DRAINAGE REPORT

STORM RUNOFF IMPACT

FOR

HIGHWAY 5 & LOWERY LN.

C-STORE

7/30/2021
Bryant, AR

PREPARED FOR
City of Bryant

By:

HOPE
CONSULTING
ENGINEERS • SURVEYORS

Summary

The calculations detailed in this report are related to the detention design of a proposed development of a property at the NE corner of the intersection of Highway 5 and Lowery Lane in Bryant. The study area considered is 2.11 acres ± and accounts for areas that by-pass the pond as well as upstream area being routed through the pond. The main tract under pre-development conditions is an undeveloped landscape. The proposed use of the site is a gas station/convenience store.

In particular these calculations detail the impact of a proposed development to a site on Highway 5, at the NE corner of the intersection with Lowery Lane in Bryant. The calculations on the following pages include:

- Pre and Post development C value for the Study area
- Rational method calculations for the pre and post development runoff leaving the pond.

The following summarized flows (cfs) are based upon a 100 year storm event:
Before routing to detention

Event	**Pre-dev**	**Post-dev**
100 year	6.04	11.21
50year	5.59	10.54
25 year	4.92	9.21
10 year	4.25	8.07
5 year	3.47	6.86
2 year	3.13	6.20

After routing to detention

Event	**Pre-dev**	**Post with Pond**
100 year	6.04	4.37
50year	5.59	3.60
25 year	4.92	2.89
10 year	4.25	2.62
5 year	3.47	2.32
2 year	3.13	2.15

Composite C

Composite Values for the acre impact study area (acres):

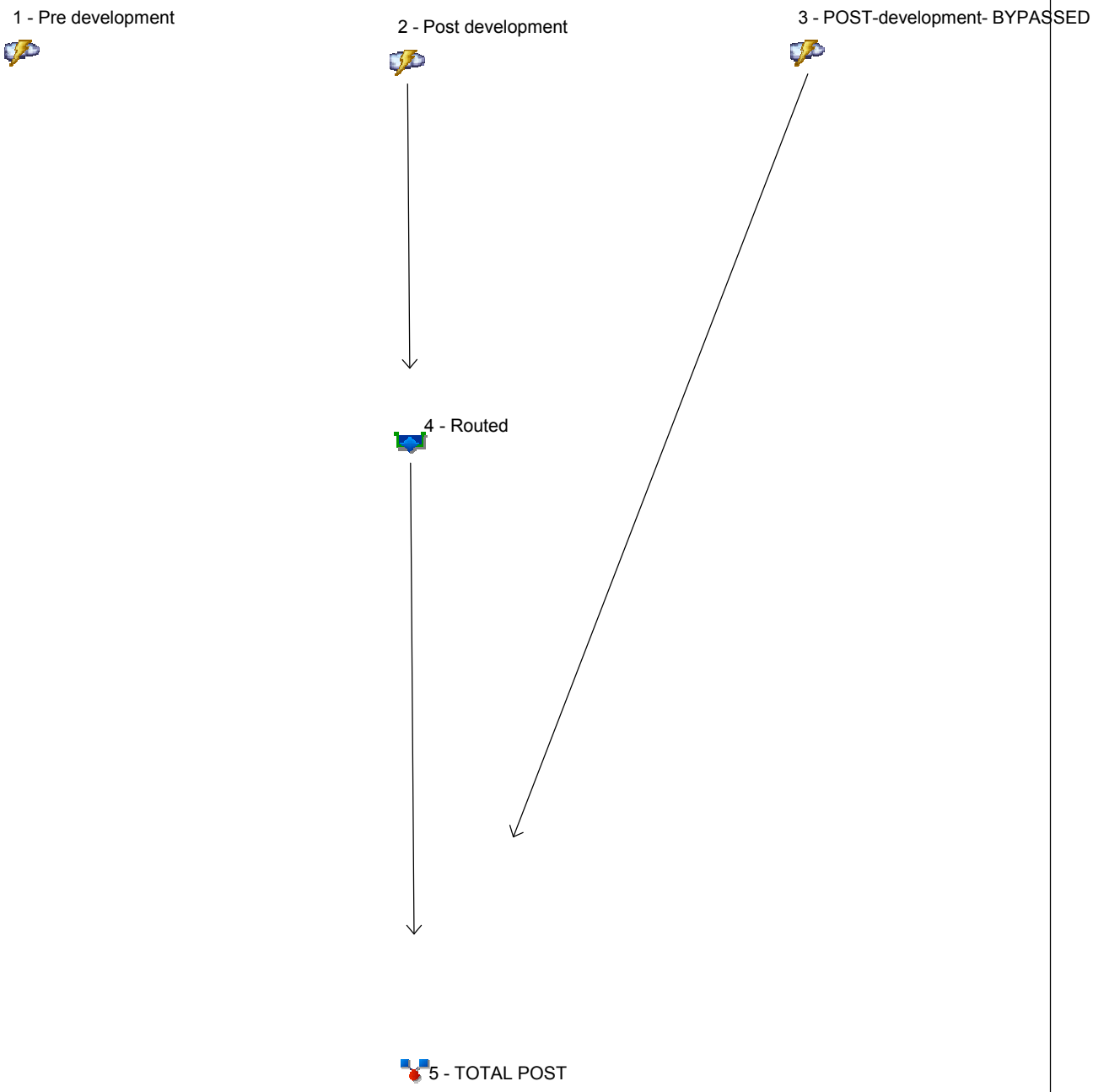
Pre-development	*0.46*
Post-development	*0.79*
By-pass	*0.46*

Time of Concentration

time of concentration (pre/post)	*30min/15min*

Watershed Model Schematic

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021



Legend

Hyd.	Origin	Description
1	Rational	Pre development
2	Rational	Post development
3	Rational	POST-development- BYPASSED
4	Reservoir	Routed
5	Combine	TOTAL POST

Hydrograph Return Period Recap

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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	Rational	------	-------	3.131	-------	3.467	4.250	4.921	5.591	6.039	Pre development
2	Rational	------	-------	5.851	-------	6.472	7.597	8.708	9.925	10.54	Post development
3	Rational	------	-------	0.348	-------	0.385	0.472	0.546	0.621	0.671	POST-development- BYPASSED
4	Reservoir	2	-------	1.849	-------	1.980	2.205	2.391	3.075	3.815	Routed
5	Combine	3, 4	-------	2.150	-------	2.317	2.623	2.885	3.600	4.373	TOTAL POST

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

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	Rational	6.039	1	30	10,870	------	------	------	Pre development
2	Rational	10.54	1	15	9,490	------	------	------	Post development
3	Rational	0.671	1	30	1,207	------	------	------	POST-development- BYPASSED
4	Reservoir	3.815	1	25	9,391	2	445.38	6,572	Routed
5	Combine	4.373	1	25	10,598	3, 4	------	------	TOTAL POST

Multi-Hydrograph Plot

Hyd. No. 1

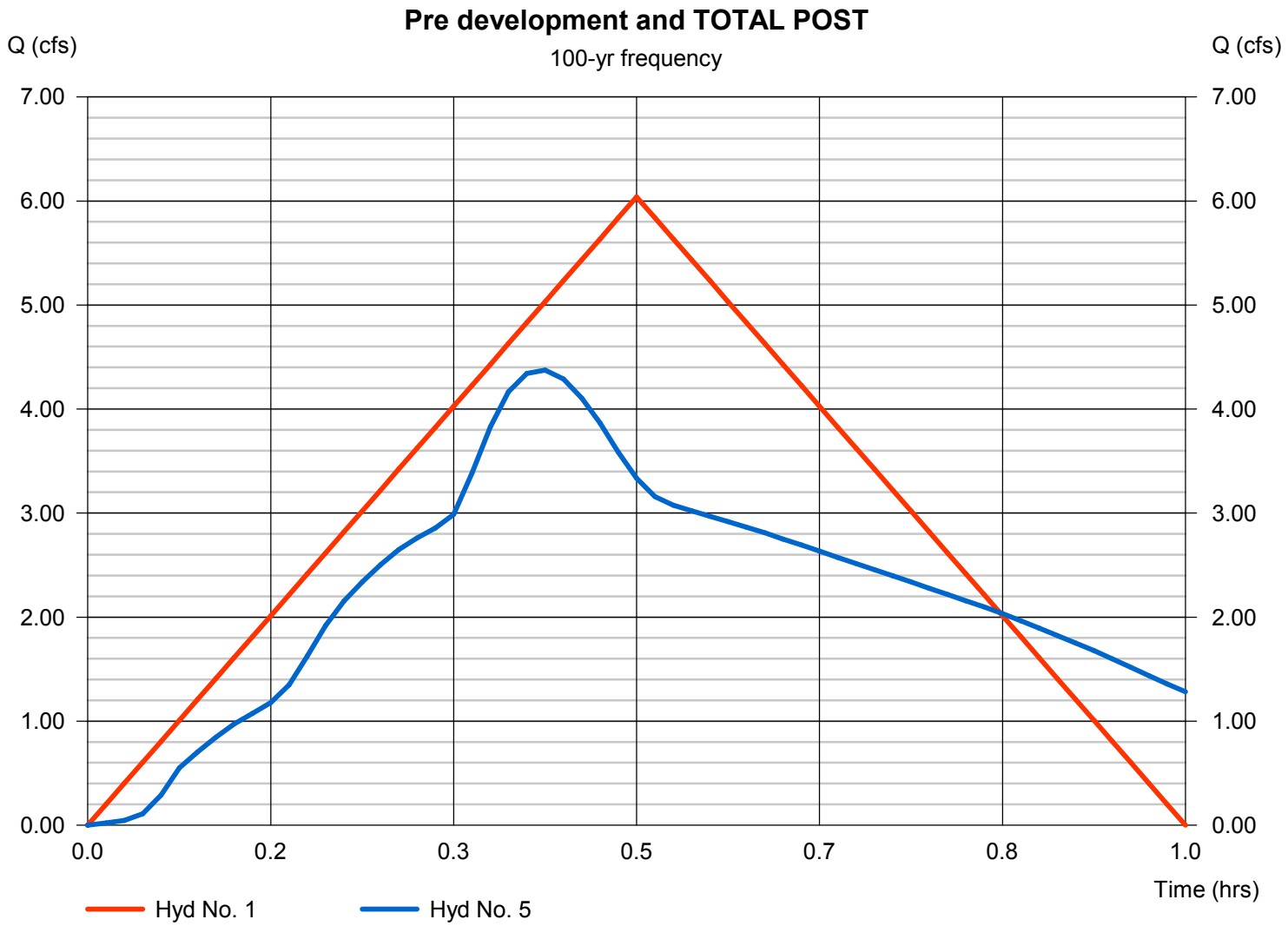
Pre development

Hydrograph type	=	Rational
Peak discharge	=	6.039 cfs
Time to peak	=	0.50 hrs
Hyd. Volume	=	10,870 cuft

Hyd. No. 5

TOTAL POST

Hydrograph type	=	Combine
Peak discharge	=	4.37 cfs
Time to peak	=	0.42 hrs
Hyd. Volume	=	10,598 cuft



Multi-Hydrograph Plot

Hyd. No. 1

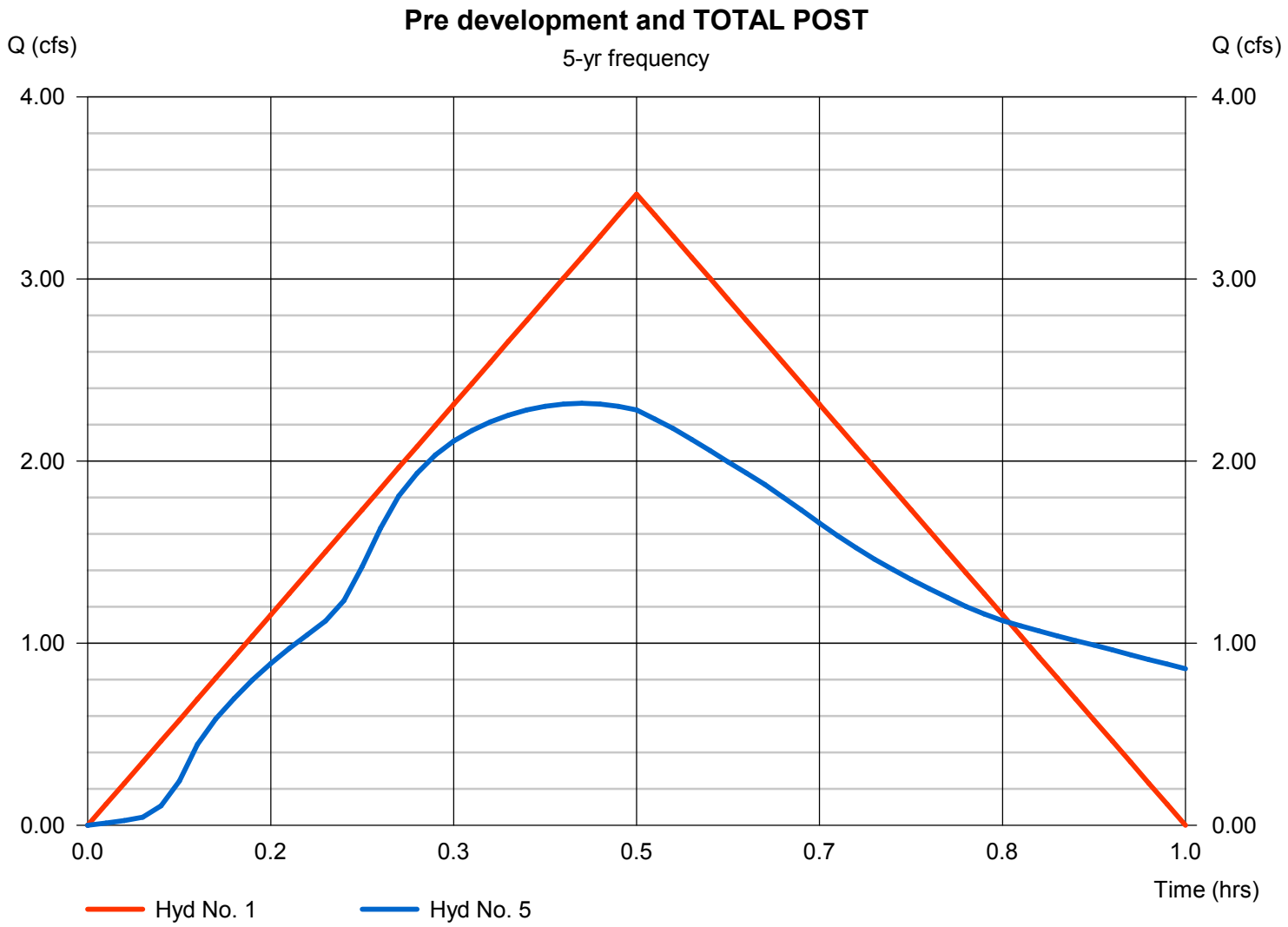
Pre development

Hydrograph type	=	Rational
Peak discharge	=	3.467 cfs
Time to peak	=	0.50 hrs
Hyd. Volume	=	6,240 cuft

Hyd. No. 5

TOTAL POST

Hydrograph type	=	Combine
Peak discharge	=	2.32 cfs
Time to peak	=	0.45 hrs
Hyd. Volume	=	6,419 cuft



Multi-Hydrograph Plot

Hyd. No. 1

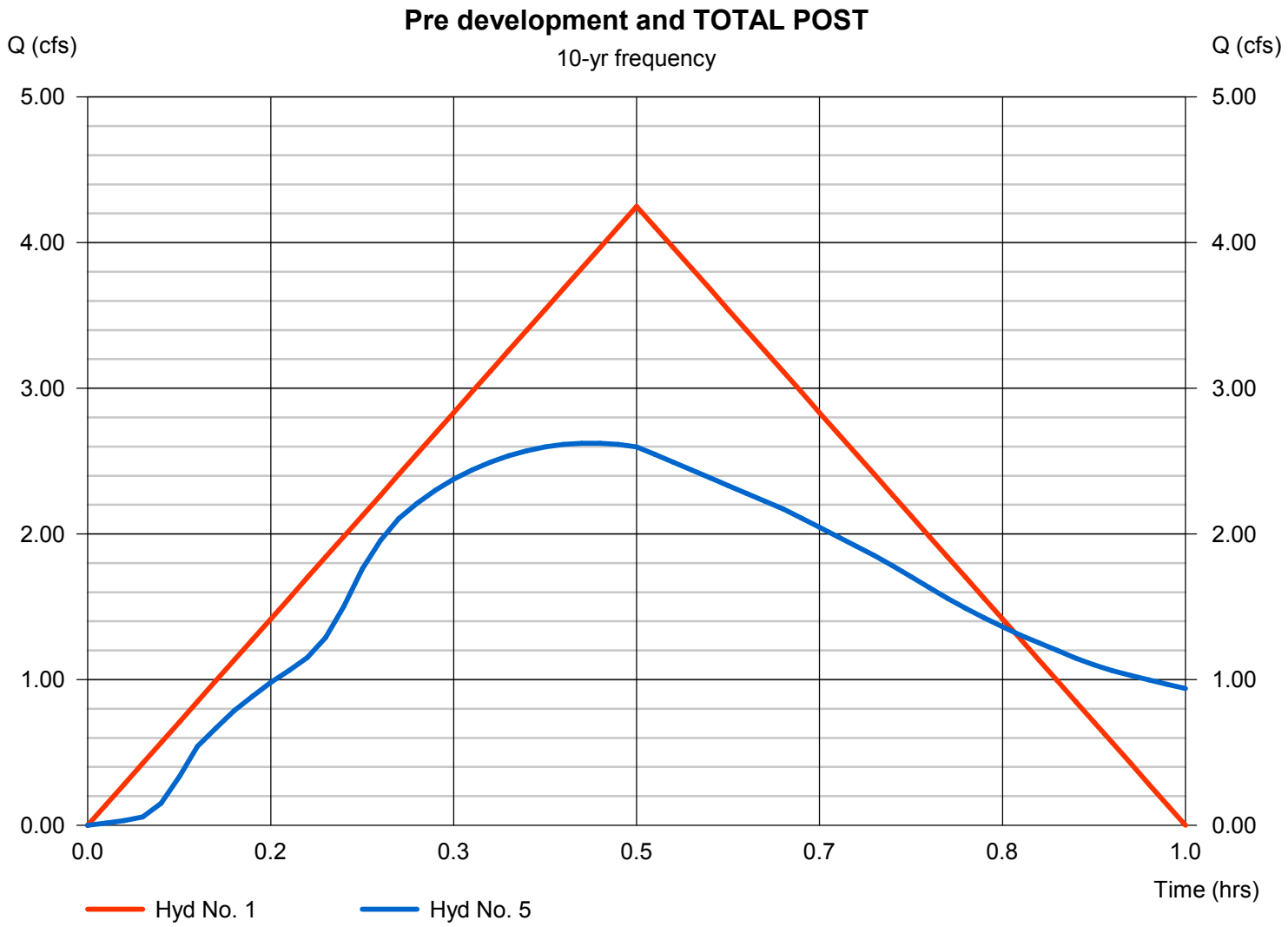
Pre development

Hydrograph type	=	Rational
Peak discharge	=	4.250 cfs
Time to peak	=	0.50 hrs
Hyd. Volume	=	7,649 cuft

Hyd. No. 5

TOTAL POST

Hydrograph type	=	Combine
Peak discharge	=	2.62 cfs
Time to peak	=	0.47 hrs
Hyd. Volume	=	7,588 cuft



Multi-Hydrograph Plot

Hyd. No. 1

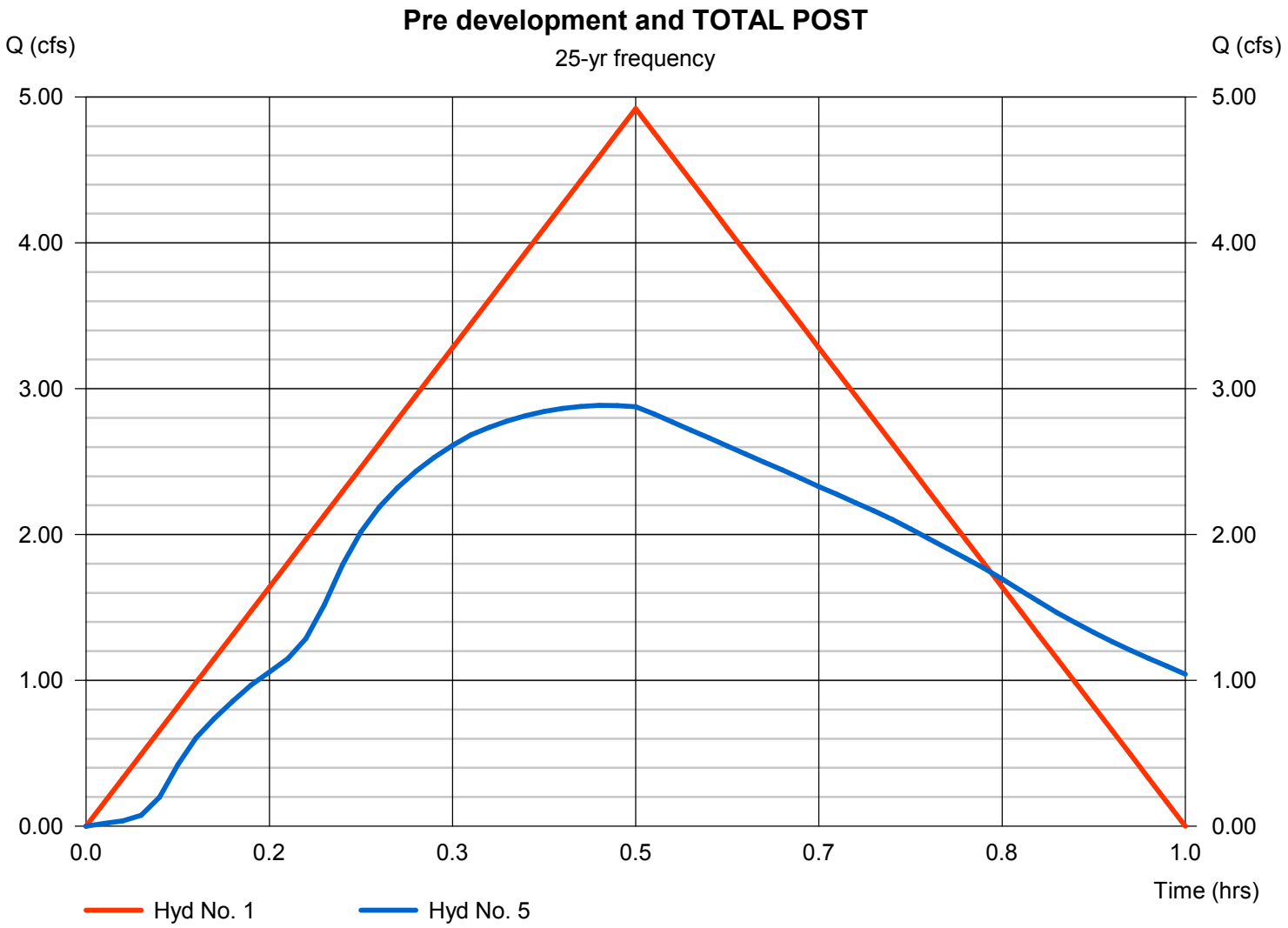
Pre development

Hydrograph type	=	Rational
Peak discharge	=	4.921 cfs
Time to peak	=	0.50 hrs
Hyd. Volume	=	8,857 cuft

Hyd. No. 5

TOTAL POST

Hydrograph type	=	Combine
Peak discharge	=	2.88 cfs
Time to peak	=	0.47 hrs
Hyd. Volume	=	8,722 cuft



Multi-Hydrograph Plot

Hyd. No. 1

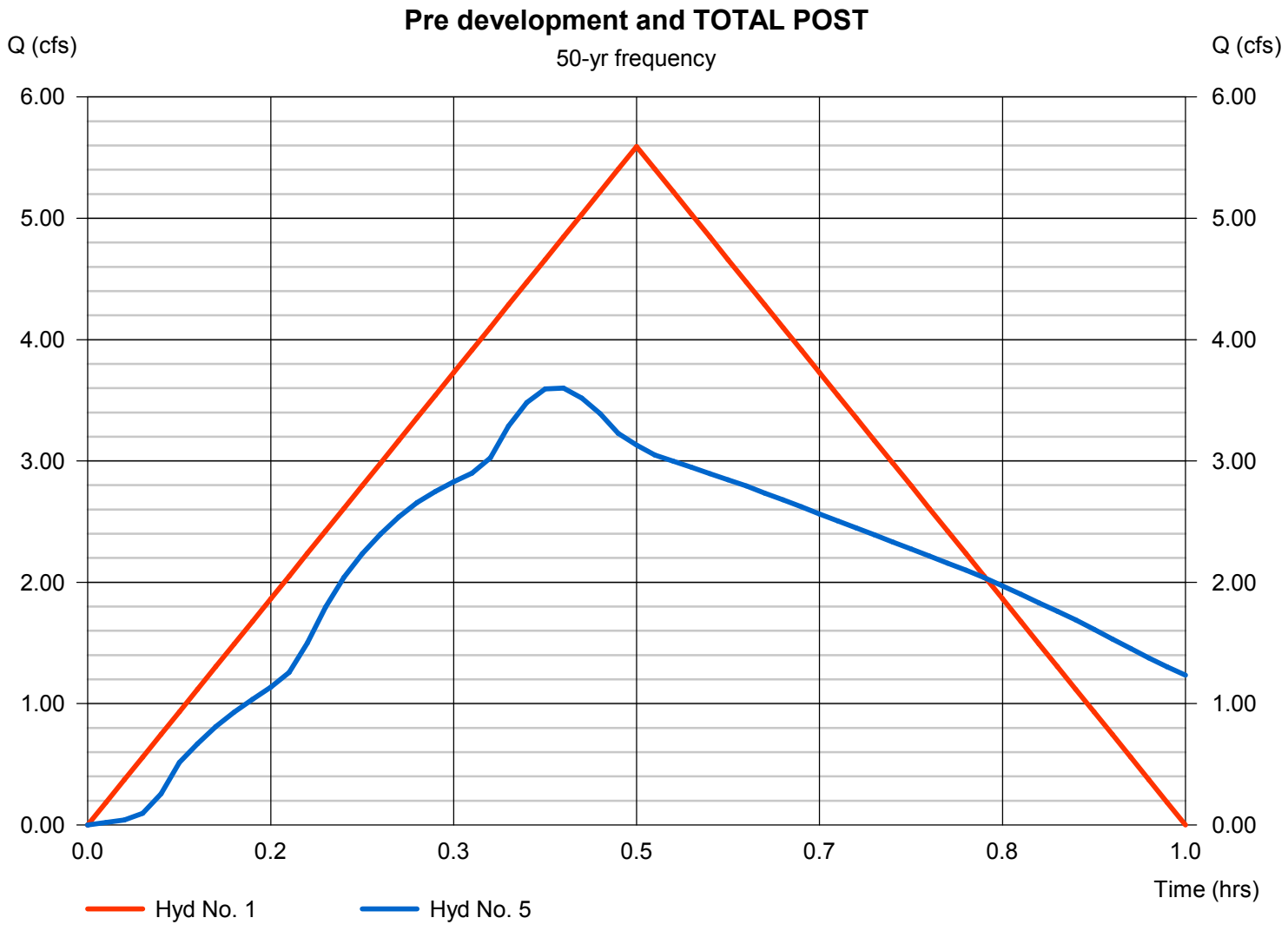
Pre development

Hydrograph type	=	Rational
Peak discharge	=	5.591 cfs
Time to peak	=	0.50 hrs
Hyd. Volume	=	10,065 cuft

Hyd. No. 5

TOTAL POST

Hydrograph type	=	Combine
Peak discharge	=	3.60 cfs
Time to peak	=	0.43 hrs
Hyd. Volume	=	9,952 cuft



Multi-Hydrograph Plot

Hyd. No. 1

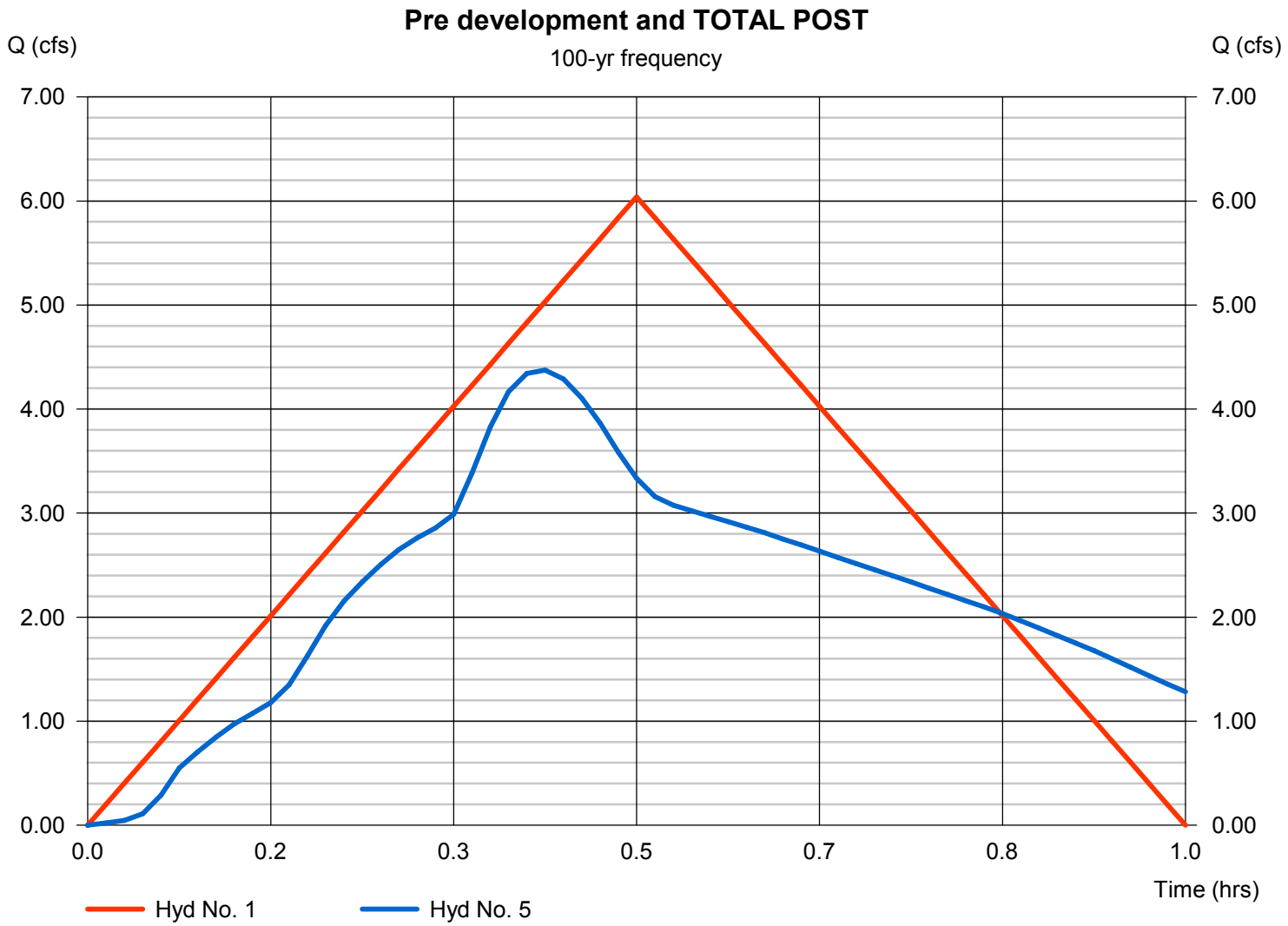
Pre development

Hydrograph type	=	Rational
Peak discharge	=	6.039 cfs
Time to peak	=	0.50 hrs
Hyd. Volume	=	10,870 cuft

Hyd. No. 5

TOTAL POST

Hydrograph type	=	Combine
Peak discharge	=	4.37 cfs
Time to peak	=	0.42 hrs
Hyd. Volume	=	10,598 cuft



Hydrograph Report

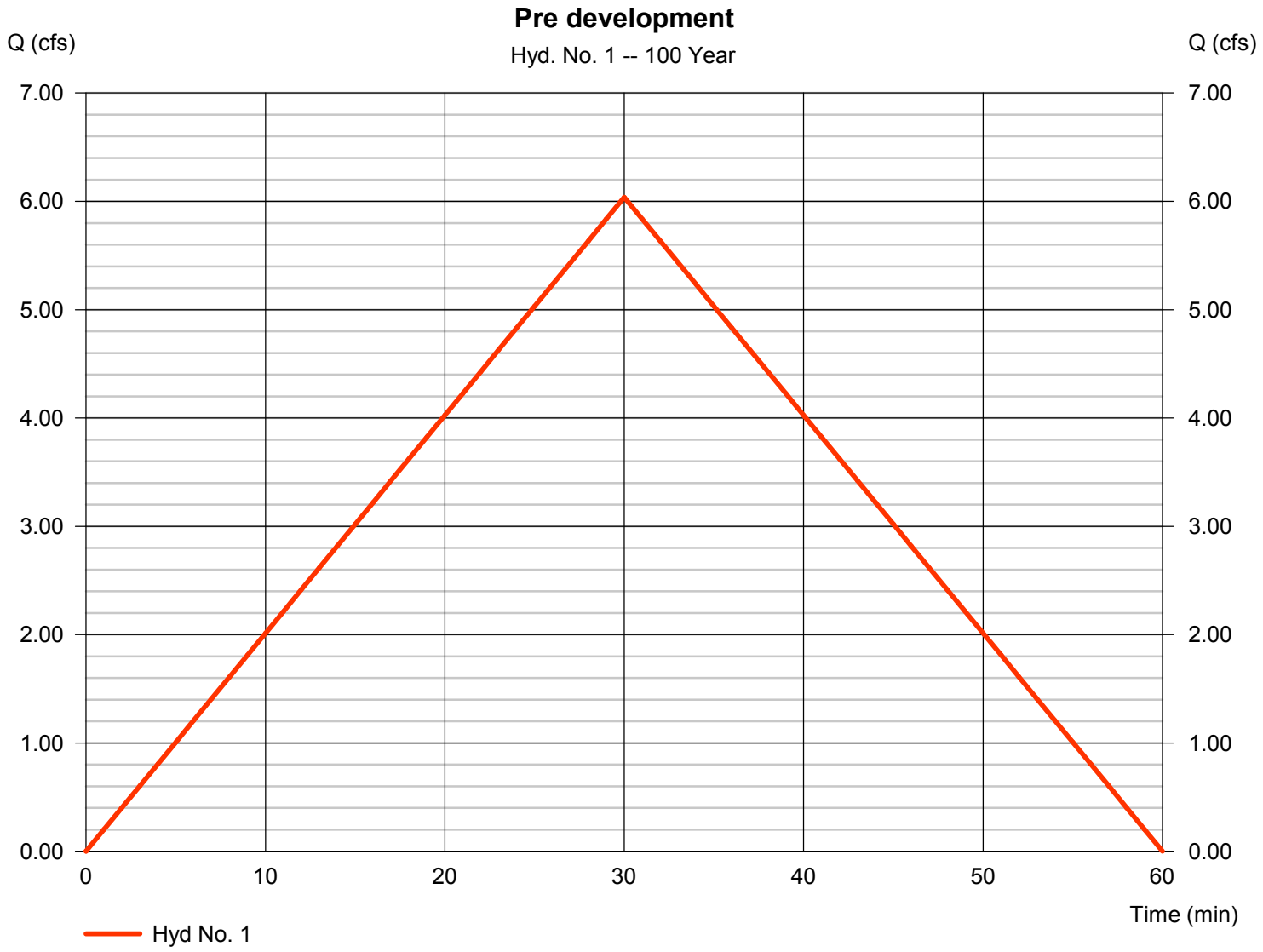
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Hyd. No. 1

Pre development

Hydrograph type	= Rational	Peak discharge	= 6.039 cfs
Storm frequency	= 100 yrs	Time to peak	= 30 min
Time interval	= 1 min	Hyd. volume	= 10,870 cuft
Drainage area	= 2.110 ac	Runoff coeff.	= 0.53*
Intensity	= 5.400 in/hr	Tc by User	= 30.00 min
IDF Curve	= bryant 2.idf	Asc/Rec limb fact	= 1/1

* Composite (Area/C) = [(0.640 x 0.70) + (0.260 x 0.46) + (0.670 x 0.46) + (0.270 x 0.46) + (0.270 x 0.46)] / 2.110



Hydrograph Report

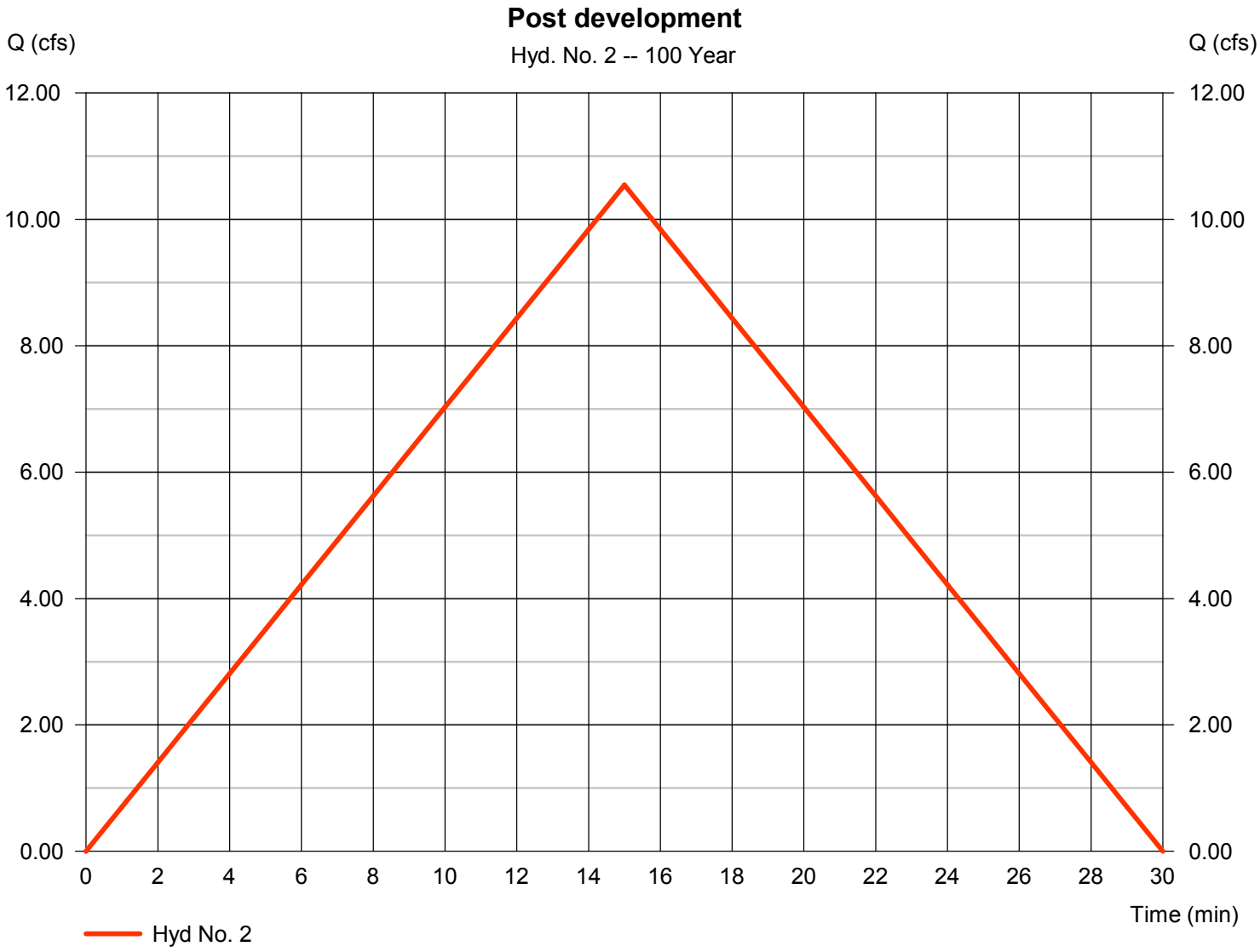
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Hyd. No. 2

Post development

Hydrograph type	= Rational	Peak discharge	= 10.54 cfs
Storm frequency	= 100 yrs	Time to peak	= 15 min
Time interval	= 1 min	Hyd. volume	= 9,490 cuft
Drainage area	= 1.840 ac	Runoff coeff.	= 0.79*
Intensity	= 7.254 in/hr	Tc by User	= 15.00 min
IDF Curve	= bryant 2.idf	Asc/Rec limb fact	= 1/1

* Composite (Area/C) = [(0.640 x 0.70) + (0.260 x 0.46) + (0.670 x 0.95) + (0.270 x 0.95)] / 1.840



Hydrograph Report

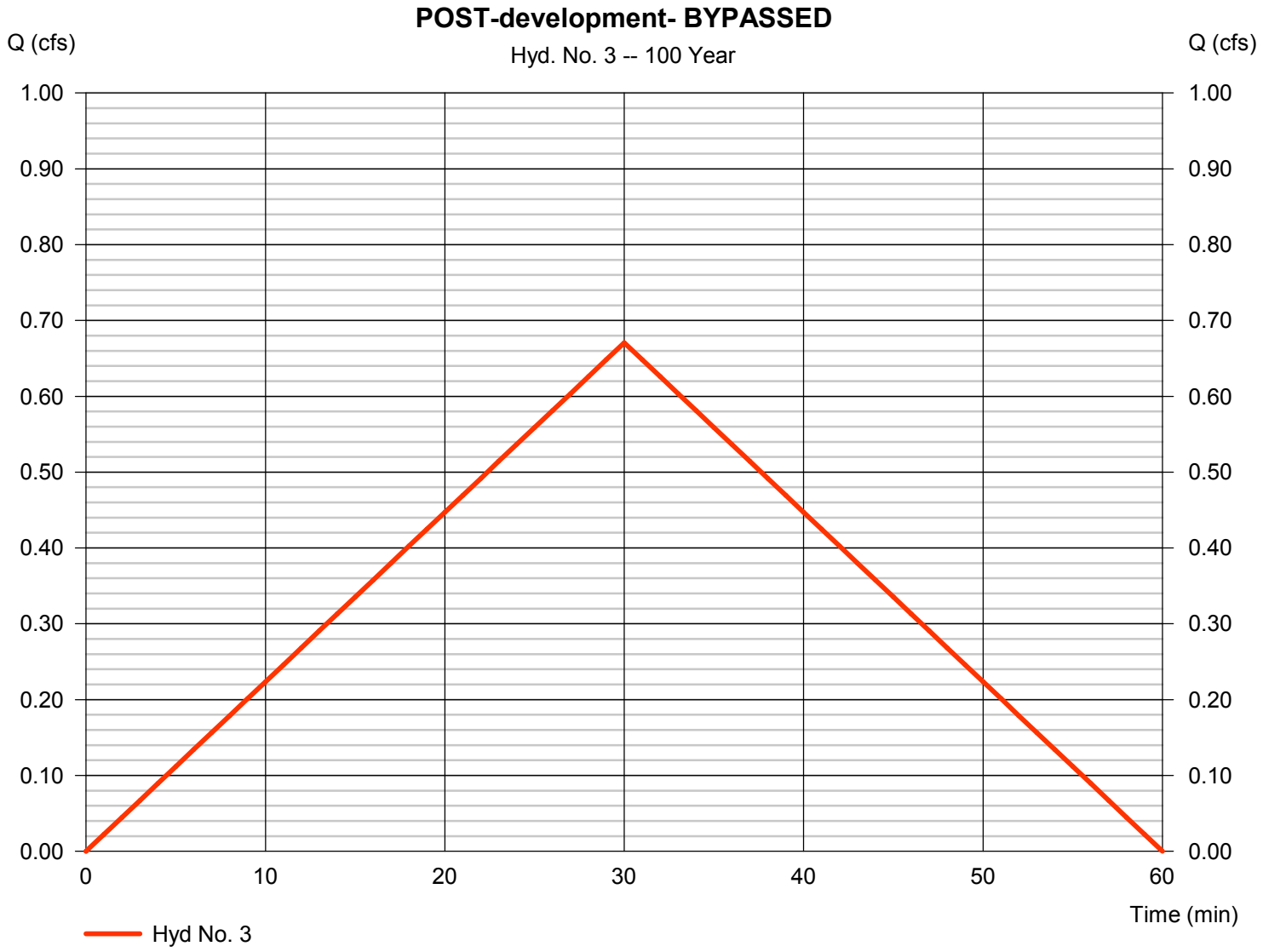
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Hyd. No. 3

POST-development- BYPASSED

Hydrograph type	= Rational	Peak discharge	= 0.671 cfs
Storm frequency	= 100 yrs	Time to peak	= 30 min
Time interval	= 1 min	Hyd. volume	= 1,207 cuft
Drainage area	= 0.270 ac	Runoff coeff.	= 0.46*
Intensity	= 5.400 in/hr	Tc by User	= 30.00 min
IDF Curve	= bryant 2.idf	Asc/Rec limb fact	= 1/1

* Composite (Area/C) = [(0.270 x 0.46)] / 0.270



Hydrograph Report

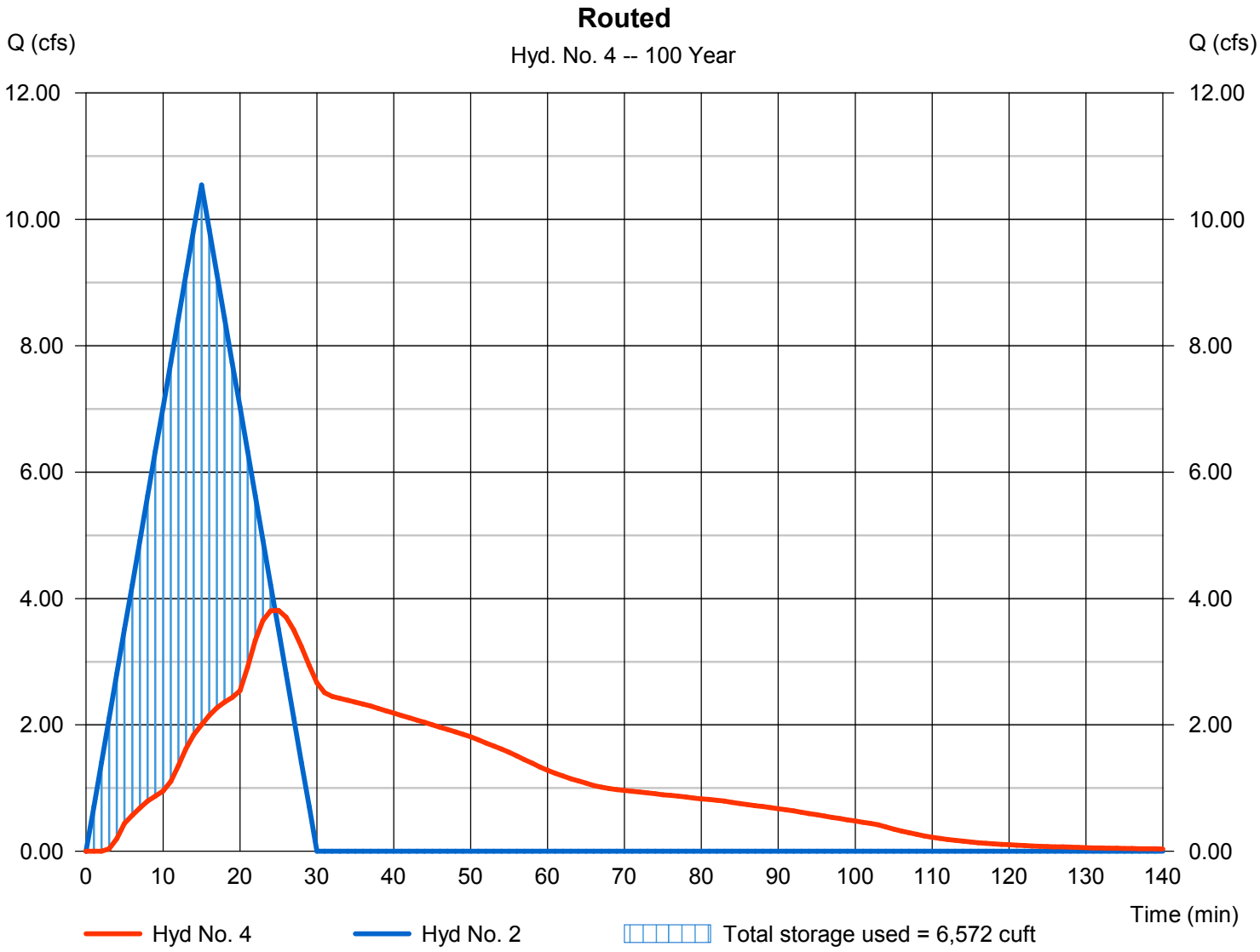
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Hyd. No. 4

Routed

Hydrograph type	= Reservoir	Peak discharge	= 3.815 cfs
Storm frequency	= 100 yrs	Time to peak	= 25 min
Time interval	= 1 min	Hyd. volume	= 9,391 cuft
Inflow hyd. No.	= 2 - Post development	Max. Elevation	= 445.38 ft
Reservoir name	= North Pond	Max. Storage	= 6,572 cuft

Storage Indication method used.



Pond Report

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Pond No. 2 - North Pond

Pond Data

Trapezoid -Bottom L x W = 130.0 x 5.0 ft, Side slope = 3.00:1, Bottom elev. = 442.20 ft, Depth = 5.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	442.20	650	0	0
0.55	442.75	1,106	482	482
1.10	443.30	1,585	739	1,221
1.65	443.85	2,085	1,008	2,229
2.20	444.40	2,606	1,289	3,518
2.75	444.95	3,150	1,582	5,100
3.30	445.50	3,715	1,887	6,987
3.85	446.05	4,302	2,204	9,190
4.40	446.60	4,911	2,533	11,723
4.95	447.15	5,542	2,873	14,596
5.50	447.70	6,194	3,226	17,823

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 18.00	6.00	6.00	Inactive
Span (in)	= 18.00	6.00	6.00	0.00
No. Barrels	= 1	1	1	0
Invert El. (ft)	= 442.20	442.30	443.70	0.00
Length (ft)	= 30.00	0.50	0.50	0.00
Slope (%)	= 1.50	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	Yes	No

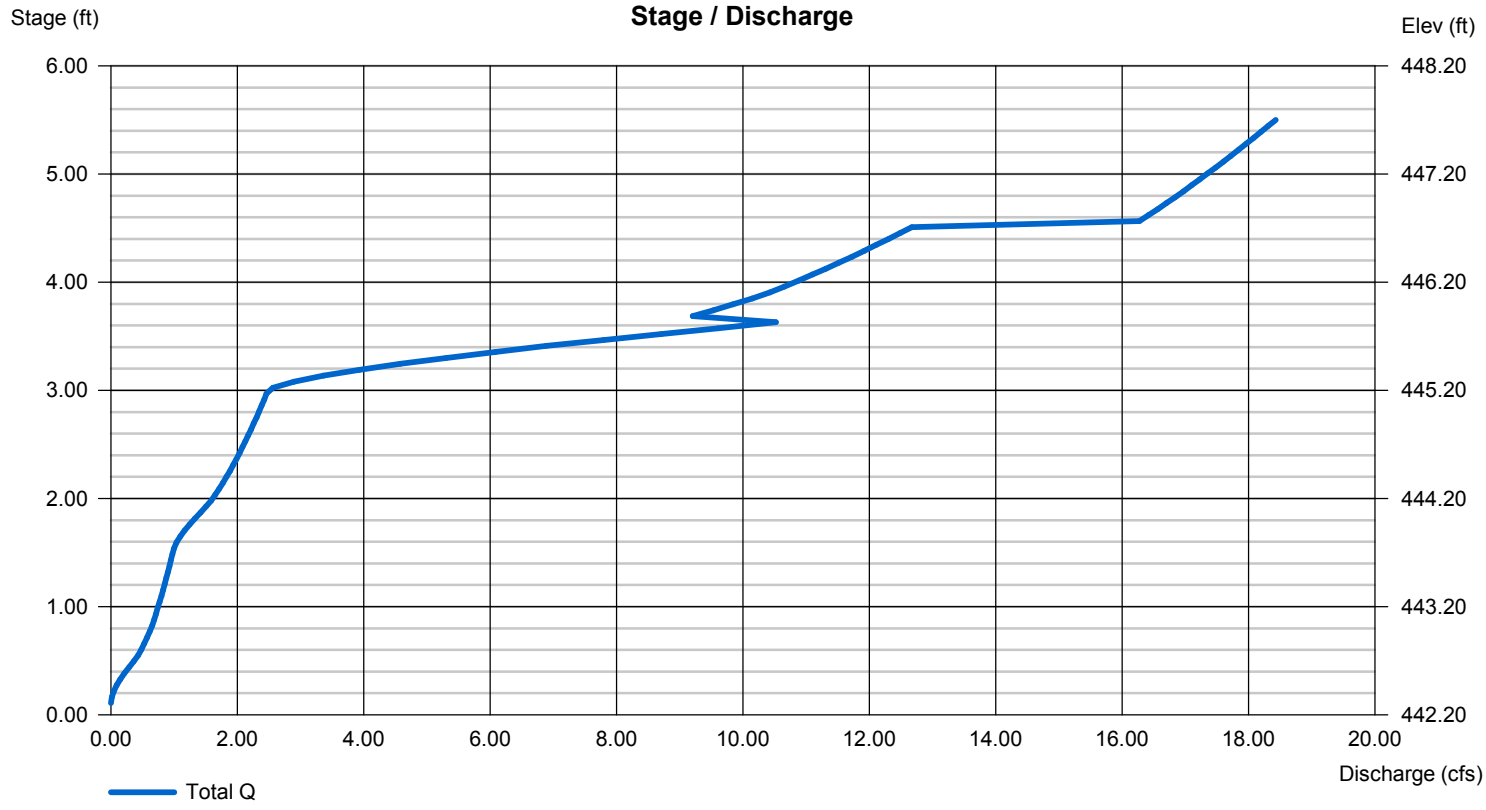
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 5.00	Inactive	Inactive	0.00
Crest El. (ft)	= 445.20	442.50	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	Rect	---	---
Multi-Stage	= Yes	Yes	No	No

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

TW Elev. (ft) = 0.00

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



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021 Wednesday, 07 / 21 / 2021

Hyd. No. 5

TOTAL POST

Hydrograph type	= Combine	Peak discharge	= 4.373 cfs
Storm frequency	= 100 yrs	Time to peak	= 25 min
Time interval	= 1 min	Hyd. volume	= 10,598 cuft
Inflow hyds.	= 3, 4	Contrib. drain. area	= 0.270 ac

