

Post Construction Stormwater Management Analysis

**Hamilton Estate
Strafford Avenue**

Radnor Township, Delaware County

Date: May 15, 2023

Plan Prepared For:

**Haverford Properties
551 W. Lancaster Avenue, Suite 307
Haverford, PA 19041**

Plan Prepared By:

**Site Engineering Concepts, LLC
P.O. Box 1992
Southeastern, PA 19399**



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Executive Summary

The applicant proposes to remove all existing improvements on 208 and 228 Strafford Avenue and 18 Forrest Lane. Proposed is the construction of 38 Townhouses and a new dwelling at 18 Forrest Lane with 2 new roads, related parking and walkways. 2 main entrance will be located on Strafford Avenue.

Four pipe storage stormwater management systems are proposed. The stormwater runoff rates are controlled per the township ordinance using different size orifices within the outlet structure at the outlet of each bed. The beds are used for storm water volume, quality and runoff rate control.

During construction erosion and sediment control will be accomplished through limited disturbance, immediate stabilization, a stabilized construction entrance, sediment basin and compost filter sock. The total limit of disturbance is approximately 7.0 acres.

STRAFFORD AVENUE
Stormwater Management Summary-Post Construction
Radnor Township Stormwater District A

Stormwater Management Summary - POI A							
Yr	Pre-Development				Post Development	Compliance	Percentage Reduction
	On-Site		Allowable Release Rate*		Total Post Developed Flow		
1	1.376		1.376		0.361	-1.02	-74%
2	2.909		1.376		1.714	0.34	25%
5	5.703		5.703		3.399	-2.30	-40%
10	8.360		8.360		4.793	-3.57	-43%
25	12.480		12.480		6.987	-5.49	-44%
50	16.210		16.210		8.585	-7.63	-47%
100	20.430		20.430		10.930	-9.50	-47%

Design Storm Proposed Conditions	Reduce to	Design Storm Existing Conditions
1yr		1 yr
2 yr		1 yr
5 yr		5 yr
10 yr		10 yr
25 yr		25 yr
50 yr		50 yr
100 yr		100 yr

INFILTRATION BED 1		
Pipe Diameter =	48	inches
Pipe Length =	1296	ft
Stone Bed Length	108	ft
Stone Bed Width =	74.0	ft
Stone Depth =	5.0	ft
<i>Pipe Volume = 16286 ft²</i>		
<i>+ Stone Voids Volume = 0 ft</i>		
Provided V_t = 16286 ft³		

Dead Storage Depth = 3.7
 Infiltration Bed Dead Storage Provided = 15,065

INFILTRATION BED 2		
Pipe Diameter =	48	inches
Pipe Length =	1170	ft
Stone Bed Length	90	ft
Stone Bed Width =	74.0	ft
Stone Depth =	5.0	ft
<i>Pipe Volume = 14703 ft²</i>		
<i>+ Stone Voids Volume = 0 ft</i>		
Provided V_t = 14703 ft³		

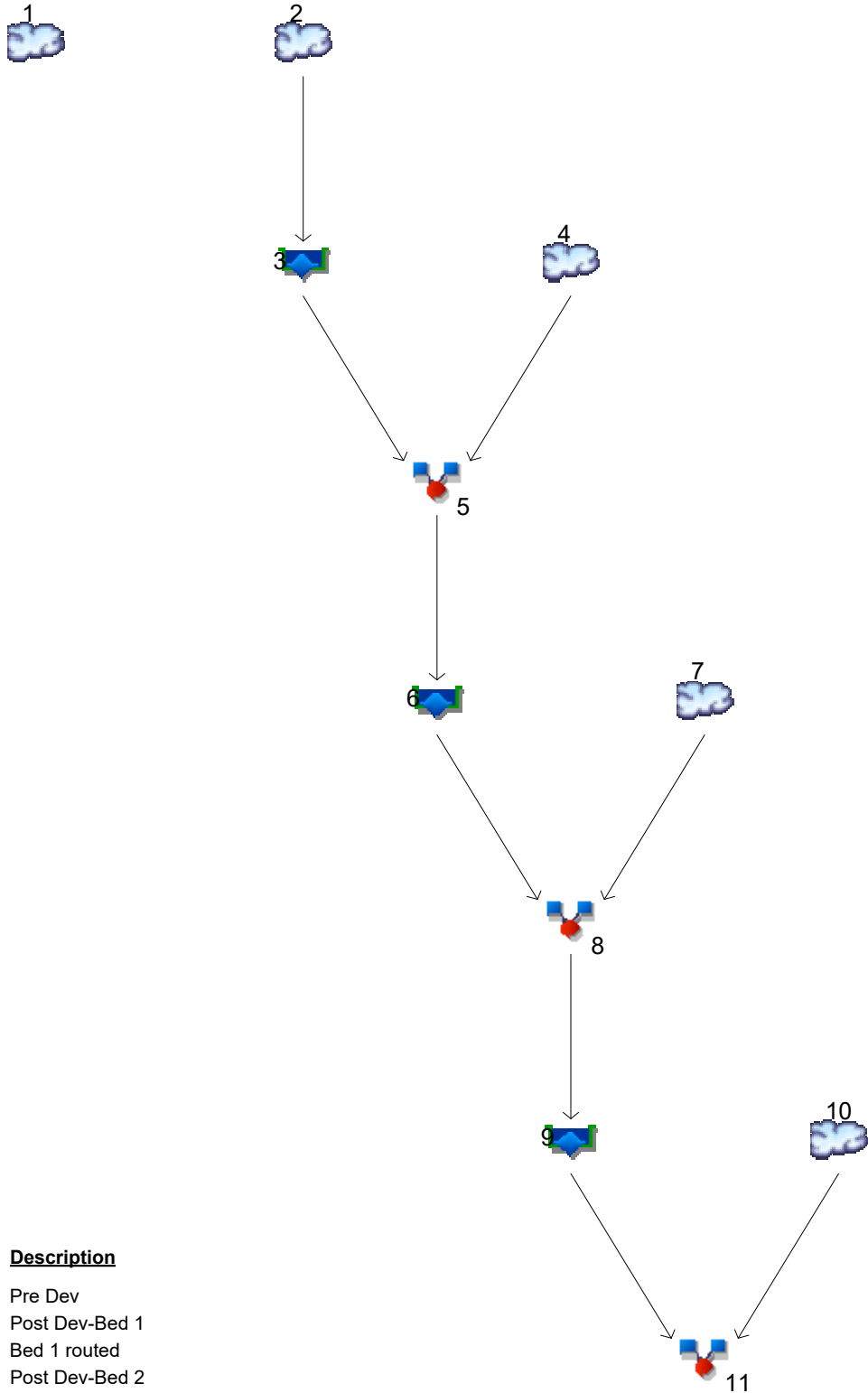
Dead Storage Depth = 3.0
 Infiltration Bed Dead Storage Provided = 11,027

INFILTRATION BED 3		
Pipe Diameter =	48	inches
Pipe Length =	980	ft
Stone Bed Length	92	ft
Stone Bed Width =	96.0	ft
Stone Depth =	5.0	ft
<i>Pipe Volume = 12315 ft²</i>		
<i>+ Stone Voids Volume = 0 ft</i>		
Provided V_t = 12315 ft³		

Dead Storage Depth = 0.0
 Infiltration Bed Dead Storage Provided = 0

Watershed Model Schematic

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2



Legend

Hyd. Origin	Description
1	SCS Runoff Pre Dev
2	SCS Runoff Post Dev-Bed 1
3	Reservoir Bed 1 routed
4	SCS Runoff Post Dev-Bed 2
5	Combine Total to Bed 2
6	Reservoir Bed 2 Routed
7	SCS Runoff Post Dev-Bed 3
8	Combine Total to Bed 3
9	Reservoir Bed 3 Routed
10	SCS Runoff Bypass
11	Combine Total Post Dev

Hydrograph Return Period Recap

Hydratlow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

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	-----	1.376	2.909	-----	5.703	8.360	12.48	16.21	20.43	Pre Dev
2	SCS Runoff	-----	1.155	1.735	-----	2.677	3.516	4.783	5.896	7.108	Post Dev-Bed 1
3	Reservoir	2	0.000	0.000	-----	0.000	0.000	0.000	0.000	0.000	Bed 1 routed
4	SCS Runoff	-----	2.555	3.967	-----	6.289	8.379	11.50	14.31	17.38	Post Dev-Bed 2
5	Combine	3, 4	2.555	3.967	-----	6.289	8.379	11.50	14.31	17.38	Total to Bed 2
6	Reservoir	5	0.000	0.000	-----	0.082	0.256	1.161	4.701	9.828	Bed 2 Routed
7	SCS Runoff	-----	2.503	3.886	-----	6.161	8.209	11.27	14.02	17.03	Post Dev-Bed 3
8	Combine	6, 7	2.503	3.886	-----	6.161	8.209	11.27	14.02	22.94	Total to Bed 3
9	Reservoir	8	0.344	1.612	-----	3.203	4.520	6.522	8.252	10.67	Bed 3 Routed
10	SCS Runoff	-----	0.104	0.196	-----	0.356	0.505	0.734	0.939	1.167	Bypass
11	Combine	9, 10	0.361	1.714	-----	3.399	4.793	6.987	8.585	10.93	Total Post Dev

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

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	1.376	2	724	5,416	-----	-----	-----	Pre Dev
2	SCS Runoff	1.155	2	718	2,346	-----	-----	-----	Post Dev-Bed 1
3	Reservoir	0.000	2	n/a	0	2	437.58	2,346	Bed 1 routed
4	SCS Runoff	2.555	2	718	5,277	-----	-----	-----	Post Dev-Bed 2
5	Combine	2.555	2	718	5,277	3, 4	-----	-----	Total to Bed 2
6	Reservoir	0.000	2	n/a	0	5	431.94	5,277	Bed 2 Routed
7	SCS Runoff	2.503	2	718	5,170	-----	-----	-----	Post Dev-Bed 3
8	Combine	2.503	2	718	5,170	6, 7	-----	-----	Total to Bed 3
9	Reservoir	0.344	2	740	5,148	8	420.57	1,747	Bed 3 Routed
10	SCS Runoff	0.104	2	718	253	-----	-----	-----	Bypass
11	Combine	0.361	2	738	5,402	9, 10	-----	-----	Total Post Dev
POI-A-Hydro.gpw					Return Period: 1 Year			Sunday, 05 / 14 / 2023	

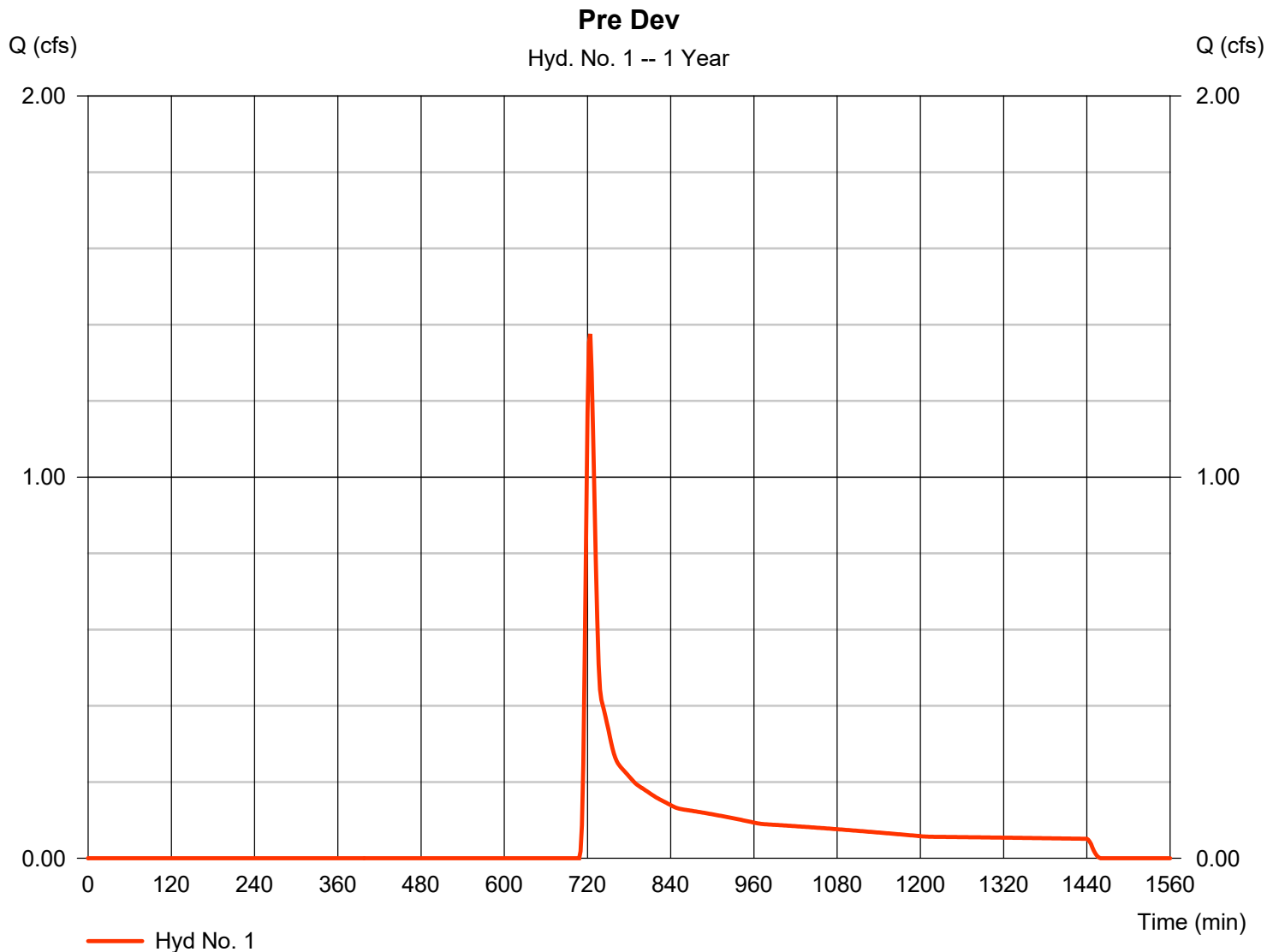
Hydrograph Report

Hyd. No. 1

Pre Dev

Hydrograph type	= SCS Runoff	Peak discharge	= 1.376 cfs
Storm frequency	= 1 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 5,416 cuft
Drainage area	= 4.250 ac	Curve number	= 64*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.10 min
Total precip.	= 2.69 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.650 x 98) + (3.600 x 58)] / 4.250



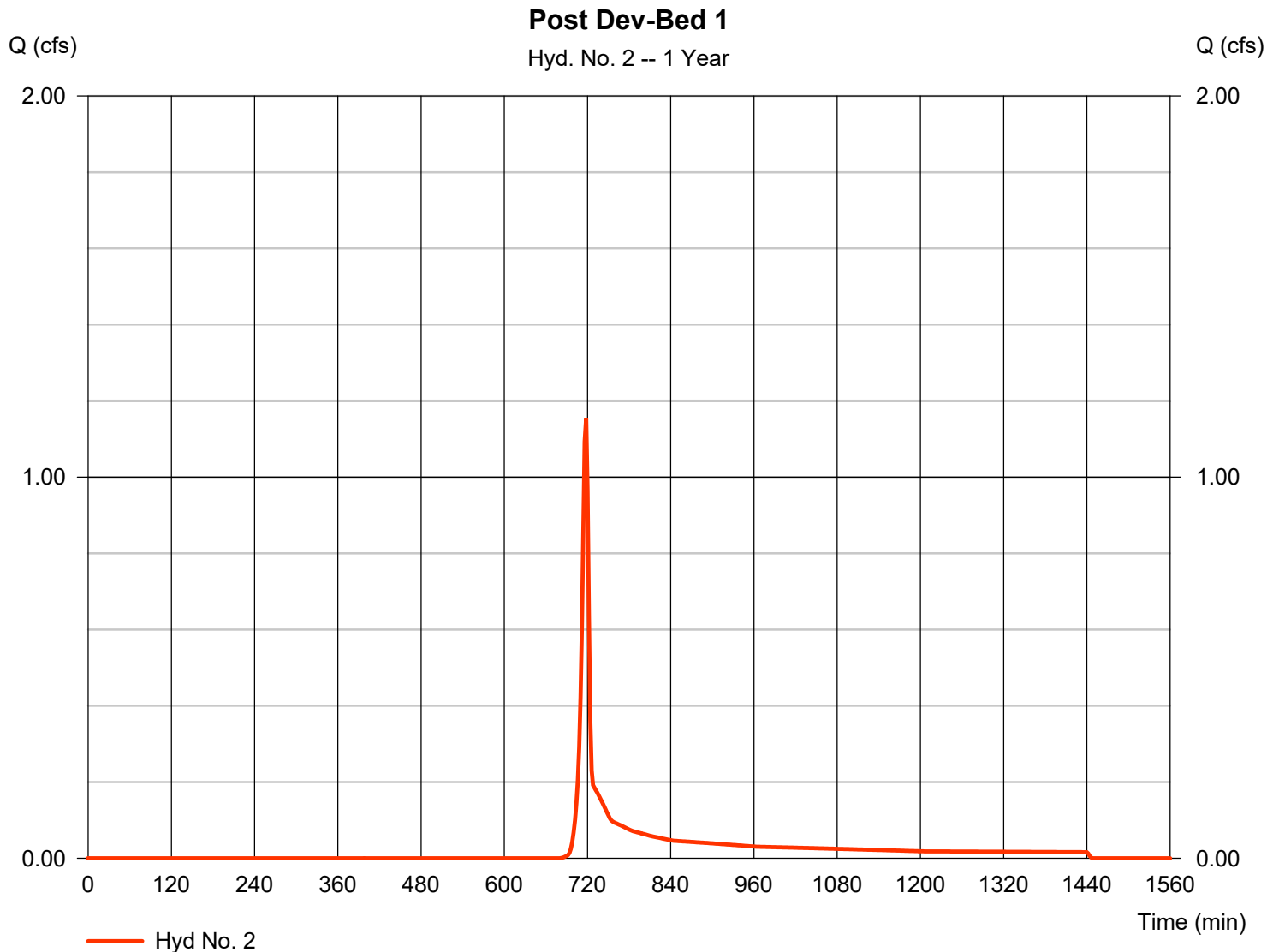
Hydrograph Report

Hyd. No. 2

Post Dev-Bed 1

Hydrograph type	= SCS Runoff	Peak discharge	= 1.155 cfs
Storm frequency	= 1 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 2,346 cuft
Drainage area	= 0.960 ac	Curve number	= 74*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.69 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = $[(0.340 \times 98) + (0.620 \times 61)] / 0.960$



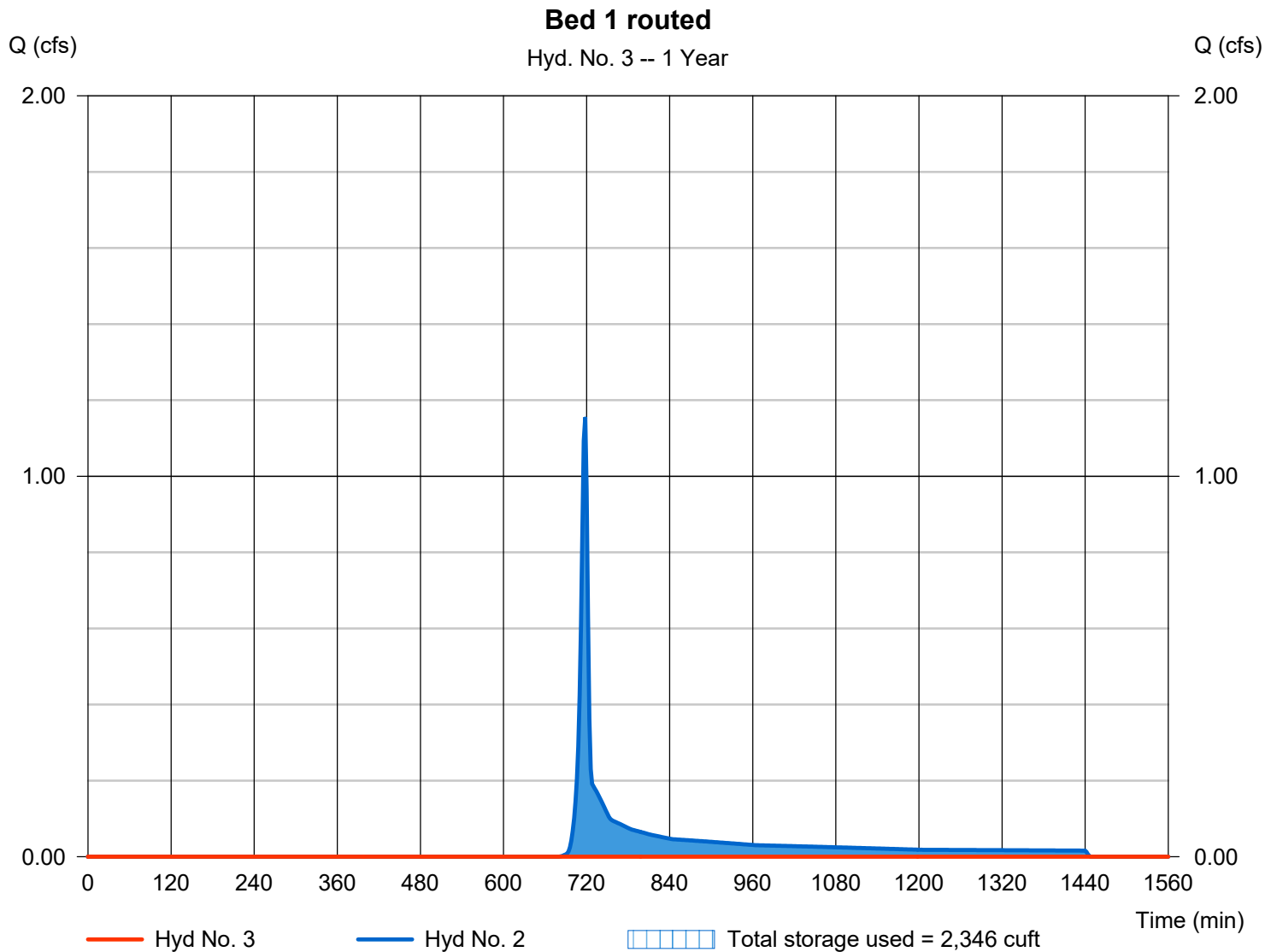
Hydrograph Report

Hyd. No. 3

Bed 1 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.	= 2 - Post Dev-Bed 1	Max. Elevation	= 437.58 ft
Reservoir name	= Bed 1	Max. Storage	= 2,346 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Bed 1

Pond Data

Pond storage is based on user-defined values.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	437.00	n/a	0	0
1.00	438.00	n/a	4,072	4,072
2.00	439.00	n/a	4,071	8,143
3.00	440.00	n/a	4,072	12,215
4.00	441.00	n/a	4,071	16,286

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 15.00	2.00	0.00	0.00
Span (in)	= 15.00	2.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 437.00	440.70	0.00	0.00
Length (ft)	= 25.00	0.00	0.00	0.00
Slope (%)	= 1.00	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)	= 4.00	0.00	0.00	0.00
Crest El. (ft)	= 440.90	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
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).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	437.00	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.10	407	437.10	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.20	814	437.20	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.30	1,222	437.30	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.40	1,629	437.40	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.50	2,036	437.50	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.60	2,443	437.60	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.70	2,850	437.70	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.80	3,258	437.80	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.90	3,665	437.90	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
1.00	4,072	438.00	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
1.10	4,479	438.10	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
1.20	4,886	438.20	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
1.30	5,293	438.30	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
1.40	5,700	438.40	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
1.50	6,108	438.50	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
1.60	6,515	438.60	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
1.70	6,922	438.70	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
1.80	7,329	438.80	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
1.90	7,736	438.90	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
2.00	8,143	439.00	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
2.10	8,550	439.10	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
2.20	8,957	439.20	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
2.30	9,365	439.30	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
2.40	9,772	439.40	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
2.50	10,179	439.50	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
2.60	10,586	439.60	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
2.70	10,993	439.70	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
2.80	11,401	439.80	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
2.90	11,808	439.90	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
3.00	12,215	440.00	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
3.10	12,622	440.10	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
3.20	13,029	440.20	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
3.30	13,436	440.30	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
3.40	13,843	440.40	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
3.50	14,250	440.50	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
3.60	14,658	440.60	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
3.70	15,065	440.70	0.00 ic	0.00 ic	---	---	0.00	---	---	---	---	---	0.000
3.80	15,472	440.80	0.01 ic	0.01 ic	---	---	0.00	---	---	---	---	---	0.015

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Bed 1

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
3.90	15,879	440.90	0.04 ic	0.04 ic	---	---	0.00	---	---	---	---	---	0.036
4.00	16,286	441.00	0.48 ic	0.05 ic	---	---	0.42	---	---	---	---	---	0.470

...End

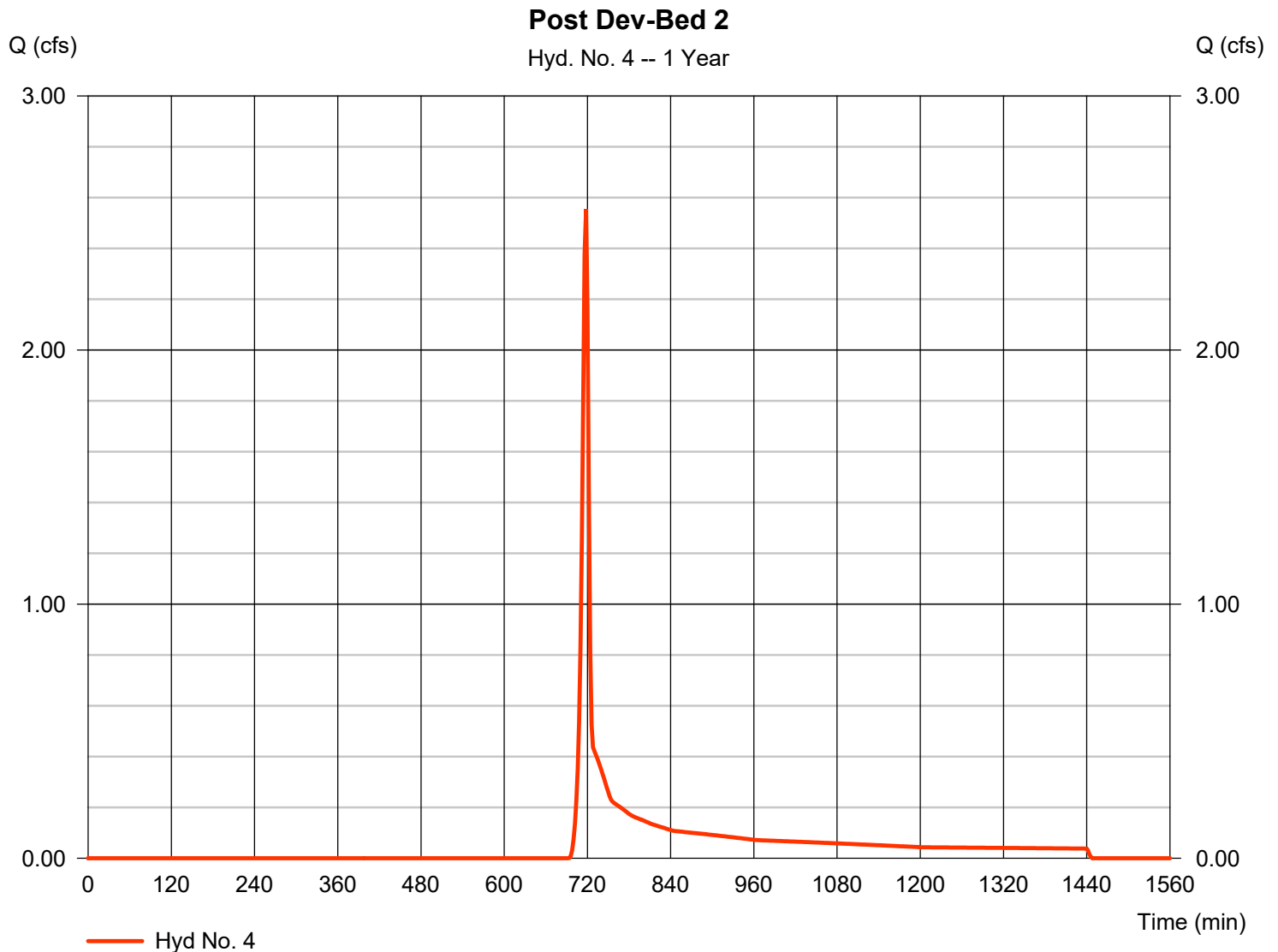
Hydrograph Report

Hyd. No. 4

Post Dev-Bed 2

Hydrograph type	= SCS Runoff	Peak discharge	= 2.555 cfs
Storm frequency	= 1 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 5,277 cuft
Drainage area	= 2.460 ac	Curve number	= 72*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.69 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = $[(0.740 \times 98) + (1.720 \times 61)] / 2.460$



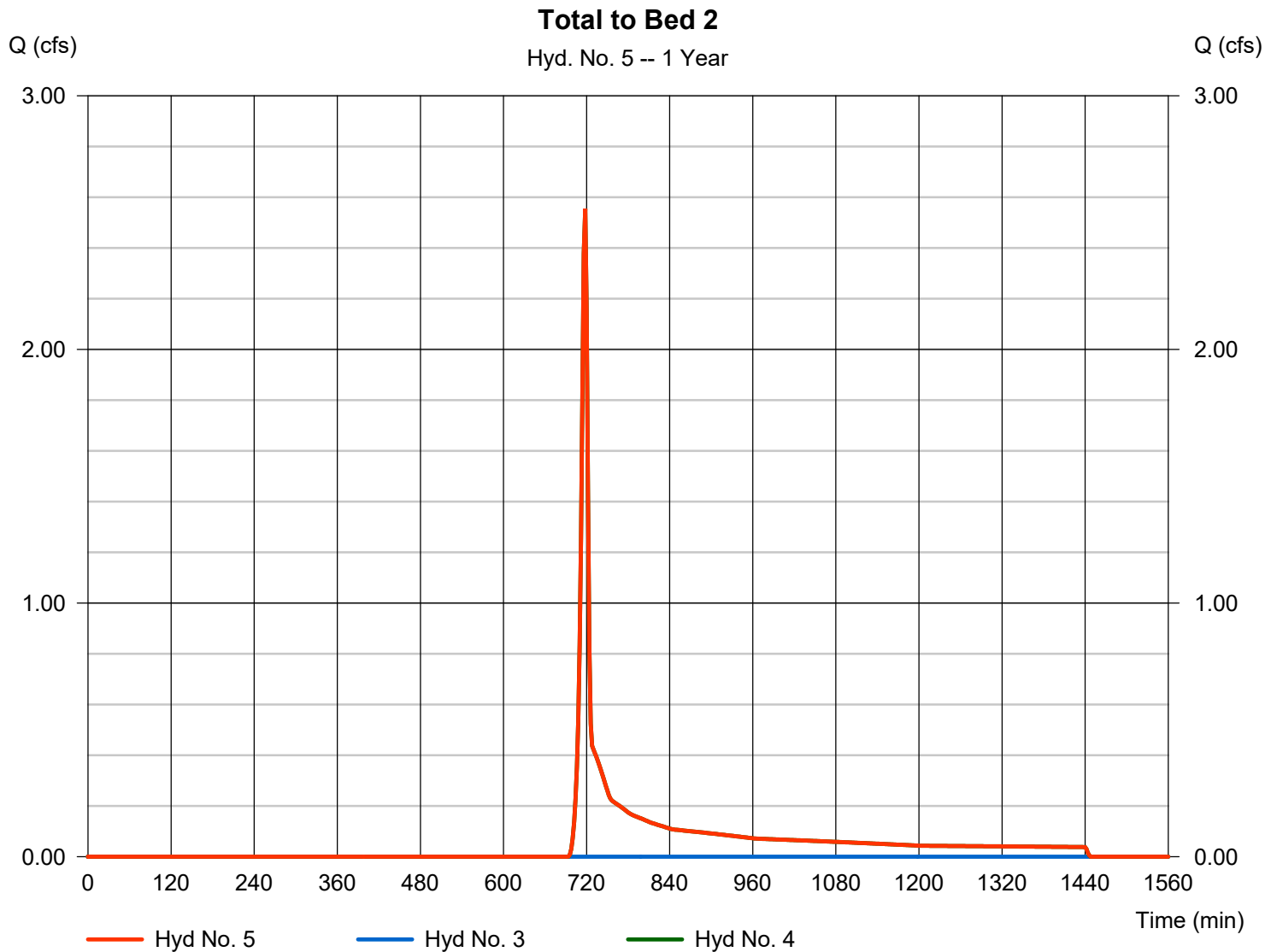
Hydrograph Report

Hyd. No. 5

Total to Bed 2

Hydrograph type = Combine
Storm frequency = 1 yrs
Time interval = 2 min
Inflow hyds. = 3, 4

Peak discharge = 2.555 cfs
Time to peak = 718 min
Hyd. volume = 5,277 cuft
Contrib. drain. area = 2.460 ac



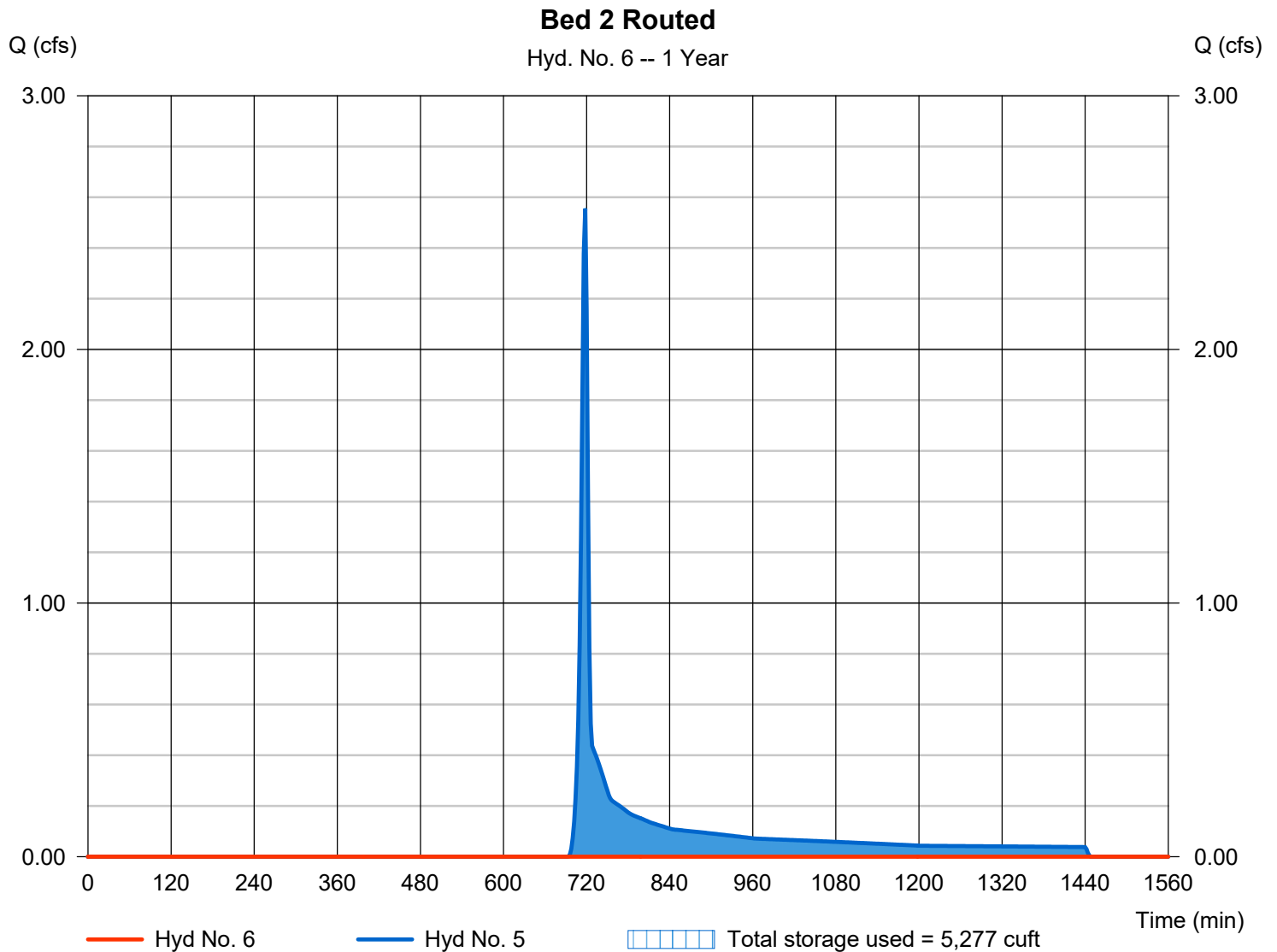
Hydrograph Report

Hyd. No. 6

Bed 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.	= 5 - Total to Bed 2	Max. Elevation	= 431.94 ft
Reservoir name	= Bed 2	Max. Storage	= 5,277 cuft

Storage Indication method used.



Pond Report

Pond No. 3 - Bed 2

Pond Data

Pond storage is based on user-defined values.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	430.50	n/a	0	0
1.00	431.50	n/a	3,676	3,676
2.00	432.50	n/a	3,676	7,352
3.00	433.50	n/a	3,675	11,027
4.00	434.50	n/a	3,676	14,703

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 15.00	2.00	0.00	0.00
Span (in)	= 15.00	2.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 430.50	433.50	0.00	0.00
Length (ft)	= 25.00	0.00	0.00	0.00
Slope (%)	= 1.00	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)	= 4.00	0.00	0.00	0.00
Crest El. (ft)	= 433.60	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
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).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	430.50	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.10	368	430.60	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.20	735	430.70	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.30	1,103	430.80	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.40	1,470	430.90	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.50	1,838	431.00	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.60	2,206	431.10	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.70	2,573	431.20	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.80	2,941	431.30	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.90	3,308	431.40	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
1.00	3,676	431.50	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
1.10	4,044	431.60	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
1.20	4,411	431.70	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
1.30	4,779	431.80	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
1.40	5,146	431.90	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
1.50	5,514	432.00	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
1.60	5,882	432.10	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
1.70	6,249	432.20	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
1.80	6,617	432.30	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
1.90	6,984	432.40	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
2.00	7,352	432.50	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
2.10	7,720	432.60	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
2.20	8,087	432.70	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
2.30	8,455	432.80	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
2.40	8,822	432.90	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
2.50	9,190	433.00	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
2.60	9,557	433.10	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
2.70	9,925	433.20	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
2.80	10,292	433.30	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
2.90	10,660	433.40	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
3.00	11,027	433.50	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
3.10	11,395	433.60	0.01 ic	0.01 ic	---	---	0.00	---	---	---	---	---	0.015
3.20	11,762	433.70	0.46 ic	0.04 ic	---	---	0.42	---	---	---	---	---	0.457
3.30	12,130	433.80	1.25 ic	0.05 ic	---	---	1.19	---	---	---	---	---	1.240
3.40	12,497	433.90	2.26 oc	0.06 ic	---	---	2.19	---	---	---	---	---	2.248
3.50	12,865	434.00	3.44 oc	0.07 ic	---	---	3.37	---	---	---	---	---	3.438
3.60	13,233	434.10	4.79 oc	0.08 ic	---	---	4.71	---	---	---	---	---	4.785
3.70	13,600	434.20	6.27 oc	0.08 ic	---	---	6.19	---	---	---	---	---	6.274
3.80	13,968	434.30	7.89 ic	0.09 ic	---	---	7.80	---	---	---	---	---	7.891

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Bed 2

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
3.90	14,335	434.40	9.47 ic	0.09 ic	---	---	9.38 s	---	---	---	---	---	9.470
4.00	14,703	434.50	10.02 ic	0.07 ic	---	---	9.94 s	---	---	---	---	---	10.01

...End

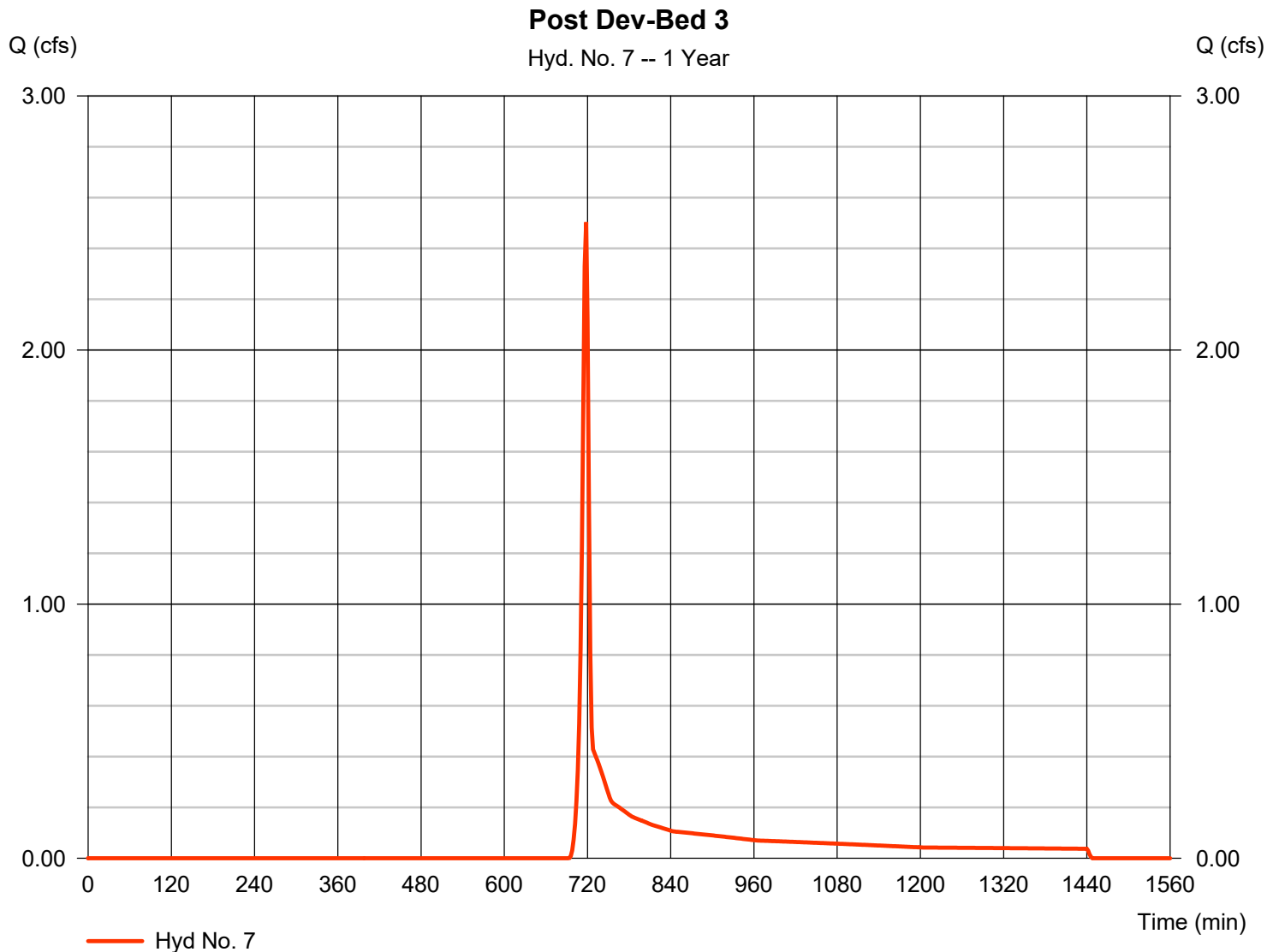
Hydrograph Report

Hyd. No. 7

Post Dev-Bed 3

Hydrograph type	= SCS Runoff	Peak discharge	= 2.503 cfs
Storm frequency	= 1 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 5,170 cuft
Drainage area	= 2.410 ac	Curve number	= 72*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.69 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.720 x 98) + (1.690 x 61)] / 2.410



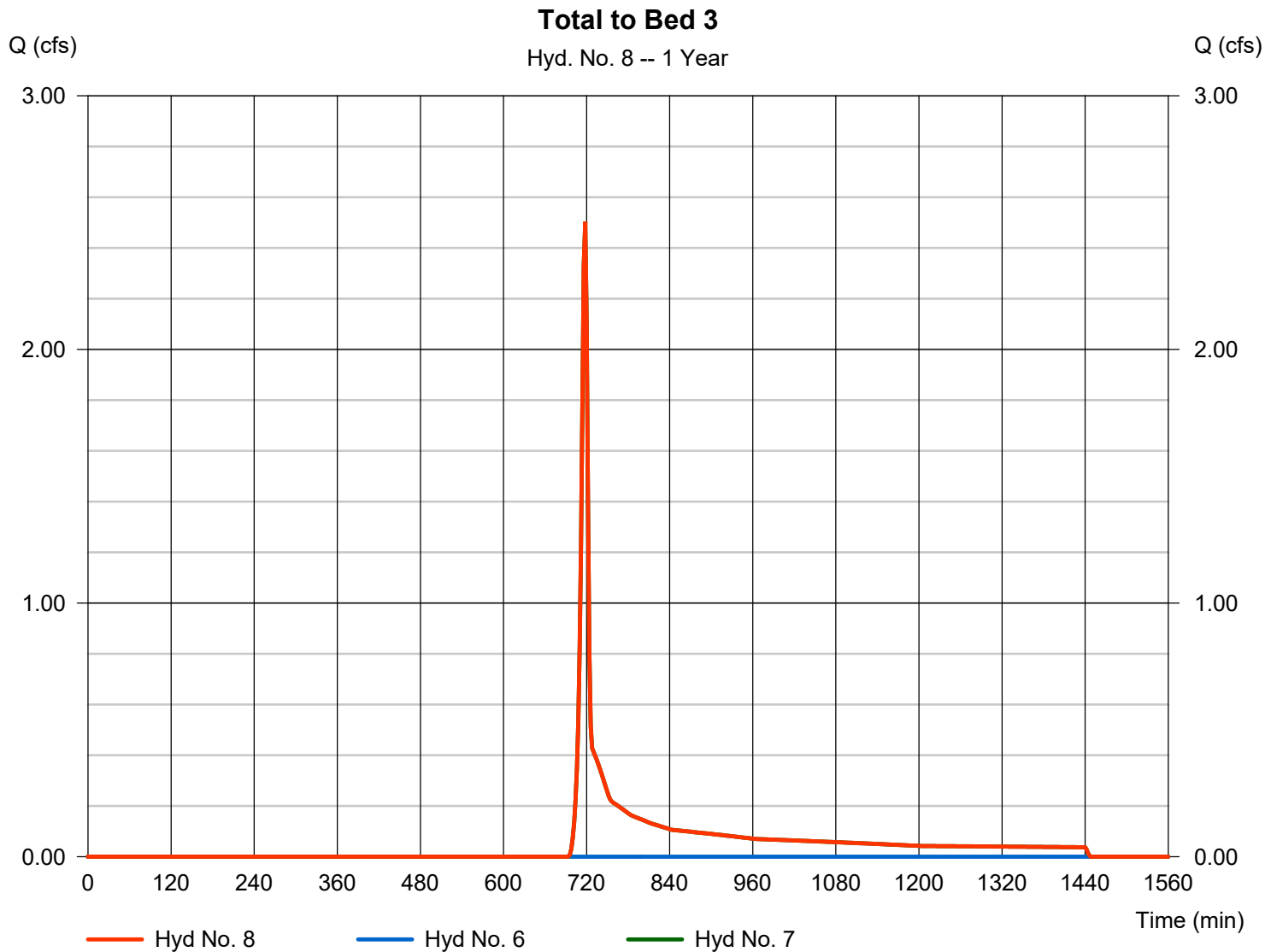
Hydrograph Report

Hyd. No. 8

Total to Bed 3

Hydrograph type = Combine
Storm frequency = 1 yrs
Time interval = 2 min
Inflow hyds. = 6, 7

Peak discharge = 2.503 cfs
Time to peak = 718 min
Hyd. volume = 5,170 cuft
Contrib. drain. area = 2.410 ac



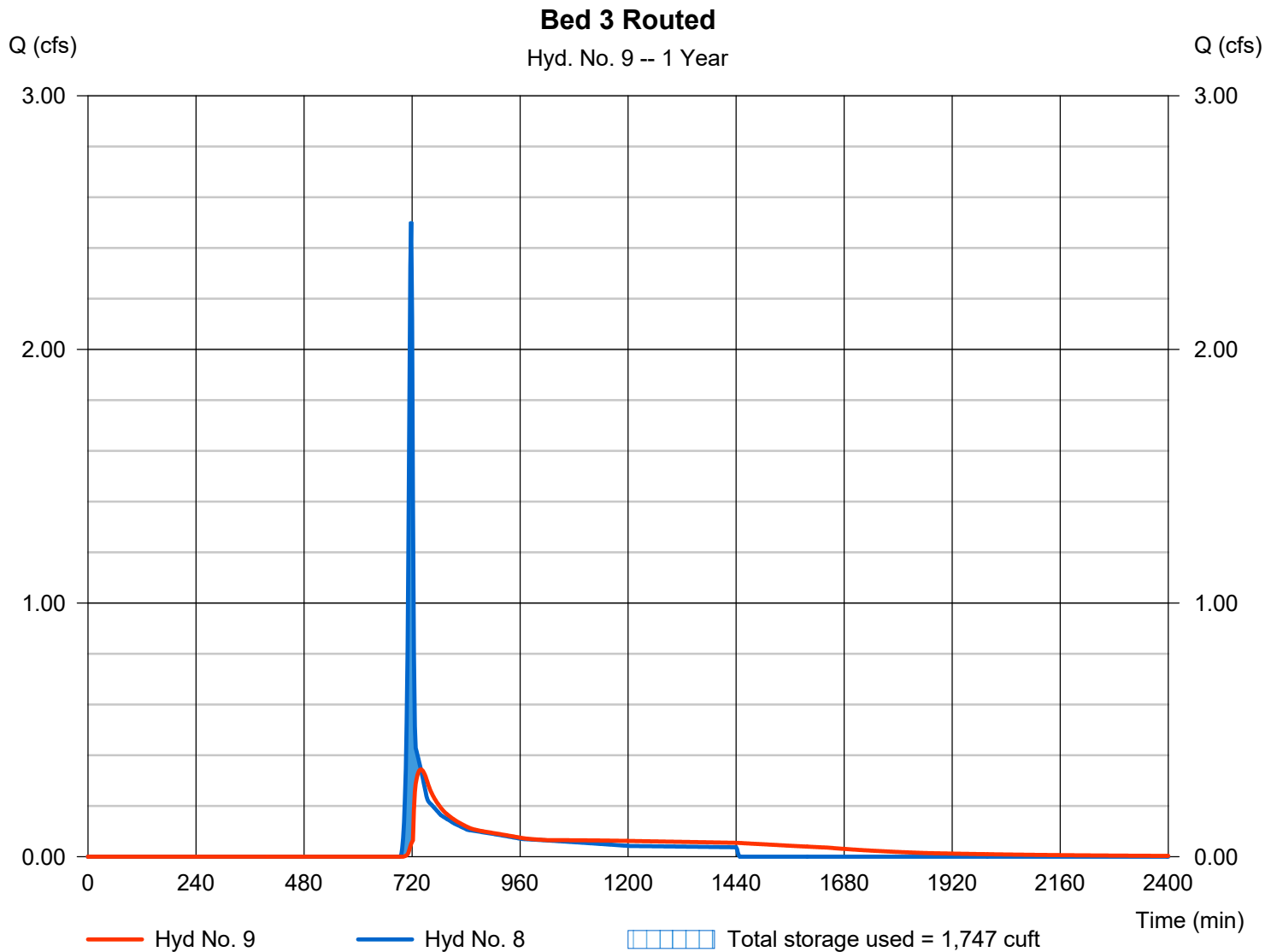
Hydrograph Report

Hyd. No. 9

Bed 3 Routed

Hydrograph type	= Reservoir	Peak discharge	= 0.344 cfs
Storm frequency	= 1 yrs	Time to peak	= 740 min
Time interval	= 2 min	Hyd. volume	= 5,148 cuft
Inflow hyd. No.	= 8 - Total to Bed 3	Max. Elevation	= 420.57 ft
Reservoir name	= Bed 3	Max. Storage	= 1,747 cuft

Storage Indication method used.



Pond Report

Pond No. 4 - Bed 3

Pond Data

Pond storage is based on user-defined values.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	420.00	n/a	0	0
1.00	421.00	n/a	3,078	3,078
2.00	422.00	n/a	3,100	6,178
3.00	423.00	n/a	3,058	9,236
4.00	424.00	n/a	3,079	12,315

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 15.00	2.00	0.00	0.00
Span (in)	= 15.00	2.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 420.00	420.00	0.00	0.00
Length (ft)	= 25.00	0.00	0.00	0.00
Slope (%)	= 1.00	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)	= 4.00	0.00	0.00	0.00
Crest El. (ft)	= 420.50	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
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).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	420.00	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.10	308	420.10	0.01 ic	0.01 ic	---	---	0.00	---	---	---	---	---	0.015
0.20	616	420.20	0.04 ic	0.04 ic	---	---	0.00	---	---	---	---	---	0.036
0.30	923	420.30	0.05 ic	0.05 ic	---	---	0.00	---	---	---	---	---	0.047
0.40	1,231	420.40	0.06 ic	0.06 ic	---	---	0.00	---	---	---	---	---	0.057
0.50	1,539	420.50	0.07 ic	0.07 ic	---	---	0.00	---	---	---	---	---	0.065
0.60	1,847	420.60	0.48 ic	0.06 ic	---	---	0.42	---	---	---	---	---	0.477
0.70	2,155	420.70	1.21 ic	0.04 ic	---	---	1.17 s	---	---	---	---	---	1.214
0.80	2,462	420.80	1.84 ic	0.04 ic	---	---	1.80 s	---	---	---	---	---	1.837
0.90	2,770	420.90	2.36 oc	0.03 ic	---	---	2.33 s	---	---	---	---	---	2.362
1.00	3,078	421.00	2.77 oc	0.03 ic	---	---	2.74 s	---	---	---	---	---	2.773
1.10	3,388	421.10	3.14 oc	0.03 ic	---	---	3.11 s	---	---	---	---	---	3.136
1.20	3,698	421.20	3.38 oc	0.02 ic	---	---	3.35 s	---	---	---	---	---	3.377
1.30	4,008	421.30	3.49 oc	0.02 ic	---	---	3.47 s	---	---	---	---	---	3.488
1.40	4,318	421.40	4.09 oc	0.02 ic	---	---	4.07 s	---	---	---	---	---	4.088
1.50	4,628	421.50	4.62 oc	0.02 ic	---	---	4.60 s	---	---	---	---	---	4.622
1.60	4,938	421.60	5.11 oc	0.02 ic	---	---	5.08 s	---	---	---	---	---	5.102
1.70	5,248	421.70	5.55 oc	0.02 ic	---	---	5.53 s	---	---	---	---	---	5.549
1.80	5,558	421.80	5.96 oc	0.02 ic	---	---	5.94 s	---	---	---	---	---	5.961
1.90	5,868	421.90	6.35 oc	0.02 ic	---	---	6.33 s	---	---	---	---	---	6.349
2.00	6,178	422.00	6.72 oc	0.02 ic	---	---	6.69 s	---	---	---	---	---	6.712
2.10	6,484	422.10	7.06 oc	0.02 ic	---	---	7.04 s	---	---	---	---	---	7.057
2.20	6,790	422.20	7.34 ic	0.02 ic	---	---	7.32 s	---	---	---	---	---	7.341
2.30	7,095	422.30	7.58 ic	0.02 ic	---	---	7.56 s	---	---	---	---	---	7.579
2.40	7,401	422.40	7.81 ic	0.02 ic	---	---	7.79 s	---	---	---	---	---	7.811
2.50	7,707	422.50	8.04 ic	0.02 ic	---	---	8.01 s	---	---	---	---	---	8.030
2.60	8,013	422.60	8.26 ic	0.02 ic	---	---	8.24 s	---	---	---	---	---	8.255
2.70	8,319	422.70	8.47 ic	0.02 ic	---	---	8.45 s	---	---	---	---	---	8.464
2.80	8,624	422.80	8.67 ic	0.01 ic	---	---	8.64 s	---	---	---	---	---	8.658
2.90	8,930	422.90	8.88 ic	0.01 ic	---	---	8.84 s	---	---	---	---	---	8.857
3.00	9,236	423.00	9.07 ic	0.01 ic	---	---	9.04 s	---	---	---	---	---	9.057
3.10	9,544	423.10	9.26 ic	0.01 ic	---	---	9.23 s	---	---	---	---	---	9.244
3.20	9,852	423.20	9.45 ic	0.01 ic	---	---	9.42 s	---	---	---	---	---	9.430
3.30	10,160	423.30	9.64 ic	0.01 ic	---	---	9.60 s	---	---	---	---	---	9.617
3.40	10,468	423.40	9.82 ic	0.01 ic	---	---	9.80 s	---	---	---	---	---	9.811
3.50	10,776	423.50	9.99 ic	0.01 ic	---	---	9.97 s	---	---	---	---	---	9.984
3.60	11,083	423.60	10.17 ic	0.01 ic	---	---	10.16 s	---	---	---	---	---	10.17
3.70	11,391	423.70	10.34 ic	0.01 ic	---	---	10.32 s	---	---	---	---	---	10.34
3.80	11,699	423.80	10.51 ic	0.01 ic	---	---	10.47 s	---	---	---	---	---	10.48

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Bed 3

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
3.90	12,007	423.90	10.67 ic	0.01 ic	---	---	10.64 s	---	---	---	---	---	10.65
4.00	12,315	424.00	10.84 ic	0.01 ic	---	---	10.80 s	---	---	---	---	---	10.81

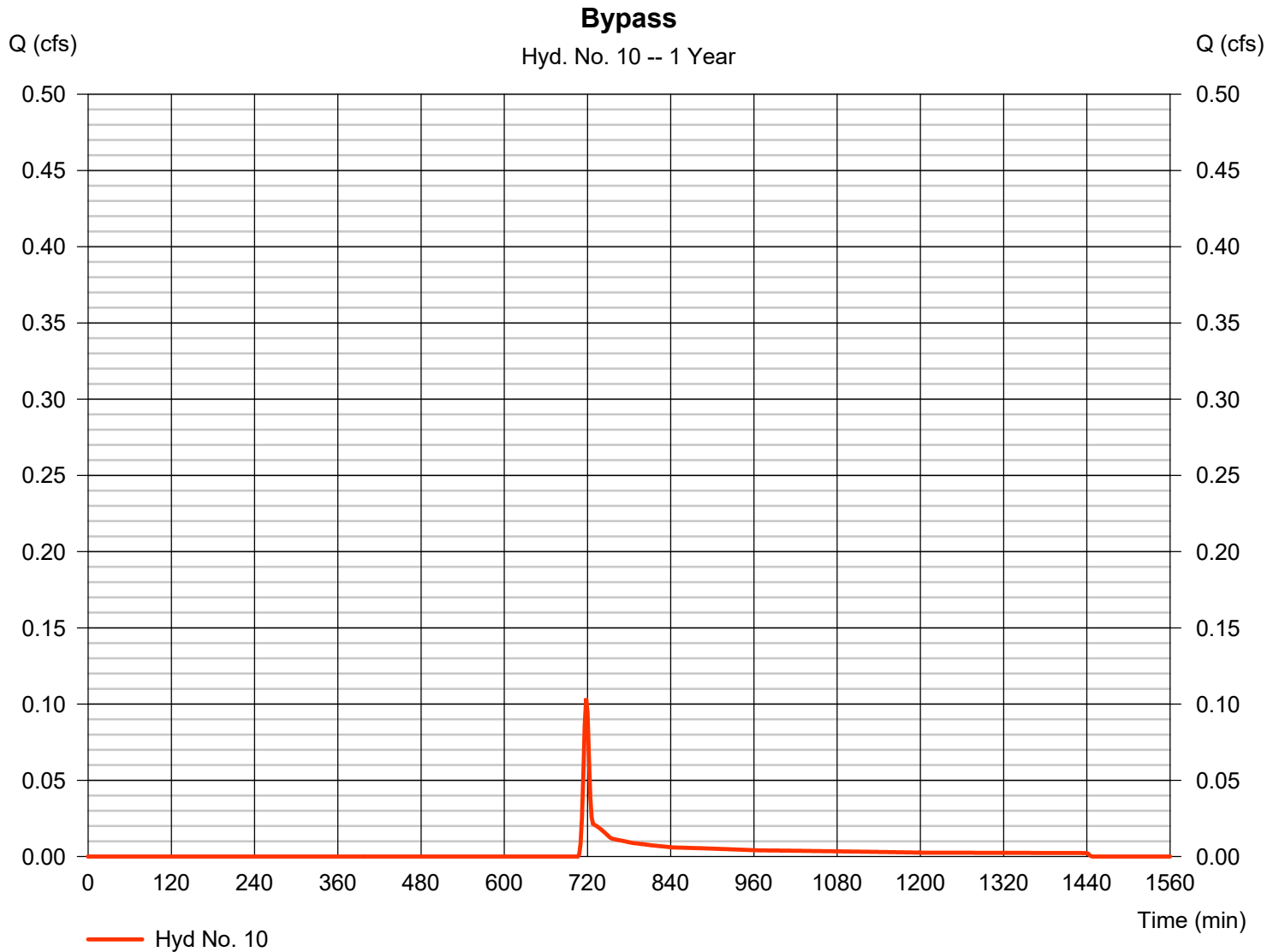
...End

Hydrograph Report

Hyd. No. 10

Bypass

Hydrograph type	= SCS Runoff	Peak discharge	= 0.104 cfs
Storm frequency	= 1 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 253 cuft
Drainage area	= 0.200 ac	Curve number	= 65
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.69 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



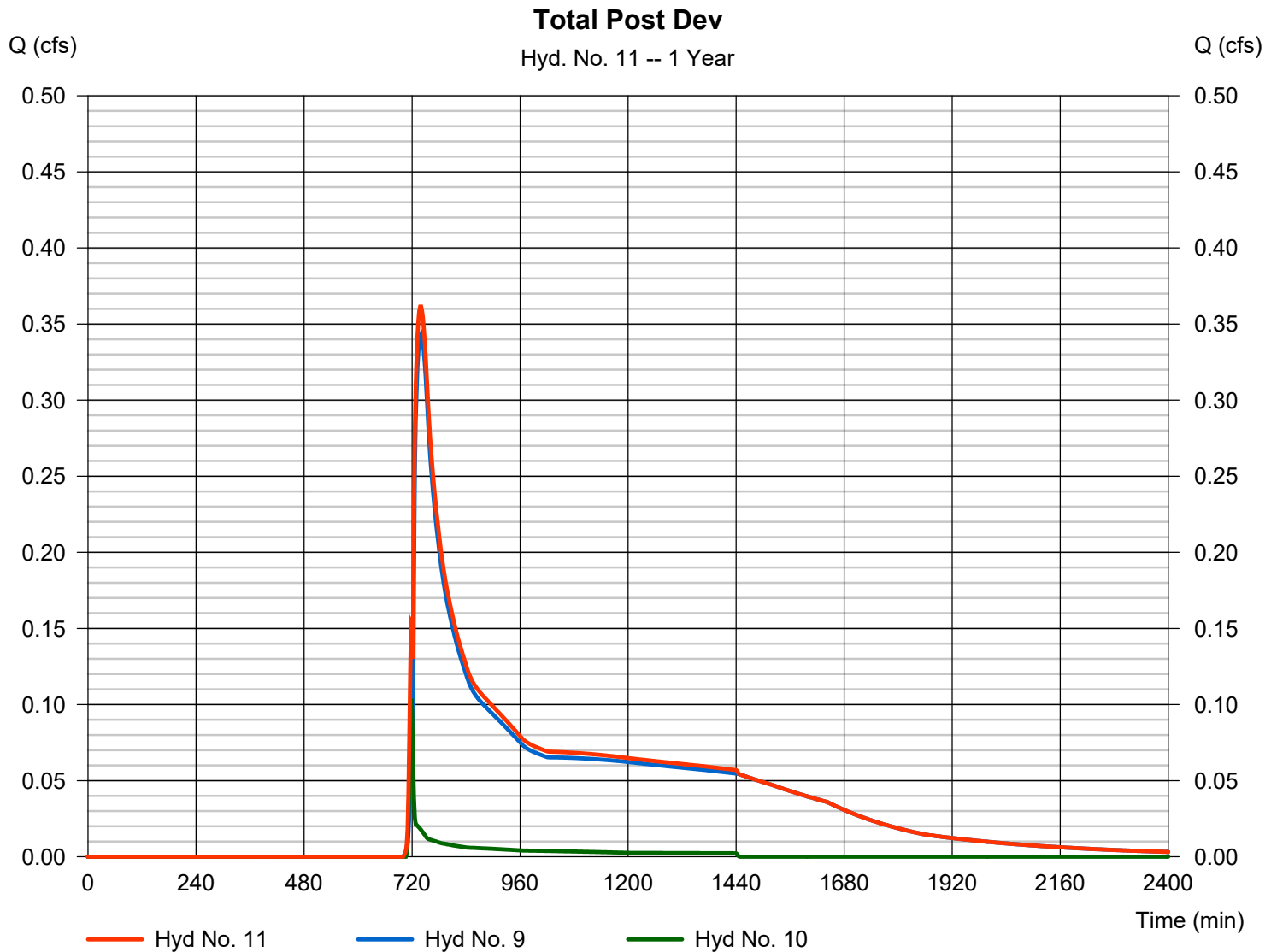
Hydrograph Report

Hyd. No. 11

Total Post Dev

Hydrograph type = Combine
Storm frequency = 1 yrs
Time interval = 2 min
Inflow hyds. = 9, 10

Peak discharge = 0.361 cfs
Time to peak = 738 min
Hyd. volume = 5,402 cuft
Contrib. drain. area = 0.200 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	2.909	2	722	9,193	-----	-----	-----	Pre Dev
2	SCS Runoff	1.735	2	718	3,476	-----	-----	-----	Post Dev-Bed 1
3	Reservoir	0.000	2	n/a	0	2	437.85	3,476	Bed 1 routed
4	SCS Runoff	3.967	2	718	7,991	-----	-----	-----	Post Dev-Bed 2
5	Combine	3.967	2	718	7,991	3, 4	-----	-----	Total to Bed 2
6	Reservoir	0.000	2	n/a	0	5	432.67	7,991	Bed 2 Routed
7	SCS Runoff	3.886	2	718	7,829	-----	-----	-----	Post Dev-Bed 3
8	Combine	3.886	2	718	7,829	6, 7	-----	-----	Total to Bed 3
9	Reservoir	1.612	2	724	7,808	8	420.77	2,351	Bed 3 Routed
10	SCS Runoff	0.196	2	718	422	-----	-----	-----	Bypass
11	Combine	1.714	2	722	8,230	9, 10	-----	-----	Total Post Dev
POI-A-Hydro.gpw					Return Period: 2 Year			Sunday, 05 / 14 / 2023	

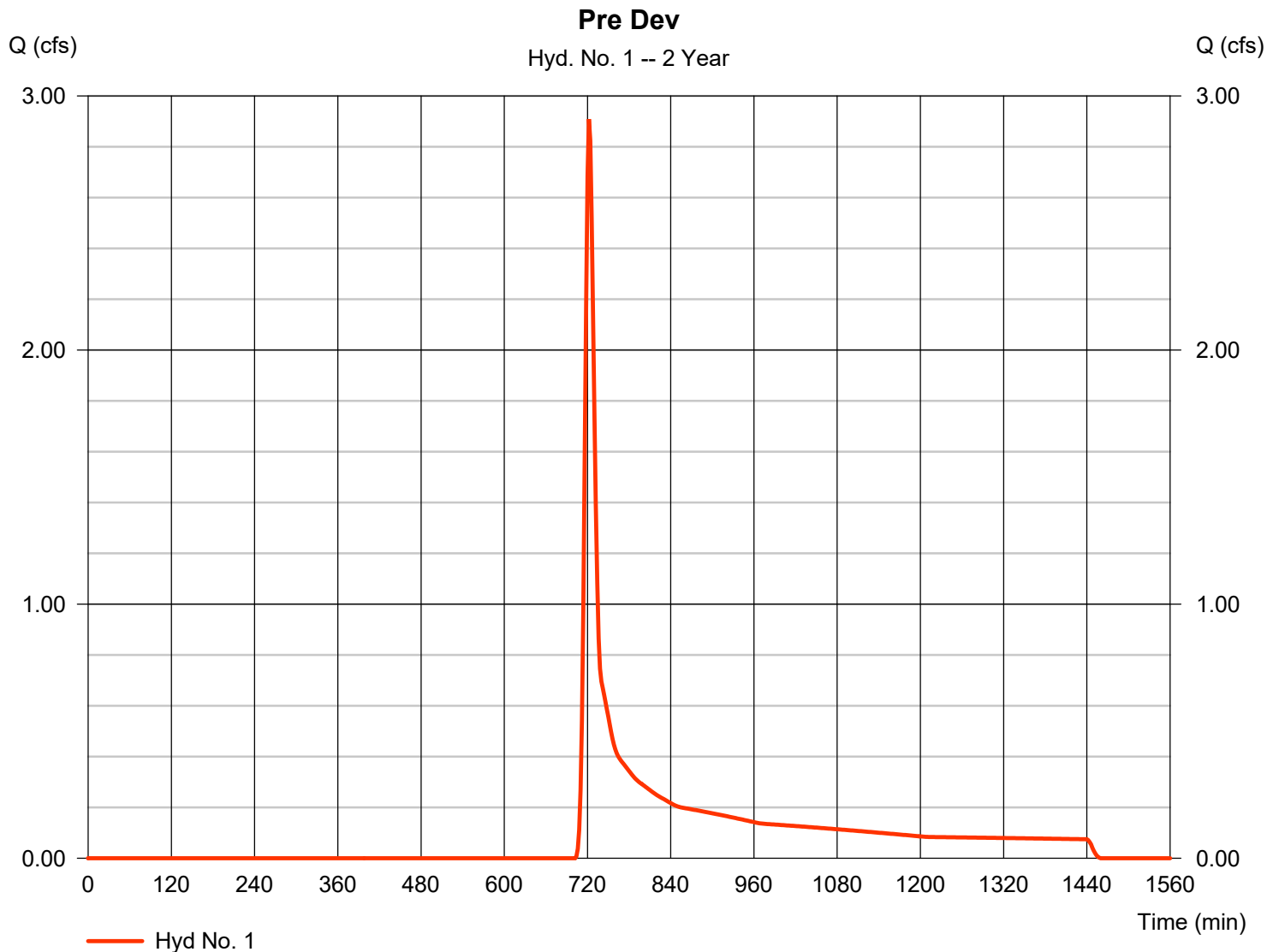
Hydrograph Report

Hyd. No. 1

Pre Dev

Hydrograph type	= SCS Runoff	Peak discharge	= 2.909 cfs
Storm frequency	= 2 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 9,193 cuft
Drainage area	= 4.250 ac	Curve number	= 64*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.10 min
Total precip.	= 3.24 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.650 x 98) + (3.600 x 58)] / 4.250



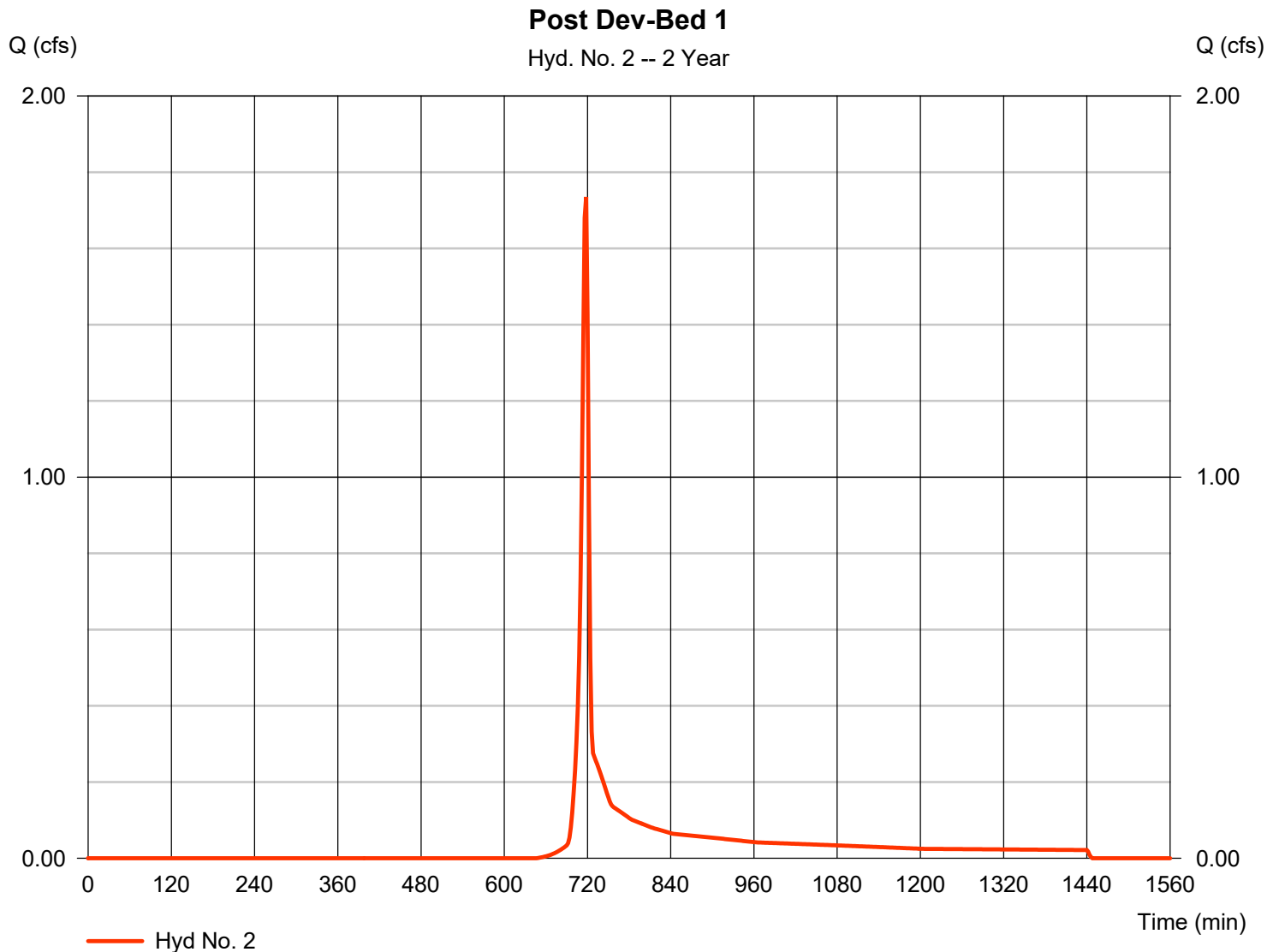
Hydrograph Report

Hyd. No. 2

Post Dev-Bed 1

Hydrograph type	= SCS Runoff	Peak discharge	= 1.735 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 3,476 cuft
Drainage area	= 0.960 ac	Curve number	= 74*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.24 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = $[(0.340 \times 98) + (0.620 \times 61)] / 0.960$



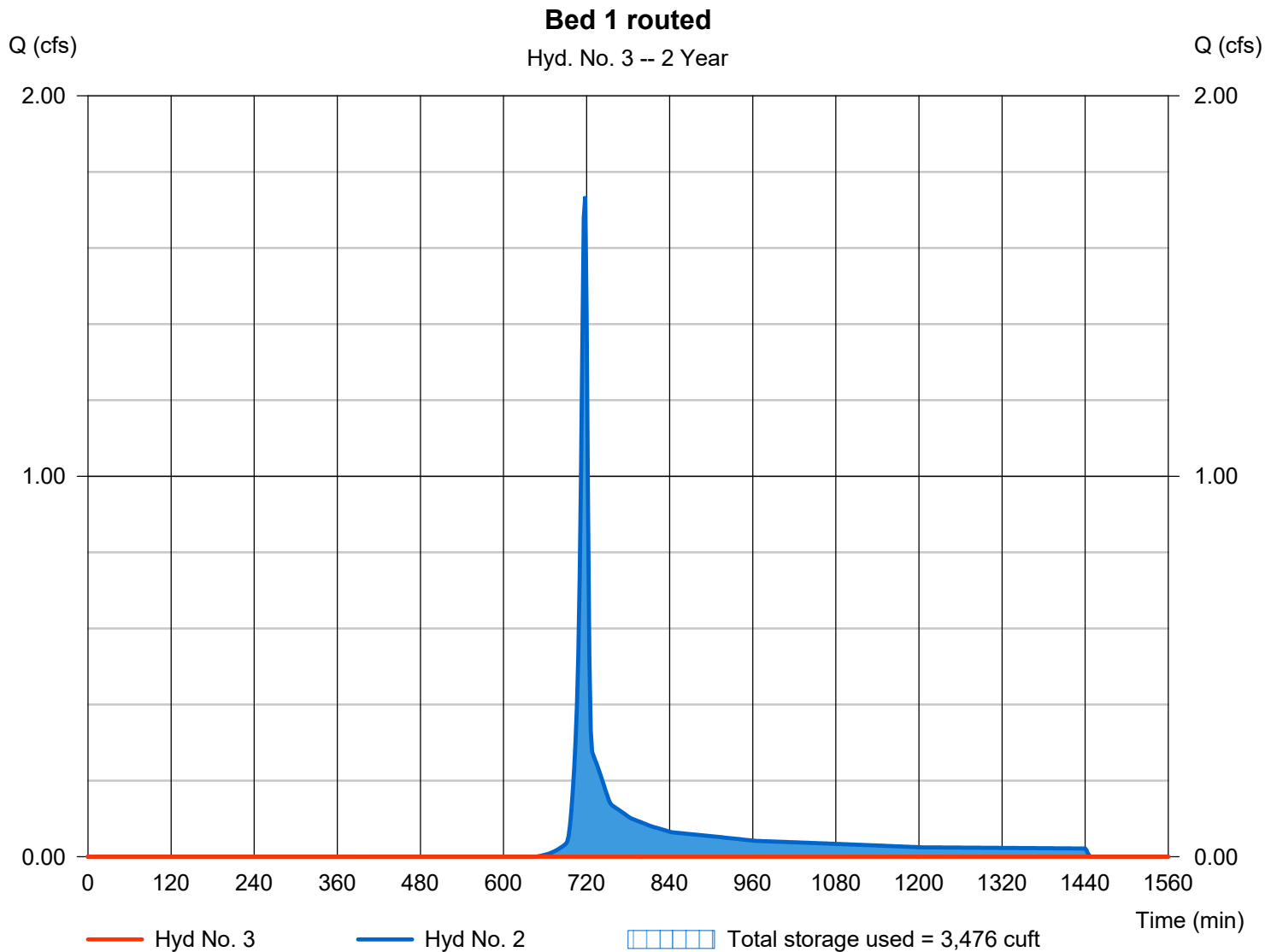
Hydrograph Report

Hyd. No. 3

Bed 1 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.	= 2 - Post Dev-Bed 1	Max. Elevation	= 437.85 ft
Reservoir name	= Bed 1	Max. Storage	= 3,476 cuft

Storage Indication method used.



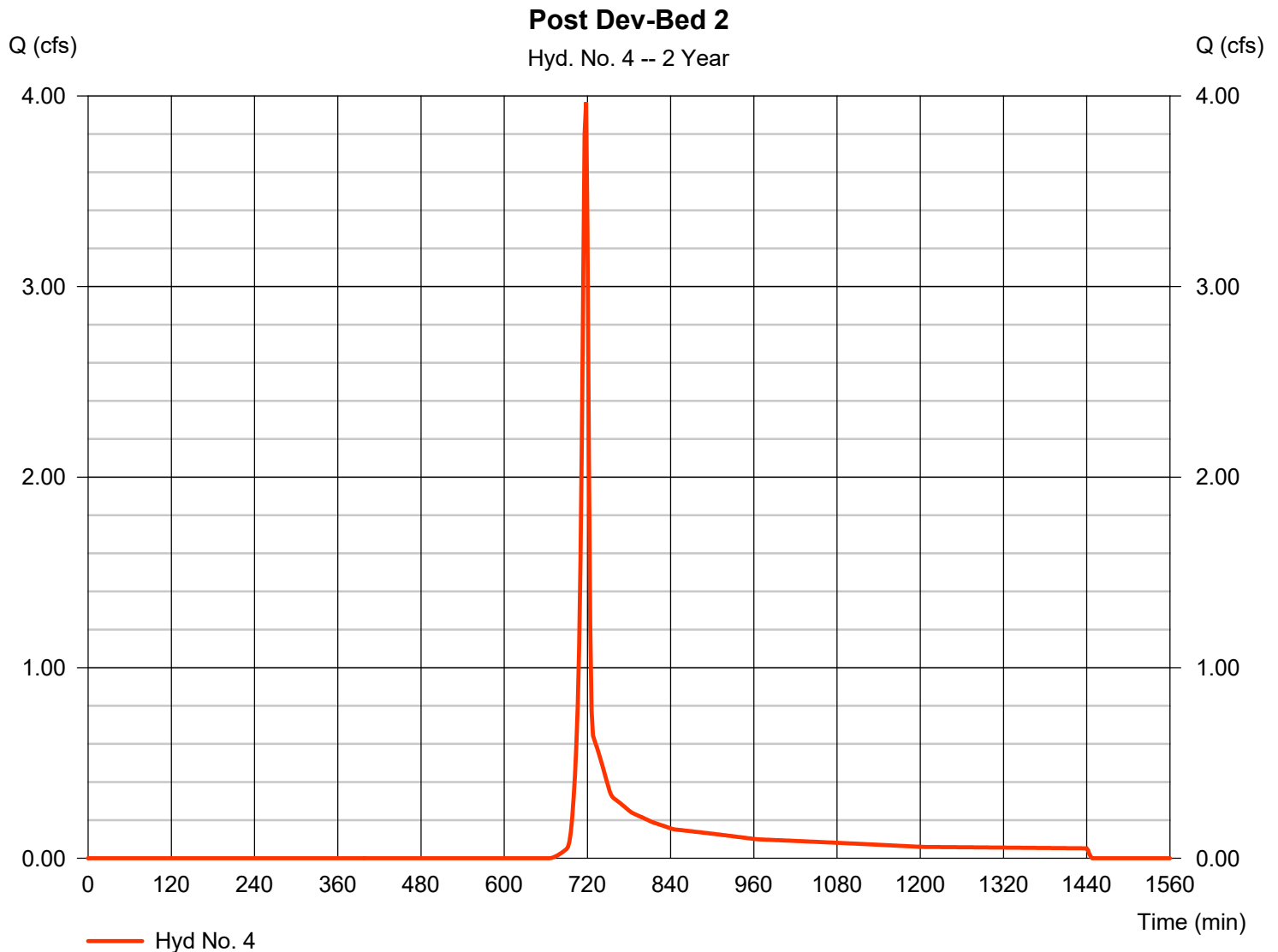
Hydrograph Report

Hyd. No. 4

Post Dev-Bed 2

Hydrograph type	= SCS Runoff	Peak discharge	= 3.967 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 7,991 cuft
Drainage area	= 2.460 ac	Curve number	= 72*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.24 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = $[(0.740 \times 98) + (1.720 \times 61)] / 2.460$



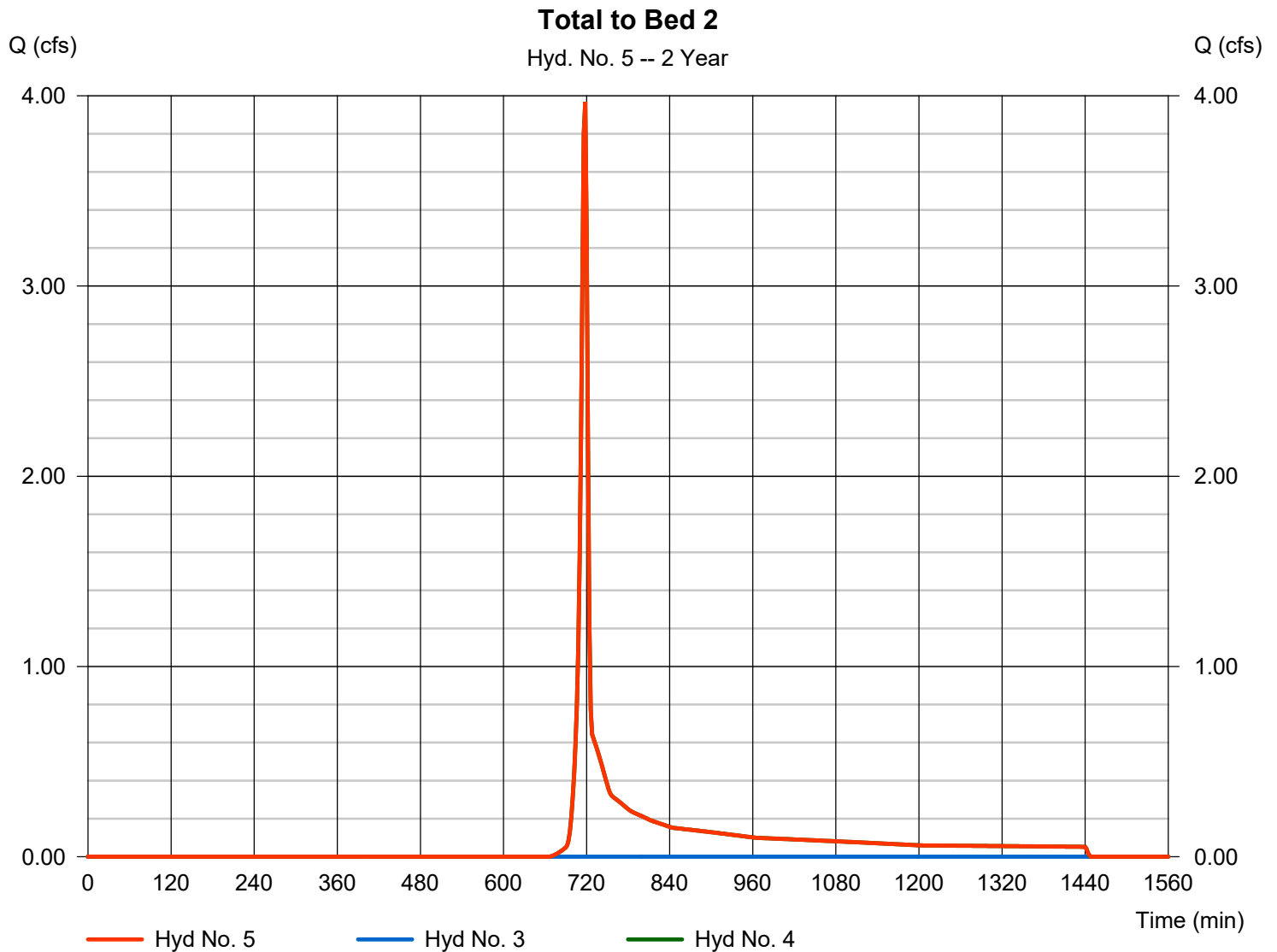
Hydrograph Report

Hyd. No. 5

Total to Bed 2

Hydrograph type = Combine
Storm frequency = 2 yrs
Time interval = 2 min
Inflow hyds. = 3, 4

Peak discharge = 3.967 cfs
Time to peak = 718 min
Hyd. volume = 7,991 cuft
Contrib. drain. area = 2.460 ac



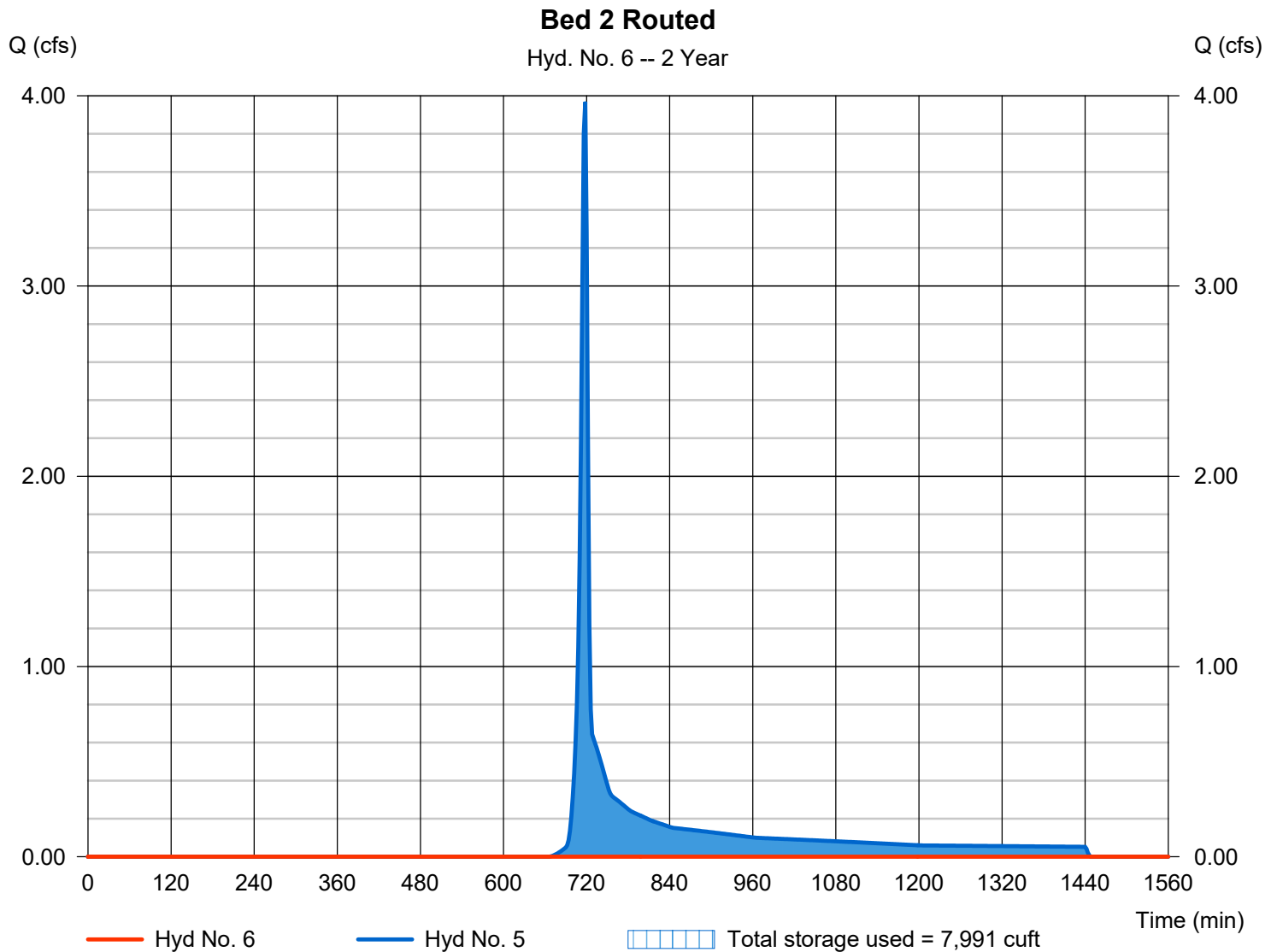
Hydrograph Report

Hyd. No. 6

Bed 2 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 - Total to Bed 2	Max. Elevation	= 432.67 ft
Reservoir name	= Bed 2	Max. Storage	= 7,991 cuft

Storage Indication method used.



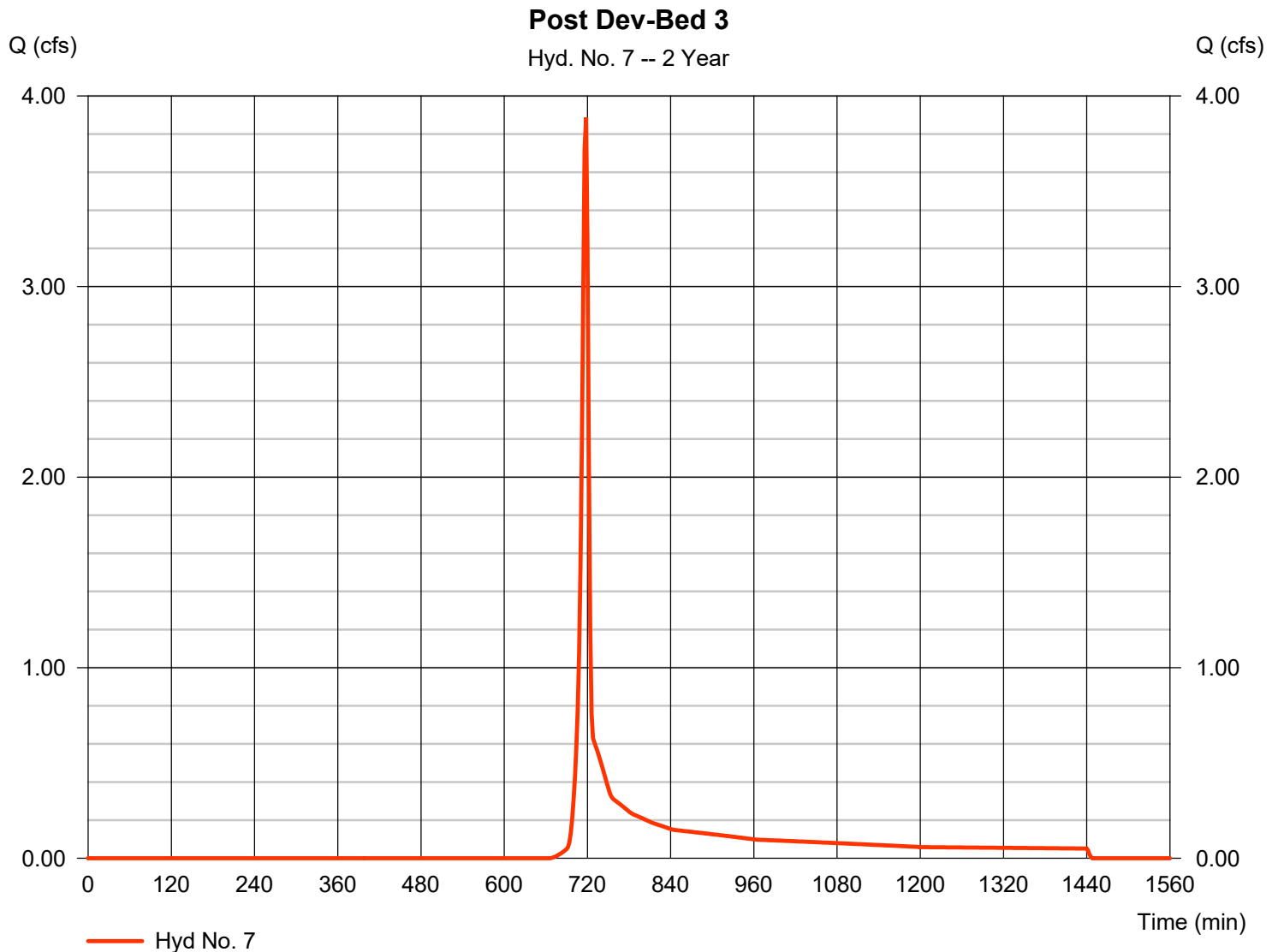
Hydrograph Report

Hyd. No. 7

Post Dev-Bed 3

Hydrograph type	= SCS Runoff	Peak discharge	= 3.886 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 7,829 cuft
Drainage area	= 2.410 ac	Curve number	= 72*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.24 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = $[(0.720 \times 98) + (1.690 \times 61)] / 2.410$



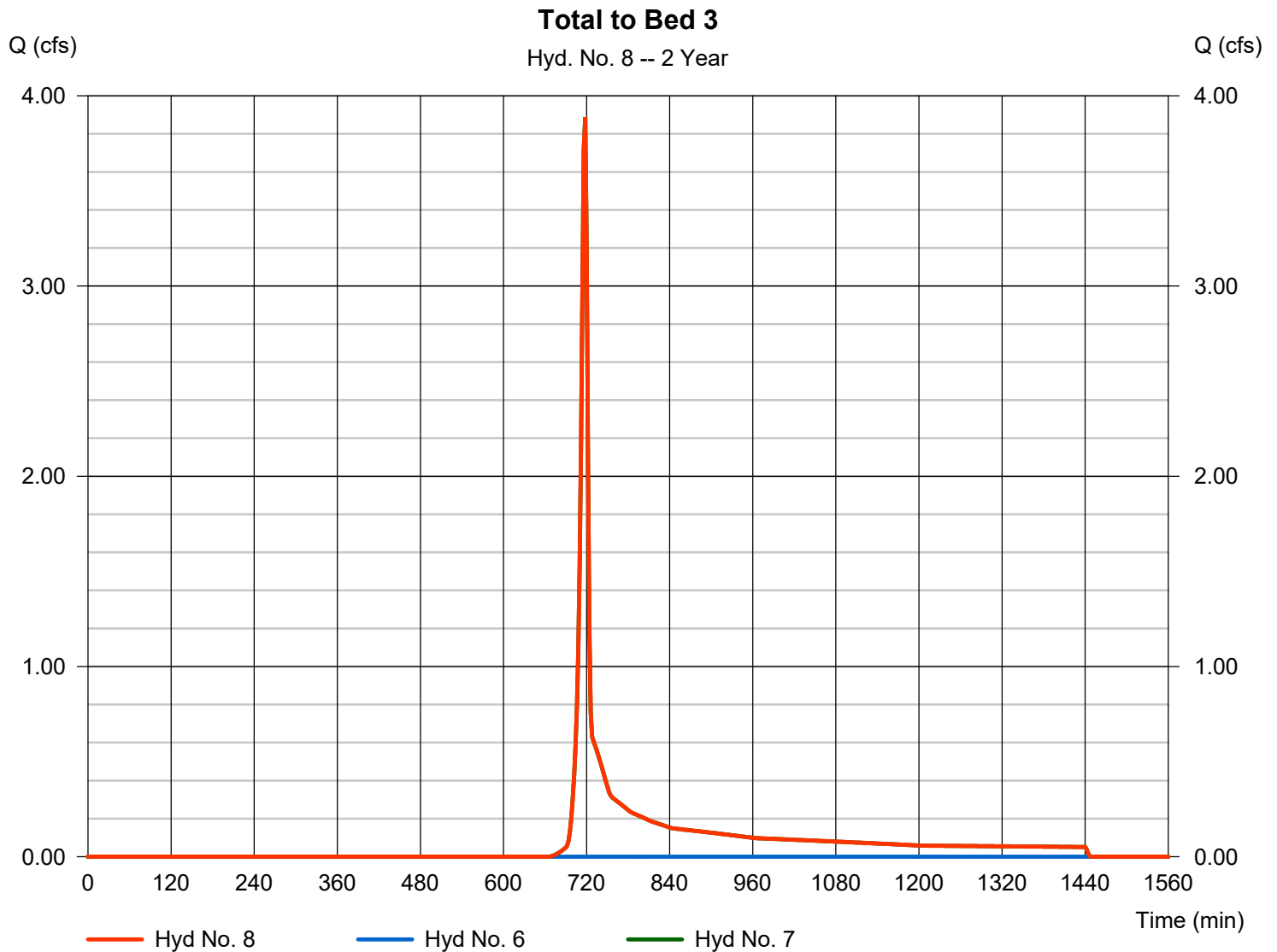
Hydrograph Report

Hyd. No. 8

Total to Bed 3

Hydrograph type = Combine
Storm frequency = 2 yrs
Time interval = 2 min
Inflow hyds. = 6, 7

Peak discharge = 3.886 cfs
Time to peak = 718 min
Hyd. volume = 7,829 cuft
Contrib. drain. area = 2.410 ac



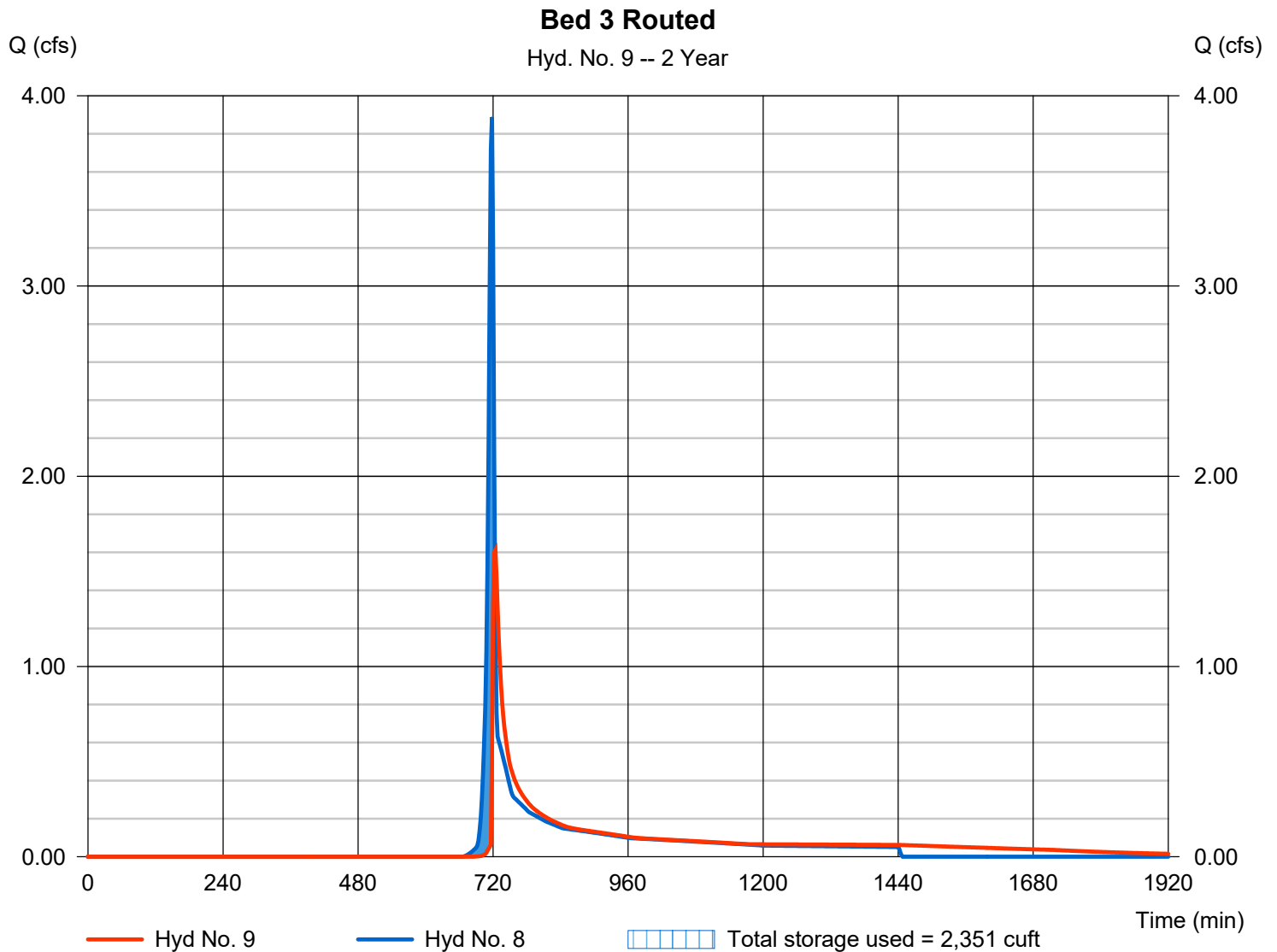
Hydrograph Report

Hyd. No. 9

Bed 3 Routed

Hydrograph type	= Reservoir	Peak discharge	= 1.612 cfs
Storm frequency	= 2 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 7,808 cuft
Inflow hyd. No.	= 8 - Total to Bed 3	Max. Elevation	= 420.77 ft
Reservoir name	= Bed 3	Max. Storage	= 2,351 cuft

Storage Indication method used.

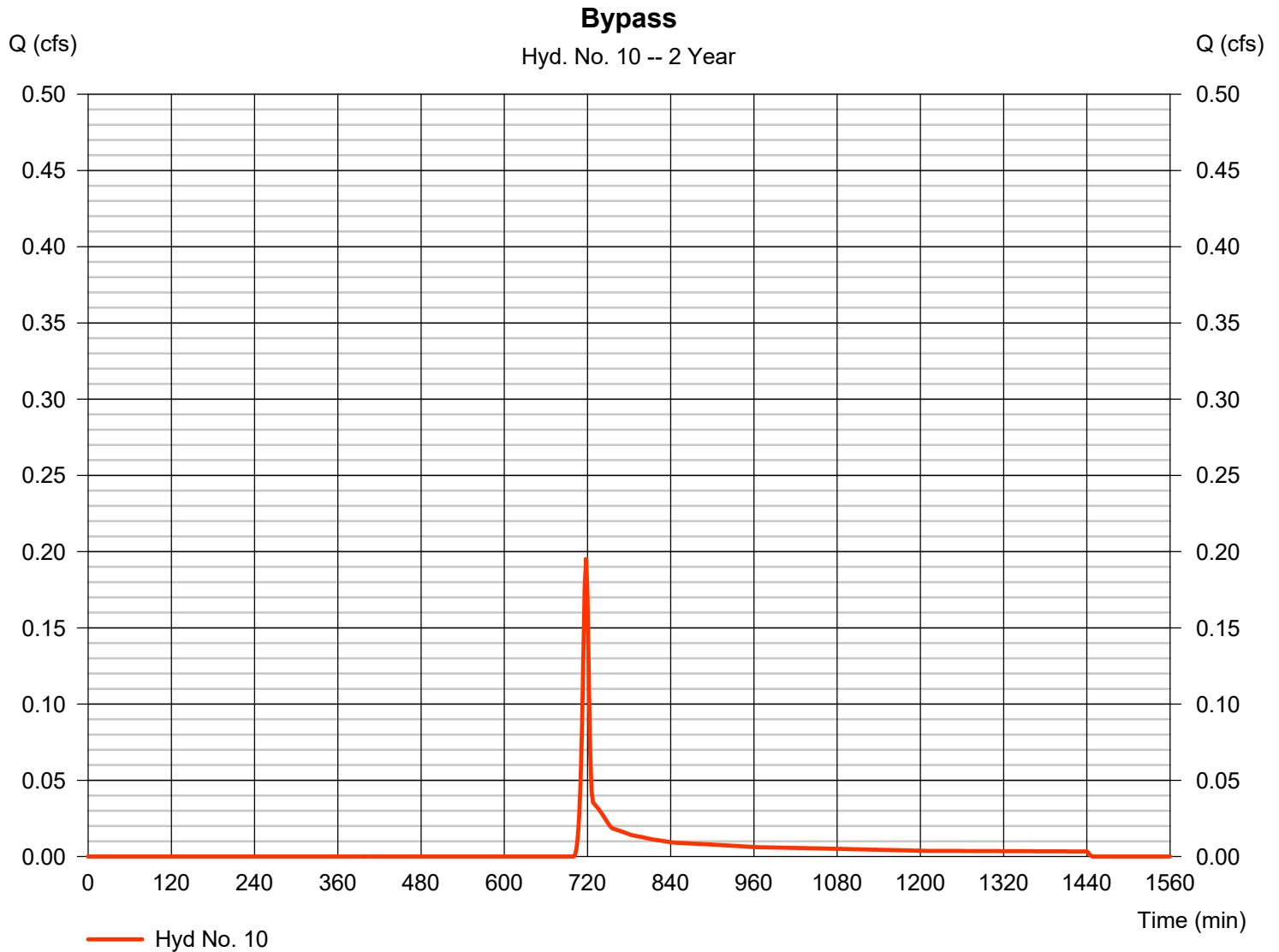


Hydrograph Report

Hyd. No. 10

Bypass

Hydrograph type	= SCS Runoff	Peak discharge	= 0.196 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 422 cuft
Drainage area	= 0.200 ac	Curve number	= 65
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.24 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



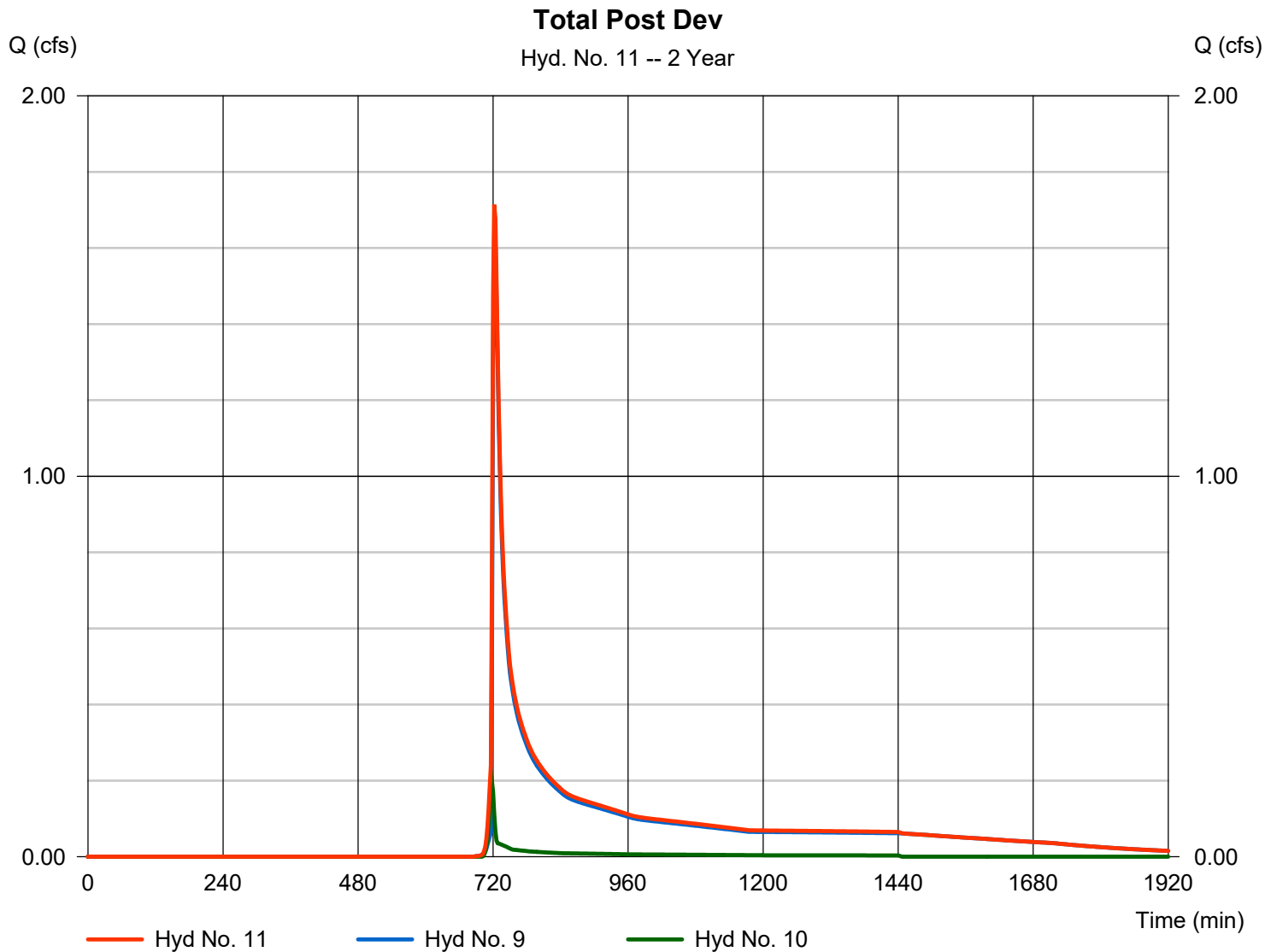
Hydrograph Report

Hyd. No. 11

Total Post Dev

Hydrograph type = Combine
Storm frequency = 2 yrs
Time interval = 2 min
Inflow hyds. = 9, 10

Peak discharge = 1.714 cfs
Time to peak = 722 min
Hyd. volume = 8,230 cuft
Contrib. drain. area = 0.200 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

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	5.703	2	722	16,010	-----	-----	-----	Pre Dev
2	SCS Runoff	2.677	2	718	5,359	-----	-----	-----	Post Dev-Bed 1
3	Reservoir	0.000	2	n/a	0	2	438.32	5,359	Bed 1 routed
4	SCS Runoff	6.289	2	718	12,577	-----	-----	-----	Post Dev-Bed 2
5	Combine	6.289	2	718	12,577	3, 4	-----	-----	Total to Bed 2
6	Reservoir	0.082	2	1266	1,525	5	433.62	11,450	Bed 2 Routed
7	SCS Runoff	6.161	2	718	12,321	-----	-----	-----	Post Dev-Bed 3
8	Combine	6.161	2	718	13,846	6, 7	-----	-----	Total to Bed 3
9	Reservoir	3.203	2	722	13,824	8	421.13	3,474	Bed 3 Routed
10	SCS Runoff	0.356	2	718	724	-----	-----	-----	Bypass
11	Combine	3.399	2	722	14,548	9, 10	-----	-----	Total Post Dev
POI-A-Hydro.gpw					Return Period: 5 Year			Sunday, 05 / 14 / 2023	

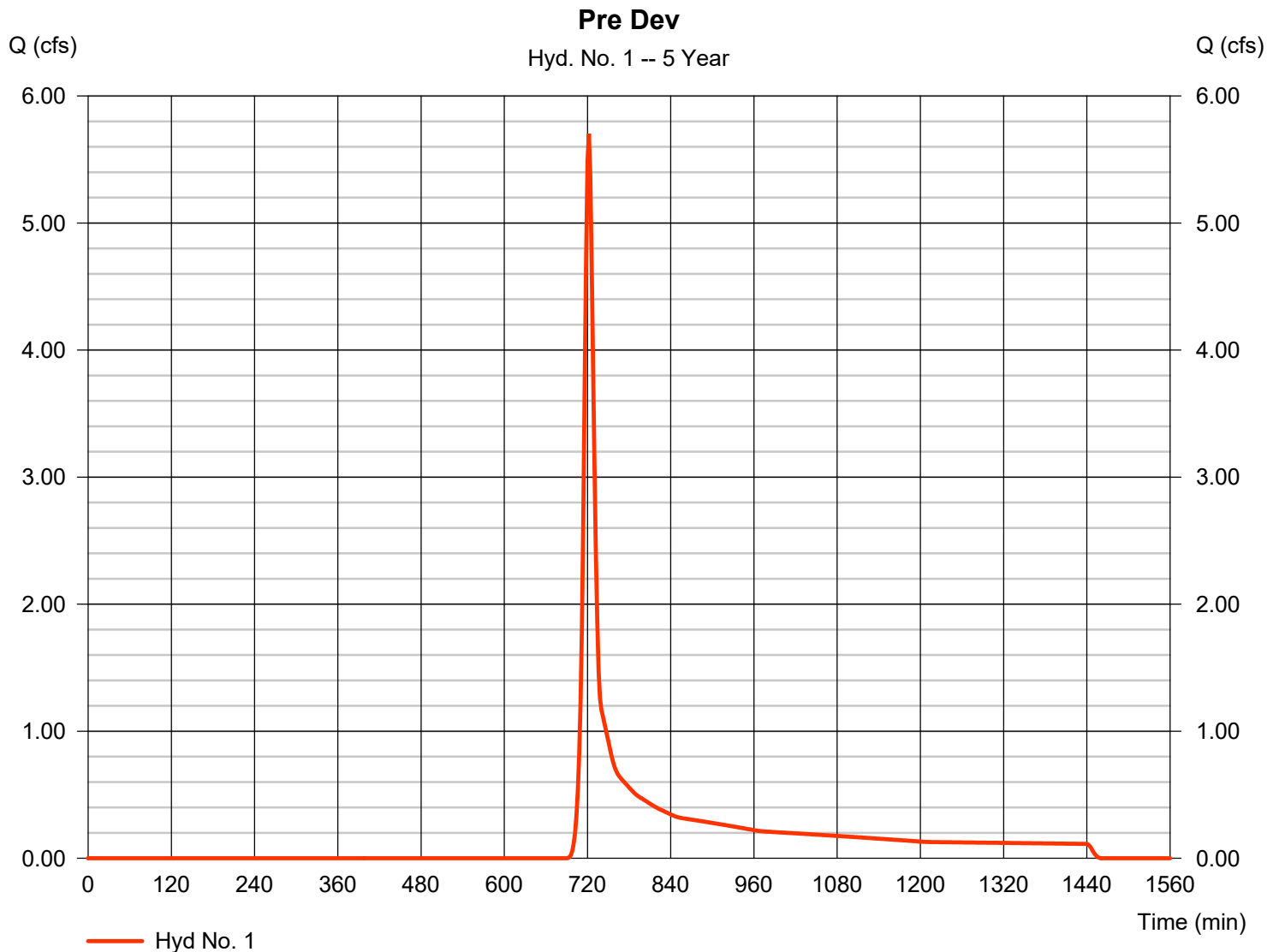
Hydrograph Report

Hyd. No. 1

Pre Dev

Hydrograph type	= SCS Runoff	Peak discharge	= 5.703 cfs
Storm frequency	= 5 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 16,010 cuft
Drainage area	= 4.250 ac	Curve number	= 64*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.10 min
Total precip.	= 4.06 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.650 x 98) + (3.600 x 58)] / 4.250



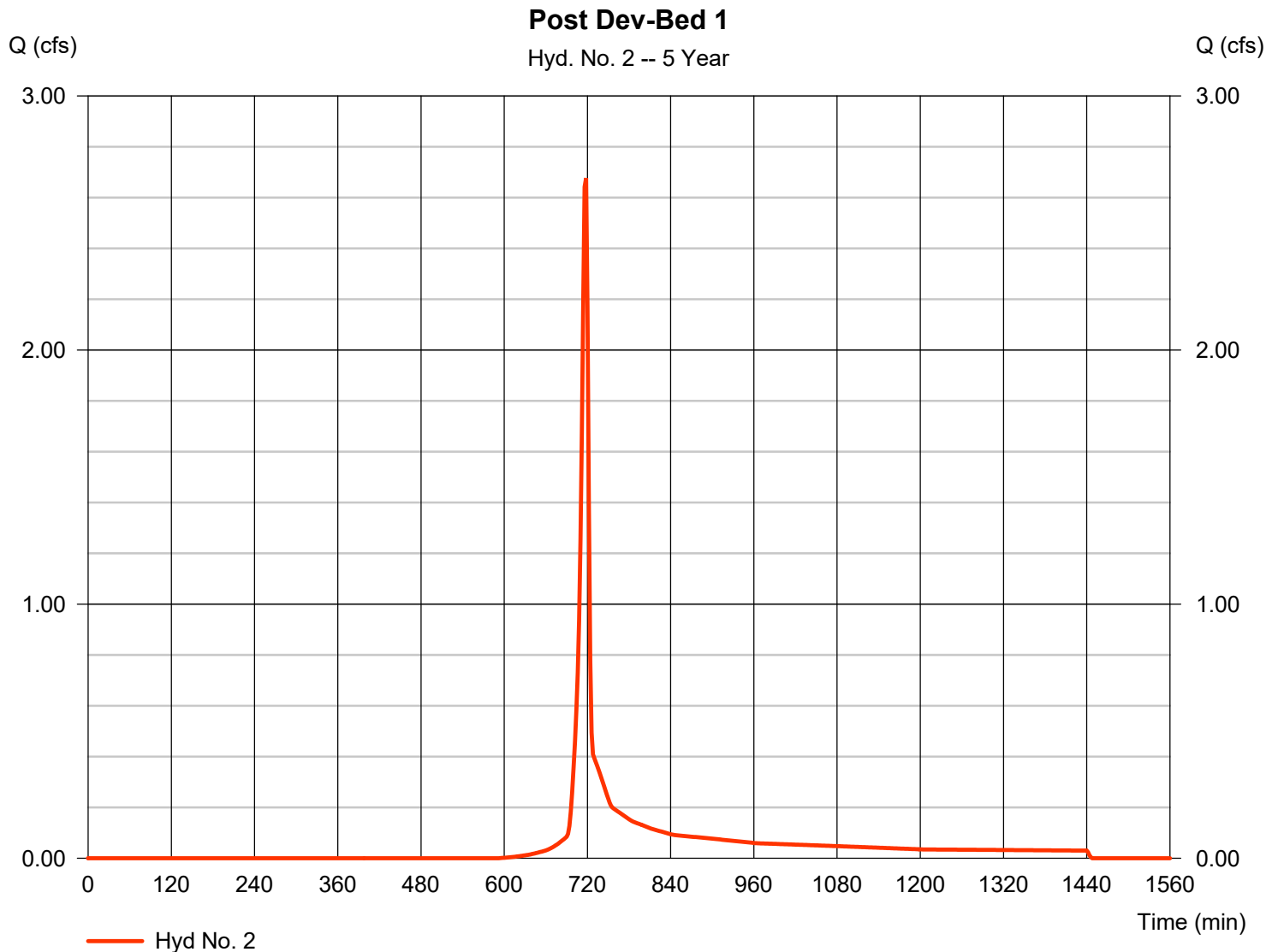
Hydrograph Report

Hyd. No. 2

Post Dev-Bed 1

Hydrograph type	= SCS Runoff	Peak discharge	= 2.677 cfs
Storm frequency	= 5 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 5,359 cuft
Drainage area	= 0.960 ac	Curve number	= 74*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.06 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = $[(0.340 \times 98) + (0.620 \times 61)] / 0.960$



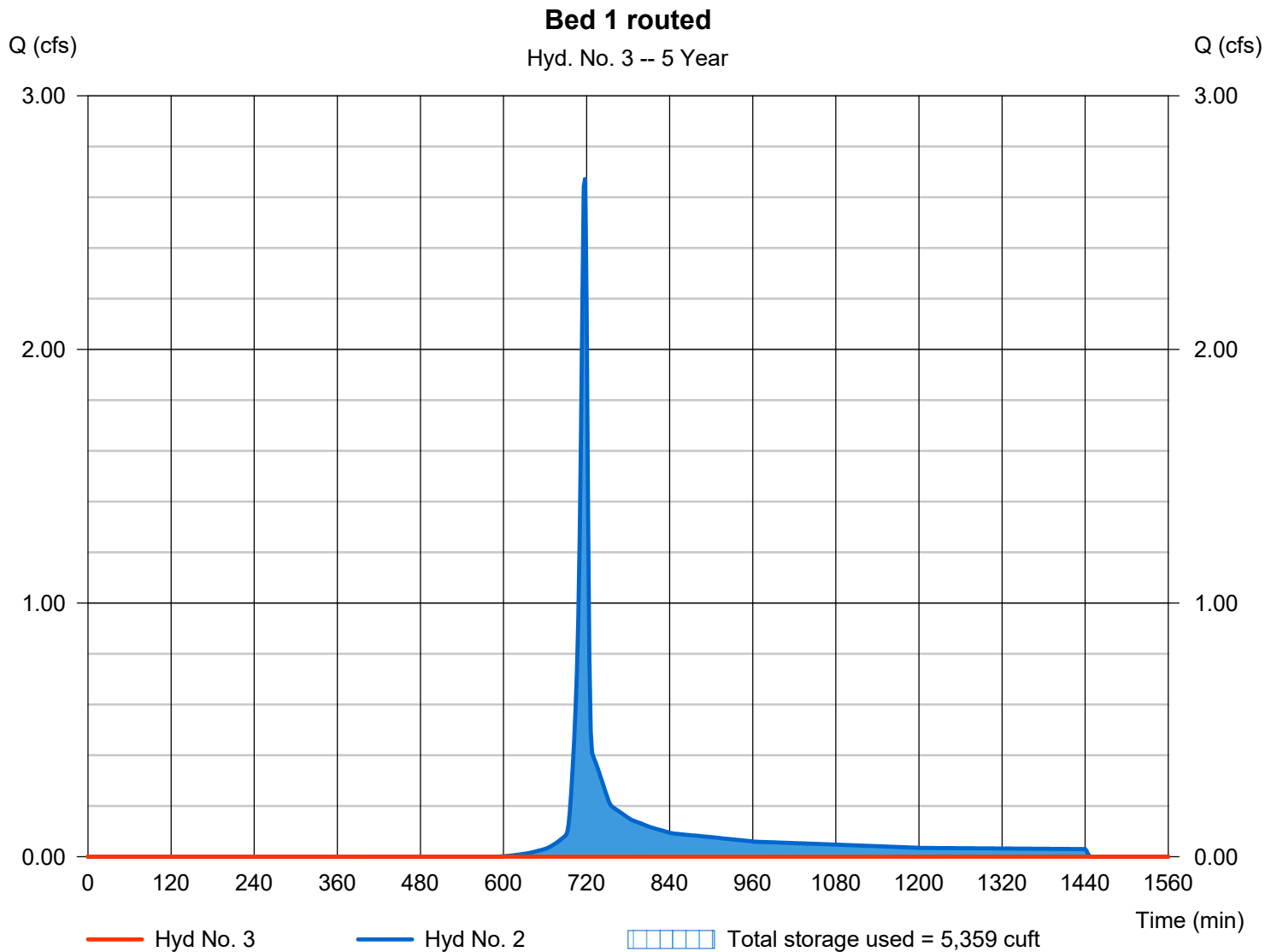
Hydrograph Report

Hyd. No. 3

Bed 1 routed

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 5 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 2 - Post Dev-Bed 1	Max. Elevation	= 438.32 ft
Reservoir name	= Bed 1	Max. Storage	= 5,359 cuft

Storage Indication method used.



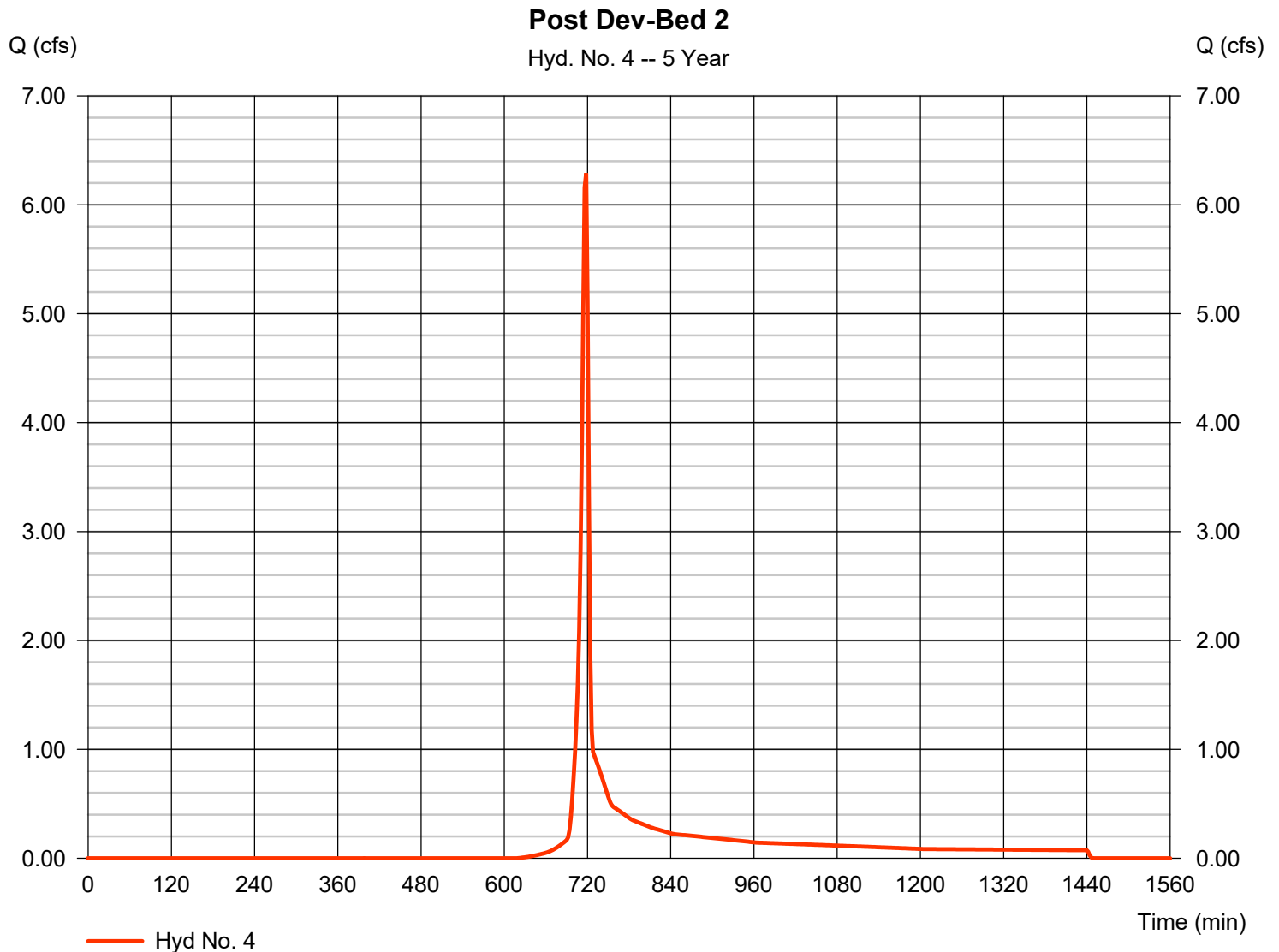
Hydrograph Report

Hyd. No. 4

Post Dev-Bed 2

Hydrograph type	= SCS Runoff	Peak discharge	= 6.289 cfs
Storm frequency	= 5 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 12,577 cuft
Drainage area	= 2.460 ac	Curve number	= 72*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.06 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = $[(0.740 \times 98) + (1.720 \times 61)] / 2.460$



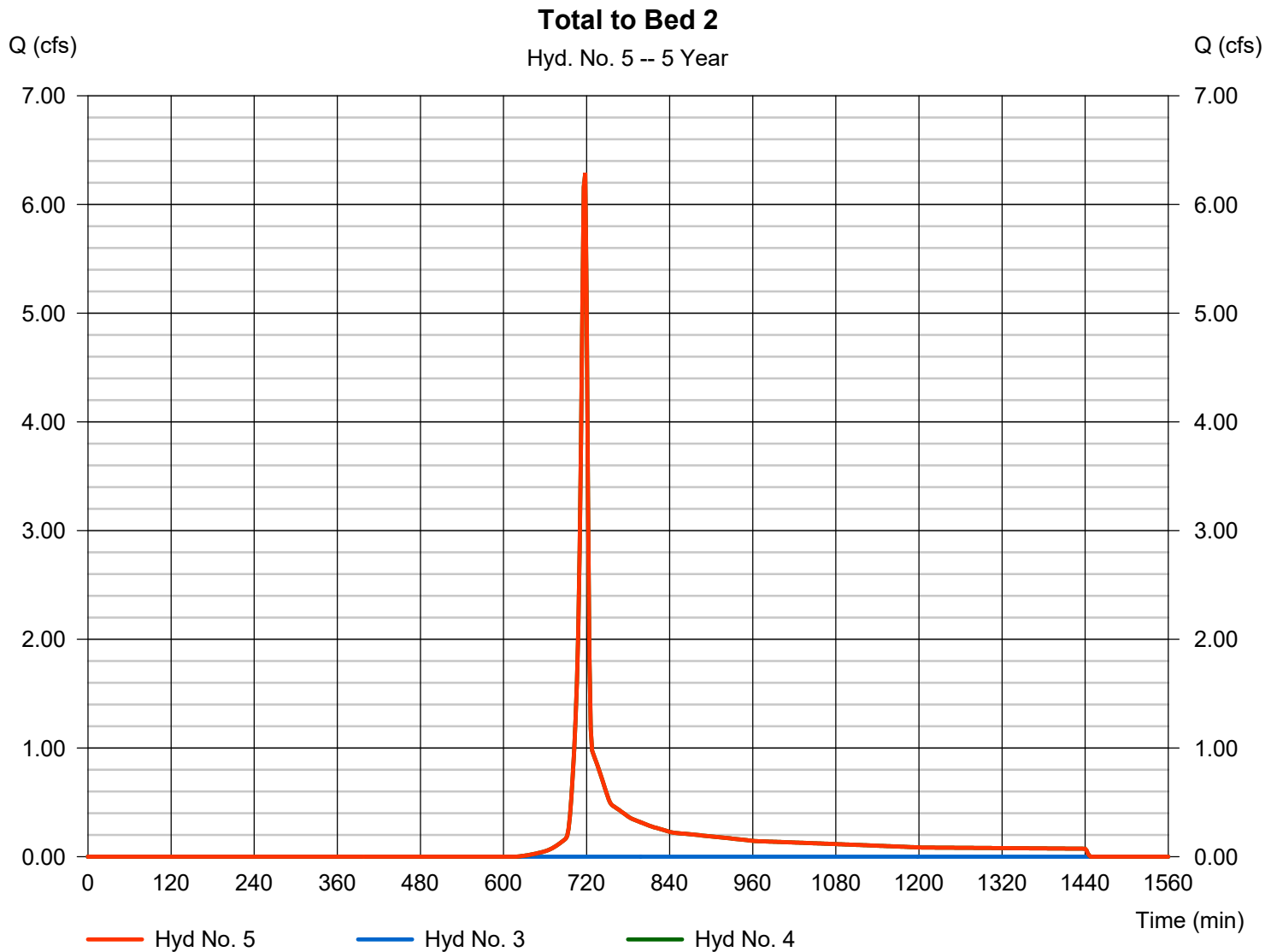
Hydrograph Report

Hyd. No. 5

Total to Bed 2

Hydrograph type = Combine
Storm frequency = 5 yrs
Time interval = 2 min
Inflow hyds. = 3, 4

Peak discharge = 6.289 cfs
Time to peak = 718 min
Hyd. volume = 12,577 cuft
Contrib. drain. area = 2.460 ac



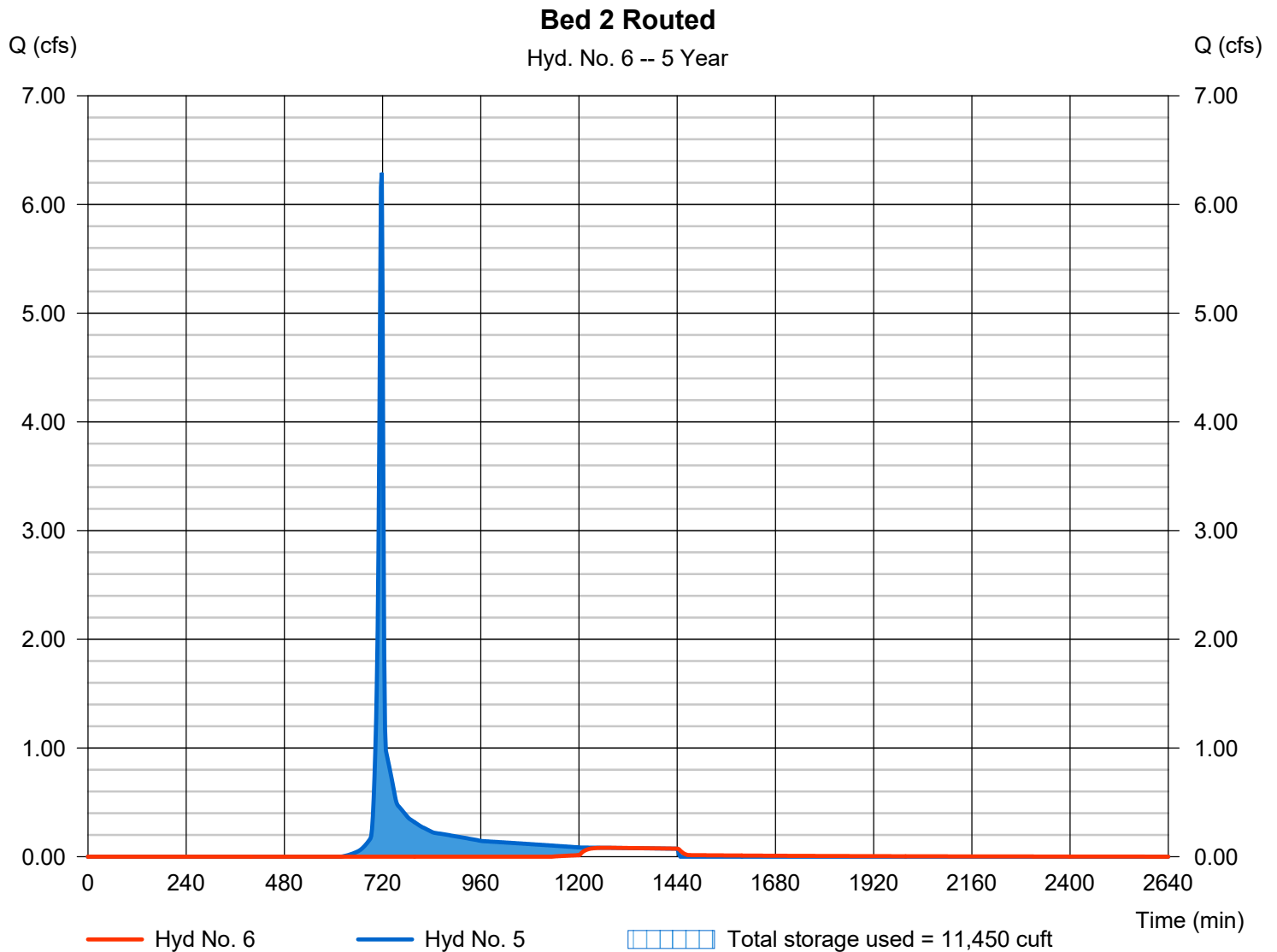
Hydrograph Report

Hyd. No. 6

Bed 2 Routed

Hydrograph type	= Reservoir	Peak discharge	= 0.082 cfs
Storm frequency	= 5 yrs	Time to peak	= 1266 min
Time interval	= 2 min	Hyd. volume	= 1,525 cuft
Inflow hyd. No.	= 5 - Total to Bed 2	Max. Elevation	= 433.62 ft
Reservoir name	= Bed 2	Max. Storage	= 11,450 cuft

Storage Indication method used.



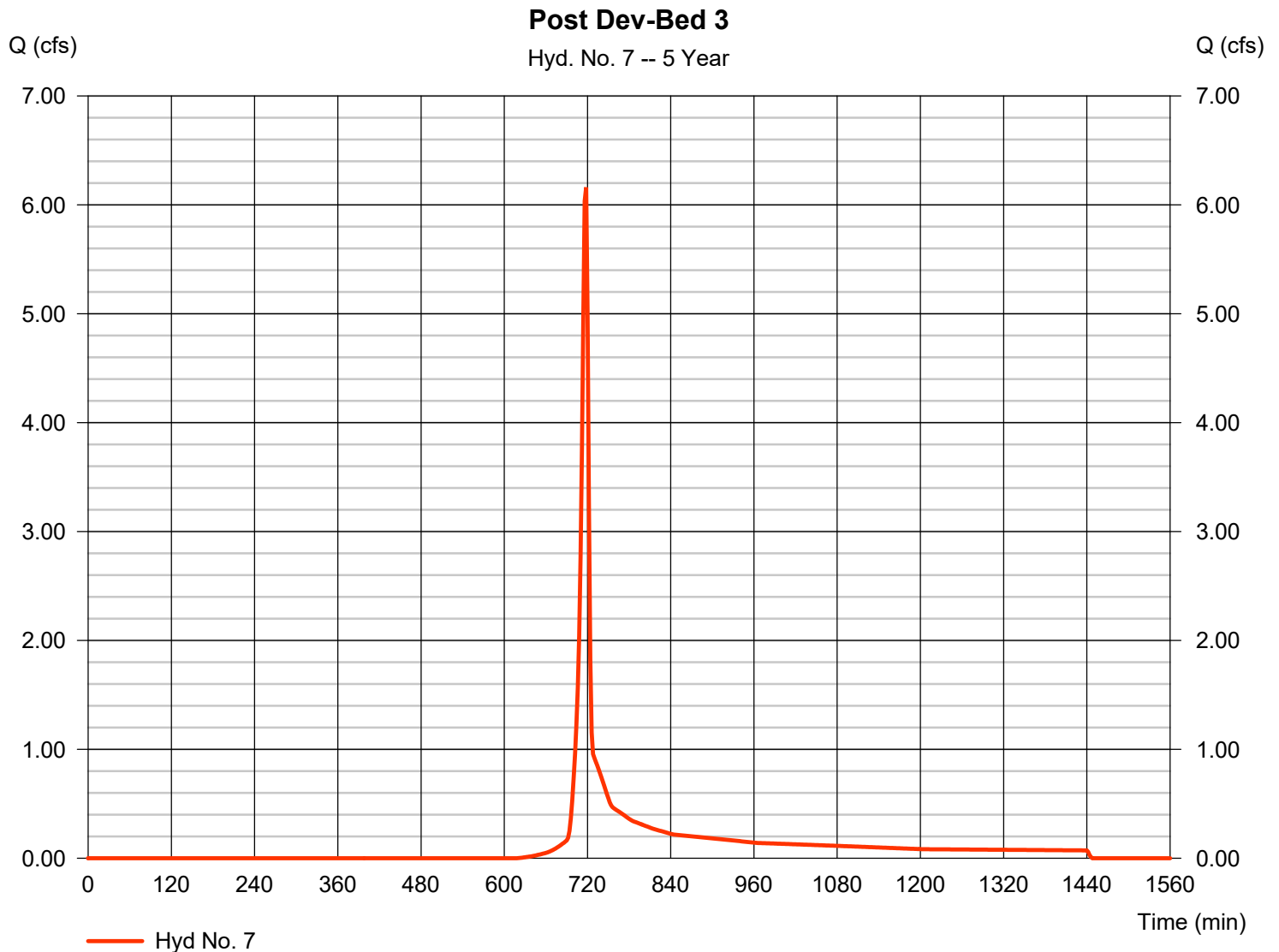
Hydrograph Report

Hyd. No. 7

Post Dev-Bed 3

Hydrograph type	= SCS Runoff	Peak discharge	= 6.161 cfs
Storm frequency	= 5 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 12,321 cuft
Drainage area	= 2.410 ac	Curve number	= 72*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.06 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = $[(0.720 \times 98) + (1.690 \times 61)] / 2.410$



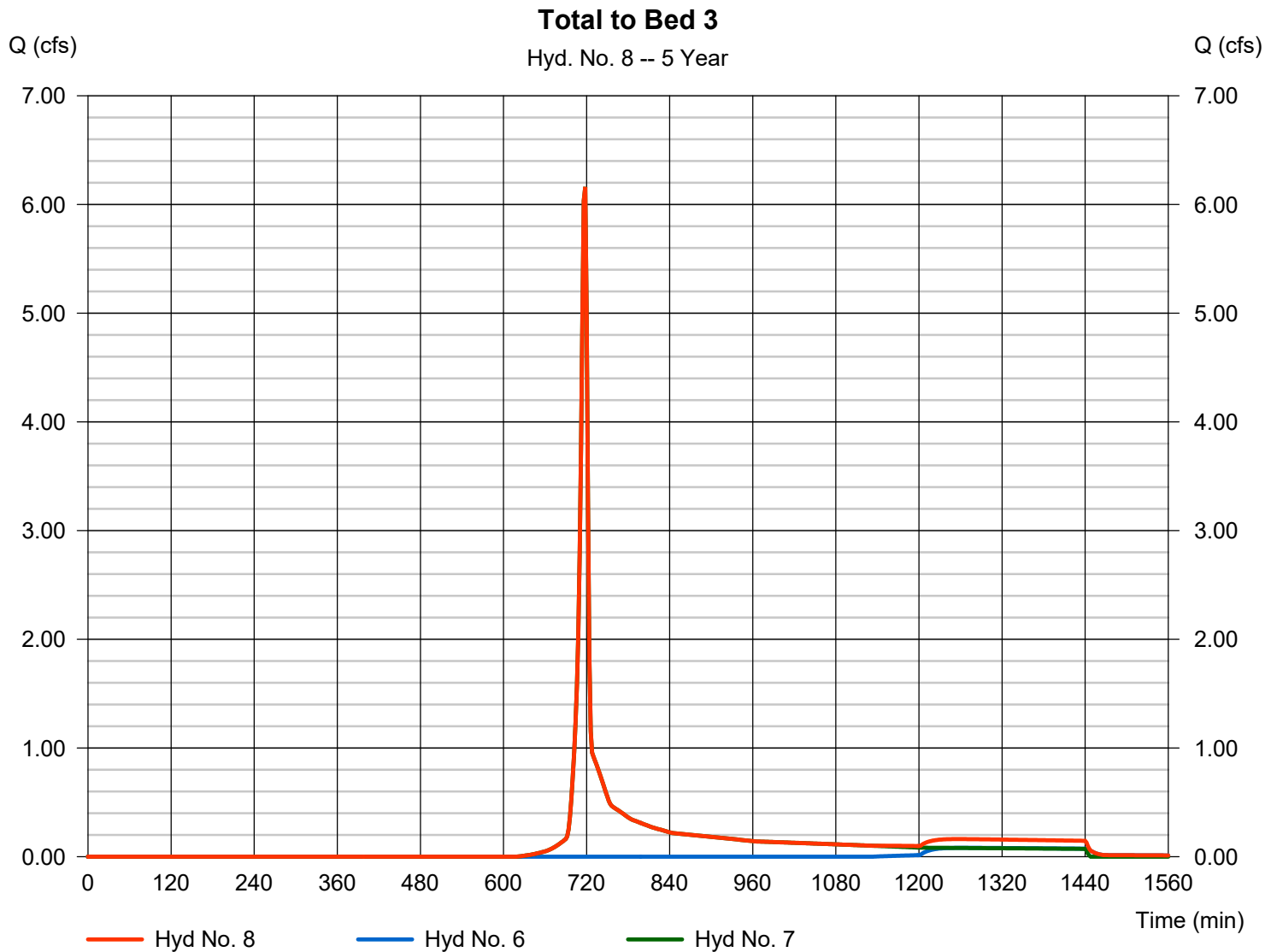
Hydrograph Report

Hyd. No. 8

Total to Bed 3

Hydrograph type = Combine
Storm frequency = 5 yrs
Time interval = 2 min
Inflow hyds. = 6, 7

Peak discharge = 6.161 cfs
Time to peak = 718 min
Hyd. volume = 13,846 cuft
Contrib. drain. area = 2.410 ac



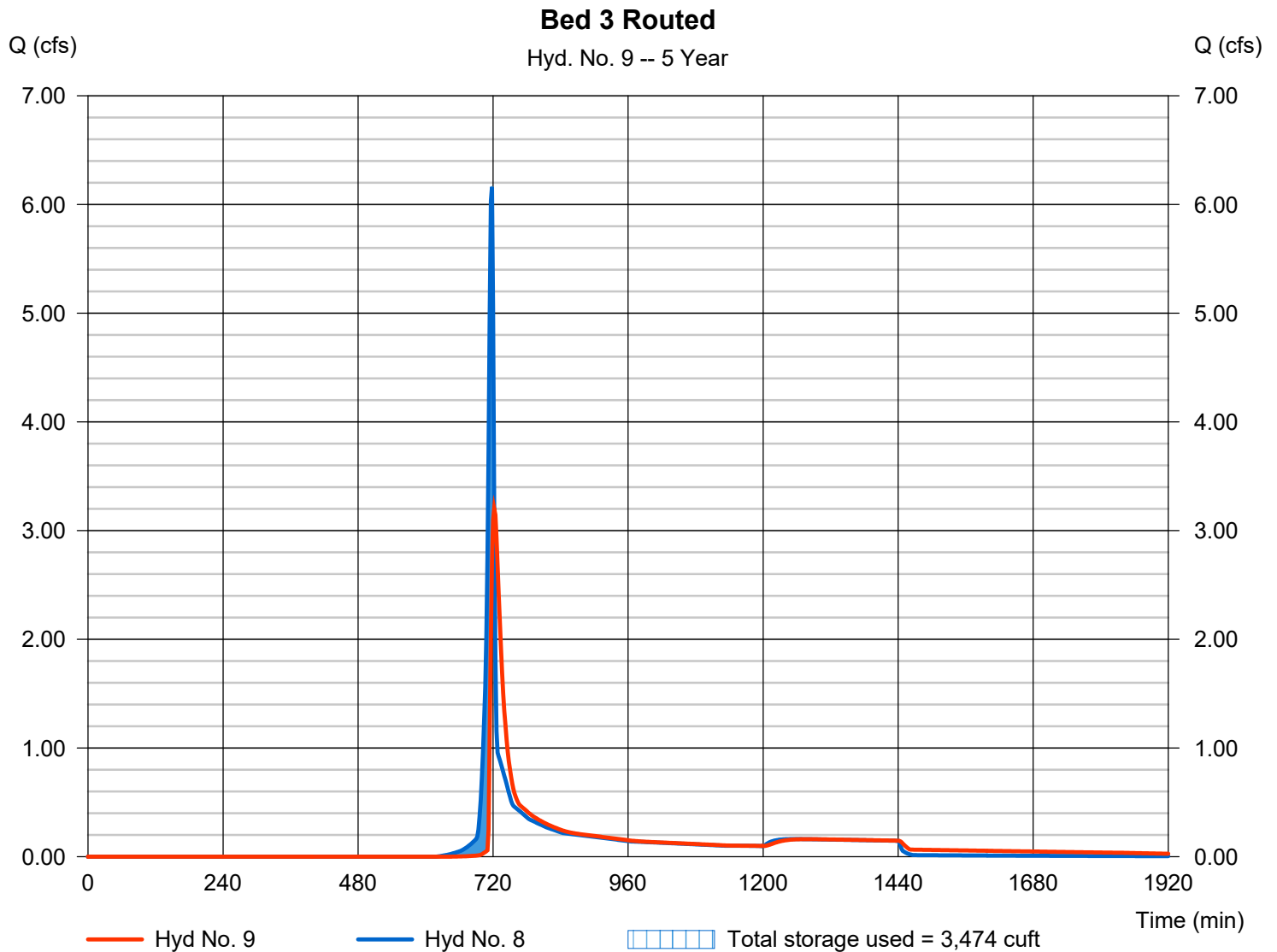
Hydrograph Report

Hyd. No. 9

Bed 3 Routed

Hydrograph type	= Reservoir	Peak discharge	= 3.203 cfs
Storm frequency	= 5 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 13,824 cuft
Inflow hyd. No.	= 8 - Total to Bed 3	Max. Elevation	= 421.13 ft
Reservoir name	= Bed 3	Max. Storage	= 3,474 cuft

Storage Indication method used.

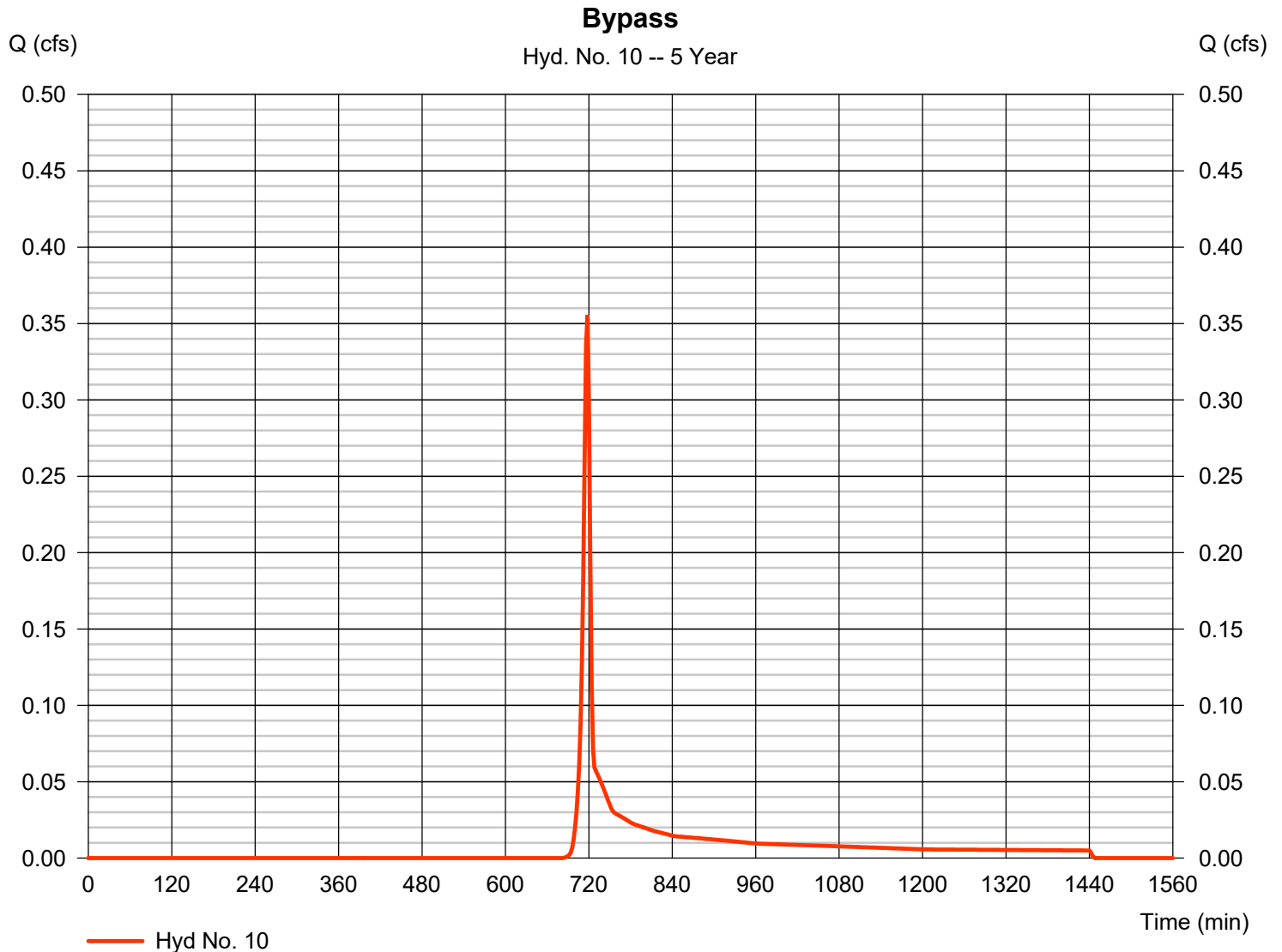


Hydrograph Report

Hyd. No. 10

Bypass

Hydrograph type	= SCS Runoff	Peak discharge	= 0.356 cfs
Storm frequency	= 5 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 724 cuft
Drainage area	= 0.200 ac	Curve number	= 65
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.06 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



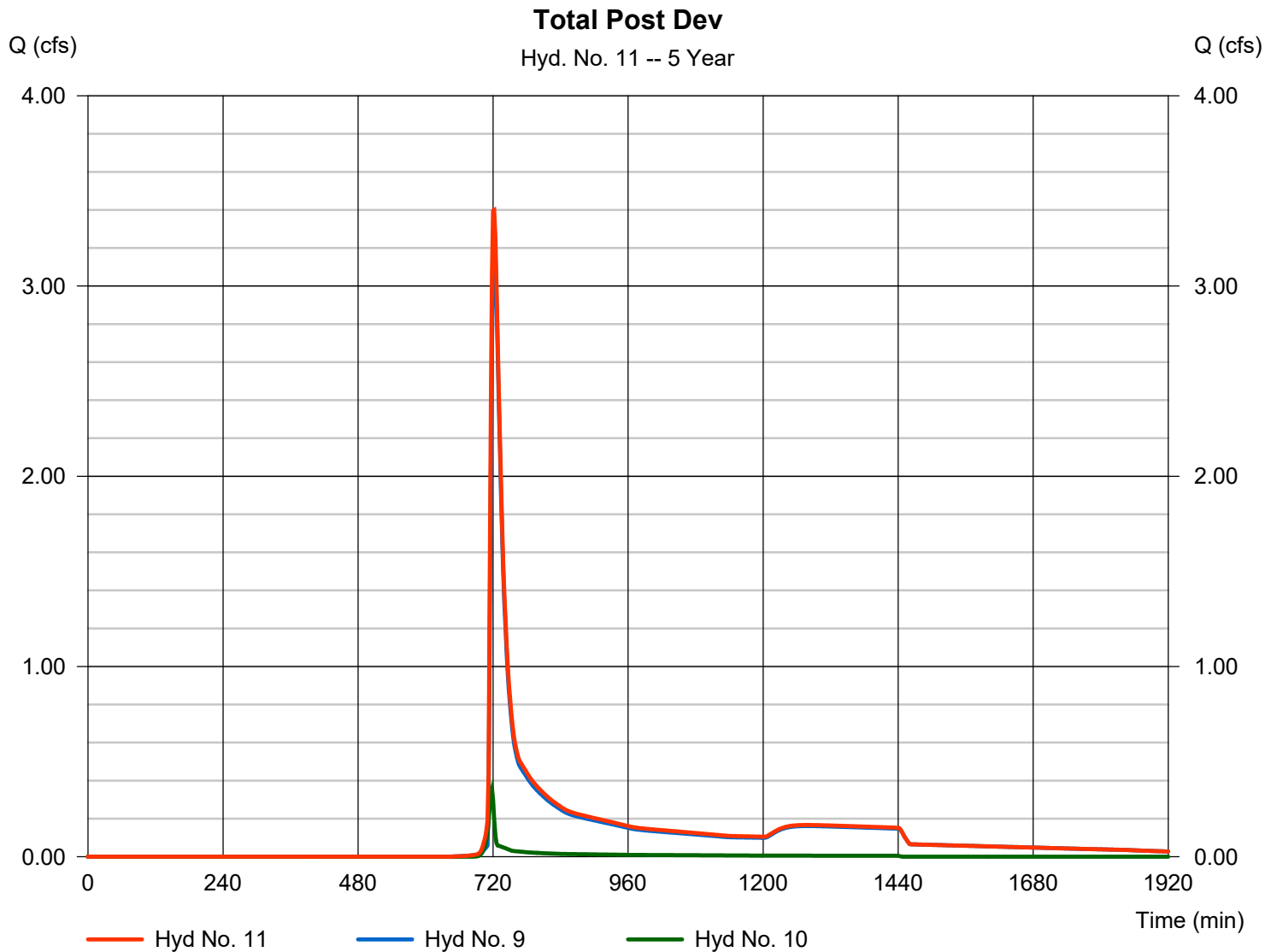
Hydrograph Report

Hyd. No. 11

Total Post Dev

Hydrograph type = Combine
Storm frequency = 5 yrs
Time interval = 2 min
Inflow hyds. = 9, 10

Peak discharge = 3.399 cfs
Time to peak = 722 min
Hyd. volume = 14,548 cuft
Contrib. drain. area = 0.200 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

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	8.360	2	722	22,601	-----	-----	-----	Pre Dev
2	SCS Runoff	3.516	2	718	7,078	-----	-----	-----	Post Dev-Bed 1
3	Reservoir	0.000	2	n/a	0	2	438.74	7,078	Bed 1 routed
4	SCS Runoff	8.379	2	718	16,803	-----	-----	-----	Post Dev-Bed 2
5	Combine	8.379	2	718	16,803	3, 4	-----	-----	Total to Bed 2
6	Reservoir	0.256	2	876	5,751	5	433.65	11,595	Bed 2 Routed
7	SCS Runoff	8.209	2	718	16,462	-----	-----	-----	Post Dev-Bed 3
8	Combine	8.209	2	718	22,213	6, 7	-----	-----	Total to Bed 3
9	Reservoir	4.520	2	722	22,192	8	421.49	4,569	Bed 3 Routed
10	SCS Runoff	0.505	2	718	1,014	-----	-----	-----	Bypass
11	Combine	4.793	2	722	23,206	9, 10	-----	-----	Total Post Dev
POI-A-Hydro.gpw					Return Period: 10 Year			Sunday, 05 / 14 / 2023	

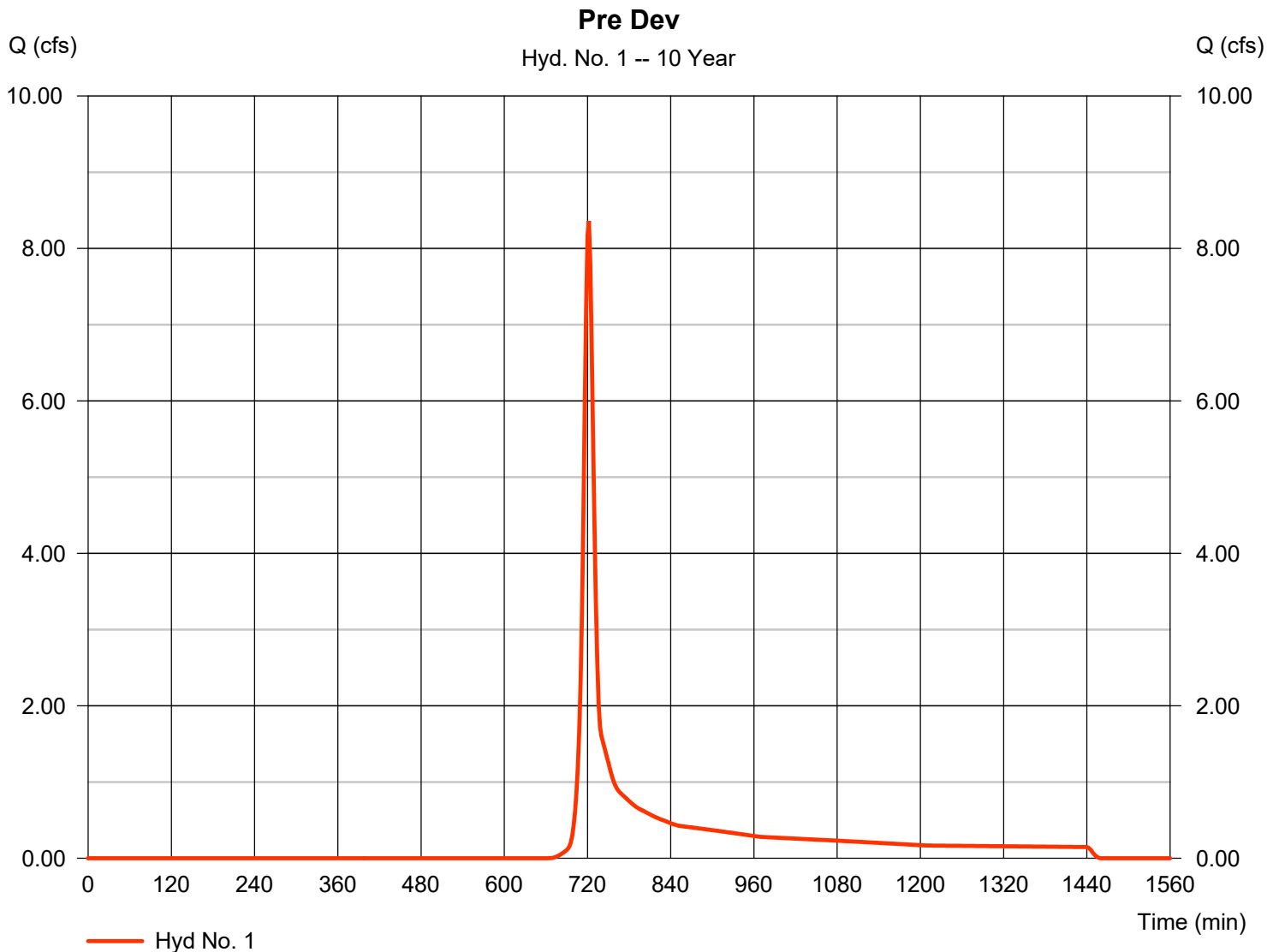
Hydrograph Report

Hyd. No. 1

Pre Dev

Hydrograph type	= SCS Runoff	Peak discharge	= 8.360 cfs
Storm frequency	= 10 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 22,601 cuft
Drainage area	= 4.250 ac	Curve number	= 64*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.10 min
Total precip.	= 4.75 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.650 x 98) + (3.600 x 58)] / 4.250



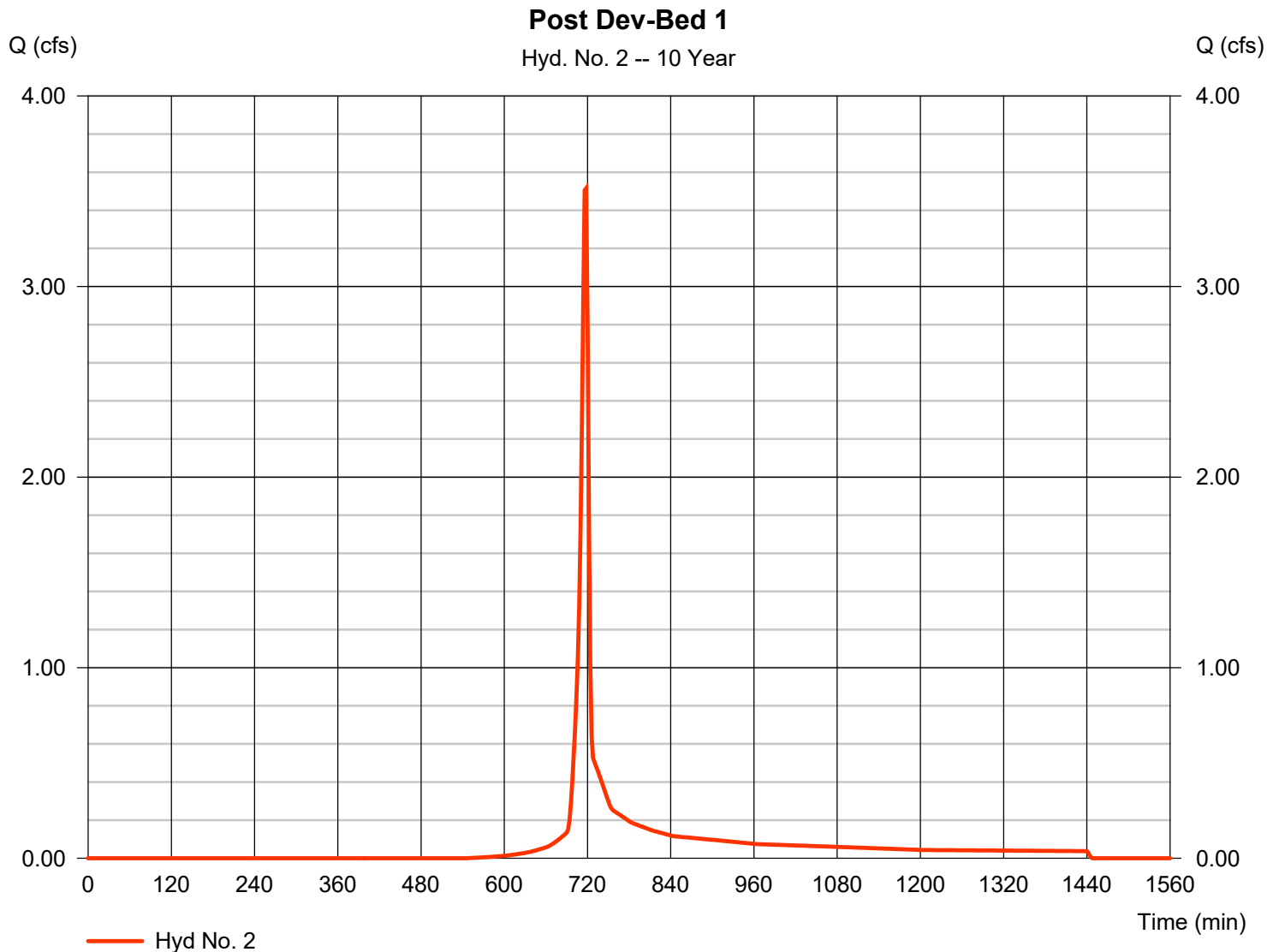
Hydrograph Report

Hyd. No. 2

Post Dev-Bed 1

Hydrograph type	= SCS Runoff	Peak discharge	= 3.516 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 7,078 cuft
Drainage area	= 0.960 ac	Curve number	= 74*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.75 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = $[(0.340 \times 98) + (0.620 \times 61)] / 0.960$



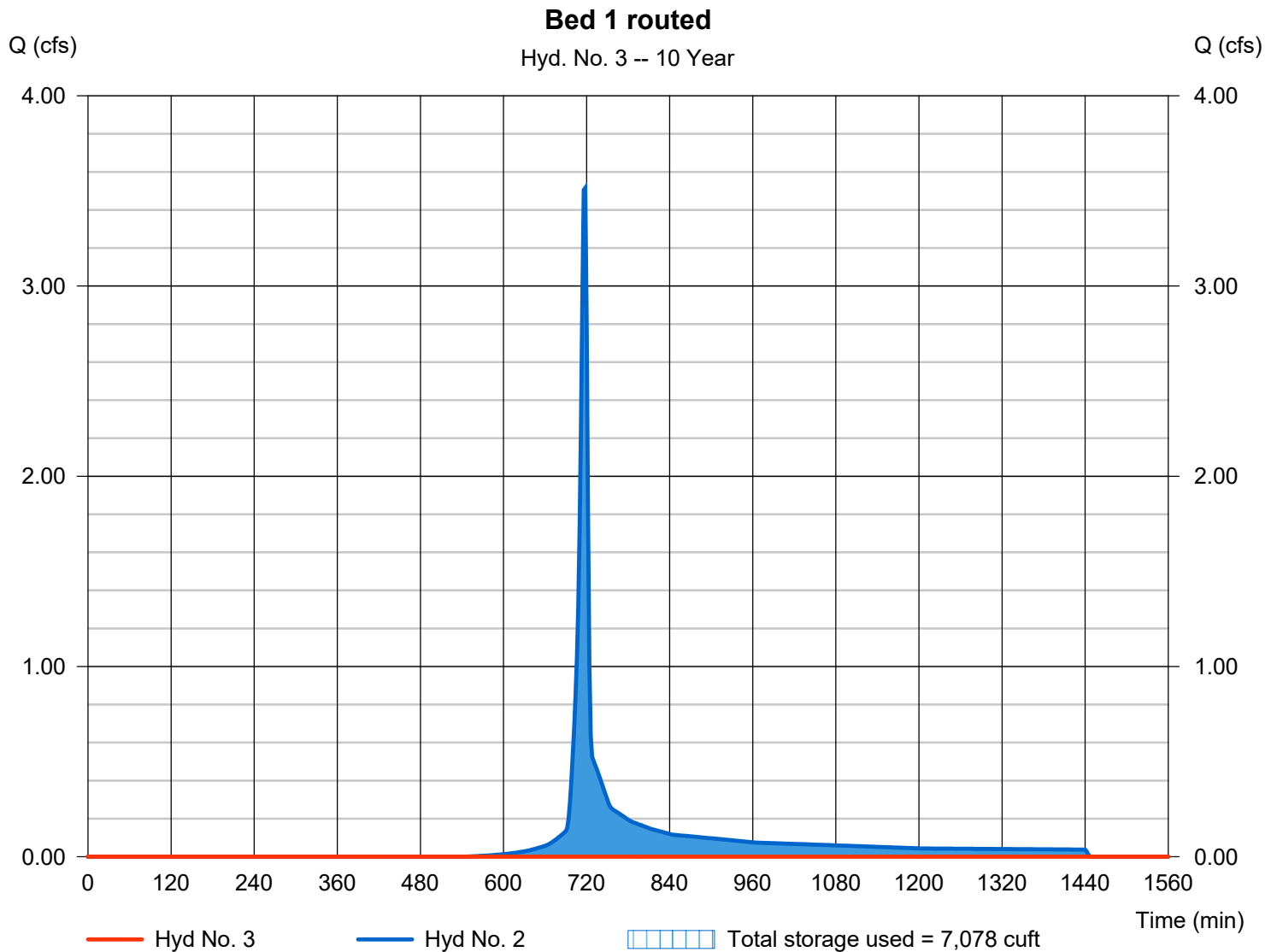
Hydrograph Report

Hyd. No. 3

Bed 1 routed

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 10 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 2 - Post Dev-Bed 1	Max. Elevation	= 438.74 ft
Reservoir name	= Bed 1	Max. Storage	= 7,078 cuft

Storage Indication method used.



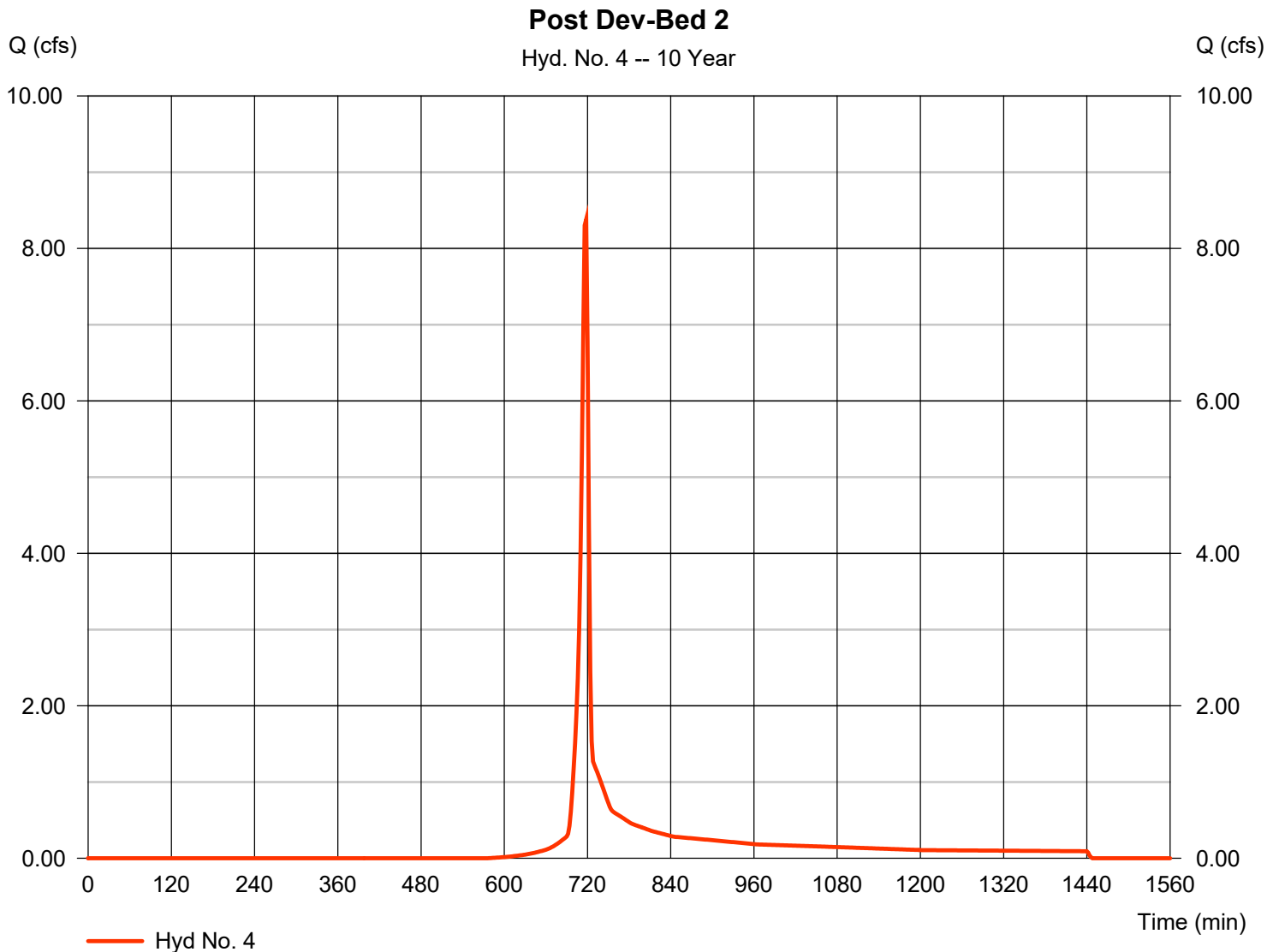
Hydrograph Report

Hyd. No. 4

Post Dev-Bed 2

Hydrograph type	= SCS Runoff	Peak discharge	= 8.379 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 16,803 cuft
Drainage area	= 2.460 ac	Curve number	= 72*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.75 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.740 x 98) + (1.720 x 61)] / 2.460



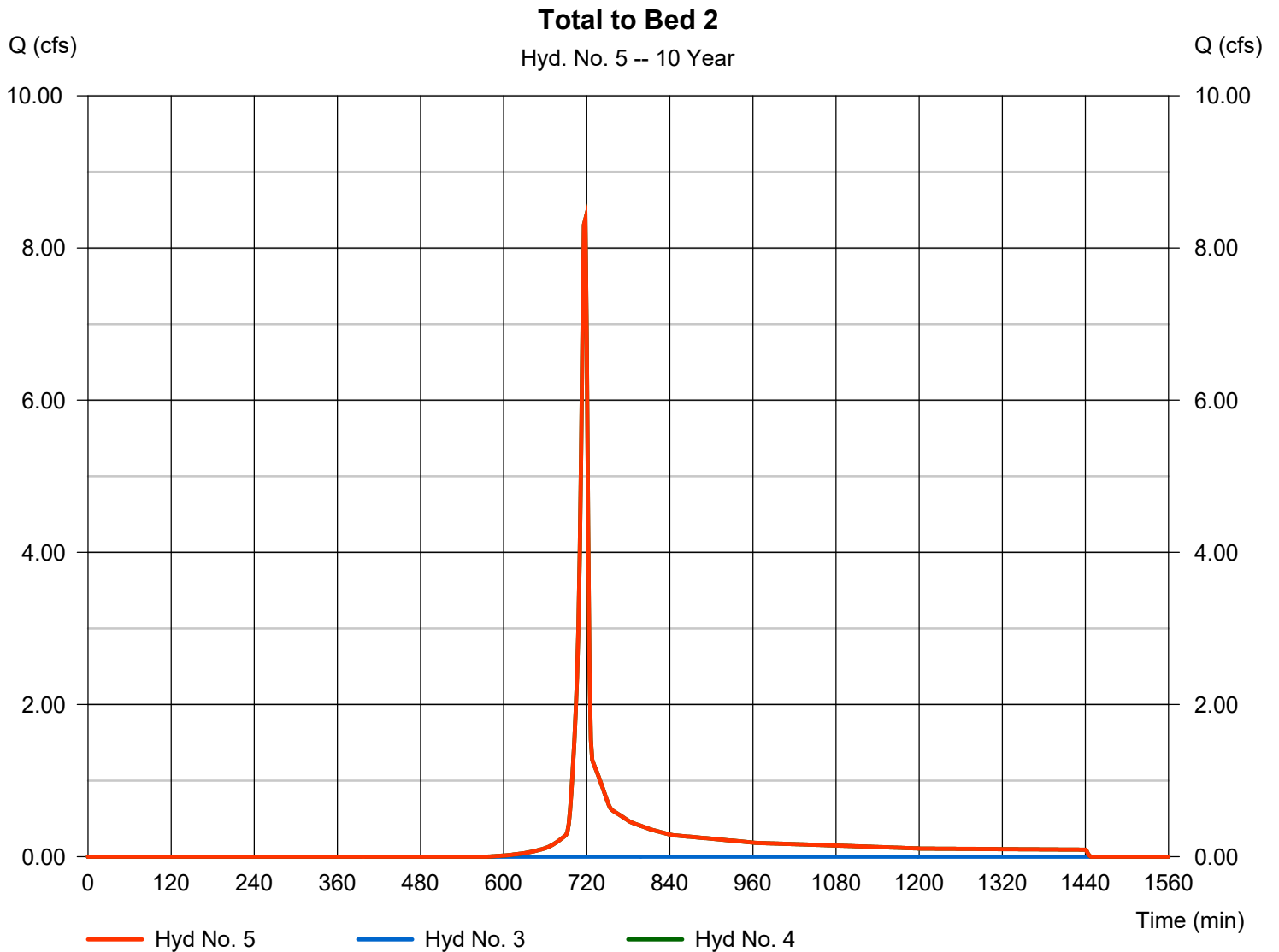
Hydrograph Report

Hyd. No. 5

Total to Bed 2

Hydrograph type = Combine
Storm frequency = 10 yrs
Time interval = 2 min
Inflow hyds. = 3, 4

Peak discharge = 8.379 cfs
Time to peak = 718 min
Hyd. volume = 16,803 cuft
Contrib. drain. area = 2.460 ac



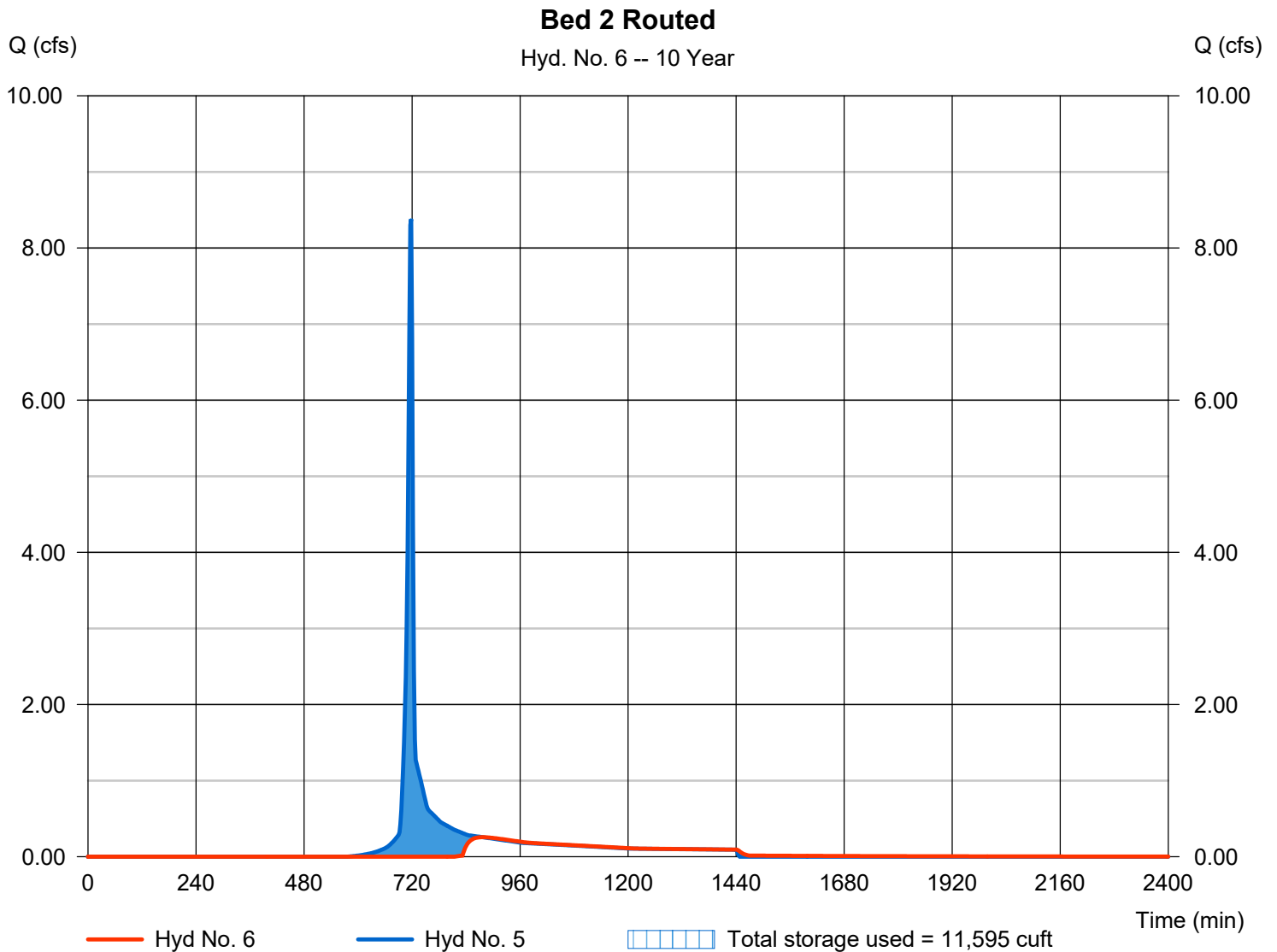
Hydrograph Report

Hyd. No. 6

Bed 2 Routed

Hydrograph type	= Reservoir	Peak discharge	= 0.256 cfs
Storm frequency	= 10 yrs	Time to peak	= 876 min
Time interval	= 2 min	Hyd. volume	= 5,751 cuft
Inflow hyd. No.	= 5 - Total to Bed 2	Max. Elevation	= 433.65 ft
Reservoir name	= Bed 2	Max. Storage	= 11,595 cuft

Storage Indication method used.



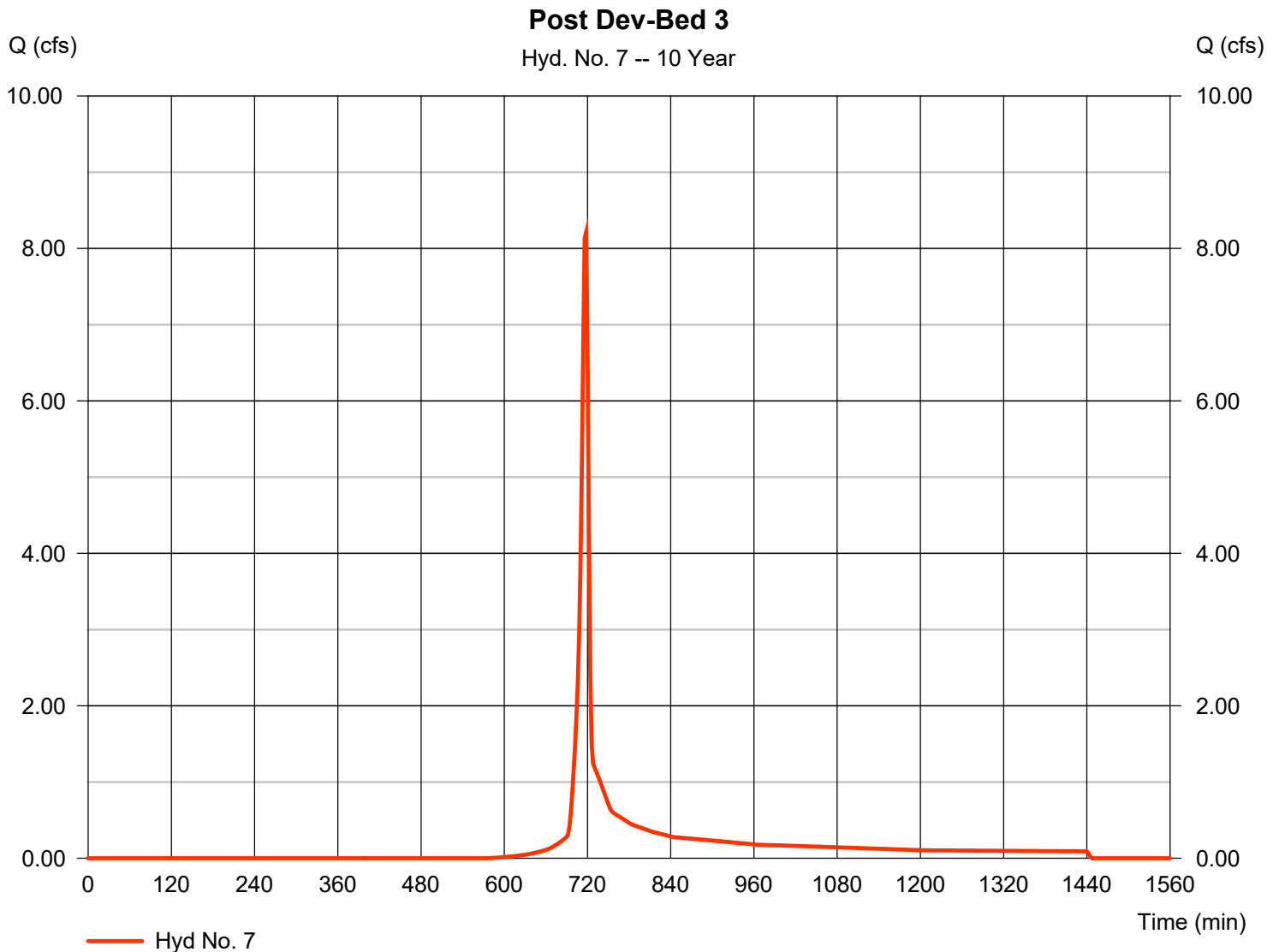
Hydrograph Report

Hyd. No. 7

Post Dev-Bed 3

Hydrograph type	= SCS Runoff	Peak discharge	= 8.209 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 16,462 cuft
Drainage area	= 2.410 ac	Curve number	= 72*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.75 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.720 x 98) + (1.690 x 61)] / 2.410



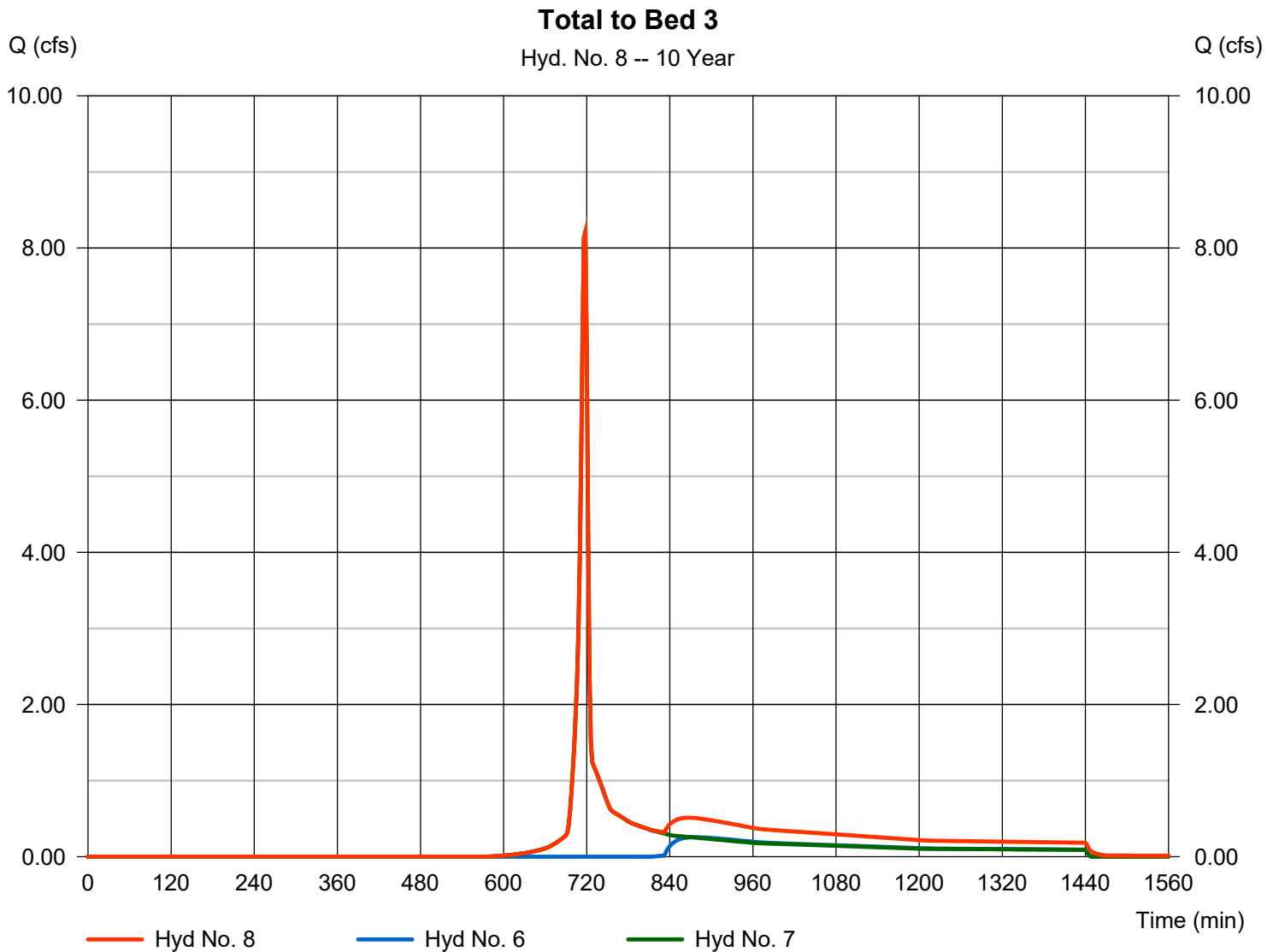
Hydrograph Report

Hyd. No. 8

Total to Bed 3

Hydrograph type = Combine
Storm frequency = 10 yrs
Time interval = 2 min
Inflow hyds. = 6, 7

Peak discharge = 8.209 cfs
Time to peak = 718 min
Hyd. volume = 22,213 cuft
Contrib. drain. area = 2.410 ac



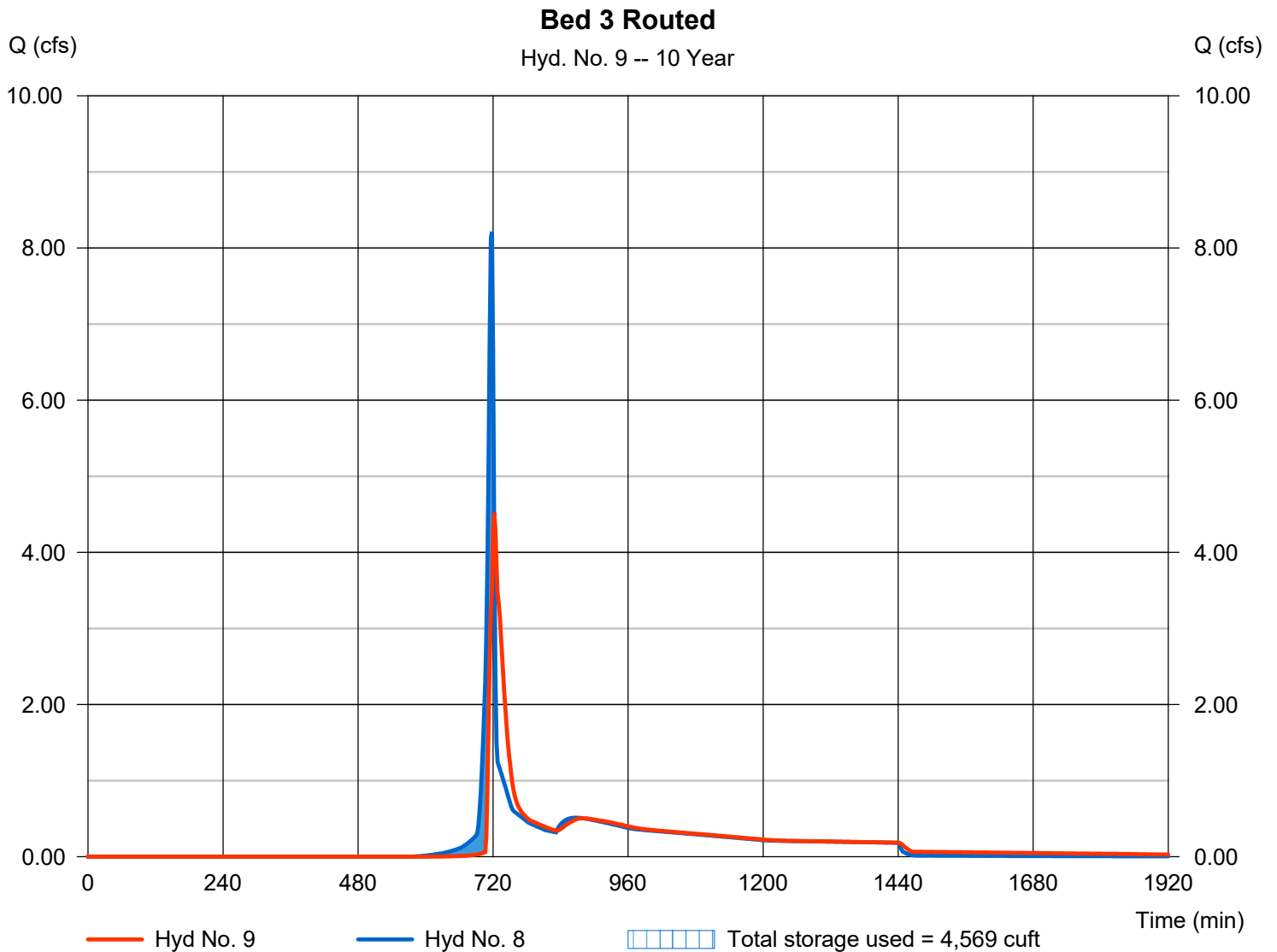
Hydrograph Report

Hyd. No. 9

Bed 3 Routed

Hydrograph type	= Reservoir	Peak discharge	= 4.520 cfs
Storm frequency	= 10 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 22,192 cuft
Inflow hyd. No.	= 8 - Total to Bed 3	Max. Elevation	= 421.49 ft
Reservoir name	= Bed 3	Max. Storage	= 4,569 cuft

Storage Indication method used.

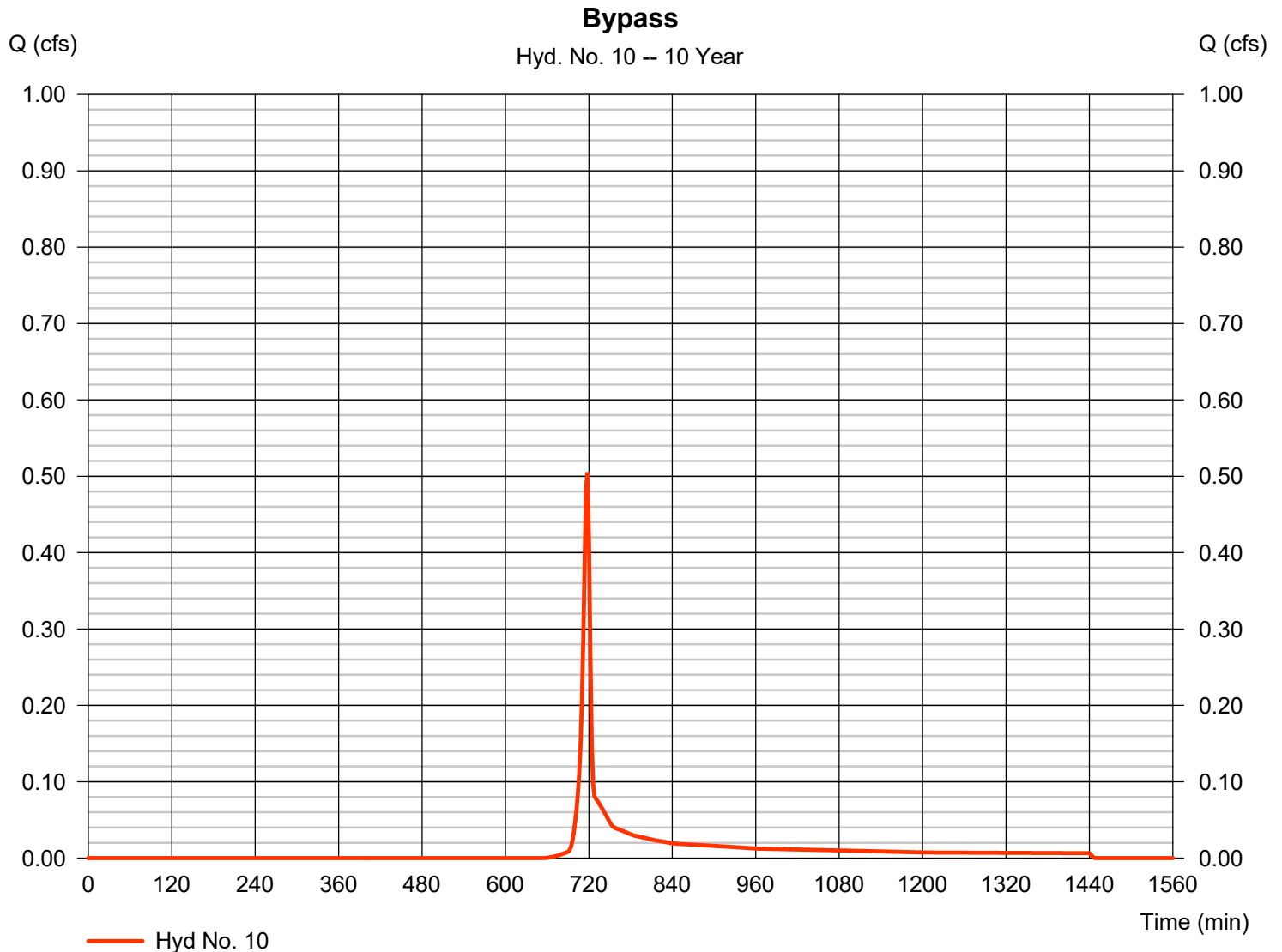


Hydrograph Report

Hyd. No. 10

Bypass

Hydrograph type	= SCS Runoff	Peak discharge	= 0.505 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 1,014 cuft
Drainage area	= 0.200 ac	Curve number	= 65
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.75 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



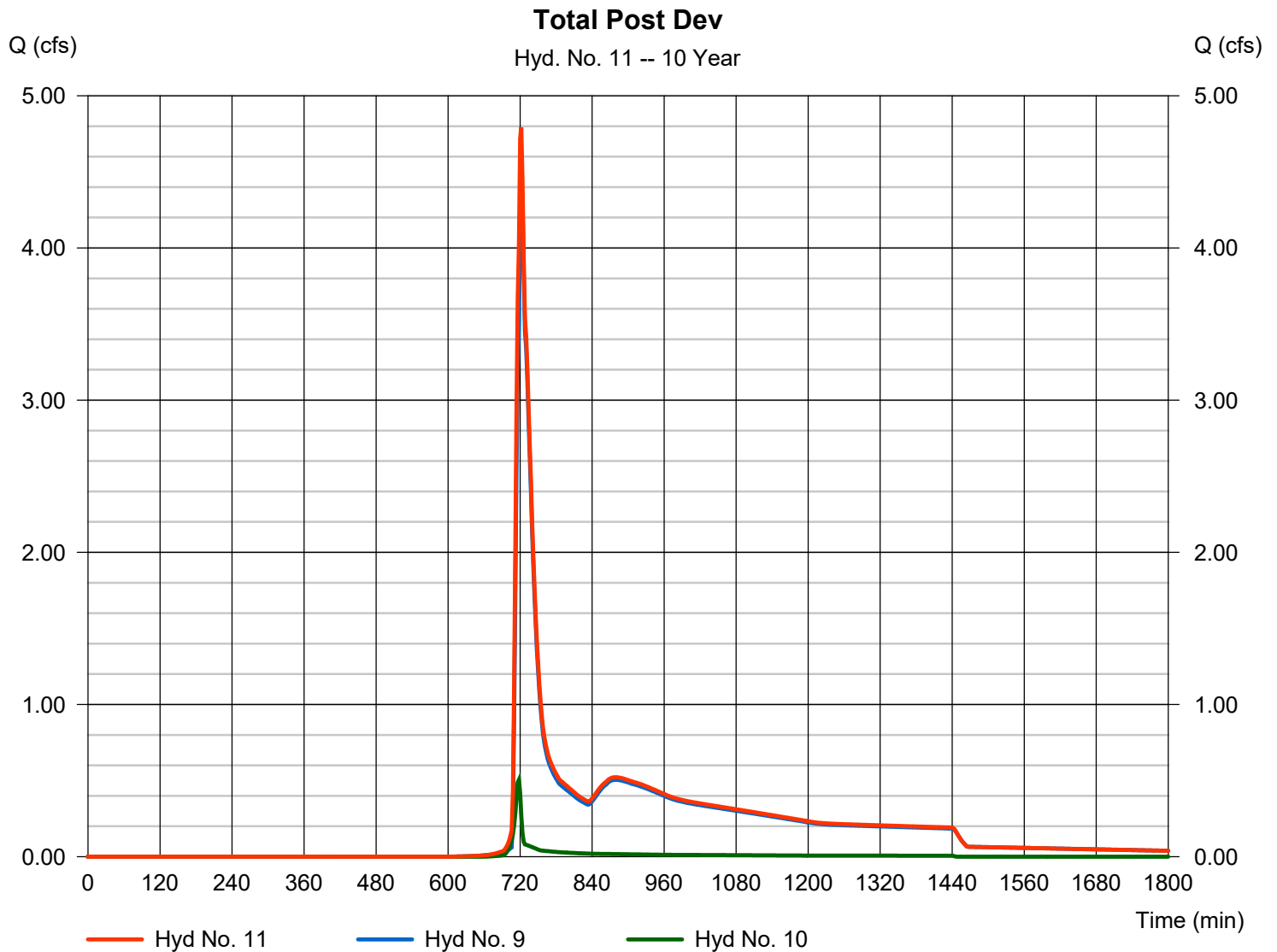
Hydrograph Report

Hyd. No. 11

Total Post Dev

Hydrograph type = Combine
Storm frequency = 10 yrs
Time interval = 2 min
Inflow hyds. = 9, 10

Peak discharge = 4.793 cfs
Time to peak = 722 min
Hyd. volume = 23,206 cuft
Contrib. drain. area = 0.200 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

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	12.48	2	722	32,979	-----	-----	-----	Pre Dev
2	SCS Runoff	4.783	2	716	9,668	-----	-----	-----	Post Dev-Bed 1
3	Reservoir	0.000	2	n/a	0	2	439.37	9,668	Bed 1 routed
4	SCS Runoff	11.50	2	716	23,222	-----	-----	-----	Post Dev-Bed 2
5	Combine	11.50	2	716	23,222	3, 4	-----	-----	Total to Bed 2
6	Reservoir	1.161	2	744	12,170	5	433.79	12,093	Bed 2 Routed
7	SCS Runoff	11.27	2	716	22,750	-----	-----	-----	Post Dev-Bed 3
8	Combine	11.27	2	716	34,921	6, 7	-----	-----	Total to Bed 3
9	Reservoir	6.522	2	722	34,900	8	421.96	6,016	Bed 3 Routed
10	SCS Runoff	0.734	2	718	1,468	-----	-----	-----	Bypass
11	Combine	6.987	2	720	36,368	9, 10	-----	-----	Total Post Dev
POI-A-Hydro.gpw					Return Period: 25 Year			Sunday, 05 / 14 / 2023	

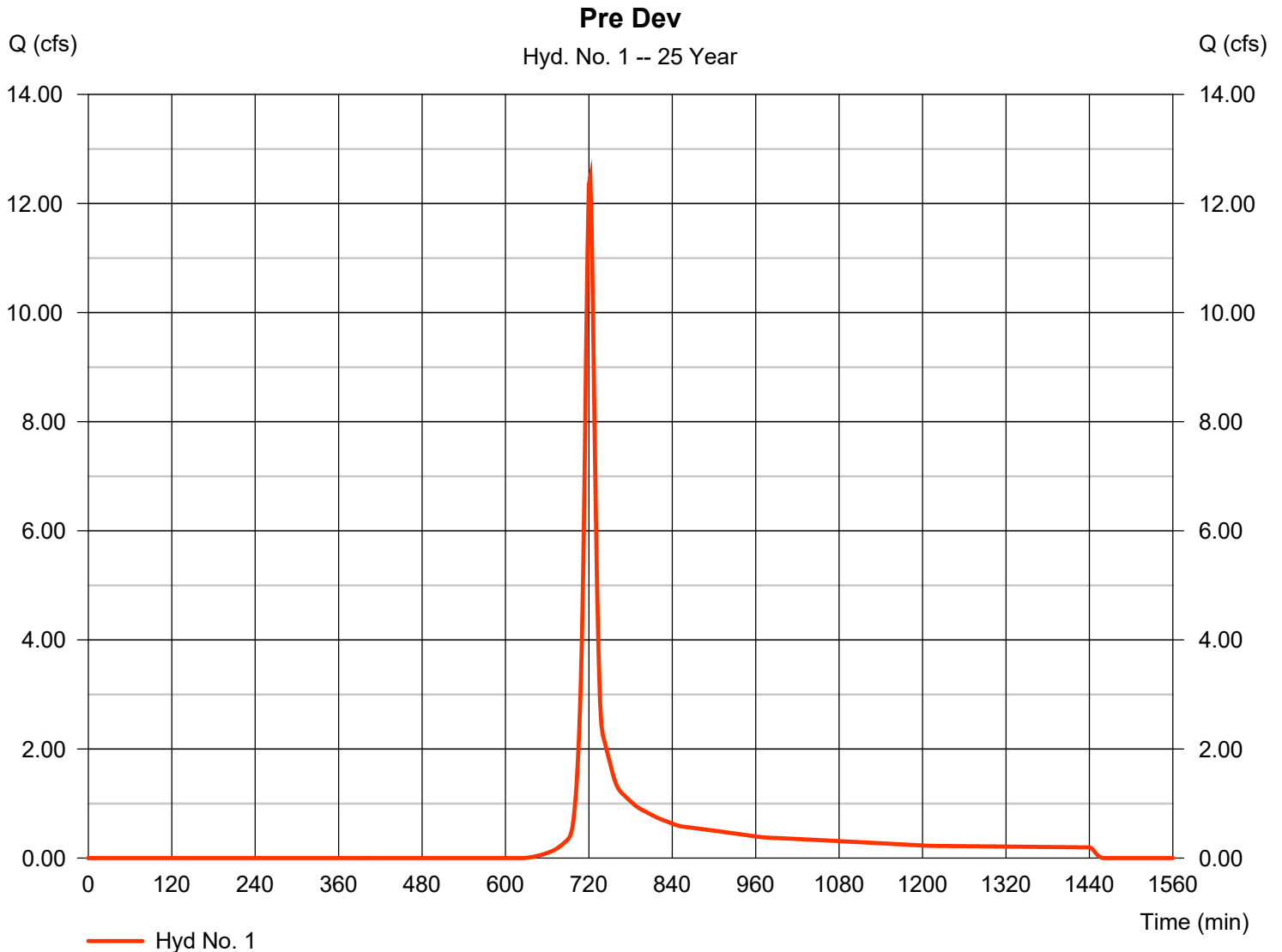
Hydrograph Report

Hyd. No. 1

Pre Dev

Hydrograph type	= SCS Runoff	Peak discharge	= 12.48 cfs
Storm frequency	= 25 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 32,979 cuft
Drainage area	= 4.250 ac	Curve number	= 64*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.10 min
Total precip.	= 5.73 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.650 x 98) + (3.600 x 58)] / 4.250



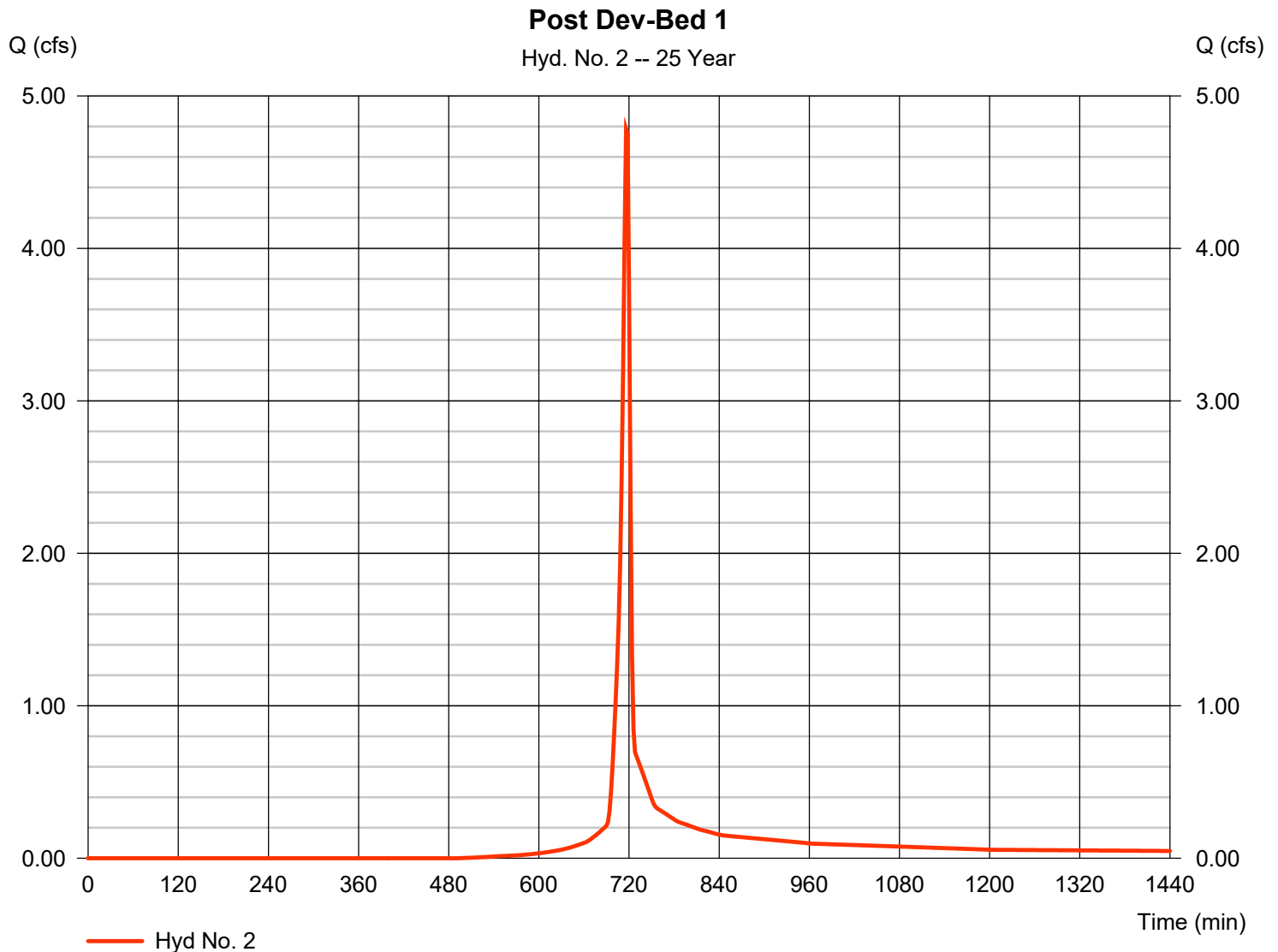
Hydrograph Report

Hyd. No. 2

Post Dev-Bed 1

Hydrograph type	= SCS Runoff	Peak discharge	= 4.783 cfs
Storm frequency	= 25 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 9,668 cuft
Drainage area	= 0.960 ac	Curve number	= 74*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.73 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = $[(0.340 \times 98) + (0.620 \times 61)] / 0.960$



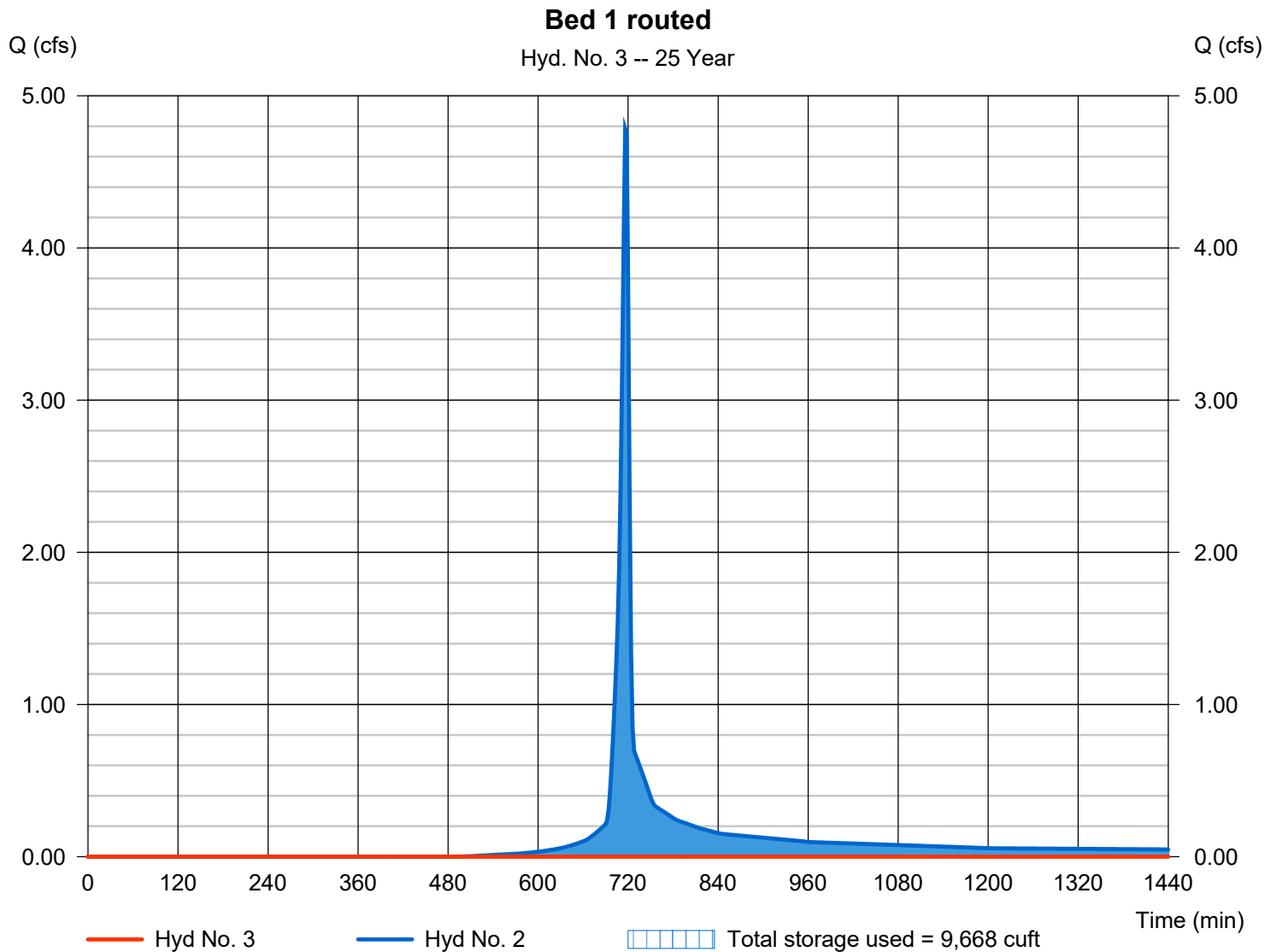
Hydrograph Report

Hyd. No. 3

Bed 1 routed

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 25 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 2 - Post Dev-Bed 1	Max. Elevation	= 439.37 ft
Reservoir name	= Bed 1	Max. Storage	= 9,668 cuft

Storage Indication method used.



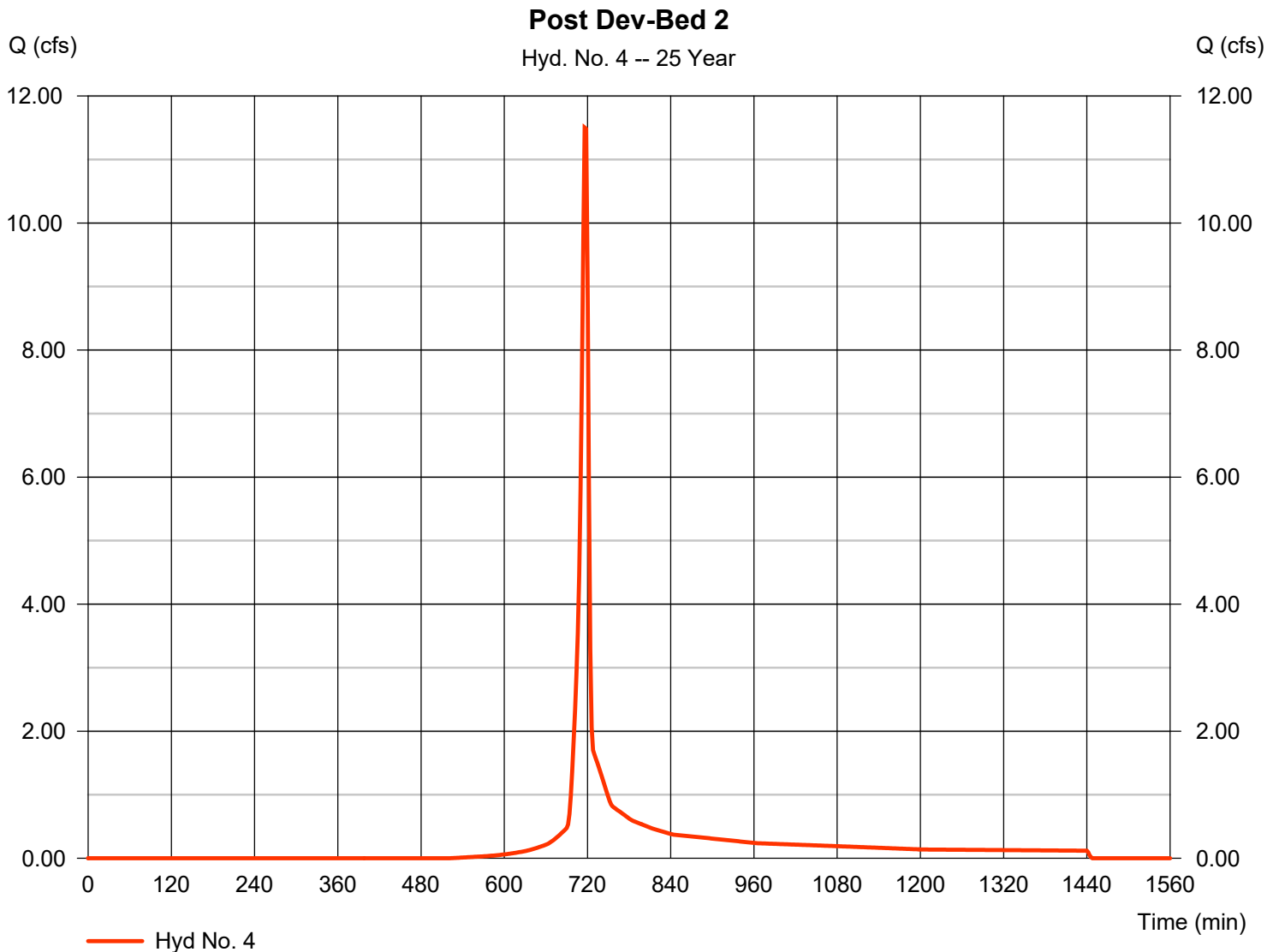
Hydrograph Report

Hyd. No. 4

Post Dev-Bed 2

Hydrograph type	= SCS Runoff	Peak discharge	= 11.50 cfs
Storm frequency	= 25 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 23,222 cuft
Drainage area	= 2.460 ac	Curve number	= 72*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.73 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = $[(0.740 \times 98) + (1.720 \times 61)] / 2.460$



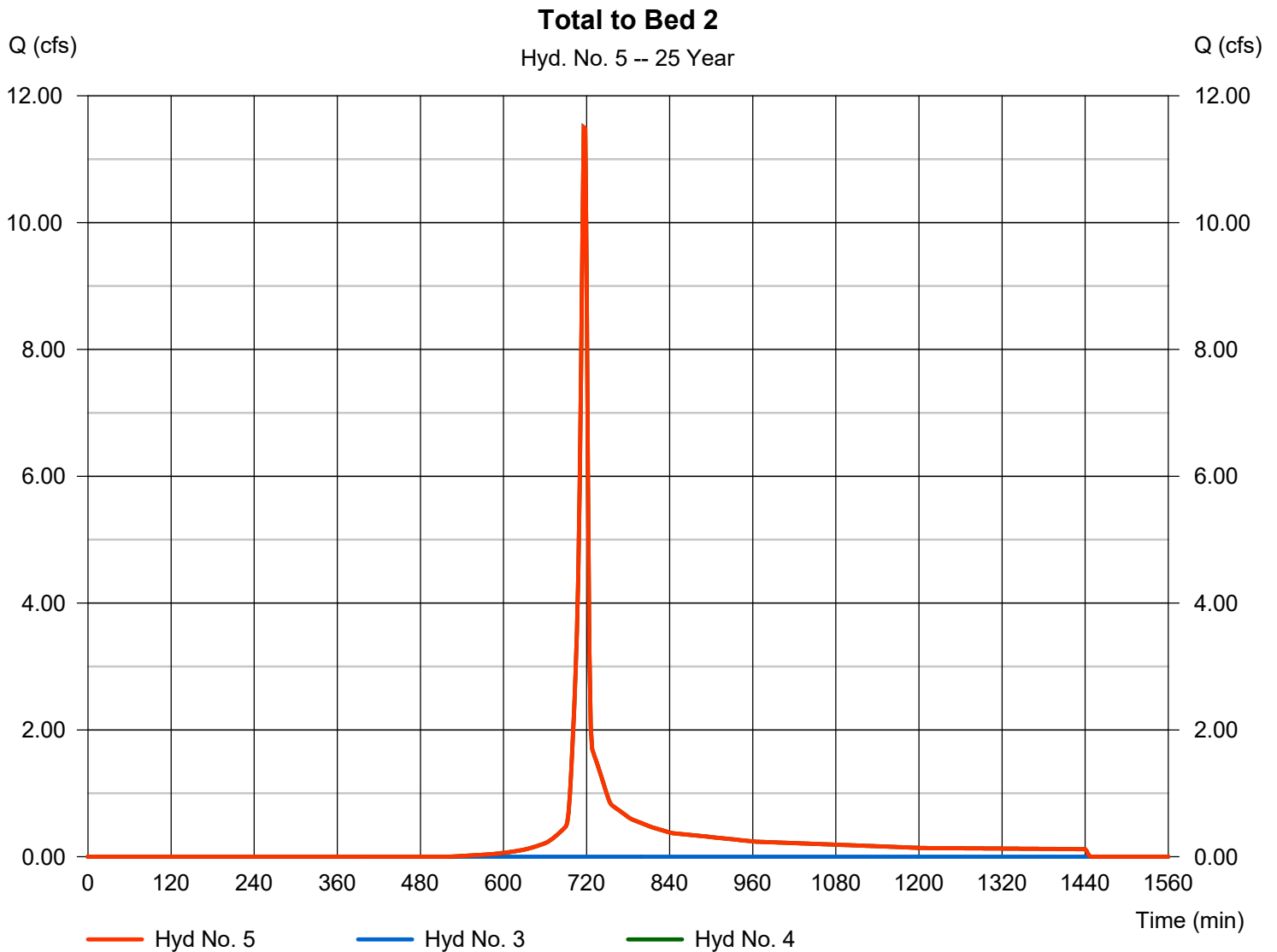
Hydrograph Report

Hyd. No. 5

Total to Bed 2

Hydrograph type = Combine
Storm frequency = 25 yrs
Time interval = 2 min
Inflow hyds. = 3, 4

Peak discharge = 11.50 cfs
Time to peak = 716 min
Hyd. volume = 23,222 cuft
Contrib. drain. area = 2.460 ac



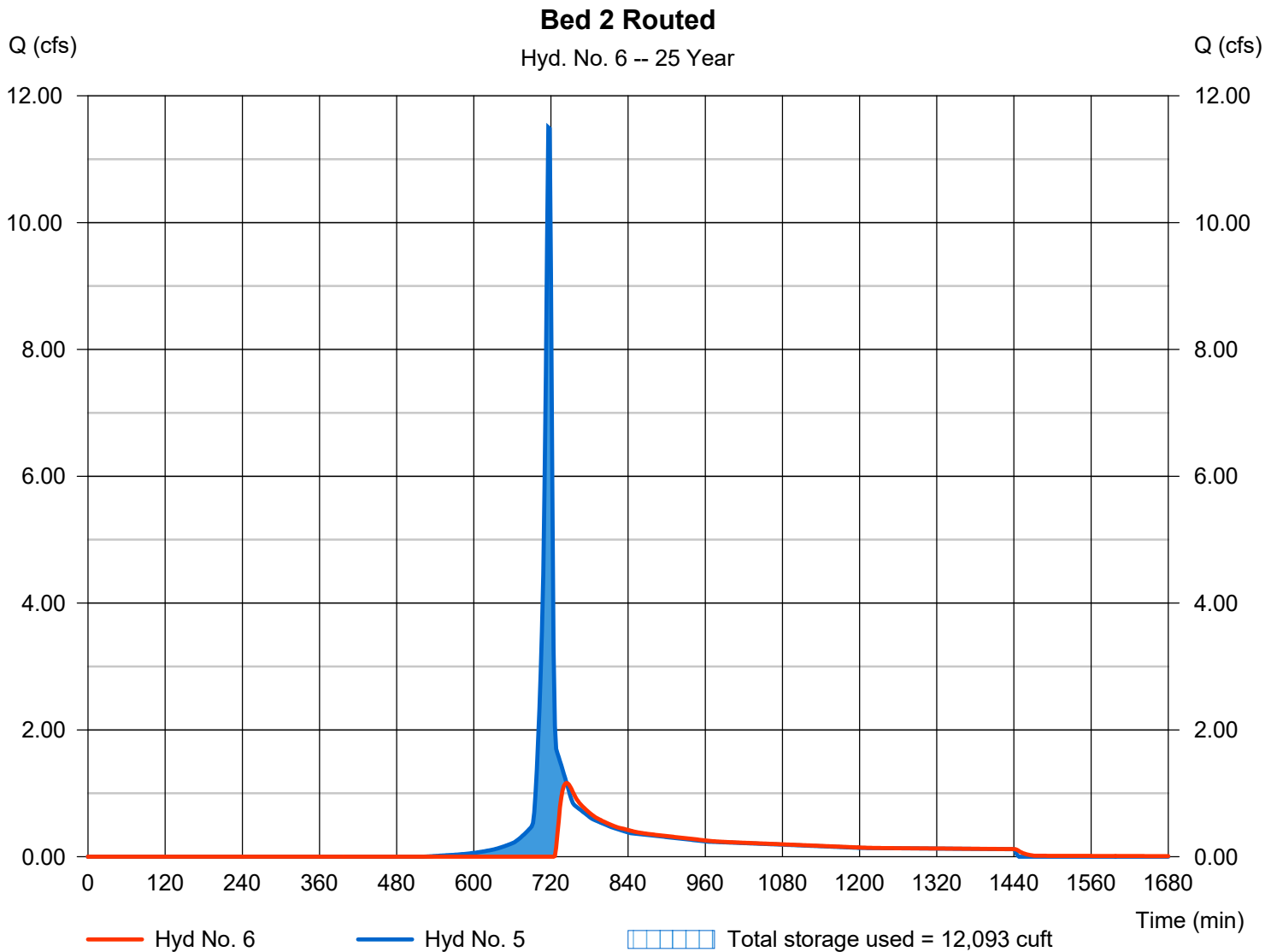
Hydrograph Report

Hyd. No. 6

Bed 2 Routed

Hydrograph type	= Reservoir	Peak discharge	= 1.161 cfs
Storm frequency	= 25 yrs	Time to peak	= 744 min
Time interval	= 2 min	Hyd. volume	= 12,170 cuft
Inflow hyd. No.	= 5 - Total to Bed 2	Max. Elevation	= 433.79 ft
Reservoir name	= Bed 2	Max. Storage	= 12,093 cuft

Storage Indication method used.



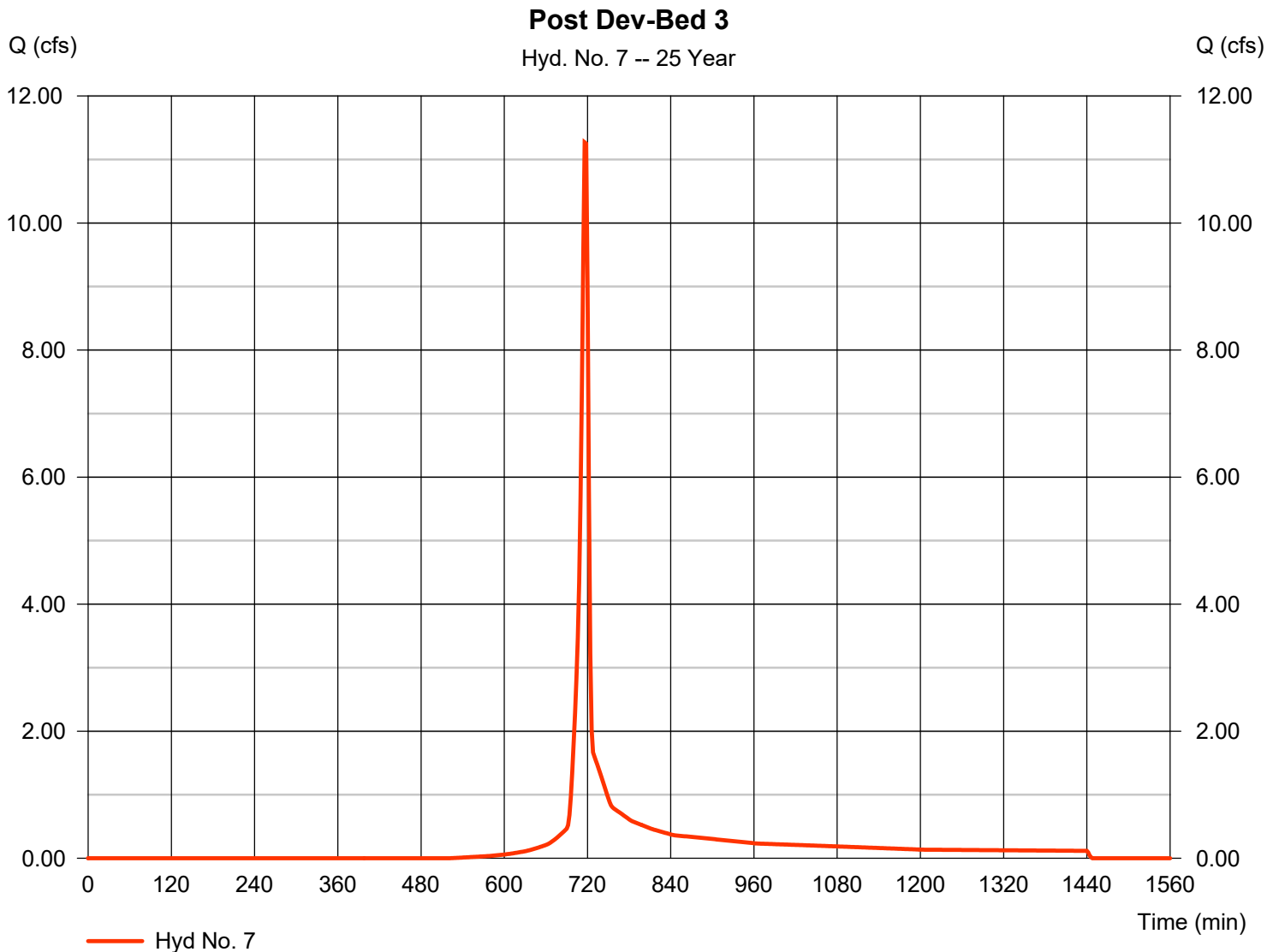
Hydrograph Report

Hyd. No. 7

Post Dev-Bed 3

Hydrograph type	= SCS Runoff	Peak discharge	= 11.27 cfs
Storm frequency	= 25 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 22,750 cuft
Drainage area	= 2.410 ac	Curve number	= 72*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.73 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.720 x 98) + (1.690 x 61)] / 2.410



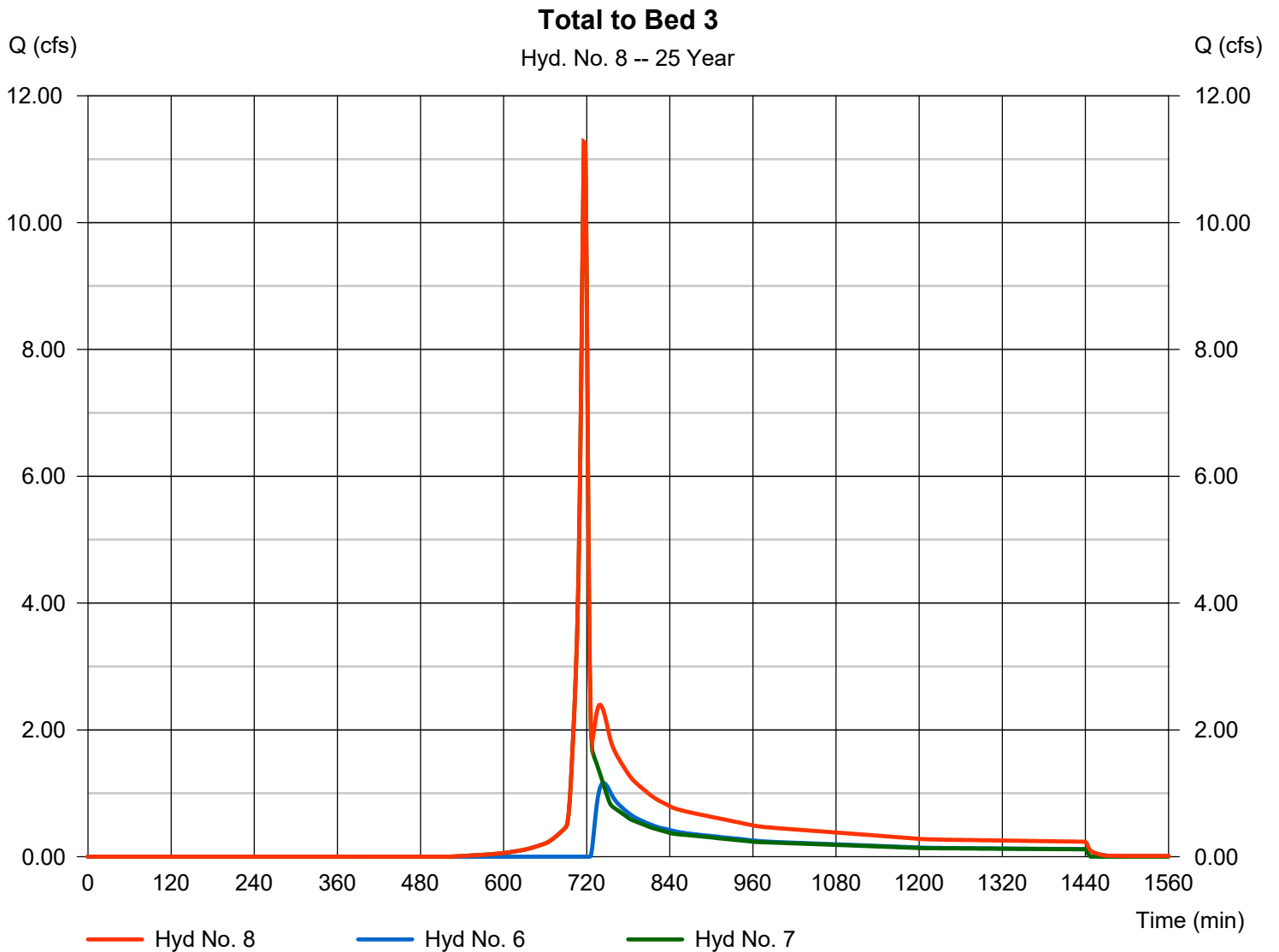
Hydrograph Report

Hyd. No. 8

Total to Bed 3

Hydrograph type = Combine
Storm frequency = 25 yrs
Time interval = 2 min
Inflow hyds. = 6, 7

Peak discharge = 11.27 cfs
Time to peak = 716 min
Hyd. volume = 34,921 cuft
Contrib. drain. area = 2.410 ac



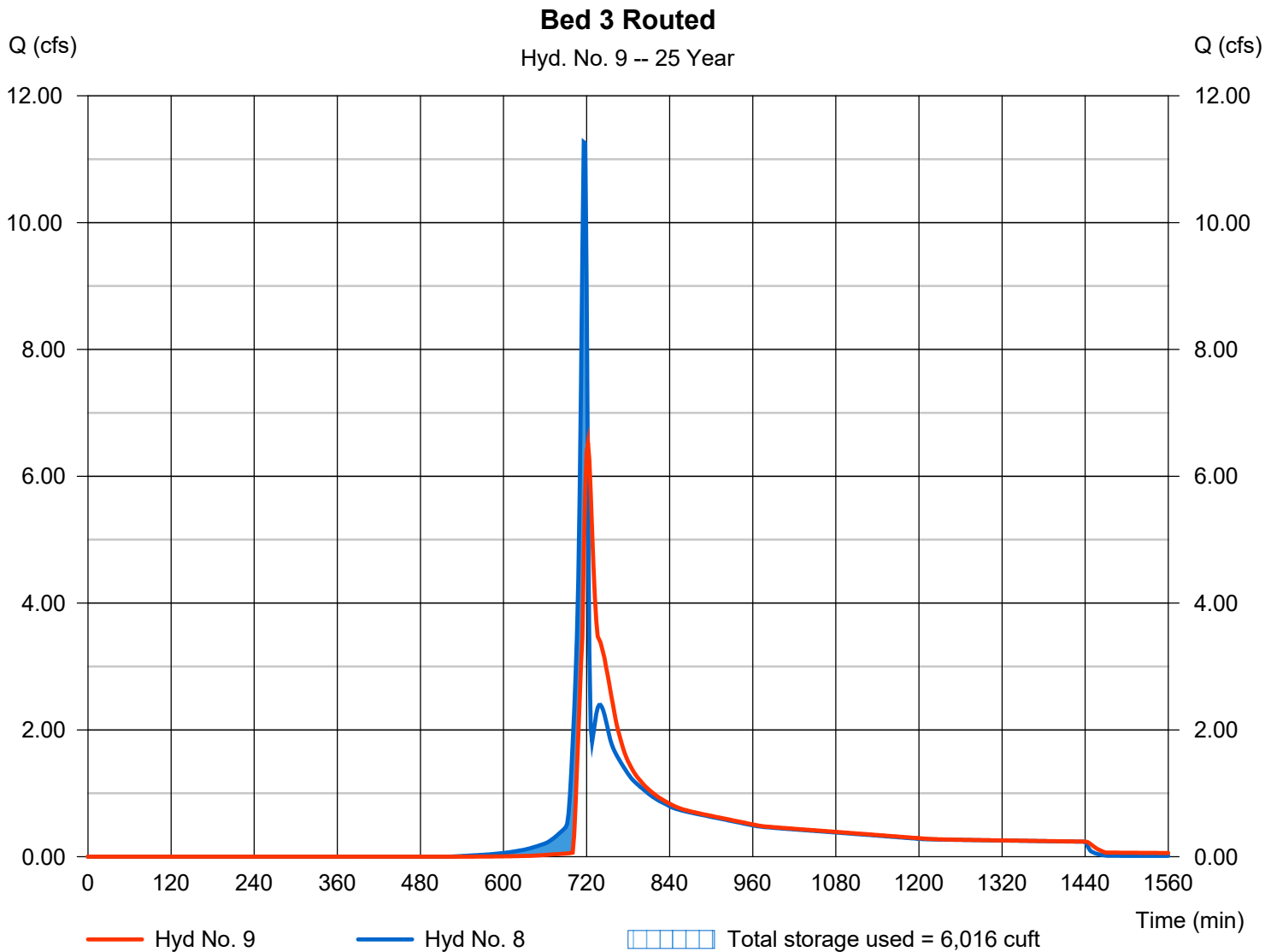
Hydrograph Report

Hyd. No. 9

Bed 3 Routed

Hydrograph type	= Reservoir	Peak discharge	= 6.522 cfs
Storm frequency	= 25 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 34,900 cuft
Inflow hyd. No.	= 8 - Total to Bed 3	Max. Elevation	= 421.96 ft
Reservoir name	= Bed 3	Max. Storage	= 6,016 cuft

Storage Indication method used.

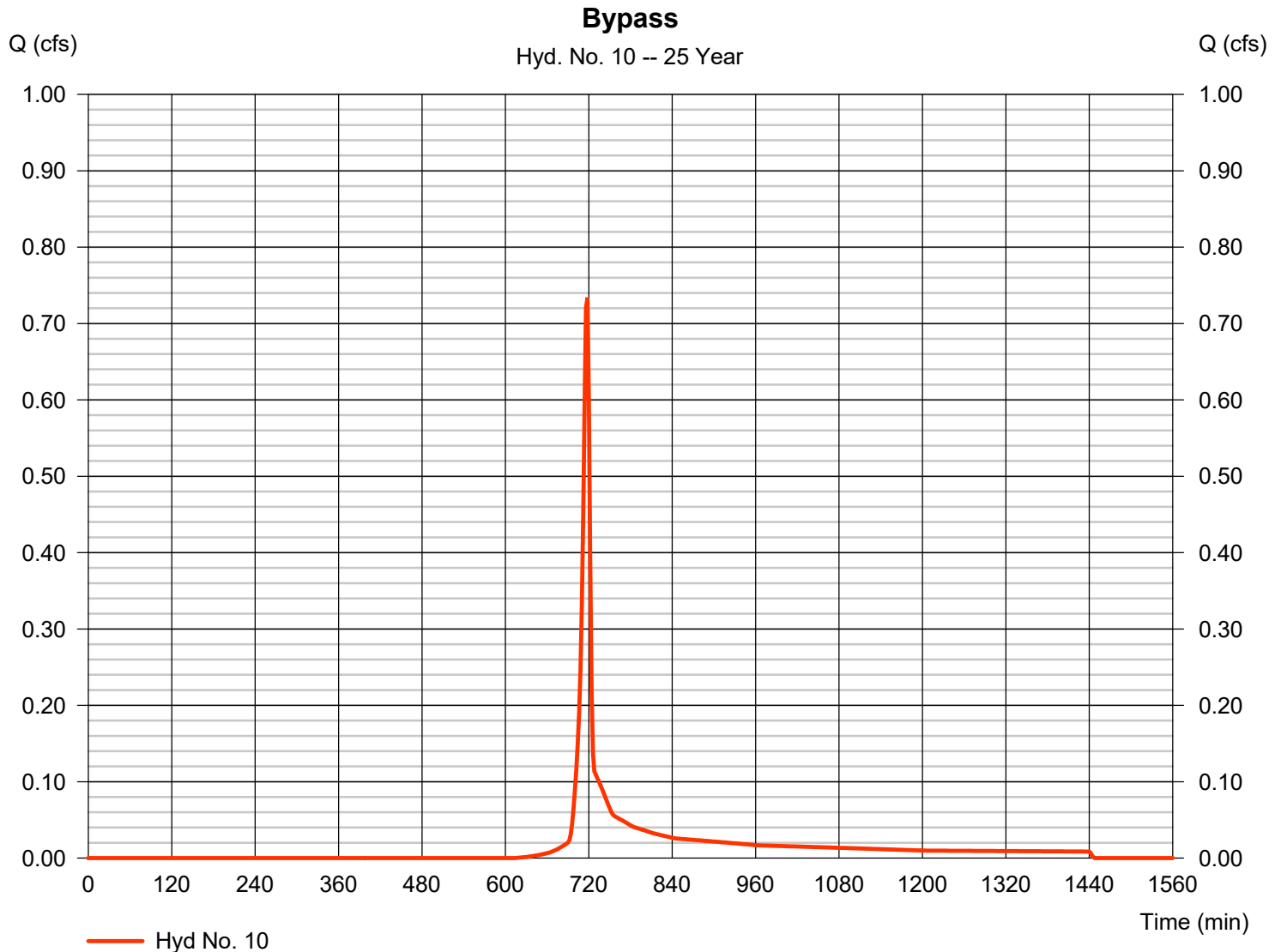


Hydrograph Report

Hyd. No. 10

Bypass

Hydrograph type	= SCS Runoff	Peak discharge	= 0.734 cfs
Storm frequency	= 25 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 1,468 cuft
Drainage area	= 0.200 ac	Curve number	= 65
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.73 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



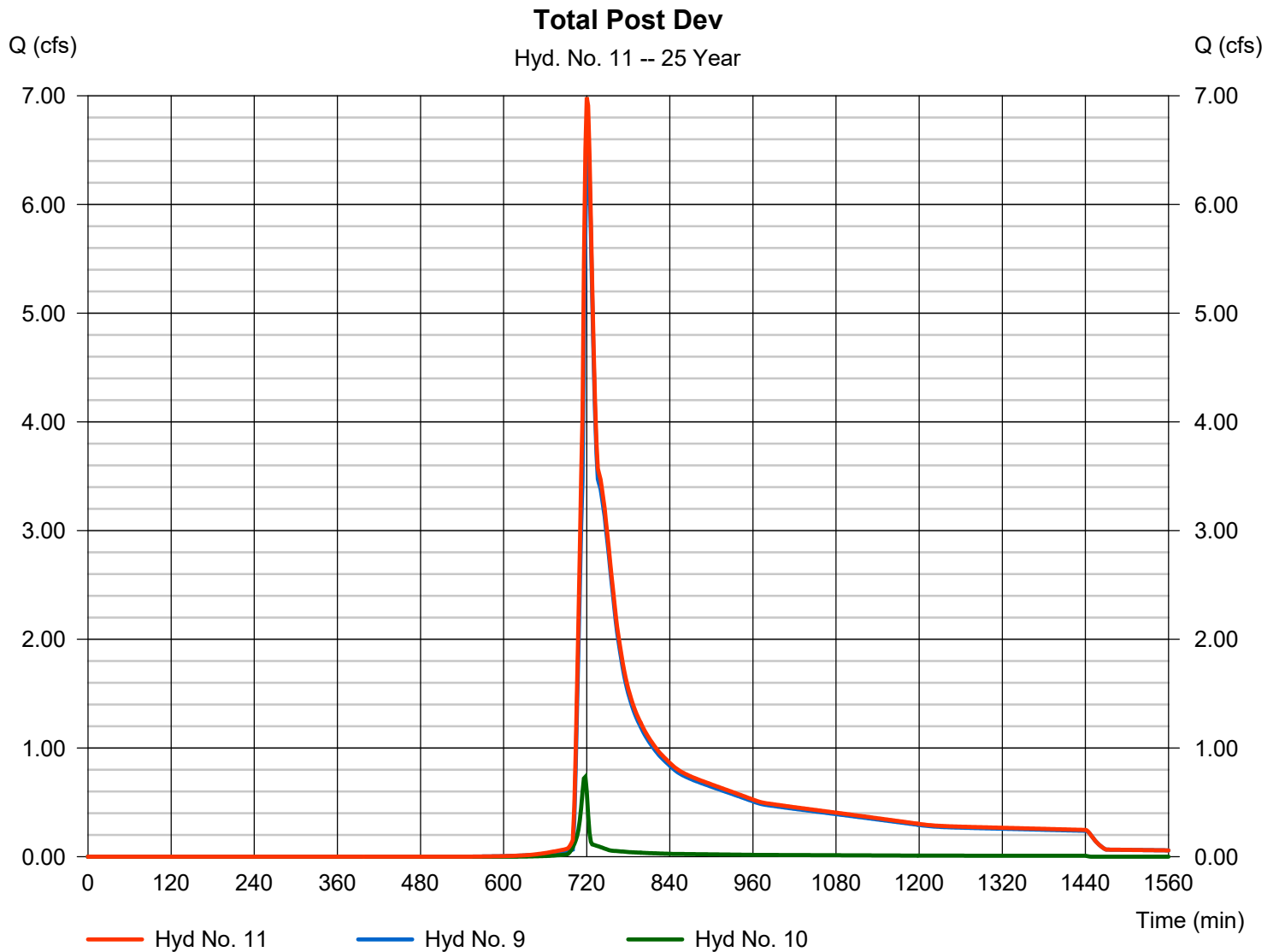
Hydrograph Report

Hyd. No. 11

Total Post Dev

Hydrograph type = Combine
Storm frequency = 25 yrs
Time interval = 2 min
Inflow hyds. = 9, 10

Peak discharge = 6.987 cfs
Time to peak = 720 min
Hyd. volume = 36,368 cuft
Contrib. drain. area = 0.200 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

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	16.21	2	722	42,492	-----	-----	-----	Pre Dev
2	SCS Runoff	5.896	2	716	11,961	-----	-----	-----	Post Dev-Bed 1
3	Reservoir	0.000	2	n/a	0	2	439.94	11,961	Bed 1 routed
4	SCS Runoff	14.31	2	716	28,942	-----	-----	-----	Post Dev-Bed 2
5	Combine	14.31	2	716	28,942	3, 4	-----	-----	Total to Bed 2
6	Reservoir	4.701	2	724	17,890	5	434.10	13,210	Bed 2 Routed
7	SCS Runoff	14.02	2	716	28,354	-----	-----	-----	Post Dev-Bed 3
8	Combine	14.02	2	716	46,244	6, 7	-----	-----	Total to Bed 3
9	Reservoir	8.252	2	724	46,222	8	422.61	8,009	Bed 3 Routed
10	SCS Runoff	0.939	2	718	1,883	-----	-----	-----	Bypass
11	Combine	8.585	2	722	48,105	9, 10	-----	-----	Total Post Dev
POI-A-Hydro.gpw					Return Period: 50 Year			Sunday, 05 / 14 / 2023	

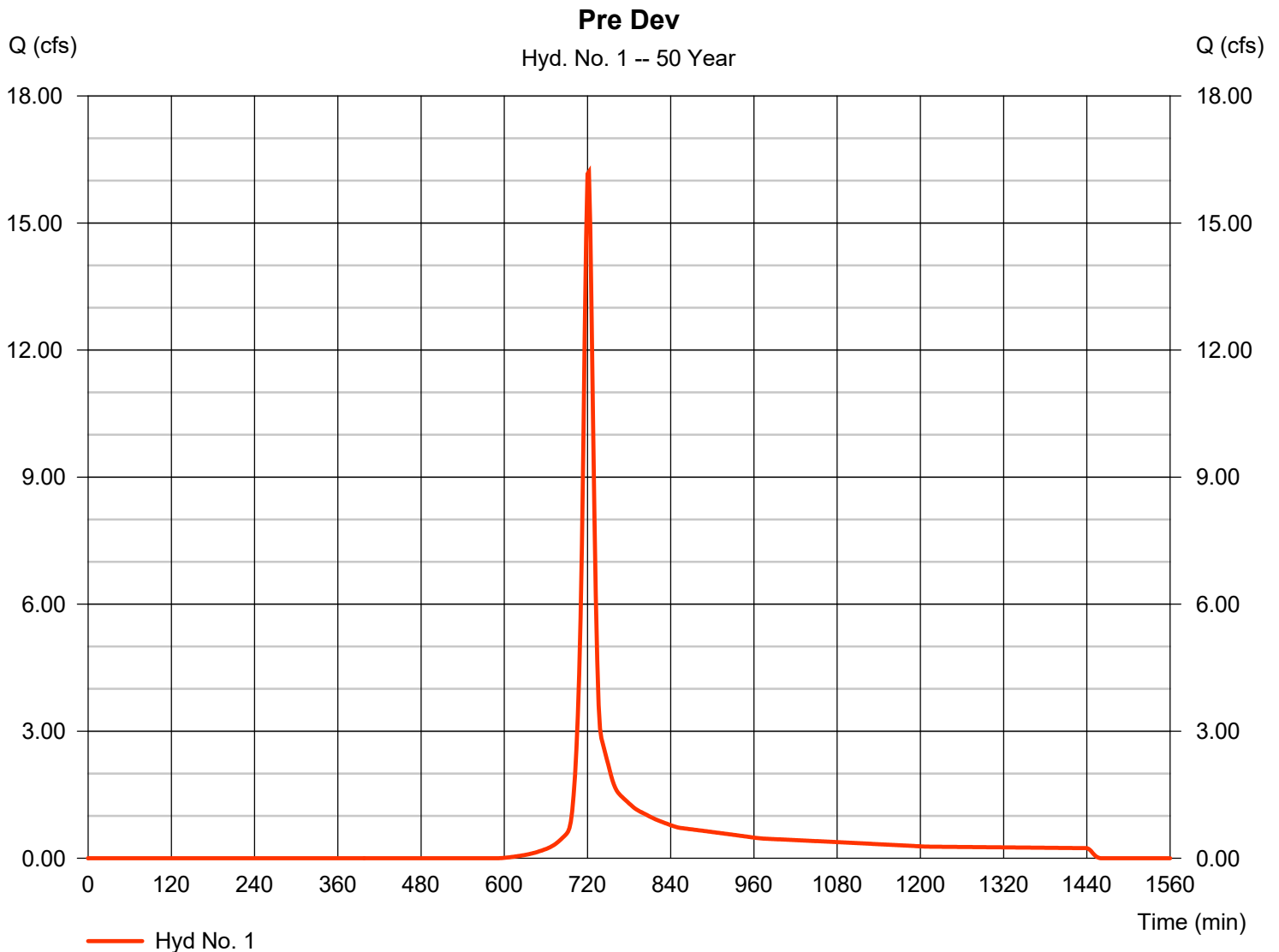
Hydrograph Report

Hyd. No. 1

Pre Dev

Hydrograph type	= SCS Runoff	Peak discharge	= 16.21 cfs
Storm frequency	= 50 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 42,492 cuft
Drainage area	= 4.250 ac	Curve number	= 64*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.10 min
Total precip.	= 6.56 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.650 x 98) + (3.600 x 58)] / 4.250



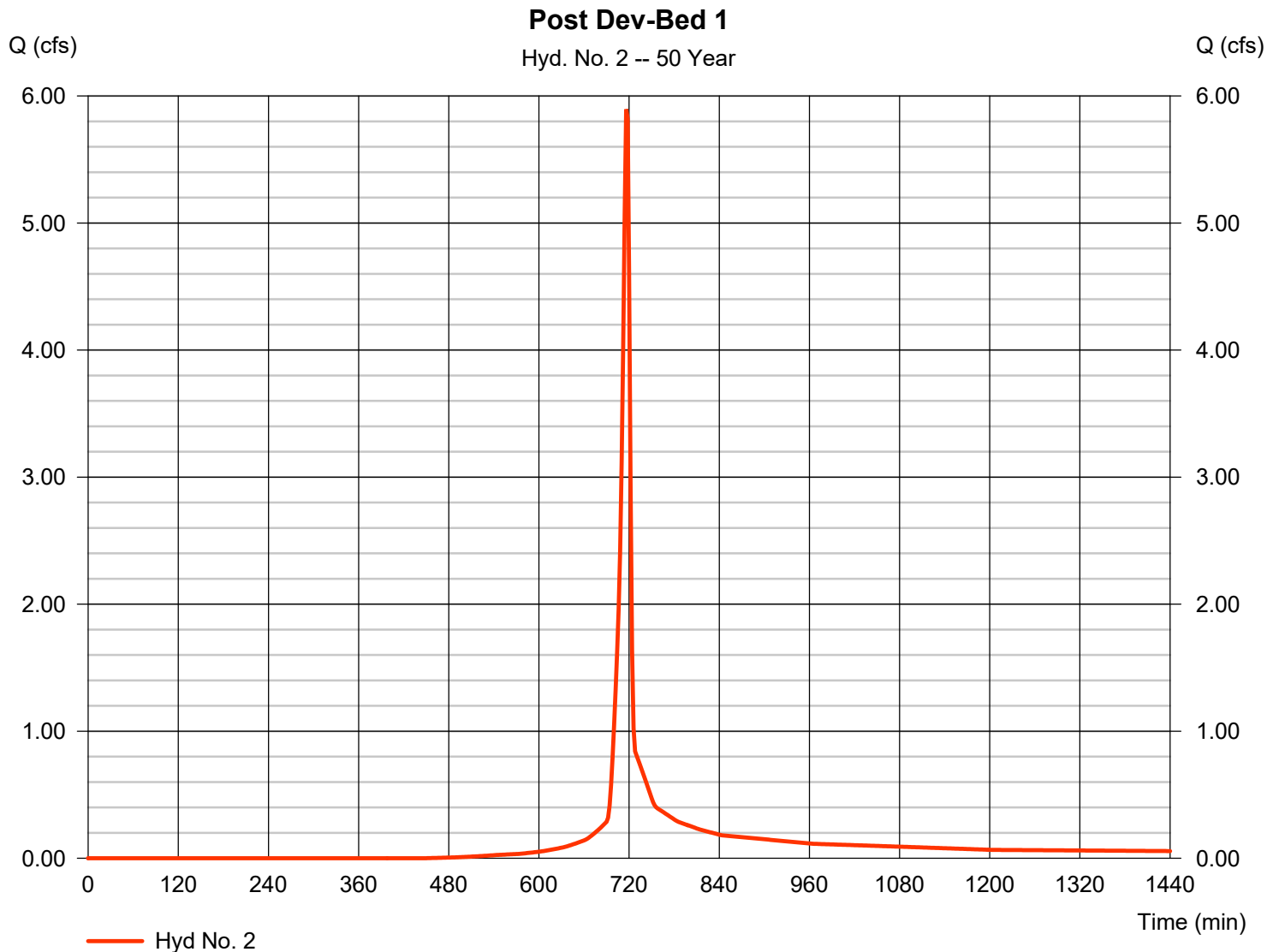
Hydrograph Report

Hyd. No. 2

Post Dev-Bed 1

Hydrograph type	= SCS Runoff	Peak discharge	= 5.896 cfs
Storm frequency	= 50 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 11,961 cuft
Drainage area	= 0.960 ac	Curve number	= 74*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.56 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = $[(0.340 \times 98) + (0.620 \times 61)] / 0.960$



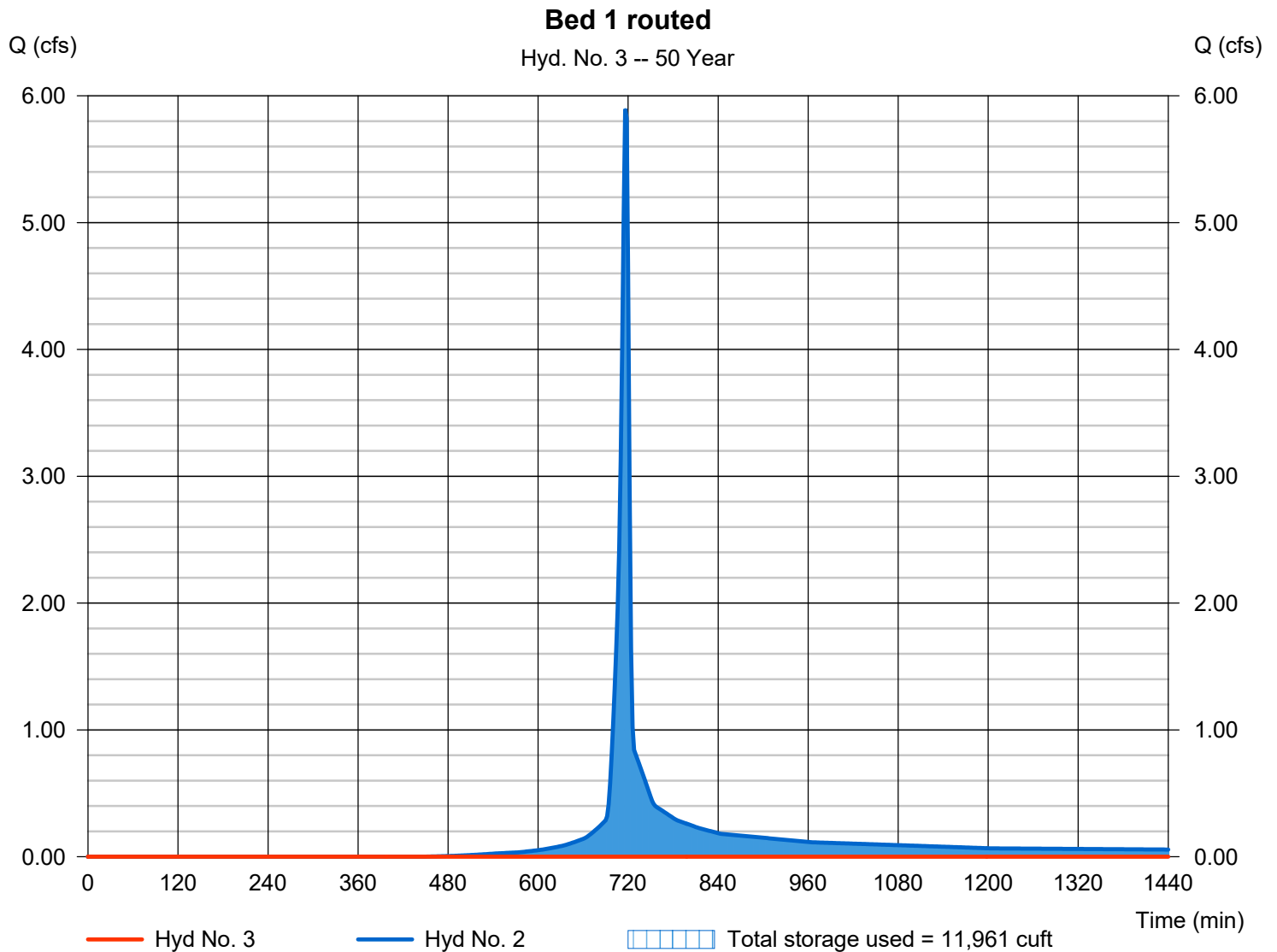
Hydrograph Report

Hyd. No. 3

Bed 1 routed

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 50 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 2 - Post Dev-Bed 1	Max. Elevation	= 439.94 ft
Reservoir name	= Bed 1	Max. Storage	= 11,961 cuft

Storage Indication method used.



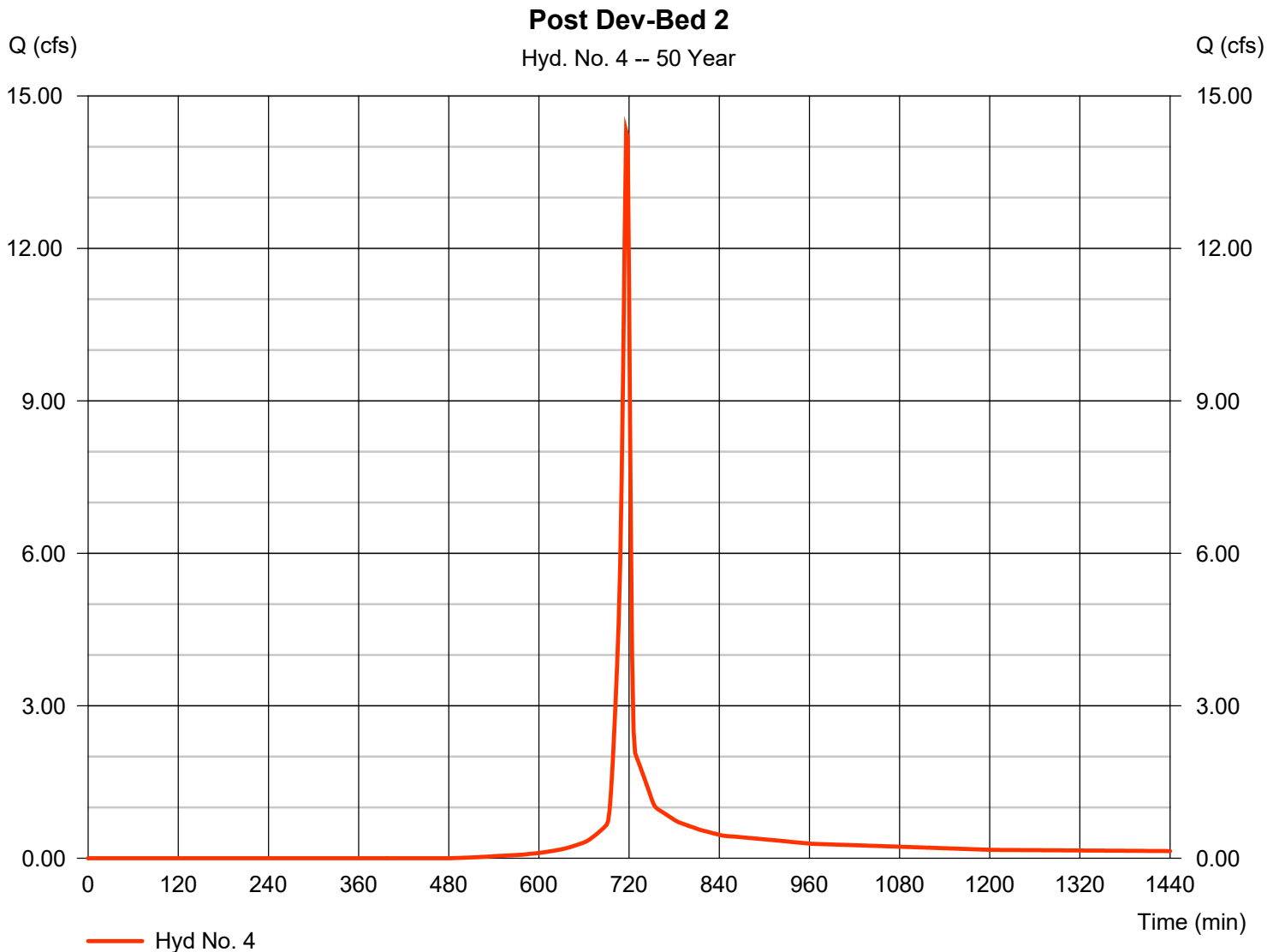
Hydrograph Report

Hyd. No. 4

Post Dev-Bed 2

Hydrograph type	= SCS Runoff	Peak discharge	= 14.31 cfs
Storm frequency	= 50 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 28,942 cuft
Drainage area	= 2.460 ac	Curve number	= 72*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.56 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = $[(0.740 \times 98) + (1.720 \times 61)] / 2.460$



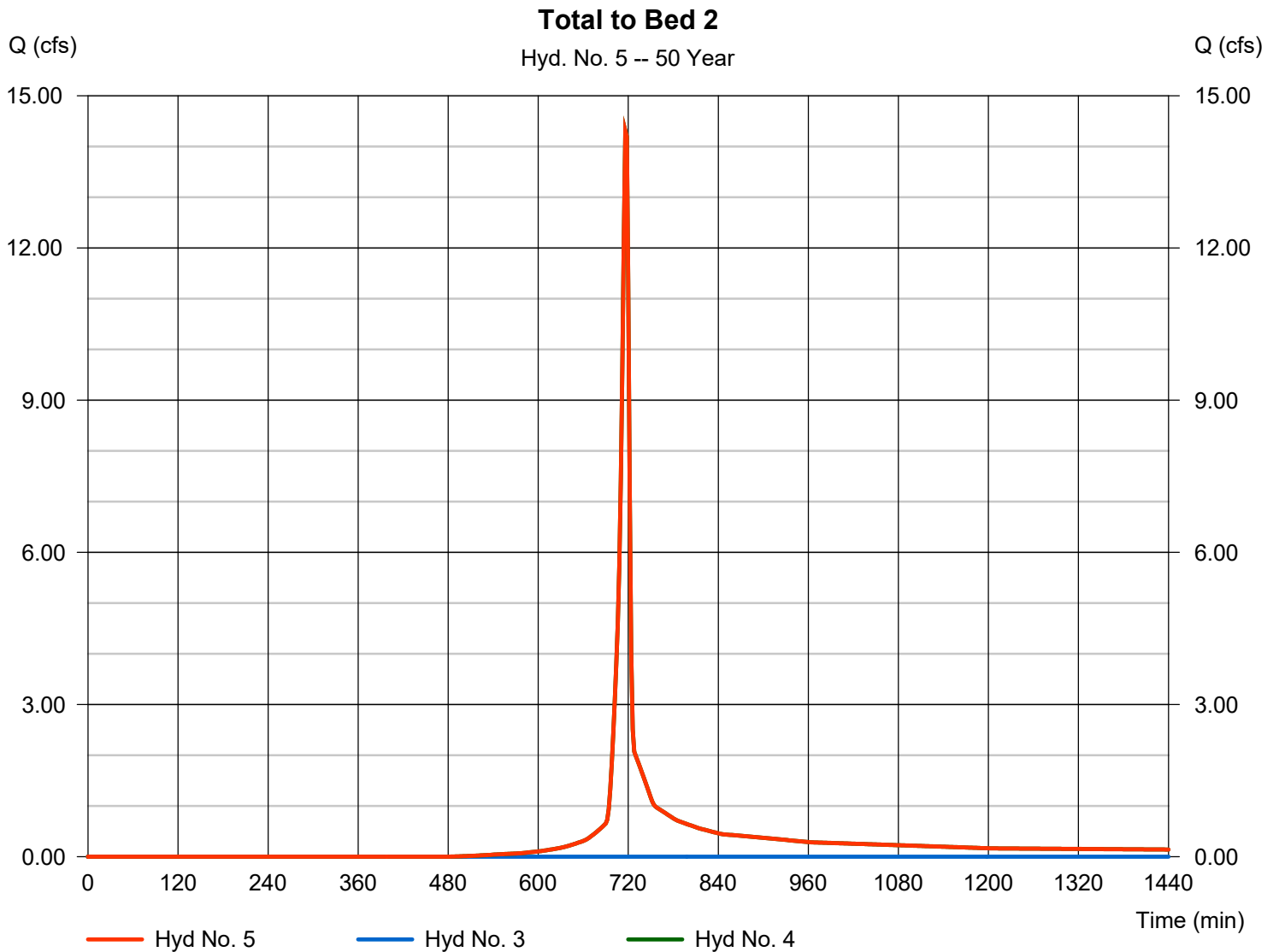
Hydrograph Report

Hyd. No. 5

Total to Bed 2

Hydrograph type = Combine
Storm frequency = 50 yrs
Time interval = 2 min
Inflow hyds. = 3, 4

Peak discharge = 14.31 cfs
Time to peak = 716 min
Hyd. volume = 28,942 cuft
Contrib. drain. area = 2.460 ac



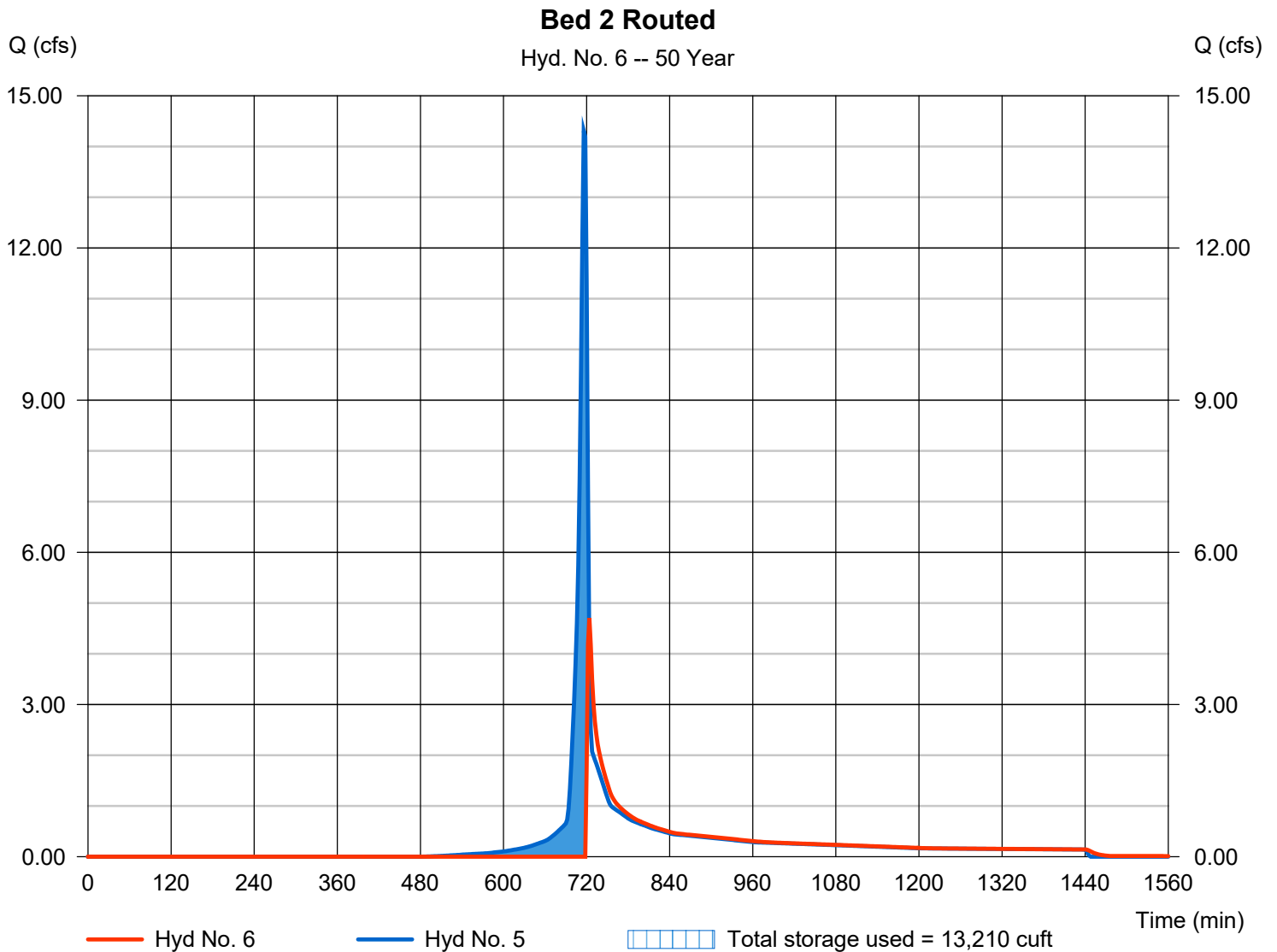
Hydrograph Report

Hyd. No. 6

Bed 2 Routed

Hydrograph type	= Reservoir	Peak discharge	= 4.701 cfs
Storm frequency	= 50 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 17,890 cuft
Inflow hyd. No.	= 5 - Total to Bed 2	Max. Elevation	= 434.10 ft
Reservoir name	= Bed 2	Max. Storage	= 13,210 cuft

Storage Indication method used.



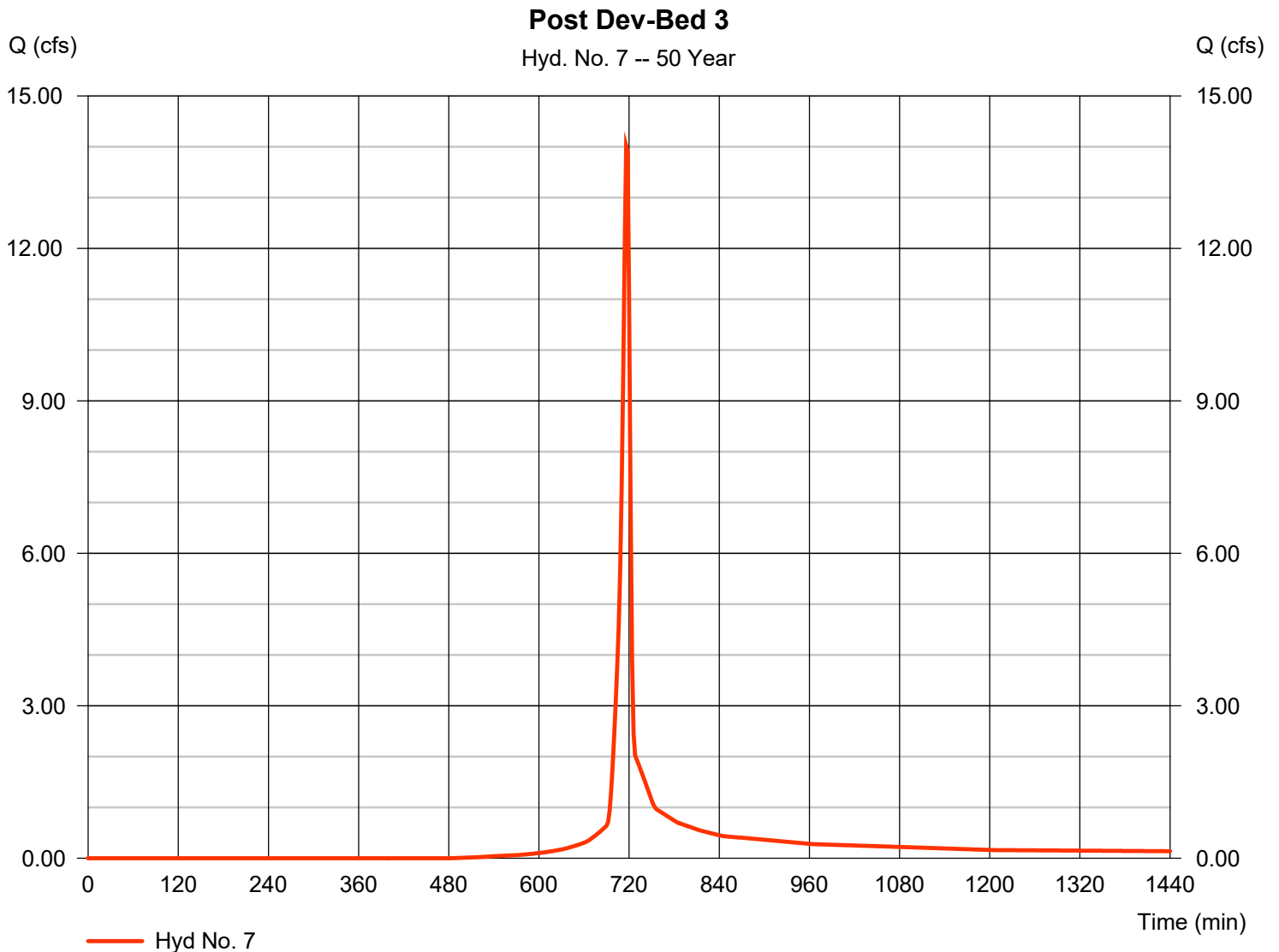
Hydrograph Report

Hyd. No. 7

Post Dev-Bed 3

Hydrograph type	= SCS Runoff	Peak discharge	= 14.02 cfs
Storm frequency	= 50 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 28,354 cuft
Drainage area	= 2.410 ac	Curve number	= 72*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.56 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = $[(0.720 \times 98) + (1.690 \times 61)] / 2.410$



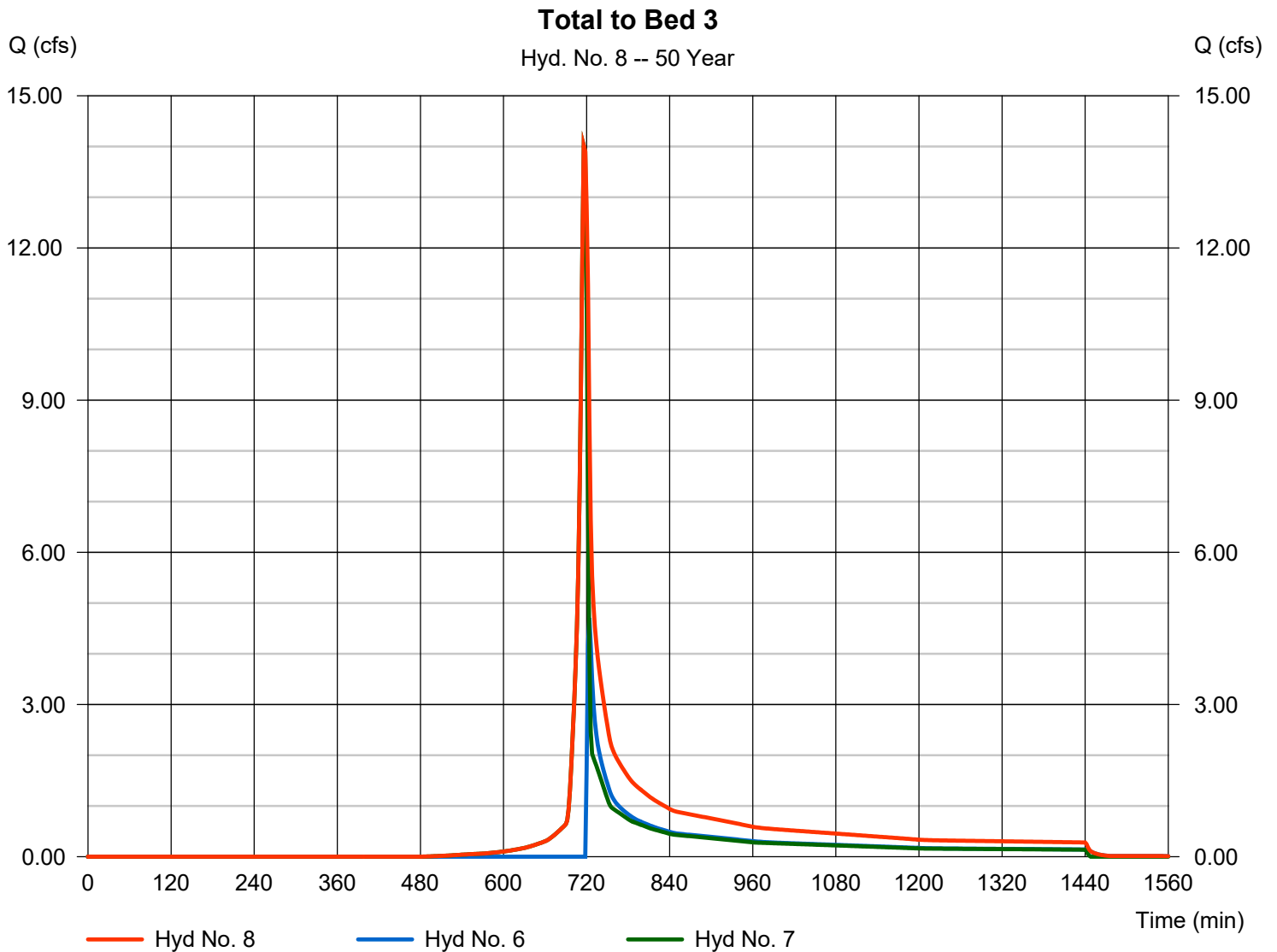
Hydrograph Report

Hyd. No. 8

Total to Bed 3

Hydrograph type = Combine
Storm frequency = 50 yrs
Time interval = 2 min
Inflow hyds. = 6, 7

Peak discharge = 14.02 cfs
Time to peak = 716 min
Hyd. volume = 46,244 cuft
Contrib. drain. area = 2.410 ac



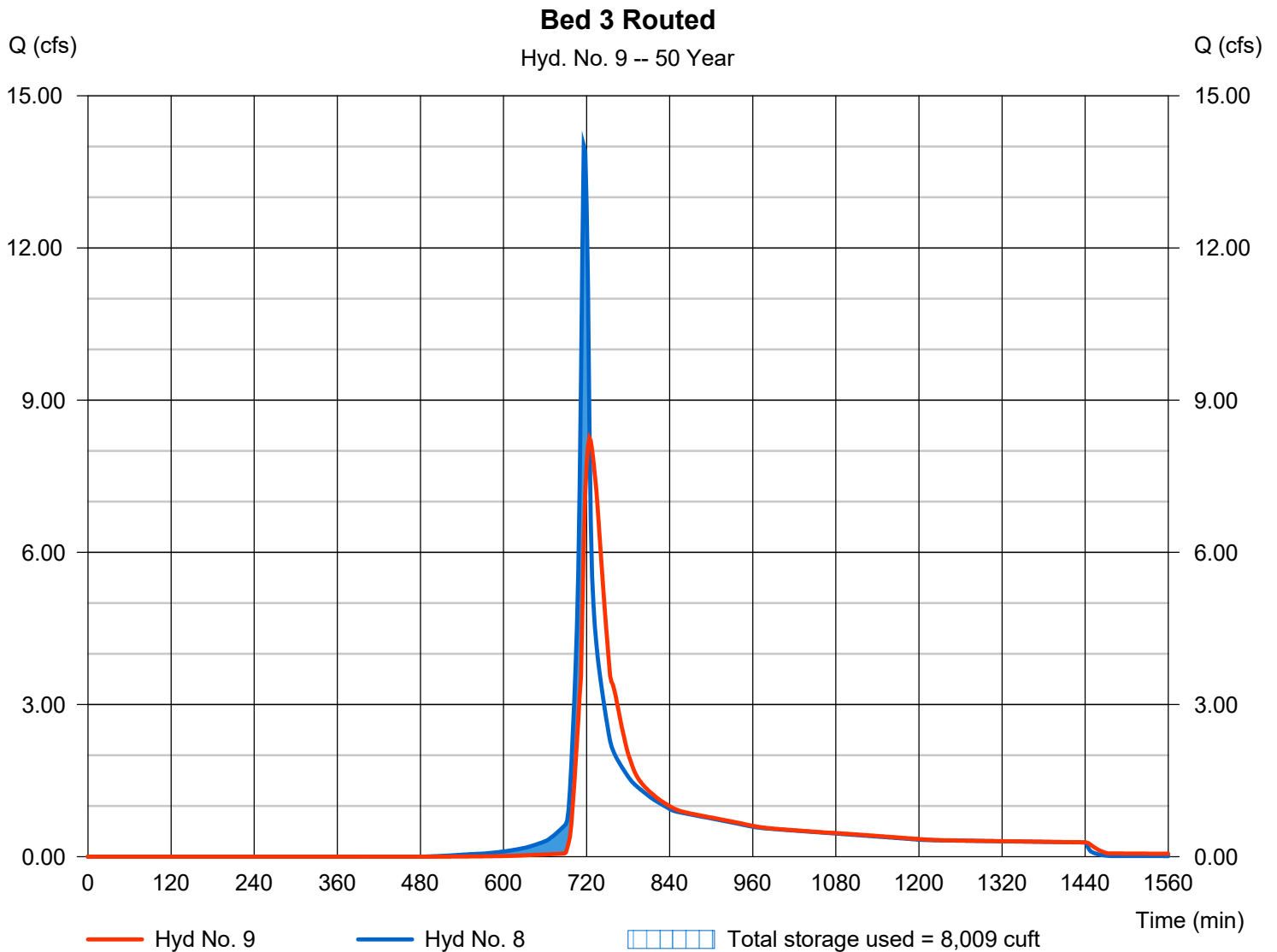
Hydrograph Report

Hyd. No. 9

Bed 3 Routed

Hydrograph type	= Reservoir	Peak discharge	= 8.252 cfs
Storm frequency	= 50 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 46,222 cuft
Inflow hyd. No.	= 8 - Total to Bed 3	Max. Elevation	= 422.61 ft
Reservoir name	= Bed 3	Max. Storage	= 8,009 cuft

Storage Indication method used.

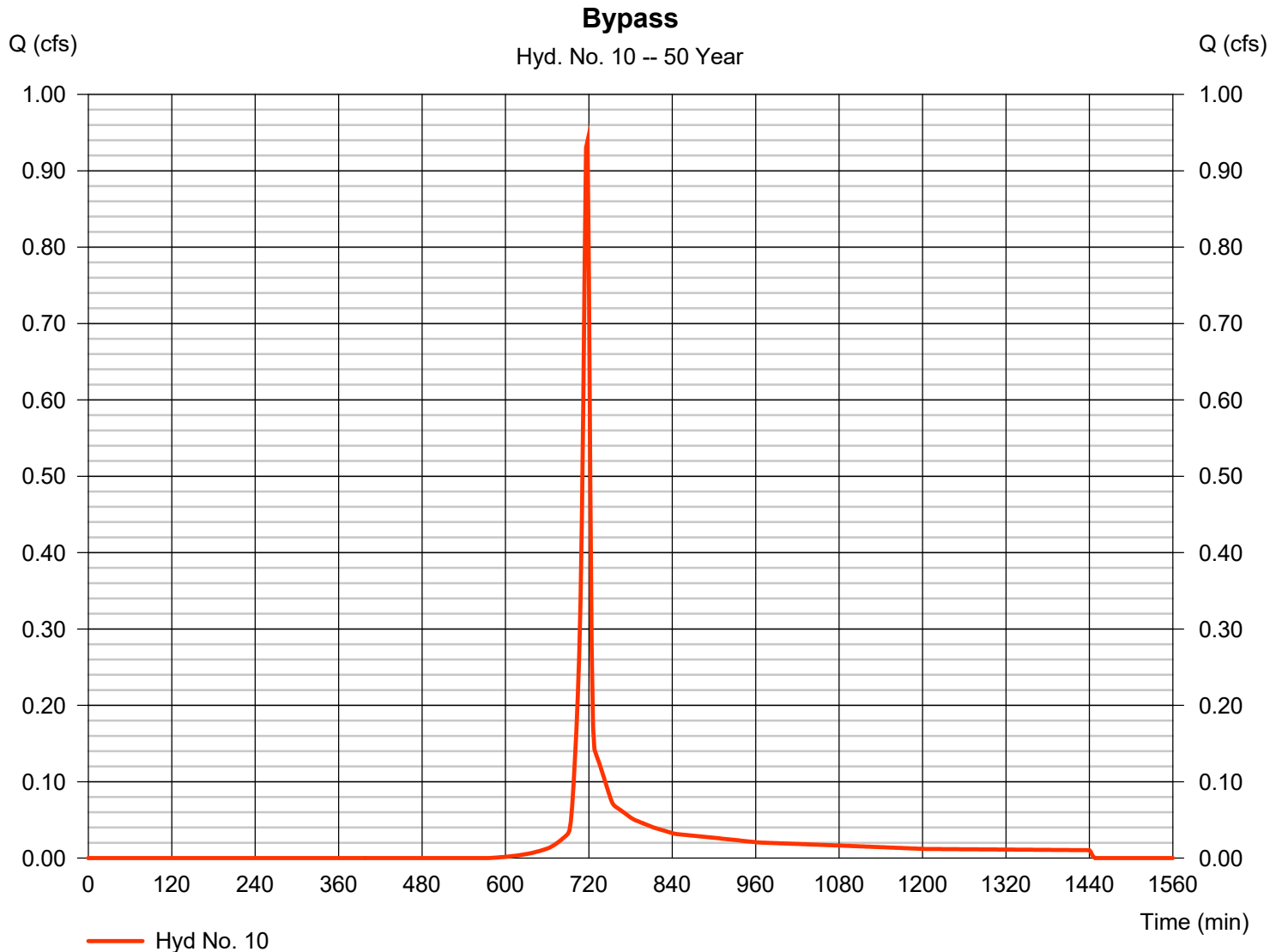


Hydrograph Report

Hyd. No. 10

Bypass

Hydrograph type	= SCS Runoff	Peak discharge	= 0.939 cfs
Storm frequency	= 50 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 1,883 cuft
Drainage area	= 0.200 ac	Curve number	= 65
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.56 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



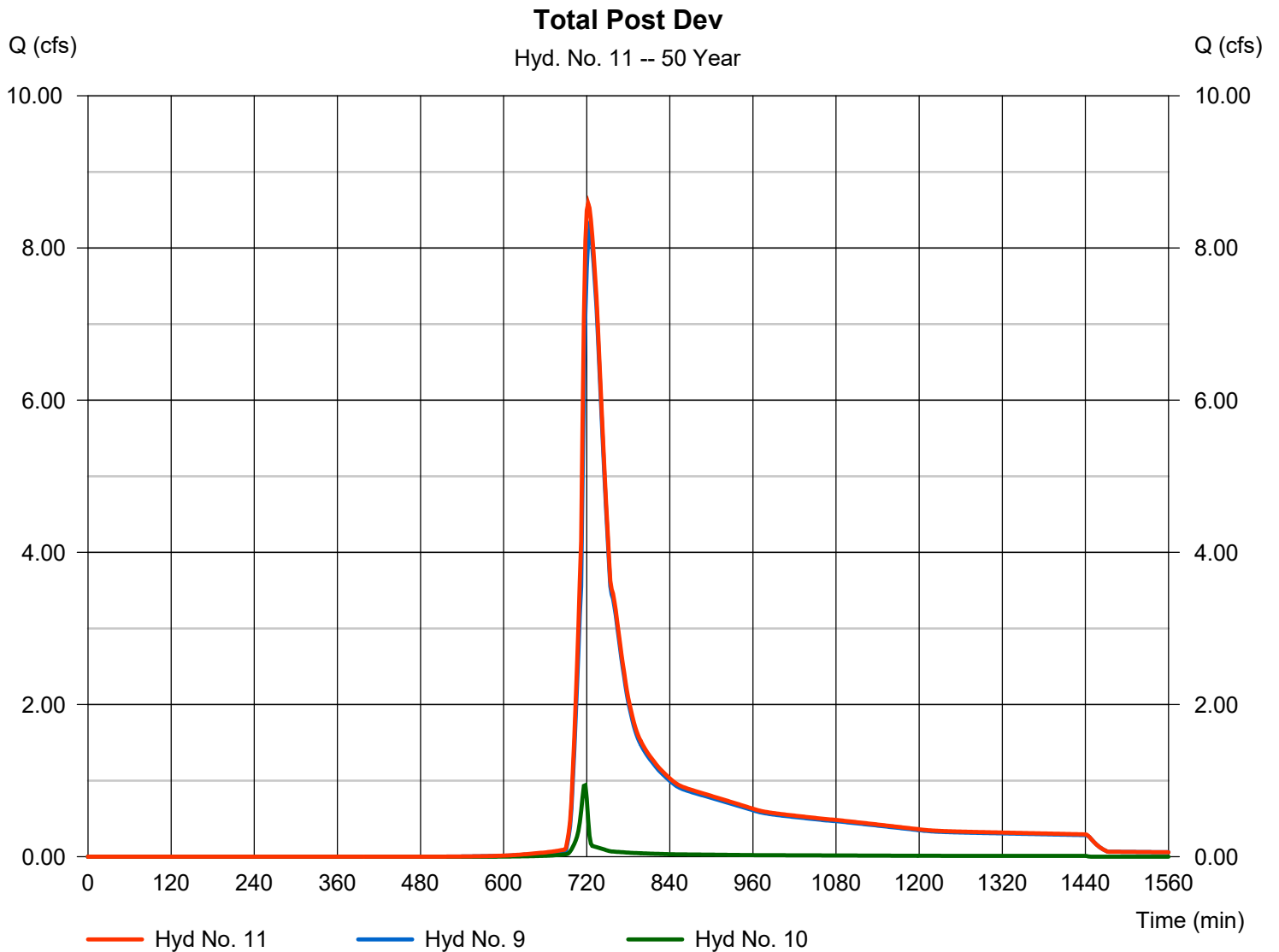
Hydrograph Report

Hyd. No. 11

Total Post Dev

Hydrograph type = Combine
Storm frequency = 50 yrs
Time interval = 2 min
Inflow hyds. = 9, 10

Peak discharge = 8.585 cfs
Time to peak = 722 min
Hyd. volume = 48,105 cuft
Contrib. drain. area = 0.200 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

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	20.43	2	720	53,261	-----	-----	-----	Pre Dev
2	SCS Runoff	7.108	2	716	14,495	-----	-----	-----	Post Dev-Bed 1
3	Reservoir	0.000	2	n/a	0	2	440.56	14,495	Bed 1 routed
4	SCS Runoff	17.38	2	716	35,289	-----	-----	-----	Post Dev-Bed 2
5	Combine	17.38	2	716	35,289	3, 4	-----	-----	Total to Bed 2
6	Reservoir	9.828	2	722	24,238	5	434.48	14,577	Bed 2 Routed
7	SCS Runoff	17.03	2	716	34,572	-----	-----	-----	Post Dev-Bed 3
8	Combine	22.94	2	720	58,810	6, 7	-----	-----	Total to Bed 3
9	Reservoir	10.67	2	726	58,789	8	423.93	12,049	Bed 3 Routed
10	SCS Runoff	1.167	2	718	2,351	-----	-----	-----	Bypass
11	Combine	10.93	2	724	61,140	9, 10	-----	-----	Total Post Dev

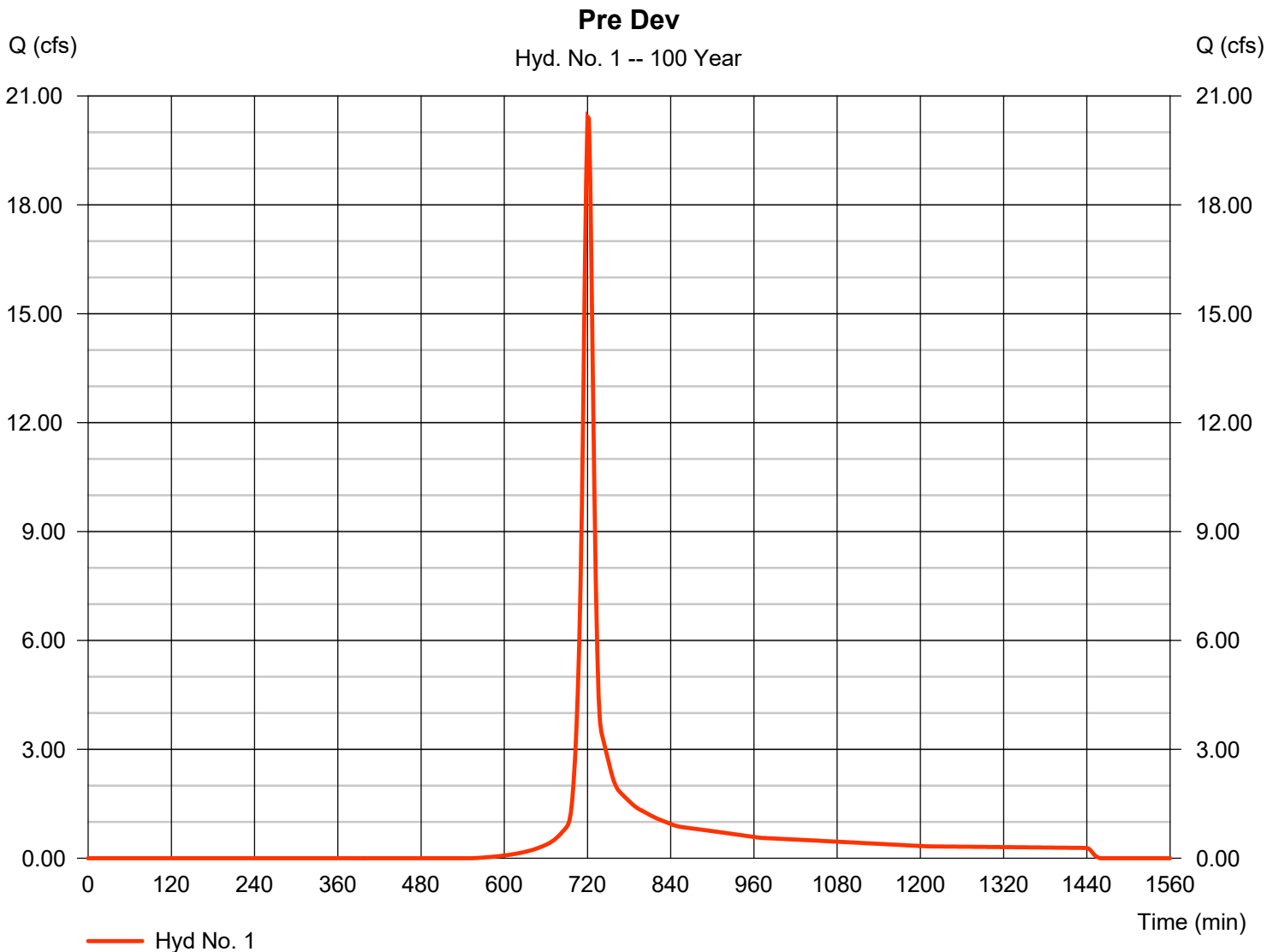
Hydrograph Report

Hyd. No. 1

Pre Dev

Hydrograph type	= SCS Runoff	Peak discharge	= 20.43 cfs
Storm frequency	= 100 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 53,261 cuft
Drainage area	= 4.250 ac	Curve number	= 64*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.10 min
Total precip.	= 7.45 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.650 x 98) + (3.600 x 58)] / 4.250



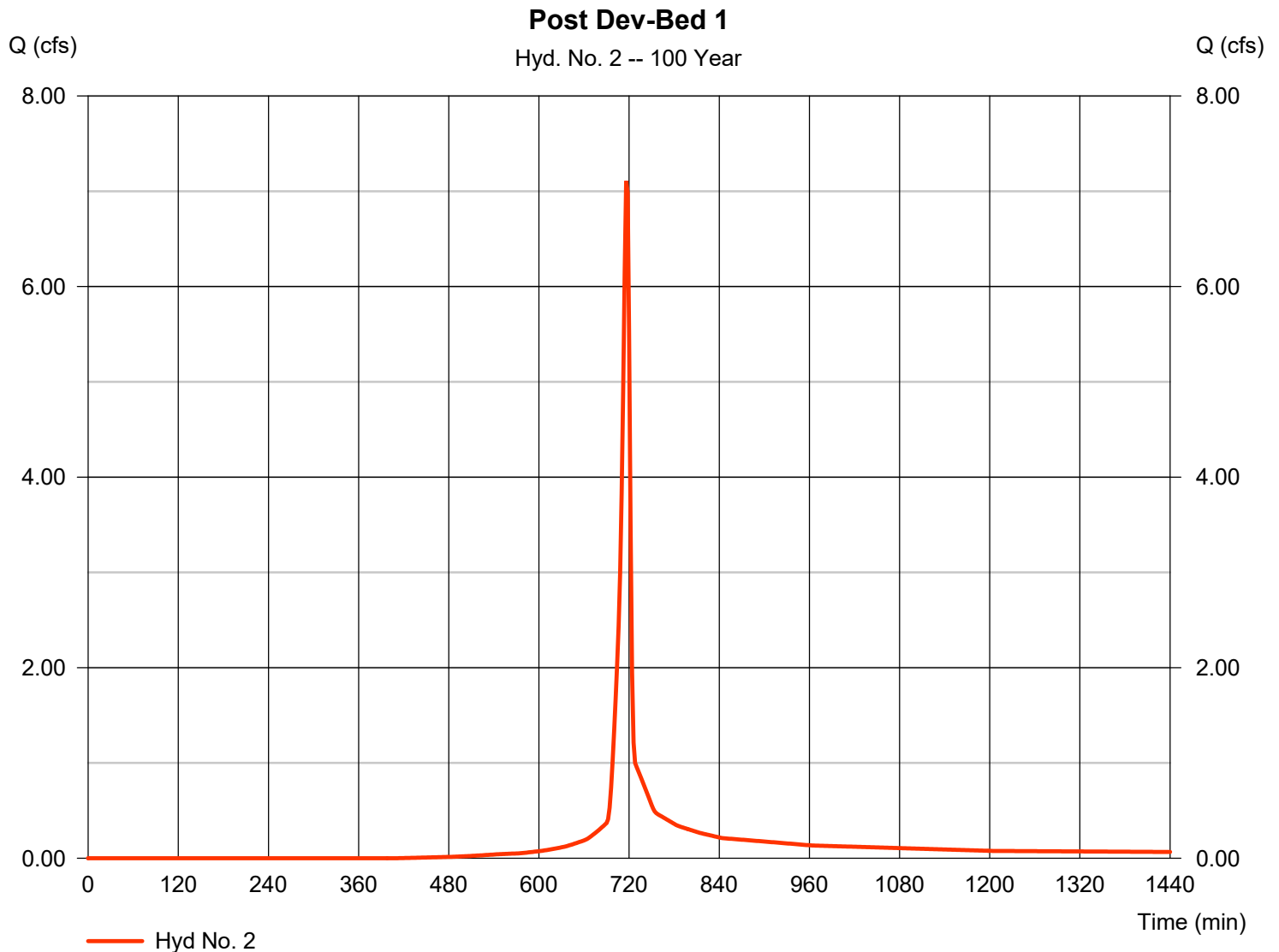
Hydrograph Report

Hyd. No. 2

Post Dev-Bed 1

Hydrograph type	= SCS Runoff	Peak discharge	= 7.108 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 14,495 cuft
Drainage area	= 0.960 ac	Curve number	= 74*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.45 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = $[(0.340 \times 98) + (0.620 \times 61)] / 0.960$



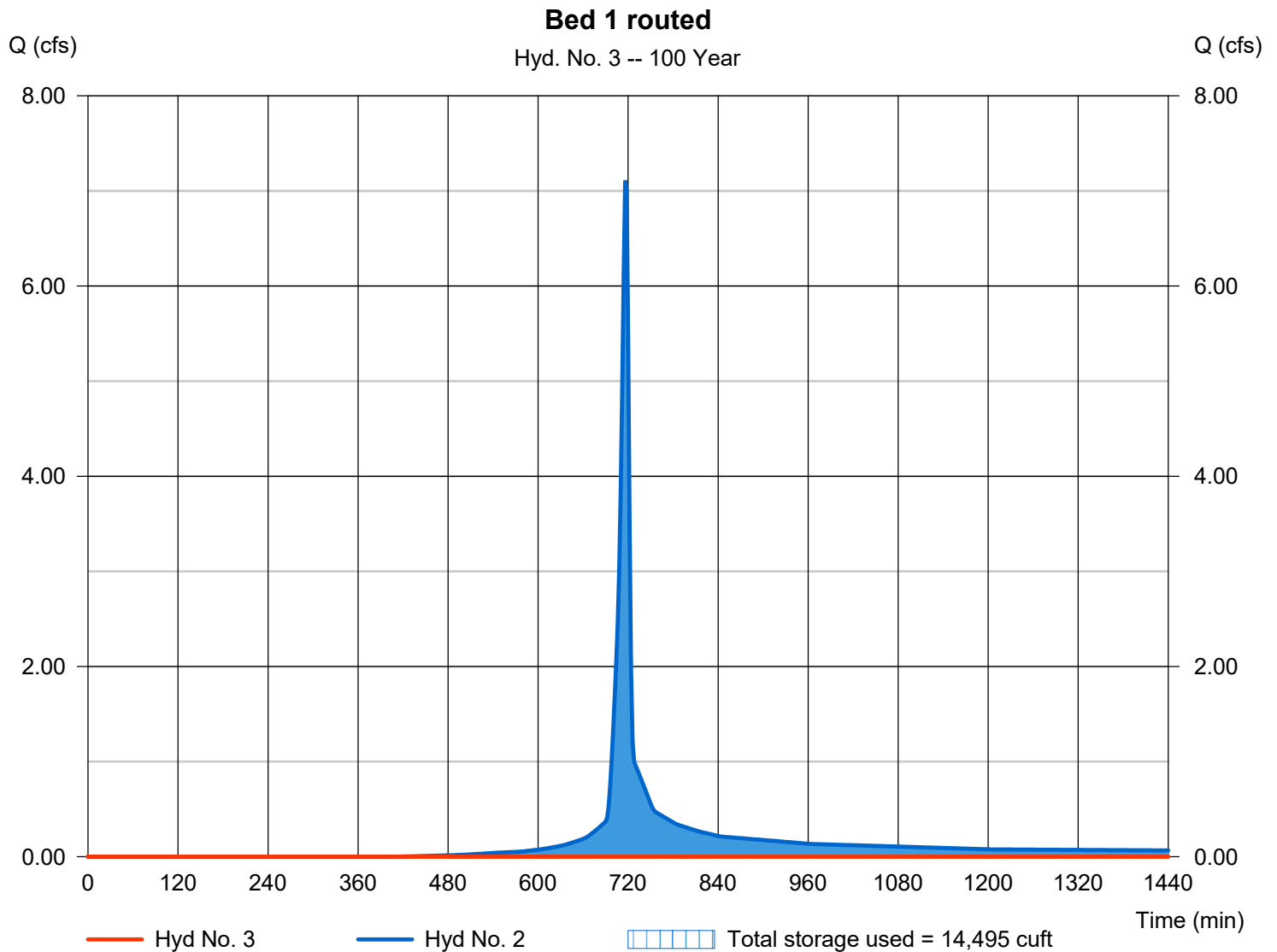
Hydrograph Report

Hyd. No. 3

Bed 1 routed

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 100 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 2 - Post Dev-Bed 1	Max. Elevation	= 440.56 ft
Reservoir name	= Bed 1	Max. Storage	= 14,495 cuft

Storage Indication method used.



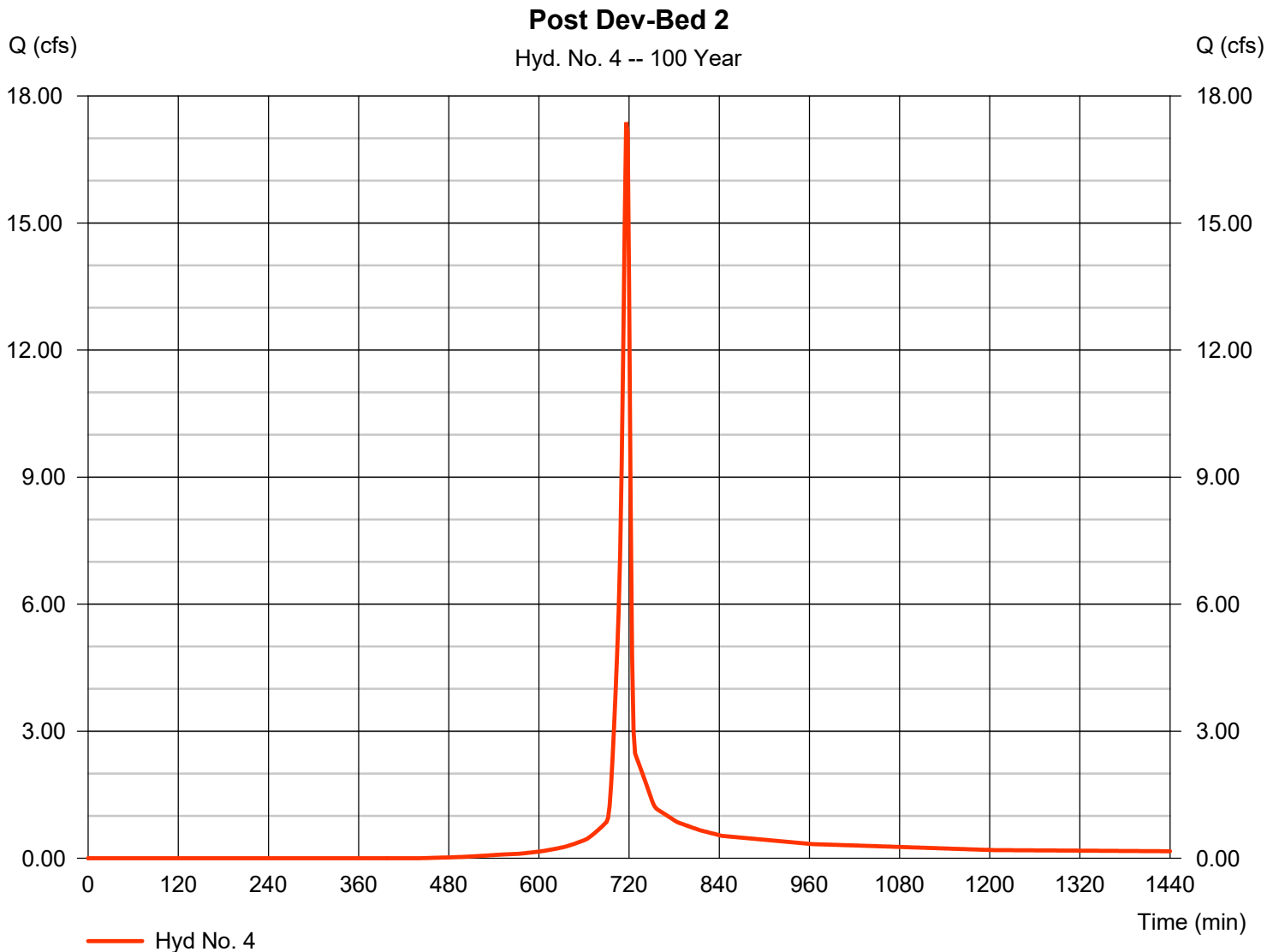
Hydrograph Report

Hyd. No. 4

Post Dev-Bed 2

Hydrograph type	= SCS Runoff	Peak discharge	= 17.38 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 35,289 cuft
Drainage area	= 2.460 ac	Curve number	= 72*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.45 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = $[(0.740 \times 98) + (1.720 \times 61)] / 2.460$



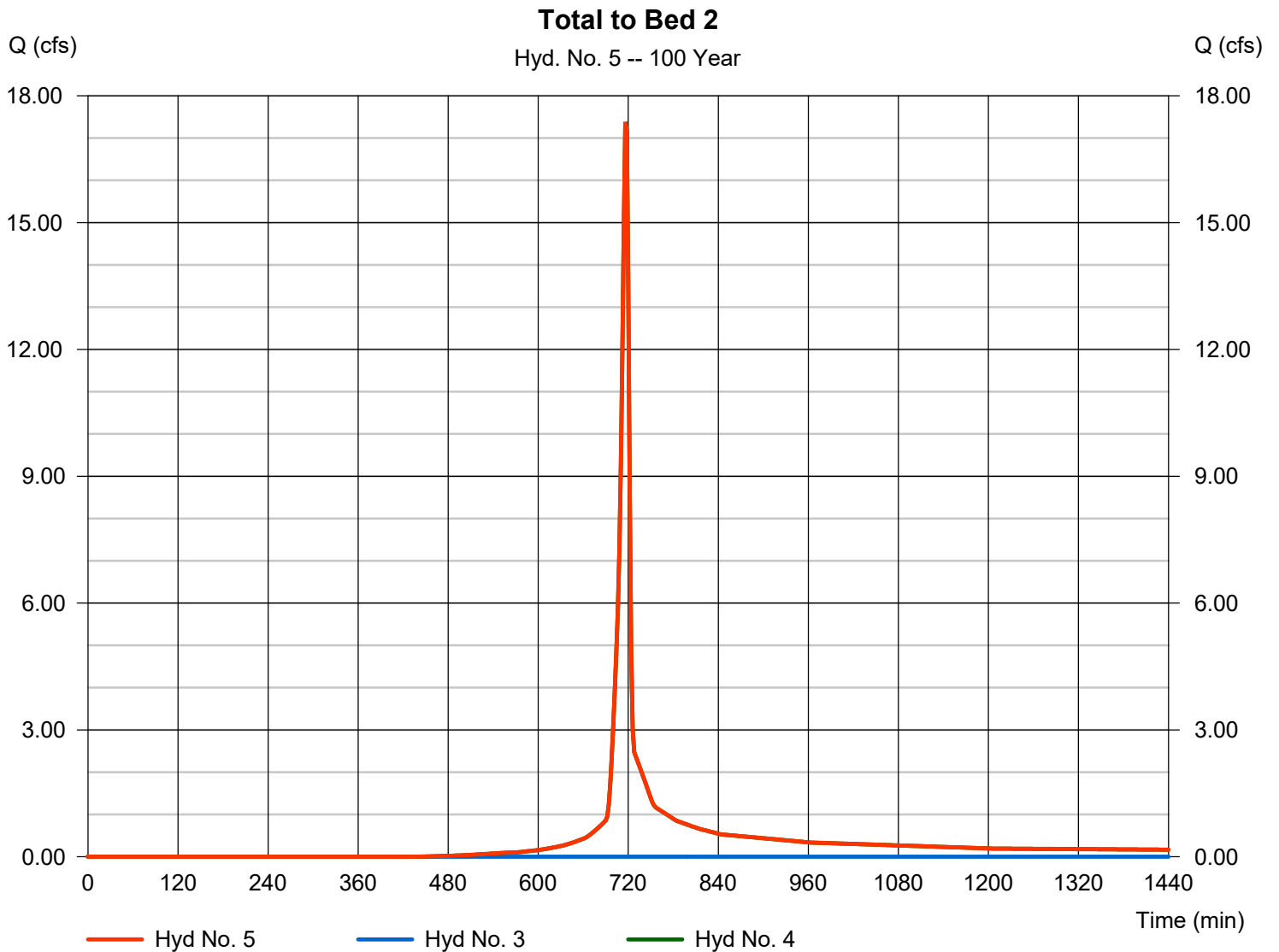
Hydrograph Report

Hyd. No. 5

Total to Bed 2

Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 2 min
Inflow hyds. = 3, 4

Peak discharge = 17.38 cfs
Time to peak = 716 min
Hyd. volume = 35,289 cuft
Contrib. drain. area = 2.460 ac



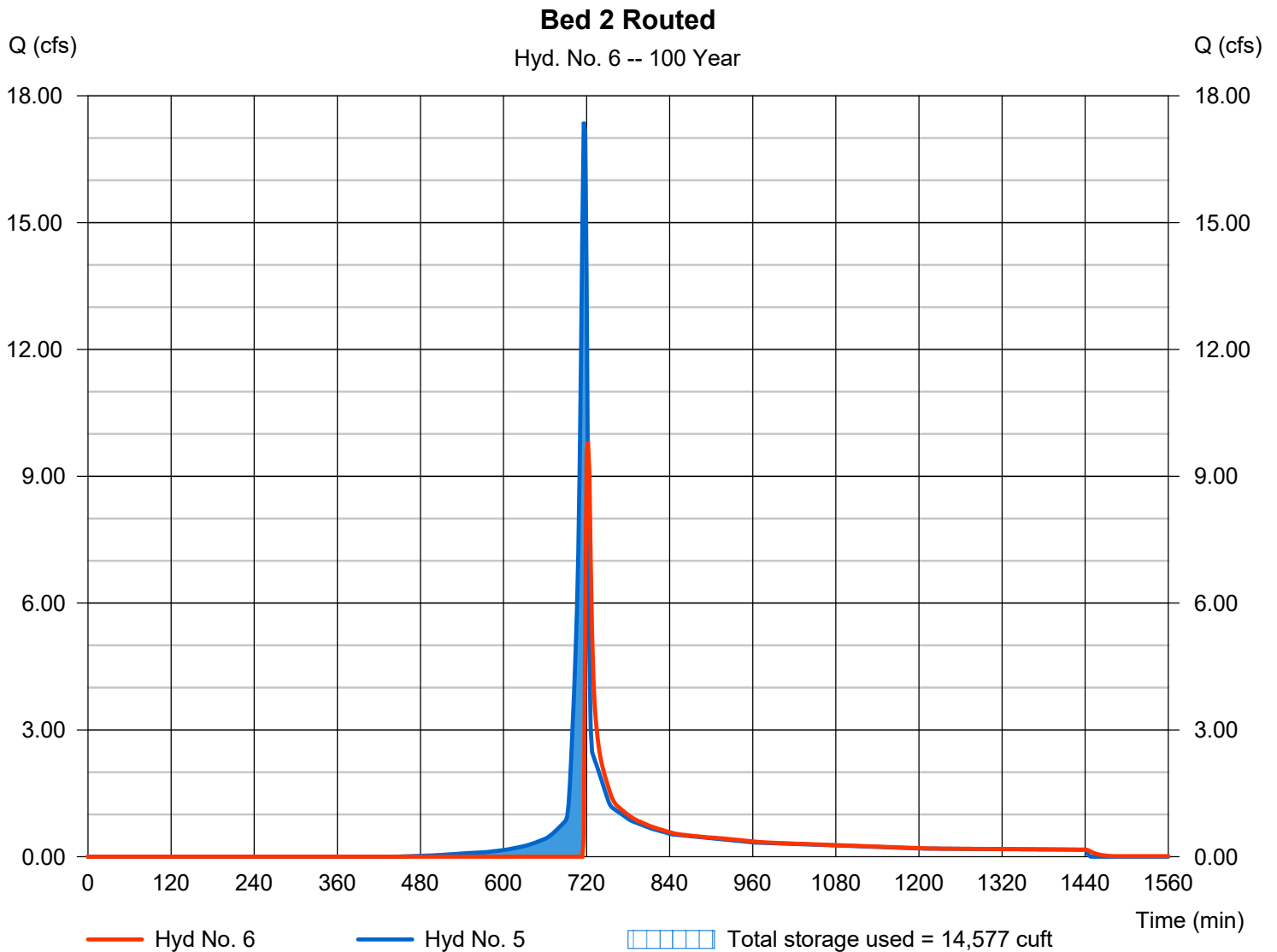
Hydrograph Report

Hyd. No. 6

Bed 2 Routed

Hydrograph type	= Reservoir	Peak discharge	= 9.828 cfs
Storm frequency	= 100 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 24,238 cuft
Inflow hyd. No.	= 5 - Total to Bed 2	Max. Elevation	= 434.48 ft
Reservoir name	= Bed 2	Max. Storage	= 14,577 cuft

Storage Indication method used.



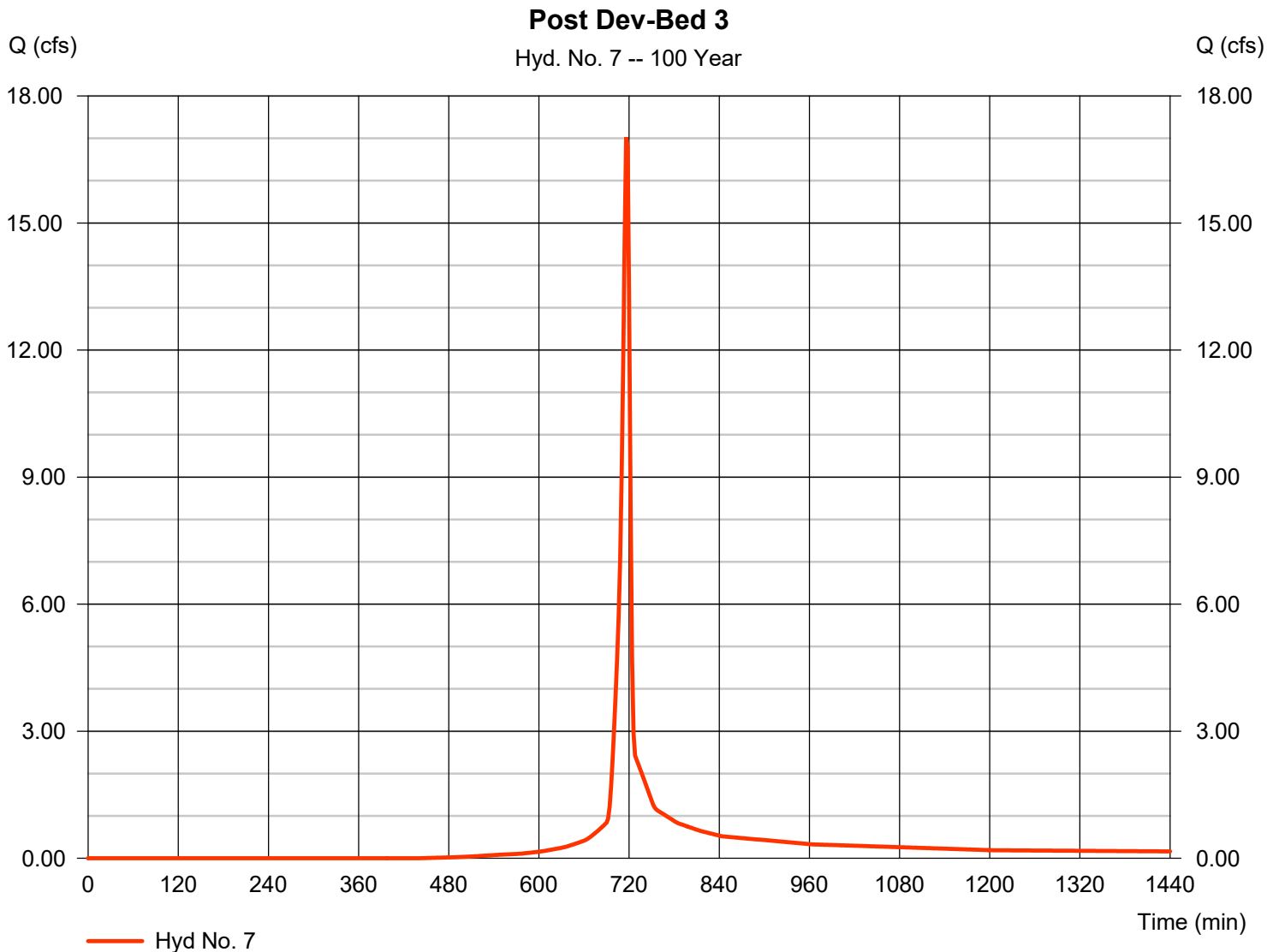
Hydrograph Report

Hyd. No. 7

Post Dev-Bed 3

Hydrograph type	= SCS Runoff	Peak discharge	= 17.03 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 34,572 cuft
Drainage area	= 2.410 ac	Curve number	= 72*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.45 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = $[(0.720 \times 98) + (1.690 \times 61)] / 2.410$



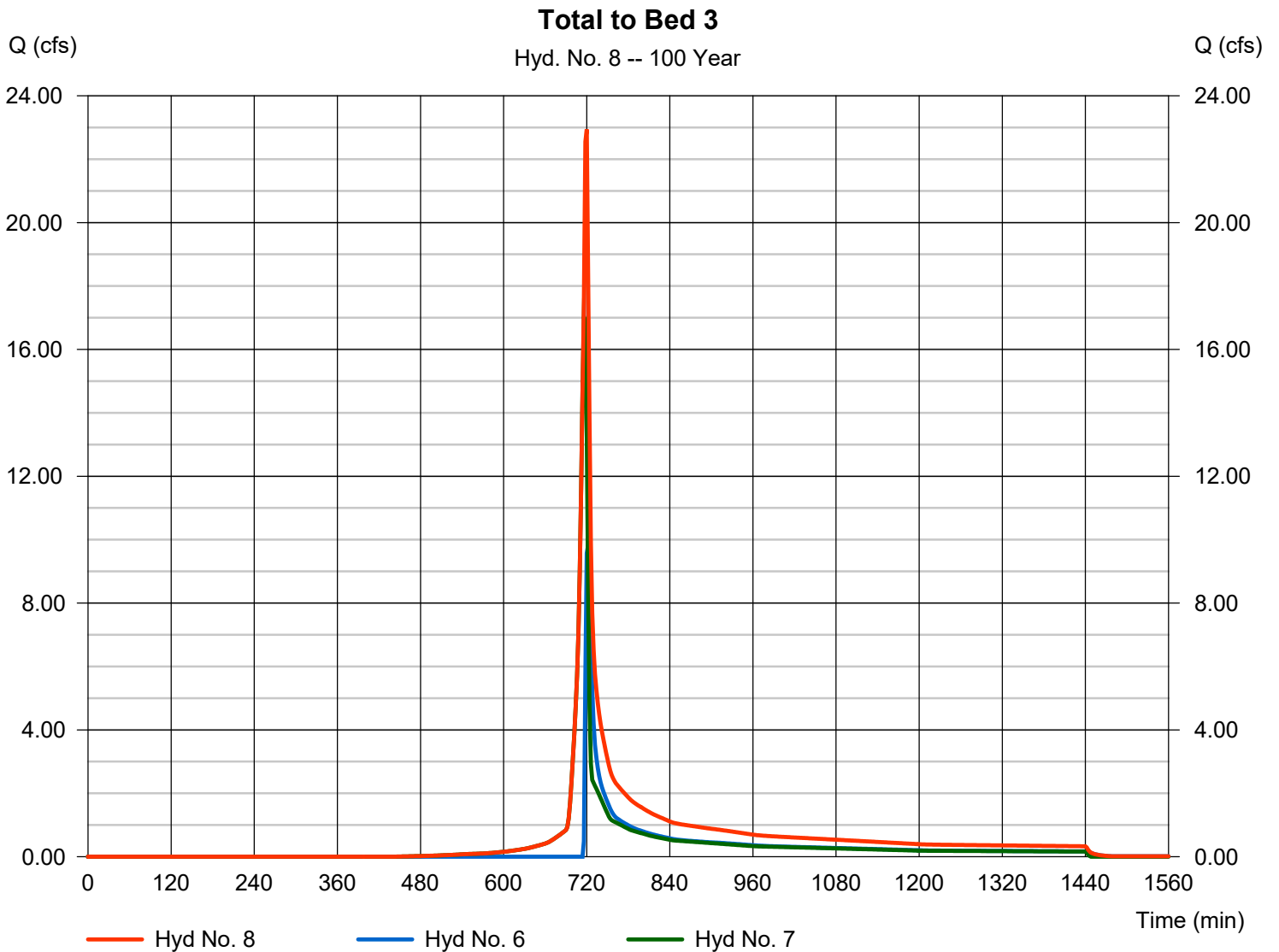
Hydrograph Report

Hyd. No. 8

Total to Bed 3

Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 2 min
Inflow hyds. = 6, 7

Peak discharge = 22.94 cfs
Time to peak = 720 min
Hyd. volume = 58,810 cuft
Contrib. drain. area = 2.410 ac



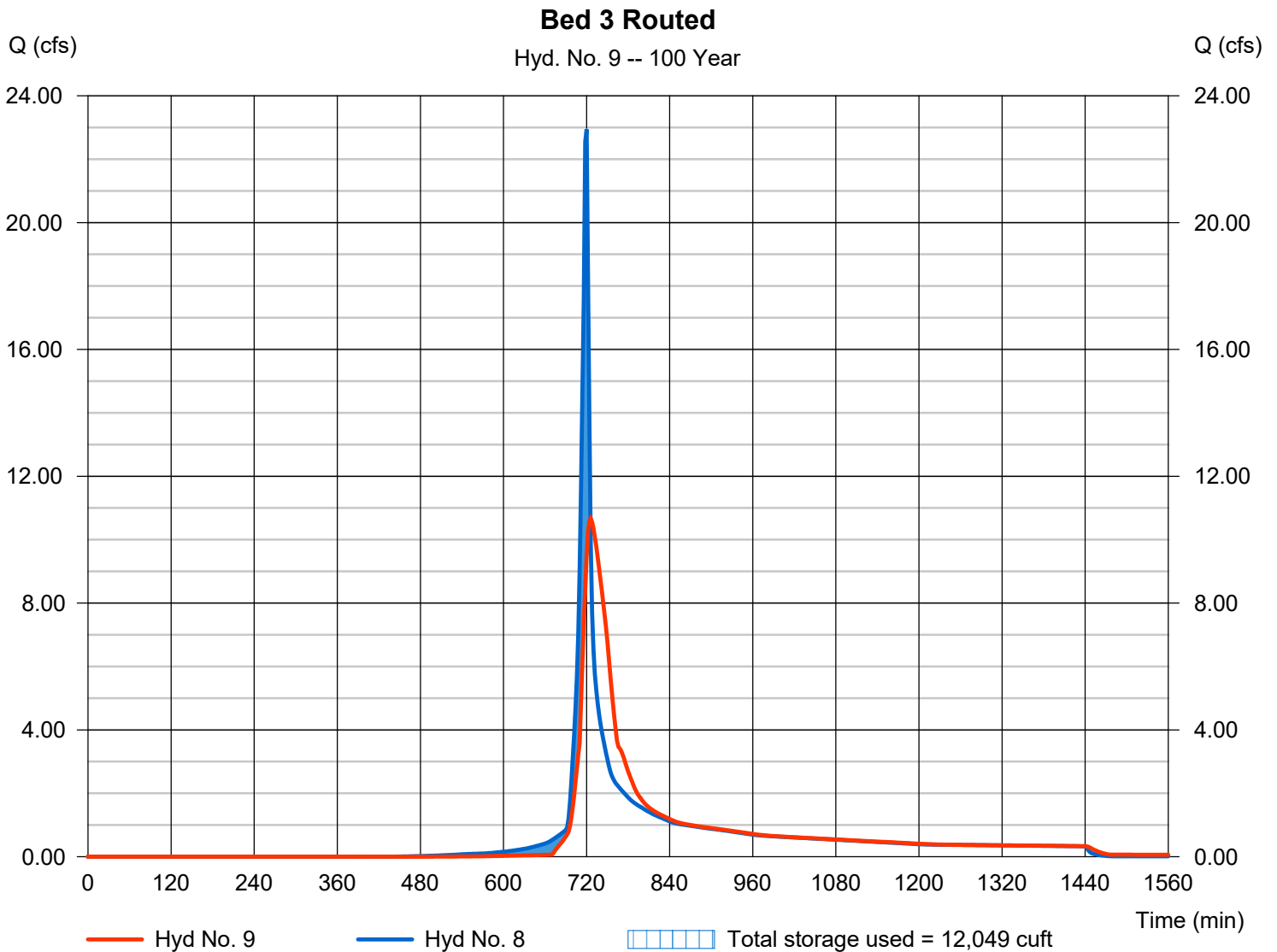
Hydrograph Report

Hyd. No. 9

Bed 3 Routed

Hydrograph type	= Reservoir	Peak discharge	= 10.67 cfs
Storm frequency	= 100 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 58,789 cuft
Inflow hyd. No.	= 8 - Total to Bed 3	Max. Elevation	= 423.93 ft
Reservoir name	= Bed 3	Max. Storage	= 12,049 cuft

Storage Indication method used.

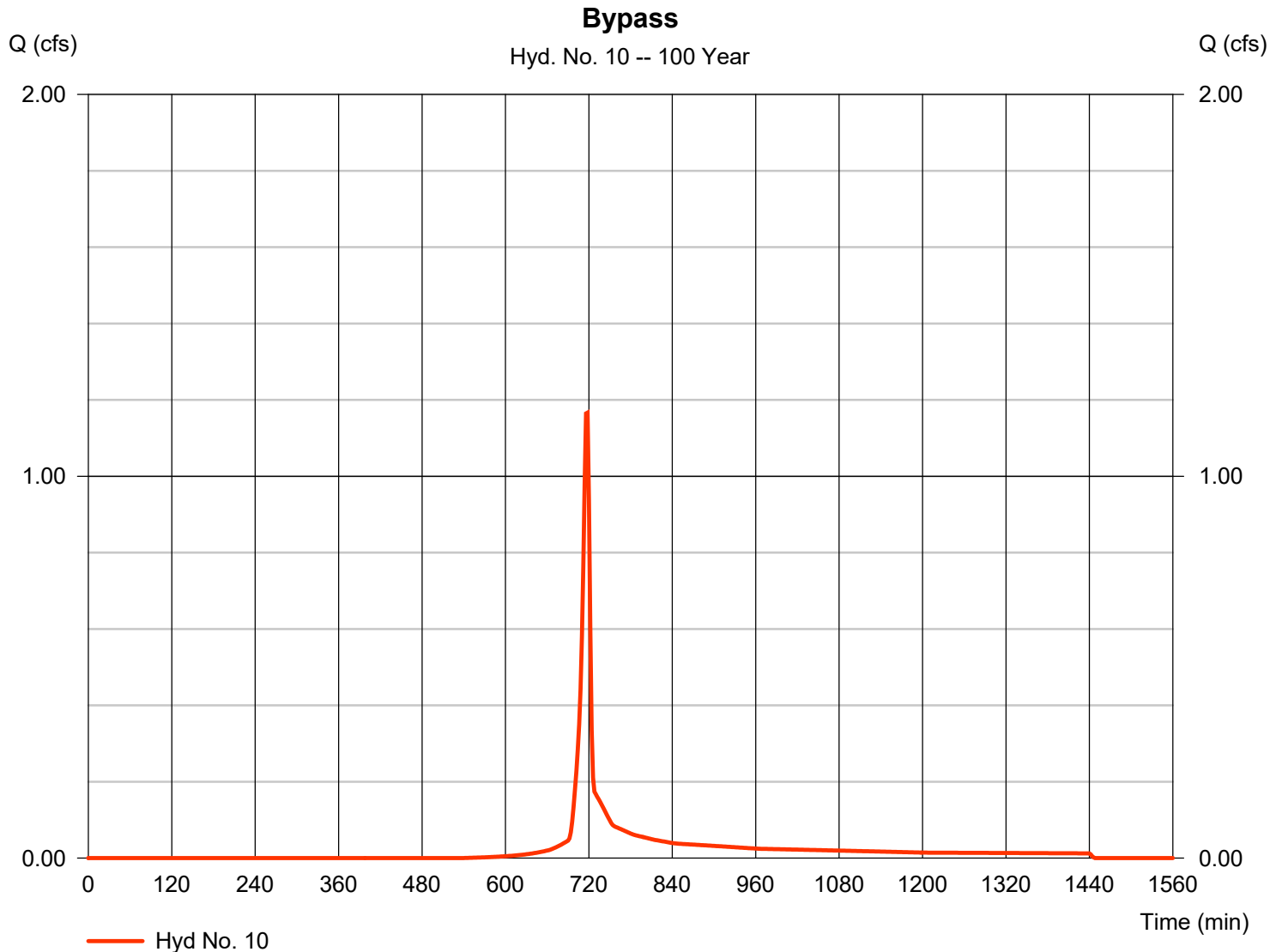


Hydrograph Report

Hyd. No. 10

Bypass

Hydrograph type	= SCS Runoff	Peak discharge	= 1.167 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 2,351 cuft
Drainage area	= 0.200 ac	Curve number	= 65
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.45 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



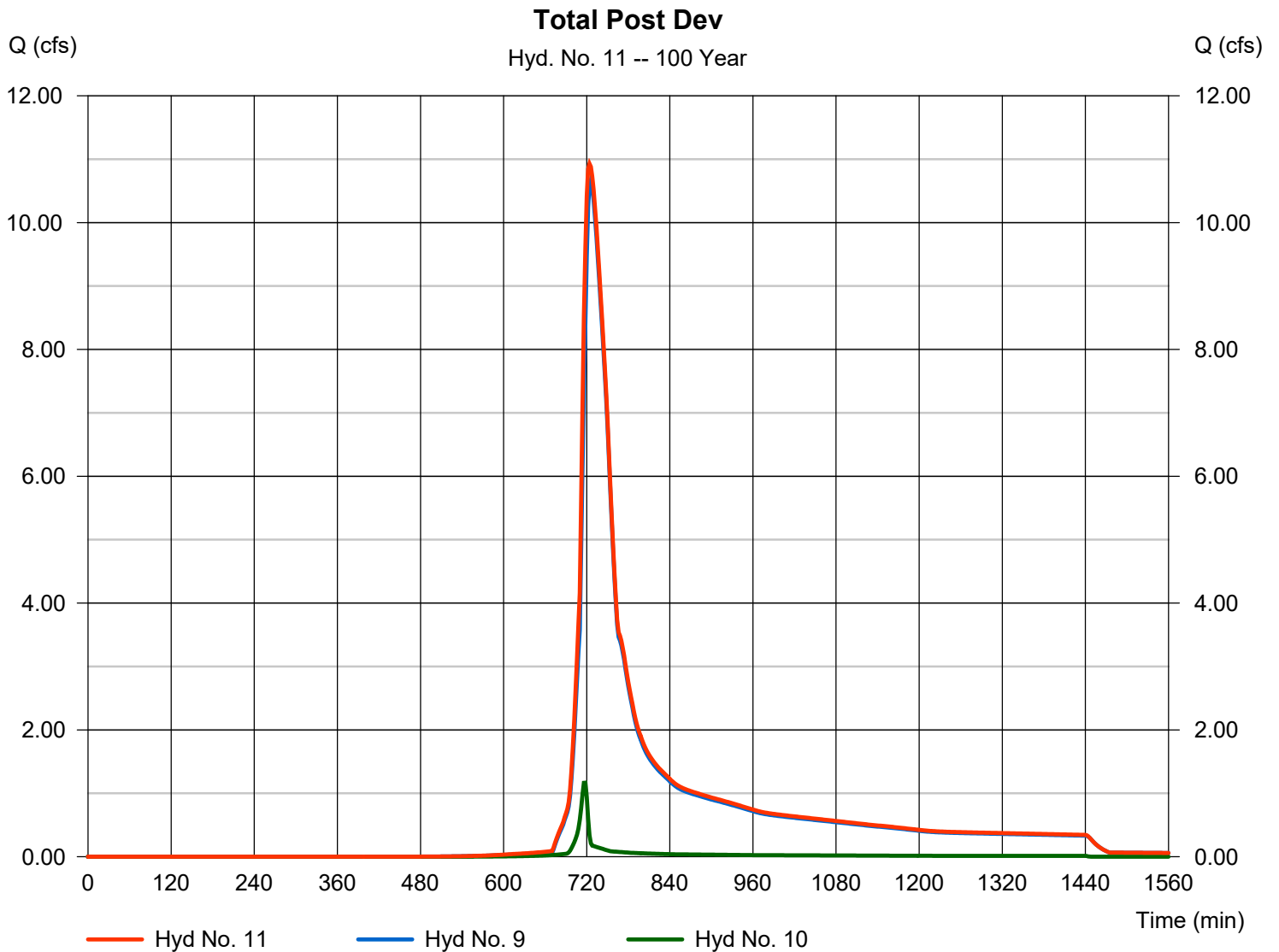
Hydrograph Report

Hyd. No. 11

Total Post Dev

Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 2 min
Inflow hyds. = 9, 10

Peak discharge = 10.93 cfs
Time to peak = 724 min
Hyd. volume = 61,140 cuft
Contrib. drain. area = 0.200 ac



STRAFFORD AVENUE
Stormwater Management Summary-Post Construction
Radnor Township Stormwater District A

Stormwater Management Summary - POI B							
Yr	Pre-Development				Post Development	Compliance	Percentage Reduction
	On-Site		Allowable Release Rate*		Total Post Developed Flow		
1	1,579		1,579		0.005	-1.57	-100%
2	2,410		1,579		0.047	-1.53	-97%
5	3,768		3,768		0.095	-3.67	-97%
10	4,983		4,983		0.377	-4.61	-92%
25	6,809		6,809		2.572	-4.24	-62%
50	8,431		8,431		6.467	-1.96	-23%
100	10,200		10,200		9.063	-1.14	-11%

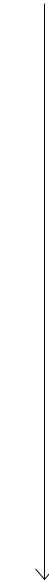
Design Storm Proposed Conditions	Reduce to	Design Storm Existing Conditions
1yr		1 yr
2 yr		1 yr
5 yr		5 yr
10 yr		10 yr
25 yr		25 yr
50 yr		50 yr
100 yr		100 yr

INFILTRATION BED 4		
Pipe Diameter =	48	inches
Pipe Length =	972	ft
Stone Bed Length	144	ft
Stone Bed Width =	80.0	ft
Stone Depth =	5.0	ft
<hr/>		
<i>Pipe Volume =</i>	<i>12215</i>	<i>ft²</i>
<i>+ Stone Voids Volume =</i>	<i>0</i>	<i>ft</i>
<hr/>		
Provided V_t =	12215	ft³

Dead Storage Depth = 1.5
Infiltration Bed Dead Storage Provided = 4,580

Watershed Model Schematic

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2



Legend

<u>Hyd.</u>	<u>Origin</u>	<u>Description</u>
1	SCS Runoff	Pre Dev
2	SCS Runoff	Post Dev
3	Reservoir	Bed 4 routed

Hydrograph Return Period Recap

Hydratlow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

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	-----	1.579	2.410	-----	3.768	4.983	6.809	8.431	10.20	Pre Dev
2	SCS Runoff	-----	2.336	3.414	-----	5.139	6.679	8.986	10.98	13.15	Post Dev
3	Reservoir	2	0.005	0.047	-----	0.092	0.377	2.572	6.467	9.063	Bed 4 routed

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

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	1.579	2	718	3,231	-----	-----	-----	Pre Dev	
2	SCS Runoff	2.336	2	718	4,699	-----	-----	-----	Post Dev	
3	Reservoir	0.005	2	1446	98	2	438.04	4,688	Bed 4 routed	
POI-B-Hydro.gpw					Return Period: 1 Year			Sunday, 05 / 14 / 2023		

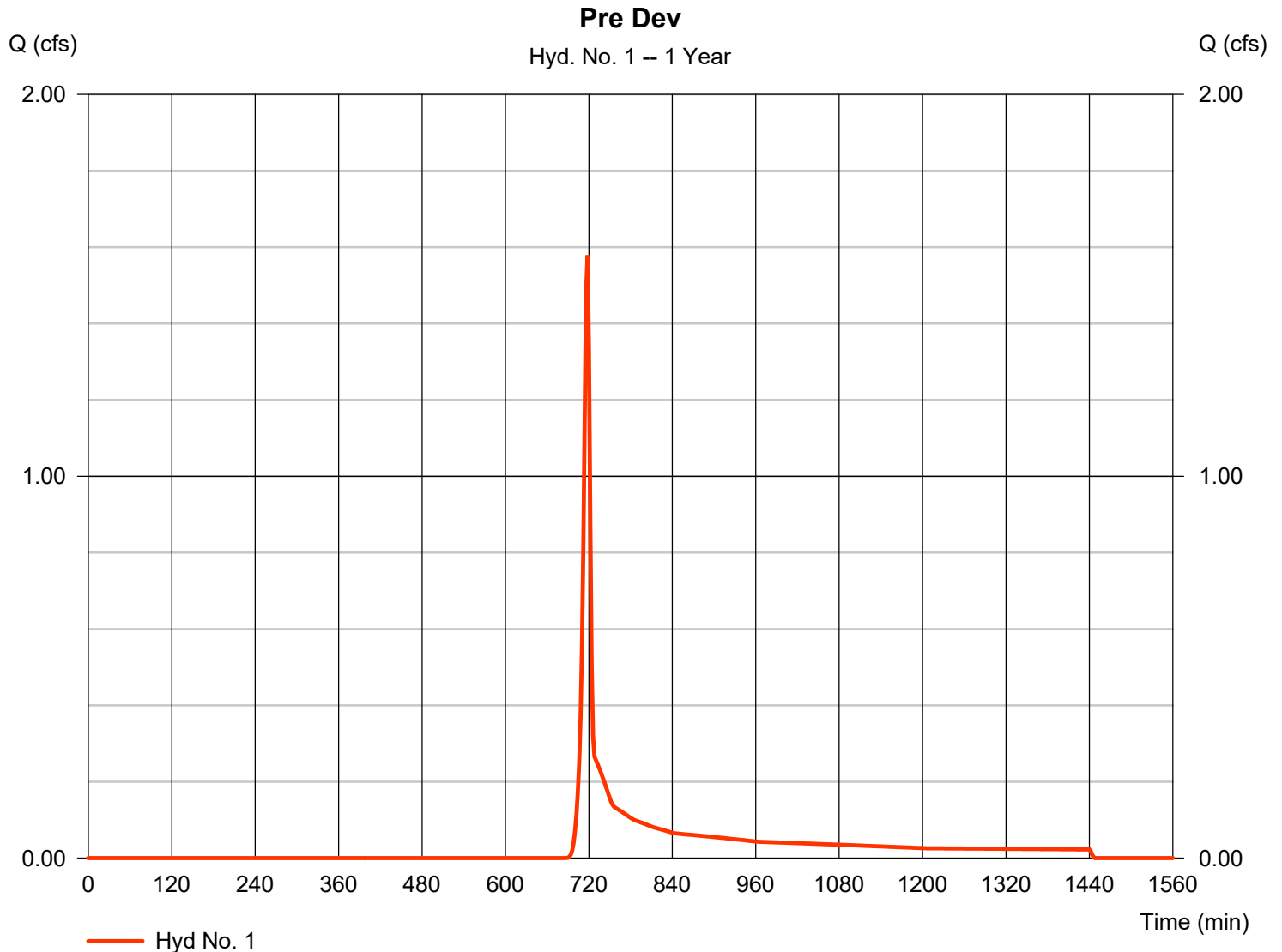
Hydrograph Report

Hyd. No. 1

Pre Dev

Hydrograph type	= SCS Runoff	Peak discharge	= 1.579 cfs
Storm frequency	= 1 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 3,231 cuft
Drainage area	= 1.410 ac	Curve number	= 73*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.69 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = $[(0.540 \times 98) + (0.870 \times 58)] / 1.410$



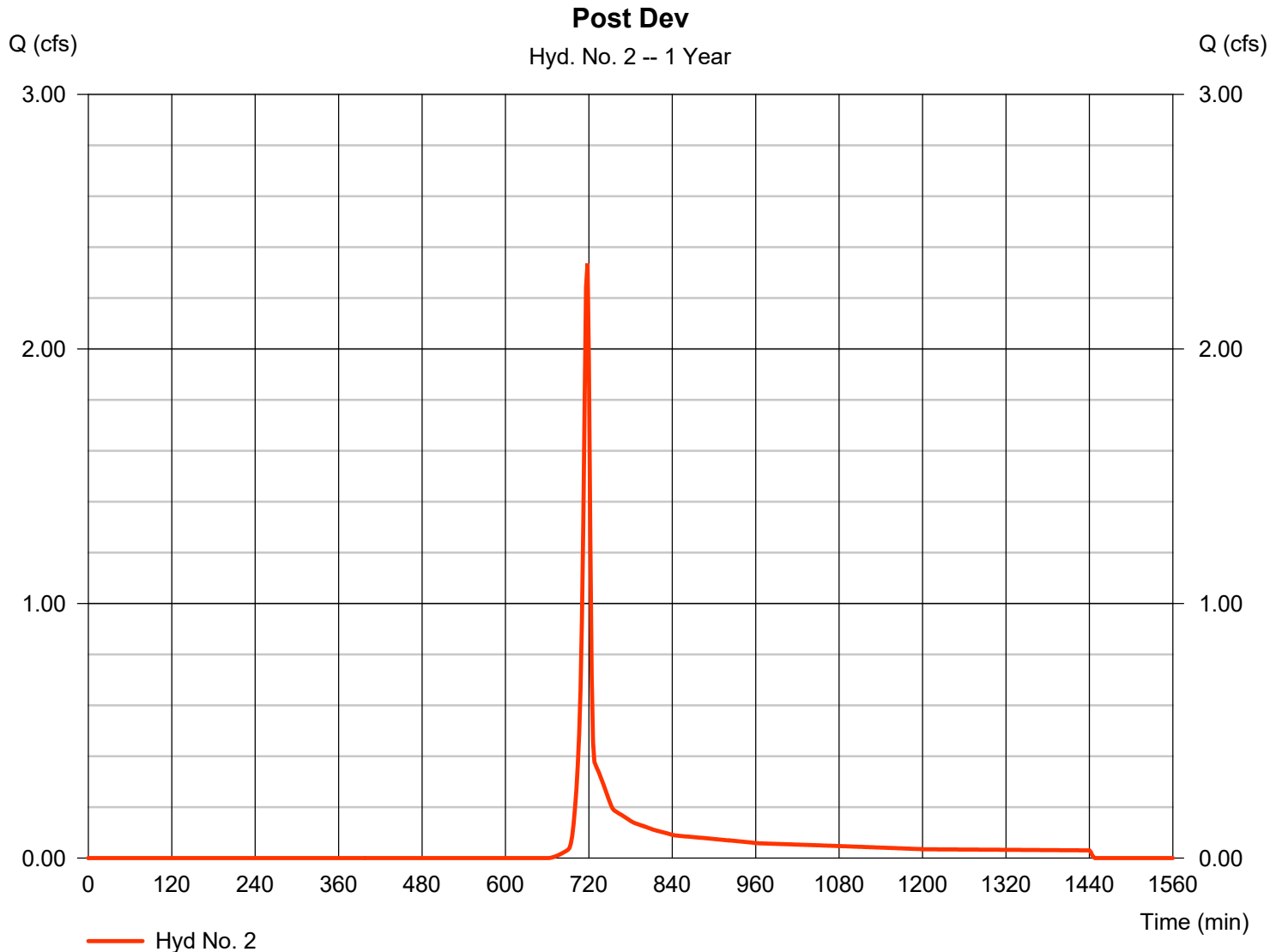
Hydrograph Report

Hyd. No. 2

Post Dev

Hydrograph type	= SCS Runoff	Peak discharge	= 2.336 cfs
Storm frequency	= 1 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 4,699 cuft
Drainage area	= 1.700 ac	Curve number	= 76*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.69 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = $[(0.700 \times 98) + (1.000 \times 61)] / 1.700$



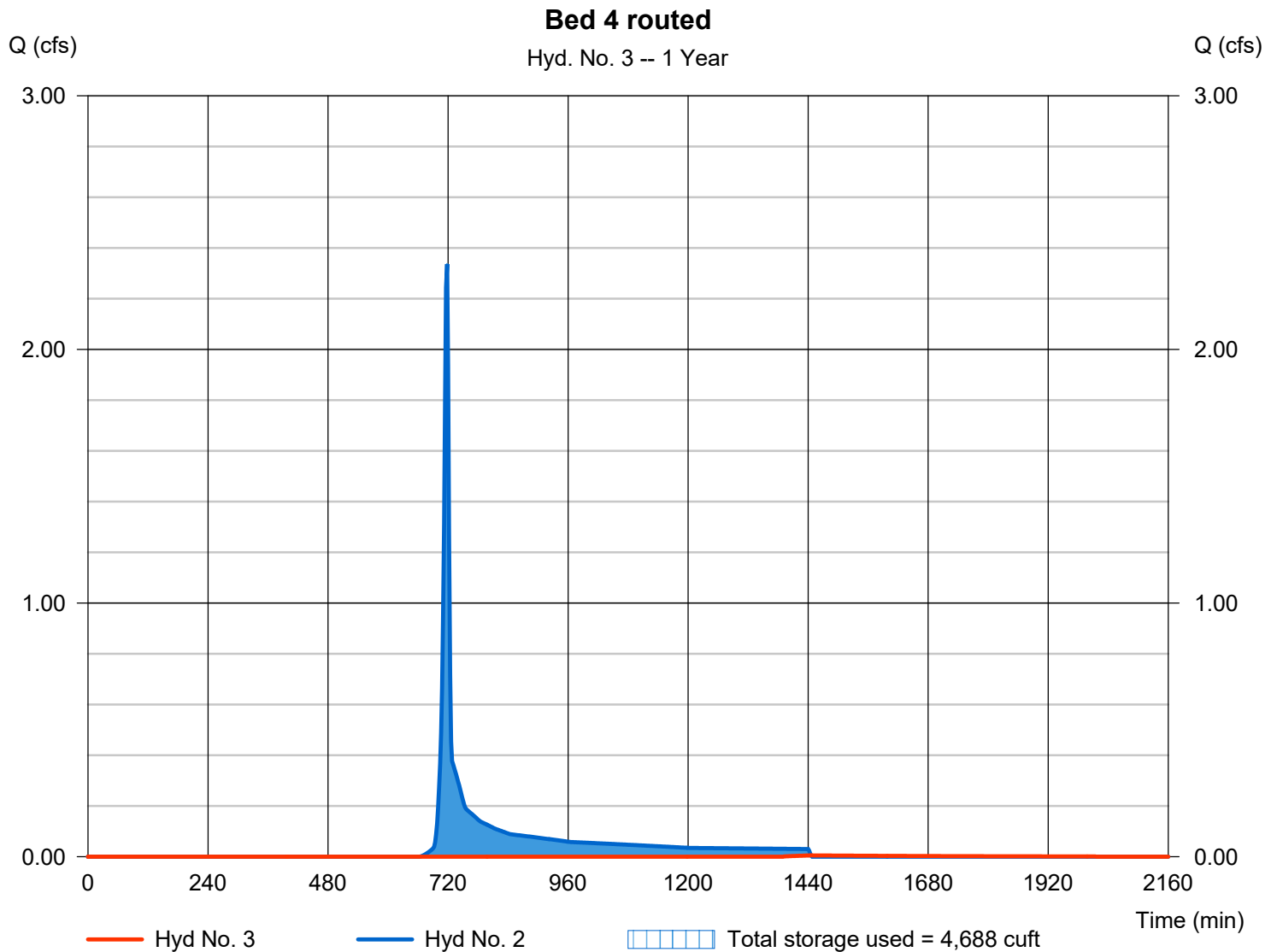
Hydrograph Report

Hyd. No. 3

Bed 4 routed

Hydrograph type	= Reservoir	Peak discharge	= 0.005 cfs
Storm frequency	= 1 yrs	Time to peak	= 1446 min
Time interval	= 2 min	Hyd. volume	= 98 cuft
Inflow hyd. No.	= 2 - Post Dev	Max. Elevation	= 438.04 ft
Reservoir name	= Bed 4	Max. Storage	= 4,688 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Bed 4

Pond Data

Pond storage is based on user-defined values.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	436.50	n/a	0	0
1.00	437.50	n/a	3,054	3,054
2.00	438.50	n/a	3,054	6,108
3.00	439.50	n/a	3,054	9,162
4.00	440.50	n/a	3,054	12,216

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 15.00	2.00	0.00	0.00
Span (in)	= 15.00	2.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 436.50	438.00	0.00	0.00
Length (ft)	= 25.00	0.00	0.00	0.00
Slope (%)	= 1.00	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)	= 4.00	0.00	0.00	0.00
Crest El. (ft)	= 439.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
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).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	436.50	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.10	305	436.60	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.20	611	436.70	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.30	916	436.80	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.40	1,222	436.90	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.50	1,527	437.00	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.60	1,832	437.10	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.70	2,138	437.20	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.80	2,443	437.30	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.90	2,749	437.40	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
1.00	3,054	437.50	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
1.10	3,359	437.60	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
1.20	3,665	437.70	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
1.30	3,970	437.80	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
1.40	4,276	437.90	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
1.50	4,581	438.00	0.00 ic	0.00 ic	---	---	0.00	---	---	---	---	---	0.000
1.60	4,886	438.10	0.01 ic	0.01 ic	---	---	0.00	---	---	---	---	---	0.015
1.70	5,192	438.20	0.04 ic	0.04 ic	---	---	0.00	---	---	---	---	---	0.036
1.80	5,497	438.30	0.05 ic	0.05 ic	---	---	0.00	---	---	---	---	---	0.049
1.90	5,803	438.40	0.06 ic	0.06 ic	---	---	0.00	---	---	---	---	---	0.059
2.00	6,108	438.50	0.07 ic	0.07 ic	---	---	0.00	---	---	---	---	---	0.068
2.10	6,413	438.60	0.08 ic	0.08 ic	---	---	0.00	---	---	---	---	---	0.075
2.20	6,719	438.70	0.08 ic	0.08 ic	---	---	0.00	---	---	---	---	---	0.082
2.30	7,024	438.80	0.09 ic	0.09 ic	---	---	0.00	---	---	---	---	---	0.089
2.40	7,330	438.90	0.10 ic	0.09 ic	---	---	0.00	---	---	---	---	---	0.095
2.50	7,635	439.00	0.10 ic	0.10 ic	---	---	0.00	---	---	---	---	---	0.101
2.60	7,940	439.10	0.53 ic	0.11 ic	---	---	0.42	---	---	---	---	---	0.527
2.70	8,246	439.20	1.33 ic	0.11 ic	---	---	1.19	---	---	---	---	---	1.303
2.80	8,551	439.30	2.33 oc	0.12 ic	---	---	2.19	---	---	---	---	---	2.305
2.90	8,857	439.40	3.49 oc	0.12 ic	---	---	3.37	---	---	---	---	---	3.491
3.00	9,162	439.50	4.83 oc	0.13 ic	---	---	4.71	---	---	---	---	---	4.834
3.10	9,467	439.60	6.31 oc	0.12 ic	---	---	6.19	---	---	---	---	---	6.308
3.20	9,773	439.70	7.89 ic	0.09 ic	---	---	7.80	---	---	---	---	---	7.895
3.30	10,078	439.80	8.71 ic	0.07 ic	---	---	8.63 s	---	---	---	---	---	8.708
3.40	10,384	439.90	9.15 ic	0.06 ic	---	---	9.08 s	---	---	---	---	---	9.148
3.50	10,689	440.00	9.49 ic	0.06 ic	---	---	9.43 s	---	---	---	---	---	9.489
3.60	10,994	440.10	9.78 ic	0.05 ic	---	---	9.72 s	---	---	---	---	---	9.776
3.70	11,300	440.20	10.03 ic	0.05 ic	---	---	9.98 s	---	---	---	---	---	10.03
3.80	11,605	440.30	10.26 ic	0.04 ic	---	---	10.21 s	---	---	---	---	---	10.26

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Bed 4

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
3.90	11,911	440.40	10.47 ic	0.04 ic	---	---	10.43 s	---	---	---	---	---	10.46
4.00	12,216	440.50	10.66 ic	0.04 ic	---	---	10.63 s	---	---	---	---	---	10.66

...End

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description	
1	SCS Runoff	2.410	2	718	4,839	-----	-----	-----	Pre Dev	
2	SCS Runoff	3.414	2	718	6,826	-----	-----	-----	Post Dev	
3	Reservoir	0.047	2	1198	2,225	2	438.28	5,451	Bed 4 routed	
POI-B-Hydro.gpw					Return Period: 2 Year			Sunday, 05 / 14 / 2023		

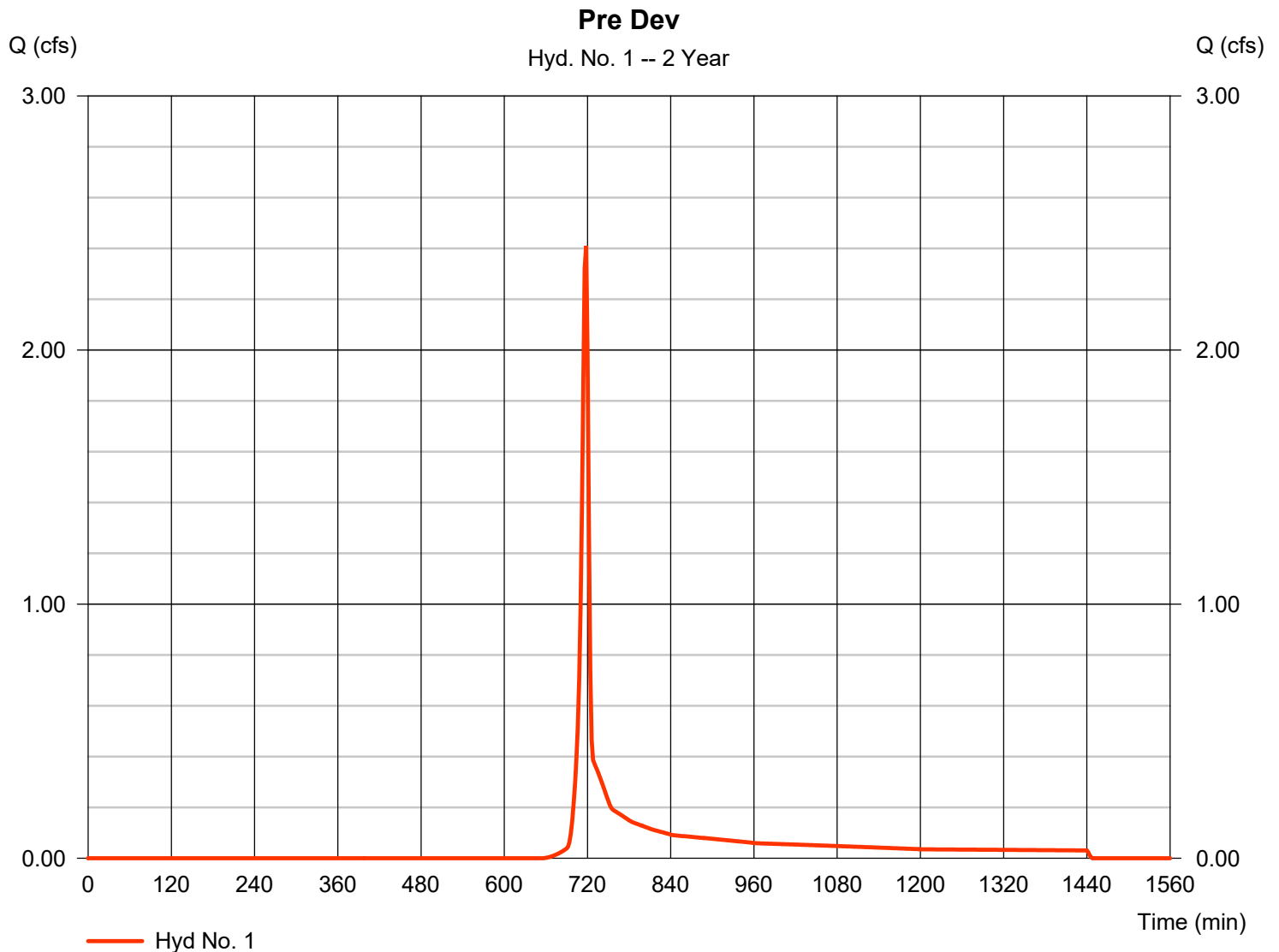
Hydrograph Report

Hyd. No. 1

Pre Dev

Hydrograph type	= SCS Runoff	Peak discharge	= 2.410 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 4,839 cuft
Drainage area	= 1.410 ac	Curve number	= 73*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.24 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = $[(0.540 \times 98) + (0.870 \times 58)] / 1.410$



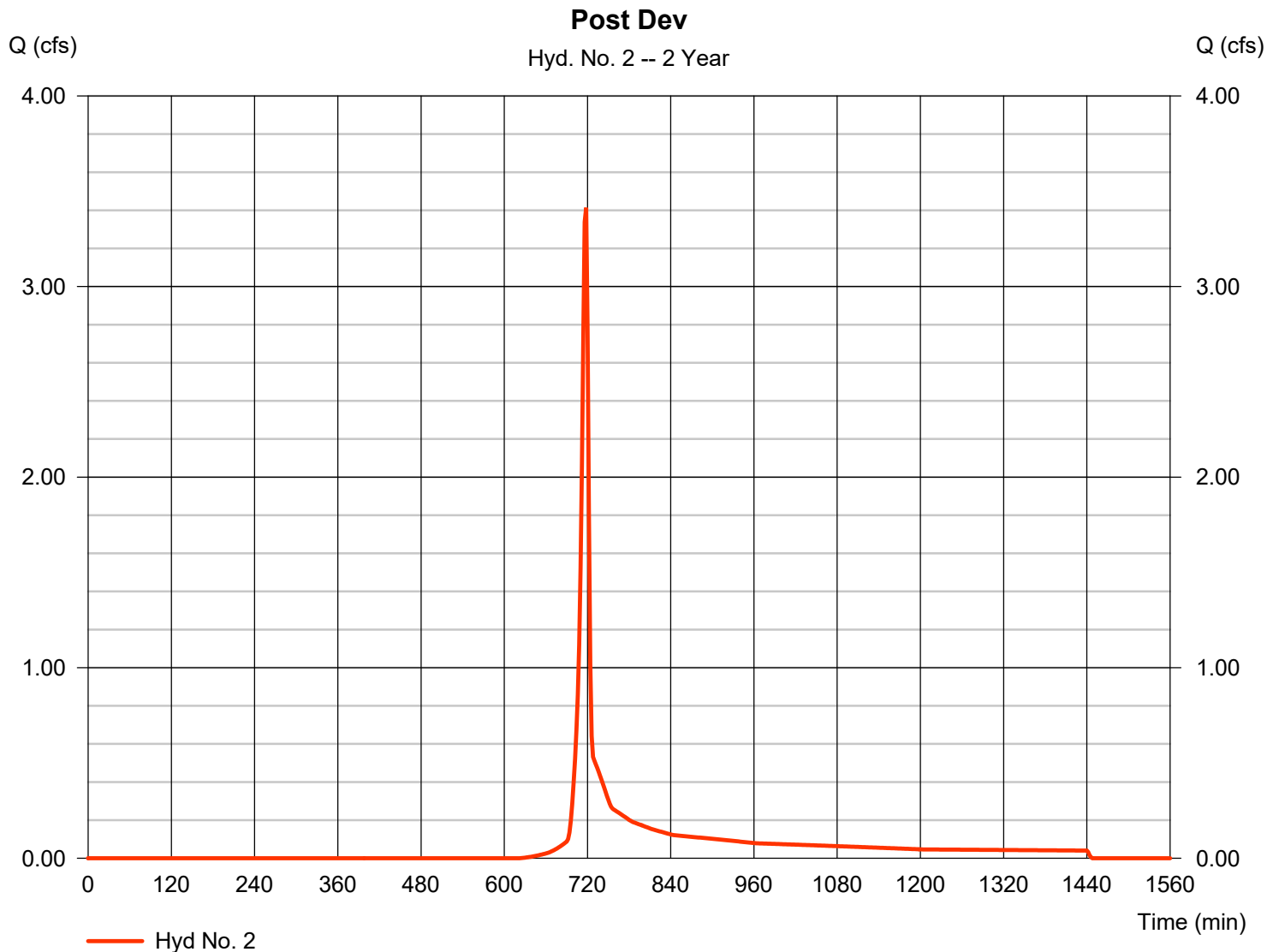
Hydrograph Report

Hyd. No. 2

Post Dev

Hydrograph type	= SCS Runoff	Peak discharge	= 3.414 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 6,826 cuft
Drainage area	= 1.700 ac	Curve number	= 76*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.24 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.700 x 98) + (1.000 x 61)] / 1.700



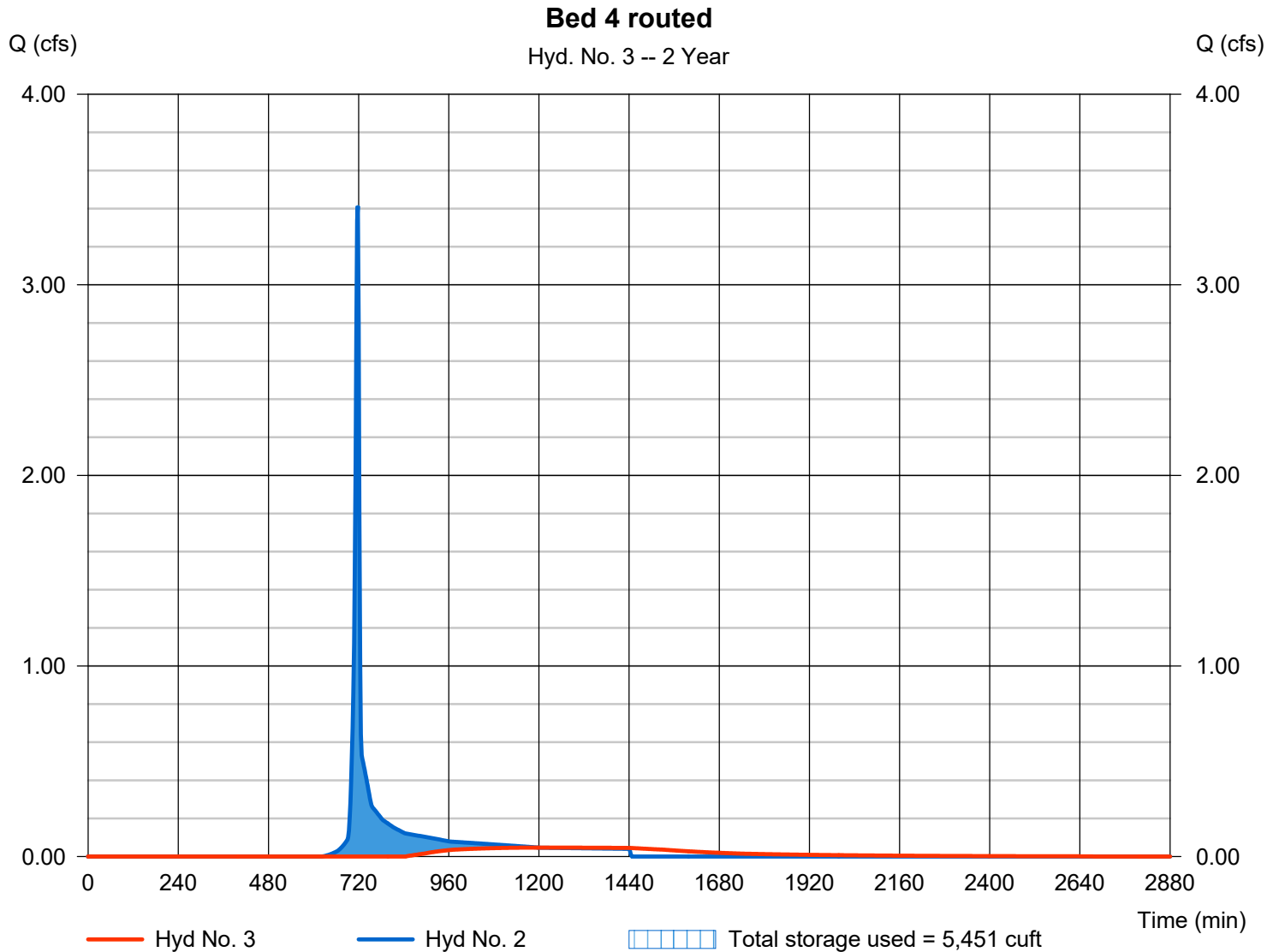
Hydrograph Report

Hyd. No. 3

Bed 4 routed

Hydrograph type	= Reservoir	Peak discharge	= 0.047 cfs
Storm frequency	= 2 yrs	Time to peak	= 1198 min
Time interval	= 2 min	Hyd. volume	= 2,225 cuft
Inflow hyd. No.	= 2 - Post Dev	Max. Elevation	= 438.28 ft
Reservoir name	= Bed 4	Max. Storage	= 5,451 cuft

Storage Indication method used.



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

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	3.768	2	718	7,537	-----	-----	-----	Pre Dev
2	SCS Runoff	5.139	2	718	10,325	-----	-----	-----	Post Dev
3	Reservoir	0.092	2	1062	5,723	2	438.85	7,168	Bed 4 routed
POI-B-Hydro.gpw					Return Period: 5 Year			Sunday, 05 / 14 / 2023	

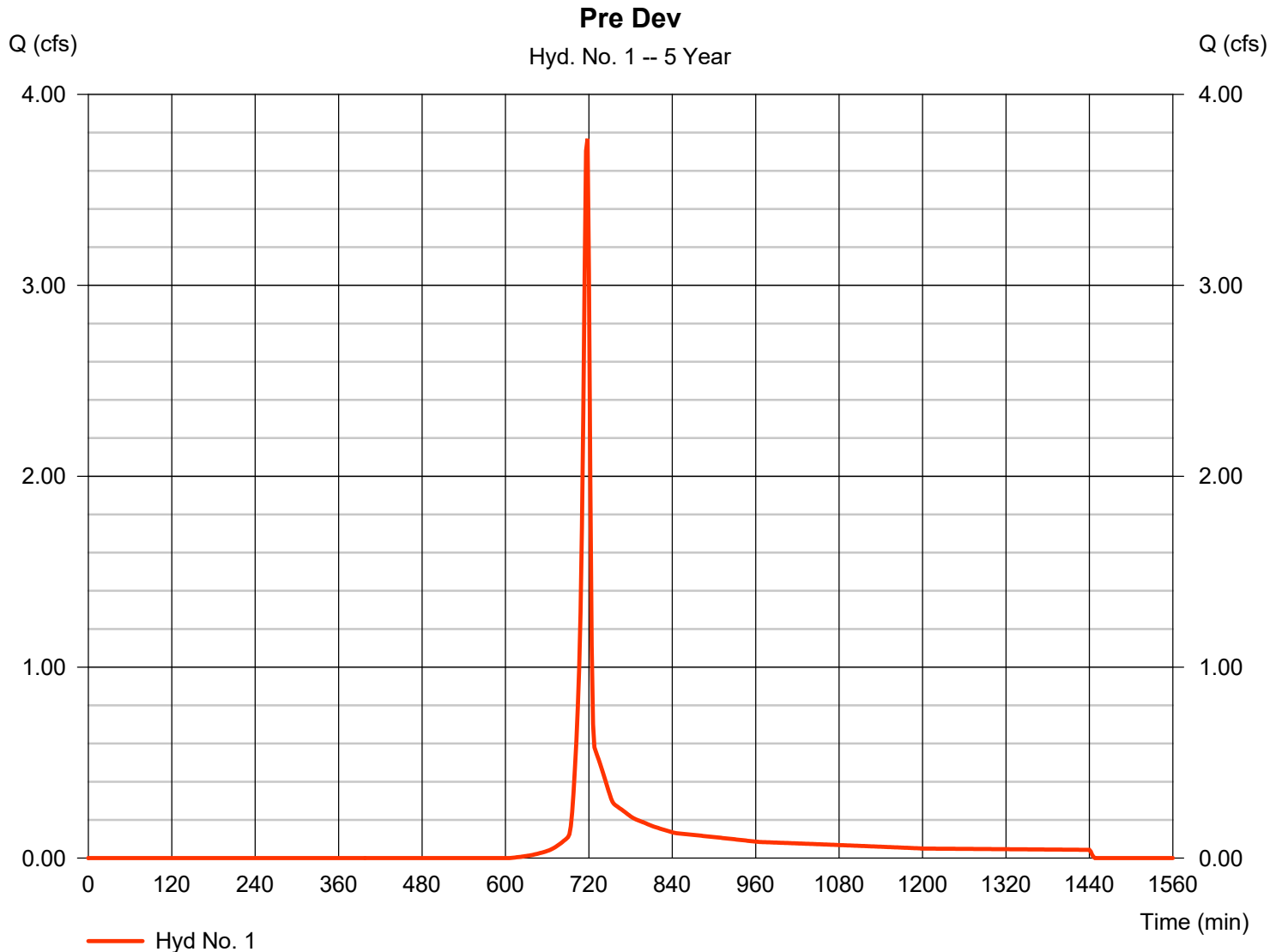
Hydrograph Report

Hyd. No. 1

Pre Dev

Hydrograph type	= SCS Runoff	Peak discharge	= 3.768 cfs
Storm frequency	= 5 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 7,537 cuft
Drainage area	= 1.410 ac	Curve number	= 73*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.06 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.540 x 98) + (0.870 x 58)] / 1.410



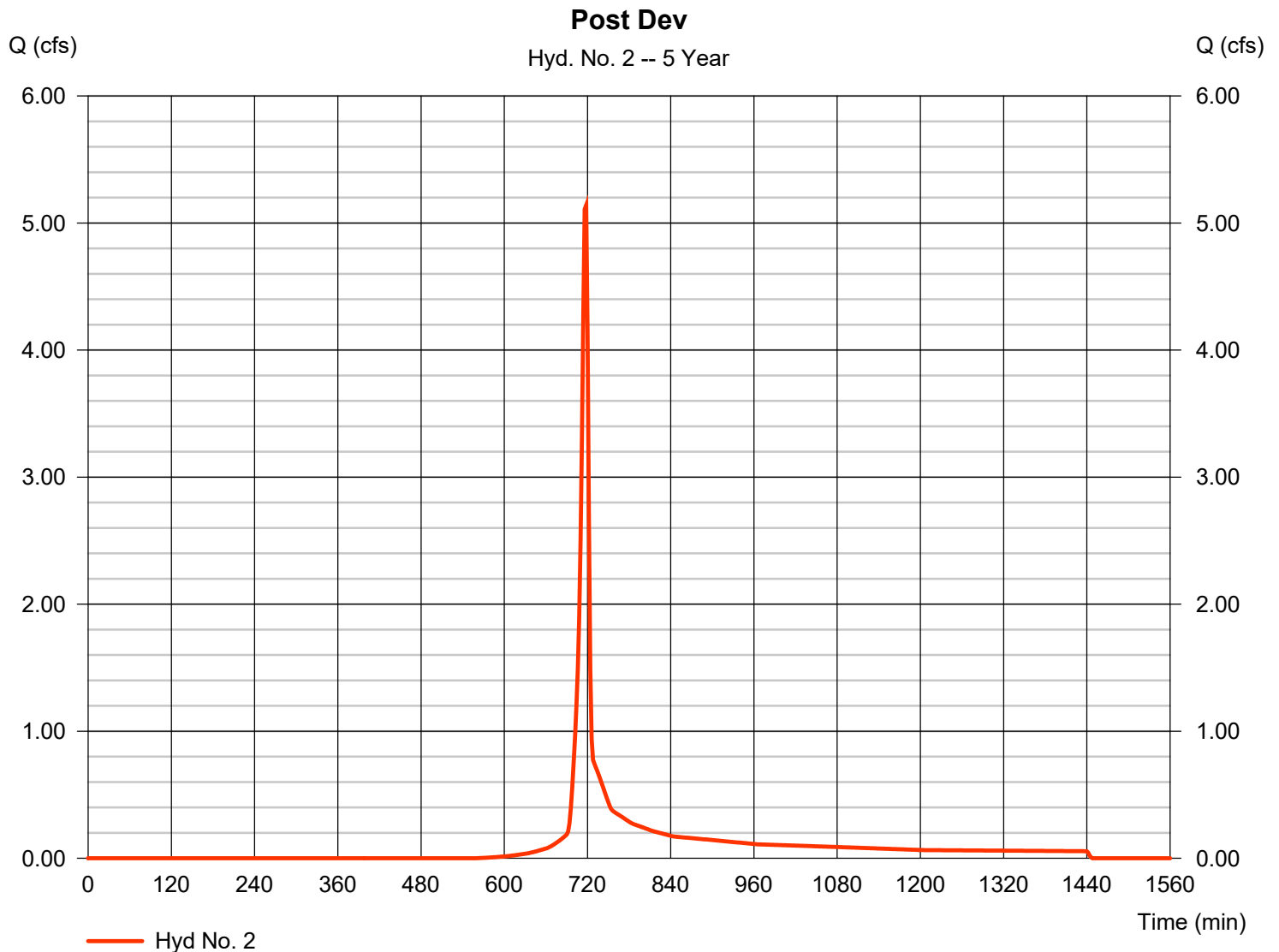
Hydrograph Report

Hyd. No. 2

Post Dev

Hydrograph type	= SCS Runoff	Peak discharge	= 5.139 cfs
Storm frequency	= 5 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 10,325 cuft
Drainage area	= 1.700 ac	Curve number	= 76*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.06 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.700 x 98) + (1.000 x 61)] / 1.700



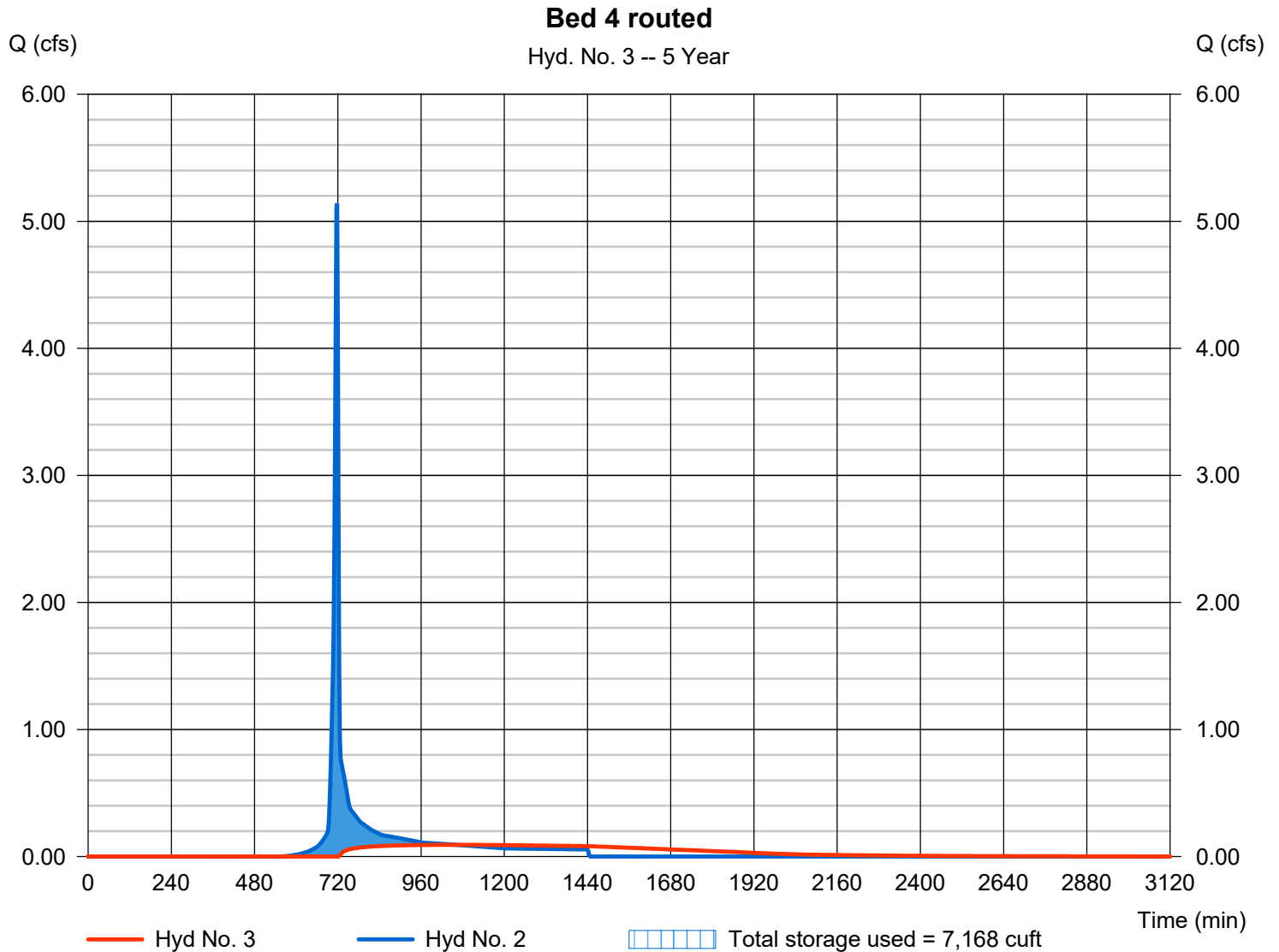
Hydrograph Report

Hyd. No. 3

Bed 4 routed

Hydrograph type	= Reservoir	Peak discharge	= 0.092 cfs
Storm frequency	= 5 yrs	Time to peak	= 1062 min
Time interval	= 2 min	Hyd. volume	= 5,723 cuft
Inflow hyd. No.	= 2 - Post Dev	Max. Elevation	= 438.85 ft
Reservoir name	= Bed 4	Max. Storage	= 7,168 cuft

Storage Indication method used.



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

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	4.983	2	718	10,010	-----	-----	-----	Pre Dev	
2	SCS Runoff	6.679	2	716	13,486	-----	-----	-----	Post Dev	
3	Reservoir	0.377	2	776	8,884	2	439.06	7,833	Bed 4 routed	
POI-B-Hydro.gpw					Return Period: 10 Year			Sunday, 05 / 14 / 2023		

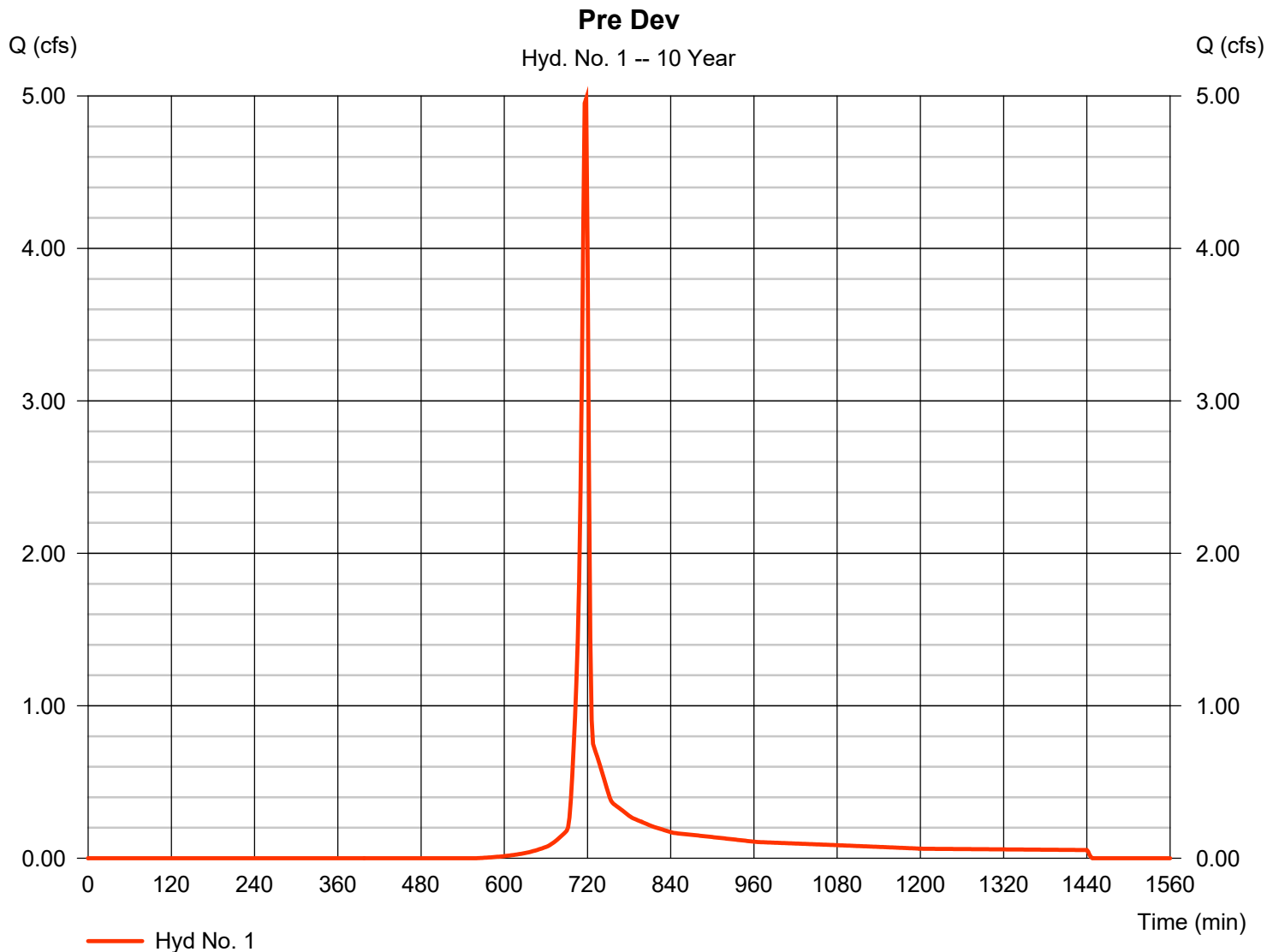
Hydrograph Report

Hyd. No. 1

Pre Dev

Hydrograph type	= SCS Runoff	Peak discharge	= 4.983 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 10,010 cuft
Drainage area	= 1.410 ac	Curve number	= 73*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.75 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = $[(0.540 \times 98) + (0.870 \times 58)] / 1.410$



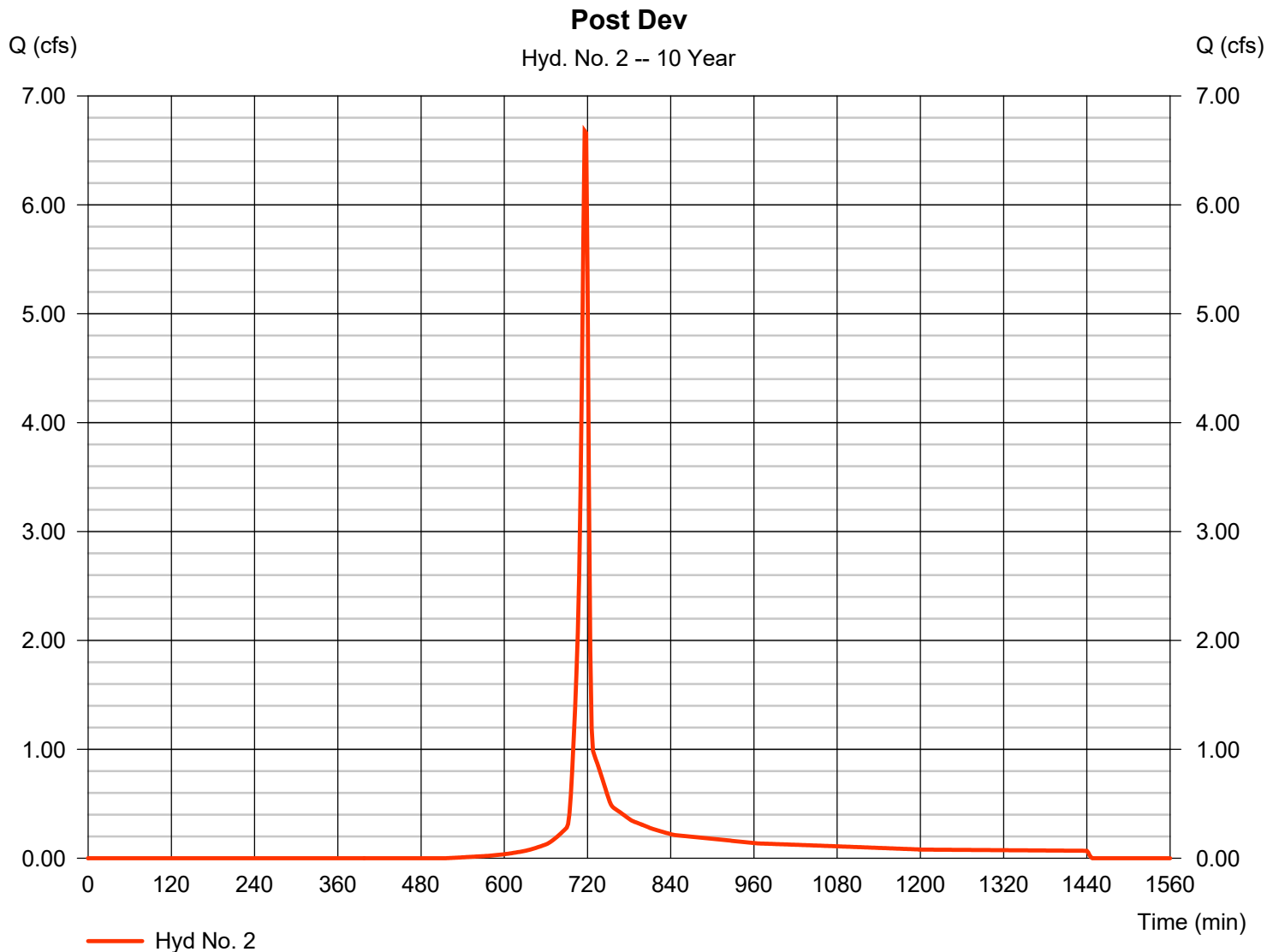
Hydrograph Report

Hyd. No. 2

Post Dev

Hydrograph type	= SCS Runoff	Peak discharge	= 6.679 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 13,486 cuft
Drainage area	= 1.700 ac	Curve number	= 76*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.75 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.700 x 98) + (1.000 x 61)] / 1.700



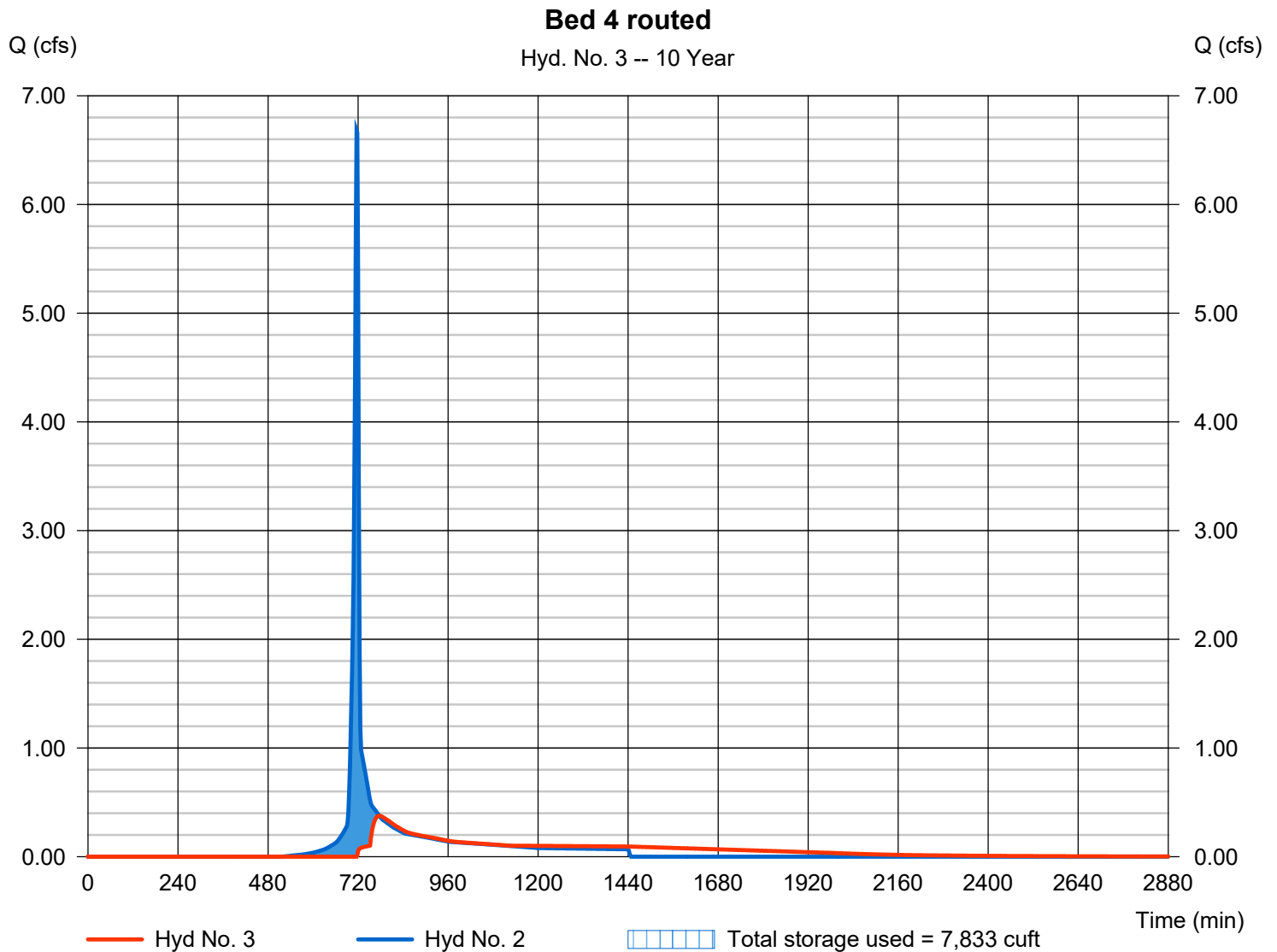
Hydrograph Report

Hyd. No. 3

Bed 4 routed

Hydrograph type	= Reservoir	Peak discharge	= 0.377 cfs
Storm frequency	= 10 yrs	Time to peak	= 776 min
Time interval	= 2 min	Hyd. volume	= 8,884 cuft
Inflow hyd. No.	= 2 - Post Dev	Max. Elevation	= 439.06 ft
Reservoir name	= Bed 4	Max. Storage	= 7,833 cuft

Storage Indication method used.



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

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	6.809	2	716	13,752	-----	-----	-----	Pre Dev	
2	SCS Runoff	8.986	2	716	18,214	-----	-----	-----	Post Dev	
3	Reservoir	2.572	2	724	13,613	2	439.32	8,620	Bed 4 routed	
POI-B-Hydro.gpw					Return Period: 25 Year			Sunday, 05 / 14 / 2023		

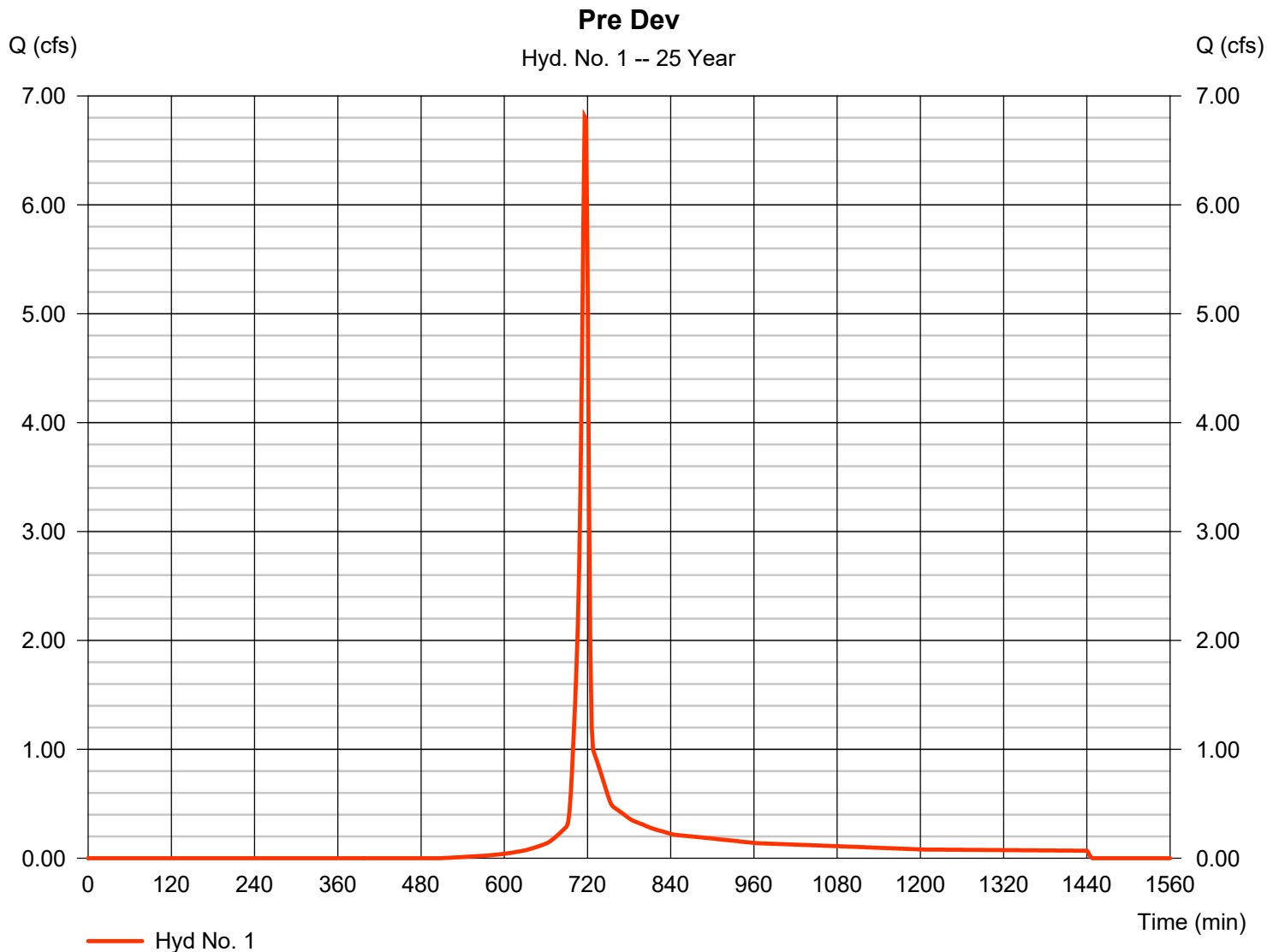
Hydrograph Report

Hyd. No. 1

Pre Dev

Hydrograph type	= SCS Runoff	Peak discharge	= 6.809 cfs
Storm frequency	= 25 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 13,752 cuft
Drainage area	= 1.410 ac	Curve number	= 73*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.73 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.540 x 98) + (0.870 x 58)] / 1.410



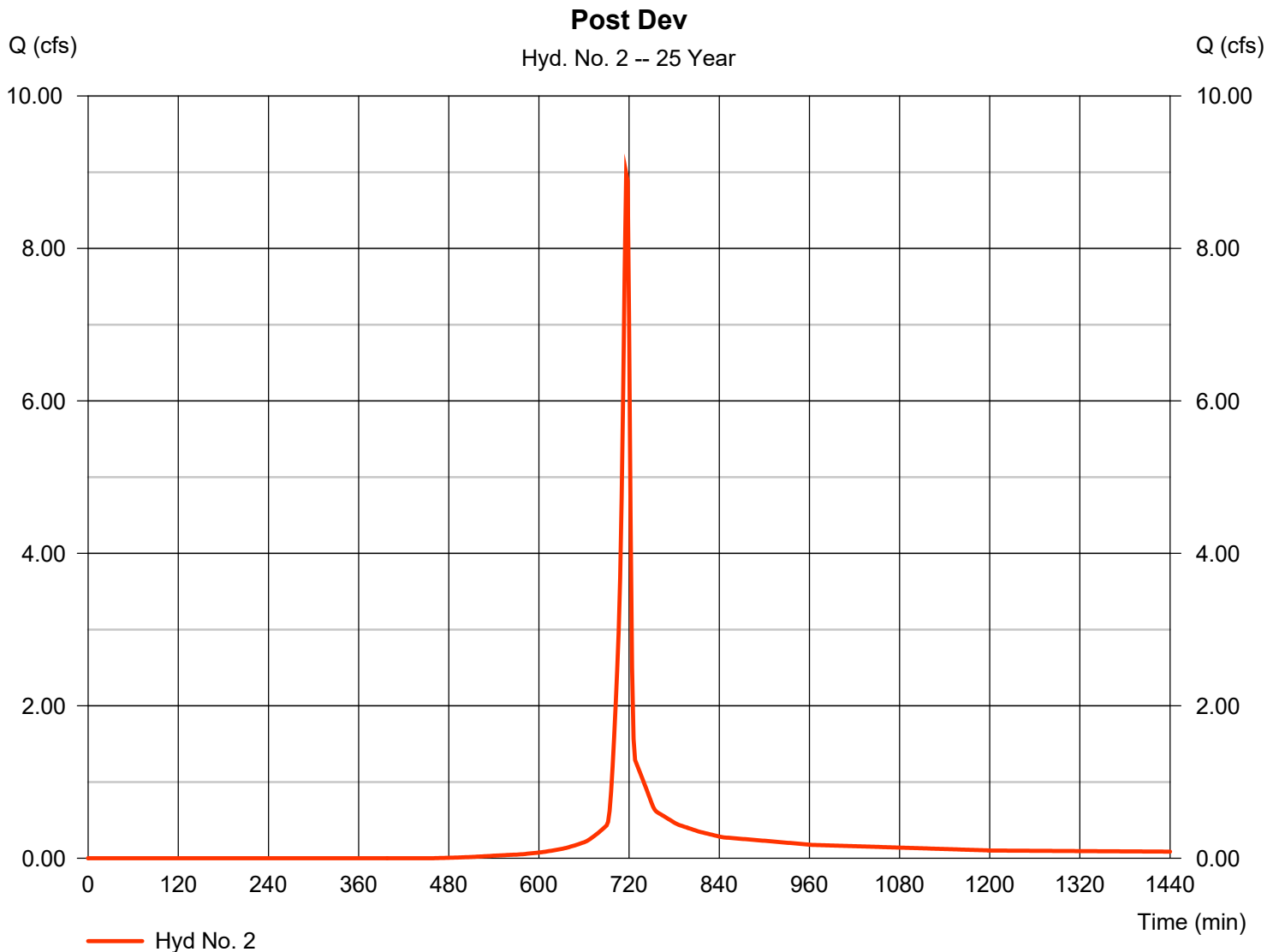
Hydrograph Report

Hyd. No. 2

Post Dev

Hydrograph type	= SCS Runoff	Peak discharge	= 8.986 cfs
Storm frequency	= 25 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 18,214 cuft
Drainage area	= 1.700 ac	Curve number	= 76*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.73 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = $[(0.700 \times 98) + (1.000 \times 61)] / 1.700$



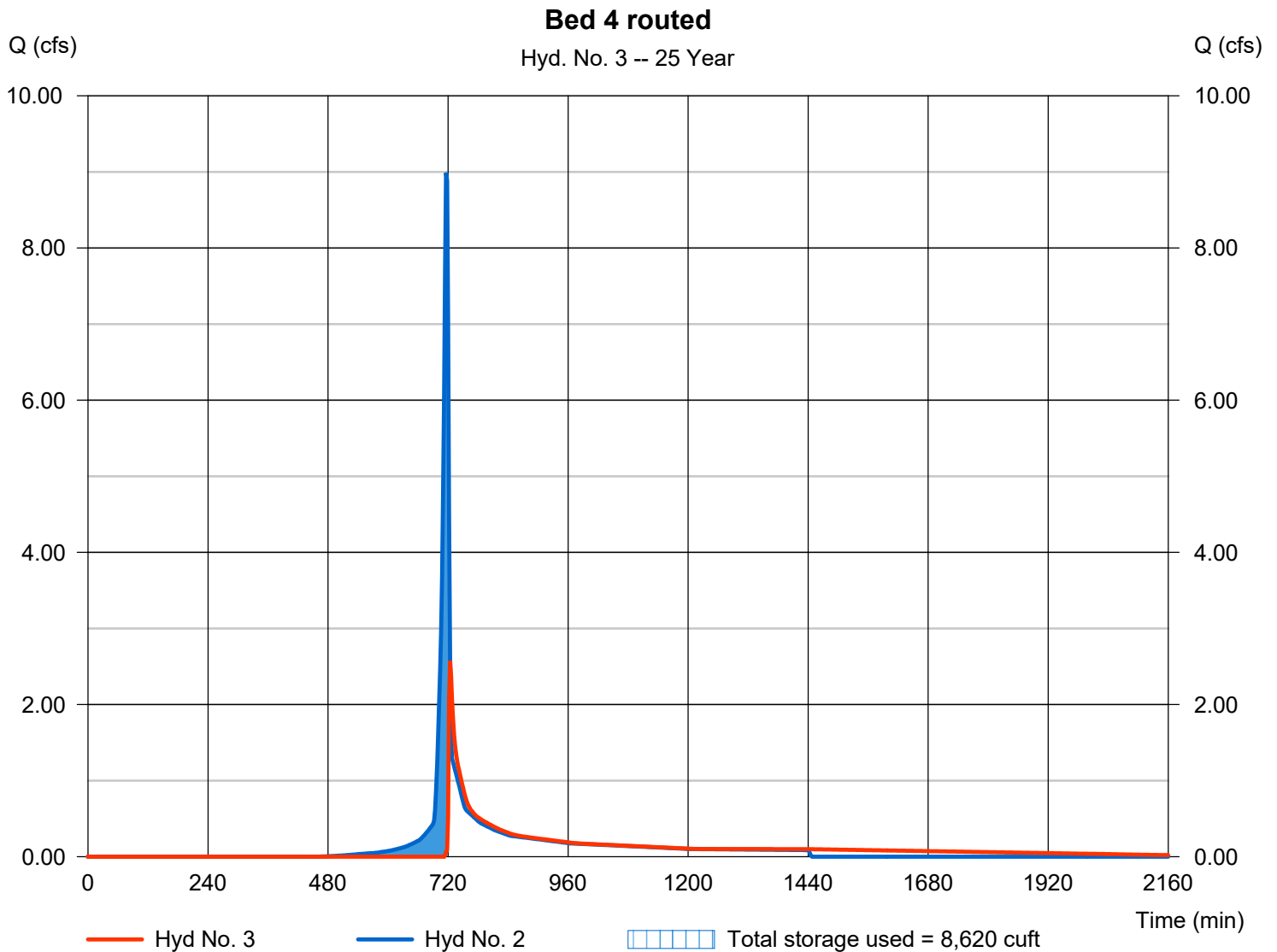
Hydrograph Report

Hyd. No. 3

Bed 4 routed

Hydrograph type	= Reservoir	Peak discharge	= 2.572 cfs
Storm frequency	= 25 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 13,613 cuft
Inflow hyd. No.	= 2 - Post Dev	Max. Elevation	= 439.32 ft
Reservoir name	= Bed 4	Max. Storage	= 8,620 cuft

Storage Indication method used.



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

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	8.431	2	716	17,076	-----	-----	-----	Pre Dev	
2	SCS Runoff	10.98	2	716	22,378	-----	-----	-----	Post Dev	
3	Reservoir	6.467	2	722	17,776	2	439.63	9,498	Bed 4 routed	
POI-B-Hydro.gpw					Return Period: 50 Year			Sunday, 05 / 14 / 2023		

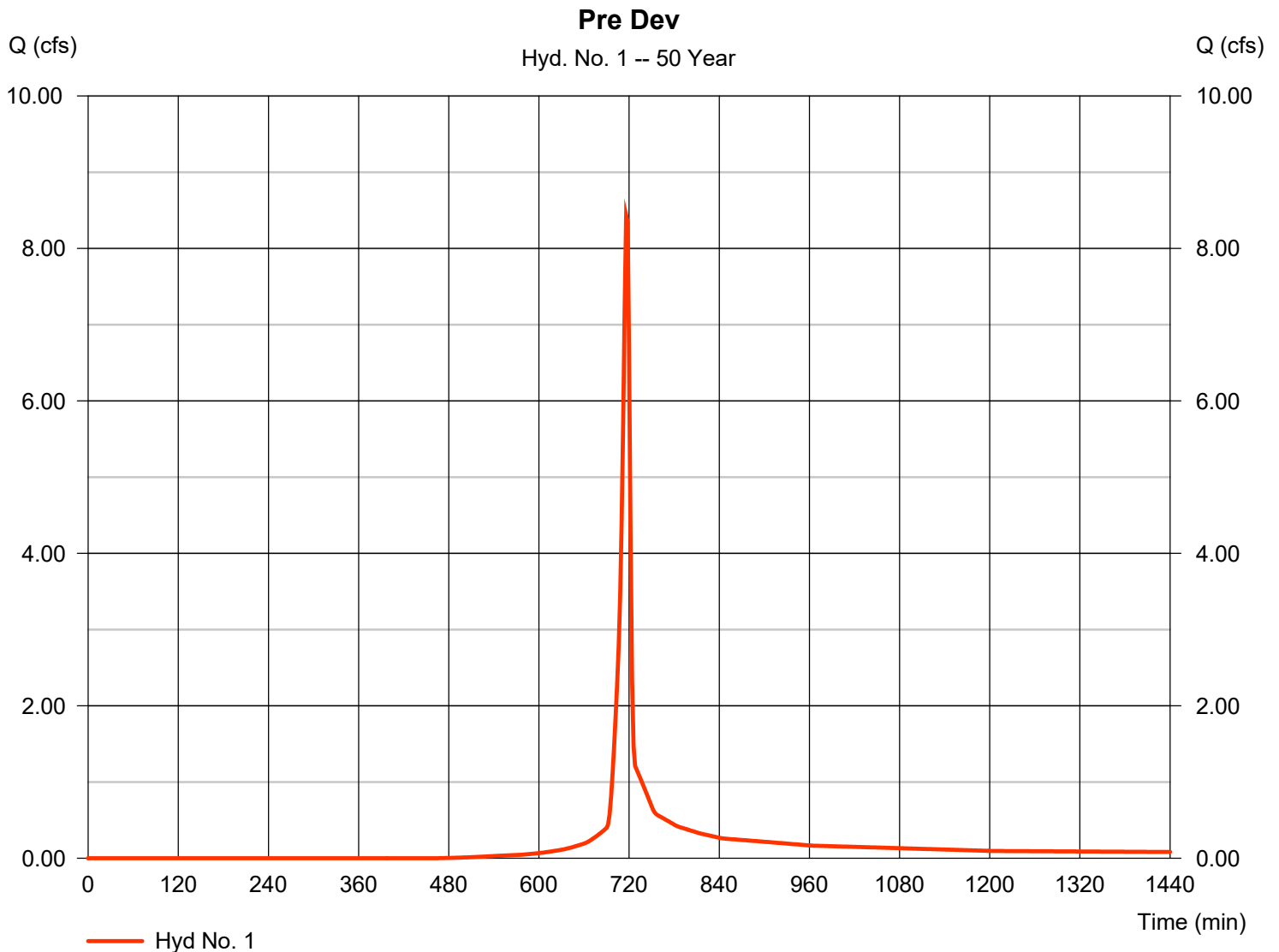
Hydrograph Report

Hyd. No. 1

Pre Dev

Hydrograph type	= SCS Runoff	Peak discharge	= 8.431 cfs
Storm frequency	= 50 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 17,076 cuft
Drainage area	= 1.410 ac	Curve number	= 73*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.56 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.540 x 98) + (0.870 x 58)] / 1.410



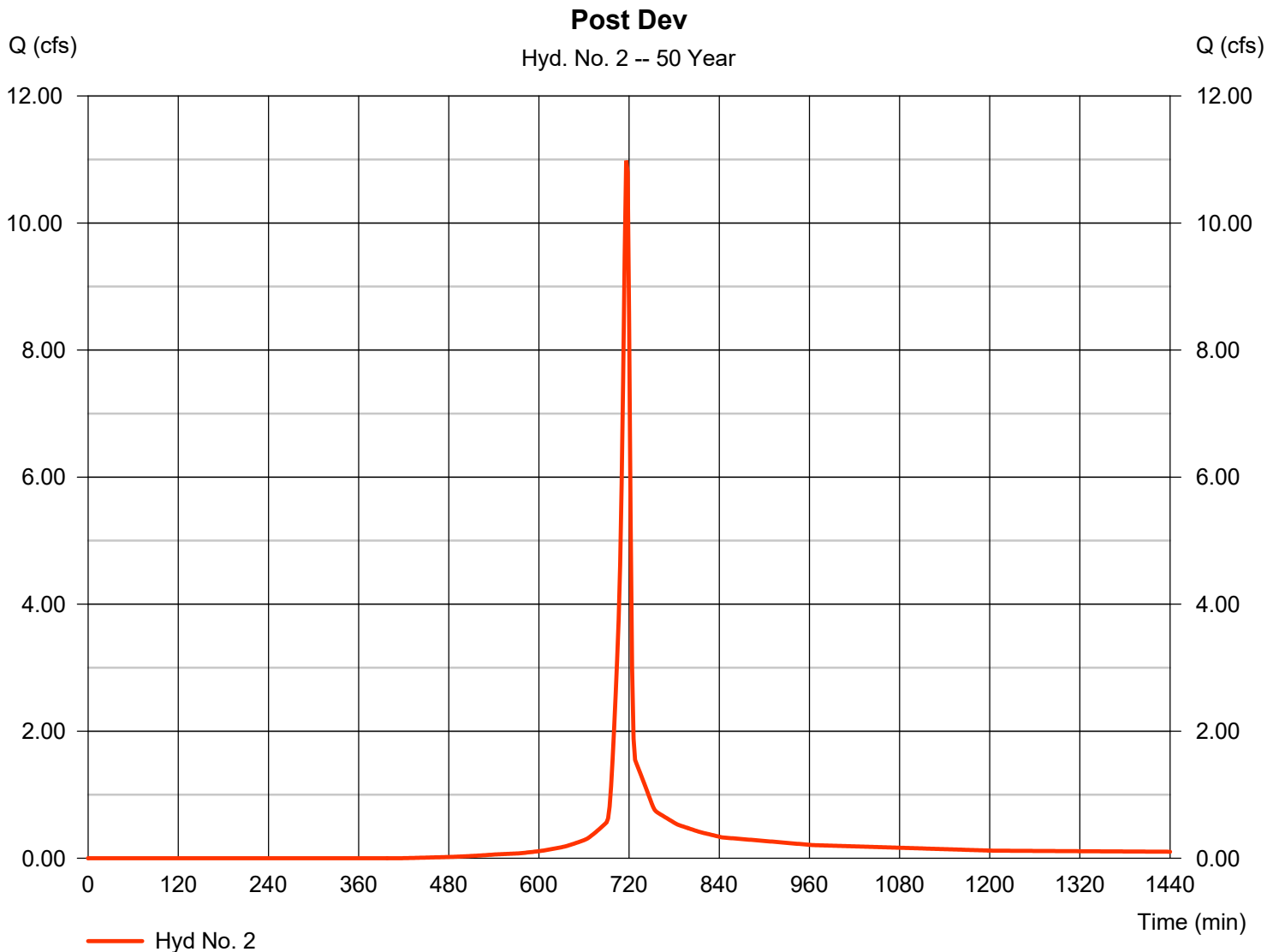
Hydrograph Report

Hyd. No. 2

Post Dev

Hydrograph type	= SCS Runoff	Peak discharge	= 10.98 cfs
Storm frequency	= 50 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 22,378 cuft
Drainage area	= 1.700 ac	Curve number	= 76*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 6.56 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.700 x 98) + (1.000 x 61)] / 1.700



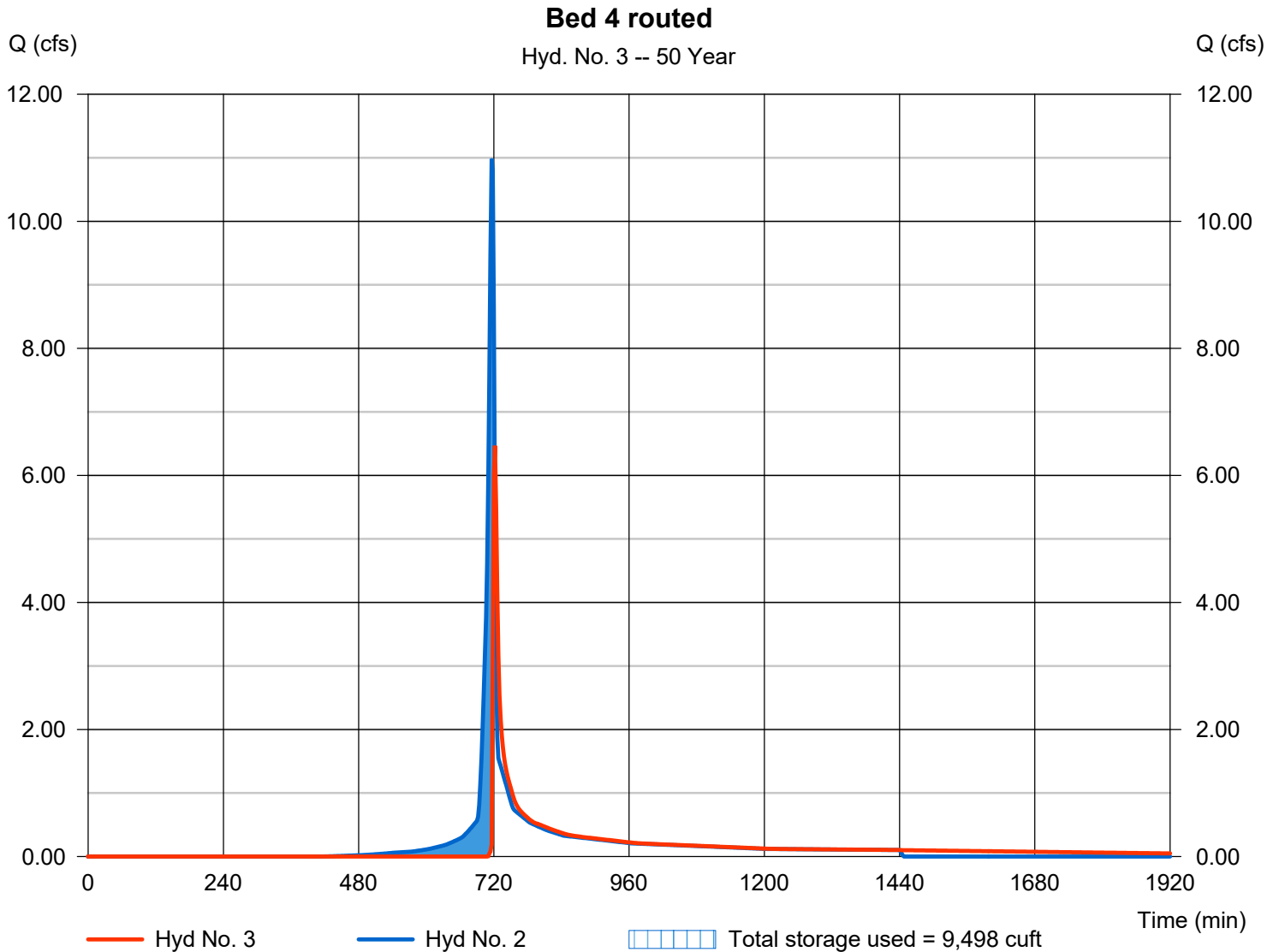
Hydrograph Report

Hyd. No. 3

Bed 4 routed

Hydrograph type	= Reservoir	Peak discharge	= 6.467 cfs
Storm frequency	= 50 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 17,776 cuft
Inflow hyd. No.	= 2 - Post Dev	Max. Elevation	= 439.63 ft
Reservoir name	= Bed 4	Max. Storage	= 9,498 cuft

Storage Indication method used.



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2019.2

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	10.20	2	716	20,757	-----	-----	-----	Pre Dev	
2	SCS Runoff	13.15	2	716	26,960	-----	-----	-----	Post Dev	
3	Reservoir	9.063	2	720	22,359	2	439.90	10,325	Bed 4 routed	
POI-B-Hydro.gpw					Return Period: 100 Year			Sunday, 05 / 14 / 2023		

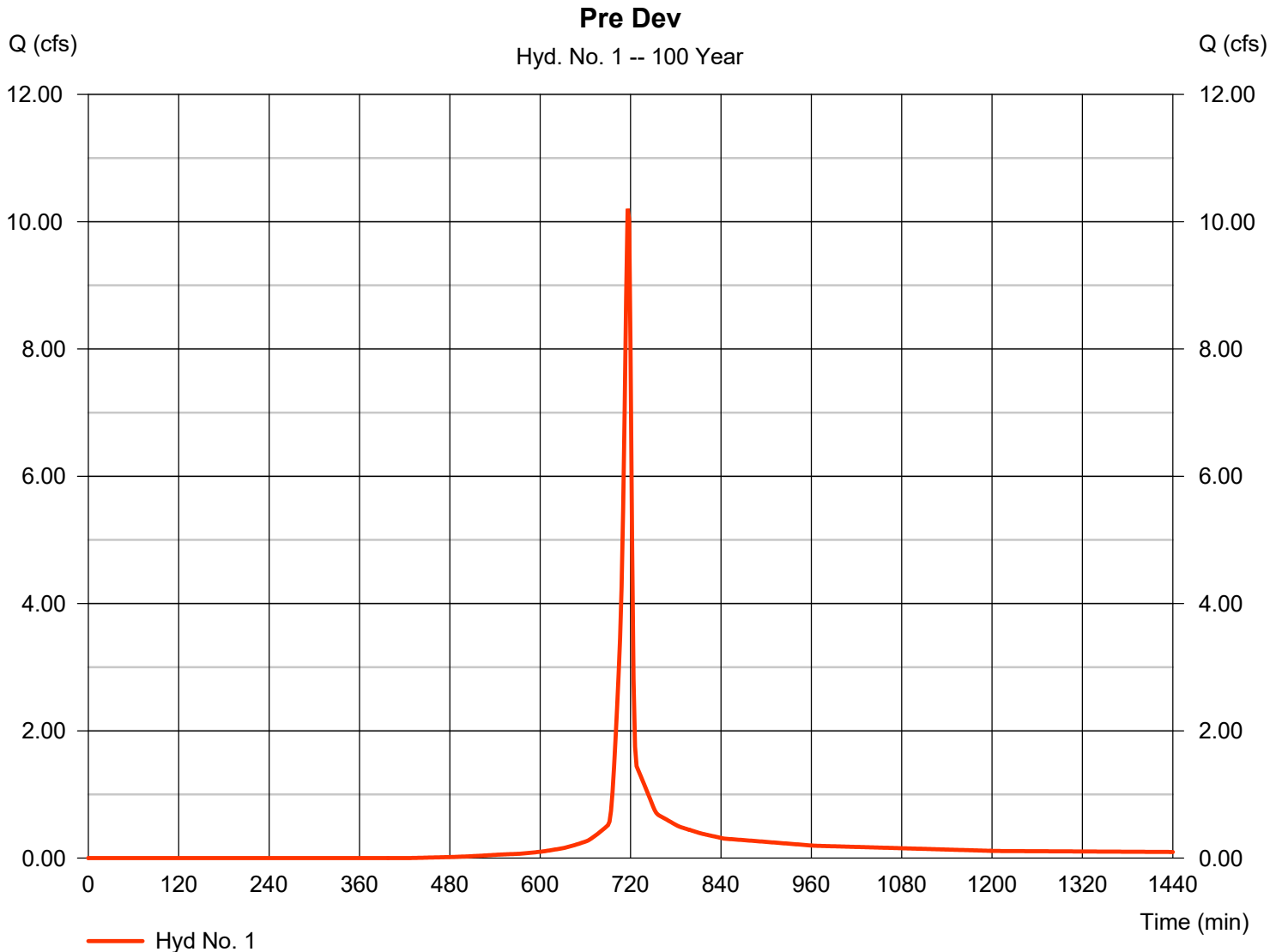
Hydrograph Report

Hyd. No. 1

Pre Dev

Hydrograph type	= SCS Runoff	Peak discharge	= 10.20 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 20,757 cuft
Drainage area	= 1.410 ac	Curve number	= 73*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.45 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.540 x 98) + (0.870 x 58)] / 1.410



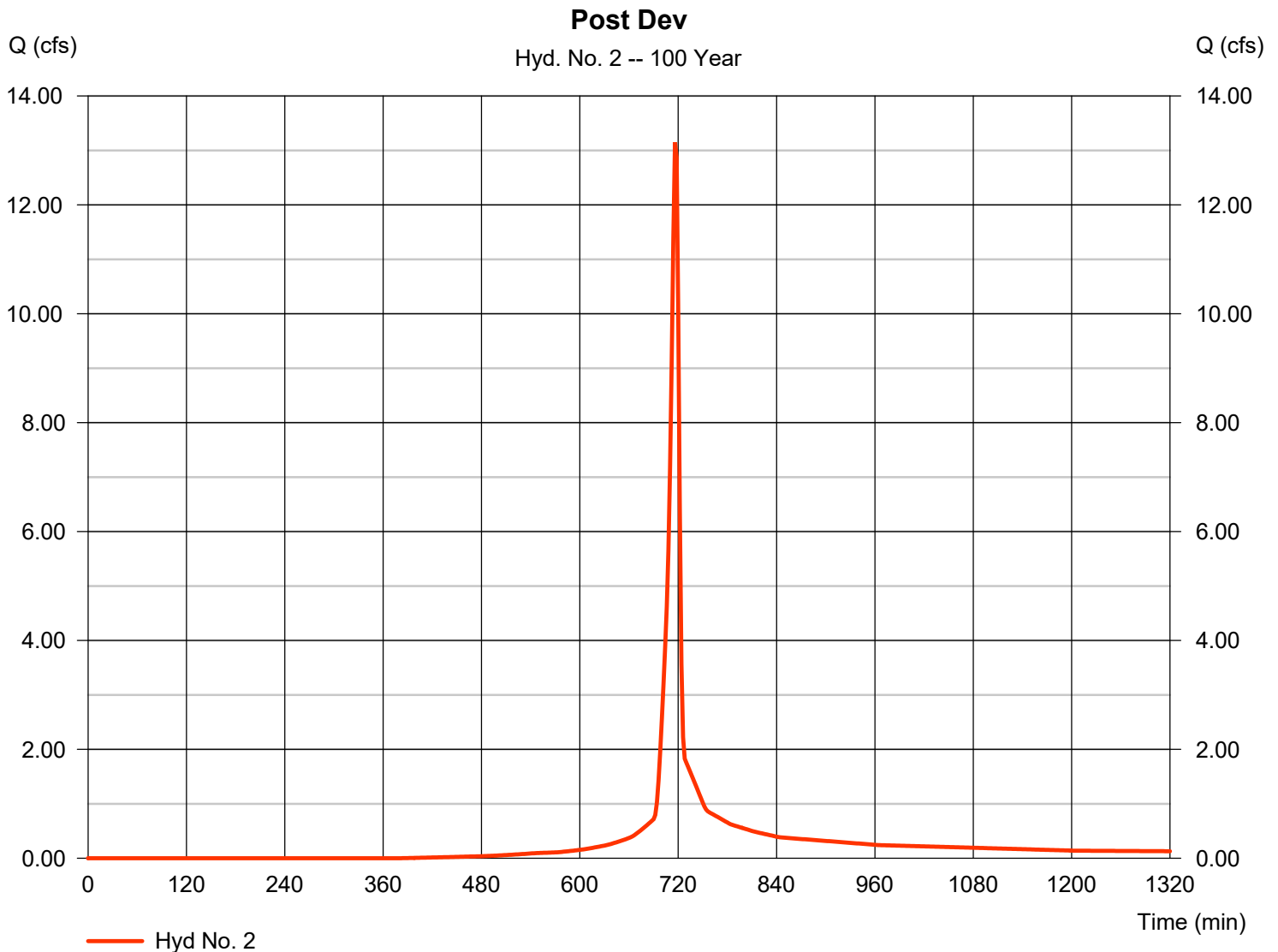
Hydrograph Report

Hyd. No. 2

Post Dev

Hydrograph type	= SCS Runoff	Peak discharge	= 13.15 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 26,960 cuft
Drainage area	= 1.700 ac	Curve number	= 76*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.45 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.700 x 98) + (1.000 x 61)] / 1.700



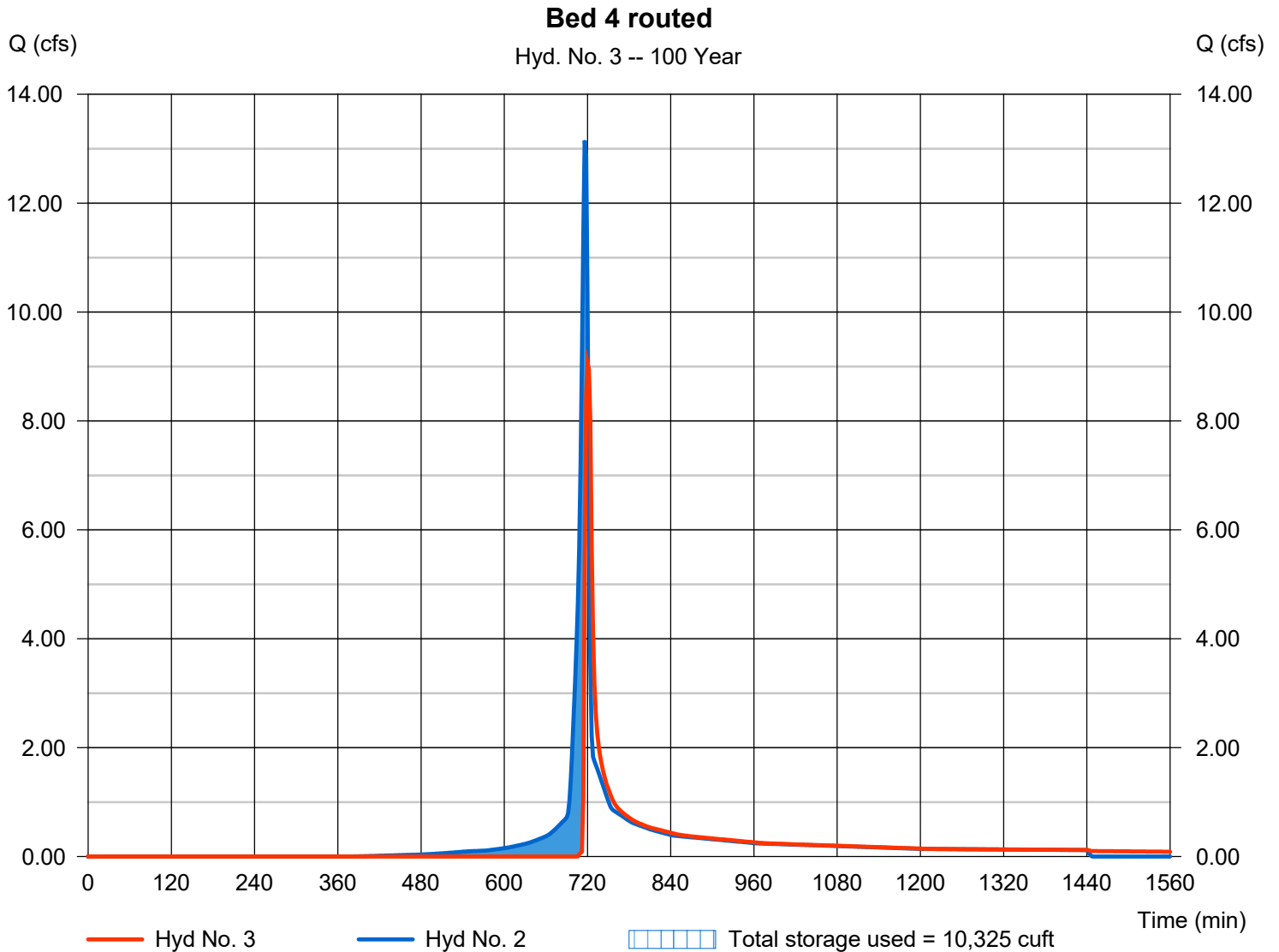
Hydrograph Report

Hyd. No. 3

Bed 4 routed

Hydrograph type	= Reservoir	Peak discharge	= 9.063 cfs
Storm frequency	= 100 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 22,359 cuft
Inflow hyd. No.	= 2 - Post Dev	Max. Elevation	= 439.90 ft
Reservoir name	= Bed 4	Max. Storage	= 10,325 cuft

Storage Indication method used.



HILBEC Engineering & Geosciences, LLC

26 Beaver Run Road, Downingtown, PA 19335-2257
Office: 610.873.6204 www.hilbec.com Fax: 610.873.6206

Wastewater * Stormwater * Hydrogeology * Environmental * Testing & Design

September 30, 2019

Site Engineering Concepts, LLC
Mr. David J. Sanders, P.E.
PO Box 1992
Southeastern, PA 19399

Re: Stormwater Soil Evaluation
Hamilton: 228 Strafford Avenue
Radnor Township, Delaware County

Dear Mr. Sanders:

On September 17 & 18, 2019, I conducted soil evaluations for proposed stormwater management systems at the above noted property. A backhoe was used to excavate test pits to determine the most suitable depth to conduct permeability testing within the soil horizons. Test holes are typically excavated to the limits of the reach of the machine, bedrock, or a depth where water may be encountered entering the excavation.

Due to the size of some of the proposed drain fields, soil evaluations were conducted at either end. Existing utilities and sensitive vegetation required adjustment of the pit locations to limit damage to the area.

Test pit #SWM-01A and #SWM-01B were similar, with no observed limiting conditions to approximately 9 feet. Although the soil at depth was somewhat friable to firm, the permeability testing indicated that any applied water would be infiltrated.

Test pit #SWM-02A and #SWM-02B were similar, with no observed limiting conditions to approximately 10 feet. Below a slightly plastic horizon near three feet, the underlying soils were friable. Existing utilities consisting of water, an old terra cotta tile field, and electric wiring were observed and damaged, all above a depth of 42”.

Test #SWM-03 was located just below the pool area and situated to minimize damage to the existing sensitive vegetation. The soil was friable below 64”. Due to the length of the test pit for safety access, a drain pipe was uncovered well south and west of the proposed field.

Test #SWM-04 indicated redoximorphic features (formerly called mottles) from 10” to 30”. However, the redox features are a result of a textural discontinuity rather than an indication of a high-water table. Although no limiting horizons were noted, the second permeability test was done at 42” to account for the variations in the topography. This shallower test at 42” failed. A drainage pipe was observed in the scrape for the shallow permeability test #PS4-B above 42” and leading away from the area.

A Guelph Permeameter was used to determine the permeability of the soil. The Guelph is a constant head borehole permeameter using the principle of the Mariotte Siphon to supply a constant level of water in the hole; unlike a percolation falling head test. The depth of the holes from existing grade level were adjusted to account for topographic variations.

The Guelph allows the Field Saturated Permeability (K_{fs}) to be determined by running the test twice, at two different heads. Two tests are run at different heads or water elevations in order to provide the “gradient” portion of the required calculations. The gradient is used to measure the flux or water movement within the soil. A fluid bulb quickly forms and allows the stabilized hydraulic conductivity to be calculated. Errors inherent in other types of permeability tests that are minimized or eliminated by the Guelph Permeameter are soil fracturing, varying heads, silted in holes, estimated readings due to scale, and leaking clay seals.

Permeability tests assume that homogeneous soil conditions exist at and below the test zone, which is why the central portions of one soil horizon are typically chosen for the test depths. However, soil suitability, PA DEP guidelines, and proposed system design may alter that test parameter. Even within a consistent soil, unseen heterogeneous soil conditions can exist and may consist of:

1. Changing soil horizons across or near the test zone
2. Rock or stony soil beneath the bottom of the test hole
3. Roots, animal burrows
4. Soil fractures & thinly laminated soils

The consistency of the soil can be estimated by comparing the assumed and calculated alpha value. The alpha value is a soil parameter that depends primarily upon the soil texture and structure. By definition, it is the ratio of gravity to capillary soil-water forces. The value of typical fine to coarse-grained soils ranges between 0.01 and 0.5 cm^{-1} . Values considerably outside of this range (and negative values) suggest that heterogeneous soil conditions, such as in stony areas, may be encountered. Large alpha values suggest coarse textured or highly structured soils. Low alpha values suggest finer grained soils or a fine matrix. The geometric mean of the single head tests can be used in place of the two head approach to provide the permeability values if heterogeneous soil conditions cannot be avoided, such as in rocky areas.

A summary of the test results is noted in the table below. The base of all stormwater systems must adhere to the 24” isolation distance to any limiting horizon or pit base as required by the PA DEP guidance. Based on the observed soil in the test pits, the following tolerances are suggested:

Test ID	Test Probe #	Test Depth (inches)	Result (in/hr)	Geometric Mean
PS1-A	SWM-01A	84”	2.47	1.75
PS1-B	SWM-01B	84”	1.23	
PS2-A	SWM-02A	96”	0.88	1.06
PS2-B	SWM-02B	96”	1.27	
PS-3A	SWM-03	96”	0.53	1.26
PS-3B		96”	2.99	
PS4-A	SWM-04	84”	0.51	0.0
PS4-B		42”	Zero	

Test Pit ID	Limiting Depth	Upper Installation Limit	Lower Installation Limit
SWM-01A	110" Pit Base	44"	86"
SWM-01B	109" Pit Base	37"	85"
SWM-02A	120" Pit Base	59"	96"
SWM-02B	120" Pit Base	43"	96"
SWM-03	120" Pit Base	64"	96"
SWM-04	122" Pit Base	45" (perm Test Fail @ 42")	98"

The base of the stormwater systems should be kept between the upper and lower limits of the testing as measured from existing grade while using the respective permeability test results. The base of the system could vary due to design conditions but the base should be kept as close to the test depths as possible. The base of the excavation should be scarified so as not to clog the void spaces.


The permeability test data indicates that the soil can infiltrate the applied stormwater assuming that a properly dimensioned and constructed stormwater system is provided (except for test area #SWM-04). No safety factor needs to be applied to the test results as this is a true permeability test, other than any additional safety factor the designer may choose to add. The rock underlying this site and within the test probes is not a carbonate material.

I have directly performed and/or supervised the test procedures and preparation of this report. All information contained herein is accurate to the best of my knowledge and all test procedures have been performed using accepted practices. HILBEC Engineering & Geosciences, LLC cannot and does not make claim, warranty or guarantee that surface and sub-surface site conditions other than described herein, either natural or as altered by construction activities, may be different at some time in the future and thus may affect these findings.

Please refer to the attached test logs, permeability test data, and location map of the test areas. If you have any further questions, please contact our office.

Very truly yours,

For HILBEC Engineering & Geosciences, LLC



Kevin R. Sech, P.G., P.E.

SOIL DESCRIPTIONS

Probe #:	SWM-01A
Test Date:	September 18, 2019
Soil Profile Limitation:	None No water or bedrock observed

Project Name:	Hamilton: 228 Strafford Ave		
Municipality:	Radnor Township		
Soil Profile Description Prepared By:	Kevin R. Sech, P.G., P.E.		
General Location of the Test Pit:	Westerly side of test area near greenhouse		

Horizon	Up	Low	Color	Texture	Structure			Consistence		CF%	Boundary		Roots	Coats	Redox
					Medium	Moderate	Granular	Friable	Avg Moisture		Abrupt	Smooth			
Ap	0	9	10YR 3/3 Dark Brown	Silt Loam	Medium	Moderate	Granular	Friable	Avg Moisture	<10%	Abrupt	Smooth	Yes	---	---
Bt 1	9	35	10YR 5/8 Yellowish Brown	Loam	Medium	Moderate	SBK	Friable	Avg Moisture	10%	Clear	Wavy	Few	---	---
Bt 2	35	44	10YR 5/6 Yellowish Brown	Silt Loam	Fine	Weak	SBK	Friable to Firm	Avg Moisture	15%	Clear	Wavy	No	---	---
BC	44	60	5YR 4/6 Variegated Yellowish Red	Loamy Sand Med	---	Massive	Structureless	V Firm	Avg Moisture	40%	Clear	Wavy	No	---	---
C	60	110	5YR 4/6 Variegated Yellowish Red	Sandy Loam	---	Single Grain	Structureless	Friable to Firm	Avg Moisture	50%	Pit Base	---	No	---	---
Method of Excavation:	Backhoe/Trackhoe			Remarks:											



I state that I have visited the site and directly performed and/or supervised all test procedures and/or preparation of this report. All information contained herein is accurate to the best of my knowledge, and all test procedures have been performed using accepted practices. HILBEC Engineering & Geosciences, LLC cannot and does not make claim, warranty, or guarantee that surface and sub-surface site conditions or test results, other than described or conducted at the time of the test, may be different at some time in the future and thus may affect these findings herein.

Kevin R. Sech
Kevin R. Sech, P.G., P.E.

Probe #:	SWM-01B
Test Date:	September 18, 2019
Soil Profile Limitation:	None No water or bedrock observed

Project Name:	Hamilton: 228 Strafford Ave		
Municipality:	Radnor Township		
Soil Profile Description Prepared By:	Kevin R. Sech, P.G., P.E.		
General Location of the Test Pit:	Easterly side of the test area near Strafford Ave.		

Horizon	Up	Low	Color	Texture	Structure			Consistence		CF%	Boundary		Roots	Coats	Redox
					Medium	Moderate	Granular	Friable	Avg Moisture		Abrupt	Smooth			
Ap	0	11	10YR 3/3 Dark Brown	Silt Loam	Medium	Moderate	Granular	Friable	Avg Moisture	<10%	Abrupt	Smooth	Yes	---	---
Bt 1	11	23	10YR 5/8 Yellowish Brown	Loam	Medium	Moderate	SBK	Friable to Firm	Avg Moisture	10%	Clear	Wavy	Few	---	---
Bt 2	23	37	10YR 5/6 Yellowish Brown	Silt Loam	Fine	Weak	SBK	Friable to Firm	Avg Moisture	20%	Clear	Wavy	No	---	---
C	37	109	10YR 5/4 Variegated Yellowish Brown	Silt Loam	---	Massive	Structureless	Friable	Avg Moisture	20%	Pit Base	---	No	---	---

Method of Excavation:	Backhoe/Trackhoe	Remarks:
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PROJECT LIMITATIONS:

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Kevin R. Sech

Kevin R. Sech, P.G., P.E.

Probe #:	SWM-02A
Test Date:	September 17, 2019
Soil Profile Limitation:	None No water or bedrock observed

Project Name:	Hamilton: 228 Strafford Ave	
Municipality:	Radnor Township	
Soil Profile Description Prepared By:	Kevin R. Sech, P.G., P.E.	
General Location of the Test Pit:	Easterly side of the test area near the pool	

Horizon	Up	Low	Color	Texture	Structure		Consistence		CF%	Boundary	Roots	Coats	Redox	
					Fine	Weak	Friable	Avg Moisture						
Ap	0	25	10YR 3/3 Dark Brown	Silt Loam		Granular		Friable	30%	Abrupt	Yes	---	---	
Historic Fill														
Bt	25	39	10YR 4/6 Dk Yellowish Brown	Silty Clay Loam	Medium	Moderate	SBK	SI Plastic	10%	Clear	Wavy	Few	---	---
Uncovered 1" water pipe @ 32" and terra cotta tile field at 42"														
BC	39	59	10YR 4/6 Variegated Dk Yellowish Brown	Silt Loam	Fine	Weak	SBK	Friable	20%	Clear	Wavy	No	---	---
C	59	120	10YR 4/6 Variegated Dk Yellowish Brown	Silt Loam	---	Massive	Structureless	Friable	35%	Pit Base	---	No	---	---
Method of Excavation:	Backhoe/Trackhoe													
Remarks:	This test pit was slid to the south to avoid further damage to buried electric													

PROJECT LIMITATIONS:

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Kevin R. Sech

 Kevin R. Sech, P.G., P.E.



Project Name:	Hamilton: 228 Strafford Ave
Municipality:	Radnor Township
Soil Profile Description Prepared By:	Kevin R. Sech, P.G., P.E.
General Location of the Test Pit:	Westerly side of the test area near Strafford Ave.

Probe #:	SWM-02B
Test Date:	September 17, 2019
Soil Profile Limitation:	None No water or bedrock observed

Horizon	Up	Low	Color	Texture	Structure		Consistence		CF%	Boundary	Roots	Coats	Redox
					Moderate	Granular	Friable	Avg Moisture					
Ap	0	12	10YR 3/3 Dark Brown	Silt Loam	Medium	Granular	Friable	Avg Moisture	<10%	Abrupt	Yes	---	---
Bt	12	33	10YR 4/6 Dk Yellowish Brown	Silty Clay Loam	Medium	SBK	SI Plastic	Avg Moisture	10%	Clear	Few	---	---
BC	33	43	10YR 4/6 Variegated Dk Yellowish Brown	Silt Loam	Fine	SBK	Friable	Avg Moisture	15%	Clear	Few	---	---
C	43	120	10YR 4/6 Variegated Dk Yellowish Brown	Silt Loam	---	Structureless	Friable	Avg Moisture	25%	Pit Base	No	---	---
Method of Excavation:	Backhoe/Trackhoe												
Remarks:													

PROJECT LIMITATIONS:

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Kevin R. Sech

Kevin R. Sech, P.G., P.E.



Probe #:	SWM-03
Test Date:	September 17, 2019
Soil Profile Limitation:	None No water or bedrock observed Redox not a high or perched water table

Project Name:	Hamilton: 228 Strafford Ave	
Municipality:	Radnor Township	
Soil Profile Description Prepared By:	Kevin R. Sech, P.G., P.E.	
General Location of the Test Pit:	Lower side of the pool	

Horizon	Up	Low	Color	Texture	Structure		Consistence		CF%	Boundary	Roots	Coats	Redox	
					Medium	Moderate	Granular	Friable						Avg Moisture
Ap	0	12	10YR 3/3 Dark Brown	Silt Loam	Medium	Moderate	Granular	Friable	Avg Moisture	<10%	Smooth	Yes	---	---
Bt	12	42	10YR 5/8 Yellowish Brown	Silty Clay Loam	Medium	Moderate	SBK	SI Plastic	Avg Moisture	10%	Wavy	Few	---	Many Prom
Textural difference - not a high water table														
BC	42	64	10YR 4/6 Dk Yellowish Brown	Silt Loam Heavy In-Part	---	Massive	Structureless	Friable to SI Plastic	Avg Moisture	15%	Wavy	No	---	---
C	64	120	10YR 4/2 Variegated Dark Grey Brown	Silt Loam	---	Massive	Structureless	Friable	Avg Moisture	30%	Pit Base	No	---	---
Method of Excavation:	Backhoe/Trackhoe													
Remarks:														

PROJECT LIMITATIONS:

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Kevin R. Sech
 Kevin R. Sech, P.G., P.E.



Project Name:	Hamilton: 228 Strafford Ave
Municipality:	Radnor Township
Soil Profile Description Prepared By:	Kevin R. Sech, P.G., P.E.
General Location of the Test Pit:	WNW Property Corner
Probe #:	SWM-04
Test Date:	September 17, 2019
Soil Profile Limitation:	None No water or bedrock observed Redox not a high or perched water table

Horizon	Up	Low	Color	Texture	Structure		Consistence	CF%	Boundary	Roots	Coats	Redox	
Ap	0	10	10YR 3/3 Dark Brown	Silt Loam	Medium	Moderate	Granular	Friable	Avg Moisture <10%	Abrupt	Smooth	Yes	---
Bt 1	10	30	10YR 5/8 Yellowish Brown	Silty Clay Loam	Medium	Moderate	SBK	V Firm	Avg Moisture 10%	Clear	Wavy	Few	Faint
Bt 2	30	45	10YR 5/8 Dk Yellowish Brown	Silt Loam	Fine	Weak	SBK	Friable	Avg Moisture 10%	Clear	Irregular	No	---
BC	45	97	10YR 4/6 Variegated Dk Yellowish Brown	Silt Loam Heavy In-Part	---	Massive	Structureless	Friable	Avg Moisture 10%	Clear	Irregular	No	---
C	97	122	10YR 4/4 Variegated Dk Yellowish Brown	Silt Loam Sandy In-Part	---	Massive	Structureless	Friable	Avg Moisture 20%	Pit Base	---	No	---

Method of Excavation:	Backhoe/Trackhoe	Remarks:	Old trench drain found in the scrape for the permeability test at the low corner of the site.
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PROJECT LIMITATIONS:

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Kevin R. Sech
Kevin R. Sech, P.G., P.E.

**PERMEABILITY TEST RESULTS
AND CALCULATIONS**

CONSTANT HEAD BOREHOLE PERMEAMETER ANALYSIS
Guelph Permeameter

RANGE OF TYPICAL TEXTURAL DATA (ALPHA VALUES)
 0.36 cm-1 Sands, Gravels, Coarse Grained Saprolite, Soil Fractures
 0.12 cm-1 Structured Soils from Clays to Loams
 0.04 cm-1 Fine & Very Fine Textured Silts and Clay
 0.01 cm-1 Compacted and Structureless Clay, Landfill Caps, etc.

TEST PARAMETERS: RUN OF FIRST APPLIED HEAD
 First Applied Head (H) 5 cm
 Cross Sectional Area of Reservoir (35.22 or 2.15) 35.22 cm²
 Time Interval Of Readings (T) 60 seconds
 Stabilized Reading 1.0 cm
 Average Rate of Fall (R₁) 1.67E-02 cm/sec
 First Head Matric Flux Potential 8.86E-03 cm²/sec
 First Head Kfs 1.06E-03 cm/sec
 First Head Kfs (in/hr) 1.51 in/hr

TEST PARAMETERS: RUN OF SECOND APPLIED HEAD
 Second Applied Head (H) 10 cm
 Cross Sectional Area of Reservoir (35.22 or 2.15) 35.22 cm²
 Time Interval Of Readings (T) 30 seconds
 Stabilized Reading 0.7 cm
 Average Rate of Fall (R₂) 2.33E-02 cm/sec
 Second Head Matric Flux Potential 1.43E-02 cm²/sec
 Second Head Kfs 8.87E-04 cm/sec
 Second Head Kfs (in/hr) 1.26 in/hr

HYDRAULIC CONDUCTIVITY ANALYSIS
 Geometric Mean of Matric Flux Potential For Single Head Methods 1.12E-02 cm²/sec
 Geometric Mean of Field Saturated Hydraulic 9.71E-04 cm/sec
 Calculated Matric Flux Potential Over Gradient (µm) 1.28E-02 cm²/sec
 Calculated Alpha Value (α*) 0.03 cm-1
 Calculated Field Saturated Conductivity 3.77E-04 cm/sec

Geometric Mean Conductivity For Single Head Analysis (Kfs) 1.38 inches/hour
Hydraulic Conductivity Over Gradient (Kfs) 0.53 inches/hour
FINAL CONDUCTIVITY RATE 0.53 inches/hour

The **Single Head Geometric Mean** is used when
 1. The Matrix Flux Potential, Alpha, or the Kfs values are Negative, a Heterogeneous soil likely exists
 2. The second rate is not greater than the first rate

CONSTANT HEAD PERMEAMETER TEST

PROJECT NAME: Hamilton: 228 Stratford Ave
TEST ID: PSS-A
TEST DEPTH: 96"
NEAR SOIL PROBE #: SWM-03

TEST DATE: September 17, 2019
WEATHER / TEMP: Sunny / 75 Degrees
HOLE DIAMETER: 6.0 cm or inch 2 3/8
SIDE OF TEST AREA: Northerly Side

1st Level at 5 cm				2nd Level at 10 cm			
Time Interval (seconds)	Water Level Reading (cm)	Previous Water Level (cm)	Change in Level (cm)	Time Interval (seconds)	Water Level Reading (cm)	Previous Water Level (cm)	Change in Level (cm)
60	2.3	1.1	1.2	1	13.6	12.6	1.0
60	3.6	2.3	1.3	2	14.5	13.6	0.9
60	4.4	3.6	0.8	3	15.2	14.5	0.7
60	5.4	4.4	1.0	4	16.1	15.2	0.9
60	6.2	5.4	0.8	5	16.9	16.1	0.8
60	7.2	6.2	1.0	6	17.6	16.9	0.7
60	8.2	7.2	1.0	7	18.3	17.6	0.7
60	9.2	8.2	1.0	8	18.9	18.3	0.6
				9	19.6	18.9	0.7
				10	20.3	19.6	0.7
				11	21.0	20.3	0.7
				12			
				13			
				14			
				15			
				16			
				17			
				18			
				19			
				20			
				21			
				22			
				23			
				24			
				25			
				26			
				27			
				28			
Stabilized At: 1.0 cm				Stabilized At: 0.7 cm			

CONSTANT HEAD BOREHOLE PERMEAMETER ANALYSIS
Guelph Permeameter

PROJECT NAME: Hamilton: 228 Strafford Ave
TEST ID: P54-A
TEST DEPTH: 84"
NEAR SOIL PROBE #: SWM-04

TEST DATE: September 17, 2019
WEATHER / TEMP: Sunny / 75 Degrees
HOLE DIAMETER: 6.0 cm or inch 2 3/8
SIDE OF TEST AREA: Easterly Side

CONSTANT HEAD PERMEAMETER TEST

1st Level at 5 cm

Time Interval (seconds)	Water Level Reading (cm)	Previous Water Level (cm)	Change in Level (cm)	Number of Tubes (1 or 2)
30	3.9	0.9	3.0	1
30	7.0	3.9	3.1	1
30	9.6	7.0	2.6	1
30	13.4	9.6	3.8	1
30	16.4	13.4	3.0	1
30	19.1	16.4	2.7	1
30	22.7	19.1	3.6	1
30	25.4	22.7	2.7	1
30	28.2	25.4	2.8	1
30	30.8	28.2	2.6	1
30	33.5	30.8	2.7	1
30	36.3	33.5	2.8	1
30	39.5	36.3	3.2	1
30	42.2	39.5	2.7	1
30	44.8	42.2	2.6	1
30	47.4	44.8	2.6	1
30	50.0	47.4	2.6	1

2nd Level at 10 cm

Time Interval (seconds)	Water Level Reading (cm)	Previous Water Level (cm)	Change in Level (cm)	Number of Tubes (1 or 2)
60	8.2	7.5	0.7	2
60	8.8	8.2	0.6	2
60	9.4	8.8	0.6	2
60	9.9	9.4	0.5	2
60	10.6	9.9	0.7	2
60	11.2	10.6	0.6	2
60	11.8	11.2	0.6	2
60	12.4	11.8	0.6	2

RANGE OF TYPICAL TEXTURAL DATA (ALPHA VALUES)
 0.36 cm-1 Sands, Gravels, Coarse Grained Saprolite, Soil Fractures
 0.12 cm-1 Structured Soils from Clays to Loams
 0.04 cm-1 Fine & Very Fine Textured Silts and Clay
 0.01 cm-1 Compacted and Structureless Clay, Landfill Caps, etc.

TEST PARAMETERS: RUN OF FIRST APPLIED HEAD
 First Applied Head (H) 5 cm
 Gross Sectional Area of Reservoir (35.22 or 2.15) 2.15 cm²
 Time Interval Of Readings (I) 30 seconds
 Stabilized Reading 2.6 cm
 Average Rate of Fall (R_s) 8.67E-02 cm/sec
 First Head Matrix Flux Potential 2.81E-03 cm²/sec
 First Head Kfs 3.37E-04 cm/sec
0.48 in/hr

TEST PARAMETERS: RUN OF SECOND APPLIED HEAD
 Second Applied Head (H) 10 cm
 Gross Sectional Area of Reservoir (35.22 or 2.15) 35.22 cm²
 Time Interval Of Readings (I) 60 seconds
 Stabilized Reading 0.6 cm
 Average Rate of Fall (R_s) 1.00E-02 cm/sec
 Second Head Matrix Flux Potential 3.75E-03 cm²/sec
 Second Head Kfs 3.80E-04 cm/sec
0.54 in/hr

HYDRAULIC CONDUCTIVITY ANALYSIS
 Geometric Mean of Matrix Flux Potential For Single Head Methods 3.25E-03 cm²/sec
 Geometric Mean of Field Saturated Hydraulic 3.58E-04 cm²/sec
 Calculated Matrix Flux Potential Over Gradient (pm) 1.86E-03 cm²/sec
 Calculated Alpha Value (α*) See Below cm-1
 Calculated Field Saturated Conductivity See 2 Below cm/sec

0.51 inches/hour
Geometric Mean Conductivity For Single Head Analysis (Kfs)
Gradient Head Does Not Apply For This Case

FINAL CONDUCTIVITY RATE
0.51 inches/hour

Stabilized At: 2.6 cm

Stabilized At: 0.6 cm

The Single Head Geometric Mean is used when
 1. The Matrix Flux Potential, Alpha, or the Kfs values are Negative, a Heterogeneous soil likely exists
 2. The second rate is not greater than the first rate

CONSTANT HEAD PERMEAMETER TEST

PROJECT NAME: Hamilton: 228 Stafford Ave
 TEST ID: PS4-B
 TEST DEPTH: 42"
 NEAR SOIL PROBE #: SWM-04

TEST DATE: September 17, 2019
 WEATHER / TEMP: Sunny / 75 Degrees
 HOLE DIAMETER: 6.0 cm or inch 2.375
 SIDE OF TEST AREA: Westerly Side

1st Level at 5 cm				
Time Interval (seconds)	Water Level Reading (cm)	Previous Water Level (cm)	Change in Level (cm)	Number of Tubes (1 or 2)
600	15.8	15.8	0.0	1
Stabilized with 3 consecutive equal readings				
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
Stabilized At:				0.0 cm

2nd Level at 10 cm				
Time Interval (seconds)	Water Level Reading (cm)	Previous Water Level (cm)	Change in Level (cm)	Number of Tubes (1 or 2)
600	19.5	19.5	0.0	2
Stabilized with 3 consecutive equal readings				
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
Stabilized At:				0.0 cm

CONSTANT HEAD BOREHOLE PERMEAMETER ANALYSIS

Guelph Permeameter

RANGE OF TYPICAL TEXTURAL DATA (ALPHA VALUES)

0.36 cm-1 Sands, Gravels, Coarse Grained Saprolite, Soil Fractures
 0.12 cm-1 Structured Soils from Clays to Loams
 0.04 cm-1 Fine & Very Fine Textured Silts and Clay
 0.01 cm-1 Compacted and Structureless Clay, Landfill Caps, etc.

TEST PARAMETERS: RUN OF FIRST APPLIED HEAD

5 cm First Applied Head (H)
 2.15 cm² Cross Sectional Area of Reservoir (35.22 or 2.15)
 600 seconds Time Interval Of Readings (T)
 0.0 cm Stabilized Reading
 0.00E+00 cm/sec Average Rate of Fall (R_f)
 0.00E+00 cm²/sec First Head Matric Flux Potential
 0.00E+00 cm/sec Second Head Kfs
 0.00 in/hr First Head Kfs (in/hr)

TEST PARAMETERS: RUN OF SECOND APPLIED HEAD

10 cm Second Applied Head (H)
 35.22 cm² Cross Sectional Area of Reservoir (35.22 or 2.15)
 600 seconds Time Interval Of Readings (T)
 0.0 cm Stabilized Reading
 0.00E+00 cm/sec Average Rate of Fall (R_f)
 0.00E+00 cm²/sec Second Head Matric Flux Potential
 0.00E+00 cm/sec Second Head Kfs
 0.00 in/hr Second Head Kfs (in/hr)

HYDRAULIC CONDUCTIVITY ANALYSIS

#NUM! cm²/sec Geometric Mean of Matric Flux Potential For Single Head Methods
 #NUM! cm/sec Geometric Mean of Field Saturated Hydraulic
 0.00E+00 cm²/sec Calculated Matric Flux Potential Over Gradient (φm)
 #DIV/0! cm-1 Calculated Alpha Value (α*)
 0.00E+00 cm/sec Calculated Field Saturated Conductivity

#NUM! inches/hour Geometric Mean Conductivity For Single Head Analysis (Kfs)
 0.00 inches/hour Hydraulic Conductivity Over Gradient (Kfs)

The **Single Head Geometric Mean** is used when

- The Matrix Flux Potential, Alpha, or the Kfs values are Negative, a Heterogeneous soil likely exists
- The second rate is not greater than the first rate

FINAL CONDUCTIVITY RATE

0.00 inches/hour

TEST LOCATION PLAN

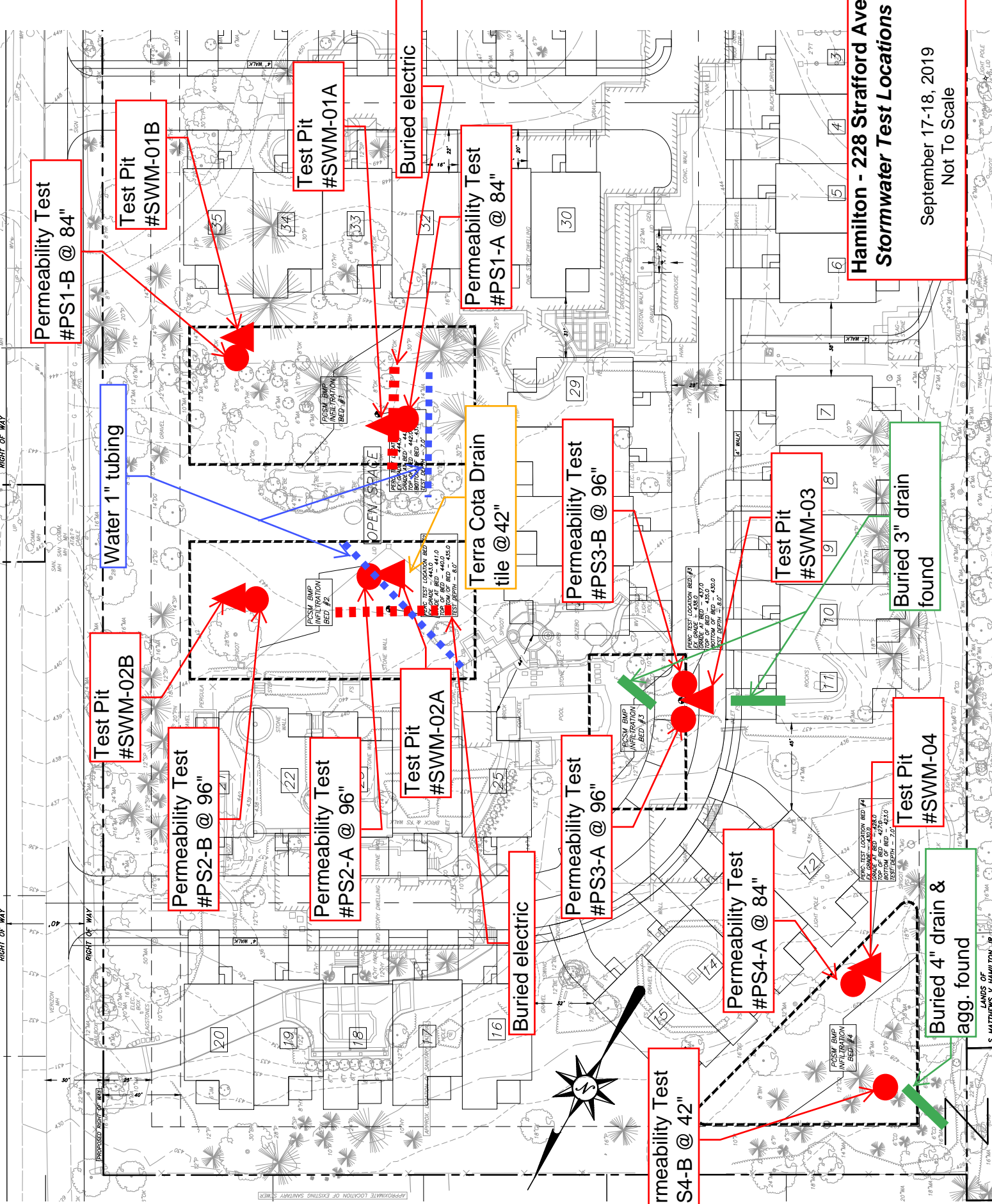
STRAFFORD AVE

LANDS N/T
ANULEET & TARA SAREEN
TAX MAP 36-11-349
DB 6202 PG 1321

DAVID SATTERFIELD & MARY
TAX MAP 36-11-349-002
DB 5981 PG 324

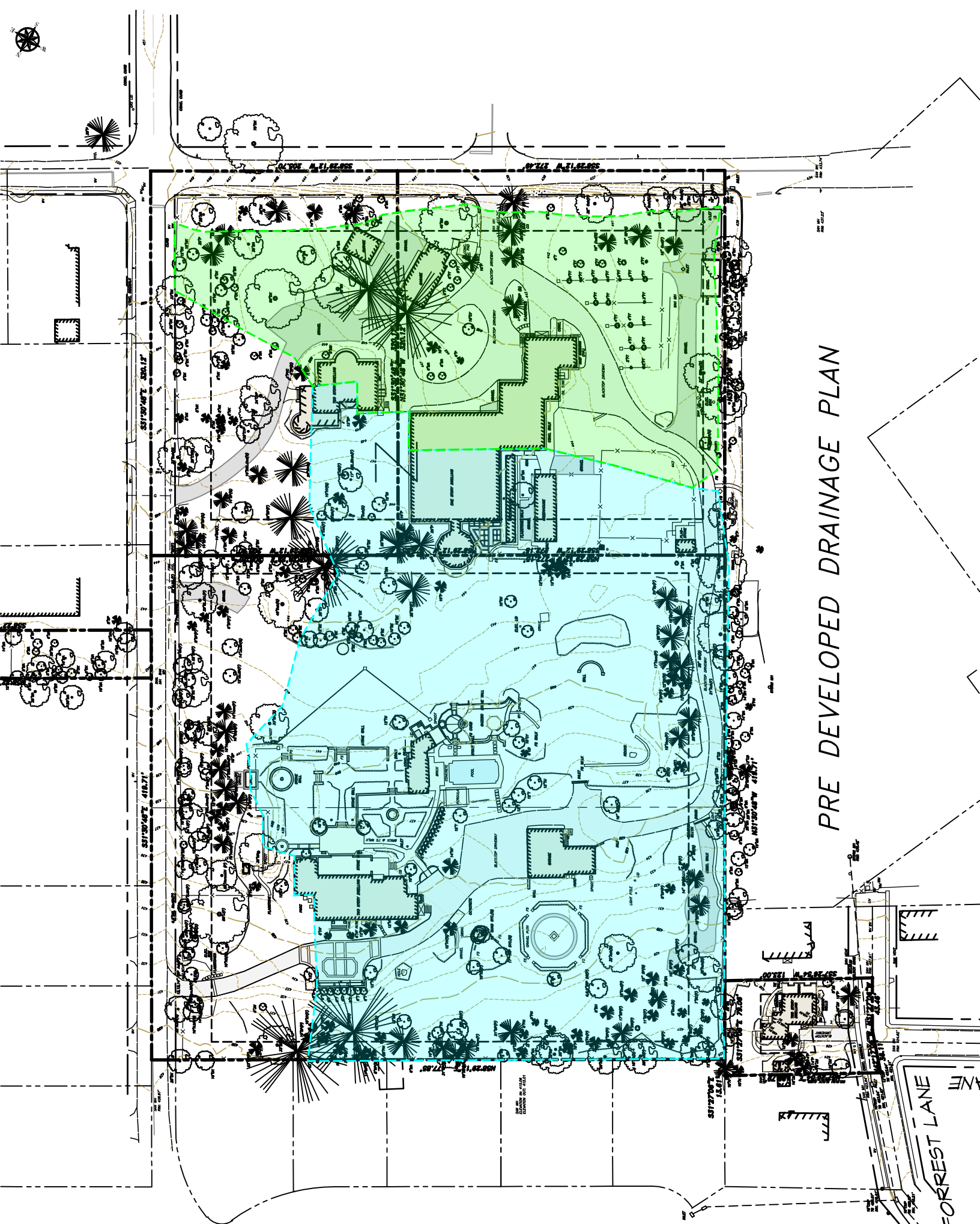
LANDS N/T
JOHN & KATHRYN BROOKS
TAX MAP 36-11-351
DB 1884 PG 443

LANDS N/T
JEREMY GRAY
TAX MAP 36-11-352
DB 5719 PG 2680



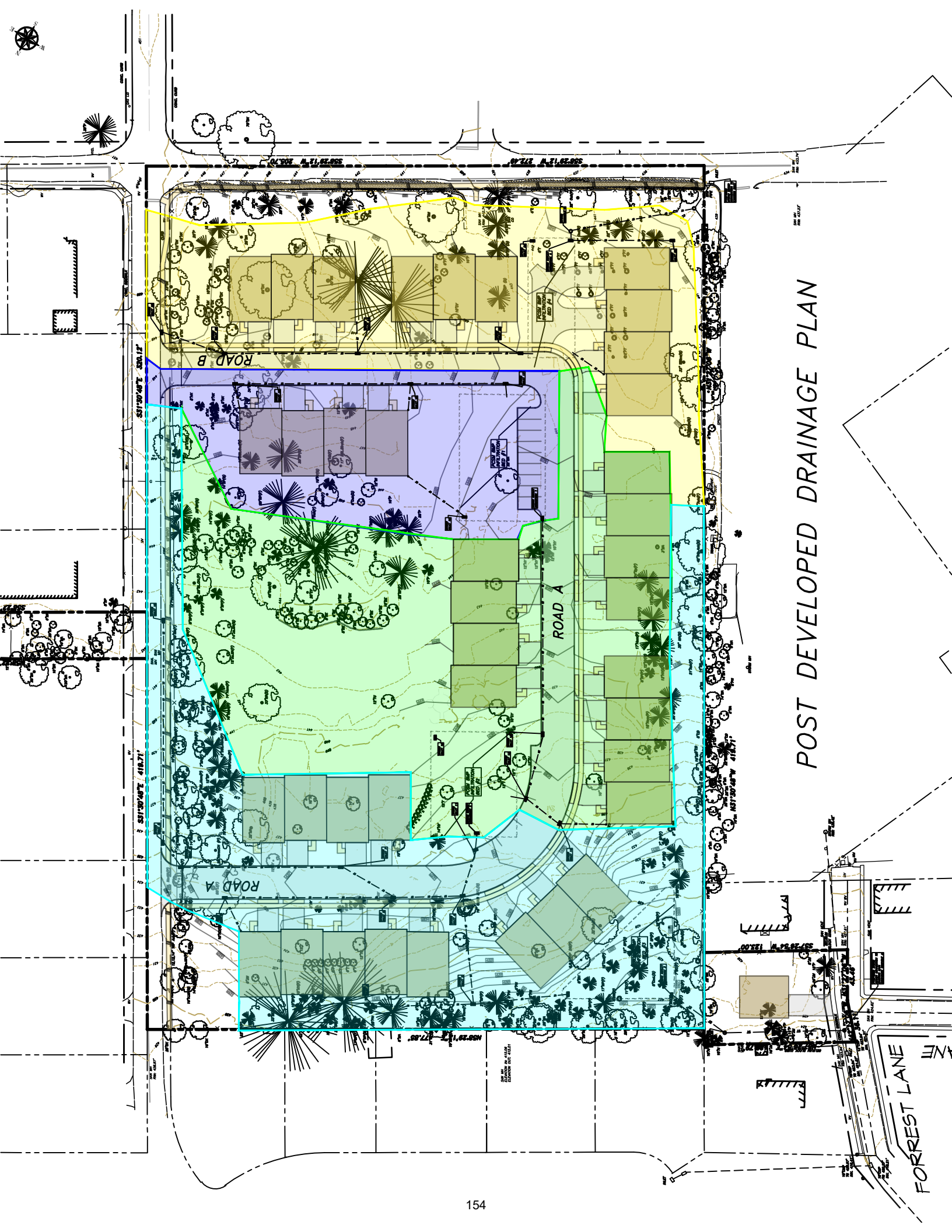
Hamilton - 228 Strafford Ave
Stormwater Test Locations

September 17-18, 2019
 Not To Scale



PRE DEVELOPED DRAINAGE PLAN

FORREST LANE



POST DEVELOPED DRAINAGE PLAN

FORREST LANE