HYDRAULIC REPORT

FOR

Public Improvements to Serve Wilshire Hills III

Lee's Summit, Missouri

PREPARED FOR:

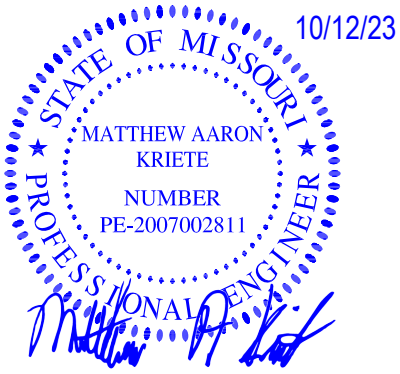
WILSHIRE HILLS III L.P.

206 PEACH WAY

COLUMBIA, MO 54202

JUNE 22, 2023

REVISED: OCTOBER 12, 2023



PREPARED BY:

Engineering Surveys & Services

1113 FAY STREET

COLUMBIA, MO 65201

(573) 449-2646

JOB NUMBER: 15925

TABLE OF CONTENTS

1 INTRODUCTION

The project consists of the construction of a public road and associated utilities to connect existing Wilshire Drive to Strother Road in Lee's Summit, MO. The road and associated storm sewer and sanitary sewer extensions will provide service to the future Wilshire Hills Phase III development and additional future development. The project shall be built in two phases. The first phase will be the rough grading of Wilshire Hills Phase III, excavation of the detention basin, and the completion of the road work. Phase III will include the completion of Wilshire Hills Phase III and future projects. Soil disturbing activities will include clearing and grubbing, installing erosion and sediment controls, grading, installation of underground utilities, and preparation for final seeding, mulching, and landscaping. Every part of the stormwater design will be accounted for to follow Lee's Summits stormwater requirements.

2 DESIGN

2.1 Erosion & Sediment Control Design

Design Standard(s):

- *Missouri Department of Natural Resources (MDNR) Protecting Water Quality Field Guide, 2011*

The Civil Site Plans and project Storm Water Pollution and Prevention Plan (SWPPP) indicate erosion and sediment control Best Management Practices (BMPs) to be utilized throughout construction activities. The proposed regional detention basin shall be used as a temporary sediment trap throughout construction. Appendix A includes erosion and sediment control storage calculations. The outfall control structure must be wrapped in filter fabric to an elevation of 916 according to these calculations.

Per the city of Lee's Summit the Detention basin has been lined with an erosion control blanket to assist in bank stabilization while the grass is being established. The basin currently has swales to assist with drainage, the future plan will include pipes from the surrounding development. The installation of this fabric in the first stage prepares the basin for future development as well as providing maximum protection.

The swales leading into the basin have temporary erosion control blankets to help protect earthwork while grass is being established. These blankets are not permanent, as are the nature of the swales. The swale was analyzed with only rip-rap and bare earth as well as vegetated and both were found to be stable. Bare earth was also calculated and resulted in being unstable. A temporary erosion blanket will provided the necessary stability to maintain the swale until vegetation establishes. The check dams and rip rap also provide excess protection and slow the water before entering the basin. The hydraulic results for each option has been included in Appendix A.

2.2 Stormwater Detention Design

Design Standard(s):

- *Lee's Summit, Missouri Stormwater Discharge Control Regulations (Code of Ordinance Chapter 34 Article 3)*
- *APWA Section 5300*
- *LS Section 5600 – Storm Drainage Systems and Facilities (revised July 2020)*

The regional detention basin has been designed to serve all sites south of Meadowview Drive and west NE Manhattan Drive. This basin will provide detention and water quality with allocations for impervious areas for future development. Table 1 shows the area of each lot, the assumed impervious area, and the total impervious treated by the regional basin for the entire development. The first development will be Wilshire Hills Phase III. The impervious area from this site will be subtracted from the overall total for future development.

Impervious areas have been approximated based on future use of each lot. The time of concentrations and curve numbers reflect these assumptions for future site development.

Table 1: Future Land Development

	Area (acres)	Impervious (acres)	Curve Number
Wilshire III (Northwest + Bypass)	2.54	1.25	87
Northeast	5.39	3.74	89
Southeast	6.27	4.57	91
Southwest	1.60	1.12	91
West	3.20	1.65	86
Total	19.0	12.33	

The pre-developed conditions were calculated based on conditions prior to any development, or pre-2006. The site was originally pasture before being cleared and mass graded for future development. Post-developed conditions include future impervious areas for future site development. This 12.33 acres of additional impervious area has been included with the design of this detention basin.

The assumptions for max release rate required all new additional impervious areas to have detention that restricts runoff to the pre project rates for the 50%, 10%, and 1% design storms. These rates come from the APWA Section 5300 and are 0.5, 2.0, and 3.0 cfs per acre in relation to the design storm. The existing onsite sediment trap will be removed and replaced with the new larger basin designed to serve all onsite lots west of the box culvert. It is important to note the large difference between pre vs. post detention that these limits create.

Appendix B includes HydraFlow detention calculations and Appendix D includes the detention drainage area maps. Table 2 shows the required discharge rates based on the area draining to the detention basin. This is then compared to the Designed basin discharge. This calculated data is then added with the offsite pass through and bypass to ensure that all is accounted for within the basin. 1 acre of Bypass is accounted

for in the design of this basin. 0.25 of this is utilized through the development of Wilshire Hills phase III. This leaves 0.75 acres for further developments to allow site bypass.

The following table is a visual representation of the data used to calculate the Total Allowed Basin Discharge in comparison to the Provided Basin Discharge. The Maximum allowable site rate is calculated using the APWA standards outlined in Lee' Summit Stormwater Requirements. Table 2 shows that the designed basin meets all discharge calculations and reduces the runoff of the site to meet the requirements according to city requirements.

Total Allowed Basin Discharge = Maximum Site Rate (cfs) + Offsite Pass Through (cfs)
Provided Basin Discharge = Designed Basin Discharge (cfs) + Offsite Pass Through (cfs) + Onsite Bypass (cfs)

Table 2: Basin Discharge Rates

Design Storm	Rate (cfs) Allowable per Acre per APWA	Area Served (acres)	Maximum Site Rate (cfs)	Offsite Pass Through (cfs)	**Total Allowed Basin Discharge (csf)**	Designed Basin Discharge (cfs)	Onsite Bypass (cfs)	**Provided Basin Discharge (cfs)**	Basin Elevation
50% (2-yr)	0.5	19.0	9.50	3.02	**12.52**	7.23	(-) 2.25	**12.50**	916.15
20% (10-yr)	2.0	19.0	38.0	14.88	**52.88**	22.20	(-) 5.80	**42.88**	919.30
1% (100-yr)	3.0	19.0	57.0	35.92	**92.92**	45.78	(-) 10.96	**92.66**	922.45

The 100-year level of rise in the basin is 922.45 and the top of the dam is 924.3, providing 1.85' of freeboard. 922.45 is the maximum water surface elevation. The emergency spillway for the basin is the grated top of the outfall structure in the basin with an elevation of 922.95. The 100-year design storm was routed through the basin, and the level of rise is 923.30, providing 1.0' of freeboard.

A spillway for the basin has been designed for the top of the earthen dam in the unlikely event the outfall structure should become completely blocked. Appendix B includes weir calculations that indicate the 100-year flow through the spillway is fully contained in the spillway and will not overtop the dam.

2.3 Water Quality

Design Standard(s):

- *APWA Section 5608.4*
- *MARC/APWA BMP Manual Chapter 6.*

The water quality required for this site is provided by a 40-hour extended detention of runoff of the 90% mean annual event. This is a 1.37"/24-hour event. The designed detention basin takes 60 hours to completely release all of the water quality storm after peaking at the 12-hour mark. This meets the

qualifications to meet water quality standards and requirements, according to APWA 5608.4 and Chapter 6 of the MARC/APWA BMP Manual.

2.4 Storm Sewer Design

Design Standard(s):

- *Lee's Summit, Missouri Stormwater Discharge Control Regulations (Code of Ordinance Chapter 34 Article 3)*
- *APWA Section 5300*
- *LS Section 5600 – Storm Drainage Systems and Facilities (revised July 2020)*

All storm sewers for the road public improvement project will be public storm sewers. They have been designed to the 25-year storm but can handle the 100-year storm without impeding traffic. Appendix C includes HydraFlow storm sewer calculations. The calculations are based on the Storm Sewer Drainage Area Map in Appendix D.

It is important to note that the future offsite industrial is currently passing through the storm sewers causing an increase in volume in the pipes. The Storm Drainage Area map shows the designed divide between the inlets TMI42 and SOI6A. Currently all of the water is directed towards SOI6A through a swale to reduce water passing over the road. This is causing a much larger volume of water to enter SOI6A than usual though the pipes are sized to handle this increase in flow.

3 CONCLUSION

Erosion and sediment control has been designed per requirements. The site meets storm water detention requirements for developments within the City of Lee's Summit and is designed for future development on the site. The storm sewers have been designed to convey the 25-year design storm. All of the City of Lee's Summit stormwater requirements have been met.

APPENDIX A:
EROSION AND SEDIMENT CONTROL CALCULATIONS

Engineering Surveys & Services
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COLUMBIA (573) 449-2646 | JEFFERSON CITY (573) 636-3303 | SEDALIA (660) 826-8618
www.ess-inc.com ess@ess-inc.com

Project: Wilshire Hills Phase III Date: 6/13/2023

Sheet: 1 of 1

BY ST

EROSION CONTROL CALCULATIONS

Temporary Sediment Trap

11.3 Acres disturbed area to sediment basin

11.3 × 3,600 CF/Ac = 40,680 CF sediment storage required

ELEVATION	CONTOUR AREA (SF)	TOTAL STORAGE (CF)
910	4,286	0
911	5,114	4693
912	6,006	10,2417
913	6,970	16,728
914	12,152	26,169
915	13,638	39,056
916	15,211	53,472

53,472 CF of sediment storage is provided at an elevation of 916.' This is below the outfall structure so will not require filter fabric to be wrapped.

It is extremely important to note that the depth of this pond is a requirement for housing fish. Once construction has been completed, the sediment accumulation in the pond must be removed back to its original elevation levels.

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Project: Wilshire Hills Phase III Date: 10/11/2023

PUBLIC IMPROVEMENTS Sheet: ____ of ____

EROSION CONTROL CALCULATIONS

SILT FENCE - ratio less than 1/4 ac/100 ft = 0.0025 ✓

1) EAST of New Wilshire Drive: STROTHER RD to FES 40
   - DISTURBED AREA: 0.58 Acres
   - SILT FENCE LENGTH: 288 Feet
   - RATIO: 0.58/288 = 0.0020 ✓

2) NORTH of Basin outfall pipe (NE Meadowview Dr)
   - DISTURBED AREA: 0.28 Acres
   - SILT FENCE LENGTH: 305 feet
   - RATIO: 0.28/305 = 0.0009 ✓

3) SOUTH of Basin outfall pipe (NE Manhatten Terrace)
   - DISTURBED AREA: 1.53 Acres
   - SILT FENCE LENGTH: 634 feet
   - RATIO: 1.53/634 = 0.0024 ✓

INLET PROTECTION - Inlet design < 1/2 acre disturbed area

- CI 41 DISTURBED AREA = 0.14 ✓
- CI 42 DISTURBED AREA = 0.13 ✓
- SOI 6A DISTURBED AREA = 0.419 ✓

North American Green - Erosion Control Materials Design Software Ver.4.2 - Channel 10/12/20 03:37 PM

Discharge (cfs)	13.4
Peak Flow Period (hrs)	2
Channel Slope (ft/ft)	0.013
Channel Bottom Width (ft)	10.00
Left Side Slope (Horiz. to 1)	3.0
Right Side Slope (Horiz. to 1)	3.0
Existing Channel Bend	○ Yes ◉ No
COMPOSITE CHANNEL LINING?	○ Yes ◉ No

Channel Liner

Matting Type	Unreinforced Vegetation
Vegetation Development Phase	
Vegetation Analysis	
Retardance Class (A-E)	E <2 in
Vegetation Type (Growth Habit)	Sod Former
Vegetation Density	4. Poor <50%
Soil Type	Clay Loam
Manning's 'n'	.024

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NORTH AMERICAN GREEN EROSION CONTROL MATERIALS DESIGN SOFTWARE VERSION 4.2
NORTH AMERICAN GREEN CHANNEL PROTECTION - ENGLISH/S.I.
USER SPECIFIED CHANNEL LINING BACK-UP COMPUTATIONS
****

PROJECT NAME: Wilshire Hills PROJECT NO.: 15925
COMPUTED BY: DATE: 10/12/2023
FROM STATION/REACH: TO STATION/REACH:
DRAINAGE AREA: DESIGN FREQUENCY:

****
INPUT PARAMETERS
****

Channel Discharge : 13.4 cfs (.38 m^3/s)
Peak Flow Period : 2 hours
Channel Slope : 0.013 ft/ft (0.013 m/m)
Channel Bottom Width : 10.0 ft (3.05 m)
Left Side Slope : 3:1
Right Side Slope : 3:1

Channel Lining : Unreinforced Vegetation Sod <50%
Permi. Shear(Tp) :2.16 psf (103.4 Pa)
Phase = 1
Class = E Vegetation
Soil = Clay Loam
Allowable Soil Shear(Ta):0.05 psf (2.39400003567338 Pa)

****
CALCULATIONS
****

Initial Depth Estimate = 0.16 * (13.4 /(0.013^0.5))^0.375 = 0.96 ft (.29 m)
Final Channel Depth (after 10 iterations) = .25 ft (0.08 m)
Flow Area = (10.0 * 0.3)+(0.5 *0.25^2 * (3.0+3.0)) = 2.7 sq.ft (0.3 m^2)
Wet Per. =10.0 +(0.3*(((3.0^2)+1)^.5 +((3.0^2)+1)^.5)) = 11.6 ft (3.5 m)
Hydraulic Radius = (2.7 / 11.6) = 0.2 ft (0.1 m)
Channel Velocity =(1.486/0.013)*(0.2^0.667)*(0.013^.5) = 4.9 fps (1.5 m/s)

Channel Effective Manning's Roughness = 0.013
Calculated Shear (Td) = 62.4 * 0.25 * 0.013 = 0.20 psf (9.8 Pa)
Safety Factor = (Tp/Td) = (2.16 /0.20) = 10.57

Effective Stress on Soil (Te)=0.2*(1-0.44)*(0.0156/0.013)^2 =0.16 psf (7.9 Pa)
Safety Factor = (Ta/Te) = (0.05 /0.165) = 0.30
"

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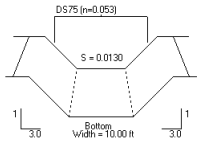
HYDRAULIC RESULTS

Discharge (cfs)	Peak Flow Period (hrs)	Velocity (fps)	Area (sq.ft)	Hydraulic Radius(ft)	Normal Depth (ft)
13.4	2.0	1.99	6.74	0.49	0.58



Not to Scale

LINER RESULTS

Reach	Matting Type	Stability Analysis	Vegetation Characteristics				Permissible Shear Stress (psf)	Calculated Shear Stress (psf)	Safety Factor	Remarks
	Staple Pattern		Phase	Class	Type	Density				
Straight	DS75	Unvegetated					1.55	0.47	3.32	STABLE
	Staple D									

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PROJECT NAME: Wilshire Hills PROJECT NO.: 15925
COMPUTED BY: DATE: 10/12/2023
FROM STATION/REACH: TO STATION/REACH:
DRAINAGE AREA: DESIGN FREQUENCY:

****
INPUT PARAMETERS
****

Channel Discharge : 13.4 cfs (.38 m^3/s)
Peak Flow Period : 2 hours
Channel Slope : 0.013 ft/ft (0.013 m/m)
Channel Bottom Width : 10.0 ft (3.05 m)
Left Side Slope : 3:1
Right Side Slope : 3:1

Channel Lining : DS75 Staple D
Permi. Shear(Tp) :1.55 psf (74.2 Pa)
Phase = 0

****
CALCULATIONS
****

Initial Depth Estimate = 0.16 * (13.4 /(0.013^0.5))^0.375 = 0.96 ft (.29 m)
Final Channel Depth (after 9 iterations) = .58 ft (0.18 m)
Flow Area = (10.0 * 0.6)+(0.5 *0.58^2 * (3.0+3.0)) = 6.7 sq.ft (0.6 m^2)
Wet Per. =10.0 +(0.6*(((3.0^2)+1)^.5 +((3.0^2)+1)^.5)) = 13.6 ft (4.2 m)
Hydraulic Radius = (6.7 / 13.6) = 0.5 ft (0.2 m)
Channel Velocity =(1.486/0.053)*(0.5^0.667)*(0.013^.5) = 2.0 fps (0.6 m/s)

Channel Effective Manning's Roughness = 0.053
Calculated Shear (Td) = 62.4 * 0.58 * 0.013 = 0.47 psf (22.3 Pa)
Safety Factor = (Tp/Td) = (1.55 /0.47) = 3.32

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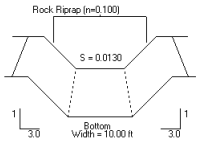
HYDRAULIC RESULTS

Discharge (cfs)	Peak Flow Period (hrs)	Velocity (fps)	Area (sq.ft)	Hydraulic Radius(ft)	Normal Depth (ft)
13.4	2.0	1.30	10.27	0.68	0.82



Not to Scale

LINER RESULTS

Reach	Matting Type / Staple Pattern	Stability Analysis	Vegetation Characteristics: Phase	Class	Type	Density	Permissible Shear Stress (psf)	Calculated Shear Stress (psf)	Safety Factor	Remarks
Straight	Rock Riprap	Unvegetated					3.33	0.67	4.99	STABLE
	10in									

"**********
NORTH AMERICAN GREEN EROSION CONTROL MATERIALS DESIGN SOFTWARE VERSION 4.2
NORTH AMERICAN GREEN CHANNEL PROTECTION - ENGLISH/S.I.
USER SPECIFIED CHANNEL LINING BACK-UP COMPUTATIONS
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PROJECT NAME: Wilshire Hills PROJECT NO.: 15925
COMPUTED BY: DATE: 10/12/2023
FROM STATION/REACH: TO STATION/REACH:
DRAINAGE AREA: DESIGN FREQUENCY:

****
INPUT PARAMETERS
****

Channel Discharge : 13.4 cfs (.38 m^3/s)
Peak Flow Period : 2 hours
Channel Slope : 0.013 ft/ft (0.013 m/m)
Channel Bottom Width : 10.0 ft (3.05 m)
Left Side Slope : 3:1
Right Side Slope : 3:1

Channel Lining : Rock Riprap 10in
Permi. Shear(Tp) :3.33 psf (159.6 Pa)
Phase = 0

****
CALCULATIONS
****

Initial Depth Estimate = 0.16 * (13.4 /(0.013^0.5))^0.375 = 0.96 ft (.29 m)
Final Channel Depth (after 9 iterations) = .82 ft (0.25 m)
Flow Area = (10.0 * 0.8)+(0.5 *0.82^2 * (3.0+3.0)) = 10.3 sq.ft (1.0 m^2)
Wet Per. =10.0 +(0.8*(((3.0^2)+1)^.5 +((3.0^2)+1)^.5)) = 15.2 ft (4.6 m)
Hydraulic Radius = (10.3 / 15.2) = 0.7 ft (0.2 m)
Channel Velocity =(1.486/0.100)*(0.7^0.667)*(0.013^.5) = 1.3 fps (0.4 m/s)

Channel Effective Manning's Roughness = 0.100
Calculated Shear (Td) = 62.4 * 0.82 * 0.013 = 0.67 psf (32.0 Pa)
Safety Factor = (Tp/Td) = (3.33 /0.67) = 4.99

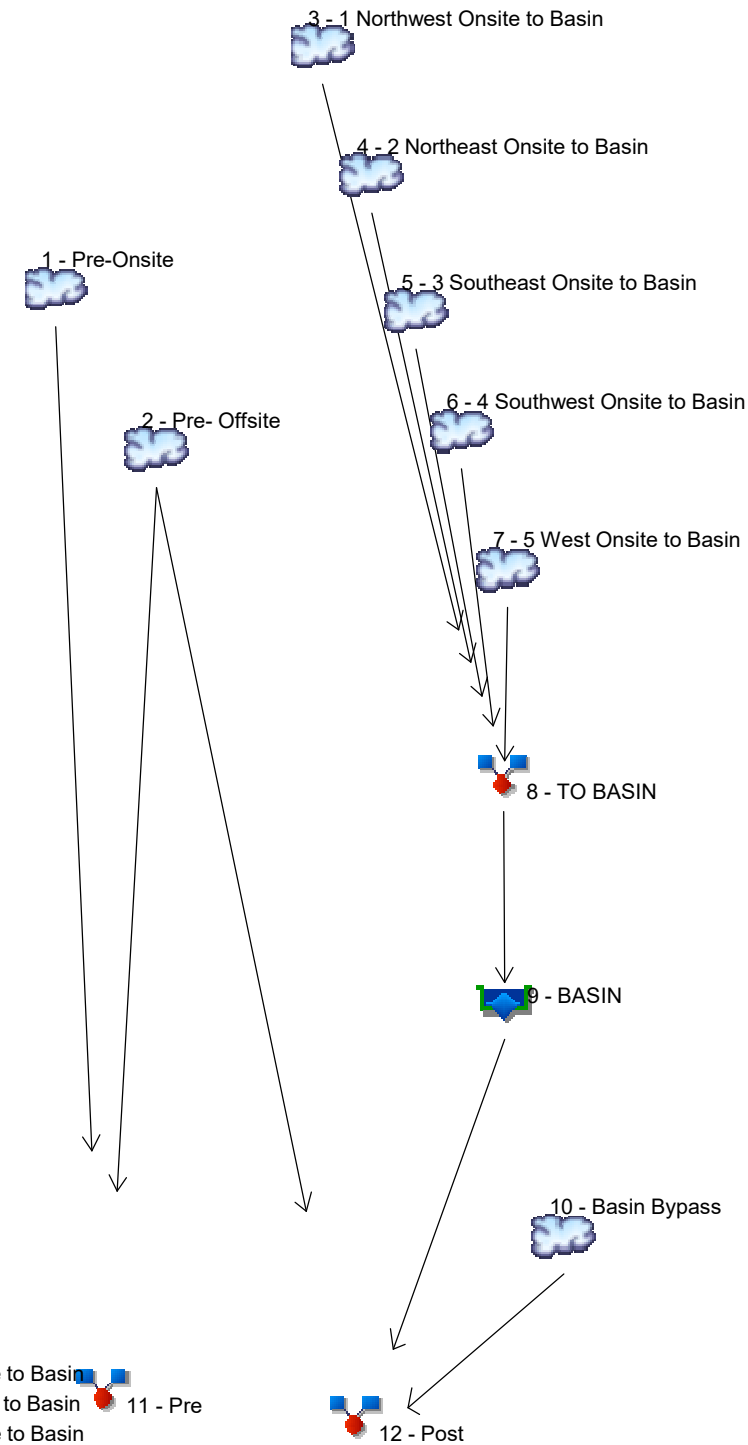
"

	Outlet Pipe Diameter	Discharge (ft3/sec)	Width Top of Flow	Width Base of Flow	Length	D50 Size	Thickness
FES 4	24”	40.58	6 ft	12 ft	15 ft	5	1 ft
FES 40	36”	1.34	9 ft	30 ft	21 ft	20	2 ft
OCS 2	Discharge into existing concrete erosion control area						

APPENDIX B:
STORMWATER DETENTION CALCULATIONS

Hydraflow Table of Contents

Watershed Model Schematic



Legend

Hyd.	Origin	Description
1	SCS Runoff	Pre-Onsite
2	SCS Runoff	Pre- Offsite
3	SCS Runoff	1 Northwest Onsite to Basin
4	SCS Runoff	2 Northeast Onsite to Basin
5	SCS Runoff	3 Southeast Onsite to Basin
6	SCS Runoff	4 Southwest Onsite to Basin
7	SCS Runoff	5 West Onsite to Basin
8	Combine	TO BASIN
9	Reservoir	BASIN
10	SCS Runoff	Basin Bypass
11	Combine	Pre
12	Combine	Post

Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)							Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	------	-------	10.59	-------	-------	49.39	-------	-------	118.20	Pre-Onsite
2	SCS Runoff	------	-------	3.023	-------	-------	14.88	-------	-------	35.92	Pre- Offsite
3	SCS Runoff	------	-------	5.273	-------	-------	11.81	-------	-------	20.88	1 Northwest Onsite to Basin
4	SCS Runoff	------	-------	13.37	-------	-------	27.66	-------	-------	47.22	2 Northeast Onsite to Basin
5	SCS Runoff	------	-------	13.08	-------	-------	27.04	-------	-------	46.17	3 Southeast Onsite to Basin
6	SCS Runoff	------	-------	4.297	-------	-------	8.859	-------	-------	15.10	4 Southwest Onsite to Basin
7	SCS Runoff	------	-------	7.062	-------	-------	16.17	-------	-------	28.87	5 West Onsite to Basin
8	Combine	3, 4, 5, 6, 7	-------	42.70	-------	-------	90.37	-------	-------	156.50	TO BASIN
9	Reservoir	8	-------	7.229	-------	-------	22.17	-------	-------	45.78	BASIN
10	SCS Runoff	------	-------	2.248	-------	-------	5.796	-------	-------	10.96	Basin Bypass
11	Combine	1, 2,	-------	12.96	-------	-------	62.47	-------	-------	148.91	Pre
12	Combine	2, 9, 10,	-------	9.807	-------	-------	35.30	-------	-------	75.68	Post

Hydrograph Summary Report

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

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	10.59	2	724	37,148	------	------	------	Pre-Onsite
2	SCS Runoff	3.023	2	732	14,805	------	------	------	Pre- Offsite
3	SCS Runoff	5.273	2	722	14,805	------	------	------	1 Northwest Onsite to Basin
4	SCS Runoff	13.37	2	724	42,351	------	------	------	2 Northeast Onsite to Basin
5	SCS Runoff	13.08	2	724	41,408	------	------	------	3 Southeast Onsite to Basin
6	SCS Runoff	4.297	2	722	12,257	------	------	------	4 Southwest Onsite to Basin
7	SCS Runoff	7.062	2	722	19,803	------	------	------	5 West Onsite to Basin
8	Combine	42.70	2	724	130,625	3, 4, 5, 6, 7	------	------	TO BASIN
9	Reservoir	7.229	2	746	130,623	8	916.15	57,710	BASIN
10	SCS Runoff	2.248	2	718	4,511	------	------	------	Basin Bypass
11	Combine	12.96	2	726	51,953	1, 2,	------	------	Pre
12	Combine	9.807	2	738	149,939	2, 9, 10,	------	------	Post

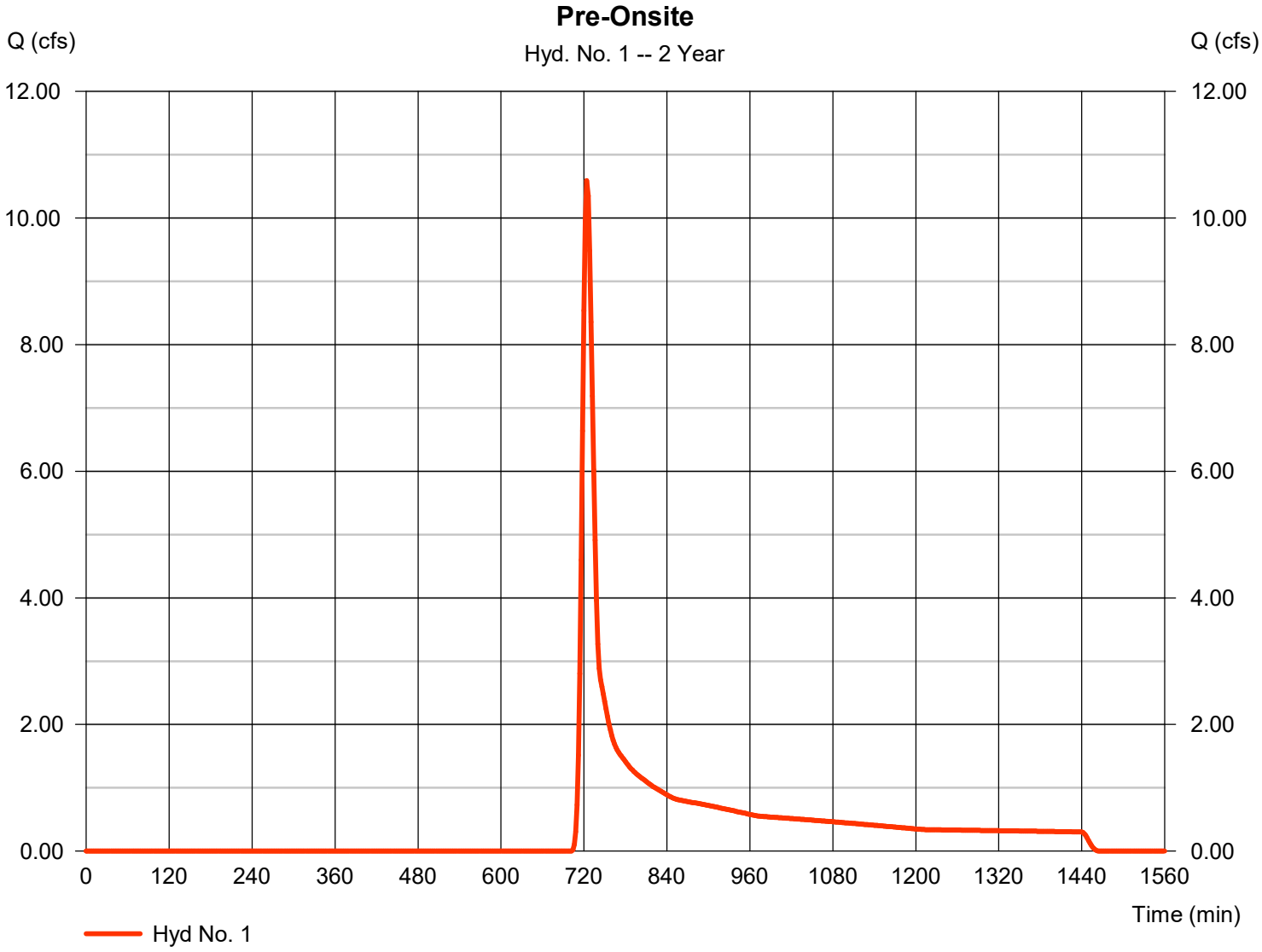
Hydrograph Report

Hyd. No. 1

Pre-Onsite

Hydrograph type	= SCS Runoff	Peak discharge	= 10.59 cfs
Storm frequency	= 2 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 37,148 cuft
Drainage area	= 19.000 ac	Curve number	= 65*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 15.30 min
Total precip.	= 3.10 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(15.510 x 74)] / 19.000



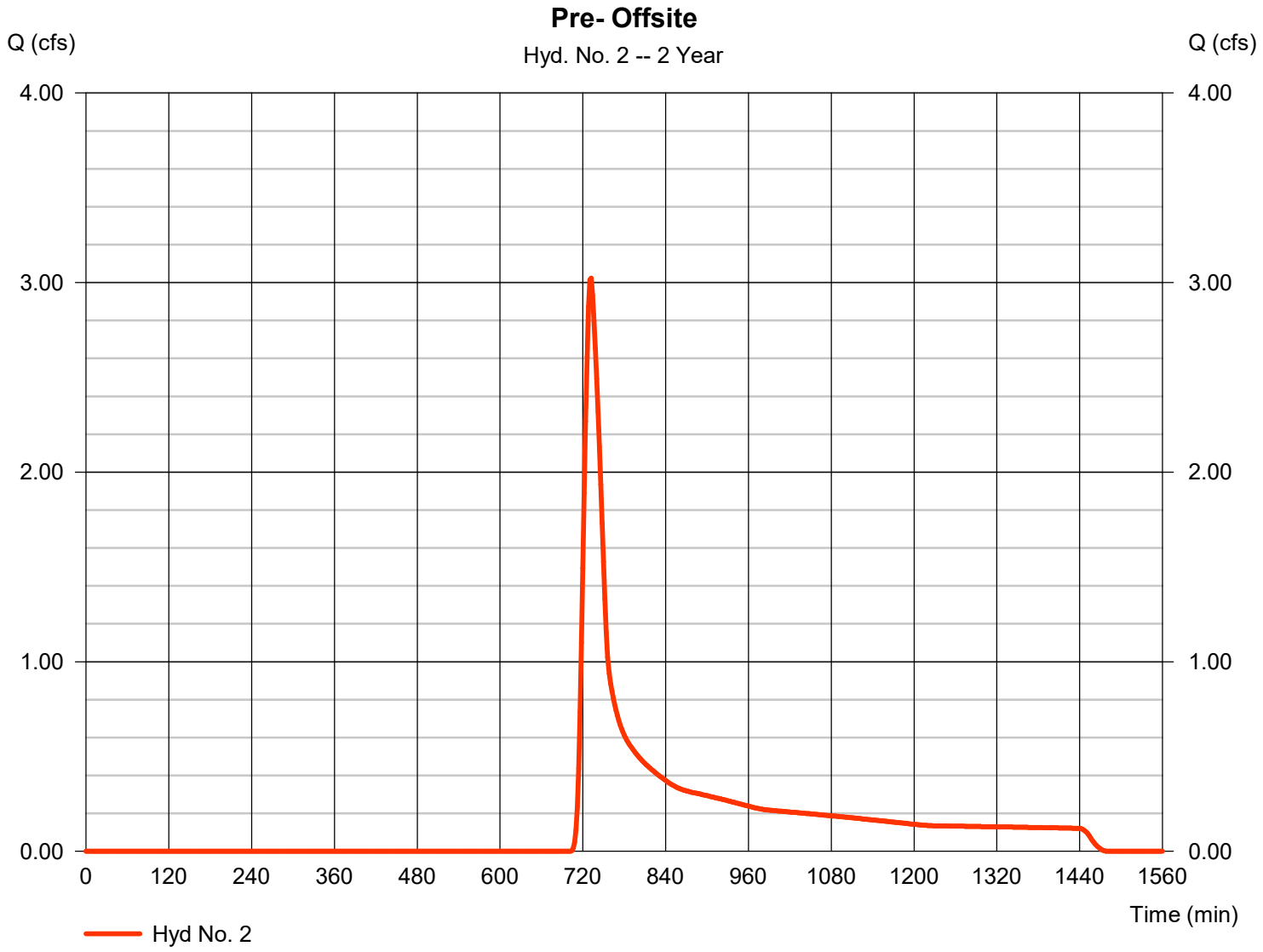
Hydrograph Report

Hyd. No. 2

Pre- Offsite

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.023 cfs
Storm frequency	=	2 yrs	Time to peak	=	732 min
Time interval	=	2 min	Hyd. volume	=	14,805 cuft
Drainage area	=	7.500 ac	Curve number	=	65*
Basin Slope	=	5.0 %	Hydraulic length	=	100 ft
Tc method	=	TR55	Time of conc. (Tc)	=	25.20 min
Total precip.	=	3.10 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(7.500 x 65)] / 7.500



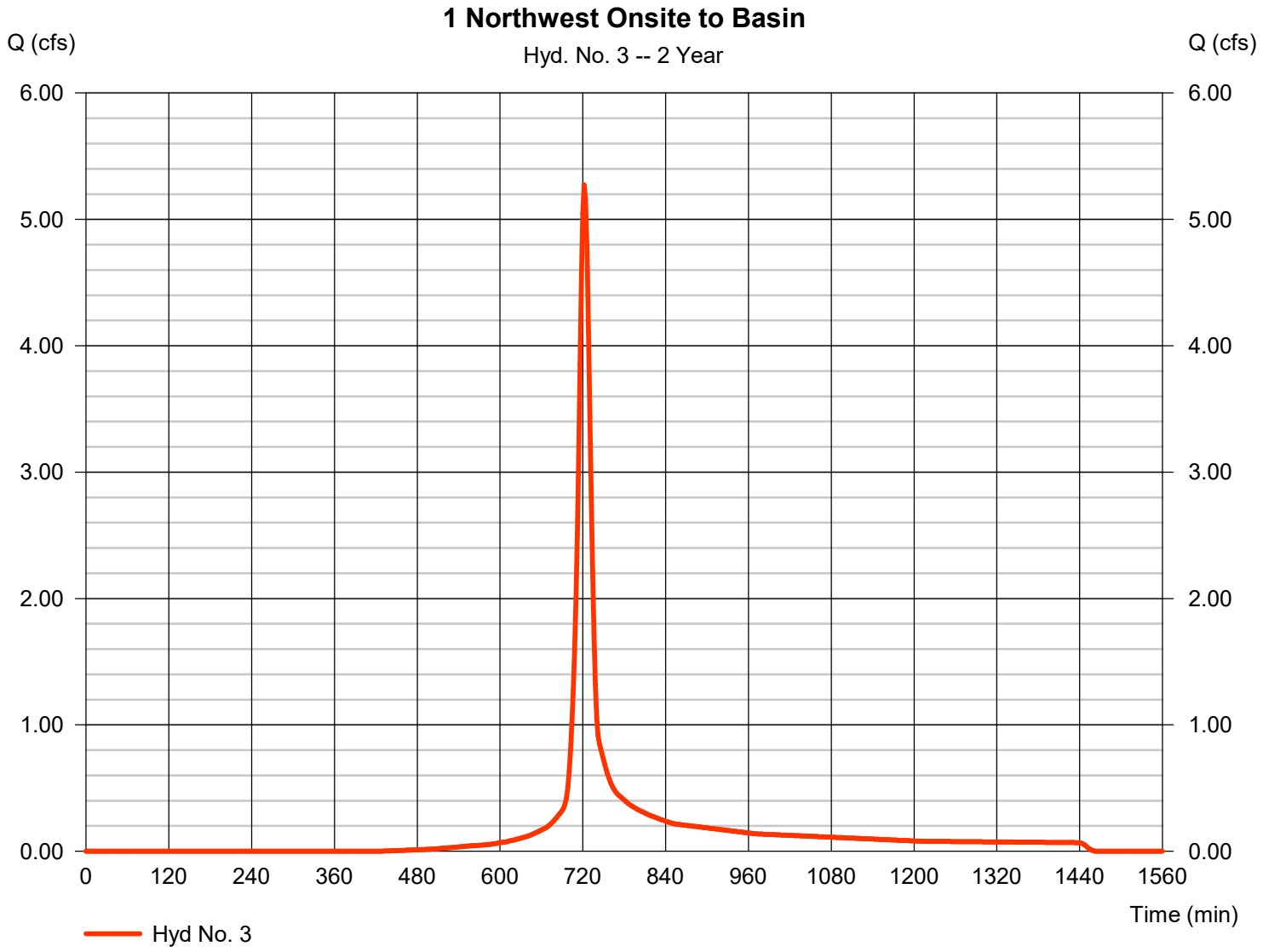
Hydrograph Report

Hyd. No. 3

1 Northwest Onsite to Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	5.273 cfs
Storm frequency	=	2 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	14,805 cuft
Drainage area	=	2.290 ac	Curve number	=	87*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	13.90 min
Total precip.	=	3.10 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(1.180 x 98) + (1.110 x 74)] / 2.290



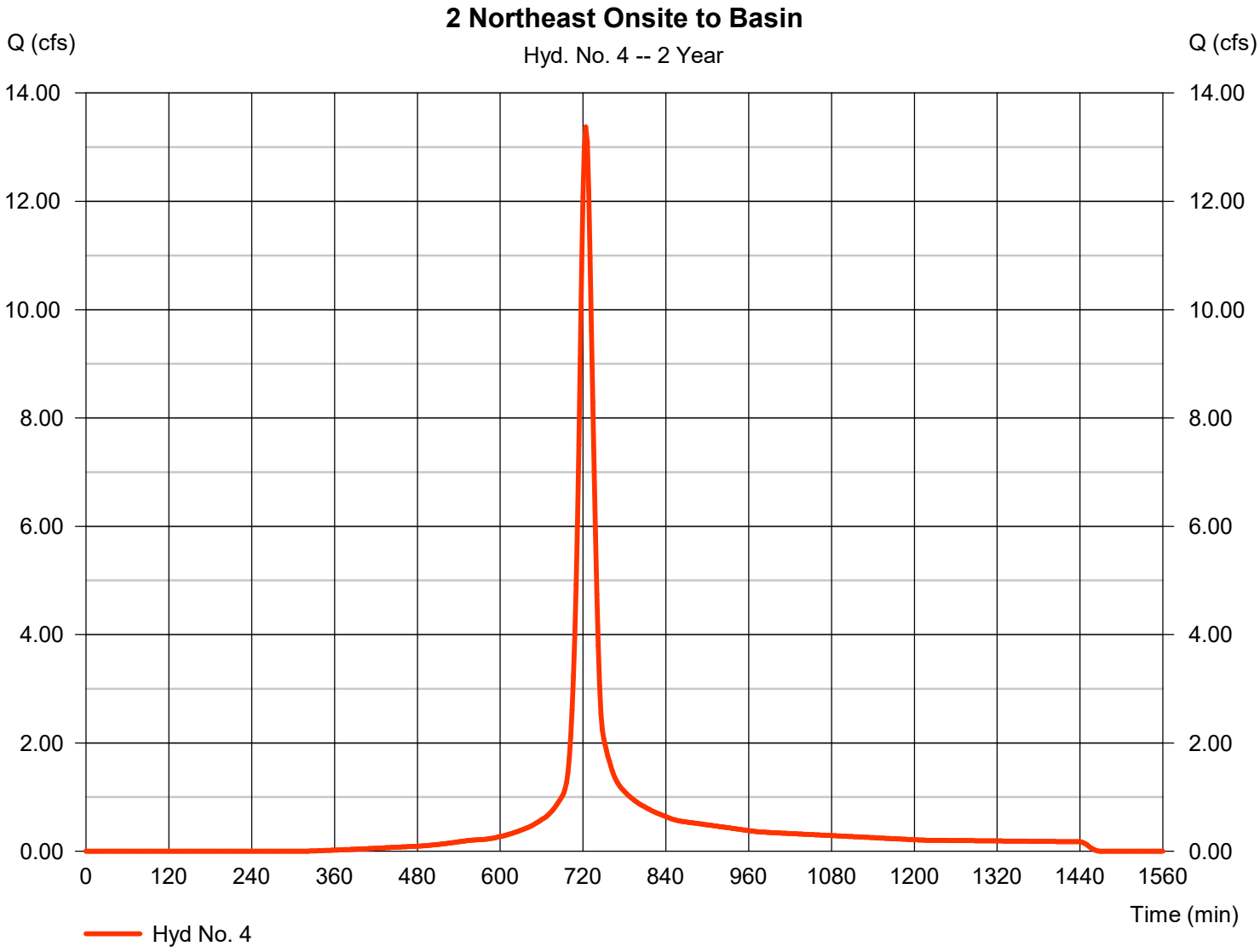
Hydrograph Report

Hyd. No. 4

2 Northeast Onsite to Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	13.37 cfs
Storm frequency	=	2 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	42,351 cuft
Drainage area	=	5.390 ac	Curve number	=	91*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	19.90 min
Total precip.	=	3.10 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(3.740 x 98) + (1.650 x 74)] / 5.390



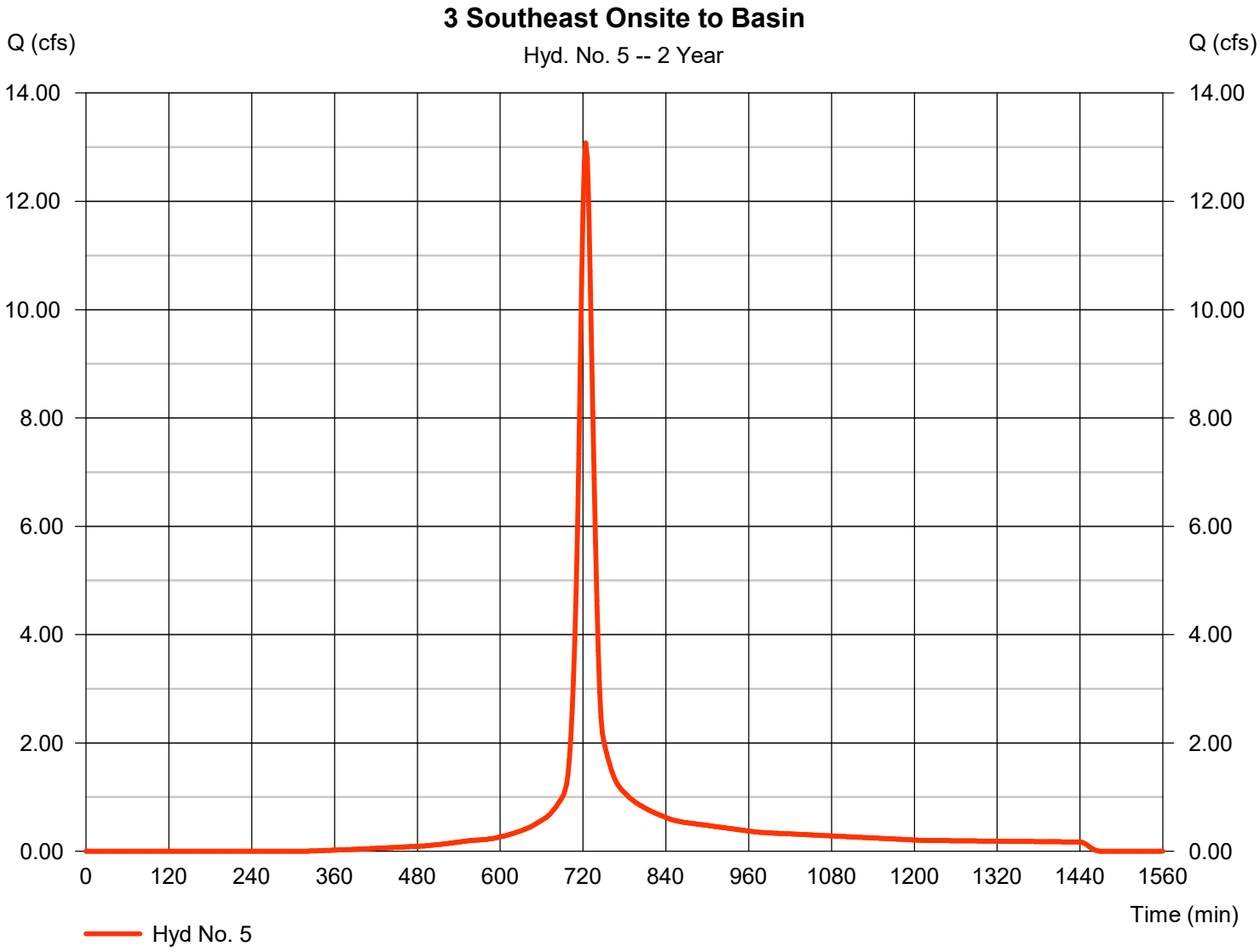
Hydrograph Report

Hyd. No. 5

3 Southeast Onsite to Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	13.08 cfs
Storm frequency	=	2 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	41,408 cuft
Drainage area	=	5.270 ac	Curve number	=	91*
Basin Slope	=	5.0 %	Hydraulic length	=	200 ft
Tc method	=	TR55	Time of conc. (Tc)	=	18.70 min
Total precip.	=	3.10 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(4.570 x 98) + (1.700 x 74)] / 5.270



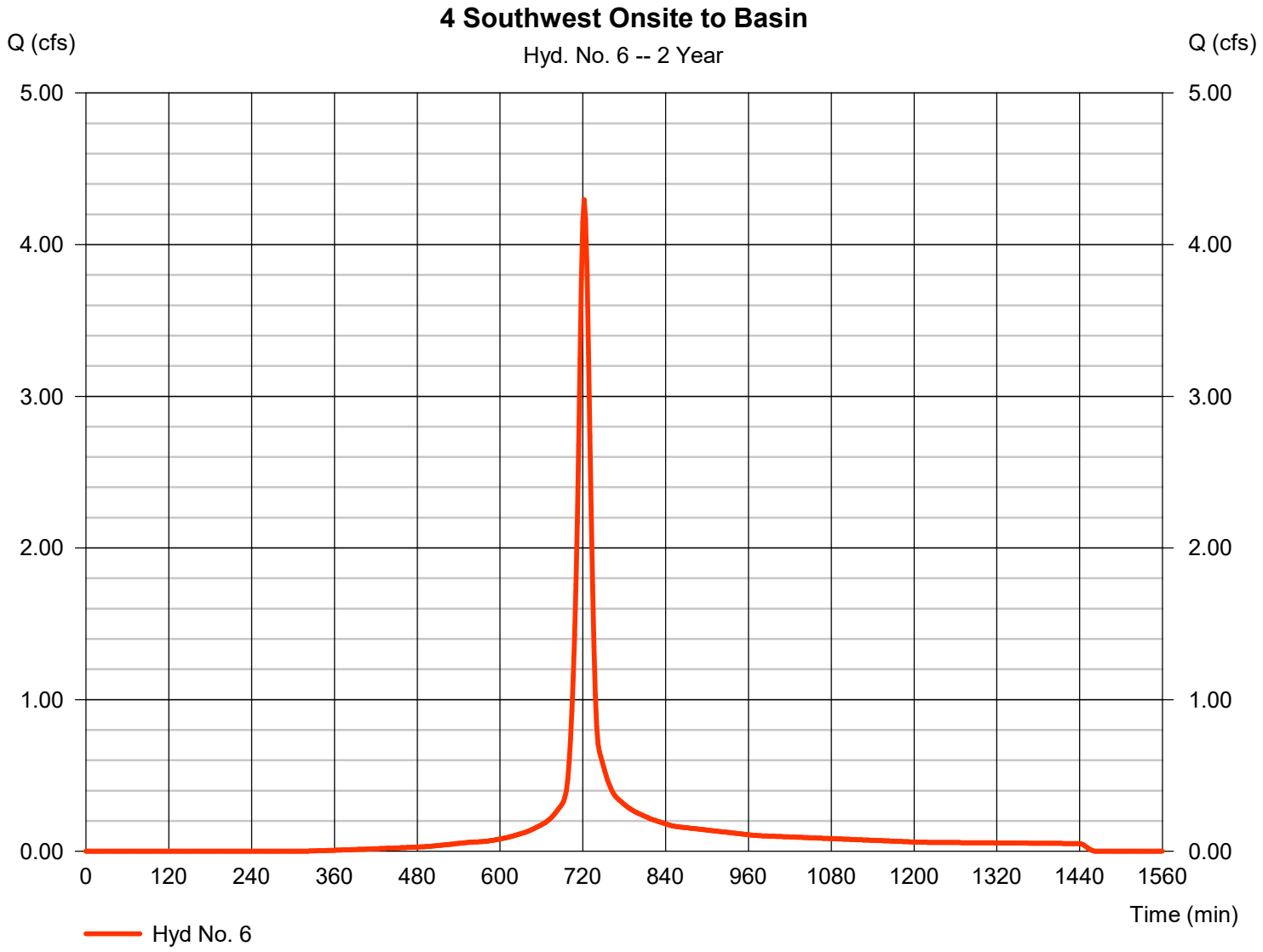
Hydrograph Report

Hyd. No. 6

4 Southwest Onsite to Basin

Hydrograph type	= SCS Runoff	Peak discharge	= 4.297 cfs
Storm frequency	= 2 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 12,257 cuft
Drainage area	= 1.600 ac	Curve number	= 91*
Basin Slope	= 5.0 %	Hydraulic length	= 126 ft
Tc method	= TR55	Time of conc. (Tc)	= 14.40 min
Total precip.	= 3.10 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.120 x 98) + (0.480 x 74)] / 1.600



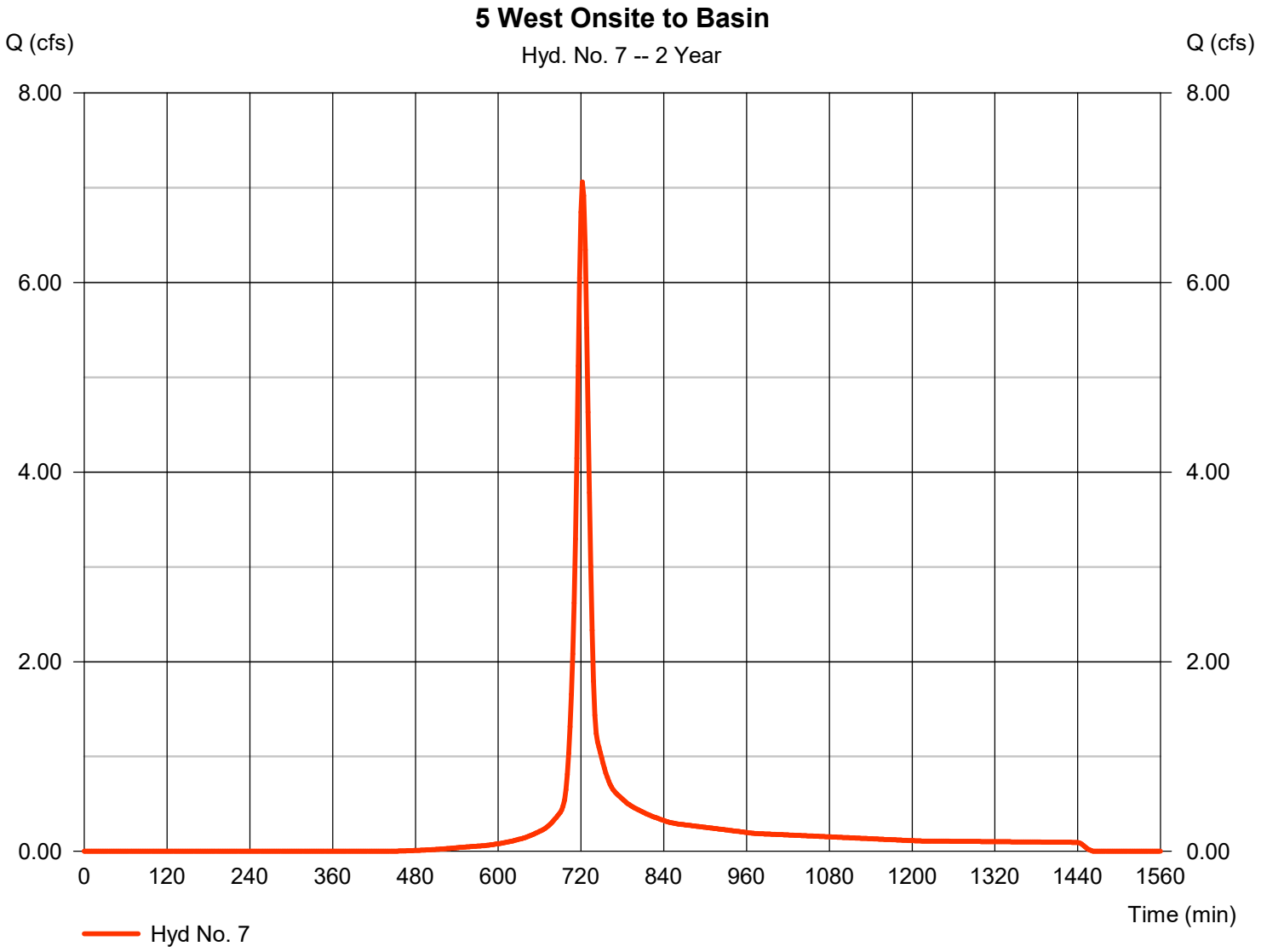
Hydrograph Report

Hyd. No. 7

5 West Onsite to Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	7.062 cfs
Storm frequency	=	2 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	19,803 cuft
Drainage area	=	3.200 ac	Curve number	=	86*
Basin Slope	=	5.0 %	Hydraulic length	=	100 ft
Tc method	=	TR55	Time of conc. (Tc)	=	14.20 min
Total precip.	=	3.10 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(1.650 x 98) + (1.550 x 74)] / 3.200

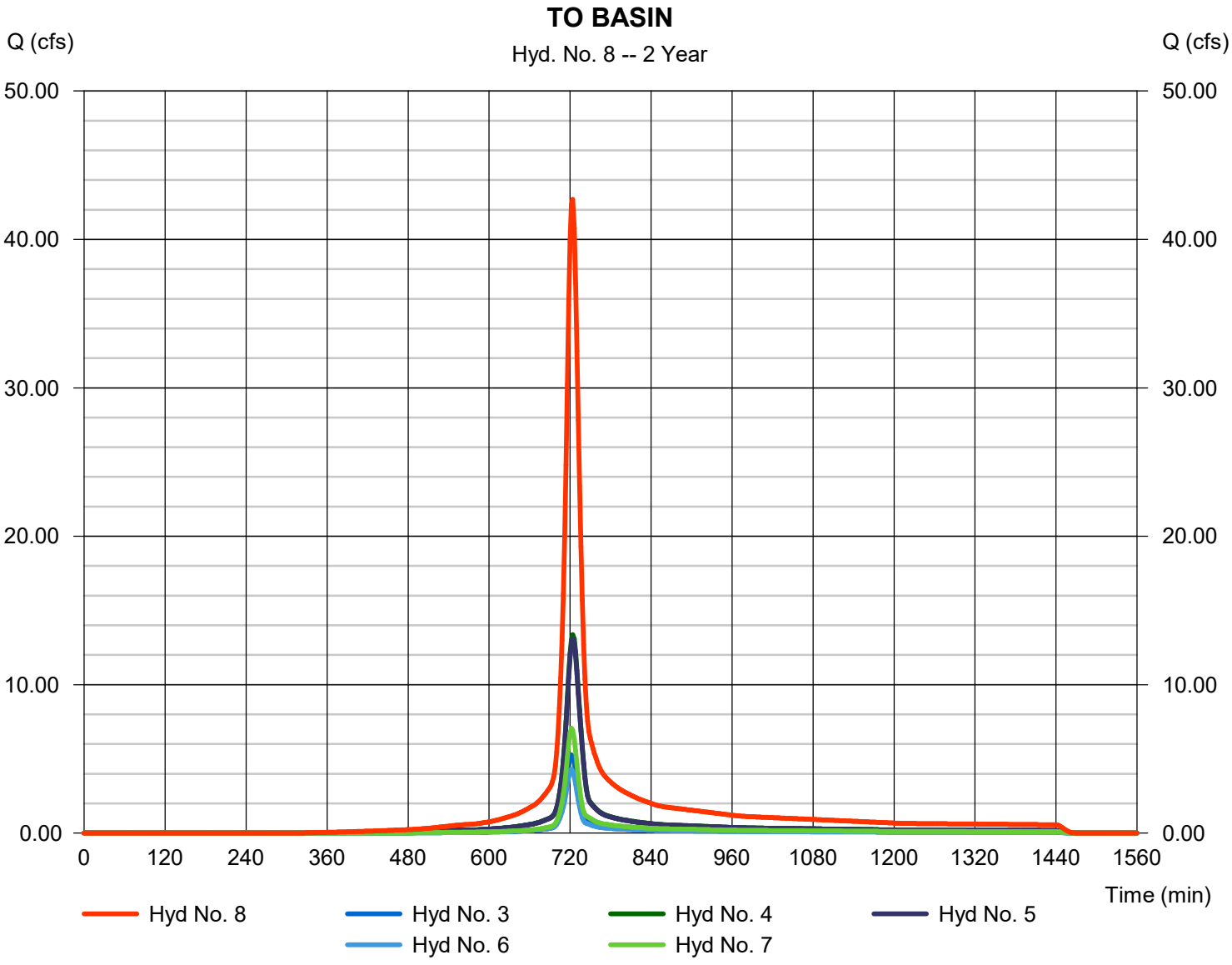


Hydrograph Report

Hyd. No. 8

TO BASIN

Hydrograph type	= Combine	Peak discharge	= 42.70 cfs
Storm frequency	= 2 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 130,625 cuft
Inflow hyds.	= 3, 4, 5, 6, 7	Contrib. drain. area	= 17.750 ac



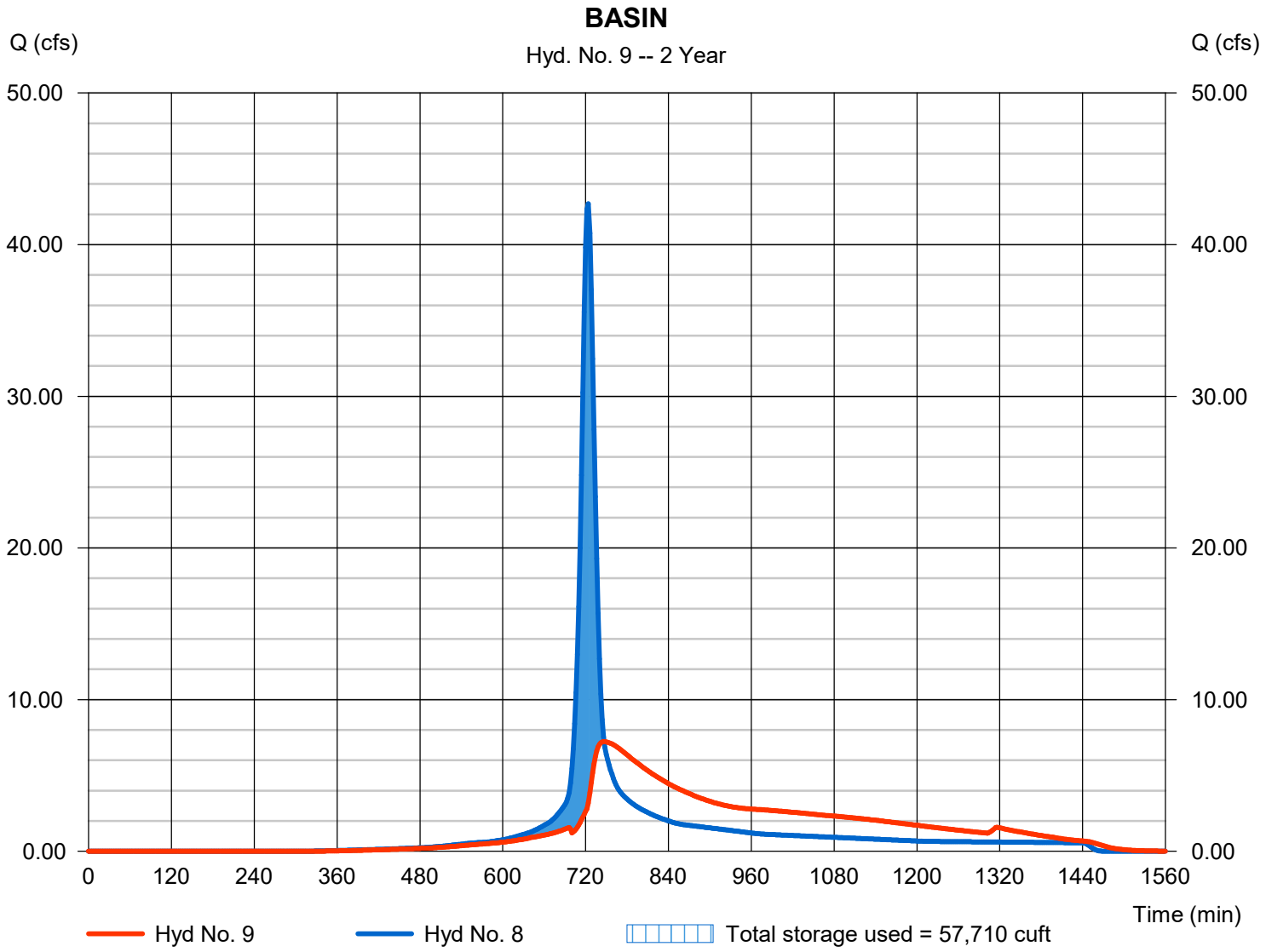
Hydrograph Report

Hyd. No. 9

BASIN

Hydrograph type	=	Reservoir	Peak discharge	=	7.229 cfs
Storm frequency	=	2 yrs	Time to peak	=	746 min
Time interval	=	2 min	Hyd. volume	=	130,623 cuft
Inflow hyd. No.	=	8 - TO BASIN	Max. Elevation	=	916.15 ft
Reservoir name	=	Regional Detention	Max. Storage	=	57,710 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Regional Detention

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 911.15 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	911.50	2,950	0	0
1.00	912.00	8,215	5,362	5,362
2.00	913.00	10,240	9,208	14,570
3.00	914.00	12,395	11,299	25,869
4.00	915.00	14,530	13,447	39,316
5.00	916.00	16,800	15,650	54,966
6.00	917.00	19,230	18,000	72,966
7.00	918.00	21,750	20,475	93,441
8.00	919.00	24,400	23,060	116,501
9.00	920.00	27,055	25,713	142,214
10.00	921.00	29,880	28,453	170,667
11.00	922.00	32,636	31,245	201,912
12.00	923.00	35,521	34,065	235,977

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 60.00	8.00	Inactive	0.00
Span (in)	= 60.00	8.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 911.00	911.15	0.00	0.00
Length (ft)	= 95.30	0.00	0.00	0.00
Slope (%)	= 0.26	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

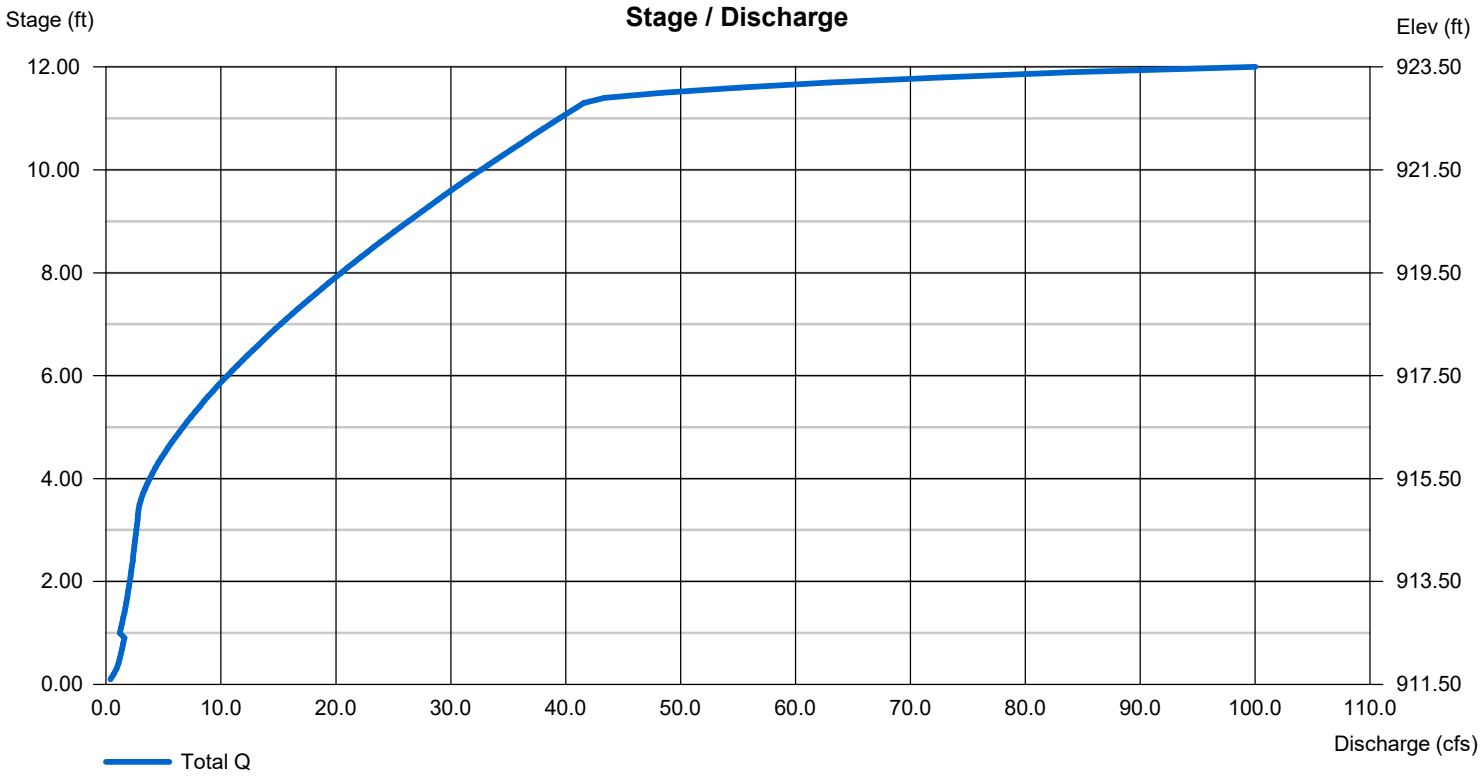
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 29.50	0.50	90.00	Inactive
Crest El. (ft)	= 922.35	914.42	922.94	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	Rect	Rect	Rect
Multi-Stage	= Yes	Yes	Yes	No

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

TW Elev. (ft) = 0.00

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



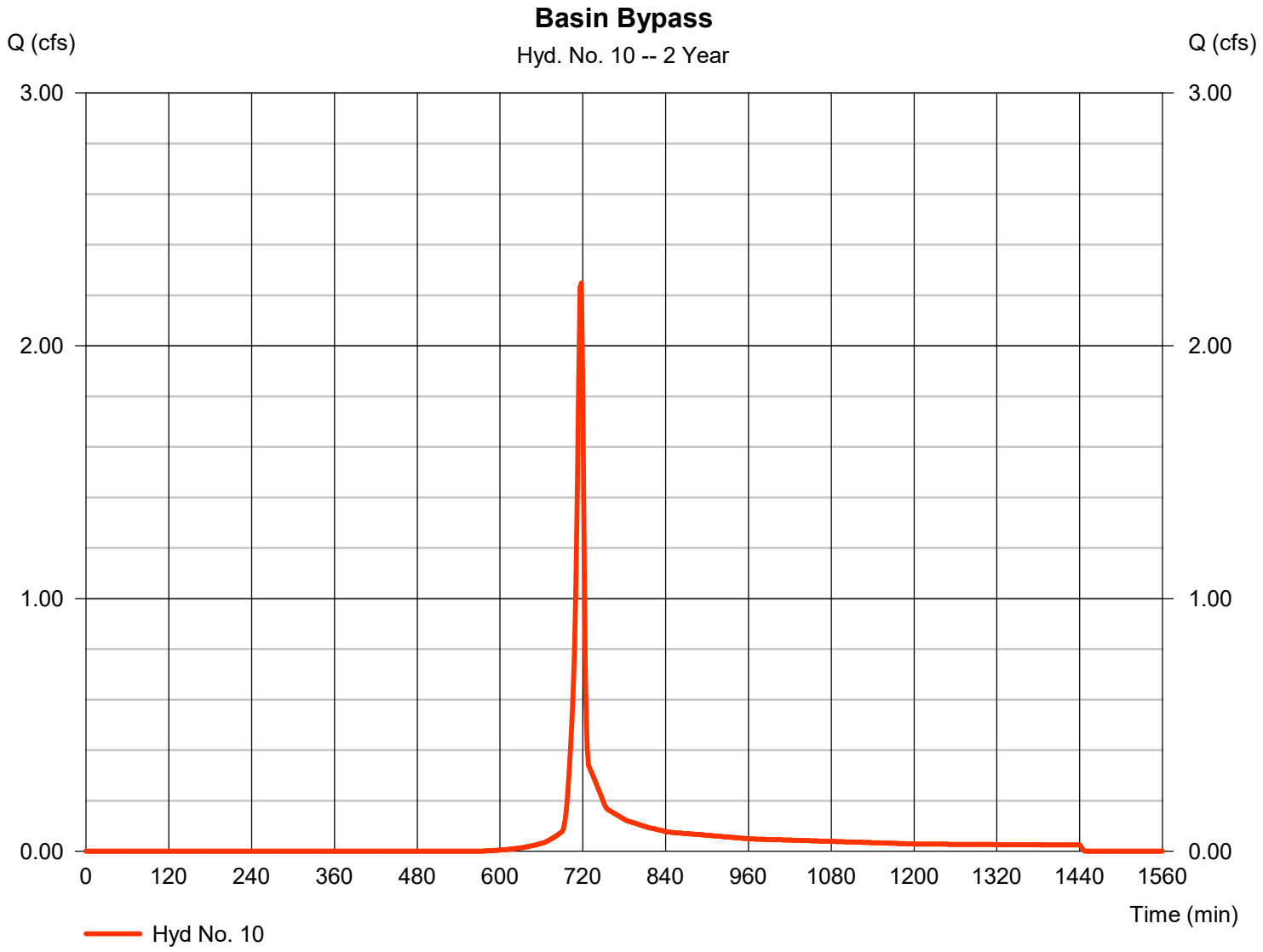
Hydrograph Report

Hyd. No. 10

Basin Bypass

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.248 cfs
Storm frequency	=	2 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	4,511 cuft
Drainage area	=	1.000 ac	Curve number	=	80*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	3.10 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.070 x 98) + (0.180 x 74)] / 1.000

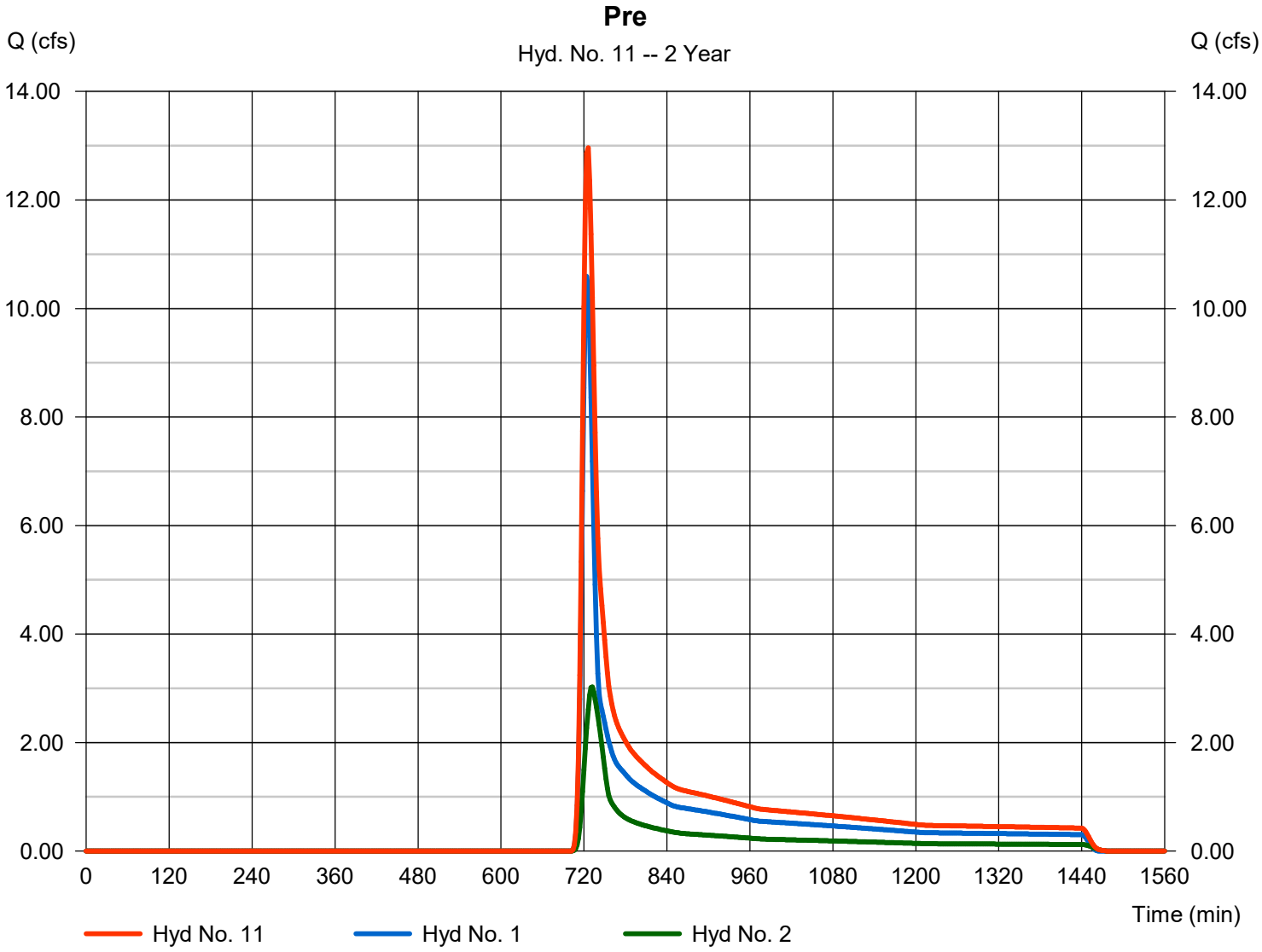


Hydrograph Report

Hyd. No. 11

Pre

Hydrograph type	= Combine	Peak discharge	= 12.96 cfs
Storm frequency	= 2 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 51,953 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 26.500 ac

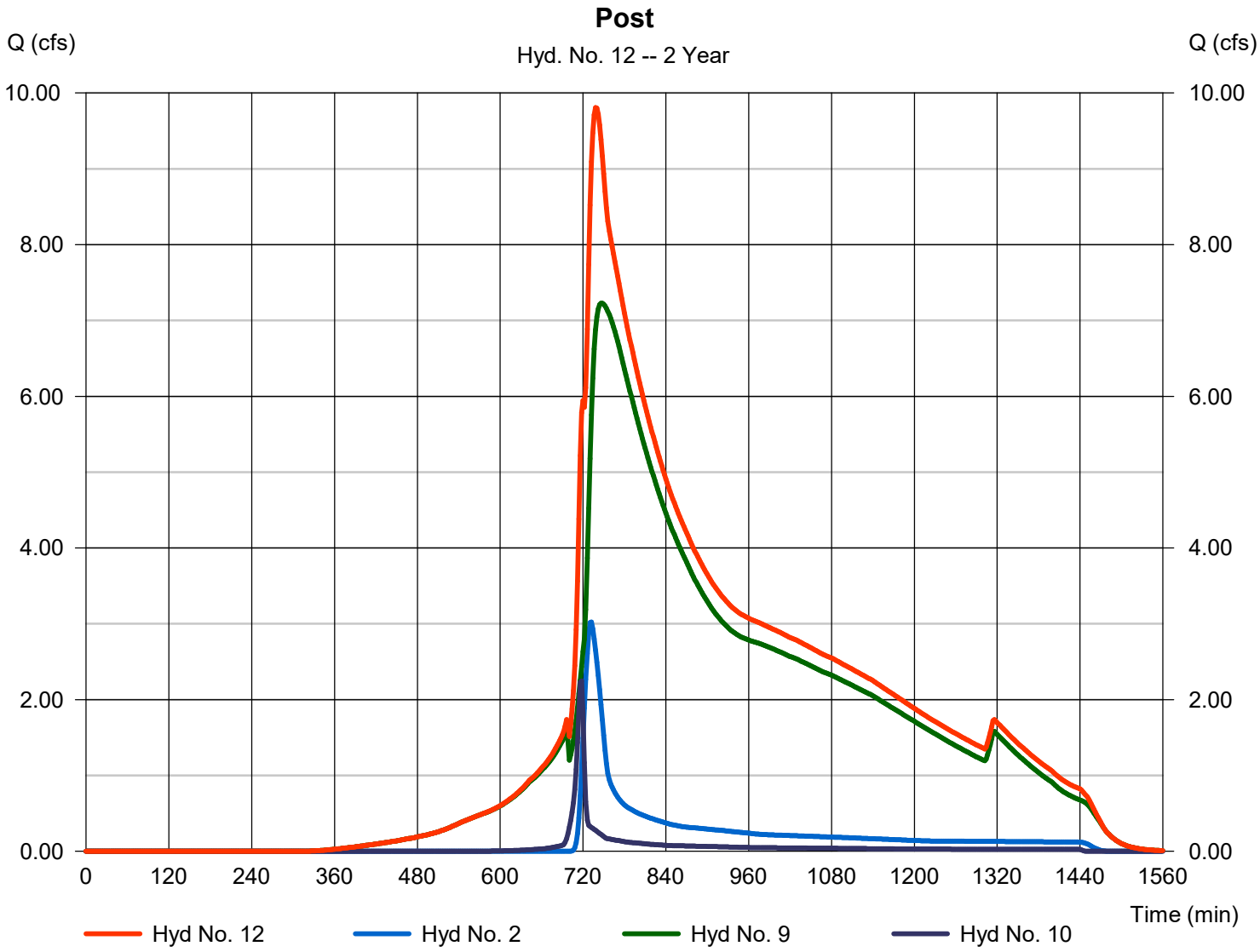


Hydrograph Report

Hyd. No. 12

Post

Hydrograph type	=	Combine	Peak discharge	=	9.807 cfs
Storm frequency	=	2 yrs	Time to peak	=	738 min
Time interval	=	2 min	Hyd. volume	=	149,939 cuft
Inflow hyds.	=	2, 9, 10	Contrib. drain. area	=	8.500 ac



Hydrograph Summary Report

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

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	49.39	2	722	142,181	------	------	------	Pre-Onsite
2	SCS Runoff	14.88	2	730	56,664	------	------	------	Pre- Offsite
3	SCS Runoff	11.81	2	722	34,058	------	------	------	1 Northwest Onsite to Basin
4	SCS Runoff	27.66	2	724	90,679	------	------	------	2 Northeast Onsite to Basin
5	SCS Runoff	27.04	2	724	88,660	------	------	------	3 Southeast Onsite to Basin
6	SCS Runoff	8.859	2	722	26,245	------	------	------	4 Southwest Onsite to Basin
7	SCS Runoff	16.17	2	722	46,396	------	------	------	5 West Onsite to Basin
8	Combine	90.37	2	722	286,037	3, 4, 5, 6, 7	------	------	TO BASIN
9	Reservoir	22.17	2	742	286,036	8	919.30	124,260	BASIN
10	SCS Runoff	5.796	2	716	11,859	------	------	------	Basin Bypass
11	Combine	62.47	2	724	198,845	1, 2,	------	------	Pre
12	Combine	35.30	2	734	354,559	2, 9, 10,	------	------	Post

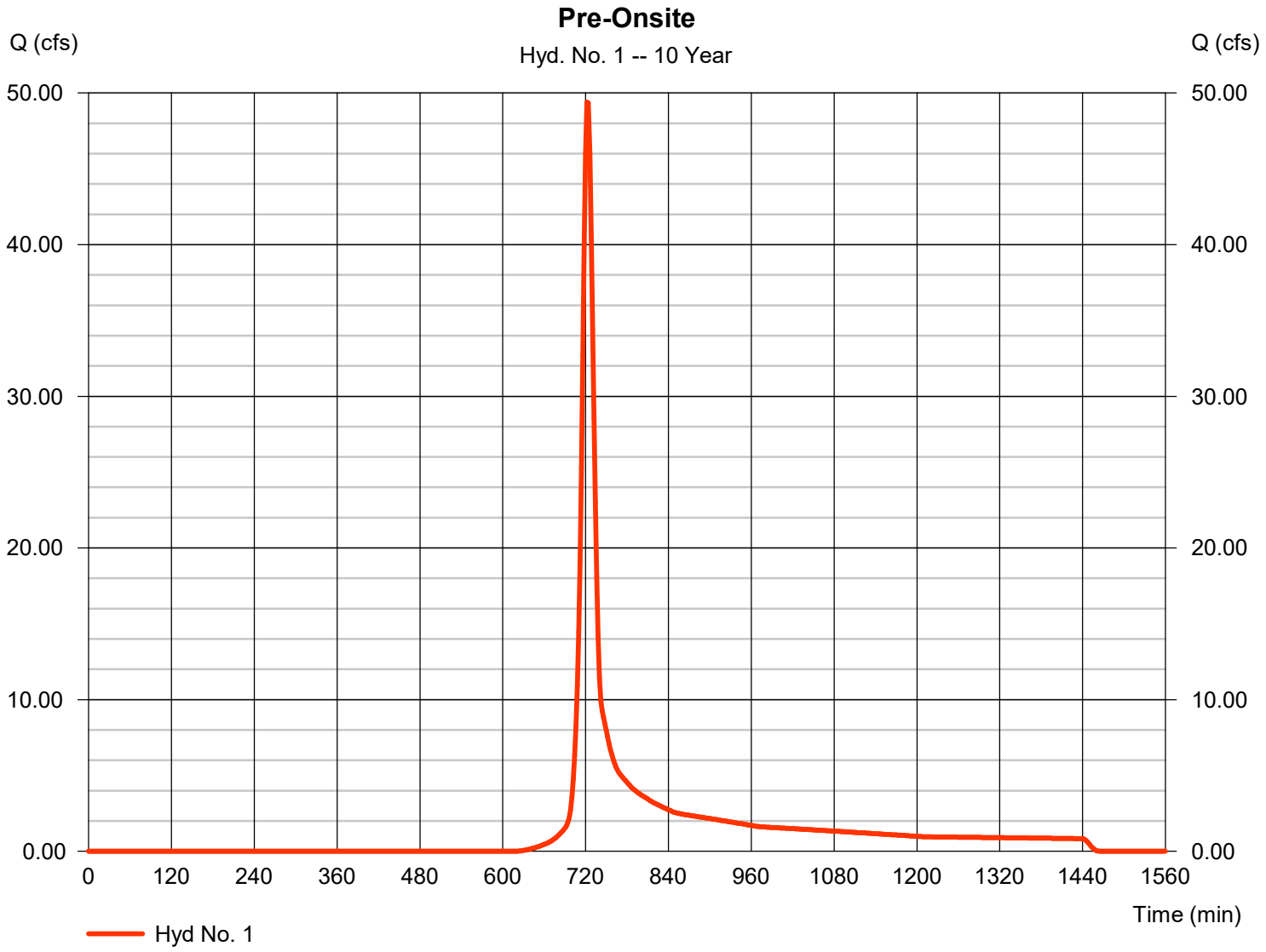
Hydrograph Report

Hyd. No. 1

Pre-Onsite

Hydrograph type	=	SCS Runoff	Peak discharge	=	49.39 cfs
Storm frequency	=	10 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	142,181 cuft
Drainage area	=	19.000 ac	Curve number	=	65*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	15.30 min
Total precip.	=	5.67 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(15.510 x 74)] / 19.000



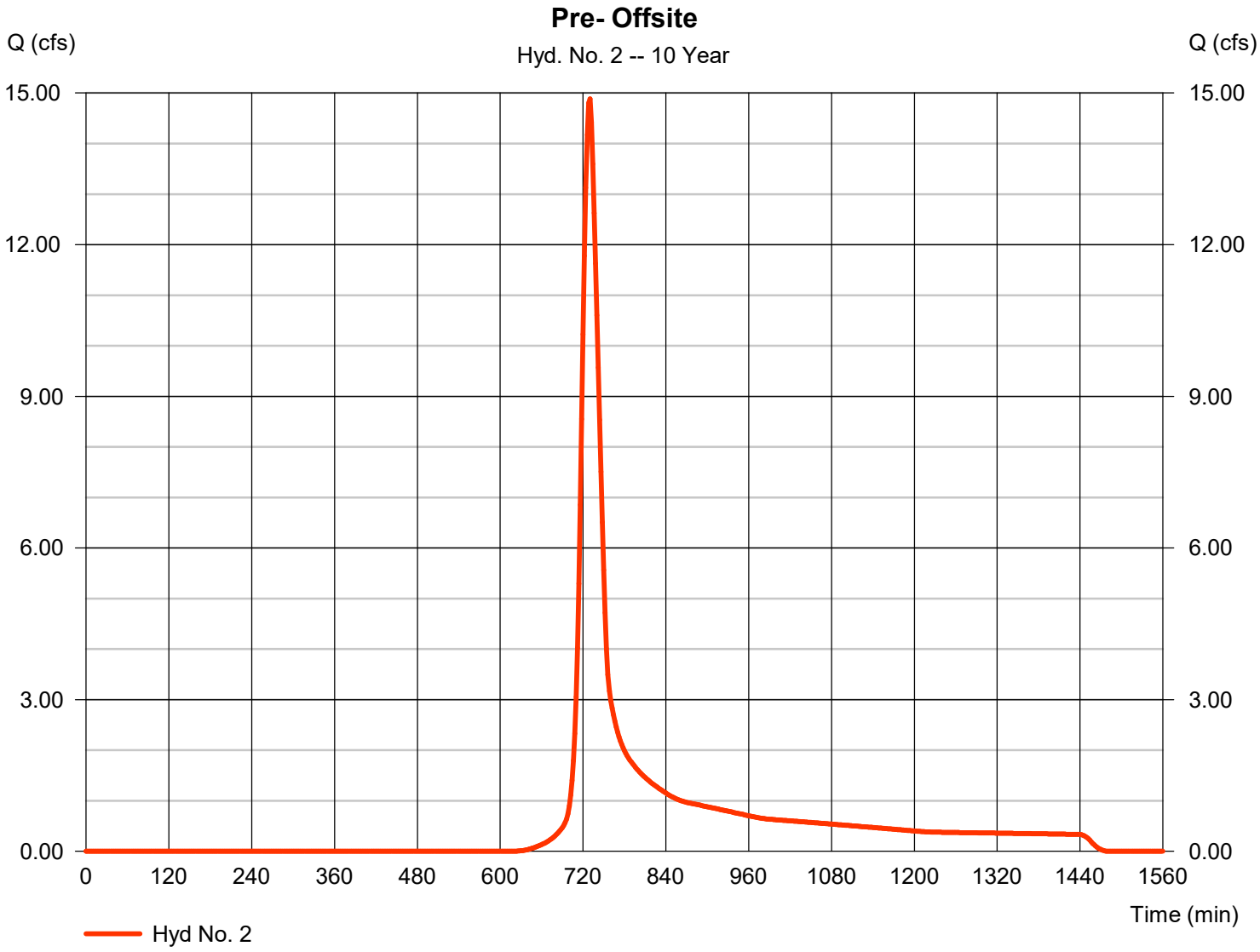
Hydrograph Report

Hyd. No. 2

Pre- Offsite

Hydrograph type	=	SCS Runoff	Peak discharge	=	14.88 cfs
Storm frequency	=	10 yrs	Time to peak	=	730 min
Time interval	=	2 min	Hyd. volume	=	56,664 cuft
Drainage area	=	7.500 ac	Curve number	=	65*
Basin Slope	=	5.0 %	Hydraulic length	=	100 ft
Tc method	=	TR55	Time of conc. (Tc)	=	25.20 min
Total precip.	=	5.67 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(7.500 x 65)] / 7.500



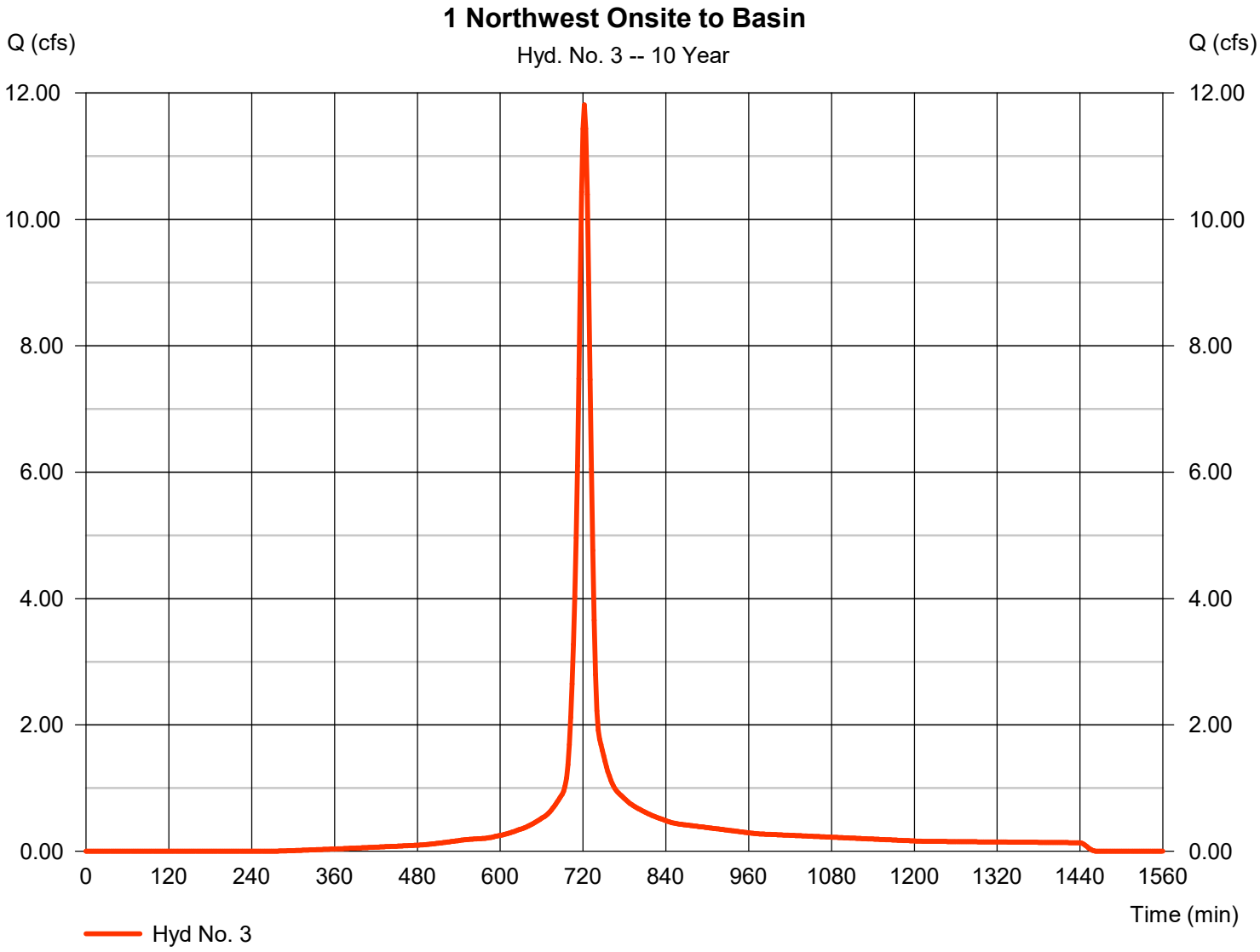
Hydrograph Report

Hyd. No. 3

1 Northwest Onsite to Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	11.81 cfs
Storm frequency	=	10 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	34,058 cuft
Drainage area	=	2.290 ac	Curve number	=	87*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	13.90 min
Total precip.	=	5.67 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(1.180 x 98) + (1.110 x 74)] / 2.290



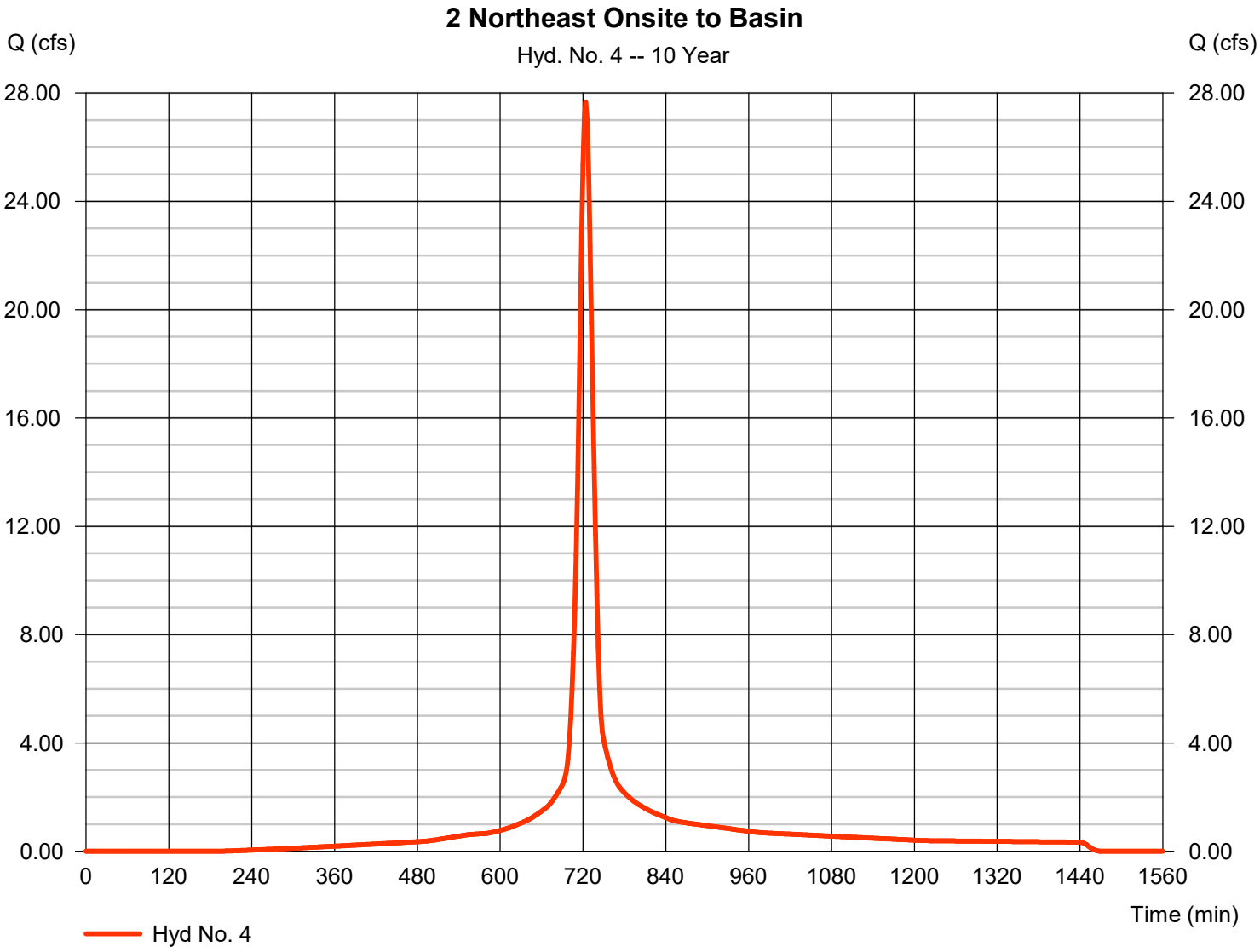
Hydrograph Report

Hyd. No. 4

2 Northeast Onsite to Basin

Hydrograph type	= SCS Runoff	Peak discharge	= 27.66 cfs
Storm frequency	= 10 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 90,679 cuft
Drainage area	= 5.390 ac	Curve number	= 91*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 19.90 min
Total precip.	= 5.67 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(3.740 x 98) + (1.650 x 74)] / 5.390



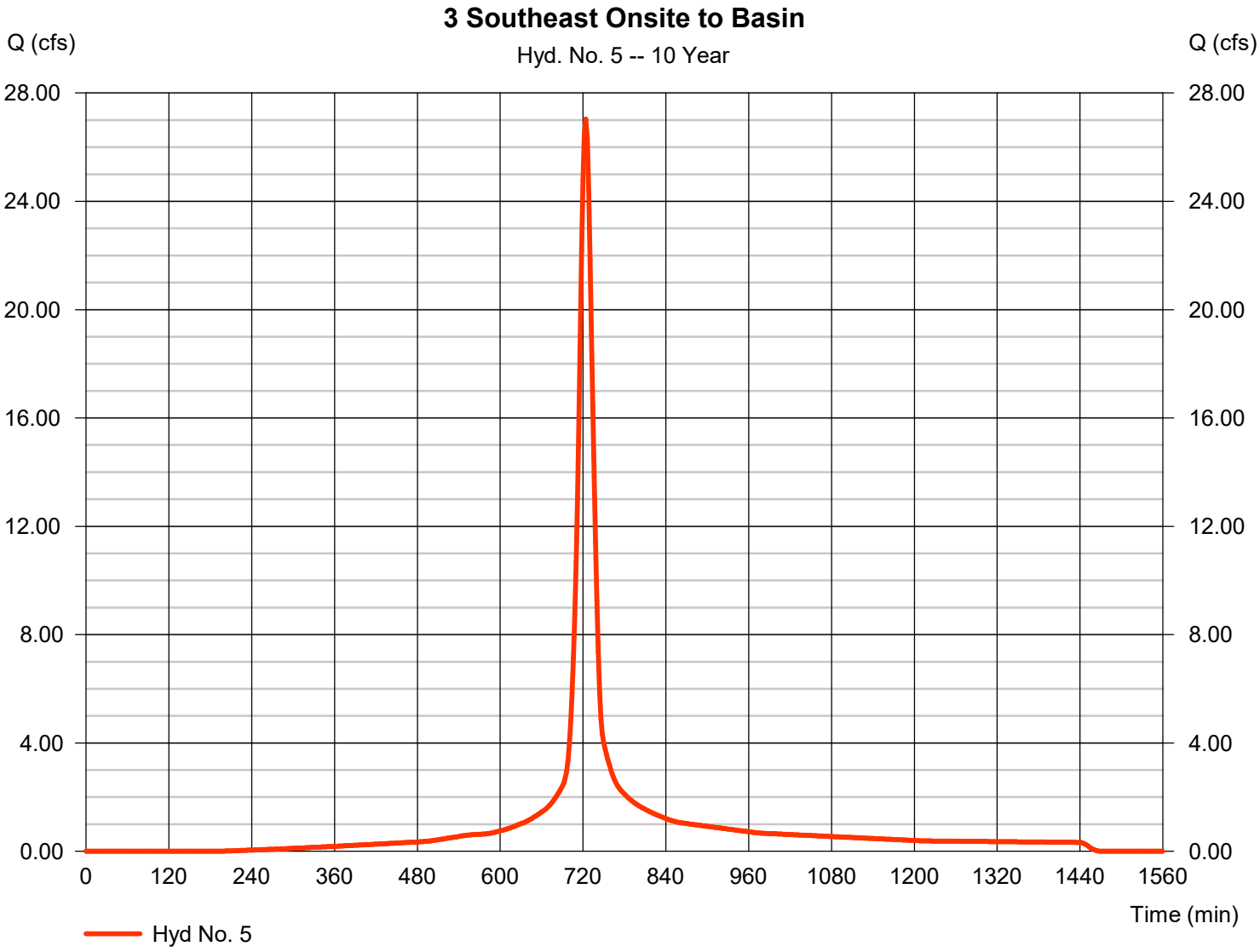
Hydrograph Report

Hyd. No. 5

3 Southeast Onsite to Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	27.04 cfs
Storm frequency	=	10 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	88,660 cuft
Drainage area	=	5.270 ac	Curve number	=	91*
Basin Slope	=	5.0 %	Hydraulic length	=	200 ft
Tc method	=	TR55	Time of conc. (Tc)	=	18.70 min
Total precip.	=	5.67 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(4.570 x 98) + (1.700 x 74)] / 5.270



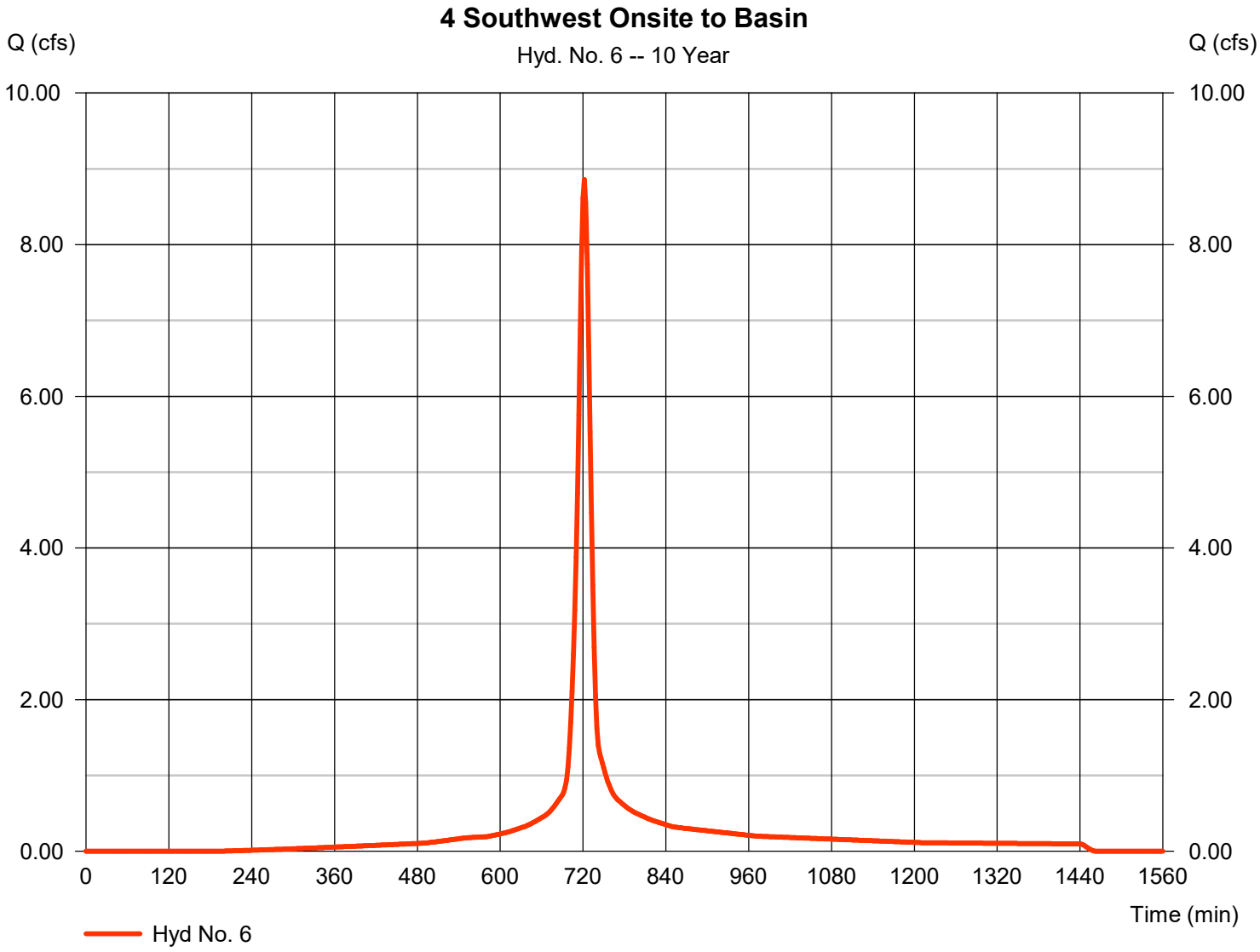
Hydrograph Report

Hyd. No. 6

4 Southwest Onsite to Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	8.859 cfs
Storm frequency	=	10 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	26,245 cuft
Drainage area	=	1.600 ac	Curve number	=	91*
Basin Slope	=	5.0 %	Hydraulic length	=	126 ft
Tc method	=	TR55	Time of conc. (Tc)	=	14.40 min
Total precip.	=	5.67 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(1.120 x 98) + (0.480 x 74)] / 1.600



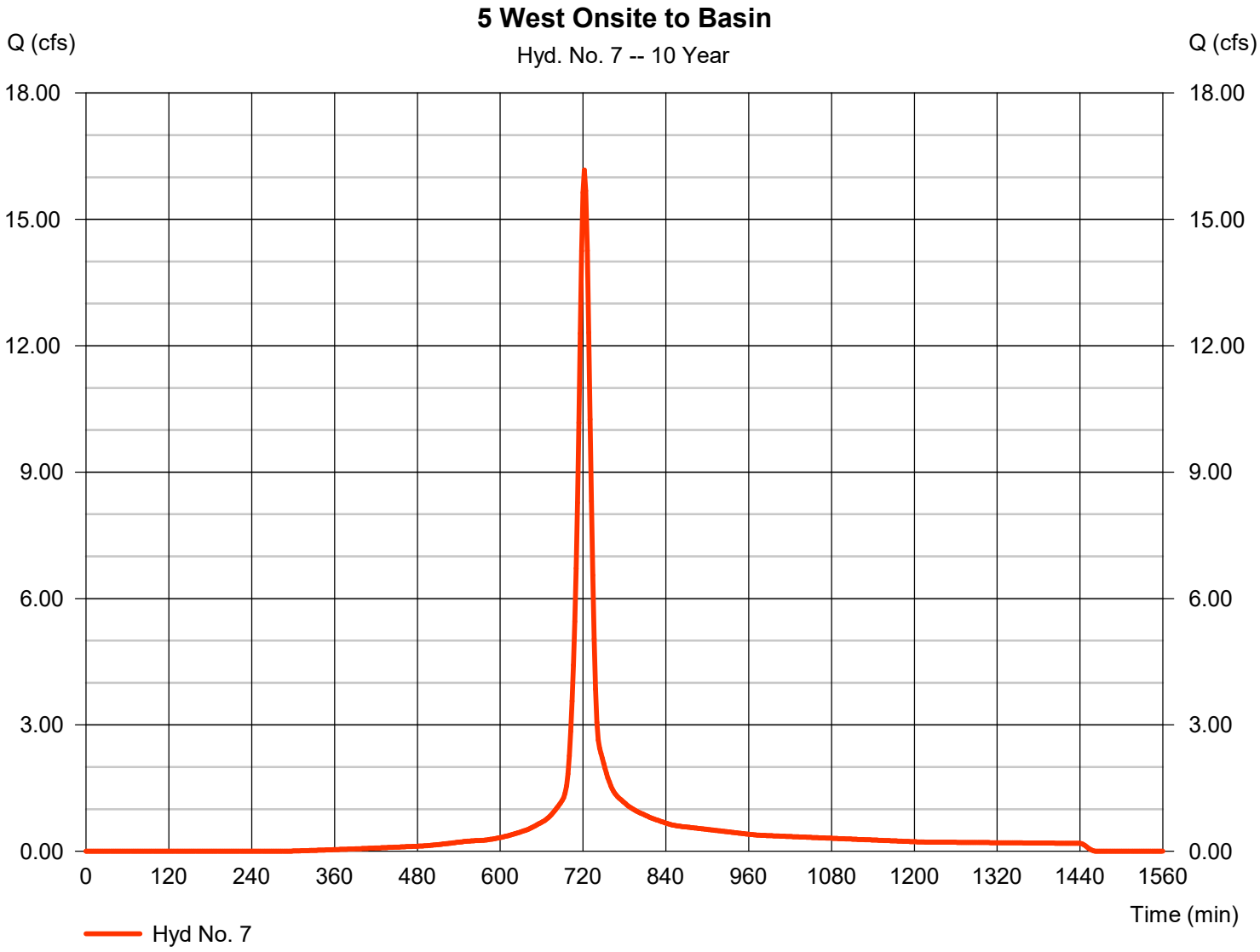
Hydrograph Report

Hyd. No. 7

5 West Onsite to Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	16.17 cfs
Storm frequency	=	10 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	46,396 cuft
Drainage area	=	3.200 ac	Curve number	=	86*
Basin Slope	=	5.0 %	Hydraulic length	=	100 ft
Tc method	=	TR55	Time of conc. (Tc)	=	14.20 min
Total precip.	=	5.67 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(1.650 x 98) + (1.550 x 74)] / 3.200

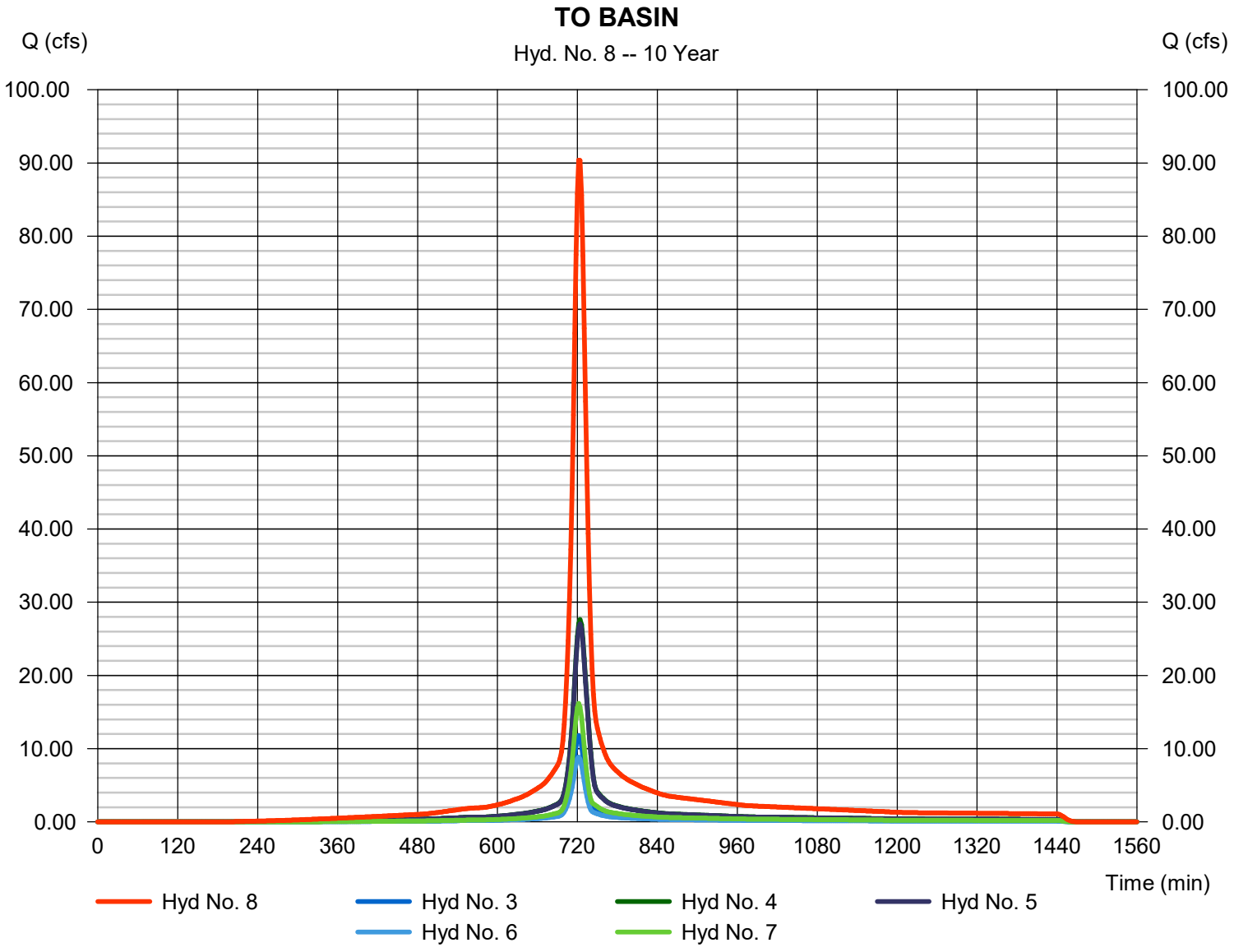


Hydrograph Report

Hyd. No. 8

TO BASIN

Hydrograph type	= Combine	Peak discharge	= 90.37 cfs
Storm frequency	= 10 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 286,037 cuft
Inflow hyds.	= 3, 4, 5, 6, 7	Contrib. drain. area	= 17.750 ac



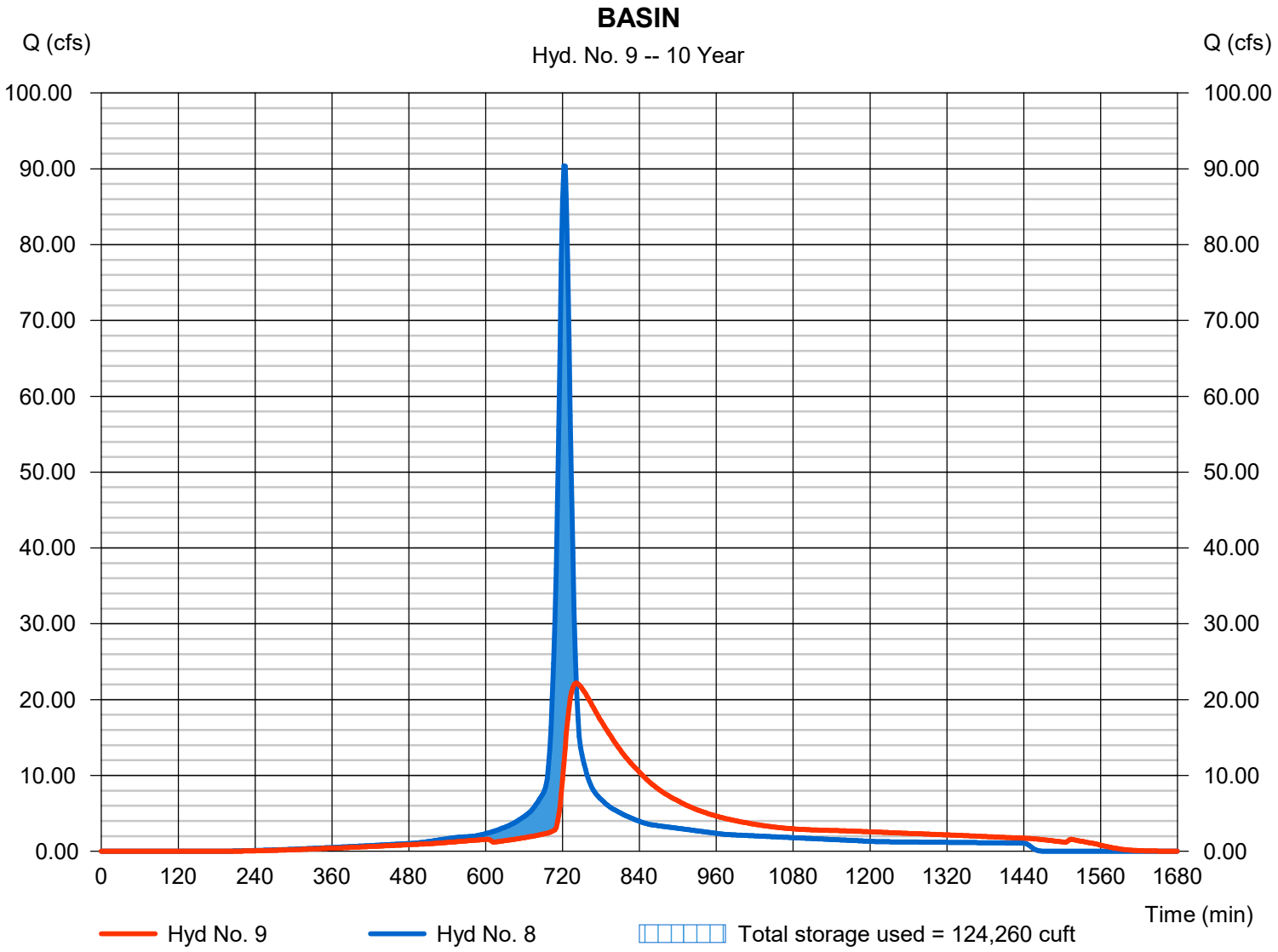
Hydrograph Report

Hyd. No. 9

BASIN

Hydrograph type	=	Reservoir	Peak discharge	=	22.17 cfs
Storm frequency	=	10 yrs	Time to peak	=	742 min
Time interval	=	2 min	Hyd. volume	=	286,036 cuft
Inflow hyd. No.	=	8 - TO BASIN	Max. Elevation	=	919.30 ft
Reservoir name	=	Regional Detention	Max. Storage	=	124,260 cuft

Storage Indication method used.



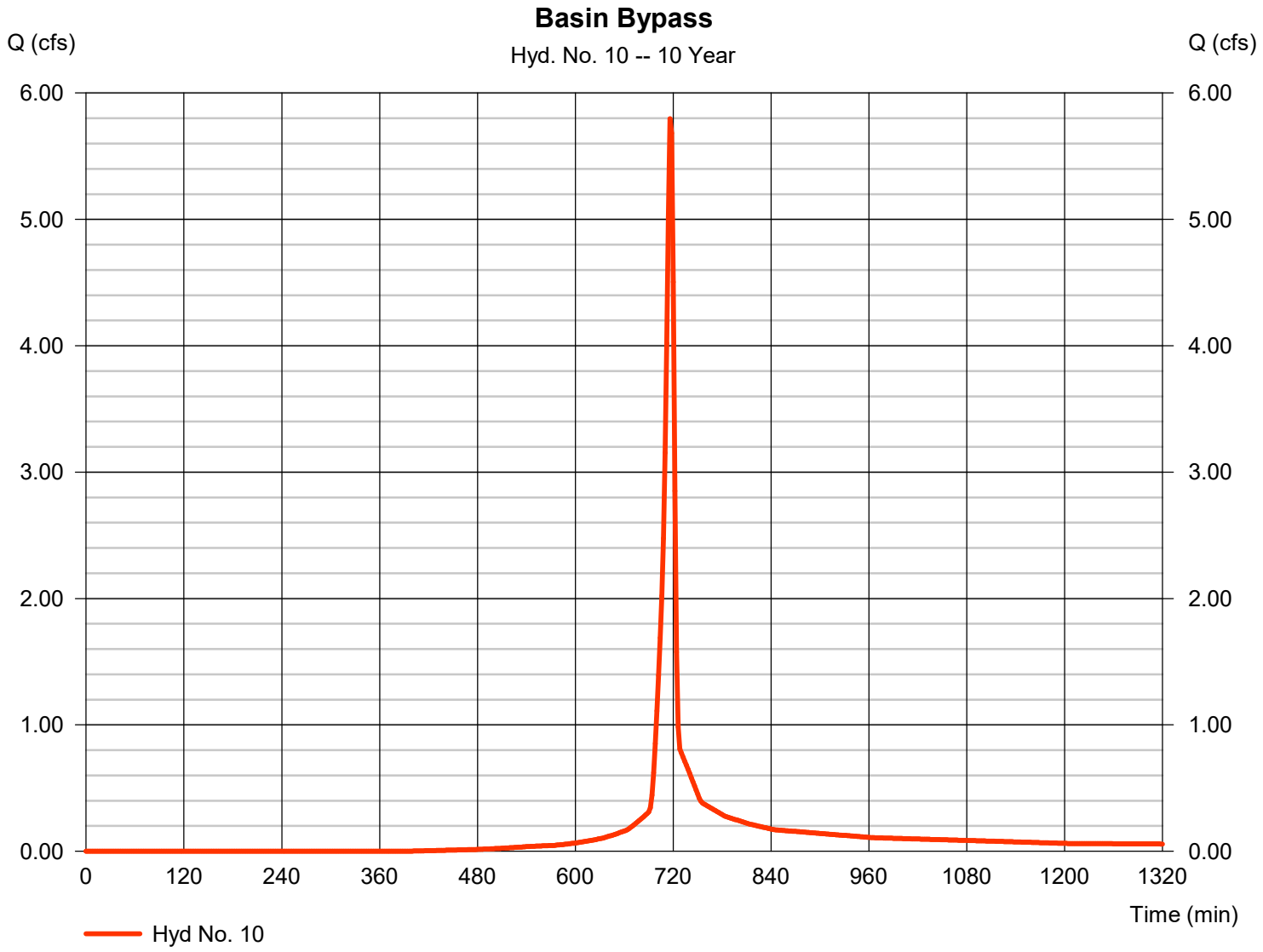
Hydrograph Report

Hyd. No. 10

Basin Bypass

Hydrograph type	=	SCS Runoff	Peak discharge	=	5.796 cfs
Storm frequency	=	10 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	11,859 cuft
Drainage area	=	1.000 ac	Curve number	=	80*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	5.67 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.070 x 98) + (0.180 x 74)] / 1.000

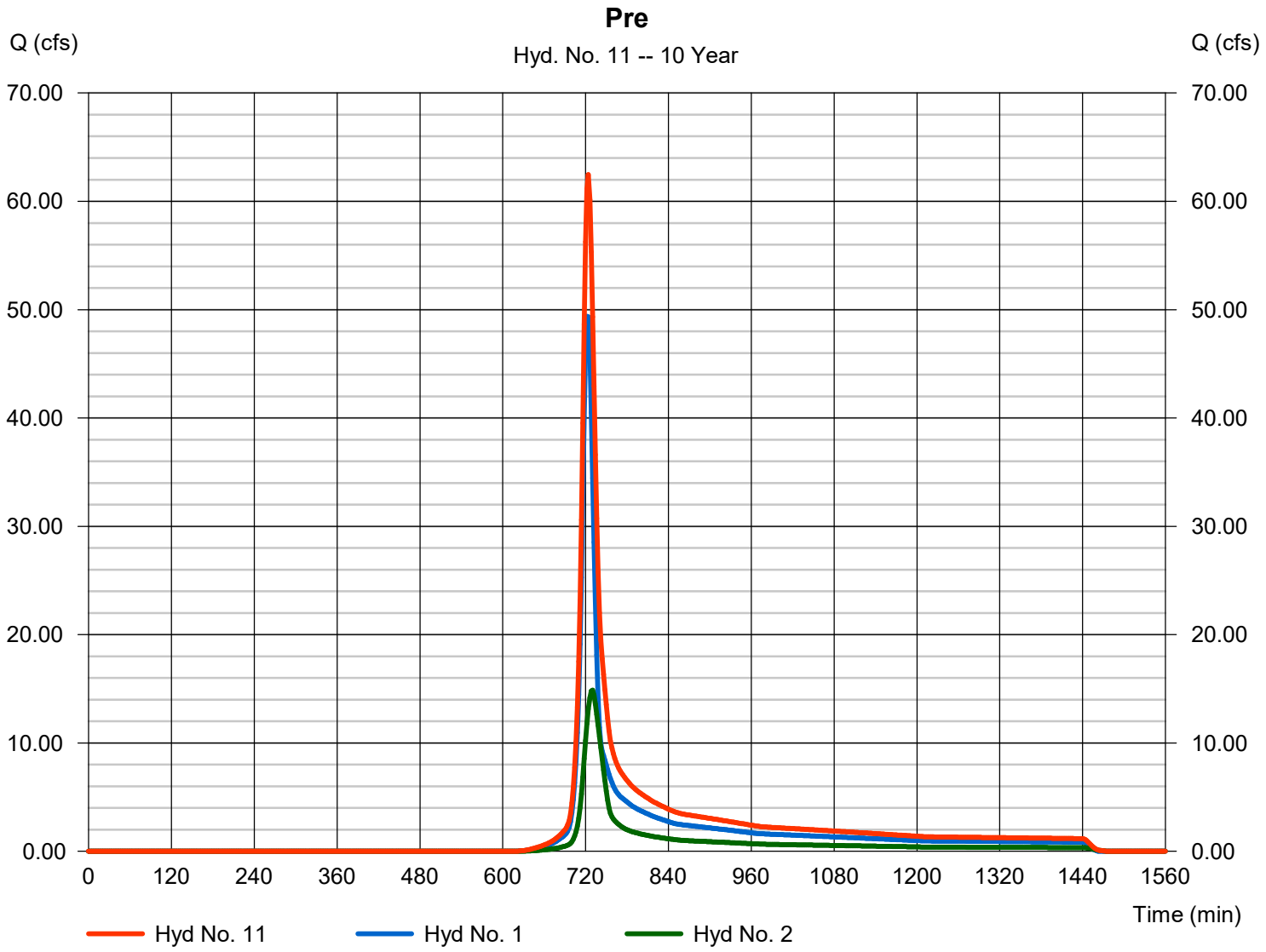


Hydrograph Report

Hyd. No. 11

Pre

Hydrograph type	= Combine	Peak discharge	= 62.47 cfs
Storm frequency	= 10 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 198,845 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 26.500 ac

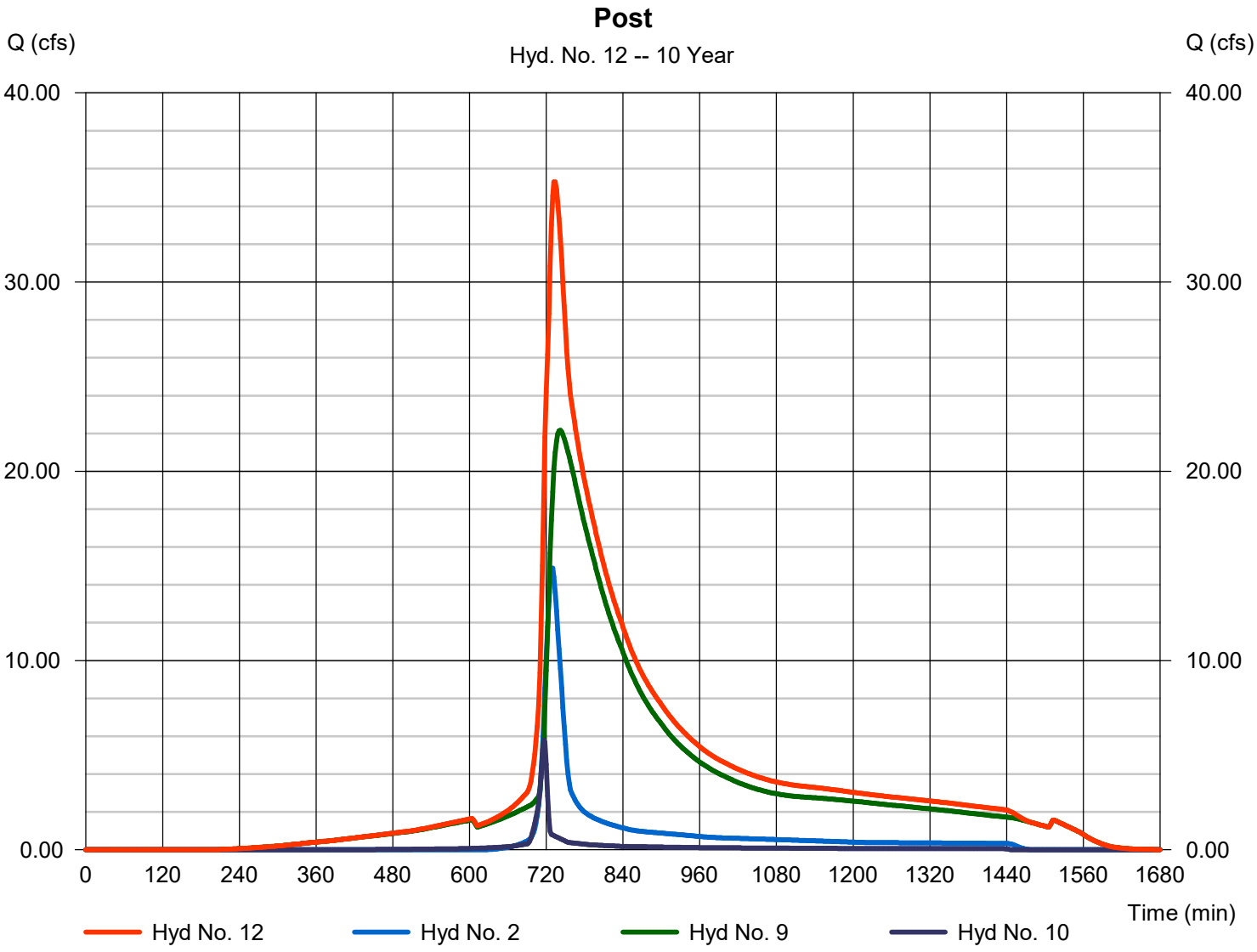


Hydrograph Report

Hyd. No. 12

Post

Hydrograph type	=	Combine	Peak discharge	=	35.30 cfs
Storm frequency	=	10 yrs	Time to peak	=	734 min
Time interval	=	2 min	Hyd. volume	=	354,559 cuft
Inflow hyds.	=	2, 9, 10	Contrib. drain. area	=	8.500 ac



Hydrograph Summary Report

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

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	118.20	2	722	331,322	------	------	------	Pre-Onsite
2	SCS Runoff	35.92	2	728	132,043	------	------	------	Pre- Offsite
3	SCS Runoff	20.88	2	722	62,170	------	------	------	1 Northwest Onsite to Basin
4	SCS Runoff	47.22	2	724	159,668	------	------	------	2 Northeast Onsite to Basin
5	SCS Runoff	46.17	2	724	156,113	------	------	------	3 Southeast Onsite to Basin
6	SCS Runoff	15.10	2	722	46,212	------	------	------	4 Southwest Onsite to Basin
7	SCS Runoff	28.87	2	722	85,482	------	------	------	5 West Onsite to Basin
8	Combine	156.50	2	722	509,644	3, 4, 5, 6, 7	------	------	TO BASIN
9	Reservoir	45.78	2	740	509,643	8	922.45	217,151	BASIN
10	SCS Runoff	10.96	2	716	23,160	------	------	------	Basin Bypass
11	Combine	148.91	2	724	463,364	1, 2,	------	------	Pre
12	Combine	75.68	2	732	664,846	2, 9, 10,	------	------	Post

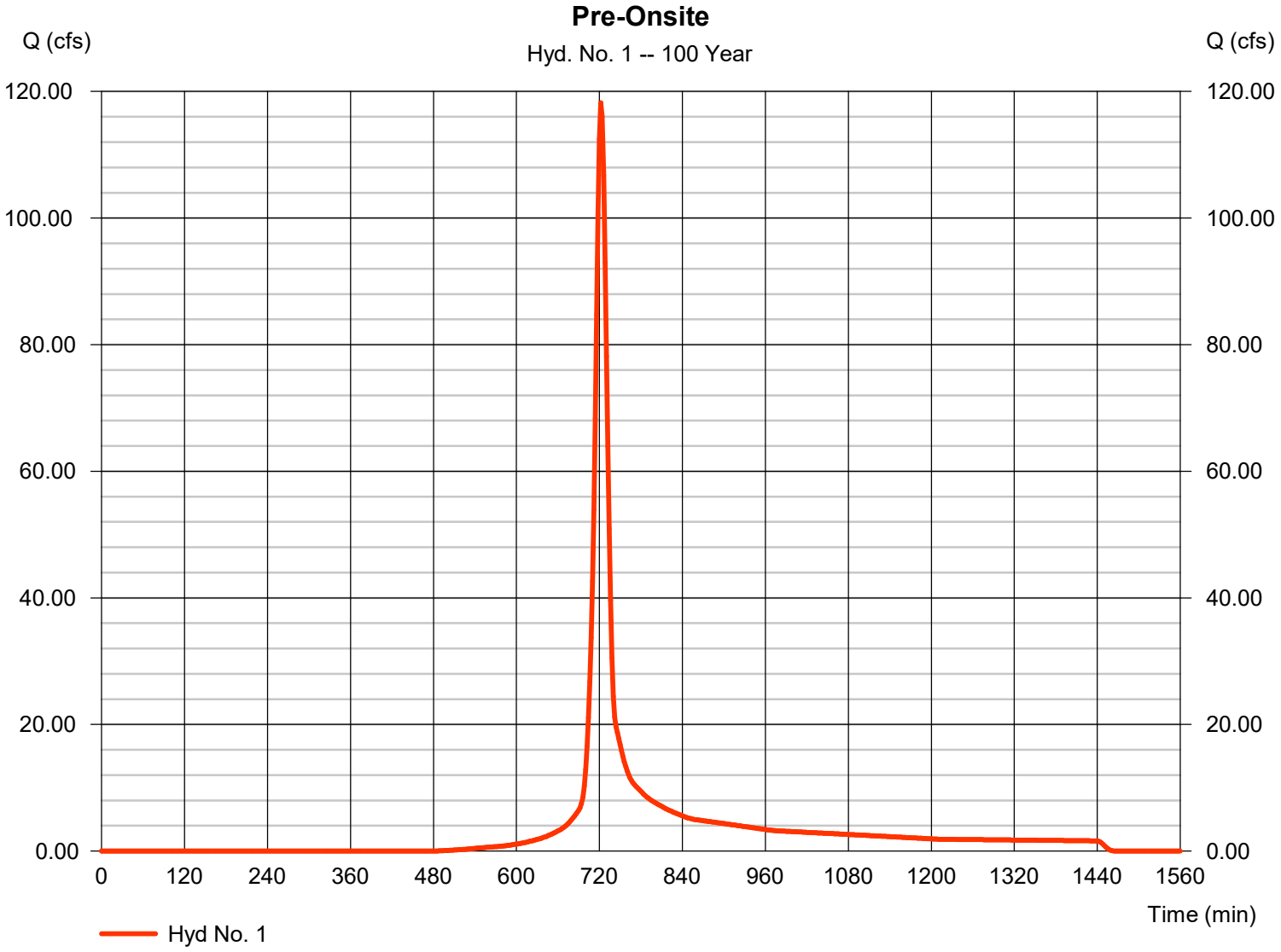
Hydrograph Report

Hyd. No. 1

Pre-Onsite

Hydrograph type	=	SCS Runoff	Peak discharge	=	118.20 cfs
Storm frequency	=	100 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	331,322 cuft
Drainage area	=	19.000 ac	Curve number	=	65*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	15.30 min
Total precip.	=	9.25 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(15.510 x 74)] / 19.000



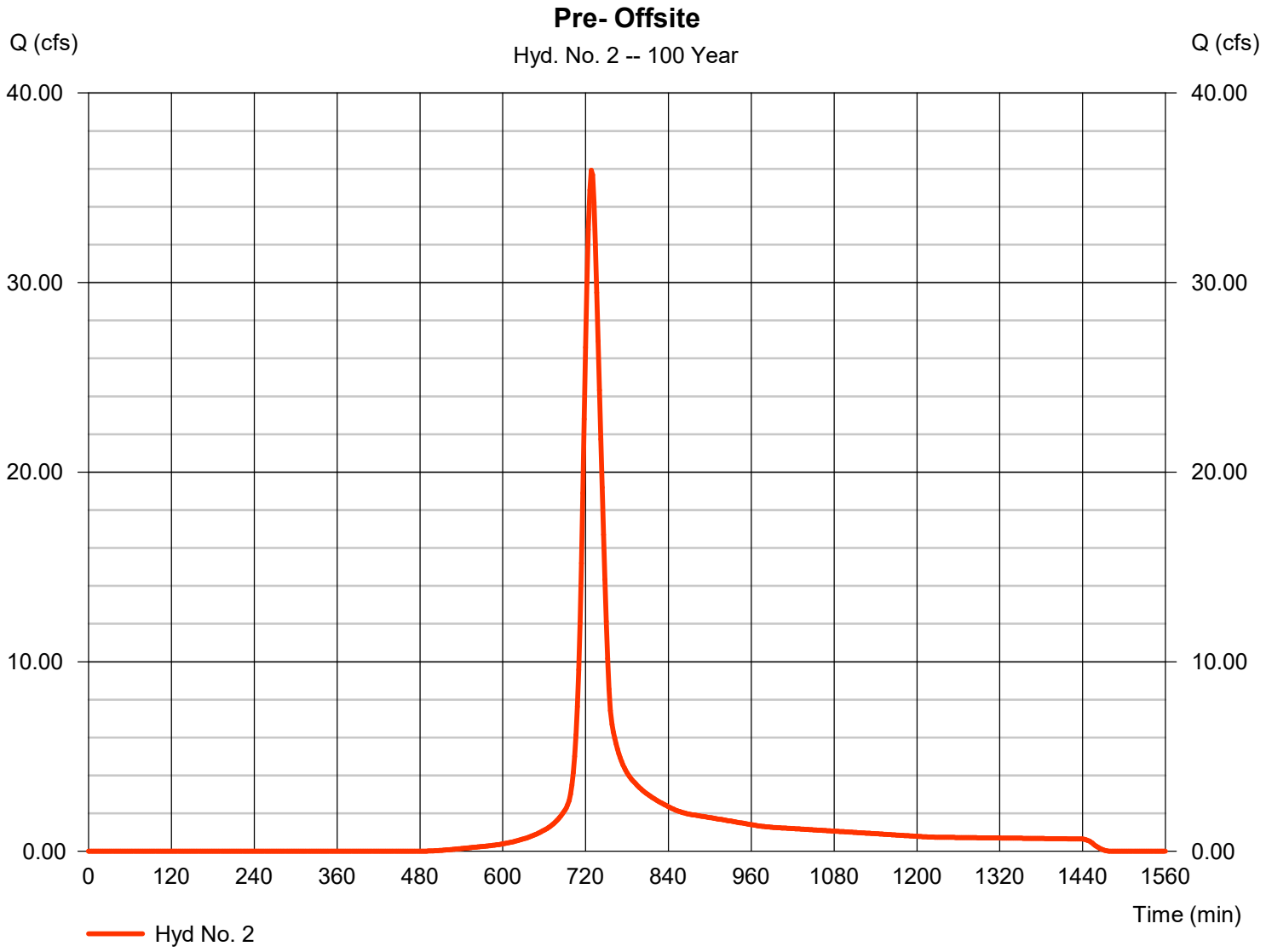
Hydrograph Report

Hyd. No. 2

Pre- Offsite

Hydrograph type	=	SCS Runoff	Peak discharge	=	35.92 cfs
Storm frequency	=	100 yrs	Time to peak	=	728 min
Time interval	=	2 min	Hyd. volume	=	132,043 cuft
Drainage area	=	7.500 ac	Curve number	=	65*
Basin Slope	=	5.0 %	Hydraulic length	=	100 ft
Tc method	=	TR55	Time of conc. (Tc)	=	25.20 min
Total precip.	=	9.25 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(7.500 x 65)] / 7.500



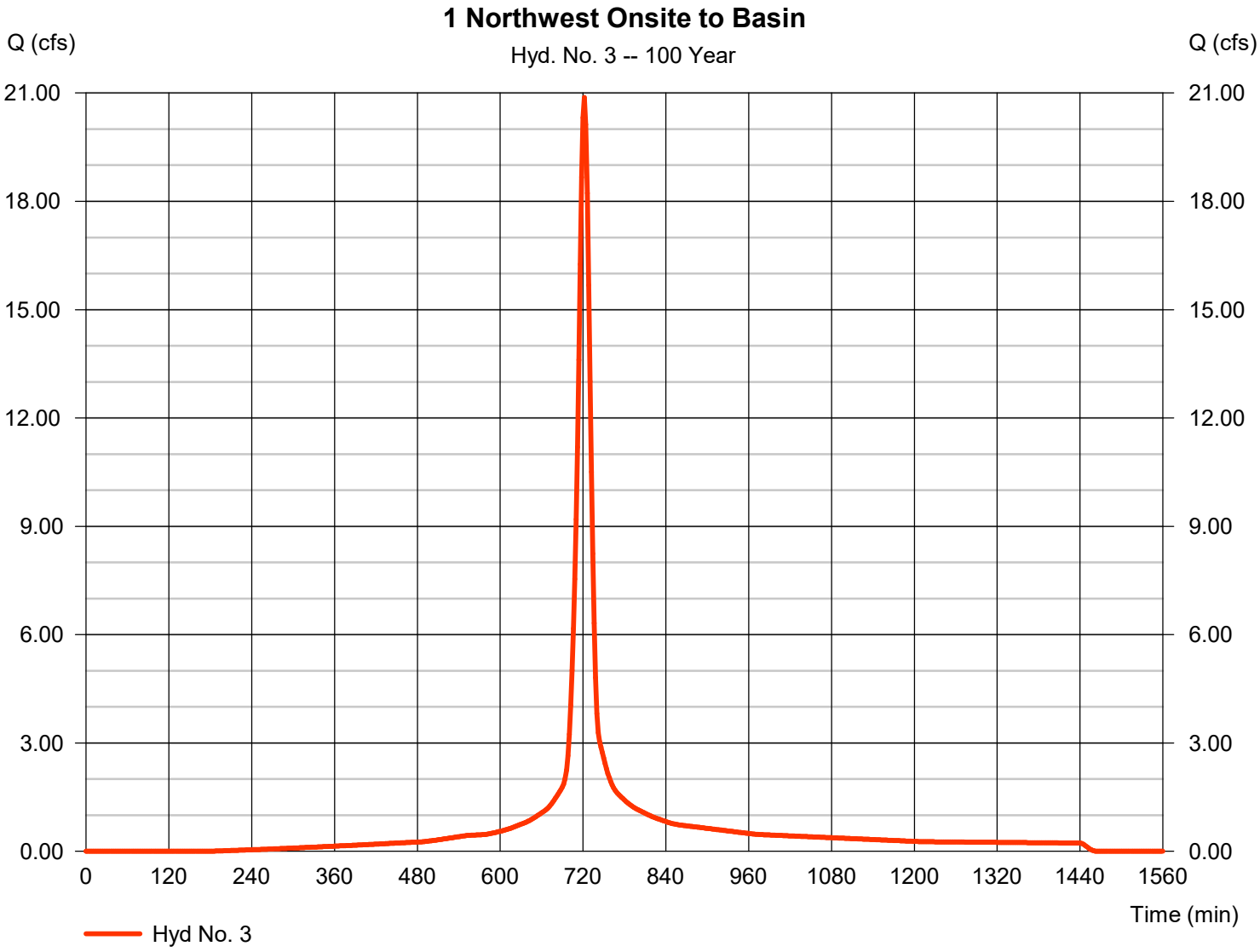
Hydrograph Report

Hyd. No. 3

1 Northwest Onsite to Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	20.88 cfs
Storm frequency	=	100 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	62,170 cuft
Drainage area	=	2.290 ac	Curve number	=	87*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	13.90 min
Total precip.	=	9.25 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(1.180 x 98) + (1.110 x 74)] / 2.290



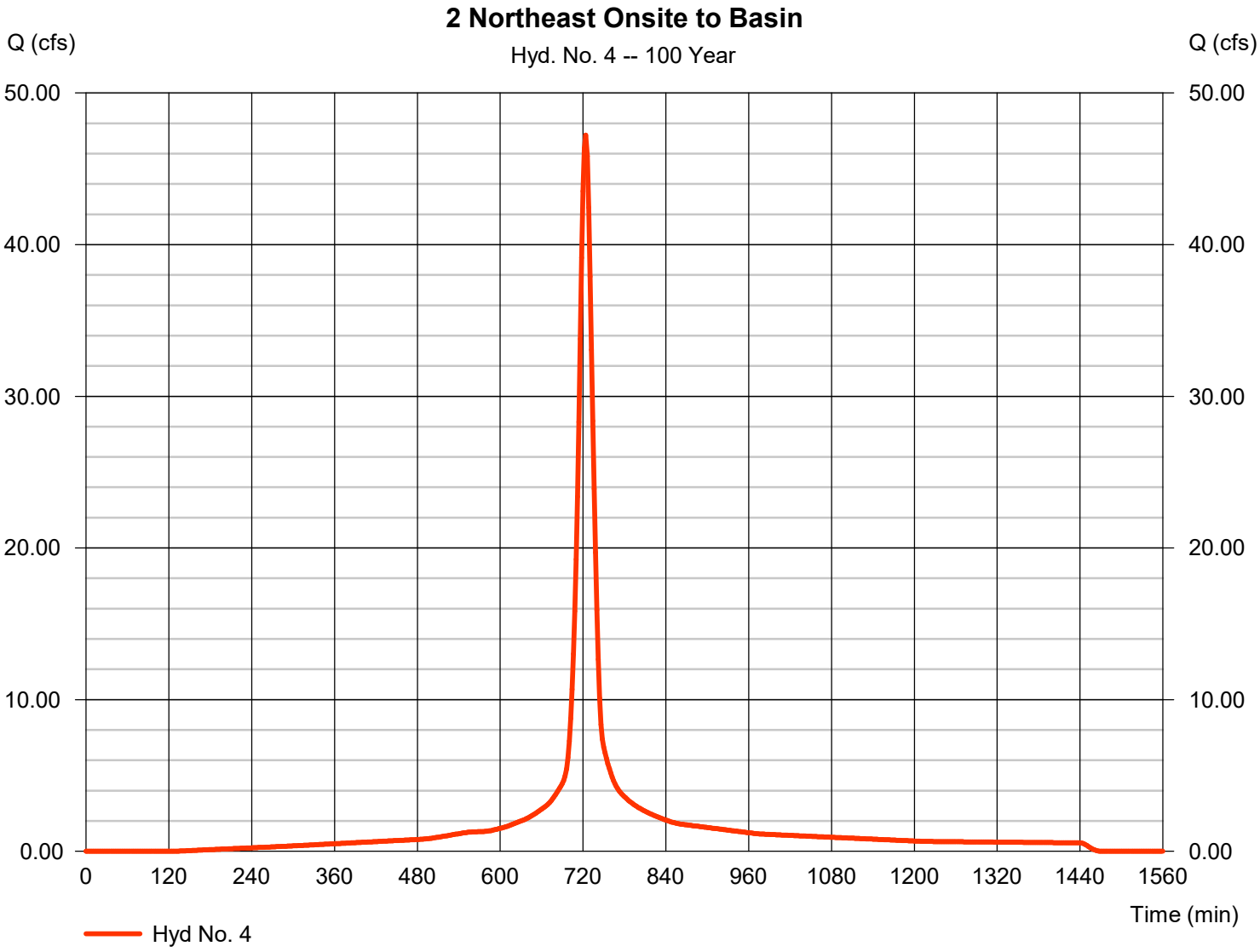
Hydrograph Report

Hyd. No. 4

2 Northeast Onsite to Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	47.22 cfs
Storm frequency	=	100 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	159,668 cuft
Drainage area	=	5.390 ac	Curve number	=	91*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	19.90 min
Total precip.	=	9.25 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(3.740 x 98) + (1.650 x 74)] / 5.390



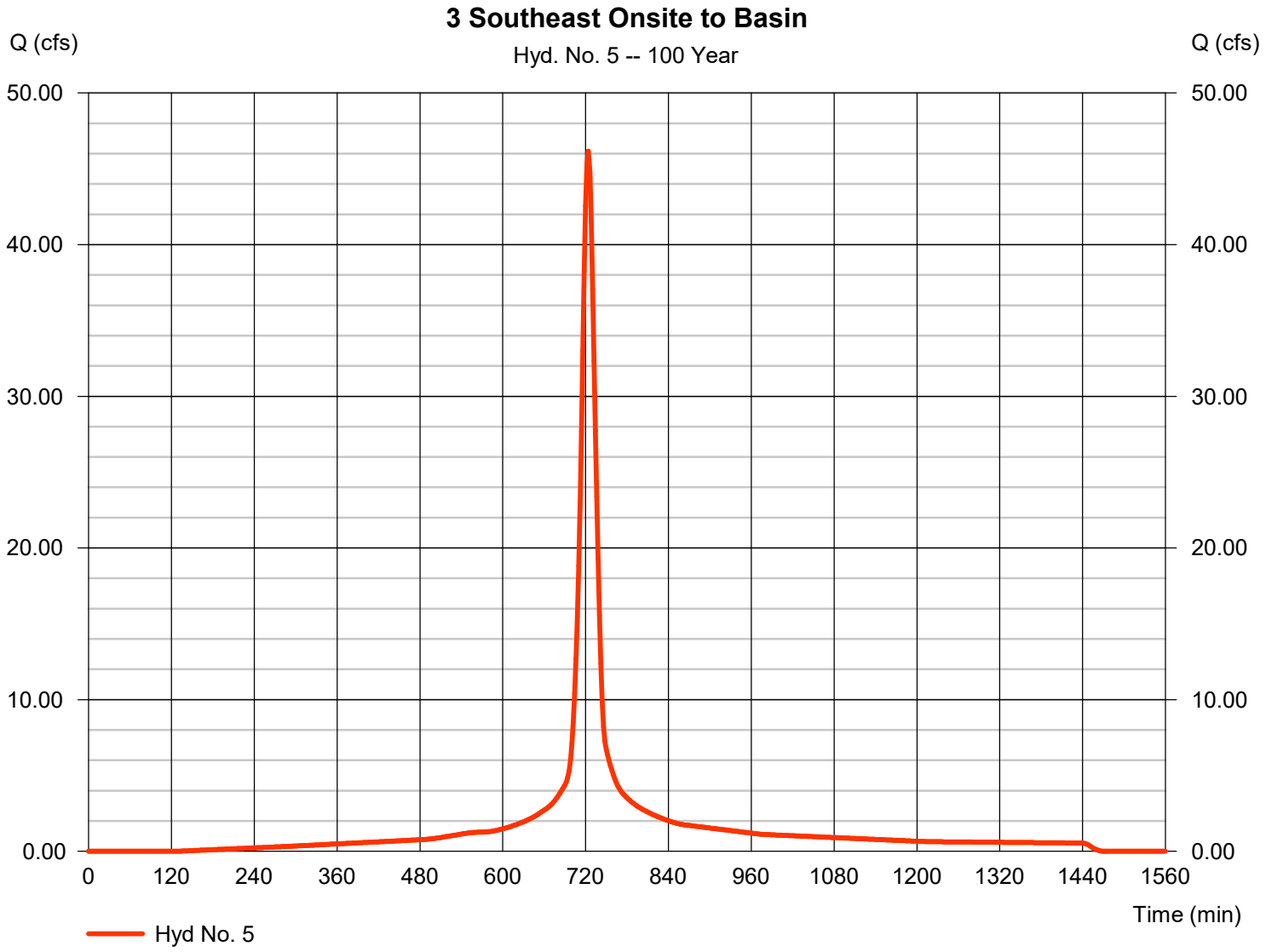
Hydrograph Report

Hyd. No. 5

3 Southeast Onsite to Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	46.17 cfs
Storm frequency	=	100 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	156,113 cuft
Drainage area	=	5.270 ac	Curve number	=	91*
Basin Slope	=	5.0 %	Hydraulic length	=	200 ft
Tc method	=	TR55	Time of conc. (Tc)	=	18.70 min
Total precip.	=	9.25 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(4.570 x 98) + (1.700 x 74)] / 5.270



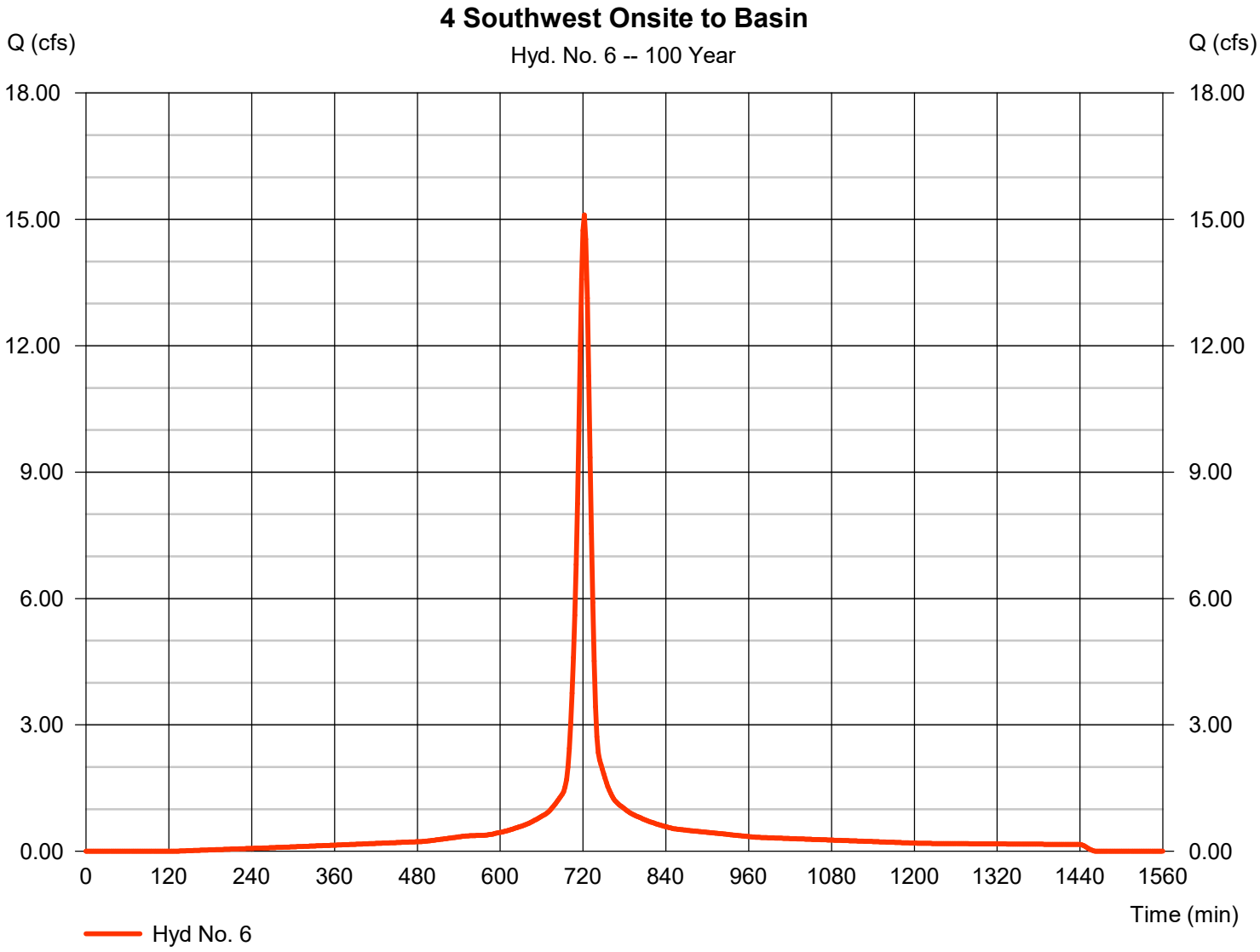
Hydrograph Report

Hyd. No. 6

4 Southwest Onsite to Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	15.10 cfs
Storm frequency	=	100 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	46,212 cuft
Drainage area	=	1.600 ac	Curve number	=	91*
Basin Slope	=	5.0 %	Hydraulic length	=	126 ft
Tc method	=	TR55	Time of conc. (Tc)	=	14.40 min
Total precip.	=	9.25 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(1.120 x 98) + (0.480 x 74)] / 1.600



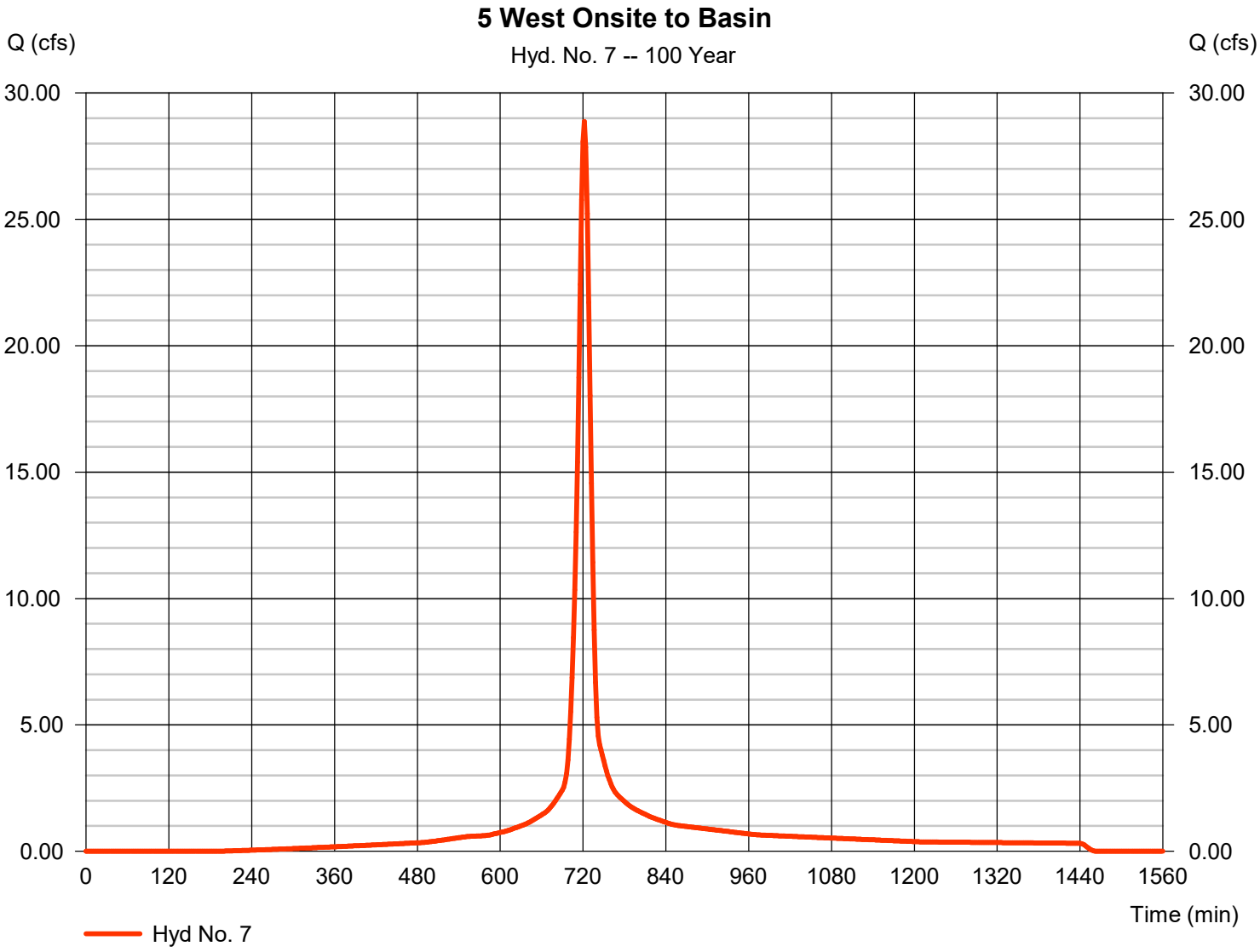
Hydrograph Report

Hyd. No. 7

5 West Onsite to Basin

Hydrograph type	=	SCS Runoff	Peak discharge	=	28.87 cfs
Storm frequency	=	100 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	85,482 cuft
Drainage area	=	3.200 ac	Curve number	=	86*
Basin Slope	=	5.0 %	Hydraulic length	=	100 ft
Tc method	=	TR55	Time of conc. (Tc)	=	14.20 min
Total precip.	=	9.25 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(1.650 x 98) + (1.550 x 74)] / 3.200

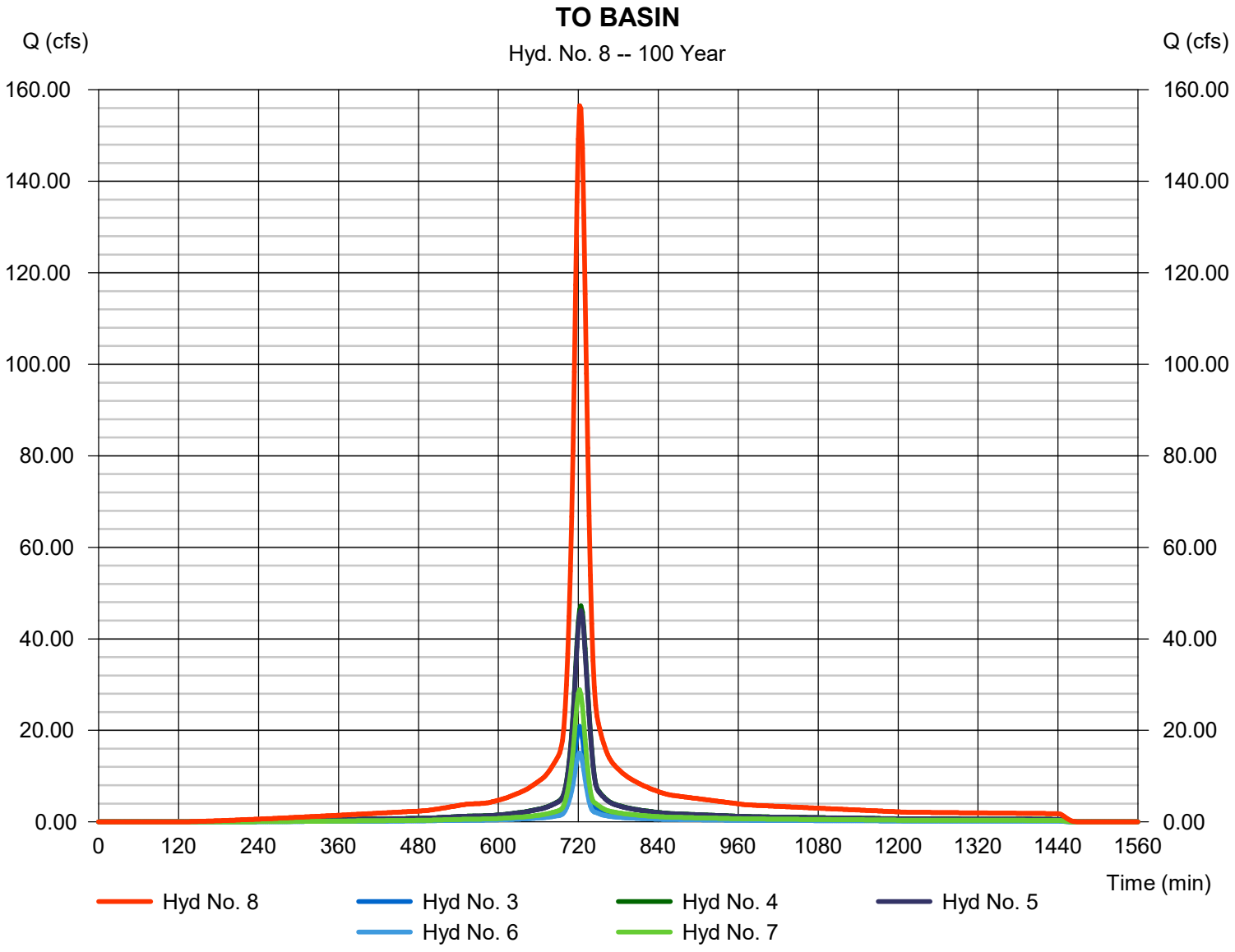


Hydrograph Report

Hyd. No. 8

TO BASIN

Hydrograph type	= Combine	Peak discharge	= 156.50 cfs
Storm frequency	= 100 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 509,644 cuft
Inflow hyds.	= 3, 4, 5, 6, 7	Contrib. drain. area	= 17.750 ac



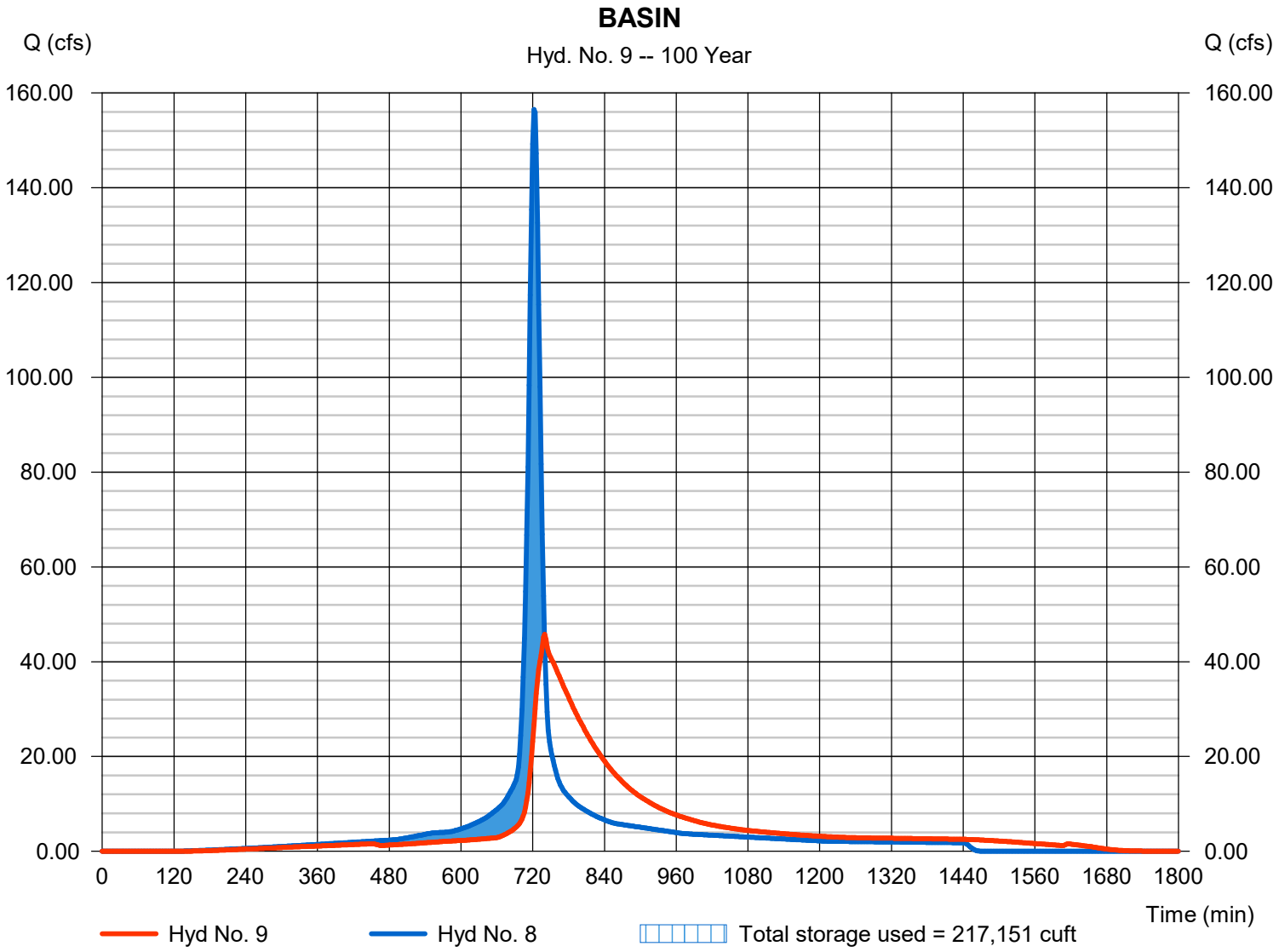
Hydrograph Report

Hyd. No. 9

BASIN

Hydrograph type	=	Reservoir	Peak discharge	=	45.78 cfs
Storm frequency	=	100 yrs	Time to peak	=	740 min
Time interval	=	2 min	Hyd. volume	=	509,643 cuft
Inflow hyd. No.	=	8 - TO BASIN	Max. Elevation	=	922.45 ft
Reservoir name	=	Regional Detention	Max. Storage	=	217,151 cuft

Storage Indication method used.



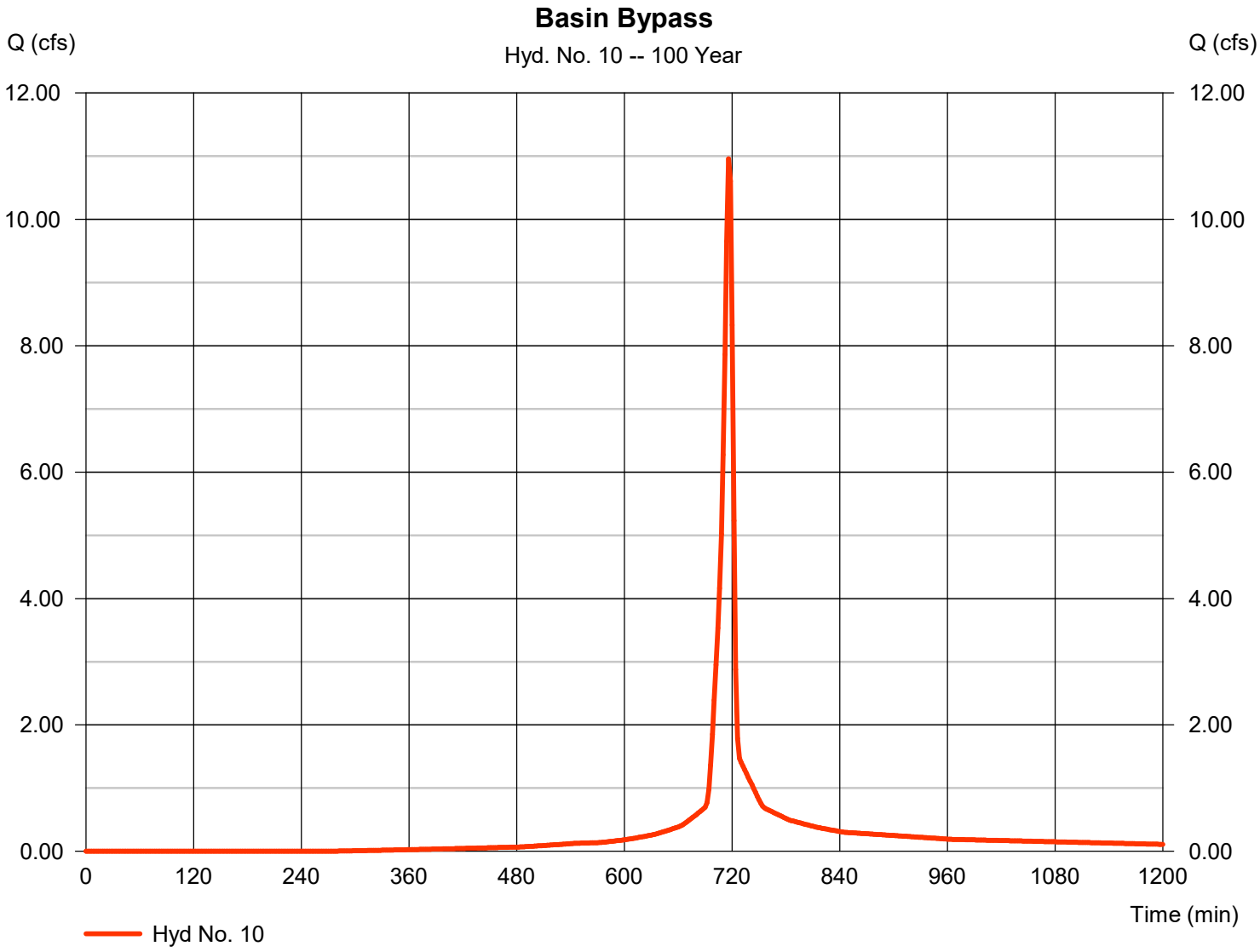
Hydrograph Report

Hyd. No. 10

Basin Bypass

Hydrograph type	=	SCS Runoff	Peak discharge	=	10.96 cfs
Storm frequency	=	100 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	23,160 cuft
Drainage area	=	1.000 ac	Curve number	=	80*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	9.25 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.070 x 98) + (0.180 x 74)] / 1.000

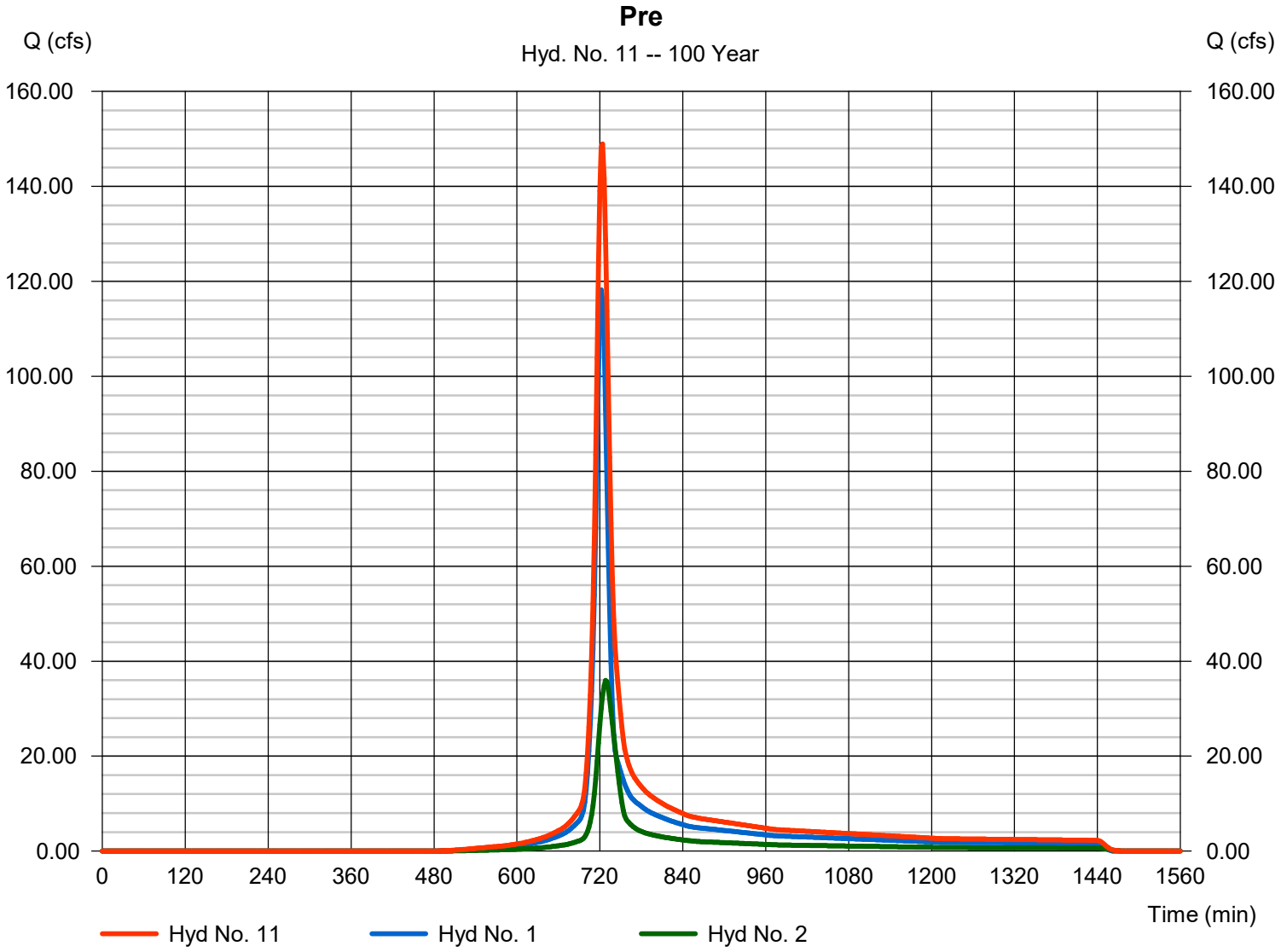


Hydrograph Report

Hyd. No. 11

Pre

Hydrograph type	= Combine	Peak discharge	= 148.91 cfs
Storm frequency	= 100 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 463,364 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 26.500 ac

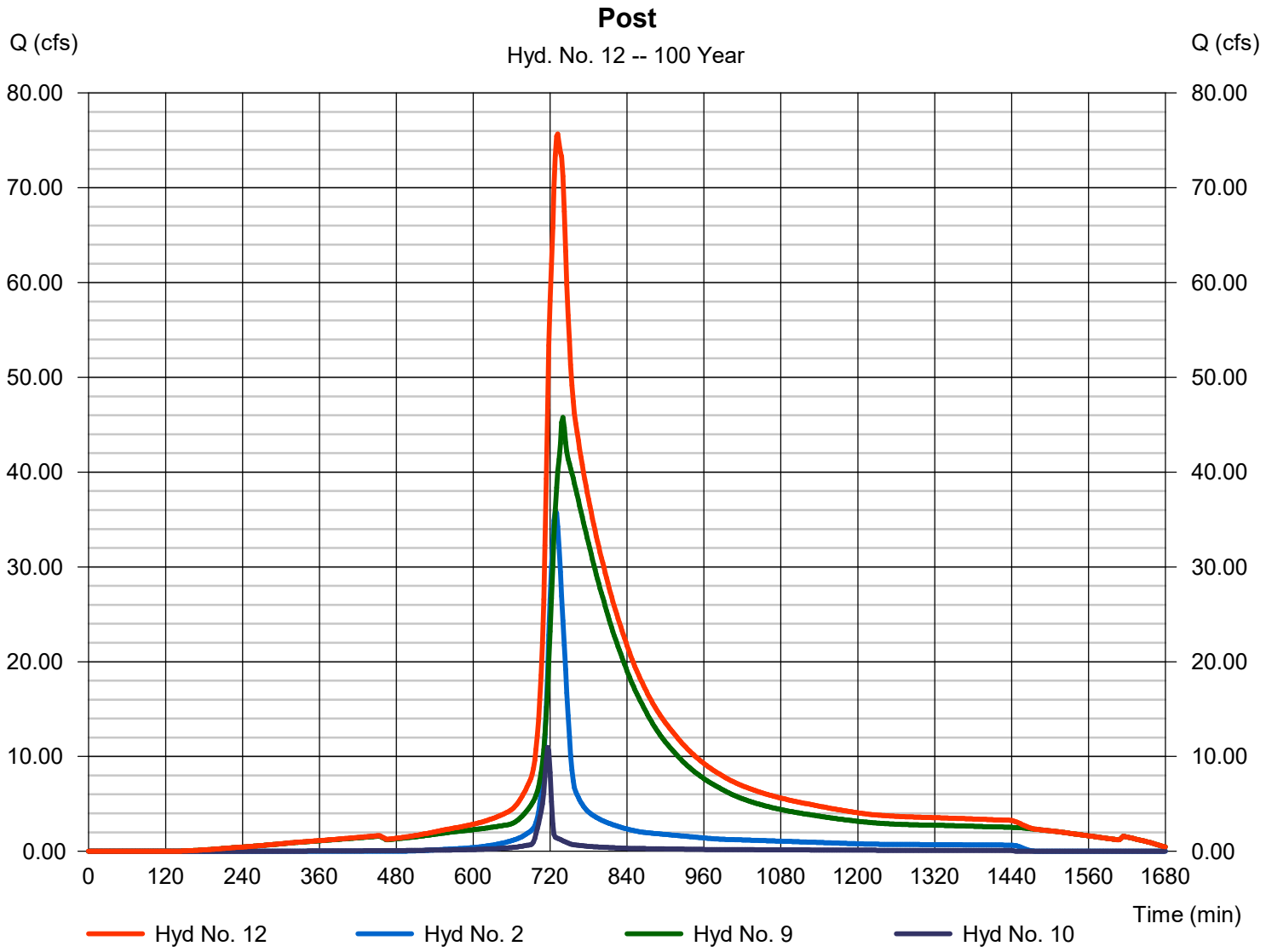


Hydrograph Report

Hyd. No. 12

Post

Hydrograph type	= Combine	Peak discharge	= 75.68 cfs
Storm frequency	= 100 yrs	Time to peak	= 732 min
Time interval	= 2 min	Hyd. volume	= 664,846 cuft
Inflow hyds.	= 2, 9, 10	Contrib. drain. area	= 8.500 ac



Weir Report

Wilshire Hills Public Improvments

Rectangular Weir

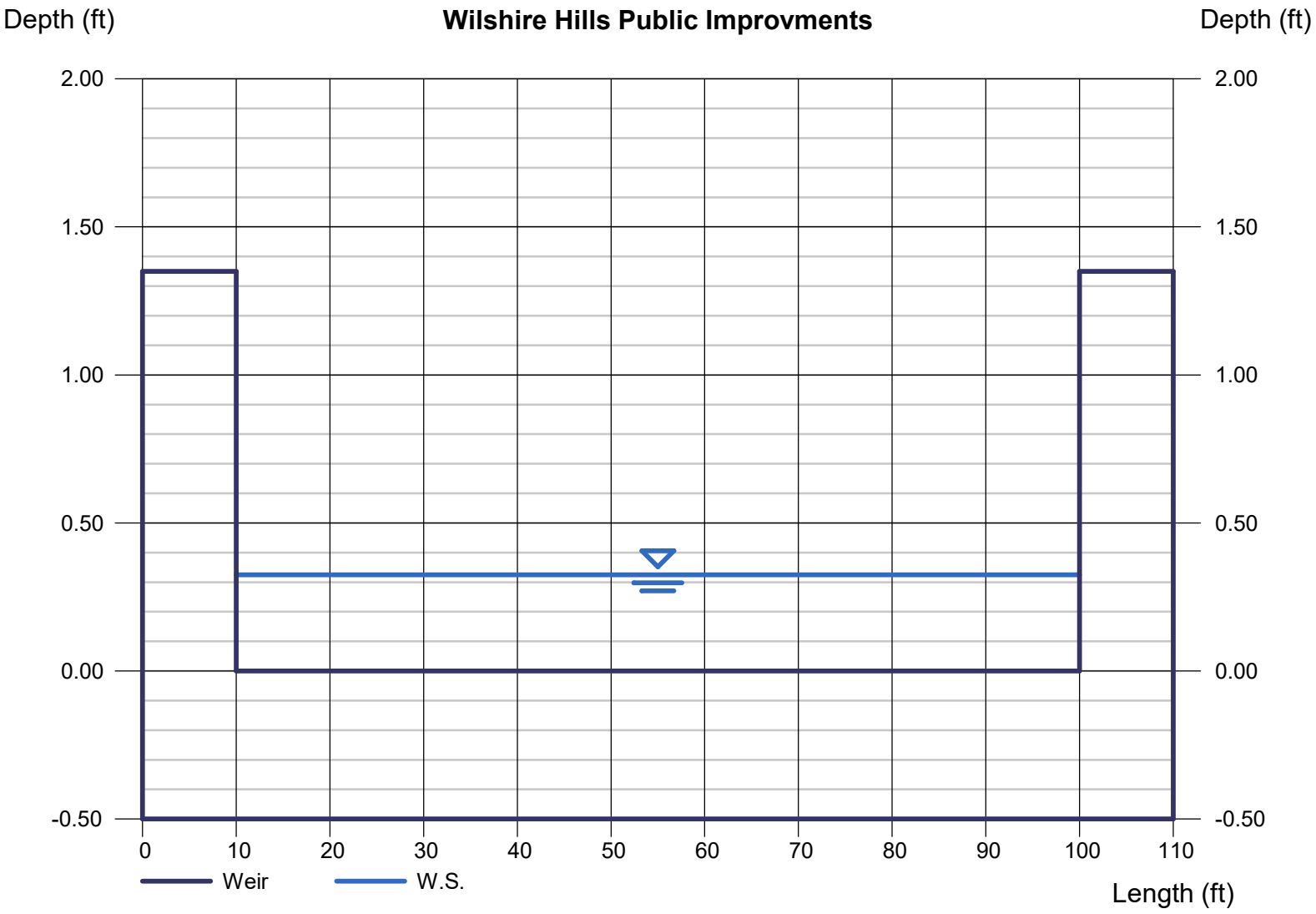
Crest	= Broad
Bottom Length (ft)	= 90.00
Total Depth (ft)	= 1.35

Calculations

Weir Coeff. Cw	= 2.60
Compute by:	Known Q
Known Q (cfs)	= 43.44

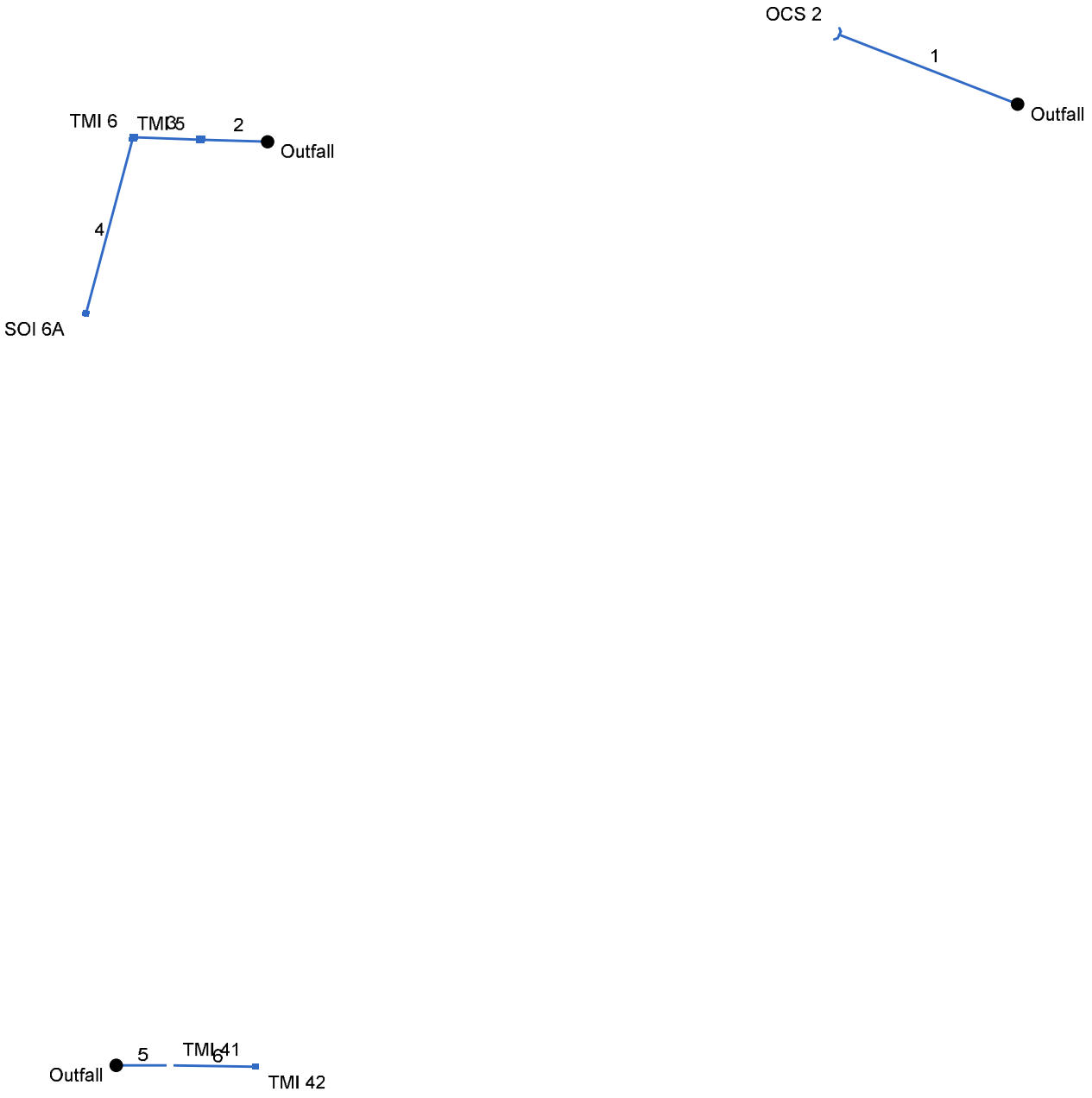
Highlighted

Depth (ft)	= 0.33
Q (cfs)	= 43.44
Area (sqft)	= 29.27
Velocity (ft/s)	= 1.48
Top Width (ft)	= 90.00



APPENDIX C:
STORM SEWER CALCULATIONS

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: Storm Sewers-OFFSITE ONLY- 25 Year Storm.stm	Number of lines: 6	Date: 10/4/2023

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1	EX WALL	16.63	60	Cir	95.300	910.75	911.15	0.420	912.32	912.27	n/a	912.27 j	End	OpenHeadwall
2	FES 4	33.34	36	Cir	33.145	922.47	922.64	0.513	924.74	924.51	0.40	924.51	End	Curb-Horiz
3	6	32.85	36	Cir	33.000	922.83	923.00	0.515	924.56	924.86	n/a	924.86	2	Curb-Horiz
4	6A	31.80	24	Cir	99.000	923.20	923.69	0.495	925.20*	926.87*	1.59	928.46	3	DropCurb
5	FES 40	1.24	24	Cir	26.463	928.76	929.03	1.020	929.08	929.41	0.07	929.41	End	Curb-Horiz
6	42	0.62	24	Cir	42.000	929.23	929.65	1.000	929.45	929.92	0.09	929.92	5	Curb-Horiz

Project File: Storm Sewers-OFFSITE ONLY- 25 Year Storm.stm | Number of lines: 6 | Run Date: 10/4/2023

NOTES: Return period = 25 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	95.300	0.00	0.00	0.00	0.00	0.00	5.0	5.0	0.0	16.63	182.8	4.10	60	0.42	910.75	911.15	912.32	912.27	0.00	920.00	EX WALL
2	End	33.145	0.16	10.59	0.64	0.10	6.97	5.0	25.2	4.8	33.34	51.75	6.50	36	0.51	922.47	922.64	924.74	924.51	0.00	928.10	FES 4
3	2	33.000	0.36	10.43	0.61	0.22	6.87	5.0	25.2	4.8	32.85	51.86	7.45	36	0.52	922.83	923.00	924.56	924.86	928.10	929.66	6
4	3	99.000	10.07	10.07	0.66	6.65	6.65	25.2	25.2	4.8	31.80	17.24	10.12	24	0.49	923.20	923.69	925.20	926.87	929.66	929.00	6A
5	End	26.463	0.13	0.26	0.58	0.08	0.15	5.0	5.0	8.2	1.24	24.75	3.39	24	1.02	928.76	929.03	929.08	929.41	0.00	934.65	FES 40
6	5	42.000	0.13	0.13	0.58	0.08	0.08	5.0	5.0	8.2	0.62	24.50	2.88	24	1.00	929.23	929.65	929.45	929.92	934.65	934.65	42

Project File: Storm Sewers-OFFSITE ONLY- 25 Year Storm.stm

Number of lines: 6

Run Date: 10/4/2023

NOTES:Intensity = 102.61 / (Inlet time + 16.50) ^ 0.82; Return period =Yrs. 25 ; Pipe travel time suppressed. ; c = cir e = ellip b = box

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1	OCS 2	16.63*	0.00	16.63	0.00	Hdwl	0.0	0.00	0.00	0.00	0.00	Sag	2.00	0.020	0.020	0.013	0.00	0.00	0.00	0.00	0.0	Off
2	TMI 5	0.84	0.00	0.84	0.00	Curb	6.0	2.93	0.00	0.00	0.00	Sag	1.50	0.020	0.020	0.013	0.21	10.48	0.21	10.48	0.0	Off
3	TMI 6	1.81	0.00	1.81	0.00	Curb	6.0	2.93	0.00	0.00	0.00	Sag	1.50	0.020	0.020	0.013	0.35	17.43	0.35	17.43	0.0	Off
4	SOI 6A	31.80	0.00	31.80	0.00	DrCrb	12.0	5.00	0.00	0.00	0.00	Sag	0.00	0.020	0.020	0.013	1.90	95.06	1.90	95.06	0.0	Off
5	TMI 41	0.62	0.00	0.62	0.00	Curb	4.0	1.00	0.00	0.00	0.00	Sag	2.00	0.050	0.020	0.013	0.21	7.55	0.21	7.55	0.0	Off
6	TMI 42	0.62	0.00	0.62	0.00	Curb	6.0	4.00	0.00	0.00	0.00	Sag	2.00	0.050	0.020	0.013	0.17	5.40	0.17	5.40	0.0	Off

Project File: Storm Sewers-OFFSITE ONLY- 25 Year Storm.stm | Number of lines: 6 | Run Date: 10/4/2023

NOTES: Inlet N-Values = 0.016; Intensity = 102.61 / (Inlet time + 16.50) ^ 0.82; Return period = 25 Yrs. ; * Indicates Known Q added. All curb inlets are Horiz throat.

Storm Sewer Inlet Time Tabulation

Line No.	Line ID	Tc Method	Sheet Flow					Shallow Concentrated Flow					Channel Flow							Total Travel Time (min)
			n-Value	flow Length (ft)	2-yr 24h P (in)	Land Slope (%)	Travel Time (min)	flow Length (ft)	Water Slope (%)	Surf Descr	Ave Vel (ft/s)	Travel Time (min)	X-sec Area (sqft)	Wetted Perim (ft)	Chan Slope (%)	n-Value	Vel	flow Length (ft)	Travel Time (min)	
1	EX WALL	User																		5.00
2	FES 4	User																		5.00
3	6	User																		5.00
4	6A	User																		25.20
5	FES 40	User																		5.00
6	42	User																		5.00

Project File: Storm Sewers-OFFSITE ONLY- 25 Year Storm.stm | Min. Tc used for intensity calculations = 5 min | Number of lines: 6 | Date: 10/4/2023

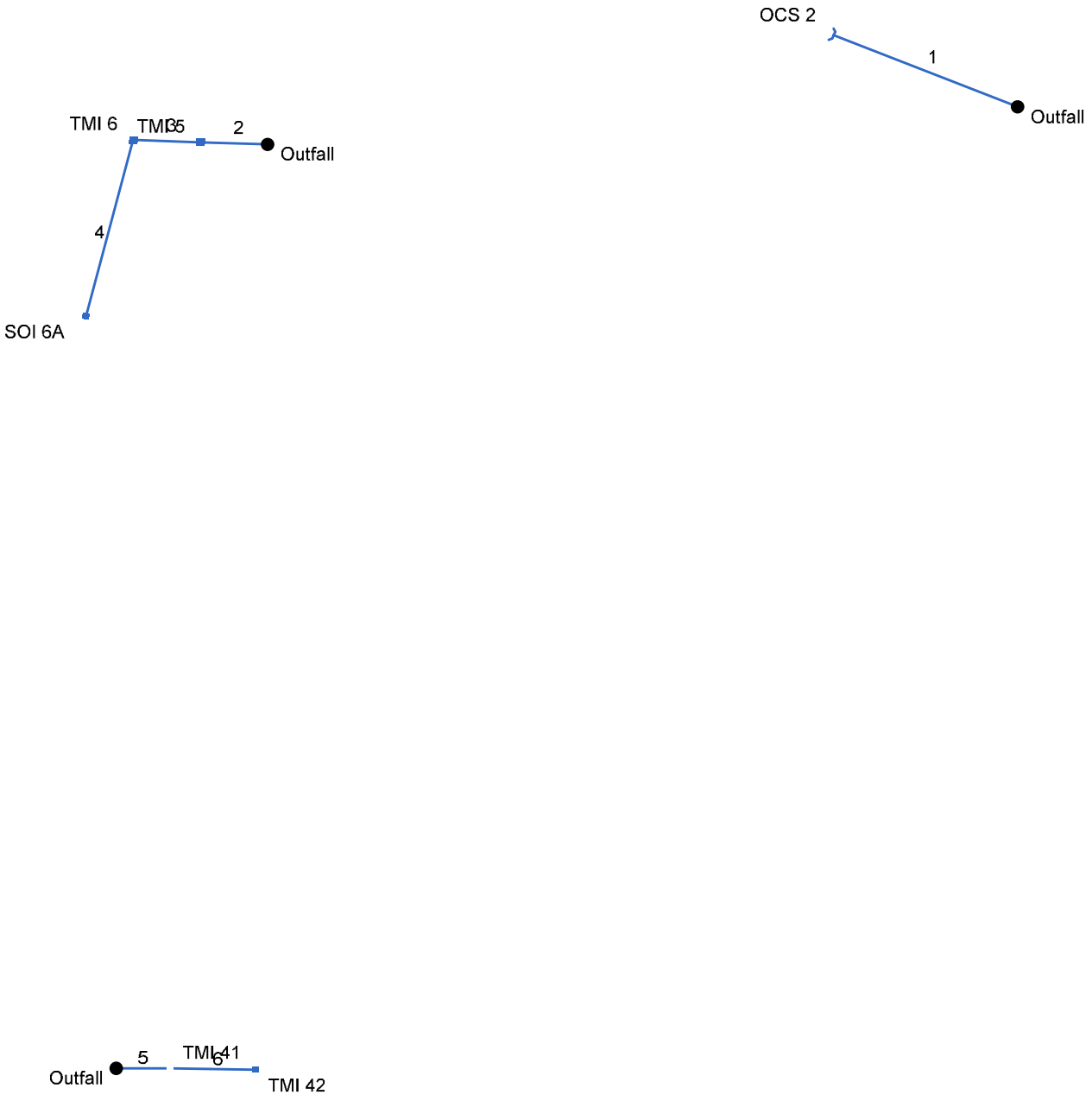
Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf		Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf	Ave Sf	Enrgy loss		
	(in)	(cfs)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(ft)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(%)	(ft)	(K)	(ft)
1	60	16.63	910.75	912.32	1.57	3.29	3.15	0.40	912.72	0.000	95.300	911.15	912.27 j	1.12**	3.29	5.05	0.40	912.67	0.000	0.000	n/a	1.00	0.40
2	36	33.34	922.47	924.74	2.27	4.64	5.81	0.80	925.54	0.000	33.145	922.64	924.51	1.87**	4.64	7.18	0.80	925.32	0.000	0.000	n/a	0.50	0.40
3	36	32.85	922.83	924.56	1.73*	4.23	7.76	0.79	925.36	0.000	33.000	923.00	924.86	1.86**	4.60	7.14	0.79	925.65	0.000	0.000	n/a	1.48	n/a
4	24	31.80	923.20	925.20	2.00*	3.14	10.13	1.59	926.79	1.685	99.000	923.69	926.87	2.00	3.14	10.12	1.59	928.46	1.685	1.685	1.668	1.00	1.59
5	24	1.24	928.76	929.08	0.32	0.32	3.83	0.13	929.21	0.000	26.463	929.03	929.41	0.38**	0.42	2.94	0.13	929.55	0.000	0.000	n/a	0.50	0.07
6	24	0.62	929.23	929.45	0.22*	0.19	3.32	0.09	929.54	0.000	42.000	929.65	929.92	0.27**	0.25	2.45	0.09	930.01	0.000	0.000	n/a	1.00	0.09

Project File: Storm Sewers-OFFSITE ONLY- 25 Year Storm.stm | Number of lines: 6 | Run Date: 10/4/2023

Notes: * Normal depth assumed; ** Critical depth.; j-Line contains hyd. jump ; c = cir e = ellip b = box

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: Storm Sewers-OFFSITE ONLY- 100 Year Storm.stm	Number of lines: 6	Date: 10/4/2023

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1	EX WALL	42.41	60	Cir	98.333	910.75	911.15	0.407	912.40	912.97	n/a	912.97	End	OpenHeadwall
2	FES 4	40.58	36	Cir	33.145	922.47	922.64	0.513	924.74	924.71	n/a	924.71	End	Curb-Horiz
3	6	40.06	36	Cir	33.000	922.83	923.00	0.515	924.81	925.06	n/a	925.06	2	Curb-Horiz
4	6A	38.88	24	Cir	99.000	923.20	923.69	0.495	925.20*	927.69*	2.38	930.07	3	DropCurb
5	FES 40	1.34	24	Cir	26.463	928.76	929.03	1.020	929.08	929.43	0.07	929.43	End	Curb-Horiz
6	42	0.74	24	Cir	42.000	929.23	929.65	1.000	929.47	929.95	0.10	929.95	5	Curb-Horiz

Project File: Storm Sewers-OFFSITE ONLY- 100 Year Storm.stm | Number of lines: 6 | Run Date: 10/4/2023

NOTES: Return period = 100 Yrs. ; *Surcharged (HGL above crown).

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	98.333	0.00	0.00	0.00	0.00	0.00	5.0	5.0	0.0	42.41	180.0	7.03	60	0.41	910.75	911.15	912.40	912.97	0.00	920.00	EX WALL
2	End	33.145	0.16	10.59	0.64	0.10	6.97	5.0	25.4	5.8	40.58	51.75	7.43	36	0.51	922.47	922.64	924.74	924.71	0.00	928.10	FES 4
3	2	33.000	0.36	10.43	0.61	0.22	6.87	5.0	25.3	5.8	40.06	51.86	7.92	36	0.52	922.83	923.00	924.81	925.06	928.10	929.66	6
4	3	99.000	10.07	10.07	0.66	6.65	6.65	25.2	25.2	5.8	38.88	17.24	12.38	24	0.49	923.20	923.69	925.20	927.69	929.66	929.00	6A
5	End	26.463	0.13	0.26	0.58	0.08	0.15	5.0	8.0	8.9	1.34	24.75	3.57	24	1.02	928.76	929.03	929.08	929.43	0.00	934.65	FES 40
6	5	42.000	0.13	0.13	0.58	0.08	0.08	5.0	5.0	9.8	0.74	24.50	3.03	24	1.00	929.23	929.65	929.47	929.95	934.65	934.65	42

Project File: Storm Sewers-OFFSITE ONLY- 100 Year Storm.stm

Number of lines: 6

Run Date: 10/4/2023

NOTES:Intensity = 127.16 / (Inlet time + 17.80) ^ 0.82; Return period =Yrs. 100 ; c = cir e = ellip b = box

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1	OCS 2	42.41*	0.00	42.41	0.00	Hdwl	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
2	TMI 5	1.01	0.00	1.01	0.00	Curb	6.0	2.93	0.00	0.00	0.00	Sag	1.50	0.020	0.020	0.013	0.24	11.78	0.24	11.78	0.0	Off
3	TMI 6	2.16	0.00	2.16	0.00	Curb	6.0	2.93	0.00	0.00	0.00	Sag	1.50	0.020	0.020	0.013	0.39	19.60	0.39	19.60	0.0	Off
4	SOI 6A	38.88	0.00	38.88	0.00	DrCrb	12.0	5.00	0.00	0.00	0.00	Sag	0.00	0.020	0.020	0.013	2.59	129.69	2.59	129.69	0.0	Off
5	TMI 41	0.74	0.00	0.74	0.00	Curb	4.0	1.00	0.00	0.00	0.00	Sag	2.00	0.050	0.020	0.013	0.23	8.49	0.23	8.49	0.0	Off
6	TMI 42	0.74	0.00	0.74	0.00	Curb	6.0	4.00	0.00	0.00	0.00	Sag	2.00	0.050	0.020	0.013	0.18	6.07	0.18	6.07	0.0	Off

Project File: Storm Sewers-OFFSITE ONLY- 100 Year Storm.stm | Number of lines: 6 | Run Date: 10/4/2023

NOTES: Inlet N-Values = 0.016; Intensity = 127.16 / (Inlet time + 17.80) ^ 0.82; Return period = 100 Yrs. ; * Indicates Known Q added. All curb inlets are Horiz throat.

Storm Sewer Inlet Time Tabulation

Line No.	Line ID	Tc Method	Sheet Flow					Shallow Concentrated Flow					Channel Flow							Total Travel Time (min)
			n-Value	flow Length (ft)	2-yr 24h P (in)	Land Slope (%)	Travel Time (min)	flow Length (ft)	Water Slope (%)	Surf Descr	Ave Vel (ft/s)	Travel Time (min)	X-sec Area (sqft)	Wetted Perim (ft)	Chan Slope (%)	n-Value	Vel	flow Length (ft)	Travel Time (min)	
1	EX WALL	User																		5.00
2	FES 4	User																		5.00
3	6	User																		5.00
4	6A	User																		25.20
5	FES 40	User																		5.00
6	42	User																		5.00

Project File: Storm Sewers-OFFSITE ONLY- 100 Year Storm.stm | Min. Tc used for intensity calculations = 5 min | Number of lines: 6 | Date: 10/4/2023

Hydraulic Grade Line Computations

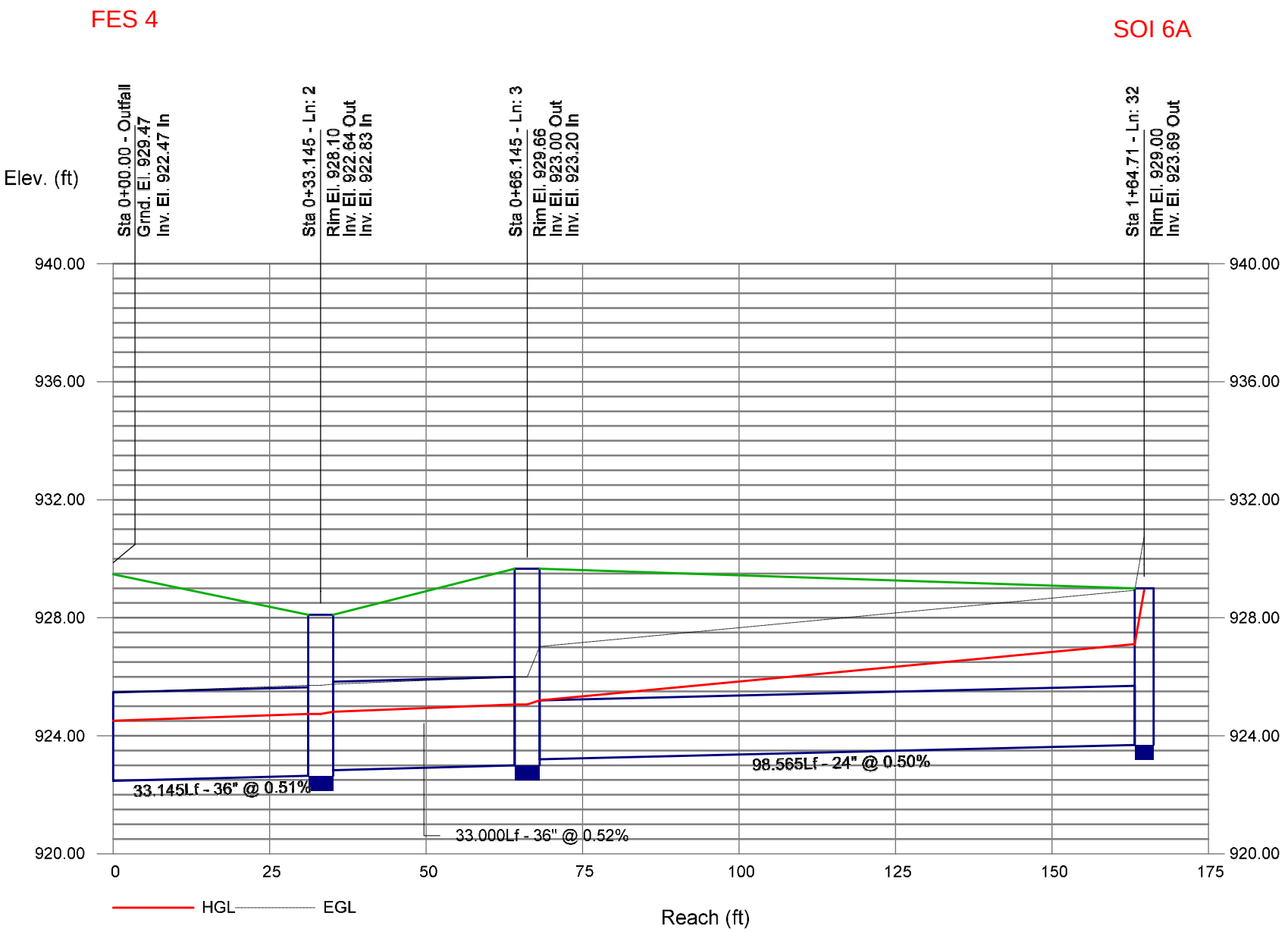
Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf		Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf	Ave Sf	Enrgy loss		
	(in)	(cfs)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(ft)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(%)	(ft)	(K)	(ft)
1	60	42.41	910.75	912.40	1.65	5.66	7.49	0.67	913.07	0.000	98.333	911.15	912.97	1.82**	6.45	6.57	0.67	913.64	0.000	0.000	n/a	1.00	n/a
2	36	40.58	922.47	924.74	2.27	5.21	7.07	0.94	925.68	0.000	33.145	922.64	924.71	2.07**	5.21	7.79	0.94	925.66	0.000	0.000	n/a	0.50	n/a
3	36	40.06	922.83	924.81	1.98*	4.95	8.09	0.93	925.74	0.000	33.000	923.00	925.06	2.06**	5.17	7.75	0.93	925.99	0.000	0.000	n/a	1.48	n/a
4	24	38.88	923.20	925.20	2.00*	3.14	12.38	2.38	927.58	2.518	99.000	923.69	927.69	2.00	3.14	12.37	2.38	930.07	2.518	2.518	2.493	1.00	2.38
5	24	1.34	928.76	929.08	0.32	0.32	4.13	0.14	929.22	0.000	26.463	929.03	929.43	0.40**	0.45	3.00	0.14	929.57	0.000	0.000	n/a	0.50	0.07
6	24	0.74	929.23	929.47	0.24*	0.21	3.49	0.10	929.57	0.000	42.000	929.65	929.95	0.30**	0.29	2.56	0.10	930.05	0.000	0.000	n/a	1.00	0.10

Project File: Storm Sewers-OFFSITE ONLY- 100 Year Storm.stm | Number of lines: 6 | Run Date: 10/4/2023

Notes: * Normal depth assumed; ** Critical depth. ; c = cir e = ellip b = box

Storm Sewer Profile

Proj. file: STORM SEWERS 6-20-23.stm



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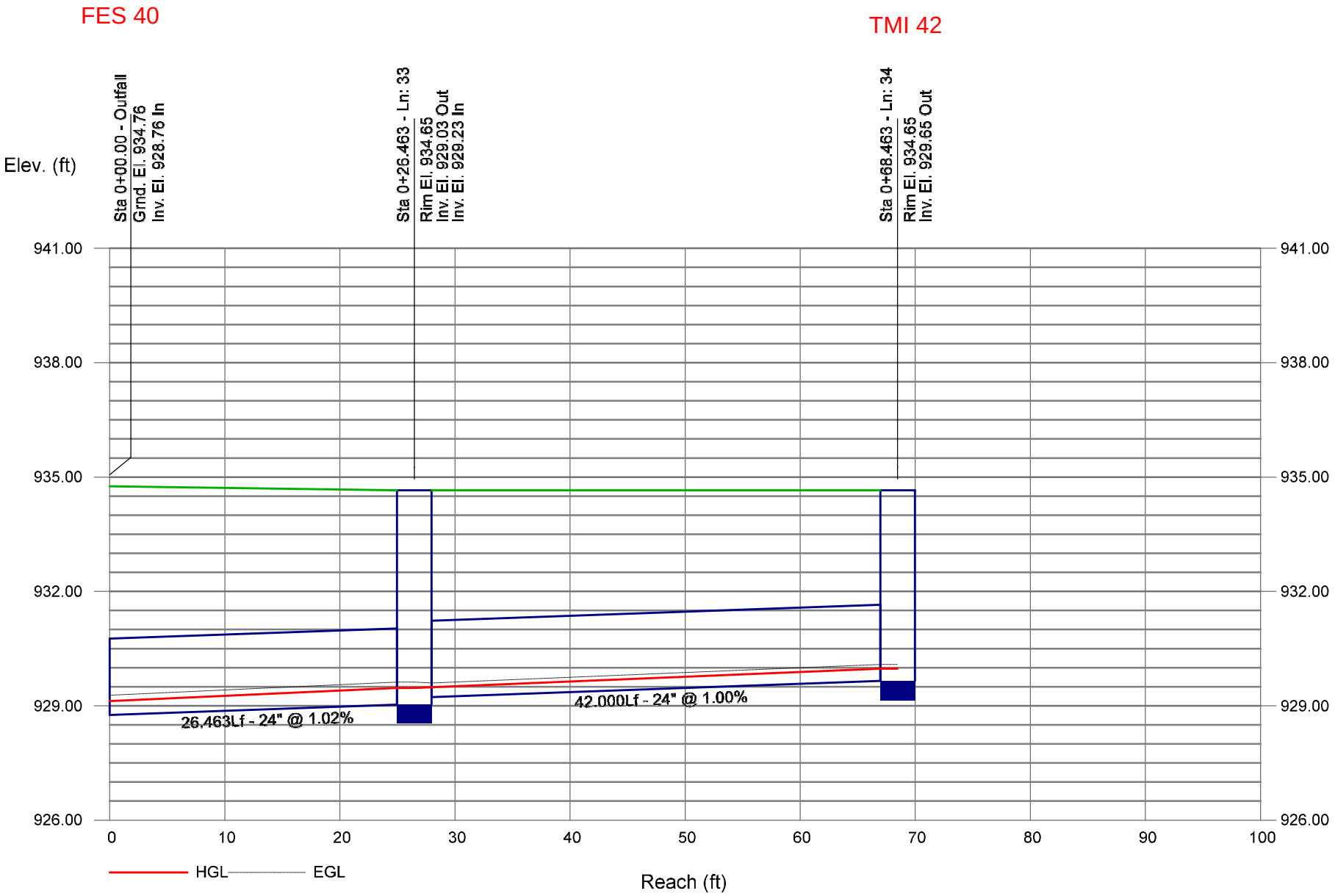

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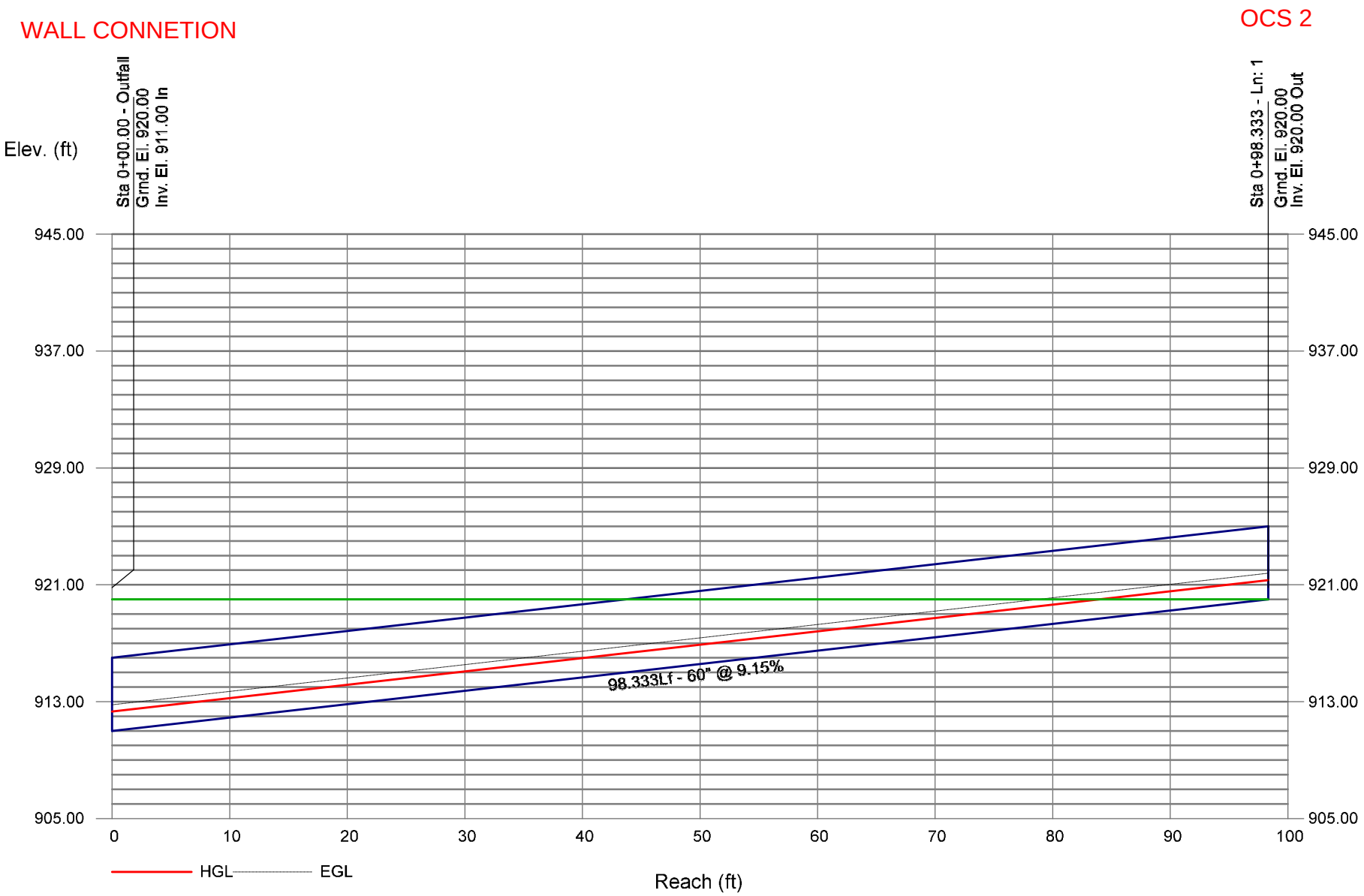
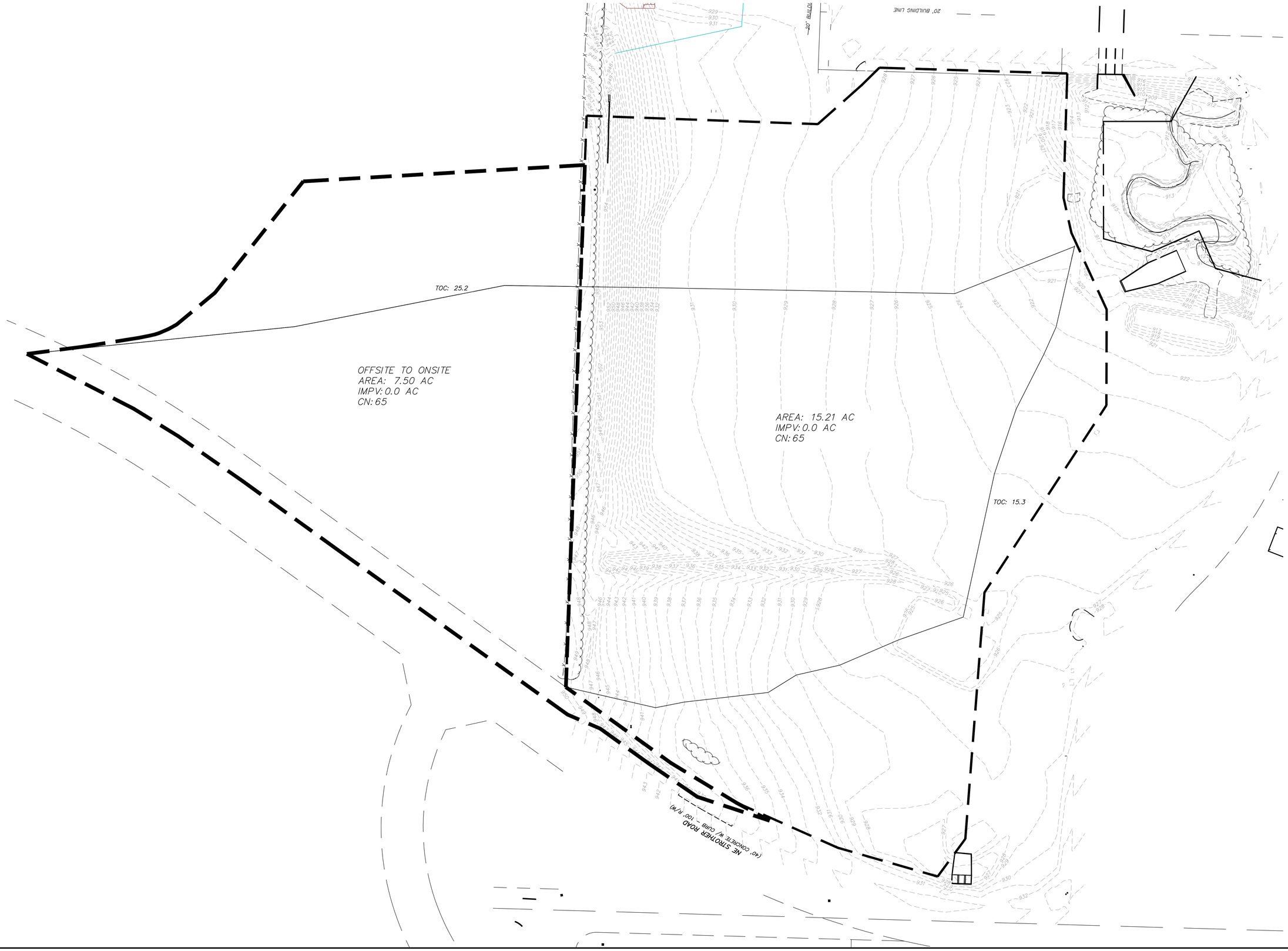


APPENDIX D:
DRAINAGE AREA MAP(S)



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PRE-DRAINAGE AREA MAP

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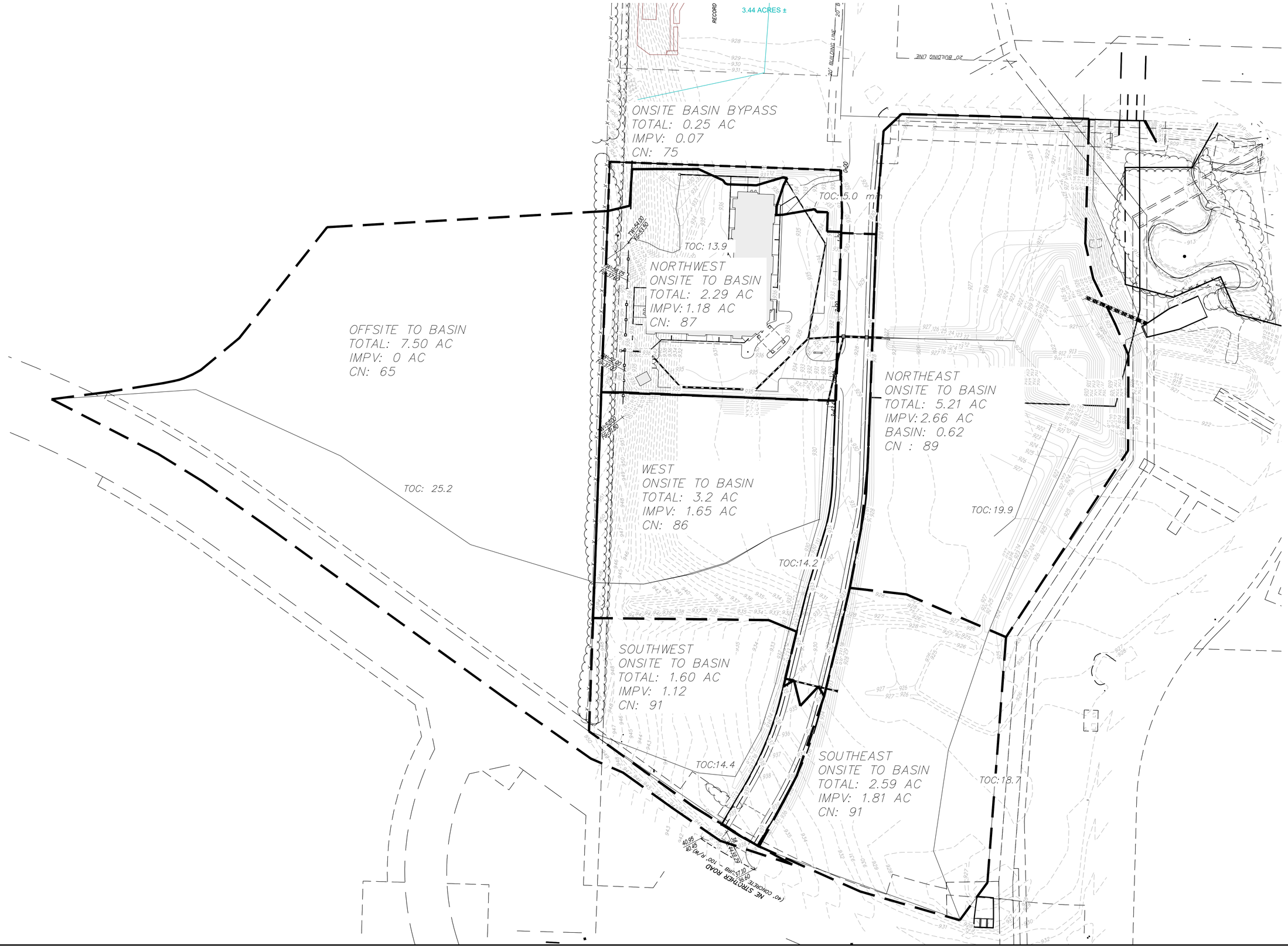

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POST-DRAINAGE AREA MAP

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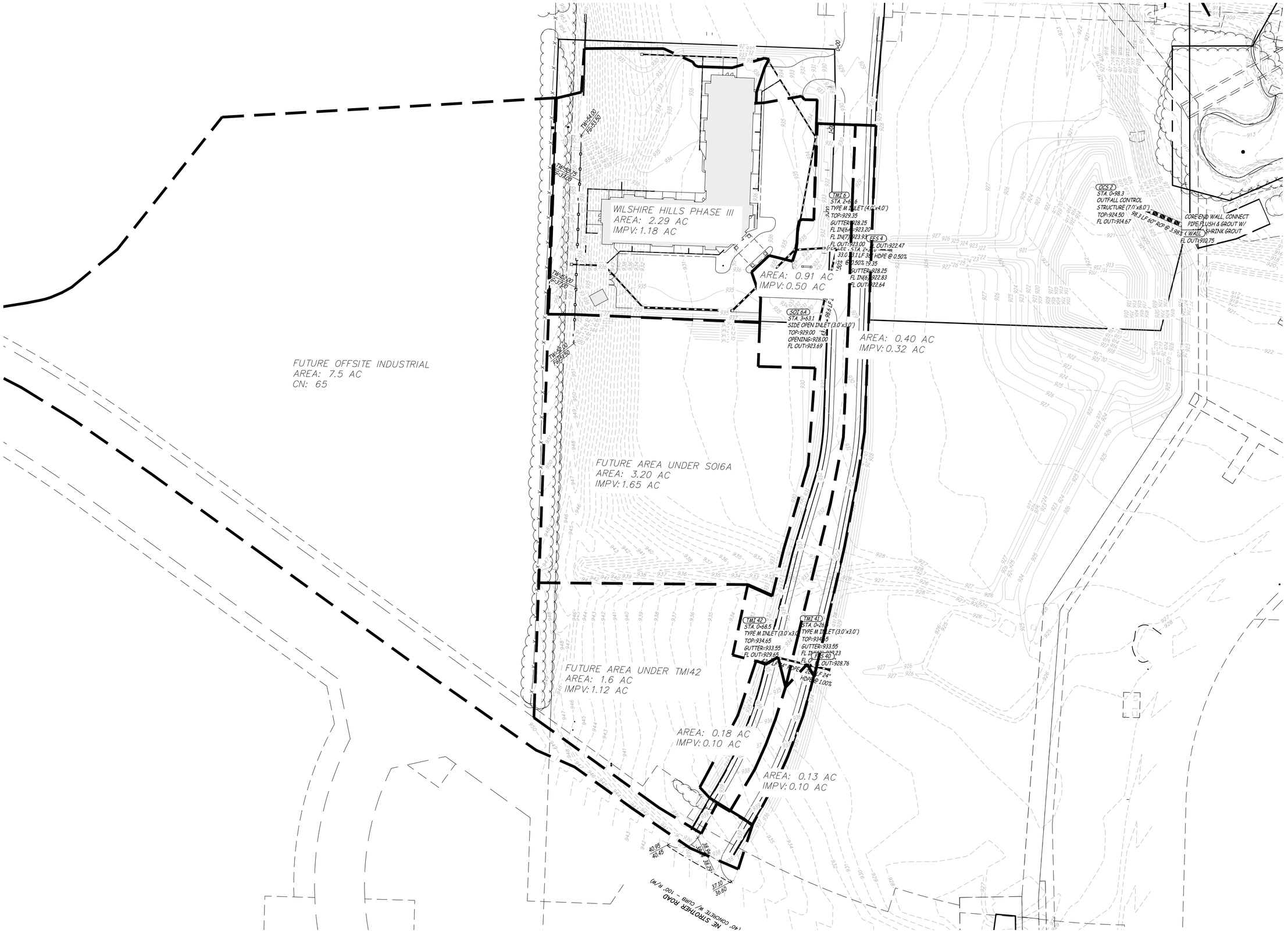

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