hrs, Volume= 4,042 cf, Depth= 0.27"
 Routed to Link 1L : Flow to the Wetlands to the southeast

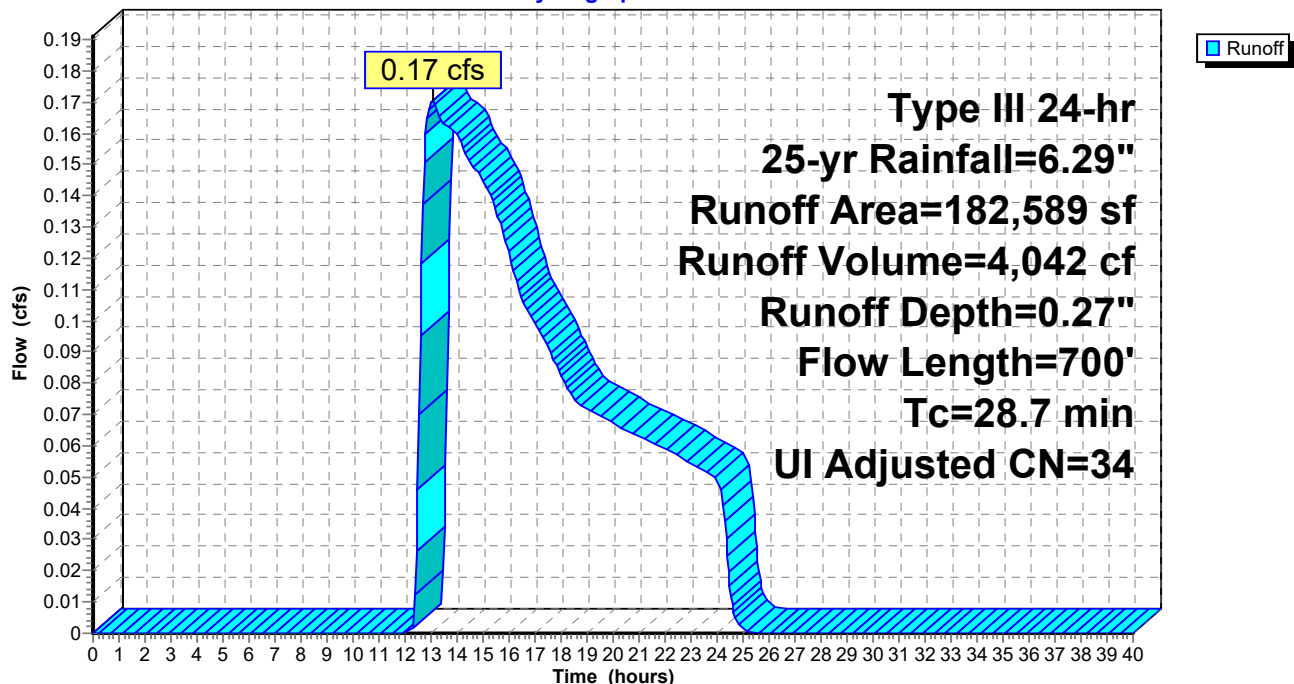
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 25-yr Rainfall=6.29"

Area (sf)	CN	Adj	Description
3,200	98		Unconnected roofs, HSG A
5,000	98		Paved parking, HSG A
40,000	39		>75% Grass cover, Good, HSG A
134,389	30		Woods, Good, HSG A
182,589	35	34	Weighted Average, UI Adjusted
174,389			95.51% Pervious Area
8,200			4.49% Impervious Area
3,200			39.02% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.2	50	0.0100	0.05		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
12.5	650	0.0300	0.87		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
28.7	700	Total			

Subcatchment 1S: EX-WETLANDS-EAST

Hydrograph



EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 30

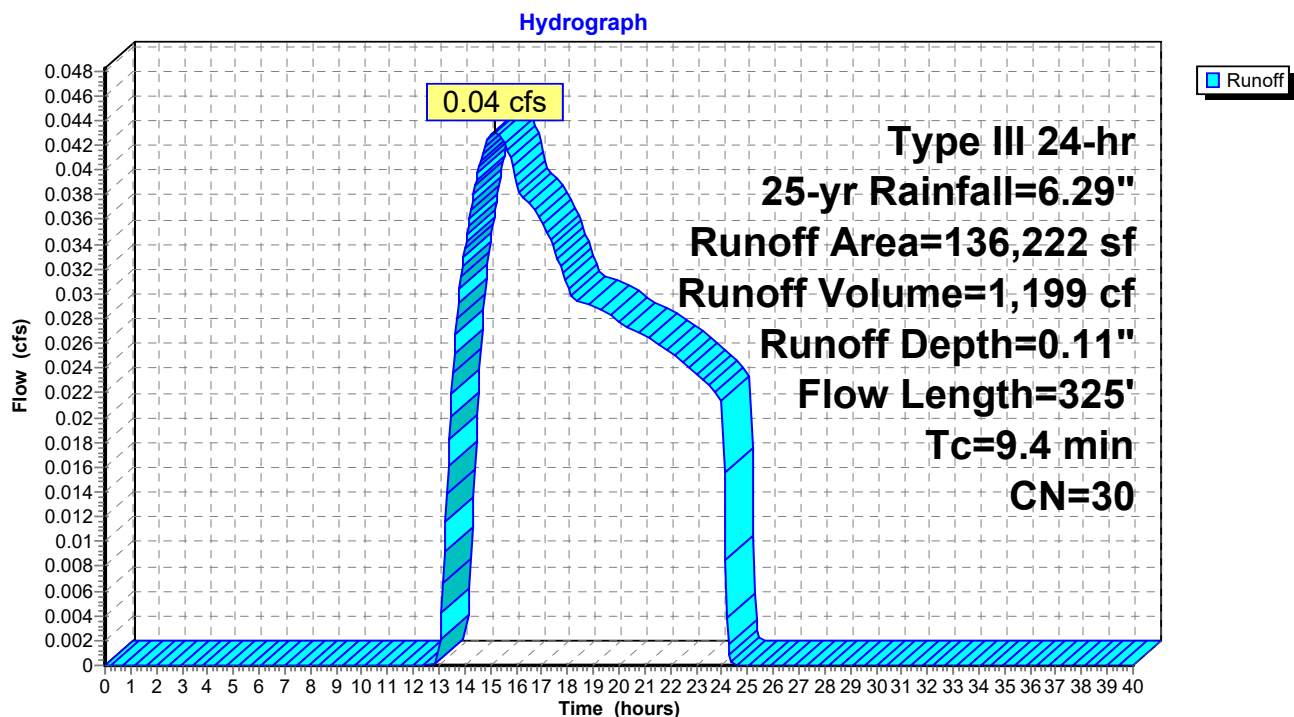
Summary for Subcatchment 2S: EX-WETLANDS-NORTH

Runoff = 0.04 cfs @ 15.19 hrs, Volume= 1,199 cf, Depth= 0.11"
 Routed to Link 2L : Flow to the Wetlands to the north

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 25-yr Rainfall=6.29"

Area (sf)	CN	Description
136,222	30	Woods, Good, HSG A
136,222		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0800	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
2.4	275	0.1500	1.94		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
9.4	325	Total			

Subcatchment 2S: EX-WETLANDS-NORTH

EXISTING

Type III 24-hr 25-yr Rainfall=6.29"

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 31

Summary for Subcatchment 3S: EX-ABUTTERS

Runoff = 0.63 cfs @ 12.47 hrs, Volume= 5,827 cf, Depth= 0.53"
 Routed to Link 1L : Flow to the Wetlands to the southeast

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 25-yr Rainfall=6.29"

Area (sf)	CN	Adj	Description
5,000	98		Unconnected roofs, HSG A
5,000	98		Paved parking, HSG A
5,000	61		>75% Grass cover, Good, HSG B
55,000	39		>75% Grass cover, Good, HSG A
61,524	30		Woods, Good, HSG A
131,524	40	39	Weighted Average, UI Adjusted
121,524			92.40% Pervious Area
10,000			7.60% Impervious Area
5,000			50.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0800	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
8.7	450	0.0300	0.87		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
15.7	500	Total			

EXISTING

Prepared by Williams & Sparages

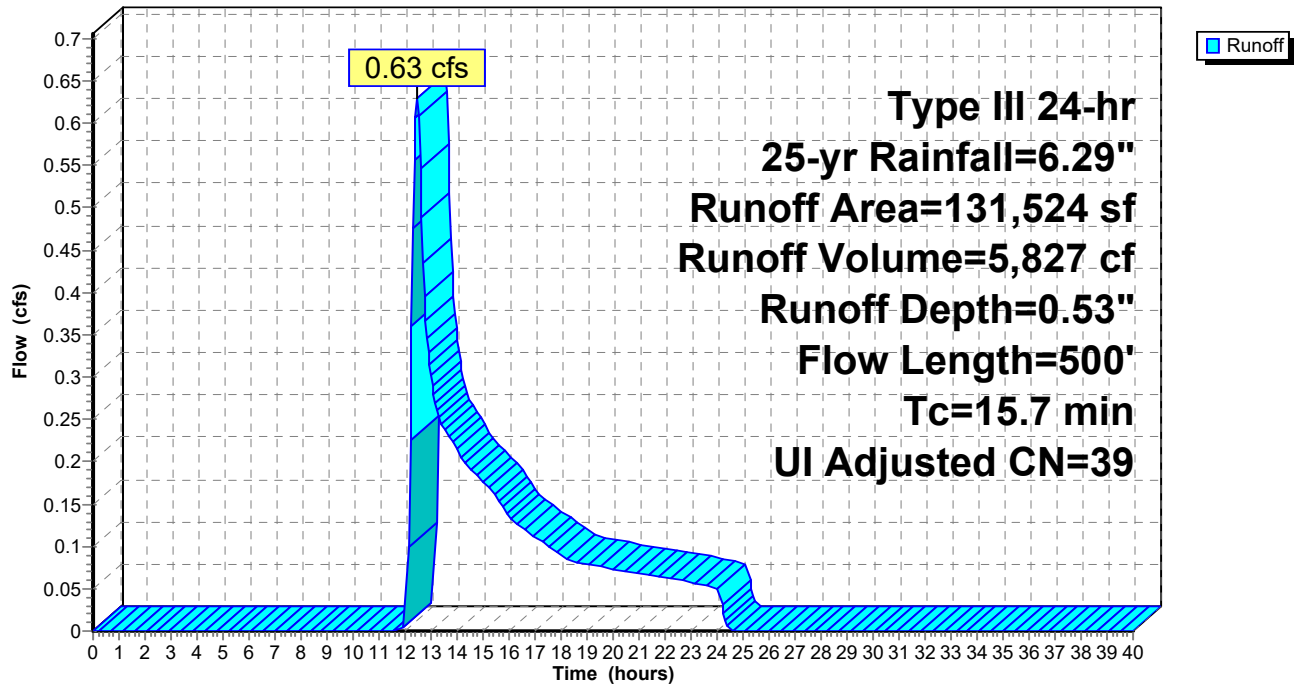
Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 32

Subcatchment 3S: EX-ABUTTERS

Hydrograph



EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 33

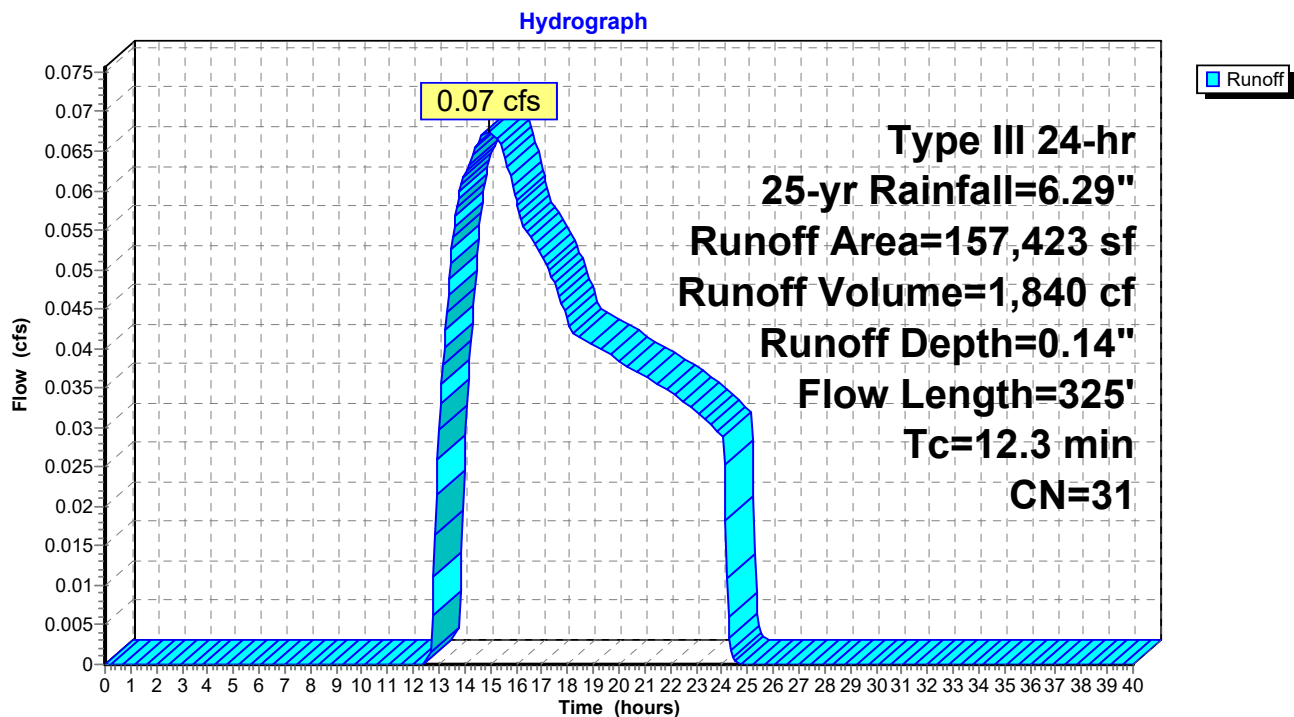
Summary for Subcatchment 4S: EX-ISOLATED AREA 1

Runoff = 0.07 cfs @ 14.92 hrs, Volume= 1,840 cf, Depth= 0.14"
 Routed to Link 4L : Isolated Area #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 25-yr Rainfall=6.29"

Area (sf)	CN	Description
153,803	30	Woods, Good, HSG A
3,620	55	Woods, Good, HSG B
157,423	31	Weighted Average
157,423		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0800	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
5.3	275	0.0300	0.87		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
12.3	325	Total			

Subcatchment 4S: EX-ISOLATED AREA 1

EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 34

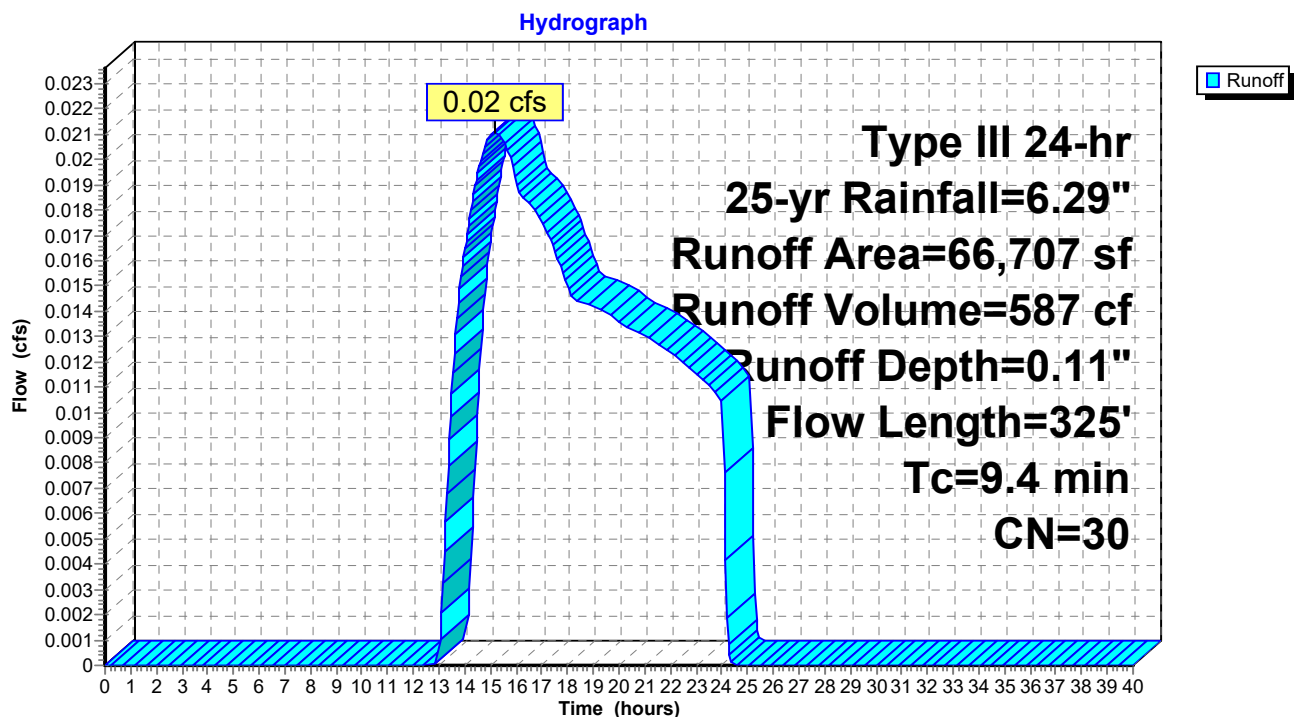
Summary for Subcatchment 5S: EX-ISOLATED AREA 2

Runoff = 0.02 cfs @ 15.19 hrs, Volume= 587 cf, Depth= 0.11"
 Routed to Link 5L : Isolated Area #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 25-yr Rainfall=6.29"

Area (sf)	CN	Description
66,707	30	Woods, Good, HSG A
66,707		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0800	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
2.4	275	0.1500	1.94		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
9.4	325	Total			

Subcatchment 5S: EX-ISOLATED AREA 2

EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 35

Summary for Subcatchment 6S: EX-ISOLATED AREA 3

Runoff = 0.01 cfs @ 15.19 hrs, Volume= 396 cf, Depth= 0.11"
 Routed to Link 6L : Isolated Area #3

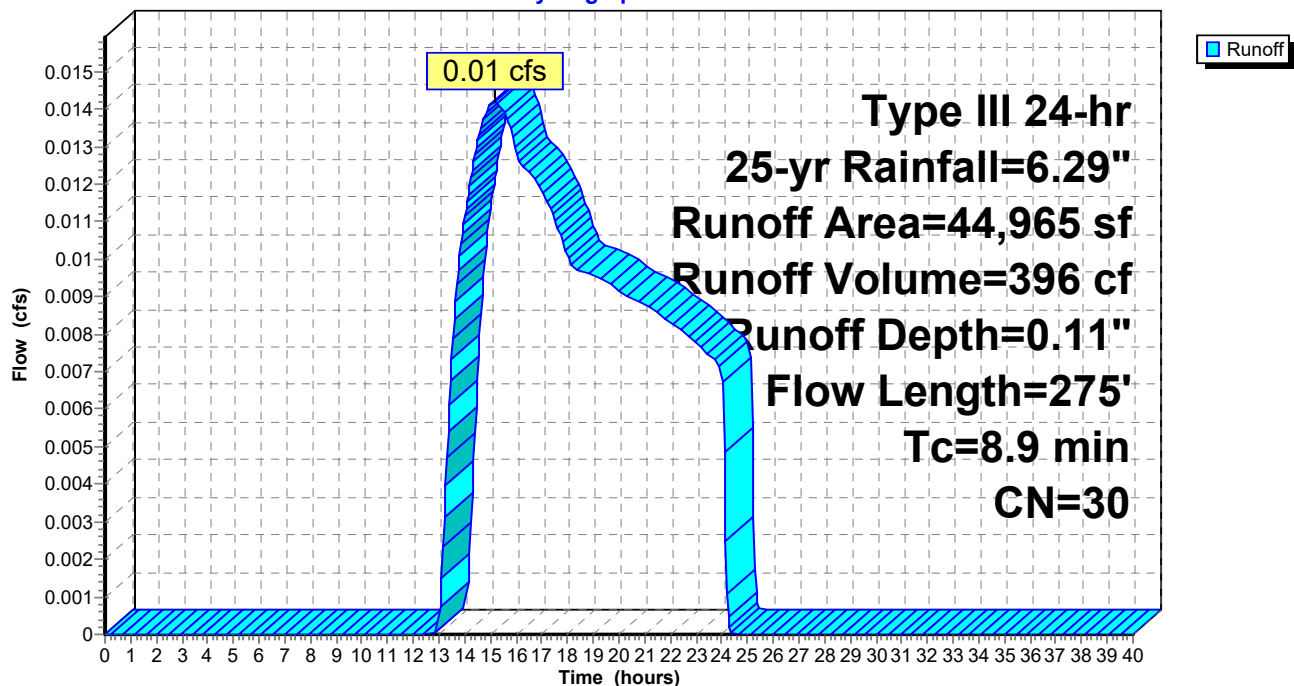
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 25-yr Rainfall=6.29"

Area (sf)	CN	Description
44,965	30	Woods, Good, HSG A
44,965		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0800	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
1.9	225	0.1500	1.94		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
8.9	275	Total			

Subcatchment 6S: EX-ISOLATED AREA 3

Hydrograph



EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

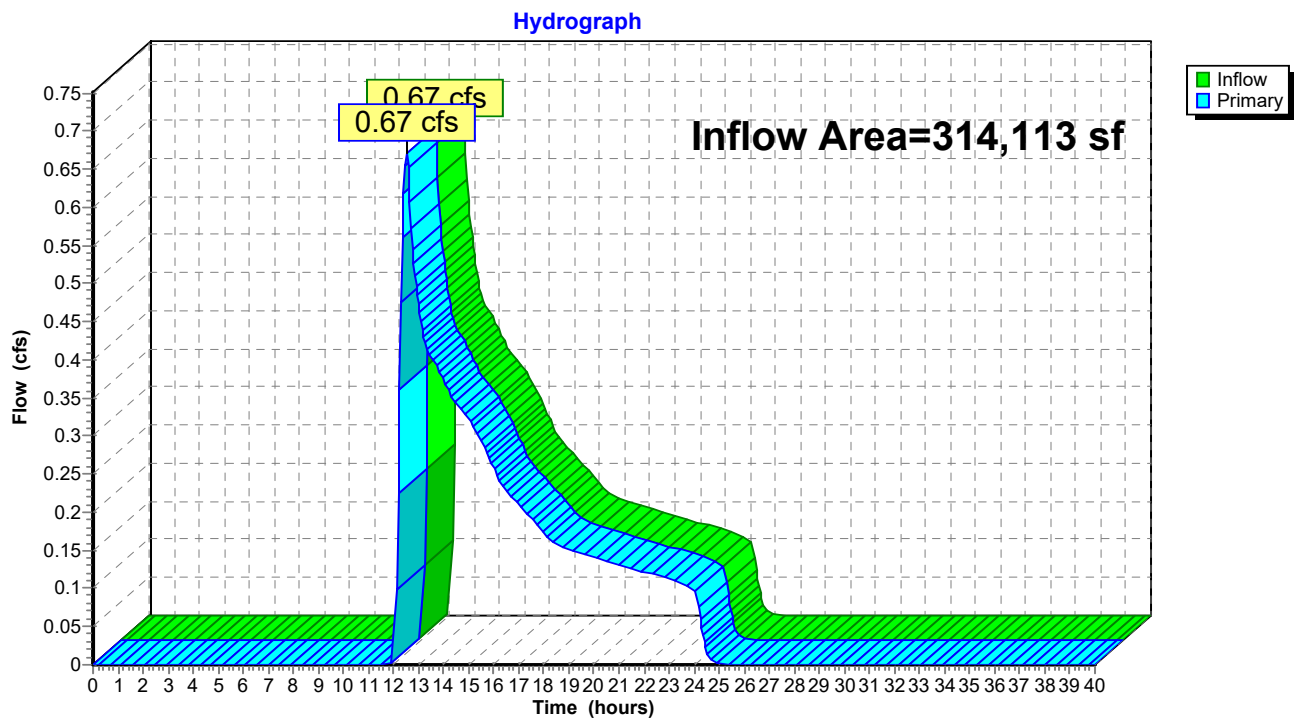
HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 36

Summary for Link 1L: Flow to the Wetlands to the southeast

Inflow Area = 314,113 sf, 5.79% Impervious, Inflow Depth = 0.38" for 25-yr event
Inflow = 0.67 cfs @ 12.51 hrs, Volume= 9,870 cf
Primary = 0.67 cfs @ 12.51 hrs, Volume= 9,870 cf, Atten= 0%, Lag= 0.0 min
Routed to Link 3L : Total flow discharging from limit of watershed analysis

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 1L: Flow to the Wetlands to the southeast

EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

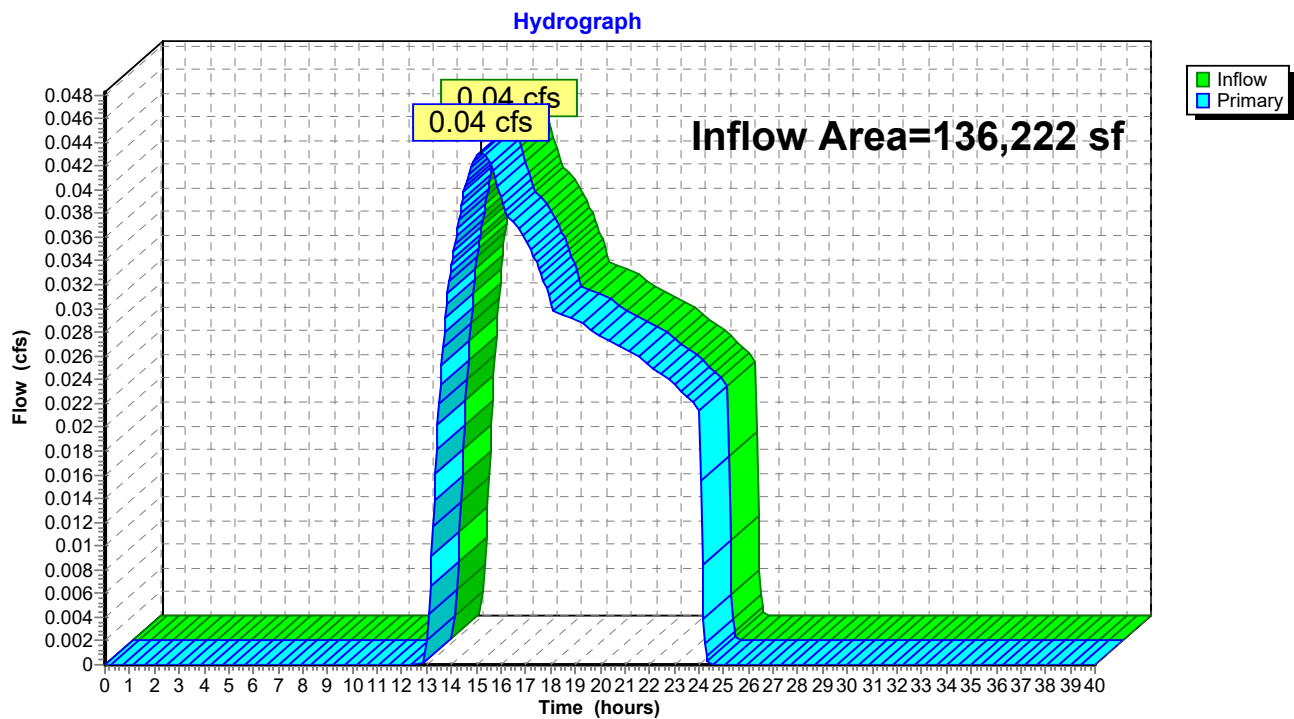
HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 37

Summary for Link 2L: Flow to the Wetlands to the north

Inflow Area = 136,222 sf, 0.00% Impervious, Inflow Depth = 0.11" for 25-yr event
Inflow = 0.04 cfs @ 15.19 hrs, Volume= 1,199 cf
Primary = 0.04 cfs @ 15.19 hrs, Volume= 1,199 cf, Atten= 0%, Lag= 0.0 min
Routed to Link 3L : Total flow discharging from limit of watershed analysis

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 2L: Flow to the Wetlands to the north

EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

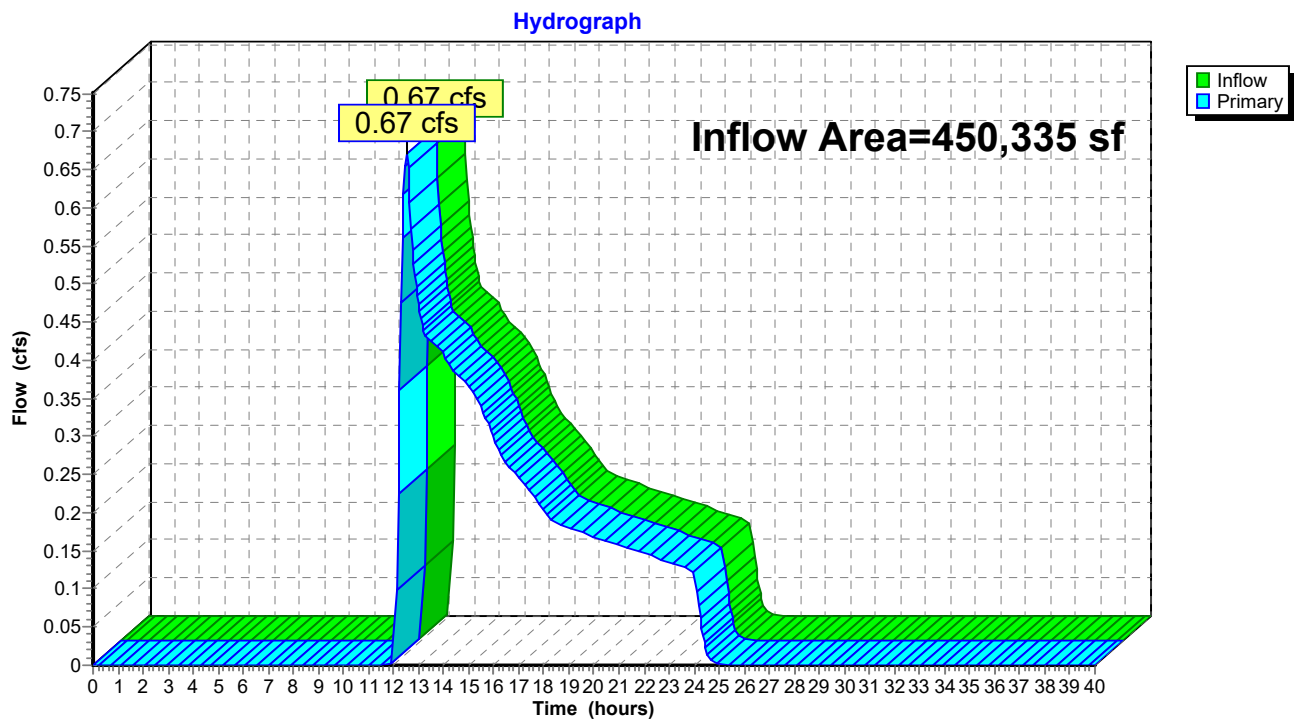
HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 38

Summary for Link 3L: Total flow discharging from limit of watershed analysis

Inflow Area = 450,335 sf, 4.04% Impervious, Inflow Depth = 0.29" for 25-yr event
Inflow = 0.67 cfs @ 12.51 hrs, Volume= 11,068 cf
Primary = 0.67 cfs @ 12.51 hrs, Volume= 11,068 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 3L: Total flow discharging from limit of watershed analysis

EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

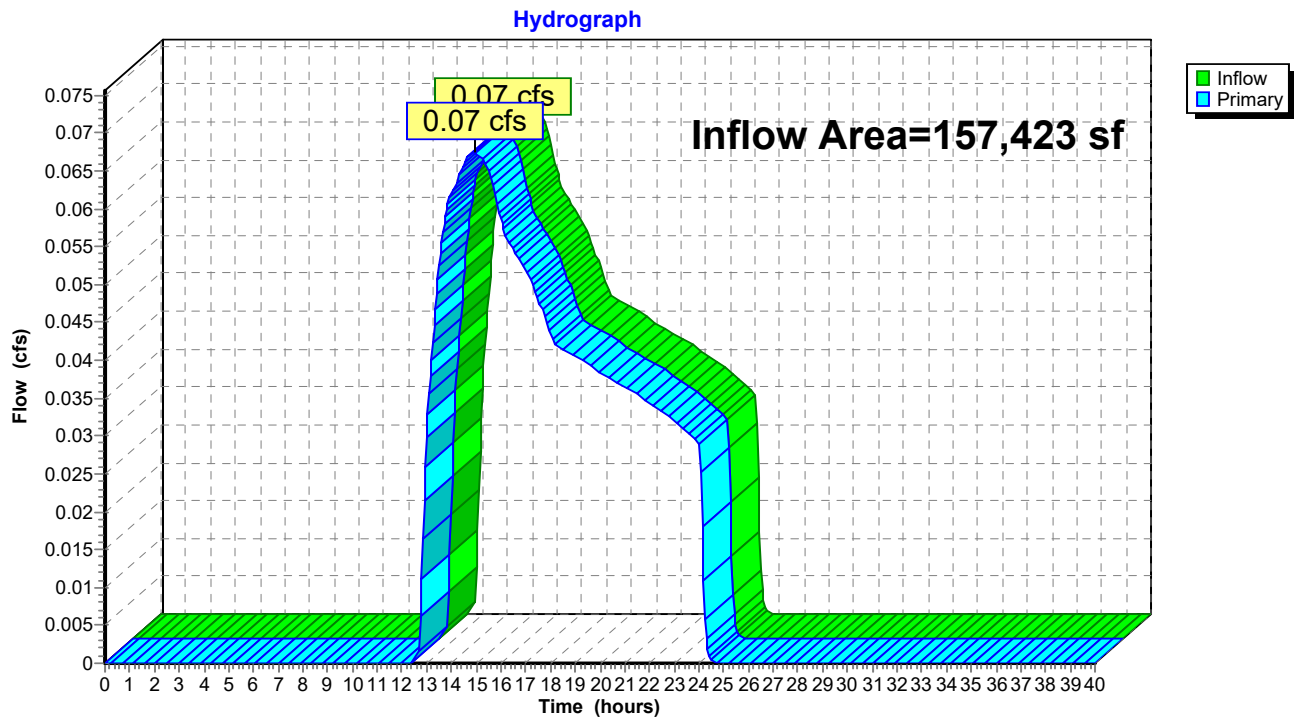
HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 39

Summary for Link 4L: Isolated Area #1

Inflow Area = 157,423 sf, 0.00% Impervious, Inflow Depth = 0.14" for 25-yr event
Inflow = 0.07 cfs @ 14.92 hrs, Volume= 1,840 cf
Primary = 0.07 cfs @ 14.92 hrs, Volume= 1,840 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 4L: Isolated Area #1

EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

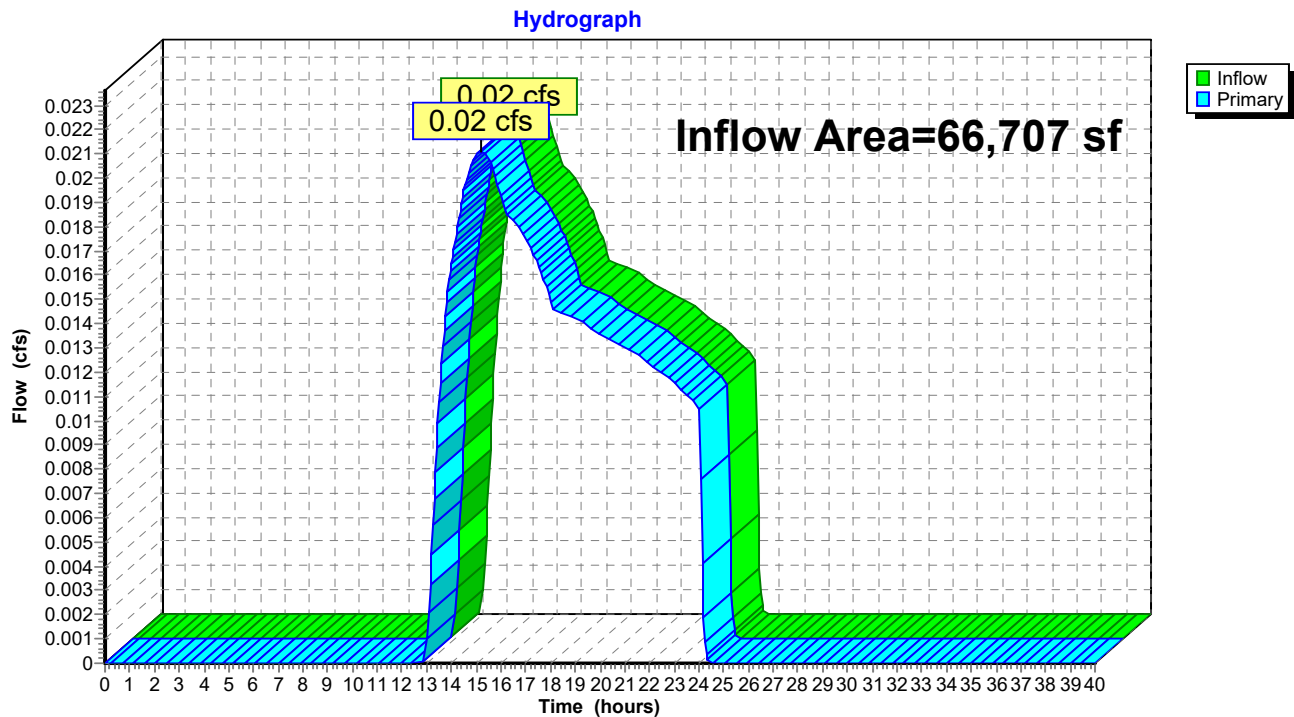
HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 40

Summary for Link 5L: Isolated Area #2

Inflow Area = 66,707 sf, 0.00% Impervious, Inflow Depth = 0.11" for 25-yr event
Inflow = 0.02 cfs @ 15.19 hrs, Volume= 587 cf
Primary = 0.02 cfs @ 15.19 hrs, Volume= 587 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 5L: Isolated Area #2

EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

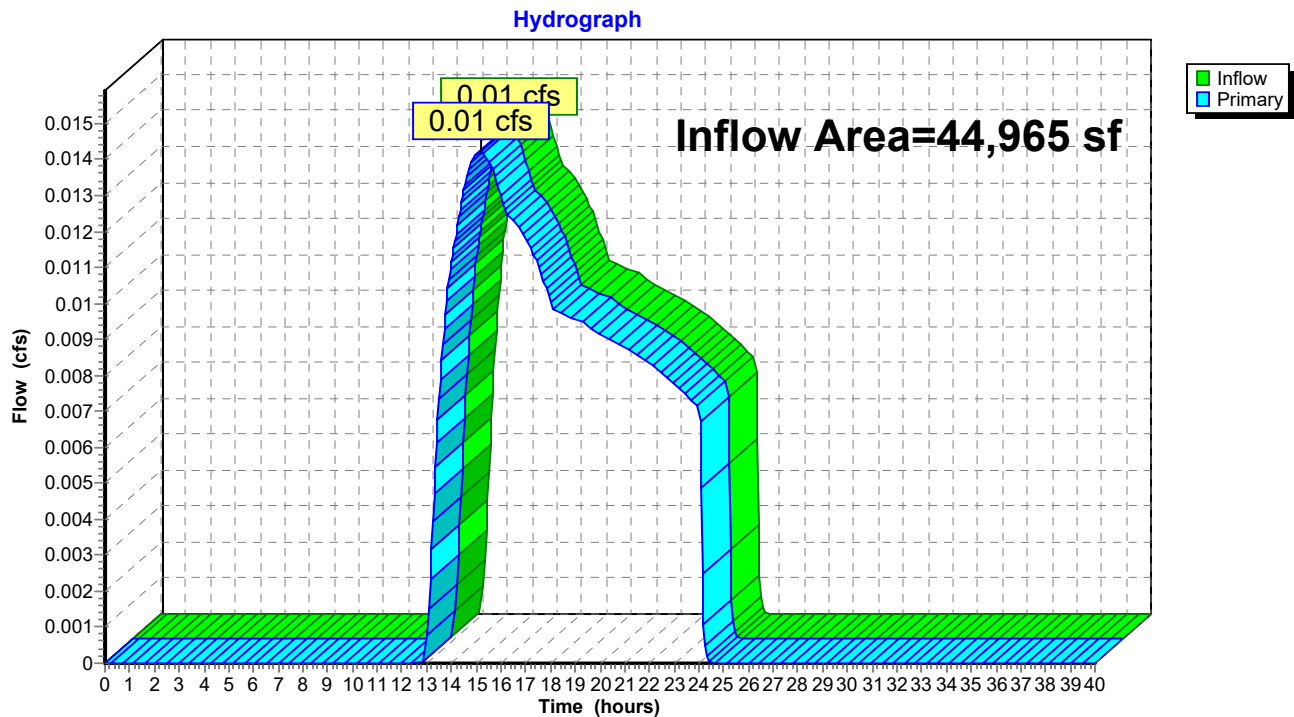
HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 41

Summary for Link 6L: Isolated Area #3

Inflow Area = 44,965 sf, 0.00% Impervious, Inflow Depth = 0.11" for 25-yr event
Inflow = 0.01 cfs @ 15.19 hrs, Volume= 396 cf
Primary = 0.01 cfs @ 15.19 hrs, Volume= 396 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 6L: Isolated Area #3

EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 42

Summary for Subcatchment 1S: EX-WETLANDS-EAST

Runoff = 0.51 cfs @ 12.71 hrs, Volume= 7,164 cf, Depth= 0.47"
 Routed to Link 1L : Flow to the Wetlands to the southeast

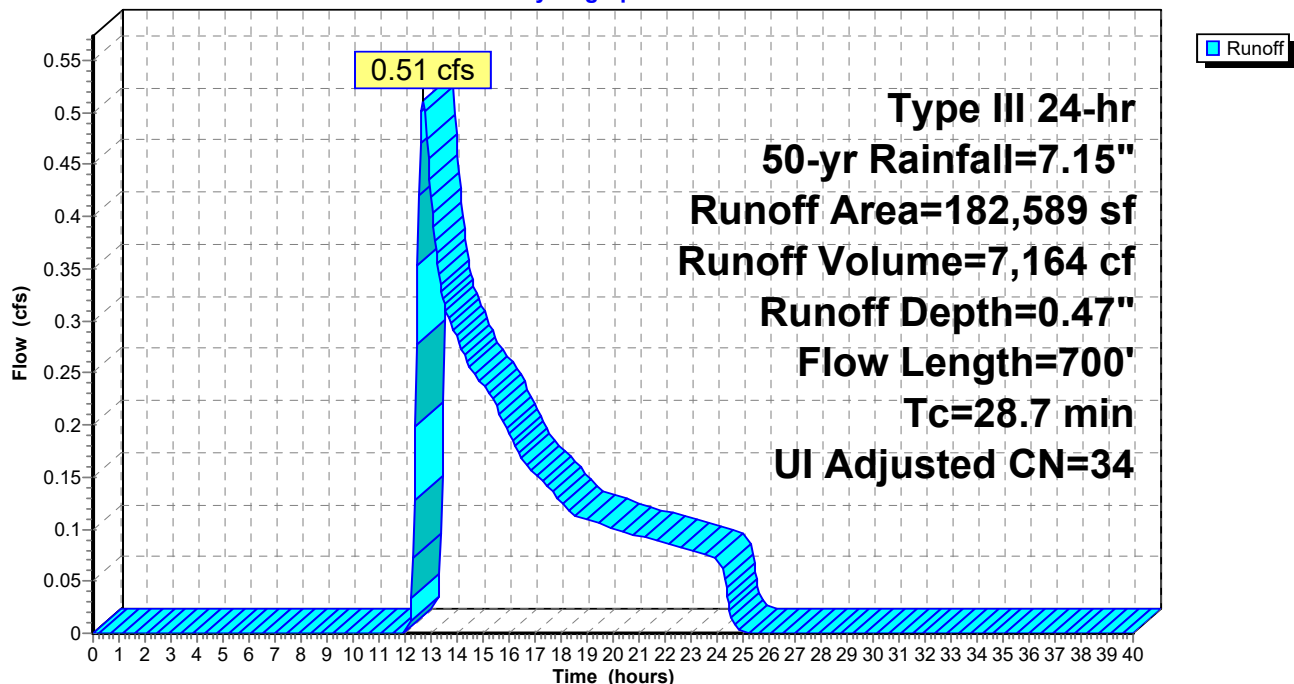
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 50-yr Rainfall=7.15"

Area (sf)	CN	Adj	Description
3,200	98		Unconnected roofs, HSG A
5,000	98		Paved parking, HSG A
40,000	39		>75% Grass cover, Good, HSG A
134,389	30		Woods, Good, HSG A
182,589	35	34	Weighted Average, UI Adjusted
174,389			95.51% Pervious Area
8,200			4.49% Impervious Area
3,200			39.02% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.2	50	0.0100	0.05		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
12.5	650	0.0300	0.87		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
28.7	700	Total			

Subcatchment 1S: EX-WETLANDS-EAST

Hydrograph



EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 43

Summary for Subcatchment 2S: EX-WETLANDS-NORTH

Runoff = 0.10 cfs @ 13.74 hrs, Volume= 2,712 cf, Depth= 0.24"
 Routed to Link 2L : Flow to the Wetlands to the north

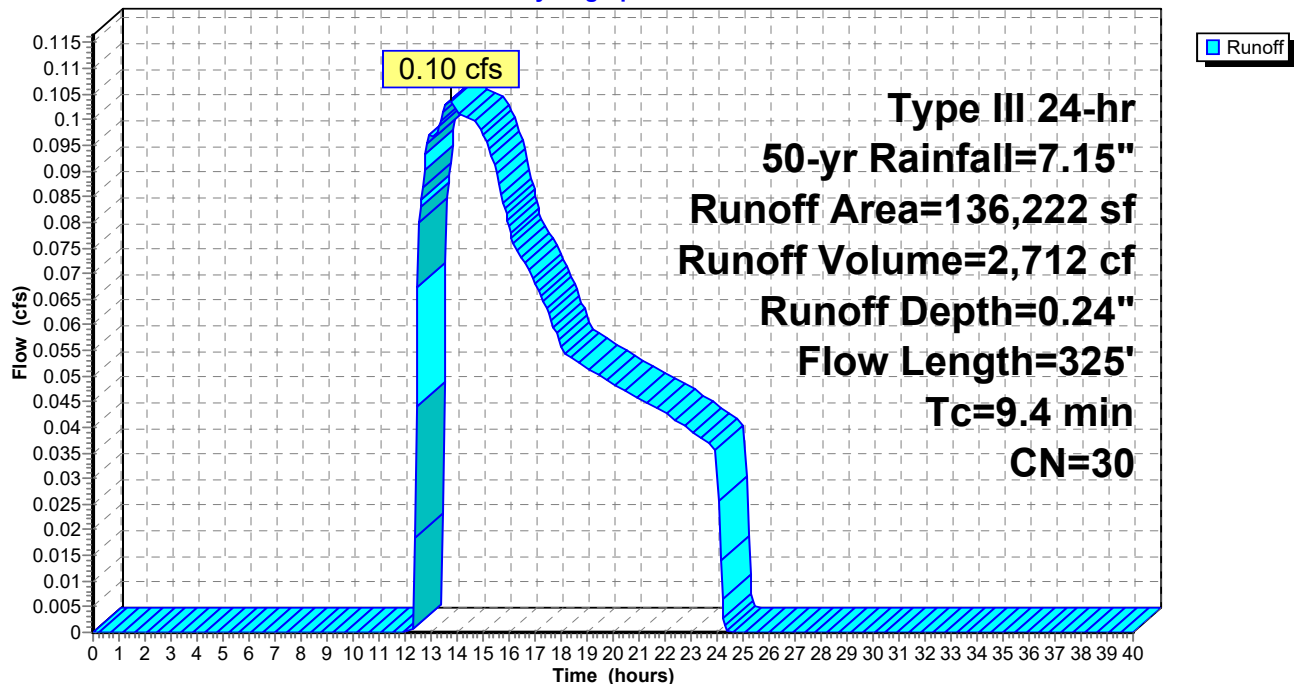
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 50-yr Rainfall=7.15"

Area (sf)	CN	Description
136,222	30	Woods, Good, HSG A
136,222		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0800	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
2.4	275	0.1500	1.94		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
9.4	325	Total			

Subcatchment 2S: EX-WETLANDS-NORTH

Hydrograph



EXISTING

Type III 24-hr 50-yr Rainfall=7.15"

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 44

Summary for Subcatchment 3S: EX-ABUTTERS

Runoff = 1.20 cfs @ 12.38 hrs, Volume= 9,016 cf, Depth= 0.82"
 Routed to Link 1L : Flow to the Wetlands to the southeast

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 50-yr Rainfall=7.15"

Area (sf)	CN	Adj	Description
5,000	98		Unconnected roofs, HSG A
5,000	98		Paved parking, HSG A
5,000	61		>75% Grass cover, Good, HSG B
55,000	39		>75% Grass cover, Good, HSG A
61,524	30		Woods, Good, HSG A
131,524	40	39	Weighted Average, UI Adjusted
121,524			92.40% Pervious Area
10,000			7.60% Impervious Area
5,000			50.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0800	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
8.7	450	0.0300	0.87		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
15.7	500	Total			

EXISTING

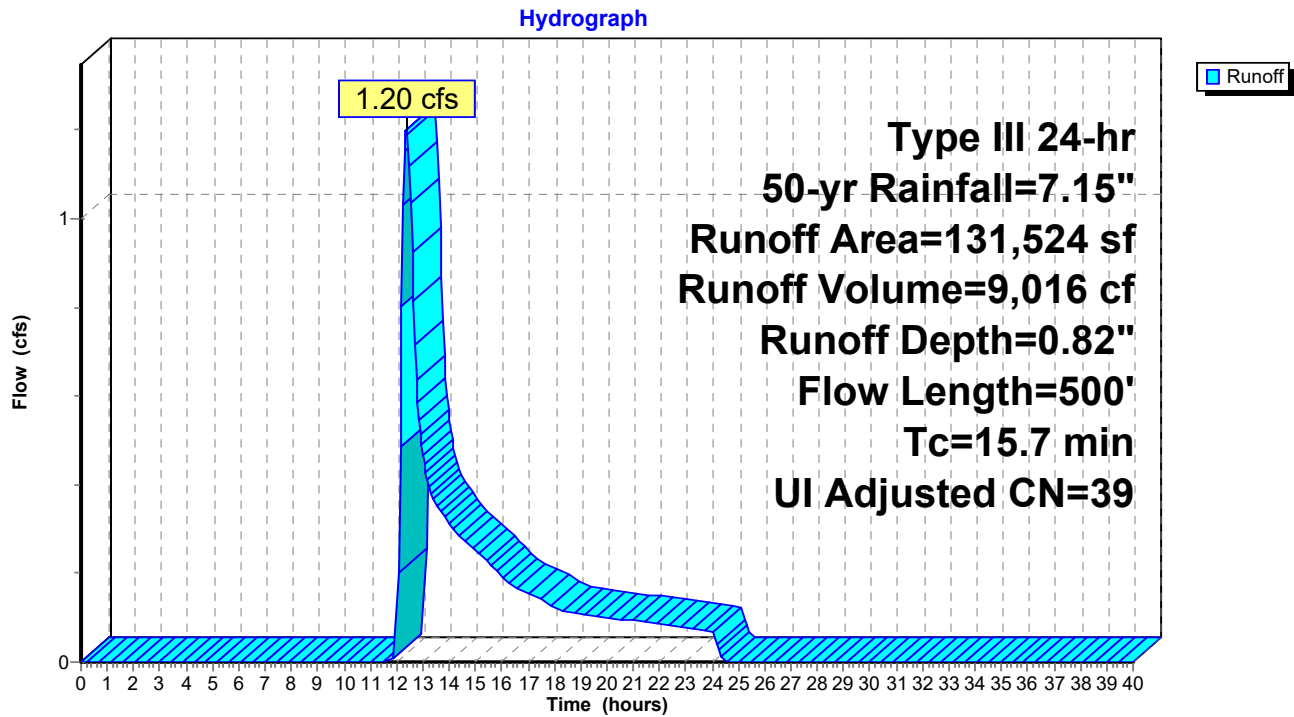
Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 45

Subcatchment 3S: EX-ABUTTERS



EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 46

Summary for Subcatchment 4S: EX-ISOLATED AREA 1

Runoff = 0.18 cfs @ 12.57 hrs, Volume= 3,827 cf, Depth= 0.29"
 Routed to Link 4L : Isolated Area #1

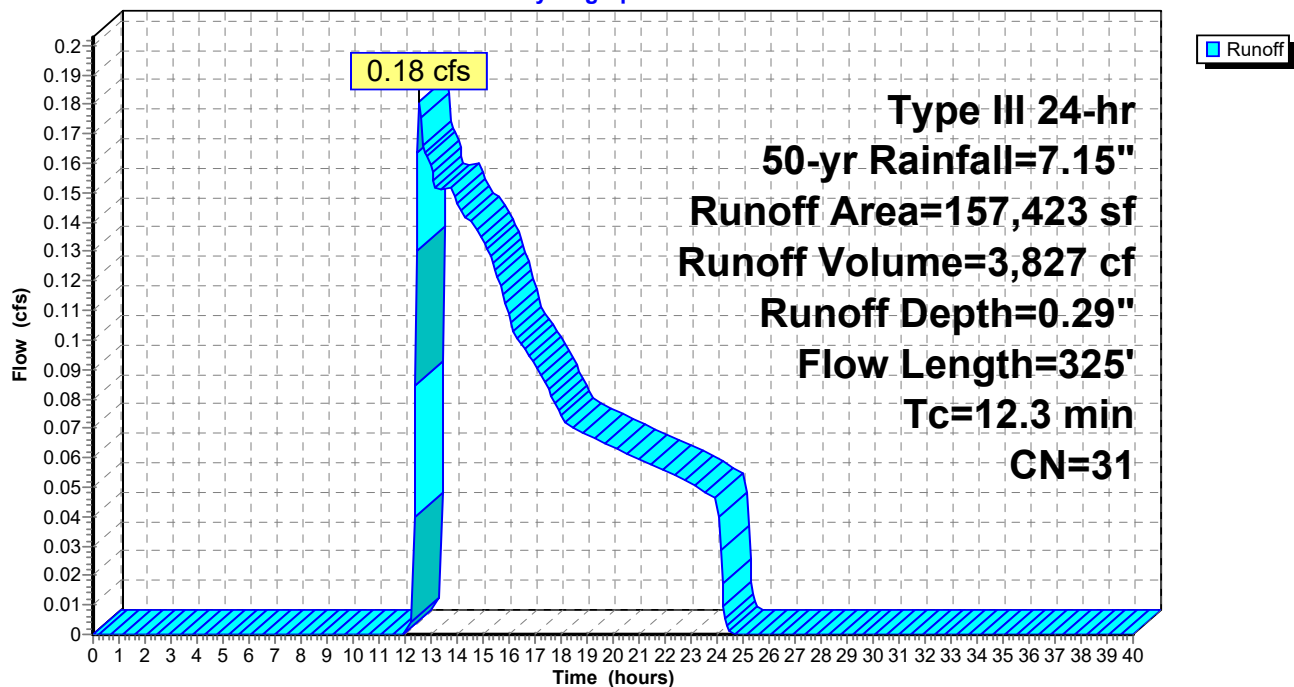
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 50-yr Rainfall=7.15"

Area (sf)	CN	Description
153,803	30	Woods, Good, HSG A
3,620	55	Woods, Good, HSG B
157,423	31	Weighted Average
157,423		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0800	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
5.3	275	0.0300	0.87		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
12.3	325	Total			

Subcatchment 4S: EX-ISOLATED AREA 1

Hydrograph



EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 47

Summary for Subcatchment 5S: EX-ISOLATED AREA 2

Runoff = 0.05 cfs @ 13.74 hrs, Volume= 1,328 cf, Depth= 0.24"
 Routed to Link 5L : Isolated Area #2

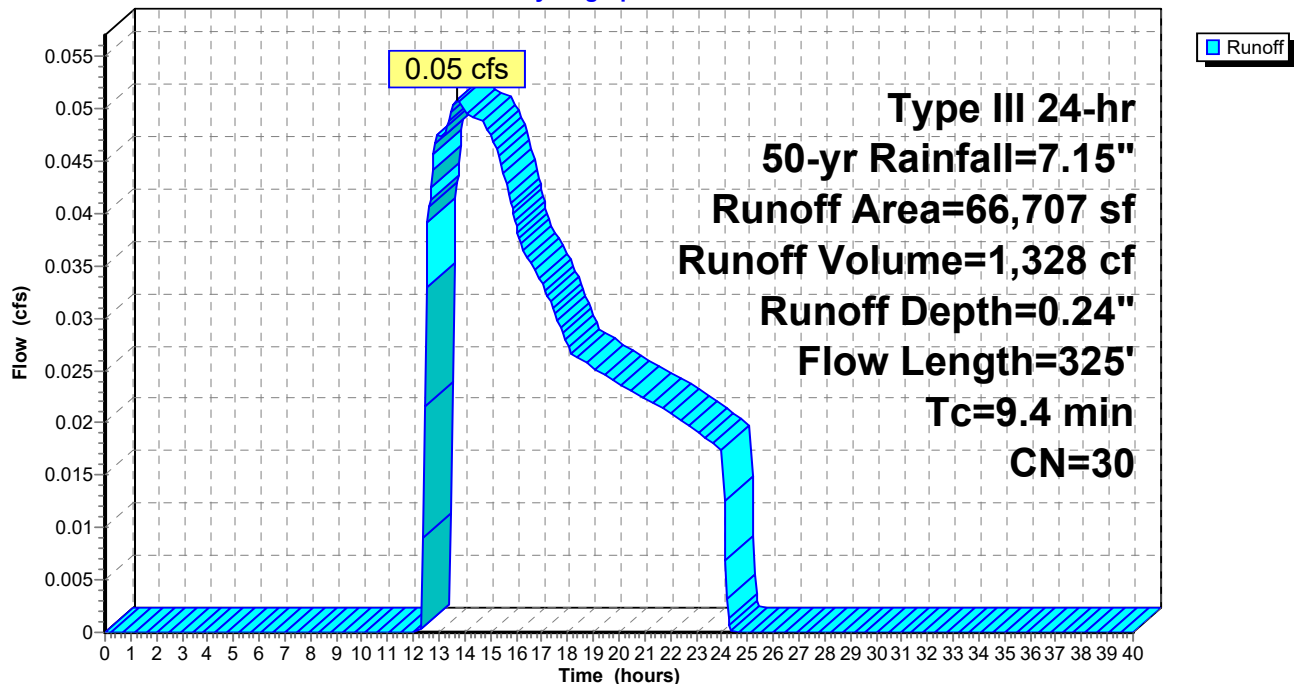
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 50-yr Rainfall=7.15"

Area (sf)	CN	Description
66,707	30	Woods, Good, HSG A
66,707		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0800	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
2.4	275	0.1500	1.94		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
9.4	325	Total			

Subcatchment 5S: EX-ISOLATED AREA 2

Hydrograph



EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 48

Summary for Subcatchment 6S: EX-ISOLATED AREA 3

Runoff = 0.03 cfs @ 13.72 hrs, Volume= 895 cf, Depth= 0.24"
 Routed to Link 6L : Isolated Area #3

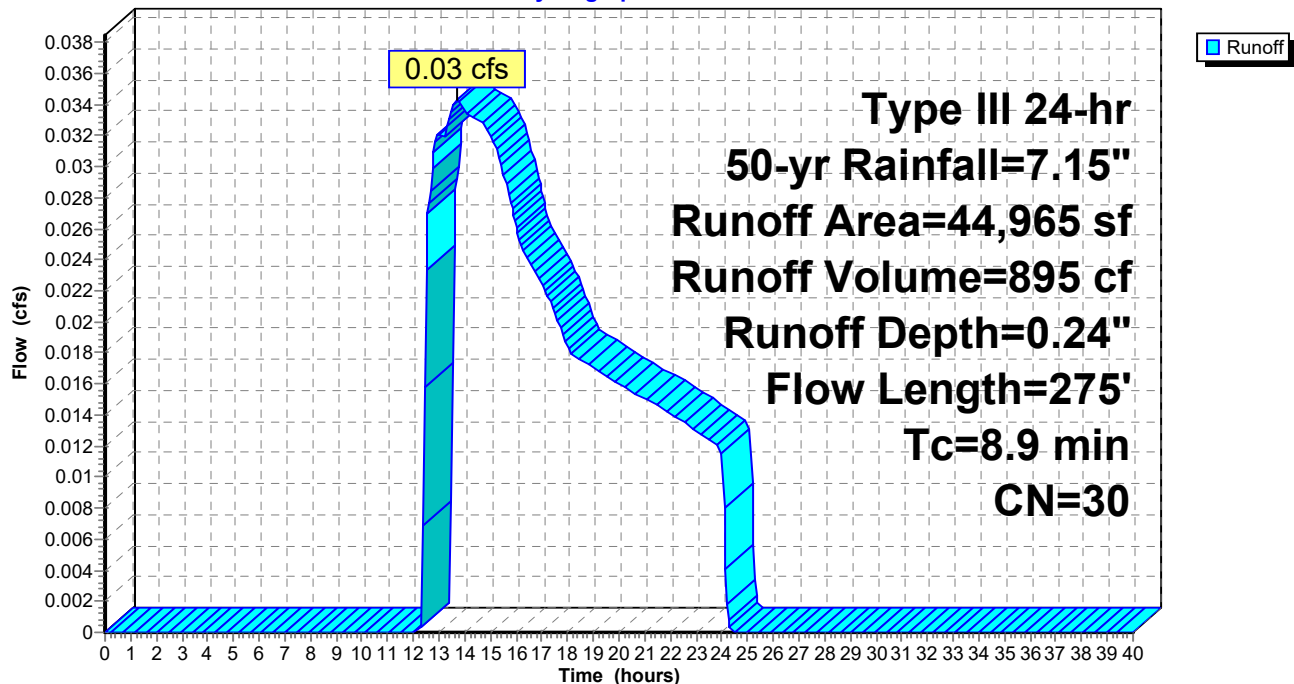
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 50-yr Rainfall=7.15"

Area (sf)	CN	Description
44,965	30	Woods, Good, HSG A
44,965		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0800	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
1.9	225	0.1500	1.94		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
8.9	275	Total			

Subcatchment 6S: EX-ISOLATED AREA 3

Hydrograph



EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

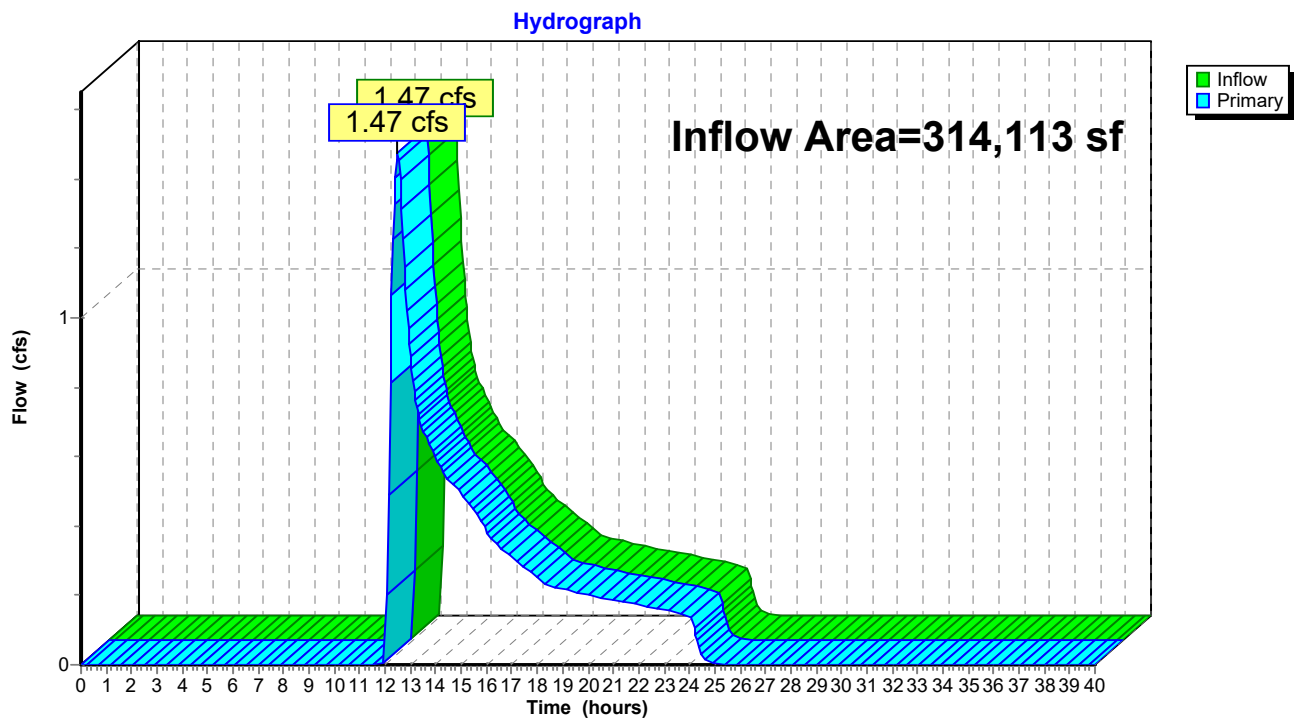
HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 49

Summary for Link 1L: Flow to the Wetlands to the southeast

Inflow Area = 314,113 sf, 5.79% Impervious, Inflow Depth = 0.62" for 50-yr event
Inflow = 1.47 cfs @ 12.50 hrs, Volume= 16,180 cf
Primary = 1.47 cfs @ 12.50 hrs, Volume= 16,180 cf, Atten= 0%, Lag= 0.0 min
Routed to Link 3L : Total flow discharging from limit of watershed analysis

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 1L: Flow to the Wetlands to the southeast

EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

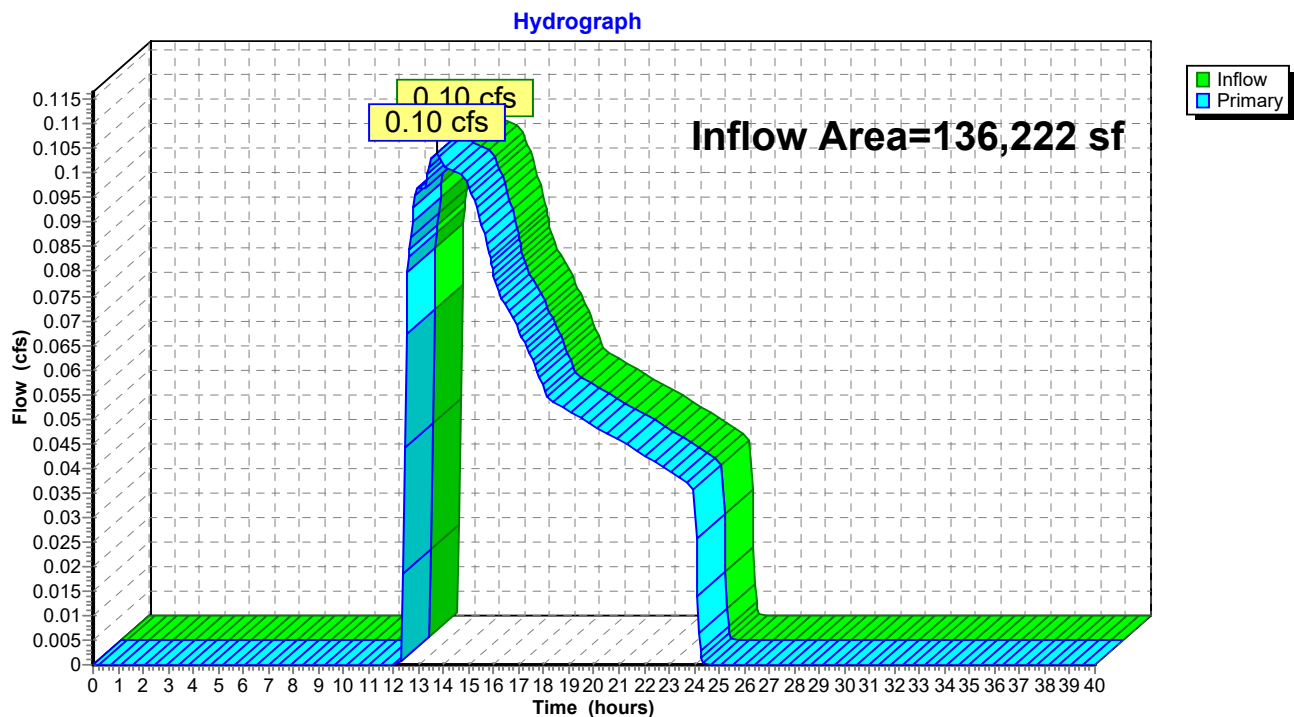
HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 50

Summary for Link 2L: Flow to the Wetlands to the north

Inflow Area = 136,222 sf, 0.00% Impervious, Inflow Depth = 0.24" for 50-yr event
Inflow = 0.10 cfs @ 13.74 hrs, Volume= 2,712 cf
Primary = 0.10 cfs @ 13.74 hrs, Volume= 2,712 cf, Atten= 0%, Lag= 0.0 min
Routed to Link 3L : Total flow discharging from limit of watershed analysis

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 2L: Flow to the Wetlands to the north

EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

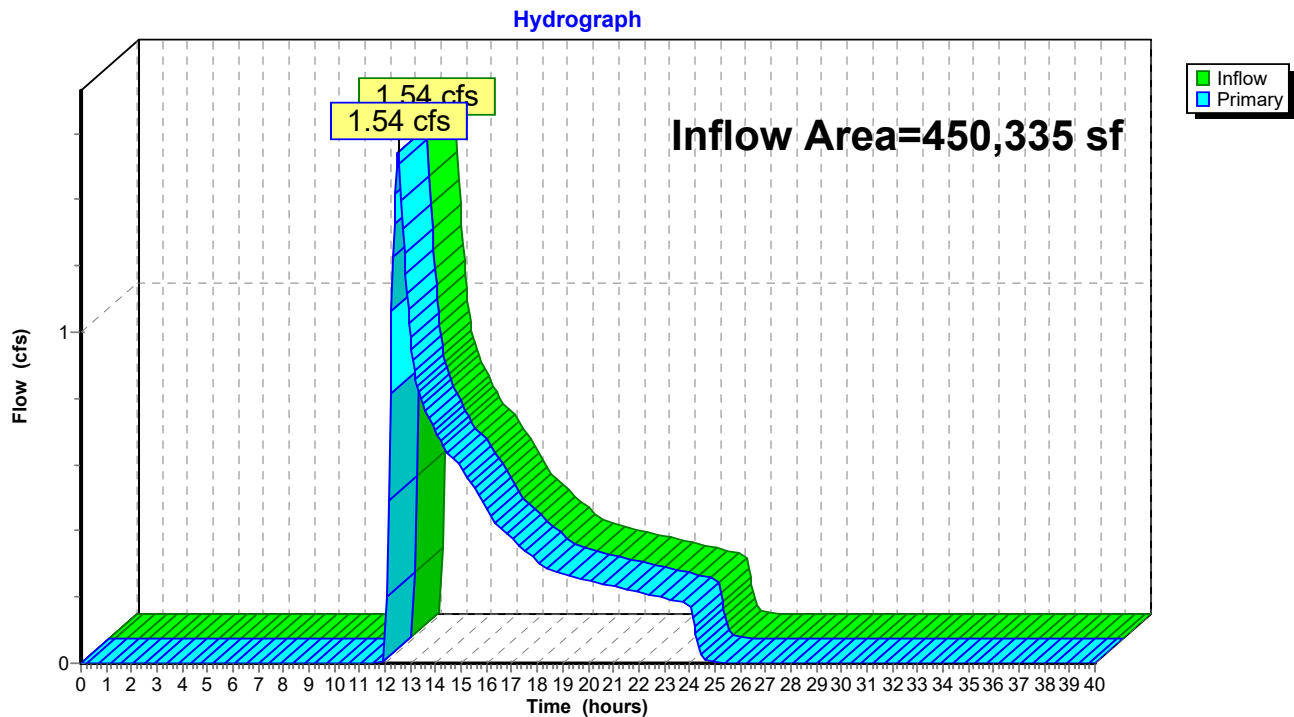
HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 51

Summary for Link 3L: Total flow discharging from limit of watershed analysis

Inflow Area = 450,335 sf, 4.04% Impervious, Inflow Depth = 0.50" for 50-yr event
Inflow = 1.54 cfs @ 12.52 hrs, Volume= 18,891 cf
Primary = 1.54 cfs @ 12.52 hrs, Volume= 18,891 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 3L: Total flow discharging from limit of watershed analysis

EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 52

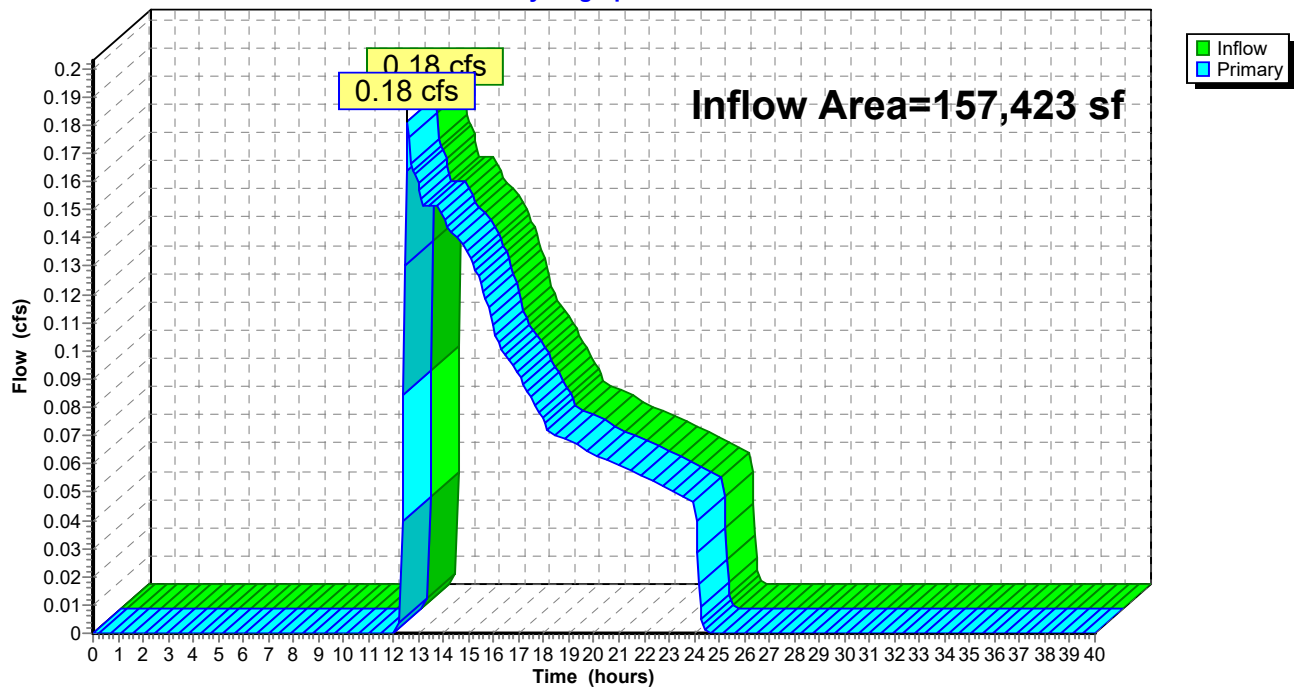
Summary for Link 4L: Isolated Area #1

Inflow Area = 157,423 sf, 0.00% Impervious, Inflow Depth = 0.29" for 50-yr event
Inflow = 0.18 cfs @ 12.57 hrs, Volume= 3,827 cf
Primary = 0.18 cfs @ 12.57 hrs, Volume= 3,827 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 4L: Isolated Area #1

Hydrograph



EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

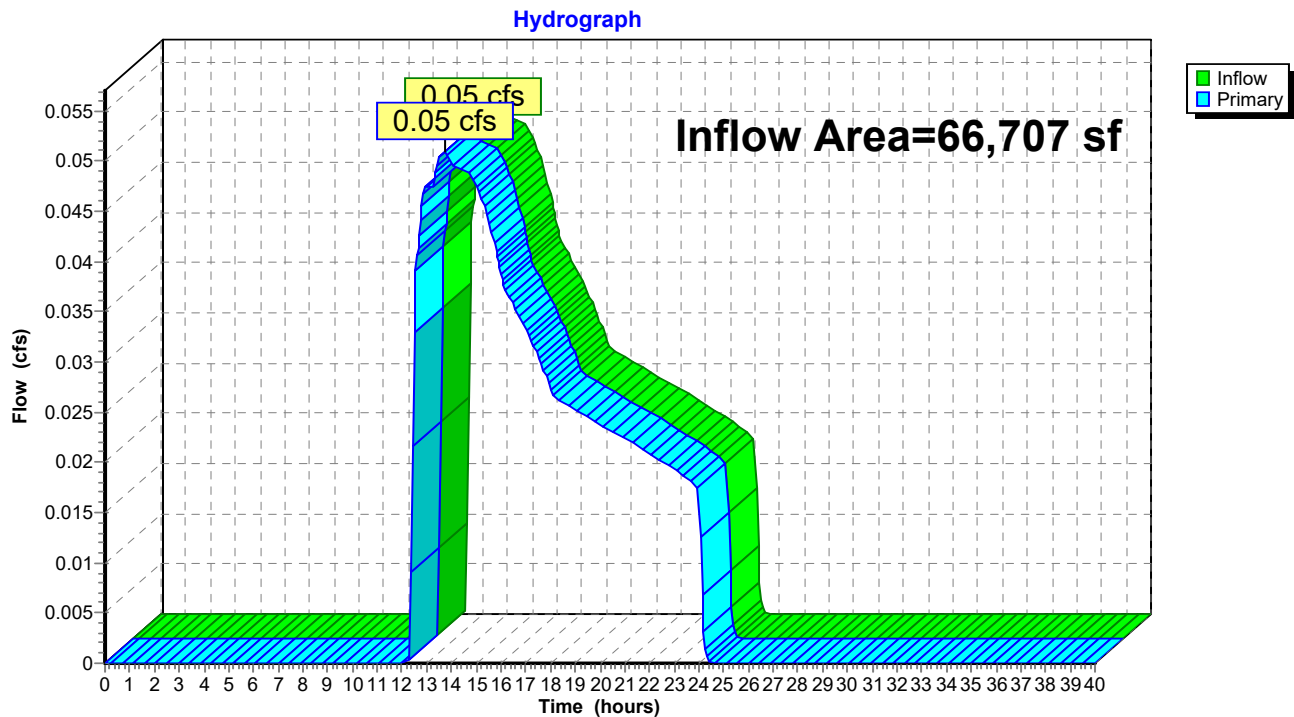
HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 53

Summary for Link 5L: Isolated Area #2

Inflow Area = 66,707 sf, 0.00% Impervious, Inflow Depth = 0.24" for 50-yr event
Inflow = 0.05 cfs @ 13.74 hrs, Volume= 1,328 cf
Primary = 0.05 cfs @ 13.74 hrs, Volume= 1,328 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 5L: Isolated Area #2

EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

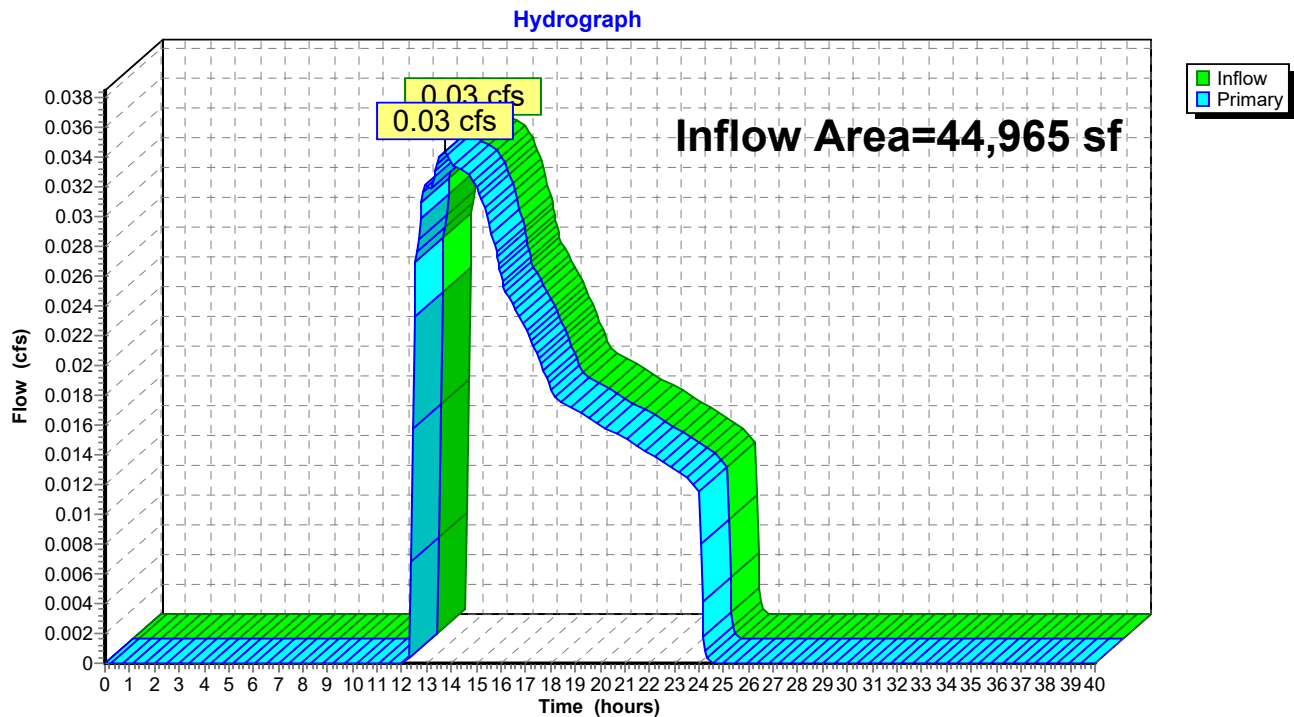
HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 54

Summary for Link 6L: Isolated Area #3

Inflow Area = 44,965 sf, 0.00% Impervious, Inflow Depth = 0.24" for 50-yr event
Inflow = 0.03 cfs @ 13.72 hrs, Volume= 895 cf
Primary = 0.03 cfs @ 13.72 hrs, Volume= 895 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 6L: Isolated Area #3

EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 55

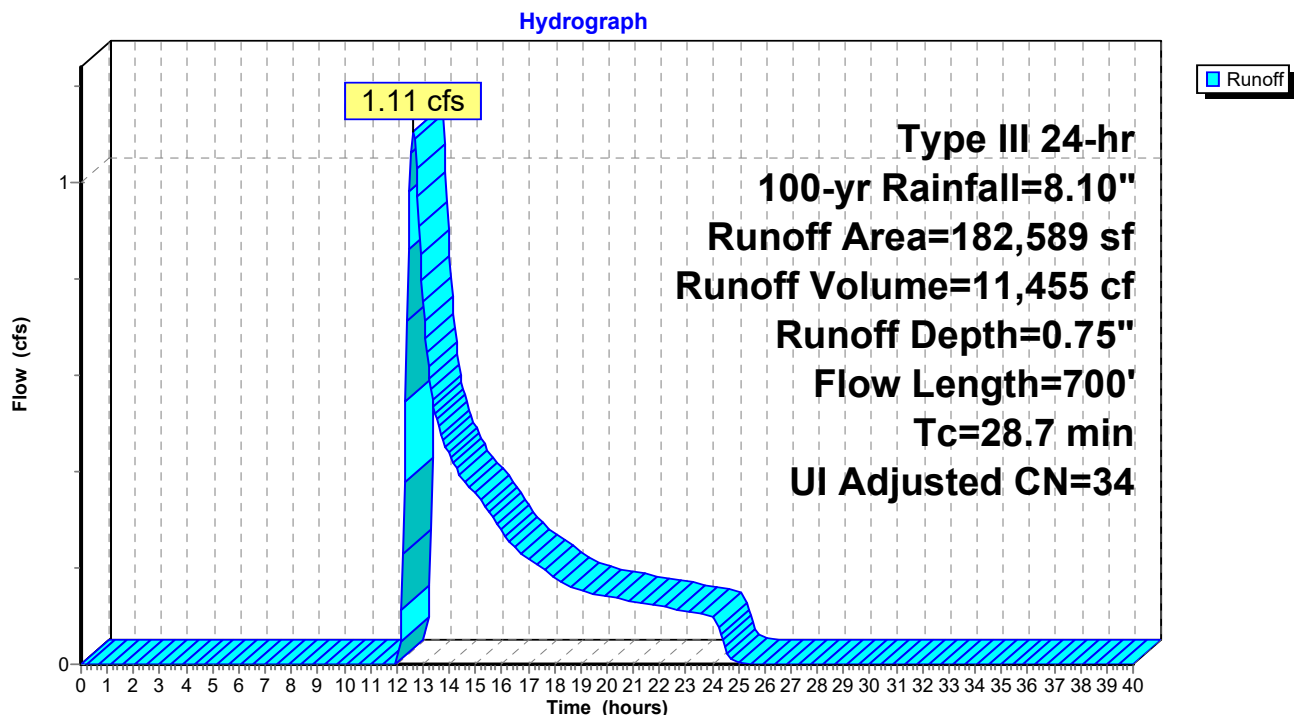
Summary for Subcatchment 1S: EX-WETLANDS-EAST

Runoff = 1.11 cfs @ 12.63 hrs, Volume= 11,455 cf, Depth= 0.75"
 Routed to Link 1L : Flow to the Wetlands to the southeast

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100-yr Rainfall=8.10"

Area (sf)	CN	Adj	Description
3,200	98		Unconnected roofs, HSG A
5,000	98		Paved parking, HSG A
40,000	39		>75% Grass cover, Good, HSG A
134,389	30		Woods, Good, HSG A
182,589	35	34	Weighted Average, UI Adjusted
174,389			95.51% Pervious Area
8,200			4.49% Impervious Area
3,200			39.02% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.2	50	0.0100	0.05		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
12.5	650	0.0300	0.87		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
28.7	700	Total			

Subcatchment 1S: EX-WETLANDS-EAST

EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 56

Summary for Subcatchment 2S: EX-WETLANDS-NORTH

Runoff = 0.39 cfs @ 12.46 hrs, Volume= 4,999 cf, Depth= 0.44"
 Routed to Link 2L : Flow to the Wetlands to the north

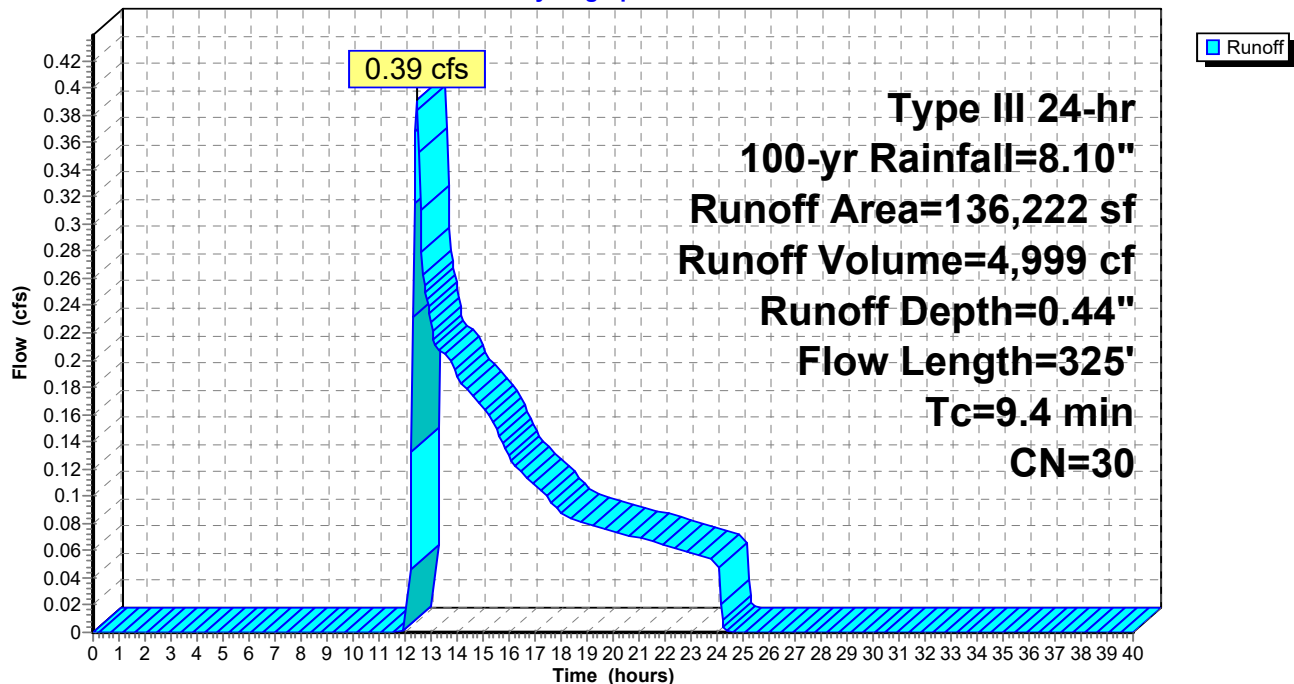
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100-yr Rainfall=8.10"

Area (sf)	CN	Description
136,222	30	Woods, Good, HSG A
136,222		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0800	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
2.4	275	0.1500	1.94		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
9.4	325	Total			

Subcatchment 2S: EX-WETLANDS-NORTH

Hydrograph



EXISTING

Type III 24-hr 100-yr Rainfall=8.10"

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 57

Summary for Subcatchment 3S: EX-ABUTTERS

Runoff = 2.10 cfs @ 12.31 hrs, Volume= 13,144 cf, Depth= 1.20"
 Routed to Link 1L : Flow to the Wetlands to the southeast

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100-yr Rainfall=8.10"

Area (sf)	CN	Adj	Description
5,000	98		Unconnected roofs, HSG A
5,000	98		Paved parking, HSG A
5,000	61		>75% Grass cover, Good, HSG B
55,000	39		>75% Grass cover, Good, HSG A
61,524	30		Woods, Good, HSG A
131,524	40	39	Weighted Average, UI Adjusted
121,524			92.40% Pervious Area
10,000			7.60% Impervious Area
5,000			50.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0800	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
8.7	450	0.0300	0.87		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
15.7	500	Total			

EXISTING

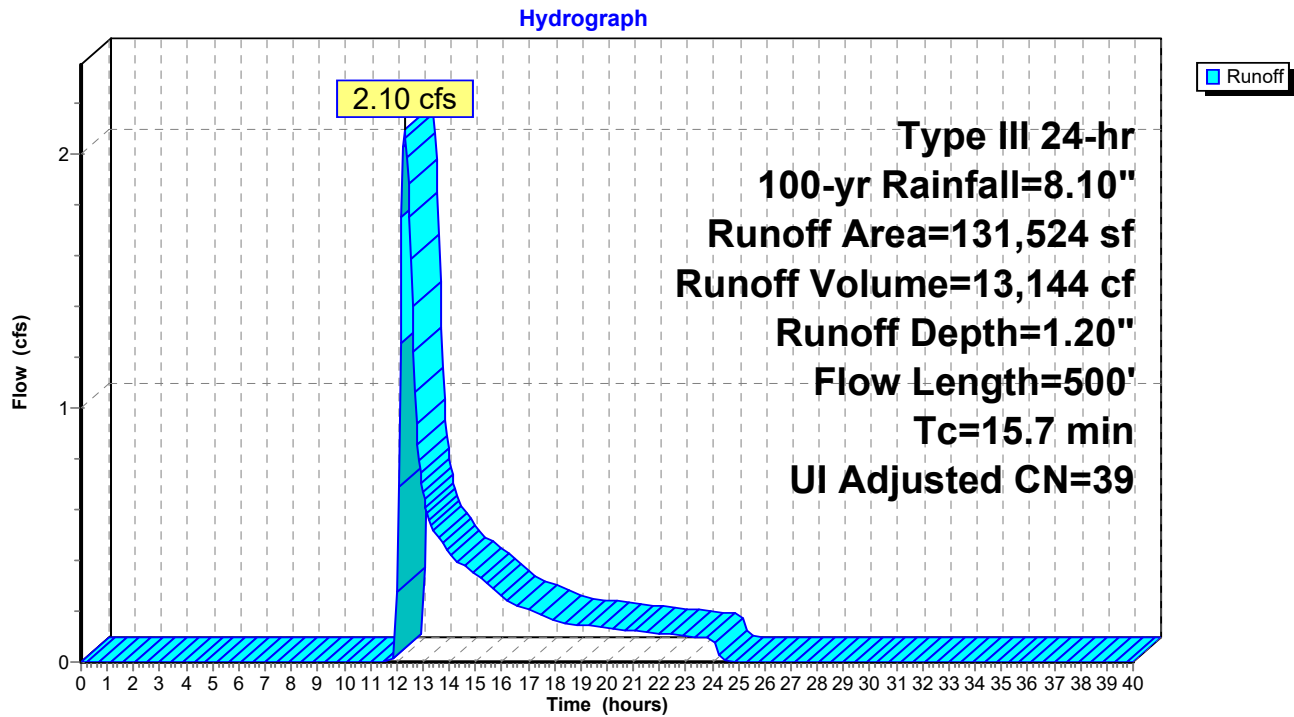
Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 58

Subcatchment 3S: EX-ABUTTERS



EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 59

Summary for Subcatchment 4S: EX-ISOLATED AREA 1

Runoff = 0.60 cfs @ 12.48 hrs, Volume= 6,740 cf, Depth= 0.51"
 Routed to Link 4L : Isolated Area #1

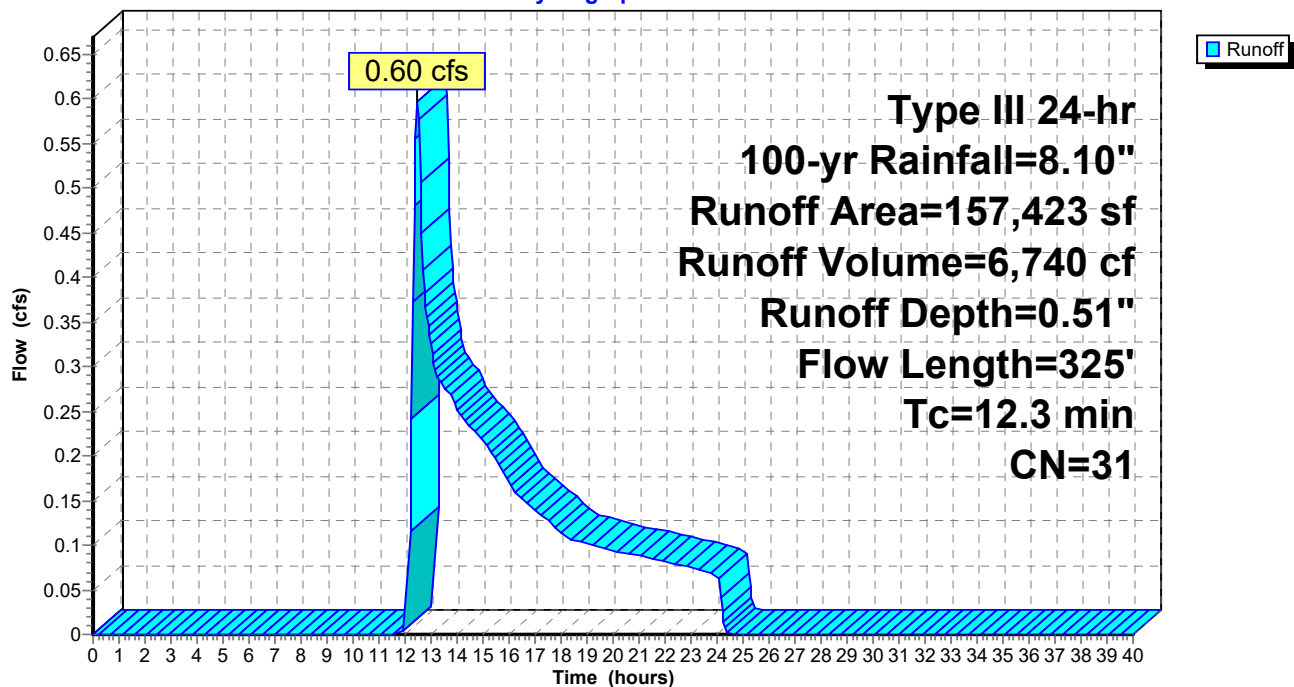
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100-yr Rainfall=8.10"

Area (sf)	CN	Description
153,803	30	Woods, Good, HSG A
3,620	55	Woods, Good, HSG B
157,423	31	Weighted Average
157,423		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0800	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
5.3	275	0.0300	0.87		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
12.3	325	Total			

Subcatchment 4S: EX-ISOLATED AREA 1

Hydrograph



EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 60

Summary for Subcatchment 5S: EX-ISOLATED AREA 2

Runoff = 0.19 cfs @ 12.46 hrs, Volume= 2,448 cf, Depth= 0.44"
 Routed to Link 5L : Isolated Area #2

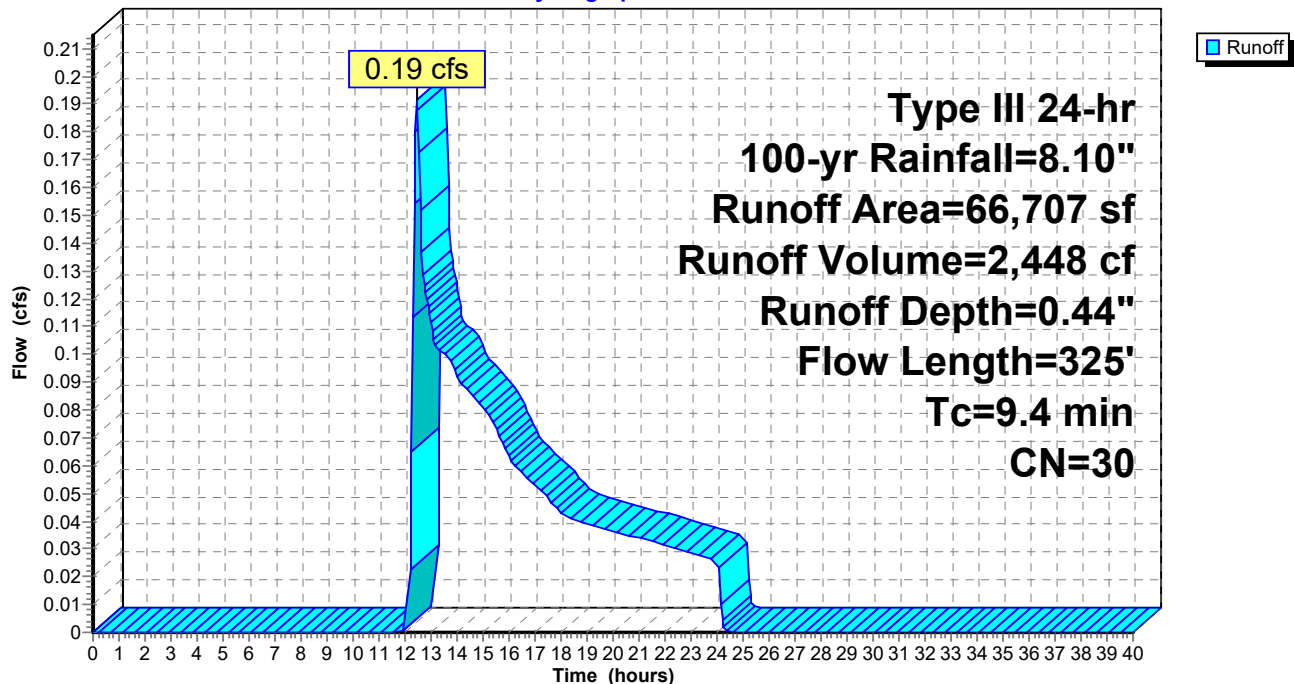
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100-yr Rainfall=8.10"

Area (sf)	CN	Description
66,707	30	Woods, Good, HSG A
66,707		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0800	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
2.4	275	0.1500	1.94		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
9.4	325	Total			

Subcatchment 5S: EX-ISOLATED AREA 2

Hydrograph



EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 61

Summary for Subcatchment 6S: EX-ISOLATED AREA 3

Runoff = 0.13 cfs @ 12.46 hrs, Volume= 1,650 cf, Depth= 0.44"
 Routed to Link 6L : Isolated Area #3

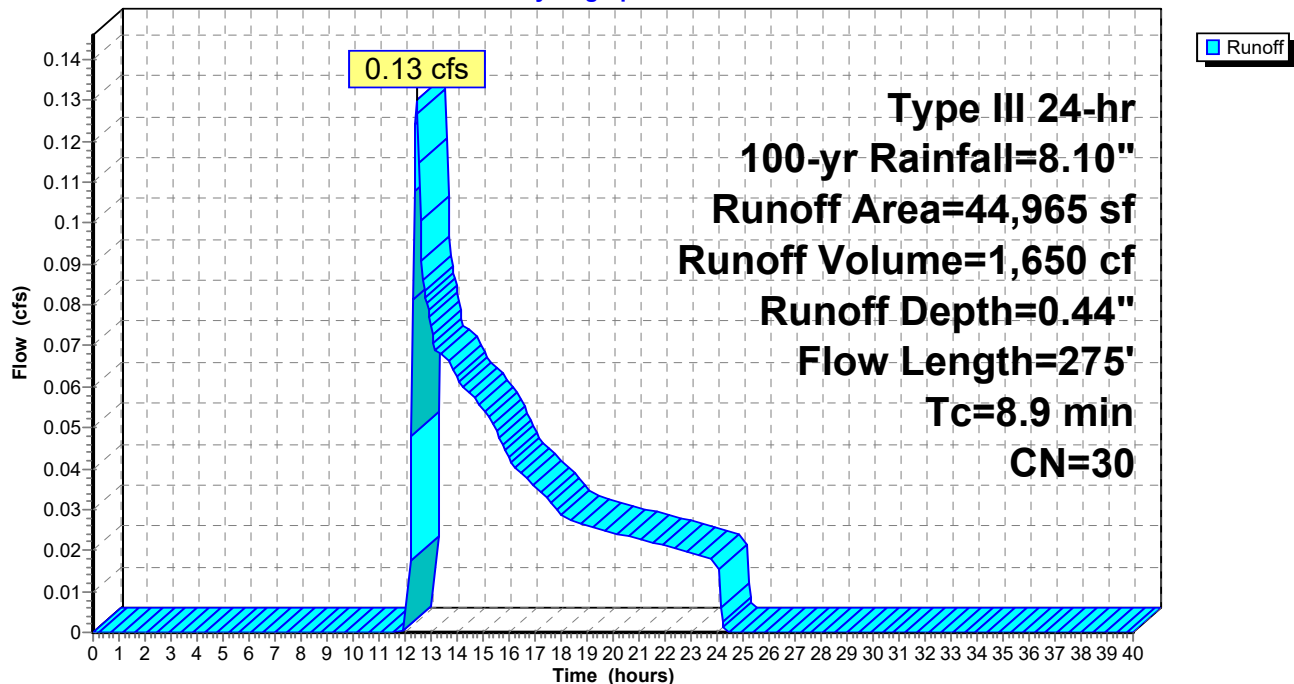
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100-yr Rainfall=8.10"

Area (sf)	CN	Description
44,965	30	Woods, Good, HSG A
44,965		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0800	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
1.9	225	0.1500	1.94		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
8.9	275	Total			

Subcatchment 6S: EX-ISOLATED AREA 3

Hydrograph



EXISTING

Prepared by Williams & Sparages

Type III 24-hr 100-yr Rainfall=8.10"

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

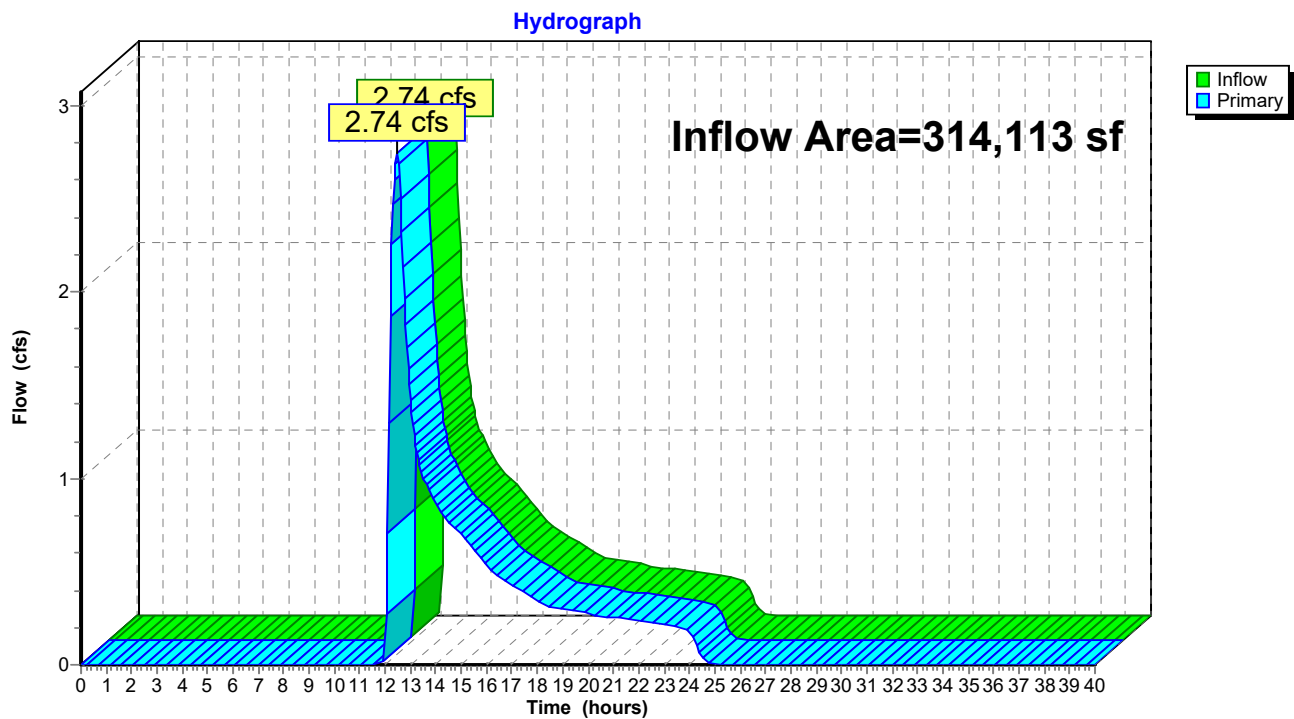
Page 62

Summary for Link 1L: Flow to the Wetlands to the southeast

Inflow Area = 314,113 sf, 5.79% Impervious, Inflow Depth = 0.94" for 100-yr event
 Inflow = 2.74 cfs @ 12.47 hrs, Volume= 24,598 cf
 Primary = 2.74 cfs @ 12.47 hrs, Volume= 24,598 cf, Atten= 0%, Lag= 0.0 min
 Routed to Link 3L : Total flow discharging from limit of watershed analysis

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 1L: Flow to the Wetlands to the southeast



EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

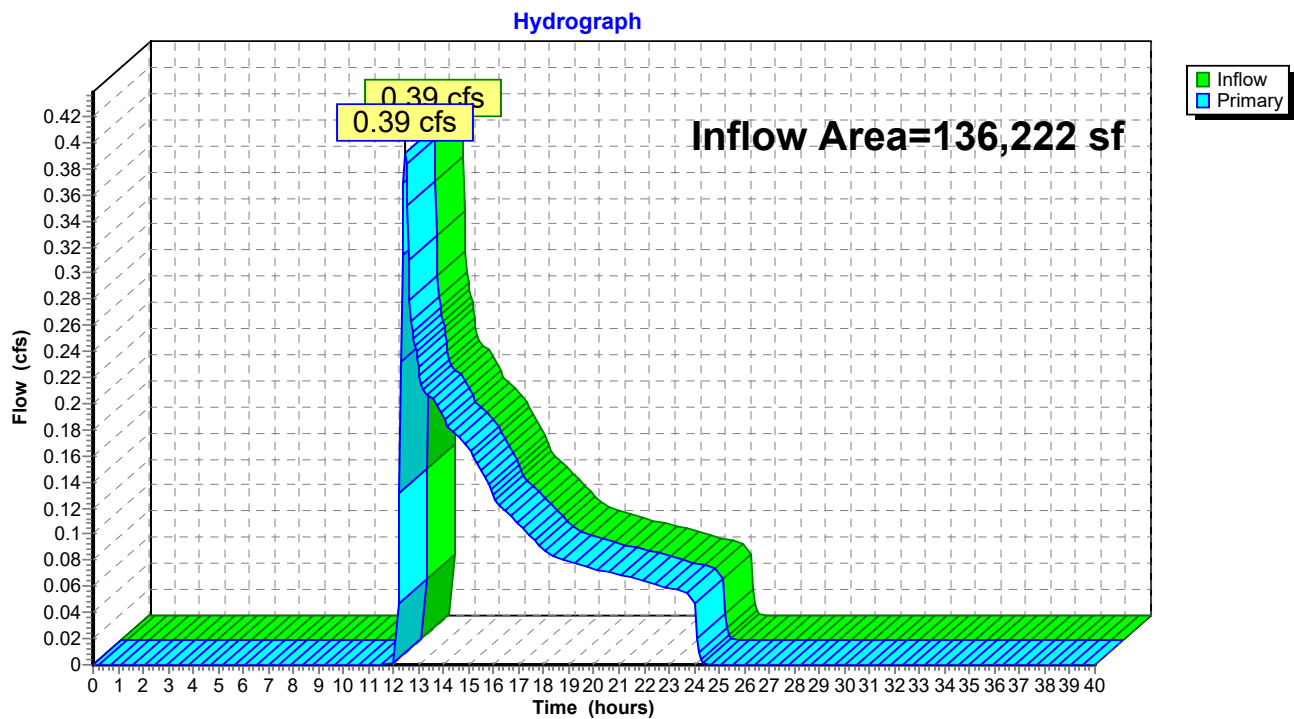
HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 63

Summary for Link 2L: Flow to the Wetlands to the north

Inflow Area = 136,222 sf, 0.00% Impervious, Inflow Depth = 0.44" for 100-yr event
Inflow = 0.39 cfs @ 12.46 hrs, Volume= 4,999 cf
Primary = 0.39 cfs @ 12.46 hrs, Volume= 4,999 cf, Atten= 0%, Lag= 0.0 min
Routed to Link 3L : Total flow discharging from limit of watershed analysis

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 2L: Flow to the Wetlands to the north

EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

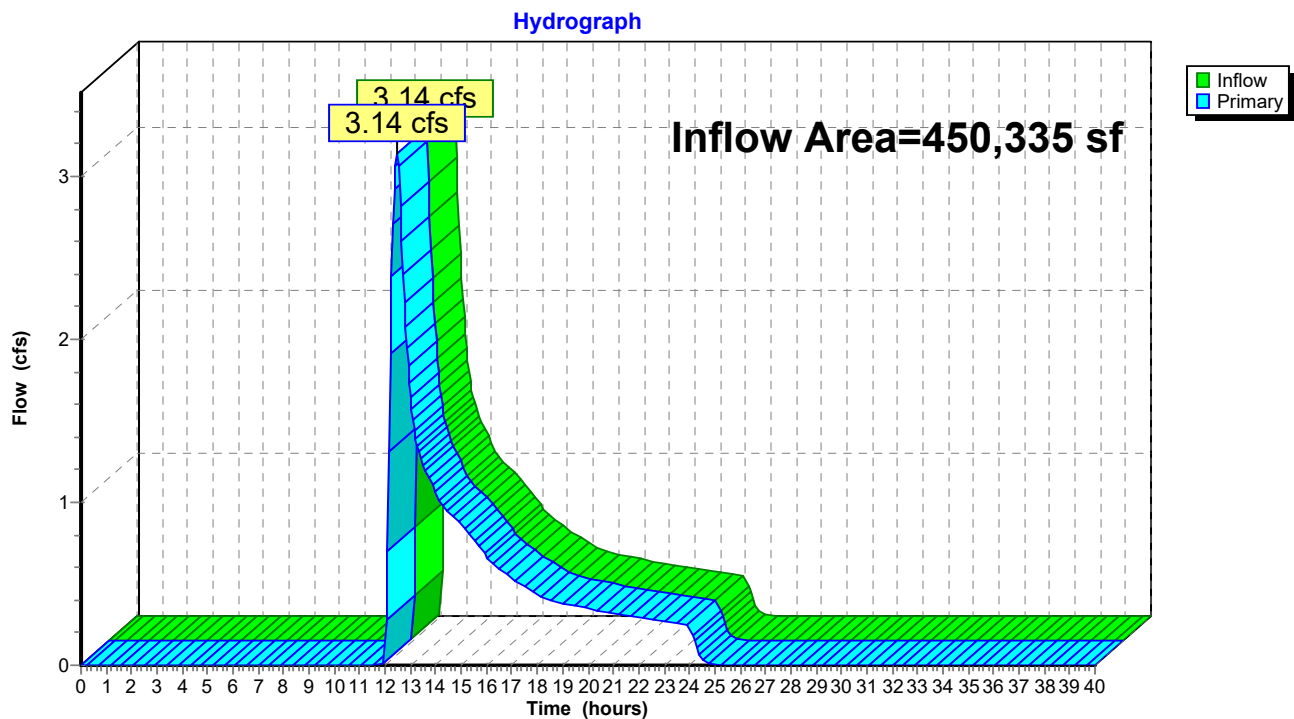
HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 64

Summary for Link 3L: Total flow discharging from limit of watershed analysis

Inflow Area = 450,335 sf, 4.04% Impervious, Inflow Depth = 0.79" for 100-yr event
Inflow = 3.14 cfs @ 12.46 hrs, Volume= 29,597 cf
Primary = 3.14 cfs @ 12.46 hrs, Volume= 29,597 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 3L: Total flow discharging from limit of watershed analysis

EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

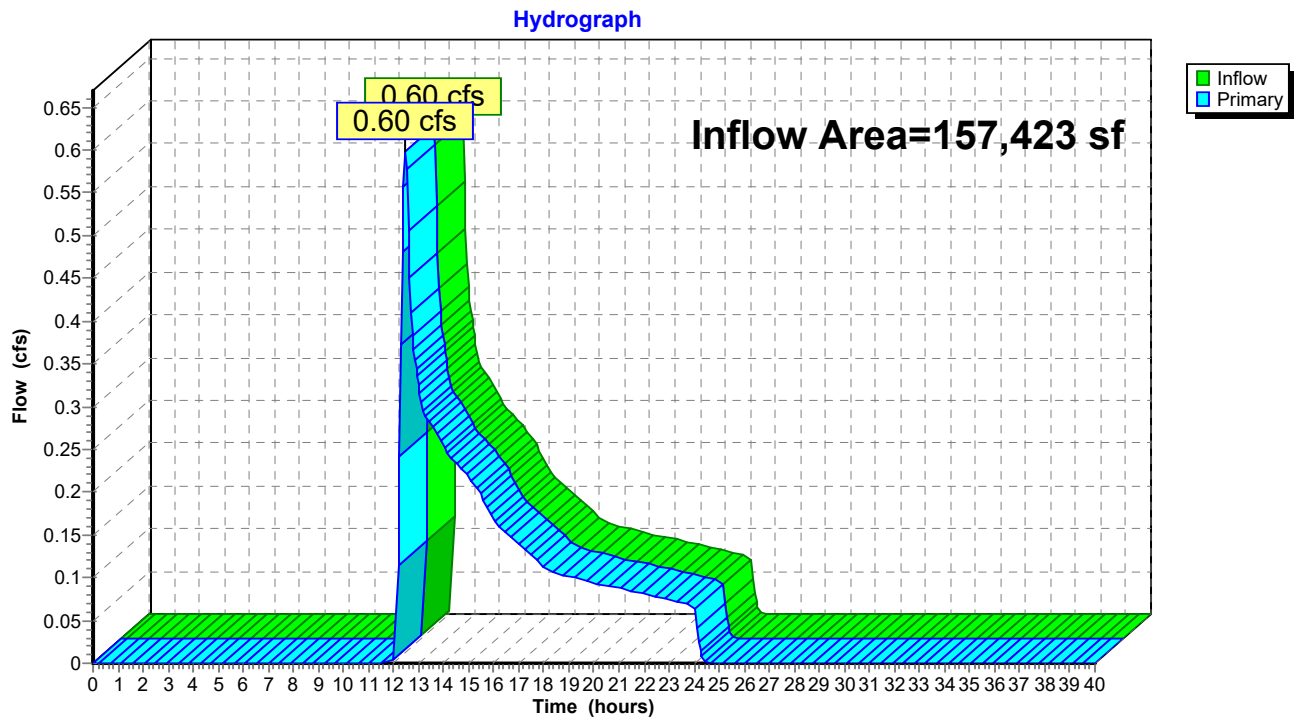
HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 65

Summary for Link 4L: Isolated Area #1

Inflow Area = 157,423 sf, 0.00% Impervious, Inflow Depth = 0.51" for 100-yr event
Inflow = 0.60 cfs @ 12.48 hrs, Volume= 6,740 cf
Primary = 0.60 cfs @ 12.48 hrs, Volume= 6,740 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 4L: Isolated Area #1

EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 66

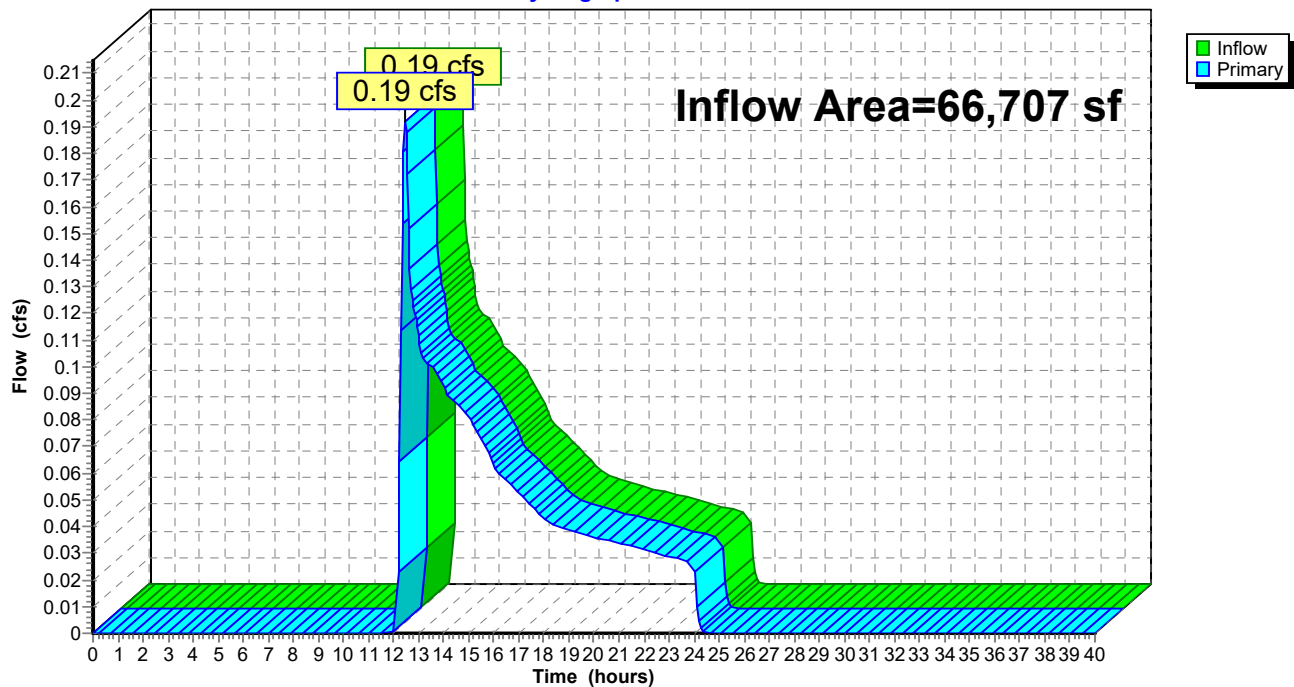
Summary for Link 5L: Isolated Area #2

Inflow Area = 66,707 sf, 0.00% Impervious, Inflow Depth = 0.44" for 100-yr event
Inflow = 0.19 cfs @ 12.46 hrs, Volume= 2,448 cf
Primary = 0.19 cfs @ 12.46 hrs, Volume= 2,448 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 5L: Isolated Area #2

Hydrograph



EXISTING

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 67

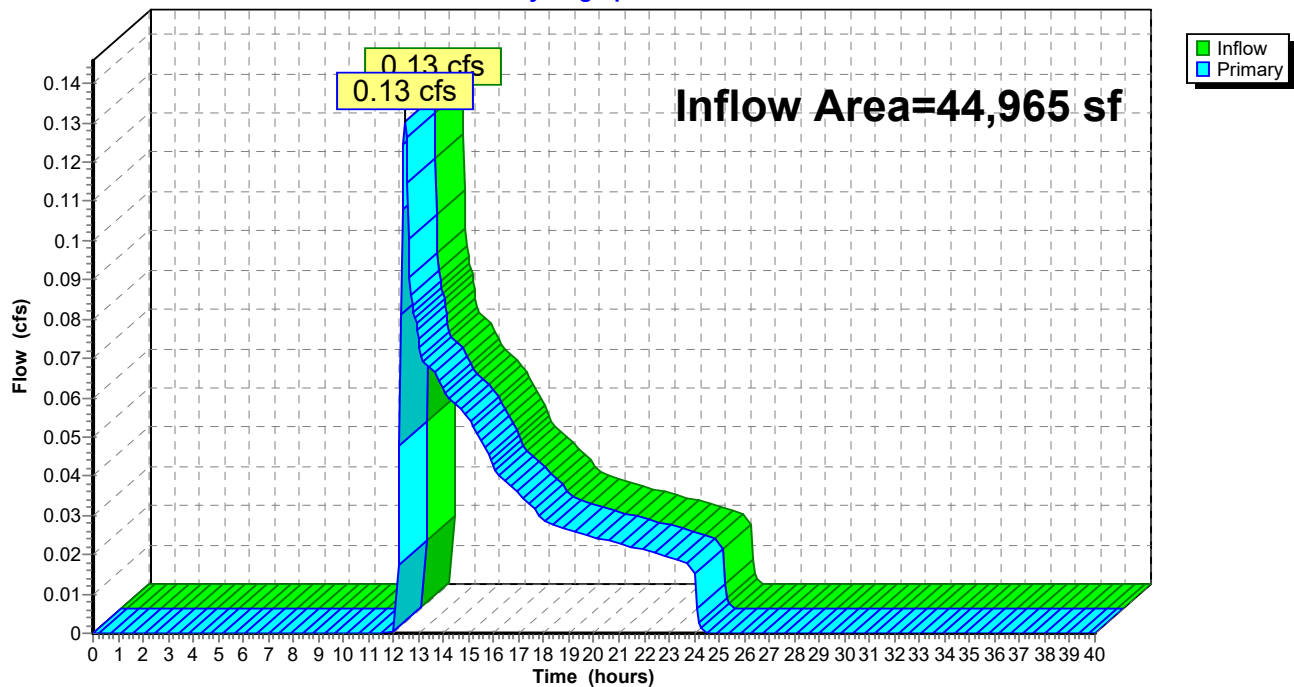
Summary for Link 6L: Isolated Area #3

Inflow Area = 44,965 sf, 0.00% Impervious, Inflow Depth = 0.44" for 100-yr event
Inflow = 0.13 cfs @ 12.46 hrs, Volume= 1,650 cf
Primary = 0.13 cfs @ 12.46 hrs, Volume= 1,650 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

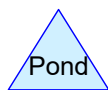
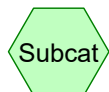
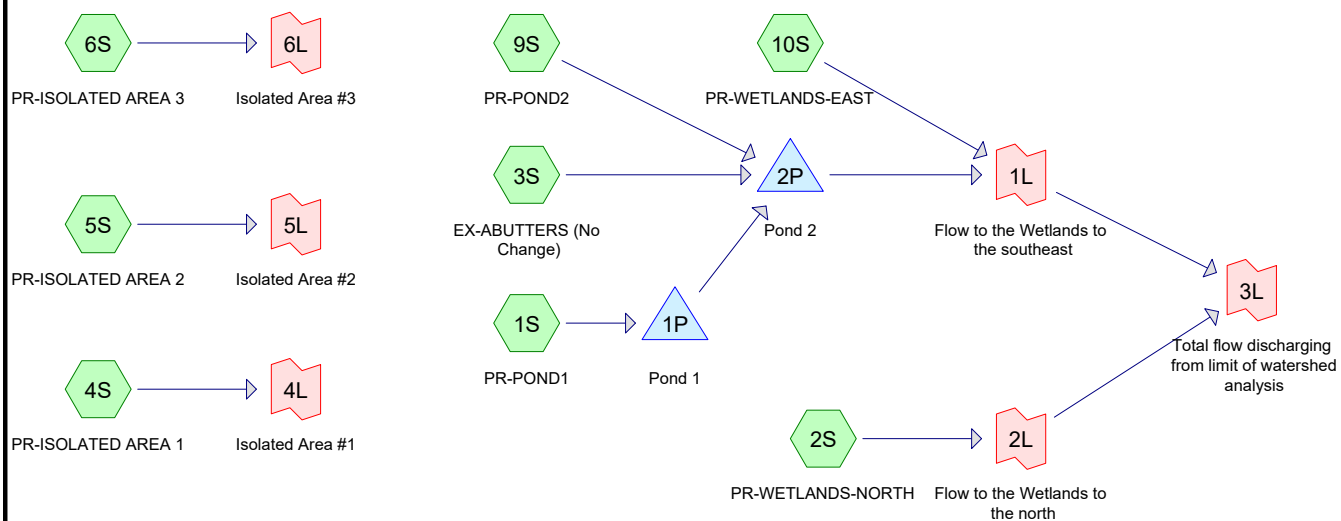
Link 6L: Isolated Area #3

Hydrograph



Proposed Condition





PROPOSED

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 2

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-yr	Type III 24-hr		Default	24.00	1	3.24	2
2	10-yr	Type III 24-hr		Default	24.00	1	5.12	2
3	25-yr	Type III 24-hr		Default	24.00	1	6.29	2
4	50-yr	Type III 24-hr		Default	24.00	1	7.15	2
5	100-yr	Type III 24-hr		Default	24.00	1	8.10	2

PROPOSED

Type III 24-hr 2-yr Rainfall=3.24"

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 3

Summary for Subcatchment 1S: PR-POND1

Runoff = 0.01 cfs @ 15.52 hrs, Volume= 187 cf, Depth= 0.05"
 Routed to Pond 1P : Pond 1

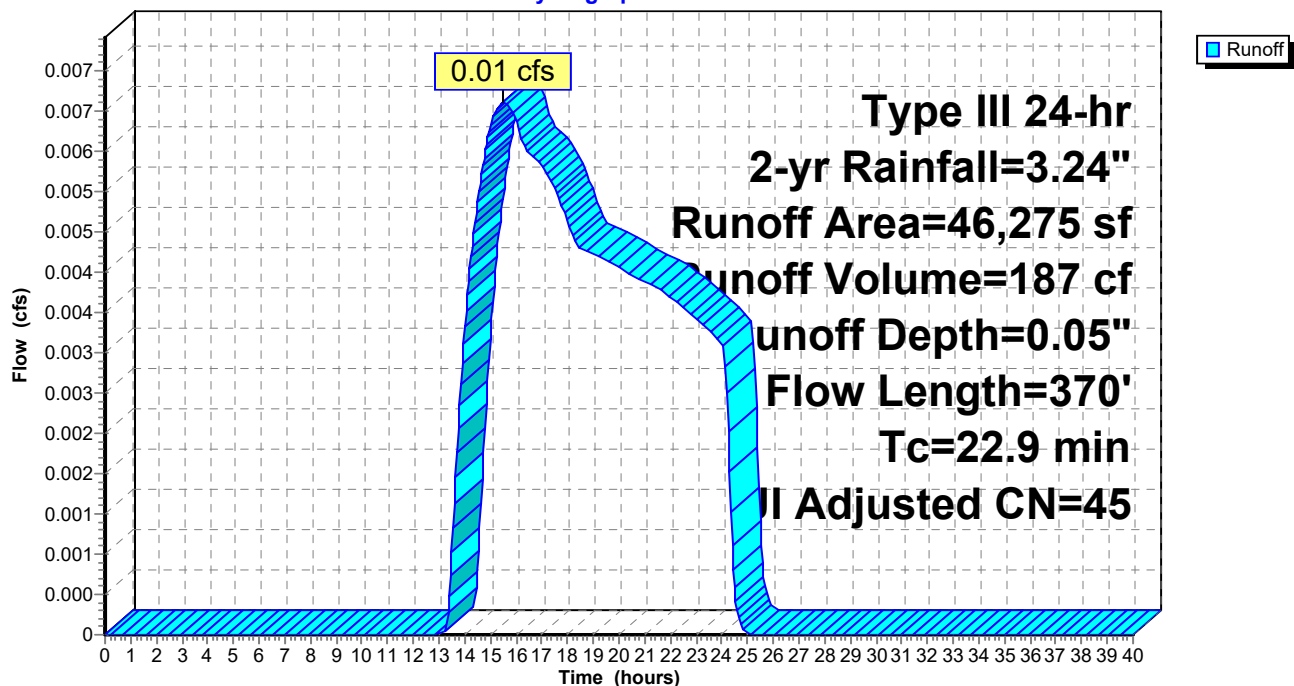
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-yr Rainfall=3.24"

Area (sf)	CN	Adj	Description
* 2,160	98		Proposed Barn, Unconnected roofs, HSG A
5,933	76		Gravel roads, HSG A
38,182	39		>75% Grass cover, Good, HSG A
46,275	46	45	Weighted Average, UI Adjusted
44,115			95.33% Pervious Area
2,160			4.67% Impervious Area
2,160			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.2	50	0.0100	0.05		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
6.7	320	0.0250	0.79		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
22.9	370	Total			

Subcatchment 1S: PR-POND1

Hydrograph



PROPOSED

Type III 24-hr 2-yr Rainfall=3.24"

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 4

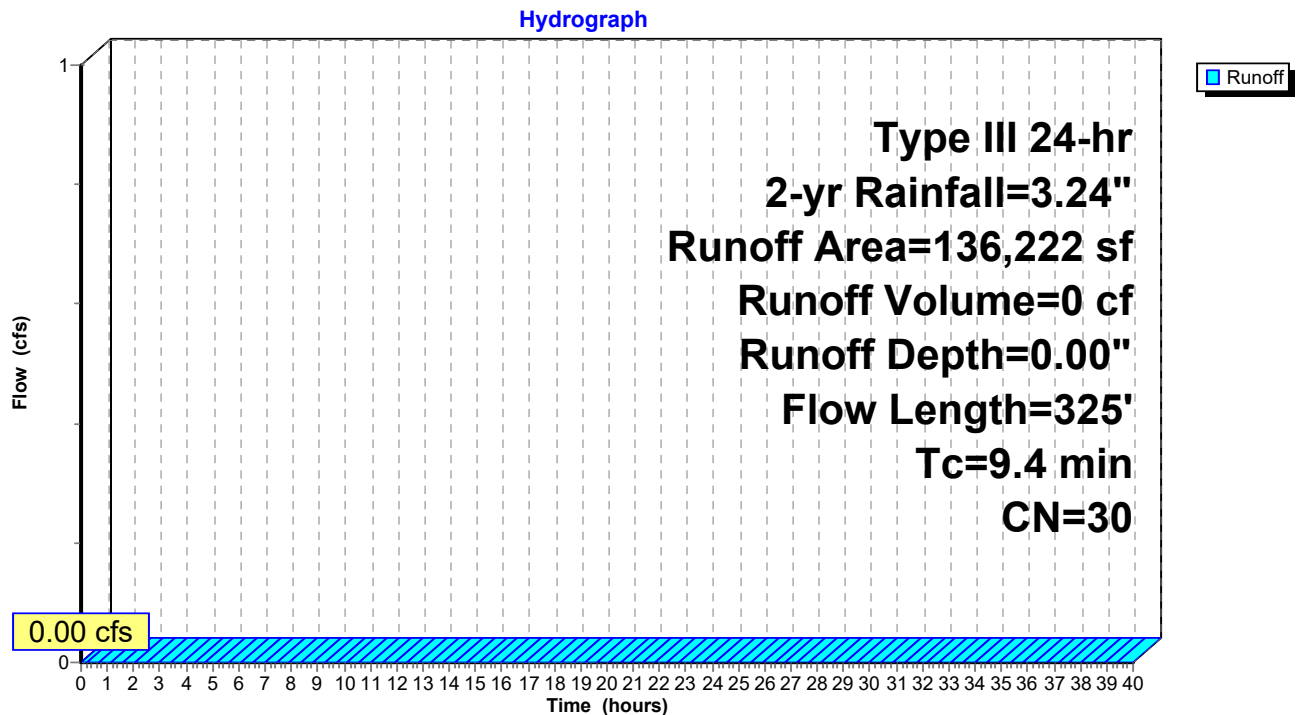
Summary for Subcatchment 2S: PR-WETLANDS-NORTH

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"
 Routed to Link 2L : Flow to the Wetlands to the north

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-yr Rainfall=3.24"

Area (sf)	CN	Description
135,222	30	Woods, Good, HSG A
1,000	39	>75% Grass cover, Good, HSG A
136,222	30	Weighted Average
136,222		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0800	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
2.4	275	0.1500	1.94		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
9.4	325	Total			

Subcatchment 2S: PR-WETLANDS-NORTH

PROPOSED*Type III 24-hr 2-yr Rainfall=3.24"*

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 5

Summary for Subcatchment 3S: EX-ABUTTERS (No Change)

Runoff = 0.00 cfs @ 24.02 hrs, Volume= 9 cf, Depth= 0.00"
 Routed to Pond 2P : Pond 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-yr Rainfall=3.24"

Area (sf)	CN	Adj	Description
5,000	98		Unconnected roofs, HSG A
5,000	98		Paved parking, HSG A
5,000	61		>75% Grass cover, Good, HSG B
55,000	39		>75% Grass cover, Good, HSG A
61,524	30		Woods, Good, HSG A
131,524	40	39	Weighted Average, UI Adjusted
121,524			92.40% Pervious Area
10,000			7.60% Impervious Area
5,000			50.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0800	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
8.7	450	0.0300	0.87		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
15.7	500	Total			

PROPOSED

Prepared by Williams & Sparages

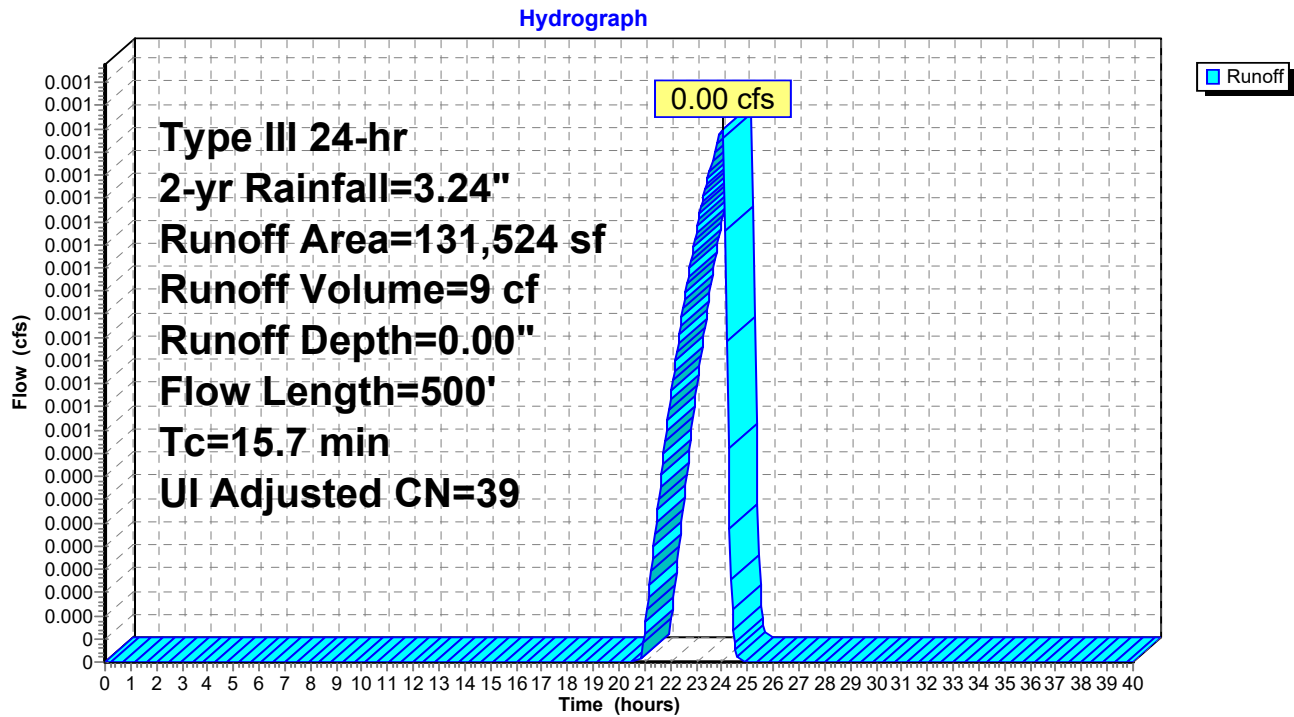
Type III 24-hr 2-yr Rainfall=3.24"

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 6

Subcatchment 3S: EX-ABUTTERS (No Change)



PROPOSED

Type III 24-hr 2-yr Rainfall=3.24"

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 7

Summary for Subcatchment 4S: PR-ISOLATED AREA 1

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"
 Routed to Link 4L : Isolated Area #1

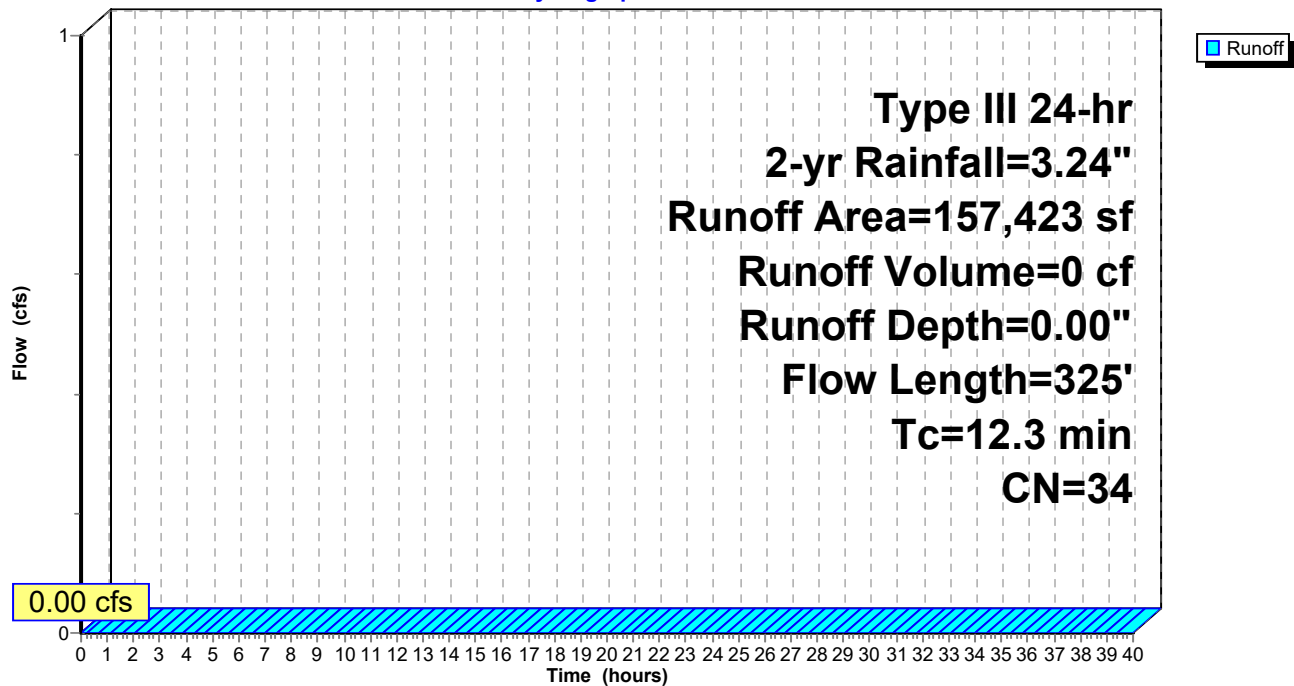
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-yr Rainfall=3.24"

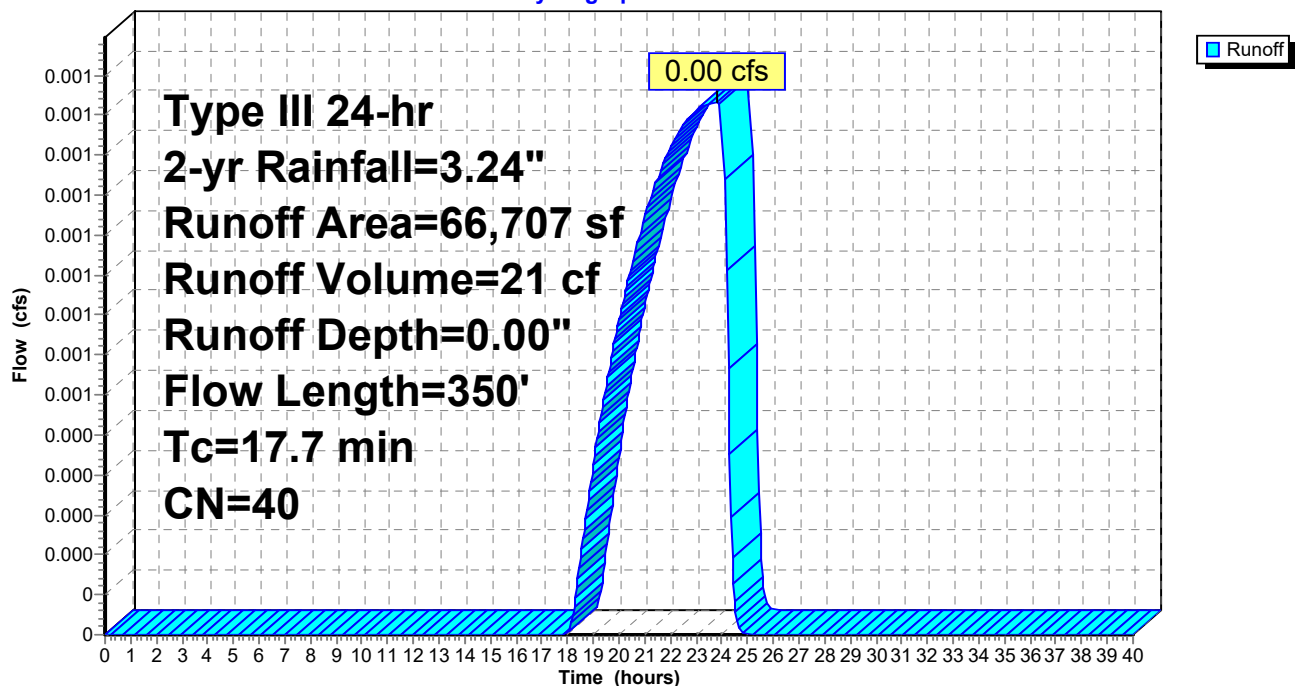
Area (sf)	CN	Description
96,900	30	Woods, Good, HSG A
3,620	55	Woods, Good, HSG B
56,903	39	>75% Grass cover, Good, HSG A
157,423	34	Weighted Average
157,423		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0800	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
5.3	275	0.0300	0.87		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
12.3	325	Total			

Subcatchment 4S: PR-ISOLATED AREA 1

Hydrograph





PROPOSED

Type III 24-hr 2-yr Rainfall=3.24"

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 9

Summary for Subcatchment 6S: PR-ISOLATED AREA 3

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"
 Routed to Link 6L : Isolated Area #3

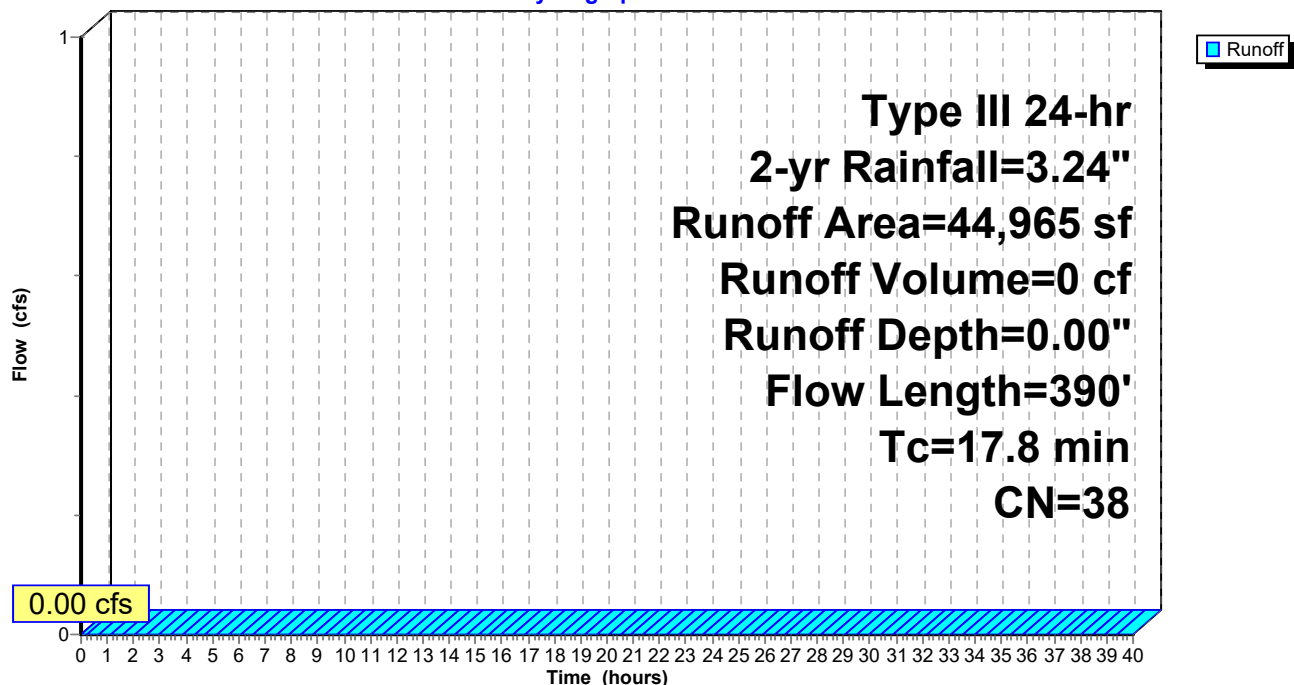
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-yr Rainfall=3.24"

Area (sf)	CN	Description
2,918	30	Woods, Good, HSG A
42,047	39	>75% Grass cover, Good, HSG A
44,965	38	Weighted Average
44,965		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.2	50	0.0100	0.05		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
1.0	100	0.0100	1.61		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
0.6	240	0.1500	6.24		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
17.8	390	Total			

Subcatchment 6S: PR-ISOLATED AREA 3

Hydrograph



PROPOSED

Type III 24-hr 2-yr Rainfall=3.24"

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 10

Summary for Subcatchment 9S: PR-POND2

Runoff = 0.02 cfs @ 14.97 hrs, Volume= 464 cf, Depth= 0.08"
 Routed to Pond 2P : Pond 2

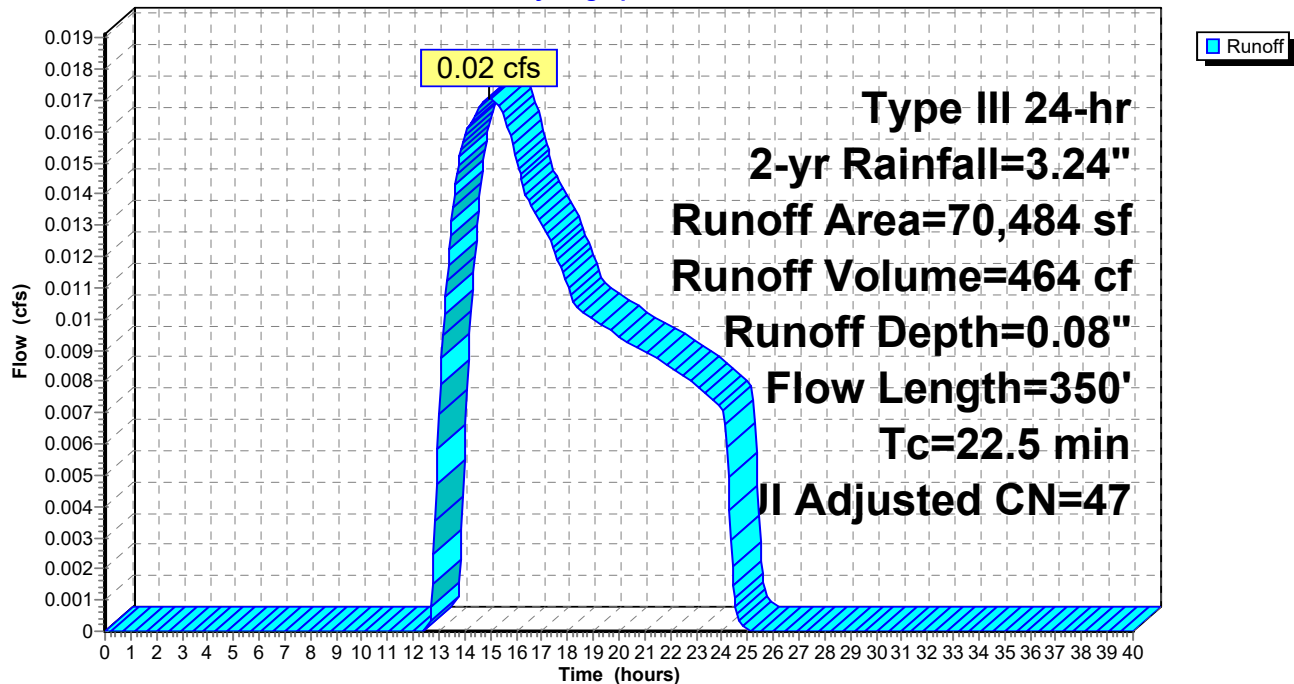
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-yr Rainfall=3.24"

Area (sf)	CN	Adj	Description
3,200	98		Unconnected roofs, HSG A
5,000	98		Paved parking, HSG A
5,498	76		Gravel roads, HSG A
56,786	39		>75% Grass cover, Good, HSG A
70,484	49	47	Weighted Average, UI Adjusted
62,284			88.37% Pervious Area
8,200			11.63% Impervious Area
3,200			39.02% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.2	50	0.0100	0.05		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
6.3	300	0.0250	0.79		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
22.5	350	Total			

Subcatchment 9S: PR-POND2

Hydrograph



PROPOSED

Type III 24-hr 2-yr Rainfall=3.24"

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 11

Summary for Subcatchment 10S: PR-WETLANDS-EAST

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"
 Routed to Link 1L : Flow to the Wetlands to the southeast

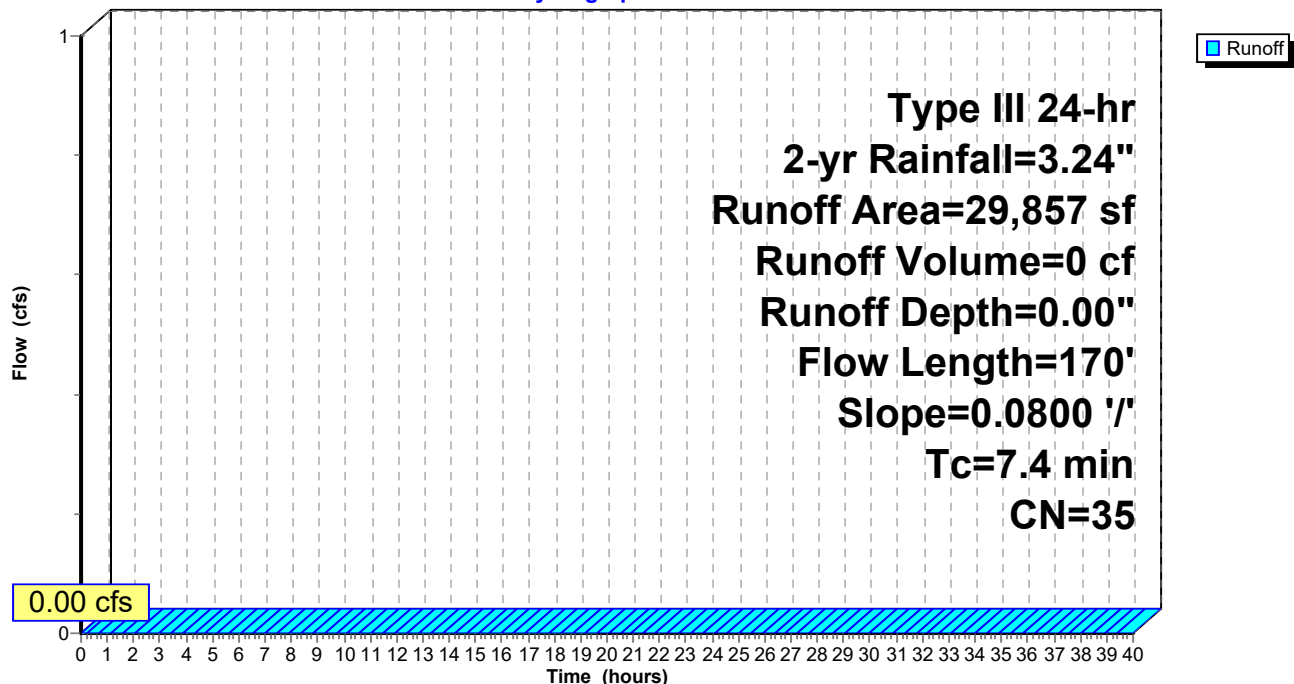
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2-yr Rainfall=3.24"

Area (sf)	CN	Description
590	98	Unconnected roofs, HSG A
500	98	Paved parking, HSG A
10,000	39	>75% Grass cover, Good, HSG A
18,767	30	Woods, Good, HSG A
29,857	35	Weighted Average
28,767		96.35% Pervious Area
1,090		3.65% Impervious Area
590		54.13% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0800	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
0.4	120	0.0800	4.55		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
7.4	170	Total			

Subcatchment 10S: PR-WETLANDS-EAST

Hydrograph



PROPOSED*Type III 24-hr 2-yr Rainfall=3.24"*

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 12

Summary for Pond 1P: Pond 1

Inflow Area = 46,275 sf, 4.67% Impervious, Inflow Depth = 0.05" for 2-yr event
 Inflow = 0.01 cfs @ 15.52 hrs, Volume= 187 cf
 Outflow = 0.01 cfs @ 15.52 hrs, Volume= 187 cf, Atten= 0%, Lag= 0.0 min
 Discarded = 0.01 cfs @ 15.52 hrs, Volume= 187 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
 Routed to Pond 2P : Pond 2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Peak Elev= 87.00' @ 0.00 hrs Surf.Area= 510 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 0.0 min (1,114.7 - 1,114.7)

Volume	Invert	Avail.Storage	Storage Description
#1	87.00'	3,968 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
87.00	510	0	0
88.00	820	665	665
89.00	1,180	1,000	1,665
90.00	1,610	1,395	3,060
90.50	2,020	908	3,968

Device	Routing	Invert	Outlet Devices
#1	Discarded	87.00'	8.270 in/hr Exfiltration over Surface area
#2	Primary	90.00'	6.0' long x 6.0' breadth Broad-Crested Rectangular Weir
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00
			2.50 3.00 3.50 4.00 4.50 5.00 5.50
			Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65
			2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Discarded OutFlow Max=0.00 cfs @ 15.52 hrs HW=87.00' (Free Discharge)

↑**1=Exfiltration** (Passes 0.00 cfs of 0.10 cfs potential flow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=87.00' TW=84.00' (Dynamic Tailwater)

↑**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

PROPOSED

Prepared by Williams & Sparages

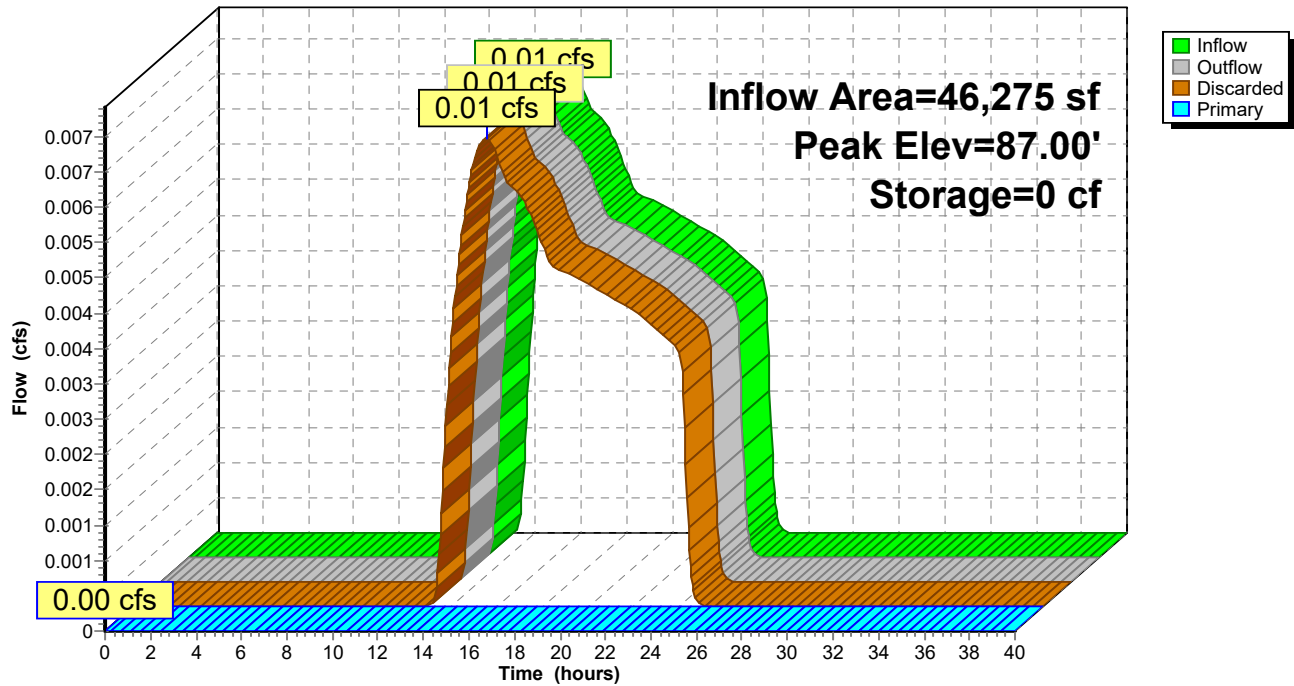
Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 13

Pond 1P: Pond 1

Hydrograph



PROPOSED*Type III 24-hr 2-yr Rainfall=3.24"*

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 14

Summary for Pond 2P: Pond 2

Inflow Area = 248,283 sf, 8.20% Impervious, Inflow Depth = 0.02" for 2-yr event
 Inflow = 0.02 cfs @ 14.97 hrs, Volume= 473 cf
 Outflow = 0.02 cfs @ 14.97 hrs, Volume= 473 cf, Atten= 0%, Lag= 0.0 min
 Discarded = 0.02 cfs @ 14.97 hrs, Volume= 473 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
 Routed to Link 1L : Flow to the Wetlands to the southeast

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Peak Elev= 84.00' @ 0.00 hrs Surf.Area= 1,950 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 0.0 min (1,075.5 - 1,075.5)

Volume	Invert	Avail.Storage	Storage Description
#1	84.00'	7,258 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
84.00	1,950	0	0
85.00	2,650	2,300	2,300
86.00	3,410	3,030	5,330
86.50	4,300	1,928	7,258

Device	Routing	Invert	Outlet Devices
#1	Discarded	84.00'	8.270 in/hr Exfiltration over Surface area
#2	Primary	86.00'	6.0' long x 6.0' breadth Broad-Crested Rectangular Weir
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00
			2.50 3.00 3.50 4.00 4.50 5.00 5.50
			Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65
			2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Discarded OutFlow Max=0.00 cfs @ 14.97 hrs HW=84.00' (Free Discharge)

↑**1=Exfiltration** (Passes 0.00 cfs of 0.37 cfs potential flow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=84.00' TW=0.00' (Dynamic Tailwater)

↑**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

PROPOSED

Prepared by Williams & Sparages

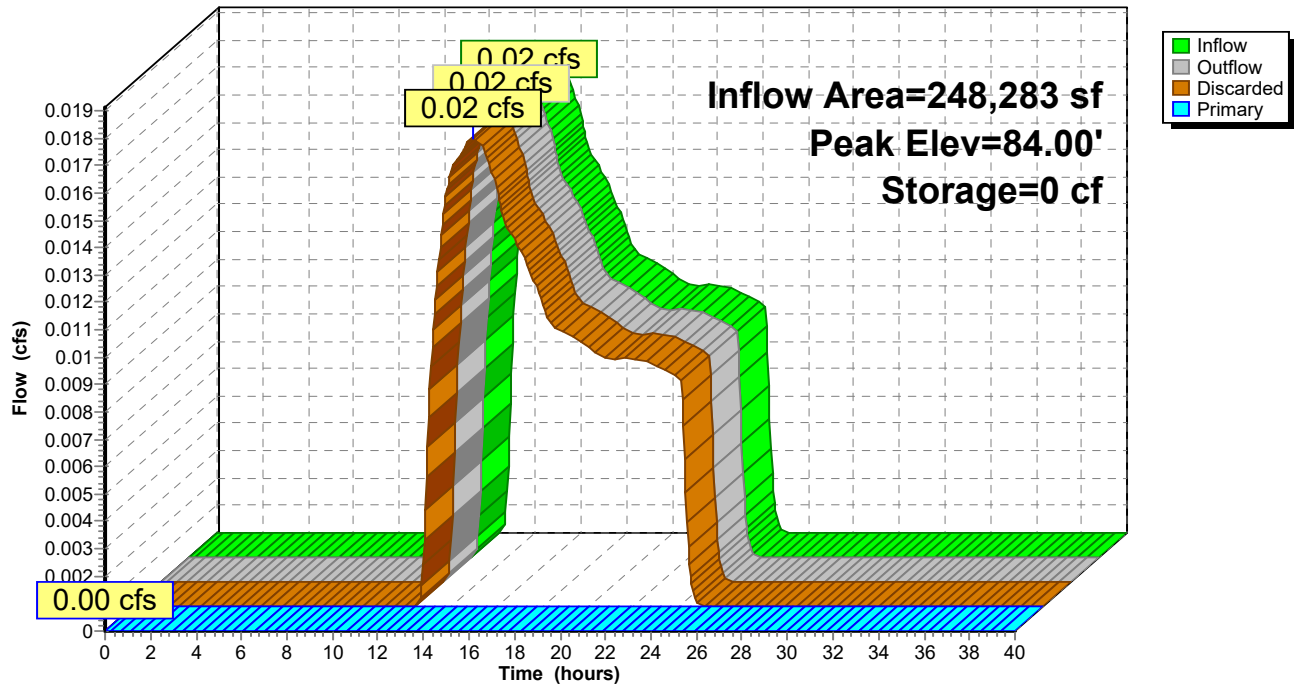
Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 15

Pond 2P: Pond 2

Hydrograph



PROPOSED

Type III 24-hr 2-yr Rainfall=3.24"

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

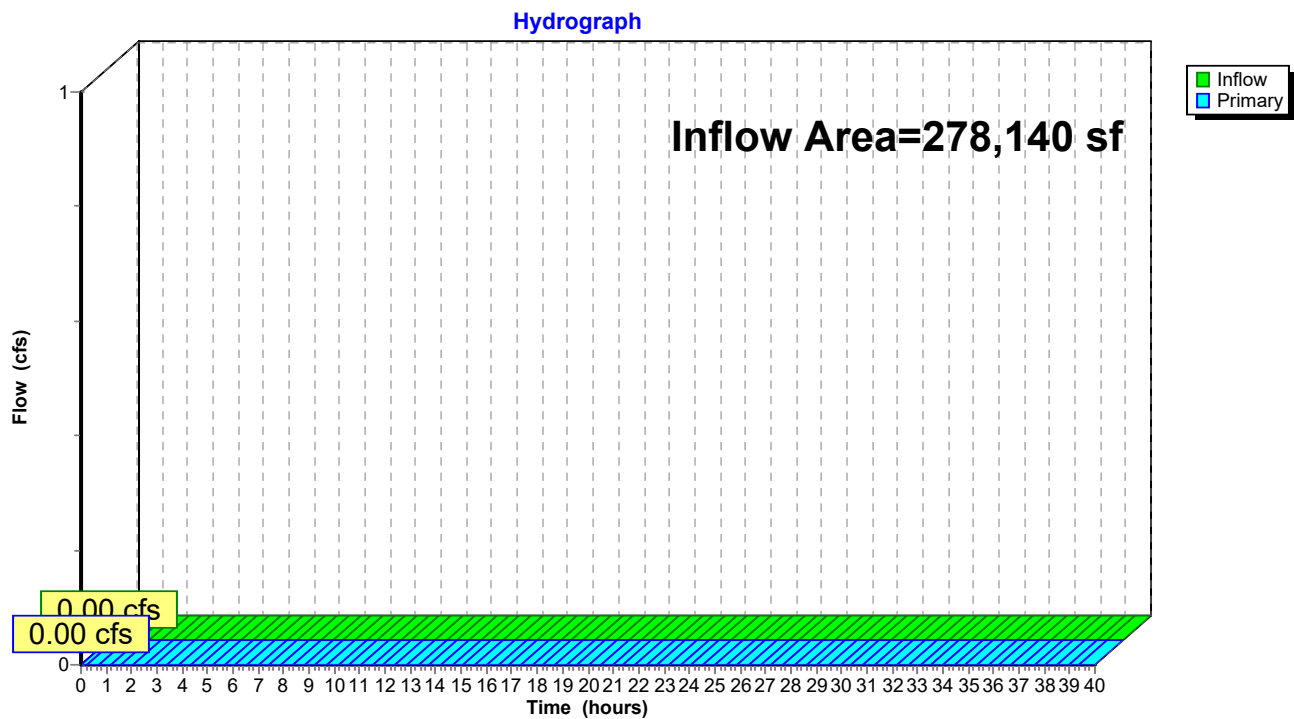
Page 16

Summary for Link 1L: Flow to the Wetlands to the southeast

Inflow Area = 278,140 sf, 7.71% Impervious, Inflow Depth = 0.00" for 2-yr event
 Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min
 Routed to Link 3L : Total flow discharging from limit of watershed analysis

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 1L: Flow to the Wetlands to the southeast



PROPOSED

Type III 24-hr 2-yr Rainfall=3.24"

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

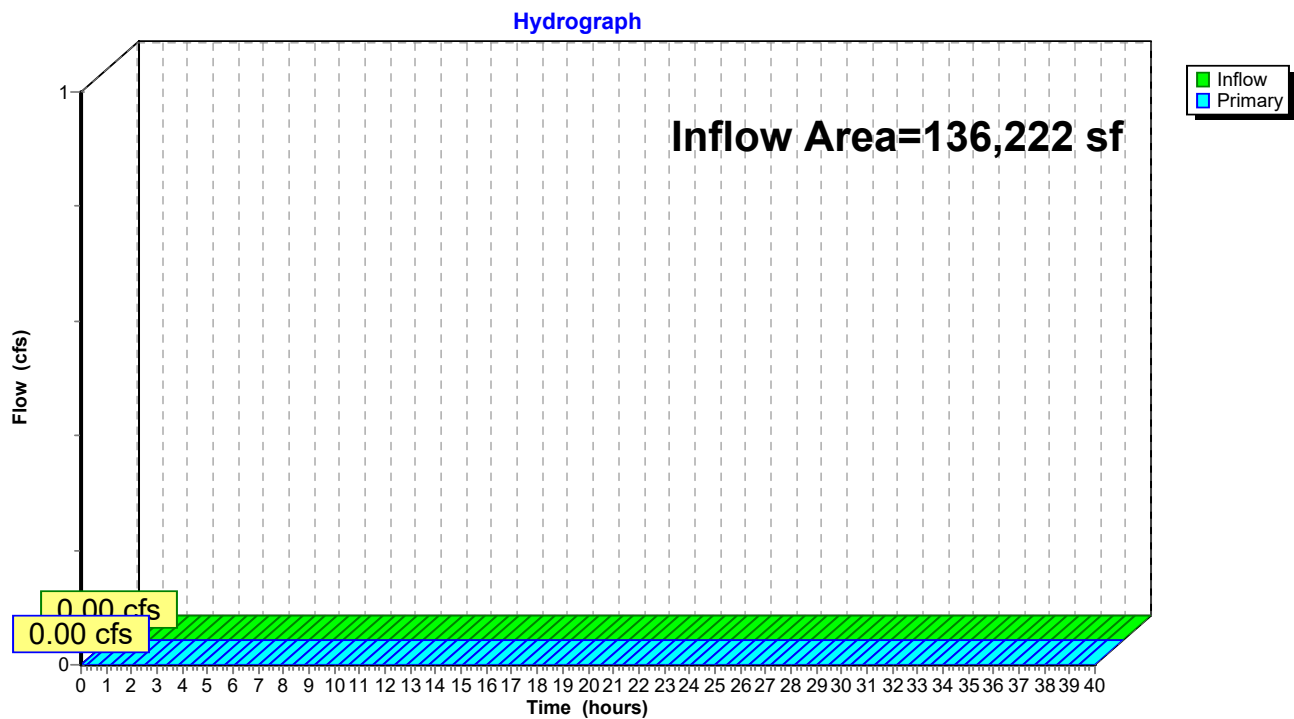
Page 17

Summary for Link 2L: Flow to the Wetlands to the north

Inflow Area = 136,222 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-yr event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min
Routed to Link 3L : Total flow discharging from limit of watershed analysis

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 2L: Flow to the Wetlands to the north



PROPOSED

Prepared by Williams & Sparages

Type III 24-hr 2-yr Rainfall=3.24"

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

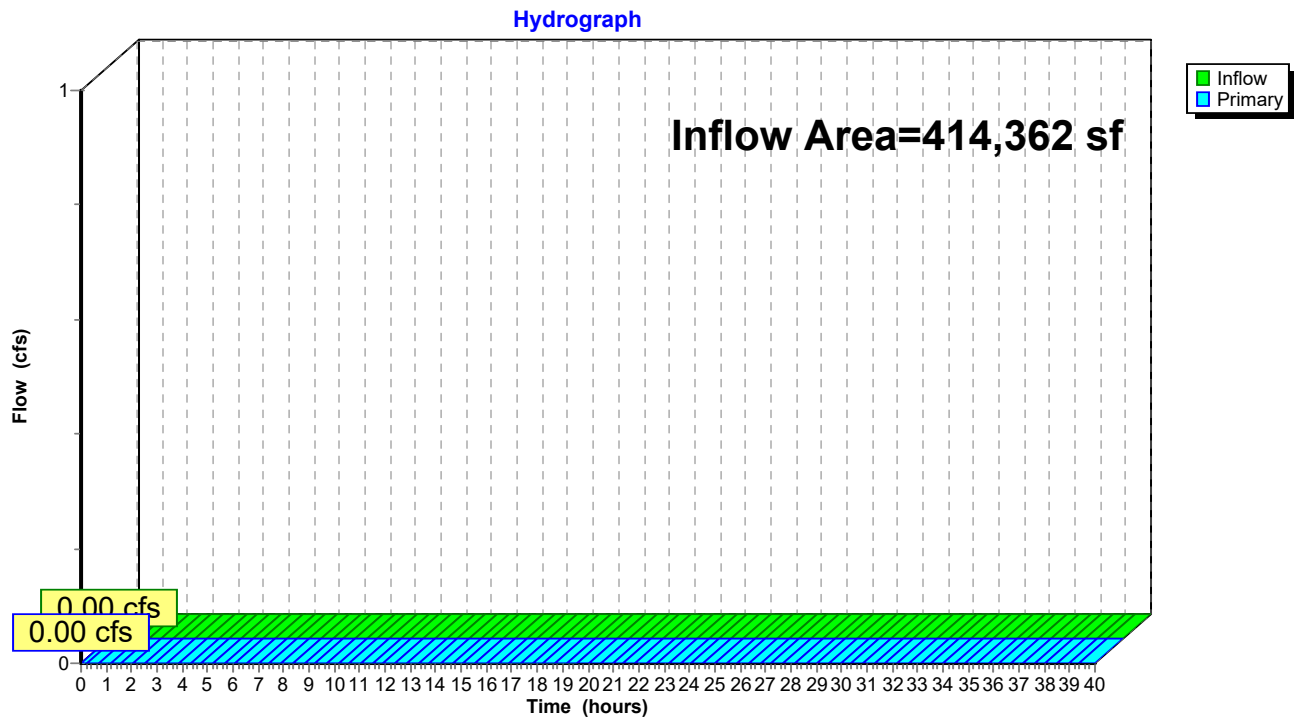
Page 18

Summary for Link 3L: Total flow discharging from limit of watershed analysis

Inflow Area = 414,362 sf, 5.18% Impervious, Inflow Depth = 0.00" for 2-yr event
 Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 3L: Total flow discharging from limit of watershed analysis



PROPOSED

Type III 24-hr 2-yr Rainfall=3.24"

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 19

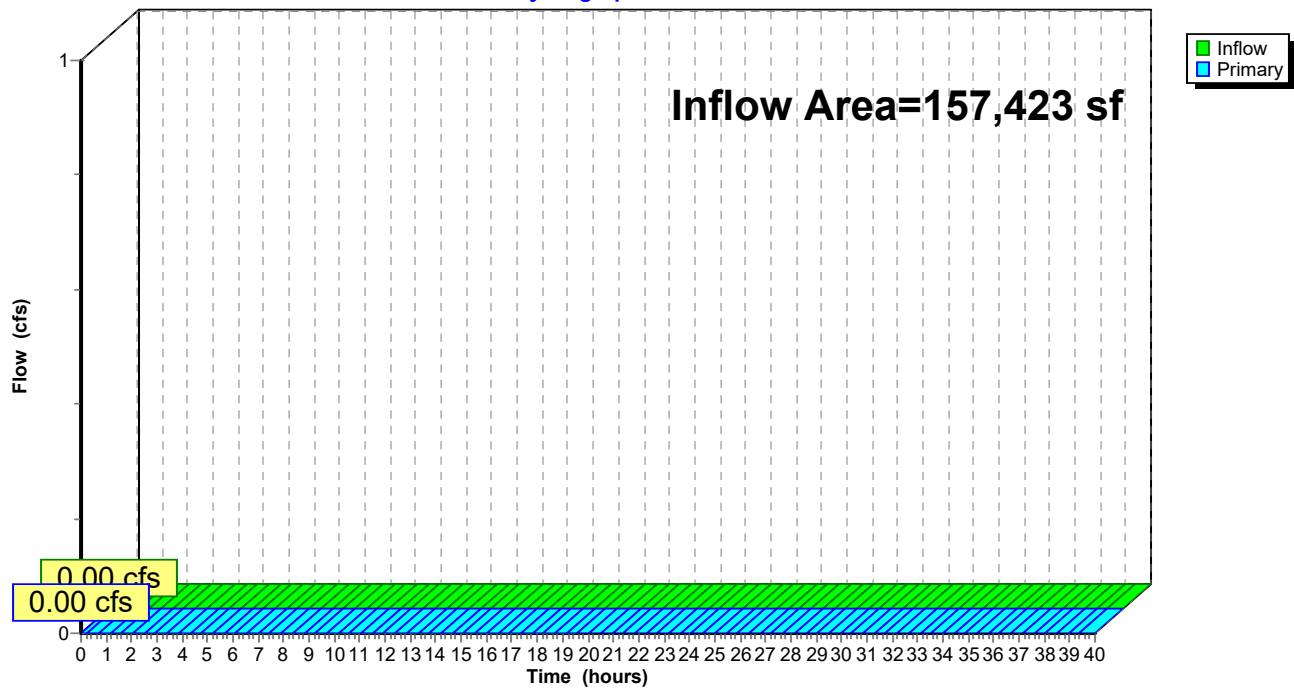
Summary for Link 4L: Isolated Area #1

Inflow Area = 157,423 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-yr event
 Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 4L: Isolated Area #1

Hydrograph



PROPOSED

Prepared by Williams & Sparages

Type III 24-hr 2-yr Rainfall=3.24"

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

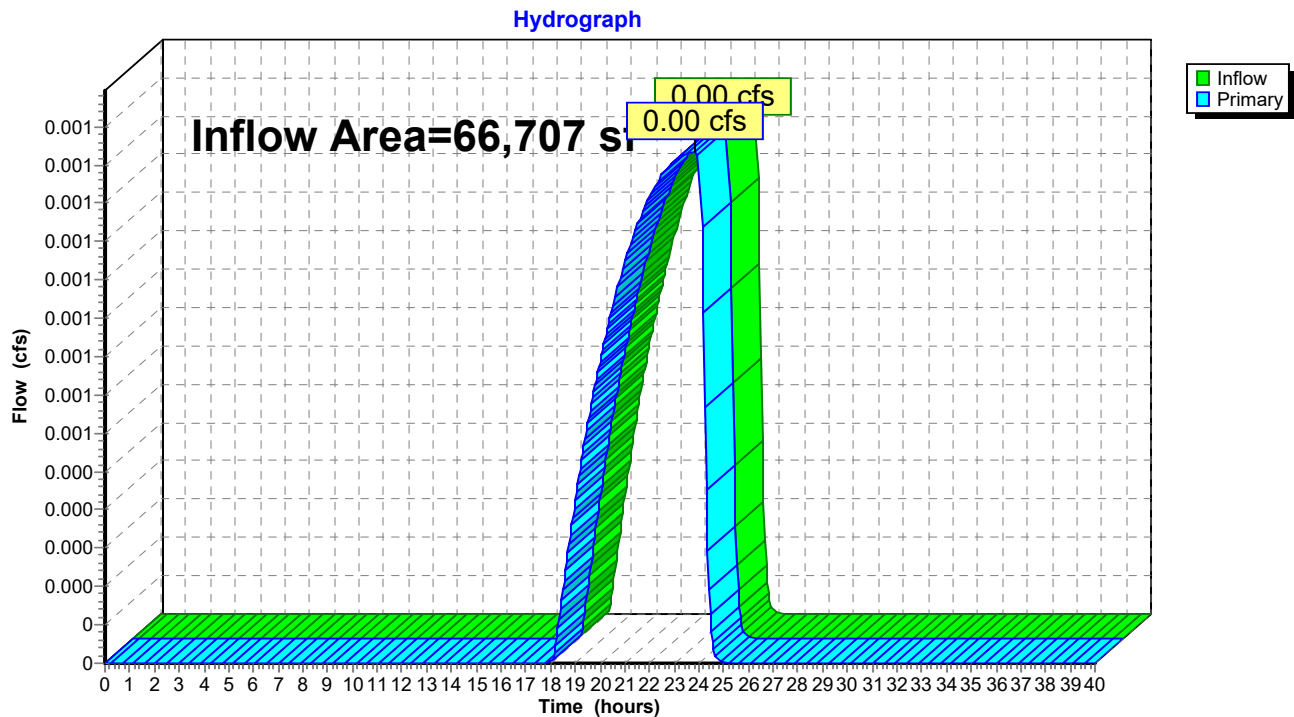
Page 20

Summary for Link 5L: Isolated Area #2

Inflow Area = 66,707 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-yr event
 Inflow = 0.00 cfs @ 23.80 hrs, Volume= 21 cf
 Primary = 0.00 cfs @ 23.80 hrs, Volume= 21 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 5L: Isolated Area #2



PROPOSED

Type III 24-hr 2-yr Rainfall=3.24"

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 21

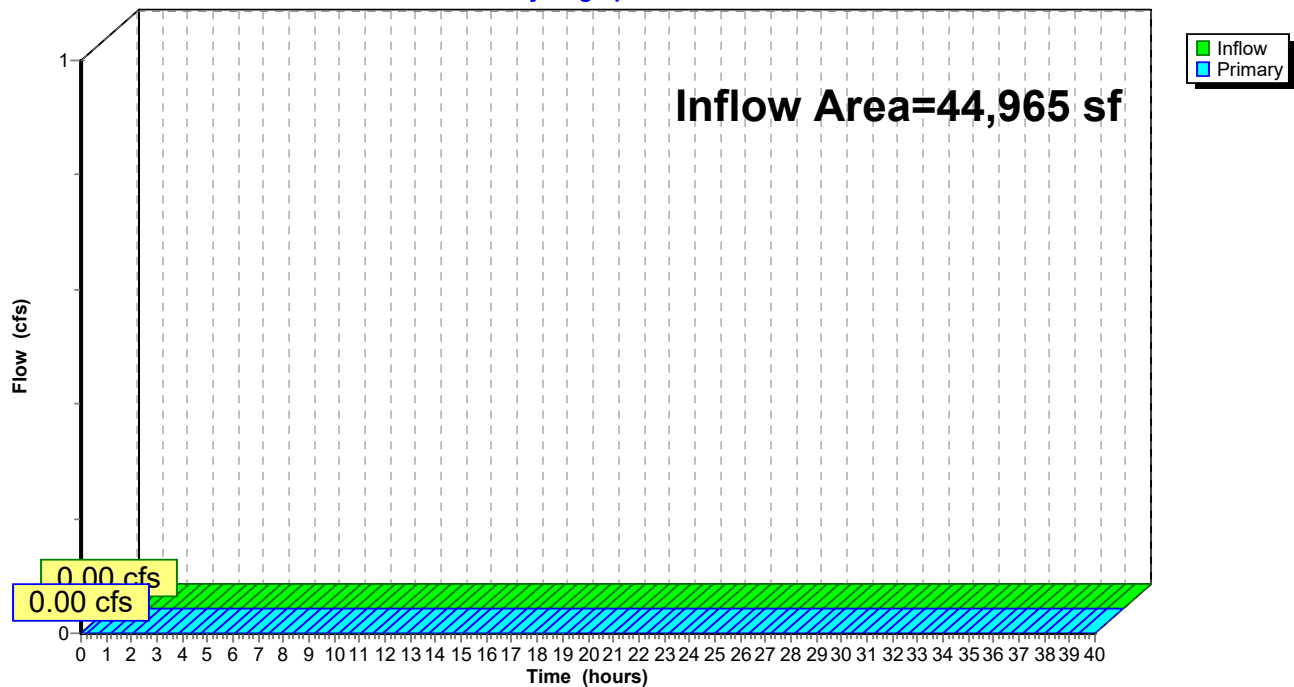
Summary for Link 6L: Isolated Area #3

Inflow Area = 44,965 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-yr event
 Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 6L: Isolated Area #3

Hydrograph



PROPOSED

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 22

Summary for Subcatchment 1S: PR-POND1

Runoff = 0.20 cfs @ 12.55 hrs, Volume= 1,853 cf, Depth= 0.48"
 Routed to Pond 1P : Pond 1

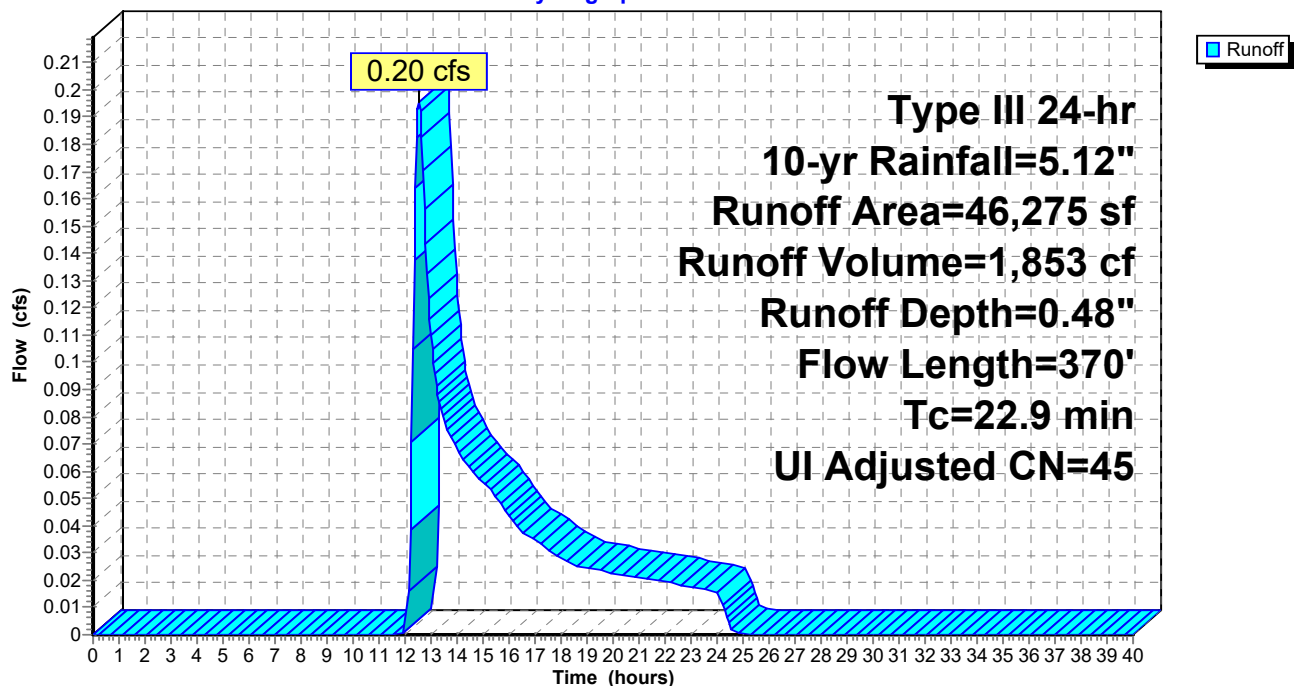
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-yr Rainfall=5.12"

Area (sf)	CN	Adj	Description
* 2,160	98		Proposed Barn, Unconnected roofs, HSG A
5,933	76		Gravel roads, HSG A
38,182	39		>75% Grass cover, Good, HSG A
46,275	46	45	Weighted Average, UI Adjusted
44,115			95.33% Pervious Area
2,160			4.67% Impervious Area
2,160			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.2	50	0.0100	0.05		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
6.7	320	0.0250	0.79		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
22.9	370	Total			

Subcatchment 1S: PR-POND1

Hydrograph



PROPOSED

Prepared by Williams & Sparages

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Type III 24-hr 10-yr Rainfall=5.12"

Printed 10/3/2023

Page 23

Summary for Subcatchment 2S: PR-WETLANDS-NORTH

Runoff = 0.01 cfs @ 23.18 hrs, Volume= 98 cf, Depth= 0.01"
Routed to Link 2L : Flow to the Wetlands to the north

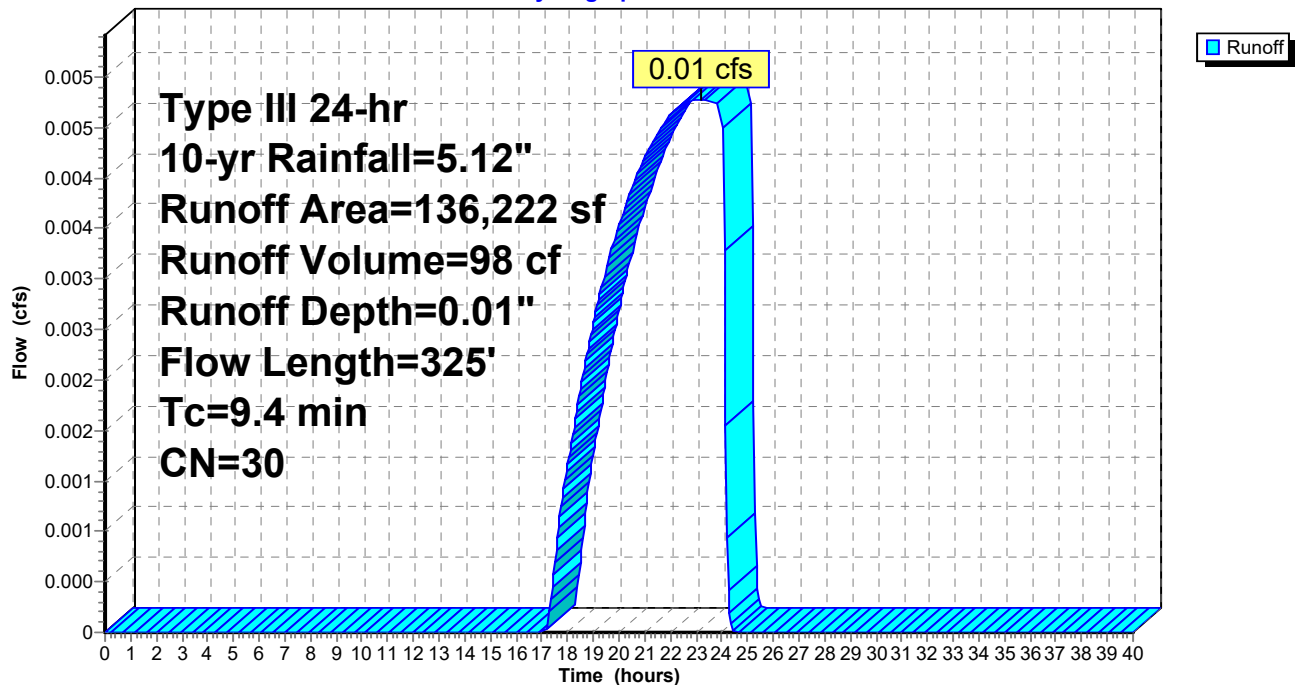
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=5.12"

Area (sf)	CN	Description
135,222	30	Woods, Good, HSG A
1,000	39	>75% Grass cover, Good, HSG A
136,222	30	Weighted Average
136,222		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0800	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
2.4	275	0.1500	1.94		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
9.4	325	Total			

Subcatchment 2S: PR-WETLANDS-NORTH

Hydrograph



PROPOSED

Type III 24-hr 10-yr Rainfall=5.12"

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 24

Summary for Subcatchment 3S: EX-ABUTTERS (No Change)

Runoff = 0.13 cfs @ 12.61 hrs, Volume= 2,466 cf, Depth= 0.22"
 Routed to Pond 2P : Pond 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-yr Rainfall=5.12"

Area (sf)	CN	Adj	Description
5,000	98		Unconnected roofs, HSG A
5,000	98		Paved parking, HSG A
5,000	61		>75% Grass cover, Good, HSG B
55,000	39		>75% Grass cover, Good, HSG A
61,524	30		Woods, Good, HSG A
131,524	40	39	Weighted Average, UI Adjusted
121,524			92.40% Pervious Area
10,000			7.60% Impervious Area
5,000			50.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0800	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
8.7	450	0.0300	0.87		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
15.7	500	Total			

PROPOSED

Prepared by Williams & Sparages

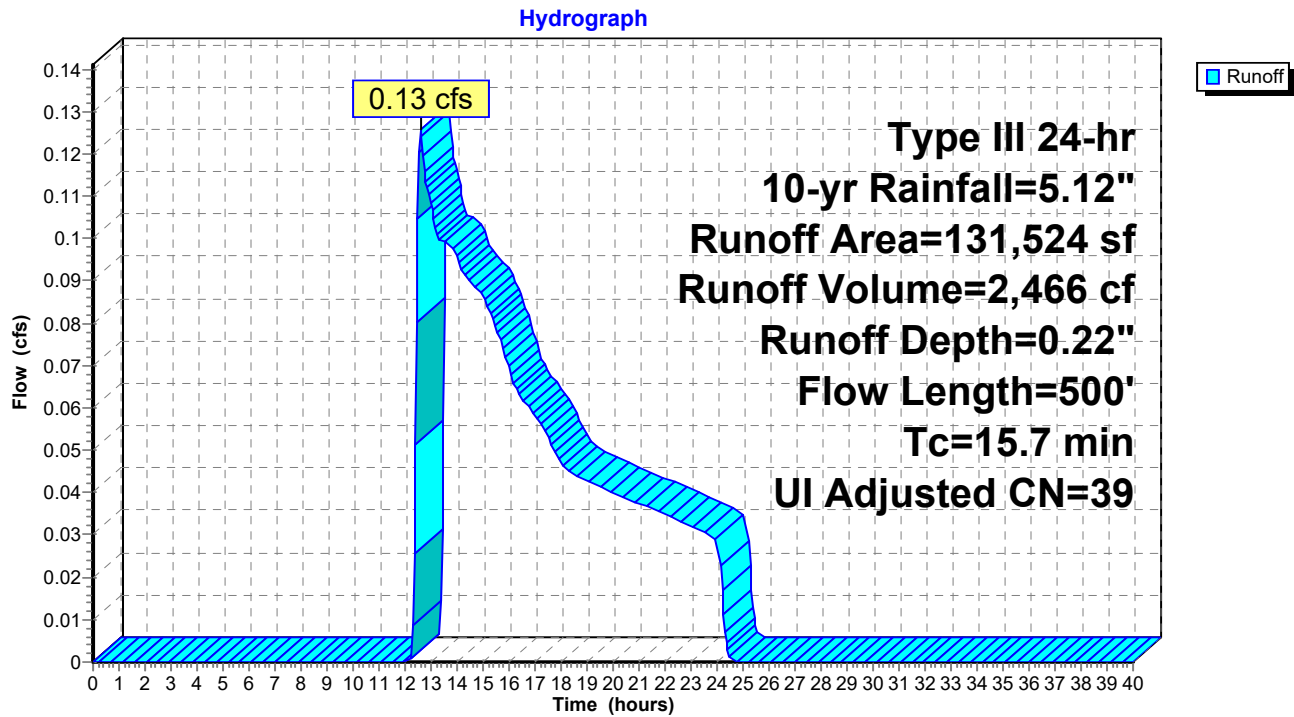
HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Type III 24-hr 10-yr Rainfall=5.12"

Printed 10/3/2023

Page 25

Subcatchment 3S: EX-ABUTTERS (No Change)



PROPOSED

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 26

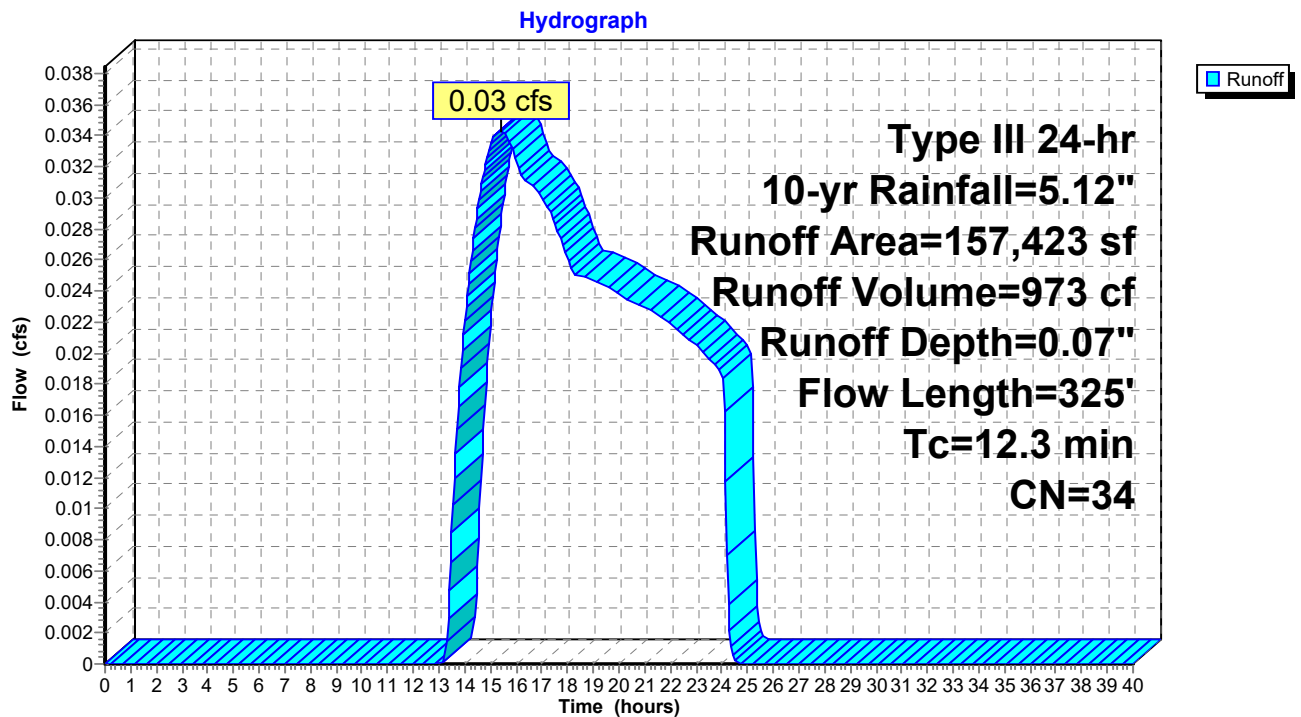
Summary for Subcatchment 4S: PR-ISOLATED AREA 1

Runoff = 0.03 cfs @ 15.40 hrs, Volume= 973 cf, Depth= 0.07"
 Routed to Link 4L : Isolated Area #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-yr Rainfall=5.12"

Area (sf)	CN	Description
96,900	30	Woods, Good, HSG A
3,620	55	Woods, Good, HSG B
56,903	39	>75% Grass cover, Good, HSG A
157,423	34	Weighted Average
157,423		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0800	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
5.3	275	0.0300	0.87		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
12.3	325	Total			

Subcatchment 4S: PR-ISOLATED AREA 1

PROPOSED

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 27

Summary for Subcatchment 5S: PR-ISOLATED AREA 2

Runoff = 0.09 cfs @ 12.60 hrs, Volume= 1,459 cf, Depth= 0.26"
 Routed to Link 5L : Isolated Area #2

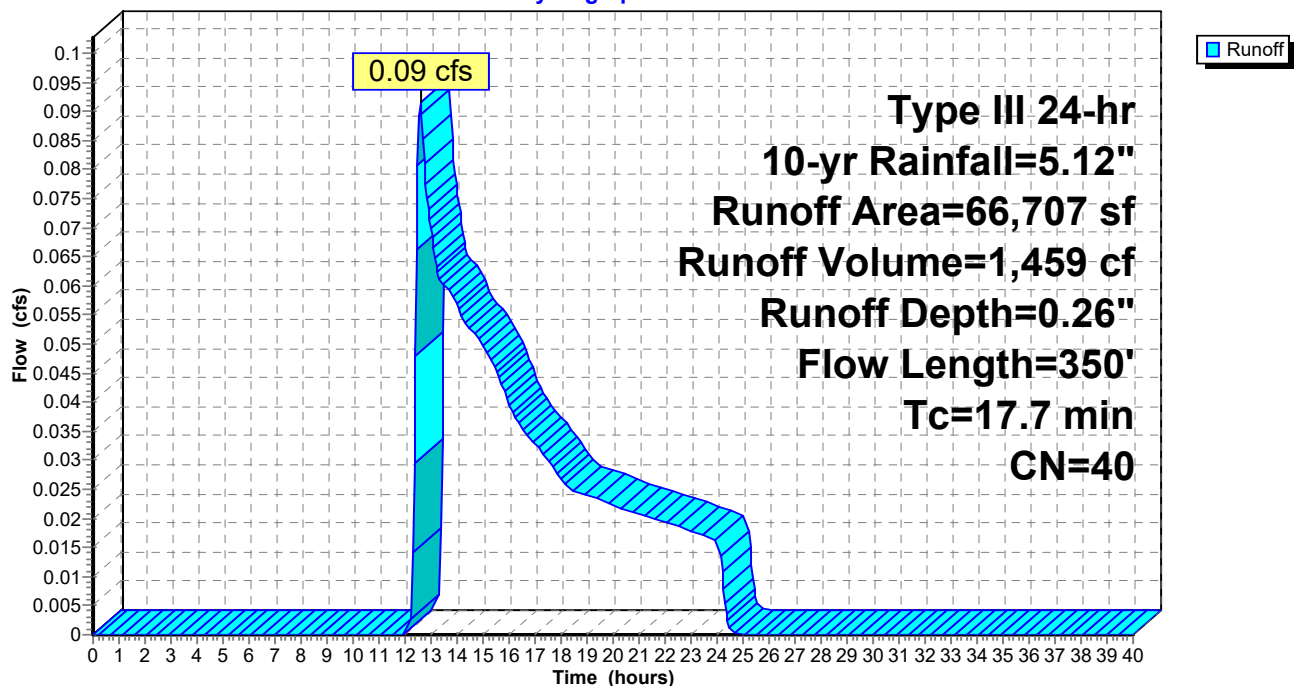
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-yr Rainfall=5.12"

Area (sf)	CN	Description
7,805	30	Woods, Good, HSG A
4,602	76	Gravel roads, HSG A
54,300	39	>75% Grass cover, Good, HSG A
66,707	40	Weighted Average
66,707		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.2	50	0.0100	0.05		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
1.0	100	0.0100	1.61		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
0.5	200	0.1500	6.24		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
17.7	350	Total			

Subcatchment 5S: PR-ISOLATED AREA 2

Hydrograph



PROPOSED

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 28

Summary for Subcatchment 6S: PR-ISOLATED AREA 3

Runoff = 0.03 cfs @ 13.77 hrs, Volume= 711 cf, Depth= 0.19"
 Routed to Link 6L : Isolated Area #3

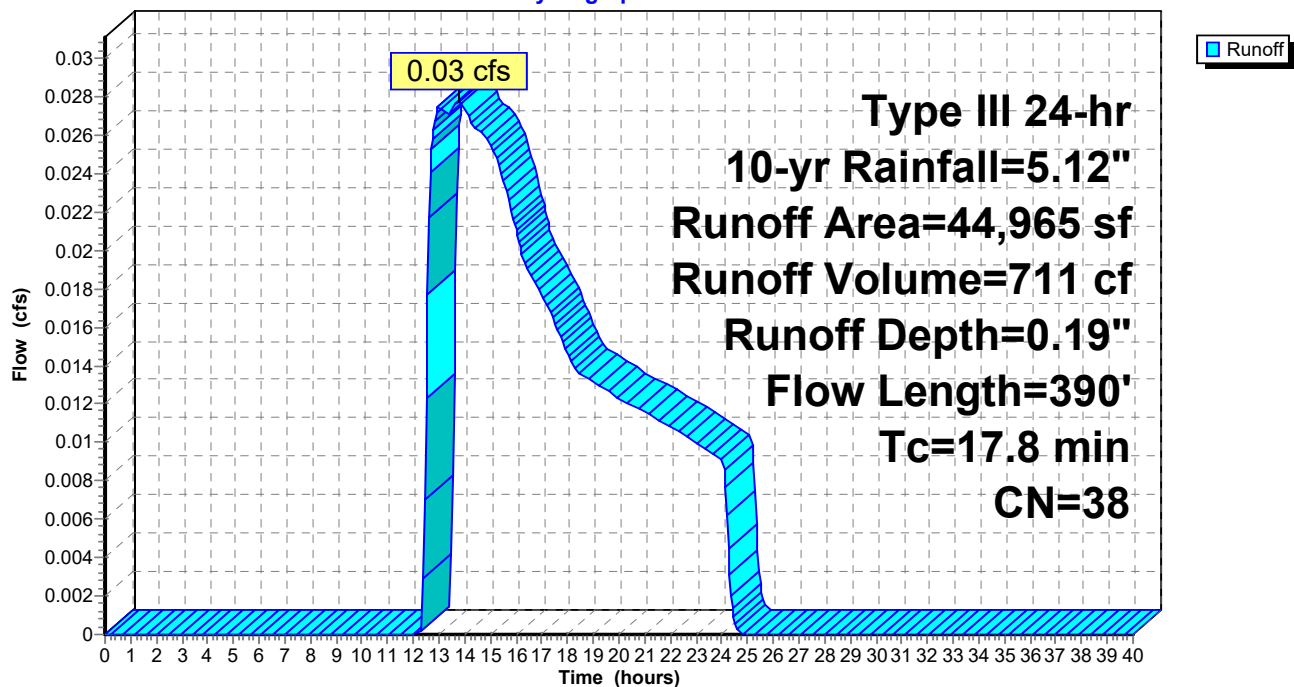
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-yr Rainfall=5.12"

Area (sf)	CN	Description
2,918	30	Woods, Good, HSG A
42,047	39	>75% Grass cover, Good, HSG A
44,965	38	Weighted Average
44,965		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.2	50	0.0100	0.05		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
1.0	100	0.0100	1.61		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
0.6	240	0.1500	6.24		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
17.8	390	Total			

Subcatchment 6S: PR-ISOLATED AREA 3

Hydrograph



PROPOSED

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 29

Summary for Subcatchment 9S: PR-POND2

Runoff = 0.41 cfs @ 12.50 hrs, Volume= 3,409 cf, Depth= 0.58"
 Routed to Pond 2P : Pond 2

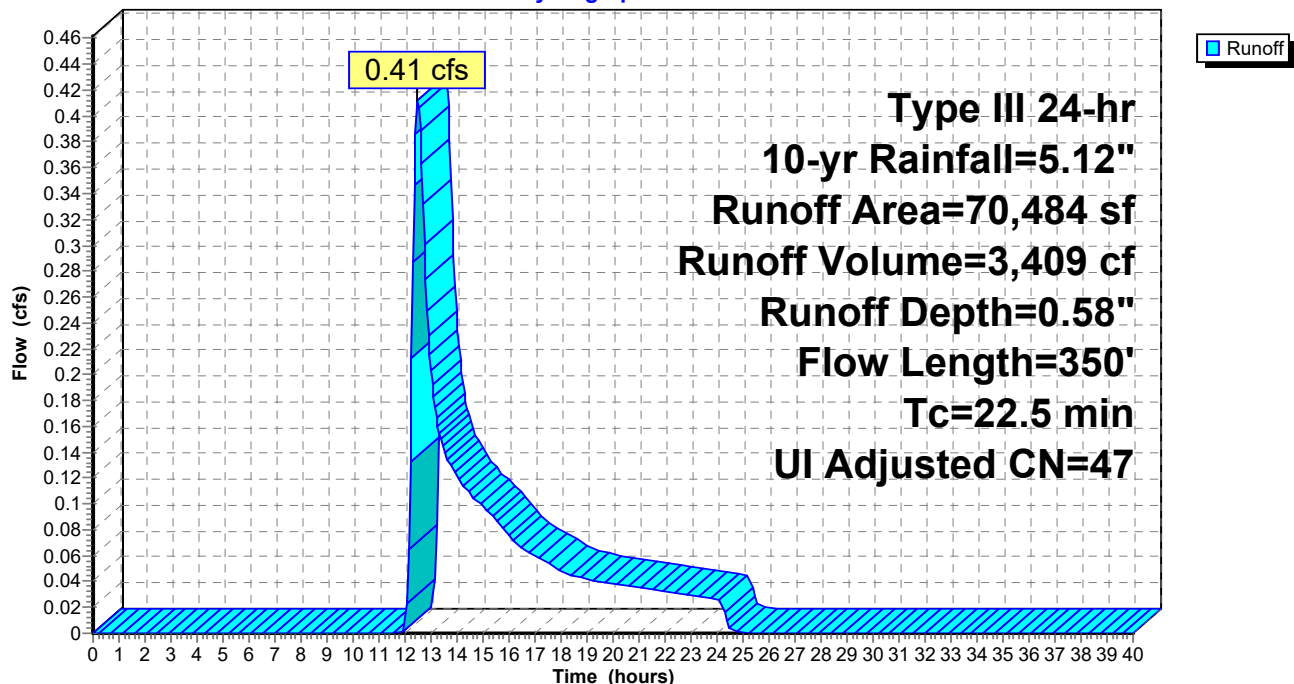
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-yr Rainfall=5.12"

Area (sf)	CN	Adj	Description
3,200	98		Unconnected roofs, HSG A
5,000	98		Paved parking, HSG A
5,498	76		Gravel roads, HSG A
56,786	39		>75% Grass cover, Good, HSG A
70,484	49	47	Weighted Average, UI Adjusted
62,284			88.37% Pervious Area
8,200			11.63% Impervious Area
3,200			39.02% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.2	50	0.0100	0.05		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
6.3	300	0.0250	0.79		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
22.5	350	Total			

Subcatchment 9S: PR-POND2

Hydrograph



PROPOSED

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 30

Summary for Subcatchment 10S: PR-WETLANDS-EAST

Runoff = 0.01 cfs @ 15.00 hrs, Volume= 246 cf, Depth= 0.10"
 Routed to Link 1L : Flow to the Wetlands to the southeast

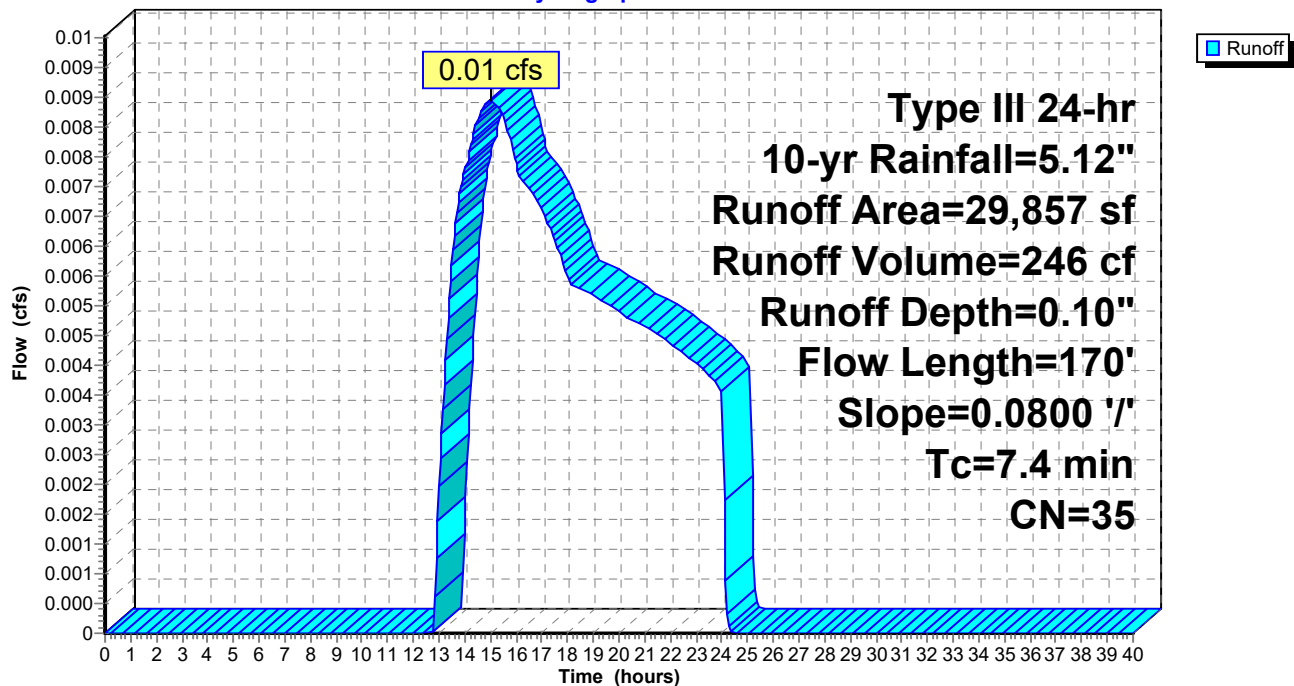
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10-yr Rainfall=5.12"

Area (sf)	CN	Description
590	98	Unconnected roofs, HSG A
500	98	Paved parking, HSG A
10,000	39	>75% Grass cover, Good, HSG A
18,767	30	Woods, Good, HSG A
29,857	35	Weighted Average
28,767		96.35% Pervious Area
1,090		3.65% Impervious Area
590		54.13% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0800	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
0.4	120	0.0800	4.55		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
7.4	170	Total			

Subcatchment 10S: PR-WETLANDS-EAST

Hydrograph



PROPOSED

Type III 24-hr 10-yr Rainfall=5.12"

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 31

Summary for Pond 1P: Pond 1

Inflow Area = 46,275 sf, 4.67% Impervious, Inflow Depth = 0.48" for 10-yr event
 Inflow = 0.20 cfs @ 12.55 hrs, Volume= 1,853 cf
 Outflow = 0.11 cfs @ 12.99 hrs, Volume= 1,855 cf, Atten= 43%, Lag= 26.4 min
 Discarded = 0.11 cfs @ 12.99 hrs, Volume= 1,855 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
 Routed to Pond 2P : Pond 2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Peak Elev= 87.24' @ 12.99 hrs Surf.Area= 583 sf Storage= 129 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 5.4 min (963.0 - 957.6)

Volume	Invert	Avail.Storage	Storage Description
#1	87.00'	3,968 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
87.00	510	0	0
88.00	820	665	665
89.00	1,180	1,000	1,665
90.00	1,610	1,395	3,060
90.50	2,020	908	3,968

Device	Routing	Invert	Outlet Devices
#1	Discarded	87.00'	8.270 in/hr Exfiltration over Surface area
#2	Primary	90.00'	6.0' long x 6.0' breadth Broad-Crested Rectangular Weir
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00
			2.50 3.00 3.50 4.00 4.50 5.00 5.50
			Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65
			2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Discarded OutFlow Max=0.11 cfs @ 12.99 hrs HW=87.24' (Free Discharge)

↑**1=Exfiltration** (Exfiltration Controls 0.11 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=87.00' TW=84.00' (Dynamic Tailwater)

↑**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

PROPOSED

Prepared by Williams & Sparages

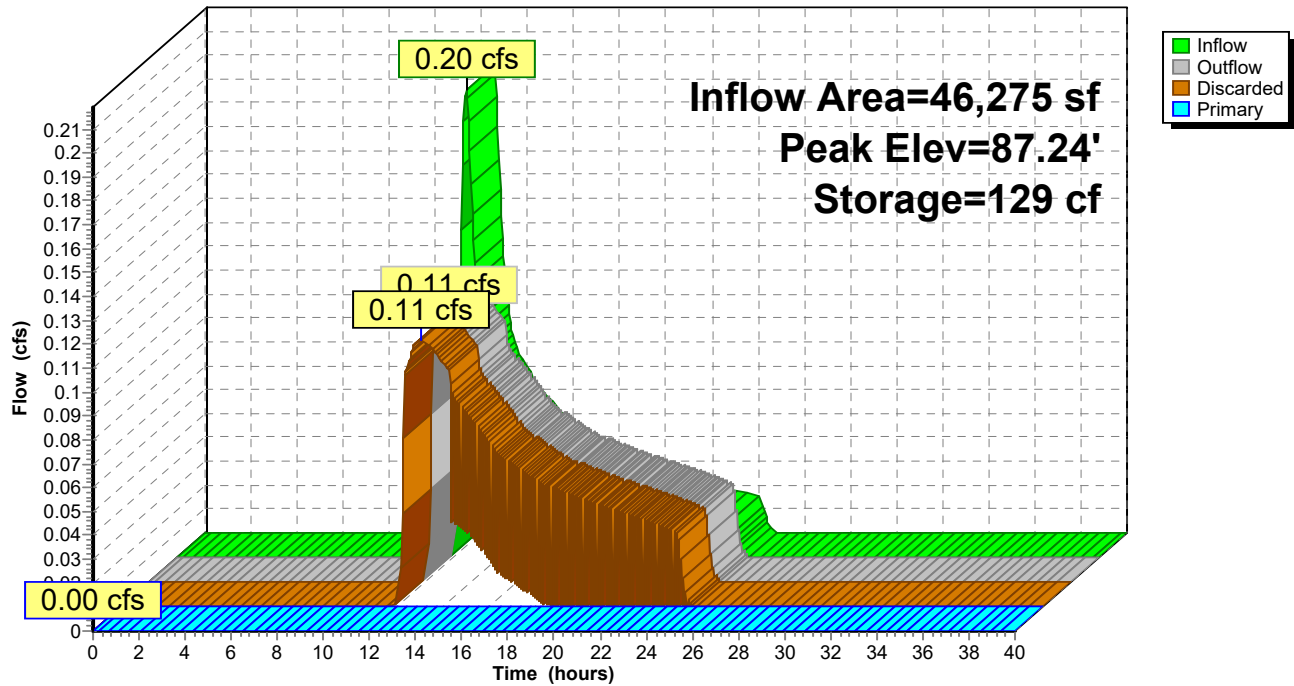
Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 32

Pond 1P: Pond 1

Hydrograph



PROPOSED

Type III 24-hr 10-yr Rainfall=5.12"

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 33

Summary for Pond 2P: Pond 2

Inflow Area = 248,283 sf, 8.20% Impervious, Inflow Depth = 0.28" for 10-yr event
 Inflow = 0.53 cfs @ 12.55 hrs, Volume= 5,875 cf
 Outflow = 0.38 cfs @ 12.81 hrs, Volume= 5,877 cf, Atten= 27%, Lag= 15.7 min
 Discarded = 0.38 cfs @ 12.81 hrs, Volume= 5,877 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
 Routed to Link 1L : Flow to the Wetlands to the southeast

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Peak Elev= 84.07' @ 12.81 hrs Surf.Area= 2,002 sf Storage= 148 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 1.1 min (973.2 - 972.1)

Volume	Invert	Avail.Storage	Storage Description
#1	84.00'	7,258 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
84.00	1,950	0	0
85.00	2,650	2,300	2,300
86.00	3,410	3,030	5,330
86.50	4,300	1,928	7,258

Device	Routing	Invert	Outlet Devices
#1	Discarded	84.00'	8.270 in/hr Exfiltration over Surface area
#2	Primary	86.00'	6.0' long x 6.0' breadth Broad-Crested Rectangular Weir
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00
			2.50 3.00 3.50 4.00 4.50 5.00 5.50
			Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65
			2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Discarded OutFlow Max=0.38 cfs @ 12.81 hrs HW=84.07' (Free Discharge)
 ↑**1=Exfiltration** (Exfiltration Controls 0.38 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=84.00' TW=0.00' (Dynamic Tailwater)
 ↑**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

PROPOSED

Prepared by Williams & Sparages

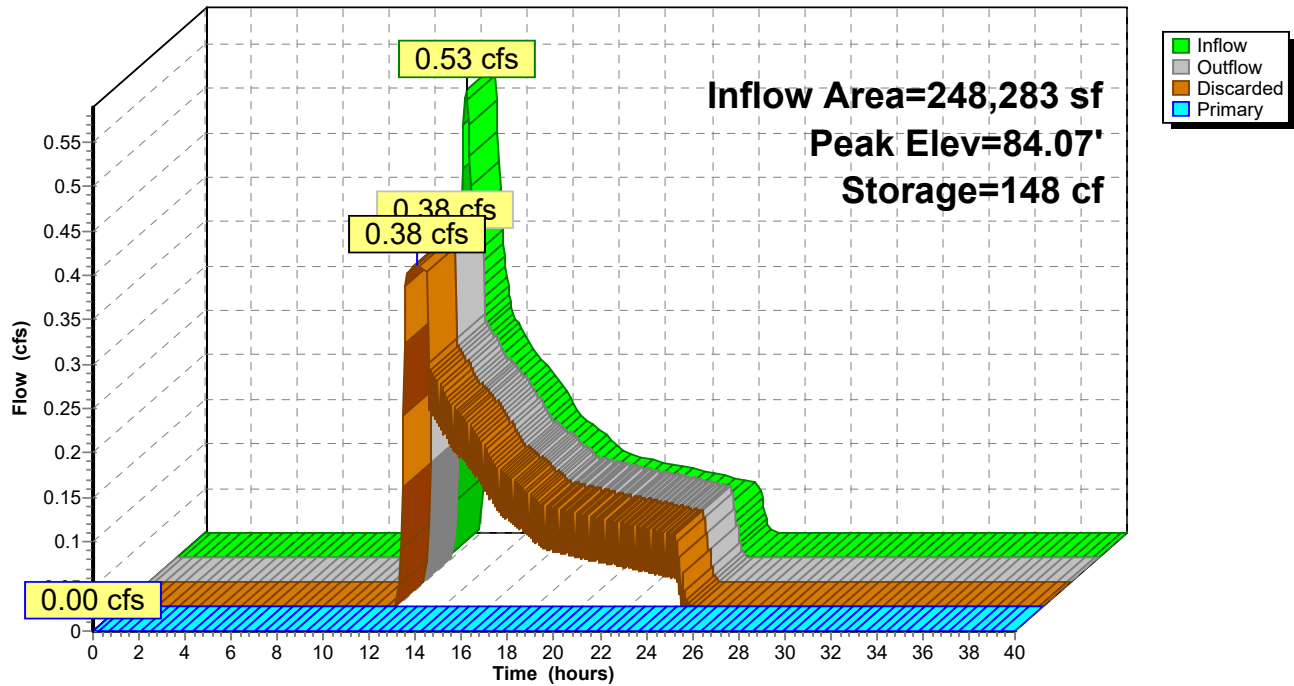
Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 34

Pond 2P: Pond 2

Hydrograph



PROPOSED

Prepared by Williams & Sparages

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Type III 24-hr 10-yr Rainfall=5.12"

Printed 10/3/2023

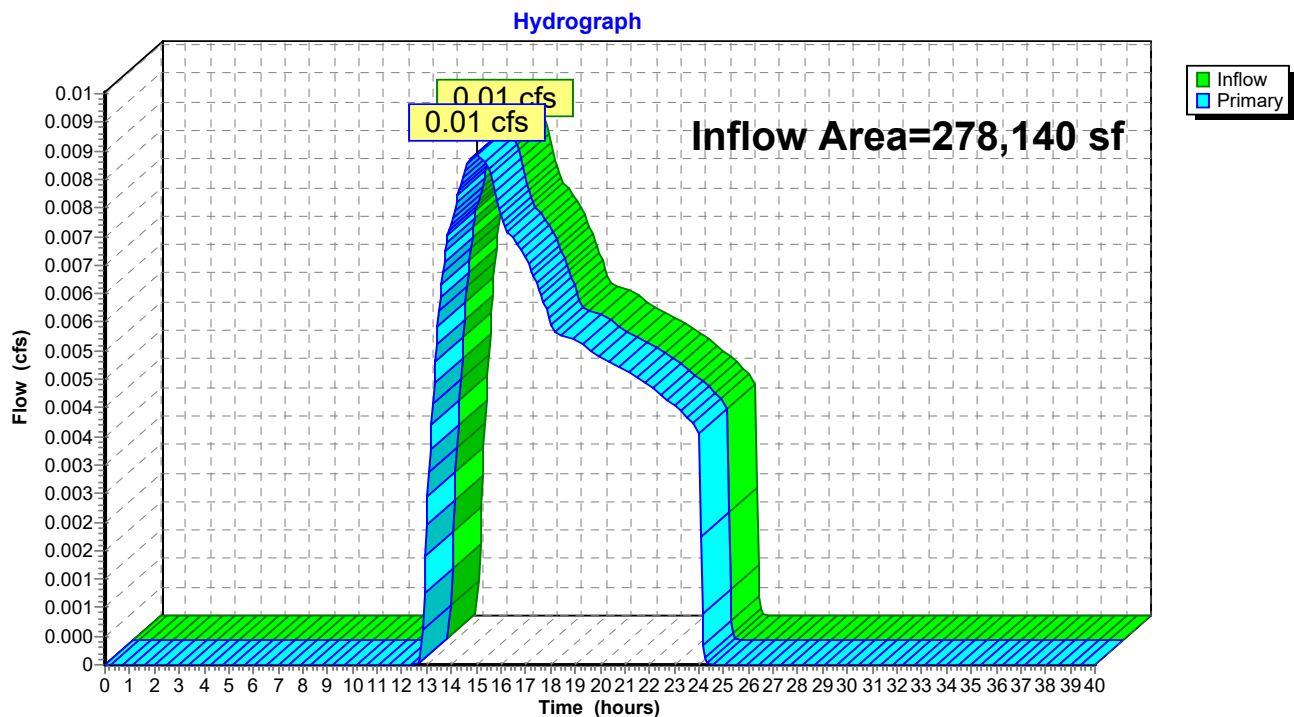
Page 35

Summary for Link 1L: Flow to the Wetlands to the southeast

Inflow Area = 278,140 sf, 7.71% Impervious, Inflow Depth = 0.01" for 10-yr event
 Inflow = 0.01 cfs @ 15.00 hrs, Volume= 246 cf
 Primary = 0.01 cfs @ 15.00 hrs, Volume= 246 cf, Atten= 0%, Lag= 0.0 min
 Routed to Link 3L : Total flow discharging from limit of watershed analysis

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 1L: Flow to the Wetlands to the southeast



PROPOSED

Prepared by Williams & Sparages

Type III 24-hr 10-yr Rainfall=5.12"

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

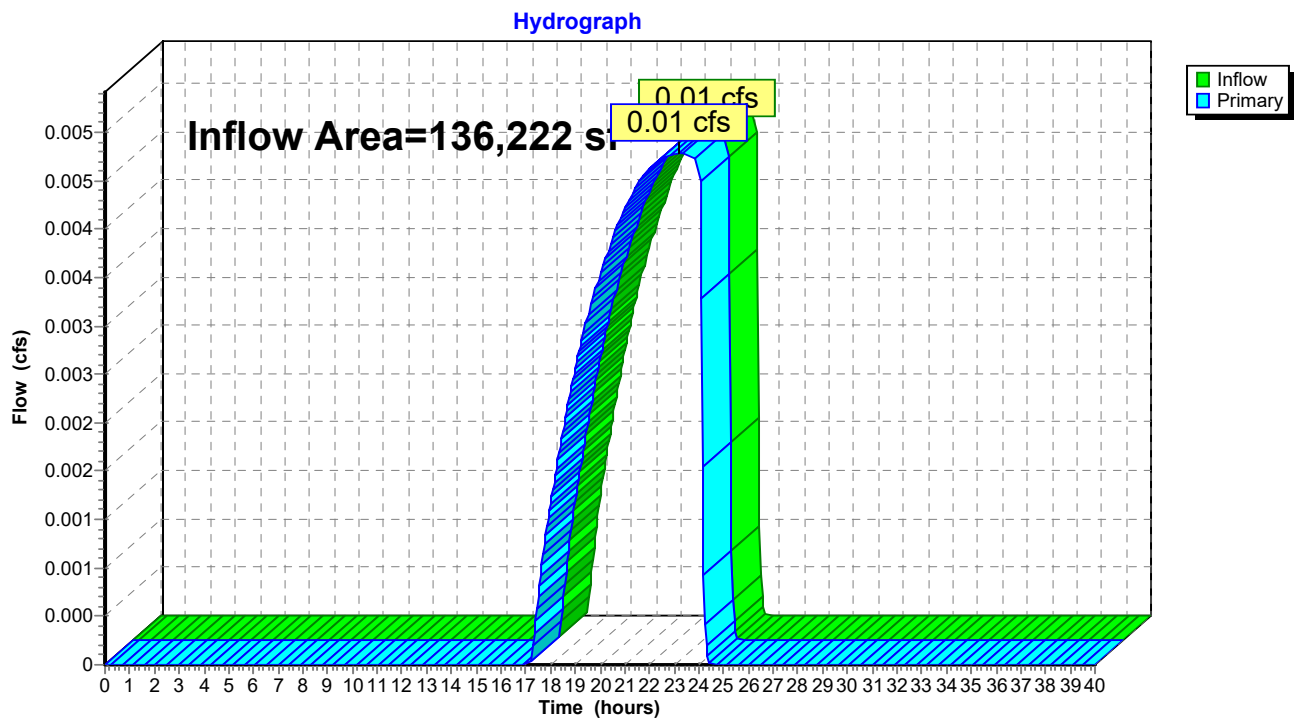
Page 36

Summary for Link 2L: Flow to the Wetlands to the north

Inflow Area = 136,222 sf, 0.00% Impervious, Inflow Depth = 0.01" for 10-yr event
 Inflow = 0.01 cfs @ 23.18 hrs, Volume= 98 cf
 Primary = 0.01 cfs @ 23.18 hrs, Volume= 98 cf, Atten= 0%, Lag= 0.0 min
 Routed to Link 3L : Total flow discharging from limit of watershed analysis

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 2L: Flow to the Wetlands to the north



PROPOSED

Prepared by Williams & Sparages

Type III 24-hr 10-yr Rainfall=5.12"

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

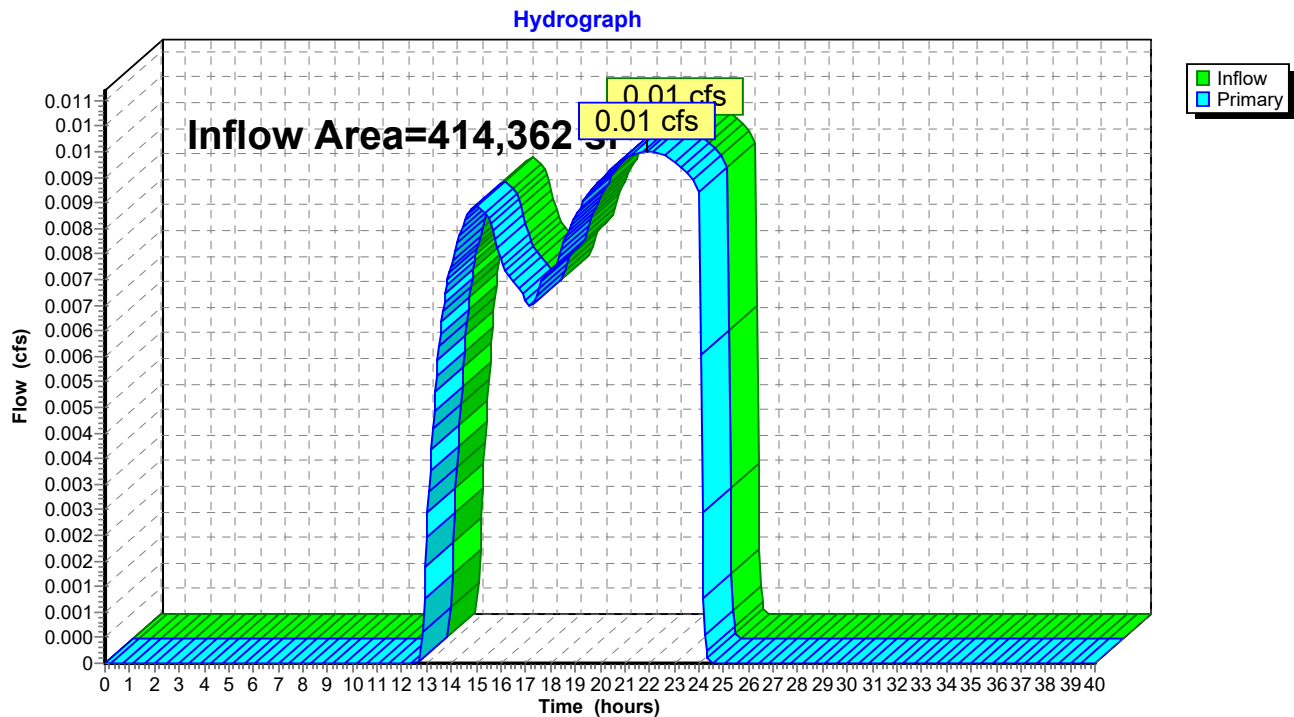
Page 37

Summary for Link 3L: Total flow discharging from limit of watershed analysis

Inflow Area = 414,362 sf, 5.18% Impervious, Inflow Depth = 0.01" for 10-yr event
 Inflow = 0.01 cfs @ 21.90 hrs, Volume= 344 cf
 Primary = 0.01 cfs @ 21.90 hrs, Volume= 344 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 3L: Total flow discharging from limit of watershed analysis



PROPOSED

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

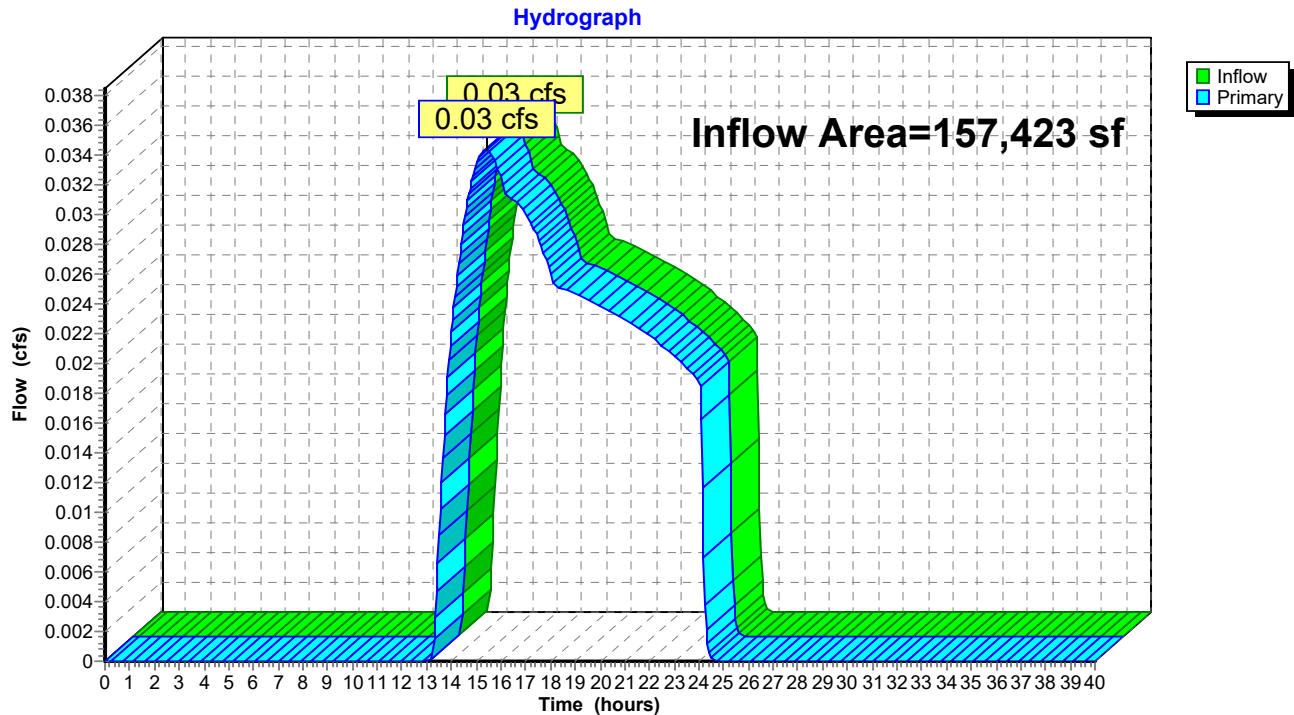
Page 38

Summary for Link 4L: Isolated Area #1

Inflow Area = 157,423 sf, 0.00% Impervious, Inflow Depth = 0.07" for 10-yr event
 Inflow = 0.03 cfs @ 15.40 hrs, Volume= 973 cf
 Primary = 0.03 cfs @ 15.40 hrs, Volume= 973 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 4L: Isolated Area #1



PROPOSED

Prepared by Williams & Sparages

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Type III 24-hr 10-yr Rainfall=5.12"

Printed 10/3/2023

Page 39

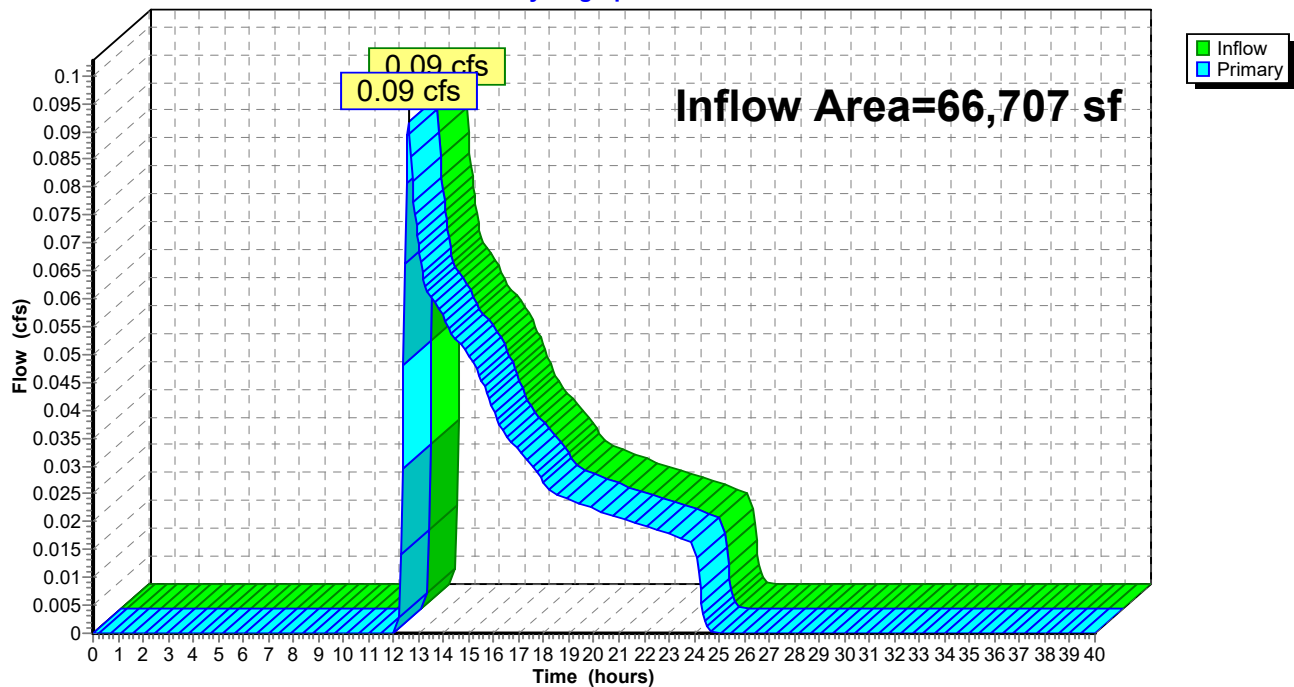
Summary for Link 5L: Isolated Area #2

Inflow Area = 66,707 sf, 0.00% Impervious, Inflow Depth = 0.26" for 10-yr event
Inflow = 0.09 cfs @ 12.60 hrs, Volume= 1,459 cf
Primary = 0.09 cfs @ 12.60 hrs, Volume= 1,459 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 5L: Isolated Area #2

Hydrograph



PROPOSED

Prepared by Williams & Sparages

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Type III 24-hr 10-yr Rainfall=5.12"

Printed 10/3/2023

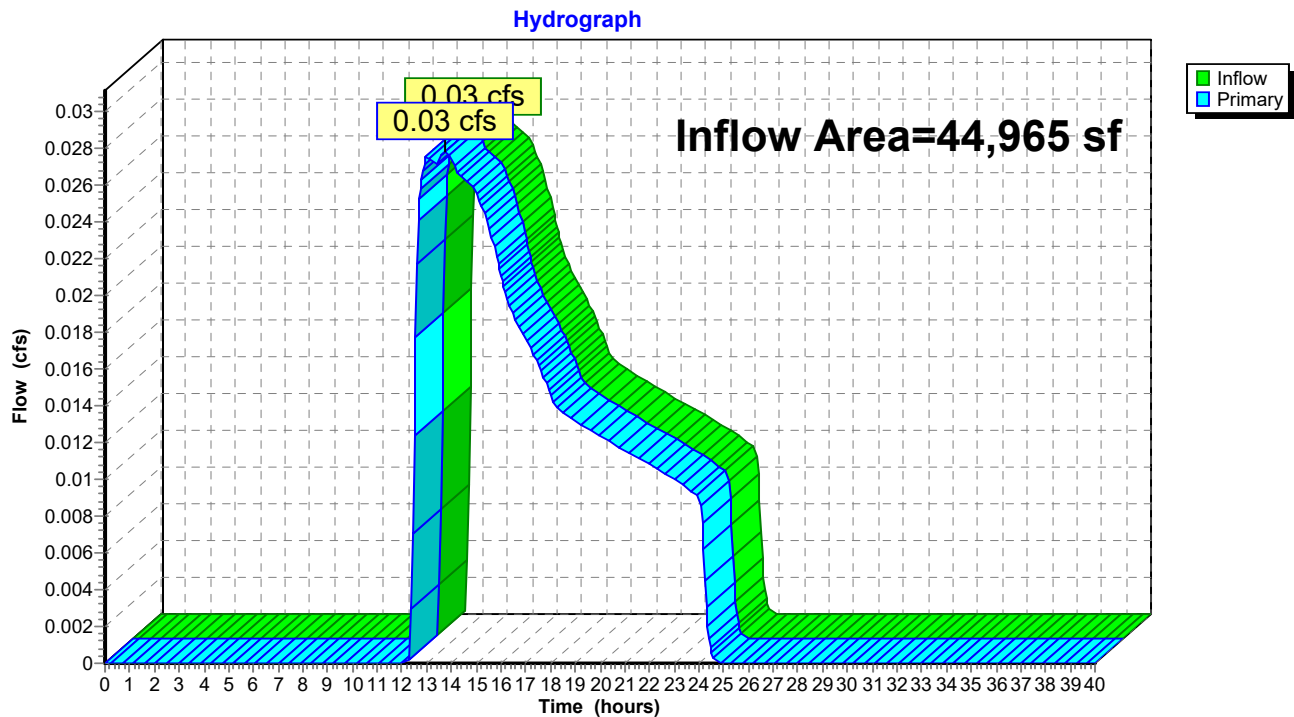
Page 40

Summary for Link 6L: Isolated Area #3

Inflow Area = 44,965 sf, 0.00% Impervious, Inflow Depth = 0.19" for 10-yr event
 Inflow = 0.03 cfs @ 13.77 hrs, Volume= 711 cf
 Primary = 0.03 cfs @ 13.77 hrs, Volume= 711 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 6L: Isolated Area #3



PROPOSED

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 41

Summary for Subcatchment 1S: PR-POND1

Runoff = 0.50 cfs @ 12.44 hrs, Volume= 3,549 cf, Depth= 0.92"
 Routed to Pond 1P : Pond 1

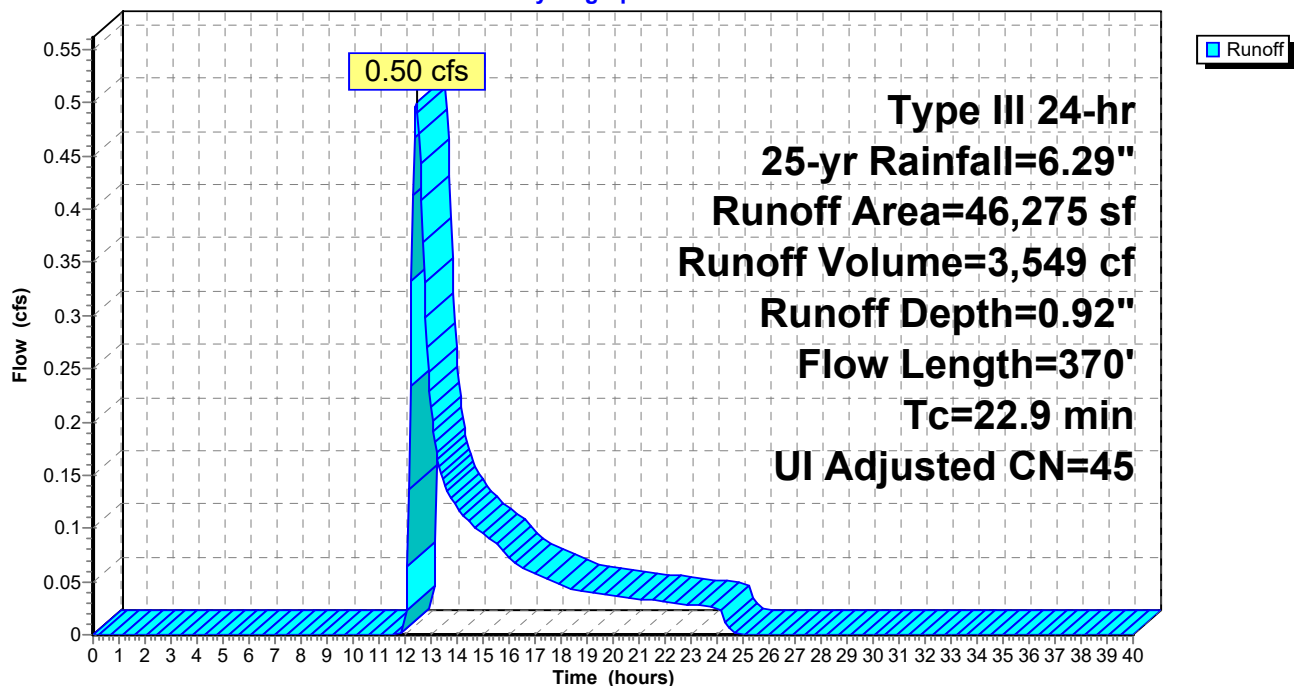
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 25-yr Rainfall=6.29"

Area (sf)	CN	Adj	Description
* 2,160	98		Proposed Barn, Unconnected roofs, HSG A
5,933	76		Gravel roads, HSG A
38,182	39		>75% Grass cover, Good, HSG A
46,275	46	45	Weighted Average, UI Adjusted
44,115			95.33% Pervious Area
2,160			4.67% Impervious Area
2,160			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.2	50	0.0100	0.05		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
6.7	320	0.0250	0.79		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
22.9	370	Total			

Subcatchment 1S: PR-POND1

Hydrograph



PROPOSED

Prepared by Williams & Sparages

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Type III 24-hr 25-yr Rainfall=6.29"

Printed 10/3/2023

Page 42

Summary for Subcatchment 2S: PR-WETLANDS-NORTH

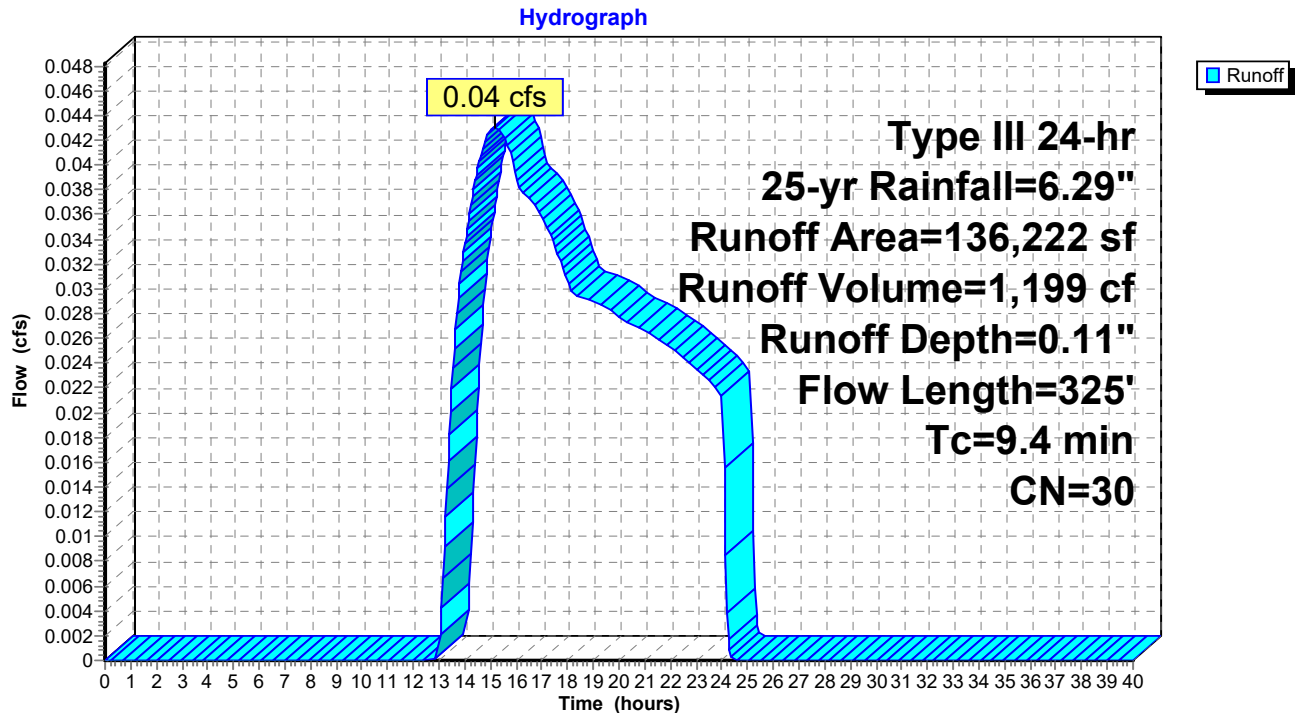
Runoff = 0.04 cfs @ 15.19 hrs, Volume= 1,199 cf, Depth= 0.11"
Routed to Link 2L : Flow to the Wetlands to the north

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=6.29"

Area (sf)	CN	Description
135,222	30	Woods, Good, HSG A
1,000	39	>75% Grass cover, Good, HSG A
136,222	30	Weighted Average
136,222		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0800	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
2.4	275	0.1500	1.94		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
9.4	325	Total			

Subcatchment 2S: PR-WETLANDS-NORTH



PROPOSED

Type III 24-hr 25-yr Rainfall=6.29"

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 43

Summary for Subcatchment 3S: EX-ABUTTERS (No Change)

Runoff = 0.63 cfs @ 12.47 hrs, Volume= 5,827 cf, Depth= 0.53"
 Routed to Pond 2P : Pond 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 25-yr Rainfall=6.29"

Area (sf)	CN	Adj	Description		
5,000	98		Unconnected roofs, HSG A		
5,000	98		Paved parking, HSG A		
5,000	61		>75% Grass cover, Good, HSG B		
55,000	39		>75% Grass cover, Good, HSG A		
61,524	30		Woods, Good, HSG A		
131,524	40	39	Weighted Average, UI Adjusted		
121,524			92.40% Pervious Area		
10,000			7.60% Impervious Area		
5,000			50.00% Unconnected		
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0800	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
8.7	450	0.0300	0.87		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
15.7	500	Total			

PROPOSED

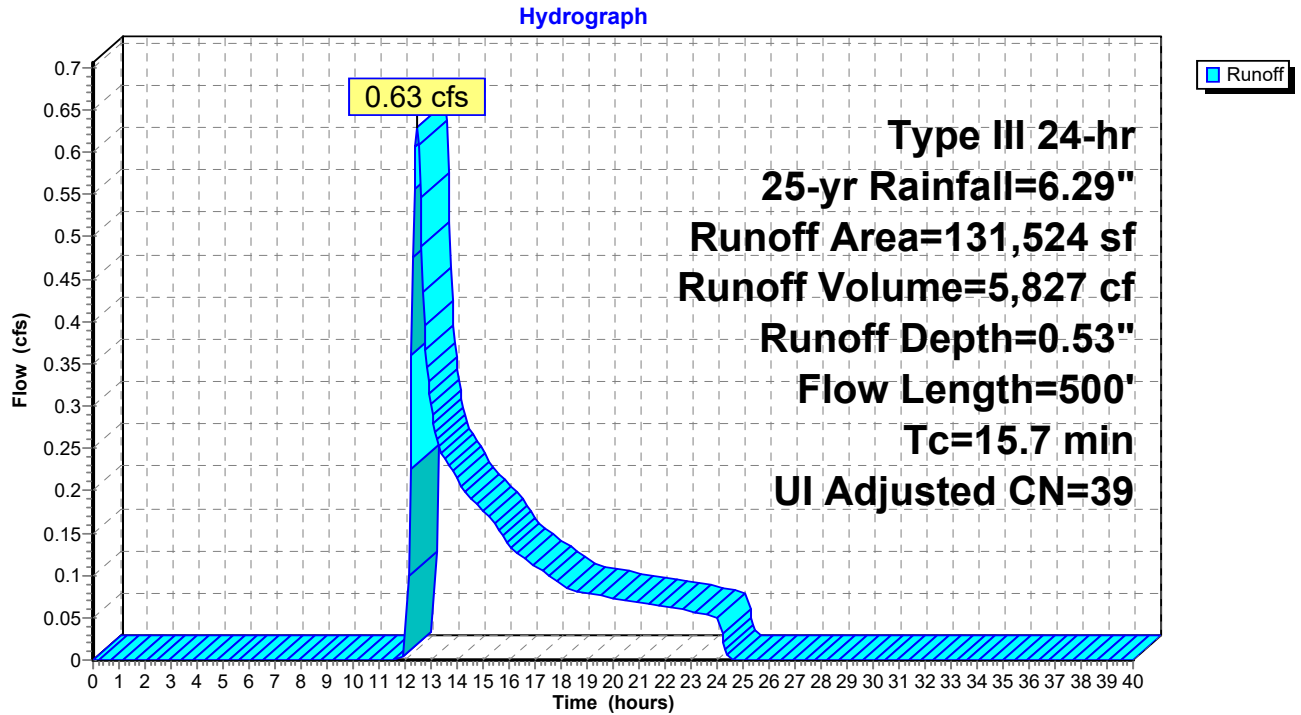
Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 44

Subcatchment 3S: EX-ABUTTERS (No Change)



PROPOSED

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 45

Summary for Subcatchment 4S: PR-ISOLATED AREA 1

Runoff = 0.18 cfs @ 12.57 hrs, Volume= 3,485 cf, Depth= 0.27"
 Routed to Link 4L : Isolated Area #1

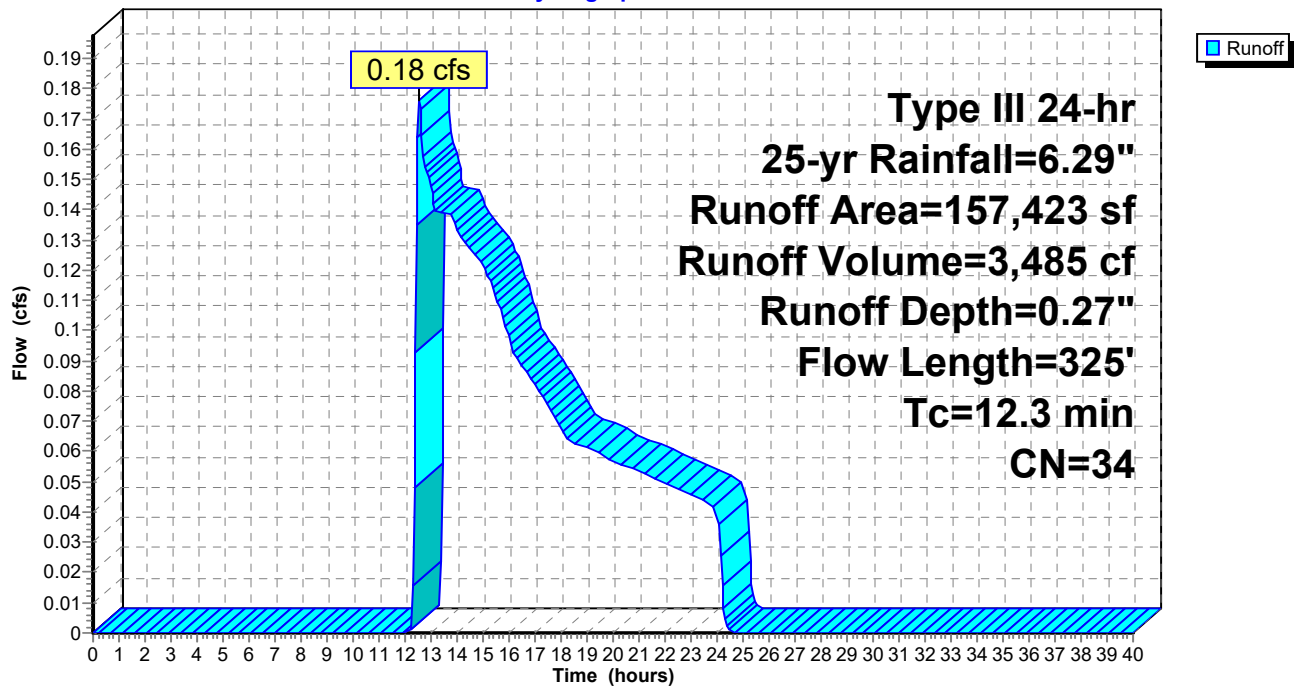
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 25-yr Rainfall=6.29"

Area (sf)	CN	Description
96,900	30	Woods, Good, HSG A
3,620	55	Woods, Good, HSG B
56,903	39	>75% Grass cover, Good, HSG A
157,423	34	Weighted Average
157,423		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0800	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
5.3	275	0.0300	0.87		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
12.3	325	Total			

Subcatchment 4S: PR-ISOLATED AREA 1

Hydrograph



PROPOSED

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 46

Summary for Subcatchment 5S: PR-ISOLATED AREA 2

Runoff = 0.37 cfs @ 12.47 hrs, Volume= 3,290 cf, Depth= 0.59"
 Routed to Link 5L : Isolated Area #2

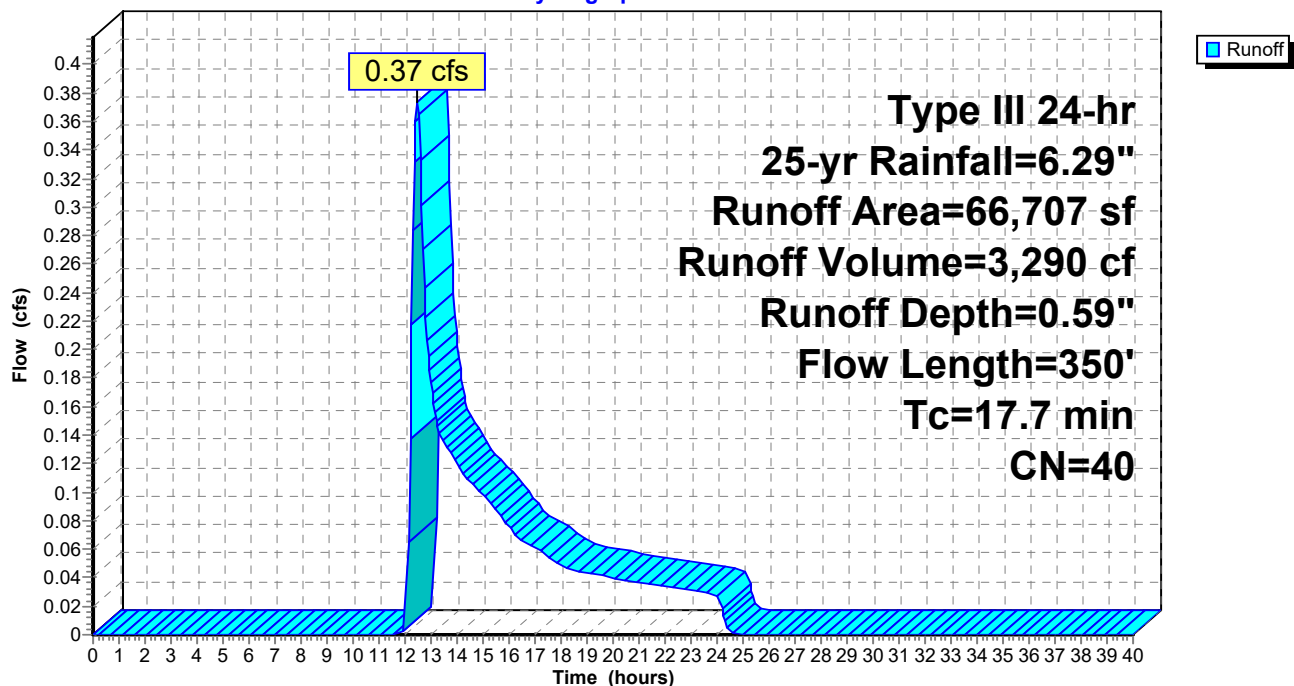
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 25-yr Rainfall=6.29"

Area (sf)	CN	Description
7,805	30	Woods, Good, HSG A
4,602	76	Gravel roads, HSG A
54,300	39	>75% Grass cover, Good, HSG A
66,707	40	Weighted Average
66,707		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.2	50	0.0100	0.05		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
1.0	100	0.0100	1.61		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
0.5	200	0.1500	6.24		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
17.7	350	Total			

Subcatchment 5S: PR-ISOLATED AREA 2

Hydrograph



PROPOSED

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 47

Summary for Subcatchment 6S: PR-ISOLATED AREA 3

Runoff = 0.17 cfs @ 12.52 hrs, Volume= 1,775 cf, Depth= 0.47"
 Routed to Link 6L : Isolated Area #3

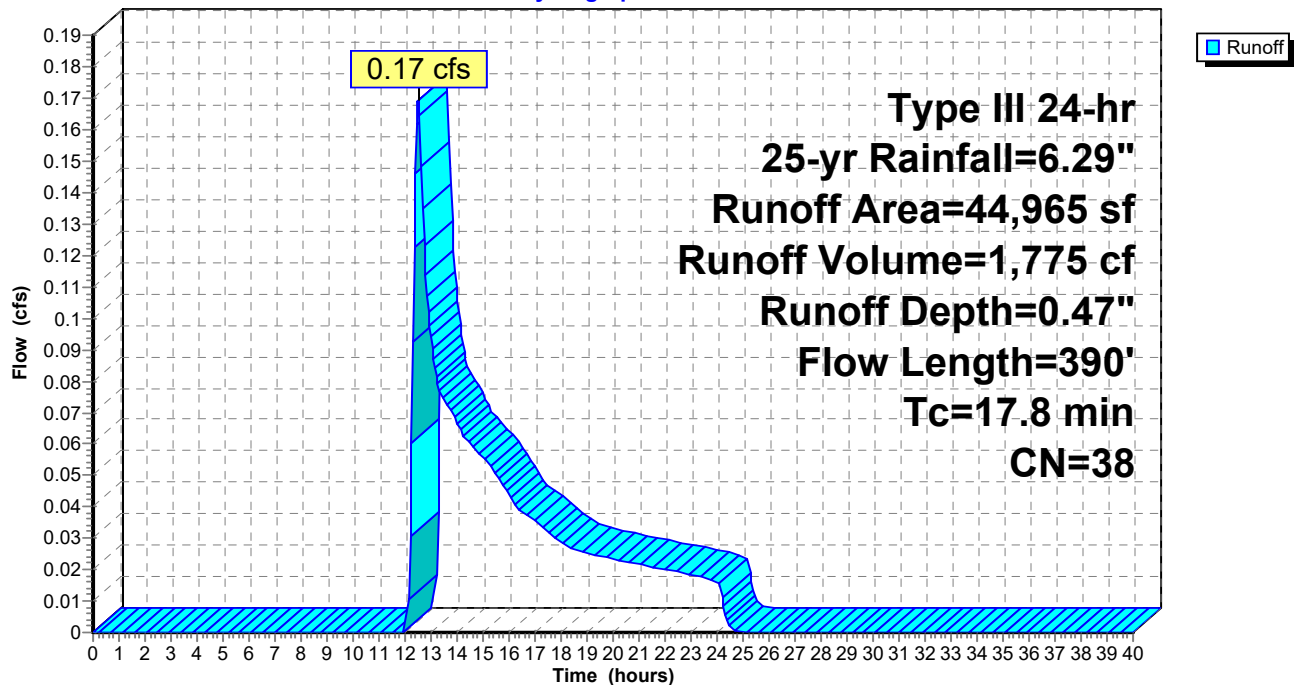
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 25-yr Rainfall=6.29"

Area (sf)	CN	Description
2,918	30	Woods, Good, HSG A
42,047	39	>75% Grass cover, Good, HSG A
44,965	38	Weighted Average
44,965		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.2	50	0.0100	0.05		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
1.0	100	0.0100	1.61		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
0.6	240	0.1500	6.24		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
17.8	390	Total			

Subcatchment 6S: PR-ISOLATED AREA 3

Hydrograph



PROPOSED

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 48

Summary for Subcatchment 9S: PR-POND2

Runoff = 0.96 cfs @ 12.41 hrs, Volume= 6,245 cf, Depth= 1.06"
 Routed to Pond 2P : Pond 2

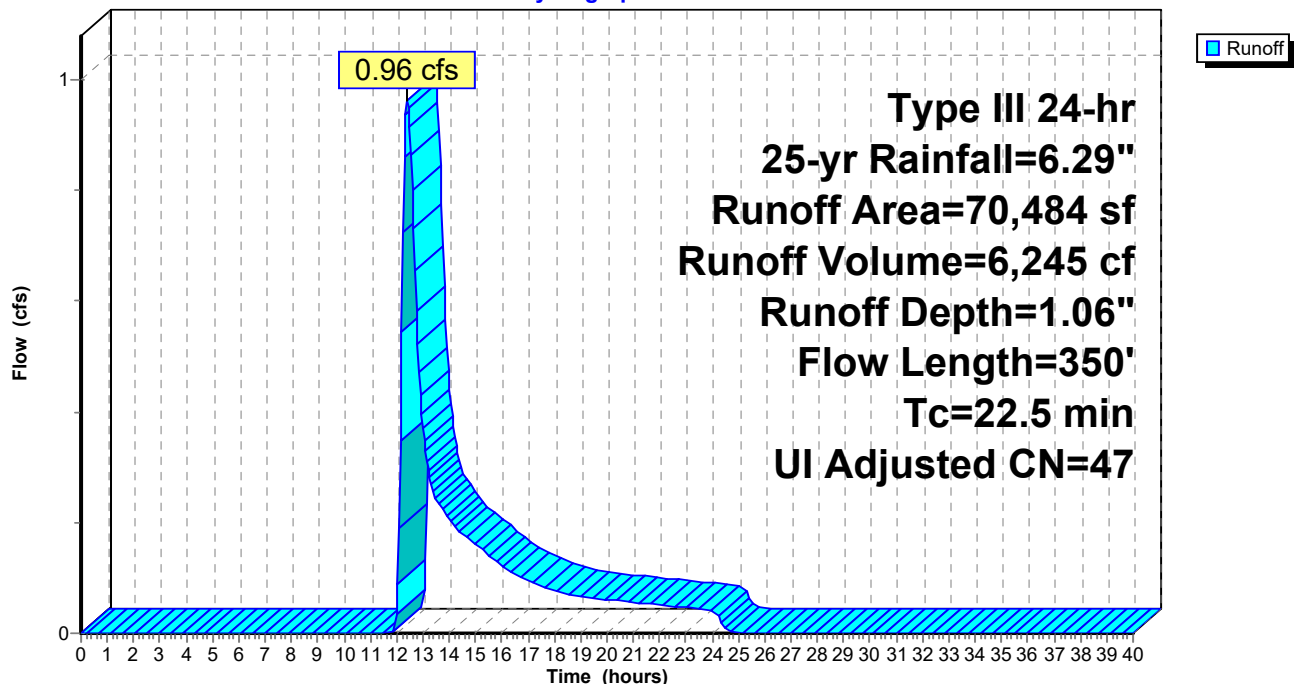
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 25-yr Rainfall=6.29"

Area (sf)	CN	Adj	Description
3,200	98		Unconnected roofs, HSG A
5,000	98		Paved parking, HSG A
5,498	76		Gravel roads, HSG A
56,786	39		>75% Grass cover, Good, HSG A
70,484	49	47	Weighted Average, UI Adjusted
62,284			88.37% Pervious Area
8,200			11.63% Impervious Area
3,200			39.02% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.2	50	0.0100	0.05		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
6.3	300	0.0250	0.79		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
22.5	350	Total			

Subcatchment 9S: PR-POND2

Hydrograph



PROPOSED

Type III 24-hr 25-yr Rainfall=6.29"

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 49

Summary for Subcatchment 10S: PR-WETLANDS-EAST

Runoff = 0.06 cfs @ 12.45 hrs, Volume= 781 cf, Depth= 0.31"
 Routed to Link 1L : Flow to the Wetlands to the southeast

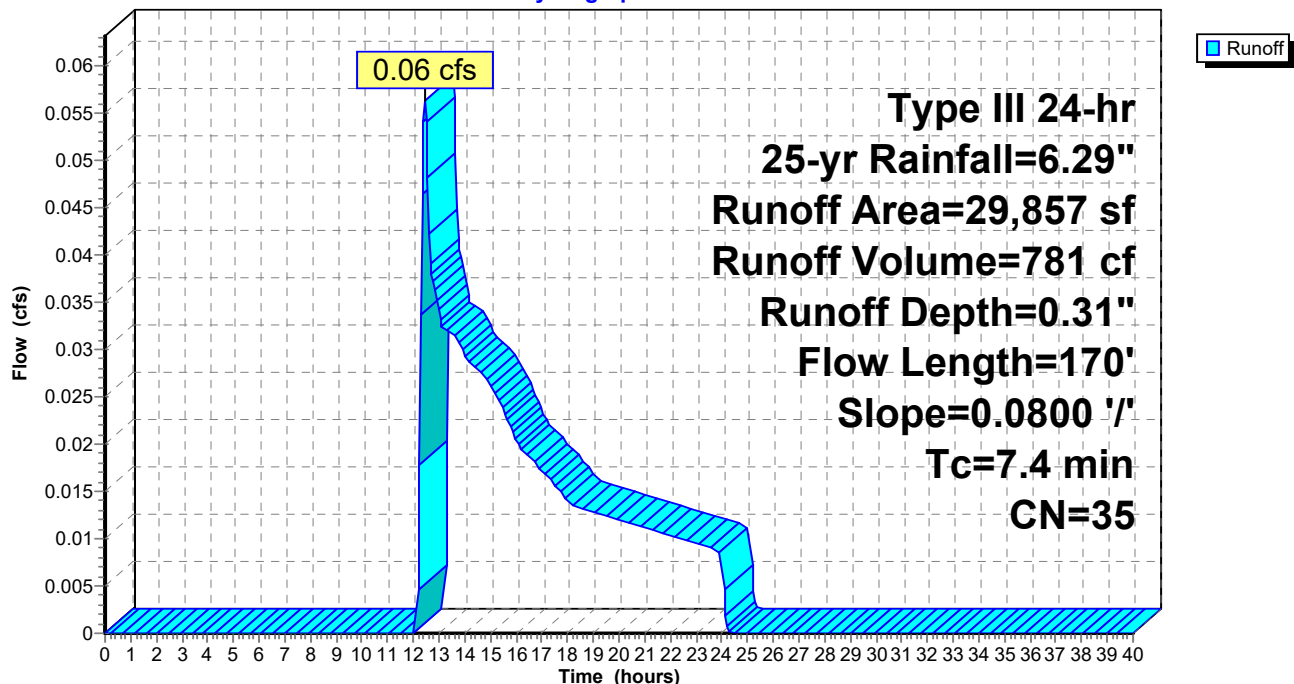
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 25-yr Rainfall=6.29"

Area (sf)	CN	Description
590	98	Unconnected roofs, HSG A
500	98	Paved parking, HSG A
10,000	39	>75% Grass cover, Good, HSG A
18,767	30	Woods, Good, HSG A
29,857	35	Weighted Average
28,767		96.35% Pervious Area
1,090		3.65% Impervious Area
590		54.13% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0800	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
0.4	120	0.0800	4.55		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
7.4	170	Total			

Subcatchment 10S: PR-WETLANDS-EAST

Hydrograph



PROPOSED

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 50

Summary for Pond 1P: Pond 1

Inflow Area = 46,275 sf, 4.67% Impervious, Inflow Depth = 0.92" for 25-yr event
 Inflow = 0.50 cfs @ 12.44 hrs, Volume= 3,549 cf
 Outflow = 0.16 cfs @ 13.27 hrs, Volume= 3,550 cf, Atten= 68%, Lag= 49.5 min
 Discarded = 0.16 cfs @ 13.27 hrs, Volume= 3,550 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
 Routed to Pond 2P : Pond 2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Peak Elev= 88.07' @ 13.27 hrs Surf.Area= 846 sf Storage= 725 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 38.9 min (965.8 - 926.9)

Volume	Invert	Avail.Storage	Storage Description
#1	87.00'	3,968 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
87.00	510	0	0
88.00	820	665	665
89.00	1,180	1,000	1,665
90.00	1,610	1,395	3,060
90.50	2,020	908	3,968

Device	Routing	Invert	Outlet Devices
#1	Discarded	87.00'	8.270 in/hr Exfiltration over Surface area
#2	Primary	90.00'	6.0' long x 6.0' breadth Broad-Crested Rectangular Weir
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00
			2.50 3.00 3.50 4.00 4.50 5.00 5.50
			Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65
			2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Discarded OutFlow Max=0.16 cfs @ 13.27 hrs HW=88.07' (Free Discharge)

↑**1=Exfiltration** (Exfiltration Controls 0.16 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=87.00' TW=84.00' (Dynamic Tailwater)

↑**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

PROPOSED

Prepared by Williams & Sparages

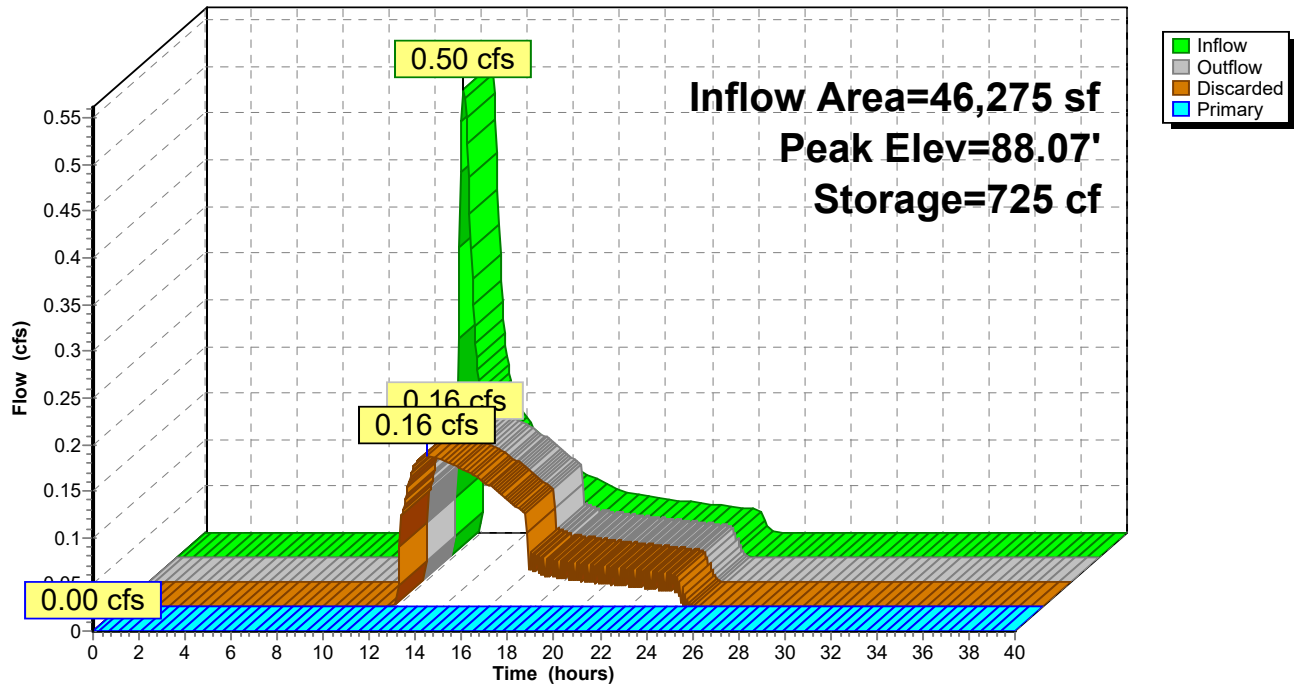
Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 51

Pond 1P: Pond 1

Hydrograph



PROPOSED*Type III 24-hr 25-yr Rainfall=6.29"*

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 52

Summary for Pond 2P: Pond 2

Inflow Area = 248,283 sf, 8.20% Impervious, Inflow Depth = 0.58" for 25-yr event
 Inflow = 1.58 cfs @ 12.43 hrs, Volume= 12,072 cf
 Outflow = 0.50 cfs @ 13.38 hrs, Volume= 12,086 cf, Atten= 68%, Lag= 56.5 min
 Discarded = 0.50 cfs @ 13.38 hrs, Volume= 12,086 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
 Routed to Link 1L : Flow to the Wetlands to the southeast

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Peak Elev= 84.96' @ 13.38 hrs Surf.Area= 2,620 sf Storage= 2,189 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 37.2 min (974.5 - 937.3)

Volume	Invert	Avail.Storage	Storage Description
#1	84.00'	7,258 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
84.00	1,950	0	0
85.00	2,650	2,300	2,300
86.00	3,410	3,030	5,330
86.50	4,300	1,928	7,258

Device	Routing	Invert	Outlet Devices
#1	Discarded	84.00'	8.270 in/hr Exfiltration over Surface area
#2	Primary	86.00'	6.0' long x 6.0' breadth Broad-Crested Rectangular Weir
Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00			
2.50 3.00 3.50 4.00 4.50 5.00 5.50			
Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65			
2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83			

Discarded OutFlow Max=0.50 cfs @ 13.38 hrs HW=84.96' (Free Discharge)

↑**1=Exfiltration** (Exfiltration Controls 0.50 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=84.00' TW=0.00' (Dynamic Tailwater)

↑**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

PROPOSED

Prepared by Williams & Sparages

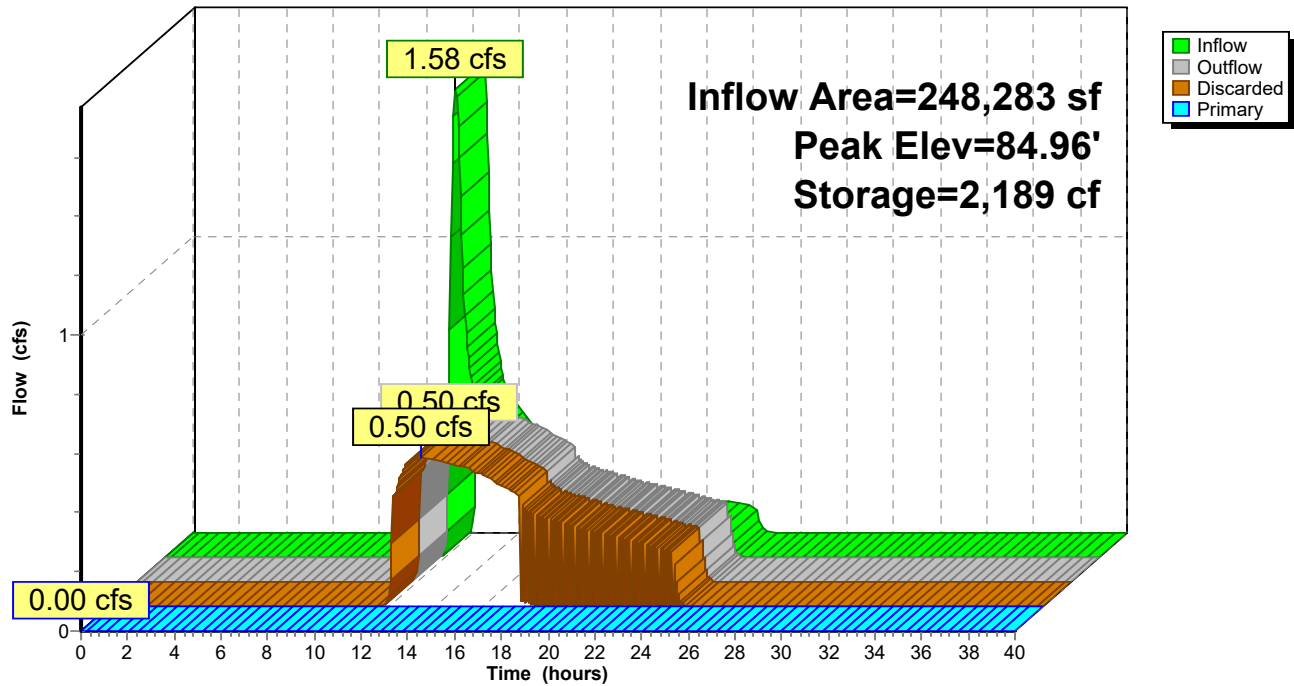
Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 53

Pond 2P: Pond 2

Hydrograph



PROPOSED

Prepared by Williams & Sparages

Type III 24-hr 25-yr Rainfall=6.29"

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

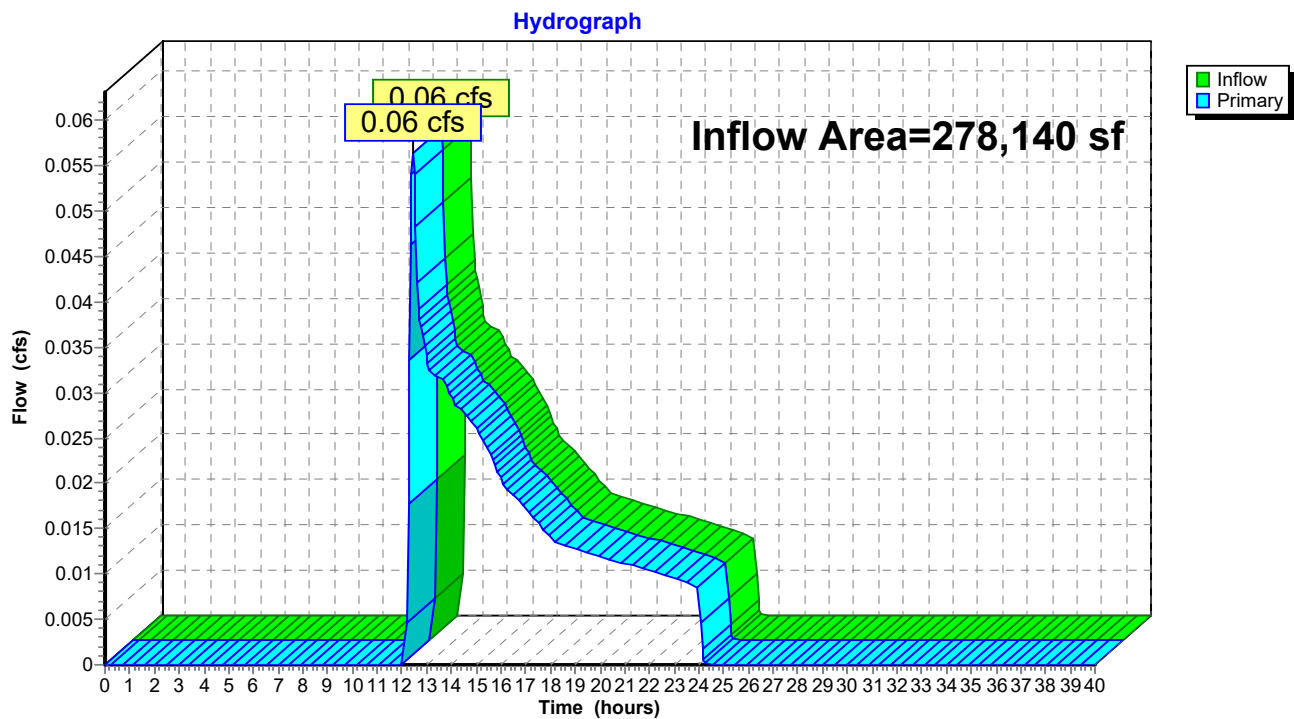
Page 54

Summary for Link 1L: Flow to the Wetlands to the southeast

Inflow Area = 278,140 sf, 7.71% Impervious, Inflow Depth = 0.03" for 25-yr event
 Inflow = 0.06 cfs @ 12.45 hrs, Volume= 781 cf
 Primary = 0.06 cfs @ 12.45 hrs, Volume= 781 cf, Atten= 0%, Lag= 0.0 min
 Routed to Link 3L : Total flow discharging from limit of watershed analysis

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 1L: Flow to the Wetlands to the southeast



PROPOSED

Type III 24-hr 25-yr Rainfall=6.29"

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

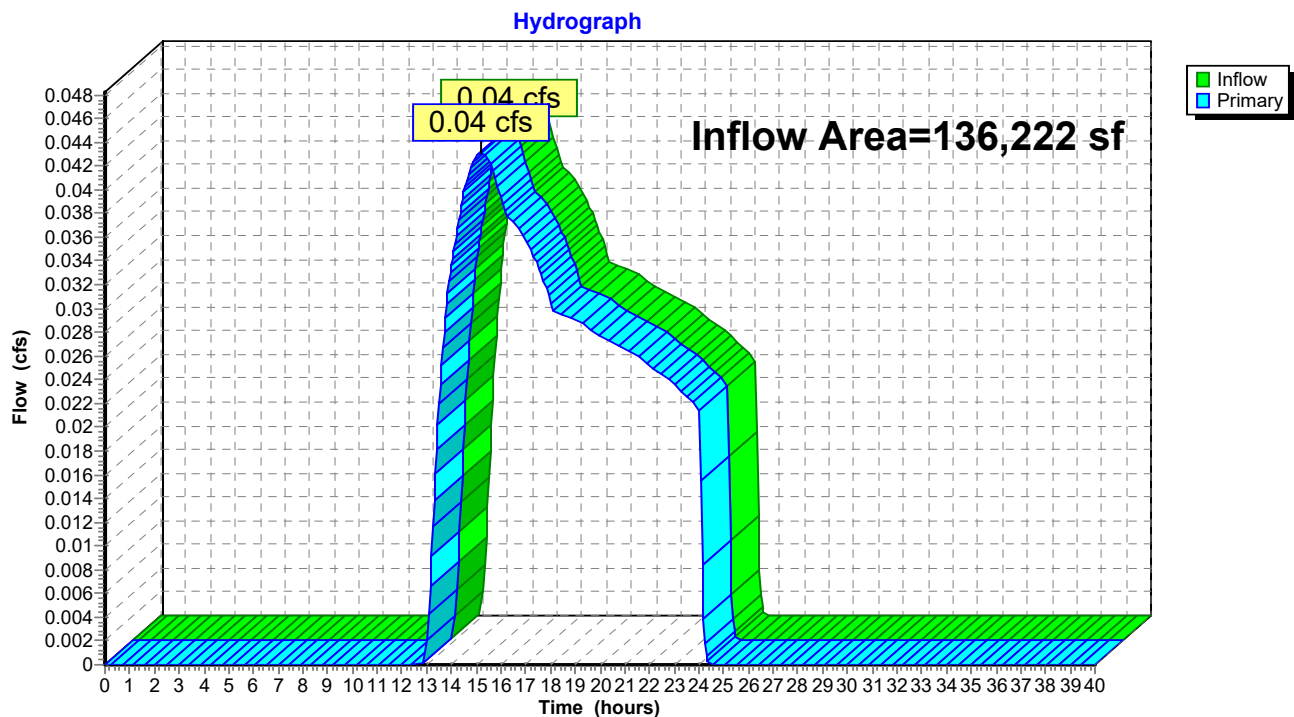
Page 55

Summary for Link 2L: Flow to the Wetlands to the north

Inflow Area = 136,222 sf, 0.00% Impervious, Inflow Depth = 0.11" for 25-yr event
 Inflow = 0.04 cfs @ 15.19 hrs, Volume= 1,199 cf
 Primary = 0.04 cfs @ 15.19 hrs, Volume= 1,199 cf, Atten= 0%, Lag= 0.0 min
 Routed to Link 3L : Total flow discharging from limit of watershed analysis

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 2L: Flow to the Wetlands to the north



PROPOSED

Prepared by Williams & Sparages

Type III 24-hr 25-yr Rainfall=6.29"

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

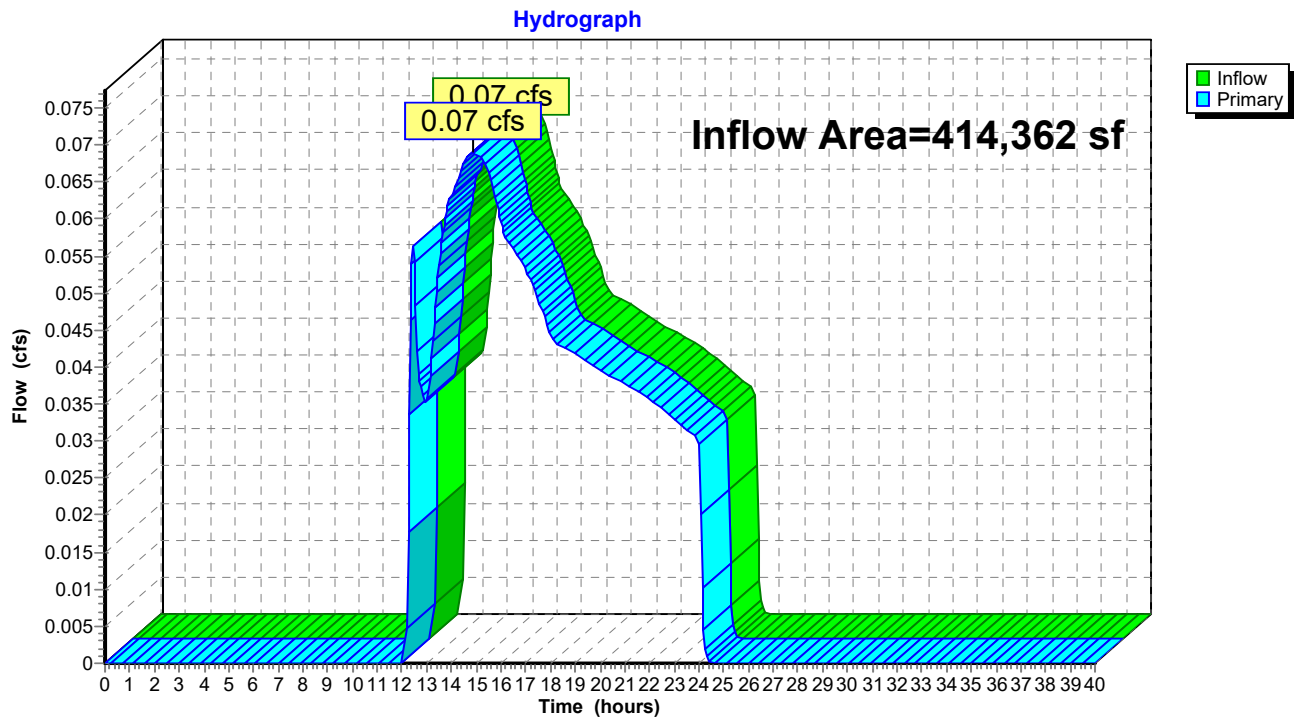
Page 56

Summary for Link 3L: Total flow discharging from limit of watershed analysis

Inflow Area = 414,362 sf, 5.18% Impervious, Inflow Depth = 0.06" for 25-yr event
 Inflow = 0.07 cfs @ 14.90 hrs, Volume= 1,979 cf
 Primary = 0.07 cfs @ 14.90 hrs, Volume= 1,979 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 3L: Total flow discharging from limit of watershed analysis



PROPOSED

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 57

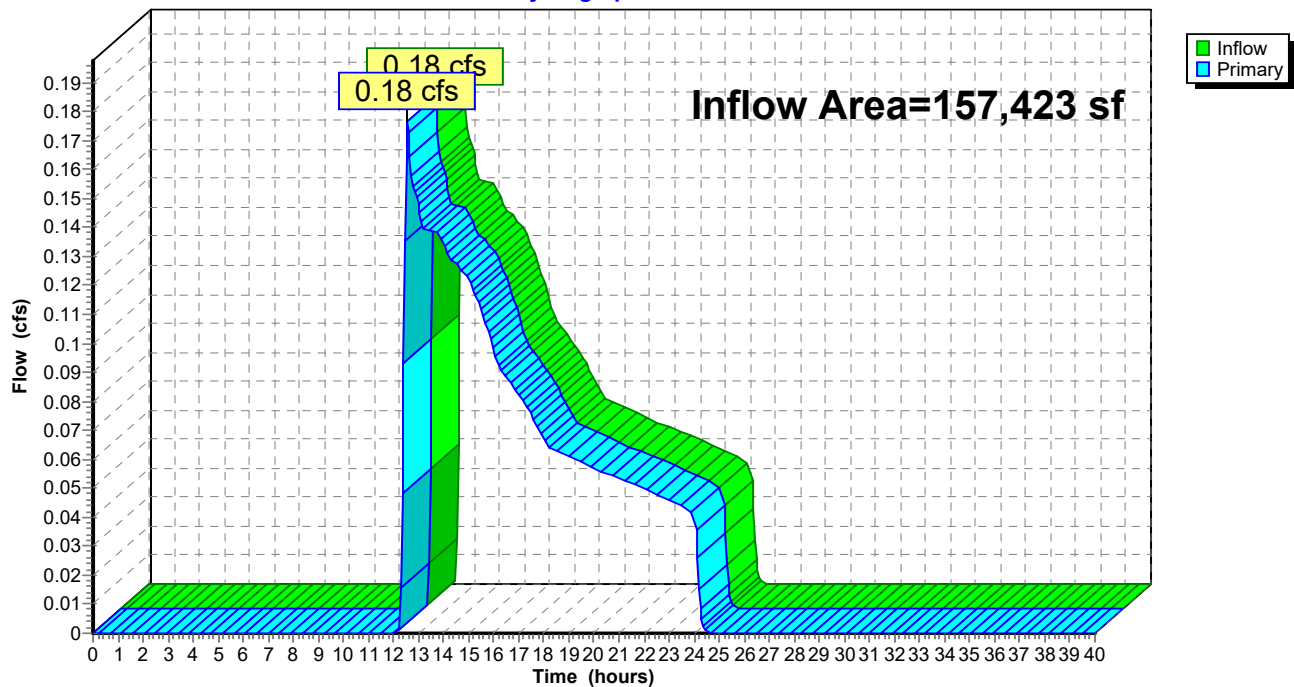
Summary for Link 4L: Isolated Area #1

Inflow Area = 157,423 sf, 0.00% Impervious, Inflow Depth = 0.27" for 25-yr event
 Inflow = 0.18 cfs @ 12.57 hrs, Volume= 3,485 cf
 Primary = 0.18 cfs @ 12.57 hrs, Volume= 3,485 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 4L: Isolated Area #1

Hydrograph



PROPOSED

Type III 24-hr 25-yr Rainfall=6.29"

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 58

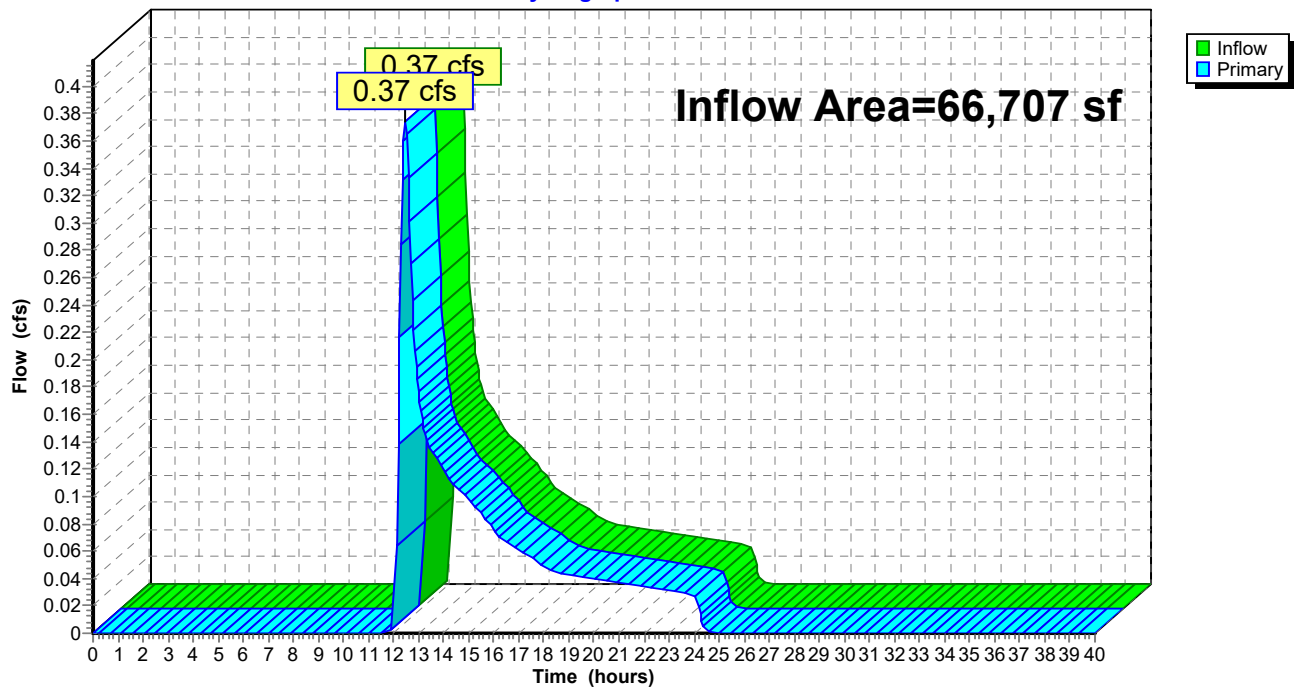
Summary for Link 5L: Isolated Area #2

Inflow Area = 66,707 sf, 0.00% Impervious, Inflow Depth = 0.59" for 25-yr event
 Inflow = 0.37 cfs @ 12.47 hrs, Volume= 3,290 cf
 Primary = 0.37 cfs @ 12.47 hrs, Volume= 3,290 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 5L: Isolated Area #2

Hydrograph



PROPOSED

Prepared by Williams & Sparages

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Type III 24-hr 25-yr Rainfall=6.29"

Printed 10/3/2023

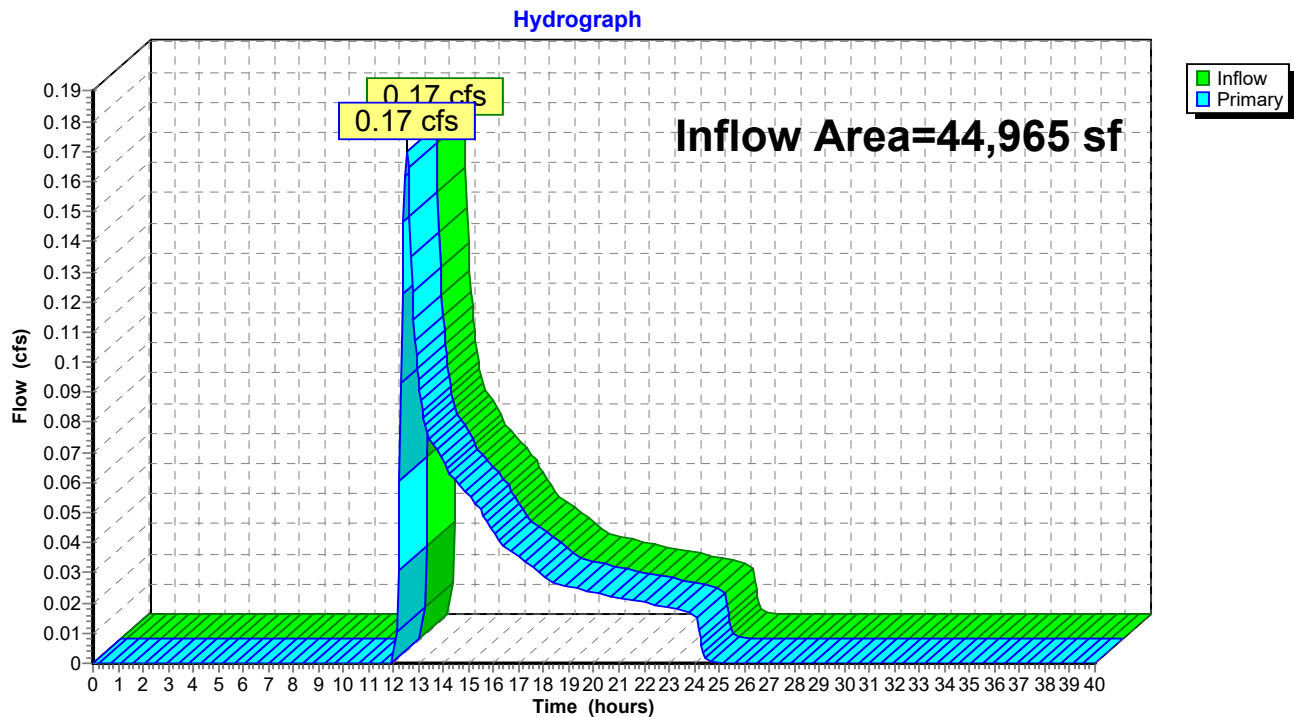
Page 59

Summary for Link 6L: Isolated Area #3

Inflow Area = 44,965 sf, 0.00% Impervious, Inflow Depth = 0.47" for 25-yr event
Inflow = 0.17 cfs @ 12.52 hrs, Volume= 1,775 cf
Primary = 0.17 cfs @ 12.52 hrs, Volume= 1,775 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 6L: Isolated Area #3



PROPOSED

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 60

Summary for Subcatchment 1S: PR-POND1

Runoff = 0.80 cfs @ 12.40 hrs, Volume= 5,044 cf, Depth= 1.31"
 Routed to Pond 1P : Pond 1

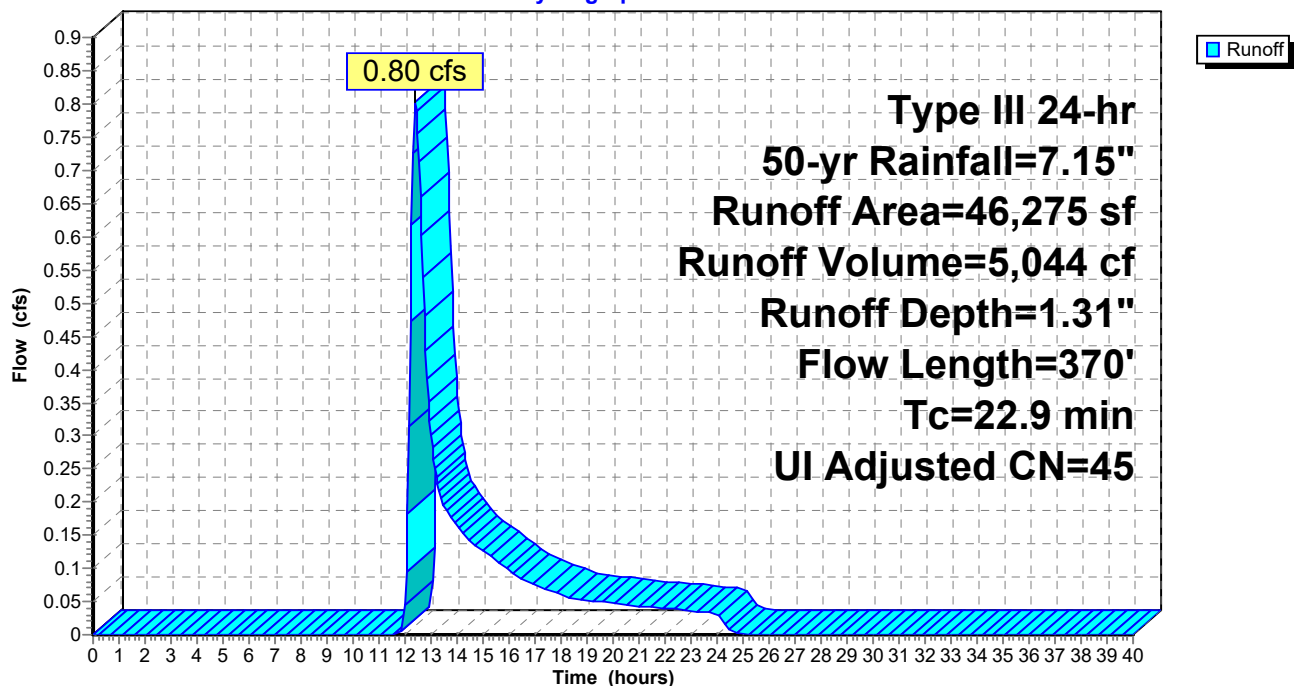
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 50-yr Rainfall=7.15"

Area (sf)	CN	Adj	Description
* 2,160	98		Proposed Barn, Unconnected roofs, HSG A
5,933	76		Gravel roads, HSG A
38,182	39		>75% Grass cover, Good, HSG A
46,275	46	45	Weighted Average, UI Adjusted
44,115			95.33% Pervious Area
2,160			4.67% Impervious Area
2,160			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.2	50	0.0100	0.05		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
6.7	320	0.0250	0.79		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
22.9	370	Total			

Subcatchment 1S: PR-POND1

Hydrograph



PROPOSED

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 61

Summary for Subcatchment 2S: PR-WETLANDS-NORTH

Runoff = 0.10 cfs @ 13.74 hrs, Volume= 2,712 cf, Depth= 0.24"
 Routed to Link 2L : Flow to the Wetlands to the north

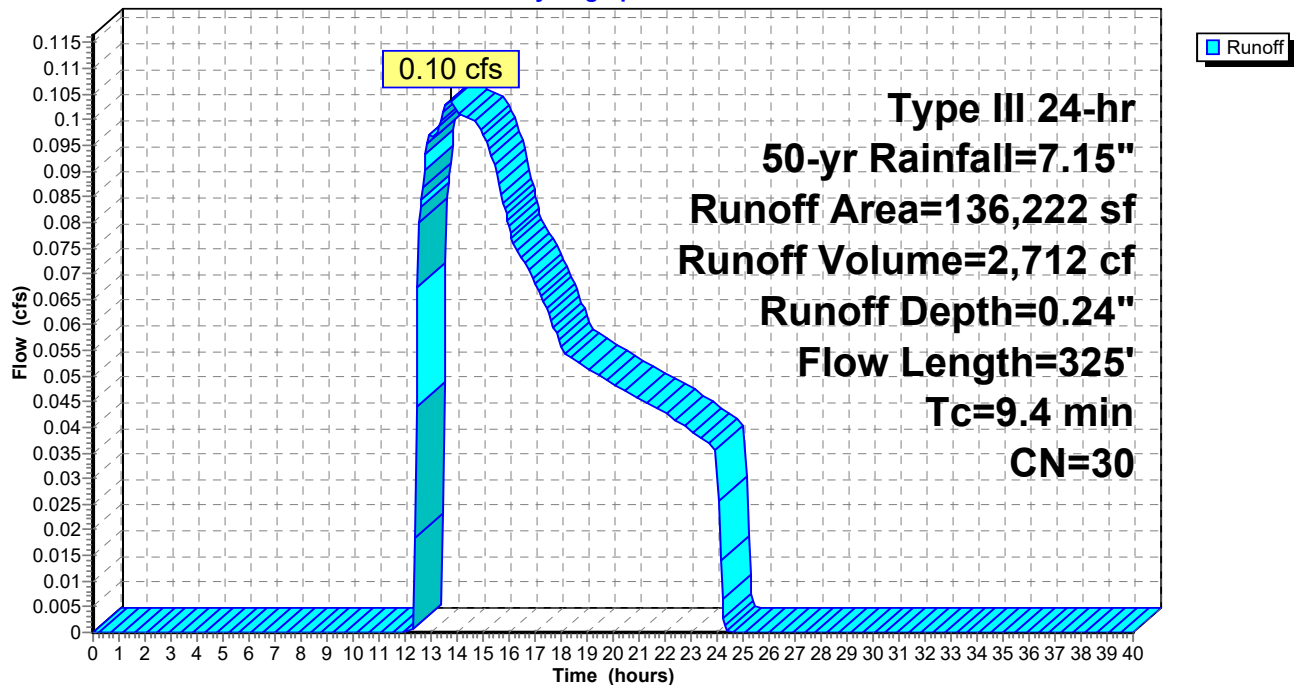
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 50-yr Rainfall=7.15"

Area (sf)	CN	Description
135,222	30	Woods, Good, HSG A
1,000	39	>75% Grass cover, Good, HSG A
136,222	30	Weighted Average
136,222		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0800	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
2.4	275	0.1500	1.94		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
9.4	325	Total			

Subcatchment 2S: PR-WETLANDS-NORTH

Hydrograph



PROPOSED

Type III 24-hr 50-yr Rainfall=7.15"

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 62

Summary for Subcatchment 3S: EX-ABUTTERS (No Change)

Runoff = 1.20 cfs @ 12.38 hrs, Volume= 9,016 cf, Depth= 0.82"
 Routed to Pond 2P : Pond 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 50-yr Rainfall=7.15"

Area (sf)	CN	Adj	Description		
5,000	98		Unconnected roofs, HSG A		
5,000	98		Paved parking, HSG A		
5,000	61		>75% Grass cover, Good, HSG B		
55,000	39		>75% Grass cover, Good, HSG A		
61,524	30		Woods, Good, HSG A		
131,524	40	39	Weighted Average, UI Adjusted		
121,524			92.40% Pervious Area		
10,000			7.60% Impervious Area		
5,000			50.00% Unconnected		
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0800	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
8.7	450	0.0300	0.87		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
15.7	500	Total			

PROPOSED

Prepared by Williams & Sparages

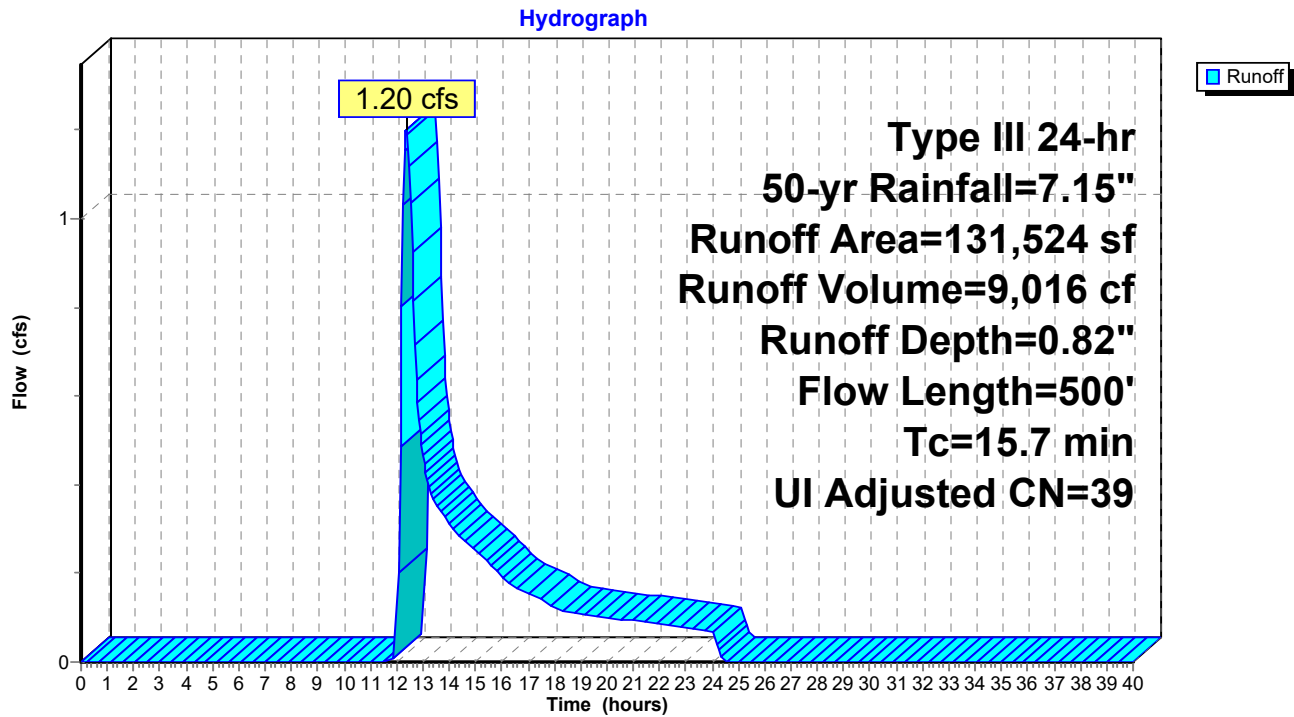
HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Type III 24-hr 50-yr Rainfall=7.15"

Printed 10/3/2023

Page 63

Subcatchment 3S: EX-ABUTTERS (No Change)



PROPOSED

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 64

Summary for Subcatchment 4S: PR-ISOLATED AREA 1

Runoff = 0.57 cfs @ 12.47 hrs, Volume= 6,176 cf, Depth= 0.47"
 Routed to Link 4L : Isolated Area #1

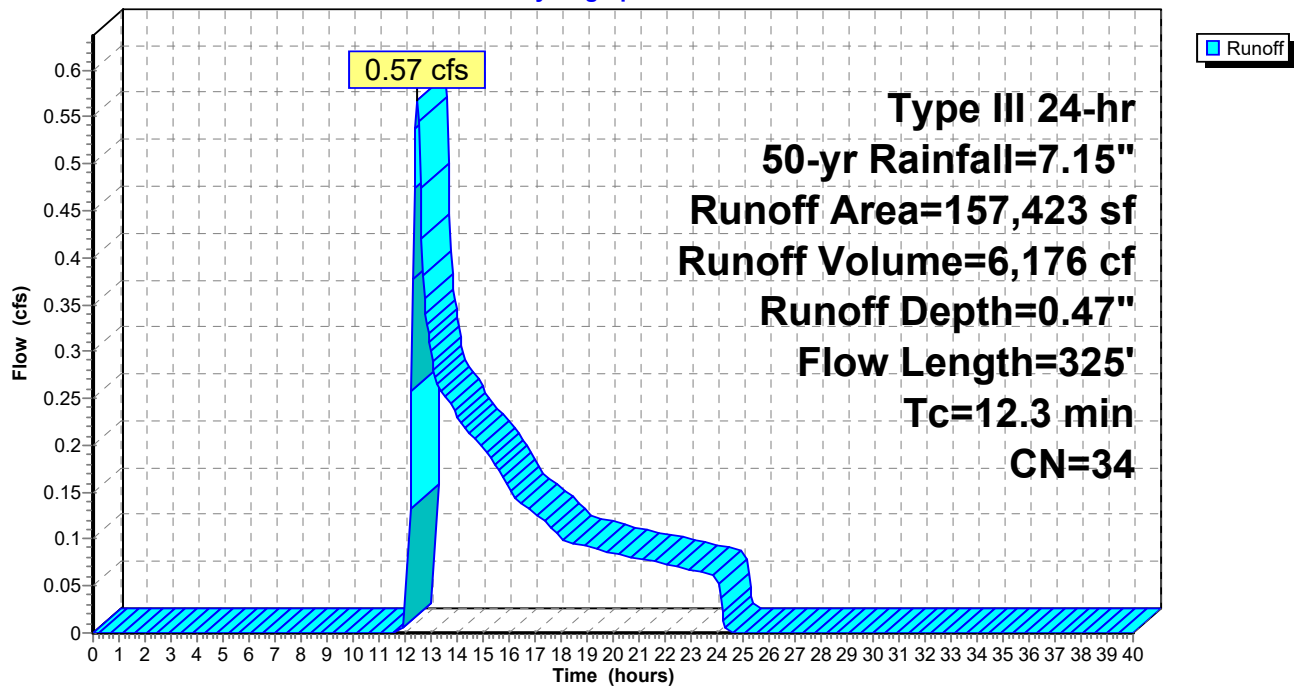
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 50-yr Rainfall=7.15"

Area (sf)	CN	Description
96,900	30	Woods, Good, HSG A
3,620	55	Woods, Good, HSG B
56,903	39	>75% Grass cover, Good, HSG A
157,423	34	Weighted Average
157,423		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0800	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
5.3	275	0.0300	0.87		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
12.3	325	Total			

Subcatchment 4S: PR-ISOLATED AREA 1

Hydrograph



PROPOSED

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 65

Summary for Subcatchment 5S: PR-ISOLATED AREA 2

Runoff = 0.69 cfs @ 12.39 hrs, Volume= 4,999 cf, Depth= 0.90"
 Routed to Link 5L : Isolated Area #2

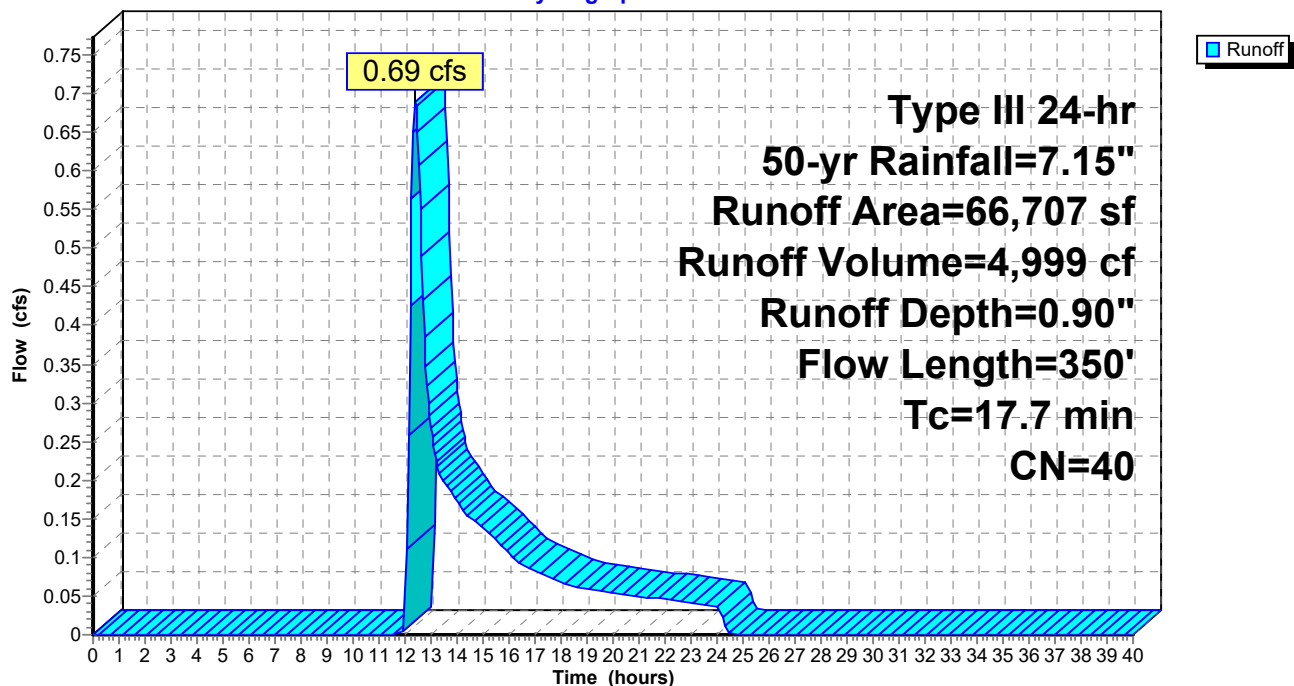
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 50-yr Rainfall=7.15"

Area (sf)	CN	Description
7,805	30	Woods, Good, HSG A
4,602	76	Gravel roads, HSG A
54,300	39	>75% Grass cover, Good, HSG A
66,707	40	Weighted Average
66,707		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.2	50	0.0100	0.05		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
1.0	100	0.0100	1.61		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
0.5	200	0.1500	6.24		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
17.7	350	Total			

Subcatchment 5S: PR-ISOLATED AREA 2

Hydrograph



PROPOSED

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 66

Summary for Subcatchment 6S: PR-ISOLATED AREA 3

Runoff = 0.34 cfs @ 12.45 hrs, Volume= 2,802 cf, Depth= 0.75"
 Routed to Link 6L : Isolated Area #3

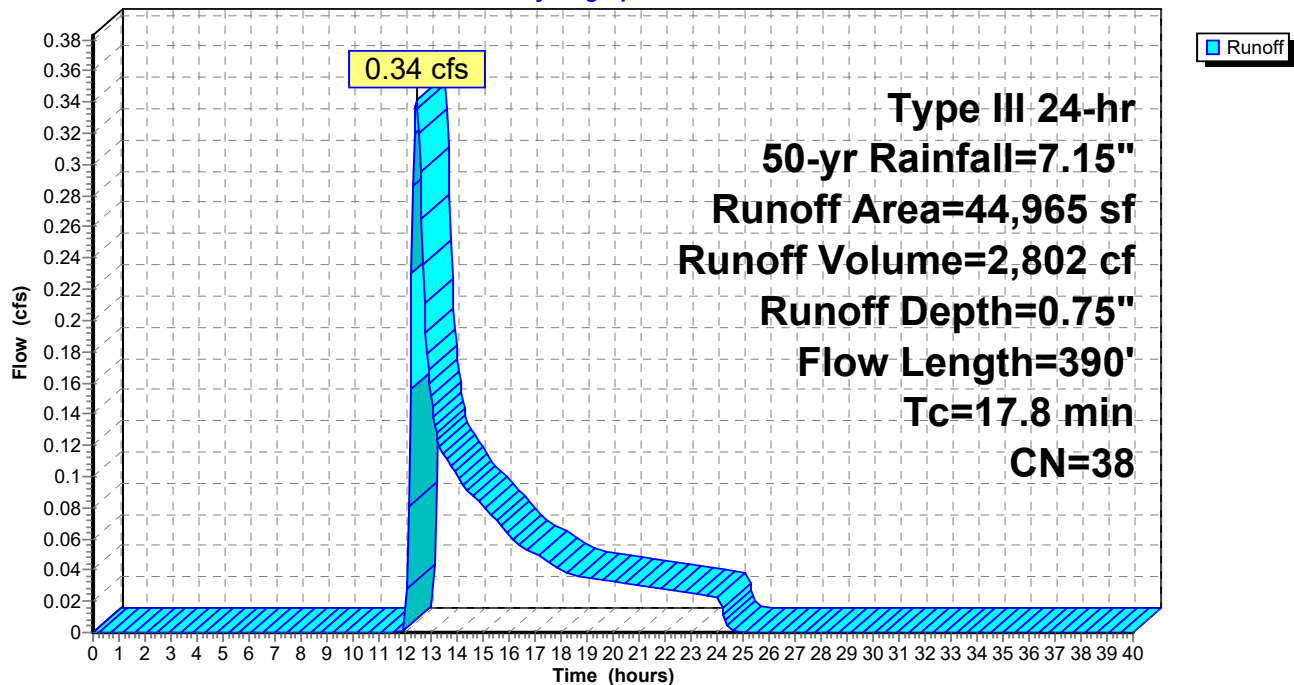
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 50-yr Rainfall=7.15"

Area (sf)	CN	Description
2,918	30	Woods, Good, HSG A
42,047	39	>75% Grass cover, Good, HSG A
44,965	38	Weighted Average
44,965		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.2	50	0.0100	0.05		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
1.0	100	0.0100	1.61		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
0.6	240	0.1500	6.24		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
17.8	390	Total			

Subcatchment 6S: PR-ISOLATED AREA 3

Hydrograph



PROPOSED

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 67

Summary for Subcatchment 9S: PR-POND2

Runoff = 1.48 cfs @ 12.38 hrs, Volume= 8,702 cf, Depth= 1.48"
 Routed to Pond 2P : Pond 2

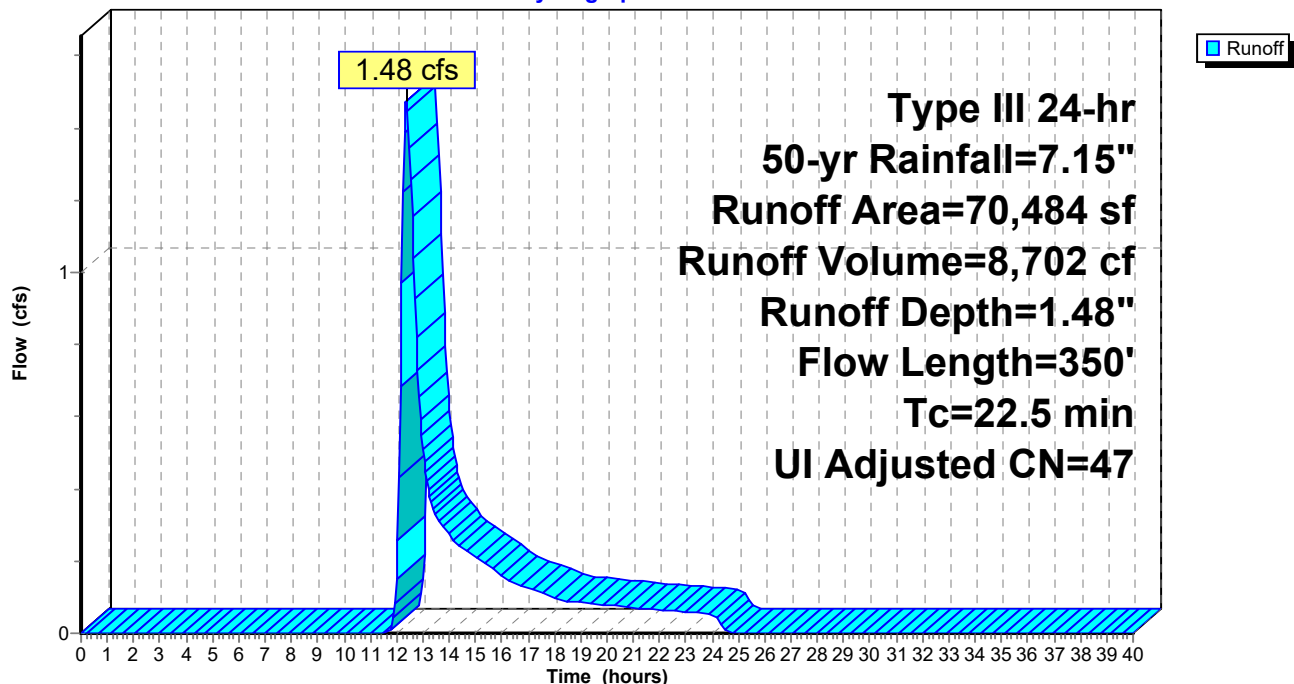
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 50-yr Rainfall=7.15"

Area (sf)	CN	Adj	Description
3,200	98		Unconnected roofs, HSG A
5,000	98		Paved parking, HSG A
5,498	76		Gravel roads, HSG A
56,786	39		>75% Grass cover, Good, HSG A
70,484	49	47	Weighted Average, UI Adjusted
62,284			88.37% Pervious Area
8,200			11.63% Impervious Area
3,200			39.02% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.2	50	0.0100	0.05		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
6.3	300	0.0250	0.79		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
22.5	350	Total			

Subcatchment 9S: PR-POND2

Hydrograph



PROPOSED

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 68

Summary for Subcatchment 10S: PR-WETLANDS-EAST

Runoff = 0.15 cfs @ 12.37 hrs, Volume= 1,335 cf, Depth= 0.54"
 Routed to Link 1L : Flow to the Wetlands to the southeast

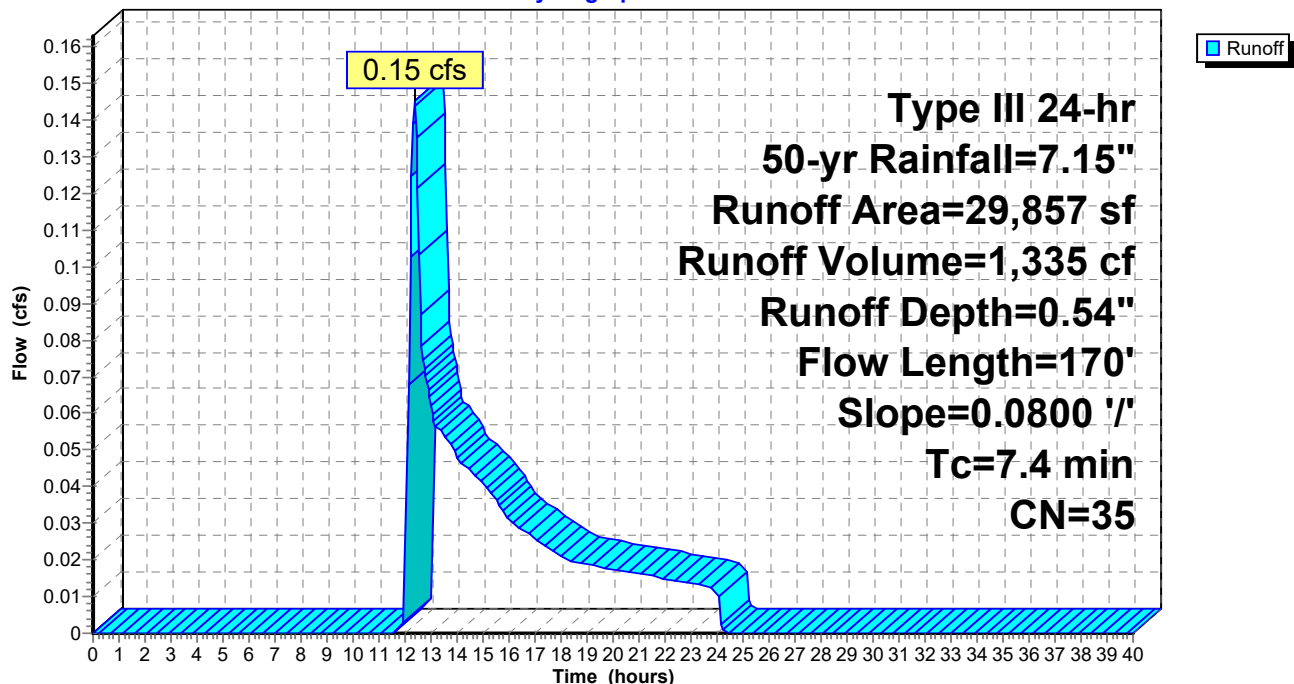
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 50-yr Rainfall=7.15"

Area (sf)	CN	Description
590	98	Unconnected roofs, HSG A
500	98	Paved parking, HSG A
10,000	39	>75% Grass cover, Good, HSG A
18,767	30	Woods, Good, HSG A
29,857	35	Weighted Average
28,767		96.35% Pervious Area
1,090		3.65% Impervious Area
590		54.13% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0800	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
0.4	120	0.0800	4.55		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
7.4	170	Total			

Subcatchment 10S: PR-WETLANDS-EAST

Hydrograph



PROPOSED*Type III 24-hr 50-yr Rainfall=7.15"*

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 69

Summary for Pond 1P: Pond 1

Inflow Area = 46,275 sf, 4.67% Impervious, Inflow Depth = 1.31" for 50-yr event
 Inflow = 0.80 cfs @ 12.40 hrs, Volume= 5,044 cf
 Outflow = 0.21 cfs @ 13.37 hrs, Volume= 5,046 cf, Atten= 74%, Lag= 58.3 min
 Discarded = 0.21 cfs @ 13.37 hrs, Volume= 5,046 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
 Routed to Pond 2P : Pond 2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Peak Elev= 88.71' @ 13.37 hrs Surf.Area= 1,076 sf Storage= 1,339 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 65.9 min (978.5 - 912.6)

Volume	Invert	Avail.Storage	Storage Description
#1	87.00'	3,968 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
87.00	510	0	0
88.00	820	665	665
89.00	1,180	1,000	1,665
90.00	1,610	1,395	3,060
90.50	2,020	908	3,968

Device	Routing	Invert	Outlet Devices
#1	Discarded	87.00'	8.270 in/hr Exfiltration over Surface area
#2	Primary	90.00'	6.0' long x 6.0' breadth Broad-Crested Rectangular Weir
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00
			2.50 3.00 3.50 4.00 4.50 5.00 5.50
			Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65
			2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Discarded OutFlow Max=0.21 cfs @ 13.37 hrs HW=88.71' (Free Discharge)

↑**1=Exfiltration** (Exfiltration Controls 0.21 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=87.00' TW=84.00' (Dynamic Tailwater)

↑**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

PROPOSED

Prepared by Williams & Sparages

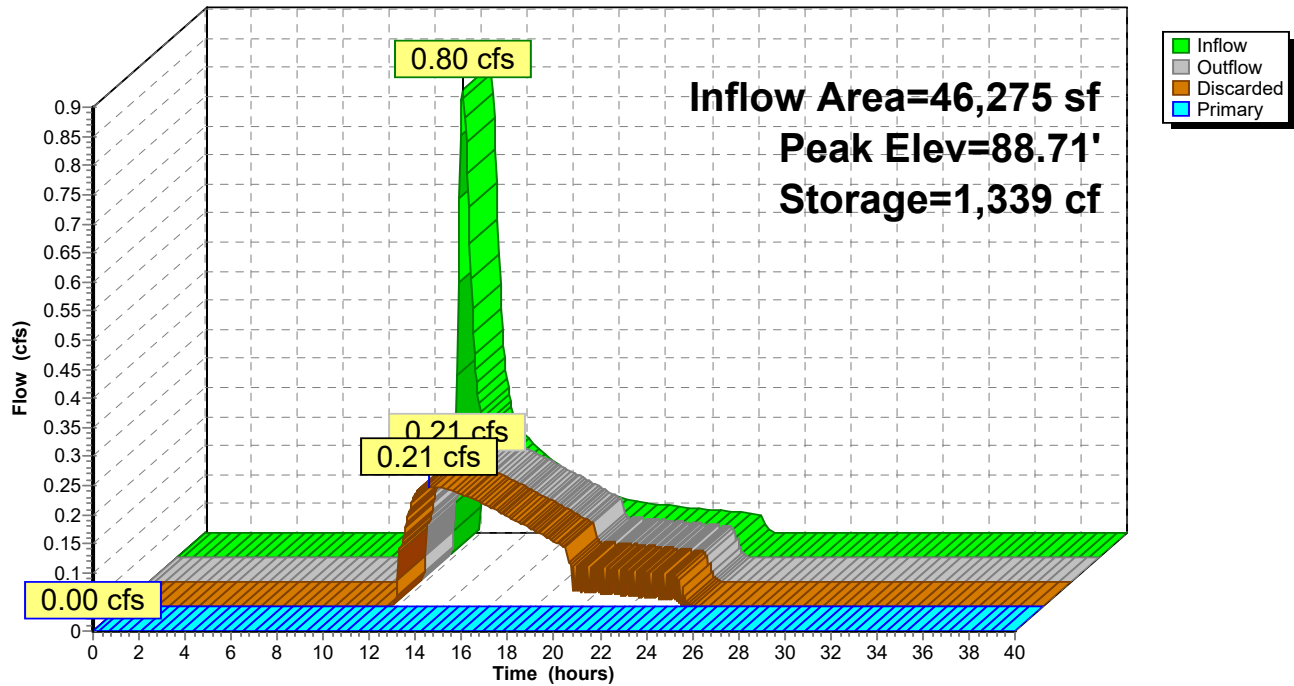
Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 70

Pond 1P: Pond 1

Hydrograph



PROPOSED

Type III 24-hr 50-yr Rainfall=7.15"

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 71

Summary for Pond 2P: Pond 2

Inflow Area = 248,283 sf, 8.20% Impervious, Inflow Depth = 0.86" for 50-yr event
 Inflow = 2.68 cfs @ 12.38 hrs, Volume= 17,718 cf
 Outflow = 0.62 cfs @ 13.82 hrs, Volume= 17,726 cf, Atten= 77%, Lag= 86.4 min
 Discarded = 0.62 cfs @ 13.82 hrs, Volume= 17,726 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
 Routed to Link 1L : Flow to the Wetlands to the southeast

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Peak Elev= 85.79' @ 13.82 hrs Surf.Area= 3,249 sf Storage= 4,625 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 76.5 min (997.3 - 920.8)

Volume	Invert	Avail.Storage	Storage Description
#1	84.00'	7,258 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
84.00	1,950	0	0
85.00	2,650	2,300	2,300
86.00	3,410	3,030	5,330
86.50	4,300	1,928	7,258

Device	Routing	Invert	Outlet Devices
#1	Discarded	84.00'	8.270 in/hr Exfiltration over Surface area
#2	Primary	86.00'	6.0' long x 6.0' breadth Broad-Crested Rectangular Weir
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00
			2.50 3.00 3.50 4.00 4.50 5.00 5.50
			Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65
			2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Discarded OutFlow Max=0.62 cfs @ 13.82 hrs HW=85.79' (Free Discharge)
 ↑**1=Exfiltration** (Exfiltration Controls 0.62 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=84.00' TW=0.00' (Dynamic Tailwater)
 ↑**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

PROPOSED

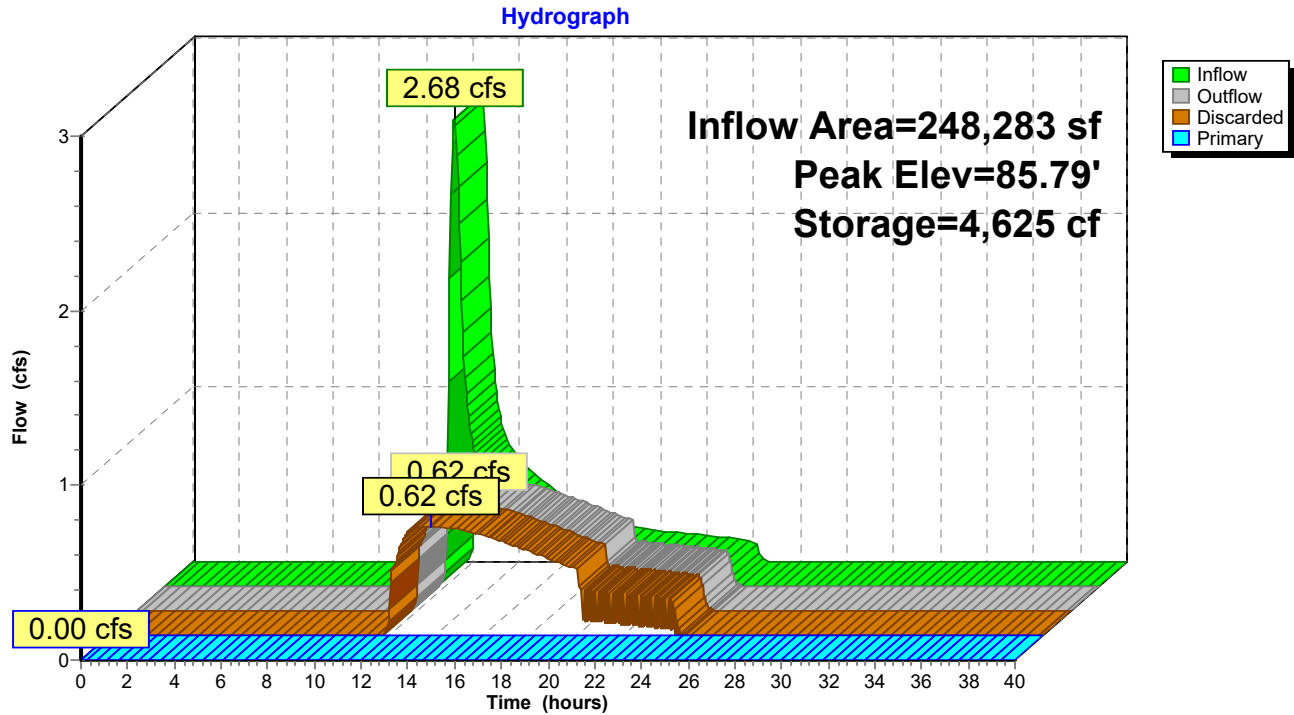
Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 72

Pond 2P: Pond 2



PROPOSED

Prepared by Williams & Sparages

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Type III 24-hr 50-yr Rainfall=7.15"

Printed 10/3/2023

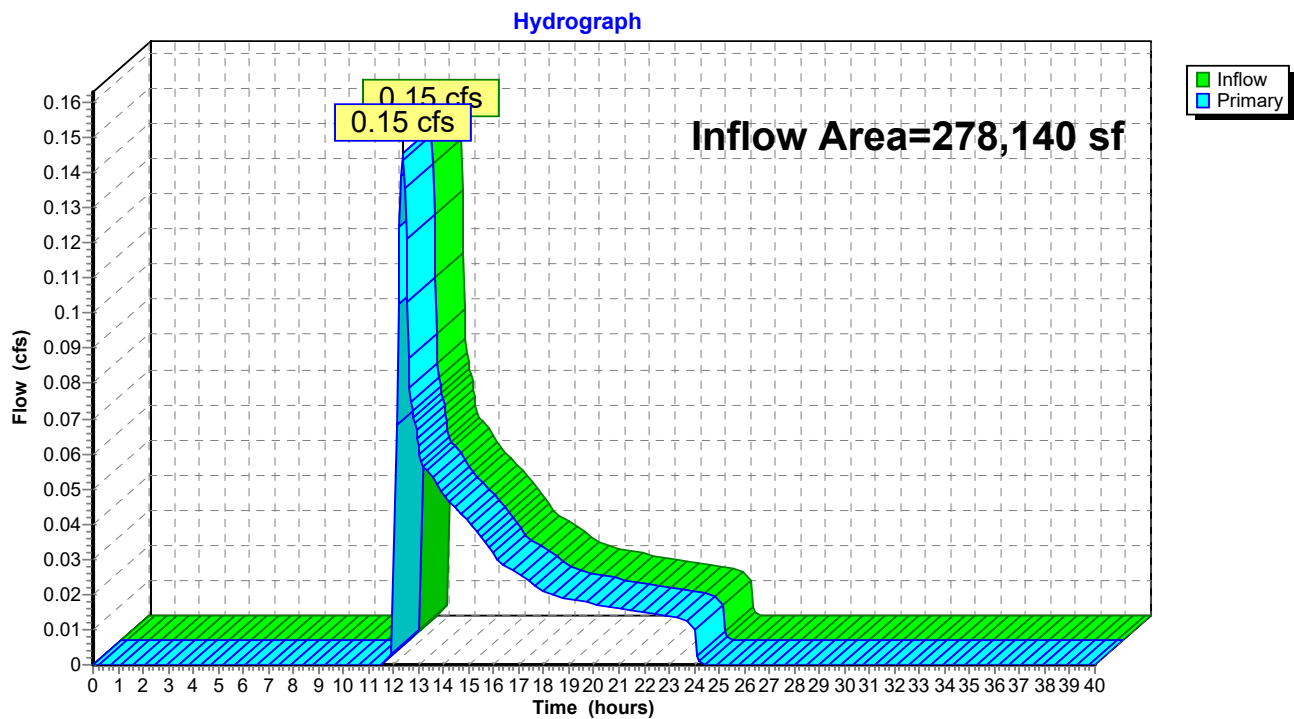
Page 73

Summary for Link 1L: Flow to the Wetlands to the southeast

Inflow Area = 278,140 sf, 7.71% Impervious, Inflow Depth = 0.06" for 50-yr event
 Inflow = 0.15 cfs @ 12.37 hrs, Volume= 1,335 cf
 Primary = 0.15 cfs @ 12.37 hrs, Volume= 1,335 cf, Atten= 0%, Lag= 0.0 min
 Routed to Link 3L : Total flow discharging from limit of watershed analysis

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 1L: Flow to the Wetlands to the southeast



PROPOSED

Type III 24-hr 50-yr Rainfall=7.15"

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

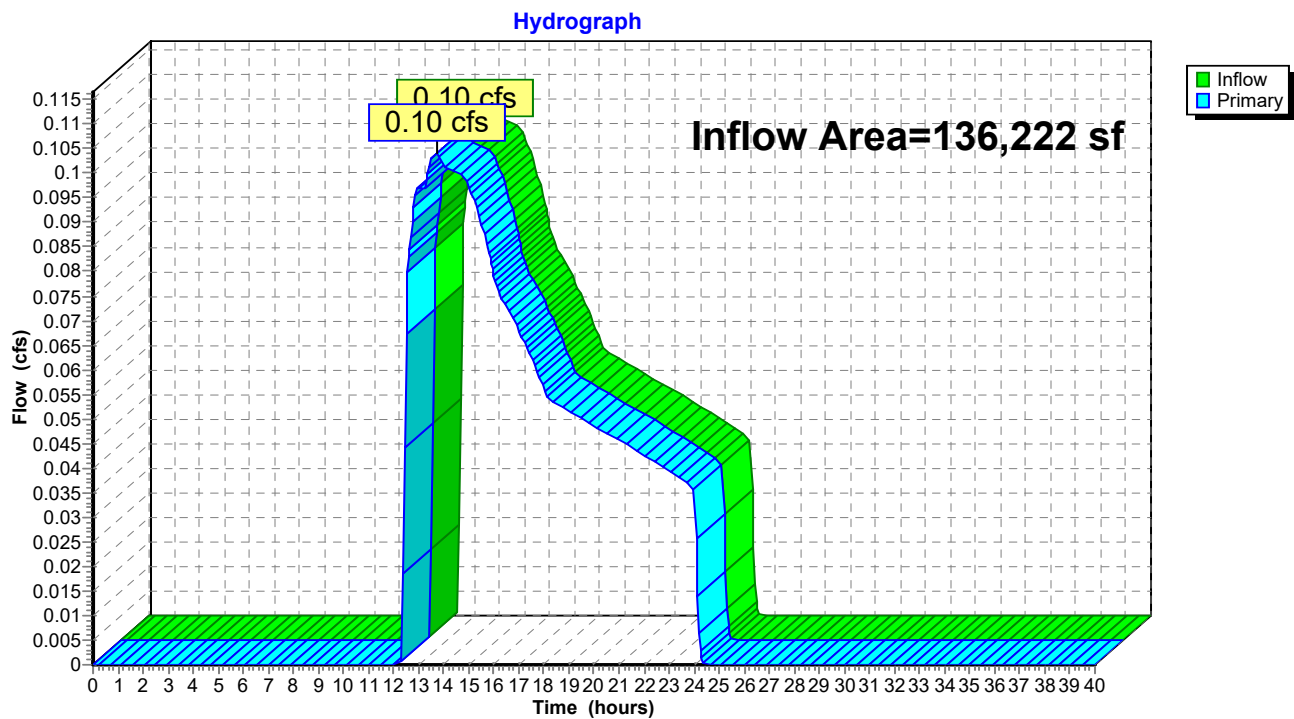
Page 74

Summary for Link 2L: Flow to the Wetlands to the north

Inflow Area = 136,222 sf, 0.00% Impervious, Inflow Depth = 0.24" for 50-yr event
 Inflow = 0.10 cfs @ 13.74 hrs, Volume= 2,712 cf
 Primary = 0.10 cfs @ 13.74 hrs, Volume= 2,712 cf, Atten= 0%, Lag= 0.0 min
 Routed to Link 3L : Total flow discharging from limit of watershed analysis

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 2L: Flow to the Wetlands to the north



PROPOSED

Prepared by Williams & Sparages

Type III 24-hr 50-yr Rainfall=7.15"

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

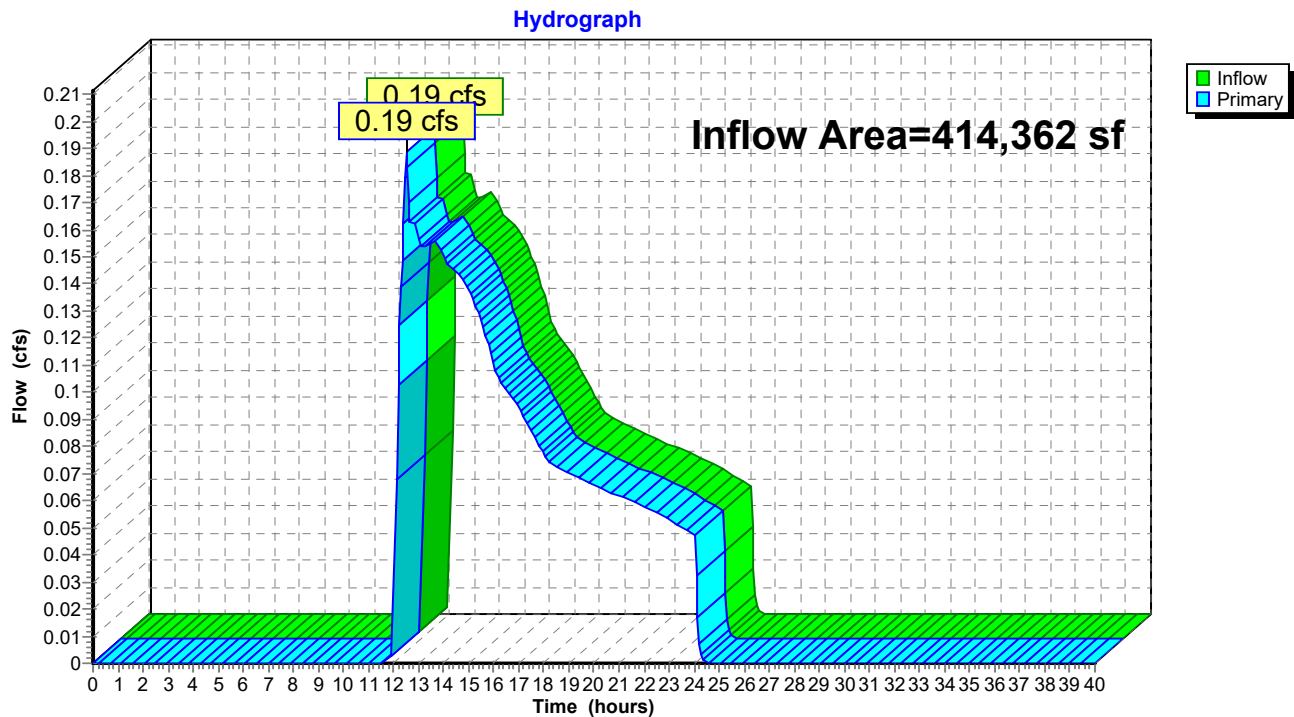
Page 75

Summary for Link 3L: Total flow discharging from limit of watershed analysis

Inflow Area = 414,362 sf, 5.18% Impervious, Inflow Depth = 0.12" for 50-yr event
Inflow = 0.19 cfs @ 12.51 hrs, Volume= 4,046 cf
Primary = 0.19 cfs @ 12.51 hrs, Volume= 4,046 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 3L: Total flow discharging from limit of watershed analysis



PROPOSED

Prepared by Williams & Sparages

Type III 24-hr 50-yr Rainfall=7.15"

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

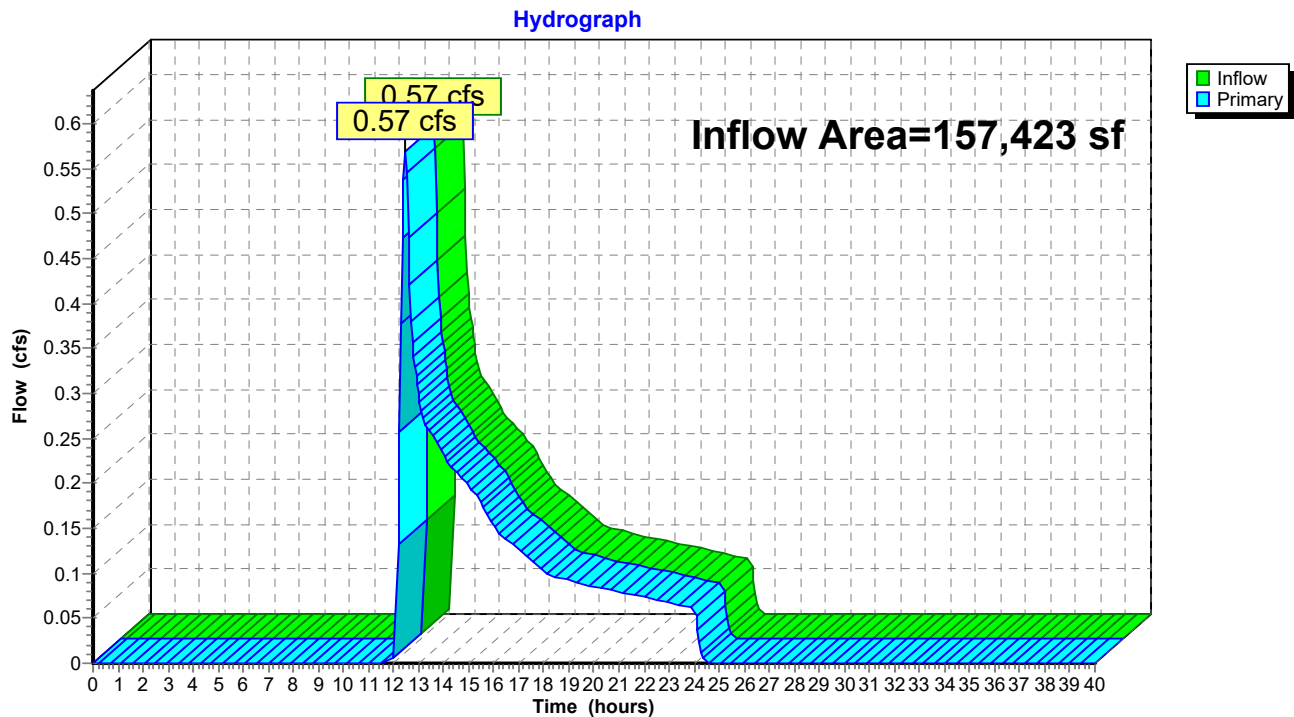
Page 76

Summary for Link 4L: Isolated Area #1

Inflow Area = 157,423 sf, 0.00% Impervious, Inflow Depth = 0.47" for 50-yr event
 Inflow = 0.57 cfs @ 12.47 hrs, Volume= 6,176 cf
 Primary = 0.57 cfs @ 12.47 hrs, Volume= 6,176 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 4L: Isolated Area #1



PROPOSED

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 77

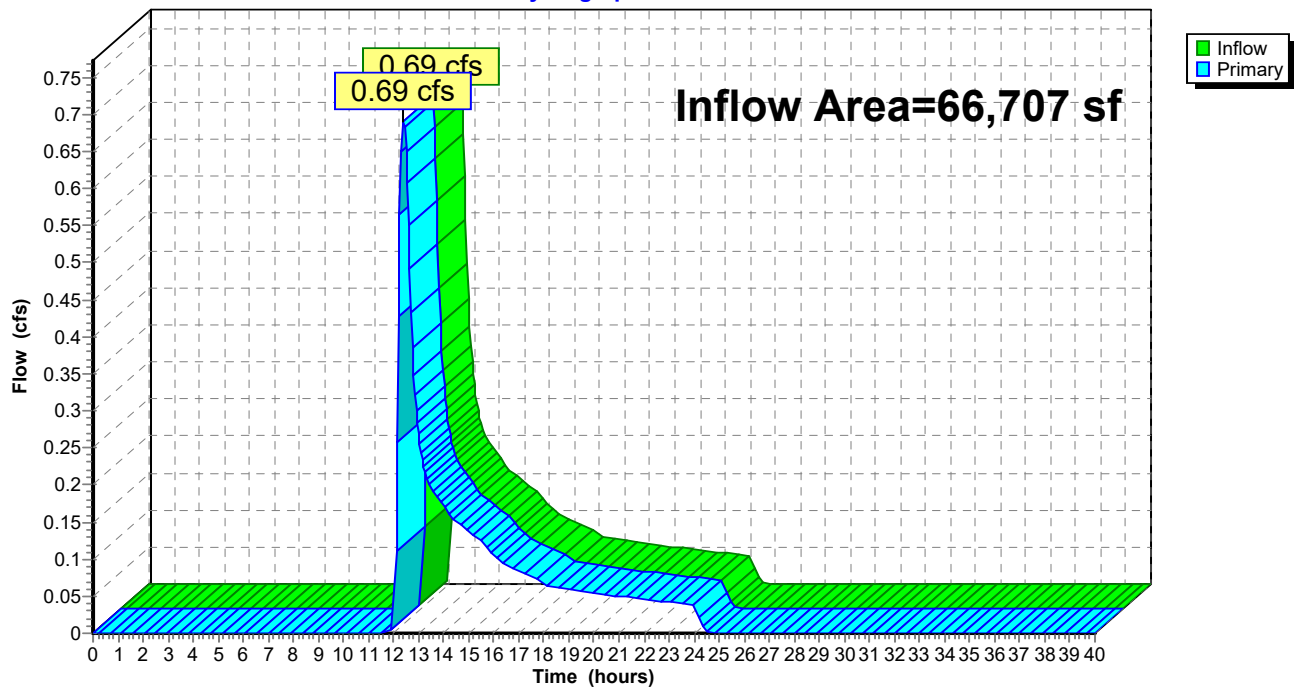
Summary for Link 5L: Isolated Area #2

Inflow Area = 66,707 sf, 0.00% Impervious, Inflow Depth = 0.90" for 50-yr event
 Inflow = 0.69 cfs @ 12.39 hrs, Volume= 4,999 cf
 Primary = 0.69 cfs @ 12.39 hrs, Volume= 4,999 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 5L: Isolated Area #2

Hydrograph



PROPOSED

Prepared by Williams & Sparages

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Type III 24-hr 50-yr Rainfall=7.15"

Printed 10/3/2023

Page 78

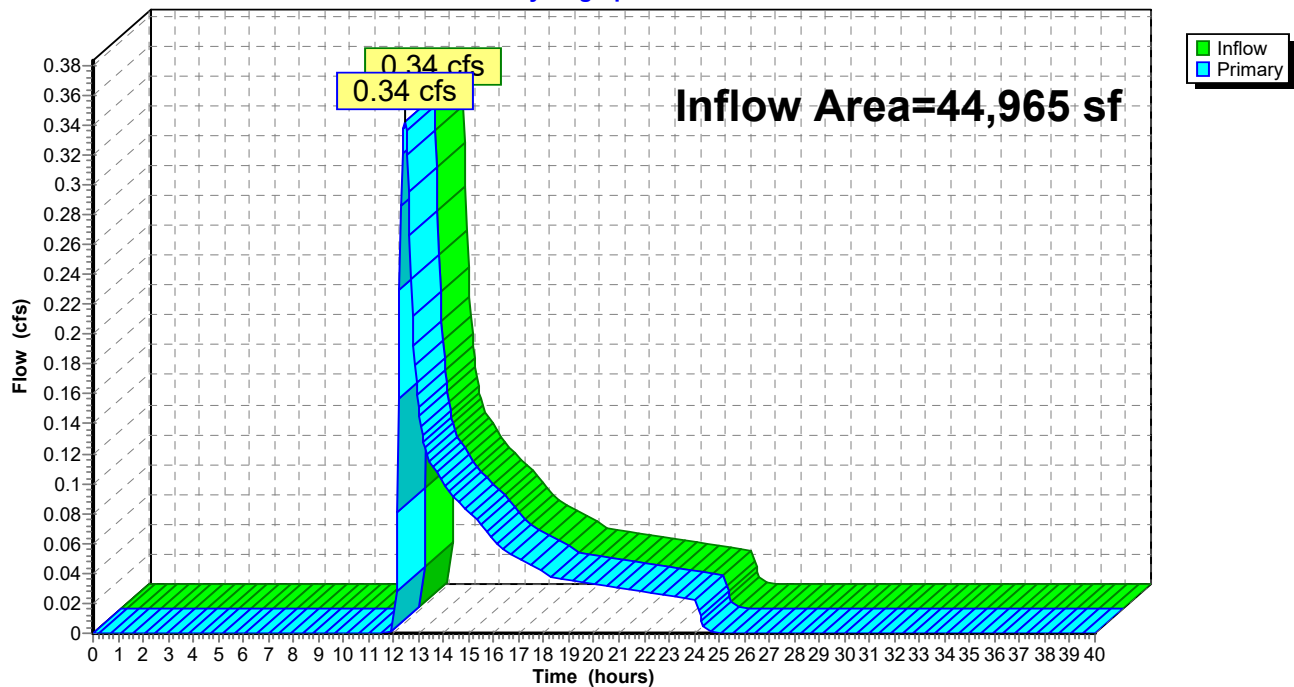
Summary for Link 6L: Isolated Area #3

Inflow Area = 44,965 sf, 0.00% Impervious, Inflow Depth = 0.75" for 50-yr event
 Inflow = 0.34 cfs @ 12.45 hrs, Volume= 2,802 cf
 Primary = 0.34 cfs @ 12.45 hrs, Volume= 2,802 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 6L: Isolated Area #3

Hydrograph



PROPOSED

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 79

Summary for Subcatchment 1S: PR-POND1

Runoff = 1.19 cfs @ 12.38 hrs, Volume= 6,899 cf, Depth= 1.79"
 Routed to Pond 1P : Pond 1

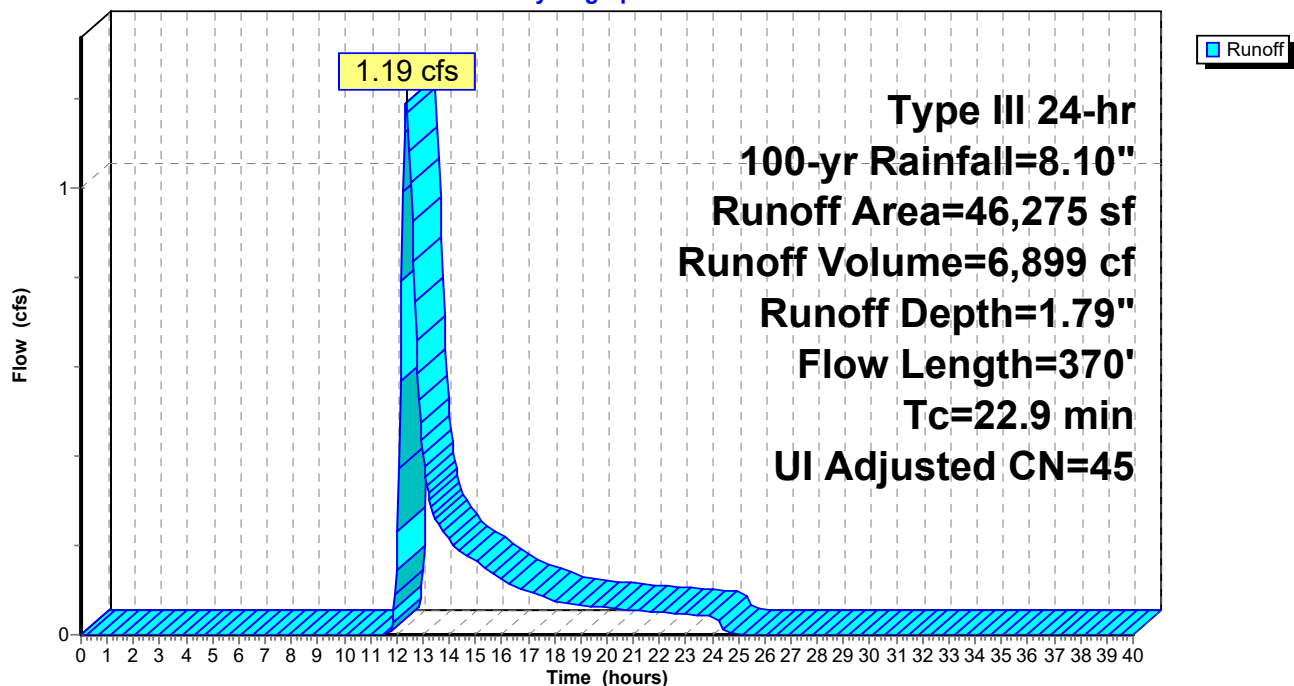
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100-yr Rainfall=8.10"

Area (sf)	CN	Adj	Description
* 2,160	98		Proposed Barn, Unconnected roofs, HSG A
5,933	76		Gravel roads, HSG A
38,182	39		>75% Grass cover, Good, HSG A
46,275	46	45	Weighted Average, UI Adjusted
44,115			95.33% Pervious Area
2,160			4.67% Impervious Area
2,160			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.2	50	0.0100	0.05		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
6.7	320	0.0250	0.79		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
22.9	370	Total			

Subcatchment 1S: PR-POND1

Hydrograph



PROPOSED

Prepared by Williams & Sparages

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Type III 24-hr 100-yr Rainfall=8.10"

Printed 10/3/2023

Page 80

Summary for Subcatchment 2S: PR-WETLANDS-NORTH

Runoff = 0.39 cfs @ 12.46 hrs, Volume= 4,999 cf, Depth= 0.44"
Routed to Link 2L : Flow to the Wetlands to the north

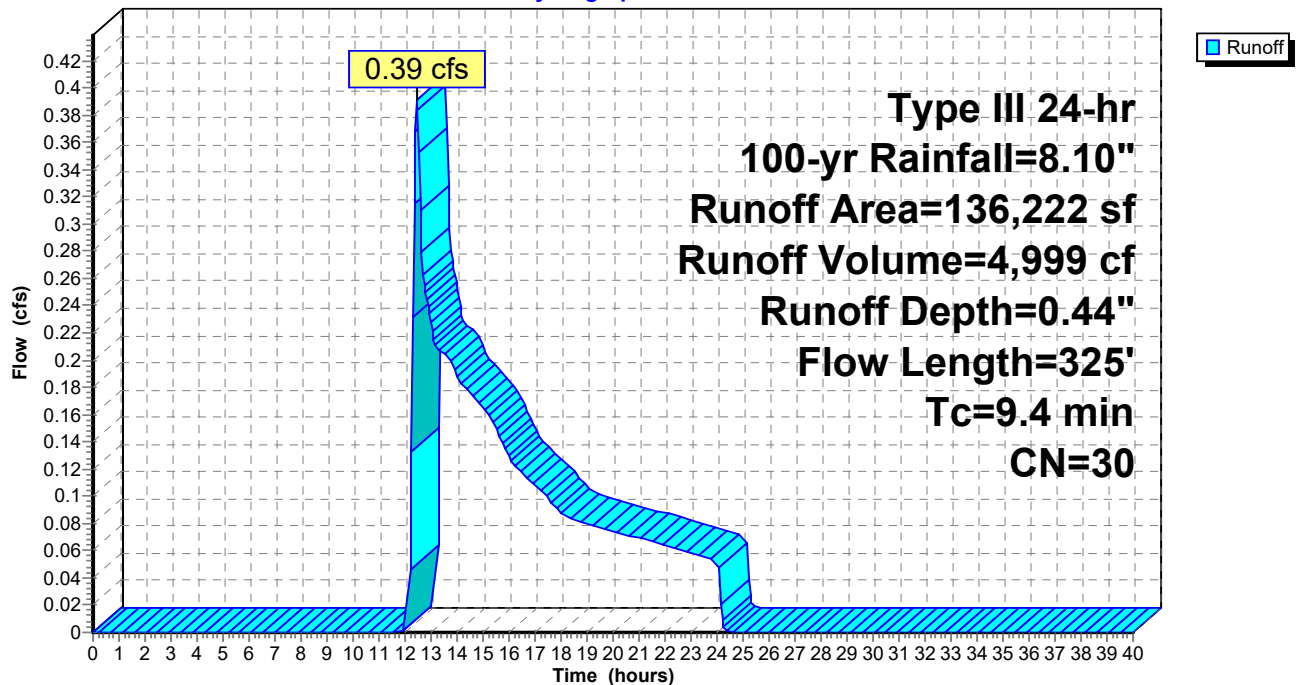
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=8.10"

Area (sf)	CN	Description
135,222	30	Woods, Good, HSG A
1,000	39	>75% Grass cover, Good, HSG A
136,222	30	Weighted Average
136,222		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0800	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
2.4	275	0.1500	1.94		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
9.4	325	Total			

Subcatchment 2S: PR-WETLANDS-NORTH

Hydrograph



PROPOSED*Type III 24-hr 100-yr Rainfall=8.10"*

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 81

Summary for Subcatchment 3S: EX-ABUTTERS (No Change)

Runoff = 2.10 cfs @ 12.31 hrs, Volume= 13,144 cf, Depth= 1.20"
 Routed to Pond 2P : Pond 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100-yr Rainfall=8.10"

Area (sf)	CN	Adj	Description		
5,000	98		Unconnected roofs, HSG A		
5,000	98		Paved parking, HSG A		
5,000	61		>75% Grass cover, Good, HSG B		
55,000	39		>75% Grass cover, Good, HSG A		
61,524	30		Woods, Good, HSG A		
131,524	40	39	Weighted Average, UI Adjusted		
121,524			92.40% Pervious Area		
10,000			7.60% Impervious Area		
5,000			50.00% Unconnected		
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0800	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
8.7	450	0.0300	0.87		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
15.7	500	Total			

PROPOSED

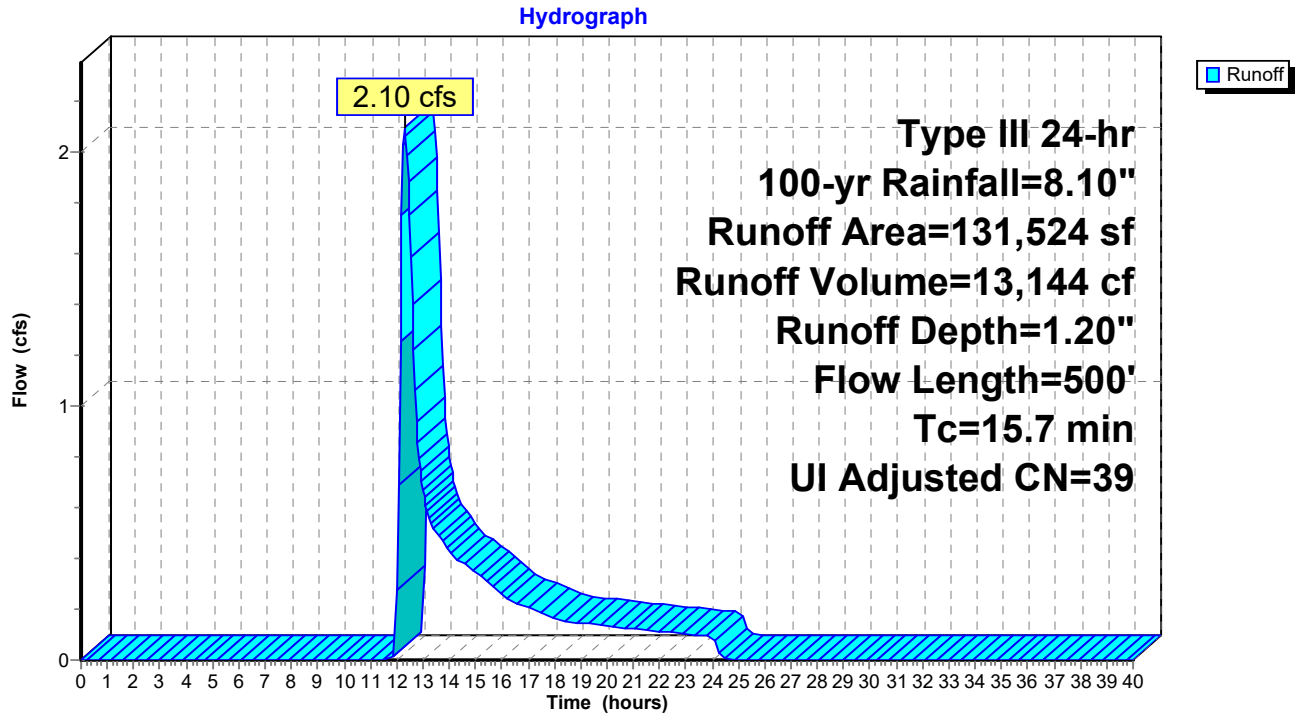
Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 82

Subcatchment 3S: EX-ABUTTERS (No Change)



PROPOSED

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 83

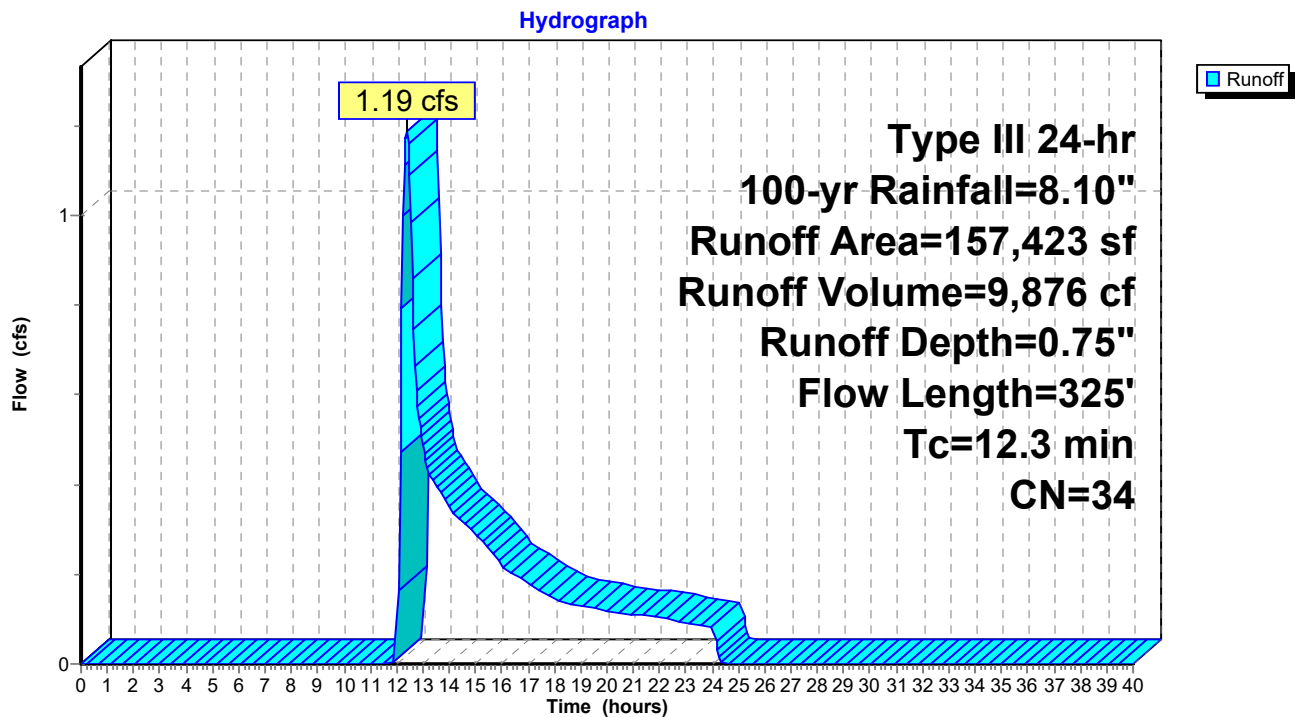
Summary for Subcatchment 4S: PR-ISOLATED AREA 1

Runoff = 1.19 cfs @ 12.39 hrs, Volume= 9,876 cf, Depth= 0.75"
 Routed to Link 4L : Isolated Area #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100-yr Rainfall=8.10"

Area (sf)	CN	Description
96,900	30	Woods, Good, HSG A
3,620	55	Woods, Good, HSG B
56,903	39	>75% Grass cover, Good, HSG A
157,423	34	Weighted Average
157,423		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0800	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
5.3	275	0.0300	0.87		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
12.3	325	Total			

Subcatchment 4S: PR-ISOLATED AREA 1

PROPOSED

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 84

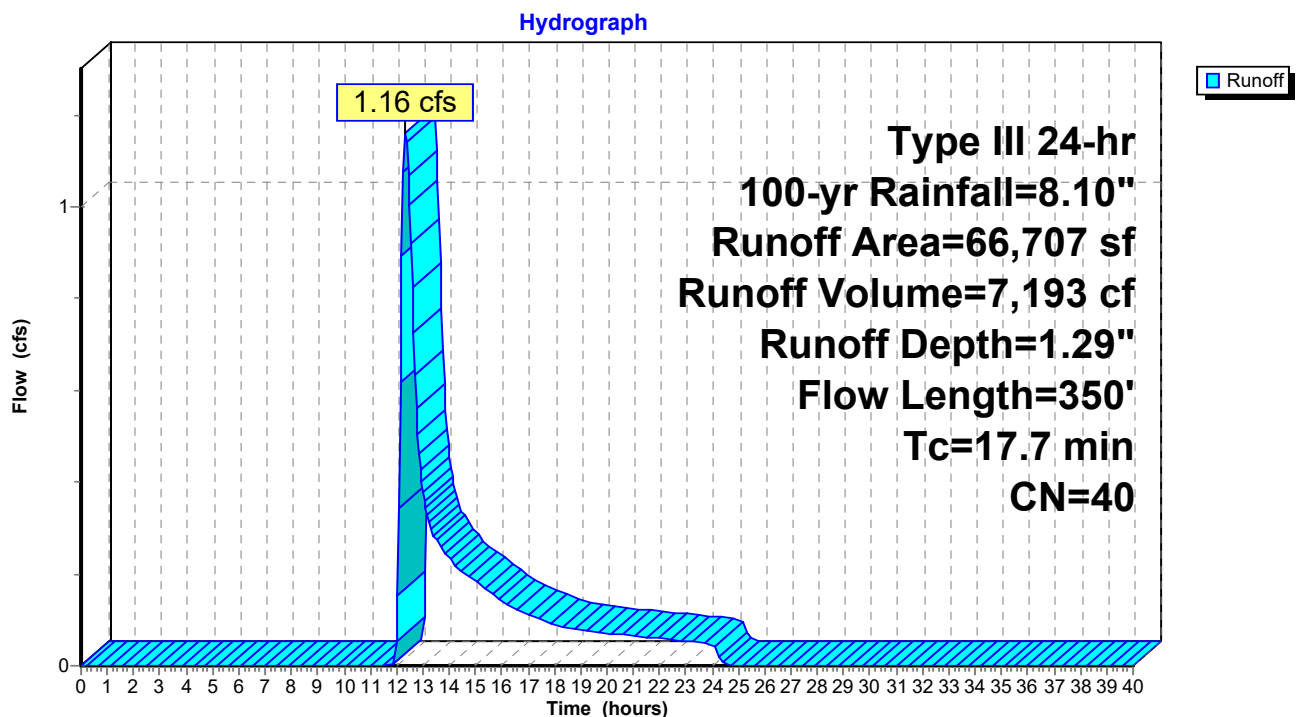
Summary for Subcatchment 5S: PR-ISOLATED AREA 2

Runoff = 1.16 cfs @ 12.33 hrs, Volume= 7,193 cf, Depth= 1.29"
 Routed to Link 5L : Isolated Area #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100-yr Rainfall=8.10"

Area (sf)	CN	Description
7,805	30	Woods, Good, HSG A
4,602	76	Gravel roads, HSG A
54,300	39	>75% Grass cover, Good, HSG A
66,707	40	Weighted Average
66,707		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.2	50	0.0100	0.05		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
1.0	100	0.0100	1.61		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
0.5	200	0.1500	6.24		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
17.7	350	Total			

Subcatchment 5S: PR-ISOLATED AREA 2

PROPOSED

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 85

Summary for Subcatchment 6S: PR-ISOLATED AREA 3

Runoff = 0.60 cfs @ 12.37 hrs, Volume= 4,144 cf, Depth= 1.11"
 Routed to Link 6L : Isolated Area #3

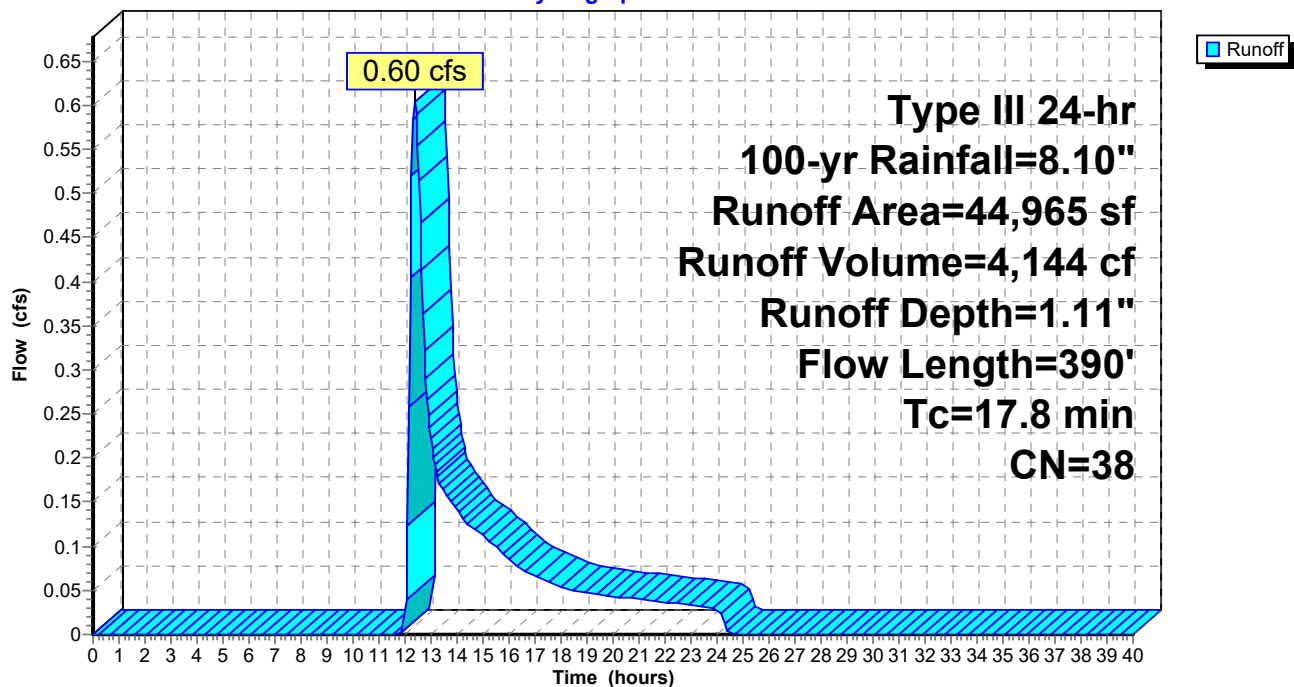
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100-yr Rainfall=8.10"

Area (sf)	CN	Description
2,918	30	Woods, Good, HSG A
42,047	39	>75% Grass cover, Good, HSG A
44,965	38	Weighted Average
44,965		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.2	50	0.0100	0.05		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
1.0	100	0.0100	1.61		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
0.6	240	0.1500	6.24		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
17.8	390	Total			

Subcatchment 6S: PR-ISOLATED AREA 3

Hydrograph



PROPOSED

Type III 24-hr 100-yr Rainfall=8.10"

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 86

Summary for Subcatchment 9S: PR-POND2

Runoff = 2.12 cfs @ 12.36 hrs, Volume= 11,719 cf, Depth= 2.00"
 Routed to Pond 2P : Pond 2

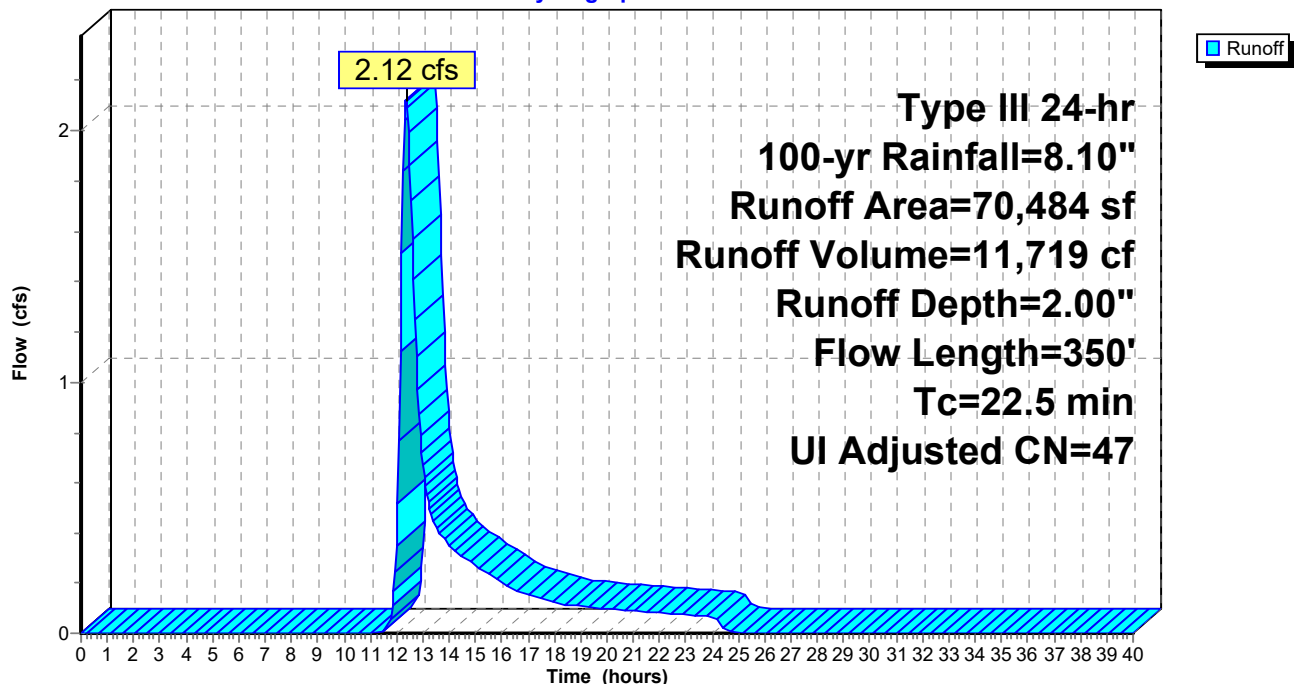
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100-yr Rainfall=8.10"

Area (sf)	CN	Adj	Description
3,200	98		Unconnected roofs, HSG A
5,000	98		Paved parking, HSG A
5,498	76		Gravel roads, HSG A
56,786	39		>75% Grass cover, Good, HSG A
70,484	49	47	Weighted Average, UI Adjusted
62,284			88.37% Pervious Area
8,200			11.63% Impervious Area
3,200			39.02% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.2	50	0.0100	0.05		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
6.3	300	0.0250	0.79		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
22.5	350	Total			

Subcatchment 9S: PR-POND2

Hydrograph



PROPOSED

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 87

Summary for Subcatchment 10S: PR-WETLANDS-EAST

Runoff = 0.28 cfs @ 12.20 hrs, Volume= 2,085 cf, Depth= 0.84"
 Routed to Link 1L : Flow to the Wetlands to the southeast

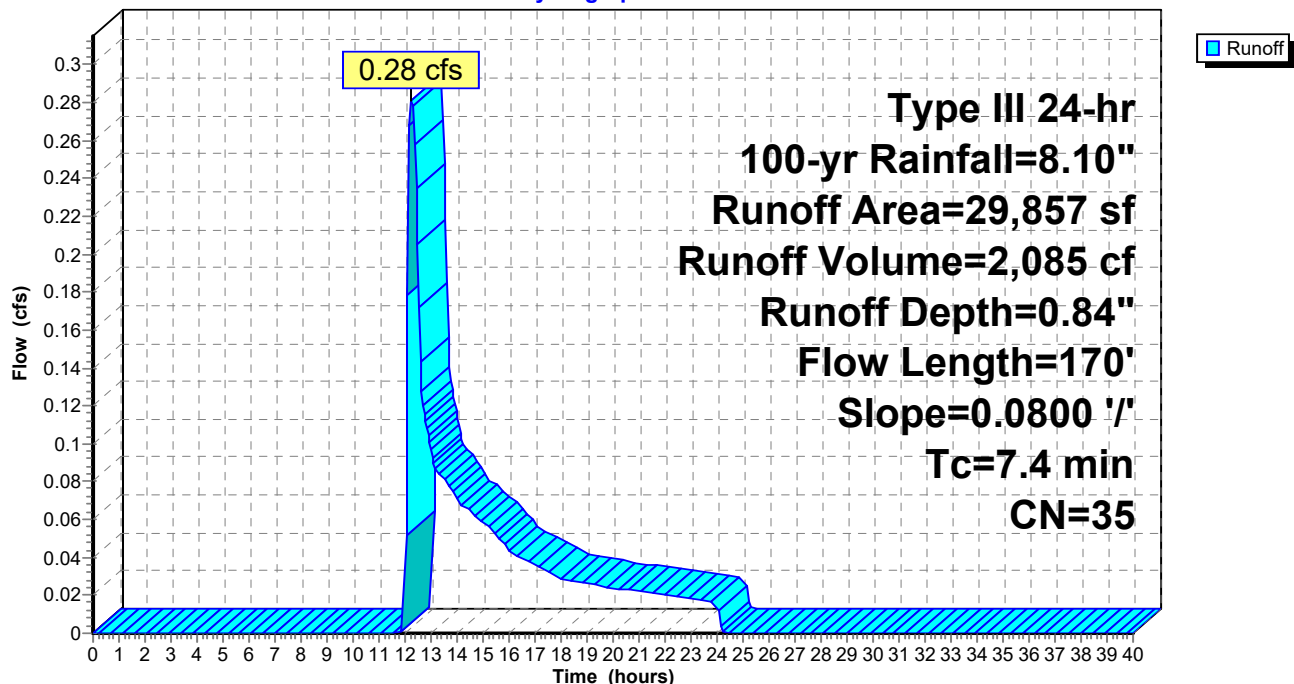
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100-yr Rainfall=8.10"

Area (sf)	CN	Description
590	98	Unconnected roofs, HSG A
500	98	Paved parking, HSG A
10,000	39	>75% Grass cover, Good, HSG A
18,767	30	Woods, Good, HSG A
29,857	35	Weighted Average
28,767		96.35% Pervious Area
1,090		3.65% Impervious Area
590		54.13% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0800	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.24"
0.4	120	0.0800	4.55		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
7.4	170	Total			

Subcatchment 10S: PR-WETLANDS-EAST

Hydrograph



PROPOSED

Type III 24-hr 100-yr Rainfall=8.10"

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 88

Summary for Pond 1P: Pond 1

Inflow Area = 46,275 sf, 4.67% Impervious, Inflow Depth = 1.79" for 100-yr event
 Inflow = 1.19 cfs @ 12.38 hrs, Volume= 6,899 cf
 Outflow = 0.26 cfs @ 13.47 hrs, Volume= 6,900 cf, Atten= 78%, Lag= 65.7 min
 Discarded = 0.26 cfs @ 13.47 hrs, Volume= 6,900 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
 Routed to Pond 2P : Pond 2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Peak Elev= 89.39' @ 13.47 hrs Surf.Area= 1,348 sf Storage= 2,159 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 93.1 min (994.1 - 901.0)

Volume	Invert	Avail.Storage	Storage Description
#1	87.00'	3,968 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
87.00	510	0	0
88.00	820	665	665
89.00	1,180	1,000	1,665
90.00	1,610	1,395	3,060
90.50	2,020	908	3,968

Device	Routing	Invert	Outlet Devices
#1	Discarded	87.00'	8.270 in/hr Exfiltration over Surface area
#2	Primary	90.00'	6.0' long x 6.0' breadth Broad-Crested Rectangular Weir
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00
			2.50 3.00 3.50 4.00 4.50 5.00 5.50
			Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65
			2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Discarded OutFlow Max=0.26 cfs @ 13.47 hrs HW=89.39' (Free Discharge)

↑**1=Exfiltration** (Exfiltration Controls 0.26 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=87.00' TW=84.00' (Dynamic Tailwater)

↑**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

PROPOSED

Prepared by Williams & Sparages

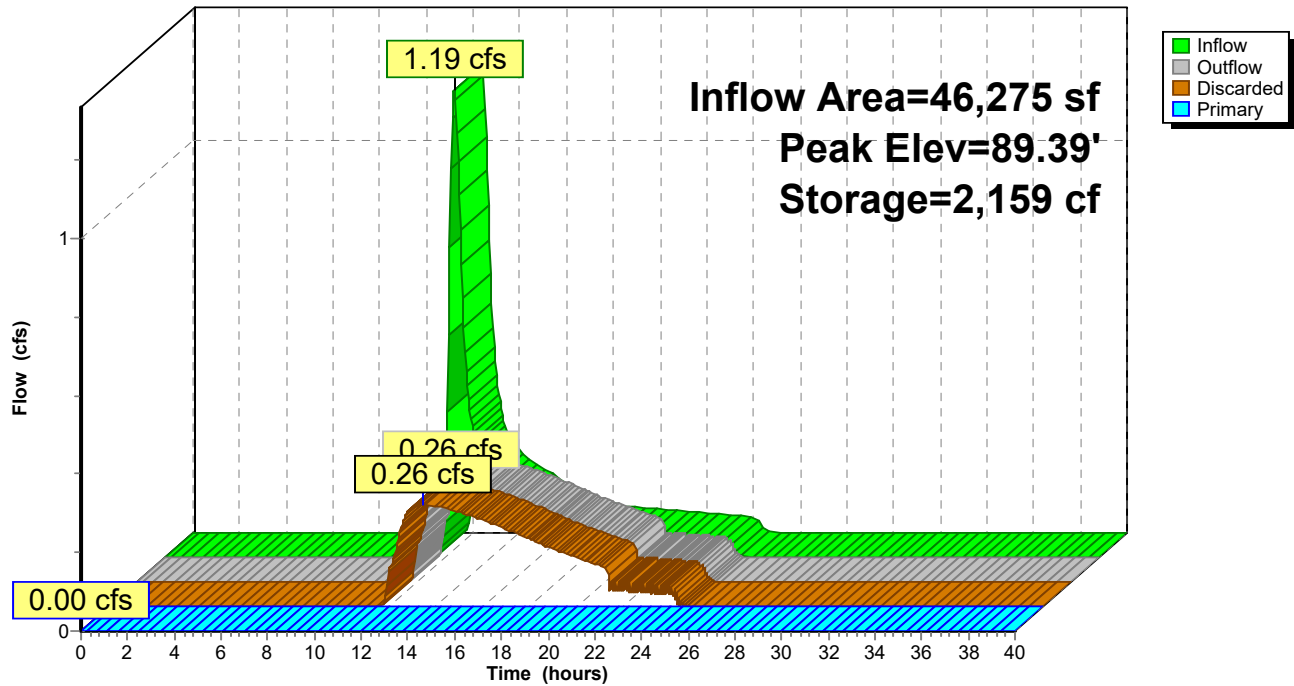
Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 89

Pond 1P: Pond 1

Hydrograph



PROPOSED

Type III 24-hr 100-yr Rainfall=8.10"

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 90

Summary for Pond 2P: Pond 2

Inflow Area = 248,283 sf, 8.20% Impervious, Inflow Depth = 1.20" for 100-yr event
 Inflow = 4.18 cfs @ 12.34 hrs, Volume= 24,863 cf
 Outflow = 1.93 cfs @ 12.78 hrs, Volume= 24,875 cf, Atten= 54%, Lag= 26.3 min
 Discarded = 0.72 cfs @ 12.78 hrs, Volume= 21,826 cf
 Primary = 1.22 cfs @ 12.78 hrs, Volume= 3,048 cf
 Routed to Link 1L : Flow to the Wetlands to the southeast

Routing by Dyn-Stor-Ind method, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs
 Peak Elev= 86.19' @ 12.78 hrs Surf.Area= 3,755 sf Storage= 6,025 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 83.1 min (990.5 - 907.5)

Volume	Invert	Avail.Storage	Storage Description
#1	84.00'	7,258 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
84.00	1,950	0	0
85.00	2,650	2,300	2,300
86.00	3,410	3,030	5,330
86.50	4,300	1,928	7,258

Device	Routing	Invert	Outlet Devices
#1	Discarded	84.00'	8.270 in/hr Exfiltration over Surface area
#2	Primary	86.00'	6.0' long x 6.0' breadth Broad-Crested Rectangular Weir
Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00			
2.50 3.00 3.50 4.00 4.50 5.00 5.50			
Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65			
2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83			

Discarded OutFlow Max=0.72 cfs @ 12.78 hrs HW=86.19' (Free Discharge)
 ↑**1=Exfiltration** (Exfiltration Controls 0.72 cfs)

Primary OutFlow Max=1.21 cfs @ 12.78 hrs HW=86.19' TW=0.00' (Dynamic Tailwater)
 ↑**2=Broad-Crested Rectangular Weir** (Weir Controls 1.21 cfs @ 1.04 fps)

PROPOSED

Prepared by Williams & Sparages

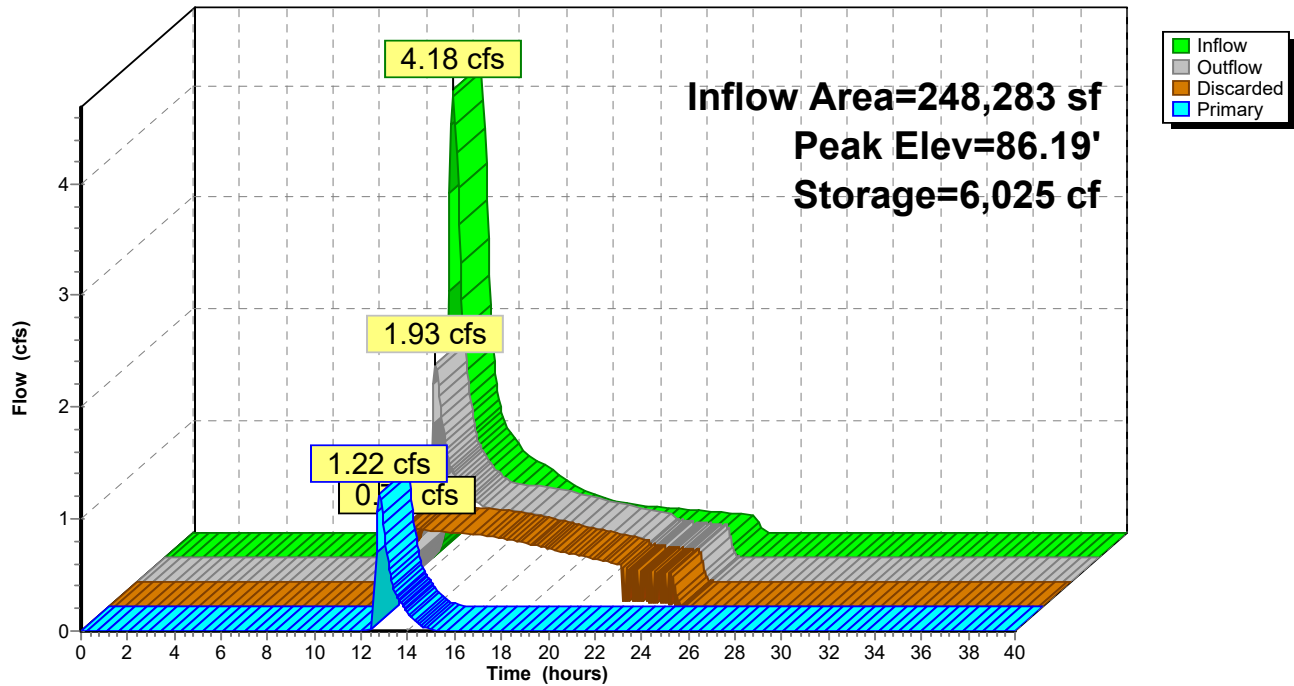
Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Page 91

Pond 2P: Pond 2

Hydrograph



PROPOSED

Prepared by Williams & Sparages

Type III 24-hr 100-yr Rainfall=8.10"

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

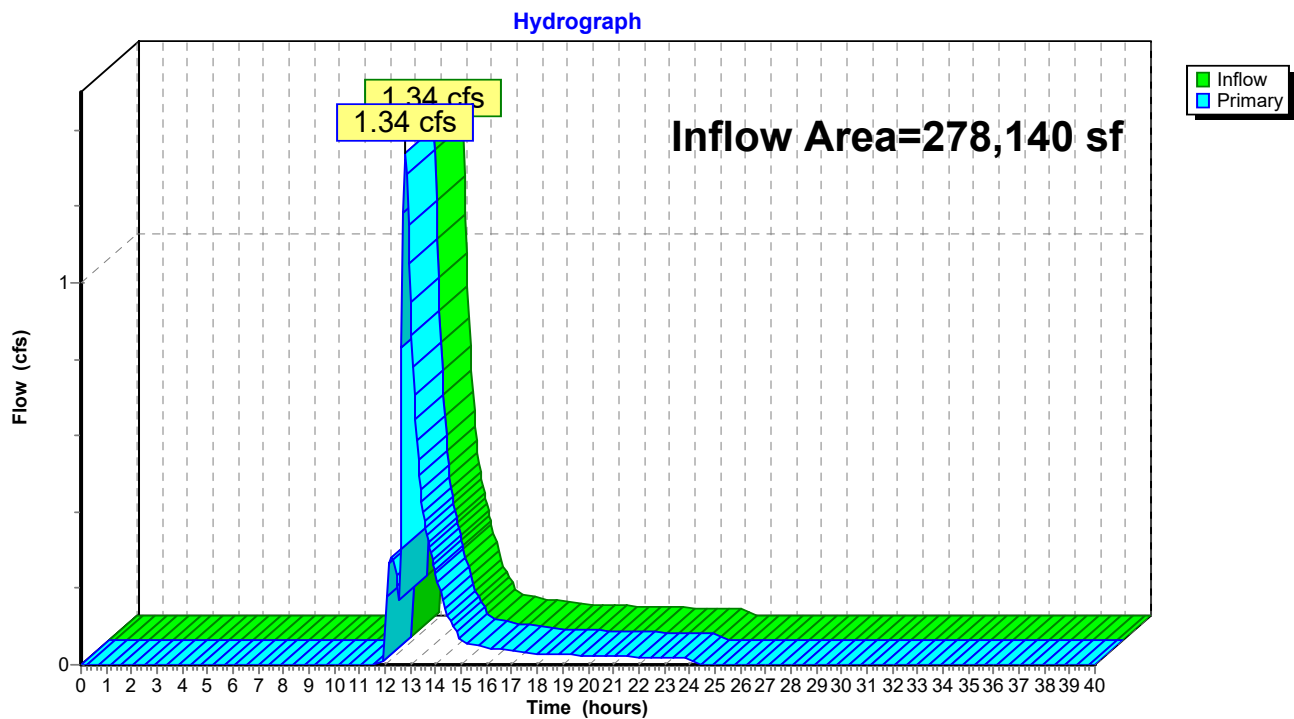
Page 92

Summary for Link 1L: Flow to the Wetlands to the southeast

Inflow Area = 278,140 sf, 7.71% Impervious, Inflow Depth = 0.22" for 100-yr event
Inflow = 1.34 cfs @ 12.77 hrs, Volume= 5,133 cf
Primary = 1.34 cfs @ 12.77 hrs, Volume= 5,133 cf, Atten= 0%, Lag= 0.0 min
Routed to Link 3L : Total flow discharging from limit of watershed analysis

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 1L: Flow to the Wetlands to the southeast



PROPOSED

Type III 24-hr 100-yr Rainfall=8.10"

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

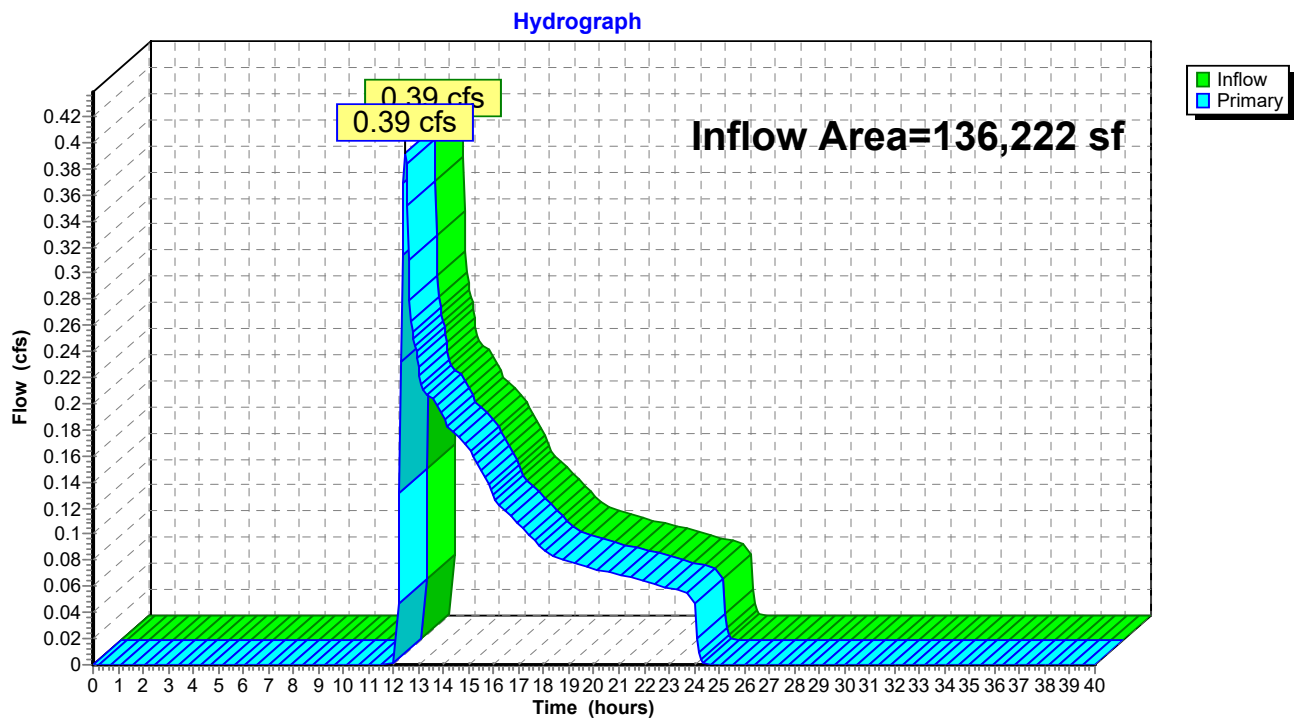
Page 93

Summary for Link 2L: Flow to the Wetlands to the north

Inflow Area = 136,222 sf, 0.00% Impervious, Inflow Depth = 0.44" for 100-yr event
 Inflow = 0.39 cfs @ 12.46 hrs, Volume= 4,999 cf
 Primary = 0.39 cfs @ 12.46 hrs, Volume= 4,999 cf, Atten= 0%, Lag= 0.0 min
 Routed to Link 3L : Total flow discharging from limit of watershed analysis

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 2L: Flow to the Wetlands to the north



PROPOSED

Prepared by Williams & Sparages

Type III 24-hr 100-yr Rainfall=8.10"

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

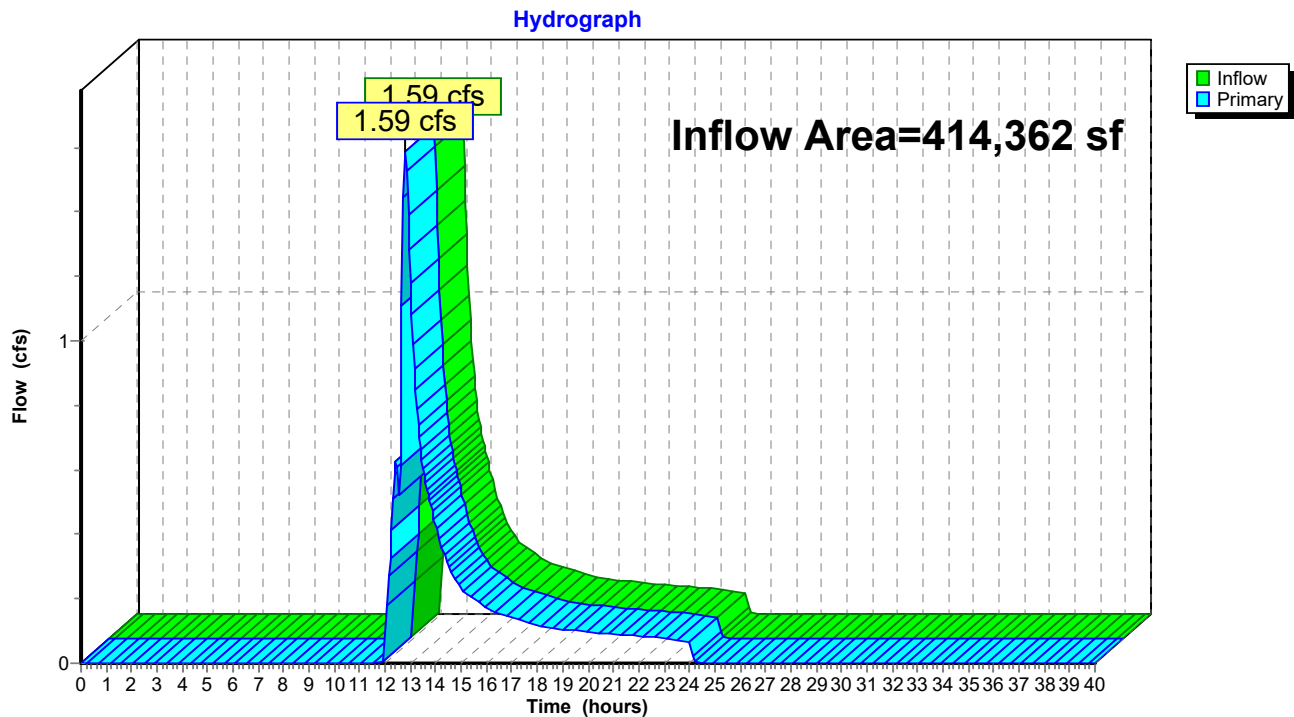
Page 94

Summary for Link 3L: Total flow discharging from limit of watershed analysis

Inflow Area = 414,362 sf, 5.18% Impervious, Inflow Depth = 0.29" for 100-yr event
 Inflow = 1.59 cfs @ 12.77 hrs, Volume= 10,132 cf
 Primary = 1.59 cfs @ 12.77 hrs, Volume= 10,132 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 3L: Total flow discharging from limit of watershed analysis



PROPOSED

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

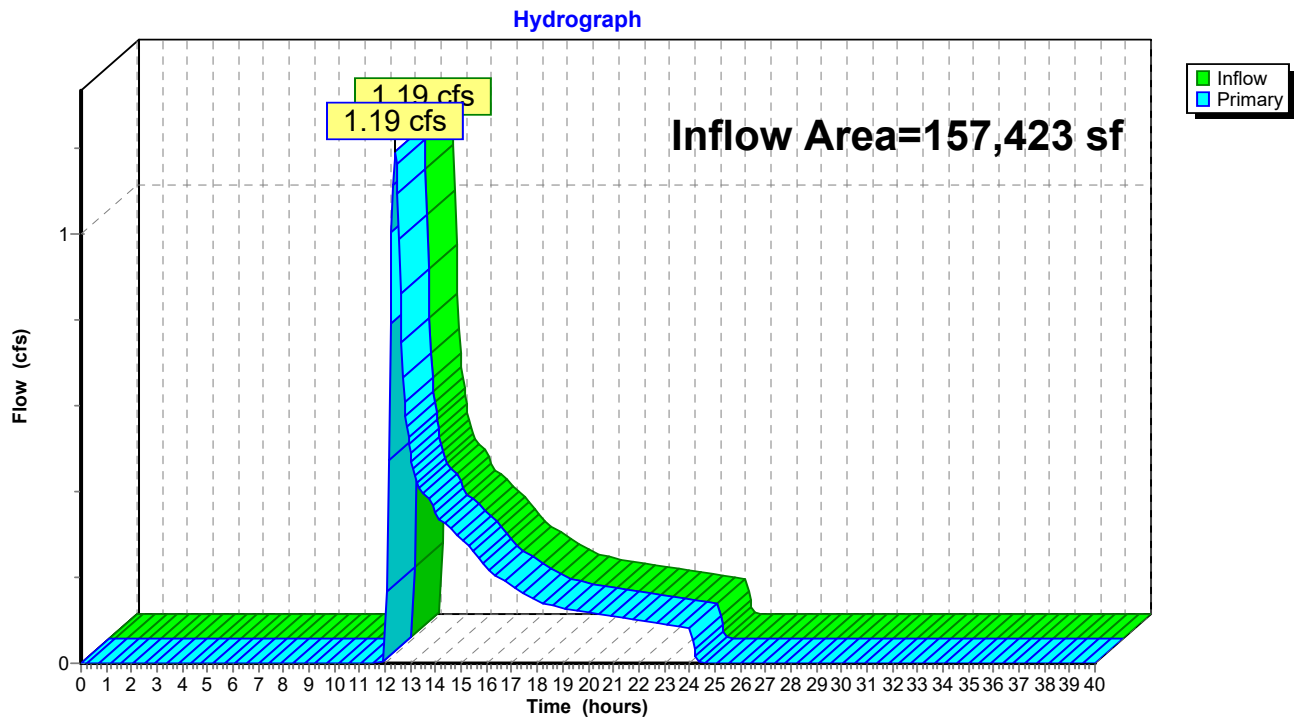
Page 95

Summary for Link 4L: Isolated Area #1

Inflow Area = 157,423 sf, 0.00% Impervious, Inflow Depth = 0.75" for 100-yr event
Inflow = 1.19 cfs @ 12.39 hrs, Volume= 9,876 cf
Primary = 1.19 cfs @ 12.39 hrs, Volume= 9,876 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 4L: Isolated Area #1



PROPOSED

Prepared by Williams & Sparages

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

Type III 24-hr 100-yr Rainfall=8.10"

Printed 10/3/2023

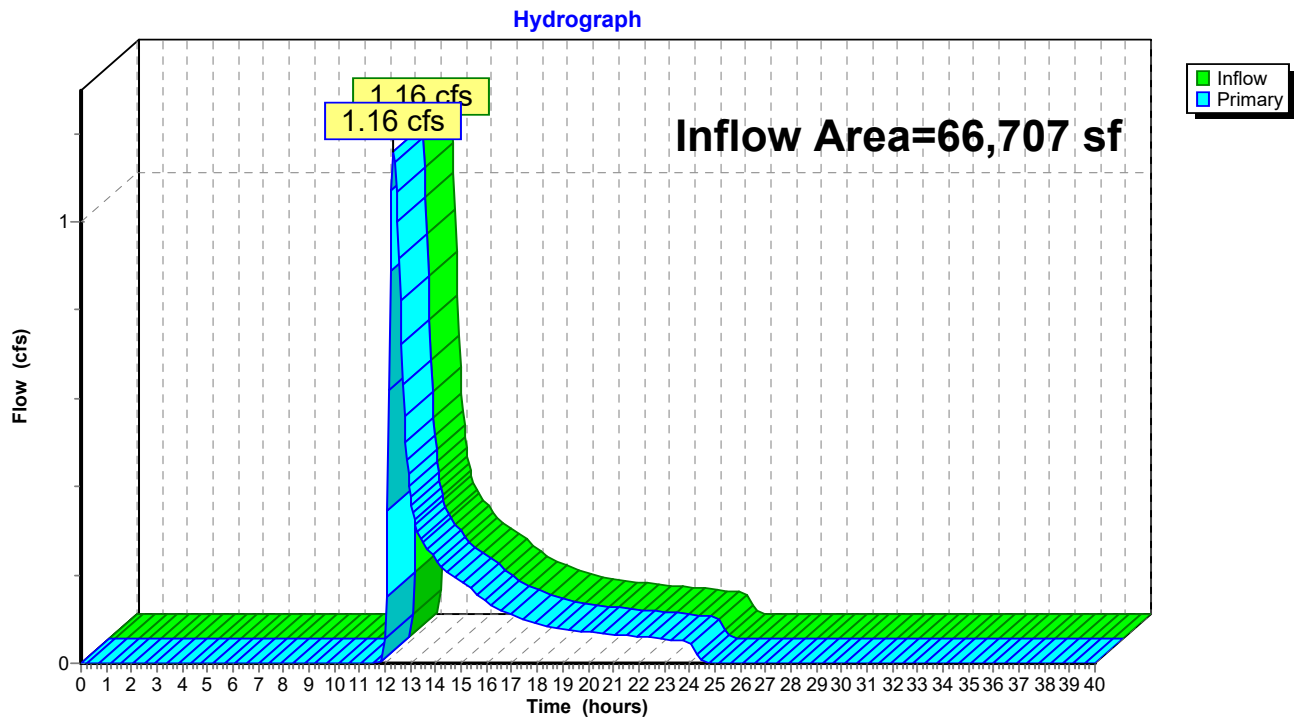
Page 96

Summary for Link 5L: Isolated Area #2

Inflow Area = 66,707 sf, 0.00% Impervious, Inflow Depth = 1.29" for 100-yr event
 Inflow = 1.16 cfs @ 12.33 hrs, Volume= 7,193 cf
 Primary = 1.16 cfs @ 12.33 hrs, Volume= 7,193 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 5L: Isolated Area #2



PROPOSED

Prepared by Williams & Sparages

Printed 10/3/2023

HydroCAD® 10.20-2f s/n 06611 © 2022 HydroCAD Software Solutions LLC

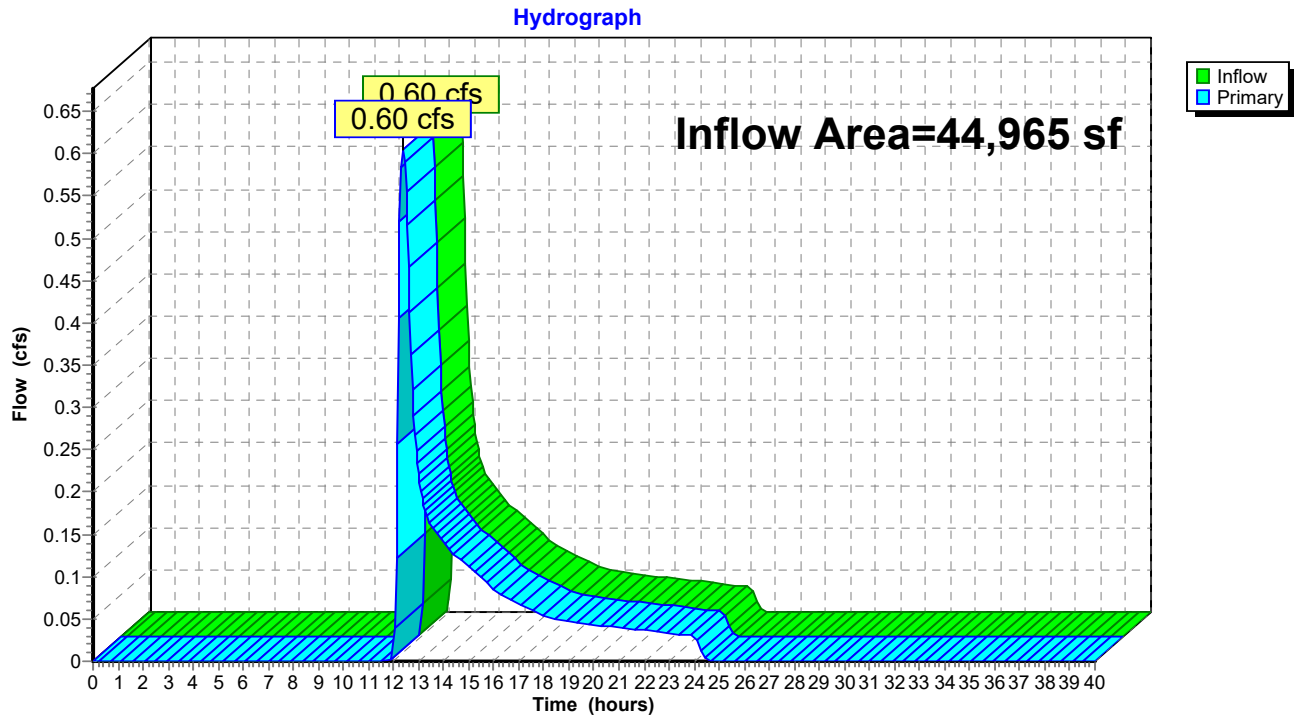
Page 97

Summary for Link 6L: Isolated Area #3

Inflow Area = 44,965 sf, 0.00% Impervious, Inflow Depth = 1.11" for 100-yr event
Inflow = 0.60 cfs @ 12.37 hrs, Volume= 4,144 cf
Primary = 0.60 cfs @ 12.37 hrs, Volume= 4,144 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-40.00 hrs, dt= 0.05 hrs

Link 6L: Isolated Area #3



| Long Term Operation & Maintenance Plan

This Operation & Maintenance Plan is prepared to comply with provisions set forth in the Massachusetts Department of Environmental Protection (MassDEP) Stormwater Management Standards.

Structural Best Management Practices (BMPs) require periodic maintenance to ensure proper function and efficiency in pollutant removal from stormwater discharges that would otherwise reach wetland resource areas untreated. Maintenance schedules found below are as recommended in MassDEP's Massachusetts Stormwater Handbook and/or as recommended in the manufacturer's specifications.

The following BMP provides groundwater recharge

Stormwater Management Areas-Ponds 1P & 2P

Basins are prone to clogging and failure so it is imperative to develop and implement aggressive maintenance plans and schedules.

Inspections and preventative maintenance shall be performed at least twice a year, and after every time drainage discharges through the high outlet orifice or a major storm event which is defined as a storm that is equal to or greater than the 2-year, 24-hour storm (3.24 inches in a 24-hour storm).

After the basin is on line, inspect it after every major storm for the first few months to ensure that it is stabilized and functioning properly. Take corrective action if necessary.

Note the time that water remains standing in the basin after a storm event. Standing water within the basin 48 to 72 hours after a storm indicates that the infiltration capacity of the basin may have been overestimated or the bottom has been clogged.

If the reason is clogging, determine the cause, e.g. erosion, excessive compaction, or low spots and take the necessary corrective action. Thereafter, inspect the infiltration basin at least twice per year.

Important items to check during the inspections include:

1. Signs of differential settlement,
2. Cracking,
3. Erosion,
4. Leakage in the embankments,
5. Tree growth on the embankments,
6. Condition of riprap,
7. Sediment accumulation and,
8. Health of the turf.

At least twice a year the buffer area, side slopes, and basin bottom shall be mowed. Remove the grass clippings and accumulated organic matter to prevent an impervious organic mat from forming. Remove trash and debris at this time as well as using deep tilling to break up any clogged surfaces, revegetate immediately. Remove sediment from the basin as necessary only when the floor of the basin is completely dry. Use light equipment to remove the top layer to prevent compacting the underlying soil. Deep till the remaining soil and revegetate as soon as possible.

Inspection and Maintenance Form

Refer to Sections above for frequency of inspection

Inspector:

Date:

Inspector Title:

Days since last rainfall:

Amount of last
rainfall:

Structural Controls: Stormwater Management Area

Structure Identification	Location	Condition of side slope % vegetated	Sediment buildup in basin % accumulation	Rilling or gullyng
Pond 1P	Adjacent to proposed gravel driveway			Minor <input type="checkbox"/> Moderate <input type="checkbox"/> Major <input type="checkbox"/>
Pond 2P	East side of existing house adjacent to Mass Electric Property			Minor <input type="checkbox"/> Moderate <input type="checkbox"/> Major <input type="checkbox"/>
				Minor <input type="checkbox"/> Moderate <input type="checkbox"/> Major <input type="checkbox"/>
				Minor <input type="checkbox"/> Moderate <input type="checkbox"/> Major <input type="checkbox"/>

Maintenance required

To be performed by:

On or before:





Commonwealth of Massachusetts
City/Town of Topsfield

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Lee Katz & Cameron Mayer

Owner Name

93/160 Bare Hill Road

Street Address

Topsfield/Boxford

City

MA

State

34-01-26 (Boxford) 9-3 (Topsfield)

Map/Lot #

01921 & 01985

Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade ☐ Repair

2. Soil Survey Available? ☒ Yes ☐ No If yes:

USDA NRCS
Source

253B
Soil Map Unit

HInckley
Soil Name

N/A
Soil Limitations

Sandy and gravelly glaciofluvial deposits
Soil Parent material

Outwash terrace
Landform

3. Surficial Geological Report Available? ☒ Yes ☐ No

If yes: MassMapper
Year Published/Source

Sand and Gravel
Map Unit

Sand

Description of Geologic Map Unit:

4. Flood Rate Insurance Map Within a regulatory floodway? ☐ Yes ☒ No

5. Within a velocity zone? ☐ Yes ☒ No

6. Within a Mapped Wetland Area? ☐ Yes ☒ No

If yes, MassGIS Wetland Data Layer:

Wetland Type

7. Current Water Resource Conditions (USGS):

6/6/2023
Month/Day/ Year

Range: ☐ Above Normal

☒ Normal ☐ Below Normal

8. Other references reviewed:



Commonwealth of Massachusetts
City/Town of Topsfield

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: 23-1 6/6/23 9:00am Sunny, 75 42.656110 -70.961850
Hole # Date Time Weather Latitude Longitude:

1. Land Use Residential Lawn None
(e.g., woodland, agricultural field, vacant lot, etc.) Vegetation Surface Stones (e.g., cobbles, stones, boulders, etc.) Slope (%)
Description of Location: _____

2. Soil Parent Material: Sandy and gravelly glaciofluvial deposits Outwash terrace SH
Landform Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from: Open Water Body 100+ feet Drainage Way 100+ feet Wetlands 100+ feet
Property Line 10+ feet Drinking Water Well 100+ feet Other _____ feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: _____ Depth Weeping from Pit _____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-12	A	FSL	10YR 3/2								
12-25	Bw	LS	10YR 6/8								
25-110	C	Med. S	5Y 5/3	80"							

Additional Notes:
ESHGW @ 80". No water observed



Commonwealth of Massachusetts
City/Town of Topsfield

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: 23-2 Hole # 6/6/23 Date 10:00am Time Sunny, 75 Weather 42.656110 Latitude -70.961850 Longitude:

1. Land Use: Residential (e.g., woodland, agricultural field, vacant lot, etc.) Lawn Vegetation None Surface Stones (e.g., cobbles, stones, boulders, etc.) 3-8% Slope (%)

Description of Location: _____

2. Soil Parent Material: Sandy and gravelly glaciofluvial deposits Outwash terrace Landform SH Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from: Open Water Body 100+ feet Drainage Way 100+ feet Wetlands 100+ feet
Property Line 10+ feet Drinking Water Well 100+ feet Other _____ feet

4. Unsuitable

Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: _____ Depth Weeping from Pit _____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-11	A	FSL	10YR 3/2								
11-24	Bw	LS	10YR 6/8								
24-112	C	Med. S	5Y 5/3	82"							

Additional Notes:

ESHGW @ 82". No water observed



Commonwealth of Massachusetts
City/Town of Topsfield

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: 23-3 6/6/23 10:30am Sunny, 75 42.656110 -70.961850
Hole # Date Time Weather Latitude Longitude:
1. Land Use Residential Lawn None
(e.g., woodland, agricultural field, vacant lot, etc.) Vegetation Surface Stones (e.g., cobbles, stones, boulders, etc.) Slope (%)
3-8%

Description of Location: _____

2. Soil Parent Material: Sandy and gravelly glaciofluvial deposits Outwash terrace SH
Landform Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from: Open Water Body 100+ feet Drainage Way 100+ feet Wetlands 100+ feet
Property Line 10+ feet Drinking Water Well 100+ feet Other _____ feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: _____ Depth Weeping from Pit _____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-10	A	FSL	10YR 3/2								
10-25	Bw	LS	10YR 6/8								
25-112	C	Med. S	5Y 5/3	90"							

Additional Notes:
ESHW @ 90". No water observed



Commonwealth of Massachusetts
City/Town of Topsfield

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: 23-4 6/6/23 11:00am Sunny, 75 42.656110 -70.961850
Hole # Date Time Weather Latitude Longitude:

1. Land Use: Residential Lawn None 3-8%
(e.g., woodland, agricultural field, vacant lot, etc.) Vegetation Surface Stones (e.g., cobbles, stones, boulders, etc.) Slope (%)

Description of Location: _____

2. Soil Parent Material: Sandy and gravelly glaciofluvial deposits Outwash terrace SH
Landform Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from: Open Water Body 100+ feet Drainage Way 100+ feet Wetlands 100+ feet
Property Line 10+ feet Drinking Water Well 100+ feet Other _____ feet

4. Unsuitable

Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: _____ Depth Weeping from Pit _____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-10	A	FSL	10YR 3/2								
10-25	Bw	LS	10YR 6/8								
25-112	C	Med. S	5Y 5/3	90"							

Additional Notes:

ESHGW @ 90". No water observed



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used:

☐ Depth observed standing water in observation hole

Obs. Hole # 23-1

_____ inches

Obs. Hole # 23-2

_____ inches

☐ Depth weeping from side of observation hole

_____ inches

_____ inches

☒ Depth to soil redoximorphic features (mottles)

80 inches

82 inches

☐ Depth to adjusted seasonal high groundwater (S_h)
(USGS methodology)

_____ inches

_____ inches

Index Well Number _____

Reading Date _____

$$S_h = S_c - [S_r \times (OW_c - OW_{max}) / OW_r]$$

Obs. Hole/Well# _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

2. Estimated Depth to High Groundwater: _____ inches

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

☒ Yes ☐ No

b. If yes, at what depth was it observed (exclude A and O Horizons)?

Upper boundary:

11
inches

Lower boundary:

112
inches

c. If no, at what depth was impervious material observed?

Upper boundary:

inches

Lower boundary:

inches



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used:

☐ Depth observed standing water in observation hole

Obs. Hole # 23-3

_____ inches

Obs. Hole # 23-4

_____ inches

☐ Depth weeping from side of observation hole

_____ inches

_____ inches

☒ Depth to soil redoximorphic features (mottles)

90 inches

90 inches

☐ Depth to adjusted seasonal high groundwater (S_h)
(USGS methodology)

_____ inches

_____ inches

Index Well Number _____

Reading Date _____

$$S_h = S_c - [S_r \times (OW_c - OW_{max}) / OW_r]$$

Obs. Hole/Well# _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

2. Estimated Depth to High Groundwater: _____ inches

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

☒ Yes ☐ No

b. If yes, at what depth was it observed (exclude A and O Horizons)?

Upper boundary:

25
inches

Lower boundary:

112
inches

c. If no, at what depth was impervious material observed?

Upper boundary:

inches

Lower boundary:

inches



Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

Thorsen Akerley

Signature of Soil Evaluator

Thorsen Akerley / #14016

Typed or Printed Name of Soil Evaluator / License #

Gerry McDonald

Name of Approving Authority Witness

6/6/23

Date

6/30/25

Expiration Date of License

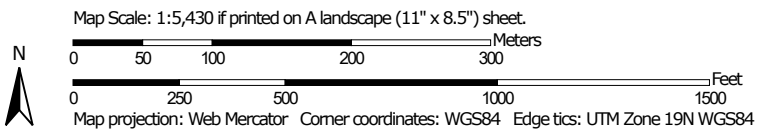
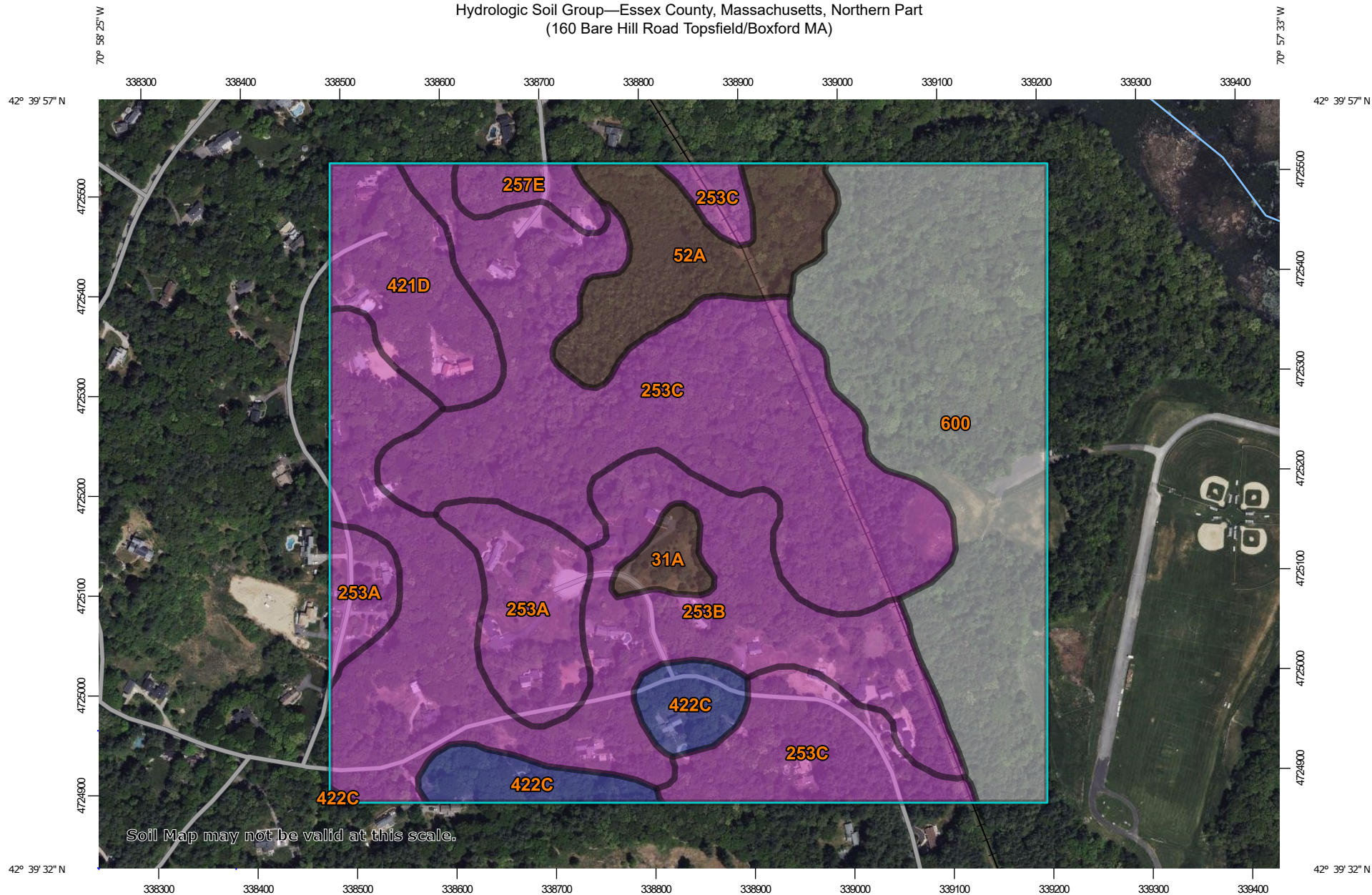
Topsfield Board of Health

Approving Authority

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with [Percolation Test Form 12](#).

Field Diagrams: Use this area for field diagrams:

Hydrologic Soil Group—Essex County, Massachusetts, Northern Part
(160 Bare Hill Road Topsfield/Boxford MA)



MAP LEGEND

Area of Interest (AOI)









 Area of Interest (AOI)

Soils

Soil Rating Polygons





 A
 A/D
 B
 B/D
 C
 C/D
 D
 Not rated or not available

Soil Rating Lines


 A
 A/D
 B
 B/D
 C
 C/D
 D
 Not rated or not available

Soil Rating Points




 A
 A/D
 B
 B/D

 C
 C/D
 D
 Not rated or not available


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 1:15,800.

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

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

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

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

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

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

Soil Survey Area: Essex County, Massachusetts, Northern Part
 Survey Area Data: Version 19, Sep 10, 2023

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

Date(s) aerial images were photographed: May 22, 2022—Jun 5, 2022

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.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
31A	Walpole sandy loam, 0 to 3 percent slopes	B/D	1.4	1.2%
52A	Freetown muck, 0 to 1 percent slopes	B/D	7.8	6.8%
253A	Hinckley loamy sand, 0 to 3 percent slopes	A	7.4	6.5%
253B	Hinckley loamy sand, 3 to 8 percent slopes	A	25.9	22.6%
253C	Hinckley loamy sand, 8 to 15 percent slopes	A	33.4	29.2%
257E	Hinckley and Windsor soils, 25 to 35 percent slopes	A	1.7	1.5%
421D	Canton fine sandy loam, 15 to 25 percent slopes, very stony	A	6.6	5.7%
422C	Canton fine sandy loam, 8 to 15 percent slopes, extremely stony	B	4.5	3.9%
600	Pits, gravel		25.8	22.5%
Totals for Area of Interest			114.7	100.0%

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher