STORMWATER MANAGEMENT REPORT

Prepared for:

Capitol Seniors Housing

Proposed Assisted Living
Block 2202, Lot 1
620 Pascack Road
Township of Washington
County of Bergen, NJ

Prepared by:

DYNAMIC ENGINEERING

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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 620 Pascack Road in the Township of Washington, Bergen County, New Jersey and specifically identified as Block 2202, Lot 1 on the Township of Washington Tax Maps. The existing site consists of a tennis club, associated surface parking, and wooded land.

Under proposed conditions, the site will be developed with a 28,874 SF senior housing facility with associated improvements including; landscaped, parking, and outdoor courtyard areas. The housing facility will be three stores high and include 85 units consisting of aproximatly 100 beds.

II. EXISTING DRAINAGE CONDITIONS

The overall subject site consists of 5.02 acres and is partially developed containing a tennis club, associated surface parking, and wooded land. Most of the wooded land is preserved by a conservation easment. The site currently consists of approximately 98,296 SF (45.0%) of impervious surface area.

Based on the Bergen County Soil Survey, the soil types native to the site include:

SOIL TYPE (SYMBOL)	SOIL TYPE (NAME)	HYDROLOGIC SOIL GROUP
RkrC	Riverhead sandy loam, 8 to 15 percent slopes	B
UdwB	Udorthents, wet substratum, 0 to 8 percent slopes	D
WeuB	Wethersfield-Urban land complex, 3 to 8 percent slopes	C

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

EXISTING DRAINAGE AREA 1:

This area includes the northwest end and southern majority of the subject property consisting primarily of building space and asphalt parking area with a small amount of landscaped and undisturbed wooded area. It contains soils belonging to hydrologic group C and D. The stormwater runoff generated from the northwest area of the site flows in a southerly direction towards existing onsite inlets located within the landscaped areas. The collected runoff from this area is then conveyed in to the Musquapsink Brook. The stormwater generated from the southern paved parking area flows in a westerly direction and is collected via existing onsite inlets located within the paved parking area. The runoff collected by this system is conveyed into the Musquapsink Brook. 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 time of concentration of 10 minutes has been used for this analysis.

EXISTING DRAINAGE AREA 2:

This drainage area includes the northern and eastern portion of the subject property, consisting primarily of building area as well as undisturbed wooded area and an asphalt parking area along the Pascack Road frontage. It contains soils belonging to hydrologic soil group D and C. The stormwater runoff generated from this area flows in an northeasteraly direction to existing onsite inlets and is conveyed into the existing stormwater system in the Pascack Road right-of-way. The driveway providing full ingress and egress access to Pascack Road sheet flows undetained into the Pacsack Road right-of-way. The 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," including the hydrologic soil group D. A time of concentration of 10 minutes has been used for this analysis.

OFFSITE 1:

This study area consists of a portion of the adjacent property to the north, from which stormwater runoff flows on to the subject property. It includes wooded area that is part of residential lots, and contains soils belonging to hydrologic soil group C. Runoff flows in a southerly direction, ultimately contributing to the existing inlet located within the wooded area of DA-1. The 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," and a time of concentration of 10 minutes has been utilized for this drainage area.

OFFSITE 2:

This study area consists of a portion of the adjacent property to the north, from which stormwater runoff flows on to the subject property. It includes wooded area that is part of residential lots, and contains soils belonging to hydrologic soil group C. Runoff flows in an southeasterly direction, ultimately contributing to the runoff produced by DA-2 which is collected via onsite inlets and conveyed into the Pascack Road right-of-way. The 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," and a time of concentration of 10 minutes has been utilized for this drainage area.

POINT OF ANALYSIS:

There will be one point of analysis for the purposes of this report. Drainage Area 2, which conveys to the existing stormwater system in the Pascack Road right-of-way, ultimitely dicharges into Musquapsink Brook. Point of Analysis 1 (POA #1) for this analysis will be the point in Musquapsink Brook where DA-1 and DA-2 converge. The two drainage areas converge approxamitely 270 LF south of the subject property.

III. PROPOSED DRAINAGE CONDITIONS

Under proposed conditions, the site will be developed with a 28,874 SF senior housing facility with associated improvements including; landscaped, 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 25,120 SF (0.58 acres). The proposed site will result in 33.5% impervious coverage compared to 45% 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 sub-watershed areas as depicted on the Proposed Drainage Area Map:

DRAINAGE AREA 1:

This area includes the northwest end and southern portion of the subject site, consisting of the entire proposed building, portion paved parking area, landscaped areas, and existing wooded area. Soils within this study area belong to hydrologic group C and D. The stormwater runoff generated form this area is collected naturally and via onliste inlets and dishareges into the Musquapsink Brook. This area is divided into two sub-drainage areas:

Sub-drainage area 1A:

This area includes the southern and central portion of DA-1, consisting of the entire proposed building, portion of the paved parking area, and landscaped areas. Stormwater runoff generated by the proposed building and parking and landscaped areas is collected via proposed onsite inlets and conveyed into Musquapsink Brook. Stormwater from this area contributes to Point of Analysis 1 (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 time of concentration of 10 has been used for the remaining portion of DA-1.

Sub-drainage Area 1B:

This area includes of the northern and western end of DA-1, consisting of pervious area. The stormwater runoff generated from this area is collected by a large pervious area that slopes towards and discharges to Musquapsink Brook. Stormwater from this area contributes to Point of Analysis 1 (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 time of concentration of 13.5 minutes has been calculated and used in this analysis.

DRAINAGE AREA 2:

This area includes the northern and eastern portion of the subject site, consisting of asphalt access drive and parking area, landscape and courtyard areas, and wooded area. Soils within this study area belong to the dydrologic group C and D. The stormwater runoff generated from this area flows in a southeastern direction and is collected via proposed onsite inlets and subsequently conveyed into the Pascack Road right-of-way. Stormwater from this area contributes to Point of Analysis 1 (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 time of concentration of 10 minutes has been used in this analysis.

OFFSITE 1:

This study area consists of a portion of the adjacent property to the north, from which stormwater runoff flows on to the subject property. It includes wooded area that is part of residential lots, and contains soils belonging to hydrologic soil group C. Runoff flows in a southerly direction, ultimately contributing to the existing inlet located within the wooded area of DA-1. The 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," and a time of concentration of 13.5 minutes has been utilized for this drainage area.

OFFSITE 2:

This study area consists of a portion of the adjacent property to the north, from which stormwater runoff flows on to the subject property. It includes wooded area that is part of residential lots, and contains soils belonging to hydrologic soil group C. Runoff flows in an southeasterly direction, ultimately contributing to the runoff produced by DA-2 which is collected via onsite inlets and conveyed into the Pascack Road right-of-way. The 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," and a time of concentration of 10 minutes has been utilized for this drainage area.

IV. DESIGN METHODOLOGY

The primary design constraints for this project are based on requirements established in the Township of Washington 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 over 1 acre of land, but will not increase impervious surface coverage by more than ¼ acre 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 approxamitely 0.58 acres. Furthermore, the project is not

required to meet post-development peak flow rates for the disturbed area of 50%, 75% and 80% for the 2-, 10- and 100- year storms set forth by the Township of Washington 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. Dynamic Survey, LLC was contracted to prepare a Boundary, Topographic, and Location 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 Bergen 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 and D. Pervious and impervious areas were modeled separately as suggested in the NJDEP Stormwater Management Best Management Practices (BMP) Manual.

V. WATER QUANTITY

As stated in the previous section, the proposed development reduces impervious surfaces by 0.58 acres and is thus not required to meet the 50%, 75% and 80% reductions for the 2-, 10-, and 100-year storms. Instead the proposed development is required to meet or reduce existing peak runoff rates. The aforementioned Point of Analysis #1 has been used to analyze and ensure reduction of peak flows discharging to Musquapsink Brook. As such, the peak discharge rates of the areas falling within the limits of disturbance of the entire site, and allowable runoff rates were then calculated. The following demonstrates the results of these calculations:

POA #1 Runoff Rates (CFS)			
Design Storm	Existing Total	Proposed Total	Percent Reduction
2-year	7.39	6.54	11.50 %
10-year	12.11	11.12	8.18 %
100-year	21.65	20.43	5.64 %

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.

Pascack Road Right-of-Way Analysis:

Further analysis was performed to ensure post-development peak runoff rates discharging to the existing stormwater system in the Pascack Road right-of-way are not being increased. Existing Drainage Area 2 and Proposed Drainage Area 2 discharge into the Pascack Road right-of-way. The following table demonstrated the results of these calculations:

Pascack Road ROW Runoff Rates (CFS)			
Design Storm	Existing Total	Proposed Total	Percent Reduction
2-year	3.52	2.61	25.85 %
10-year	5.74	4.50	21.60 %
100-year	10.23	8.35	18.38 %

As indicated above, the peak flows for stormwater discharging into the Pascack Road right-of-way is being reduced by the proposed development. The proposed development will not prove additional strain to this stormwater system.

VI. WATER QUALITY

A development is required to meet 80% TSS removal per the Township of Washington 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 0.58 acres. Thus water quality measures are not required

VII. OFF-SITE STABILITY

In accordance to The Standards for Soil Erosion and Sediment Control in New Jersey, the proposed design meets the intent of section 21.1 Standards for Off-Site Stability. Musquapsink Brook is categorized as a well defined waterway. As shown in the table below, peak Runoff Rates at the point of discharge for Storm Structure #200 are reduced under proposed conditions when compared to pre-development conditions. Therefore the stability at the point of discharge is not compromised.

Storm Sturcture #200 Point of Discharge Runoff Rates (CFS)			
Design Storm	Existing Total	Proposed Total	Percent Reduction
2-year	3.79	3.07	19.0%
10-year	6.17	4.78	22.53%
100-year	10.96	8.15	25.64%

Downstream Stability Analysis was performed by analyzing the Flood Insurance Study for Bergen County, NJ last revised August 28, 2019. Upon review of Peak Discharges at POA #1 it was determined the proposed runoff rates are reduced when compared to existing conditions. The proposed discharge is insignificant compared to the discharge outlined in the Flood Insurance Report. The following table represents the relationship of the pre- and post-development and total Musquapsink Brook peak run off-rates at POA #1:

Downstream Stability Analysis at POA #1 Runoff Rates (CFS)				
Design Storm	Existing Total	Proposed Total	Percent Reduction	Musquapsink Brook Peak Flow at POA #1*
2-year	7.39	6.54	11.50 %	-
10-year	12.11	11.12	8.18 %	710
100-year	21.65	20.43	5.64 %	1,410

* USGS Gauge No. 01377475 (Pascack Rd)

As shown above, the proposed discharge rate represents approxamitely 1.5% of the Musquapsink Brook Peak Flow at POA #1. Therefore, discharge generated from the proposed development is insignificant and will not impact the Downstream Stability of Musquapsink Brook.

VIII. CONCLUSION

The proposed development has been designed with provisions for the safe and efficient control of stormwater runoff in a manner that will not adversely impact the existing drainage patterns, adjacent roadways, or adjacent parcels.

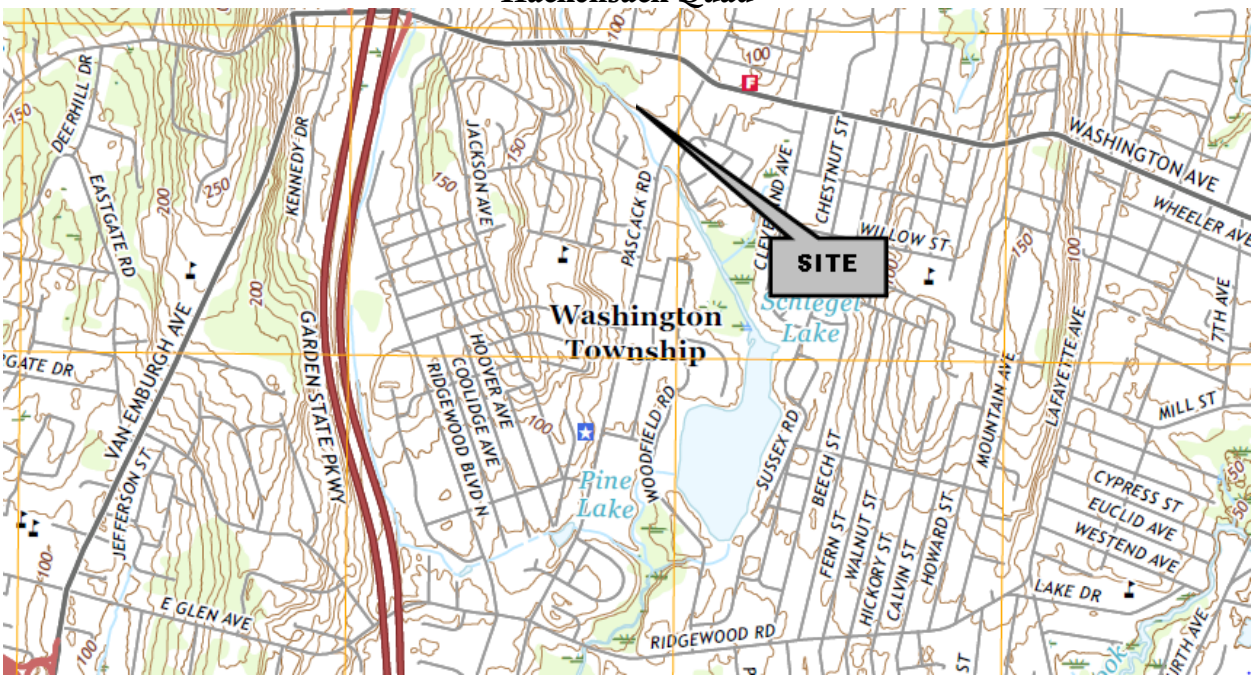
The stormwater management design reduces peak flow rates for the proposed development areaa and/or reduces runoff to be under the curve of the existing hydrographs at all times as required by the Township of Washington and NJAC 7:8.

APPENDIX

USGS MAP

USGS Map

Hackensack Quad



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SOIL SURVEY

Map Scale: 1:1,210 if printed on B landscape (17" x 11") sheet.

N

Meters: 0 15 30 60 90

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

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 1:24,000.

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: Bergen County, New Jersey
Survey Area Data: Version 15, Sep 13, 2018

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

Date(s) aerial images were photographed: Oct 7, 2013—Feb 26, 2017

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
RkrC	Riverhead sandy loam, 8 to 15 percent slopes	B	0.0	0.0%
UdwB	Udorthents, wet substratum, 0 to 8 percent slopes	D	4.4	85.7%
WeuB	Wethersfield-Urban land complex, 3 to 8 percent slopes	C	0.7	14.3%
Totals for Area of Interest			**5.1**	**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

Aggregation is the process by which a set of component attribute values is reduced to a single value that represents the map unit as a whole.

A map unit is typically composed of one or more "components". A component is either some type of soil or some nonsoil entity, e.g., rock outcrop. For the attribute being aggregated, the first step of the aggregation process is to derive one attribute value for each of a map unit's components. From this set of component attributes, the next step of the aggregation process derives a single value that represents the map unit as a whole. Once a single value for each map unit is derived, a thematic map for soil map units can be rendered. Aggregation must be done because, on any soil map, map units are delineated but components are not.

For each of a map unit's components, a corresponding percent composition is recorded. A percent composition of 60 indicates that the corresponding component typically makes up approximately 60% of the map unit. Percent composition is a critical factor in some, but not all, aggregation methods.

The aggregation method "Dominant Condition" first groups like attribute values for the components in a map unit. For each group, percent composition is set to the sum of the percent composition of all components participating in that group. These groups now represent "conditions" rather than components. The attribute value associated with the group with the highest cumulative percent composition is returned. If more than one group shares the highest cumulative percent composition, the corresponding "tie-break" rule determines which value should be returned. The "tie-break" rule indicates whether the lower or higher group value should be returned in the case of a percent composition tie. The result returned by this aggregation method represents the dominant condition throughout the map unit only when no tie has occurred.

Component Percent Cutoff: None Specified

Components whose percent composition is below the cutoff value will not be considered. If no cutoff value is specified, all components in the database will be considered. The data for some contrasting soils of minor extent may not be in the database, and therefore are not considered.

Tie-break Rule: Higher

The tie-break rule indicates which value should be selected from a set of multiple candidate values, or which value should be selected in the event of a percent composition tie.

RUNOFF CURVE NUMBER (CN) CALCULATIONS

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EXISTING DRAINAGE AREA SUMMARY AND AVERAGE CURVE NUMBER(CN) CALCULATIONS

Project:	Capital Seniors	Computed By:	TMT
Job #:	1423-99-003	Checked By:	DTS
Location:	Township of Washington	Date:	10/21/2019

Drainage Area	Impervious Area (acre)	Impervious Area (sf)	Curve Number (CN) Used	HSG C - Wooded Area (acre)	HSG C - Wooded Area (sf)	Curve Number (CN) Used	HSG D - Open Space Area (acre)	HSG D - Open Space Area (sf)	Curve Number (CN) Used	HSG D - Wooded Area (acre)	HSG D - Wooded Area (sf)	Curve Number (CN) Used	Avg. Perv. Curve Number	Total PerviousArea (acres)	Total Area (acres)	TC (Min.)
DA-2	1.10	48,130	98	0.14	6,037	70	0.19	8,180	80	0.20	8,900	77	76	0.53	1.64	10
DA-2-OFF	0.00	-	98	0.04	1,700	70	0.00	-	80	0.00	-	77	70	0.04	0.04	10
DA-1	1.20	52,216	98	0.20	8,660	70	0.34	14,869	80	0.00	-	77	76	0.54	1.74	10
DA-1-OFF	0.00	-	98	0.06	2,635	70	0.00	-	80	0.00	-	77	70	0.06	0.06	10
Total	**2.30**	**100346.00**		**0.44**	**19032.00**		**0.53**	**23049.00**		**0.20**	**8900.00**			**1.17**	**3.47**	

Per Bergen Soil Survey -	WeuB	HSG	C	Soil	Wethersfield - Urban Land Complex
Per Bergen Soil Survey -	UdwB	HSG	D	Soil	Udorthents, Wet Substratum

Description	Runoff Curve Number (CN) (HSG C)	Runoff Curve Number (CN) (HSG D)
Impervious Surface	98	98
Open Space (lawn) (good)	74	80
Woods (good)	70	77

DYNAMIC ENGINEERING

PROPOSED DRAINAGE AREA SUMMARY AND AVERAGE CURVE NUMBER(CN) CALCULATIONS

Project:	Capital Seniors	Computed By:	GAL
Job #:	1423-99-003	Checked By:	DTS
Location:	Township of Washington	Date:	1/9/2020

Drainage Area	Impervious Area (acre)	Impervious Area (sf)	Curve Number (CN) Used	HSG C - Wooded Area (acre)	HSG C - Wooded Area (sf)	Curve Number (CN) Used	HSG D - Open Space Area (acre)	HSG D - Open Space Area (sf)	Curve Number (CN) Used	Avg. Perv. Curve Number	Total PerviousArea (acres)	Total Area (acres)	TC (Min.)
DA-2	0.61	26,780	98	0.15	6,580	70	0.61	26,768	80	78	0.77	1.38	10
DA-OFF-2	0.00	-	98	0.04	1,700	70	0.00	-	80	70	0.04	0.04	10
DA-1A	1.09	47,414	98	0.00	-	70	0.14	6,256	80	80	0.14	1.23	10
DA-1B	0.00	-	99	0.21	9,072	70	0.55	23,898	80	77	0.76	0.76	13.5
DA-OFF-1B	0.00	-	98	0.06	2,635	70	0.00	-	80	70	0.06	0.06	13.5
Total	**1.70**	**74194.00**		**0.46**	**19987.00**		**1.31**	**56922.00**			**1.77**	**3.47**	

Per Bergen Soil Survey -	WeuB	HSG	C	Soil	Wethersfield - Urban Land Complex
Per Bergen Soil Survey -	UdwB	HSG	D	Soil	Udorthents, Wet Substratum

Description	Runoff Curve Number (CN) (HSG C)	Runoff Curve Number (CN) (HSG D)
Impervious Surface	98	98
Open Space (lawn) (good)	74	80
Woods (good)	70	77

TIME OF CONCENTRATION (Tc) CALCULATIONS

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(908)-879-9229

Date:	1/1/2020
Project:	CSH Washington
Project No:	1423-99-003
Calculated By:	STL
Checked By:	DTS

Worksheet 3: Time of Concentration (T_c) Calculations

Land Condition: Proposed
Drainage Area: DA-1B

• Sheet Flow :

	AB		BC		CD		
1. Surface Description	Dense Grasses		Dense Grasses		Dense Grasses		
2. Manning's Roughness Coefficient, n	0.24		0.24		0.24		
3. Flow Length, L { total $L \leq 100$ ft }	22.0 ft		19.0 ft		59.0 ft		
4. Two-Year 24-hour Rainfall, p_2 for . . . Bergen County	3.34 in		3.34 in		3.34 in		
5. Land Slope, s (ft/ft)	0.150 ft/ft		0.079 ft/ft		0.036 ft/ft		
6. Travel Time, $T_t = \frac{0.007\,(n\,L)^{0.8}}{p_2^{\,0.5}\,s^{0.4}}$	0.031 hr	+	0.036 hr	+	0.121 hr	=	0.187 hr

• Shallow Concentrated Flow :

	DE		EF		FG		
7. Surface Description	Unpaved		Unpaved		Unpaved		
8. Flow Length, L	78.0 ft		165.0 ft		24.0 ft		
9. Watercourse Slope, s	0.008 ft/ft		0.017 ft/ft		0.250 ft/ft		
10. Average velocity, V { see Figure 3.1)	1.42 ft/s		2.10 ft/s		8.07 ft/s		
11. Travel Time, $T_t = \frac{L}{3600\,V}$	0.015 hr	+	0.022 hr	+	0.001 hr	=	0.038 hr

• Channel Flow :

12. Pipe Diameter, D							
13. Cross-Sectional Flow Area, A							
14. Wetted Perimeter, p_w							
15. Hydraulic Radius, $r = A / p_w$							
16. Channel Slope, s							
17. Pipe Material							
18. Manning's Roughness Coefficient, n							
19. Velocity, $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$							
20. Flow Length, L							
21. Travel Time, $T_t = \frac{L}{3600\,V}$	0.000 hr	+	0.000 hr	+	0.000 hr	=	0.000 hr
22. Watershed or subarea Time of Concentration, T_c { add T_t in steps 6, 11 and 21 }							0.225 hr
							13.5 min

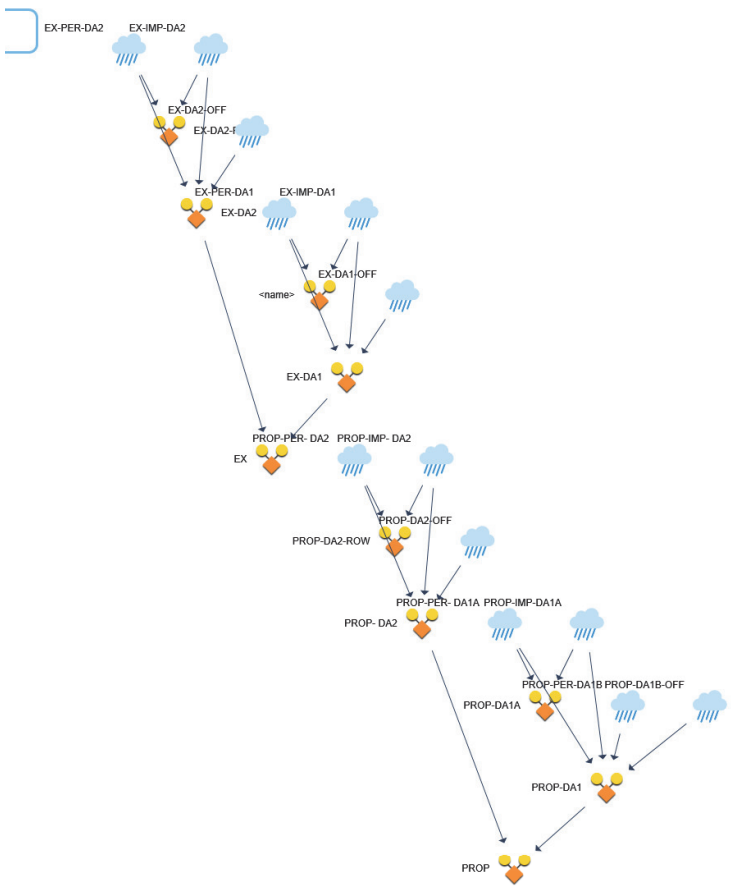
HYDROGRAPH SUMMARY REPORTS – EXISTING AND PROPOSED CONDITIONS 2-YR, 10-YR, & 100-YR

Basin Model

Project Name:

Hydrology Studio v 3.0.0.14

03-20-2020



Hydrograph by Return Period

Project Name:

Hydrology Studio v 3.0.0.14

03-20-2020

Hyd. No.	Hydrograph Type	Hydrograph Name	Peak Outflow (cfs)							
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
1	NRCS Runoff	EX-PER-DA2		0.621			1.319	1.840		2.810
2	NRCS Runoff	EX-IMP-DA2		2.896			4.425	5.492		7.419
3	Junction	EX-DA2-ROW		3.516			5.744	7.332		10.23
4	NRCS Runoff	EX-DA2-OFF		0.032			0.079	0.116		0.187
5	Junction	EX-DA2		3.548			5.823	7.448		10.42
7	NRCS Runoff	EX-PER-DA1		0.632			1.344	1.875		2.863
8	NRCS Runoff	EX-IMP-DA1		3.159			4.827	5.991		8.093
9	Junction	EX-DA1-BROOK		3.791			6.171	7.866		10.96
10	NRCS Runoff	EX-DA1-OFF		0.049			0.119	0.174		0.280
11	Junction	EX-DA1		3.839			6.290	8.040		11.24
13	Junction	EX		7.388			12.11	15.49		21.65
16	NRCS Runoff	PROP-PER- DA2		1.004			2.048	2.816		4.233
17	NRCS Runoff	PROP-IMP- DA2		1.606			2.454	3.045		4.114
18	Junction	PROP-DA2-ROW		2.610			4.502	5.862		8.347
19	NRCS Runoff	PROP-DA2-OFF		0.032			0.079	0.116		0.187
20	Junction	PROP- DA2		2.642			4.581	5.978		8.534
22	NRCS Runoff	PROP-PER- DA1A		0.202			0.396	0.537		0.796
23	NRCS Runoff	PROP-IMP-DA1A		2.869			4.385	5.442		7.351
24	Junction	PROP-DA1A		3.071			4.781	5.979		8.147
26	NRCS Runoff	PROP-PER-DA1B		0.831			1.730	2.397		3.631
27	NRCS Runoff	PROP-DA1B-OFF		0.043			0.105	0.154		0.248
28	Junction	PROP-DA1		3.899			6.541	8.436		11.90
30	Junction	PROP		6.541			11.12	14.41		20.43

Hydrograph 2-yr Summary

Project Name:

Hydrology Studio v 3.0.0.14

03-20-2020

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-PER-DA2	0.621	12.17	2,481	---		
2	NRCS Runoff	EX-IMP-DA2	2.896	12.17	12,794	---		
3	Junction	EX-DA2-ROW	3.516	12.17	15,275	1, 2		
4	NRCS Runoff	EX-DA2-OFF	0.032	12.20	136	---		
5	Junction	EX-DA2	3.548	12.17	15,411	1, 2, 4		
7	NRCS Runoff	EX-PER-DA1	0.632	12.17	2,528	---		
8	NRCS Runoff	EX-IMP-DA1	3.159	12.17	13,957	---		
9	Junction	EX-DA1-BROOK	3.791	12.17	16,485	7, 8		
10	NRCS Runoff	EX-DA1-OFF	0.049	12.20	205	---		
11	Junction	EX-DA1	3.839	12.17	16,689	7, 8, 10		
13	Junction	EX	7.388	12.17	32,101	5, 11		
16	NRCS Runoff	PROP-PER- DA2	1.004	12.17	3,969	---		
17	NRCS Runoff	PROP-IMP- DA2	1.606	12.17	7,095	---		
18	Junction	PROP-DA2-ROW	2.610	12.17	11,064	16, 17		
19	NRCS Runoff	PROP-DA2-OFF	0.032	12.20	136	---		
20	Junction	PROP- DA2	2.642	12.17	11,200	16, 17, 19		
22	NRCS Runoff	PROP-PER- DA1A	0.202	12.17	792	---		
23	NRCS Runoff	PROP-IMP-DA1A	2.869	12.17	12,678	---		
24	Junction	PROP-DA1A	3.071	12.17	13,469	22, 23		
26	NRCS Runoff	PROP-PER-DA1B	0.831	12.20	3,531	---		
27	NRCS Runoff	PROP-DA1B-OFF	0.043	12.23	193	---		
28	Junction	PROP-DA1	3.899	12.17	17,194	22, 23, 26, 27		
30	Junction	PROP	6.541	12.17	28,394	20, 28		

Hydrograph Report

Project Name:

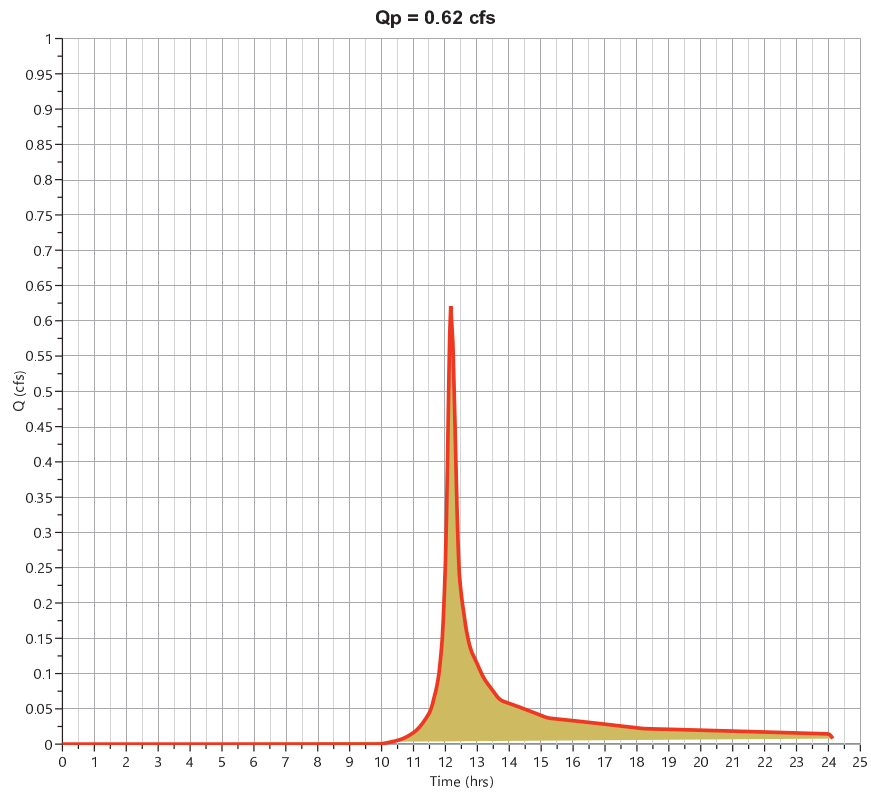
Hydrology Studio v 3.0.0.14

03-20-2020

EX-PER-DA2

Hyd. No. 1

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.621 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 2,481 cuft
Drainage Area	= 0.53 ac	Curve Number	= 76
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 3.34 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

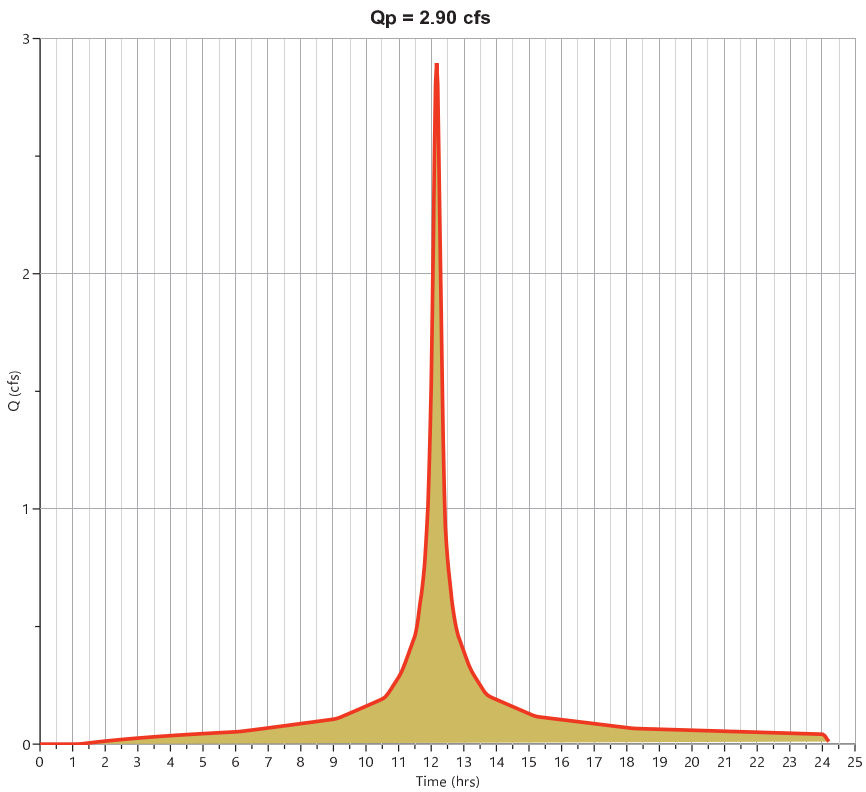
Hydrology Studio v 3.0.0.14

03-20-2020

EX-IMP-DA2

Hyd. No. 2

Hydrograph Type	= NRCS Runoff	Peak Flow	= 2.896 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 12,794 cuft
Drainage Area	= 1.1 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 3.34 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

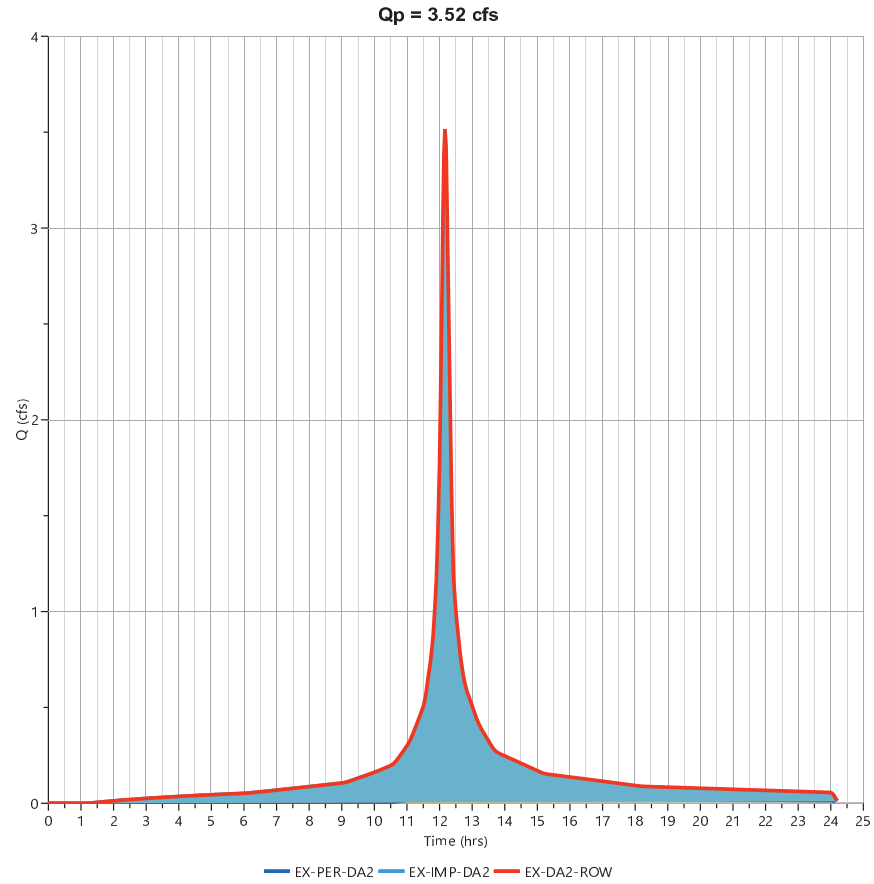
Hydrology Studio v 3.0.0.14

03-20-2020

EX-DA2-ROW

Hyd. No. 3

Hydrograph Type	= Junction	Peak Flow	= 3.516 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 15,275 cuft
Inflow Hydrographs	= 1, 2	Total Contrib. Area	= 1.63 ac



Hydrograph Report

Project Name:

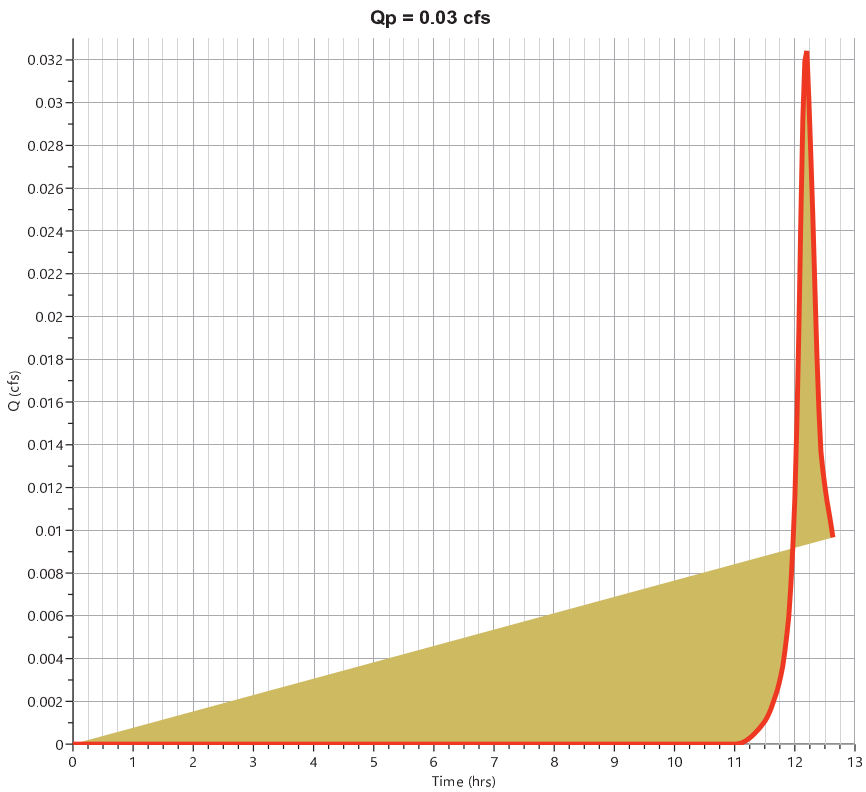
Hydrology Studio v 3.0.0.14

03-20-2020

EX-DA2-OFF

Hyd. No. 4

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.032 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Runoff Volume	= 136 cuft
Drainage Area	= 0.04 ac	Curve Number	= 70
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 3.34 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

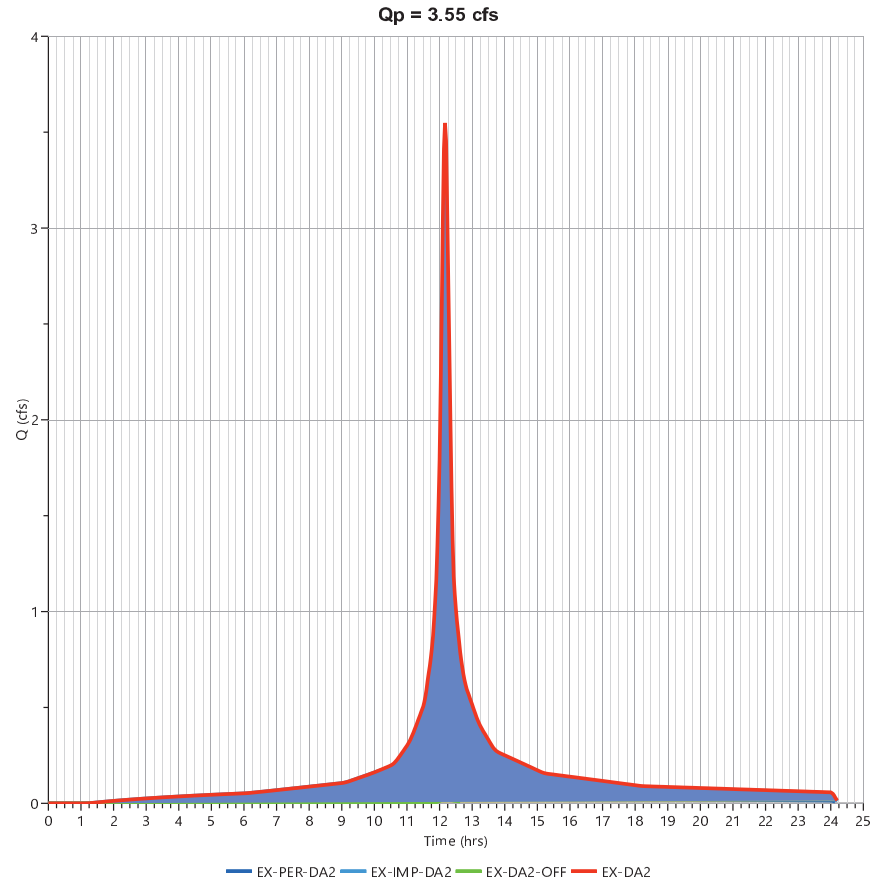
Hydrology Studio v 3.0.0.14

03-20-2020

EX-DA2

Hyd. No. 5

Hydrograph Type	= Junction	Peak Flow	= 3.548 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 15,411 cuft
Inflow Hydrographs	= 1, 2, 4	Total Contrib. Area	= 1.67 ac



Hydrograph Report

Project Name:

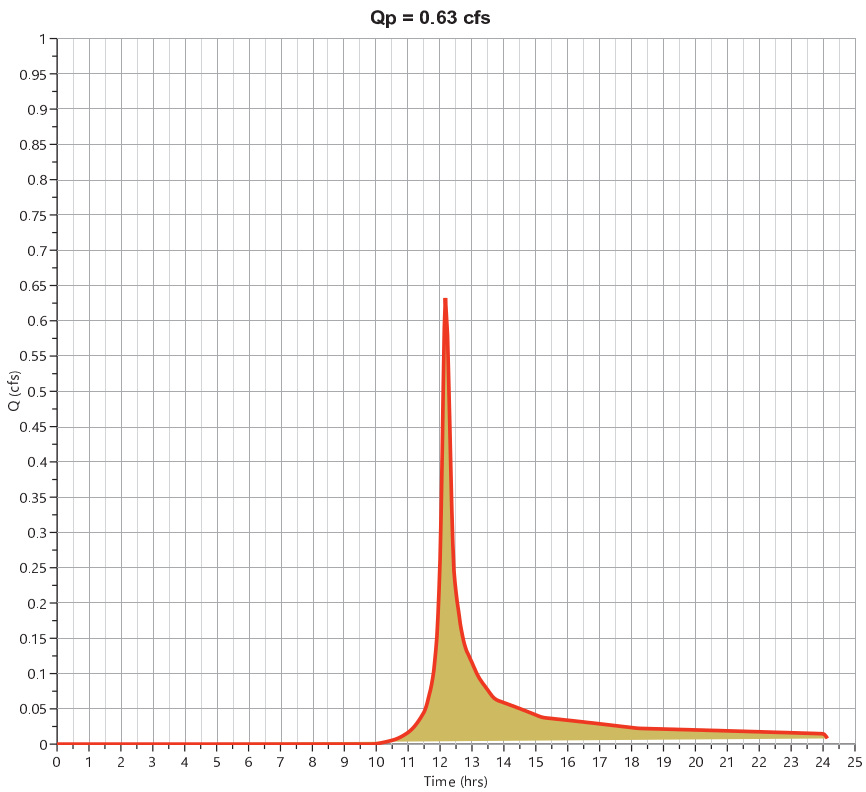
Hydrology Studio v 3.0.0.14

03-20-2020

EX-PER-DA1

Hyd. No. 7

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.632 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 2,528 cuft
Drainage Area	= 0.54 ac	Curve Number	= 76
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 3.34 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

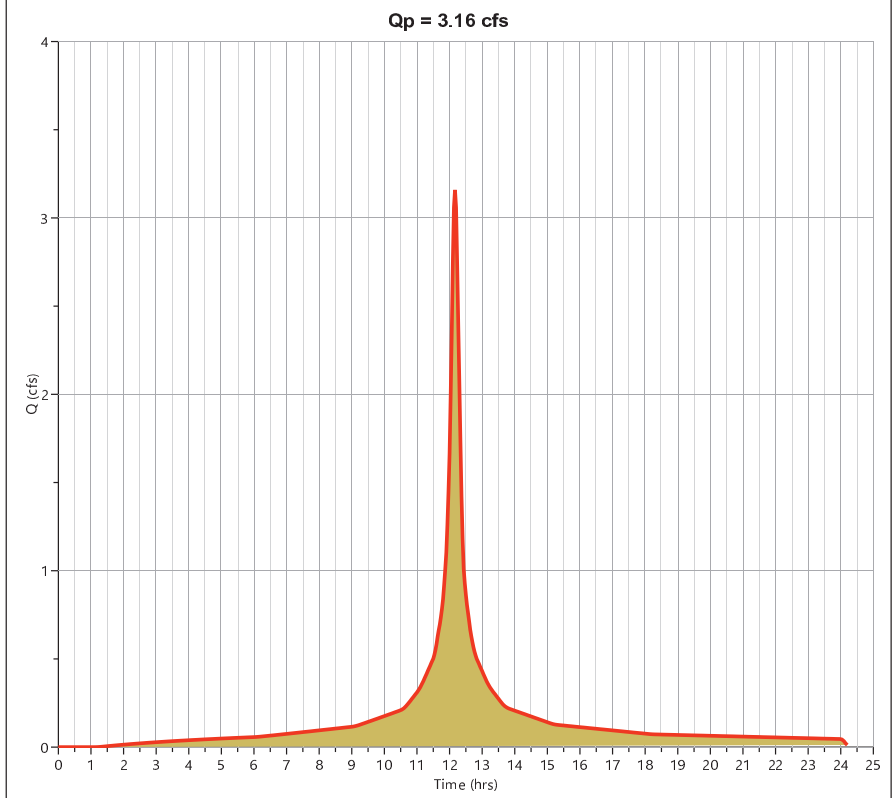
Hydrology Studio v 3.0.0.14

03-20-2020

EX-IMP-DA1

Hyd. No. 8

Hydrograph Type	= NRCS Runoff	Peak Flow	= 3.159 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 13,957 cuft
Drainage Area	= 1.2 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 3.34 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.14

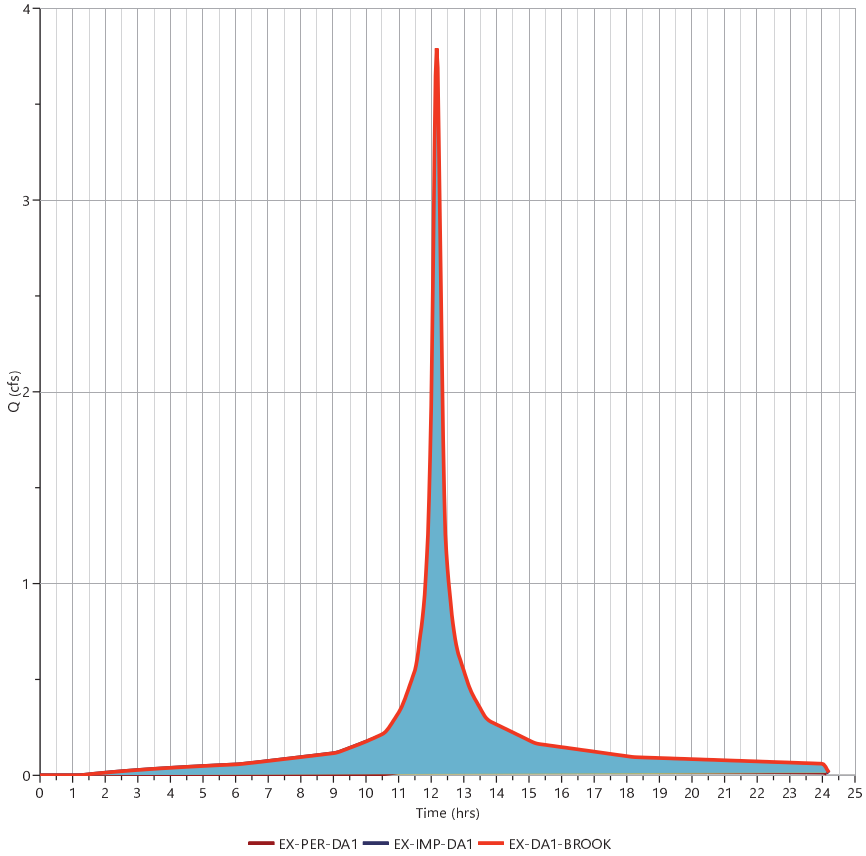
03-20-2020

EX-DA1-BROOK

Hyd. No. 9

Hydrograph Type	= Junction	Peak Flow	= 3.791 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 16,485 cuft
Inflow Hydrographs	= 7, 8	Total Contrib. Area	= 1.74 ac

Qp = 3.79 cfs



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.14

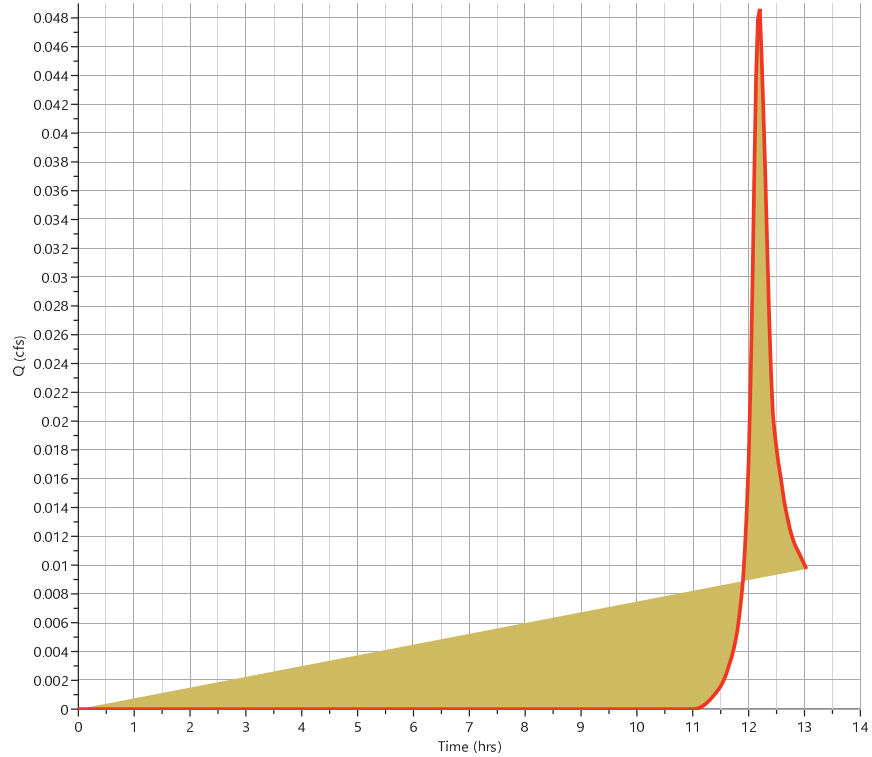
03-20-2020

EX-DA1-OFF

Hyd. No. 10

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.049 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Runoff Volume	= 205 cuft
Drainage Area	= 0.06 ac	Curve Number	= 70
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 3.34 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484

Qp = 0.05 cfs



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.14

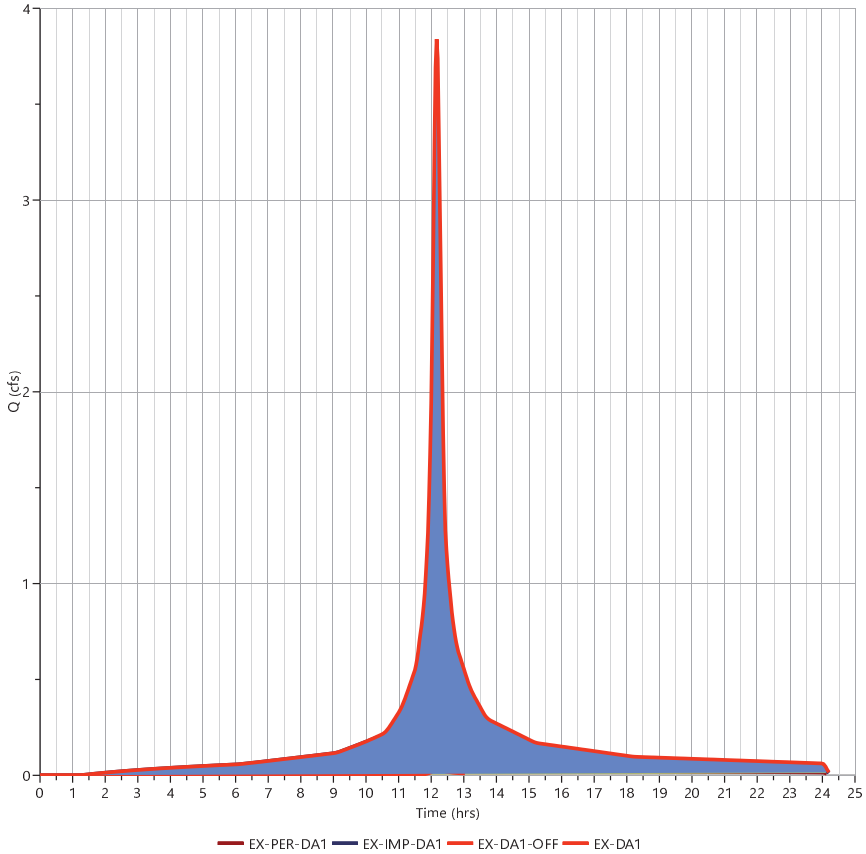
03-20-2020

EX-DA1

Hyd. No. 11

Hydrograph Type	= Junction	Peak Flow	= 3.839 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 16,689 cuft
Inflow Hydrographs	= 7, 8, 10	Total Contrib. Area	= 1.8 ac

Qp = 3.84 cfs



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.14

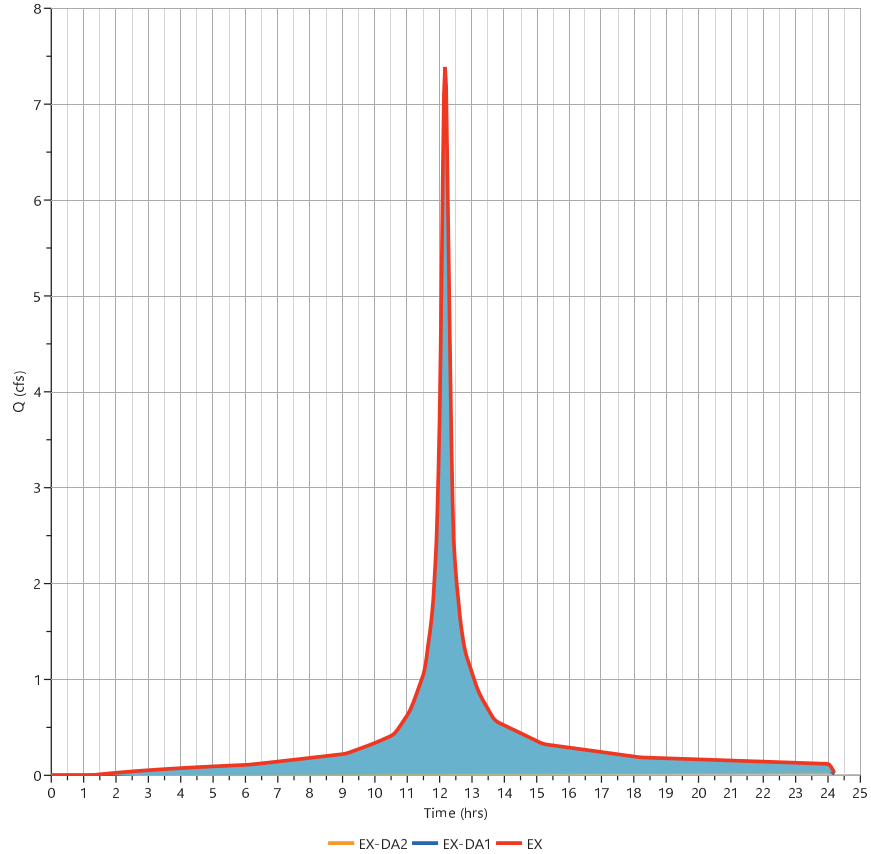
03-20-2020

EX

Hyd. No. 13

Hydrograph Type	= Junction	Peak Flow	= 7.388 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 32,101 cuft
Inflow Hydrographs	= 5, 11	Total Contrib. Area	= 3.47 ac

Qp = 7.39 cfs



Hydrograph Report

Project Name:

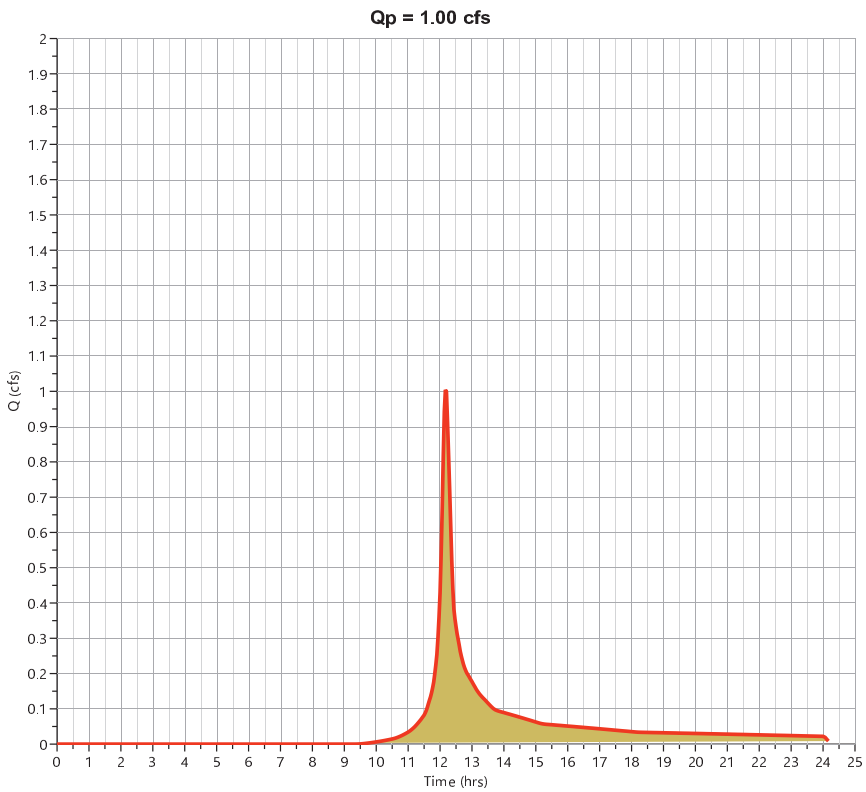
Hydrology Studio v 3.0.0.14

03-20-2020

PROP-PER- DA2

Hyd. No. 16

Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.004 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 3,969 cuft
Drainage Area	= 0.77 ac	Curve Number	= 78
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 3.34 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

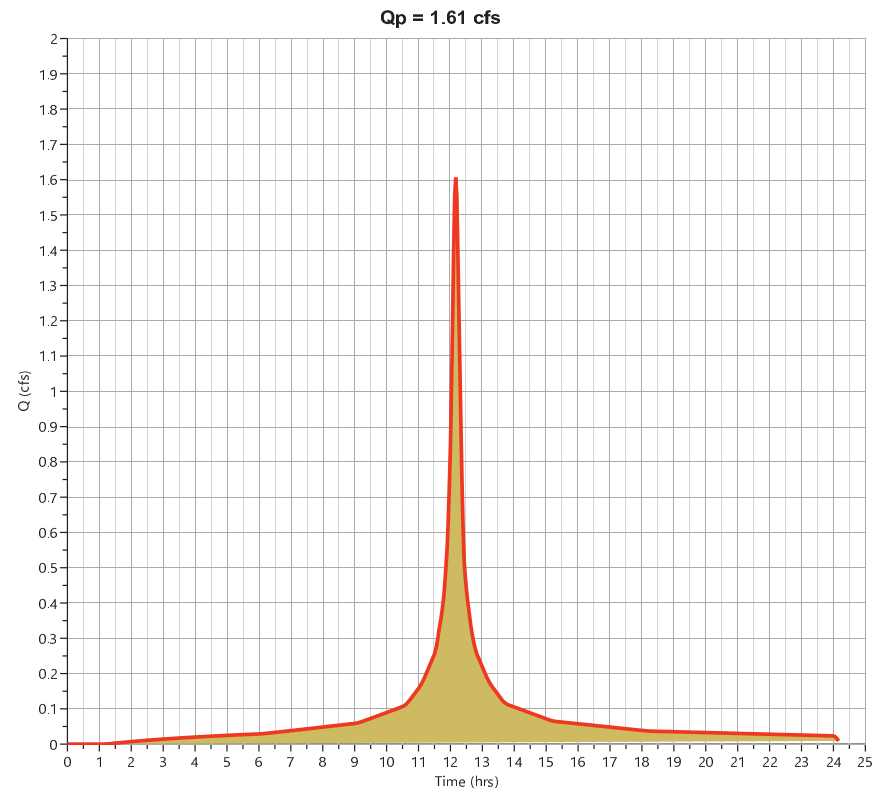
Hydrology Studio v 3.0.0.14

03-20-2020

PROP-IMP- DA2

Hyd. No. 17

Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.606 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 7,095 cuft
Drainage Area	= 0.61 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 3.34 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.14

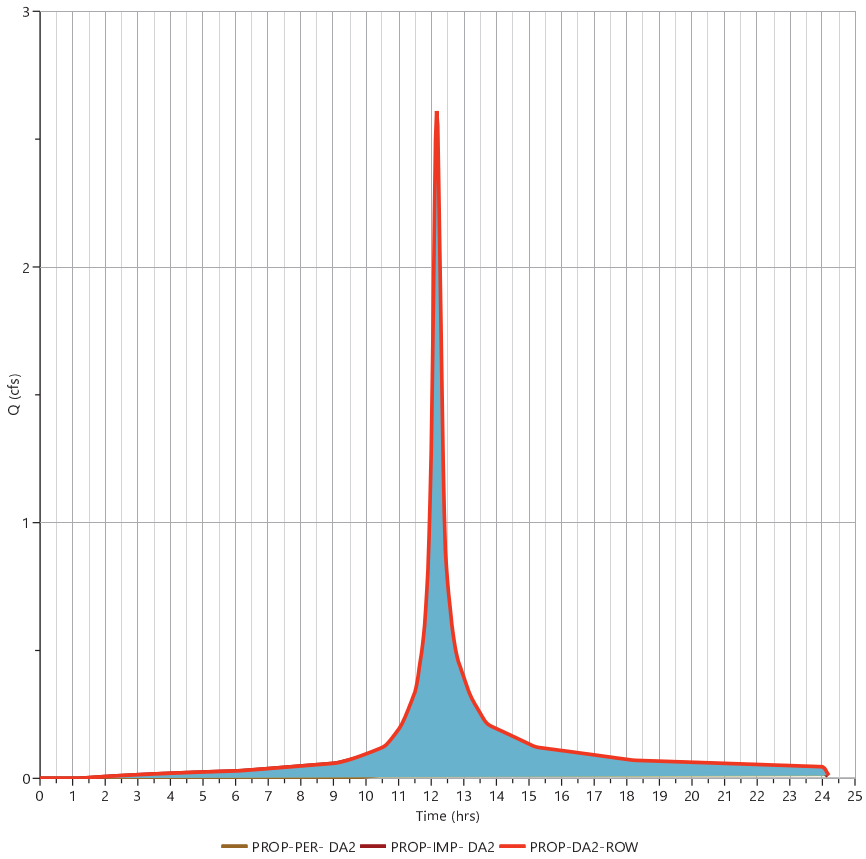
03-20-2020

PROP-DA2-ROW

Hyd. No. 18

Hydrograph Type	= Junction	Peak Flow	= 2.610 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 11,064 cuft
Inflow Hydrographs	= 16, 17	Total Contrib. Area	= 1.38 ac

Qp = 2.61 cfs



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.14

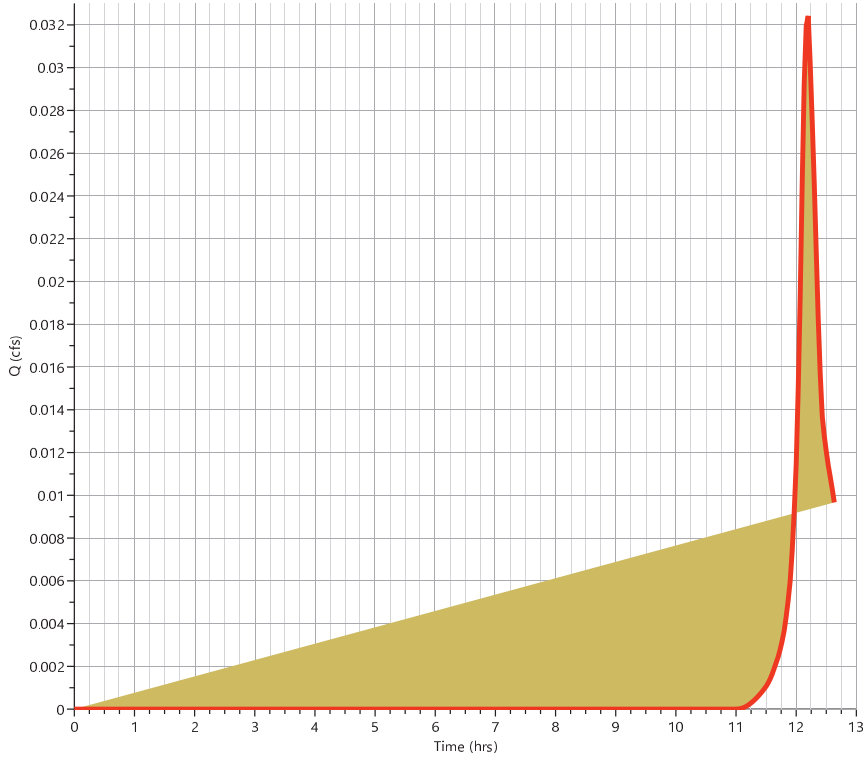
03-20-2020

PROP-DA2-OFF

Hyd. No. 19

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.032 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Runoff Volume	= 136 cuft
Drainage Area	= 0.04 ac	Curve Number	= 70
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 3.34 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484

Qp = 0.03 cfs



Hydrograph Report

Project Name:

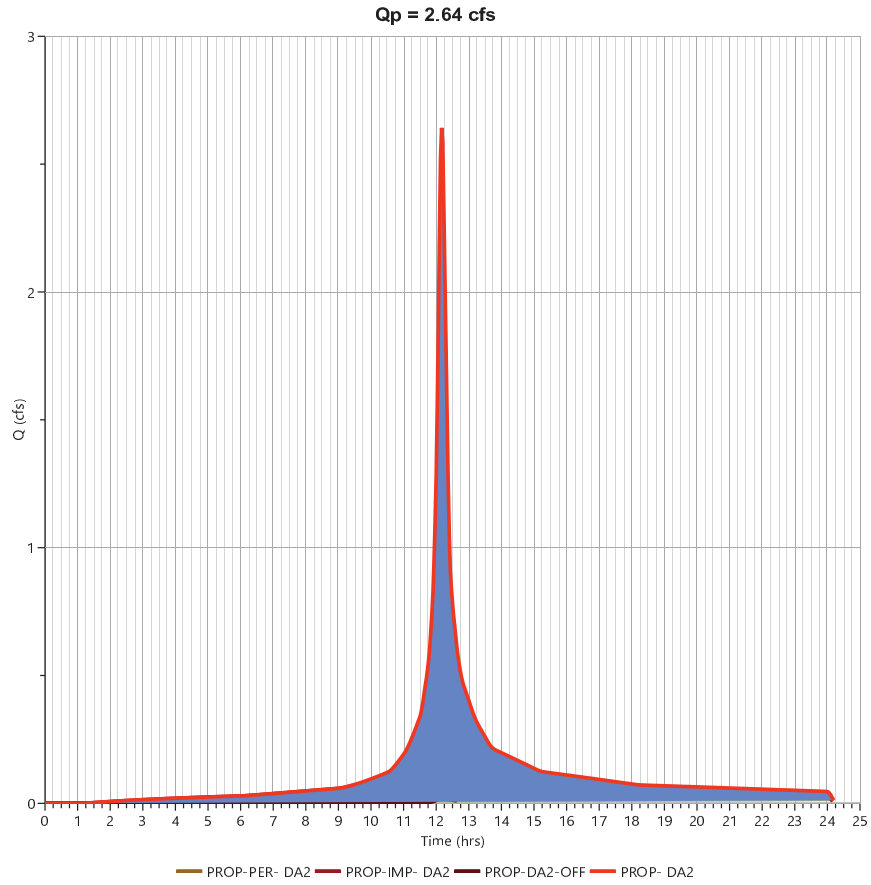
Hydrology Studio v 3.0.0.14

03-20-2020

PROP- DA2

Hyd. No. 20

Hydrograph Type	= Junction	Peak Flow	= 2.642 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 11,200 cuft
Inflow Hydrographs	= 16, 17, 19	Total Contrib. Area	= 1.42 ac



Hydrograph Report

Project Name:

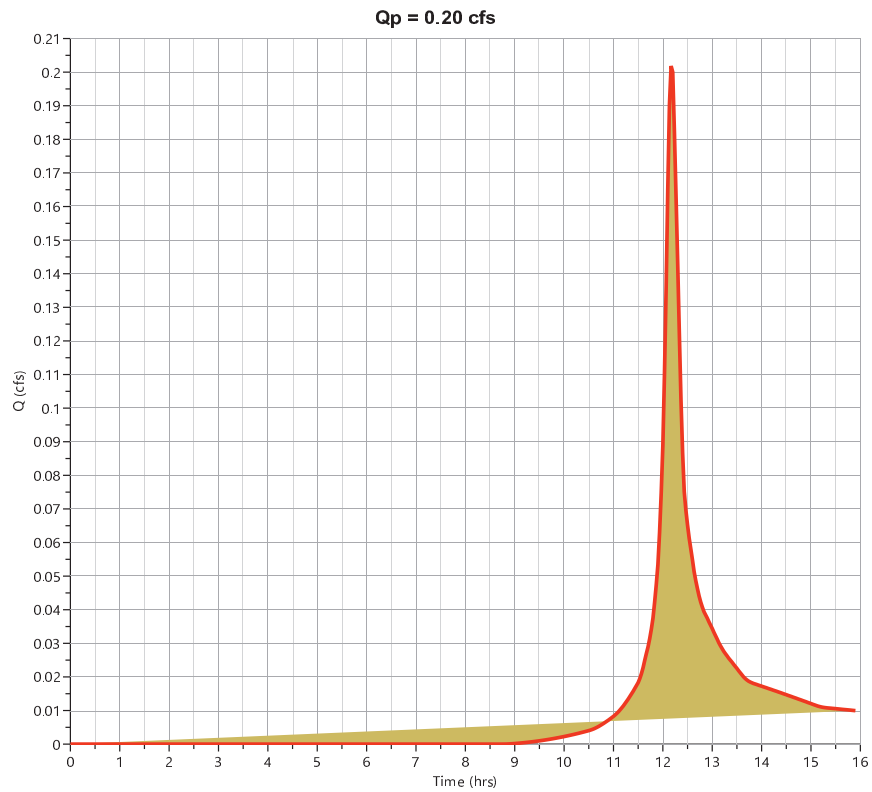
Hydrology Studio v 3.0.0.14

03-20-2020

PROP-PER- DA1A

Hyd. No. 22

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.202 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 792 cuft
Drainage Area	= 0.14 ac	Curve Number	= 80
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 3.34 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

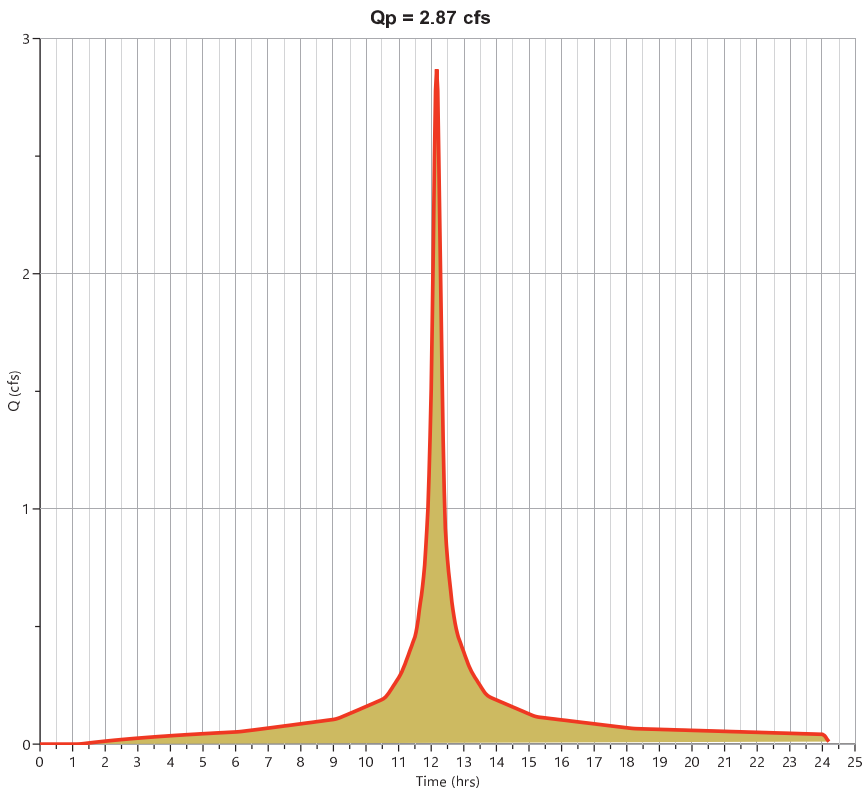
Hydrology Studio v 3.0.0.14

03-20-2020

PROP-IMP-DA1A

Hyd. No. 23

Hydrograph Type	= NRCS Runoff	Peak Flow	= 2.869 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 12,678 cuft
Drainage Area	= 1.09 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 3.34 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

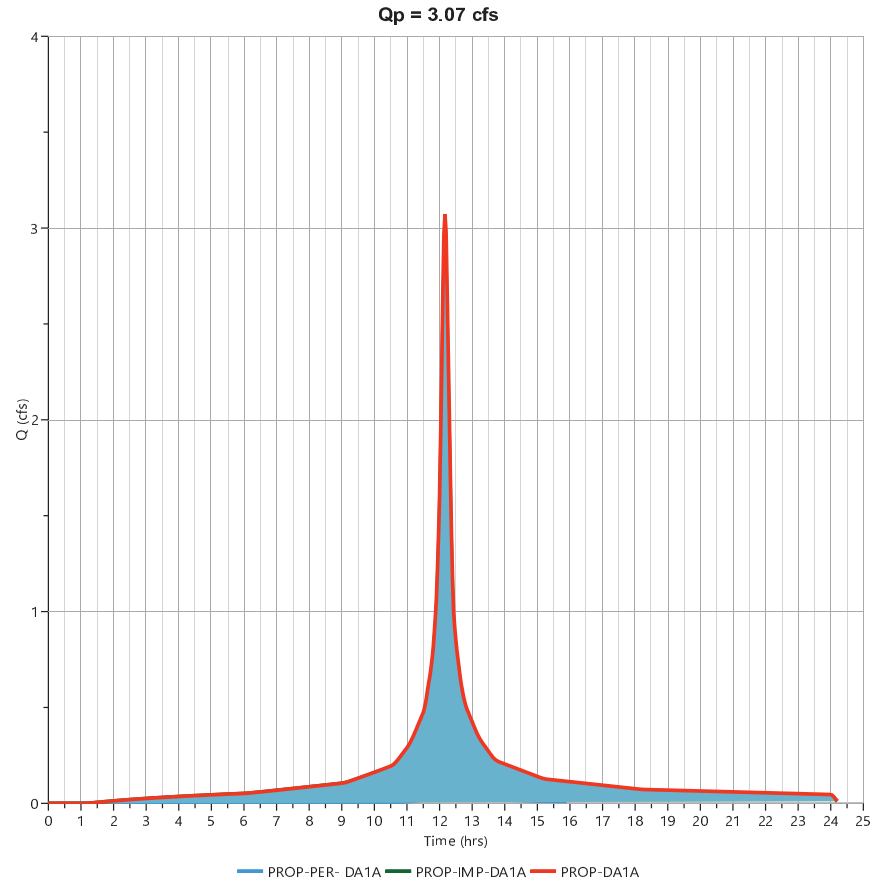
Hydrology Studio v 3.0.0.14

03-20-2020

PROP-DA1A

Hyd. No. 24

Hydrograph Type	= Junction	Peak Flow	= 3.071 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 13,469 cuft
Inflow Hydrographs	= 22, 23	Total Contrib. Area	= 1.23 ac



Hydrograph Report

Project Name:

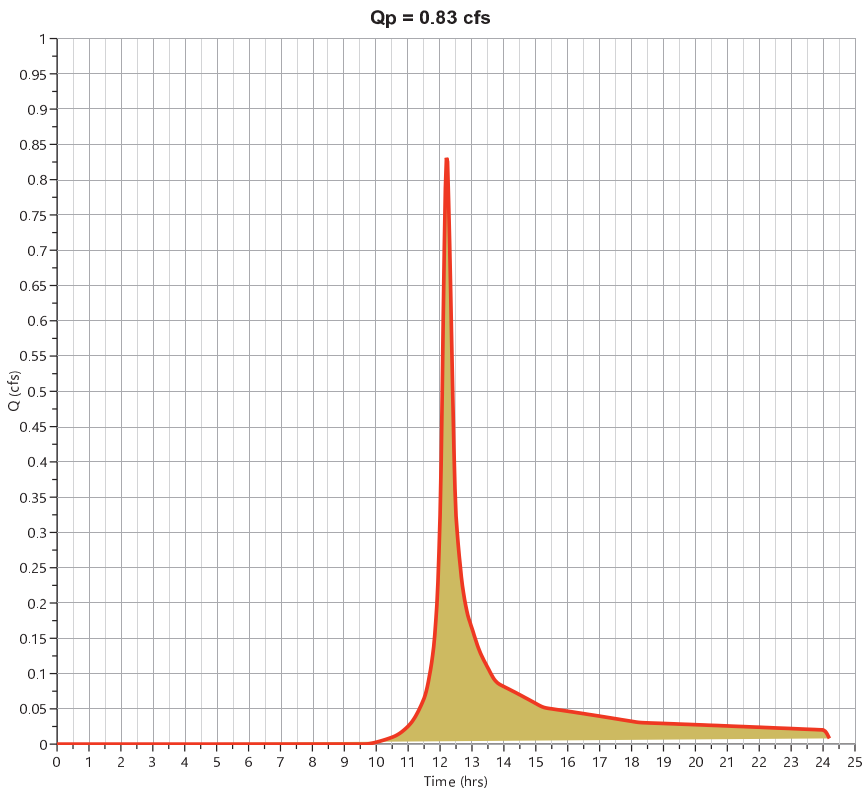
Hydrology Studio v 3.0.0.14

03-20-2020

PROP-PER-DA1B

Hyd. No. 26

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.831 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Runoff Volume	= 3,531 cuft
Drainage Area	= 0.76 ac	Curve Number	= 77
Tc Method	= User	Time of Conc. (Tc)	= 13.5 min
Total Rainfall	= 3.34 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

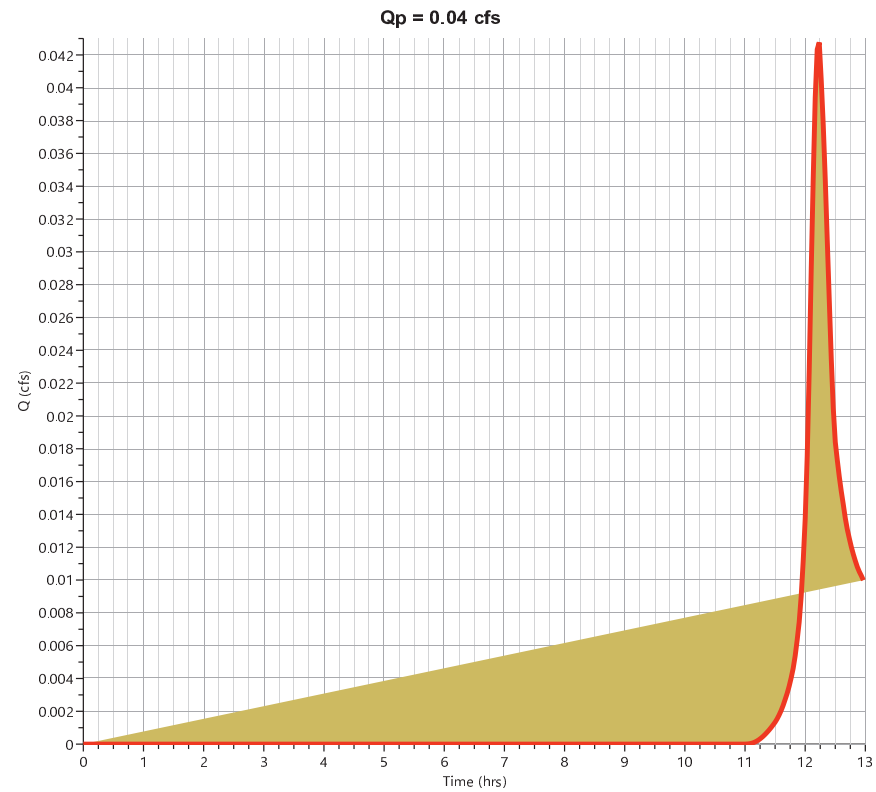
Hydrology Studio v 3.0.0.14

03-20-2020

PROP-DA1B-OFF

Hyd. No. 27

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.043 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.23 hrs
Time Interval	= 2 min	Runoff Volume	= 193 cuft
Drainage Area	= 0.06 ac	Curve Number	= 70
Tc Method	= User	Time of Conc. (Tc)	= 13.5 min
Total Rainfall	= 3.34 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.14

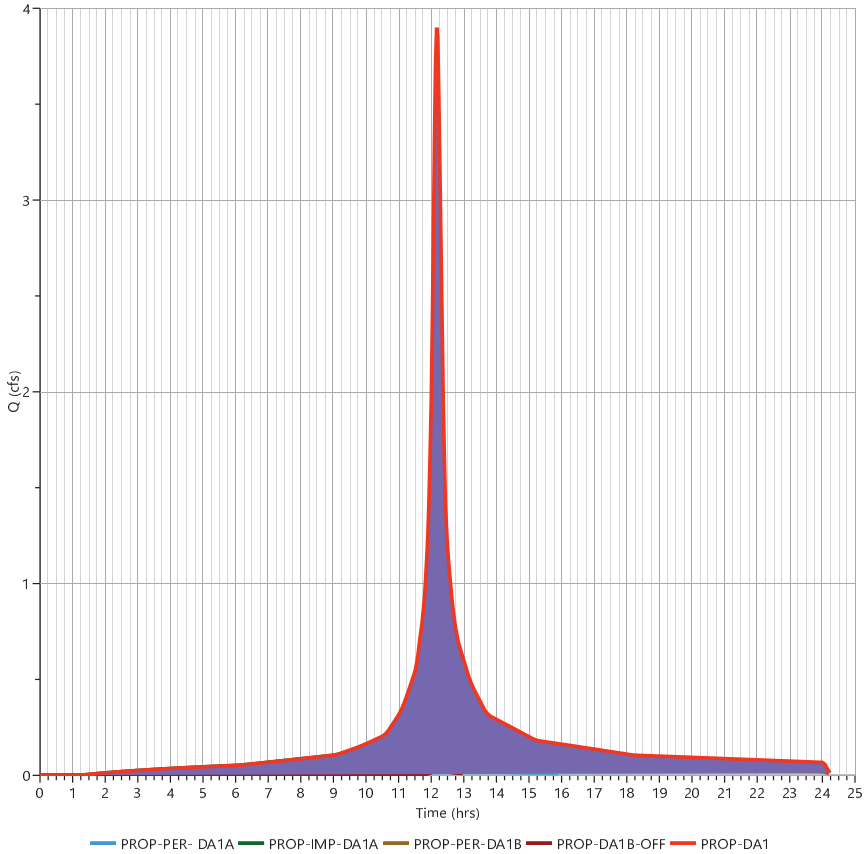
03-20-2020

PROP-DA1

Hyd. No. 28

Hydrograph Type	= Junction	Peak Flow	= 3.899 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 17,194 cuft
Inflow Hydrographs	= 22, 23, 26, 27	Total Contrib. Area	= 2.05 ac

Qp = 3.90 cfs



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.14

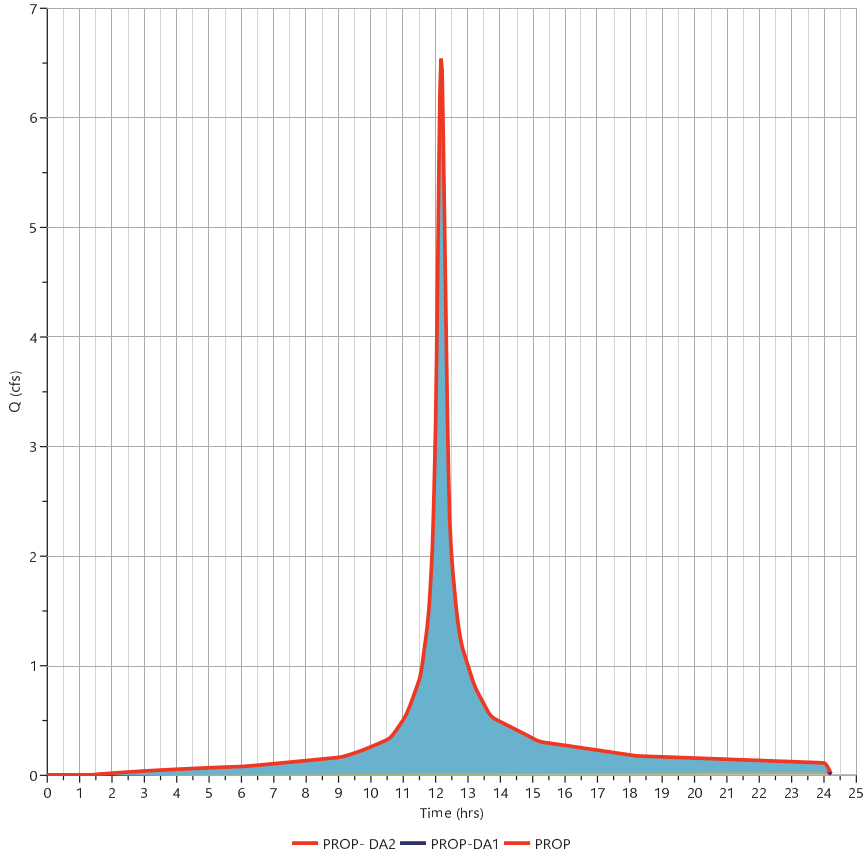
03-20-2020

PROP

Hyd. No. 30

Hydrograph Type	= Junction	Peak Flow	= 6.541 cfs
Storm Frequency	= 2-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 28,394 cuft
Inflow Hydrographs	= 20, 28	Total Contrib. Area	= 3.47 ac

Qp = 6.54 cfs



Design Storm Report

Custom Storm filename:

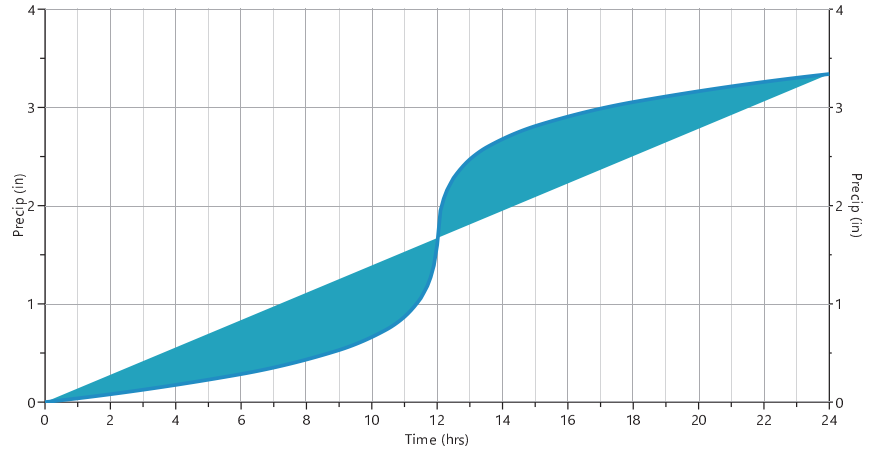
Hydrology Studio v 3.0.0.14

03-20-2020

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	3.34	0.00	0.00	5.07	6.28	0.00	8.47	

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	1.044297	11.47	1.496315	11.83	4.036951	12.20	4.036975	12.57	1.496315
11.13	1.156759	11.50	1.496375	11.87	4.036844	12.23	2.909088	12.60	1.496315
11.17	1.156753	11.53	2.015138	11.90	4.036963	12.27	2.909160	12.63	1.383901
11.20	1.156783	11.57	2.015078	11.93	6.963885	12.30	2.909112	12.67	1.383877
11.23	1.270318	11.60	2.015138	11.97	6.963921	12.33	2.120924	12.70	1.383877
11.27	1.270288	11.63	2.120888	12.00	6.963861	12.37	2.120900	12.73	1.270342
11.30	1.270318	11.67	2.120912	12.03	11.619880	12.40	2.120924	12.77	1.270270
11.33	1.383859	11.70	2.120888	12.07	11.619900	12.43	2.015162	12.80	1.270294
11.37	1.383883	11.73	2.909148	**12.10**	**11.619900**	12.47	2.015090	12.83	1.156783
11.40	1.383865	11.77	2.909148	12.13	4.036963	12.50	2.015138	12.87	1.156759
11.43	1.496327	11.80	2.909243	12.17	4.036844	12.53	1.496291	12.90	1.156735



Hydrograph 10-yr Summary

Project Name:

Hydrology Studio v 3.0.0.14

03-20-2020

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-PER-DA2	1.319	12.17	5,145	—		
2	NRCS Runoff	EX-IMP-DA2	4.425	12.17	19,901	—		
3	Junction	EX-DA2-ROW	5.744	12.17	25,047	1, 2		
4	NRCS Runoff	EX-DA2-OFF	0.079	12.17	313	—		
5	Junction	EX-DA2	5.823	12.17	25,359	1, 2, 4		
7	NRCS Runoff	EX-PER-DA1	1.344	12.17	5,242	—		
8	NRCS Runoff	EX-IMP-DA1	4.827	12.17	21,711	—		
9	Junction	EX-DA1-BROOK	6.171	12.17	26,953	7, 8		
10	NRCS Runoff	EX-DA1-OFF	0.119	12.17	469	—		
11	Junction	EX-DA1	6.290	12.17	27,422	7, 8, 10		
13	Junction	EX	12.11	12.17	52,781	5, 11		
16	NRCS Runoff	PROP-PER- DA2	2.048	12.17	7,988	—		
17	NRCS Runoff	PROP-IMP- DA2	2.454	12.17	11,036	—		
18	Junction	PROP-DA2-ROW	4.502	12.17	19,024	16, 17		
19	NRCS Runoff	PROP-DA2-OFF	0.079	12.17	313	—		
20	Junction	PROP- DA2	4.581	12.17	19,337	16, 17, 19		
22	NRCS Runoff	PROP-PER- DA1A	0.396	12.17	1,548	—		
23	NRCS Runoff	PROP-IMP-DA1A	4.385	12.17	19,721	—		
24	Junction	PROP-DA1A	4.781	12.17	21,269	22, 23		
26	NRCS Runoff	PROP-PER-DA1B	1.730	12.20	7,213	—		
27	NRCS Runoff	PROP-DA1B-OFF	0.105	12.20	443	—		
28	Junction	PROP-DA1	6.541	12.17	28,925	22, 23, 26, 27		
30	Junction	PROP	11.12	12.17	48,262	20, 28		

Hydrograph Report

Project Name:

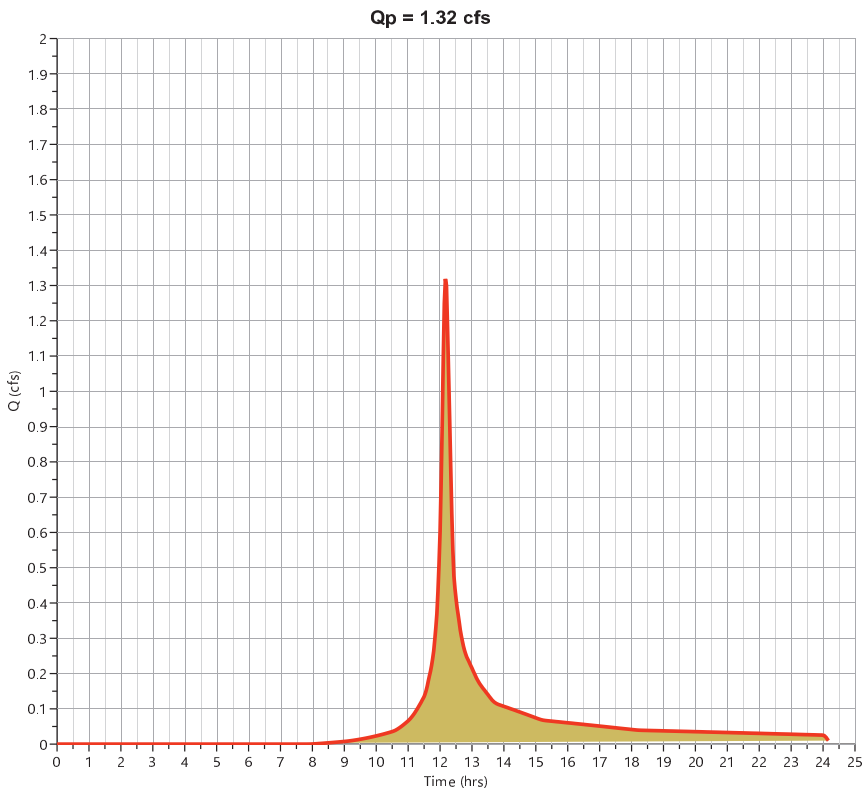
Hydrology Studio v 3.0.0.14

03-20-2020

EX-PER-DA2

Hyd. No. 1

Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.319 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 5,145 cuft
Drainage Area	= 0.53 ac	Curve Number	= 76
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 5.07 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

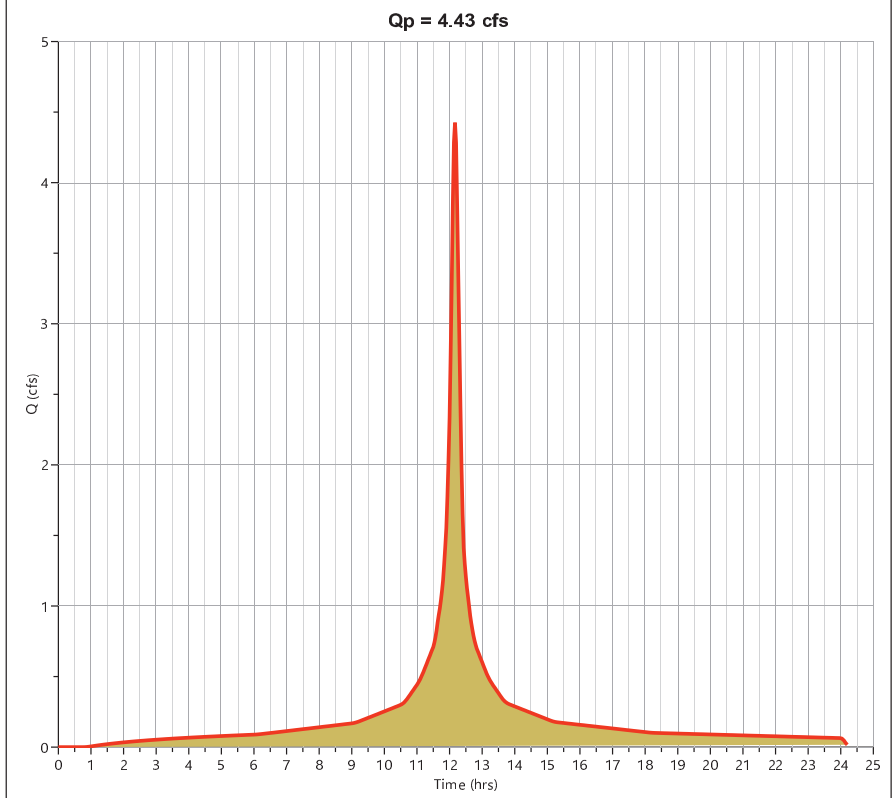
Hydrology Studio v 3.0.0.14

03-20-2020

EX-IMP-DA2

Hyd. No. 2

Hydrograph Type	= NRCS Runoff	Peak Flow	= 4.425 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 19,901 cuft
Drainage Area	= 1.1 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 5.07 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

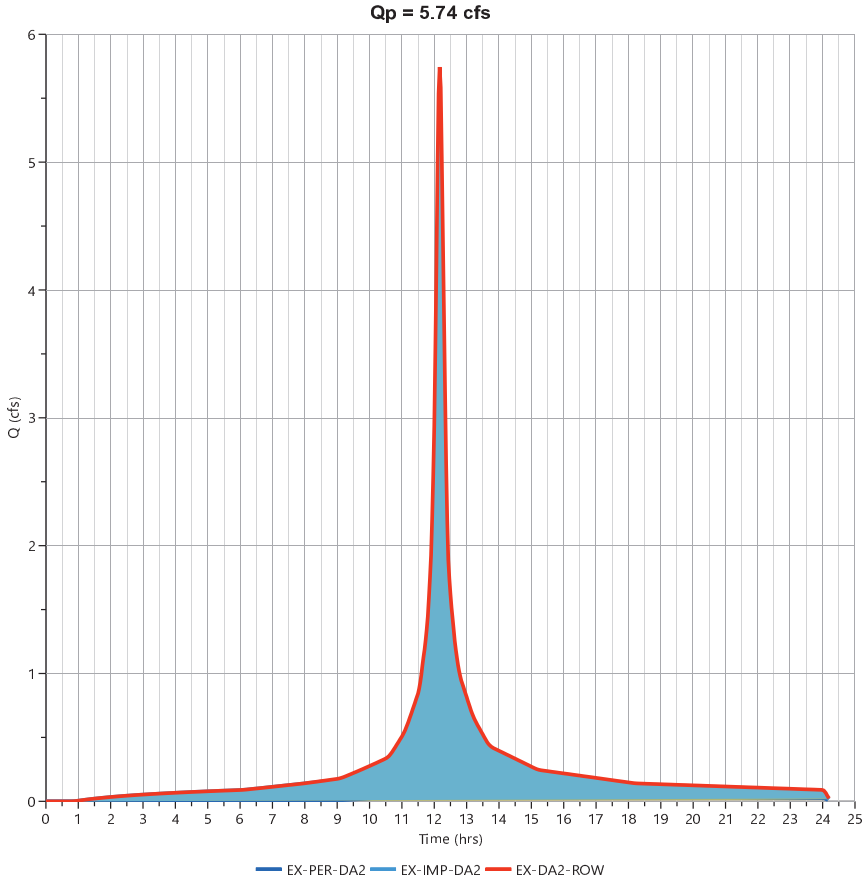
Hydrology Studio v 3.0.0.14

03-20-2020

EX-DA2-ROW

Hyd. No. 3

Hydrograph Type	= Junction	Peak Flow	= 5.744 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 25,047 cuft
Inflow Hydrographs	= 1, 2	Total Contrib. Area	= 1.63 ac



Hydrograph Report

Project Name:

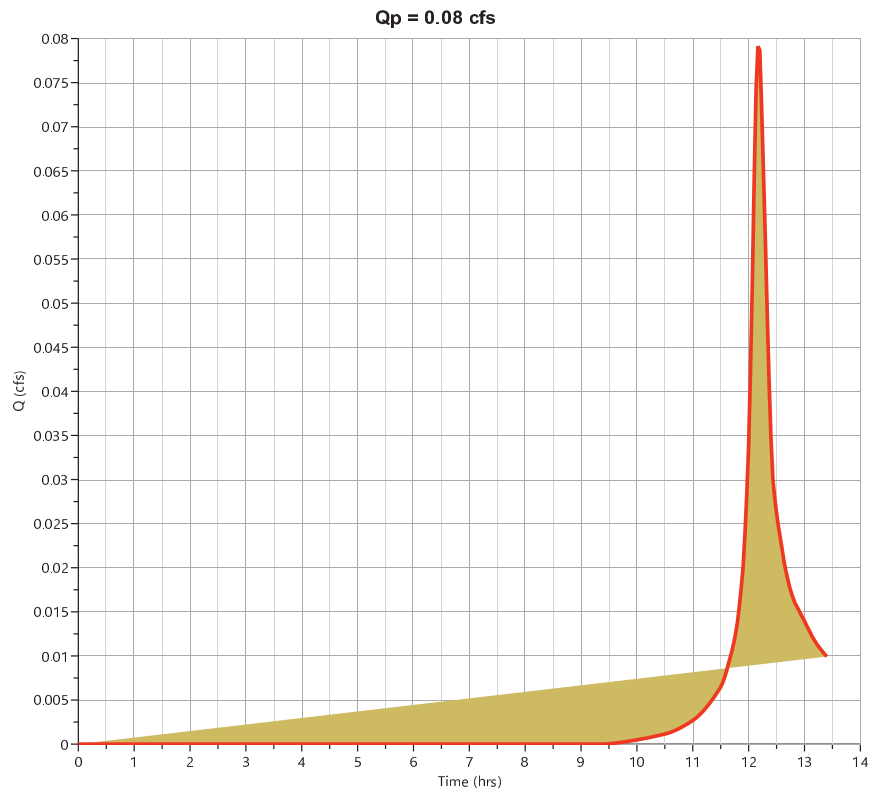
Hydrology Studio v 3.0.0.14

03-20-2020

EX-DA2-OFF

Hyd. No. 4

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.079 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 313 cuft
Drainage Area	= 0.04 ac	Curve Number	= 70
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 5.07 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

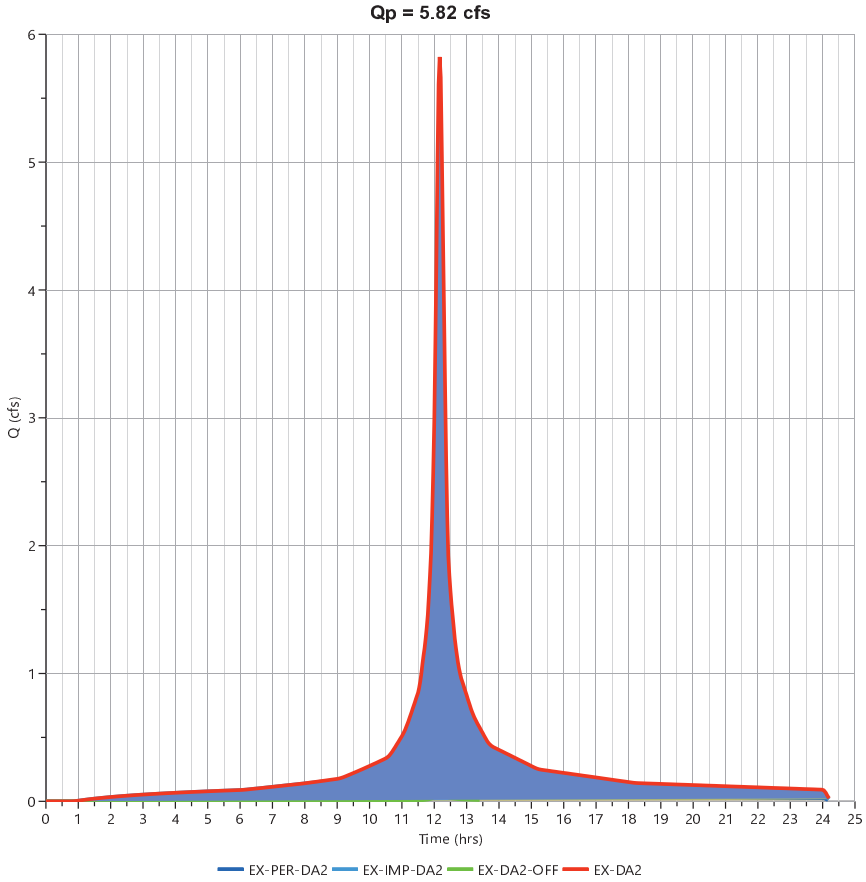
Hydrology Studio v 3.0.0.14

03-20-2020

EX-DA2

Hyd. No. 5

Hydrograph Type	= Junction	Peak Flow	= 5.823 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 25,359 cuft
Inflow Hydrographs	= 1, 2, 4	Total Contrib. Area	= 1.67 ac



Hydrograph Report

Project Name:

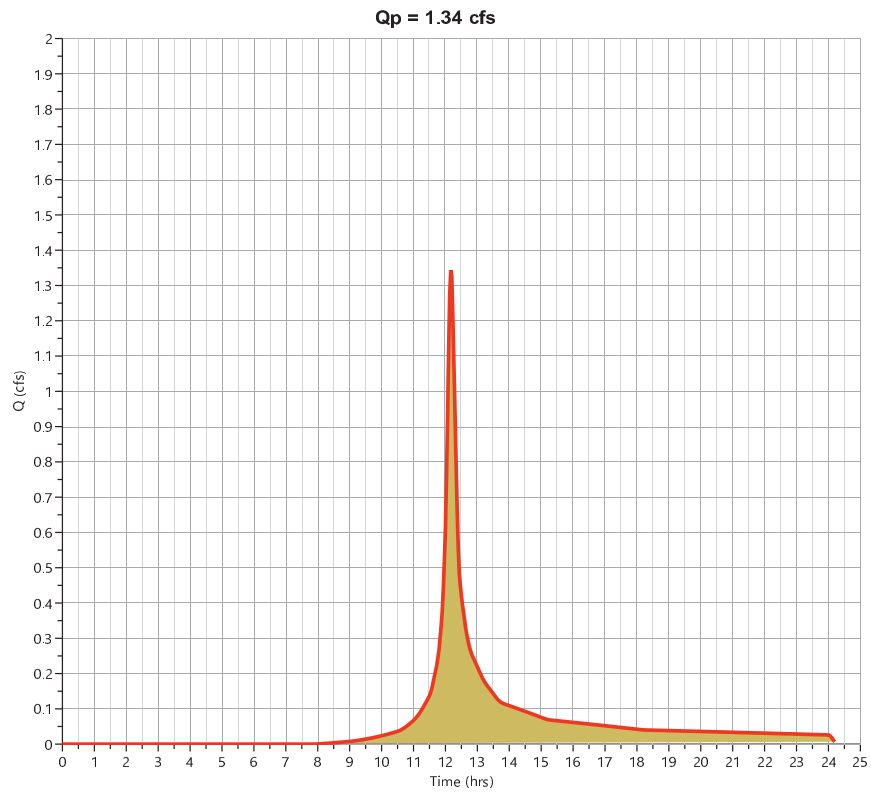
Hydrology Studio v 3.0.0.14

03-20-2020

EX-PER-DA1

Hyd. No. 7

Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.344 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 5,242 cuft
Drainage Area	= 0.54 ac	Curve Number	= 76
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 5.07 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

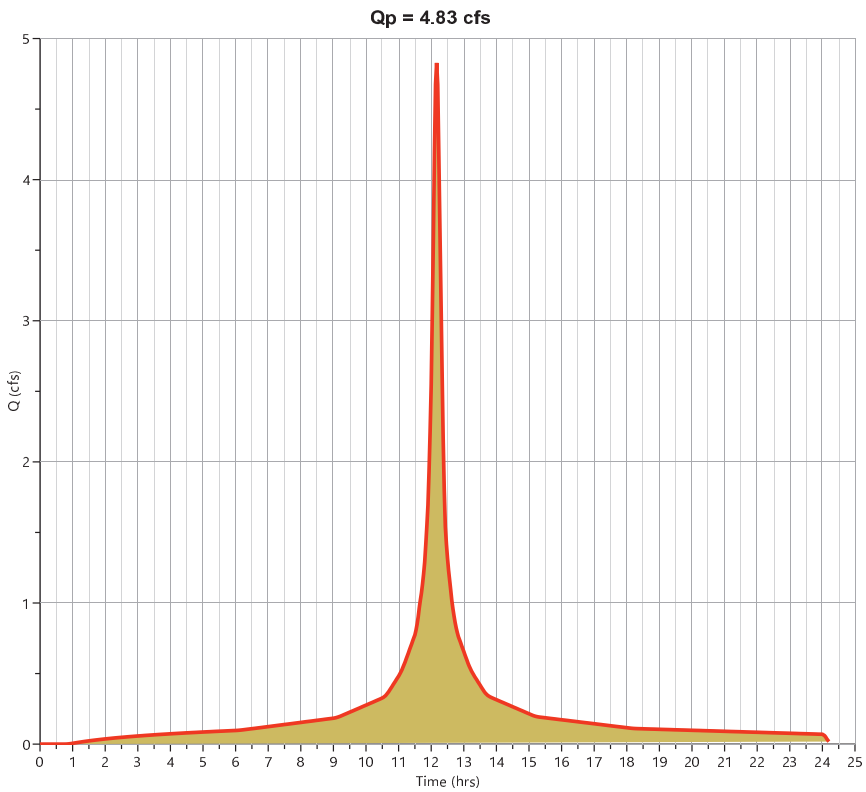
Hydrology Studio v 3.0.0.14

03-20-2020

EX-IMP-DA1

Hyd. No. 8

Hydrograph Type	= NRCS Runoff	Peak Flow	= 4.827 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 21,711 cuft
Drainage Area	= 1.2 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 5.07 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

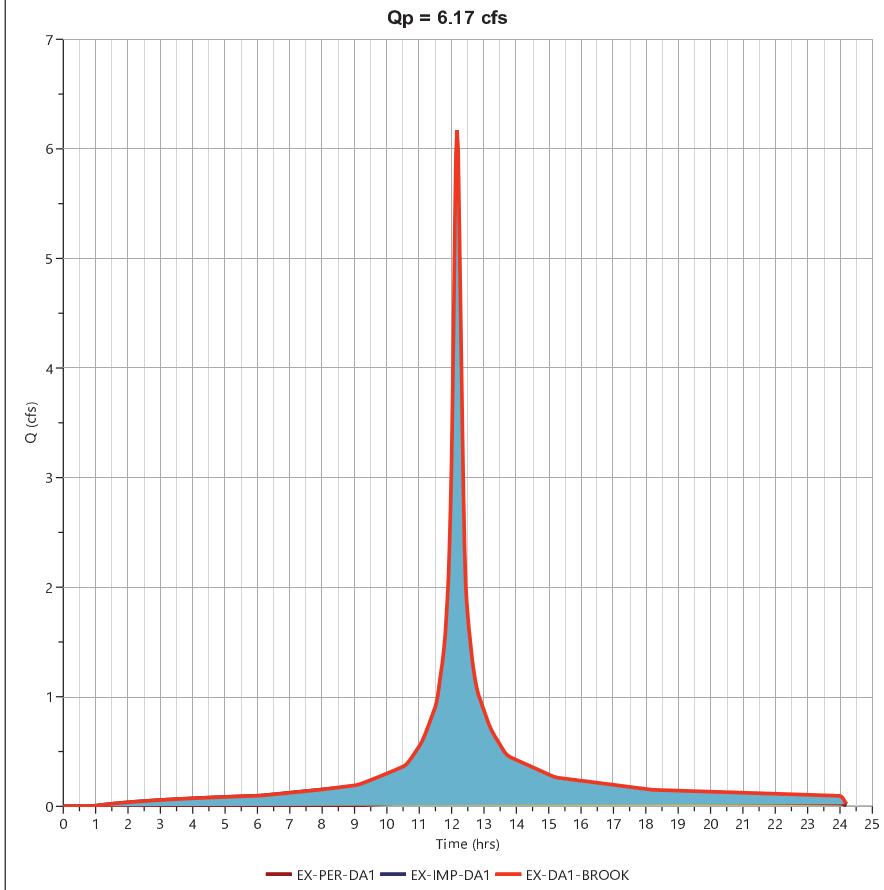
Hydrology Studio v 3.0.0.14

03-20-2020

EX-DA1-BROOK

Hyd. No. 9

Hydrograph Type	= Junction	Peak Flow	= 6.171 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 26,953 cuft
Inflow Hydrographs	= 7, 8	Total Contrib. Area	= 1.74 ac



Hydrograph Report

Project Name:

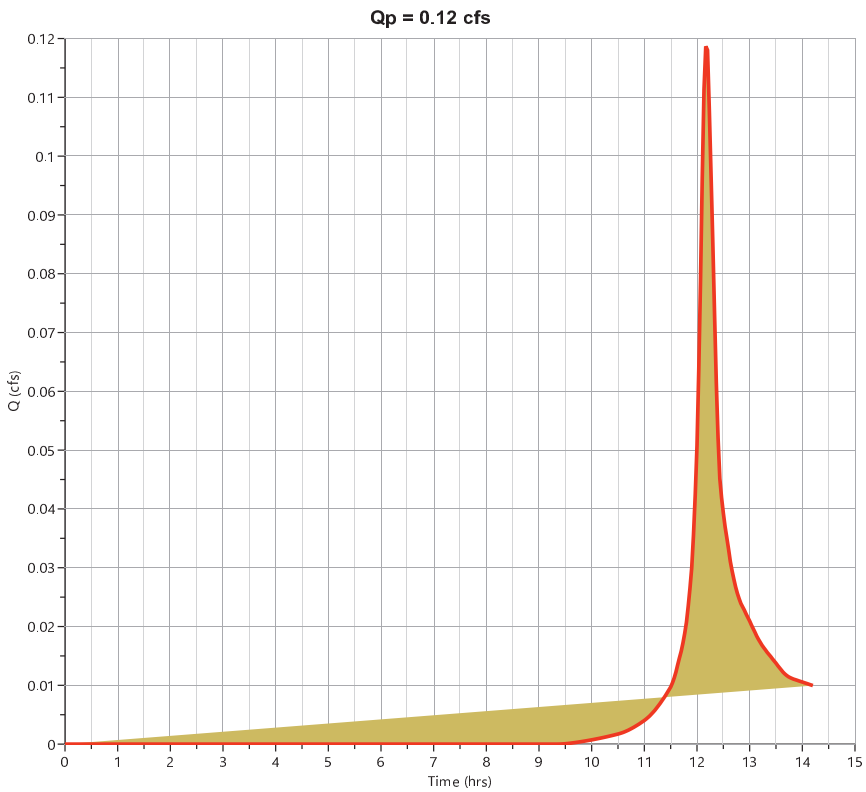
Hydrology Studio v 3.0.0.14

03-20-2020

EX-DA1-OFF

Hyd. No. 10

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.119 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 469 cuft
Drainage Area	= 0.06 ac	Curve Number	= 70
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 5.07 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

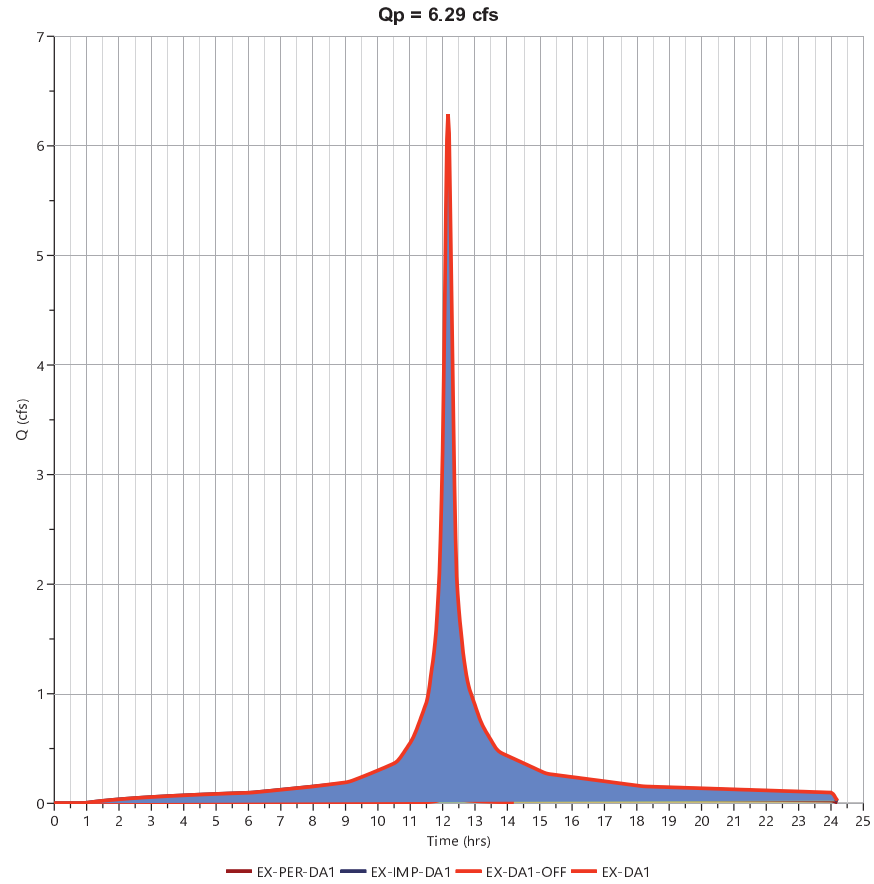
Hydrology Studio v 3.0.0.14

03-20-2020

EX-DA1

Hyd. No. 11

Hydrograph Type	= Junction	Peak Flow	= 6.290 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 27,422 cuft
Inflow Hydrographs	= 7, 8, 10	Total Contrib. Area	= 1.8 ac



Hydrograph Report

Project Name:

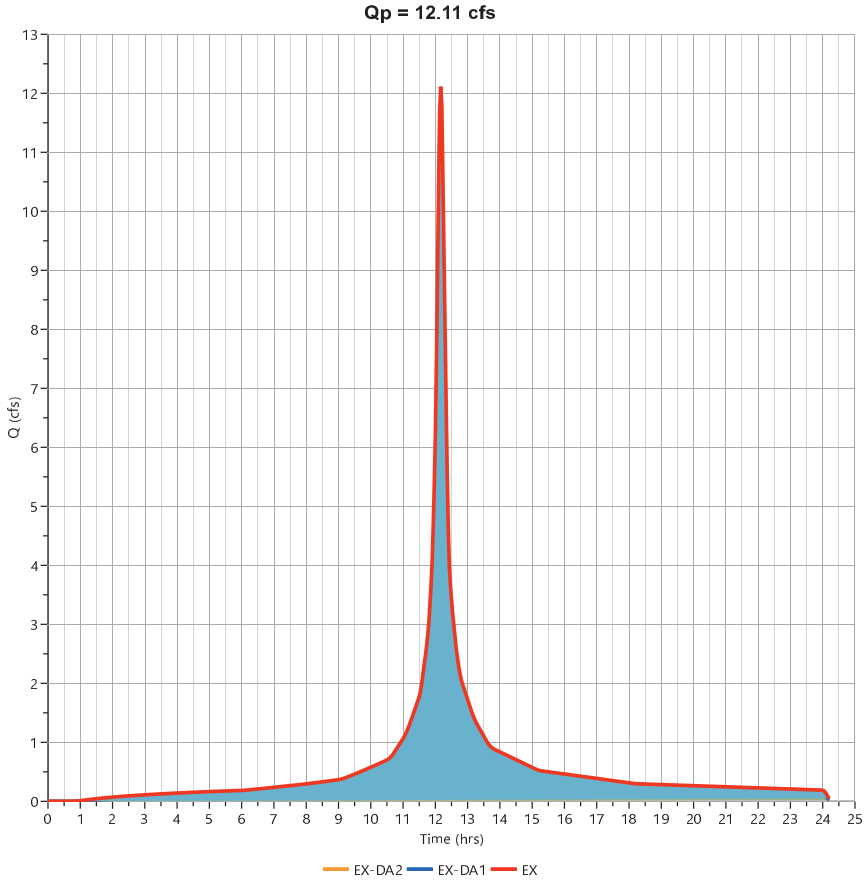
Hydrology Studio v 3.0.0.14

03-20-2020

EX

Hyd. No. 13

Hydrograph Type	= Junction	Peak Flow	= 12.11 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 52,781 cuft
Inflow Hydrographs	= 5, 11	Total Contrib. Area	= 3.47 ac



Hydrograph Report

Project Name:

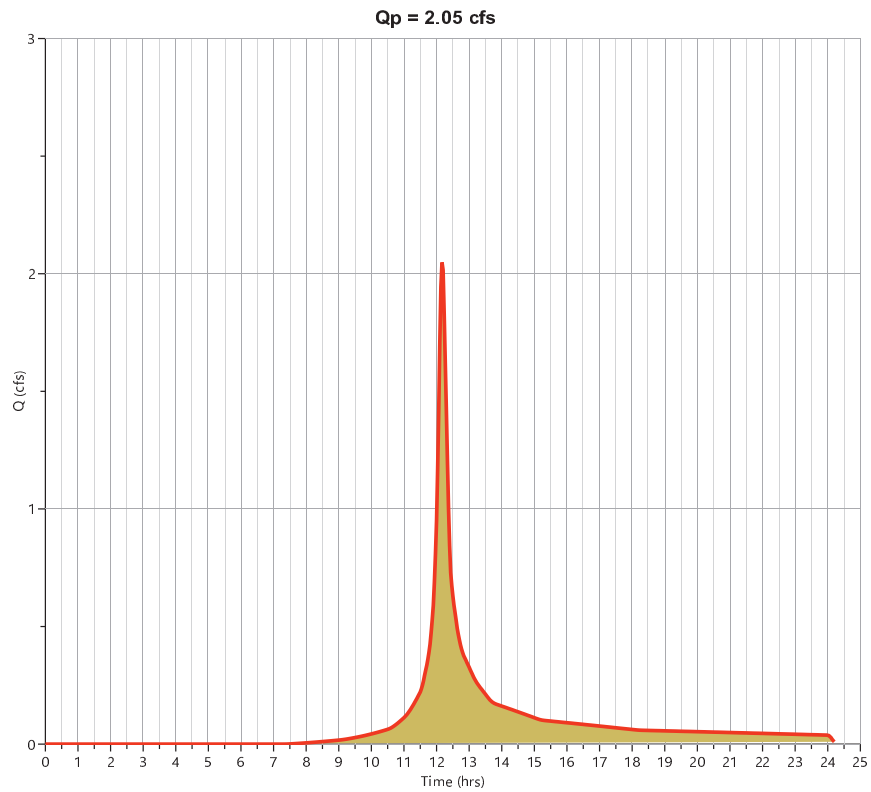
Hydrology Studio v 3.0.0.14

03-20-2020

PROP-PER- DA2

Hyd. No. 16

Hydrograph Type	= NRCS Runoff	Peak Flow	= 2.048 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 7,988 cuft
Drainage Area	= 0.77 ac	Curve Number	= 78
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 5.07 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

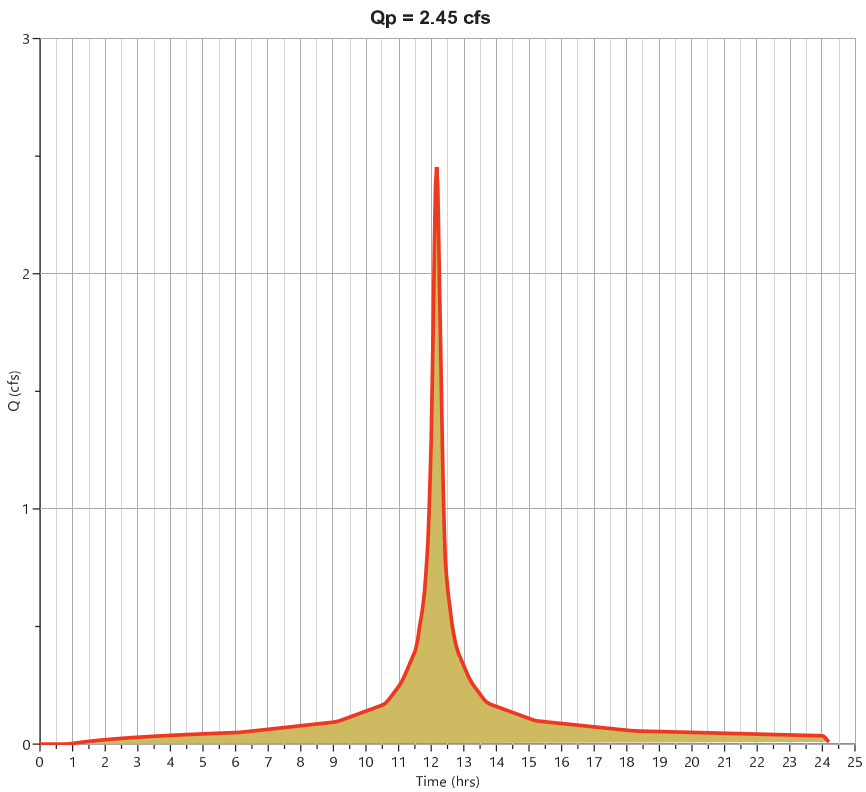
Hydrology Studio v 3.0.0.14

03-20-2020

PROP-IMP- DA2

Hyd. No. 17

Hydrograph Type	= NRCS Runoff	Peak Flow	= 2.454 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 11,036 cuft
Drainage Area	= 0.61 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 5.07 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

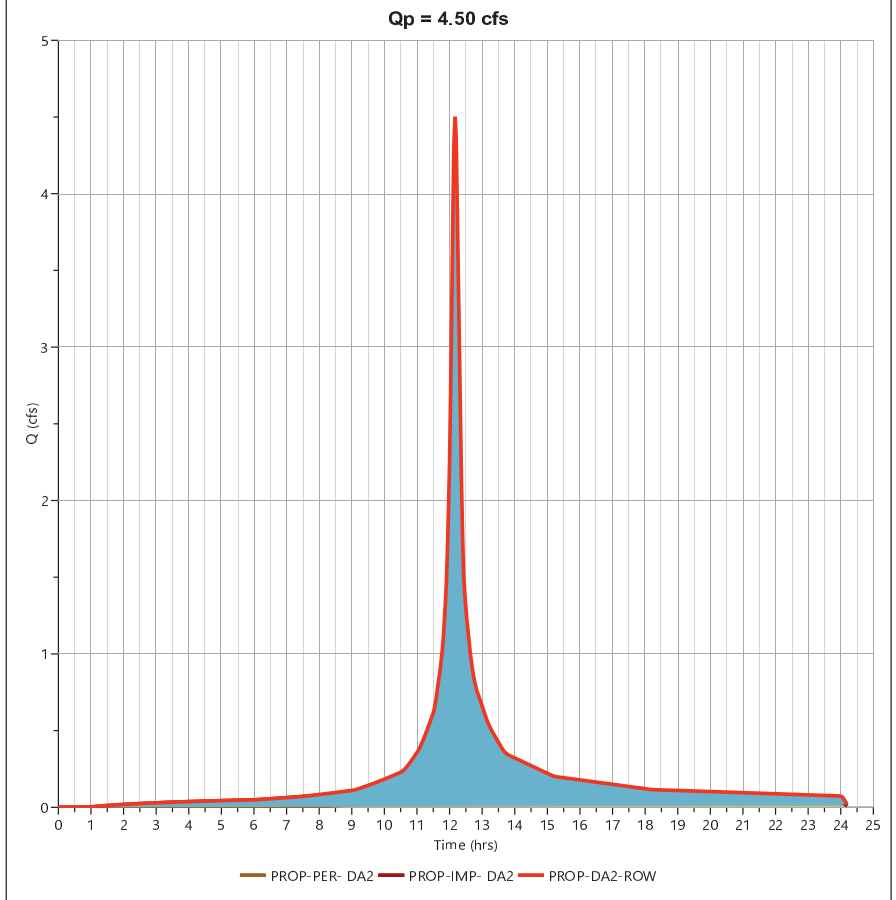
Hydrology Studio v 3.0.0.14

03-20-2020

PROP-DA2-ROW

Hyd. No. 18

Hydrograph Type	= Junction	Peak Flow	= 4.502 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 19,024 cuft
Inflow Hydrographs	= 16, 17	Total Contrib. Area	= 1.38 ac



Hydrograph Report

Project Name:

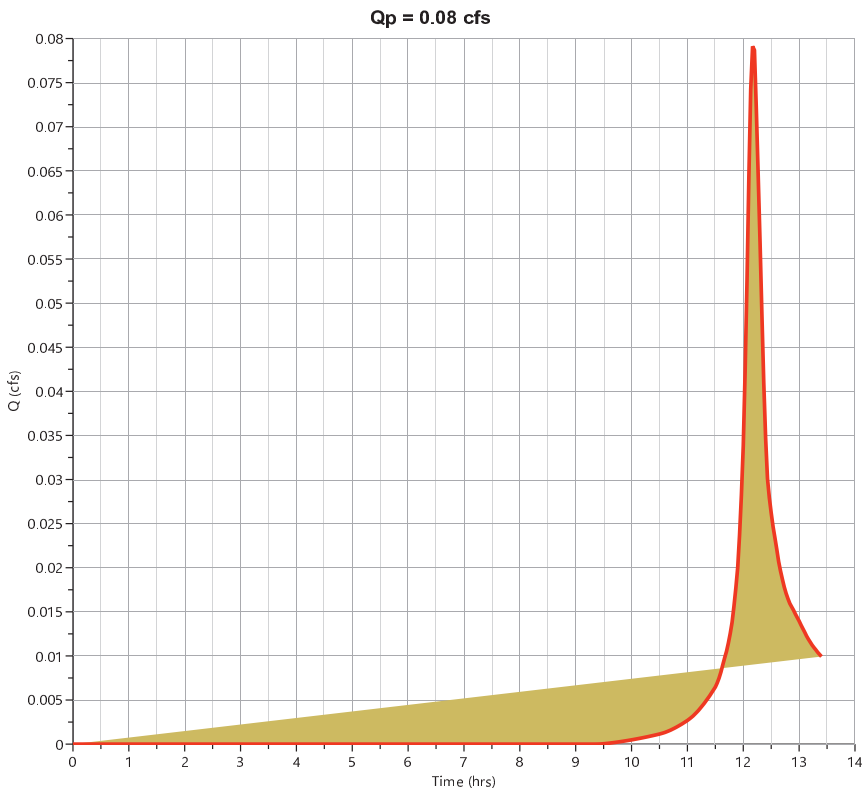
Hydrology Studio v 3.0.0.14

03-20-2020

PROP-DA2-OFF

Hyd. No. 19

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.079 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 313 cuft
Drainage Area	= 0.04 ac	Curve Number	= 70
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 5.07 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

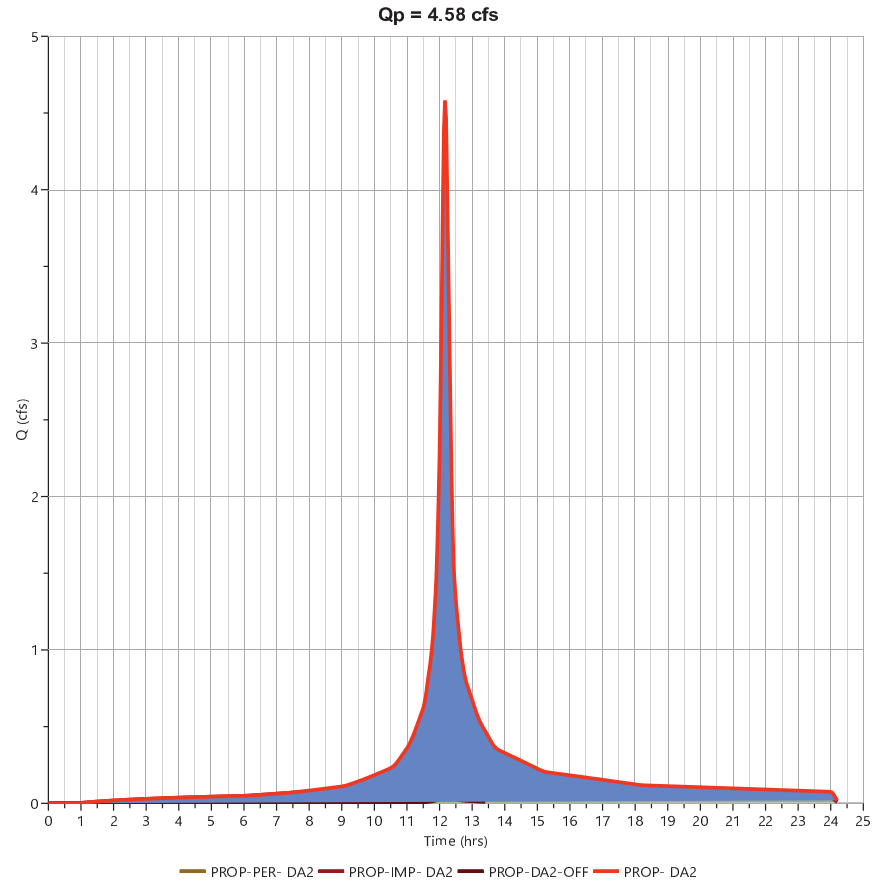
Hydrology Studio v 3.0.0.14

03-20-2020

PROP- DA2

Hyd. No. 20

Hydrograph Type	= Junction	Peak Flow	= 4.581 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 19,337 cuft
Inflow Hydrographs	= 16, 17, 19	Total Contrib. Area	= 1.42 ac



Hydrograph Report

Project Name:

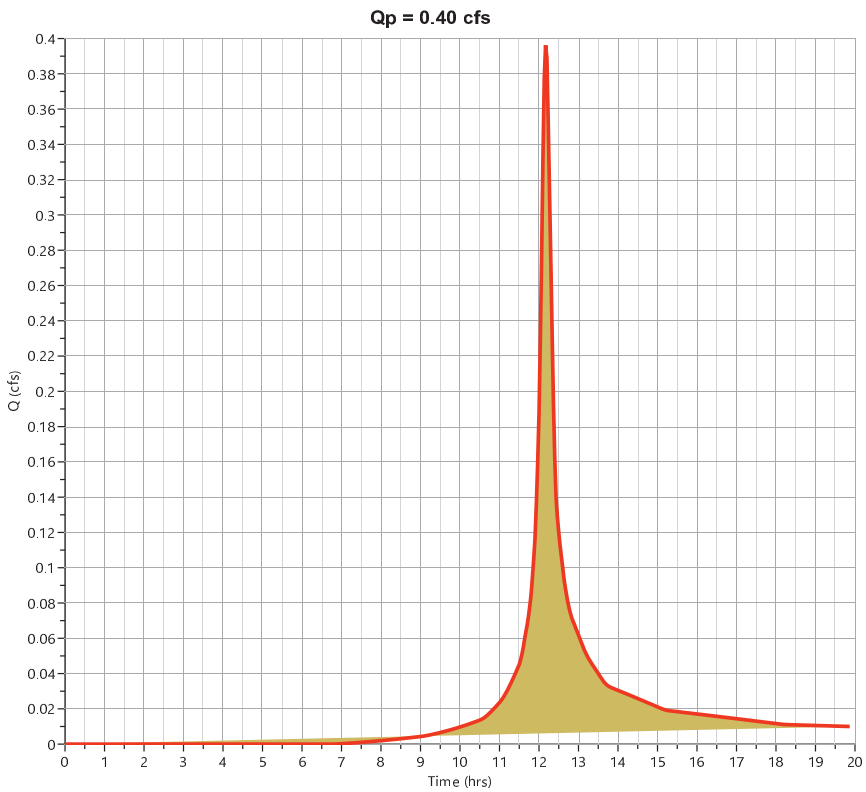
Hydrology Studio v 3.0.0.14

03-20-2020

PROP-PER- DA1A

Hyd. No. 22

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.396 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 1,548 cuft
Drainage Area	= 0.14 ac	Curve Number	= 80
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 5.07 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

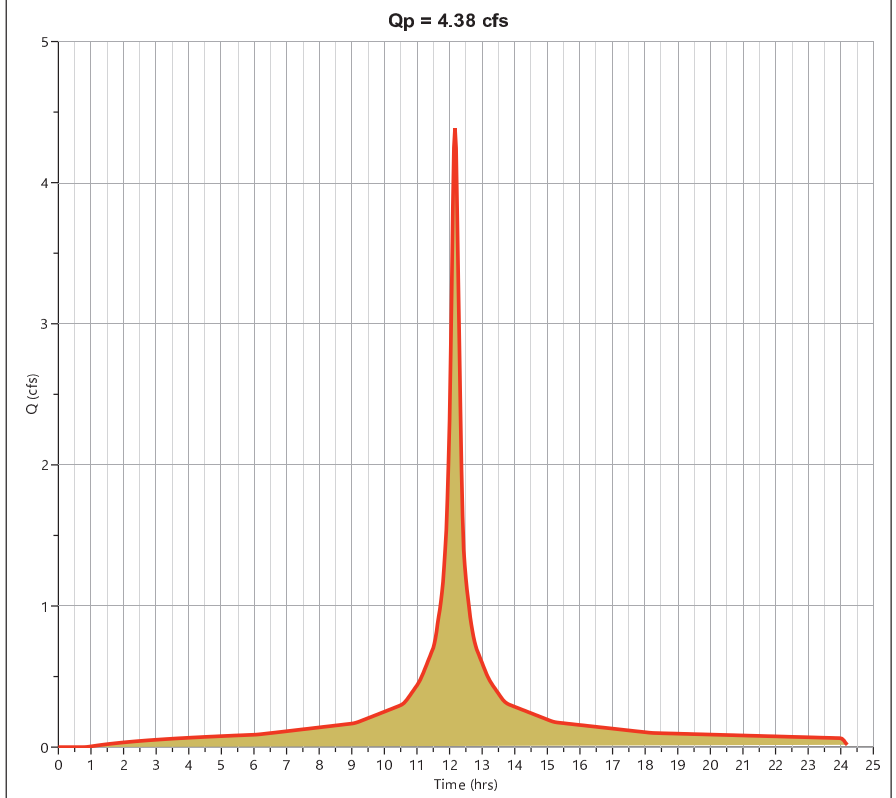
Hydrology Studio v 3.0.0.14

03-20-2020

PROP-IMP-DA1A

Hyd. No. 23

Hydrograph Type	= NRCS Runoff	Peak Flow	= 4.385 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 19,721 cuft
Drainage Area	= 1.09 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 5.07 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

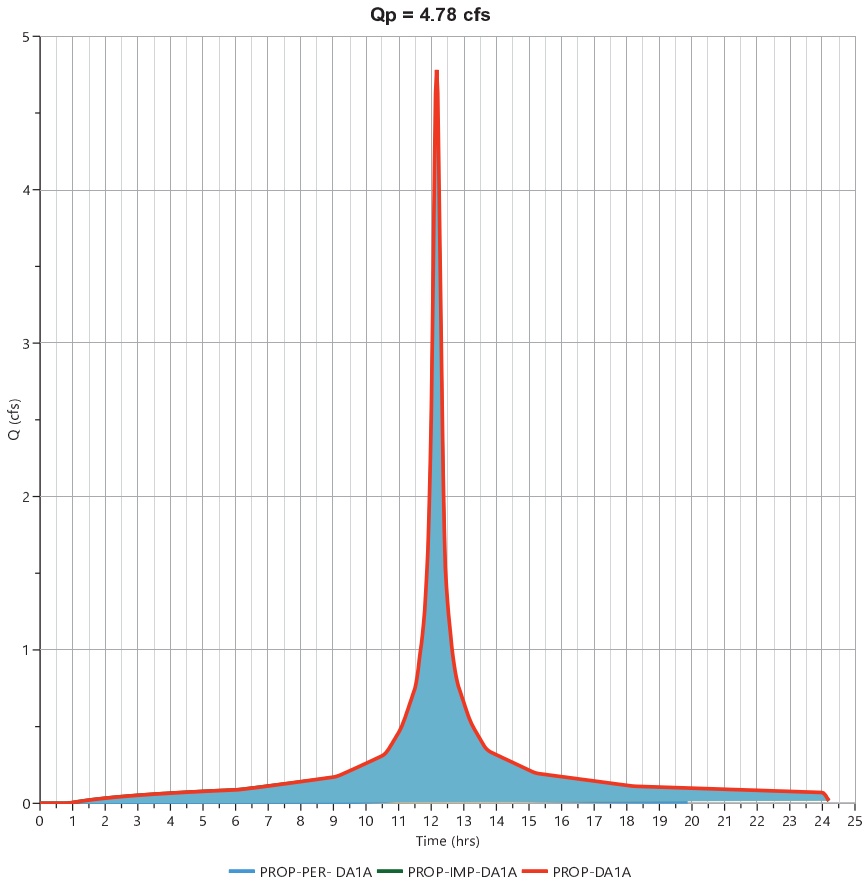
Hydrology Studio v 3.0.0.14

03-20-2020

PROP-DA1A

Hyd. No. 24

Hydrograph Type	= Junction	Peak Flow	= 4.781 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 21,269 cuft
Inflow Hydrographs	= 22, 23	Total Contrib. Area	= 1.23 ac



Hydrograph Report

Project Name:

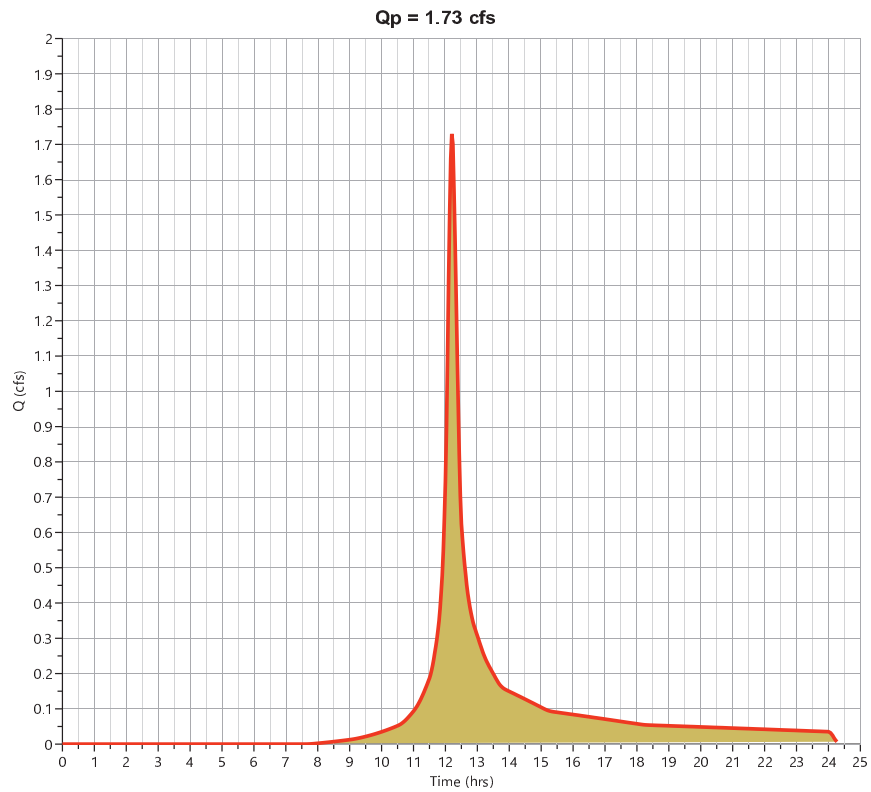
Hydrology Studio v 3.0.0.14

03-20-2020

PROP-PER-DA1B

Hyd. No. 26

Hydrograph Type	= NRCS Runoff	Peak Flow	= 1.730 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Runoff Volume	= 7,213 cuft
Drainage Area	= 0.76 ac	Curve Number	= 77
Tc Method	= User	Time of Conc. (Tc)	= 13.5 min
Total Rainfall	= 5.07 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

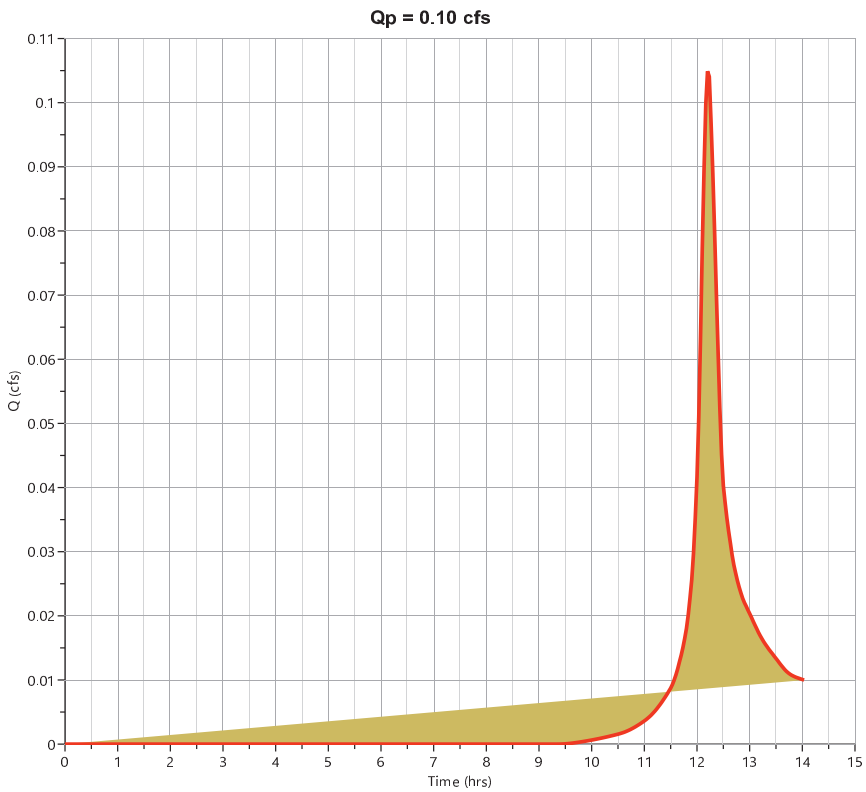
Hydrology Studio v 3.0.0.14

03-20-2020

PROP-DA1B-OFF

Hyd. No. 27

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.105 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Runoff Volume	= 443 cuft
Drainage Area	= 0.06 ac	Curve Number	= 70
Tc Method	= User	Time of Conc. (Tc)	= 13.5 min
Total Rainfall	= 5.07 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

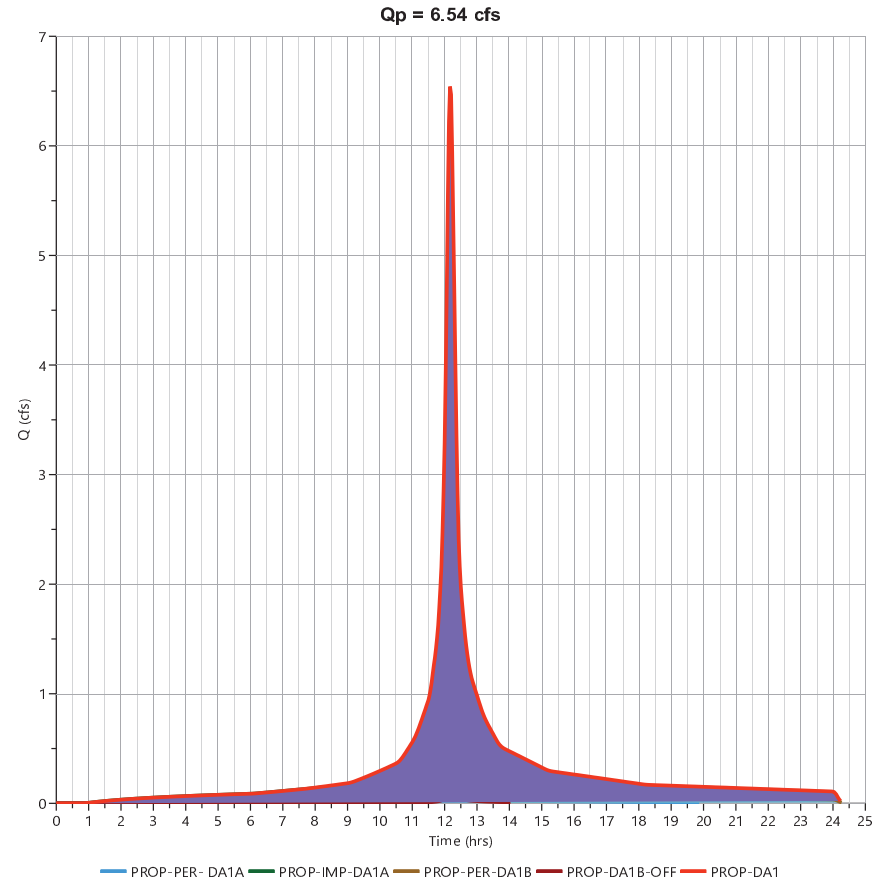
Hydrology Studio v 3.0.0.14

03-20-2020

PROP-DA1

Hyd. No. 28

Hydrograph Type	= Junction	Peak Flow	= 6.541 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 28,925 cuft
Inflow Hydrographs	= 22, 23, 26, 27	Total Contrib. Area	= 2.05 ac



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.14

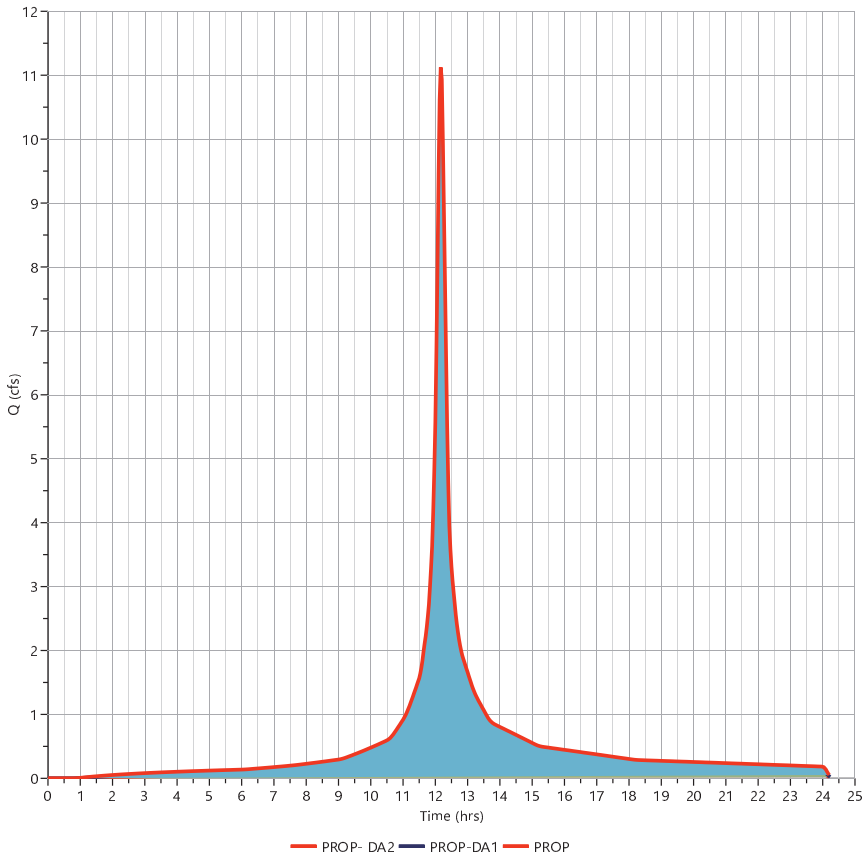
03-20-2020

PROP

Hyd. No. 30

Hydrograph Type	= Junction	Peak Flow	= 11.12 cfs
Storm Frequency	= 10-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 48,262 cuft
Inflow Hydrographs	= 20, 28	Total Contrib. Area	= 3.47 ac

Qp = 11.12 cfs



Design Storm Report

Custom Storm filename:

Hydrology Studio v 3.0.0.14

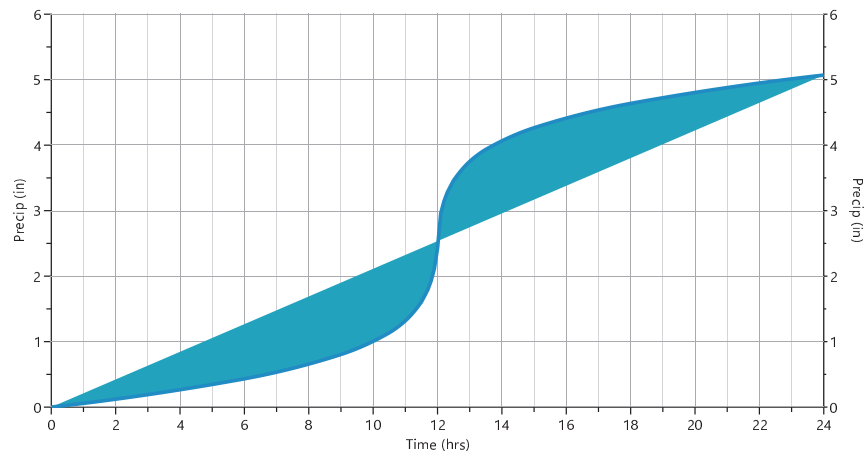
03-20-2020

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	3.34	0.00	0.00	5.07	6.28	0.00	8.47	

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)
11.10	1.585209	11.47	2.271366	11.83	6.127942	12.20	6.127977	12.57	2.271366
11.13	1.755917	11.50	2.271438	11.87	6.127799	12.23	4.415917	12.60	2.271342
11.17	1.755917	11.53	3.058910	11.90	6.127954	12.27	4.415989	12.63	2.100682
11.20	1.755953	11.57	3.058815	11.93	10.570930	12.30	4.415941	12.67	2.100706
11.23	1.928294	11.60	3.058898	11.97	10.570980	12.33	3.219461	12.70	2.100682
11.27	1.928258	11.63	3.219438	12.00	10.570880	12.37	3.219461	12.73	1.928329
11.30	1.928294	11.67	3.219461	12.03	17.638590	12.40	3.219485	12.77	1.928210
11.33	2.100646	11.70	3.219438	12.07	17.638590	12.43	3.058934	12.80	1.928282
11.37	2.100682	11.73	4.415989	**12.10**	**17.638590**	12.47	3.058839	12.83	1.755929
11.40	2.100646	11.77	4.415977	12.13	6.127954	12.50	3.058934	12.87	1.755929
11.43	2.271378	11.80	4.416120	12.17	6.127787	12.53	2.271295	12.90	1.755881



Hydrograph 100-yr Summary

Project Name:

Hydrology Studio v 3.0.0.14

03-20-2020

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-PER-DA2	2.810	12.17	11,086	---		
2	NRCS Runoff	EX-IMP-DA2	7.419	12.17	33,889	---		
3	Junction	EX-DA2-ROW	10.23	12.17	44,975	1, 2		
4	NRCS Runoff	EX-DA2-OFF	0.187	12.17	729	---		
5	Junction	EX-DA2	10.42	12.17	45,704	1, 2, 4		
7	NRCS Runoff	EX-PER-DA1	2.863	12.17	11,295	---		
8	NRCS Runoff	EX-IMP-DA1	8.093	12.17	36,970	---		
9	Junction	EX-DA1-BROOK	10.96	12.17	48,265	7, 8		
10	NRCS Runoff	EX-DA1-OFF	0.280	12.17	1,094	---		
11	Junction	EX-DA1	11.24	12.17	49,359	7, 8, 10		
13	Junction	EX	21.65	12.17	95,062	5, 11		
16	NRCS Runoff	PROP-PER- DA2	4.233	12.17	16,796	---		
17	NRCS Runoff	PROP-IMP- DA2	4.114	12.17	18,793	---		
18	Junction	PROP-DA2-ROW	8.347	12.17	35,589	16, 17		
19	NRCS Runoff	PROP-DA2-OFF	0.187	12.17	729	---		
20	Junction	PROP- DA2	8.534	12.17	36,318	16, 17, 19		
22	NRCS Runoff	PROP-PER- DA1A	0.796	12.17	3,180	---		
23	NRCS Runoff	PROP-IMP-DA1A	7.351	12.17	33,581	---		
24	Junction	PROP-DA1A	8.147	12.17	36,761	22, 23		
26	NRCS Runoff	PROP-PER-DA1B	3.631	12.20	15,351	---		
27	NRCS Runoff	PROP-DA1B-OFF	0.248	12.20	1,034	---		
28	Junction	PROP-DA1	11.90	12.17	53,146	22, 23, 26, 27		
30	Junction	PROP	20.43	12.17	89,465	20, 28		

Hydrograph Report

Project Name:

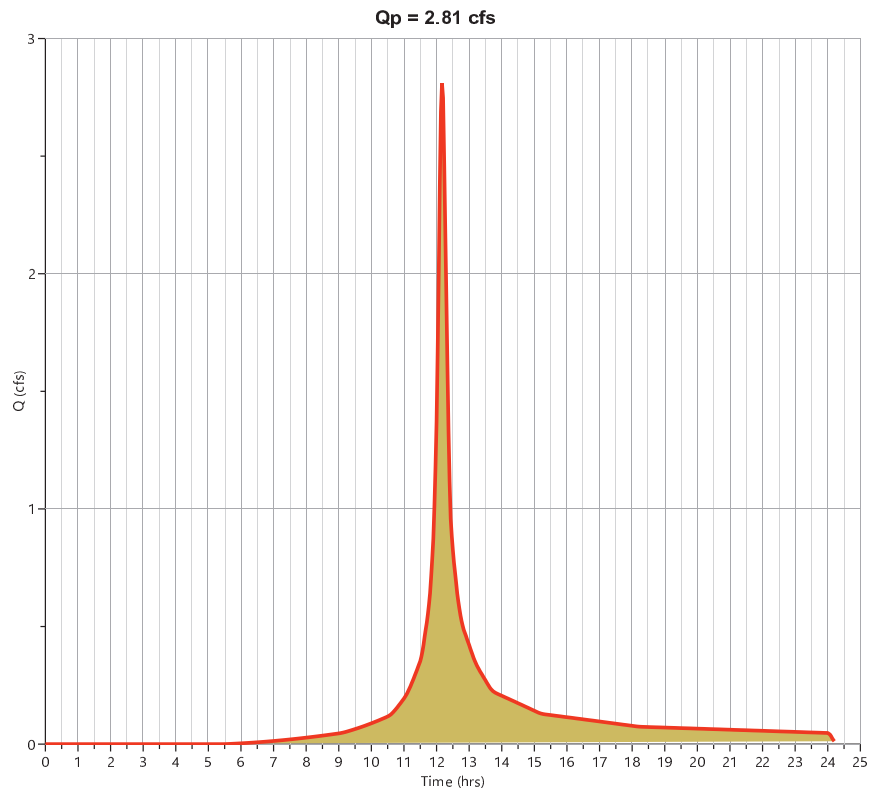
Hydrology Studio v 3.0.0.14

03-20-2020

EX-PER-DA2

Hyd. No. 1

Hydrograph Type	= NRCS Runoff	Peak Flow	= 2.810 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 11,086 cuft
Drainage Area	= 0.53 ac	Curve Number	= 76
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 8.47 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

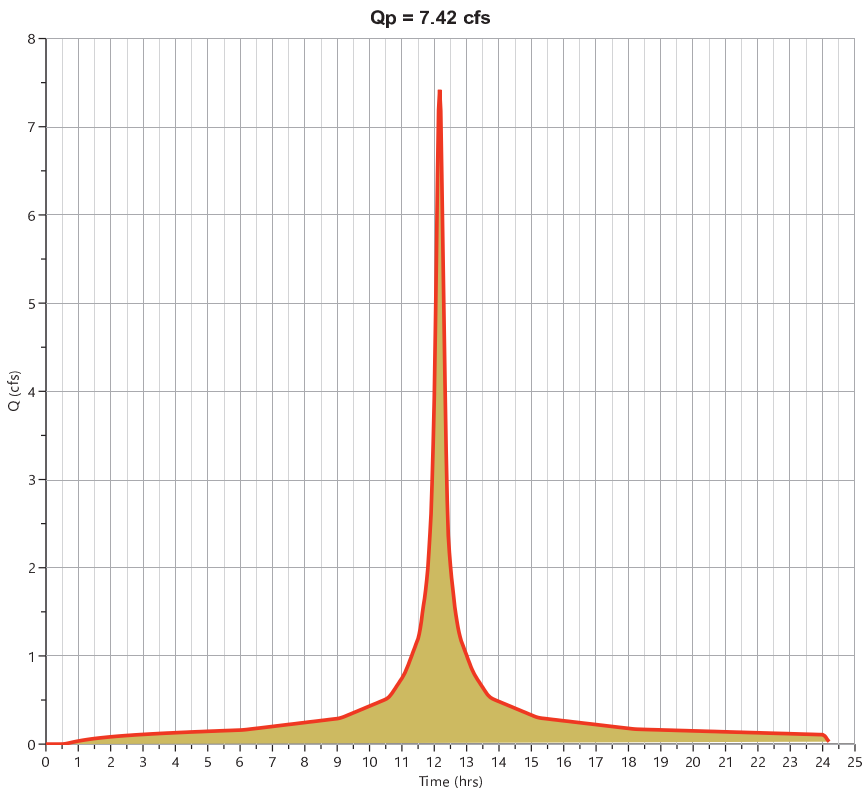
Hydrology Studio v 3.0.0.14

03-20-2020

EX-IMP-DA2

Hyd. No. 2

Hydrograph Type	= NRCS Runoff	Peak Flow	= 7.419 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 33,889 cuft
Drainage Area	= 1.1 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 8.47 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

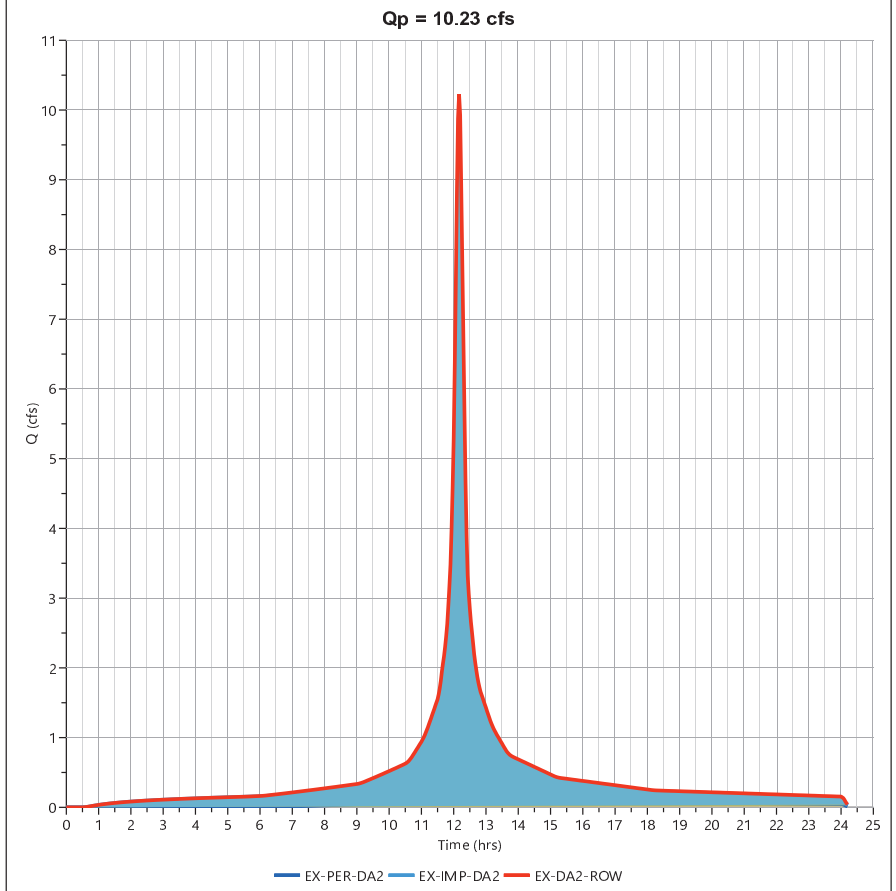
Hydrology Studio v 3.0.0.14

03-20-2020

EX-DA2-ROW

Hyd. No. 3

Hydrograph Type	= Junction	Peak Flow	= 10.23 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 44,975 cuft
Inflow Hydrographs	= 1, 2	Total Contrib. Area	= 1.63 ac



Hydrograph Report

Project Name:

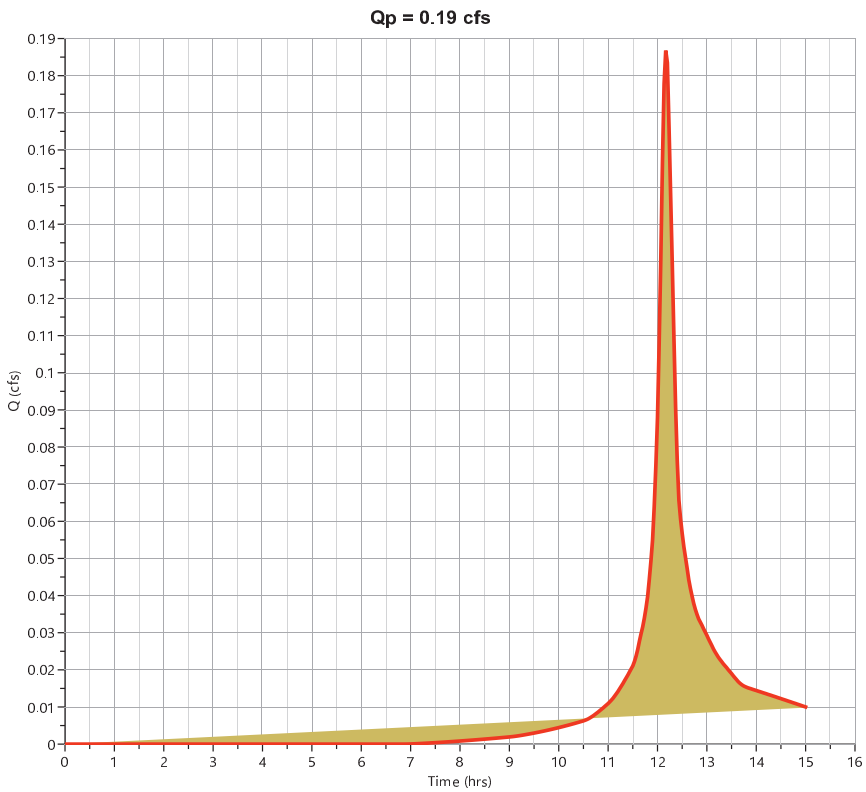
Hydrology Studio v 3.0.0.14

03-20-2020

EX-DA2-OFF

Hyd. No. 4

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.187 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 729 cuft
Drainage Area	= 0.04 ac	Curve Number	= 70
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 8.47 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

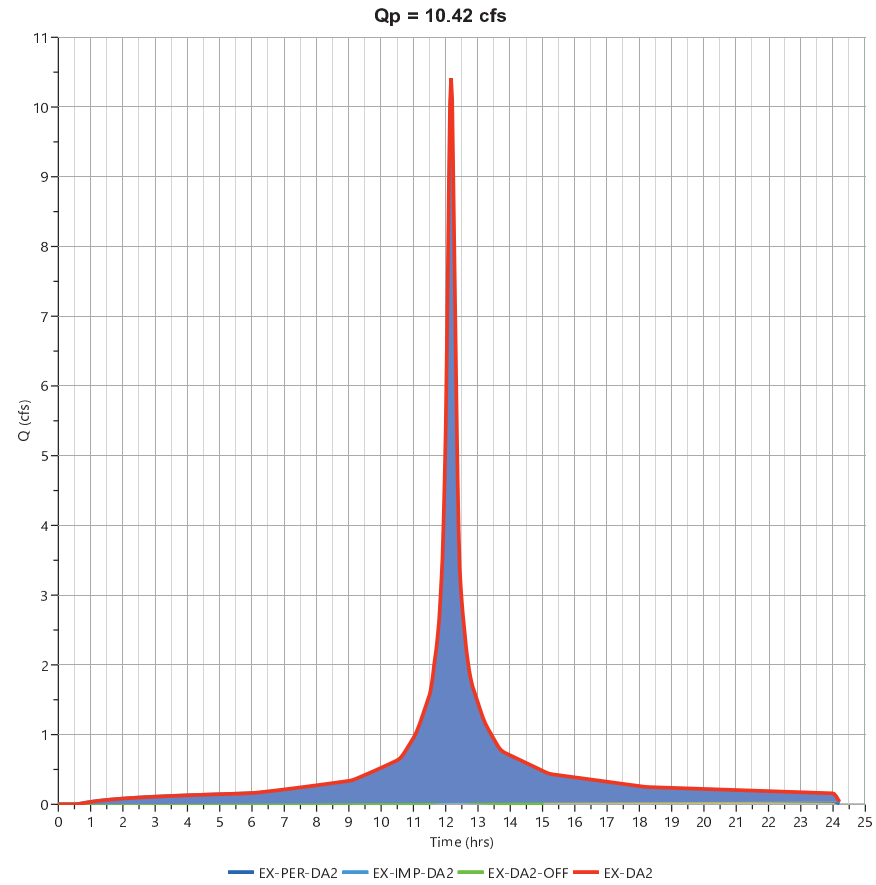
Hydrology Studio v 3.0.0.14

03-20-2020

EX-DA2

Hyd. No. 5

Hydrograph Type	= Junction	Peak Flow	= 10.42 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 45,704 cuft
Inflow Hydrographs	= 1, 2, 4	Total Contrib. Area	= 1.67 ac



Hydrograph Report

Project Name:

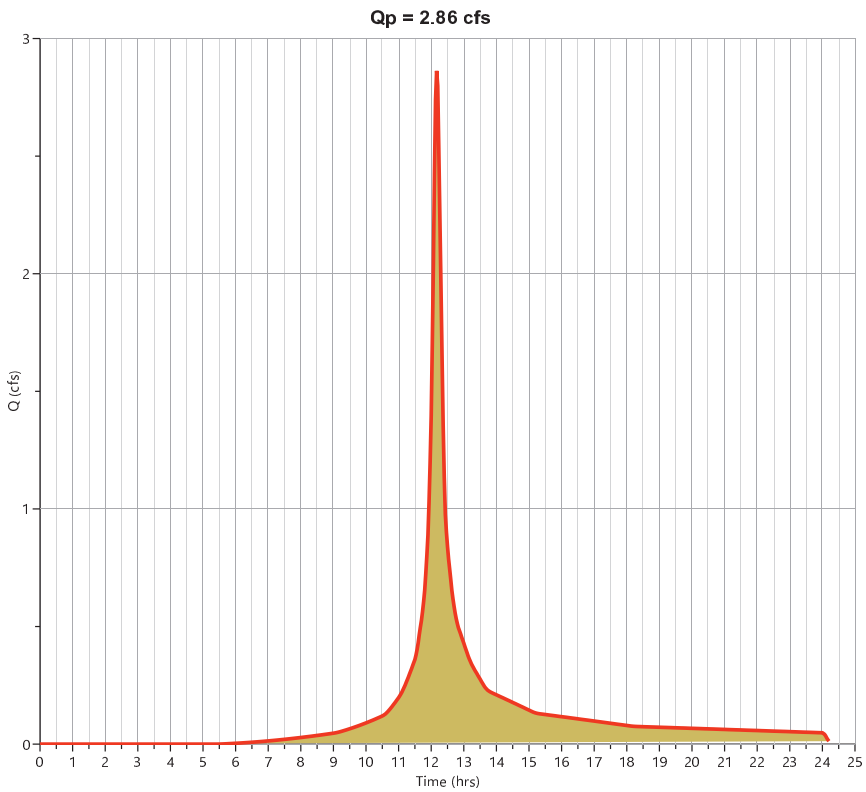
Hydrology Studio v 3.0.0.14

03-20-2020

EX-PER-DA1

Hyd. No. 7

Hydrograph Type	= NRCS Runoff	Peak Flow	= 2.863 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 11,295 cuft
Drainage Area	= 0.54 ac	Curve Number	= 76
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 8.47 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

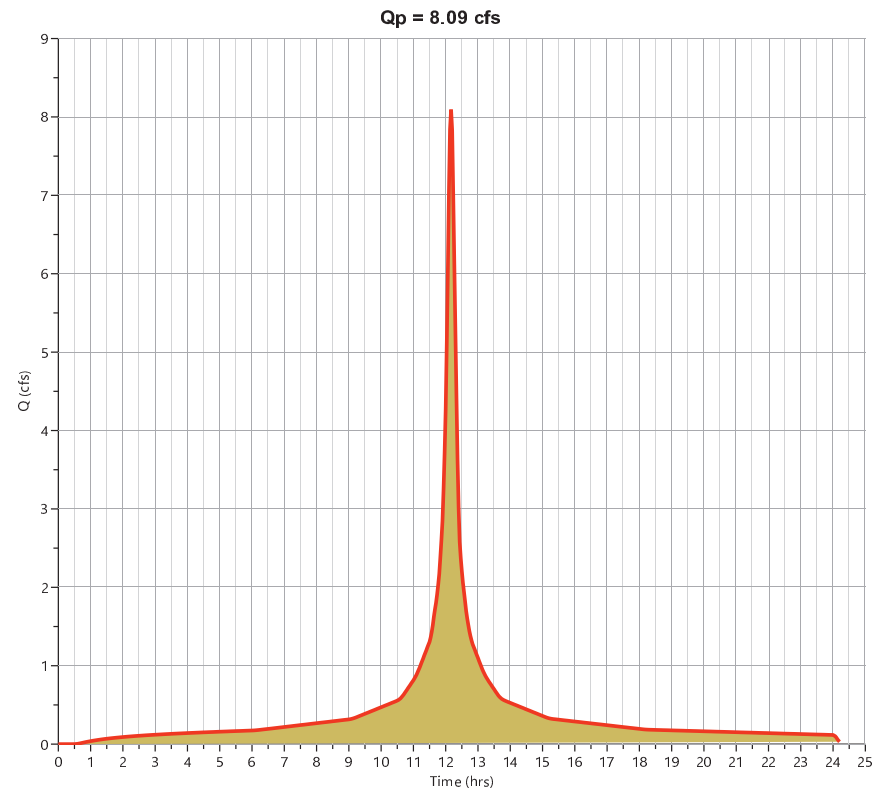
Hydrology Studio v 3.0.0.14

03-20-2020

EX-IMP-DA1

Hyd. No. 8

Hydrograph Type	= NRCS Runoff	Peak Flow	= 8.093 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 36,970 cuft
Drainage Area	= 1.2 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 8.47 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.14

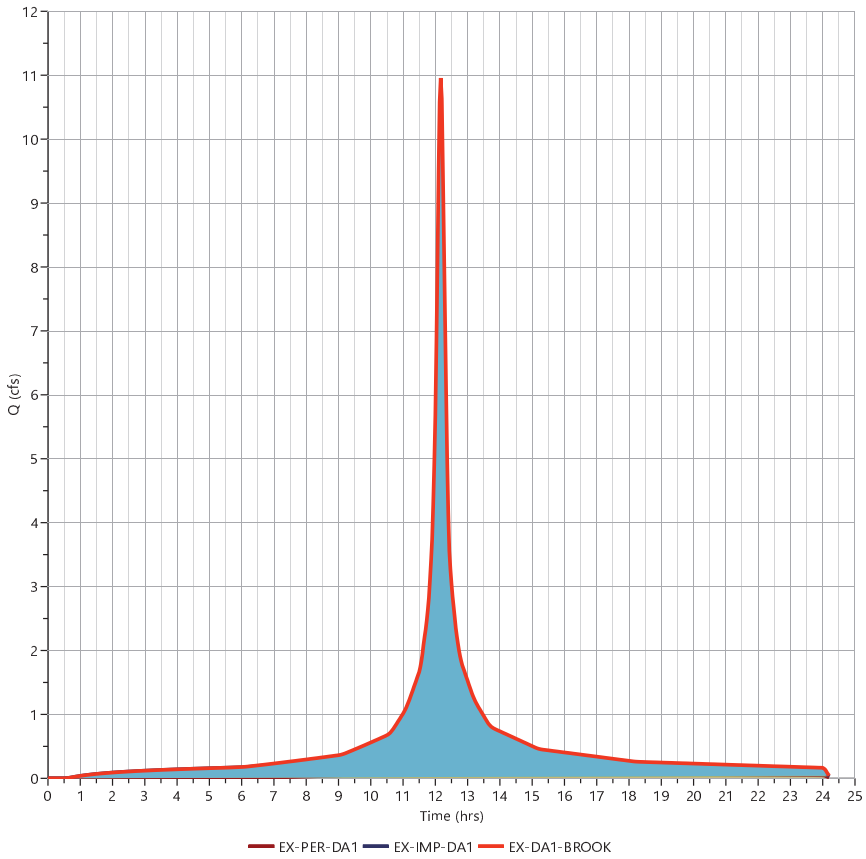
03-20-2020

EX-DA1-BROOK

Hyd. No. 9

Hydrograph Type	= Junction	Peak Flow	= 10.96 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 48,265 cuft
Inflow Hydrographs	= 7, 8	Total Contrib. Area	= 1.74 ac

Qp = 10.96 cfs



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.14

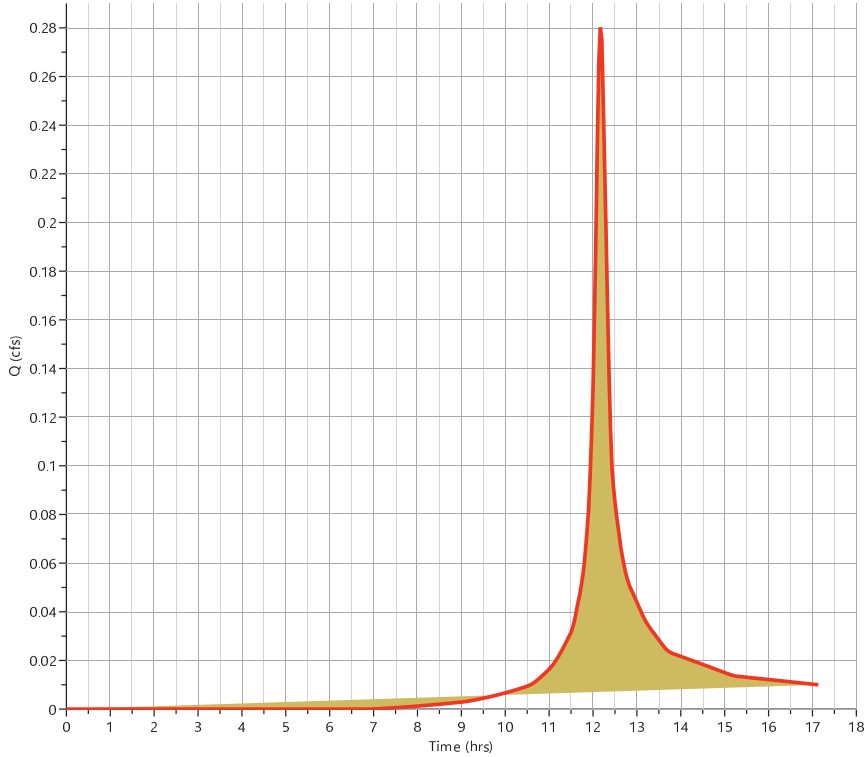
03-20-2020

EX-DA1-OFF

Hyd. No. 10

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.280 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 1,094 cuft
Drainage Area	= 0.06 ac	Curve Number	= 70
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 8.47 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484

Qp = 0.28 cfs



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.14

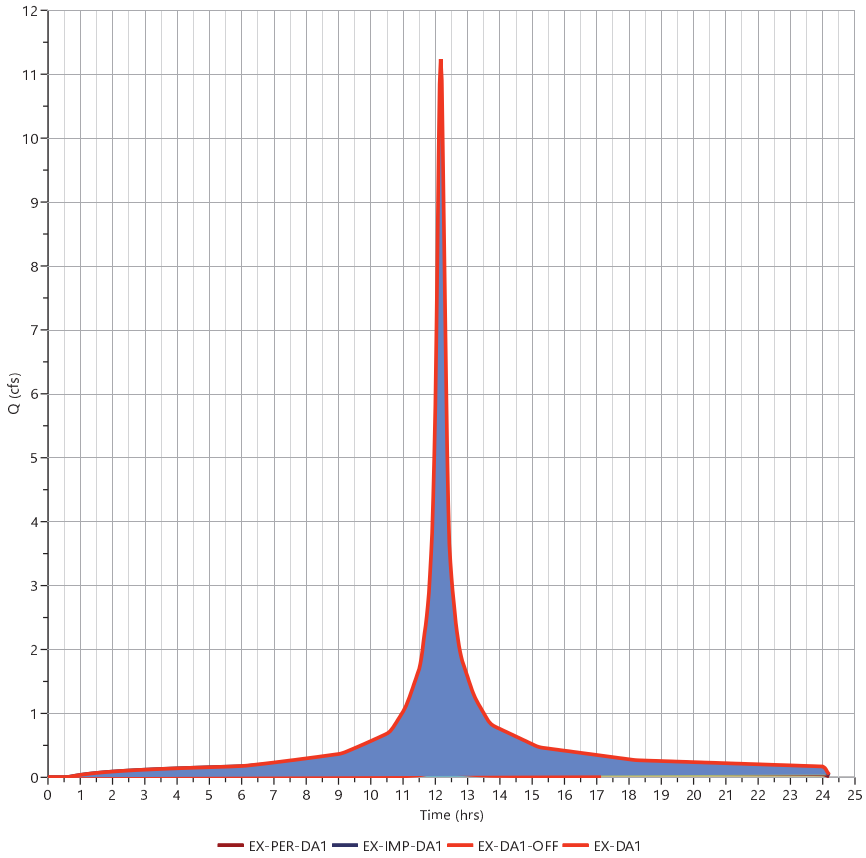
03-20-2020

EX-DA1

Hyd. No. 11

Hydrograph Type	= Junction	Peak Flow	= 11.24 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 49,359 cuft
Inflow Hydrographs	= 7, 8, 10	Total Contrib. Area	= 1.8 ac

Qp = 11.24 cfs



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.14

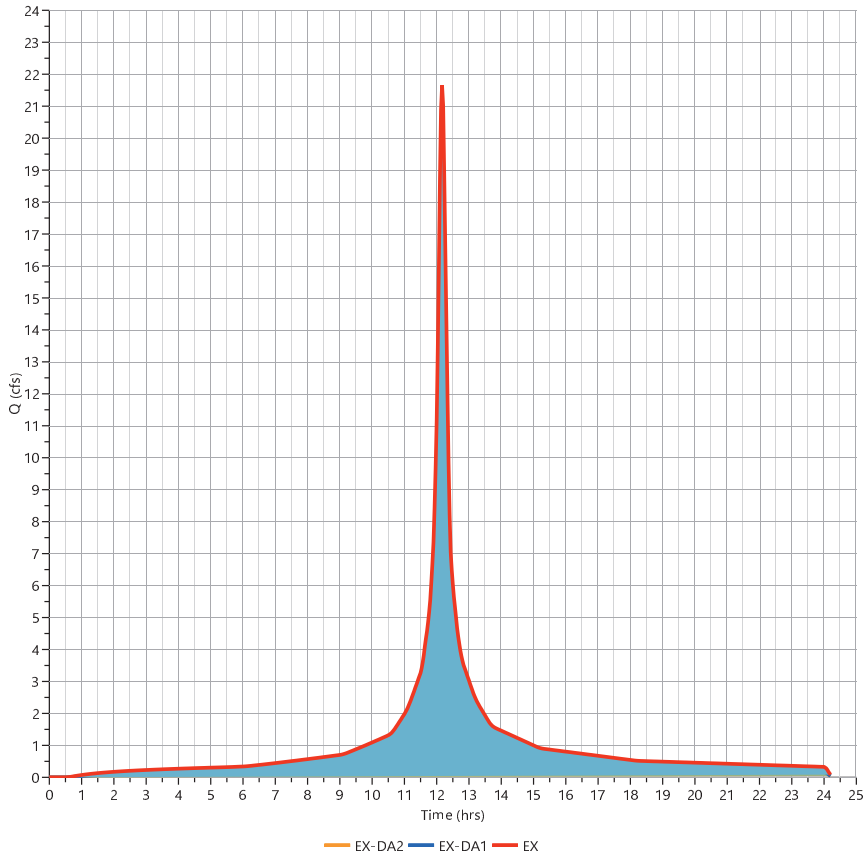
03-20-2020

EX

Hyd. No. 13

Hydrograph Type	= Junction	Peak Flow	= 21.65 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 95,062 cuft
Inflow Hydrographs	= 5, 11	Total Contrib. Area	= 3.47 ac

Qp = 21.65 cfs



Hydrograph Report

Project Name:

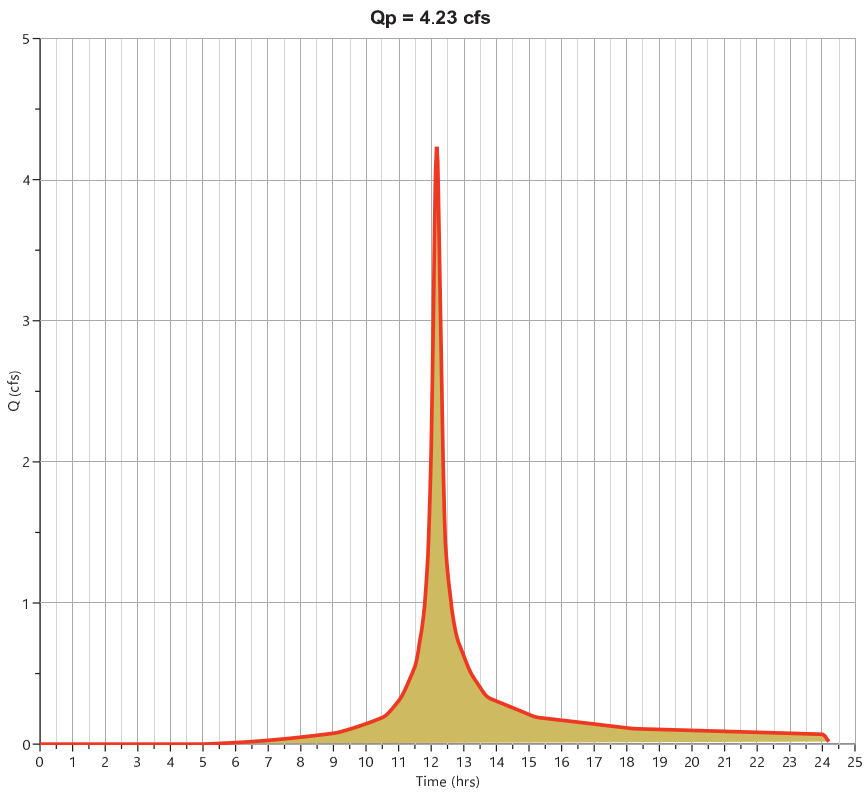
Hydrology Studio v 3.0.0.14

03-20-2020

PROP-PER- DA2

Hyd. No. 16

Hydrograph Type	= NRCS Runoff	Peak Flow	= 4.233 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 16,796 cuft
Drainage Area	= 0.77 ac	Curve Number	= 78
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 8.47 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

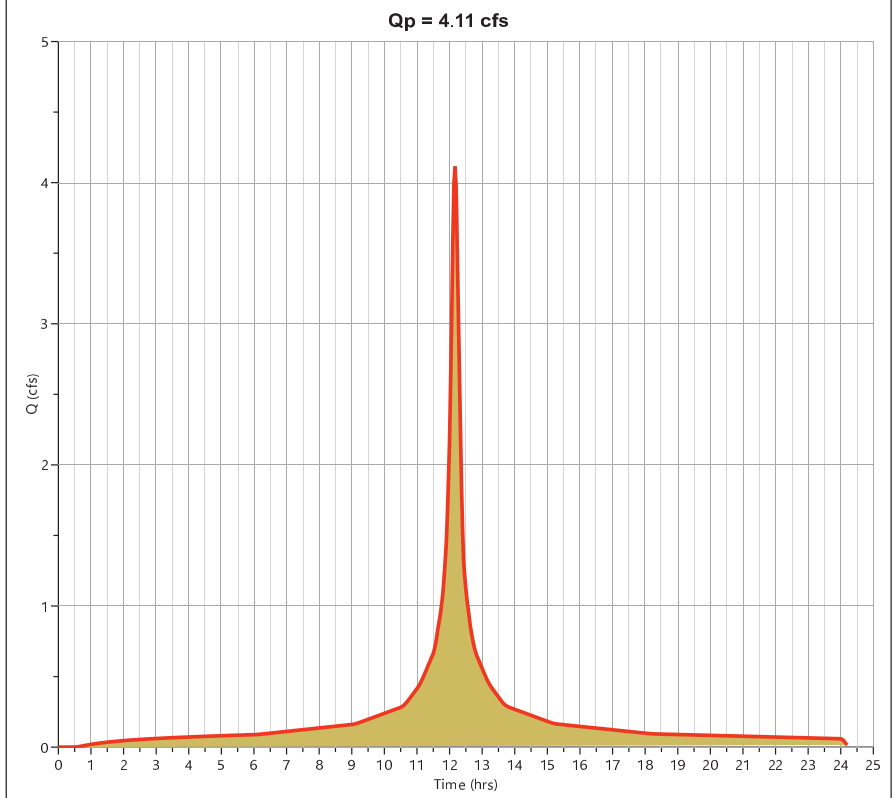
Hydrology Studio v 3.0.0.14

03-20-2020

PROP-IMP- DA2

Hyd. No. 17

Hydrograph Type	= NRCS Runoff	Peak Flow	= 4.114 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 18,793 cuft
Drainage Area	= 0.61 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 8.47 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

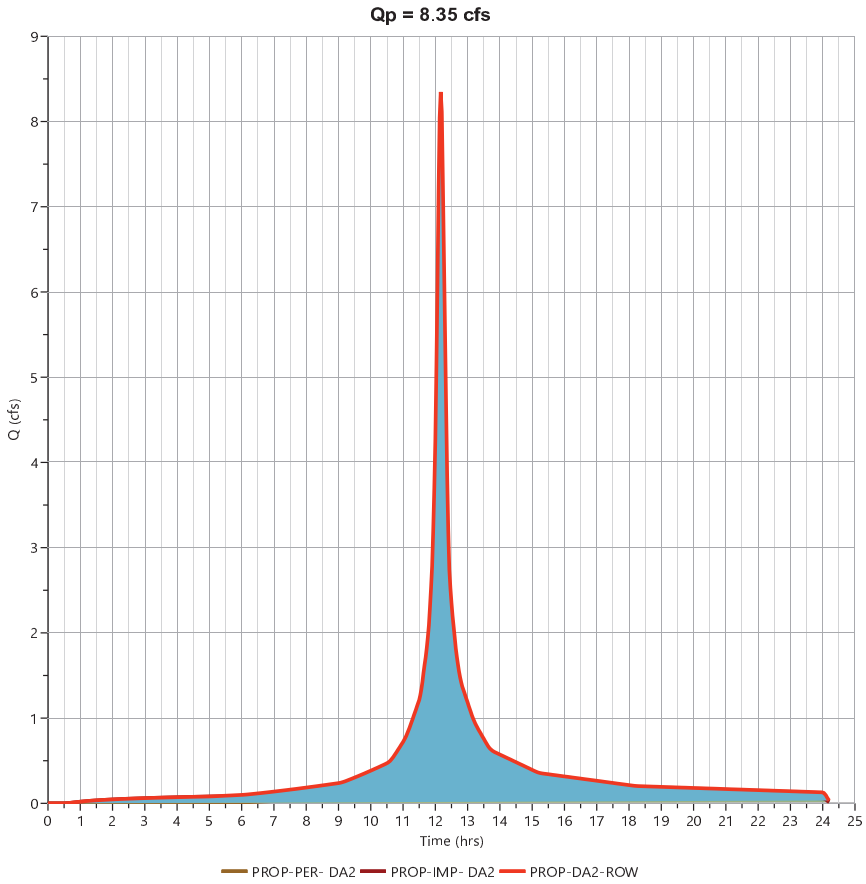
Hydrology Studio v 3.0.0.14

03-20-2020

PROP-DA2-ROW

Hyd. No. 18

Hydrograph Type	= Junction	Peak Flow	= 8.347 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 35,589 cuft
Inflow Hydrographs	= 16, 17	Total Contrib. Area	= 1.38 ac



Hydrograph Report

Project Name:

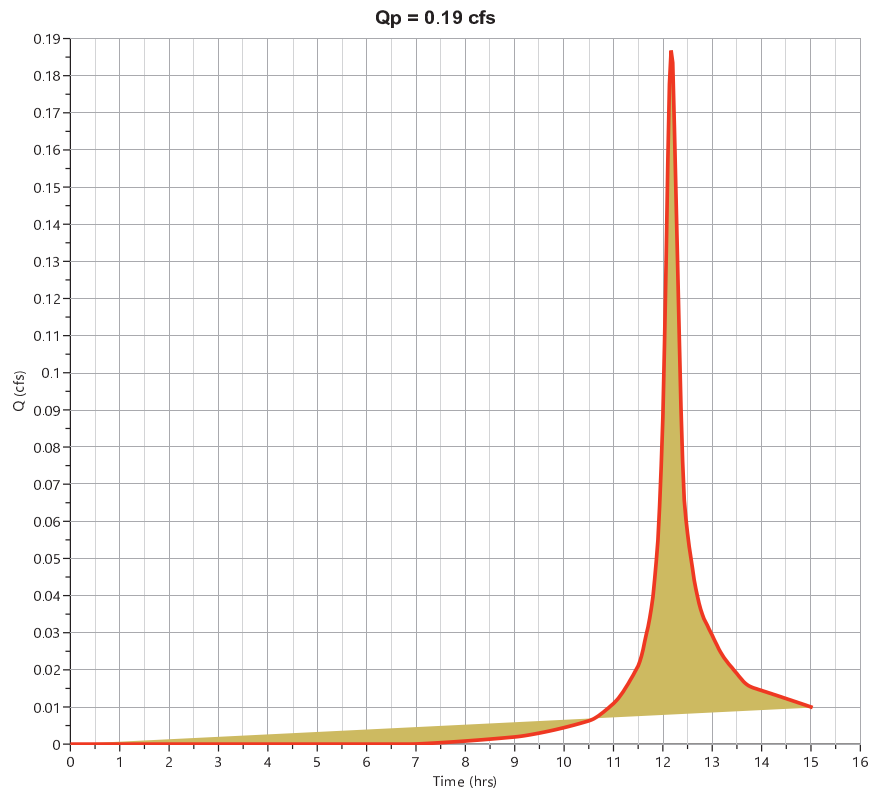
Hydrology Studio v 3.0.0.14

03-20-2020

PROP-DA2-OFF

Hyd. No. 19

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.187 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 729 cuft
Drainage Area	= 0.04 ac	Curve Number	= 70
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 8.47 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

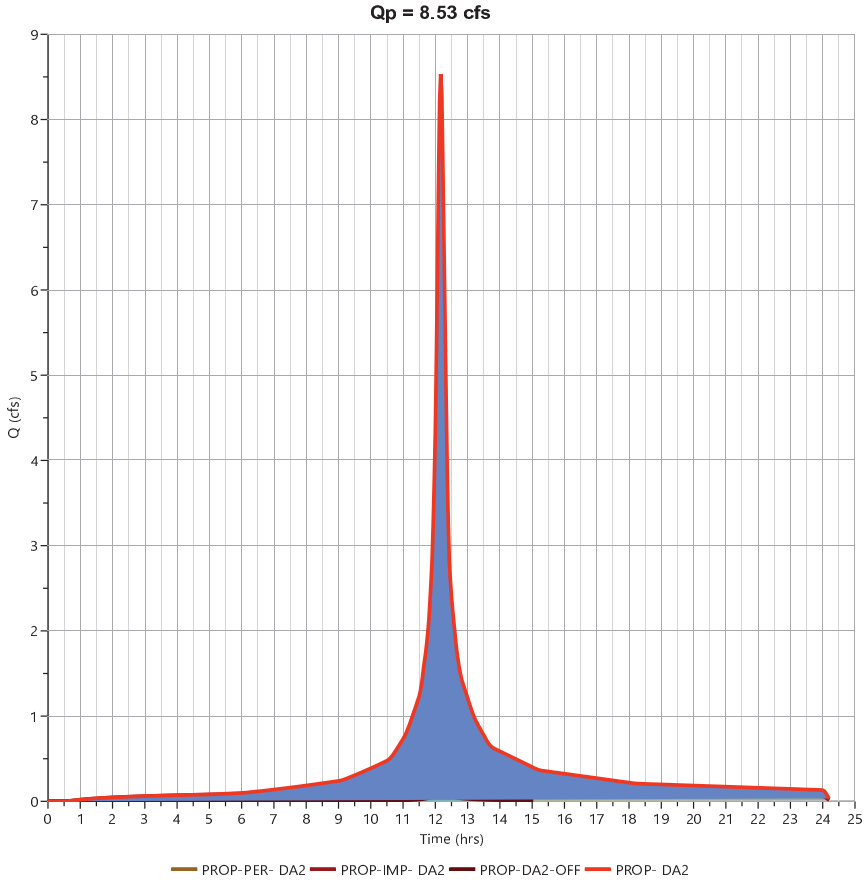
Hydrology Studio v 3.0.0.14

03-20-2020

PROP- DA2

Hyd. No. 20

Hydrograph Type	= Junction	Peak Flow	= 8.534 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 36,318 cuft
Inflow Hydrographs	= 16, 17, 19	Total Contrib. Area	= 1.42 ac



Hydrograph Report

Project Name:

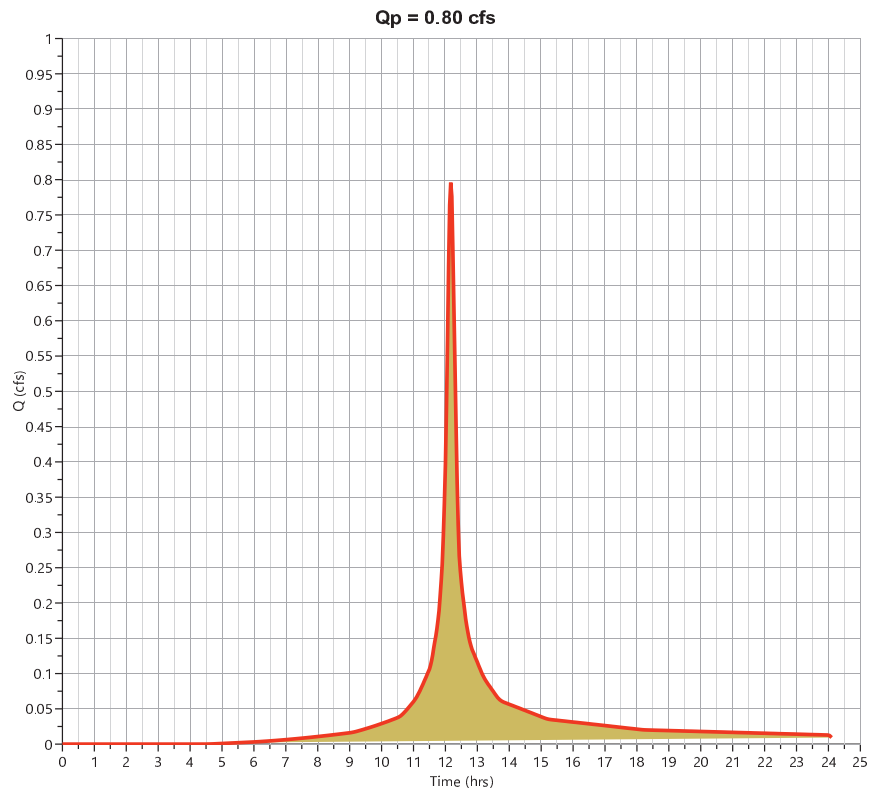
Hydrology Studio v 3.0.0.14

03-20-2020

PROP-PER- DA1A

Hyd. No. 22

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.796 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 3,180 cuft
Drainage Area	= 0.14 ac	Curve Number	= 80
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 8.47 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

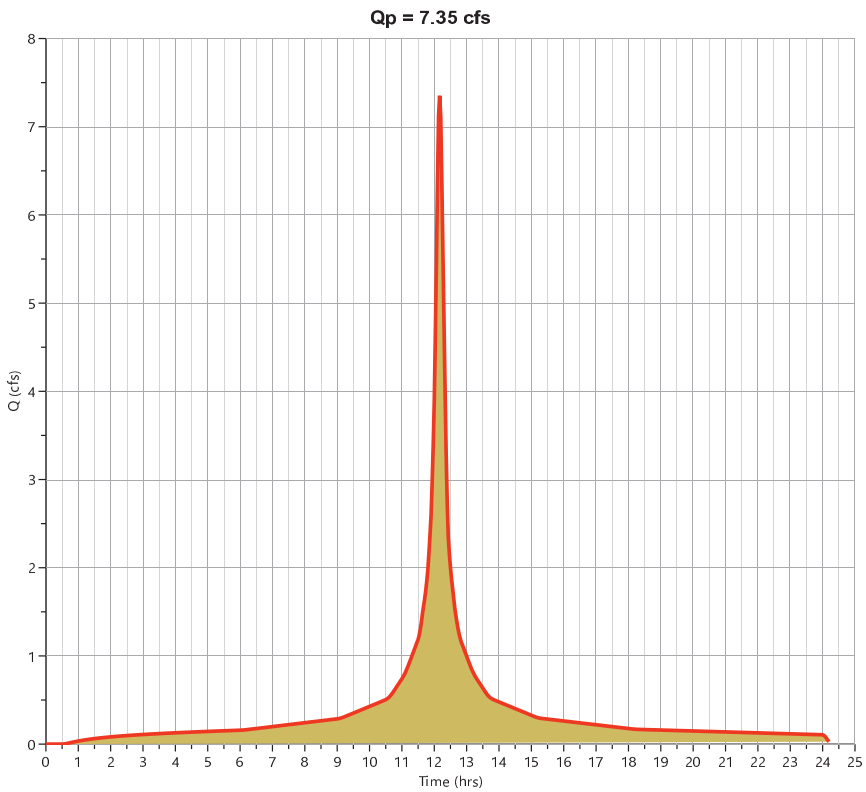
Hydrology Studio v 3.0.0.14

03-20-2020

PROP-IMP-DA1A

Hyd. No. 23

Hydrograph Type	= NRCS Runoff	Peak Flow	= 7.351 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Runoff Volume	= 33,581 cuft
Drainage Area	= 1.09 ac	Curve Number	= 98
Tc Method	= User	Time of Conc. (Tc)	= 10.0 min
Total Rainfall	= 8.47 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

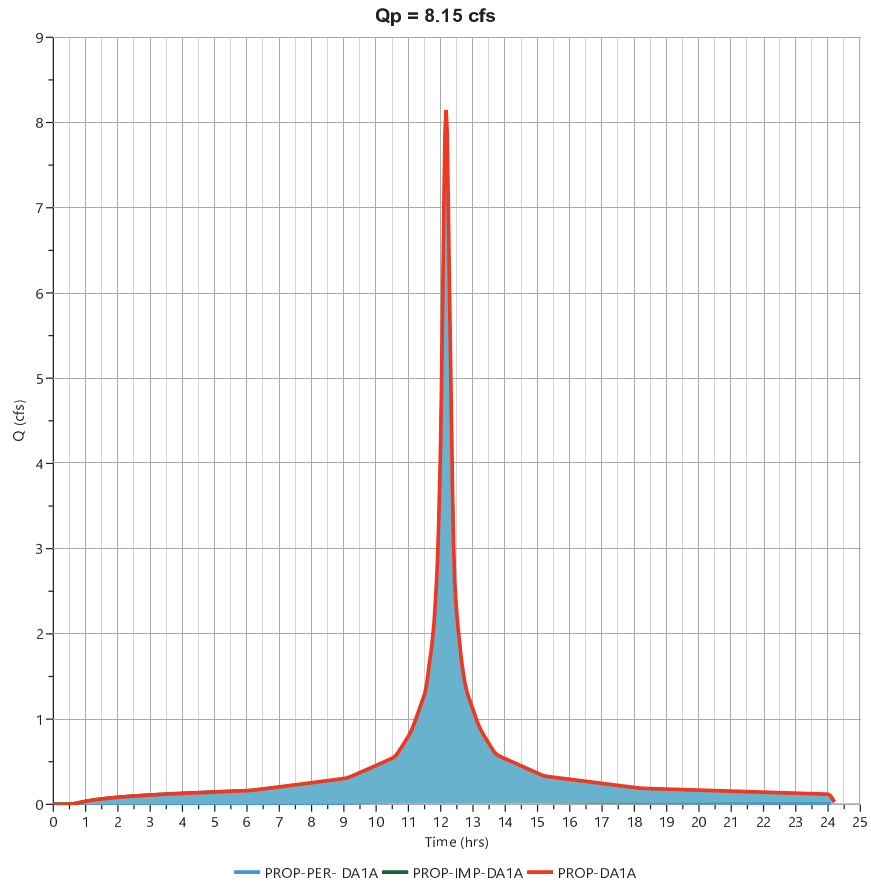
Hydrology Studio v 3.0.0.14

03-20-2020

PROP-DA1A

Hyd. No. 24

Hydrograph Type	= Junction	Peak Flow	= 8.147 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 36,761 cuft
Inflow Hydrographs	= 22, 23	Total Contrib. Area	= 1.23 ac



Hydrograph Report

Project Name:

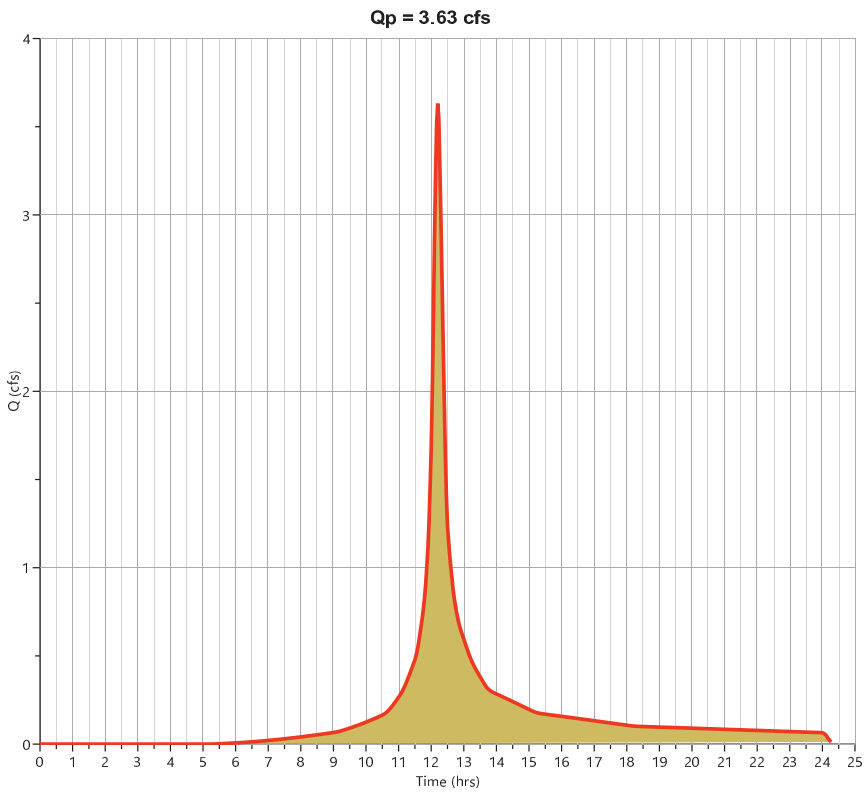
Hydrology Studio v 3.0.0.14

03-20-2020

PROP-PER-DA1B

Hyd. No. 26

Hydrograph Type	= NRCS Runoff	Peak Flow	= 3.631 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Runoff Volume	= 15,351 cuft
Drainage Area	= 0.76 ac	Curve Number	= 77
Tc Method	= User	Time of Conc. (Tc)	= 13.5 min
Total Rainfall	= 8.47 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

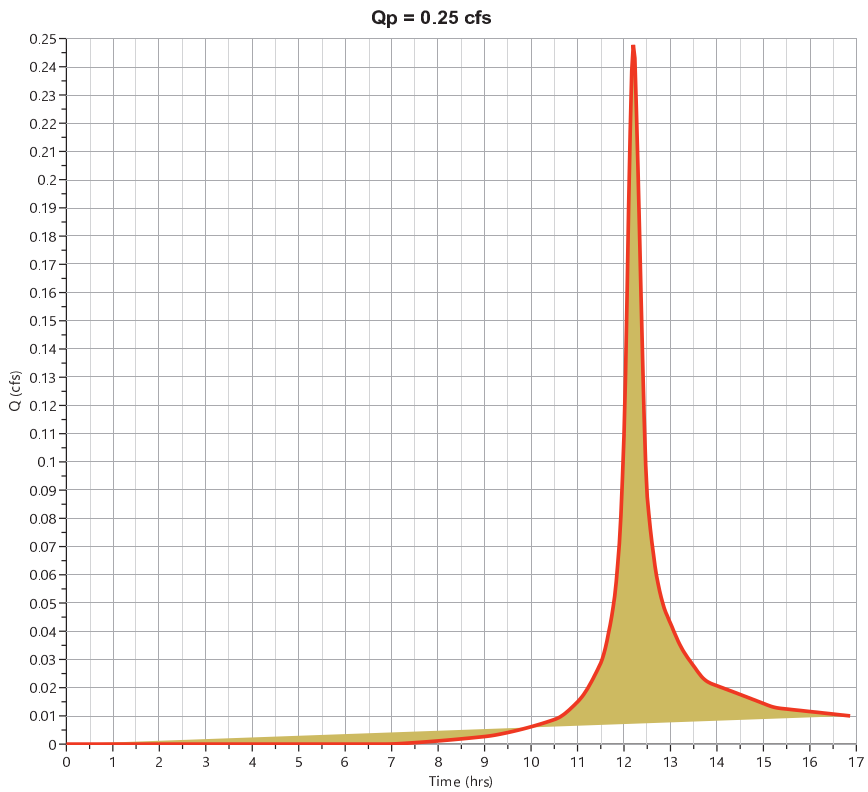
Hydrology Studio v 3.0.0.14

03-20-2020

PROP-DA1B-OFF

Hyd. No. 27

Hydrograph Type	= NRCS Runoff	Peak Flow	= 0.248 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.20 hrs
Time Interval	= 2 min	Runoff Volume	= 1,034 cuft
Drainage Area	= 0.06 ac	Curve Number	= 70
Tc Method	= User	Time of Conc. (Tc)	= 13.5 min
Total Rainfall	= 8.47 in	Design Storm	= NOAA-D
Storm Duration	= 24 hrs	Shape Factor	= 484



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.14

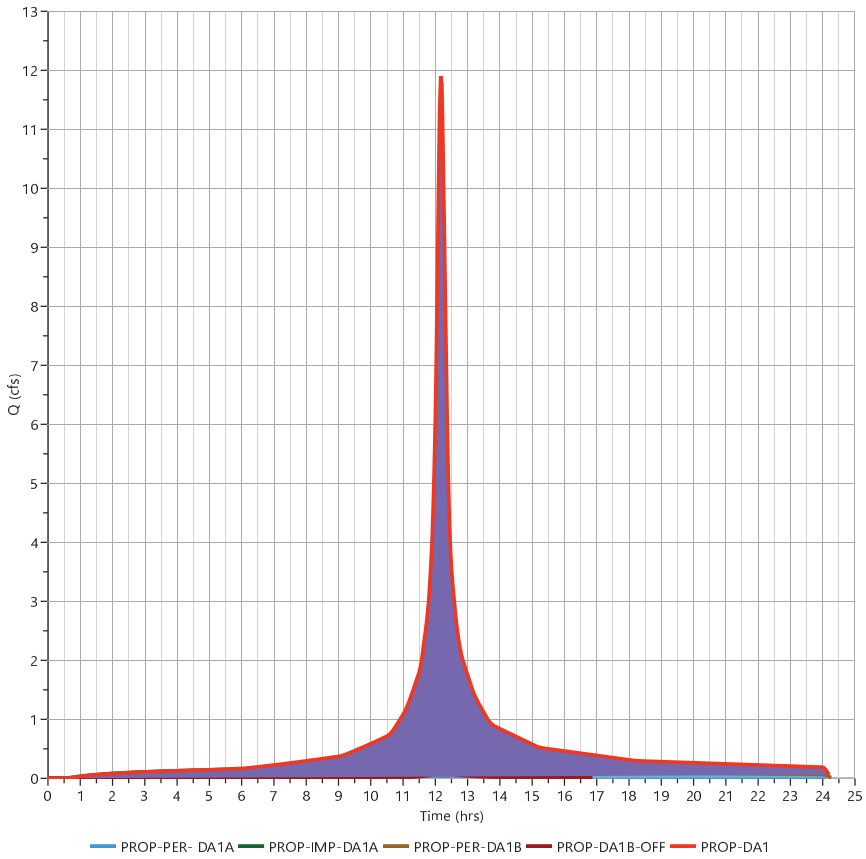
03-20-2020

PROP-DA1

Hyd. No. 28

Hydrograph Type	= Junction	Peak Flow	= 11.90 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 53,146 cuft
Inflow Hydrographs	= 22, 23, 26, 27	Total Contrib. Area	= 2.05 ac

Qp = 11.90 cfs



Hydrograph Report

Project Name:

Hydrology Studio v 3.0.0.14

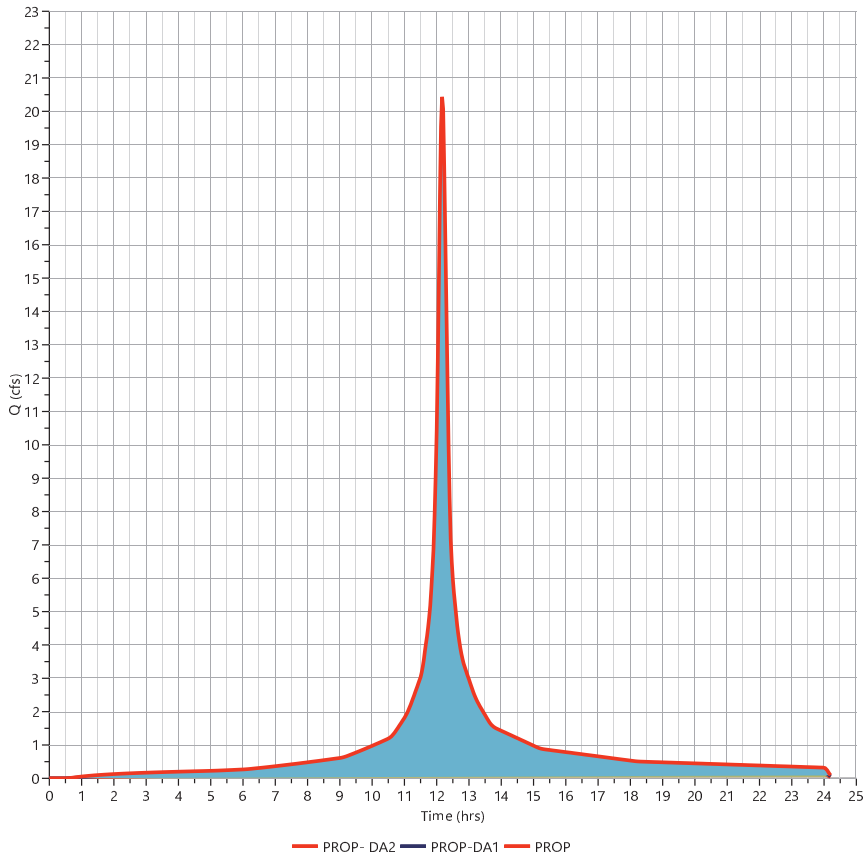
03-20-2020

PROP

Hyd. No. 30

Hydrograph Type	= Junction	Peak Flow	= 20.43 cfs
Storm Frequency	= 100-yr	Time to Peak	= 12.17 hrs
Time Interval	= 2 min	Hydrograph Volume	= 89,465 cuft
Inflow Hydrographs	= 20, 28	Total Contrib. Area	= 3.47 ac

Qp = 20.43 cfs



Design Storm Report

Custom Storm filename:

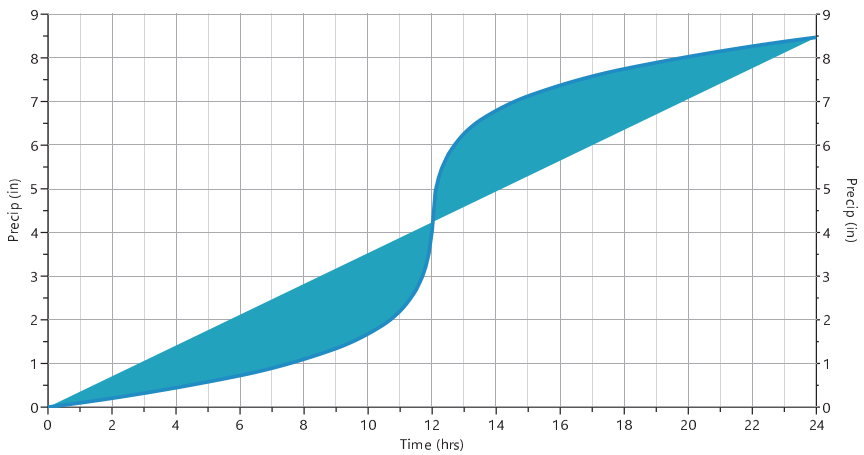
Hydrology Studio v 3.0.0.14

03-20-2020

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	3.34	0.00	0.00	5.07	6.28	0.00	8.47	

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)
11.10	2.648258	11.47	3.794575	11.83	10.237410	12.20	10.237460	12.57	3.794527
11.13	2.933455	11.50	3.794694	11.87	10.237170	12.23	7.377291	12.60	3.794527
11.17	2.933455	11.53	5.110240	11.90	10.237430	12.27	7.377386	12.63	3.509426
11.20	2.933526	11.57	5.110097	11.93	17.659930	12.30	7.377338	12.67	3.509474
11.23	3.221440	11.60	5.110240	11.97	17.660000	12.33	5.378437	12.70	3.509426
11.27	3.221345	11.63	5.378437	12.00	17.659830	12.37	5.378485	12.73	3.221464
11.30	3.221440	11.67	5.378461	12.03	29.467200	12.40	5.378532	12.77	3.221321
11.33	3.509378	11.70	5.378437	12.07	29.467250	12.43	5.110264	12.80	3.221416
11.37	3.509402	11.73	7.377386	**12.10**	**29.467200**	12.47	5.110121	12.83	2.933455
11.40	3.509378	11.77	7.377386	12.13	10.237460	12.50	5.110312	12.87	2.933455
11.43	3.794575	11.80	7.377625	12.17	10.237170	12.53	3.794479	12.90	2.933407



STORMWATER CONVEYANCE CALCULATIONS (PIPE SIZING)

DYNAMIC ENGINEERING

Stormwater Collection System Calculations

Project: CSH Washington
Job #: 1423-99-003
Location: Washington Township
Design Storm: 25 Yr

Computed By: STL
Checked By: DTS
Date: 1/8/2020

NOTES:
1) Design method used is Rational Method, unless otherwise noted.
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)	Pipe Velocity (fps)
IA233	IA234	0.13	0.98	0.13	0.13	10.00	0.12	10.00	6.80	0.88	0.88	15	40.0	0.012	0.0100	7.00	5.71
IA234	IA232	0.09	0.98	0.09	0.22	10.00	0.12	10.12	6.80	0.61	1.50	15	42.0	0.012	0.0100	7.00	5.71
IA232	IA102	0.28	0.98	0.27	0.49	10.00	0.29	10.24	6.80	1.84	3.33	15	100.0	0.012	0.0100	7.00	5.71
IA102	IA101	0.19	0.98	0.19	0.68	10.00	0.32	10.53	6.68	1.27	4.54	18	124.0	0.012	0.0100	11.38	6.44
IA101	EX-A	0.08	0.98	0.08	0.76	10.00	0.24	10.85	6.68	0.53	5.08	18	91.0	0.012	0.0100	11.38	6.44
EX-A	ROW	0.04	0.98	0.04	0.80	10.00	0.05	11.09	6.56	0.26	5.25	18	25.0	0.013	0.0212	15.29	8.66
IA203	ROW	0.14	0.98	0.14	0.14	10.00	0.06	10.00	6.80	0.95	0.95	15	21.0	0.012	0.0100	7.00	5.71
ROOF	MH244	0.66	0.98	0.65	0.65	10.00	0.03	10.00	6.80	4.42	4.42	12	10.0	0.012	0.0150	4.72	6.01
MH244	IA201	0.00	0.98	0.00	0.65	10.00	0.09	10.03	6.80	0.00	4.42	15	36.0	0.012	0.0150	8.57	6.99
IA201	IA200	0.12	0.98	0.12	0.77	10.00	0.19	10.12	6.80	0.82	5.24	15	66.0	0.012	0.0100	7.00	5.71
IA231	IA202	0.21	0.98	0.21	0.21	10.00	0.22	10.00	6.80	1.43	1.43	15	76.0	0.012	0.0100	7.00	5.71
IA202	IA200	0.17	0.98	0.17	0.38	10.00	0.27	10.22	6.80	1.16	2.58	15	91.0	0.012	0.0100	7.00	5.71
IA200	STREAM	0.07	0.98	0.07	1.22	10.00	0.01	10.49	6.80	0.48	8.30	24	3.5	0.012	0.0050	17.33	5.52

CONDUIT OUTLET PROTECTION CALCULATIONS (RIP RAP)

DYNAMIC ENGINEERING
245 Main Street, Suite 110, Chester, NJ 07930
(908) 879-9229

Date: 3/3/2020
Project: CSH Pascack
Project No: 1423-99-003

Calculated By: DRL
Checked By: WB

Conduit Outlet Protection Calculations

Rip Rap Pad # 1

Design Parameters:

Design Storm Flow for 25 Year, Q	6.00	cfs
Vertical Dimension of Outlet Pipe, D_o	18	in
Horizontal Dimension of Outlet Pipe, W_o	18	in
Tailwater Depth, TW[1]	0.30	ft

Apron Dimension Calculations:

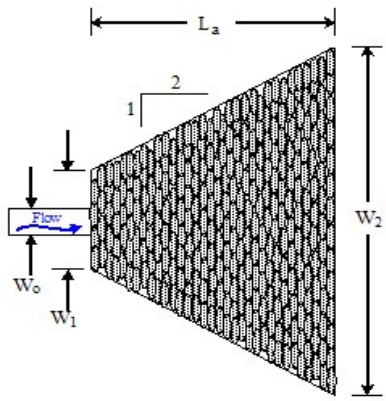
Unit Dicharge, $q = Q/D_o$ = 4.00 cfs per foot

- **Case I: $TW < 1/2\ D_o$**

Apron Length, $L_a = \frac{1.8q}{D_o^{1/2}} + 7D_o$ = 16.38 ft or L_a = 17 ft

Width, $W_1 = 3W_o$ = 4.5 ft or W_1 = 5 ft

Width, $W_2 = 3W_o + L_a$ = 20.88 ft or W_2 = 21 ft

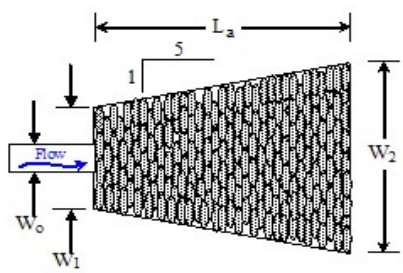


- **Case II: $TW \geq 1/2\ D_o$**

Apron Length, $L_a = \frac{3q}{D_o^{1/2}}$ = L_a =

Width, $W_1 = 3W_o$ = W_1 =

Width, $W_2 = 3W_o + 0.4L_a$ = W_2 =



Rip Rap Stone Size Calculations:

Median Stone, $d_{50} = \frac{0.02q^{1.33}}{TW}$ = 5.06 in d_{50} = 6 in

Notes:

1. Where there is a well-defined channel downstream of the apron, the bottom width of the apron shall be at least equal to the bottom width of the channel and the structural lining shall extend at least one foot above the tailwater elevation, but no lower than two-thirds of the vertical conduit dimension above the conduit invert.
2. The side slopes shall be 2:1 or flatter.
3. The bottom grade shall be 0.0% (level).
4. There shall be no overfall at the end of the apron or at the end of the culvert.
5. Fifty (50) percent by weight of the rip-rap mixture shall be smaller than the median size stone designated as d_{50}. The largest stone size in the mixture shall be 1.5 times the d_{50} size. The rip-rap shall be reasonably well graded.
6. The thickness of the rip-rap apron may be two (2) times the median stone diameter provided that the apron is constructed on a bedding of four (4) inches of 3/4 inch clean stone on approved filter fabric material.
7. Rip-rap and filter fabric shall meet the standards of the governing Soil Conservation District as well as the requirements of the local municipality.
8. No bends or curves at the intersection of the conduit and apron will be permitted.

Footnote:

1. Tailwater depth shall be the 2-year storm if discharging into a detention basin. For areas where tailwater cannot be computed, use $TW = 0.2D_o$.
2. For multiple pipes, increase rip-rap sizes by 25% when pipe spacing is greater than or equal to $1/4W_o$.

FLOOD INSUARANCE STUDY MUSQUAPSINK BROOK

TABLE 8 - SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-Percent	2-Percent	1-Percent	02-Percent
MUSQUAPSINK BROOK					
At confluence with Pascack Brook	7.00	390	570	660	880
At USGS gauge No. 01377490 (Bogert Pond)	6.40	390	560	650	870
At Lafayette Avenue	5.57	560	810	940	1,260
Washington Lake Dam	*	550	890	1,080	1,730
At USGS gauge No. 01377475 (Pascack Road)	2.19	710	1,160	1,410	2,280
Approximately 1,500 feet downstream of Hillsdale Av.	*	690	1,130	1,370	2,220
Approximately 1,800 feet upstream of Werimus Rd.	*	390	650	790	1,310
MUSQUAPSINK BROOK BY-PASS					
At Woodfield Road	2.66	261	430	544	688
NORWOOD BROOK					
At confluence with Oradell Reservoir	1.90	243/926[2]	406	499/2,002[1]	753
Upstream of CONRAIL bridge	1.60	215/858[2]	360	444/1,750[1]	671
OOST VAL BROOK					
At confluence with East Branch Saddle River	3.63	*	*	839	1,200
OVERPECK CREEK					
At confluence with Hackensack River	17.30	1,810	2,240	2,665	4,000
Upstream of confluence of Teaneck Creek	12.00	1,635	2,030	2,390	3,500

*Data not available.

[1] Discharge determined using Special Report No. 38/Discharge calculated considering interbasin flow transfer. The second value reflects the 1% chance flood flow in the stream.

DRAINAGE AREA MAPS

THIS PLAN TO BE UTILIZED FOR STORMWATER/DRAINAGE ANALYSIS PURPOSES ONLY

STUDY AREA DA-OFF-1

STUDY AREA DA-OFF-2

STUDY AREA DA-2

STUDY AREA DA-1

AA ZONE

TAX LOT 1
N/F BIG-WASH TSP CORP
DB. 1236, PG. 2010
218,435 SF, 5.015 AC.
1 Story Building

TAX LOT 2
N/F TJ REALTY, LLC
DB. 8047, PG. 340

TAX LOT 3
N/F TAJ, INC.T/A SEASONS CAFE & REST.
DB./PG. N/A

TAX LOT 4
N/F ROGER ITALIA
DB./PG. N/A

TAX LOT 5
N/F ROGER ITALIA
DB./PG. N/A

TAX LOT 6
N/F CJK WASHINGTON AVE REALTY LLC
DB. 665, PG. 2010

TAX LOT 7
N/F CJK WASHINGTON AVE REALTY LLC
DB. 665, PG. 2010

TAX LOT 8
N/F CJK WASHINGTON AVE ARTY LLC
DB. 665, PG. 2024

TAX LOT 9
N/F SANDRA L. KEMP
DB. 986, PG. 709

TAX LOT 10
N/F CHRISTOPHER ANSI ETA
DB. 3138, PG. 4000

TAX LOT 4.01
BLOCK 2203
N/F JUDY DENTON
DB./PG. N/A

TAX LOT 10
BLOCK 2202.01
N/F FERRARA FAMILY TRUST
DB. 9551, PG. 172

TAX LOT 9
N/F JEFFREY & BLANCA GRINKOVITCH
DB. 268, PG. 26

TAX LOT 5
BLOCK 2202.02
N/F VINCENT & MARIE OROTELLI
DB./PG. N/A

TAX LOT 4
N/F JAMIE R. & KURT F. AHRENS
DB. 1247, PG. 2375

TAX LOT 12
BLOCK 2202
N/F 590 PASCACK REALTY LLC
DB. 2925, PG. 1490

PASCACK ROAD (CR 502)
(VARIABLE ROW WIDTH PER TAX MAP)
(SPEED LIMIT = 40 MPH)

AMHERST DRIVE
(50' ROW WIDTH PER TAX MAP)

MUSQUAPSINK BROOK

BLOCK LIMIT LINE

517.46' (DR1) N59° 09' 30"W

N37° 54' 30"E 83.00' (DR1)

364.75' (DR1)

L=4.87' (DR1)
R=350.00'(DR1)
CB=S36° 34' 32"E
CD=4.87'

PROP. NJFHA DESIGN ELEVATION

ALL EXISTING TREES OUTSIDE LIMIT OF DISTURBANCE TO REMAIN

ALL EXISTING TREES WITHIN LIMIT OF DISTURBANCE TO BE REMOVED (EXCEPT AS NOTED)

TO BE REMOVED

Building HT. 35'±

Building HT. 40'±

Conservation Easement Area Per DB. 7472, PG. 366

ZONE "X" (Area Outside of 0.2% Annual Chance Flood)

ZONE "AE" (EL 79 through 85) (Based Flood Elevations Determined)

Flood Hazard Line (See General Notes)

Variable Width Sanitary Sewer Easement Per DB. 5632, PG. 211

Proposed Manhole (Not Found)

Type "A" Inlet
INV(A): 76.08
INV(B): 75.84
INV(C): 74.00

Broken Timber Tie Wall

Vault

Asphalt Pavement

Approximate Location Rights Granted to PSE&G Per DB. 6194, PG. 277

UP No ID TO REMAIN

UP B60057WT w/ Transformer TO REMAIN

UP B60058WT w/ Light

EX. HYDRANT TO REMAIN

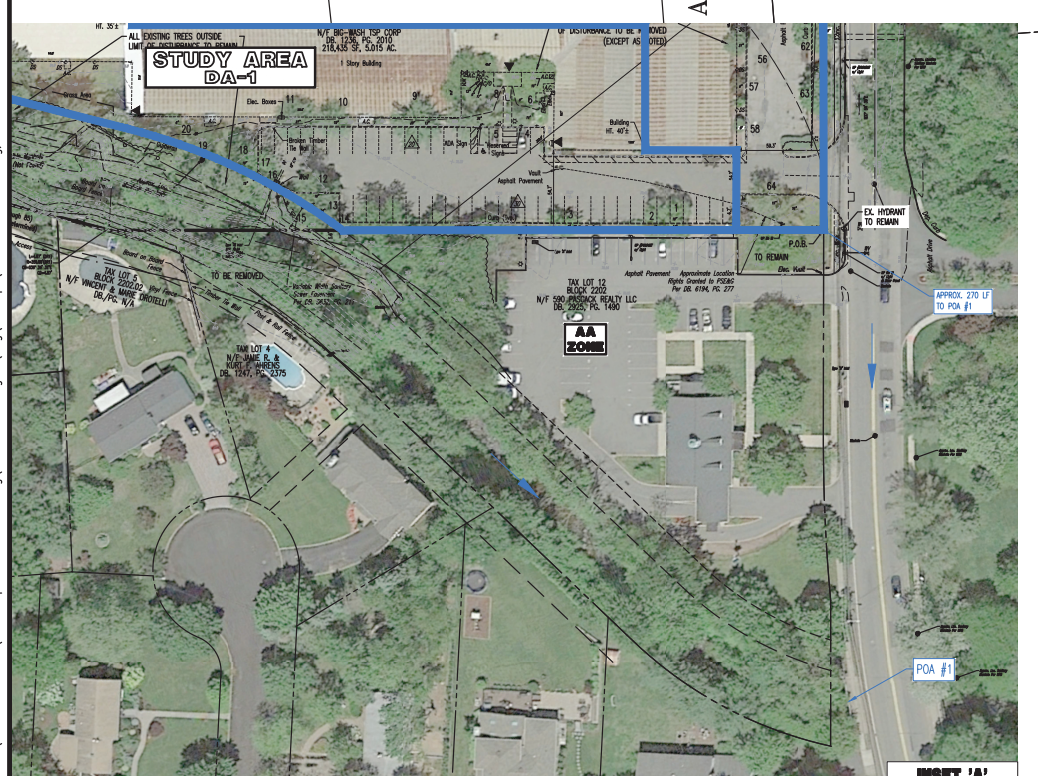
P.O.B.

APPROX. 270 LF TO POA #1

SEE INSET 'A'

GRAPHIC SCALE

(IN FEET)
1 INCH = 40 FT.



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Rev.	Date	Comments	By
1	03/20/20	REVISED PER COMPLETENESS COMMENTS	JTG

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Allen, Texas T: 972.534.2100 | Austin, Texas T:512.646.2646 | Houston, Texas T: 281.799.6400
Newtown, Pennsylvania T: 267.685.0276 | Delray Beach, Florida T: 561.921.8570

TITLE:

EXISTING DRAINAGE AREA MAP

PROJECT: **CAPITOL SENIORS HOUSING**
PROPOSED SENIOR HOUSING DEVELOPMENT
BLOCK 2202, LOT 1
620 PASCACK ROAD (CR 502)
TOWNSHIP OT WASHINGTON, BERGEN COUNTY, NEW JERSEY

JOSEPH G. JAWORSKI
PROFESSIONAL ENGINEER
NEW JERSEY LICENSE No. 36618

DANIEL T. SEHNAL
PROFESSIONAL ENGINEER
NEW JERSEY LICENSE No. 53572

JOB No:	1423-99-003
DATE:	01/10/2020
DRAWN BY:	JED
SCALE: (H) 1"=40' (V)	
DESIGNED BY:	MLR
CHECKED BY:	DTS
CHECKED BY:	–
SHEET No:	1 OF 3
Rev. #	1

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FOR STATE SPECIFIC DIRECT PHONE NUMBERS VISIT: WWW.CALL811.COM

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File: P:\DEDPC PROJECTS\1423 Capitol Seniors Housing\99-003 Washington\dwg\DA Maps\D142399003EDAM1.dwg, ----> 01 EXISTING DRAINAGE AREA MAP

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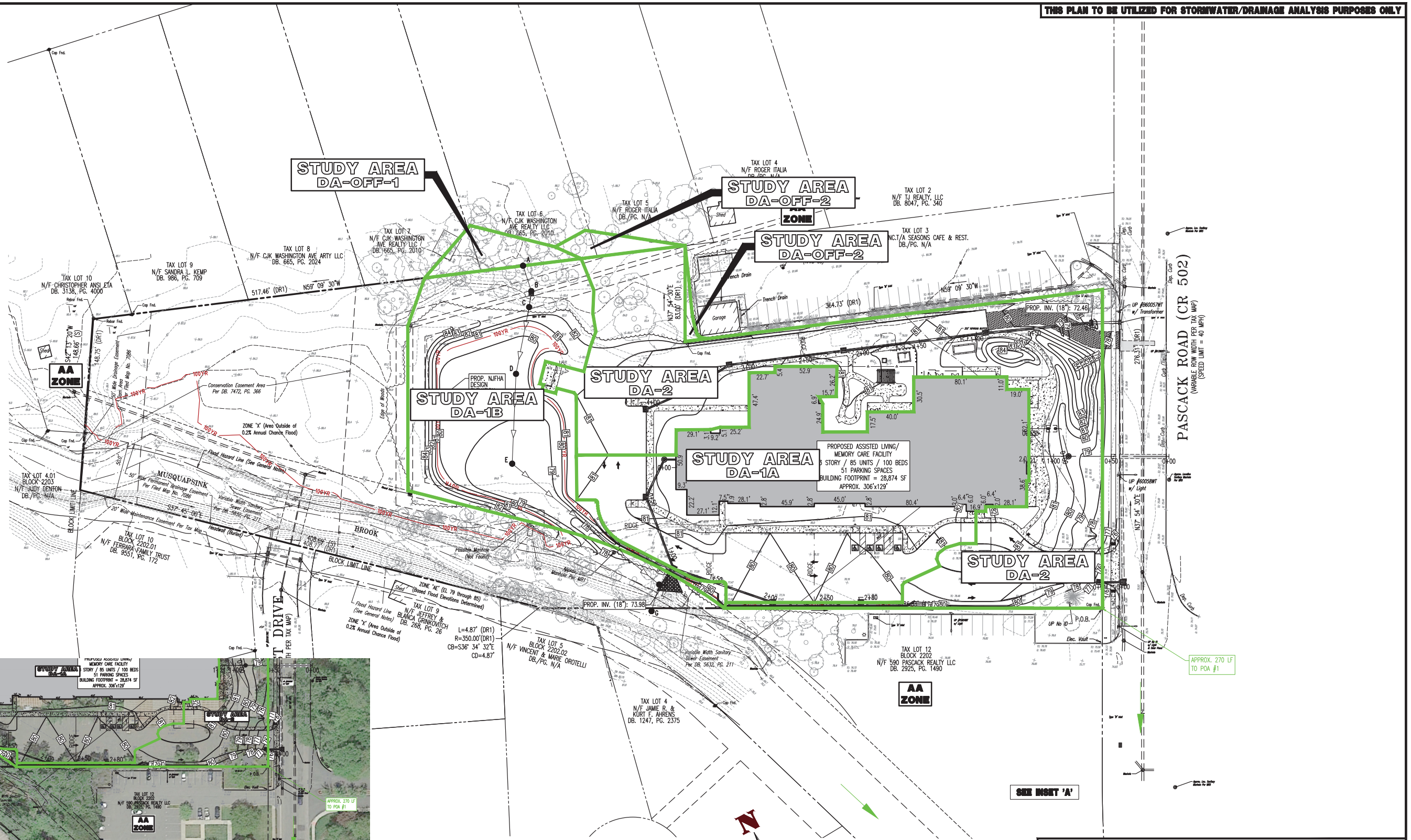

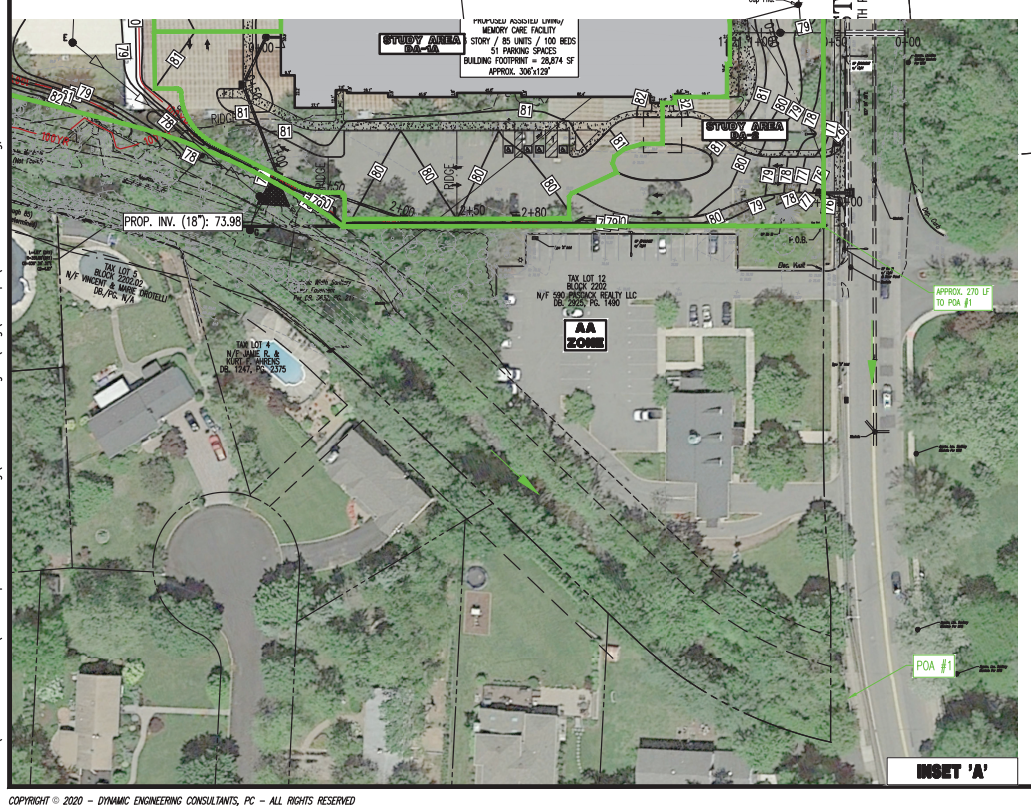

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Rev.	Date	Comments	By
1	03/20/20	REVISED PER COMPLETENESS COMMENTS	JTG

TITLE: PROPOSED DRAINAGE AREA MAP

PROJECT: **CAPITOL SENIORS HOUSING**
PROPOSED SENIOR HOUSING DEVELOPMENT
BLOCK 2202, LOT 1
620 PASCACK ROAD (CR 502)
TOWNSHIP OT WASHINGTON, BERGEN COUNTY, NEW JERSEY

JOB No:	1423-99-003
DATE:	01/10/2020
DRAWN BY:	JED
SCALE: (H)	1"=20'
(V)	
DESIGNED BY:	MLR
CHECKED BY:	DTS
CHECKED BY:	_
SHEET No:	2 OF 3
Rev. #	1

JOSEPH G. JAWORSKI
PROFESSIONAL ENGINEER
NEW JERSEY LICENSE No. 36618

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File: P:\DECPC PROJECTS\1423 Capitol Seniors Housing\99-003 Washington\Dwg\DA Maps\D1423990O3PDAM1.dwg, ----> 02 PROPOSED DRAINAGE AREA MAP

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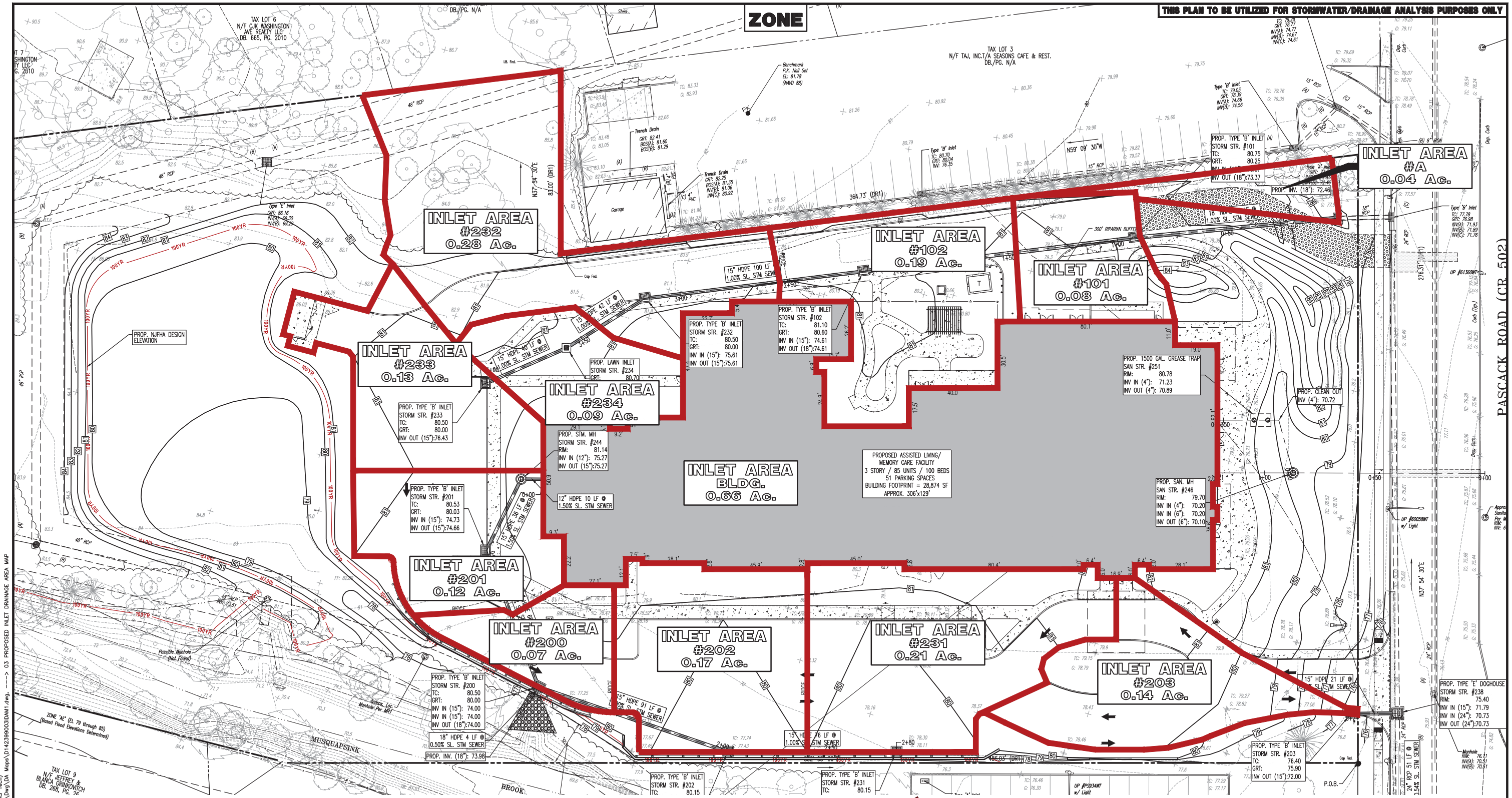

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Rev.	Date	Comments	By
1	03/20/20	REVISED PER COMPLETENESS COMMENTS	JTG

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TITLE: PROPOSED INLET DRAINAGE AREA MAP

PROJECT: **CAPITOL SENIORS HOUSING**
PROPOSED SENIOR HOUSING DEVELOPMENT
BLOCK 2202, LOT 1
620 PASCACK ROAD (CR 502)
TOWNSHIP OT WASHINGTON, BERGEN COUNTY, NEW JERSEY

JOB No:	1423-99-003
DATE:	01/10/2020
DRAWN BY:	JED
SCALE: (H) 1"=20' (V) _	
DESIGNED BY:	MLR
CHECKED BY:	DTS
CHECKED BY:	_
SHEET No:	3 OF 3
Rev. #	1

JOSEPH G. JAWORSKI
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File: P:\DEC\PC PROJECTS\1423 Capitol Seniors Housing\99-003 Washington\Dwg\DA Maps\D1423990031DM1.dwg, ----> 03 PROPOSED INLET DRAINAGE AREA MAP

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