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: NOVEMBER 28, 2023

PREPARED BY:

Engineering Surveys & Services

1113 FAY STREET

COLUMBIA, MO 65201

(573) 449-2646

JOB NUMBER: 15925

11/28//23

STATE OF MISSOURI
MATTHEW AARON KRIETE
NUMBER PE-2007002811
PROFESSIONAL ENGINEER

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 water quality 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 Water Quality Design

Design Standard(s):

- *Lee's Summit, Missouri Stormwater Discharge Control Regulations (Code of Ordinance Chapter 34 Article 3)*
- *APWA Section 5300*
- *APWA Section 5608.4*
- *MARC/APWA BMP Manual Chapter 6.*
- *LS Section 5600 – Storm Drainage Systems and Facilities (revised July 2020)*

The City of Lee's Summit has requested for detention to not be designed for the site (phone conversation November 3rd, 2023. This is due to the effect of detention extending the peak of watershed flow further negatively impacting the watershed downstream. A water quality basin has been provided to serve the 19 acres to the west of Meadowview Drive.

A hydraflow analysis has been conducted comparing the impact of the water quality storm on the development. The analysis was also run with the original basin and shown to further negatively impact the basin on delaying the peak of the runoff.

The water quality basin has been designed to serve all sites south of Meadowview Drive and west NE Manhattan Drive. The basin has been sized to provide water quality for future impervious areas. Table 1 shows the area of each lot, the assumed impervious area, and the total impervious treated by the water quality 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 the water quality basin.

Appendix B includes HydraFlow detention calculations and Appendix D includes the detention drainage area maps. Water quality requirements have also been included in Appendix D. The designed basin

provides the required 40-hour extended detention of runoff for the local 90% mean annual event (1.37"/24-hour rainfall).

The required water quality volume calculations can be found in Appendix D. The volume required was 52,555 CF of storage. The orifice sized to provide this drawdown was 4.55 inches. The resulting water quality elevation was 917.0.

The 100-year level of rise in the basin is 919.0 and the top of the emergency spillway is 919.5. The clogged water surface elevation is 920.5. The top of dam is 921.5. 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 while providing the necessary freeboard set by Lee's Summit Stormwater Report Requirements.

2.3 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 quality 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

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Project: Wilshire Hills Phase III Date: 11/28/2023

Sheet: ____ of ____

EROSION CONTROL CALCULATIONS

Temporary Sediment Trap

11.3 Acres disturbed to sediment basin

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

ELEVATION	CONTOUR AREA (SF)	TOTAL STORAGE (CF)
912	5,000	0
913	7,800	6,348
914	9,600	15,031
915	11,500	25,566
916	13,500	38,051
917	15,600	52,587
918	17,800	69,273
919	21,100	88,210

40,680 CF of sediment storage is provided at an elevation of 916. The outfall structure must be wrapped with filter fabric below this elevation.

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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: STRUTHERS 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

"**********
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)

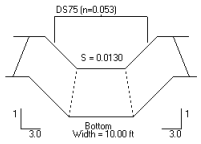
Channel Effective Manning's Roughness = 0.013
Calculated Shear (Td) = 62.4 * 0.25 * 0.013 = 0.20 psf (9.8 Pa)
Safety Factor = (Tp/Td) = (2.16 /0.20) = 10.57

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
"

North American Green - ECMDS Version 4.2 | 10/12/2010 3:44 PM

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									

"**
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 : 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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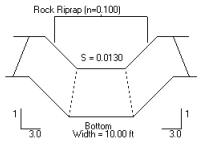
HYDRAULIC RESULTS

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	Stability Analysis	Vegetation Characteristics				Permissible Shear Stress (psf)	Calculated Shear Stress (psf)	Safety Factor	Remarks
	Staple Pattern		Phase	Class	Type	Density				
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

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Water Quality - Basin Elevations

Development Name: **Wilshire Hills Phase III Public Improvements**
Location: **Lee's Summit, MO**
Date: **Novemener 13, 2023**
Project No: **15925**

Basin Stage Elevations

Elevation	Area (SF)	Storage (CF)
912	5,000	0
913	7,800	6,300
914	9,600	8,600
915	11,500	25,600
916	13,500	38,000
917	15,600	52,600
918	17,800	69,200
919	20,100	88,210
920	22,555	109,524

WQv = 52,555 CF (from calculation)

Elevation of WQv:

$$\frac{919 - 918}{116{,}501 - 93{,}441} = \frac{919 - X}{116{,}501 - 93{,}441}$$

X = WQv Elevation = 917.00

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Water Quality - Orifice Sizing

Development Name: **Wilshire Hills Phase III Public Improvements**
Location: **Lee's Summit, MO**
Date: **Novemener 13, 2023**
Project No: **15925**

H_{max} = WQv elevation - basin bottom elevation (or top of Volume Reduction elevation)

H_{max} = 1026.94 - 1026 = 5.00 (ft)

Q_{avg} = WQv/(24 hr)(3,600 s/hr)

CPv= 52,555 CF (from GA Review Tool Spreadsheet)

Q_{avg} = 0.61 CFS

$Q_{max} = Q_{avg} \times 2$ = 1.22 CFS

$Q = CA(2gH)^{0.5}$ rearanging $A = Q/C(2gH)^{0.5}$

C = discharge coefficient = 0.6
g = acceleration due to gravity (ft/s)= 32.2

A = orifice area = 0.11302 SF

$A = (\pi/4)d^2$ rearanging $d = (4A/\pi)^{0.5}$

d = orifice diameter = 0.38 ft.

d = orifice diameter =	**4.55**	**in.**

WQv Orifice Size > CPv Orifice Size
therefore orifice shall be the CPv Orifice Size

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Water Quality Protection Volume Calculation (WQ_v)

Development Name: **Wilshire Hills Phase III Public Improvements**
Location: **Lee's Summit, MO**
Date: **November 13, 2023**
Project No: **15925**

Runoff Calculation:

$$R_V = 0.05 + 0.009(I)$$

$$WQ_v = \frac{1.2\ R_v\ A}{12}$$

I =	percent of impervious cover (%)
WQ_V =	water quality protection volume (acre-feet)
R_V =	volumetric runoff
A =	total drainage area (acres)

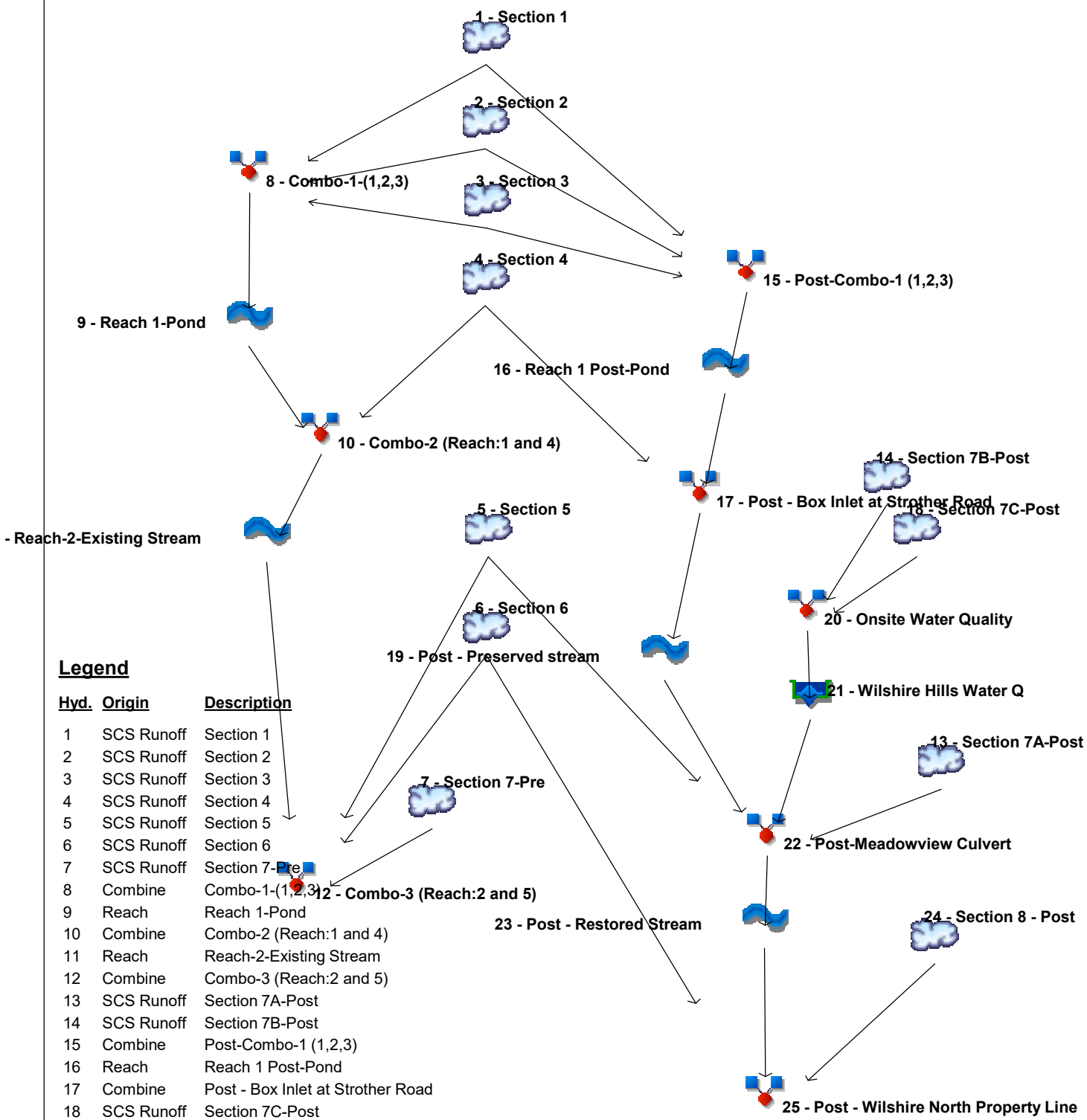
Runoff Calculation Inputs:

Total Drainage Area	19.00	Acres	
% Impervious Area	65%	Acres	
Riparian Buffer Area	0.00	Acres	
Regulated Floodplain Area	0.00	Acres	
Total Conservation Area	0.00	Acres	Site area - ESA - Floodplain.
Reduced Drainage Area	19.00	Acres	
R_V	0.64		
UnReduced WQ_V	**1.207**	**ac-ft**	
Reduced WQ_V	**1.207**	**ac-ft**	

Reduced WQ_V **52,555** **ft^3**

Hydraflow Table of Contents

Watershed Model Schematic



Legend

Hyd.	Origin	Description
1	SCS Runoff	Section 1
2	SCS Runoff	Section 2
3	SCS Runoff	Section 3
4	SCS Runoff	Section 4
5	SCS Runoff	Section 5
6	SCS Runoff	Section 6
7	SCS Runoff	Section 7-Pre
8	Combine	Combo-1-(1,2,3)
9	Reach	Reach 1-Pond
10	Combine	Combo-2 (Reach:1 and 4)
11	Reach	Reach-2-Existing Stream
12	Combine	Combo-3 (Reach:2 and 5)
13	SCS Runoff	Section 7A-Post
14	SCS Runoff	Section 7B-Post
15	Combine	Post-Combo-1 (1,2,3)
16	Reach	Reach 1 Post-Pond
17	Combine	Post - Box Inlet at Strother Road
18	SCS Runoff	Section 7C-Post
19	Reach	Post - Preserved stream
20	Combine	Onsite Water Quality
21	Reservoir	Wilshire Hills Water Q
22	Combine	Post-Meadowview Culvert
23	Reach	Post - Restored Stream
24	SCS Runoff	Section 8 - Post
25	Combine	Post - Wilshire North Property Line

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	------	-------	101.55	-------	-------	208.96	-------	-------	371.96	Section 1
2	SCS Runoff	------	-------	84.52	-------	-------	173.92	-------	-------	309.59	Section 2
3	SCS Runoff	------	-------	133.42	-------	-------	251.46	-------	-------	423.43	Section 3
4	SCS Runoff	------	-------	139.44	-------	-------	241.00	-------	-------	381.91	Section 4
5	SCS Runoff	------	-------	194.03	-------	-------	349.09	-------	-------	566.77	Section 5
6	SCS Runoff	------	-------	31.44	-------	-------	51.76	-------	-------	79.63	Section 6
7	SCS Runoff	------	-------	124.23	-------	-------	211.12	-------	-------	331.06	Section 7-Pre
8	Combine	1, 2, 3,	-------	318.04	-------	-------	630.52	-------	-------	1088.09	Combo-1-(1,2,3)
9	Reach	8	-------	309.37	-------	-------	625.41	-------	-------	1086.87	Reach 1-Pond
10	Combine	4, 9	-------	448.17	-------	-------	863.25	-------	-------	1461.77	Combo-2 (Reach:1 and 4)
11	Reach	10	-------	427.66	-------	-------	842.35	-------	-------	1443.93	Reach-2-Existing Stream
12	Combine	5, 6, 7, 11	-------	543.72	-------	-------	1052.66	-------	-------	1800.57	Combo-3 (Reach:2 and 5)
13	SCS Runoff	------	-------	51.77	-------	-------	87.66	-------	-------	137.12	Section 7A-Post
14	SCS Runoff	------	-------	5.349	-------	-------	14.45	-------	-------	30.63	Section 7B-Post
15	Combine	1, 2, 3,	-------	318.04	-------	-------	630.52	-------	-------	1088.09	Post-Combo-1 (1,2,3)
16	Reach	15	-------	308.94	-------	-------	624.92	-------	-------	1086.45	Reach 1 Post-Pond
17	Combine	4, 16	-------	447.74	-------	-------	862.75	-------	-------	1461.36	Post - Box Inlet at Strother Road
18	SCS Runoff	------	-------	40.01	-------	-------	67.99	-------	-------	106.61	Section 7C-Post
19	Reach	17	-------	436.46	-------	-------	855.12	-------	-------	1458.31	Post - Preserved stream
20	Combine	14, 18,	-------	45.35	-------	-------	82.38	-------	-------	135.80	Onsite Water Quality
21	Reservoir	20	-------	38.83	-------	-------	80.69	-------	-------	123.42	Wilshire Hills Water Q
22	Combine	5, 13, 19, 21	-------	508.69	-------	-------	991.07	-------	-------	1721.03	Post-Meadowview Culvert
23	Reach	22	-------	504.21	-------	-------	982.21	-------	-------	1713.16	Post - Restored Stream
24	SCS Runoff	------	-------	27.49	-------	-------	46.04	-------	-------	71.57	Section 8 - Post
25	Combine	6, 23, 24	-------	519.75	-------	-------	1017.03	-------	-------	1766.33	Post - Wilshire North Property Line

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	101.55	6	732	424,243	------	------	------	Section 1
2	SCS Runoff	84.52	6	732	353,103	------	------	------	Section 2
3	SCS Runoff	133.42	6	738	672,646	------	------	------	Section 3
4	SCS Runoff	139.44	6	732	700,644	------	------	------	Section 4
5	SCS Runoff	194.03	6	720	596,307	------	------	------	Section 5
6	SCS Runoff	31.44	6	720	97,720	------	------	------	Section 6
7	SCS Runoff	124.23	6	726	504,834	------	------	------	Section 7-Pre
8	Combine	318.04	6	732	1,449,992	1, 2, 3,	------	------	Combo-1-(1,2,3)
9	Reach	309.37	6	738	1,449,990	8	------	------	Reach 1-Pond
10	Combine	448.17	6	738	2,150,634	4, 9	------	------	Combo-2 (Reach:1 and 4)
11	Reach	427.66	6	744	2,150,629	10	------	------	Reach-2-Existing Stream
12	Combine	543.72	6	738	3,349,490	5, 6, 7, 11	------	------	Combo-3 (Reach:2 and 5)
13	SCS Runoff	51.77	6	720	159,632	------	------	------	Section 7A-Post
14	SCS Runoff	5.349	6	726	19,193	------	------	------	Section 7B-Post
15	Combine	318.04	6	732	1,449,992	1, 2, 3,	------	------	Post-Combo-1 (1,2,3)
16	Reach	308.94	6	738	1,449,989	15	------	------	Reach 1 Post-Pond
17	Combine	447.74	6	738	2,150,633	4, 16	------	------	Post - Box Inlet at Strother Road
18	SCS Runoff	40.01	6	726	162,574	------	------	------	Section 7C-Post
19	Reach	436.46	6	744	2,150,631	17	------	------	Post - Preserved stream
20	Combine	45.35	6	726	181,767	14, 18,	------	------	Onsite Water Quality
21	Reservoir	38.83	6	738	181,742	20	917.52	61,270	Wilshire Hills Water Q
22	Combine	508.69	6	744	3,088,313	5, 13, 19, 21	------	------	Post-Meadowview Culvert
23	Reach	504.21	6	750	3,088,094	22	------	------	Post - Restored Stream
24	SCS Runoff	27.49	6	726	111,965	------	------	------	Section 8 - Post
25	Combine	519.75	6	750	3,297,777	6, 23, 24	------	------	Post - Wilshire North Property Line

P:\General Projects\15925E-JES-Wilshire-Hills-Eng\Stormwater\15925 Downstream Analysis (based update).gpw

Return Period: 2 Year

Tuesday, 11 / 28 / 2023

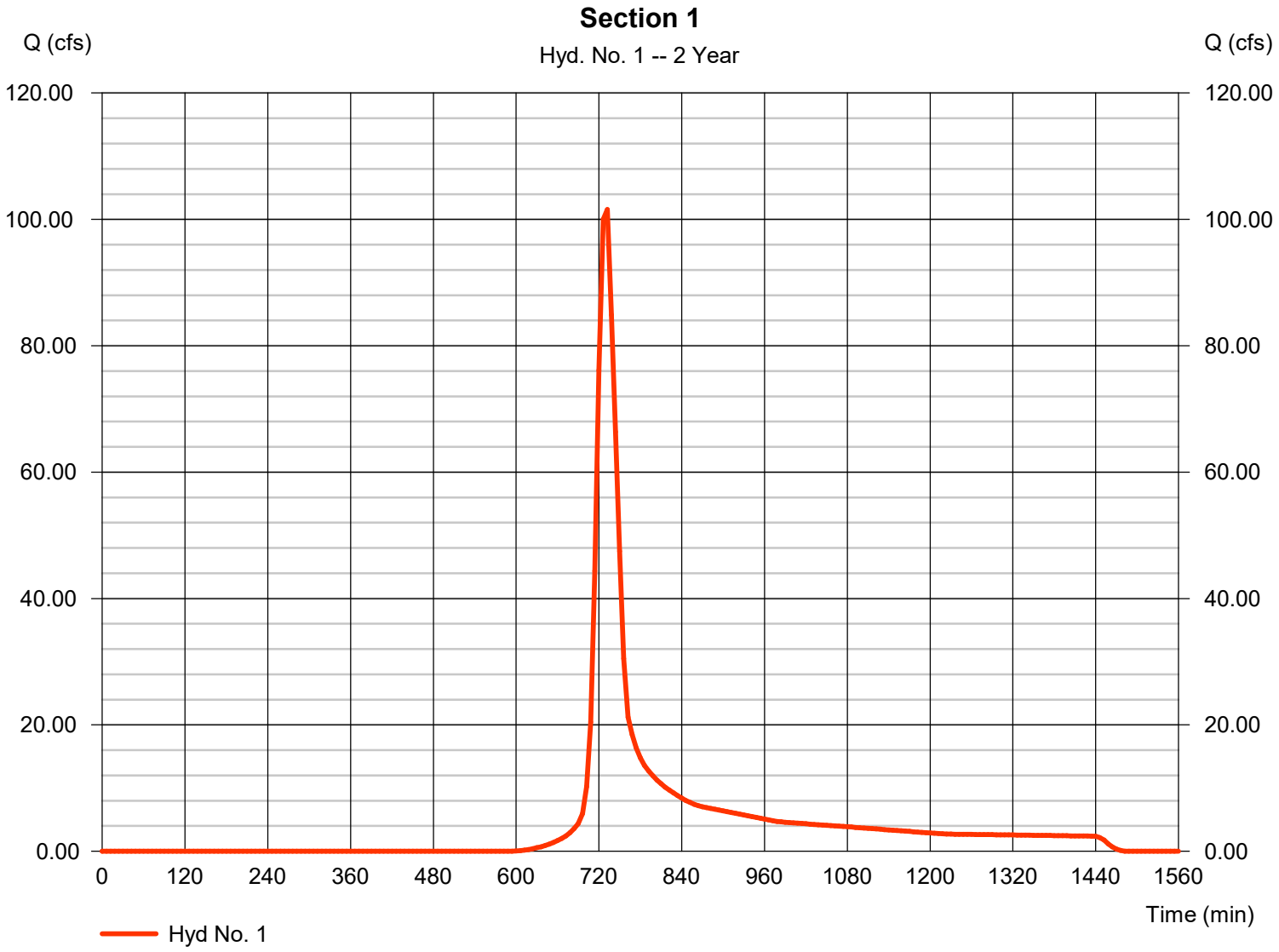
Hydrograph Report

Hyd. No. 1

Section 1

Hydrograph type	=	SCS Runoff	Peak discharge	=	101.55 cfs
Storm frequency	=	2 yrs	Time to peak	=	732 min
Time interval	=	6 min	Hyd. volume	=	424,243 cuft
Drainage area	=	81.700 ac	Curve number	=	77*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	24.30 min
Total precip.	=	3.50 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(3.600 x 81) + (13.500 x 98) + (49.000 x 73) + (15.600 x 69)] / 81.700



TR55 Tc Worksheet

Hyd. No. 1

Section 1

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.240		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.50		0.00		0.00		
Land slope (%)	= 2.80		0.00		0.00		
Travel Time (min)	**= 11.93**	**+**	**0.00**	**+**	**0.00**	**=**	**11.93**
Shallow Concentrated Flow							
Flow length (ft)	= 1100.00		0.00		0.00		
Watercourse slope (%)	= 2.80		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.70		0.00		0.00		
Travel Time (min)	**= 6.79**	**+**	**0.00**	**+**	**0.00**	**=**	**6.79**
Channel Flow							
X sectional flow area (sqft)	= 24.00		3.14		0.00		
Wetted perimeter (ft)	= 14.00		6.30		0.00		
Channel slope (%)	= 2.00		1.00		0.00		
Manning's n-value	= 0.050		0.015		0.015		
Velocity (ft/s)	=6.05						
			6.23				
					0.00		
Flow length (ft)	({0})1500.0		550.0		0.0		
Travel Time (min)	**= 4.13**	**+**	**1.47**	**+**	**0.00**	**=**	**5.61**

Total Travel Time, Tc ..... 24.30 min

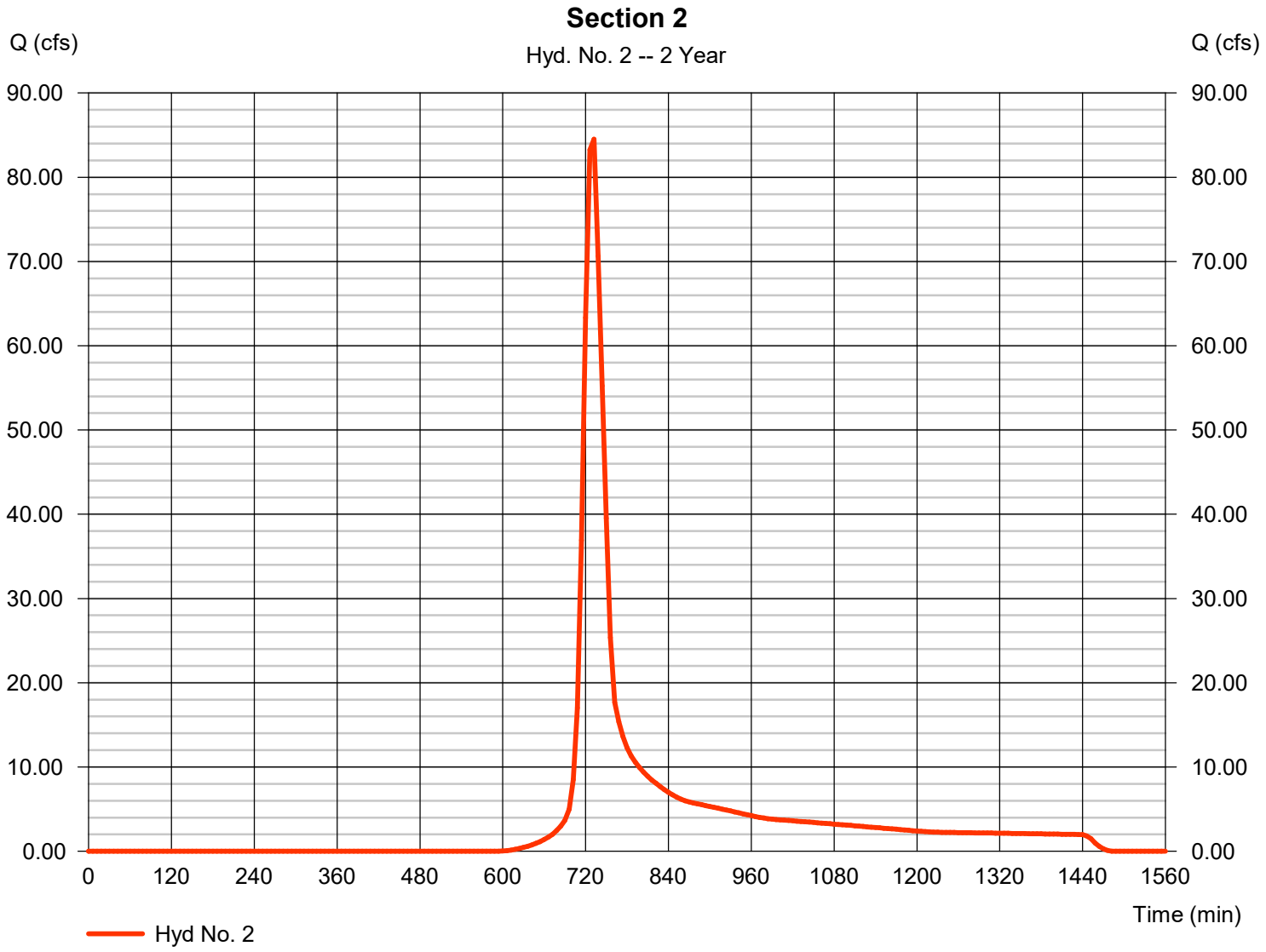
Hydrograph Report

Hyd. No. 2

Section 2

Hydrograph type	=	SCS Runoff	Peak discharge	=	84.52 cfs
Storm frequency	=	2 yrs	Time to peak	=	732 min
Time interval	=	6 min	Hyd. volume	=	353,103 cuft
Drainage area	=	68.000 ac	Curve number	=	77*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	25.30 min
Total precip.	=	3.50 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(8.000 x 98) + (0.500 x 77) + (30.800 x 79) + (28.700 x 69)] / 68.000



TR55 Tc Worksheet

Hyd. No. 2

Section 2

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.240		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.20		0.00		0.00		
Land slope (%)	= 2.20		0.00		0.00		
Travel Time (min)	**= 16.57**	**+**	**0.00**	**+**	**0.00**	**=**	**16.57**
Shallow Concentrated Flow							
Flow length (ft)	= 1000.00		0.00		0.00		
Watercourse slope (%)	= 2.20		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.39		0.00		0.00		
Travel Time (min)	**= 6.96**	**+**	**0.00**	**+**	**0.00**	**=**	**6.96**
Channel Flow							
X sectional flow area (sqft)	= 24.00		50.00		0.00		
Wetted perimeter (ft)	= 14.00		20.00		0.00		
Channel slope (%)	= 3.00		2.50		0.00		
Manning's n-value	= 0.050		0.025		0.015		
Velocity (ft/s)	=7.41						
			17.41				
					0.00		
Flow length (ft)	({0})400.0		950.0		0.0		
Travel Time (min)	**= 0.90**	**+**	**0.91**	**+**	**0.00**	**=**	**1.81**

Total Travel Time, Tc ..... 25.30 min

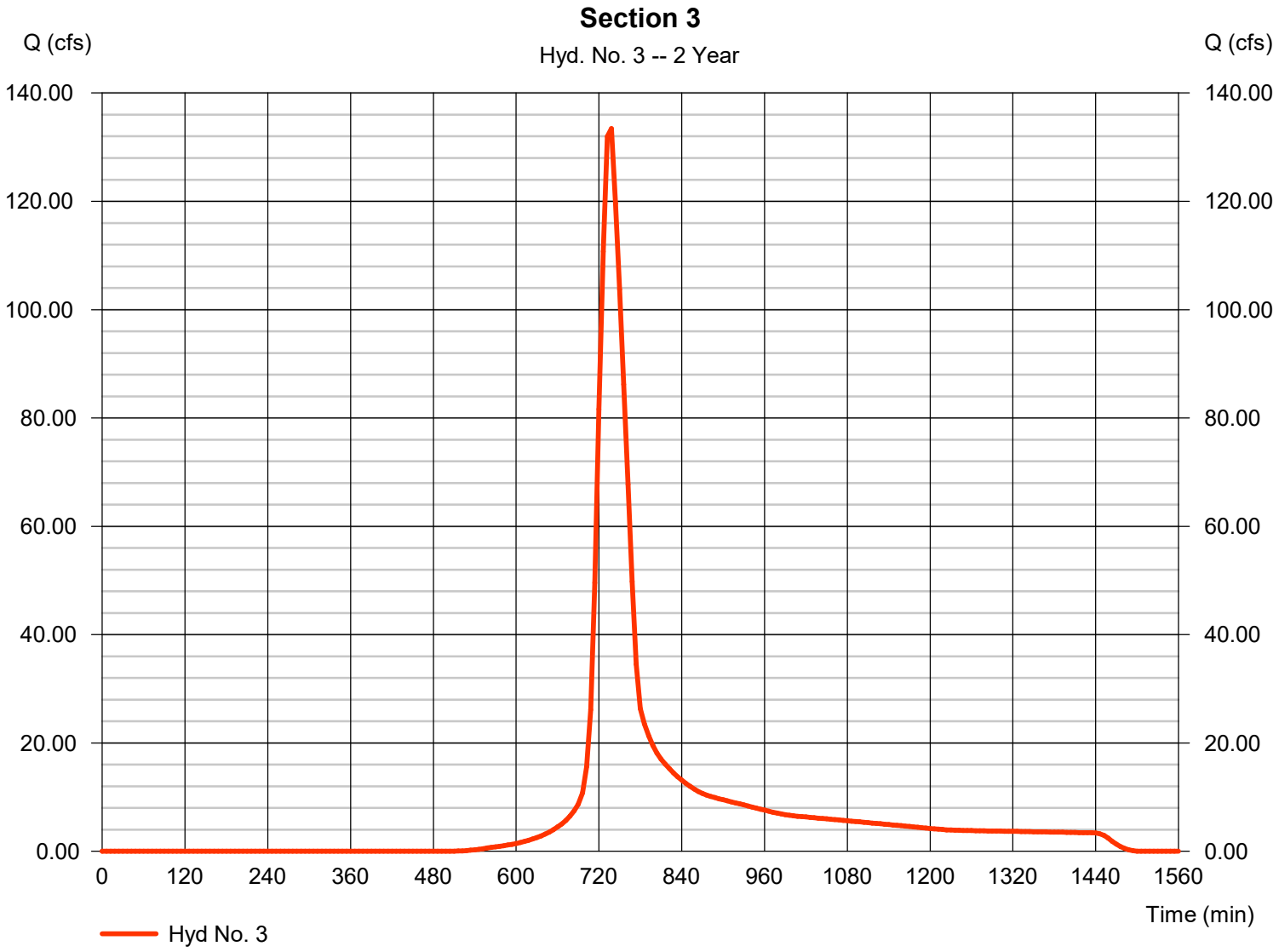
Hydrograph Report

Hyd. No. 3

Section 3

Hydrograph type	=	SCS Runoff	Peak discharge	=	133.42 cfs
Storm frequency	=	2 yrs	Time to peak	=	738 min
Time interval	=	6 min	Hyd. volume	=	672,646 cuft
Drainage area	=	100.800 ac	Curve number	=	82*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	30.20 min
Total precip.	=	3.50 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(18.200 x 98) + (3.000 x 77) + (79.600 x 79)] / 100.800



TR55 Tc Worksheet

Hyd. No. 3

Section 3

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.240		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.20		0.00		0.00		
Land slope (%)	= 1.00		0.00		0.00		
Travel Time (min)	**= 22.71**	**+**	**0.00**	**+**	**0.00**	**=**	**22.71**
Shallow Concentrated Flow							
Flow length (ft)	= 400.00		0.00		0.00		
Watercourse slope (%)	= 1.80		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.16		0.00		0.00		
Travel Time (min)	**= 3.08**	**+**	**0.00**	**+**	**0.00**	**=**	**3.08**
Channel Flow							
X sectional flow area (sqft)	= 24.00		50.00		0.00		
Wetted perimeter (ft)	= 14.00		20.00		0.00		
Channel slope (%)	= 2.40		1.30		0.00		
Manning's n-value	= 0.050		0.025		0.015		
Velocity (ft/s)	=6.62						
			12.56				
					0.00		
Flow length (ft)	({0})850.0		1700.0		0.0		
Travel Time (min)	**= 2.14**	**+**	**2.26**	**+**	**0.00**	**=**	**4.40**

Total Travel Time, Tc ..... 30.20 min

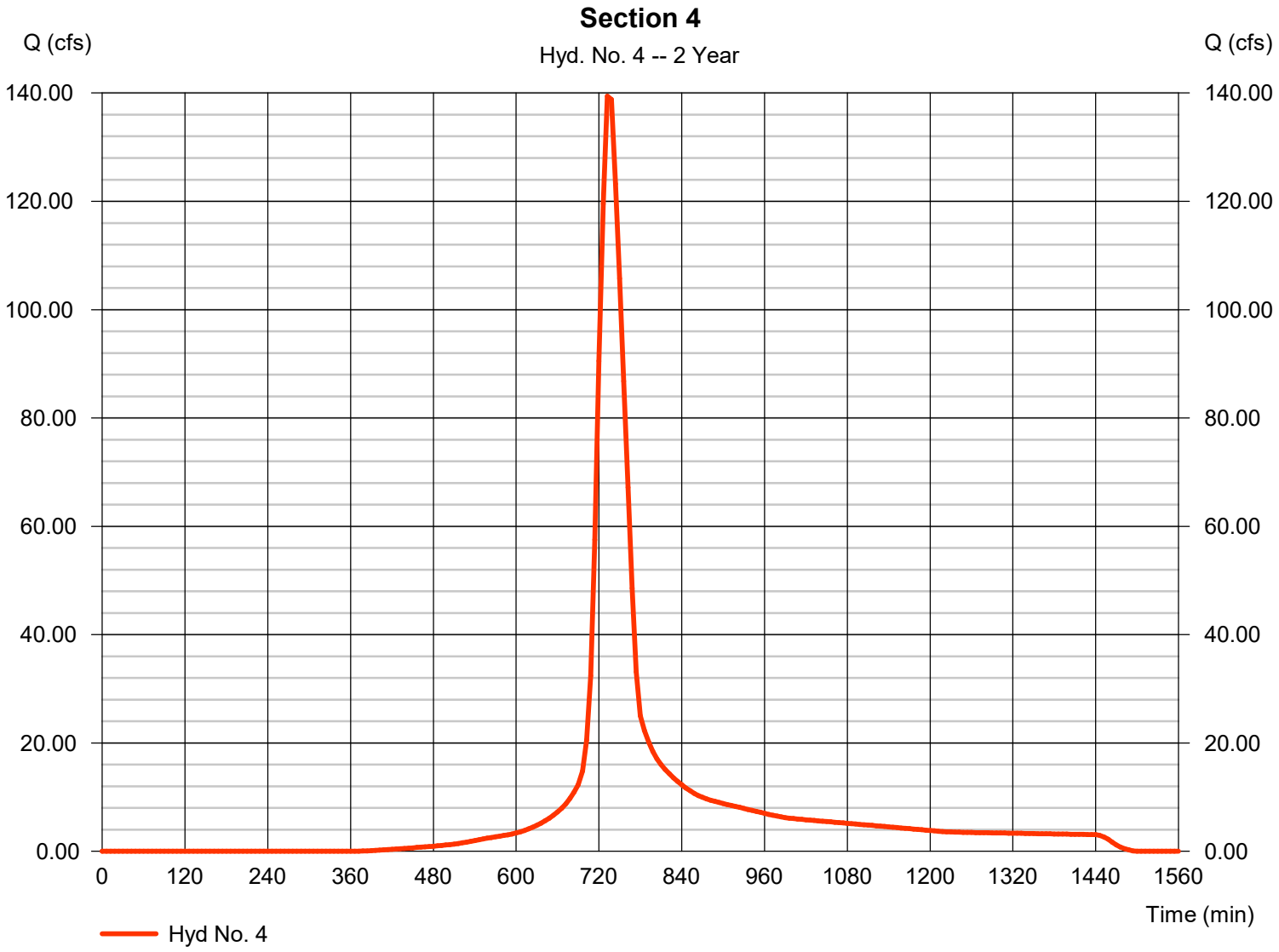
Hydrograph Report

Hyd. No. 4

Section 4

Hydrograph type	=	SCS Runoff	Peak discharge	=	139.44 cfs
Storm frequency	=	2 yrs	Time to peak	=	732 min
Time interval	=	6 min	Hyd. volume	=	700,644 cuft
Drainage area	=	82.500 ac	Curve number	=	88*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	30.70 min
Total precip.	=	3.50 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(49.680 x 98) + (32.820 x 74)] / 82.500



TR55 Tc Worksheet

Hyd. No. 4

Section 4

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.240		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.20		0.00		0.00		
Land slope (%)	= 1.00		0.00		0.00		
Travel Time (min)	**= 22.71**	**+**	**0.00**	**+**	**0.00**	**=**	**22.71**
Shallow Concentrated Flow							
Flow length (ft)	= 900.00		0.00		0.00		
Watercourse slope (%)	= 1.50		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=1.98		0.00		0.00		
Travel Time (min)	**= 7.59**	**+**	**0.00**	**+**	**0.00**	**=**	**7.59**
Channel Flow							
X sectional flow area (sqft)	= 10.00		0.00		0.00		
Wetted perimeter (ft)	= 6.00		0.00		0.00		
Channel slope (%)	= 5.10		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=31.59						
			0.00				
					0.00		
Flow length (ft)	({0})700.0		0.0		0.0		
Travel Time (min)	**= 0.37**	**+**	**0.00**	**+**	**0.00**	**=**	**0.37**

Total Travel Time, Tc ..... 30.70 min

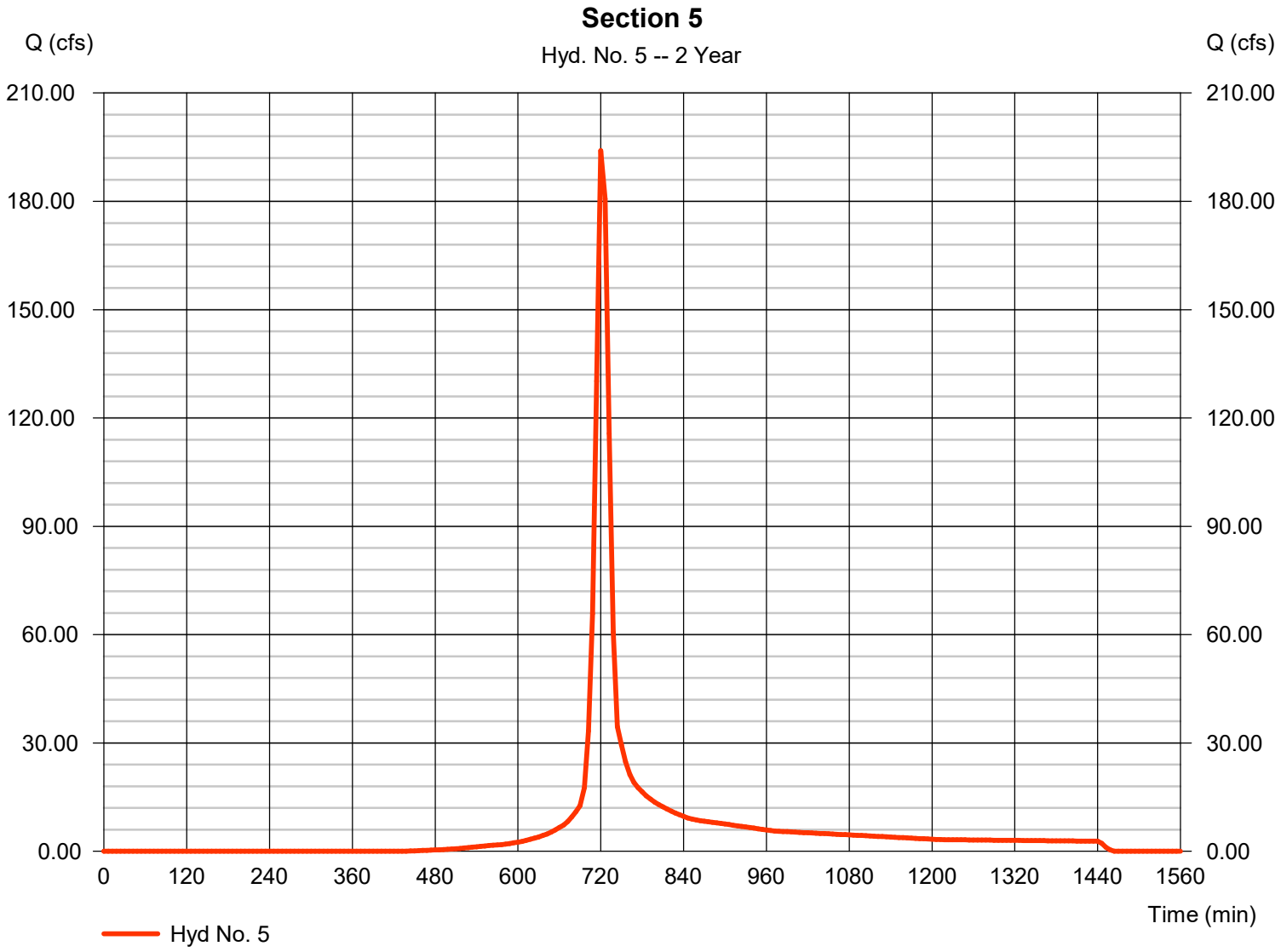
Hydrograph Report

Hyd. No. 5

Section 5

Hydrograph type	=	SCS Runoff	Peak discharge	=	194.03 cfs
Storm frequency	=	2 yrs	Time to peak	=	720 min
Time interval	=	6 min	Hyd. volume	=	596,307 cuft
Drainage area	=	86.900 ac	Curve number	=	85*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	15.60 min
Total precip.	=	3.50 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(40.000 x 98) + (46.900 x 74)] / 86.900



TR55 Tc Worksheet

Hyd. No. 5

Section 5

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.024		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.50		0.00		0.00		
Land slope (%)	= 1.00		0.00		0.00		
Travel Time (min)	**= 2.85**	**+**	**0.00**	**+**	**0.00**	**=**	**2.85**
Shallow Concentrated Flow							
Flow length (ft)	= 1150.00		0.00		0.00		
Watercourse slope (%)	= 1.00		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=1.61		0.00		0.00		
Travel Time (min)	**= 11.88**	**+**	**0.00**	**+**	**0.00**	**=**	**11.88**
Channel Flow							
X sectional flow area (sqft)	= 24.00		50.00		0.00		
Wetted perimeter (ft)	= 14.00		20.00		0.00		
Channel slope (%)	= 3.20		2.50		0.00		
Manning's n-value	= 0.050		0.015		0.025		
Velocity (ft/s)	=7.65						
			29.02				
					0.00		
Flow length (ft)	({0})250.0		550.0		0.0		
Travel Time (min)	**= 0.54**	**+**	**0.32**	**+**	**0.00**	**=**	**0.86**

Total Travel Time, Tc ..... 15.60 min

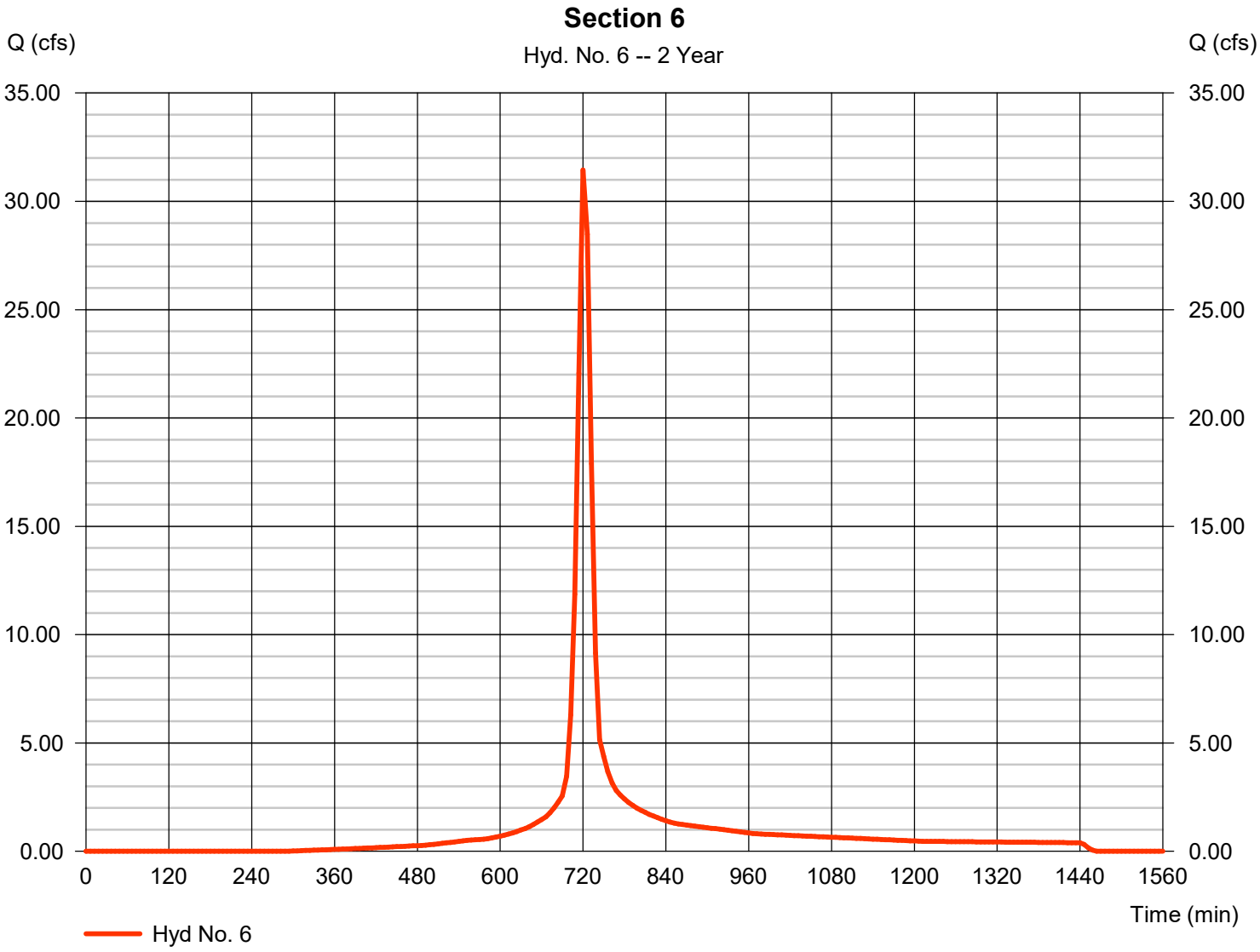
Hydrograph Report

Hyd. No. 6

Section 6

Hydrograph type	= SCS Runoff	Peak discharge	= 31.44 cfs
Storm frequency	= 2 yrs	Time to peak	= 720 min
Time interval	= 6 min	Hyd. volume	= 97,720 cuft
Drainage area	= 11.300 ac	Curve number	= 91*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 18.60 min
Total precip.	= 3.50 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(11.300 x 91)] / 11.300



TR55 Tc Worksheet

Hyd. No. 6

Section 6

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.240		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.50		0.00		0.00		
Land slope (%)	= 2.00		0.00		0.00		
Travel Time (min)	**= 13.64**	**+**	**0.00**	**+**	**0.00**	**=**	**13.64**
Shallow Concentrated Flow							
Flow length (ft)	= 800.00		0.00		0.00		
Watercourse slope (%)	= 13.80		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=5.99		0.00		0.00		
Travel Time (min)	**= 2.22**	**+**	**0.00**	**+**	**0.00**	**=**	**2.22**
Channel Flow							
X sectional flow area (sqft)	= 12.60		7.00		0.00		
Wetted perimeter (ft)	= 12.56		9.40		0.00		
Channel slope (%)	= 1.00		3.00		0.00		
Manning's n-value	= 0.030		0.015		0.015		
Velocity (ft/s)	=4.98						
			14.12				
					0.00		
Flow length (ft)	({0})700.0		300.0		0.0		
Travel Time (min)	**= 2.34**	**+**	**0.35**	**+**	**0.00**	**=**	**2.70**

Total Travel Time, Tc ..... 18.60 min

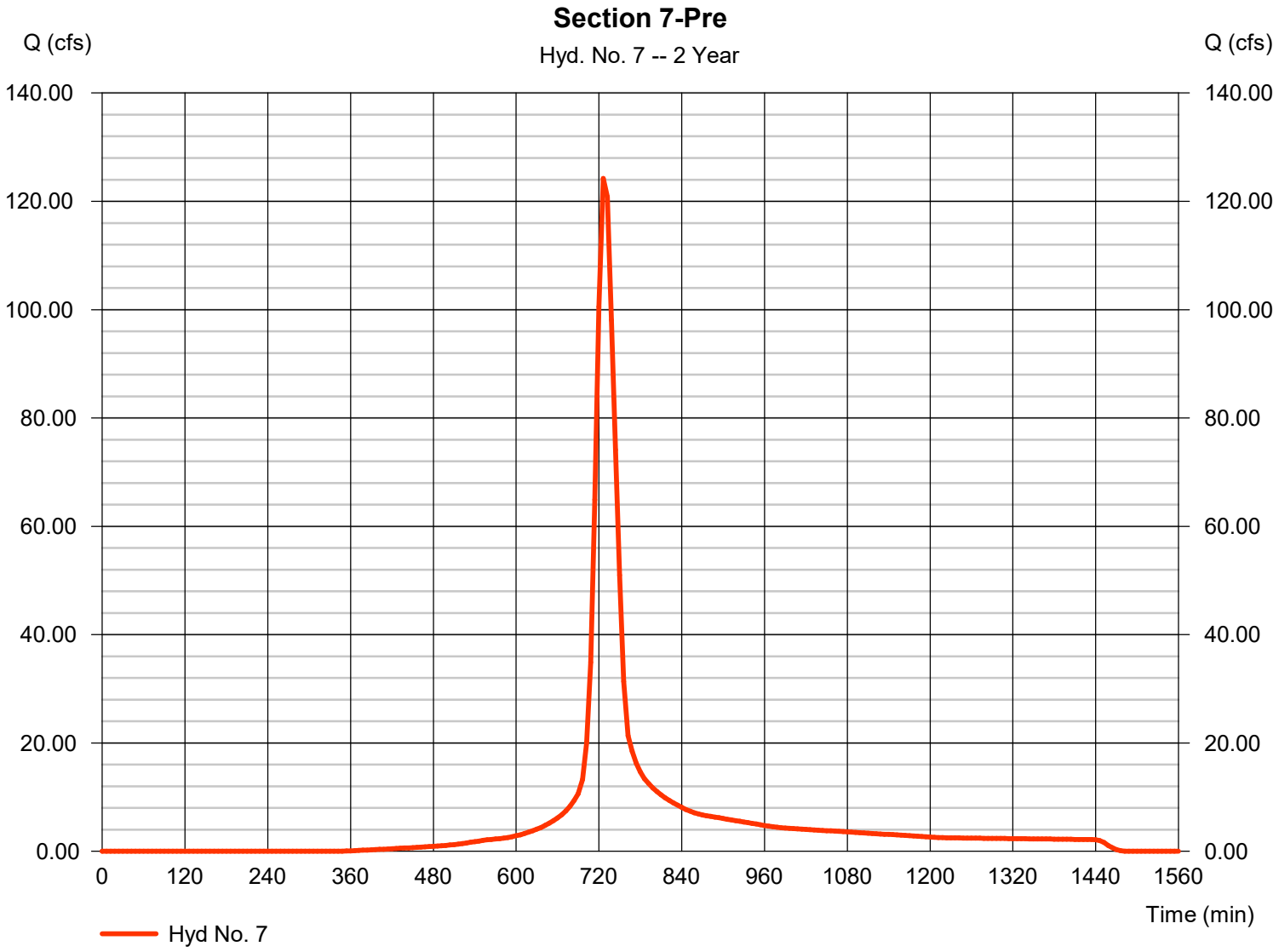
Hydrograph Report

Hyd. No. 7

Section 7-Pre

Hydrograph type	=	SCS Runoff	Peak discharge	=	124.23 cfs
Storm frequency	=	2 yrs	Time to peak	=	726 min
Time interval	=	6 min	Hyd. volume	=	504,834 cuft
Drainage area	=	59.000 ac	Curve number	=	89*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	23.83 min
Total precip.	=	3.50 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(59.000 x 79)] / 59.000



TR55 Tc Worksheet

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

Hyd. No. 7

Section 7-Pre

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.240		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.50		0.00		0.00		
Land slope (%)	= 1.00		0.00		0.00		
Travel Time (min)	**= 18.00**	**+**	**0.00**	**+**	**0.00**	**=**	**18.00**
Shallow Concentrated Flow							
Flow length (ft)	= 1000.00		0.00		0.00		
Watercourse slope (%)	= 5.00		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=3.61		0.00		0.00		
Travel Time (min)	**= 4.62**	**+**	**0.00**	**+**	**0.00**	**=**	**4.62**
Channel Flow							
X sectional flow area (sqft)	= 3.14		0.00		0.00		
Wetted perimeter (ft)	= 6.30		0.00		0.00		
Channel slope (%)	= 1.50		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.025		
Velocity (ft/s)	=7.63						
			0.00				
					0.00		
Flow length (ft)	({0})550.0		0.0		0.0		
Travel Time (min)	**= 1.20**	**+**	**0.00**	**+**	**0.00**	**=**	**1.20**

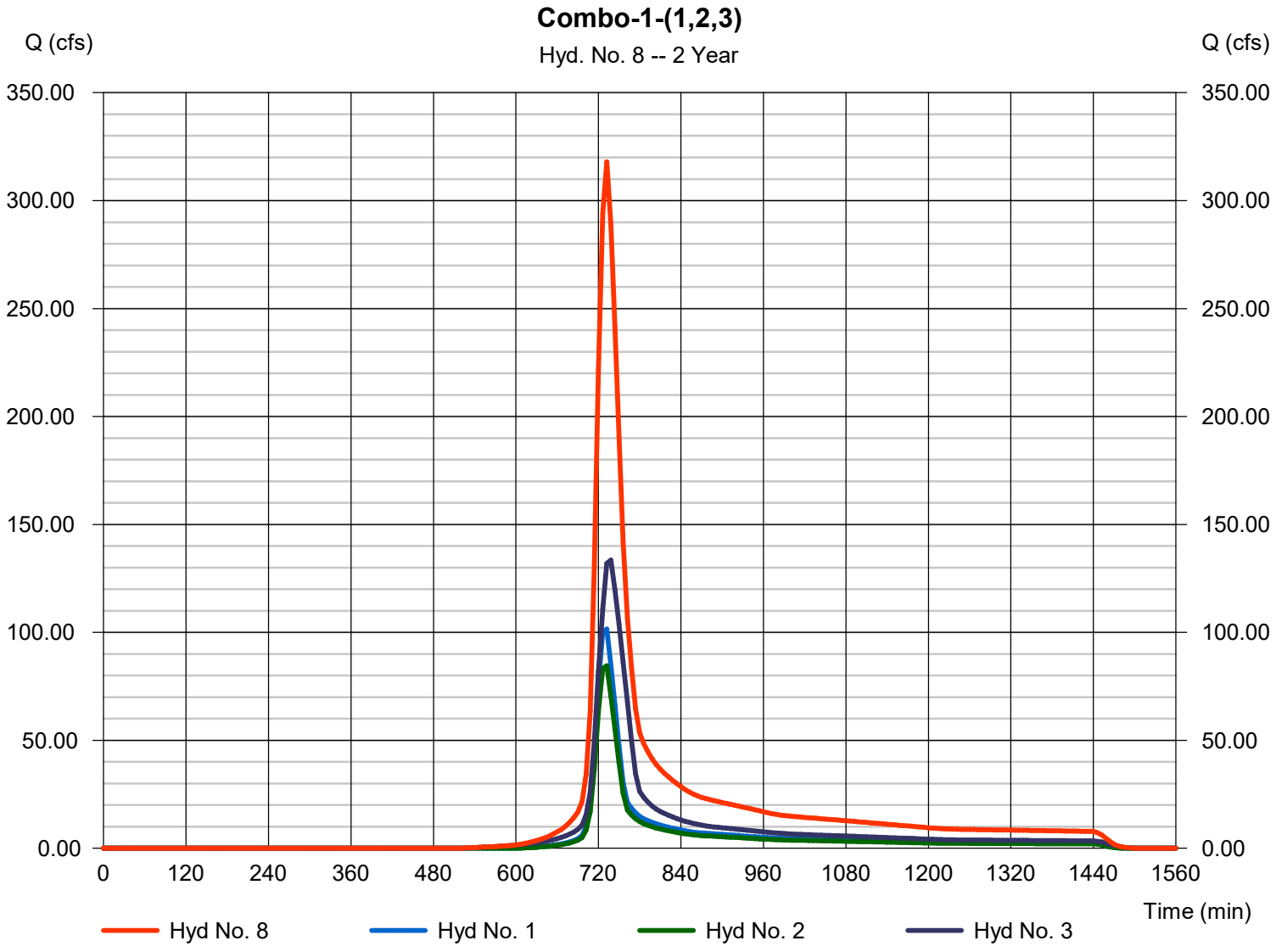
Total Travel Time, Tc ..... 23.83 min

Hydrograph Report

Hyd. No. 8

Combo-1-(1,2,3)

Hydrograph type	= Combine	Peak discharge	= 318.04 cfs
Storm frequency	= 2 yrs	Time to peak	= 732 min
Time interval	= 6 min	Hyd. volume	= 1,449,992 cuft
Inflow hyds.	= 1, 2, 3	Contrib. drain. area	= 250.500 ac



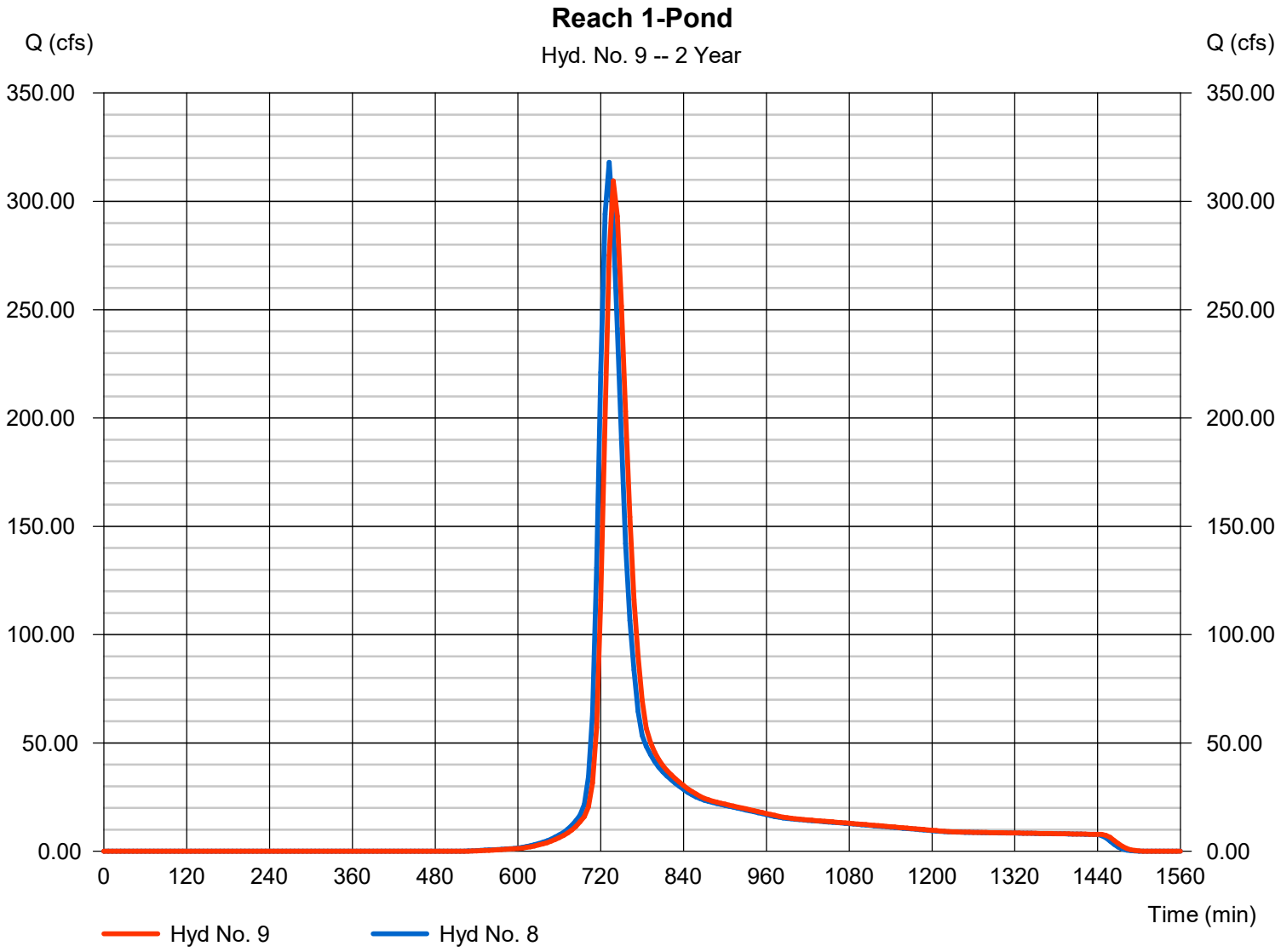
Hydrograph Report

Hyd. No. 9

Reach 1-Pond

Hydrograph type	=	Reach	Peak discharge	=	309.37 cfs
Storm frequency	=	2 yrs	Time to peak	=	738 min
Time interval	=	6 min	Hyd. volume	=	1,449,990 cuft
Inflow hyd. No.	=	8 - Combo-1-(1,2,3)	Section type	=	Trapezoidal
Reach length	=	1000.0 ft	Channel slope	=	2.0 %
Manning's n	=	0.020	Bottom width	=	150.0 ft
Side slope	=	30.0:1	Max. depth	=	16.0 ft
Rating curve x	=	0.373	Rating curve m	=	1.407
Ave. velocity	=	2.62 ft/s	Routing coeff.	=	0.7984

Modified Att-Kin routing method used.

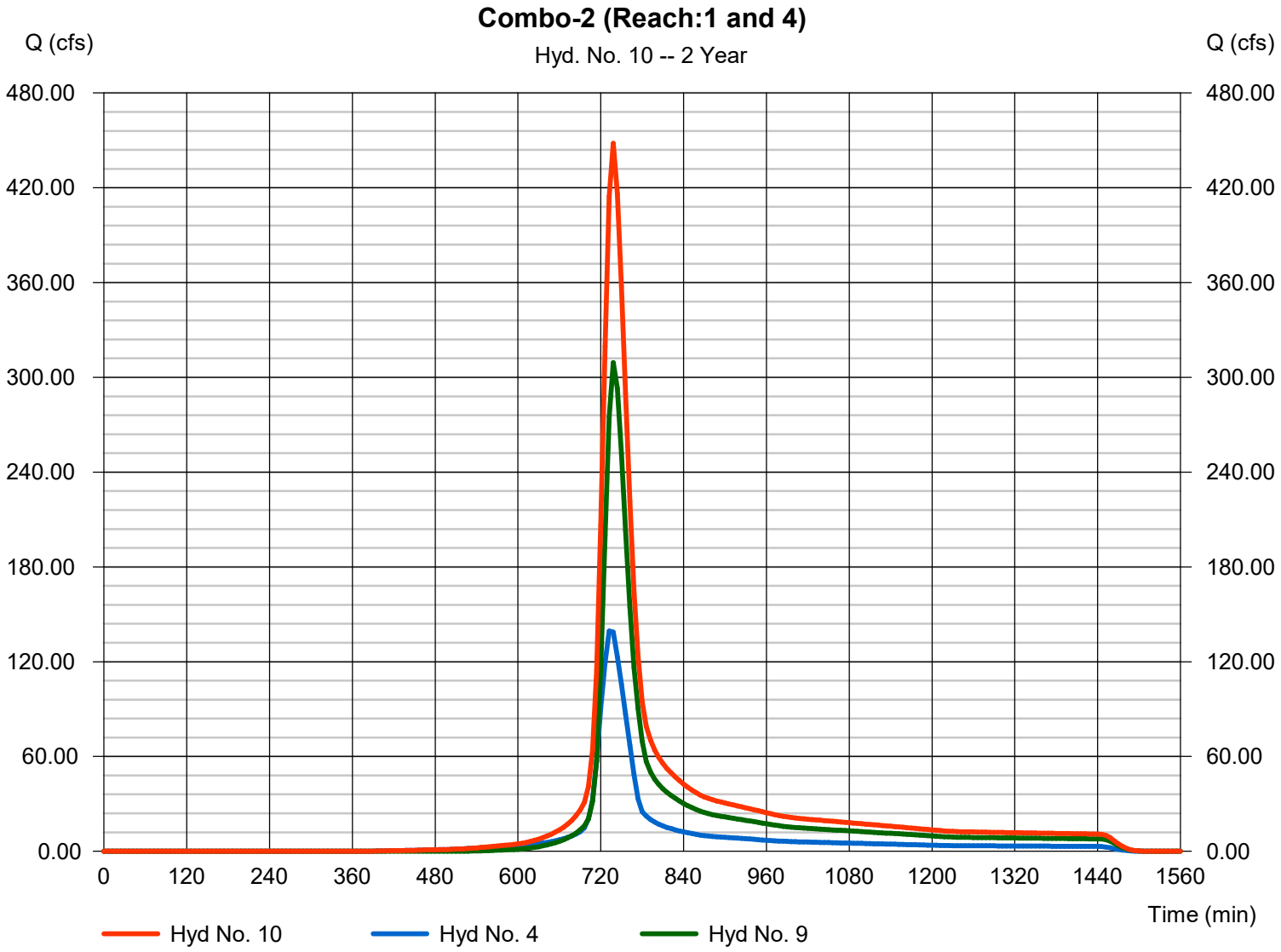


Hydrograph Report

Hyd. No. 10

Combo-2 (Reach:1 and 4)

Hydrograph type	= Combine	Peak discharge	= 448.17 cfs
Storm frequency	= 2 yrs	Time to peak	= 738 min
Time interval	= 6 min	Hyd. volume	= 2,150,634 cuft
Inflow hyds.	= 4, 9	Contrib. drain. area	= 82.500 ac



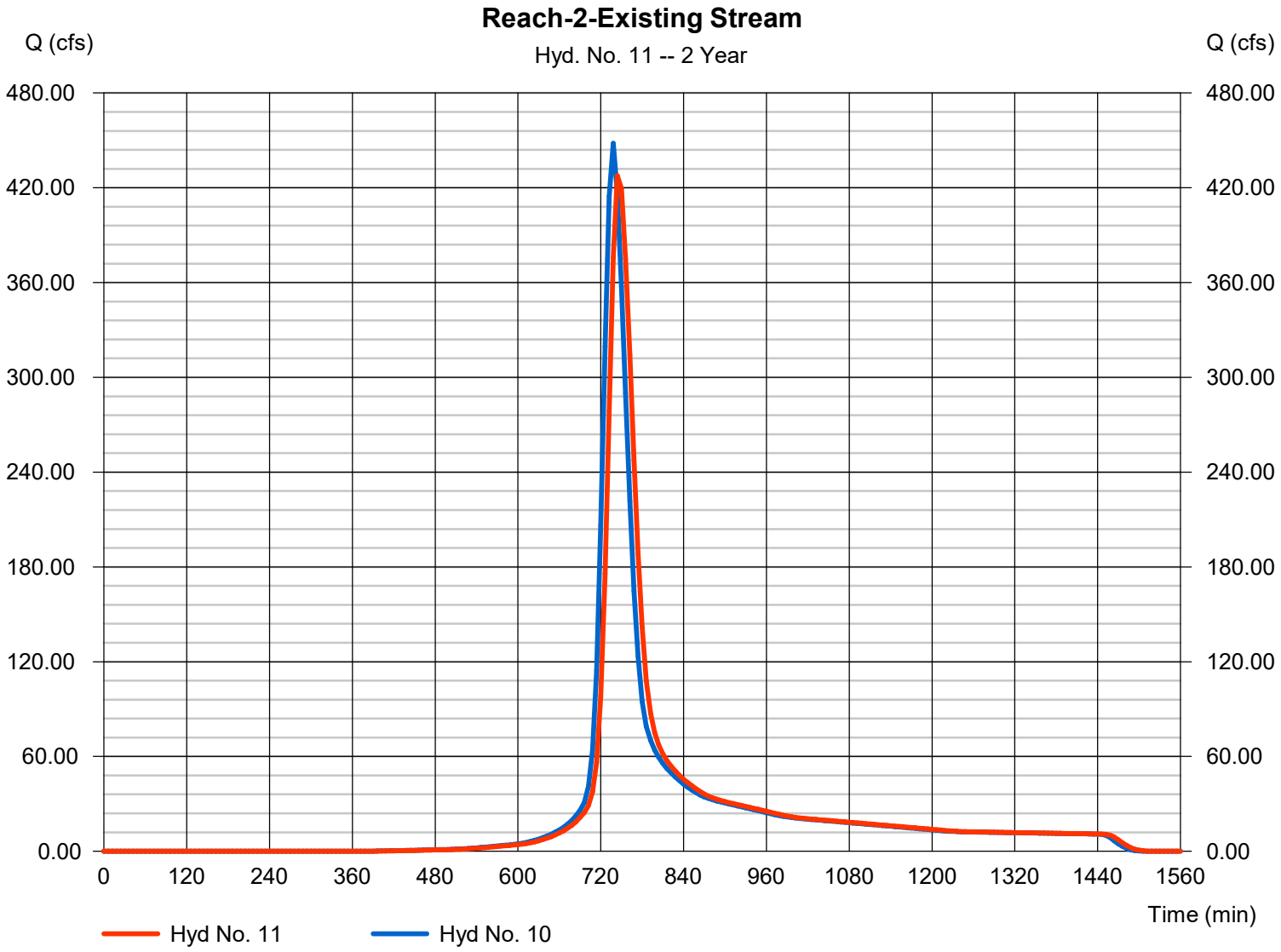
Hydrograph Report

Hyd. No. 11

Reach-2-Existing Stream

Hydrograph type	= Reach	Peak discharge	= 427.66 cfs
Storm frequency	= 2 yrs	Time to peak	= 744 min
Time interval	= 6 min	Hyd. volume	= 2,150,629 cuft
Inflow hyd. No.	= 10 - Combo-2 (Reach:1 and 4)	Section type	= Trapezoidal
Reach length	= 2200.0 ft	Channel slope	= 1.4 %
Manning's n	= 0.030	Bottom width	= 5.0 ft
Side slope	= 20.0:1	Max. depth	= 5.0 ft
Rating curve x	= 2.009	Rating curve m	= 1.231
Ave. velocity	= 5.54 ft/s	Routing coeff.	= 0.7161

Modified Att-Kin routing method used.

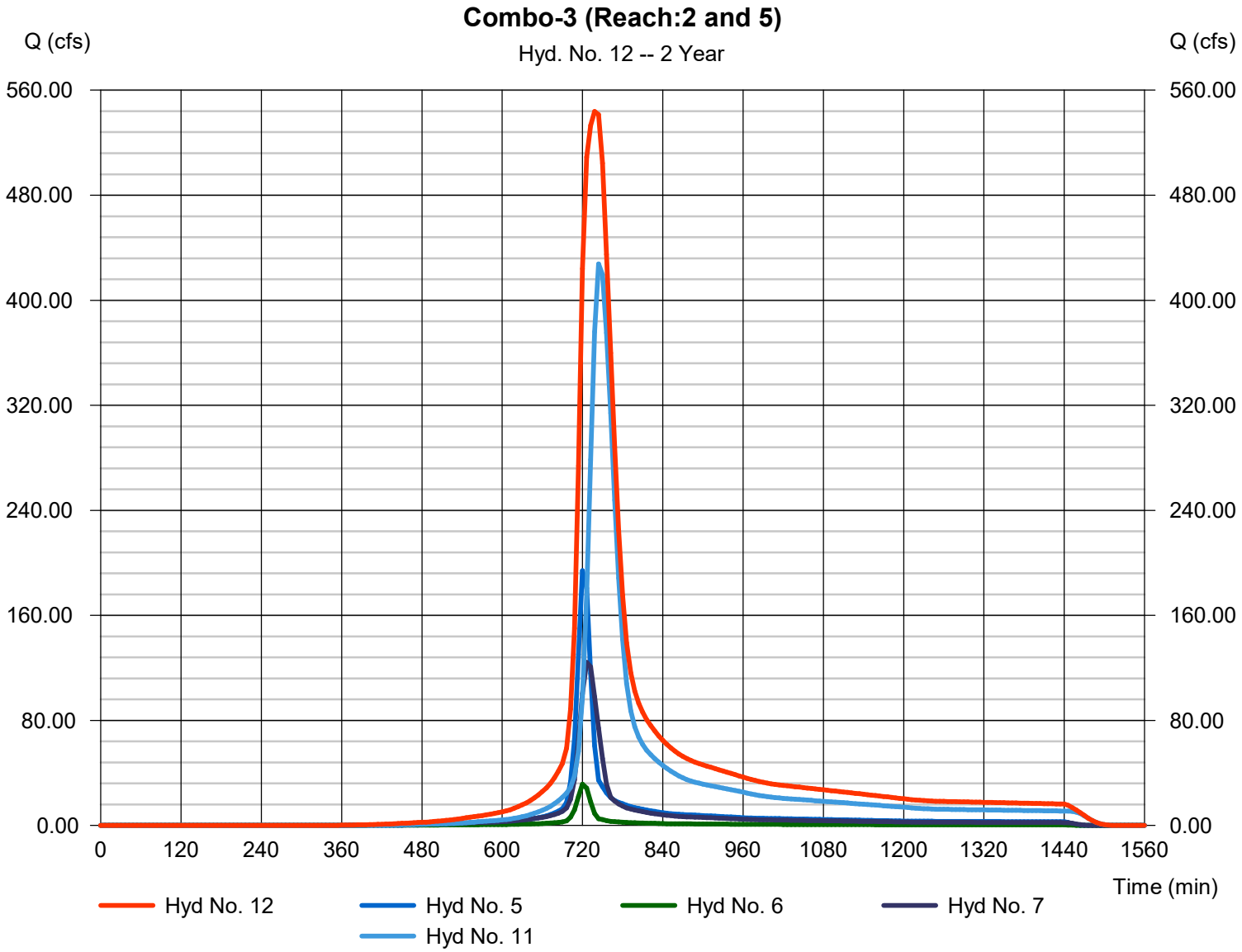


Hydrograph Report

Hyd. No. 12

Combo-3 (Reach:2 and 5)

Hydrograph type	= Combine	Peak discharge	= 543.72 cfs
Storm frequency	= 2 yrs	Time to peak	= 738 min
Time interval	= 6 min	Hyd. volume	= 3,349,490 cuft
Inflow hyds.	= 5, 6, 7, 11	Contrib. drain. area	= 157.200 ac



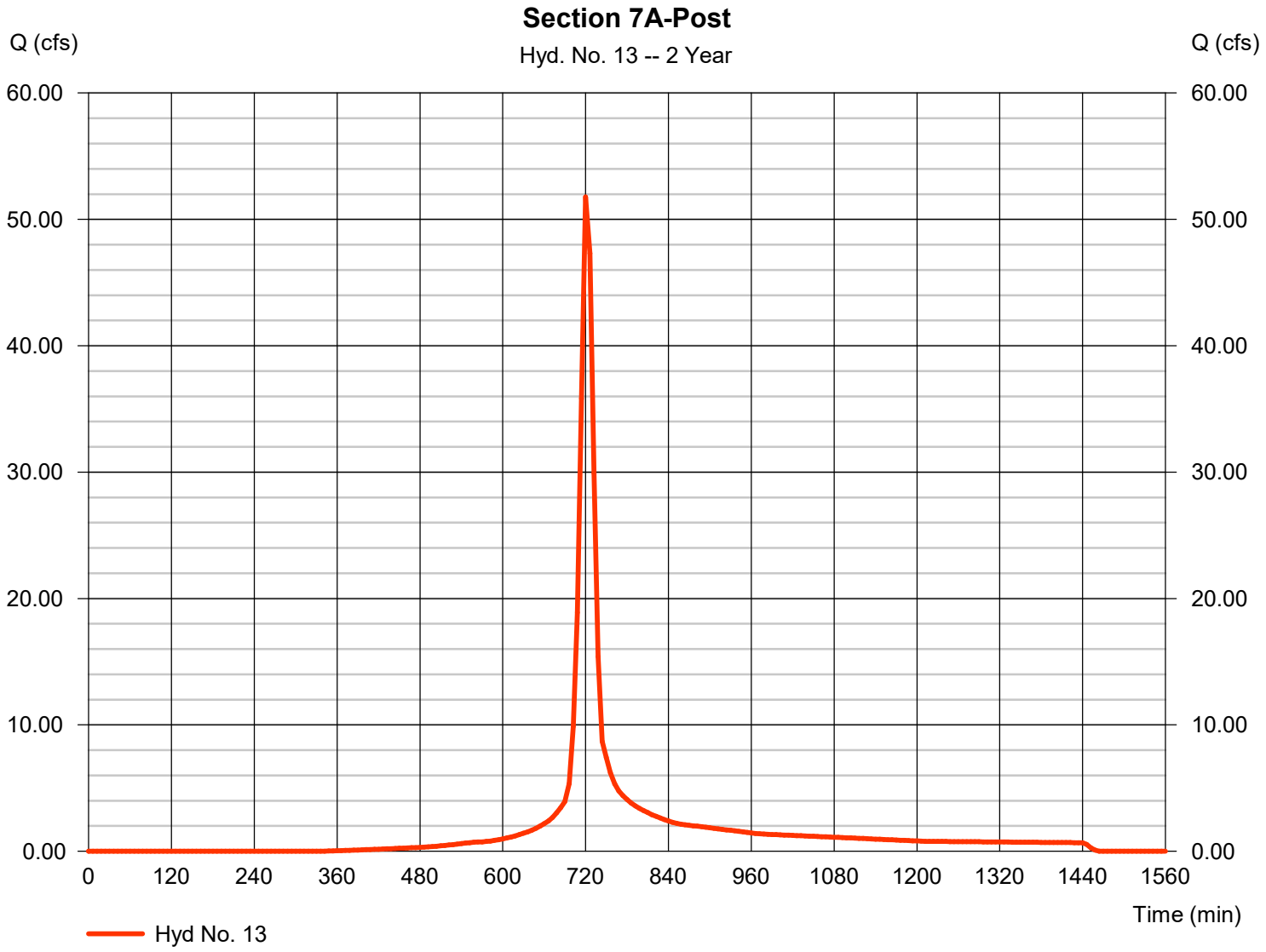
Hydrograph Report

Hyd. No. 13

Section 7A-Post

Hydrograph type	=	SCS Runoff	Peak discharge	=	51.77 cfs
Storm frequency	=	2 yrs	Time to peak	=	720 min
Time interval	=	6 min	Hyd. volume	=	159,632 cuft
Drainage area	=	19.900 ac	Curve number	=	89*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	19.30 min
Total precip.	=	3.50 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(19.900 x 89)] / 19.900



TR55 Tc Worksheet

Hyd. No. 13

Section 7A-Post

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.240		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.50		0.00		0.00		
Land slope (%)	= 2.00		0.00		0.00		
Travel Time (min)	**= 13.64**	**+**	**0.00**	**+**	**0.00**	**=**	**13.64**
Shallow Concentrated Flow							
Flow length (ft)	= 662.00		0.00		0.00		
Watercourse slope (%)	= 2.00		0.00		0.00		
Surface description	= Paved		Unpaved		Unpaved		
Average velocity (ft/s)	=2.87		0.00		0.00		
Travel Time (min)	**= 3.84**	**+**	**0.00**	**+**	**0.00**	**=**	**3.84**
Channel Flow							
X sectional flow area (sqft)	= 1.52		4.21		0.00		
Wetted perimeter (ft)	= 3.32		5.54		0.00		
Channel slope (%)	= 2.00		1.00		0.00		
Manning's n-value	= 0.012		0.012		0.025		
Velocity (ft/s)	=10.39						
			10.33				
					0.00		
Flow length (ft)	({0})383.0		725.0		0.0		
Travel Time (min)	**= 0.61**	**+**	**1.17**	**+**	**0.00**	**=**	**1.78**

Total Travel Time, Tc ..... 19.30 min

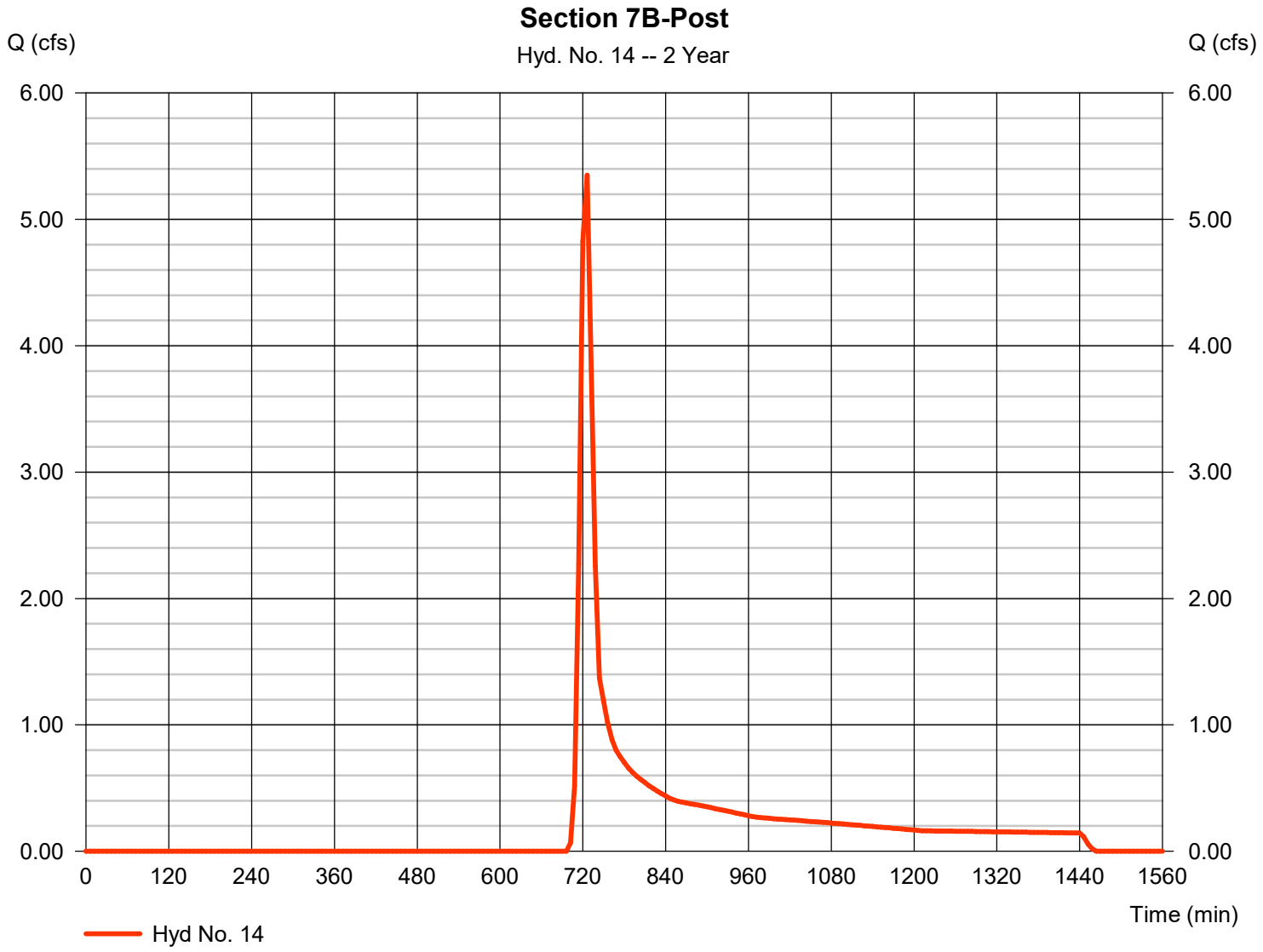
Hydrograph Report

Hyd. No. 14

Section 7B-Post

Hydrograph type	=	SCS Runoff	Peak discharge	=	5.349 cfs
Storm frequency	=	2 yrs	Time to peak	=	726 min
Time interval	=	6 min	Hyd. volume	=	19,193 cuft
Drainage area	=	7.500 ac	Curve number	=	65*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	18.80 min
Total precip.	=	3.50 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(13.900 x 89)] / 7.500



TR55 Tc Worksheet

Hyd. No. 14

Section 7B-Post

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.240		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.50		0.00		0.00		
Land slope (%)	= 2.00		0.00		0.00		
Travel Time (min)	**= 13.64**	**+**	**0.00**	**+**	**0.00**	**=**	**13.64**
Shallow Concentrated Flow							
Flow length (ft)	= 474.00		0.00		0.00		
Watercourse slope (%)	= 2.00		0.00		0.00		
Surface description	= Paved		Unpaved		Unpaved		
Average velocity (ft/s)	=2.87		0.00		0.00		
Travel Time (min)	**= 2.75**	**+**	**0.00**	**+**	**0.00**	**=**	**2.75**
Channel Flow							
X sectional flow area (sqft)	= 1.52		4.21		0.00		
Wetted perimeter (ft)	= 3.32		5.54		0.00		
Channel slope (%)	= 2.00		1.00		0.00		
Manning's n-value	= 0.012		0.012		0.025		
Velocity (ft/s)	=10.39						
			10.33				
					0.00		
Flow length (ft)	({0})627.0		890.0		0.0		
Travel Time (min)	**= 1.01**	**+**	**1.44**	**+**	**0.00**	**=**	**2.44**

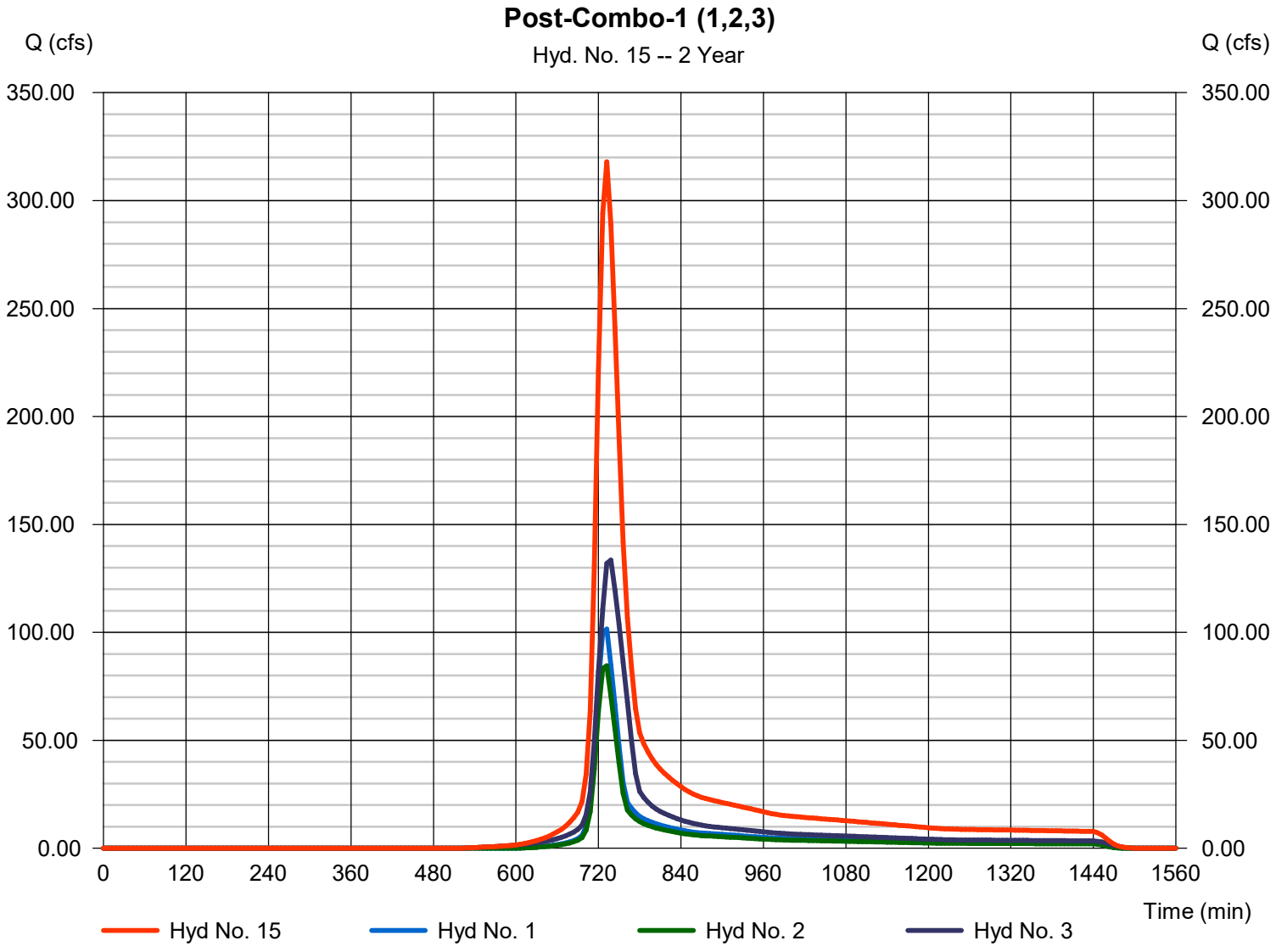
Total Travel Time, Tc ..... 18.80 min

Hydrograph Report

Hyd. No. 15

Post-Combo-1 (1,2,3)

Hydrograph type	= Combine	Peak discharge	= 318.04 cfs
Storm frequency	= 2 yrs	Time to peak	= 732 min
Time interval	= 6 min	Hyd. volume	= 1,449,992 cuft
Inflow hyds.	= 1, 2, 3	Contrib. drain. area	= 250.500 ac



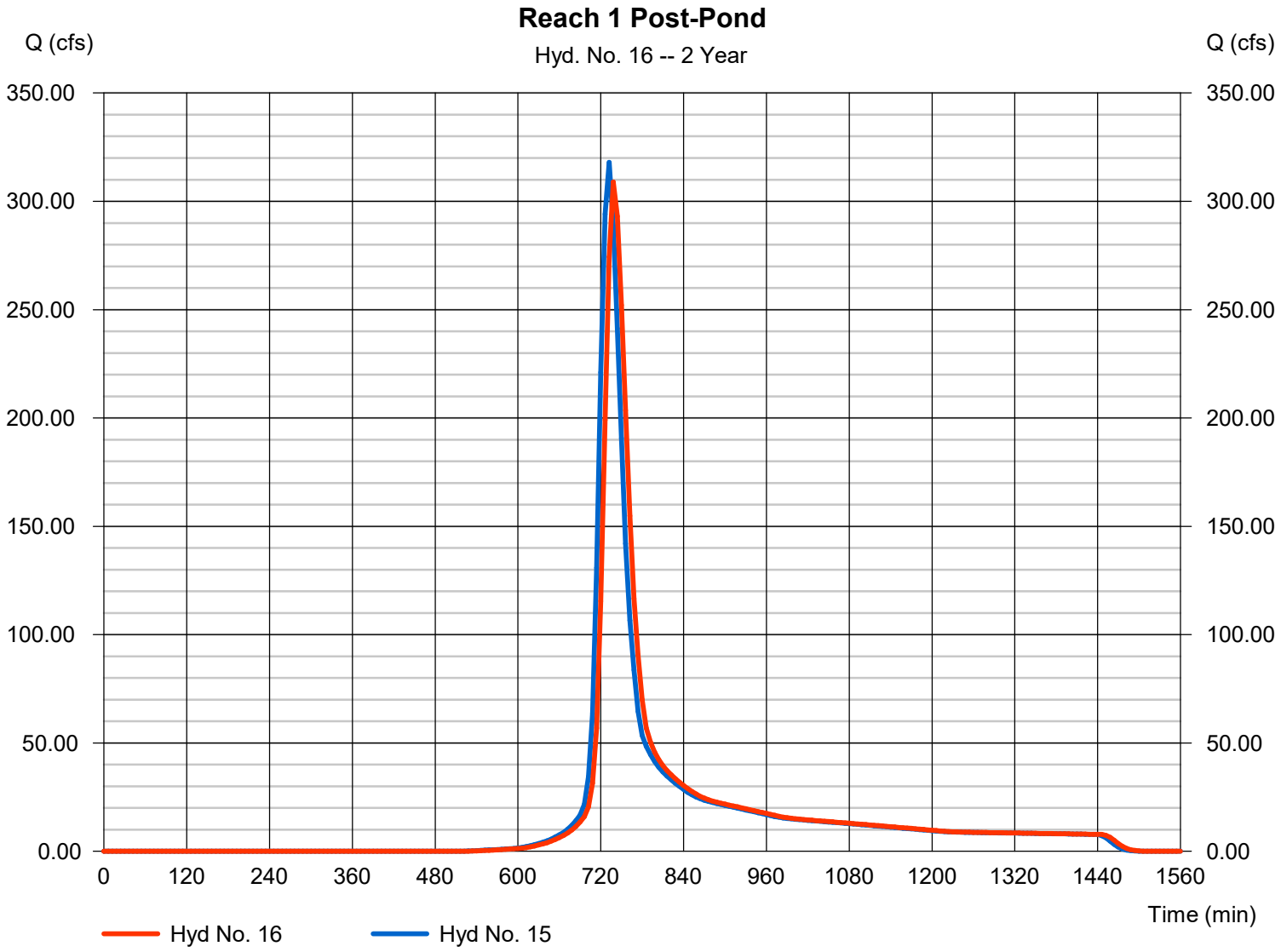
Hydrograph Report

Hyd. No. 16

Reach 1 Post-Pond

Hydrograph type	=	Reach	Peak discharge	=	308.94 cfs
Storm frequency	=	2 yrs	Time to peak	=	738 min
Time interval	=	6 min	Hyd. volume	=	1,449,989 cuft
Inflow hyd. No.	=	15 - Post-Combo-1 (1,2,3)	Section type	=	Trapezoidal
Reach length	=	1000.0 ft	Channel slope	=	2.0 %
Manning's n	=	0.020	Bottom width	=	150.0 ft
Side slope	=	32.0:1	Max. depth	=	16.0 ft
Rating curve x	=	0.373	Rating curve m	=	1.404
Ave. velocity	=	2.59 ft/s	Routing coeff.	=	0.7920

Modified Att-Kin routing method used.

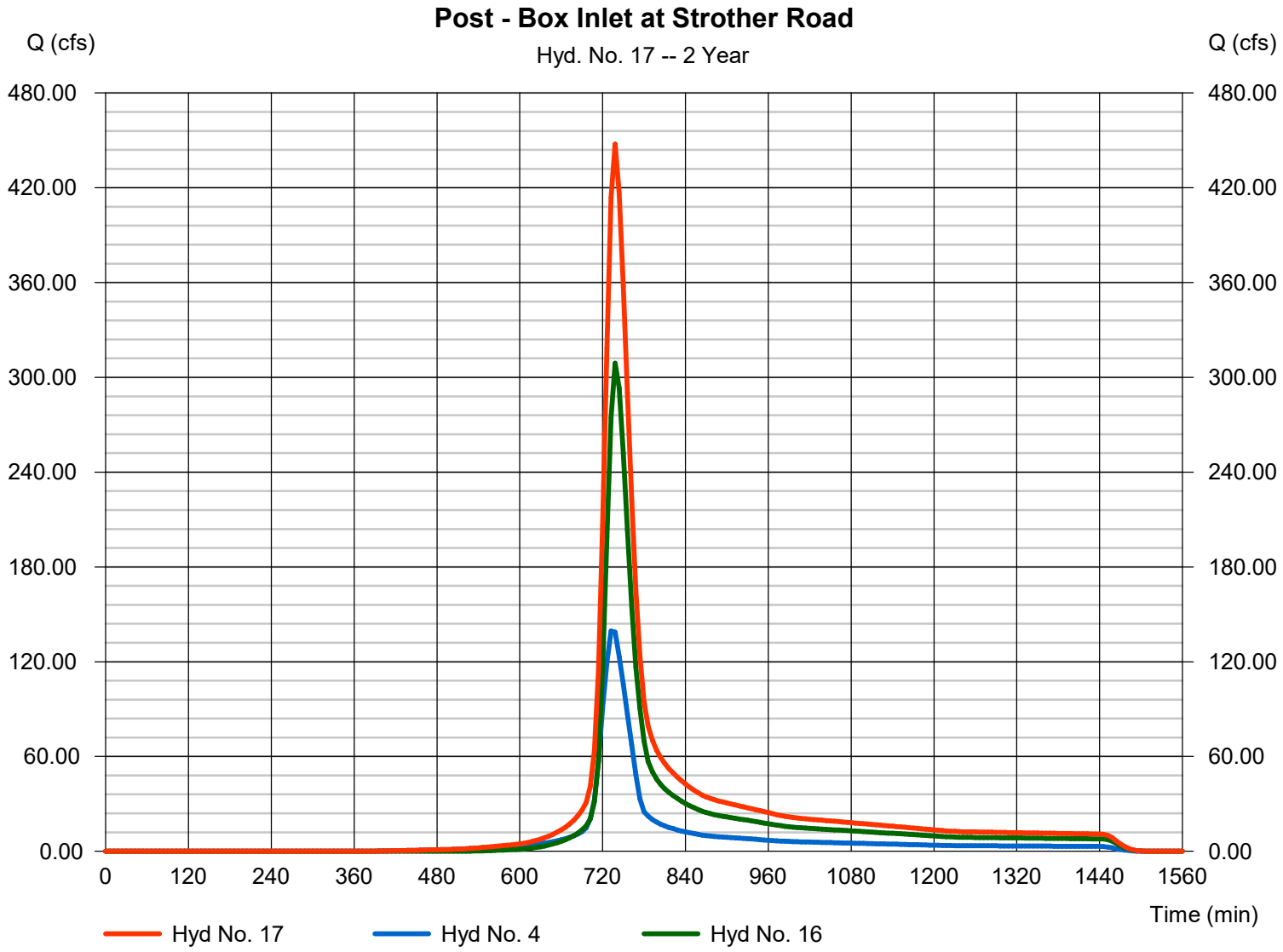


Hydrograph Report

Hyd. No. 17

Post - Box Inlet at Strother Road

Hydrograph type	= Combine	Peak discharge	= 447.74 cfs
Storm frequency	= 2 yrs	Time to peak	= 738 min
Time interval	= 6 min	Hyd. volume	= 2,150,633 cuft
Inflow hyds.	= 4, 16	Contrib. drain. area	= 82.500 ac



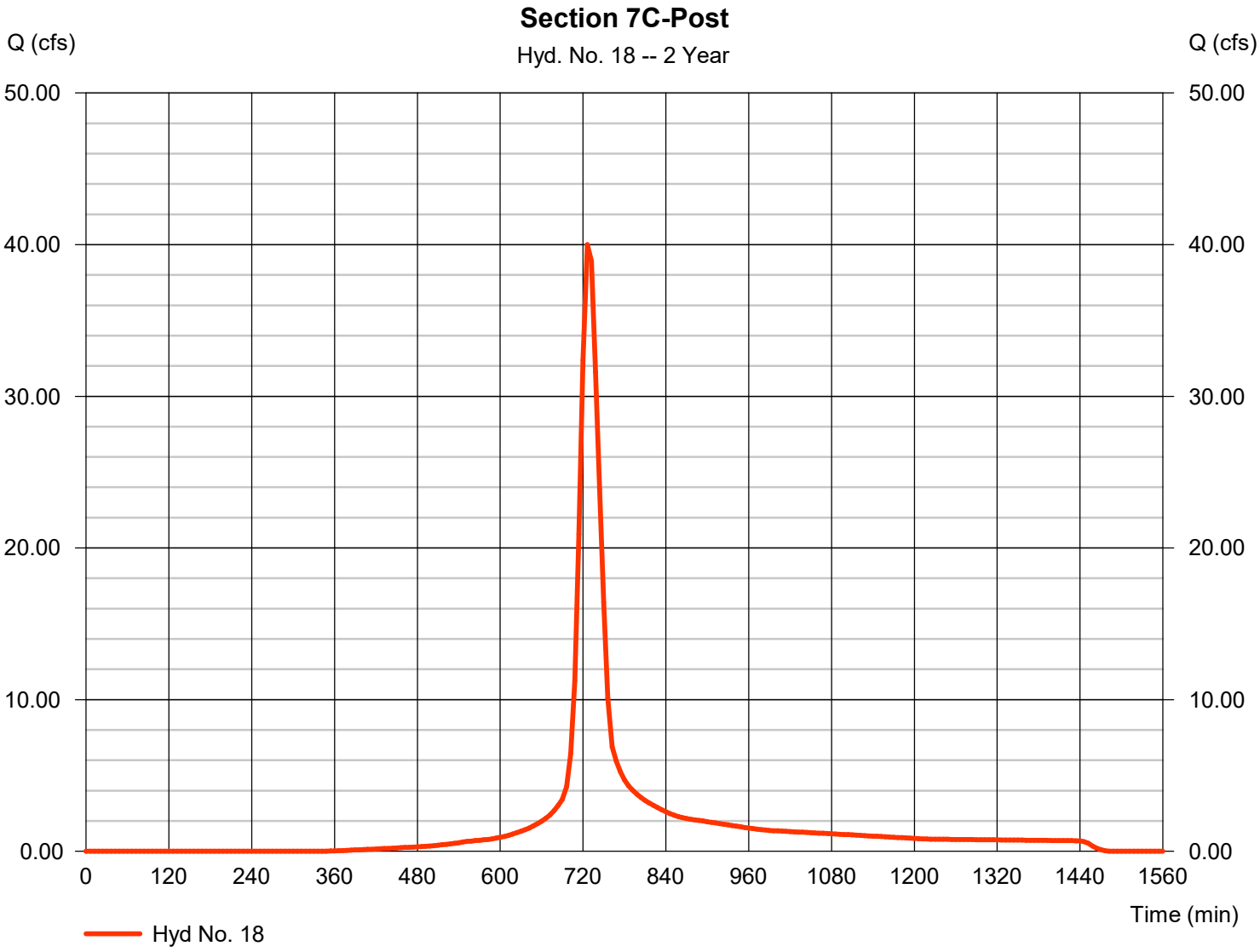
Hydrograph Report

Hyd. No. 18

Section 7C-Post

Hydrograph type	=	SCS Runoff	Peak discharge	=	40.01 cfs
Storm frequency	=	2 yrs	Time to peak	=	726 min
Time interval	=	6 min	Hyd. volume	=	162,574 cuft
Drainage area	=	19.000 ac	Curve number	=	89*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	19.80 min
Total precip.	=	3.50 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(19.000 x 89)] / 19.000



TR55 Tc Worksheet

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

Hyd. No. 18

Section 7C-Post

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.240		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.50		0.00		0.00		
Land slope (%)	= 2.00		0.00		0.00		
Travel Time (min)	**= 13.64**	**+**	**0.00**	**+**	**0.00**	**=**	**13.64**
Shallow Concentrated Flow							
Flow length (ft)	= 496.00		326.00		0.00		
Watercourse slope (%)	= 2.00		2.00		0.00		
Surface description	= Paved		Unpaved		Paved		
Average velocity (ft/s)	=2.87		2.28		0.00		
Travel Time (min)	**= 2.88**	**+**	**2.38**	**+**	**0.00**	**=**	**5.26**
Channel Flow							
X sectional flow area (sqft)	= 3.00		0.00		0.00		
Wetted perimeter (ft)	= 5.00		0.00		0.00		
Channel slope (%)	= 1.90		0.00		0.00		
Manning's n-value	= 0.012		0.015		0.015		
Velocity (ft/s)	=12.15						
			0.00				
					0.00		
Flow length (ft)	({0})620.0		0.0		0.0		
Travel Time (min)	**= 0.85**	**+**	**0.00**	**+**	**0.00**	**=**	**0.85**

Total Travel Time, Tc ..... 19.80 min

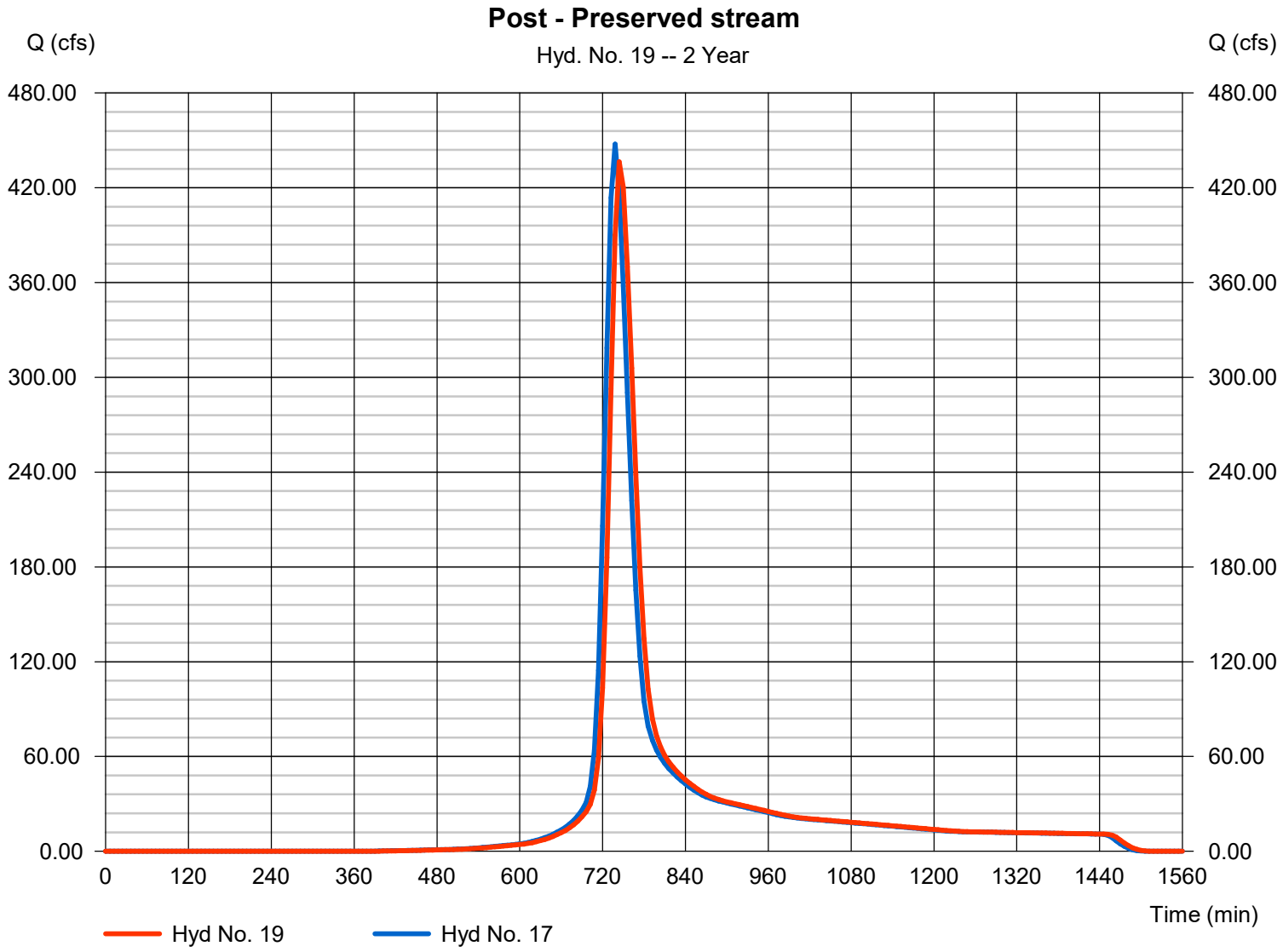
Hydrograph Report

Hyd. No. 19

Post - Preserved stream

Hydrograph type	=	Reach	Peak discharge	=	436.46 cfs
Storm frequency	=	2 yrs	Time to peak	=	744 min
Time interval	=	6 min	Hyd. volume	=	2,150,631 cuft
Inflow hyd. No.	=	17 - Post - Box Inlet at Strother Road	Section type	=	Trapezoidal
Reach length	=	500.0 ft	Channel slope	=	0.5 %
Manning's n	=	0.100	Bottom width	=	10.0 ft
Side slope	=	14.0:1	Max. depth	=	8.0 ft
Rating curve x	=	0.227	Rating curve m	=	1.318
Ave. velocity	=	1.42 ft/s	Routing coeff.	=	0.8045

Modified Att-Kin routing method used.

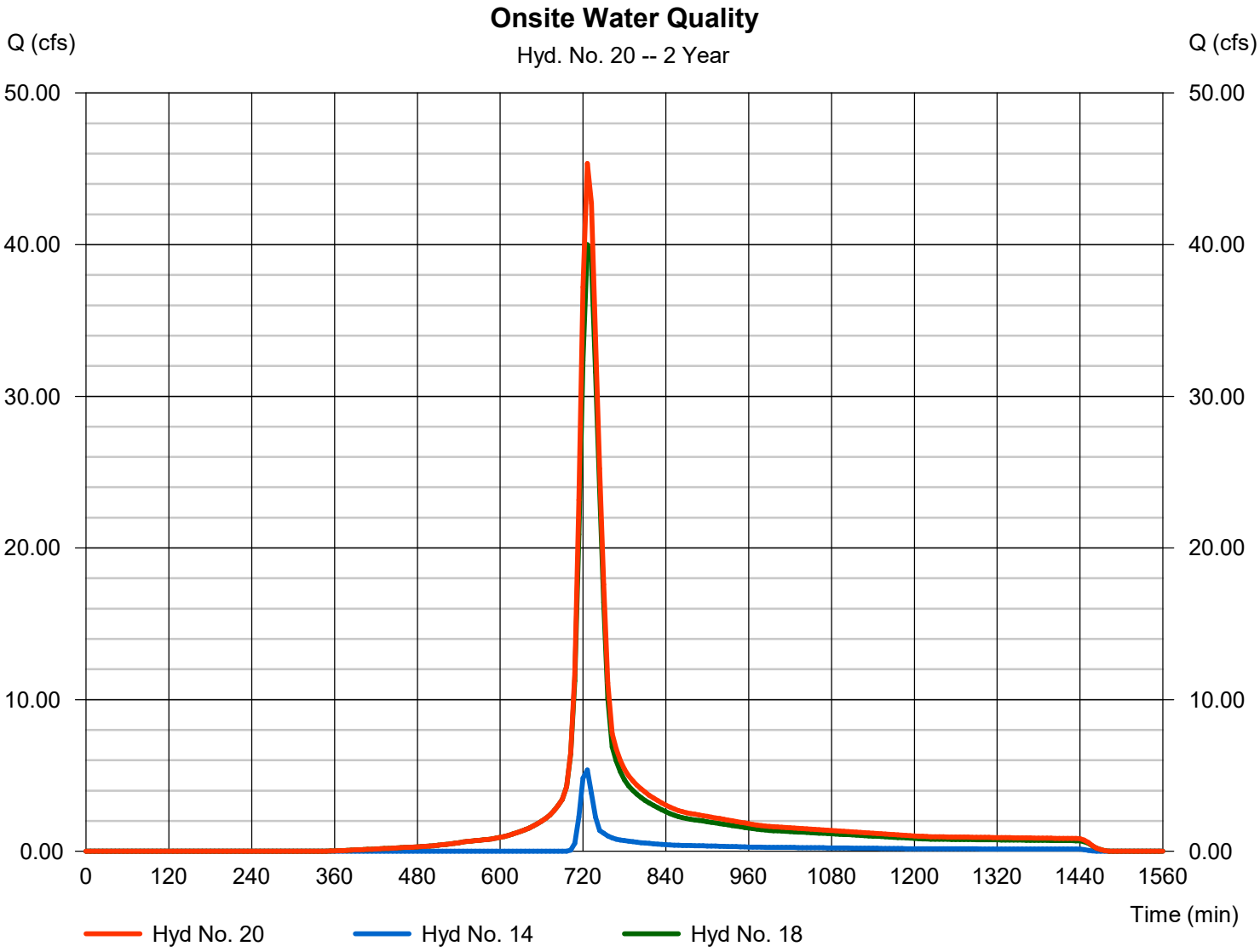


Hydrograph Report

Hyd. No. 20

Onsite Water Quality

Hydrograph type	= Combine	Peak discharge	= 45.35 cfs
Storm frequency	= 2 yrs	Time to peak	= 726 min
Time interval	= 6 min	Hyd. volume	= 181,767 cuft
Inflow hyds.	= 14, 18	Contrib. drain. area	= 26.500 ac



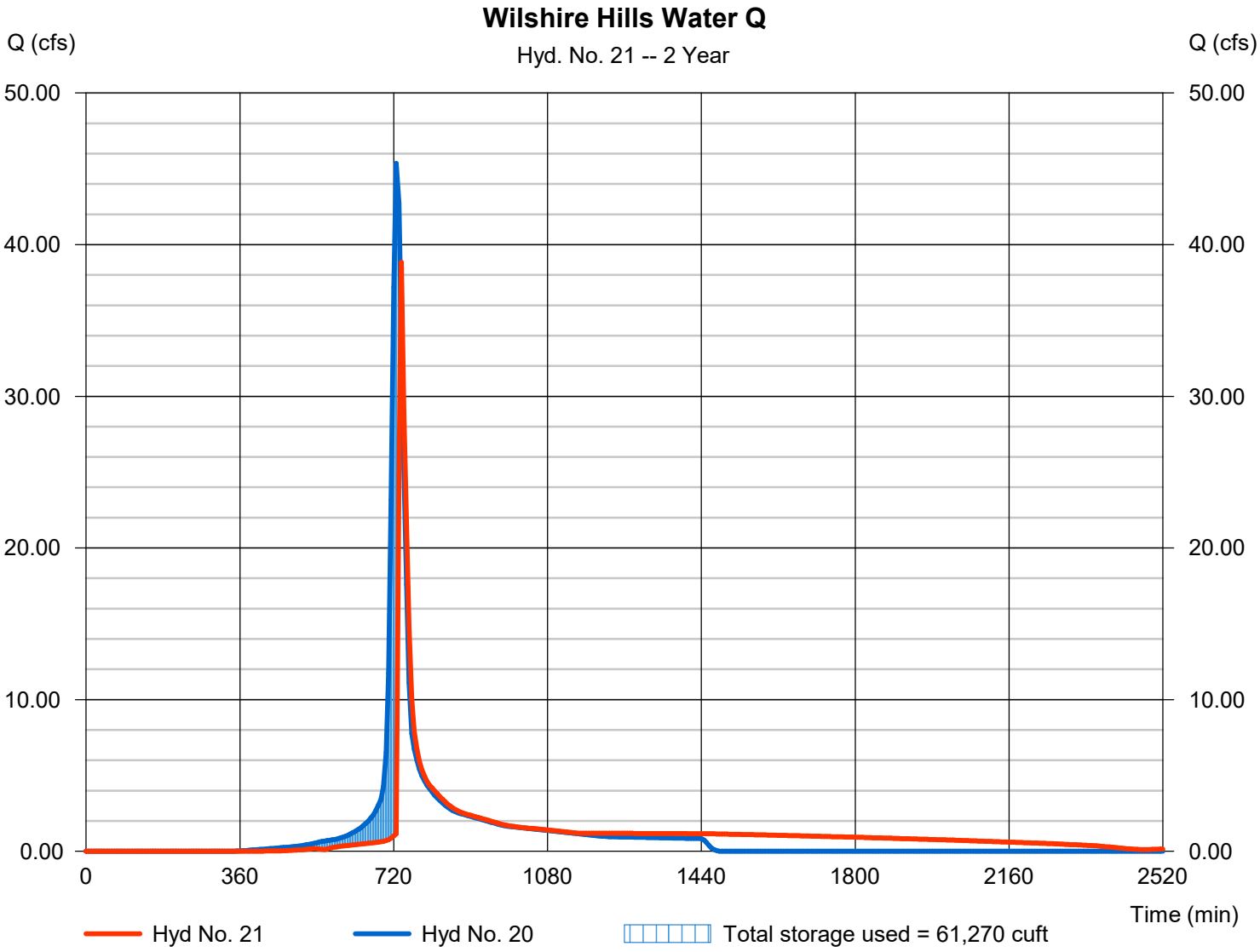
Hydrograph Report

Hyd. No. 21

Wilshire Hills Water Q

Hydrograph type	=	Reservoir	Peak discharge	=	38.83 cfs
Storm frequency	=	2 yrs	Time to peak	=	738 min
Time interval	=	6 min	Hyd. volume	=	181,742 cuft
Inflow hyd. No.	=	20 - Onsite Water Quality	Max. Elevation	=	917.52 ft
Reservoir name	=	Wilshire Hills Water Quality Basin	Max. Storage	=	61,270 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Wilshire Hills Water Quality Basin

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 912.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	912.00	5,000	0	0
1.00	913.00	7,800	6,348	6,348
2.00	914.00	9,600	8,684	15,031
3.00	915.00	11,500	10,535	25,566
4.00	916.00	13,500	12,485	38,051
5.00	917.00	15,600	14,536	52,587
6.00	918.00	17,800	16,686	69,273
7.00	919.00	20,100	18,936	88,210
8.00	920.00	22,555	21,314	109,524

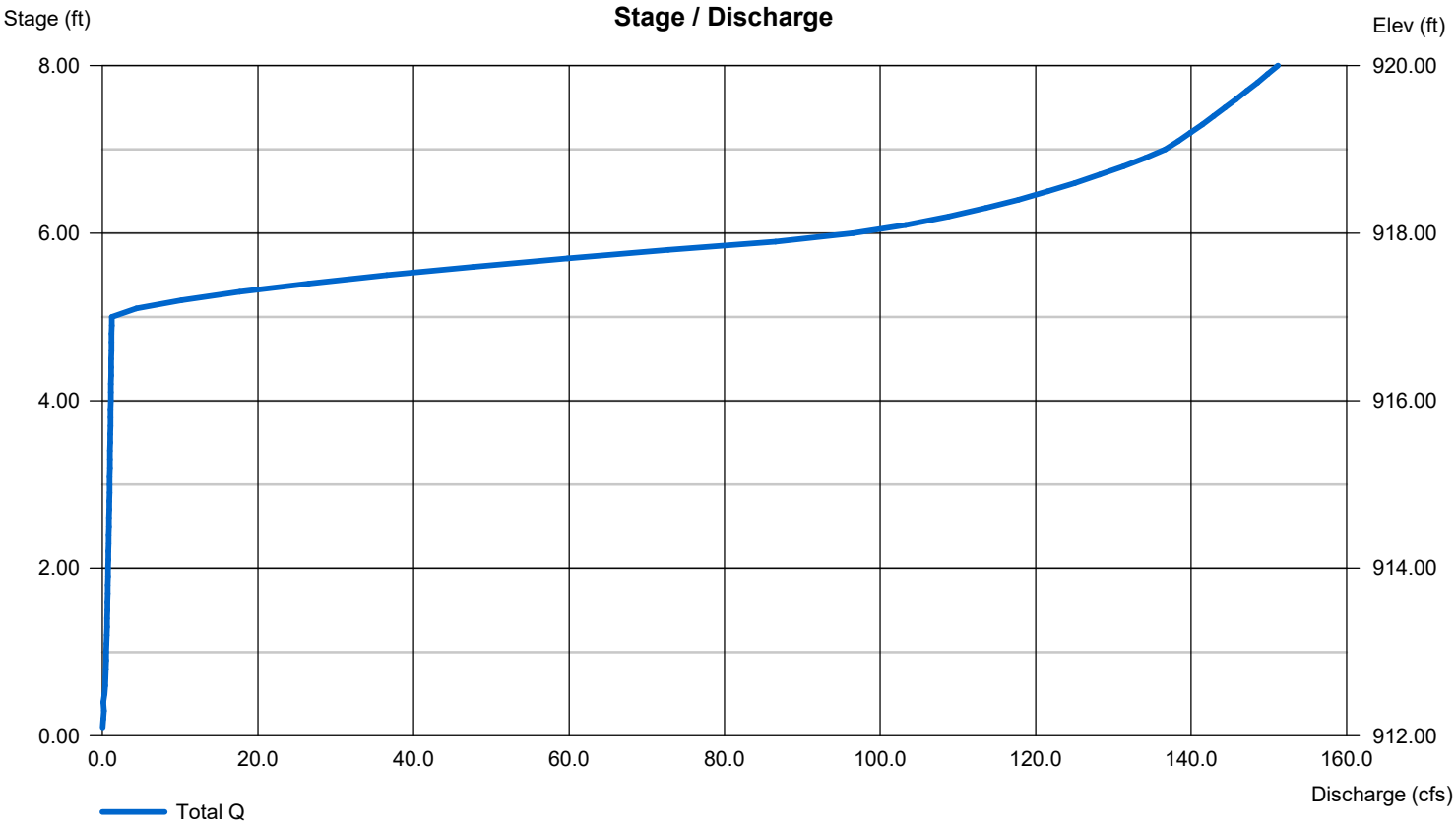
Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 48.00	4.55	Inactive	0.00
Span (in)	= 48.00	4.55	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 911.80	912.00	0.00	0.00
Length (ft)	= 42.80	0.50	0.00	0.00
Slope (%)	= 0.20	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)	= 30.00	Inactive	0.00	Inactive
Crest El. (ft)	= 917.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	---	---	---
Multi-Stage	= Yes	No	No	No
Exfil.(in/hr)	= 0.000 (by Wet area)			
TW Elev. (ft)	= 0.00			

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

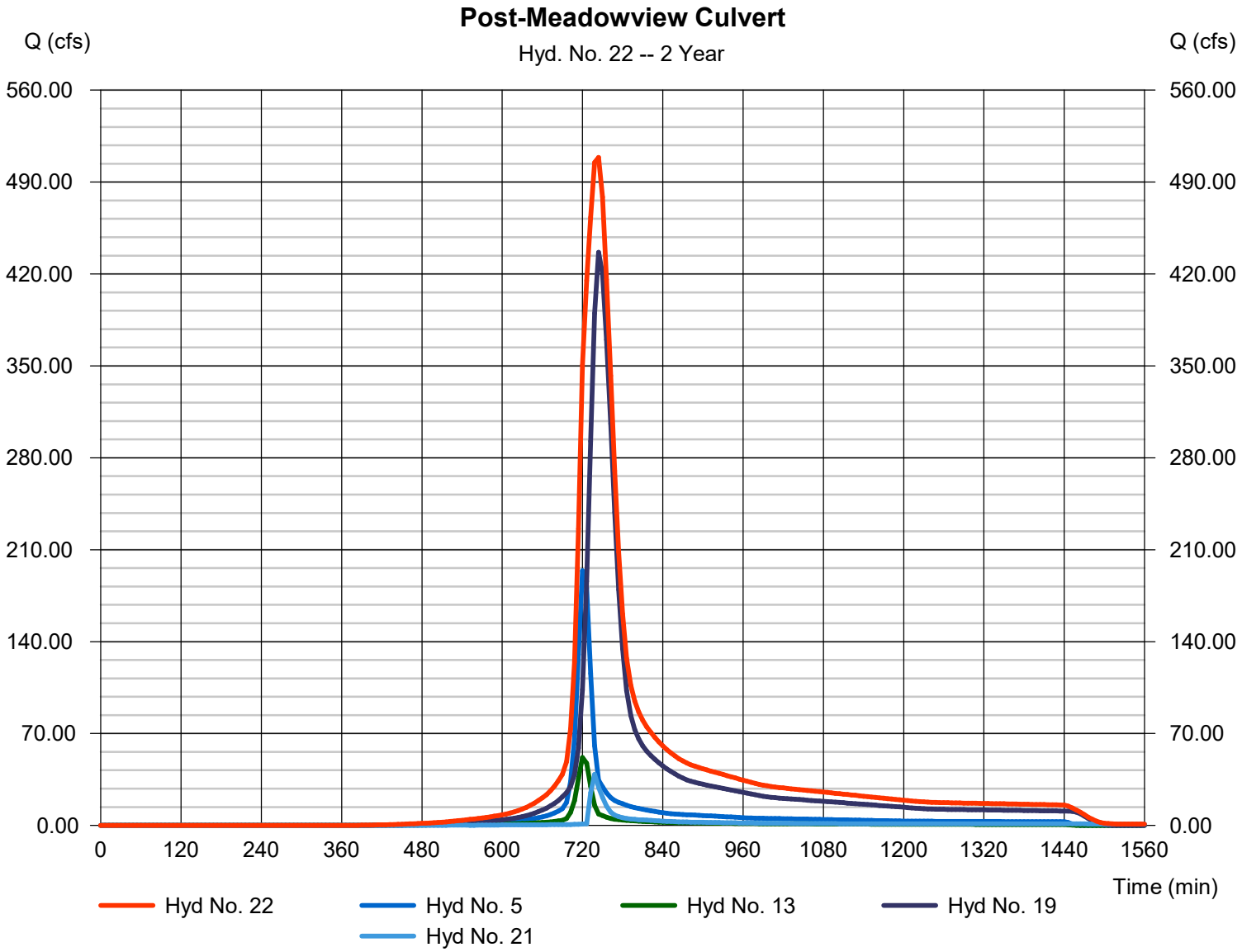


Hydrograph Report

Hyd. No. 22

Post-Meadowview Culvert

Hydrograph type	= Combine	Peak discharge	= 508.69 cfs
Storm frequency	= 2 yrs	Time to peak	= 744 min
Time interval	= 6 min	Hyd. volume	= 3,088,313 cuft
Inflow hyds.	= 5, 13, 19, 21	Contrib. drain. area	= 106.800 ac



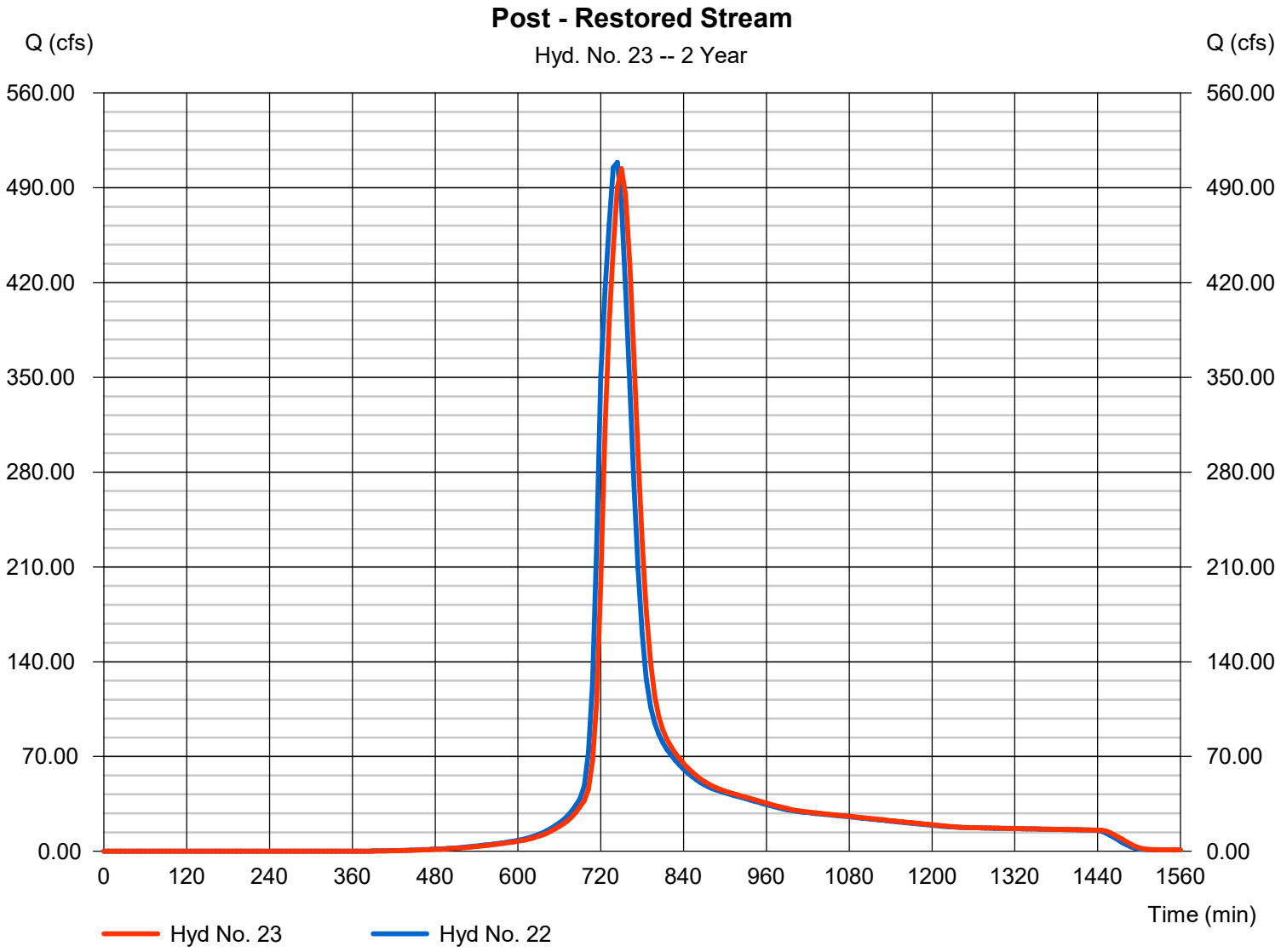
Hydrograph Report

Hyd. No. 23

Post - Restored Stream

Hydrograph type	= Reach	Peak discharge	= 504.21 cfs
Storm frequency	= 2 yrs	Time to peak	= 750 min
Time interval	= 6 min	Hyd. volume	= 3,088,094 cuft
Inflow hyd. No.	= 22 - Post-Meadowview Culvert	Section type	= Trapezoidal
Reach length	= 1340.0 ft	Channel slope	= 0.8 %
Manning's n	= 0.030	Bottom width	= 20.0 ft
Side slope	= 10.0:1	Max. depth	= 4.0 ft
Rating curve x	= 0.595	Rating curve m	= 1.345
Ave. velocity	= 3.36 ft/s	Routing coeff.	= 0.7560

Modified Att-Kin routing method used.



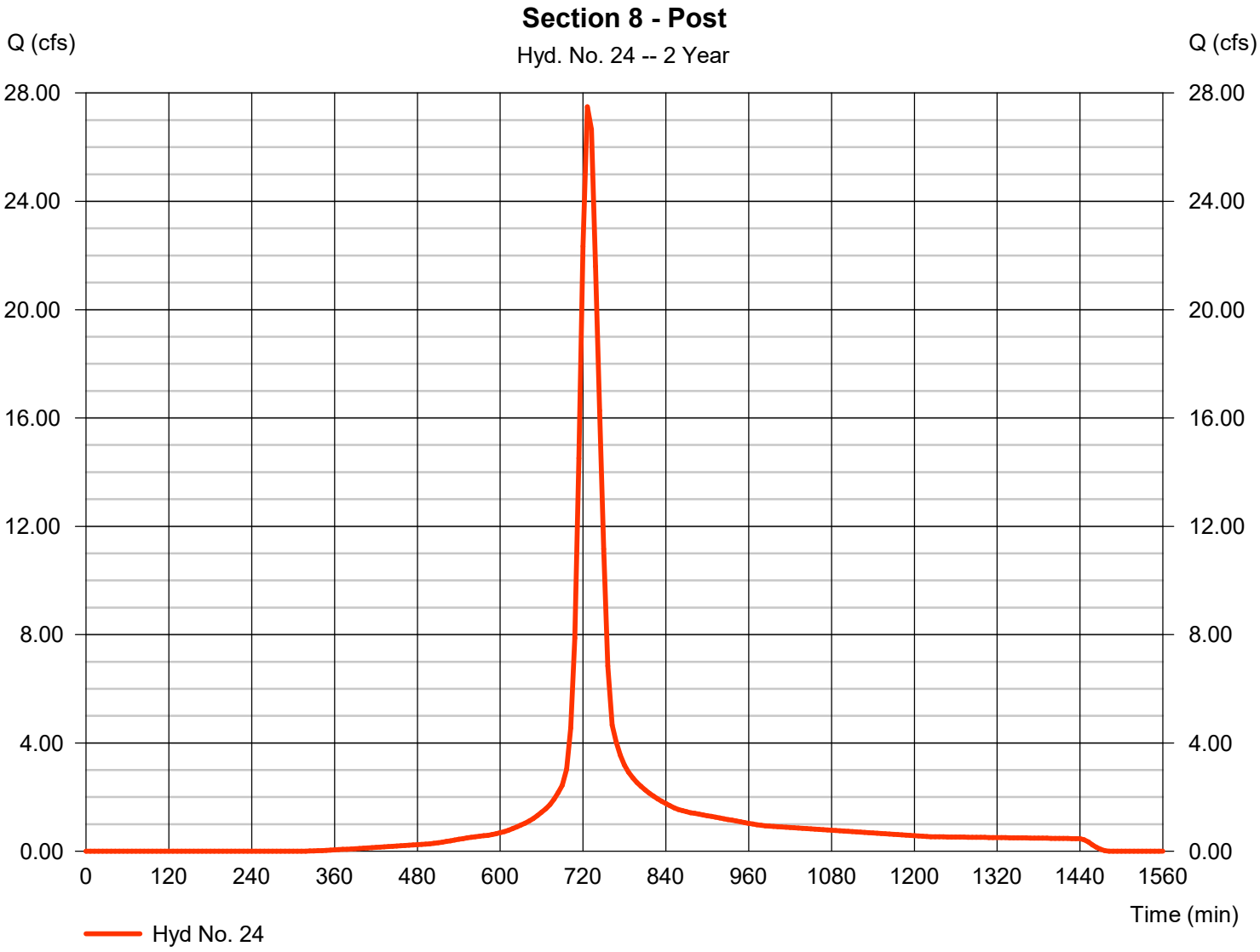
Hydrograph Report

Hyd. No. 24

Section 8 - Post

Hydrograph type	=	SCS Runoff	Peak discharge	=	27.49 cfs
Storm frequency	=	2 yrs	Time to peak	=	726 min
Time interval	=	6 min	Hyd. volume	=	111,965 cuft
Drainage area	=	12.600 ac	Curve number	=	90*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	23.90 min
Total precip.	=	3.50 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(12.600 x 90)] / 12.600



TR55 Tc Worksheet

Hyd. No. 24

Section 8 - Post

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.240		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.50		0.00		0.00		
Land slope (%)	= 1.00		0.00		0.00		
Travel Time (min)	**= 18.00**	**+**	**0.00**	**+**	**0.00**	**=**	**18.00**
Shallow Concentrated Flow							
Flow length (ft)	= 1000.00		0.00		0.00		
Watercourse slope (%)	= 3.00		0.00		0.00		
Surface description	= Paved		Paved		Paved		
Average velocity (ft/s)	=3.52		0.00		0.00		
Travel Time (min)	**= 4.73**	**+**	**0.00**	**+**	**0.00**	**=**	**4.73**
Channel Flow							
X sectional flow area (sqft)	= 3.14		0.00		0.00		
Wetted perimeter (ft)	= 6.30		0.00		0.00		
Channel slope (%)	= 1.50		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=7.63						
			0.00				
					0.00		
Flow length (ft)	({0})550.0		0.0		0.0		
Travel Time (min)	**= 1.20**	**+**	**0.00**	**+**	**0.00**	**=**	**1.20**

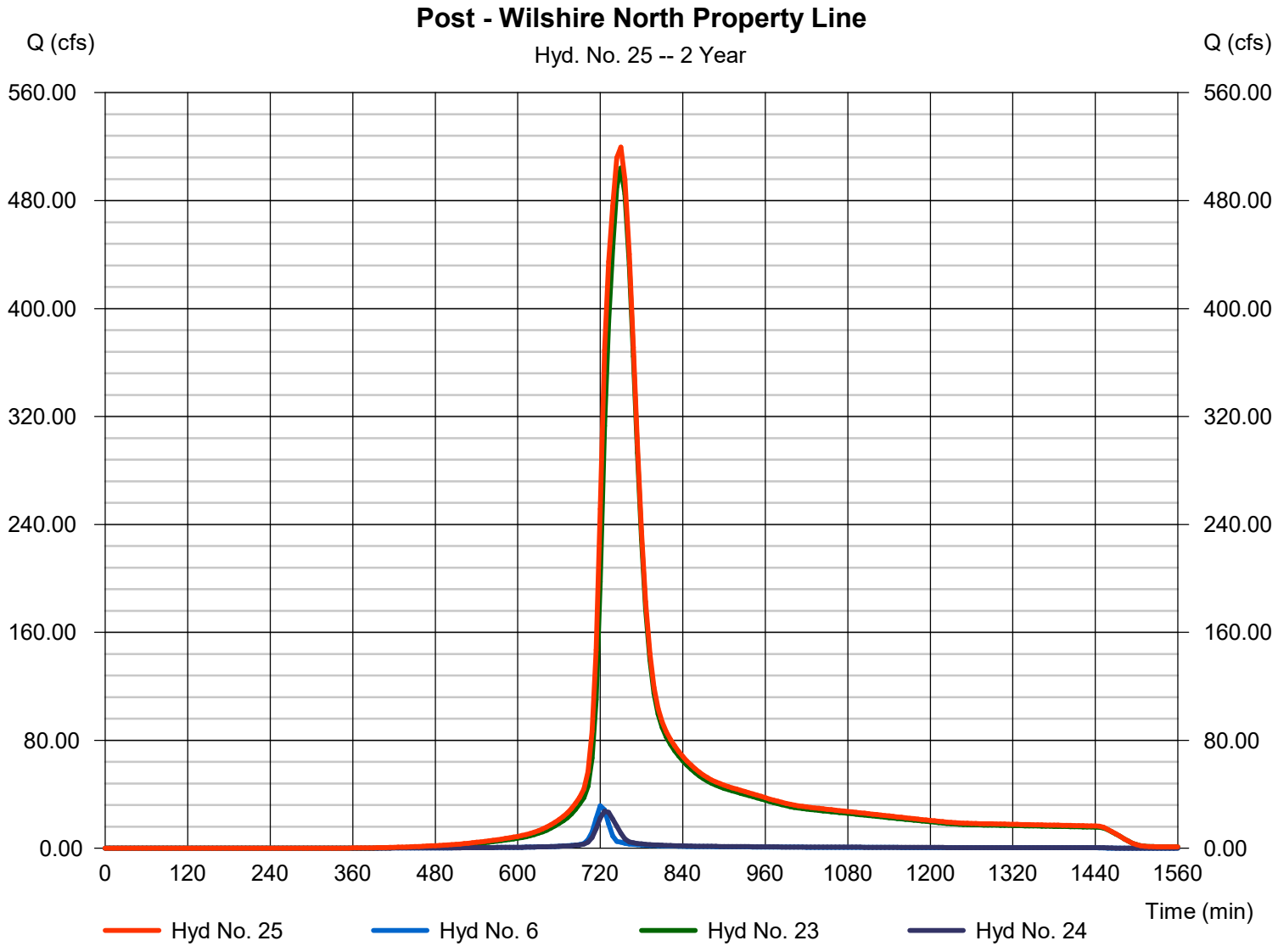
Total Travel Time, Tc ..... 23.90 min

Hydrograph Report

Hyd. No. 25

Post - Wilshire North Property Line

Hydrograph type	= Combine	Peak discharge	= 519.75 cfs
Storm frequency	= 2 yrs	Time to peak	= 750 min
Time interval	= 6 min	Hyd. volume	= 3,297,777 cuft
Inflow hyds.	= 6, 23, 24	Contrib. drain. area	= 23.900 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	208.96	6	726	852,902	------	------	------	Section 1
2	SCS Runoff	173.92	6	726	709,882	------	------	------	Section 2
3	SCS Runoff	251.46	6	732	1,263,608	------	------	------	Section 3
4	SCS Runoff	241.00	6	732	1,221,310	------	------	------	Section 4
5	SCS Runoff	349.09	6	720	1,078,338	------	------	------	Section 5
6	SCS Runoff	51.76	6	720	164,349	------	------	------	Section 6
7	SCS Runoff	211.12	6	726	869,479	------	------	------	Section 7-Pre
8	Combine	630.52	6	732	2,826,393	1, 2, 3,	------	------	Combo-1-(1,2,3)
9	Reach	625.41	6	738	2,826,391	8	------	------	Reach 1-Pond
10	Combine	863.25	6	738	4,047,704	4, 9	------	------	Combo-2 (Reach:1 and 4)
11	Reach	842.35	6	744	4,047,701	10	------	------	Reach-2-Existing Stream
12	Combine	1052.66	6	738	6,159,866	5, 6, 7, 11	------	------	Combo-3 (Reach:2 and 5)
13	SCS Runoff	87.66	6	720	274,936	------	------	------	Section 7A-Post
14	SCS Runoff	14.45	6	720	47,378	------	------	------	Section 7B-Post
15	Combine	630.52	6	732	2,826,393	1, 2, 3,	------	------	Post-Combo-1 (1,2,3)
16	Reach	624.92	6	738	2,826,392	15	------	------	Reach 1 Post-Pond
17	Combine	862.75	6	738	4,047,703	4, 16	------	------	Post - Box Inlet at Strother Road
18	SCS Runoff	67.99	6	726	280,002	------	------	------	Section 7C-Post
19	Reach	855.12	6	744	4,047,699	17	------	------	Post - Preserved stream
20	Combine	82.38	6	726	327,380	14, 18,	------	------	Onsite Water Quality
21	Reservoir	80.69	6	726	327,355	20	917.86	66,896	Wilshire Hills Water Q
22	Combine	991.07	6	738	5,728,325	5, 13, 19, 21	------	------	Post-Meadowview Culvert
23	Reach	982.21	6	744	5,728,105	22	------	------	Post - Restored Stream
24	SCS Runoff	46.04	6	726	190,551	------	------	------	Section 8 - Post
25	Combine	1017.03	6	744	6,083,003	6, 23, 24	------	------	Post - Wilshire North Property Line

P:\General Projects\15925E-JES-Wilshire-Hills-Eng\Stormwater\15925 Downstream Analysis (basin update).gpw

Return Period: 10 Year

Tuesday, 11 / 28 / 2023

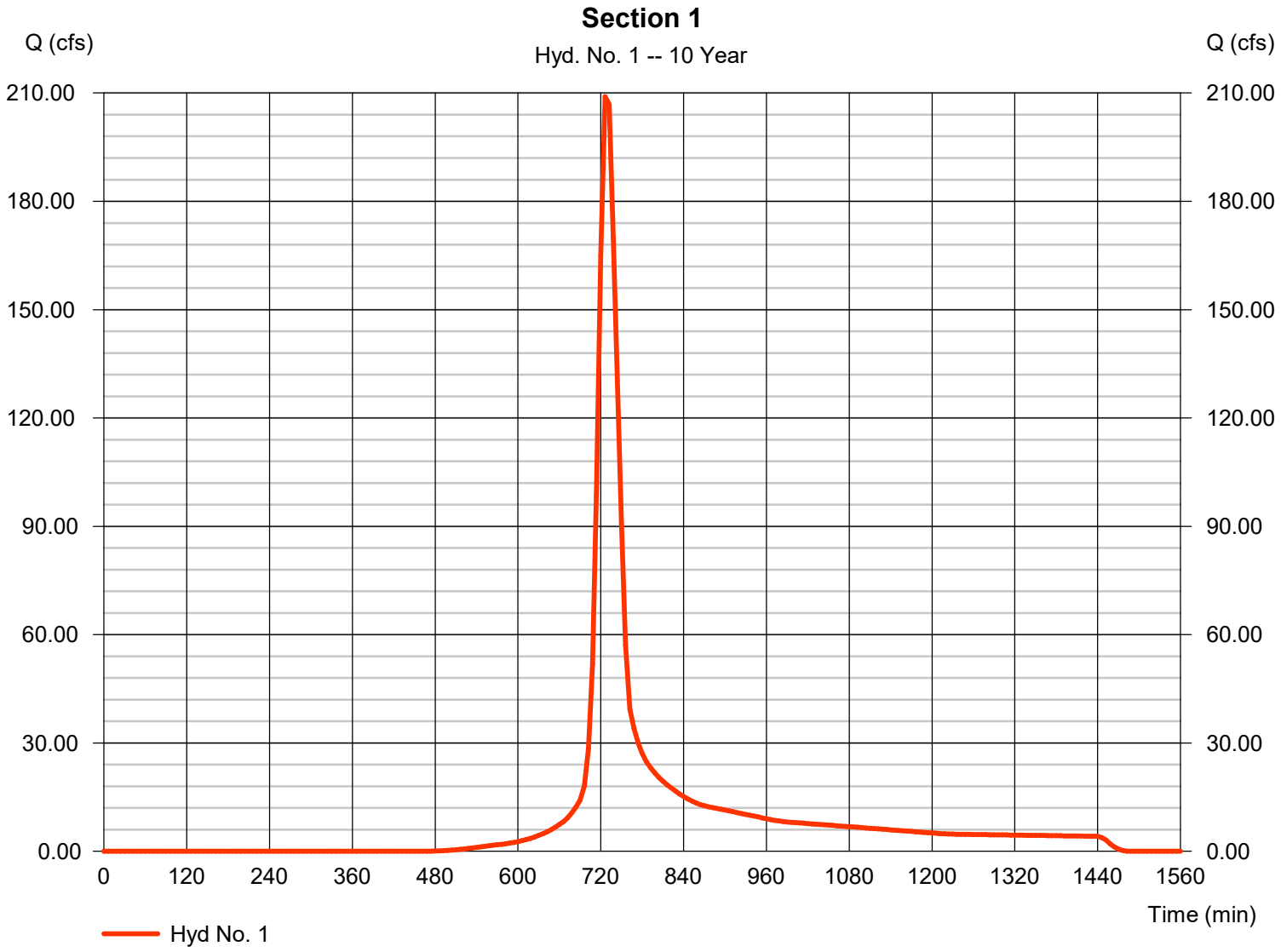
Hydrograph Report

Hyd. No. 1

Section 1

Hydrograph type	=	SCS Runoff	Peak discharge	=	208.96 cfs
Storm frequency	=	10 yrs	Time to peak	=	726 min
Time interval	=	6 min	Hyd. volume	=	852,902 cuft
Drainage area	=	81.700 ac	Curve number	=	77*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	24.30 min
Total precip.	=	5.30 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(3.600 x 81) + (13.500 x 98) + (49.000 x 73) + (15.600 x 69)] / 81.700



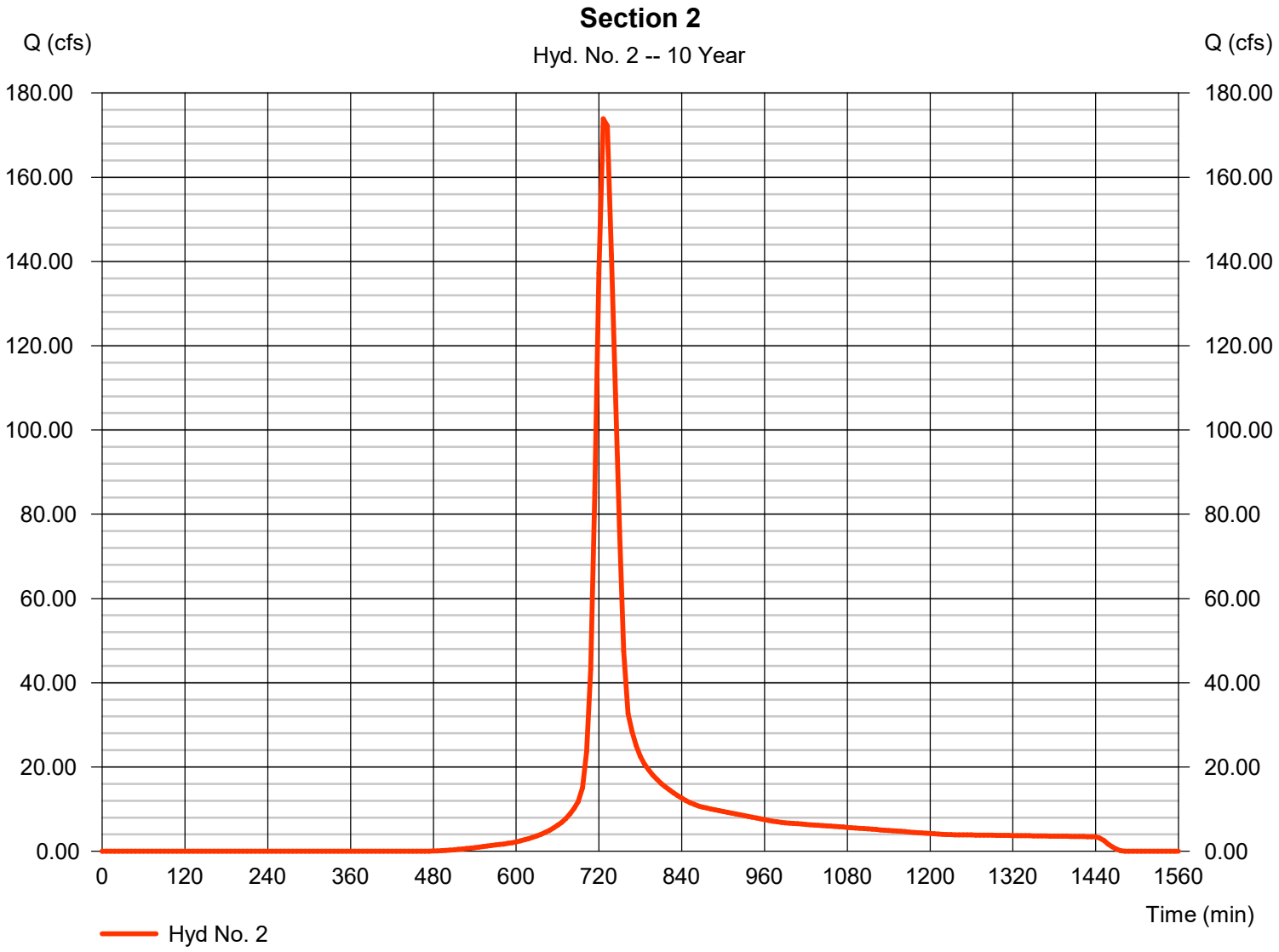
Hydrograph Report

Hyd. No. 2

Section 2

Hydrograph type	=	SCS Runoff	Peak discharge	=	173.92 cfs
Storm frequency	=	10 yrs	Time to peak	=	726 min
Time interval	=	6 min	Hyd. volume	=	709,882 cuft
Drainage area	=	68.000 ac	Curve number	=	77*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	25.30 min
Total precip.	=	5.30 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(8.000 x 98) + (0.500 x 77) + (30.800 x 79) + (28.700 x 69)] / 68.000



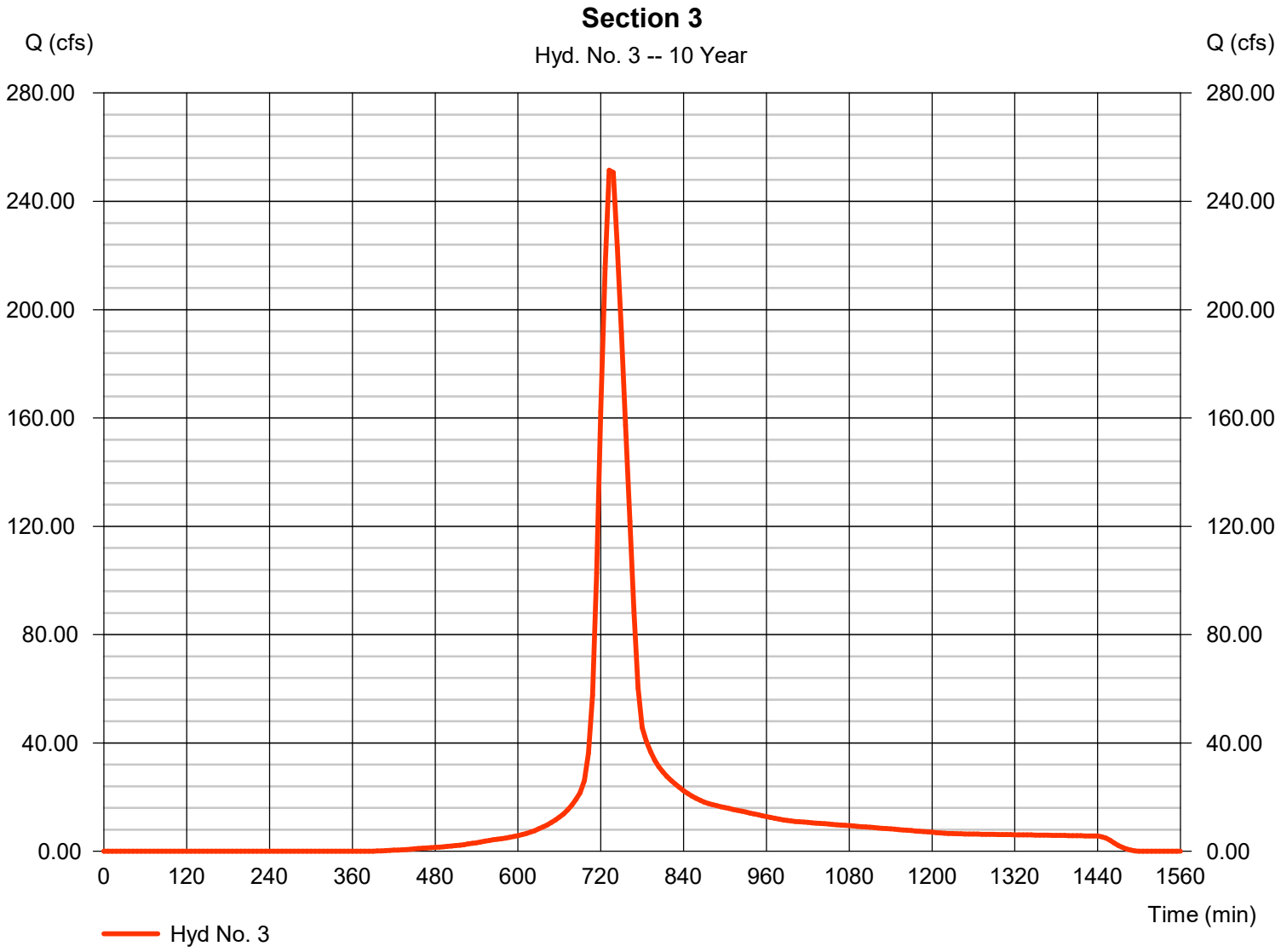
Hydrograph Report

Hyd. No. 3

Section 3

Hydrograph type	=	SCS Runoff	Peak discharge	=	251.46 cfs
Storm frequency	=	10 yrs	Time to peak	=	732 min
Time interval	=	6 min	Hyd. volume	=	1,263,608 cuft
Drainage area	=	100.800 ac	Curve number	=	82*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	30.20 min
Total precip.	=	5.30 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(18.200 x 98) + (3.000 x 77) + (79.600 x 79)] / 100.800



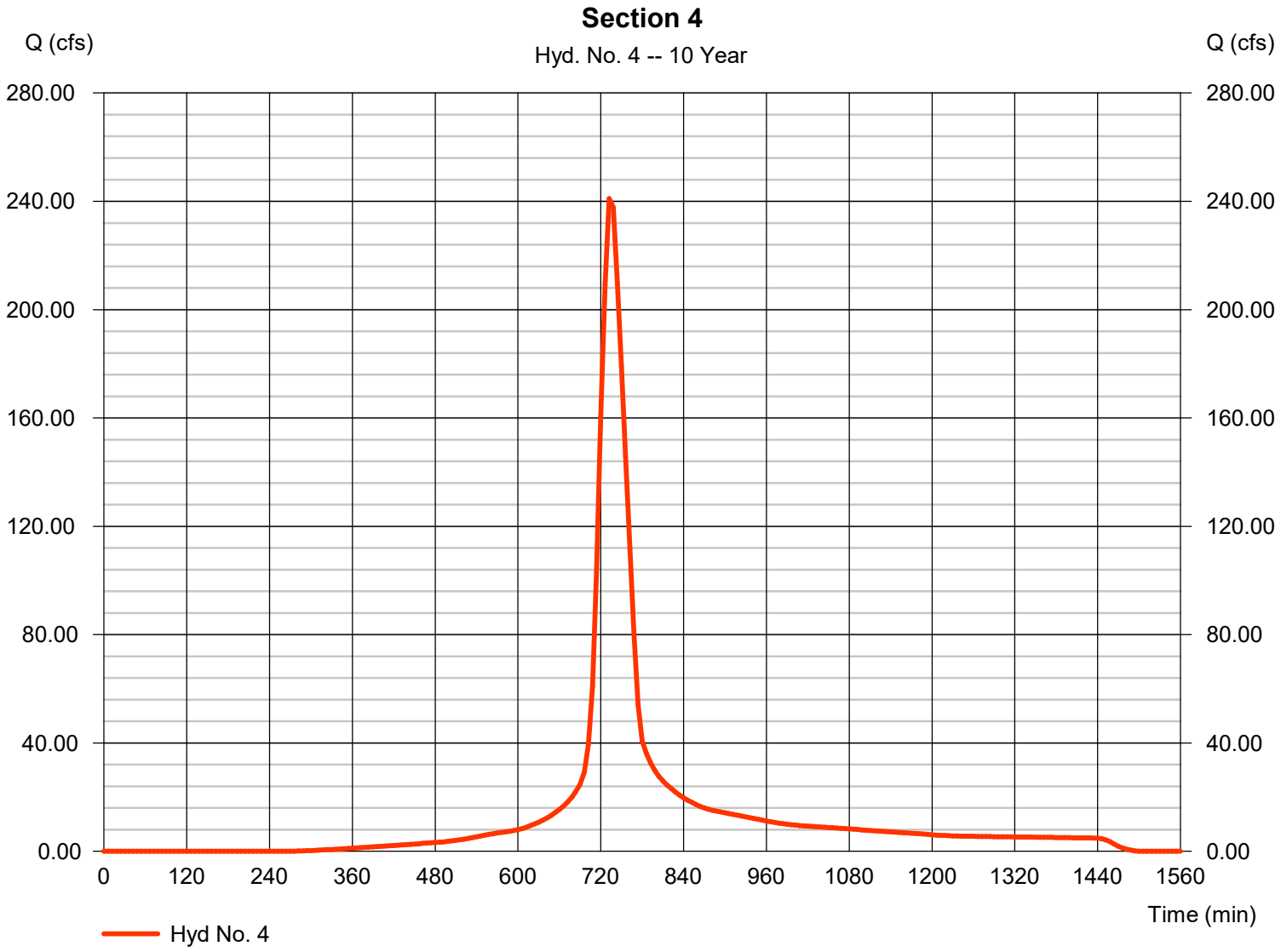
Hydrograph Report

Hyd. No. 4

Section 4

Hydrograph type	= SCS Runoff	Peak discharge	= 241.00 cfs
Storm frequency	= 10 yrs	Time to peak	= 732 min
Time interval	= 6 min	Hyd. volume	= 1,221,310 cuft
Drainage area	= 82.500 ac	Curve number	= 88*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 30.70 min
Total precip.	= 5.30 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(49.680 x 98) + (32.820 x 74)] / 82.500



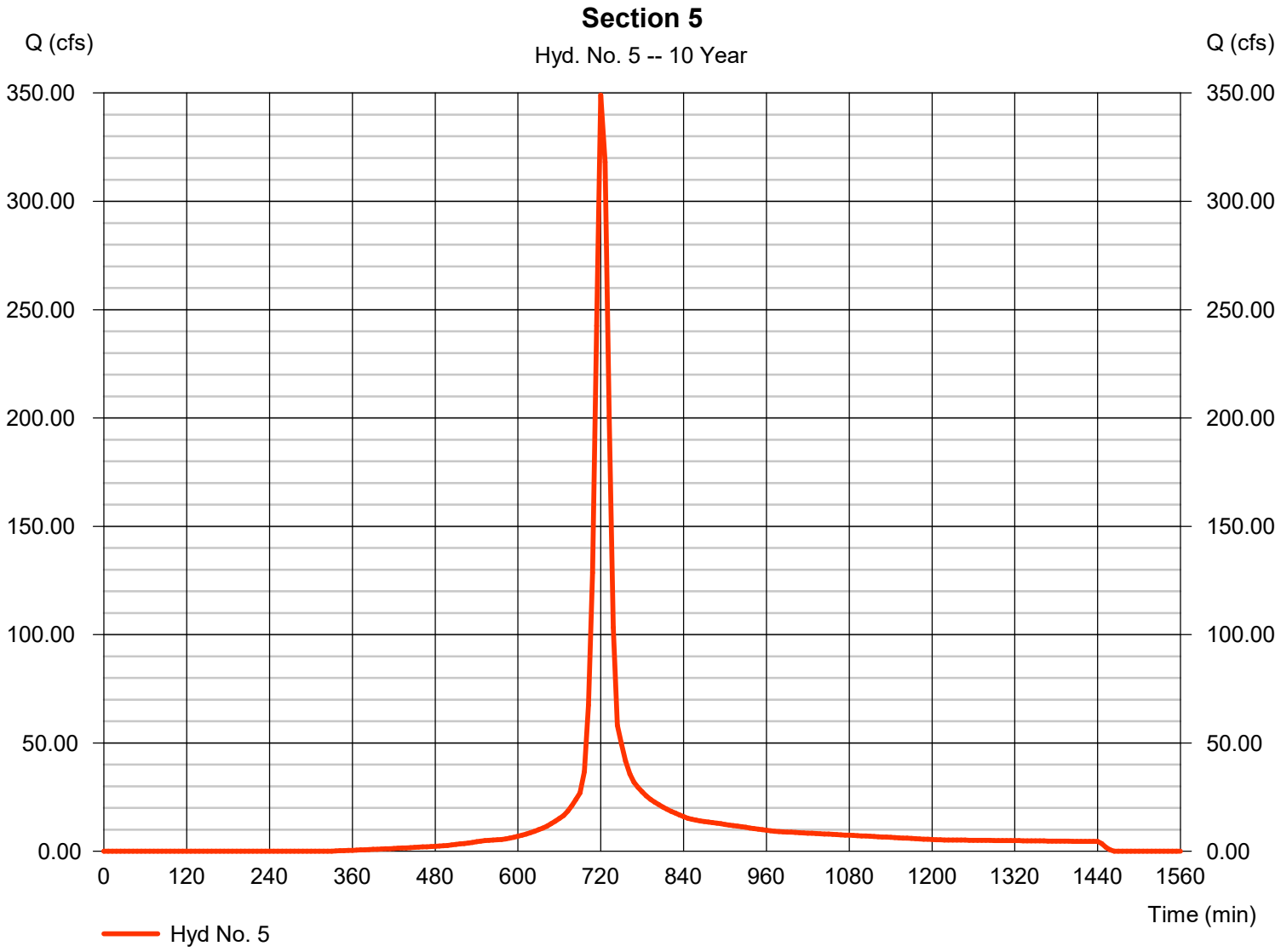
Hydrograph Report

Hyd. No. 5

Section 5

Hydrograph type	=	SCS Runoff	Peak discharge	=	349.09 cfs
Storm frequency	=	10 yrs	Time to peak	=	720 min
Time interval	=	6 min	Hyd. volume	=	1,078,338 cuft
Drainage area	=	86.900 ac	Curve number	=	85*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	15.60 min
Total precip.	=	5.30 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(40.000 x 98) + (46.900 x 74)] / 86.900



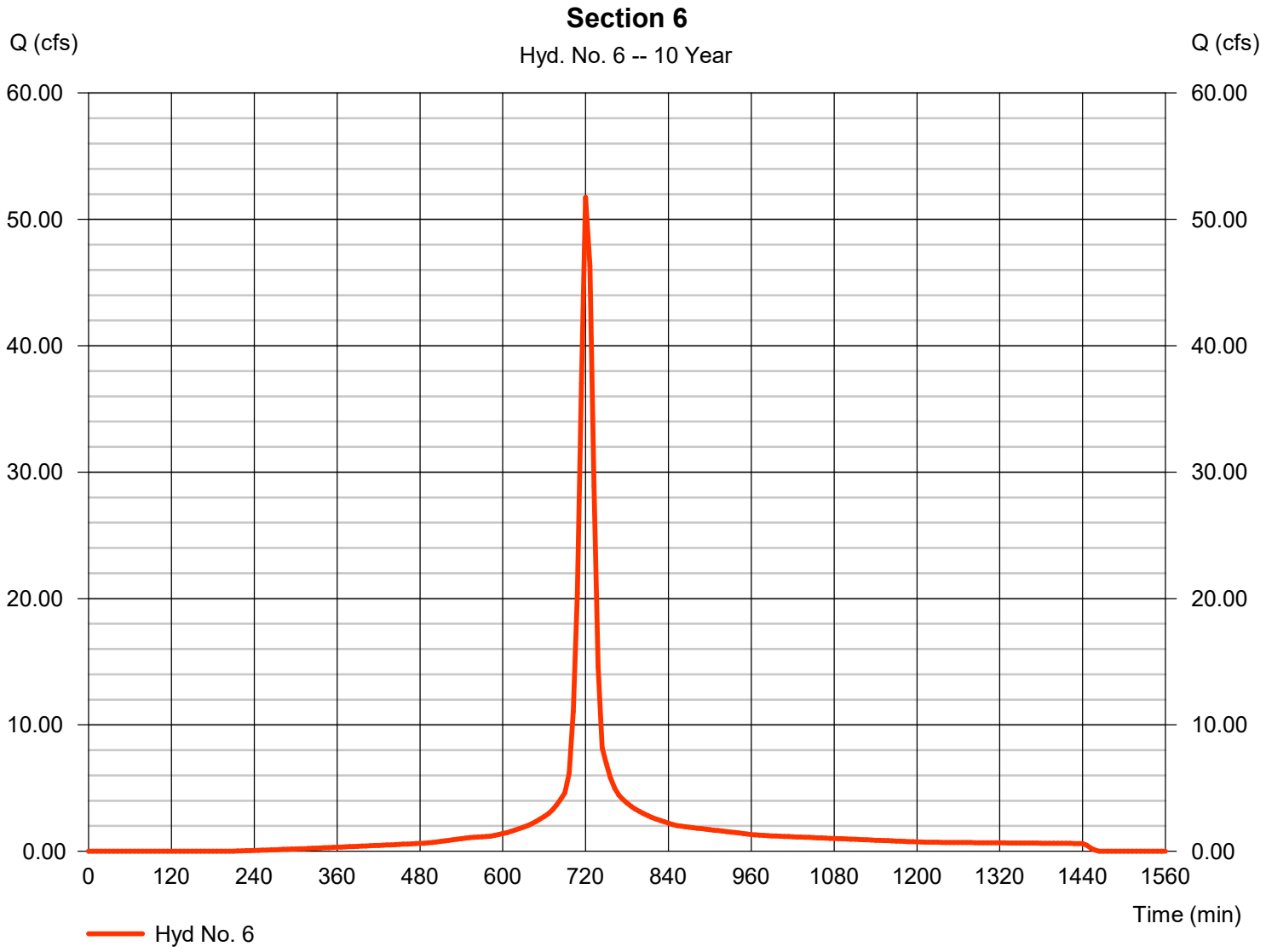
Hydrograph Report

Hyd. No. 6

Section 6

Hydrograph type	=	SCS Runoff	Peak discharge	=	51.76 cfs
Storm frequency	=	10 yrs	Time to peak	=	720 min
Time interval	=	6 min	Hyd. volume	=	164,349 cuft
Drainage area	=	11.300 ac	Curve number	=	91*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	18.60 min
Total precip.	=	5.30 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(11.300 x 91)] / 11.300



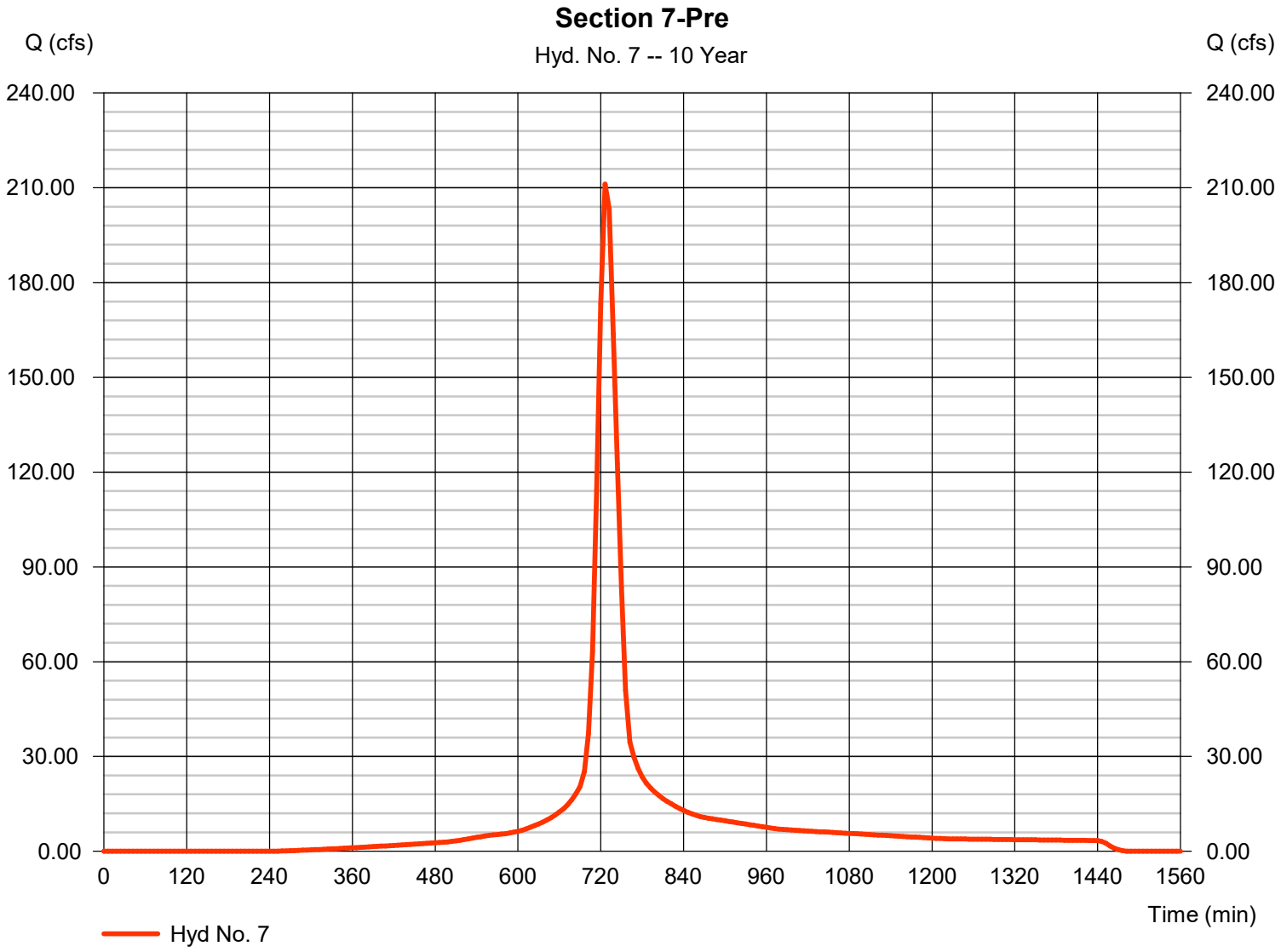
Hydrograph Report

Hyd. No. 7

Section 7-Pre

Hydrograph type	=	SCS Runoff	Peak discharge	=	211.12 cfs
Storm frequency	=	10 yrs	Time to peak	=	726 min
Time interval	=	6 min	Hyd. volume	=	869,479 cuft
Drainage area	=	59.000 ac	Curve number	=	89*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	23.83 min
Total precip.	=	5.30 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(59.000 x 79)] / 59.000

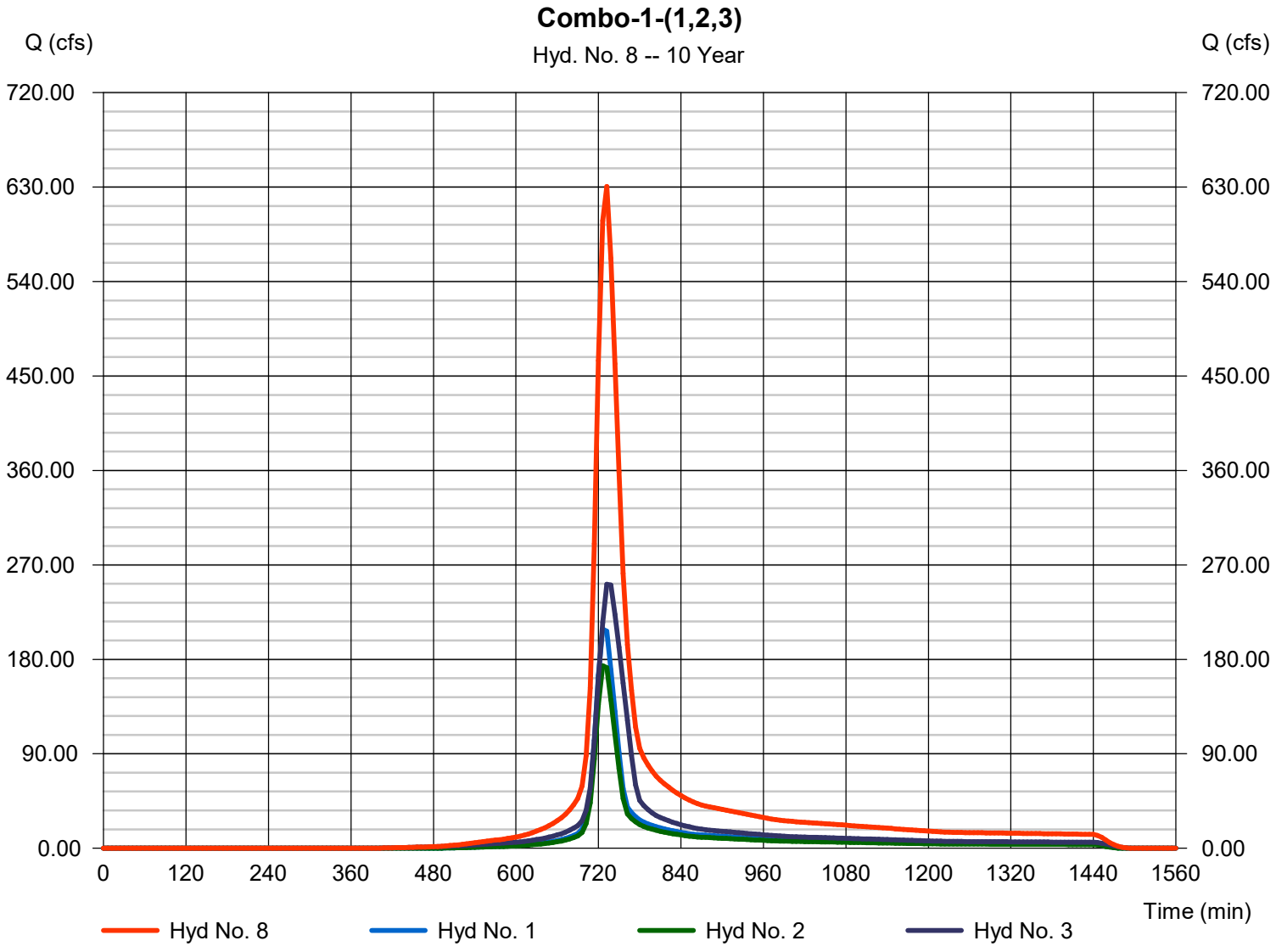


Hydrograph Report

Hyd. No. 8

Combo-1-(1,2,3)

Hydrograph type	= Combine	Peak discharge	= 630.52 cfs
Storm frequency	= 10 yrs	Time to peak	= 732 min
Time interval	= 6 min	Hyd. volume	= 2,826,393 cuft
Inflow hyds.	= 1, 2, 3	Contrib. drain. area	= 250.500 ac



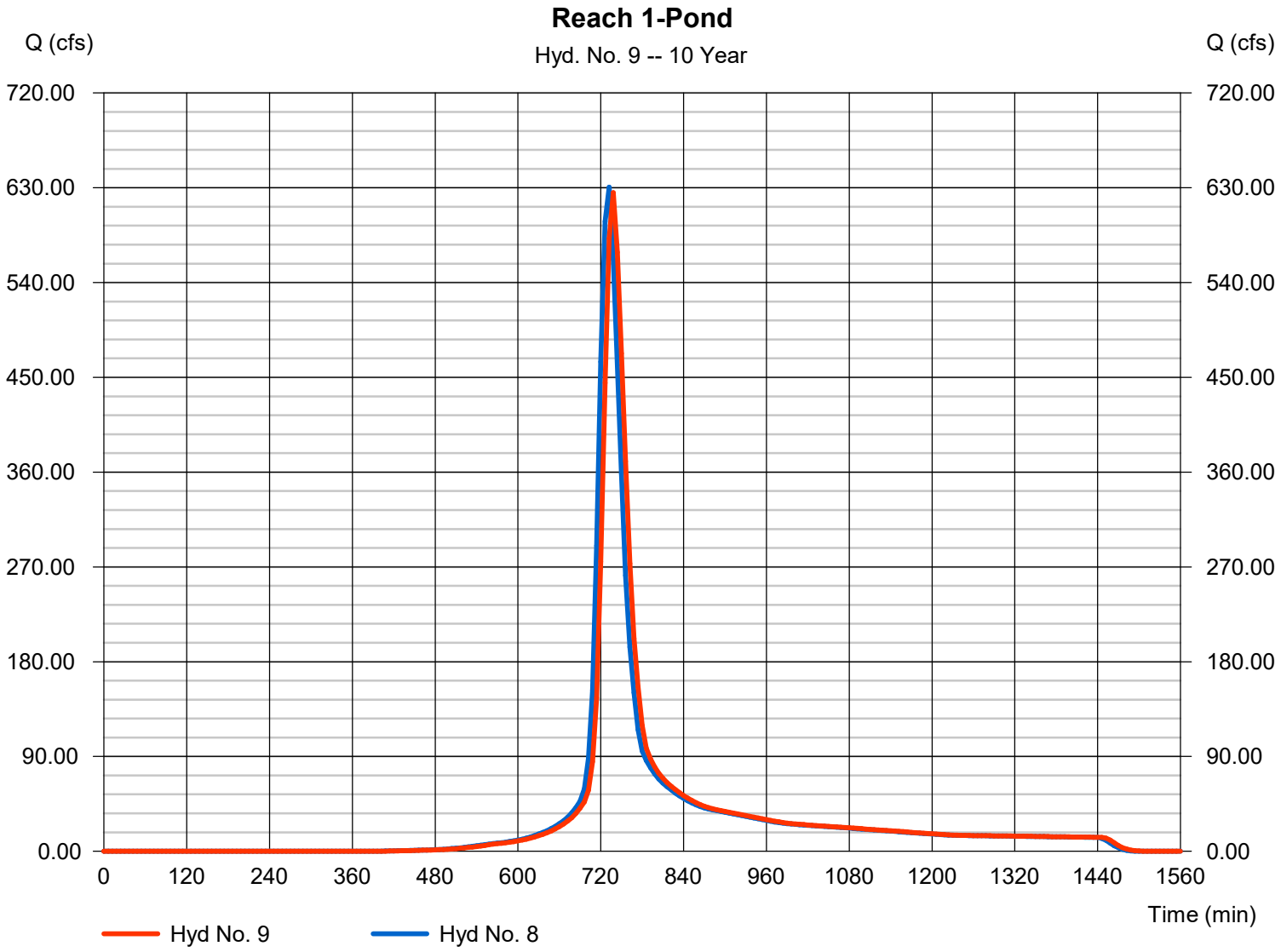
Hydrograph Report

Hyd. No. 9

Reach 1-Pond

Hydrograph type	=	Reach	Peak discharge	=	625.41 cfs
Storm frequency	=	10 yrs	Time to peak	=	738 min
Time interval	=	6 min	Hyd. volume	=	2,826,391 cuft
Inflow hyd. No.	=	8 - Combo-1-(1,2,3)	Section type	=	Trapezoidal
Reach length	=	1000.0 ft	Channel slope	=	2.0 %
Manning's n	=	0.020	Bottom width	=	150.0 ft
Side slope	=	30.0:1	Max. depth	=	16.0 ft
Rating curve x	=	0.373	Rating curve m	=	1.407
Ave. velocity	=	3.20 ft/s	Routing coeff.	=	0.8950

Modified Att-Kin routing method used.

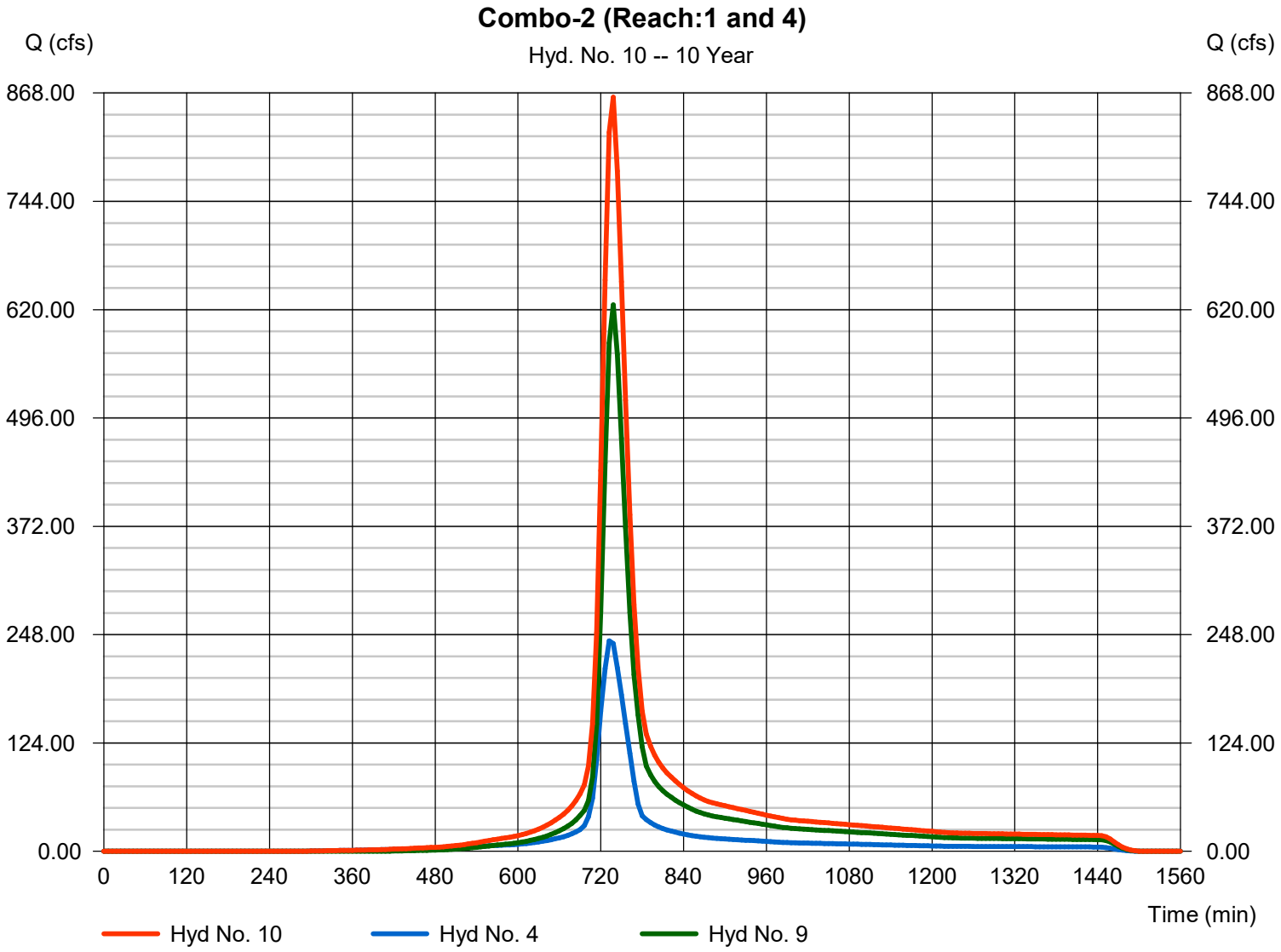


Hydrograph Report

Hyd. No. 10

Combo-2 (Reach:1 and 4)

Hydrograph type	= Combine	Peak discharge	= 863.25 cfs
Storm frequency	= 10 yrs	Time to peak	= 738 min
Time interval	= 6 min	Hyd. volume	= 4,047,704 cuft
Inflow hyds.	= 4, 9	Contrib. drain. area	= 82.500 ac



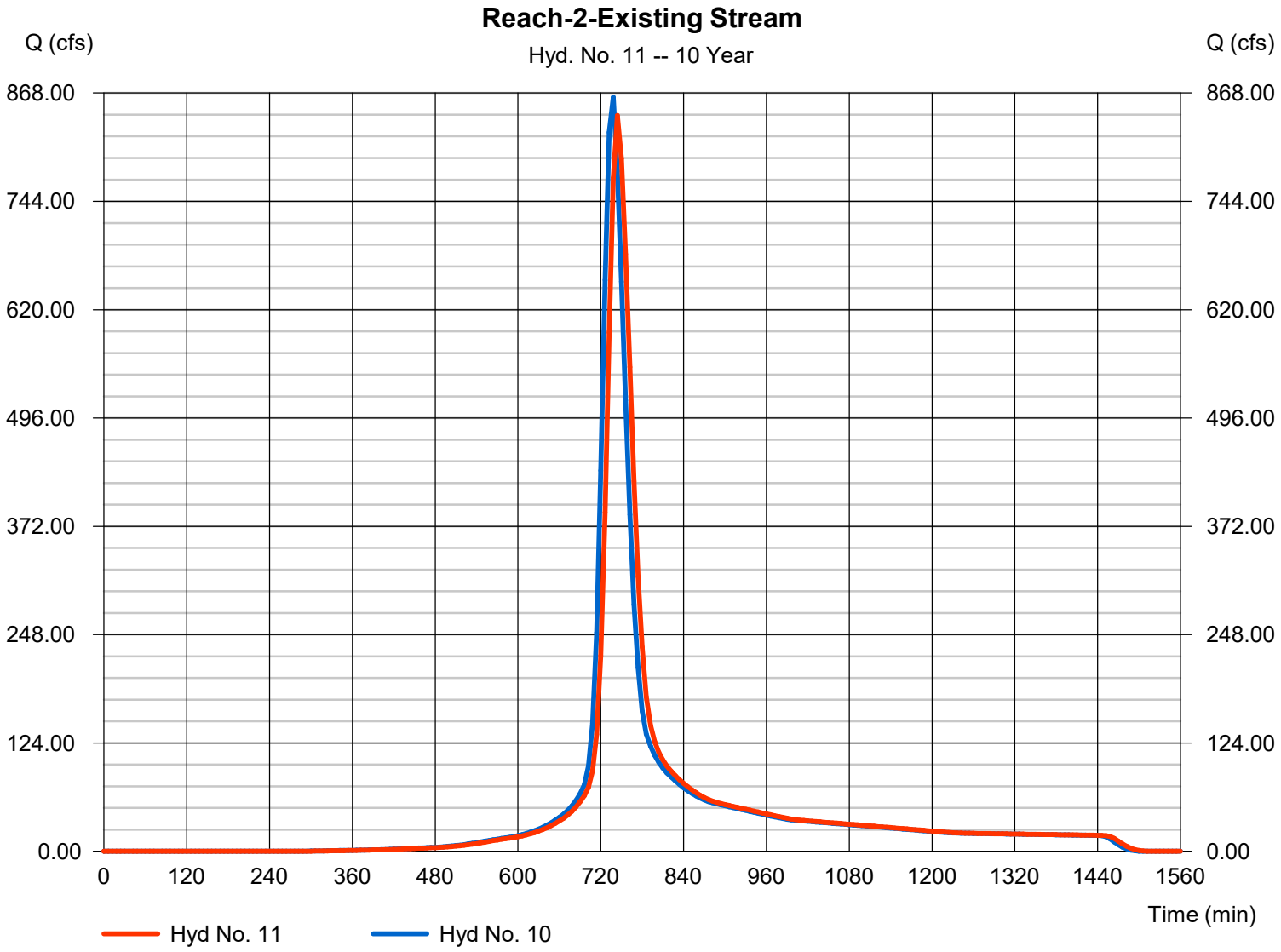
Hydrograph Report

Hyd. No. 11

Reach-2-Existing Stream

Hydrograph type	= Reach	Peak discharge	= 842.35 cfs
Storm frequency	= 10 yrs	Time to peak	= 744 min
Time interval	= 6 min	Hyd. volume	= 4,047,701 cuft
Inflow hyd. No.	= 10 - Combo-2 (Reach:1 and 4)	Section type	= Trapezoidal
Reach length	= 2200.0 ft	Channel slope	= 1.4 %
Manning's n	= 0.030	Bottom width	= 5.0 ft
Side slope	= 20.0:1	Max. depth	= 5.0 ft
Rating curve x	= 2.009	Rating curve m	= 1.231
Ave. velocity	= 6.26 ft/s	Routing coeff.	= 0.7736

Modified Att-Kin routing method used.

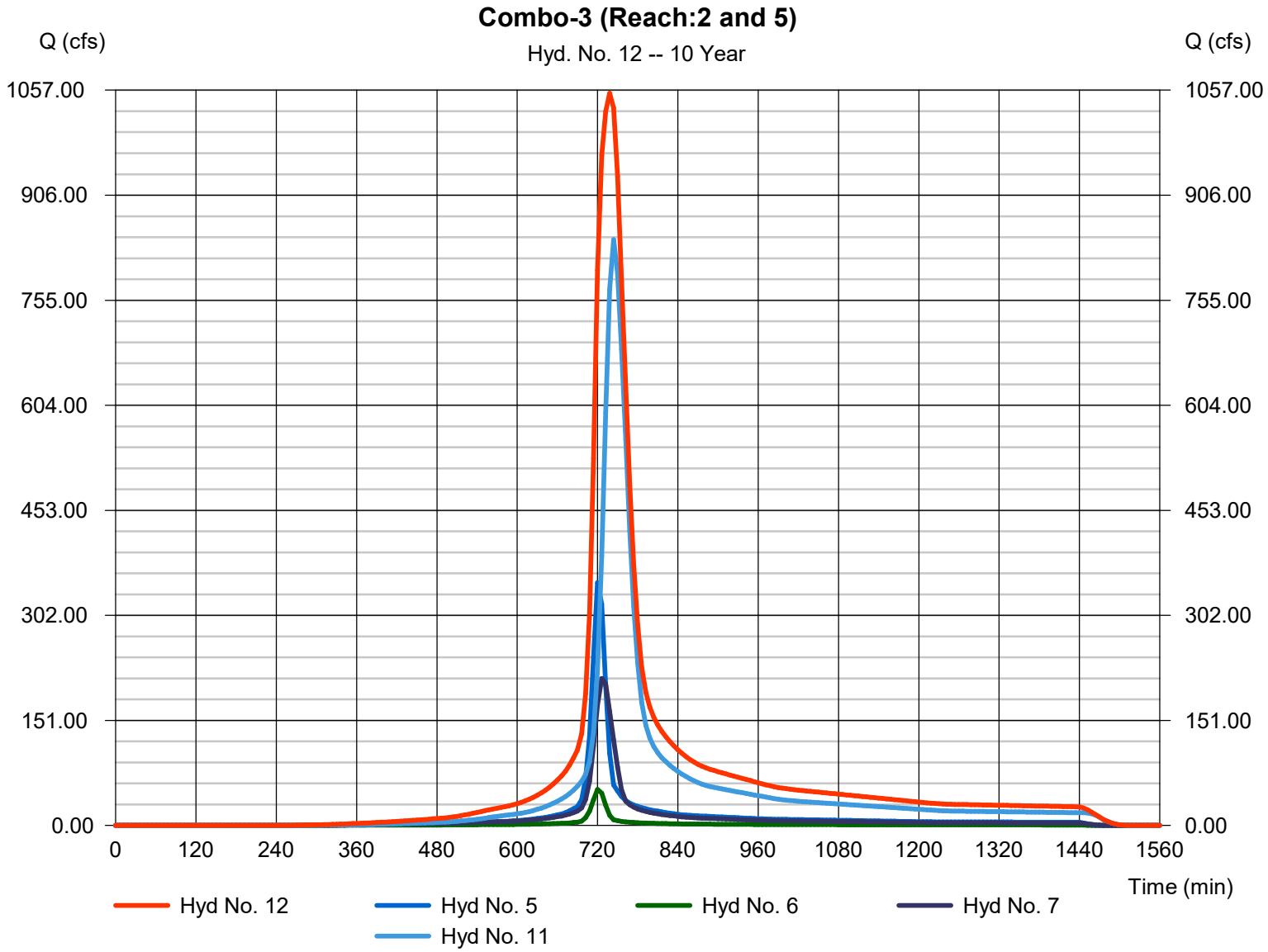


Hydrograph Report

Hyd. No. 12

Combo-3 (Reach:2 and 5)

Hydrograph type	= Combine	Peak discharge	= 1052.66 cfs
Storm frequency	= 10 yrs	Time to peak	= 738 min
Time interval	= 6 min	Hyd. volume	= 6,159,866 cuft
Inflow hyds.	= 5, 6, 7, 11	Contrib. drain. area	= 157.200 ac



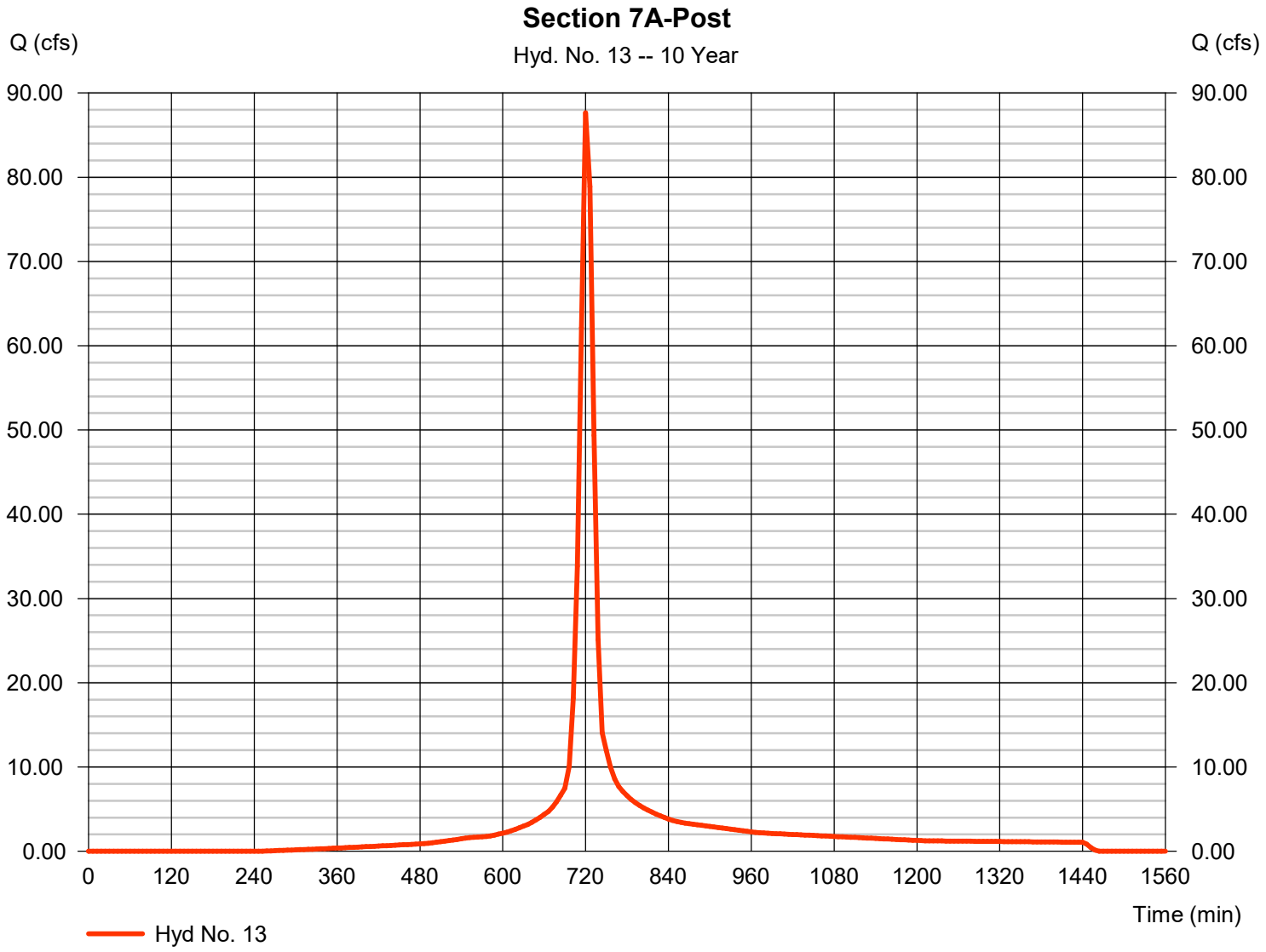
Hydrograph Report

Hyd. No. 13

Section 7A-Post

Hydrograph type	=	SCS Runoff	Peak discharge	=	87.66 cfs
Storm frequency	=	10 yrs	Time to peak	=	720 min
Time interval	=	6 min	Hyd. volume	=	274,936 cuft
Drainage area	=	19.900 ac	Curve number	=	89*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	19.30 min
Total precip.	=	5.30 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(19.900 x 89)] / 19.900



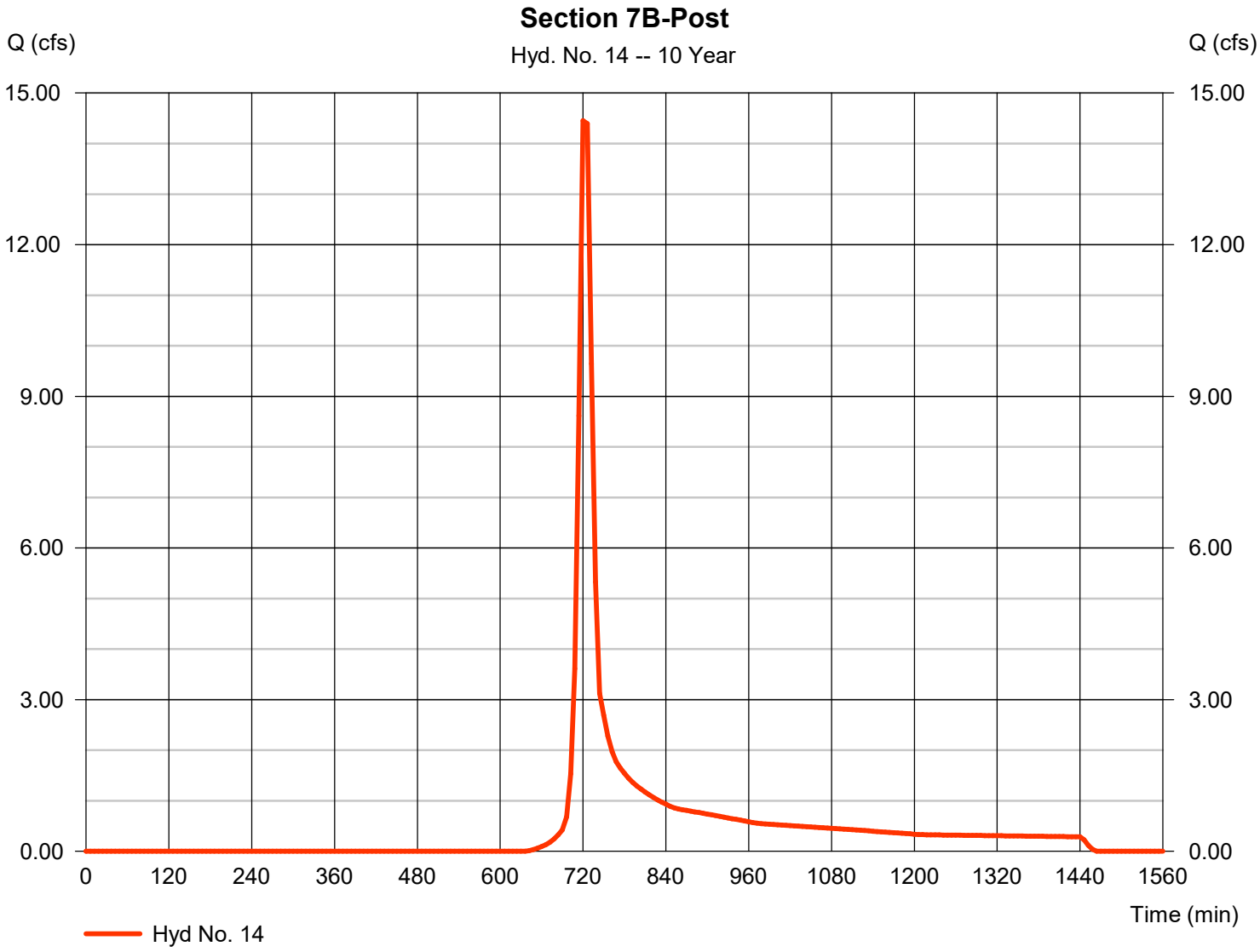
Hydrograph Report

Hyd. No. 14

Section 7B-Post

Hydrograph type	=	SCS Runoff	Peak discharge	=	14.45 cfs
Storm frequency	=	10 yrs	Time to peak	=	720 min
Time interval	=	6 min	Hyd. volume	=	47,378 cuft
Drainage area	=	7.500 ac	Curve number	=	65*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	18.80 min
Total precip.	=	5.30 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(13.900 x 89)] / 7.500

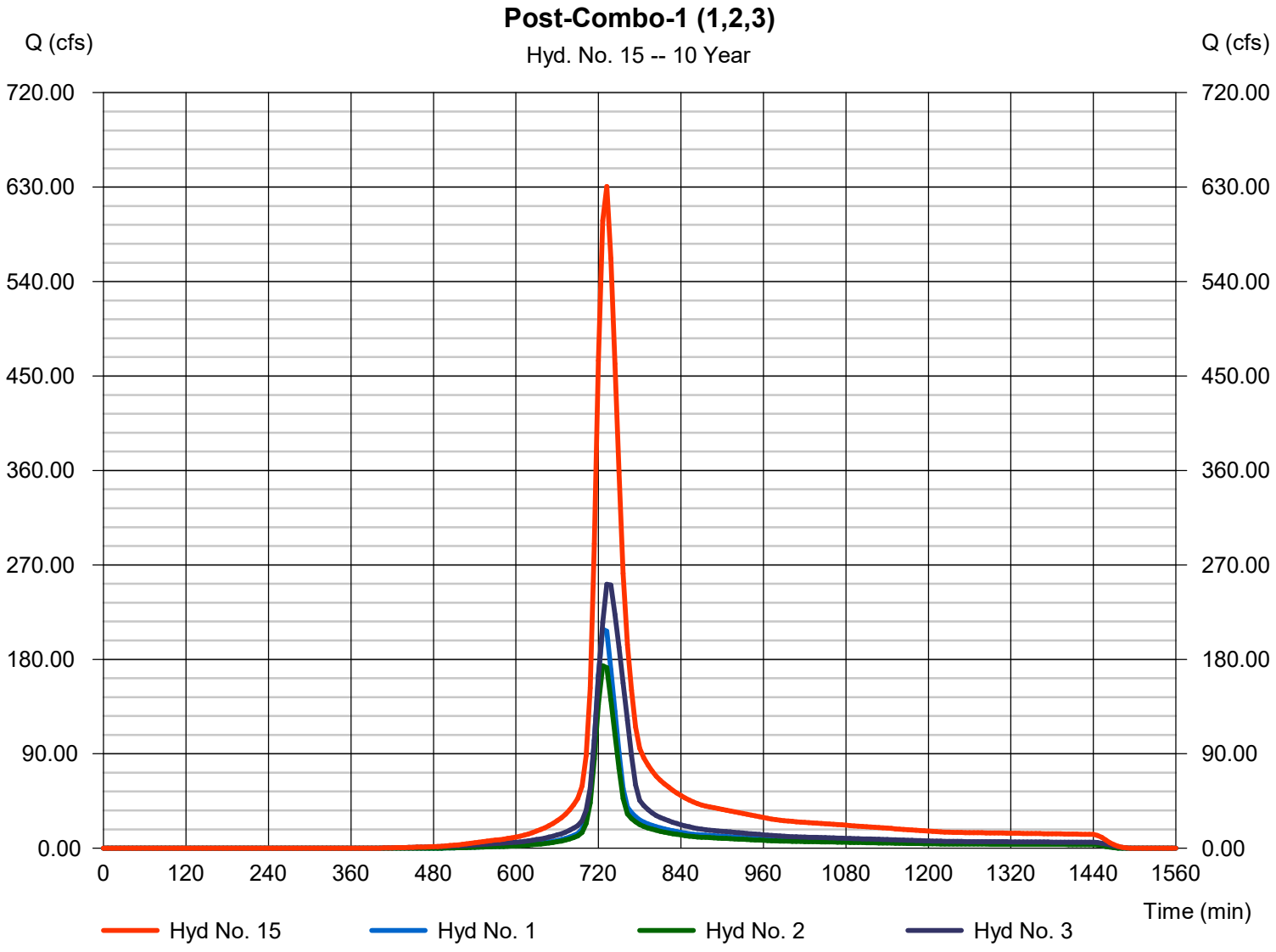


Hydrograph Report

Hyd. No. 15

Post-Combo-1 (1,2,3)

Hydrograph type	= Combine	Peak discharge	= 630.52 cfs
Storm frequency	= 10 yrs	Time to peak	= 732 min
Time interval	= 6 min	Hyd. volume	= 2,826,393 cuft
Inflow hyds.	= 1, 2, 3	Contrib. drain. area	= 250.500 ac



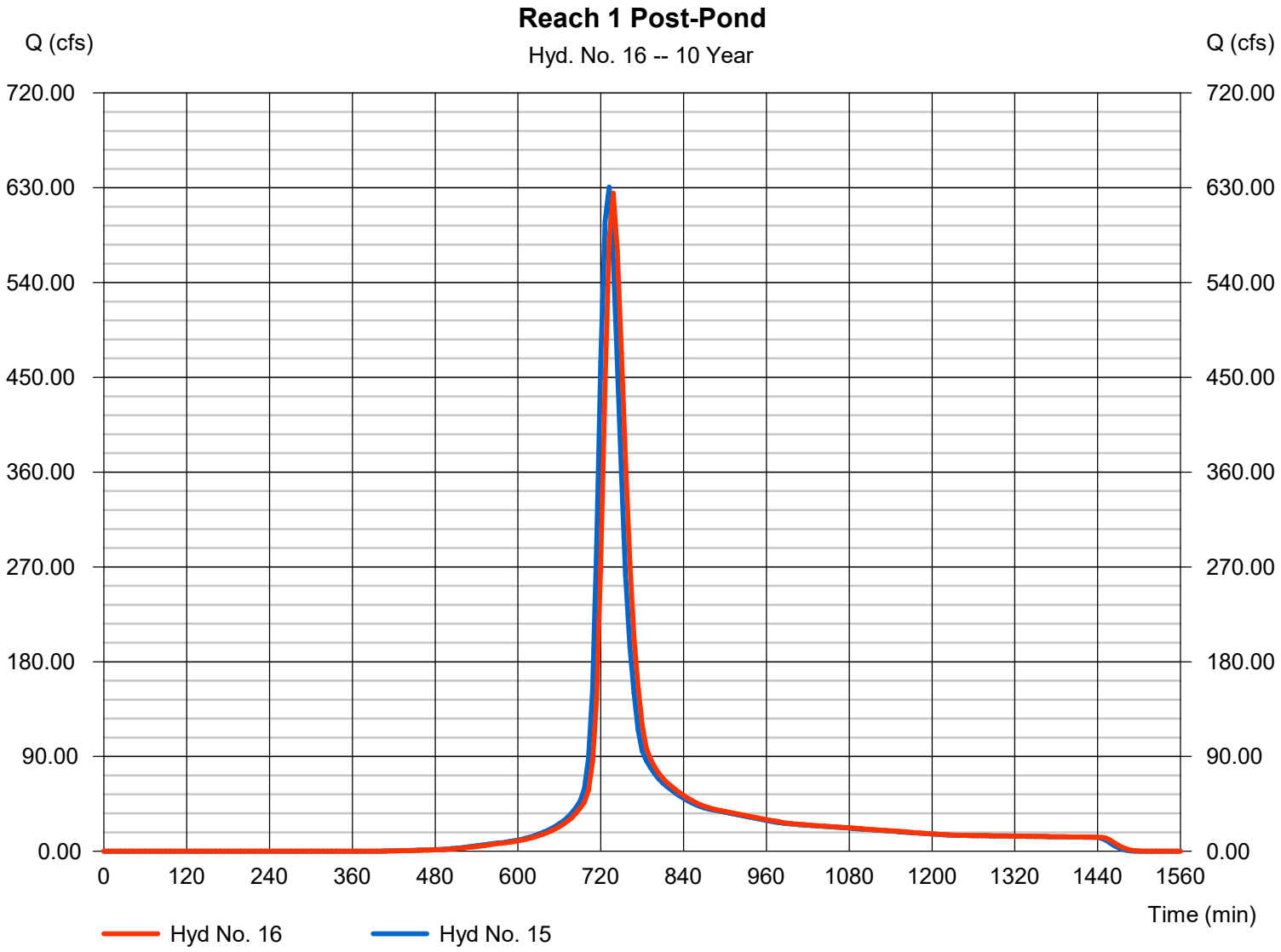
Hydrograph Report

Hyd. No. 16

Reach 1 Post-Pond

Hydrograph type	=	Reach	Peak discharge	=	624.92 cfs
Storm frequency	=	10 yrs	Time to peak	=	738 min
Time interval	=	6 min	Hyd. volume	=	2,826,392 cuft
Inflow hyd. No.	=	15 - Post-Combo-1 (1,2,3)	Section type	=	Trapezoidal
Reach length	=	1000.0 ft	Channel slope	=	2.0 %
Manning's n	=	0.020	Bottom width	=	150.0 ft
Side slope	=	32.0:1	Max. depth	=	16.0 ft
Rating curve x	=	0.373	Rating curve m	=	1.404
Ave. velocity	=	3.16 ft/s	Routing coeff.	=	0.8878

Modified Att-Kin routing method used.

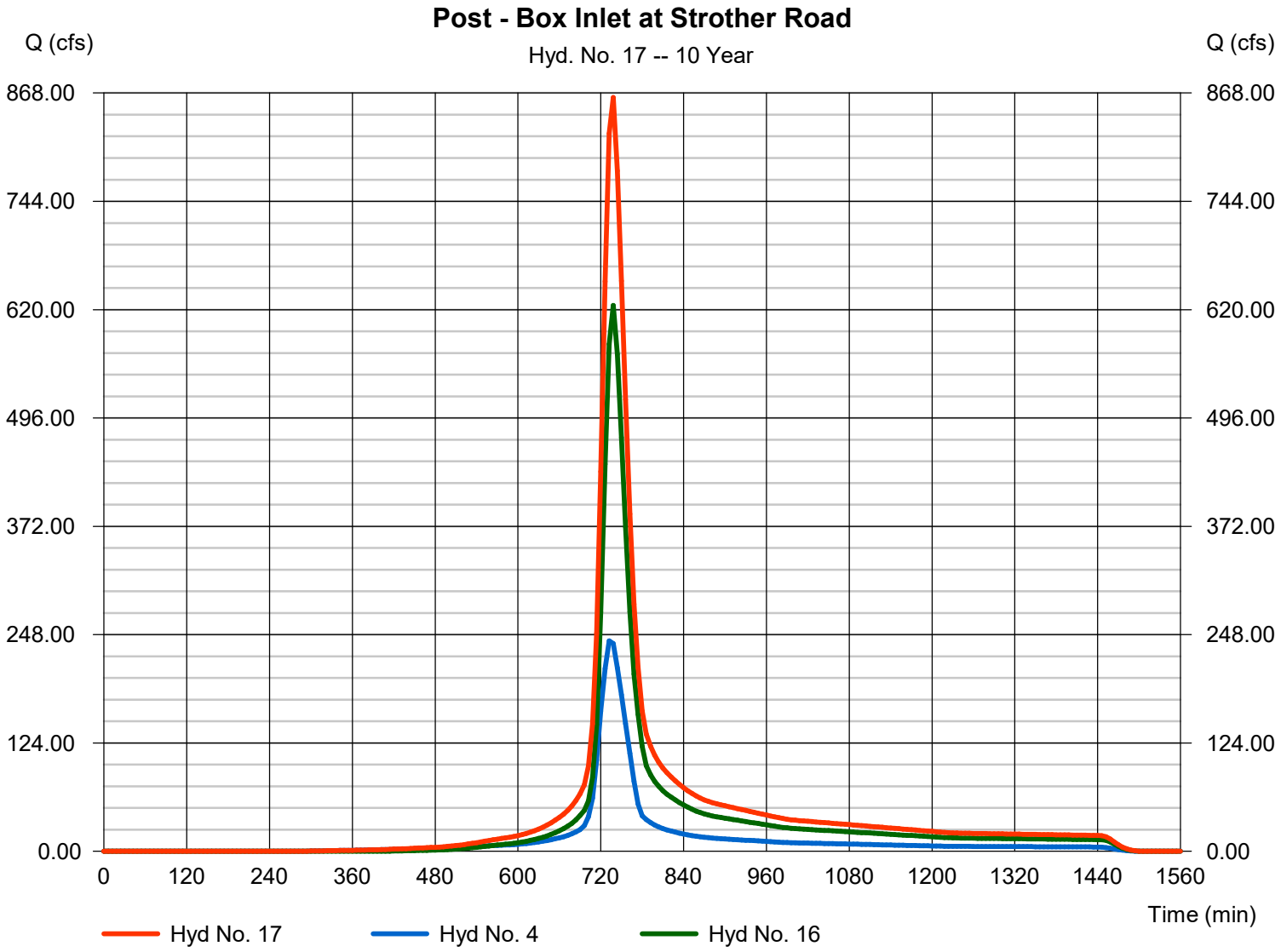


Hydrograph Report

Hyd. No. 17

Post - Box Inlet at Strother Road

Hydrograph type	= Combine	Peak discharge	= 862.75 cfs
Storm frequency	= 10 yrs	Time to peak	= 738 min
Time interval	= 6 min	Hyd. volume	= 4,047,703 cuft
Inflow hyds.	= 4, 16	Contrib. drain. area	= 82.500 ac



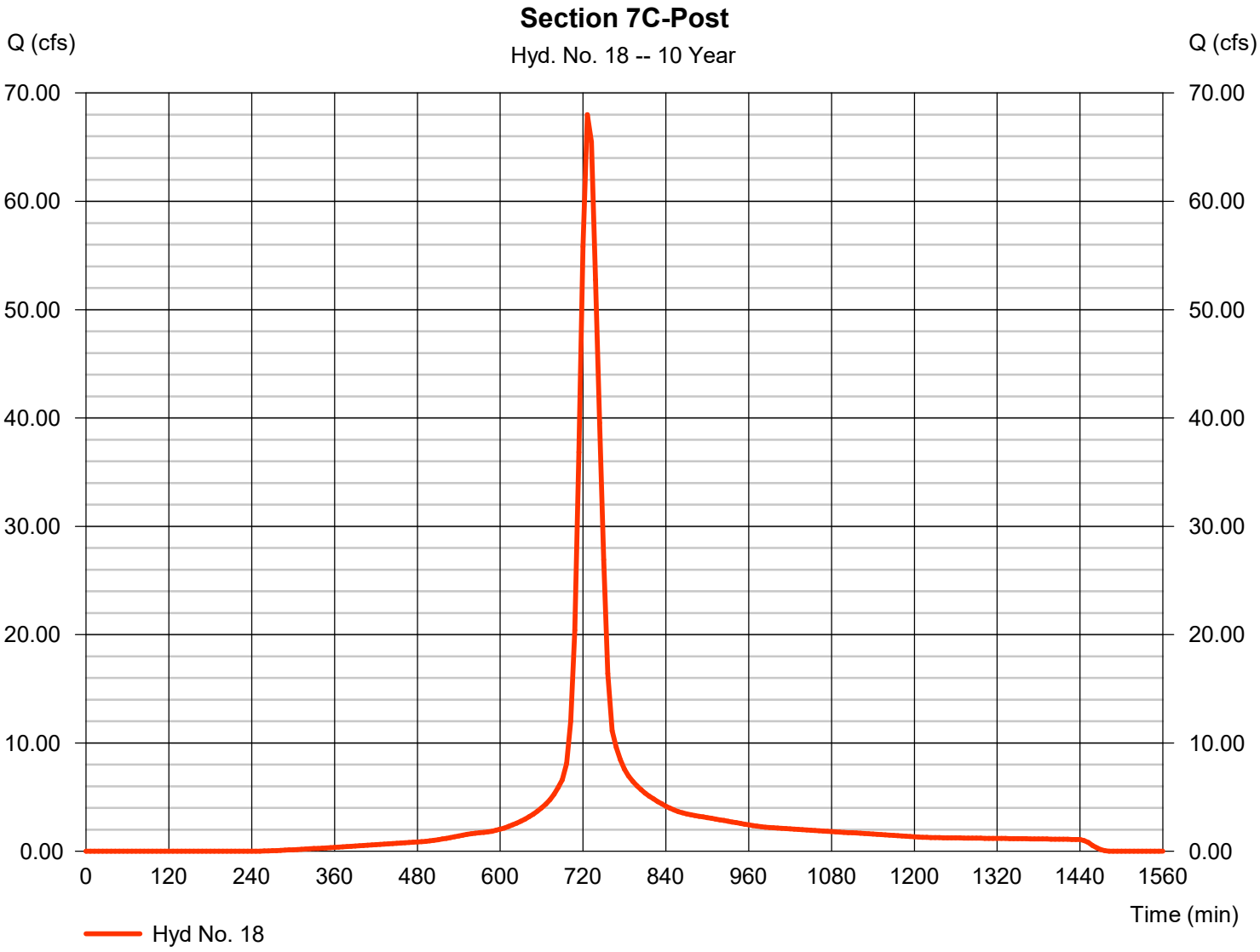
Hydrograph Report

Hyd. No. 18

Section 7C-Post

Hydrograph type	=	SCS Runoff	Peak discharge	=	67.99 cfs
Storm frequency	=	10 yrs	Time to peak	=	726 min
Time interval	=	6 min	Hyd. volume	=	280,002 cuft
Drainage area	=	19.000 ac	Curve number	=	89*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	19.80 min
Total precip.	=	5.30 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(19.000 x 89)] / 19.000



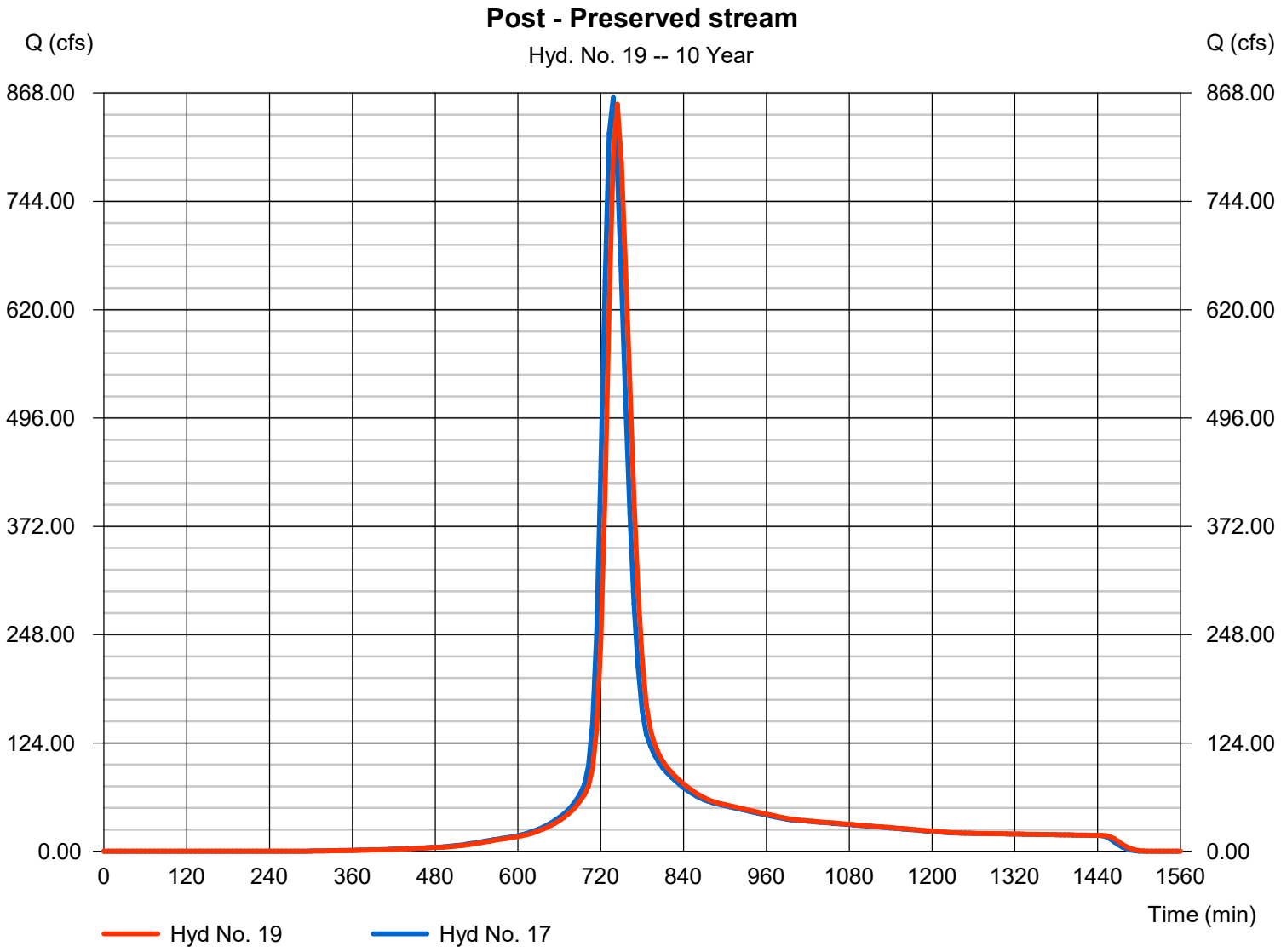
Hydrograph Report

Hyd. No. 19

Post - Preserved stream

Hydrograph type	=	Reach	Peak discharge	=	855.12 cfs
Storm frequency	=	10 yrs	Time to peak	=	744 min
Time interval	=	6 min	Hyd. volume	=	4,047,699 cuft
Inflow hyd. No.	=	17 - Post - Box Inlet at Strother Road	Section type	=	Trapezoidal
Reach length	=	500.0 ft	Channel slope	=	0.5 %
Manning's n	=	0.100	Bottom width	=	10.0 ft
Side slope	=	14.0:1	Max. depth	=	8.0 ft
Rating curve x	=	0.227	Rating curve m	=	1.318
Ave. velocity	=	1.66 ft/s	Routing coeff.	=	0.8817

Modified Att-Kin routing method used.

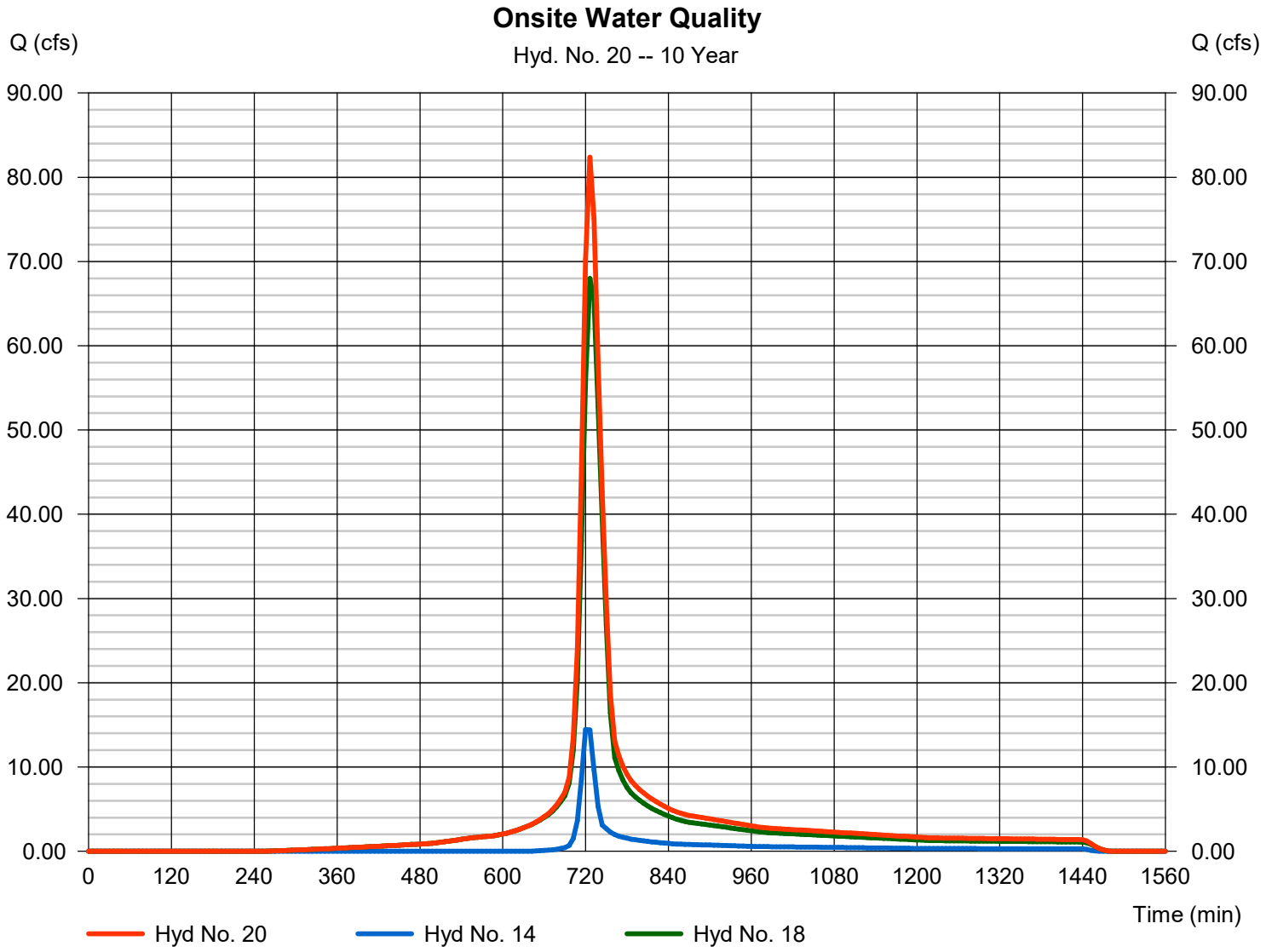


Hydrograph Report

Hyd. No. 20

Onsite Water Quality

Hydrograph type	= Combine	Peak discharge	= 82.38 cfs
Storm frequency	= 10 yrs	Time to peak	= 726 min
Time interval	= 6 min	Hyd. volume	= 327,380 cuft
Inflow hyds.	= 14, 18	Contrib. drain. area	= 26.500 ac



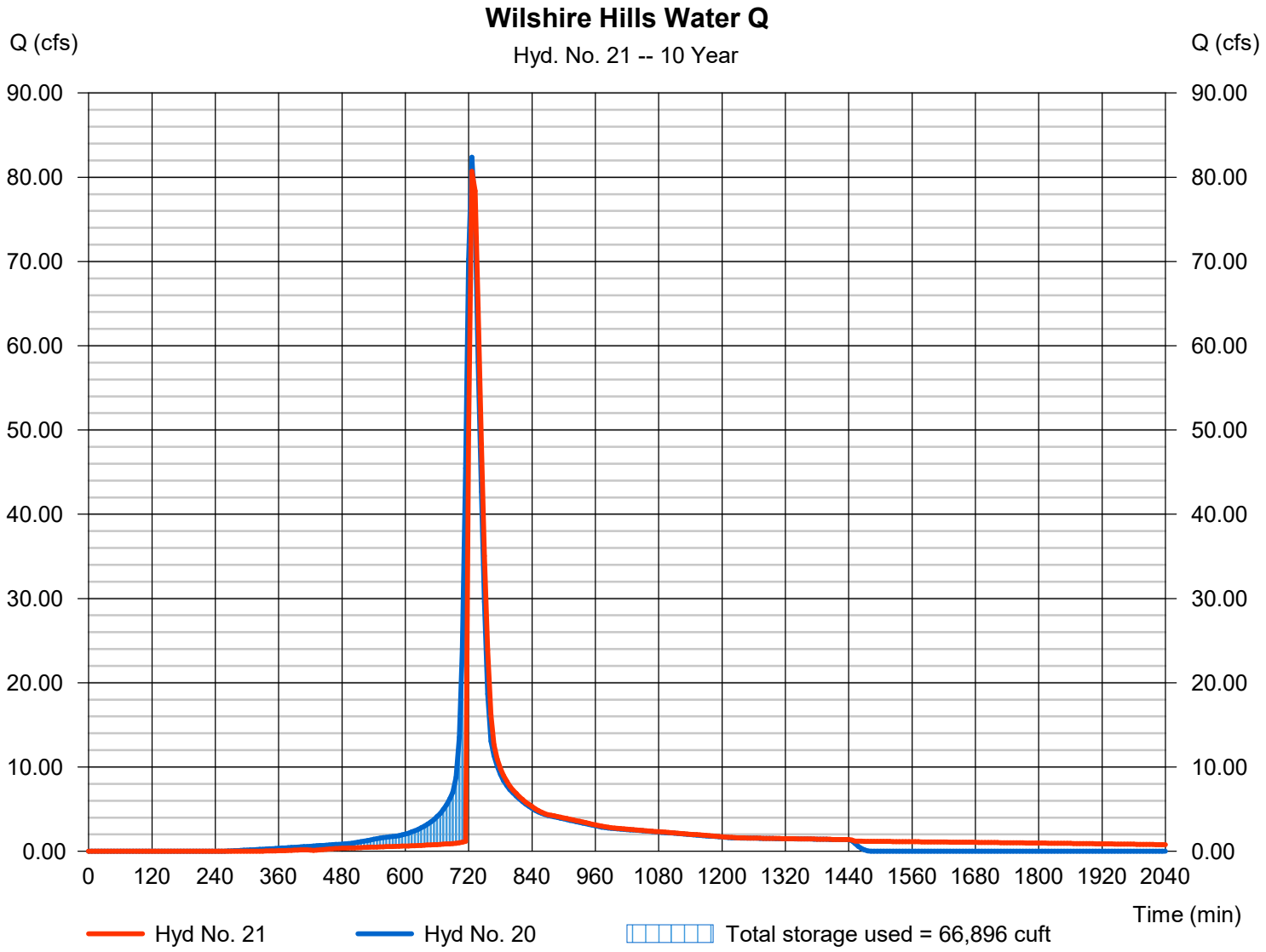
Hydrograph Report

Hyd. No. 21

Wilshire Hills Water Q

Hydrograph type	=	Reservoir	Peak discharge	=	80.69 cfs
Storm frequency	=	10 yrs	Time to peak	=	726 min
Time interval	=	6 min	Hyd. volume	=	327,355 cuft
Inflow hyd. No.	=	20 - Onsite Water Quality	Max. Elevation	=	917.86 ft
Reservoir name	=	Wilshire Hills Water Quality Basin	Max. Storage	=	66,896 cuft

Storage Indication method used.

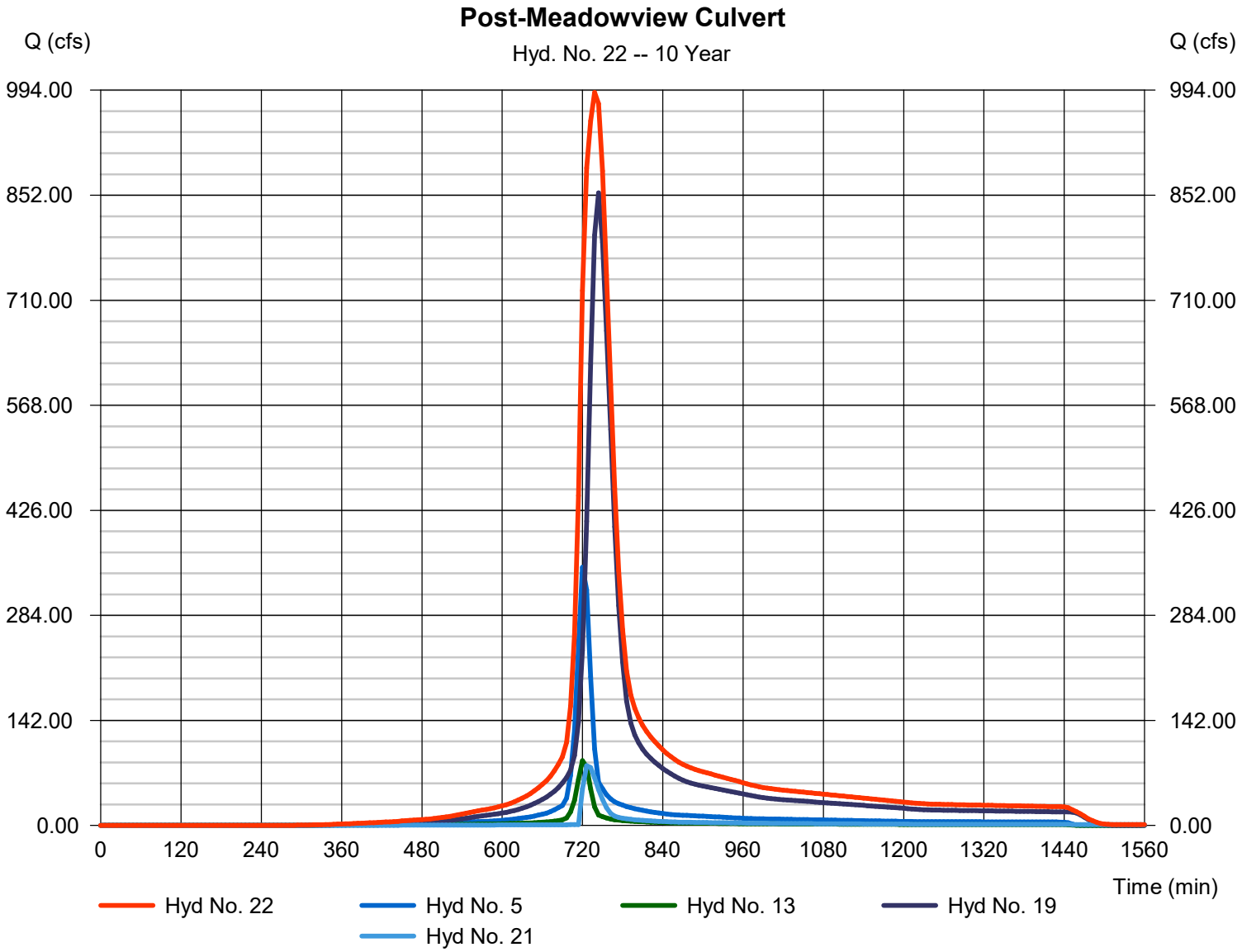


Hydrograph Report

Hyd. No. 22

Post-Meadowview Culvert

Hydrograph type	= Combine	Peak discharge	= 991.07 cfs
Storm frequency	= 10 yrs	Time to peak	= 738 min
Time interval	= 6 min	Hyd. volume	= 5,728,325 cuft
Inflow hyds.	= 5, 13, 19, 21	Contrib. drain. area	= 106.800 ac



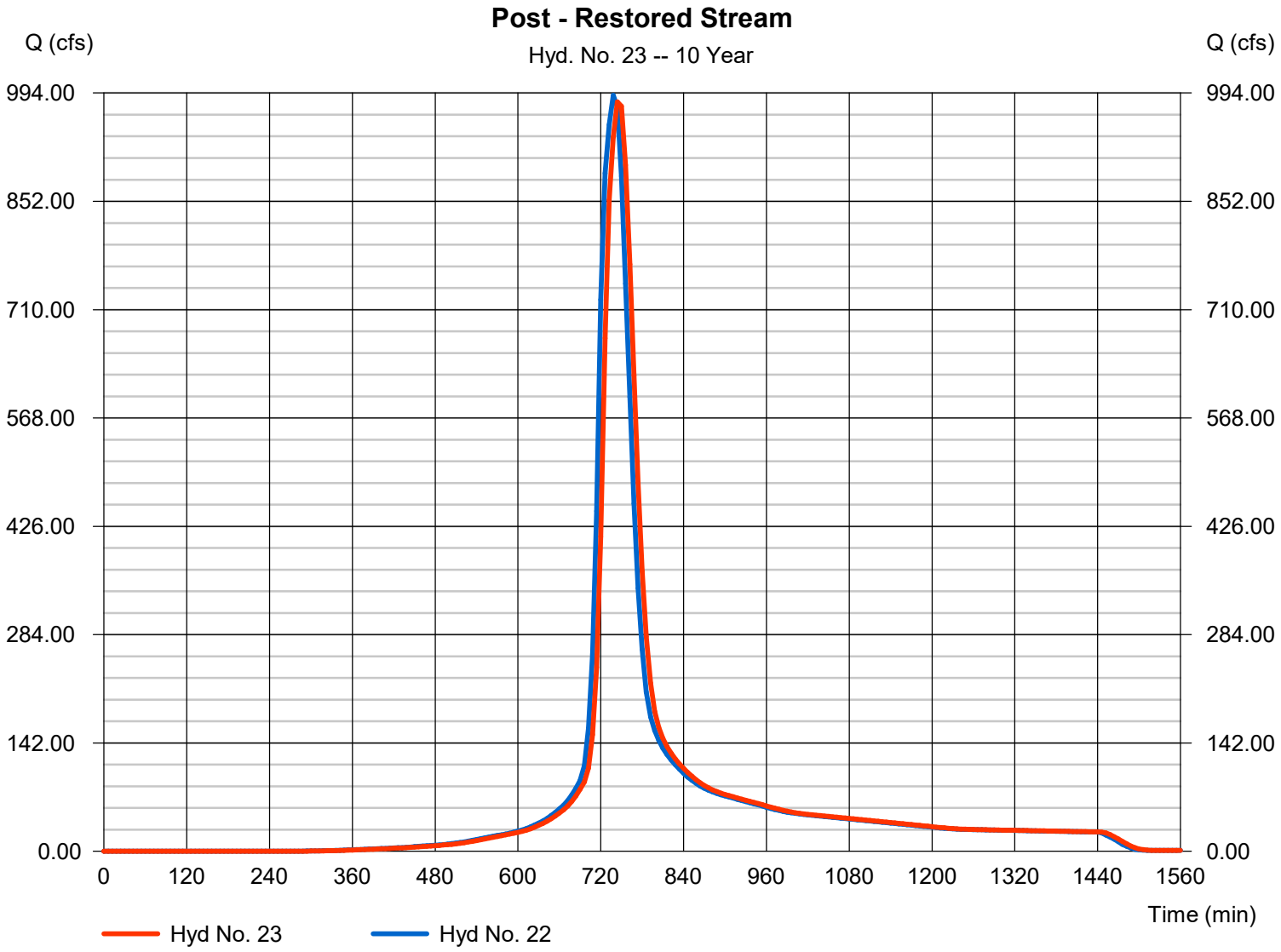
Hydrograph Report

Hyd. No. 23

Post - Restored Stream

Hydrograph type	=	Reach	Peak discharge	=	982.21 cfs
Storm frequency	=	10 yrs	Time to peak	=	744 min
Time interval	=	6 min	Hyd. volume	=	5,728,105 cuft
Inflow hyd. No.	=	22 - Post-Meadowview Culvert	Section type	=	Trapezoidal
Reach length	=	1340.0 ft	Channel slope	=	0.8 %
Manning's n	=	0.030	Bottom width	=	20.0 ft
Side slope	=	10.0:1	Max. depth	=	4.0 ft
Rating curve x	=	0.595	Rating curve m	=	1.345
Ave. velocity	=	3.99 ft/s	Routing coeff.	=	0.8380

Modified Att-Kin routing method used.



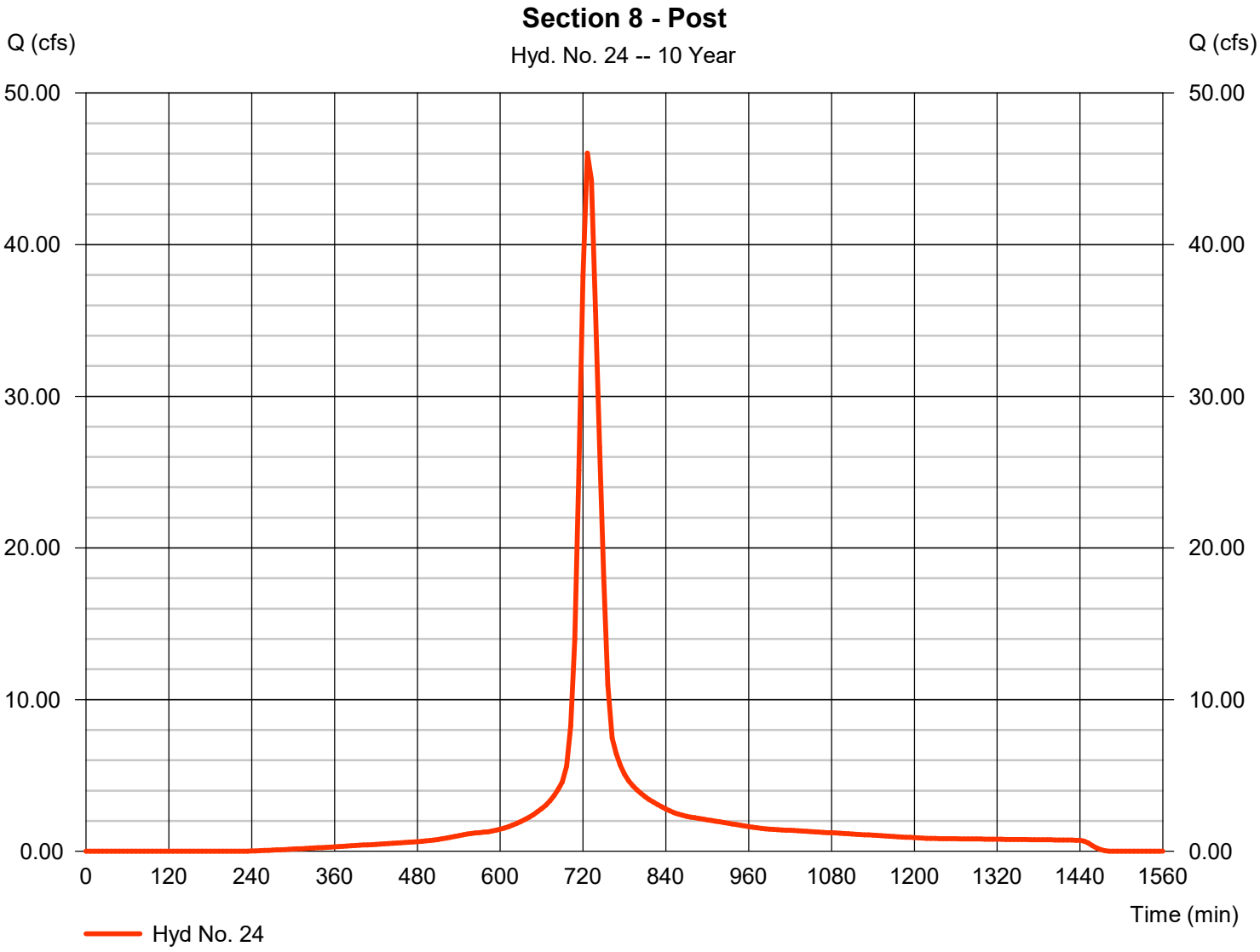
Hydrograph Report

Hyd. No. 24

Section 8 - Post

Hydrograph type	=	SCS Runoff	Peak discharge	=	46.04 cfs
Storm frequency	=	10 yrs	Time to peak	=	726 min
Time interval	=	6 min	Hyd. volume	=	190,551 cuft
Drainage area	=	12.600 ac	Curve number	=	90*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	23.90 min
Total precip.	=	5.30 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(12.600 x 90)] / 12.600

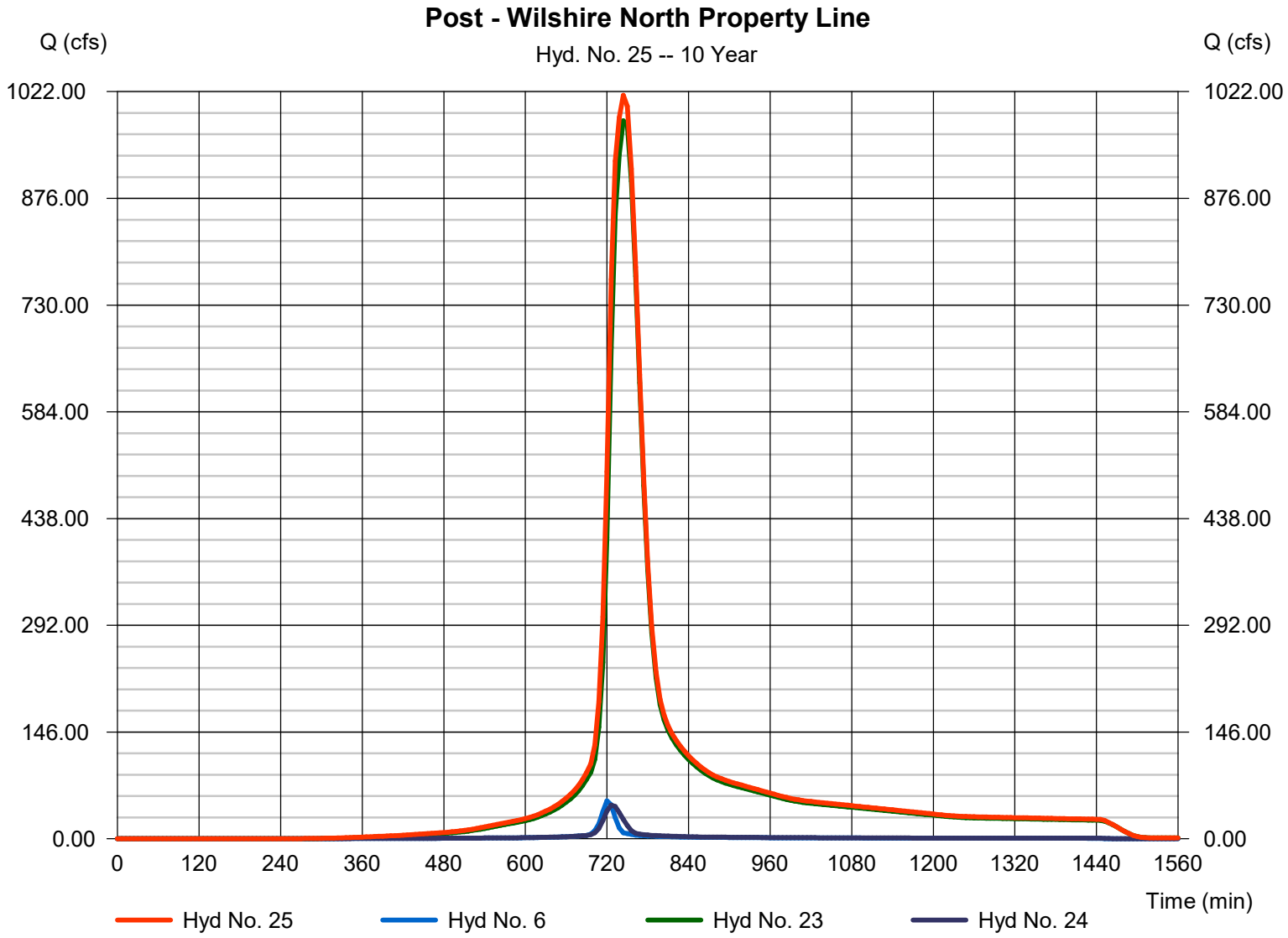


Hydrograph Report

Hyd. No. 25

Post - Wilshire North Property Line

Hydrograph type	= Combine	Peak discharge	= 1017.03 cfs
Storm frequency	= 10 yrs	Time to peak	= 744 min
Time interval	= 6 min	Hyd. volume	= 6,083,003 cuft
Inflow hyds.	= 6, 23, 24	Contrib. drain. area	= 23.900 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	371.96	6	726	1,509,905	------	------	------	Section 1
2	SCS Runoff	309.59	6	726	1,256,714	------	------	------	Section 2
3	SCS Runoff	423.43	6	732	2,139,542	------	------	------	Section 3
4	SCS Runoff	381.91	6	732	1,968,128	------	------	------	Section 4
5	SCS Runoff	566.77	6	720	1,780,429	------	------	------	Section 5
6	SCS Runoff	79.63	6	720	258,690	------	------	------	Section 6
7	SCS Runoff	331.06	6	726	1,390,106	------	------	------	Section 7-Pre
8	Combine	1088.09	6	732	4,906,160	1, 2, 3,	------	------	Combo-1-(1,2,3)
9	Reach	1086.87	6	738	4,906,159	8	------	------	Reach 1-Pond
10	Combine	1461.77	6	738	6,874,286	4, 9	------	------	Combo-2 (Reach:1 and 4)
11	Reach	1443.93	6	744	6,874,286	10	------	------	Reach-2-Existing Stream
12	Combine	1800.57	6	738	10,303,506	5, 6, 7, 11	------	------	Combo-3 (Reach:2 and 5)
13	SCS Runoff	137.12	6	720	439,562	------	------	------	Section 7A-Post
14	SCS Runoff	30.63	6	720	95,283	------	------	------	Section 7B-Post
15	Combine	1088.09	6	732	4,906,160	1, 2, 3,	------	------	Post-Combo-1 (1,2,3)
16	Reach	1086.45	6	738	4,906,155	15	------	------	Reach 1 Post-Pond
17	Combine	1461.36	6	738	6,874,285	4, 16	------	------	Post - Box Inlet at Strother Road
18	SCS Runoff	106.61	6	726	447,661	------	------	------	Section 7C-Post
19	Reach	1458.31	6	744	6,874,284	17	------	------	Post - Preserved stream
20	Combine	135.80	6	726	542,944	14, 18,	------	------	Onsite Water Quality
21	Reservoir	123.42	6	732	542,919	20	918.55	79,754	Wilshire Hills Water Q
22	Combine	1721.03	6	738	9,637,193	5, 13, 19, 21	------	------	Post-Meadowview Culvert
23	Reach	1713.16	6	744	9,636,978	22	------	------	Post - Restored Stream
24	SCS Runoff	71.57	6	726	302,271	------	------	------	Section 8 - Post
25	Combine	1766.33	6	744	10,197,938	6, 23, 24	------	------	Post - Wilshire North Property Line

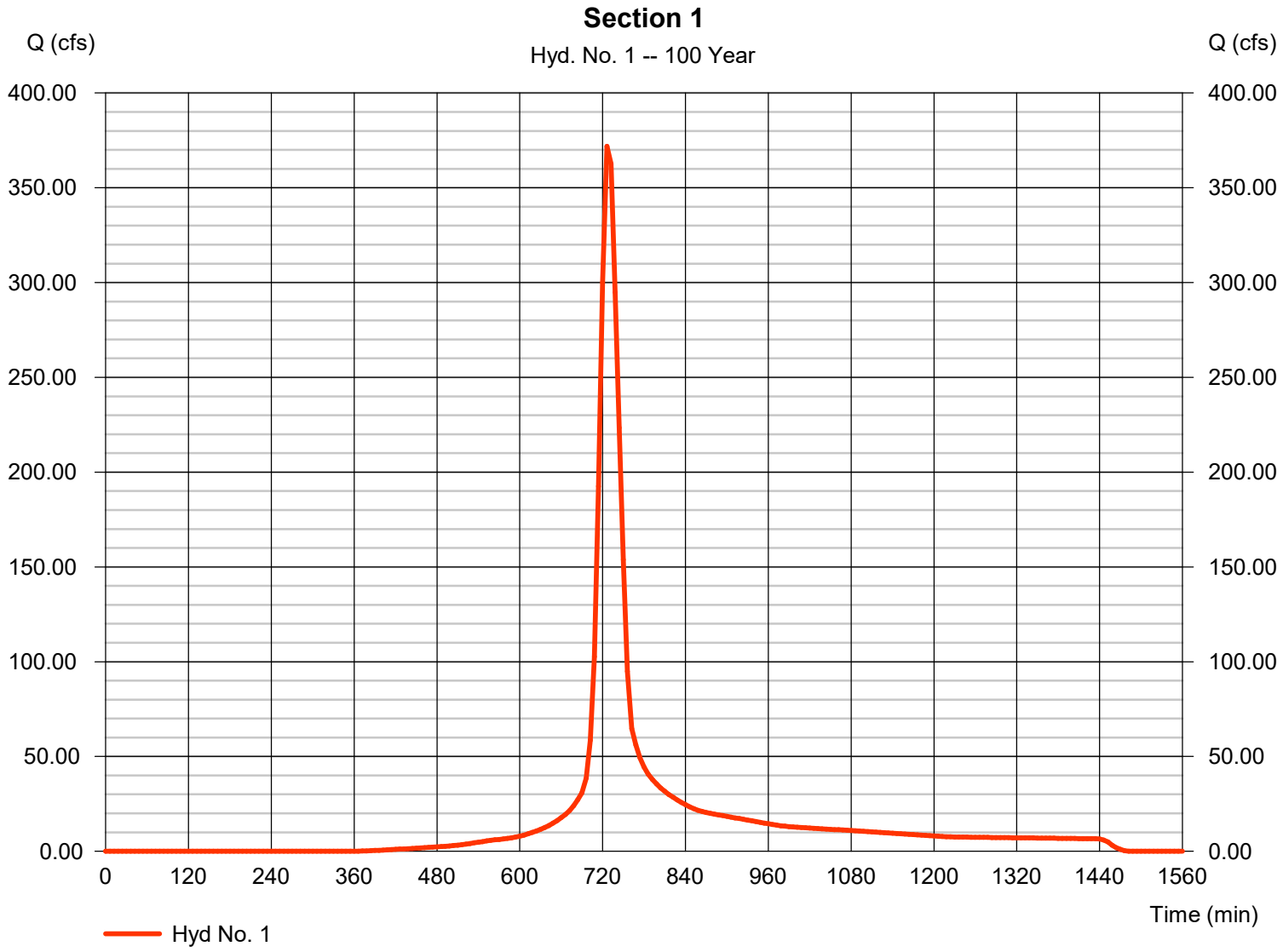
Hydrograph Report

Hyd. No. 1

Section 1

Hydrograph type	=	SCS Runoff	Peak discharge	=	371.96 cfs
Storm frequency	=	100 yrs	Time to peak	=	726 min
Time interval	=	6 min	Hyd. volume	=	1,509,905 cuft
Drainage area	=	81.700 ac	Curve number	=	77*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	24.30 min
Total precip.	=	7.80 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(3.600 x 81) + (13.500 x 98) + (49.000 x 73) + (15.600 x 69)] / 81.700



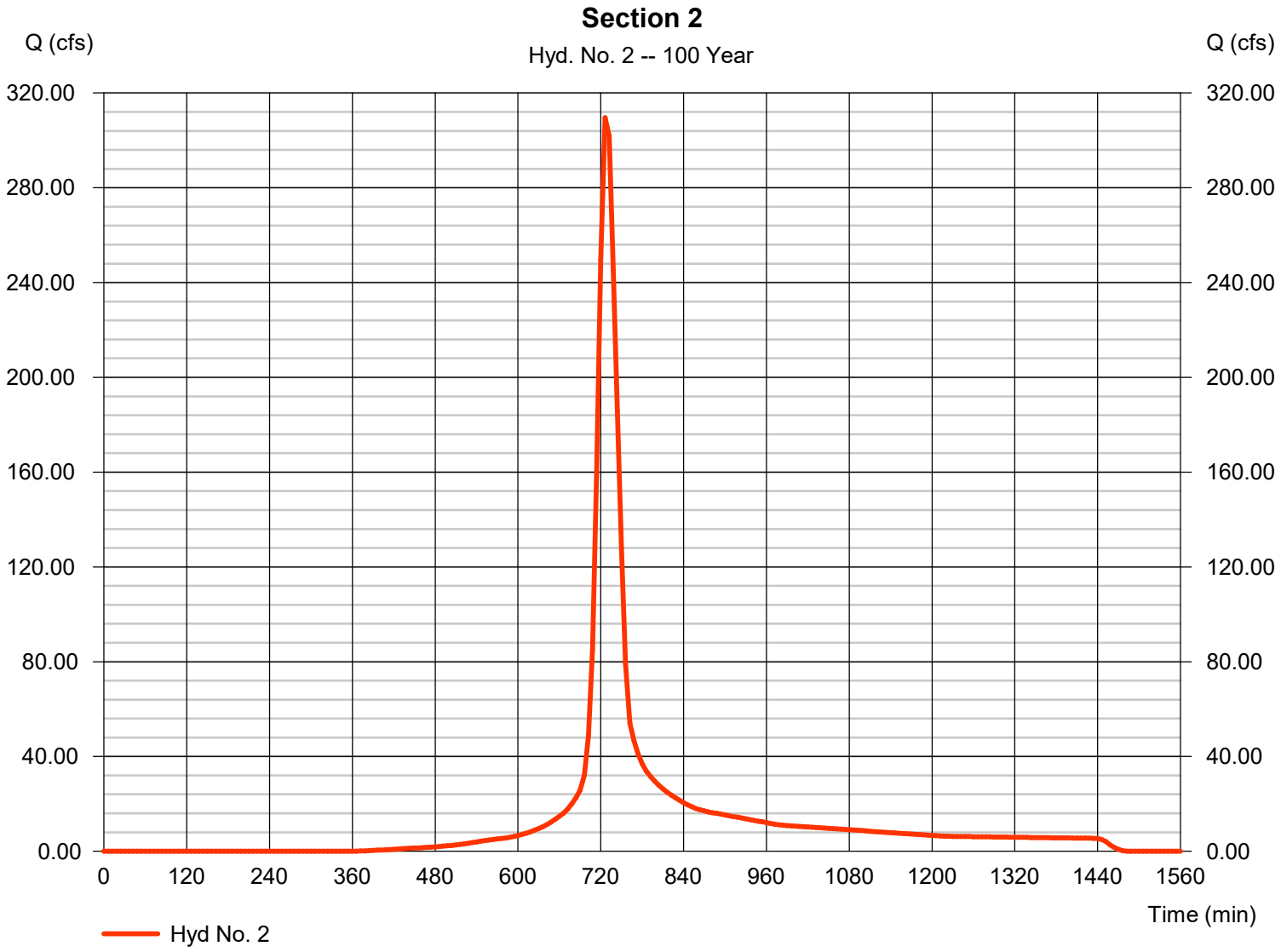
Hydrograph Report

Hyd. No. 2

Section 2

Hydrograph type	=	SCS Runoff	Peak discharge	=	309.59 cfs
Storm frequency	=	100 yrs	Time to peak	=	726 min
Time interval	=	6 min	Hyd. volume	=	1,256,714 cuft
Drainage area	=	68.000 ac	Curve number	=	77*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	25.30 min
Total precip.	=	7.80 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(8.000 x 98) + (0.500 x 77) + (30.800 x 79) + (28.700 x 69)] / 68.000



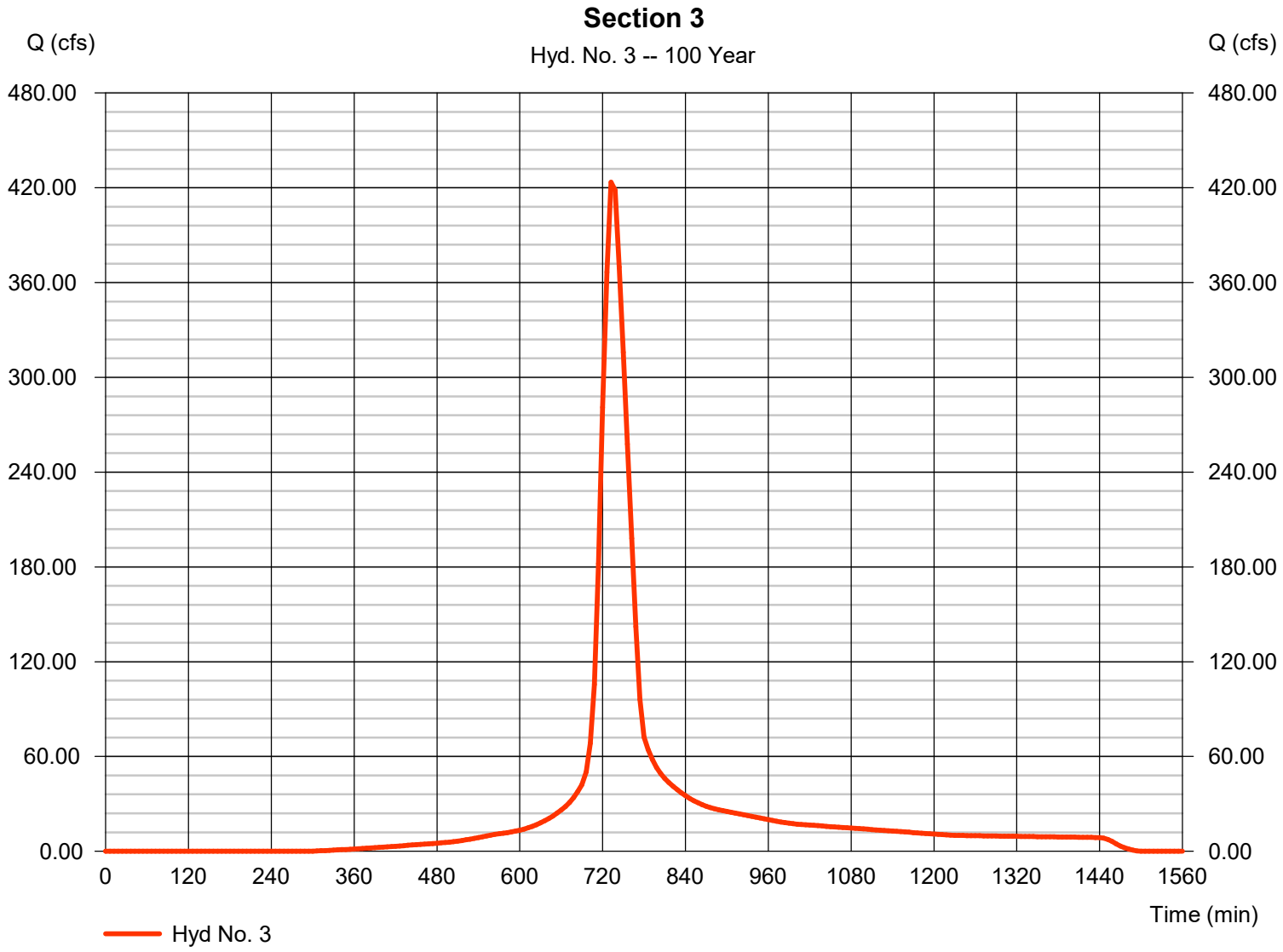
Hydrograph Report

Hyd. No. 3

Section 3

Hydrograph type	=	SCS Runoff	Peak discharge	=	423.43 cfs
Storm frequency	=	100 yrs	Time to peak	=	732 min
Time interval	=	6 min	Hyd. volume	=	2,139,542 cuft
Drainage area	=	100.800 ac	Curve number	=	82*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	30.20 min
Total precip.	=	7.80 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(18.200 x 98) + (3.000 x 77) + (79.600 x 79)] / 100.800



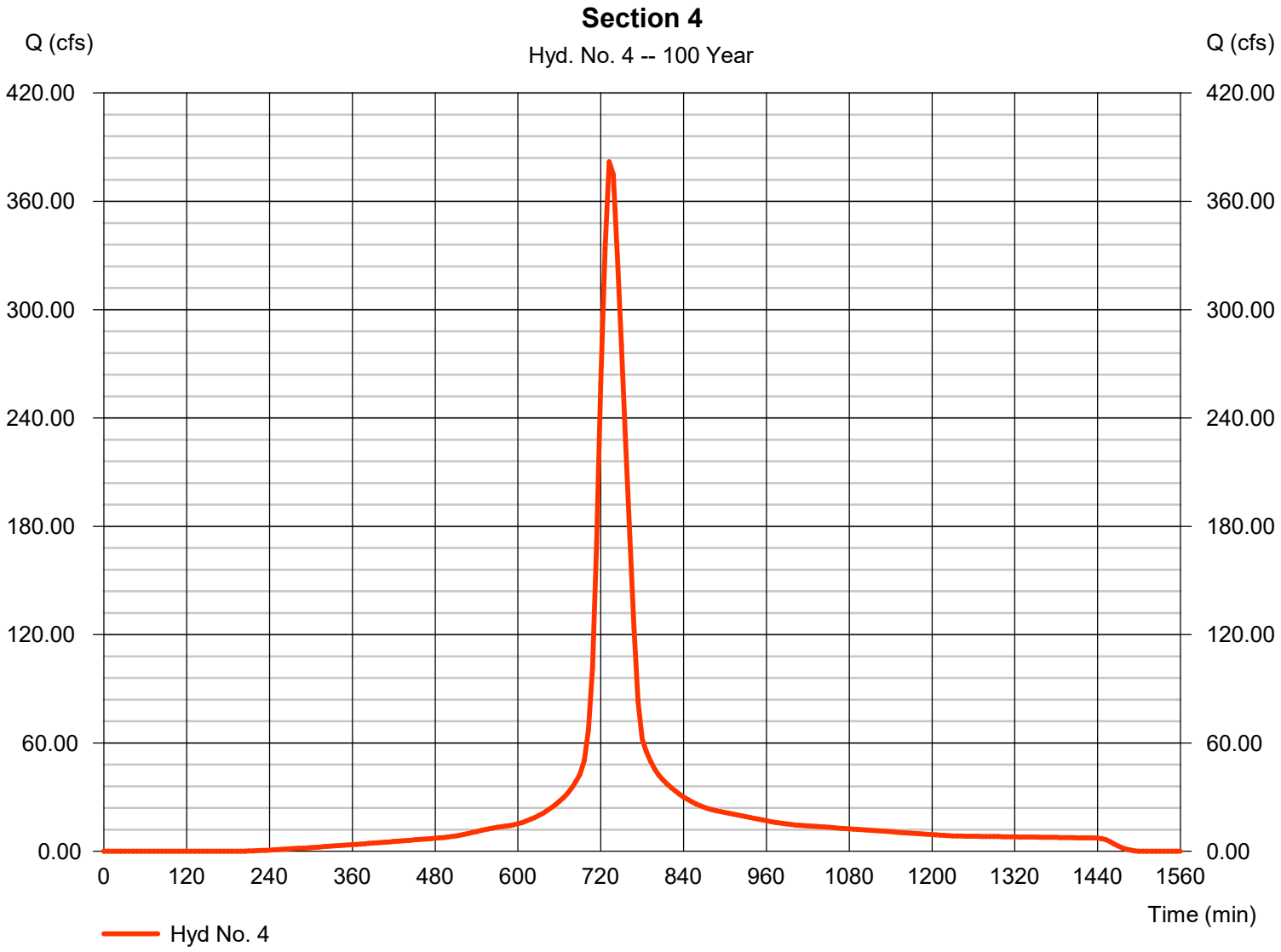
Hydrograph Report

Hyd. No. 4

Section 4

Hydrograph type	=	SCS Runoff	Peak discharge	=	381.91 cfs
Storm frequency	=	100 yrs	Time to peak	=	732 min
Time interval	=	6 min	Hyd. volume	=	1,968,128 cuft
Drainage area	=	82.500 ac	Curve number	=	88*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	30.70 min
Total precip.	=	7.80 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(49.680 x 98) + (32.820 x 74)] / 82.500



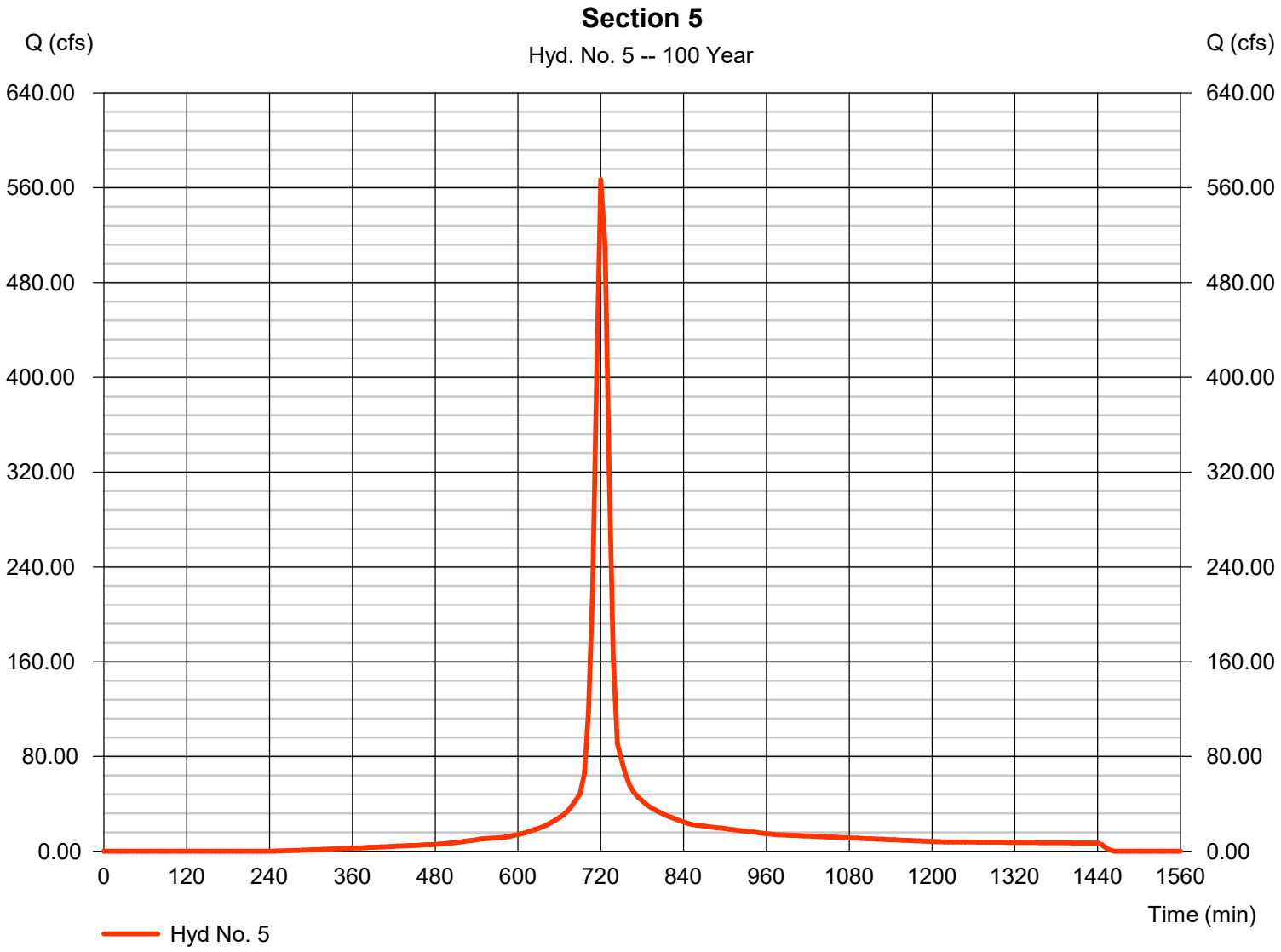
Hydrograph Report

Hyd. No. 5

Section 5

Hydrograph type	=	SCS Runoff	Peak discharge	=	566.77 cfs
Storm frequency	=	100 yrs	Time to peak	=	720 min
Time interval	=	6 min	Hyd. volume	=	1,780,429 cuft
Drainage area	=	86.900 ac	Curve number	=	85*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	15.60 min
Total precip.	=	7.80 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(40.000 x 98) + (46.900 x 74)] / 86.900



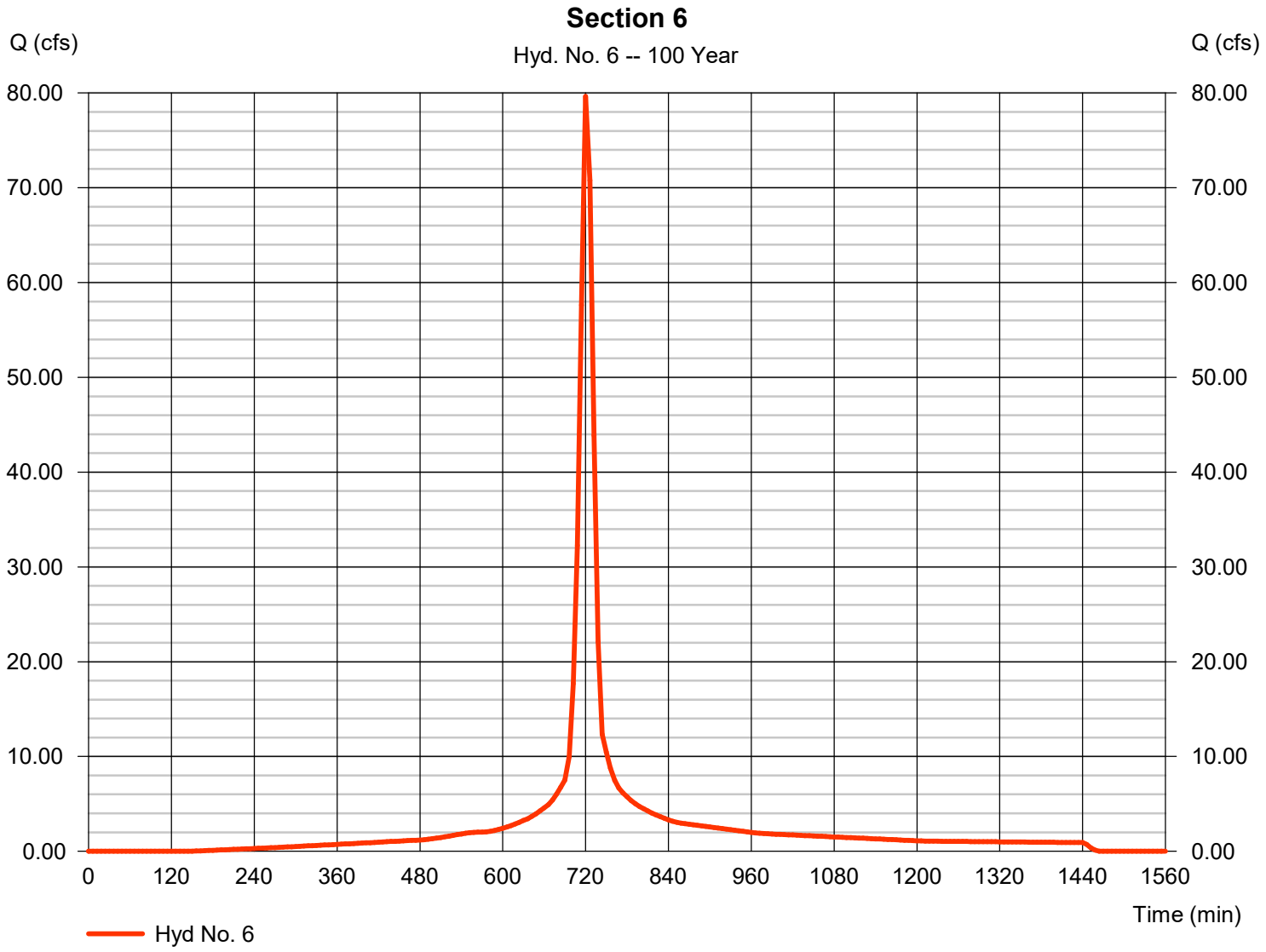
Hydrograph Report

Hyd. No. 6

Section 6

Hydrograph type	=	SCS Runoff	Peak discharge	=	79.63 cfs
Storm frequency	=	100 yrs	Time to peak	=	720 min
Time interval	=	6 min	Hyd. volume	=	258,690 cuft
Drainage area	=	11.300 ac	Curve number	=	91*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	18.60 min
Total precip.	=	7.80 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(11.300 x 91)] / 11.300



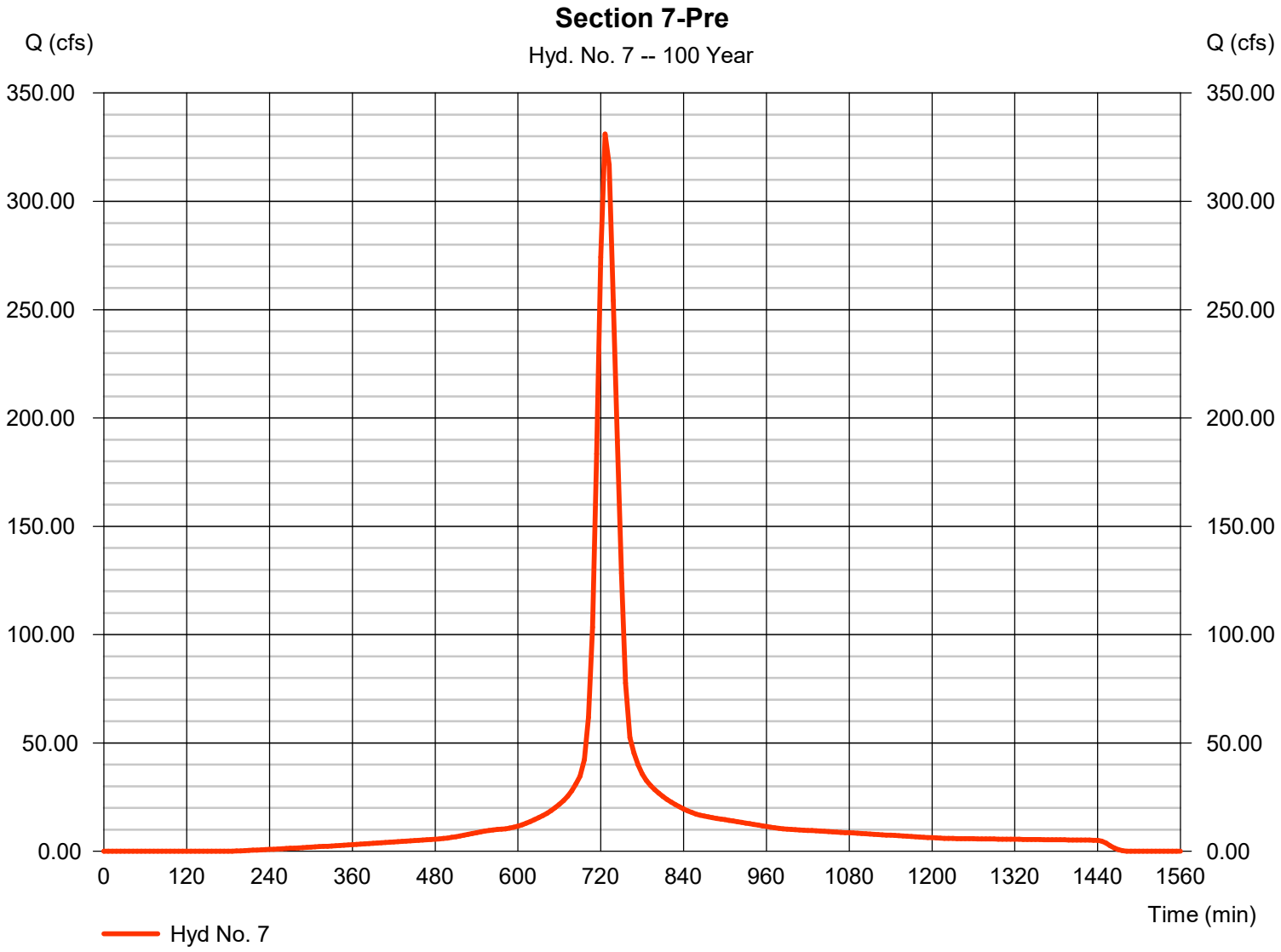
Hydrograph Report

Hyd. No. 7

Section 7-Pre

Hydrograph type	=	SCS Runoff	Peak discharge	=	331.06 cfs
Storm frequency	=	100 yrs	Time to peak	=	726 min
Time interval	=	6 min	Hyd. volume	=	1,390,106 cuft
Drainage area	=	59.000 ac	Curve number	=	89*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	23.83 min
Total precip.	=	7.80 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(59.000 x 79)] / 59.000

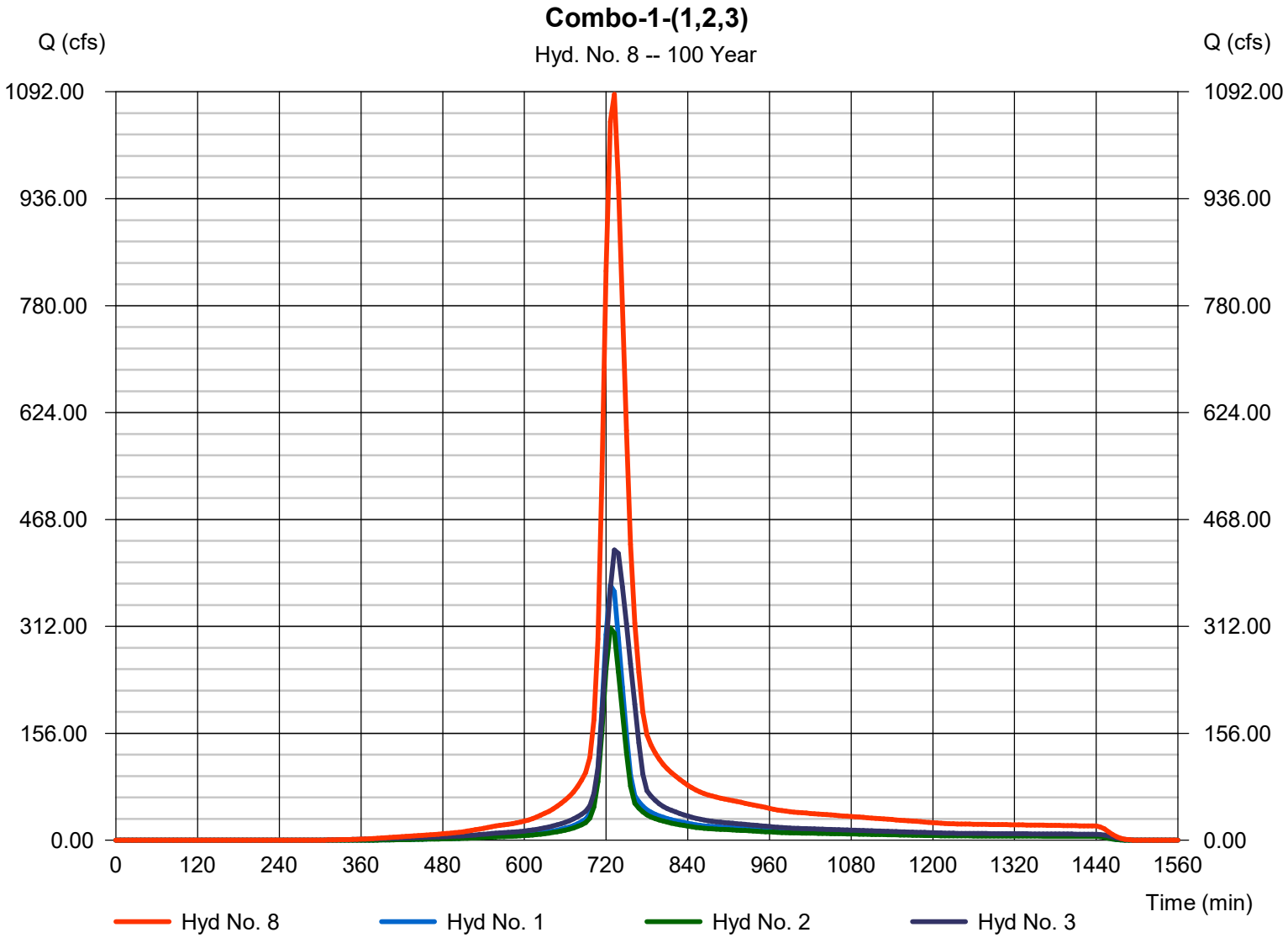


Hydrograph Report

Hyd. No. 8

Combo-1-(1,2,3)

Hydrograph type	= Combine	Peak discharge	= 1088.09 cfs
Storm frequency	= 100 yrs	Time to peak	= 732 min
Time interval	= 6 min	Hyd. volume	= 4,906,160 cuft
Inflow hyds.	= 1, 2, 3	Contrib. drain. area	= 250.500 ac



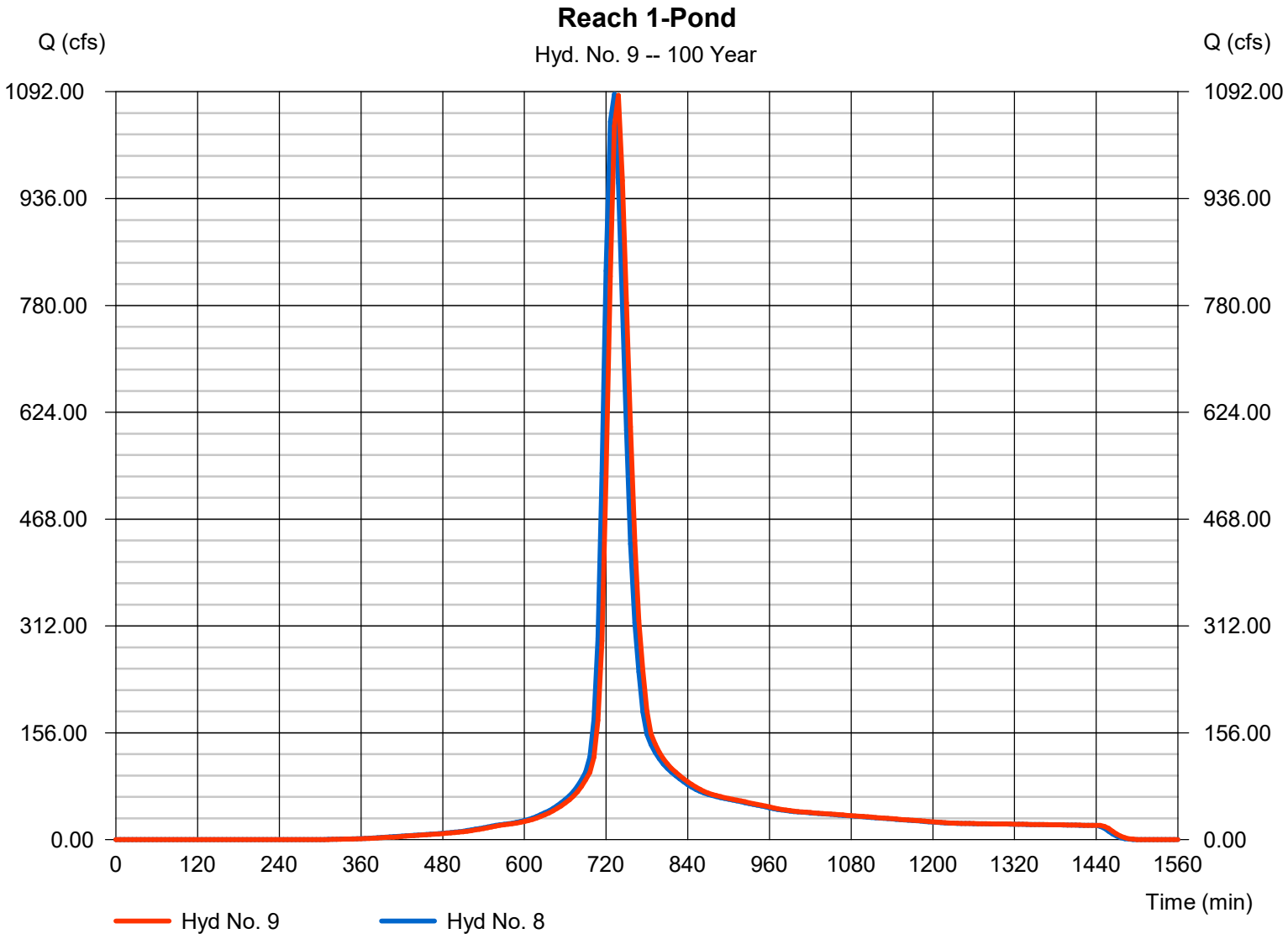
Hydrograph Report

Hyd. No. 9

Reach 1-Pond

Hydrograph type	=	Reach	Peak discharge	=	1086.87 cfs
Storm frequency	=	100 yrs	Time to peak	=	738 min
Time interval	=	6 min	Hyd. volume	=	4,906,159 cuft
Inflow hyd. No.	=	8 - Combo-1-(1,2,3)	Section type	=	Trapezoidal
Reach length	=	1000.0 ft	Channel slope	=	2.0 %
Manning's n	=	0.020	Bottom width	=	150.0 ft
Side slope	=	30.0:1	Max. depth	=	16.0 ft
Rating curve x	=	0.373	Rating curve m	=	1.407
Ave. velocity	=	3.74 ft/s	Routing coeff.	=	0.9735

Modified Att-Kin routing method used.

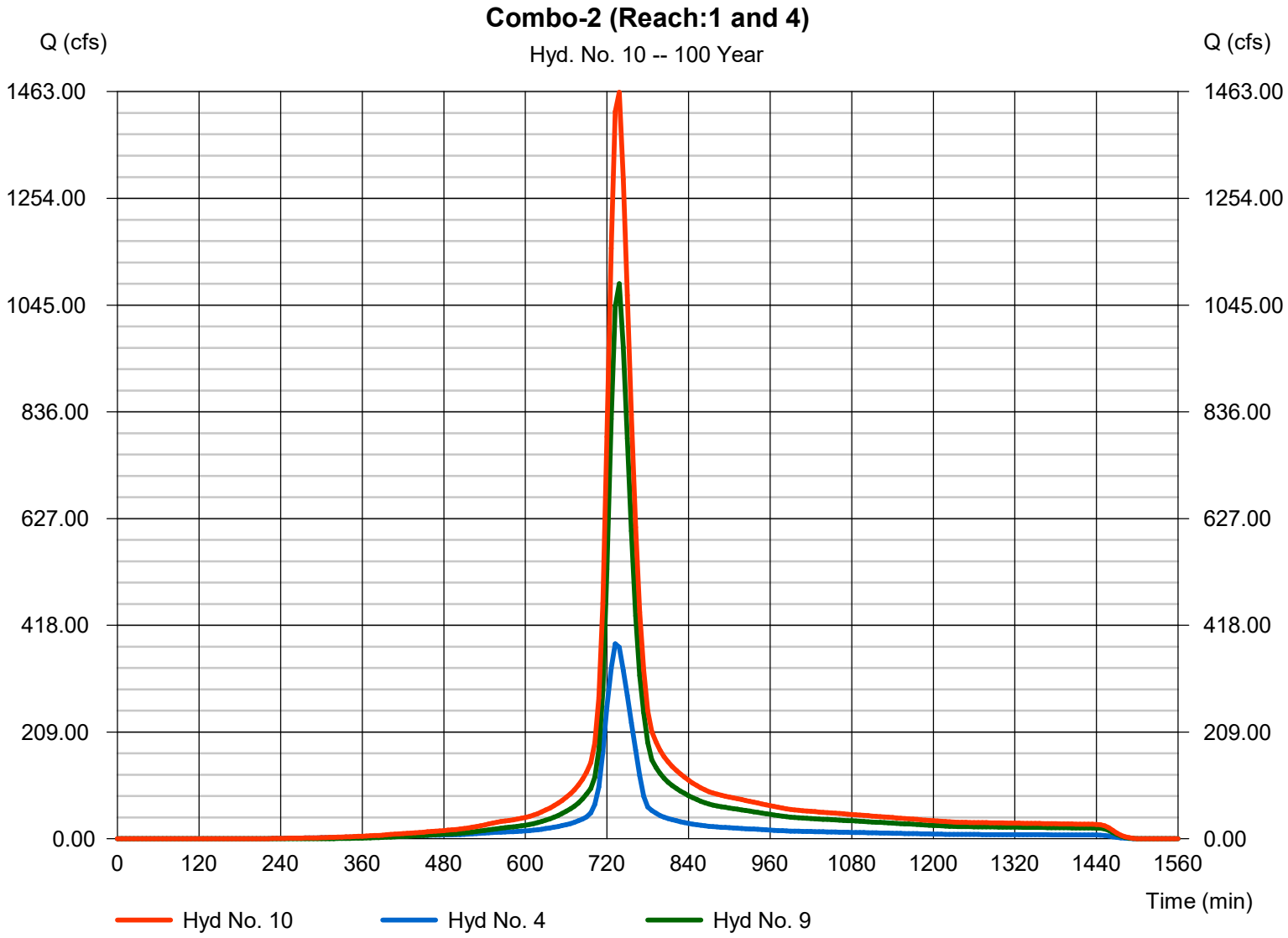


Hydrograph Report

Hyd. No. 10

Combo-2 (Reach:1 and 4)

Hydrograph type	= Combine	Peak discharge	= 1461.77 cfs
Storm frequency	= 100 yrs	Time to peak	= 738 min
Time interval	= 6 min	Hyd. volume	= 6,874,286 cuft
Inflow hyds.	= 4, 9	Contrib. drain. area	= 82.500 ac



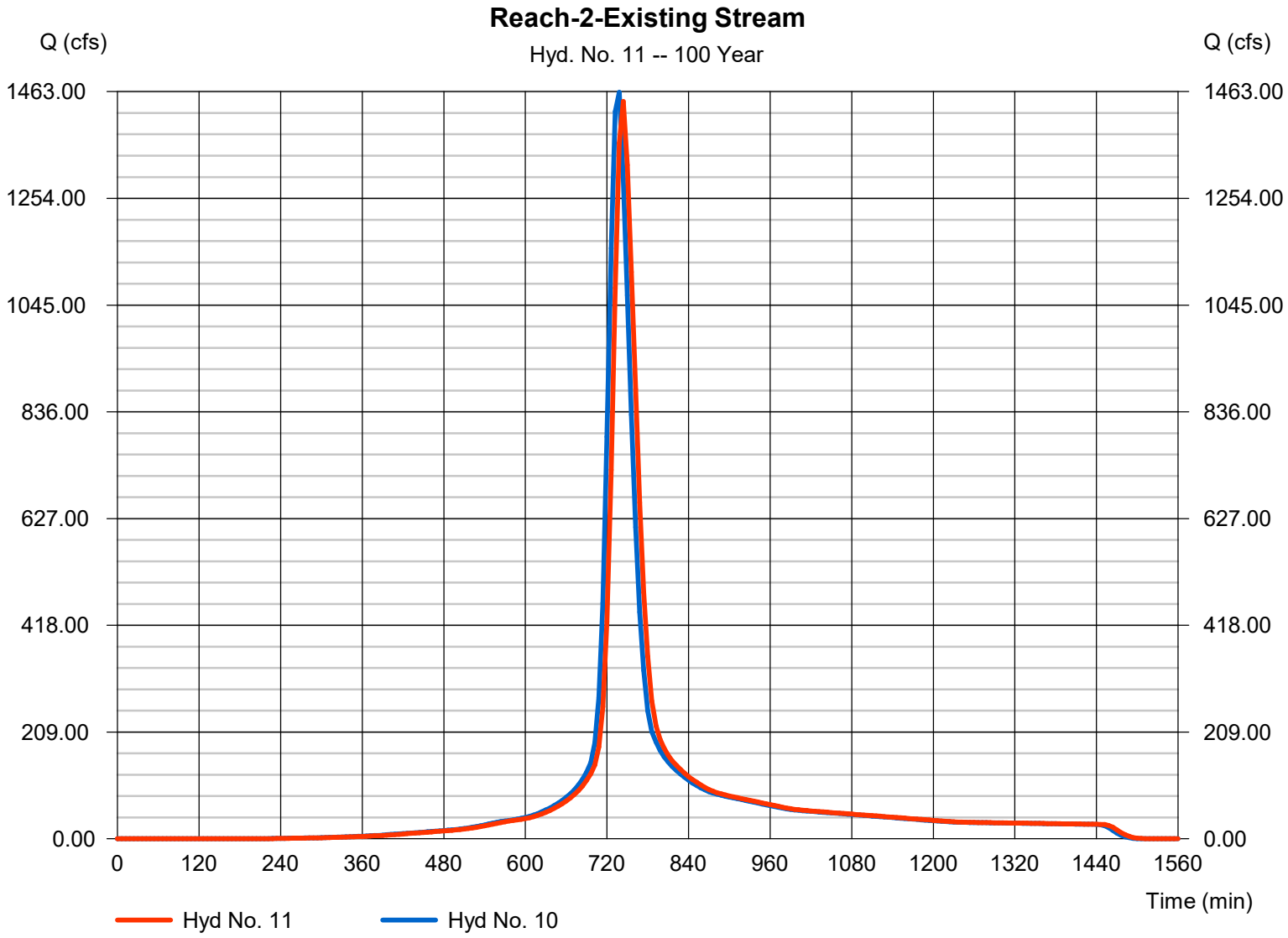
Hydrograph Report

Hyd. No. 11

Reach-2-Existing Stream

Hydrograph type	=	Reach	Peak discharge	=	1443.93 cfs
Storm frequency	=	100 yrs	Time to peak	=	744 min
Time interval	=	6 min	Hyd. volume	=	6,874,286 cuft
Inflow hyd. No.	=	10 - Combo-2 (Reach:1 and 4)	Section type	=	Trapezoidal
Reach length	=	2200.0 ft	Channel slope	=	1.4 %
Manning's n	=	0.030	Bottom width	=	5.0 ft
Side slope	=	20.0:1	Max. depth	=	5.0 ft
Rating curve x	=	2.009	Rating curve m	=	1.231
Ave. velocity	=	6.91 ft/s	Routing coeff.	=	0.8209

Modified Att-Kin routing method used.

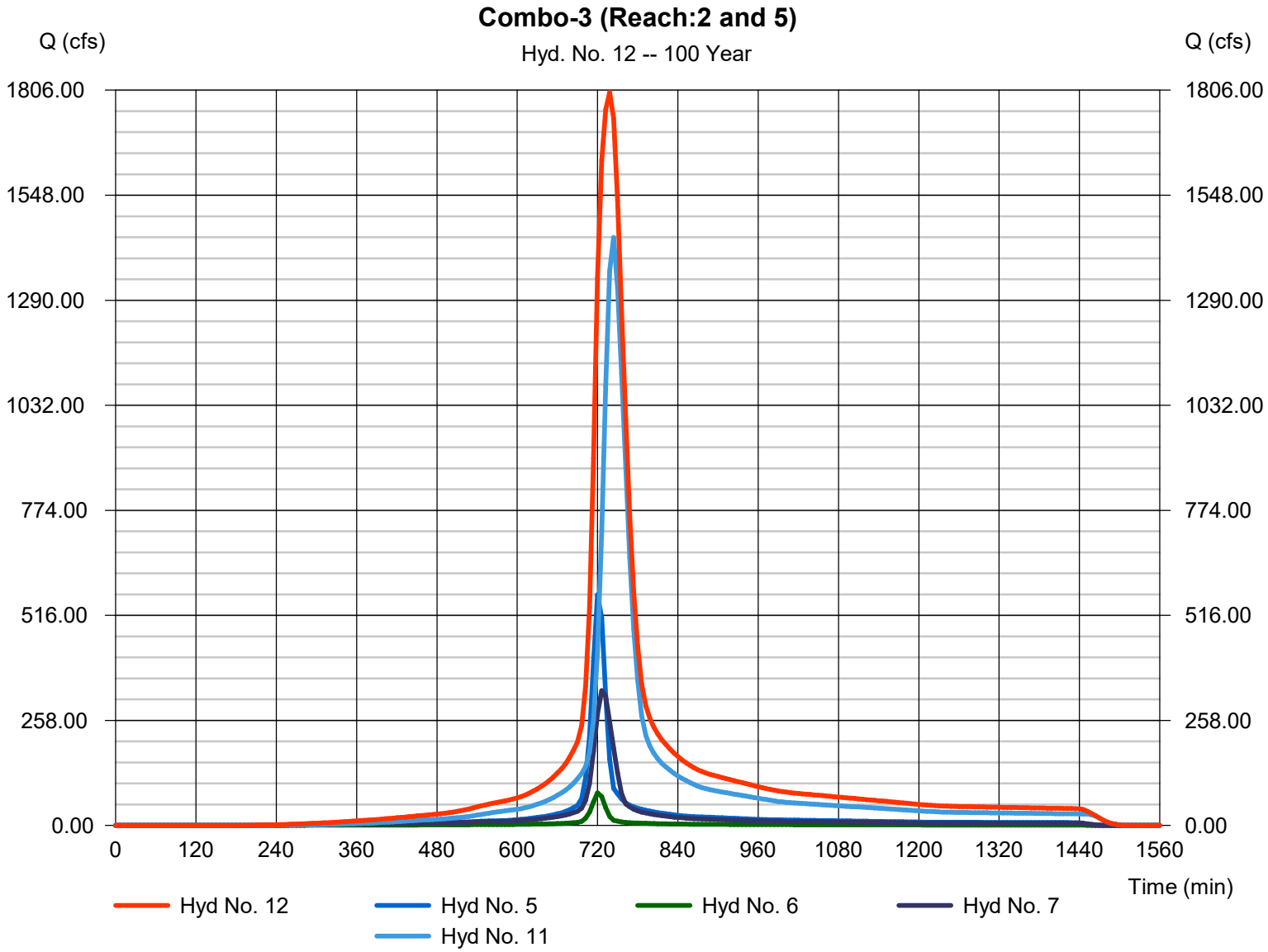


Hydrograph Report

Hyd. No. 12

Combo-3 (Reach:2 and 5)

Hydrograph type	= Combine	Peak discharge	= 1800.57 cfs
Storm frequency	= 100 yrs	Time to peak	= 738 min
Time interval	= 6 min	Hyd. volume	= 10,303,506 cuft
Inflow hyds.	= 5, 6, 7, 11	Contrib. drain. area	= 157.200 ac



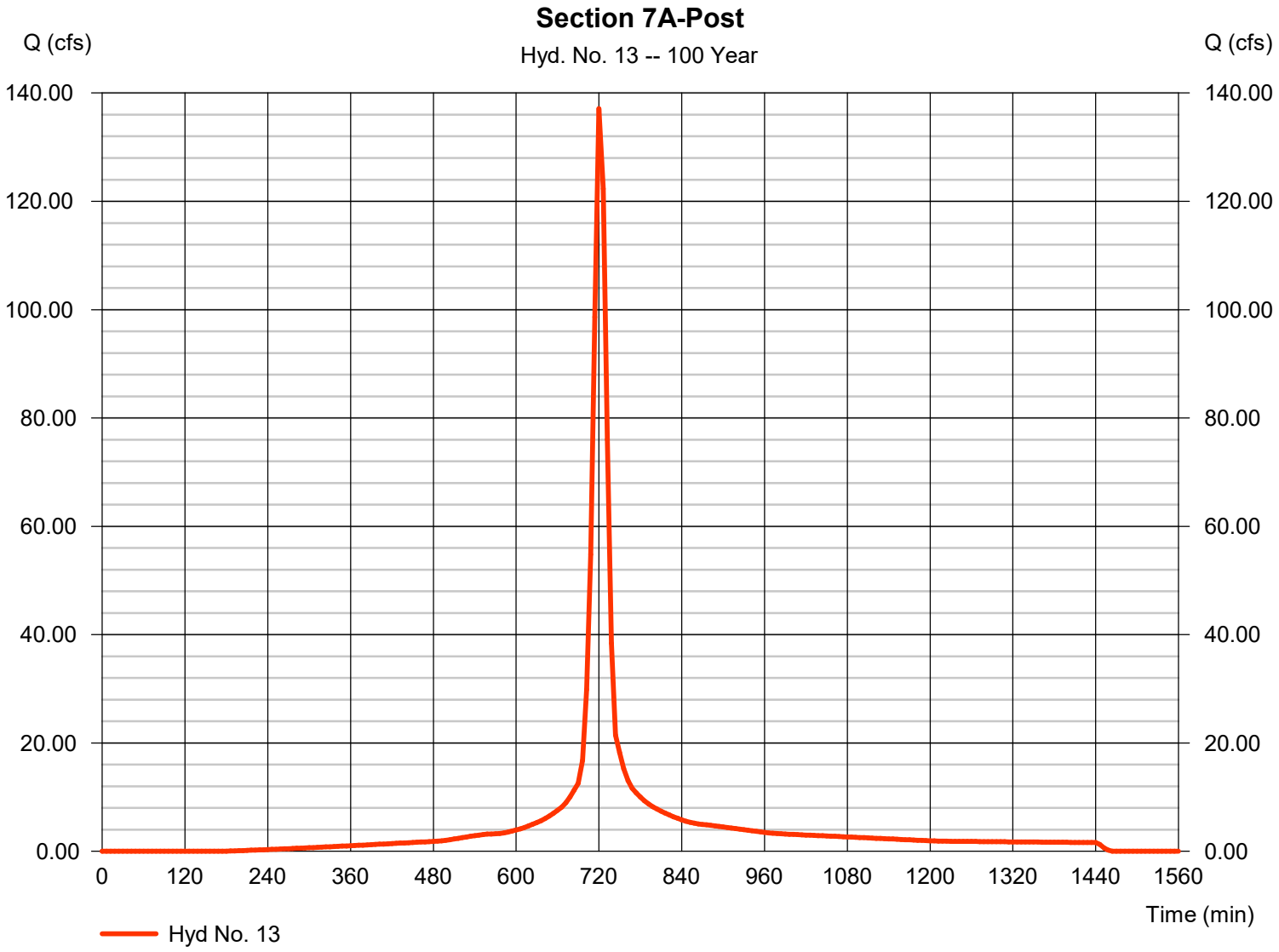
Hydrograph Report

Hyd. No. 13

Section 7A-Post

Hydrograph type	=	SCS Runoff	Peak discharge	=	137.12 cfs
Storm frequency	=	100 yrs	Time to peak	=	720 min
Time interval	=	6 min	Hyd. volume	=	439,562 cuft
Drainage area	=	19.900 ac	Curve number	=	89*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	19.30 min
Total precip.	=	7.80 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(19.900 x 89)] / 19.900



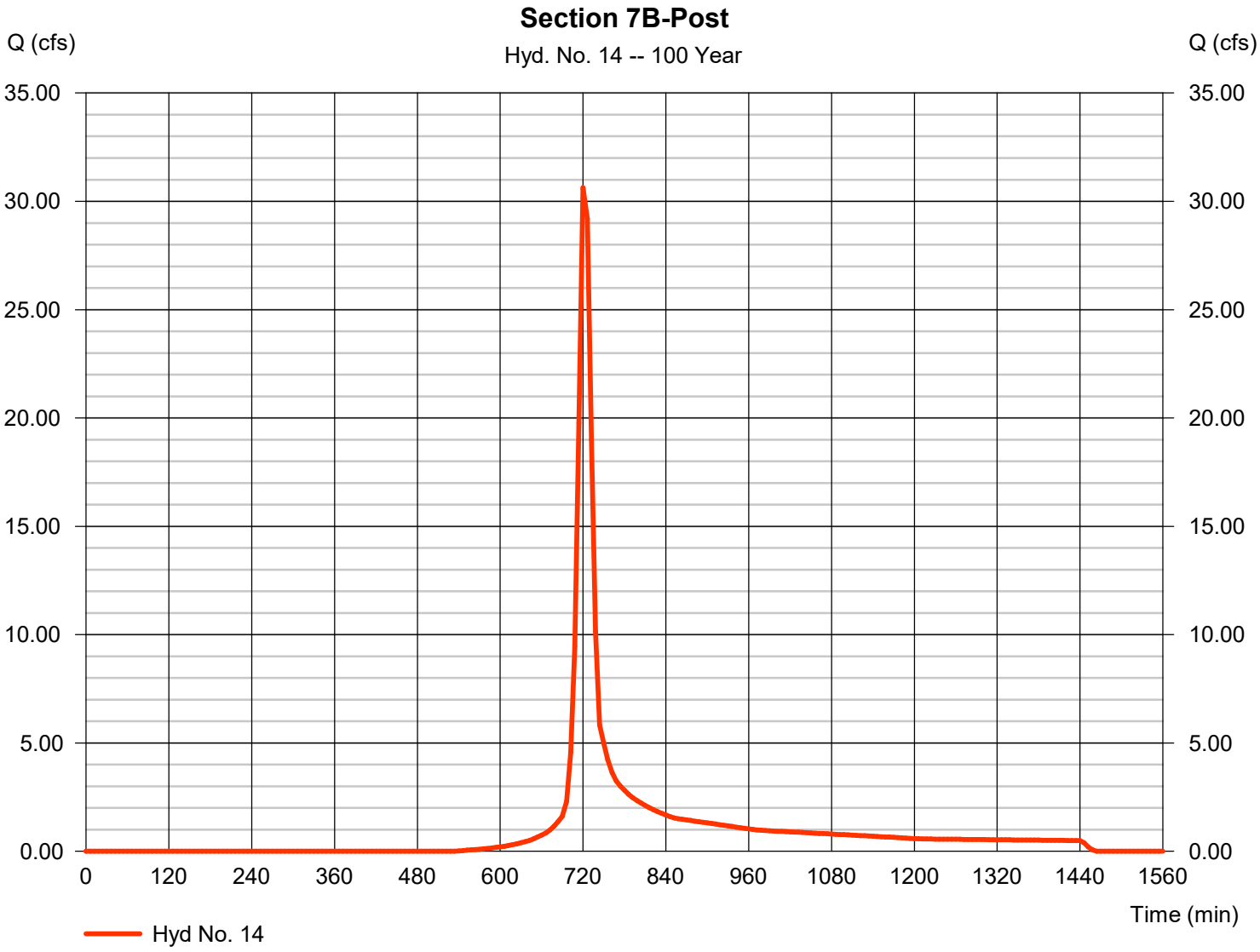
Hydrograph Report

Hyd. No. 14

Section 7B-Post

Hydrograph type	=	SCS Runoff	Peak discharge	=	30.63 cfs
Storm frequency	=	100 yrs	Time to peak	=	720 min
Time interval	=	6 min	Hyd. volume	=	95,283 cuft
Drainage area	=	7.500 ac	Curve number	=	65*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	18.80 min
Total precip.	=	7.80 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(13.900 x 89)] / 7.500

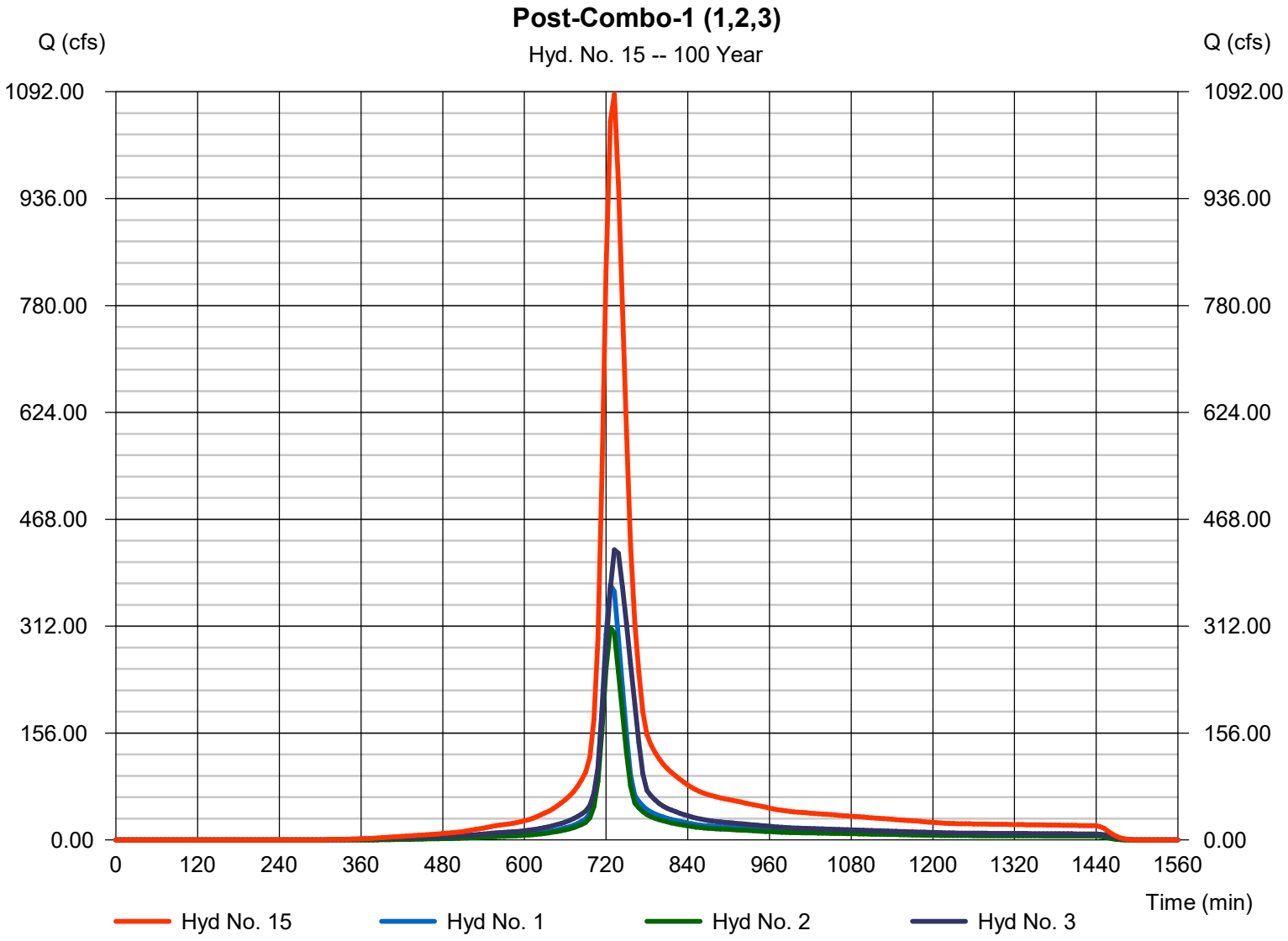


Hydrograph Report

Hyd. No. 15

Post-Combo-1 (1,2,3)

Hydrograph type	= Combine	Peak discharge	= 1088.09 cfs
Storm frequency	= 100 yrs	Time to peak	= 732 min
Time interval	= 6 min	Hyd. volume	= 4,906,160 cuft
Inflow hyds.	= 1, 2, 3	Contrib. drain. area	= 250.500 ac



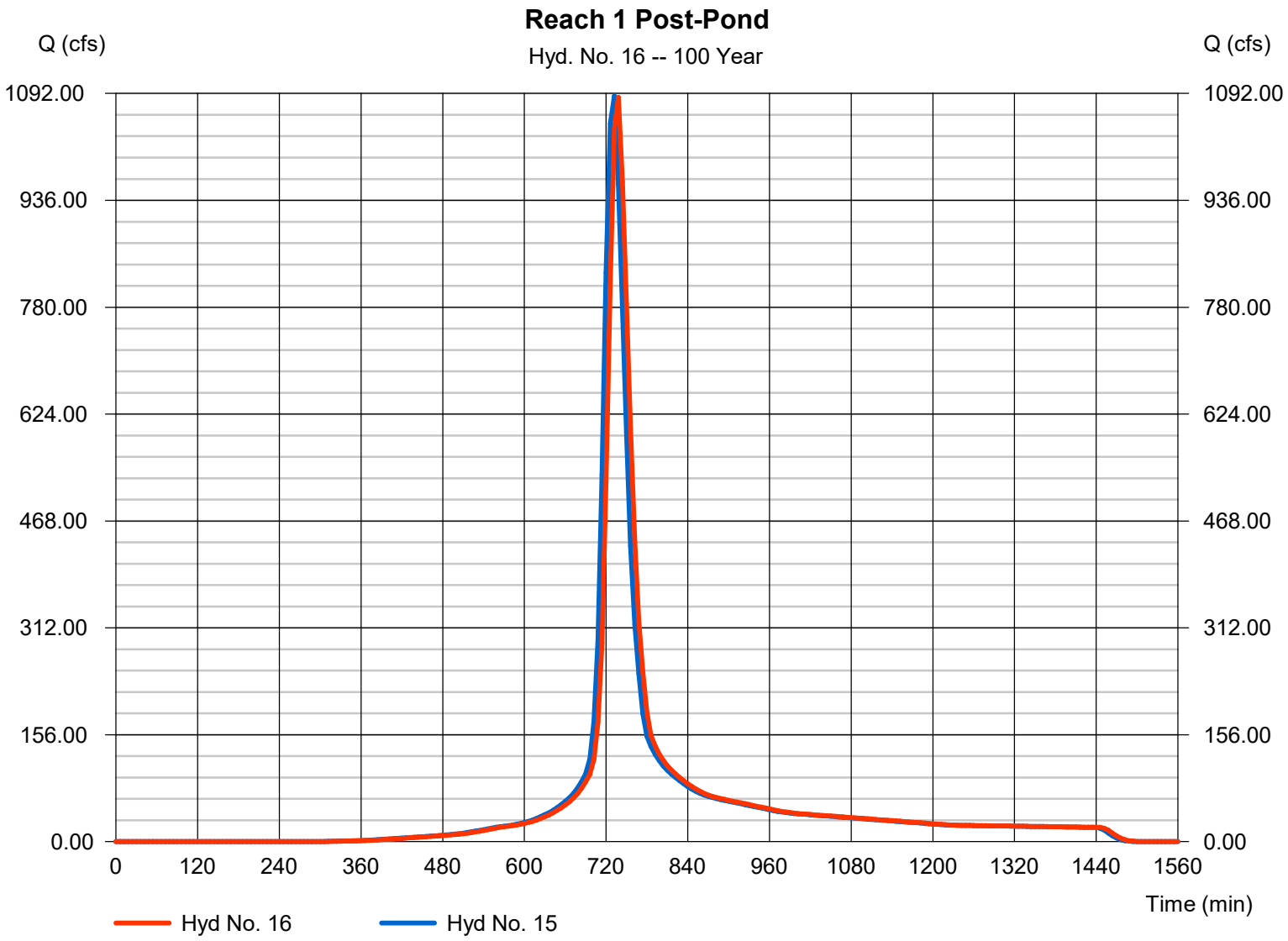
Hydrograph Report

Hyd. No. 16

Reach 1 Post-Pond

Hydrograph type	=	Reach	Peak discharge	=	1086.45 cfs
Storm frequency	=	100 yrs	Time to peak	=	738 min
Time interval	=	6 min	Hyd. volume	=	4,906,155 cuft
Inflow hyd. No.	=	15 - Post-Combo-1 (1,2,3)	Section type	=	Trapezoidal
Reach length	=	1000.0 ft	Channel slope	=	2.0 %
Manning's n	=	0.020	Bottom width	=	150.0 ft
Side slope	=	32.0:1	Max. depth	=	16.0 ft
Rating curve x	=	0.373	Rating curve m	=	1.404
Ave. velocity	=	3.70 ft/s	Routing coeff.	=	0.9658

Modified Att-Kin routing method used.

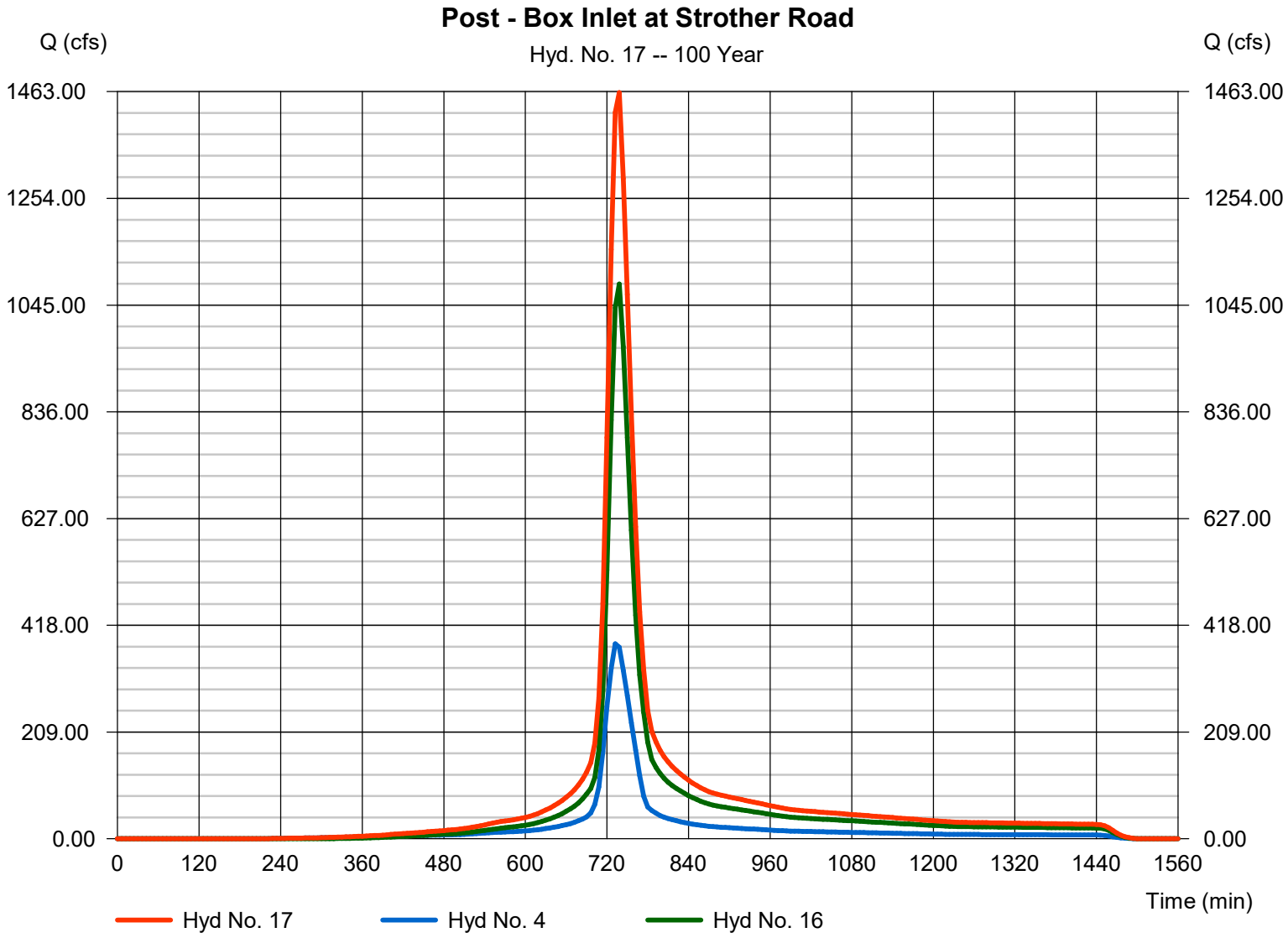


Hydrograph Report

Hyd. No. 17

Post - Box Inlet at Strother Road

Hydrograph type	= Combine	Peak discharge	= 1461.36 cfs
Storm frequency	= 100 yrs	Time to peak	= 738 min
Time interval	= 6 min	Hyd. volume	= 6,874,285 cuft
Inflow hyds.	= 4, 16	Contrib. drain. area	= 82.500 ac



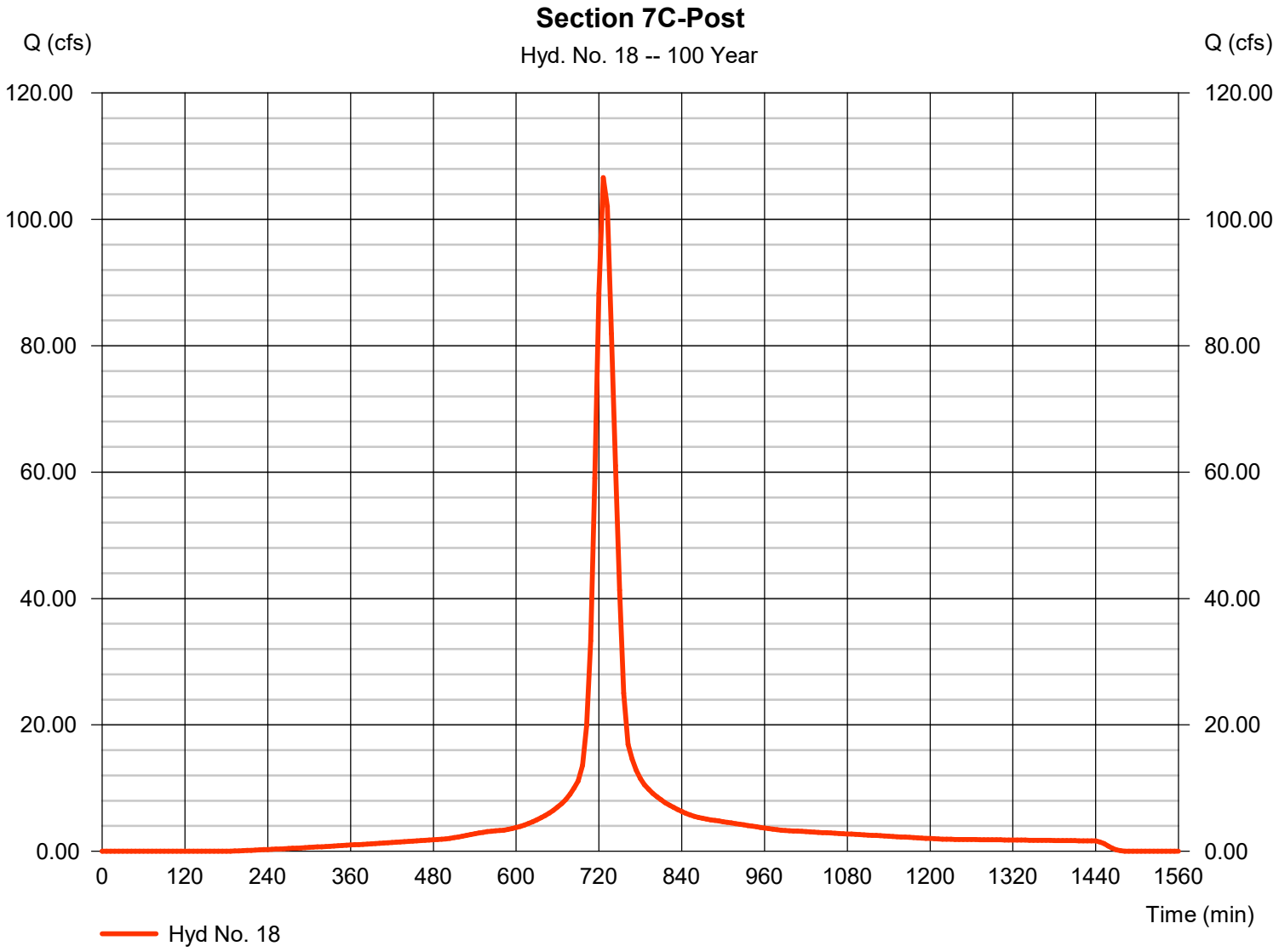
Hydrograph Report

Hyd. No. 18

Section 7C-Post

Hydrograph type	=	SCS Runoff	Peak discharge	=	106.61 cfs
Storm frequency	=	100 yrs	Time to peak	=	726 min
Time interval	=	6 min	Hyd. volume	=	447,661 cuft
Drainage area	=	19.000 ac	Curve number	=	89*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	19.80 min
Total precip.	=	7.80 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(19.000 x 89)] / 19.000



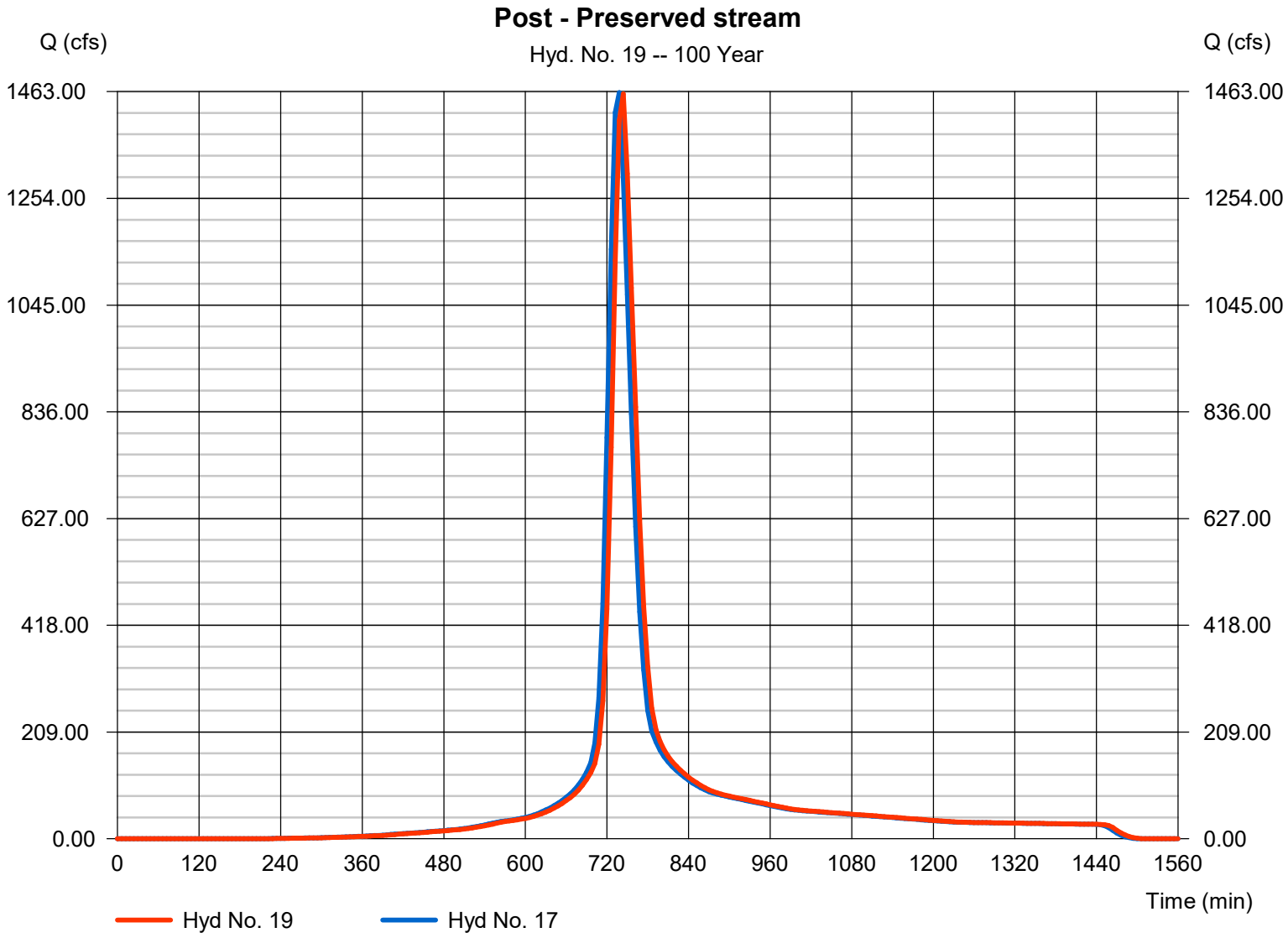
Hydrograph Report

Hyd. No. 19

Post - Preserved stream

Hydrograph type	=	Reach	Peak discharge	=	1458.31 cfs
Storm frequency	=	100 yrs	Time to peak	=	744 min
Time interval	=	6 min	Hyd. volume	=	6,874,284 cuft
Inflow hyd. No.	=	17 - Post - Box Inlet at Strother Road	Section type	=	Trapezoidal
Reach length	=	500.0 ft	Channel slope	=	0.5 %
Manning's n	=	0.100	Bottom width	=	10.0 ft
Side slope	=	14.0:1	Max. depth	=	8.0 ft
Rating curve x	=	0.227	Rating curve m	=	1.318
Ave. velocity	=	1.89 ft/s	Routing coeff.	=	0.9448

Modified Att-Kin routing method used.

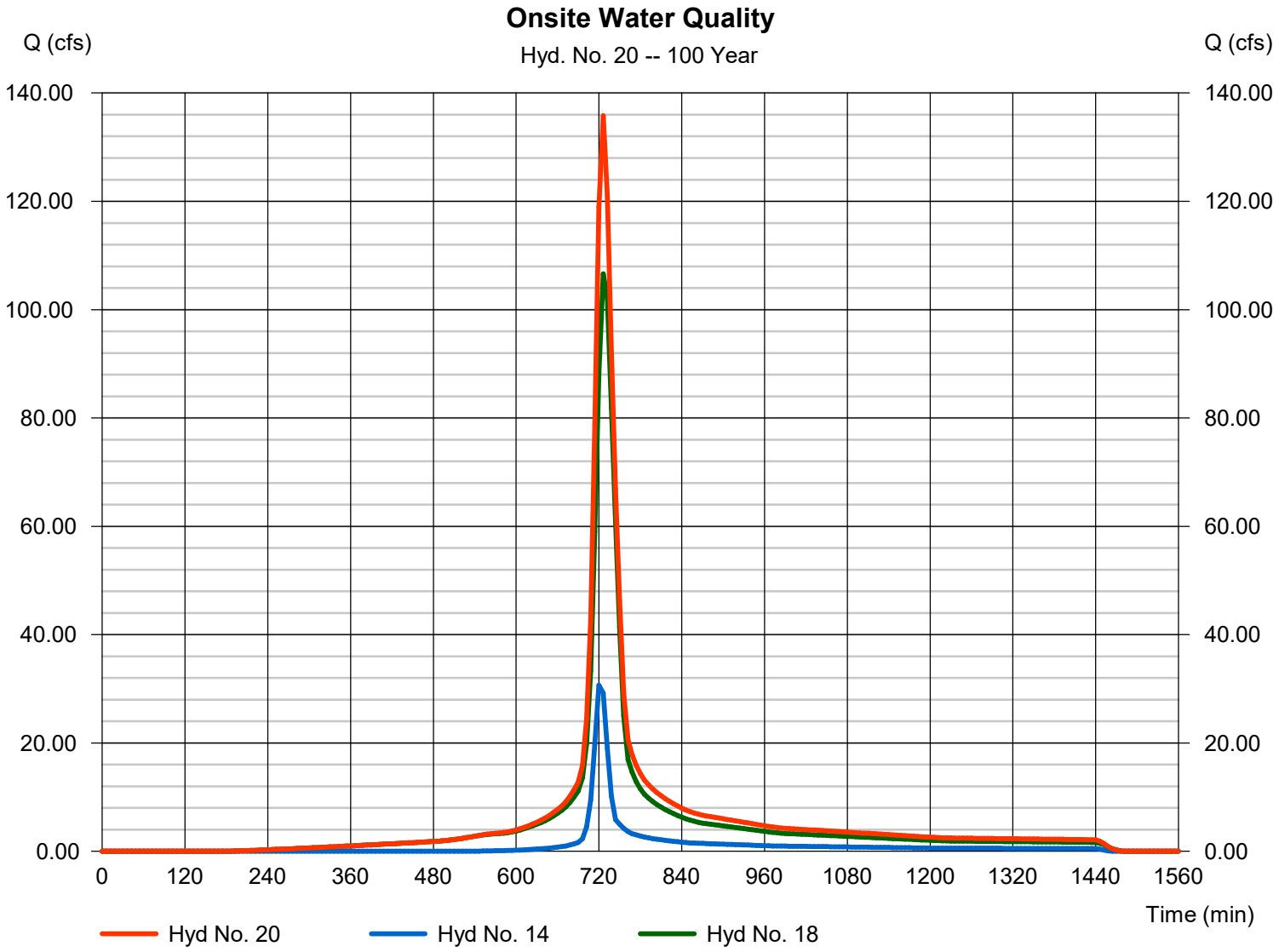


Hydrograph Report

Hyd. No. 20

Onsite Water Quality

Hydrograph type	= Combine	Peak discharge	= 135.80 cfs
Storm frequency	= 100 yrs	Time to peak	= 726 min
Time interval	= 6 min	Hyd. volume	= 542,944 cuft
Inflow hyds.	= 14, 18	Contrib. drain. area	= 26.500 ac



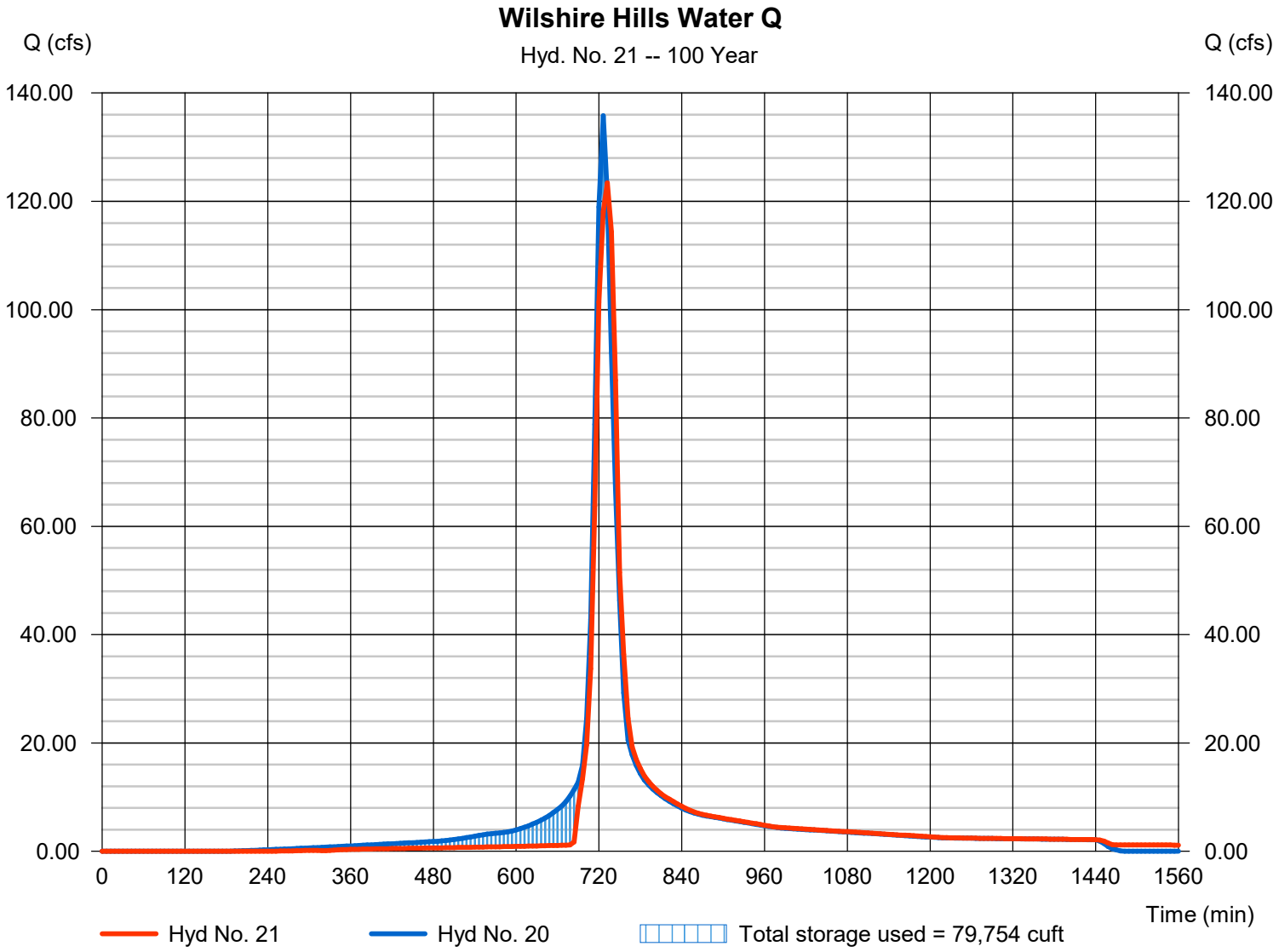
Hydrograph Report

Hyd. No. 21

Wilshire Hills Water Q

Hydrograph type	=	Reservoir	Peak discharge	=	123.42 cfs
Storm frequency	=	100 yrs	Time to peak	=	732 min
Time interval	=	6 min	Hyd. volume	=	542,919 cuft
Inflow hyd. No.	=	20 - Onsite Water Quality	Max. Elevation	=	918.55 ft
Reservoir name	=	Wilshire Hills Water Quality Basin	Max. Storage	=	79,754 cuft

Storage Indication method used.

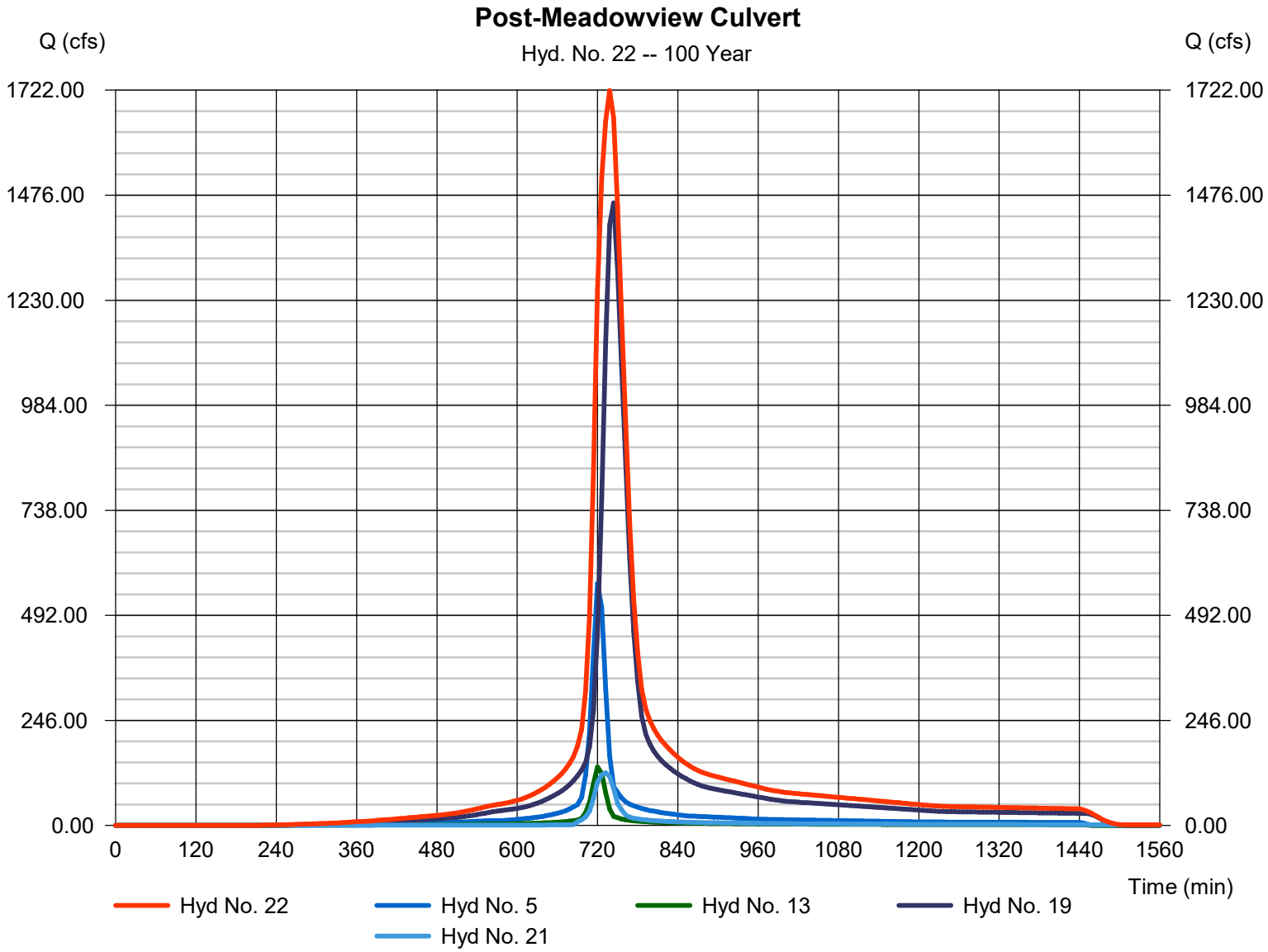


Hydrograph Report

Hyd. No. 22

Post-Meadowview Culvert

Hydrograph type	= Combine	Peak discharge	= 1721.03 cfs
Storm frequency	= 100 yrs	Time to peak	= 738 min
Time interval	= 6 min	Hyd. volume	= 9,637,193 cuft
Inflow hyds.	= 5, 13, 19, 21	Contrib. drain. area	= 106.800 ac



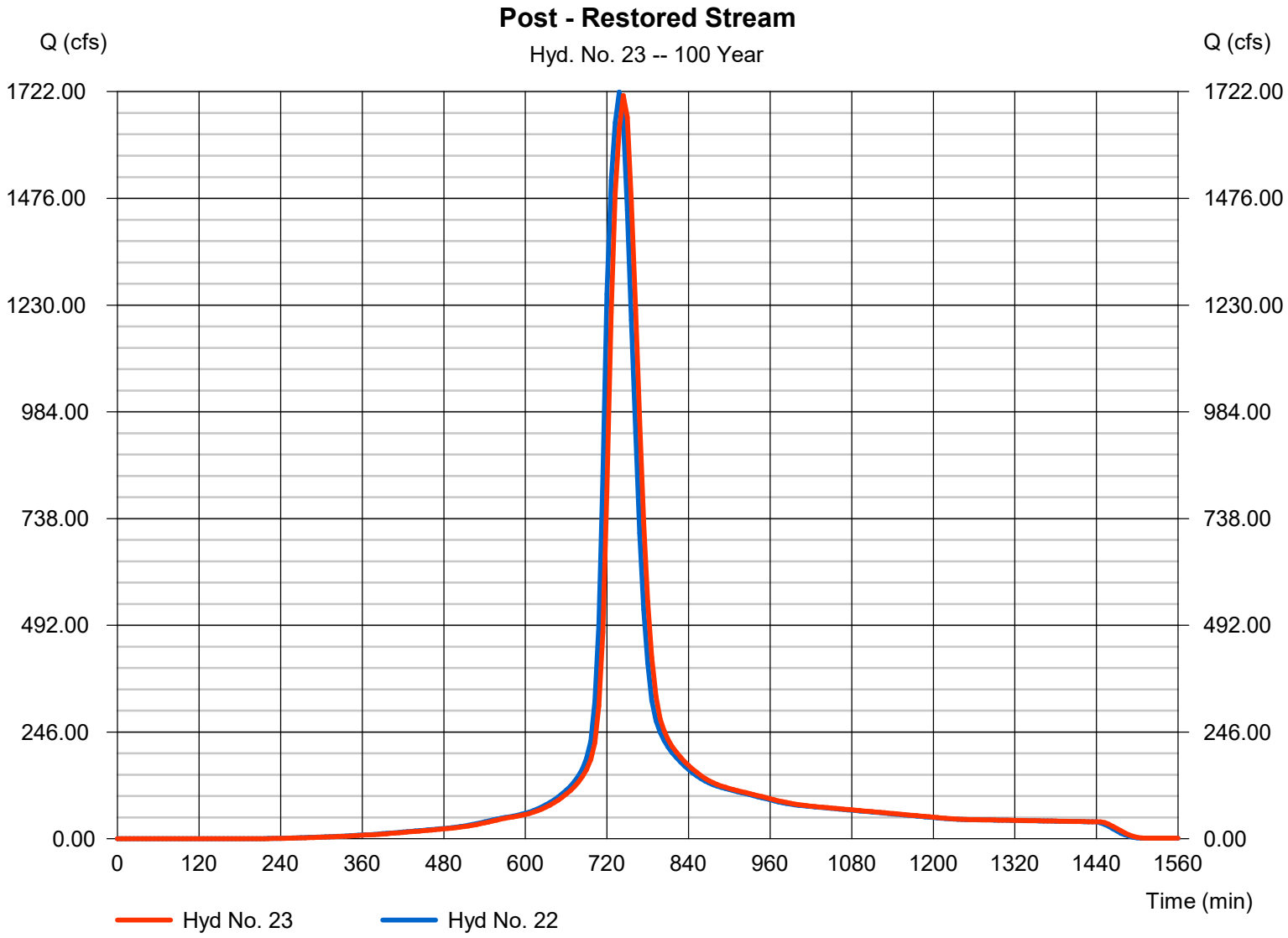
Hydrograph Report

Hyd. No. 23

Post - Restored Stream

Hydrograph type	= Reach	Peak discharge	= 1713.16 cfs
Storm frequency	= 100 yrs	Time to peak	= 744 min
Time interval	= 6 min	Hyd. volume	= 9,636,978 cuft
Inflow hyd. No.	= 22 - Post-Meadowview Culvert	Section type	= Trapezoidal
Reach length	= 1340.0 ft	Channel slope	= 0.8 %
Manning's n	= 0.030	Bottom width	= 20.0 ft
Side slope	= 10.0:1	Max. depth	= 4.0 ft
Rating curve x	= 0.595	Rating curve m	= 1.345
Ave. velocity	= 4.60 ft/s	Routing coeff.	= 0.9077

Modified Att-Kin routing method used.



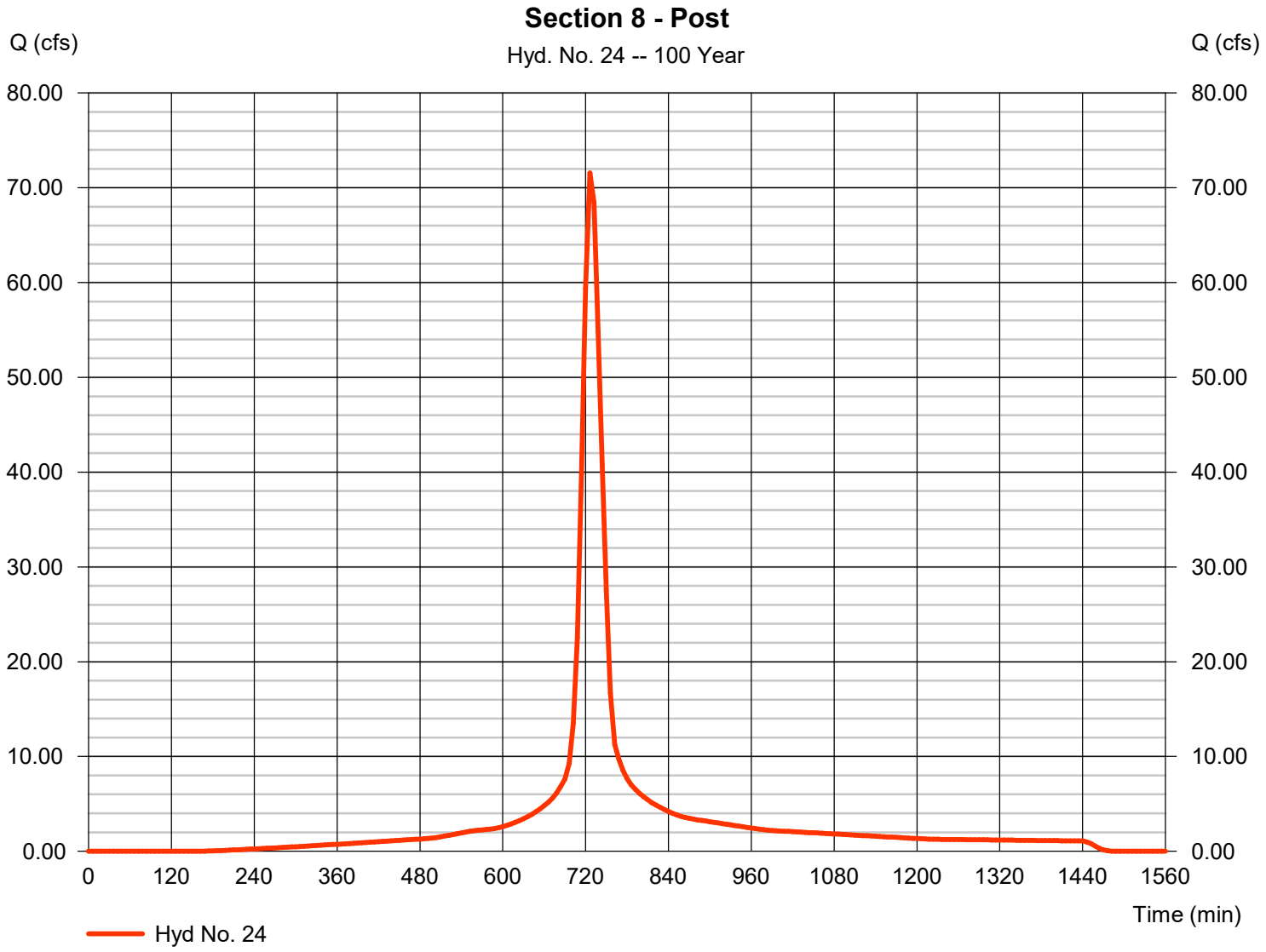
Hydrograph Report

Hyd. No. 24

Section 8 - Post

Hydrograph type	=	SCS Runoff	Peak discharge	=	71.57 cfs
Storm frequency	=	100 yrs	Time to peak	=	726 min
Time interval	=	6 min	Hyd. volume	=	302,271 cuft
Drainage area	=	12.600 ac	Curve number	=	90*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	23.90 min
Total precip.	=	7.80 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(12.600 x 90)] / 12.600

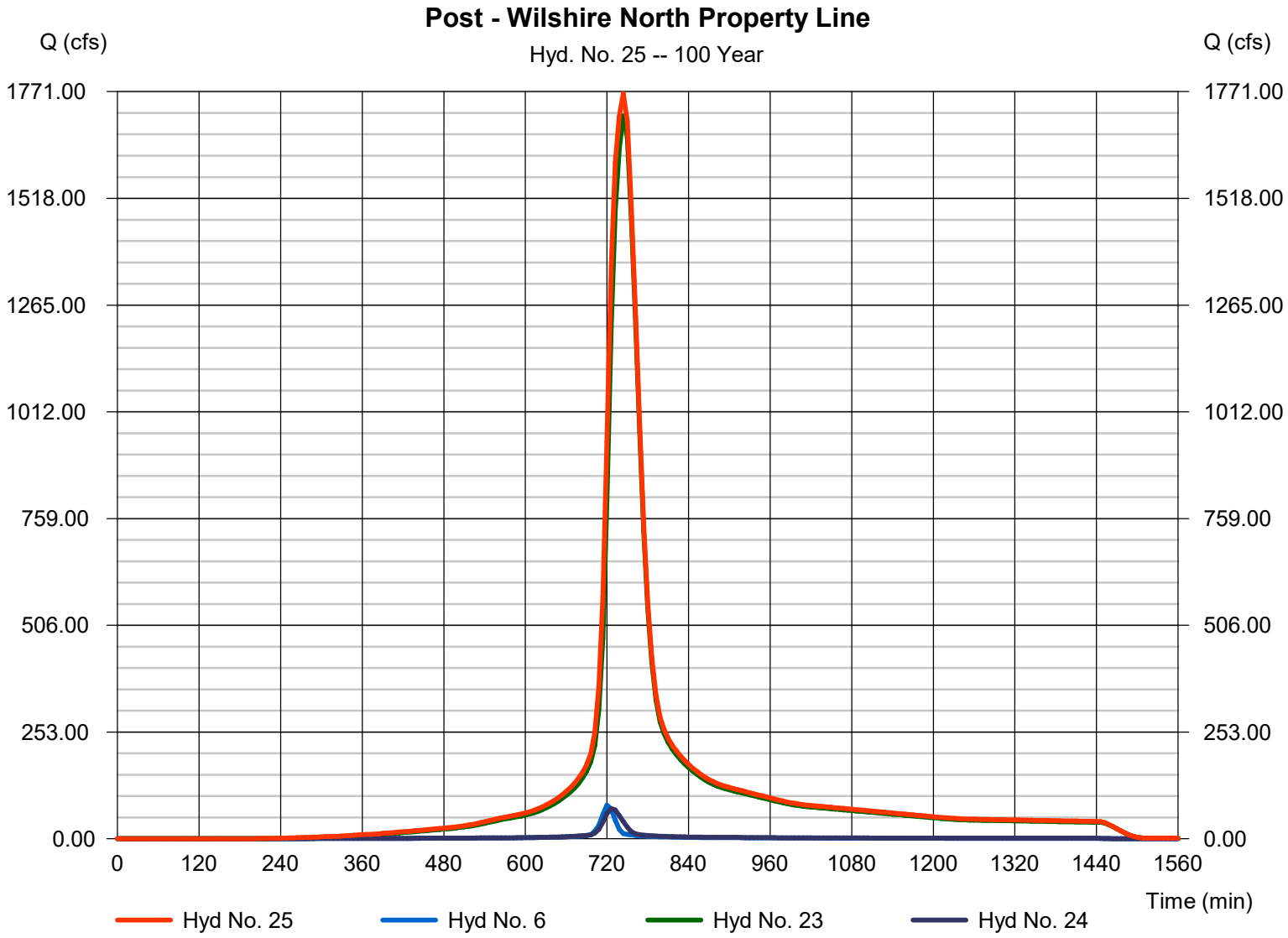


Hydrograph Report

Hyd. No. 25

Post - Wilshire North Property Line

Hydrograph type	= Combine	Peak discharge	= 1766.33 cfs
Storm frequency	= 100 yrs	Time to peak	= 744 min
Time interval	= 6 min	Hyd. volume	= 10,197,938 cuft
Inflow hyds.	= 6, 23, 24	Contrib. drain. area	= 23.900 ac



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	0.0000	0.0000	0.0000	--------
2	58.7310	12.5000	0.8339	--------
3	0.0000	0.0000	0.0000	--------
5	76.3517	14.4000	0.8324	--------
10	89.1197	15.3000	0.8331	--------
25	108.4324	16.3000	0.8361	--------
50	123.7045	16.9000	0.8383	--------
100	140.0626	17.5000	0.8416	--------

File name: Kansas City, MO Area.IDF

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	5.40	4.38	3.70	3.22	2.86	2.58	2.35	2.16	2.00	1.87	1.75	1.65
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	6.47	5.34	4.58	4.02	3.59	3.25	2.97	2.74	2.55	2.38	2.24	2.11
10	7.26	6.04	5.20	4.58	4.10	3.72	3.41	3.15	2.93	2.74	2.58	2.43
25	8.40	7.05	6.09	5.38	4.83	4.39	4.03	3.73	3.47	3.25	3.06	2.89
50	9.31	7.83	6.79	6.01	5.40	4.91	4.51	4.18	3.89	3.65	3.44	3.25
100	10.19	8.61	7.48	6.63	5.97	5.44	5.00	4.63	4.31	4.04	3.81	3.60

Tc = time in minutes. Values may exceed 60.

Precip. file name: C:\MYFILES\Kansas City, MO Area.pcp

Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	3.00	3.50	0.00	4.60	5.30	6.20	7.00	7.80
SCS 6-Hr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-1st	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Weir Report

Wilshire Hills Water Quality Basin

Rectangular Weir

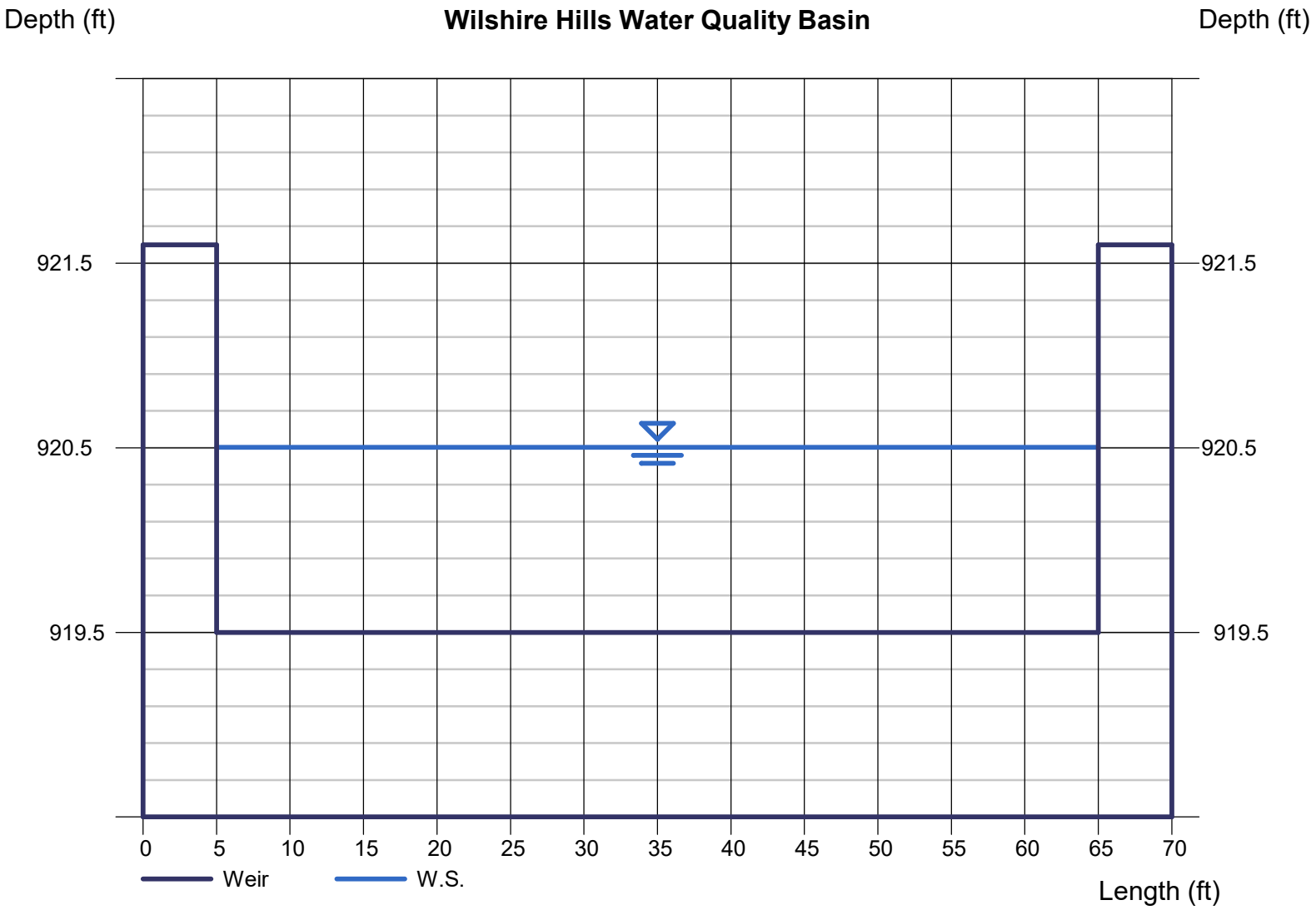
Crest	= Broad
Bottom Length (ft)	= 60.00
Total Depth (ft)	= 2.10

Calculations

Weir Coeff. Cw	= 2.60
Compute by:	Known Q
Known Q (cfs)	= 156.50

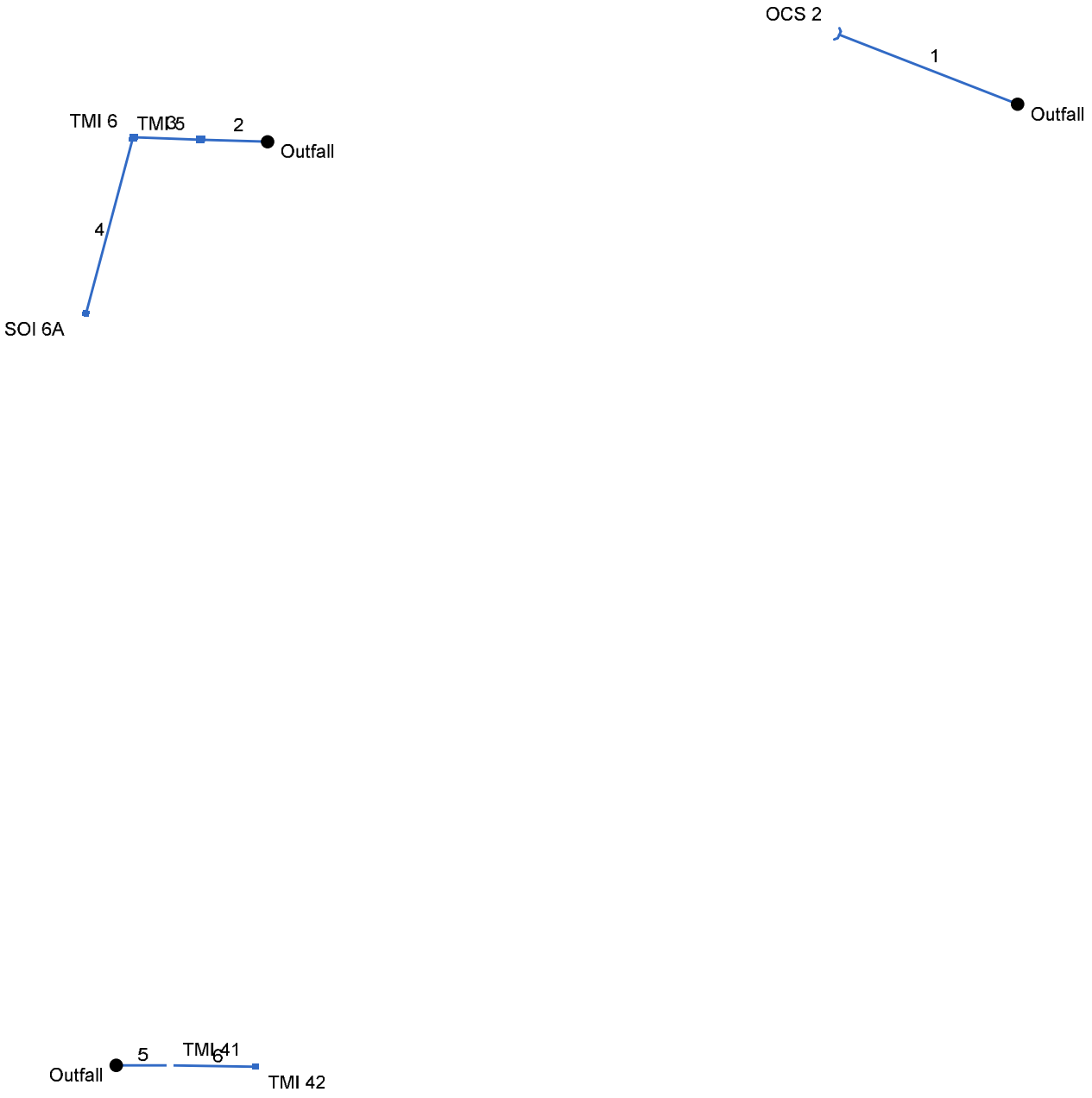
Highlighted

Depth (ft)	= 1.00
Q (cfs)	= 156.50
Area (sqft)	= 60.13
Velocity (ft/s)	= 2.60
Top Width (ft)	= 60.00



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

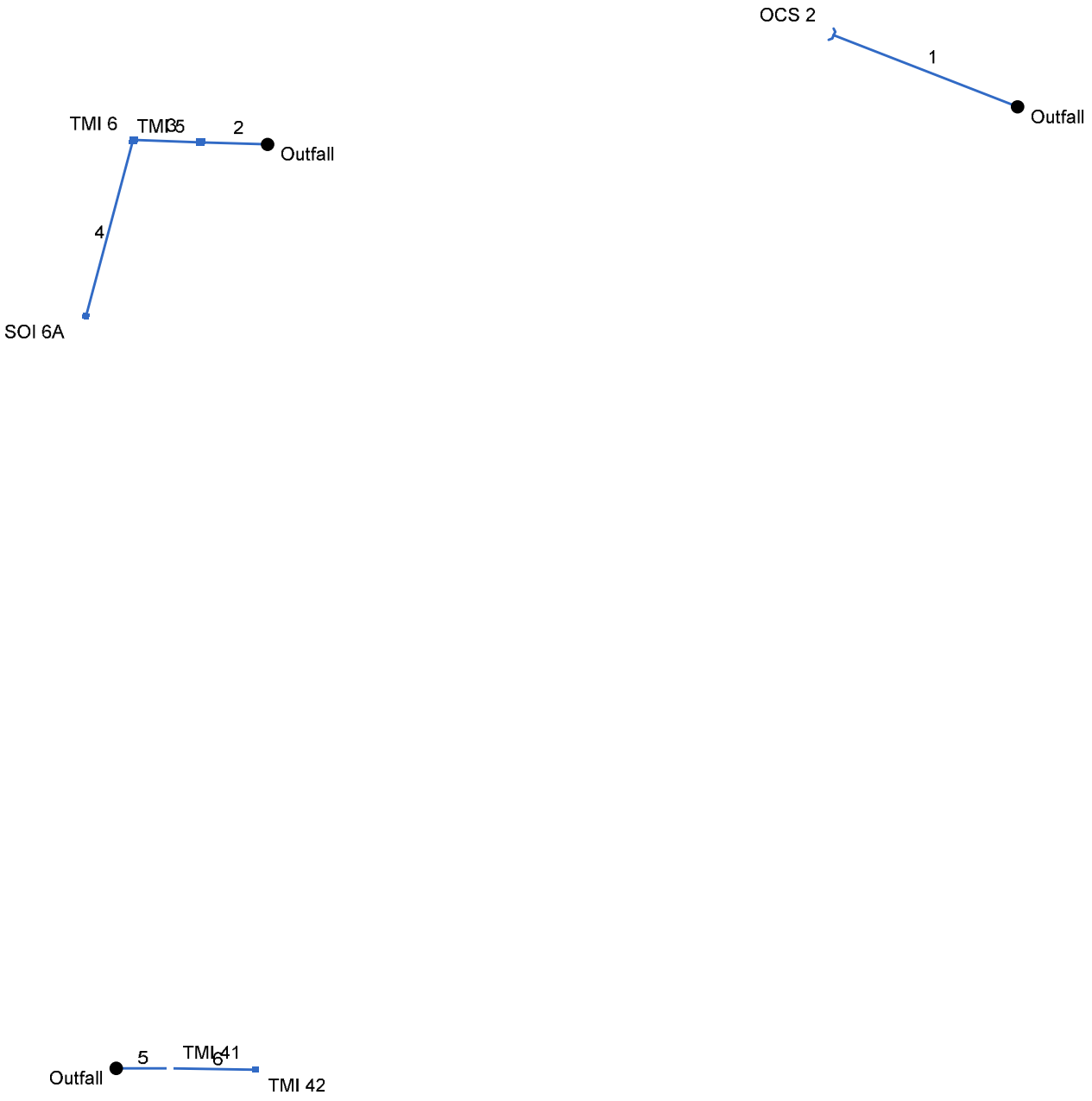
Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (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

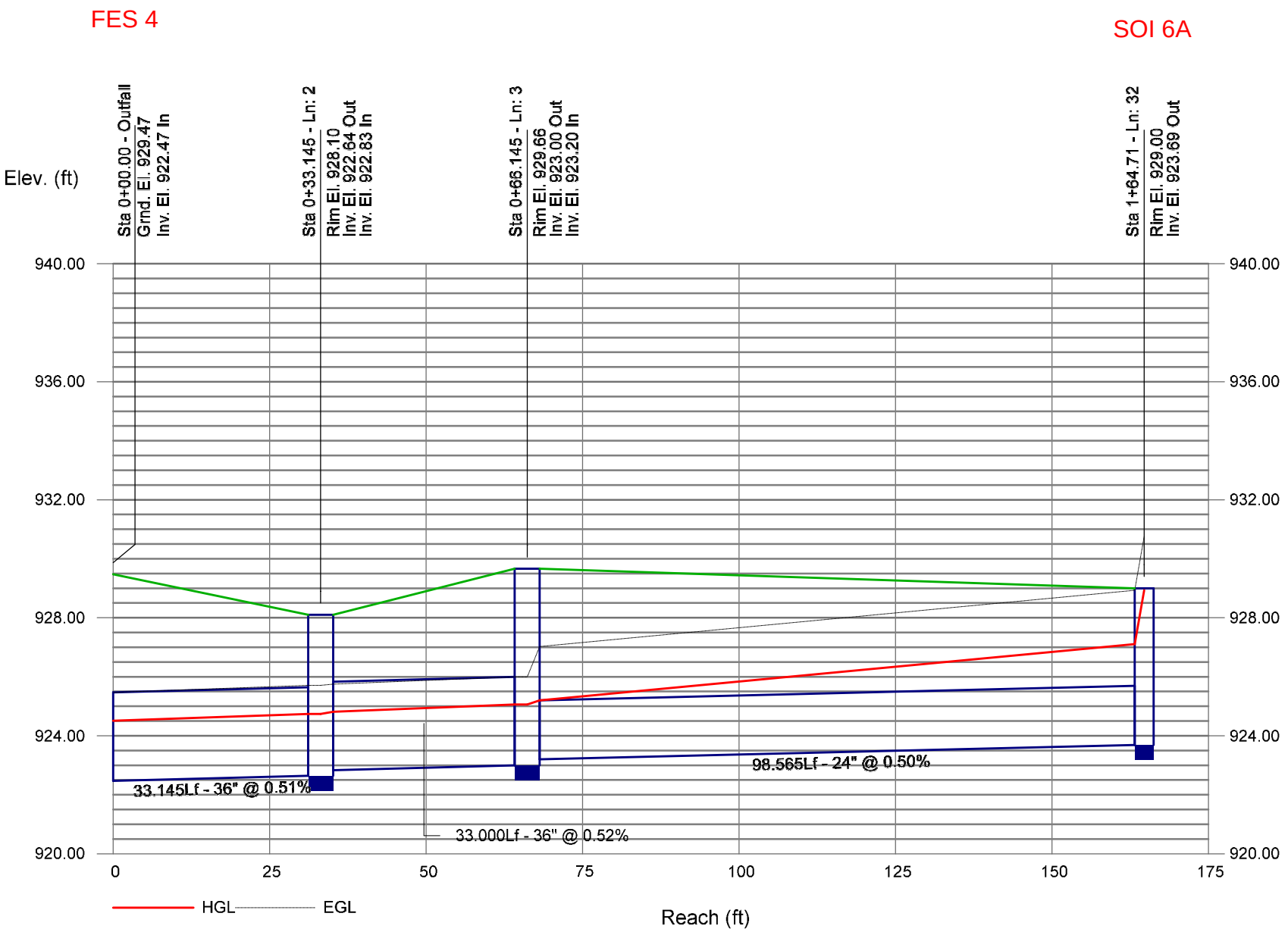
Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf		Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf	Ave Sf	Enrgy loss		
	(in)	(cfs)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(ft)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(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



Storm Sewer Profile

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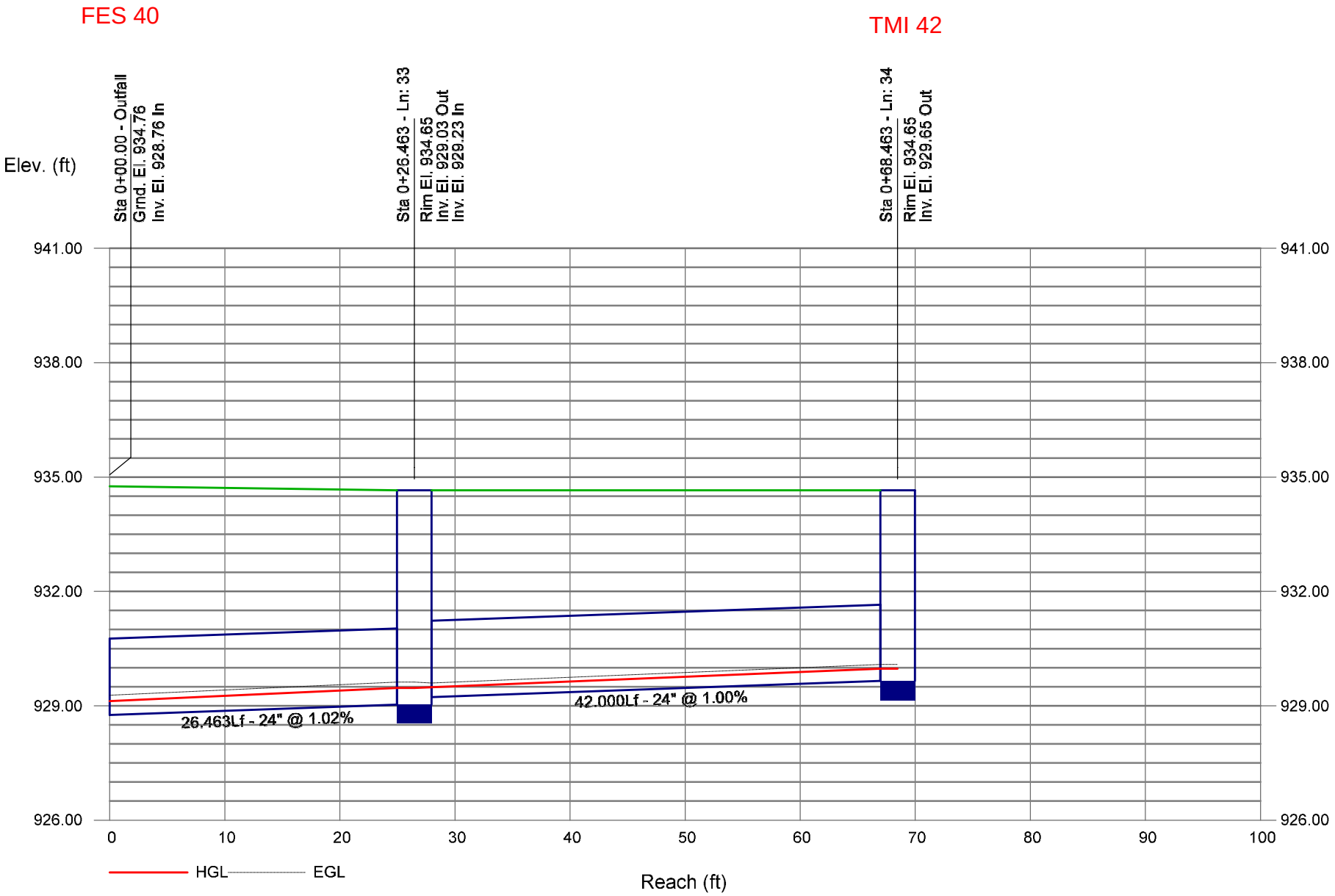

Storm Sewer Profile

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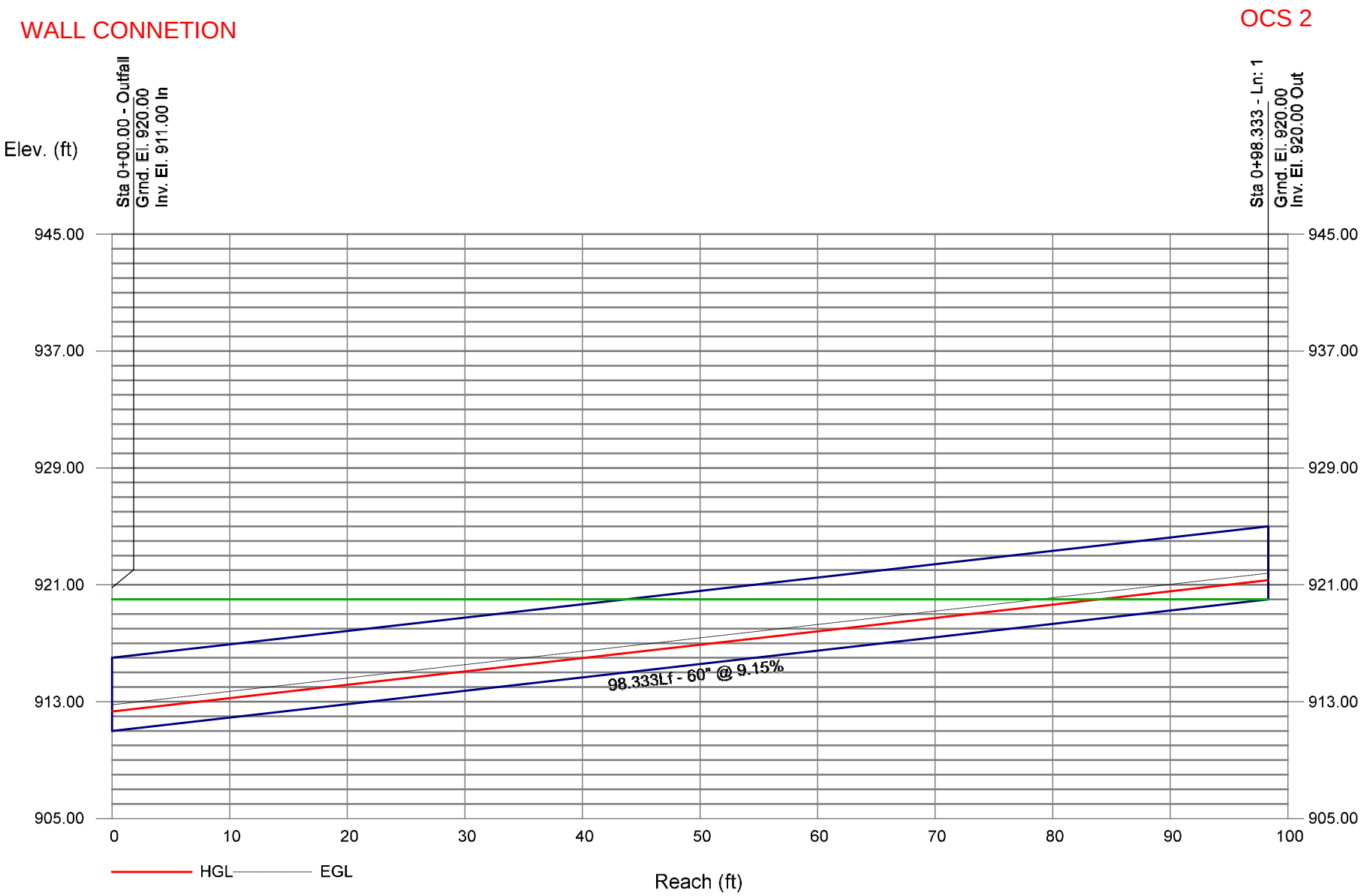
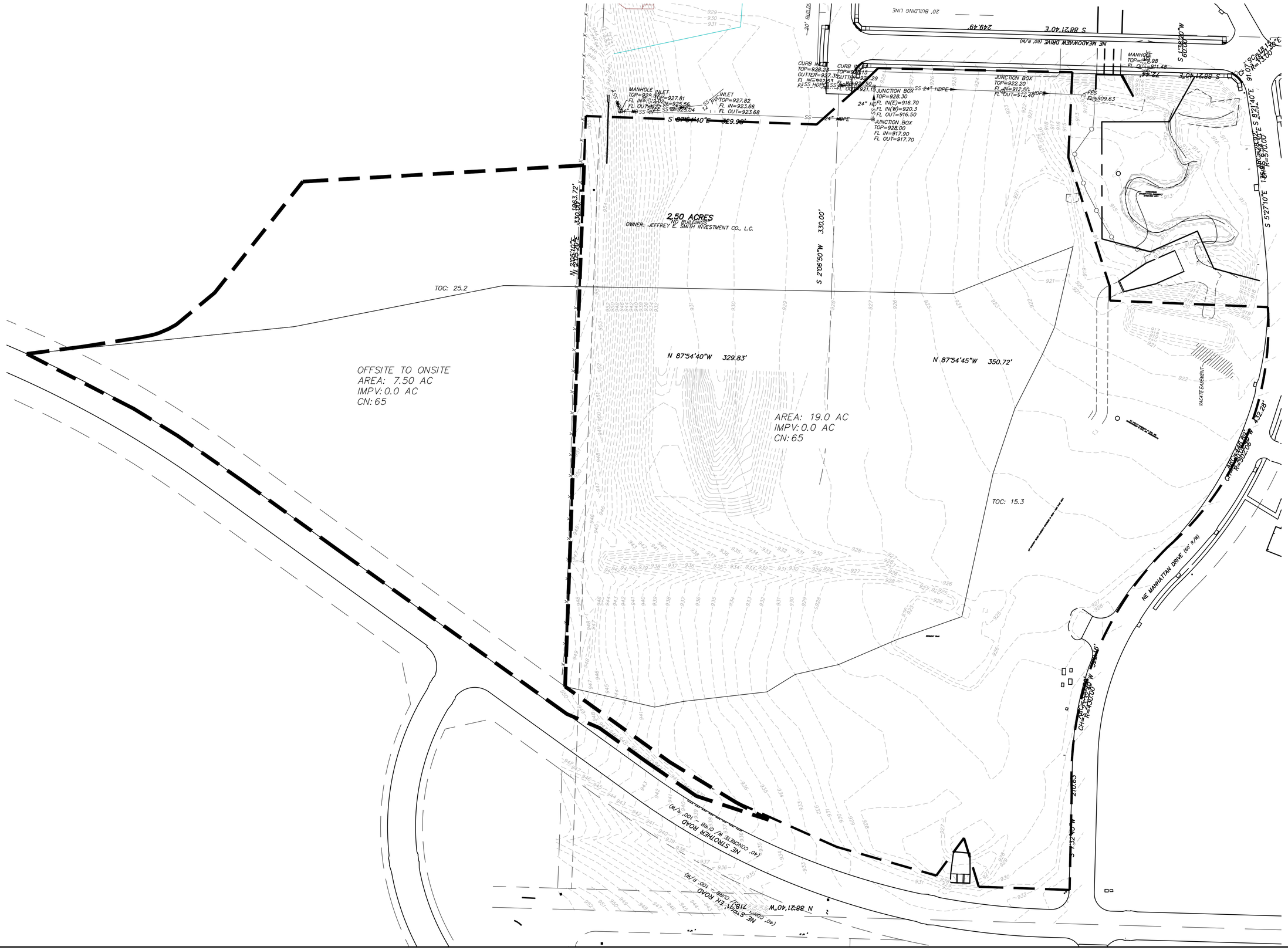


APPENDIX D:
DRAINAGE AREA MAP(S)



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0 1"
SCALE: 1" = 60'

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LEE'S SUMMIT JACKSON COUNTY, MISSOURI

10/12/2023

STATE OF MISSOURI
MATTHEW AARON KRIETE
NUMBER PE-2007002811
PROFESSIONAL ENGINEER

MATTHEW A. KRIETE
PROFESSIONAL ENGINEER
PE-2007002811

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PRE-DRAINAGE AREA MAP

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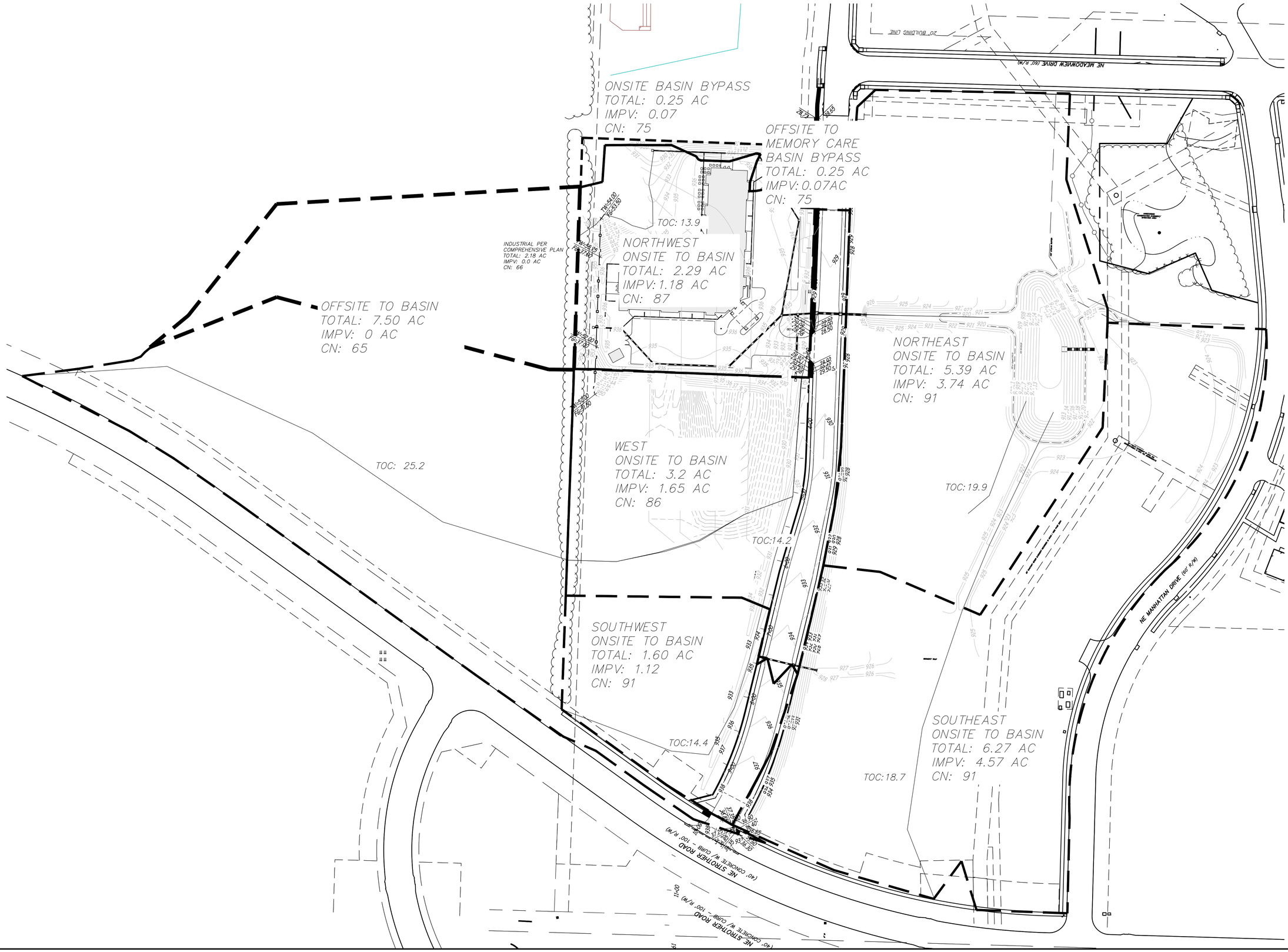

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POST-DRAINAGE AREA MAP

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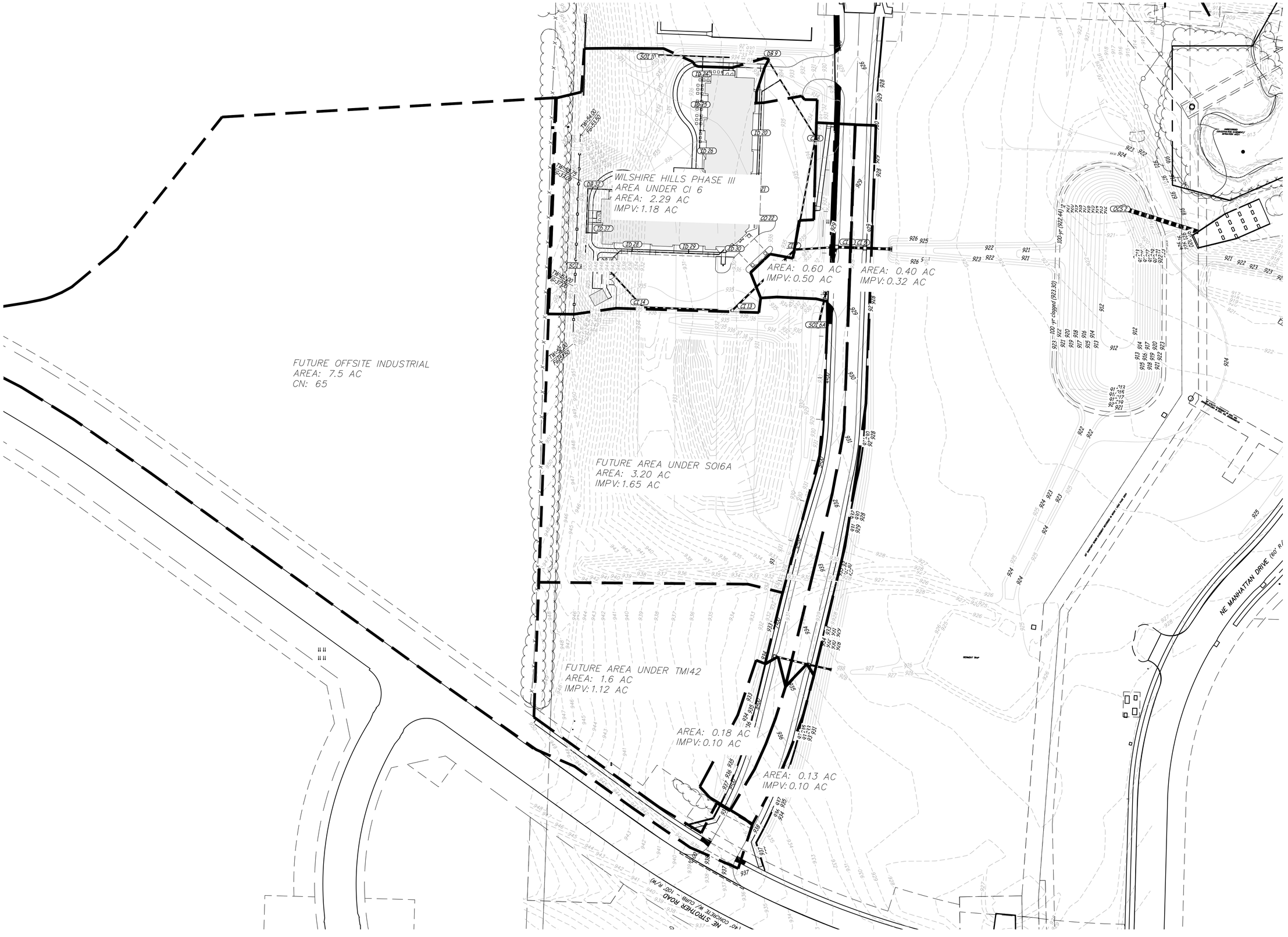

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STORM SEWER
DRAINAGE AREA MAP

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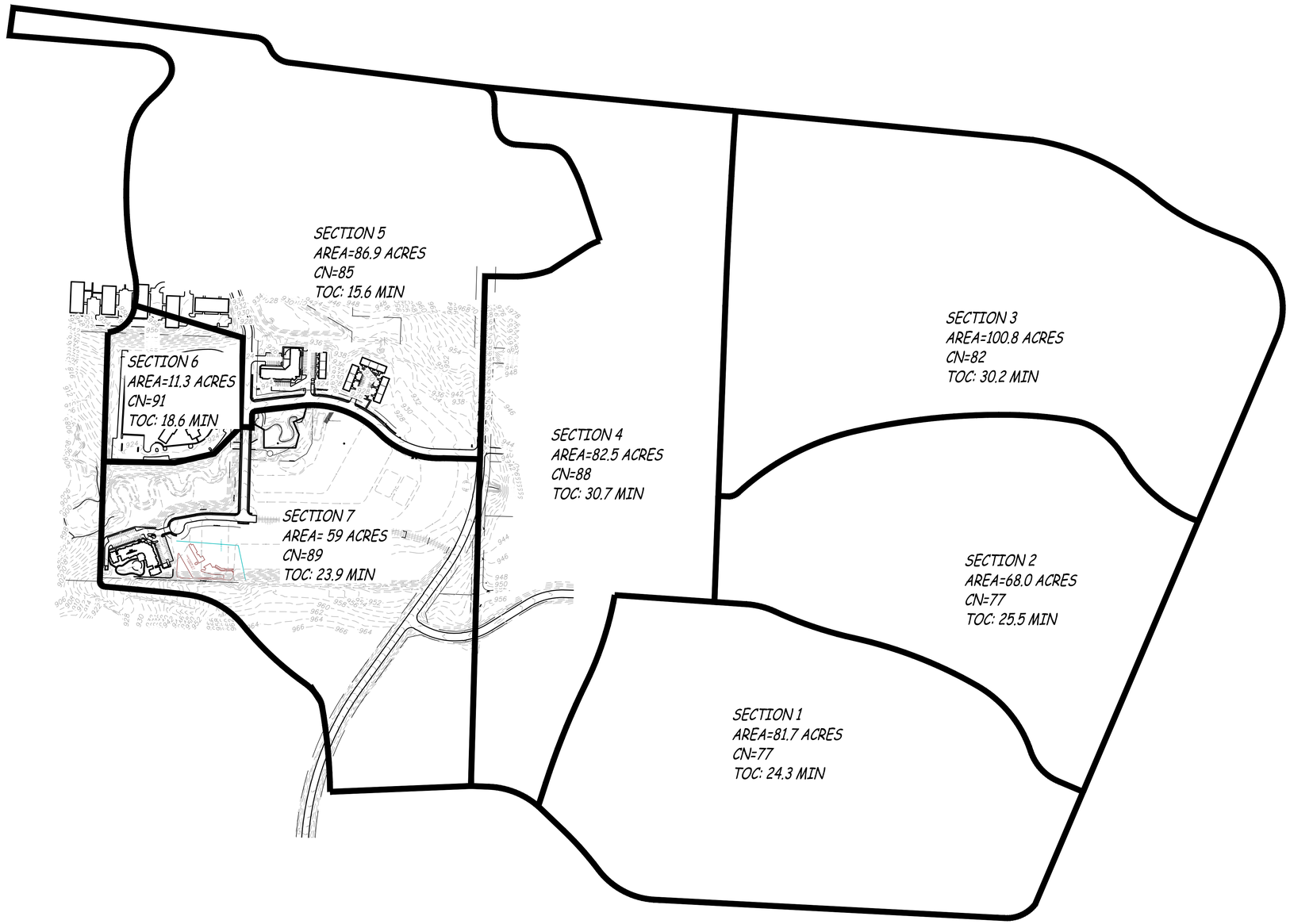

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0 1"
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PRE DOWNSTREAM ANALYSIS MAP

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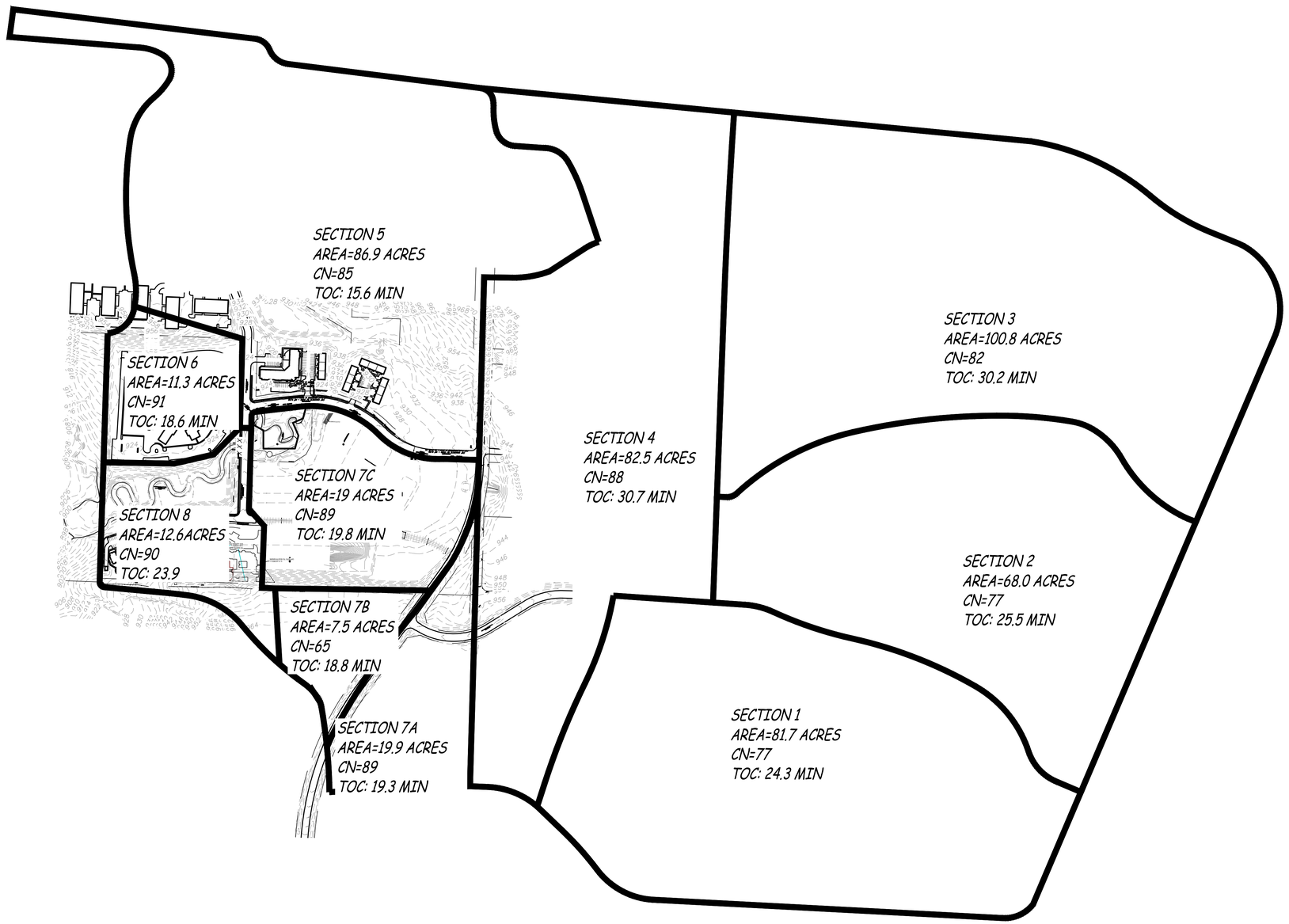

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POST DOWNSTREAM ANALYSIS MAP

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