

STORMWATER MANAGEMENT REPORT

Prepared for:

CSH Development, LLC

**Proposed Senior Living Facility
Block 152.22, Lot 1412.01
609 Eagle Rock Avenue (CR-611)
Township of West Orange
County of Essex, NJ**

Prepared by:



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A handwritten signature in black ink, appearing to read 'D. Sehnal', is positioned above a horizontal line.

Daniel T. Sehnal, PE
NJ Professional Engineer License #53572

January 2021

DEC# 1423-99-005

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I. INTRODUCTION

The intent of this study is to analyze the stormwater drainage conditions that will occur as a result of the proposed senior housing facility for the site located at 609 Eagle Rock Avenue in the Township of West Orange, Essex County, New Jersey and specifically identified as Block 152.22, Lot 1412.01 on the Township of West Orange Tax Maps. The existing site consists of a catering venue with associated surface parking and site improvements.

Under proposed conditions, the site will be redeveloped with a assisted living facility consisting of approximately 28,000 SF (footprint) with associated improvements including surface parking, landscaping, pedestrian sidewalks, and outdoor courtyard areas. The housing facility will be three stores high and will include 85 units.

II. EXISTING DRAINAGE CONDITIONS

The overall subject site consists of 2.53 acres and is developed as a catering venue with associated surface parking and site improvements. The site currently consists of approximately 91,250 SF (83.0%) of impervious surface area.

Per the Essex County Soil Survey, the soil types on site are considered undetermined. The soils immediately surrounding the subject site include Boonton urban land, Boonton substratum complex with slopes ranging from 0-15%, belonging to Hydrologic Soil Group C. For the purposes of this study, the onsite soils are considered to be the same as the surrounding soils.

The site has been evaluated using the TR-55 'Urban Hydrology for Small Watersheds' standards and with the following existing drainage watershed area as depicted on the Existing Drainage Area Map:

EXISTING DRAINAGE AREA:

The entire subject site is considered to be within the same drainage area, containing all existing improvements. The stormwater runoff generated by the site generally flows in a northwesterly direction and is captured by various existing onsite inlets. The collected runoff is then conveyed to an existing 42-inch RCP storm sewer main located within an existing Storm Sewer Right-of-Way immediately adjacent to the west of the site. For the purposes of this study, the existing inlet near the northwestern corner of the subject site along the 42-inch RCP main is considered Point of Analysis #1 (POA #1). Runoff Curve Numbers, included within the Appendix of this Report, were chosen to best reflect the existing site conditions as outlined in the USDA's "Urban Hydrology for Small Watersheds: TR-55." A minimum time of concentration of 10 minutes has been used for this analysis.

III. PROPOSED DRAINAGE CONDITIONS

Under proposed conditions, the site will be developed with a assisted living facility consisting of approximately 28,000 SF (footprint) with associated improvements including landscaping, surface parking, outdoor courtyard areas, and a stormwater management system to capture and discharge runoff created by the new development. The proposed site improvements will result in an overall decrease in impervious coverage of approximately 16,300 SF (0.37 acres). The proposed redevelopment will result in approximately 68% impervious coverage compared to 83% under existing conditions. The proposed design serves to match the existing drainage patterns to the maximum extent practical. The site has been evaluated using the TR-55 'Urban Hydrology for Small Watersheds' standards and with the following proposed drainage area as depicted on the Proposed Drainage Area Map:

PROPOSED DRAINAGE AREA:

The proposed drainage area includes the entire subject site, including the proposed building, parking areas, and all other proposed site improvements. The stormwater runoff generated from this area is collected via onsite inlets and is conveyed to an existing inlet near the northwestern corner of the subject site along the 42-inch RCP storm sewer main (POA #1). The Runoff Curve Numbers, included within the Appendix of this Report, were chosen to best reflect the proposed site conditions as outlined in the USDA's "Urban Hydrology for Small Watersheds: TR-55." A minimum time of concentration of 10 has been used for this study area.

IV. DESIGN METHODOLOGY

The primary design constraints for this project are based on requirements established in the Township of West Orange Land Development Ordinance, New Jersey Soil Erosion and Sediment Control Standards, and NJAC 7:8. More specifically, the stormwater management design will serve to maintain existing drainage patterns to the maximum extent practical and reduce proposed runoff rates when compared to pre-development runoff rates for disturbed areas. The proposed project will disturb more than one (1) acre of land, but will reduce impervious surface coverage when compared to existing conditions. As a result, the project meets the definition of a "major development" as defined NJAC 7:8. The proposed development will decrease impervious surfaces by approximately 0.37 acres. Furthermore, the project is not required to meet post-development peak flow rates for the disturbed area of 50%, 75% and 80% of the 2-, 10- and 100- year storms set forth by the Township of West Orange and NJAC 7:8 as the post-construction runoff hydrographs for the 2, 10, and 100 year storm events do not exceed, at any point in time, the pre-construction runoff hydrographs due to the reduction in impervious cover on the site.

In order to prepare the stormwater calculations for the project, extensive initial investigation of the property and topographic survey was performed. On-site review of the tract was performed by Dynamic Engineering Consultants, PC to verify existing site conditions and land cover characteristics. Blue Marsh Associates, Inc. was contracted to prepare an ALTA/NSPS Land Title Survey of the existing site. Based on a review of the existing site conditions and the Survey, the Drainage Area Maps for the existing and proposed site conditions as defined within this report were established. The grading plan within the accompanying engineering drawings was developed for the proposed site improvements with consideration to the existing drainage patterns.

The 2-, 10- and 100-year quantity design storms are based upon the New Jersey 24 Hour Rainfall Frequency Data for Essex County as published by the USDA NRCS utilizing a Type D rainfall distribution. Curve number calculations have been included within the Appendix and are based upon HSG C. Pervious and impervious areas were modeled separately as suggested in the NJDEP Stormwater Management Best Management Practices (BMP) Manual.

V. WATER QUANTITY

As previously stated, the proposed development reduces impervious surfaces by 0.37 acres and is thus reducing the hydrographs when compared to pre-development conditions for the 2-, 10-, and 100-year storms. This meets the requirements set forth in the governing regulations and the development is not subject to further stormwater runoff quantity reductions. The aforementioned Point of Analysis #1 has been used to analyze and ensure reduction of peak flows discharging to the existing inlet located within the Storm Sewer Right-of-Way (POA #1). As such, the peak discharge rates of the areas falling within the limits of disturbance of the site, and allowable runoff rates were then determined. The following demonstrates the results of these calculations:

POA #1 Runoff Rates (CFS)			
Design Storm	Existing Total	Proposed Total	Percent Reduction
2-year	6.18	5.55	10.19 %
10-year	9.75	9.07	6.97 %
100-year	16.74	16.07	4.00 %

As indicated above, the peak flows for POA #1 have been reduced when compared to existing conditions, thus meeting the requirements set forth in the Township ordinance and N.J.A.C. 7:8.

VI. WATER QUALITY

Any development is required to meet 80% TSS removal per the Township of West Orange and NJAC 7:8 if it proposes an increase of more than one-quarter (1/4) acre of impervious coverage. The proposed development will decrease impervious surfaces by 0.37 acres. As such, water quality measures are not required

VII. GROUNDWATER RECHARGE

Per the governing regulations, the proposed development is subject to the groundwater recharge requirements specified within NJAC 7:8. As previously discussed, the project proposes to reduce impervious coverage by approximately 0.37 acres and an increase in pervious surfaces, therefore, inherently providing more than 100% of the pre-construction groundwater recharge volume and satisfying the groundwater recharge requirement.

VIII. CONCLUSION

By meeting the requirements set forth by the governing regulations for water quality, water quantity, and groundwater recharge, it is anticipated that the proposed redevelopment will improve the existing stormwater conditions will not adversely impact the surrounding properties or downstream conveyance facilities.

APPENDIX

USGS MAP

USGS Map Caldwell Quad



1904 Main Street, Lake Como, NJ 07719 T. 732-974-0198

245 Main Street, Suite 110, Chester, NJ 07930 T. 908-879-9229

8 Robbins Street, Suite 102, Toms River, NJ 08753 T. 732-974-0198

826 Newtown Yardley Rd., Suite 201, Newtown, PA 18940 T. 267-685-0276

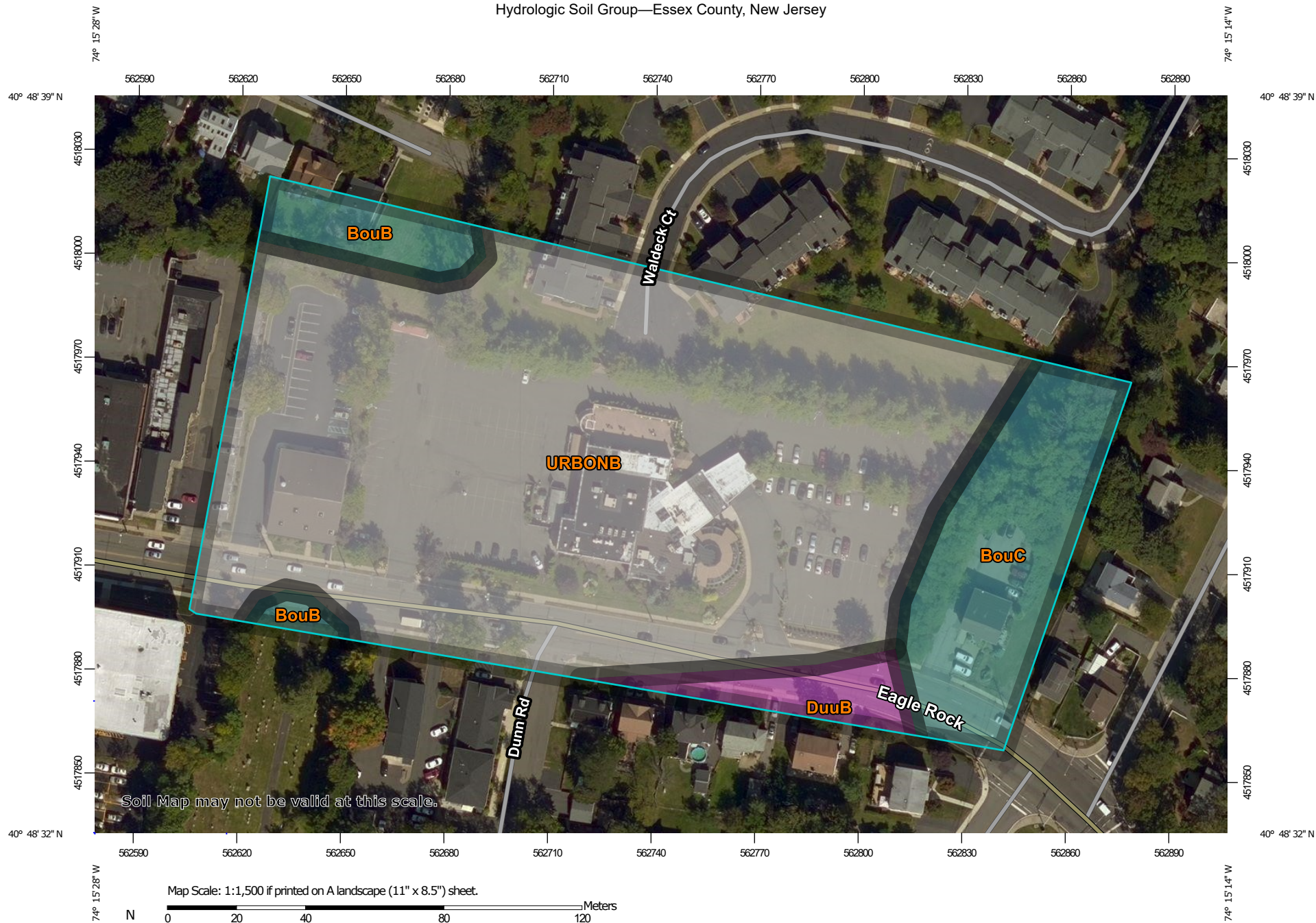
100 NE 5th Avenue, Suite B2, Delray Beach, FL 33483 T. 561-291-8570

14521 Old Katy Road, Suite 270, Houston, TX 77079 T. 281-789-6400

714 S. Greenville Avenue, Suite 100, Allen, TX 75002 T. 972-534-2100

SOIL SURVEY

Hydrologic Soil Group—Essex County, New Jersey



Natural Resources
Conservation Service

Web Soil Survey
National Cooperative Soil Survey

1/20/2021
Page 1 of 4

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 1:12,000.

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
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, New Jersey
Survey Area Data: Version 16, Jun 1, 2020

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

Date(s) aerial images were photographed: Aug 25, 2014—Sep 27, 2014

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
BouB	Boonton - Urban land, Boonton substratum complex, 0 to 8 percent slopes	C	0.4	4.8%
BouC	Boonton - Urban land, Boonton substratum complex, 8 to 15 percent slopes	C	1.0	14.0%
DuuB	Dunellen - Urban land, Dunellen substratum complex, 0 to 8 percent slopes	A	0.3	3.6%
URBONB	Urban land, Boonton substratum, 0 to 8 percent slopes		5.7	77.6%
Totals for Area of Interest			7.4	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

RUNOFF CURVE NUMBER (CN) CALCULATIONS



EXISTING AVERAGE CURVE NUMBER(CN) CALCULATIONS

Project: Capitol Seniors Housing
 Job #: 1423-99-005
 Location: West Orange, NJ

Computed By: DRL
 Checked By: DTS
 Date: 1/24/2020

Drainage Area	Impervious Area (acre)	Impervious Area (sf)	Curve Number (CN) Used	HSG C - Open Space Area (acre)	HSG C - Open Space Area (sf)	Curve Number (CN) Used	Avg. Perv. Curve Number	Total Pervious Area (acres)	Total Area (acres)	TC (Min.)
EX-DA 1	2.09	91,249	98	0.43	18,754	74	74	0.43	2.53	10
Total	2.09	91249.00		0.43	18754.00			0.43	2.53	

Per Essex County Soil Survey -	BouB	HSG	C	Soil	Boonton urban land, boonton osubstratum complex
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Description	Runoff Curve Number (CN) (HSG C)	Runoff Curve Number (CN) (HSG D)
Impervious Surface	98	98
Open Space (lawn) (good)	74	80



PROPOSED AVERAGE CURVE NUMBER(CN) CALCULATIONS

Project: Capitol Seniors Housing
 Job #: 1423-99-005
 Location: West Orange, NJ

Computed By: DRL
 Checked By: DTS
 Date: 1/24/2020

Drainage Area	Impervious Area (acre)	Impervious Area (sf)	Curve Number (CN) Used	HSG C - Open Space Area (acre)	HSG C - Open Space Area (sf)	Curve Number (CN) Used	Avg. Perv. Curve Number	Total Pervious Area (acres)	Total Area (acres)	TC (Min.)
EX-DA 1	1.72	74,979	98	0.80	35,024	74	74	0.80	2.53	10
Total	1.72	74979.00		0.80	35024.00			0.80	2.53	

Per Essex County Soil Survey -	BouB	HSG	C	Soil	Boonton urban land, boonton osubstratum complex
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Description	Runoff Curve Number (CN) (HSG C)	Runoff Curve Number (CN) (HSG D)
Impervious Surface	98	98
Open Space (lawn) (good)	74	80

**HYDROGRAPH SUMMARY REPORTS –
EXISTING AND PROPOSED CONDITIONS
2-YR, 10-YR, & 100-YR**

Hydrograph 2-yr Summary

Project Name: 01-26-2021

Hydrology Studio v 3.0.0.17

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	NRCS Runoff	EX-DA-1 Imp.	5,670	12.17	25,088	---		
2	NRCS Runoff	EX-DA 1 Per.	0.478	12.20	1,930	---		
3	Junction	EX-DA 1	6,148	12.17	27,018	1, 2		
5	NRCS Runoff	DA-1 Imp.	4,666	12.17	20,647	---		
6	NRCS Runoff	DA-1 Per.	0.890	12.20	3,590	---		
7	Junction	DA-1	5,555	12.17	24,237	5, 6		

Hydrograph by Return Period

Project Name: 01-26-2021

Hydrology Studio v 3.0.0.17

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Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.17

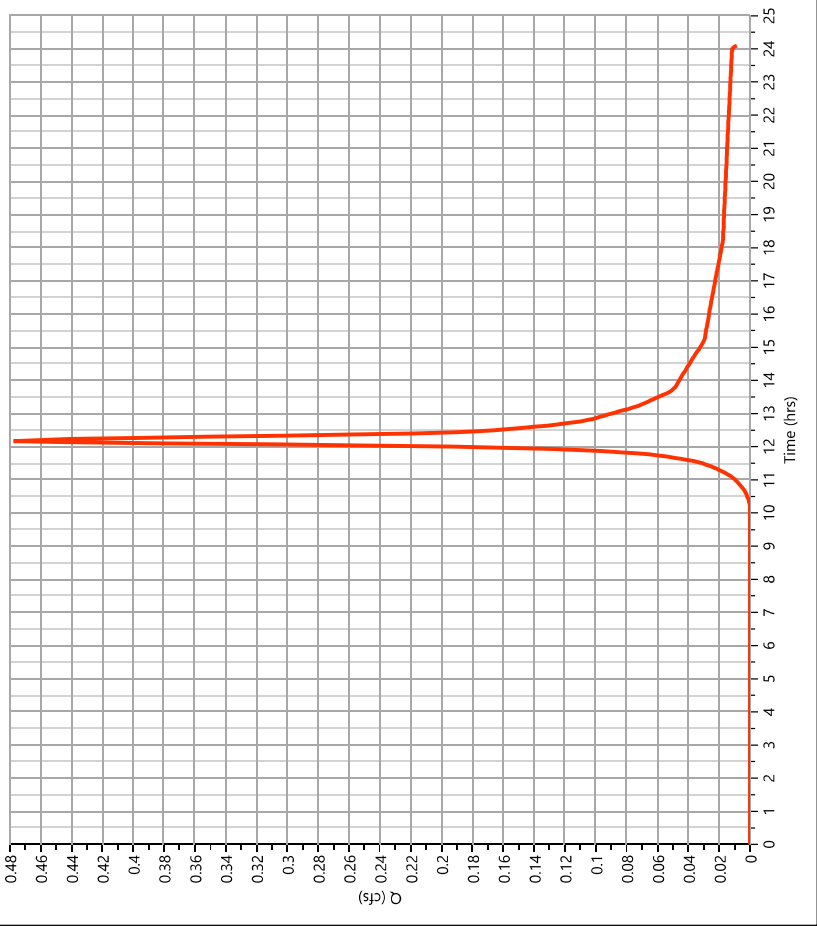
01-26-2021

EX-DA 1 Perv.

Hyd. No. 2

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.478 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Runoff Volume	= 1,930 cuft
Drainage Area	= 0.43 ac	Curve Number	= 74
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 3.44 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484

Qp = 0.48 cfs



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.17

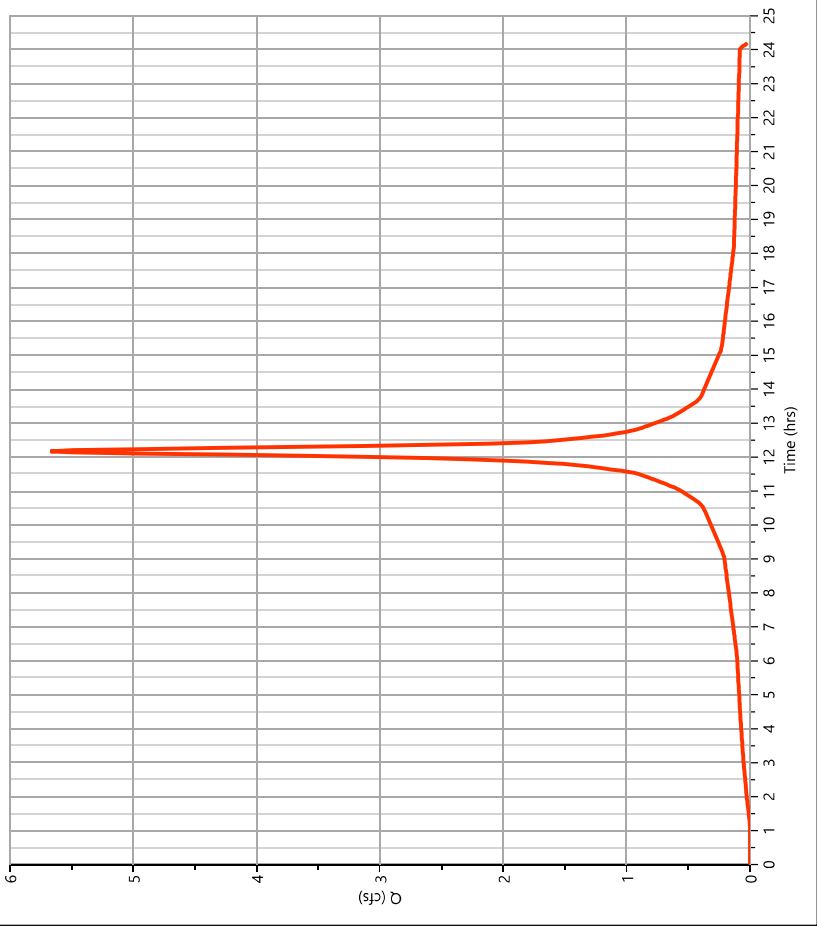
01-26-2021

EX-DA-1 Imp.

Hyd. No. 1

Hydrograph Type	= NRCS Runoff	Peak Flow	= 5.670 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 25,088 cuft
Drainage Area	= 2.09 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 3.44 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484

Qp = 5.67 cfs



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.17

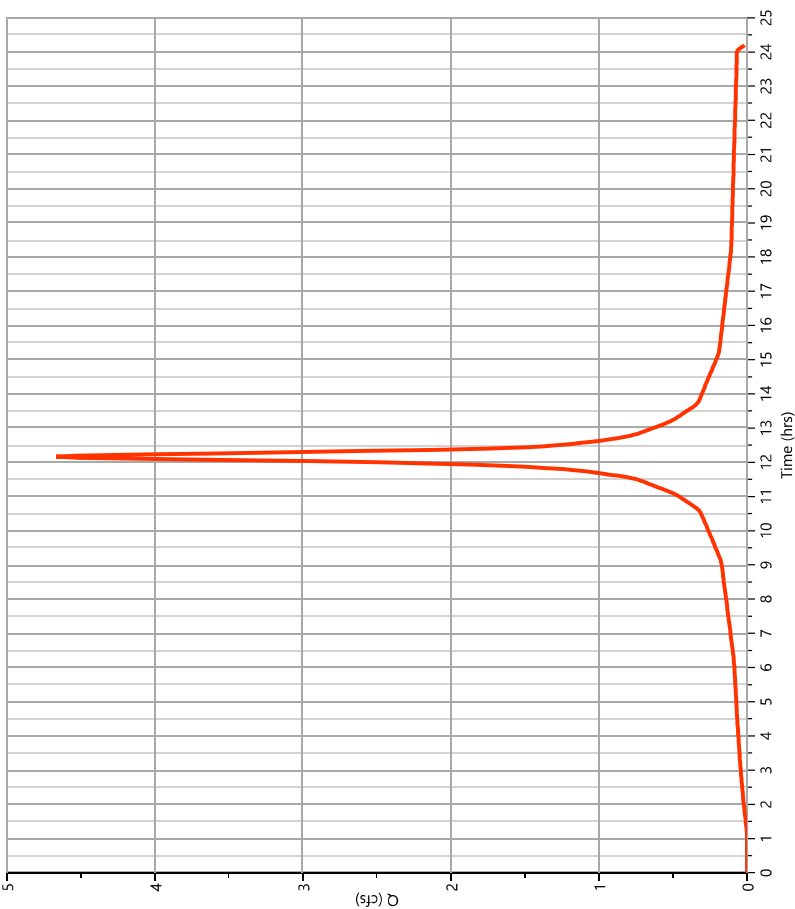
01-26-2021

DA-1 Imp.

Hyd. No. 5

Hydrograph Type	= NRCS Runoff	Peak Flow	= 4,666 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 20,647 cuft
Drainage Area	= 1.72 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 3.44 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484

Qp = 4.67 cfs



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.17

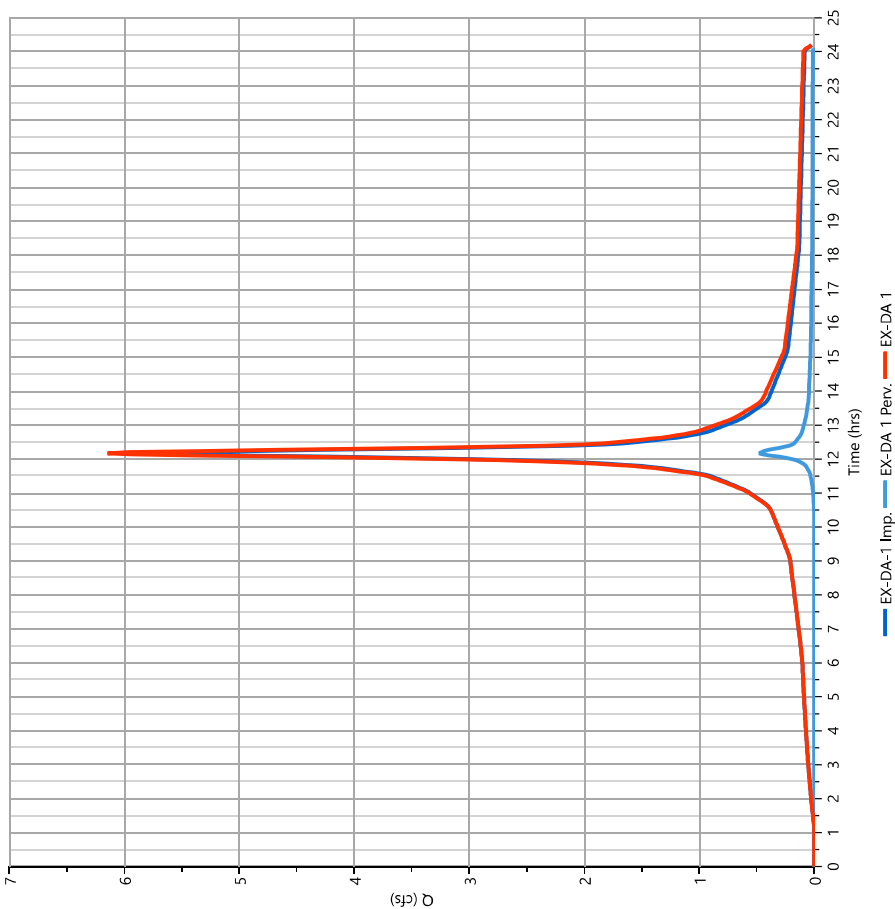
01-26-2021

EX-DA 1

Hyd. No. 3

Hydrograph Type	= Junction	Peak Flow	= 6,148 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 27,018 cuft
Inflow Hydrographs	= 1, 2	Total Contrib. Area	= 2.52 ac

Qp = 6.15 cfs



Hydrograph Report

Project Name:

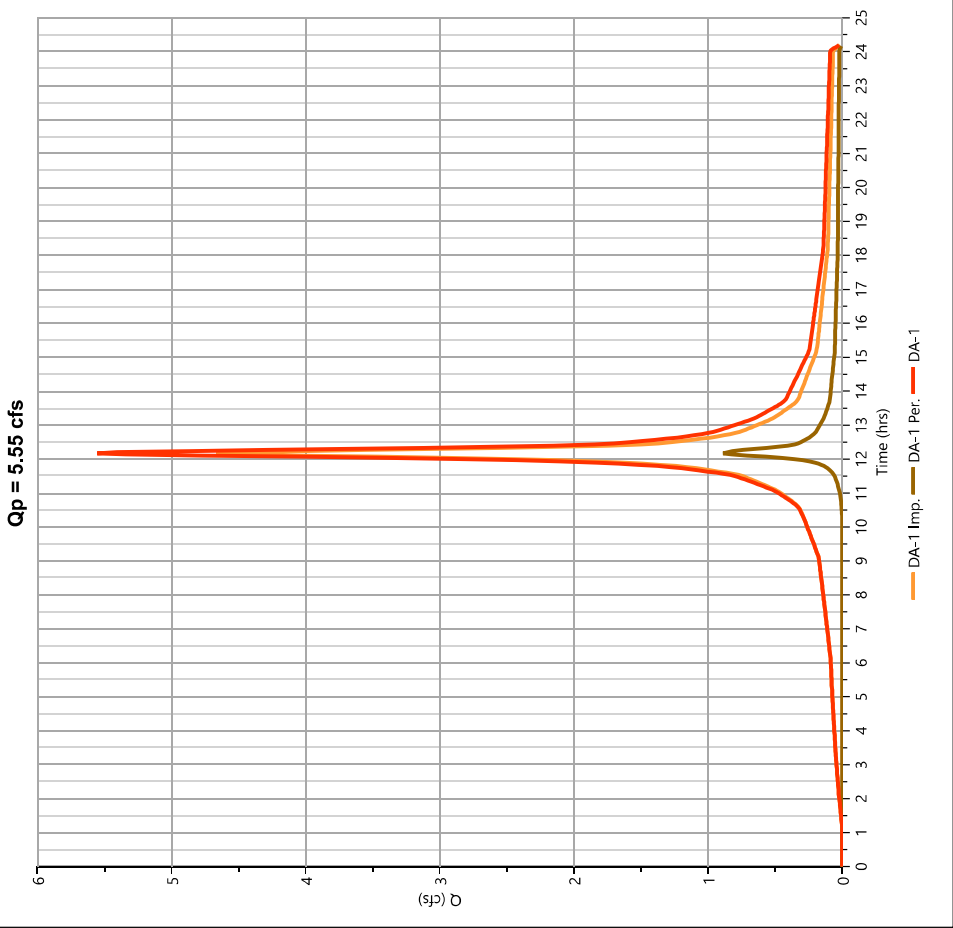
Hydrology Studio v 3.0.0.17

01-26-2021

DA-1

Hyd. No. 7

Hydrograph Type	= Junction	Peak Flow	= 5.555 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 24,237 cuft
Inflow Hydrographs	= 5, 6	Total Contrib. Area	= 2.52 ac



Hydrograph Report

Project Name:

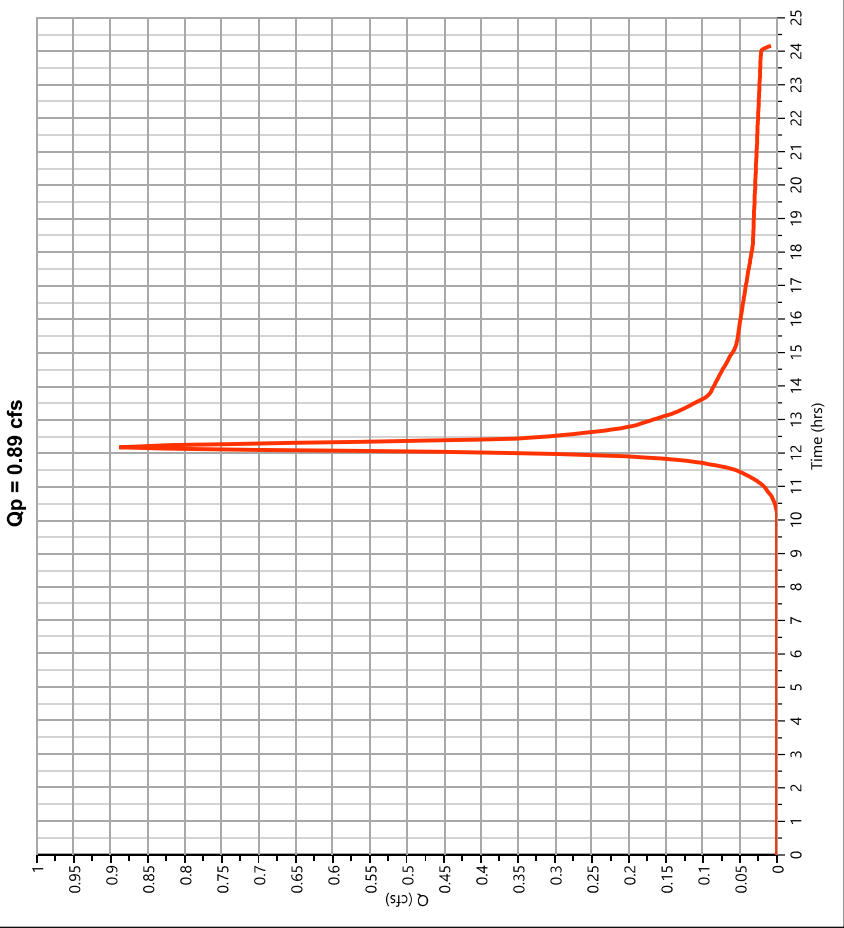
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01-26-2021

DA-1 Per.

Hyd. No. 6

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.890 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Runoff Volume	= 3,590 cuft
Drainage Area	= 0.8 ac	Curve Number	= 74
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 3.44 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph 10-yr Summary

Project Name:
01-26-2021

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuft)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuft)
1	NRCS Runoff	EX-DA-1 Imp.	8,659	12.17	38,985	---		
2	NRCS Runoff	EX-DA-1 Per.	1,047	12.17	4,090	---		
3	Junction	EX-DA-1	9,706	12.17	43,075	1, 2		
5	NRCS Runoff	DA-1 Imp.	7,126	12.17	32,083	---		
6	NRCS Runoff	DA-1 Per.	1,948	12.17	7,610	---		
7	Junction	DA-1	9,074	12.17	39,693	5, 6		

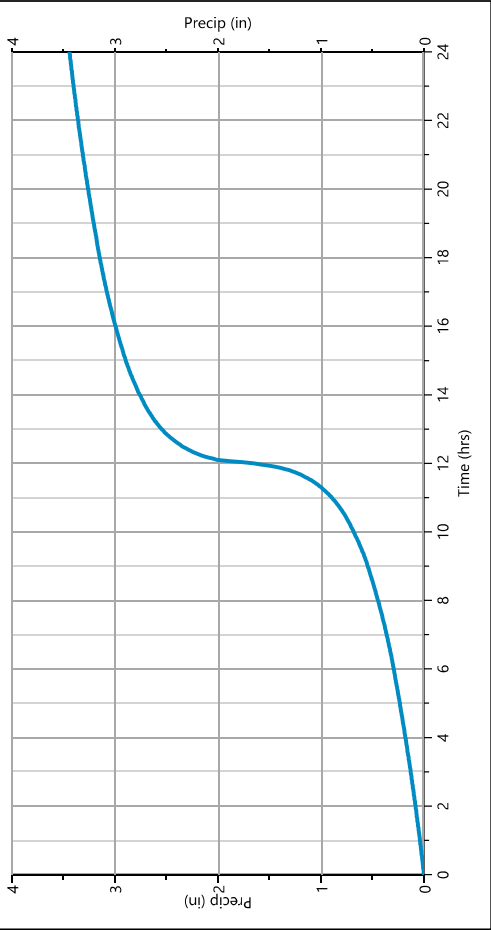
Design Storm Report

Custom Storm filename:
Hydrology Studio v 3.0.0.17
01-26-2021

Storm Distribution: Custom - NOAA-D

Storm Duration	Total Rainfall Volume (in)							
	1-yr	✓ 2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
24 hrs	0.00	3.44	0.00	0.00	5.22	0.00	0.00	8.66

Incremental Rainfall Distribution, 2-yr									
Time (hrs)	Precip (in)	Time (hrs)	Precip (in)	Time (hrs)	Precip (in)	Time (hrs)	Precip (in)	Time (hrs)	Precip (in)
11.10	0.010756	11.47	0.015411	11.83	0.041578	12.20	0.041578	12.57	0.015411
11.13	0.011914	11.50	0.015412	11.87	0.041577	12.23	0.029962	12.60	0.015411
11.17	0.011914	11.53	0.020755	11.90	0.041578	12.27	0.029962	12.63	0.014253
11.20	0.011914	11.57	0.020754	11.93	0.071724	12.30	0.029962	12.67	0.014253
11.23	0.013084	11.60	0.020755	11.97	0.071724	12.33	0.021844	12.70	0.014253
11.27	0.013083	11.63	0.021844	12.00	0.071724	12.37	0.021844	12.73	0.013084
11.30	0.013084	11.67	0.021844	12.03	0.119678	12.40	0.021844	12.77	0.013083
11.33	0.014253	11.70	0.021844	12.07	0.119678	12.43	0.020755	12.80	0.013083
11.37	0.014253	11.73	0.029963	12.10	0.119678	12.47	0.020754	12.83	0.011914
11.40	0.014253	11.77	0.029962	12.13	0.041578	12.50	0.020755	12.87	0.011914
11.43	0.015411	11.80	0.029963	12.17	0.041577	12.53	0.015411	12.90	0.011914



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.17

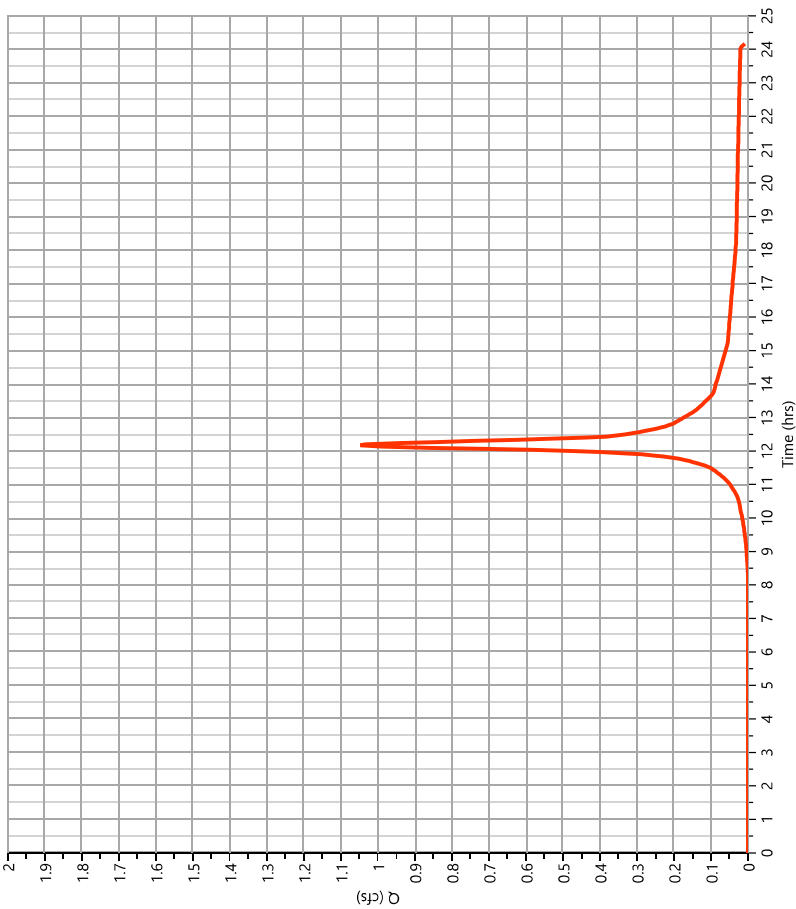
01-26-2021

EX-DA 1 Perv.

Hyd. No. 2

Hydrograph Type	= NRCS Runoff	Peak Flow	= 1,047 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 4,090 cuft
Drainage Area	= 0.43 ac	Curve Number	= 74
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 5.22 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484

Qp = 1.05 cfs



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.17

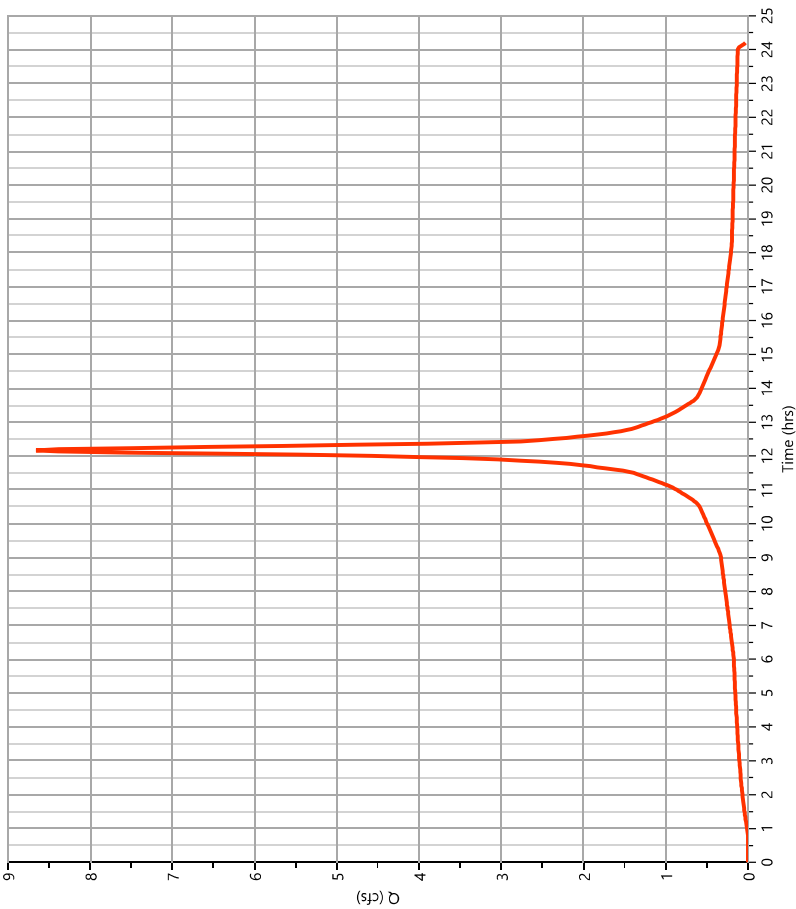
01-26-2021

EX-DA-1 Imp.

Hyd. No. 1

Hydrograph Type	= NRCS Runoff	Peak Flow	= 8,659 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 38,985 cuft
Drainage Area	= 2.09 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 5.22 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484

Qp = 8.66 cfs



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.17

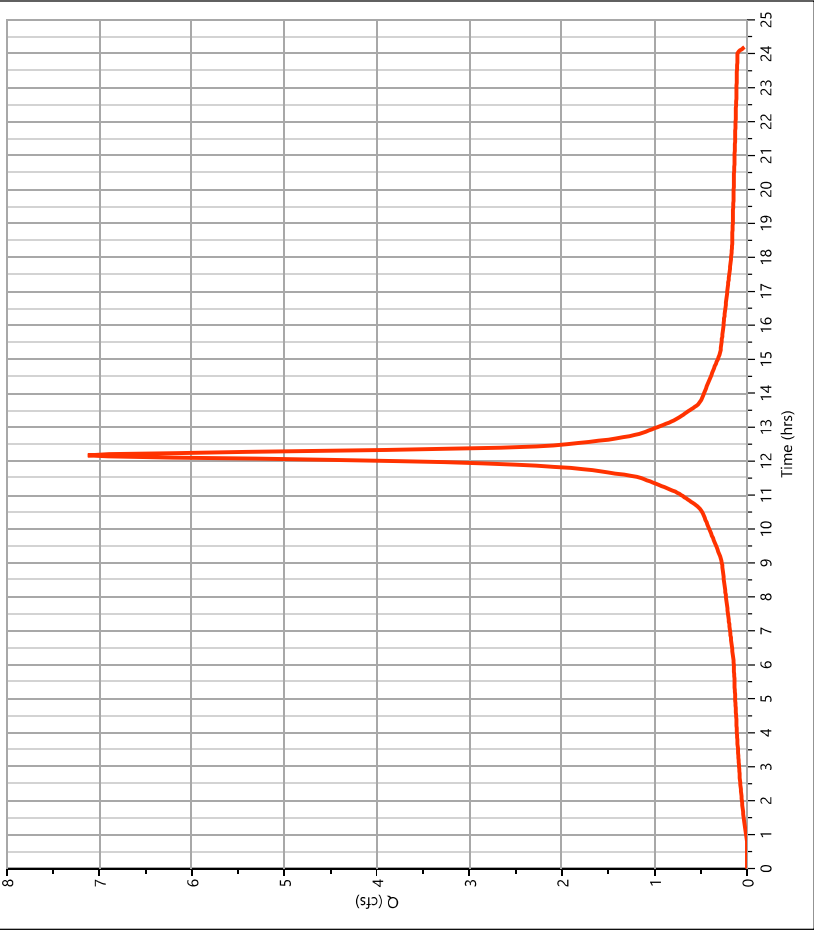
01-26-2021

DA-1 Imp.

Hyd. No. 5

Hydrograph Type	= NRCS Runoff	Peak Flow	= 7.126 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 32,083 cuft
Drainage Area	= 1.72 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 5.22 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484

Qp = 7.13 cfs



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.17

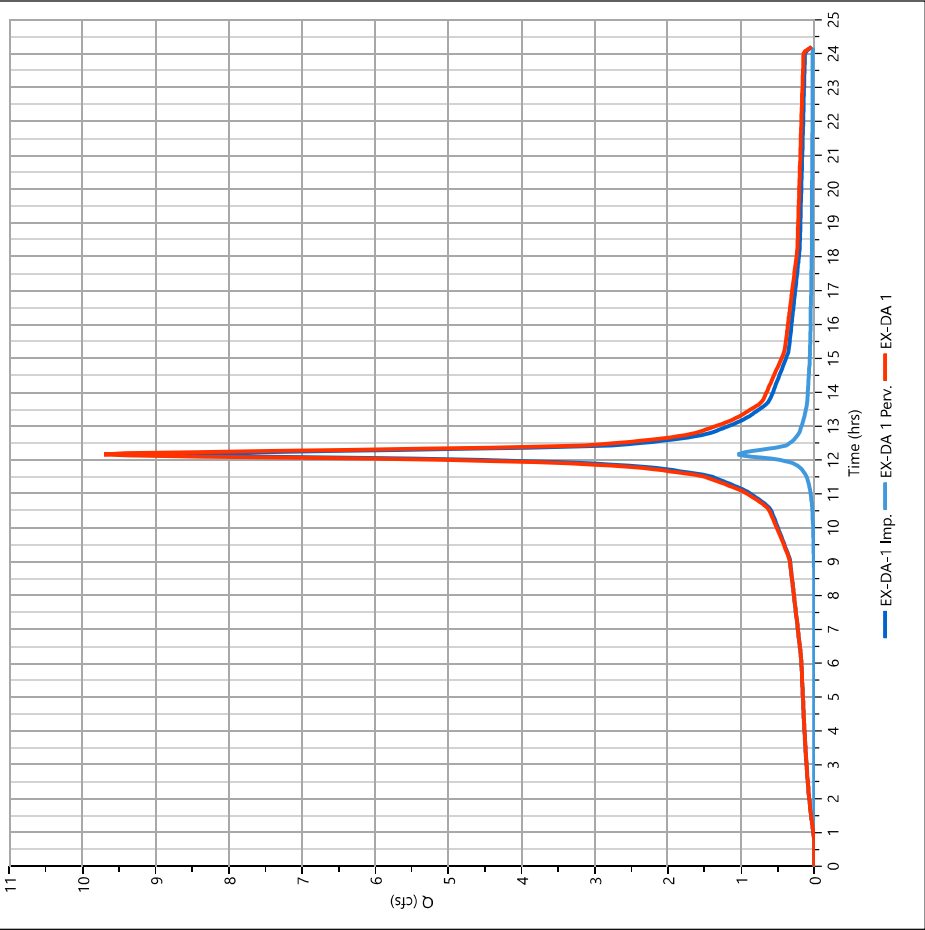
01-26-2021

EX-DA 1

Hyd. No. 3

Hydrograph Type	= Junction	Peak Flow	= 9.706 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 43,075 cuft
Inflow Hydrographs	= 1, 2	Total Contrib. Area	= 2.52 ac

Qp = 9.71 cfs



Hydrograph Report

Project Name:

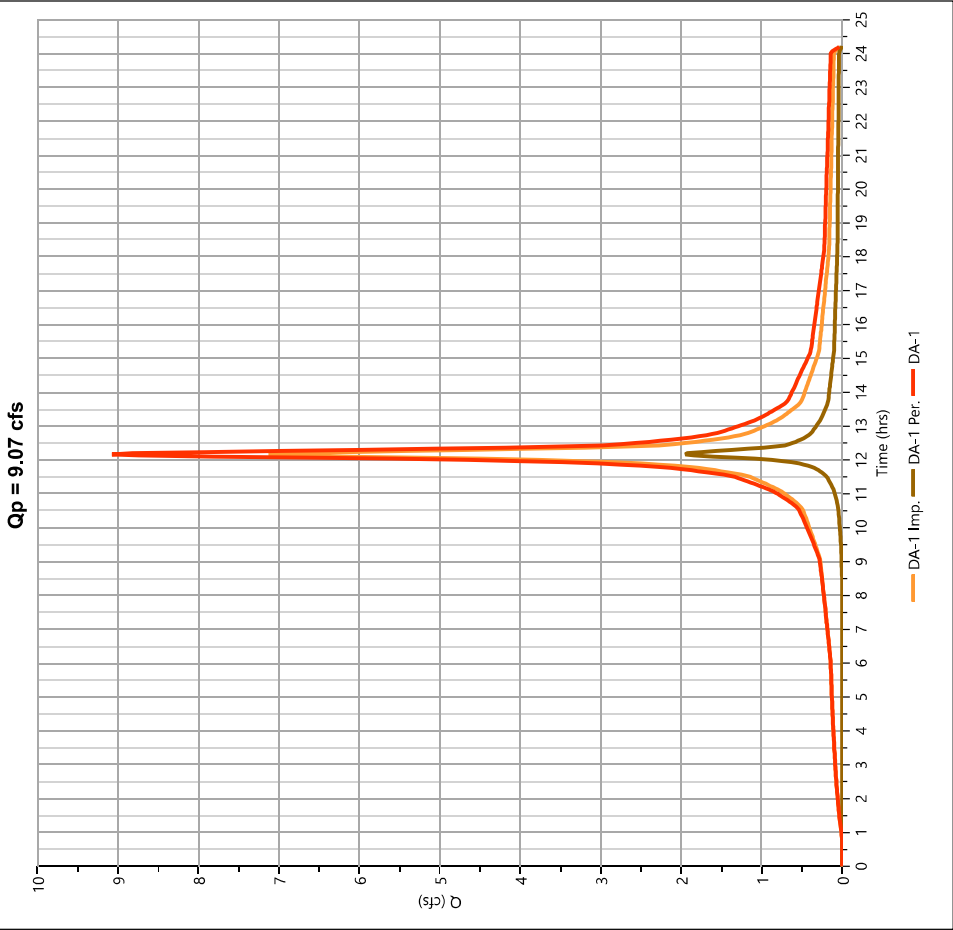
Hydrology Studio v 3.0.0.17

01-26-2021

DA-1

Hyd. No. 7

Hydrograph Type	= Junction	Peak Flow	= 9,074 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 39,693 cuft
Inflow Hydrographs	= 5, 6	Total Contrib. Area	= 2.52 ac



Hydrograph Report

Project Name:

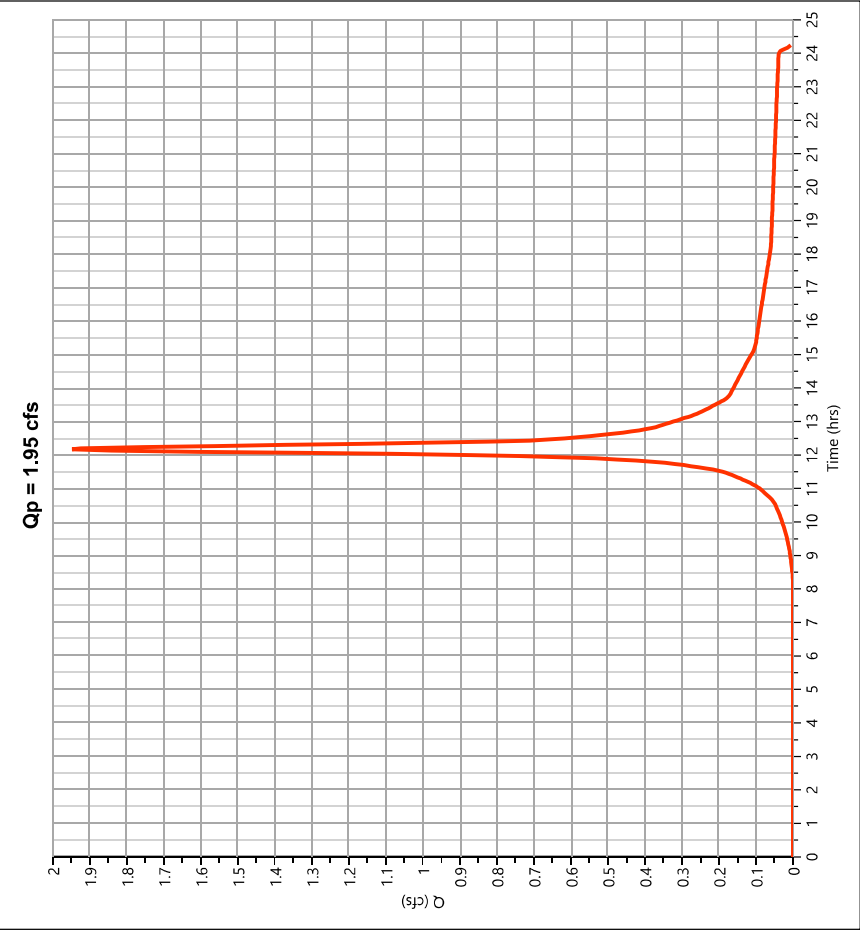
Hydrology Studio v 3.0.0.17

01-26-2021

DA-1 Per.

Hyd. No. 6

Hydrograph Type	= NRCS Runoff	Peak Flow	= 1,948 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 7,610 cuft
Drainage Area	= 0.8 ac	Curve Number	= 74
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 5.22 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph 100-yr Summary

Project Name:
01-26-2021

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Flow (cfs)	Time to Peak (hrs)	Hydrograph Volume (cuf)	Inflow Hyd(s)	Maximum Elevation (ft)	Maximum Storage (cuf)
1	NRCS Runoff	EX-DA-1 Imp.	14.41	12.17	65,975	---		
2	NRCS Runoff	EX-DA-1 Per.	2,260	12.17	8,885	---		
3	Junction	EX-DA-1	16.67	12.17	74,760	1, 2		
5	NRCS Runoff	DA-1 Imp.	11.86	12.17	54,213	---		
6	NRCS Runoff	DA-1 Per.	4,205	12.17	16,531	---		
7	Junction	DA-1	16.07	12.17	70,744	5, 6		

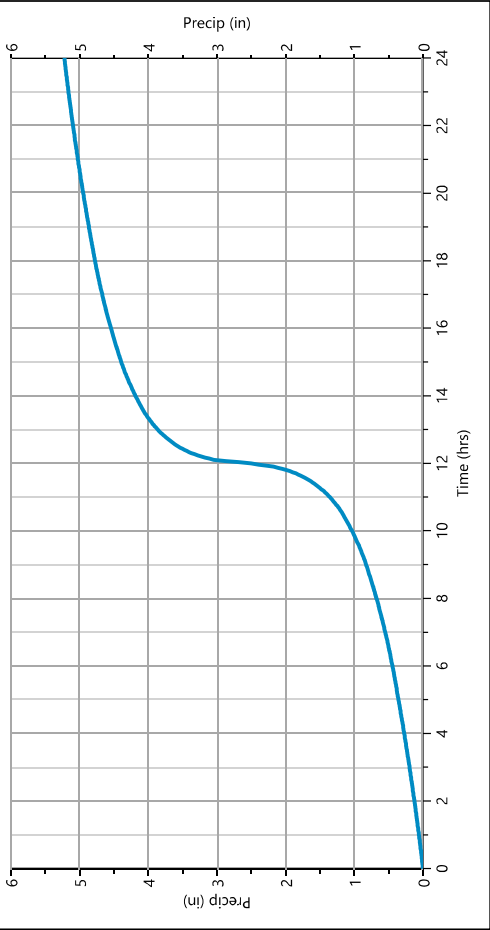
Design Storm Report

Custom Storm filename:
Hydrology Studio v 3.0.0.17
01-26-2021

Storm Distribution: Custom - NOAA-D

Storm Duration	Total Rainfall Volume (in)					
	1-yr	2-yr	3-yr	5-yr	10-yr	50-yr
24 hrs	0.00	3.44	0.00	0.00	5.22	0.00
						8.66

Incremental Rainfall Distribution, 10-yr											
Time (hrs)	Precip (in)	Time (hrs)	Precip (in)	Time (hrs)	Precip (in)	Time (hrs)	Precip (in)	Time (hrs)	Precip (in)	Time (hrs)	Precip (in)
11.10	0.016321	11.47	0.023386	11.83	0.063092	12.20	0.063093	12.57	0.023386		
11.13	0.018079	11.50	0.023386	11.87	0.063091	12.23	0.045466	12.60	0.023386		
11.17	0.018079	11.53	0.031494	11.90	0.063093	12.27	0.045466	12.63	0.021628		
11.20	0.018079	11.57	0.031493	11.93	0.108837	12.30	0.045466	12.67	0.021628		
11.23	0.019853	11.60	0.031494	11.97	0.108837	12.33	0.033147	12.70	0.021628		
11.27	0.019853	11.63	0.033147	12.00	0.108836	12.37	0.033147	12.73	0.019854		
11.30	0.019853	11.67	0.033147	12.03	0.181604	12.40	0.033147	12.77	0.019853		
11.33	0.021628	11.70	0.033147	12.07	0.181604	12.43	0.031494	12.80	0.019853		
11.37	0.021628	11.73	0.045466	12.10	0.181604	12.47	0.031493	12.83	0.018079		
11.40	0.021628	11.77	0.045466	12.13	0.063093	12.50	0.031494	12.87	0.018079		
11.43	0.023386	11.80	0.045468	12.17	0.063091	12.53	0.023385	12.90	0.018079		



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.17

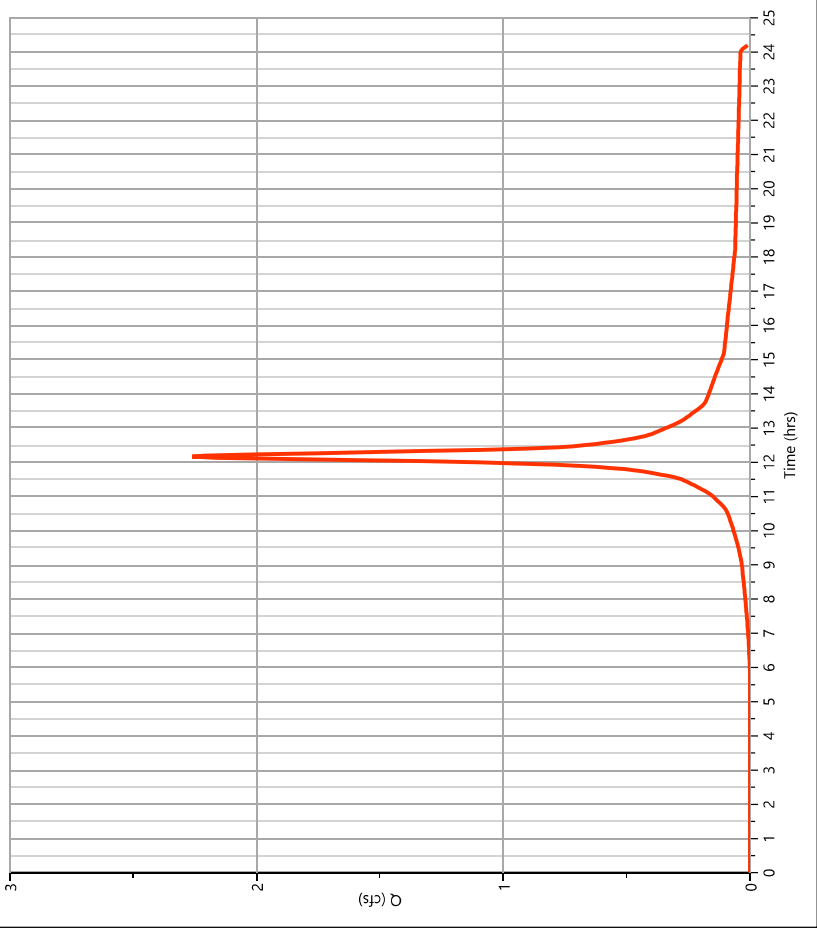
01-26-2021

EX-DA 1 Perv.

Hyd. No. 2

Hydrograph Type	= NRCS Runoff	Peak Flow	= 2.260 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 8,885 cuft
Drainage Area	= 0.43 ac	Curve Number	= 74
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 8.66 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484

Qp = 2.26 cfs



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.17

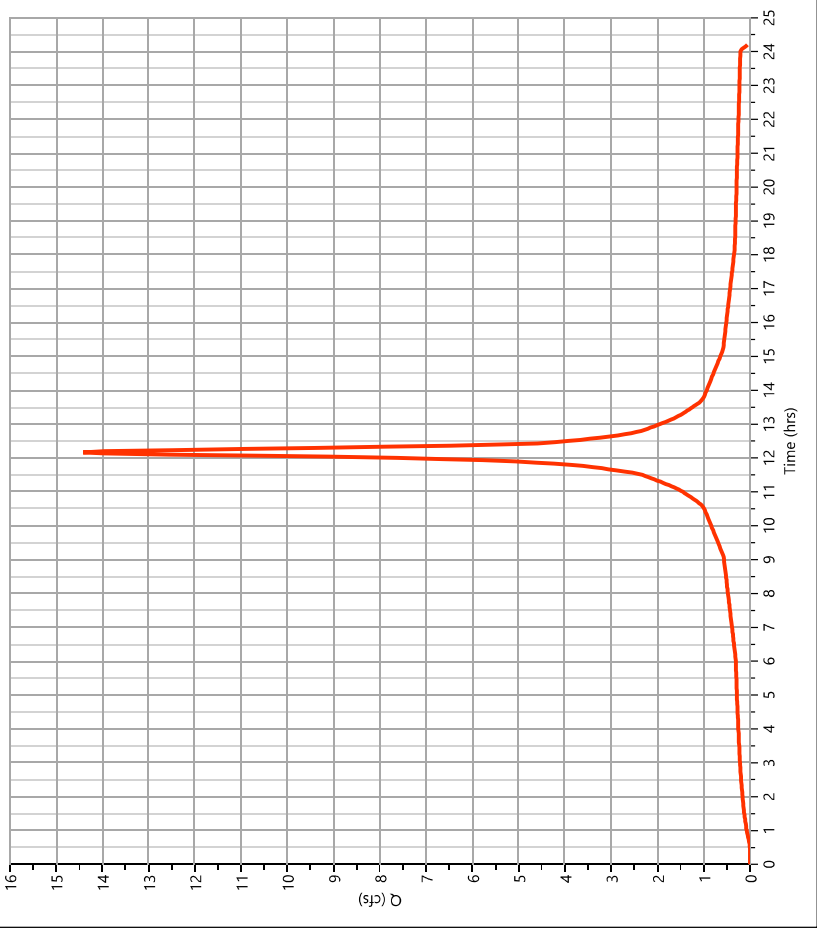
01-26-2021

EX-DA-1 Imp.

Hyd. No. 1

Hydrograph Type	= NRCS Runoff	Peak Flow	= 14.41 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 65,875 cuft
Drainage Area	= 2.09 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 8.66 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484

Qp = 14.41 cfs



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.17

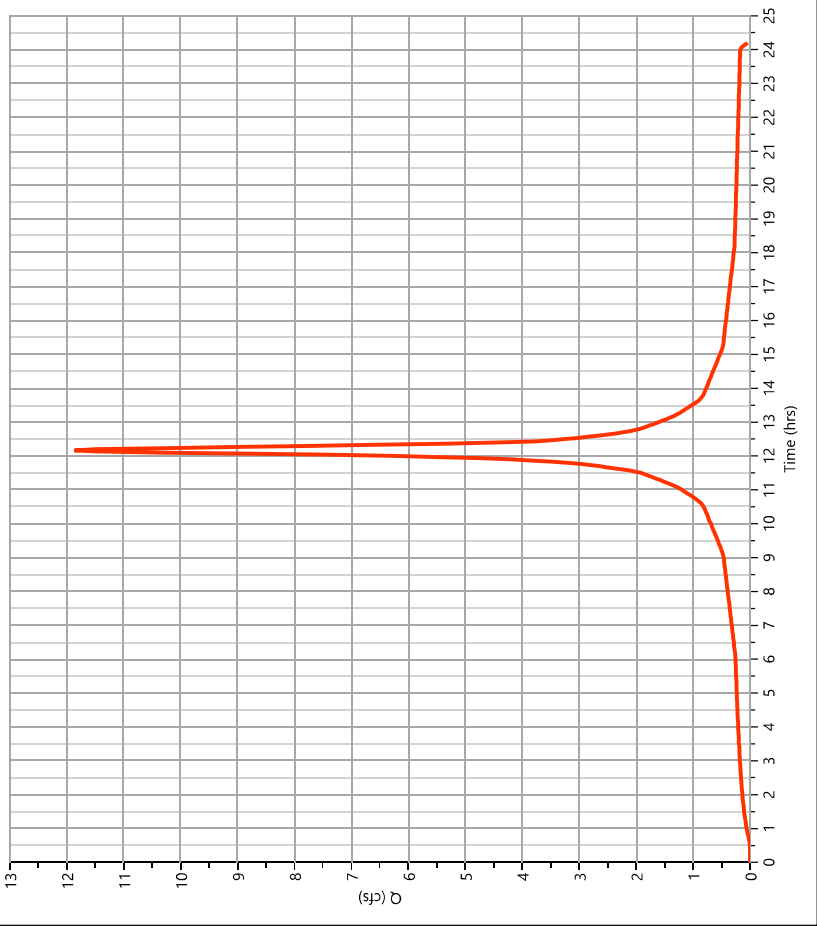
01-26-2021

DA-1 Imp.

Hyd. No. 5

Hydrograph Type	= NRCS Runoff	Peak Flow	= 11.86 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 54,213 cuft
Drainage Area	= 1.72 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 8.66 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484

Qp = 11.86 cfs



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.17

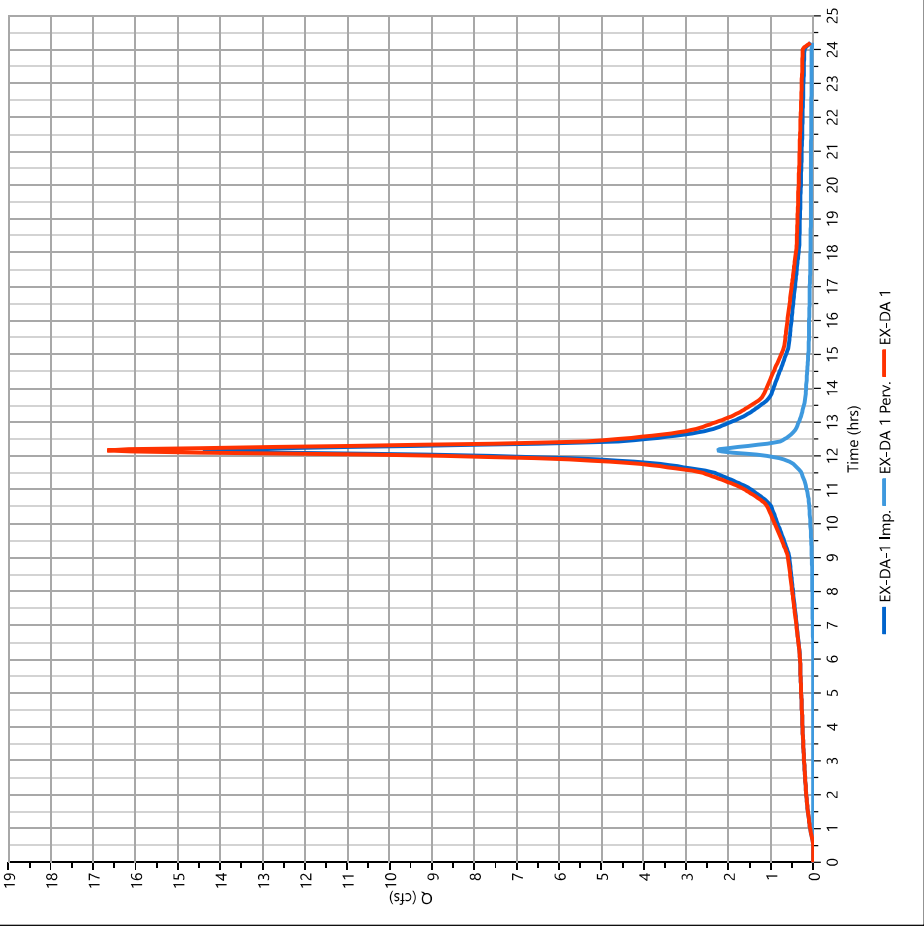
01-26-2021

EX-DA 1

Hyd. No. 3

Hydrograph Type	= Junction	Peak Flow	= 16.67 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 74,760 cuft
Inflow Hydrographs	= 1, 2	Total Contrib. Area	= 2.52 ac

Qp = 16.67 cfs



Hydrograph Report

Project Name:

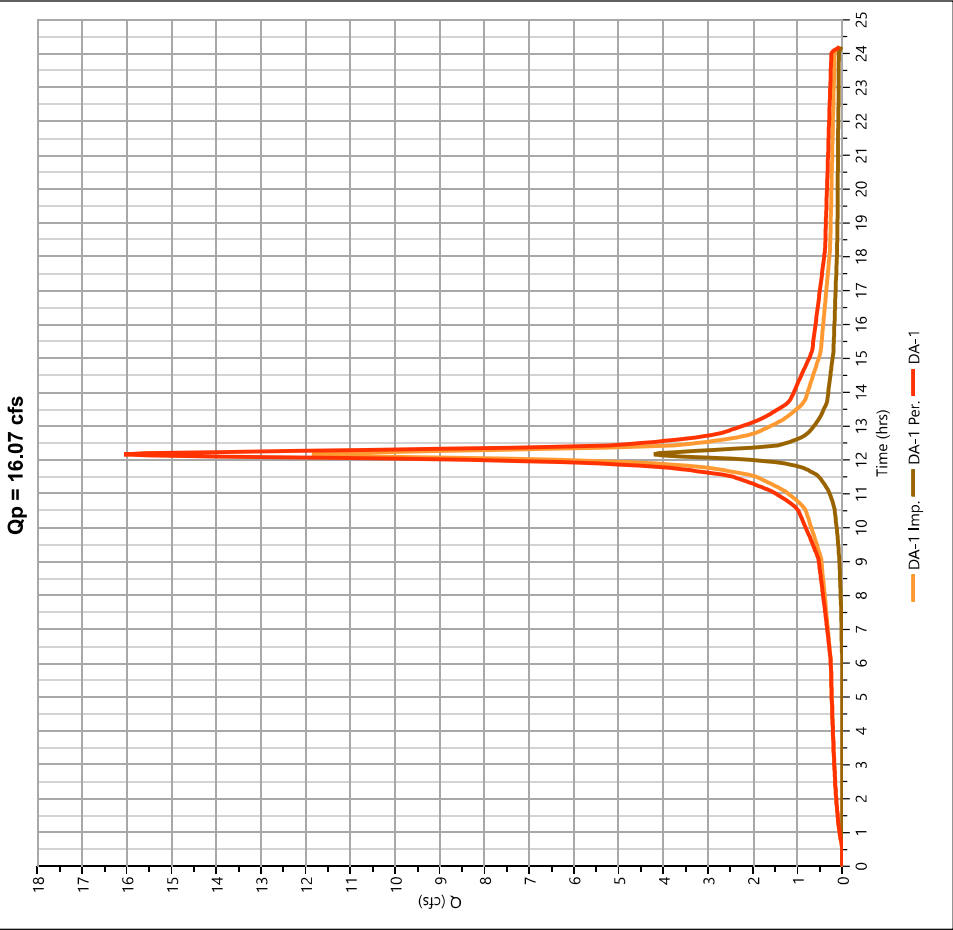
Hydrology Studio v 3.0.0.17

01-26-2021

DA-1

Hyd. No. 7

Hydrograph Type	= Junction	Peak Flow	= 16.07 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 70,744 cuft
Inflow Hydrographs	= 5, 6	Total Contrib. Area	= 2.52 ac



Hydrograph Report

Project Name:

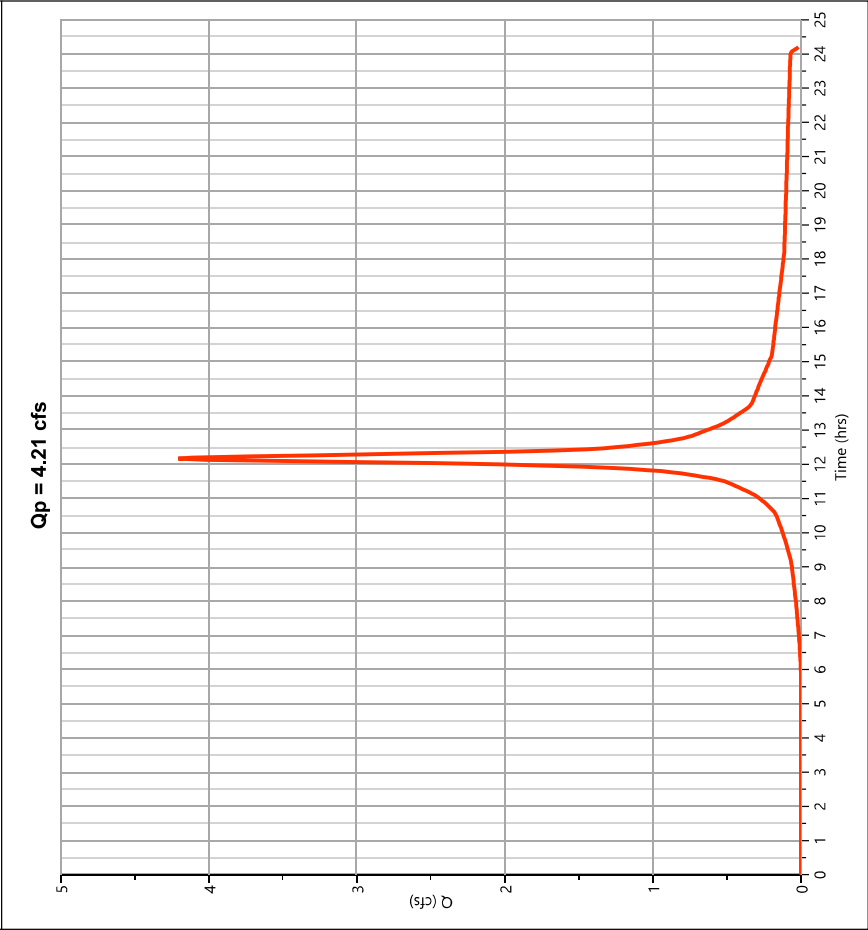
Hydrology Studio v 3.0.0.17

01-26-2021

DA-1 Per.

Hyd. No. 6

Hydrograph Type	= NRCS Runoff	Peak Flow	= 4.205 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 16,531 cuft
Drainage Area	= 0.8 ac	Curve Number	= 74
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 8.66 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



IDF Report

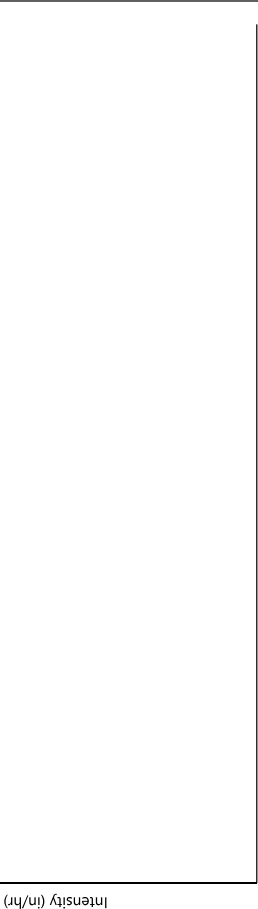
IDF filename: TRENTON.idf
01-26-2021

Equation Coefficients	Intensity = B / (Tc + D)^E (in/hr)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
B	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
D	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
E	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Minimum Tc = 5 minutes

Tc (min)	Intensity Values (in/hr)									
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr		
Cf	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		
5	0	0	0	0	0	0	0	0		
10	0	0	0	0	0	0	0	0		
15	0	0	0	0	0	0	0	0		
20	0	0	0	0	0	0	0	0		
25	0	0	0	0	0	0	0	0		
30	0	0	0	0	0	0	0	0		
35	0	0	0	0	0	0	0	0		
40	0	0	0	0	0	0	0	0		
45	0	0	0	0	0	0	0	0		
50	0	0	0	0	0	0	0	0		
55	0	0	0	0	0	0	0	0		
60	0	0	0	0	0	0	0	0		

Cf = Correction Factor applied to Rational Method runoff coefficient.



Design Storm Report

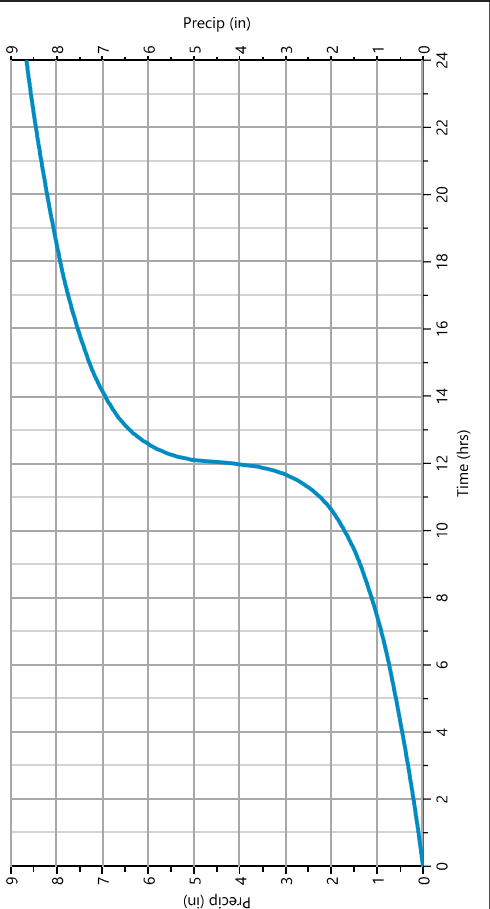
Custom Storm filename:
01-26-2021

Hydrology Studio v 3.0.0.17

Storm Distribution: Custom - NOAA-D

Storm Duration	Total Rainfall Volume (in)					
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr
24 hrs	0.00	3.44	0.00	0.00	5.22	0.00
						8.66

Incremental Rainfall Distribution, 100-yr											
Time (hrs)	Precip (in)	Time (hrs)	Precip (in)	Time (hrs)	Precip (in)	Time (hrs)	Precip (in)	Time (hrs)	Precip (in)	Time (hrs)	Precip (in)
11.10	0.027077	11.47	0.038797	11.83	0.104671	12.20	0.104671	12.57	0.104671	12.90	0.038797
11.13	0.029893	11.50	0.038798	11.87	0.104668	12.23	0.104668	12.60	0.075428	12.90	0.038796
11.17	0.029893	11.53	0.052249	11.90	0.104671	12.27	0.075428	12.63	0.075428	12.90	0.035882
11.20	0.029893	11.57	0.052247	11.93	0.180561	12.30	0.075428	12.67	0.075428	12.90	0.035882
11.23	0.032937	11.60	0.052248	11.97	0.180562	12.33	0.054991	12.70	0.054991	12.90	0.035882
11.27	0.032936	11.63	0.054991	12.00	0.180560	12.37	0.054991	12.73	0.054991	12.90	0.032938
11.30	0.032937	11.67	0.054991	12.03	0.301282	12.40	0.054992	12.77	0.054992	12.90	0.032936
11.33	0.035881	11.70	0.054991	12.07	0.301282	12.43	0.052249	12.80	0.052249	12.90	0.032937
11.37	0.035881	11.73	0.075429	12.10	0.301282	12.47	0.052248	12.83	0.052248	12.90	0.029893
11.40	0.035881	11.77	0.075429	12.13	0.104671	12.50	0.052249	12.87	0.052249	12.90	0.029893
11.43	0.038797	11.80	0.075431	12.17	0.104668	12.53	0.038796	12.90	0.038796	12.90	0.029892



Precipitation Report Cont'd

Rainfall totals in Inches

01-26-2021

Precipitation filename: Essex County NRCS.pcp

Precipitation Report

Hydrology Studio v 3.0.0.17 (Rainfall totals in Inches)

01-26-2021

Precipitation filename: Essex County NRCS.pcp

[illegible]

	Active	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
			✓			✓			✓
	SCS Storms	> SCS Dimensionless Storms							
	SCS 6hr	0	0	0	0	0	0	0	0
	Type I, 24-hr	0	0	0	0	0	0	0	0
	Type IA, 24-hr	0	0	0	0	0	0	0	0
	Type II, 24-hr	0	0	0	0	0	0	0	0
	Type II FL, 24-hr	0	0	0	0	0	0	0	0
	Type III, 24-hr	2.85	3.44	0	4.40	5.22	6.44	7.49	8.66
	Synthetic Storms	> IDF-Based Synthetic Storms							
	1-hr	0	0	0	0	0	0	0	0
	2-hr	0	0	0	0	0	0	0	0
	3-hr	0	0	0	0	0	0	0	0
	6-hr	0	0	0	0	0	0	0	0
	12-hr	0	0	0	0	0	0	0	0
	24-hr	0	0	0	0	0	0	0	0
	Huff Distribution	> 1st Quartile (0 to 6 hrs)							
	1-hr	0.76	0.98	0	1.33	1.61	2.01	2.34	2.69
	2-hr	0.89	1.14	0	1.50	1.80	2.24	2.60	2.99
	3-hr	0.98	1.24	0	1.59	1.90	2.33	2.68	3.07
	6-hr	1.20	1.50	0	1.86	2.18	2.64	3.01	3.41
	Huff Distribution	> 2nd Quartile (>6 to 12 hrs)							
	8-hr	0	0	0	0	0	0	0	0
	12-hr	0	0	0	0	0	0	0	0
	Huff Distribution	> 3rd Quartile (>12 to 24 hrs)							
	18-hr	0	0	0	0	0	0	0	0
	24-hr	0	0	0	0	0	0	0	0
	Custom Storms	> Custom Storm Distributions							
	NJ Water Quality	1.25	0	0	0	0	0	0	0
	My Custom Storm 2	0	0	0	0	0	0	0	0
	My Custom Storm 3	0	0	0	0	0	0	0	0
	My Custom Storm 4	0	0	0	0	0	0	0	0
	My Custom Storm 5	0	0	0	0	0	0	0	0
	My Custom Storm 6	0	0	0	0	0	0	0	0
	My Custom Storm 7	0	0	0	0	0	0	0	0
	My Custom Storm 8	0	0	0	0	0	0	0	0
	My Custom Storm 9	0	0	0	0	0	0	0	0
	My Custom Storm 10	0	0	0	0	0	0	0	0

Precipitation filename: Essex County NRCS.pcp

01-26-2021

[illegible]

STORMWATER CONVEYANCE CALCULATIONS (PIPE SIZING)



Stormwater Collection System Calculations

Project: Capitol Seniors Housing

Job #: 1423-99-005

Location: West Orange, NJ

Design Storm: 25-Year

Computed By: DRL

Checked By: DTS

Date: 1/25/2021

Revised:

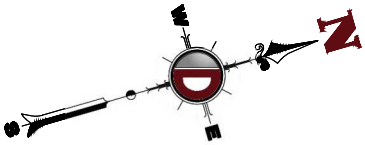
NOTES:

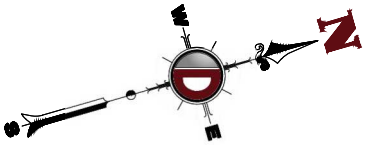
1) Design method used is Rational Method

2) Refer to Weighted Runoff Coefficient table for calculation of incremental areas and C values

PIPE SECTION		SUBCATCHMENT AREA	INCREMENTAL		CUMULATIVE	TIME OF CONCENTRATION			I	PEAK RUNOFF		PIPING INPUT			PIPING DATA			
FROM	TO	Area (Acres)	"C"	A x C Ac	A x C (acres)	Tc to Inlet (min)	Tc in Pipe (min.)	Final Tc (min)	(In/Hr)	Q to Inlet (CFS)	Q cum. for Pipe (CFS)	Dia. (In)	Length (Ft)	Man. "n"	Slope (ft/ft)	Pipe Capacity (cfs)	Full Pipe Velocity (fps)	Actual Pipe Velocity (fps)
108	104	0.05	0.95	0.05	0.05	10.00	0.22	10.00	6.80	0.34	0.34	12	64.0	0.012	0.0100	3.86	4.92	1.85
104	103	0.13	0.95	0.12	0.58	10.00	0.22	10.47	6.80	0.82	3.94	15	77.0	0.012	0.0100	7.00	5.71	5.98
103	102	0.06	0.95	0.06	0.64	10.00	0.40	10.69	6.68	0.40	4.28	15	136.0	0.012	0.0100	7.00	5.71	6.16
RD1	102	0.26	0.95	0.25	0.25	10.00	0.23	10.00	6.80	1.70	1.70	12	47.0	0.012	0.0050	2.73	3.48	3.77
102	101	0.21	0.95	0.20	1.09	10.00	0.17	11.09	6.56	1.31	7.15	24	81.0	0.012	0.0100	24.50	7.80	5.96
114	113	0.17	0.95	0.16	0.16	10.00	0.25	10.00	6.80	1.09	1.09	15	86.0	0.012	0.0100	7.00	5.71	3.08
113	112	0.08	0.95	0.08	0.24	10.00	0.43	10.25	6.80	0.54	1.63	15	147.0	0.012	0.0100	7.00	5.71	3.82
RD2	112	0.39	0.95	0.37	0.37	10.00	0.17	10.00	6.80	2.52	2.52	12	50.0	0.012	0.0100	3.86	4.92	5.42
112	111	0.20	0.95	0.19	0.80	10.00	0.25	10.68	6.68	1.27	5.34	15	86.0	0.012	0.0100	7.00	5.71	6.49
111	110	0.07	0.95	0.07	0.87	10.00	0.34	10.93	6.68	0.47	5.81	15	116.0	0.012	0.0100	7.00	5.71	6.52
110	109	0.27	0.95	0.26	1.13	10.00	0.56	11.27	6.56	1.71	7.41	18	154.0	0.012	0.0050	8.04	4.55	5.09
109	101	0.12	0.95	0.11	1.24	10.00	0.05	11.83	6.44	0.71	7.99	24	15.0	0.012	0.0050	17.33	5.52	5.33
101	EX Inlet	0.07	0.95	0.07	2.40	10.00	0.06	11.88	6.44	0.45	15.46	30	24.0	0.012	0.0050	31.42	6.40	6.36

DRAINAGE AREA MAPS

[illegible]

[illegible]

DRAWN BY: DRL	DESIGNED BY: DRL	CHECKED BY: DTS	CHECKED BY: —
------------------	---------------------	--------------------	------------------

PROJECT: **CSH DEVELOPMENT, LLC**
PROPOSED ASSISTED LIVING FACILITY
BLOCK 152.22, LOT 1412.01
609 EAGLE ROCK AVENUE (CR-611)
TOWNSHIP OF WEST ORANGE, ESSEX COUNTY, NEW JERSEY

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JOSEPH G. JAWORSKI

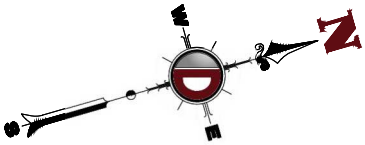
PROFESSIONAL ENGINEER
NEW JERSEY LICENSE No. 36618

TITLE:
PROPOSED DRAINAGE
AREA MAP

SCALE: (H) 1" = 30'	DATE:
(V)	01/25/2022
PROJECT No:	
1423-99-005	

SHEET No: Rev.

2

[illegible]

DRAWN BY: <u>DRL</u>	DESIGNED BY: <u>DRL</u>	CHECKED BY: <u>DTS</u>	CHECKED BY: <u>-</u>
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PROJECT: **CSH DEVELOPMENT, LLC**
PROPOSED ASSISTED LIVING FACILITY
BLOCK 152.22, LOT 1412.01
609 EAGLE ROCK AVENUE (CR-611)
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TITLE:
INLET DRAINAGE
AREA MAP

SCALE: (H) 1" = 30'	DATE:
(V)	01/25/2022
PROJECT No:	
1423-99-005	

SHELL NO: **3** NEW: **0** OF **3**