PRELIMINARY STORMWATER MANAGEMENT REPORT

for

STOKES ESTATE
85 RESIDENTIAL LOTS

Residential Development
Westtown Township
Chester County, Pennsylvania

March 17, 2023

Howell Job# 3868

Prepared for:

Fox Clearing, LLC
227 Granite Run Drive, Suite 100
Lancaster, PA 17601

Prepared by:
HOWELL ENGINEERING
1250 Wrights Lane, West Chester, PA 19380
Phone: 610-918-9002 Fax: 610-918-9003

TABLE OF CONTENTS

Section Page

1.0 INTRODUCTION 1
1.1 Land Use 1
1.2 Site Soils 1
1.3 Soil/Geologic Limitations 2

2.0 RUNOFF MANAGEMENT 4

3.0 PERMANENT BMPs 4

4.0 CONCLUSIONS 5

LIST OF FIGURES

Figure 1-1 Site Location Map 3

APPENDICES

Appendix A Stormwater Volume Calculations
Appendix B Peak Flow Summary
Appendix C SCS Runoff Coefficients Calculations
Appendix D SCS Hydrograph Reports & Basin Routings
Appendix E USDA NRCS Soil Report
Appendix F Stormwater Infiltration Testing Report

1.0 INTRODUCTION

This Stormwater Management Report presents the preliminary permanent control measures/facilities required to support construction activities for the Stokes Estate Residential Development . The 80 +/-acre combined tract is located in Westtown Township (Figure 1-1).

The proposed land development consists of constructing 82 residential dwelling units combined with three (3) existing dwellings (total 85 homes), access roads, stormwater management facilities, and public utilities. Two (2) access points to the parcel will be off Shiloh Road. The buildings and roads will be constructed to comply with design standards and safety requirements of the Townships and local Fire Marshals.

1.1 LAND USE

The existing land is currently utilized for agriculture and residential with pastures for livestock, with a few hedgerows and mature trees scattered throughout, mostly along the existing driveway and near the existing residence and outbuildings. The site generally drains to two separate water bodies, where the southern portion of the property drains to an Unnamed Tributary to the East Branch of Chester Creek that flows through the property, and the eastern end of the site drains directly to the East Branch of Chester Creek, also on the property. Therefore, the entire site is located in the Chester Creek watershed. Per Pennsylvania Department of Environmental Protection, 25 Pa. Code, 93.9g "Water Quality Standards" Chester Creek is classified as Trout Stocking Fishery (TSF).

1.2 SITE SOILS

Site soils mapping provided by the United States Department of Agriculture Natural Resources Conservation Service – Web Soil Survey. According to the Web Soil Survey mapping, the following soil types are located within the project study area;

Baile Silt Loam (Ba)
Codorus Silt Loam (Co)
Gladstone Gravelly Loam (GdB) (GdC) (GfD)
Hatboro Silt Loam (Ha)
Manor Loam (MaD)
Urban land – Gladstone complex, 0 to 8 percent

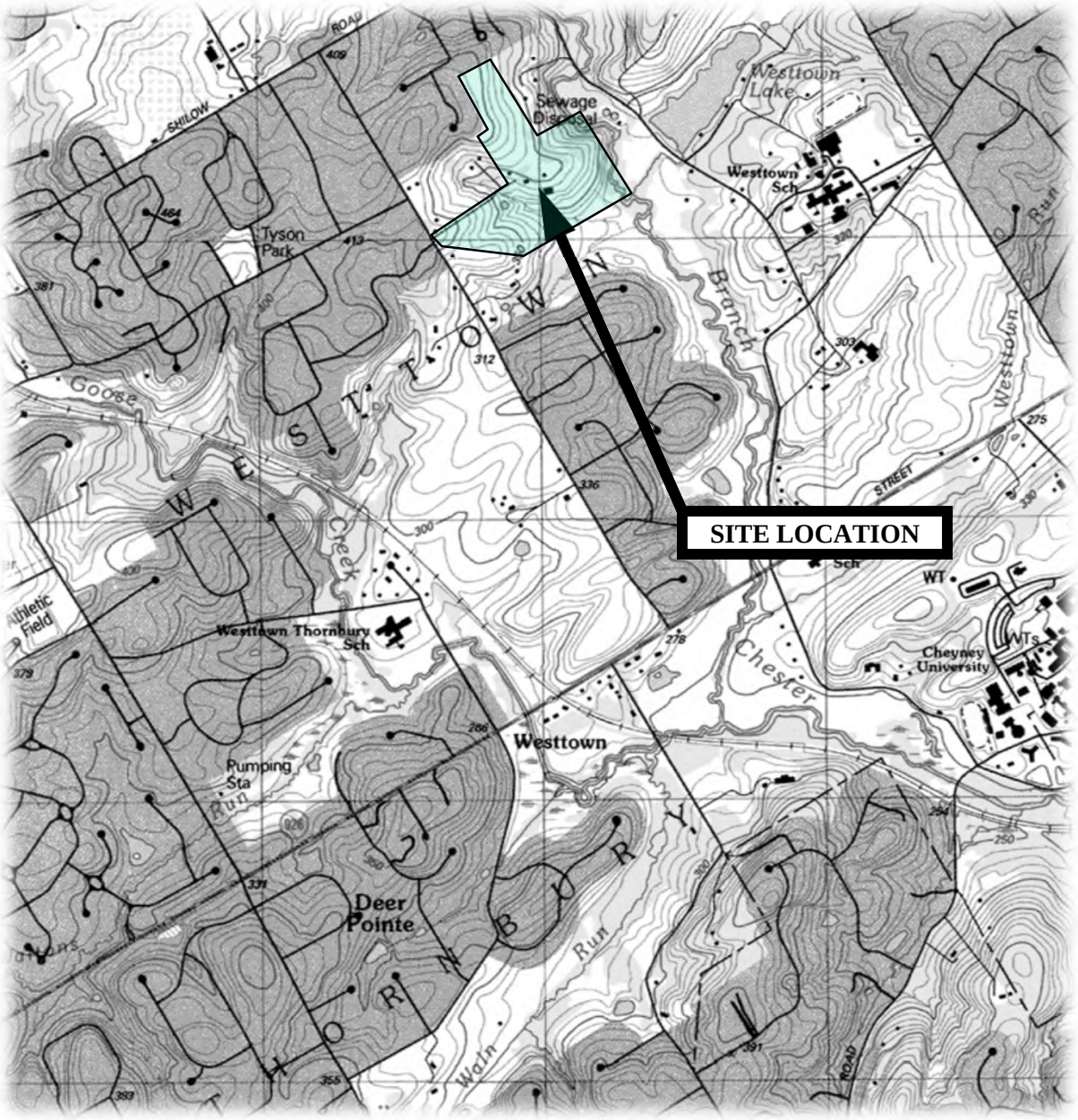
Refer to Appendix E for Soils Map and report.

1.3 SOIL/GEOLOGIC LIMITATIONS:

Some groundwater and rock were encountered in a few locations during infiltration testing. Howell has taken into consideration these known soil limitations when designing the infiltration BMPs for the project. The stormwater infiltration facilities have either been relocated to areas where limiting areas weren't encountered or has been set a minimum of 2 feet higher than any prohibitive soil limitation elevations witnessed during infiltration testing and adequate infiltration results have been achieved at the adjusted elevations.

If during construction, any other unknown soil limitation (i.e. bedrock or high water) is discovered the contractor is responsible for immediately contacting the site geo-technical engineer, design engineer, conservation district and the township engineer for an appropriate solution. The site design drawings contain a pumped water filter bag detail which should be utilized if any excavations need to be dewatered due to high groundwater or excessive rainfall.

Geologic formations/soil conditions that may have the potential to cause pollution:
Furthermore, there are no known geologic formations or soil conditions that have the potential to cause pollution during earth disturbance activities. If during construction, an unknown geologic formations or soil conditions is discovered the contractor is responsible for immediately contacting the Chester County Conservation District and the design engineer.



Source:
United States Department of the Interior Geological Survey
7.5 Minute Series (Topographic) Map
West Chester, Pennsylvania Quadrangle
Scale 1:24000

DLHowell
Civil Engineering & Land Planning
www.DLHowell.com

Stokes Estate

Westtown Township
Chester County, Pennsylvania

Figure Number:
FIGURE 1-1

Title:
SITE LOCATION MAP

2.0 RUNOFF MANAGEMENT

The purpose of the stormwater management design is to quantify and control stormwater runoff generated by the modifications of the ground surface conditions to the site (i.e. roads, buildings, driveways, etc.). Post-development stormwater management is achieved at the site through five (5) combination surface/subsurface infiltration basins strategically located throughout the site to control runoff.

The infiltration basins with stone beds have been designed utilizing Soil Conservation Service (SCS) method for infiltration and peak flow requirements and Westttown Township regulations for peak flow calculations (See Appendices for worksheets). The stormwater management control for this project was designed to include all impervious surfaces associated with this subdivision application, with an assumption of 3,800 SF of impervious coverage per single family lot. These systems are designed to provide an overall reduction in the post-developed runoff for the 2-year, 10-year, 25-year, 50-year, and 100-year, 24-hour storm event to less than 50% of the pre-development runoff rates for the equivalent storm events based on the Chester Creek Watershed Release Rate Map. A stormwater conveyance system will be utilized to convey runoff from the proposed improvements to the proposed stormwater facilities. The stormwater conveyance system will be designed to convey flows up to the 100-year storm event. Flows to the pipes will be generated using the Universal Rational Method and the pipes sized using Manning's Method and Hydraulic Grade Line calculations will also be provided. The infiltration basins have been designed and sized to fully infiltrate the increase in volume, pre to post-development for the 2-year storm as required by the NPDES Phase II regulations.

3.0 NPDES STORMWATER COMPLIANCE

As stated above, the infiltration facilities have been designed and sized to fully infiltrate the 2-year increase in volume; therefore the NPDES Phase II infiltration requirement has been met. Furthermore, as described above, the infiltration basins have been designed to incorporate Pennsylvania Department of Environmental Protection's infiltration guidelines, as stated in Appendix C of the Pennsylvania Stormwater Best Management Practices Manual dated December 2006. The stormwater management systems have been designed to maximize infiltration best management practice (BMP) technologies and minimize point source discharges. This plan will further act to perform/provide the following:

- Preserve the integrity of stream channels and maintain and protect the physical, biological and chemical qualities of the receiving stream by utilizing several BMPs to handle the increase in runoff and volume prior to reaching the stream.
- Prevent an increase in the rate of stormwater runoff by utilizing BMPs to reduce the peak flow rate of all storm events up to the 100 year to below the equivalent storm in the pre developed condition.
- Minimize any increase in stormwater runoff volume by utilizing infiltration BMPs which are designed and sized to fully infiltrate the 2-year increase in volume.
- Minimize impervious areas
- Maximize the protection of existing drainage features and existing vegetation by capturing stormwater runoff from the proposed impervious areas then conveying the flow to stormwater BMPs facilities prior to any release to the existing stream, thereby protecting it from any sediment.
- Minimize land clearing and grading by protecting and preserving the majority of the existing woodlands, and natural areas.
- Minimize soil compaction by specifying the installation of orange construction fencing to protect the areas of the proposed infiltration BMPs.
- Utilize other structural or nonstructural BMPs that prevent or minimize changes in stormwater runoff. The structural BMPs are infiltration beds, and water quality filters, while the non-

structural BMPs are protecting existing riparian buffers, minimizing total disturbed area, and protecting sensitive features.

Howell Engineering has designed Best management Practices (BMP's) consistent with Chapter 6 of the PA Stormwater Best Management Practices Manual within the stormwater collection and conveyance system in addition to infiltrating the net increase in volume from pre to post-development for the 2-year storm event.

The applicant has been able to demonstrate compliance with 102.8(b), through the use of infiltration.

Permanent BMP's proposed for the developed site are as follows:

- Vegetated Swales
- Infiltration Basins/Beds
- Forebays
- Level Spreaders

4.0 CONCLUSIONS

Howell Engineering has completed a preliminary stormwater engineering design for the proposed project in Westtown Township, Chester County, Pennsylvania. Using site-specific topography, soils, land cover, hydrologic data, and Township Ordinances, Howell Engineering designed the stormwater management system for the proposed facilities. The objective of the stormwater design was to develop site-specific stormwater management structures that reduced post-development runoff to pre-development runoff rates and provided volumetric storage per PADEP NPDES Phase II requirements. Post-development stormwater management is achieved through a stormwater collection system consisting of curbed inlets, swales, catch basins, and stormwater infiltration basins/beds.

APPENDIX A

STORMWATER VOLUME CALCULATIONS

DLHowell
Civil Engineering & Land Planning
www.DLHowell.com

CHANGE IN RUNOFF VOLUME FOR 2-YR STORM EVENT

Worksheet 4, Pennsylvania Stormwater Best Management Practices Manual — Chapter 8

PROJECT: Stokes Estate
Drainage Area: DP001 Chester Creek
2-Year Rainfall: 3.2 **in**

Total Site Area: _____ **acres**
Protected Site Area: _____ **acres**
Managed Area: 13.67 **acres**

Existing Conditions

Cover Type/Conditions	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
Woodland	**A**		0.00	25	30.0000	6.0000	0.29	
Meadow	**A**		0.00	30	23.3333	4.6667	0.10	
Impervious	**A**		0.00	98	0.20	0.04	2.97	
Woodland	**B**		0.00	55	8.1818	1.6364	0.25	
Meadow	**B**	672,131	15.43	58	7.2414	1.4483	0.34	19,111
Meadow (20% Imperv)	**B**		0.00	58	7.2414	1.4483	0.34	
Impervious (80%)	**B**		0.00	98	0.2041	0.0408	2.97	
Woodland	**C**		0.00	70	4.2857	0.8571	0.83	
Meadow	**C**		0.00	71	4.0845	0.8169	0.88	
Impervious	**C**		0.00	98	0.2041	0.0408	2.97	
Woodland	**D**		0.00	77	2.9870	0.5974	1.21	
Meadow	**D**		0.00	78	2.8205	0.5641	1.27	
Impervious	**D**		0.00	98	0.2041	0.0408	2.97	
TOTAL:		**672,131**	**15.43**					**19,111**

Developed Conditions

Cover Type/Conditions	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
Lawn	**B**	323,952	7.44	61	6.3934	1.2787	0.44	11,985
Impervious	**N/A**	153,121	3.52	98	0.2041	0.0408	2.97	37,865
Meadow	**B**	118,483	2.72	58	7.2414	1.4483	0.34	3,369
			0.00					
			0.00					
			0.00					
			0.00					
			0.00					
TOTAL:		**595,556**	**13.67**					**53,220**

2-Year Volume Increase (ft^3):	**34,108**

2-Year Volume Increase = Developed Conditions Runoff Volume - Existing Conditions Runoff Volume

1. Runoff (in) = Q = (P - 0.2S)2 / (P + 08.S)
   P = 2-Year Rainfall (in)
   S = (1000/CN) - 10

2. Runoff Volume (CF) = Q x Area x 1/12
   Q = Runoff (in)
   Area = Land Use Area (Sq. Ft)

Note: Runoff Volume must be calculated for EACH land use type/condition and HSGI.
The use of a weighted CN value for volume calculations is not acceptable.

DLHowell
Civil Engineering & Land Planning
www.DLHowell.com

CHANGE IN RUNOFF VOLUME FOR 2-YR STORM EVENT

Worksheet 4, Pennsylvania Stormwater Best Management Practices Manual — Chapter 8

PROJECT: Rustin Residential
Drainage Area: DP002 UNT Chester Creek
2-Year Rainfall: 3.2 **in**

Total Site Area: _____ **acres**
Protected Site Area: _____ **acres**
Managed Area: 20.97 **acres**

Existing Conditions

Cover Type/Conditions	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
Woodland	**A**		0.00	25	30.0000	6.0000	0.29	
Meadow	**A**		0.00	30	23.3333	4.6667	0.10	
Impervious	**A**		0.00	98	0.20	0.04	2.97	
Woodland	**B**		0.00	55	8.1818	1.6364	0.25	
Meadow	**B**	745,375	17.11	58	7.2414	1.4483	0.34	21,194
Meadow (20% Imperv)	**B**		0.00	58	7.2414	1.4483	0.34	
Impervious (80%)	**B**		0.00	98	0.2041	0.0408	2.97	
Woodland	**C**		0.00	70	4.2857	0.8571	0.83	
Meadow	**C**	91,390	2.10	71	4.0845	0.8169	0.88	6,687
Impervious	**C**		0.00	98	0.2041	0.0408	2.97	
Woodland	**D**		0.00	77	2.9870	0.5974	1.21	
Meadow	**D**		0.00	78	2.8205	0.5641	1.27	
Impervious	**D**		0.00	98	0.2041	0.0408	2.97	
TOTAL:		**836,765**	**19.21**					**27,882**

Developed Conditions

Cover Type/Conditions	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
Lawn	**C**	75,360	1.73	74	3.5135	0.7027	1.04	6,516
Lawn	**B**	563,811	12.94	61	6.3934	1.2787	0.44	20,859
Impervious	**N/A**	274,153	6.29	98	0.2041	0.0408	2.97	67,795
			0.00					
			0.00					
			0.00					
			0.00					
			0.00					
			0.00					
TOTAL:		**913,324**	**20.97**					**95,170**

2-Year Volume Increase (ft^3):	**67,289**

2-Year Volume Increase = Developed Conditions Runoff Volume - Existing Conditions Runoff Volume

1. Runoff (in) = Q = (P - 0.2S)2 / (P + 08.S)
   P = 2-Year Rainfall (in)
   S = (1000/CN) - 10

2. Runoff Volume (CF) = Q x Area x 1/12
   Q = Runoff (in)
   Area = Land Use Area (Sq. Ft)

Note: Runoff Volume must be calculated for EACH land use type/condition and HSGI.
The use of a weighted CN value for volume calculations is not acceptable.

DLHowell
Civil Engineering & Land Planning
www.DLHowell.com

CHANGE IN RUNOFF VOLUME FOR 2-YR STORM EVENT

Worksheet 4, Pennsylvania Stormwater Best Management Practices Manual — Chapter 8

PROJECT: Stokes Estate
Drainage Area: DP003 UNT Chester Creek
2-Year Rainfall: 3.2 **in**

Total Site Area: _____ **acres**
Protected Site Area: _____ **acres**
Managed Area: 7.87 **acres**

Existing Conditions

Cover Type/Conditions	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
Woodland	**A**		0.00	25	30.0000	6.0000	0.29	
Meadow	**A**		0.00	30	23.3333	4.6667	0.10	
Impervious	**A**		0.00	98	0.20	0.04	2.97	
Woodland	**B**		0.00	55	8.1818	1.6364	0.25	
Meadow	**B**	104,108	2.39	58	7.2414	1.4483	0.34	2,960
Meadow (20% Imperv)	**B**		0.00	58	7.2414	1.4483	0.34	
Impervious (80%)	**B**		0.00	98	0.2041	0.0408	2.97	
Woodland	**C**		0.00	70	4.2857	0.8571	0.83	
Meadow	**C**	211,266	4.85	71	4.0845	0.8169	0.88	15,459
Impervious	**C**		0.00	98	0.2041	0.0408	2.97	
Woodland	**D**		0.00	77	2.9870	0.5974	1.21	
Meadow	**D**	41,382	0.95	78	2.8205	0.5641	1.27	4,391
Impervious	**D**		0.00	98	0.2041	0.0408	2.97	
TOTAL:		**356,756**	**8.19**					**22,811**

Developed Conditions

Cover Type/Conditions	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff[1] (in)	Runoff Volume[2] (ft^3)
Lawn	**B**	49,632	1.14	61	6.3934	1.2787	0.44	1,836
Impervious	**N/A**	98,822	2.27	98	0.2041	0.0408	2.97	24,438
Lawn	**C**	175,962	4.04	78	2.8205	0.5641	1.27	18,672
Lawn	**D**	32,340	0.74	81	2.3457	0.4691	1.47	3,959
			0.00					
			0.00					
			0.00					
			0.00					
TOTAL:		**356,756**	**8.19**					**48,905**

2-Year Volume Increase (ft^3): 26,094

2-Year Volume Increase = Developed Conditions Runoff Volume - Existing Conditions Runoff Volume

1. Runoff (in) = Q = (P - 0.2S)2 / (P + 08.S)
   P = 2-Year Rainfall (in)
   S = (1000/CN) - 10

2. Runoff Volume (CF) = Q x Area x 1/12
   Q = Runoff (in)
   Area = Land Use Area (Sq. Ft)

Note: Runoff Volume must be calculated for EACH land use type/condition and HSGI.
The use of a weighted CN value for volume calculations is not acceptable.

HOWELL ENGINEERING

STRUCTURAL BMP VOLUME CREDITS

Worksheet 5, Pennsylvania Stormwater Best Management Practices Manual — Chapter 8

PROJECT: Stokes Estate
Sub-Basin Chester Creek DP001

Required Control Volume	34,108	**Cubic Feet**
Non-Structural Volume Credit	0	**Cubic Feet**
Structure Volume Requirement	34,108	**Cubic Feet**

Section	Proposed BMP	Area (sf)	Storage Volume (ft^3)
6.4.1	Porous Pavement		
6.4.2	Infiltration Basin		35,889
6.4.3	Infltration Bed		
6.4.4	Infiltration Trench		
6.4.5	Rain Garden/Bioretention		
6.4.6	Dry Well/Seepage Pit		
6.4.7	Constructed Filter		
6.4.8	Vegetated Swale		
6.4.9	Vegetated Filter Strip		
6.4.10	Infiltration Berm		
6.5.1	Vegetated Roof		
6.5.2	Capture and Re-Use		
6.6.1	Constructed Wetlands		
6.6.2	Wet Pond/Retention Basin		
6.6.3	Dry Extended Detention Basin		
6.6.4	Water Quality Filters		
6.7.1	Riparian Buffer Restoration		
6.7.2	Landscape Restoration / Reforestation		
6.7.3	Soil Amendment		
6.8.1	Level Spreader		
6.8.2	Special Storage Areas		
	Other		
		0	**35,889**

Total Structural Volume (cf)	**35,889**
Structural Volume Requirement (cf)	**34,108**
DIFFERENCE	**1,781**

HOWELL ENGINEERING

STRUCTURAL BMP VOLUME CREDITS

Worksheet 5, Pennsylvania Stormwater Best Management Practices Manual — Chapter 8

PROJECT: Stokes Estate
Sub-Basin UNT Chester Creek DP002

Required Control Volume	67,289	**Cubic Feet**
Non-Structural Volume Credit	0	**Cubic Feet**
Structure Volume Requirement	67,289	**Cubic Feet**

Section	Proposed BMP	Area (sf)	Storage Volume (ft^3)
6.4.2	Infiltration Basin 1 Combined		34,254
6.4.2	Infiltration Basin 2		33,072
6.4.3	Infltration Bed(s)		
6.4.5	Rain Garden/Bioretention		
6.4.6	Dry Well/Seepage Pit		
6.4.7	Constructed Filter		
6.4.8	Vegetated Swale		
6.4.9	Vegetated Filter Strip		
6.4.10	Infiltration Berm		
6.5.1	Vegetated Roof		
6.5.2	Capture and Re-Use		
6.6.1	Constructed Wetlands		
6.6.2	Wet Pond/Retention Basin		
6.6.3	Dry Extended Detention Basin		
6.6.4	Water Quality Filters		
6.7.1	Riparian Buffer Restoration		
6.7.2	Landscape Restoration / Reforestation		
6.7.3	Soil Amendment		
6.8.1	Level Spreader		
6.8.2	Special Storage Areas		
	Other		
		0	**67,326**

Total Structural Volume (cf)	**67,326**
Structural Volume Requirement (cf)	**67,289**
DIFFERENCE	**37**

HOWELL ENGINEERING

STRUCTURAL BMP VOLUME CREDITS

Worksheet 5, Pennsylvania Stormwater Best Management Practices Manual — Chapter 8

PROJECT: Stokes Estate
Sub-Basin UNT Chester Creek DP003

Required Control Volume	26,094	**Cubic Feet**
Non-Structural Volume Credit	0	**Cubic Feet**
Structure Volume Requirement	26,094	**Cubic Feet**

Section	Proposed BMP	Area (sf)	Storage Volume (ft^3)
6.4.2	Basin 4		14,188
6.4.3	UG Bed 1 w/ Basin		12,096
6.4.3	Infiltration Bed(s)		
6.4.5	Rain Garden/Bioretention		
6.4.6	Dry Well/Seepage Pit		
6.4.7	Constructed Filter		
6.4.8	Vegetated Swale		
6.4.9	Vegetated Filter Strip		
6.4.10	Infiltration Berm		
6.5.1	Vegetated Roof		
6.5.2	Capture and Re-Use		
6.6.1	Constructed Wetlands		
6.6.2	Wet Pond/Retention Basin		
6.6.3	Dry Extended Detention Basin		
6.6.4	Water Quality Filters		
6.7.1	Riparian Buffer Restoration		
6.7.2	Landscape Restoration / Reforestation		
6.7.3	Soil Amendment		
6.8.1	Level Spreader		
6.8.2	Special Storage Areas		
	Other		
		0	**26,284**

Total Structural Volume (cf)	**26,284**
Structural Volume Requirement (cf)	**26,094**
DIFFERENCE	**190**

HOWELL ENGINEERING

INFILTRATION VOLUME CALCULATION

Basin 1 Upper

PROJECT NAME: ***Stokes Estate***

LOCATION: ***Westtown Township***

PREPARED BY: ***DWG*** DATE: ***3/30/2021***

CHECKED BY: ***DLH*** DATE:

WATER SURFACE ELEVATION (FEET)	AREA AREA (SQ.FT.)	AVERAGE AREA (SQ.FT.)	DIFFERENCE IN ELEVATION (FEET)	STORAGE VOLUME (CUBIC FEET)	
				INCREMENTAL	TOTAL
320.00	**13,236**				**0**
		14,996	**2.00**	**29991**	
322.00	**16,755**				**29,991**
		18,686	**2.00**	**37372**	
324.00	**20,617**				**67,363**
		22,559	**2.00**	**45117**	
326.00	**24,500**				**112,480**

Proposed Infiltration Volume

Elevation	Storage Volume (CF)
322.00	29,991
322.50	***39,334***
324.00	67,363

Volume = 39,334 CF

*Only 34,254 CF drains to the basin in the 2 year storm, therefore only 34,254 CF is being taken credit for

HOWELL ENGINEERING

INFILTRATION VOLUME CALCULATION

Basin 1 Lower

PROJECT NAME: ***Stokes Estate***

LOCATION: ***Westtown Township***

PREPARED BY: ***DWG*** DATE: ***3/30/2021***

CHECKED BY: ***DLH*** DATE:

WATER SURFACE ELEVATION (FEET)	AREA AREA (SQ.FT.)	AVERAGE AREA (SQ.FT.)	DIFFERENCE IN ELEVATION (FEET)	STORAGE VOLUME (CUBIC FEET)	
				INCREMENTAL	TOTAL
302.00	**2,215**				**0**
		3,094	**2.00**	**6187**	
304.00	**3,972**				**6,187**
		7,254	**2.00**	**14507**	
306.00	**10,535**				**20,694**
		12,703	**2.00**	**25405**	
308.00	**14,870**				**46,099**

Proposed Infiltration Volume

Elevation	Storage Volume (CF)
302.00	0
304.00	***6,187***
304.00	6,187

Volume = 6,187 CF

*the full two year volume to the upper basin is proposed to be infiltrated, the lower basin will infiltrate the volume that drains directly to it.

HOWELL ENGINEERING

INFILTRATION VOLUME CALCULATION

Basin 2

PROJECT NAME: ***Stokes Estate***

LOCATION: ***Westtown Township***

PREPARED BY: ***DWG*** DATE: ***3/30/2021***

CHECKED BY: ***DLH*** DATE:

WATER SURFACE ELEVATION (FEET)	AREA AREA (SQ.FT.)	AVERAGE AREA (SQ.FT.)	DIFFERENCE IN ELEVATION (FEET)	STORAGE VOLUME (CUBIC FEET)	
				INCREMENTAL	TOTAL
306.00	**8,255**				**0**
		10,349	**2.00**	**20698**	
308.00	**12,443**				**20,698**
		14,558	**2.00**	**29116**	
310.00	**16,673**				**49,814**
		18,892	**2.00**	**37783**	
312.00	**21,110**				**87,597**

Proposed Infiltration Volume

Elevation	Storage Volume (CF)
308.00	20,698
306.85	***3,956***
310.00	49,814

Volume = 3,956 CF

HOWELL ENGINEERING

INFILTRATION VOLUME CALCULATION

Basin 3

PROJECT NAME: ***Stokes Estate***

LOCATION: ***Westtown Township***

PREPARED BY: ***DWG*** DATE: ***3/30/2021***

CHECKED BY: ***DLH*** DATE:

WATER SURFACE ELEVATION (FEET)	AREA AREA (SQ.FT.)	AVERAGE AREA (SQ.FT.)	DIFFERENCE IN ELEVATION (FEET)	STORAGE VOLUME (CUBIC FEET)	
				INCREMENTAL	TOTAL
316.00	**15,345**				**0**
		17,505	**2.00**	**35010**	
318.00	**19,665**				**35,010**
		21,938	**2.00**	**43876**	
320.00	**24,211**				**78,886**
		25,391	**1.00**	**25391**	
321.00	**26,570**				**104,277**

Proposed Infiltration Volume

Elevation	Storage Volume (CF)
318.00	35,010
318.50	***45,979***
320.00	78,886

Volume = 45,979 CF

*Only 35,889 CF drains to the basin in the 2 year storm, therefore only 35,889 CF is being taken credit for

HOWELL ENGINEERING

INFILTRATION VOLUME CALCULATION

Basin 4

PROJECT NAME: ***Stokes Estate***

LOCATION: ***Westtown Township***

PREPARED BY: ***DWG*** DATE: ***3/17/2023***

CHECKED BY: ***DLH*** DATE:

WATER SURFACE ELEVATION (FEET)	AREA AREA (SQ.FT.)	AVERAGE AREA (SQ.FT.)	DIFFERENCE IN ELEVATION (FEET)	STORAGE VOLUME (CUBIC FEET)	
				INCREMENTAL	TOTAL
342.00	**Stone**				**0**
			2.00	**0**	
344.00	**4,413**				**1,063**
		5,565	**2.00**	**11130**	
346.00	**6,717**				**12,193**
		7,982	**2.00**	**15963**	
348.00	**9,246**				**28,156**
		10,623	**2.00**	**21246**	
350.00	**12,000**				**49,402**

Proposed Infiltration Volume

Elevation	Storage Volume (CF)
346.00	12,193
346.25	***14,188***
348.00	28,156

Volume = 14,188 CF

HOWELL ENGINEERING

INFILTRATION VOLUME CALCULATION

UG BED 1 w/ Basin

PROJECT NAME: ***Stokes Estate***

LOCATION: ***Westtown Township***

PREPARED BY: ***DWG*** DATE: ***3/17/2023***

CHECKED BY: ***DLH*** DATE:

WATER SURFACE ELEVATION (FEET)	AREA AREA (SQ.FT.)	AVERAGE AREA (SQ.FT.)	DIFFERENCE IN ELEVATION (FEET)	STORAGE VOLUME (CUBIC FEET)	
				INCREMENTAL	TOTAL
336.00	**Stone**				**0**
			3.00	**0**	
339.00	**Stone**				**6,750**
			1.00	**0**	
340.00	**3,380**				**11,253**
		4,215	**2.00**	**8430**	
342.00	**5,050**				**19,683**
		5,998	**2.00**	**11995**	
344.00	**6,945**				**31,678**

Proposed Infiltration Volume

Elevation	Storage Volume (CF)
340.00	11,253
340.20	***12,096***
342.00	19,683

Volume = 12,096 CF

APPENDIX B

TOWNSHIP POST DEVELOPMENT

FLOW REDUCTION SUMMARIES

Stormwater Summary
Peak Flow Reduction Requirements

DATE: 9/30/2021
BY: DWG

JOB NO.: 3868 **PROJECT:** Stokes Estate **TOWNSHIP:** Westtown
DESCRIPTION: Stormwater Summary DP001 Chester Creek

				% Reduction
1-year	Pre-Developed	1.30 cfs	*Hydrograph 1*	55%
1-year	Post-Developed	0.58 cfs	*Hydrograph 8*	
2-year	Pre-Developed	4.32 cfs	*Hydrograph 1*	73%
2-year	Post-Developed	1.15 cfs	*Hydrograph 8*	
5-year	Pre-Developed	12.58 cfs	*Hydrograph 1*	82%
5-year	Post-Developed	2.31 cfs	*Hydrograph 8*	
10-year	Pre-Developed	20.75 cfs	*Hydrograph 1*	84%
10-year	Post-Developed	3.34 cfs	*Hydrograph 8*	
25-year	Pre-Developed	33.98 cfs	*Hydrograph 1*	80%
25-year	Post-Developed	6.86 cfs	*Hydrograph 8*	
50-year	Pre-Developed	46.28 cfs	*Hydrograph 1*	53%
50-year	Post-Developed	21.53 cfs	*Hydrograph 8*	
100-year	Pre-Developed	60.31 cfs	*Hydrograph 1*	52%
100-year	Post-Developed	29.04 cfs	*Hydrograph 8*	

CHESTER CREEK 0.50 RELEASE RATE AREA

Post Developed 2 Year Flow =	**1.15**	**cfs**	SATISFIED
Pre Developed 1 Year Flow =	**1.30**	**cfs**	
Post Developed 5 Year Flow =	**2.31**	**cfs**	SATISFIED
50% Pre Developed 5 Year Flow =	**6.29**	**cfs**	
Post Developed 10 Year Flow =	**3.34**	**cfs**	SATISFIED
50% Pre Developed 10 Year Flow =	**10.38**	**cfs**	
Post Developed 25 Year Flow =	**6.86**	**cfs**	SATISFIED
50% Pre Developed 25 Year Flow =	**16.99**	**cfs**	
Post Developed 50 Year Flow =	**21.53**	**cfs**	SATISFIED
50% Pre Developed 50Year Flow =	**23.14**	**cfs**	
Post Developed 100 Year Flow =	**29.04**	**cfs**	SATISFIED
50% Pre Developed 100 Year Flow =	**30.16**	**cfs**	

Stormwater Summary
Peak Flow Reduction Requirements

DATE: 9/30/2021
BY: DWG

JOB NO.: 3868 **PROJECT:** Stokes Estate **TOWNSHIP:** Westtown
DESCRIPTION: Stormwater Summary DP002 UNT Chester Creek

				% Reduction
1-year	Pre-Developed	2.47 cfs	*Hydrograph 2*	83%
1-year	Post-Developed	0.42 cfs	*Hydrograph 16*	
2-year	Pre-Developed	6.85 cfs	*Hydrograph 2*	86%
2-year	Post-Developed	0.96 cfs	*Hydrograph 16*	
5-year	Pre-Developed	18.02 cfs	*Hydrograph 2*	88%
5-year	Post-Developed	2.12 cfs	*Hydrograph 16*	
10-year	Pre-Developed	28.64 cfs	*Hydrograph 2*	89%
10-year	Post-Developed	3.17 cfs	*Hydrograph 16*	
25-year	Pre-Developed	45.70 cfs	*Hydrograph 2*	86%
25-year	Post-Developed	6.17 cfs	*Hydrograph 16*	
50-year	Pre-Developed	46.28 cfs	*Hydrograph 2*	54%
50-year	Post-Developed	21.32 cfs	*Hydrograph 16*	
100-year	Pre-Developed	79.34 cfs	*Hydrograph 2*	52%
100-year	Post-Developed	37.69 cfs	*Hydrograph 16*	

CHESTER CREEK 0.50 RELEASE RATE AREA

Post Developed 2 Year Flow =	**0.96**	**cfs**	SATISFIED
Pre Developed 1 Year Flow =	**2.47**	**cfs**	
Post Developed 5 Year Flow =	**2.12**	**cfs**	SATISFIED
50% Pre Developed 5 Year Flow =	**9.01**	**cfs**	
Post Developed 10 Year Flow =	**3.17**	**cfs**	SATISFIED
50% Pre Developed 10 Year Flow =	**14.32**	**cfs**	
Post Developed 25 Year Flow =	**6.17**	**cfs**	SATISFIED
50% Pre Developed 25 Year Flow =	**22.85**	**cfs**	
Post Developed 50 Year Flow =	**21.32**	**cfs**	SATISFIED
50% Pre Developed 50Year Flow =	**23.14**	**cfs**	
Post Developed 100 Year Flow =	**37.69**	**cfs**	SATISFIED
50% Pre Developed 100 Year Flow =	**39.67**	**cfs**	

Stormwater Summary
Peak Flow Reduction Requirements

DATE: 3/13/2023
BY: DWG
REV: 0

JOB NO.: 3868 **PROJECT:** Stokes Estate **TOWNSHIP:** Westtown
DESCRIPTION: Stormwater Summary DP003 UNT Chester Creek

1-year	Pre-Developed	4.79 cfs	*Hydrograph 3*
1-year	Post-Developed	0.97 cfs	*Hydrograph 23*
1-year	Peak Flow (Outside LOD)[1]	0.27 cfs	*Hydrograph 4*
2-year	Pre-Developed	8.02 cfs	*Hydrograph 3*
2-year	Post-Developed	1.59 cfs	*Hydrograph 23*
2-year	Peak Flow (Outside LOD)[1]	0.57 cfs	*Hydrograph 4*
5-year	Pre-Developed	14.55 cfs	*Hydrograph 3*
5-year	Post-Developed	2.82 cfs	*Hydrograph 23*
5-year	Peak Flow (Outside LOD)[1]	1.20 cfs	*Hydrograph 4*
10-year	Pre-Developed	20.20 cfs	*Hydrograph 3*
10-year	Post-Developed	3.88 cfs	*Hydrograph 23*
10-year	Peak Flow (Outside LOD)[1]	1.77 cfs	*Hydrograph 4*
25-year	Pre-Developed	28.88 cfs	*Hydrograph 3*
25-year	Post-Developed	10.00 cfs	*Hydrograph 23*
25-year	Peak Flow (Outside LOD)[1]	2.65 cfs	*Hydrograph 4*
50-year	Pre-Developed	36.78 cfs	*Hydrograph 3*
50-year	Post-Developed	16.17 cfs	*Hydrograph 23*
50-year	Peak Flow (Outside LOD)[1]	3.46 cfs	*Hydrograph 4*
100-year	Pre-Developed	45.54 cfs	*Hydrograph 3*
100-year	Post-Developed	25.00 cfs	*Hydrograph 23*
100-year	Peak Flow (Outside LOD)[1]	4.36 cfs	*Hydrograph 4*

[1]This area is outside the regulated activity (ORA) (or outside the limit of disturbance (LOD)), therefore is not subject to peak flow rate control requirements. As such, the flow from the area outside the LOD is added to the Pre Developed flow that is within the regulated activity to determine the allowable post developed flow.

CHESTER CREEK 0.50 RELEASE RATE AREA

Post Developed 2 Year Flow =	**1.59**	**cfs**	SATISFIED
Pre Developed 1 Year Flow + 2 Year Outside LOD =	**5.36**	**cfs**	
Post Developed 5 Year Flow =	**2.82**	**cfs**	SATISFIED
50% Pre Developed 5 Year Flow + 5 Year Outside LOD =	**8.48**	**cfs**	
Post Developed 10 Year Flow =	**3.88**	**cfs**	SATISFIED
50% Pre Developed 10 Year Flow + 10 Year Outside LOD =	**11.87**	**cfs**	
Post Developed 25 Year Flow =	**10.00**	**cfs**	SATISFIED
50% Pre Developed 25 Year Flow + 25 Year Outside LOD =	**17.09**	**cfs**	
Post Developed 50 Year Flow =	**16.17**	**cfs**	SATISFIED
50% Pre Developed 50 Year Flow + 50 Year Outside LOD =	**21.85**	**cfs**	
Post Developed 100 Year Flow =	**25.00**	**cfs**	SATISFIED
50% Pre Developed 100 Year Flow + 100 Year Outside LOD =	**27.13**	**cfs**	

HOWELL ENGINEERING

SOIL CONSERVATION SERVICE
HYDROLOGIC DATA FOR WATERSHED
RUNOFF COMPUTATIONS

DATE: 3/29/2021
BY: DWG

JOB NO.: 3868 **PROJECT:** Stokes Estate **TOWNSHIP:** Westtown
DESCRIPTION: PREDEVELOPED AREA CHESTER CREEK DP001

Total Area: 15.43 acres

Symbol	Soil Name	Hydrological Soil Group	Land Use	Hydrologic Condition	Soil Runoff Curve Number	Area acres	Complex Number acres	Comment
GdB	Gladstone	B	Meadow	Good	58	15.43	894.94	
	Loam	B	Woods	Good	55	0.00	0.00	
Ba	Baile Silt	C	Meadow	Good	71	0.00	0.00	
	Loam	C	Woods	Good	70	0.00	0.00	
					Total Area	15.43	894.94	

Weighted Soil Complex Number = 894.9 / 15.4 = 58.0

**SEE HYDRAFLOW REPORT FOR TIME OF CONCENTRATION*

HOWELL ENGINEERING

SOIL CONSERVATION SERVICE
HYDROLOGIC DATA FOR WATERSHED
RUNOFF COMPUTATIONS

DATE: 3/29/2021
BY: DWG

JOB NO.: 3868 **PROJECT:** Stokes Estate **TOWNSHIP:** Westtown
DESCRIPTION: PREDEVELOPED AREA UNT CHESTER CREEK DP002

Total Area: 19.21 acres

Symbol	Soil Name	Hydrological Soil Group	Land Use	Hydrologic Condition	Soil Runoff Curve Number	Area acres	Complex Number acres	Comment
GdB	Gladstone	B	Meadow	Good	58	17.11	992.38	
	Loam	B	Woods	Good	55	0.00	0.00	
Ba	Baile Silt	C	Meadow	Good	71	2.10	149.10	
	Loam	C	Woods	Good	70	0.00	0.00	
					Total Area	19.21	1141.48	

Weighted Soil Complex Number: 1141.5 / 19.2 = 59.4

**SEE HYDRAFLOW REPORT FOR TIME OF CONCENTRATION*

HOWELL ENGINEERING

SOIL CONSERVATION SERVICE
HYDROLOGIC DATA FOR WATERSHED
RUNOFF COMPUTATIONS

DATE: 3/29/2021
BY: DWG

JOB NO.: 3868 **PROJECT:** Stokes Estate **TOWNSHIP:** Westtown
DESCRIPTION: PREDEVELOPED AREA UNT CHESTER CREEK DP003

Total Area: 8.19 acres

Symbol	Soil Name	Hydrological Soil Group	Land Use	Hydrologic Condition	Soil Runoff Curve Number	Area acres	Complex Number acres	Comment
GdB	Gladstone	B	Meadow	Good	58	2.39	138.62	
	Loam	B	Woods	Good	55	0.00	0.00	
Ba	Baile Silt	C	Meadow	Good	71	4.85	344.35	
	Loam	C	Woods	Good	70	0.00	0.00	
Ca	Califon	D	Meadow	Good	80	0.95	76.00	
					Total Area	8.19	558.97	

Weighted Soil Complex Number: 559.0 / 8.2 = 68.3

**SEE HYDRAFLOW REPORT FOR TIME OF CONCENTRATION*

HOWELL ENGINEERING

SOIL CONSERVATION SERVICE
HYDROLOGIC DATA FOR WATERSHED
RUNOFF COMPUTATIONS

DATE: 3/29/2021
BY: DWG

JOB NO.: 3868 **PROJECT:** Stokes Estate **TOWNSHIP:** Westtown
DESCRIPTION: PREDEVELOPED AREA UNT CHESTER CREEK DP003

Total Area: 0.81 acres

Symbol	Soil Name	Hydrological Soil Group	Land Use	Hydrologic Condition	Soil Runoff Curve Number	Area acres	Complex Number acres	Comment
GdB	Gladstone	B	Meadow	Good	58	0.73	42.34	
	Loam	B	Woods	Good	55	0.00	0.00	
		B	Impervious	N/A	98	0.08	7.84	Existing Drive
Ba	Baile Silt	C	Meadow	Good	71	0.00	0.00	
	Loam	C	Woods	Good	70	0.00	0.00	
					Total Area	0.81	50.18	

Weighted Soil Complex Number = 50.2 / 0.8 = 62.0

ASSUMES 5 MINUTE TIME OF CONCENTRATION

HOWELL ENGINEERING

SOIL CONSERVATION SERVICE
HYDROLOGIC DATA FOR WATERSHED
RUNOFF COMPUTATIONS

DATE: 3/29/2021
BY: DWG

JOB NO.: 3868 **PROJECT:** Stokes Estate **TOWNSHIP:** Westtown
DESCRIPTION: POST DEVELOPED BASIN 3

Total Area: 12.15 acres

Symbol	Soil Name	Hydrological Soil Group	Land Use	Hydrologic Condition	Soil Runoff Curve Number	Area acres	Complex Number acres	Comment
GdB	Gladstone	B	Meadow	Good	58	2.47	143.26	
	Loam	B	Lawn	Good	61	6.25	381.38	
		N/A	Impervious	N/A	98	3.43	335.94	
Ba	Baile Silt	C	Meadow	Good	71	0.00	0.00	
	Loam	C	Lawn	Good	74	0.00	0.00	
					Total Area	12.15	860.57	

Weighted Soil Complex Number = 860.6 / 12.2 = 70.8

ASSUMES 5 MINUTE TIME OF CONCENTRATION

HOWELL ENGINEERING

SOIL CONSERVATION SERVICE
HYDROLOGIC DATA FOR WATERSHED
RUNOFF COMPUTATIONS

DATE: 3/29/2021
BY: DWG

JOB NO.: 3868 **PROJECT:** Stokes Estate **TOWNSHIP:** Westtown
DESCRIPTION: POST DEVELOPED BYPASS DP002

Total Area: 1.49 acres

Symbol	Soil Name	Hydrological Soil Group	Land Use	Hydrologic Condition	Soil Runoff Curve Number	Area acres	Complex Number acres	Comment
GdB	Gladstone	B	Meadow	Good	58	0.00	0.00	
	Loam	B	Lawn	Good	61	1.40	85.40	
		N/A	Impervious	N/A	98	0.09	8.55	
Ba	Baile Silt	C	Meadow	Good	71	0.00	0.00	
	Loam	C	Lawn	Good	74	0.00	0.00	
					Total Area	1.49	93.95	

Weighted Soil Complex Number: 93.9 / 1.5 = 63.2

ASSUMES 5 MINUTE TIME OF CONCENTRATION

HOWELL ENGINEERING

SOIL CONSERVATION SERVICE
HYDROLOGIC DATA FOR WATERSHED
RUNOFF COMPUTATIONS

DATE: 3/29/2021
BY: DWG

JOB NO.: 3868 **PROJECT:** Stokes Estate **TOWNSHIP:** Westtown
DESCRIPTION: POST DEVELOPED BASIN 1

Total Area: 10.95 acres

Symbol	Soil Name	Hydrological Soil Group	Land Use	Hydrologic Condition	Soil Runoff Curve Number	Area acres	Complex Number acres	Comment
GdB	Gladstone	B	Meadow	Good	58	0.00	0.00	
	Loam	B	Lawn	Good	61	7.57	461.77	
		N/A	Impervious	N/A	98	3.08	301.86	
Ba	Baile Silt	C	Meadow	Good	71	0.00	0.00	
	Loam	C	Lawn	Good	74	0.30	22.20	
					Total Area	10.95	785.83	

Weighted Soil Complex Number: 785.8 / 11.0 = 71.8

ASSUMES 5 MINUTE TIME OF CONCENTRATION

HOWELL ENGINEERING

SOIL CONSERVATION SERVICE
HYDROLOGIC DATA FOR WATERSHED
RUNOFF COMPUTATIONS

DATE: 3/29/2021
BY: DWG

JOB NO.: 3868 **PROJECT:** Stokes Estate **TOWNSHIP:** Westtown
DESCRIPTION: POST DEVELOPED BASIN 2

Total Area: 8.54 acres

Symbol	Soil Name	Hydrological Soil Group	Land Use	Hydrologic Condition	Soil Runoff Curve Number	Area acres	Complex Number acres	Comment
GdB	Gladstone	B	Meadow	Good	58	0.00	0.00	
	Loam	B	Lawn	Good	61	4.41	269.01	
		N/A	Impervious	N/A	98	3.23	316.23	
Ba	Baile Silt	C	Meadow	Good	71	0.00	0.00	
	Loam	C	Lawn	Good	74	0.90	66.60	
					Total Area	8.54	651.84	

Weighted Soil Complex Number = 651.8 / 8.5 = 76.4

ASSUMES 5 MINUTE TIME OF CONCENTRATION

HOWELL ENGINEERING

SOIL CONSERVATION SERVICE
HYDROLOGIC DATA FOR WATERSHED
RUNOFF COMPUTATIONS

DATE: 3/29/2021
BY: DWG

JOB NO.: 3868 **PROJECT:** Stokes Estate **TOWNSHIP:** Westtown
DESCRIPTION: POST DEVELOPED BYPASS DP002

Total Area: 1.54 acres

Symbol	Soil Name	Hydrological Soil Group	Land Use	Hydrologic Condition	Soil Runoff Curve Number	Area acres	Complex Number acres	Comment
GdB	Gladstone	B	Meadow	Good	58	0.00	0.00	
	Loam	B	Lawn	Good	61	1.54	93.94	
		N/A	Impervious	N/A	98	0.00	0.00	
Ba	Baile Silt	C	Meadow	Good	71	0.00	0.00	
	Loam	C	Lawn	Good	74	0.00	0.00	
					Total Area	1.54	93.94	

Weighted Soil Complex Number: 93.9 / 1.5 = 61.0

ASSUMES 5 MINUTE TIME OF CONCENTRATION

HOWELL ENGINEERING

SOIL CONSERVATION SERVICE
HYDROLOGIC DATA FOR WATERSHED
RUNOFF COMPUTATIONS

DATE: 3/13/2023
BY: DWG

JOB NO.: 3868 **PROJECT:** Stokes Estate **TOWNSHIP:** Westtown
DESCRIPTION: POST DEVELOPED BASIN 4

Total Area: 4.42 acres

Symbol	Soil Name	Hydrological Soil Group	Land Use	Hydrologic Condition	Soil Runoff Curve Number	Area acres	Complex Number acres	Comment
GdB	Gladstone	B	Meadow	Good	58	0.00	0.00	
	Loam	B	Lawn	Good	61	1.77	107.97	
		N/A	Impervious	N/A	98	1.30	127.47	
Ba	Baile Silt	C	Meadow	Good	71	0.00	0.00	
	Loam	C	Lawn	Good	74	1.35	99.90	
					Total Area	4.42	335.34	

Weighted Soil Complex Number = 335.3 / 4.4 = 75.9

ASSUMES 5 MINUTE TIME OF CONCENTRATION

HOWELL ENGINEERING

SOIL CONSERVATION SERVICE
HYDROLOGIC DATA FOR WATERSHED
RUNOFF COMPUTATIONS

DATE: 3/13/2023
BY: DWG

JOB NO.: 3868 **PROJECT:** Stokes Estate **TOWNSHIP:** Westtown
DESCRIPTION: POST DEVELOPED UG BED 1

Total Area: 2.82 acres

Symbol	Soil Name	Hydrological Soil Group	Land Use	Hydrologic Condition	Soil Runoff Curve Number	Area acres	Complex Number acres	Comment
GdB	Gladstone	B	Meadow	Good	58	0.00	0.00	
	Loam	B	Lawn	Good	61	0.72	43.92	
		N/A	Impervious	N/A	98	1.08	105.53	
Ba	Baile Silt	C	Meadow	Good	71	0.00	0.00	
	Loam	C	Lawn	Good	74	1.02	75.48	
					Total Area	2.82	224.93	

Weighted Soil Complex Number = 224.9 / 2.8 = 79.9

ASSUMES 5 MINUTE TIME OF CONCENTRATION

HOWELL ENGINEERING

SOIL CONSERVATION SERVICE
HYDROLOGIC DATA FOR WATERSHED
RUNOFF COMPUTATIONS

DATE: 3/29/2021
BY: DWG

JOB NO.: 3868 **PROJECT:** Stokes Estate **TOWNSHIP:** Westtown
DESCRIPTION: POST DEVELOPED BYPASS DP002

Total Area: 1.34 acres

Symbol	Soil Name	Hydrological Soil Group	Land Use	Hydrologic Condition	Soil Runoff Curve Number	Area acres	Complex Number acres	Comment
GdB	Gladstone	B	Meadow	Good	58	0.00	0.00	
	Loam	B	Lawn	Good	61	0.80	48.80	
		N/A	Impervious	N/A	98	0.09	8.55	
Ba	Baile Silt	C	Meadow	Good	71	0.00	0.00	
	Loam	C	Lawn	Good	74	0.45	33.30	
					Total Area	1.34	90.65	

Weighted Soil Complex Number: 90.6 / 1.3 = 67.8

ASSUMES 5 MINUTE TIME OF CONCENTRATION

APPENDIX D

HYDRAFLOW HYDROGRAPH REPORTS

Hydraflow Table of Contents

Hydrograph Return Period Recap..... 1

1 - Year

Summary Report..... 2
Hydrograph Reports..... 3
Hydrograph No. 1, SCS Runoff, Pre Developed DP001..... 3
TR-55 Tc Worksheet..... 4
Hydrograph No. 2, SCS Runoff, Pre Developed DP002..... 5
TR-55 Tc Worksheet..... 6
Hydrograph No. 3, SCS Runoff, Pre Developed DP003..... 7
TR-55 Tc Worksheet..... 8
Hydrograph No. 4, SCS Runoff, Pre Developed DP003 ORA..... 9
Hydrograph No. 5, SCS Runoff, Post Basin 3..... 10
Hydrograph No. 6, Reservoir, Basin 3 Routed..... 11
Pond Report - Basin 3..... 12
Hydrograph No. 7, SCS Runoff, Post Bypass DP001..... 13
Hydrograph No. 8, Combine, Post Total DP001..... 14
Hydrograph No. 10, SCS Runoff, Post Basin 1..... 15
Hydrograph No. 11, Reservoir, Basin 1 Upper Routed..... 16
Pond Report - Basin 1 Upper..... 17
Hydrograph No. 12, Reservoir, Basin 1 Lower Routed..... 18
Pond Report - Basin 1 Lower..... 19
Hydrograph No. 13, SCS Runoff, Post Basin 2..... 20
Hydrograph No. 14, Reservoir, Basin 2 Routed..... 21
Pond Report - Basin 2..... 22
Hydrograph No. 15, SCS Runoff, Post Bypass DP002..... 23
Hydrograph No. 16, Combine, Post Total DP002..... 24
Hydrograph No. 18, SCS Runoff, Post to Basin 4..... 25
Hydrograph No. 19, Reservoir, Basin 4 Routed..... 26
Pond Report - Basin 4..... 27
Hydrograph No. 20, SCS Runoff, Post to Bed 1/Basin..... 28
Hydrograph No. 21, Reservoir, UG Bed 1/Basin Routed..... 29
Pond Report - UG Bed 1/Basin..... 30
Hydrograph No. 22, SCS Runoff, Post Bypass DP003..... 31
Hydrograph No. 23, Combine, Post Total DP003..... 32

2 - Year

Summary Report..... 33
Hydrograph Reports..... 34
Hydrograph No. 1, SCS Runoff, Pre Developed DP001..... 34
Hydrograph No. 2, SCS Runoff, Pre Developed DP002..... 35
Hydrograph No. 3, SCS Runoff, Pre Developed DP003..... 36
Hydrograph No. 4, SCS Runoff, Pre Developed DP003 ORA..... 37
Hydrograph No. 5, SCS Runoff, Post Basin 3..... 38
Hydrograph No. 6, Reservoir, Basin 3 Routed..... 39
Hydrograph No. 7, SCS Runoff, Post Bypass DP001..... 40
Hydrograph No. 8, Combine, Post Total DP001..... 41
Hydrograph No. 10, SCS Runoff, Post Basin 1..... 42

Hydrograph No. 11, Reservoir, Basin 1 Upper Routed..... 43
Hydrograph No. 12, Reservoir, Basin 1 Lower Routed..... 44
Hydrograph No. 13, SCS Runoff, Post Basin 2..... 45
Hydrograph No. 14, Reservoir, Basin 2 Routed..... 46
Hydrograph No. 15, SCS Runoff, Post Bypass DP002..... 47
Hydrograph No. 16, Combine, Post Total DP002..... 48
Hydrograph No. 18, SCS Runoff, Post to Basin 4..... 49
Hydrograph No. 19, Reservoir, Basin 4 Routed..... 50
Hydrograph No. 20, SCS Runoff, Post to Bed 1/Basin..... 51
Hydrograph No. 21, Reservoir, UG Bed 1/Basin Routed..... 52
Hydrograph No. 22, SCS Runoff, Post Bypass DP003..... 53
Hydrograph No. 23, Combine, Post Total DP003..... 54

5 - Year

Summary Report..... 55
Hydrograph Reports..... 56
Hydrograph No. 1, SCS Runoff, Pre Developed DP001..... 56
Hydrograph No. 2, SCS Runoff, Pre Developed DP002..... 57
Hydrograph No. 3, SCS Runoff, Pre Developed DP003..... 58
Hydrograph No. 4, SCS Runoff, Pre Developed DP003 ORA..... 59
Hydrograph No. 5, SCS Runoff, Post Basin 3..... 60
Hydrograph No. 6, Reservoir, Basin 3 Routed..... 61
Hydrograph No. 7, SCS Runoff, Post Bypass DP001..... 62
Hydrograph No. 8, Combine, Post Total DP001..... 63
Hydrograph No. 10, SCS Runoff, Post Basin 1..... 64
Hydrograph No. 11, Reservoir, Basin 1 Upper Routed..... 65
Hydrograph No. 12, Reservoir, Basin 1 Lower Routed..... 66
Hydrograph No. 13, SCS Runoff, Post Basin 2..... 67
Hydrograph No. 14, Reservoir, Basin 2 Routed..... 68
Hydrograph No. 15, SCS Runoff, Post Bypass DP002..... 69
Hydrograph No. 16, Combine, Post Total DP002..... 70
Hydrograph No. 18, SCS Runoff, Post to Basin 4..... 71
Hydrograph No. 19, Reservoir, Basin 4 Routed..... 72
Hydrograph No. 20, SCS Runoff, Post to Bed 1/Basin..... 73
Hydrograph No. 21, Reservoir, UG Bed 1/Basin Routed..... 74
Hydrograph No. 22, SCS Runoff, Post Bypass DP003..... 75
Hydrograph No. 23, Combine, Post Total DP003..... 76

10 - Year

Summary Report..... 77
Hydrograph Reports..... 78
Hydrograph No. 1, SCS Runoff, Pre Developed DP001..... 78
Hydrograph No. 2, SCS Runoff, Pre Developed DP002..... 79
Hydrograph No. 3, SCS Runoff, Pre Developed DP003..... 80
Hydrograph No. 4, SCS Runoff, Pre Developed DP003 ORA..... 81
Hydrograph No. 5, SCS Runoff, Post Basin 3..... 82
Hydrograph No. 6, Reservoir, Basin 3 Routed..... 83
Hydrograph No. 7, SCS Runoff, Post Bypass DP001..... 84
Hydrograph No. 8, Combine, Post Total DP001..... 85
Hydrograph No. 10, SCS Runoff, Post Basin 1..... 86

Hydrograph No. 11, Reservoir, Basin 1 Upper Routed 87
Hydrograph No. 12, Reservoir, Basin 1 Lower Routed 88
Hydrograph No. 13, SCS Runoff, Post Basin 2 89
Hydrograph No. 14, Reservoir, Basin 2 Routed 90
Hydrograph No. 15, SCS Runoff, Post Bypass DP002 91
Hydrograph No. 16, Combine, Post Total DP002 92
Hydrograph No. 18, SCS Runoff, Post to Basin 4 93
Hydrograph No. 19, Reservoir, Basin 4 Routed 94
Hydrograph No. 20, SCS Runoff, Post to Bed 1/Basin 95
Hydrograph No. 21, Reservoir, UG Bed 1/Basin Routed 96
Hydrograph No. 22, SCS Runoff, Post Bypass DP003 97
Hydrograph No. 23, Combine, Post Total DP003 98

25 - Year

Summary Report 99
Hydrograph Reports 100
Hydrograph No. 1, SCS Runoff, Pre Developed DP001 100
Hydrograph No. 2, SCS Runoff, Pre Developed DP002 101
Hydrograph No. 3, SCS Runoff, Pre Developed DP003 102
Hydrograph No. 4, SCS Runoff, Pre Developed DP003 ORA 103
Hydrograph No. 5, SCS Runoff, Post Basin 3 104
Hydrograph No. 6, Reservoir, Basin 3 Routed 105
Hydrograph No. 7, SCS Runoff, Post Bypass DP001 106
Hydrograph No. 8, Combine, Post Total DP001 107
Hydrograph No. 10, SCS Runoff, Post Basin 1 108
Hydrograph No. 11, Reservoir, Basin 1 Upper Routed 109
Hydrograph No. 12, Reservoir, Basin 1 Lower Routed 110
Hydrograph No. 13, SCS Runoff, Post Basin 2 111
Hydrograph No. 14, Reservoir, Basin 2 Routed 112
Hydrograph No. 15, SCS Runoff, Post Bypass DP002 113
Hydrograph No. 16, Combine, Post Total DP002 114
Hydrograph No. 18, SCS Runoff, Post to Basin 4 115
Hydrograph No. 19, Reservoir, Basin 4 Routed 116
Hydrograph No. 20, SCS Runoff, Post to Bed 1/Basin 117
Hydrograph No. 21, Reservoir, UG Bed 1/Basin Routed 118
Hydrograph No. 22, SCS Runoff, Post Bypass DP003 119
Hydrograph No. 23, Combine, Post Total DP003 120

50 - Year

Summary Report 121
Hydrograph Reports 122
Hydrograph No. 1, SCS Runoff, Pre Developed DP001 122
Hydrograph No. 2, SCS Runoff, Pre Developed DP002 123
Hydrograph No. 3, SCS Runoff, Pre Developed DP003 124
Hydrograph No. 4, SCS Runoff, Pre Developed DP003 ORA 125
Hydrograph No. 5, SCS Runoff, Post Basin 3 126
Hydrograph No. 6, Reservoir, Basin 3 Routed 127
Hydrograph No. 7, SCS Runoff, Post Bypass DP001 128
Hydrograph No. 8, Combine, Post Total DP001 129
Hydrograph No. 10, SCS Runoff, Post Basin 1 130

Hydrograph No. 11, Reservoir, Basin 1 Upper Routed 131
Hydrograph No. 12, Reservoir, Basin 1 Lower Routed 132
Hydrograph No. 13, SCS Runoff, Post Basin 2 133
Hydrograph No. 14, Reservoir, Basin 2 Routed 134
Hydrograph No. 15, SCS Runoff, Post Bypass DP002 135
Hydrograph No. 16, Combine, Post Total DP002 136
Hydrograph No. 18, SCS Runoff, Post to Basin 4 137
Hydrograph No. 19, Reservoir, Basin 4 Routed 138
Hydrograph No. 20, SCS Runoff, Post to Bed 1/Basin 139
Hydrograph No. 21, Reservoir, UG Bed 1/Basin Routed 140
Hydrograph No. 22, SCS Runoff, Post Bypass DP003 141
Hydrograph No. 23, Combine, Post Total DP003 142

100 - Year

Summary Report 143
Hydrograph Reports 144
Hydrograph No. 1, SCS Runoff, Pre Developed DP001 144
Hydrograph No. 2, SCS Runoff, Pre Developed DP002 145
Hydrograph No. 3, SCS Runoff, Pre Developed DP003 146
Hydrograph No. 4, SCS Runoff, Pre Developed DP003 ORA 147
Hydrograph No. 5, SCS Runoff, Post Basin 3 148
Hydrograph No. 6, Reservoir, Basin 3 Routed 149
Hydrograph No. 7, SCS Runoff, Post Bypass DP001 150
Hydrograph No. 8, Combine, Post Total DP001 151
Hydrograph No. 10, SCS Runoff, Post Basin 1 152
Hydrograph No. 11, Reservoir, Basin 1 Upper Routed 153
Hydrograph No. 12, Reservoir, Basin 1 Lower Routed 154
Hydrograph No. 13, SCS Runoff, Post Basin 2 155
Hydrograph No. 14, Reservoir, Basin 2 Routed 156
Hydrograph No. 15, SCS Runoff, Post Bypass DP002 157
Hydrograph No. 16, Combine, Post Total DP002 158
Hydrograph No. 18, SCS Runoff, Post to Basin 4 159
Hydrograph No. 19, Reservoir, Basin 4 Routed 160
Hydrograph No. 20, SCS Runoff, Post to Bed 1/Basin 161
Hydrograph No. 21, Reservoir, UG Bed 1/Basin Routed 162
Hydrograph No. 22, SCS Runoff, Post Bypass DP003 163
Hydrograph No. 23, Combine, Post Total DP003 164

Hydrograph Return Period Recap

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

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	------	1.295	4.322	-------	12.58	20.75	33.98	46.28	60.31	Pre Developed DP001
2	SCS Runoff	------	2.474	6.847	-------	18.02	28.64	45.70	61.46	79.34	Pre Developed DP002
3	SCS Runoff	------	4.785	8.022	-------	14.55	20.20	28.88	36.78	45.54	Pre Developed DP003
4	SCS Runoff	------	0.265	0.566	-------	1.200	1.766	2.654	3.460	4.363	Pre Developed DP003 ORA
5	SCS Runoff	------	11.58	17.70	-------	29.68	39.83	55.13	68.94	84.16	Post Basin 3
6	Reservoir	5	0.000	0.000	-------	0.543	1.424	6.253	19.64	24.38	Basin 3 Routed
7	SCS Runoff	------	0.583	1.146	-------	2.314	3.349	4.966	6.425	8.052	Post Bypass DP001
8	Combine	6, 7	0.583	1.146	-------	2.314	3.349	6.859	21.53	29.04	Post Total DP001
10	SCS Runoff	------	11.30	16.97	-------	28.01	37.29	51.31	63.94	77.75	Post Basin 1
11	Reservoir	10	0.000	0.000	-------	0.510	1.244	3.633	10.69	30.18	Basin 1 Upper Routed
12	Reservoir	11	0.000	0.000	-------	0.375	0.928	2.071	5.226	13.13	Basin 1 Lower Routed
13	SCS Runoff	------	12.13	17.09	-------	26.44	34.26	46.02	56.20	67.22	Post Basin 2
14	Reservoir	13	0.000	0.120	-------	0.682	1.706	5.509	18.98	33.12	Basin 2 Routed
15	SCS Runoff	------	0.417	0.956	-------	2.121	3.170	4.826	6.335	8.028	Post Bypass DP002
16	Combine	12, 14, 15	0.417	0.956	-------	2.121	3.170	6.169	21.32	37.69	Post Total DP002
18	SCS Runoff	------	6.085	8.620	-------	13.42	17.42	23.48	28.74	34.43	Post to Basin 4
19	Reservoir	18	0.000	0.111	-------	0.503	1.282	3.119	4.373	10.28	Basin 4 Routed
20	SCS Runoff	------	4.701	6.430	-------	9.677	12.38	16.34	19.73	23.40	Post to Bed 1/Basin
21	Reservoir	20	0.000	0.073	-------	0.351	1.100	4.714	7.370	10.57	UG Bed 1/Basin Routed
22	SCS Runoff	------	0.972	1.588	-------	2.821	3.883	5.505	6.944	8.571	Post Bypass DP003
23	Combine	19, 21, 22	0.972	1.588	-------	2.821	3.883	10.00	16.17	25.00	Post Total DP003

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

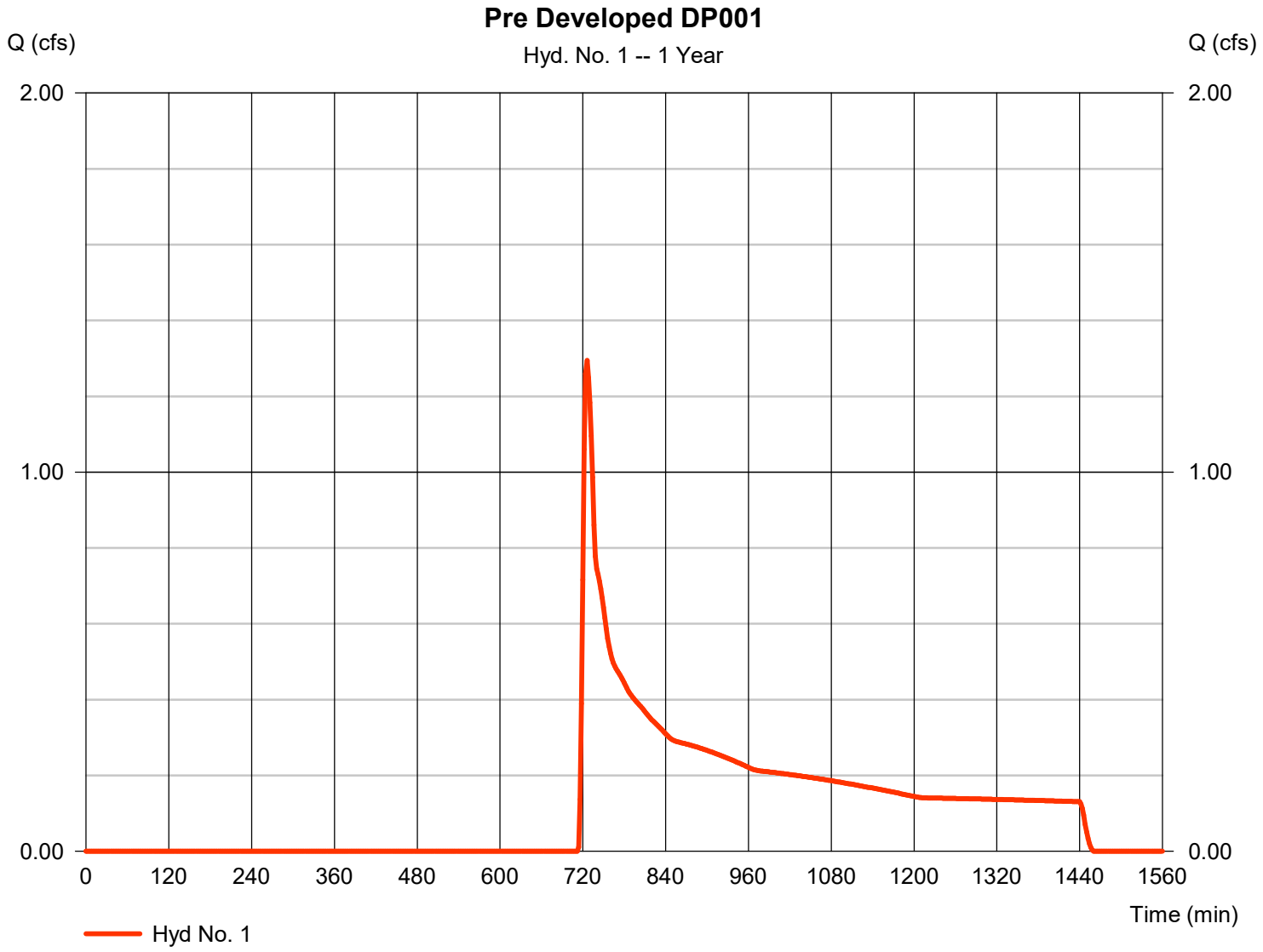
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	1.295	2	726	10,628	------	------	------	Pre Developed DP001
2	SCS Runoff	2.474	2	724	15,638	------	------	------	Pre Developed DP002
3	SCS Runoff	4.785	2	722	15,004	------	------	------	Pre Developed DP003
4	SCS Runoff	0.265	2	718	787	------	------	------	Pre Developed DP003 ORA
5	SCS Runoff	11.58	2	718	24,233	------	------	------	Post Basin 3
6	Reservoir	0.000	2	n/a	0	5	317.29	24,233	Basin 3 Routed
7	SCS Runoff	0.583	2	718	1,570	------	------	------	Post Bypass DP001
8	Combine	0.583	2	718	1,570	6, 7	------	------	Post Total DP001
10	SCS Runoff	11.30	2	718	23,379	------	------	------	Post Basin 1
11	Reservoir	0.000	2	n/a	0	10	321.56	23,379	Basin 1 Upper Routed
12	Reservoir	0.000	2	n/a	0	11	302.20	0.000	Basin 1 Lower Routed
13	SCS Runoff	12.13	2	718	24,366	------	------	------	Post Basin 2
14	Reservoir	0.000	2	n/a	0	13	308.25	24,366	Basin 2 Routed
15	SCS Runoff	0.417	2	720	1,355	------	------	------	Post Bypass DP002
16	Combine	0.417	2	720	1,355	12, 14, 15	------	------	Post Total DP002
18	SCS Runoff	6.085	2	718	12,240	------	------	------	Post to Basin 4
19	Reservoir	0.000	2	n/a	0	18	346.01	12,240	Basin 4 Routed
20	SCS Runoff	4.701	2	718	9,401	------	------	------	Post to Bed 1/Basin
21	Reservoir	0.000	2	n/a	0	20	339.59	9,401	UG Bed 1/Basin Routed
22	SCS Runoff	0.972	2	718	2,149	------	------	------	Post Bypass DP003
23	Combine	0.972	2	718	2,149	19, 21, 22	------	------	Post Total DP003

Hydrograph Report

Hyd. No. 1

Pre Developed DP001

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.295 cfs
Storm frequency	=	1 yrs	Time to peak	=	726 min
Time interval	=	2 min	Hyd. volume	=	10,628 cuft
Drainage area	=	15.430 ac	Curve number	=	58
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	12.00 min
Total precip.	=	2.70 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



TR55 Tc Worksheet

Hyd. No. 1

Pre Developed DP001

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.240		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.20		0.00		0.00		
Land slope (%)	= 4.00		0.00		0.00		
Travel Time (min)	**= 10.81**	**+**	**0.00**	**+**	**0.00**	**=**	**10.81**
Shallow Concentrated Flow							
Flow length (ft)	= 330.00		0.00		0.00		
Watercourse slope (%)	= 9.00		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=4.84		0.00		0.00		
Travel Time (min)	**= 1.14**	**+**	**0.00**	**+**	**0.00**	**=**	**1.14**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

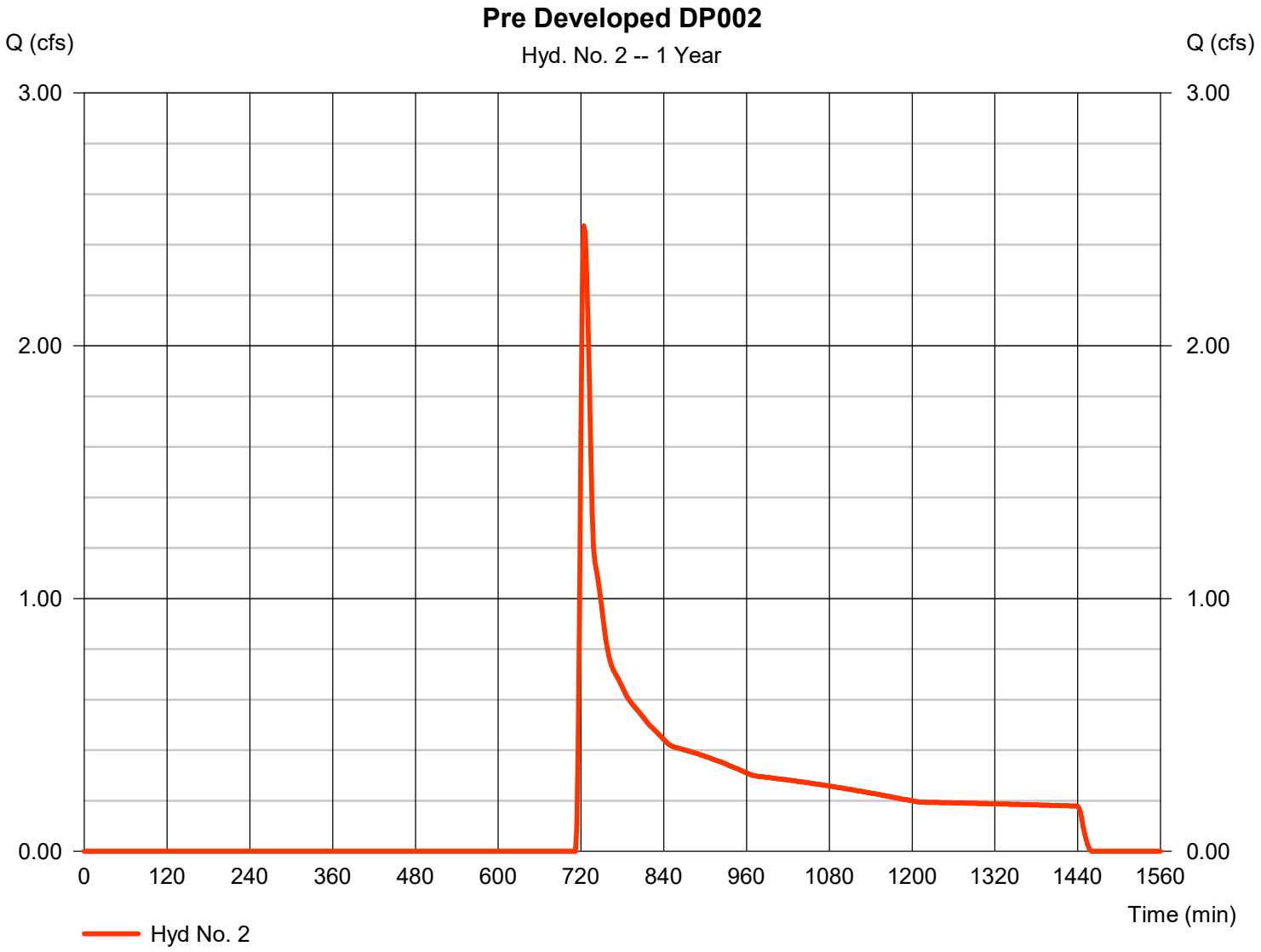
Total Travel Time, Tc ..... 12.00 min

Hydrograph Report

Hyd. No. 2

Pre Developed DP002

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.474 cfs
Storm frequency	=	1 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	15,638 cuft
Drainage area	=	19.210 ac	Curve number	=	59.4
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	12.00 min
Total precip.	=	2.70 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



TR55 Tc Worksheet

Hyd. No. 2

Pre Developed DP002

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.240		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.20		0.00		0.00		
Land slope (%)	= 7.00		0.00		0.00		
Travel Time (min)	**= 8.65**	**+**	**0.00**	**+**	**0.00**	**=**	**8.65**
Shallow Concentrated Flow							
Flow length (ft)	= 957.00		0.00		0.00		
Watercourse slope (%)	= 8.90		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=4.81		0.00		0.00		
Travel Time (min)	**= 3.31**	**+**	**0.00**	**+**	**0.00**	**=**	**3.31**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

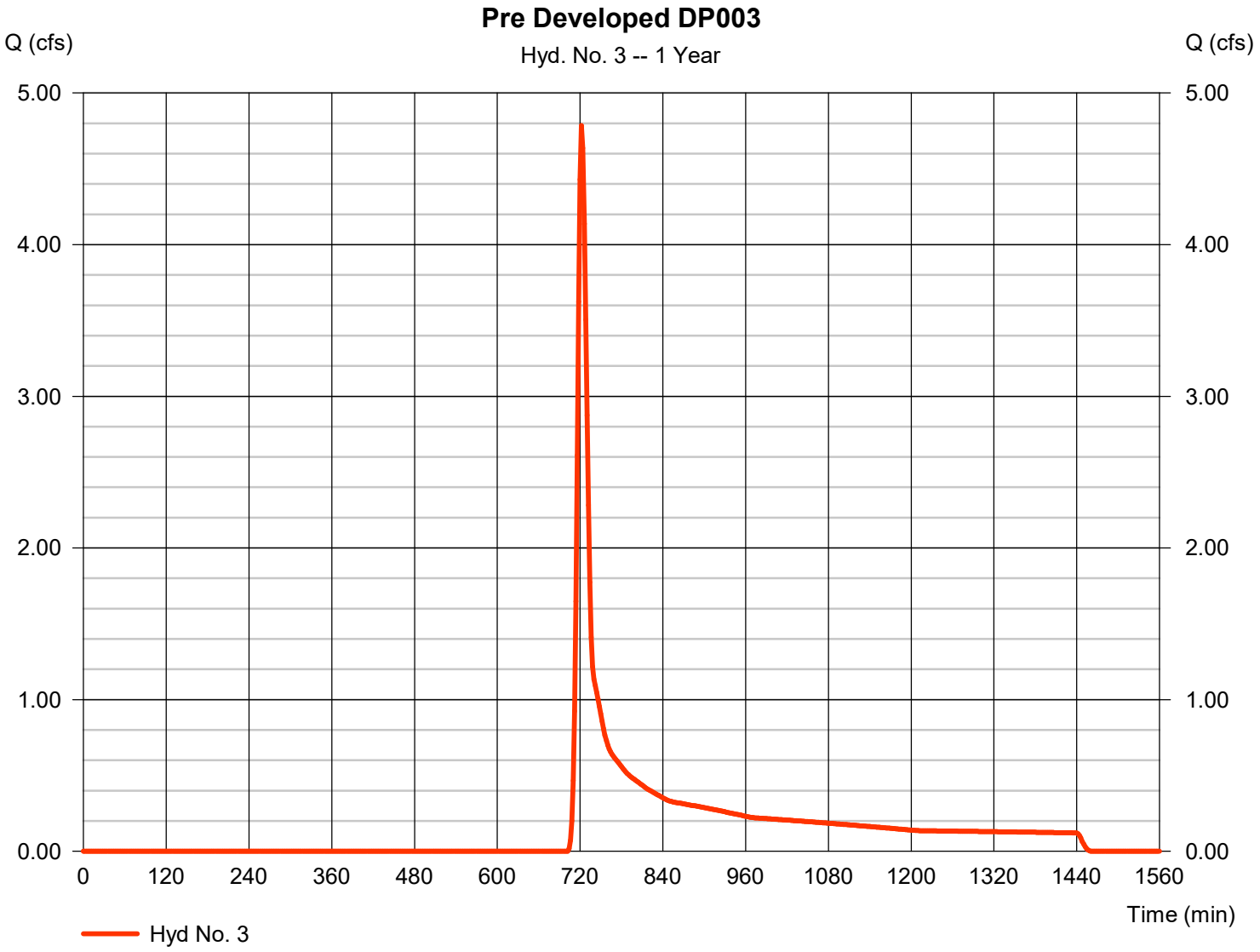
Total Travel Time, Tc ..... 12.00 min

Hydrograph Report

Hyd. No. 3

Pre Developed DP003

Hydrograph type	=	SCS Runoff	Peak discharge	=	4.785 cfs
Storm frequency	=	1 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	15,004 cuft
Drainage area	=	8.190 ac	Curve number	=	68.3
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	11.00 min
Total precip.	=	2.70 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



TR55 Tc Worksheet

Hyd. No. 3

Pre Developed DP003

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.240		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.20		0.00		0.00		
Land slope (%)	= 10.00		0.00		0.00		
Travel Time (min)	**= 7.50**	**+**	**0.00**	**+**	**0.00**	**=**	**7.50**
Shallow Concentrated Flow							
Flow length (ft)	= 566.00		0.00		0.00		
Watercourse slope (%)	= 8.80		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=4.79		0.00		0.00		
Travel Time (min)	**= 1.97**	**+**	**0.00**	**+**	**0.00**	**=**	**1.97**
Channel Flow							
X sectional flow area (sqft)	= 1.50		0.00		0.00		
Wetted perimeter (ft)	= 3.00		0.00		0.00		
Channel slope (%)	= 3.40		0.00		0.00		
Manning's n-value	= 0.035		0.015		0.015		
Velocity (ft/s)	=4.93						
			0.00				
					0.00		
Flow length (ft)	({0})440.0		0.0		0.0		
Travel Time (min)	**= 1.49**	**+**	**0.00**	**+**	**0.00**	**=**	**1.49**

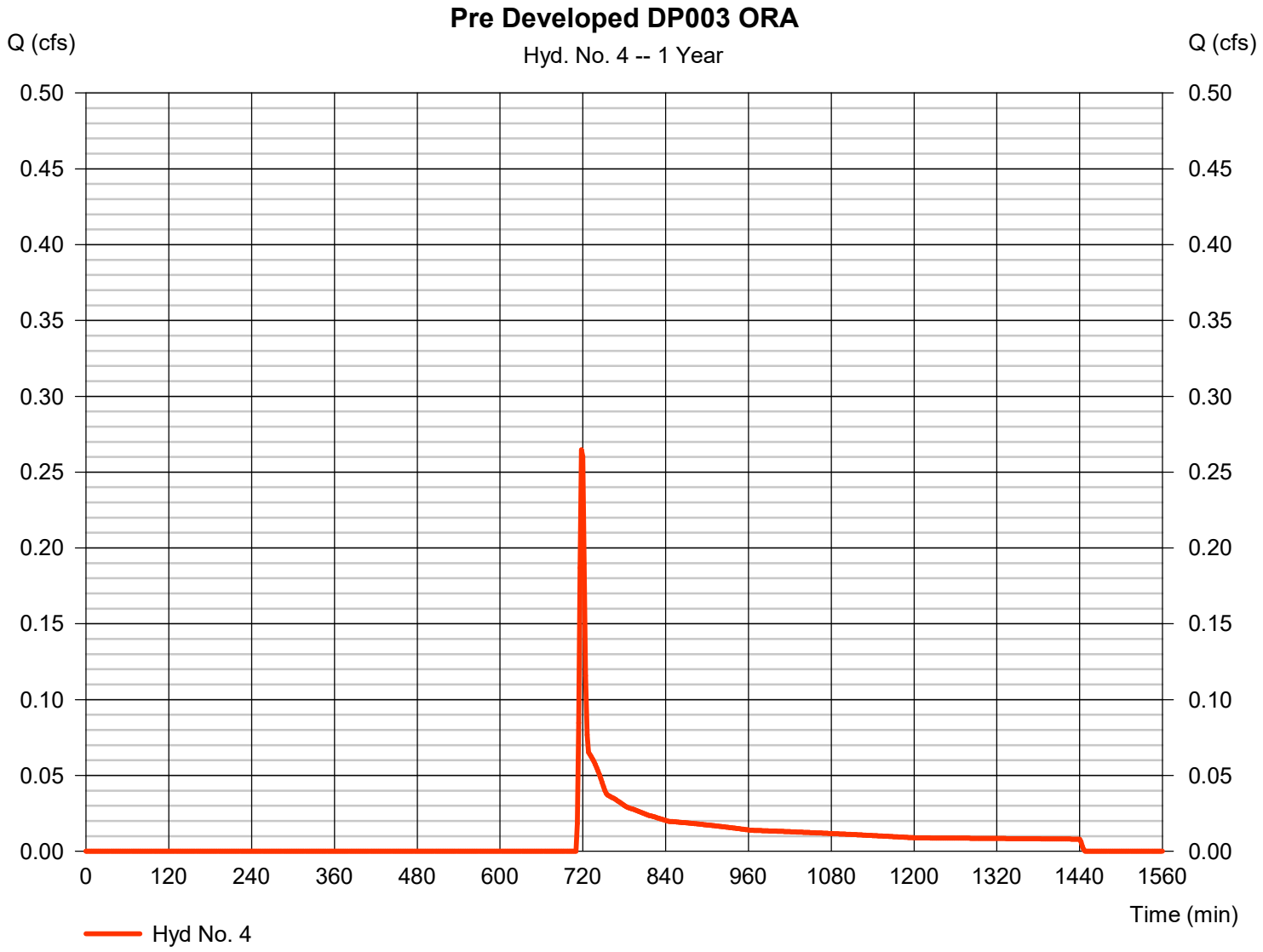
Total Travel Time, Tc ..... 11.00 min

Hydrograph Report

Hyd. No. 4

Pre Developed DP003 ORA

Hydrograph type	= SCS Runoff	Peak discharge	= 0.265 cfs
Storm frequency	= 1 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 787 cuft
Drainage area	= 0.810 ac	Curve number	= 62
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.70 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

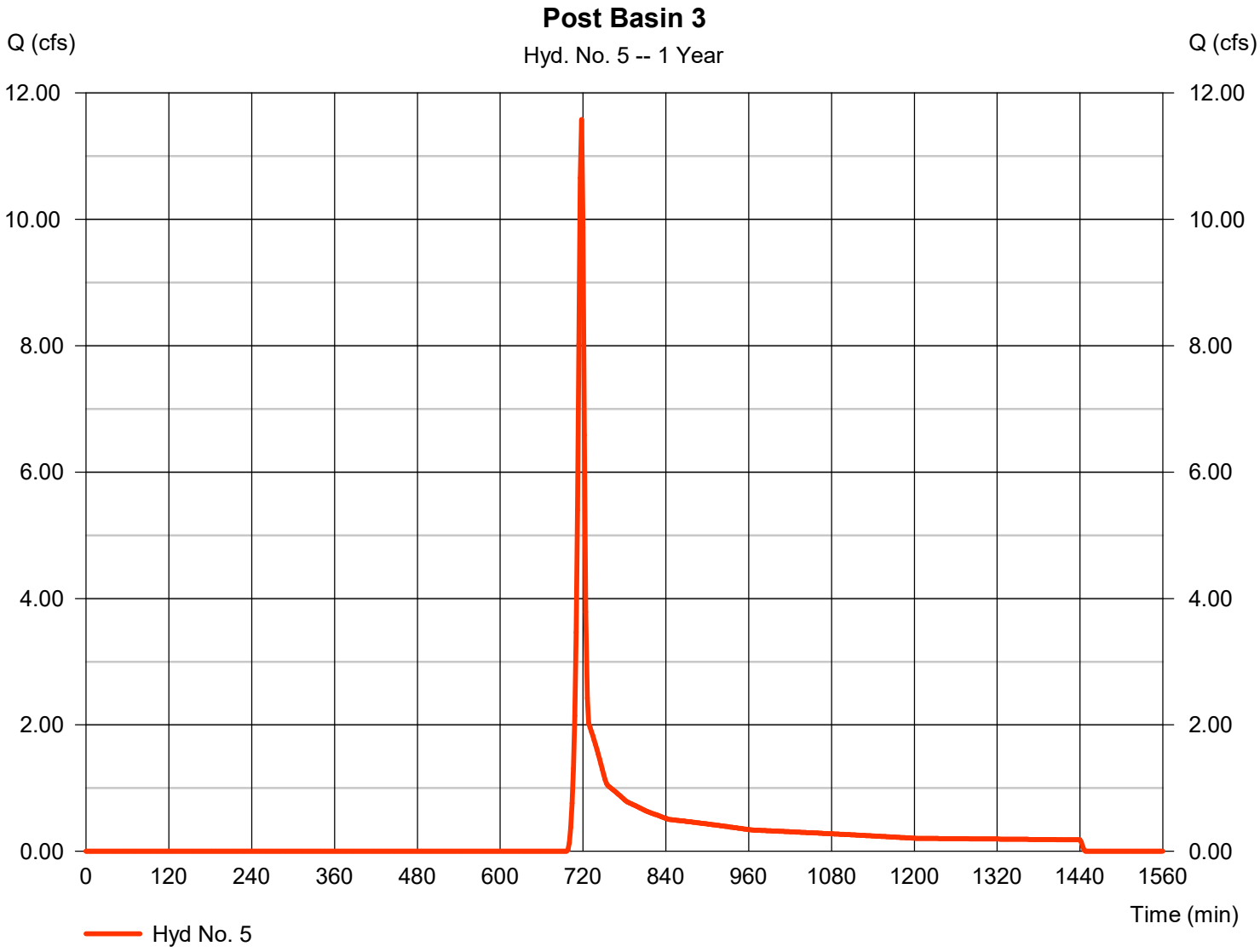


Hydrograph Report

Hyd. No. 5

Post Basin 3

Hydrograph type	=	SCS Runoff	Peak discharge	=	11.58 cfs
Storm frequency	=	1 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	24,233 cuft
Drainage area	=	12.150 ac	Curve number	=	70.8
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.70 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



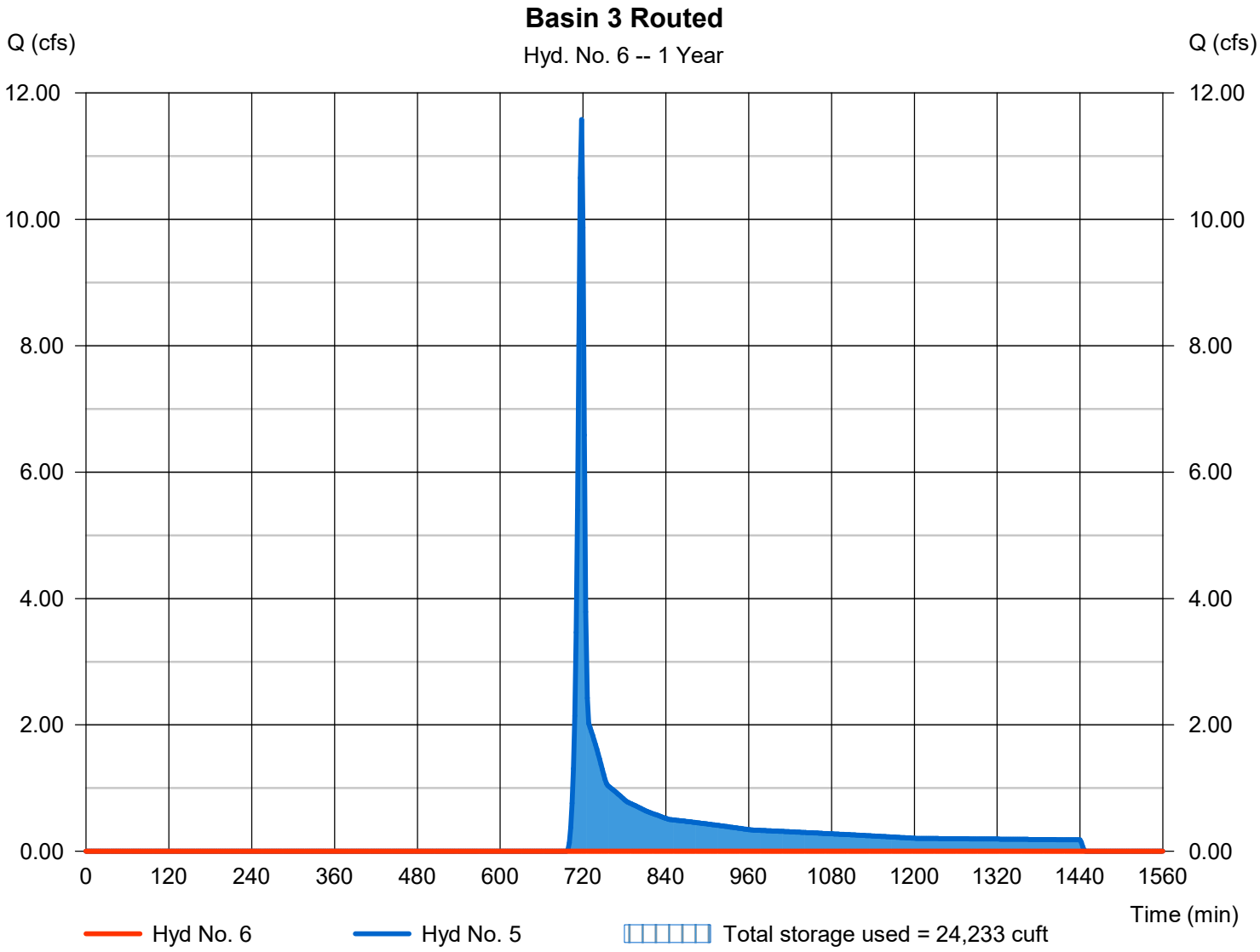
Hydrograph Report

Hyd. No. 6

Basin 3 Routed

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	1 yrs	Time to peak	=	n/a
Time interval	=	2 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	5 - Post Basin 3	Max. Elevation	=	317.29 ft
Reservoir name	=	Basin 3	Max. Storage	=	24,233 cuft

Storage Indication method used.



Pond Report

Pond No. 5 - Basin 3

Pond Data

Contours -User-defined contour areas. Average end areas method used for volume calculation. Begining Elevation = 314.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	314.00	2,000	0	0
0.20	314.20	2,000	159	159
0.40	314.40	2,000	159	318
0.60	314.60	2,000	159	478
0.80	314.80	2,000	159	637
1.00	314.99	2,000	159	796
1.19	315.19	2,000	159	955
1.39	315.39	2,000	159	1,114
1.59	315.59	2,000	159	1,274
1.79	315.79	2,000	159	1,433
1.99	315.99	2,000	159	1,592
2.00	316.00	15,345	87	1,679
4.00	318.00	19,665	35,010	36,689
6.00	320.00	24,211	43,876	80,565
7.00	321.00	26,570	25,390	105,955

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 18.00	Inactive	0.00	0.00
Span (in)	= 18.00	5.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 312.00	318.00	0.00	0.00
Length (ft)	= 50.00	0.00	0.00	0.00
Slope (%)	= 5.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

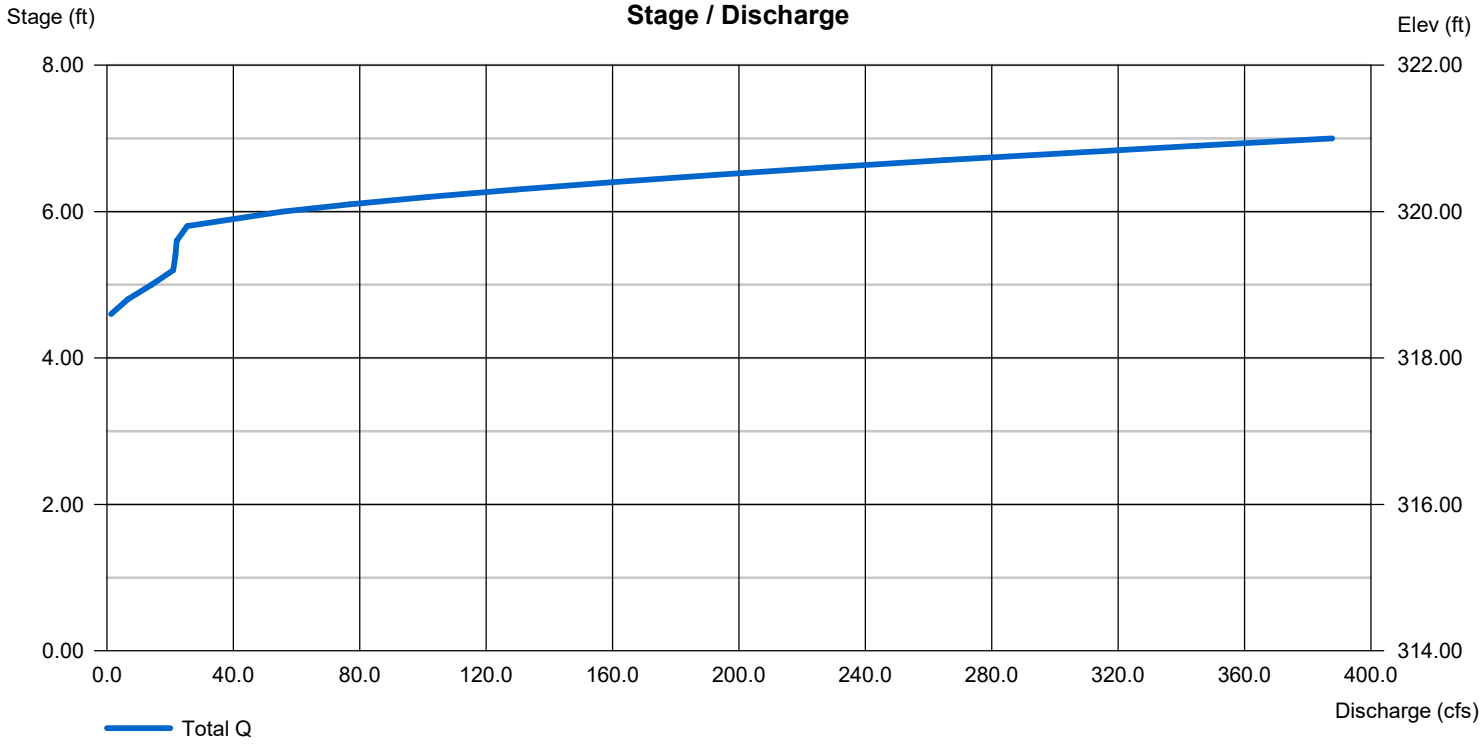
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 12.00	Inactive	100.00	0.00
Crest El. (ft)	= 318.50	318.00	319.75	0.00
Weir Coeff.	= 3.33	3.33	2.60	3.33
Weir Type	= 1	Rect	Broad	---
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).

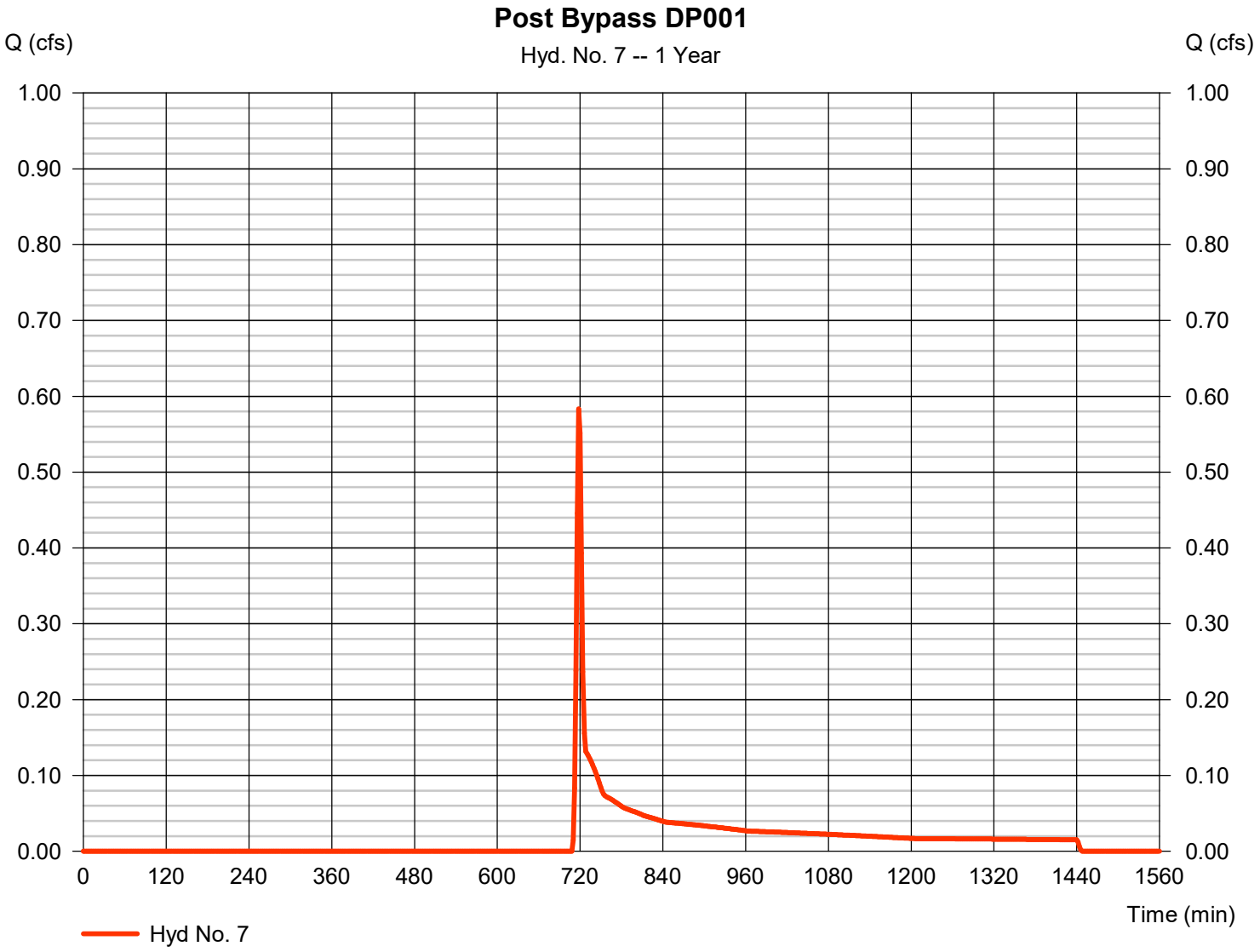


Hydrograph Report

Hyd. No. 7

Post Bypass DP001

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.583 cfs
Storm frequency	=	1 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	1,570 cuft
Drainage area	=	1.440 ac	Curve number	=	63.2
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.70 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

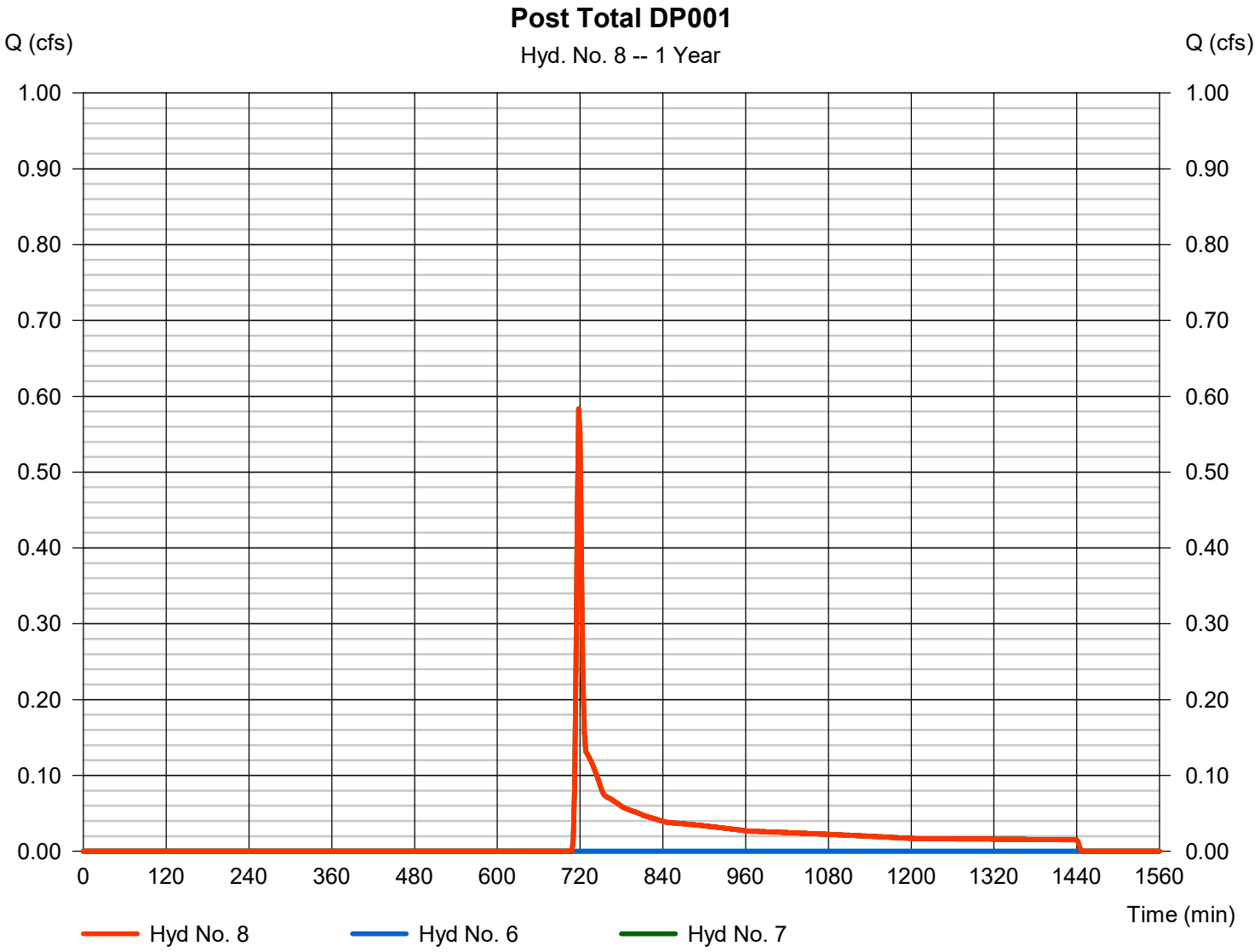


Hydrograph Report

Hyd. No. 8

Post Total DP001

Hydrograph type	= Combine	Peak discharge	= 0.583 cfs
Storm frequency	= 1 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 1,570 cuft
Inflow hyds.	= 6, 7	Contrib. drain. area	= 1.440 ac

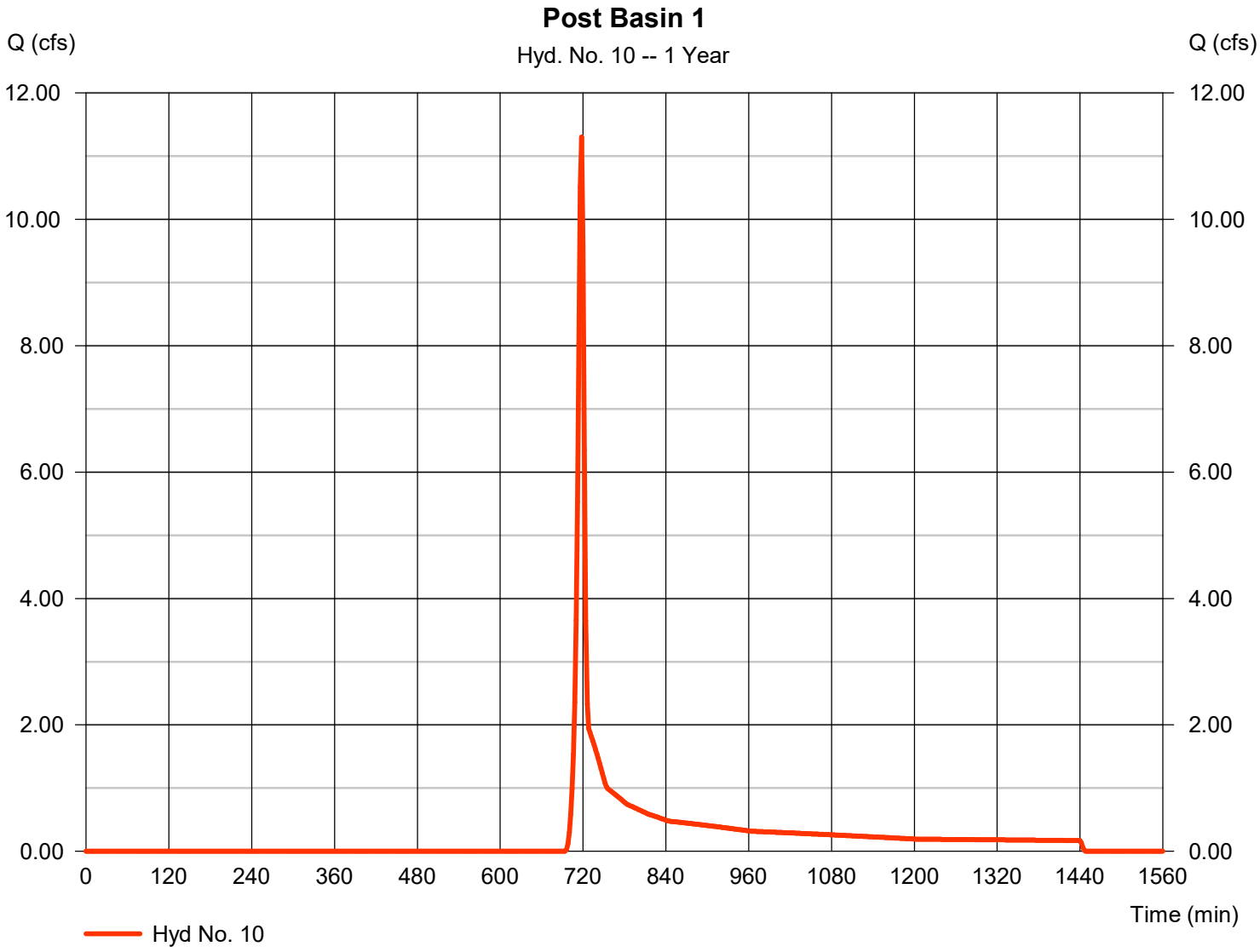


Hydrograph Report

Hyd. No. 10

Post Basin 1

Hydrograph type	=	SCS Runoff	Peak discharge	=	11.30 cfs
Storm frequency	=	1 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	23,379 cuft
Drainage area	=	10.950 ac	Curve number	=	71.8
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.70 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



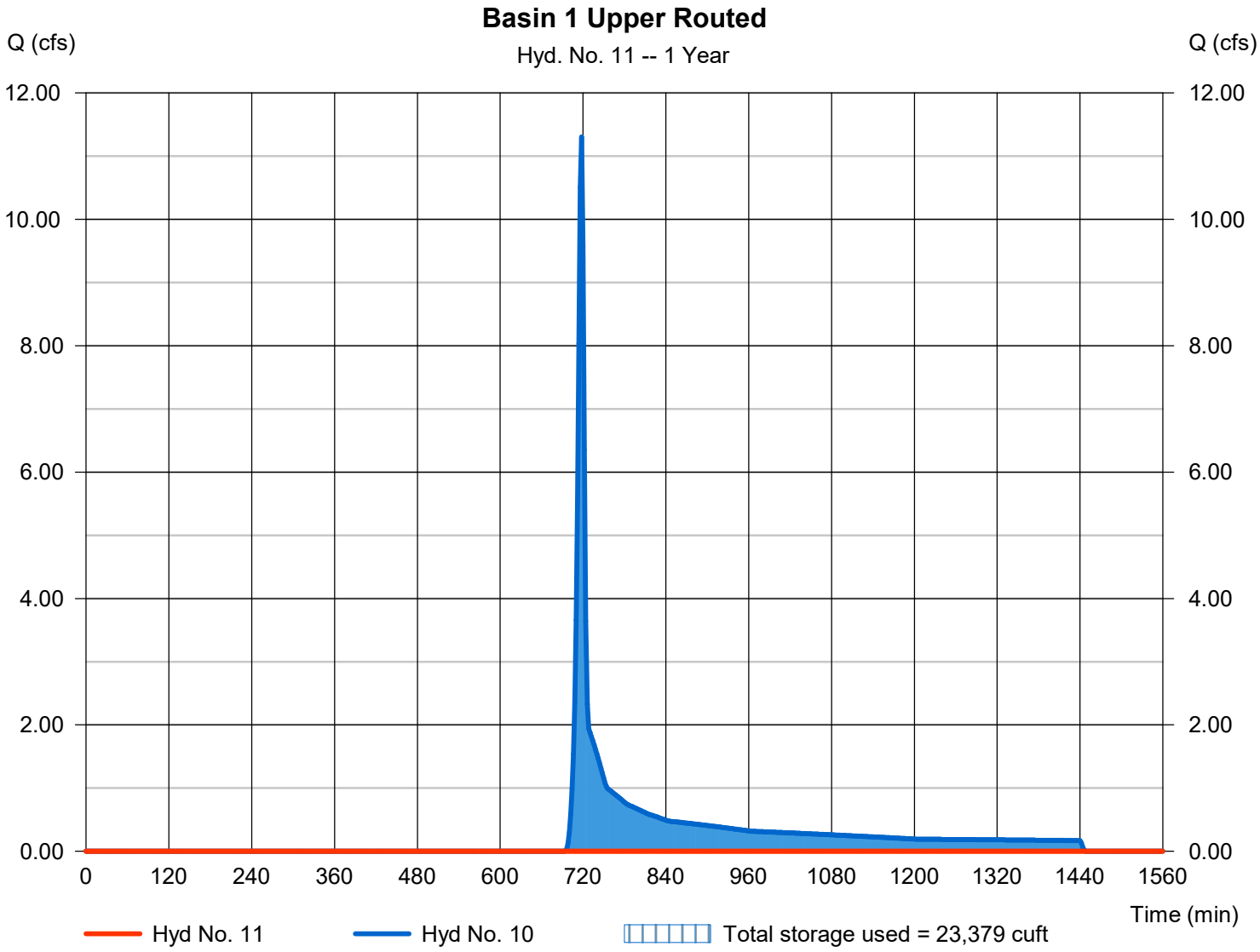
Hydrograph Report

Hyd. No. 11

Basin 1 Upper Routed

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	1 yrs	Time to peak	=	n/a
Time interval	=	2 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	10 - Post Basin 1	Max. Elevation	=	321.56 ft
Reservoir name	=	Basin 1 Upper	Max. Storage	=	23,379 cuft

Storage Indication method used.



Pond Report

Pond No. 2 - Basin 1 Upper

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 320.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	320.00	13,236	0	0
2.00	322.00	16,755	29,991	29,991
4.00	324.00	20,617	37,372	67,363
6.00	326.00	24,500	45,117	112,480

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	0.00	0.00	0.00
Span (in)	= 24.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 314.00	0.00	0.00	0.00
Length (ft)	= 50.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

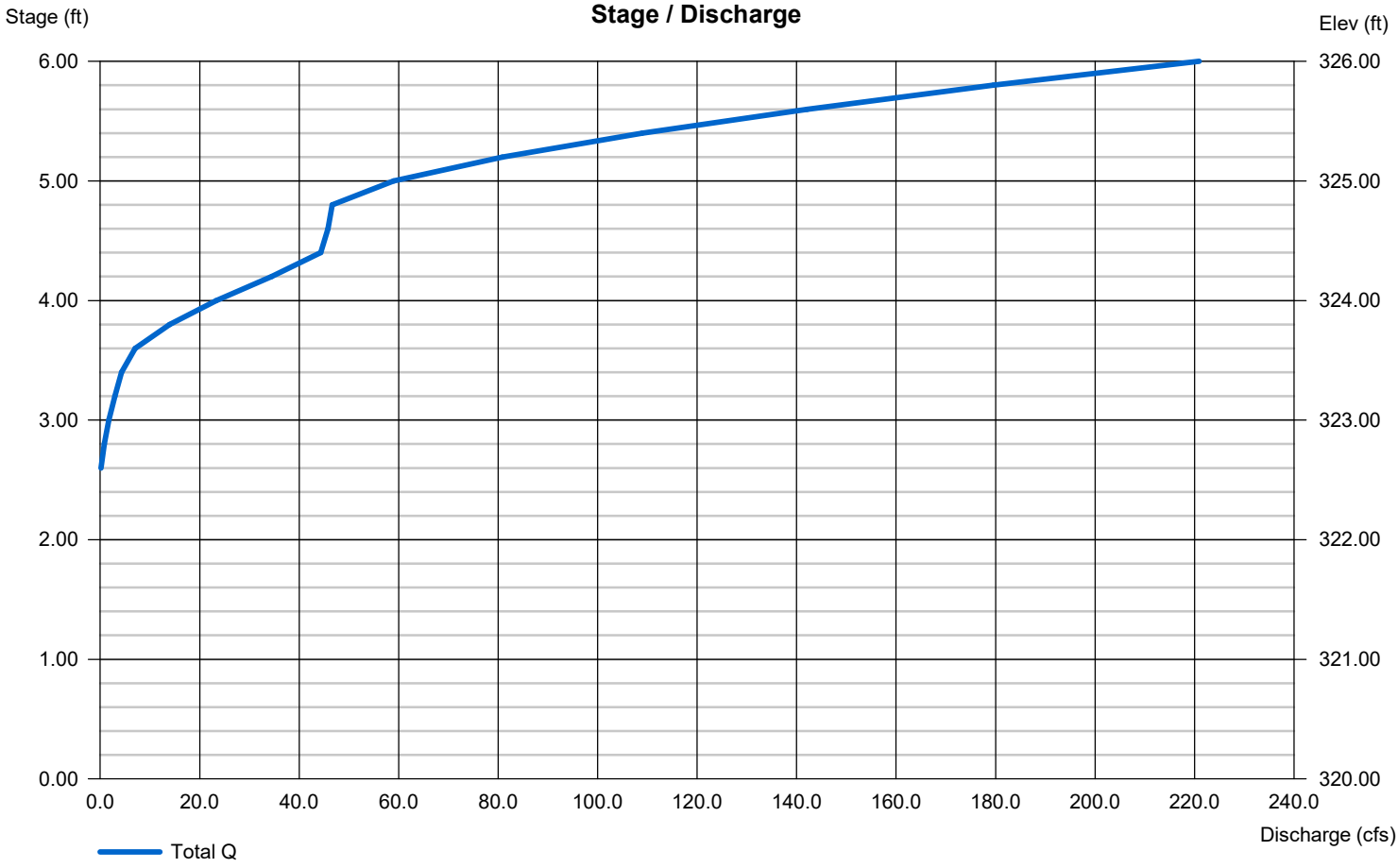
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 12.00	1.50	50.00	0.00
Crest El. (ft)	= 323.50	322.50	324.80	0.00
Weir Coeff.	= 3.33	3.33	2.60	3.33
Weir Type	= 1	Rect	Broad	---
Multi-Stage	= Yes	Yes	No	No

Exfil.(in/hr) = 0.000 (by Contour)

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).



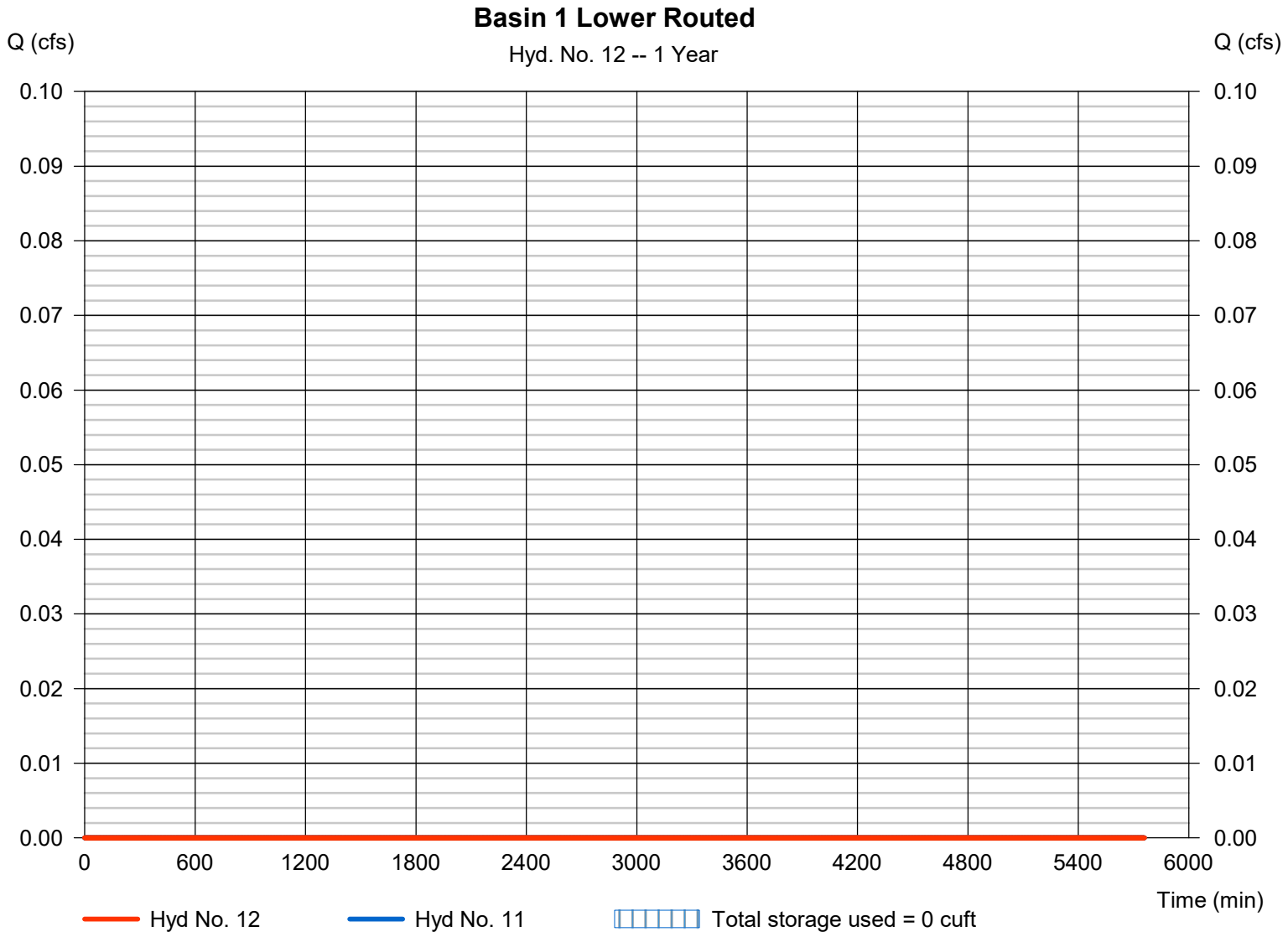
Hydrograph Report

Hyd. No. 12

Basin 1 Lower Routed

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	1 yrs	Time to peak	=	n/a
Time interval	=	2 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	11 - Basin 1 Upper Routed	Max. Elevation	=	302.20 ft
Reservoir name	=	Basin 1 Lower	Max. Storage	=	0 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Basin 1 Lower

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 302.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	302.00	2,215	0	0
2.00	304.00	3,972	6,187	6,187
4.00	306.00	10,535	14,507	20,694
6.00	308.00	14,870	25,405	46,099

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 18.00	9.00	0.00	0.00
Span (in)	= 18.00	9.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 302.00	304.00	0.00	0.00
Length (ft)	= 50.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

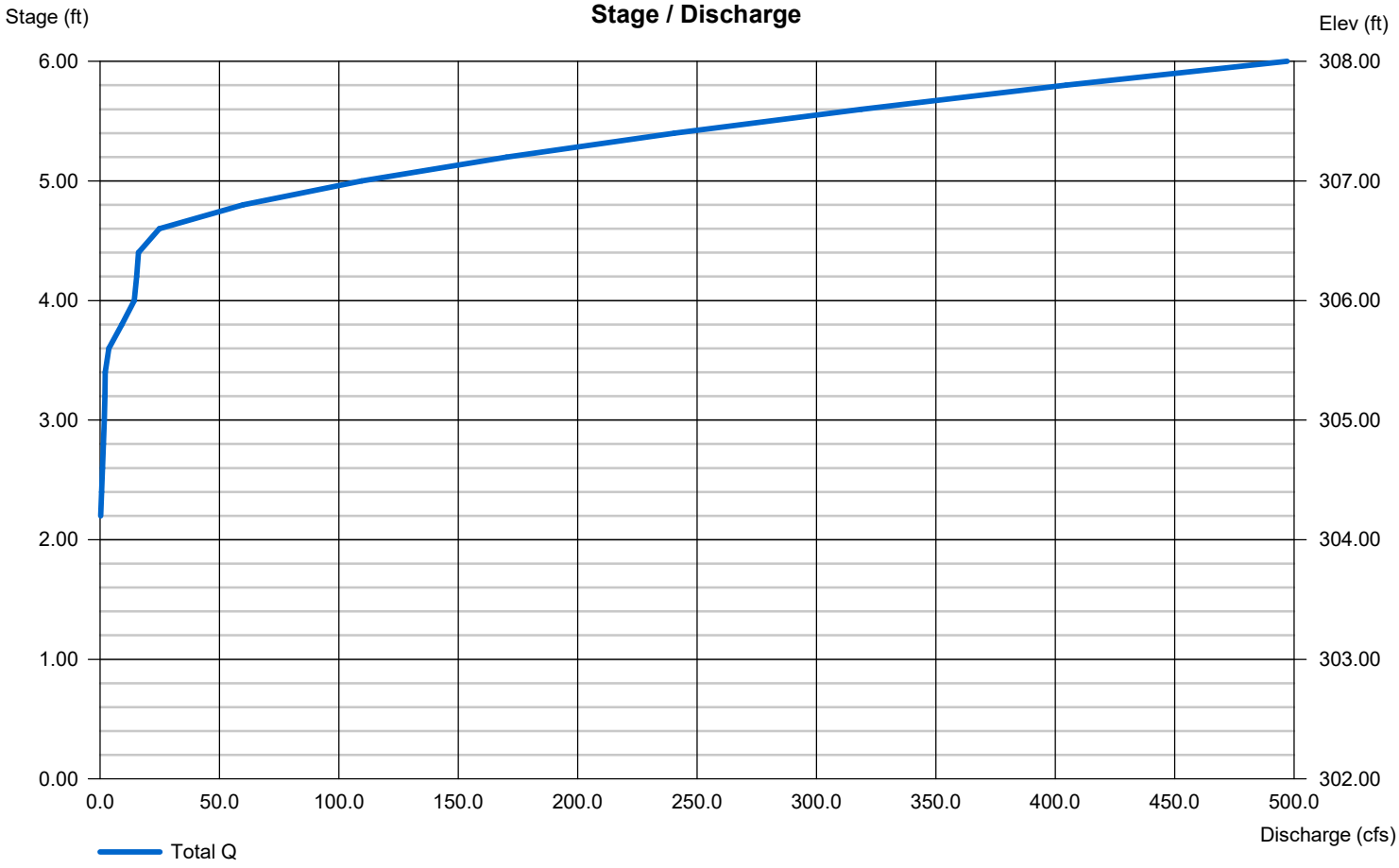
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 12.00	100.00	0.00	0.00
Crest El. (ft)	= 305.50	306.50	0.00	0.00
Weir Coeff.	= 3.33	2.60	3.33	3.33
Weir Type	= 1	Broad	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Contour)

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).

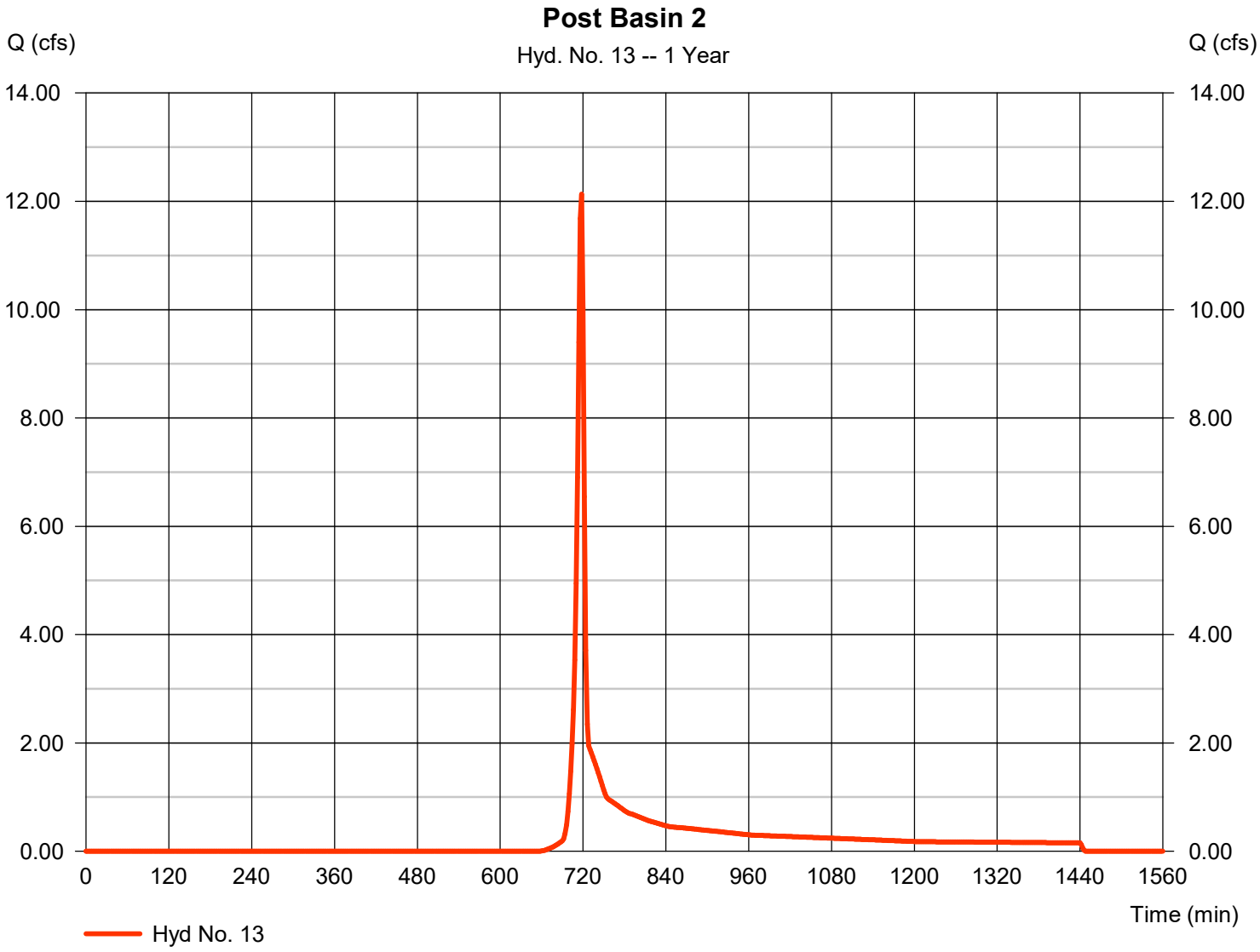


Hydrograph Report

Hyd. No. 13

Post Basin 2

Hydrograph type	=	SCS Runoff	Peak discharge	=	12.13 cfs
Storm frequency	=	1 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	24,366 cuft
Drainage area	=	8.540 ac	Curve number	=	76.4
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.70 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



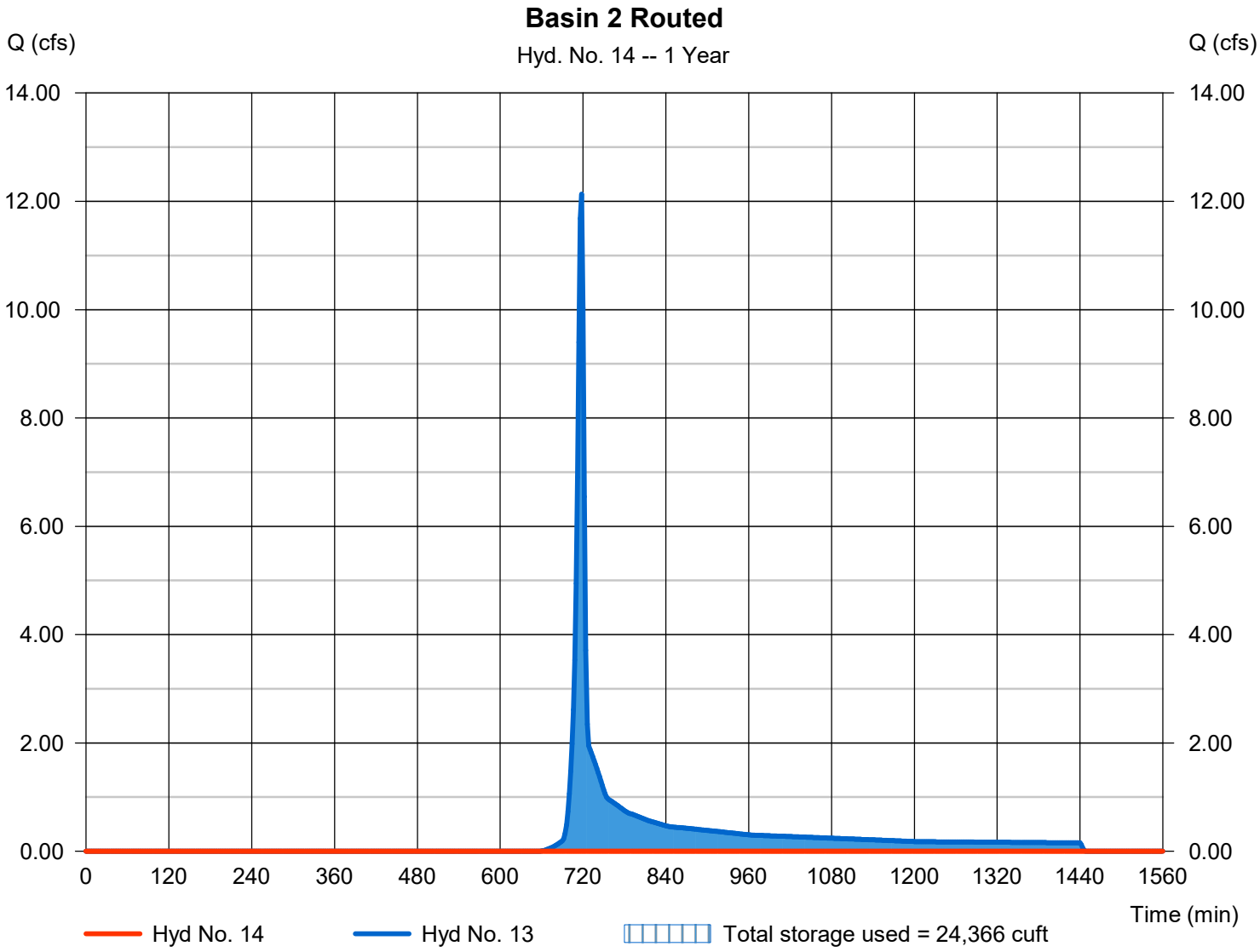
Hydrograph Report

Hyd. No. 14

Basin 2 Routed

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	1 yrs	Time to peak	=	n/a
Time interval	=	2 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	13 - Post Basin 2	Max. Elevation	=	308.25 ft
Reservoir name	=	Basin 2	Max. Storage	=	24,366 cuft

Storage Indication method used.



Pond Report

Pond No. 3 - Basin 2

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 306.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	306.00	8,255	0	0
2.00	308.00	12,443	20,698	20,698
4.00	310.00	16,673	29,116	49,814
6.00	312.00	21,110	37,783	87,597

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	0.00	0.00	0.00
Span (in)	= 24.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 304.00	0.00	0.00	0.00
Length (ft)	= 50.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

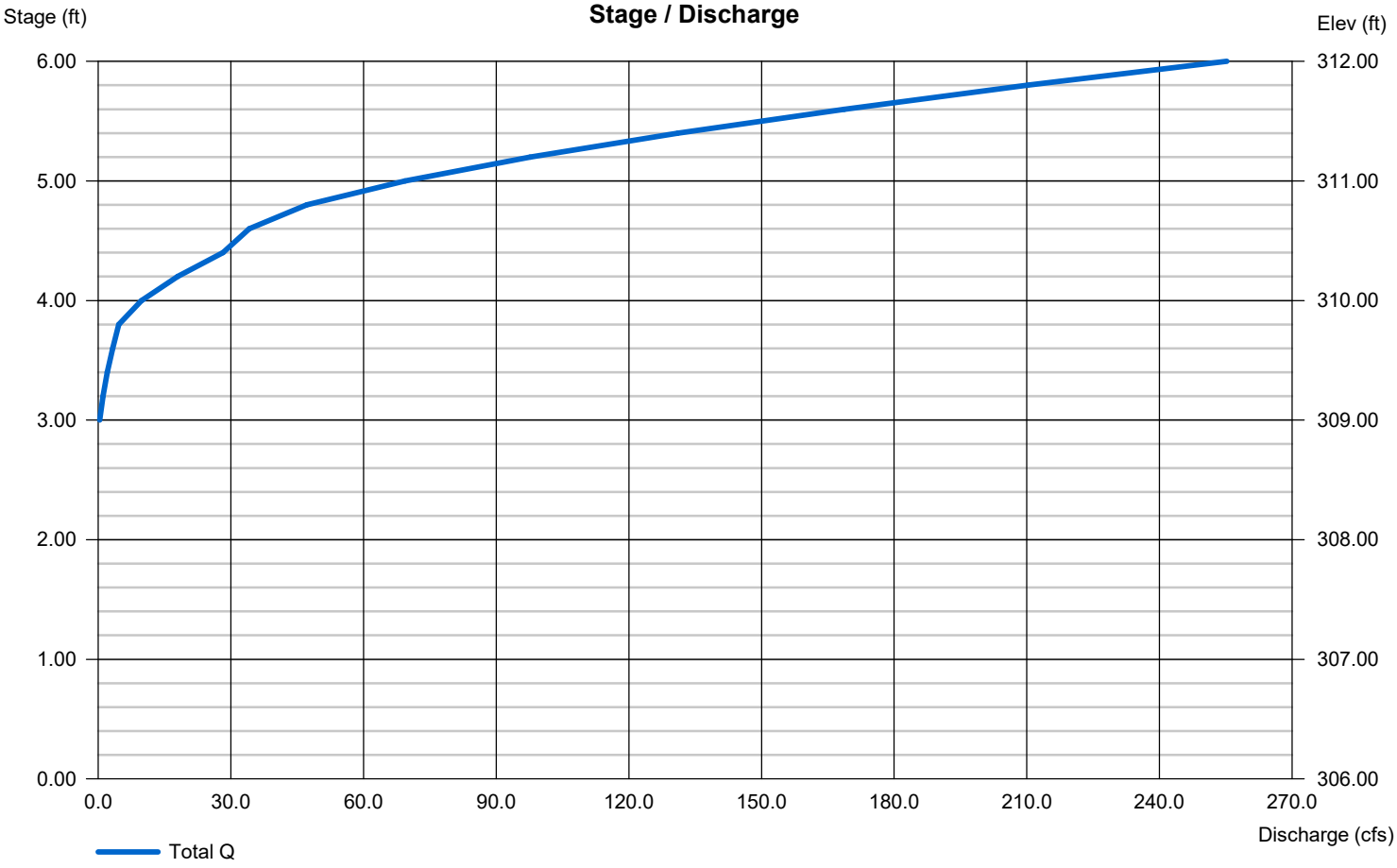
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 12.00	1.50	50.00	0.00
Crest El. (ft)	= 309.80	308.85	310.60	0.00
Weir Coeff.	= 3.33	3.33	2.60	3.33
Weir Type	= 1	Rect	Broad	---
Multi-Stage	= Yes	Yes	No	No

Exfil.(in/hr) = 0.000 (by Contour)

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).

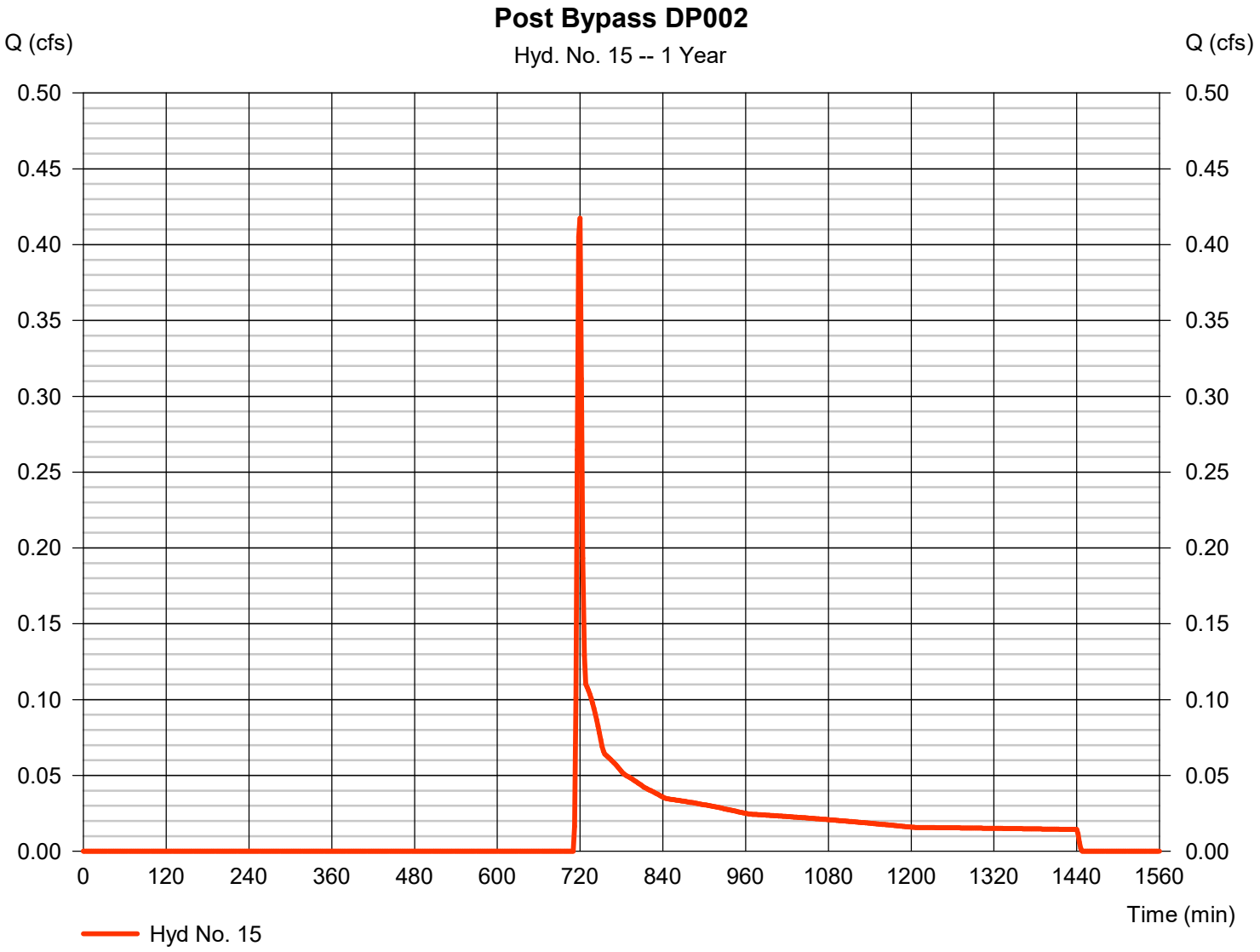


Hydrograph Report

Hyd. No. 15

Post Bypass DP002

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.417 cfs
Storm frequency	=	1 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	1,355 cuft
Drainage area	=	1.540 ac	Curve number	=	61
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.70 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

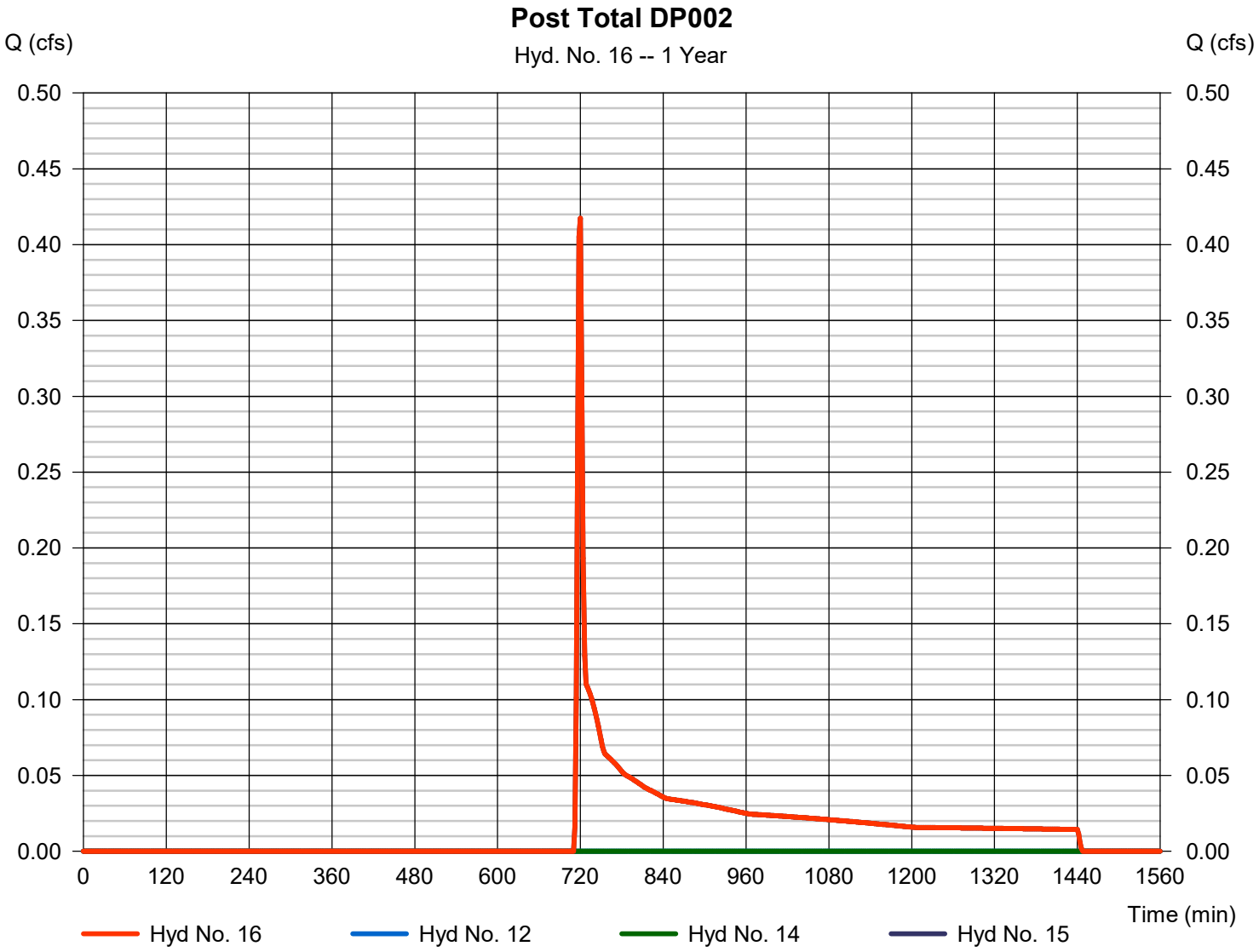


Hydrograph Report

Hyd. No. 16

Post Total DP002

Hydrograph type	= Combine	Peak discharge	= 0.417 cfs
Storm frequency	= 1 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 1,355 cuft
Inflow hyds.	= 12, 14, 15	Contrib. drain. area	= 1.540 ac



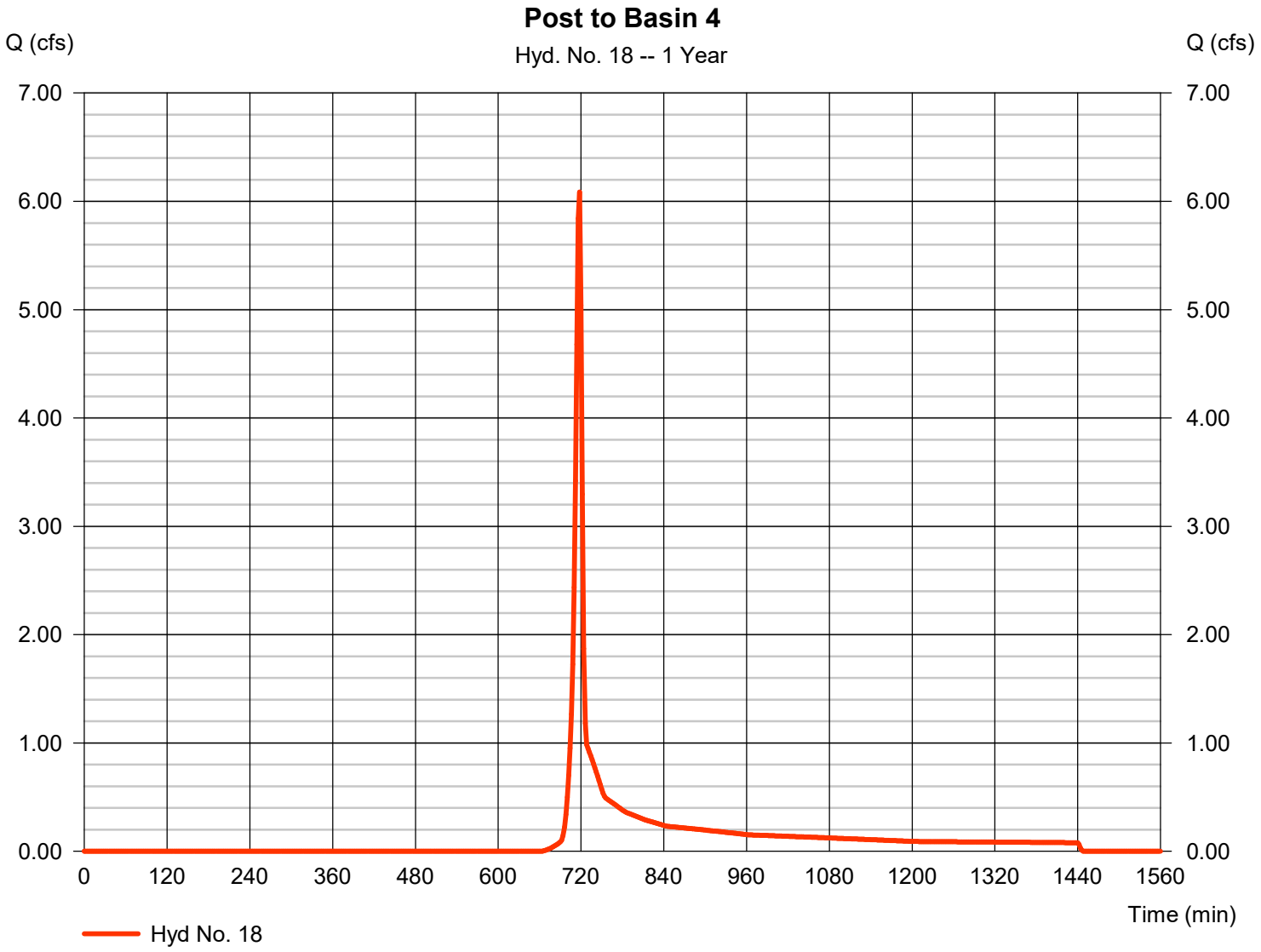
Hydrograph Report

Hyd. No. 18

Post to Basin 4

Hydrograph type	=	SCS Runoff	Peak discharge	=	6.085 cfs
Storm frequency	=	1 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	12,240 cuft
Drainage area	=	4.420 ac	Curve number	=	75.9*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.70 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.910 x 61) + (2.270 x 98) + (3.040 x 78)] / 4.420



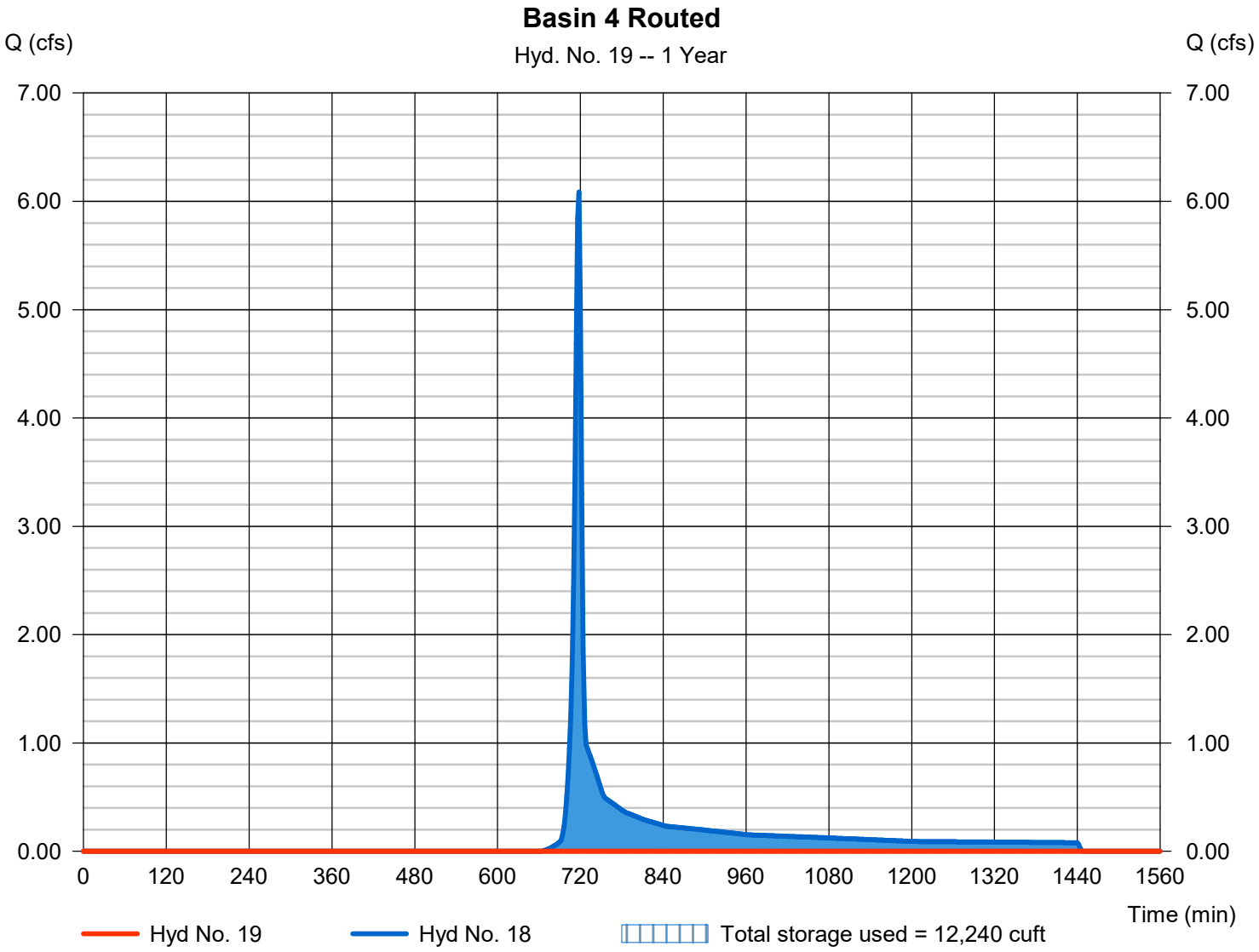
Hydrograph Report

Hyd. No. 19

Basin 4 Routed

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	1 yrs	Time to peak	=	n/a
Time interval	=	2 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	18 - Post to Basin 4	Max. Elevation	=	346.01 ft
Reservoir name	=	Basin 4	Max. Storage	=	12,240 cuft

Storage Indication method used.



Pond Report

Pond No. 7 - Basin 4

Pond Data

Contours -User-defined contour areas. Average end areas method used. Begin Elevation = 342.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	342.00	1,300	0	0
0.20	342.20	1,300	103	103
0.40	342.40	1,300	103	207
0.60	342.60	1,300	103	310
0.80	342.80	1,300	103	414
1.00	342.99	1,300	103	517
1.19	343.19	1,300	103	621
1.39	343.39	1,300	103	724
1.59	343.59	1,300	103	828
1.79	343.79	1,300	103	931
1.99	343.99	1,300	103	1,035
2.00	344.00	4,413	29	1,063
4.00	346.00	6,717	11,130	12,193
6.00	348.00	9,246	15,963	28,156
8.00	350.00	12,000	21,246	49,402

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 18.00	12.00	0.00	0.00
Span (in)	= 18.00	12.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 344.00	346.20	0.00	0.00
Length (ft)	= 50.00	0.00	0.00	0.00
Slope (%)	= 2.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

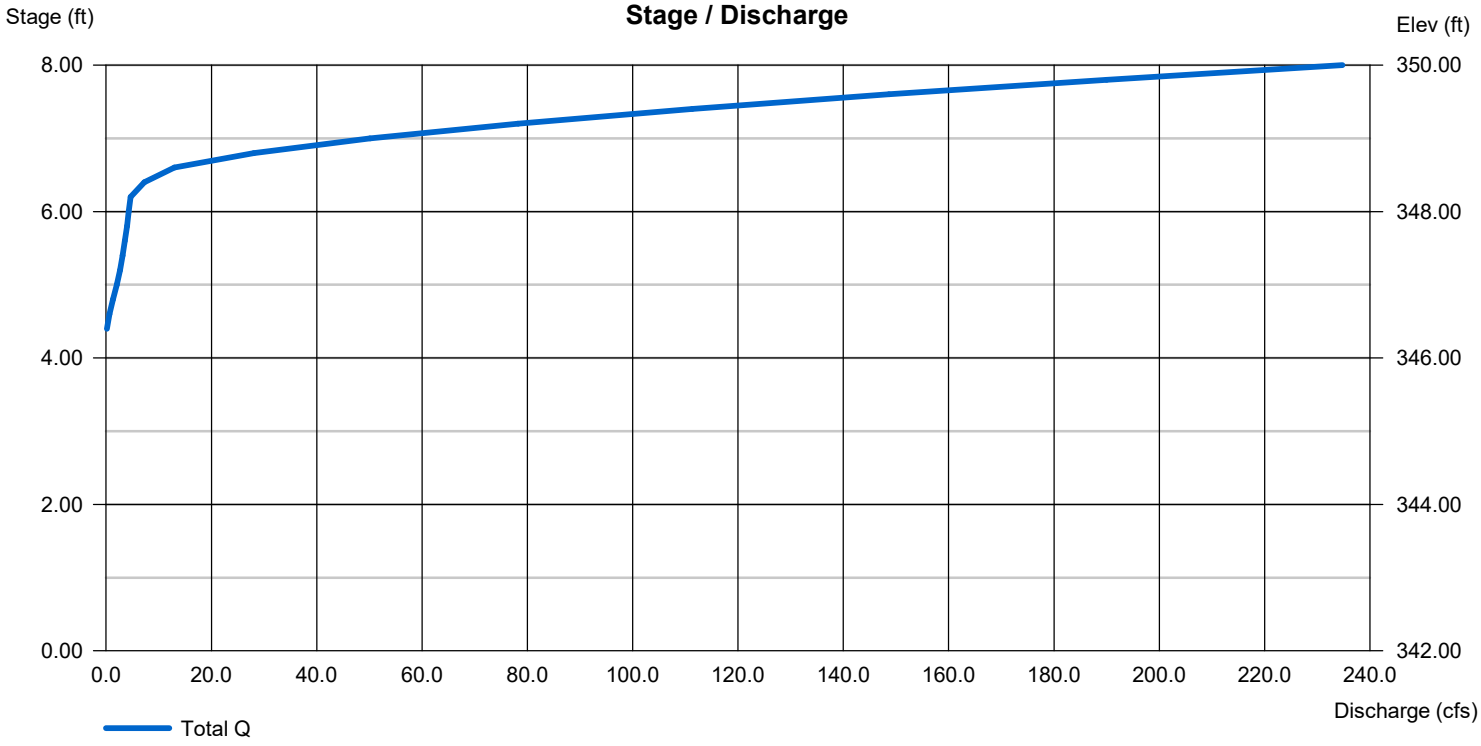
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 12.00	0.00	50.00	0.00
Crest El. (ft)	= 348.25	0.00	348.60	0.00
Weir Coeff.	= 3.33	3.33	2.60	3.33
Weir Type	= 1	---	Broad	---
Multi-Stage	= Yes	No	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).



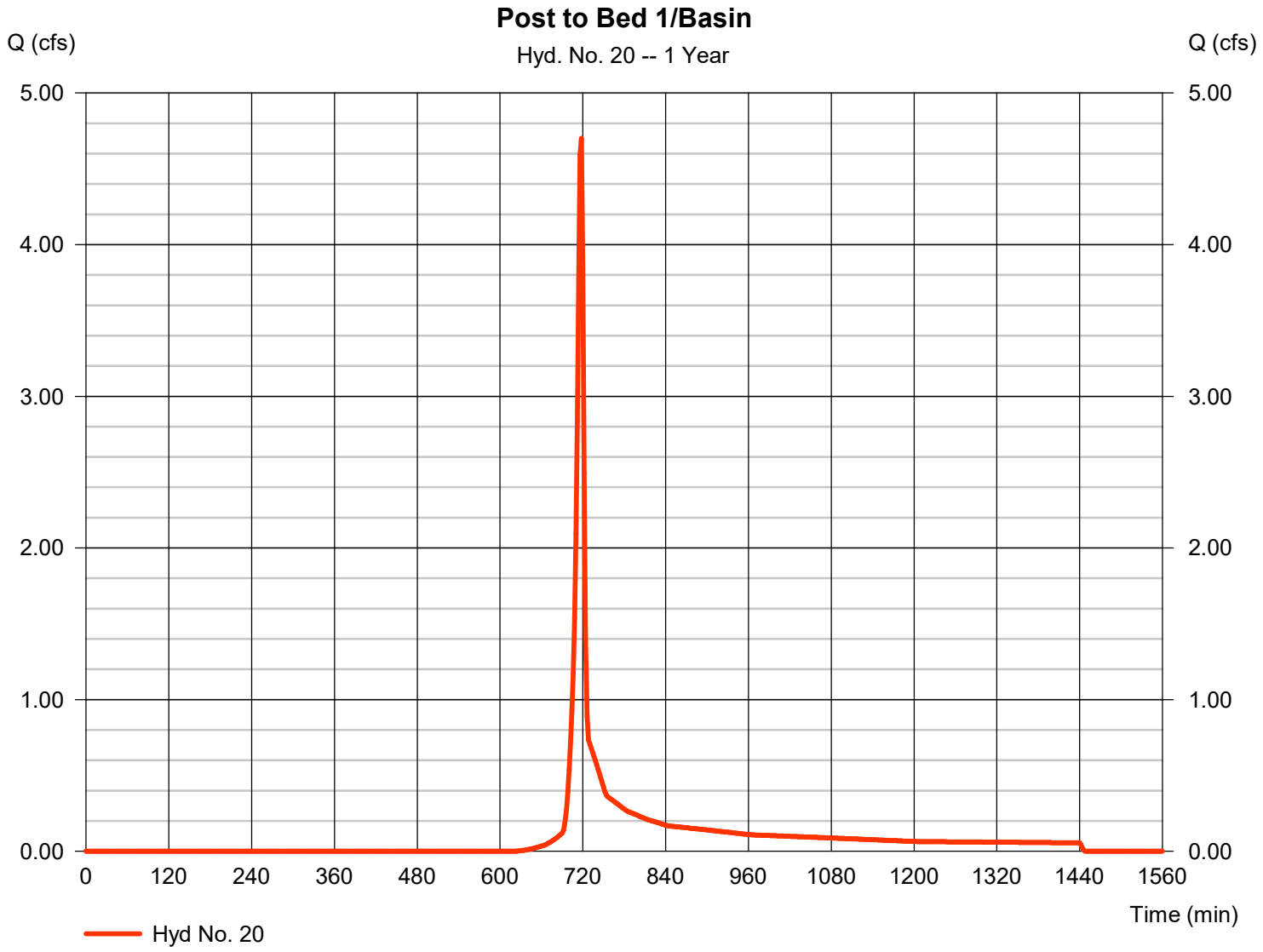
Hydrograph Report

Hyd. No. 20

Post to Bed 1/Basin

Hydrograph type	= SCS Runoff	Peak discharge	= 4.701 cfs
Storm frequency	= 1 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 9,401 cuft
Drainage area	= 2.820 ac	Curve number	= 79.1*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.70 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.910 x 61) + (2.270 x 98) + (3.040 x 78)] / 2.820



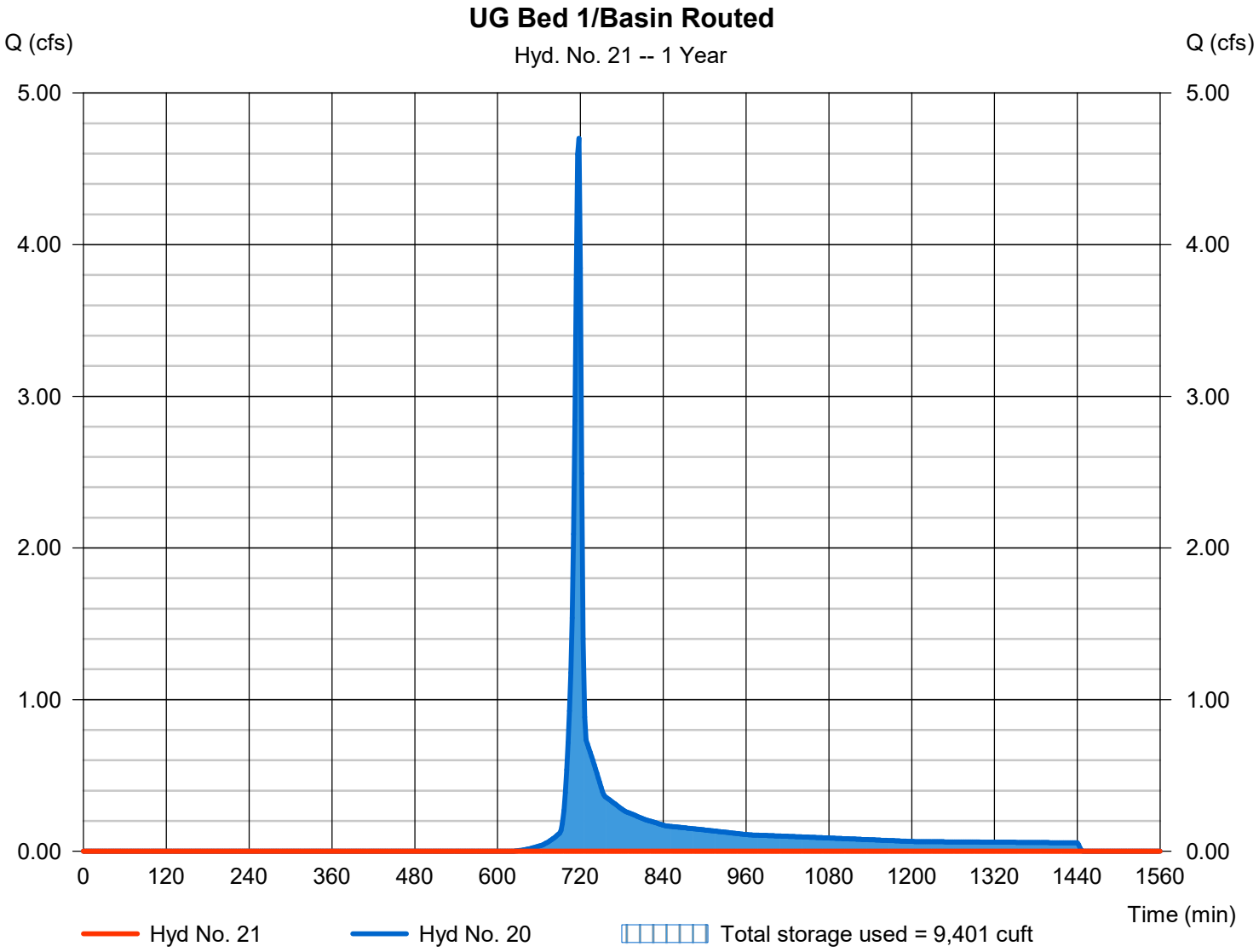
Hydrograph Report

Hyd. No. 21

UG Bed 1/Basin Routed

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	1 yrs	Time to peak	=	n/a
Time interval	=	2 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	20 - Post to Bed 1/Basin	Max. Elevation	=	339.59 ft
Reservoir name	=	UG Bed 1/Basin	Max. Storage	=	9,401 cuft

Storage Indication method used.



Pond Report

Pond No. 6 - UG Bed 1/Basin

Pond Data

Contours -Bottom invert = 336.00 ft, Depth = 3.00 ft, Elevation = 344.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	336.00	5,625	0	0
0.30	336.30	5,625	675	675
0.60	336.60	5,625	675	1,350
0.90	336.90	5,625	675	2,025
1.20	337.20	5,625	675	2,700
1.50	337.50	5,625	675	3,375
1.80	337.80	5,625	675	4,050
2.10	338.10	5,625	675	4,725
2.40	338.40	5,625	675	5,400
2.70	338.70	5,625	675	6,075
3.00	339.00	5,625	675	6,750
4.00	340.00	3,380	4,503	11,253
6.00	342.00	5,050	8,430	19,683
8.00	344.00	6,945	11,995	31,678

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 15.00	12.00	0.00	0.00
Span (in)	= 15.00	18.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 336.00	340.20	0.00	0.00
Length (ft)	= 50.00	0.00	0.00	0.00
Slope (%)	= 2.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

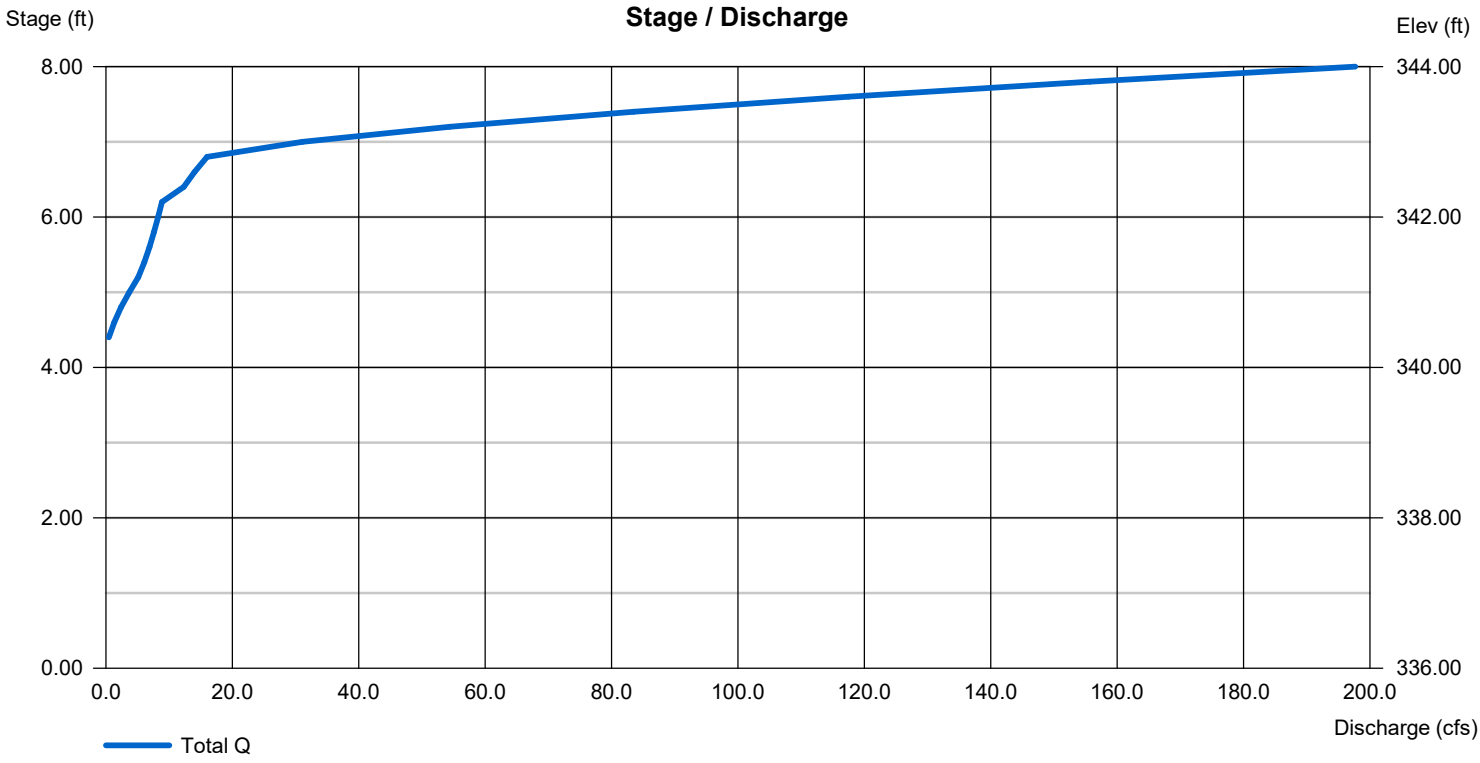
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 12.00	0.00	50.00	0.00
Crest El. (ft)	= 342.20	0.00	342.75	0.00
Weir Coeff.	= 3.33	3.33	2.60	3.33
Weir Type	= 1	---	Broad	---
Multi-Stage	= Yes	No	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).

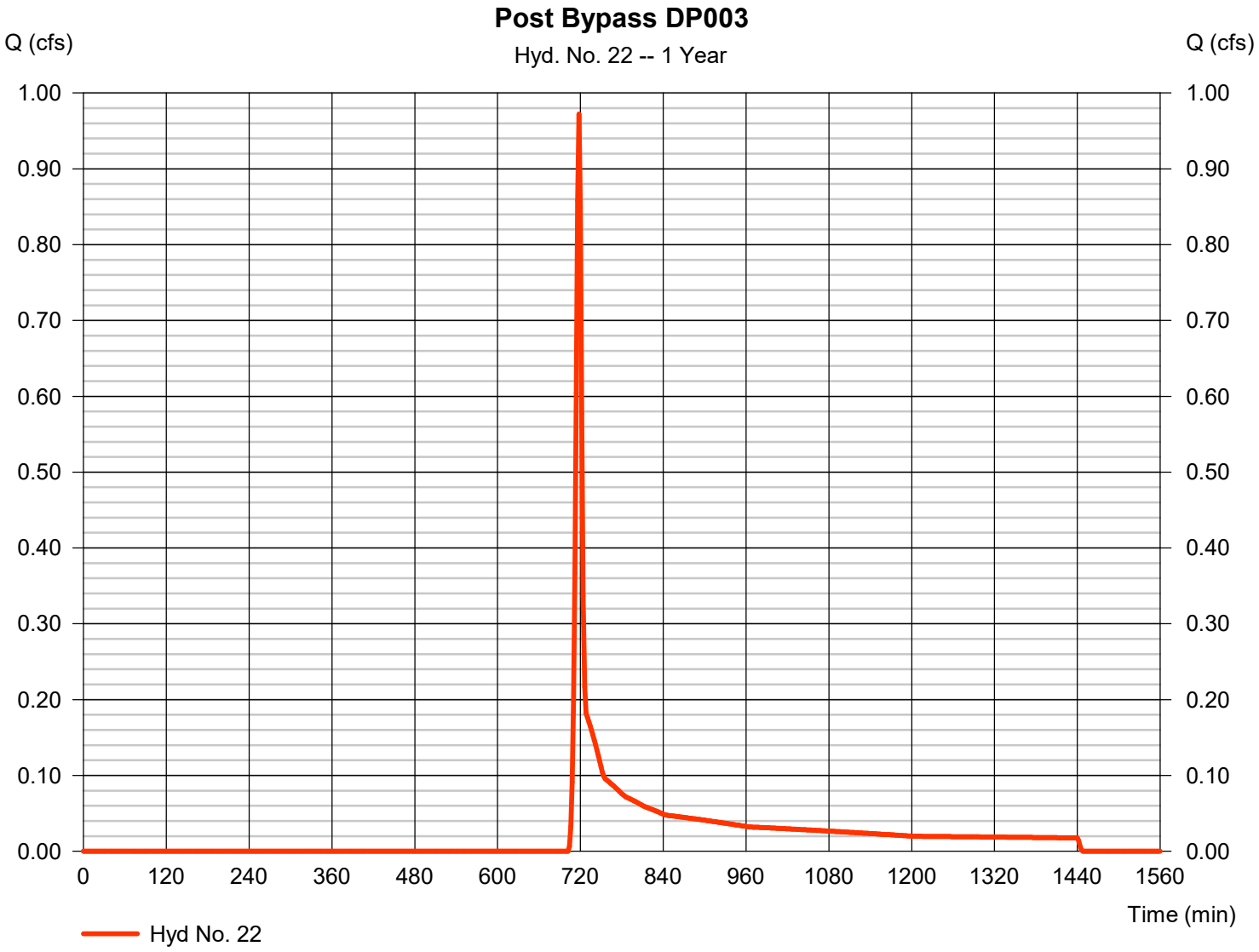


Hydrograph Report

Hyd. No. 22

Post Bypass DP003

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.972 cfs
Storm frequency	=	1 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	2,149 cuft
Drainage area	=	1.340 ac	Curve number	=	67.8
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	2.70 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

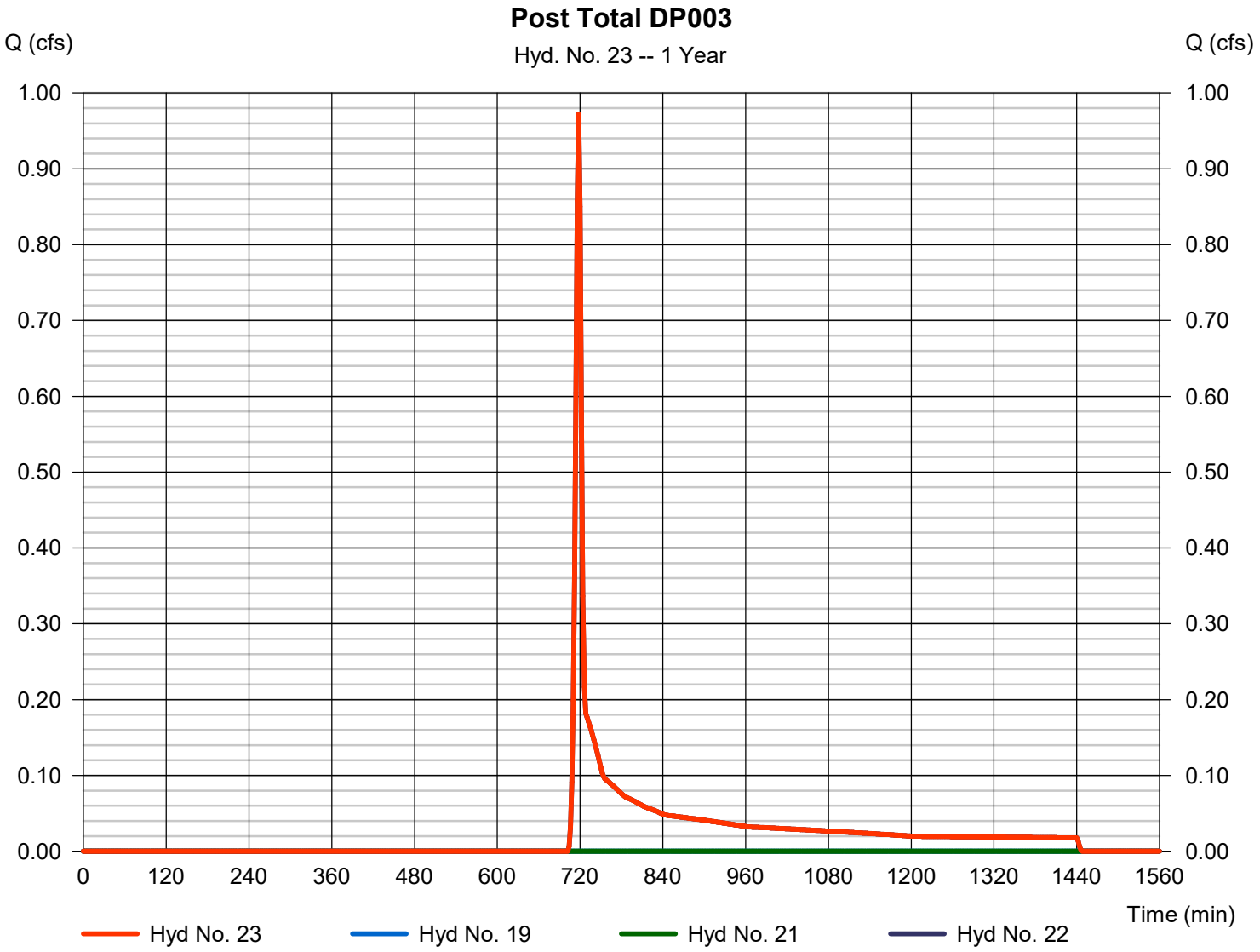


Hydrograph Report

Hyd. No. 23

Post Total DP003

Hydrograph type	= Combine	Peak discharge	= 0.972 cfs
Storm frequency	= 1 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 2,149 cuft
Inflow hyds.	= 19, 21, 22	Contrib. drain. area	= 1.340 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

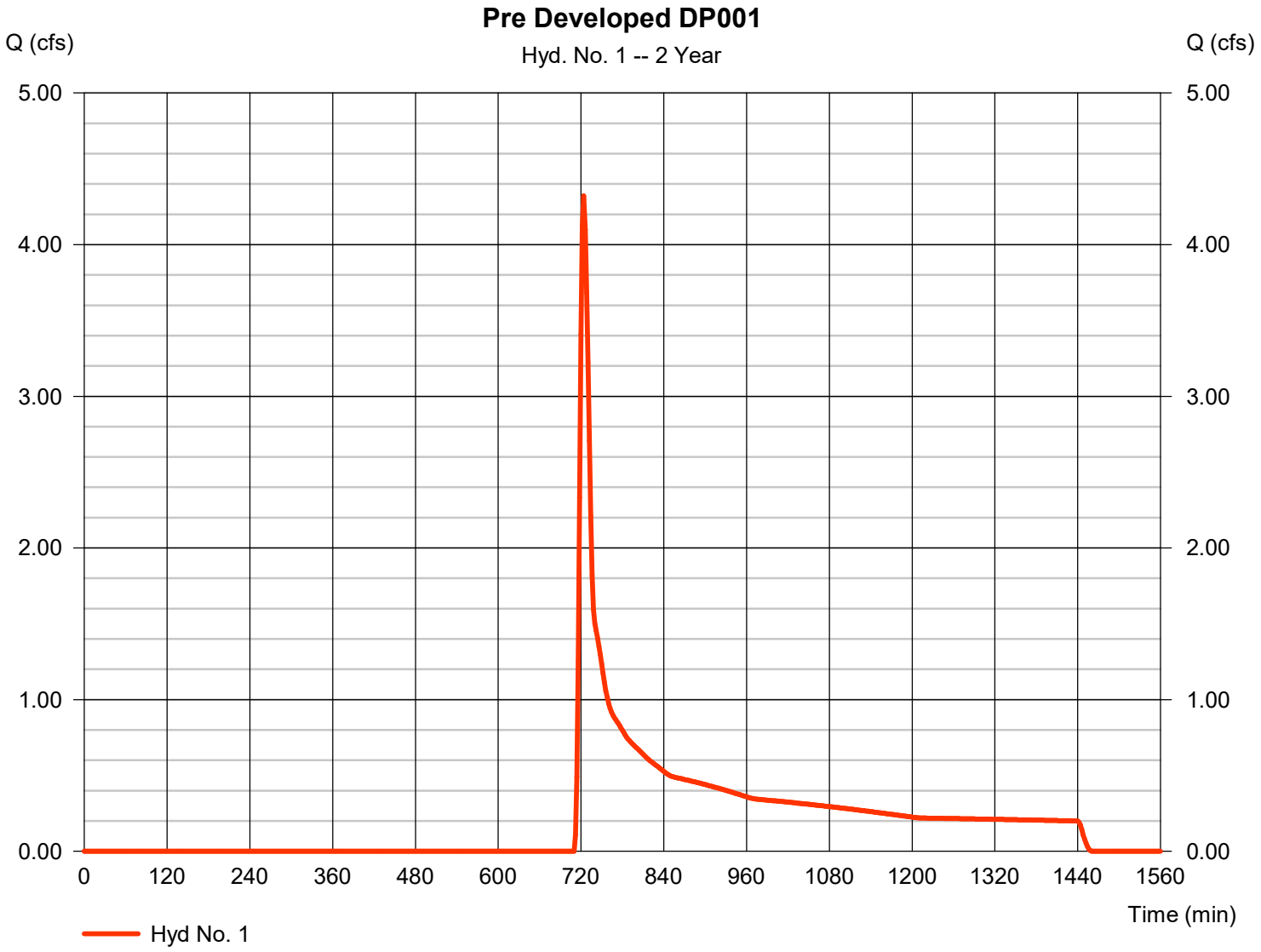
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	4.322	2	724	19,687	------	------	------	Pre Developed DP001
2	SCS Runoff	6.847	2	724	27,873	------	------	------	Pre Developed DP002
3	SCS Runoff	8.022	2	722	22,888	------	------	------	Pre Developed DP003
4	SCS Runoff	0.566	2	718	1,326	------	------	------	Pre Developed DP003 ORA
5	SCS Runoff	17.70	2	718	35,889	------	------	------	Post Basin 3
6	Reservoir	0.000	2	n/a	0	5	317.95	35,889	Basin 3 Routed
7	SCS Runoff	1.146	2	718	2,583	------	------	------	Post Bypass DP001
8	Combine	1.146	2	718	2,583	6, 7	------	------	Post Total DP001
10	SCS Runoff	16.97	2	718	34,254	------	------	------	Post Basin 1
11	Reservoir	0.000	2	n/a	0	10	322.23	34,254	Basin 1 Upper Routed
12	Reservoir	0.000	2	n/a	0	11	302.20	0.000	Basin 1 Lower Routed
13	SCS Runoff	17.09	2	718	34,170	------	------	------	Post Basin 2
14	Reservoir	0.120	2	1444	1,815	13	308.88	33,546	Basin 2 Routed
15	SCS Runoff	0.956	2	718	2,327	------	------	------	Post Bypass DP002
16	Combine	0.956	2	718	4,142	12, 14, 15	------	------	Post Total DP002
18	SCS Runoff	8.620	2	718	17,240	------	------	------	Post to Basin 4
19	Reservoir	0.111	2	1308	3,441	18	346.32	14,787	Basin 4 Routed
20	SCS Runoff	6.430	2	718	12,890	------	------	------	Post to Bed 1/Basin
21	Reservoir	0.073	2	1390	793	20	340.23	12,231	UG Bed 1/Basin Routed
22	SCS Runoff	1.588	2	718	3,299	------	------	------	Post Bypass DP003
23	Combine	1.588	2	718	7,533	19, 21, 22	------	------	Post Total DP003

Hydrograph Report

Hyd. No. 1

Pre Developed DP001

Hydrograph type	=	SCS Runoff	Peak discharge	=	4.322 cfs
Storm frequency	=	2 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	19,687 cuft
Drainage area	=	15.430 ac	Curve number	=	58
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	12.00 min
Total precip.	=	3.20 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

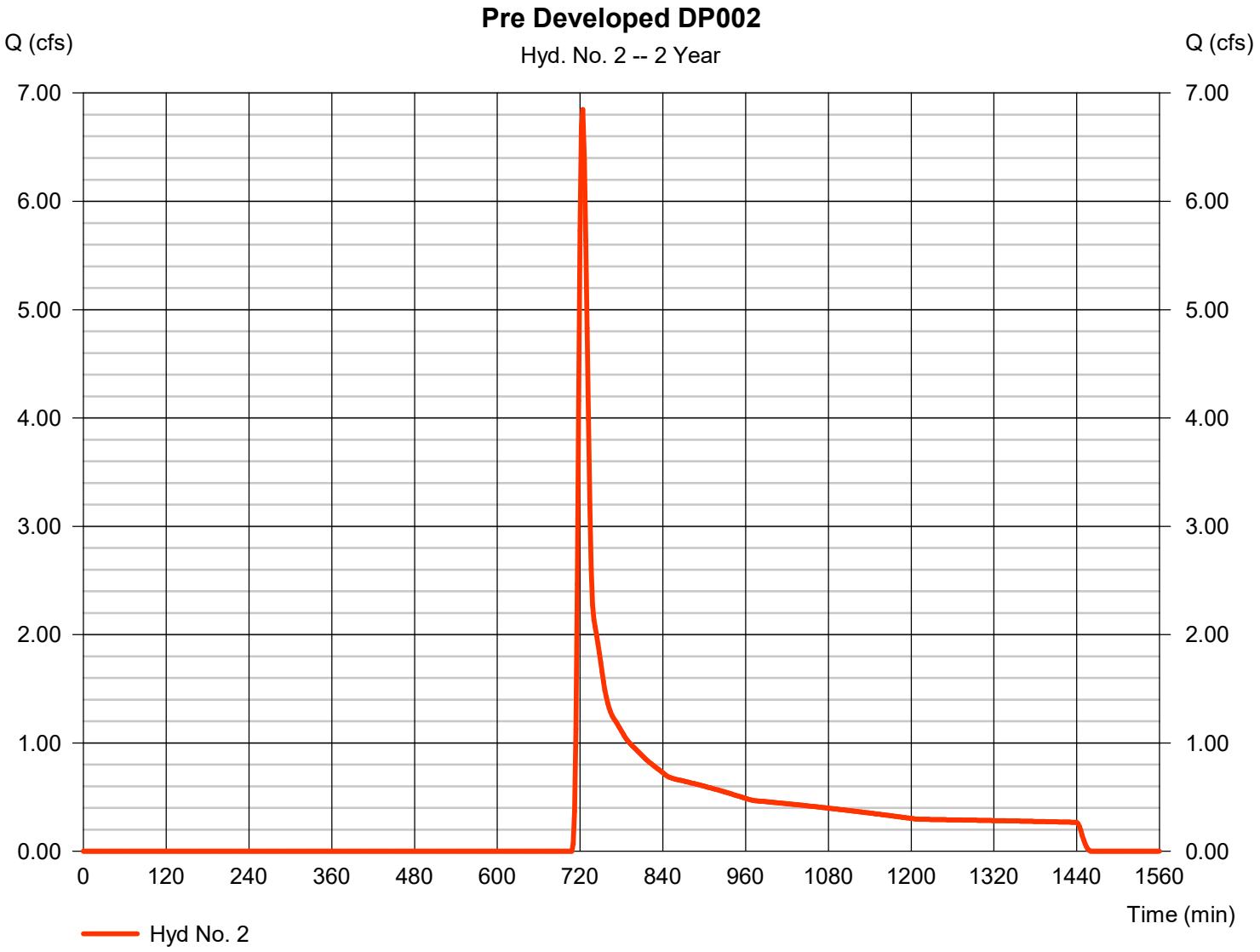


Hydrograph Report

Hyd. No. 2

Pre Developed DP002

Hydrograph type	=	SCS Runoff	Peak discharge	=	6.847 cfs
Storm frequency	=	2 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	27,873 cuft
Drainage area	=	19.210 ac	Curve number	=	59.4
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	12.00 min
Total precip.	=	3.20 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

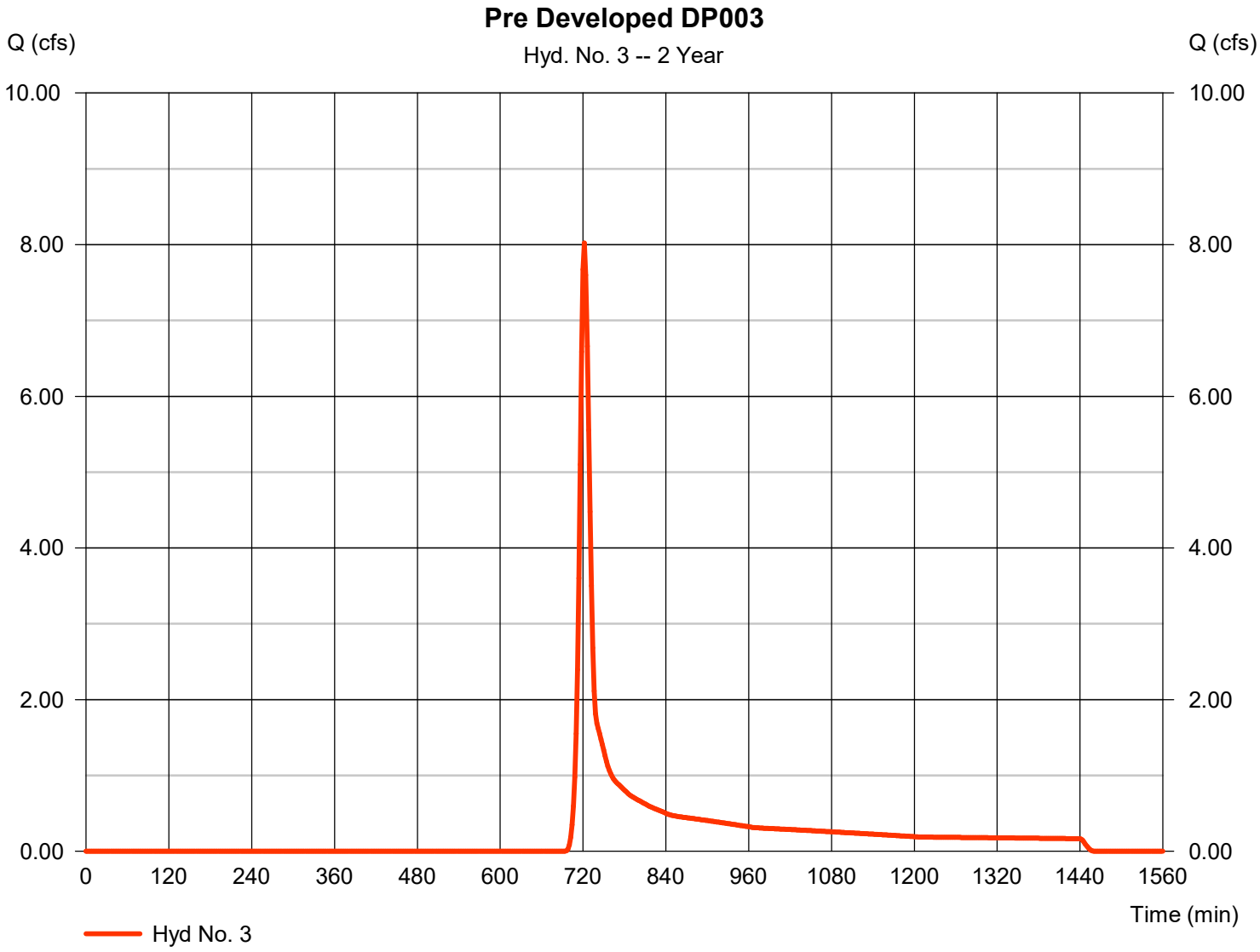


Hydrograph Report

Hyd. No. 3

Pre Developed DP003

Hydrograph type	=	SCS Runoff	Peak discharge	=	8.022 cfs
Storm frequency	=	2 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	22,888 cuft
Drainage area	=	8.190 ac	Curve number	=	68.3
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	11.00 min
Total precip.	=	3.20 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

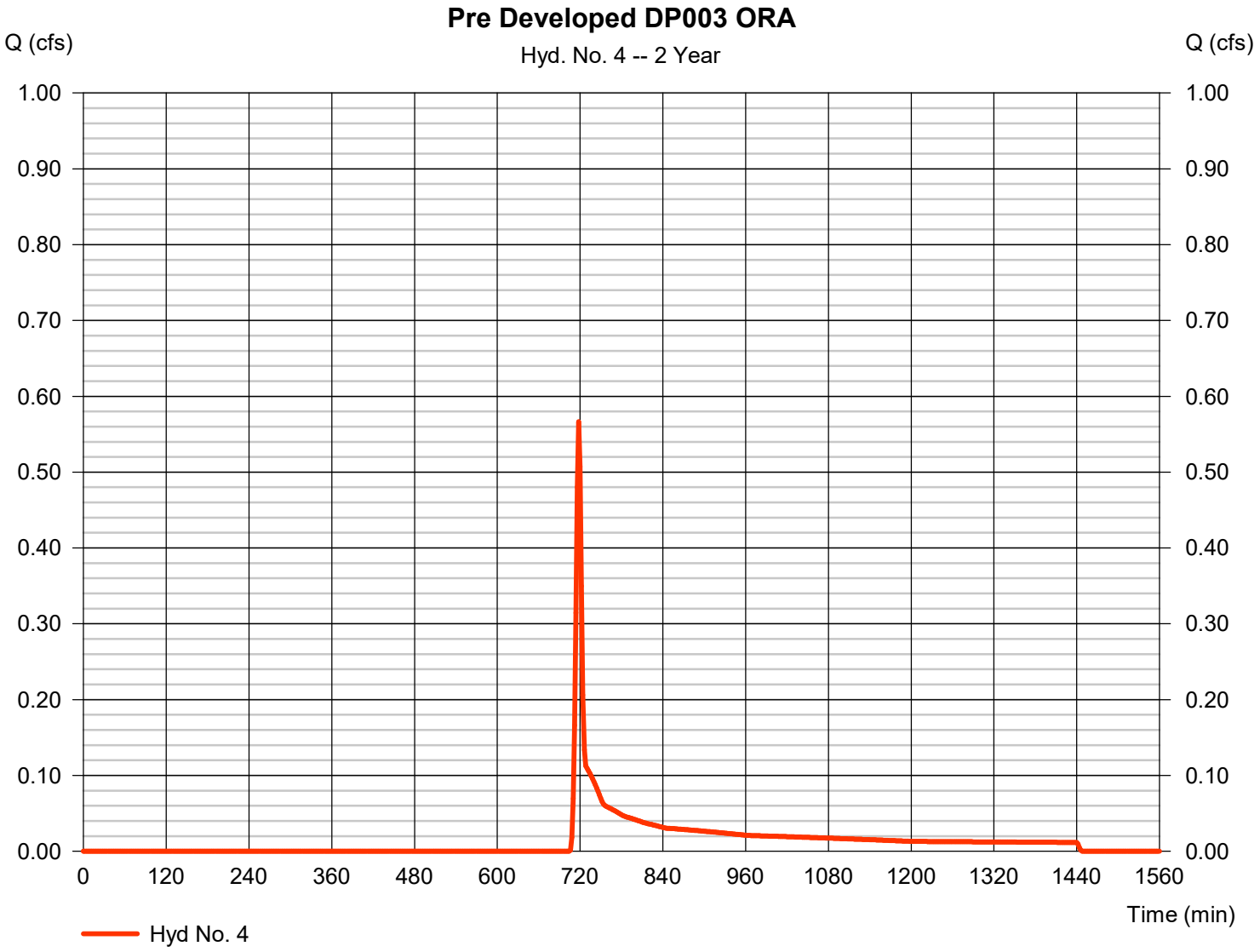


Hydrograph Report

Hyd. No. 4

Pre Developed DP003 ORA

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.566 cfs
Storm frequency	=	2 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	1,326 cuft
Drainage area	=	0.810 ac	Curve number	=	62
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.20 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

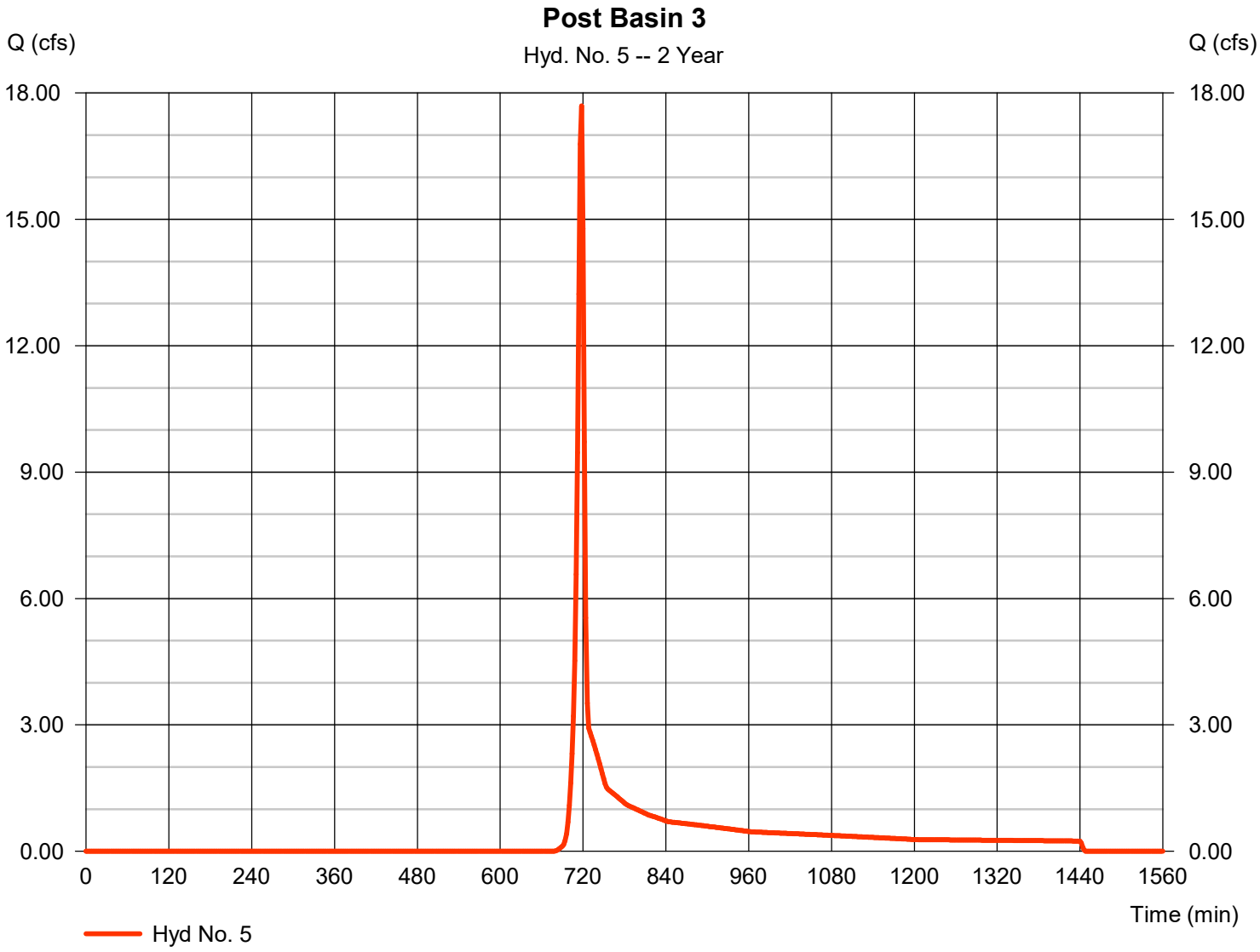


Hydrograph Report

Hyd. No. 5

Post Basin 3

Hydrograph type	=	SCS Runoff	Peak discharge	=	17.70 cfs
Storm frequency	=	2 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	35,889 cuft
Drainage area	=	12.150 ac	Curve number	=	70.8
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.20 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



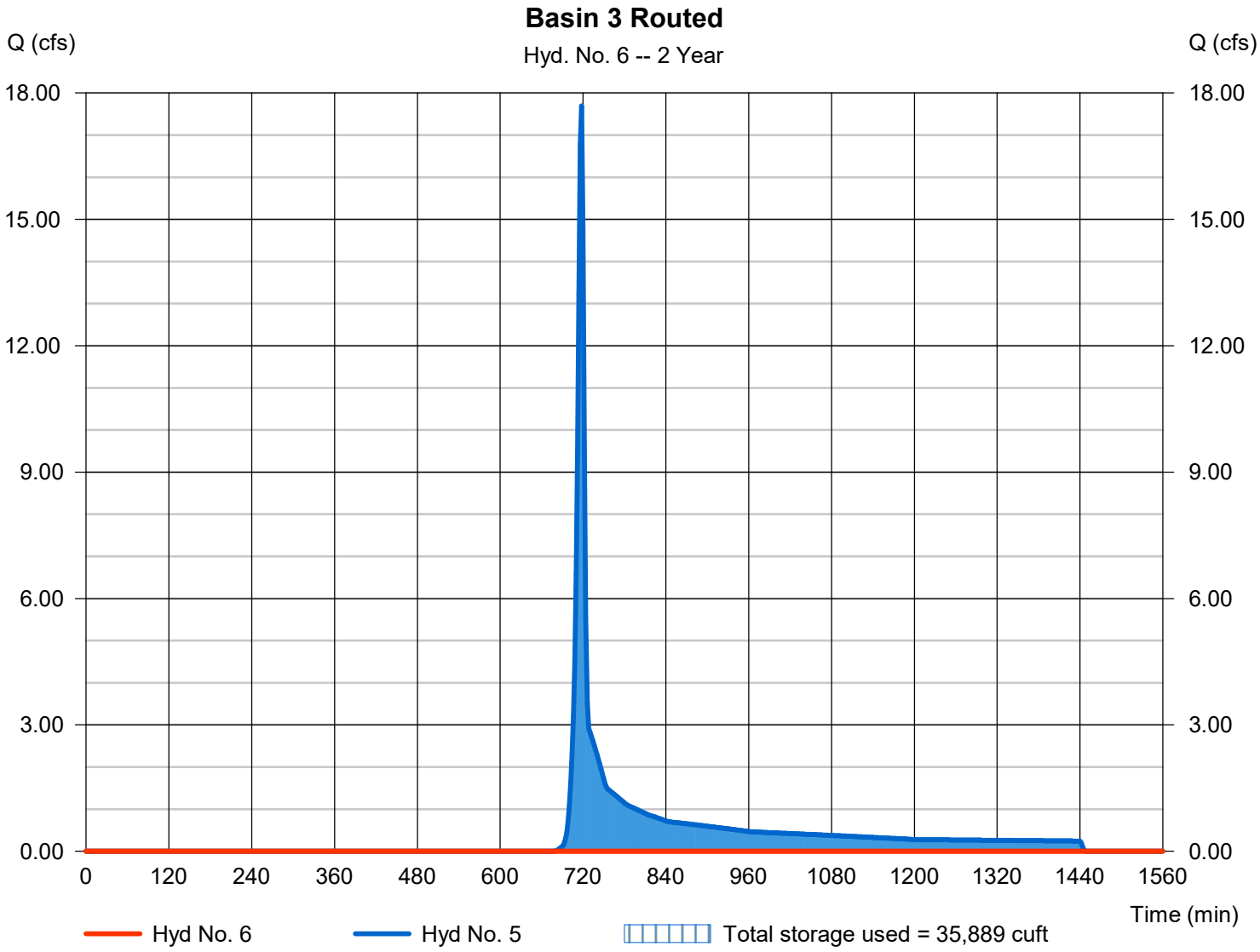
Hydrograph Report

Hyd. No. 6

Basin 3 Routed

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	2 yrs	Time to peak	=	n/a
Time interval	=	2 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	5 - Post Basin 3	Max. Elevation	=	317.95 ft
Reservoir name	=	Basin 3	Max. Storage	=	35,889 cuft

Storage Indication method used.

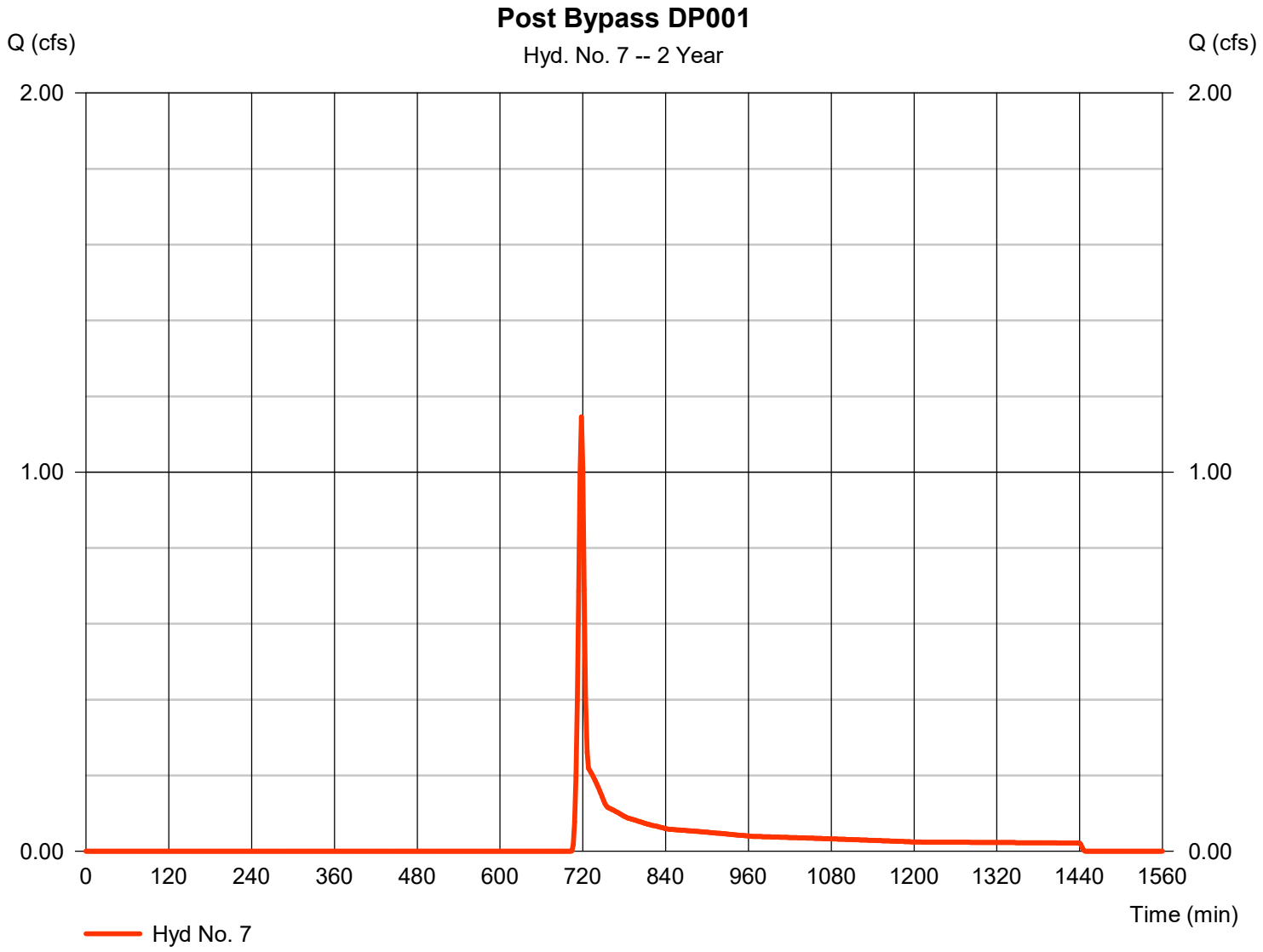


Hydrograph Report

Hyd. No. 7

Post Bypass DP001

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.146 cfs
Storm frequency	=	2 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	2,583 cuft
Drainage area	=	1.440 ac	Curve number	=	63.2
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.20 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

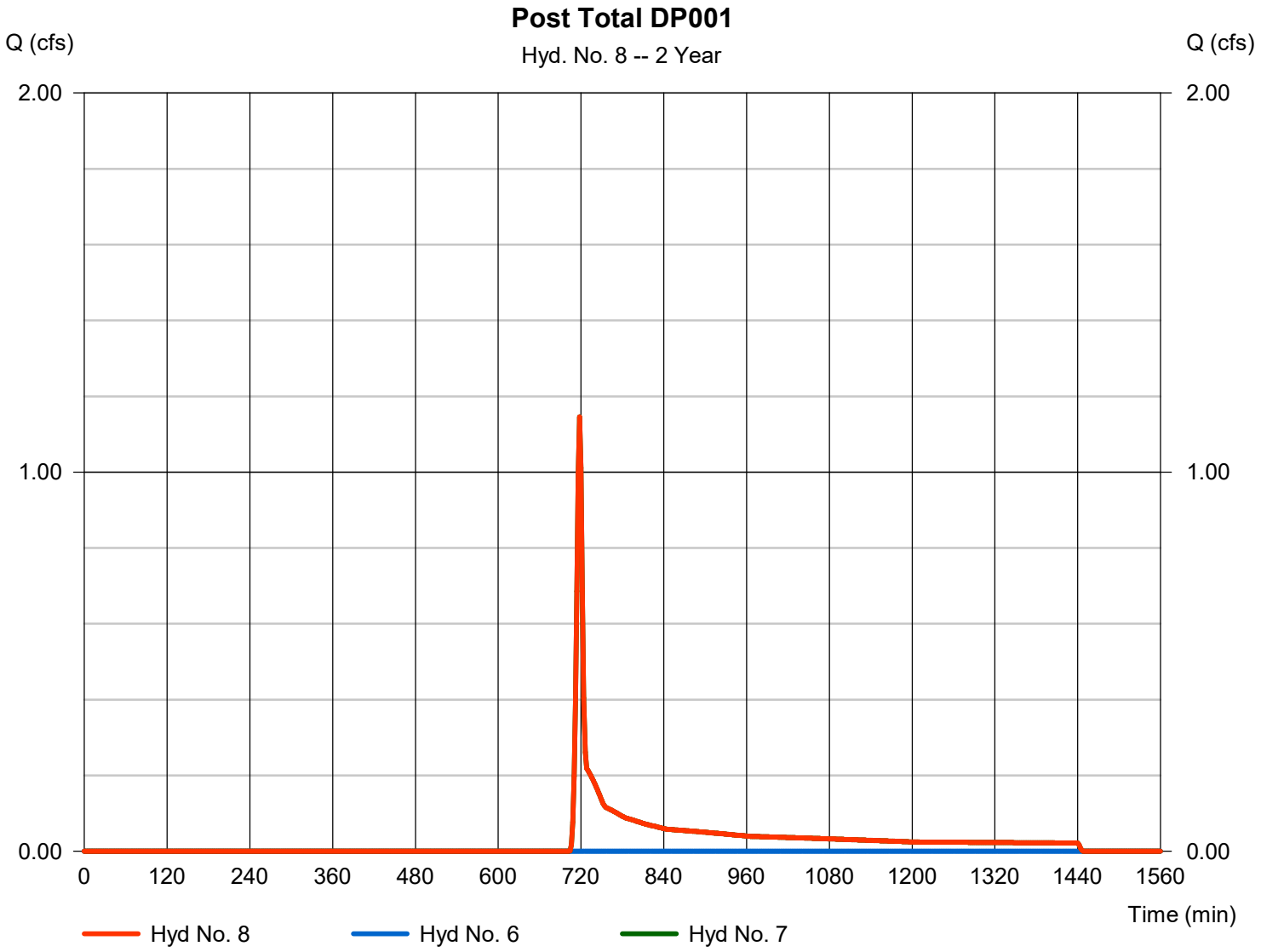


Hydrograph Report

Hyd. No. 8

Post Total DP001

Hydrograph type	= Combine	Peak discharge	= 1.146 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 2,583 cuft
Inflow hyds.	= 6, 7	Contrib. drain. area	= 1.440 ac

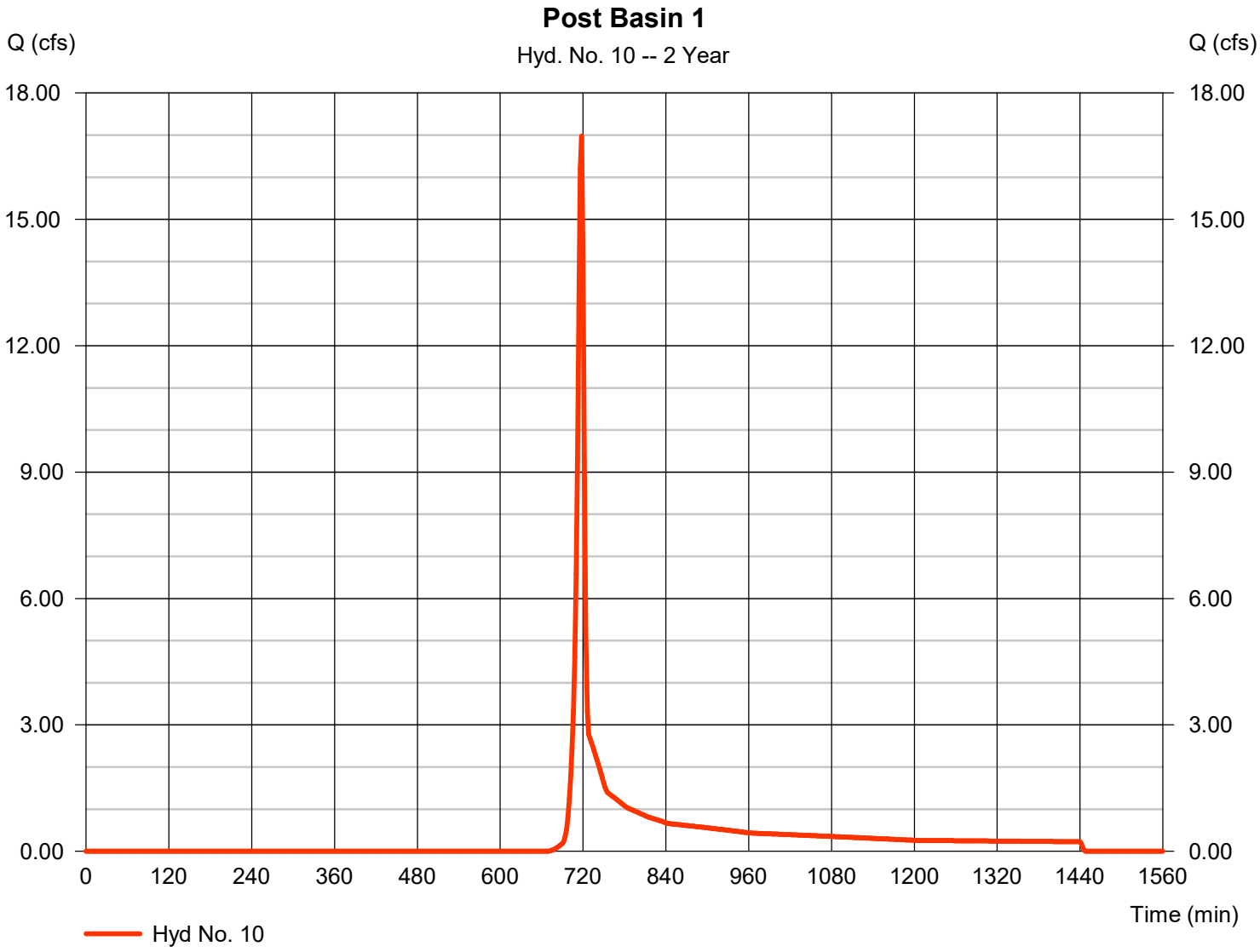


Hydrograph Report

Hyd. No. 10

Post Basin 1

Hydrograph type	=	SCS Runoff	Peak discharge	=	16.97 cfs
Storm frequency	=	2 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	34,254 cuft
Drainage area	=	10.950 ac	Curve number	=	71.8
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.20 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



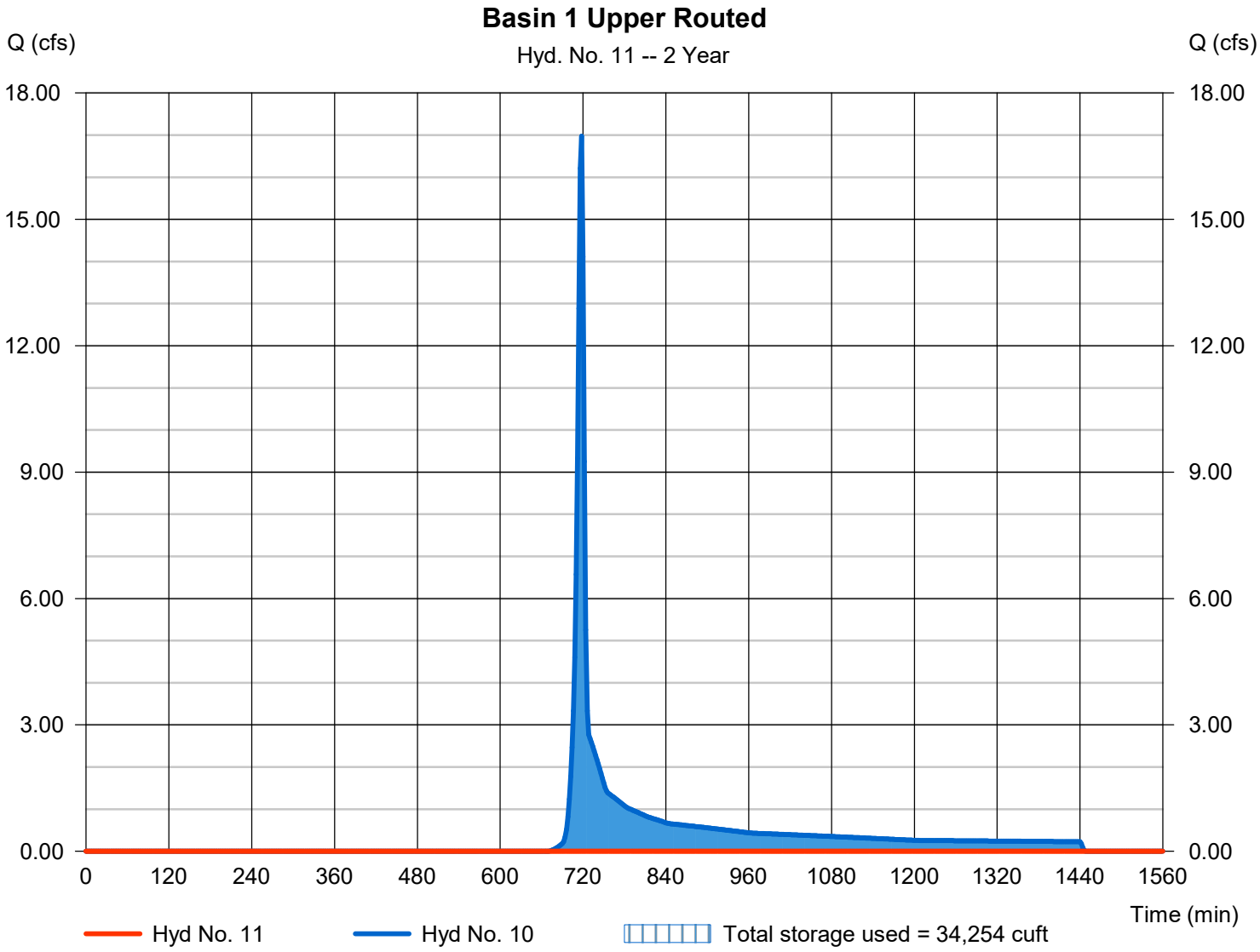
Hydrograph Report

Hyd. No. 11

Basin 1 Upper Routed

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	2 yrs	Time to peak	=	n/a
Time interval	=	2 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	10 - Post Basin 1	Max. Elevation	=	322.23 ft
Reservoir name	=	Basin 1 Upper	Max. Storage	=	34,254 cuft

Storage Indication method used.



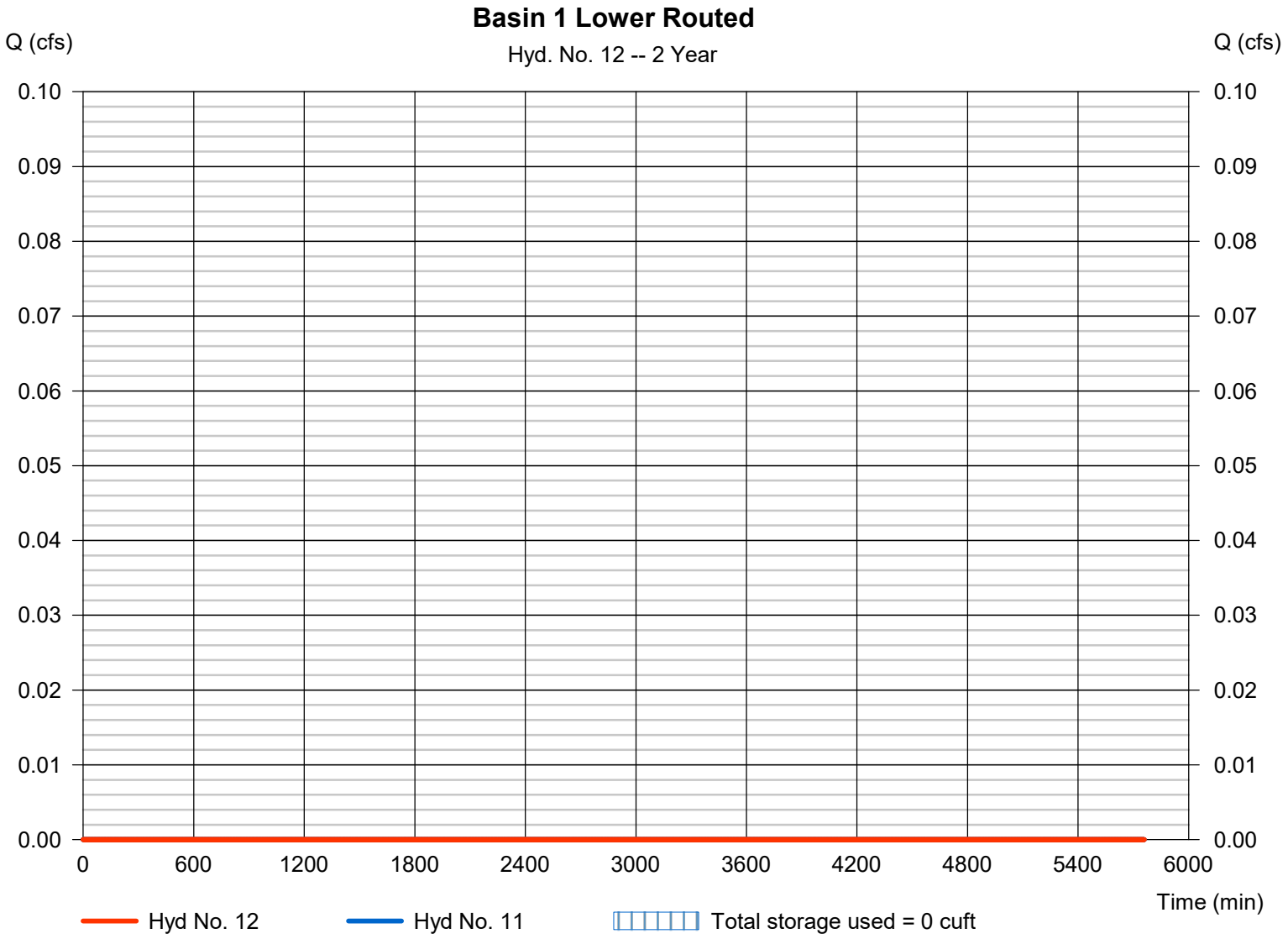
Hydrograph Report

Hyd. No. 12

Basin 1 Lower Routed

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	2 yrs	Time to peak	=	n/a
Time interval	=	2 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	11 - Basin 1 Upper Routed	Max. Elevation	=	302.20 ft
Reservoir name	=	Basin 1 Lower	Max. Storage	=	0 cuft

Storage Indication method used.

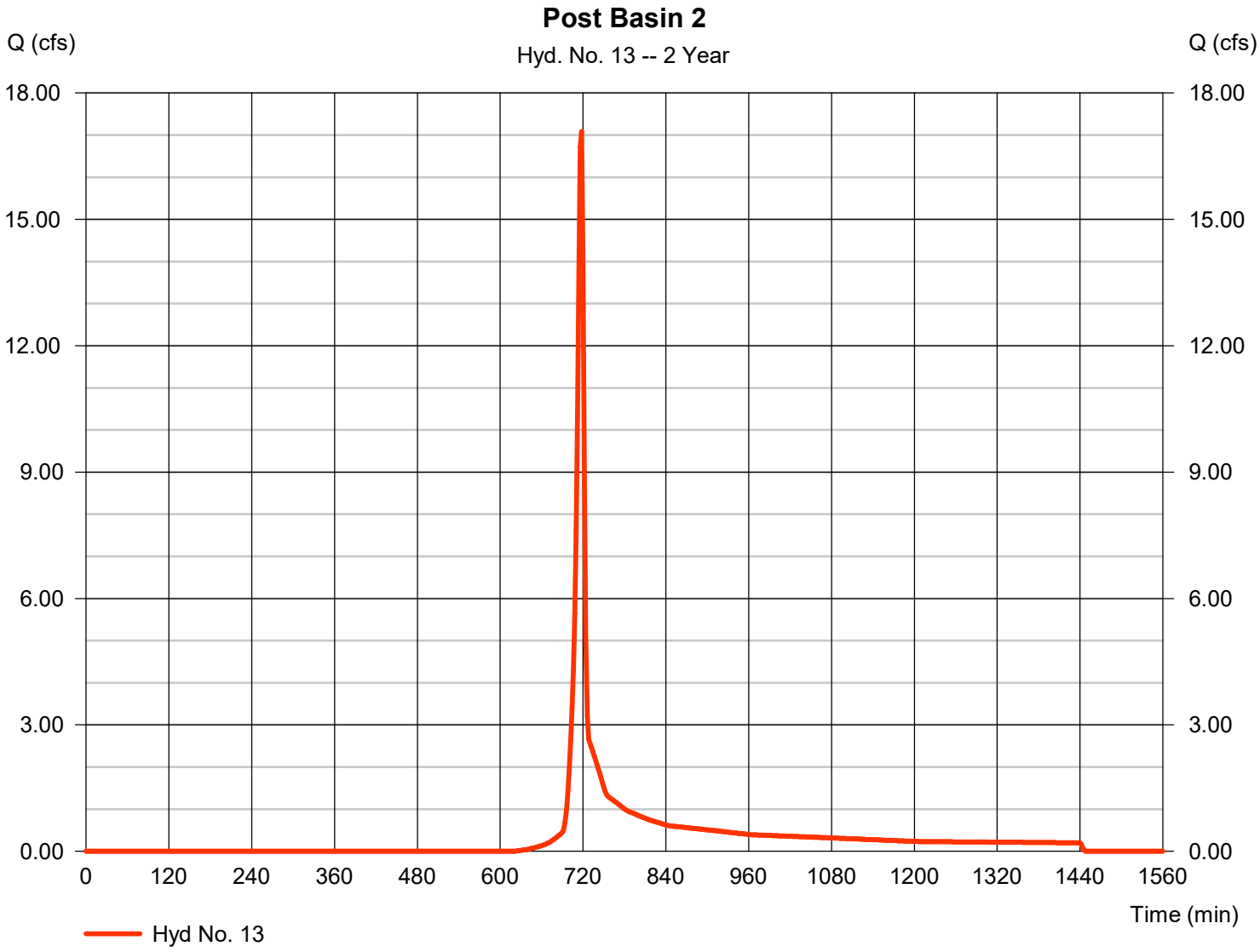


Hydrograph Report

Hyd. No. 13

Post Basin 2

Hydrograph type	=	SCS Runoff	Peak discharge	=	17.09 cfs
Storm frequency	=	2 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	34,170 cuft
Drainage area	=	8.540 ac	Curve number	=	76.4
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.20 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



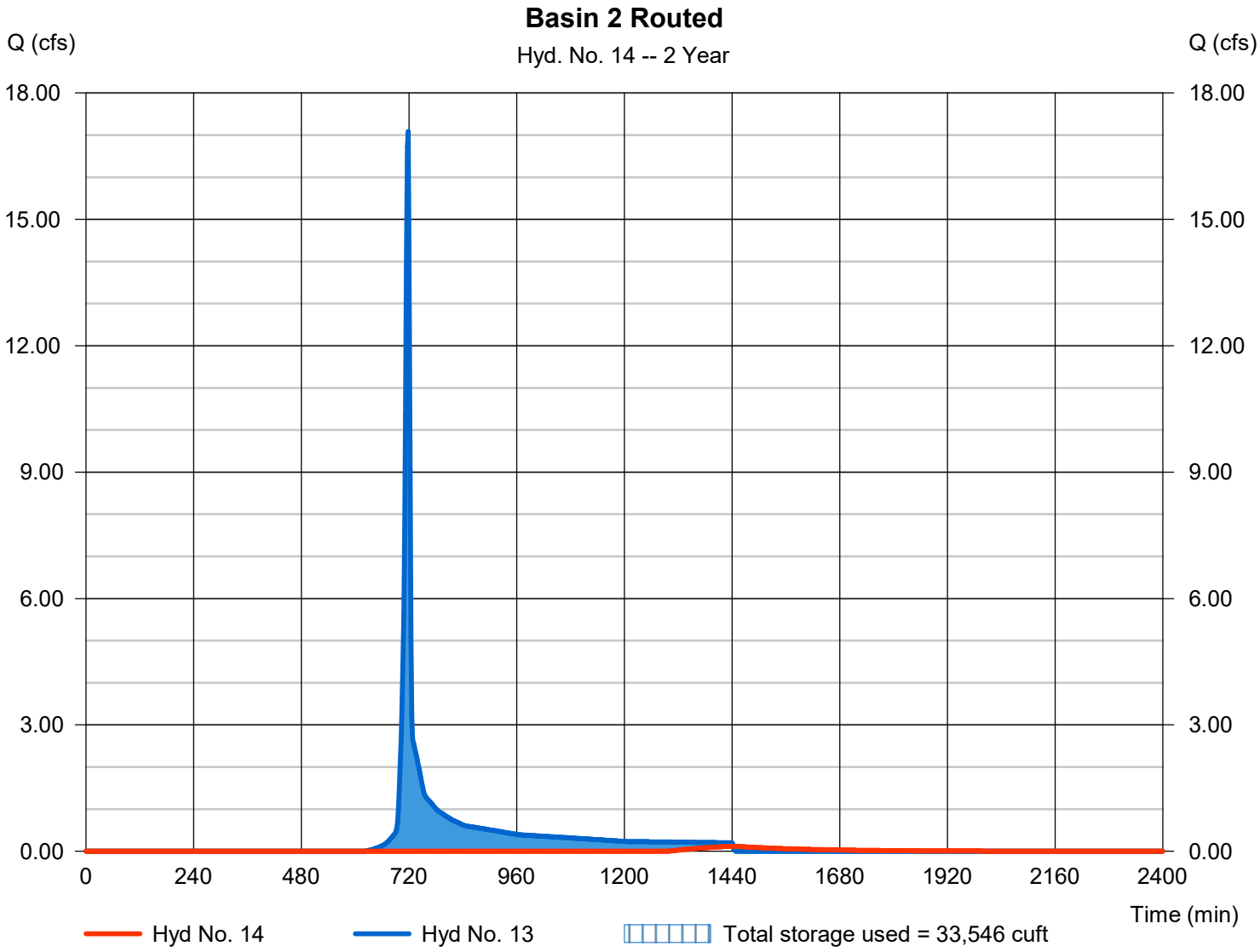
Hydrograph Report

Hyd. No. 14

Basin 2 Routed

Hydrograph type	=	Reservoir	Peak discharge	=	0.120 cfs
Storm frequency	=	2 yrs	Time to peak	=	1444 min
Time interval	=	2 min	Hyd. volume	=	1,815 cuft
Inflow hyd. No.	=	13 - Post Basin 2	Max. Elevation	=	308.88 ft
Reservoir name	=	Basin 2	Max. Storage	=	33,546 cuft

Storage Indication method used.

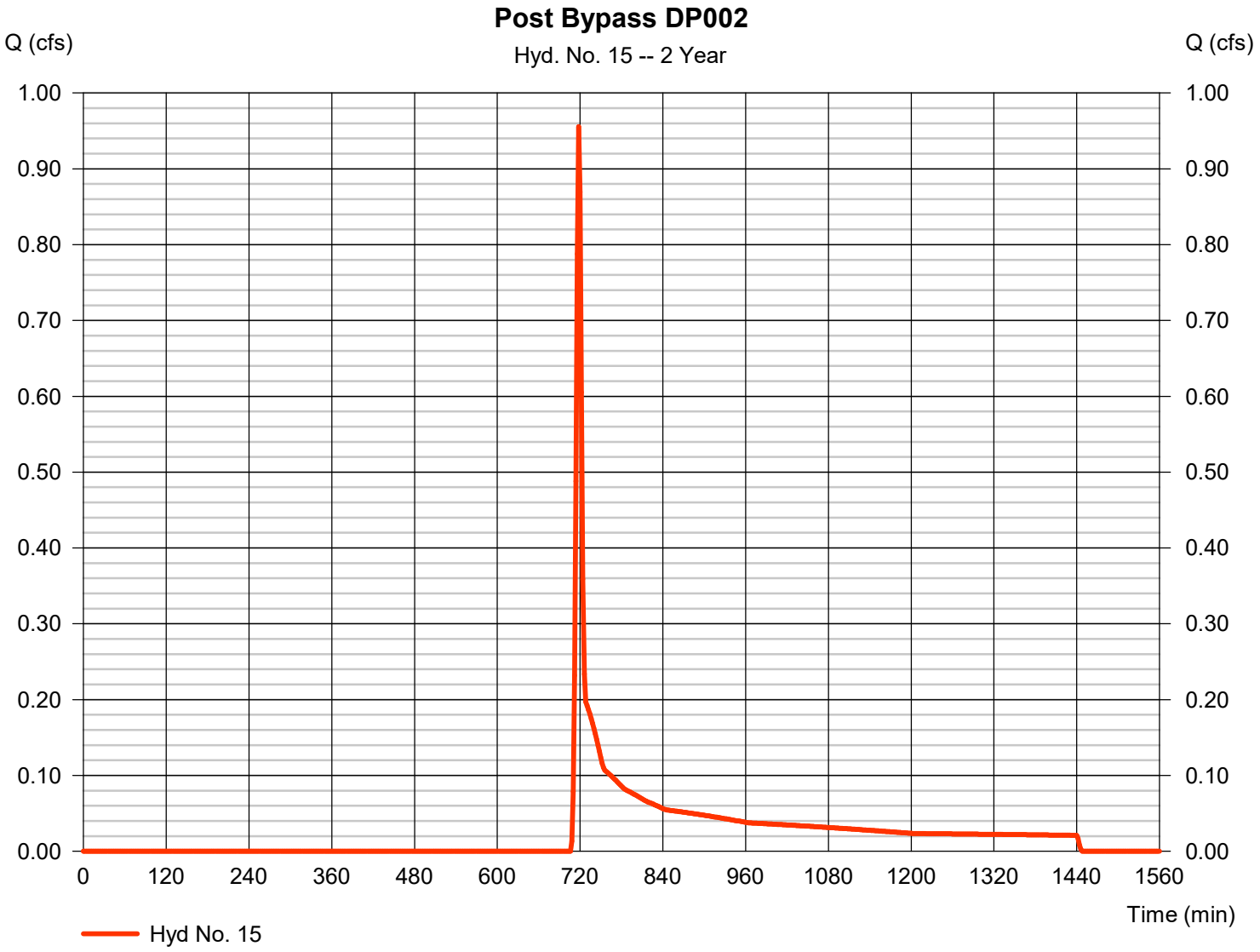


Hydrograph Report

Hyd. No. 15

Post Bypass DP002

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.956 cfs
Storm frequency	=	2 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	2,327 cuft
Drainage area	=	1.540 ac	Curve number	=	61
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.20 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

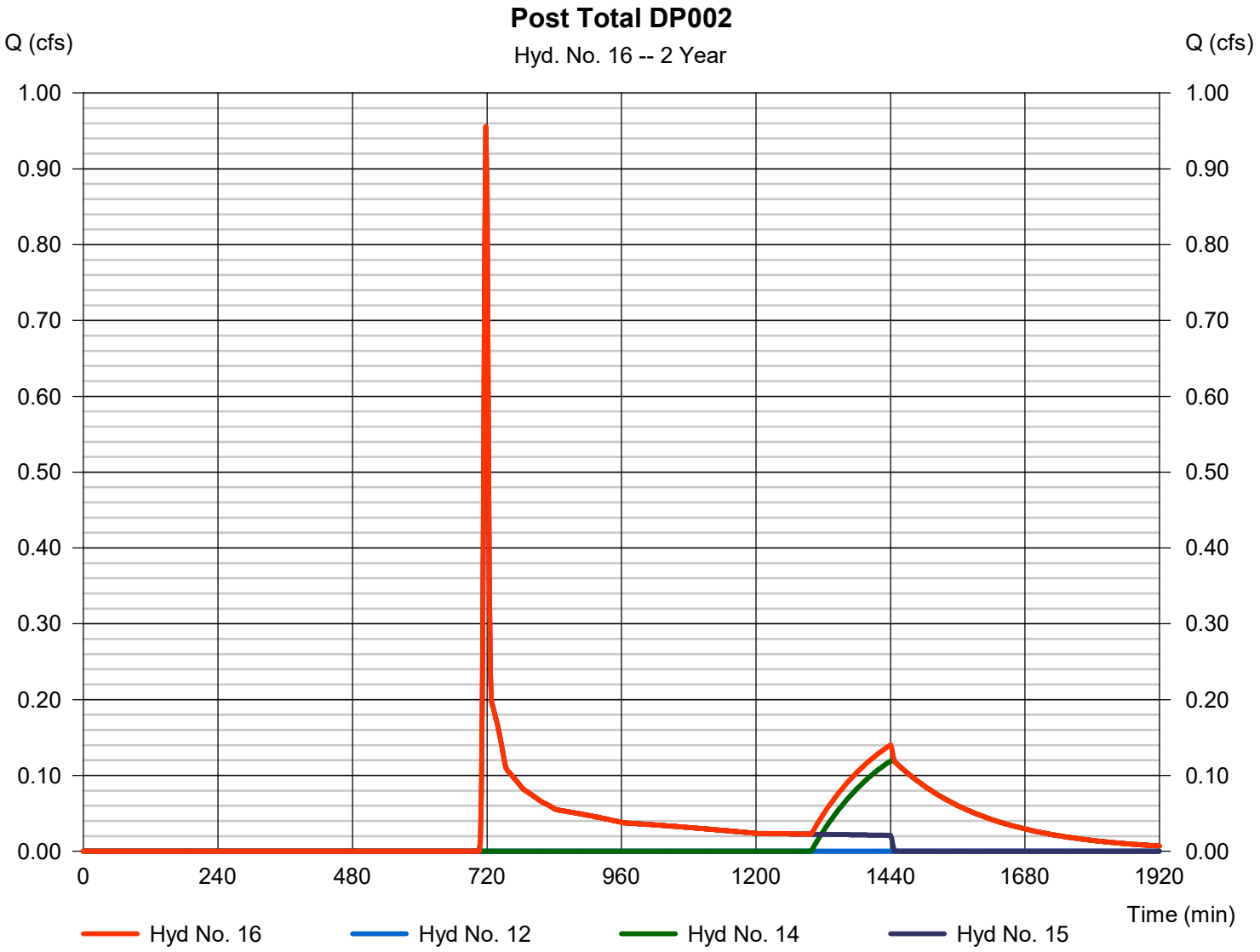


Hydrograph Report

Hyd. No. 16

Post Total DP002

Hydrograph type	= Combine	Peak discharge	= 0.956 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 4,142 cuft
Inflow hyds.	= 12, 14, 15	Contrib. drain. area	= 1.540 ac



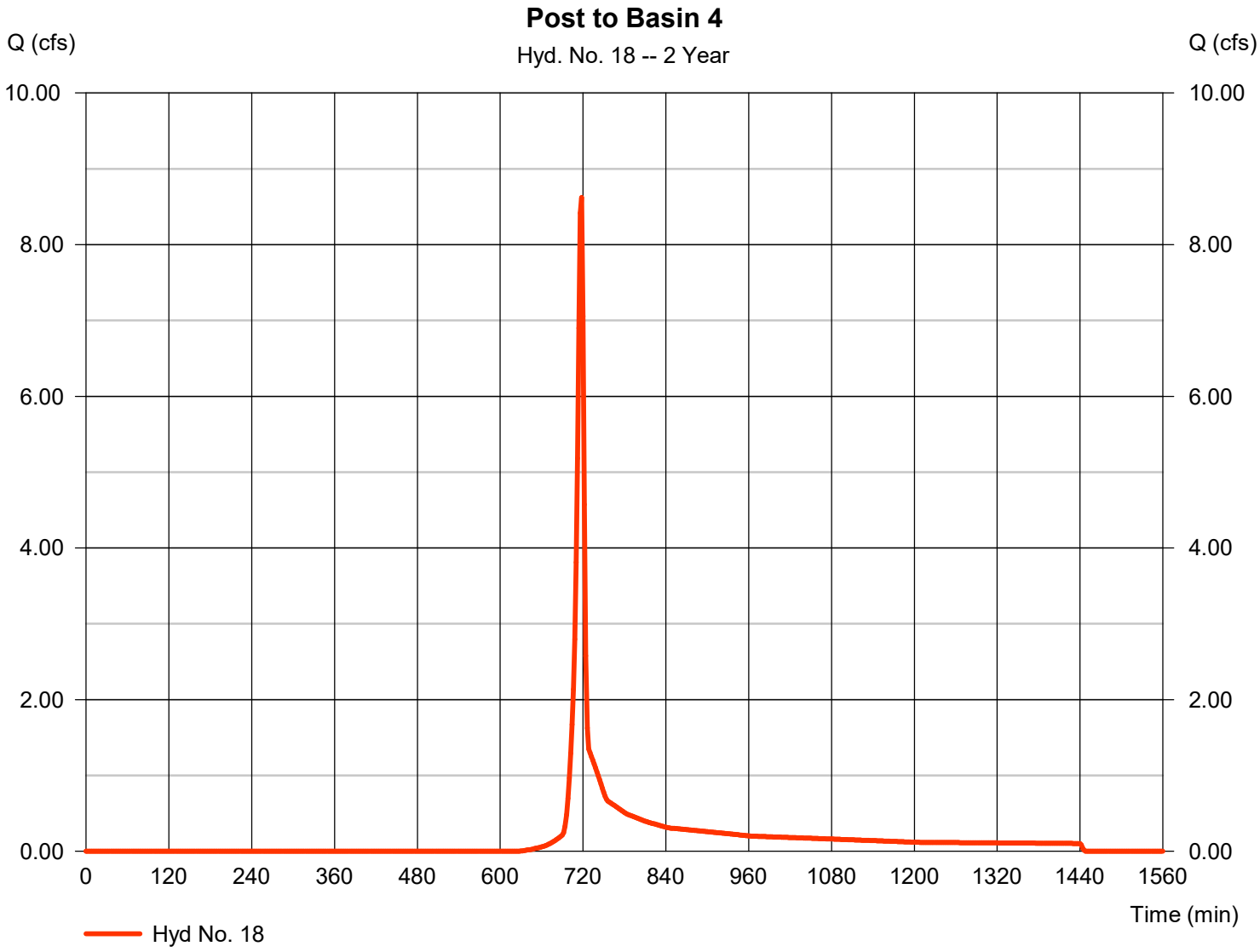
Hydrograph Report

Hyd. No. 18

Post to Basin 4

Hydrograph type	=	SCS Runoff	Peak discharge	=	8.620 cfs
Storm frequency	=	2 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	17,240 cuft
Drainage area	=	4.420 ac	Curve number	=	75.9*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.20 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.910 x 61) + (2.270 x 98) + (3.040 x 78)] / 4.420



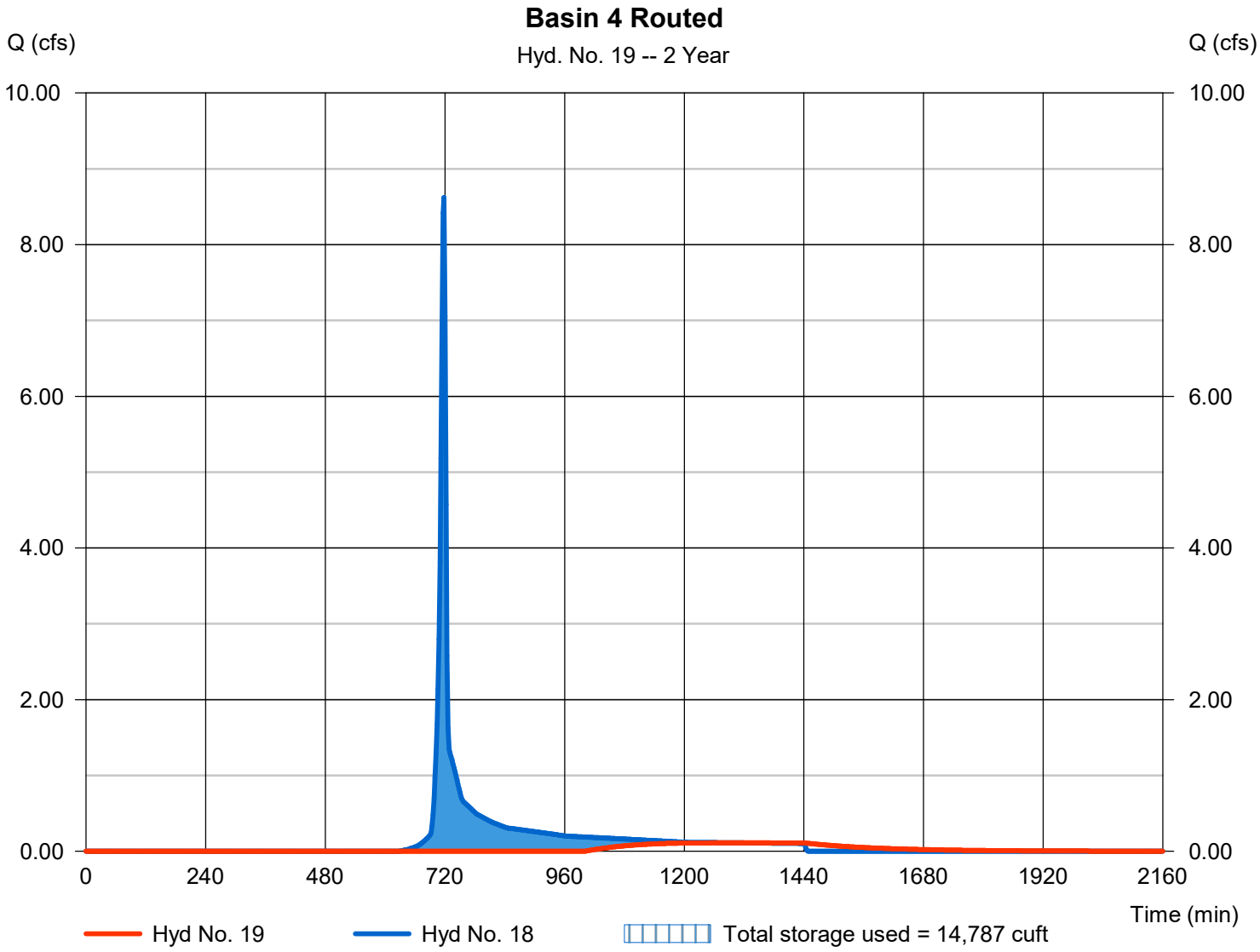
Hydrograph Report

Hyd. No. 19

Basin 4 Routed

Hydrograph type	=	Reservoir	Peak discharge	=	0.111 cfs
Storm frequency	=	2 yrs	Time to peak	=	1308 min
Time interval	=	2 min	Hyd. volume	=	3,441 cuft
Inflow hyd. No.	=	18 - Post to Basin 4	Max. Elevation	=	346.32 ft
Reservoir name	=	Basin 4	Max. Storage	=	14,787 cuft

Storage Indication method used.



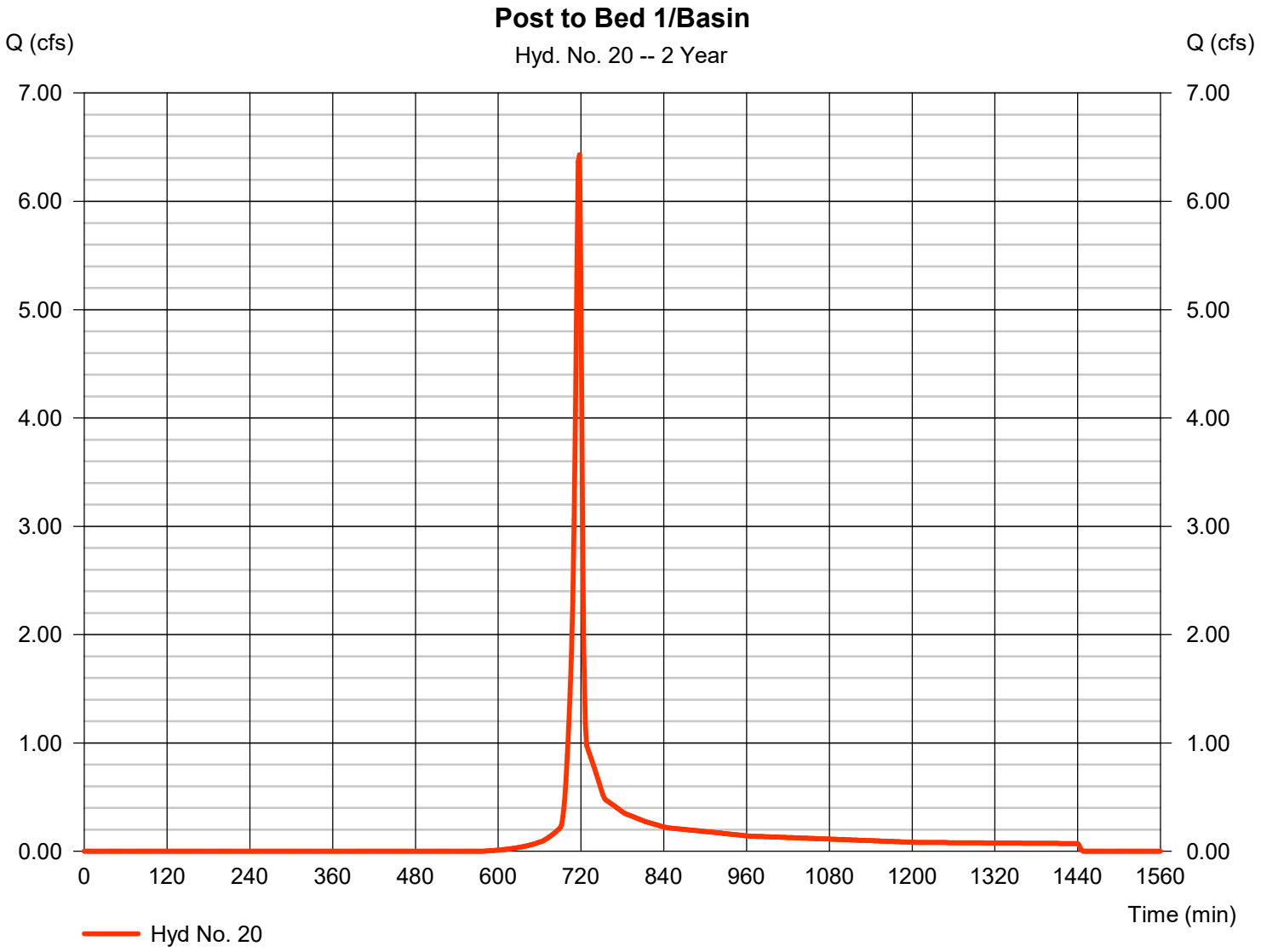
Hydrograph Report

Hyd. No. 20

Post to Bed 1/Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	6.430 cfs
Storm frequency	=	2 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	12,890 cuft
Drainage area	=	2.820 ac	Curve number	=	79.1*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.20 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.910 x 61) + (2.270 x 98) + (3.040 x 78)] / 2.820



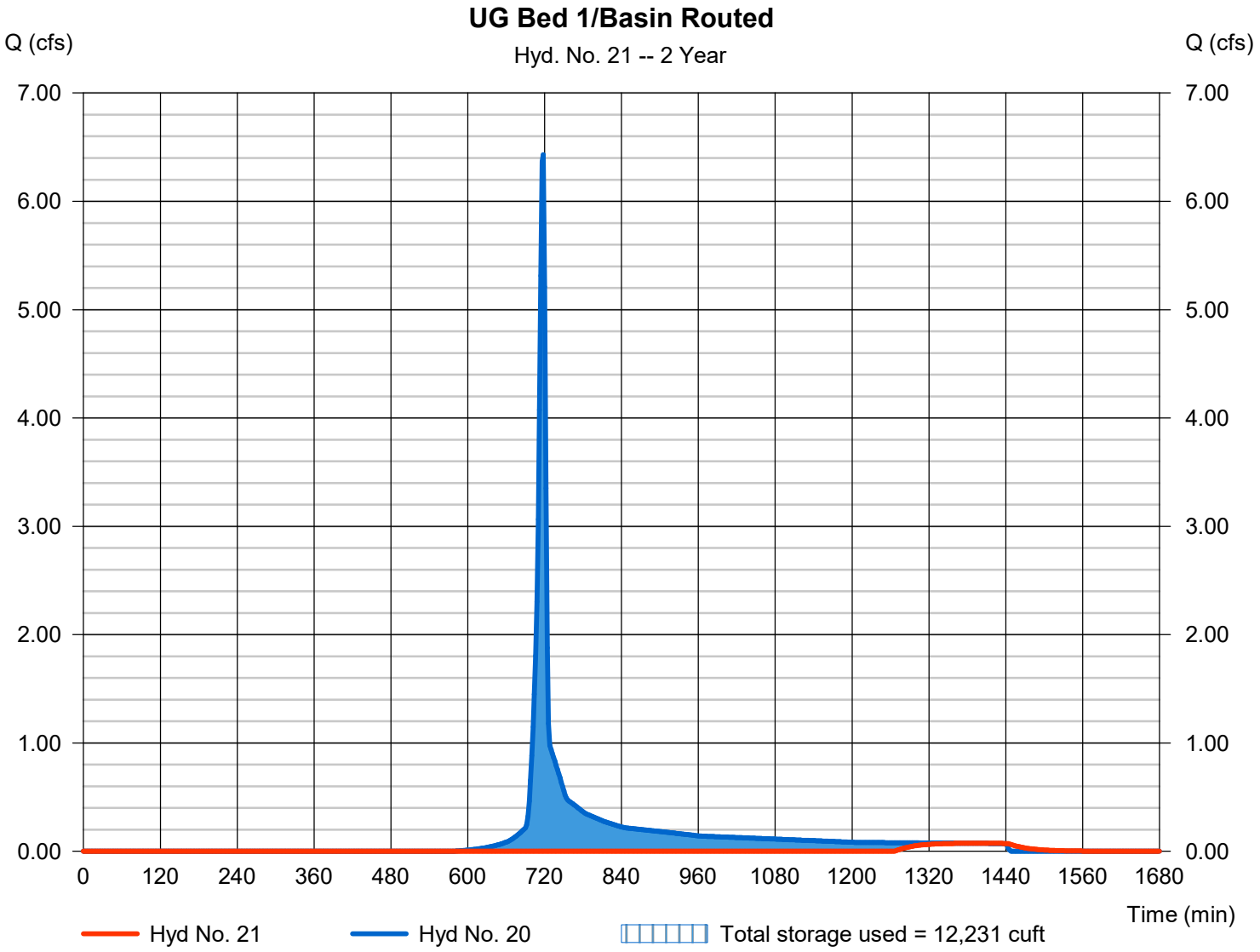
Hydrograph Report

Hyd. No. 21

UG Bed 1/Basin Routed

Hydrograph type	=	Reservoir	Peak discharge	=	0.073 cfs
Storm frequency	=	2 yrs	Time to peak	=	1390 min
Time interval	=	2 min	Hyd. volume	=	793 cuft
Inflow hyd. No.	=	20 - Post to Bed 1/Basin	Max. Elevation	=	340.23 ft
Reservoir name	=	UG Bed 1/Basin	Max. Storage	=	12,231 cuft

Storage Indication method used.

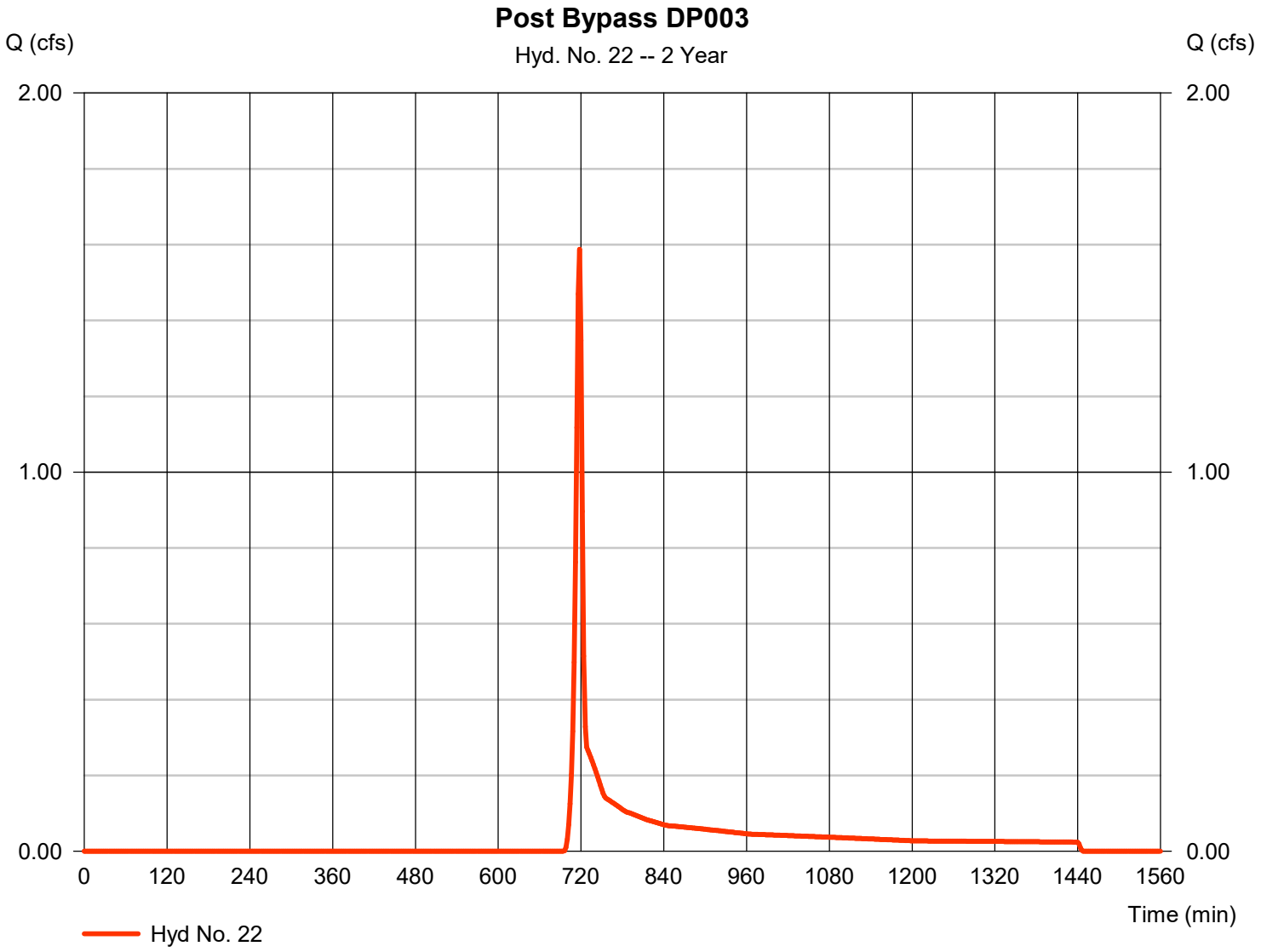


Hydrograph Report

Hyd. No. 22

Post Bypass DP003

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.588 cfs
Storm frequency	=	2 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	3,299 cuft
Drainage area	=	1.340 ac	Curve number	=	67.8
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.20 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

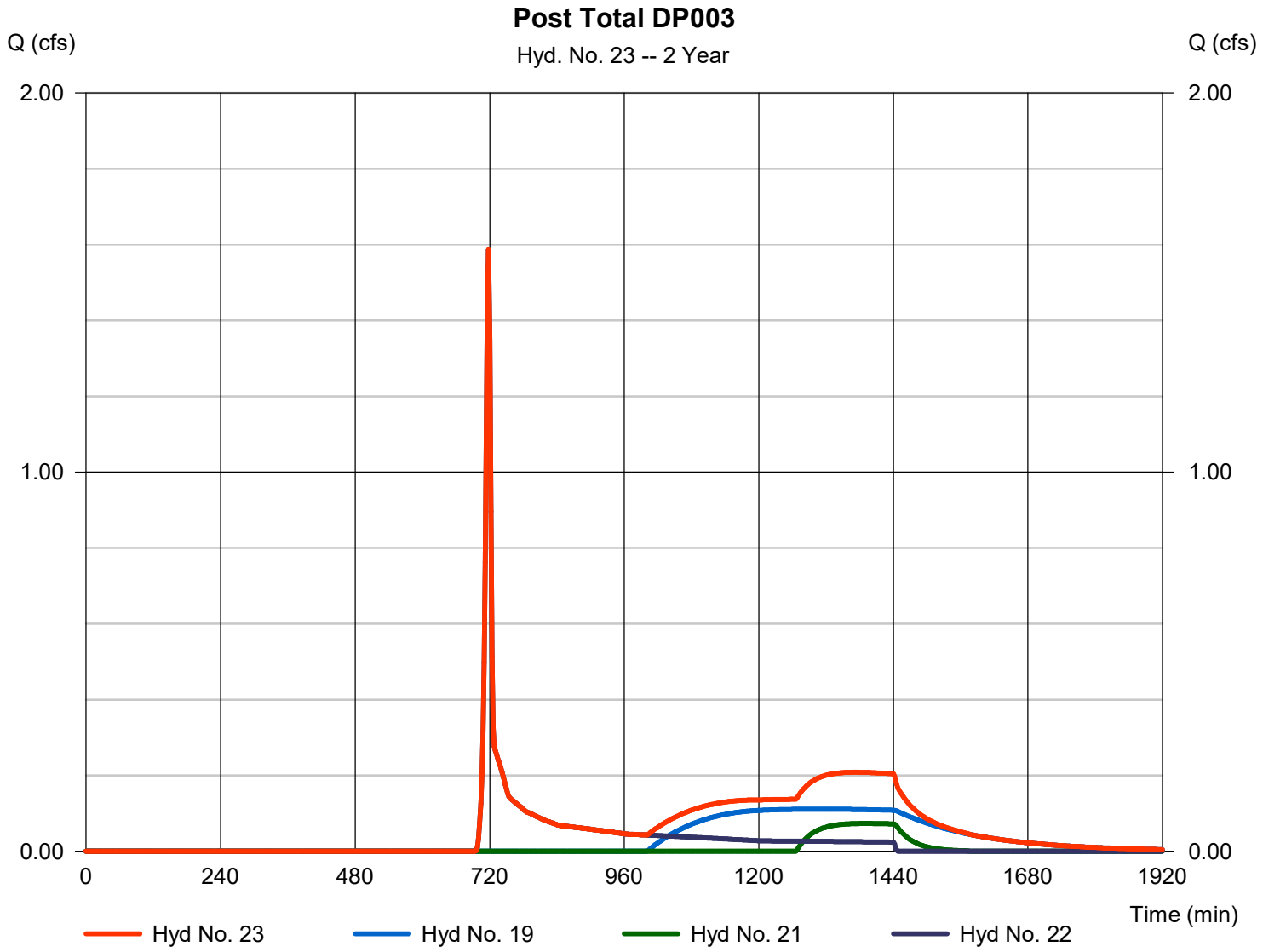


Hydrograph Report

Hyd. No. 23

Post Total DP003

Hydrograph type	=	Combine	Peak discharge	=	1.588 cfs
Storm frequency	=	2 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	7,533 cuft
Inflow hyds.	=	19, 21, 22	Contrib. drain. area	=	1.340 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

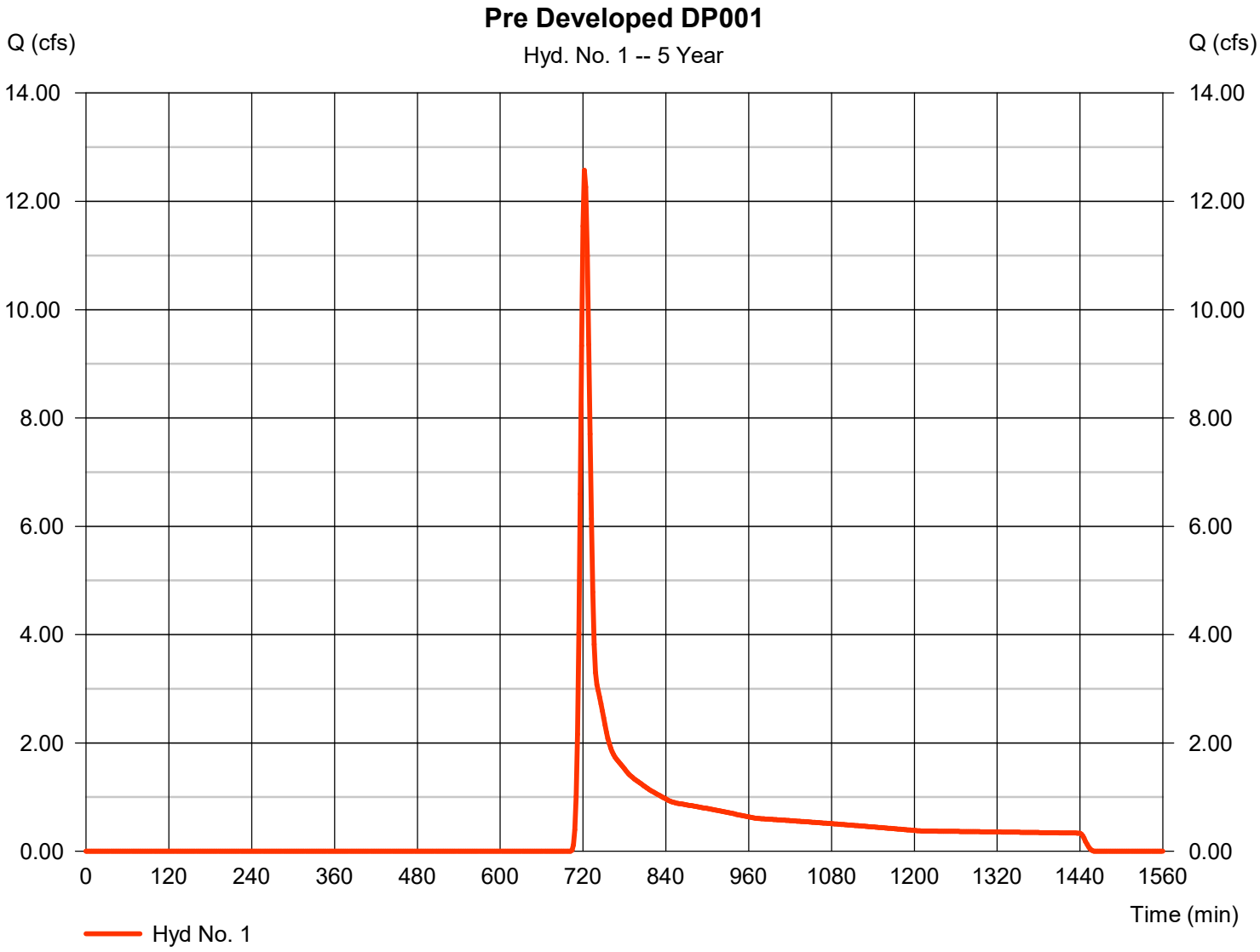
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	12.58	2	722	40,519	------	------	------	Pre Developed DP001
2	SCS Runoff	18.02	2	722	55,435	------	------	------	Pre Developed DP002
3	SCS Runoff	14.55	2	722	39,080	------	------	------	Pre Developed DP003
4	SCS Runoff	1.200	2	718	2,500	------	------	------	Pre Developed DP003 ORA
5	SCS Runoff	29.68	2	718	59,371	------	------	------	Post Basin 3
6	Reservoir	0.543	2	1094	13,903	5	318.49	47,347	Basin 3 Routed
7	SCS Runoff	2.314	2	718	4,767	------	------	------	Post Bypass DP001
8	Combine	2.314	2	718	18,670	6, 7	------	------	Post Total DP001
10	SCS Runoff	28.01	2	718	56,002	------	------	------	Post Basin 1
11	Reservoir	0.510	2	1086	18,513	10	322.71	43,189	Basin 1 Upper Routed
12	Reservoir	0.375	2	1362	12,317	11	304.32	8,514	Basin 1 Lower Routed
13	SCS Runoff	26.44	2	718	53,176	------	------	------	Post Basin 2
14	Reservoir	0.682	2	918	20,822	13	309.11	36,790	Basin 2 Routed
15	SCS Runoff	2.121	2	718	4,472	------	------	------	Post Bypass DP002
16	Combine	2.121	2	718	37,611	12, 14, 15	------	------	Post Total DP002
18	SCS Runoff	13.42	2	718	26,965	------	------	------	Post to Basin 4
19	Reservoir	0.503	2	830	13,166	18	346.54	16,497	Basin 4 Routed
20	SCS Runoff	9.677	2	716	19,544	------	------	------	Post to Bed 1/Basin
21	Reservoir	0.351	2	828	7,446	20	340.35	12,744	UG Bed 1/Basin Routed
22	SCS Runoff	2.821	2	718	5,670	------	------	------	Post Bypass DP003
23	Combine	2.821	2	718	26,283	19, 21, 22	------	------	Post Total DP003

Hydrograph Report

Hyd. No. 1

Pre Developed DP001

Hydrograph type	=	SCS Runoff	Peak discharge	=	12.58 cfs
Storm frequency	=	5 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	40,519 cuft
Drainage area	=	15.430 ac	Curve number	=	58
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	12.00 min
Total precip.	=	4.08 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

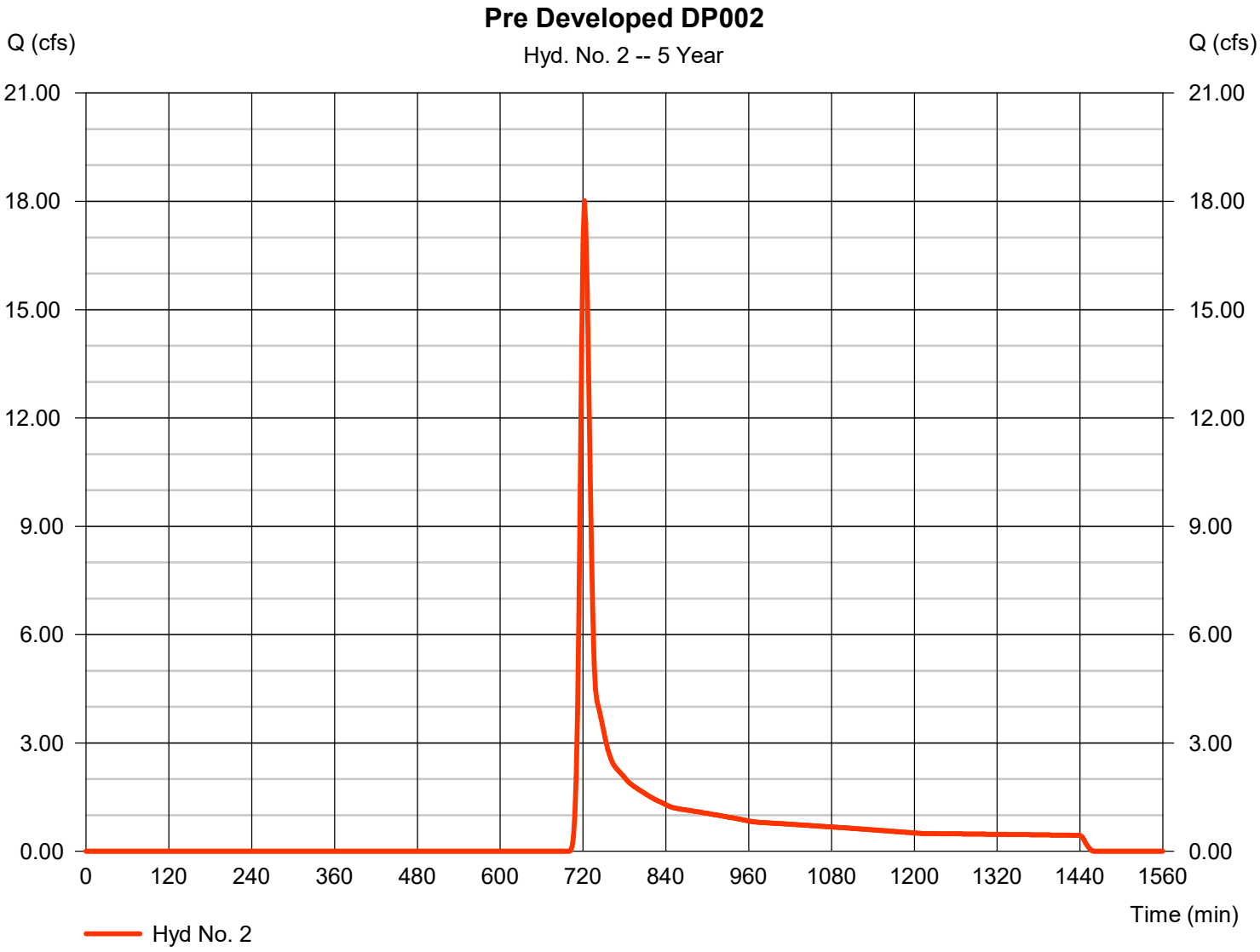


Hydrograph Report

Hyd. No. 2

Pre Developed DP002

Hydrograph type	= SCS Runoff	Peak discharge	= 18.02 cfs
Storm frequency	= 5 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 55,435 cuft
Drainage area	= 19.210 ac	Curve number	= 59.4
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.00 min
Total precip.	= 4.08 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

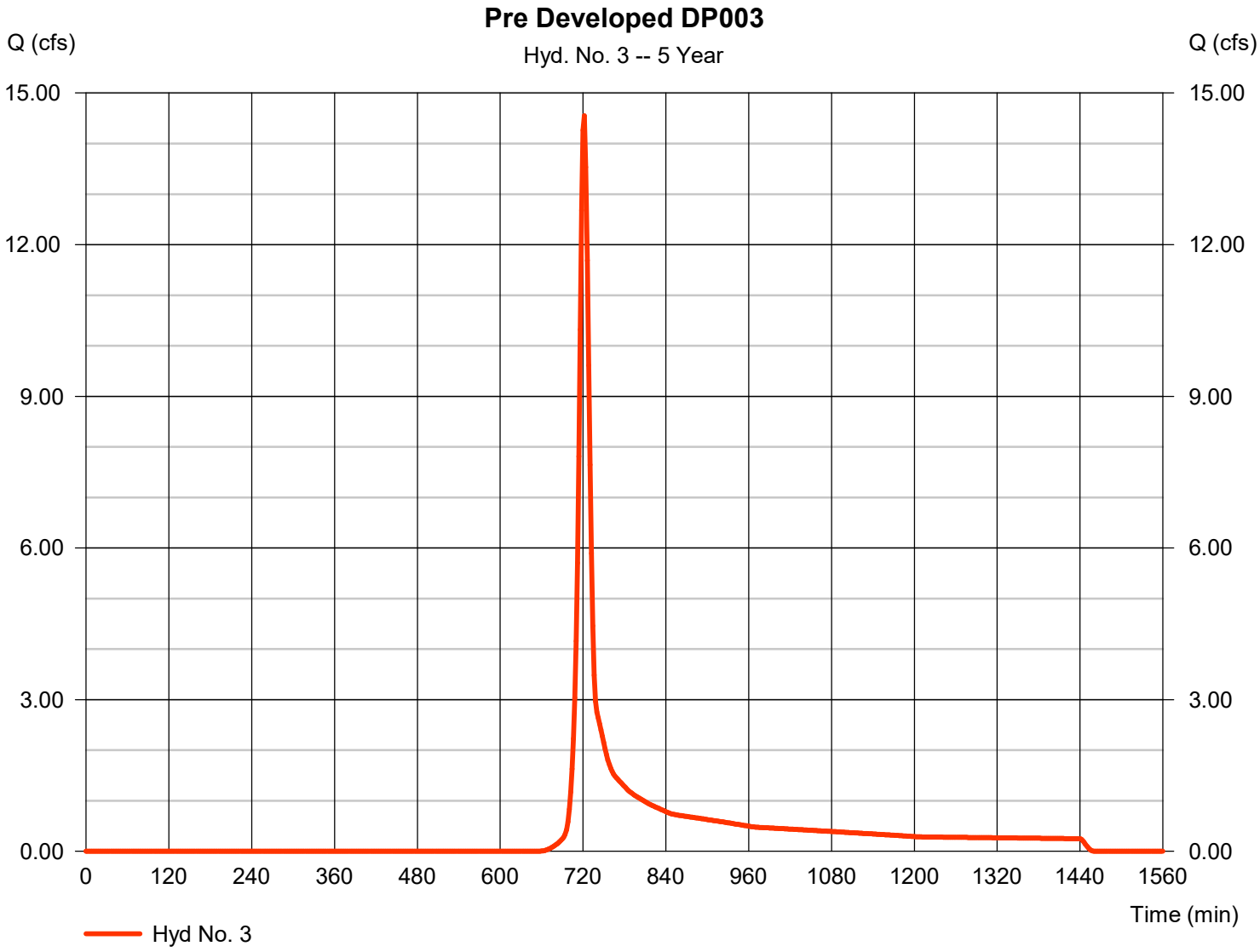


Hydrograph Report

Hyd. No. 3

Pre Developed DP003

Hydrograph type	=	SCS Runoff	Peak discharge	=	14.55 cfs
Storm frequency	=	5 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	39,080 cuft
Drainage area	=	8.190 ac	Curve number	=	68.3
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	11.00 min
Total precip.	=	4.08 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

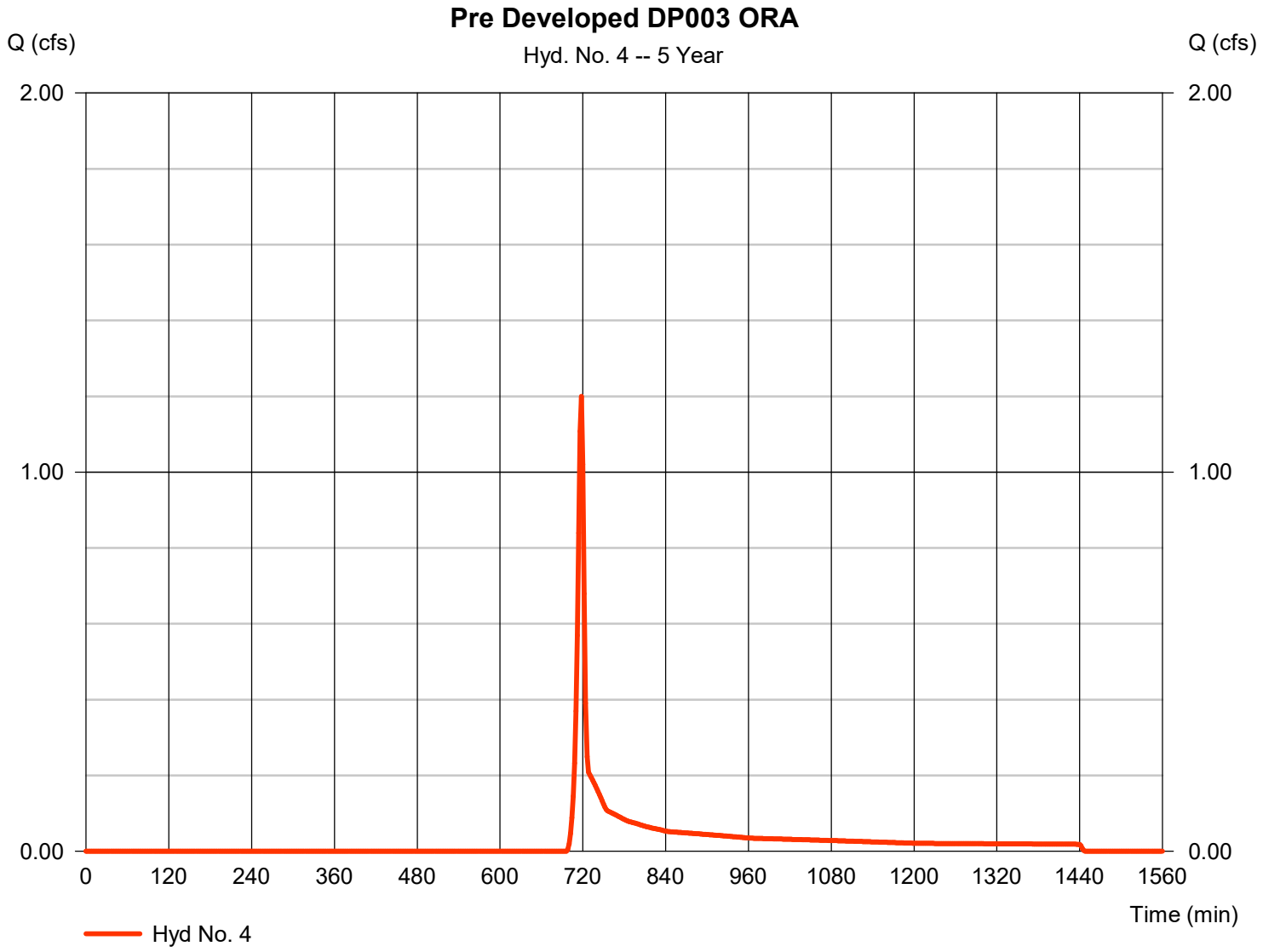


Hydrograph Report

Hyd. No. 4

Pre Developed DP003 ORA

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.200 cfs
Storm frequency	=	5 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	2,500 cuft
Drainage area	=	0.810 ac	Curve number	=	62
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	4.08 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

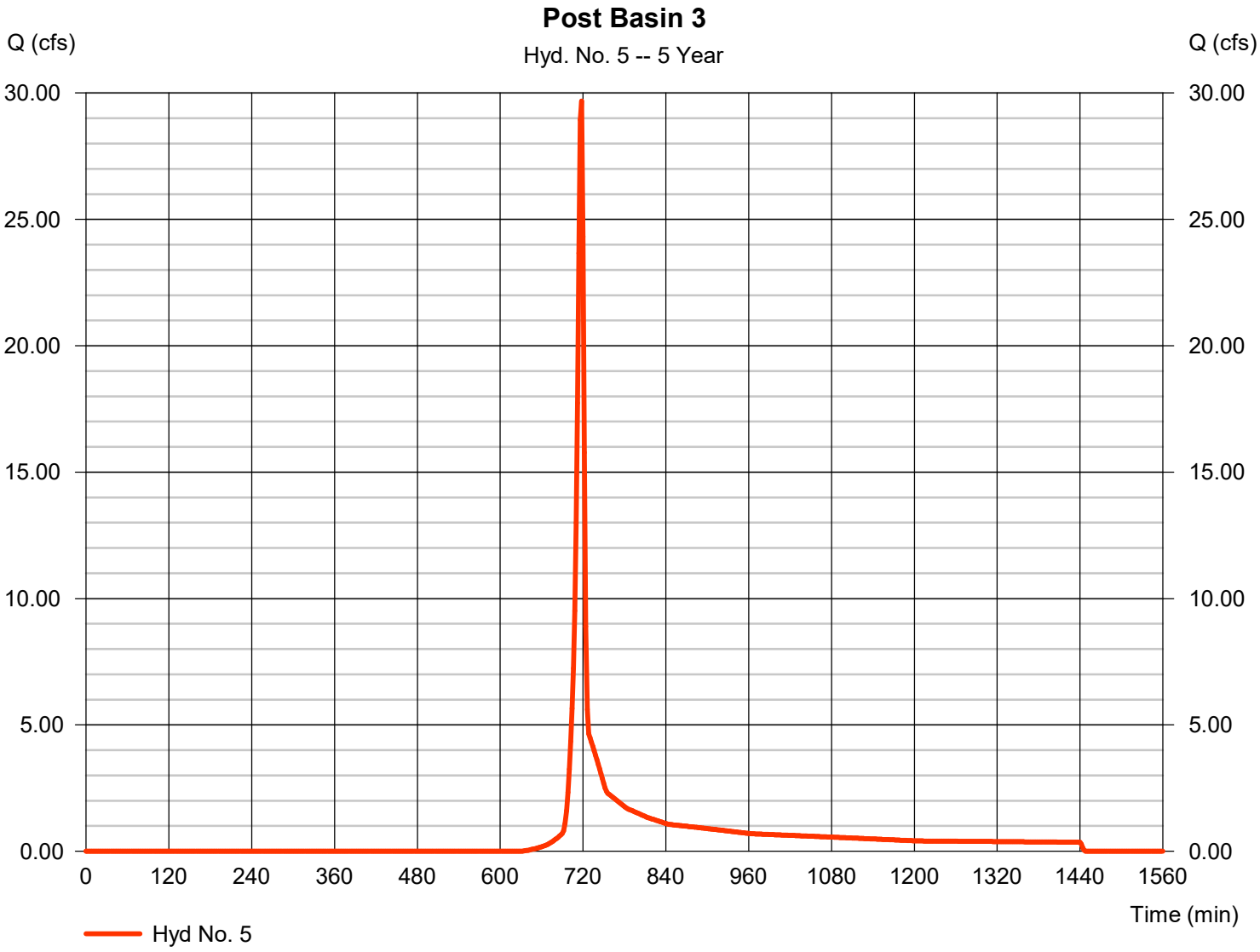


Hydrograph Report

Hyd. No. 5

Post Basin 3

Hydrograph type	=	SCS Runoff	Peak discharge	=	29.68 cfs
Storm frequency	=	5 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	59,371 cuft
Drainage area	=	12.150 ac	Curve number	=	70.8
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	4.08 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



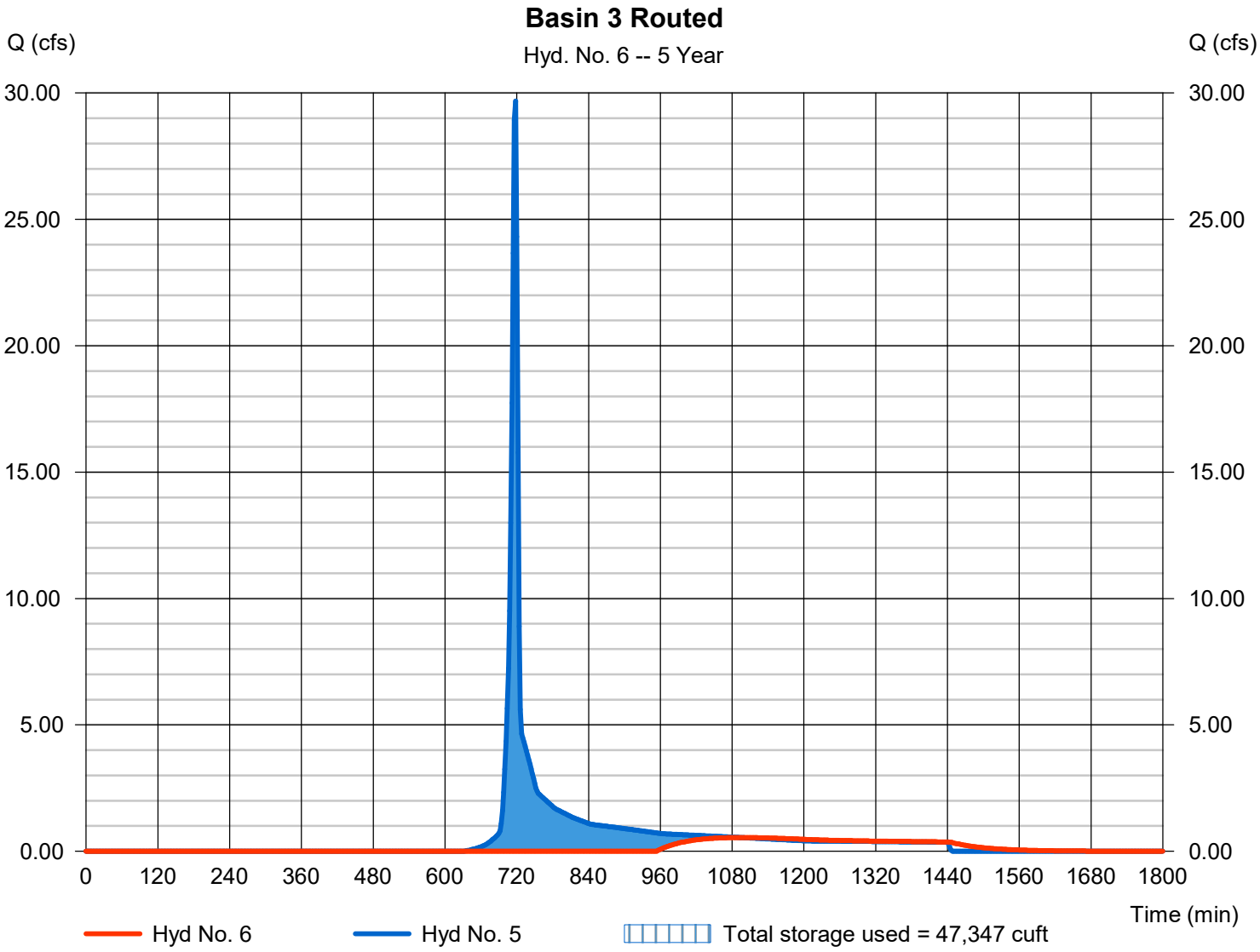
Hydrograph Report

Hyd. No. 6

Basin 3 Routed

Hydrograph type	=	Reservoir	Peak discharge	=	0.543 cfs
Storm frequency	=	5 yrs	Time to peak	=	1094 min
Time interval	=	2 min	Hyd. volume	=	13,903 cuft
Inflow hyd. No.	=	5 - Post Basin 3	Max. Elevation	=	318.49 ft
Reservoir name	=	Basin 3	Max. Storage	=	47,347 cuft

Storage Indication method used.

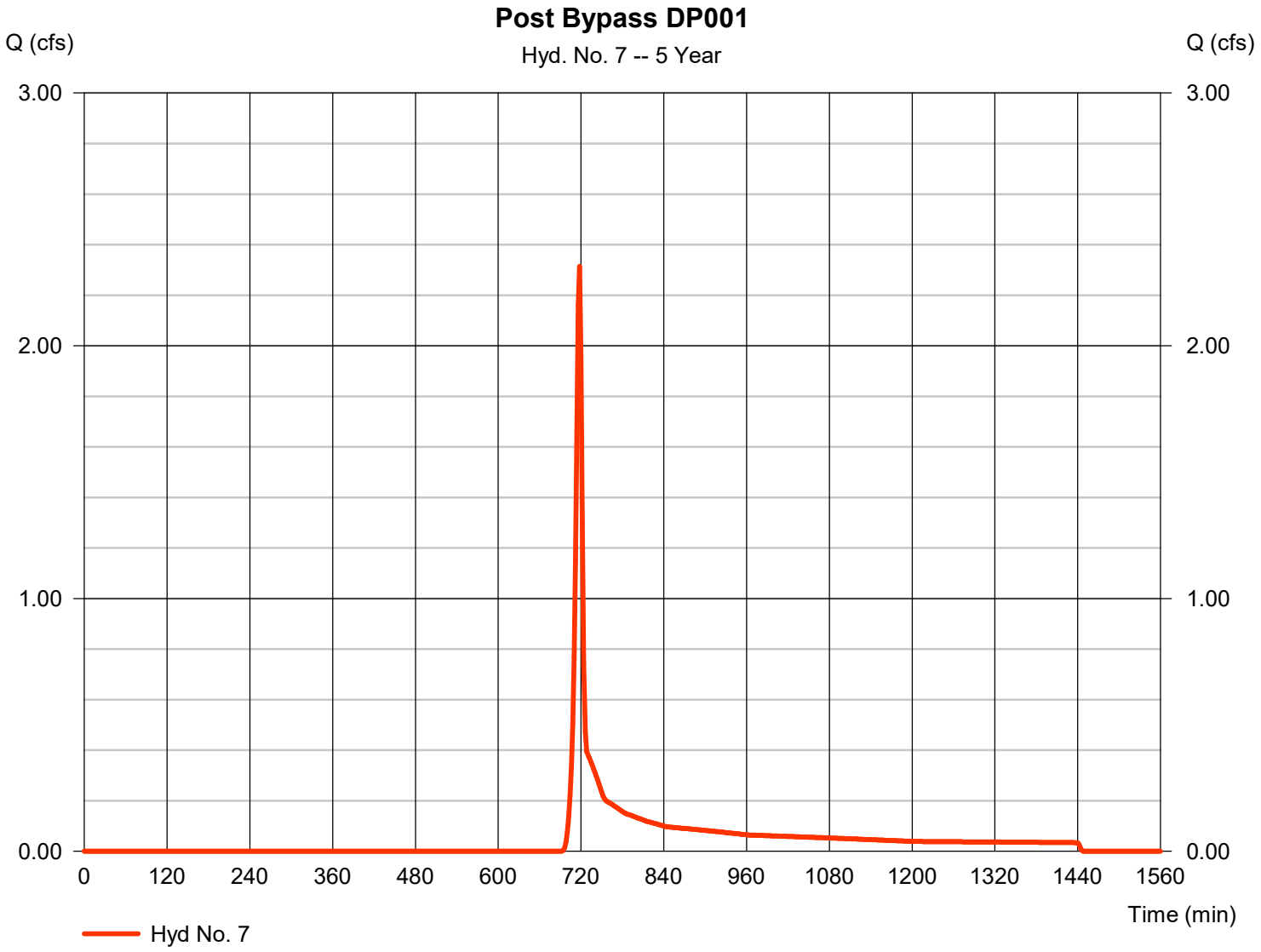


Hydrograph Report

Hyd. No. 7

Post Bypass DP001

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.314 cfs
Storm frequency	=	5 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	4,767 cuft
Drainage area	=	1.440 ac	Curve number	=	63.2
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	4.08 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

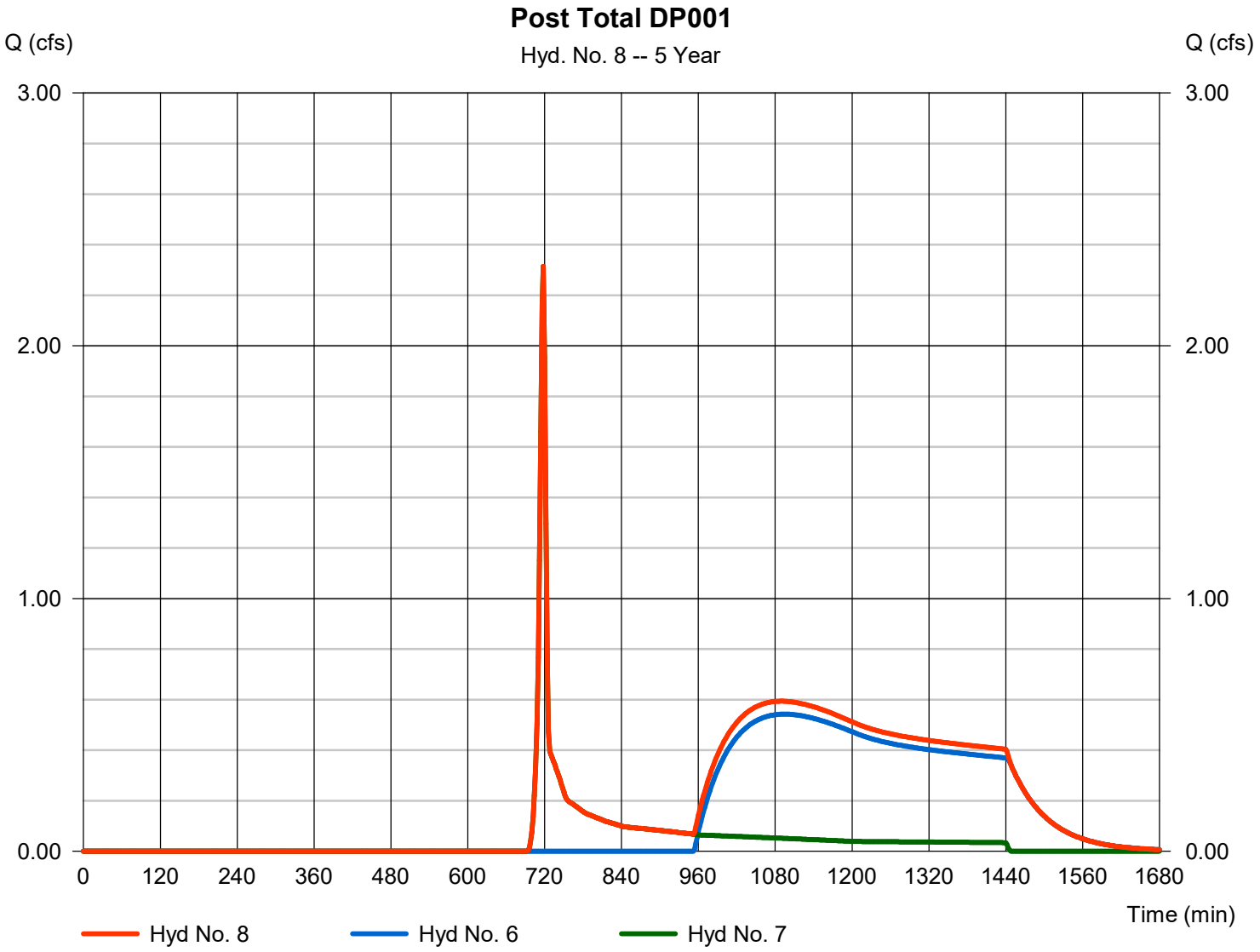


Hydrograph Report

Hyd. No. 8

Post Total DP001

Hydrograph type	= Combine	Peak discharge	= 2.314 cfs
Storm frequency	= 5 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 18,670 cuft
Inflow hyds.	= 6, 7	Contrib. drain. area	= 1.440 ac

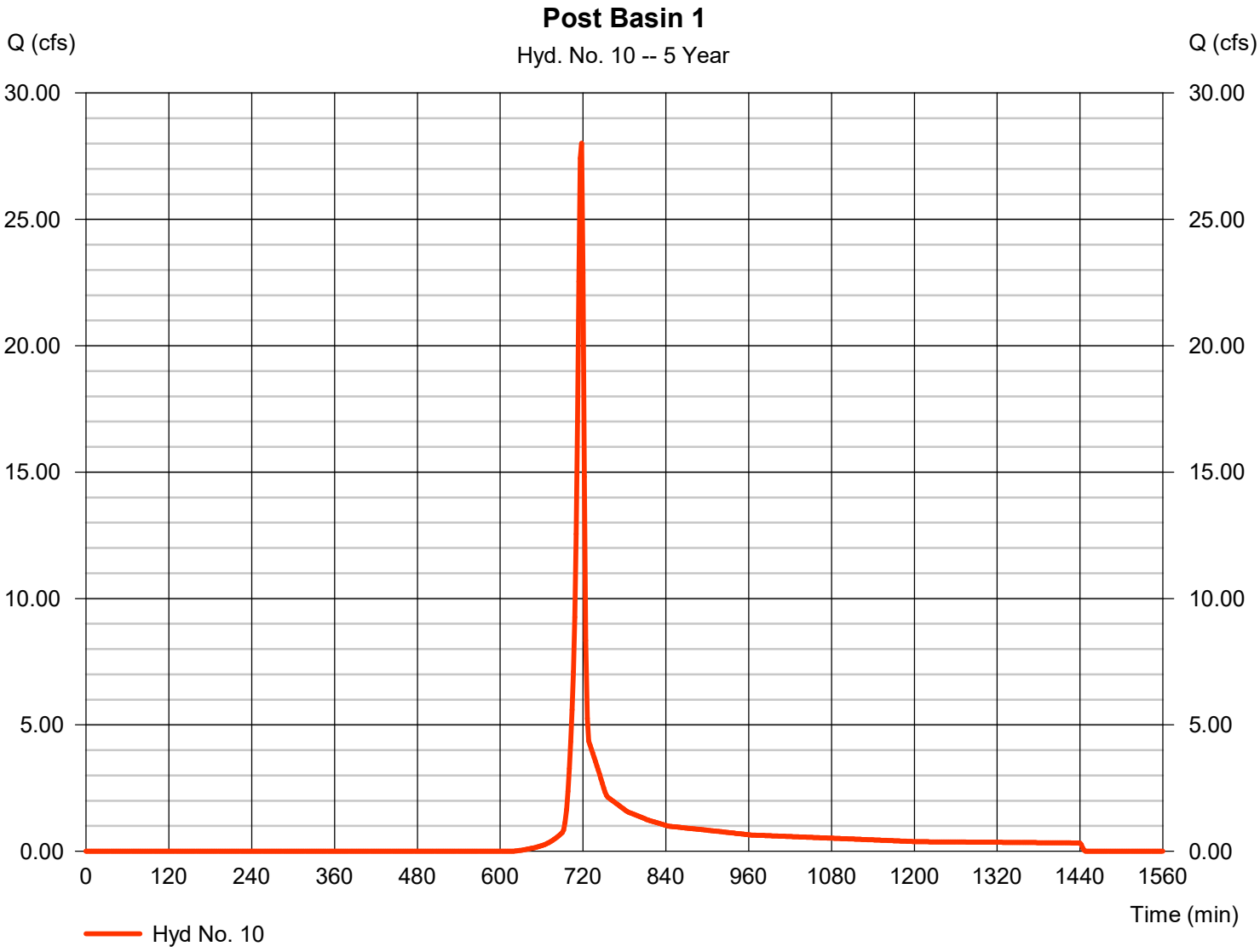


Hydrograph Report

Hyd. No. 10

Post Basin 1

Hydrograph type	=	SCS Runoff	Peak discharge	=	28.01 cfs
Storm frequency	=	5 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	56,002 cuft
Drainage area	=	10.950 ac	Curve number	=	71.8
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	4.08 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



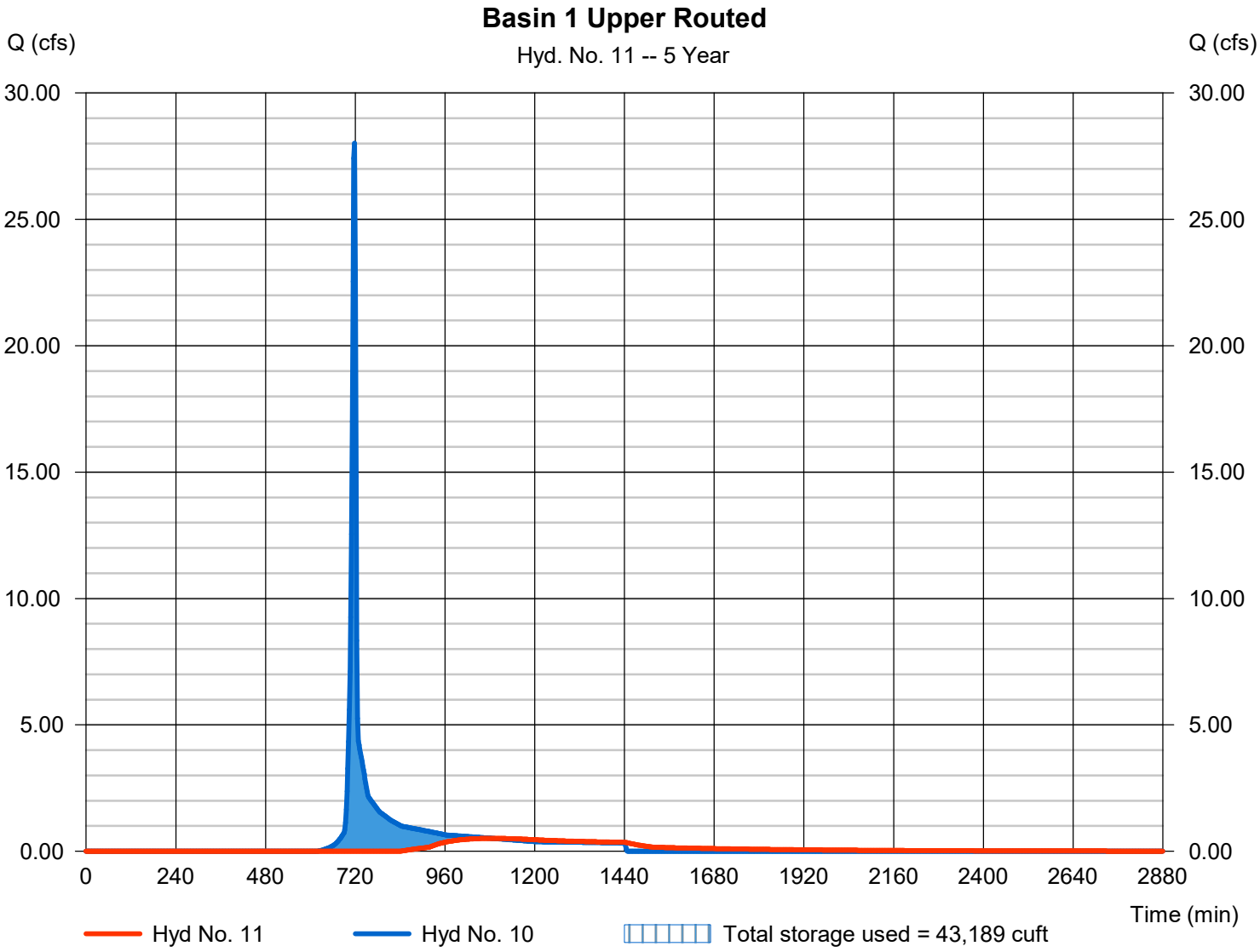
Hydrograph Report

Hyd. No. 11

Basin 1 Upper Routed

Hydrograph type	=	Reservoir	Peak discharge	=	0.510 cfs
Storm frequency	=	5 yrs	Time to peak	=	1086 min
Time interval	=	2 min	Hyd. volume	=	18,513 cuft
Inflow hyd. No.	=	10 - Post Basin 1	Max. Elevation	=	322.71 ft
Reservoir name	=	Basin 1 Upper	Max. Storage	=	43,189 cuft

Storage Indication method used.



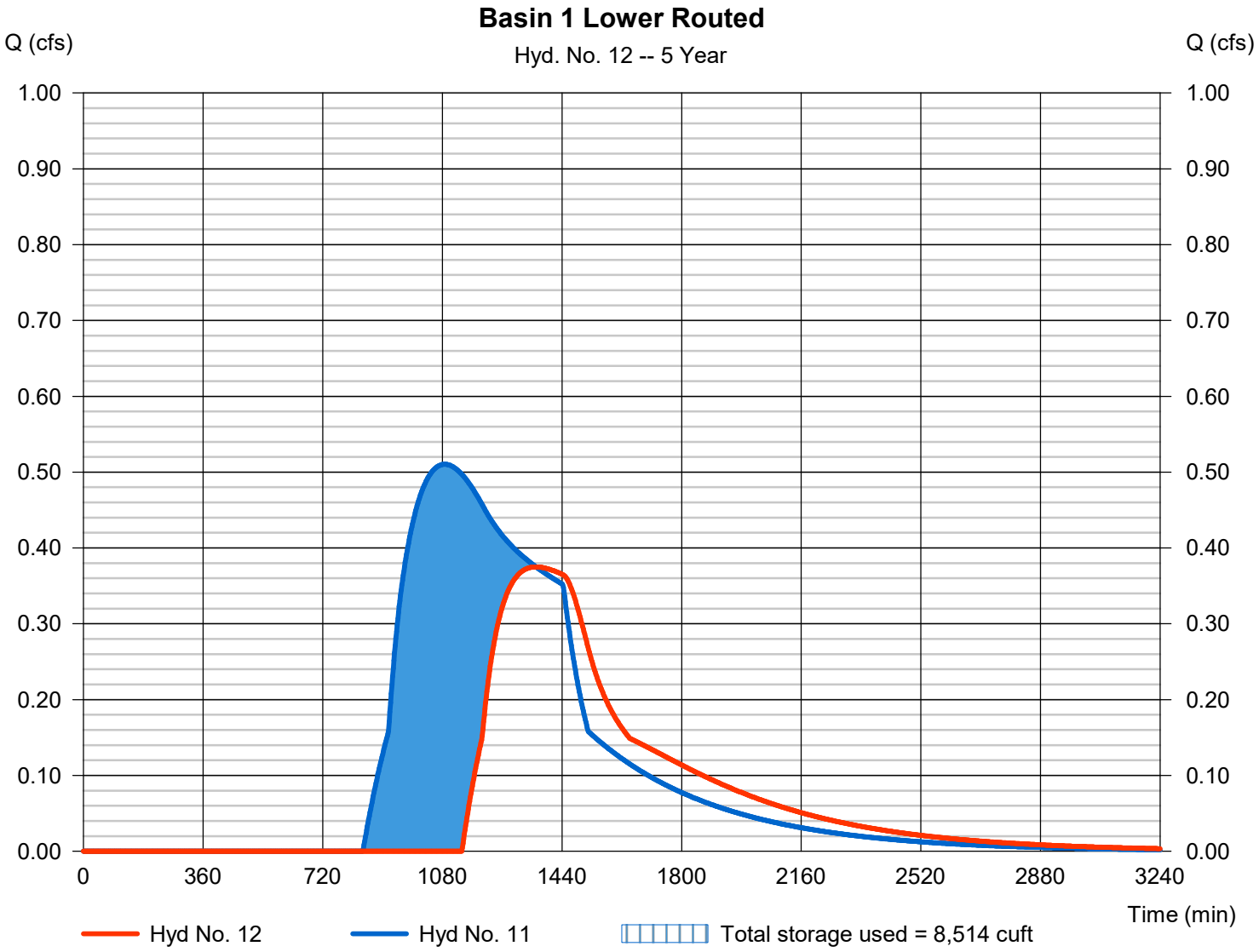
Hydrograph Report

Hyd. No. 12

Basin 1 Lower Routed

Hydrograph type	=	Reservoir	Peak discharge	=	0.375 cfs
Storm frequency	=	5 yrs	Time to peak	=	1362 min
Time interval	=	2 min	Hyd. volume	=	12,317 cuft
Inflow hyd. No.	=	11 - Basin 1 Upper Routed	Max. Elevation	=	304.32 ft
Reservoir name	=	Basin 1 Lower	Max. Storage	=	8,514 cuft

Storage Indication method used.

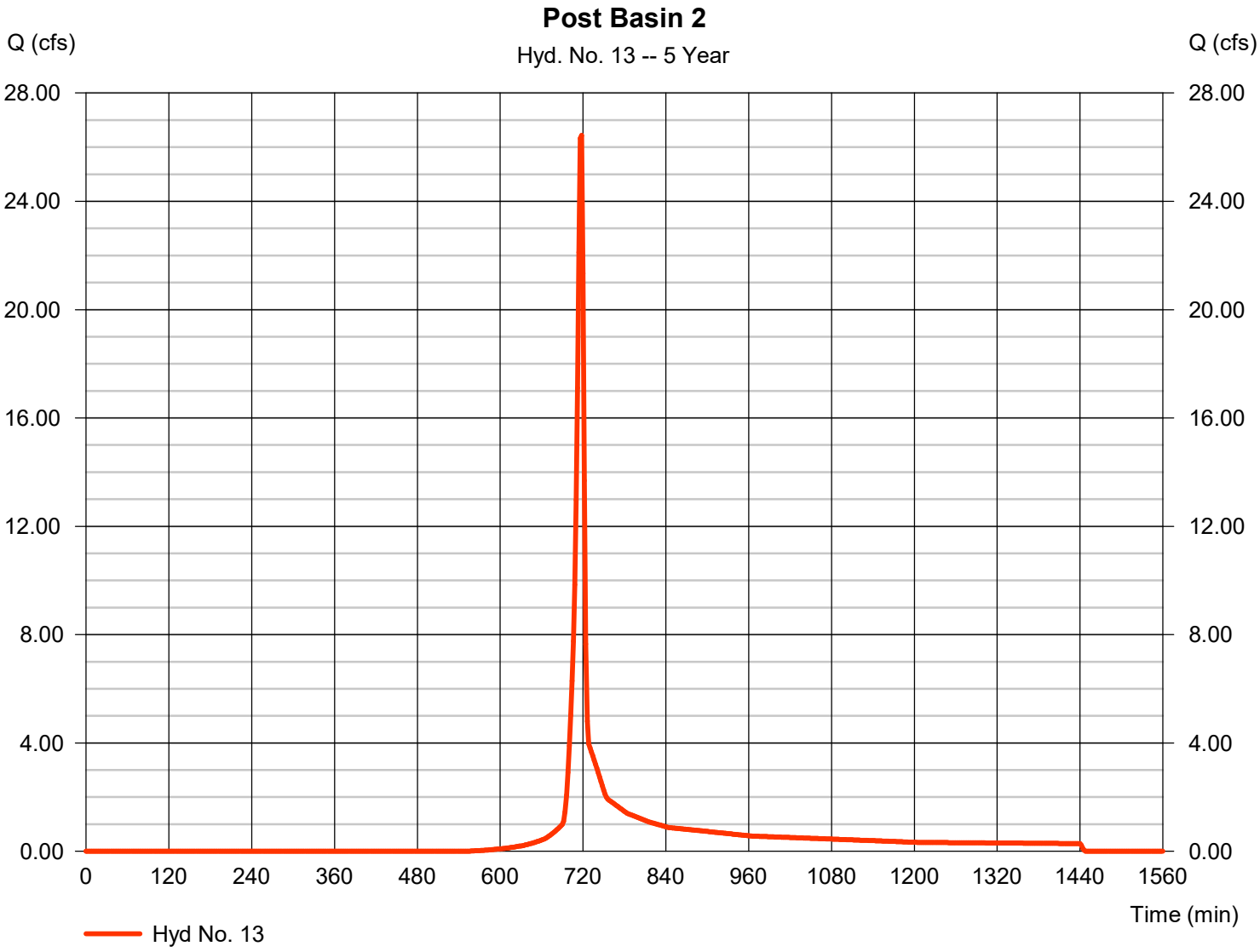


Hydrograph Report

Hyd. No. 13

Post Basin 2

Hydrograph type	=	SCS Runoff	Peak discharge	=	26.44 cfs
Storm frequency	=	5 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	53,176 cuft
Drainage area	=	8.540 ac	Curve number	=	76.4
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	4.08 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



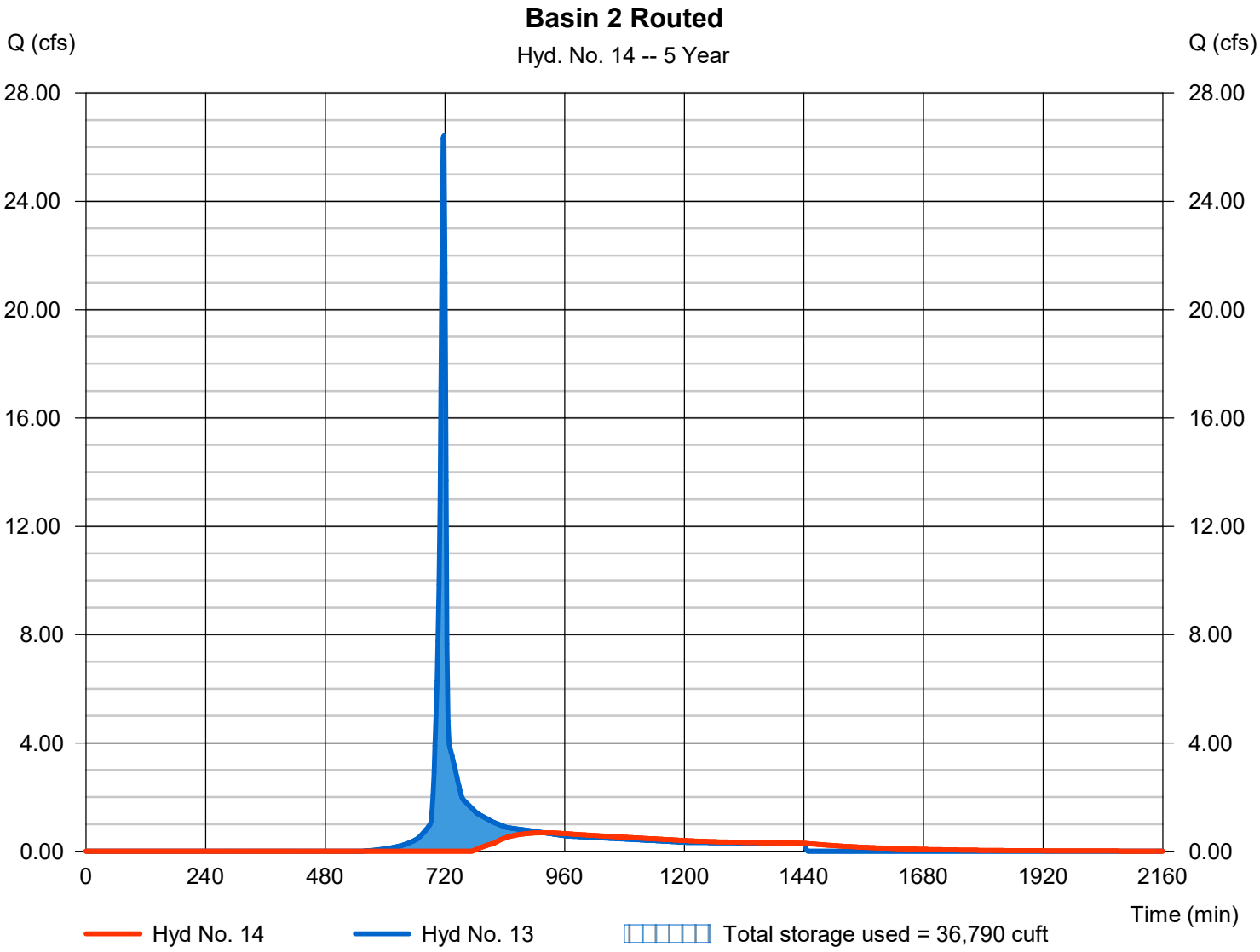
Hydrograph Report

Hyd. No. 14

Basin 2 Routed

Hydrograph type	=	Reservoir	Peak discharge	=	0.682 cfs
Storm frequency	=	5 yrs	Time to peak	=	918 min
Time interval	=	2 min	Hyd. volume	=	20,822 cuft
Inflow hyd. No.	=	13 - Post Basin 2	Max. Elevation	=	309.11 ft
Reservoir name	=	Basin 2	Max. Storage	=	36,790 cuft

Storage Indication method used.

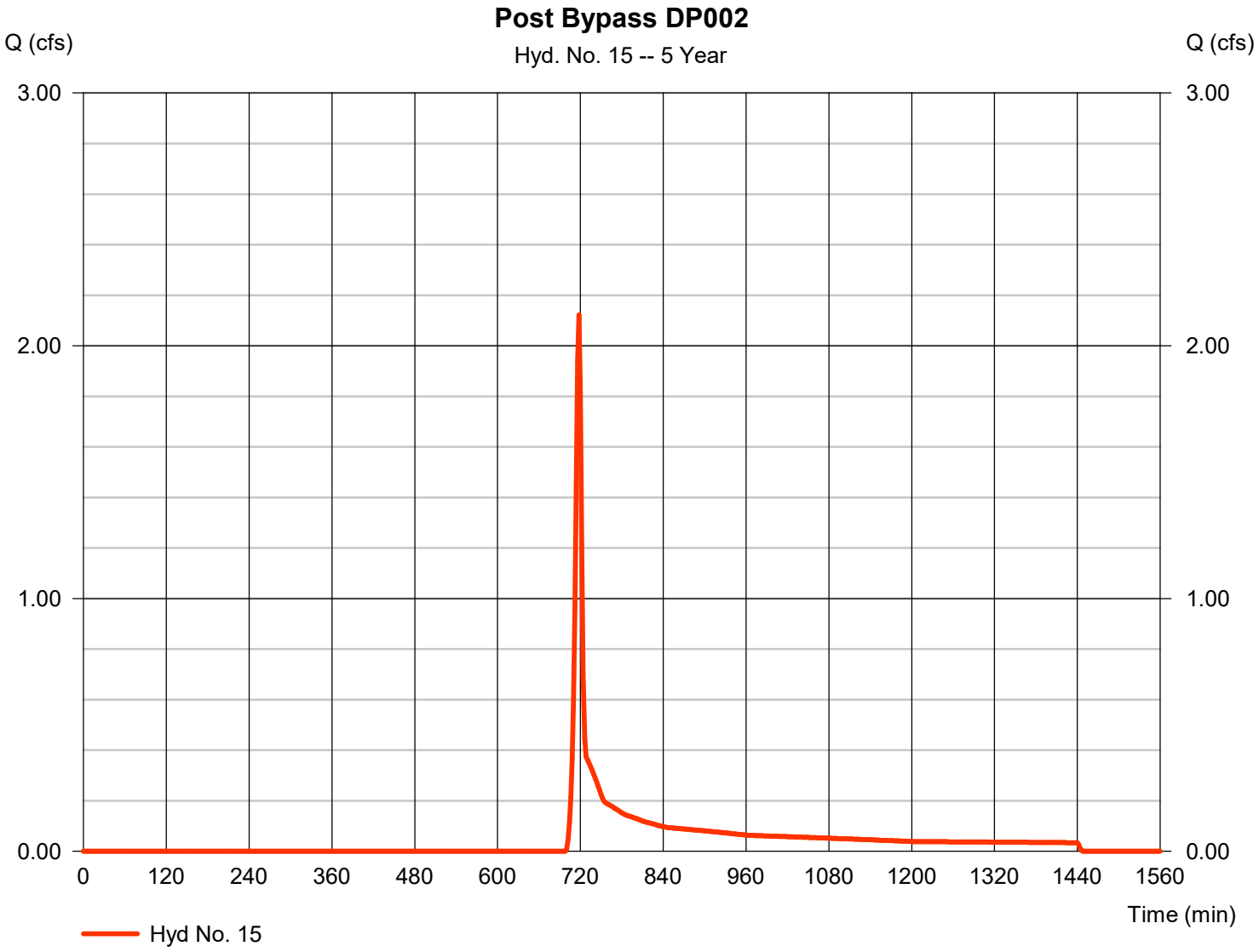


Hydrograph Report

Hyd. No. 15

Post Bypass DP002

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.121 cfs
Storm frequency	=	5 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	4,472 cuft
Drainage area	=	1.540 ac	Curve number	=	61
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	4.08 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

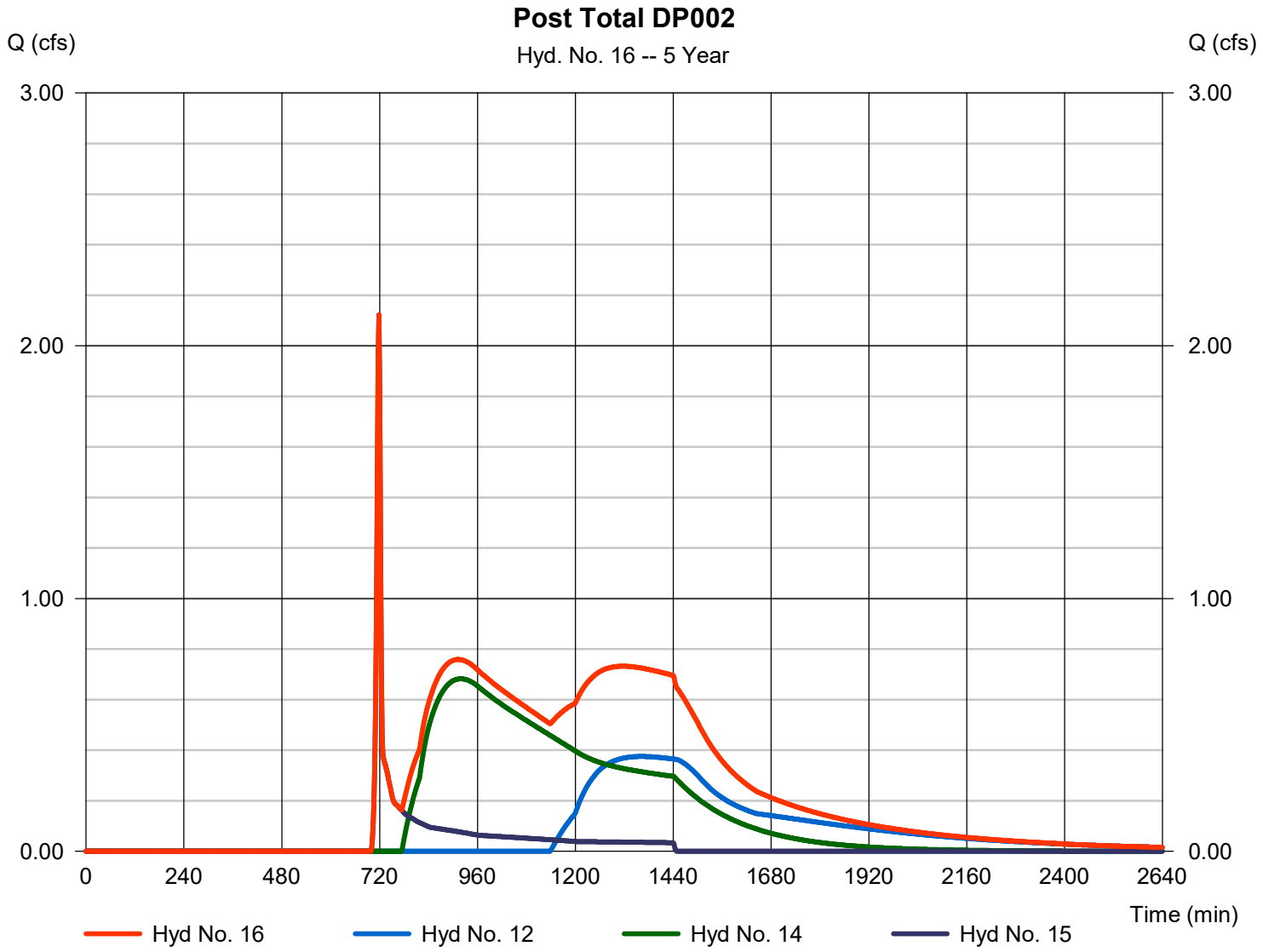


Hydrograph Report

Hyd. No. 16

Post Total DP002

Hydrograph type	= Combine	Peak discharge	= 2.121 cfs
Storm frequency	= 5 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 37,611 cuft
Inflow hyds.	= 12, 14, 15	Contrib. drain. area	= 1.540 ac



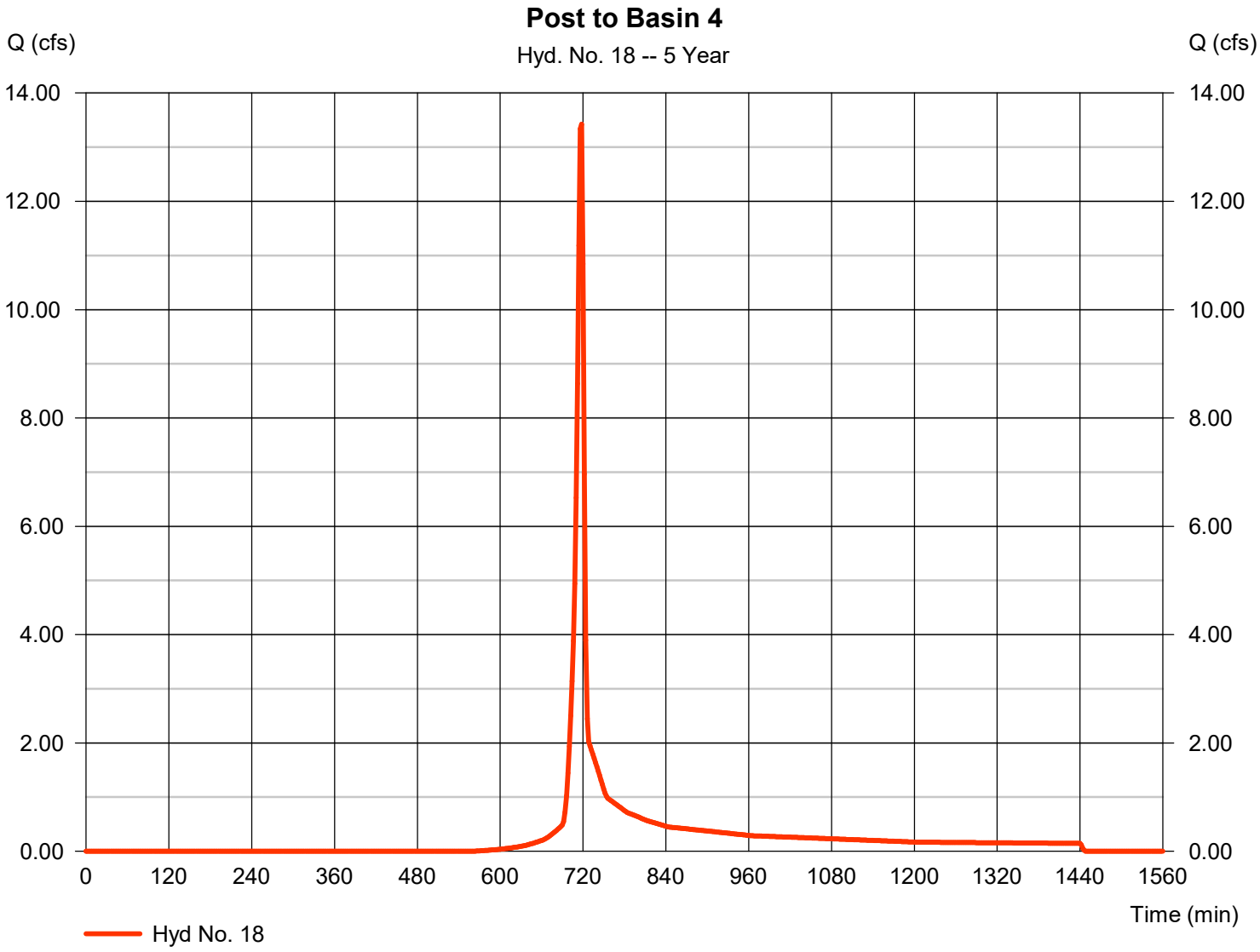
Hydrograph Report

Hyd. No. 18

Post to Basin 4

Hydrograph type	=	SCS Runoff	Peak discharge	=	13.42 cfs
Storm frequency	=	5 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	26,965 cuft
Drainage area	=	4.420 ac	Curve number	=	75.9*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	4.08 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.910 x 61) + (2.270 x 98) + (3.040 x 78)] / 4.420



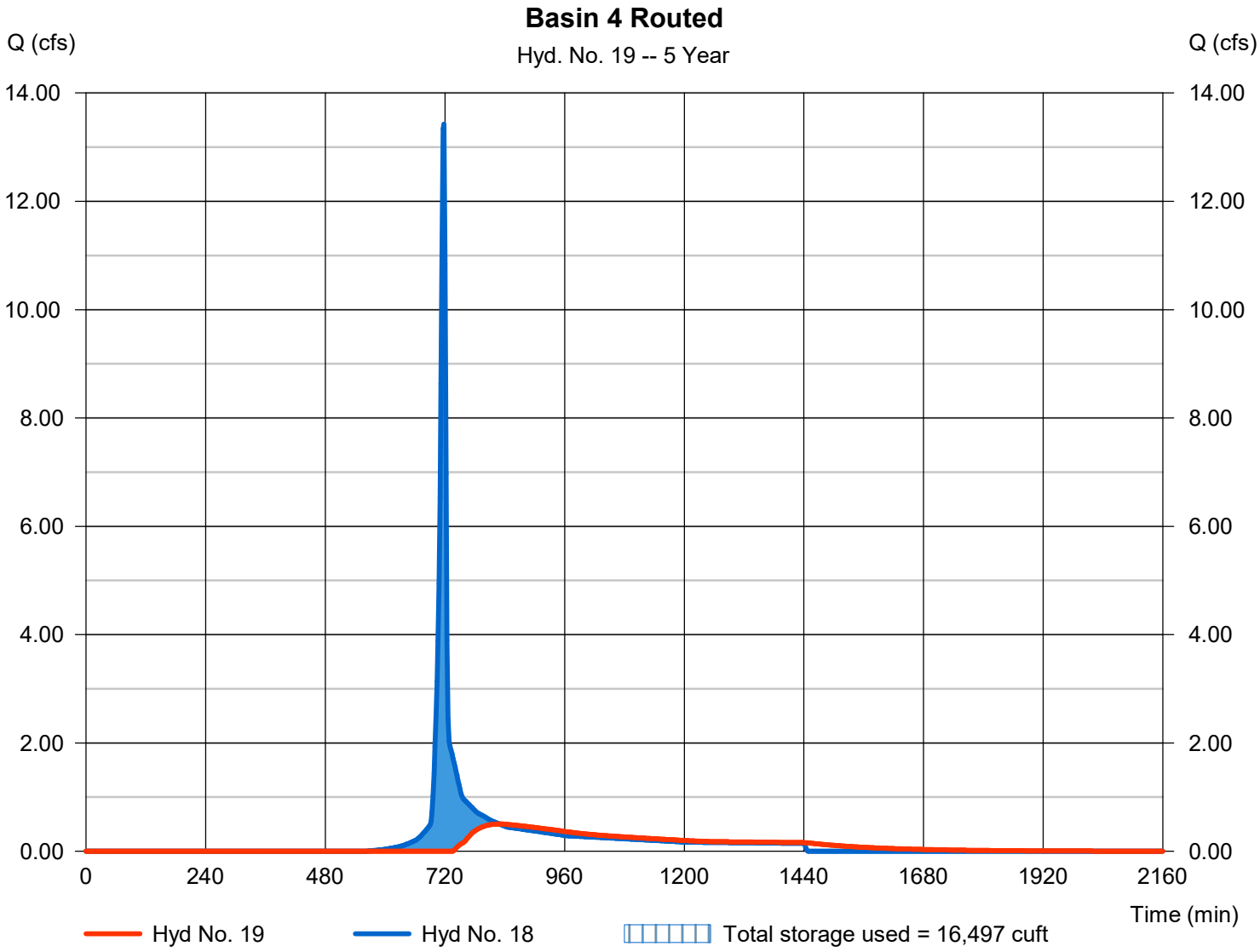
Hydrograph Report

Hyd. No. 19

Basin 4 Routed

Hydrograph type	=	Reservoir	Peak discharge	=	0.503 cfs
Storm frequency	=	5 yrs	Time to peak	=	830 min
Time interval	=	2 min	Hyd. volume	=	13,166 cuft
Inflow hyd. No.	=	18 - Post to Basin 4	Max. Elevation	=	346.54 ft
Reservoir name	=	Basin 4	Max. Storage	=	16,497 cuft

Storage Indication method used.



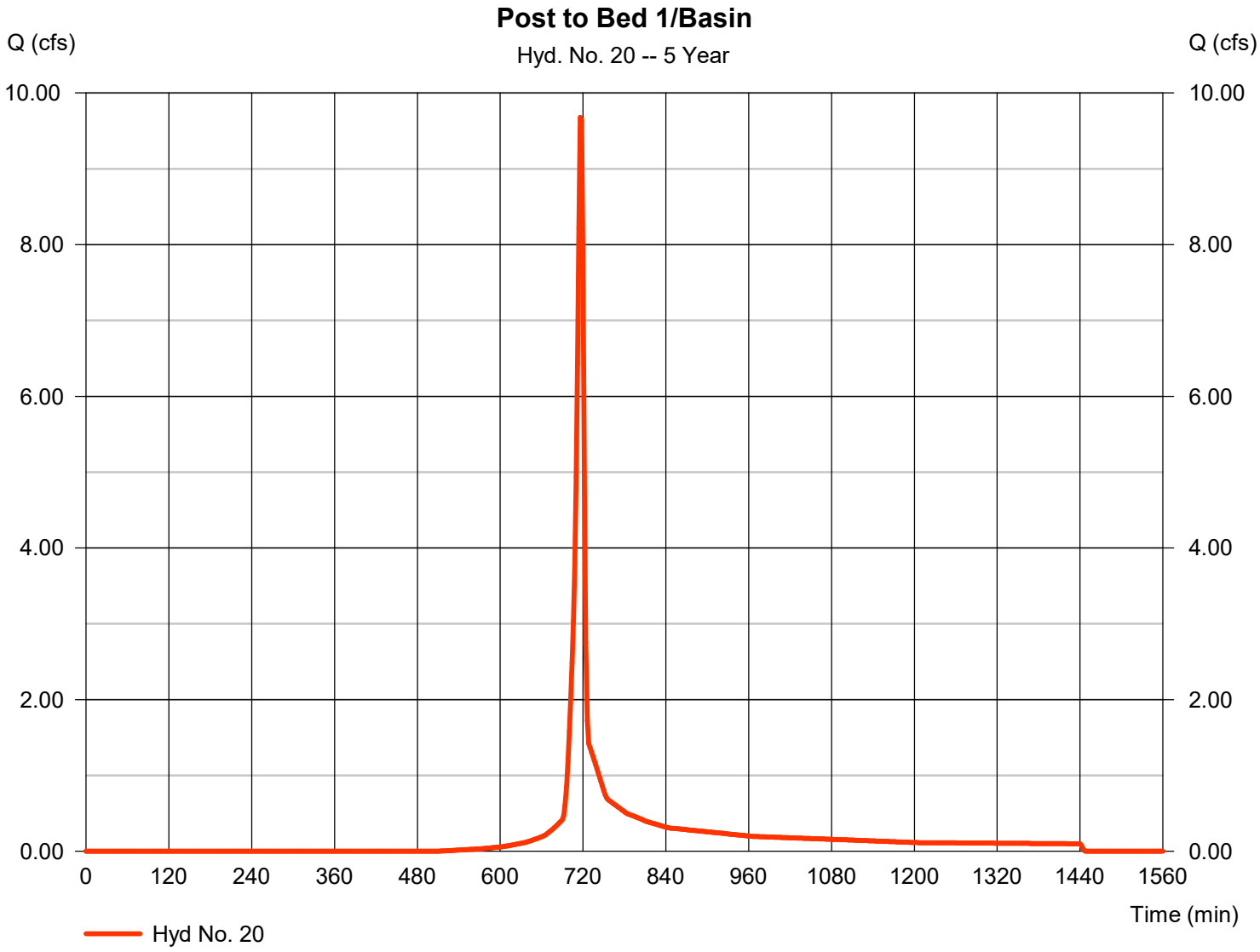
Hydrograph Report

Hyd. No. 20

Post to Bed 1/Basin

Hydrograph type	= SCS Runoff	Peak discharge	= 9.677 cfs
Storm frequency	= 5 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 19,544 cuft
Drainage area	= 2.820 ac	Curve number	= 79.1*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.08 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.910 x 61) + (2.270 x 98) + (3.040 x 78)] / 2.820



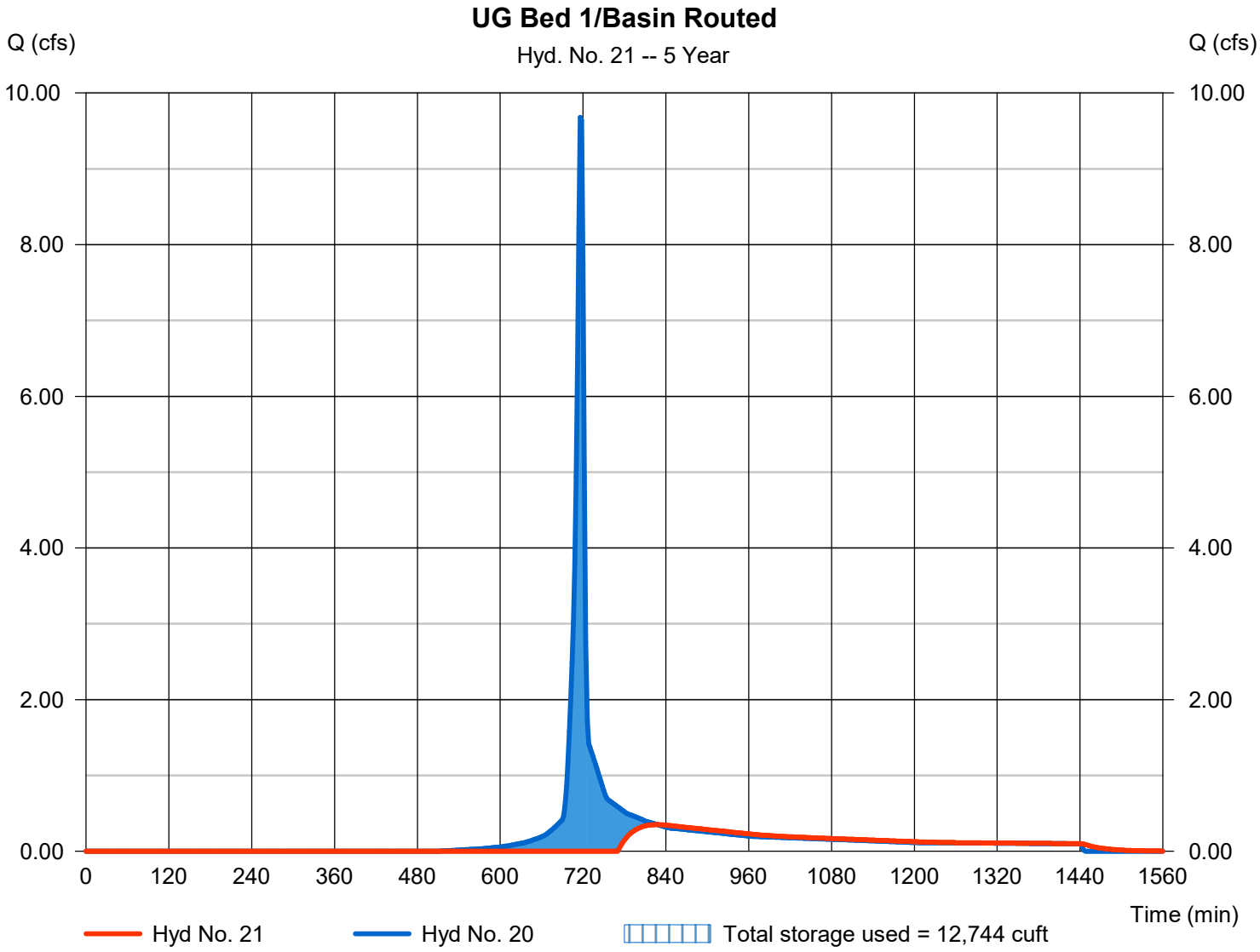
Hydrograph Report

Hyd. No. 21

UG Bed 1/Basin Routed

Hydrograph type	=	Reservoir	Peak discharge	=	0.351 cfs
Storm frequency	=	5 yrs	Time to peak	=	828 min
Time interval	=	2 min	Hyd. volume	=	7,446 cuft
Inflow hyd. No.	=	20 - Post to Bed 1/Basin	Max. Elevation	=	340.35 ft
Reservoir name	=	UG Bed 1/Basin	Max. Storage	=	12,744 cuft

Storage Indication method used.

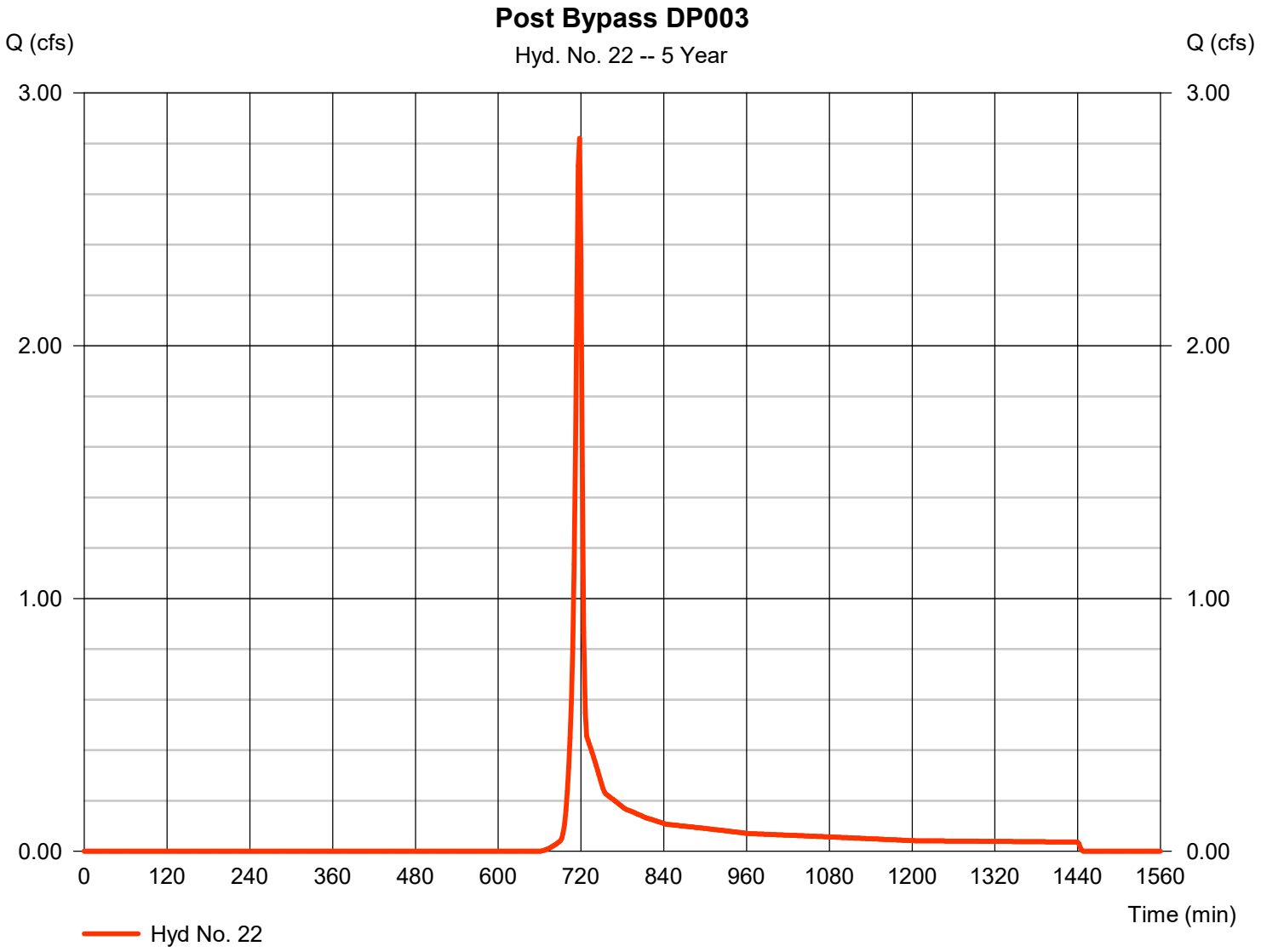


Hydrograph Report

Hyd. No. 22

Post Bypass DP003

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.821 cfs
Storm frequency	=	5 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	5,670 cuft
Drainage area	=	1.340 ac	Curve number	=	67.8
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	4.08 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

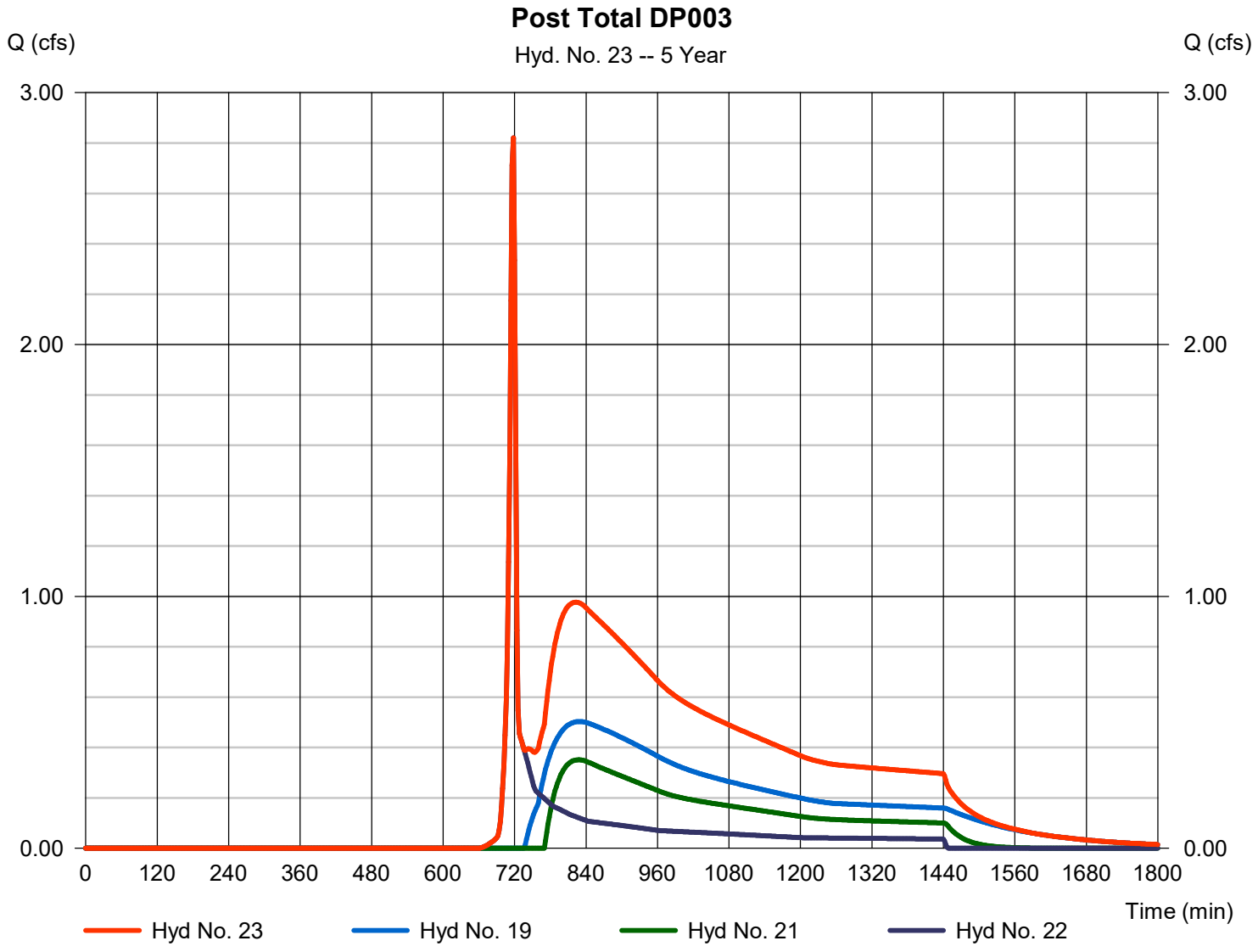


Hydrograph Report

Hyd. No. 23

Post Total DP003

Hydrograph type	=	Combine	Peak discharge	=	2.821 cfs
Storm frequency	=	5 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	26,283 cuft
Inflow hyds.	=	19, 21, 22	Contrib. drain. area	=	1.340 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

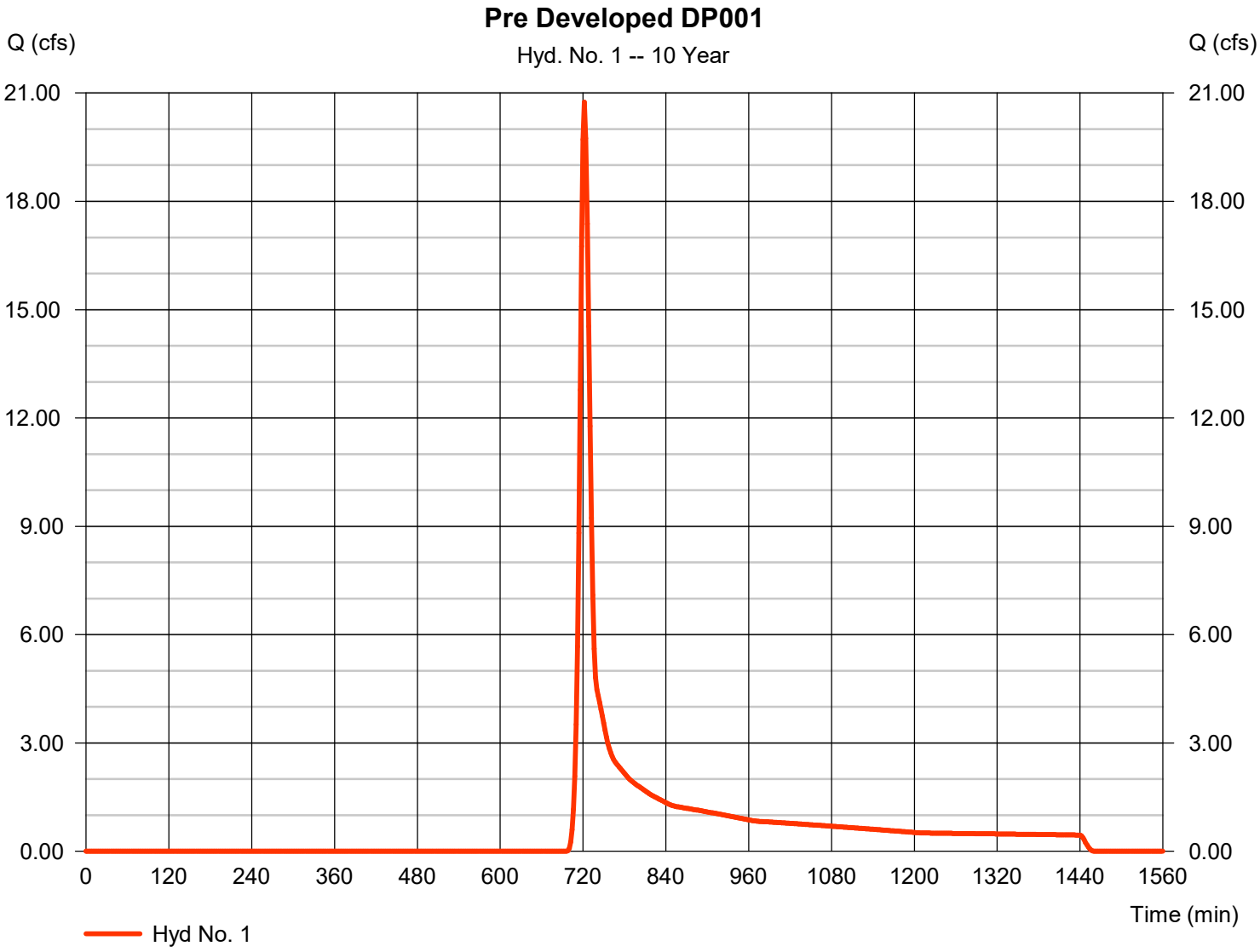
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	20.75	2	722	60,334	------	------	------	Pre Developed DP001
2	SCS Runoff	28.64	2	722	81,339	------	------	------	Pre Developed DP002
3	SCS Runoff	20.20	2	722	53,341	------	------	------	Pre Developed DP003
4	SCS Runoff	1.766	2	718	3,580	------	------	------	Pre Developed DP003 ORA
5	SCS Runoff	39.83	2	718	79,751	------	------	------	Post Basin 3
6	Reservoir	1.424	2	838	34,284	5	318.61	49,983	Basin 3 Routed
7	SCS Runoff	3.349	2	718	6,757	------	------	------	Post Bypass DP001
8	Combine	3.349	2	718	41,040	6, 7	------	------	Post Total DP001
10	SCS Runoff	37.29	2	718	74,773	------	------	------	Post Basin 1
11	Reservoir	1.244	2	848	37,284	10	322.89	46,611	Basin 1 Upper Routed
12	Reservoir	0.928	2	996	31,087	11	304.57	10,321	Basin 1 Lower Routed
13	SCS Runoff	34.26	2	716	69,196	------	------	------	Post Basin 2
14	Reservoir	1.706	2	788	36,842	13	309.33	40,115	Basin 2 Routed
15	SCS Runoff	3.170	2	718	6,463	------	------	------	Post Bypass DP002
16	Combine	3.170	2	718	74,392	12, 14, 15	------	------	Post Total DP002
18	SCS Runoff	17.42	2	716	35,181	------	------	------	Post to Basin 4
19	Reservoir	1.282	2	754	21,383	18	346.79	18,533	Basin 4 Routed
20	SCS Runoff	12.38	2	716	25,081	------	------	------	Post to Bed 1/Basin
21	Reservoir	1.100	2	748	12,984	20	340.55	13,588	UG Bed 1/Basin Routed
22	SCS Runoff	3.883	2	718	7,766	------	------	------	Post Bypass DP003
23	Combine	3.883	2	718	42,133	19, 21, 22	------	------	Post Total DP003

Hydrograph Report

Hyd. No. 1

Pre Developed DP001

Hydrograph type	=	SCS Runoff	Peak discharge	=	20.75 cfs
Storm frequency	=	10 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	60,334 cuft
Drainage area	=	15.430 ac	Curve number	=	58
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	12.00 min
Total precip.	=	4.77 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

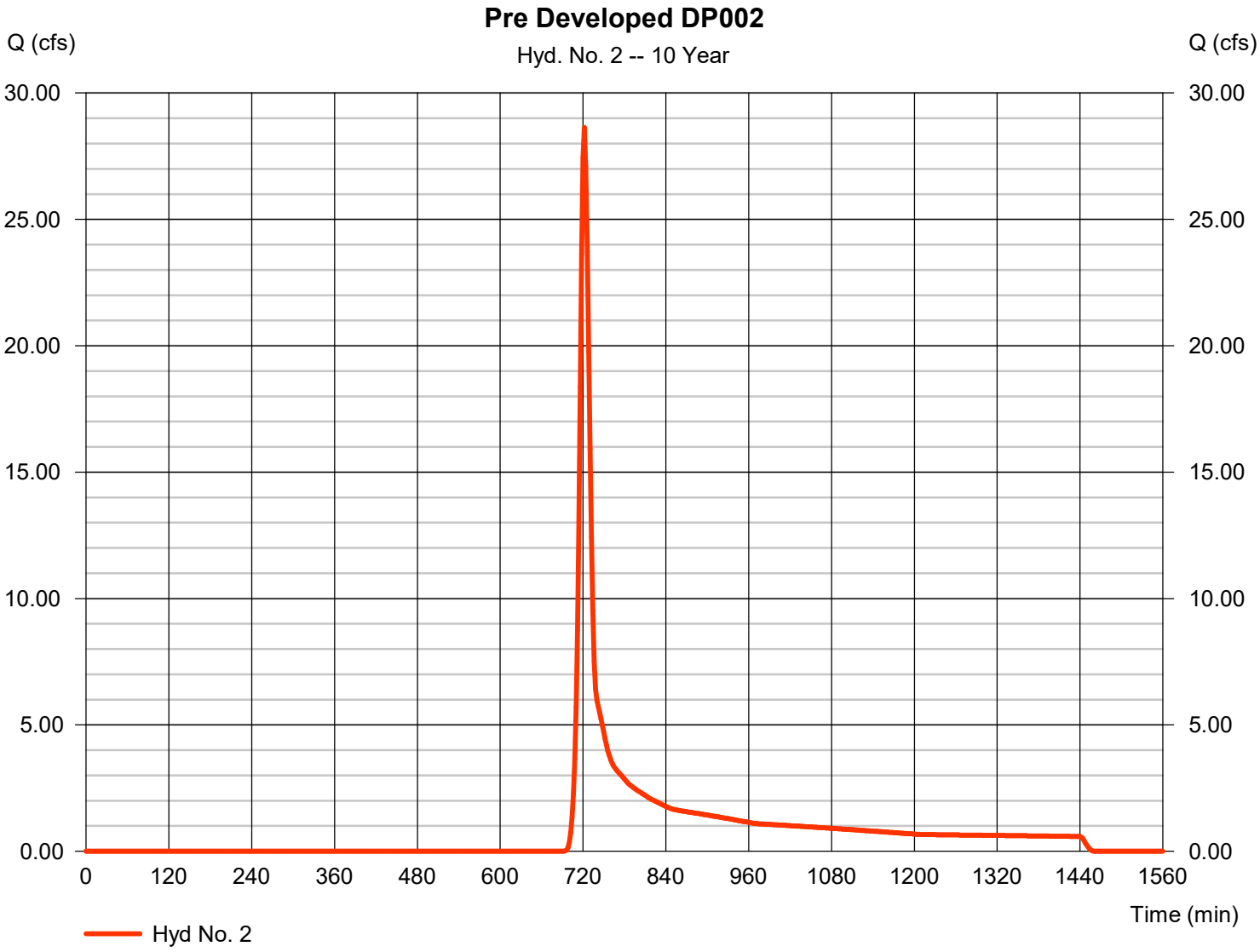


Hydrograph Report

Hyd. No. 2

Pre Developed DP002

Hydrograph type	=	SCS Runoff	Peak discharge	=	28.64 cfs
Storm frequency	=	10 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	81,339 cuft
Drainage area	=	19.210 ac	Curve number	=	59.4
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	12.00 min
Total precip.	=	4.77 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

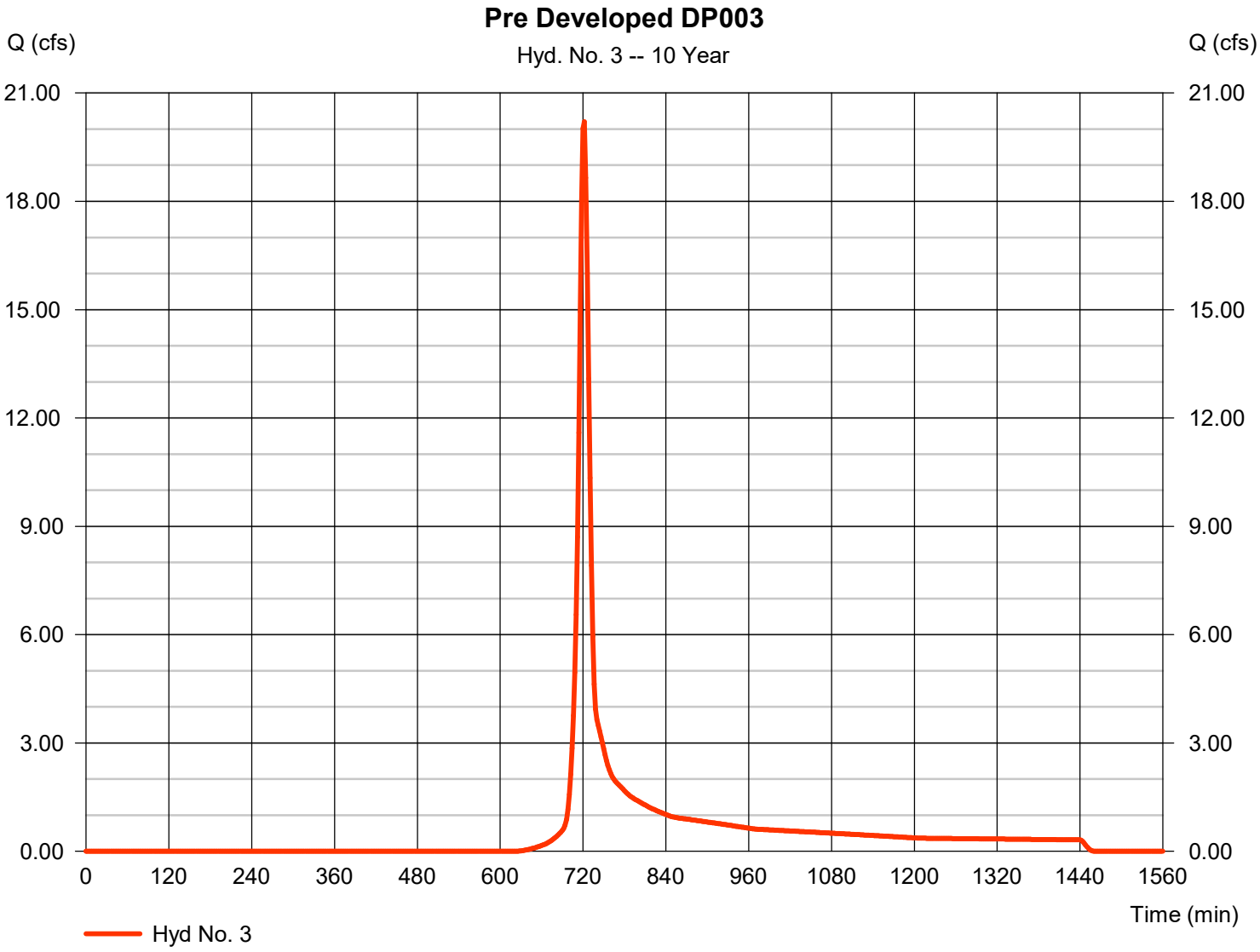


Hydrograph Report

Hyd. No. 3

Pre Developed DP003

Hydrograph type	=	SCS Runoff	Peak discharge	=	20.20 cfs
Storm frequency	=	10 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	53,341 cuft
Drainage area	=	8.190 ac	Curve number	=	68.3
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	11.00 min
Total precip.	=	4.77 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

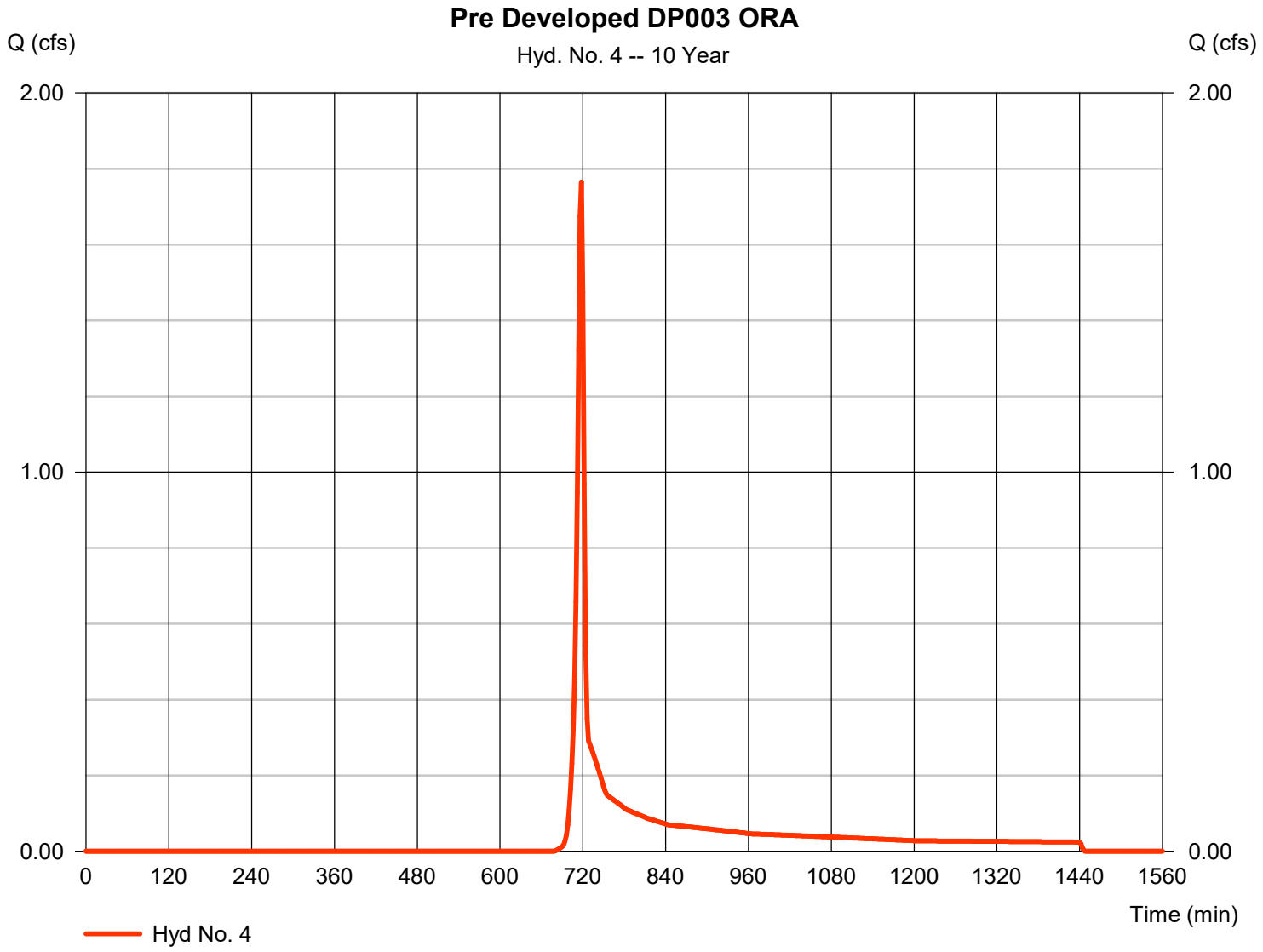


Hydrograph Report

Hyd. No. 4

Pre Developed DP003 ORA

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.766 cfs
Storm frequency	=	10 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	3,580 cuft
Drainage area	=	0.810 ac	Curve number	=	62
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	4.77 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

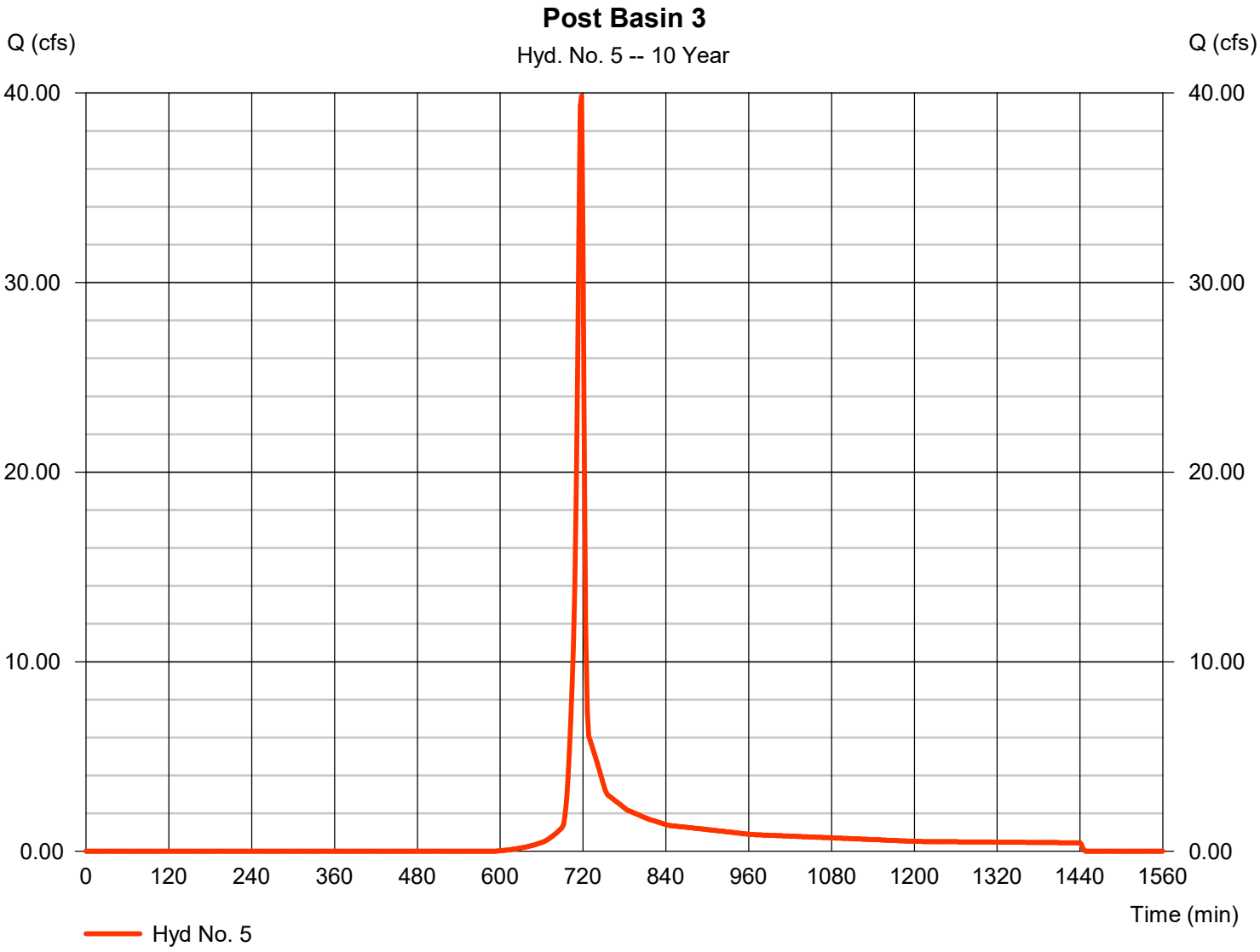


Hydrograph Report

Hyd. No. 5

Post Basin 3

Hydrograph type	=	SCS Runoff	Peak discharge	=	39.83 cfs
Storm frequency	=	10 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	79,751 cuft
Drainage area	=	12.150 ac	Curve number	=	70.8
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	4.77 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



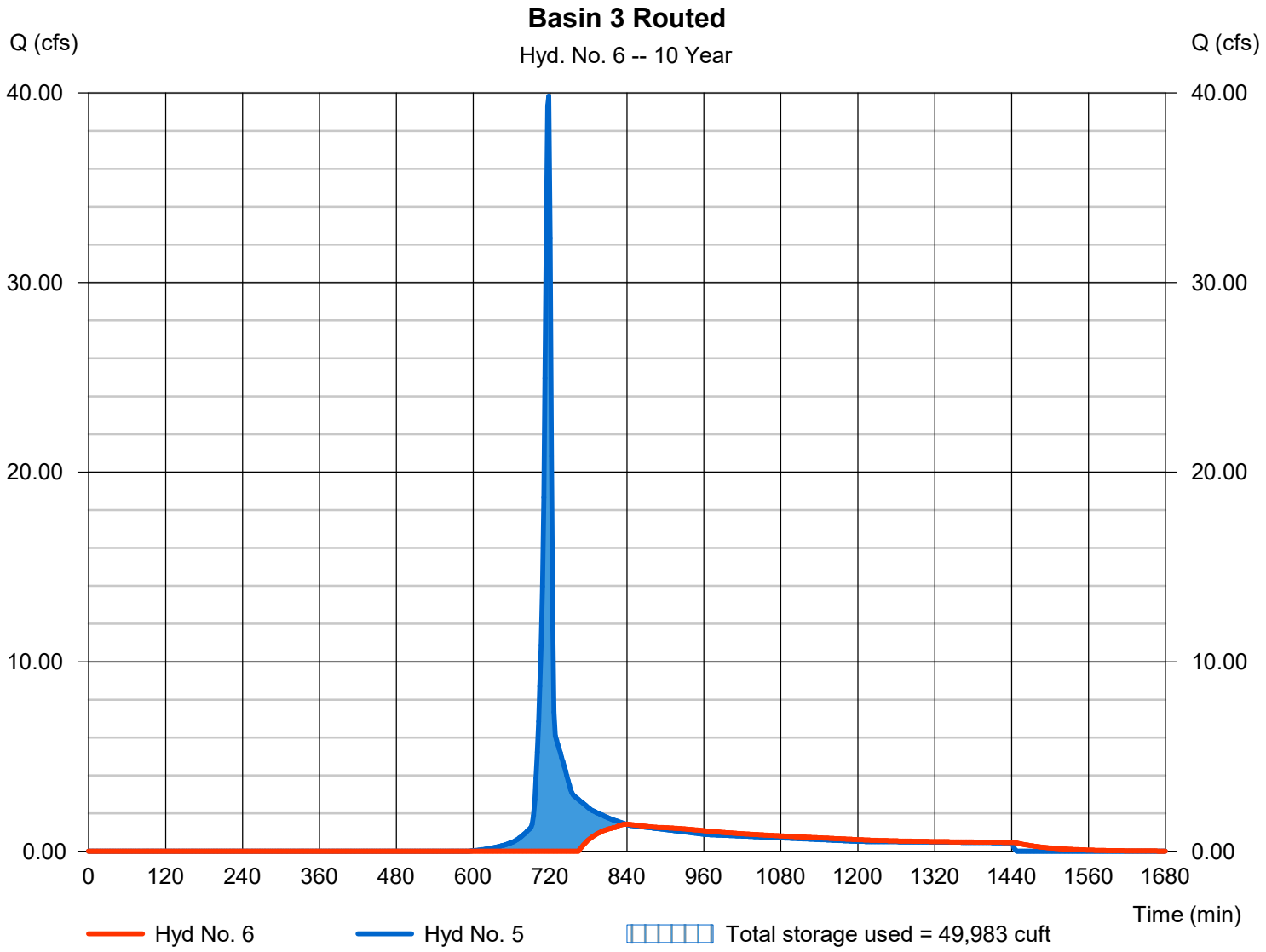
Hydrograph Report

Hyd. No. 6

Basin 3 Routed

Hydrograph type	=	Reservoir	Peak discharge	=	1.424 cfs
Storm frequency	=	10 yrs	Time to peak	=	838 min
Time interval	=	2 min	Hyd. volume	=	34,284 cuft
Inflow hyd. No.	=	5 - Post Basin 3	Max. Elevation	=	318.61 ft
Reservoir name	=	Basin 3	Max. Storage	=	49,983 cuft

Storage Indication method used.

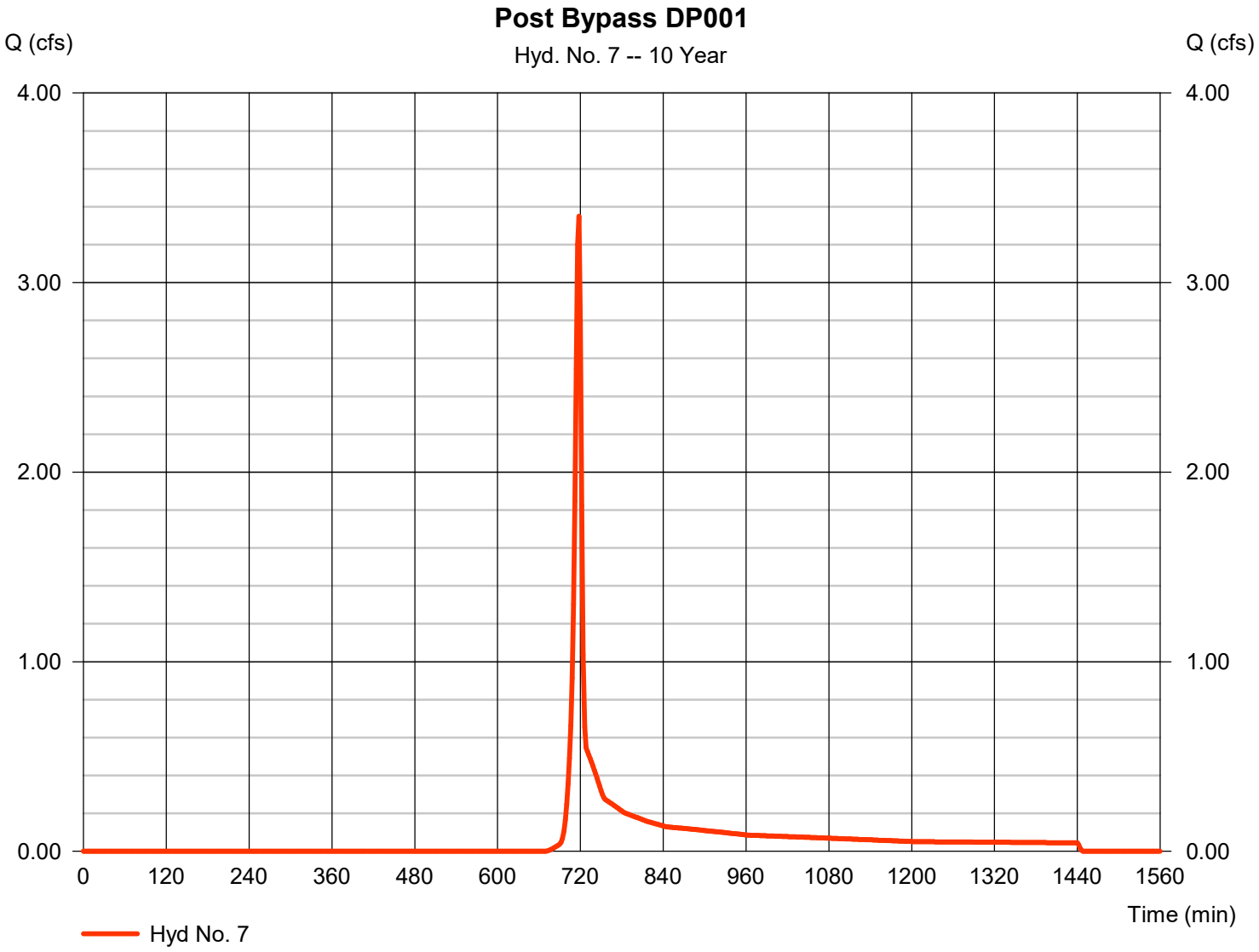


Hydrograph Report

Hyd. No. 7

Post Bypass DP001

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.349 cfs
Storm frequency	=	10 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	6,757 cuft
Drainage area	=	1.440 ac	Curve number	=	63.2
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	4.77 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

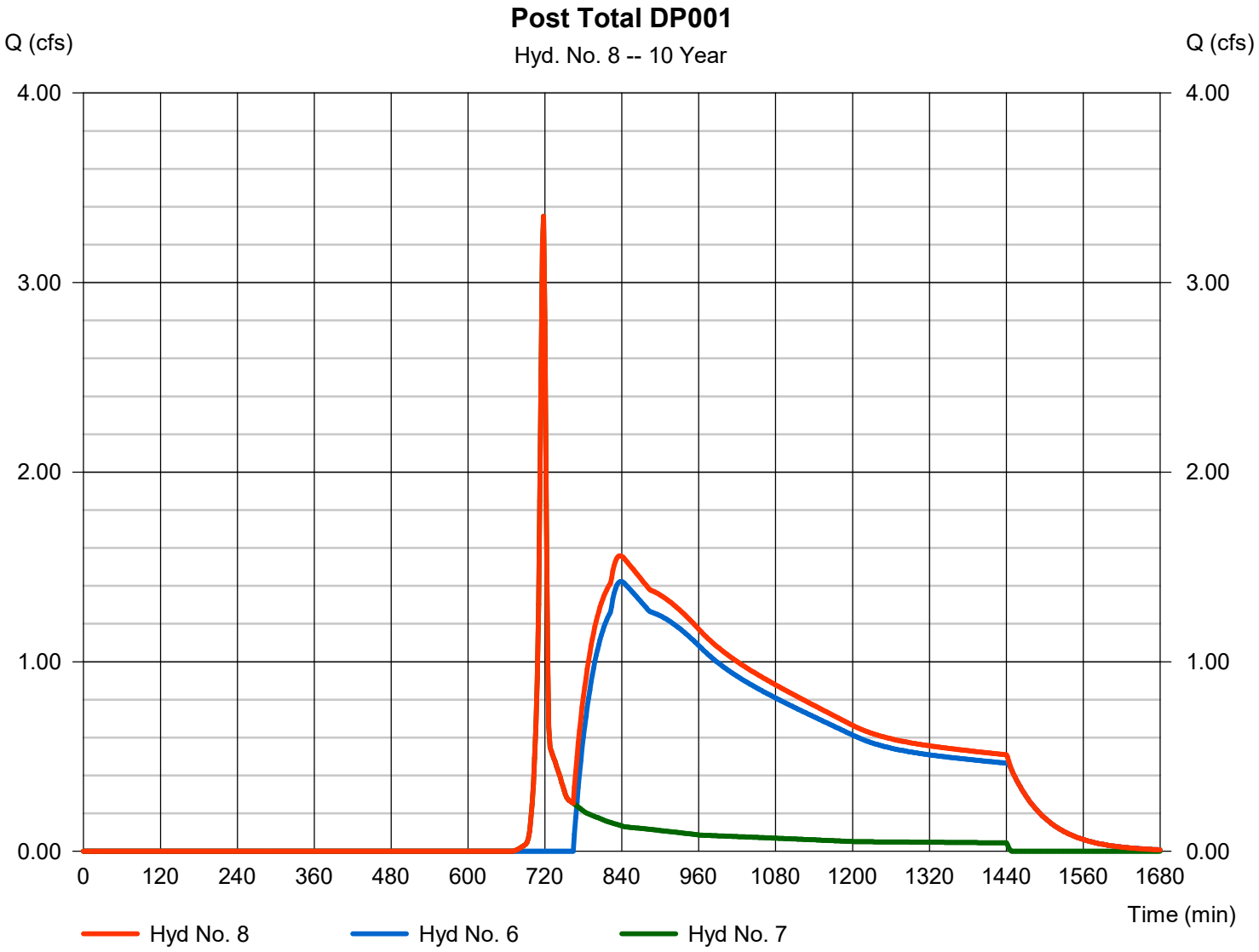


Hydrograph Report

Hyd. No. 8

Post Total DP001

Hydrograph type	= Combine	Peak discharge	= 3.349 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 41,040 cuft
Inflow hyds.	= 6, 7	Contrib. drain. area	= 1.440 ac

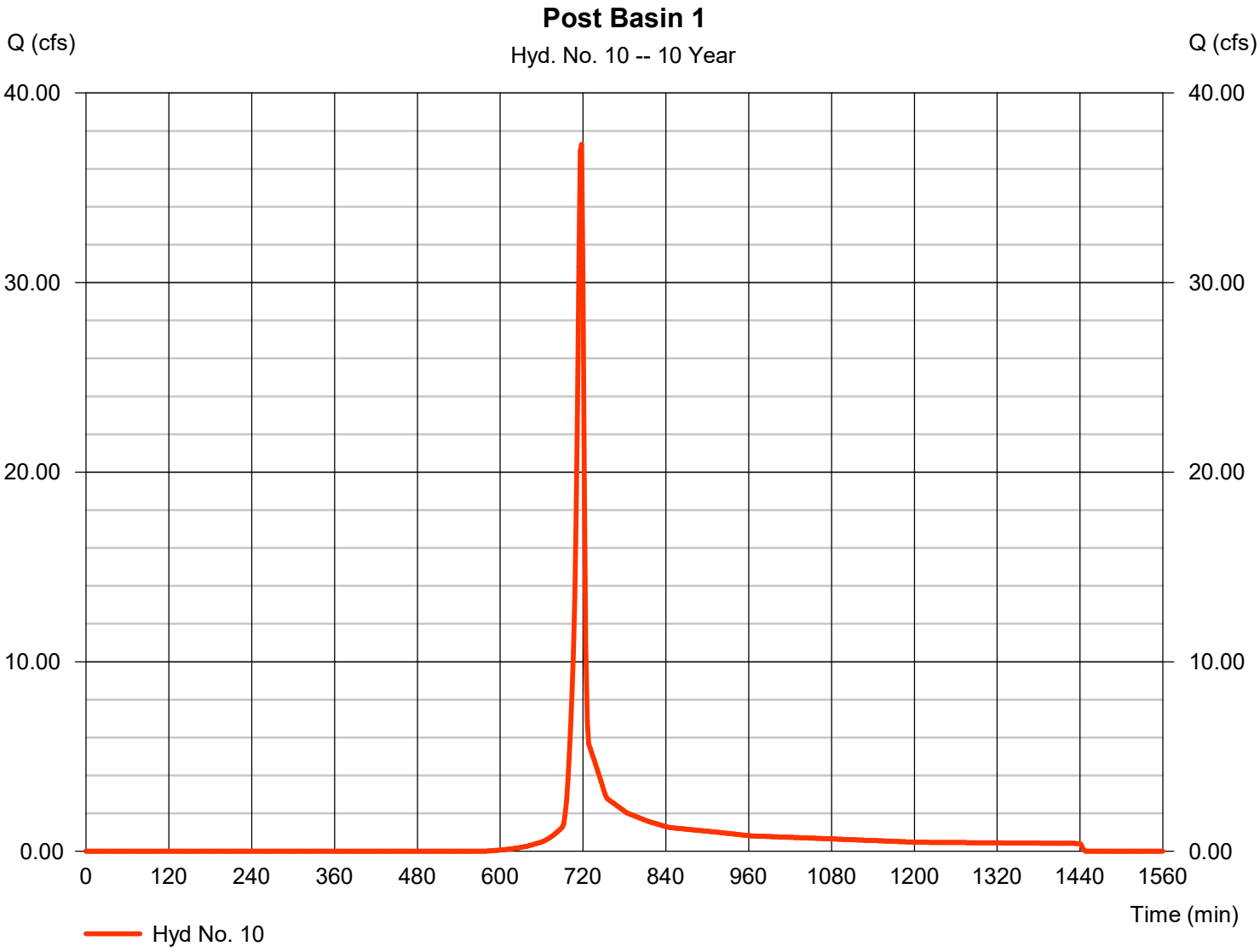


Hydrograph Report

Hyd. No. 10

Post Basin 1

Hydrograph type	=	SCS Runoff	Peak discharge	=	37.29 cfs
Storm frequency	=	10 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	74,773 cuft
Drainage area	=	10.950 ac	Curve number	=	71.8
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	4.77 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



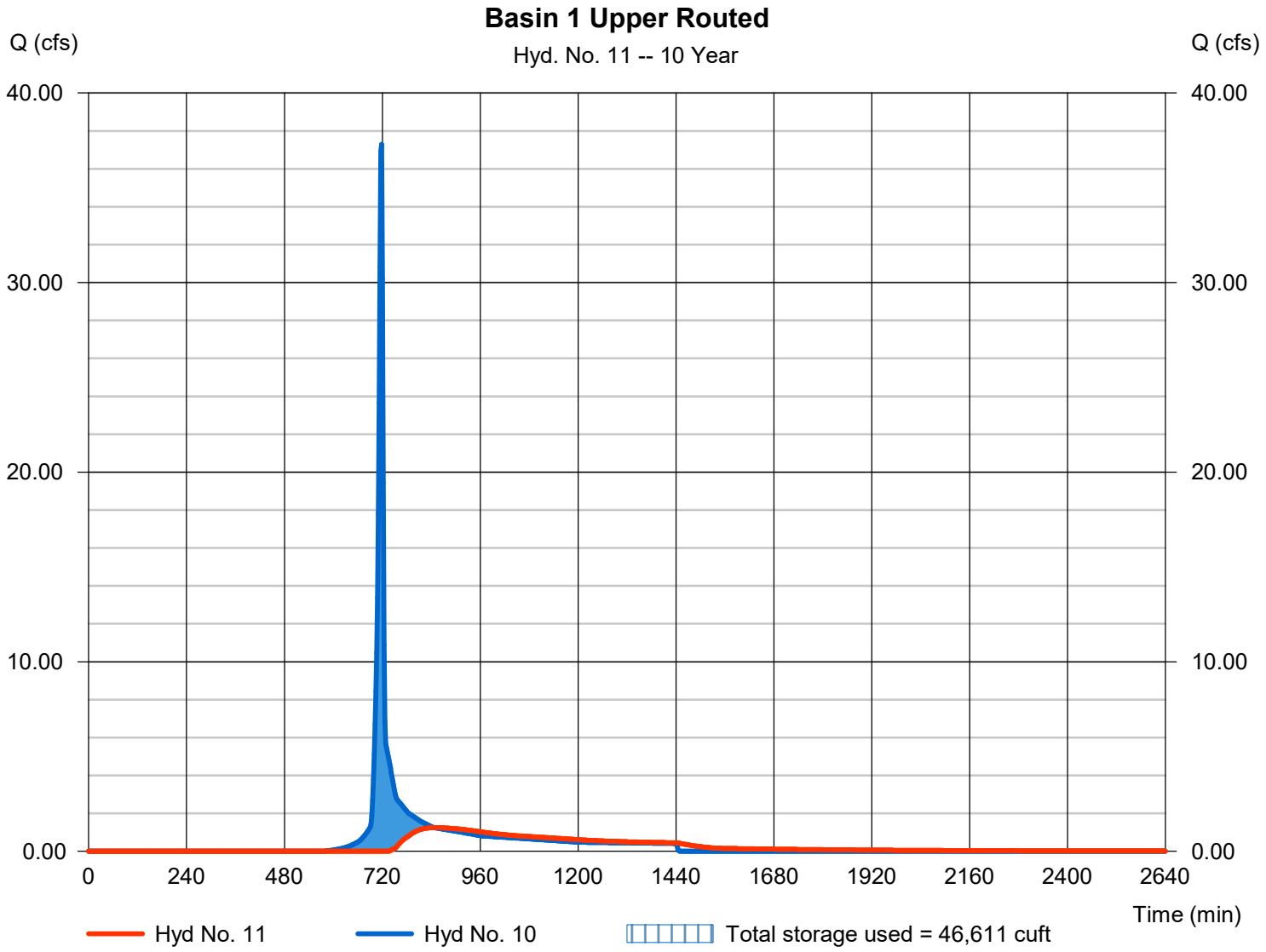
Hydrograph Report

Hyd. No. 11

Basin 1 Upper Routed

Hydrograph type	=	Reservoir	Peak discharge	=	1.244 cfs
Storm frequency	=	10 yrs	Time to peak	=	848 min
Time interval	=	2 min	Hyd. volume	=	37,284 cuft
Inflow hyd. No.	=	10 - Post Basin 1	Max. Elevation	=	322.89 ft
Reservoir name	=	Basin 1 Upper	Max. Storage	=	46,611 cuft

Storage Indication method used.



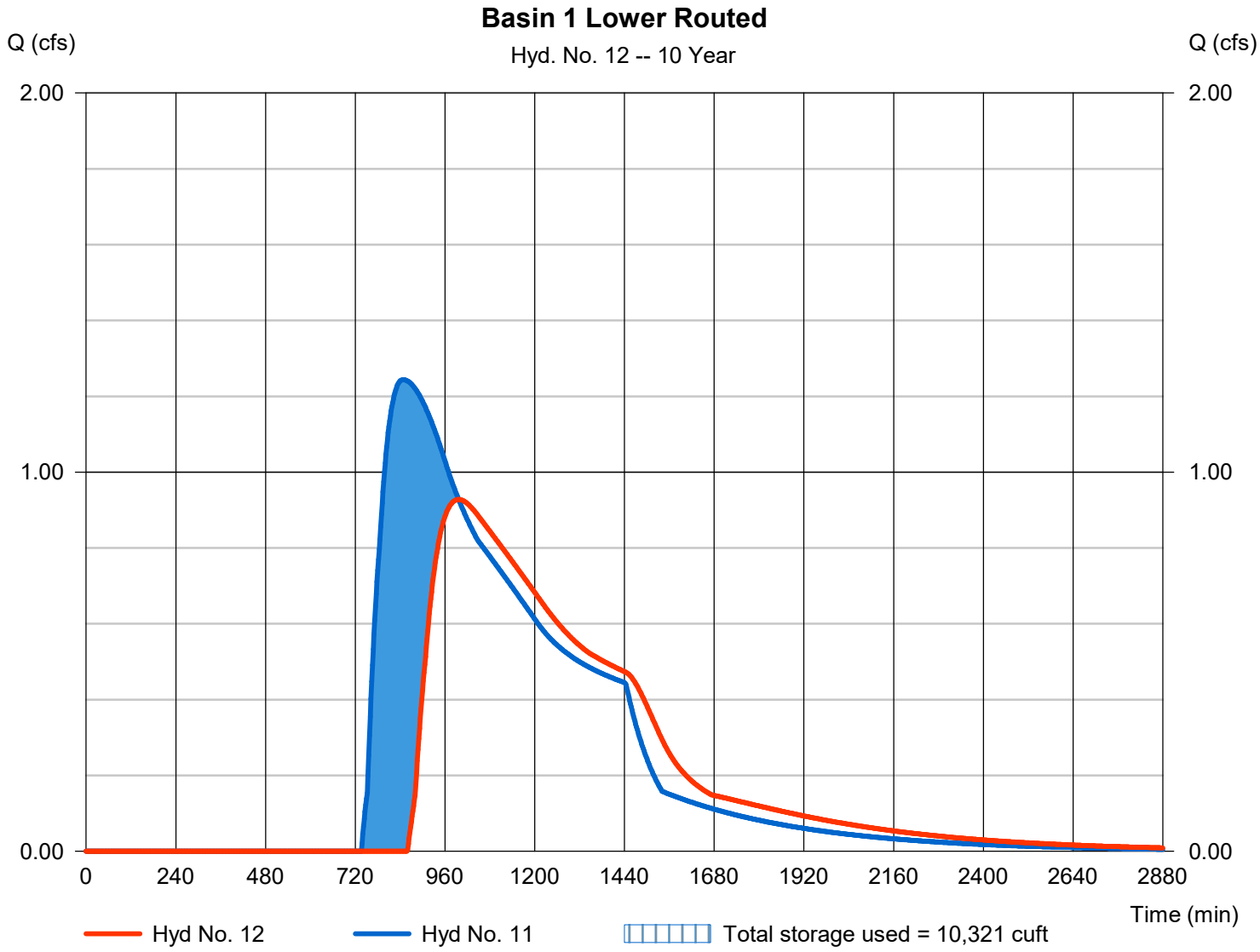
Hydrograph Report

Hyd. No. 12

Basin 1 Lower Routed

Hydrograph type	=	Reservoir	Peak discharge	=	0.928 cfs
Storm frequency	=	10 yrs	Time to peak	=	996 min
Time interval	=	2 min	Hyd. volume	=	31,087 cuft
Inflow hyd. No.	=	11 - Basin 1 Upper Routed	Max. Elevation	=	304.57 ft
Reservoir name	=	Basin 1 Lower	Max. Storage	=	10,321 cuft

Storage Indication method used.

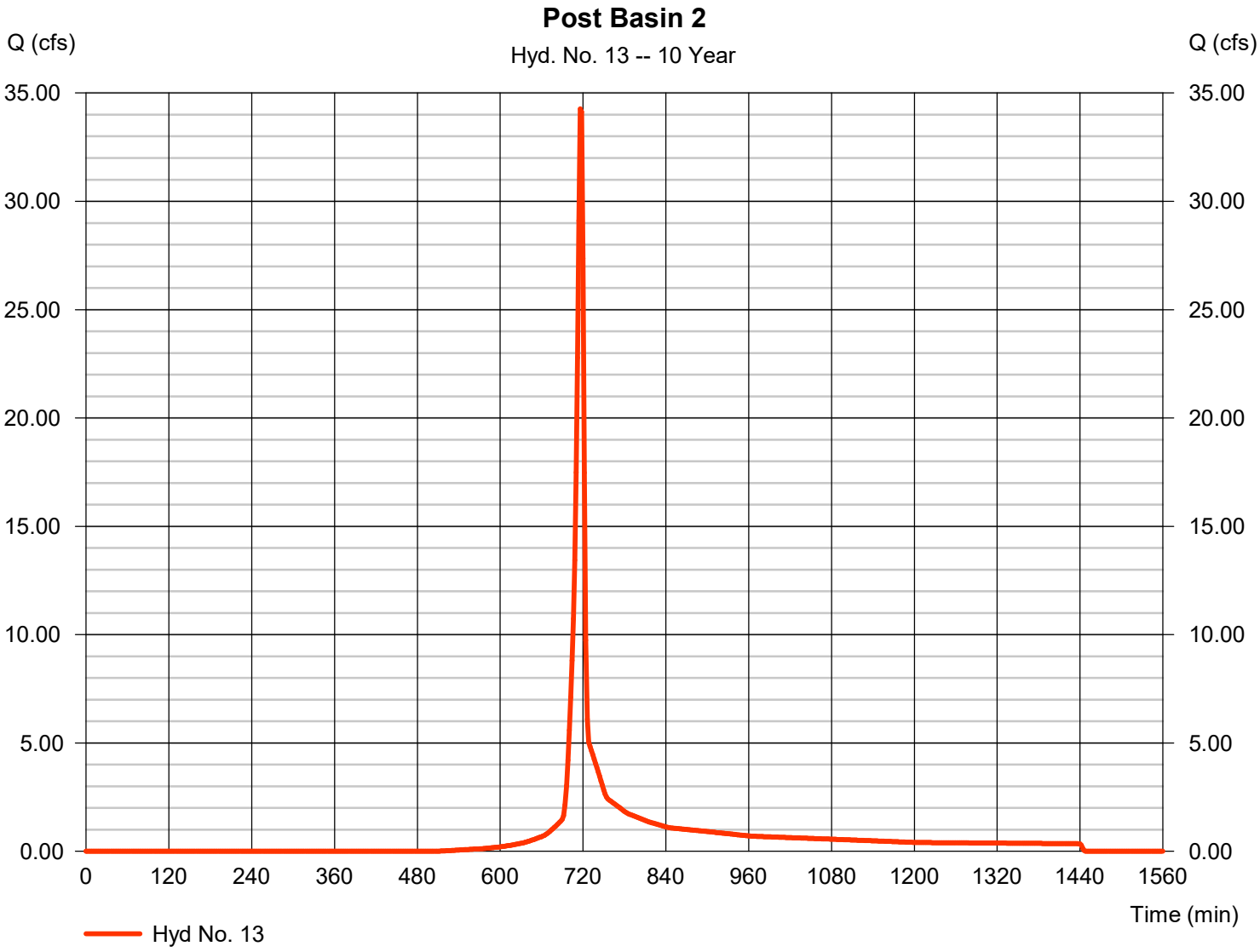


Hydrograph Report

Hyd. No. 13

Post Basin 2

Hydrograph type	=	SCS Runoff	Peak discharge	=	34.26 cfs
Storm frequency	=	10 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	69,196 cuft
Drainage area	=	8.540 ac	Curve number	=	76.4
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	4.77 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



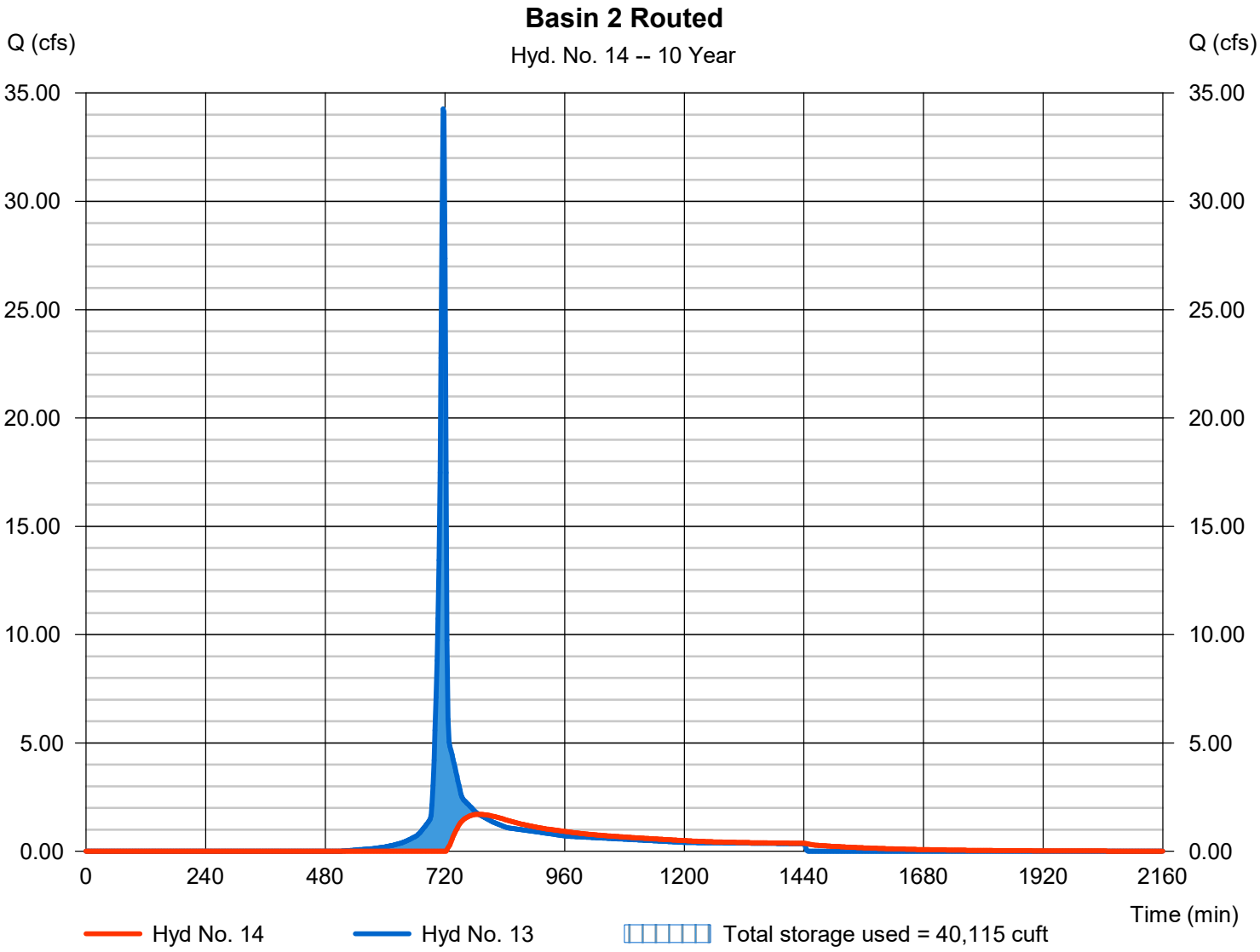
Hydrograph Report

Hyd. No. 14

Basin 2 Routed

Hydrograph type	=	Reservoir	Peak discharge	=	1.706 cfs
Storm frequency	=	10 yrs	Time to peak	=	788 min
Time interval	=	2 min	Hyd. volume	=	36,842 cuft
Inflow hyd. No.	=	13 - Post Basin 2	Max. Elevation	=	309.33 ft
Reservoir name	=	Basin 2	Max. Storage	=	40,115 cuft

Storage Indication method used.

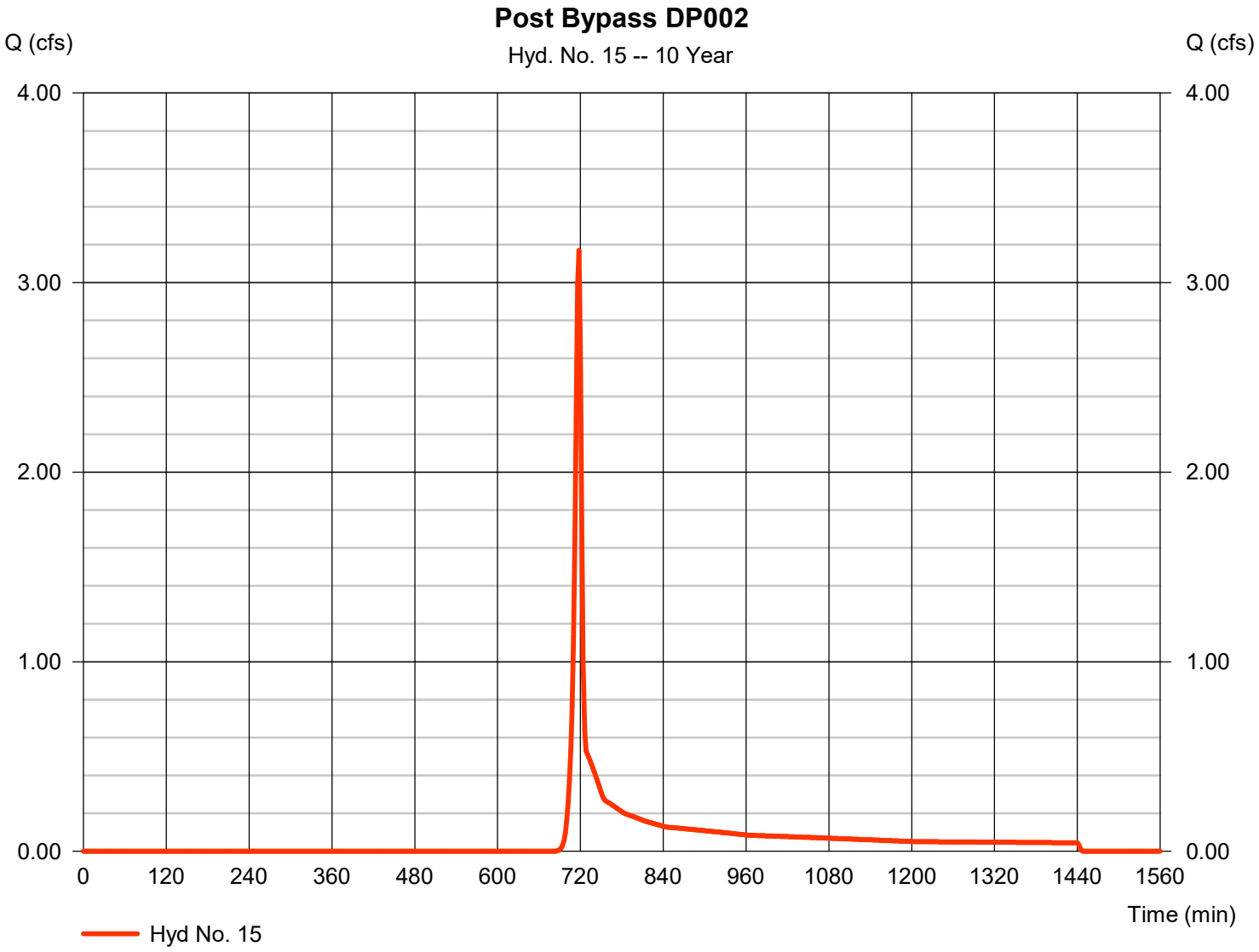


Hydrograph Report

Hyd. No. 15

Post Bypass DP002

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.170 cfs
Storm frequency	=	10 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	6,463 cuft
Drainage area	=	1.540 ac	Curve number	=	61
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	4.77 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

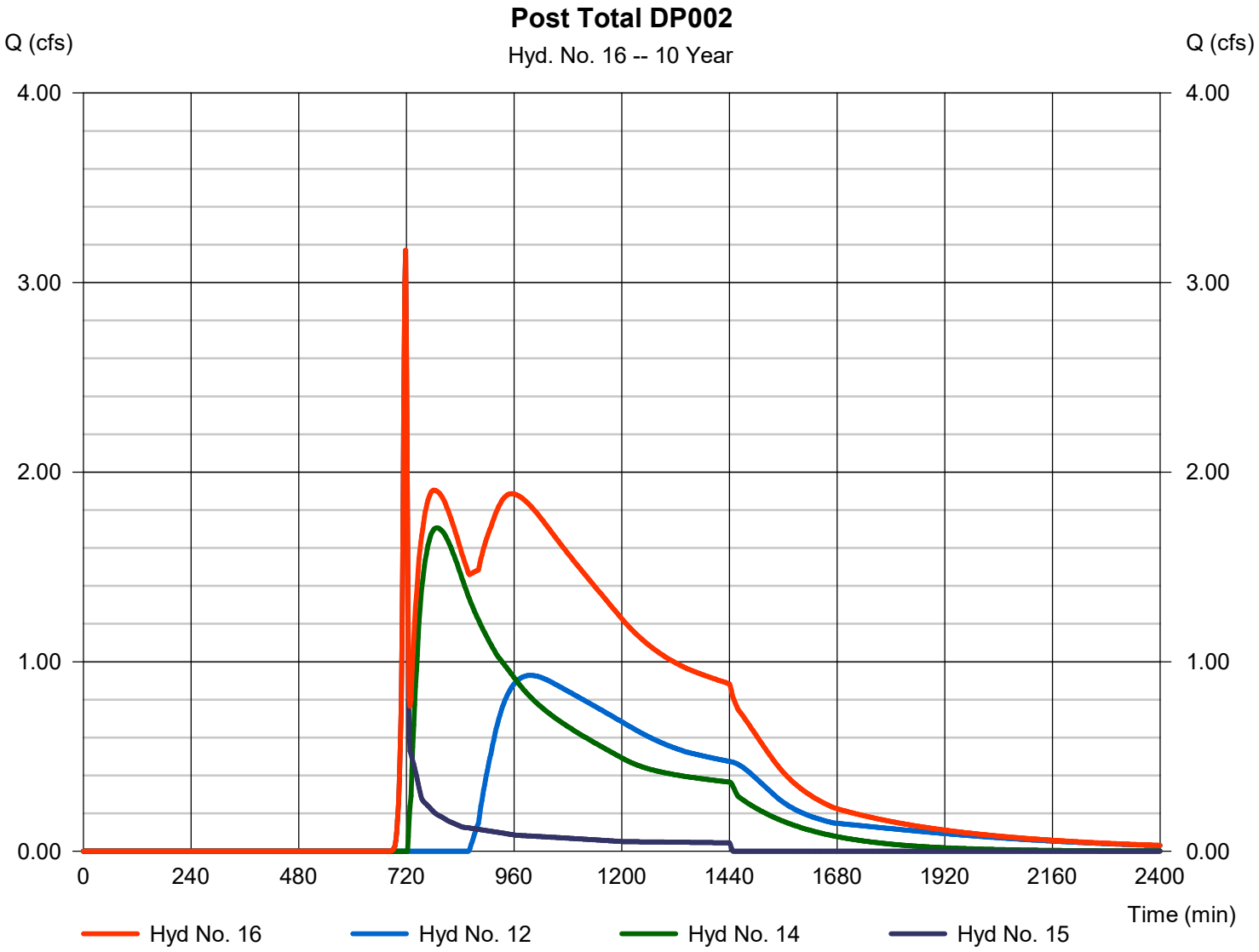


Hydrograph Report

Hyd. No. 16

Post Total DP002

Hydrograph type	= Combine	Peak discharge	= 3.170 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 74,392 cuft
Inflow hyds.	= 12, 14, 15	Contrib. drain. area	= 1.540 ac



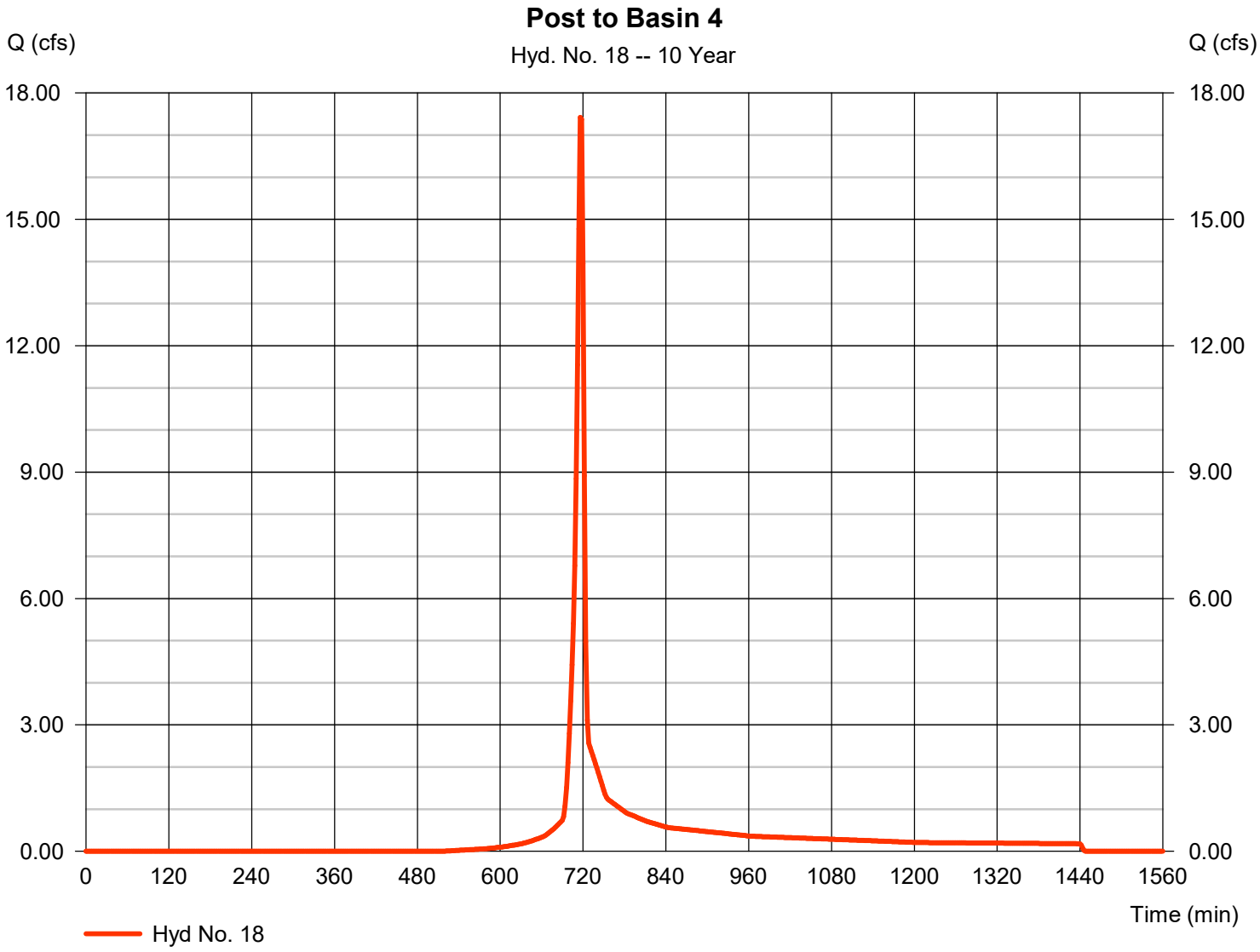
Hydrograph Report

Hyd. No. 18

Post to Basin 4

Hydrograph type	=	SCS Runoff	Peak discharge	=	17.42 cfs
Storm frequency	=	10 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	35,181 cuft
Drainage area	=	4.420 ac	Curve number	=	75.9*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	4.77 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.910 x 61) + (2.270 x 98) + (3.040 x 78)] / 4.420



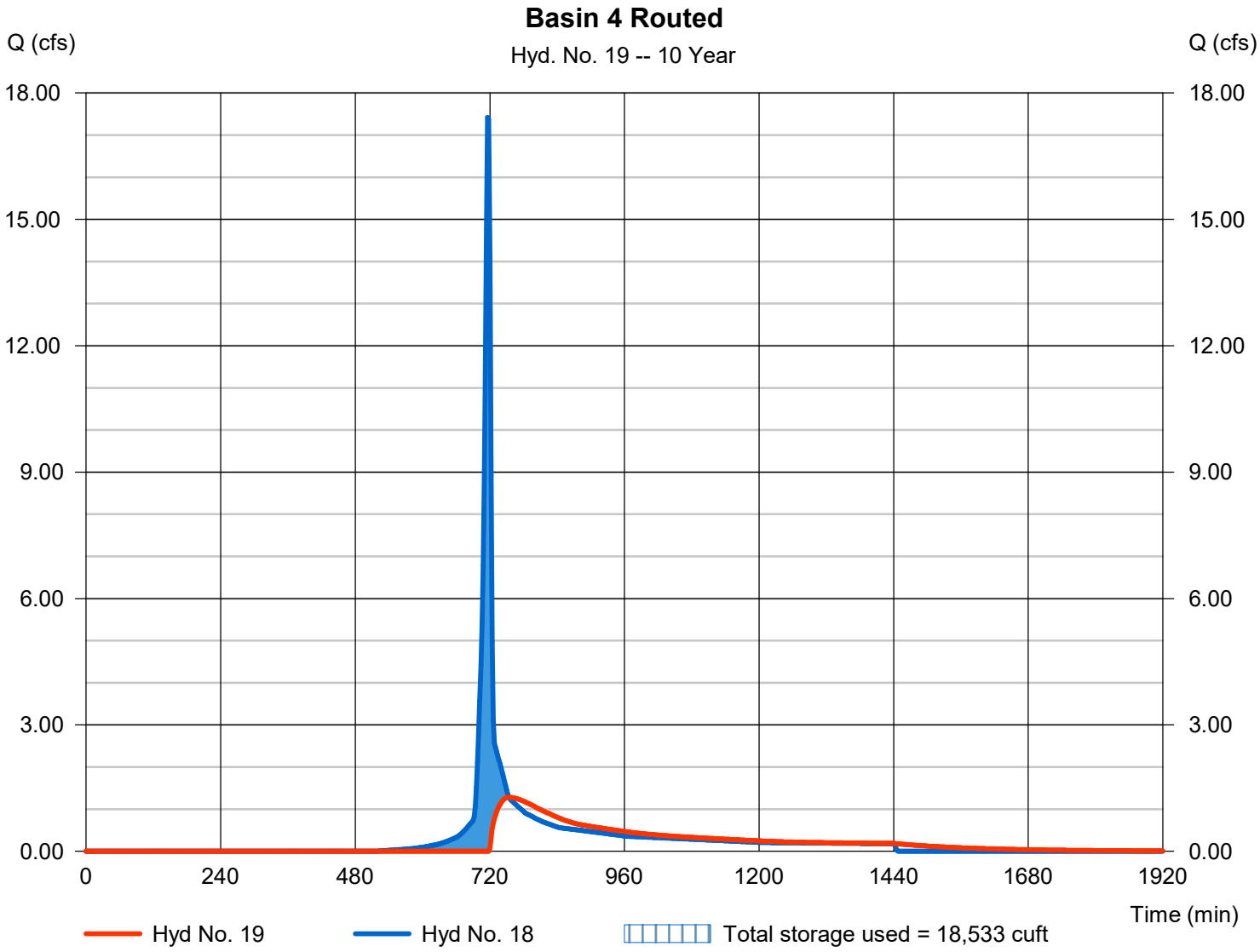
Hydrograph Report

Hyd. No. 19

Basin 4 Routed

Hydrograph type	=	Reservoir	Peak discharge	=	1.282 cfs
Storm frequency	=	10 yrs	Time to peak	=	754 min
Time interval	=	2 min	Hyd. volume	=	21,383 cuft
Inflow hyd. No.	=	18 - Post to Basin 4	Max. Elevation	=	346.79 ft
Reservoir name	=	Basin 4	Max. Storage	=	18,533 cuft

Storage Indication method used.



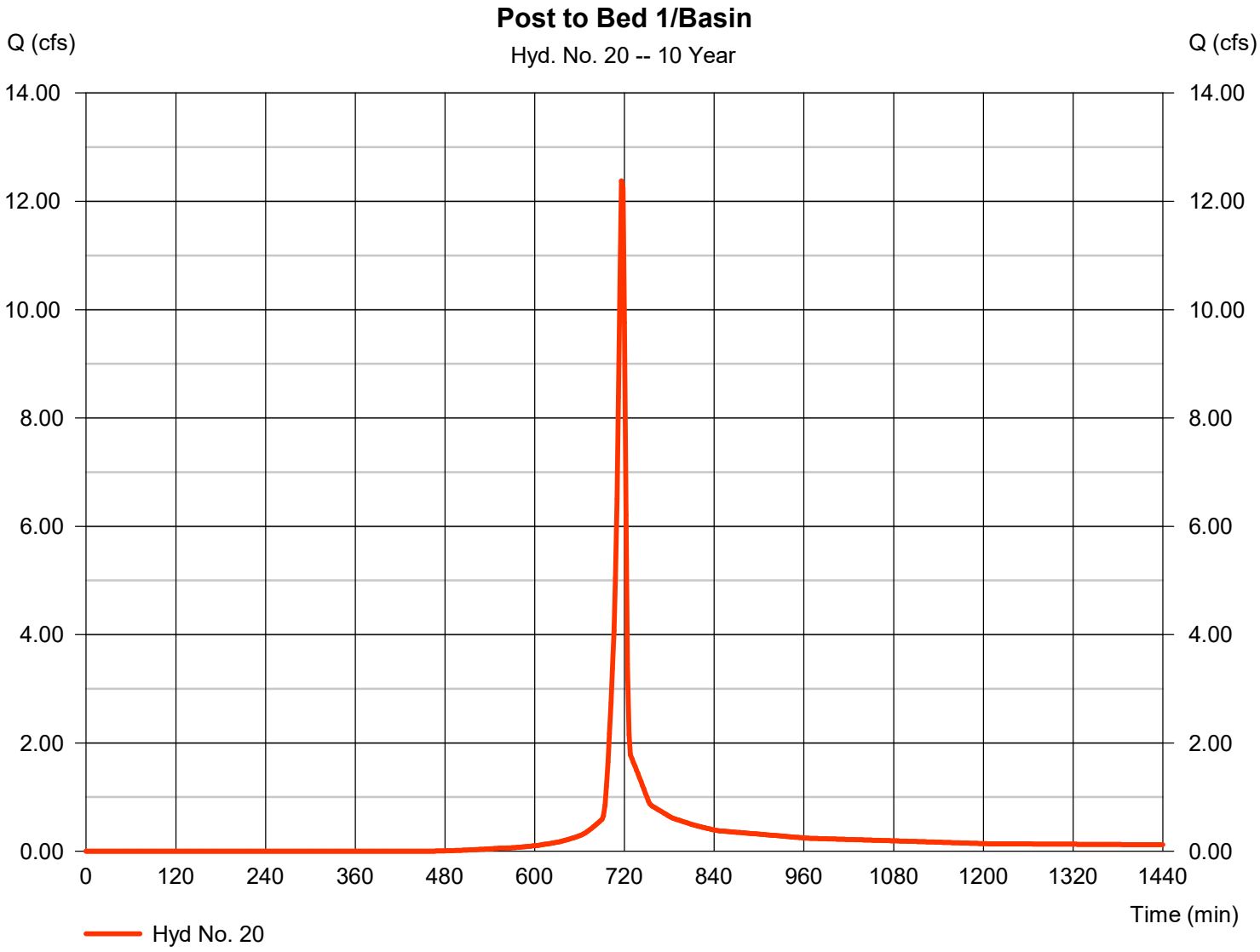
Hydrograph Report

Hyd. No. 20

Post to Bed 1/Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	12.38 cfs
Storm frequency	=	10 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	25,081 cuft
Drainage area	=	2.820 ac	Curve number	=	79.1*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	4.77 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.910 x 61) + (2.270 x 98) + (3.040 x 78)] / 2.820



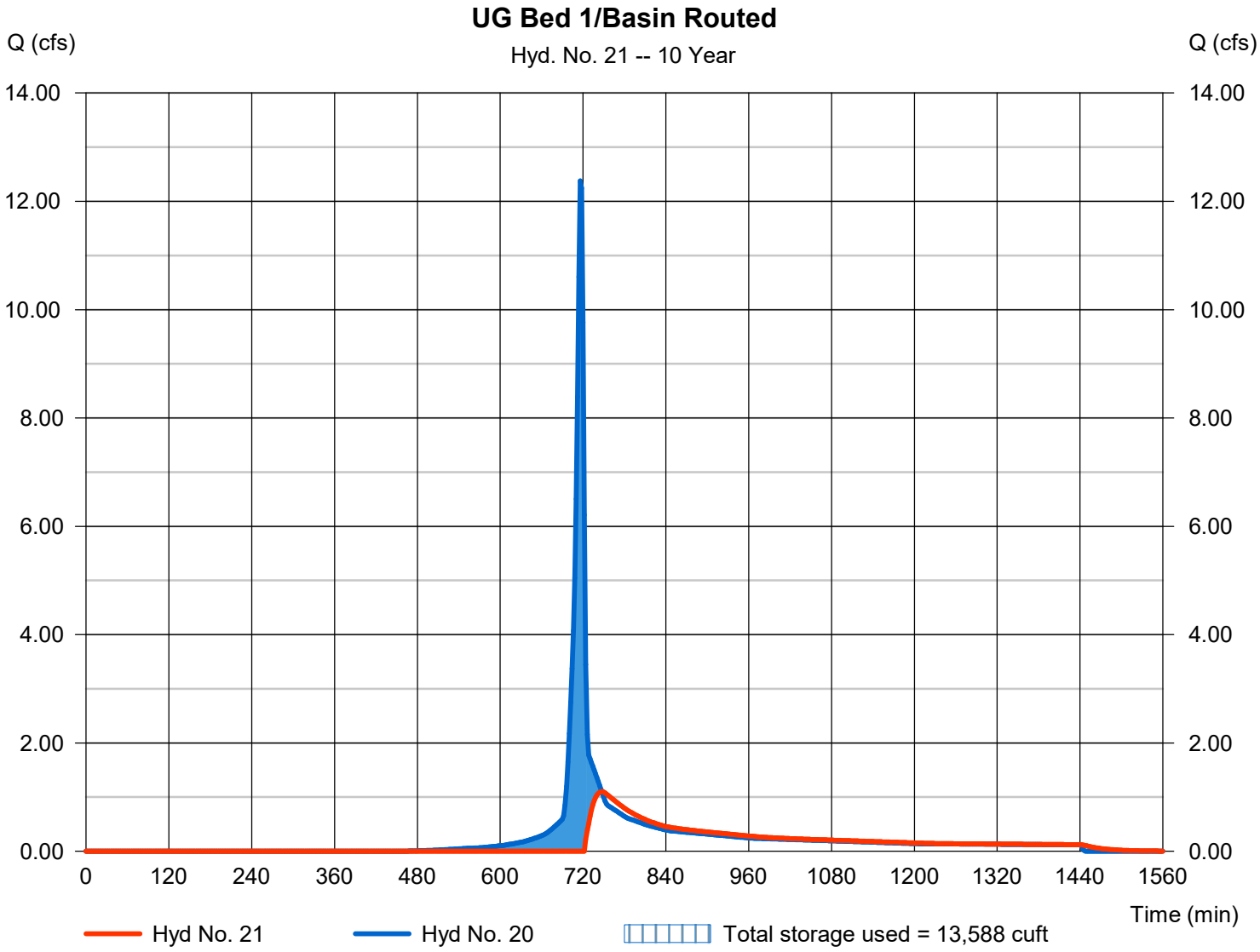
Hydrograph Report

Hyd. No. 21

UG Bed 1/Basin Routed

Hydrograph type	= Reservoir	Peak discharge	= 1.100 cfs
Storm frequency	= 10 yrs	Time to peak	= 748 min
Time interval	= 2 min	Hyd. volume	= 12,984 cuft
Inflow hyd. No.	= 20 - Post to Bed 1/Basin	Max. Elevation	= 340.55 ft
Reservoir name	= UG Bed 1/Basin	Max. Storage	= 13,588 cuft

Storage Indication method used.

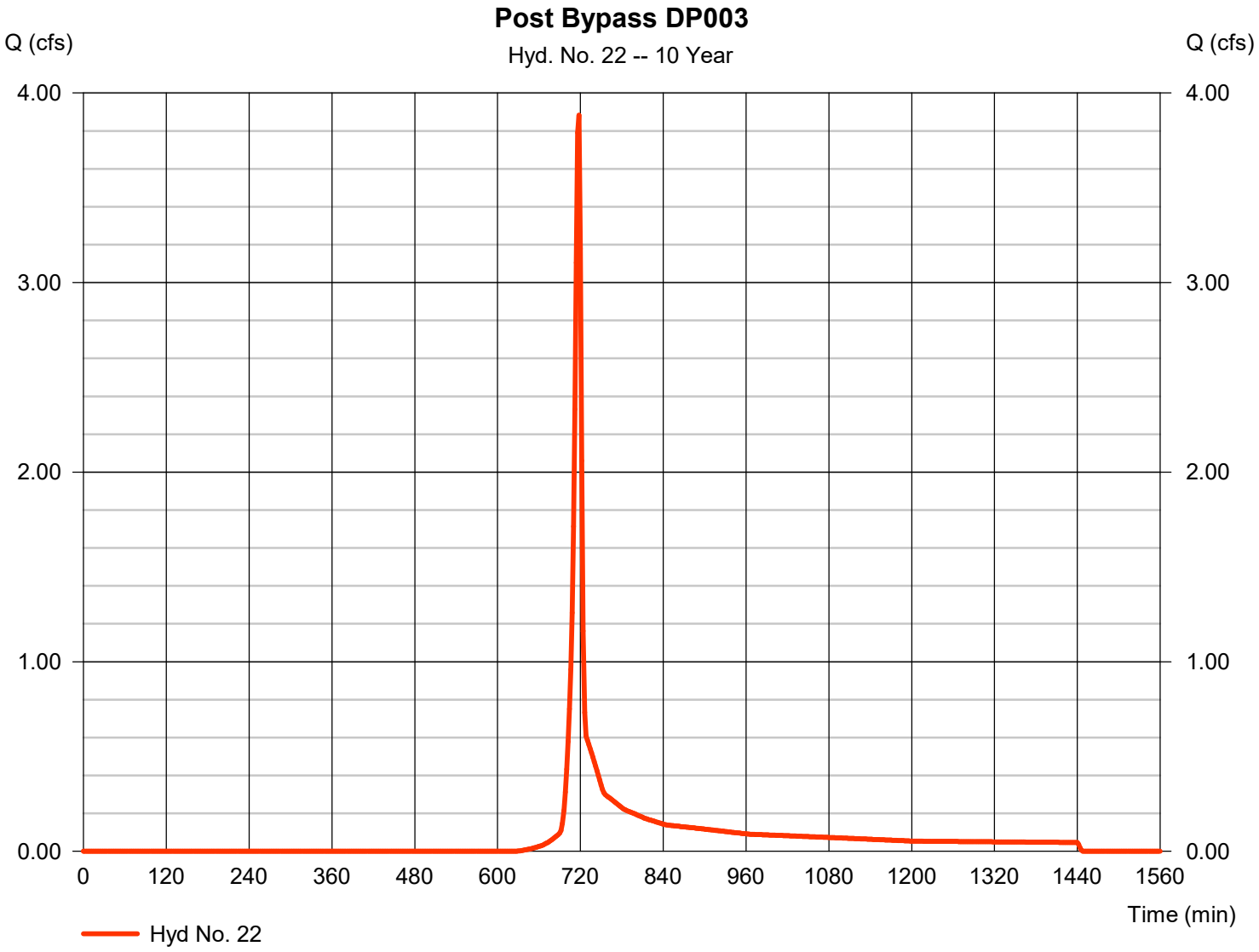


Hydrograph Report

Hyd. No. 22

Post Bypass DP003

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.883 cfs
Storm frequency	=	10 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	7,766 cuft
Drainage area	=	1.340 ac	Curve number	=	67.8
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	4.77 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

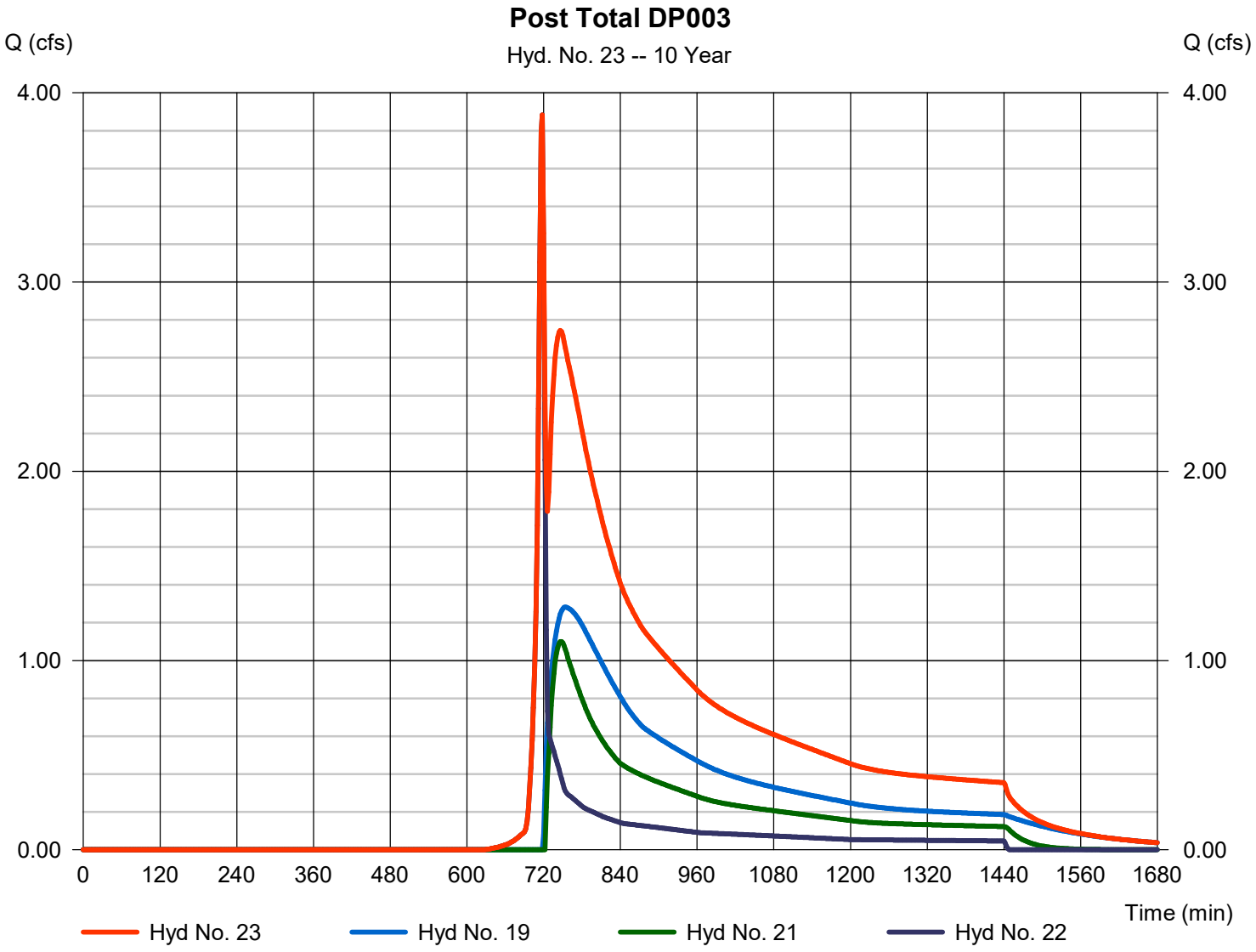


Hydrograph Report

Hyd. No. 23

Post Total DP003

Hydrograph type	=	Combine	Peak discharge	=	3.883 cfs
Storm frequency	=	10 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	42,133 cuft
Inflow hyds.	=	19, 21, 22	Contrib. drain. area	=	1.340 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

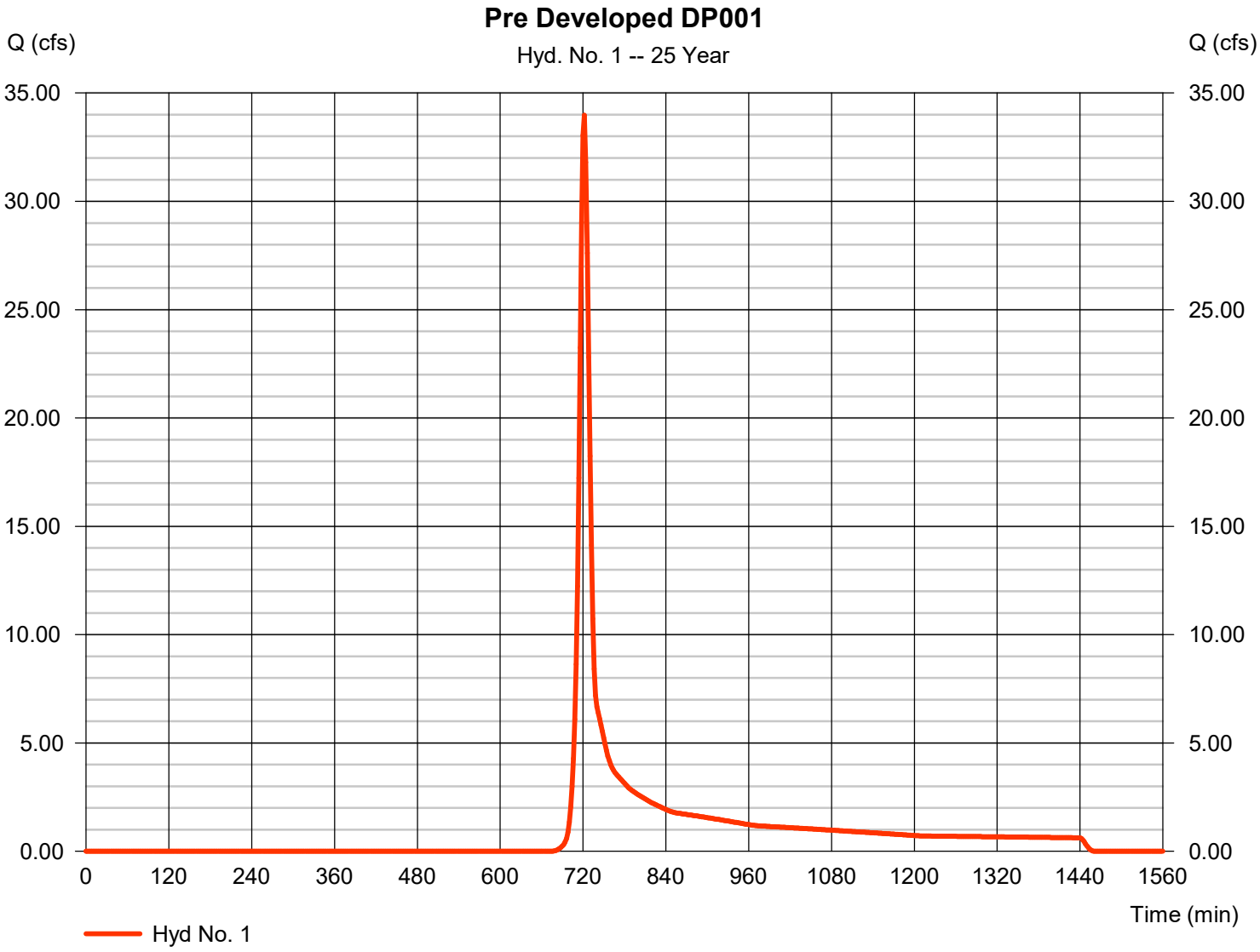
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	33.98	2	722	92,948	------	------	------	Pre Developed DP001
2	SCS Runoff	45.70	2	722	123,600	------	------	------	Pre Developed DP002
3	SCS Runoff	28.88	2	722	75,557	------	------	------	Pre Developed DP003
4	SCS Runoff	2.654	2	718	5,315	------	------	------	Pre Developed DP003 ORA
5	SCS Runoff	55.13	2	718	111,161	------	------	------	Post Basin 3
6	Reservoir	6.253	2	740	65,694	5	318.79	53,978	Basin 3 Routed
7	SCS Runoff	4.966	2	718	9,933	------	------	------	Post Bypass DP001
8	Combine	6.859	2	740	75,627	6, 7	------	------	Post Total DP001
10	SCS Runoff	51.31	2	716	103,585	------	------	------	Post Basin 1
11	Reservoir	3.633	2	756	66,096	10	323.31	54,387	Basin 1 Upper Routed
12	Reservoir	2.071	2	874	59,899	11	305.33	15,802	Basin 1 Lower Routed
13	SCS Runoff	46.02	2	716	93,362	------	------	------	Post Basin 2
14	Reservoir	5.509	2	736	61,008	13	309.83	47,406	Basin 2 Routed
15	SCS Runoff	4.826	2	718	9,678	------	------	------	Post Bypass DP002
16	Combine	6.169	2	736	130,585	12, 14, 15	------	------	Post Total DP002
18	SCS Runoff	23.48	2	716	47,598	------	------	------	Post to Basin 4
19	Reservoir	3.119	2	732	33,800	18	347.38	23,223	Basin 4 Routed
20	SCS Runoff	16.34	2	716	33,358	------	------	------	Post to Bed 1/Basin
21	Reservoir	4.714	2	724	21,261	20	341.15	16,082	UG Bed 1/Basin Routed
22	SCS Runoff	5.505	2	718	11,037	------	------	------	Post Bypass DP003
23	Combine	10.00	2	722	66,098	19, 21, 22	------	------	Post Total DP003

Hydrograph Report

Hyd. No. 1

Pre Developed DP001

Hydrograph type	=	SCS Runoff	Peak discharge	=	33.98 cfs
Storm frequency	=	25 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	92,948 cuft
Drainage area	=	15.430 ac	Curve number	=	58
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	12.00 min
Total precip.	=	5.76 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

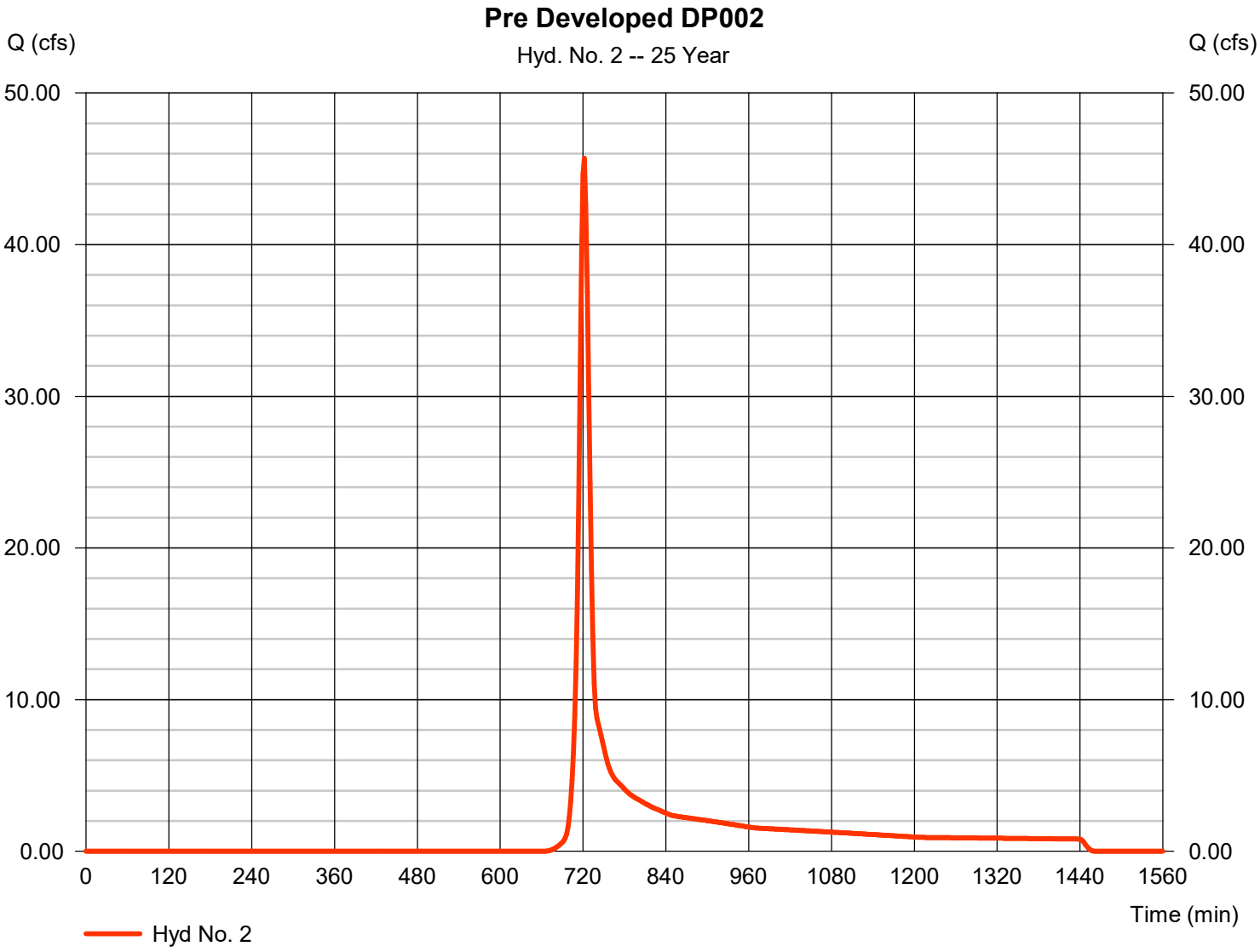


Hydrograph Report

Hyd. No. 2

Pre Developed DP002

Hydrograph type	=	SCS Runoff	Peak discharge	=	45.70 cfs
Storm frequency	=	25 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	123,600 cuft
Drainage area	=	19.210 ac	Curve number	=	59.4
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	12.00 min
Total precip.	=	5.76 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

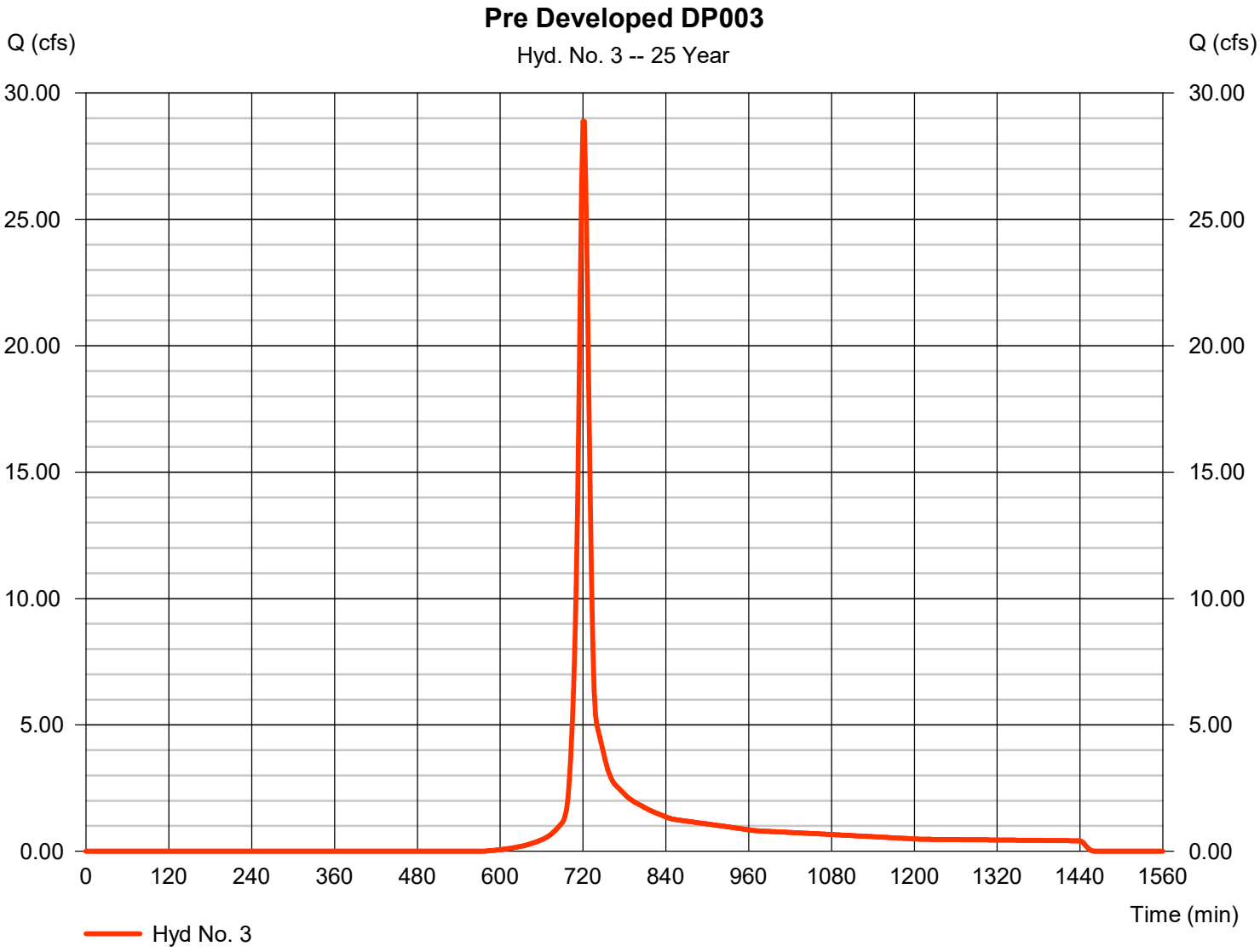


Hydrograph Report

Hyd. No. 3

Pre Developed DP003

Hydrograph type	=	SCS Runoff	Peak discharge	=	28.88 cfs
Storm frequency	=	25 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	75,557 cuft
Drainage area	=	8.190 ac	Curve number	=	68.3
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	11.00 min
Total precip.	=	5.76 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

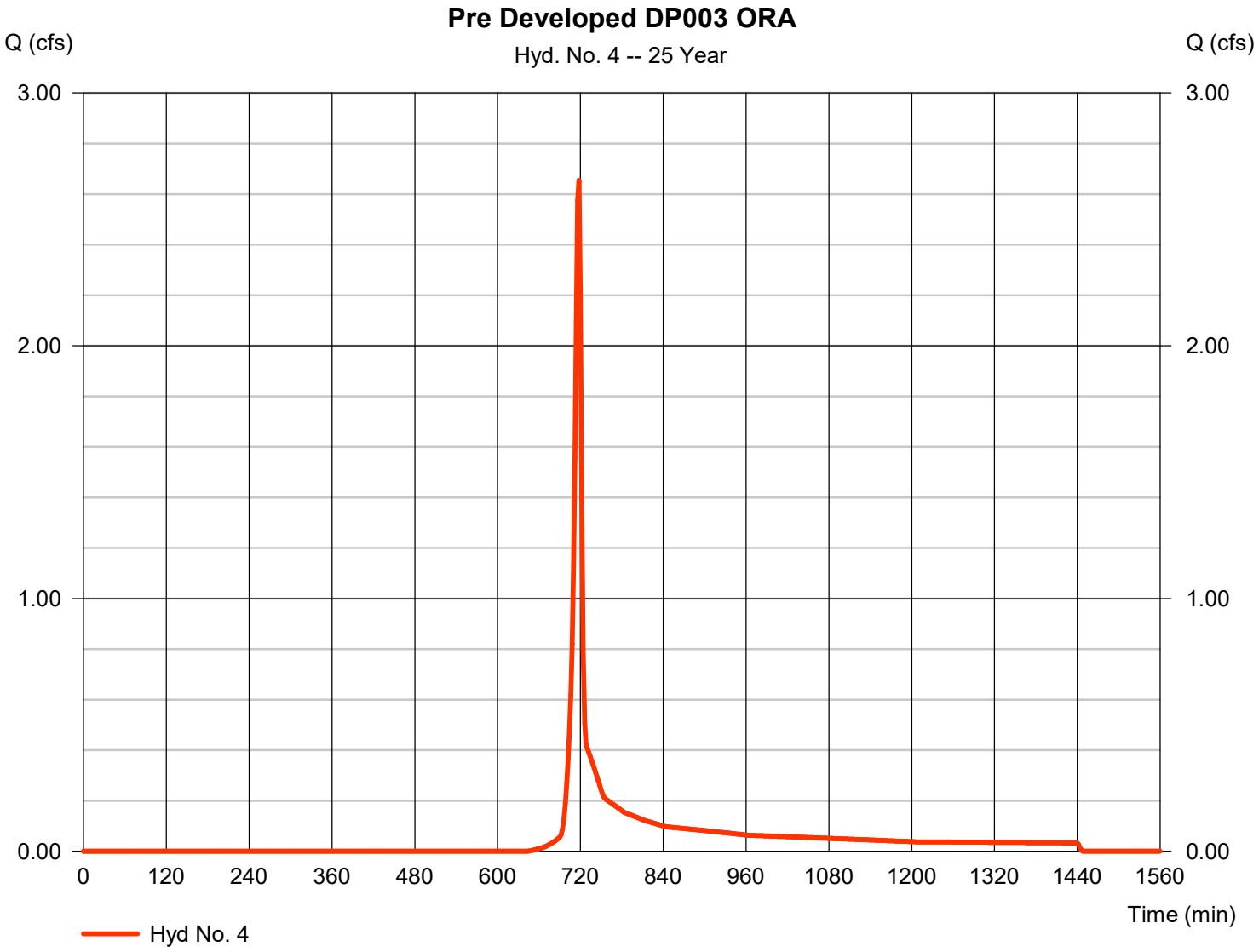


Hydrograph Report

Hyd. No. 4

Pre Developed DP003 ORA

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.654 cfs
Storm frequency	=	25 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	5,315 cuft
Drainage area	=	0.810 ac	Curve number	=	62
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	5.76 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

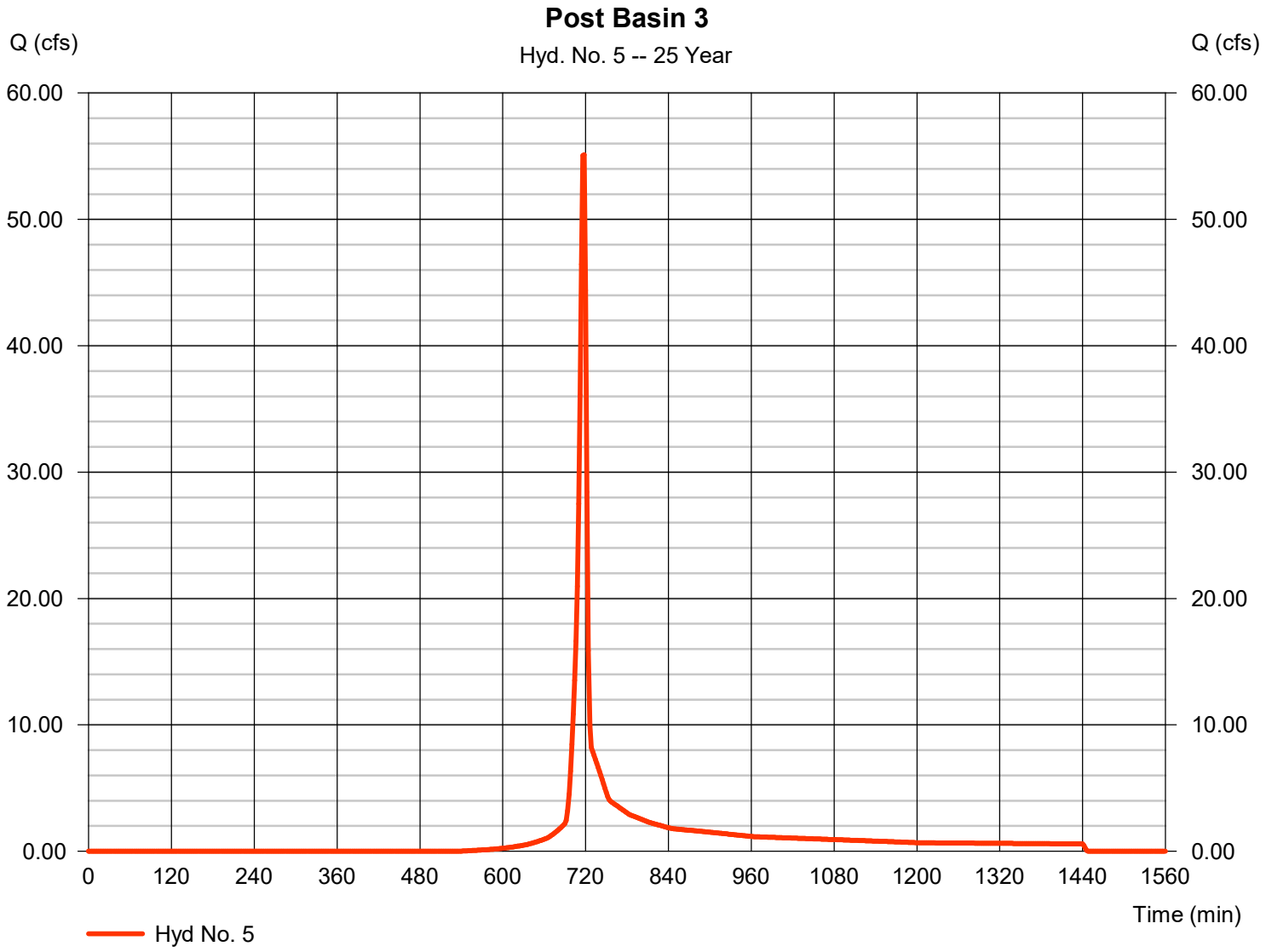


Hydrograph Report

Hyd. No. 5

Post Basin 3

Hydrograph type	=	SCS Runoff	Peak discharge	=	55.13 cfs
Storm frequency	=	25 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	111,161 cuft
Drainage area	=	12.150 ac	Curve number	=	70.8
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	5.76 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



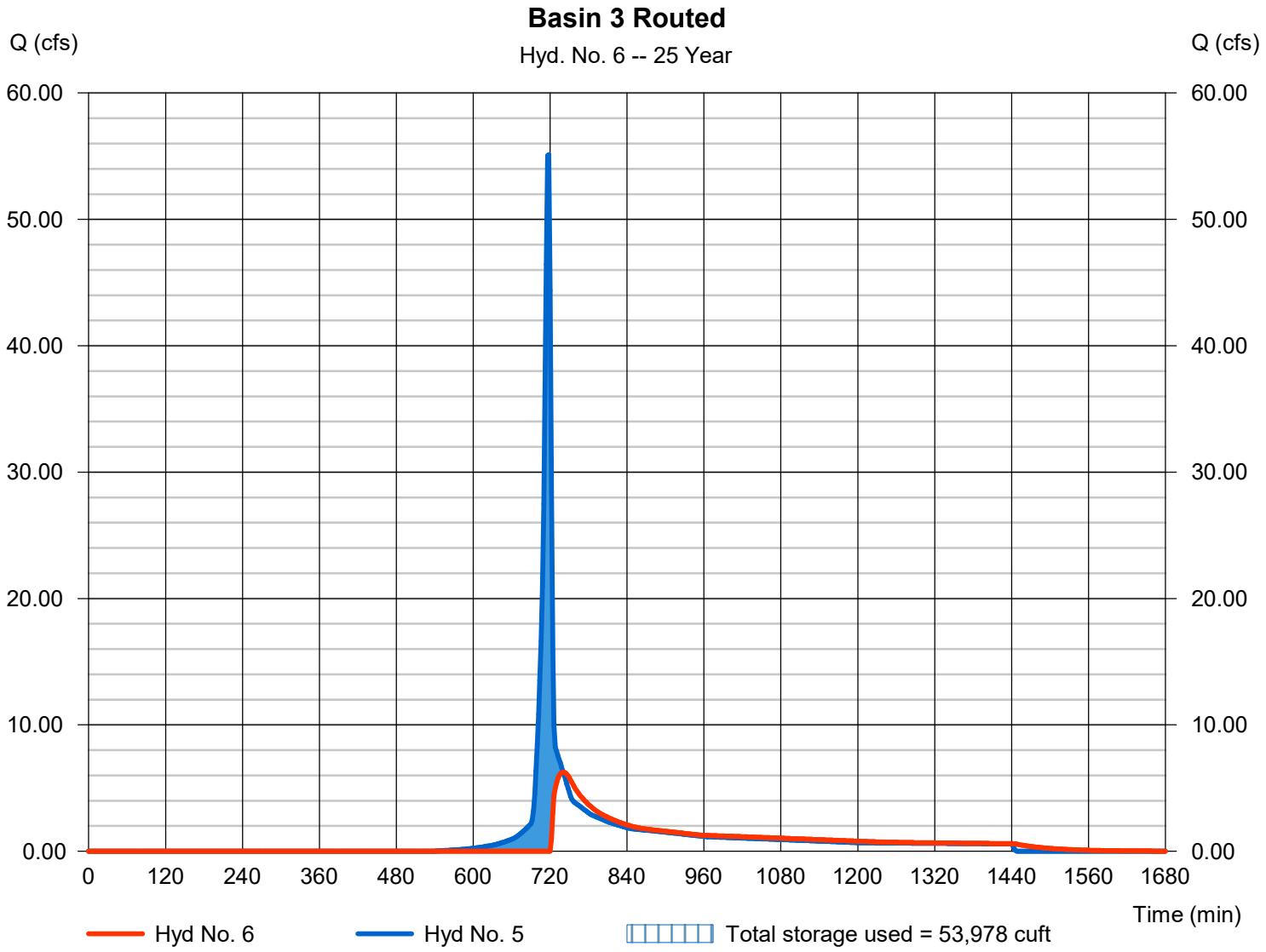
Hydrograph Report

Hyd. No. 6

Basin 3 Routed

Hydrograph type	=	Reservoir	Peak discharge	=	6.253 cfs
Storm frequency	=	25 yrs	Time to peak	=	740 min
Time interval	=	2 min	Hyd. volume	=	65,694 cuft
Inflow hyd. No.	=	5 - Post Basin 3	Max. Elevation	=	318.79 ft
Reservoir name	=	Basin 3	Max. Storage	=	53,978 cuft

Storage Indication method used.

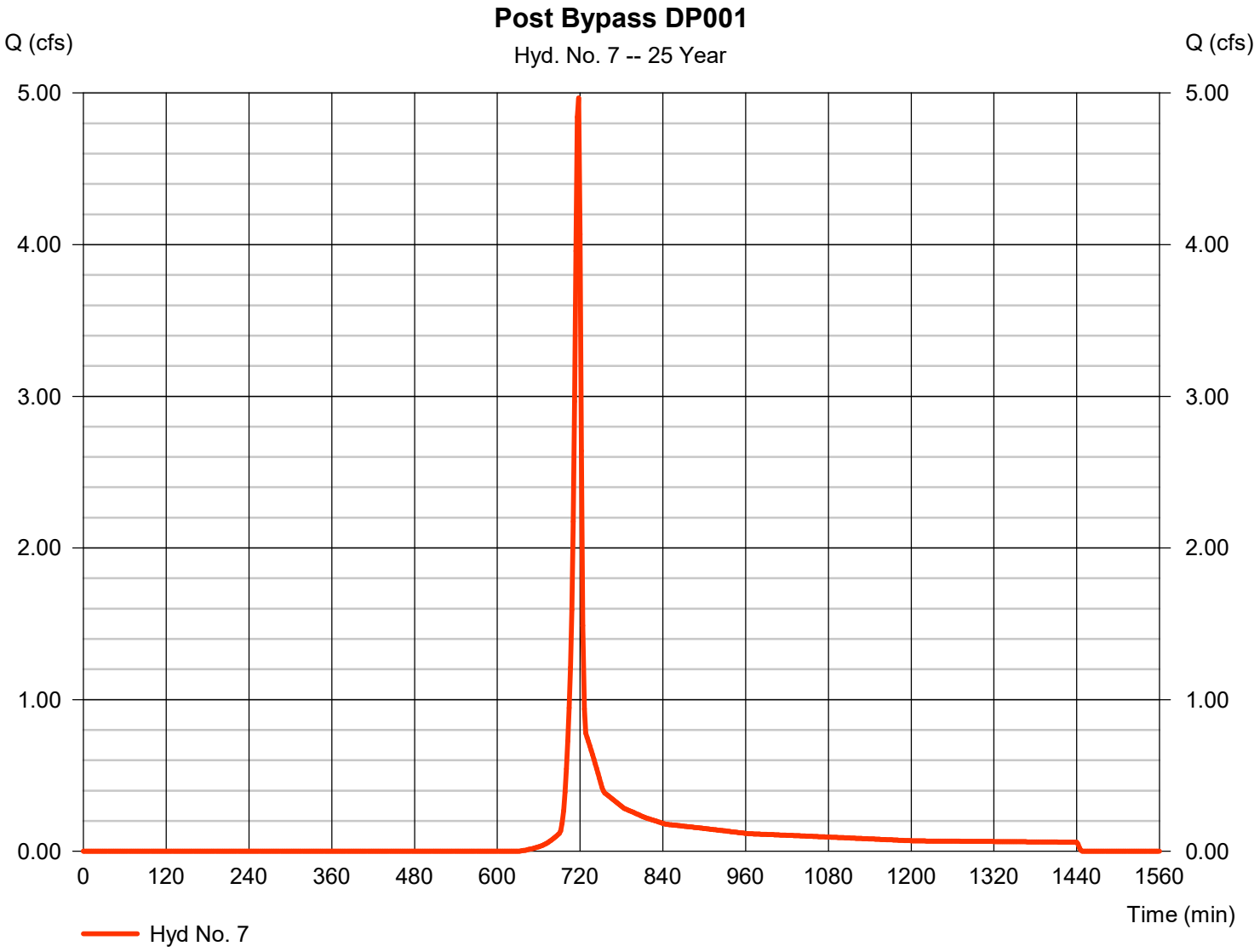


Hydrograph Report

Hyd. No. 7

Post Bypass DP001

Hydrograph type	=	SCS Runoff	Peak discharge	=	4.966 cfs
Storm frequency	=	25 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	9,933 cuft
Drainage area	=	1.440 ac	Curve number	=	63.2
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	5.76 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

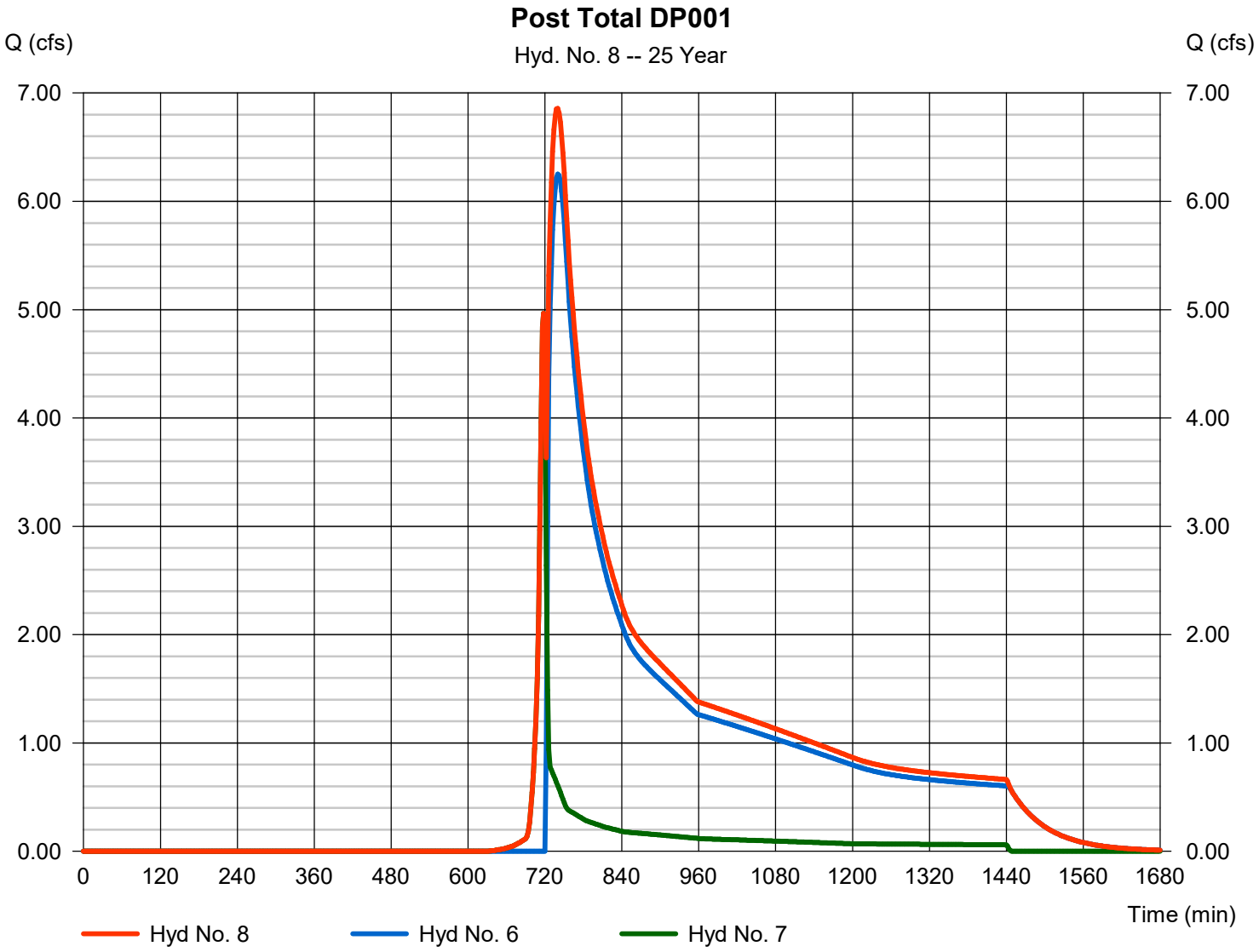


Hydrograph Report

Hyd. No. 8

Post Total DP001

Hydrograph type	=	Combine	Peak discharge	=	6.859 cfs
Storm frequency	=	25 yrs	Time to peak	=	740 min
Time interval	=	2 min	Hyd. volume	=	75,627 cuft
Inflow hyds.	=	6, 7	Contrib. drain. area	=	1.440 ac

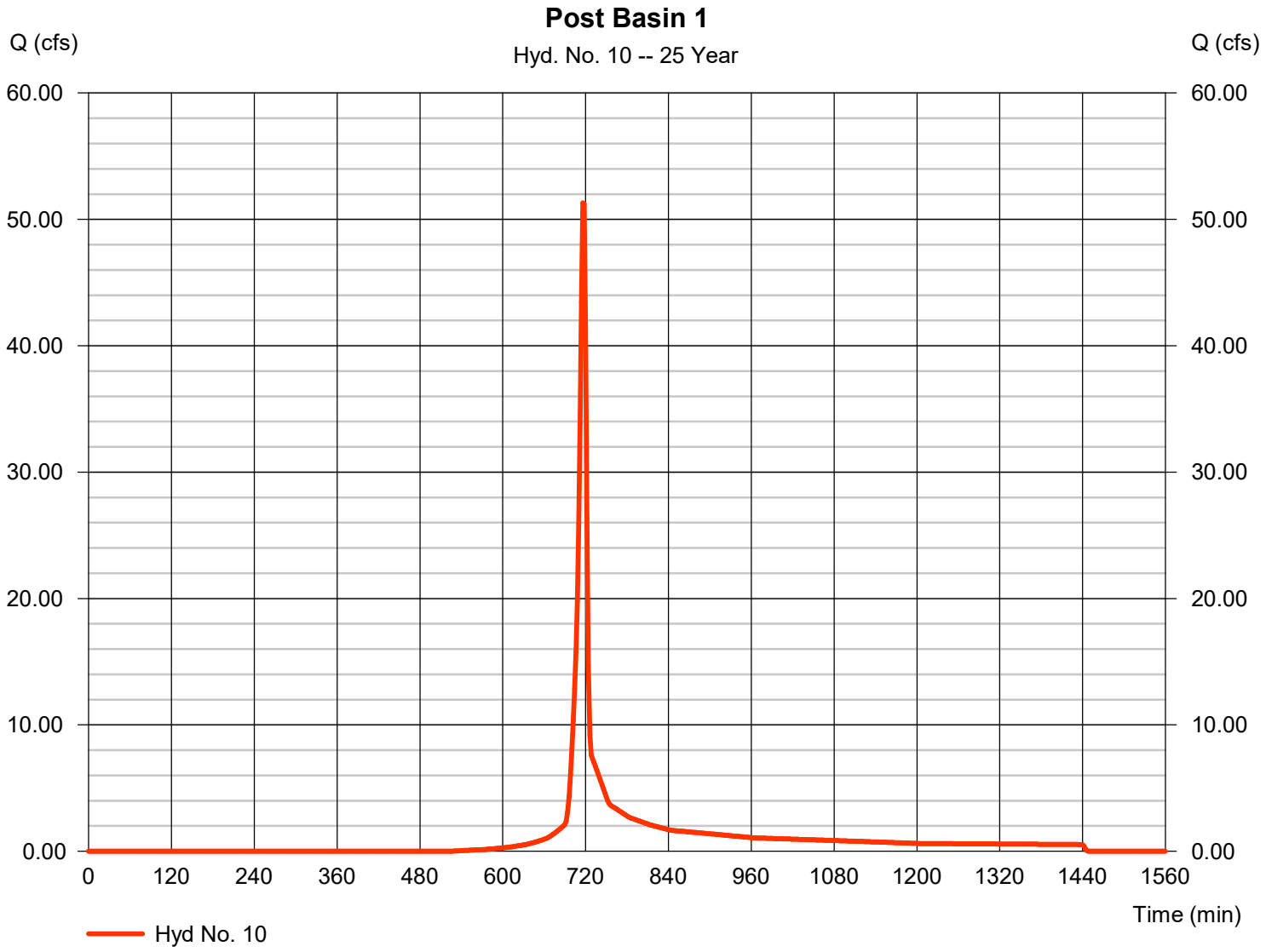


Hydrograph Report

Hyd. No. 10

Post Basin 1

Hydrograph type	=	SCS Runoff	Peak discharge	=	51.31 cfs
Storm frequency	=	25 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	103,585 cuft
Drainage area	=	10.950 ac	Curve number	=	71.8
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	5.76 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



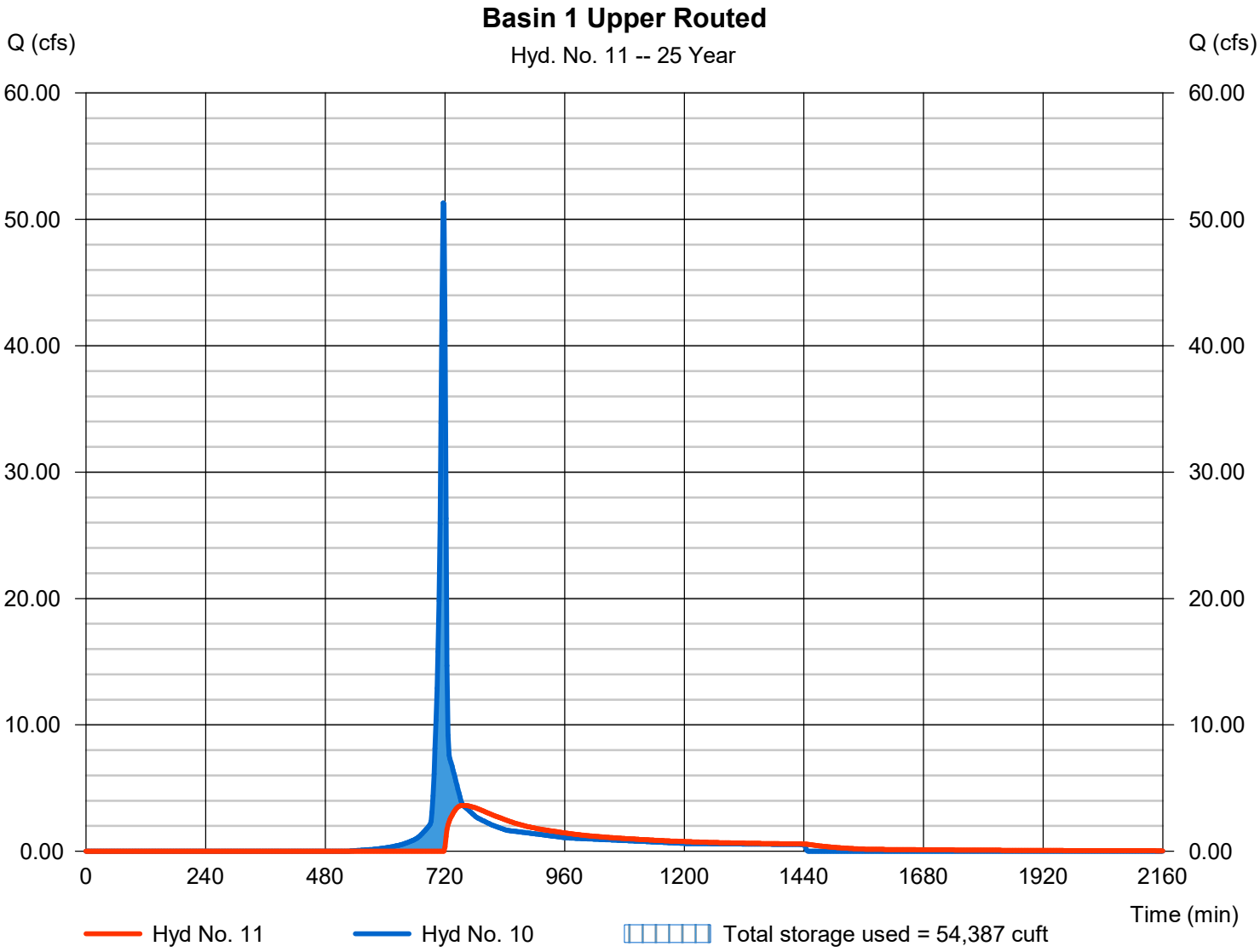
Hydrograph Report

Hyd. No. 11

Basin 1 Upper Routed

Hydrograph type	=	Reservoir	Peak discharge	=	3.633 cfs
Storm frequency	=	25 yrs	Time to peak	=	756 min
Time interval	=	2 min	Hyd. volume	=	66,096 cuft
Inflow hyd. No.	=	10 - Post Basin 1	Max. Elevation	=	323.31 ft
Reservoir name	=	Basin 1 Upper	Max. Storage	=	54,387 cuft

Storage Indication method used.



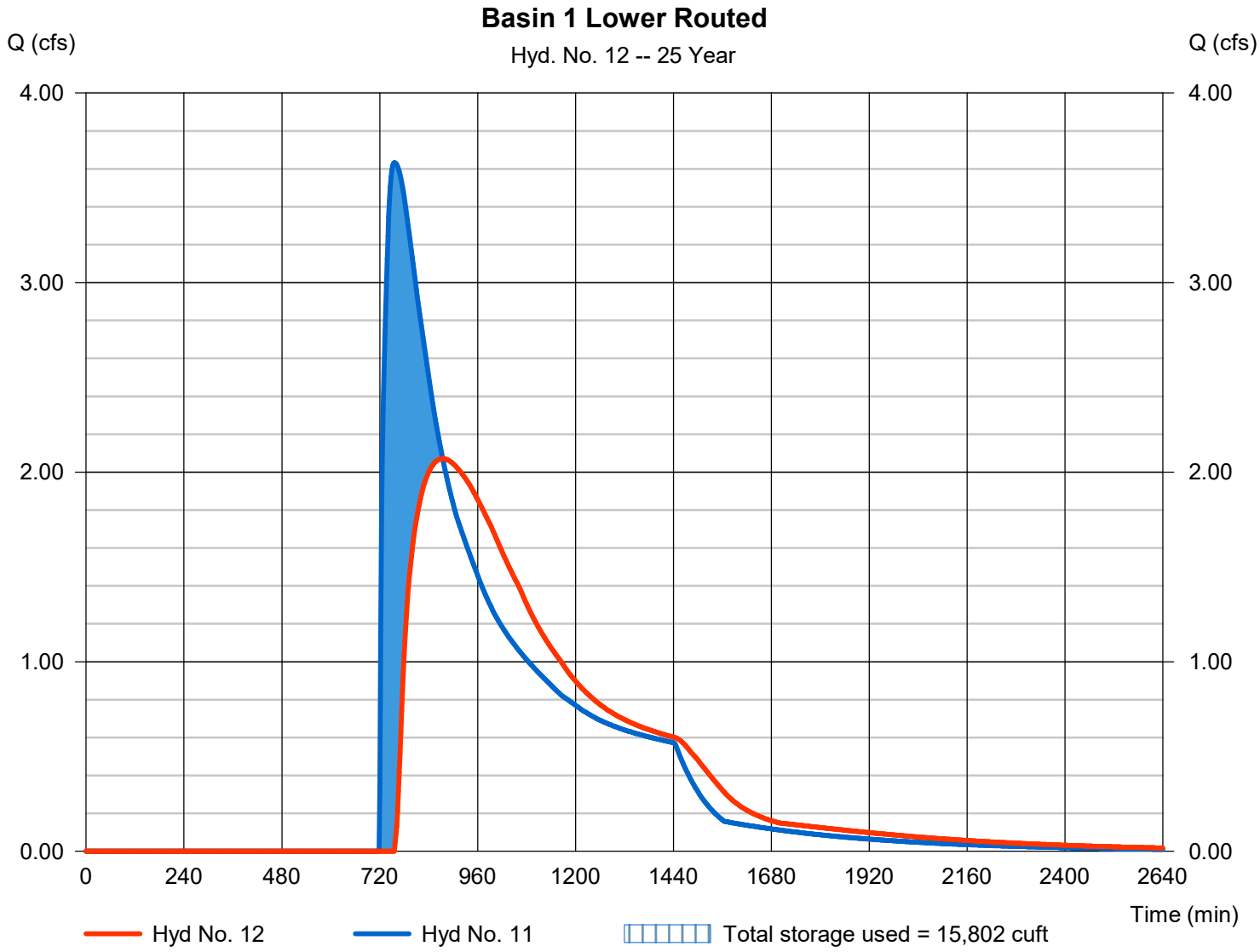
Hydrograph Report

Hyd. No. 12

Basin 1 Lower Routed

Hydrograph type	=	Reservoir	Peak discharge	=	2.071 cfs
Storm frequency	=	25 yrs	Time to peak	=	874 min
Time interval	=	2 min	Hyd. volume	=	59,899 cuft
Inflow hyd. No.	=	11 - Basin 1 Upper Routed	Max. Elevation	=	305.33 ft
Reservoir name	=	Basin 1 Lower	Max. Storage	=	15,802 cuft

Storage Indication method used.

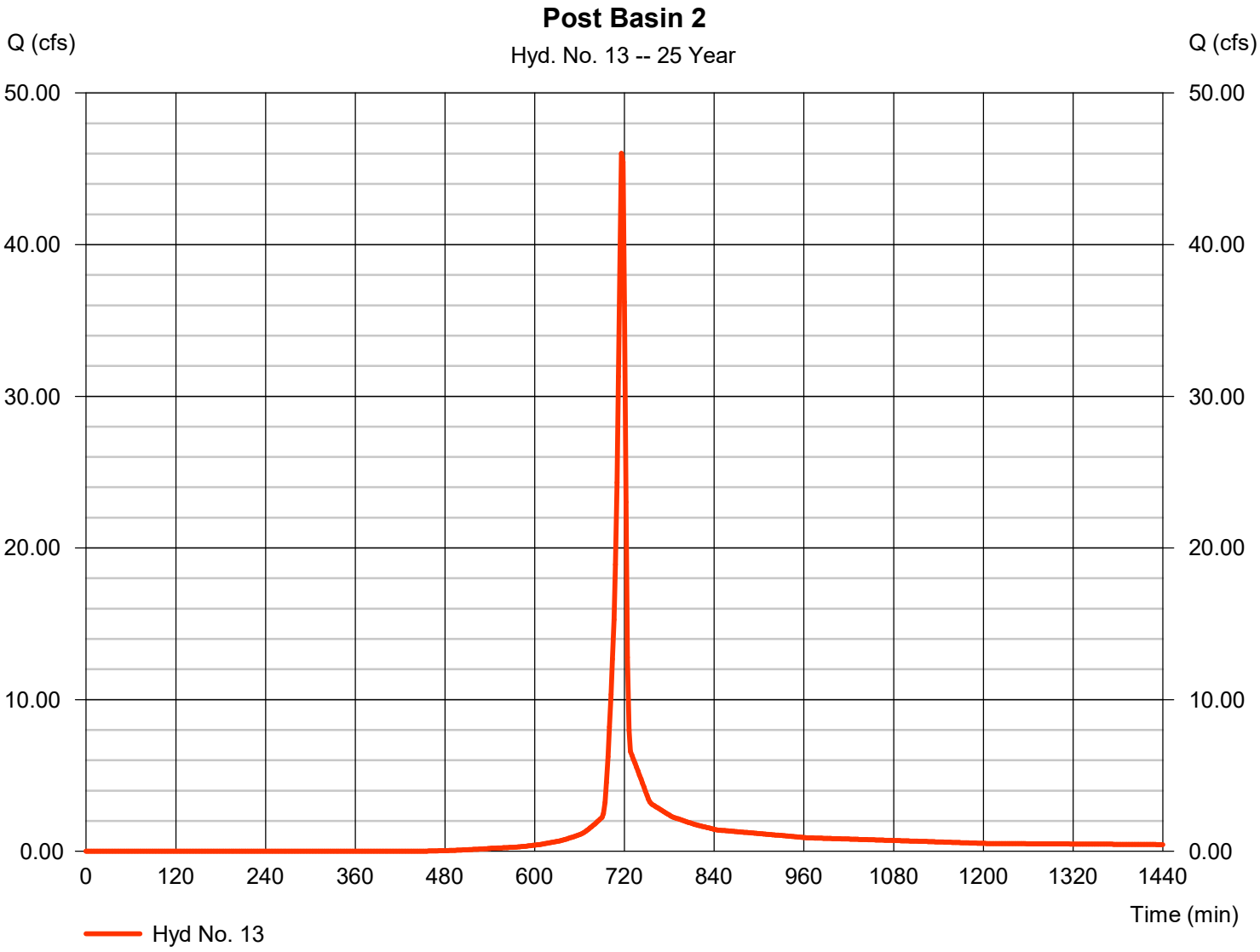


Hydrograph Report

Hyd. No. 13

Post Basin 2

Hydrograph type	=	SCS Runoff	Peak discharge	=	46.02 cfs
Storm frequency	=	25 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	93,362 cuft
Drainage area	=	8.540 ac	Curve number	=	76.4
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	5.76 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



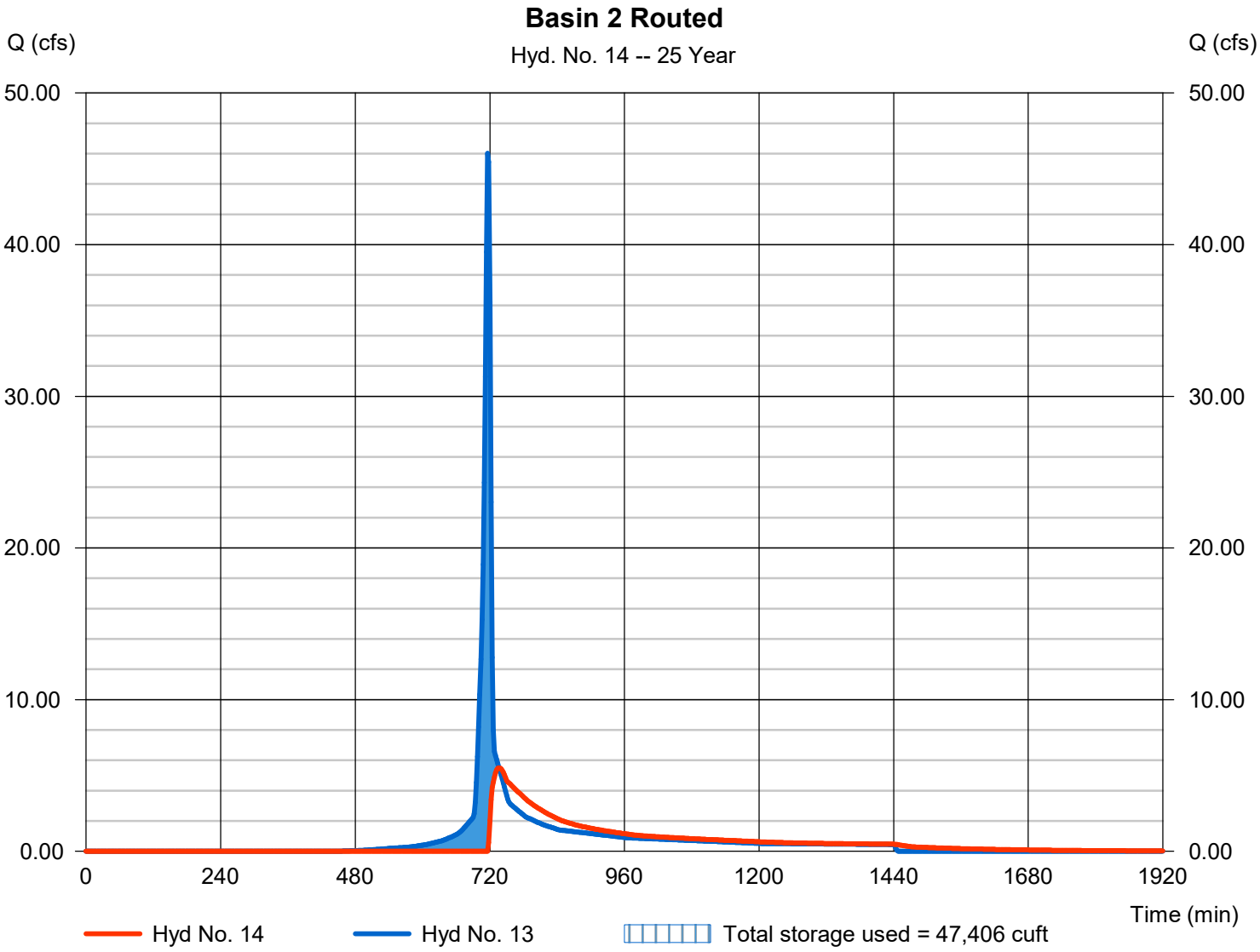
Hydrograph Report

Hyd. No. 14

Basin 2 Routed

Hydrograph type	=	Reservoir	Peak discharge	=	5.509 cfs
Storm frequency	=	25 yrs	Time to peak	=	736 min
Time interval	=	2 min	Hyd. volume	=	61,008 cuft
Inflow hyd. No.	=	13 - Post Basin 2	Max. Elevation	=	309.83 ft
Reservoir name	=	Basin 2	Max. Storage	=	47,406 cuft

Storage Indication method used.

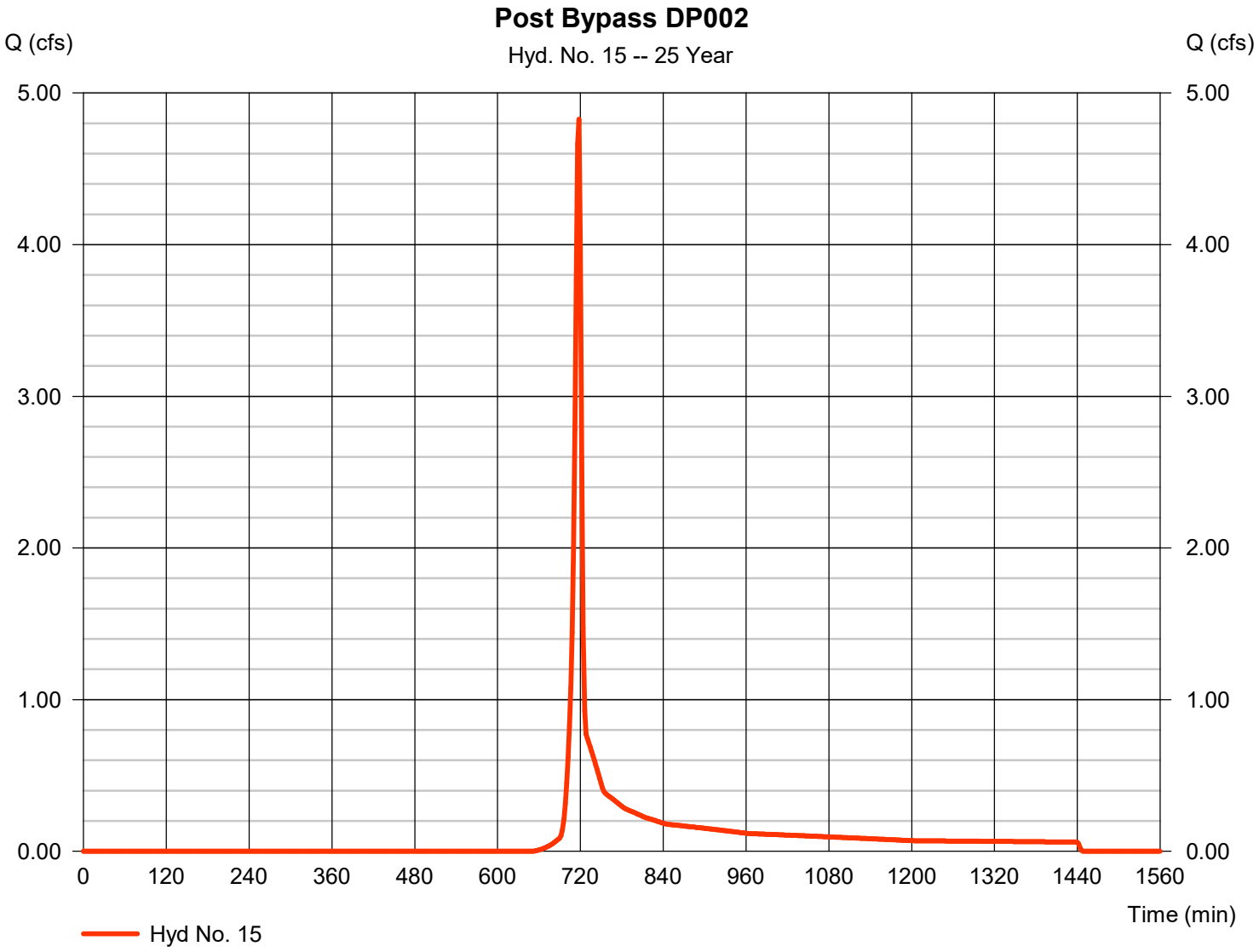


Hydrograph Report

Hyd. No. 15

Post Bypass DP002

Hydrograph type	=	SCS Runoff	Peak discharge	=	4.826 cfs
Storm frequency	=	25 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	9,678 cuft
Drainage area	=	1.540 ac	Curve number	=	61
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	5.76 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

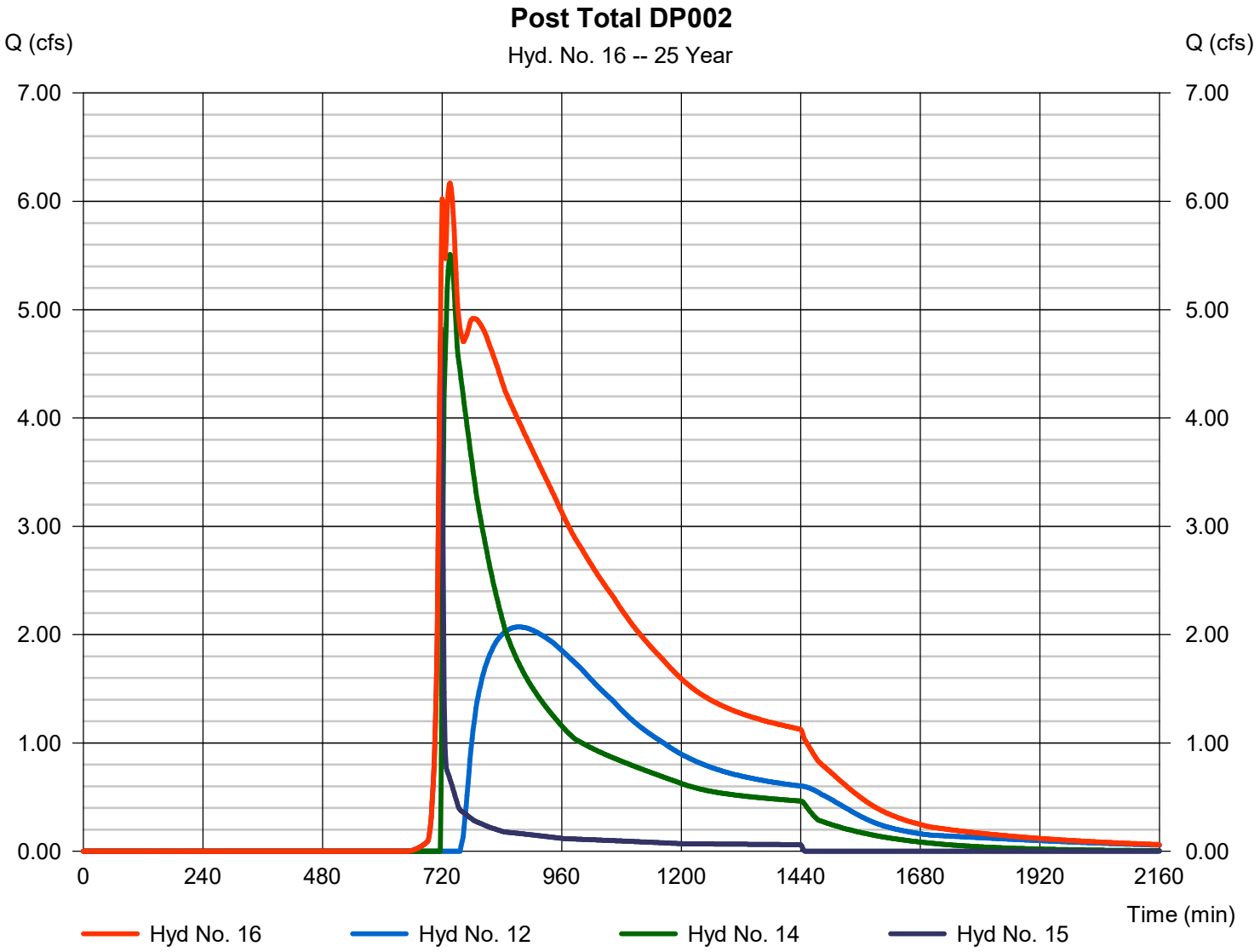


Hydrograph Report

Hyd. No. 16

Post Total DP002

Hydrograph type	=	Combine	Peak discharge	=	6.169 cfs
Storm frequency	=	25 yrs	Time to peak	=	736 min
Time interval	=	2 min	Hyd. volume	=	130,585 cuft
Inflow hyds.	=	12, 14, 15	Contrib. drain. area	=	1.540 ac



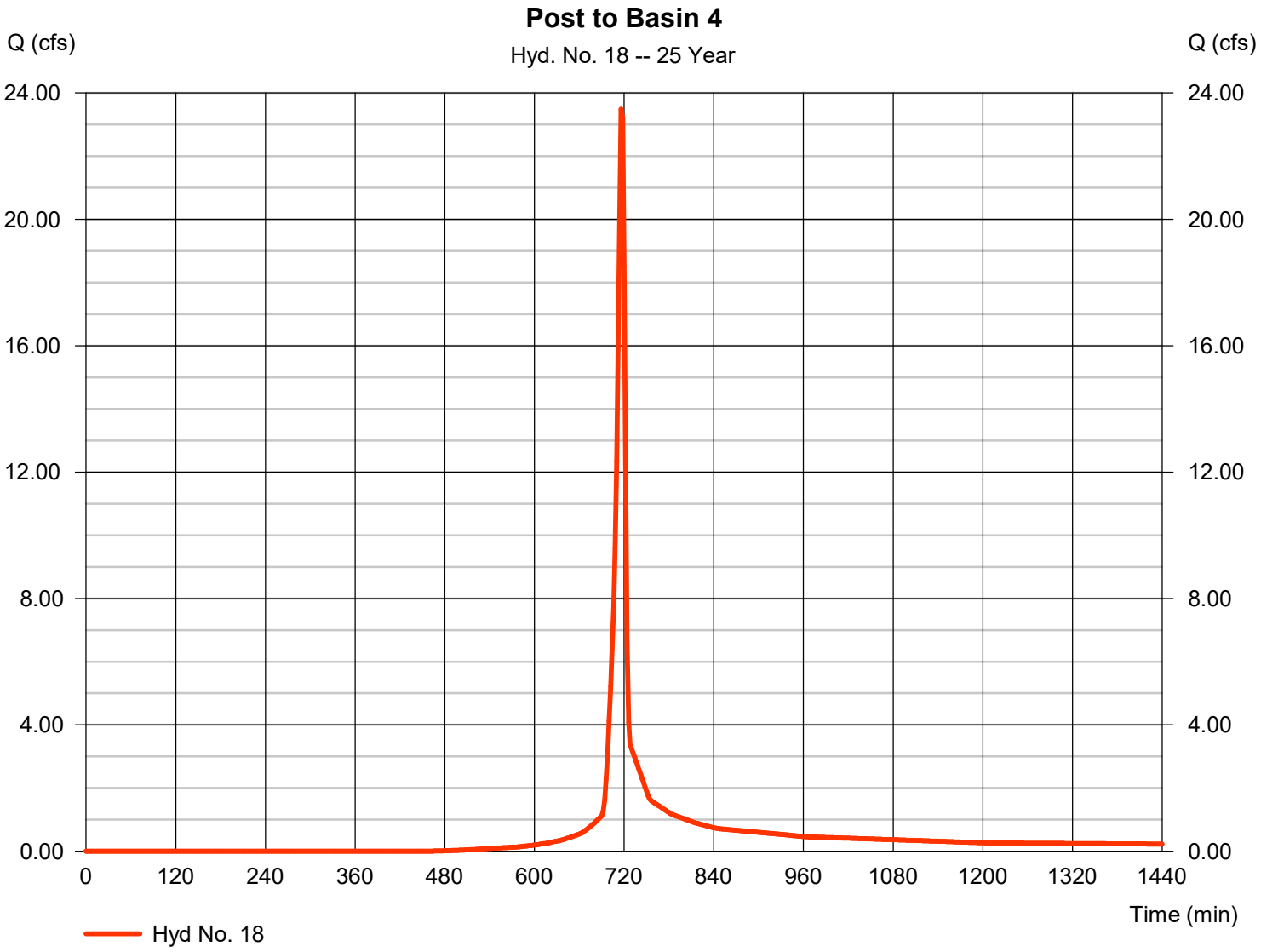
Hydrograph Report

Hyd. No. 18

Post to Basin 4

Hydrograph type	=	SCS Runoff	Peak discharge	=	23.48 cfs
Storm frequency	=	25 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	47,598 cuft
Drainage area	=	4.420 ac	Curve number	=	75.9*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	5.76 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.910 x 61) + (2.270 x 98) + (3.040 x 78)] / 4.420



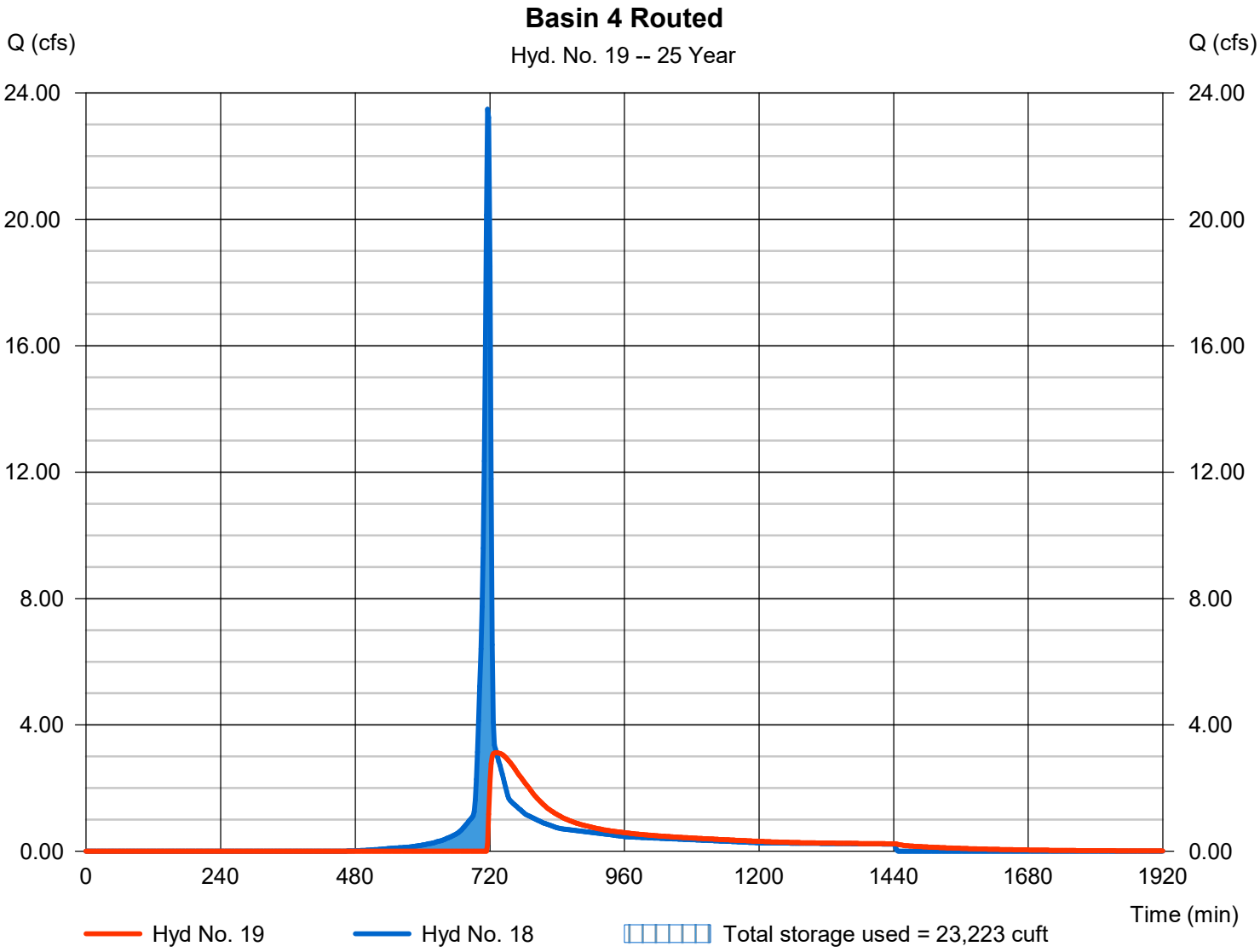
Hydrograph Report

Hyd. No. 19

Basin 4 Routed

Hydrograph type	=	Reservoir	Peak discharge	=	3.119 cfs
Storm frequency	=	25 yrs	Time to peak	=	732 min
Time interval	=	2 min	Hyd. volume	=	33,800 cuft
Inflow hyd. No.	=	18 - Post to Basin 4	Max. Elevation	=	347.38 ft
Reservoir name	=	Basin 4	Max. Storage	=	23,223 cuft

Storage Indication method used.



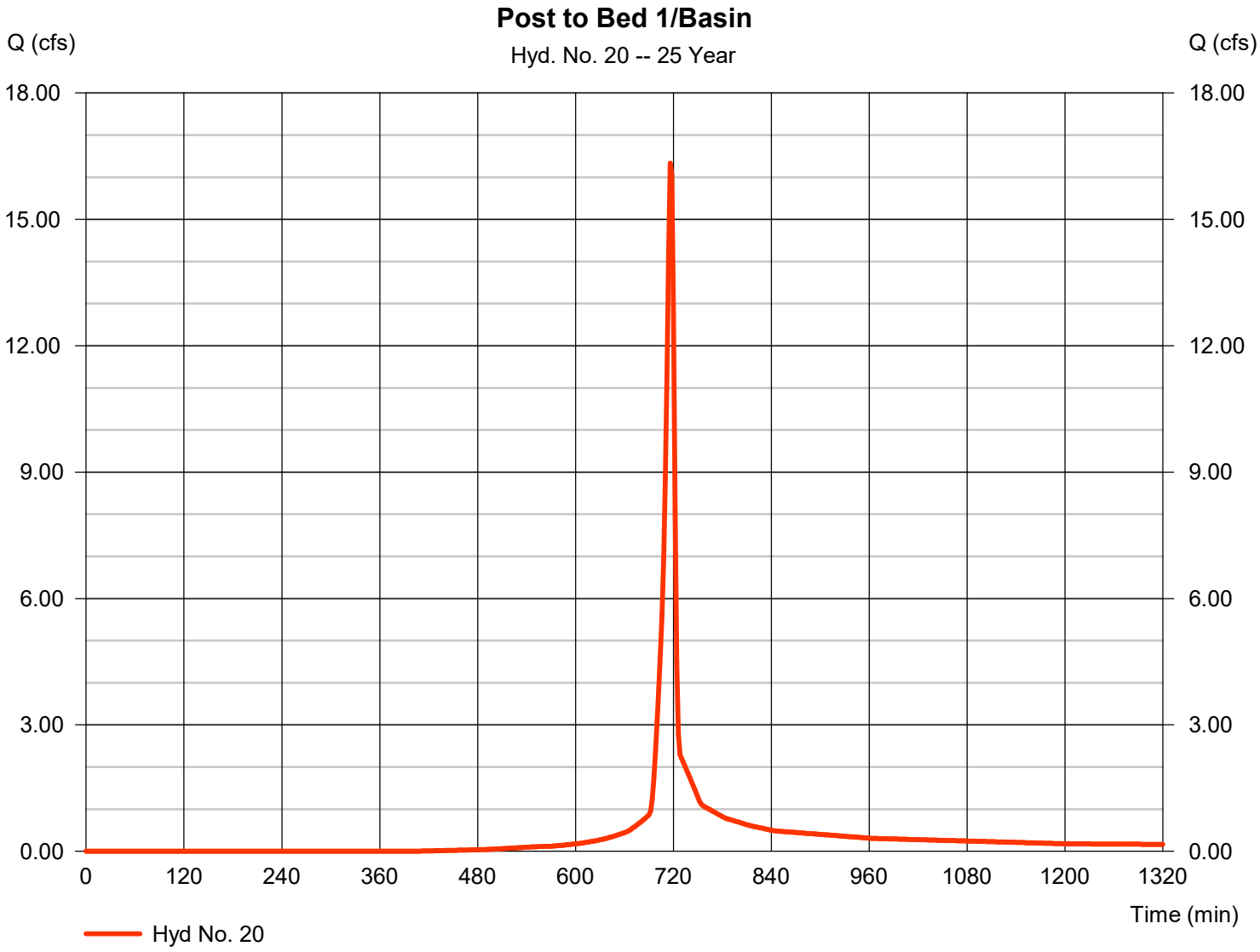
Hydrograph Report

Hyd. No. 20

Post to Bed 1/Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	16.34 cfs
Storm frequency	=	25 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	33,358 cuft
Drainage area	=	2.820 ac	Curve number	=	79.1*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	5.76 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.910 x 61) + (2.270 x 98) + (3.040 x 78)] / 2.820



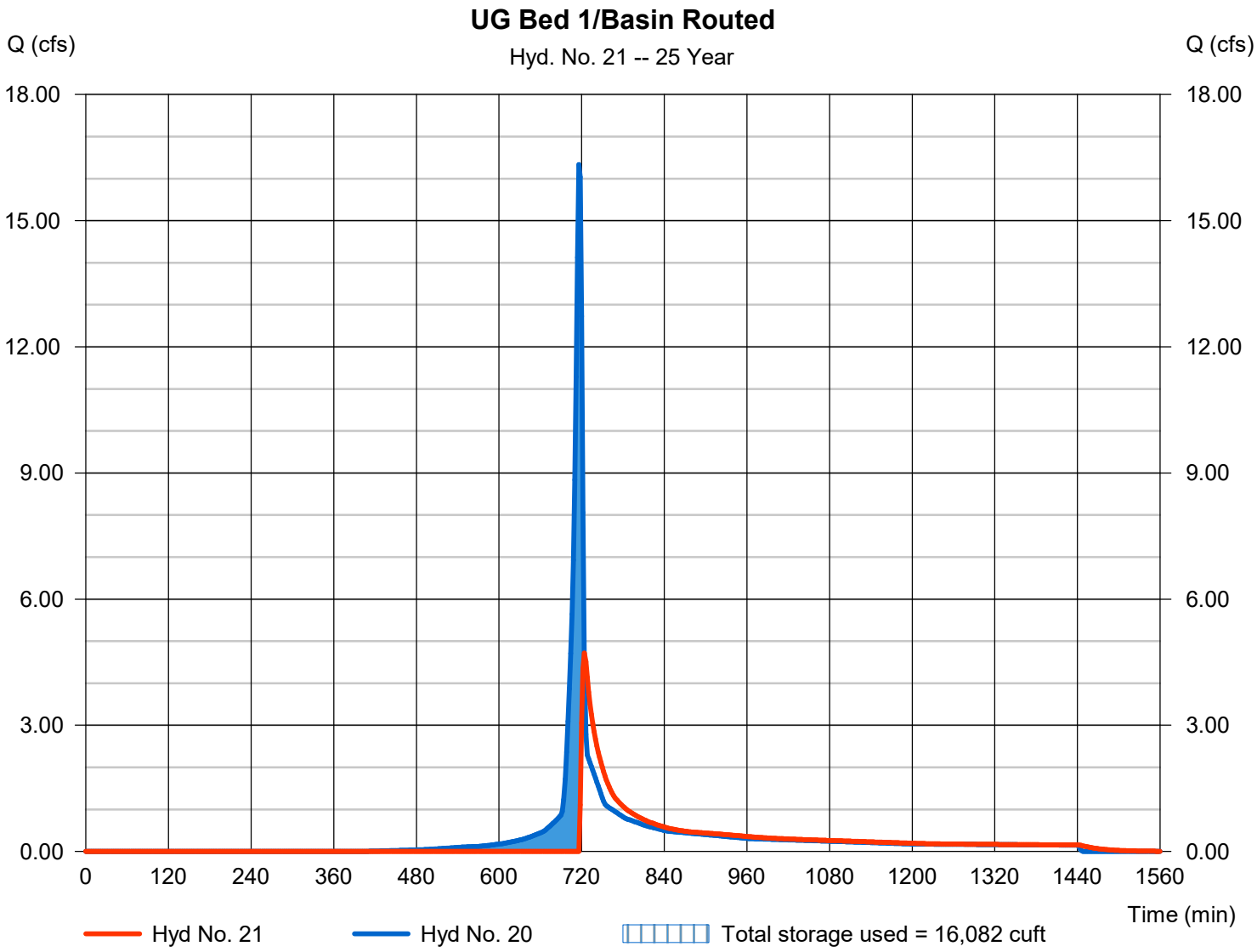
Hydrograph Report

Hyd. No. 21

UG Bed 1/Basin Routed

Hydrograph type	=	Reservoir	Peak discharge	=	4.714 cfs
Storm frequency	=	25 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	21,261 cuft
Inflow hyd. No.	=	20 - Post to Bed 1/Basin	Max. Elevation	=	341.15 ft
Reservoir name	=	UG Bed 1/Basin	Max. Storage	=	16,082 cuft

Storage Indication method used.

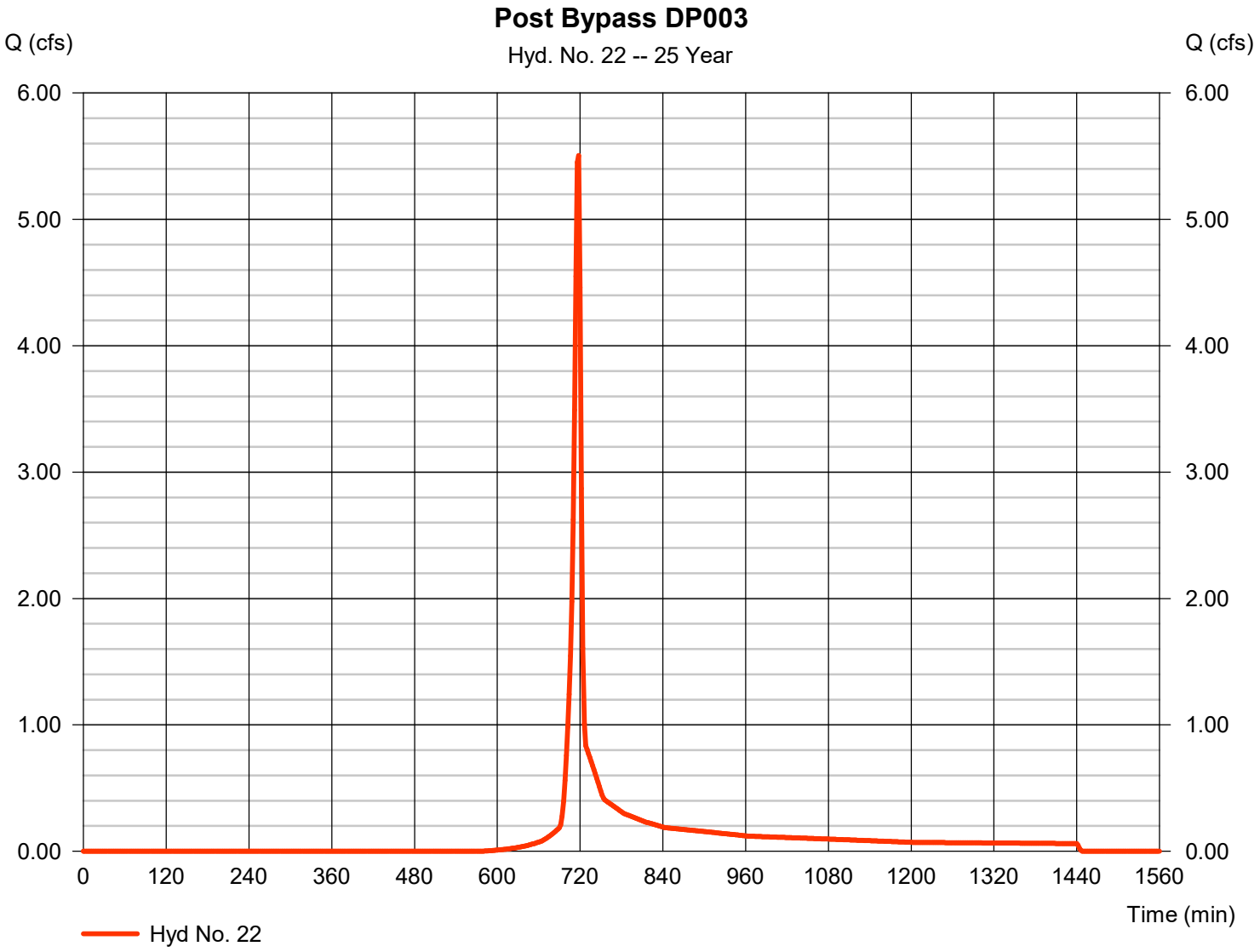


Hydrograph Report

Hyd. No. 22

Post Bypass DP003

Hydrograph type	=	SCS Runoff	Peak discharge	=	5.505 cfs
Storm frequency	=	25 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	11,037 cuft
Drainage area	=	1.340 ac	Curve number	=	67.8
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	5.76 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

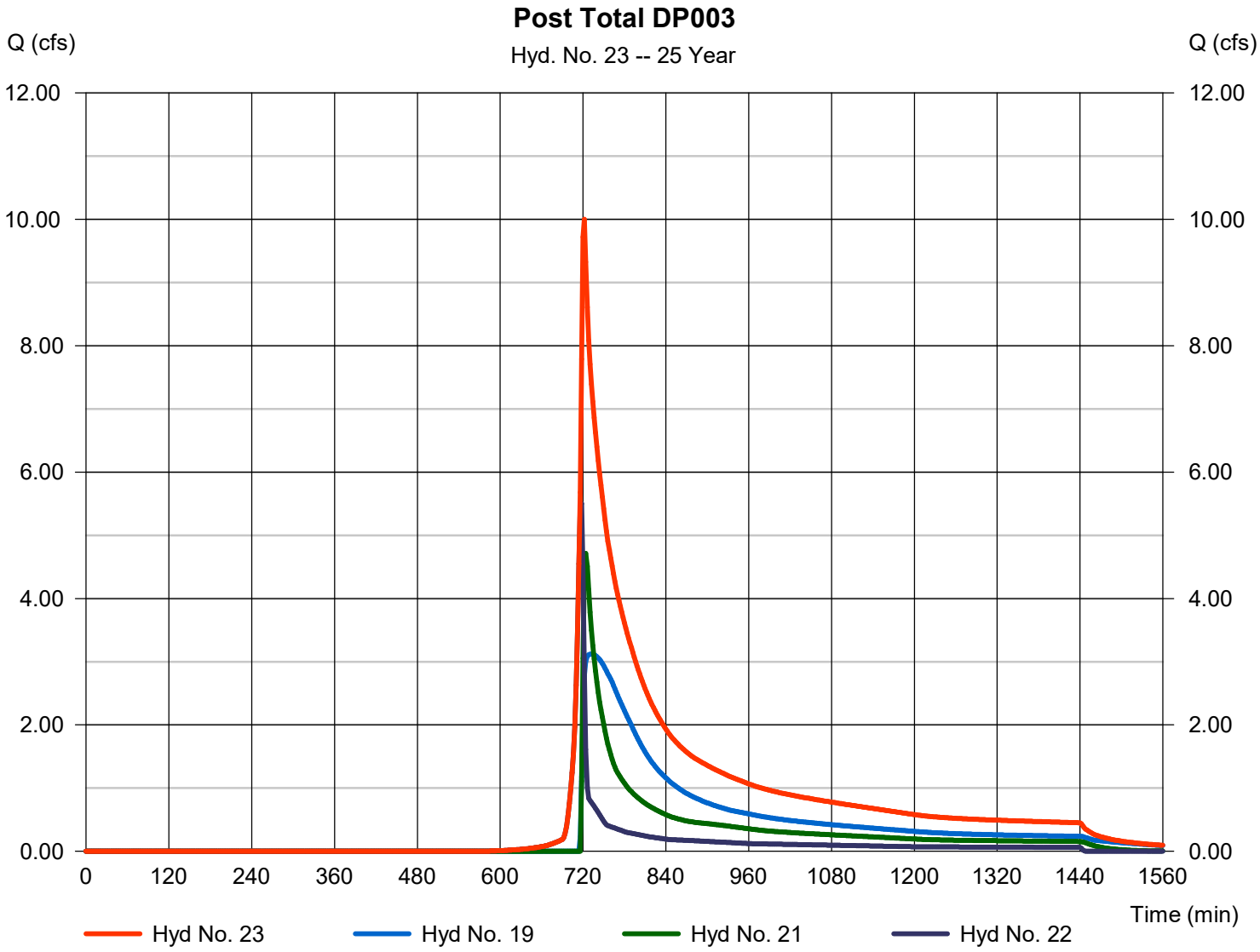


Hydrograph Report

Hyd. No. 23

Post Total DP003

Hydrograph type	=	Combine	Peak discharge	=	10.00 cfs
Storm frequency	=	25 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	66,098 cuft
Inflow hyds.	=	19, 21, 22	Contrib. drain. area	=	1.340 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

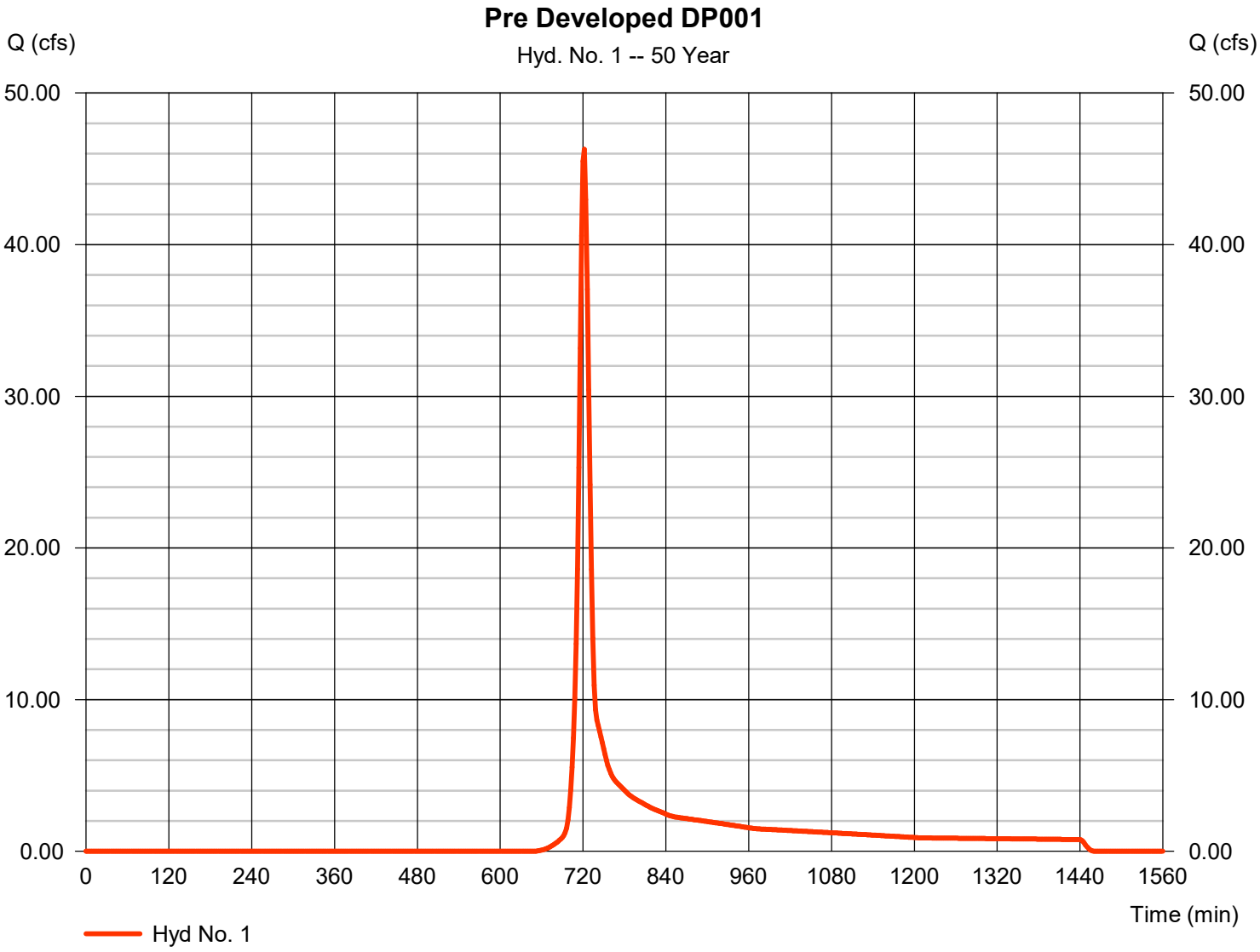
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	46.28	2	722	123,698	------	------	------	Pre Developed DP001
2	SCS Runoff	61.46	2	722	163,179	------	------	------	Pre Developed DP002
3	SCS Runoff	36.78	2	720	95,632	------	------	------	Pre Developed DP003
4	SCS Runoff	3.460	2	718	6,921	------	------	------	Pre Developed DP003 ORA
5	SCS Runoff	68.94	2	716	139,306	------	------	------	Post Basin 3
6	Reservoir	19.64	2	724	93,838	5	319.16	62,202	Basin 3 Routed
7	SCS Runoff	6.425	2	718	12,860	------	------	------	Post Bypass DP001
8	Combine	21.53	2	724	106,698	6, 7	------	------	Post Total DP001
10	SCS Runoff	63.94	2	716	129,320	------	------	------	Post Basin 1
11	Reservoir	10.69	2	726	91,830	10	323.71	61,860	Basin 1 Upper Routed
12	Reservoir	5.226	2	772	85,633	11	305.66	18,217	Basin 1 Lower Routed
13	SCS Runoff	56.20	2	716	114,655	------	------	------	Post Basin 2
14	Reservoir	18.98	2	724	82,300	13	310.22	53,973	Basin 2 Routed
15	SCS Runoff	6.335	2	718	12,668	------	------	------	Post Bypass DP002
16	Combine	21.32	2	722	180,602	12, 14, 15	------	------	Post Total DP002
18	SCS Runoff	28.74	2	716	58,554	------	------	------	Post to Basin 4
19	Reservoir	4.373	2	728	44,756	18	348.04	28,565	Basin 4 Routed
20	SCS Runoff	19.73	2	716	40,599	------	------	------	Post to Bed 1/Basin
21	Reservoir	7.370	2	724	28,502	20	341.74	18,600	UG Bed 1/Basin Routed
22	SCS Runoff	6.944	2	718	13,999	------	------	------	Post Bypass DP003
23	Combine	16.17	2	720	87,257	19, 21, 22	------	------	Post Total DP003

Hydrograph Report

Hyd. No. 1

Pre Developed DP001

Hydrograph type	=	SCS Runoff	Peak discharge	=	46.28 cfs
Storm frequency	=	50 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	123,698 cuft
Drainage area	=	15.430 ac	Curve number	=	58
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	12.00 min
Total precip.	=	6.60 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

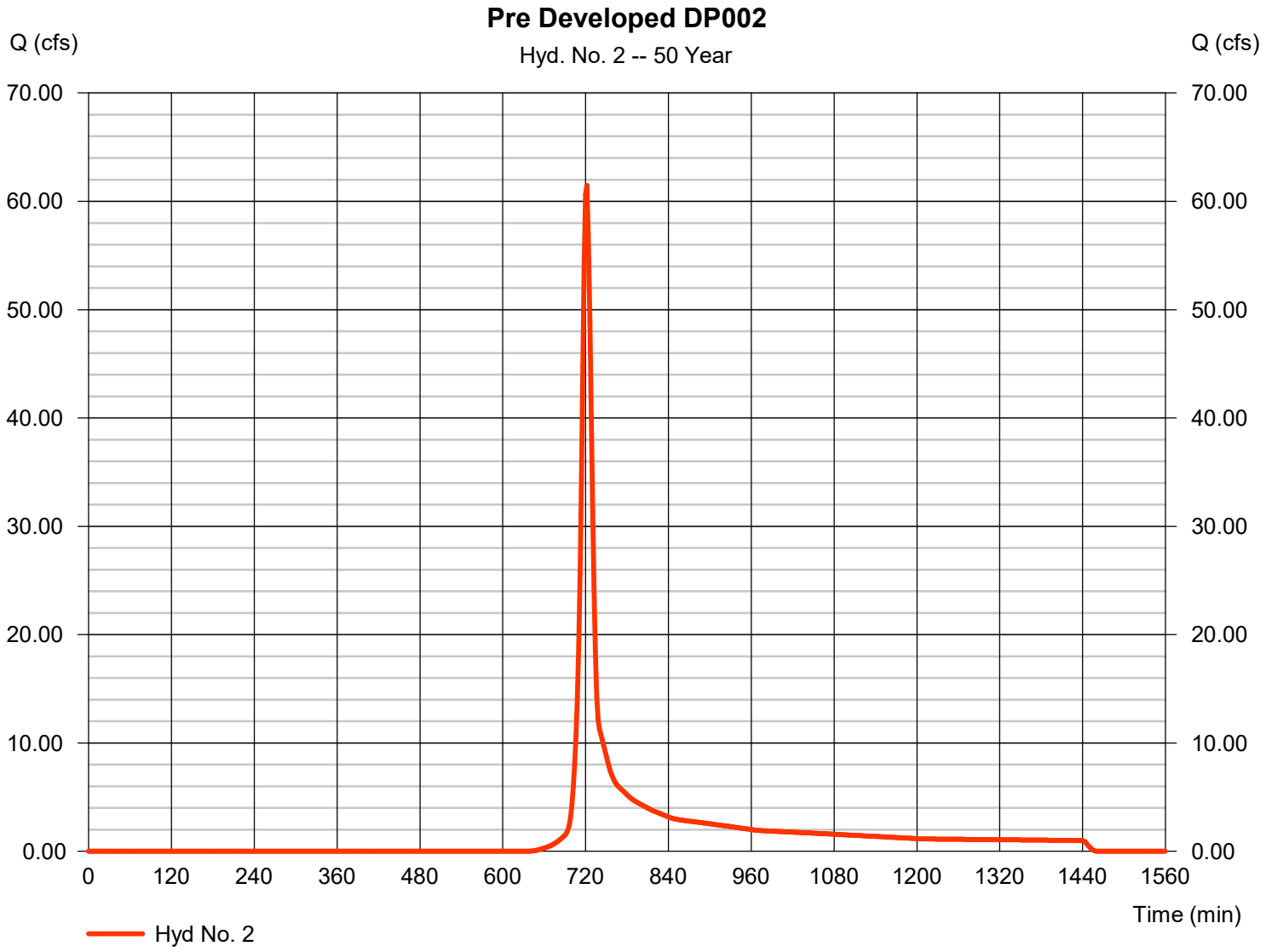


Hydrograph Report

Hyd. No. 2

Pre Developed DP002

Hydrograph type	=	SCS Runoff	Peak discharge	=	61.46 cfs
Storm frequency	=	50 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	163,179 cuft
Drainage area	=	19.210 ac	Curve number	=	59.4
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	12.00 min
Total precip.	=	6.60 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

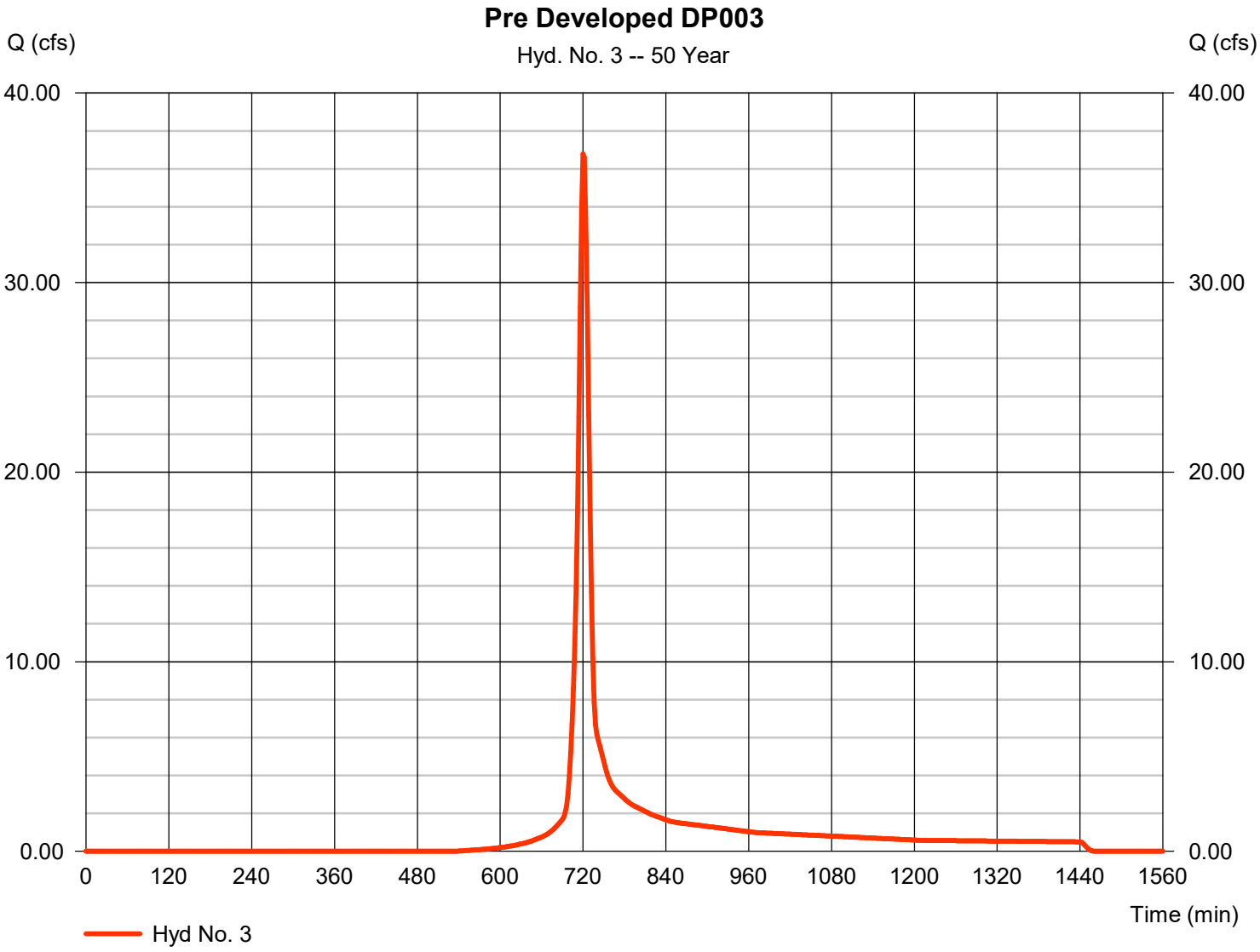


Hydrograph Report

Hyd. No. 3

Pre Developed DP003

Hydrograph type	=	SCS Runoff	Peak discharge	=	36.78 cfs
Storm frequency	=	50 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	95,632 cuft
Drainage area	=	8.190 ac	Curve number	=	68.3
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	11.00 min
Total precip.	=	6.60 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

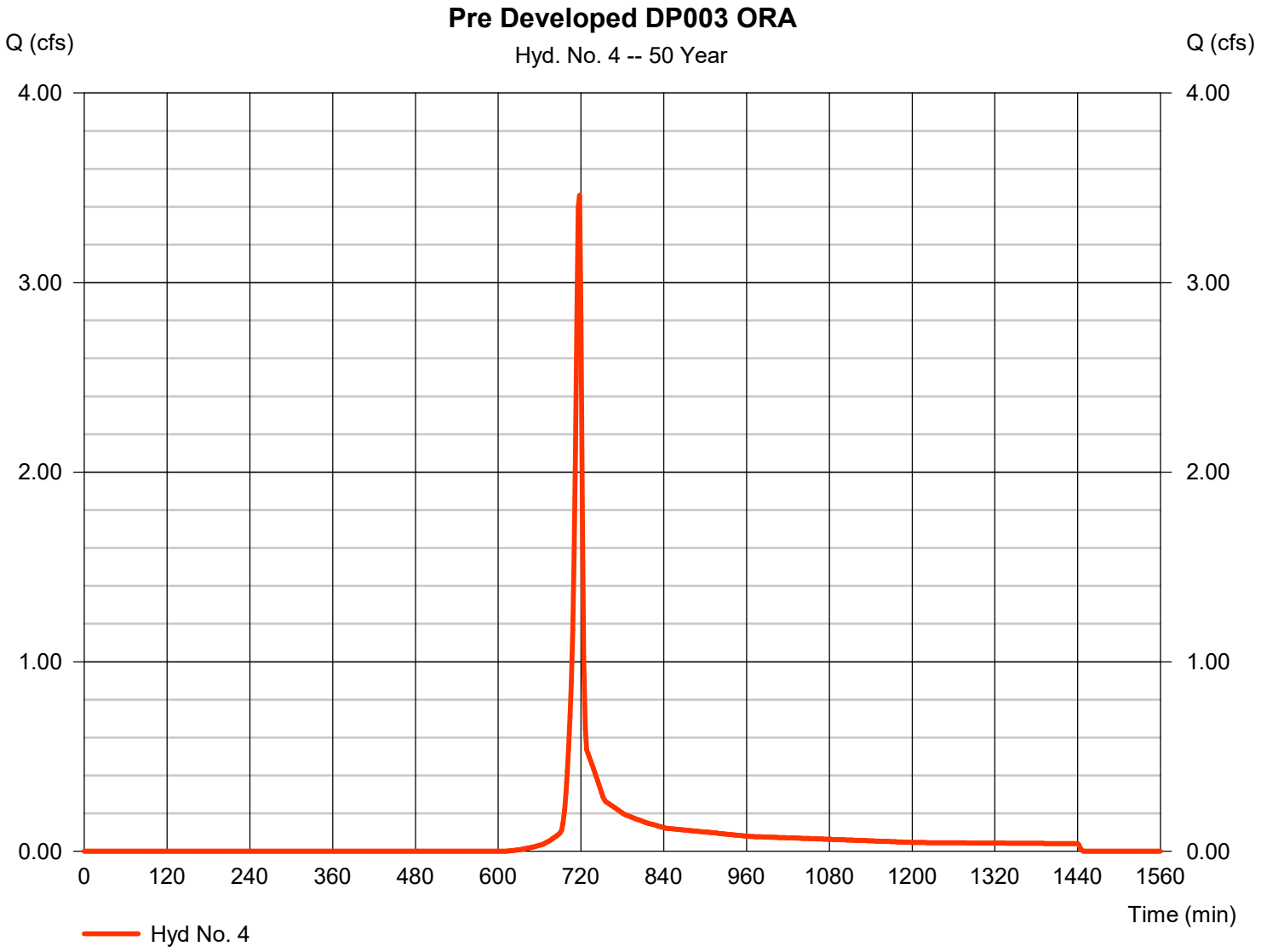


Hydrograph Report

Hyd. No. 4

Pre Developed DP003 ORA

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.460 cfs
Storm frequency	=	50 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	6,921 cuft
Drainage area	=	0.810 ac	Curve number	=	62
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	6.60 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

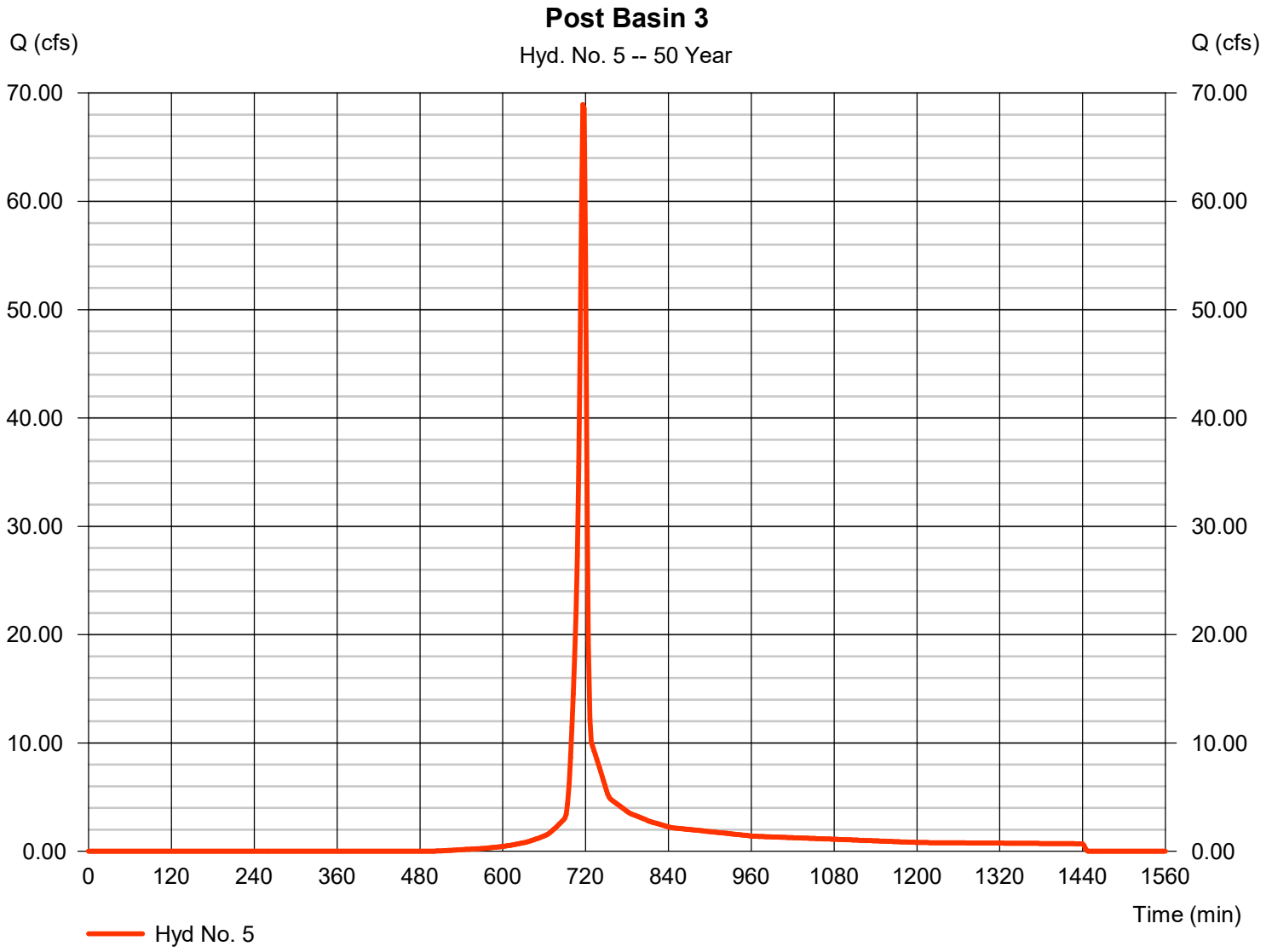


Hydrograph Report

Hyd. No. 5

Post Basin 3

Hydrograph type	=	SCS Runoff	Peak discharge	=	68.94 cfs
Storm frequency	=	50 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	139,306 cuft
Drainage area	=	12.150 ac	Curve number	=	70.8
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	6.60 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



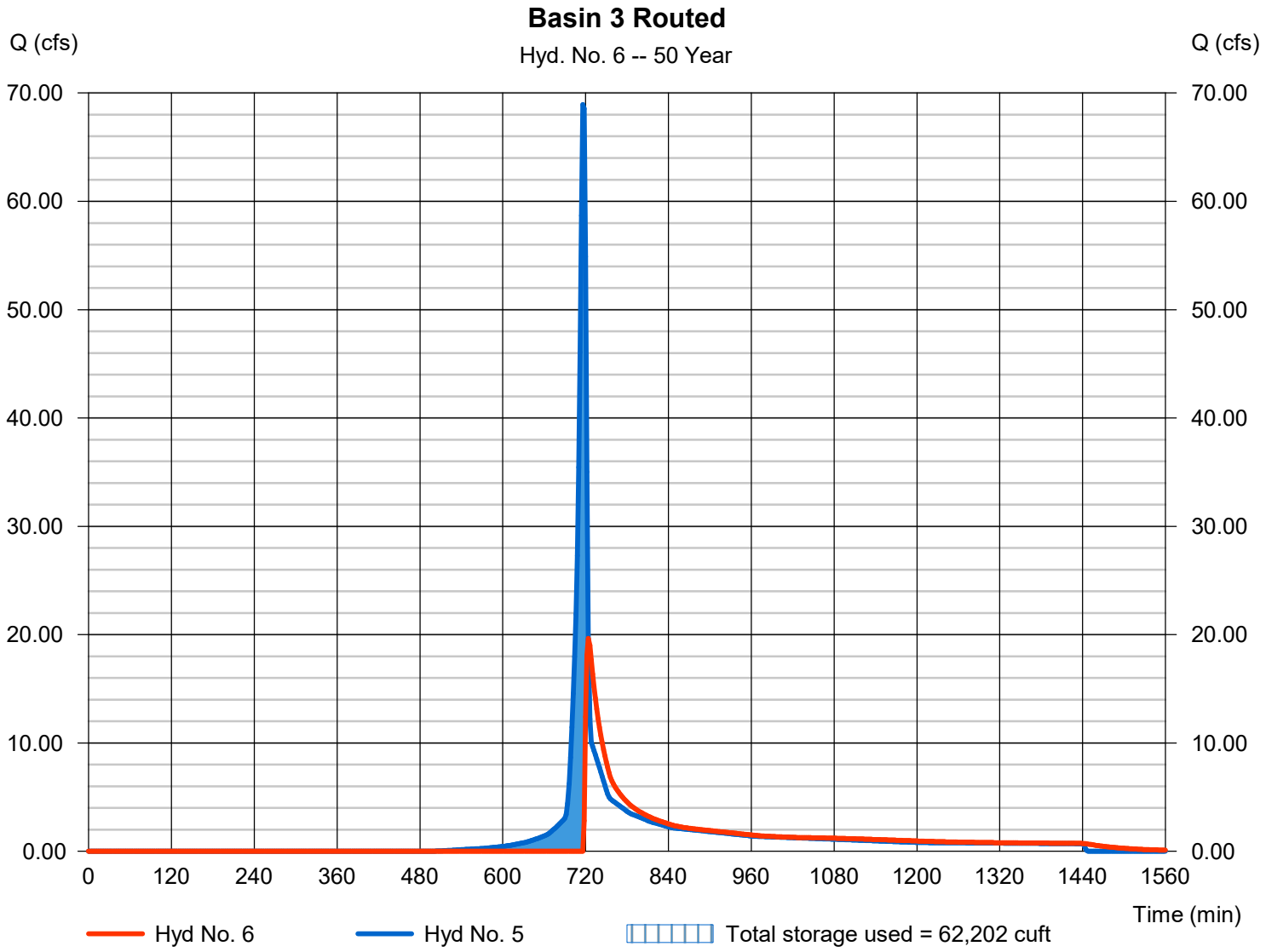
Hydrograph Report

Hyd. No. 6

Basin 3 Routed

Hydrograph type	=	Reservoir	Peak discharge	=	19.64 cfs
Storm frequency	=	50 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	93,838 cuft
Inflow hyd. No.	=	5 - Post Basin 3	Max. Elevation	=	319.16 ft
Reservoir name	=	Basin 3	Max. Storage	=	62,202 cuft

Storage Indication method used.

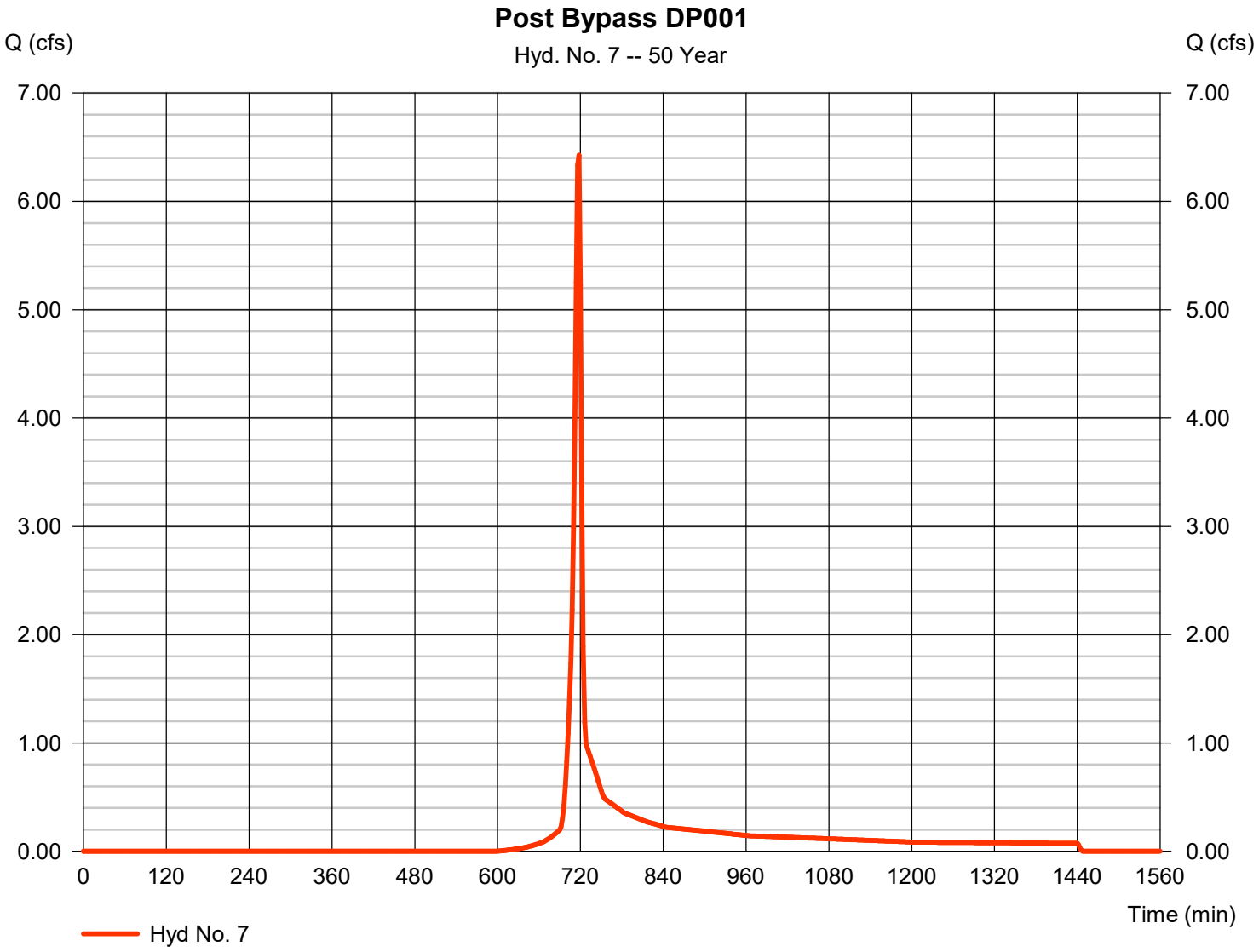


Hydrograph Report

Hyd. No. 7

Post Bypass DP001

Hydrograph type	=	SCS Runoff	Peak discharge	=	6.425 cfs
Storm frequency	=	50 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	12,860 cuft
Drainage area	=	1.440 ac	Curve number	=	63.2
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	6.60 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

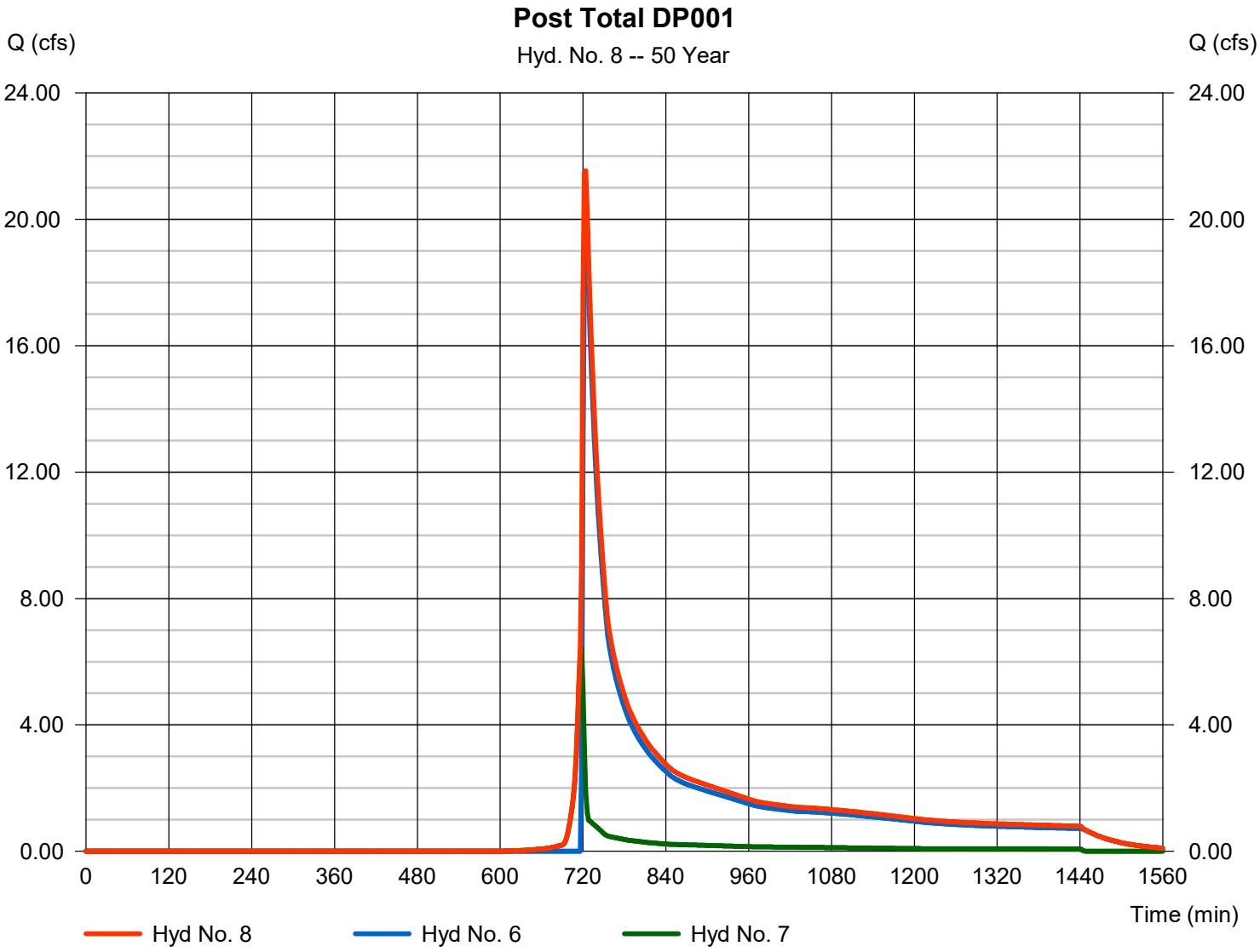


Hydrograph Report

Hyd. No. 8

Post Total DP001

Hydrograph type	=	Combine	Peak discharge	=	21.53 cfs
Storm frequency	=	50 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	106,698 cuft
Inflow hyds.	=	6, 7	Contrib. drain. area	=	1.440 ac

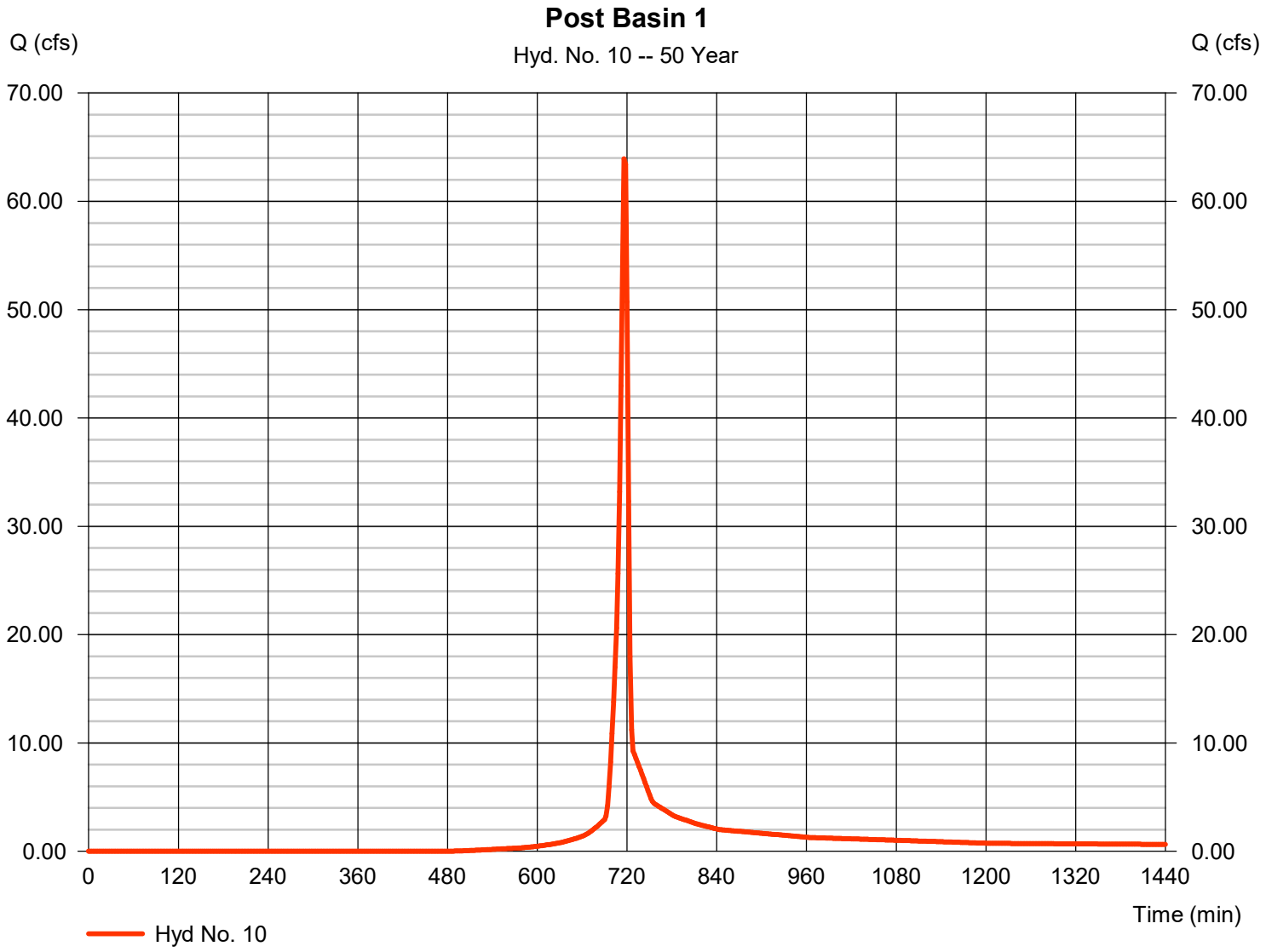


Hydrograph Report

Hyd. No. 10

Post Basin 1

Hydrograph type	=	SCS Runoff	Peak discharge	=	63.94 cfs
Storm frequency	=	50 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	129,320 cuft
Drainage area	=	10.950 ac	Curve number	=	71.8
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	6.60 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



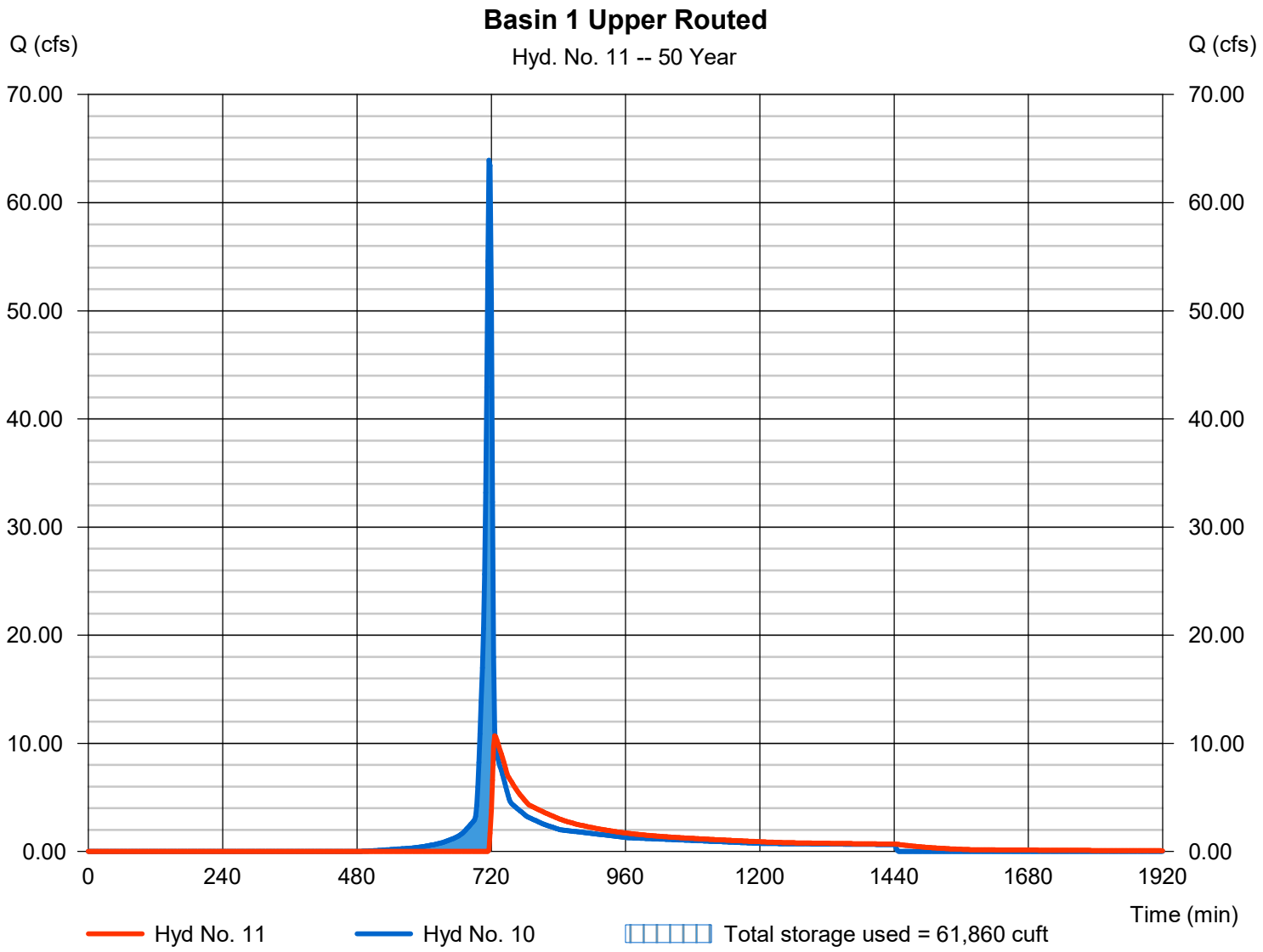
Hydrograph Report

Hyd. No. 11

Basin 1 Upper Routed

Hydrograph type	=	Reservoir	Peak discharge	=	10.69 cfs
Storm frequency	=	50 yrs	Time to peak	=	726 min
Time interval	=	2 min	Hyd. volume	=	91,830 cuft
Inflow hyd. No.	=	10 - Post Basin 1	Max. Elevation	=	323.71 ft
Reservoir name	=	Basin 1 Upper	Max. Storage	=	61,860 cuft

Storage Indication method used.



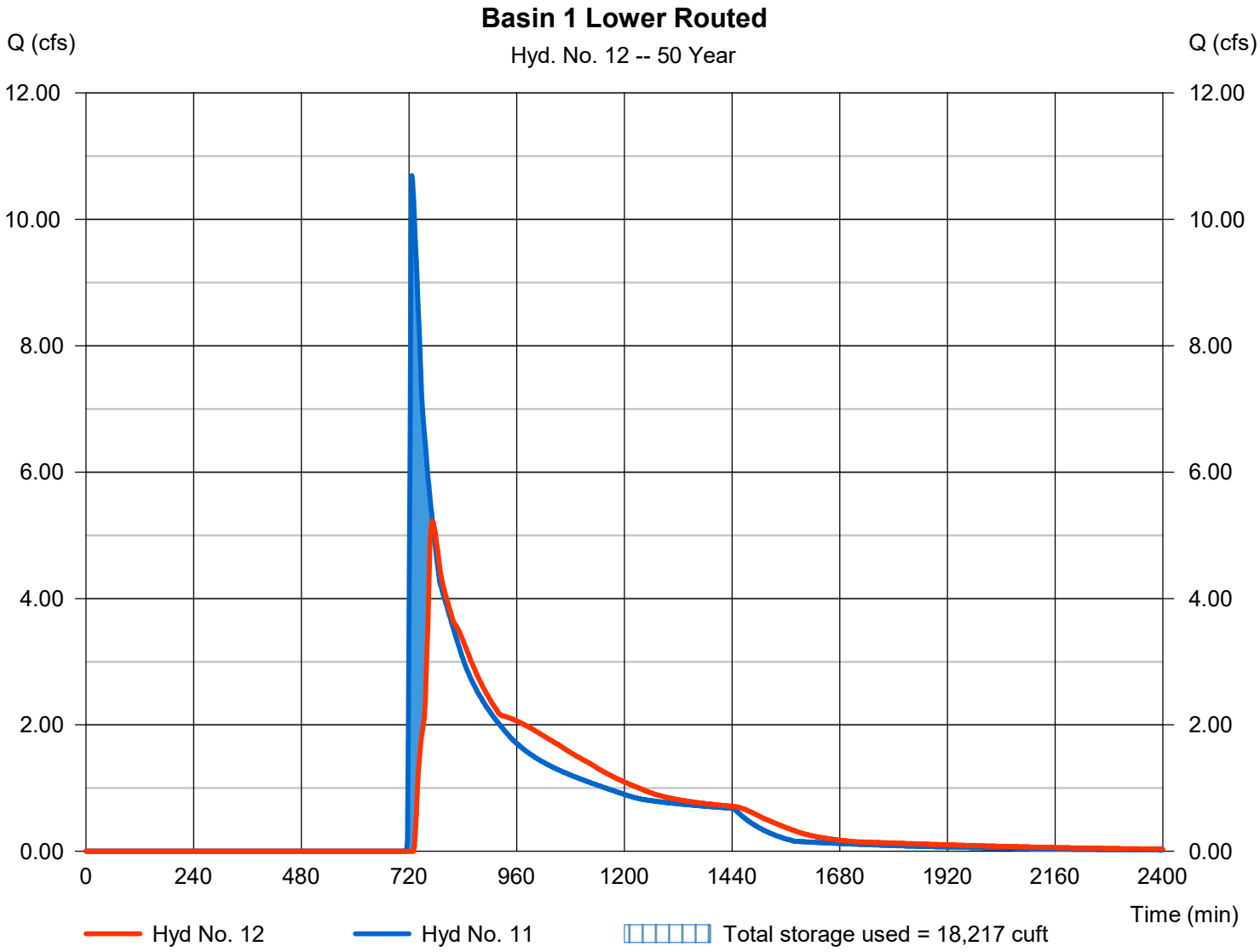
Hydrograph Report

Hyd. No. 12

Basin 1 Lower Routed

Hydrograph type	=	Reservoir	Peak discharge	=	5.226 cfs
Storm frequency	=	50 yrs	Time to peak	=	772 min
Time interval	=	2 min	Hyd. volume	=	85,633 cuft
Inflow hyd. No.	=	11 - Basin 1 Upper Routed	Max. Elevation	=	305.66 ft
Reservoir name	=	Basin 1 Lower	Max. Storage	=	18,217 cuft

Storage Indication method used.

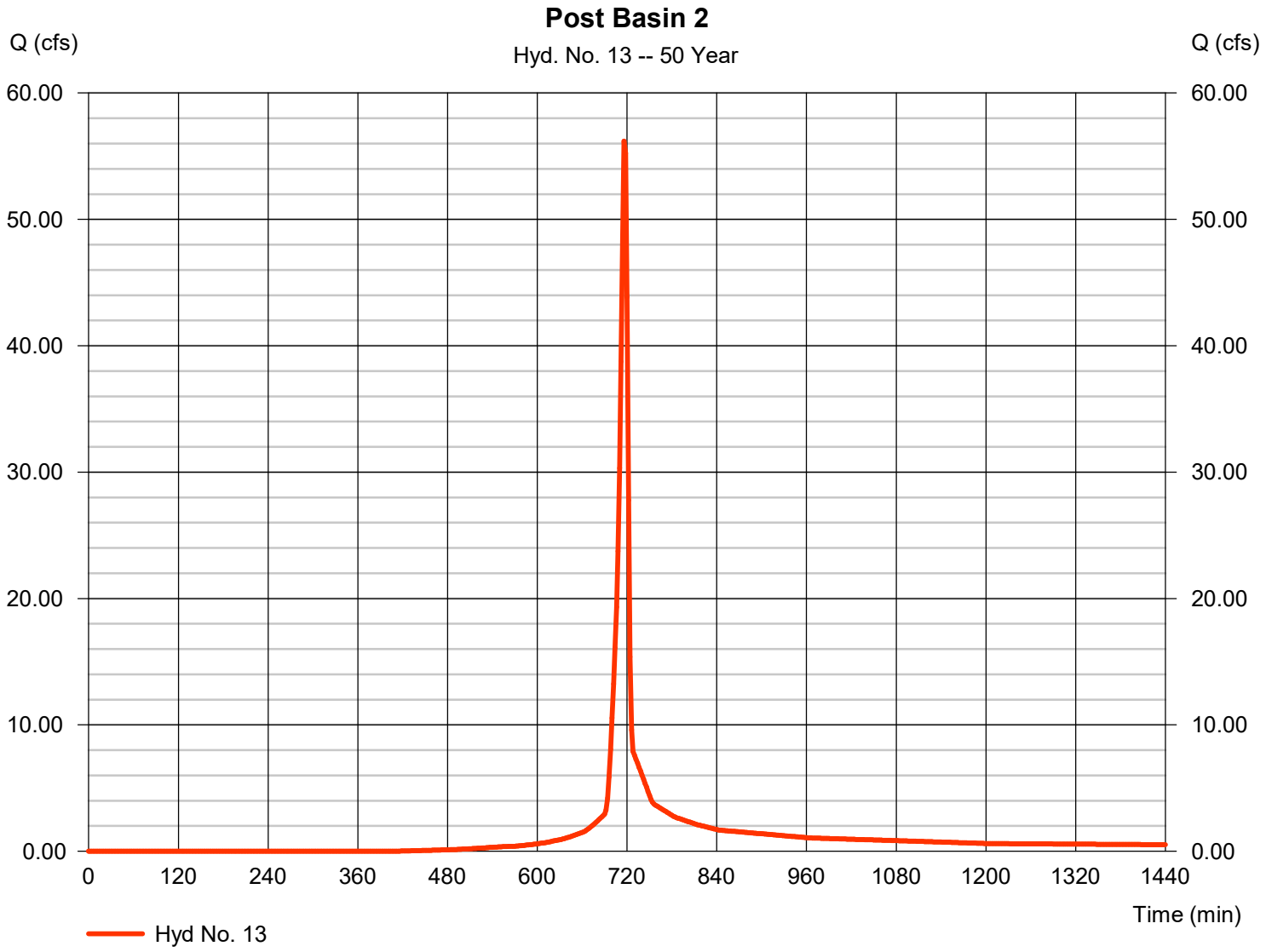


Hydrograph Report

Hyd. No. 13

Post Basin 2

Hydrograph type	=	SCS Runoff	Peak discharge	=	56.20 cfs
Storm frequency	=	50 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	114,655 cuft
Drainage area	=	8.540 ac	Curve number	=	76.4
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	6.60 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



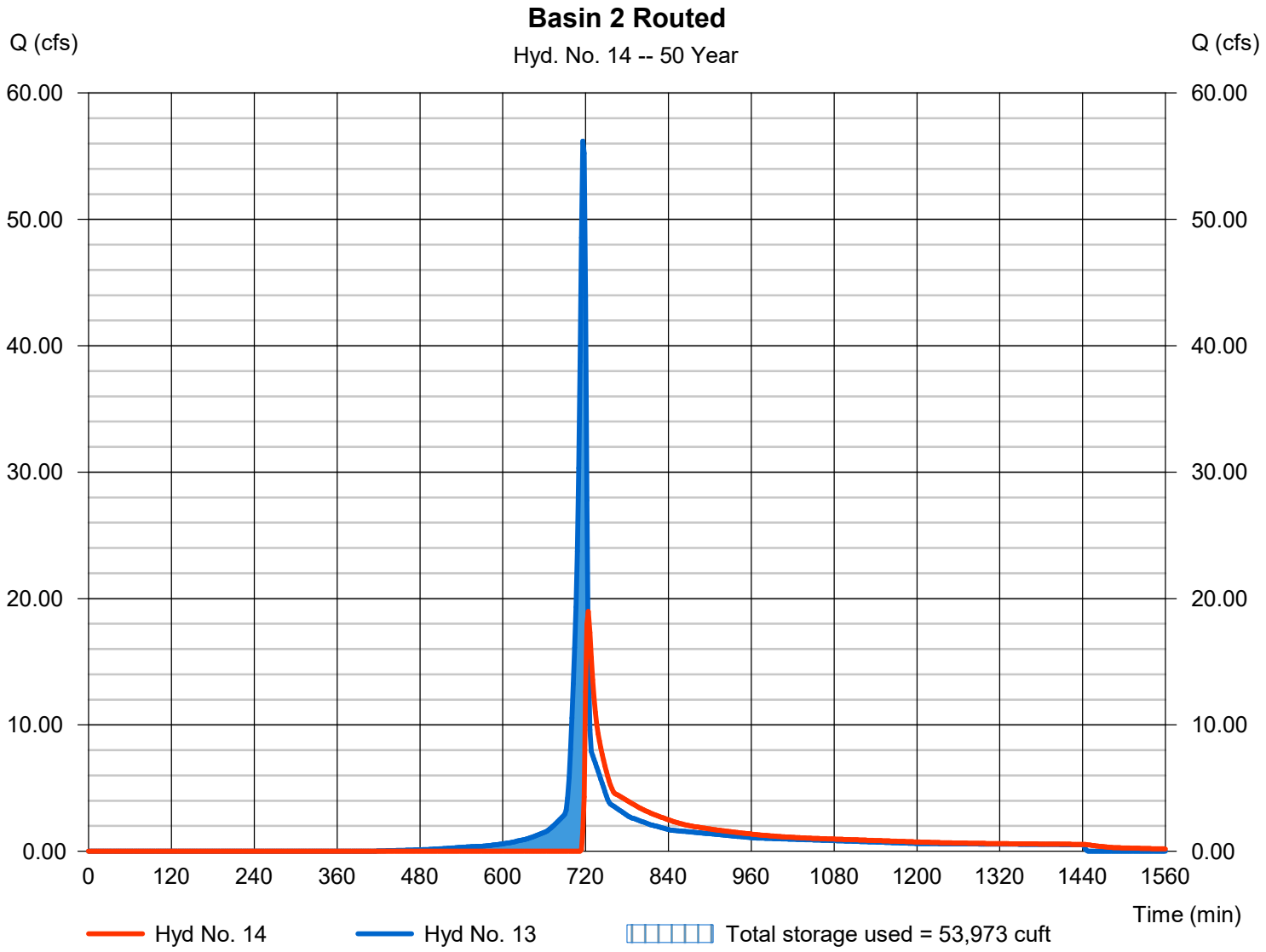
Hydrograph Report

Hyd. No. 14

Basin 2 Routed

Hydrograph type	=	Reservoir	Peak discharge	=	18.98 cfs
Storm frequency	=	50 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	82,300 cuft
Inflow hyd. No.	=	13 - Post Basin 2	Max. Elevation	=	310.22 ft
Reservoir name	=	Basin 2	Max. Storage	=	53,973 cuft

Storage Indication method used.

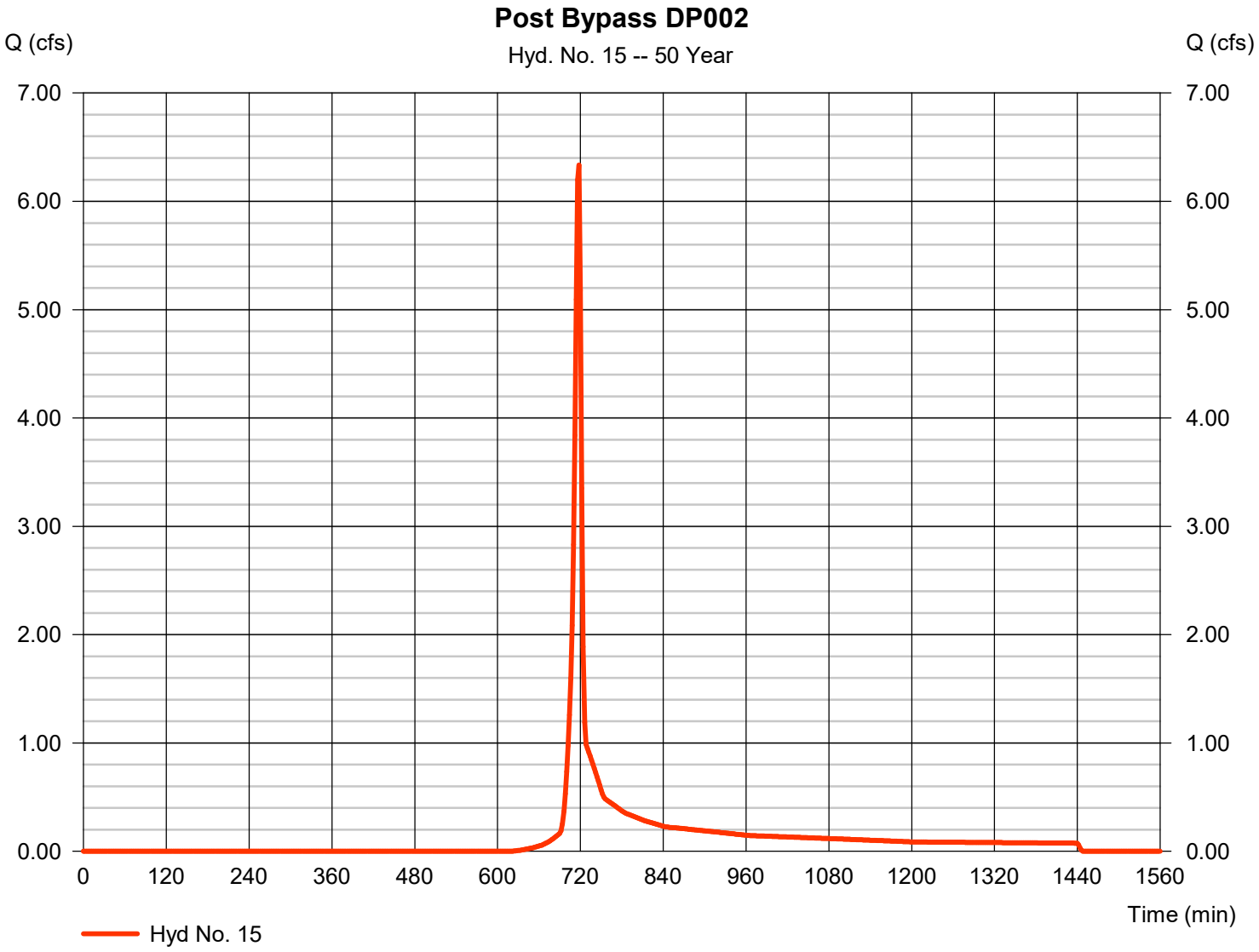


Hydrograph Report

Hyd. No. 15

Post Bypass DP002

Hydrograph type	=	SCS Runoff	Peak discharge	=	6.335 cfs
Storm frequency	=	50 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	12,668 cuft
Drainage area	=	1.540 ac	Curve number	=	61
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	6.60 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

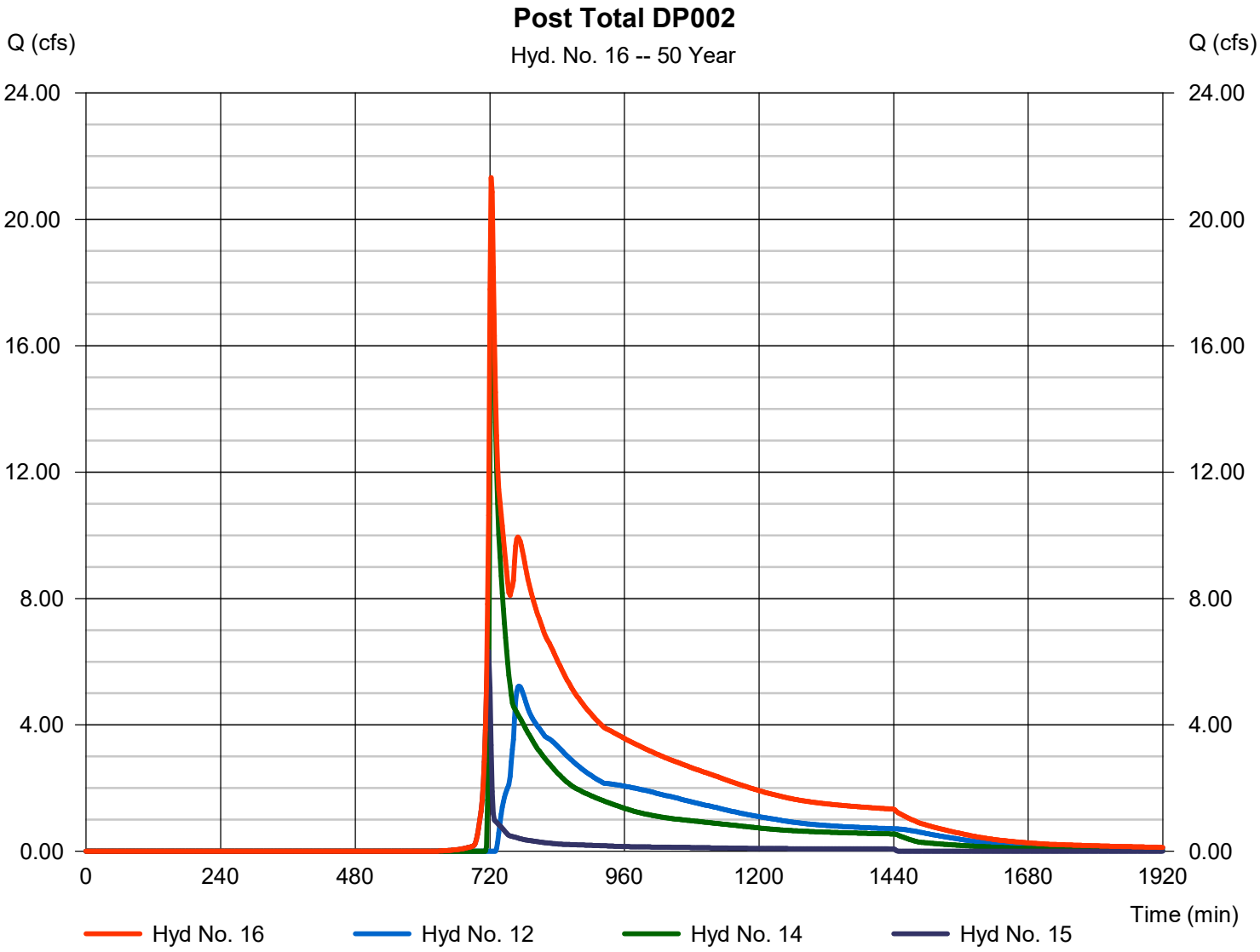


Hydrograph Report

Hyd. No. 16

Post Total DP002

Hydrograph type	=	Combine	Peak discharge	=	21.32 cfs
Storm frequency	=	50 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	180,602 cuft
Inflow hyds.	=	12, 14, 15	Contrib. drain. area	=	1.540 ac



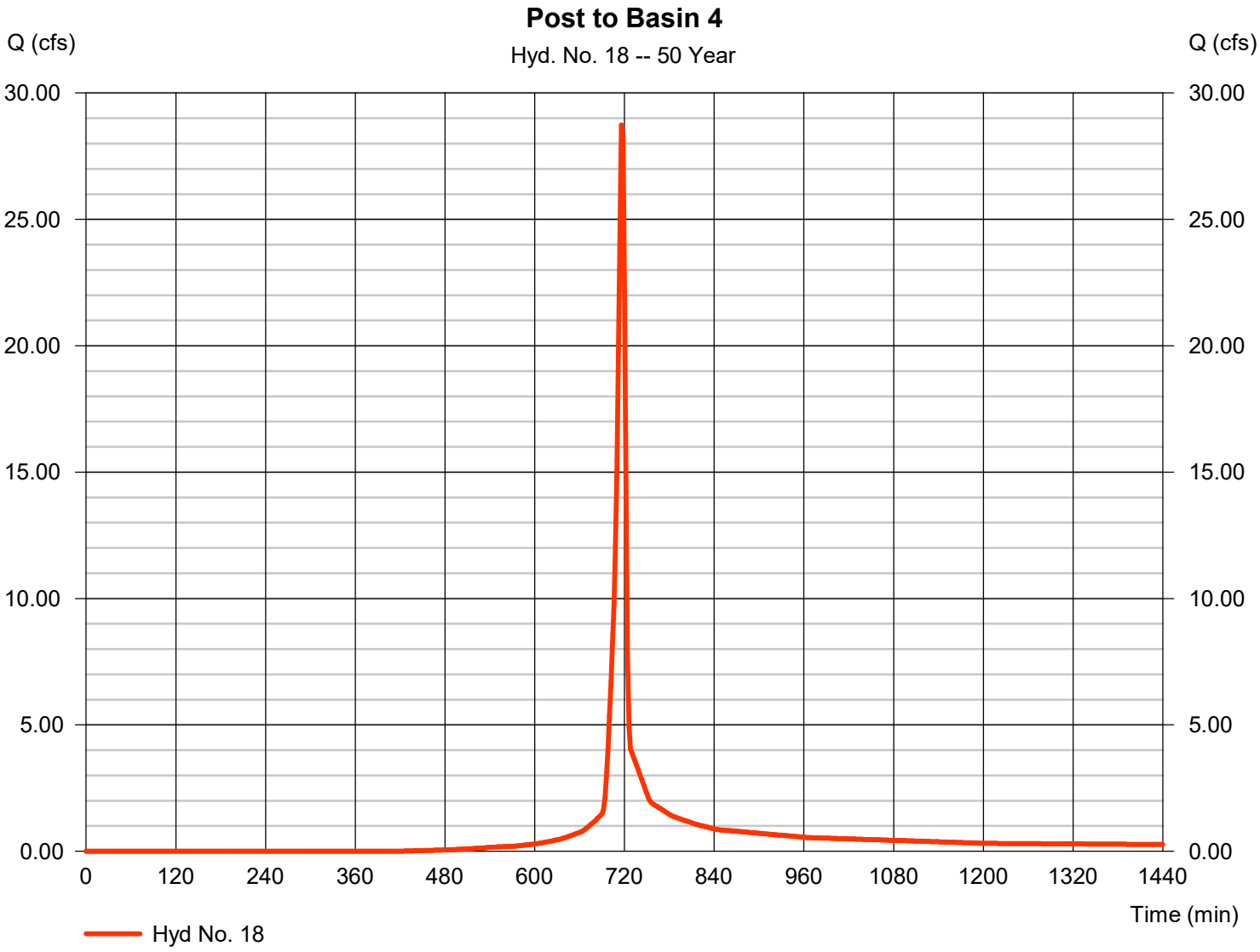
Hydrograph Report

Hyd. No. 18

Post to Basin 4

Hydrograph type	=	SCS Runoff	Peak discharge	=	28.74 cfs
Storm frequency	=	50 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	58,554 cuft
Drainage area	=	4.420 ac	Curve number	=	75.9*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	6.60 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.910 x 61) + (2.270 x 98) + (3.040 x 78)] / 4.420



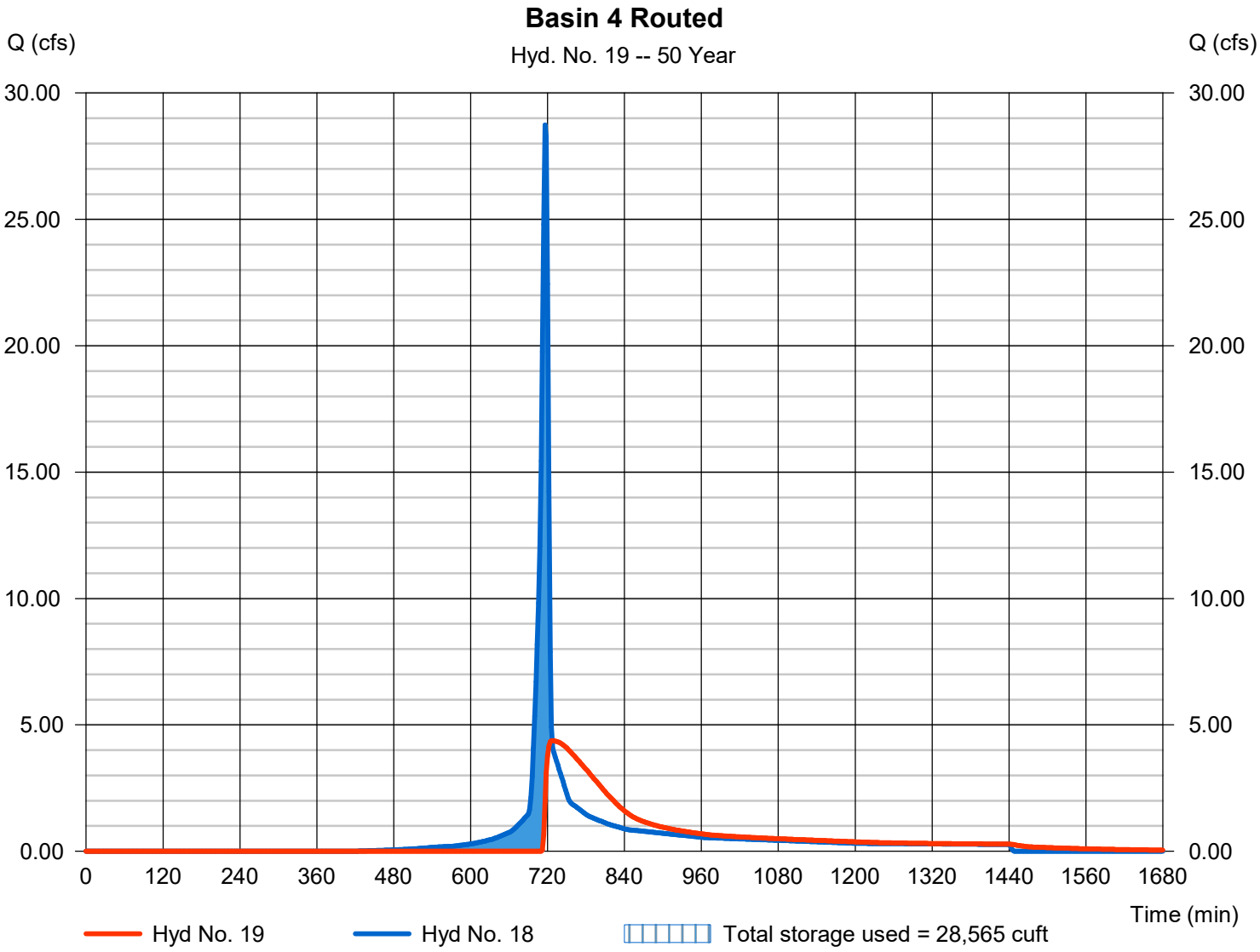
Hydrograph Report

Hyd. No. 19

Basin 4 Routed

Hydrograph type	=	Reservoir	Peak discharge	=	4.373 cfs
Storm frequency	=	50 yrs	Time to peak	=	728 min
Time interval	=	2 min	Hyd. volume	=	44,756 cuft
Inflow hyd. No.	=	18 - Post to Basin 4	Max. Elevation	=	348.04 ft
Reservoir name	=	Basin 4	Max. Storage	=	28,565 cuft

Storage Indication method used.



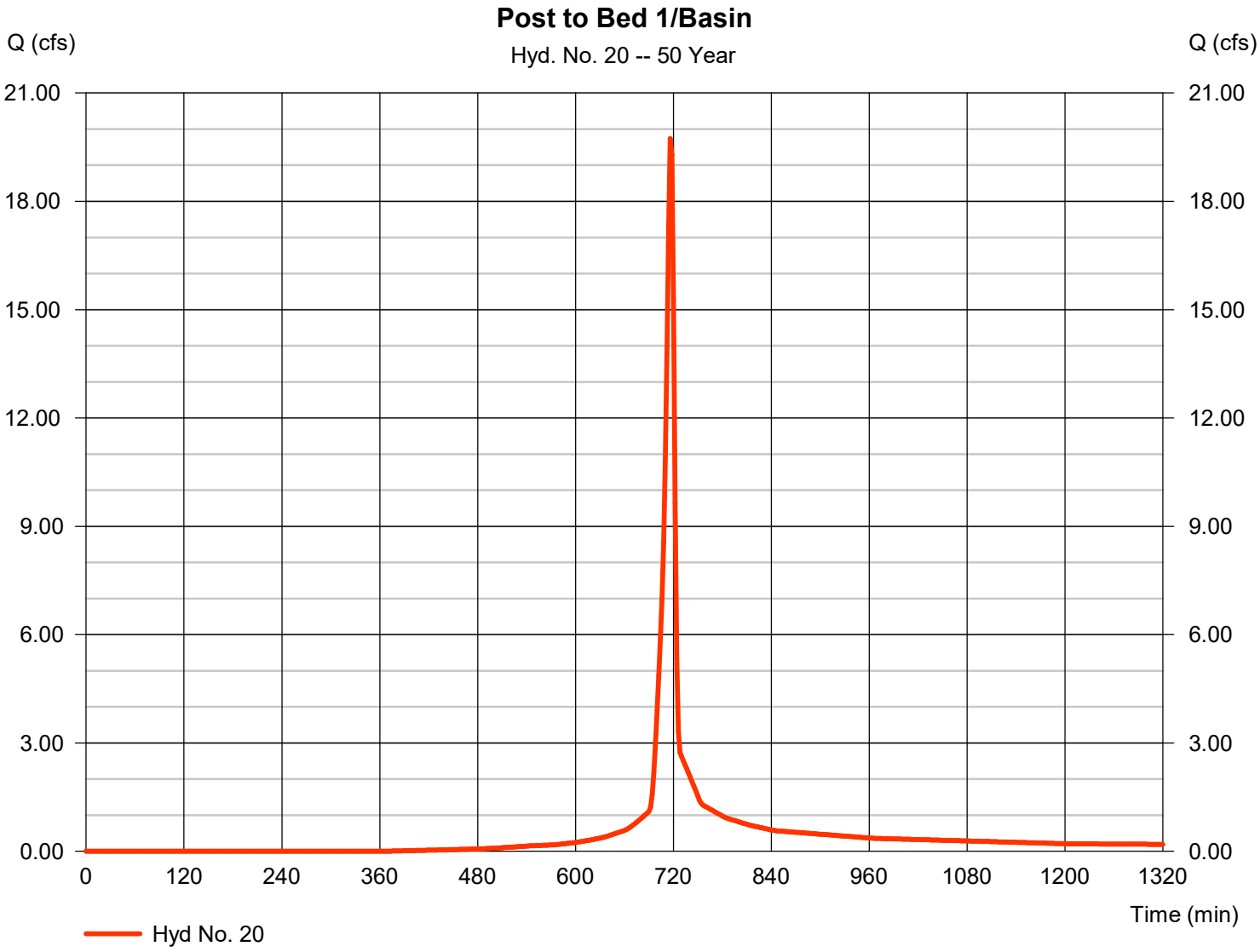
Hydrograph Report

Hyd. No. 20

Post to Bed 1/Basin

Hydrograph type	= SCS Runoff	Peak discharge	= 19.73 cfs
Storm frequency	= 50 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 40,599 cuft
Drainage area	= 2.820 ac	Curve number	= 79.1*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.60 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.910 x 61) + (2.270 x 98) + (3.040 x 78)] / 2.820



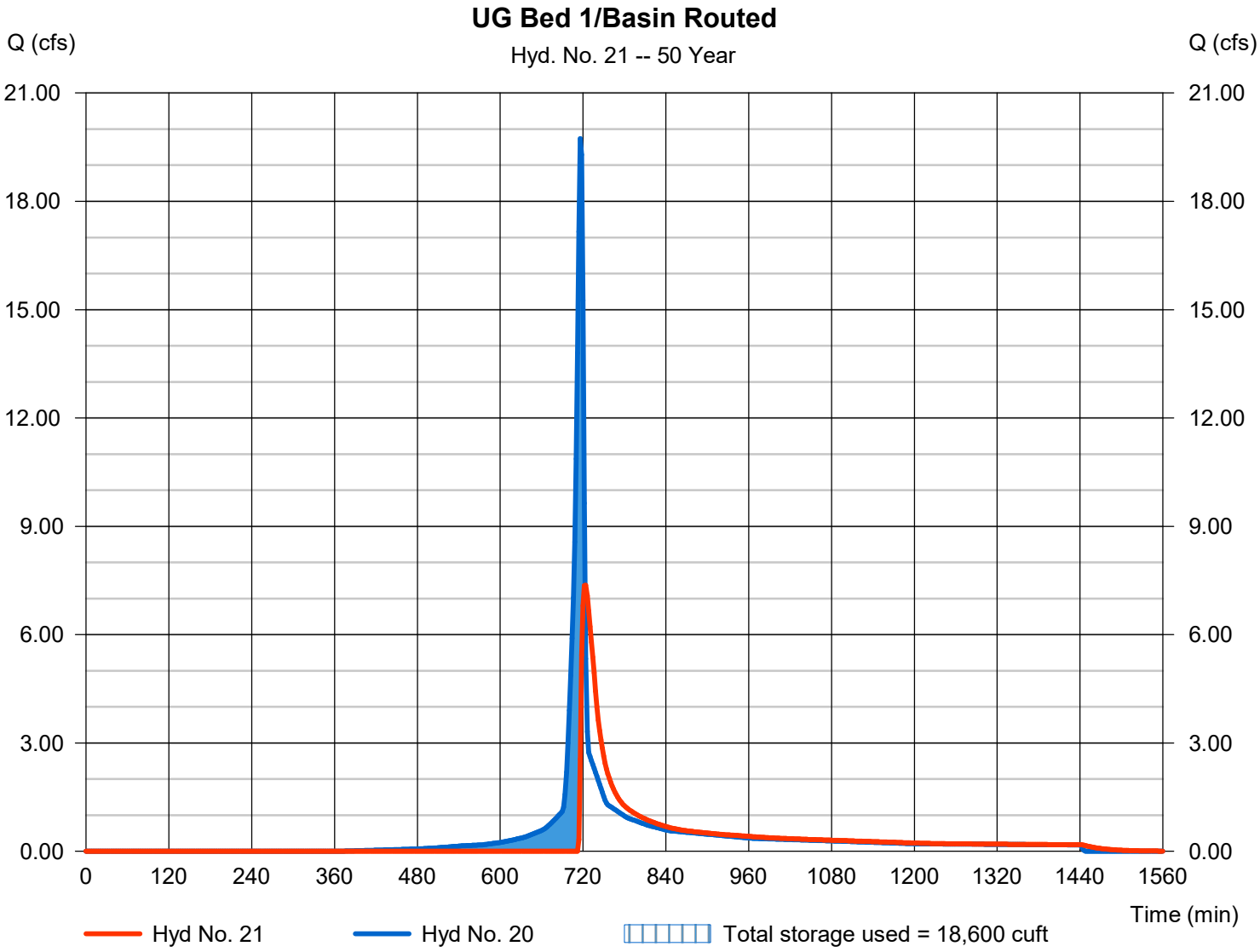
Hydrograph Report

Hyd. No. 21

UG Bed 1/Basin Routed

Hydrograph type	=	Reservoir	Peak discharge	=	7.370 cfs
Storm frequency	=	50 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	28,502 cuft
Inflow hyd. No.	=	20 - Post to Bed 1/Basin	Max. Elevation	=	341.74 ft
Reservoir name	=	UG Bed 1/Basin	Max. Storage	=	18,600 cuft

Storage Indication method used.

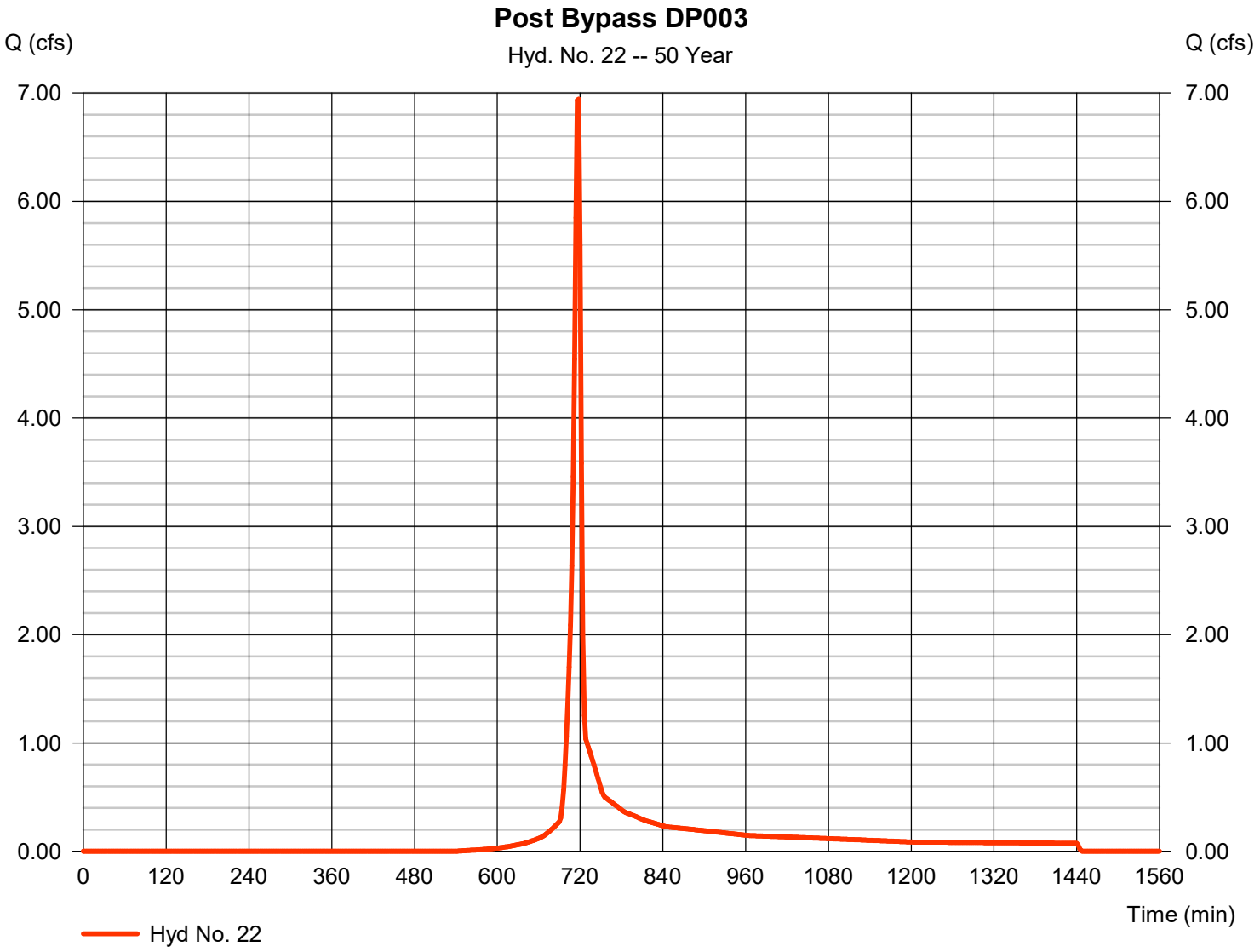


Hydrograph Report

Hyd. No. 22

Post Bypass DP003

Hydrograph type	=	SCS Runoff	Peak discharge	=	6.944 cfs
Storm frequency	=	50 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	13,999 cuft
Drainage area	=	1.340 ac	Curve number	=	67.8
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	6.60 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

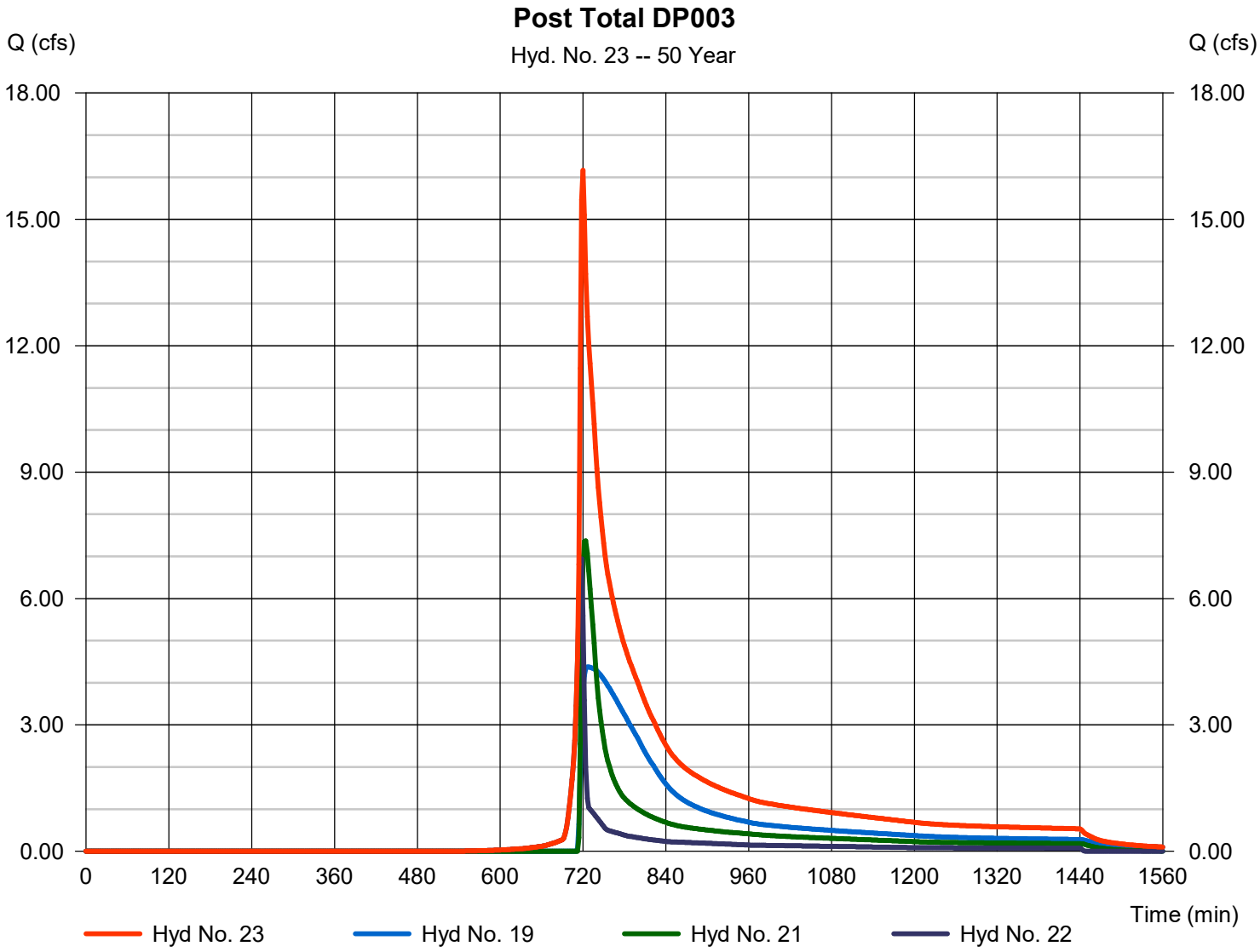


Hydrograph Report

Hyd. No. 23

Post Total DP003

Hydrograph type	=	Combine	Peak discharge	=	16.17 cfs
Storm frequency	=	50 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	87,257 cuft
Inflow hyds.	=	19, 21, 22	Contrib. drain. area	=	1.340 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

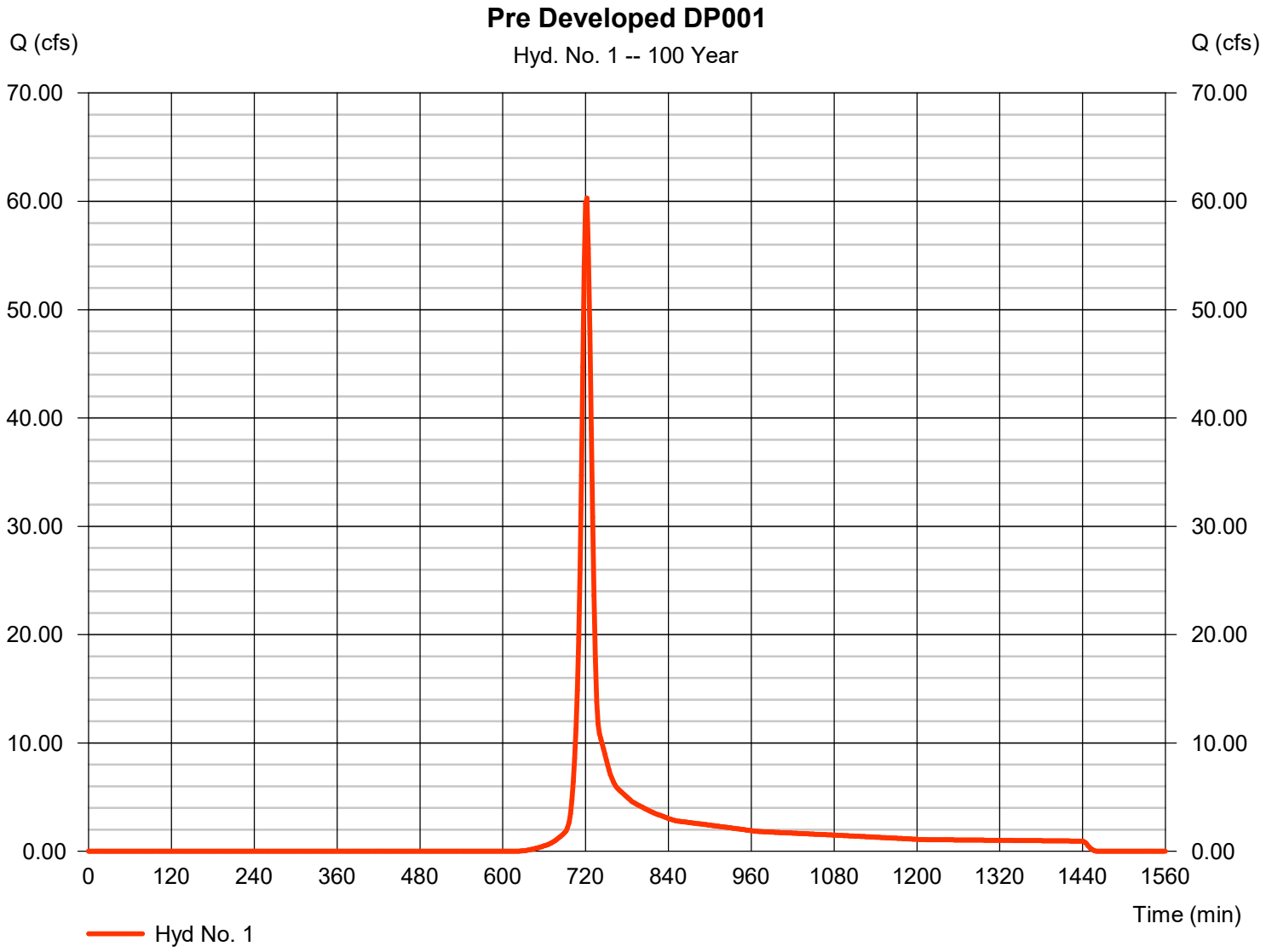
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	60.31	2	722	159,136	------	------	------	Pre Developed DP001
2	SCS Runoff	79.34	2	722	208,579	------	------	------	Pre Developed DP002
3	SCS Runoff	45.54	2	720	118,084	------	------	------	Pre Developed DP003
4	SCS Runoff	4.363	2	718	8,749	------	------	------	Pre Developed DP003 ORA
5	SCS Runoff	84.16	2	716	170,598	------	------	------	Post Basin 3
6	Reservoir	24.38	2	724	125,131	5	319.74	74,844	Basin 3 Routed
7	SCS Runoff	8.052	2	718	16,178	------	------	------	Post Bypass DP001
8	Combine	29.04	2	718	141,309	6, 7	------	------	Post Total DP001
10	SCS Runoff	77.75	2	716	157,867	------	------	------	Post Basin 1
11	Reservoir	30.18	2	722	120,378	10	324.12	70,140	Basin 1 Upper Routed
12	Reservoir	13.13	2	738	114,181	11	305.96	20,385	Basin 1 Lower Routed
13	SCS Runoff	67.22	2	716	138,052	------	------	------	Post Basin 2
14	Reservoir	33.12	2	722	105,698	13	310.57	60,504	Basin 2 Routed
15	SCS Runoff	8.028	2	718	16,080	------	------	------	Post Bypass DP002
16	Combine	37.69	2	720	235,959	12, 14, 15	------	------	Post Total DP002
18	SCS Runoff	34.43	2	716	70,605	------	------	------	Post to Basin 4
19	Reservoir	10.28	2	724	56,806	18	348.51	33,532	Basin 4 Routed
20	SCS Runoff	23.40	2	716	48,517	------	------	------	Post to Bed 1/Basin
21	Reservoir	10.57	2	722	36,419	20	342.30	21,484	UG Bed 1/Basin Routed
22	SCS Runoff	8.571	2	716	17,315	------	------	------	Post Bypass DP003
23	Combine	25.00	2	722	110,541	19, 21, 22	------	------	Post Total DP003

Hydrograph Report

Hyd. No. 1

Pre Developed DP001

Hydrograph type	=	SCS Runoff	Peak discharge	=	60.31 cfs
Storm frequency	=	100 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	159,136 cuft
Drainage area	=	15.430 ac	Curve number	=	58
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	12.00 min
Total precip.	=	7.50 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

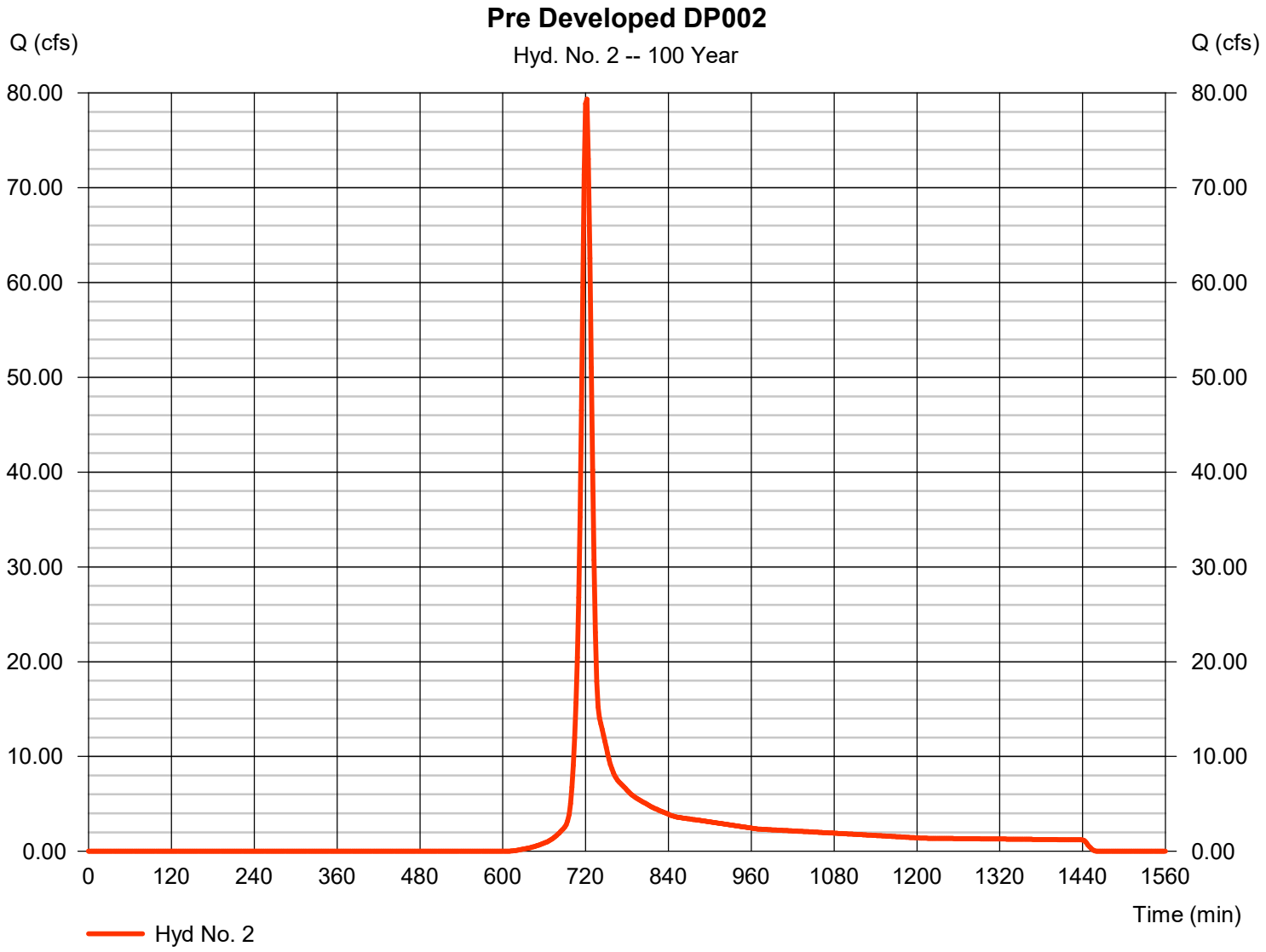


Hydrograph Report

Hyd. No. 2

Pre Developed DP002

Hydrograph type	=	SCS Runoff	Peak discharge	=	79.34 cfs
Storm frequency	=	100 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	208,579 cuft
Drainage area	=	19.210 ac	Curve number	=	59.4
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	12.00 min
Total precip.	=	7.50 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

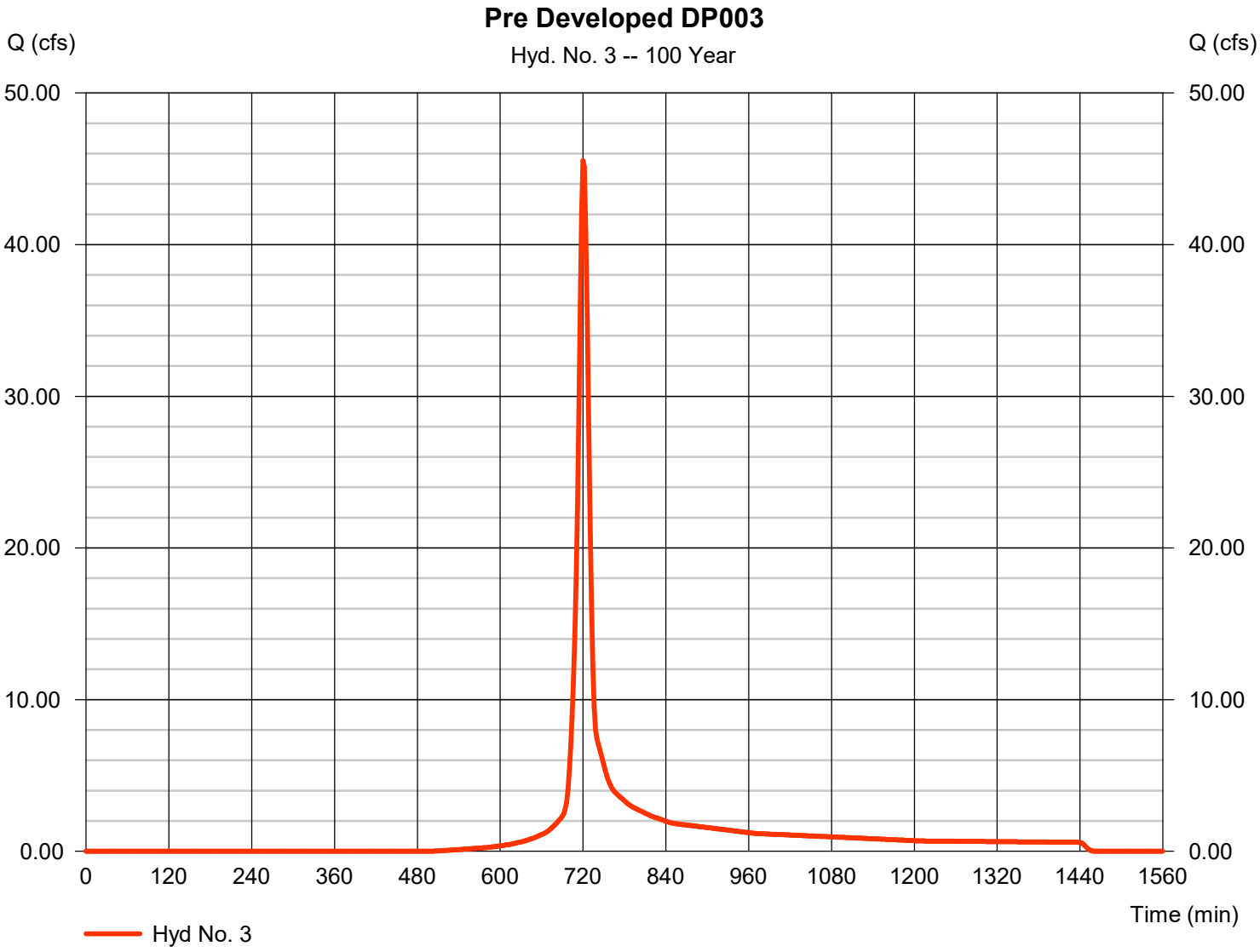


Hydrograph Report

Hyd. No. 3

Pre Developed DP003

Hydrograph type	=	SCS Runoff	Peak discharge	=	45.54 cfs
Storm frequency	=	100 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	118,084 cuft
Drainage area	=	8.190 ac	Curve number	=	68.3
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	11.00 min
Total precip.	=	7.50 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

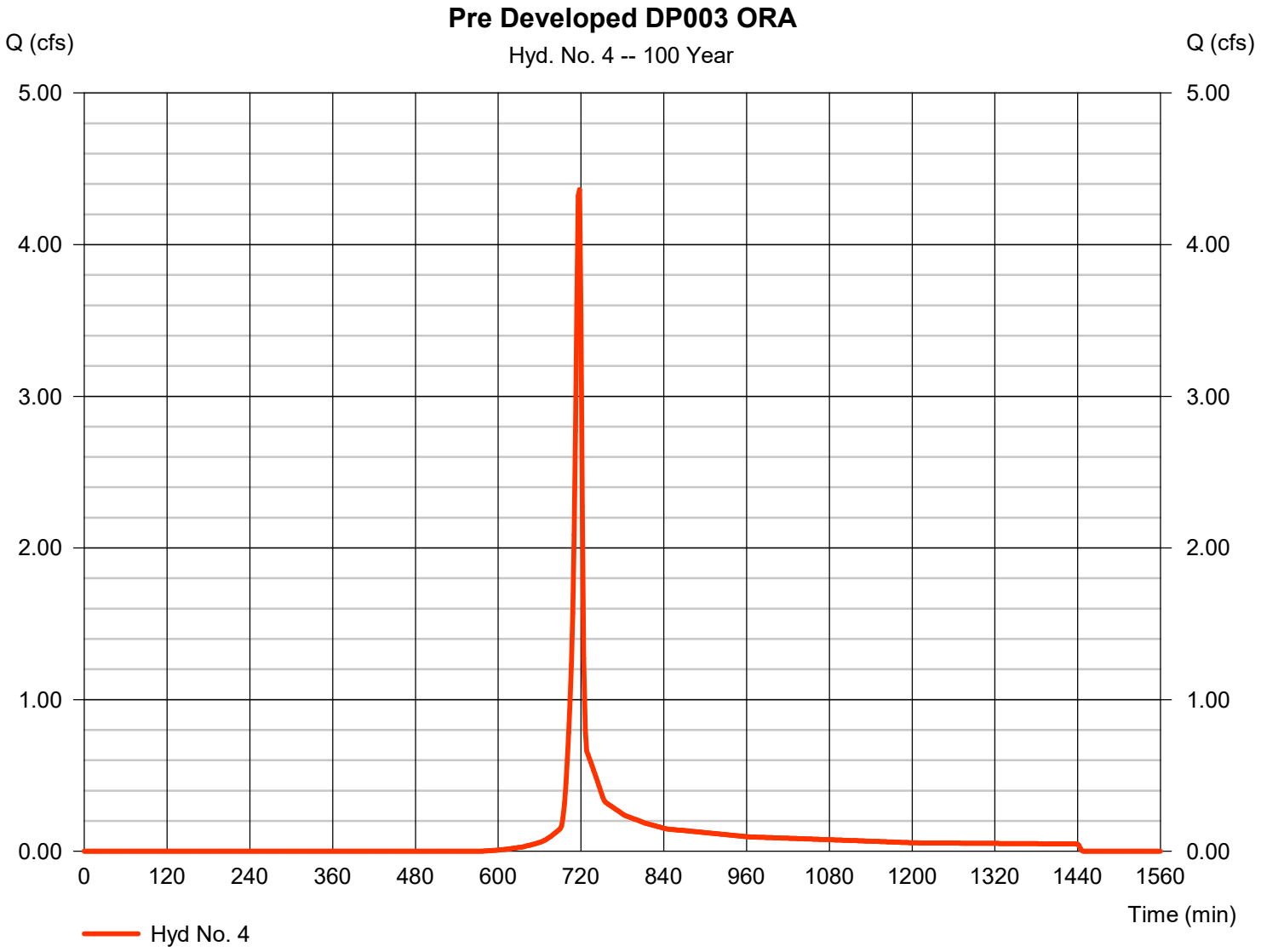


Hydrograph Report

Hyd. No. 4

Pre Developed DP003 ORA

Hydrograph type	=	SCS Runoff	Peak discharge	=	4.363 cfs
Storm frequency	=	100 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	8,749 cuft
Drainage area	=	0.810 ac	Curve number	=	62
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	7.50 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

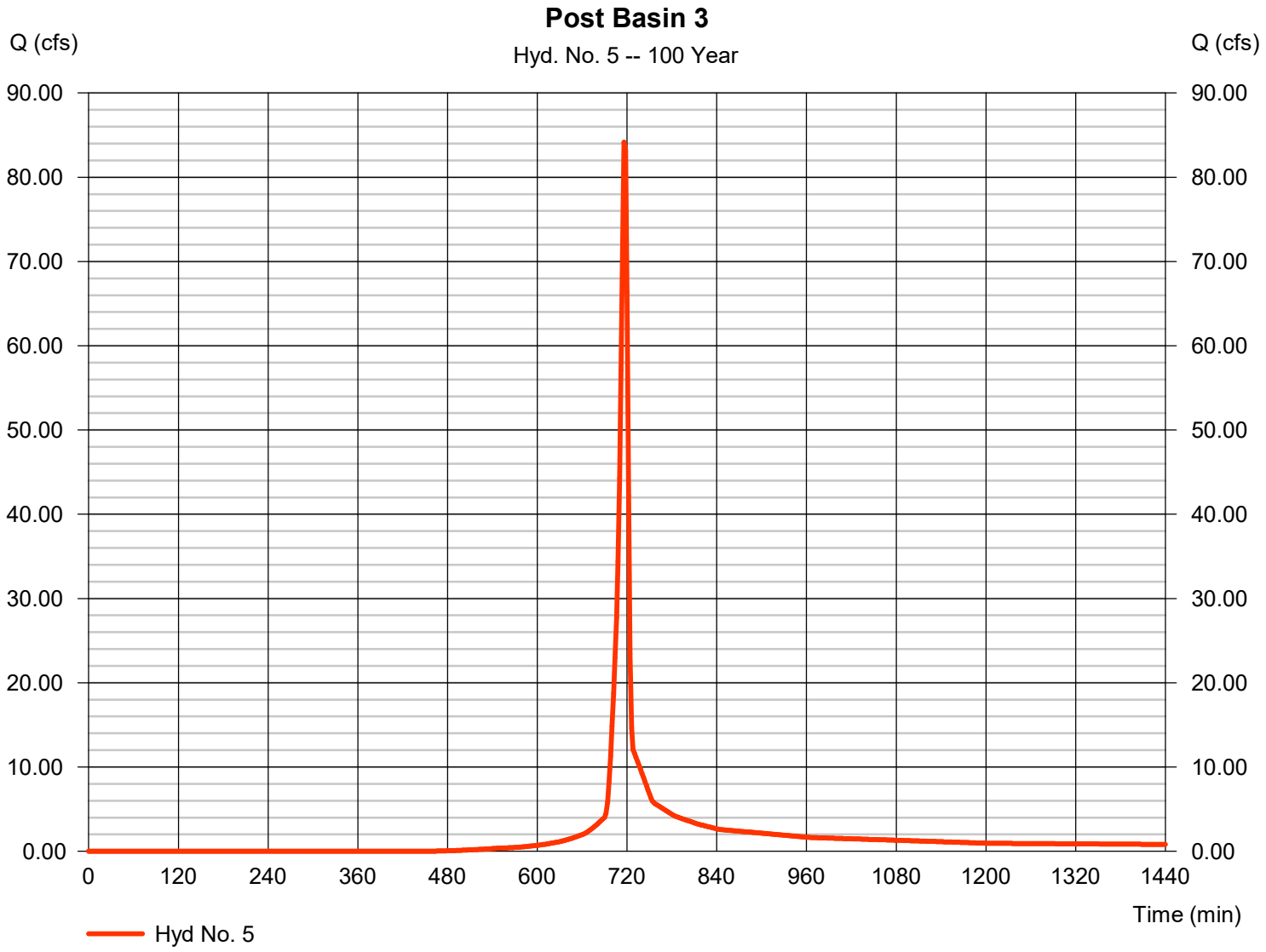


Hydrograph Report

Hyd. No. 5

Post Basin 3

Hydrograph type	=	SCS Runoff	Peak discharge	=	84.16 cfs
Storm frequency	=	100 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	170,598 cuft
Drainage area	=	12.150 ac	Curve number	=	70.8
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	7.50 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



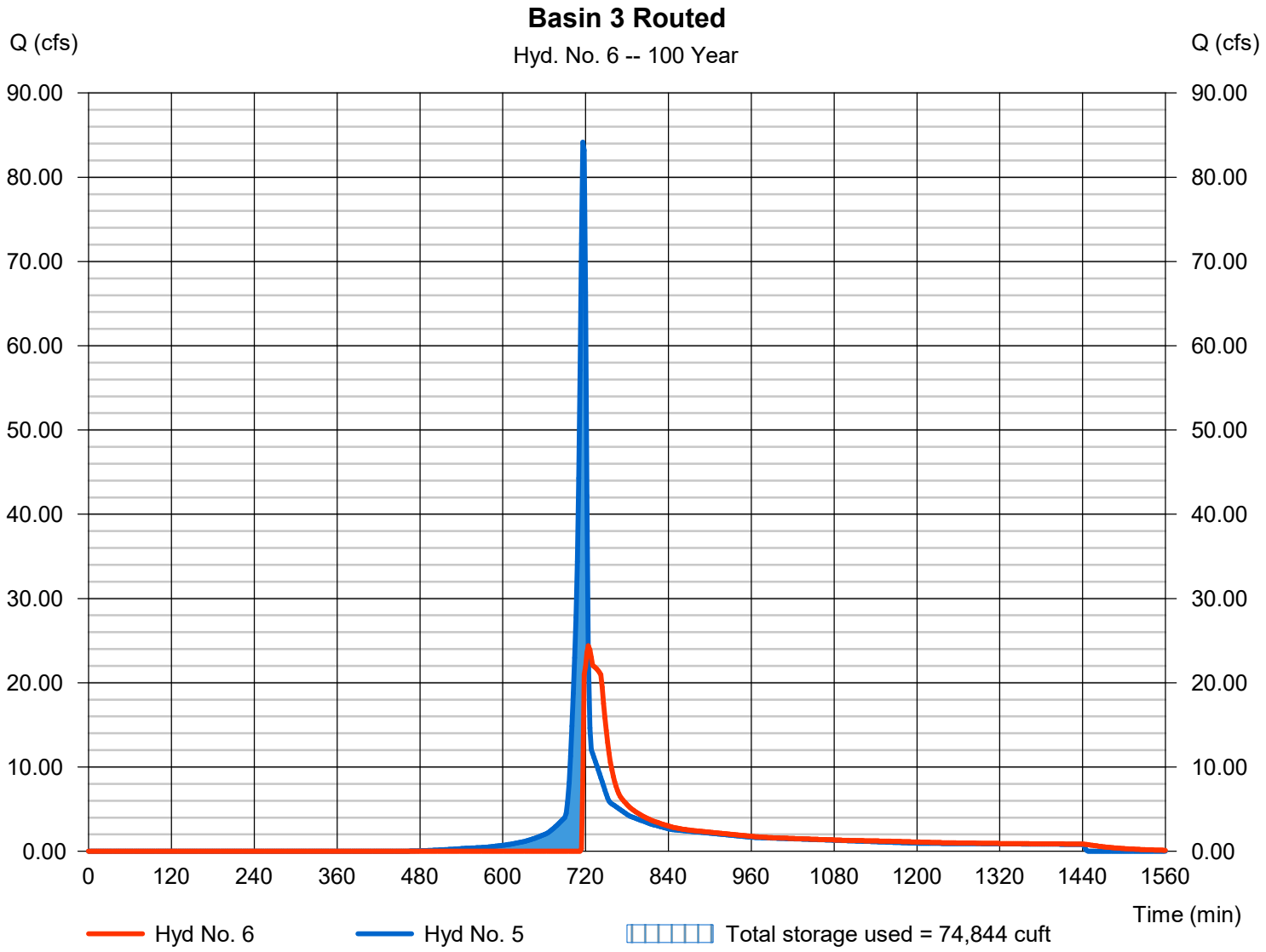
Hydrograph Report

Hyd. No. 6

Basin 3 Routed

Hydrograph type	=	Reservoir	Peak discharge	=	24.38 cfs
Storm frequency	=	100 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	125,131 cuft
Inflow hyd. No.	=	5 - Post Basin 3	Max. Elevation	=	319.74 ft
Reservoir name	=	Basin 3	Max. Storage	=	74,844 cuft

Storage Indication method used.

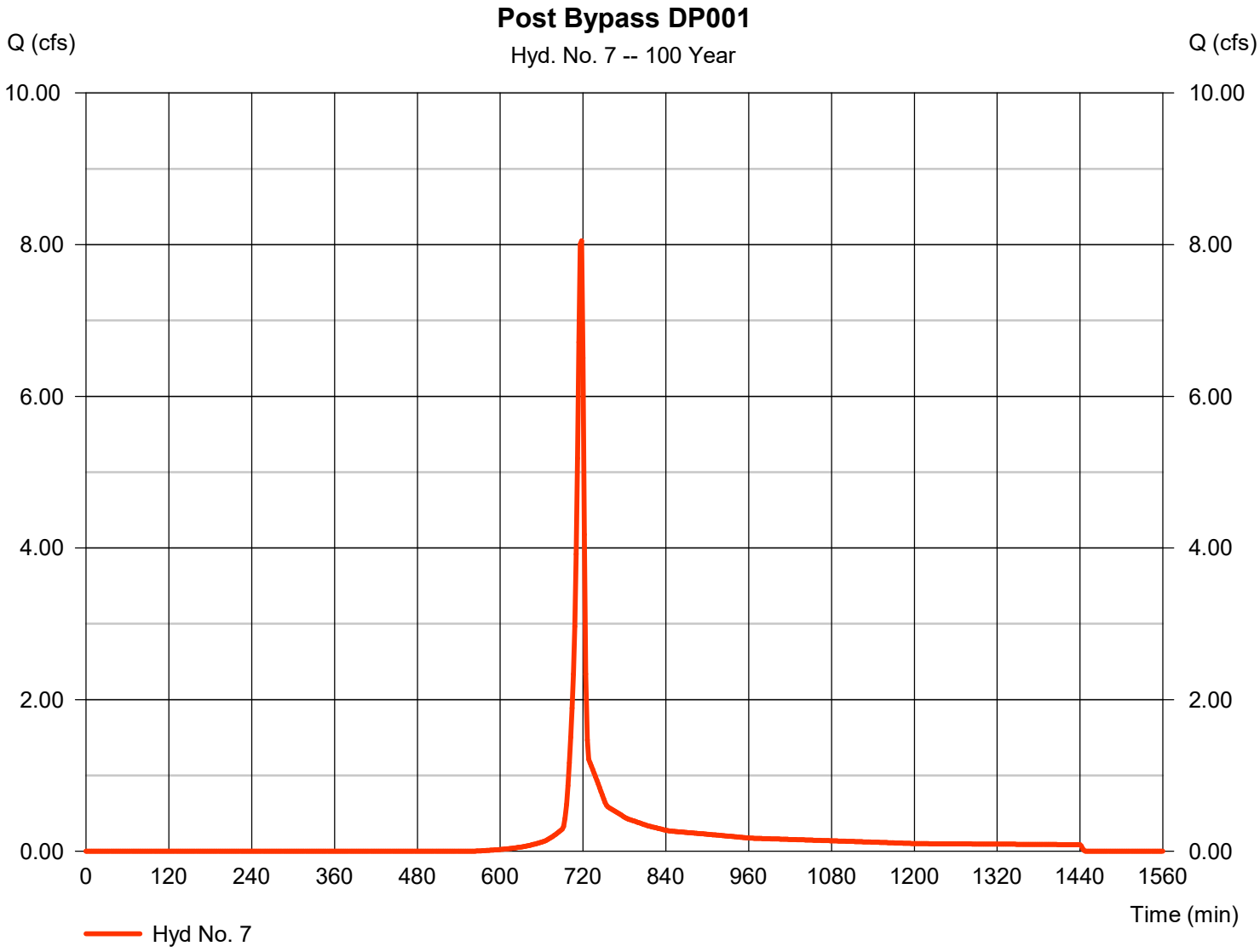


Hydrograph Report

Hyd. No. 7

Post Bypass DP001

Hydrograph type	=	SCS Runoff	Peak discharge	=	8.052 cfs
Storm frequency	=	100 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	16,178 cuft
Drainage area	=	1.440 ac	Curve number	=	63.2
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	7.50 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

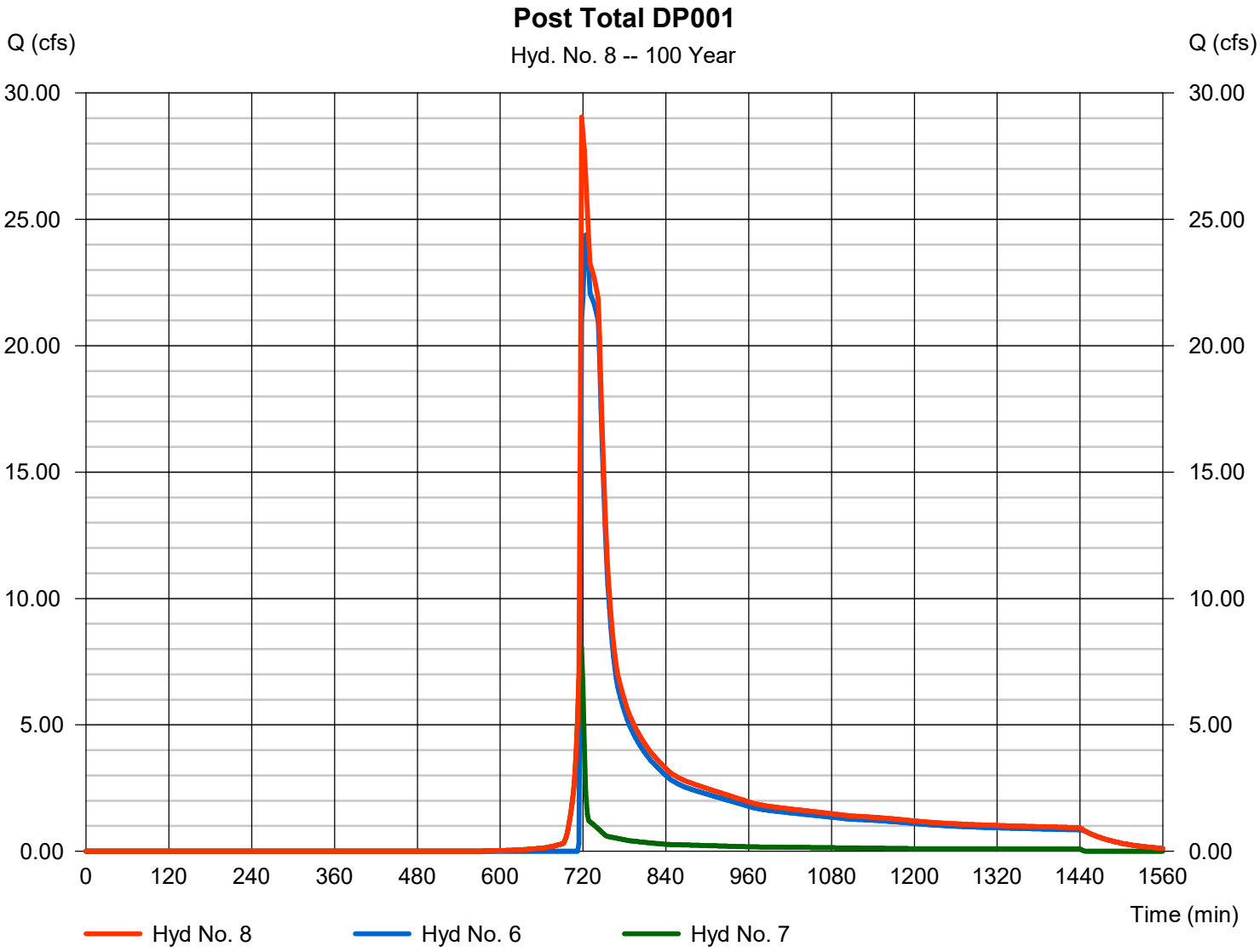


Hydrograph Report

Hyd. No. 8

Post Total DP001

Hydrograph type	=	Combine	Peak discharge	=	29.04 cfs
Storm frequency	=	100 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	141,309 cuft
Inflow hyds.	=	6, 7	Contrib. drain. area	=	1.440 ac

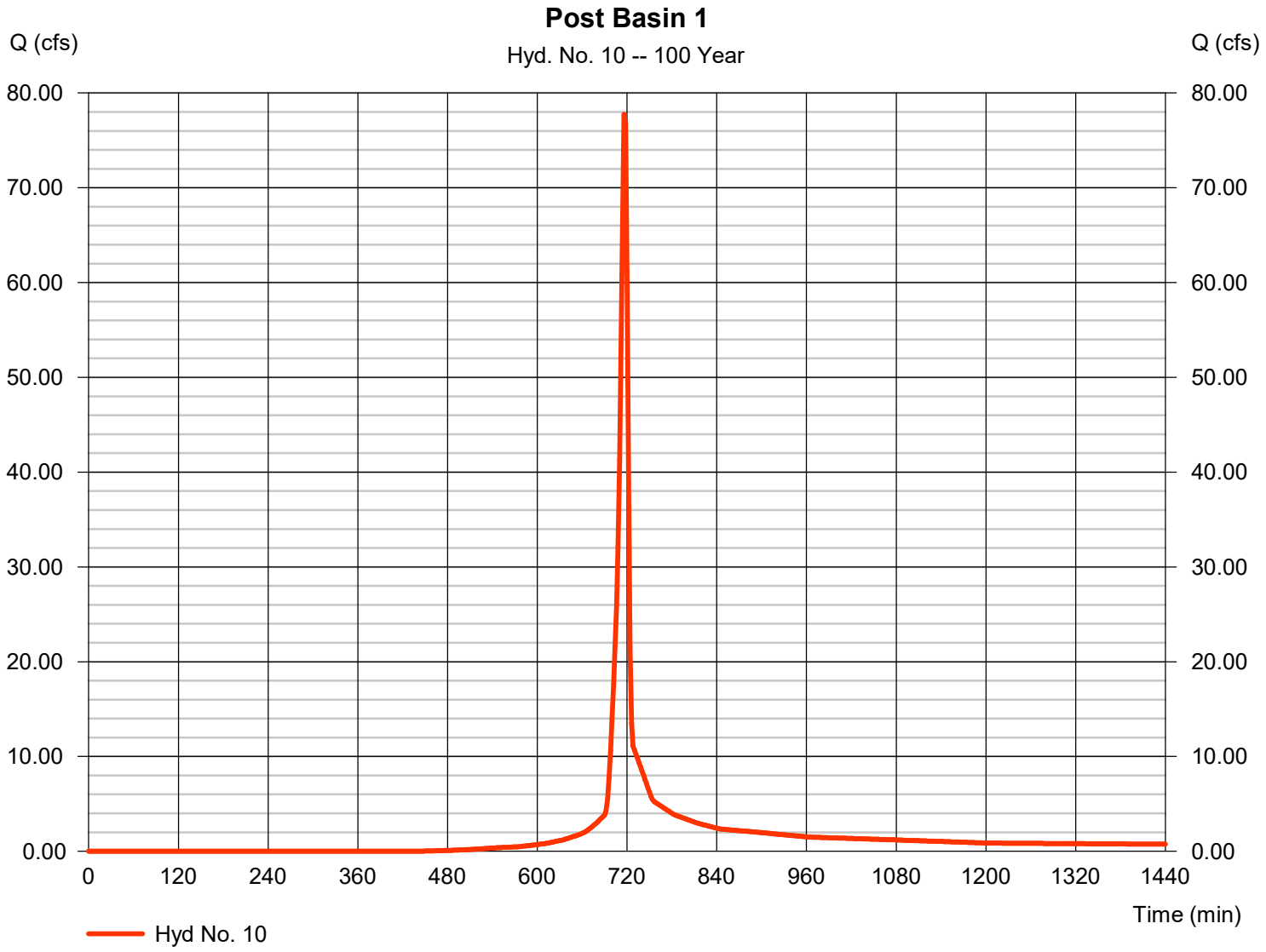


Hydrograph Report

Hyd. No. 10

Post Basin 1

Hydrograph type	=	SCS Runoff	Peak discharge	=	77.75 cfs
Storm frequency	=	100 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	157,867 cuft
Drainage area	=	10.950 ac	Curve number	=	71.8
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	7.50 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



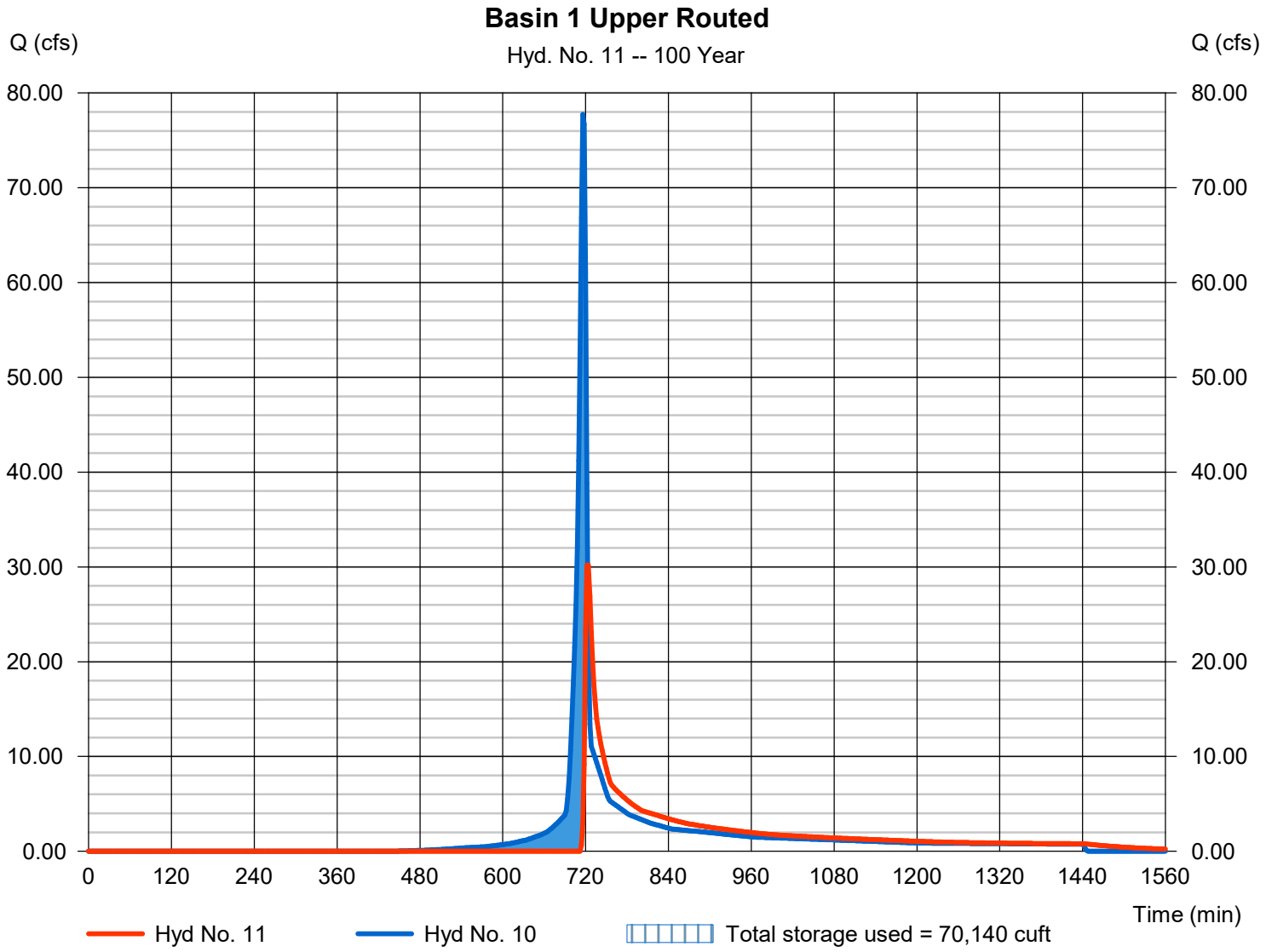
Hydrograph Report

Hyd. No. 11

Basin 1 Upper Routed

Hydrograph type	=	Reservoir	Peak discharge	=	30.18 cfs
Storm frequency	=	100 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	120,378 cuft
Inflow hyd. No.	=	10 - Post Basin 1	Max. Elevation	=	324.12 ft
Reservoir name	=	Basin 1 Upper	Max. Storage	=	70,140 cuft

Storage Indication method used.



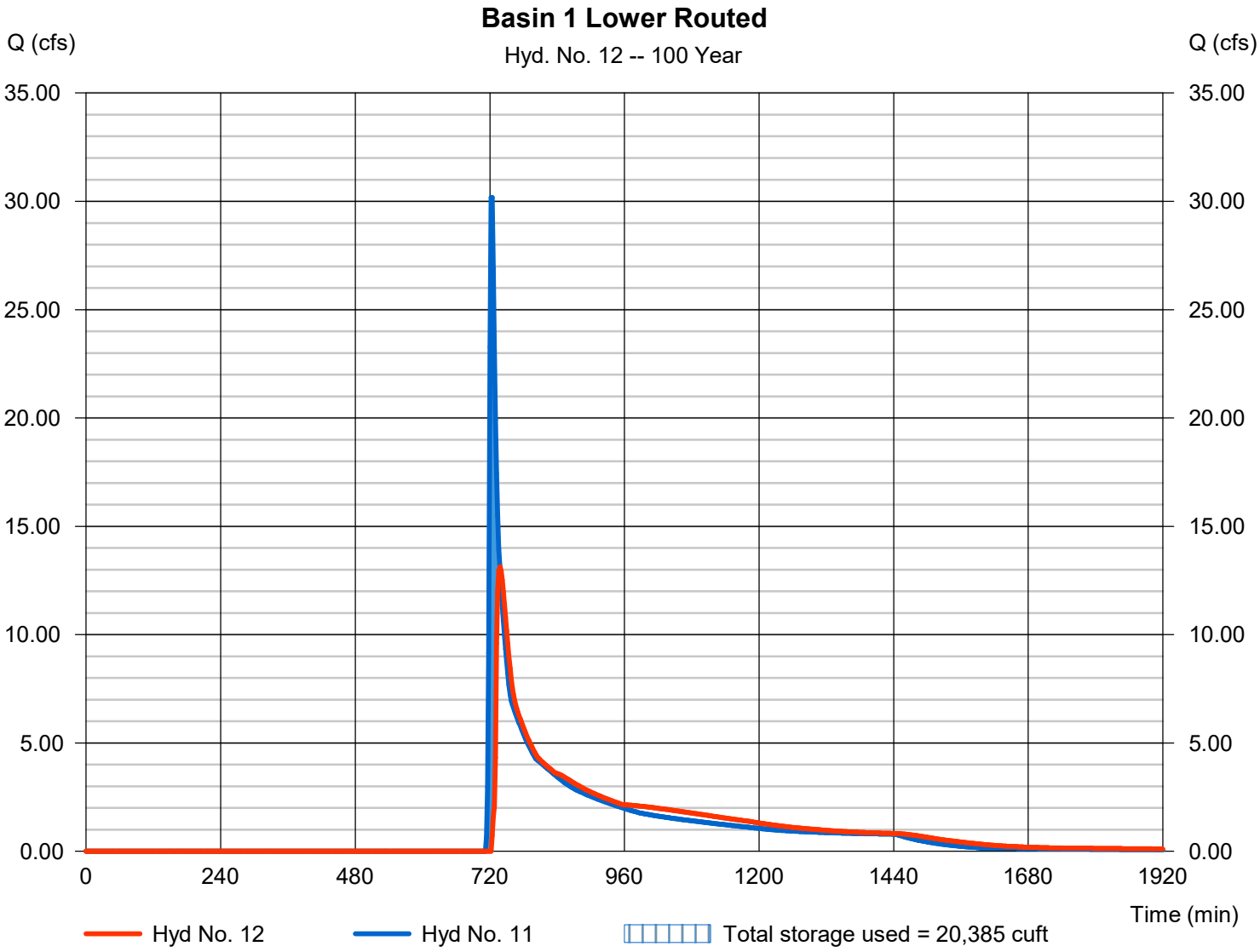
Hydrograph Report

Hyd. No. 12

Basin 1 Lower Routed

Hydrograph type	=	Reservoir	Peak discharge	=	13.13 cfs
Storm frequency	=	100 yrs	Time to peak	=	738 min
Time interval	=	2 min	Hyd. volume	=	114,181 cuft
Inflow hyd. No.	=	11 - Basin 1 Upper Routed	Max. Elevation	=	305.96 ft
Reservoir name	=	Basin 1 Lower	Max. Storage	=	20,385 cuft

Storage Indication method used.

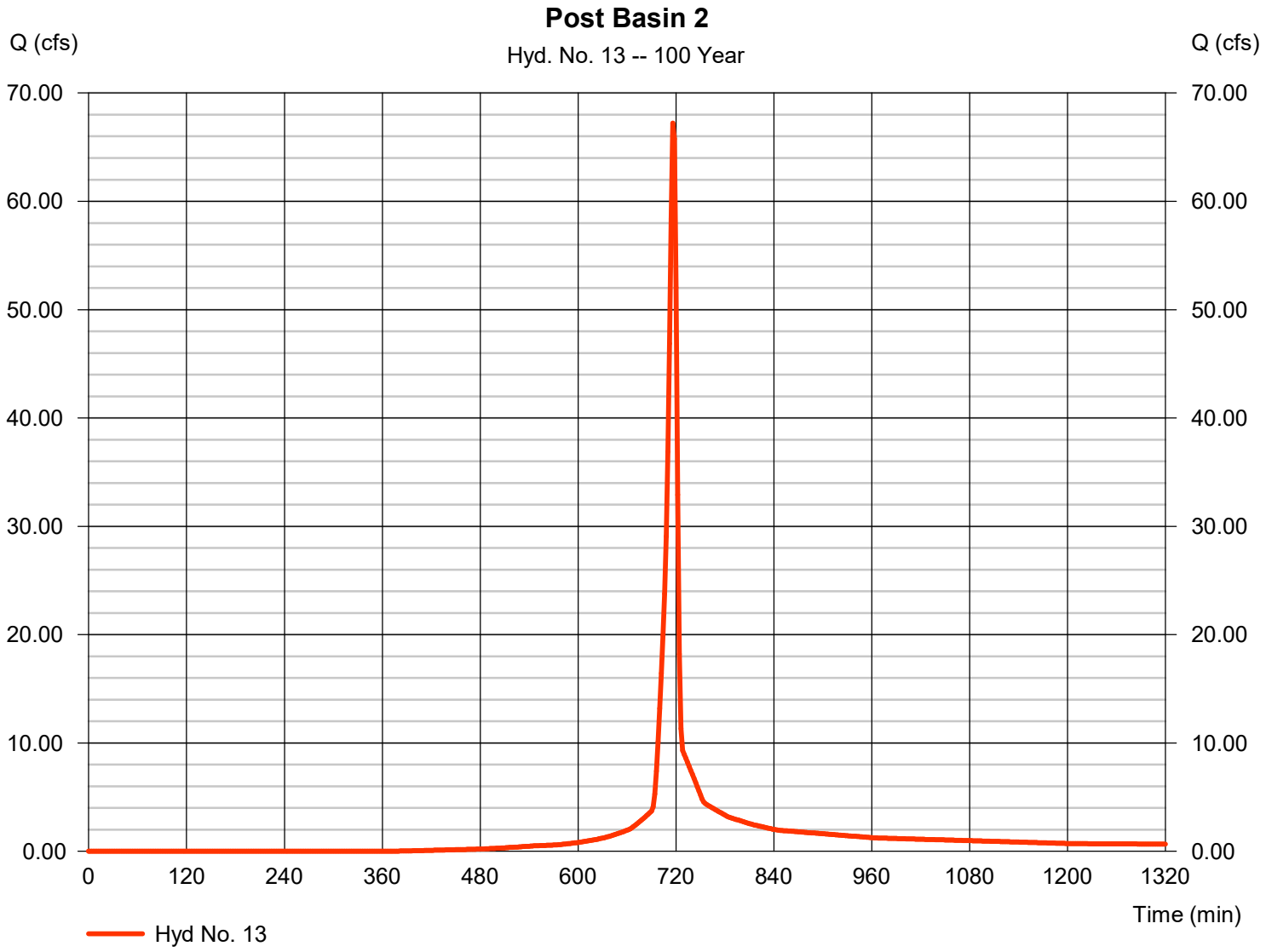


Hydrograph Report

Hyd. No. 13

Post Basin 2

Hydrograph type	=	SCS Runoff	Peak discharge	=	67.22 cfs
Storm frequency	=	100 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	138,052 cuft
Drainage area	=	8.540 ac	Curve number	=	76.4
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	7.50 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



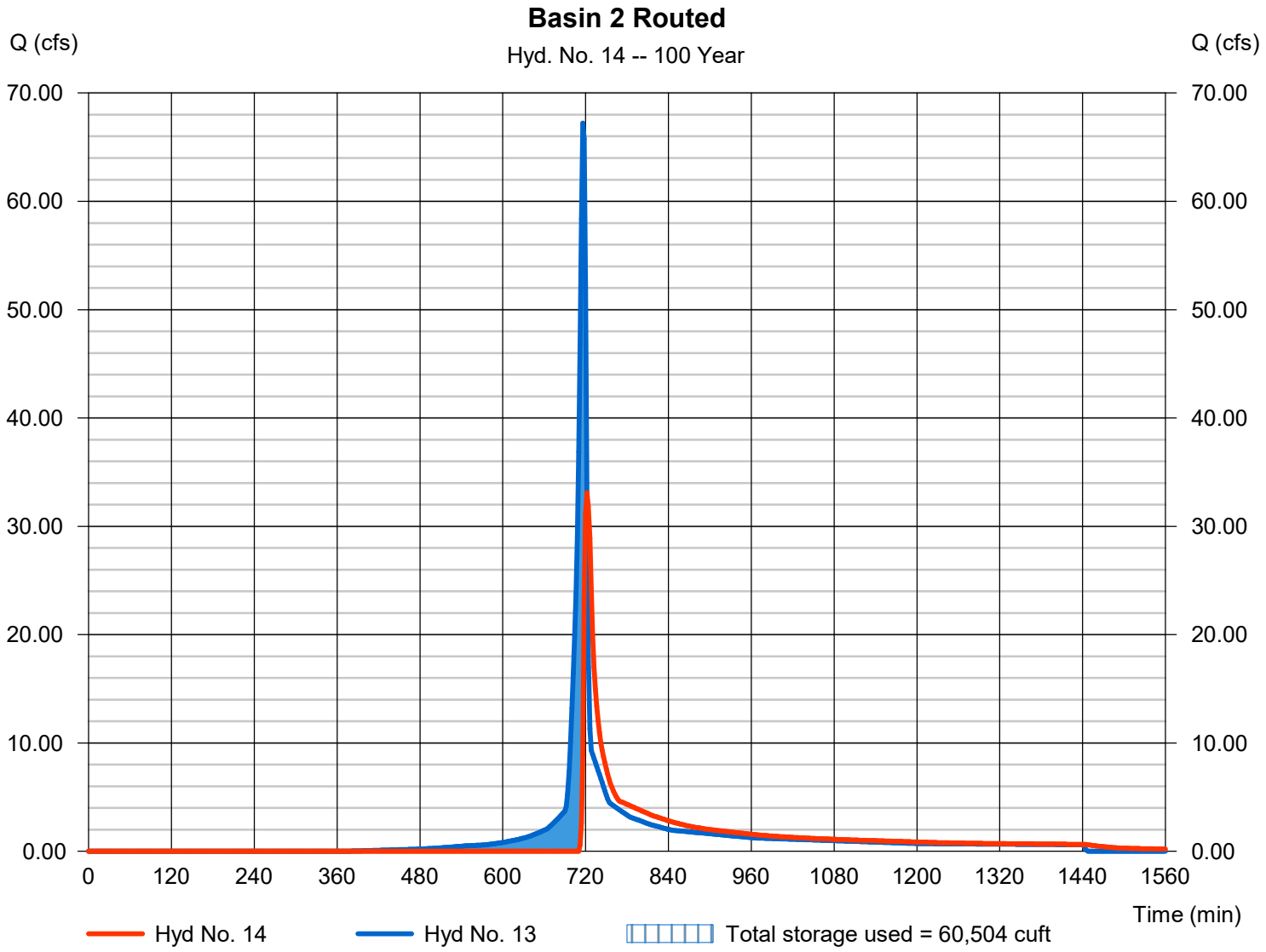
Hydrograph Report

Hyd. No. 14

Basin 2 Routed

Hydrograph type	=	Reservoir	Peak discharge	=	33.12 cfs
Storm frequency	=	100 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	105,698 cuft
Inflow hyd. No.	=	13 - Post Basin 2	Max. Elevation	=	310.57 ft
Reservoir name	=	Basin 2	Max. Storage	=	60,504 cuft

Storage Indication method used.

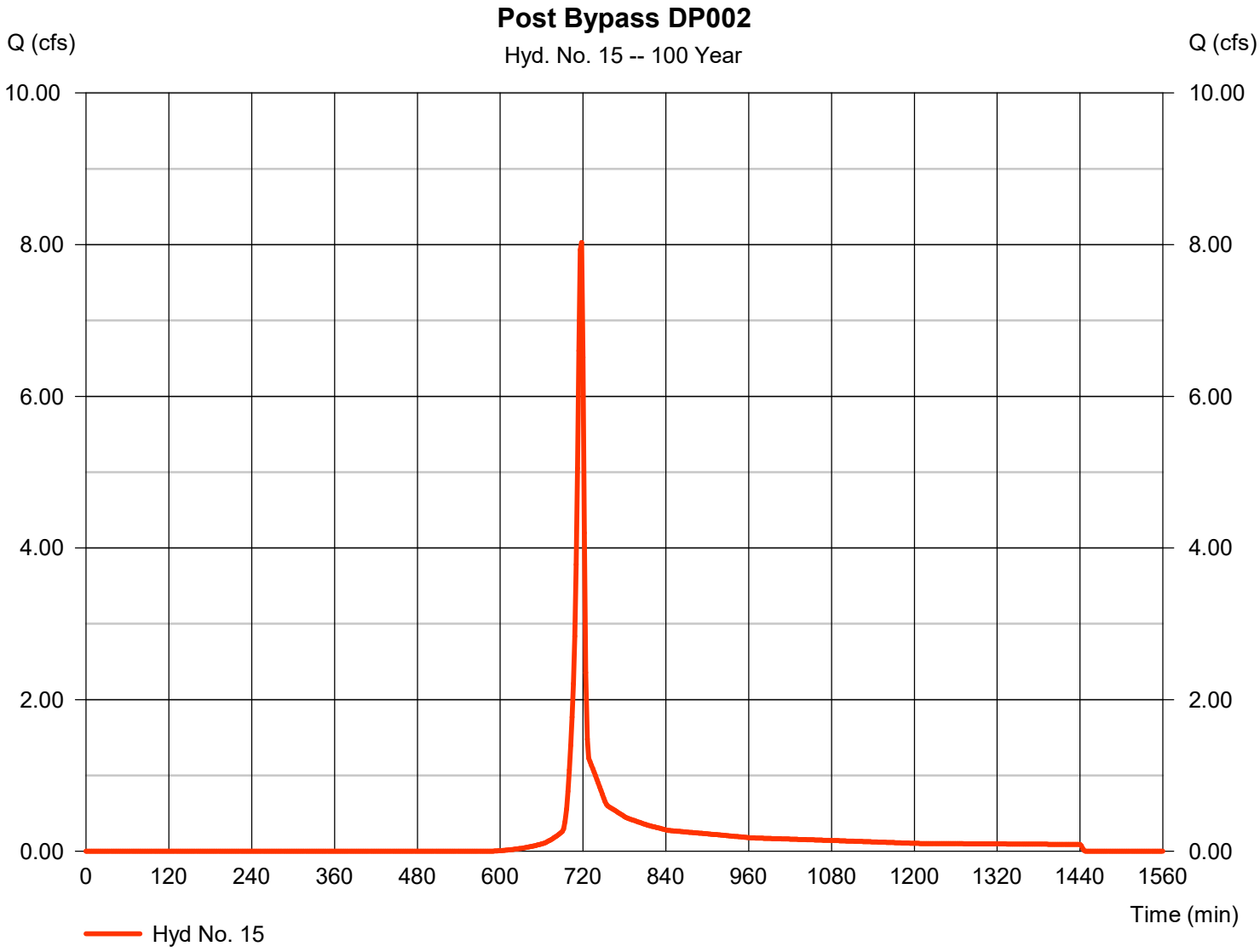


Hydrograph Report

Hyd. No. 15

Post Bypass DP002

Hydrograph type	=	SCS Runoff	Peak discharge	=	8.028 cfs
Storm frequency	=	100 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	16,080 cuft
Drainage area	=	1.540 ac	Curve number	=	61
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	7.50 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

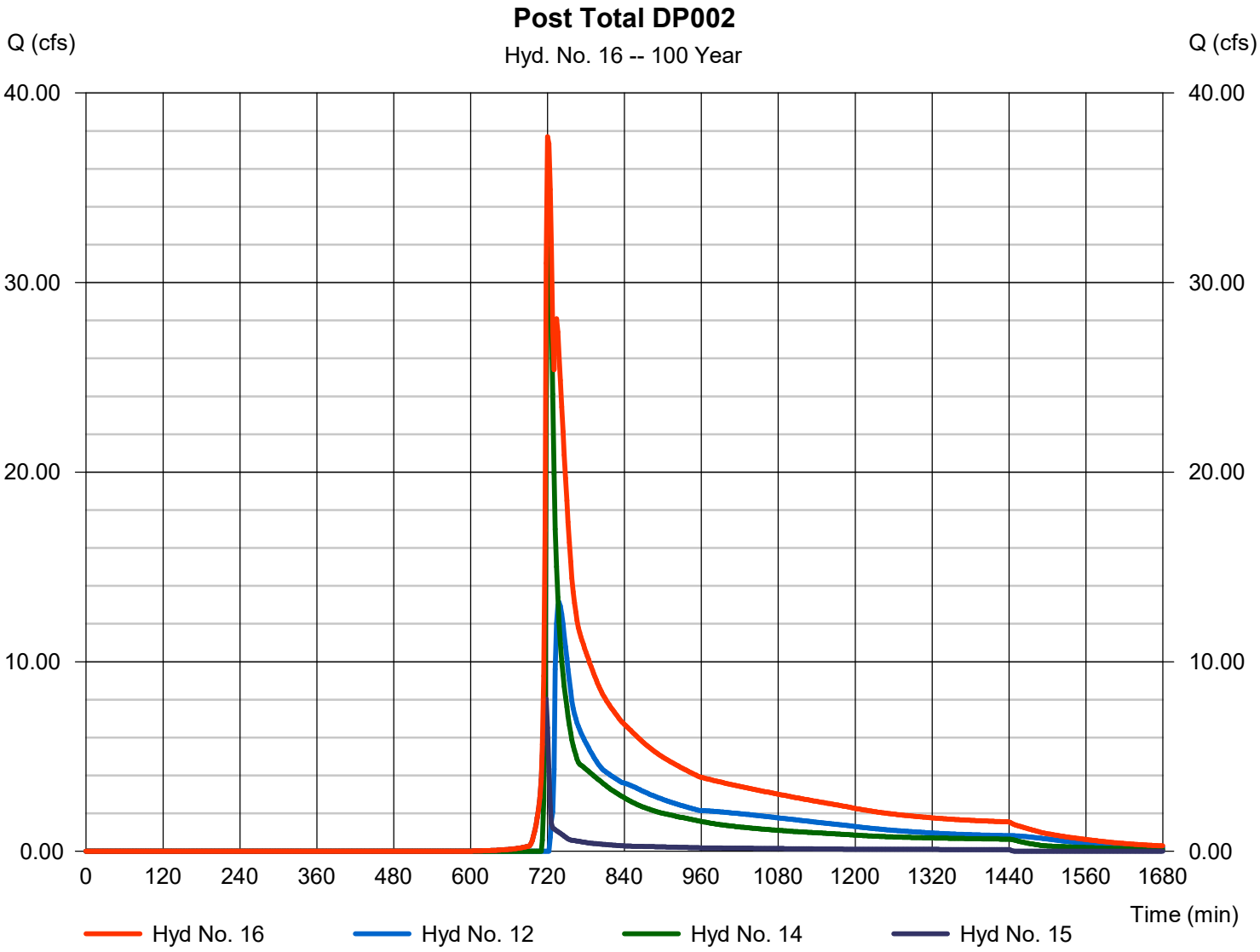


Hydrograph Report

Hyd. No. 16

Post Total DP002

Hydrograph type	= Combine	Peak discharge	= 37.69 cfs
Storm frequency	= 100 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 235,959 cuft
Inflow hyds.	= 12, 14, 15	Contrib. drain. area	= 1.540 ac



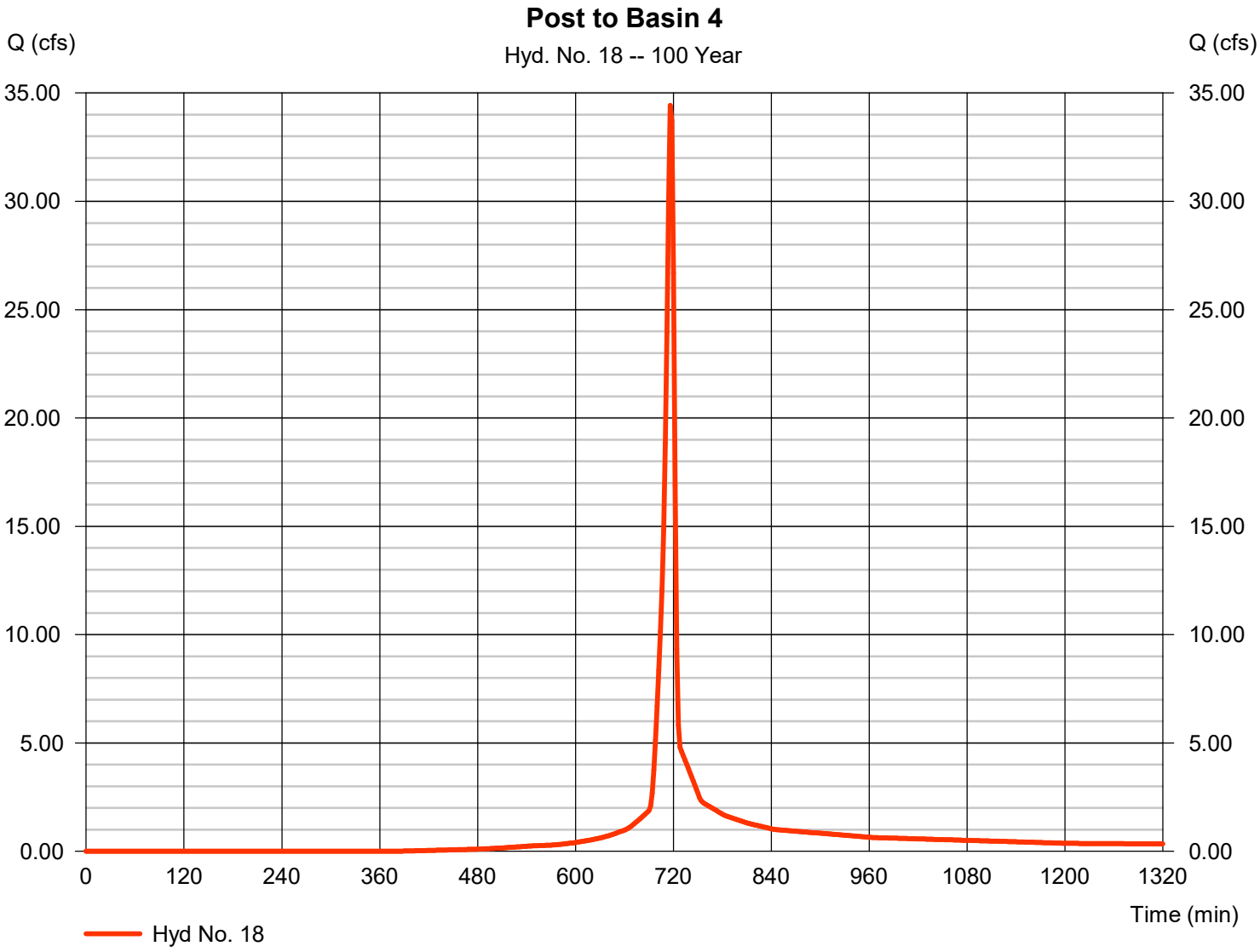
Hydrograph Report

Hyd. No. 18

Post to Basin 4

Hydrograph type	=	SCS Runoff	Peak discharge	=	34.43 cfs
Storm frequency	=	100 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	70,605 cuft
Drainage area	=	4.420 ac	Curve number	=	75.9*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	7.50 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.910 x 61) + (2.270 x 98) + (3.040 x 78)] / 4.420



Hydrograph Report

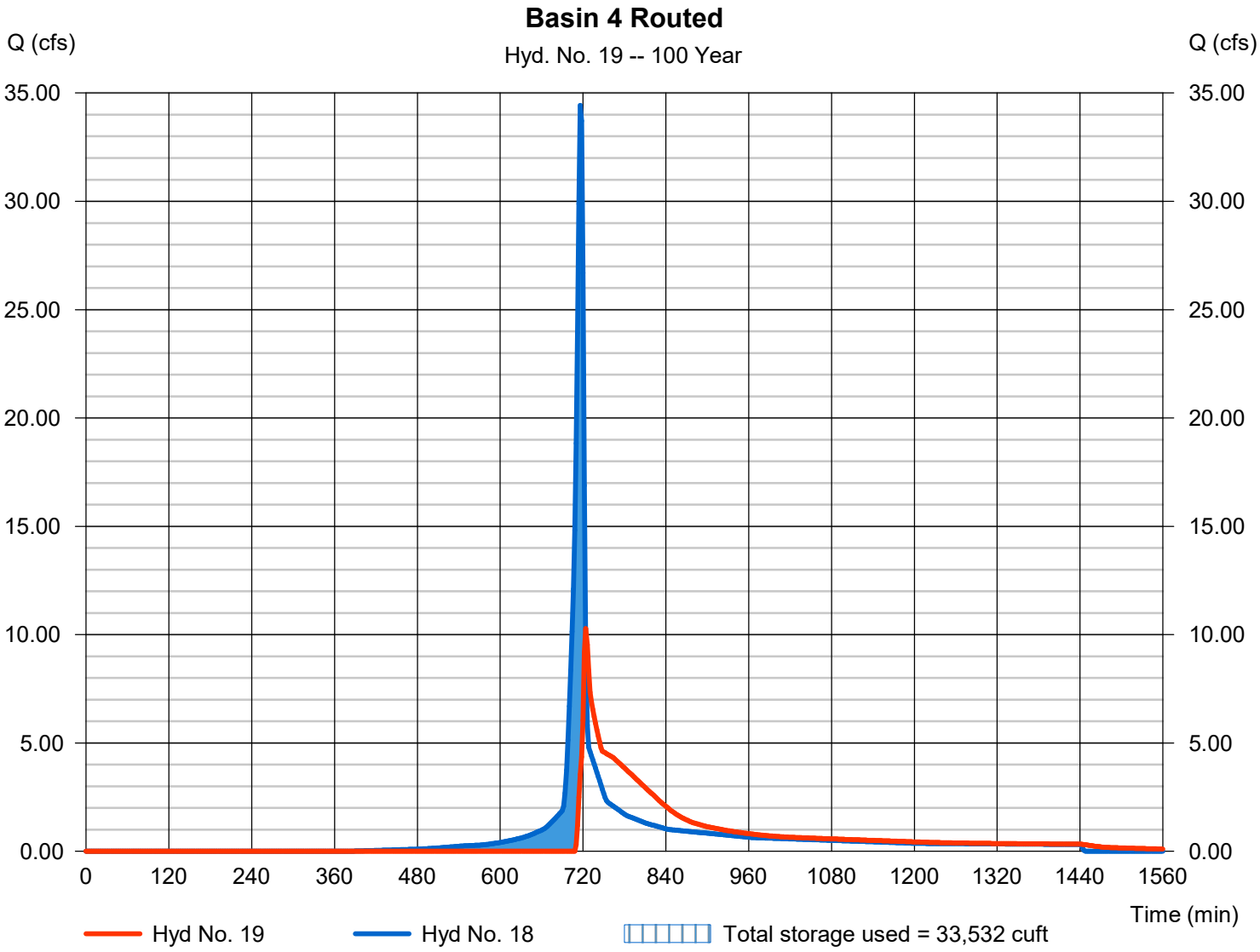
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020 Wednesday, 03 / 22 / 2023

Hyd. No. 19

Basin 4 Routed

Hydrograph type	=	Reservoir	Peak discharge	=	10.28 cfs
Storm frequency	=	100 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	56,806 cuft
Inflow hyd. No.	=	18 - Post to Basin 4	Max. Elevation	=	348.51 ft
Reservoir name	=	Basin 4	Max. Storage	=	33,532 cuft

Storage Indication method used.



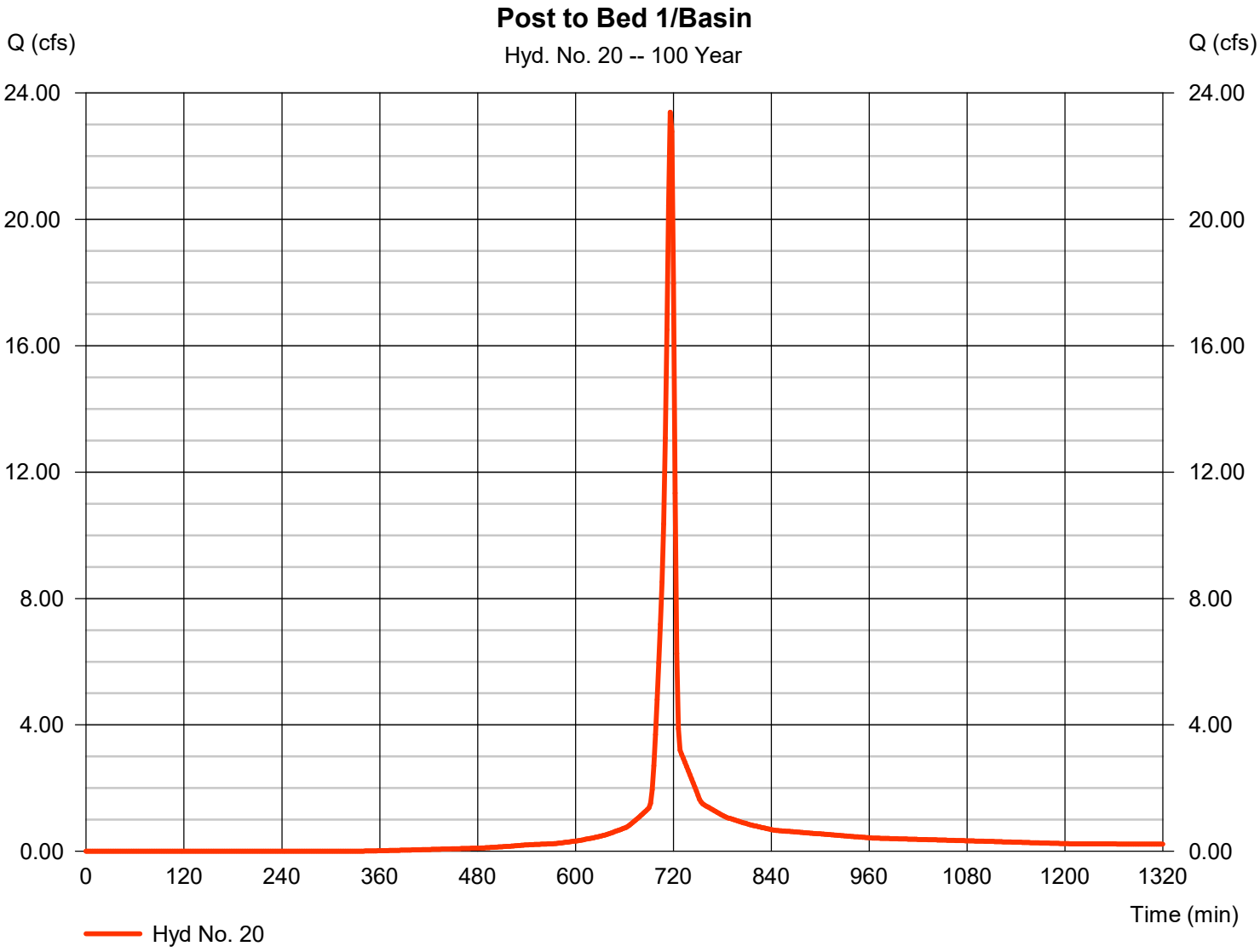
Hydrograph Report

Hyd. No. 20

Post to Bed 1/Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	23.40 cfs
Storm frequency	=	100 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	48,517 cuft
Drainage area	=	2.820 ac	Curve number	=	79.1*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	7.50 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.910 x 61) + (2.270 x 98) + (3.040 x 78)] / 2.820



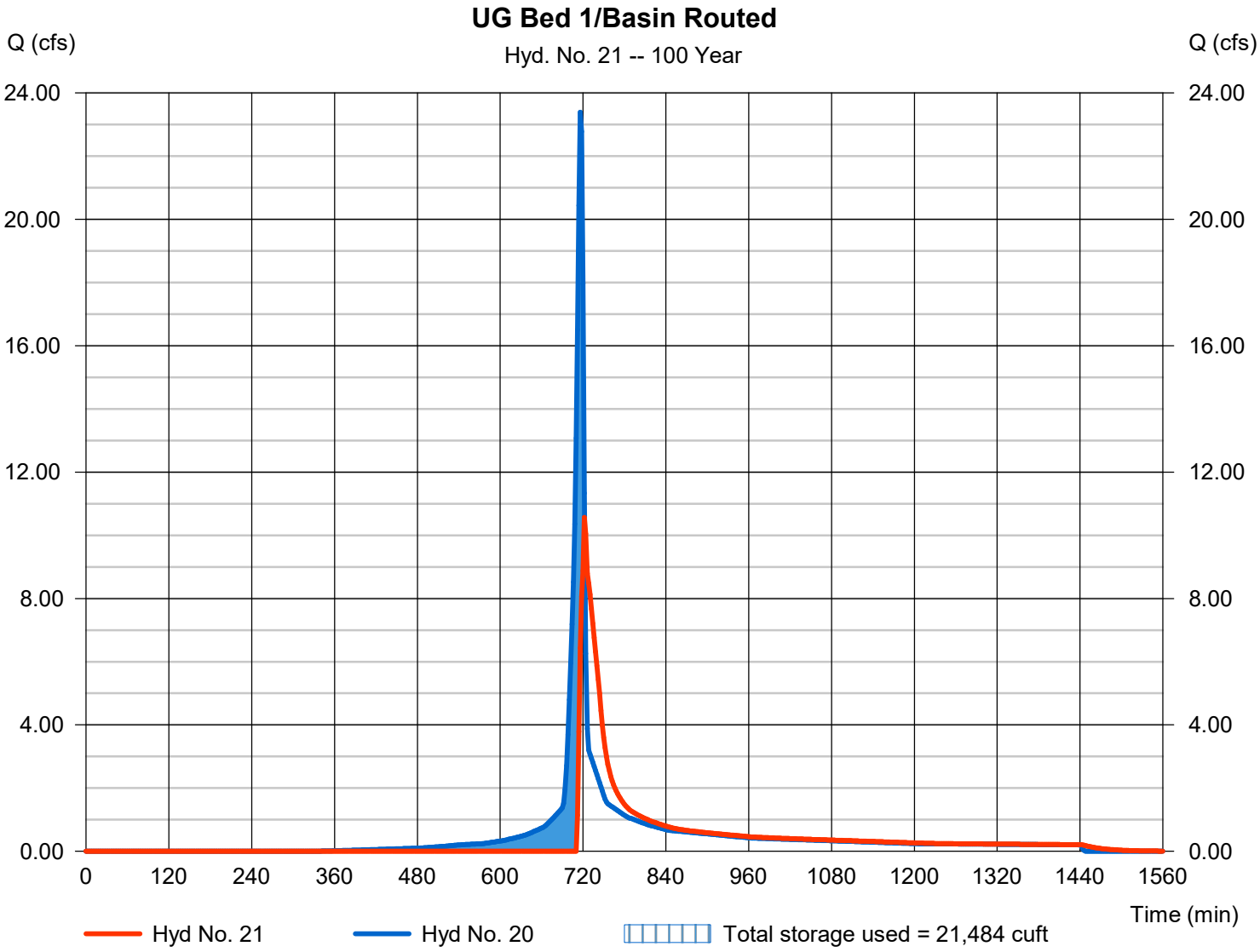
Hydrograph Report

Hyd. No. 21

UG Bed 1/Basin Routed

Hydrograph type	=	Reservoir	Peak discharge	=	10.57 cfs
Storm frequency	=	100 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	36,419 cuft
Inflow hyd. No.	=	20 - Post to Bed 1/Basin	Max. Elevation	=	342.30 ft
Reservoir name	=	UG Bed 1/Basin	Max. Storage	=	21,484 cuft

Storage Indication method used.

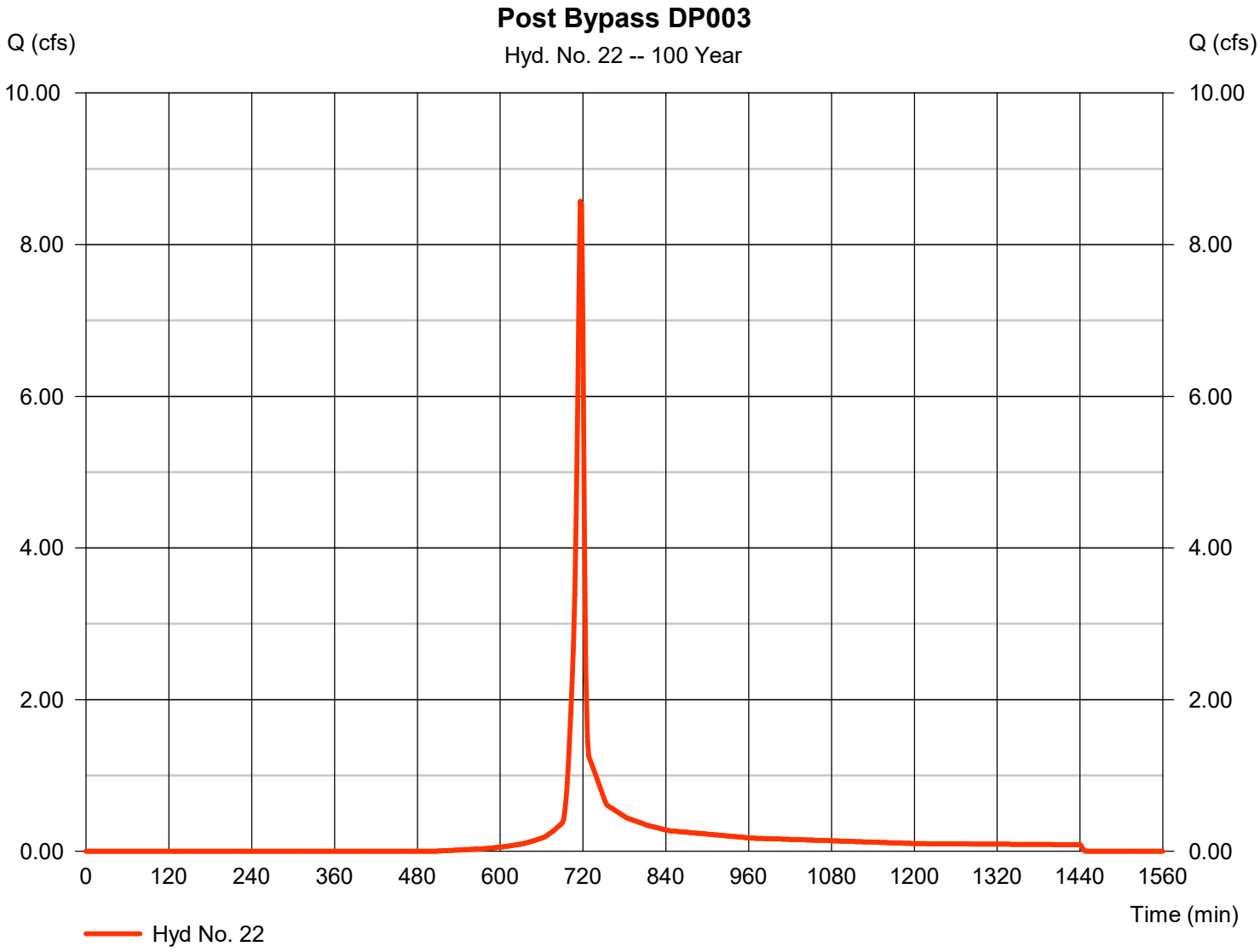


Hydrograph Report

Hyd. No. 22

Post Bypass DP003

Hydrograph type	=	SCS Runoff	Peak discharge	=	8.571 cfs
Storm frequency	=	100 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	17,315 cuft
Drainage area	=	1.340 ac	Curve number	=	67.8
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	7.50 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

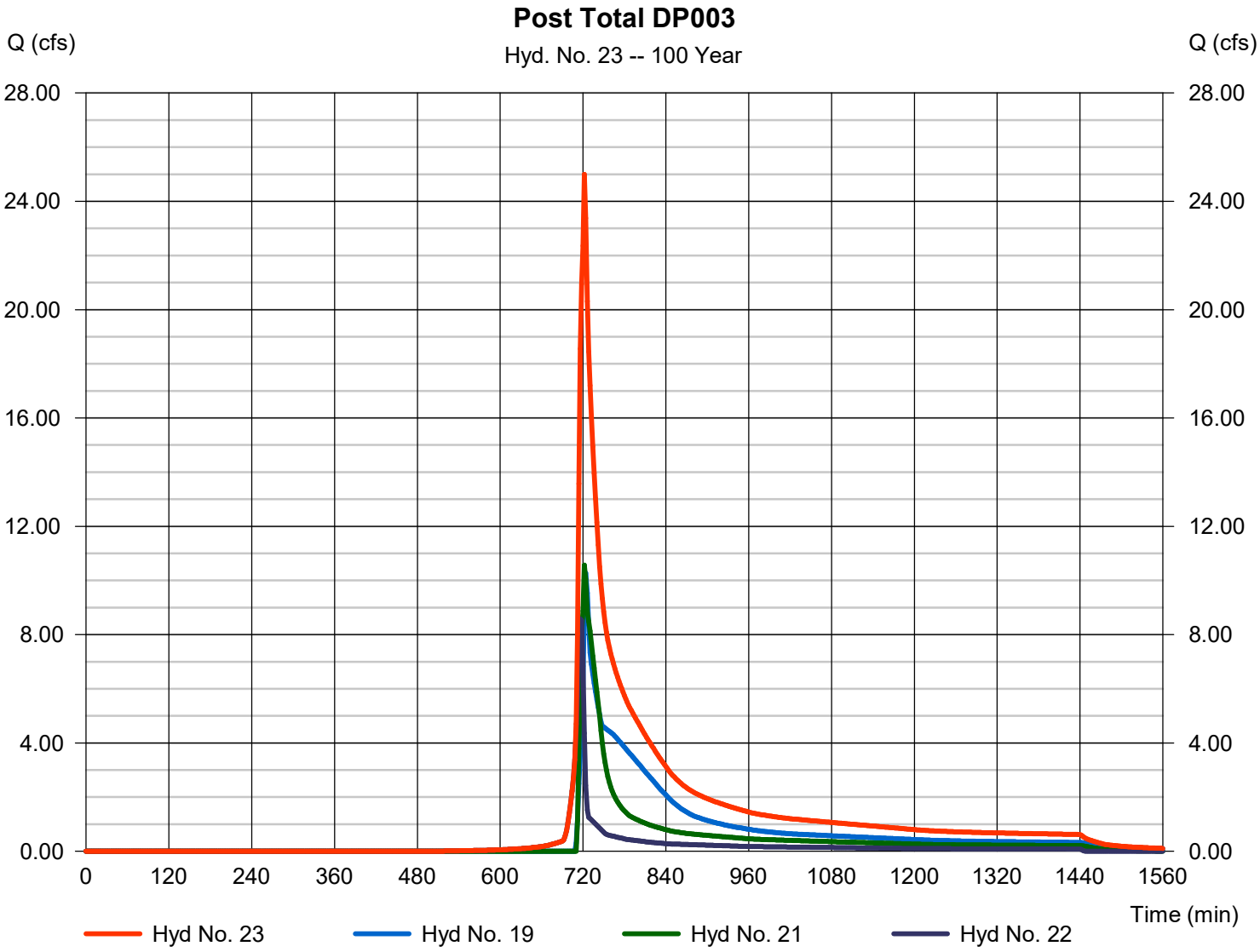


Hydrograph Report

Hyd. No. 23

Post Total DP003

Hydrograph type	= Combine	Peak discharge	= 25.00 cfs
Storm frequency	= 100 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 110,541 cuft
Inflow hyds.	= 19, 21, 22	Contrib. drain. area	= 1.340 ac



APPENDIX E

USDA NRCS SOIL REPORT

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Chester County, Pennsylvania

Stokes

March 28, 2021

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

Preface.....2
How Soil Surveys Are Made.....5
Soil Map.....8
Soil Map.....9
Legend.....10
Map Unit Legend.....11
Map Unit Descriptions.....11
Chester County, Pennsylvania.....13
Ba—Baile silt loam.....13
Co—Codorus silt loam.....14
GdB—Gladstone gravelly loam, 3 to 8 percent slopes.....16
GdC—Gladstone gravelly loam, 8 to 15 percent slopes.....17
GfD—Gladstone gravelly loam, 8 to 25 percent slopes, very bouldery.....19
Ha—Hatboro silt loam.....20
MaD—Manor loam, 15 to 25 percent slopes.....21
UrlB—Urban land-Gladstone complex, 0 to 8 percent slopes.....23

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:6,030 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 50 100 200 300

Feet
0 250 500 1000 1500

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 Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

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: Chester County, Pennsylvania
Survey Area Data: Version 13, Jun 5, 2020

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

Date(s) aerial images were photographed: May 26, 2019—Jul 10, 2019

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.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Ba	Baile silt loam	11.2	16.9%
Co	Codorus silt loam	1.1	1.6%
GdB	Gladstone gravelly loam, 3 to 8 percent slopes	6.0	9.1%
GdC	Gladstone gravelly loam, 8 to 15 percent slopes	32.3	49.0%
GfD	Gladstone gravelly loam, 8 to 25 percent slopes, very bouldery	5.5	8.4%
Ha	Hatboro silt loam	6.0	9.1%
MaD	Manor loam, 15 to 25 percent slopes	3.8	5.8%
UrlB	Urban land-Gladstone complex, 0 to 8 percent slopes	0.1	0.1%
Totals for Area of Interest		**66.0**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit

descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Chester County, Pennsylvania

Ba—Baile silt loam

Map Unit Setting

National map unit symbol: pjb7
Elevation: 200 to 2,000 feet
Mean annual precipitation: 35 to 55 inches
Mean annual air temperature: 45 to 61 degrees F
Frost-free period: 110 to 235 days
Farmland classification: Not prime farmland

Map Unit Composition

Baile and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Baile

Setting

Landform: Depressions
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear, concave
Across-slope shape: Concave, linear
Parent material: Local alluvium over residuum weathered from mica schist

Typical profile

Ap - 0 to 10 inches: silt loam
Btg - 10 to 40 inches: silt loam
Cg - 40 to 60 inches: loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 60 to 99 inches to lithic bedrock
Drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: High (about 11.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: C/D
Hydric soil rating: Yes

Minor Components

Glenville

Percent of map unit: 9 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope, backslope

Landform position (three-dimensional): Side slope, head slope
Down-slope shape: Linear, concave
Across-slope shape: Concave, linear
Hydric soil rating: No

Manor

Percent of map unit: 2 percent
Landform: Hills
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope, nose slope
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear
Hydric soil rating: No

Chester

Percent of map unit: 2 percent
Landform: Hills
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear
Hydric soil rating: No

Glenelg

Percent of map unit: 2 percent
Landform: Hillslopes
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear
Hydric soil rating: No

Co—Codorus silt loam

Map Unit Setting

National map unit symbol: pjfx
Elevation: 200 to 2,000 feet
Mean annual precipitation: 35 to 50 inches
Mean annual air temperature: 45 to 57 degrees F
Frost-free period: 120 to 220 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Codorus and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Codorus

Setting

Landform: Flood plains

Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from gneiss and/or alluvium derived from mica schist

Typical profile

Ap - 0 to 12 inches: silt loam
Bw - 12 to 48 inches: silt loam
C - 48 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 72 to 99 inches to lithic bedrock
Drainage class: Moderately well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: OccasionalNone
Frequency of ponding: None
Available water capacity: Moderate (about 8.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Hatboro

Percent of map unit: 8 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Hydric soil rating: Yes

Glenville

Percent of map unit: 4 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope, backslope
Landform position (three-dimensional): Side slope, head slope
Down-slope shape: Linear, concave
Across-slope shape: Concave, linear
Hydric soil rating: No

Baile

Percent of map unit: 3 percent
Landform: Depressions
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear, concave
Across-slope shape: Concave, linear

Hydric soil rating: Yes

GdB—Gladstone gravelly loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2v7gk
Elevation: 250 to 1,200 feet
Mean annual precipitation: 30 to 64 inches
Mean annual air temperature: 46 to 79 degrees F
Frost-free period: 131 to 178 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Gladstone and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Gladstone

Setting

Landform: Hills
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Loamy colluvium derived from granite and gneiss and/or loamy residuum weathered from granite and gneiss

Typical profile

Ap - 0 to 10 inches: gravelly loam
Bt1 - 10 to 22 inches: sandy clay loam
Bt2 - 22 to 37 inches: loam
C - 37 to 66 inches: sandy loam
R - 66 to 76 inches: bedrock

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 60 to 80 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 8.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Califon

Percent of map unit: 5 percent
Landform: Flats
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Annandale

Percent of map unit: 5 percent
Landform: Hills
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Parker

Percent of map unit: 5 percent
Landform: Hills
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

GdC—Gladstone gravelly loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2v7gl
Elevation: 250 to 1,200 feet
Mean annual precipitation: 30 to 64 inches
Mean annual air temperature: 46 to 79 degrees F
Frost-free period: 170 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Gladstone and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Gladstone

Setting

Landform: Hillslopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope

Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Loamy colluvium derived from granite and gneiss and/or loamy residuum weathered from granite and gneiss

Typical profile

Ap - 0 to 10 inches: gravelly loam
Bt1 - 10 to 22 inches: gravelly sandy clay loam
Bt2 - 22 to 37 inches: gravelly loam
C - 37 to 66 inches: gravelly sandy loam
R - 66 to 76 inches: bedrock

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 65 to 67 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to high (0.00 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 6.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Parker

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Califon

Percent of map unit: 5 percent
Landform: Flats
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Annandale

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

GfD—Gladstone gravelly loam, 8 to 25 percent slopes, very bouldery

Map Unit Setting

National map unit symbol: wphh
Elevation: 200 to 1,200 feet
Mean annual precipitation: 40 to 48 inches
Mean annual air temperature: 45 to 55 degrees F
Frost-free period: 150 to 190 days
Farmland classification: Not prime farmland

Map Unit Composition

Gladstone, very bouldery, and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Gladstone, Very Bouldery

Setting

Landform: Hillslopes
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Nose slope, side slope
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Parent material: Local colluvium and residuum weathered from granite and gneiss

Typical profile

A - 0 to 10 inches: gravelly loam
Bt - 10 to 42 inches: gravelly clay loam
C - 42 to 68 inches: very gravelly loam
R - 68 to 78 inches: bedrock

Properties and qualities

Slope: 8 to 25 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 60 to 100 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Very low to high (0.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 6.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Cokesbury

Percent of map unit: 5 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Califon

Percent of map unit: 5 percent
Landform: Hills
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Head slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Hydric soil rating: No

Ha—Hatboro silt loam

Map Unit Setting

National map unit symbol: 1lwqq
Elevation: 200 to 800 feet
Mean annual precipitation: 36 to 50 inches
Mean annual air temperature: 48 to 57 degrees F
Frost-free period: 140 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Hatboro and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hatboro

Setting

Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Parent material: Alluvium derived from metamorphic and sedimentary rock

Typical profile

Ap - 0 to 9 inches: silt loam
Bg - 9 to 44 inches: silt loam
Cg - 44 to 56 inches: sandy clay loam
C - 56 to 70 inches: stratified gravelly sand to clay

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 60 to 99 inches to lithic bedrock
Drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: FrequentNone
Frequency of ponding: None
Available water capacity: High (about 9.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: B/D
Hydric soil rating: Yes

Minor Components

Glenville

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope, backslope
Landform position (three-dimensional): Side slope, head slope
Down-slope shape: Linear, concave
Across-slope shape: Concave, linear
Hydric soil rating: No

MaD—Manor loam, 15 to 25 percent slopes

Map Unit Setting

National map unit symbol: 2tmcg
Elevation: 250 to 1,000 feet
Mean annual precipitation: 40 to 55 inches
Mean annual air temperature: 48 to 57 degrees F
Frost-free period: 150 to 192 days
Farmland classification: Not prime farmland

Map Unit Composition

Manor and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Manor

Setting

Landform: Hillslopes
Landform position (two-dimensional): Shoulder, backslope, summit
Landform position (three-dimensional): Side slope

Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from mica schist

Typical profile

A1 - 0 to 2 inches: loam
A2 - 2 to 6 inches: sandy loam
Bw1 - 6 to 13 inches: fine sandy loam
Bw2 - 13 to 22 inches: fine sandy loam
C1 - 22 to 30 inches: fine sandy loam
C2 - 30 to 44 inches: channery coarse sand
C3 - 44 to 53 inches: loamy sand
C4 - 53 to 83 inches: channery loamy sand
Cr - 83 to 108 inches: bedrock
R - 108 to 138 inches: bedrock

Properties and qualities

Slope: 15 to 25 percent
Surface area covered with cobbles, stones or boulders: 0.0 percent
Depth to restrictive feature: 59 to 100 inches to paralithic bedrock; 100 to 128 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low (0.01 to 0.07 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 8.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Glenville

Percent of map unit: 5 percent
Landform: Drainageways, swales
Landform position (two-dimensional): Footslope, backslope
Landform position (three-dimensional): Base slope, head slope, interfluve
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

Mt. airy

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, summit, shoulder
Landform position (three-dimensional): Nose slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Blocktown

Percent of map unit: 5 percent

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

UrlB—Urban land-Gladstone complex, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 1r3cq
Elevation: 200 to 1,200 feet
Mean annual precipitation: 36 to 48 inches
Mean annual air temperature: 44 to 57 degrees F
Frost-free period: 130 to 190 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 65 percent
Gladstone and similar soils: 25 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Landform: Hills
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Pavement, buildings and other artifically covered areas

Typical profile

C - 0 to 6 inches: variable

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 10 to 100 inches to lithic bedrock
Available water capacity: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: No

Description of Gladstone

Setting

Landform: Hillslopes
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Nose slope, side slope
Down-slope shape: Linear, convex

Across-slope shape: Linear, convex
Parent material: Local colluvium and residuum weathered from granite and gneiss

Typical profile

A - 0 to 10 inches: gravelly loam
C - 10 to 42 inches: gravelly clay loam
2Ap - 42 to 68 inches: gravelly loam
R - 68 to 78 inches: bedrock

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 60 to 100 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Very low to high (0.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 6.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Cokesbury

Percent of map unit: 5 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Califon

Percent of map unit: 5 percent
Landform: Hills
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Head slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Hydric soil rating: No

APPENDIX E

STORMWATER INFILTRATION TESTING REPORT

STORMWATER INFILTRATION REPORT

FOR

1013 SHILOH ROAD
WESTTOWN TOWNSHIP
CHESTER COUNTY

PREPARED FOR:

Keystone Custom Homes

PREPARED BY:

D.L. Howell & Associates, Inc.
1250 Wrights Lane
West Chester, PA 19380

March 2021

DLHowell
Civil Engineering & Land Planning
www.DLHowell.com

Stormwater Infiltration Test Report
1013 Shiloh Road
Westtown Township
Chester County

On Monday and Tuesday, March 22-23, 2021, D.L. Howell and Associates, Inc. preformed hydraulic conductivity tests for the proposed stormwater management areas for the property located at 1013 Shiloh Road in Westtown Township, Chester County. The purpose of the hydraulic conductivity testing was to determine site suitability for the proposed stormwater infiltration areas associated with proposed improvements at the site (see development plan).

Testing was conducted in general accordance with the Pennsylvania Department of Environmental Protection (PADEP)'s Pennsylvania Stormwater Best Management Practices Manual specifications, in a cased, sealed, borehole utilizing the falling head method designed to measure the vertical hydraulic conductivity of the soil. An approximate five-inch diameter borehole was hand dug to the depth of the proposed bottom elevation of the infiltration structure and a 3-inch diameter PVC casing was installed. A mixture of bentonite and soil was placed around the annulus of the casing and packed to seal the casing in place. The casing was presoaked immediately prior to the start of the test to simulate field saturated conditions. A measured amount of water was poured into the sealed casing to begin the 30-minute presoak. After the final 30-minute presoaking period, the water in the casing was adjusted to a known depth and consecutively re-adjusted after each reading and the drop of the water column is measured. The test continued until the readings became stabilized or for a maximum of eight readings. A stabilized rate of drop means a difference of ¼ inch or less of drop between the highest and lowest readings of four consecutive readings.

Within the site, four hydraulic conductivity tests were conducted at the elevations associated with the proposed bottom of the infiltration structures. One deep test pit was excavated at each infiltration test location to identify limiting conditions such as mottling, depth of bedrock, and depth of groundwater. Testing was to be conducted within the footprint of the proposed infiltration structures.

- Infiltration Test 3-23-1 was conducted at approximately ± 5.0 feet below existing grade, which corresponds to an approximate infiltration elevation of 317.0. One deep test pit was excavated at this location to a depth of 7.0 feet below existing grade. During excavation, rock was encountered at a depth of approximately 7.0 feet below existing grade.

Based on the hydraulic conductivity testing located within the footprint of the infiltration structure, D.L. Howell & Associates, Inc., recommends the following infiltration rate for the soils underlying Test 3-23-1: an infiltration rate of 1.50 inches per hour shall be used.

- Infiltration Test 3-23-2 was conducted at approximately ± 4.0 feet below existing grade, which corresponds to an approximate infiltration elevation of 314.0. One deep test pit was excavated at this location to a depth of 6.0 feet below existing grade. No limiting conditions were identified at the time of excavation.

Based on the hydraulic conductivity testing located within the footprint of the infiltration structure, D.L. Howell & Associates, Inc., recommends the following infiltration rate for the soils underlying Test 3-23-2: an infiltration rate of 1.14 inches per hour shall be used.

- Infiltration Test 3-23-3 was conducted at approximately ± 3.5 feet below existing grade, which corresponds to an approximate infiltration elevation of 303.5. One deep test pit was excavated at this location to a depth of 5.5 feet below existing grade. During excavation, rock was encountered at a depth of approximately 5.5 feet below existing grade.

Based on the hydraulic conductivity testing located within the footprint of the infiltration structure, D.L. Howell & Associates, Inc., recommends the following infiltration rate for the soils underlying Test 3-23-3: an infiltration rate of 1.68 inches per hour shall be used.

- Infiltration Test 3-23-4 was conducted at approximately ± 5.0 feet below existing grade, which corresponds to an approximate infiltration elevation of 298.0. One deep test pit was excavated at this location to a depth of 7.0 feet below existing grade. During excavation, groundwater was encountered at a depth of approximately 7.0 feet below existing grade.

Based on the hydraulic conductivity testing located within the footprint of the infiltration structure, D.L. Howell & Associates, Inc., recommends the following infiltration rate for the soils underlying Test 3-23-4: an infiltration rate of 1.96 inches per hour shall be used.

- Infiltration Test 3-22-5 was conducted at approximately ± 6.0 feet below existing grade, which corresponds to an approximate infiltration elevation of 334.0. One deep test pit was excavated at this location to a depth of 8.0 feet below existing grade. No limiting conditions were encountered at the time of excavation.

Based on the hydraulic conductivity testing located within the footprint of the infiltration structure, D.L. Howell & Associates, Inc., recommends the following infiltration rate for the soils underlying Test 3-22-5: an infiltration rate of 2.81 inches per hour shall be used.

- Infiltration Test 3-22-6 was conducted at approximately ± 2.0 feet below existing grade, which corresponds to an approximate infiltration elevation of 306.0. One

deep test pit was excavated at this location to a depth of 6.0 feet below existing grade. No limiting conditions were encountered at the time of excavation.

Based on the hydraulic conductivity testing located within the footprint of the infiltration structure, D.L. Howell & Associates, Inc., recommends the following infiltration rate for the soils underlying Test 3-22-6: an infiltration rate of 2.93 inches per hour shall be used.

- Infiltration Test 3-22-7 was conducted at approximately ± 2.0 feet below existing grade, which corresponds to an approximate infiltration elevation of 336.0. One deep test pit was excavated at this location to a depth of 4.0 feet below existing grade. During excavation, rock was encountered at a depth of approximately 4.0 feet below existing grade.

Based on the hydraulic conductivity testing located within the footprint of the infiltration structure, D.L. Howell & Associates, Inc., recommends the following infiltration rate for the soils underlying Test 3-22-7: an infiltration rate of 0.88 inches per hour shall be used.

- Infiltration Test 3-22-8 was conducted at approximately ± 2.0 feet below existing grade, which corresponds to an approximate infiltration elevation of 314.0. One deep test pit was excavated at this location to a depth of 4.0 feet below existing grade. During excavation, rock was encountered at a depth of approximately 4.0 feet below existing grade.

Based on the hydraulic conductivity testing located within the footprint of the infiltration structure, D.L. Howell & Associates, Inc., recommends the following infiltration rate for the soils underlying Test 3-22-8: an infiltration rate of 0.43 inches per hour shall be used.

Please reference plan drawings for exact locations and visual representation of infiltration tests and test pits. Results of the hydraulic conductivity testing and soil horizon descriptions can be found in the enclosed attachments.

Hydraulic Conductivity Calculation

Coefficient of Permeability: $K = [A/(F*D*t)] \times \ln (h1 / h2)$

Where:
K = permeability (inches per hour)
A = cross sectional area of cased hole
F = shape factor (2.75 constant of flat bottom)
D = cased hole diameter
t = time for head change from h1 to h2
h1 = initial height of water column in casing
h2 = final height of water column in casing

*Reference *Soil Hydraulic Conductivity Analysis Form* for infiltration testing data and *Soil Morphology Form* for soil profile data.

DLHowell
Civil Engineering & Land Planning
www.DLHowell.com

Stormwater Infiltration Testing &

Hydraulic Conductivity Calculations

JOB NO.: 3868 **DATE:** 3/22/2021
LOCATION: 1013 Shiloh Road **BY:** DD
MUNICIPALITY: Westtown Township, Chester County, Pa.
DESCRIPTION: Stormwater Infiltration Testing

Field Test Results

WEATHER CONDITIONS: SUNNY **TEMPERATURE:** 62 °F
PRECIPITATION IN LAST 24 HOURS: None

Hole #	Depth (Inches)	Readings								
		Pre-Soak	1st	2nd	3rd	4th	5th	6th	7th	8th
Test 3-22-5	72									
Time(min.)		30	**30**	**30**	**30**	**30**	**30**	**30**	**30**	**30**
Drop(inches)		15.00	14.75	14.75	14.50	14.50	n/a	n/a	n/a	n/a
Initial Water Level Depth (inches)		18	18	18	18	18	n/a	n/a	n/a	n/a

Hole #	Depth (Inches)	Readings								
		Pre-Soak	1st	2nd	3rd	4th	5th	6th	7th	8th
Test 3-22-6	24									
Time(min.)		30	**30**	**30**	**30**	**30**	**30**	**30**	**30**	**30**
Drop(inches)		15.25	15.00	14.75	14.75	14.75	n/a	n/a	n/a	n/a
Initial Water Level Depth (inches)		18	18	18	18	18	n/a	n/a	n/a	n/a

Determination of Hydraulic Conductivity (Kv)

$$Kv = [\ A/(F*D*t)\ ] * \ln(h1/h2)$$

		Test 3-22-5 Results		Test 3-22-6 Results	
Kv =	***Vertical Permeability***	**2.8062**	**(in/hour)**	**2.93319**	**(in/hour)**
A =	***Cross-sectional area of cased hole***	7.06858	(Sq.in.)	7.06858	(Sq.in.)
F =	***shape factor (2.75 constant for flat bottom)***	2.75	(Units)	2.75	(Units)
D =	***cased hole diameter***	3	(Inches)	3	(Inches)
t =	***time for head to change from h1 to h2***	0.5	(hrs.)	0.5	(hrs.)
h1 =	***initial height of water column in casing***	18	(Inches)	18	(Inches)
h2 =	***final height of water column in casing***	3.50	(Inches)	3.25	(Inches)

DLHowell
Civil Engineering & Land Planning
www.DLHowell.com

Stormwater Infiltration Testing &

Hydraulic Conductivity Calculations

JOB NO.: 3868 **DATE:** 3/22/2021
LOCATION: 1013 Shiloh Road **BY:** DD
MUNICIPALITY: Westtown Township, Chester County, Pa.
DESCRIPTION: Stormwater Infiltration Testing

Field Test Results

WEATHER CONDITIONS: SUNNY **TEMPERATURE:** 62 °F
PRECIPITATION IN LAST 24 HOURS: None

Hole #	Depth (Inches)	Readings								
		Pre-Soak	1st	2nd	3rd	4th	5th	6th	7th	8th
Test 3-22-7	24									
Time(min.)		30	**30**	**30**	**30**	**30**	**30**	**30**	**30**	**30**
Drop(inches)		7.25	7.25	7.25	7.25	7.25	n/a	n/a	n/a	n/a
Initial Water Level Depth (inches)		18	18	18	18	18	n/a	n/a	n/a	n/a

Hole #	Depth (Inches)	Readings								
		Pre-Soak	1st	2nd	3rd	4th	5th	6th	7th	8th
Test 3-22-8	24									
Time(min.)		30	**30**	**30**	**30**	**30**	**30**	**30**	**30**	**30**
Drop(inches)		4.25	4.00	4.00	4.00	4.00	n/a	n/a	n/a	n/a
Initial Water Level Depth (inches)		18	18	18	18	18	n/a	n/a	n/a	n/a

Determination of Hydraulic Conductivity (Kv)

$$Kv = [\ A/(F*D*t)\ ] * \ln(h1/h2)$$

		Test 3-22-7 Results		Test 3-22-8 Results	
Kv =	***Vertical Permeability***	**0.8833**	**(in/hour)**	**0.43065**	**(in/hour)**
A =	***Cross-sectional area of cased hole***	7.06858	(Sq.in.)	7.06858	(Sq.in.)
F =	***shape factor (2.75 constant for flat bottom)***	2.75	(Units)	2.75	(Units)
D =	***cased hole diameter***	3	(Inches)	3	(Inches)
t =	***time for head to change from h1 to h2***	0.5	(hrs.)	0.5	(hrs.)
h1 =	***initial height of water column in casing***	18	(Inches)	18	(Inches)
h2 =	***final height of water column in casing***	10.75	(Inches)	14.00	(Inches)

DLHowell
Civil Engineering & Land Planning
www.DLHowell.com

Stormwater Infiltration Testing &

Hydraulic Conductivity Calculations

JOB NO.: 3868 **DATE:** 3/23/2021
LOCATION: 1013 Shiloh Road **BY:** DD
MUNICIPALITY: Westtown Township, Chester County, Pa.
DESCRIPTION: Stormwater Infiltration Testing

Field Test Results

WEATHER CONDITIONS: SUNNY **TEMPERATURE:** 64 °F
PRECIPITATION IN LAST 24 HOURS: None

Hole #	Depth (Inches)	Readings								
		Pre-Soak	1st	2nd	3rd	4th	5th	6th	7th	8th
Test 3-23-1	60									
Time(min.)		30	**30**	**30**	**30**	**30**	**30**	**30**	**30**	**30**
Drop(inches)		11.75	10.50	10.50	10.50	10.50	n/a	n/a	n/a	n/a
Initial Water Level Depth (inches)		18	18	18	18	18	n/a	n/a	n/a	n/a

Hole #	Depth (Inches)	Readings								
		Pre-Soak	1st	2nd	3rd	4th	5th	6th	7th	8th
Test 3-23-2	48									
Time(min.)		30	**30**	**30**	**30**	**30**	**30**	**30**	**30**	**30**
Drop(inches)		10.50	8.75	8.75	8.75	8.75	n/a	n/a	n/a	n/a
Initial Water Level Depth (inches)		18	18	18	18	18	n/a	n/a	n/a	n/a

Determination of Hydraulic Conductivity (Kv)

$$Kv = [\ A/(F*D*t)\ ] * \ln(h1/h2)$$

		Test 3-23-1 Results		Test 3-23-2 Results	
Kv =	***Vertical Permeability***	**1.5002**	**(in/hour)**	**1.14082**	**(in/hour)**
A =	***Cross-sectional area of cased hole***	7.06858	(Sq.in.)	7.06858	(Sq.in.)
F =	***shape factor (2.75 constant for flat bottom)***	2.75	(Units)	2.75	(Units)
D =	***cased hole diameter***	3	(Inches)	3	(Inches)
t =	***time for head to change from h1 to h2***	0.5	(hrs.)	0.5	(hrs.)
h1 =	***initial height of water column in casing***	18	(Inches)	18	(Inches)
h2 =	***final height of water column in casing***	7.50	(Inches)	9.25	(Inches)

DLHowell
Civil Engineering & Land Planning
www.DLHowell.com

Stormwater Infiltration Testing &

Hydraulic Conductivity Calculations

JOB NO.: 3868 **DATE:** 3/23/2021
LOCATION: 1013 Shiloh Road **BY:** DD
MUNICIPALITY: Westtown Township, Chester County, Pa.
DESCRIPTION: Stormwater Infiltration Testing

Field Test Results

WEATHER CONDITIONS: SUNNY **TEMPERATURE:** 64 °F
PRECIPITATION IN LAST 24 HOURS: None

Hole #	Depth (Inches)	Readings								
		Pre-Soak	1st	2nd	3rd	4th	5th	6th	7th	8th
Test 3-23-3	42									
Time(min.)		30	**30**	**30**	**30**	**30**	**30**	**30**	**30**	**30**
Drop(inches)		11.75	11.25	11.25	11.25	11.25	n/a	n/a	n/a	n/a
Initial Water Level Depth (inches)		18	18	18	18	18	n/a	n/a	n/a	n/a

Hole #	Depth (Inches)	Readings								
		Pre-Soak	1st	2nd	3rd	4th	5th	6th	7th	8th
Test 3-23-4	60									
Time(min.)		30	**30**	**30**	**30**	**30**	**30**	**30**	**30**	**30**
Drop(inches)		12.25	12.25	12.25	12.25	12.25	n/a	n/a	n/a	n/a
Initial Water Level Depth (inches)		18	18	18	18	18	n/a	n/a	n/a	n/a

Determination of Hydraulic Conductivity (Kv)

$$Kv = [\ A/(F*D*t)\ ] * \ln(h1/h2)$$

		Test 3-23-3 Results		Test 3-23-4 Results	
Kv =	***Vertical Permeability***	**1.68075**	**(in/hour)**	**1.95551**	**(in/hour)**
A =	***Cross-sectional area of cased hole***	7.06858	(Sq.in.)	7.06858	(Sq.in.)
F =	***shape factor (2.75 constant for flat bottom)***	2.75	(Units)	2.75	(Units)
D =	***cased hole diameter***	3	(Inches)	3	(Inches)
t =	***time for head to change from h1 to h2***	0.5	(hrs.)	0.5	(hrs.)
h1 =	***initial height of water column in casing***	18	(Inches)	18	(Inches)
h2 =	***final height of water column in casing***	6.75	(Inches)	5.75	(Inches)

Soil Morphology Form

DLHowell
Civil Engineering & Land Planning
www.DLHowell.com

PIT NUMBER: TP 3-23-1 DLH NUMBER: 3868 INVESTIGATOR: DWD
DATE: 3/23/2021 STATE: PA COUNTY: CHESTER
MUNICIPALITY: WESTTOWN TOWNSHIP CLIENT: KEYSTONE CUSTOM HOMES
SUBDIVISION: STOKES ESTATE SITE LOCATION: 1013 SHILOH ROAD
MORPHOLOGIC DETERMINATION: SEWAGE **STORMWATER** SHWT SOILS

Horizon	Depth		Boundary		Color	Texture	%CFs	REDOX			Structure	Consistence	NOTES	
	Upper	Lower	Distrnct	Topo				A	S	C				
	0	11	A	W	10 YR 4/2	SILT LOAM	0				GRAN	FRI		
	11	46	A	W	10 YR 5/6	SILTY CLAY	0				MA	FIRM		
	46	84			VAR	SANDY SILT	0				GRAN	LO		

COMMENTS: This Deep Test Pit was conducted at Test 3-23-1. During excavation, rock was encountered at a depth of approximately 84 inches below existing grade.

SOIL TYPE:	Soil Drainage Class:		Soil Scientist Signature:
LIMITING CONDITION: Rock	Excessively Drained	Somewhat Poorly Drained	
Type: Water **Rock** Mottling	**Well Drained**	Poorly Drained	
Depth: ~84"	Moderately Well Drained	Very Poorly Drained	

WEATHER: 64° Sunny METHOD: Excavator
SLOPE: EXCAVATION DEPTH: 84"
COVER: Meadow LANDSCAPE POSITION: SW

REDOX – Redoxymorphic features (Drainage Mottling) A/S/C – Abundance/Size/Contrast
Roots/Pores – f – few, c – common, m – many / f – fine, m – medium, c – coarse

1250 Wrights Lane
West Chester, PA 19380
P: (610) 918-9002
F: (610) 918-9003

Soil Morphology Form

DLHowell
Civil Engineering & Land Planning
www.DLHowell.com

PIT NUMBER: TP 3-23-2 DLH NUMBER: 3868 INVESTIGATOR: DWD
DATE: 3/23/2021 STATE: PA COUNTY: CHESTER
MUNICIPALITY: WESTTOWN TOWNSHIP CLIENT: KEYSTONE CUSTOM HOMES
SUBDIVISION: STOKES ESTATE SITE LOCATION: 1013 SHILOH ROAD
MORPHOLOGIC DETERMINATION: SEWAGE **STORMWATER** SHWT SOILS

Horizon	Depth		Boundary		Color	Texture	%CFs	REDOX			Structure	Consistence	NOTES	
	Upper	Lower	Distrnct	Topo				A	S	C				
	0	9	A	W	10 YR 4/2	SILT LOAM	0				GRAN	FRI		
	9	35	A	IR	10 YR 5/6	SILTY CLAY	0				MA	FIRM		
	35	72			VAR	SANDY SILT	0				GRAN	FRI		

COMMENTS: This Deep Test Pit was conducted at Test 3-23-2. No limiting conditions were identified at the time of excavation.

SOIL TYPE:	Soil Drainage Class:	Soil Scientist Signature:
LIMITING CONDITION:	Excessively Drained Somewhat Poorly Drained	
Type: Water Rock Mottling	**Well Drained** Poorly Drained	
Depth: +72"	Moderately Well Drained Very Poorly Drained	

WEATHER: 64° Sunny METHOD: Excavator
SLOPE: EXCAVATION DEPTH: 72"
COVER: Meadow LANDSCAPE POSITION: S

REDOX – Redoxymorphic features (Drainage Mottling) A/S/C – Abundance/Size/Contrast
Roots/Pores – f – few, c – common, m – many / f – fine, m – medium, c – coarse

1250 Wrights Lane
West Chester, PA 19380
P: (610) 918-9002
F: (610) 918-9003

Soil Morphology Form

DLHowell
Civil Engineering & Land Planning
www.DLHowell.com

PIT NUMBER: TP 3-23-3 DLH NUMBER: 3868 INVESTIGATOR: DWD
DATE: 3/23/2021 STATE: PA COUNTY: CHESTER
MUNICIPALITY: WESTTOWN TOWNSHIP CLIENT: KEYSTONE CUSTOM HOMES
SUBDIVISION: STOKES ESTATE SITE LOCATION: 1013 SHILOH ROAD
MORPHOLOGIC DETERMINATION: SEWAGE **STORMWATER** SHWT SOILS

Horizon	Depth		Boundary		Color	Texture	%CFs	REDOX			Structure	Consistence	NOTES	
	Upper	Lower	Distrnct	Topo				A	S	C				
	0	11	A	W	10 YR 4/2	SILT LOAM	0				GRAN	FRI		
	11	47	A	W	10 YR 5/6	SILTY CLAY	0				MA	FIRM		
	47	66			10 YR 3/4	STONY SILT	<20				GRAN	LO		

COMMENTS: This Deep Test Pit was conducted at Test 3-23-1. During excavation, rock was encountered at a depth of approximately 66 inches below existing grade.

SOIL TYPE:	Soil Drainage Class:		Soil Scientist Signature:
LIMITING CONDITION: Rock	Excessively Drained	Somewhat Poorly Drained	
Type: Water **Rock** Mottling	**Well Drained**	Poorly Drained	
Depth: ~66"	Moderately Well Drained	Very Poorly Drained	

WEATHER: 64° Sunny METHOD: Excavator
SLOPE: EXCAVATION DEPTH: 66"
COVER: Meadow LANDSCAPE POSITION: S

REDOX – Redoxymorphic features (Drainage Mottling) A/S/C – Abundance/Size/Contrast
Roots/Pores – f – few, c – common, m – many / f – fine, m – medium, c – coarse

1250 Wrights Lane
West Chester, PA 19380
P: (610) 918-9002
F: (610) 918-9003

Soil Morphology Form

DLHowell
Civil Engineering & Land Planning
www.DLHowell.com

PIT NUMBER: TP 3-23-4 DLH NUMBER: 3868 INVESTIGATOR: DWD
DATE: 3/23/2021 STATE: PA COUNTY: CHESTER
MUNICIPALITY: WESTTOWN TOWNSHIP CLIENT: KEYSTONE CUSTOM HOMES
SUBDIVISION: STOKES ESTATE SITE LOCATION: 1013 SHILOH ROAD
MORPHOLOGIC DETERMINATION: SEWAGE **STORMWATER** SHWT SOILS

Horizon	Depth		Boundary		Color	Texture	%CFs	REDOX			Structure	Consistence	NOTES	
	Upper	Lower	Distrnct	Topo				A	S	C				
	0	8	A	W	10 YR 4/2	SILT LOAM	0				GRAN	FRI		
	8	31	A	W	10 YR 4/4	SILTY CLAY	0				MA	FIRM		
	31	47	G	W	10 YR 6/4	SILT LOAM	0				MA	FRI		
	47	84			VAR	SANDY SILT					GRAN	LO		

COMMENTS: This Deep Test Pit was conducted at Test 3-23-4. During excavation, groundwater was encountered at a depth of approximately 84 inches below existing grade.

SOIL TYPE:	Soil Drainage Class:		Soil Scientist Signature:
LIMITING CONDITION: Groundwater	Excessively Drained	Somewhat Poorly Drained	
Type: **Water** **Rock** Mottling	**Well Drained**	Poorly Drained	
Depth: ~84"	Moderately Well Drained	Very Poorly Drained	

WEATHER: 64° Sunny METHOD: Excavator
SLOPE: EXCAVATION DEPTH: 84"
COVER: Meadow LANDSCAPE POSITION: S

REDOX – Redoxymorphic features (Drainage Mottling) A/S/C – Abundance/Size/Contrast
Roots/Pores – f – few, c – common, m – many / f – fine, m – medium, c – coarse

1250 Wrights Lane
West Chester, PA 19380
P: (610) 918-9002
F: (610) 918-9003

Soil Morphology Form

DLHowell
Civil Engineering & Land Planning
www.DLHowell.com

PIT NUMBER: TP 3-22-1 DLH NUMBER: 3868 INVESTIGATOR: DWD
DATE: 3/22/2021 STATE: PA COUNTY: CHESTER
MUNICIPALITY: WESTTOWN TOWNSHIP CLIENT: KEYSTONE CUSTOM HOMES
SUBDIVISION: STOKES ESTATE SITE LOCATION: 1013 SHILOH ROAD
MORPHOLOGIC DETERMINATION: SEWAGE **STORMWATER** SHWT SOILS

Horizon	Depth		Boundary		Color	Texture	%CFs	REDOX			Structure	Consistence	NOTES	
	Upper	Lower	Distrnct	Topo				A	S	C				
	0	5	A	W	10 YR 4/2	SILT LOAM	0				SBK	FRI		
	5	50	A	W	7.5 YR 4/3	SILTY CLAY	0				MA	FIRM		
	50	96			VAR	SILT LOAM	0				GRAN	FRI		

COMMENTS: This Deep Test Pit was conducted at Test 3-22-5. No limiting conditions were identified at the time of excavation.

SOIL TYPE:	Soil Drainage Class:	Soil Scientist Signature:
LIMITING CONDITION:	Excessively Drained Somewhat Poorly Drained	
Type: Water Rock Mottling	Well Drained **Poorly Drained**	
Depth: +96"	Moderately Well Drained Very Poorly Drained	

WEATHER: 62° Sunny METHOD: Excavator
SLOPE: EXCAVATION DEPTH: 96"
COVER: Meadow LANDSCAPE POSITION: SW

REDOX – Redoxymorphic features (Drainage Mottling) A/S/C – Abundance/Size/Contrast
Roots/Pores – f – few, c – common, m – many / f – fine, m – medium, c – coarse

1250 Wrights Lane
West Chester, PA 19380
P: (610) 918-9002
F: (610) 918-9003

Soil Morphology Form

DLHowell
Civil Engineering & Land Planning
www.DLHowell.com

PIT NUMBER: TP 3-22-6 DLH NUMBER: 3868 INVESTIGATOR: DWD
DATE: 3/22/2021 STATE: PA COUNTY: CHESTER
MUNICIPALITY: WESTTOWN TOWNSHIP CLIENT: KEYSTONE CUSTOM HOMES
SUBDIVISION: STOKES ESTATE SITE LOCATION: 1013 SHILOH ROAD
MORPHOLOGIC DETERMINATION: SEWAGE **STORMWATER** SHWT SOILS

Horizon	Depth		Boundary		Color	Texture	%CFs	REDOX			Structure	Consistence	NOTES	
	Upper	Lower	Distrnct	Topo				A	S	C				
	0	7	A	W	10 YR 4/2	SILT LOAM	0				MA	FRI		
	7	35	A	W	10 YR 4/3	SILTY CLAY	0				MA	FIRM		
	35	72			VAR	SANDY SILT	0				GRAN	FRI		

COMMENTS: This Deep Test Pit was conducted at Test 3-22-6. No limiting conditions were identified at the time of excavation.

SOIL TYPE:	Soil Drainage Class:	Soil Scientist Signature:
LIMITING CONDITION: Rock	Excessively Drained Somewhat Poorly Drained	
Type: Water **Rock** Mottling	Well Drained **Poorly Drained**	
Depth: ~84"	Moderately Well Drained Very Poorly Drained	

WEATHER: 62° Sunny METHOD: Excavator
SLOPE: EXCAVATION DEPTH: 84"
COVER: Meadow LANDSCAPE POSITION: SW

REDOX – Redoxymorphic features (Drainage Mottling) A/S/C – Abundance/Size/Contrast
Roots/Pores – f – few, c – common, m – many / f – fine, m – medium, c – coarse

1250 Wrights Lane
West Chester, PA 19380
P: (610) 918-9002
F: (610) 918-9003

Soil Morphology Form

DLHowell
Civil Engineering & Land Planning
www.DLHowell.com

PIT NUMBER: TP 3-22-7 DLH NUMBER: 3868 INVESTIGATOR: DWD
DATE: 3/22/2021 STATE: PA COUNTY: CHESTER
MUNICIPALITY: WESTTOWN TOWNSHIP CLIENT: KEYSTONE CUSTOM HOMES
SUBDIVISION: STOKES ESTATE SITE LOCATION: 1013 SHILOH ROAD
MORPHOLOGIC DETERMINATION: SEWAGE **STORMWATER** SHWT SOILS

Horizon	Depth		Boundary		Color	Texture	%CFs	REDOX			Structure	Consistence	NOTES	
	Upper	Lower	Distrnct	Topo				A	S	C				
	0	4	A	W	10 YR 4/2	SILT LOAM	0				GRAN	FRI		
	4	48			10 YR 5/4	STONY SILT	<20				GRAN	FRI		

COMMENTS: This Deep Test Pit was conducted at Test 3-22-7. During excavation, rock was encountered at a depth of approximately 48 inches below existing grade.

SOIL TYPE:	Soil Drainage Class:		Soil Scientist Signature:
LIMITING CONDITION: Rock	Excessively Drained	Somewhat Poorly Drained	
Type: Water **Rock** Mottling	Well Drained	Poorly Drained	
Depth: ~48"	**Moderately Well Drained**	Very Poorly Drained	

WEATHER: 62° Sunny METHOD: Excavator
SLOPE: EXCAVATION DEPTH: 48"
COVER: Meadow LANDSCAPE POSITION: NE

REDOX – Redoxymorphic features (Drainage Mottling) A/S/C – Abundance/Size/Contrast
Roots/Pores – f – few, c – common, m – many / f – fine, m – medium, c – coarse

1250 Wrights Lane
West Chester, PA 19380

P: (610) 918-9002
F: (610) 918-9003

Soil Morphology Form

DLHowell
Civil Engineering & Land Planning
www.DLHowell.com

PIT NUMBER: TP 3-22-8 DLH NUMBER: 3868 INVESTIGATOR: DWD
DATE: 3/22/2021 STATE: PA COUNTY: CHESTER
MUNICIPALITY: WESTTOWN TOWNSHIP CLIENT: KEYSTONE CUSTOM HOMES
SUBDIVISION: STOKES ESTATE SITE LOCATION: 1013 SHILOH ROAD
MORPHOLOGIC DETERMINATION: SEWAGE **STORMWATER** SHWT SOILS

Horizon	Depth		Boundary		Color	Texture	%CFs	REDOX			Structure	Consistence	NOTES	
	Upper	Lower	Distrnct	Topo				A	S	C				
	0	3	A	W	10 YR 3/1	SILT LOAM	0				GRAN	FRI		
	3	11	A	W	2.5 Y 5/3	SILTY CLAY	0				MA	FRI		
	11	31	G	W	10 YR 5/6	SILTY CLAY	0				MA	FRI		
	31	48			10 YR 4/4	STONY SILT	<20				GRAN	FRI		

COMMENTS: This Deep Test Pit was conducted at Test 3-22-8. During excavation, rock was encountered at a depth of approximately 48 inches below existing grade.

SOIL TYPE:	Soil Drainage Class:		Soil Scientist Signature:
LIMITING CONDITION: Rock	Excessively Drained	Somewhat Poorly Drained	
Type: Water **Rock** Mottling	Well Drained	Poorly Drained	
Depth: ~48"	**Moderately Well Drained**	Very Poorly Drained	

WEATHER: 62° Sunny METHOD: Excavator
SLOPE: EXCAVATION DEPTH: 48"
COVER: Woodlands LANDSCAPE POSITION: NE

REDOX – Redoxymorphic features (Drainage Mottling) A/S/C – Abundance/Size/Contrast
Roots/Pores – f – few, c – common, m – many / f – fine, m – medium, c – coarse

1250 Wrights Lane
West Chester, PA 19380
P: (610) 918-9002
F: (610) 918-9003

STORMWATER INFILTRATION REPORT

FOR

1007, 1011, 1013 SHILOH ROAD
WESTTOWN TOWNSHIP
CHESTER COUNTY

PREPARED FOR:

Keystone Custom Homes
227 Granite Run Drive, Suite 100
Lancaster, PA 17601

PREPARED BY:

Howell Engineering
1250 Wrights Lane
West Chester, PA 19380

February 2023

HOWELL ENGINEERING
Local Knowhow. Engineered.

Stormwater Infiltration Test Report
1007, 1011, 1013 Shiloh Road
Westtown Township
Chester County

On Wednesday-Thursday, February 1-2, 2023, Howell Engineering preformed hydraulic conductivity tests for the proposed stormwater management areas for the properties located at 1107, 1011, and 1013 Shiloh Road in Westtown Township, Chester County. The purpose of the hydraulic conductivity testing was to determine site suitability for the proposed stormwater infiltration area associated with proposed improvements at the site (see development plan).

Testing was conducted in general accordance with the Pennsylvania Department of Environmental Protection (PADEP)'s Pennsylvania Stormwater Best Management Practices Manual specifications, in a cased, sealed, borehole utilizing the falling head method designed to measure the vertical hydraulic conductivity of the soil. An approximate five-inch diameter borehole was hand dug to the depth of the proposed bottom elevation of the infiltration structure and a 3-inch diameter PVC casing was installed. A mixture of bentonite and soil was placed around the annulus of the casing and packed to seal the casing in place. The casing was presoaked immediately prior to the start of the test to simulate field saturated conditions. A measured amount of water was poured into the sealed casing to begin the 30-minute presoak. After the final 30-minute presoaking period, the water in the casing was adjusted to a known depth and consecutively re-adjusted after each reading and the drop of the water column is measured. The test continued until the readings became stabilized or for a maximum of eight readings. A stabilized rate of drop means a difference of ¼ inch or less of drop between the highest and lowest readings of four consecutive readings.

On lot 1007 Shiloh Road (Obrien property), one hydraulic conductivity test was conducted within the proposed infiltration area at the elevation associated with the proposed bottom of the infiltration structure. One deep test pit was excavated at this infiltration test to identify limiting conditions such as mottling, depth of bedrock, and depth of groundwater. Testing was to be conducted within the footprint of the proposed infiltration structure.

- Infiltration Test 2-1-1 was conducted at approximately ± 6.0 feet below existing grade, which corresponds to an approximate infiltration elevation of 336.50. One deep test pit was excavated at this location to a depth of 9.0 feet below existing grade. During excavation, redoximorphic features were identified between 6-54 inches below existing grade. It is the opinion of Howell Engineering the observed redox was a result of variable permeability within that specific soil horizon and not an indication of a seasonably high water table.

Based on the hydraulic conductivity testing located within the footprint of the infiltration structure, Howell Engineering recommends the following infiltration rate for the soils underlying Test 2-1-1: an infiltration rate of 0.15 inches per hour shall be used.

On lot 1011 Shiloh Road (Galilea property), one hydraulic conductivity test was conducted within the proposed infiltration area at the elevation associated with the proposed bottom of the infiltration structure. One deep test pit was excavated at this infiltration test to identify limiting conditions such as mottling, depth of bedrock, and depth of groundwater. Testing was to be conducted within the footprint of the proposed infiltration structure.

- Infiltration Test 2-2-1 was conducted at approximately ± 4.0 feet below existing grade, which corresponds to an approximate infiltration elevation of 332.2. One deep test pit was excavated at this location to a depth of 76 inches below existing grade. During excavation, groundwater was encountered at a depth of approximately 76 inches below existing grade.

Based on the hydraulic conductivity testing located within the footprint of the infiltration structure, Howell Engineering recommends the following infiltration rate for the soils underlying Test 2-2-1: an infiltration rate of 0.20 inches per hour shall be used.

- A second infiltration test (2-2-2) was proposed on this property. During excavation, groundwater was encountered at a depth of approximately 26 inches below existing grade. AS a result of the groundwater encountered, no infiltration testing was conducted at this location.

On lot 1013 Shiloh Road (Stokes property), one hydraulic conductivity test was conducted within the proposed infiltration area at the elevation associated with the proposed bottom of the infiltration structure. One deep test pit was excavated at this infiltration test to identify limiting conditions such as mottling, depth of bedrock, and depth of groundwater. Testing was to be conducted within the footprint of the proposed infiltration structure.

- Infiltration Test 2-2-3 was conducted at approximately ± 7.0 feet below existing grade, which corresponds to an approximate infiltration elevation of 336.0. One deep test pit was excavated at this location to a depth of 9.0 feet below existing grade. No limiting conditions were identified at the time of excavation.

Based on the hydraulic conductivity testing located within the footprint of the infiltration structure, Howell Engineering recommends the following infiltration rate for the soils underlying Test 2-2-3: an infiltration rate of 0.77 inches per hour shall be used.

Please reference plan drawings for exact locations and visual representation of infiltration tests and test pits. Results of the hydraulic conductivity testing and soil horizon descriptions can be found in the enclosed attachments.

Hydraulic Conductivity Calculation

Coefficient of Permeability: $K = [A/(F*D*t)] \times \ln (h1 / h2)$

Where:
K = permeability (inches per hour)
A = cross sectional area of cased hole
F = shape factor (2.75 constant of flat bottom)
D = cased hole diameter
t = time for head change from h1 to h2
h1 = initial height of water column in casing
h2 = final height of water column in casing

*Reference *Soil Hydraulic Conductivity Analysis Form* for infiltration testing data and *Soil Morphology Form* for soil profile data.

HOWELL ENGINEERING
Local Knowhow. Engineered.

Stormwater Infiltration Testing & Hydraulic Conductivity Calculations

JOB NO.: 3868 **DATE:** 2/2/2023
LOCATION: 1011-1013 Shiloh Road **BY:** DWD
MUNICIPALITY: Westtown Township, Chester County, Pa.
DESCRIPTION: Stormwater Infiltration Testing

Field Test Results

WEATHER CONDITIONS: SUNNY **TEMPERATURE:** 43 °F
PRECIPITATION IN LAST 24 HOURS: None

Hole #	Depth (Inches)	Readings								
		Pre-Soak	1st	2nd	3rd	4th	5th	6th	7th	8th
Test 2-2-1	48									
Time(min.)		*30*	**30**	**30**	**30**	**30**	**30**	**30**	**30**	**30**
Drop(inches)		*2.50*	2.00	2.00	2.00	2.00	n/a	n/a	n/a	n/a
Initial Water Level Depth (inches)		*18*	18	18	18	18	n/a	n/a	n/a	n/a

Hole #	Depth (Inches)	Readings								
		Pre-Soak	1st	2nd	3rd	4th	5th	6th	7th	8th
Test 2-2-3	84									
Time(min.)		*30*	**30**	**30**	**30**	**30**	**30**	**30**	**30**	**30**
Drop(inches)		*8.75*	6.50	6.50	6.50	6.50	n/a	n/a	n/a	n/a
Initial Water Level Depth (inches)		*18*	18	18	18	18	n/a	n/a	n/a	n/a

Detemination of Hydraulic Conductivity (Kv)

$$Kv = [\ A/F*D*t\ ] * \ln(h1/h2)$$

		Test 2-2-1 Results		Test 2-2-3 Results	
Kv =	***Vertical Permeability***	**0.201833**	**(in/hour)**	**0.767733**	**(in/hour)**
A =	***Cross-sectional area of cased hole***	7.068583	(Sq.in.)	7.068583	(Sq.in.)
F =	***shape factor (2.75 constant for flat bottom)***	2.75	(Units)	2.75	(Units)
D =	***cased hole diameter***	3	(Inches)	3	(Inches)
t =	***time for head to change from h1 to h2***	0.5	(hrs.)	0.5	(hrs.)
h1 =	***initial height of water column in casing***	18	(Inches)	18	(Inches)
h2 =	***final height of water column in casing***	16.00	(Inches)	11.50	(Inches)

HOWELL ENGINEERING
Local Knowhow. Engineered.

Stormwater Infiltration Testing & Hydraulic Conductivity Calculations

JOB NO.: 3868 **DATE:** 2/1/2023
LOCATION: 1007 Shiloh Road **BY:** DWD
MUNICIPALITY: Westtown Township, Chester County, Pa.
DESCRIPTION: Stormwater Infiltration Testing

Field Test Results

WEATHER CONDITIONS: SUNNY **TEMPERATURE:** 41 °F
PRECIPITATION IN LAST 24 HOURS: None

Hole #	Depth (Inches)	Readings								
		Pre-Soak	1st	2nd	3rd	4th	5th	6th	7th	8th
Test 2-1-1	72									
Time(min.)		*30*	**30**	**30**	**30**	**30**	**30**	**30**	**30**	**30**
Drop(inches)		*1.50*	1.50	1.50	1.50	1.50	n/a	n/a	n/a	n/a
Initial Water Level Depth (inches)		*18*	18	18	18	18	18	18	n/a	n/a

Hole #	Depth (Inches)	Readings								
		Pre-Soak	1st	2nd	3rd	4th	5th	6th	7th	8th
Test										
Time(min.)		*30*	**30**	**30**	**30**	**30**	**30**	**30**	**30**	**30**
Drop(inches)			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Initial Water Level Depth (inches)		*18*	18	18	18	18	n/a	n/a	n/a	n/a

Detemination of Hydraulic Conductivity (Kv)

$$Kv = [\ A/F*D*t\ ] * \ln(h1/h2)$$

		Test 2-1-1 Results		Test Results	
Kv =	***Vertical Permeability***	**0.1491**	**(in/hour)**		**(in/hour)**
A =	***Cross-sectional area of cased hole***	7.06858	(Sq.in.)	7.0686	(Sq.in.)
F =	***shape factor (2.75 constant for flat bottom)***	2.75	(Units)	2.75	(Units)
D =	***cased hole diameter***	3	(Inches)	3	(Inches)
t =	***time for head to change from h1 to h2***	0.5	(hrs.)	0.5	(hrs.)
h1 =	***initial height of water column in casing***	18	(Inches)	18	(Inches)
h2 =	***final height of water column in casing***	16.50	(Inches)		(Inches)

Test Permeability **0.15** (in./hr)

Soil Morphology Form

HOWELL ENGINEERING
Local Knowhow. Engineered.

PIT NUMBER: TP 2-1-1 JOB NUMBER: 3868 INVESTIGATOR: DWD
DATE: 2/1/2023 STATE: PA COUNTY: CHESTER
MUNICIPALITY: WESTTOWN TOWNSHIP CLIENT: KEYSTONE CUSTOM HOMES
SUBDIVISION: N/A SITE LOCATION: 1007 SHILOH RD
MORPHOLOGIC DETERMINATION: SEWAGE **STORMWATER** SHWT SOILS

Horizon	Depth		Boundary		Color	Texture	%CFs	REDOX			Structure	Consistence	NOTES	
	Upper	Lower	Distrnct	Topo				A	S	C				
	0	6	G	S	10 YR 4/2	SILT LOAM	0				GRAN	FRI		
	6	54	A	W	10 YR 6/4	SILTY CLAY	0				MA	VFIRM		
	54	88	A	W	10 YR 4/3	STONY SILT	<20				GRAN	FIRM		
	88	108			10 YR 5/4	SILT LOAM	0				GRAN	LO		

COMMENTS: This Deep Test Pit was conducted at Test 2-1-1. Redoximorphic (redox) features were encountered from approximately 6-54 inches below existing grade.

SOIL TYPE:	Soil Drainage Class:	Soil Scientist Signature:
LIMITING CONDITION:	Excessively Drained Somewhat Poorly Drained	
Type: Water Rock Mottling	Well Drained **Poorly Drained**	
Depth: +108"	Moderately Well Drained Very Poorly Drained	

WEATHER: 41° Mostly Sunny METHOD: Excavator
SLOPE: EXCAVATION DEPTH: 108"
COVER: Lawn LANDSCAPE POSITION: N

REDOX – Redoxymorphic features (Drainage Mottling) A/S/C – Abundance/Size/Contrast
Roots/Pores – f – few, c – common, m – many / f – fine, m – medium, c – coarse

1250 Wrights Lane
West Chester, PA 19380
P: (610) 918-9002
F: (610) 918-9003

Soil Morphology Form

HOWELL ENGINEERING
Local Knowhow. Engineered.

PIT NUMBER: TP 2-2-1 JOB NUMBER: 3868 INVESTIGATOR: DWD
DATE: 2/2/2023 STATE: PA COUNTY: CHESTER
MUNICIPALITY: WESTTOWN TOWNSHIP CLIENT: KEYSTONE CUSTOM HOMES
SUBDIVISION: N/A SITE LOCATION: 1011 SHILOH RD
MORPHOLOGIC DETERMINATION: SEWAGE **STORMWATER** SHWT SOILS

Horizon	Depth		Boundary		Color	Texture	%CFs	REDOX			Structure	Consistence	NOTES	
	Upper	Lower	Distrnct	Topo				A	S	C				
	0	6	G	S	10 YR 4/2	SILT LOAM	0				GRAN	FRI		
	6	20	A	W	10 YR 4/4	SILTY CLAY	0				MA	FRI		
	20	48	A	W	2.5 Y 6/4	SILTY CLAY	0				MA	FIRM		
	48	76			10 YR 5/1	SANDY SILT	0				GRAN	FRI		

COMMENTS: This Deep Test Pit was conducted at Test 2-2-1. Groundwater was encountered at approximately 76 inches below existing grade.

SOIL TYPE:	Soil Drainage Class:	Soil Scientist Signature:
LIMITING CONDITION: Groundwater	Excessively Drained **Somewhat Poorly Drained**	
Type: **Water** Rock Mottling	Well Drained Poorly Drained	
Depth: ~76"	Moderately Well Drained Very Poorly Drained	

WEATHER: 43° Mostly Sunny METHOD: Excavator
SLOPE: EXCAVATION DEPTH: 76"
COVER: Lawn LANDSCAPE POSITION: E

REDOX – Redoxymorphic features (Drainage Mottling) A/S/C – Abundance/Size/Contrast
Roots/Pores – f – few, c – common, m – many / f – fine, m – medium, c – coarse

1250 Wrights Lane
West Chester, PA 19380

P: (610) 918-9002
F: (610) 918-9003

Soil Morphology Form

HOWELL ENGINEERING
Local Knowhow. Engineered.

PIT NUMBER: TP 2-2-3 JOB NUMBER: 3868 INVESTIGATOR: DWD
DATE: 2/2/2023 STATE: PA COUNTY: CHESTER
MUNICIPALITY: WESTTOWN TOWNSHIP CLIENT: KEYSTONE CUSTOM HOMES
SUBDIVISION: N/A SITE LOCATION: 1013 SHILOH RD
MORPHOLOGIC DETERMINATION: SEWAGE **STORMWATER** SHWT SOILS

Horizon	Depth		Boundary		Color	Texture	%CFs	REDOX			Structure	Consistence	NOTES	
	Upper	Lower	Distrnct	Topo				A	S	C				
	0	7	G	S	10 YR 4/3	SILT LOAM	0				GRAN	FRI		
	7	35	A	W	10 YR 5/4	SILTY CLAY	0				MA	FRI		
	35	108			VAR	SANDY SILT	0				GRAN	FRI		

COMMENTS: This Deep Test Pit was conducted at Test 2-2-3. No limiting conditions were identified at the time of excavation.

SOIL TYPE:	Soil Drainage Class:	Soil Scientist Signature:
LIMITING CONDITION:	Excessively Drained Somewhat Poorly Drained	
Type: Water Rock Mottling	Well Drained Poorly Drained	
Depth: +108"	**Moderately Well Drained** Very Poorly Drained	

WEATHER: 43° Mostly Sunny METHOD: Excavator
SLOPE: EXCAVATION DEPTH: 108"
COVER: Lawn LANDSCAPE POSITION: W

REDOX – Redoxymorphic features (Drainage Mottling) A/S/C – Abundance/Size/Contrast
Roots/Pores – f – few, c – common, m – many / f – fine, m – medium, c – coarse

1250 Wrights Lane
West Chester, PA 19380

P: (610) 918-9002
F: (610) 918-9003

STORMWATER INFILTRATION REPORT

FOR

1007 & 1011 SHILOH ROAD
WESTTOWN TOWNSHIP
CHESTER COUNTY

PREPARED FOR:

Keystone Custom Homes
227 Granite Run Drive, Suite 100
Lancaster, PA 17601

PREPARED BY:

Howell Engineering
1250 Wrights Lane
West Chester, PA 19380

March 2023

HOWELL ENGINEERING
Local Knowhow. Engineered.

Stormwater Infiltration Test Report
1007 & 1011 Shiloh Road
Westtown Township
Chester County

On Wednesday-Thursday, March 8-9, 2023, Howell Engineering preformed hydraulic conductivity tests for the proposed stormwater management areas for the properties located at 1007 and 1011 Shiloh Road in Westtown Township, Chester County. The purpose of the hydraulic conductivity testing was to determine site suitability for the proposed stormwater infiltration area associated with proposed improvements at the site (see development plan).

Testing was conducted in general accordance with the Pennsylvania Department of Environmental Protection (PADEP)'s Pennsylvania Stormwater Best Management Practices Manual specifications, in a cased, sealed, borehole utilizing the falling head method designed to measure the vertical hydraulic conductivity of the soil. An approximate five-inch diameter borehole was hand dug to the depth of the proposed bottom elevation of the infiltration structure and a 3-inch diameter PVC casing was installed. A mixture of bentonite and soil was placed around the annulus of the casing and packed to seal the casing in place. The casing was presoaked immediately prior to the start of the test to simulate field saturated conditions. A measured amount of water was poured into the sealed casing to begin the 30-minute presoak. After the final 30-minute presoaking period, the water in the casing was adjusted to a known depth and consecutively re-adjusted after each reading and the drop of the water column is measured. The test continued until the readings became stabilized or for a maximum of eight readings. A stabilized rate of drop means a difference of ¼ inch or less of drop between the highest and lowest readings of four consecutive readings.

On lot 1007 Shiloh Road (Obrien property), two hydraulic conductivity tests were conducted within the proposed infiltration areas at the elevations associated with the proposed bottom of the infiltration structures. One deep test pit was excavated at each infiltration test to identify limiting conditions such as mottling, depth of bedrock, and depth of groundwater. Testing was to be conducted within the footprint of the proposed infiltration structure.

- Infiltration Test 3-9-1 was conducted at approximately ± 3.0 feet below existing grade, which corresponds to an approximate infiltration elevation of 377.0. One deep test pit was excavated at this location to a depth of 5.0 feet below existing grade. During excavation, rock was encountered at a depth of approximately 61 inches below existing grade.

Based on the hydraulic conductivity testing located within the footprint of the infiltration structure, Howell Engineering recommends the following infiltration rate for the soils underlying Test 3-9-1: an infiltration rate of 0.175 inches per hour shall be used.

- Infiltration Test 3-9-2 was conducted at approximately ± 8.0 feet below existing grade, which corresponds to an approximate infiltration elevation of 342.0. One deep test pit was excavated at this location to a depth of 10.0 feet below existing grade. No limiting conditions were identified at the time of excavation.

Based on the hydraulic conductivity testing located within the footprint of the infiltration structure, Howell Engineering recommends the following infiltration rate for the soils underlying Test 3-9-2: an infiltration rate of 2.376 inches per hour shall be used.

On lot 1011 Shiloh Road (Galilea property), three hydraulic conductivity tests were conducted within the proposed infiltration areas at the elevations associated with the proposed bottom of the infiltration structures. One deep test pit was excavated at each infiltration test to identify limiting conditions such as mottling, depth of bedrock, and depth of groundwater. Testing was to be conducted within the footprint of the proposed infiltration structures.

- Infiltration Test 3-8-1 was conducted at approximately ± 8.0 feet below existing grade, which corresponds to an approximate infiltration elevation of 364.0. One deep test pit was excavated at this location to a depth of 10.0 feet below existing grade. No limiting conditions were identified at the time of excavation.

Based on the hydraulic conductivity testing located within the footprint of the infiltration structure, Howell Engineering recommends the following infiltration rate for the soils underlying Test 3-8-1: an infiltration rate of 4.855 inches per hour shall be used.

- Infiltration Test 3-8-2 was conducted at approximately ± 4.0 feet below existing grade, which corresponds to an approximate infiltration elevation of 362.0. One deep test pit was excavated at this location to a depth of 6.0 feet below existing grade. No limiting conditions were identified at the time of excavation.

Based on the hydraulic conductivity testing located within the footprint of the infiltration structure, Howell Engineering recommends the following infiltration rate for the soils underlying Test 3-8-2: an infiltration rate of 0.284 inches per hour shall be used.

- Infiltration Test 3-8-3 was conducted at approximately ± 4.0 feet below existing grade, which corresponds to an approximate infiltration elevation of 357.0. One deep test pit was excavated at this location to a depth of 6.0 feet below existing grade. During excavation, redoximorphic features were identified from approximately 41-72 inches below existing grade.

Based on the hydraulic conductivity testing located within the footprint of the infiltration structure, Howell Engineering recommends the following infiltration rate for the soils underlying Test 3-8-3: an infiltration rate of 0.123 inches per hour shall be used.

Please reference plan drawings for exact locations and visual representation of infiltration tests and test pits. Results of the hydraulic conductivity testing and soil horizon descriptions can be found in the enclosed attachments.

Hydraulic Conductivity Calculation

Coefficient of Permeability: $K = [A/(F*D*t)] \times \ln (h1 / h2)$

Where:
K = permeability (inches per hour)
A = cross sectional area of cased hole
F = shape factor (2.75 constant of flat bottom)
D = cased hole diameter
t = time for head change from h1 to h2
h1 = initial height of water column in casing
h2 = final height of water column in casing

*Reference *Soil Hydraulic Conductivity Analysis Form* for infiltration testing data and *Soil Morphology Form* for soil profile data.

HOWELL ENGINEERING
Local Knowhow. Engineered.

Stormwater Infiltration Testing & Hydraulic Conductivity Calculations

JOB NO.: 3868 **DATE:** 3/9/2023
LOCATION: 1007 Shiloh Road **BY:** DWD
MUNICIPALITY: Westtown Township, Chester County, Pa.
DESCRIPTION: Stormwater Infiltration Testing

Field Test Results

WEATHER CONDITIONS: SUNNY **TEMPERATURE:** 48 °F
PRECIPITATION IN LAST 24 HOURS: None

Hole #	Depth (Inches)	Readings								
		Pre-Soak	1st	2nd	3rd	4th	5th	6th	7th	8th
Test 3-9-1	36									
Time(min.)		*30*	**30**	**30**	**30**	**30**	**30**	**30**	**30**	**30**
Drop(inches)		*2.50*	2.00	1.75	1.75	1.75	n/a	n/a	n/a	n/a
Initial Water Level Depth (inches)		*18*	18	18	18	18	n/a	n/a	n/a	n/a

Hole #	Depth (Inches)	Readings								
		Pre-Soak	1st	2nd	3rd	4th	5th	6th	7th	8th
Test 3-9-2	96									
Time(min.)		*30*	**30**	**30**	**30**	**30**	**30**	**30**	**30**	**30**
Drop(inches)		*13.50*	13.50	13.50	13.50	13.50	n/a	n/a	n/a	n/a
Initial Water Level Depth (inches)		*18*	18	18	18	18	n/a	n/a	n/a	n/a

Detemination of Hydraulic Conductivity (Kv)

$$Kv = [\ A/F*D*t\ ] * \ln(h1/h2)$$

		Test 3-9-1 Results		Test 3-9-2 Results	
Kv =	***Vertical Permeability***	**0.17526**	**(in/hour)**	**2.375548**	**(in/hour)**
A =	***Cross-sectional area of cased hole***	7.06858	(Sq.in.)	7.068583	(Sq.in.)
F =	***shape factor (2.75 constant for flat bottom)***	2.75	(Units)	2.75	(Units)
D =	***cased hole diameter***	3	(Inches)	3	(Inches)
t =	***time for head to change from h1 to h2***	0.5	(hrs.)	0.5	(hrs.)
h1 =	***initial height of water column in casing***	18	(Inches)	18	(Inches)
h2 =	***final height of water column in casing***	16.25	(Inches)	4.50	(Inches)

HOWELL ENGINEERING
Local Knowhow. Engineered.

Stormwater Infiltration Testing & Hydraulic Conductivity Calculations

JOB NO.: 3868 **DATE:** 3/8/2023
LOCATION: 1011 Shiloh Road **BY:** DWD
MUNICIPALITY: Westtown Township, Chester County, Pa.
DESCRIPTION: Stormwater Infiltration Testing

Field Test Results

WEATHER CONDITIONS: Mostly Sunny **TEMPERATURE:** 48 °F
PRECIPITATION IN LAST 24 HOURS: None

Hole #	Depth (Inches)	Readings								
		Pre-Soak	1st	2nd	3rd	4th	5th	6th	7th	8th
Test 3-8-1	96									
Time(min.)		30	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**
Drop(inches)		18.00	11.50	11.00	11.00	11.00	11.00	n/a	n/a	n/a
Initial Water Level Depth (inches)		18	18	18	18	18	18	n/a	n/a	n/a

Hole #	Depth (Inches)	Readings								
		Pre-Soak	1st	2nd	3rd	4th	5th	6th	7th	8th
Test 3-8-2	48									
Time(min.)		30	**30**	**30**	**30**	**30**	**30**	**30**	**30**	**30**
Drop(inches)		3.50	3.00	2.75	2.75	2.75	n/a	n/a	n/a	n/a
Initial Water Level Depth (inches)		18	18	18	18	18	n/a	n/a	n/a	n/a

Hole #	Depth (Inches)	Readings								
		Pre-Soak	1st	2nd	3rd	4th	5th	6th	7th	8th
Test 3-8-3	48									
Time(min.)		30	**30**	**30**	**30**	**30**	**30**	**30**	**30**	**30**
Drop(inches)		1.50	1.50	1.25	1.25	1.25	n/a	n/a	n/a	n/a
Initial Water Level Depth (inches)		18	18	18	18	18	n/a	n/a	n/a	n/a

Determination of Hydraulic Conductivity (Kv)

$$Kv = [\ A/(F*D*t)\ ] * \ln(h1/h2)$$

		Test 3-8-1 Results		Test 3-8-2 Results		Test 3-8-3 Results	
Kv =	***Vertical Permeability***	**4.85528**	**(in/hour)**	**0.2841**	**(in/hour)**	**0.12333**	**(in/hour)**
A =	***Cross-sectional area of cased hole***	7.06858	(Sq.in.)	7.06858	(Sq.in.)	7.06858	(Sq.in.)
F =	***shape factor (2.75 constant for flat bottom)***	2.75	(Units)	2.75	(Units)	2.75	(Units)
D =	***cased hole diameter***	3	(Inches)	3	(Inches)	3	(Inches)
t =	***time for head to change from h1 to h2***	0.16667	(hrs.)	0.5	(hrs.)	0.5	(hrs.)
h1 =	***initial height of water column in casing***	18	(Inches)	18	(Inches)	18	(Inches)
h2 =	***final height of water column in casing***	7.00	(Inches)	15.25	(Inches)	16.75	(Inches)

Soil Morphology Form

HOWELL ENGINEERING
Local Knowhow. Engineered.

PIT NUMBER: TP 3-9-1 JOB NUMBER: 3868 INVESTIGATOR: DWD
DATE: 3/9/2023 STATE: PA COUNTY: CHESTER
MUNICIPALITY: WESTTOWN TOWNSHIP CLIENT: KEYSTONE CUSTOM HOMES
SUBDIVISION: N/A SITE LOCATION: 1007 SHILOH RD
MORPHOLOGIC DETERMINATION: SEWAGE **STORMWATER** SHWT SOILS

Horizon	Depth		Boundary		Color	Texture	%CFs	REDOX			Structure	Consistence	NOTES	
	Upper	Lower	Distrnct	Topo				A	S	C				
	0	10	A	W	10 YR 4/2	SILT LOAM	0				GRAN	FRI		
	10	37	A	W	7.5 YR 4/4	SILTY CLAY	0				MA	VFIRM		
	37	61			7.5 YR 4/6	STONY SILT	<20				GRAN	FRI		

COMMENTS: This Deep Test Pit was conducted at Test 3-9-1. During excavation, rock was encountered at a depth of approximately 61 inches below existing grade.

SOIL TYPE:	Soil Drainage Class:	Soil Scientist Signature:
LIMITING CONDITION: Rock	Excessively Drained **Somewhat Poorly Drained**	
Type: Water **Rock** Mottling	Well Drained Poorly Drained	
Depth: approx. 61"	Moderately Well Drained Very Poorly Drained	

WEATHER: 48° Mostly Sunny METHOD: Excavator
SLOPE: EXCAVATION DEPTH: 61"
COVER: Lawn LANDSCAPE POSITION: N

REDOX – Redoxymorphic features (Drainage Mottling) A/S/C – Abundance/Size/Contrast
Roots/Pores – f – few, c – common, m – many / f – fine, m – medium, c – coarse

1250 Wrights Lane
West Chester, PA 19380

P: (610) 918-9002
F: (610) 918-9003

Soil Morphology Form

HOWELL ENGINEERING
Local Knowhow. Engineered.

PIT NUMBER: TP 3-9-2 JOB NUMBER: 3868 INVESTIGATOR: DWD
DATE: 3/9/2023 STATE: PA COUNTY: CHESTER
MUNICIPALITY: WESTTOWN TOWNSHIP CLIENT: KEYSTONE CUSTOM HOMES
SUBDIVISION: N/A SITE LOCATION: 1007 SHILOH RD
MORPHOLOGIC DETERMINATION: SEWAGE **STORMWATER** SHWT SOILS

Horizon	Depth		Boundary		Color	Texture	%CFs	REDOX			Structure	Consistence	NOTES	
	Upper	Lower	Distrnct	Topo				A	S	C				
	0	6	A	W	10 YR 4/2	SILT LOAM	0				SBK	FRI		
	6	24	G	S	10 YR 4/6	SILT LOAM	0				MA	FRI		
	24	57	G	S	10 YR 4/3	SILT LOAM	0				GRAN	FRI		
	57	120			VAR	SANDY SILT	0				GRAN	LO	some large rock	

COMMENTS: This Deep Test Pit was conducted at Test 3-9-2. No limiting conditions were identified at the time of excavation.

SOIL TYPE:	Soil Drainage Class:		Soil Scientist Signature:
LIMITING CONDITION:	Excessively Drained	Somewhat Poorly Drained	
Type: Water Rock Mottling	**Well Drained**	Poorly Drained	
Depth: +120"	Moderately Well Drained	Very Poorly Drained	

WEATHER: 48° Mostly Sunny METHOD: Excavator
SLOPE: EXCAVATION DEPTH: 120"
COVER: Lawn LANDSCAPE POSITION: E

REDOX – Redoxymorphic features (Drainage Mottling) A/S/C – Abundance/Size/Contrast
Roots/Pores – f – few, c – common, m – many / f – fine, m – medium, c – coarse

1250 Wrights Lane
West Chester, PA 19380

P: (610) 918-9002
F: (610) 918-9003

Soil Morphology Form

HOWELL ENGINEERING
Local Knowhow. Engineered.

PIT NUMBER: TP 3-8-1 JOB NUMBER: 3868 INVESTIGATOR: DWD
DATE: 3/8/2023 STATE: PA COUNTY: CHESTER
MUNICIPALITY: WESTTOWN TOWNSHIP CLIENT: KEYSTONE CUSTOM HOMES
SUBDIVISION: N/A SITE LOCATION: 1011 SHILOH RD
MORPHOLOGIC DETERMINATION: SEWAGE **STORMWATER** SHWT SOILS

Horizon	Depth		Boundary		Color	Texture	%CFs	REDOX			Structure	Consistence	NOTES	
	Upper	Lower	Distrnct	Topo				A	S	C				
	0	4	A	W	10 YR 4/2	SILT LOAM	0				SBK	FIRM		
	4	33	G	S	7.5 YR 4/4	SILTY CLAY	0				MA	FRI		
	33	59	A	C	VAR	SILTY CLAY	0				MA	FRI		
	59	120			VAR	SANDY SILT	0				GRAN	LO		

COMMENTS: This Deep Test Pit was conducted at Test 3-8-1. No limiting conditions were identified at the time of excavation.

SOIL TYPE:	Soil Drainage Class:	Soil Scientist Signature:
LIMITING CONDITION:	Excessively Drained Somewhat Poorly Drained	
Type: Water Rock Mottling	**Well Drained** Poorly Drained	
Depth: +120"	Moderately Well Drained Very Poorly Drained	

WEATHER: 48° Mostly Sunny METHOD: Excavator
SLOPE: EXCAVATION DEPTH: 120"
COVER: Pasture LANDSCAPE POSITION: N

REDOX – Redoxymorphic features (Drainage Mottling) A/S/C – Abundance/Size/Contrast
Roots/Pores – f – few, c – common, m – many / f – fine, m – medium, c – coarse

1250 Wrights Lane
West Chester, PA 19380

P: (610) 918-9002
F: (610) 918-9003

Soil Morphology Form

HOWELL ENGINEERING
Local Knowhow. Engineered.

PIT NUMBER: TP 3-8-2 JOB NUMBER: 3868 INVESTIGATOR: DWD
DATE: 3/8/2023 STATE: PA COUNTY: CHESTER
MUNICIPALITY: WESTTOWN TOWNSHIP CLIENT: KEYSTONE CUSTOM HOMES
SUBDIVISION: N/A SITE LOCATION: 1011 SHILOH RD
MORPHOLOGIC DETERMINATION: SEWAGE **STORMWATER** SHWT SOILS

Horizon	Depth		Boundary		Color	Texture	%CFs	REDOX			Structure	Consistence	NOTES	
	Upper	Lower	Distrnct	Topo				A	S	C				
	0	7	A	W	10 YR 5/2	SILT LOAM	0				SBK	FIRM		
	7	45	G	S	10 YR 5/8	SILTY CLAY	0				MA	VFIRM		
	45	72			10 YR 3/3	SILT LOAM	0				GRAN	FRI		

COMMENTS: This Deep Test Pit was conducted at Test 3-8-2. No limiting conditions were identified at the time of excavation.

SOIL TYPE:	Soil Drainage Class:	Soil Scientist Signature:
LIMITING CONDITION:	Excessively Drained **Somewhat Poorly Drained**	
Type: Water Rock Mottling	Well Drained Poorly Drained	
Depth: +72"	Moderately Well Drained Very Poorly Drained	

WEATHER: 48° Mostly Sunny METHOD: Excavator
SLOPE: EXCAVATION DEPTH: 72"
COVER: Pasture LANDSCAPE POSITION: N

REDOX – Redoxymorphic features (Drainage Mottling) A/S/C – Abundance/Size/Contrast
Roots/Pores – f – few, c – common, m – many / f – fine, m – medium, c – coarse

1250 Wrights Lane
West Chester, PA 19380

P: (610) 918-9002
F: (610) 918-9003

Soil Morphology Form

HOWELL ENGINEERING
Local Knowhow. Engineered.

PIT NUMBER: TP 3-8-3 JOB NUMBER: 3868 INVESTIGATOR: DWD
DATE: 3/8/2023 STATE: PA COUNTY: CHESTER
MUNICIPALITY: WESTTOWN TOWNSHIP CLIENT: KEYSTONE CUSTOM HOMES
SUBDIVISION: N/A SITE LOCATION: 1011 SHILOH RD
MORPHOLOGIC DETERMINATION: SEWAGE **STORMWATER** SHWT SOILS

Horizon	Depth		Boundary		Color	Texture	%CFs	REDOX			Structure	Consistence	NOTES	
	Upper	Lower	Distrnct	Topo				A	S	C				
	0	13	A	W	10 YR 4/2	SILT LOAM	0				MA	FRI		
	13	41	G	S	10 YR 5/6	SILTY CLAY	0				MA	FIRM		
	41	72			10 YR 6/4	SILTY CLAY	0	f	c	d	MA	FIRM		

COMMENTS: This Deep Test Pit was conducted at Test 3-8-3. During excavation, redoximorphic features were identified at approximatley 41-72 inches below exiting grade.

SOIL TYPE:	Soil Drainage Class:		Soil Scientist Signature:
LIMITING CONDITION: Redox	Excessively Drained	Somewhat Poorly Drained	
Type: Water Rock **Mottling**	Well Drained	**Poorly Drained**	
Depth: approx 41-72"	Moderately Well Drained	Very Poorly Drained	

WEATHER: 48° Mostly Sunny METHOD: Excavator
SLOPE: EXCAVATION DEPTH: 72"
COVER: Pasture LANDSCAPE POSITION: SE

REDOX – Redoxymorphic features (Drainage Mottling) A/S/C – Abundance/Size/Contrast
Roots/Pores – f – few, c – common, m – many / f – fine, m – medium, c – coarse

1250 Wrights Lane
West Chester, PA 19380

P: (610) 918-9002
F: (610) 918-9003

LEGEND

- EX. PROPERTY LINE
- PROP. PROPERTY LINE
- EX. RIGHT-OF-WAY
- PROP. RIGHT-OF-WAY
- EX. MONUMENT
- PROP. MONUMENT
- EX. IRON PIPE
- PROP. IRON PIPE
- EX. EASEMENT
- PROP. EASEMENT
- EX. WETLANDS
- 242 EXISTING CONTOUR
- [242] PROPOSED CONTOUR
- x 123.00 EXISTING SPOT ELEV.
- x [123.00] NEW SPOT ELEV.
- GeB2 SOILS TYPE
- SOILS LINE
- EX. CONC. CURB
- PROP. CONC. CURB
- EX. EDGE OF PAVING
- PROP. EDGE OF PAVING
- EX. LIGHT POLE
- PROP. LIGHT POLE
- X EX. FENCE
- MB EX. MAIL BOX
- EX. SIGN
- PROP. SIGN
- EXIST. PARKING SPACES
- PROP. PARKING SPACES (TBR) TO BE REMOVED
- EX. TELE. LINE
- T PROP. TELE. LINE
- E EX. ELEC. LINE
- E PROP. ELEC. LINE
- EX. UTILITY POLE
- PROP. UTILITY POLE
- EX. GUY ANCHOR
- G EX. GAS LINE
- G PROP. GAS LINE
- G.V. EX. GAS VALVE
- G.V. PROP. GAS VALVE
- EX. STORM SEWER LINE
- PROP. STORM SEWER LINE
- EX. STORM INLET
- PROP. STORM INLET
- PROP. STORM INLET ID
- PROP. SEEPAGE BED
- S EX. SANITARY SEWER LINE
- S PROP. SAN. SEWER LINE
- L PROP. SAN. SEWER LATERAL
- MH 1 PROP. SANITARY MH. ID
- W EX. WATER LINE
- W PROP. WATER LINE
- WL PROP. WATER LATERAL
- FW PROP. FIRE WATER LINE
- W.V. EX. WATER VALVE
- W.V. PROP. WATER VALVE
- F.H. EX. HYDRANT
- F.H. PROP. HYDRANT
- EX. MANHOLE
- PROP. MANHOLE
- ZONE AE FLOODPLAIN
- 15%-25% SLOPES
- 25%+ SLOPES
- WETLANDS

PRE-DEVELOPED DRAINAGE AREA PLAN

SCALE: 1"=100'

100 0 50 100 200

GRAPHIC SCALE
1 inch = 100 feet

DLHowell
Civil Engineering
Land Planning
Environmental
www.DLHowell.com

1250 Wrights Lane
West Chester, PA 19380
Phone: (610) 918-9002
Fax: (610) 918-9003

REV.	DATE	DESCRIPTION
1		
2		
3		
4		
5		
6		
7		
8		

PRE-DEVELOPED DRAINAGE AREA PLAN

CLIENT: FOX CLEARING, LLC
PROJECT: STOKES ESTATE
LOCATION: 1013 SHILOH ROAD
WESTTOWN TOWNSHIP, CHESTER COUNTY, PA

DATE:	09/01/21
SCALE:	1"=100'
DRAWN BY:	ADM
CHECKED BY:	DWG
PROJECT NO.:	3868
CAD FILE:	Drainage Area Plan.dwg
PLOTTED:	09/01/21
DRAWING NO.:	SWM-1
SHEET	1 of 2

LEGEND

- EX. PROPERTY LINE
- PROP. PROPERTY LINE
- EX. RIGHT-OF-WAY
- PROP. RIGHT-OF-WAY
- EX. MONUMENT
- PROP. MONUMENT
- EX. IRON PIPE
- PROP. IRON PIPE
- EX. EASEMENT
- PROP. EASEMENT
- EX. WETLANDS
- 242 EXISTING CONTOUR
- 242 PROPOSED CONTOUR
- X 123.00 EXISTING SPOT ELEV.
- x 123.00 NEW SPOT ELEV.
- GEB2 SOILS TYPE
- SOILS LINE
- EX. CONC. CURB
- PROP. CONC. CURB
- EX. EDGE OF PAVING
- PROP. EDGE OF PAVING
- EX. LIGHT POLE
- PROP. LIGHT POLE
- EX. FENCE
- EX. MAIL BOX
- EX. SIGN
- PROP. SIGN
- EXIST. PARKING SPACES
- PROP. PARKING SPACES
- (TBR) TO BE REMOVED
- EX. TELE. LINE
- T PROP. TELE. LINE
- E EX. ELEC. LINE
- E PROP. ELEC. LINE
- EX. UTILITY POLE
- PROP. UTILITY POLE
- EX. GUY ANCHOR
- G EX. GAS LINE
- G PROP. GAS LINE
- G.V. EX. GAS VALVE
- G.V. PROP. GAS VALVE
- EX. STORM SEWER LINE
- PROP. STORM SEWER LINE
- EX. STORM INLET
- PROP. STORM INLET
- PROP. STORM INLET ID
- PROP. SEEPAGE BED
- S EX. SANITARY SEWER LINE
- S PROP. SAN. SEWER LINE
- L PROP. SAN. SEWER LATERAL
- MH 1 PROP. SANITARY MH. ID
- W EX. WATER LINE
- W PROP. WATER LINE
- WL PROP. WATER LATERAL
- FW PROP. FIRE WATER LINE
- W.V. EX. WATER VALVE
- W.V. PROP. WATER VALVE
- F.H. EX. HYDRANT
- F.H. PROP. HYDRANT
- EX. MANHOLE
- PROP. MANHOLE
- ZONE AE FLOODPLAIN
- 15%-25% SLOPES
- 25%+ SLOPES
- WETLANDS

POST-DEVELOPED DRAINAGE AREA PLAN

SCALE: 1"=100'

100 0 50 100 200

GRAPHIC SCALE
1 inch = 100 feet

DLHowell
Civil Engineering
Land Planning
Environmental
www.DLHowell.com

1250 Wrights Lane
West Chester, PA 19380
Phone: (610) 918-9002
Fax: (610) 918-9003

BSV.	DATE	DESCRIPTION
8		
7		
6		
5		
4		
3		
2		
1		

POST-DEVELOPED DRAINAGE AREA PLAN

CLIENT: FOX CLEARING, LLC
PROJECT: STOKES ESTATE
LOCATION: 1013 SHILOH ROAD
WESTTOWN TOWNSHIP, CHESTER COUNTY, PA

DATE:	09/01/21
SCALE:	1"=100'
DRAWN BY:	ADM
CHECKED BY:	DWG
PROJECT NO.:	3868
CAD FILE:	Drainage Area Plan.dwg
PLOTTED:	09/01/21
DRAWING NO.:	SWM-2
SHEET	2 OF 2