

MEMORANDUM

TO: Peter Ten Kate, P.E.
FROM: Sean Savage
SUBJECT: Runoff Volume Memo

DATE: July 31, 2023
PROJECT NO.: 19-720
PROJECT NAME: Spectrum 360

This memo has been prepared for the purpose of demonstrating that peak flow volume remains the same when switching from Delmarva to SCS Hydrographs for a representative area of 1-acre with a runoff coefficient of 74 at different time of concentrations.

Time of Concentration = 10 minutes

Storm Event (yr)	Delmarva Peak Flow Rate (cfs)	SCS Peak Flow Rate (cfs)	Delmarva Peak Flow Volume (af)	SCS Peak Flow Volume (af)
2	0.84	1.14	0.099	0.099
10	1.87	2.49	0.210	0.210
100	4.11	5.43	0.462	0.462

Time of Concentration = 15 minutes

Storm Event (yr)	Delmarva Peak Flow Rate (cfs)	SCS Peak Flow Rate (cfs)	Delmarva Peak Flow Volume (af)	SCS Peak Flow Volume (af)
2	0.68	0.98	0.099	0.099
10	1.54	2.16	0.210	0.210
100	3.40	4.72	0.462	0.462

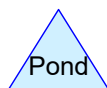
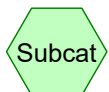
Time of Concentration = 20 minutes

Storm Event (yr)	Delmarva Peak Flow Rate (cfs)	SCS Peak Flow Rate (cfs)	Delmarva Peak Flow Volume (af)	SCS Peak Flow Volume (af)
2	0.58	0.86	0.099	0.099
10	1.31	1.90	0.210	0.210
100	2.92	4.16	0.462	0.462

**TIME OF CONCENTRATION: 10 MINUTES
DELMARVA UNIT HYDROGRAPH**



Area 1



Routing Diagram for Post-Development

Prepared by Matrix New World Engineering, Printed 7/31/2023
HydroCAD® 10.00-22 s/n 03376 © 2018 HydroCAD Software Solutions LLC

Post-Development

Prepared by Matrix New World Engineering

HydroCAD® 10.00-22 s/n 03376 © 2018 HydroCAD Software Solutions LLC

NOAA 24-hr D 2-yr Rainfall=3.42"

Printed 7/31/2023

Page 2

Summary for Subcatchment 65S: Area 1

Runoff = 0.84 cfs @ 12.21 hrs, Volume= 0.099 af, Depth= 1.19"

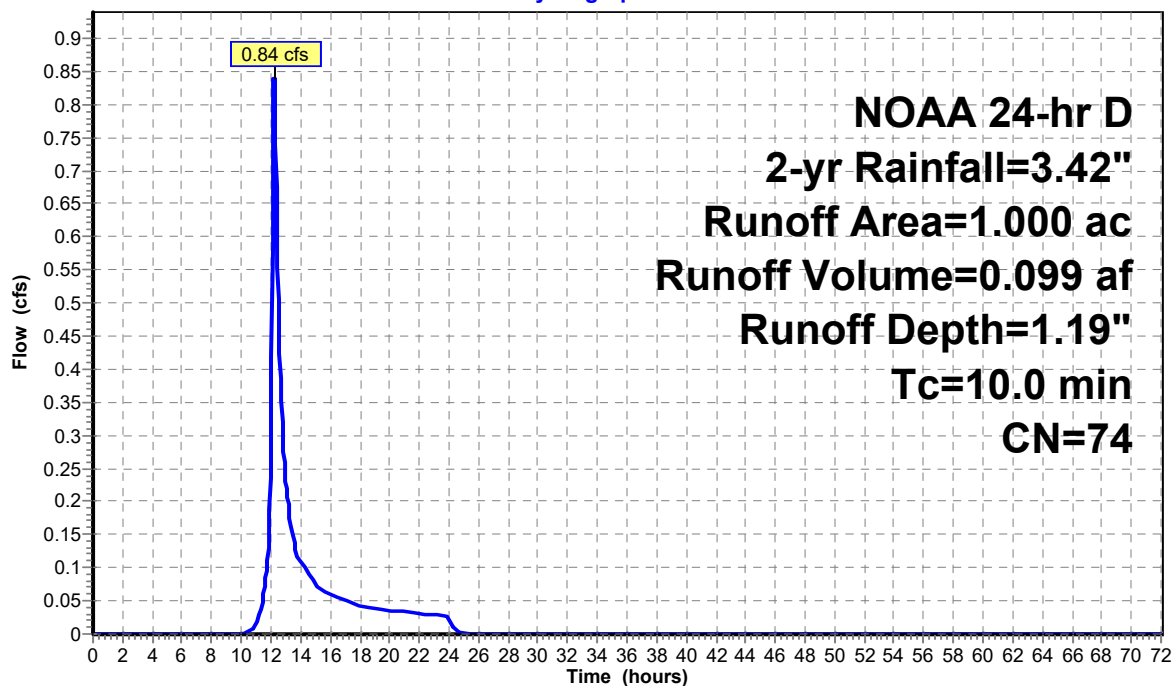
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-yr Rainfall=3.42"

Area (ac)	CN	Description
1.000	74	>75% Grass cover, Good, HSG C
1.000		100.00% Pervious Area

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

Subcatchment 65S: Area 1

Hydrograph



Post-Development

Prepared by Matrix New World Engineering

HydroCAD® 10.00-22 s/n 03376 © 2018 HydroCAD Software Solutions LLC

NOAA 24-hr D 10-yr Rainfall=5.20"

Printed 7/31/2023

Page 3

Summary for Subcatchment 65S: Area 1

Runoff = 1.87 cfs @ 12.20 hrs, Volume= 0.210 af, Depth= 2.52"

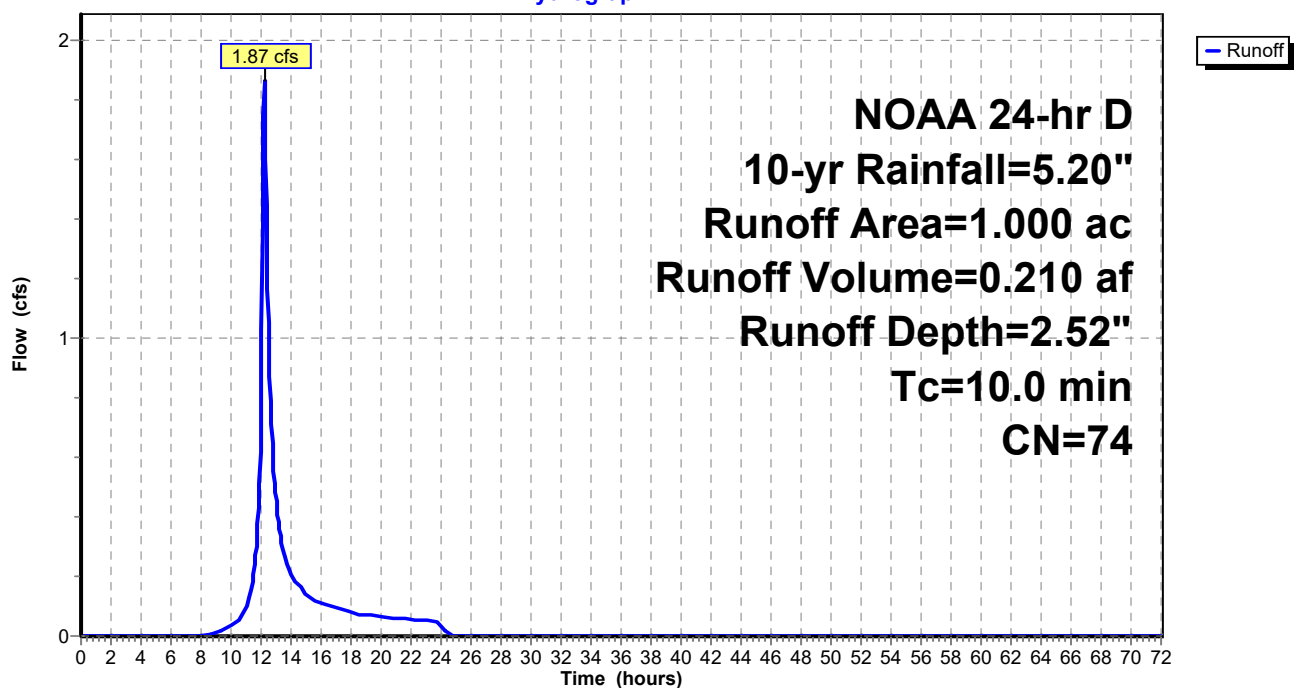
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-yr Rainfall=5.20"

Area (ac)	CN	Description
1.000	74	>75% Grass cover, Good, HSG C
1.000		100.00% Pervious Area

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

Subcatchment 65S: Area 1

Hydrograph



Post-Development

Prepared by Matrix New World Engineering

HydroCAD® 10.00-22 s/n 03376 © 2018 HydroCAD Software Solutions LLC

NOAA 24-hr D 100-yr Rainfall=8.69"

Printed 7/31/2023

Page 4

Summary for Subcatchment 65S: Area 1

Runoff = 4.11 cfs @ 12.20 hrs, Volume= 0.462 af, Depth= 5.55"

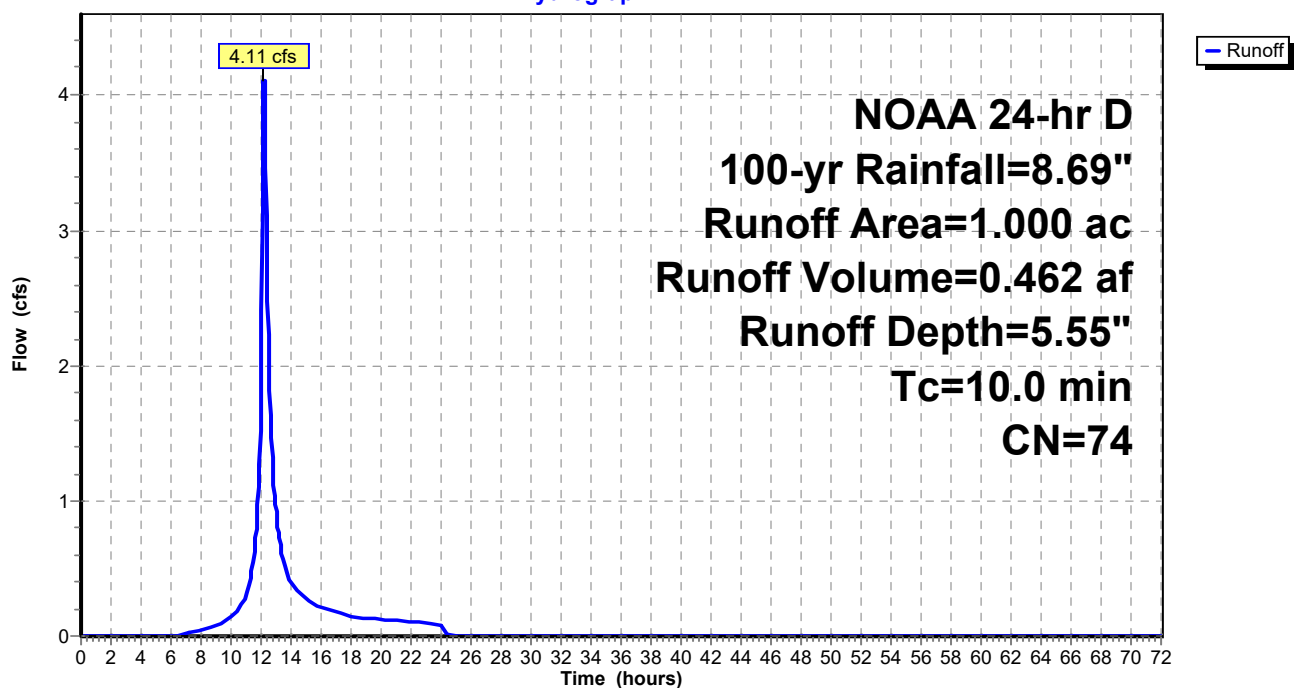
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-yr Rainfall=8.69"

Area (ac)	CN	Description
1.000	74	>75% Grass cover, Good, HSG C
1.000		100.00% Pervious Area

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

Subcatchment 65S: Area 1

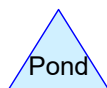
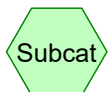
Hydrograph



**TIME OF CONCENTRATION: 10 MINUTES
SCS UNIT HYDROGRAPH**



Area 1



Routing Diagram for Post-Development

Prepared by Matrix New World Engineering, Printed 7/31/2023
HydroCAD® 10.00-22 s/n 03376 © 2018 HydroCAD Software Solutions LLC

Post-Development

Prepared by Matrix New World Engineering

HydroCAD® 10.00-22 s/n 03376 © 2018 HydroCAD Software Solutions LLC

NOAA 24-hr D 2-yr Rainfall=3.42"

Printed 7/31/2023

Page 2

Summary for Subcatchment 65S: Area 1

Runoff = 1.14 cfs @ 12.18 hrs, Volume= 0.099 af, Depth= 1.19"

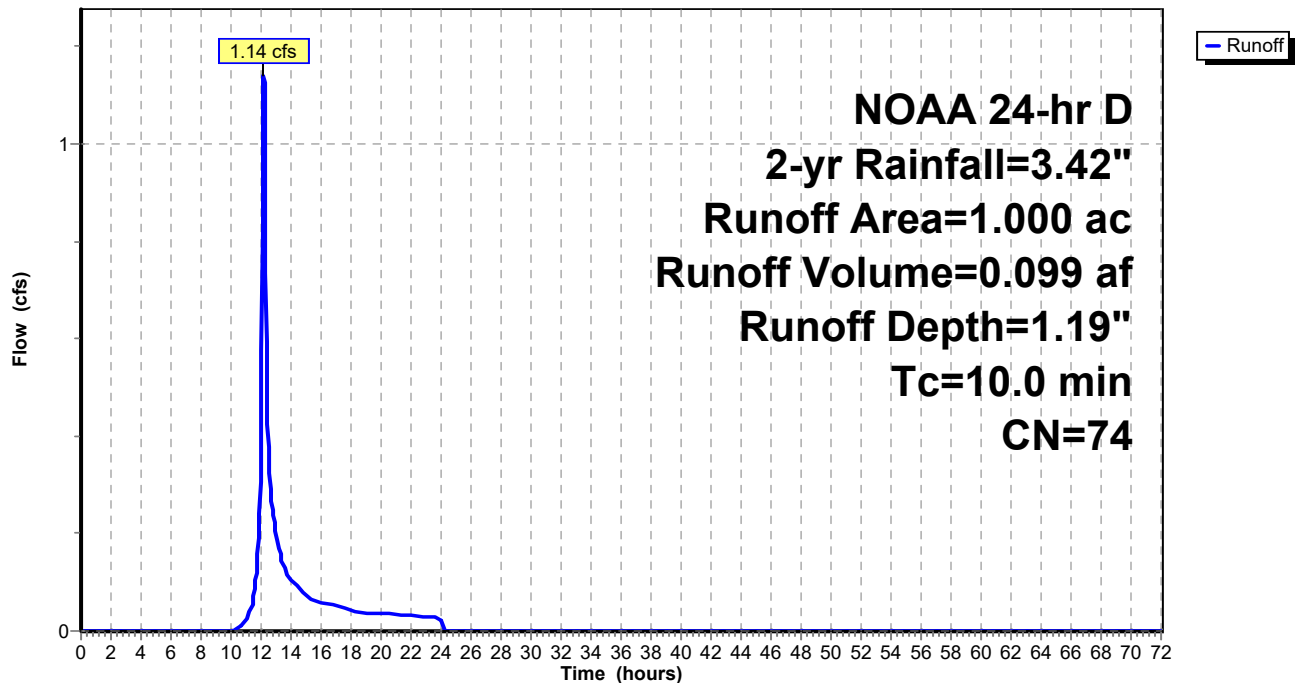
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-yr Rainfall=3.42"

Area (ac)	CN	Description
1.000	74	>75% Grass cover, Good, HSG C
1.000		100.00% Pervious Area

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

Subcatchment 65S: Area 1

Hydrograph



Post-Development

Prepared by Matrix New World Engineering

HydroCAD® 10.00-22 s/n 03376 © 2018 HydroCAD Software Solutions LLC

NOAA 24-hr D 10-yr Rainfall=5.20"

Printed 7/31/2023

Page 3

Summary for Subcatchment 65S: Area 1

Runoff = 2.49 cfs @ 12.18 hrs, Volume= 0.210 af, Depth= 2.52"

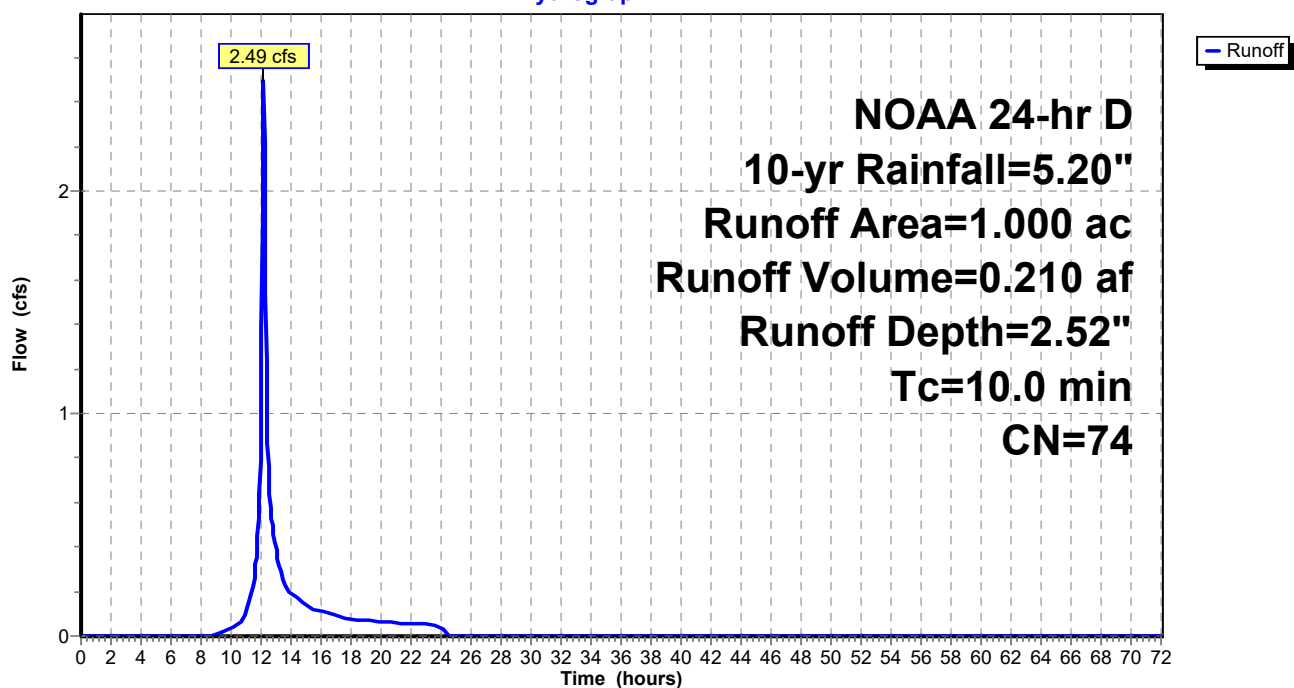
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-yr Rainfall=5.20"

Area (ac)	CN	Description
1.000	74	>75% Grass cover, Good, HSG C
1.000		100.00% Pervious Area

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

Subcatchment 65S: Area 1

Hydrograph



Post-Development

Prepared by Matrix New World Engineering

HydroCAD® 10.00-22 s/n 03376 © 2018 HydroCAD Software Solutions LLC

NOAA 24-hr D 100-yr Rainfall=8.69"

Printed 7/31/2023

Page 4

Summary for Subcatchment 65S: Area 1

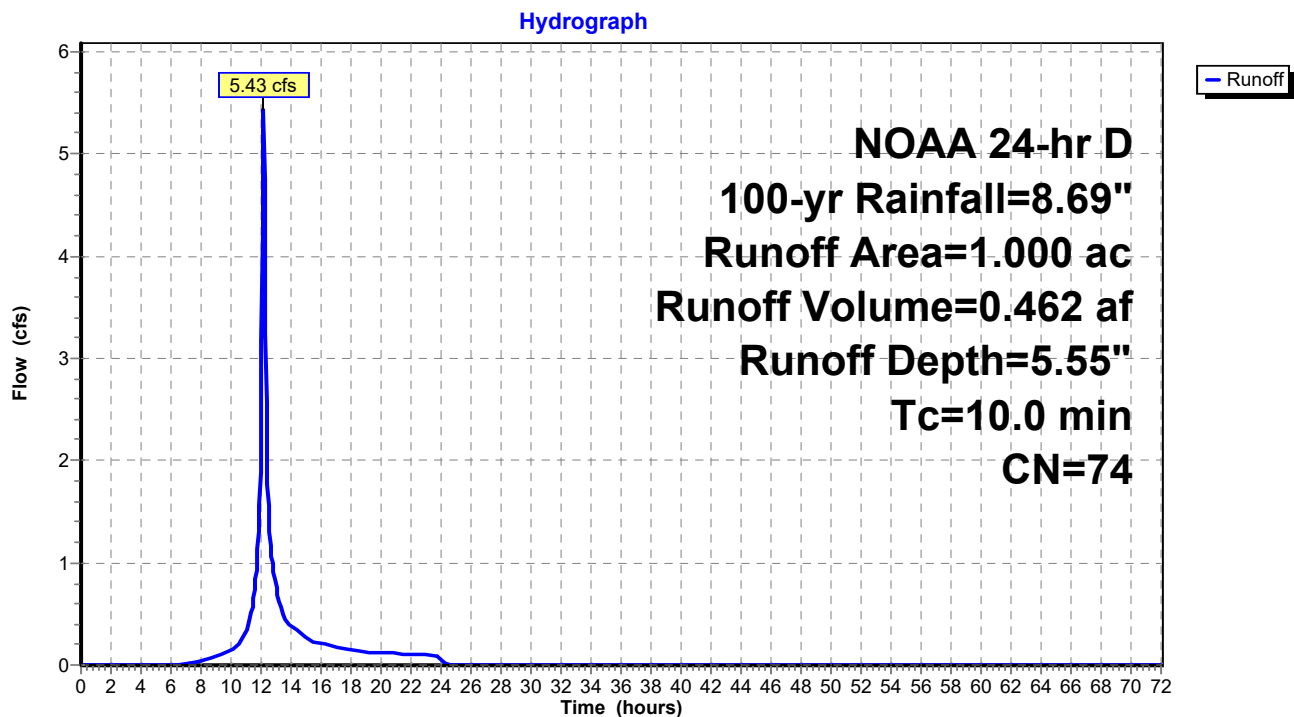
Runoff = 5.43 cfs @ 12.17 hrs, Volume= 0.462 af, Depth= 5.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-yr Rainfall=8.69"

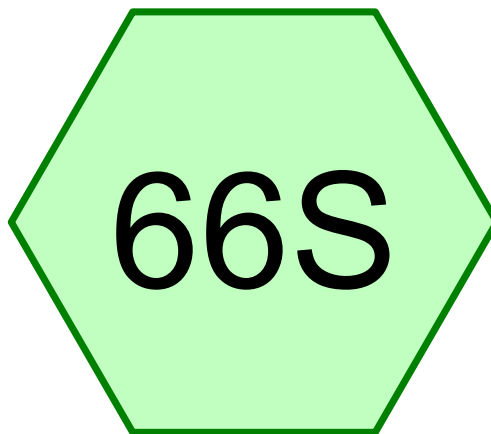
Area (ac)	CN	Description
1.000	74	>75% Grass cover, Good, HSG C
1.000		100.00% Pervious Area

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

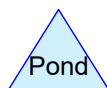
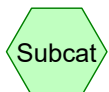
Subcatchment 65S: Area 1



**TIME OF CONCENTRATION: 15 MINUTES
DELMARVA UNIT HYDROGRAPH**



Area 2



Routing Diagram for Post-Development

Prepared by Matrix New World Engineering, Printed 7/31/2023
HydroCAD® 10.00-22 s/n 03376 © 2018 HydroCAD Software Solutions LLC

Post-Development

Prepared by Matrix New World Engineering

HydroCAD® 10.00-22 s/n 03376 © 2018 HydroCAD Software Solutions LLC

NOAA 24-hr D 2-yr Rainfall=3.42"

Printed 7/31/2023

Page 2

Summary for Subcatchment 66S: Area 2

Runoff = 0.68 cfs @ 12.27 hrs, Volume= 0.099 af, Depth= 1.19"

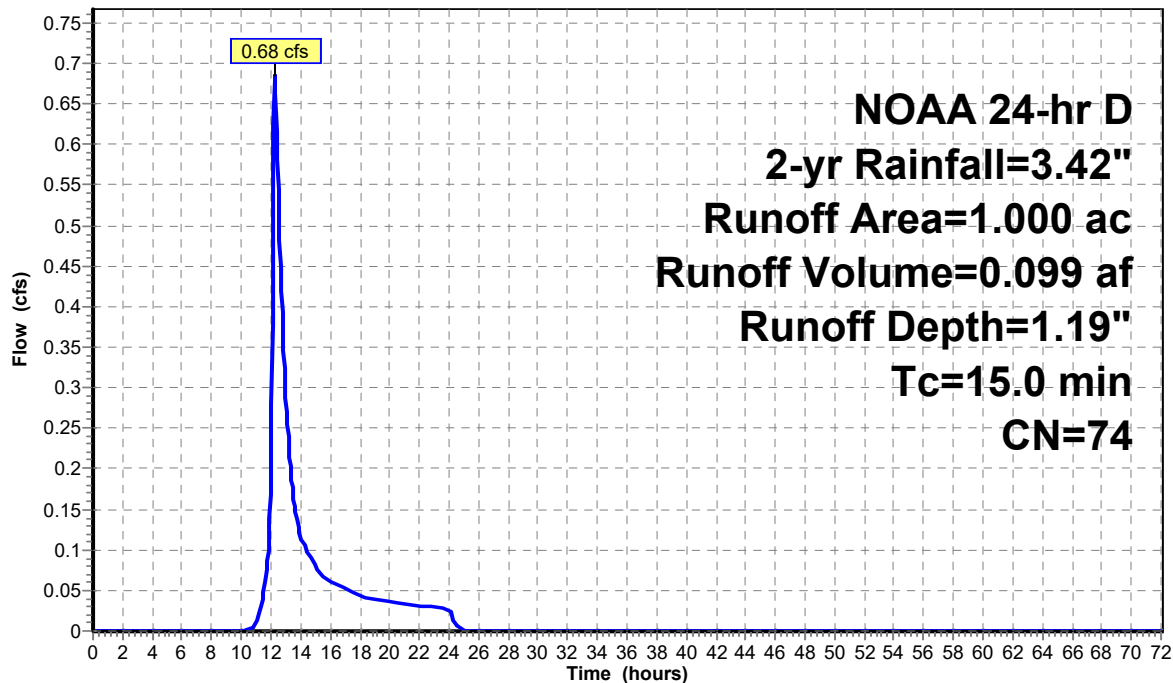
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-yr Rainfall=3.42"

Area (ac)	CN	Description
1.000	74	>75% Grass cover, Good, HSG C
1.000		100.00% Pervious Area

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

Subcatchment 66S: Area 2

Hydrograph



Post-Development

Prepared by Matrix New World Engineering

HydroCAD® 10.00-22 s/n 03376 © 2018 HydroCAD Software Solutions LLC

NOAA 24-hr D 10-yr Rainfall=5.20"

Printed 7/31/2023

Page 3

Summary for Subcatchment 66S: Area 2

Runoff = 1.54 cfs @ 12.26 hrs, Volume= 0.210 af, Depth= 2.52"

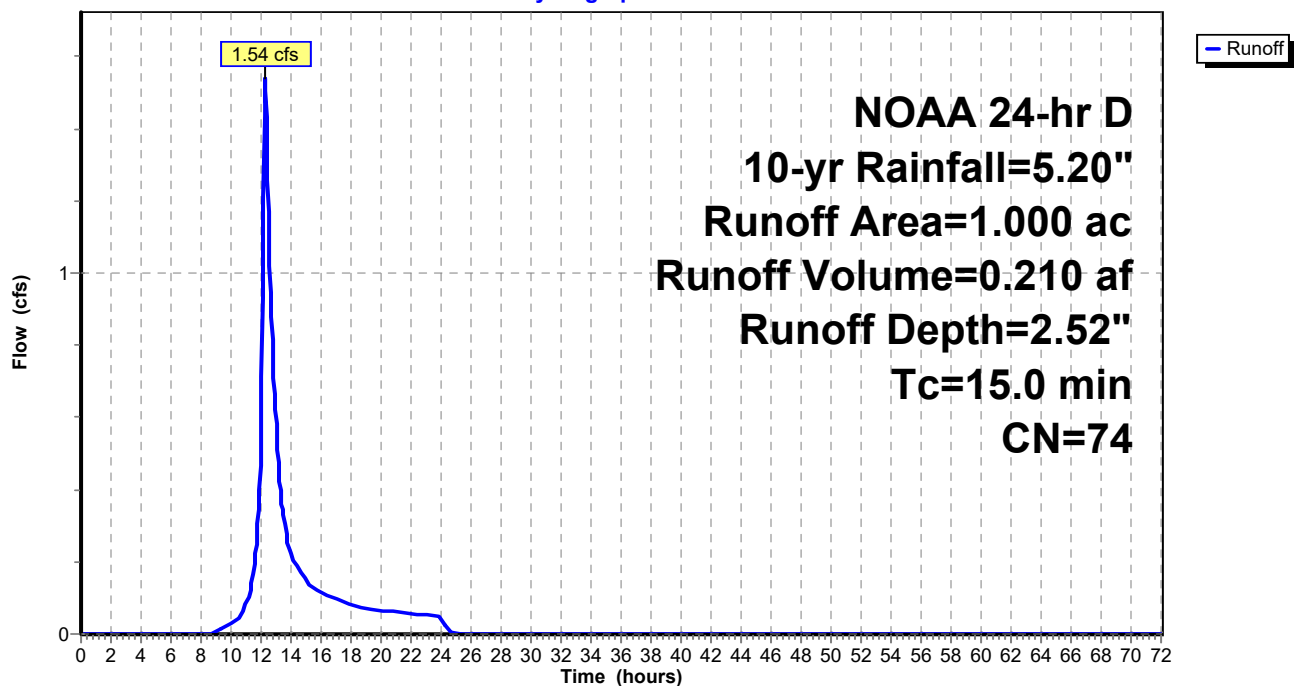
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-yr Rainfall=5.20"

Area (ac)	CN	Description
1.000	74	>75% Grass cover, Good, HSG C
1.000		100.00% Pervious Area

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

Subcatchment 66S: Area 2

Hydrograph



Post-Development

Prepared by Matrix New World Engineering

HydroCAD® 10.00-22 s/n 03376 © 2018 HydroCAD Software Solutions LLC

NOAA 24-hr D 100-yr Rainfall=8.69"

Printed 7/31/2023

Page 4

Summary for Subcatchment 66S: Area 2

Runoff = 3.40 cfs @ 12.26 hrs, Volume= 0.462 af, Depth= 5.55"

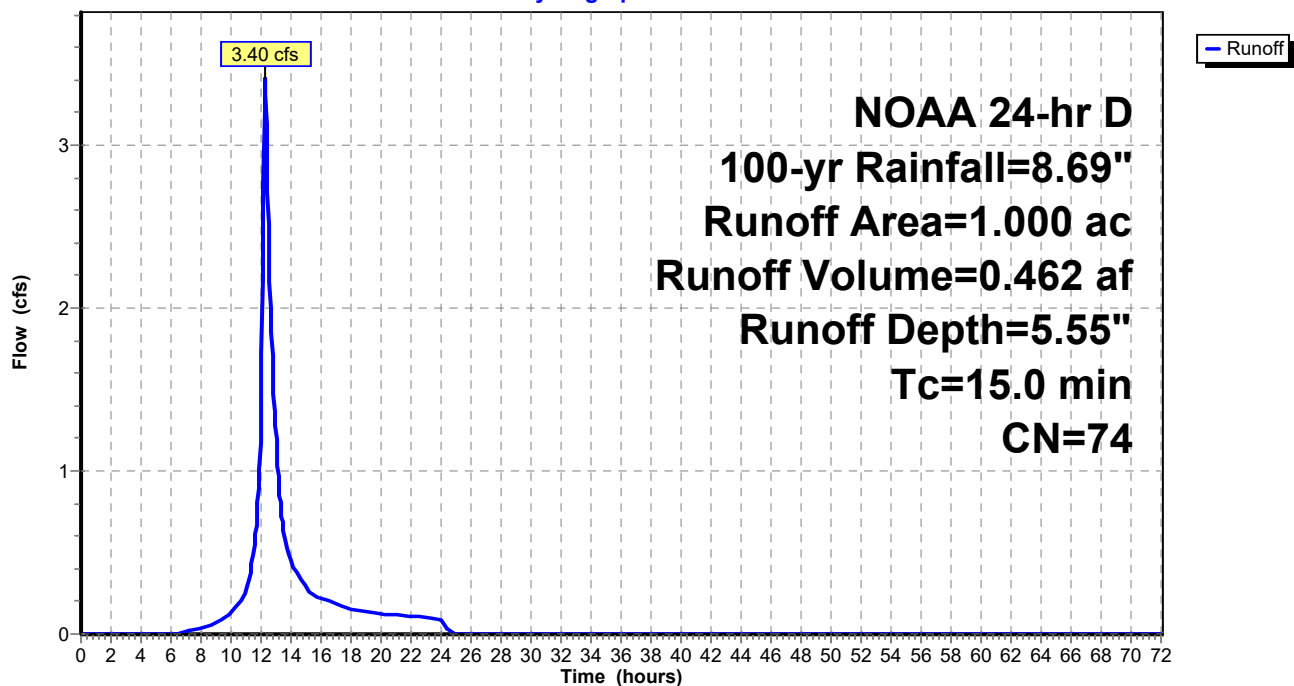
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-yr Rainfall=8.69"

Area (ac)	CN	Description
1.000	74	>75% Grass cover, Good, HSG C
1.000		100.00% Pervious Area

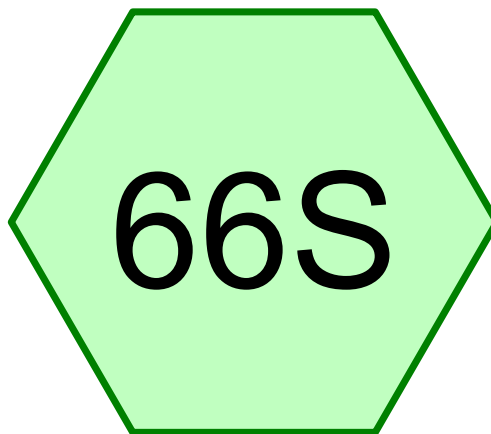
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.0					Direct Entry,

Subcatchment 66S: Area 2

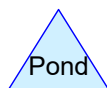
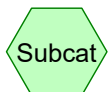
Hydrograph



**TIME OF CONCENTRATION: 15 MINUTES
SCS UNIT HYDROGRAPH**



Area 2



Routing Diagram for Post-Development

Prepared by Matrix New World Engineering, Printed 7/31/2023
HydroCAD® 10.00-22 s/n 03376 © 2018 HydroCAD Software Solutions LLC

Post-Development

Prepared by Matrix New World Engineering

HydroCAD® 10.00-22 s/n 03376 © 2018 HydroCAD Software Solutions LLC

NOAA 24-hr D 2-yr Rainfall=3.42"

Printed 7/31/2023

Page 2

Summary for Subcatchment 66S: Area 2

Runoff = 0.98 cfs @ 12.24 hrs, Volume= 0.099 af, Depth= 1.19"

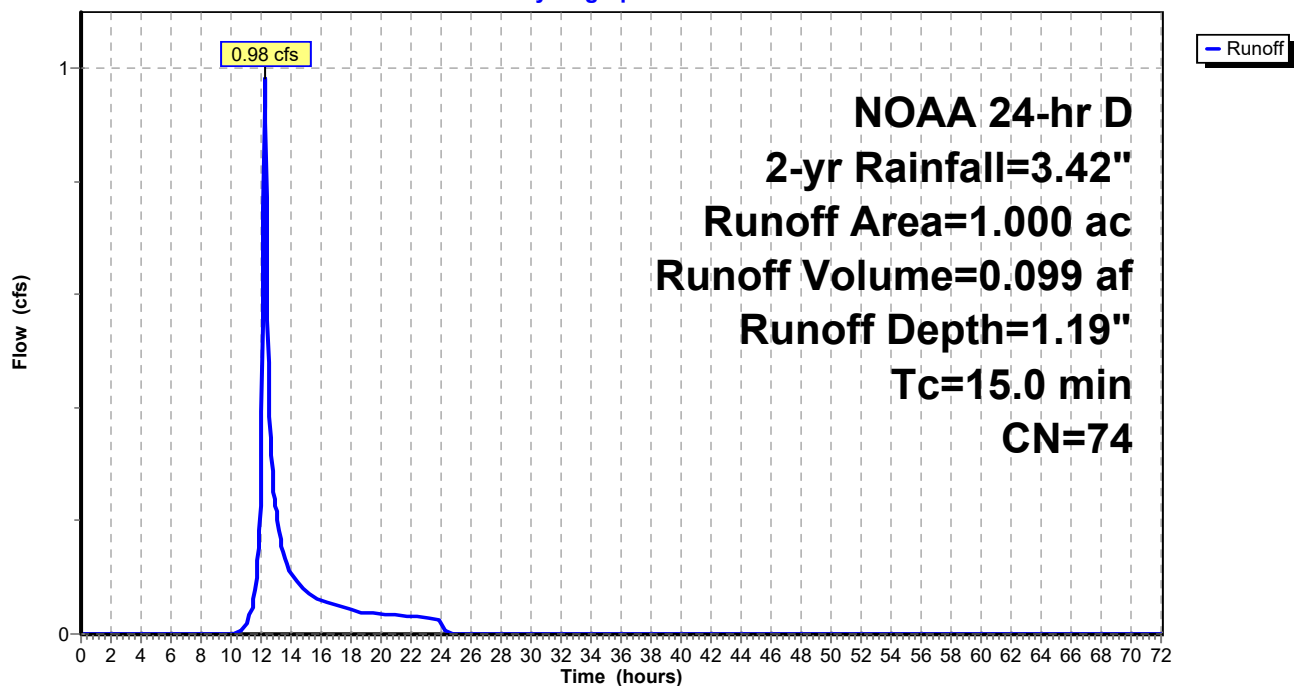
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-yr Rainfall=3.42"

Area (ac)	CN	Description
1.000	74	>75% Grass cover, Good, HSG C
1.000		100.00% Pervious Area

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

Subcatchment 66S: Area 2

Hydrograph



Post-Development

Prepared by Matrix New World Engineering

HydroCAD® 10.00-22 s/n 03376 © 2018 HydroCAD Software Solutions LLC

NOAA 24-hr D 10-yr Rainfall=5.20"

Printed 7/31/2023

Page 3

Summary for Subcatchment 66S: Area 2

Runoff = 2.16 cfs @ 12.24 hrs, Volume= 0.210 af, Depth= 2.52"

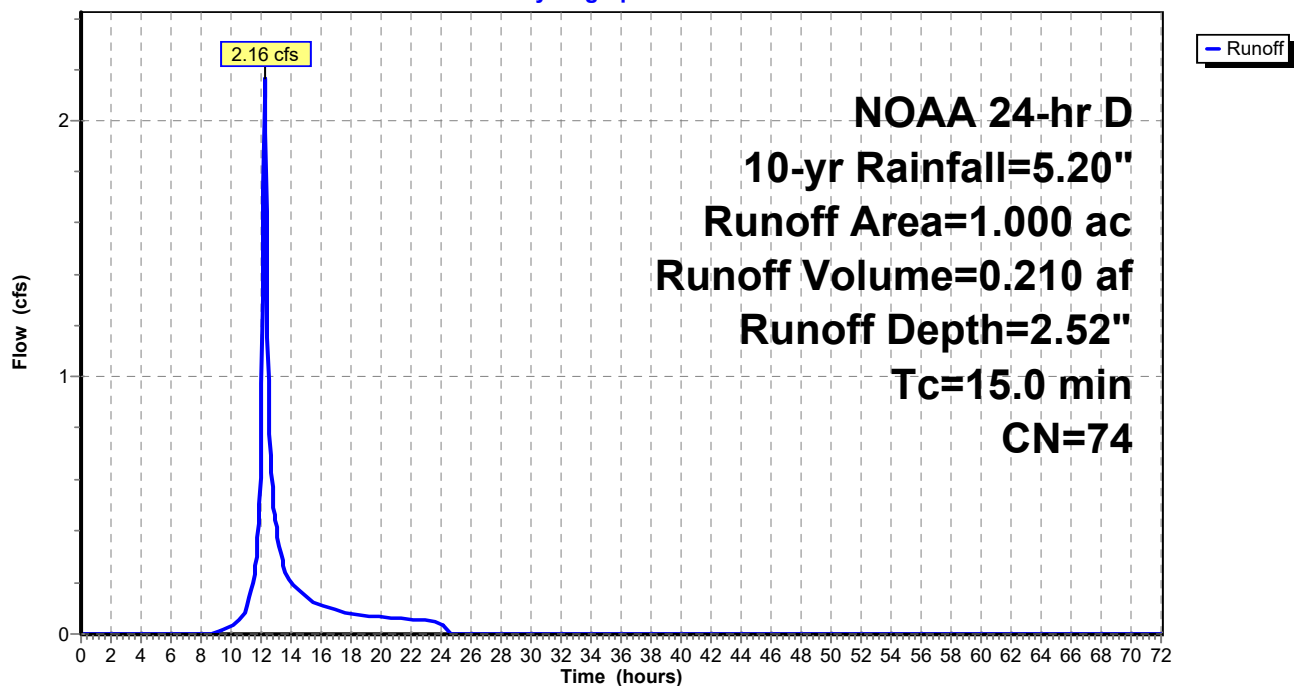
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-yr Rainfall=5.20"

Area (ac)	CN	Description
1.000	74	>75% Grass cover, Good, HSG C
1.000		100.00% Pervious Area

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

Subcatchment 66S: Area 2

Hydrograph



Post-Development

Prepared by Matrix New World Engineering

HydroCAD® 10.00-22 s/n 03376 © 2018 HydroCAD Software Solutions LLC

NOAA 24-hr D 100-yr Rainfall=8.69"

Printed 7/31/2023

Page 4

Summary for Subcatchment 66S: Area 2

Runoff = 4.72 cfs @ 12.23 hrs, Volume= 0.462 af, Depth= 5.55"

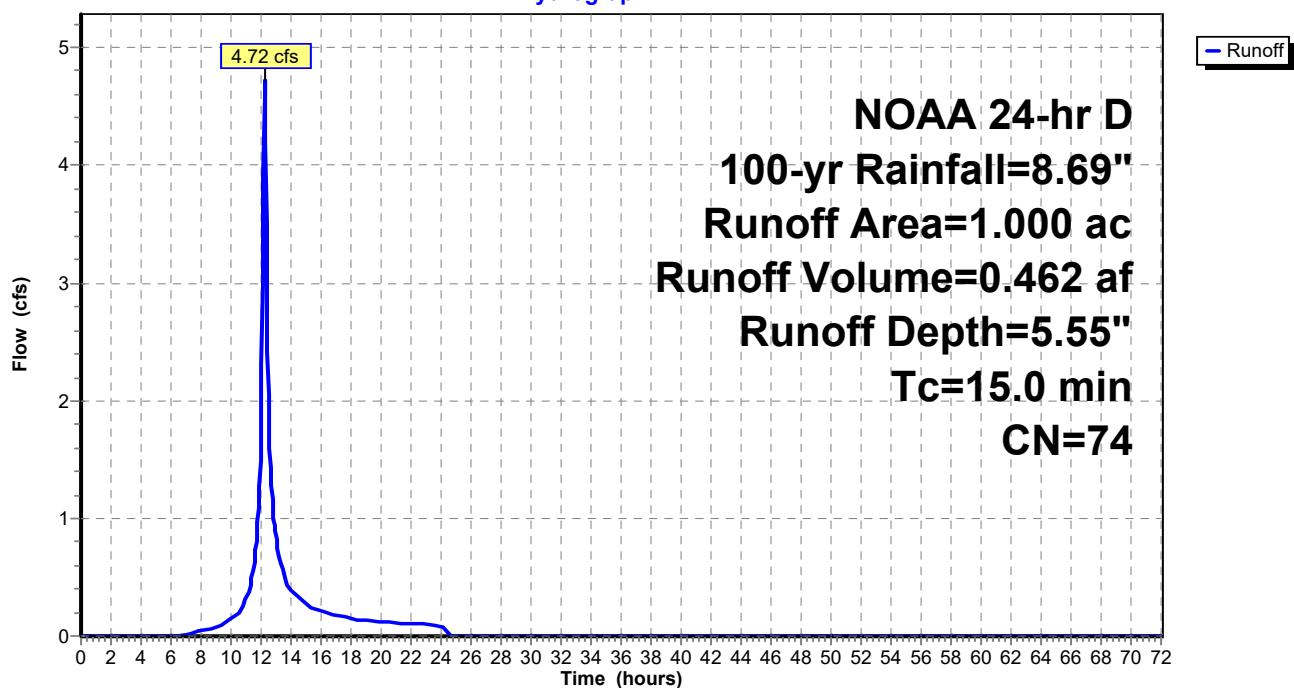
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-yr Rainfall=8.69"

Area (ac)	CN	Description
1.000	74	>75% Grass cover, Good, HSG C
1.000		100.00% Pervious Area

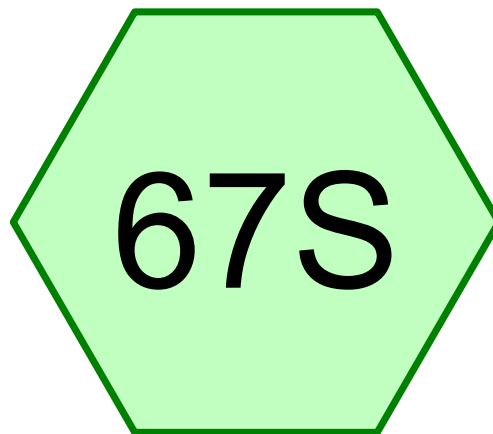
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.0					Direct Entry,

Subcatchment 66S: Area 2

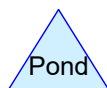
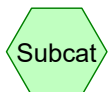
Hydrograph



**TIME OF CONCENTRATION: 20 MINUTES
DELMARVA UNIT HYDROGRAPH**



Area 3



Routing Diagram for Post-Development

Prepared by Matrix New World Engineering, Printed 7/31/2023
HydroCAD® 10.00-22 s/n 03376 © 2018 HydroCAD Software Solutions LLC

Post-Development

Prepared by Matrix New World Engineering

HydroCAD® 10.00-22 s/n 03376 © 2018 HydroCAD Software Solutions LLC

NOAA 24-hr D 2-yr Rainfall=3.42"

Printed 7/31/2023

Page 2

Summary for Subcatchment 67S: Area 3

Runoff = 0.58 cfs @ 12.35 hrs, Volume= 0.099 af, Depth= 1.19"

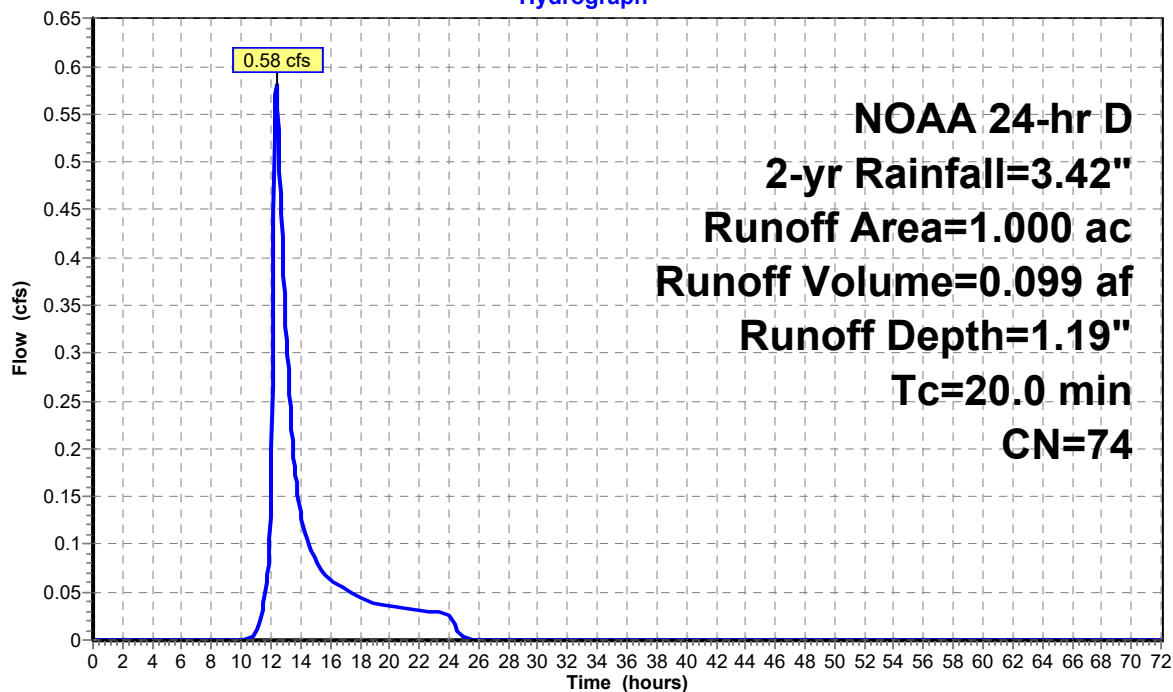
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-yr Rainfall=3.42"

Area (ac)	CN	Description
1.000	74	>75% Grass cover, Good, HSG C
1.000		100.00% Pervious Area

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

Subcatchment 67S: Area 3

Hydrograph



Post-Development

Prepared by Matrix New World Engineering

HydroCAD® 10.00-22 s/n 03376 © 2018 HydroCAD Software Solutions LLC

NOAA 24-hr D 10-yr Rainfall=5.20"

Printed 7/31/2023

Page 3

Summary for Subcatchment 67S: Area 3

Runoff = 1.31 cfs @ 12.33 hrs, Volume= 0.210 af, Depth= 2.52"

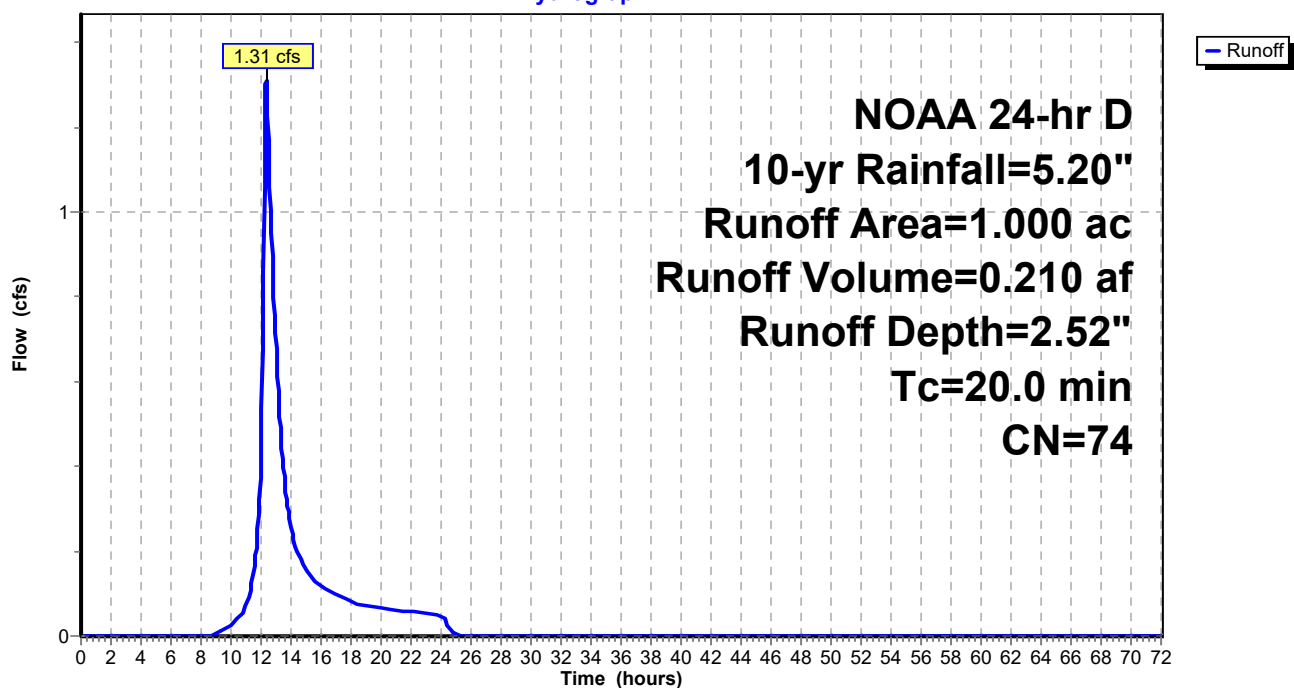
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-yr Rainfall=5.20"

Area (ac)	CN	Description
1.000	74	>75% Grass cover, Good, HSG C
1.000		100.00% Pervious Area

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

Subcatchment 67S: Area 3

Hydrograph



Post-Development

Prepared by Matrix New World Engineering

HydroCAD® 10.00-22 s/n 03376 © 2018 HydroCAD Software Solutions LLC

NOAA 24-hr D 100-yr Rainfall=8.69"

Printed 7/31/2023

Page 4

Summary for Subcatchment 67S: Area 3

Runoff = 2.92 cfs @ 12.32 hrs, Volume= 0.462 af, Depth= 5.55"

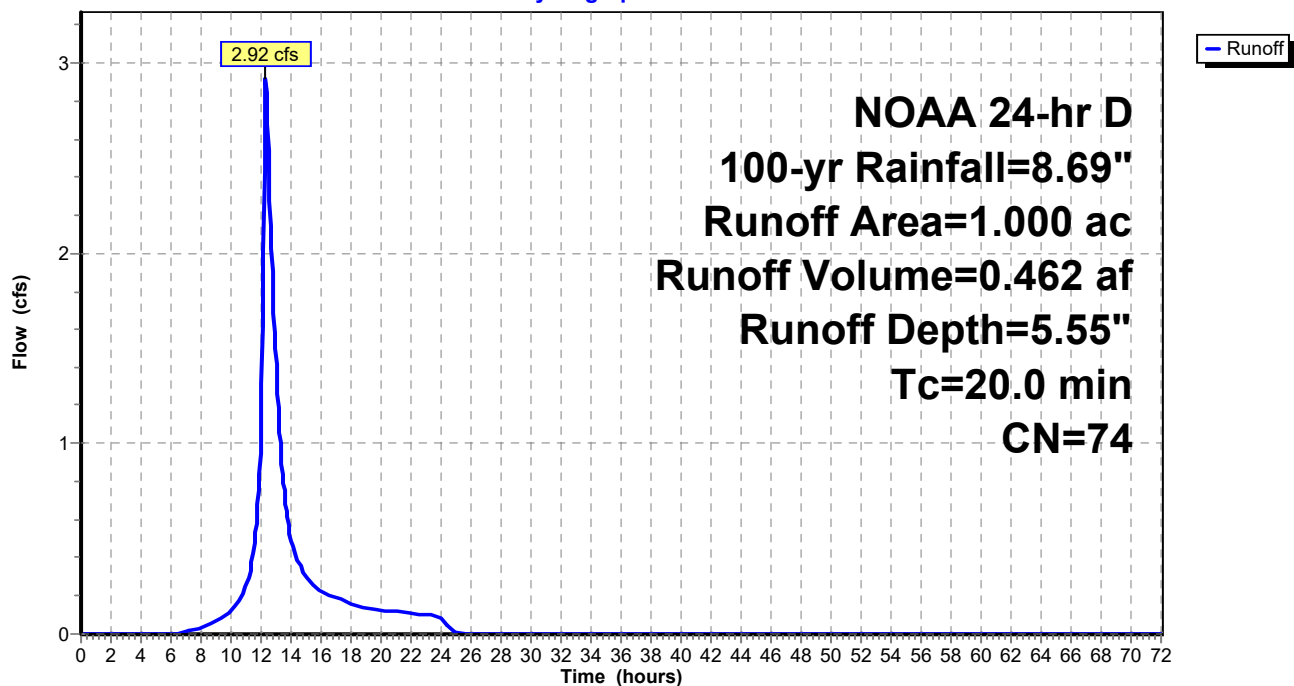
Runoff by SCS TR-20 method, UH=Delmarva, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-yr Rainfall=8.69"

Area (ac)	CN	Description
1.000	74	>75% Grass cover, Good, HSG C
1.000		100.00% Pervious Area

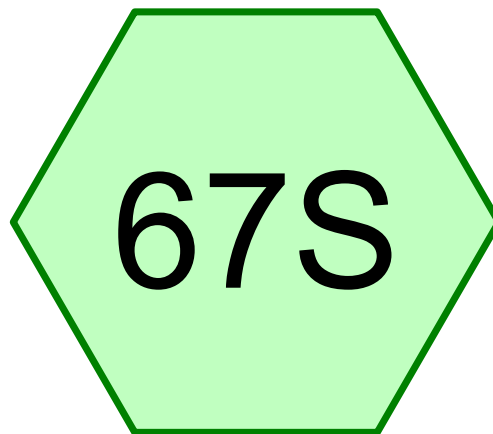
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.0					Direct Entry,

Subcatchment 67S: Area 3

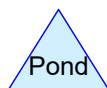
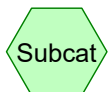
Hydrograph



**TIME OF CONCENTRATION: 20 MINUTES
SCS UNIT HYDROGRAPH**



Area 3



Routing Diagram for Post-Development

Prepared by Matrix New World Engineering, Printed 7/31/2023
HydroCAD® 10.00-22 s/n 03376 © 2018 HydroCAD Software Solutions LLC

Post-Development

Prepared by Matrix New World Engineering

HydroCAD® 10.00-22 s/n 03376 © 2018 HydroCAD Software Solutions LLC

NOAA 24-hr D 2-yr Rainfall=3.42"

Printed 7/31/2023

Page 2

Summary for Subcatchment 67S: Area 3

Runoff = 0.86 cfs @ 12.31 hrs, Volume= 0.099 af, Depth= 1.19"

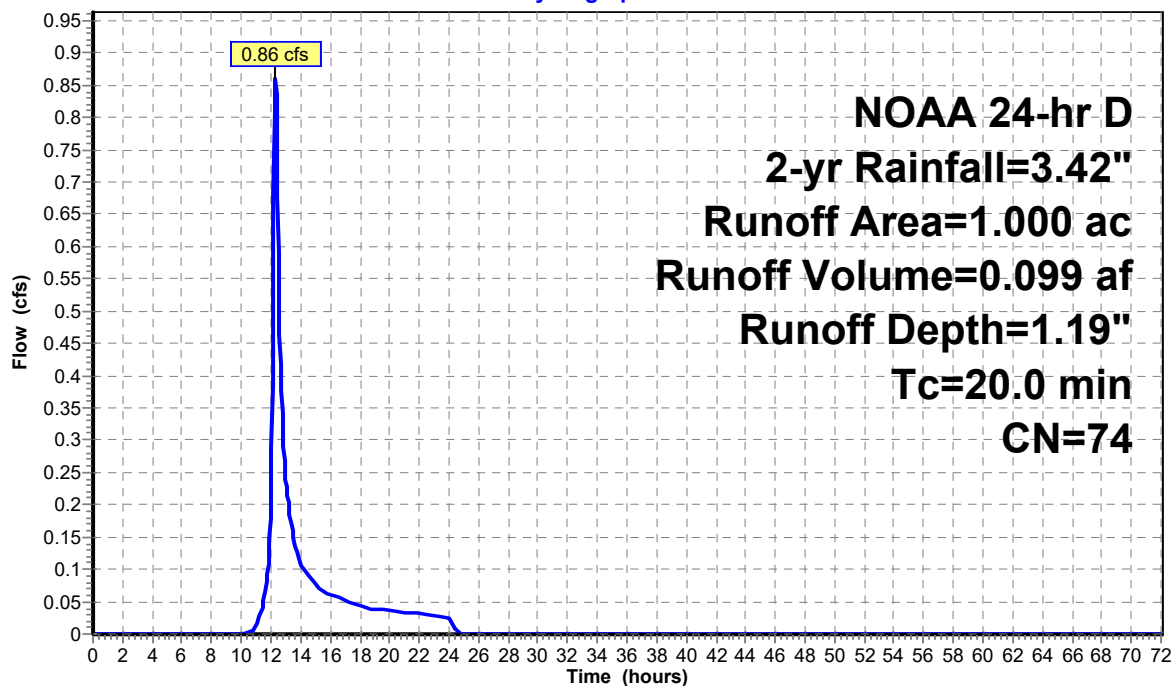
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-yr Rainfall=3.42"

Area (ac)	CN	Description
1.000	74	>75% Grass cover, Good, HSG C
1.000		100.00% Pervious Area

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

Subcatchment 67S: Area 3

Hydrograph



Post-Development

Prepared by Matrix New World Engineering

HydroCAD® 10.00-22 s/n 03376 © 2018 HydroCAD Software Solutions LLC

NOAA 24-hr D 10-yr Rainfall=5.20"

Printed 7/31/2023

Page 3

Summary for Subcatchment 67S: Area 3

Runoff = 1.90 cfs @ 12.30 hrs, Volume= 0.210 af, Depth= 2.52"

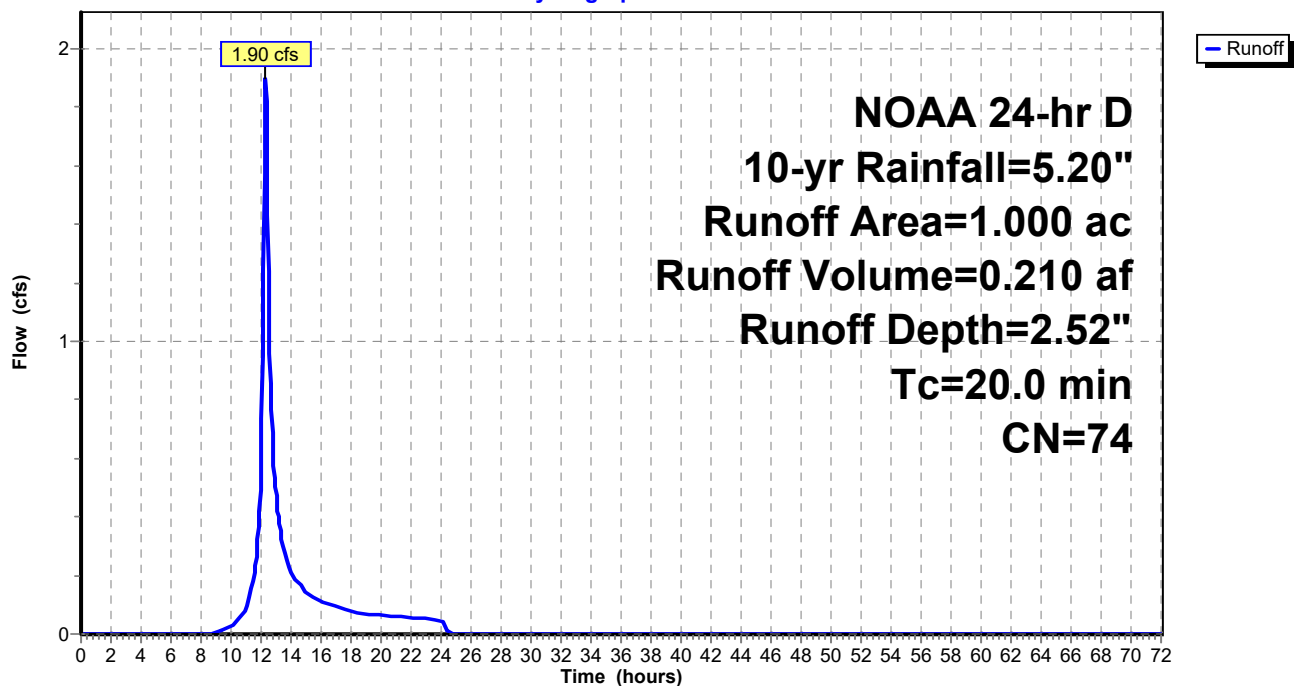
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-yr Rainfall=5.20"

Area (ac)	CN	Description
1.000	74	>75% Grass cover, Good, HSG C
1.000		100.00% Pervious Area

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

Subcatchment 67S: Area 3

Hydrograph



Post-Development

Prepared by Matrix New World Engineering

HydroCAD® 10.00-22 s/n 03376 © 2018 HydroCAD Software Solutions LLC

NOAA 24-hr D 100-yr Rainfall=8.69"

Printed 7/31/2023

Page 4

Summary for Subcatchment 67S: Area 3

Runoff = 4.16 cfs @ 12.29 hrs, Volume= 0.462 af, Depth= 5.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-yr Rainfall=8.69"

Area (ac)	CN	Description
1.000	74	>75% Grass cover, Good, HSG C
1.000		100.00% Pervious Area

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

Subcatchment 67S: Area 3

Hydrograph

