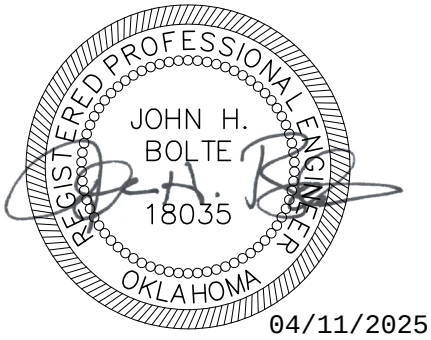
STORMWATER REPORT

For

Vita Nova Village
4301 S. Rangeline Rd.
Joplin, MO

Prepared For
City of Joplin

April 2025



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Introduction & Project Background

Small Arrow Engineering (SAE) was hired by Vita Nova Village to prepare a hydraulic and hydrologic analysis of a proposed tiny home community. The site is located at 1201 Byers Avenue in Joplin, MO. The purpose of this study is to demonstrate that the proposed development is in compliance with the City of Joplin Stormwater Management Criteria and will not have adverse effects downstream. Aerial and topographic maps of the site can be found in Appendix A.

Site Description

Per Section 10.2 of the City of Joplin Stormwater Management Criteria Manual, the "Pre-Development Conditions" used in the hydrologic analysis of the site refers to completely undeveloped conditions. The exact date of development on this site is unknown, but a review of historic aerials revealed that the area has been developed since at least prior to 1959. Earlier historic aerials were unavailable, so it is assumed that the "undeveloped" conditions for this site are open space in good condition that primarily drains northeast to Joplin Creek West. No sinkholes or karst topography are known to be present at this site. A soil survey of the site was conducted using the USDA Web Soil Survey tool, and the soil was found to be predominantly HSG Type C. The soil study was conducted using NRCS resources and is included in Appendix B of this report.

Pre-Development Conditions

Since the exact topography of the site in pre-development conditions is limited to information from large-scale USGS historic topography maps, this analysis will be conducted using current topographic conditions as of a survey conducted in January 2025. The existing topography of the site is divided into two main drainage areas. Pre-Development Drainage Area 1 (Pre-DA 1) has been further divided into three subbasins. Pre-DA 1A consists of 1.60 acres of HSG C Open Space with a curve number of 74. Runoff drains northeast into Joplin Creek West.

Table 1.1: Pre-DA 1A Land Uses

Land Use	Area (ac)	CN
HSG C Open Space	1.60	74
Total	**1.60**	**74**

Pre-DA 1B represents offsite drainage north of the proposed development and consists of 0.01 acres of HSG C Open Space with a curve number of 74. Runoff drains southeast into Joplin Creek West.

Table 1.2: Pre-DA 1B Land Uses

Land Use	Area (ac)	CN
HSG C Open Space	0.01	74
Total	**0.01**	**74**

Pre-DA 1C represents offsite drainage south of the proposed development and consists of 0.42 acres of HSG C Open Space with a curve number of 74. Runoff drains northeast into Joplin Creek West.

Table 1.3: Pre-DA 1C Land Uses

Land Use	Area (ac)	CN
HSG C Open Space	0.42	74
Total	**0.42**	**74**

Pre-Development Drainage Area 2 (Pre-DA 2) consists of 0.01 acres of HSG C Open Space with a curve number of 74. Runoff drains to the northwest.

Table 1.4: Pre-DA 2 Land Uses

Land Use	Area (ac)	CN
HSG D Woods	0.01	74
Total	**0.01**	**74**

All three subbasins of Pre-DA 1 drain directly to Joplin Creek West. Pre-DA 2 drains to an existing stormwater curb inlet along Byers Avenue. These are considered the final pre-development outfalls for the site. The Pre-Development Drainage Area Map can be found in Appendix C.

Table 1.5: Pre-Development Drainage Summary

Drainage Area	Land Use	Area (ac)	CN	Tc (min)
Pre-DA 1A	Open Space	1.60	74	13.90
Pre-DA 1B	Open Space	0.01	74	5.00
Pre-DA 1C	Open Space	0.42	74	6.20
Pre-DA 2	Open Space	0.01	74	5.00

Post-Development Conditions

The proposed site is split into two main drainage areas. Post-Development Drainage Area 1 (Post-DA 1) has been further divided into four subbasins. Post-DA 1A consists of HSG C Open Space, HSG C Gravel, and Impervious Area. The total area is 0.50 acres, and the cumulative curve number is 84. Runoff drains northeast into Joplin Creek West.

Table 2.1: Post-DA 1A Land Uses

Land Use	Area (ac)	CN
HSG C Open Space	0.28	74
HSG C Gravel	0.04	89
Impervious	0.17	98
Total	**0.50**	**84**

Post-DA 1B represents offsite drainage north of the proposed development and consists of 0.01 acres of HSG C Open Space with a curve number of 74. Runoff drains southeast into Joplin Creek West.

Table 2.2: Post-DA 1B Land Uses

Land Use	Area (ac)	CN
HSG C Open Space	0.01	74
Total	**0.01**	**74**

Post-DA 1C consists of HSG C Open Space and Impervious Area. The total area is 1.09 acres, and the cumulative curve number is 85. Runoff drains southeast into the proposed detention pond.

Table 2.3: Post-DA 1C Land Uses

Land Use	Area (ac)	CN
HSG C Open Space	0.60	74
Impervious	0.49	98
Total	**1.09**	**85**

Post-DA 1D represents offsite drainage south of the proposed development and consists of HSG C Open Space, HSG C Gravel, and Impervious Area. The total area is 0.42 acres, and the cumulative curve number is 82. Runoff drains northeast into the proposed detention pond.

Table 2.4: Post-DA 1D Land Uses

Land Use	Area (ac)	CN
HSG C Open Space	0.23	74
HSG C Gravel	0.12	89
Impervious	0.07	98
Total	**0.42**	**82**

Post-Development Drainage Area 2 (Post-DA 2) consists of 0.02 acres of HSG C Open Space with a curve number of 74. Runoff drains to the northwest.

Table 2.5: Post-DA 2 Land Uses

Land Use	Area (ac)	CN
HSG C Open Space	0.02	74
Total	**0.02**	**74**

All four subbasins of Post-DA 1 eventually drain to Joplin Creek West, with Post-DA 1A and 1B draining directly to the creek and Post-DA 1C and 1D draining to the creek after being temporarily detained. Post-DA 2 drains to an existing stormwater curb inlet along Byers Avenue. These are considered the final post-development outfalls for the site. The Post-Development Drainage Area Map can be found in Appendix C.

Table 2.6: Post-Development Drainage Summary

Drainage Area	Land Use	Area (ac)	CN	Tc (min)
Post-DA 1A	Open Space, Gravel, Impervious Area	0.50	84	5.00
Post-DA 1B	Open Space	0.01	74	5.00
Post-DA 1C	Open Space, Impervious Area	1.09	85	7.30
Post-DA 1D	Open Space, Gravel, Impervious Area	0.42	82	5.00
Post-DA 2	Open Space	0.02	74	5.00

Analysis

Computerized modelling using AutoCAD's Hydraflow Extension was performed to determine peak discharges for each drainage area. Precipitation data from Table A in the City of Joplin Stormwater Management Criteria Manual was used for this analysis, and the time of concentration of each drainage area was calculated using the TR-55 method.

Critical Storm Determination

The Huff Distribution Method was used in this model, and a Critical Storm Analysis was conducted to determine the correct storm duration:

Pre-Development Critical Storm Analysis

Table 3.1: Pre-Development DA 1 Critical Storm Analysis

Storm Duration	Storm Event		
	2-Year	10-Year	100-Year
1-Hr	0.838	2.752	5.819
2-Hr	0.804	2.387	4.958
3-Hr	0.825	2.071	3.961
6-Hr	0.602	1.299	2.840
12-Hr	0.568	1.207	2.382
24-Hr	0.525	0.995	1.719

Table 3.2: Pre-Development DA 2 Critical Storm Analysis

Storm Duration	Storm Event		
	2-Year	10-Year	100-Year
1-Hr	0.005	0.016	0.034
2-Hr	0.004	0.013	0.025
3-Hr	0.004	0.011	0.021
6-Hr	0.003	0.007	0.017
12-Hr	0.003	0.006	0.012
24-Hr	0.003	0.005	0.009

Post-Development Critical Storm Analysis

Table 4.1: Post-Development DA 1A & 1B Critical Storm Analysis

Storm Duration	Storm Event		
	2-Year	10-Year	100-Year
1-Hr	0.615	1.513	2.781
2-Hr	0.476	1.078	2.206
3-Hr	0.417	0.983	1.894
6-Hr	0.305	0.671	1.310
12-Hr	0.226	0.413	0.745
24-Hr	0.181	0.306	0.490

Table 4.2: Post-Development DA 1C & 1D Critical Storm Analysis

Storm Duration	Storm Event		
	2-Year	10-Year	100-Year
1-Hr	1.780	4.364	7.954
2-Hr	1.378	3.094	6.183
3-Hr	1.205	2.793	5.352
6-Hr	0.880	1.920	3.730
12-Hr	0.648	1.184	2.126
24-Hr	0.519	0.873	1.396

Table 4.3: Post-Development DA 2 Critical Storm Analysis

Storm Duration	Storm Event		
	2-Year	10-Year	100-Year
1-Hr	0.009	0.033	0.069
2-Hr	0.009	0.026	0.051
3-Hr	0.009	0.021	0.043
6-Hr	0.006	0.013	0.033
12-Hr	0.006	0.012	0.024
24-Hr	0.005	0.010	0.017

The critical storm for all scenarios was the 1-hr storm. The following rainfall data from the City of Joplin Drainage Criteria Manual was used in the model:

Table 5: Huff 1st Quartile, 1-hr Storm Precipitation Data

Return Period	Depth (in)
2-Year	1.80
10-Year	2.87
100-Year	4.10

Time of Concentration Calculations

The time of concentration for each scenario was determined using the TR-55 Method. The sheet flow, shallow concentrated flow, and channel flow were calculated for each drainage area and summed for a total time of concentration. A time of concentration of 5.0 minutes was used for drainage areas with a calculated time of concentration less than 5.0 minutes. Detailed calculations for the time of concentration can be found in Appendix D.

Detention Pond and Water Quality Calculations

The detention pond and outlet structure were designed to reduce Post-Development flows to match Pre-Development Conditions and to treat runoff based on City of Joplin's water quality requirements. Two methods were evaluated to determine the water quality volume per Section 13.4a of the City of Joplin Stormwater Management Criteria Manual. Method 1 evaluated the first 0.5" of runoff from the directly connected impervious area in the development and produced a volume of 1,281 cubic feet. Method 2 evaluated the runoff resulting from the total rainfall depth of 1" in 24 hours over the entire development. This method was calculated using Hydraflow and produced a volume of 887 cubic feet. Since Method 1 produced a greater volume for the site, a WQCV of 1,281 cubic feet was used.

At an elevation of 1010.90', 116% of the water quality volume is stored in the detention pond, and the water quality orifice was designed to release this volume over 47 hours.

In addition to the extended dry detention basin, a vegetative filter strip was designed to treat the impervious area in Post-DA 1A that will be discharging directly to Joplin Creek West without being routed to the proposed pond. This area consists of the roofs of the tiny homes to the north of the drive aisle, four storm shelters, and a portion of the proposed pavement. The rational method was used to analyze the runoff draining to the proposed vegetative filter strip, and a peak flow of 0.85 cfs was calculated for the 2-year storm. The Unit Hydraulic Loading was determined to be 0.002 cfs/ft based on the length of the filter strip, which is less than the 0.05 cfs/ft limit outlined in Section 13.4c of the Joplin Stormwater Management Criteria Manual. The strip was designed to extend from the back of the upstream impervious area to the retaining wall of the existing channel or to the northern property boundary. It has a minimum width of 6.5', which is greater than 20% of the width of the runoff from the tiny home roofs and storm shelters. The maximum width of the pavement parallel to the flow of runoff is 35.3', and the vegetative filter strip adjacent to the pavement has a minimum width of 10', or 28% of the width of the runoff.

Detailed water quality calculations can be found in Appendix E. Stage-storage data and outlet/weir information were entered into Hydraflow to determine routing and storage of the proposed detention pond. The full Hydraflow report can be found in Appendix F.

Results

Table 6: Detention Pond Stage-Storage Data

Stage (FT)	Elevation (FT)	Contour Area (SF)	Incremental Storage (CF)	Total Storage (CF)
0.00	1009.81	0	0.0	0.0
0.19	1010.00	503	31.9	31.9
1.19	1011.00	3,096	1,616	1,648
2.19	1012.00	4,135	3,603	5,251
3.19	1013.00	5,360	4,734	9,984
3.69	1013.50	6,577	2,979	12,963

Table 7: Detention Pond Storage & Discharge Summary

Return Period	Maximum Water Elevation (FT)	Freeboard (FT)	Flow Into Pond (CFS)	Flow Out of Pond (CFS)
2-Year	1011.27	2.23	1.78	0.40
10-Year	1011.78	1.72	4.36	1.39
100-Year	1012.36	1.14	7.95	2.95

Table 8.1: Pre-Development Peak Flow Summary

Return Period	Pre-DA 1 Peak Flow (cfs)	Pre-DA 2 Peak Flow (cfs)
2-Year	0.84	0.01
10-Year	2.75	0.02
100-Year	5.82	0.03

Table 8.2: Post-Development Peak Flow Summary

Return Period	Post-DA 1 Peak Flow (cfs)	Post-DA 2 Peak Flow (cfs)
2-Year	0.63	0.01
10-Year	2.05	0.03
100-Year	4.22	0.07

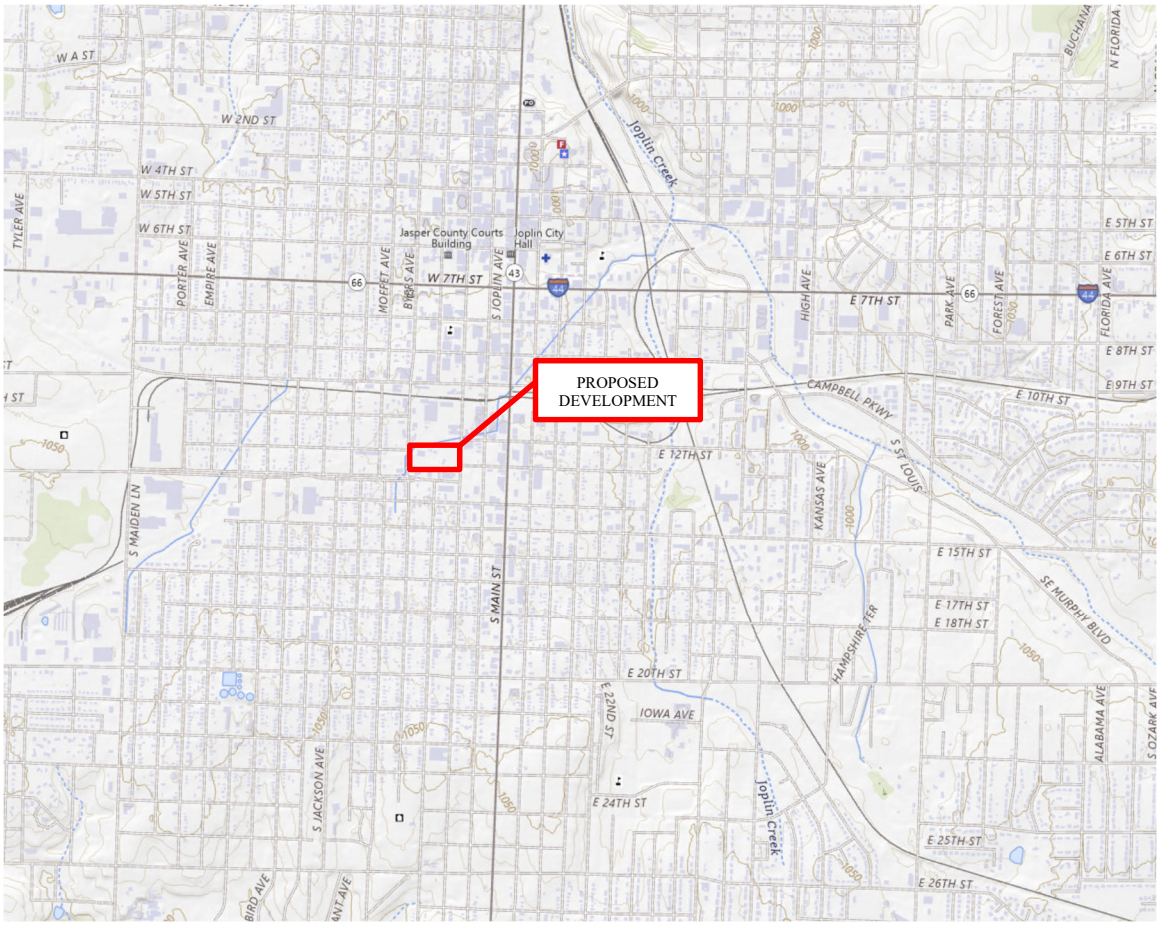
Summary

The results of the model show that peak flows for DA 1 draining to Joplin Creek West will decrease for the 2-year, 10-year, and 100-year storms. The flow rates for DA 2 will stay the same for the 2-year storm but increase slightly for the 10-year and 100-year storms. However, the increase is insignificant and will not result in negative impacts downstream. The detention pond was designed for both water quality and flood control and adequately reduces peak flows while maintaining a minimum of approximately 1.14 feet of freeboard to the top of pond, 1.72 feet to the lowest point of the pavement, and 2.47 feet to the lowest finish floor elevation of the tiny homes. Overall, the proposed development is not expected to have any adverse effects on downstream properties.

APPENDIX A

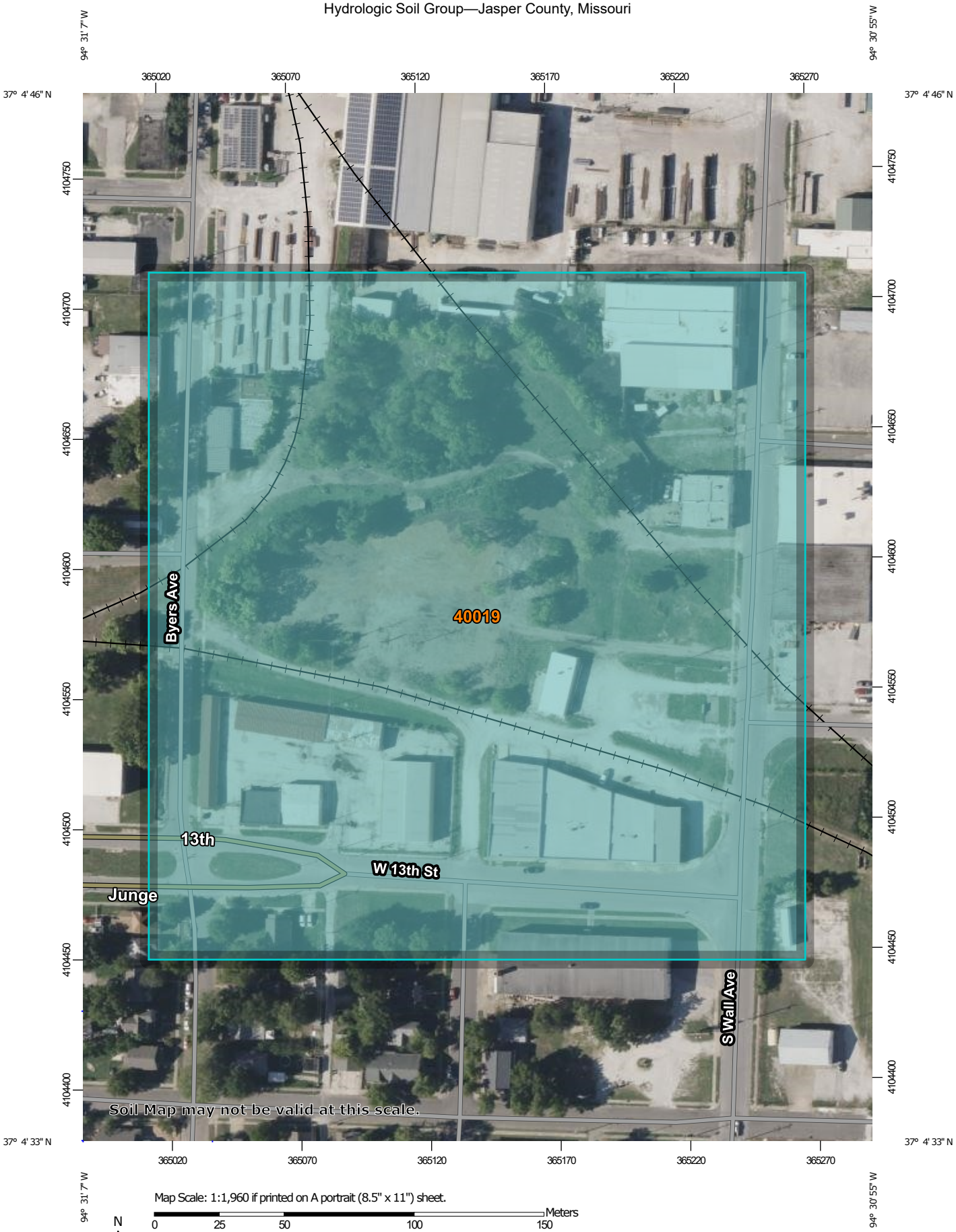
Site Maps




PROPOSED DEVELOPMENT
W A ST
W 2ND ST
W 4TH ST
W 5TH ST
W 6TH ST
TYLER AVE
PORTER AVE
EMPIRE AVE
MOFFET AVE
BIRD'S AVE
S JOPLIN AVE
Jasper County Courts Building
Joplin City Hall
W 7TH ST
Joplin Creek
HIGH AVE
E 7TH ST
PARK AVE
FOREST AVE
FLORIDA AVE
E 5TH ST
E 6TH ST
E 8TH ST
E 9TH ST
E 10TH ST
CAMPBELL PKWY
S ST LOUIS
E 12TH ST
KANSAS AVE
E 15TH ST
E 17TH ST
E 18TH ST
SE MURPHY BLVD
HAMPSHIRE TER
S MAIDEN LN
S MAIN ST
E 20TH ST
E 22ND ST
IOWA AVE
E 24TH ST
S JACKSON AVE
ALABAMA AVE
S OZARK AVE
E 25TH ST
E 26TH ST
BUCHANAN
N FLORIDA

APPENDIX B

HSG Soil Maps



Map Scale: 1:1,960 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 25 50 100 150

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 15N 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: Jasper County, Missouri
Survey Area Data: Version 28, Aug 19, 2024

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

Date(s) aerial images were photographed: Jul 20, 2022—Sep 1, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
40019	Newtonia-Eldorado silt loams, 1 to 3 percent slopes	C	16.6	100.0%
Totals for Area of Interest			**16.6**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

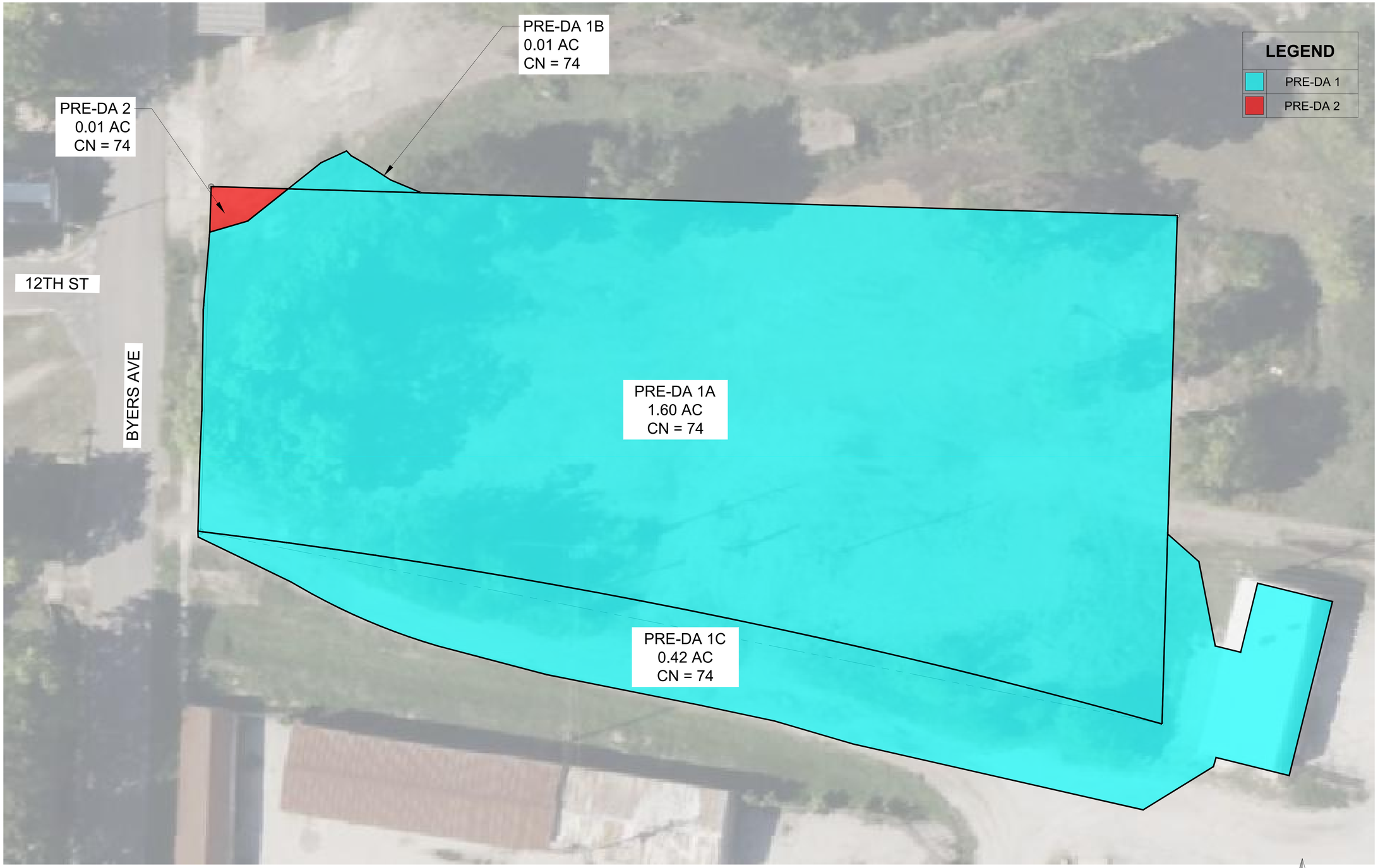
Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

APPENDIX C

Pre- and Post-Development Drainage Maps



PRE-DEVELOPMENT
DRAINAGE MAP

0 10 20 40
SCALE: 1" = 20'

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OKLAHOMA No. 5937
ARKANSAS No. 2097

REVISIONS

NO.	DATE	DESCRIPTION

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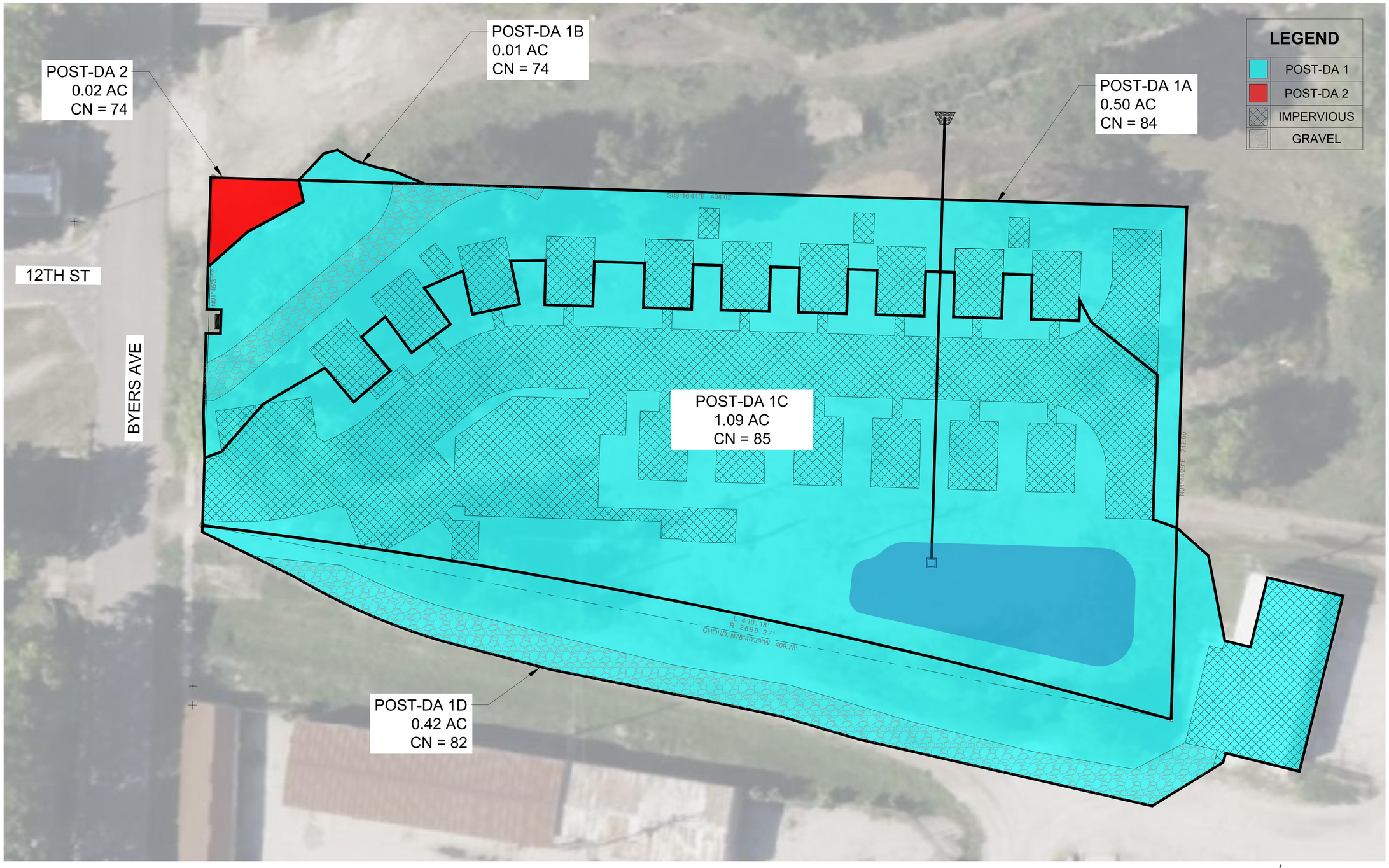
VITA NOVA VILLAGE
1201 BYERS AVENUE
JOPLIN, JASPER COUNTY, MISSOURI
PRE-DEVELOPMENT DRAINAGE MAP

NOT FOR CONSTRUCTION

JOHN H. BOLTE
PROFESSIONAL ENGINEER
MO LIC E22511 OK LIC 18035
KS LIC 14094 AR LIC 14310

SURVEY BY: MJ SURVEY
DRAWN: EMT CHKD: JHB
SCALE: 1"=20'
PROJECT #:
DWG:
DATE: 04/11/2025

PROJECT: VITA NOVA VILLAGE
SHEET DESC: EXHIBIT
SHEET: 1 OF: 1



POST-DEVELOPMENT
DRAINAGE MAP

0 10 20 40
SCALE: 1" = 20'

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KANSAS No. E-1930
OKLAHOMA No. 5937
ARKANSAS No. 2097

REVISIONS

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VITA NOVA VILLAGE
1201 BYERS AVENUE
JOPLIN, JASPER COUNTY, MISSOURI
POST-DEVELOPMENT DRAINAGE MAP

JOHN H. BOLTE
PROFESSIONAL ENGINEER
MO LIC E22511 OK LIC 18035
KS LIC 14094 AR LIC 14310

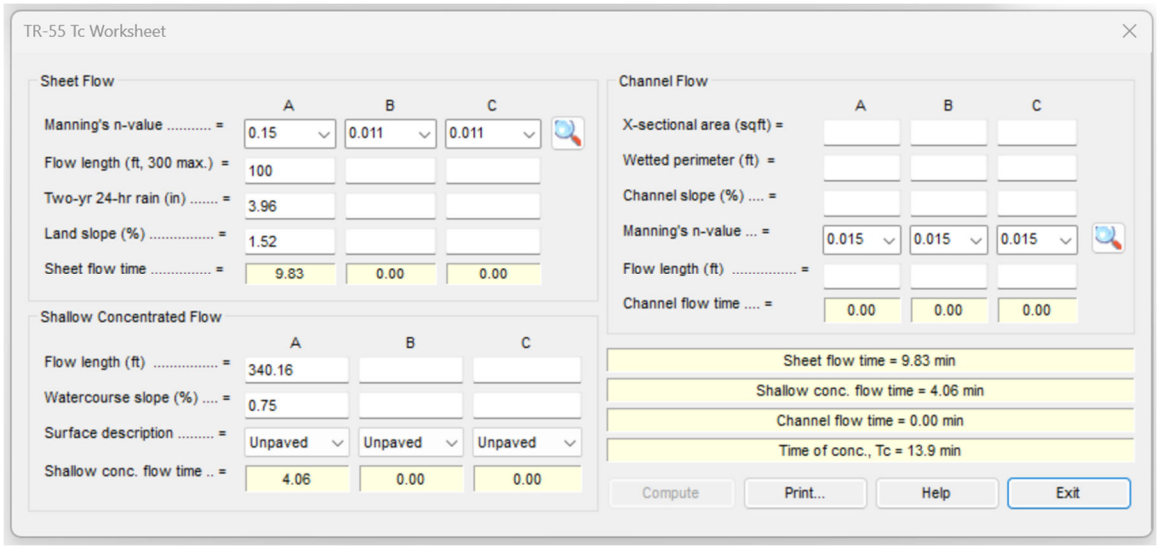
SURVEY BY: MJ SURVEY
DRAWN: EMT CHKD: JHB
SCALE: 1"=20'
PROJECT #:
DWG:
DATE: 04/11/2025

PROJECT: VITA NOVA VILLAGE
SHEET DESC: EXHIBIT
SHEET: 1 OF: 1

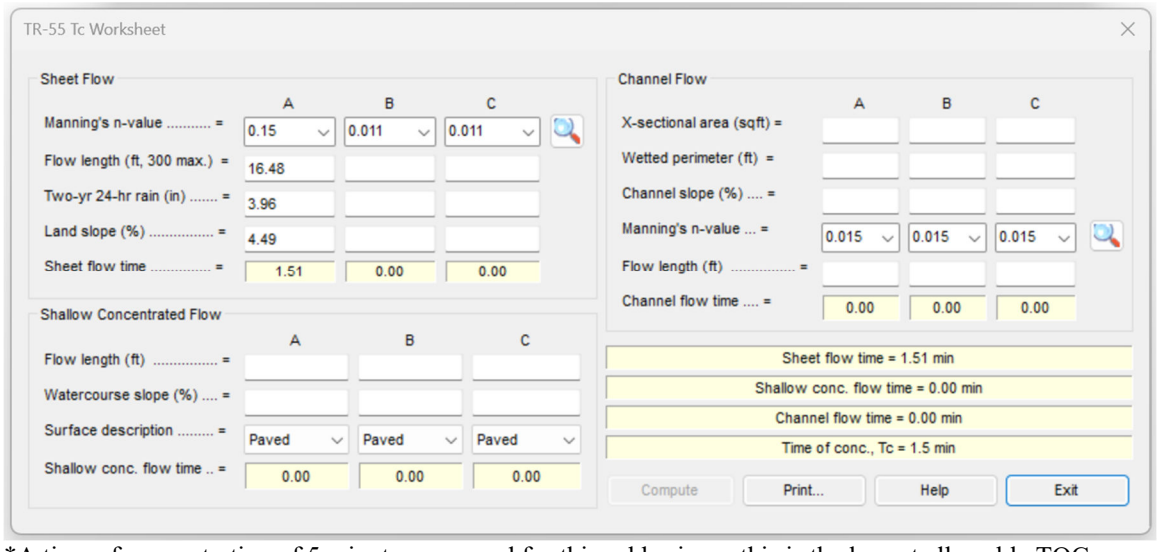
APPENDIX D

Time of Concentration Calculations

Pre-DA 1A

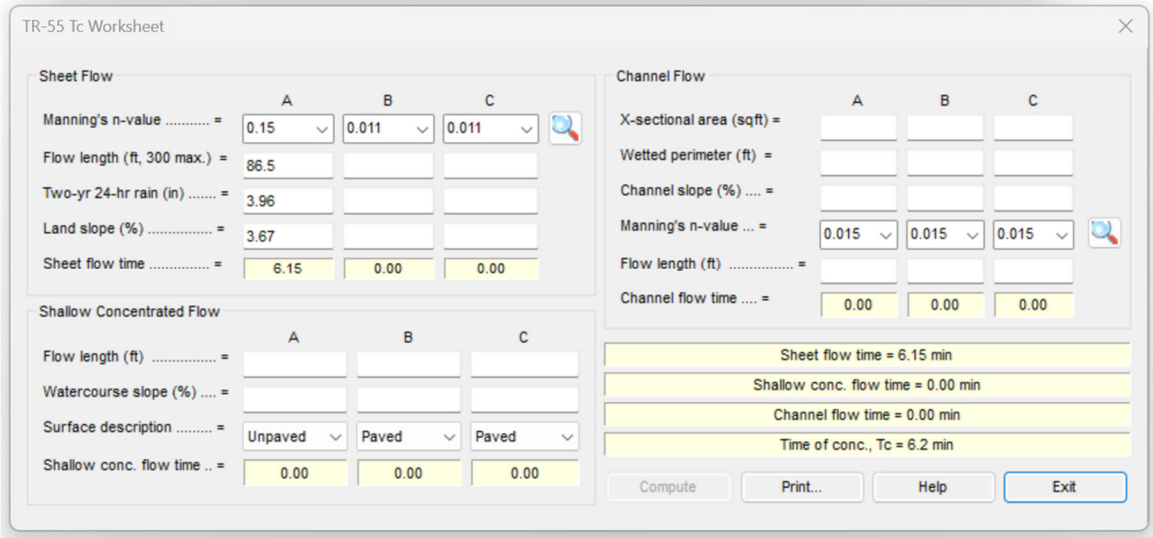


Pre-DA 1B



*A time of concentration of 5 minutes was used for this subbasin, as this is the lowest allowable TOC.

Pre-DA 1C



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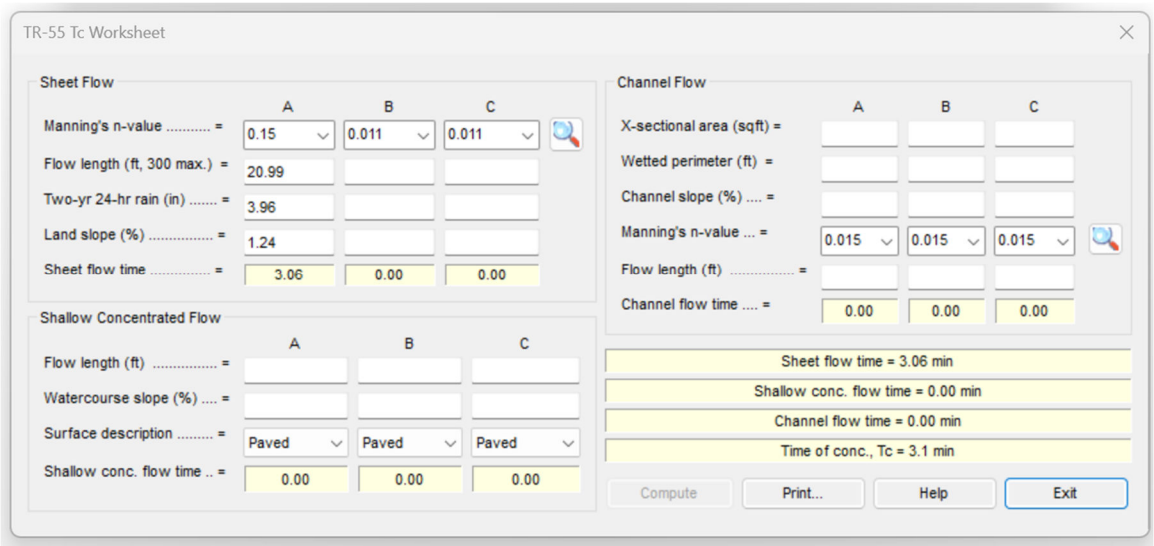
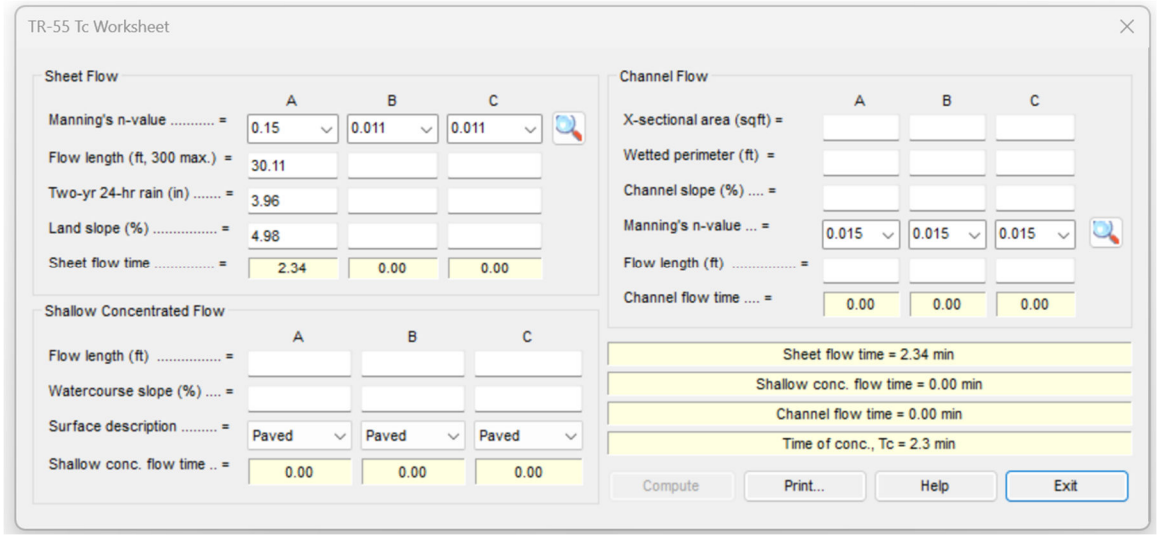


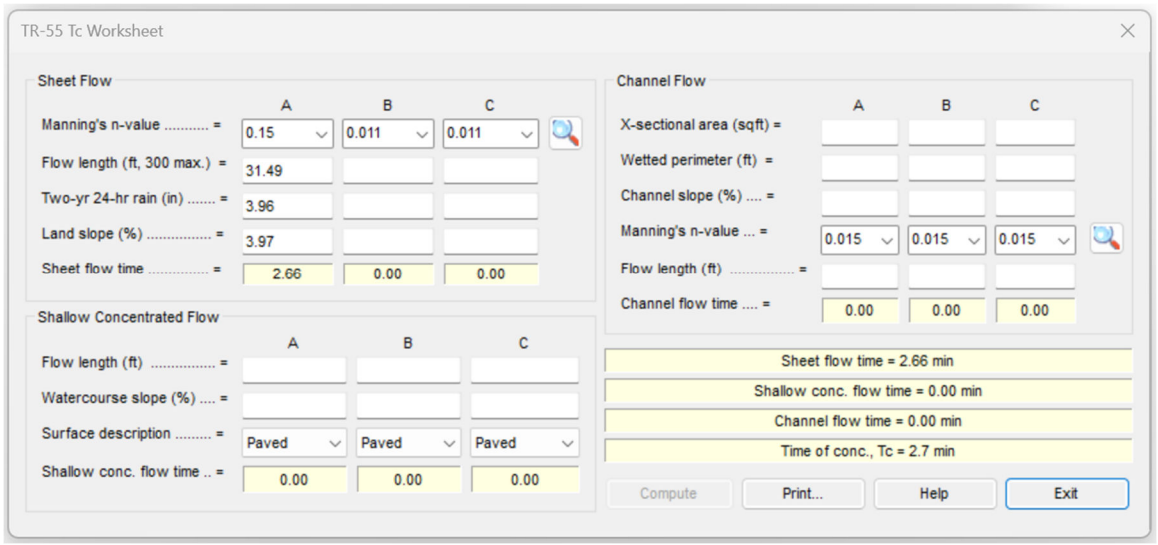
*A time of concentration of 5 minutes was used for this subbasin, as this is the lowest allowable TOC.

Post-DA 1A



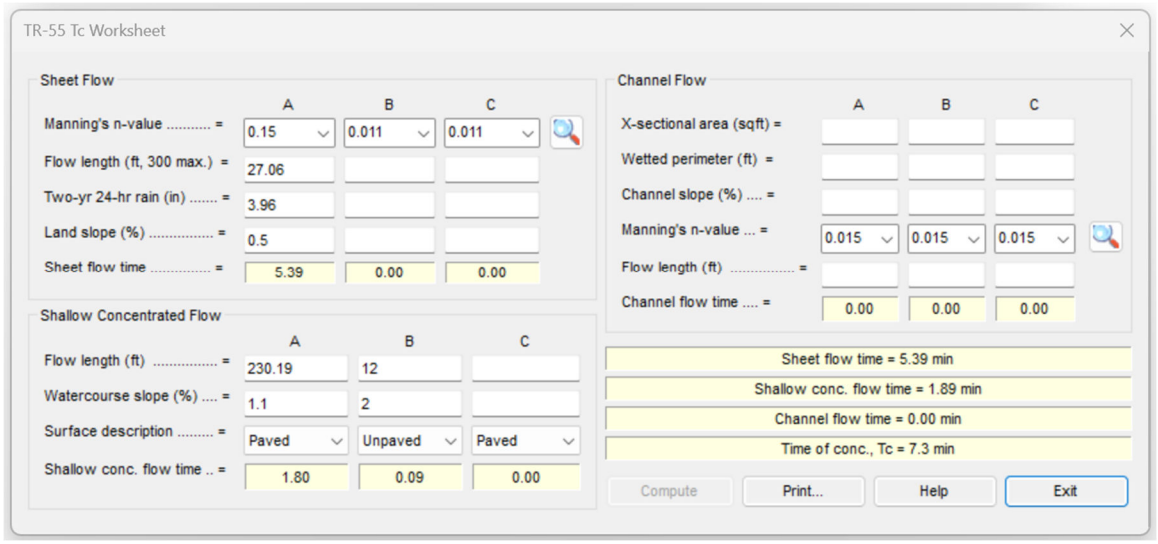
*A time of concentration of 5 minutes was used for this subbasin, as this is the lowest allowable TOC.

Post-DA 1B

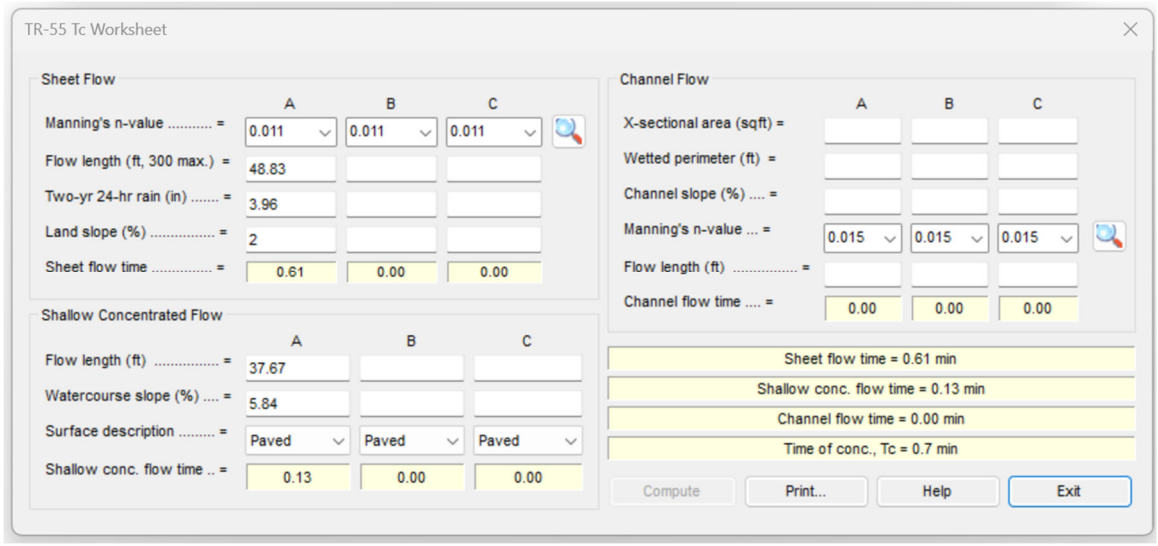


*A time of concentration of 5 minutes was used for this subbasin, as this is the lowest allowable TOC.

Post-DA 1C

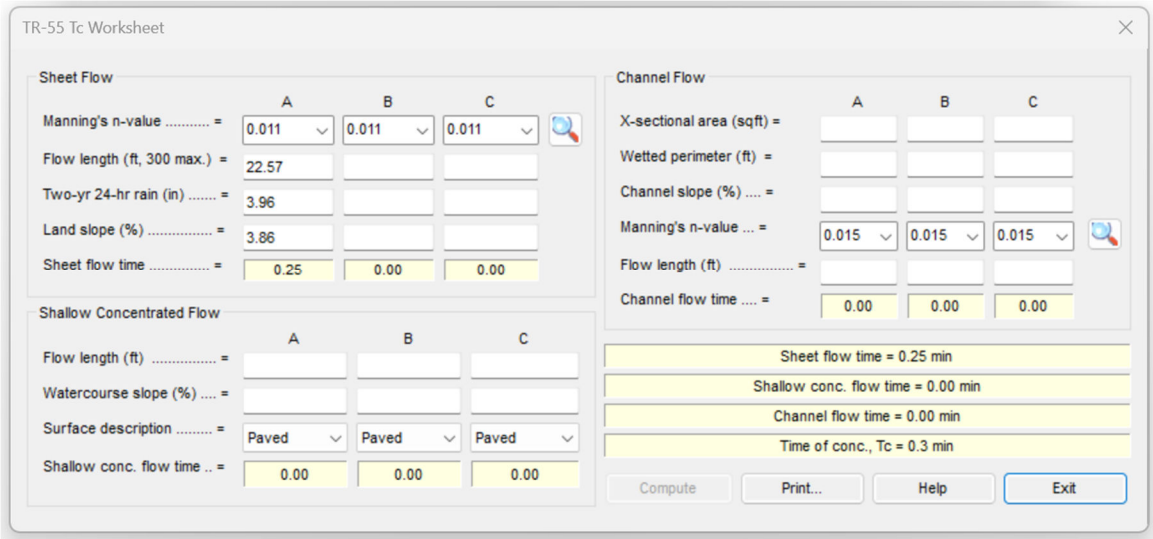


Post-DA 1D



*A time of concentration of 5 minutes was used for this subbasin, as this is the lowest allowable TOC.

Post DA 2



*A time of concentration of 5 minutes was used for this subbasin, as this is the lowest allowable TOC.

APPENDIX E

Water Quality Calculations

Water Quality Volume (Method 1)		
Total Impervious Area=	30732.52	SF
Depth of Rainfall=	0.5	IN
	0.042	FT
WQCV=	1280.52	CF

Water Quality Volume (Method 2)			
Onsite Land Uses			
Land Use	**Area (SF)**	**Area (AC)**	**CN**
HSG C Open Space, Good	39321.281	0.90	74
HSG C Gravel	1900.9159	0.04	89
Impervious	28831.6	0.66	98
Total	**70,053.80**	**1.61**	**84**

Hydrologic Volume: 887.00 CF
(See Hydraflow Report)

Extended Dry Detention - WQV Drawdown Time								
Stage (ft)	Elevation (ft)	Storage (cf)	Discharge (cfs)	dstor (cf)	Qave (cfs)	Inc. Time (s)	Inc. Time (hr)	Cum. Time (hr)
0.00	1009.81	0	0.000	0.0	0.000	0.00	0.00	0.00
0.02	1009.83	3	0.000	3.2	0.000	0.00	0.00	0.00
0.04	1009.85	6	0.000	3.2	0.000	0.00	0.00	0.00
0.06	1009.87	10	0.000	3.2	0.000	0.00	0.00	0.00
0.08	1009.89	13	0.000	3.2	0.000	0.00	0.00	0.00
0.10	1010.90	16	0.000	3.1	0.000	0.00	0.00	0.00
0.11	1010.92	19.1	0.000	3.2	0.000	0.00	0.00	0.00
0.13	1010.94	22.3	0.001	3.2	0.001	6400.00	1.78	1.78
0.15	1010.96	25.5	0.002	3.2	0.002	2133.33	0.59	2.37
0.17	1010.98	28.7	0.003	3.2	0.003	1280.00	0.36	2.73
0.19	1010.00	31.9	0.004	3.2	0.004	914.29	0.25	2.98
0.29	1010.10	193	0.006	161	0.005	32220.00	8.95	11.93
0.39	1010.20	355	0.008	162	0.007	23142.86	6.43	18.36
0.49	1010.30	517	0.009	162	0.009	19058.82	5.29	23.65
0.59	1010.40	678	0.010	161	0.010	16947.37	4.71	28.36
0.69	1010.50	840	0.011	162	0.011	15428.57	4.29	32.65
0.79	1010.60	1001	0.012	161	0.012	14000.00	3.89	36.53
0.89	1010.70	1163	0.013	162	0.013	12960.00	3.60	40.13
0.99	1010.80	1325	0.014	162	0.014	12000.00	3.33	43.47
1.09	1010.90	1486	0.014	161	0.014	11500.00	3.19	46.66

*Discharges were taken from the Hydraflow Pond Report, Culvert B Quantities

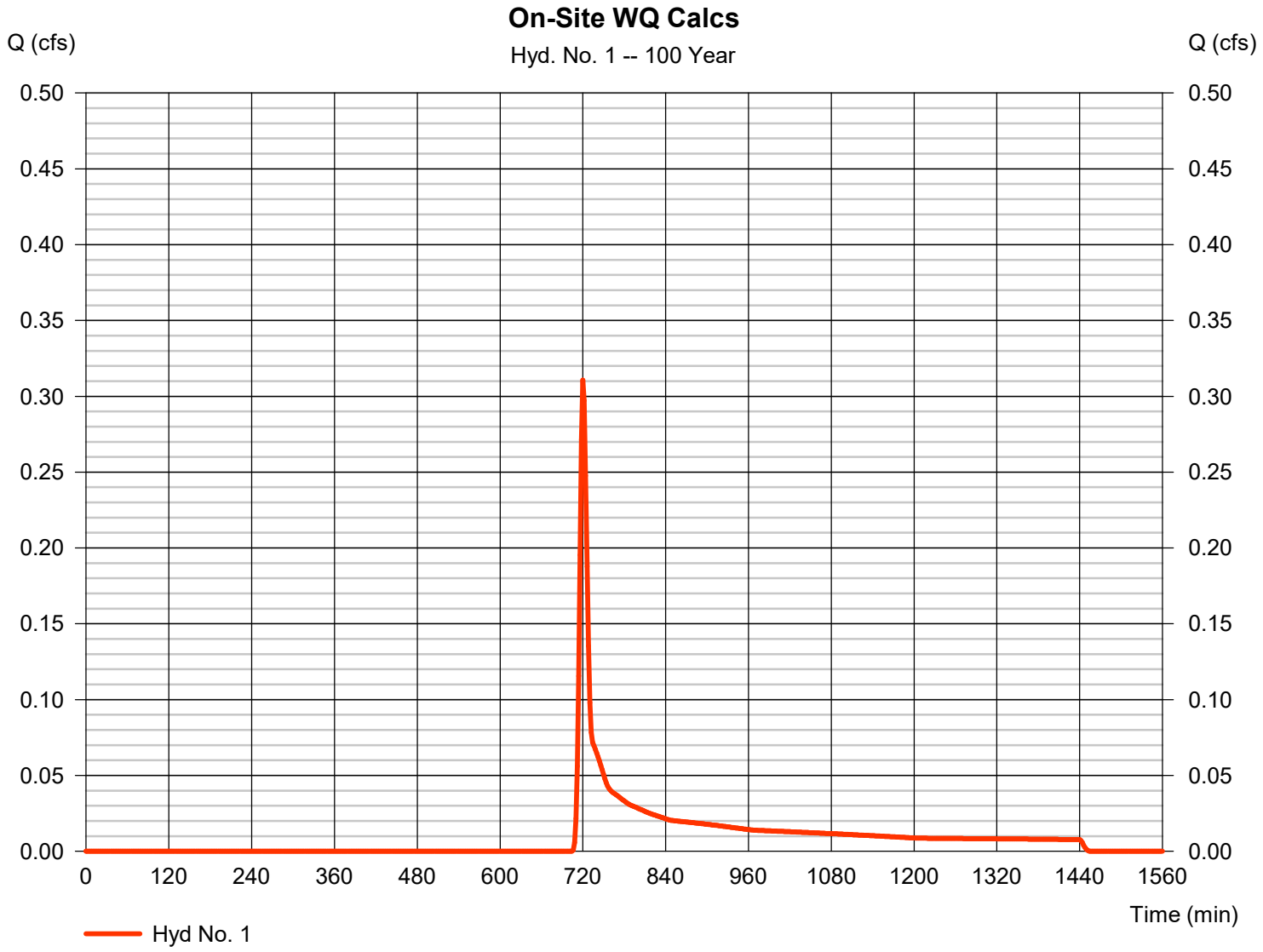
Hydrograph Report

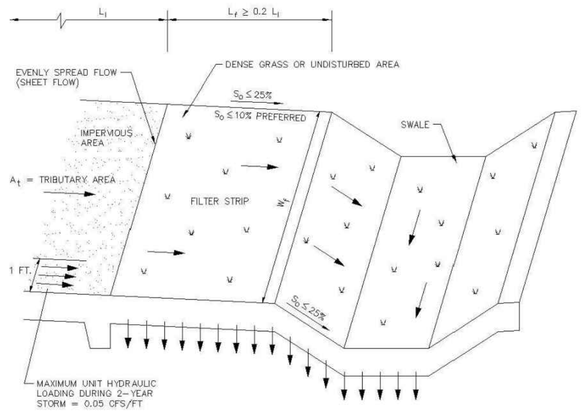
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Tuesday, 04 / 8 / 2025

Hyd. No. 1

On-Site WQ Calcs

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.311 cfs
Storm frequency	=	100 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	887 cuft
Drainage area	=	1.610 ac	Curve number	=	84
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	7.30 min
Total precip.	=	1.00 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484





ADAPTED FROM DENVER URBAN DRAINAGE & FLOOD CONTROL DISTRICT – DRAINAGE CRITERIA MANUAL

CITY OF JOPLIN MISSOURI

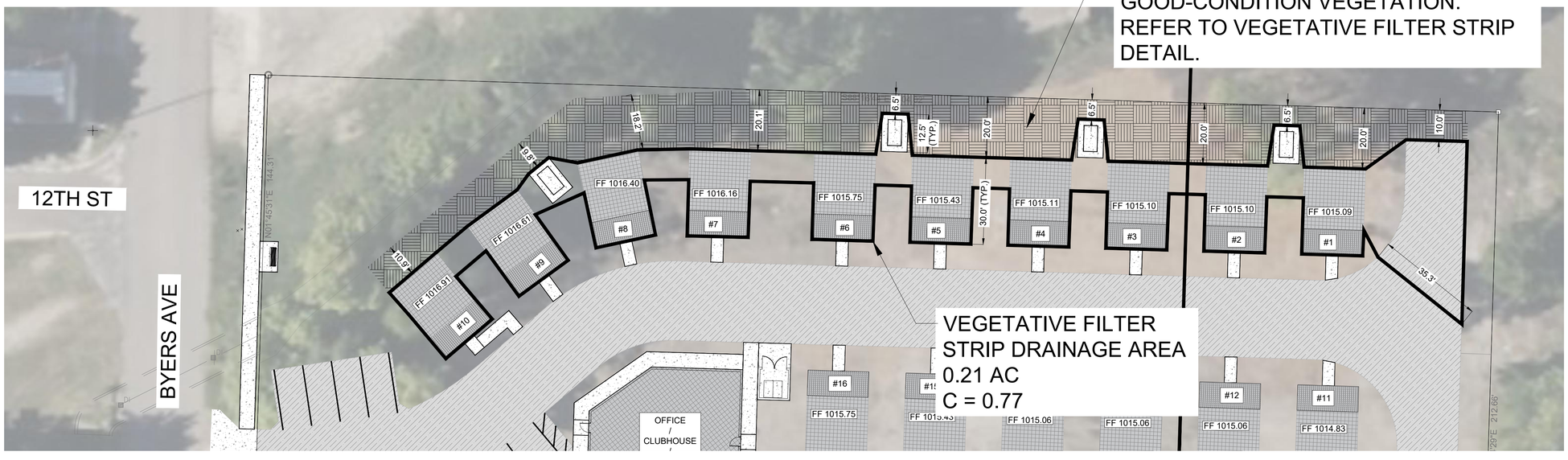
JOPLIN, MISSSOURI
STORMWATER MANAGEMENT
CRITERIA

VEGETATVIE FILTER STRIP
WATER QUALITY BMP

FIGURE 34

Vegetative Filter Strip			
Land Use	**Area (SF)**	**Area (AC)**	**C**
Open Space	1,734.71	0.04	0.20
Impervious Area	7275.0326	0.17	0.90
Total	**9,009.74**	**0.21**	**0.77**

Rational "C" =	0.77	
Intensity =	5.39	in/hr
Area =	0.21	ac
Peak Flow =	**0.85**	**cfs**
Length of Filter Strip =	450.67	ft
Unit Hydraulic Loading =	**0.0019**	**cfs/ft**



VEGETATIVE FILTER STRIP

0 10 20 40
SCALE: 1" = 20'

SMALL ARROW ENGINEERING, LLC

1302 S. MAIN STREET
PO BOX 1538
JOPLIN, MISSOURI 64802
TEL: 417.624.2333
FAX: 417.624.2441
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SMALL ARROW ENGINEERING, LLC.
CERTIFICATES OF AUTHORIZATION:
MISSOURI E-2010013647
KANSAS No. E-1930
OKLAHOMA No. 5937
ARKANSAS No. 2097

REVISIONS

NO.	DATE	DESCRIPTION

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VITA NOVA VILLAGE
1201 BYERS AVENUE
JOPLIN, JASPER COUNTY, MISSOURI
VEGETATIVE FILTER STRIP

JOHN H. BOLTE
PROFESSIONAL ENGINEER
MO LIC E22511 OK LIC 18035
KS LIC 14094 AR LIC 14310

SURVEY BY: MJ SURVEY
DRAWN: EMT CHKD: JHB
SCALE: 1"=20'
PROJECT #:
DWG:
DATE: 04/11/2025

PROJECT: VITA NOVA VILLAGE
SHEET DESC: EXHIBIT
SHEET: 1 OF: 1

APPENDIX F

Hydraflow Report

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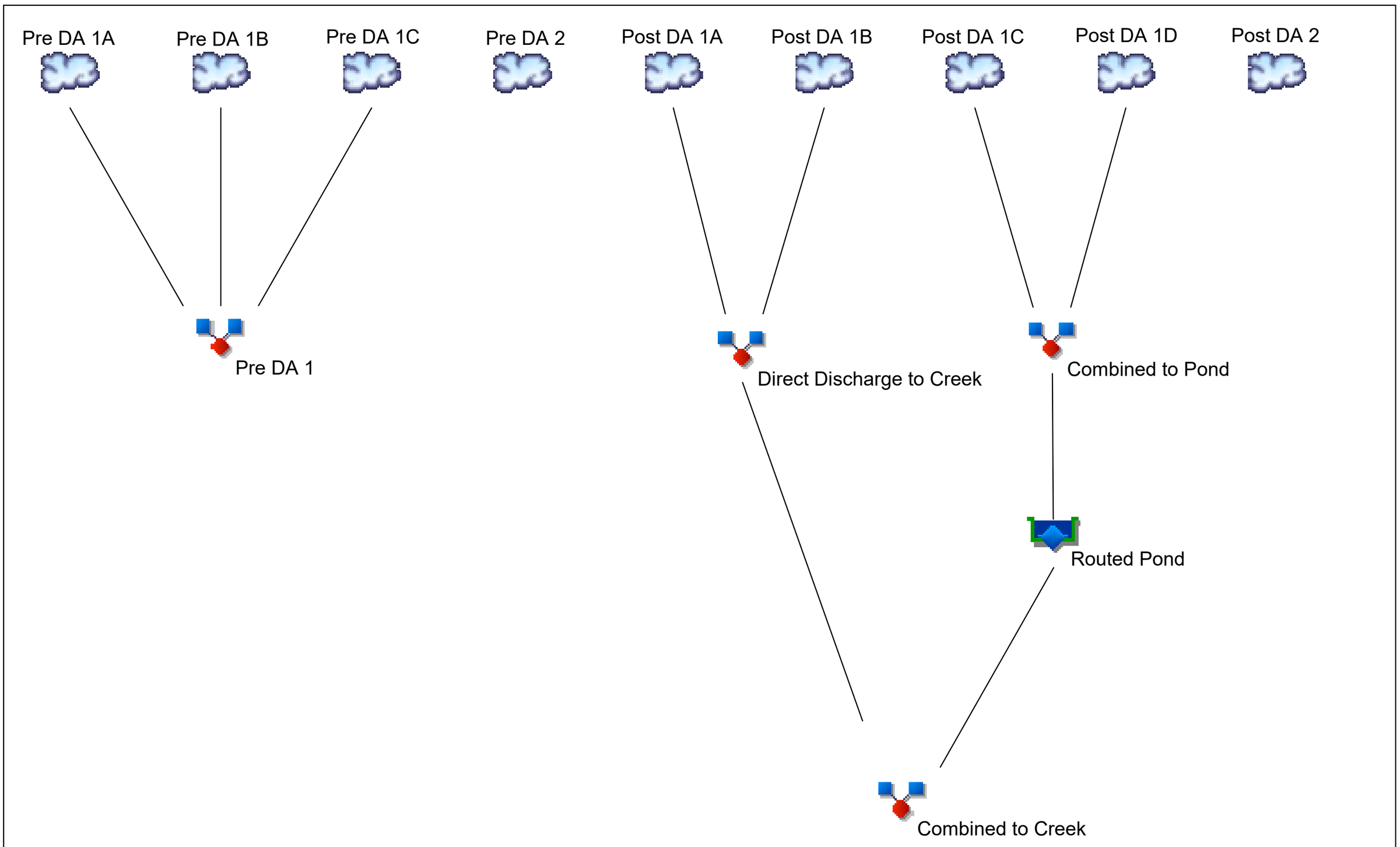
Watershed Model Schematic

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023



Legend

Hyd.	Origin	Description
1	SCS Runoff	Pre DA 1A
2	SCS Runoff	Pre DA 1B
3	SCS Runoff	Pre DA 1C
4	SCS Runoff	Pre DA 2
5	SCS Runoff	Post DA 1A
6	SCS Runoff	Post DA 1B
7	SCS Runoff	Post DA 1C
8	SCS Runoff	Post DA 1D
9	SCS Runoff	Post DA 2
10	Combine	Pre DA 1
11	Combine	Direct Discharge to Creek
12	Combine	Combined to Pond
13	Reservoir	Routed Pond
14	Combine	Combined to Creek

Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)							Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	------	-------	0.662	-------	-------	2.209	-------	-------	4.663	Pre DA 1A
2	SCS Runoff	------	-------	0.005	-------	-------	0.016	-------	-------	0.034	Pre DA 1B
3	SCS Runoff	------	-------	0.194	-------	-------	0.689	-------	-------	1.446	Pre DA 1C
4	SCS Runoff	------	-------	0.005	-------	-------	0.016	-------	-------	0.034	Pre DA 2
5	SCS Runoff	------	-------	0.612	-------	-------	1.498	-------	-------	2.750	Post DA 1A
6	SCS Runoff	------	-------	0.005	-------	-------	0.016	-------	-------	0.034	Post DA 1B
7	SCS Runoff	------	-------	1.346	-------	-------	3.246	-------	-------	5.859	Post DA 1C
8	SCS Runoff	------	-------	0.434	-------	-------	1.120	-------	-------	2.098	Post DA 1D
9	SCS Runoff	------	-------	0.009	-------	-------	0.033	-------	-------	0.069	Post DA 2
10	Combine	1, 2, 3,	-------	0.838	-------	-------	2.752	-------	-------	5.819	Pre DA 1
11	Combine	5, 6,	-------	0.615	-------	-------	1.513	-------	-------	2.781	Direct Discharge to Creek
12	Combine	7, 8,	-------	1.780	-------	-------	4.364	-------	-------	7.954	Combined to Pond
13	Reservoir	12	-------	0.396	-------	-------	1.389	-------	-------	2.950	Routed Pond
14	Combine	11, 13	-------	0.625	-------	-------	2.045	-------	-------	4.224	Combined to Creek

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

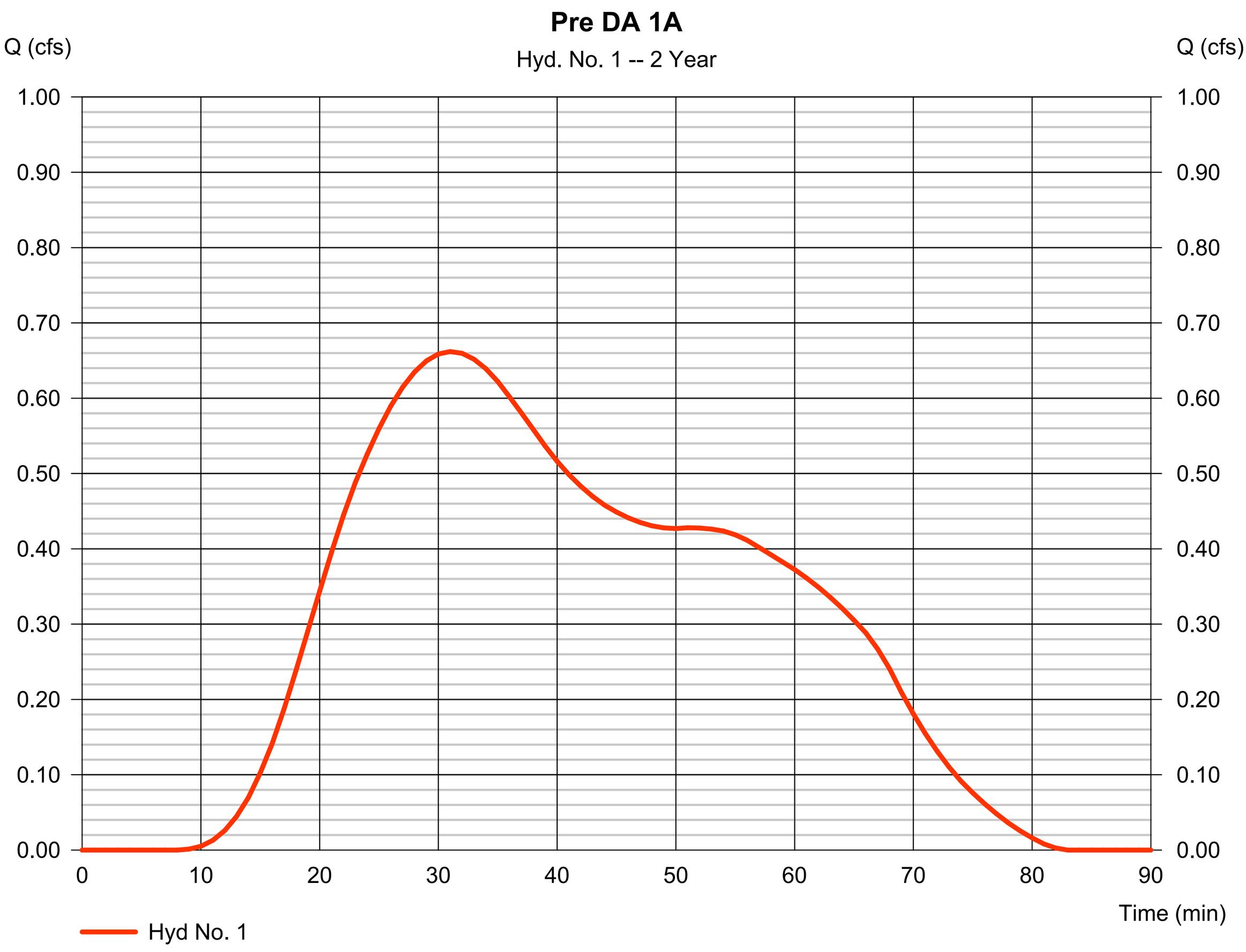
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	0.662	1	31	1,516	------	------	------	Pre DA 1A
2	SCS Runoff	0.005	1	21	10	------	------	------	Pre DA 1B
3	SCS Runoff	0.194	1	21	411	------	------	------	Pre DA 1C
4	SCS Runoff	0.005	1	21	10	------	------	------	Pre DA 2
5	SCS Runoff	0.612	1	17	1,134	------	------	------	Post DA 1A
6	SCS Runoff	0.005	1	21	10	------	------	------	Post DA 1B
7	SCS Runoff	1.346	1	18	2,512	------	------	------	Post DA 1C
8	SCS Runoff	0.434	1	18	817	------	------	------	Post DA 1D
9	SCS Runoff	0.009	1	21	20	------	------	------	Post DA 2
10	Combine	0.838	1	30	1,937	1, 2, 3,	------	------	Pre DA 1
11	Combine	0.615	1	17	1,144	5, 6,	------	------	Direct Discharge to Creek
12	Combine	1.780	1	18	3,329	7, 8,	------	------	Combined to Pond
13	Reservoir	0.396	1	64	3,284	12	1011.27	2,627	Routed Pond
14	Combine	0.625	1	17	4,428	11, 13	------	------	Combined to Creek

Hydrograph Report

Hyd. No. 1

Pre DA 1A

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.662 cfs
Storm frequency	=	2 yrs	Time to peak	=	31 min
Time interval	=	1 min	Hyd. volume	=	1,516 cuft
Drainage area	=	1.600 ac	Curve number	=	74
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	13.90 min
Total precip.	=	1.80 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

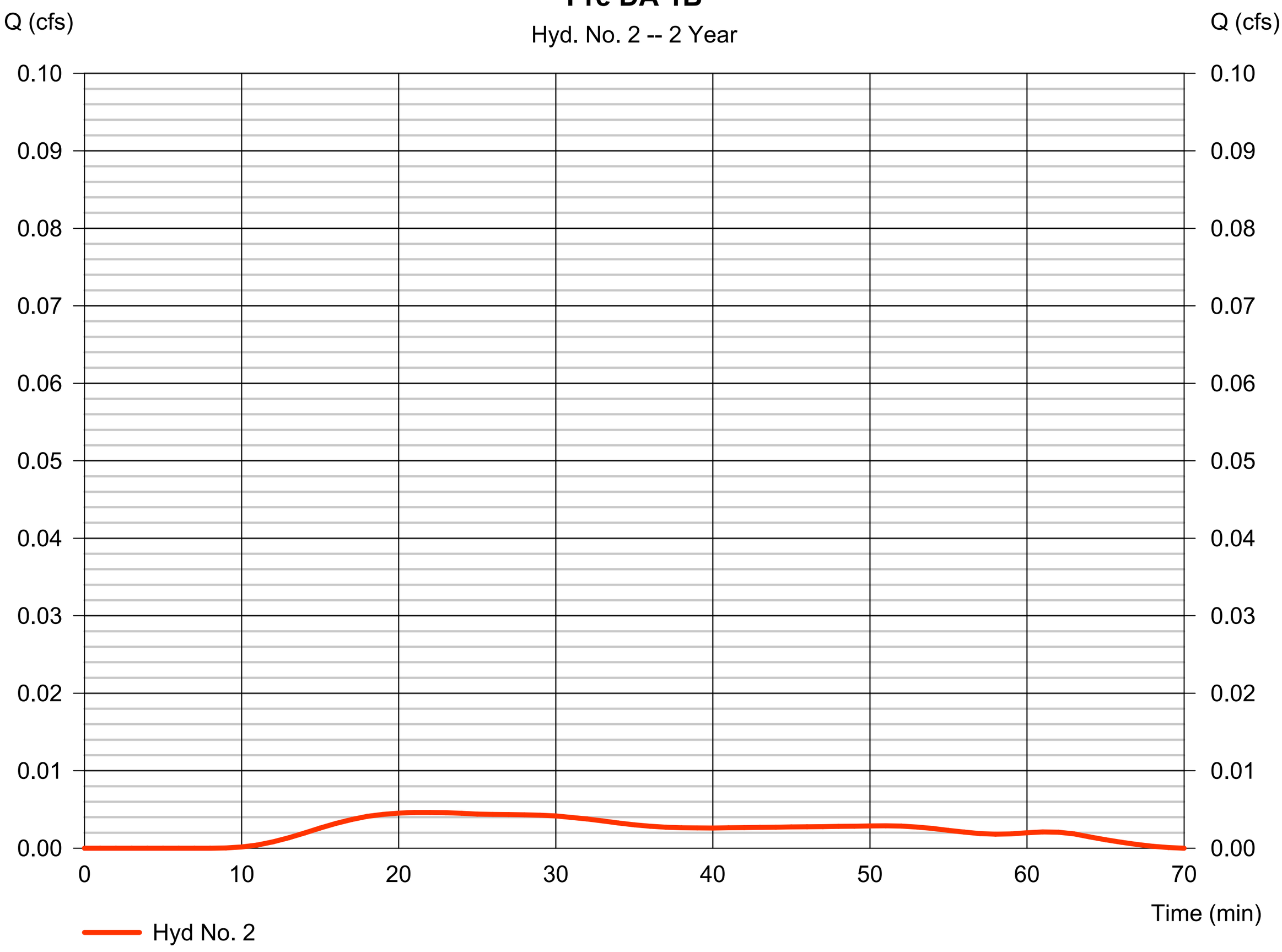


Hydrograph Report

Hyd. No. 2

Pre DA 1B

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.005 cfs
Storm frequency	=	2 yrs	Time to peak	=	21 min
Time interval	=	1 min	Hyd. volume	=	10 cuft
Drainage area	=	0.010 ac	Curve number	=	74
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	1.80 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

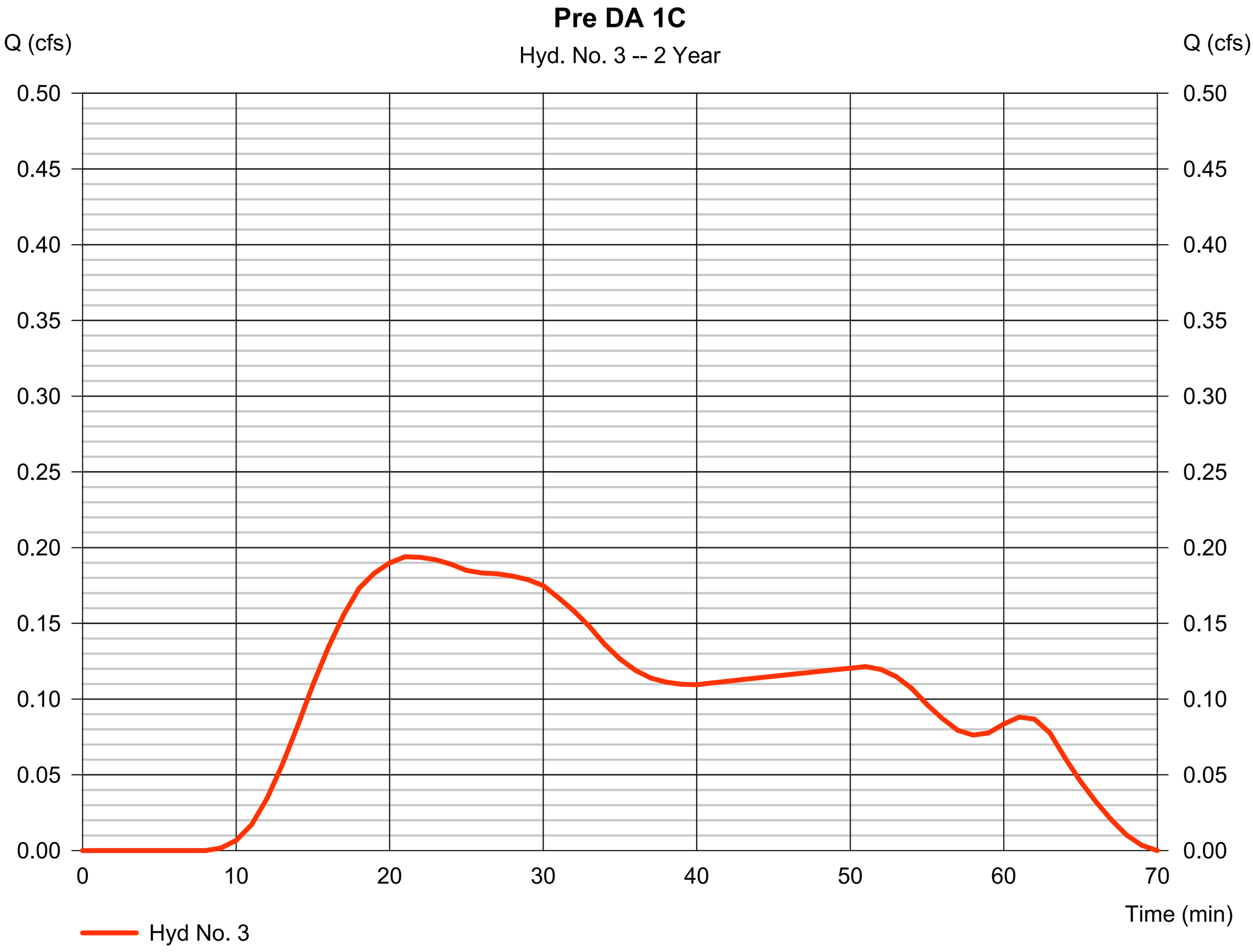


Hydrograph Report

Hyd. No. 3

Pre DA 1C

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.194 cfs
Storm frequency	=	2 yrs	Time to peak	=	21 min
Time interval	=	1 min	Hyd. volume	=	411 cuft
Drainage area	=	0.420 ac	Curve number	=	74
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	6.20 min
Total precip.	=	1.80 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

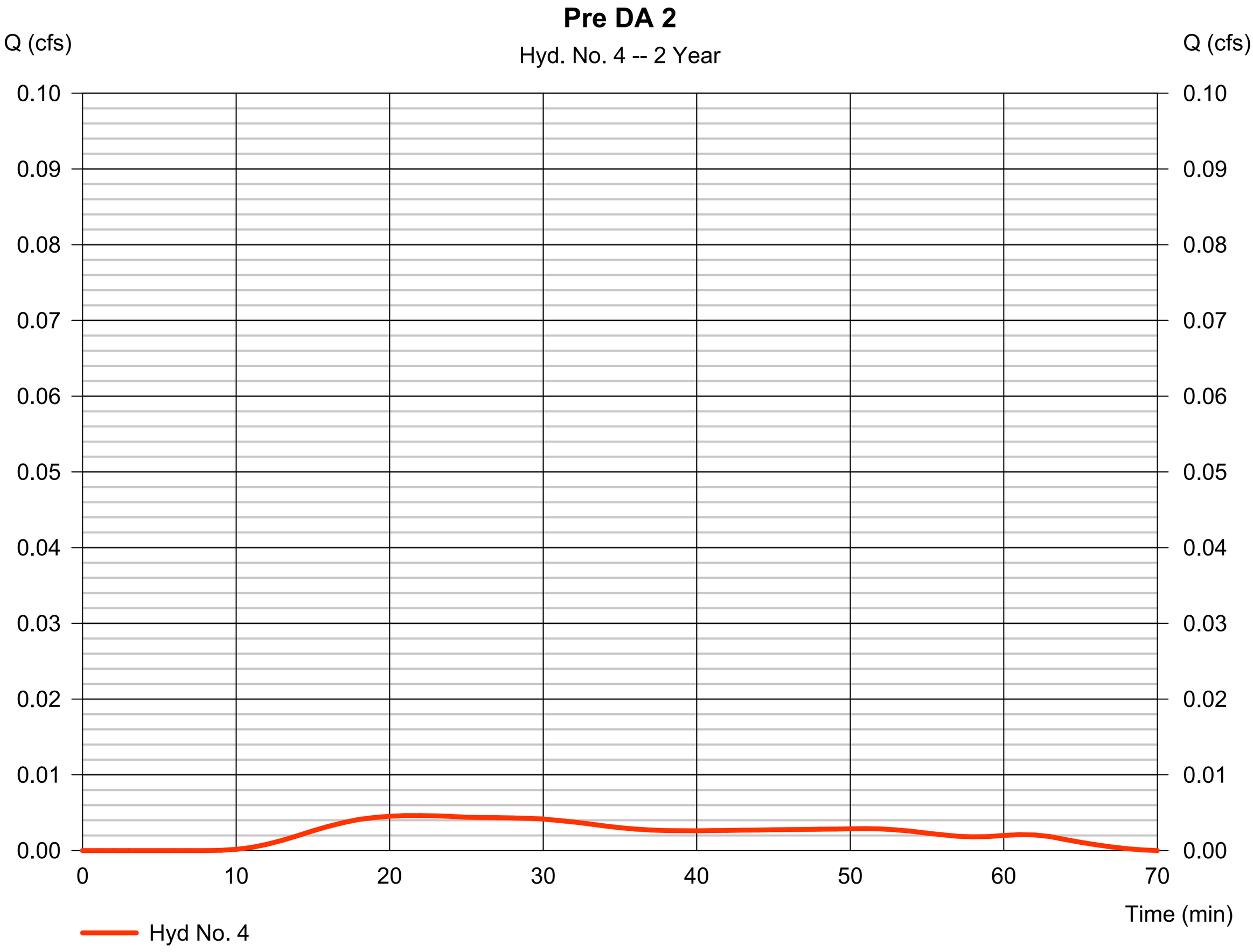


Hydrograph Report

Hyd. No. 4

Pre DA 2

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.005 cfs
Storm frequency	=	2 yrs	Time to peak	=	21 min
Time interval	=	1 min	Hyd. volume	=	10 cuft
Drainage area	=	0.010 ac	Curve number	=	74
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	1.80 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

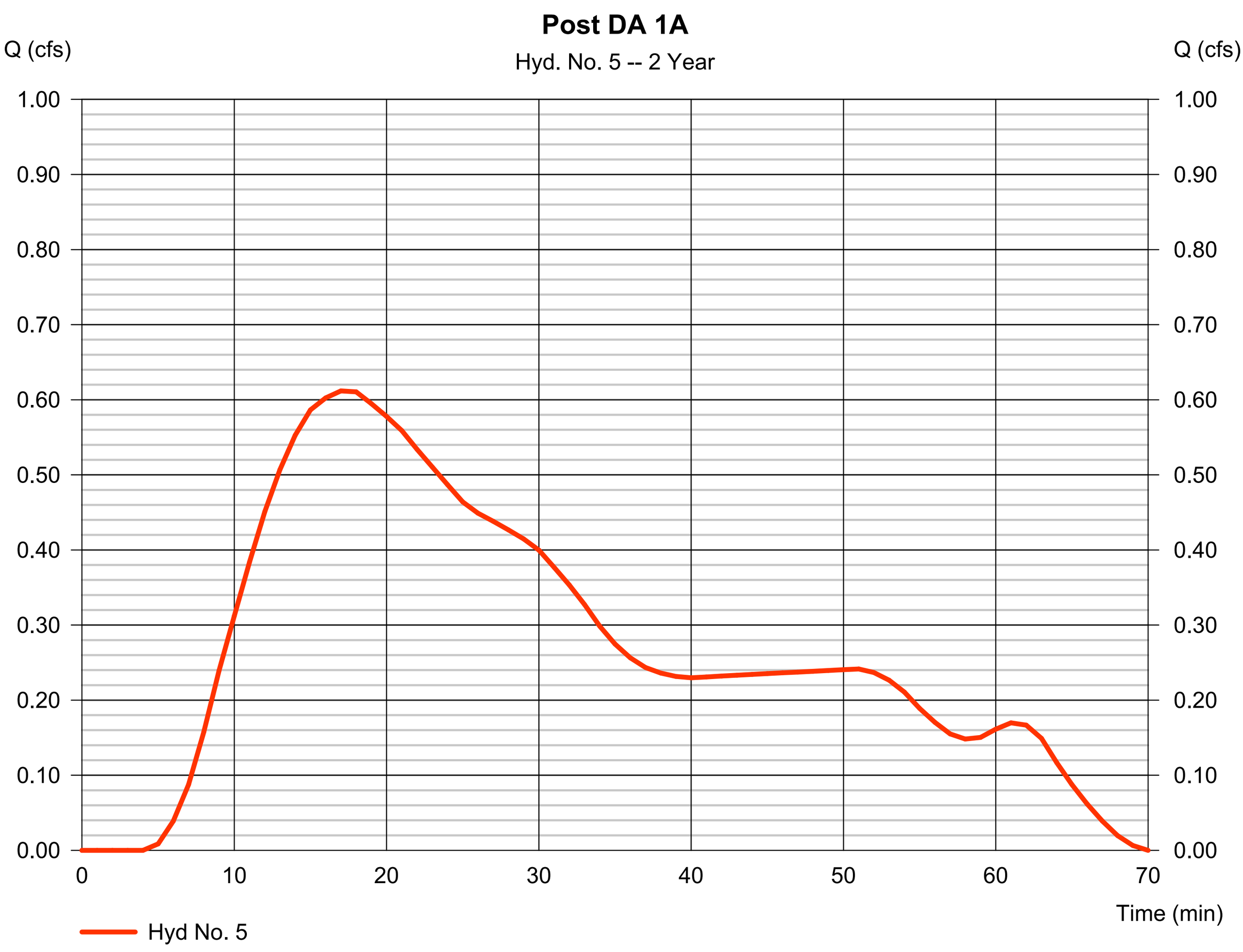


Hydrograph Report

Hyd. No. 5

Post DA 1A

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.612 cfs
Storm frequency	=	2 yrs	Time to peak	=	17 min
Time interval	=	1 min	Hyd. volume	=	1,134 cuft
Drainage area	=	0.500 ac	Curve number	=	84
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	1.80 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

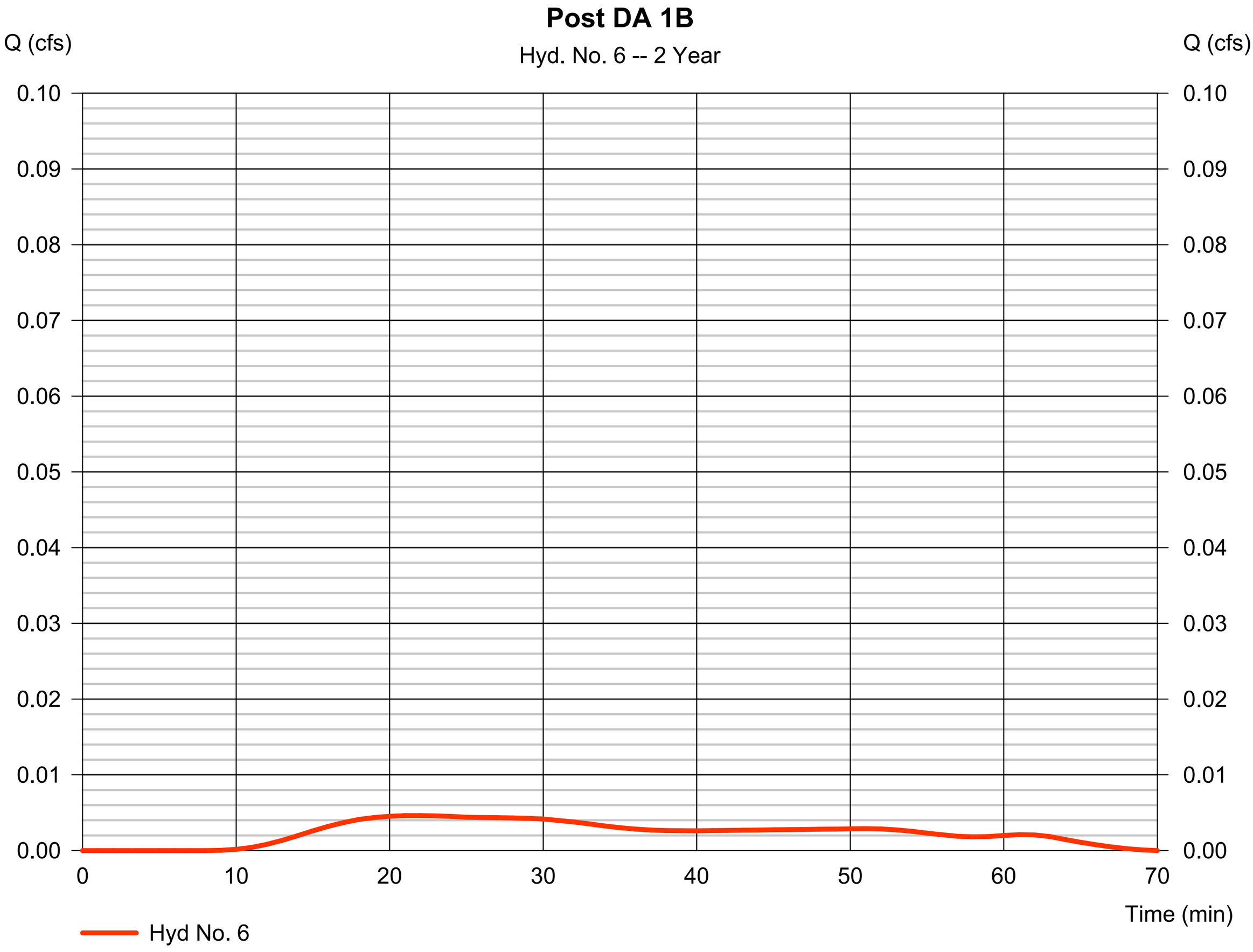


Hydrograph Report

Hyd. No. 6

Post DA 1B

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.005 cfs
Storm frequency	=	2 yrs	Time to peak	=	21 min
Time interval	=	1 min	Hyd. volume	=	10 cuft
Drainage area	=	0.010 ac	Curve number	=	74
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	1.80 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

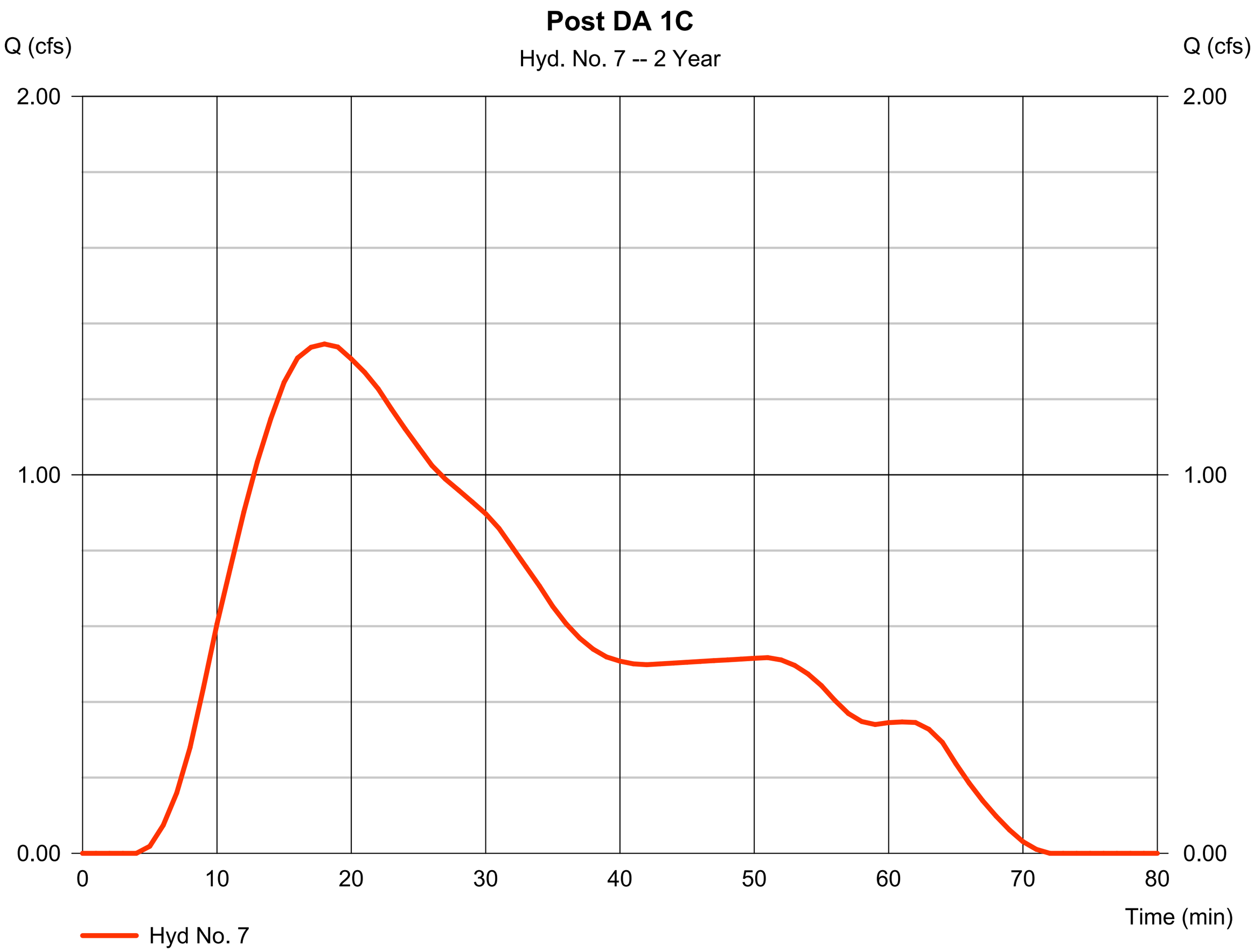


Hydrograph Report

Hyd. No. 7

Post DA 1C

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.346 cfs
Storm frequency	=	2 yrs	Time to peak	=	18 min
Time interval	=	1 min	Hyd. volume	=	2,512 cuft
Drainage area	=	1.090 ac	Curve number	=	85
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	7.30 min
Total precip.	=	1.80 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

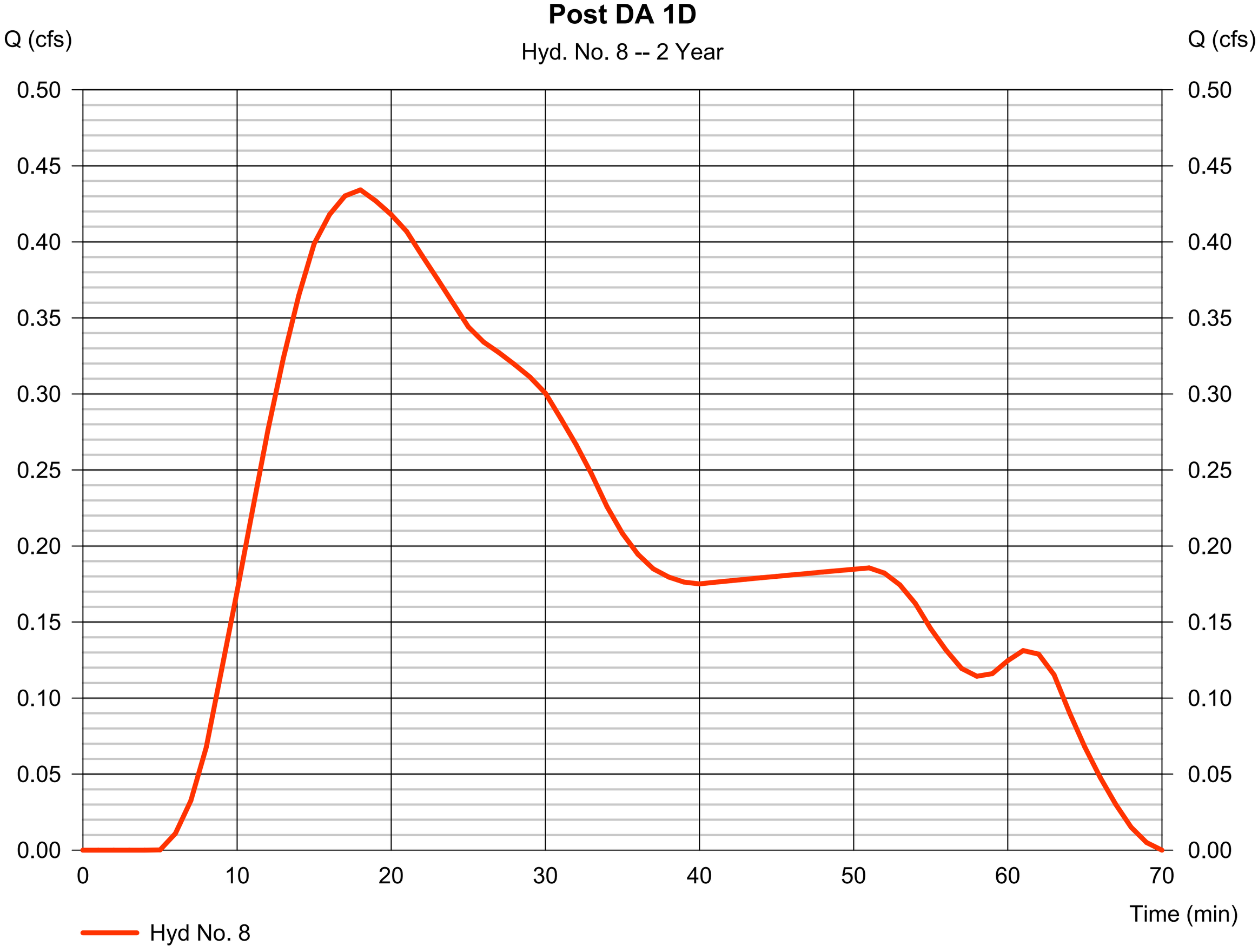


Hydrograph Report

Hyd. No. 8

Post DA 1D

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.434 cfs
Storm frequency	=	2 yrs	Time to peak	=	18 min
Time interval	=	1 min	Hyd. volume	=	817 cuft
Drainage area	=	0.420 ac	Curve number	=	82
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	1.80 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

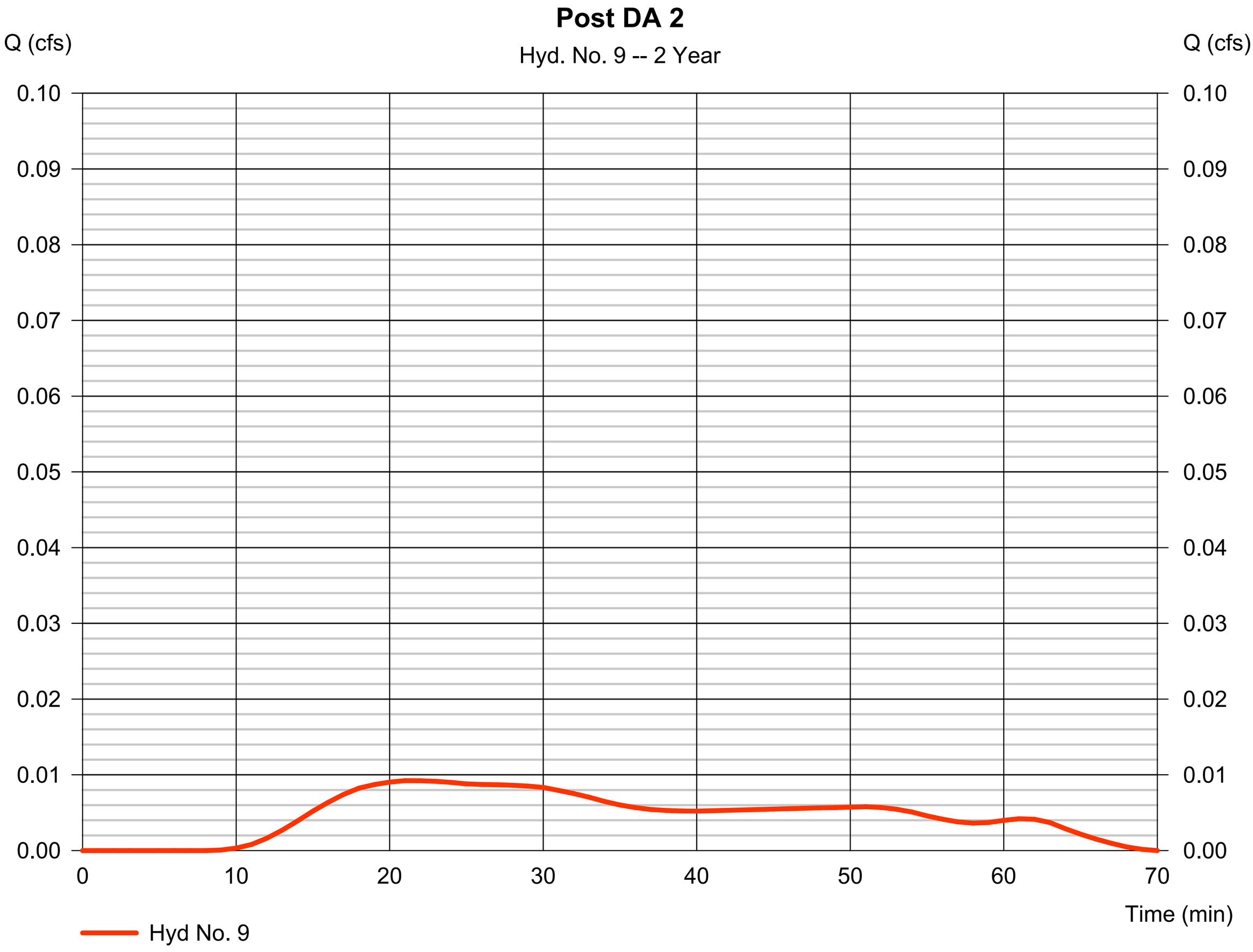


Hydrograph Report

Hyd. No. 9

Post DA 2

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.009 cfs
Storm frequency	=	2 yrs	Time to peak	=	21 min
Time interval	=	1 min	Hyd. volume	=	20 cuft
Drainage area	=	0.020 ac	Curve number	=	74
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	1.80 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

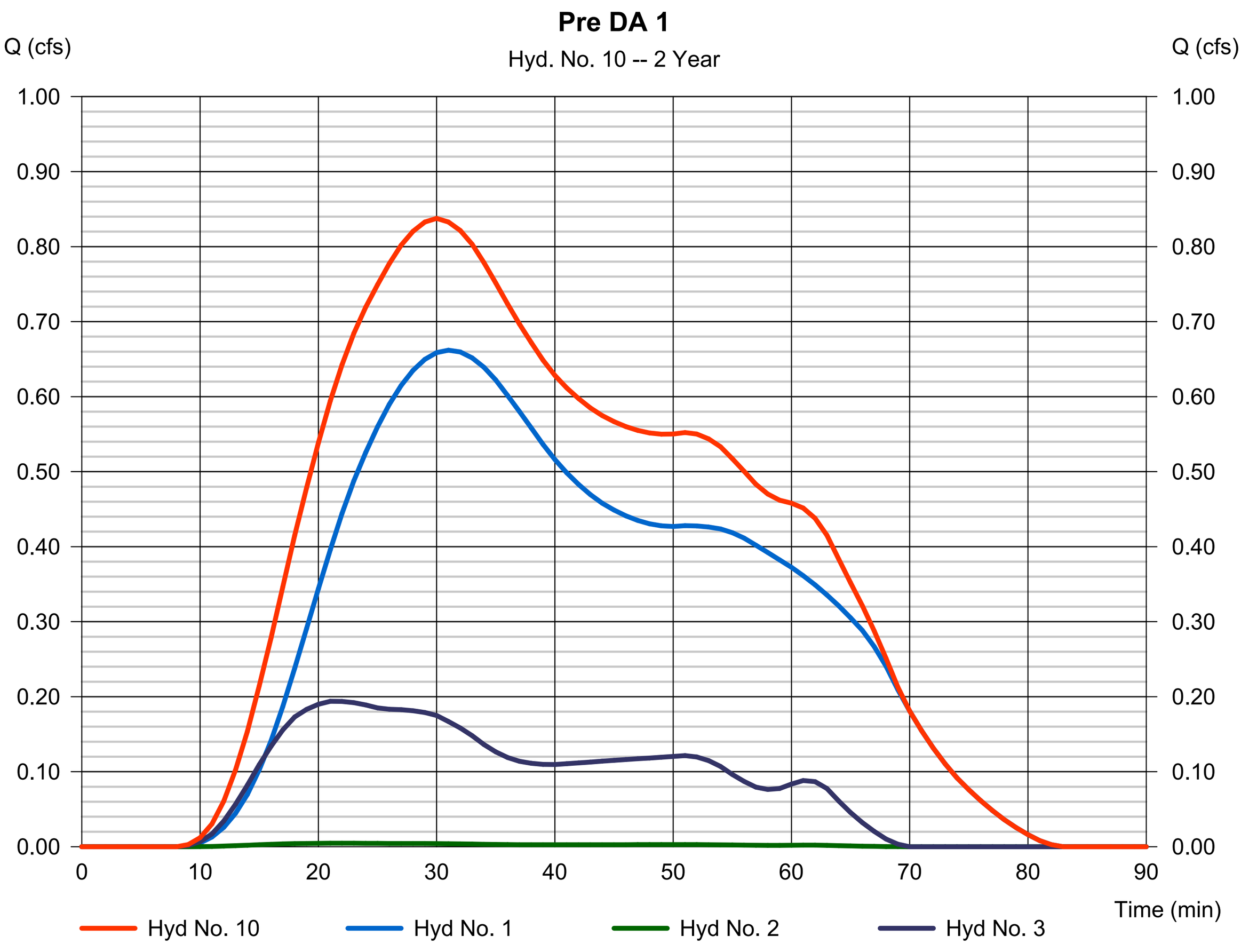


Hydrograph Report

Hyd. No. 10

Pre DA 1

Hydrograph type	=	Combine	Peak discharge	=	0.838 cfs
Storm frequency	=	2 yrs	Time to peak	=	30 min
Time interval	=	1 min	Hyd. volume	=	1,937 cuft
Inflow hyds.	=	1, 2, 3	Contrib. drain. area	=	2.030 ac

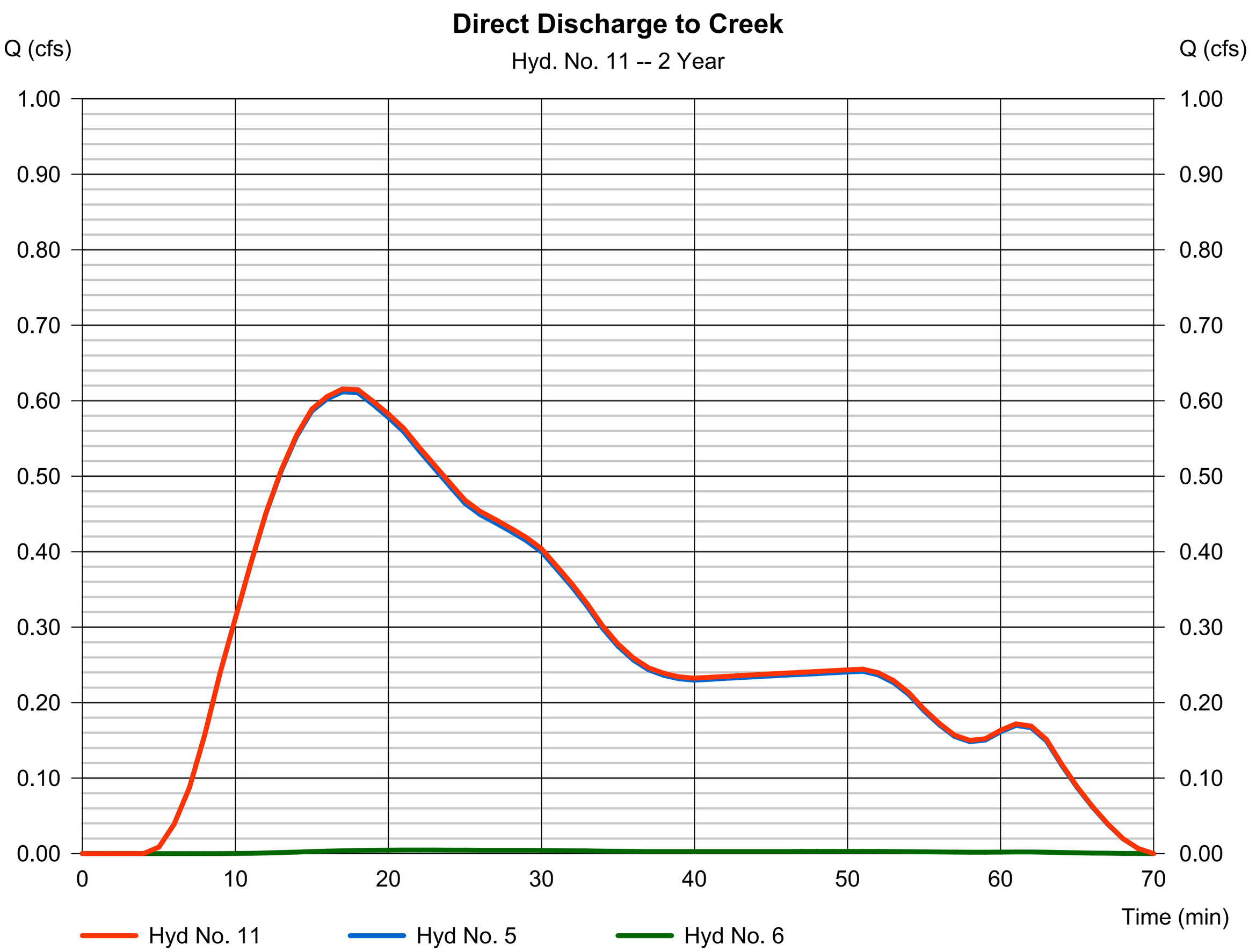


Hydrograph Report

Hyd. No. 11

Direct Discharge to Creek

Hydrograph type	=	Combine	Peak discharge	=	0.615 cfs
Storm frequency	=	2 yrs	Time to peak	=	17 min
Time interval	=	1 min	Hyd. volume	=	1,144 cuft
Inflow hyds.	=	5, 6	Contrib. drain. area	=	0.510 ac

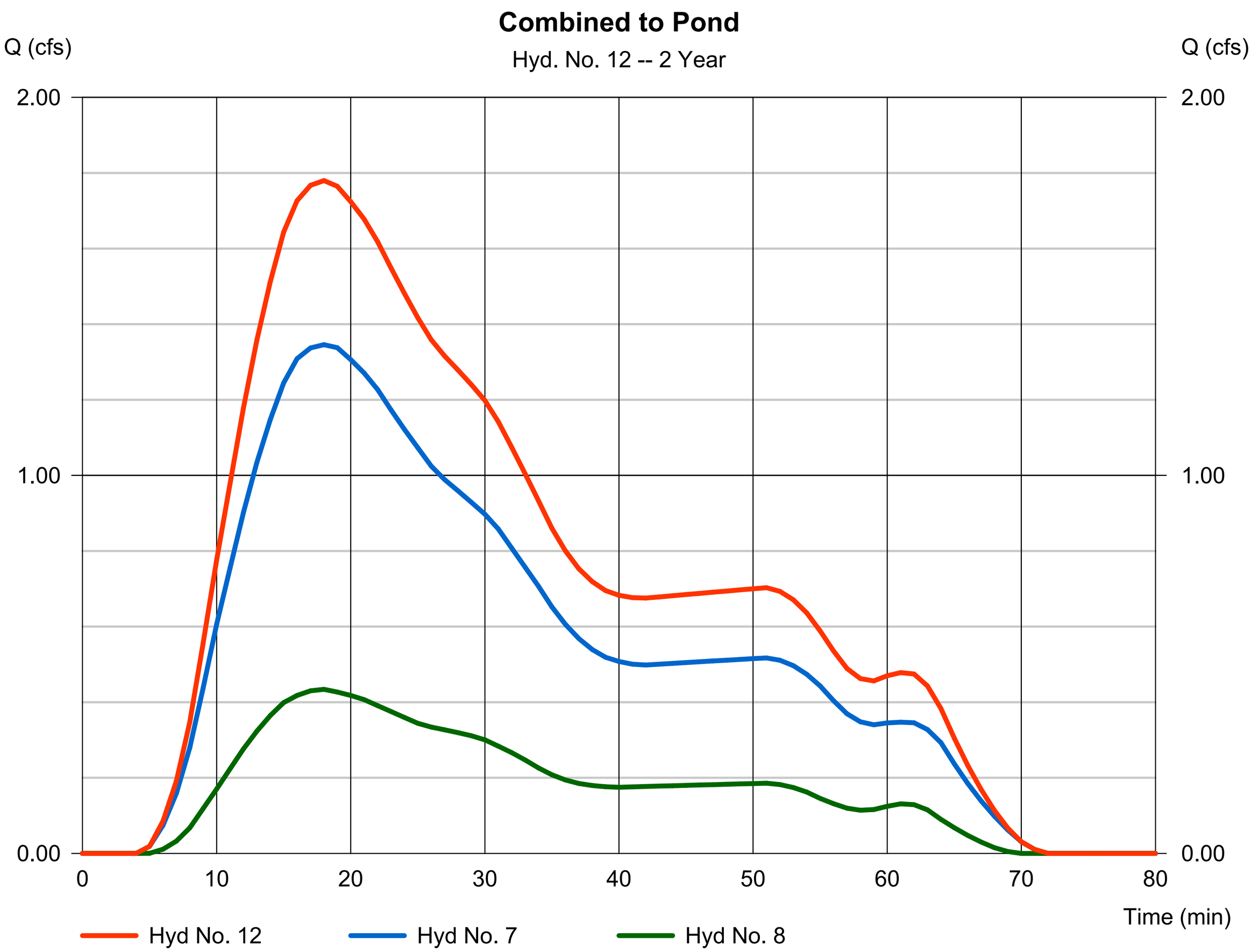


Hydrograph Report

Hyd. No. 12

Combined to Pond

Hydrograph type	=	Combine	Peak discharge	=	1.780 cfs
Storm frequency	=	2 yrs	Time to peak	=	18 min
Time interval	=	1 min	Hyd. volume	=	3,329 cuft
Inflow hyds.	=	7, 8	Contrib. drain. area	=	1.510 ac



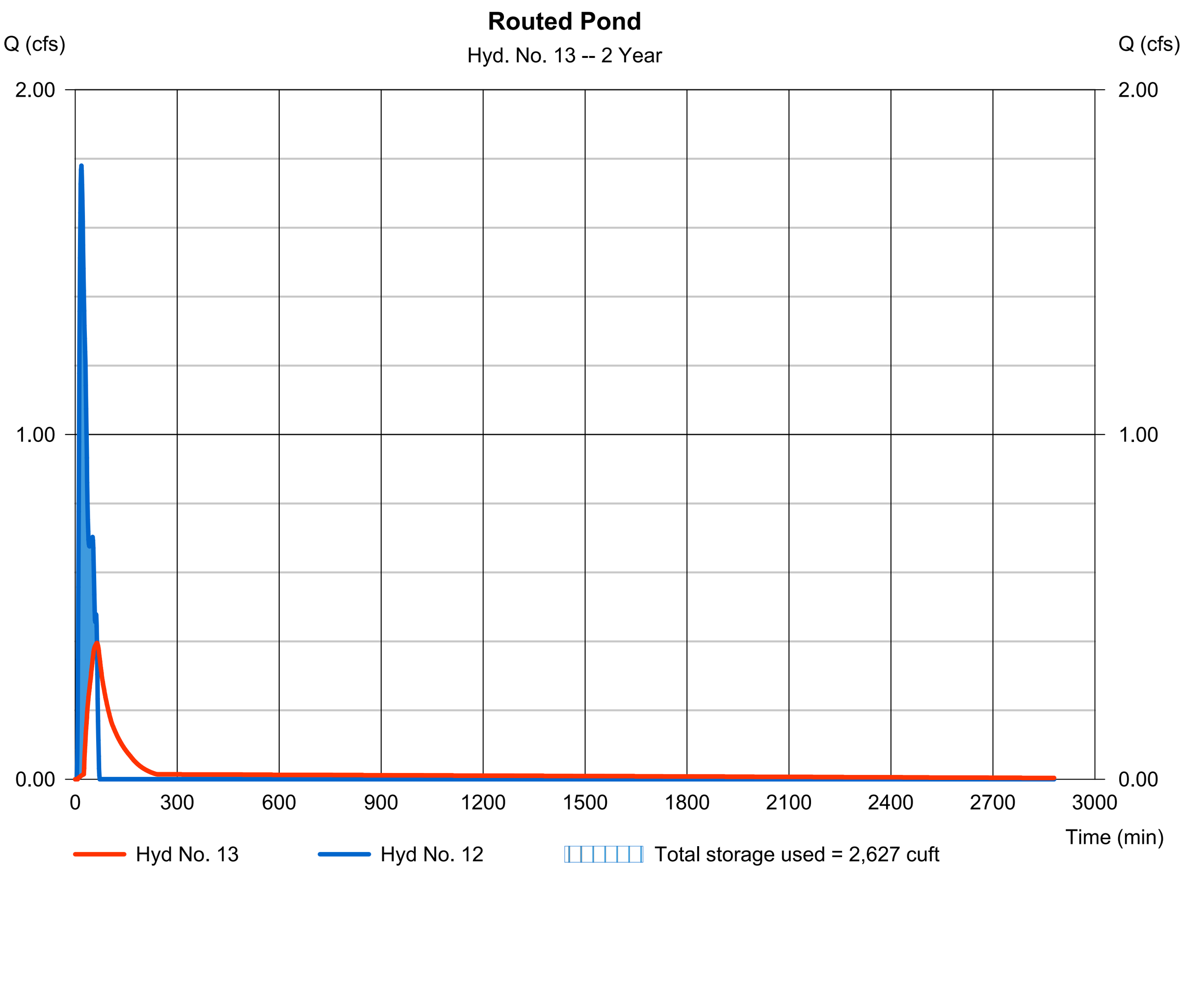
Hydrograph Report

Hyd. No. 13

Routed Pond

Hydrograph type	=	Reservoir	Peak discharge	=	0.396 cfs
Storm frequency	=	2 yrs	Time to peak	=	64 min
Time interval	=	1 min	Hyd. volume	=	3,284 cuft
Inflow hyd. No.	=	12 - Combined to Pond	Max. Elevation	=	1011.27 ft
Reservoir name	=	Detention Pond	Max. Storage	=	2,627 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Detention Pond

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1009.81 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1009.81	00	0	0
0.19	1010.00	503	32	32
1.19	1011.00	3,096	1,616	1,648
2.19	1012.00	4,135	3,603	5,251
3.19	1013.00	5,360	4,734	9,984
3.69	1013.50	6,577	2,979	12,963

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 15.00	0.75	Inactive	0.00
Span (in)	= 15.00	0.75	0.00	0.00
No. Barrels	= 1	1	1	0
Invert El. (ft)	= 1009.81	1009.91	0.00	0.00
Length (ft)	= 183.44	0.10	0.00	0.00
Slope (%)	= 0.50	0.10	0.00	n/a
N-Value	= .012	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 8.00	0.50	0.00	0.00
Crest El. (ft)	= 1012.50	1010.90	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	Rect	---	---
Multi-Stage	= Yes	Yes	No	No

Exfil.(in/hr) = 0.000 (by Wet area)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	1009.81	0.00	0.00	---	---	0.00	0.00	---	---	---	---	0.000
0.02	3	1009.83	0.00	0.00	---	---	0.00	0.00	---	---	---	---	0.000
0.04	6	1009.85	0.00	0.00	---	---	0.00	0.00	---	---	---	---	0.000
0.06	10	1009.87	0.00	0.00	---	---	0.00	0.00	---	---	---	---	0.000
0.08	13	1009.89	0.00	0.00	---	---	0.00	0.00	---	---	---	---	0.000
0.10	16	1009.90	0.00	0.00	---	---	0.00	0.00	---	---	---	---	0.000
0.11	19	1009.92	0.00 oc	0.00 ic	---	---	0.00	0.00	---	---	---	---	0.000
0.13	22	1009.94	0.00 ic	0.00 ic	---	---	0.00	0.00	---	---	---	---	0.001
0.15	26	1009.96	0.00 ic	0.00 ic	---	---	0.00	0.00	---	---	---	---	0.002
0.17	29	1009.98	0.00 ic	0.00 ic	---	---	0.00	0.00	---	---	---	---	0.003
0.19	32	1010.00	0.00 ic	0.00 ic	---	---	0.00	0.00	---	---	---	---	0.004
0.29	193	1010.10	0.01 ic	0.01 ic	---	---	0.00	0.00	---	---	---	---	0.006
0.39	355	1010.20	0.01 ic	0.01 ic	---	---	0.00	0.00	---	---	---	---	0.008
0.49	517	1010.30	0.01 ic	0.01 ic	---	---	0.00	0.00	---	---	---	---	0.009
0.59	678	1010.40	0.01 ic	0.01 ic	---	---	0.00	0.00	---	---	---	---	0.010
0.69	840	1010.50	0.01 ic	0.01 ic	---	---	0.00	0.00	---	---	---	---	0.011
0.79	1,001	1010.60	0.01 ic	0.01 ic	---	---	0.00	0.00	---	---	---	---	0.012
0.89	1,163	1010.70	0.01 ic	0.01 ic	---	---	0.00	0.00	---	---	---	---	0.013
0.99	1,325	1010.80	0.01 ic	0.01 ic	---	---	0.00	0.00	---	---	---	---	0.014
1.09	1,486	1010.90	0.01 ic	0.01 ic	---	---	0.00	0.00	---	---	---	---	0.014
1.19	1,648	1011.00	0.07 ic	0.02 ic	---	---	0.00	0.05	---	---	---	---	0.068
1.29	2,008	1011.10	0.17 ic	0.02 ic	---	---	0.00	0.15	---	---	---	---	0.164
1.39	2,368	1011.20	0.29 ic	0.02 ic	---	---	0.00	0.27	---	---	---	---	0.289
1.49	2,729	1011.30	0.44 ic	0.02 ic	---	---	0.00	0.42	---	---	---	---	0.437
1.59	3,089	1011.40	0.61 ic	0.02 ic	---	---	0.00	0.59	---	---	---	---	0.605
1.69	3,449	1011.50	0.80 ic	0.02 ic	---	---	0.00	0.77	---	---	---	---	0.790
1.79	3,810	1011.60	1.01 ic	0.02 ic	---	---	0.00	0.97	---	---	---	---	0.992
1.89	4,170	1011.70	1.21 ic	0.02 ic	---	---	0.00	1.19	---	---	---	---	1.208
1.99	4,530	1011.80	1.46 ic	0.02 ic	---	---	0.00	1.42	---	---	---	---	1.439
2.09	4,890	1011.90	1.68 ic	0.02 ic	---	---	0.00	1.66	---	---	---	---	1.682
2.19	5,251	1012.00	1.97 ic	0.02 ic	---	---	0.00	1.92	---	---	---	---	1.939
2.29	5,724	1012.10	2.21 ic	0.02 ic	---	---	0.00	2.19	---	---	---	---	2.207
2.39	6,197	1012.20	2.51 ic	0.02 ic	---	---	0.00	2.47	---	---	---	---	2.486
2.49	6,671	1012.30	2.80 ic	0.02 ic	---	---	0.00	2.76	---	---	---	---	2.777
2.59	7,144	1012.40	3.09 ic	0.02 ic	---	---	0.00	3.06	---	---	---	---	3.078
2.69	7,618	1012.50	3.40 ic	0.02 ic	---	---	0.00	3.37	---	---	---	---	3.389
2.79	8,091	1012.60	4.45 oc	0.02 ic	---	---	0.84	3.59 s	---	---	---	---	4.449

Continues on next page...

Detention Pond

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
2.89	8,564	1012.70	5.72 oc	0.01 ic	---	---	2.38	3.32 s	---	---	---	---	5.716
2.99	9,038	1012.80	6.73 oc	0.01 ic	---	---	4.33 s	2.39 s	---	---	---	---	6.729
3.09	9,511	1012.90	7.05 oc	0.01 ic	---	---	5.08 s	1.97 s	---	---	---	---	7.051
3.19	9,984	1013.00	7.26 oc	0.00 ic	---	---	5.52 s	1.73 s	---	---	---	---	7.256
3.24	10,282	1013.05	7.34 oc	0.00 ic	---	---	5.70 s	1.64 s	---	---	---	---	7.343
3.29	10,580	1013.10	7.42 oc	0.00 ic	---	---	5.85 s	1.57 s	---	---	---	---	7.420
3.34	10,878	1013.15	7.50 oc	0.00 ic	---	---	5.99 s	1.50 s	---	---	---	---	7.497
3.39	11,176	1013.20	7.57 oc	0.00 ic	---	---	6.12 s	1.45 s	---	---	---	---	7.568
3.44	11,474	1013.25	7.64 oc	0.00 ic	---	---	6.24 s	1.40 s	---	---	---	---	7.639
3.49	11,772	1013.30	7.71 oc	0.00 ic	---	---	6.35 s	1.35 s	---	---	---	---	7.704
3.54	12,070	1013.35	7.78 oc	0.00 ic	---	---	6.45 s	1.32 s	---	---	---	---	7.768
3.59	12,367	1013.40	7.84 oc	0.00 ic	---	---	6.55 s	1.28 s	---	---	---	---	7.838
3.64	12,665	1013.45	7.90 oc	0.00 ic	---	---	6.65 s	1.25 s	---	---	---	---	7.904
3.69	12,963	1013.50	7.97 oc	0.00 ic	---	---	6.74 s	1.22 s	---	---	---	---	7.967

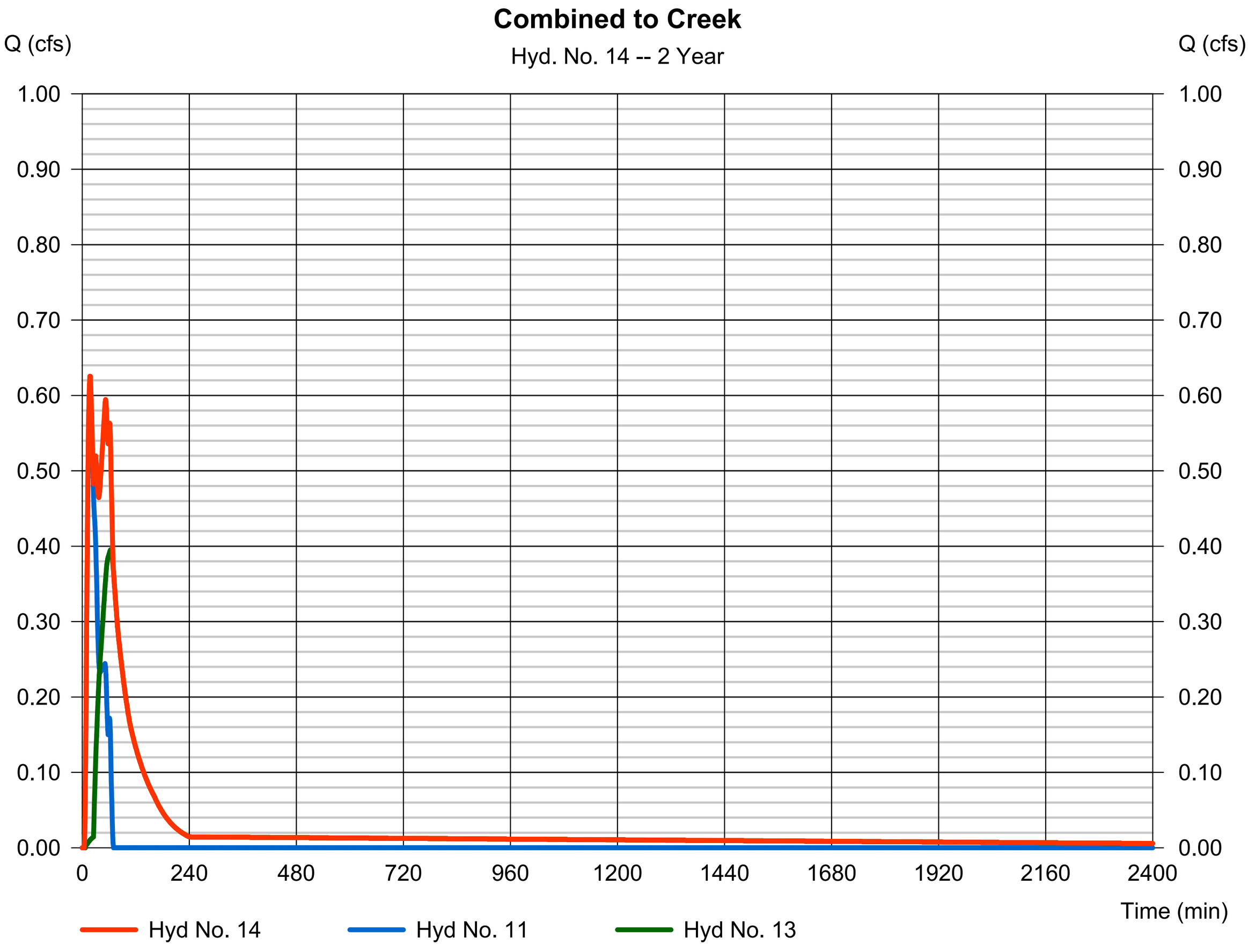
...End

Hydrograph Report

Hyd. No. 14

Combined to Creek

Hydrograph type	=	Combine	Peak discharge	=	0.625 cfs
Storm frequency	=	2 yrs	Time to peak	=	17 min
Time interval	=	1 min	Hyd. volume	=	4,428 cuft
Inflow hyds.	=	11, 13	Contrib. drain. area	=	0.000 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

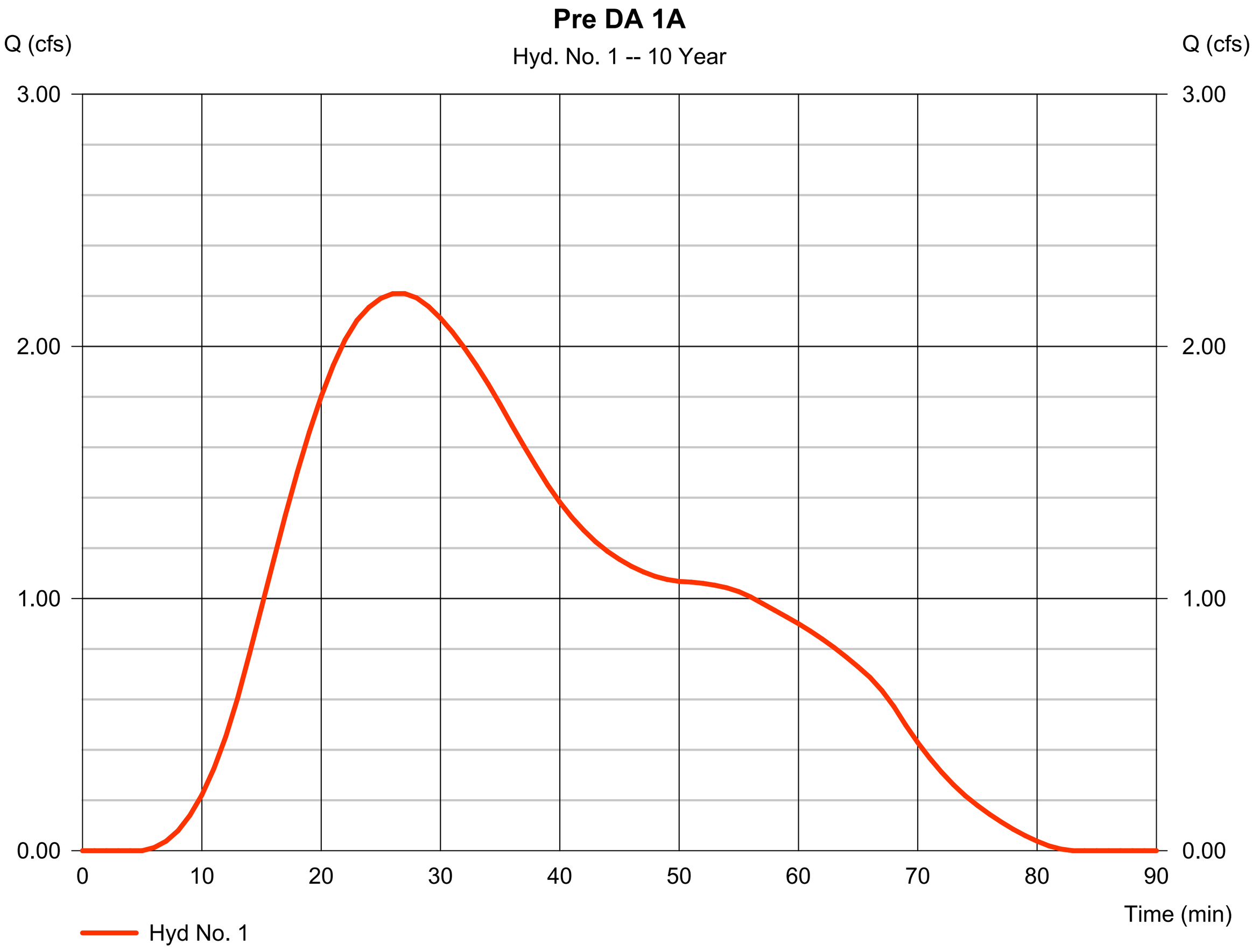
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	2.209	1	27	4,792	------	------	------	Pre DA 1A
2	SCS Runoff	0.016	1	18	31	------	------	------	Pre DA 1B
3	SCS Runoff	0.689	1	18	1,297	------	------	------	Pre DA 1C
4	SCS Runoff	0.016	1	18	31	------	------	------	Pre DA 2
5	SCS Runoff	1.498	1	15	2,633	------	------	------	Post DA 1A
6	SCS Runoff	0.016	1	18	31	------	------	------	Post DA 1B
7	SCS Runoff	3.246	1	16	5,703	------	------	------	Post DA 1C
8	SCS Runoff	1.120	1	15	2,008	------	------	------	Post DA 1D
9	SCS Runoff	0.033	1	18	62	------	------	------	Post DA 2
10	Combine	2.752	1	26	6,120	1, 2, 3,	------	------	Pre DA 1
11	Combine	1.513	1	15	2,664	5, 6,	------	------	Direct Discharge to Creek
12	Combine	4.364	1	16	7,711	7, 8,	------	------	Combined to Pond
13	Reservoir	1.389	1	39	7,658	12	1011.78	4,452	Routed Pond
14	Combine	2.045	1	30	10,322	11, 13	------	------	Combined to Creek

Hydrograph Report

Hyd. No. 1

Pre DA 1A

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.209 cfs
Storm frequency	=	10 yrs	Time to peak	=	27 min
Time interval	=	1 min	Hyd. volume	=	4,792 cuft
Drainage area	=	1.600 ac	Curve number	=	74
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	13.90 min
Total precip.	=	2.87 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

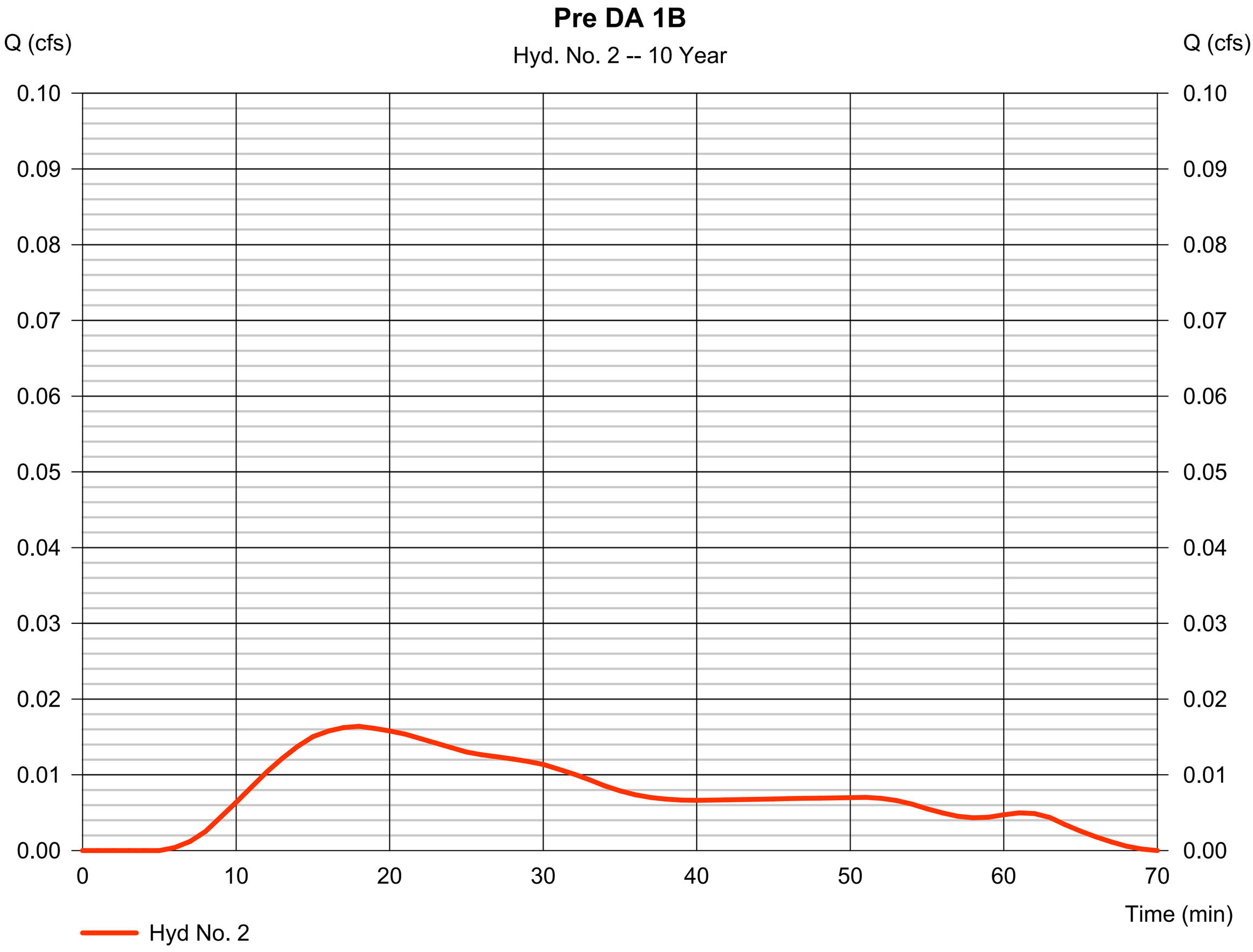


Hydrograph Report

Hyd. No. 2

Pre DA 1B

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.016 cfs
Storm frequency	=	10 yrs	Time to peak	=	18 min
Time interval	=	1 min	Hyd. volume	=	31 cuft
Drainage area	=	0.010 ac	Curve number	=	74
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.87 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

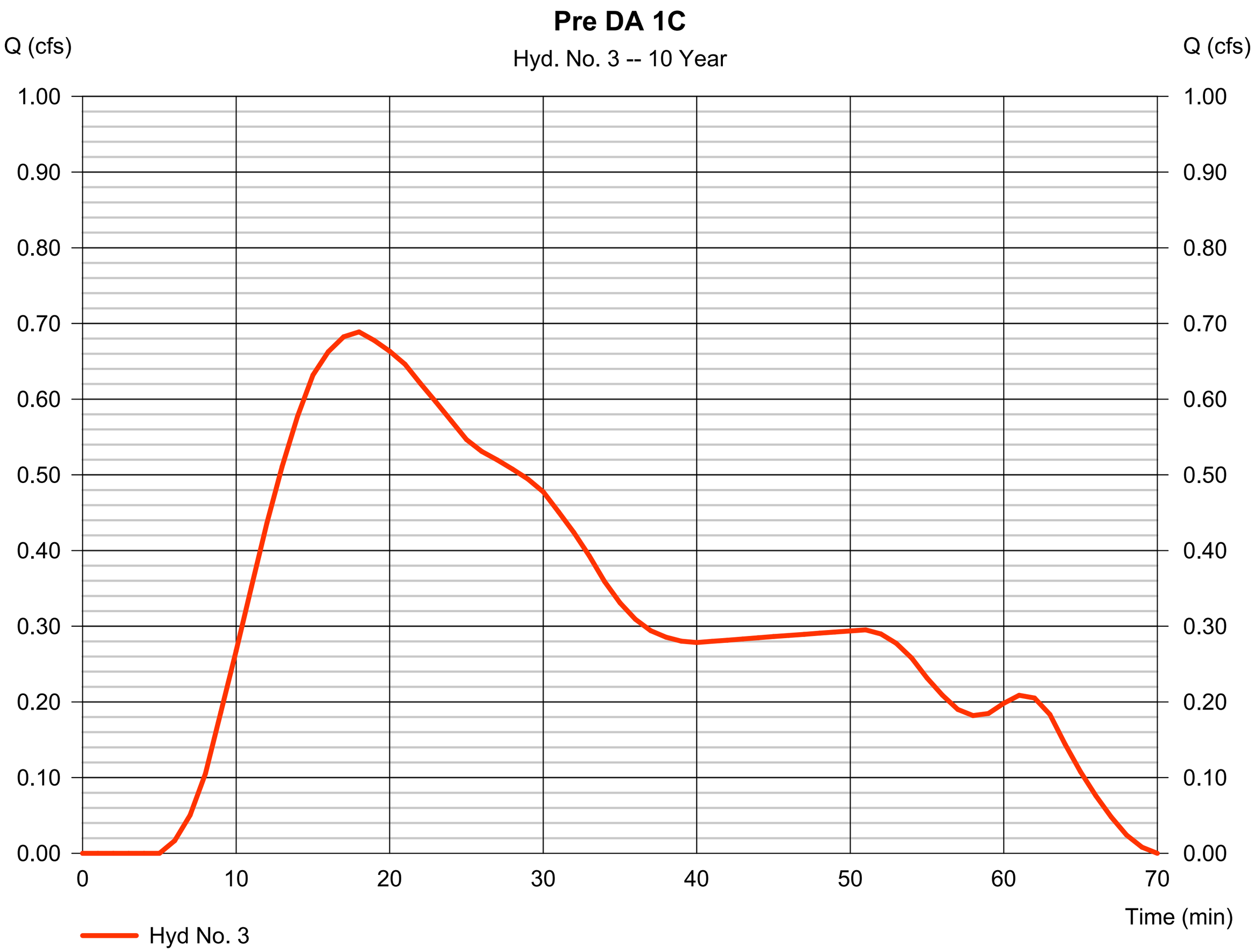


Hydrograph Report

Hyd. No. 3

Pre DA 1C

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.689 cfs
Storm frequency	=	10 yrs	Time to peak	=	18 min
Time interval	=	1 min	Hyd. volume	=	1,297 cuft
Drainage area	=	0.420 ac	Curve number	=	74
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	6.20 min
Total precip.	=	2.87 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

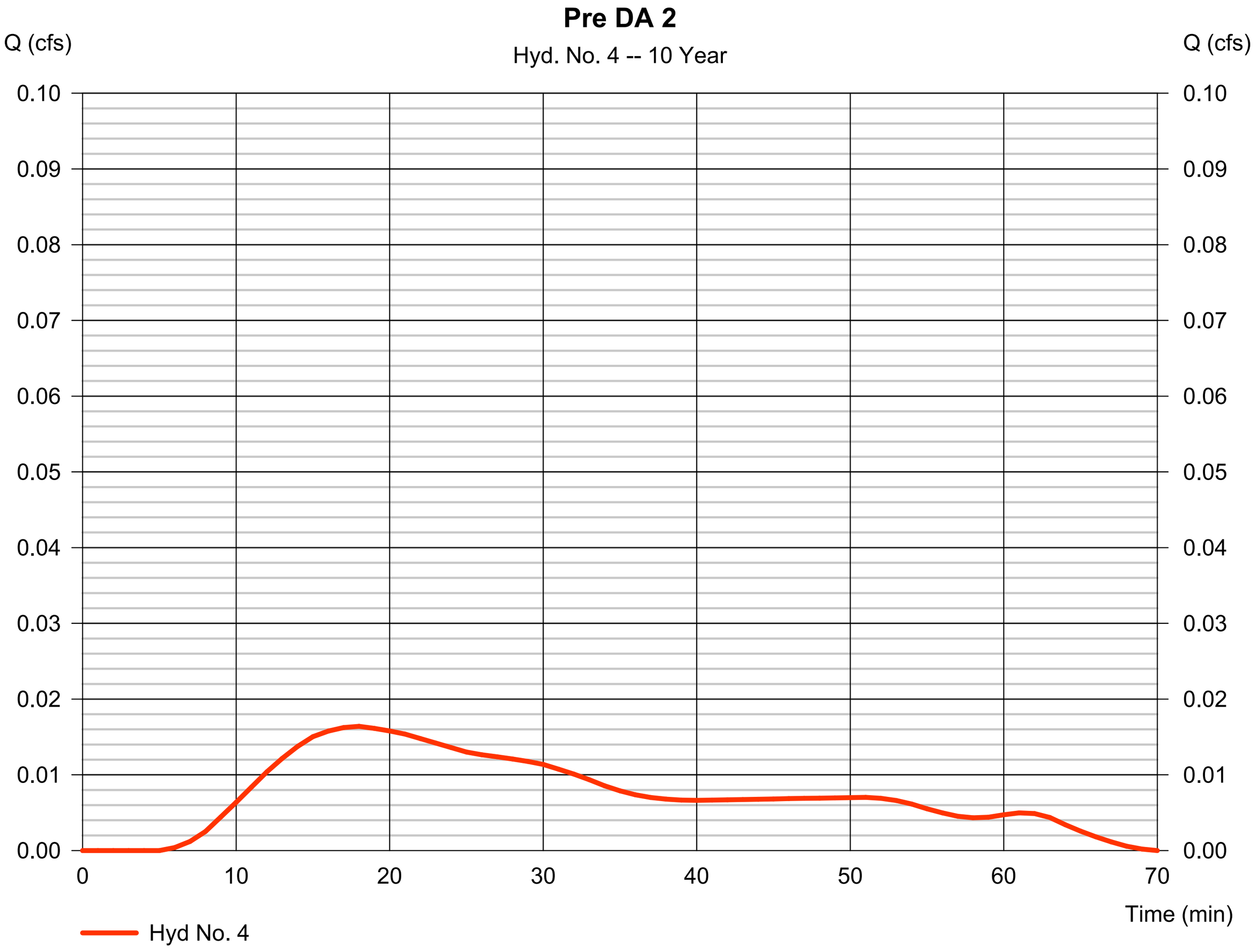


Hydrograph Report

Hyd. No. 4

Pre DA 2

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.016 cfs
Storm frequency	=	10 yrs	Time to peak	=	18 min
Time interval	=	1 min	Hyd. volume	=	31 cuft
Drainage area	=	0.010 ac	Curve number	=	74
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.87 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

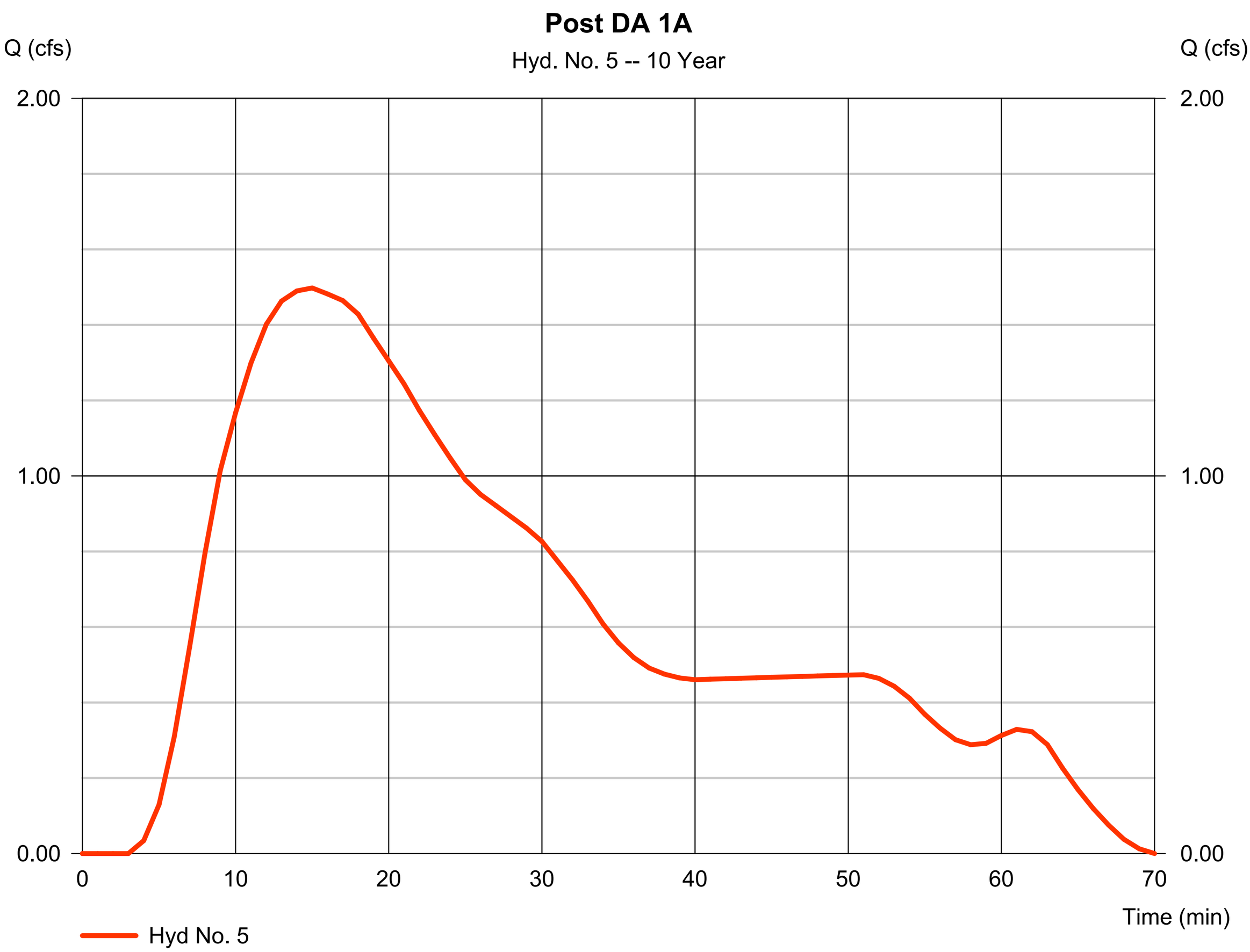


Hydrograph Report

Hyd. No. 5

Post DA 1A

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.498 cfs
Storm frequency	=	10 yrs	Time to peak	=	15 min
Time interval	=	1 min	Hyd. volume	=	2,633 cuft
Drainage area	=	0.500 ac	Curve number	=	84
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.87 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

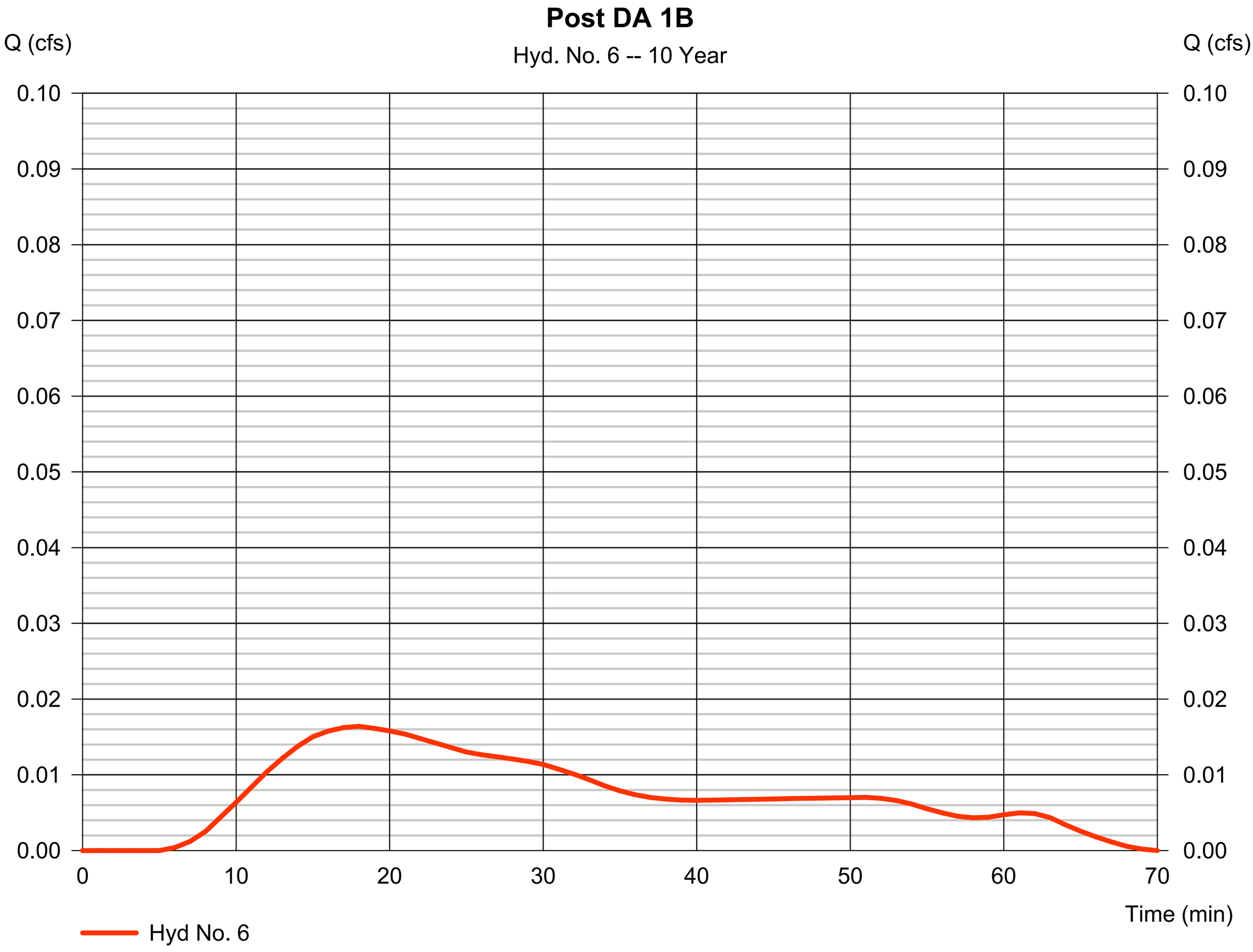


Hydrograph Report

Hyd. No. 6

Post DA 1B

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.016 cfs
Storm frequency	=	10 yrs	Time to peak	=	18 min
Time interval	=	1 min	Hyd. volume	=	31 cuft
Drainage area	=	0.010 ac	Curve number	=	74
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.87 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

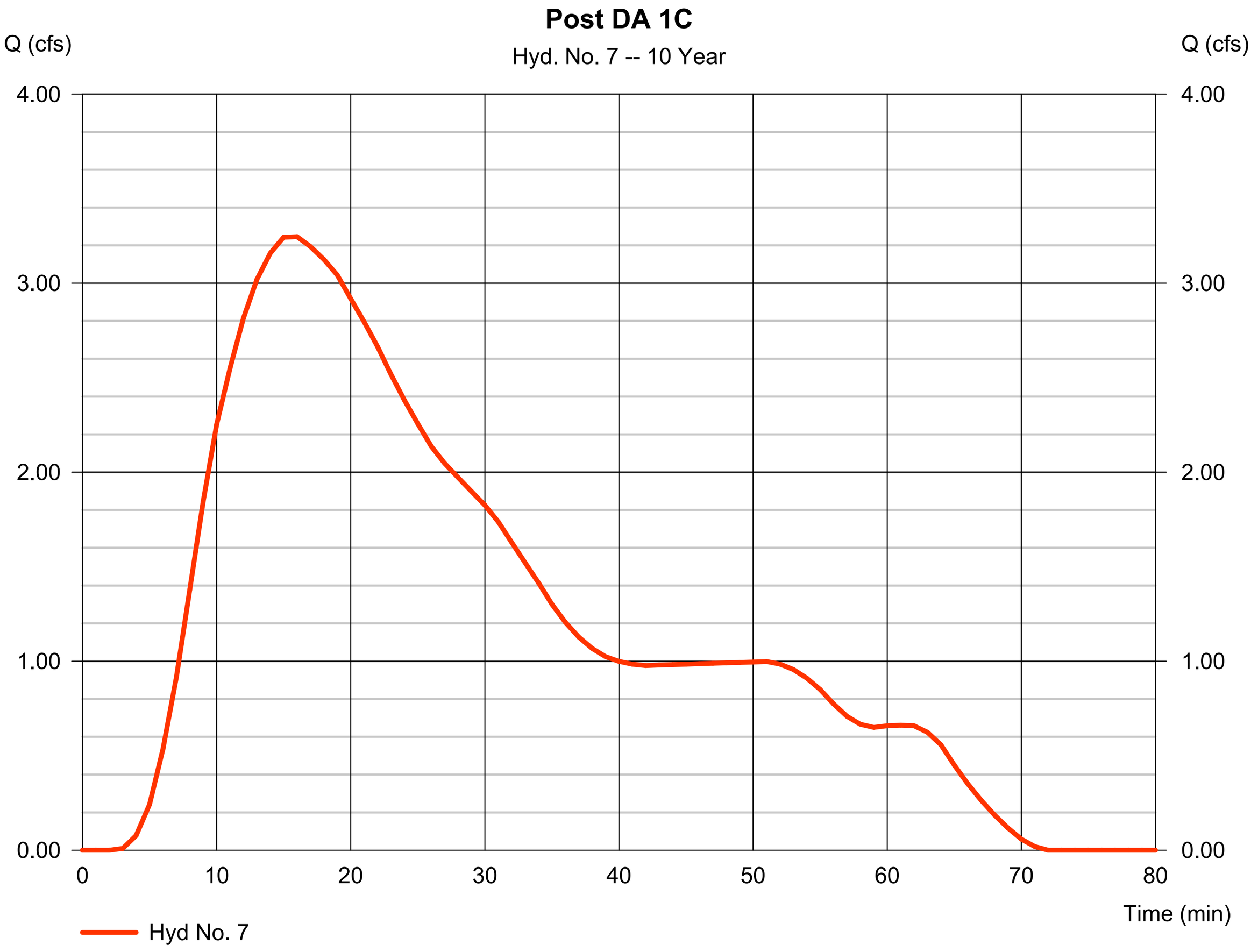


Hydrograph Report

Hyd. No. 7

Post DA 1C

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.246 cfs
Storm frequency	=	10 yrs	Time to peak	=	16 min
Time interval	=	1 min	Hyd. volume	=	5,703 cuft
Drainage area	=	1.090 ac	Curve number	=	85
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	7.30 min
Total precip.	=	2.87 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

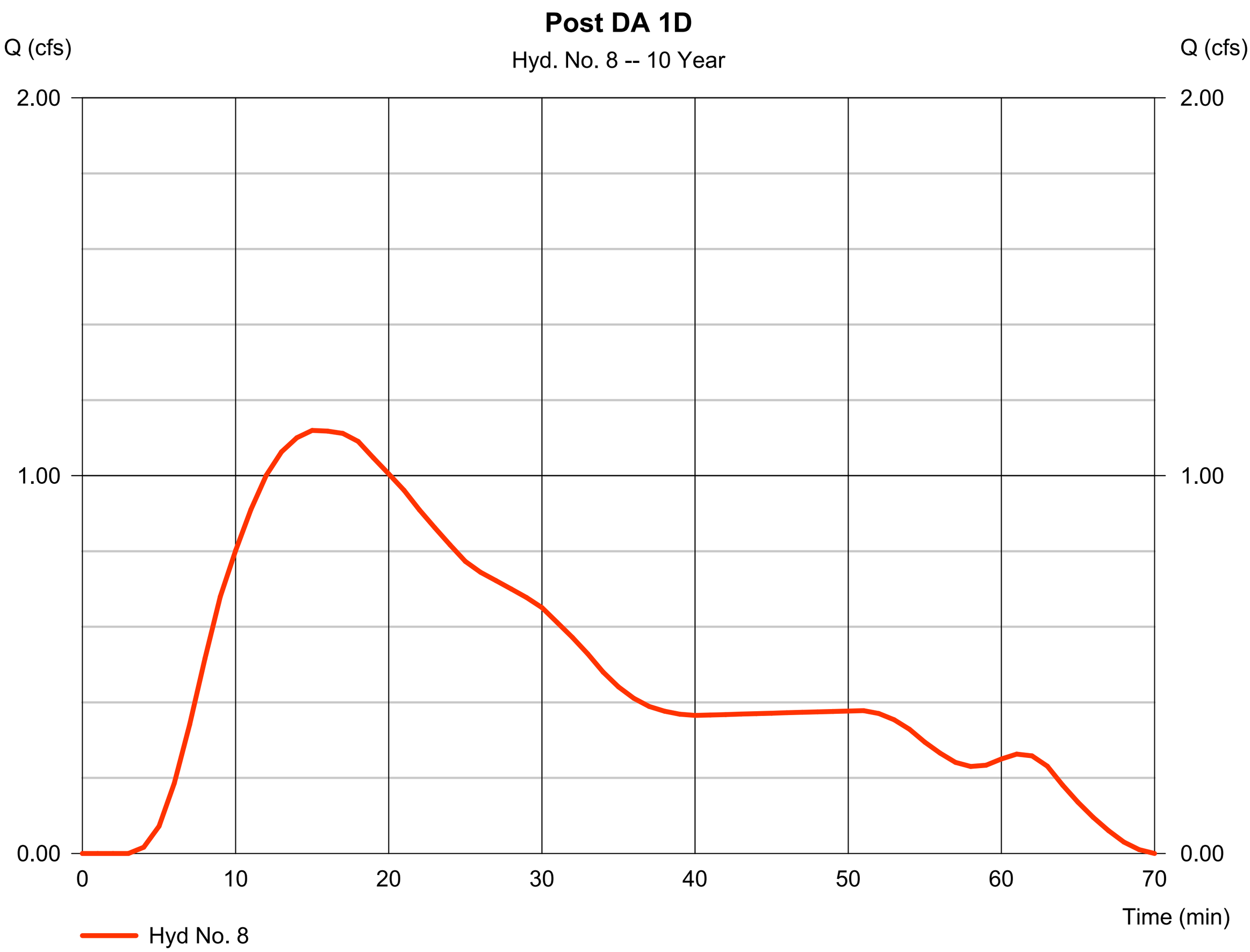


Hydrograph Report

Hyd. No. 8

Post DA 1D

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.120 cfs
Storm frequency	=	10 yrs	Time to peak	=	15 min
Time interval	=	1 min	Hyd. volume	=	2,008 cuft
Drainage area	=	0.420 ac	Curve number	=	82
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.87 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

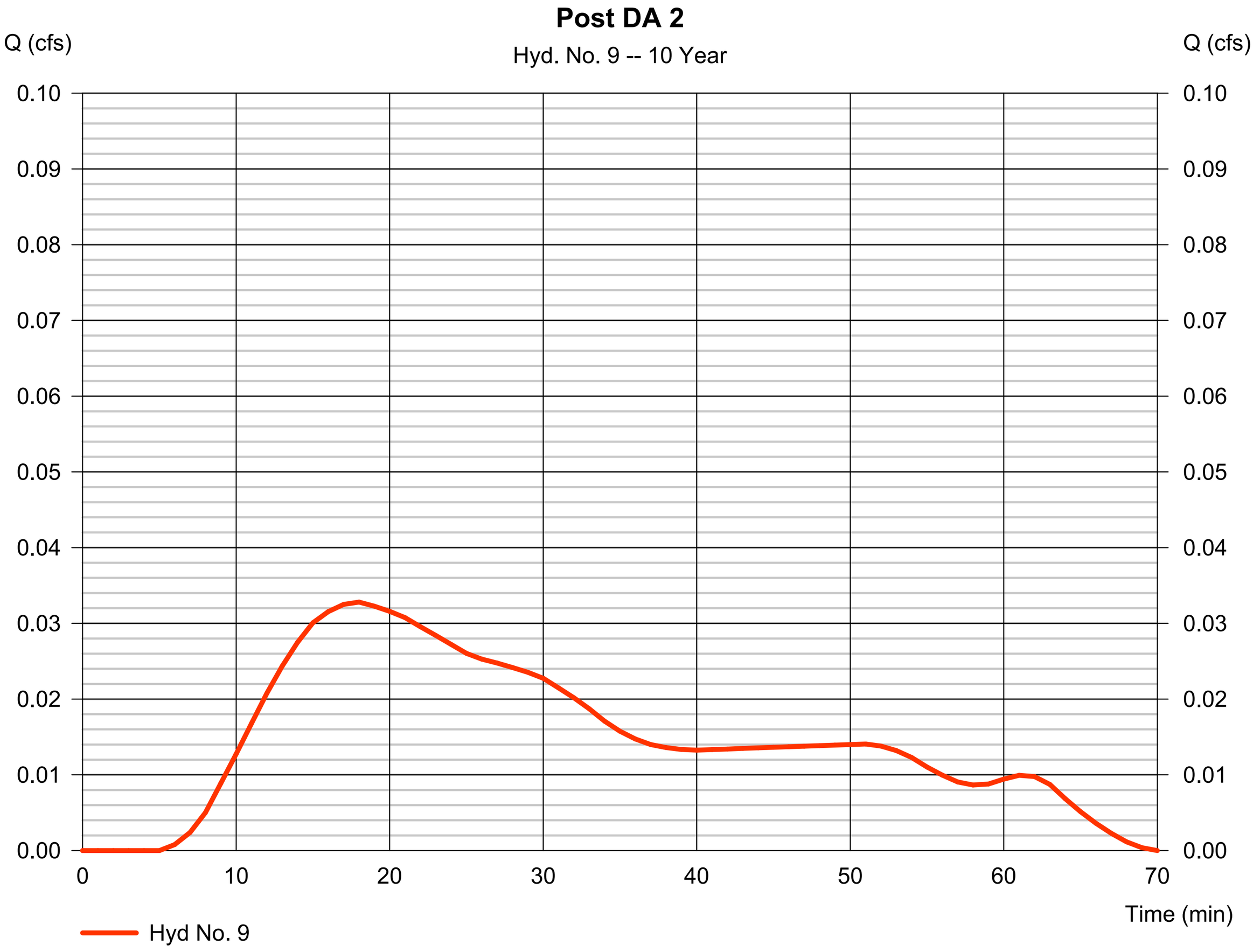


Hydrograph Report

Hyd. No. 9

Post DA 2

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.033 cfs
Storm frequency	=	10 yrs	Time to peak	=	18 min
Time interval	=	1 min	Hyd. volume	=	62 cuft
Drainage area	=	0.020 ac	Curve number	=	74
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.87 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

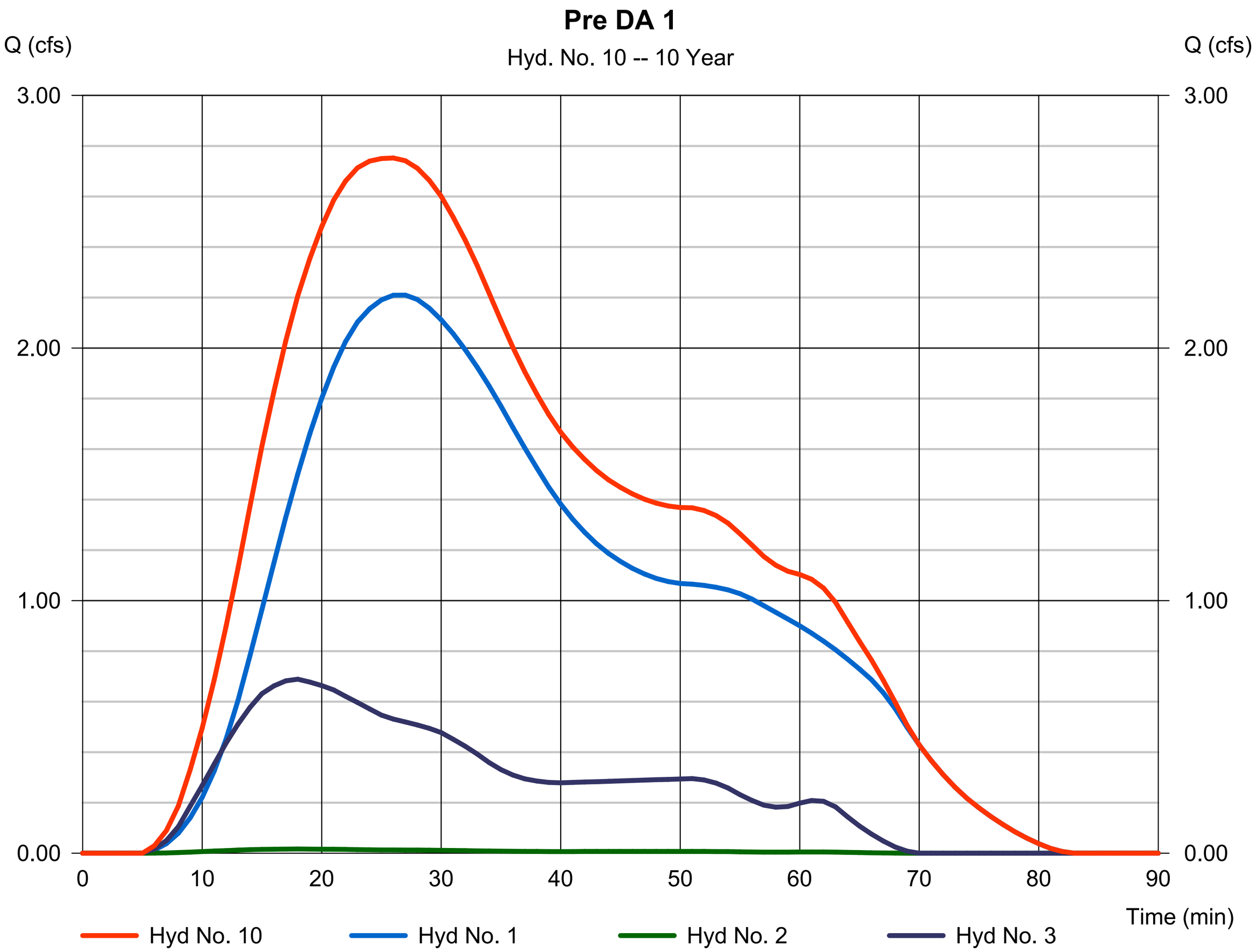


Hydrograph Report

Hyd. No. 10

Pre DA 1

Hydrograph type	= Combine	Peak discharge	= 2.752 cfs
Storm frequency	= 10 yrs	Time to peak	= 26 min
Time interval	= 1 min	Hyd. volume	= 6,120 cuft
Inflow hyds.	= 1, 2, 3	Contrib. drain. area	= 2.030 ac

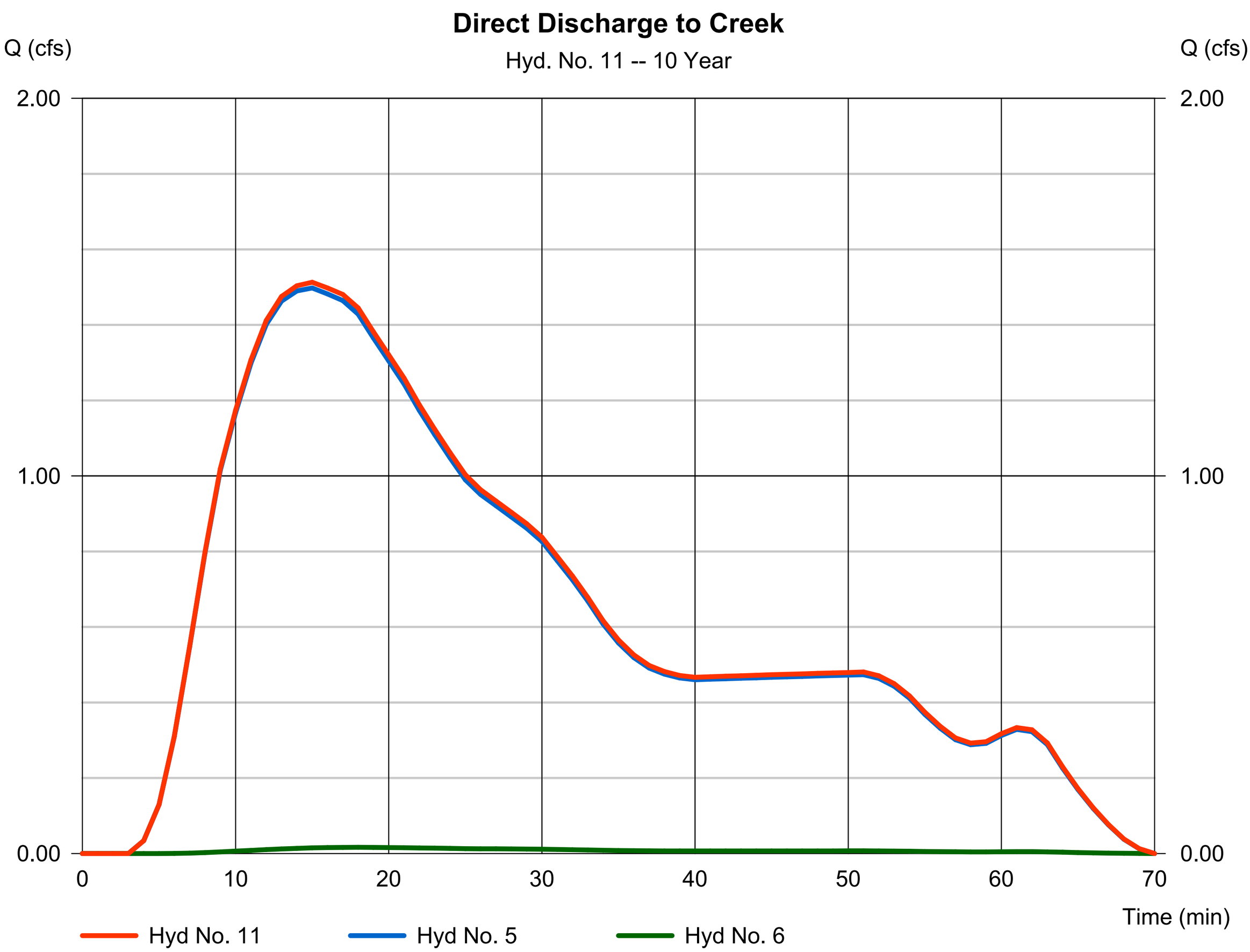


Hydrograph Report

Hyd. No. 11

Direct Discharge to Creek

Hydrograph type	=	Combine	Peak discharge	=	1.513 cfs
Storm frequency	=	10 yrs	Time to peak	=	15 min
Time interval	=	1 min	Hyd. volume	=	2,664 cuft
Inflow hyds.	=	5, 6	Contrib. drain. area	=	0.510 ac

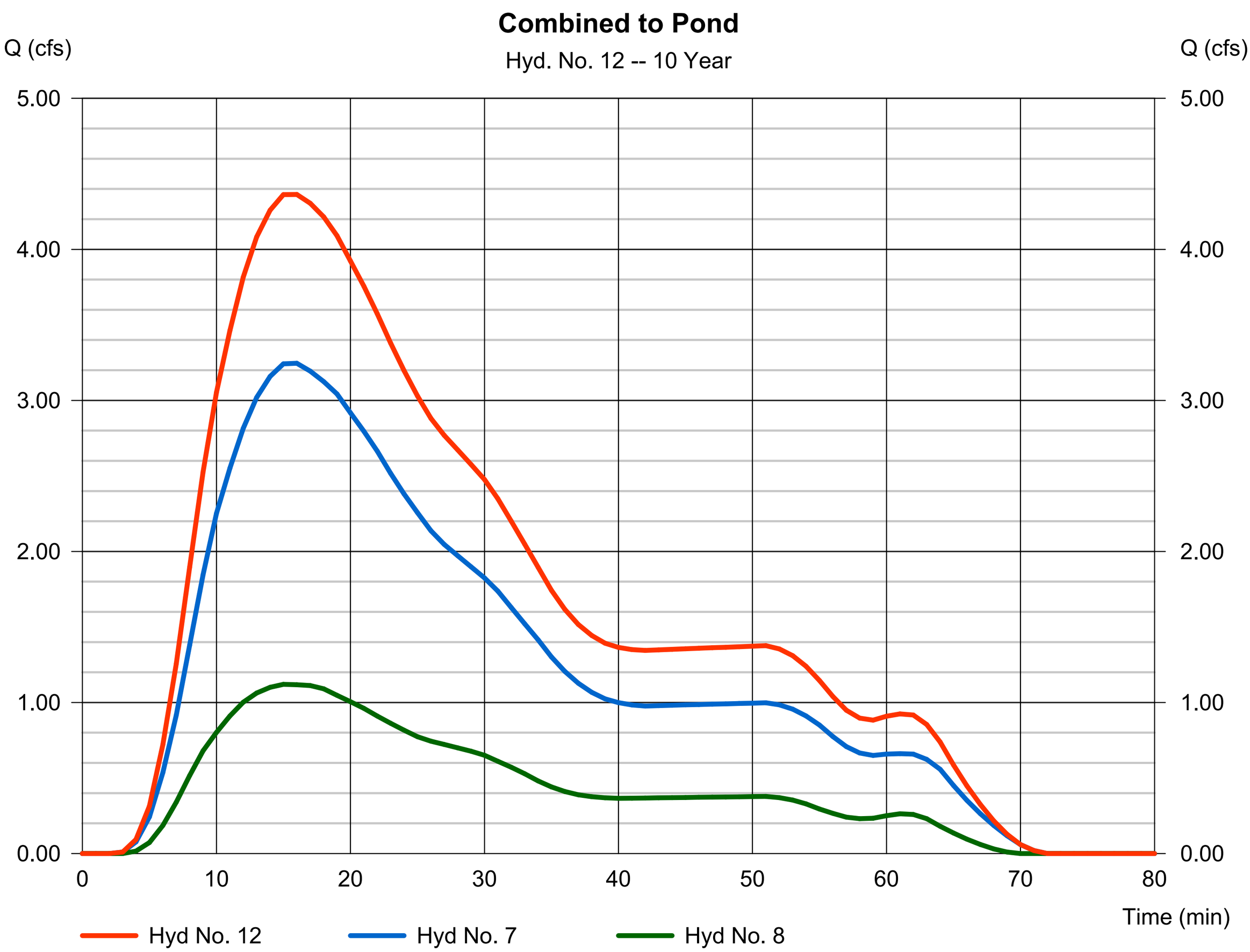


Hydrograph Report

Hyd. No. 12

Combined to Pond

Hydrograph type	=	Combine	Peak discharge	=	4.364 cfs
Storm frequency	=	10 yrs	Time to peak	=	16 min
Time interval	=	1 min	Hyd. volume	=	7,711 cuft
Inflow hyds.	=	7, 8	Contrib. drain. area	=	1.510 ac



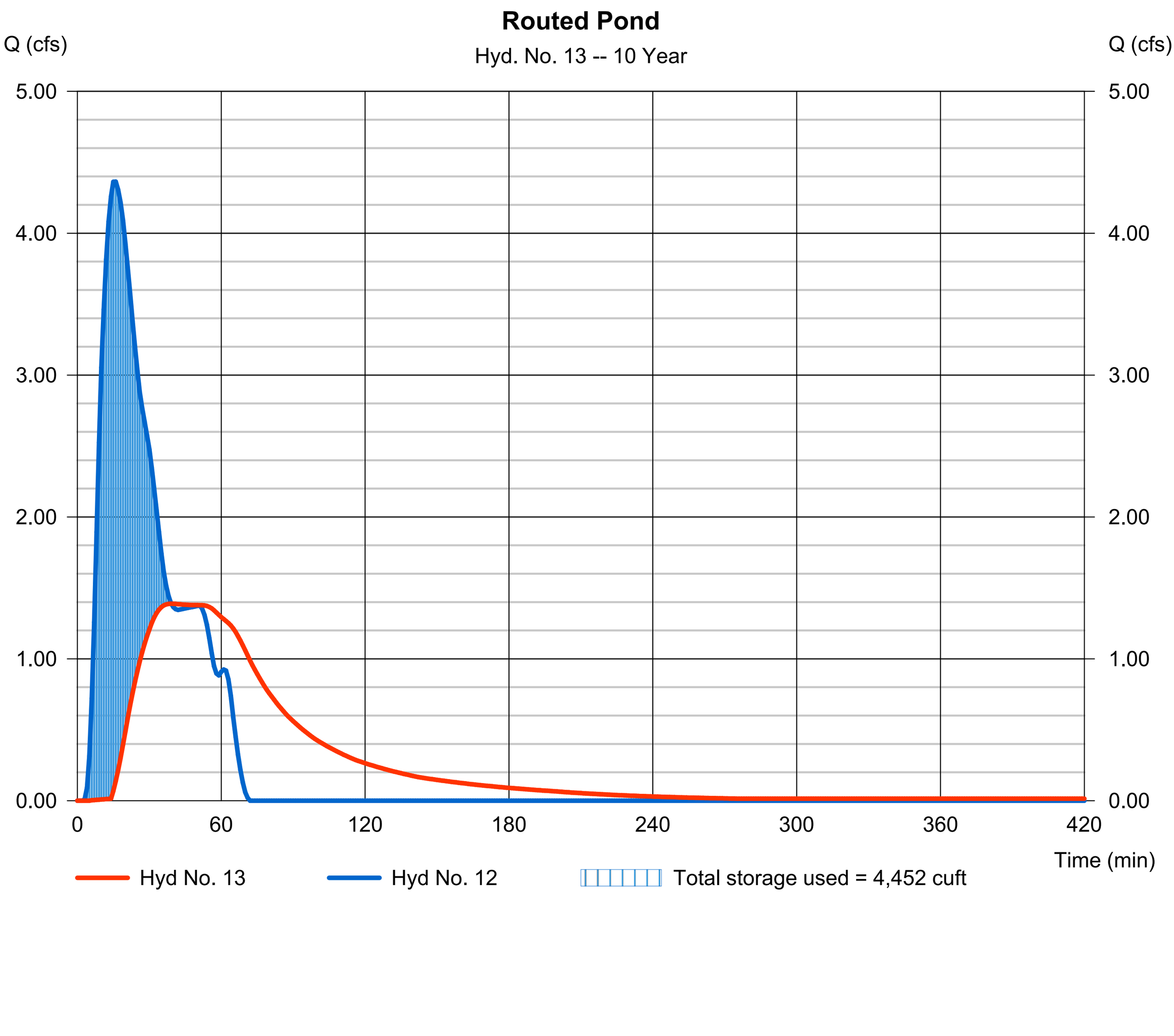
Hydrograph Report

Hyd. No. 13

Routed Pond

Hydrograph type	=	Reservoir	Peak discharge	=	1.389 cfs
Storm frequency	=	10 yrs	Time to peak	=	39 min
Time interval	=	1 min	Hyd. volume	=	7,658 cuft
Inflow hyd. No.	=	12 - Combined to Pond	Max. Elevation	=	1011.78 ft
Reservoir name	=	Detention Pond	Max. Storage	=	4,452 cuft

Storage Indication method used.

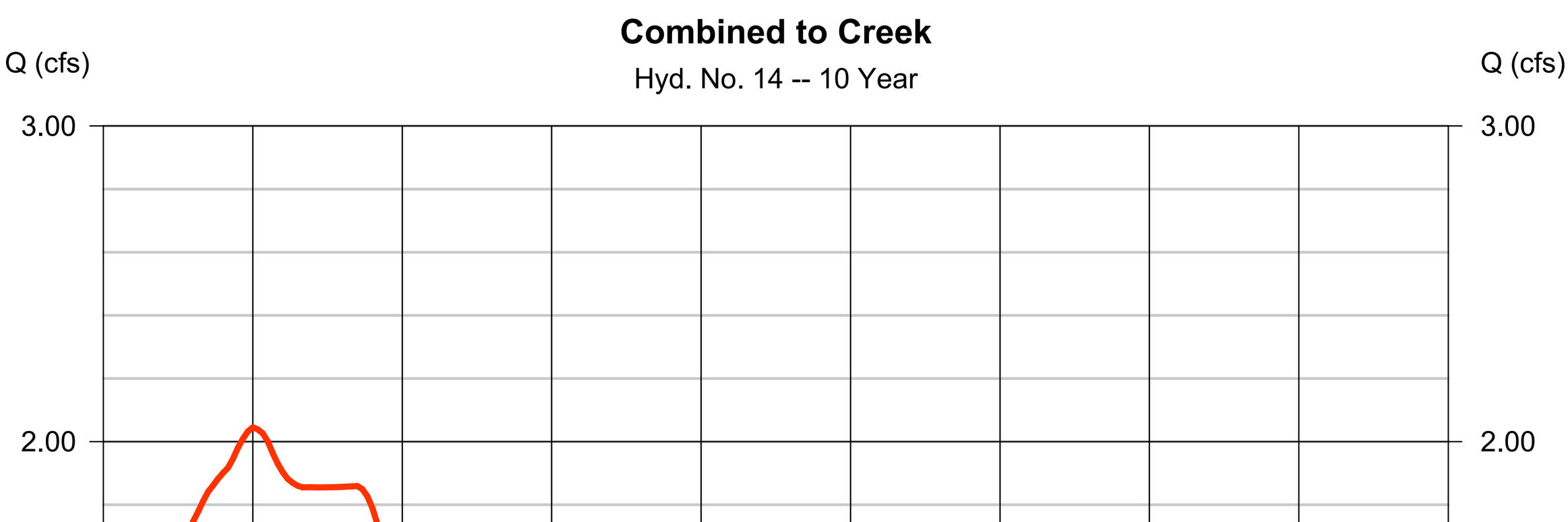


Hydrograph Report

Hyd. No. 14

Combined to Creek

Hydrograph type	=	Combine	Peak discharge	=	2.045 cfs
Storm frequency	=	10 yrs	Time to peak	=	30 min
Time interval	=	1 min	Hyd. volume	=	10,322 cuft
Inflow hyds.	=	11, 13	Contrib. drain. area	=	0.000 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

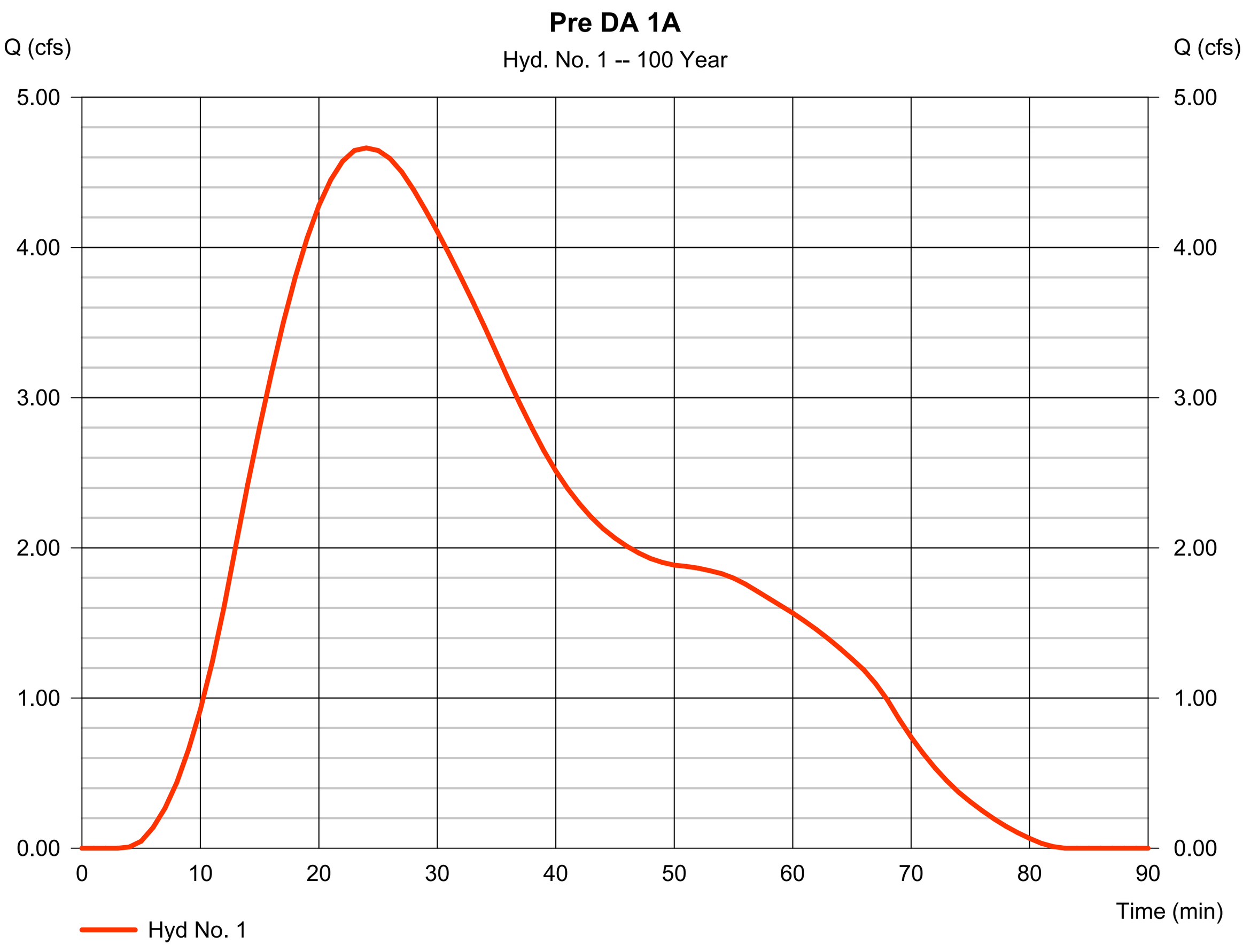
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	4.663	1	24	9,696	------	------	------	Pre DA 1A
2	SCS Runoff	0.034	1	17	62	------	------	------	Pre DA 1B
3	SCS Runoff	1.446	1	17	2,625	------	------	------	Pre DA 1C
4	SCS Runoff	0.034	1	17	62	------	------	------	Pre DA 2
5	SCS Runoff	2.750	1	13	4,600	------	------	------	Post DA 1A
6	SCS Runoff	0.034	1	17	62	------	------	------	Post DA 1B
7	SCS Runoff	5.859	1	14	9,812	------	------	------	Post DA 1C
8	SCS Runoff	2.098	1	13	3,598	------	------	------	Post DA 1D
9	SCS Runoff	0.069	1	17	125	------	------	------	Post DA 2
10	Combine	5.819	1	23	12,383	1, 2, 3,	------	------	Pre DA 1
11	Combine	2.781	1	13	4,663	5, 6,	------	------	Direct Discharge to Creek
12	Combine	7.954	1	14	13,411	7, 8,	------	------	Combined to Pond
13	Reservoir	2.950	1	34	13,353	12	1012.36	6,943	Routed Pond
14	Combine	4.224	1	29	18,016	11, 13	------	------	Combined to Creek

Hydrograph Report

Hyd. No. 1

Pre DA 1A

Hydrograph type	=	SCS Runoff	Peak discharge	=	4.663 cfs
Storm frequency	=	100 yrs	Time to peak	=	24 min
Time interval	=	1 min	Hyd. volume	=	9,696 cuft
Drainage area	=	1.600 ac	Curve number	=	74
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	13.90 min
Total precip.	=	4.10 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

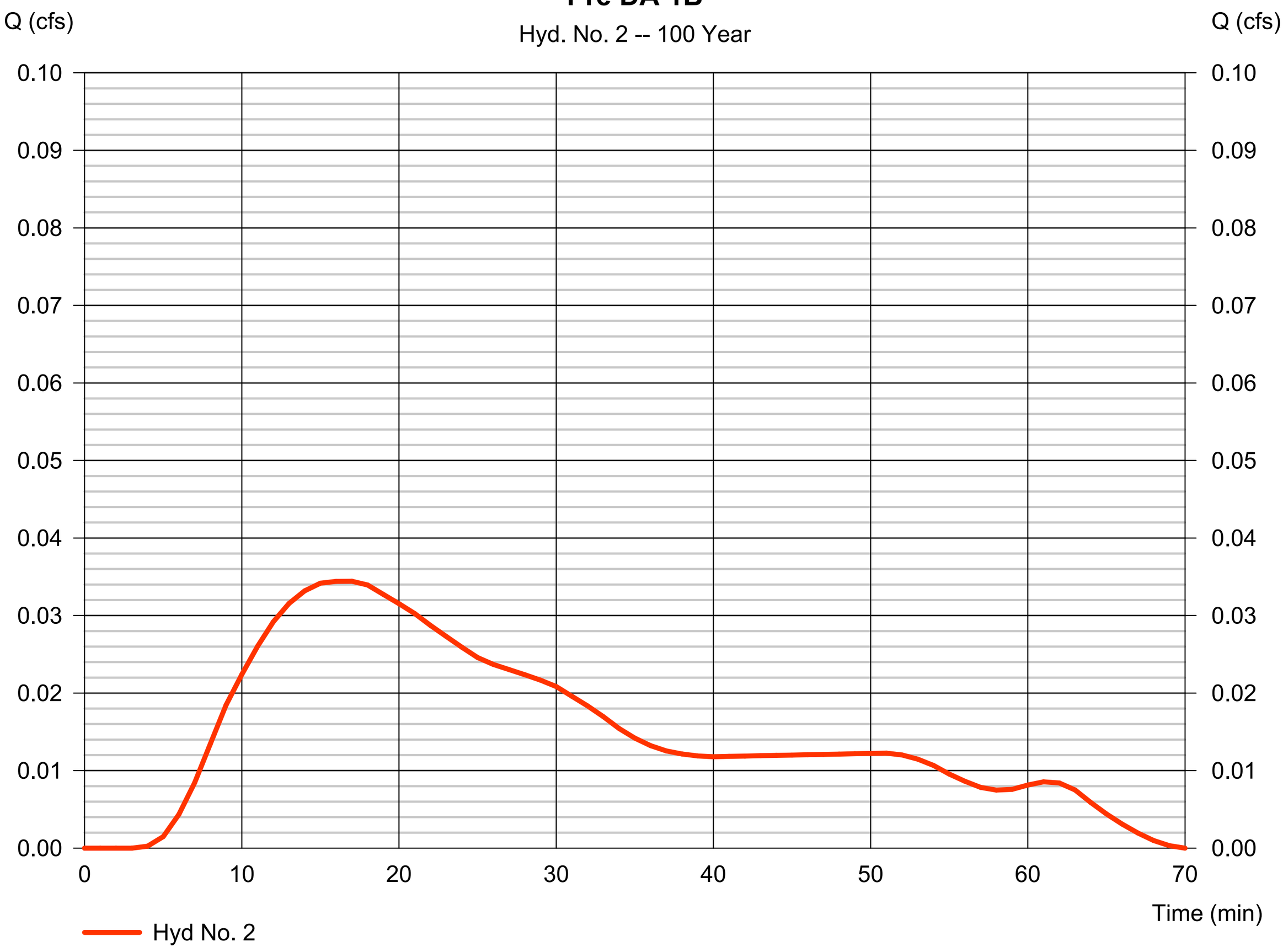


Hydrograph Report

Hyd. No. 2

Pre DA 1B

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.034 cfs
Storm frequency	=	100 yrs	Time to peak	=	17 min
Time interval	=	1 min	Hyd. volume	=	62 cuft
Drainage area	=	0.010 ac	Curve number	=	74
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	4.10 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

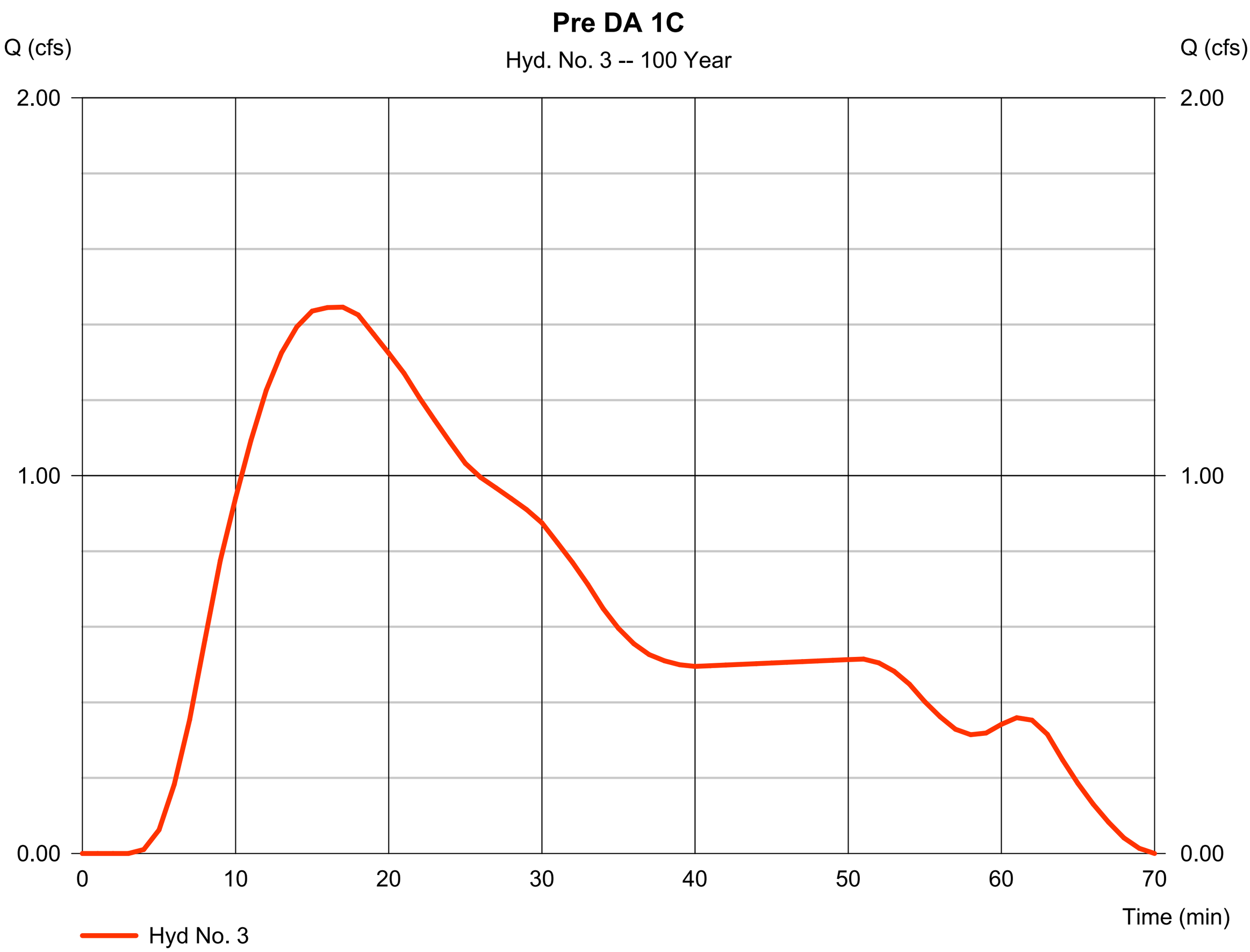


Hydrograph Report

Hyd. No. 3

Pre DA 1C

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.446 cfs
Storm frequency	=	100 yrs	Time to peak	=	17 min
Time interval	=	1 min	Hyd. volume	=	2,625 cuft
Drainage area	=	0.420 ac	Curve number	=	74
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	6.20 min
Total precip.	=	4.10 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

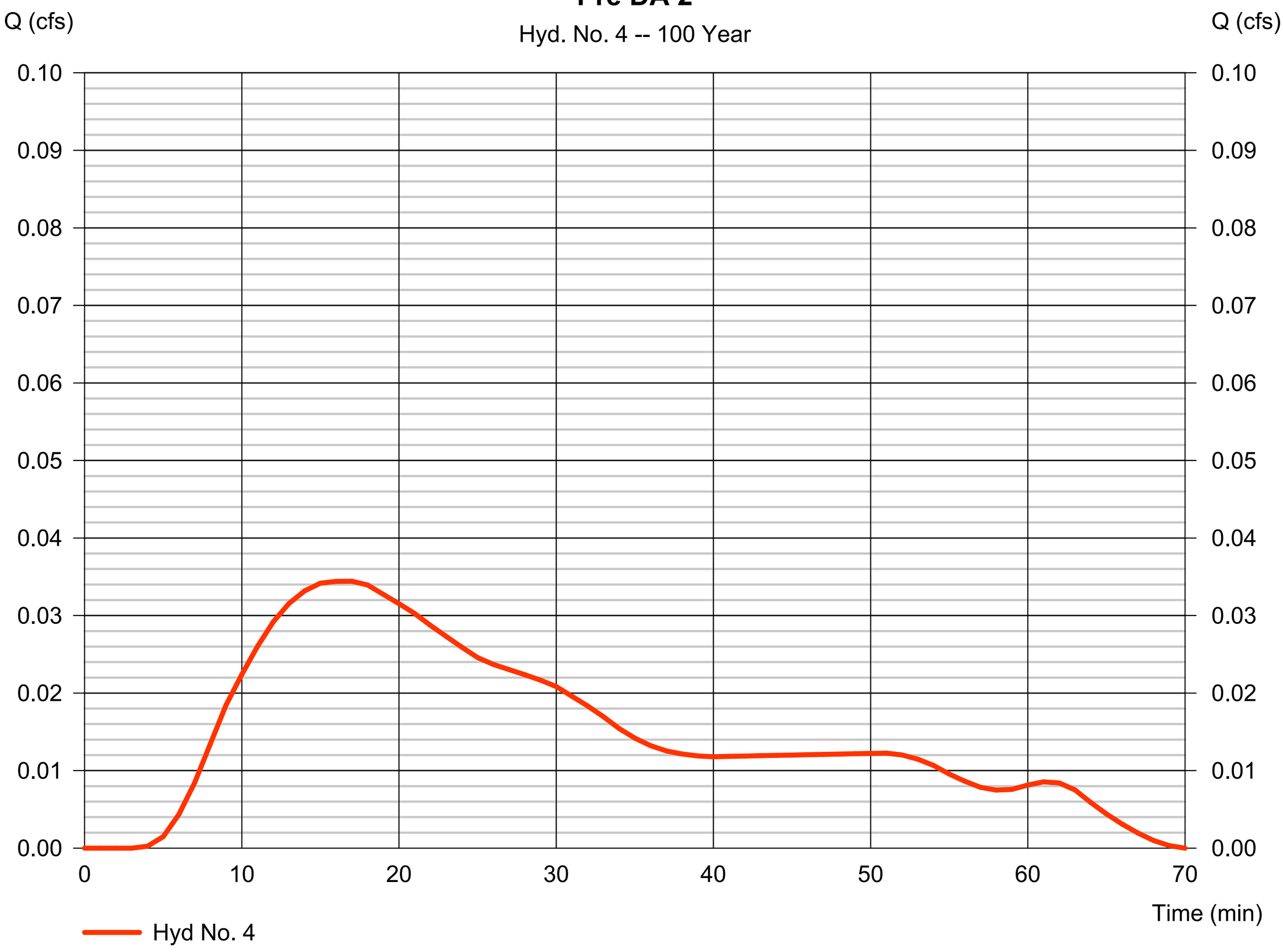


Hydrograph Report

Hyd. No. 4

Pre DA 2

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.034 cfs
Storm frequency	=	100 yrs	Time to peak	=	17 min
Time interval	=	1 min	Hyd. volume	=	62 cuft
Drainage area	=	0.010 ac	Curve number	=	74
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	4.10 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

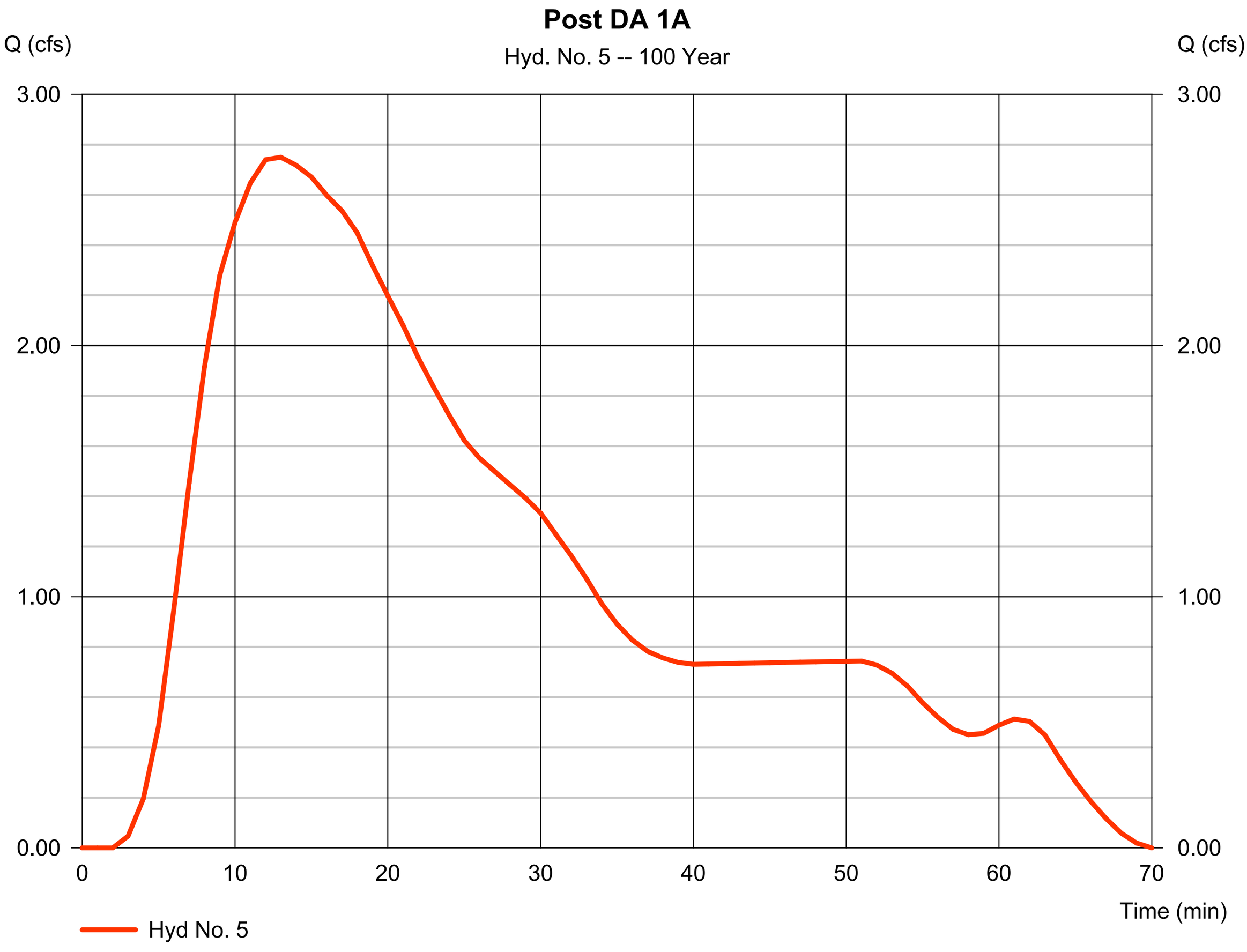


Hydrograph Report

Hyd. No. 5

Post DA 1A

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.750 cfs
Storm frequency	=	100 yrs	Time to peak	=	13 min
Time interval	=	1 min	Hyd. volume	=	4,600 cuft
Drainage area	=	0.500 ac	Curve number	=	84
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	4.10 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

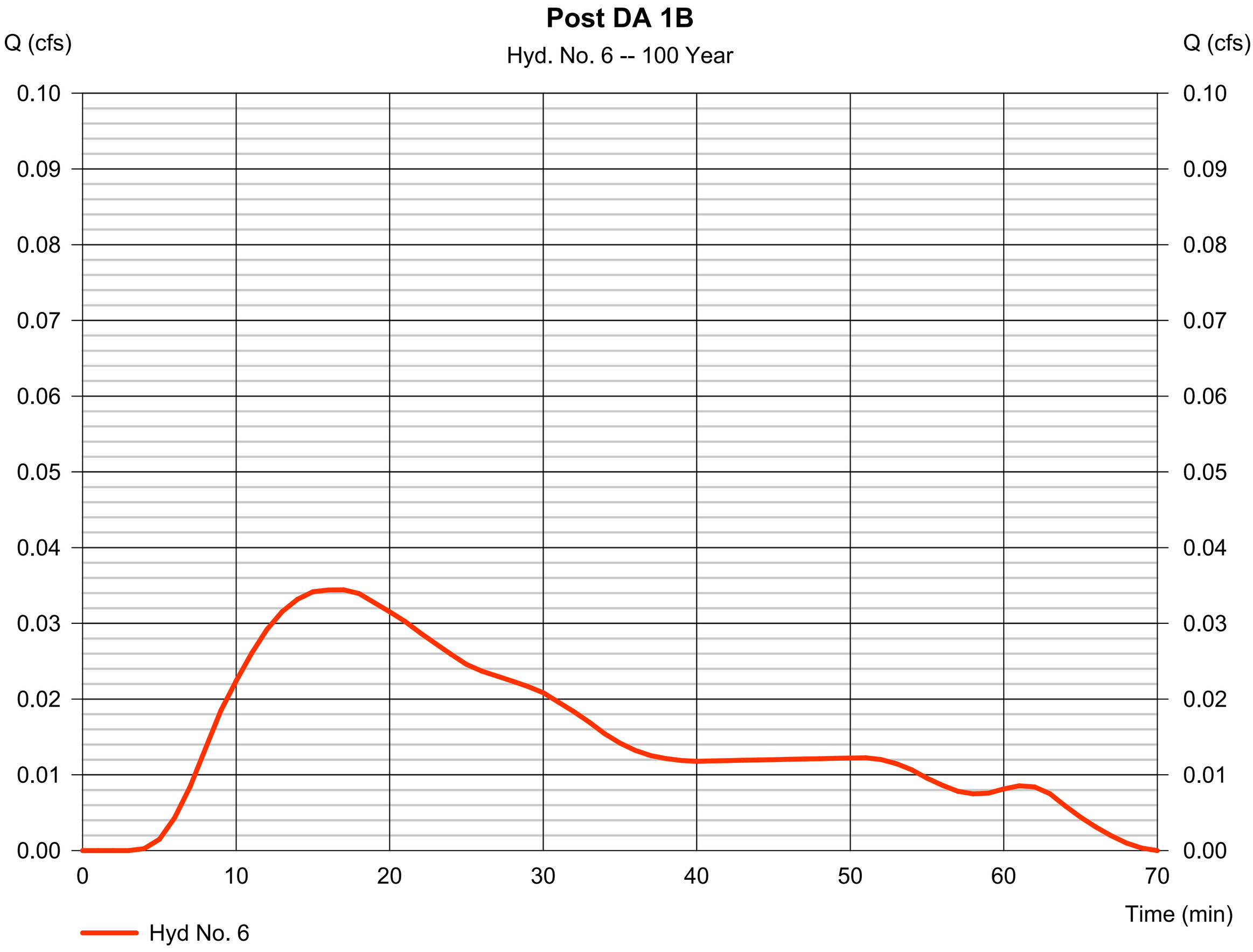


Hydrograph Report

Hyd. No. 6

Post DA 1B

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.034 cfs
Storm frequency	=	100 yrs	Time to peak	=	17 min
Time interval	=	1 min	Hyd. volume	=	62 cuft
Drainage area	=	0.010 ac	Curve number	=	74
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	4.10 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

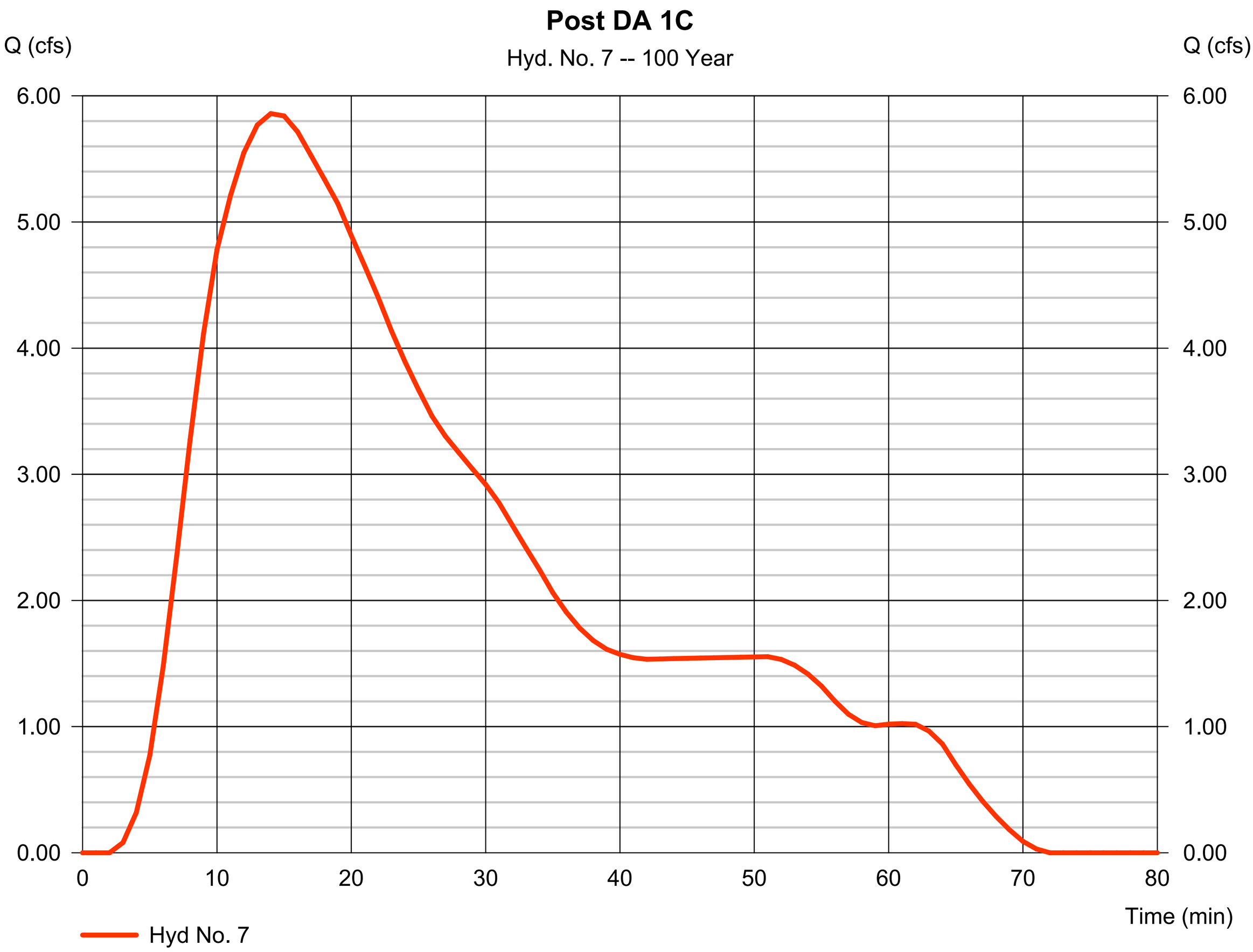


Hydrograph Report

Hyd. No. 7

Post DA 1C

Hydrograph type	=	SCS Runoff	Peak discharge	=	5.859 cfs
Storm frequency	=	100 yrs	Time to peak	=	14 min
Time interval	=	1 min	Hyd. volume	=	9,812 cuft
Drainage area	=	1.090 ac	Curve number	=	85
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	7.30 min
Total precip.	=	4.10 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

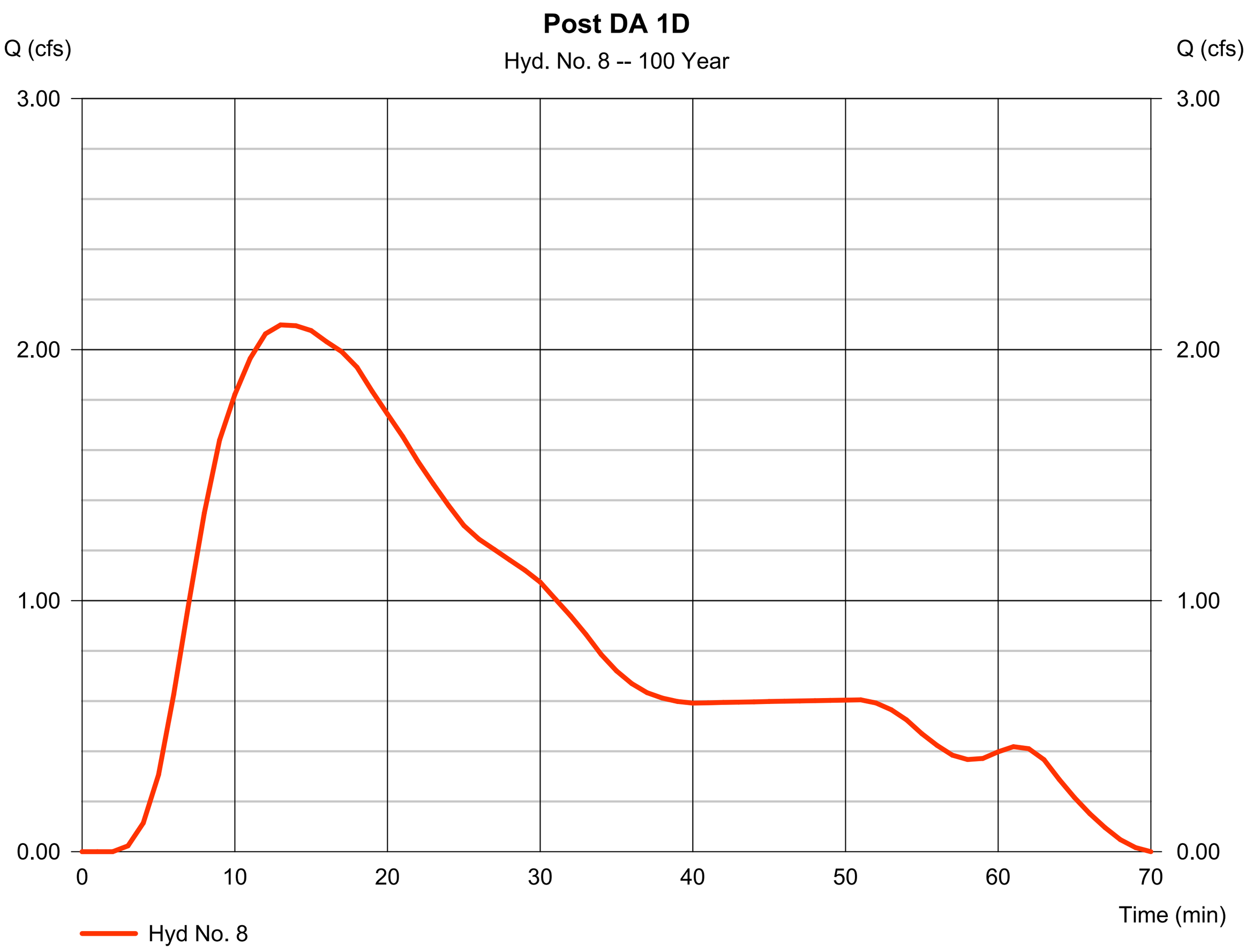


Hydrograph Report

Hyd. No. 8

Post DA 1D

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.098 cfs
Storm frequency	=	100 yrs	Time to peak	=	13 min
Time interval	=	1 min	Hyd. volume	=	3,598 cuft
Drainage area	=	0.420 ac	Curve number	=	82
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	4.10 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

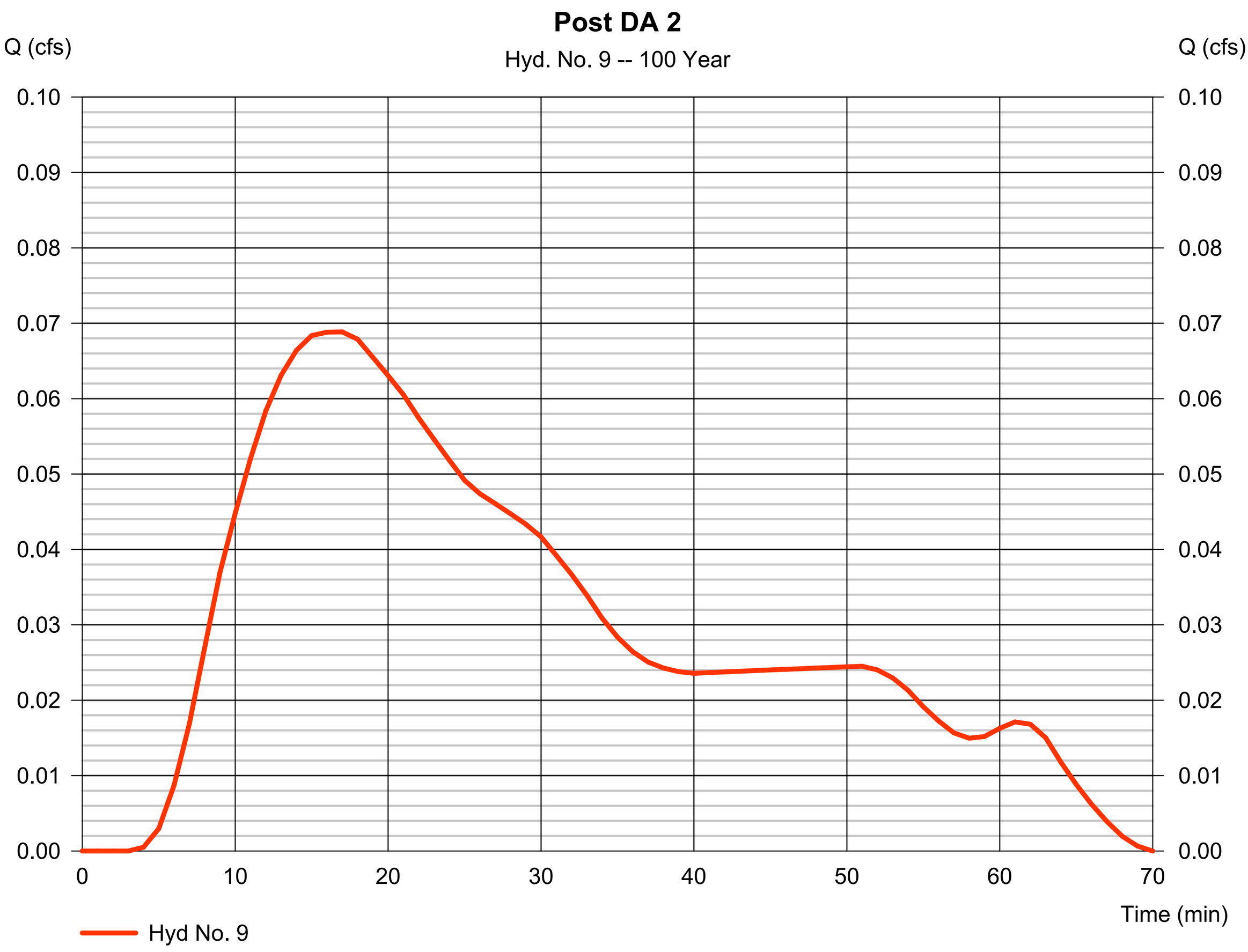


Hydrograph Report

Hyd. No. 9

Post DA 2

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.069 cfs
Storm frequency	=	100 yrs	Time to peak	=	17 min
Time interval	=	1 min	Hyd. volume	=	125 cuft
Drainage area	=	0.020 ac	Curve number	=	74
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	4.10 in	Distribution	=	Huff-1st
Storm duration	=	1.00 hrs	Shape factor	=	484

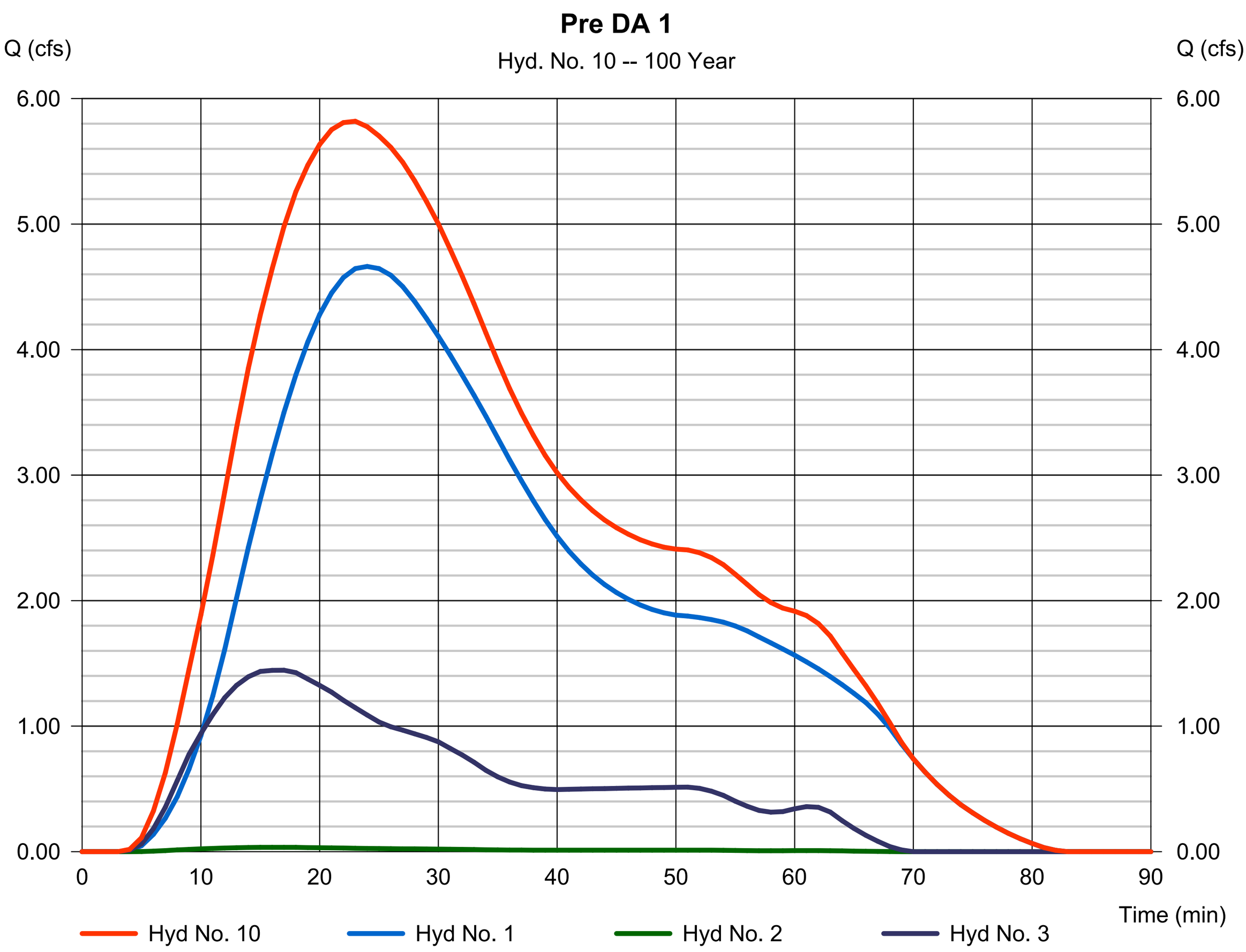


Hydrograph Report

Hyd. No. 10

Pre DA 1

Hydrograph type	= Combine	Peak discharge	= 5.819 cfs
Storm frequency	= 100 yrs	Time to peak	= 23 min
Time interval	= 1 min	Hyd. volume	= 12,383 cuft
Inflow hyds.	= 1, 2, 3	Contrib. drain. area	= 2.030 ac

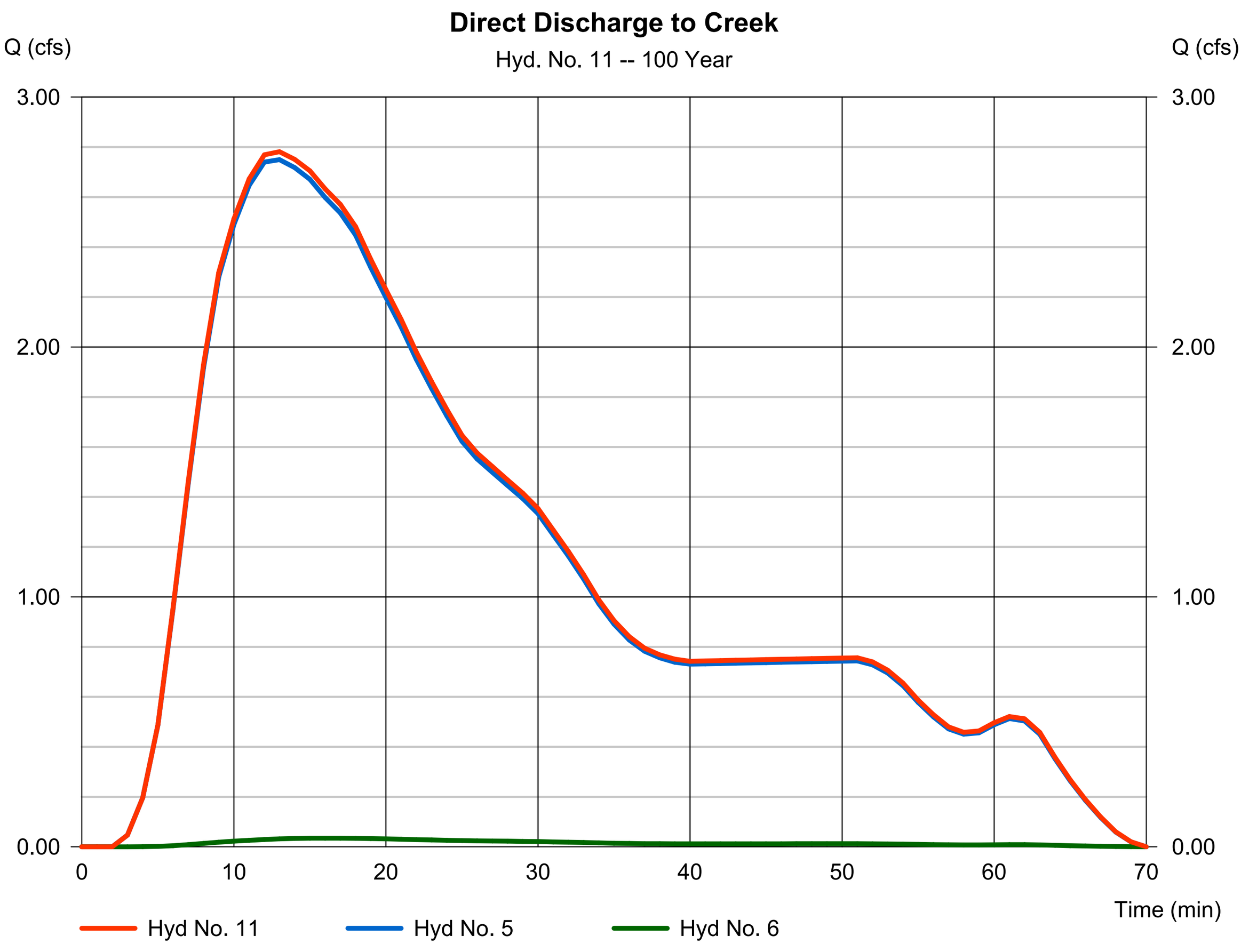


Hydrograph Report

Hyd. No. 11

Direct Discharge to Creek

Hydrograph type	=	Combine	Peak discharge	=	2.781 cfs
Storm frequency	=	100 yrs	Time to peak	=	13 min
Time interval	=	1 min	Hyd. volume	=	4,663 cuft
Inflow hyds.	=	5, 6	Contrib. drain. area	=	0.510 ac

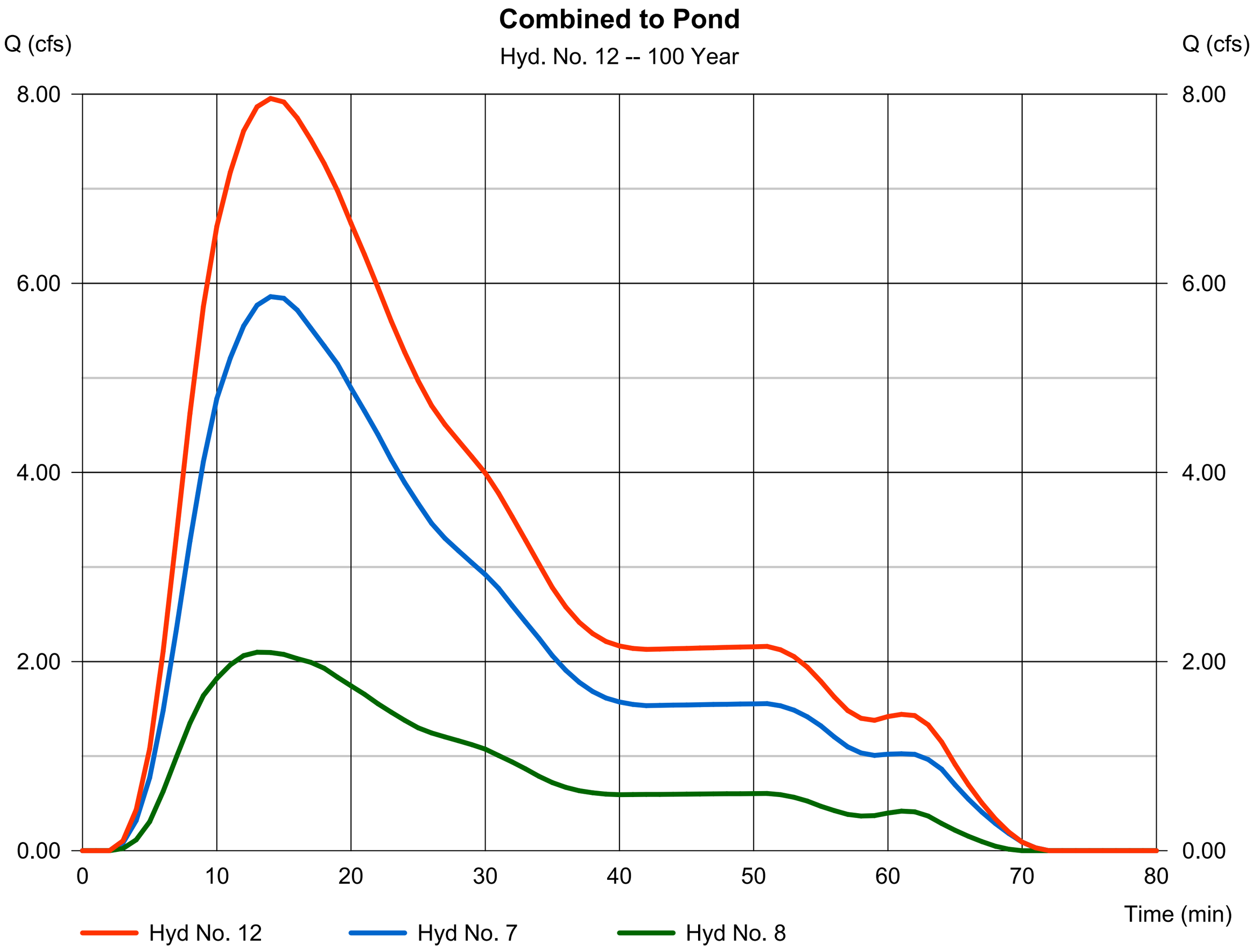


Hydrograph Report

Hyd. No. 12

Combined to Pond

Hydrograph type	=	Combine	Peak discharge	=	7.954 cfs
Storm frequency	=	100 yrs	Time to peak	=	14 min
Time interval	=	1 min	Hyd. volume	=	13,411 cuft
Inflow hyds.	=	7, 8	Contrib. drain. area	=	1.510 ac



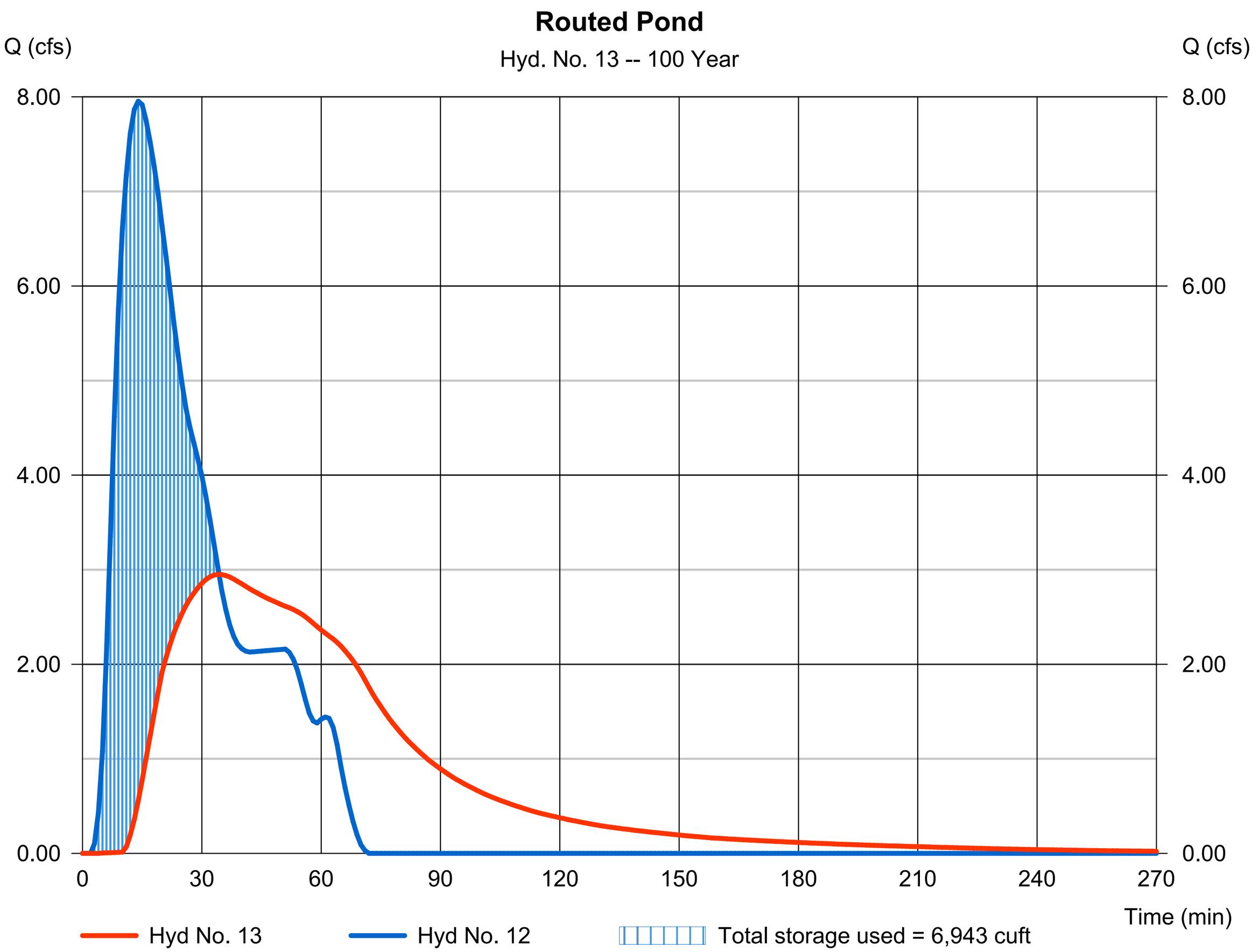
Hydrograph Report

Hyd. No. 13

Routed Pond

Hydrograph type	=	Reservoir	Peak discharge	=	2.950 cfs
Storm frequency	=	100 yrs	Time to peak	=	34 min
Time interval	=	1 min	Hyd. volume	=	13,353 cuft
Inflow hyd. No.	=	12 - Combined to Pond	Max. Elevation	=	1012.36 ft
Reservoir name	=	Detention Pond	Max. Storage	=	6,943 cuft

Storage Indication method used.

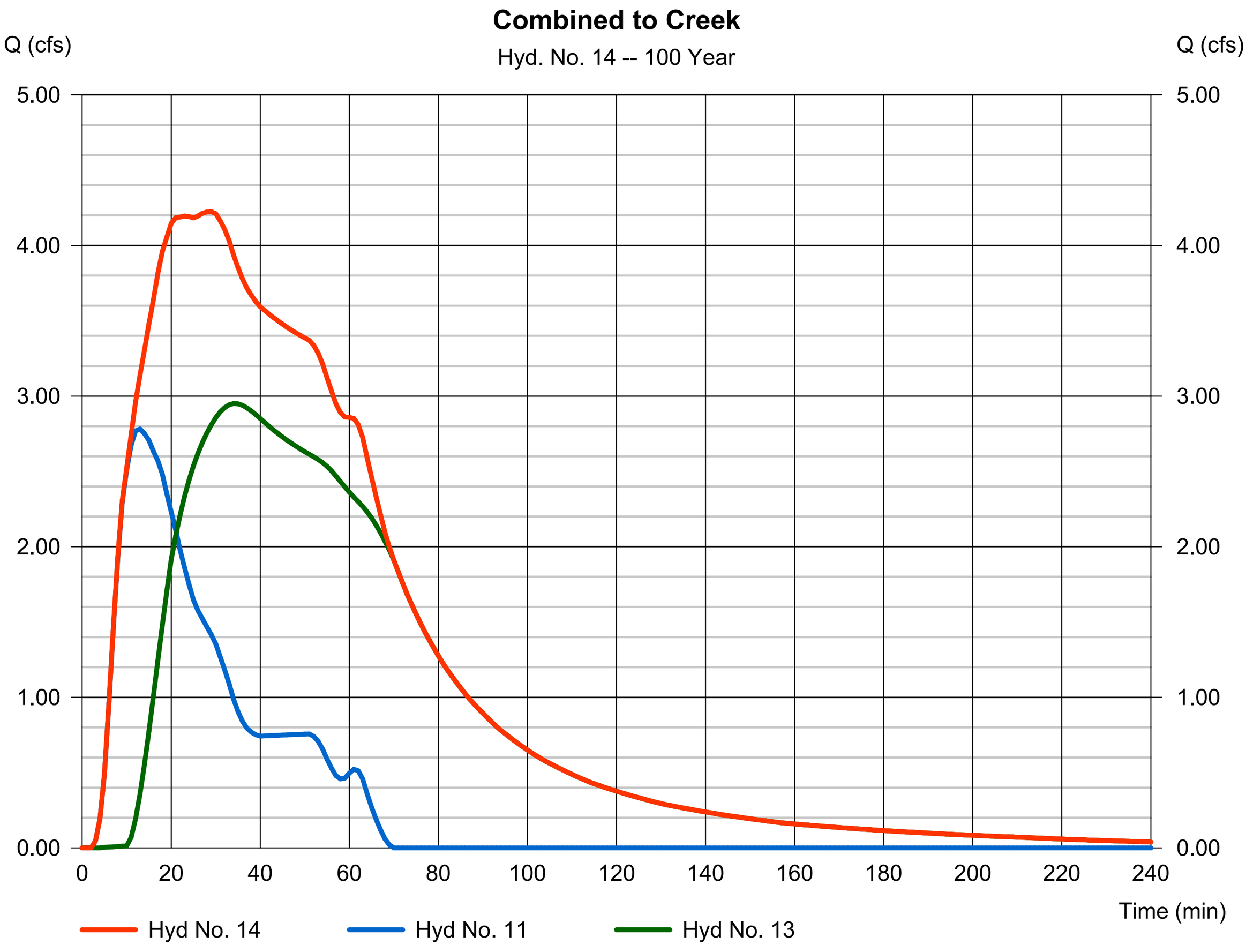


Hydrograph Report

Hyd. No. 14

Combined to Creek

Hydrograph type	=	Combine	Peak discharge	=	4.224 cfs
Storm frequency	=	100 yrs	Time to peak	=	29 min
Time interval	=	1 min	Hyd. volume	=	18,016 cuft
Inflow hyds.	=	11, 13	Contrib. drain. area	=	0.000 ac



APPENDIX G

Drainage Plan