HILLTOP LANDING SUBDIVISION

HILLTOP ROAD & MILLER ROAD, BRYANT, AR 72022

DRAINAGE REPORT

FOR
City of Bryant, Saline County, AR

April 2023

Owner & Developer: NXT GEN HOMES LLC.

By:

HOPE
CONSULTING
ENGINEERS - SURVEYORS

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Narrative & Summary

PROJECT TITLE

Hilltop Landing Subdivision

PROJECT PROPERTY OWNER

Nxt Gen Homes LLC.

PROJECT LOCATION

Hilltop Road and Miller Road, Bryant, AR

PROJECT DESCRIPTION

The proposed sub divisional development is on Hilltop Road and Miller Road, Bryant, AR . Total development site area is 54.0 acres.

DRAINAGE ANALYSIS

On Site Drainage- Rational method was used to determine the existing and proposed flows from proposed site. There will be four detention ponds to detain water from this development. Detailed drainage calculations considering the future expected development has been conducted to determine the required detention ponds and culvert dimensions. Summary of the calculations are below:

Detention Pond-1

- Pond is situated on the north east side of the property.
- Pre-development area 34.50 acres.
- Post-development area 36.28 acres.
- Pre-development runoff coefficient 0.47.
- Post-development runoff cumulative coefficient 0.65
- Pond has a bottom area of 18,760 sft with bottom elevation of 437.50'.
- One 42'' HDPE with 1.08% slope are proposed for outflow pipes.

Peak flows for Pre and post development phase of onsite area have been tabulated below-

Period of time	Pre-development	Post-dev. Without detention	Post-dev. With detention
	Peak Flow (cfs)	Peak Flow (cfs)	Peak Flow (cfs)
2-Year	65.96	90.29	32.54
5-Year	72.96	99.87	35.52
10-Year	85.63	117.23	39.88
25-Year	98.15	134.37	45.74
50-Year	111.88	153.15	57.52
100-Year	118.85	162.70	63.55

Detention Pond-2

- Pond is situated on the South-west side of the property.
- Pre-development area 7.2 acres.
- Post-development area 4.11 acres.
- Pre-development runoff coefficient 0.40.
- Post-development runoff cumulative coefficient 0.40
- Pond has a bottom area of 18,270 sft with bottom elevation of 511.00'.
- One 12'' HDPE with 9% slope are proposed for outflow pipes.

Peak flows for Pre and post development phase of onsite area have been tabulated below-

Period of time	Pre-development	Post-dev. Without detention	Post-dev. With detention
	Peak Flow (cfs)	Peak Flow (cfs)	Peak Flow (cfs)
2-Year	12.77	6.629	0.387
5-Year	14.20	7.333	0.462
10-Year	16.42	8.607	0.613
25-Year	18.77	9.865	0.773
50-Year	21.35	11.24	0.959
100-Year	22.64	11.95	1.059

Detention Pond-3

- Pond is situated on the south east side of the property.
- Pre-development area 2.25 acres.
- Post-development area 3.21 acres.
- Pre-development runoff coefficient 0.47.
- Post-development runoff cumulative coefficient 0.65
- Pond has a bottom area of 5,512 sft with bottom elevation of 495.00'.
- One 18'' HDPE with 12.74% slope are proposed for outflow pipes.

Peak flows for Pre and post development phase of onsite area have been tabulated below-

Period of time	Pre-development	Post-dev. Without detention	Post-dev. With detention
	Peak Flow (cfs)	Peak Flow (cfs)	Peak Flow (cfs)
2-Year	5.039	9.942	2.797
5-Year	5.635	11.12	3.269
10-Year	6.430	12.69	3.910
25-Year	7.337	14.48	4.642
50-Year	8.326	16.43	5.424
100-Year	8.825	17.40	5.810

Detention Pond-4

- Pond is situated on the West side of the property.
- Pre-development area 14.40 acres.
- Post-development area 13.97 acres.
- Pre-development runoff coefficient 0.47.
- Post-development runoff cumulative coefficient 0.65
- Pond has a bottom area of 7,680 sft with bottom elevation of 511.00'.
- One 36" HDPE with 9.34% slope is proposed for outflow pipes.

Peak flows for Pre and post development phase of onsite area have been tabulated below-

Period of time	Pre-development	Post-dev. Without detention	Post-dev. With detention
	Peak Flow (cfs)	Peak Flow (cfs)	Peak Flow (cfs)
2-Year	31.09	43.27	18.44
5-Year	34.66	48.39	21.11
10-Year	39.81	55.21	24.59
25-Year	45.47	63.00	28.39
50-Year	51.67	71.49	32.15
100-Year	54.77	75.78	33.77

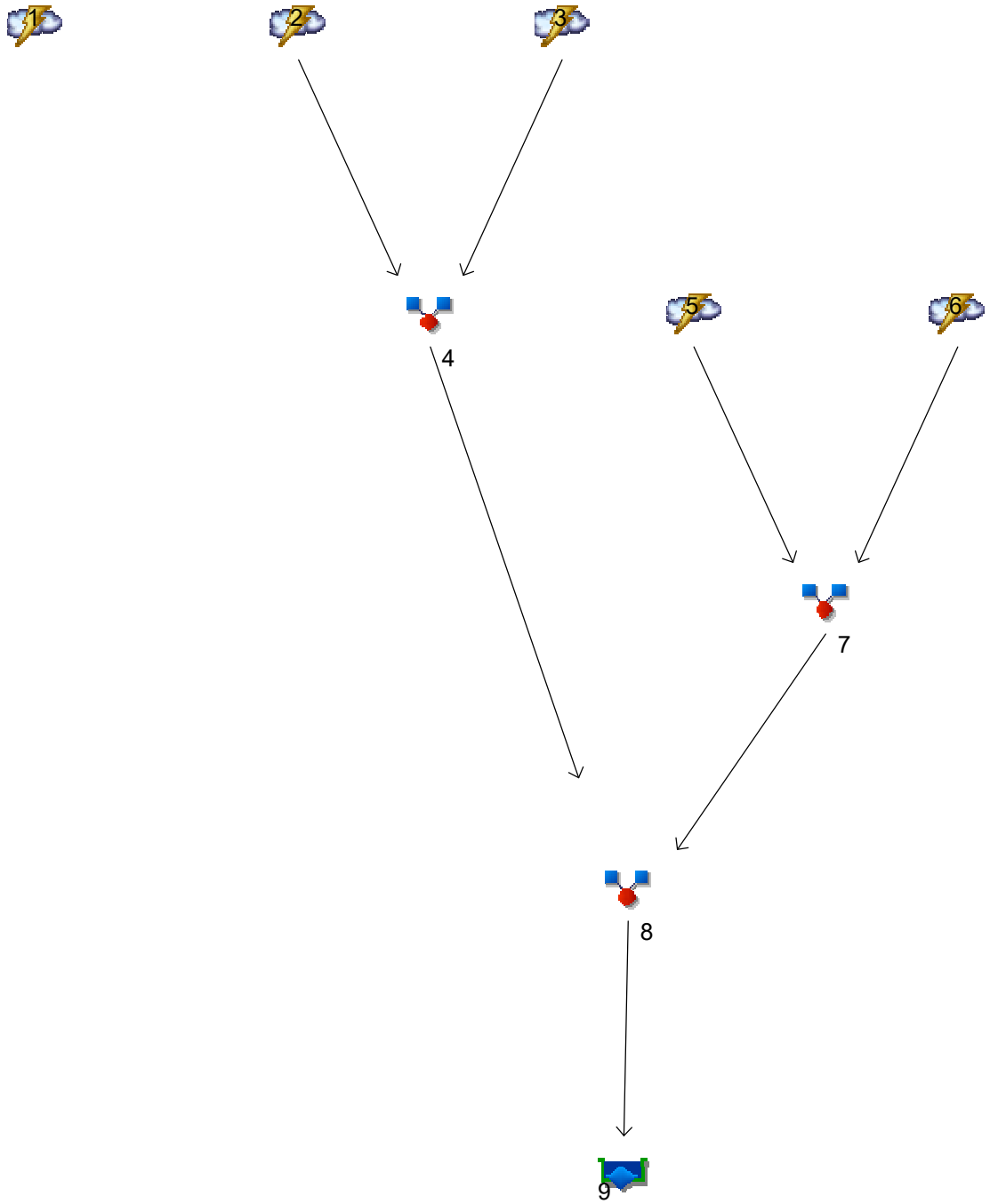
CONCLUSION

From the onsite drainage calculation, it is seen that there is decrease in flow for all storm events due to the proposed detention ponds.

Hydrograph Summary Report

Watershed Model Schematic

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



Legend

Hyd.	Origin	Description
1	Rational	Pre Development
2	Rational	Post development-1a
3	Rational	post development-1b
4	Combine	combine-1
5	Rational	post development-2a
6	Rational	post development-2b
7	Combine	combine-2
8	Combine	<no description>
9	Reservoir	detention pond 1

Multi-Hydrograph Plot

Hyd. No. 1

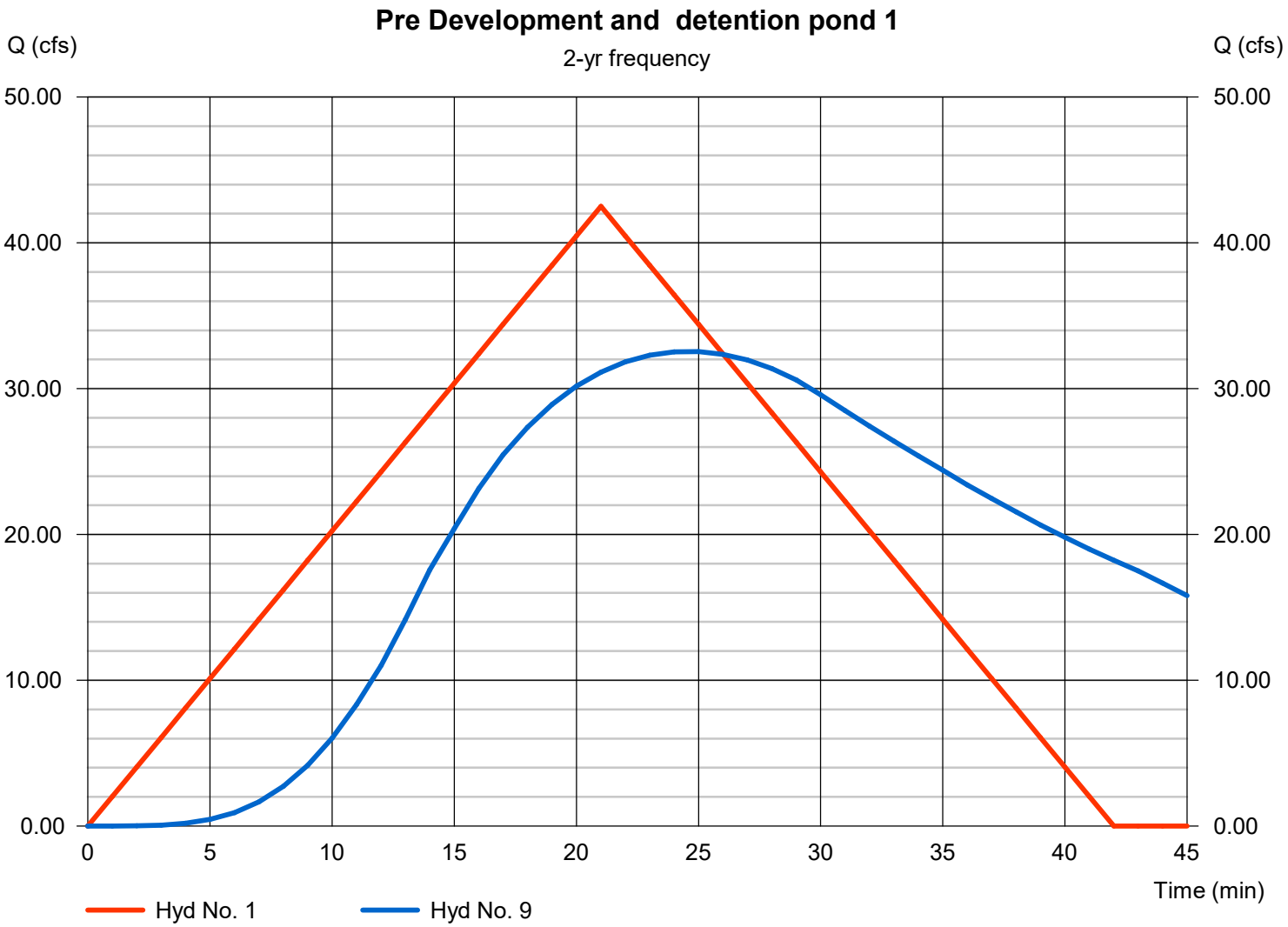
Pre Development

Hydrograph type	=	Rational
Peak discharge	=	42.51 cfs
Time to peak	=	21 min
Hyd. Volume	=	53,568 cuft

Hyd. No. 9

detention pond 1

Hydrograph type	=	Reservoir
Peak discharge	=	32.54 cfs
Time to peak	=	25 min
Hyd. Volume	=	81,205 cuft



Multi-Hydrograph Plot

Hyd. No. 1

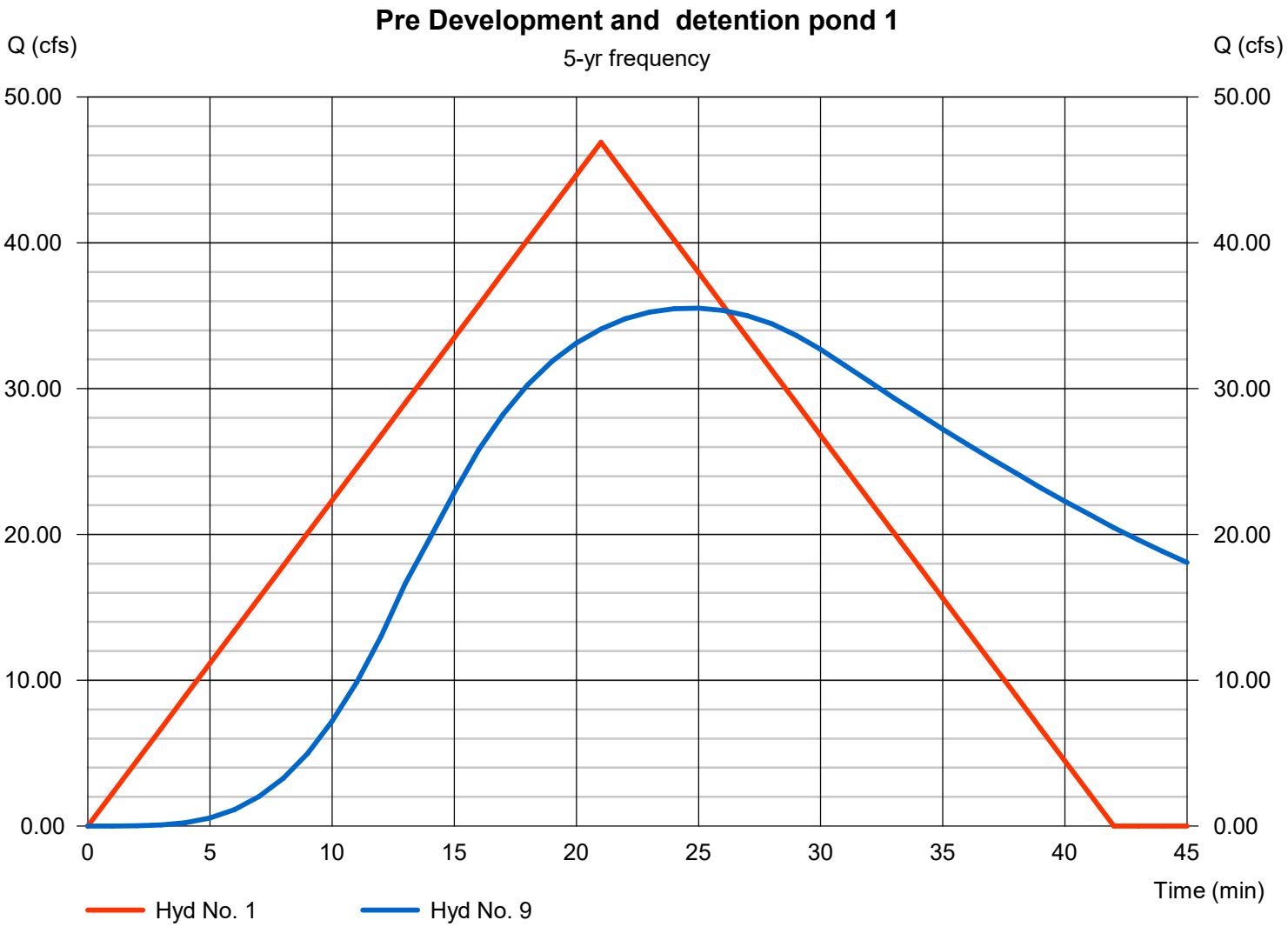
Pre Development

Hydrograph type	=	Rational
Peak discharge	=	46.89 cfs
Time to peak	=	21 min
Hyd. Volume	=	59,077 cuft

Hyd. No. 9

detention pond 1

Hydrograph type	=	Reservoir
Peak discharge	=	35.52 cfs
Time to peak	=	25 min
Hyd. Volume	=	89,828 cuft



Multi-Hydrograph Plot

Hyd. No. 1

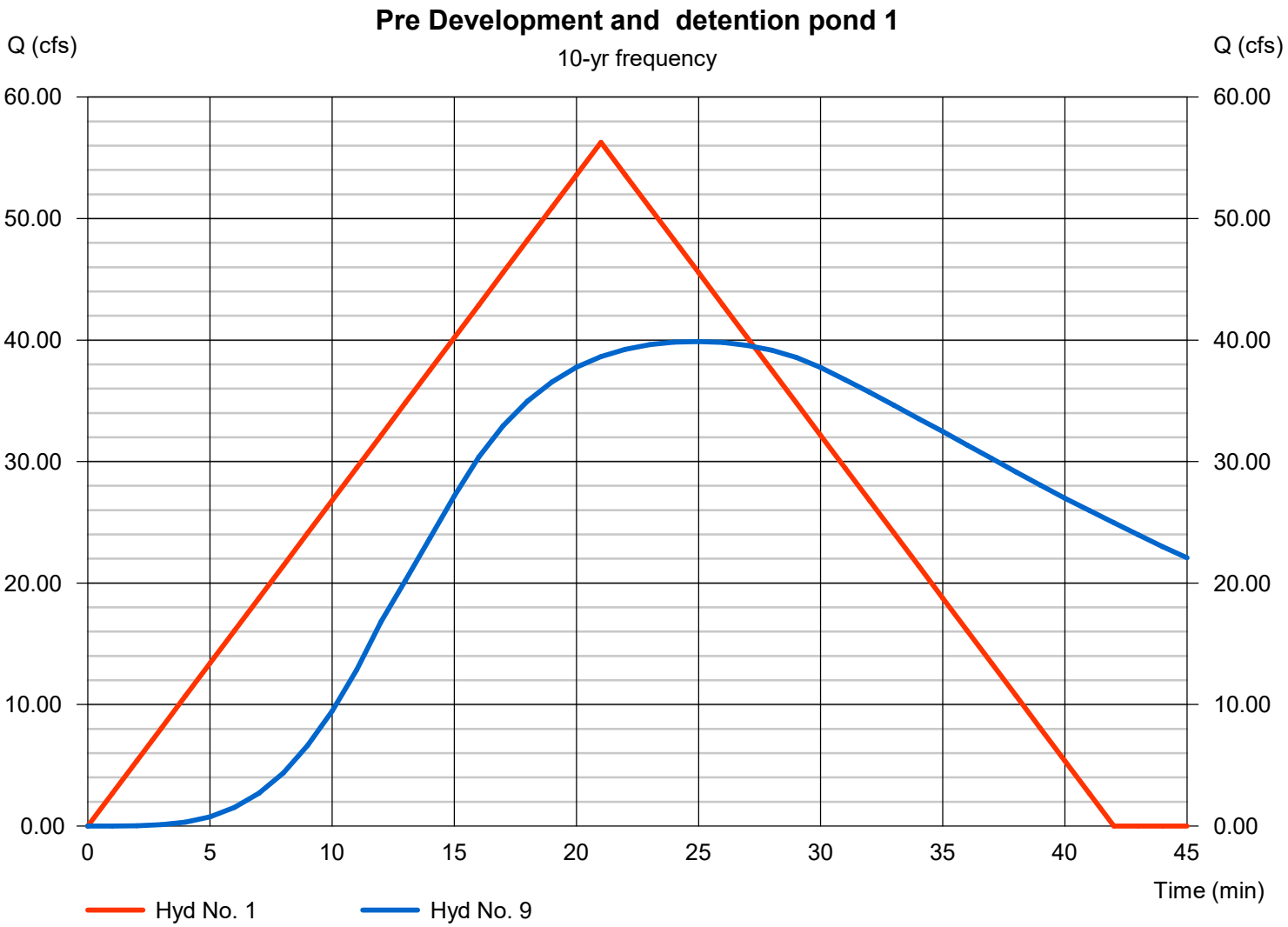
Pre Development

Hydrograph type	=	Rational
Peak discharge	=	56.26 cfs
Time to peak	=	21 min
Hyd. Volume	=	70,892 cuft

Hyd. No. 9

detention pond 1

Hydrograph type	=	Reservoir
Peak discharge	=	39.88 cfs
Time to peak	=	25 min
Hyd. Volume	=	105,448 cuft



Multi-Hydrograph Plot

Hyd. No. 1

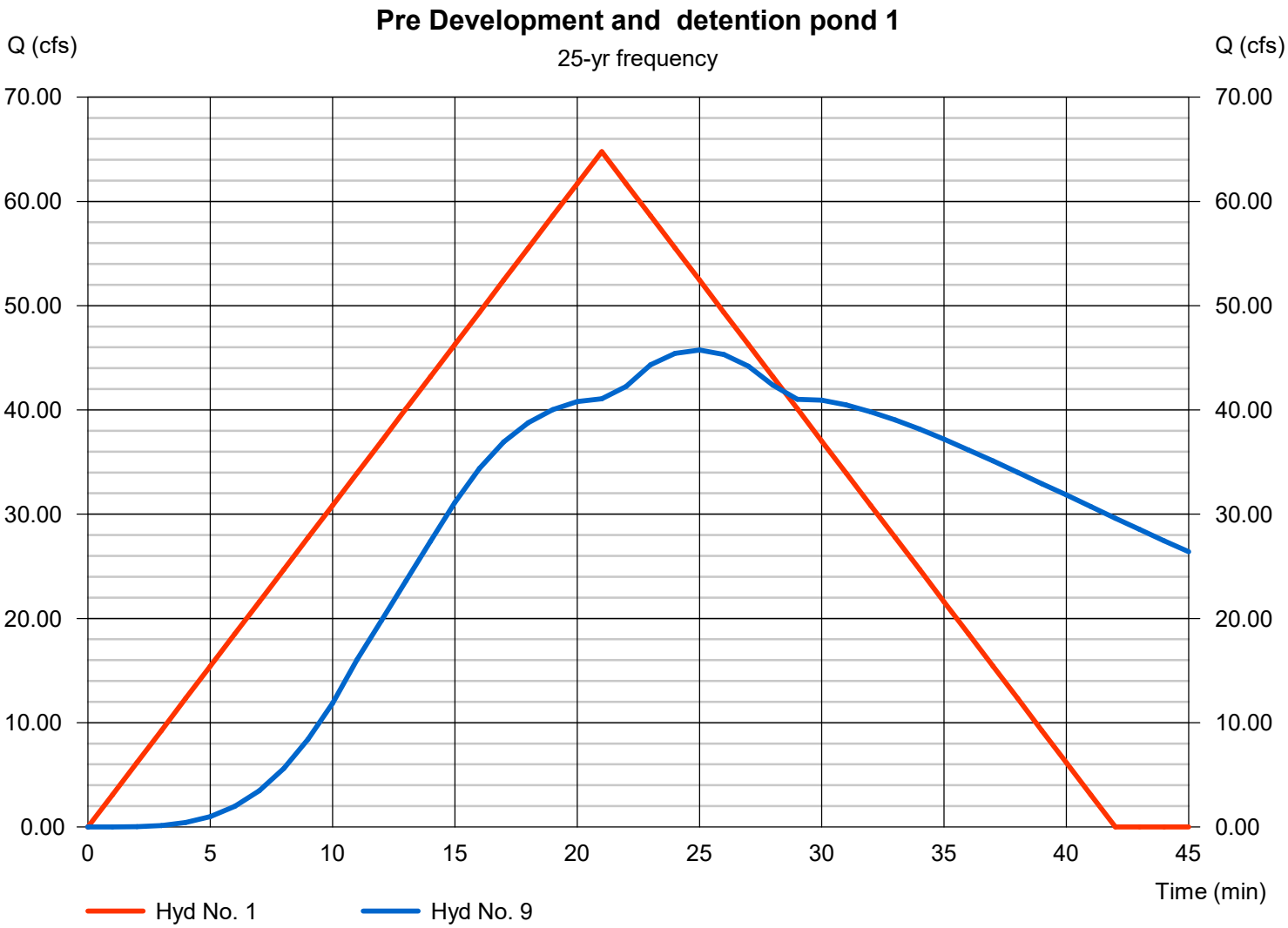
Pre Development

Hydrograph type	=	Rational
Peak discharge	=	64.78 cfs
Time to peak	=	21 min
Hyd. Volume	=	81,626 cuft

Hyd. No. 9

detention pond 1

Hydrograph type	=	Reservoir
Peak discharge	=	45.74 cfs
Time to peak	=	25 min
Hyd. Volume	=	120,872 cuft



Multi-Hydrograph Plot

Hyd. No. 1

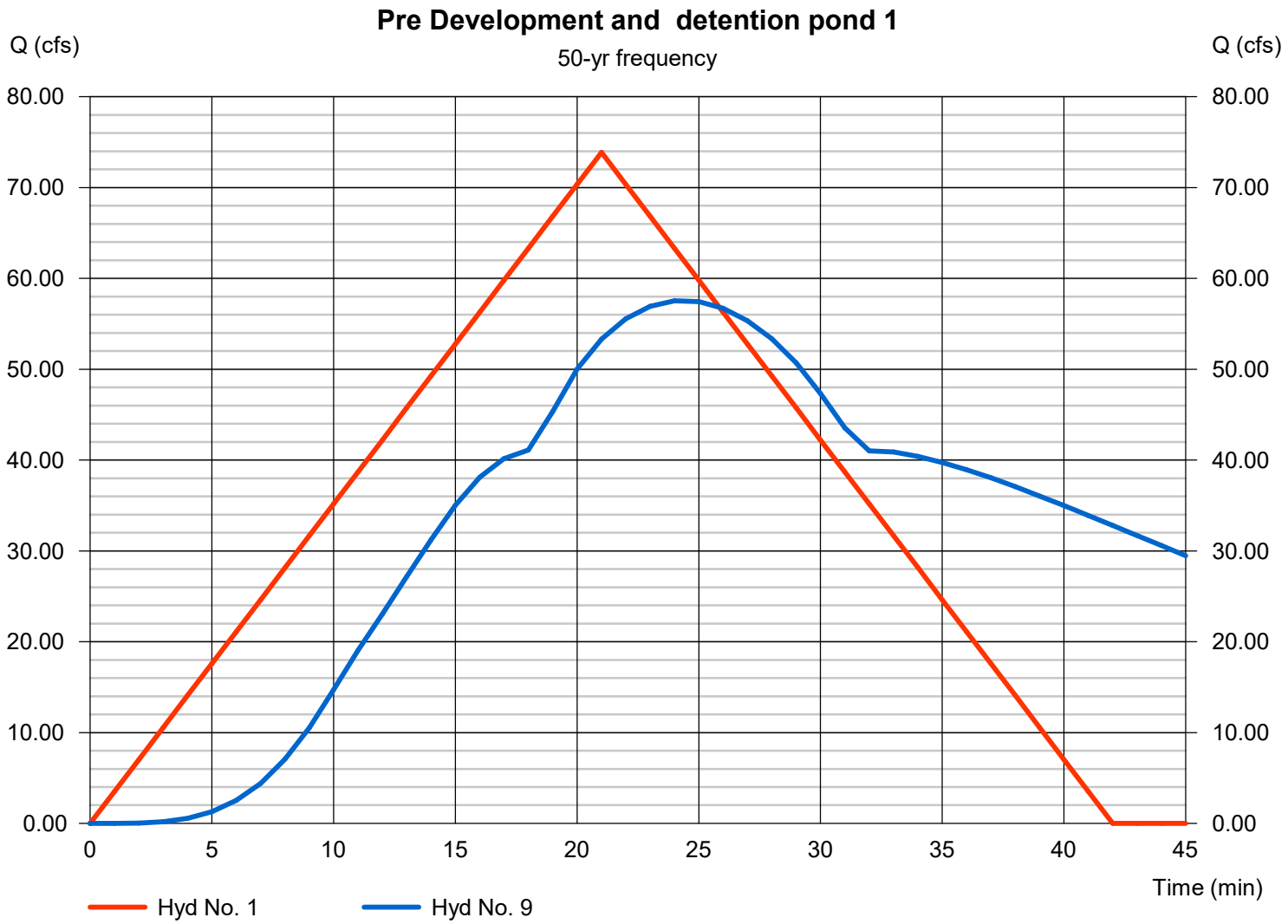
Pre Development

Hydrograph type	=	Rational
Peak discharge	=	73.87 cfs
Time to peak	=	21 min
Hyd. Volume	=	93,080 cuft

Hyd. No. 9

detention pond 1

Hydrograph type	=	Reservoir
Peak discharge	=	57.52 cfs
Time to peak	=	24 min
Hyd. Volume	=	137,777 cuft



Multi-Hydrograph Plot

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

Hyd. No. 1

Pre Development

Hydrograph type	=	Rational
Peak discharge	=	78.94 cfs
Time to peak	=	21 min
Hyd. Volume	=	99,461 cuft

Hyd. No. 9

detention pond 1

Hydrograph type	=	Reservoir
Peak discharge	=	63.55 cfs
Time to peak	=	24 min
Hyd. Volume	=	146,374 cuft



Pond Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 — Wednesday, 04 / 19 / 2023

Pond No. 2 - Detention Pond 1

Pond Data

Trapezoid -Bottom L x W = 268.0 x 70.0 ft, Side slope = 3.00:1, Bottom elev. = 437.50 ft, Depth = 5.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	437.50	18,760	0	0
0.50	438.00	19,783	9,635	9,635
1.00	438.50	20,824	10,151	19,786
1.50	439.00	21,883	10,676	30,462
2.00	439.50	22,960	11,210	41,672
2.50	440.00	24,055	11,753	53,425
3.00	440.50	25,168	12,305	65,730
3.50	441.00	26,299	12,866	78,596
4.00	441.50	27,448	13,436	92,032
4.50	442.00	28,615	14,015	106,047
5.00	442.50	29,800	14,603	120,650

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 42.00	Inactive	Inactive	0.00
Span (in)	= 42.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 437.50	0.00	0.00	0.00
Length (ft)	= 46.00	0.00	0.00	0.00
Slope (%)	= 1.08	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

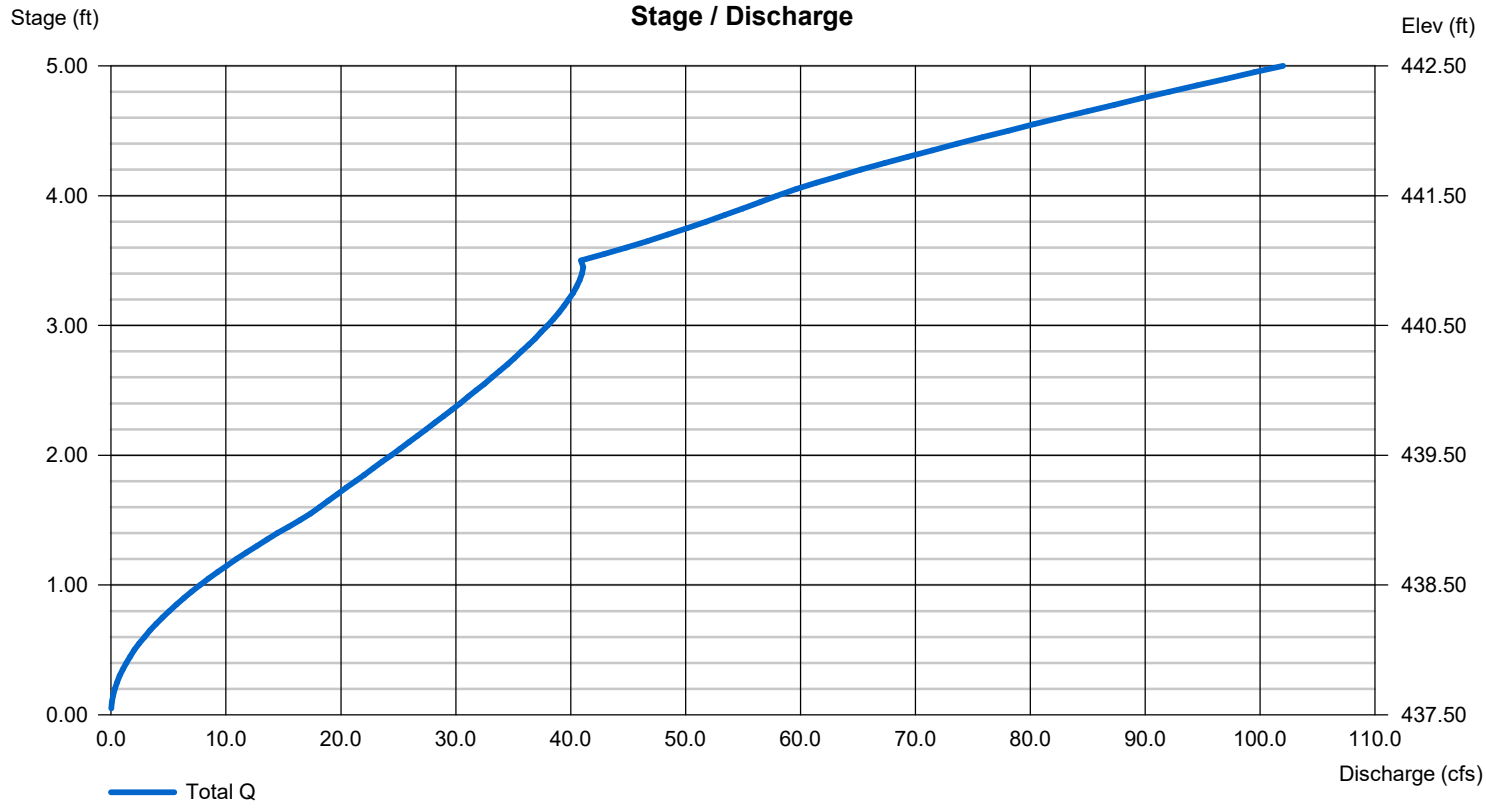
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 6.00	Inactive	Inactive	0.00
Crest El. (ft)	= 441.50	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= No	No	No	No

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

TW Elev. (ft) = 0.00

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



Hydrograph Summary Report

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

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	42.51	1	21	53,568	------	------	------	Pre Development
2	Rational	60.00	1	15	53,998	------	------	------	Post development-1a
3	Rational	5.960	1	15	5,364	------	------	------	post development-1b
4	Combine	65.96	1	15	59,362	2, 3	------	------	combine-1
5	Rational	18.19	1	15	16,367	------	------	------	post development-2a
6	Rational	6.149	1	15	5,534	------	------	------	post development-2b
7	Combine	24.33	1	15	21,901	5, 6	------	------	combine-2
8	Combine	90.29	1	15	81,262	4, 7	------	------	<no description>
9	Reservoir	32.54	1	25	81,205	8	440.05	54,740	detention pond 1

Hydrograph Summary Report

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

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	46.89	1	21	59,077	------	------	------	Pre Development
2	Rational	66.36	1	15	59,728	------	------	------	Post development-1a
3	Rational	6.592	1	15	5,933	------	------	------	post development-1b
4	Combine	72.96	1	15	65,661	2, 3	------	------	combine-1
5	Rational	20.11	1	15	18,103	------	------	------	post development-2a
6	Rational	6.801	1	15	6,121	------	------	------	post development-2b
7	Combine	26.92	1	15	24,225	5, 6	------	------	combine-2
8	Combine	99.87	1	15	89,885	4, 7	------	------	<no description>
9	Reservoir	35.52	1	25	89,828	8	440.28	60,392	detention pond 1

Hydrograph Summary Report

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

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	56.26	1	21	70,892	------	------	------	Pre Development
2	Rational	77.90	1	15	70,107	------	------	------	Post development-1a
3	Rational	7.738	1	15	6,964	------	------	------	post development-1b
4	Combine	85.63	1	15	77,071	2, 3	------	------	combine-1
5	Rational	23.61	1	15	21,249	------	------	------	post development-2a
6	Rational	7.983	1	15	7,185	------	------	------	post development-2b
7	Combine	31.59	1	15	28,434	5, 6	------	------	combine-2
8	Combine	117.23	1	15	105,505	4, 7	------	------	<no description>
9	Reservoir	39.88	1	25	105,448	8	440.71	71,054	detention pond 1

Hydrograph Summary Report

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

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	64.78	1	21	81,626	------	------	------	Pre Development
2	Rational	89.29	1	15	80,357	------	------	------	Post development-1a
3	Rational	8.869	1	15	7,982	------	------	------	post development-1b
4	Combine	98.15	1	15	88,339	2, 3	------	------	combine-1
5	Rational	27.06	1	15	24,356	------	------	------	post development-2a
6	Rational	9.151	1	15	8,235	------	------	------	post development-2b
7	Combine	36.21	1	15	32,591	5, 6	------	------	combine-2
8	Combine	134.37	1	15	120,930	4, 7	------	------	<no description>
9	Reservoir	45.74	1	25	120,872	8	441.12	81,944	detention pond 1

Hydrograph Summary Report

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

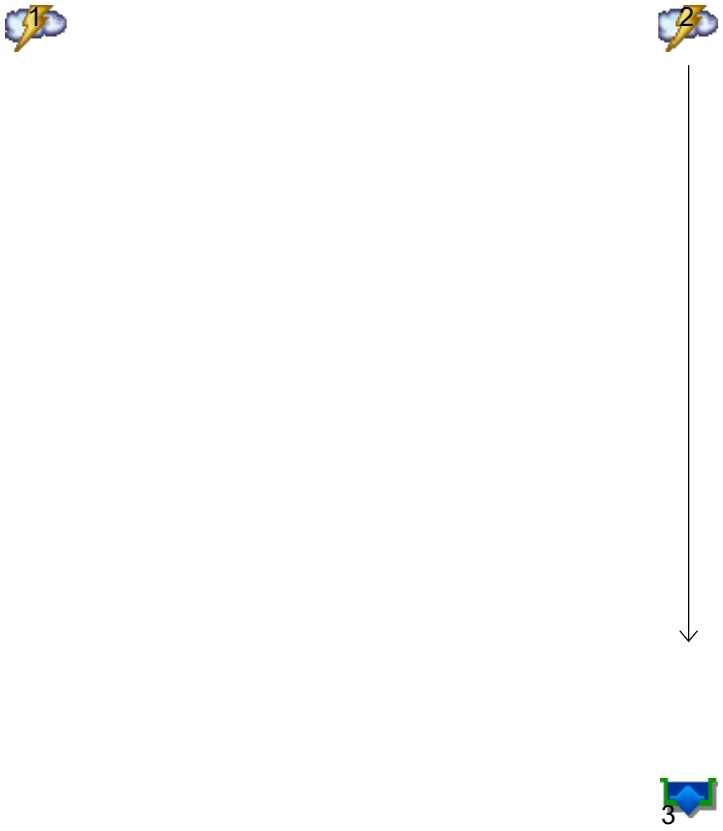
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	73.87	1	21	93,080	------	------	------	Pre Development
2	Rational	101.77	1	15	91,590	------	------	------	Post development-1a
3	Rational	10.11	1	15	9,098	------	------	------	post development-1b
4	Combine	111.88	1	15	100,688	2, 3	------	------	combine-1
5	Rational	30.85	1	15	27,761	------	------	------	post development-2a
6	Rational	10.43	1	15	9,387	------	------	------	post development-2b
7	Combine	41.27	1	15	37,147	5, 6	------	------	combine-2
8	Combine	153.15	1	15	137,835	4, 7	------	------	<no description>
9	Reservoir	57.52	1	24	137,777	8	441.49	91,647	detention pond 1

Hydrograph Summary Report

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

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	78.94	1	21	99,461	------	------	------	Pre Development
2	Rational	108.11	1	15	97,303	------	------	------	Post development-1a
3	Rational	10.74	1	15	9,665	------	------	------	post development-1b
4	Combine	118.85	1	15	106,968	2, 3	------	------	combine-1
5	Rational	32.77	1	15	29,492	------	------	------	post development-2a
6	Rational	11.08	1	15	9,972	------	------	------	post development-2b
7	Combine	43.85	1	15	39,464	5, 6	------	------	combine-2
8	Combine	162.70	1	15	146,433	4, 7	------	------	<no description>
9	Reservoir	63.55	1	24	146,374	8	441.66	96,403	detention pond 1

Watershed Model Schematic



Legend

Hyd.	Origin	Description
1	Rational	Pre development
2	Rational	Post development
3	Reservoir	detention pond

Multi-Hydrograph Plot

Hyd. No. 1

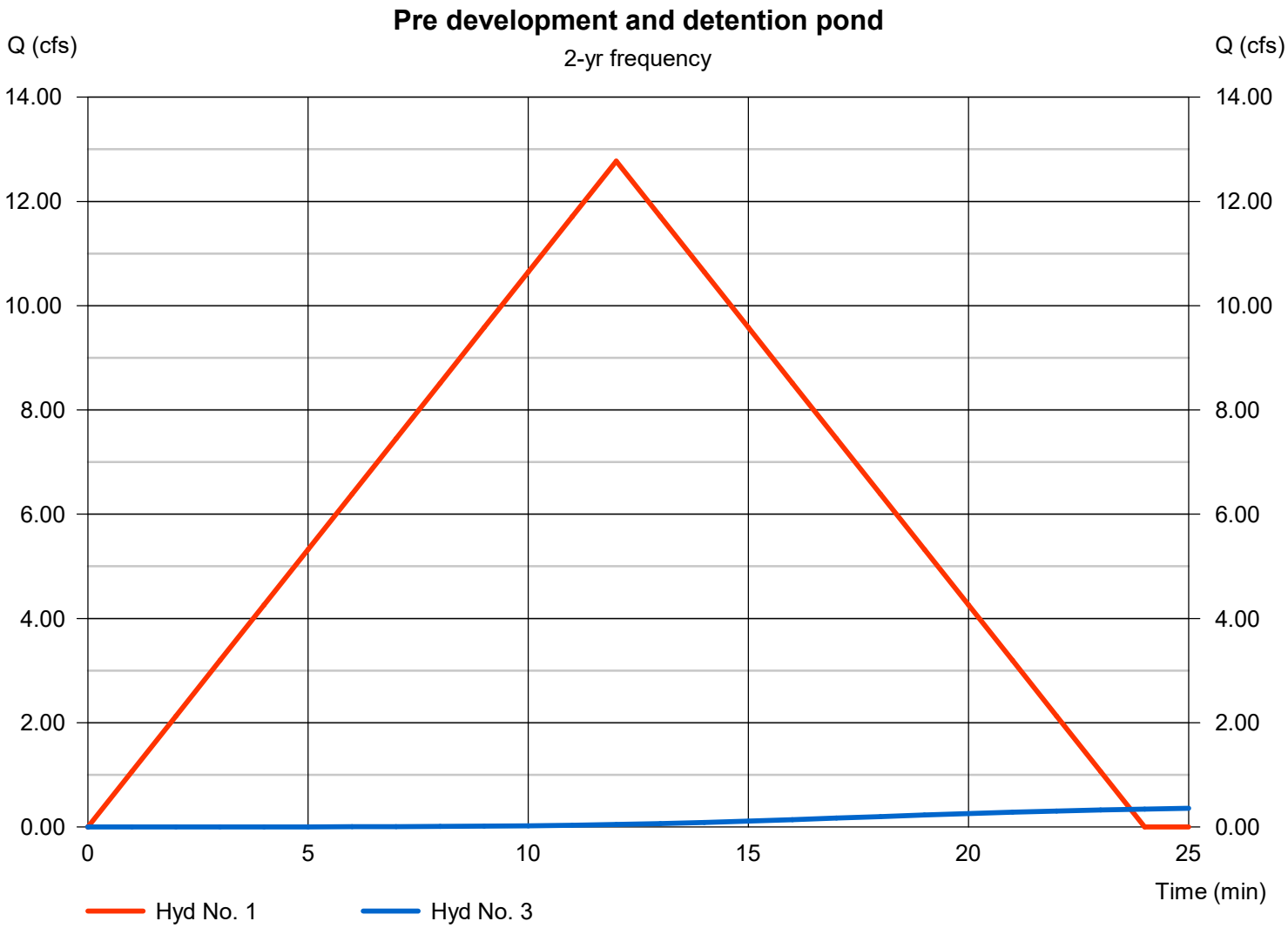
Pre development

Hydrograph type	=	Rational
Peak discharge	=	12.77 cfs
Time to peak	=	12 min
Hyd. Volume	=	9,197 cuft

Hyd. No. 3

detention pond

Hydrograph type	=	Reservoir
Peak discharge	=	0.39 cfs
Time to peak	=	29 min
Hyd. Volume	=	5,573 cuft



Multi-Hydrograph Plot

Hyd. No. 1

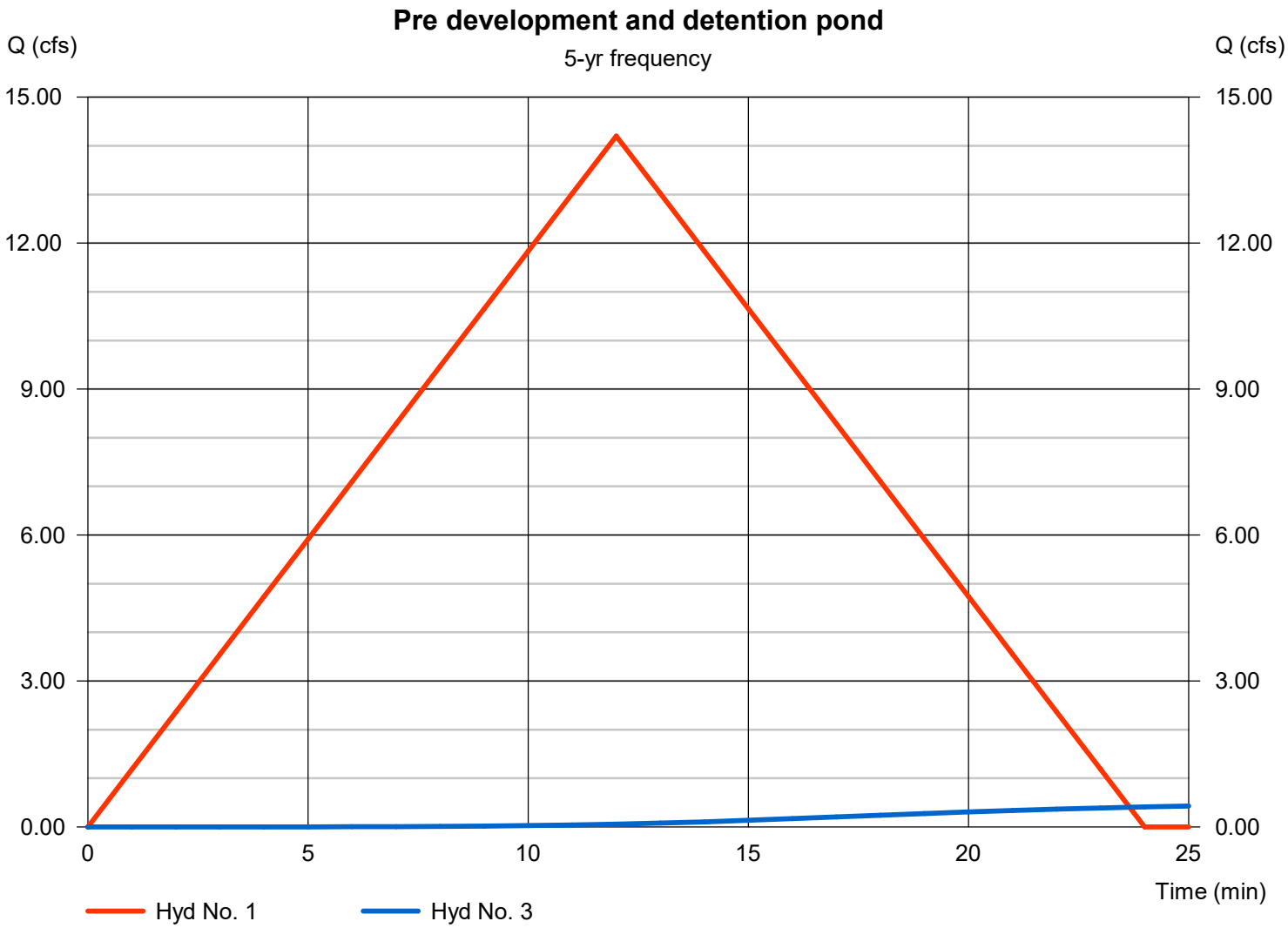
Pre development

Hydrograph type	=	Rational
Peak discharge	=	14.20 cfs
Time to peak	=	12 min
Hyd. Volume	=	10,226 cuft

Hyd. No. 3

detention pond

Hydrograph type	=	Reservoir
Peak discharge	=	0.46 cfs
Time to peak	=	29 min
Hyd. Volume	=	6,203 cuft



Multi-Hydrograph Plot

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

Hyd. No. 1

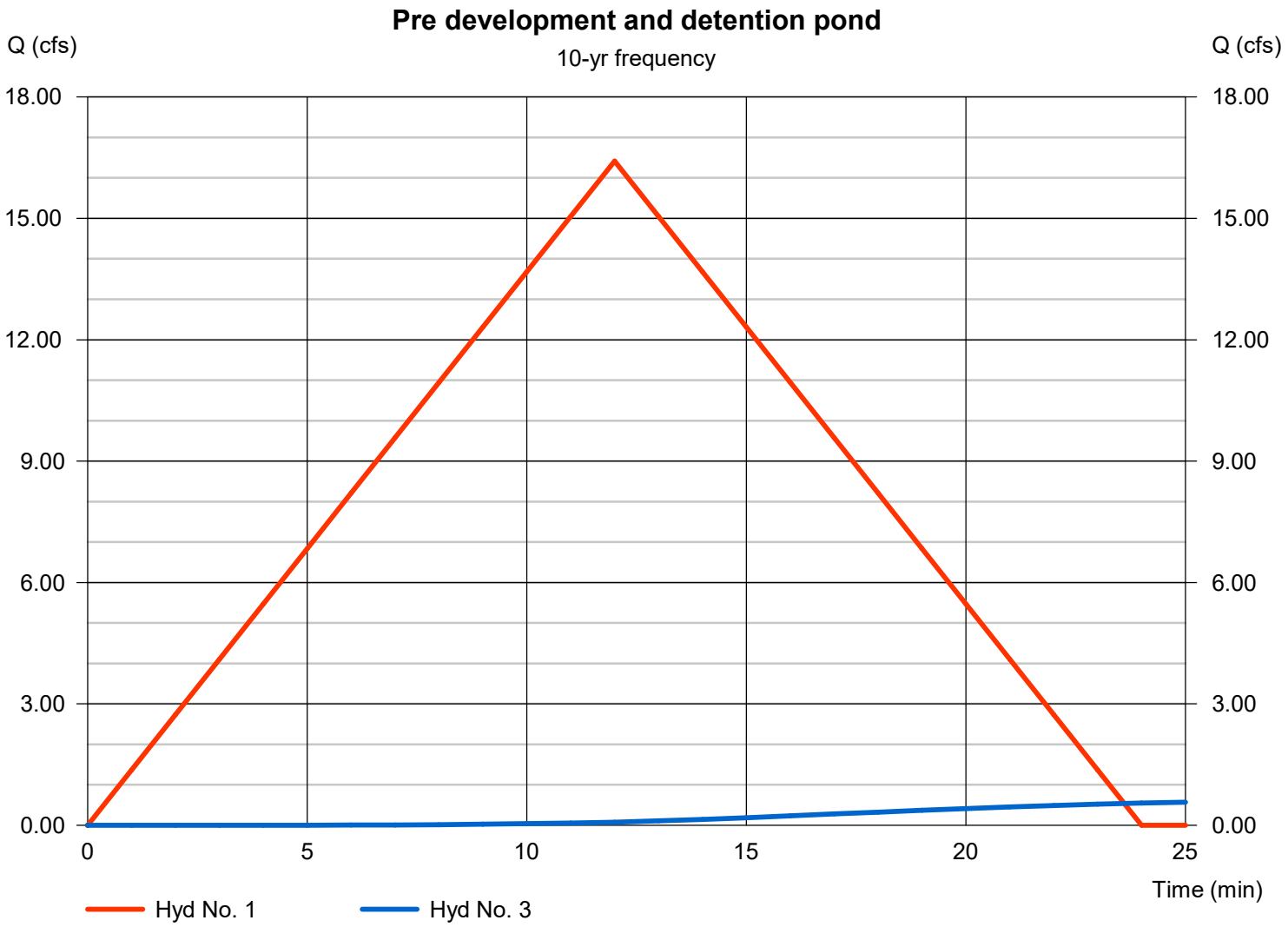
Pre development

Hydrograph type	=	Rational
Peak discharge	=	16.42 cfs
Time to peak	=	12 min
Hyd. Volume	=	11,819 cuft

Hyd. No. 3

detention pond

Hydrograph type	=	Reservoir
Peak discharge	=	0.61 cfs
Time to peak	=	29 min
Hyd. Volume	=	7,345 cuft



Multi-Hydrograph Plot

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

Hyd. No. 1

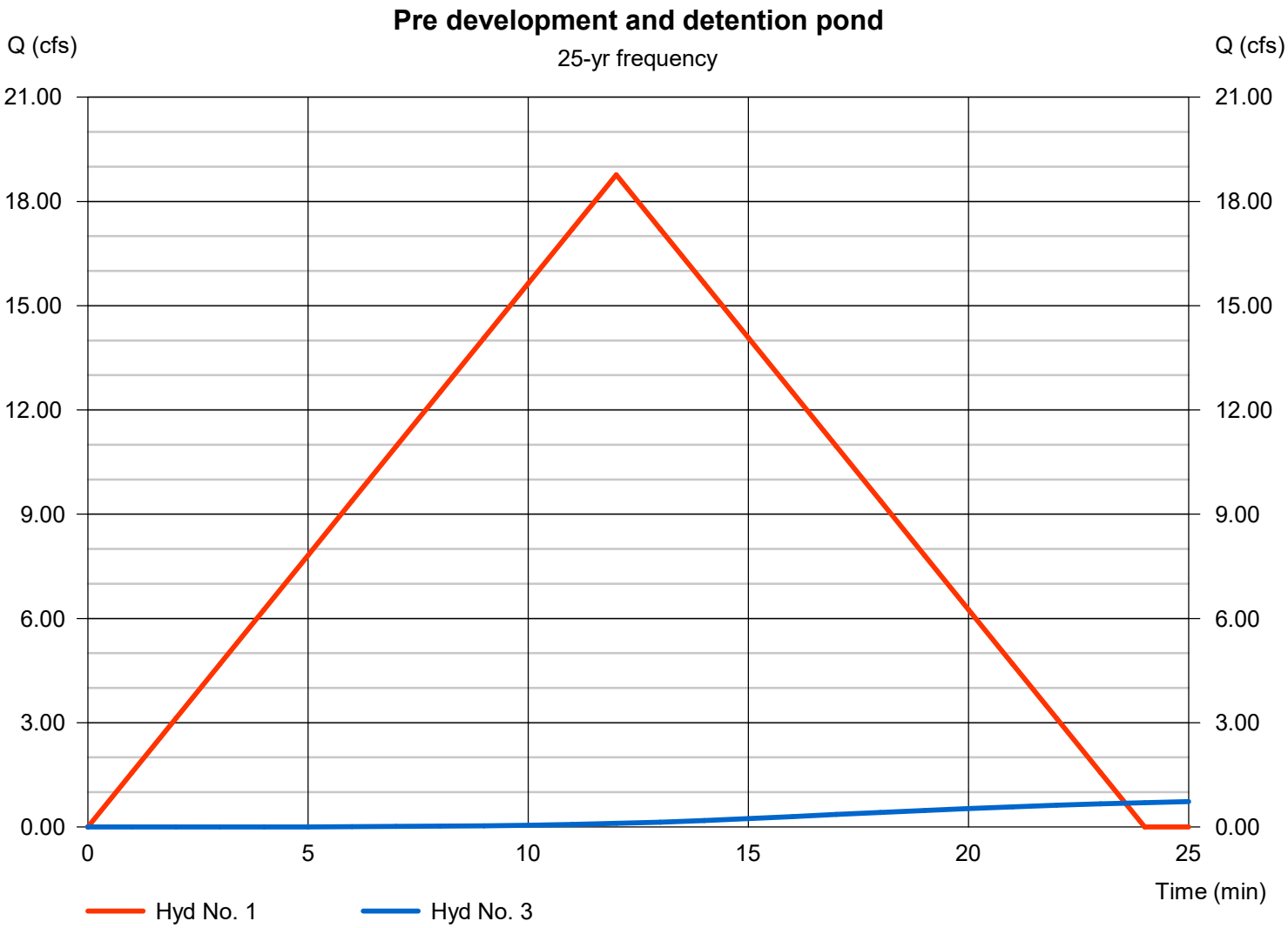
Pre development

Hydrograph type	=	Rational
Peak discharge	=	18.77 cfs
Time to peak	=	12 min
Hyd. Volume	=	13,512 cuft

Hyd. No. 3

detention pond

Hydrograph type	=	Reservoir
Peak discharge	=	0.77 cfs
Time to peak	=	29 min
Hyd. Volume	=	8,475 cuft



Multi-Hydrograph Plot

Hyd. No. 1

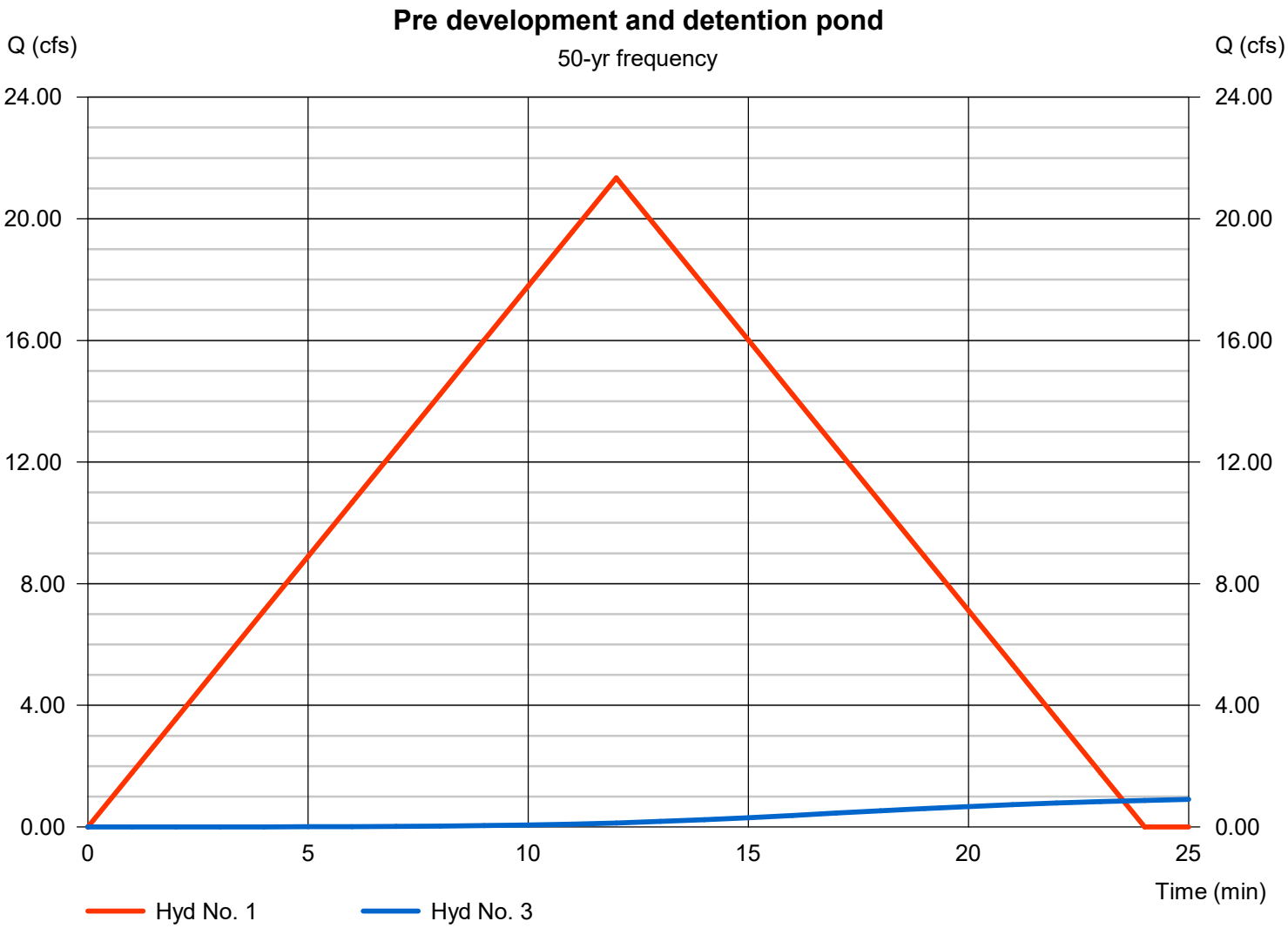
Pre development

Hydrograph type	=	Rational
Peak discharge	=	21.35 cfs
Time to peak	=	12 min
Hyd. Volume	=	15,370 cuft

Hyd. No. 3

detention pond

Hydrograph type	=	Reservoir
Peak discharge	=	0.96 cfs
Time to peak	=	29 min
Hyd. Volume	=	9,713 cuft



Multi-Hydrograph Plot

Hyd. No. 1

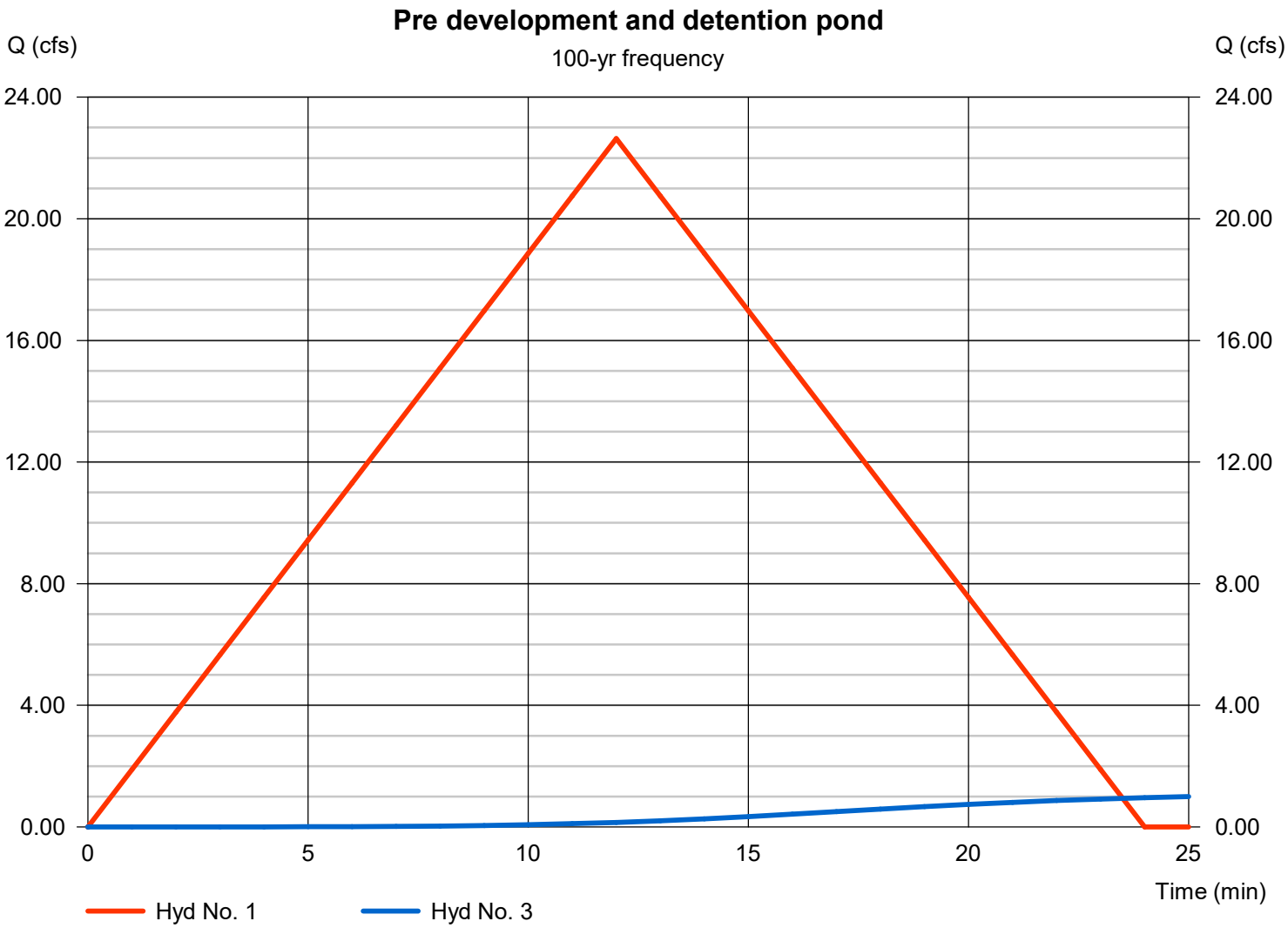
Pre development

Hydrograph type	=	Rational
Peak discharge	=	22.64 cfs
Time to peak	=	12 min
Hyd. Volume	=	16,299 cuft

Hyd. No. 3

detention pond

Hydrograph type	=	Reservoir
Peak discharge	=	1.06 cfs
Time to peak	=	29 min
Hyd. Volume	=	10,343 cuft



Pond Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Thursday, 10 / 6 / 2022

Pond No. 1 - Detention Pond 2

Pond Data

Trapezoid -Bottom L x W = 145.0 x 126.0 ft, Side slope = 3.00:1, Bottom elev. = 511.00 ft, Depth = 2.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	511.00	18,270	0	0
0.20	511.20	18,597	3,687	3,687
0.40	511.40	18,926	3,752	7,439
0.60	511.60	19,259	3,818	11,257
0.80	511.80	19,594	3,885	15,142
1.00	512.00	19,932	3,953	19,095
1.20	512.20	20,273	4,020	23,115
1.40	512.40	20,617	4,089	27,204
1.60	512.60	20,964	4,158	31,362
1.80	512.80	21,313	4,228	35,590
2.00	513.00	21,666	4,298	39,888

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	Inactive	Inactive	0.00
Span (in)	= 12.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 511.00	0.00	0.00	0.00
Length (ft)	= 64.00	0.00	0.00	0.00
Slope (%)	= 9.00	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	No	No	No

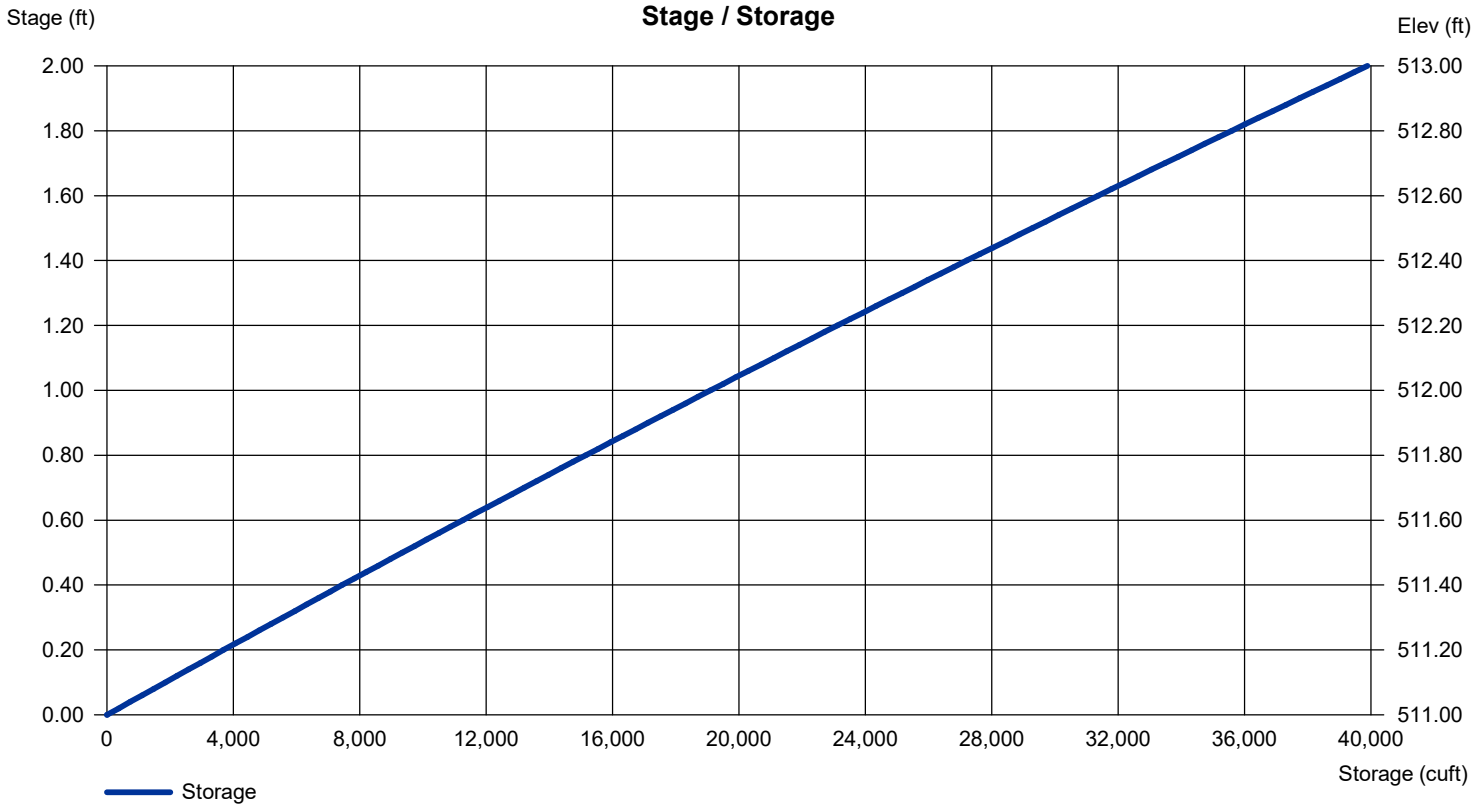
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 6.00	0.00	0.00	0.00
Crest El. (ft)	= 512.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= No	No	No	No

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

TW Elev. (ft) = 0.00

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



Hydrograph Summary Report

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

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	12.77	1	12	9,197	------	------	------	Pre development
2	Rational	6.629	1	15	5,966	------	------	------	Post development
3	Reservoir	0.387	1	29	5,573	2	511.31	5,693	detention pond

Hydrograph Summary Report

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

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	14.20	1	12	10,226	------	------	------	Pre development
2	Rational	7.333	1	15	6,599	------	------	------	Post development
3	Reservoir	0.462	1	29	6,203	2	511.34	6,272	detention pond

Hydrograph Summary Report

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

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	16.42	1	12	11,819	------	------	------	Pre development
2	Rational	8.607	1	15	7,746	------	------	------	Post development
3	Reservoir	0.613	1	29	7,345	2	511.39	7,310	detention pond

Hydrograph Summary Report

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

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	18.77	1	12	13,512	------	------	------	Pre development
2	Rational	9.865	1	15	8,879	------	------	------	Post development
3	Reservoir	0.773	1	29	8,475	2	511.45	8,325	detention pond

Hydrograph Summary Report

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

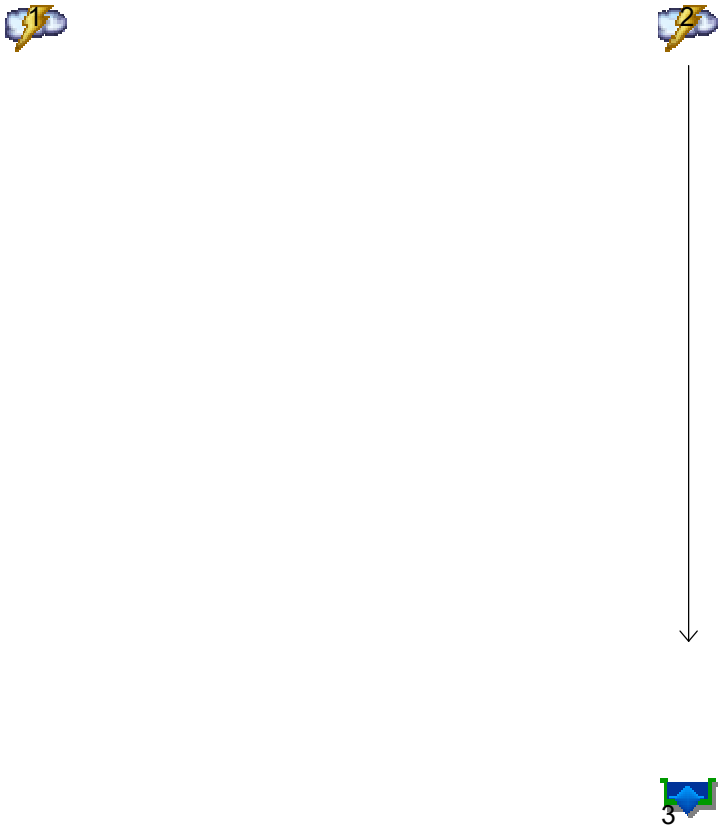
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	21.35	1	12	15,370	------	------	------	Pre development
2	Rational	11.24	1	15	10,120	------	------	------	Post development
3	Reservoir	0.959	1	29	9,713	2	511.50	9,427	detention pond

Hydrograph Summary Report

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

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	22.64	1	12	16,299	------	------	------	Pre development
2	Rational	11.95	1	15	10,751	------	------	------	Post development
3	Reservoir	1.059	1	29	10,343	2	511.53	9,983	detention pond

Watershed Model Schematic



Multi-Hydrograph Plot

Hyd. No. 1

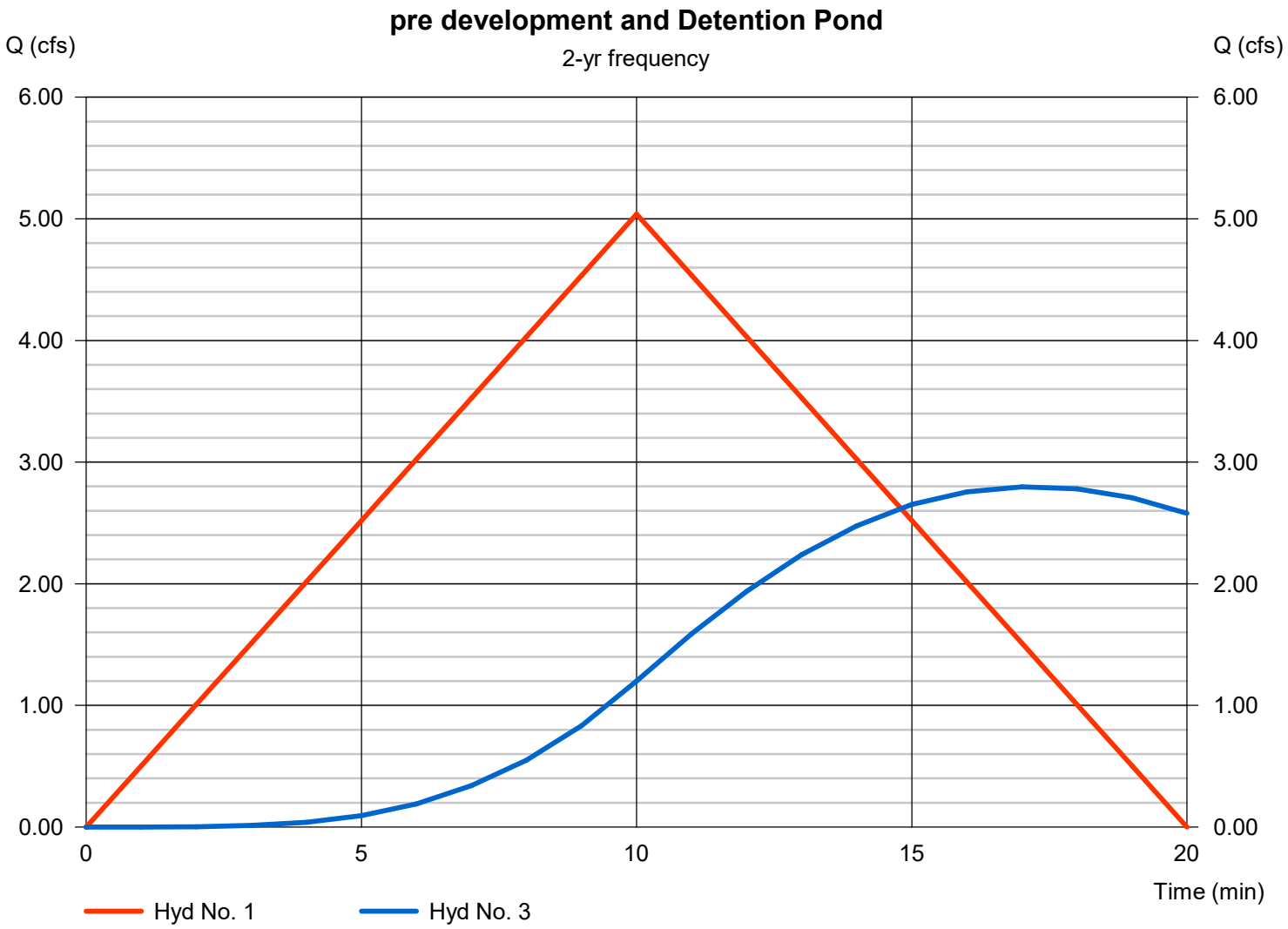
pre development

Hydrograph type	=	Rational
Peak discharge	=	5.039 cfs
Time to peak	=	10 min
Hyd. Volume	=	3,023 cuft

Hyd. No. 3

Detention Pond

Hydrograph type	=	Reservoir
Peak discharge	=	2.80 cfs
Time to peak	=	17 min
Hyd. Volume	=	5,925 cuft



Multi-Hydrograph Plot

Hyd. No. 1

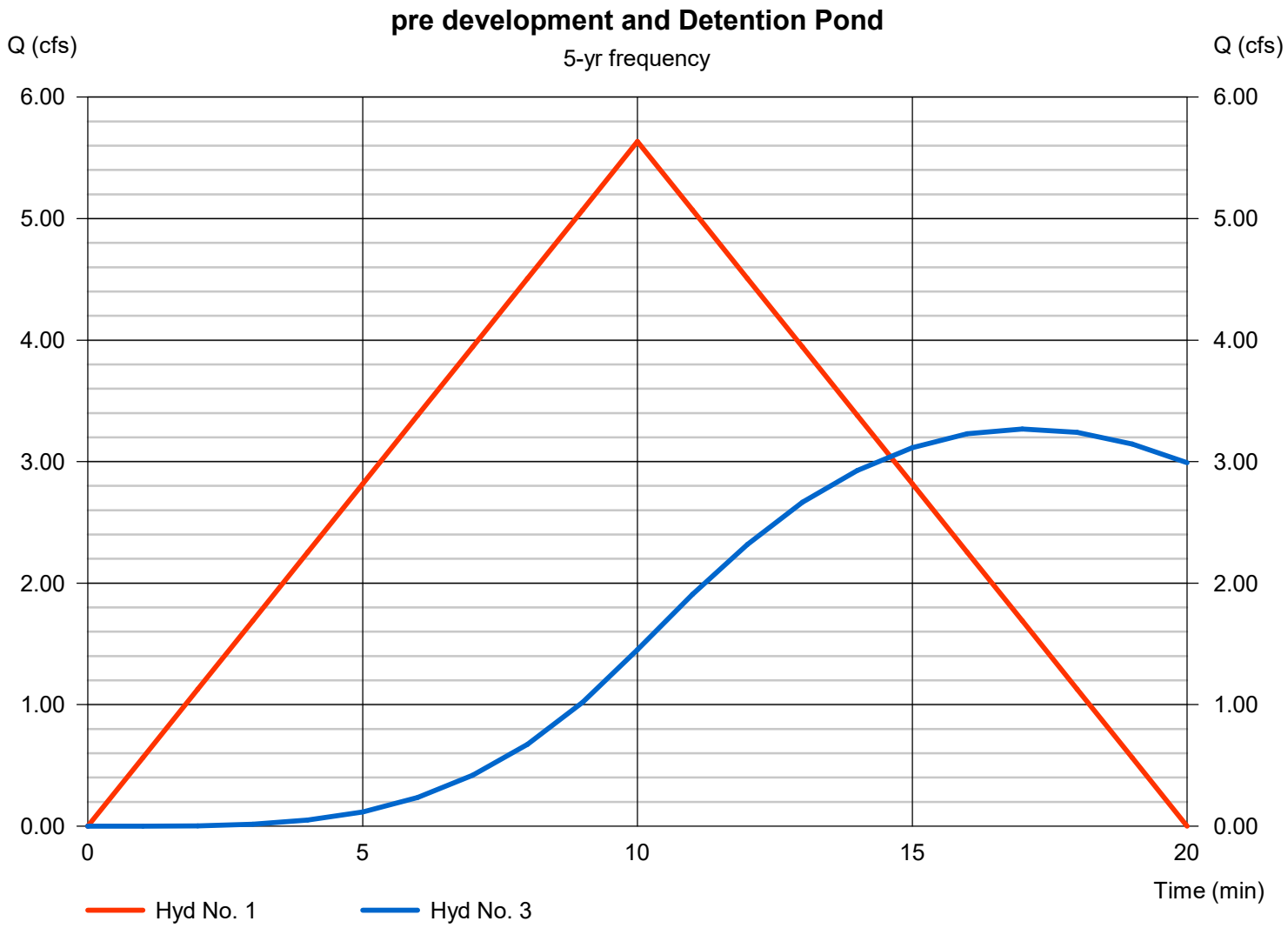
pre development

Hydrograph type	=	Rational
Peak discharge	=	5.635 cfs
Time to peak	=	10 min
Hyd. Volume	=	3,381 cuft

Hyd. No. 3

Detention Pond

Hydrograph type	=	Reservoir
Peak discharge	=	3.27 cfs
Time to peak	=	17 min
Hyd. Volume	=	6,630 cuft



Multi-Hydrograph Plot

Hyd. No. 1

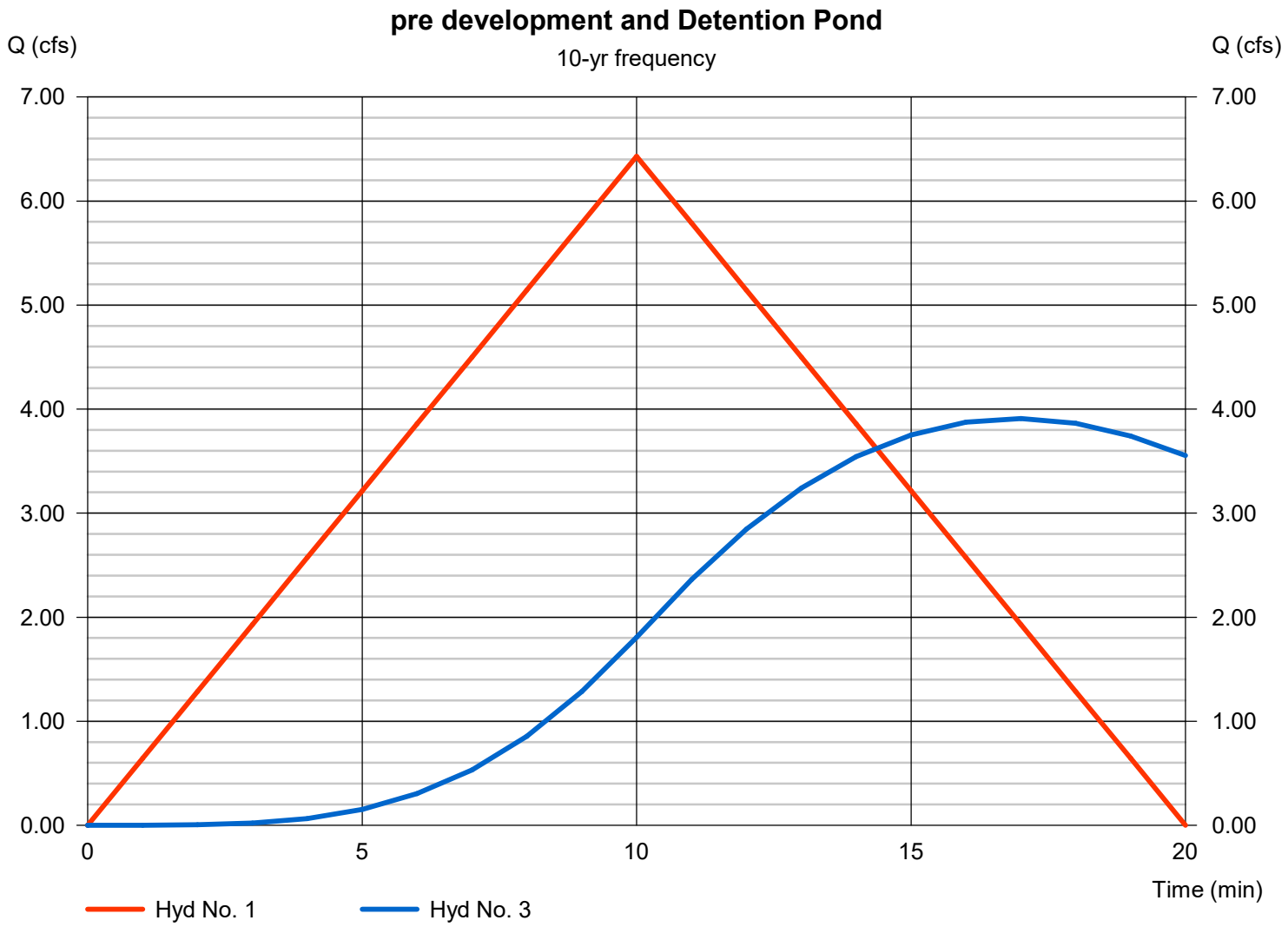
pre development

Hydrograph type	=	Rational
Peak discharge	=	6.430 cfs
Time to peak	=	10 min
Hyd. Volume	=	3,858 cuft

Hyd. No. 3

Detention Pond

Hydrograph type	=	Reservoir
Peak discharge	=	3.91 cfs
Time to peak	=	17 min
Hyd. Volume	=	7,571 cuft



Multi-Hydrograph Plot

Hyd. No. 1

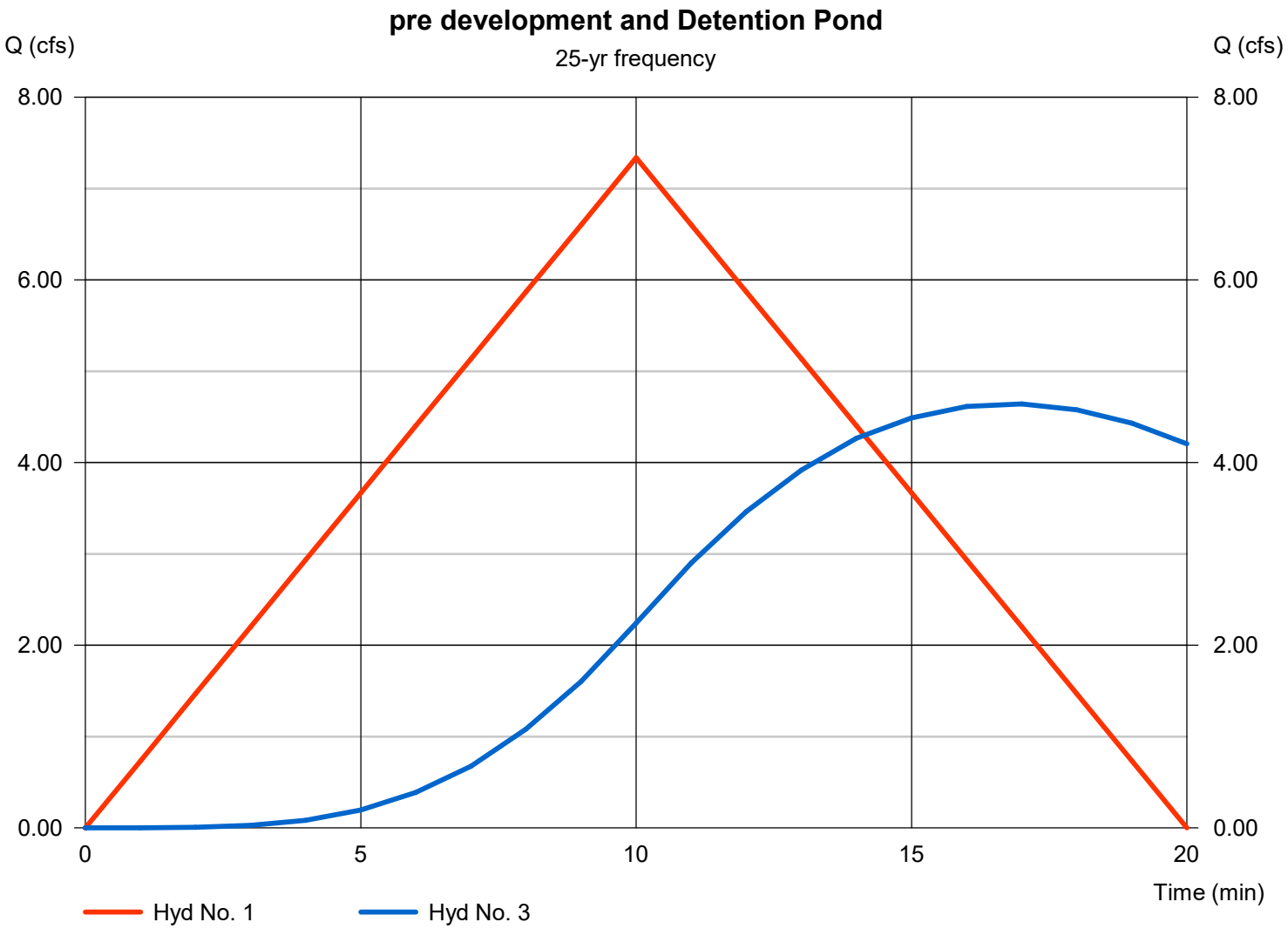
pre development

Hydrograph type	=	Rational
Peak discharge	=	7.337 cfs
Time to peak	=	10 min
Hyd. Volume	=	4,402 cuft

Hyd. No. 3

Detention Pond

Hydrograph type	=	Reservoir
Peak discharge	=	4.64 cfs
Time to peak	=	17 min
Hyd. Volume	=	8,645 cuft



Multi-Hydrograph Plot

Hyd. No. 1

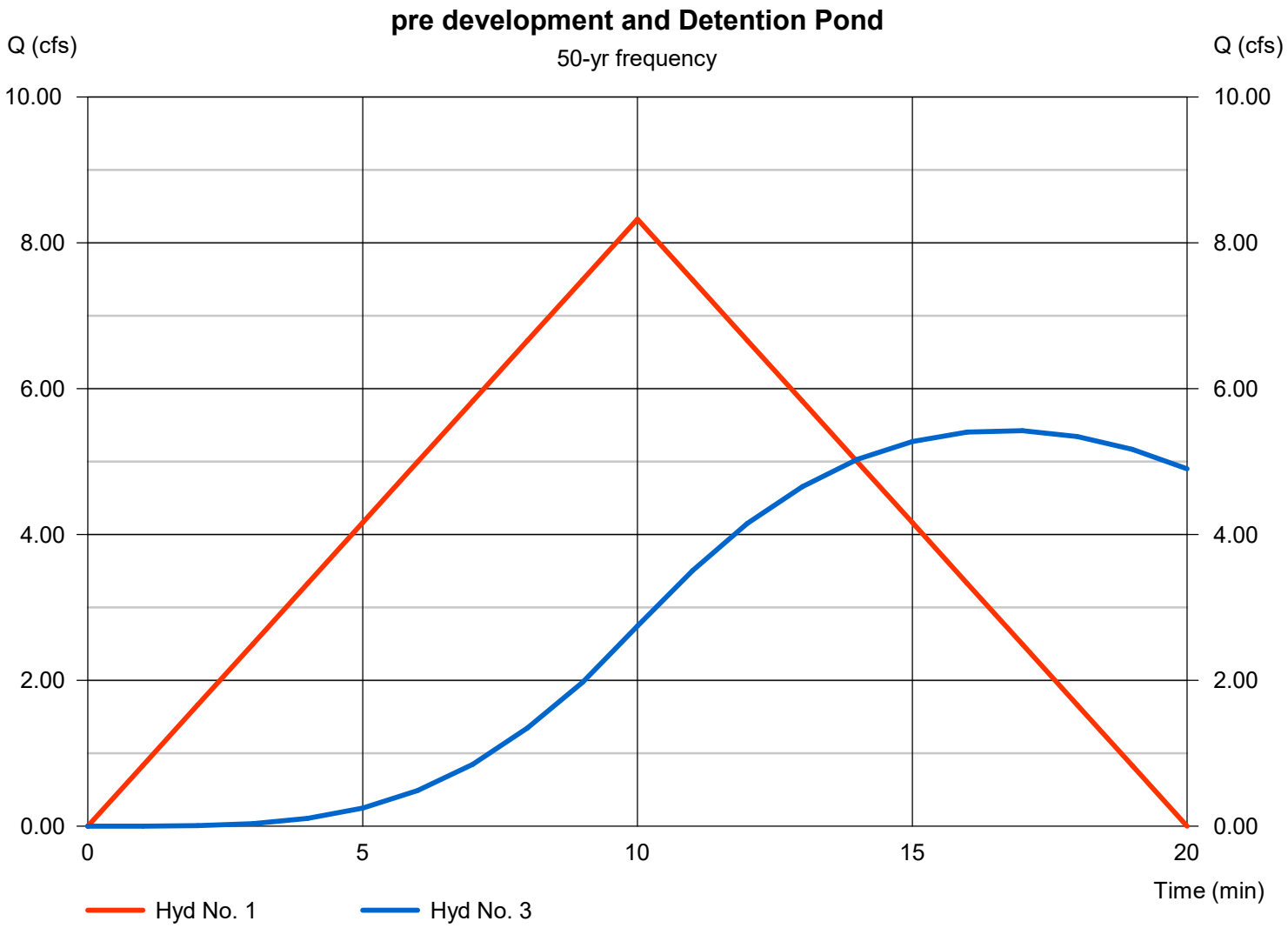
pre development

Hydrograph type	=	Rational
Peak discharge	=	8.326 cfs
Time to peak	=	10 min
Hyd. Volume	=	4,995 cuft

Hyd. No. 3

Detention Pond

Hydrograph type	=	Reservoir
Peak discharge	=	5.42 cfs
Time to peak	=	17 min
Hyd. Volume	=	9,816 cuft



Multi-Hydrograph Plot

Hyd. No. 1

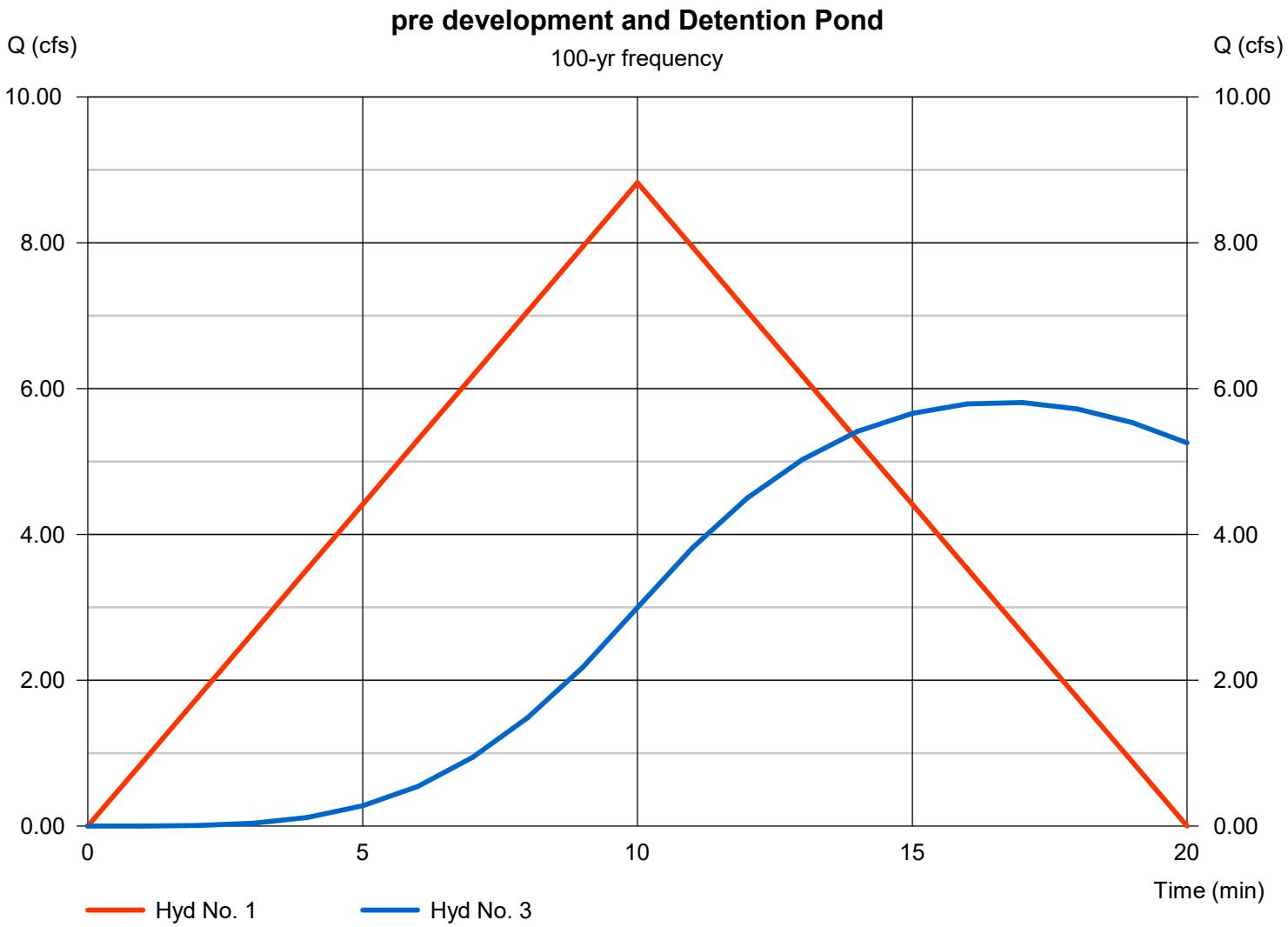
pre development

Hydrograph type	=	Rational
Peak discharge	=	8.825 cfs
Time to peak	=	10 min
Hyd. Volume	=	5,295 cuft

Hyd. No. 3

Detention Pond

Hydrograph type	=	Reservoir
Peak discharge	=	5.81 cfs
Time to peak	=	17 min
Hyd. Volume	=	10,406 cuft



Pond Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 — Wednesday, 04 / 19 / 2023

Pond No. 1 - Detention Pond -3

Pond Data

Trapezoid -Bottom L x W = 106.0 x 52.0 ft, Side slope = 3.00:1, Bottom elev. = 495.00 ft, Depth = 2.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	495.00	5,512	0	0
0.25	495.25	5,751	1,408	1,408
0.50	495.50	5,995	1,468	2,876
0.75	495.75	6,243	1,530	4,406
1.00	496.00	6,496	1,592	5,998
1.25	496.25	6,753	1,656	7,654
1.50	496.50	7,015	1,721	9,375
1.75	496.75	7,281	1,787	11,162
2.00	497.00	7,552	1,854	13,016
2.25	497.25	7,827	1,922	14,938
2.50	497.50	8,107	1,992	16,930

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 18.00	0.00	0.00	0.00
Span (in)	= 18.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 495.00	0.00	0.00	0.00
Length (ft)	= 29.00	0.00	0.00	0.00
Slope (%)	= 12.74	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

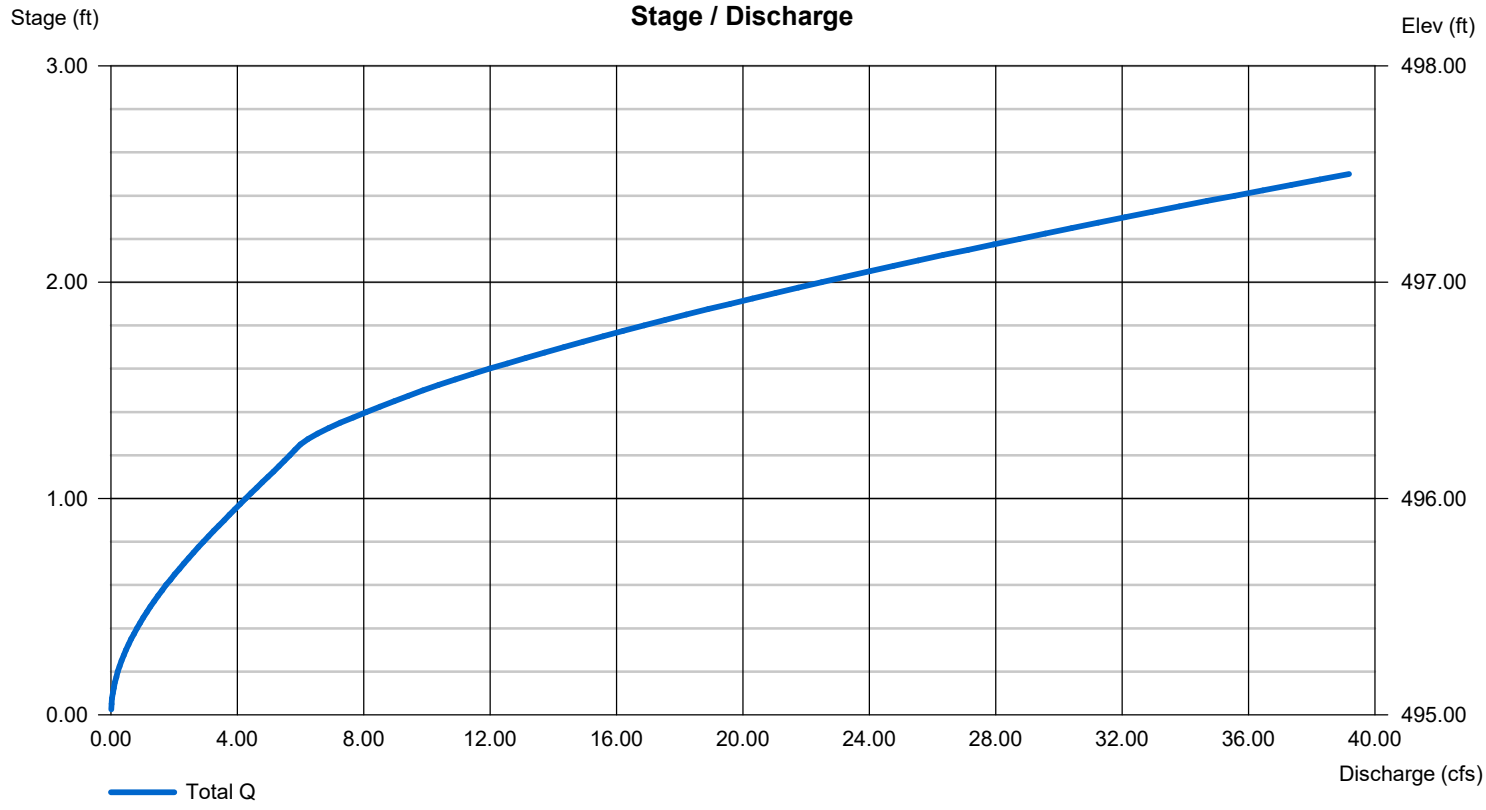
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 6.00	0.00	0.00	0.00
Crest El. (ft)	= 496.25	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= No	No	No	No

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

TW Elev. (ft) = 0.00

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



Hydrograph Summary Report

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

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	5.039	1	10	3,023	------	------	------	pre development
2	Rational	9.942	1	10	5,965	------	------	------	post development
3	Reservoir	2.797	1	17	5,925	2	495.78	4,598	Detention Pond

Hydrograph Summary Report

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

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	5.635	1	10	3,381	------	------	------	pre development
2	Rational	11.12	1	10	6,671	------	------	------	post development
3	Reservoir	3.269	1	17	6,630	2	495.85	5,064	Detention Pond

Hydrograph Summary Report

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

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	6.430	1	10	3,858	------	------	------	pre development
2	Rational	12.69	1	10	7,612	------	------	------	post development
3	Reservoir	3.910	1	17	7,571	2	495.95	5,674	Detention Pond

Hydrograph Summary Report

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

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	7.337	1	10	4,402	------	------	------	pre development
2	Rational	14.48	1	10	8,686	------	------	------	post development
3	Reservoir	4.642	1	17	8,645	2	496.05	6,359	Detention Pond

Hydrograph Summary Report

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

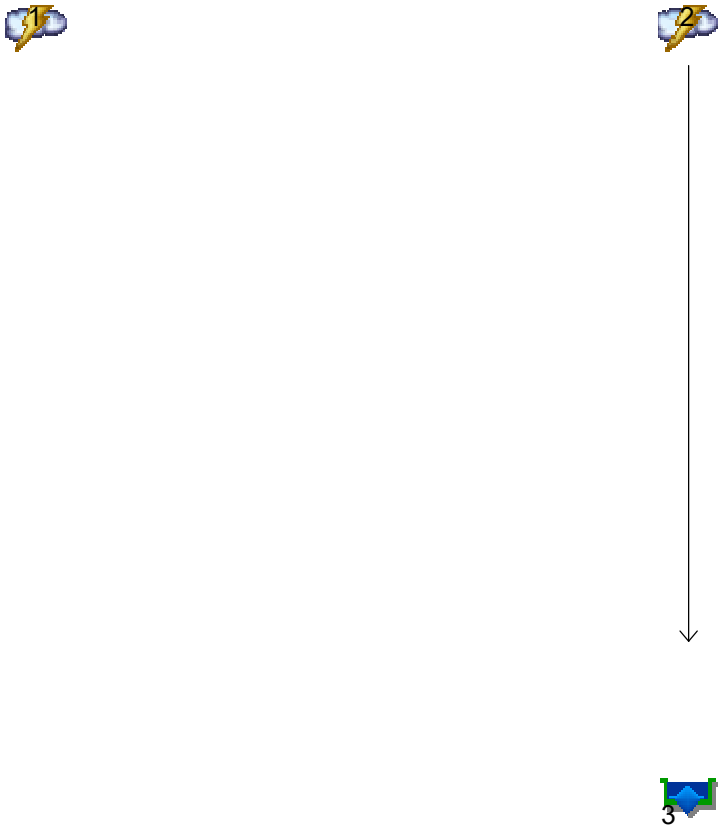
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	8.326	1	10	4,995	------	------	------	pre development
2	Rational	16.43	1	10	9,856	------	------	------	post development
3	Reservoir	5.424	1	17	9,816	2	496.17	7,100	Detention Pond

Hydrograph Summary Report

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

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	8.825	1	10	5,295	------	------	------	pre development
2	Rational	17.41	1	10	10,447	------	------	------	post development
3	Reservoir	5.810	1	17	10,406	2	496.22	7,475	Detention Pond

Watershed Model Schematic



Multi-Hydrograph Plot

Hyd. No. 1

pre development

Hydrograph type	=	Rational
Peak discharge	=	31.09 cfs
Time to peak	=	11 min
Hyd. Volume	=	20,519 cuft

Hyd. No. 3

Reservior

Hydrograph type	=	Reservoir
Peak discharge	=	18.44 cfs
Time to peak	=	16 min
Hyd. Volume	=	25,931 cuft



Multi-Hydrograph Plot

Hyd. No. 1

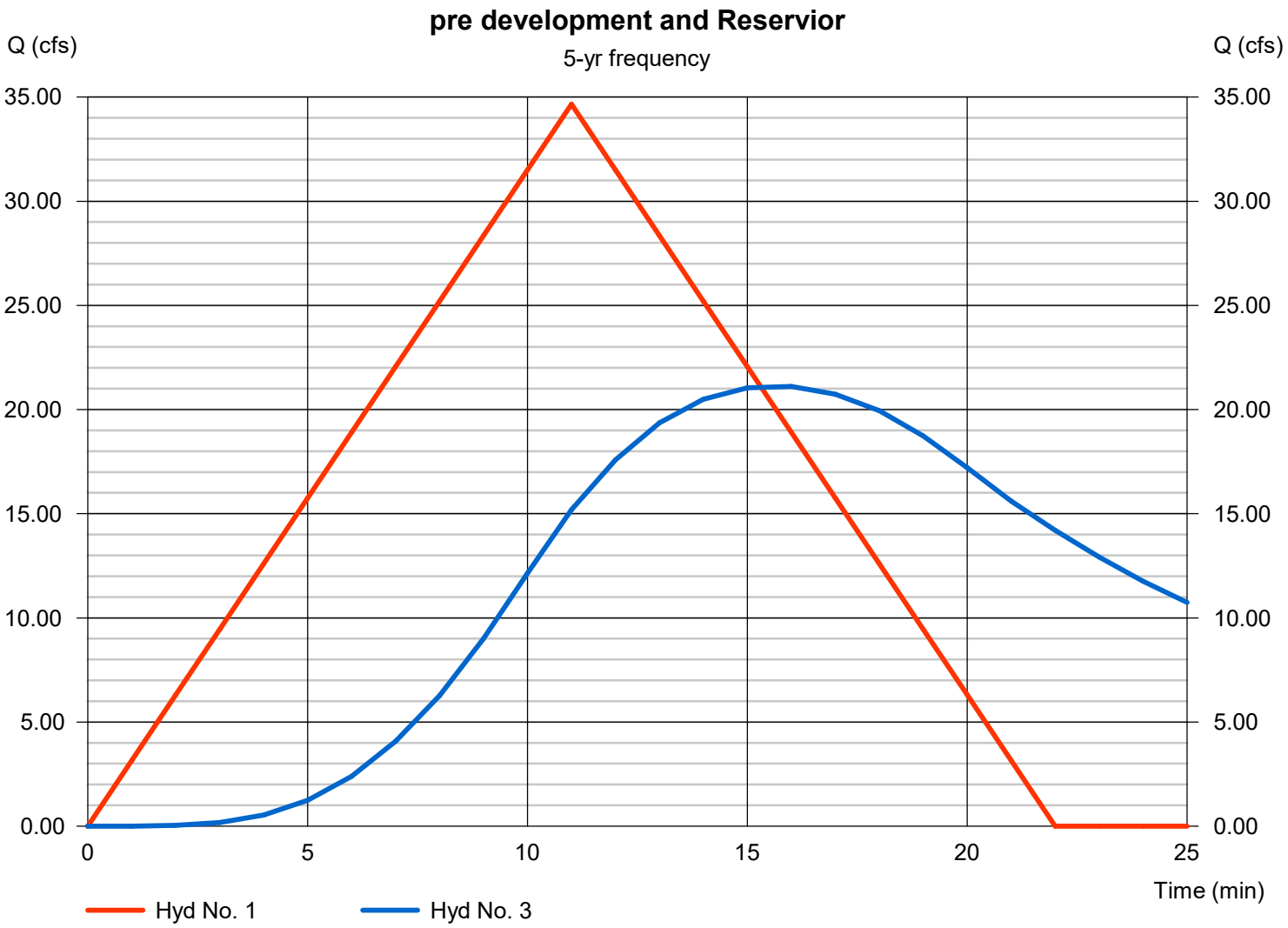
pre development

Hydrograph type	=	Rational
Peak discharge	=	34.66 cfs
Time to peak	=	11 min
Hyd. Volume	=	22,873 cuft

Hyd. No. 3

Reservior

Hydrograph type	=	Reservoir
Peak discharge	=	21.11 cfs
Time to peak	=	16 min
Hyd. Volume	=	29,001 cuft



Multi-Hydrograph Plot

Hyd. No. 1

pre development

Hydrograph type	=	Rational
Peak discharge	=	39.81 cfs
Time to peak	=	11 min
Hyd. Volume	=	26,276 cuft

Hyd. No. 3

Reservior

Hydrograph type	=	Reservoir
Peak discharge	=	24.59 cfs
Time to peak	=	16 min
Hyd. Volume	=	33,097 cuft



Multi-Hydrograph Plot

Hyd. No. 1

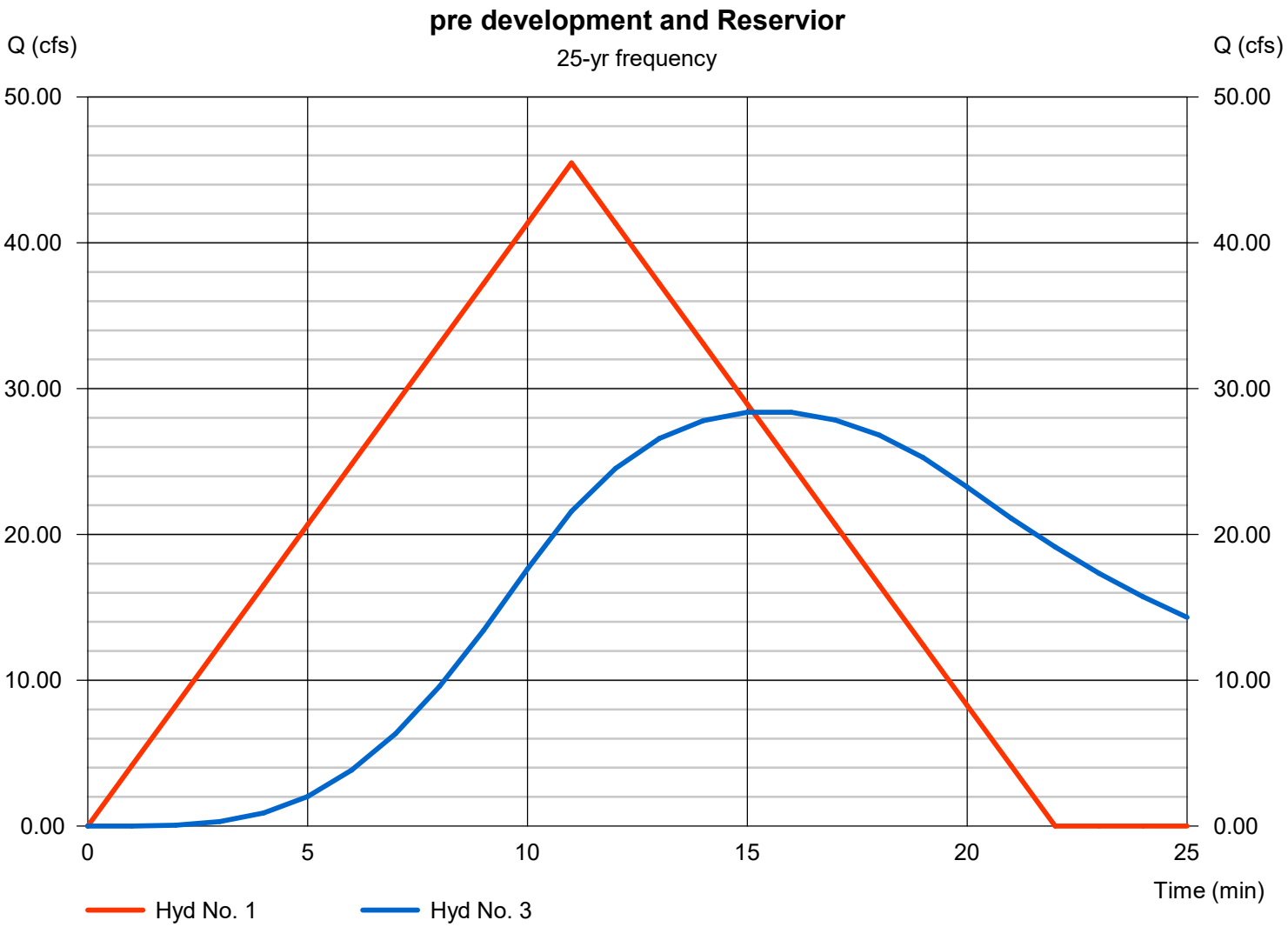
pre development

Hydrograph type	=	Rational
Peak discharge	=	45.47 cfs
Time to peak	=	11 min
Hyd. Volume	=	30,012 cuft

Hyd. No. 3

Reservior

Hydrograph type	=	Reservoir
Peak discharge	=	28.39 cfs
Time to peak	=	15 min
Hyd. Volume	=	37,772 cuft



Multi-Hydrograph Plot

Hyd. No. 1

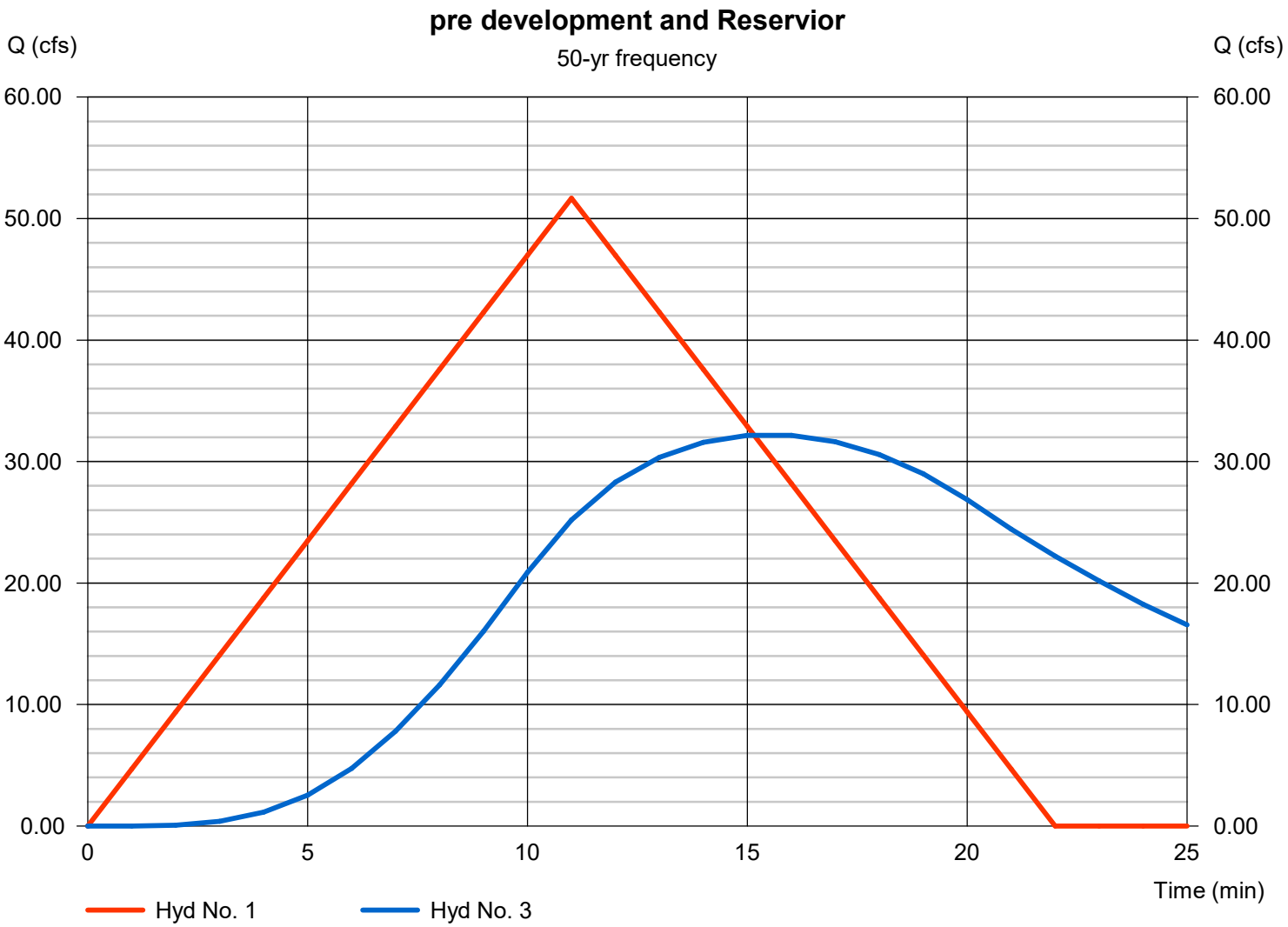
pre development

Hydrograph type	=	Rational
Peak discharge	=	51.67 cfs
Time to peak	=	11 min
Hyd. Volume	=	34,102 cuft

Hyd. No. 3

Reservior

Hydrograph type	=	Reservoir
Peak discharge	=	32.15 cfs
Time to peak	=	16 min
Hyd. Volume	=	42,865 cuft



Multi-Hydrograph Plot

Hyd. No. 1

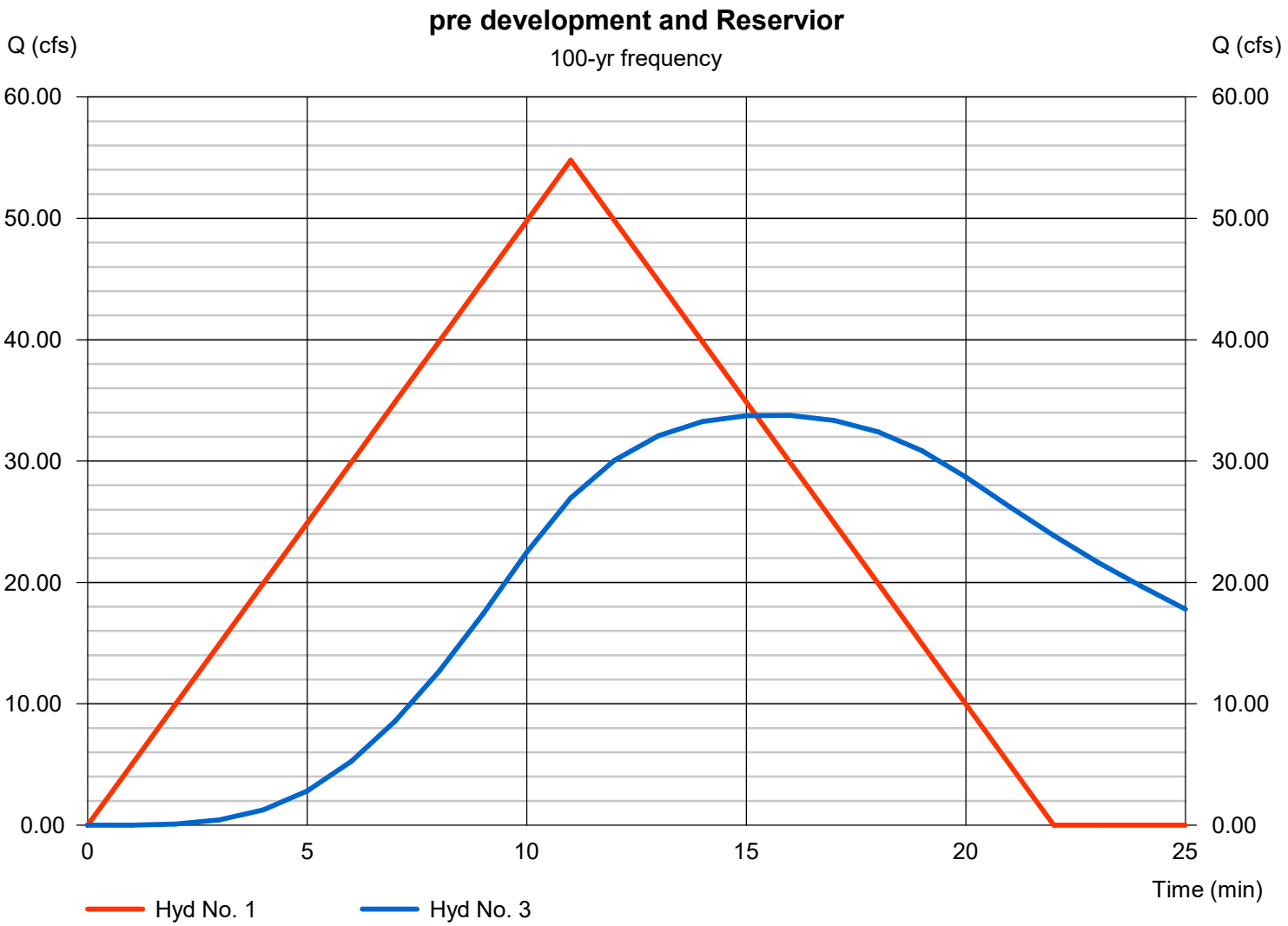
pre development

Hydrograph type	=	Rational
Peak discharge	=	54.77 cfs
Time to peak	=	11 min
Hyd. Volume	=	36,151 cuft

Hyd. No. 3

Reservior

Hydrograph type	=	Reservoir
Peak discharge	=	33.77 cfs
Time to peak	=	16 min
Hyd. Volume	=	45,435 cuft



Pond Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Wednesday, 04 / 19 / 2023

Pond No. 1 - Detention Pond -4

Pond Data

Trapezoid -Bottom L x W = 120.0 x 64.0 ft, Side slope = 3.00:1, Bottom elev. = 511.00 ft, Depth = 4.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	511.00	7,680	0	0
0.40	511.40	8,127	3,161	3,161
0.80	511.80	8,586	3,342	6,503
1.20	512.20	9,057	3,528	10,032
1.60	512.60	9,539	3,719	13,750
2.00	513.00	10,032	3,914	17,664
2.40	513.40	10,537	4,113	21,777
2.80	513.80	11,053	4,318	26,095
3.20	514.20	11,581	4,527	30,622
3.60	514.60	12,121	4,740	35,362
4.00	515.00	12,672	4,958	40,320

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 36.00	Inactive	Inactive	0.00
Span (in)	= 36.00	24.00	24.00	0.00
No. Barrels	= 1	1	1	0
Invert El. (ft)	= 511.00	511.00	513.00	0.00
Length (ft)	= 103.00	0.50	0.00	0.00
Slope (%)	= 9.34	0.01	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.50	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

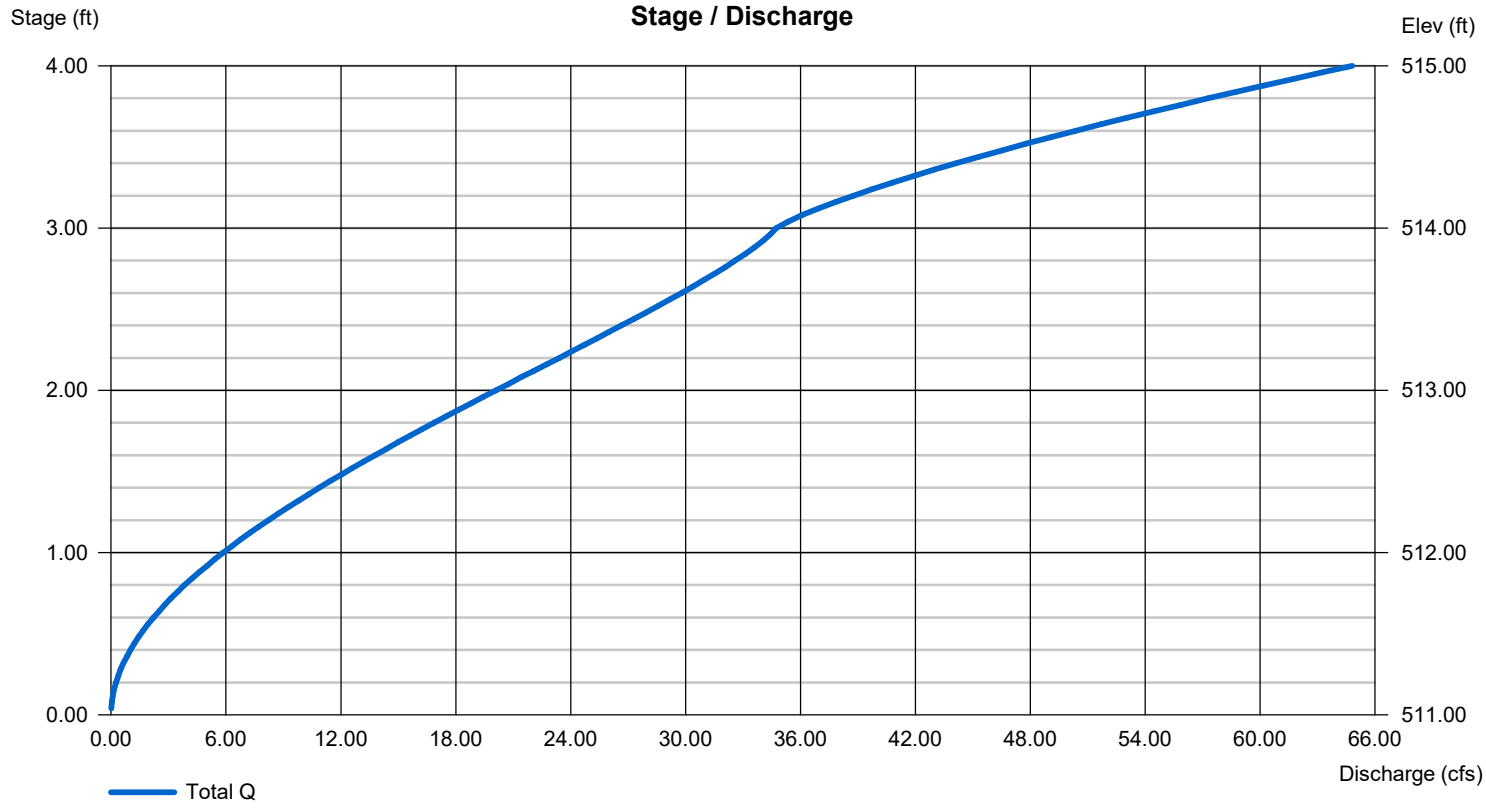
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	Inactive	6.00	Inactive	0.00
Crest El. (ft)	= 511.00	514.00	511.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	Rect	Rect	---
Multi-Stage	= No	No	No	No

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

TW Elev. (ft) = 0.00

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



Hydrograph Summary Report

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

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	31.09	1	11	20,519	------	------	------	pre development
2	Rational	43.27	1	10	25,961	------	------	------	post development
3	Reservoir	18.44	1	16	25,931	2	512.90	16,675	Reservior

Hydrograph Summary Report

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

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	34.66	1	11	22,873	------	------	------	pre development
2	Rational	48.39	1	10	29,031	------	------	------	post development
3	Reservoir	21.11	1	16	29,001	2	513.06	18,301	Reservior

Hydrograph Summary Report

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

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	39.81	1	11	26,276	------	------	------	pre development
2	Rational	55.21	1	10	33,127	------	------	------	post development
3	Reservoir	24.59	1	16	33,097	2	513.27	20,466	Reservior

Hydrograph Summary Report

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

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	45.47	1	11	30,012	------	------	------	pre development
2	Rational	63.00	1	10	37,802	------	------	------	post development
3	Reservoir	28.39	1	15	37,772	2	513.51	22,950	Reservior

Hydrograph Summary Report

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

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	51.67	1	11	34,102	------	------	------	pre development
2	Rational	71.49	1	10	42,895	------	------	------	post development
3	Reservoir	32.15	1	16	42,865	2	513.77	25,730	Reservior

Hydrograph Summary Report

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

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	54.77	1	11	36,151	------	------	------	pre development
2	Rational	75.78	1	10	45,465	------	------	------	post development
3	Reservoir	33.77	1	16	45,435	2	513.90	27,191	Reservior