HYDRAULIC REPORT

FOR

Public Improvements to Serve Wilshire Hills III

Lee's Summit, Missouri

PREPARED FOR:

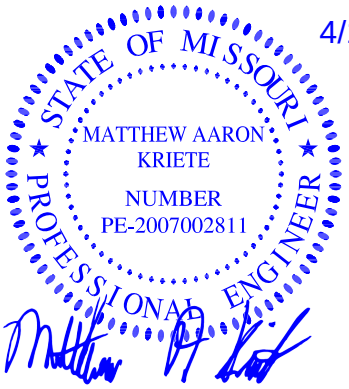
WILSHIRE HILLS III L.P.

206 PEACH WAY

COLUMBIA, MO 54202

JUNE 22, 2023

REVISED: APRIL 16, 2024



4/16/24

PREPARED BY:

Engineering Surveys & Services

1113 FAY STREET

COLUMBIA, MO 65201

(573) 449-2646

JOB NUMBER: 15925

TABLE OF CONTENTS

1 INTRODUCTION

The project consists of the construction of a public road and associated utilities to connect existing Wilshire Drive to Strother Road in Lee's Summit, MO. The road and associated storm sewer and sanitary sewer extensions will provide service to Wilshire Hills Phase III on Lot 5 and additional future development. 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. Public Improvements for the development include the extension of utilities including water, sewer, and electric. Storm sewers will be constructed along with the extension of Wilshire Hill Drive to Strother Road.

The purpose of this report is to demonstrate compliance with the city of Lee's Summit storm water requirements. The report specifically addresses the following.

1. Compliance with the APWA Comprehensive Control Strategy for Stormwater.
2. Stormwater quality for the proposed development.
3. Design of best management practices during construction.
4. Proposed storm sewer and channel design.
5. Impact of proposed and future development of storm water runoff from the site and the downstream watershed.

2 POST CONSTRUCTION STORMWATER MANAGEMENT

2.1 Analysis Goals

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 purpose of this analysis is to evaluate the hydrological impact of the development of Wilshire Hills Lot 5 and the future lot development. The base data has been collected from aerial imagery, historical data, and maps and analyzed based on the KC-APWA 5600 standards. The KC-APWA standards are summarized by the Comprehensive Control Strategy and met by Wilshire Hills Development. These requirements include stream protection, detention, water quality, and erosion control. The allowable runoff specified for detention facilities in Section 5608 is intended to manage maximum storm water release rates to minimize flooding while the water quality aspect of a basin addresses impacts on downstream erosion and the environment.

The Comprehensive Control Strategy provided the basis for design of the onsite shared detention basin. The discharge rates set forth by the APWA, shown in 2.5 are based on the area treated. The analysis also includes water quality, extended detention, and erosion and sediment control.

2.2 Flood Plain

The Federal Emergency Management Agency (FEMA) Flood Boundary and Floodway Map Community Panel Number 2909C0430G classifies all portions of Wilshire Hills as Zone X, area of minimal flood hazard. Portions immediately downstream of the Wilshire Hills property are classified as Zone A with a 1% annual chance of flooding along the creek. The referenced FEMA map is available in Appendix A.

2.3 Soils

Soil maps published by the Natural Resources Conservation Service (NRCS) Web Soil Survey were used to categorize soils located at Wilshire Hills as well as the watershed analysis area. The following table displays the map of soils on the property as well as their hydrological soil group. Appendix A contains the full soil map as well as the soil classifications.

Table 2: Wilshire Hills Soil Classifications

Soil Type	Hydrological Soil Group	Acres	Percent
Greenton-Urban land complex, 5-9 percent slopes	D	4.5	24.4%
Sibley silt loam, 2-5 percent slopes	C	0.2	0.9%
Greenton silty clay loam, 5 to 9 percent slopes	C/D	13.9	74.7%
	Totals for Area of Interest	18.6	100%

Table 3 is a scaled representation of the soil classifications for the entirety of May Brook Creek Watershed.

Table 3: May Brook Creek Soil Classifications

Soil Type	Hydrological Soil Group	Acres	Percent
Greenton-Urban land complex, 5-9 percent slopes	D	277.9	56.7
Sibley-Urban land complex, 2-5 percent slopes	C	133.8	27.3
Other (less than 10%)	C/D	78.4	16.0
	Totals for Area of Interest	490.2	100%

2.4 Comprehensive Basin Analysis

The detention basin was designed to match the Lee's Summit Comprehensive Basin requirements. Section 7B shown on page C2.20 in Appendix E shows the area west of the site which currently flows onto Wilshire Hills. The basin has been sized to allow this offsite pass through.

The detention basin follows the KC-APWA 5600 requirements that limit the allowable discharge based on the size of the site. The offsite passthrough was added to the allowed rate to maintain the flow requirements. The following calculations and table analyze the design of the APWA Detention Basin.

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

Table 5: Basin Discharge Rates

Design Storm	Rate (cfs) Allowable per Acre per APWA	Area Served (acres)	Maximum Site Rate (cfs)	Offsite Pass Through (cfs)	**Total Allowed Basin Discharge (csf)**	**Provided Basin Discharge (cfs)**	Basin Elevation
50% (2-yr)	0.5	19.0	9.50	8.05	**17.55**	**16.25**	917.14
20% (10-yr)	2.0	19.0	38.0	17.6	**55.60**	**48.60**	918.99
1% (100-yr)	3.0	19.0	57.0	32.34	**89.34**	**89.20**	921.00

The basin meets all Comprehensive Control Requirements for extended detention and the allowable flat rate discharge rates for the 2-, 10-, or 100-year storms. Additionally, the 2-yr, 10yr, and 100-yr storms have reduced the post developed peak discharge rate of May Brook Creek at Study Point 1 to less than the predeveloped rate.

The basin has been sized to match KC-APWA 5600 water quality requirements. Appendix C contains calculations displaying the use of basin stage elevations to calculate the water quality volume required from the runoff calculation. Based on the designed basin stage elevations, the required water quality volume is 48,607 ft^3. The water quality orifice was sized at 4.5 inches.

The water quality elevation was 915.5. The basin was designed to hold the water quality storm for the 40-hour detention period. This will include the first flush which helps filtrate out the majority of the sediment and trash accumulation.

An emergency 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 E includes weir calculations that indicate the 100-year flow through the spillway when the outfall control structure is completely blocked 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.

The 100-year level of rise in the basin is 921.00. The emergency spillway is 921.5, 6-inches above the 100 year elevation. The clogged water surface elevation with 100% of the 100-year storm passing the emergency spillway is 922.18, a depth of 0.68 feet. The top of dam is 923.2, providing over one foot of freeboard. See Appendix D.

2.5 Downstream Analysis

To confirm that the development did not have an adverse effect on May Brook Stream, a downstream analysis was conducted. Stormwater models were created for the 2-. 10- and 100- year storm to

determine the effect on the development on May Brook Creek. Figure 1 shows the watershed, May Brook Creek, Wilshire Hills, and Study Point 1. The confluence points of the North end of Wilshire Hills and the upper 490.2-acre watershed.

This analysis includes 490.2 acres of the May Brook Creek watershed. The study point used was the end of the restored stream on the northern property line of Wilshire Hills. This point is approximately 3,000 ft upstream of Lakewood Lake East. The 19 acres of the Wilshire Hills development is approximately 4% of the watershed.

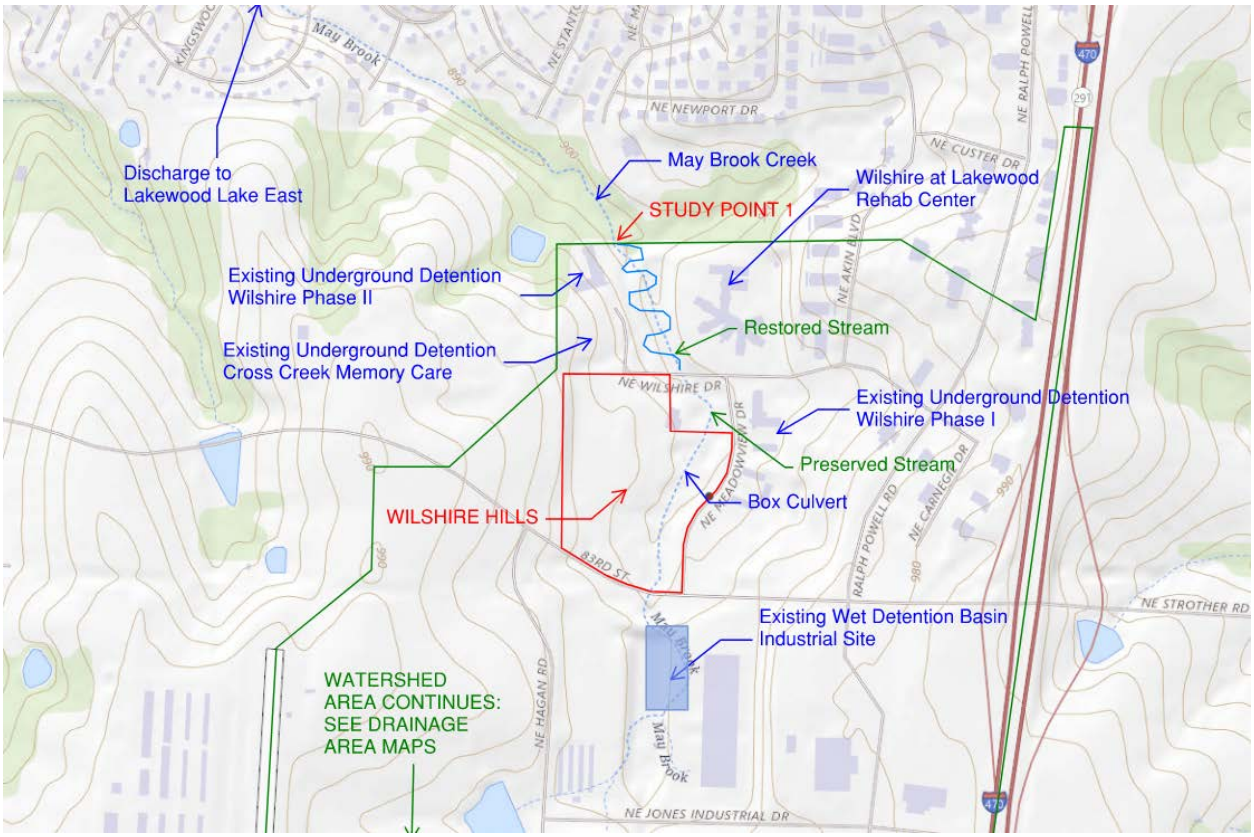


Figure 1: Location Map

2.5.1 Existing Conditions

The Wilshire Hills development site analyzed with this study includes 19.0 contributing acres separated by NE Meadowview Drive to the east, Strother Road to the south, NE Wilshire Drive to the North, and industrial property to the west. The system was analyzed both locally as well as a part of a downstream analysis. To analyze the impact of the proposed Wilshire Hills Development, we first have to model the predeveloped assumptions of the site prior to the development of Wilshire Hills in 2006. The following describes the existing watershed, history of development, and methods used to develop the predevelopment model.

Due to downstream flooding and sedimentation issues, the study point of the downstream analysis, shown in Figure 1, is the edge of the Wilshire Hills development. The area contained upstream of this point includes 490.2 acres of May Brook Creek watershed.

The May Brook Creek watershed contains residential, commercial, and industrial development. The south side of the drainage area is composed of Lee's Summit Airport and a large industrial area. The airport mainly consists of concrete with a large amount of grass but has no detention. The industrial area is served by a large detention pond. This detention offsets the peak storm with the large volume of water contained before being released into the culvert under Strother Road. This detention pond is modeled as a reach in the hydraflow analysis.

Before 2006, May Brook Creek was an incised natural and manmade stream that bisected Wilshire Hills past an above ground detention pond at Lakewood Rehab Center. It discharged out of the detention basin into the existing stream approximately 3000 ft upstream of Lakewood Lake East.

The following table outlines the existing conditions for the May Brook Creek Watershed. See Appendix E for the full report. Appendix E has the pre drainage area map C2.19 that showcases each area and its associated curve number and time of concentration. These curve numbers were calculated using aerial images to measure impervious areas. The Time of concentrations were calculated using contours as well as street photos to analyze slope and water movement.

Table 1: May Brook Creek Watershed Pre-Development to Study Point 1

Section	Area (acres)	Curve Number	Time of Concentration (min)	Q 2-yr (cfs)	Q 10-yr (cfs)	Q 100-yr (cfs)
1	81.7	77	24.3	111.0	228.55	403.79
2	68.0	77	25.3	92.38	190.22	336.08
3	100.8	82	30.2	162.30	306.37	512.72
4	82.5	88	30.7	159.01	273.45	431.92
5	86.9	85	15.6	221.05	394.04	636.00
6	11.3	91	18.6	32.72	53.70	82.47
7	59.0	89	25.2	134.69	227.73	355.97
Total	490.02			660.85	1263.54	2145.77

2.5.2 Proposed Conditions

Post 2006, Wilshire Hills Development has seen new development and changes to the existing conditions. May Brook Creek was enclosed into an 850-foot-long Box Culvert with a large energy dissipator at the outlet. The detention basin for Lakewood Rehab Center was removed and replaced with a restored meandering stream and floodplain.

In addition, Wilshire Hills Phase II and the Cross Creek Memory Care facilities were constructed with underground detention. The underground detention basins impact 8.07 acres and are not modeled in the study. Appendix E contains the Post Drainage Area Map on page C2.20 which outlines the improvements to the Wilshire Hills watershed since 2006.

Wilshire Hills Phase III and associated public improvements are the next phase in completing the development of Wilshire Hills. Public improvement to the site includes the extension of Wilshire Drive, looping the water main, mass grading, as well as sanitary and electric extensions to serve Willshire Hills Phase III.

Future development has been planned for with the extension of public utilities, construction of NE Wilshire Drive, and the detention basin being sized for future development. The current PDP plan calls for commercial and office development for the remaining lots. Impervious areas have been approximated for each area and can be found in Table 8 in Section 2.9 of this report. As development occurs, the constructed impervious will be subtracted from the total for the basin ensuring all 19 acres will be treated.

The basemap for the predeveloped watershed can be found in Appendix E page C2.19. The curve numbers were calculated using the aerial image as well as soil maps found in Appendix A and section 2.4 in this report. The times of concentration were calculated using the aerial image and contours. The calculations for both curve numbers and time of concentration can be found in Appendix E. The calculations are located in Appendix E. Table 4 includes the areas May Brook Creek Watershed was divided into as well as the associated curve number and time of concentration. The predevelopment flow rate is listed for the 2-, 10-, and 100-yr storm.

Table 4: May Brook Creek Watershed Post-Development to Study Point 1 (no detention)

Section	Area (acres)	Curve Number	Time of Concentration (min)	Q 2-yr (cfs)	Q 10-yr (cfs)	Q 100-yr (cfs)
1	81.7	77	24.3	111.0	228.55	403.79
2	68.0	77	25.3	92.38	190.22	336.08
3	100.8	82	30.2	162.30	306.37	512.72
4	82.5	88	30.7	159.01	273.45	431.92
5	86.9	85	15.6	221.05	394.04	636.00
6	11.3	91	18.6	32.72	53.70	82.47
7A	19.9	89	19.3	54.00	91.08	142.13
7B	7.5	65	20.5	5.01	14.26	29.71
7C	19.0	92	9.3	76.22	122.92	185.23
Lot 5	2.54	86	20.60	5.14	9.08	14.58
Northeast	5.37	86	15.3	14.19	24.92	39.85
West	3.2	86	12.4	9.67	10.96	27.10
Southwest	1.6	91	6.6	6.24	10.19	15.60
Southeast	6.27	91	7.1	24.46	39.93	61.12
Bypass	0.25	75	30.7	0.27	0.57	1.03
8	12.6	90	23.9	29.76	49.61	76.90
Total	490.2			603.42	1200.342	2072.34

2.5.3 Downstream Analysis

Due to the location within the watershed, and the known Lakewood Lake East sedimentation and flooding issues, the basin has been inserted into a downstream analysis. The detention basin meets the flat rate discharge requirements set by KC-APWA 5600. The following text and Appendices provide analysis and the supporting data for this analysis.

The 490.2 acres of May Brook Creek analyzed for the downstream analysis includes one large above ground detention basin and three below ground detention basins. When analyzing peak flows for the watershed, it is important to remember that the time of concentration for flow through the underground basins is negated to zero. The above ground detention in the industrial area south of Strother was included in the Hydraflow report as a reach. The following table details the sections, shown on page C2.20.

The detention basin was designed to match the flat rate discharge delays of the peak discharge rate from Wilshire Hills to closely match the peak rate time in the watershed as well as match water quality standards. Therefore, the basin discharges earlier, ahead of the watershed peak. This earlier discharge provides a lower 100-year discharge rate for the downstream analysis.

Table 7: Downstream Analysis at Study Point 1

	Pre-Developed	Post –Detention Basin
	2-year Storm	
Time to Peak (min)	732	738
Peak Flow (cfs)	660.85	603.42
	10-year Storm	
Time to Peak (min)	732	736
Peak Flow (cfs)	1263.54	1200.34
	100-year Storm	
Team to Peak (min)	732	736
Peak Flow (cfs)	2145.77	2072.34

2.6 Final Design Summary

The designed detention basin reduces post development discharge to the level of the AWPA Comprehensive Control Strategy limit. The Comprehensive control strategy parameters and KC-APWA Section 5608.4 requirement of 40 hour extended detention for water quality have been met by the basin design. The basin has also been analyzed to ensure it has no adverse impact to the May Brook Creek Watershed at Study Point 1.

The following table provides the allowed impervious acreage for each site in the planned development. The current PDP plan shows future lot uses as commercial and office development. The designed amount of impervious as well as curve numbers will ensure future developments are treated by the water quality basin. As impervious area is developed, it will be subtracted from the overall total of the development.

Table 8: Allowed Impervious Area for Future Development in Wilshire Hills

Wilshire Hills	**Total Area (acres)**	**Designed Imperious (acres)**	**Designed CN**	**Current Impervious (acres)**	**Remaining Impervious (acres)**
Lot 5 (Wilshire Hills III + Bypass)	2.54	1.25	86	1.18	0.07
Northeast Area (includes Lot 6)	5.37	2.70	86	0.0	2.70

West Area	3.2	1.65	86	0.82	0.83
Southwest Area	1.6	1.12	91	0.2	0.92
Southeast Area	6.27	4.57	91	0.09	4.48
Total	**19**	**11.29**	**89**	**2.29**	**9.0**

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 F includes HydraFlow storm sewer calculations. The calculations are based on the Storm Sewer Drainage Area Map in Appendix G. Pipes have been sized to convey the offsite bypass calculated for the detention analysis.

The outfall control structure for the water quality basin is covered by a large grade to prevent debris from entering the structure. The low flow orifice is outfitted with a perforated pipe to prevent clogging. The 10" pipe exits the structure at 90° before bending vertically. The pipe has a cap both on the top of its vertical bend as well as the entrance to the structure wall. The cap inside of the control structure has a 4.55" orifice drilled into it. This restricts the flow to the required water quality storm while providing protection from clogging.

4 EROSION AND SEDIMENT CONTROL AND 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 B includes erosion and sediment control storage calculations. The outfall control structure must be wrapped in filter fabric to an elevation of 919.0 according to these calculations.

Per the city of Lee's Summit, the water quality 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 development 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 riprap 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 provide 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 have been included in Appendix B.

The restored portion of May Brook Creek, north of Meadowview Drive and South of Meadowview to the end of the box culvert falls within the requirements of the KC-APWA Section 5605.3 Stream Preservation and Buffer Zones. A stream buffer has been outlined from the Ordinary High-Water Mark and extended onto the site. Part of the platting process for this site development ensured that the stream buffer became a permanent boundary protecting this area from future development. This meander of stream as well as the restored portion north of Meadowview Drive benefit May Brook Creek with water quality enhancement as well as slowing peak flows to reduce the downstream impact. No impact to this stream buffer will occur during development.

5 CONCLUSION

This hydraulic analysis was completed to evaluate the impact generated by the public improvements and future site development for Wilshire Hills. The project includes 19 acres of development including both commercial and residential living. The detention basin meets the Lee's Summit Comprehensive Control Strategy for stormwater management. Therefore, the basin provides the required water quality and meets the runoff reduction standards based on site area. Additional analysis shows the site does not have an adverse impact on the May Brook Creek watershed.

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.

APPENDIX A:
MAPS

National Flood Hazard Layer FIRMette

FEMA

94°22'20"W 38°58'29"N

94°21'43"W 38°58'1"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Basemap Imagery Source: USGS National Map 2023

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 1/30/2024 at 5:37 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

Map Scale: 1:2,260 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 30 60 120 180

Feet: 0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 15N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Jackson County, Missouri
Survey Area Data: Version 25, Aug 22, 2023

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 30, 2022—Sep 8, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
10024	Greenton-Urban land complex, 5 to 9 percent slopes	4.5	24.4%
10132	Sibley silt loam, 2 to 5 percent slopes	0.2	0.9%
30080	Greenton silty clay loam, 5 to 9 percent slopes	13.9	74.7%
Totals for Area of Interest		**18.6**	**100.0%**

Soil Map—Jackson County, Missouri
(Wilshire Hills Public Improvements)

Map Scale: 1:10,900 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 150 300 600 900

Feet
0 500 1000 2000 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 15N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Jackson County, Missouri
Survey Area Data: Version 25, Aug 22, 2023

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 30, 2022—Sep 8, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
10024	Greenton-Urban land complex, 5 to 9 percent slopes	242.9	56.7%
10132	Sibley silt loam, 2 to 5 percent slopes	33.7	7.9%
10136	Sibley-Urban land complex, 2 to 5 percent slopes	117.1	27.3%
10143	Snead-Urban land complex, 9 to 30 percent slopes	2.8	0.6%
30080	Greenton silty clay loam, 5 to 9 percent slopes	32.1	7.5%
Totals for Area of Interest		**428.6**	**100.0%**

Approximate AOI used- actual watershed area = 490.2 acres
Acres/ Percent Scaled to remain similar

Jackson County, Missouri

10024—Greenton-Urban land complex, 5 to 9 percent slopes

Map Unit Setting

National map unit symbol: 2qky4
Elevation: 800 to 1,100 feet
Mean annual precipitation: 33 to 41 inches
Mean annual air temperature: 50 to 55 degrees F
Frost-free period: 177 to 220 days
Farmland classification: Not prime farmland

Map Unit Composition

Greenton and similar soils: 60 percent
Urban land: 40 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Greenton

Setting

Landform: Hillslopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Concave, convex
Parent material: Loess over residuum weathered from limestone and shale

Typical profile

A - 0 to 16 inches: silty clay loam
Bt1 - 16 to 26 inches: silty clay loam
2Bt2 - 26 to 80 inches: silty clay

Properties and qualities

Slope: 5 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 12 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: D

Ecological site: R109XY002MO - Loess Upland Prairie
Other vegetative classification: Grass/Prairie (Herbaceous Vegetation)
Hydric soil rating: No

Description of Urban Land

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Across-slope shape: Concave, convex

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: No

Data Source Information

Soil Survey Area: Jackson County, Missouri
Survey Area Data: Version 25, Aug 22, 2023

Jackson County, Missouri

10136—Sibley-Urban land complex, 2 to 5 percent slopes

Map Unit Setting

National map unit symbol: 2ql0j
Elevation: 720 to 1,440 feet
Mean annual precipitation: 33 to 41 inches
Mean annual air temperature: 49 to 55 degrees F
Frost-free period: 155 to 220 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Sibley and similar soils: 60 percent
Urban land: 35 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sibley

Setting

Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loess

Typical profile

A - 0 to 17 inches: silt loam
Bt - 17 to 65 inches: silty clay loam
C - 65 to 80 inches: silt loam

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 12.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C

Ecological site: R107XB002MO - Deep Loess Upland Prairie
Other vegetative classification: Grass/Prairie (Herbaceous Vegetation)
Hydric soil rating: No

Description of Urban Land

Setting

Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Across-slope shape: Convex

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: No

Minor Components

Macksburg

Percent of map unit: 5 percent
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R108XD860IA - Loess Upland Prairie
Hydric soil rating: No

Data Source Information

Soil Survey Area: Jackson County, Missouri
Survey Area Data: Version 25, Aug 22, 2023

Jackson County, Missouri

30080—Greenton silty clay loam, 5 to 9 percent slopes

Map Unit Setting

National map unit symbol: 2xjd9
Elevation: 640 to 1,120 feet
Mean annual precipitation: 35 to 41 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 177 to 209 days
Farmland classification: Not prime farmland

Map Unit Composition

Greenton and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Greenton

Setting

Landform: Hillslopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loess over residuum weathered from limestone and shale

Typical profile

Ap - 0 to 12 inches: silty clay loam
Bt - 12 to 28 inches: silty clay
2Bt - 28 to 30 inches: silty clay
2C - 30 to 79 inches: silty clay

Properties and qualities

Slope: 5 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 12 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 9.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C/D
Ecological site: R109XY002MO - Loess Upland Prairie
Hydric soil rating: No

Minor Components

Sampsel

Percent of map unit: 10 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: R109XY002MO - Loess Upland Prairie
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Jackson County, Missouri
Survey Area Data: Version 25, Aug 22, 2023

APPENDIX B:
EROSION AND SEDIMENT CONTROL CALCULATIONS

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

Project: Wilshire Hills Public Improvements - Erosion Control

Date: 3/27/2024

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	2360	0
913	13600	8370
914	15500	22900
915	17500	39400
916	19500	57900
917	21900	79600
918	23800	101500
919	26500	126700
920	30000	154900

40,680 CF of sediment storage is provided at an elevation of 915. The outfall structure must be wrapped with filter fabric below this elevation.

Engineering Surveys & Services
DELIVERING YOUR VISION ™

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

Project: Wilshire Hills Phase III Date: 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 ✓

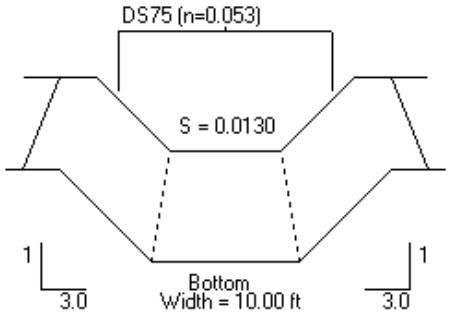
3) SOUTH of Basin outfall pipe (NE Manhatten Terrace)
   - DISTURBED AREA: 1.53 Acres
   - SILT FENCE LENGTH: 634 feet
   - RATIO: 1.53/634 = 0.0024 ✓

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 ✓

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 / Staple Pattern	Stability Analysis	Vegetation Characteristics				Permissible Shear Stress (psf)	Calculated Shear Stress (psf)	Safety Factor	Remarks
			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
****

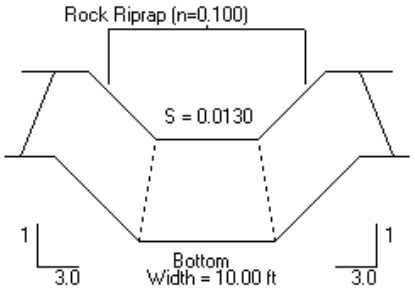
Initial Depth Estimate = 0.16 * (13.4 /(0.013^0.5))^0.375 = 0.96 ft (.29 m)
Final Channel Depth (after 9 iterations) = .58 ft (0.18 m)
Flow Area = (10.0 * 0.6)+(0.5 *0.58^2 * (3.0+3.0)) = 6.7 sq.ft (0.6 m^2)
Wet Per. =10.0 +(0.6*(((3.0^2)+1)^.5 +((3.0^2)+1)^.5)) = 13.6 ft (4.2 m)
Hydraulic Radius = (6.7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

"

HYDRAULIC RESULTS

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



Not to Scale

LINER RESULTS

Reach	Matting Type / Staple Pattern	Stability Analysis	Vegetation Characteristics				Permissible Shear Stress (psf)	Calculated Shear Stress (psf)	Safety Factor	Remarks
			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
****

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

"

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
"

APPENDIX C:
WATER QUALITY

Engineering Surveys & Services
DELIVERING YOUR VISION ™
1113 Fay St
Columbia, MO 65201
www.ess-inc.com
573-449-2646

Channel Protection & Water Quality - Basin Elevations

Development Name: **Wilshire Hills Phase III Public Improvements**
Location: **Lee's Summit, MO**
Date: **March 27, 2024**
Project No: **15925**

Basin Stage Elevations

Elevation	Area (SF)	Storage (CF)
911.7		
911.7	0	0
911.7	0	0
912		343
913		8,305
914		22,879
915		39,366
916		57,851
917		78,417

WQv = 48,607 CF (from calculation)

Elevation of WQv:

$$\frac{918 - 917}{56{,}048 - 41{,}292} = \frac{918 - X}{56{,}048 - 48{,}607}$$

X = WQv Elevation = 915.50

Engineering Surveys & Services
DELIVERING YOUR VISION ™
1113 Fay St
Columbia, MO 65201
www.ess-inc.com
573-449-2646

Water Quality Protection Volume Calculation (WQ_v)

Development Name: **Wilshire Hills Phase III Public Improvements**
Location: **Lee's Summit, MO**
Date: **March 27, 2024**
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	60%	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	0.59		
UnReduced WQ_V	**1.116**	**ac-ft**	
Reduced WQ_V	**1.116**	**ac-ft**	

Reduced WQ_V **48,607** **ft^3**

Engineering Surveys & Services
DELIVERING YOUR VISION ™

1113 Fay St
Columbia, MO 65201
www.ess-inc.com
573-449-2646

Water Quality - Orifice Sizing

Development Name: **Wilshire Hills Phase III Public Improvements**
Location: **Lee's Summit, MO**
Date: **February 6, 2024**
Project No: **15925**

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

H_{max} = 3.80 (ft)

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

CPv= 48,607 CF (from GA Review Tool Spreadsheet)

Q_{avg} = 0.56 CFS

$Q_{max} = Q_{avg} \times 2$ = 1.13 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 = 0.11988 SF

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

d = orifice diameter = 0.39 ft.

d = orifice diameter = 4.69 in.

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

APPENDIX D:
EMERGENCY SPILLWAY

Weir Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Mar 28 2024

Wilshire Hills Water Quality Basin

Rectangular Weir

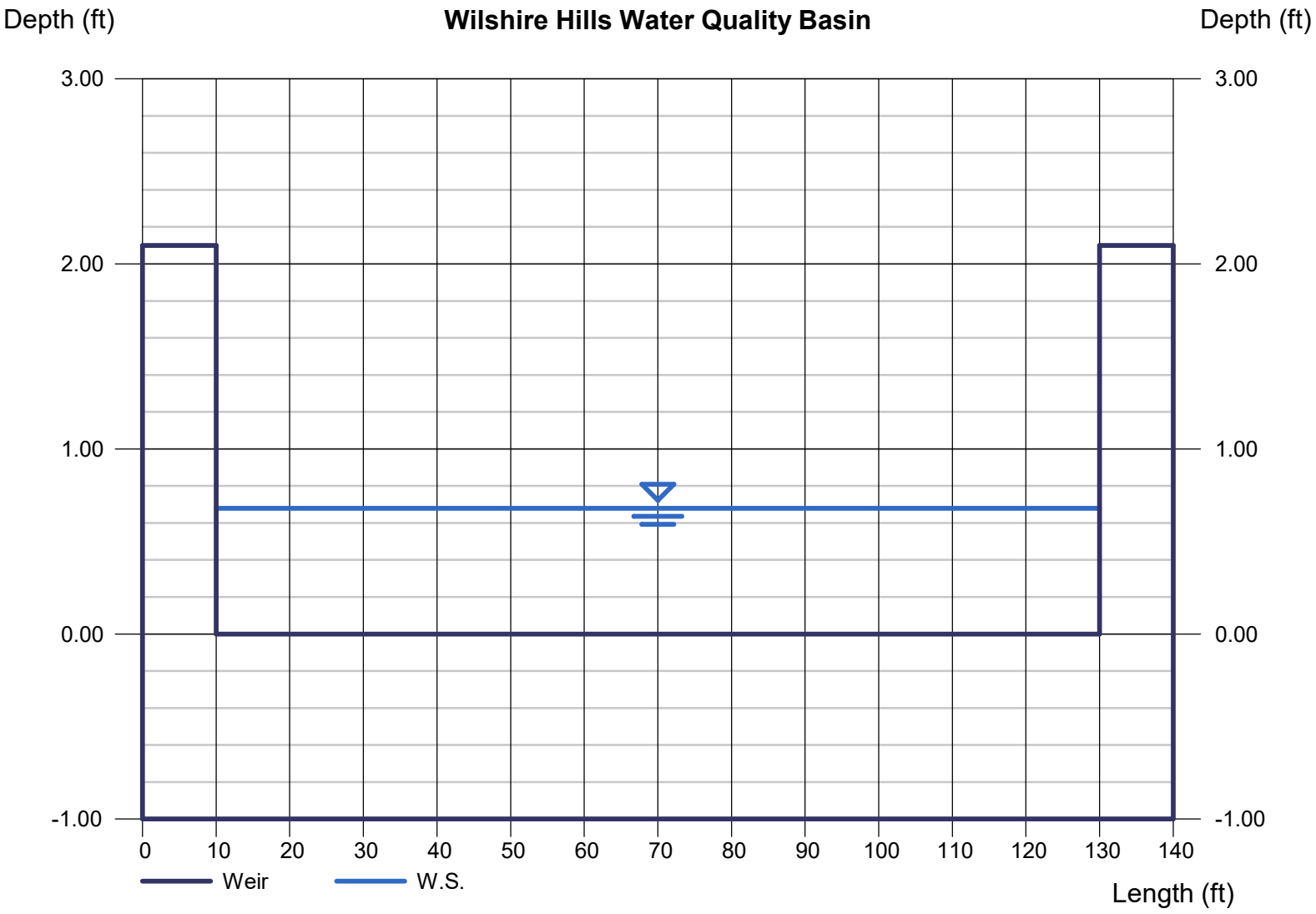
Crest	= Broad
Bottom Length (ft)	= 120.00
Total Depth (ft)	= 2.10

Calculations

Weir Coeff. Cw	= 2.60
Compute by:	Known Q
Known Q (cfs)	= 174.65

Highlighted

Depth (ft)	= 0.68
Q (cfs)	= 174.65
Area (sqft)	= 81.49
Velocity (ft/s)	= 2.14
Top Width (ft)	= 120.00



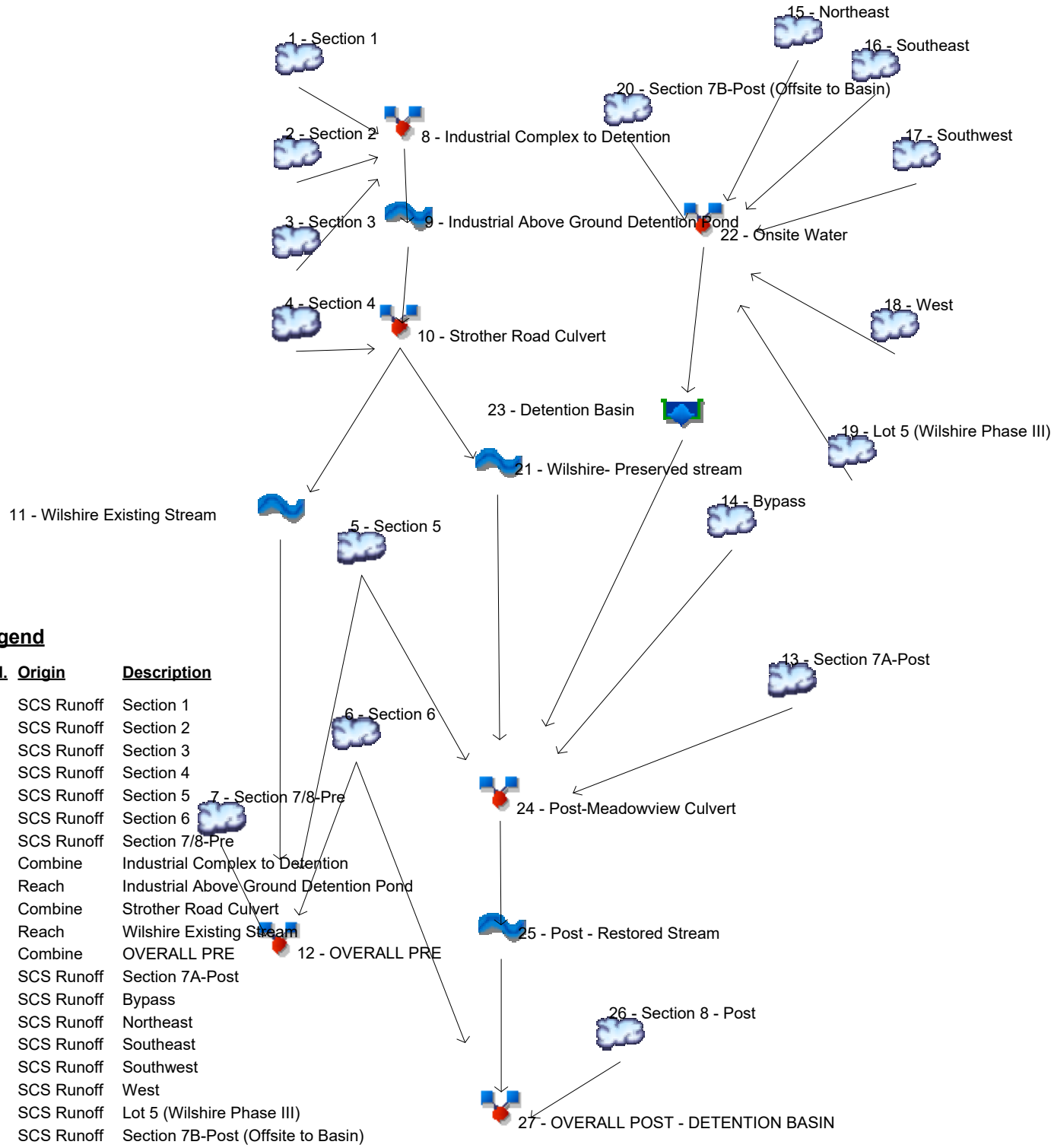
APPENDIX E:
COMPREHENSIVE BASIN & DOWNSTREAM BASIN ANALYSIS

Hydraflow Table of Contents

10 - Year

100 - Year

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 7/8-Pre
8	Combine	Industrial Complex to Detention
9	Reach	Industrial Above Ground Detention Pond
10	Combine	Strother Road Culvert
11	Reach	Wilshire Existing Stream
12	Combine	OVERALL PRE
13	SCS Runoff	Section 7A-Post
14	SCS Runoff	Bypass
15	SCS Runoff	Northeast
16	SCS Runoff	Southeast
17	SCS Runoff	Southwest
18	SCS Runoff	West
19	SCS Runoff	Lot 5 (Wilshire Phase III)
20	SCS Runoff	Section 7B-Post (Offsite to Basin)
21	Reach	Wilshire- Preserved stream
22	Combine	Onsite Water
23	Reservoir	Detention Basin
24	Combine	Post-Meadowview Culvert
25	Reach	Post - Restored Stream
26	SCS Runoff	Section 8 - Post
27	Combine	OVERALL POST - DETENTION BASIN

Hydrograph Return Period Recap

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

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	------	-------	111.00	-------	-------	228.55	-------	-------	403.79	Section 1
2	SCS Runoff	------	-------	92.38	-------	-------	190.22	-------	-------	336.08	Section 2
3	SCS Runoff	------	-------	162.30	-------	-------	306.37	-------	-------	512.72	Section 3
4	SCS Runoff	------	-------	159.01	-------	-------	273.45	-------	-------	431.92	Section 4
5	SCS Runoff	------	-------	221.05	-------	-------	394.04	-------	-------	636.00	Section 5
6	SCS Runoff	------	-------	32.72	-------	-------	53.70	-------	-------	82.47	Section 6
7	SCS Runoff	------	-------	134.69	-------	-------	227.73	-------	-------	355.97	Section 7/8-Pre
8	Combine	1, 2, 3,	-------	365.68	-------	-------	722.19	-------	-------	1243.39	Industrial Complex to Detention
9	Reach	8	-------	344.64	-------	-------	695.55	-------	-------	1211.21	Industrial Above Ground Detention Po
10	Combine	4, 9	-------	502.85	-------	-------	966.72	-------	-------	1643.13	Strother Road Culvert
11	Reach	10	-------	470.44	-------	-------	915.90	-------	-------	1570.20	Wilshire Existing Stream
12	Combine	5, 6, 7, 11	-------	660.85	-------	-------	1263.54	-------	-------	2145.77	OVERALL PRE
13	SCS Runoff	------	-------	54.00	-------	-------	91.08	-------	-------	142.13	Section 7A-Post
14	SCS Runoff	------	-------	0.266	-------	-------	0.570	-------	-------	1.034	Bypass
15	SCS Runoff	------	-------	14.19	-------	-------	24.92	-------	-------	39.85	Northeast
16	SCS Runoff	------	-------	24.46	-------	-------	39.93	-------	-------	61.12	Southeast
17	SCS Runoff	------	-------	6.241	-------	-------	10.19	-------	-------	15.60	Southwest
18	SCS Runoff	------	-------	9.666	-------	-------	16.96	-------	-------	27.10	West
19	SCS Runoff	------	-------	5.142	-------	-------	9.081	-------	-------	14.58	Lot 5 (Wilshire Phase III)
20	SCS Runoff	------	-------	8.054	-------	-------	17.60	-------	-------	32.34	Section 7B-Post (Offsite to Basin)
21	Reach	10	-------	478.83	-------	-------	933.75	-------	-------	1596.55	Wilshire- Preserved stream
22	Combine	15, 16, 17, 18, 19, 20,	-------	62.25	-------	-------	108.85	-------	-------	174.64	Onsite Water
23	Reservoir	22	-------	16.23	-------	-------	48.60	-------	-------	89.20	Detention Basin
24	Combine	5, 13, 14, 21, 23	-------	585.20	-------	-------	1161.71	-------	-------	2004.22	Post-Meadowview Culvert
25	Reach	24	-------	569.55	-------	-------	1138.21	-------	-------	1970.08	Post - Restored Stream
26	SCS Runoff	------	-------	29.76	-------	-------	49.61	-------	-------	76.90	Section 8 - Post
27	Combine	6, 25, 26	-------	603.42	-------	-------	1200.34	-------	-------	2072.34	OVERALL POST - DETENTION BASI

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

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	111.00	2	730	417,615	------	------	------	Section 1
2	SCS Runoff	92.38	2	730	347,587	------	------	------	Section 2
3	SCS Runoff	162.30	2	730	652,264	------	------	------	Section 3
4	SCS Runoff	159.01	2	732	687,904	------	------	------	Section 4
5	SCS Runoff	221.05	2	722	620,159	------	------	------	Section 5
6	SCS Runoff	32.72	2	724	104,234	------	------	------	Section 6
7	SCS Runoff	134.69	2	728	496,946	------	------	------	Section 7/8-Pre
8	Combine	365.68	2	730	1,417,466	1, 2, 3,	------	------	Industrial Complex to Detention
9	Reach	344.64	2	734	1,417,464	8	------	------	Industrial Above Ground Detention Po
10	Combine	502.85	2	734	2,105,367	4, 9	------	------	Strother Road Culvert
11	Reach	470.44	2	740	2,105,365	10	------	------	Wilshire Existing Stream
12	Combine	660.85	2	732	3,326,706	5, 6, 7, 11	------	------	OVERALL PRE
13	SCS Runoff	54.00	2	724	170,275	------	------	------	Section 7A-Post
14	SCS Runoff	0.266	2	734	1,196	------	------	------	Bypass
15	SCS Runoff	14.19	2	722	39,881	------	------	------	Northeast
16	SCS Runoff	24.46	2	718	57,836	------	------	------	Southeast
17	SCS Runoff	6.241	2	718	14,759	------	------	------	Southwest
18	SCS Runoff	9.666	2	720	25,136	------	------	------	West
19	SCS Runoff	5.142	2	726	17,754	------	------	------	Lot 5 (Wilshire Phase III)
20	SCS Runoff	8.054	2	732	33,757	------	------	------	Section 7B-Post (Offsite to Basin)
21	Reach	478.83	2	740	2,105,365	10	------	------	Wilshire- Preserved stream
22	Combine	62.25	2	720	189,123	15, 16, 17, 18, 19, 20,	------	------	Onsite Water
23	Reservoir	16.23	2	742	189,109	22	917.14	81,770	Detention Basin
24	Combine	585.20	2	734	3,086,111	5, 13, 14, 21, 23	------	------	Post-Meadowview Culvert
25	Reach	569.55	2	740	3,086,047	24	------	------	Post - Restored Stream
26	SCS Runoff	29.76	2	728	110,215	------	------	------	Section 8 - Post
27	Combine	603.42	2	738	3,300,498	6, 25, 26	------	------	OVERALL POST - DETENTION BASI

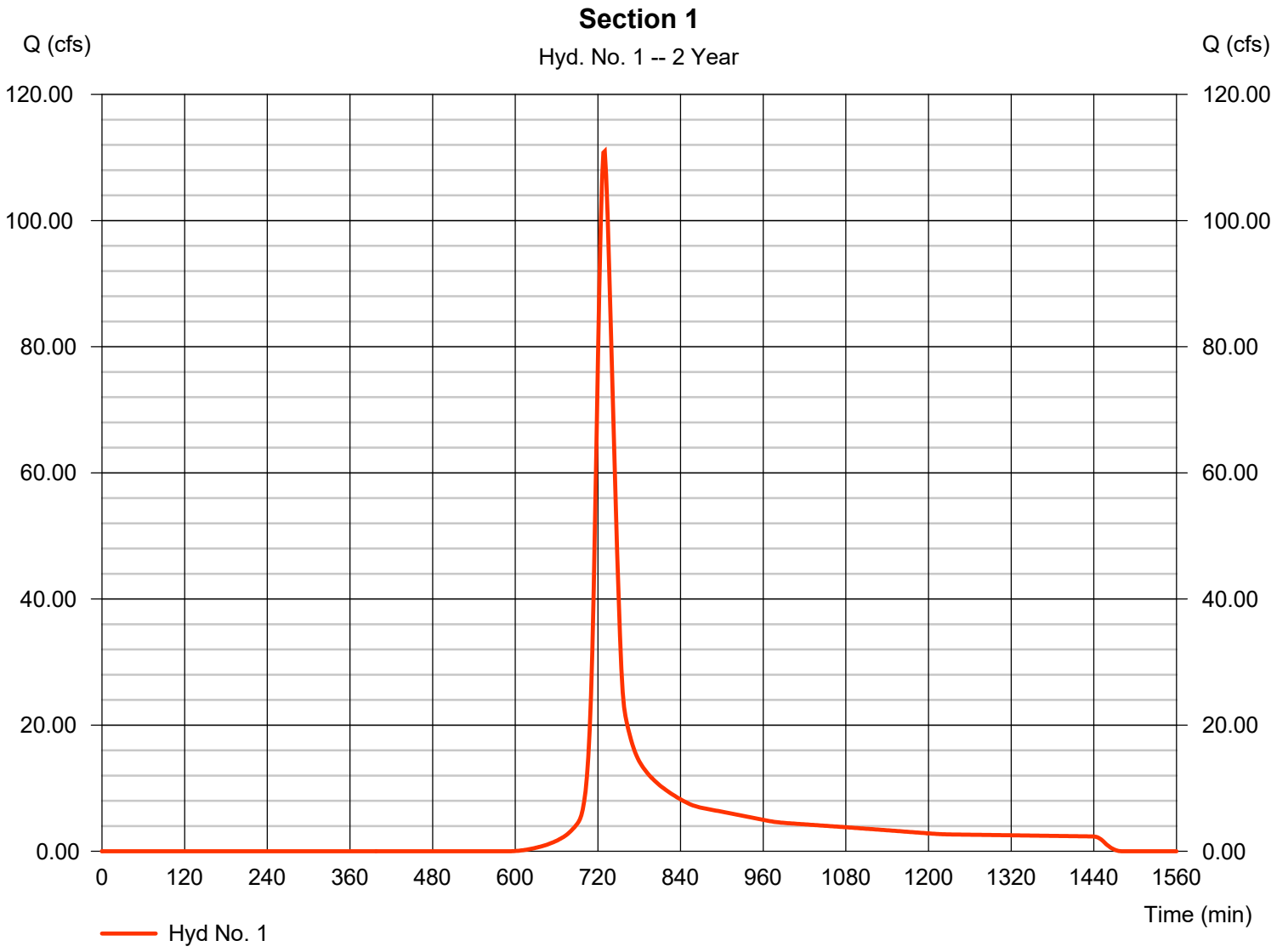
Hydrograph Report

Hyd. No. 1

Section 1

Hydrograph type	=	SCS Runoff	Peak discharge	=	111.00 cfs
Storm frequency	=	2 yrs	Time to peak	=	730 min
Time interval	=	2 min	Hyd. volume	=	417,615 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

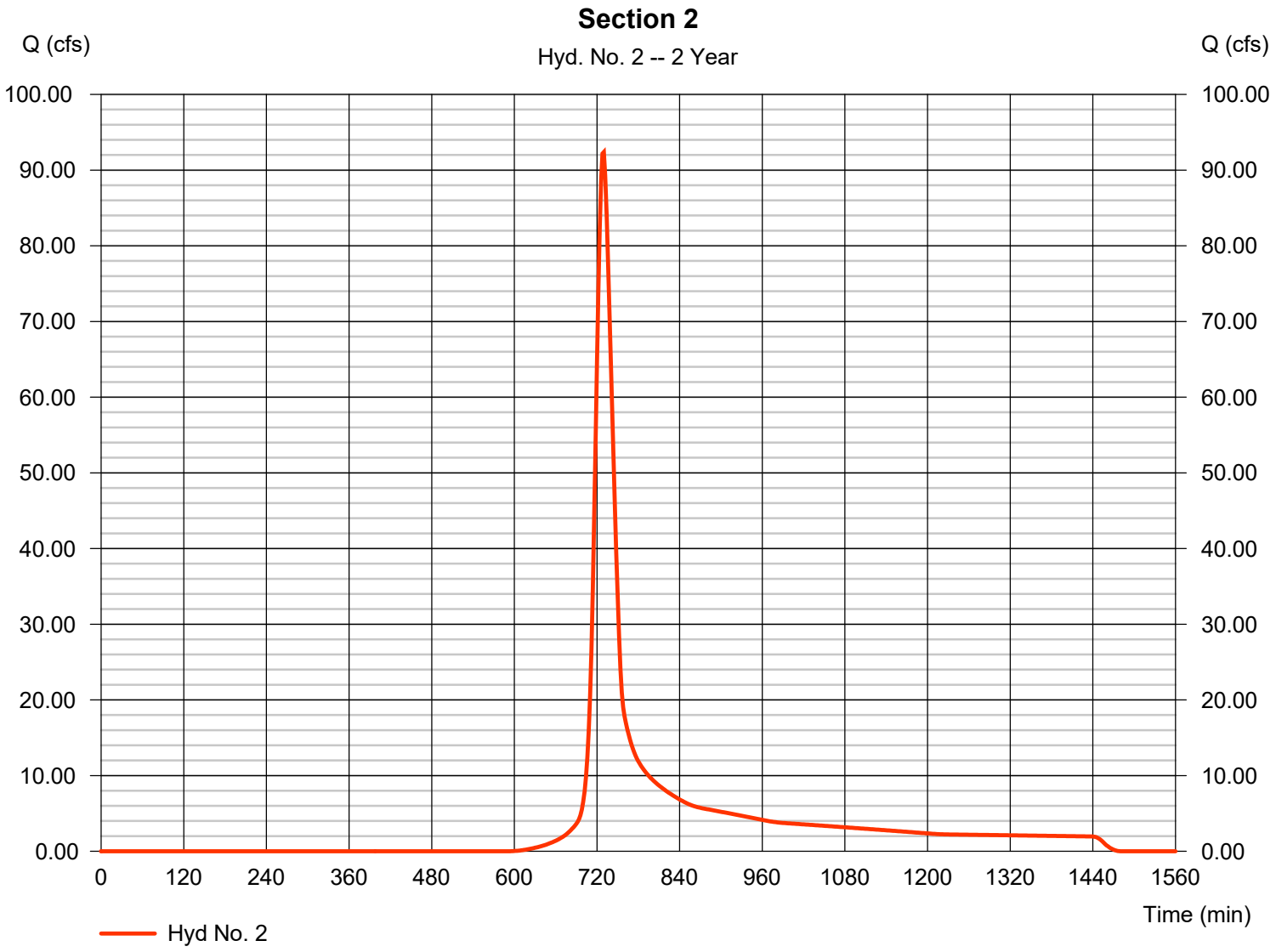
Hydrograph Report

Hyd. No. 2

Section 2

Hydrograph type	=	SCS Runoff	Peak discharge	=	92.38 cfs
Storm frequency	=	2 yrs	Time to peak	=	730 min
Time interval	=	2 min	Hyd. volume	=	347,587 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

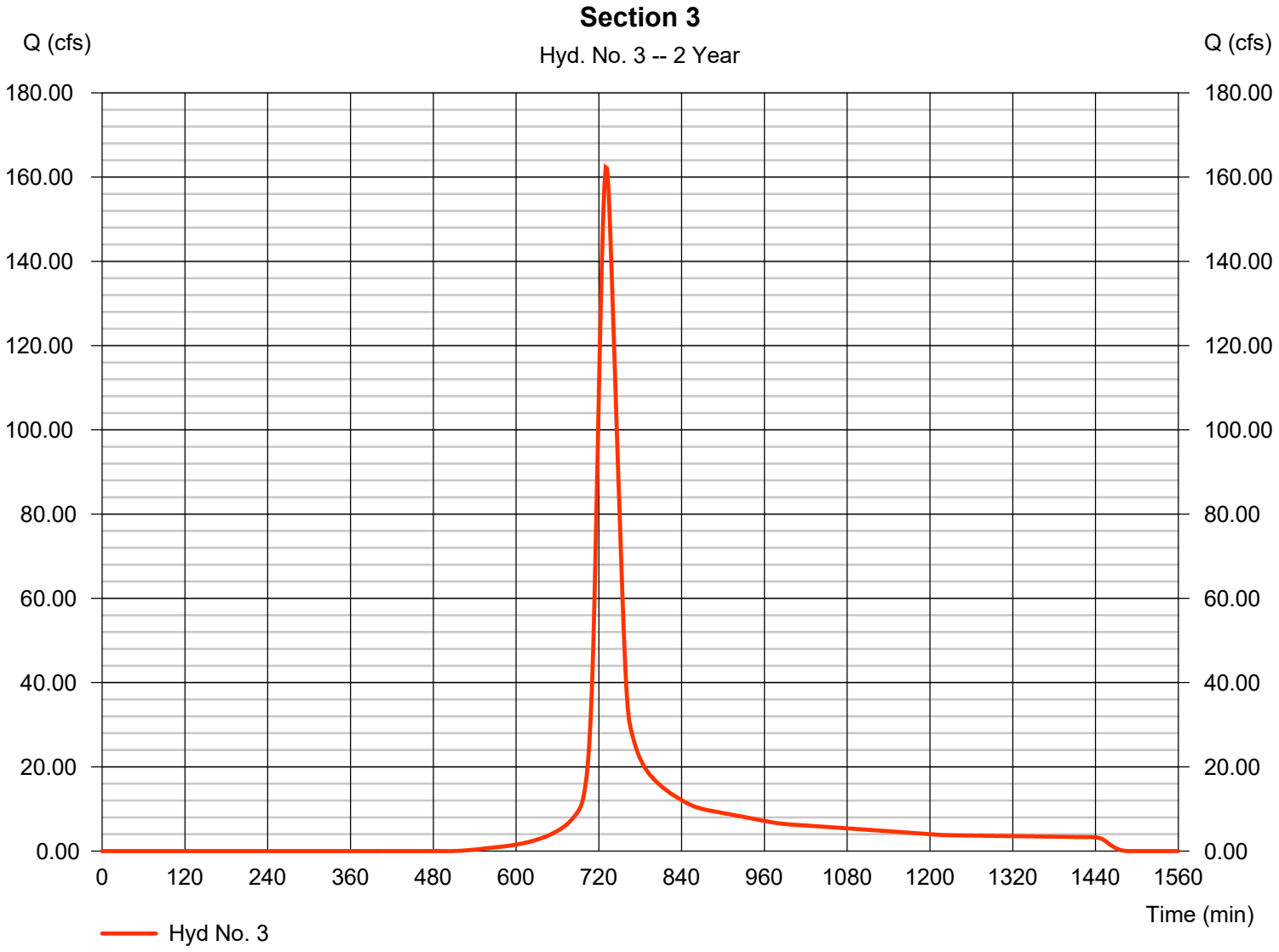
Hydrograph Report

Hyd. No. 3

Section 3

Hydrograph type	=	SCS Runoff	Peak discharge	=	162.30 cfs
Storm frequency	=	2 yrs	Time to peak	=	730 min
Time interval	=	2 min	Hyd. volume	=	652,264 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

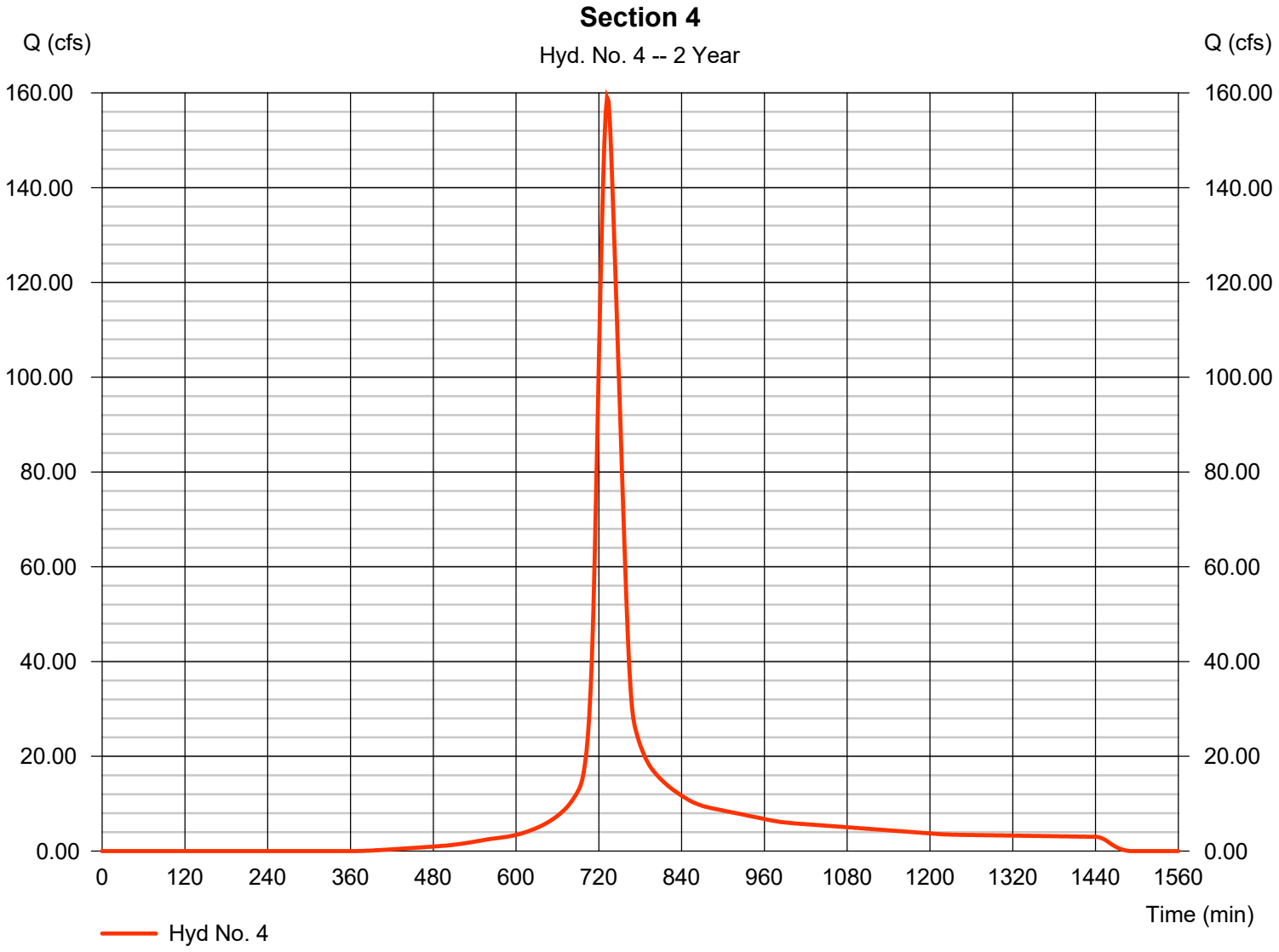
Hydrograph Report

Hyd. No. 4

Section 4

Hydrograph type	= SCS Runoff	Peak discharge	= 159.01 cfs
Storm frequency	= 2 yrs	Time to peak	= 732 min
Time interval	= 2 min	Hyd. volume	= 687,904 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

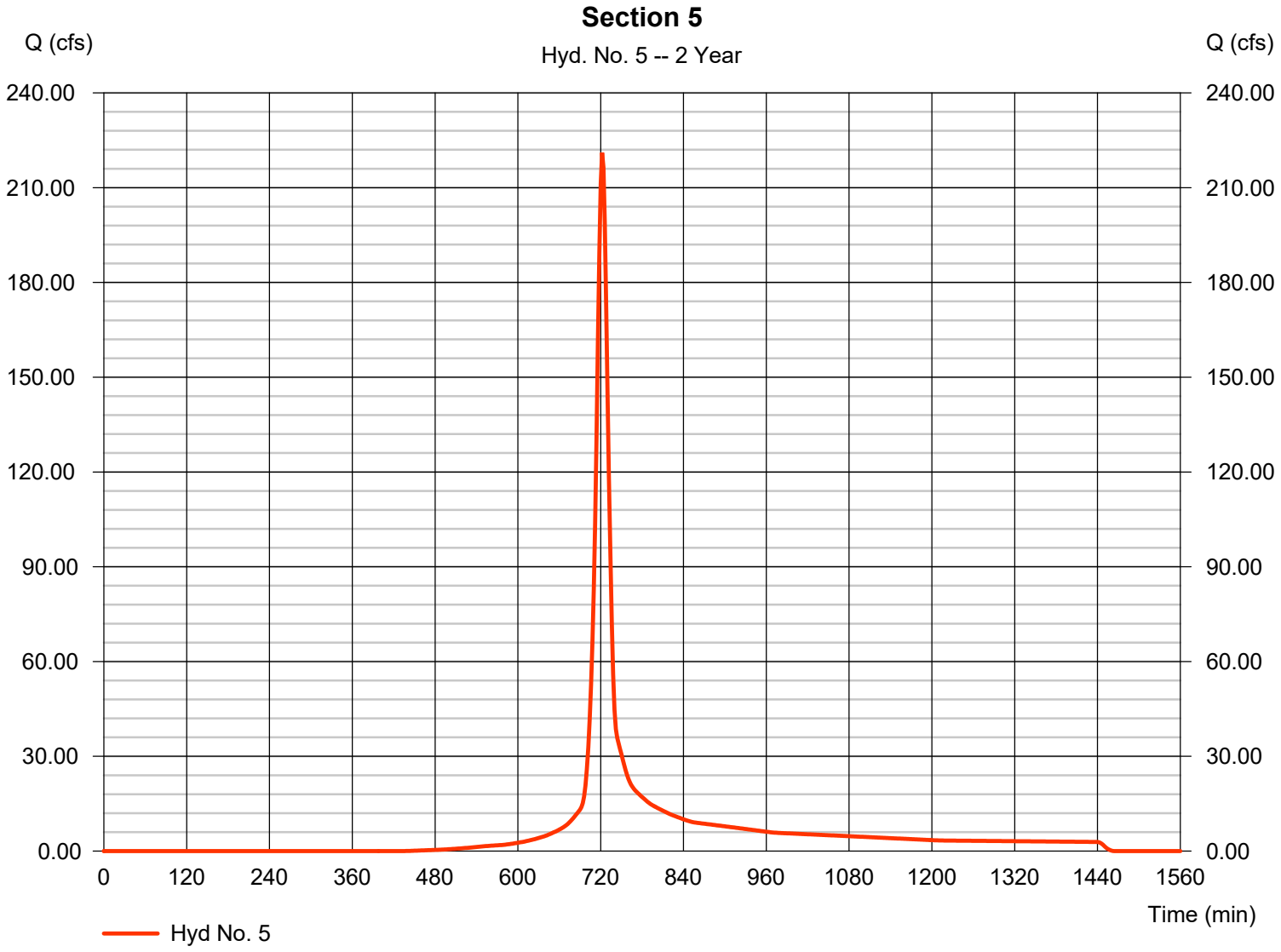
Hydrograph Report

Hyd. No. 5

Section 5

Hydrograph type	=	SCS Runoff	Peak discharge	=	221.05 cfs
Storm frequency	=	2 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	620,159 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

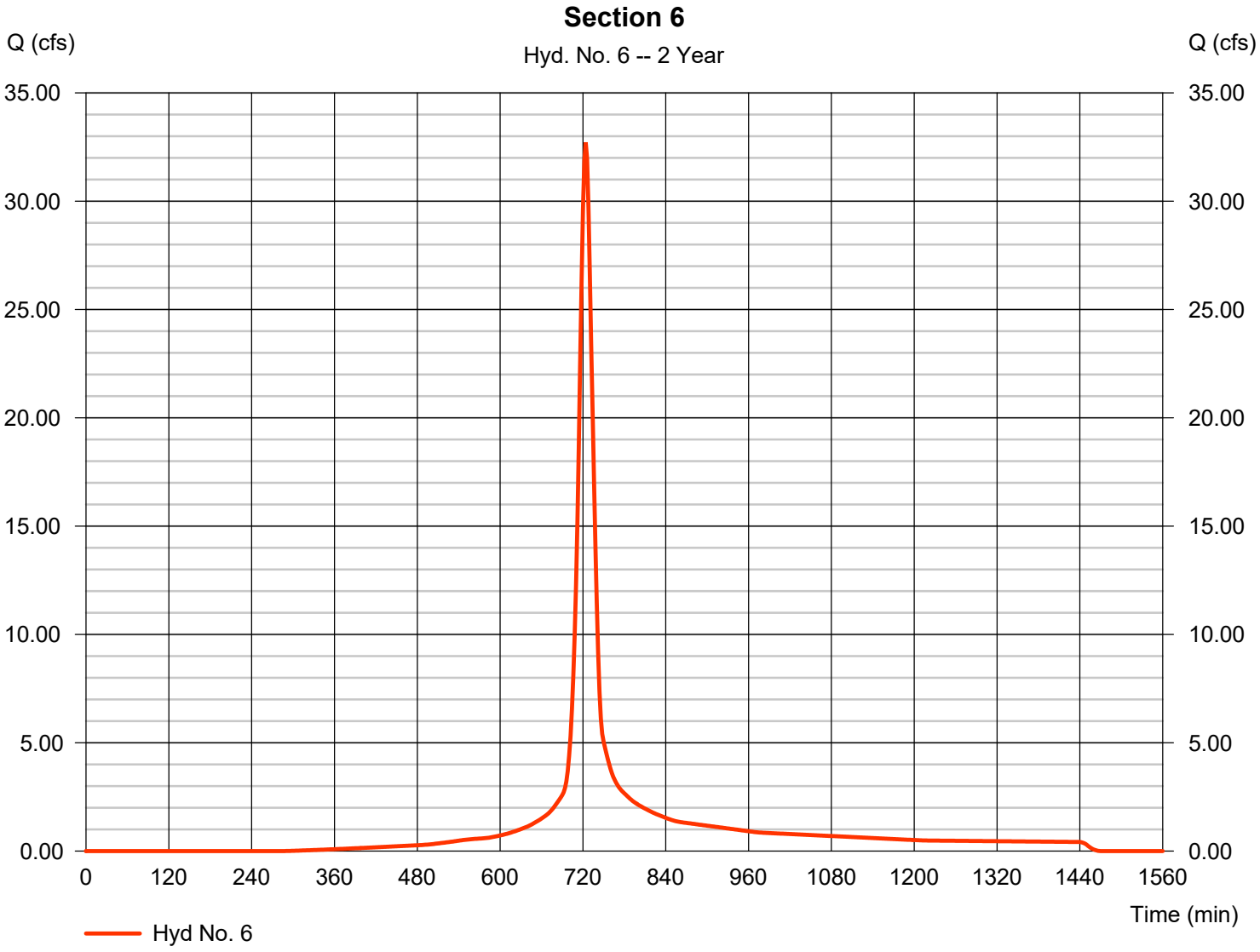
Hydrograph Report

Hyd. No. 6

Section 6

Hydrograph type	=	SCS Runoff	Peak discharge	=	32.72 cfs
Storm frequency	=	2 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	104,234 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

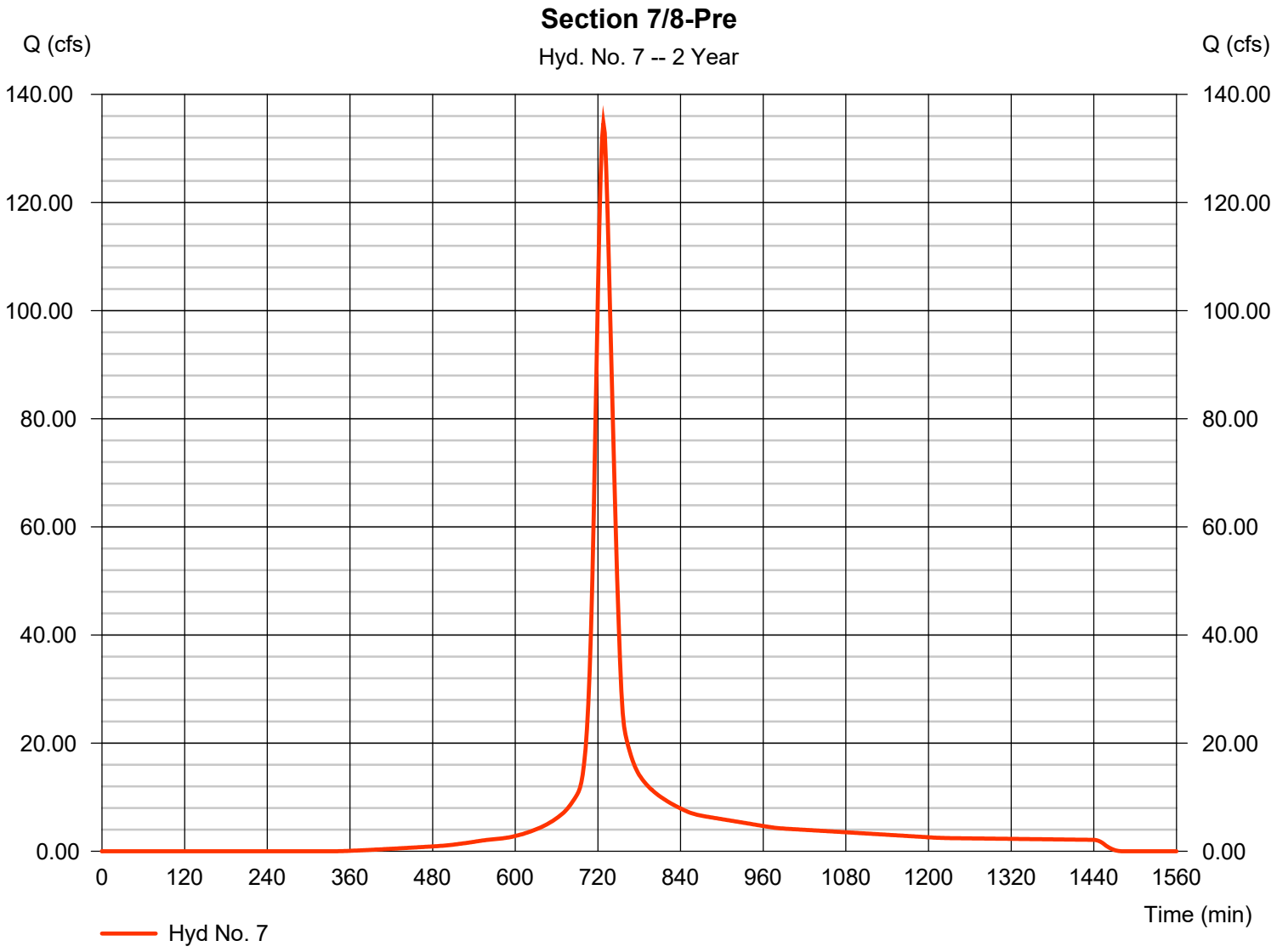
Hydrograph Report

Hyd. No. 7

Section 7/8-Pre

Hydrograph type	=	SCS Runoff	Peak discharge	=	134.69 cfs
Storm frequency	=	2 yrs	Time to peak	=	728 min
Time interval	=	2 min	Hyd. volume	=	496,946 cuft
Drainage area	=	59.000 ac	Curve number	=	89*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	25.20 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

Hyd. No. 7

Section 7/8-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)	= 3.10		0.00		0.00		
Land slope (%)	= 1.00		0.00		0.00		
Travel Time (min)	**= 19.13**	**+**	**0.00**	**+**	**0.00**	**=**	**19.13**
Shallow Concentrated Flow							
Flow length (ft)	= 1000.00		0.00		0.00		
Watercourse slope (%)	= 4.50		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=3.42		0.00		0.00		
Travel Time (min)	**= 4.87**	**+**	**0.00**	**+**	**0.00**	**=**	**4.87**
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**

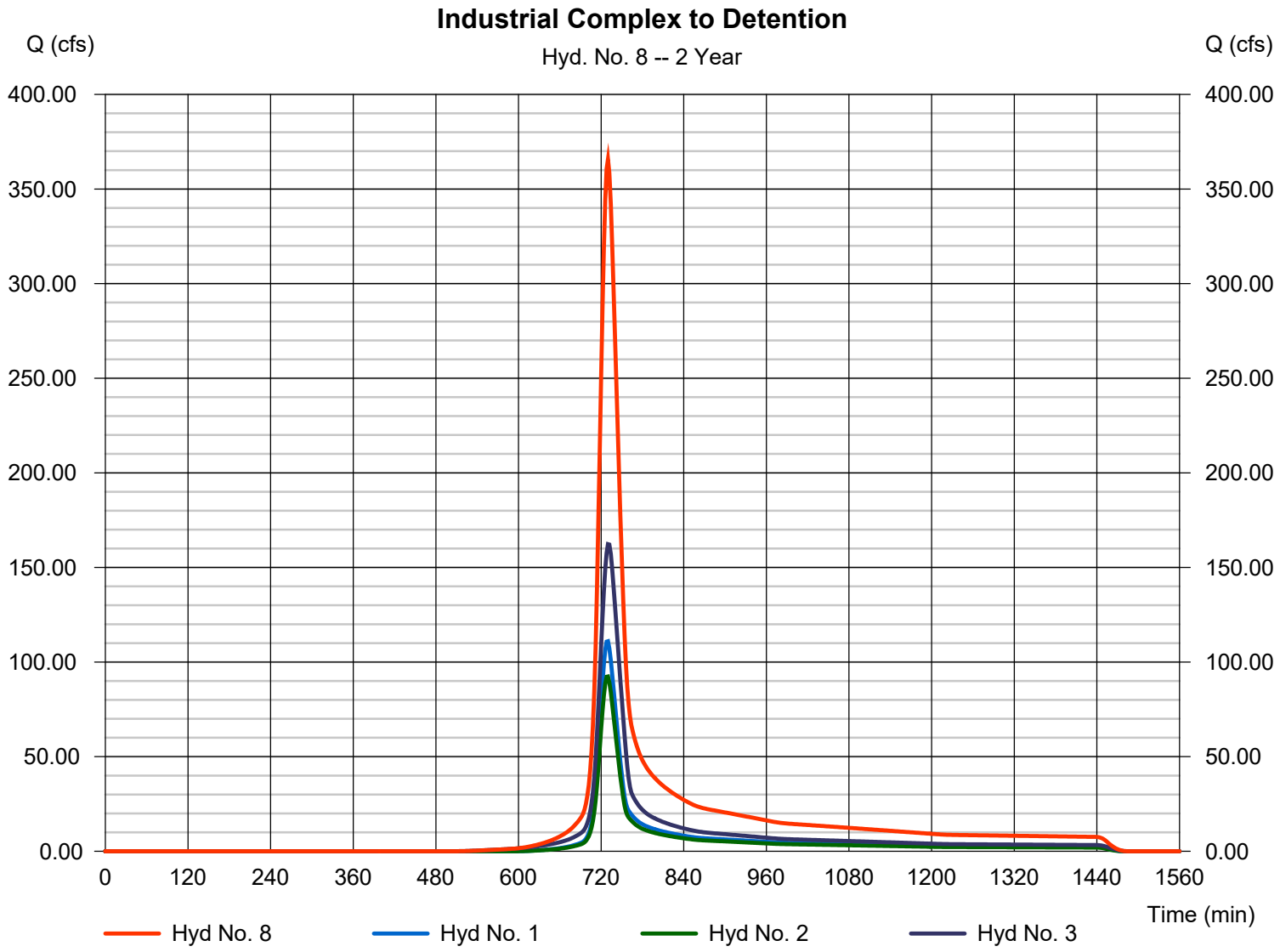
Total Travel Time, Tc ..... 25.20 min

Hydrograph Report

Hyd. No. 8

Industrial Complex to Detention

Hydrograph type	= Combine	Peak discharge	= 365.68 cfs
Storm frequency	= 2 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 1,417,466 cuft
Inflow hyds.	= 1, 2, 3	Contrib. drain. area	= 250.500 ac



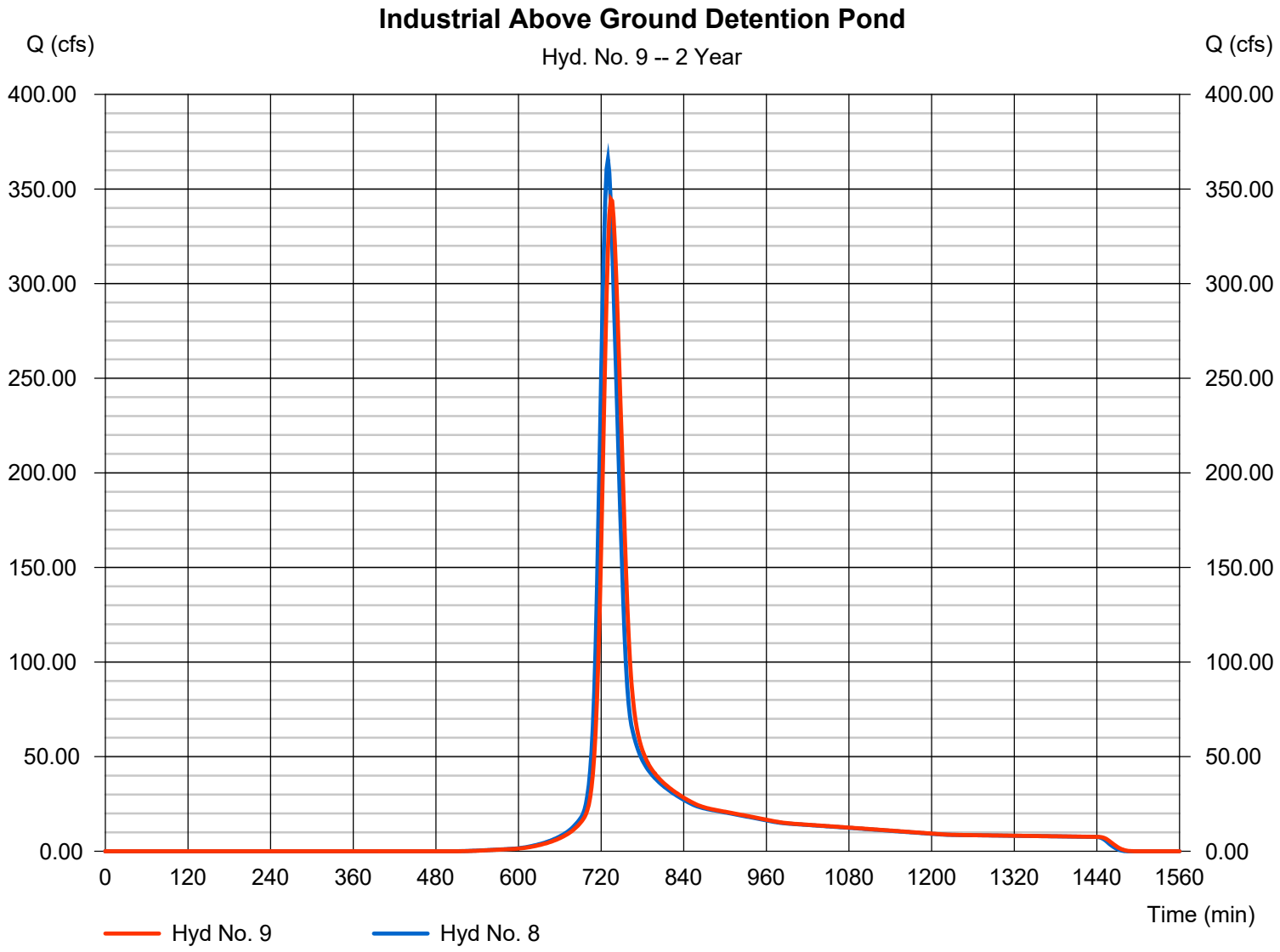
Hydrograph Report

Hyd. No. 9

Industrial Above Ground Detention Pond

Hydrograph type	=	Reach	Peak discharge	=	344.64 cfs
Storm frequency	=	2 yrs	Time to peak	=	734 min
Time interval	=	2 min	Hyd. volume	=	1,417,464 cuft
Inflow hyd. No.	=	8 - Industrial Complex to Detention	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	=	2.73 ft/s	Routing coeff.	=	0.3748

Modified Att-Kin routing method used.

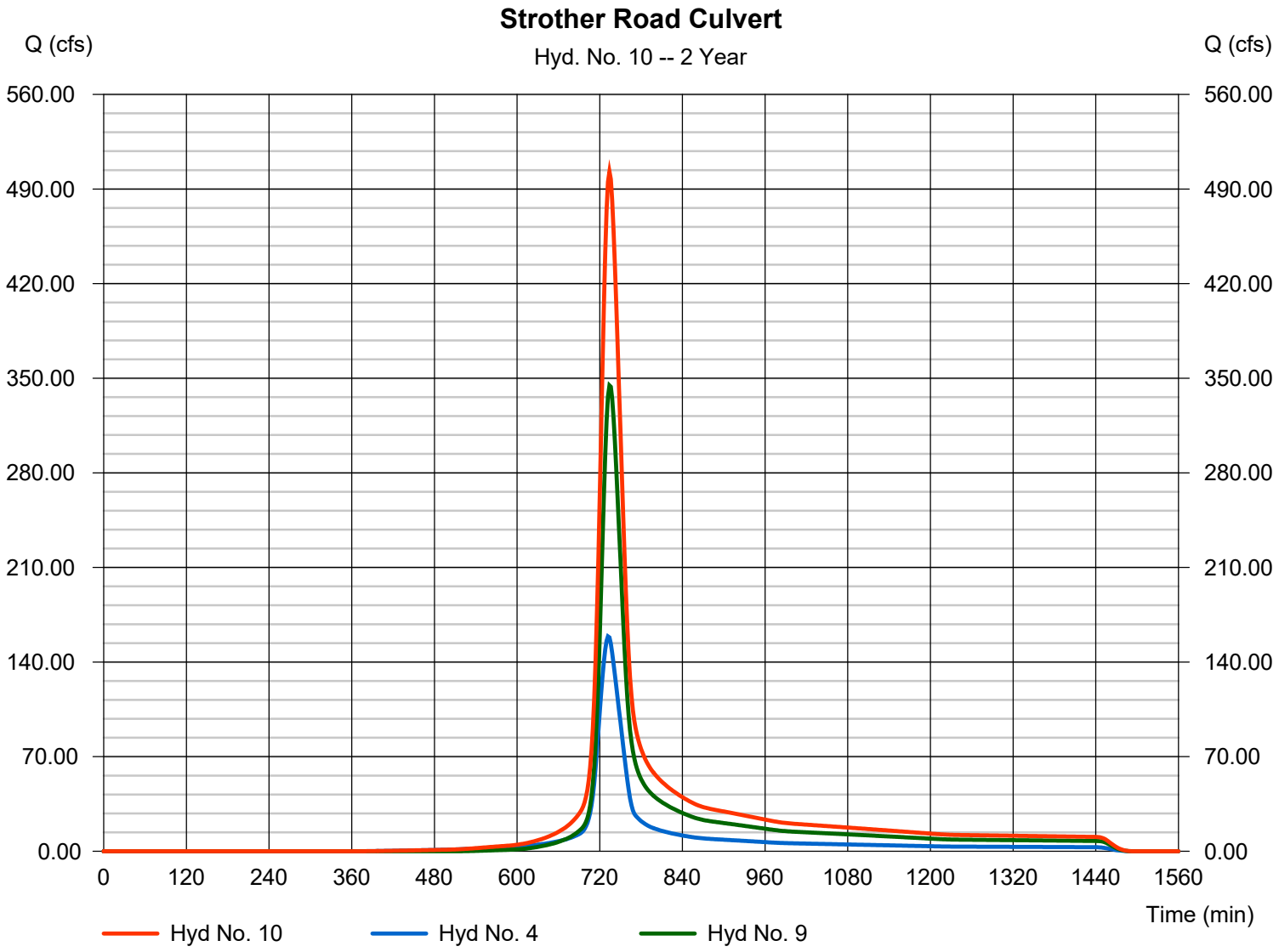


Hydrograph Report

Hyd. No. 10

Strother Road Culvert

Hydrograph type	= Combine	Peak discharge	= 502.85 cfs
Storm frequency	= 2 yrs	Time to peak	= 734 min
Time interval	= 2 min	Hyd. volume	= 2,105,367 cuft
Inflow hyds.	= 4, 9	Contrib. drain. area	= 82.500 ac



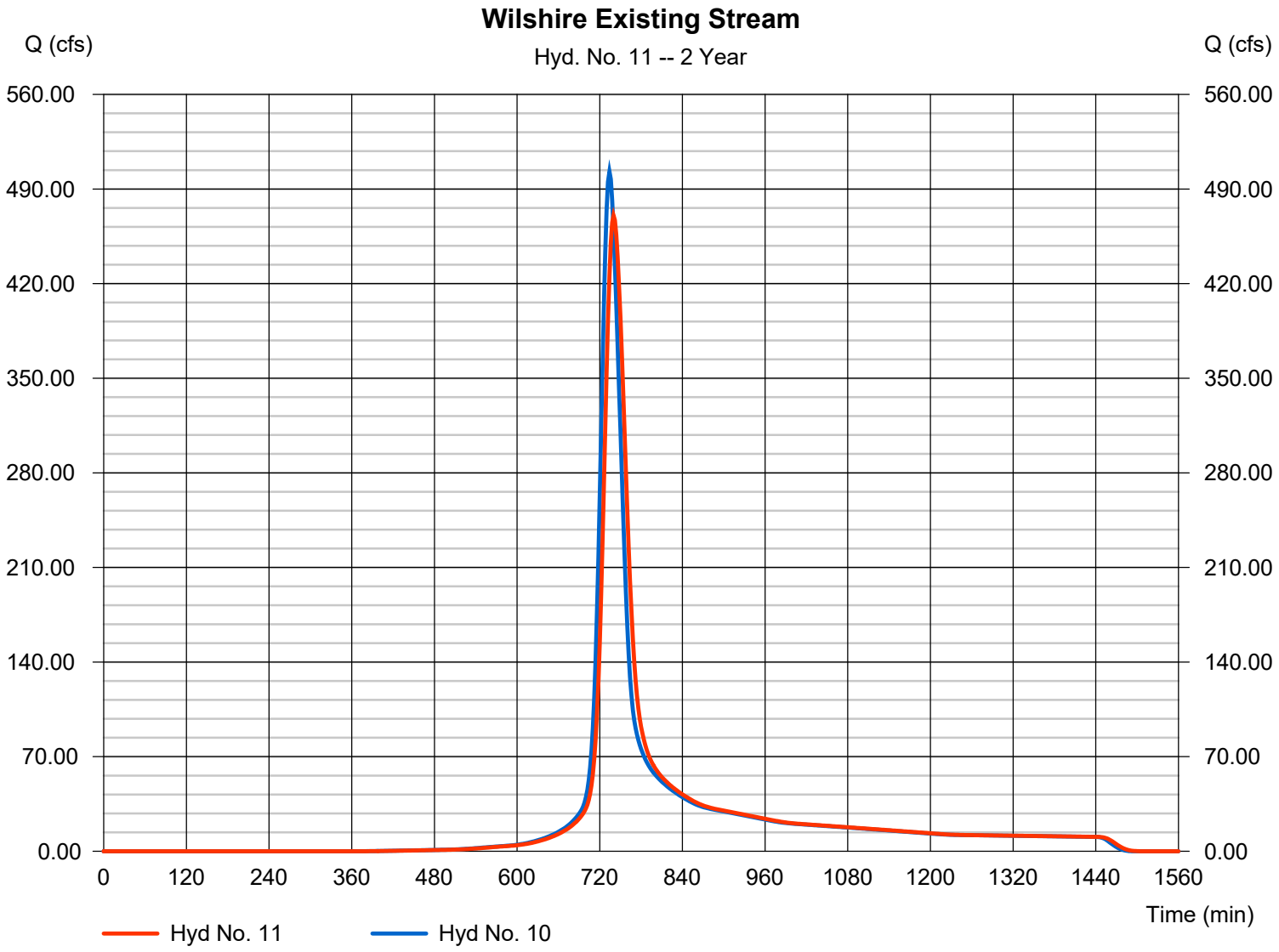
Hydrograph Report

Hyd. No. 11

Wilshire Existing Stream

Hydrograph type	=	Reach	Peak discharge	=	470.44 cfs
Storm frequency	=	2 yrs	Time to peak	=	740 min
Time interval	=	2 min	Hyd. volume	=	2,105,365 cuft
Inflow hyd. No.	=	10 - Strother Road Culvert	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	=	5.66 ft/s	Routing coeff.	=	0.3193

Modified Att-Kin routing method used.

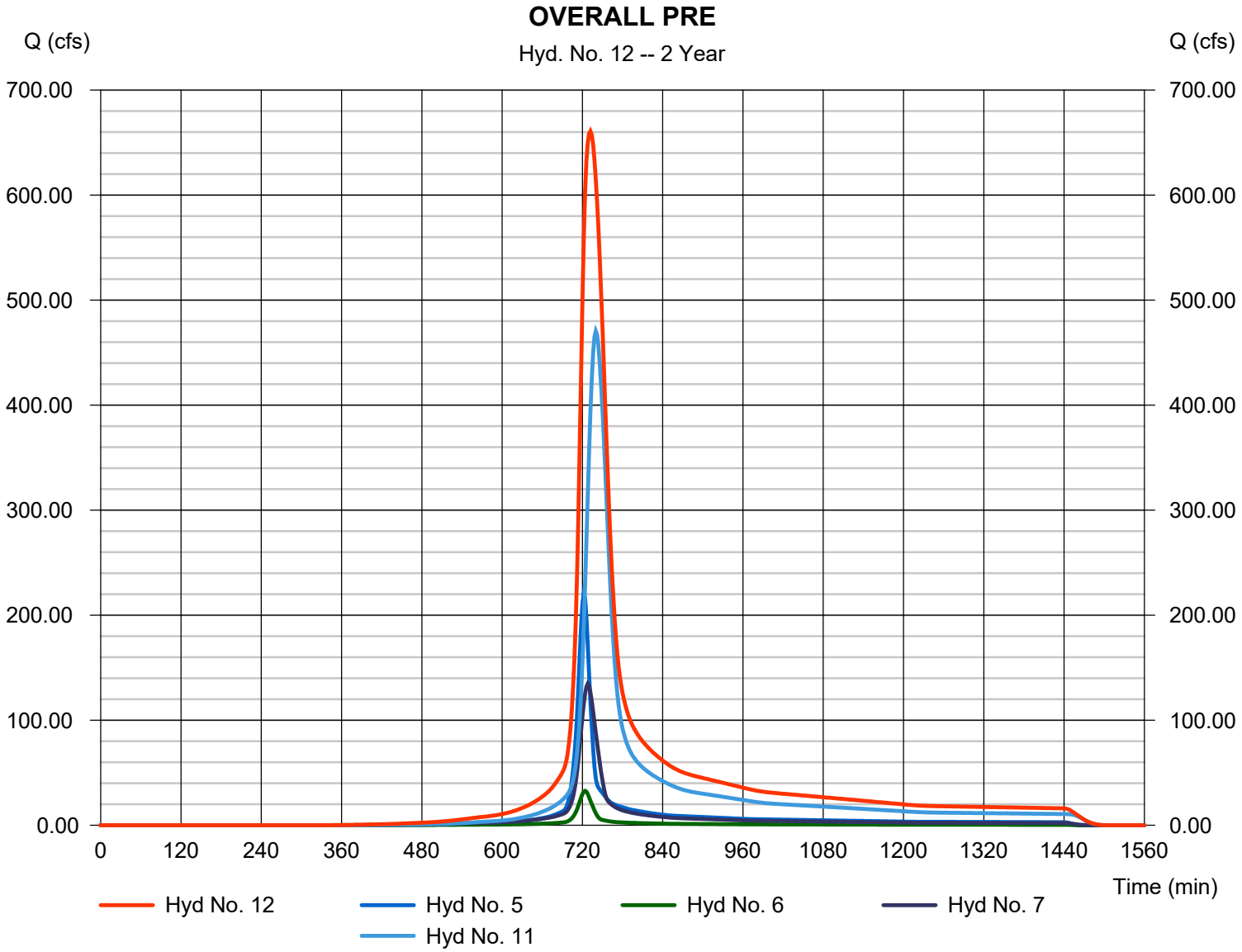


Hydrograph Report

Hyd. No. 12

OVERALL PRE

Hydrograph type	= Combine	Peak discharge	= 660.85 cfs
Storm frequency	= 2 yrs	Time to peak	= 732 min
Time interval	= 2 min	Hyd. volume	= 3,326,706 cuft
Inflow hyds.	= 5, 6, 7, 11	Contrib. drain. area	= 157.200 ac



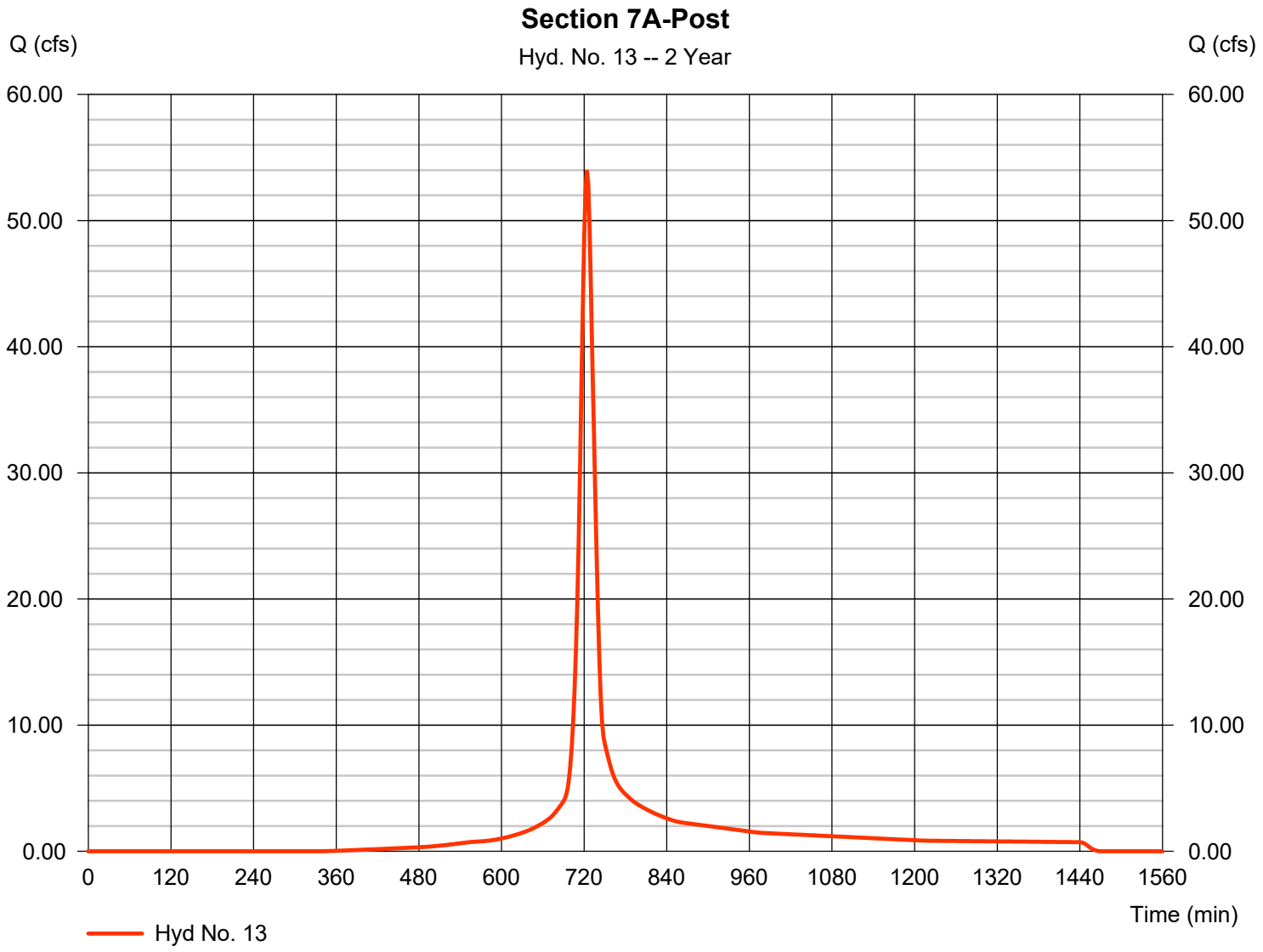
Hydrograph Report

Hyd. No. 13

Section 7A-Post

Hydrograph type	=	SCS Runoff	Peak discharge	=	54.00 cfs
Storm frequency	=	2 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	170,275 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

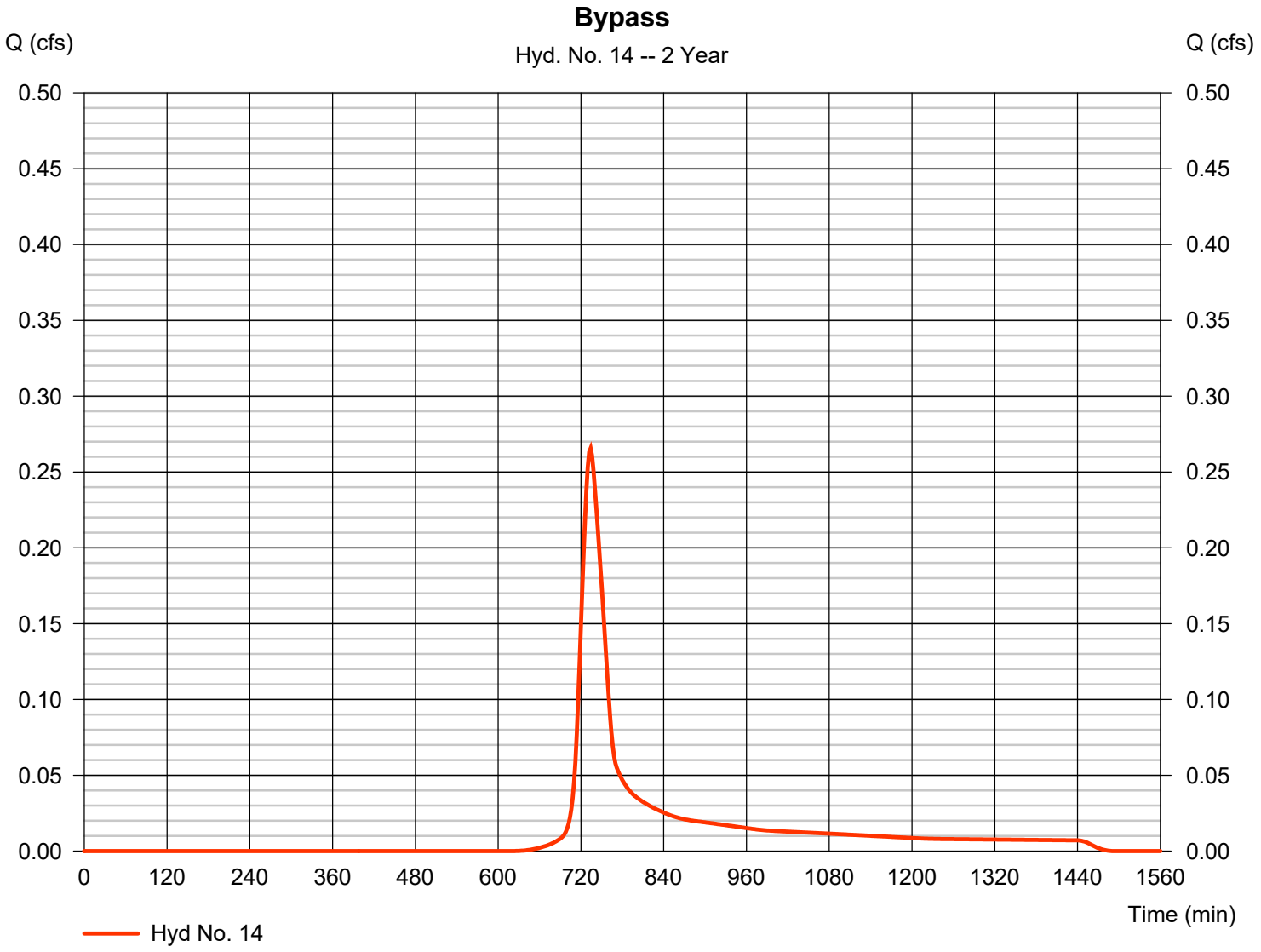
Hydrograph Report

Hyd. No. 14

Bypass

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.266 cfs
Storm frequency	=	2 yrs	Time to peak	=	734 min
Time interval	=	2 min	Hyd. volume	=	1,196 cuft
Drainage area	=	0.250 ac	Curve number	=	75*
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) = [(0.010 x 98) + (0.240 x 74)] / 0.250



TR55 Tc Worksheet

Hyd. No. 14

Bypass

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

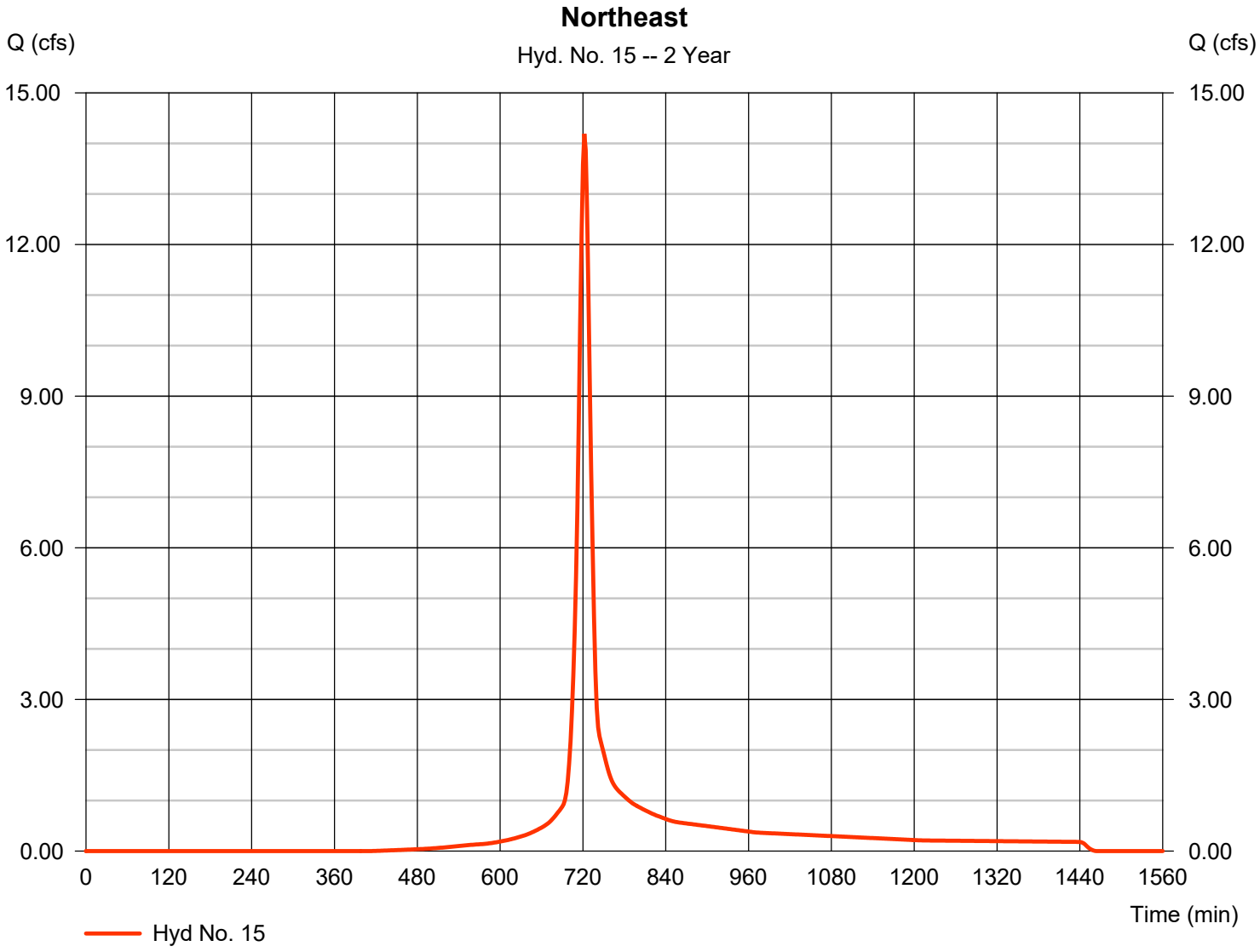
Hydrograph Report

Hyd. No. 15

Northeast

Hydrograph type	=	SCS Runoff	Peak discharge	=	14.19 cfs
Storm frequency	=	2 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	39,881 cuft
Drainage area	=	5.370 ac	Curve number	=	86*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	15.30 min
Total precip.	=	3.50 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(2.700 x 98) + (2.670 x 74)] / 5.370



TR55 Tc Worksheet

Hyd. No. 15

Northeast

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)	= 150.00		0.00		0.00		
Watercourse slope (%)	= 2.00		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.28		0.00		0.00		
Travel Time (min)	**= 1.10**	**+**	**0.00**	**+**	**0.00**	**=**	**1.10**
Channel Flow							
X sectional flow area (sqft)	= 24.00		0.00		0.00		
Wetted perimeter (ft)	= 14.00		0.00		0.00		
Channel slope (%)	= 3.20		0.00		0.00		
Manning's n-value	= 0.050		0.015		0.015		
Velocity (ft/s)	=7.65						
			0.00				
					0.00		
Flow length (ft)	({0})250.0		0.0		0.0		
Travel Time (min)	**= 0.54**	**+**	**0.00**	**+**	**0.00**	**=**	**0.54**

Total Travel Time, Tc ..... 15.30 min

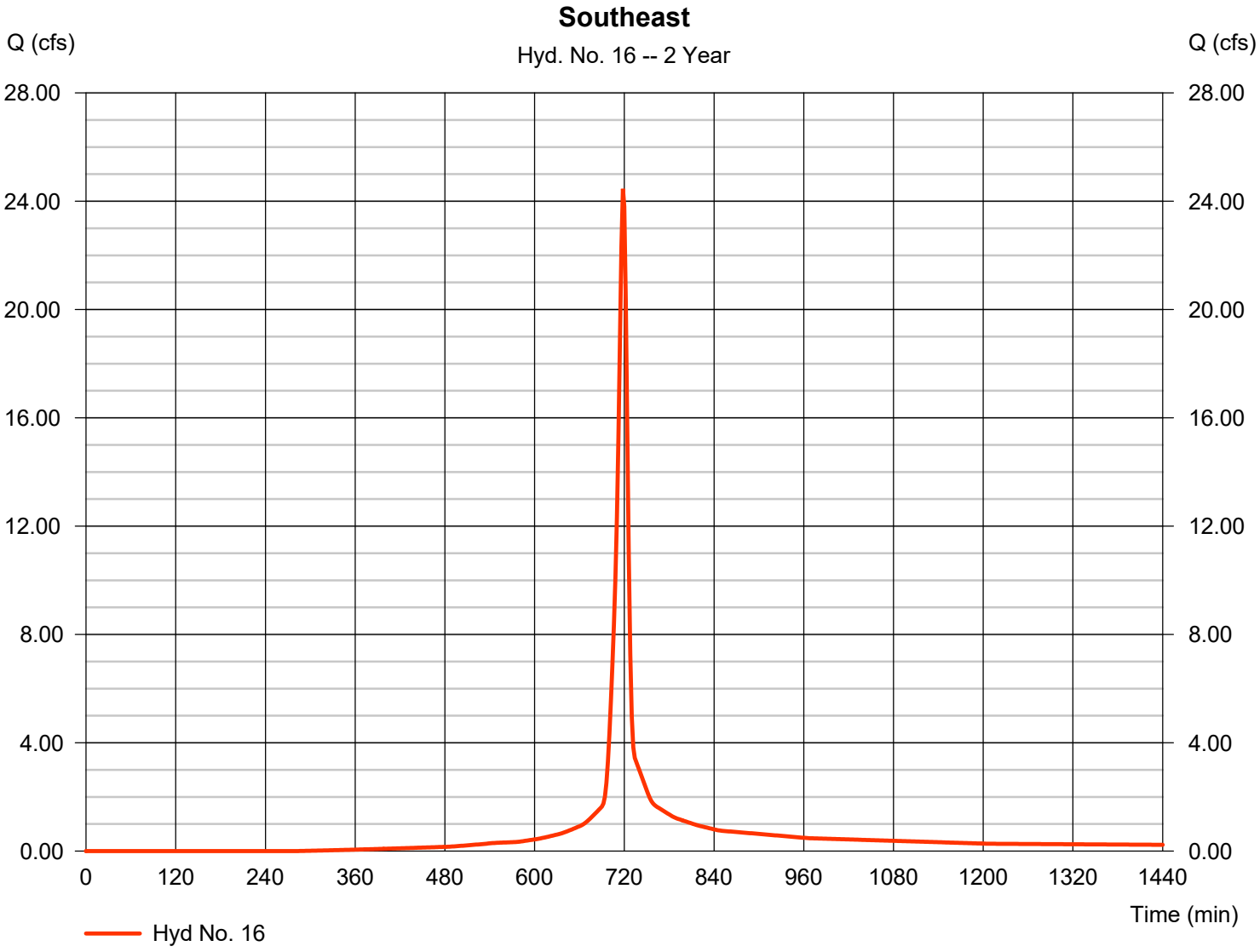
Hydrograph Report

Hyd. No. 16

Southeast

Hydrograph type	=	SCS Runoff	Peak discharge	=	24.46 cfs
Storm frequency	=	2 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	57,836 cuft
Drainage area	=	6.270 ac	Curve number	=	91*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	7.10 min
Total precip.	=	3.50 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(4.570 x 98) + (1.700 x 74)] / 6.270



TR55 Tc Worksheet

Hyd. No. 16

Southeast

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.240		0.011		0.011		
Flow length (ft)	= 25.0		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)	**= 4.50**	**+**	**0.00**	**+**	**0.00**	**=**	**4.50**
Shallow Concentrated Flow							
Flow length (ft)	= 15.00		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)	**= 0.07**	**+**	**0.00**	**+**	**0.00**	**=**	**0.07**
Channel Flow							
X sectional flow area (sqft)	= 12.60		0.00		0.00		
Wetted perimeter (ft)	= 12.56		0.00		0.00		
Channel slope (%)	= 1.00		0.00		0.00		
Manning's n-value	= 0.030		0.015		0.015		
Velocity (ft/s)	=4.98						
			0.00				
					0.00		
Flow length (ft)	({0})750.0		0.0		0.0		
Travel Time (min)	**= 2.51**	**+**	**0.00**	**+**	**0.00**	**=**	**2.51**

Total Travel Time, Tc ..... 7.10 min

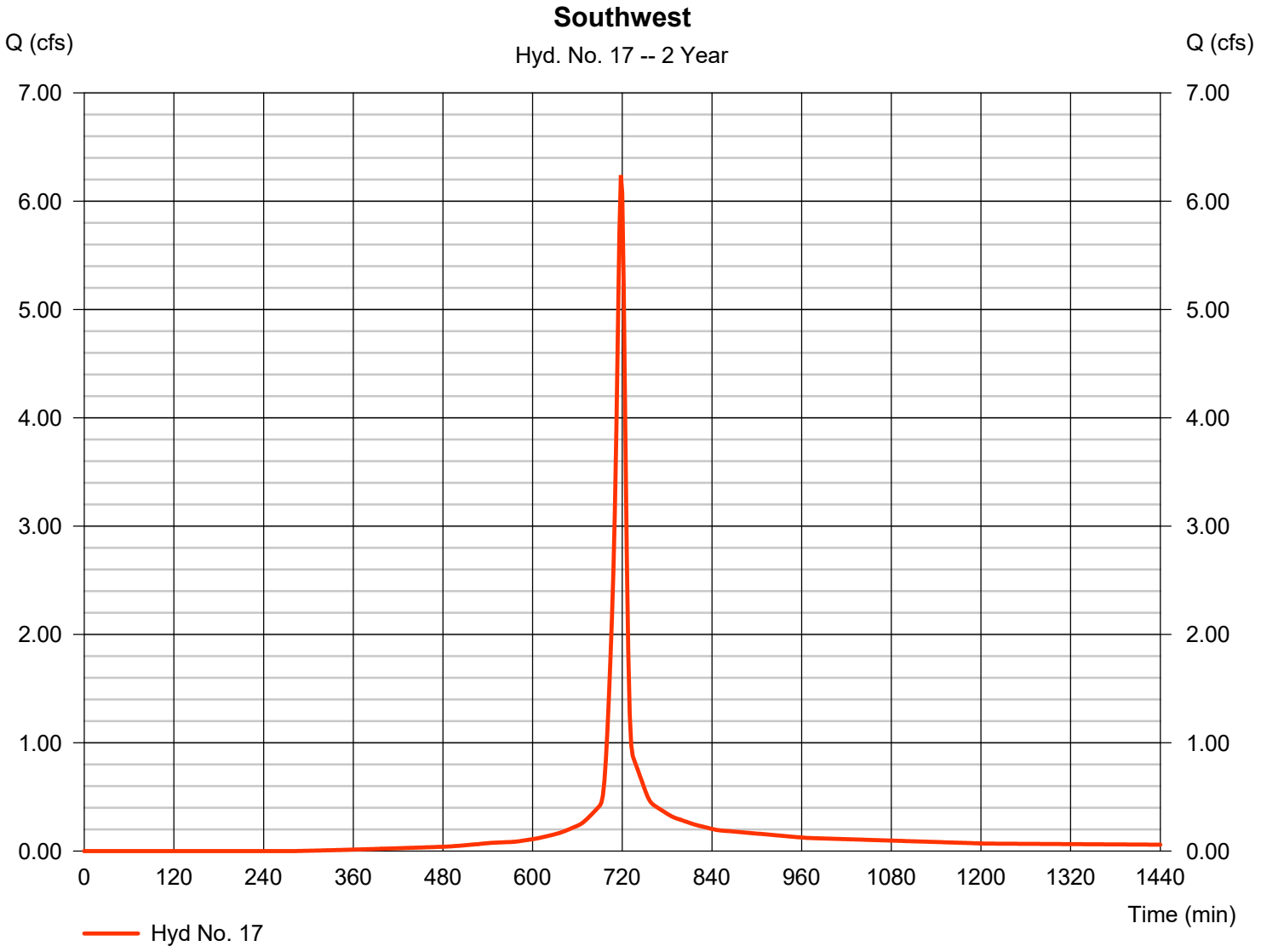
Hydrograph Report

Hyd. No. 17

Southwest

Hydrograph type	=	SCS Runoff	Peak discharge	=	6.241 cfs
Storm frequency	=	2 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	14,759 cuft
Drainage area	=	1.600 ac	Curve number	=	91*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	6.60 min
Total precip.	=	3.50 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

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



TR55 Tc Worksheet

Hyd. No. 17

Southwest

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.240		0.011		0.011		
Flow length (ft)	= 25.0		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)	**= 4.50**	**+**	**0.00**	**+**	**0.00**	**=**	**4.50**
Shallow Concentrated Flow							
Flow length (ft)	= 75.00		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)	**= 0.36**	**+**	**0.00**	**+**	**0.00**	**=**	**0.36**
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})800.0		0.0		0.0		
Travel Time (min)	**= 1.75**	**+**	**0.00**	**+**	**0.00**	**=**	**1.75**

Total Travel Time, Tc ..... 6.60 min

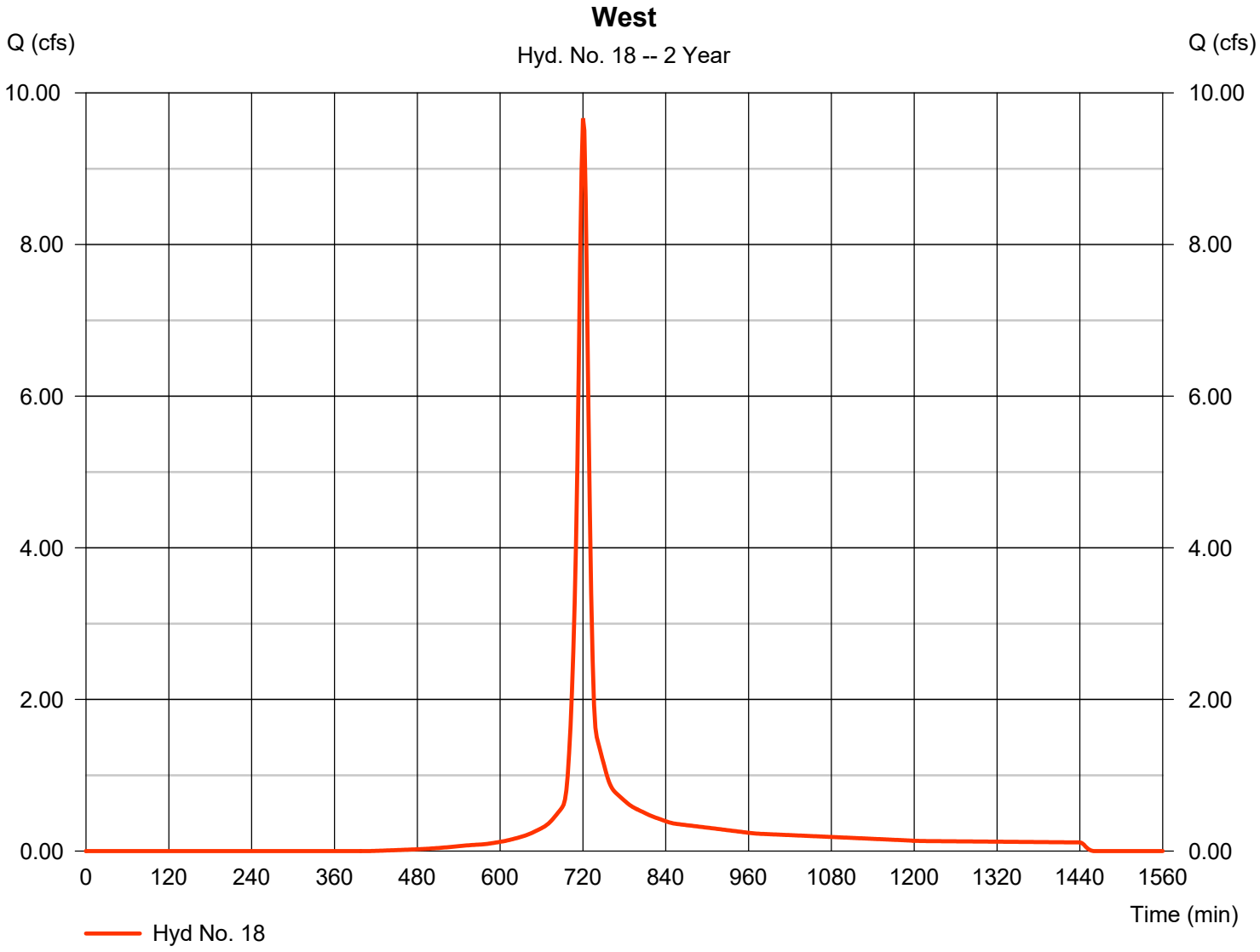
Hydrograph Report

Hyd. No. 18

West

Hydrograph type	=	SCS Runoff	Peak discharge	=	9.666 cfs
Storm frequency	=	2 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	25,136 cuft
Drainage area	=	3.200 ac	Curve number	=	86*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	12.40 min
Total precip.	=	3.50 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

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



TR55 Tc Worksheet

Hyd. No. 18

West

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.240		0.011		0.011		
Flow length (ft)	= 75.0		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)	**= 10.84**	**+**	**0.00**	**+**	**0.00**	**=**	**10.84**
Shallow Concentrated Flow							
Flow length (ft)	= 75.00		0.00		0.00		
Watercourse slope (%)	= 2.00		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.28		0.00		0.00		
Travel Time (min)	**= 0.55**	**+**	**0.00**	**+**	**0.00**	**=**	**0.55**
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		0.015		
Velocity (ft/s)	=10.39						
			10.33				
					0.00		
Flow length (ft)	({0})383.0		225.0		0.0		
Travel Time (min)	**= 0.61**	**+**	**0.36**	**+**	**0.00**	**=**	**0.98**

Total Travel Time, Tc ..... 12.40 min

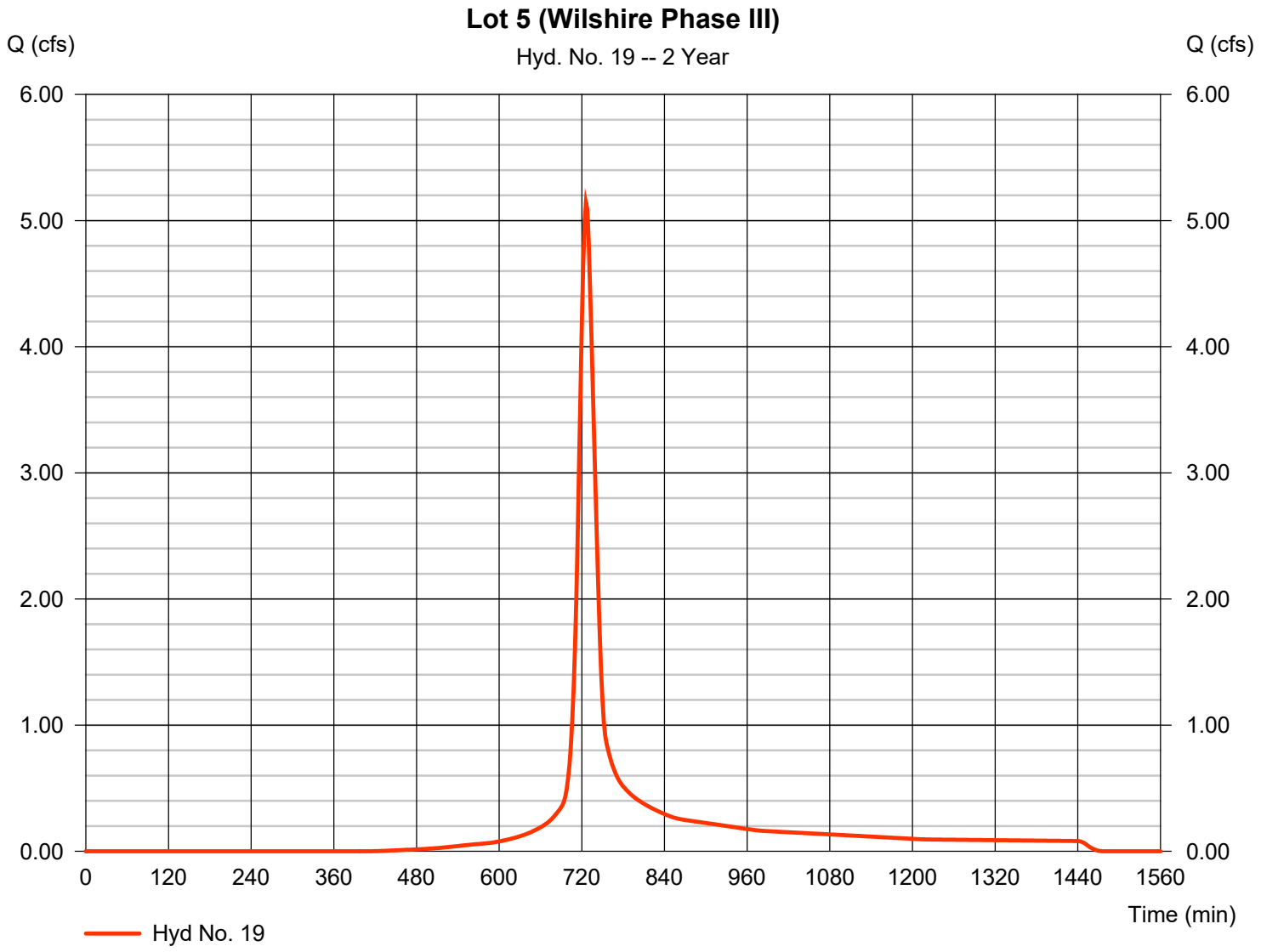
Hydrograph Report

Hyd. No. 19

Lot 5 (Wilshire Phase III)

Hydrograph type	=	SCS Runoff	Peak discharge	=	5.142 cfs
Storm frequency	=	2 yrs	Time to peak	=	726 min
Time interval	=	2 min	Hyd. volume	=	17,754 cuft
Drainage area	=	2.290 ac	Curve number	=	86*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	20.60 min
Total precip.	=	3.50 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

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



TR55 Tc Worksheet

Hyd. No. 19

Lot 5 (Wilshire Phase III)

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)	= 3.10		0.00		0.00		
Land slope (%)	= 1.50		0.00		0.00		
Travel Time (min)	**= 16.27**	**+**	**0.00**	**+**	**0.00**	**=**	**16.27**
Shallow Concentrated Flow							
Flow length (ft)	= 155.00		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)	**= 1.31**	**+**	**0.00**	**+**	**0.00**	**=**	**1.31**
Channel Flow							
X sectional flow area (sqft)	= 5.00		0.00		0.00		
Wetted perimeter (ft)	= 31.00		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)	=3.58						
			0.00				
					0.00		
Flow length (ft)	({0})650.0		0.0		0.0		
Travel Time (min)	**= 3.02**	**+**	**0.00**	**+**	**0.00**	**=**	**3.02**

Total Travel Time, Tc ..... 20.60 min

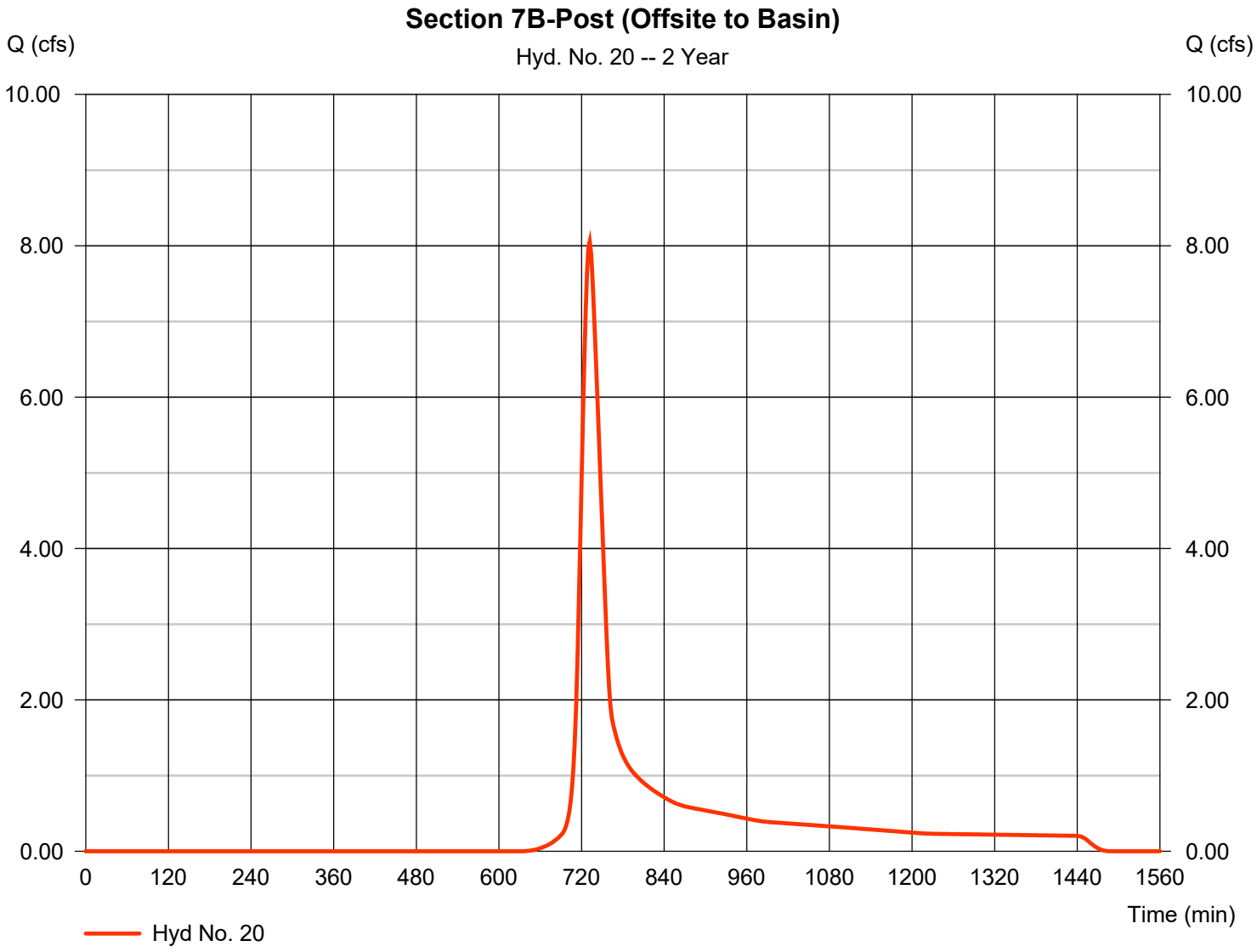
Hydrograph Report

Hyd. No. 20

Section 7B-Post (Offsite to Basin)

Hydrograph type	=	SCS Runoff	Peak discharge	=	8.054 cfs
Storm frequency	=	2 yrs	Time to peak	=	732 min
Time interval	=	2 min	Hyd. volume	=	33,757 cuft
Drainage area	=	7.500 ac	Curve number	=	74*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	28.30 min
Total precip.	=	3.50 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(13.900 x 74)] / 7.500



TR55 Tc Worksheet

Hyd. No. 20

Section 7B-Post (Offsite to Basin)

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)	= 3.10		0.00		0.00		
Land slope (%)	= 2.00		0.00		0.00		
Travel Time (min)	**= 14.50**	**+**	**0.00**	**+**	**0.00**	**=**	**14.50**
Shallow Concentrated Flow							
Flow length (ft)	= 850.00		0.00		0.00		
Watercourse slope (%)	= 2.00		5.00		1.00		
Surface description	= Unpaved		Unpaved		Unpaved		
Average velocity (ft/s)	=2.28		3.61		1.61		
Travel Time (min)	**= 6.21**	**+**	**0.00**	**+**	**0.00**	**=**	**6.21**
Channel Flow							
X sectional flow area (sqft)	= 2.00		5.00		0.00		
Wetted perimeter (ft)	= 12.00		31.00		0.00		
Channel slope (%)	= 0.50		2.00		0.00		
Manning's n-value	= 0.015		0.015		0.025		
Velocity (ft/s)	=2.11		4.14		0.00		
Flow length (ft)	({0})850.0		216.0		0.0		
Travel Time (min)	**= 6.70**	**+**	**0.87**	**+**	**0.00**	**=**	**7.57**

Total Travel Time, Tc ..... 28.30 min

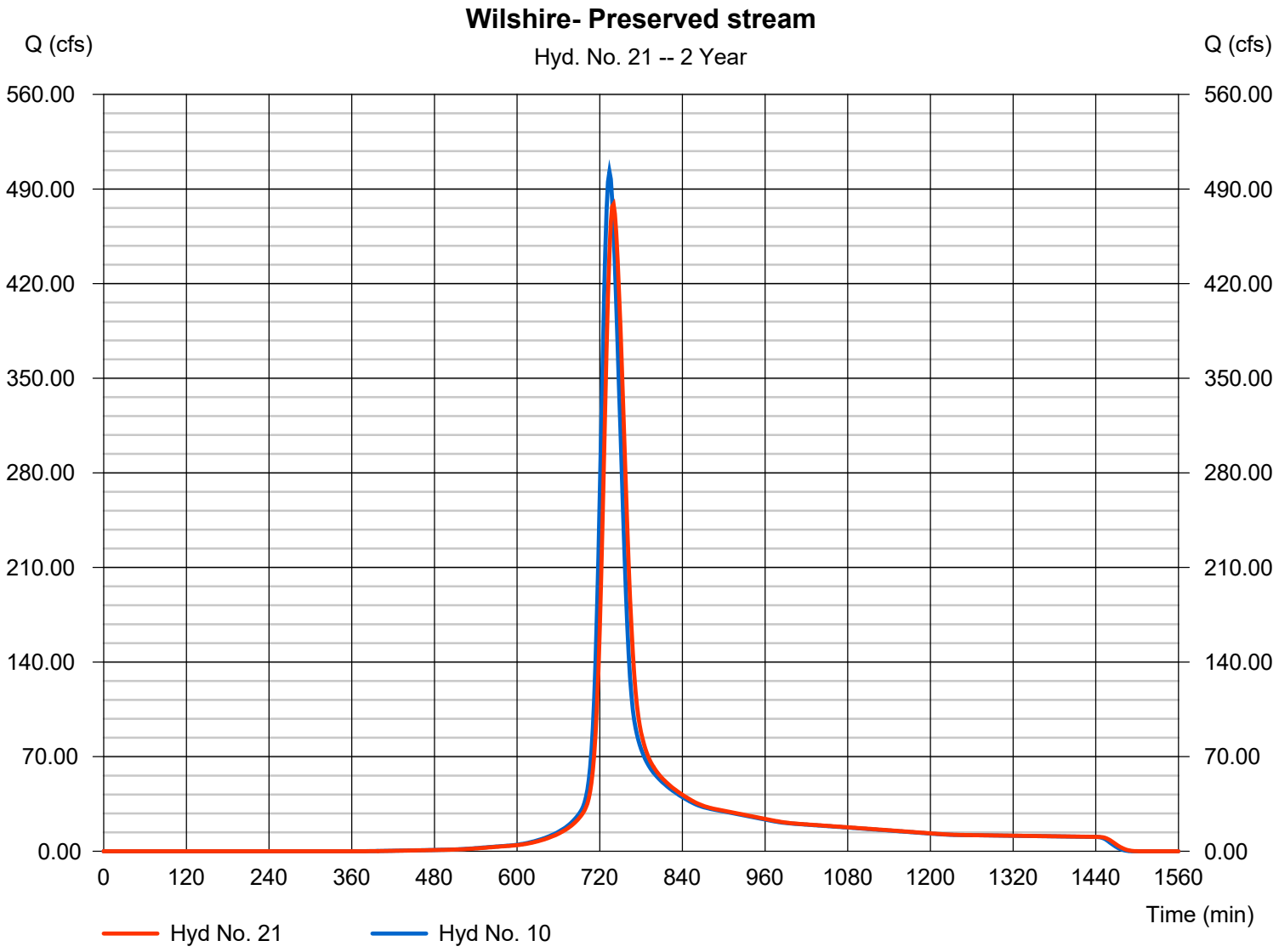
Hydrograph Report

Hyd. No. 21

Wilshire- Preserved stream

Hydrograph type	=	Reach	Peak discharge	=	478.83 cfs
Storm frequency	=	2 yrs	Time to peak	=	740 min
Time interval	=	2 min	Hyd. volume	=	2,105,365 cuft
Inflow hyd. No.	=	10 - Strother Road Culvert	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	=	1.46 ft/s	Routing coeff.	=	0.3749

Modified Att-Kin routing method used.

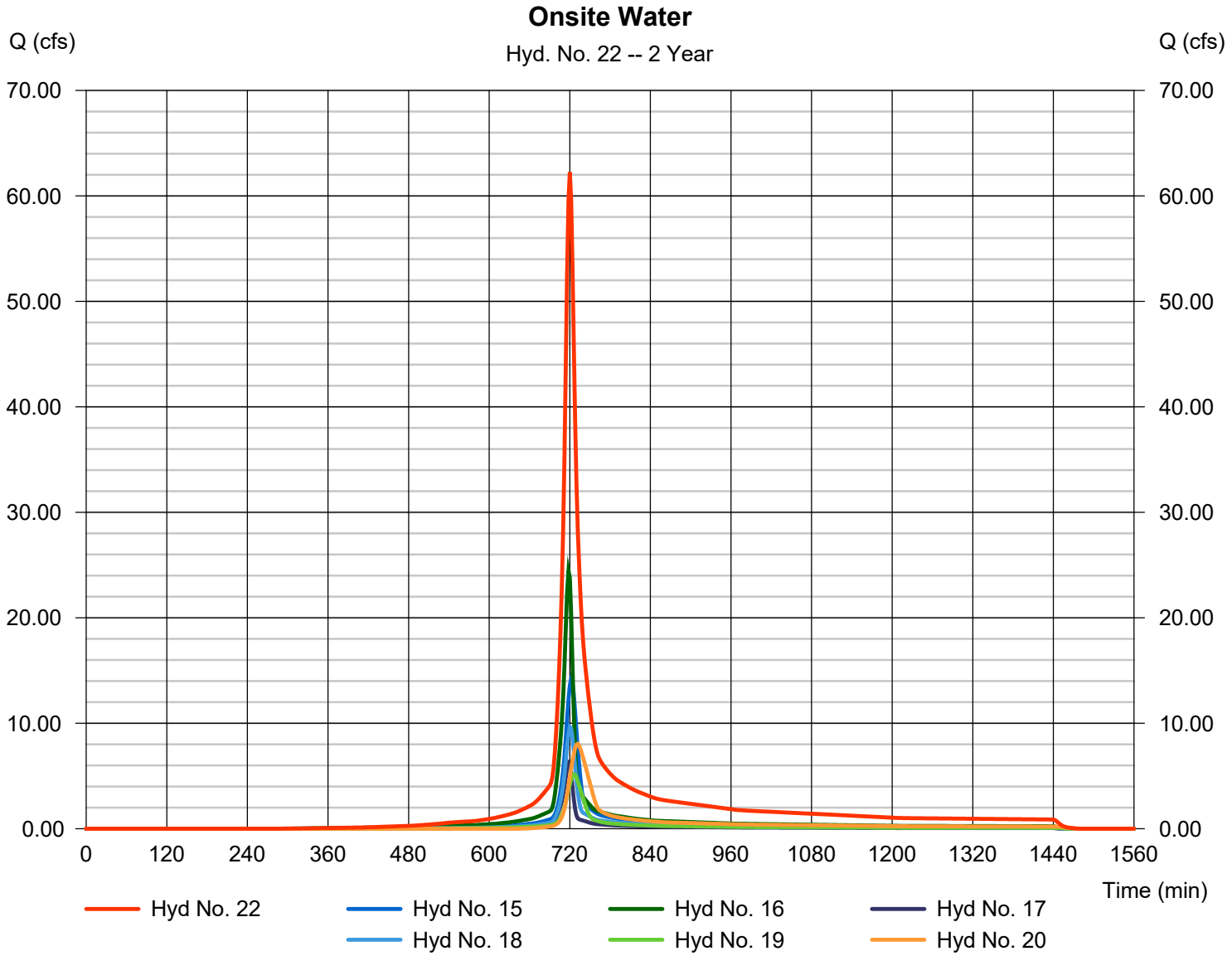


Hydrograph Report

Hyd. No. 22

Onsite Water

Hydrograph type	= Combine	Peak discharge	= 62.25 cfs
Storm frequency	= 2 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 189,123 cuft
Inflow hyds.	= 15, 16, 17, 18, 19, 20	Contrib. drain. area	= 26.230 ac



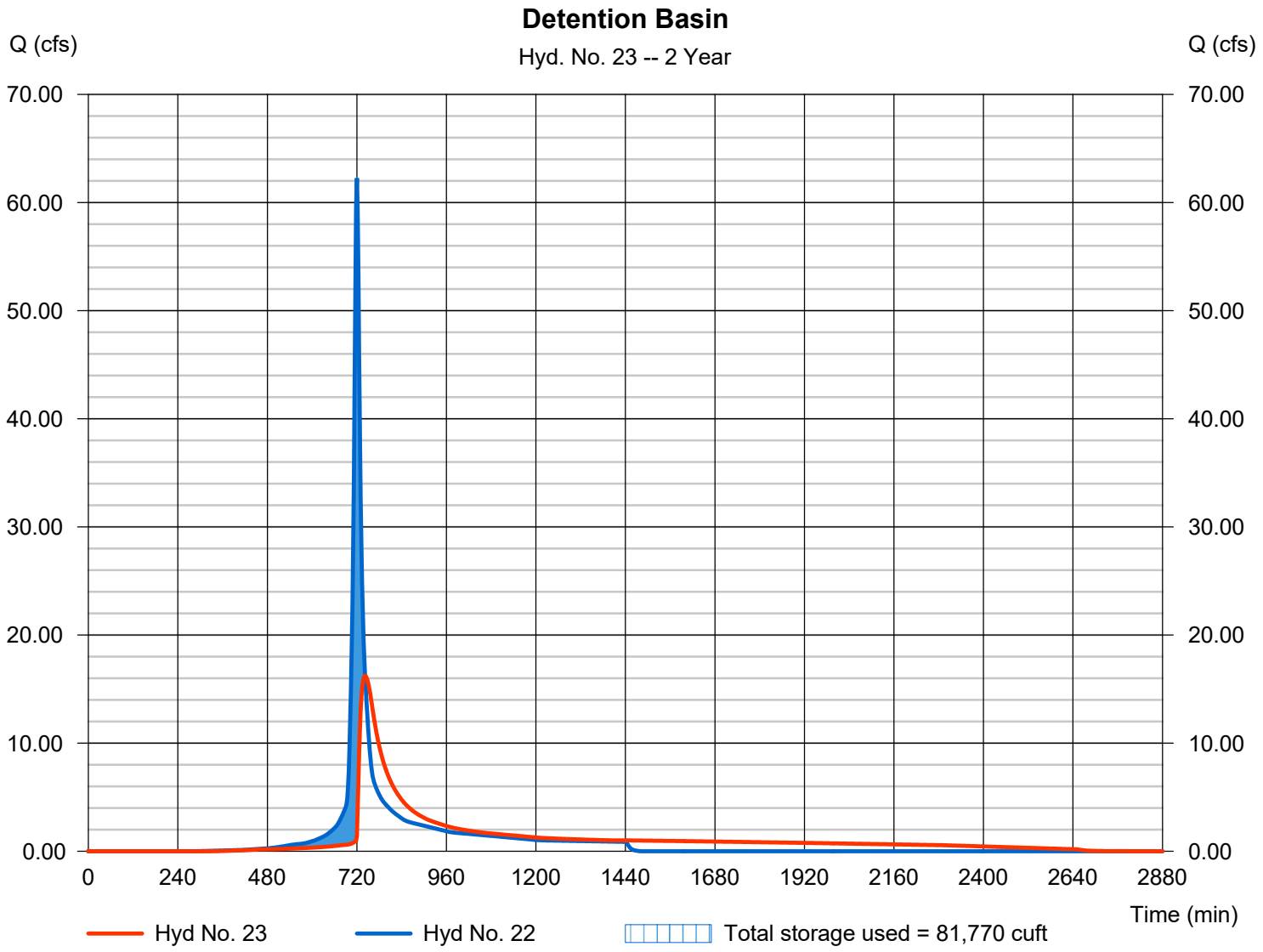
Hydrograph Report

Hyd. No. 23

Detention Basin

Hydrograph type	=	Reservoir	Peak discharge	=	16.23 cfs
Storm frequency	=	2 yrs	Time to peak	=	742 min
Time interval	=	2 min	Hyd. volume	=	189,109 cuft
Inflow hyd. No.	=	22 - Onsite Water	Max. Elevation	=	917.14 ft
Reservoir name	=	Detention Basin	Max. Storage	=	81,770 cuft

Storage Indication method used.



Pond No. 1 - Detention Basin

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Begining Elevation = 911.70 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	911.70	00	0	0
0.30	912.00	2,386	358	358
1.30	913.00	13,639	8,013	8,370
2.30	914.00	15,509	14,574	22,944
3.30	915.00	17,465	16,487	39,431
4.30	916.00	19,505	18,485	57,916
5.30	917.00	21,926	20,716	78,632
6.30	918.00	23,832	22,879	101,511
7.30	919.00	26,575	25,204	126,714
8.30	920.00	29,956	28,266	154,980
9.30	921.00	31,503	30,730	185,709
10.30	922.00	33,676	32,590	218,299

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 42.00	4.50	Inactive	0.00
Span (in)	= 42.00	4.50	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 911.50	911.70	0.00	0.00
Length (ft)	= 47.30	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	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 25.00	2.20	0.00	0.00
Crest El. (ft)	= 920.96	915.50	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	Rect	---	---
Multi-Stage	= Yes	Yes	No	No

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

TW Elev. (ft) = 0.00

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

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	911.70	0.00	0.00	---	---	0.00	0.00	---	---	---	---	0.000
0.03	36	911.73	0.25 oc	0.00 ic	---	---	0.00	0.00	---	---	---	---	0.003
0.06	72	911.76	0.25 oc	0.01 ic	---	---	0.00	0.00	---	---	---	---	0.010
0.09	107	911.79	0.25 oc	0.02 ic	---	---	0.00	0.00	---	---	---	---	0.021
0.12	143	911.82	0.25 oc	0.04 ic	---	---	0.00	0.00	---	---	---	---	0.036
0.15	179	911.85	0.25 oc	0.06 ic	---	---	0.00	0.00	---	---	---	---	0.056
0.18	215	911.88	0.25 oc	0.08 ic	---	---	0.00	0.00	---	---	---	---	0.077
0.21	251	911.91	0.25 oc	0.10 ic	---	---	0.00	0.00	---	---	---	---	0.100
0.24	286	911.94	0.25 oc	0.13 ic	---	---	0.00	0.00	---	---	---	---	0.126
0.27	322	911.97	0.25 oc	0.15 ic	---	---	0.00	0.00	---	---	---	---	0.152
0.30	358	912.00	0.25 oc	0.18 ic	---	---	0.00	0.00	---	---	---	---	0.177
0.40	1,159	912.10	0.25 oc	0.25 ic	---	---	0.00	0.00	---	---	---	---	0.245
0.50	1,960	912.20	0.32 oc	0.30 ic	---	---	0.00	0.00	---	---	---	---	0.297
0.60	2,762	912.30	0.35 oc	0.34 ic	---	---	0.00	0.00	---	---	---	---	0.341
0.70	3,563	912.40	0.39 oc	0.38 ic	---	---	0.00	0.00	---	---	---	---	0.381
0.80	4,364	912.50	0.44 oc	0.42 ic	---	---	0.00	0.00	---	---	---	---	0.416
0.90	5,165	912.60	0.48 oc	0.45 ic	---	---	0.00	0.00	---	---	---	---	0.449
1.00	5,967	912.70	0.48 oc	0.48 ic	---	---	0.00	0.00	---	---	---	---	0.479
1.10	6,768	912.80	0.53 oc	0.51 ic	---	---	0.00	0.00	---	---	---	---	0.508
1.20	7,569	912.90	0.58 oc	0.53 ic	---	---	0.00	0.00	---	---	---	---	0.535
1.30	8,370	913.00	0.58 oc	0.56 ic	---	---	0.00	0.00	---	---	---	---	0.561
1.40	9,828	913.10	0.63 oc	0.59 ic	---	---	0.00	0.00	---	---	---	---	0.585
1.50	11,285	913.20	0.63 oc	0.61 ic	---	---	0.00	0.00	---	---	---	---	0.609
1.60	12,743	913.30	0.63 oc	0.63 ic	---	---	0.00	0.00	---	---	---	---	0.632
1.70	14,200	913.40	0.69 oc	0.65 ic	---	---	0.00	0.00	---	---	---	---	0.654
1.80	15,657	913.50	0.69 oc	0.68 ic	---	---	0.00	0.00	---	---	---	---	0.675
1.90	17,115	913.60	0.75 oc	0.70 ic	---	---	0.00	0.00	---	---	---	---	0.696
2.00	18,572	913.70	0.75 oc	0.72 ic	---	---	0.00	0.00	---	---	---	---	0.716
2.10	20,030	913.80	0.75 oc	0.74 ic	---	---	0.00	0.00	---	---	---	---	0.735
2.20	21,487	913.90	0.82 oc	0.75 ic	---	---	0.00	0.00	---	---	---	---	0.754
2.30	22,944	914.00	0.82 oc	0.77 ic	---	---	0.00	0.00	---	---	---	---	0.773

Continues on next page...

Detention Basin

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
2.40	24,593	914.10	0.82 oc	0.79 ic	---	---	0.00	0.00	---	---	---	---	0.791
2.50	26,242	914.20	0.82 oc	0.81 ic	---	---	0.00	0.00	---	---	---	---	0.809
2.60	27,890	914.30	0.88 oc	0.83 ic	---	---	0.00	0.00	---	---	---	---	0.826
2.70	29,539	914.40	0.88 oc	0.84 ic	---	---	0.00	0.00	---	---	---	---	0.843
2.80	31,188	914.50	0.88 oc	0.86 ic	---	---	0.00	0.00	---	---	---	---	0.859
2.90	32,837	914.60	0.88 oc	0.88 ic	---	---	0.00	0.00	---	---	---	---	0.876
3.00	34,485	914.70	0.95 oc	0.89 ic	---	---	0.00	0.00	---	---	---	---	0.889
3.10	36,134	914.80	0.95 oc	0.91 ic	---	---	0.00	0.00	---	---	---	---	0.905
3.20	37,783	914.90	0.95 oc	0.92 ic	---	---	0.00	0.00	---	---	---	---	0.921
3.30	39,431	915.00	0.95 oc	0.94 ic	---	---	0.00	0.00	---	---	---	---	0.936
3.40	41,280	915.10	0.95 oc	0.95 ic	---	---	0.00	0.00	---	---	---	---	0.951
3.50	43,128	915.20	1.02 oc	0.96 ic	---	---	0.00	0.00	---	---	---	---	0.963
3.60	44,977	915.30	1.02 oc	0.98 ic	---	---	0.00	0.00	---	---	---	---	0.978
3.70	46,825	915.40	1.02 oc	0.99 ic	---	---	0.00	0.00	---	---	---	---	0.992
3.80	48,674	915.50	1.02 oc	1.01 ic	---	---	0.00	0.00	---	---	---	---	1.006
3.90	50,522	915.60	1.26 oc	1.01 ic	---	---	0.00	0.23	---	---	---	---	1.244
4.00	52,371	915.70	1.72 oc	1.01 ic	---	---	0.00	0.65	---	---	---	---	1.667
4.10	54,219	915.80	2.26 oc	1.01 ic	---	---	0.00	1.20	---	---	---	---	2.215
4.20	56,068	915.90	2.87 oc	1.01 ic	---	---	0.00	1.85	---	---	---	---	2.862
4.30	57,916	916.00	3.71 oc	1.00 ic	---	---	0.00	2.59	---	---	---	---	3.595
4.40	59,988	916.10	4.47 oc	1.00 ic	---	---	0.00	3.40	---	---	---	---	4.406
4.50	62,059	916.20	5.29 oc	1.00 ic	---	---	0.00	4.29	---	---	---	---	5.287
4.60	64,131	916.30	6.33 oc	0.99 ic	---	---	0.00	5.24	---	---	---	---	6.230
4.70	66,203	916.40	7.42 oc	0.98 ic	---	---	0.00	6.25	---	---	---	---	7.234
4.80	68,274	916.50	8.35 oc	0.97 ic	---	---	0.00	7.32	---	---	---	---	8.299
4.90	70,346	916.60	9.47 oc	0.97 ic	---	---	0.00	8.45	---	---	---	---	9.415
5.00	72,417	916.70	10.58 oc	0.95 ic	---	---	0.00	9.63	---	---	---	---	10.58
5.10	74,489	916.80	11.84 oc	0.94 ic	---	---	0.00	10.86	---	---	---	---	11.80
5.20	76,560	916.90	13.19 oc	0.93 ic	---	---	0.00	12.13	---	---	---	---	13.06
5.30	78,632	917.00	14.40 oc	0.91 ic	---	---	0.00	13.46	---	---	---	---	14.37
5.40	80,920	917.10	15.79 oc	0.89 ic	---	---	0.00	14.83	---	---	---	---	15.71
5.50	83,208	917.20	17.10 oc	0.85 ic	---	---	0.00	16.24	---	---	---	---	17.09
5.60	85,496	917.30	18.50 oc	0.81 ic	---	---	0.00	17.69	---	---	---	---	18.50
5.70	87,783	917.40	20.01 oc	0.82 ic	---	---	0.00	19.19	---	---	---	---	20.00
5.80	90,071	917.50	21.56 oc	0.83 ic	---	---	0.00	20.72	---	---	---	---	21.55
5.90	92,359	917.60	23.14 oc	0.85 ic	---	---	0.00	22.29	---	---	---	---	23.14
6.00	94,647	917.70	24.77 oc	0.86 ic	---	---	0.00	23.90	---	---	---	---	24.76
6.10	96,935	917.80	26.42 oc	0.87 ic	---	---	0.00	25.55	---	---	---	---	26.42
6.20	99,223	917.90	28.12 oc	0.88 ic	---	---	0.00	27.23	---	---	---	---	28.12
6.30	101,511	918.00	29.85 oc	0.89 ic	---	---	0.00	28.96	---	---	---	---	29.85
6.40	104,031	918.10	31.62 oc	0.90 ic	---	---	0.00	30.71	---	---	---	---	31.62
6.50	106,552	918.20	33.42 oc	0.92 ic	---	---	0.00	32.50	---	---	---	---	33.42
6.60	109,072	918.30	35.25 oc	0.92 ic	---	---	0.00	34.32	---	---	---	---	35.25
6.70	111,592	918.40	37.12 oc	0.93 ic	---	---	0.00	36.18	---	---	---	---	37.11
6.80	114,113	918.50	39.01 oc	0.94 ic	---	---	0.00	38.06	---	---	---	---	39.01
6.90	116,633	918.60	40.94 oc	0.95 ic	---	---	0.00	39.98	---	---	---	---	40.93
7.00	119,153	918.70	42.89 oc	0.96 ic	---	---	0.00	41.93	---	---	---	---	42.89
7.10	121,674	918.80	44.88 oc	0.97 ic	---	---	0.00	43.91 s	---	---	---	---	44.88
7.20	124,194	918.90	46.86 oc	0.97 ic	---	---	0.00	45.88 s	---	---	---	---	46.85
7.30	126,714	919.00	48.84 oc	0.98 ic	---	---	0.00	47.86 s	---	---	---	---	48.84
7.40	129,541	919.10	50.82 oc	0.98 ic	---	---	0.00	49.83 s	---	---	---	---	50.82
7.50	132,368	919.20	52.80 oc	0.99 ic	---	---	0.00	51.81 s	---	---	---	---	52.80
7.60	135,194	919.30	54.79 oc	0.99 ic	---	---	0.00	53.80 s	---	---	---	---	54.79
7.70	138,021	919.40	56.79 oc	1.00 ic	---	---	0.00	55.79 s	---	---	---	---	56.79
7.80	140,847	919.50	58.79 oc	1.00 ic	---	---	0.00	57.78 s	---	---	---	---	58.79
7.90	143,674	919.60	60.79 oc	1.01 ic	---	---	0.00	59.78 s	---	---	---	---	60.79
8.00	146,500	919.70	62.80 oc	1.01 ic	---	---	0.00	61.78 s	---	---	---	---	62.80
8.10	149,327	919.80	64.80 oc	1.01 ic	---	---	0.00	63.79 s	---	---	---	---	64.80
8.20	152,153	919.90	66.81 oc	1.02 ic	---	---	0.00	65.79 s	---	---	---	---	66.81
8.30	154,980	920.00	68.82 oc	1.02 ic	---	---	0.00	67.80 s	---	---	---	---	68.82
8.40	158,053	920.10	70.82 oc	1.02 ic	---	---	0.00	69.80 s	---	---	---	---	70.82
8.50	161,126	920.20	72.82 oc	1.02 ic	---	---	0.00	71.80 s	---	---	---	---	72.82
8.60	164,199	920.30	74.82 oc	1.03 ic	---	---	0.00	73.79 s	---	---	---	---	74.82
8.70	167,272	920.40	76.81 oc	1.03 ic	---	---	0.00	75.78 s	---	---	---	---	76.81
8.80	170,345	920.50	78.80 oc	1.03 ic	---	---	0.00	77.77 s	---	---	---	---	78.79
8.90	173,418	920.60	80.78 oc	1.03 ic	---	---	0.00	79.74 s	---	---	---	---	80.77
9.00	176,491	920.70	82.75 oc	1.03 ic	---	---	0.00	81.72 s	---	---	---	---	82.75
9.10	179,564	920.80	84.71 oc	1.03 ic	---	---	0.00	83.68 s	---	---	---	---	84.71
9.20	182,637	920.90	86.67 oc	1.03 ic	---	---	0.00	85.64 s	---	---	---	---	86.67
9.30	185,709	921.00	89.11 oc	1.03 ic	---	---	0.67	87.42 s	---	---	---	---	89.11
9.40	188,968	921.10	93.71 oc	1.01 ic	---	---	4.36	88.35 s	---	---	---	---	93.71
9.50	192,227	921.20	99.33 ic	0.97 ic	---	---	9.78	88.57 s	---	---	---	---	99.33

Continues on next page...

Detention Basin

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
9.60	195,486	921.30	104.49 ic	0.91 ic	---	---	16.50	87.08 s	---	---	---	---	104.49
9.70	198,745	921.40	109.71 ic	0.85 ic	---	---	24.29	84.57 s	---	---	---	---	109.71
9.80	202,004	921.50	114.80 ic	0.77 ic	---	---	33.02	81.00 s	---	---	---	---	114.80
9.90	205,263	921.60	119.61 ic	0.69 ic	---	---	42.61	76.32 s	---	---	---	---	119.61
10.00	208,522	921.70	124.04 ic	0.60 ic	---	---	52.97	70.47 s	---	---	---	---	124.04
10.10	211,781	921.80	128.01 ic	0.51 ic	---	---	64.07	63.43 s	---	---	---	---	128.00
10.20	215,040	921.90	130.63 ic	0.44 ic	---	---	71.81 s	58.37 s	---	---	---	---	130.63
10.30	218,299	922.00	132.46 ic	0.40 ic	---	---	76.88 s	55.18 s	---	---	---	---	132.46

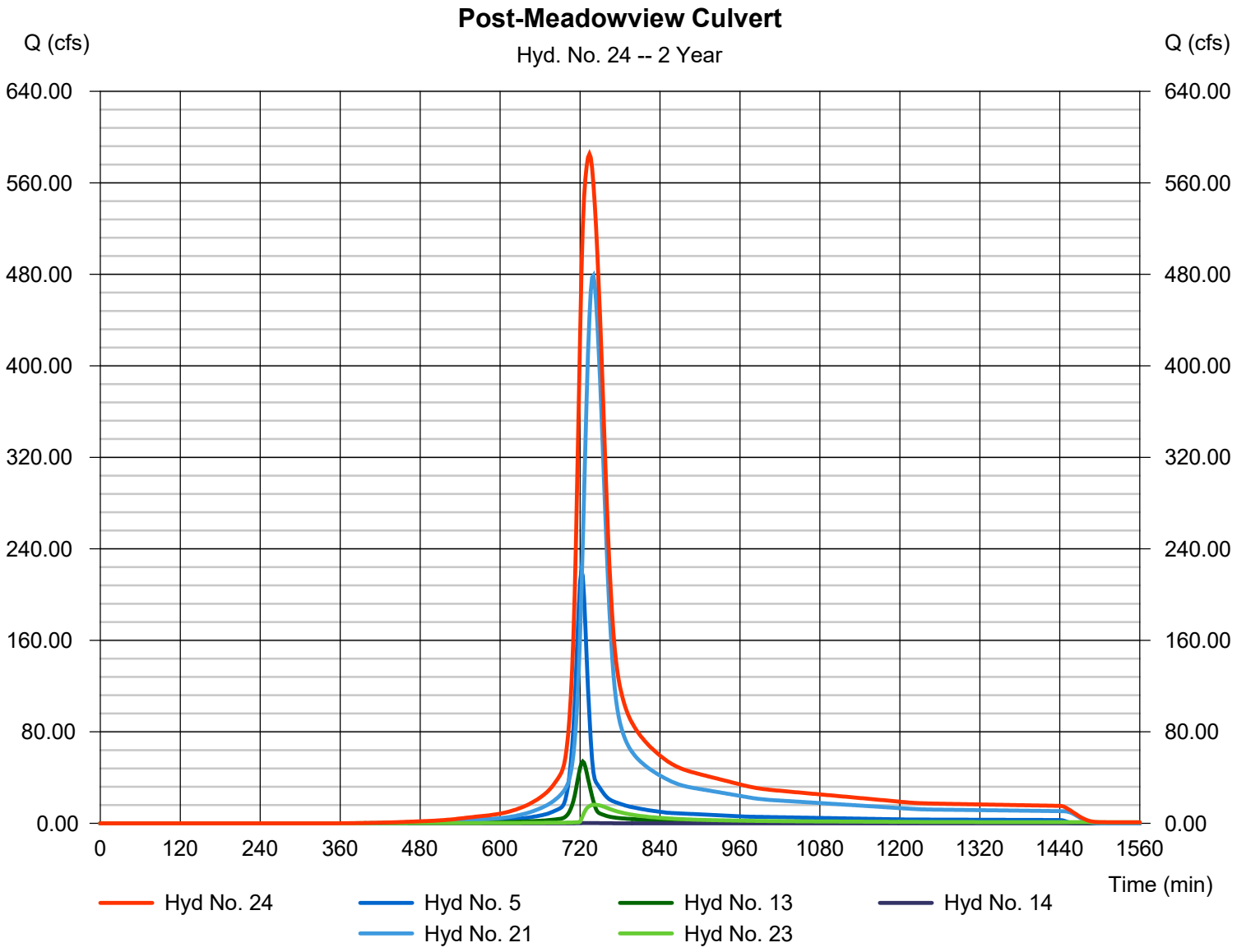
...End

Hydrograph Report

Hyd. No. 24

Post-Meadowview Culvert

Hydrograph type	=	Combine	Peak discharge	=	585.20 cfs
Storm frequency	=	2 yrs	Time to peak	=	734 min
Time interval	=	2 min	Hyd. volume	=	3,086,111 cuft
Inflow hyds.	=	5, 13, 14, 21, 23	Contrib. drain. area	=	107.050 ac



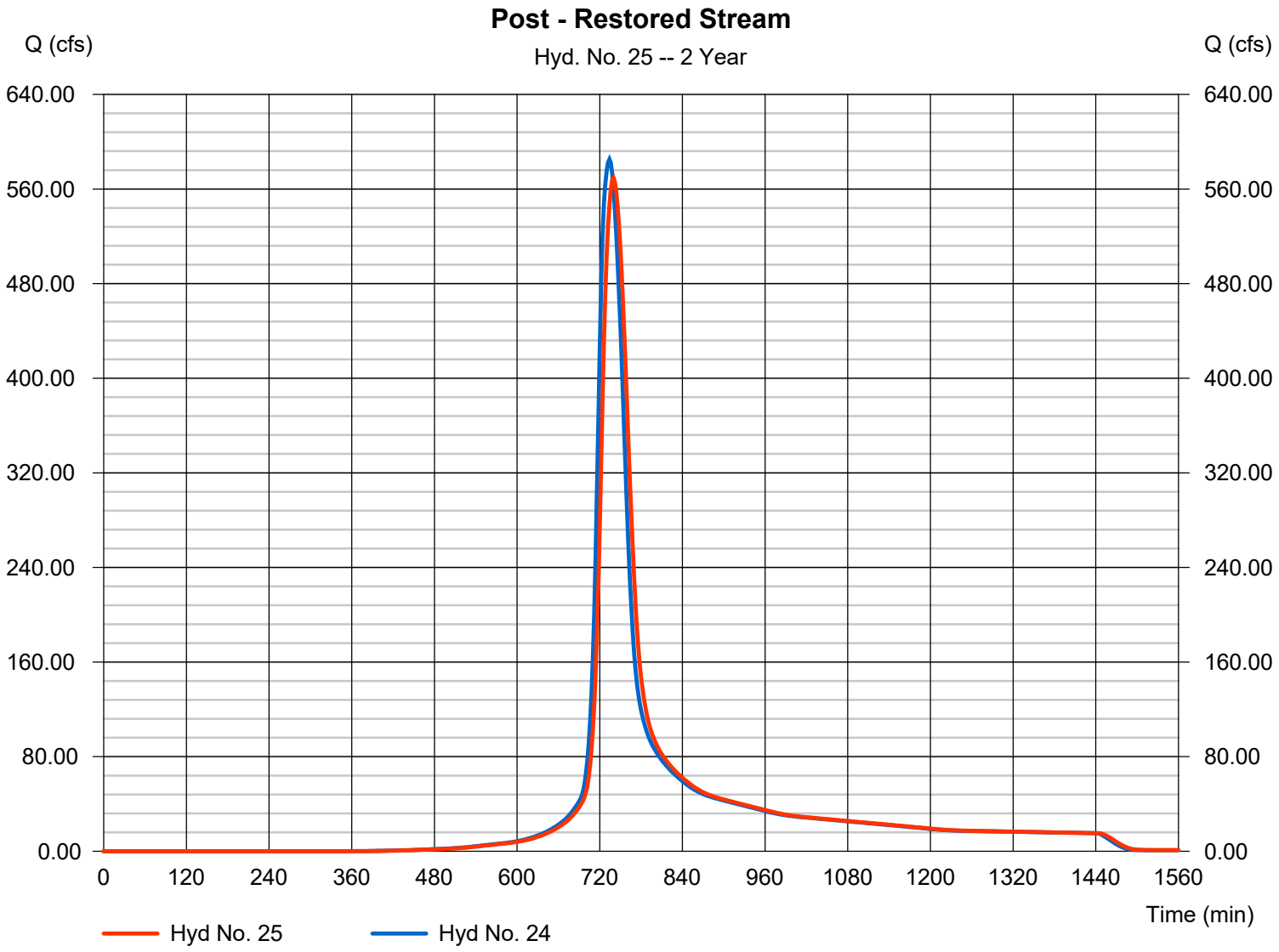
Hydrograph Report

Hyd. No. 25

Post - Restored Stream

Hydrograph type	=	Reach	Peak discharge	=	569.55 cfs
Storm frequency	=	2 yrs	Time to peak	=	740 min
Time interval	=	2 min	Hyd. volume	=	3,086,047 cuft
Inflow hyd. No.	=	24 - 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	=	3.49 ft/s	Routing coeff.	=	0.3471

Modified Att-Kin routing method used.



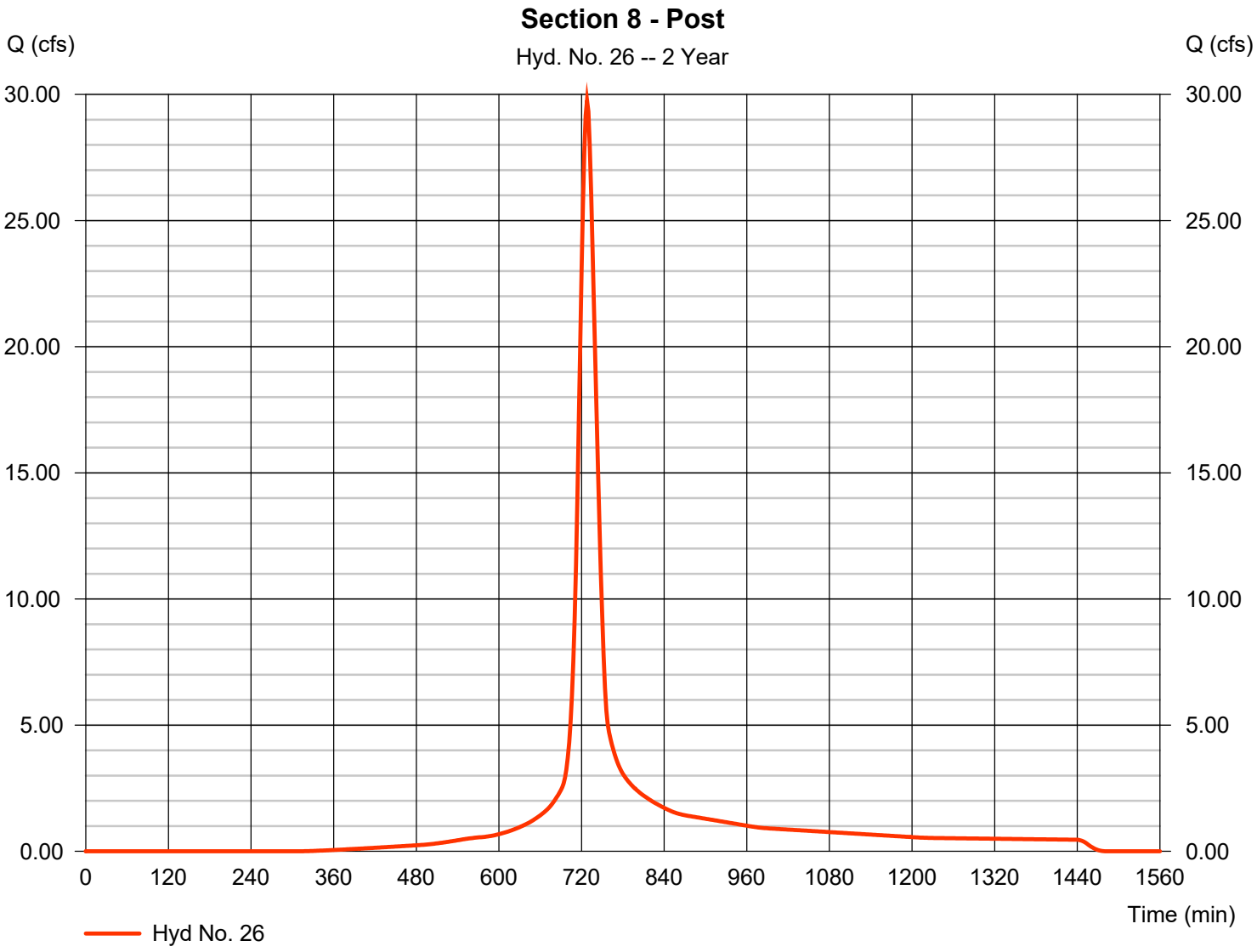
Hydrograph Report

Hyd. No. 26

Section 8 - Post

Hydrograph type	=	SCS Runoff	Peak discharge	=	29.76 cfs
Storm frequency	=	2 yrs	Time to peak	=	728 min
Time interval	=	2 min	Hyd. volume	=	110,215 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. 26

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**

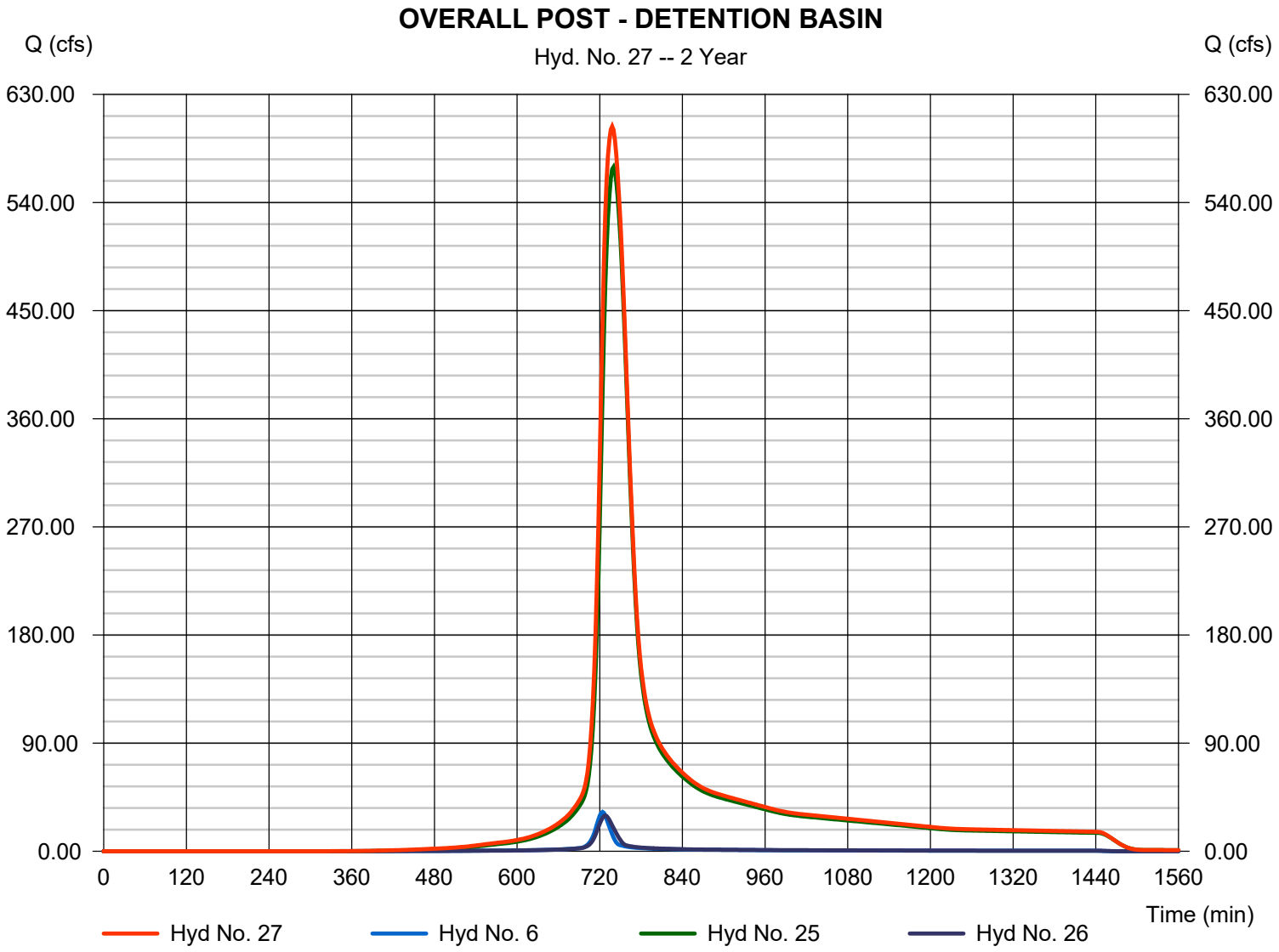
Total Travel Time, Tc ..... 23.90 min

Hydrograph Report

Hyd. No. 27

OVERALL POST - DETENTION BASIN

Hydrograph type	=	Combine	Peak discharge	=	603.42 cfs
Storm frequency	=	2 yrs	Time to peak	=	738 min
Time interval	=	2 min	Hyd. volume	=	3,300,498 cuft
Inflow hyds.	=	6, 25, 26	Contrib. drain. area	=	23.900 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

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	228.55	2	728	839,577	------	------	------	Section 1
2	SCS Runoff	190.22	2	728	698,792	------	------	------	Section 2
3	SCS Runoff	306.37	2	730	1,225,319	------	------	------	Section 3
4	SCS Runoff	273.45	2	732	1,199,107	------	------	------	Section 4
5	SCS Runoff	394.04	2	722	1,121,472	------	------	------	Section 5
6	SCS Runoff	53.70	2	724	175,306	------	------	------	Section 6
7	SCS Runoff	227.73	2	728	855,894	------	------	------	Section 7/8-Pre
8	Combine	722.19	2	730	2,763,687	1, 2, 3,	------	------	Industrial Complex to Detention
9	Reach	695.55	2	734	2,763,686	8	------	------	Industrial Above Ground Detention Po
10	Combine	966.72	2	734	3,962,792	4, 9	------	------	Strother Road Culvert
11	Reach	915.90	2	738	3,962,789	10	------	------	Wilshire Existing Stream
12	Combine	1263.54	2	732	6,115,463	5, 6, 7, 11	------	------	OVERALL PRE
13	SCS Runoff	91.08	2	724	293,265	------	------	------	Section 7A-Post
14	SCS Runoff	0.570	2	734	2,476	------	------	------	Bypass
15	SCS Runoff	24.92	2	722	71,232	------	------	------	Northeast
16	SCS Runoff	39.93	2	718	97,271	------	------	------	Southeast
17	SCS Runoff	10.19	2	718	24,822	------	------	------	Southwest
18	SCS Runoff	16.96	2	720	44,896	------	------	------	West
19	SCS Runoff	9.081	2	726	31,711	------	------	------	Lot 5 (Wilshire Phase III)
20	SCS Runoff	17.60	2	730	70,943	------	------	------	Section 7B-Post (Offsite to Basin)
21	Reach	933.75	2	738	3,962,789	10	------	------	Wilshire- Preserved stream
22	Combine	108.85	2	720	340,876	15, 16, 17, 18, 19, 20,	------	------	Onsite Water
23	Reservoir	48.60	2	732	340,861	22	918.99	126,409	Detention Basin
24	Combine	1161.71	2	732	5,720,853	5, 13, 14, 21, 23	------	------	Post-Meadowview Culvert
25	Reach	1138.21	2	738	5,720,807	24	------	------	Post - Restored Stream
26	SCS Runoff	49.61	2	728	187,574	------	------	------	Section 8 - Post
27	Combine	1200.34	2	736	6,083,689	6, 25, 26	------	------	OVERALL POST - DETENTION BASI

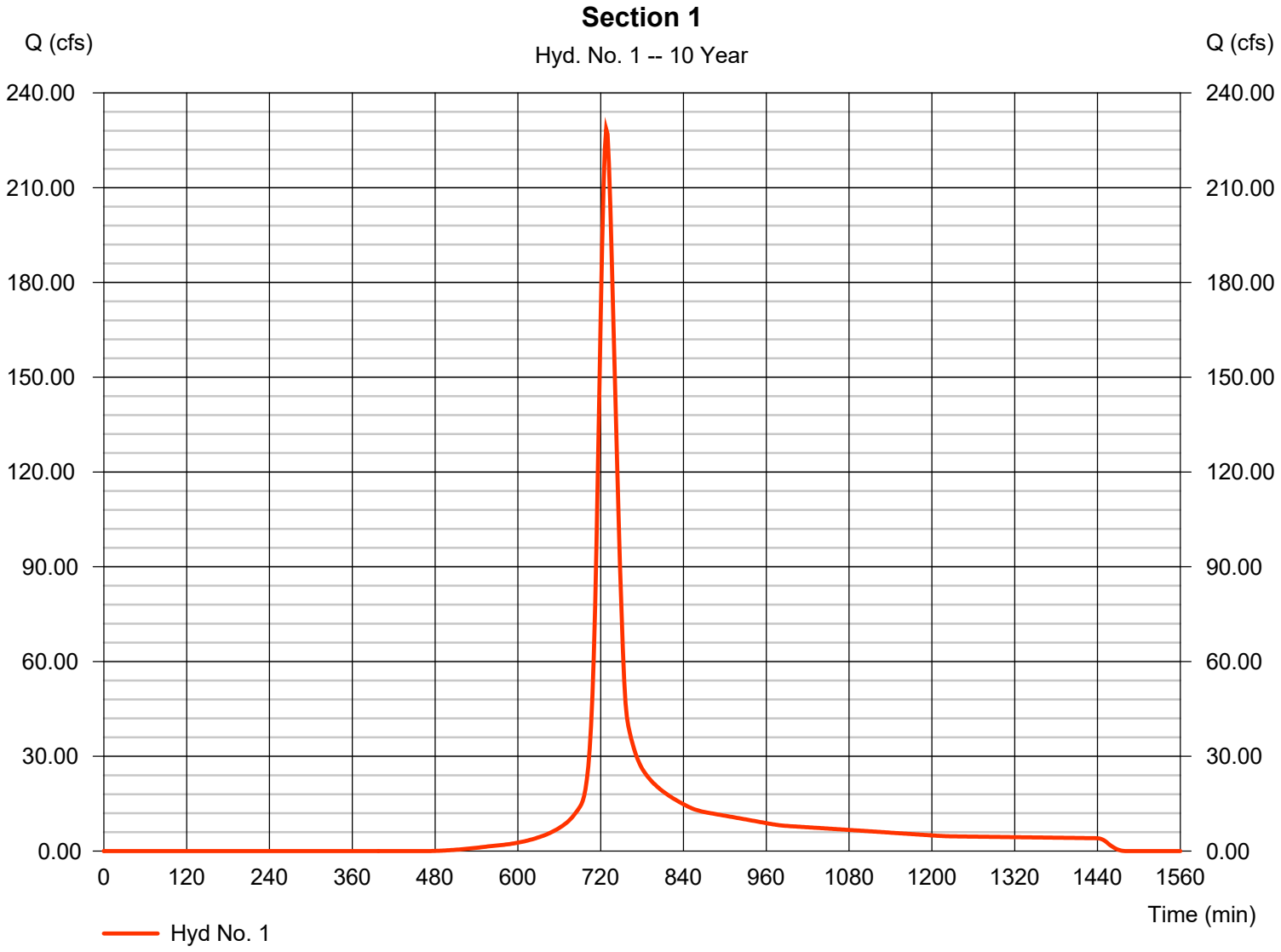
Hydrograph Report

Hyd. No. 1

Section 1

Hydrograph type	=	SCS Runoff	Peak discharge	=	228.55 cfs
Storm frequency	=	10 yrs	Time to peak	=	728 min
Time interval	=	2 min	Hyd. volume	=	839,577 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



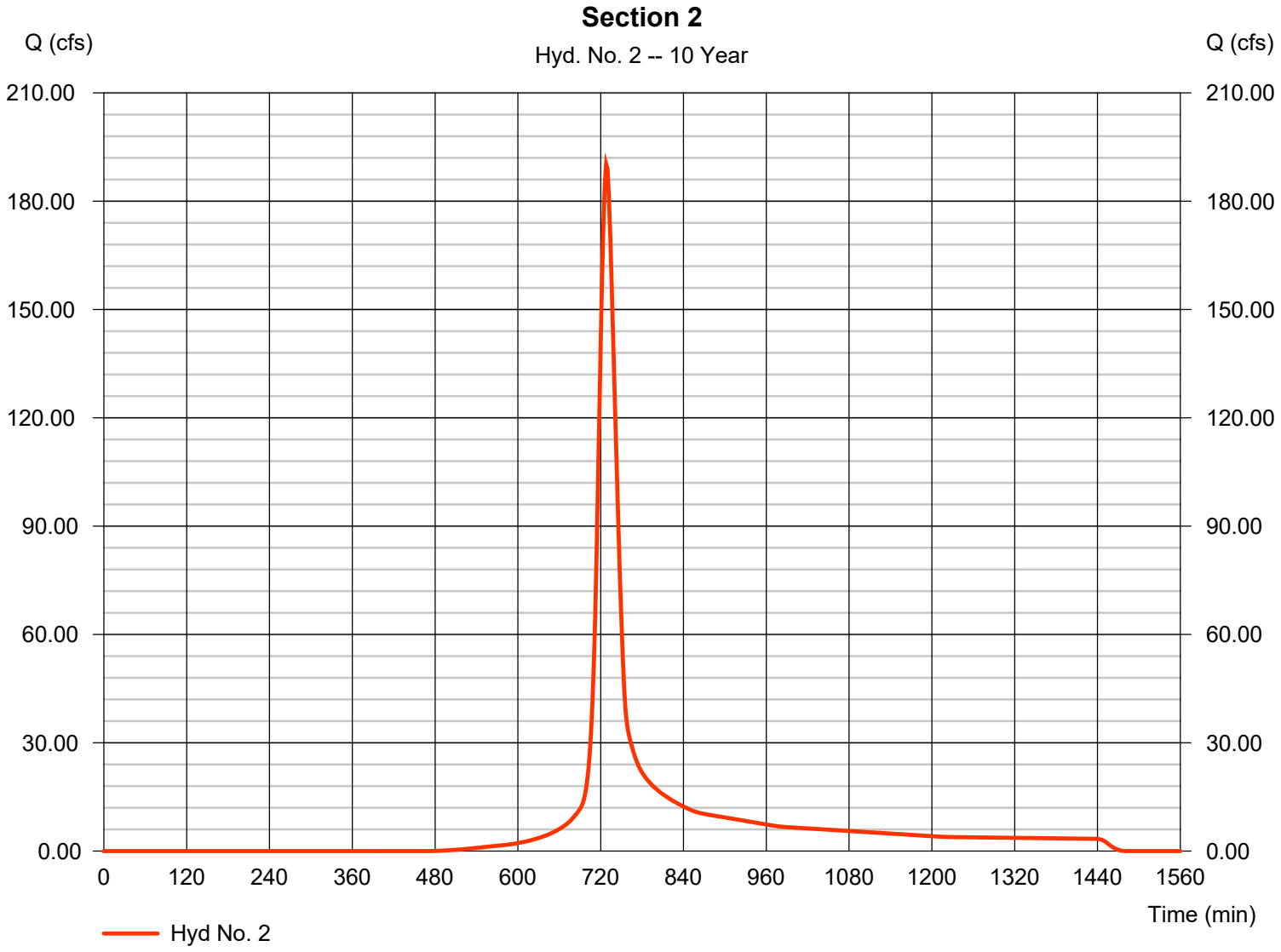
Hydrograph Report

Hyd. No. 2

Section 2

Hydrograph type	=	SCS Runoff	Peak discharge	=	190.22 cfs
Storm frequency	=	10 yrs	Time to peak	=	728 min
Time interval	=	2 min	Hyd. volume	=	698,792 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



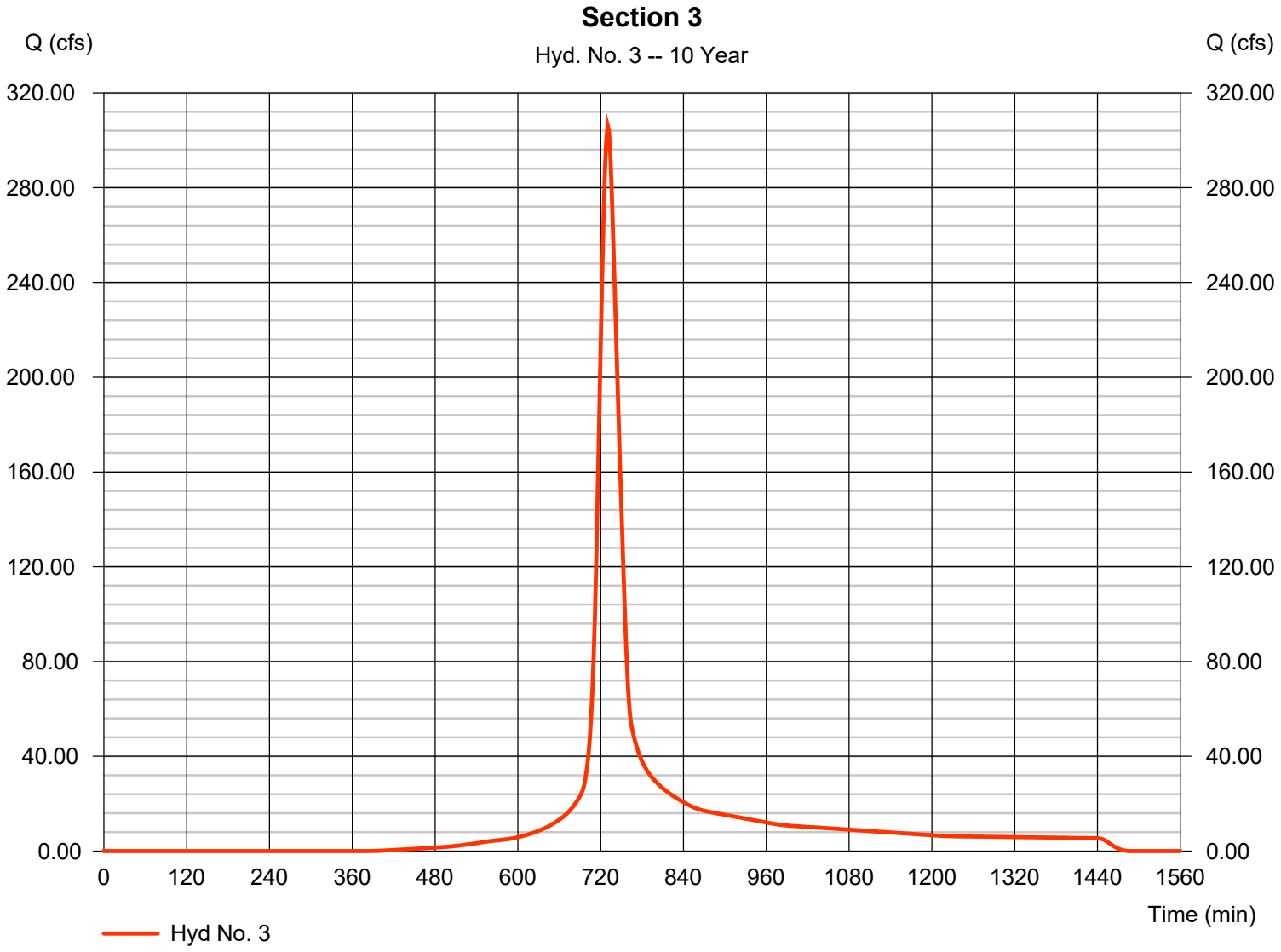
Hydrograph Report

Hyd. No. 3

Section 3

Hydrograph type	=	SCS Runoff	Peak discharge	=	306.37 cfs
Storm frequency	=	10 yrs	Time to peak	=	730 min
Time interval	=	2 min	Hyd. volume	=	1,225,319 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



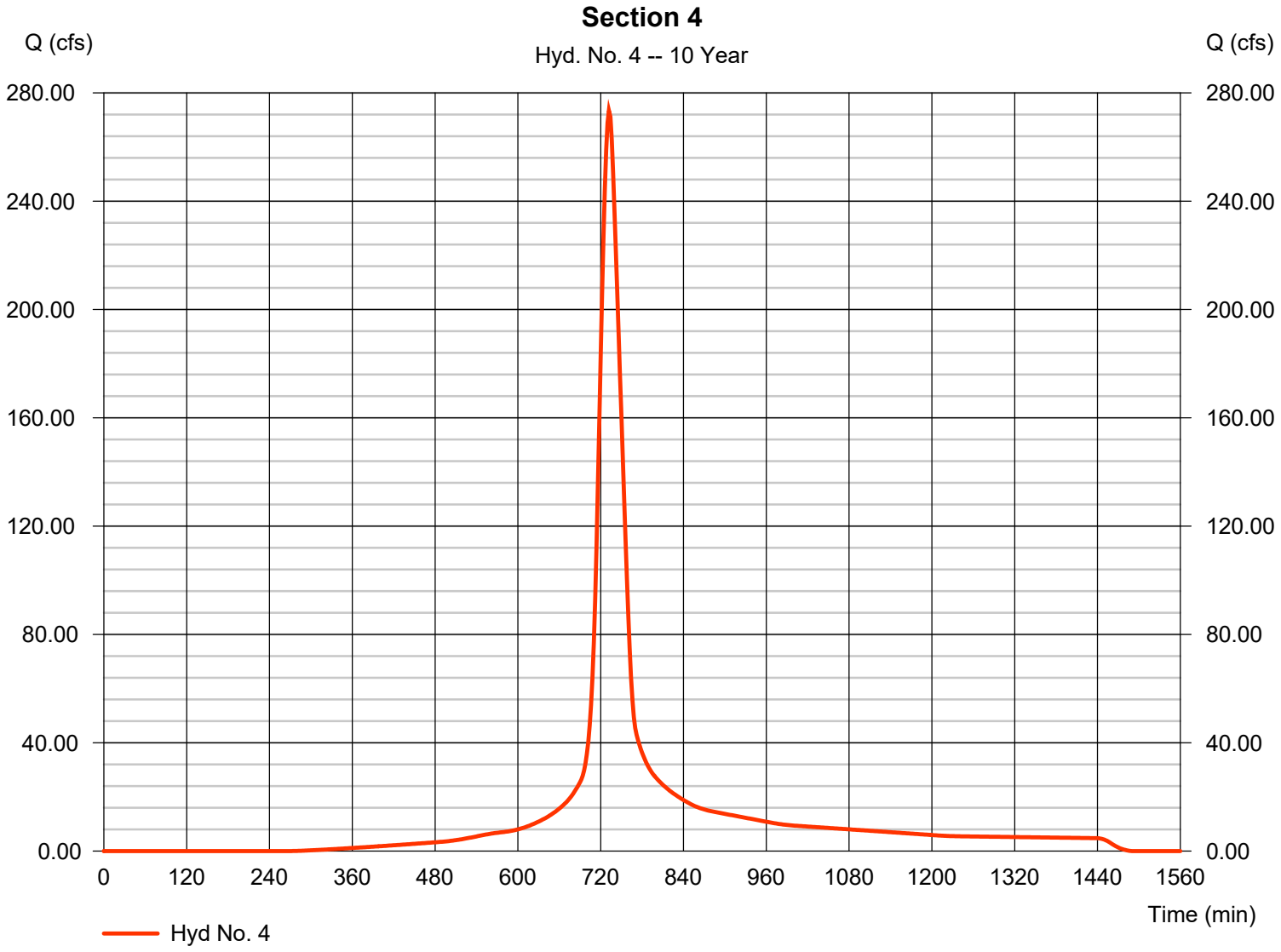
Hydrograph Report

Hyd. No. 4

Section 4

Hydrograph type	=	SCS Runoff	Peak discharge	=	273.45 cfs
Storm frequency	=	10 yrs	Time to peak	=	732 min
Time interval	=	2 min	Hyd. volume	=	1,199,107 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



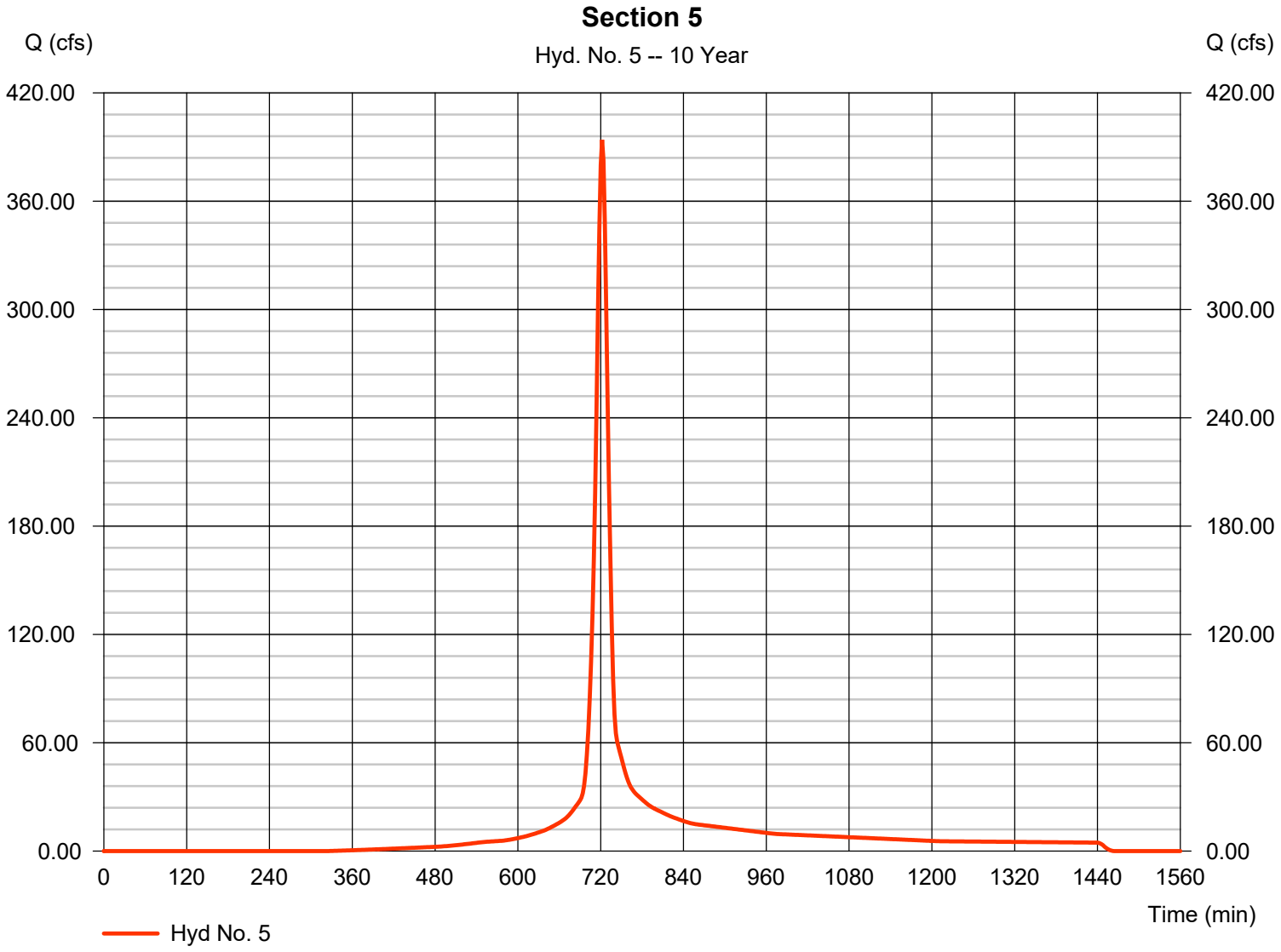
Hydrograph Report

Hyd. No. 5

Section 5

Hydrograph type	=	SCS Runoff	Peak discharge	=	394.04 cfs
Storm frequency	=	10 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	1,121,472 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



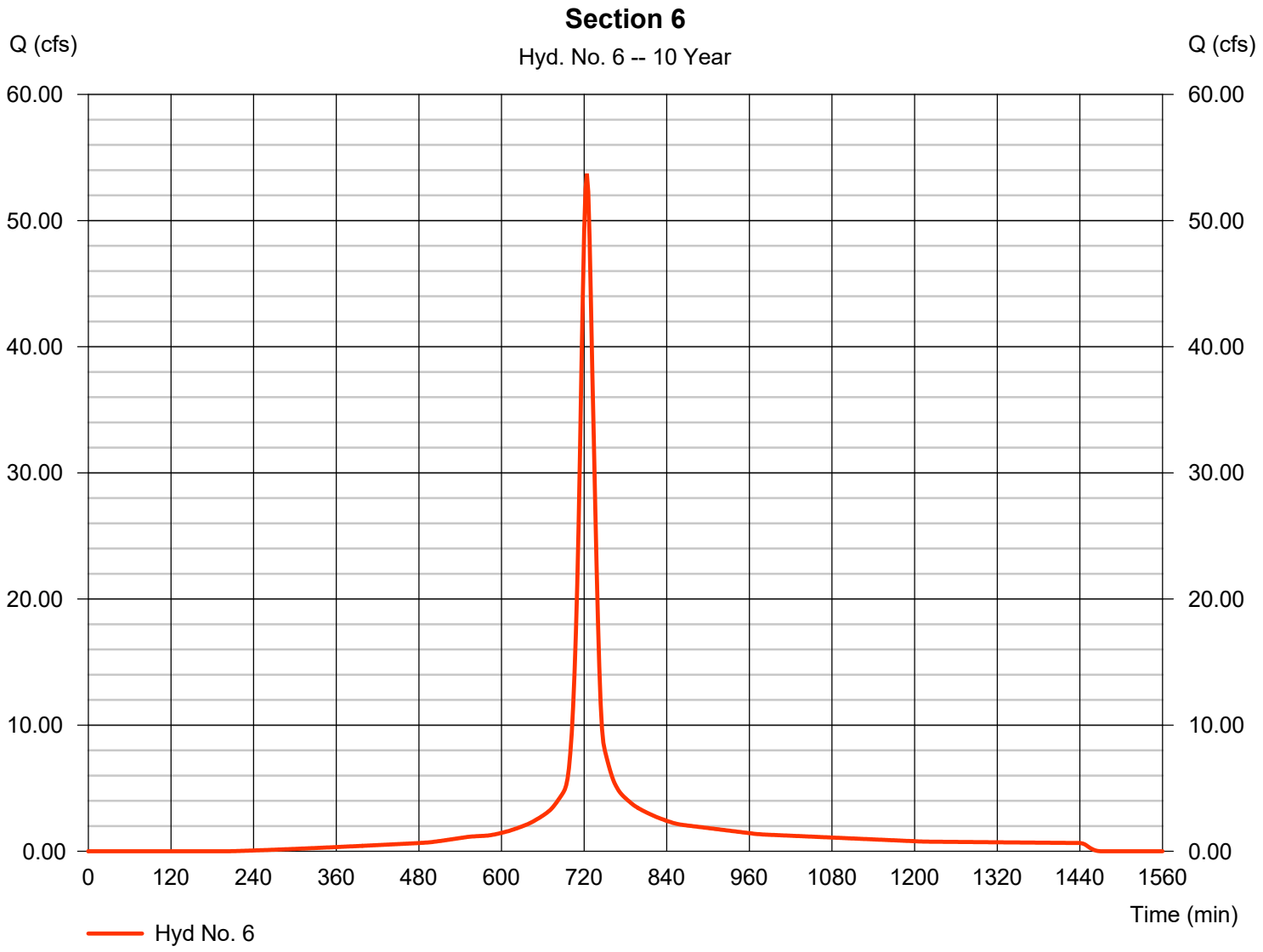
Hydrograph Report

Hyd. No. 6

Section 6

Hydrograph type	=	SCS Runoff	Peak discharge	=	53.70 cfs
Storm frequency	=	10 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	175,306 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

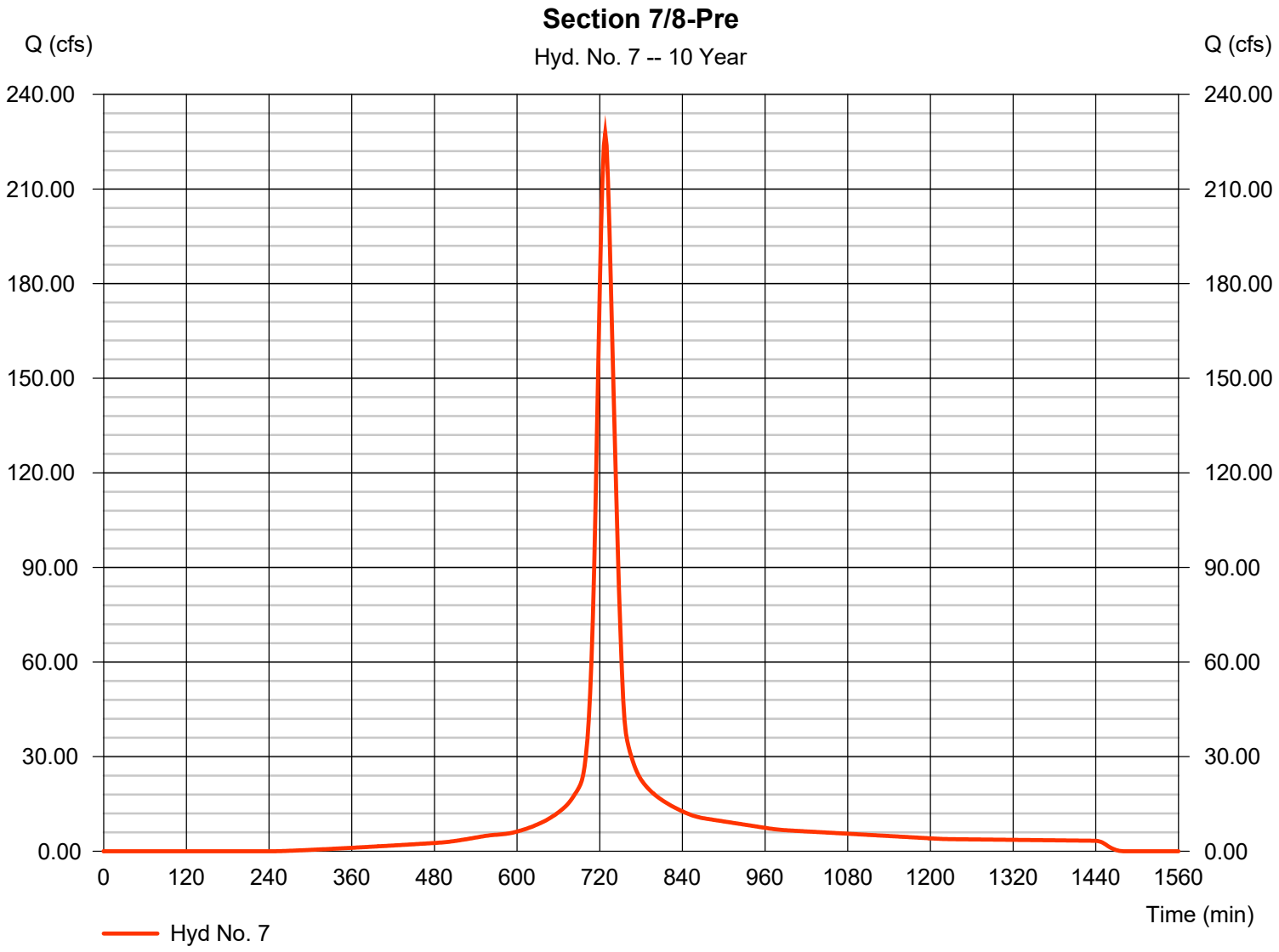
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020 Wednesday, 04 / 17 / 2024

Hyd. No. 7

Section 7/8-Pre

Hydrograph type	=	SCS Runoff	Peak discharge	=	227.73 cfs
Storm frequency	=	10 yrs	Time to peak	=	728 min
Time interval	=	2 min	Hyd. volume	=	855,894 cuft
Drainage area	=	59.000 ac	Curve number	=	89*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	25.20 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

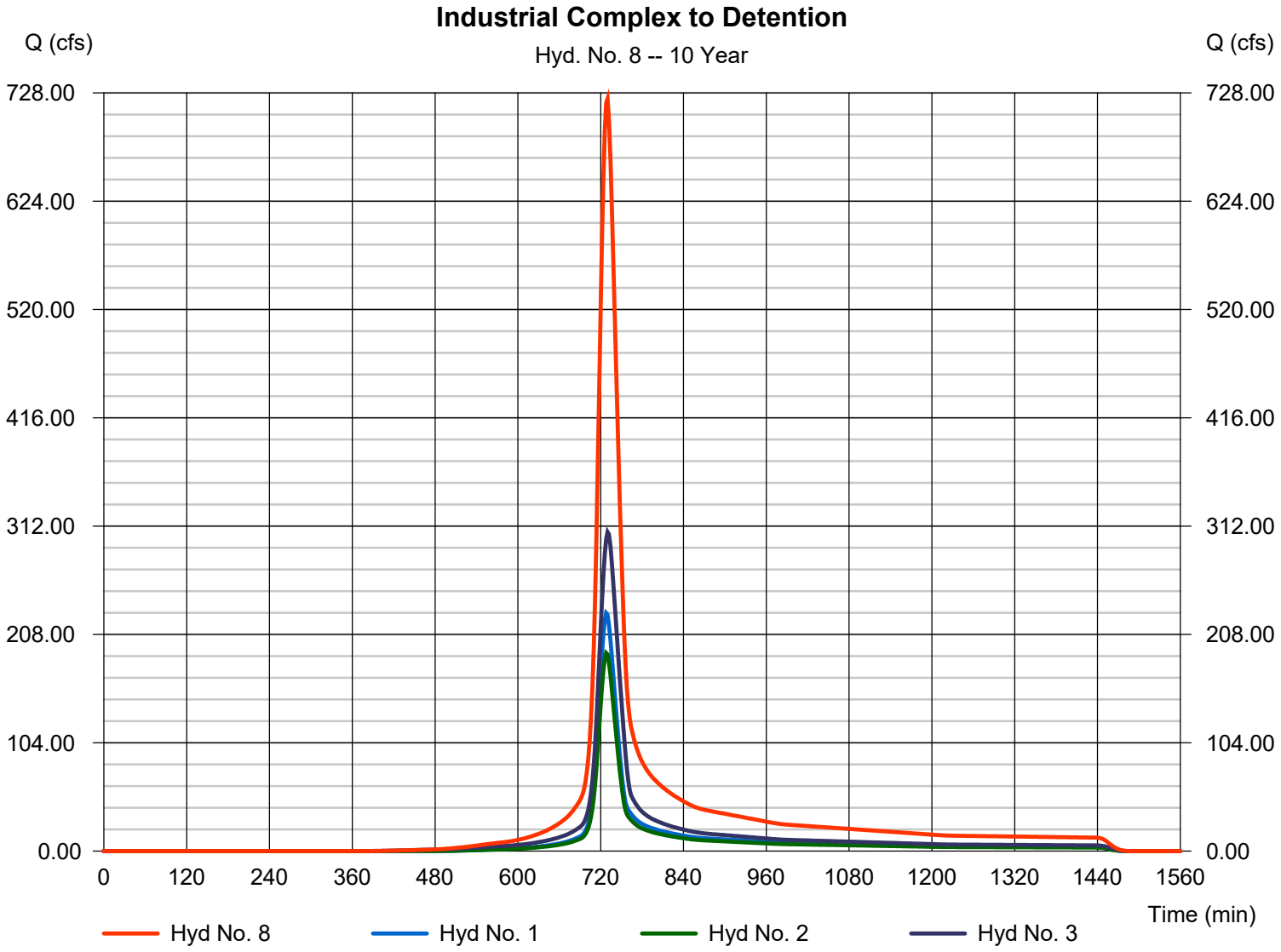


Hydrograph Report

Hyd. No. 8

Industrial Complex to Detention

Hydrograph type	= Combine	Peak discharge	= 722.19 cfs
Storm frequency	= 10 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 2,763,687 cuft
Inflow hyds.	= 1, 2, 3	Contrib. drain. area	= 250.500 ac



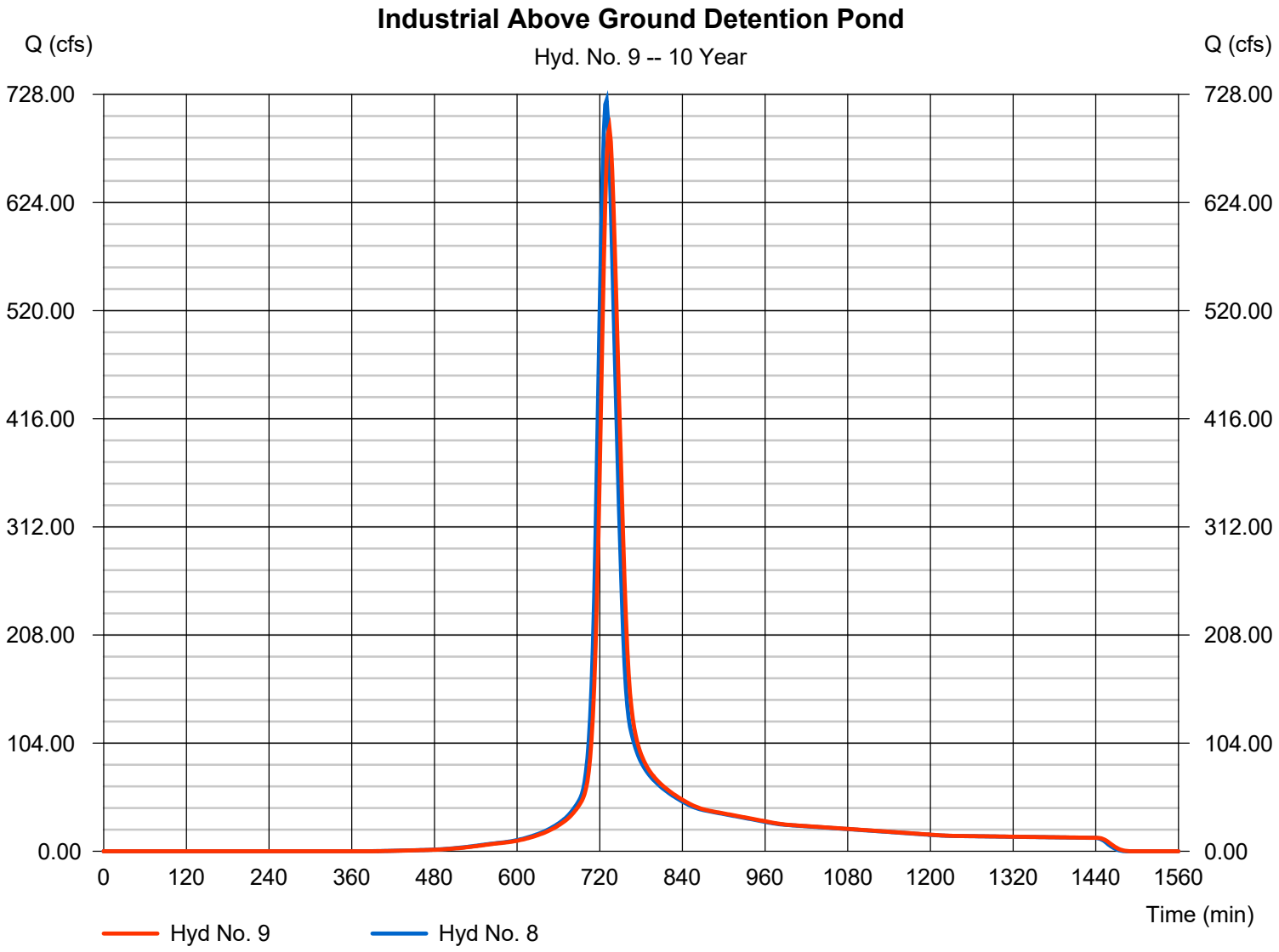
Hydrograph Report

Hyd. No. 9

Industrial Above Ground Detention Pond

Hydrograph type	=	Reach	Peak discharge	=	695.55 cfs
Storm frequency	=	10 yrs	Time to peak	=	734 min
Time interval	=	2 min	Hyd. volume	=	2,763,686 cuft
Inflow hyd. No.	=	8 - Industrial Complex to Detention	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	=	3.33 ft/s	Routing coeff.	=	0.4384

Modified Att-Kin routing method used.

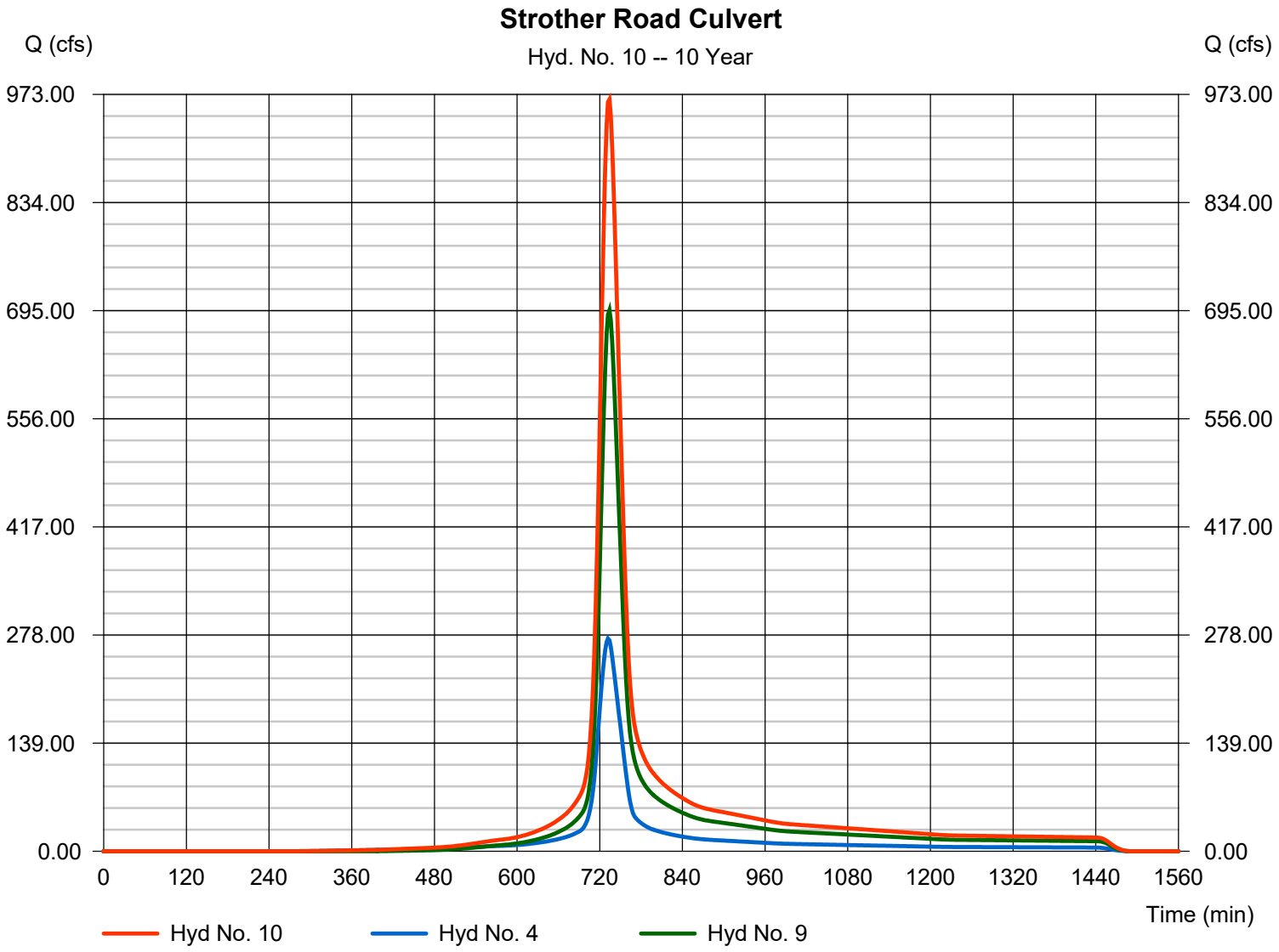


Hydrograph Report

Hyd. No. 10

Strother Road Culvert

Hydrograph type	=	Combine	Peak discharge	=	966.72 cfs
Storm frequency	=	10 yrs	Time to peak	=	734 min
Time interval	=	2 min	Hyd. volume	=	3,962,792 cuft
Inflow hyds.	=	4, 9	Contrib. drain. area	=	82.500 ac



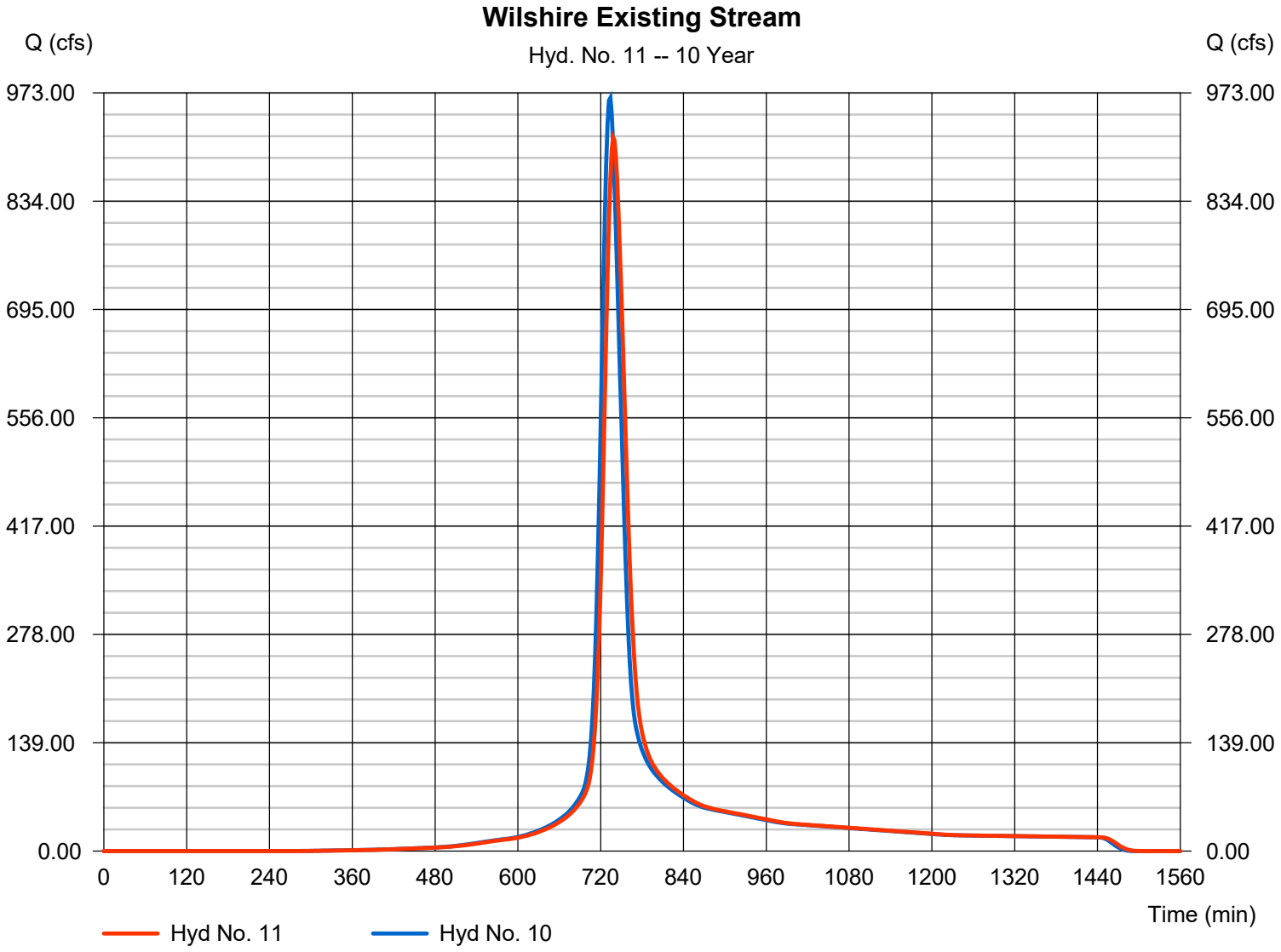
Hydrograph Report

Hyd. No. 11

Wilshire Existing Stream

Hydrograph type	=	Reach	Peak discharge	=	915.90 cfs
Storm frequency	=	10 yrs	Time to peak	=	738 min
Time interval	=	2 min	Hyd. volume	=	3,962,789 cuft
Inflow hyd. No.	=	10 - Strother Road Culvert	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	=	6.40 ft/s	Routing coeff.	=	0.3536

Modified Att-Kin routing method used.

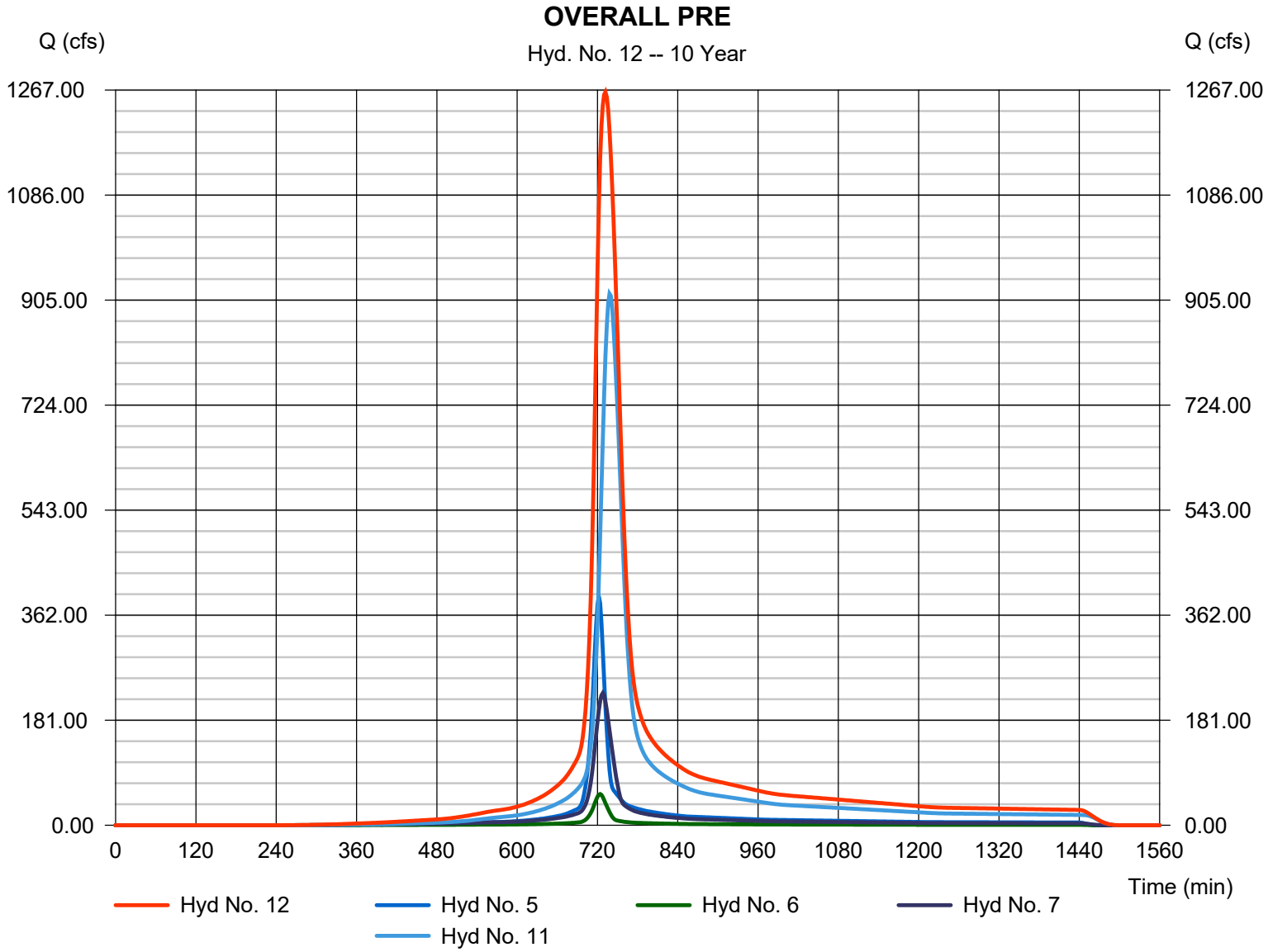


Hydrograph Report

Hyd. No. 12

OVERALL PRE

Hydrograph type	= Combine	Peak discharge	= 1263.54 cfs
Storm frequency	= 10 yrs	Time to peak	= 732 min
Time interval	= 2 min	Hyd. volume	= 6,115,463 cuft
Inflow hyds.	= 5, 6, 7, 11	Contrib. drain. area	= 157.200 ac



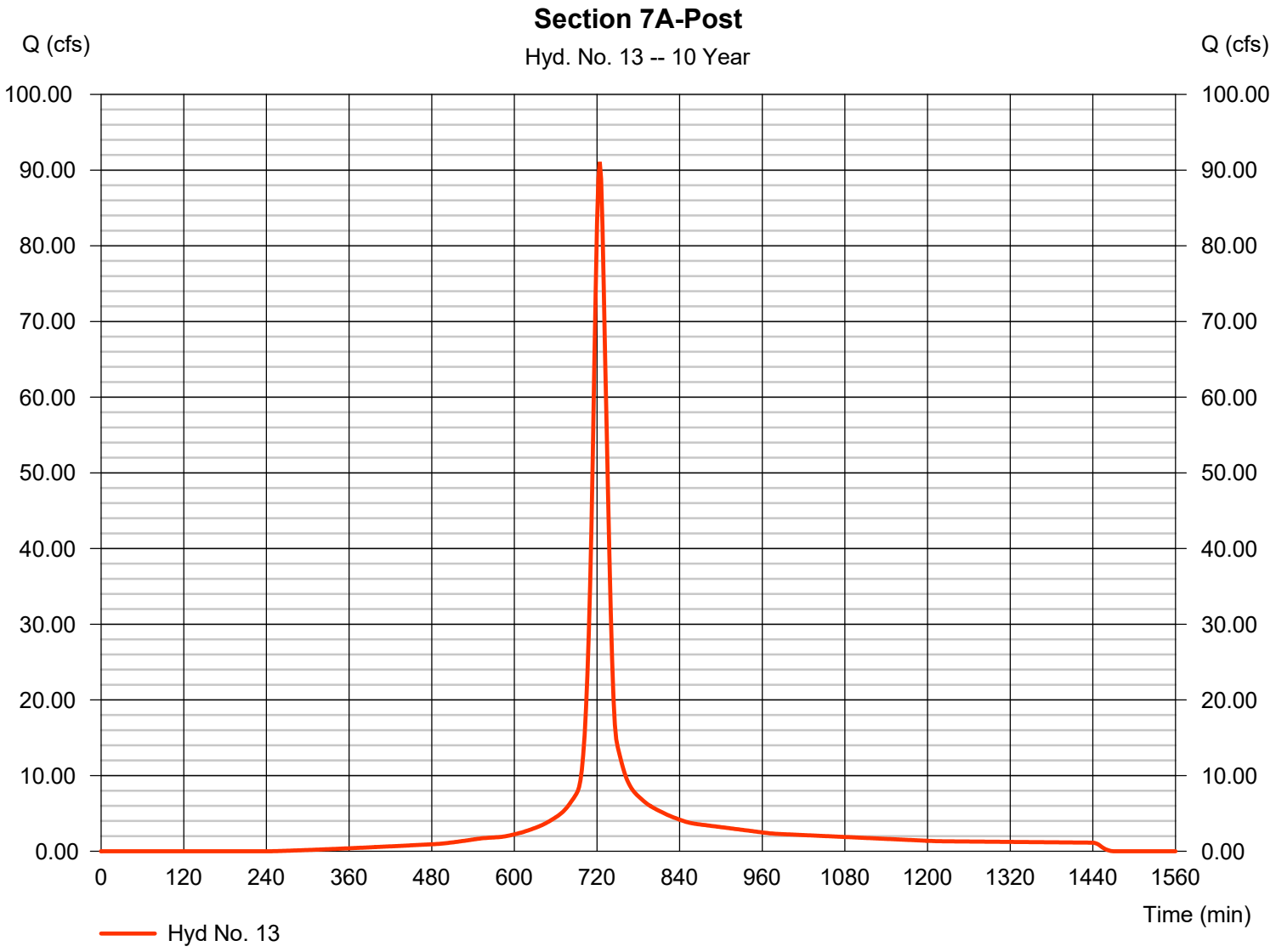
Hydrograph Report

Hyd. No. 13

Section 7A-Post

Hydrograph type	=	SCS Runoff	Peak discharge	=	91.08 cfs
Storm frequency	=	10 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	293,265 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



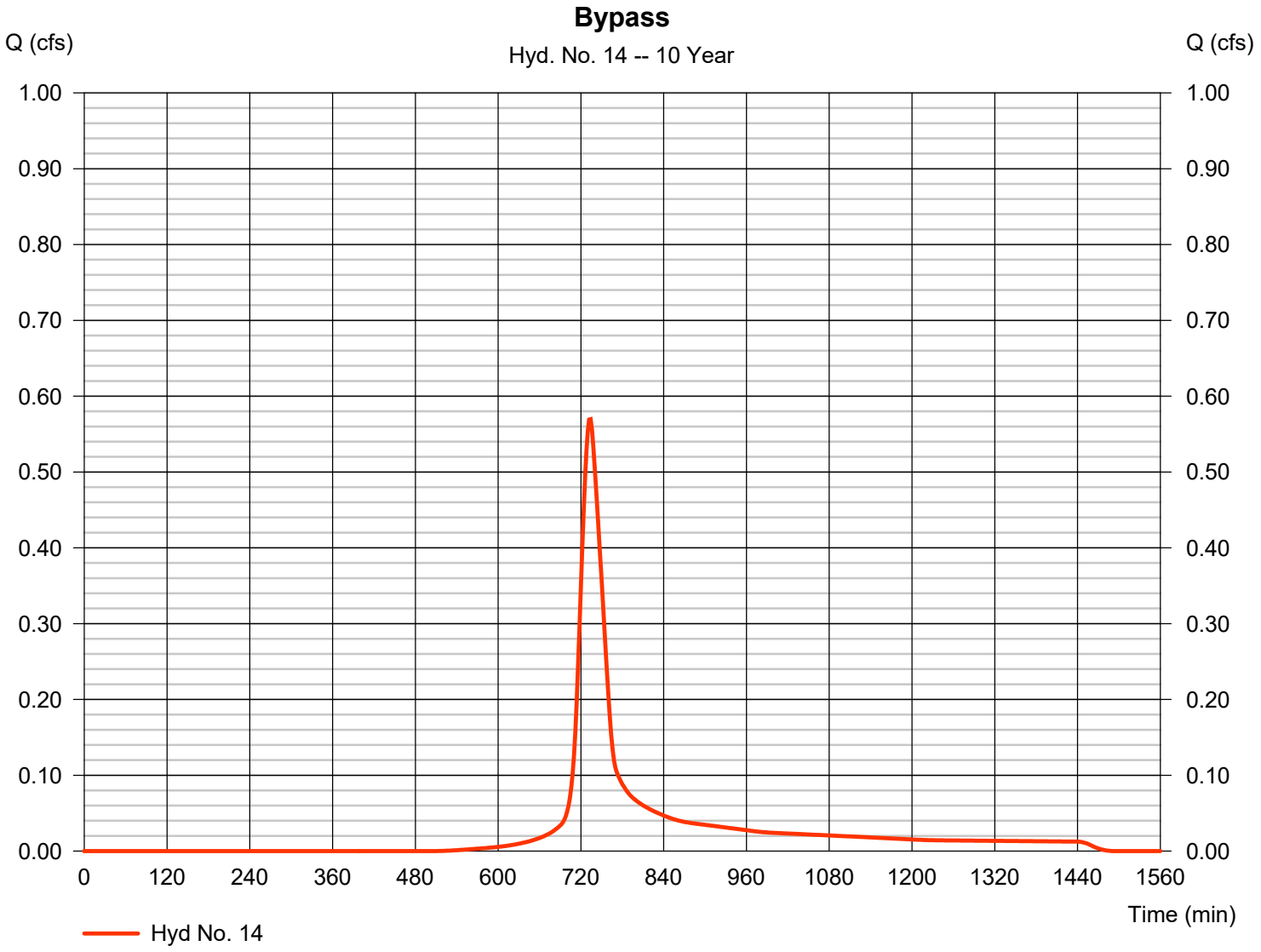
Hydrograph Report

Hyd. No. 14

Bypass

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.570 cfs
Storm frequency	=	10 yrs	Time to peak	=	734 min
Time interval	=	2 min	Hyd. volume	=	2,476 cuft
Drainage area	=	0.250 ac	Curve number	=	75*
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) = [(0.010 x 98) + (0.240 x 74)] / 0.250



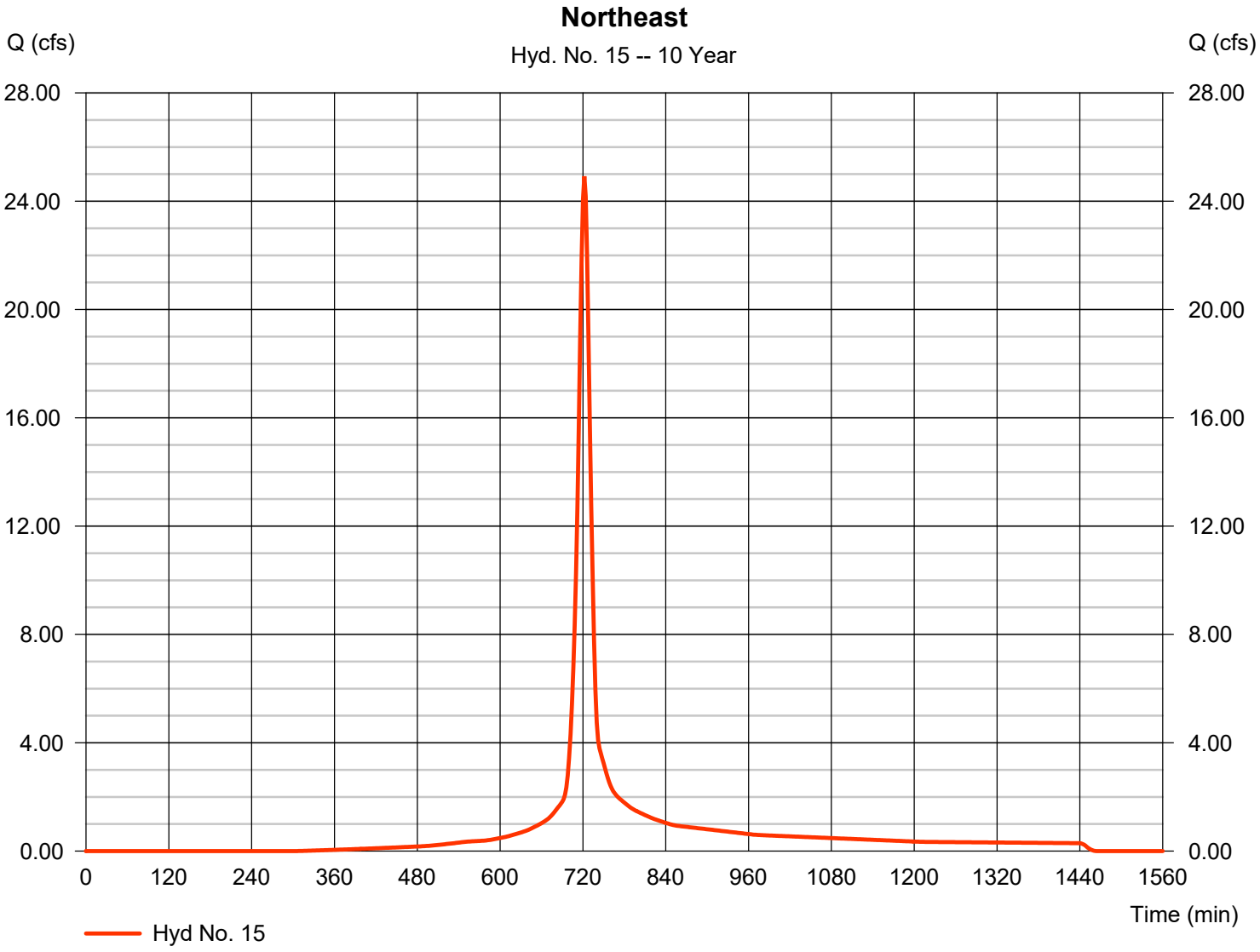
Hydrograph Report

Hyd. No. 15

Northeast

Hydrograph type	=	SCS Runoff	Peak discharge	=	24.92 cfs
Storm frequency	=	10 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	71,232 cuft
Drainage area	=	5.370 ac	Curve number	=	86*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	15.30 min
Total precip.	=	5.30 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(2.700 x 98) + (2.670 x 74)] / 5.370



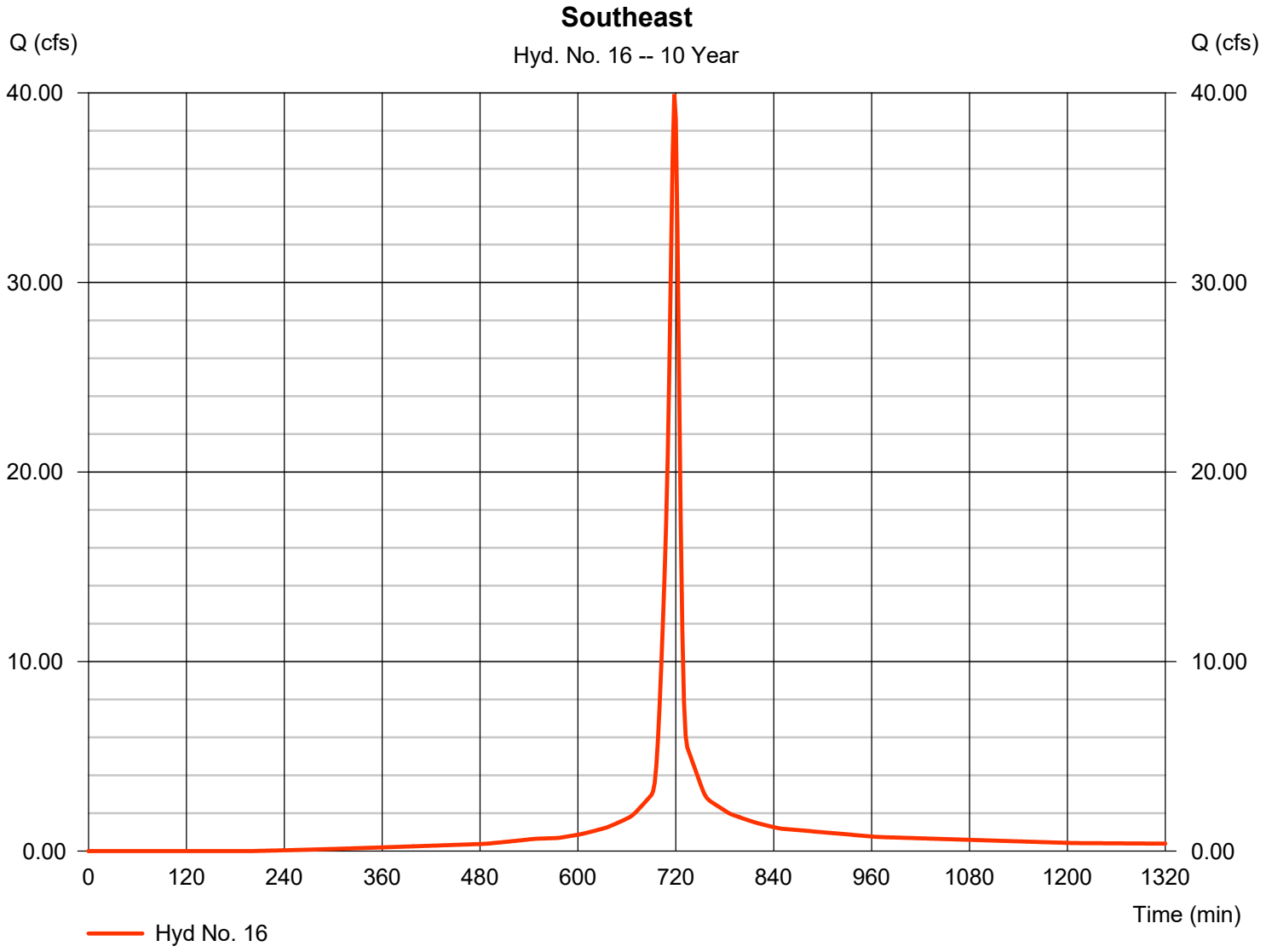
Hydrograph Report

Hyd. No. 16

Southeast

Hydrograph type	=	SCS Runoff	Peak discharge	=	39.93 cfs
Storm frequency	=	10 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	97,271 cuft
Drainage area	=	6.270 ac	Curve number	=	91*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	7.10 min
Total precip.	=	5.30 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(4.570 x 98) + (1.700 x 74)] / 6.270



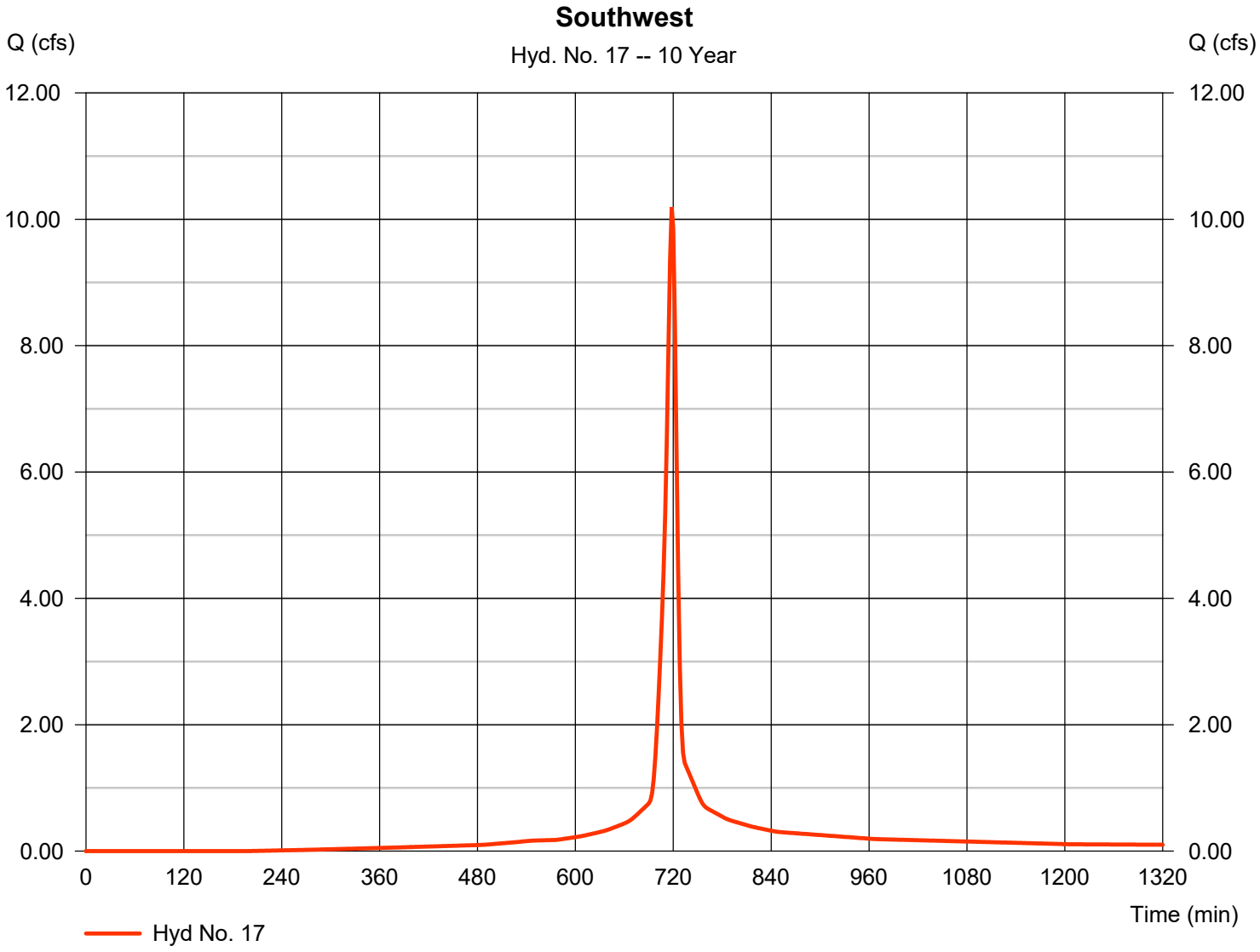
Hydrograph Report

Hyd. No. 17

Southwest

Hydrograph type	=	SCS Runoff	Peak discharge	=	10.19 cfs
Storm frequency	=	10 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	24,822 cuft
Drainage area	=	1.600 ac	Curve number	=	91*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	6.60 min
Total precip.	=	5.30 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

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



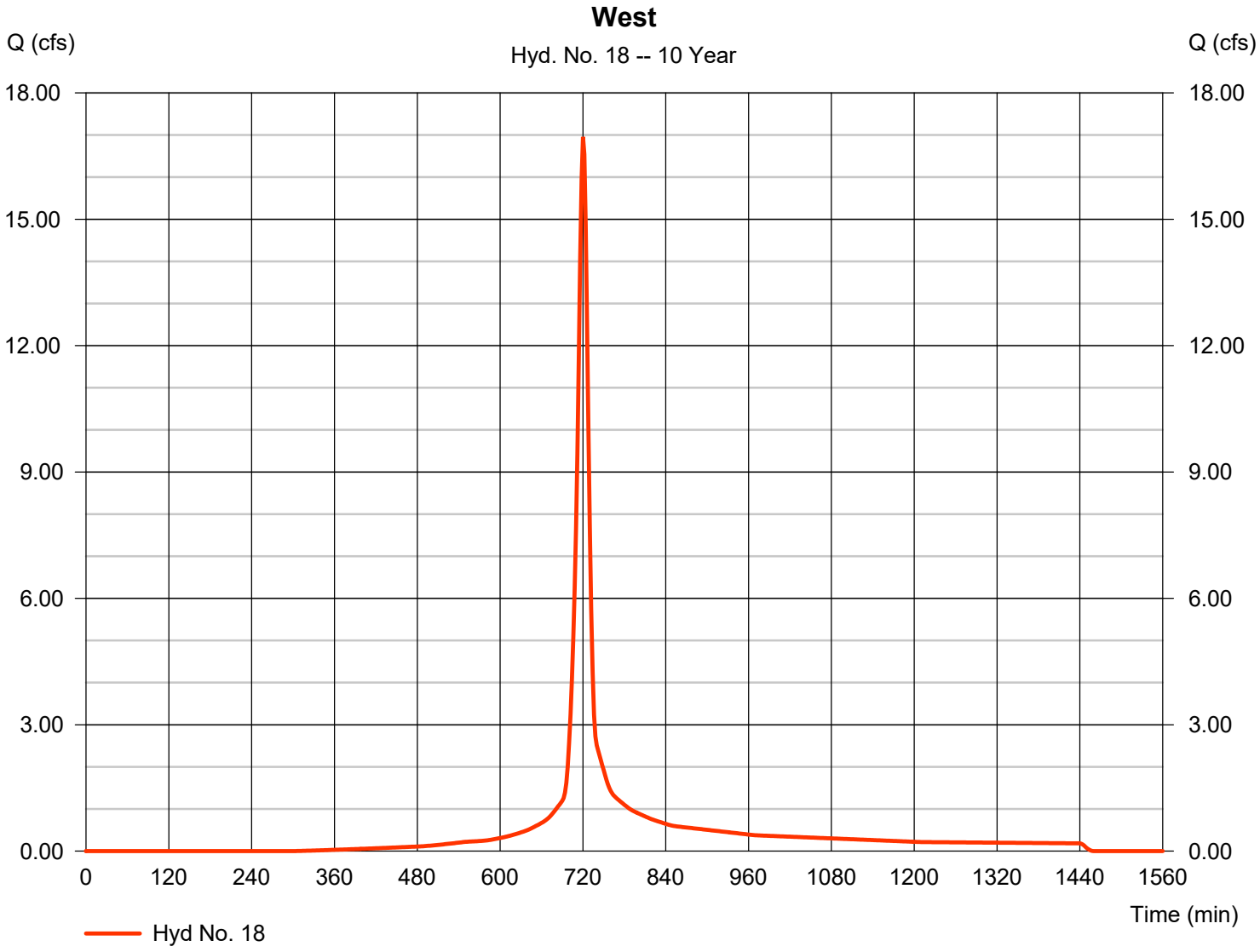
Hydrograph Report

Hyd. No. 18

West

Hydrograph type	=	SCS Runoff	Peak discharge	=	16.96 cfs
Storm frequency	=	10 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	44,896 cuft
Drainage area	=	3.200 ac	Curve number	=	86*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	12.40 min
Total precip.	=	5.30 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

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



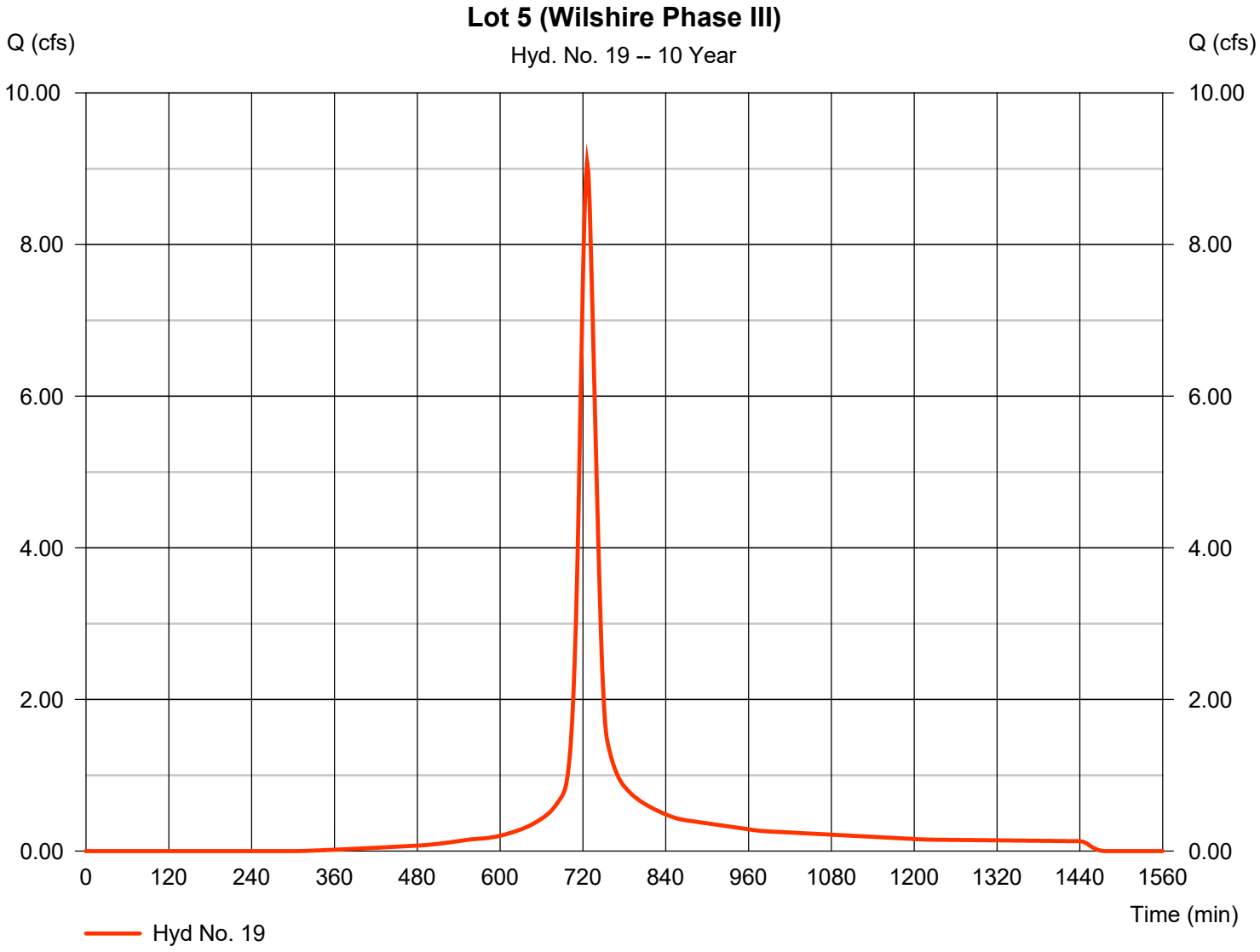
Hydrograph Report

Hyd. No. 19

Lot 5 (Wilshire Phase III)

Hydrograph type	=	SCS Runoff	Peak discharge	=	9.081 cfs
Storm frequency	=	10 yrs	Time to peak	=	726 min
Time interval	=	2 min	Hyd. volume	=	31,711 cuft
Drainage area	=	2.290 ac	Curve number	=	86*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	20.60 min
Total precip.	=	5.30 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

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



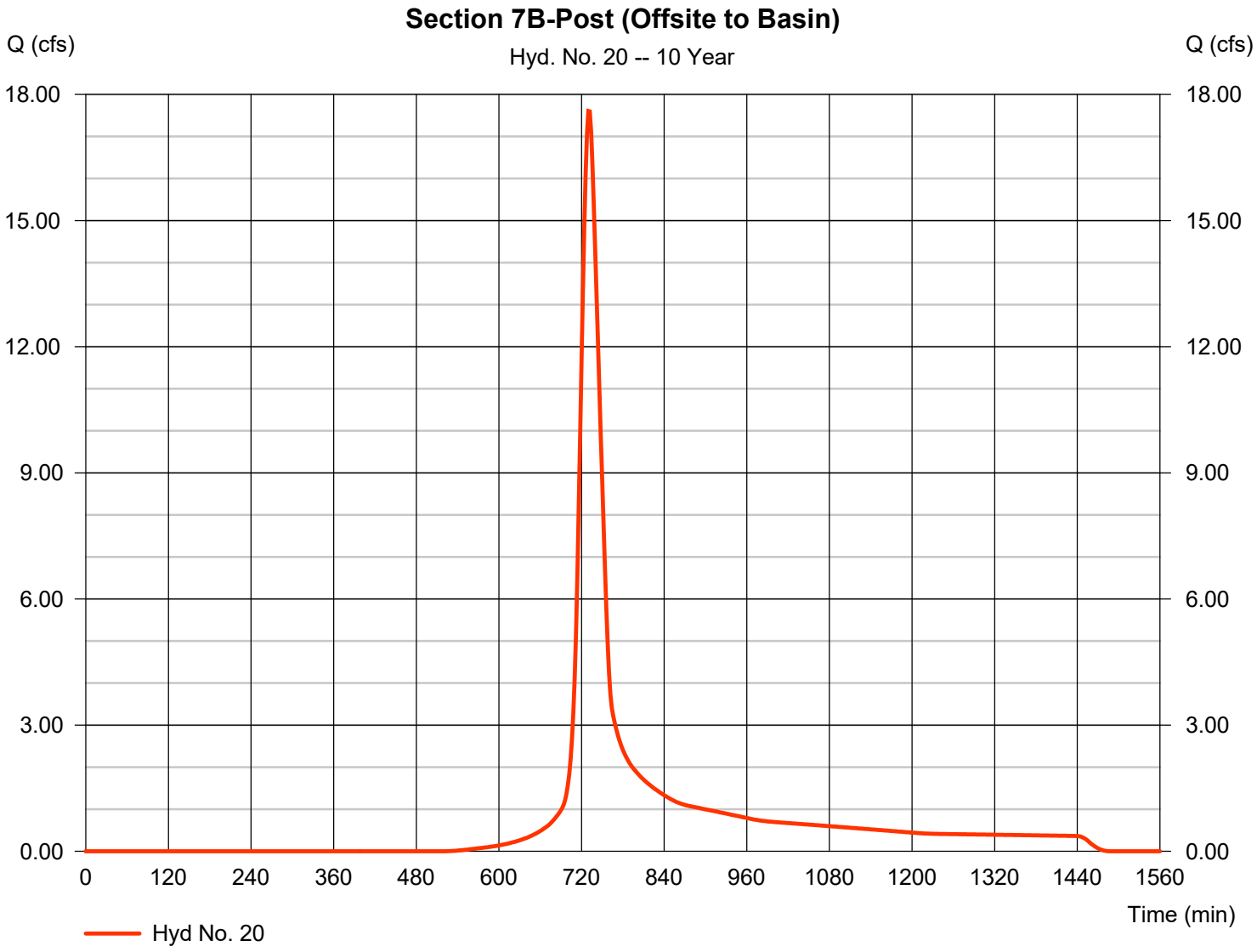
Hydrograph Report

Hyd. No. 20

Section 7B-Post (Offsite to Basin)

Hydrograph type	= SCS Runoff	Peak discharge	= 17.60 cfs
Storm frequency	= 10 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 70,943 cuft
Drainage area	= 7.500 ac	Curve number	= 74*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 28.30 min
Total precip.	= 5.30 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(13.900 x 74)] / 7.500



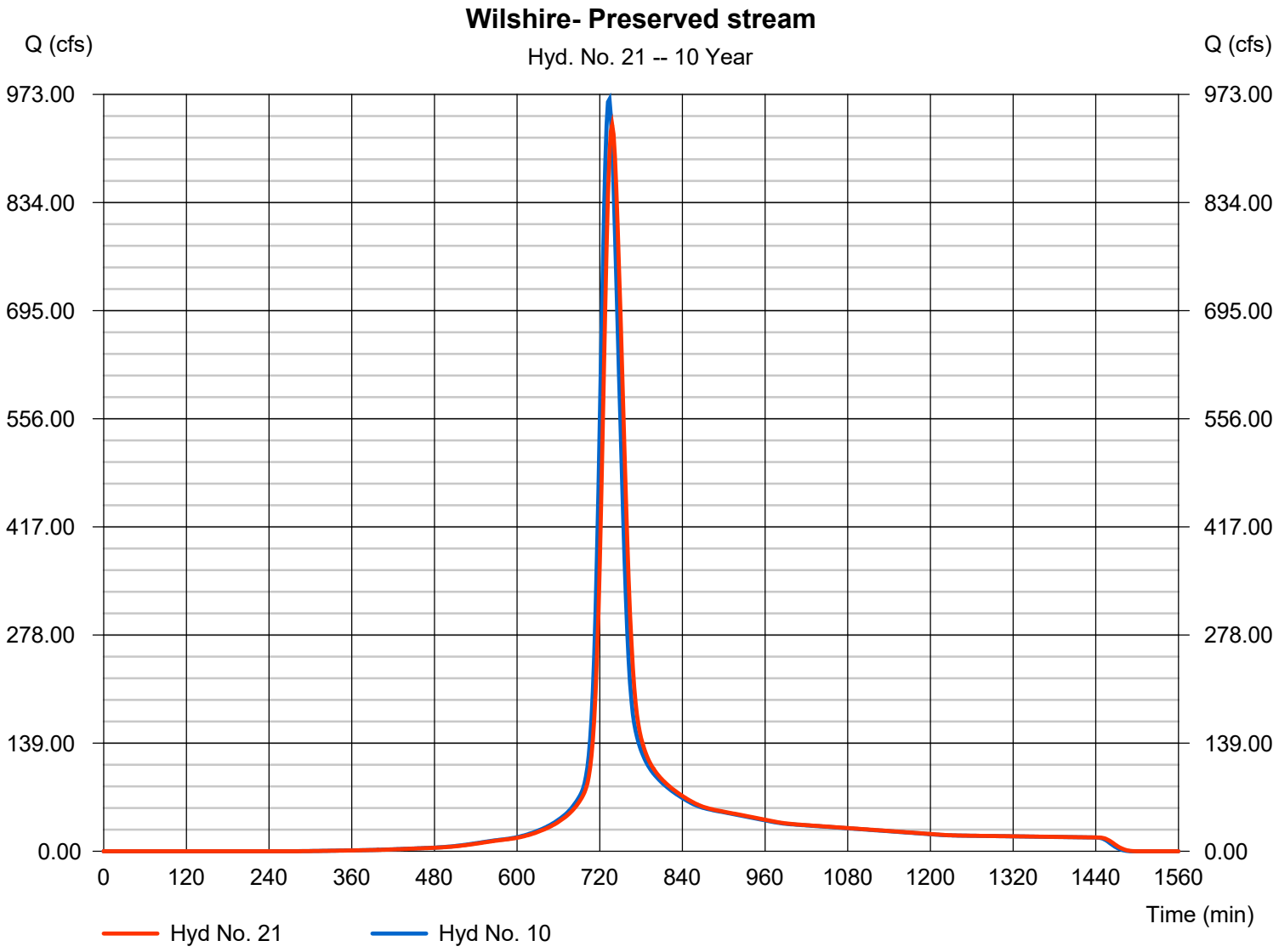
Hydrograph Report

Hyd. No. 21

Wilshire- Preserved stream

Hydrograph type	=	Reach	Peak discharge	=	933.75 cfs
Storm frequency	=	10 yrs	Time to peak	=	738 min
Time interval	=	2 min	Hyd. volume	=	3,962,789 cuft
Inflow hyd. No.	=	10 - Strother Road Culvert	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	=	1.71 ft/s	Routing coeff.	=	0.4254

Modified Att-Kin routing method used.

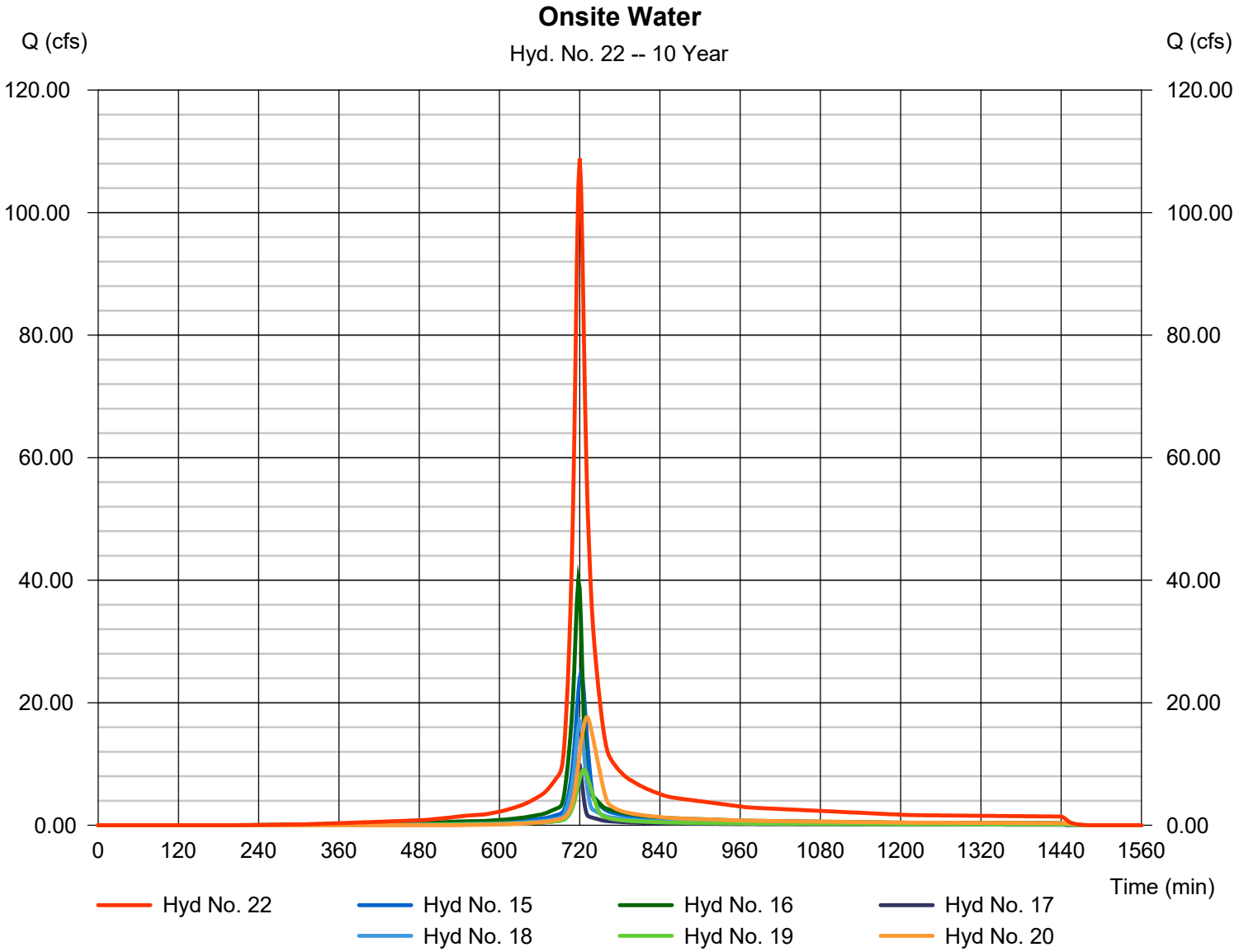


Hydrograph Report

Hyd. No. 22

Onsite Water

Hydrograph type	= Combine	Peak discharge	= 108.85 cfs
Storm frequency	= 10 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 340,876 cuft
Inflow hyds.	= 15, 16, 17, 18, 19, 20	Contrib. drain. area	= 26.230 ac



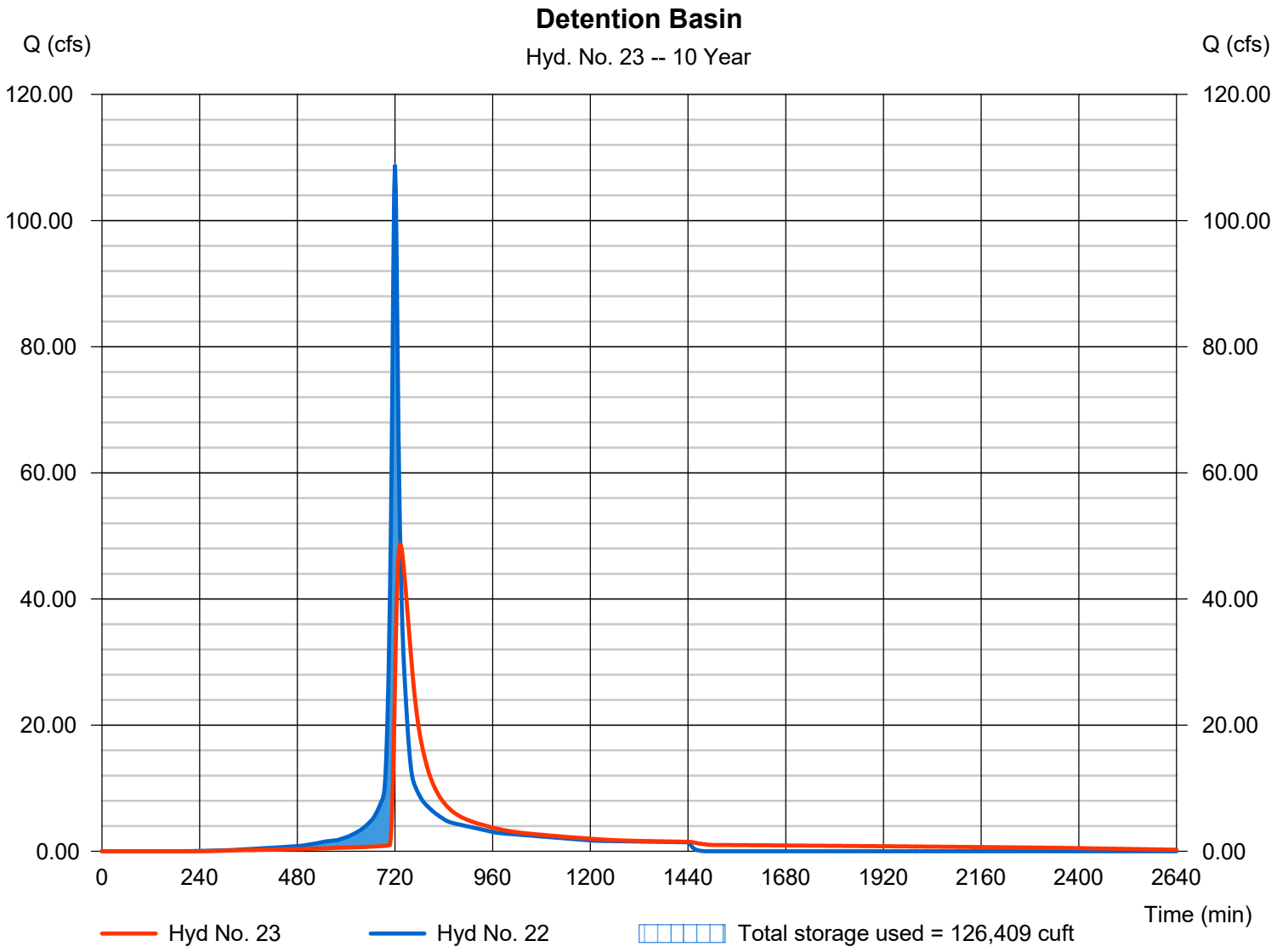
Hydrograph Report

Hyd. No. 23

Detention Basin

Hydrograph type	=	Reservoir	Peak discharge	=	48.60 cfs
Storm frequency	=	10 yrs	Time to peak	=	732 min
Time interval	=	2 min	Hyd. volume	=	340,861 cuft
Inflow hyd. No.	=	22 - Onsite Water	Max. Elevation	=	918.99 ft
Reservoir name	=	Detention Basin	Max. Storage	=	126,409 cuft

Storage Indication method used.

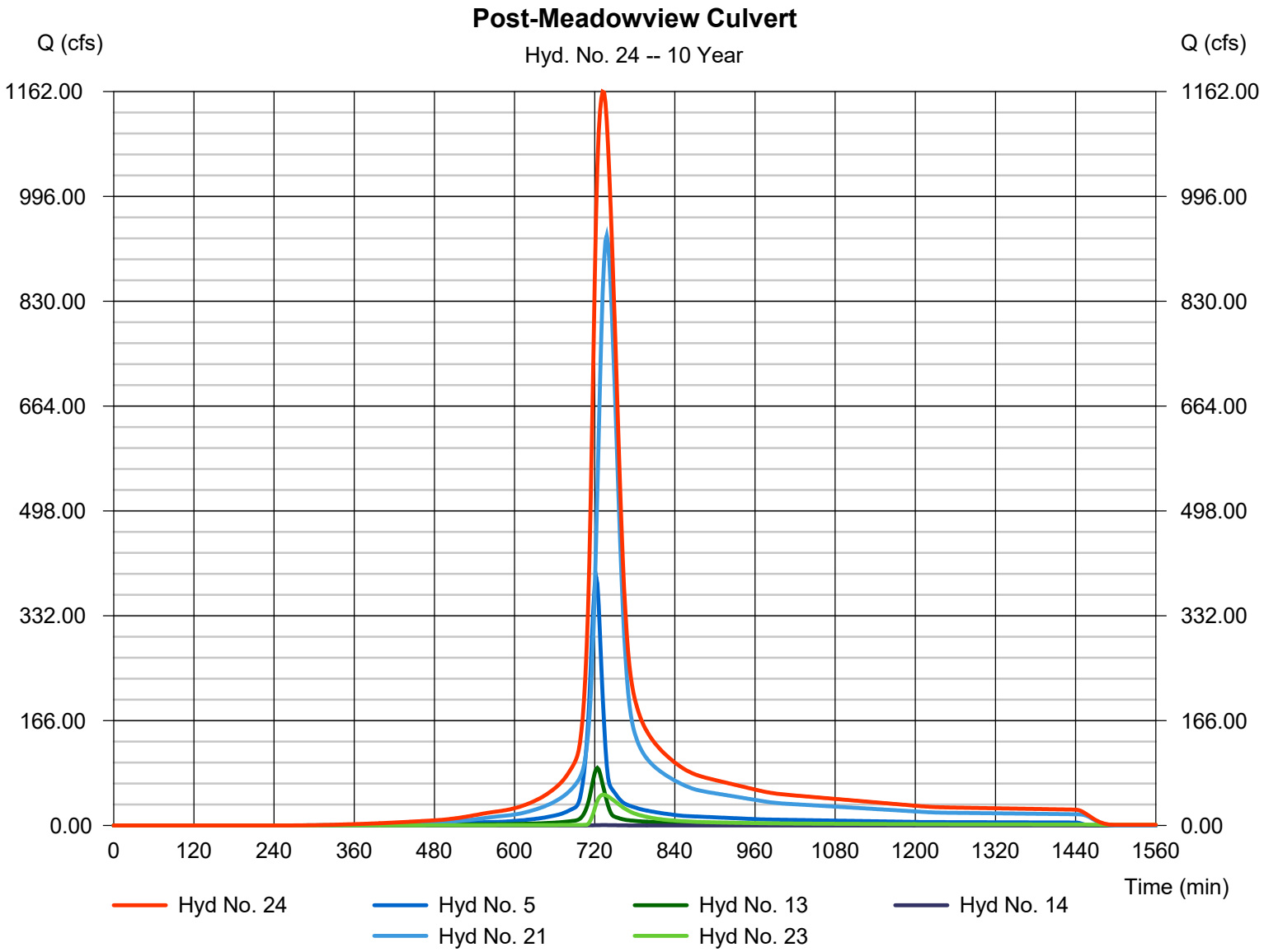


Hydrograph Report

Hyd. No. 24

Post-Meadowview Culvert

Hydrograph type	=	Combine	Peak discharge	=	1161.71 cfs
Storm frequency	=	10 yrs	Time to peak	=	732 min
Time interval	=	2 min	Hyd. volume	=	5,720,853 cuft
Inflow hyds.	=	5, 13, 14, 21, 23	Contrib. drain. area	=	107.050 ac



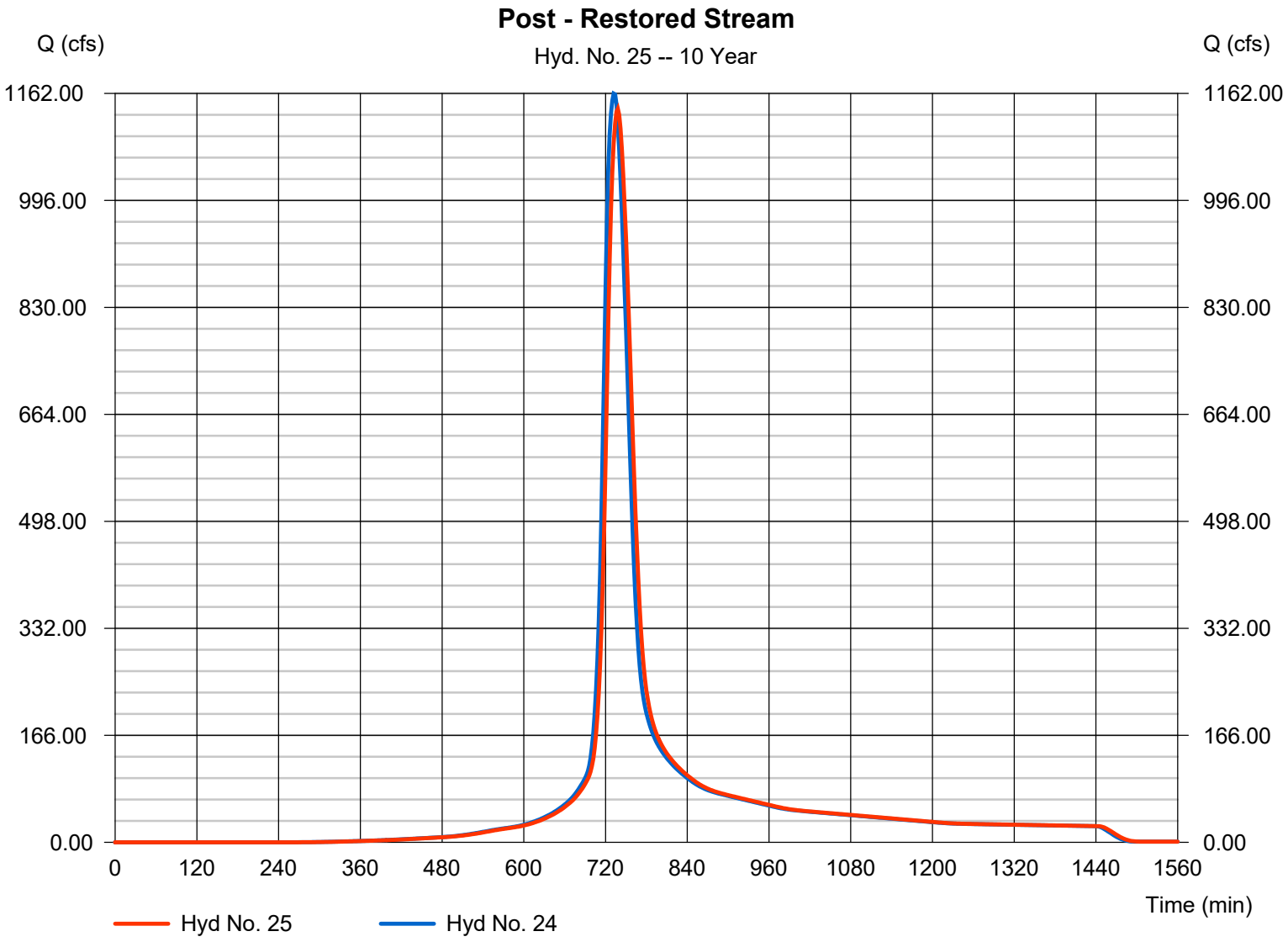
Hydrograph Report

Hyd. No. 25

Post - Restored Stream

Hydrograph type	= Reach	Peak discharge	= 1138.21 cfs
Storm frequency	= 10 yrs	Time to peak	= 738 min
Time interval	= 2 min	Hyd. volume	= 5,720,807 cuft
Inflow hyd. No.	= 24 - 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	= 4.16 ft/s	Routing coeff.	= 0.4005

Modified Att-Kin routing method used.



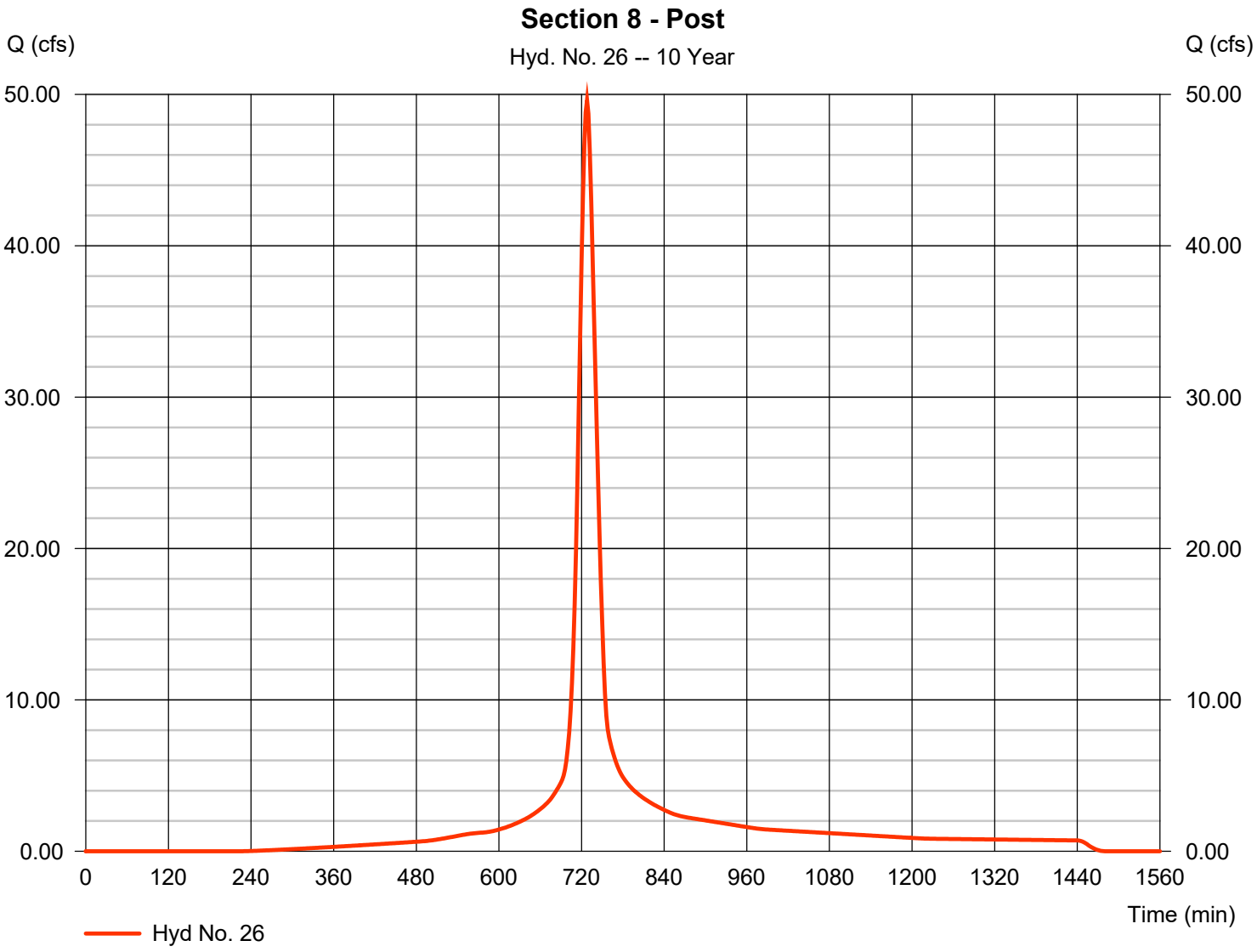
Hydrograph Report

Hyd. No. 26

Section 8 - Post

Hydrograph type	=	SCS Runoff	Peak discharge	=	49.61 cfs
Storm frequency	=	10 yrs	Time to peak	=	728 min
Time interval	=	2 min	Hyd. volume	=	187,574 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

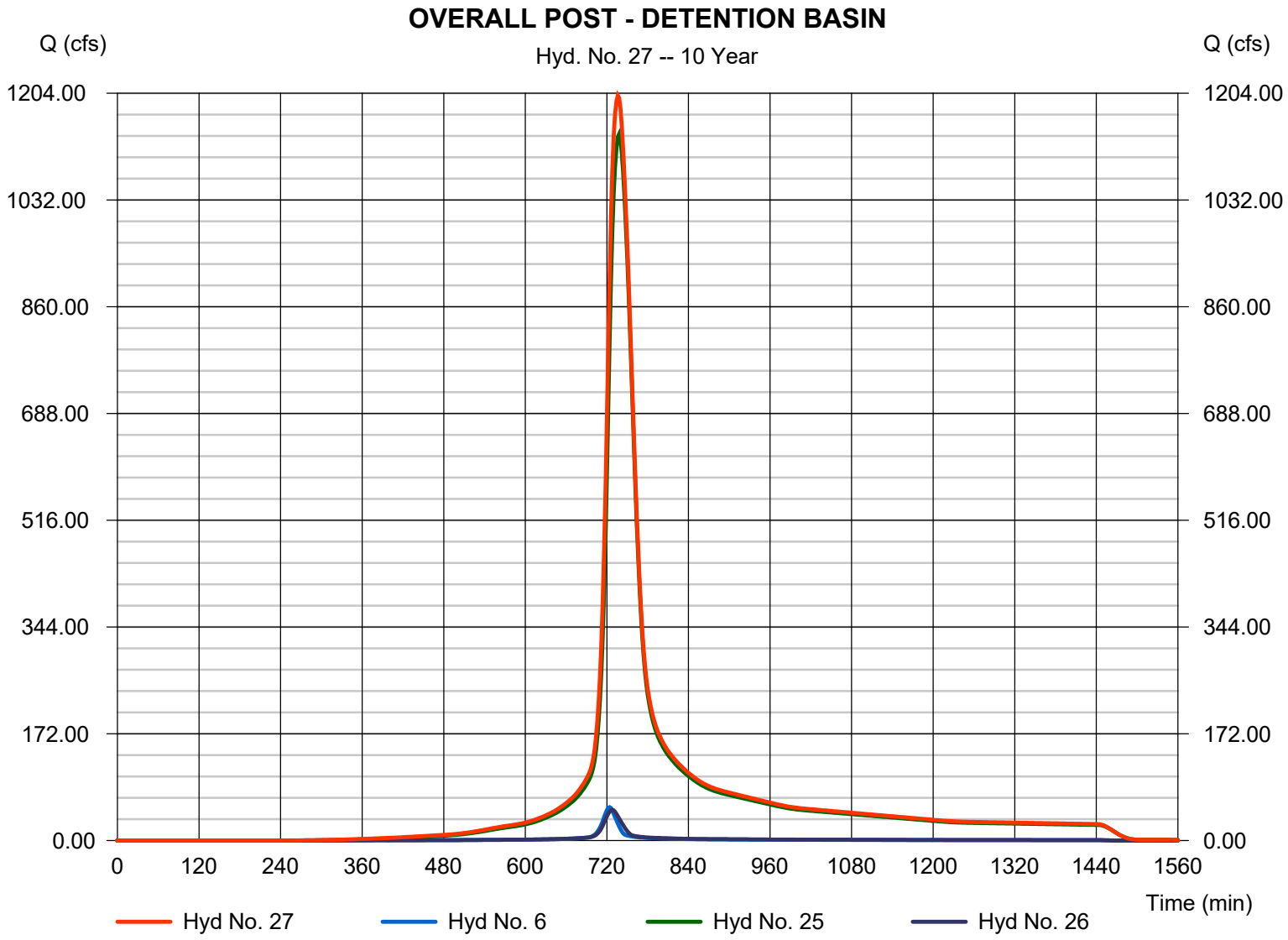


Hydrograph Report

Hyd. No. 27

OVERALL POST - DETENTION BASIN

Hydrograph type	= Combine	Peak discharge	= 1200.34 cfs
Storm frequency	= 10 yrs	Time to peak	= 736 min
Time interval	= 2 min	Hyd. volume	= 6,083,689 cuft
Inflow hyds.	= 6, 25, 26	Contrib. drain. area	= 23.900 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

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	403.79	2	728	1,486,312	------	------	------	Section 1
2	SCS Runoff	336.08	2	728	1,237,077	------	------	------	Section 2
3	SCS Runoff	512.72	2	730	2,074,709	------	------	------	Section 3
4	SCS Runoff	431.92	2	732	1,932,345	------	------	------	Section 4
5	SCS Runoff	636.00	2	722	1,851,646	------	------	------	Section 5
6	SCS Runoff	82.47	2	724	275,937	------	------	------	Section 6
7	SCS Runoff	355.97	2	728	1,368,386	------	------	------	Section 7/8-Pre
8	Combine	1243.39	2	728	4,798,103	1, 2, 3,	------	------	Industrial Complex to Detention
9	Reach	1211.21	2	732	4,798,098	8	------	------	Industrial Above Ground Detention Po
10	Combine	1643.13	2	732	6,730,445	4, 9	------	------	Strother Road Culvert
11	Reach	1570.20	2	738	6,730,444	10	------	------	Wilshire Existing Stream
12	Combine	2145.77	2	732	10,226,411	5, 6, 7, 11	------	------	OVERALL PRE
13	SCS Runoff	142.13	2	724	468,866	------	------	------	Section 7A-Post
14	SCS Runoff	1.034	2	732	4,467	------	------	------	Bypass
15	SCS Runoff	39.85	2	722	116,651	------	------	------	Northeast
16	SCS Runoff	61.12	2	718	153,108	------	------	------	Southeast
17	SCS Runoff	15.60	2	718	39,071	------	------	------	Southwest
18	SCS Runoff	27.10	2	720	73,523	------	------	------	West
19	SCS Runoff	14.58	2	726	51,932	------	------	------	Lot 5 (Wilshire Phase III)
20	SCS Runoff	32.34	2	730	129,243	------	------	------	Section 7B-Post (Offsite to Basin)
21	Reach	1596.55	2	736	6,730,439	10	------	------	Wilshire- Preserved stream
22	Combine	174.64	2	720	563,527	15, 16, 17, 18, 19, 20,	------	------	Onsite Water
23	Reservoir	89.20	2	732	563,512	22	921.00	185,773	Detention Basin
24	Combine	2004.22	2	732	9,618,901	5, 13, 14, 21, 23	------	------	Post-Meadowview Culvert
25	Reach	1970.08	2	736	9,618,877	24	------	------	Post - Restored Stream
26	SCS Runoff	76.90	2	728	297,548	------	------	------	Section 8 - Post
27	Combine	2072.34	2	736	10,192,359	6, 25, 26	------	------	OVERALL POST - DETENTION BASI

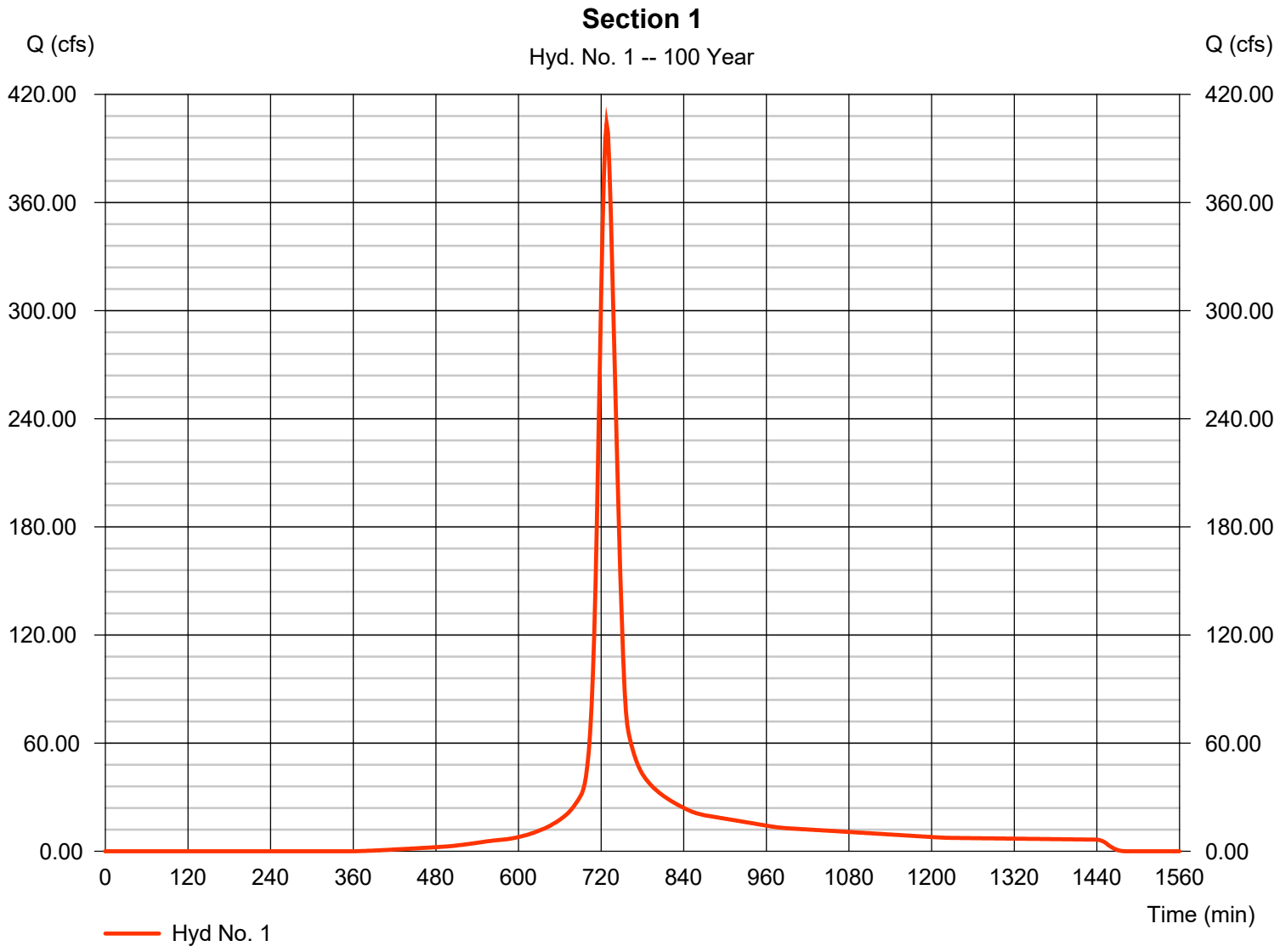
Hydrograph Report

Hyd. No. 1

Section 1

Hydrograph type	=	SCS Runoff	Peak discharge	=	403.79 cfs
Storm frequency	=	100 yrs	Time to peak	=	728 min
Time interval	=	2 min	Hyd. volume	=	1,486,312 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



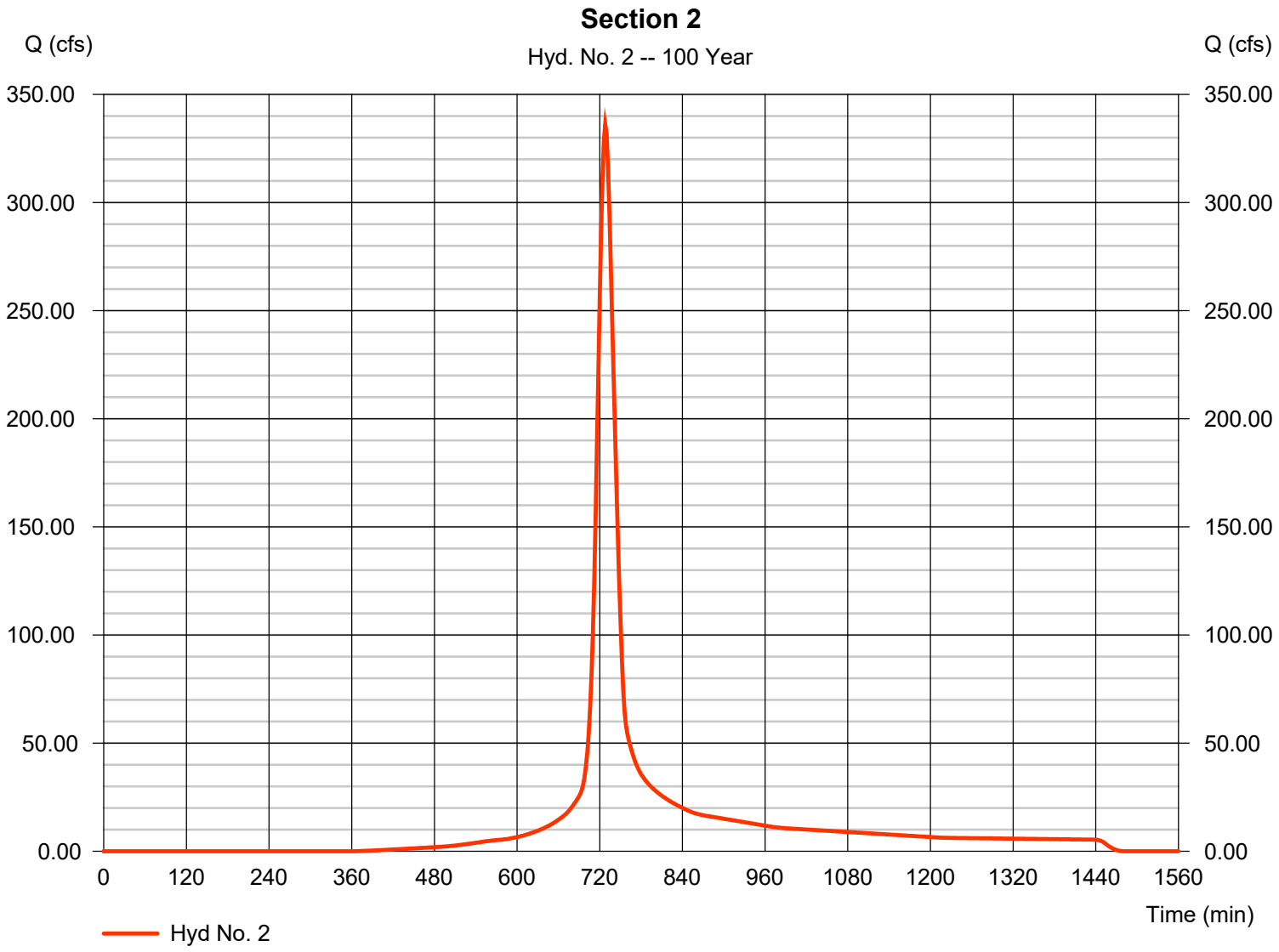
Hydrograph Report

Hyd. No. 2

Section 2

Hydrograph type	=	SCS Runoff	Peak discharge	=	336.08 cfs
Storm frequency	=	100 yrs	Time to peak	=	728 min
Time interval	=	2 min	Hyd. volume	=	1,237,077 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



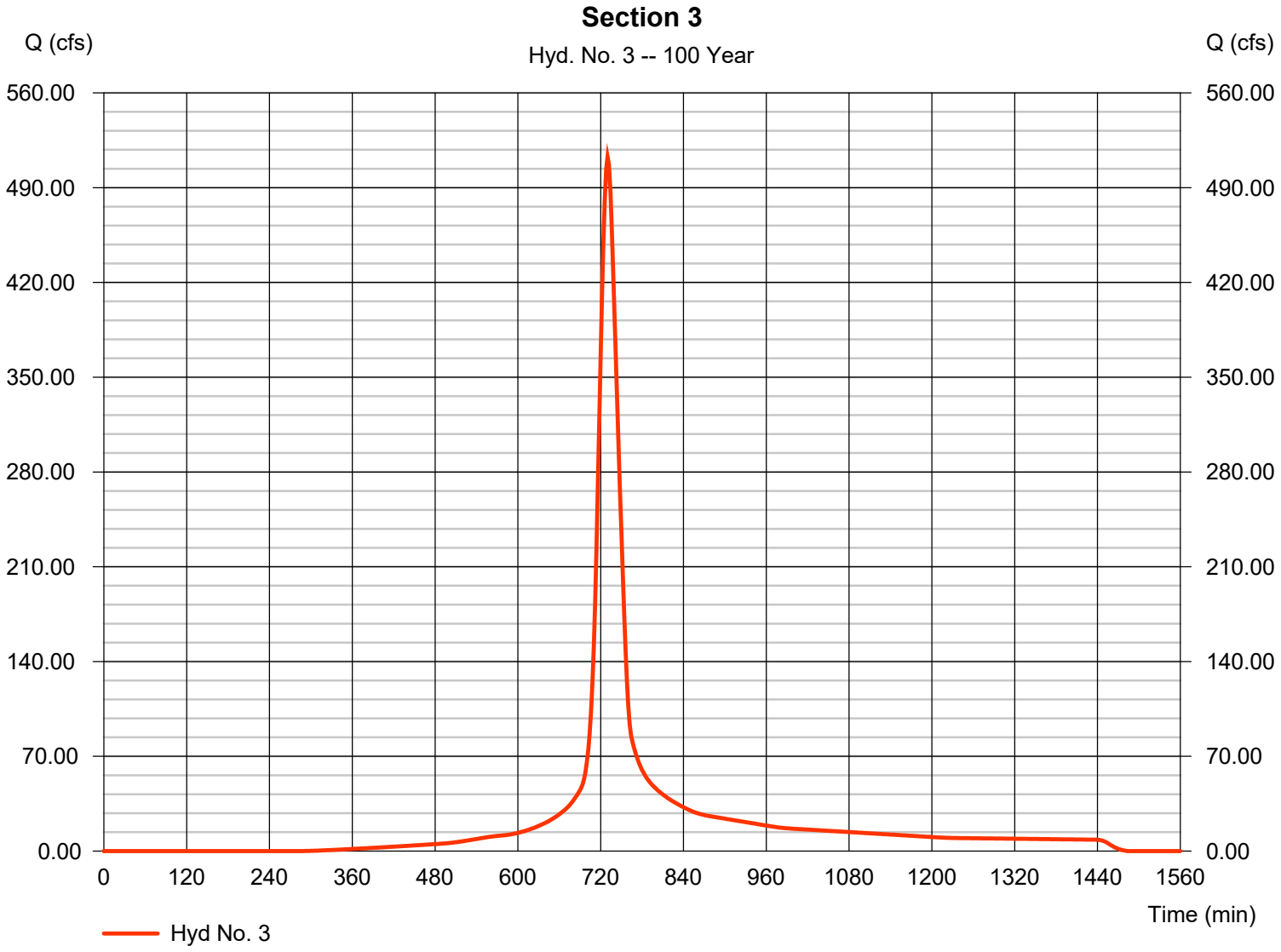
Hydrograph Report

Hyd. No. 3

Section 3

Hydrograph type	=	SCS Runoff	Peak discharge	=	512.72 cfs
Storm frequency	=	100 yrs	Time to peak	=	730 min
Time interval	=	2 min	Hyd. volume	=	2,074,709 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



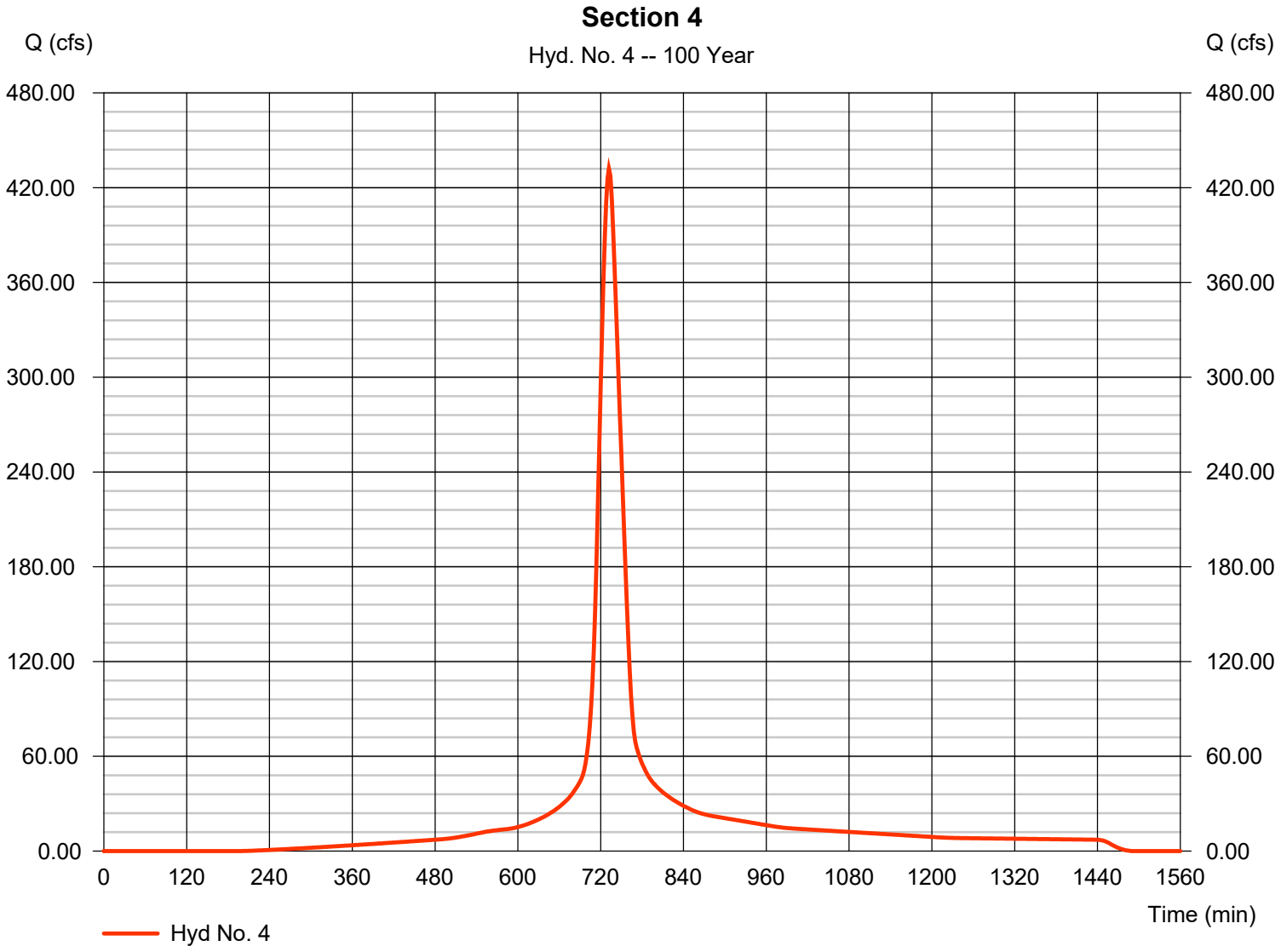
Hydrograph Report

Hyd. No. 4

Section 4

Hydrograph type	=	SCS Runoff	Peak discharge	=	431.92 cfs
Storm frequency	=	100 yrs	Time to peak	=	732 min
Time interval	=	2 min	Hyd. volume	=	1,932,345 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

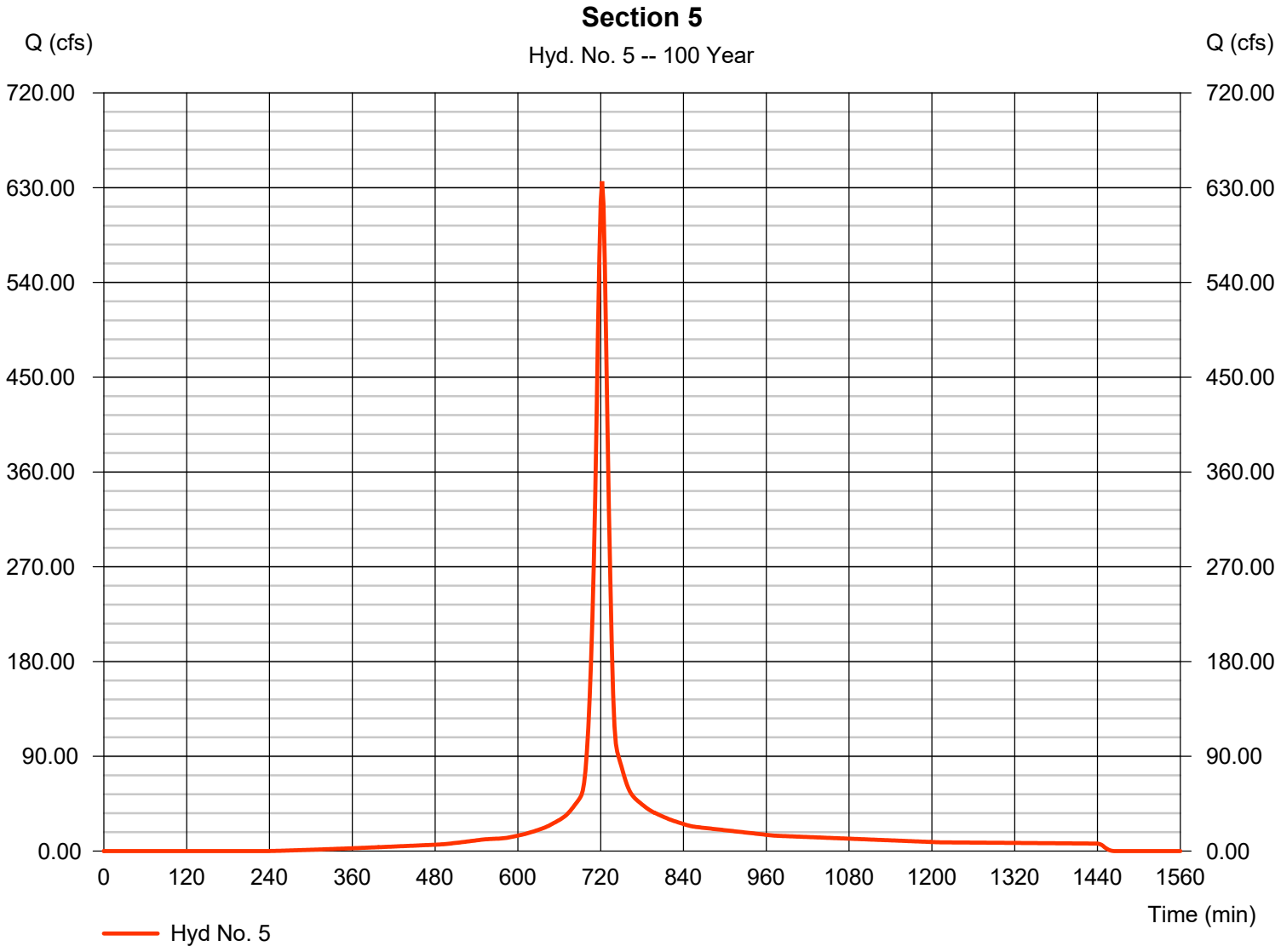
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020 Wednesday, 04 / 17 / 2024

Hyd. No. 5

Section 5

Hydrograph type	=	SCS Runoff	Peak discharge	=	636.00 cfs
Storm frequency	=	100 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	1,851,646 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



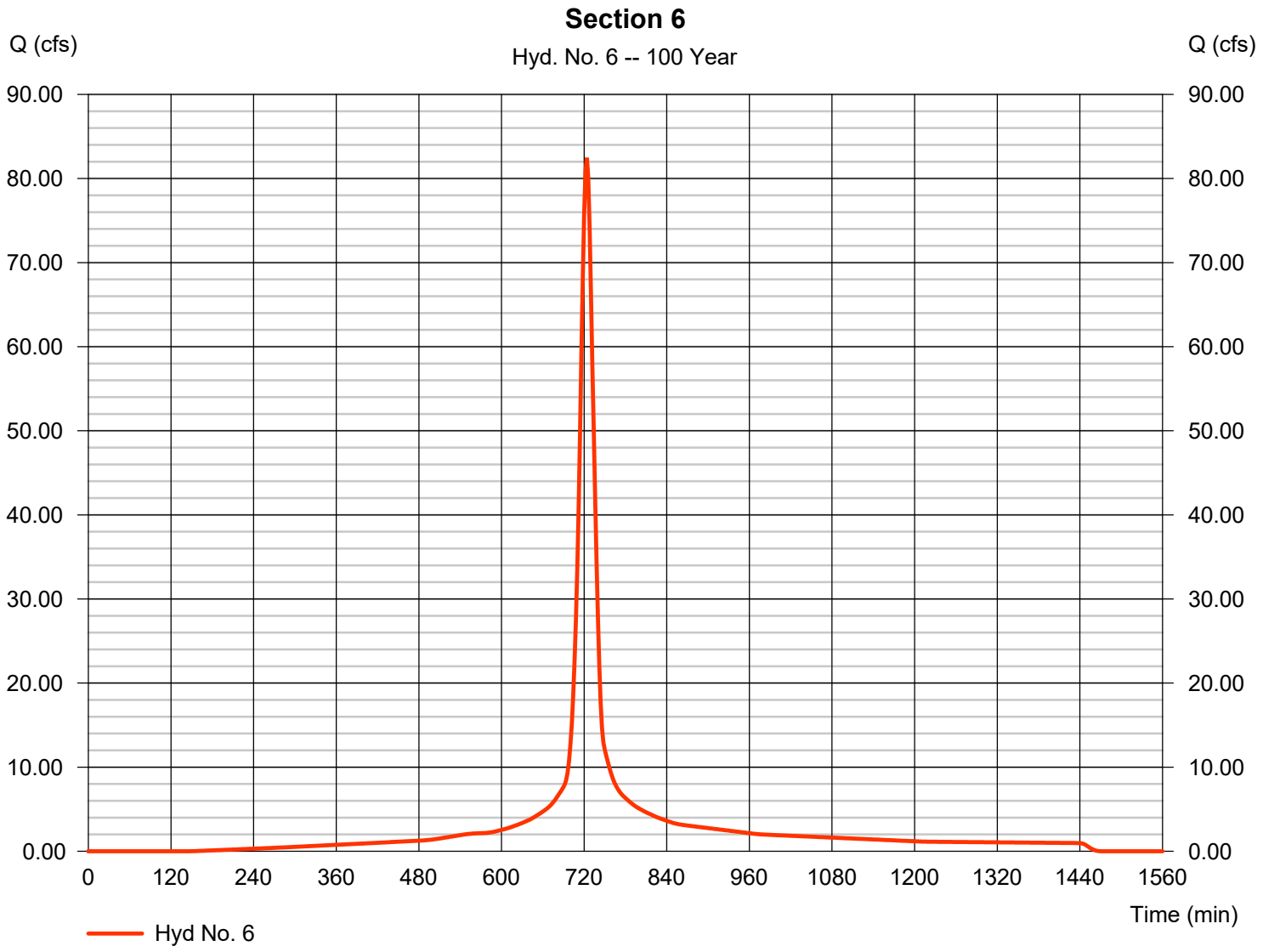
Hydrograph Report

Hyd. No. 6

Section 6

Hydrograph type	=	SCS Runoff	Peak discharge	=	82.47 cfs
Storm frequency	=	100 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	275,937 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



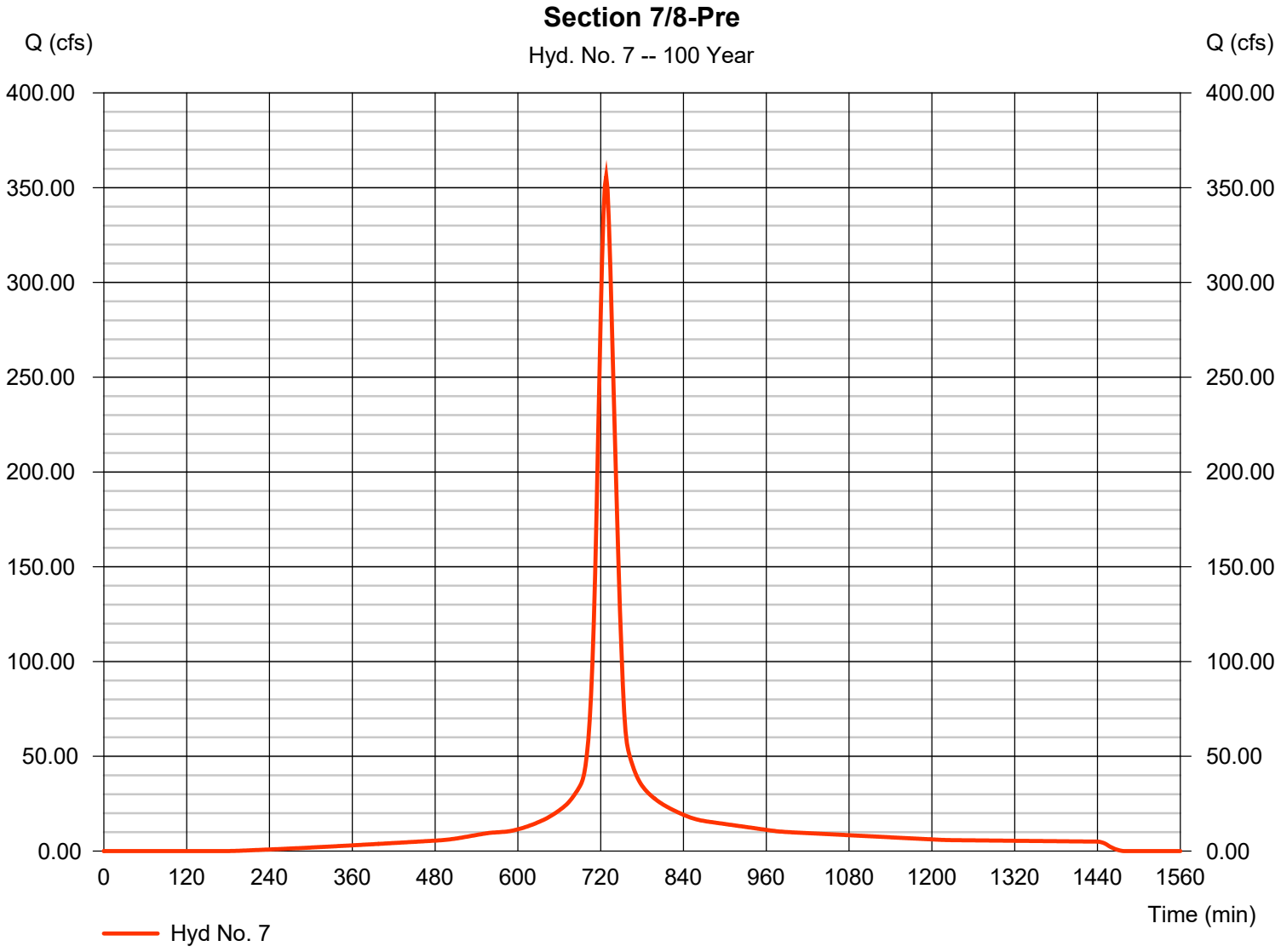
Hydrograph Report

Hyd. No. 7

Section 7/8-Pre

Hydrograph type	=	SCS Runoff	Peak discharge	=	355.97 cfs
Storm frequency	=	100 yrs	Time to peak	=	728 min
Time interval	=	2 min	Hyd. volume	=	1,368,386 cuft
Drainage area	=	59.000 ac	Curve number	=	89*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	25.20 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

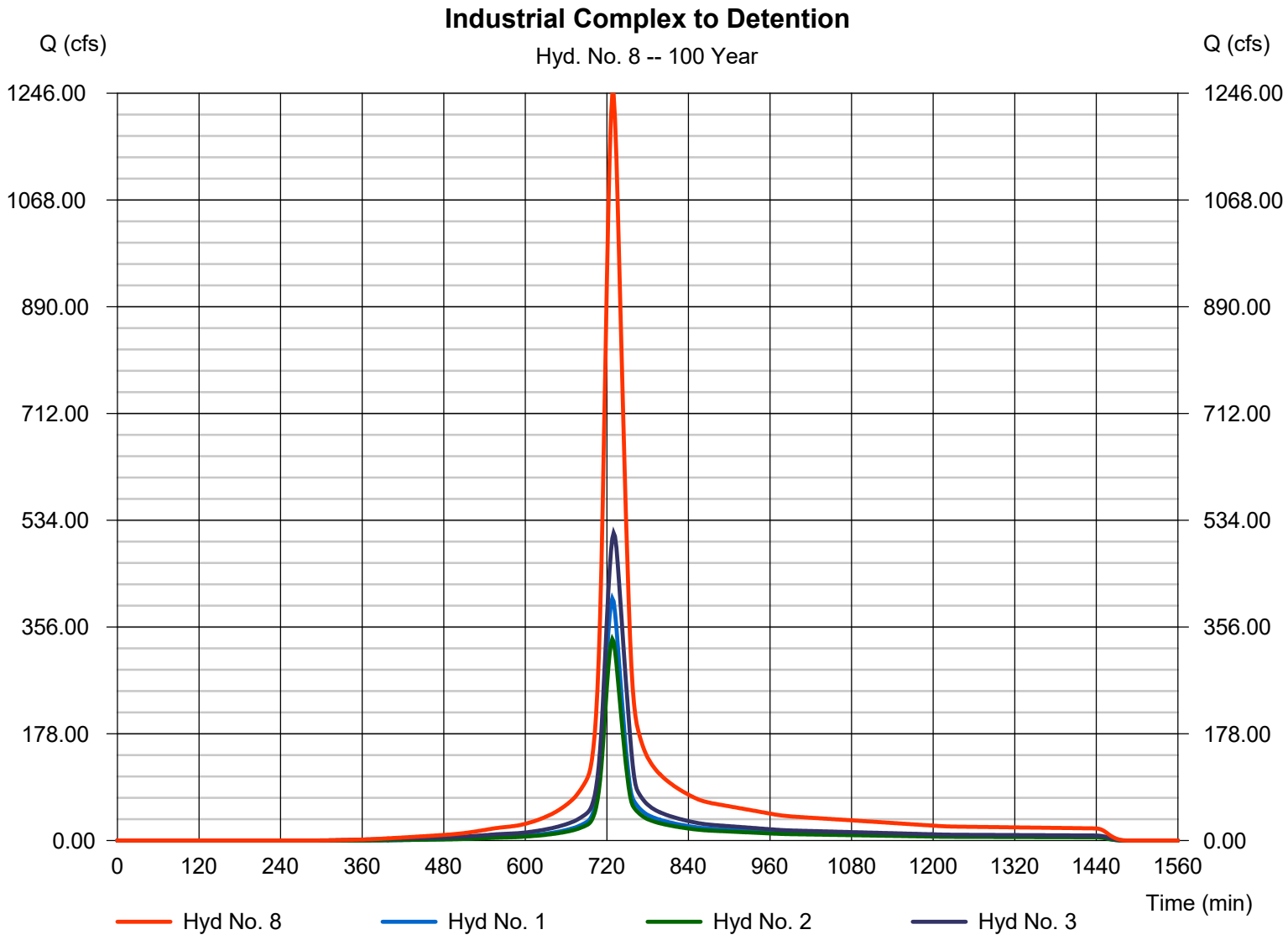


Hydrograph Report

Hyd. No. 8

Industrial Complex to Detention

Hydrograph type	= Combine	Peak discharge	= 1243.39 cfs
Storm frequency	= 100 yrs	Time to peak	= 728 min
Time interval	= 2 min	Hyd. volume	= 4,798,103 cuft
Inflow hyds.	= 1, 2, 3	Contrib. drain. area	= 250.500 ac



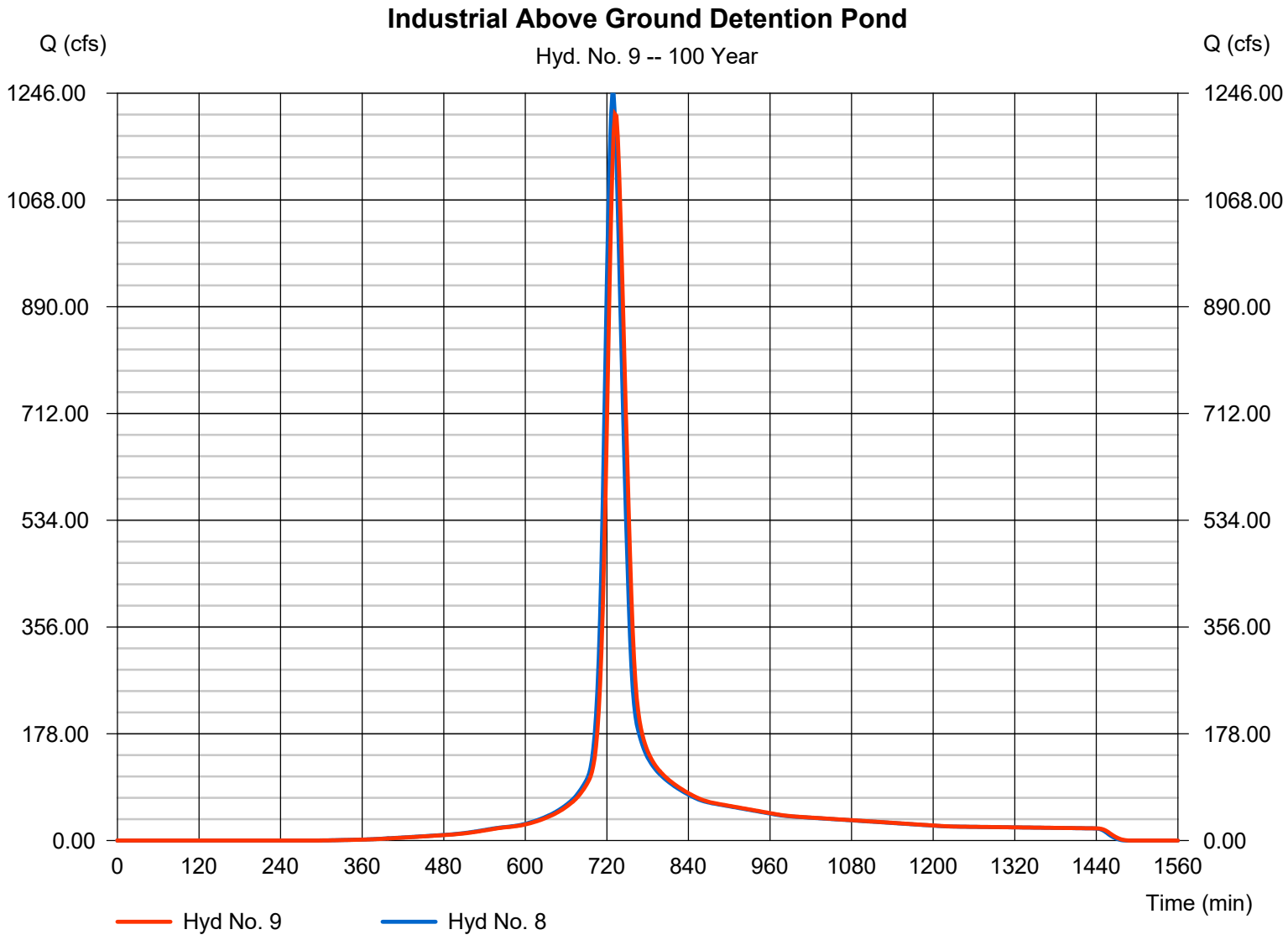
Hydrograph Report

Hyd. No. 9

Industrial Above Ground Detention Pond

Hydrograph type	=	Reach	Peak discharge	=	1211.21 cfs
Storm frequency	=	100 yrs	Time to peak	=	732 min
Time interval	=	2 min	Hyd. volume	=	4,798,098 cuft
Inflow hyd. No.	=	8 - Industrial Complex to Detention	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	=	3.89 ft/s	Routing coeff.	=	0.4946

Modified Att-Kin routing method used.

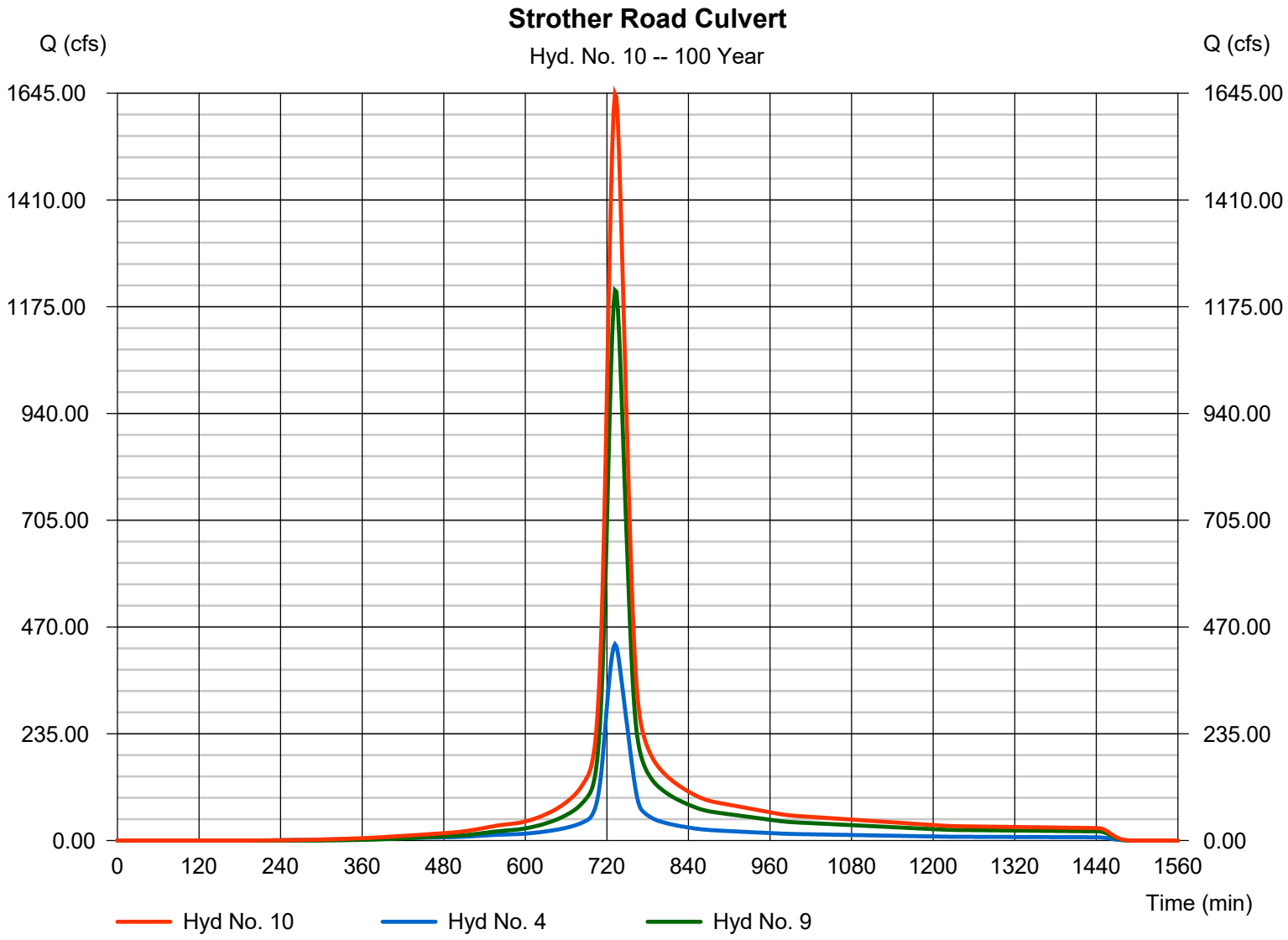


Hydrograph Report

Hyd. No. 10

Strother Road Culvert

Hydrograph type	=	Combine	Peak discharge	=	1643.13 cfs
Storm frequency	=	100 yrs	Time to peak	=	732 min
Time interval	=	2 min	Hyd. volume	=	6,730,445 cuft
Inflow hyds.	=	4, 9	Contrib. drain. area	=	82.500 ac



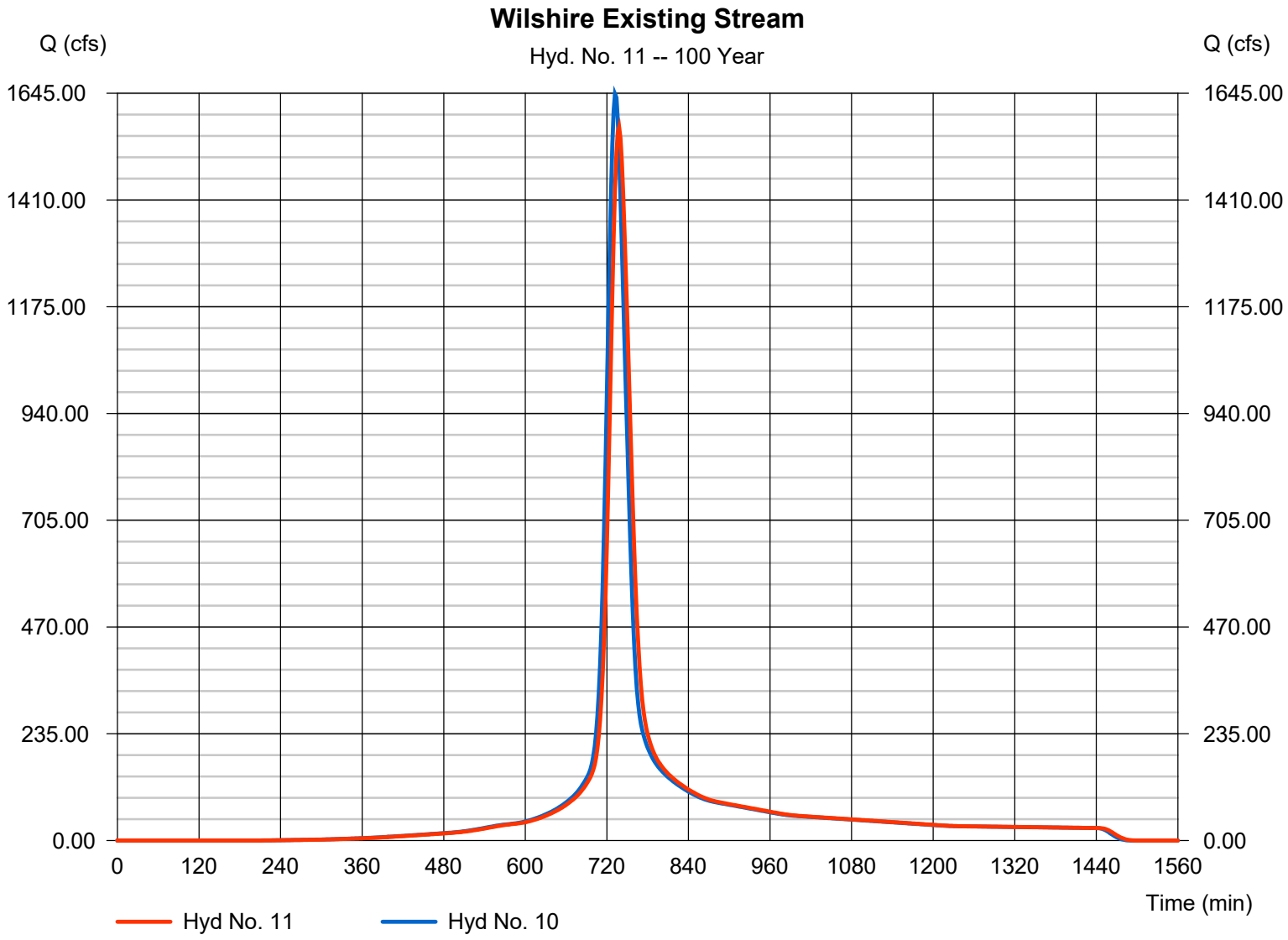
Hydrograph Report

Hyd. No. 11

Wilshire Existing Stream

Hydrograph type	=	Reach	Peak discharge	=	1570.20 cfs
Storm frequency	=	100 yrs	Time to peak	=	738 min
Time interval	=	2 min	Hyd. volume	=	6,730,444 cuft
Inflow hyd. No.	=	10 - Strother Road Culvert	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	=	7.07 ft/s	Routing coeff.	=	0.3835

Modified Att-Kin routing method used.

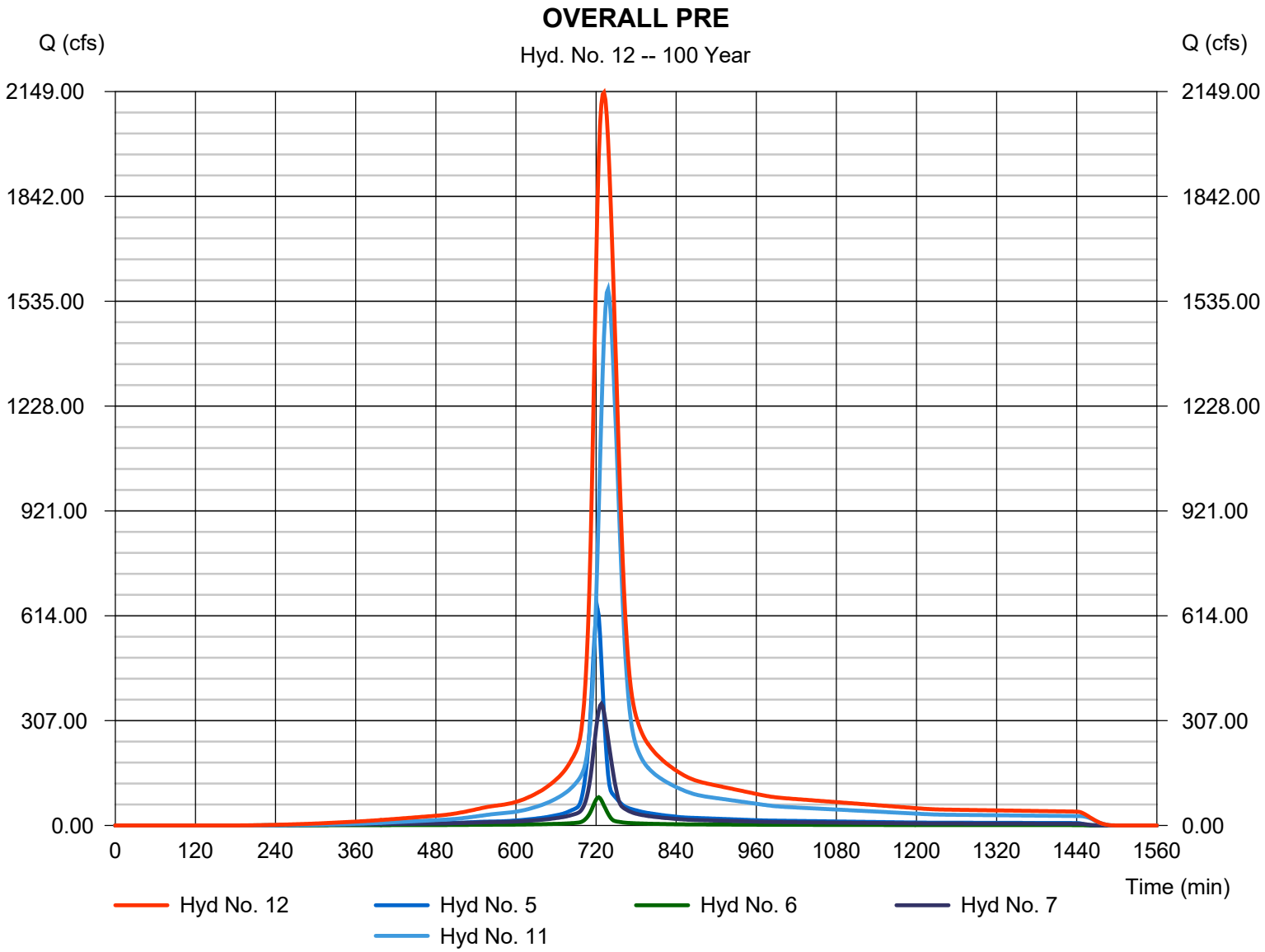


Hydrograph Report

Hyd. No. 12

OVERALL PRE

Hydrograph type	=	Combine	Peak discharge	=	2145.77 cfs
Storm frequency	=	100 yrs	Time to peak	=	732 min
Time interval	=	2 min	Hyd. volume	=	10,226,411 cuft
Inflow hyds.	=	5, 6, 7, 11	Contrib. drain. area	=	157.200 ac



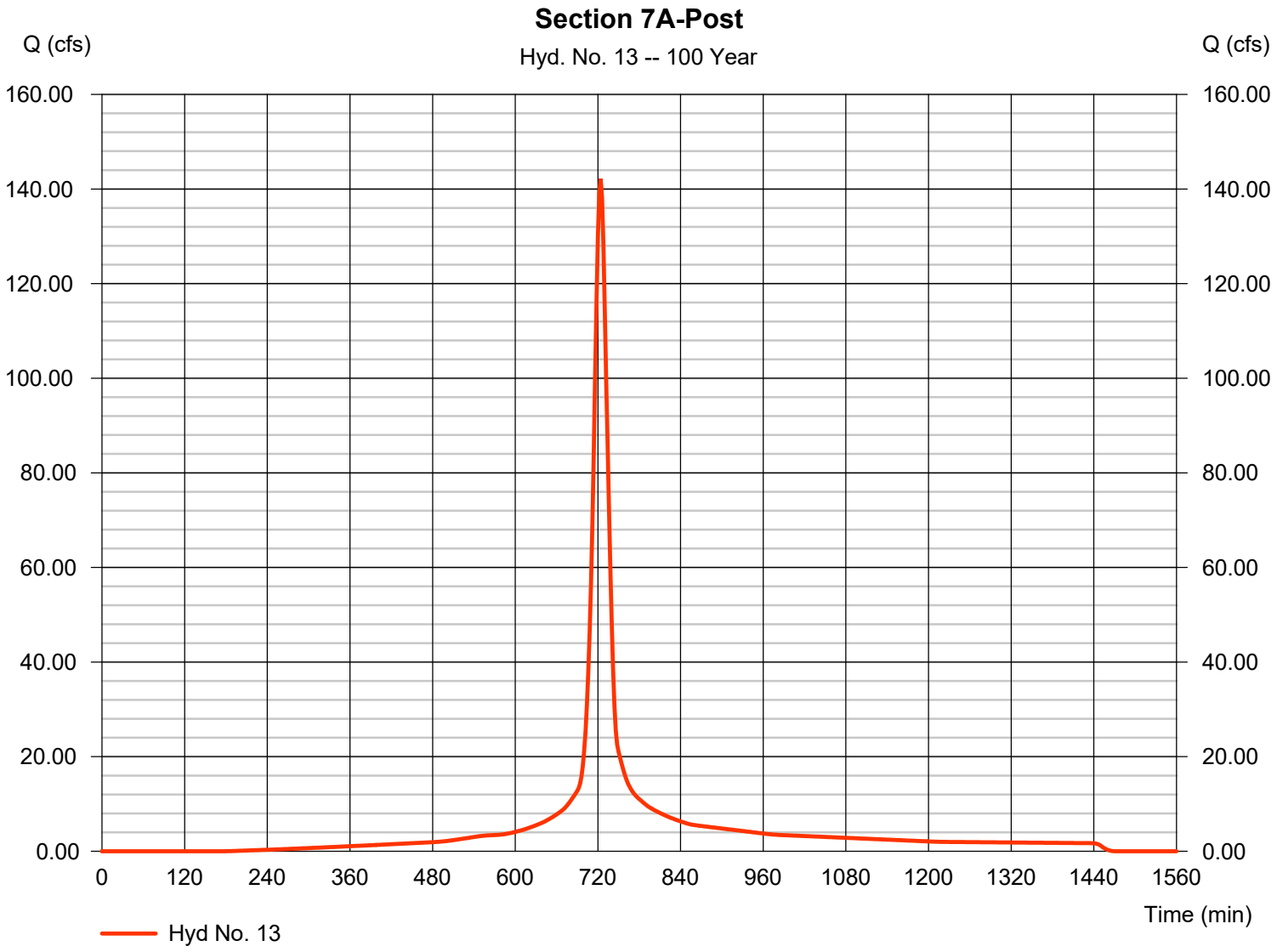
Hydrograph Report

Hyd. No. 13

Section 7A-Post

Hydrograph type	=	SCS Runoff	Peak discharge	=	142.13 cfs
Storm frequency	=	100 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	468,866 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

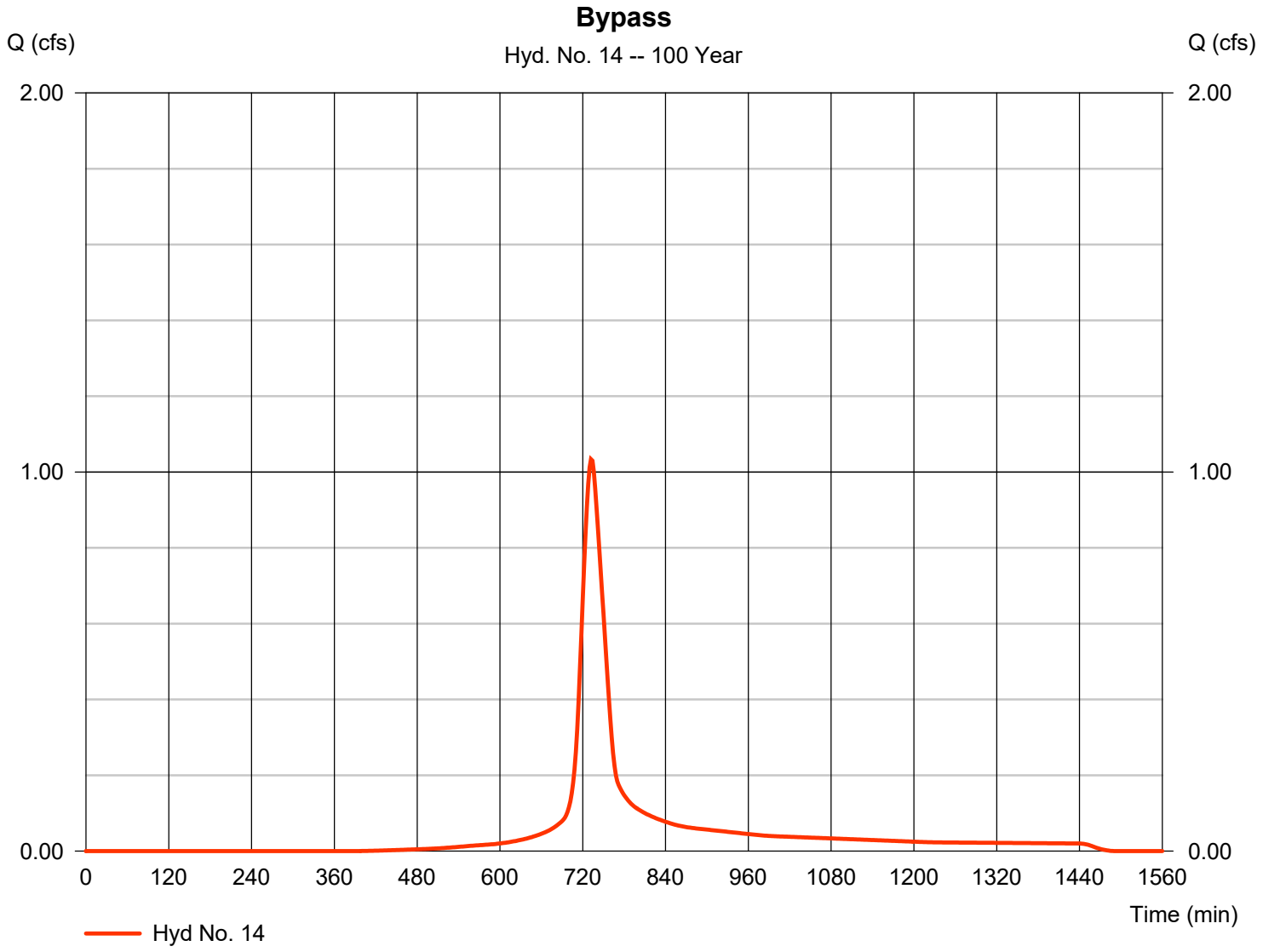
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020 Wednesday, 04 / 17 / 2024

Hyd. No. 14

Bypass

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.034 cfs
Storm frequency	=	100 yrs	Time to peak	=	732 min
Time interval	=	2 min	Hyd. volume	=	4,467 cuft
Drainage area	=	0.250 ac	Curve number	=	75*
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) = [(0.010 x 98) + (0.240 x 74)] / 0.250



Hydrograph Report

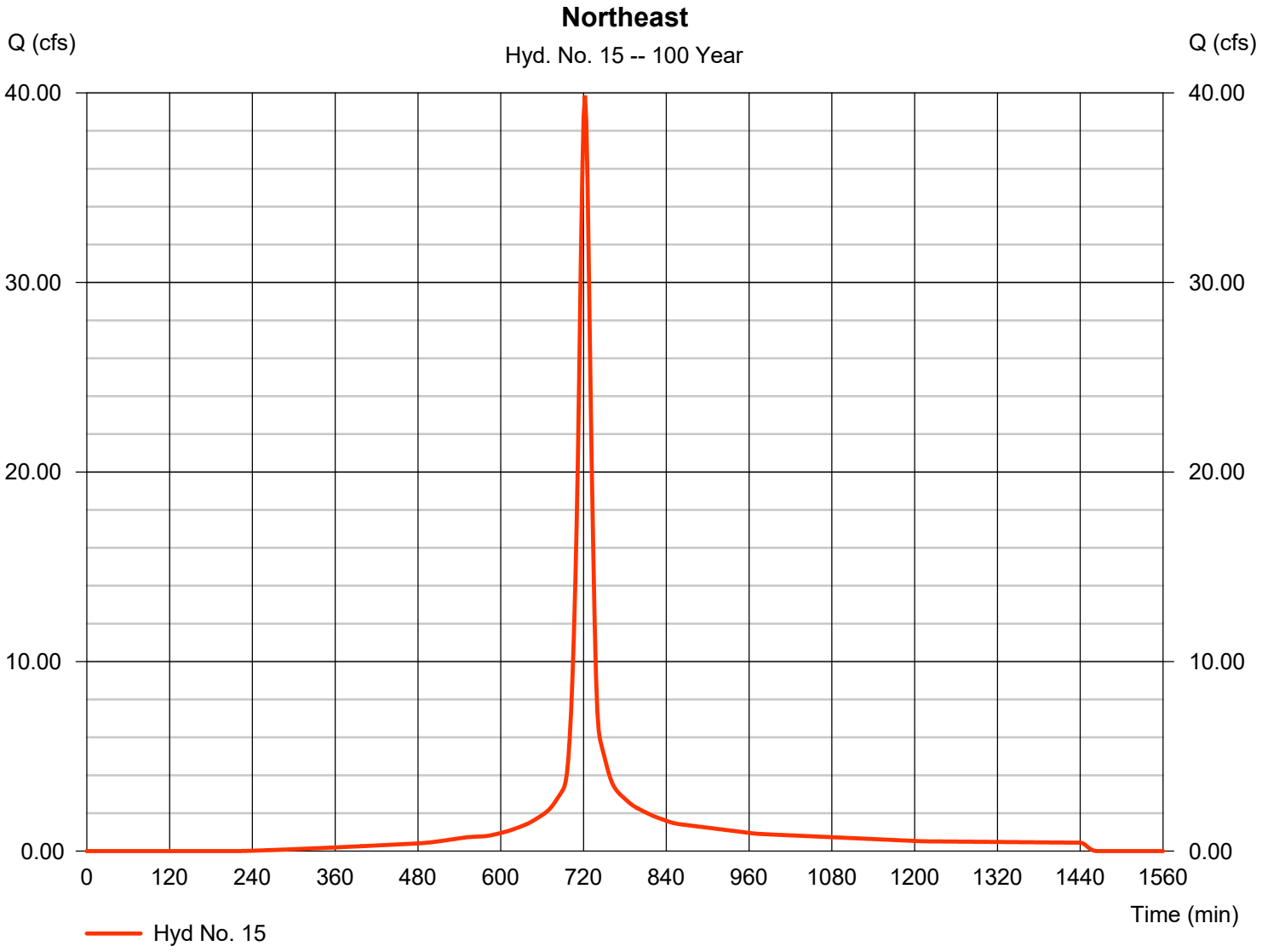
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020 Wednesday, 04 / 17 / 2024

Hyd. No. 15

Northeast

Hydrograph type	=	SCS Runoff	Peak discharge	=	39.85 cfs
Storm frequency	=	100 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	116,651 cuft
Drainage area	=	5.370 ac	Curve number	=	86*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	15.30 min
Total precip.	=	7.80 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(2.700 x 98) + (2.670 x 74)] / 5.370



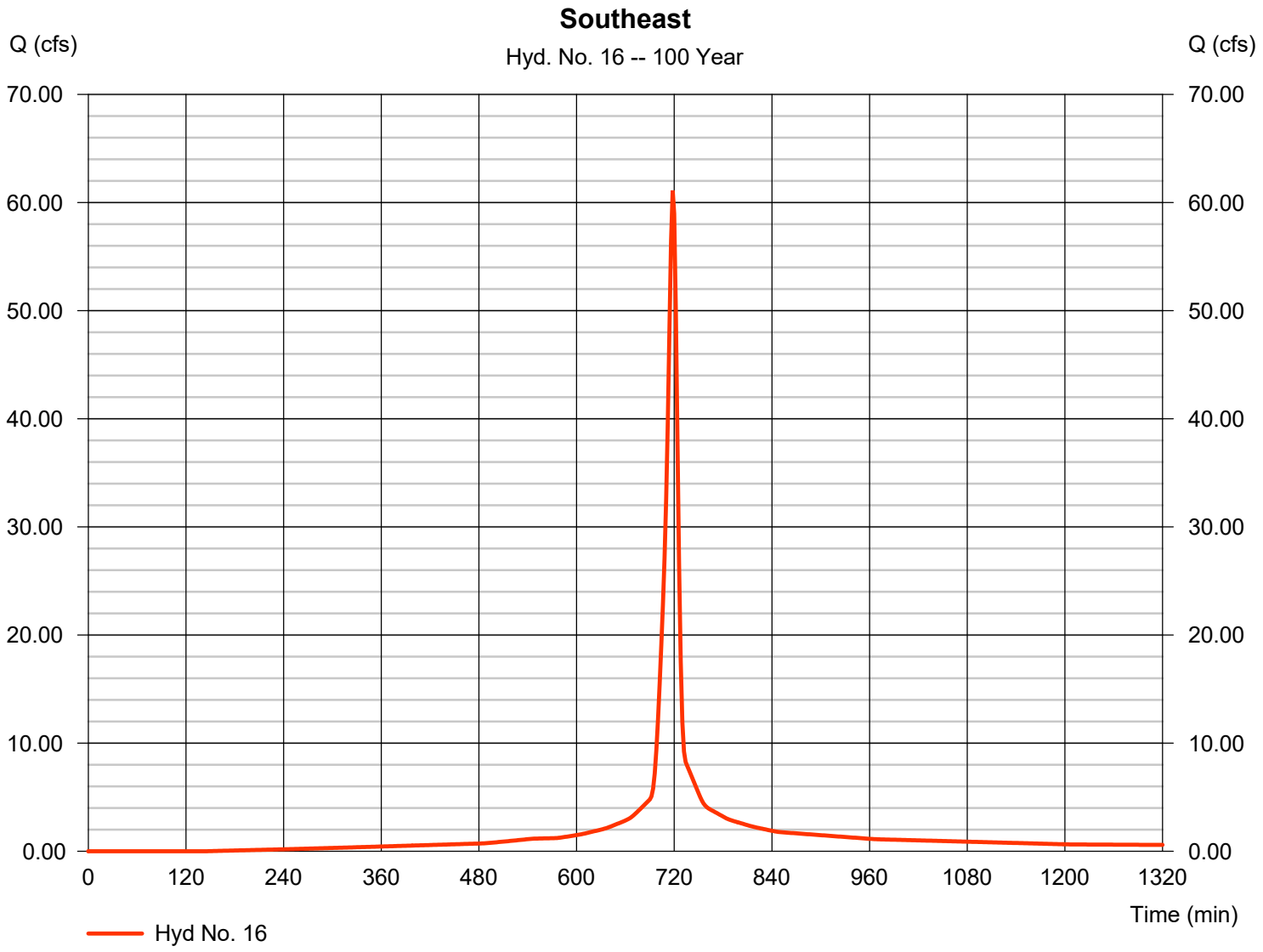
Hydrograph Report

Hyd. No. 16

Southeast

Hydrograph type	=	SCS Runoff	Peak discharge	=	61.12 cfs
Storm frequency	=	100 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	153,108 cuft
Drainage area	=	6.270 ac	Curve number	=	91*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	7.10 min
Total precip.	=	7.80 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(4.570 x 98) + (1.700 x 74)] / 6.270



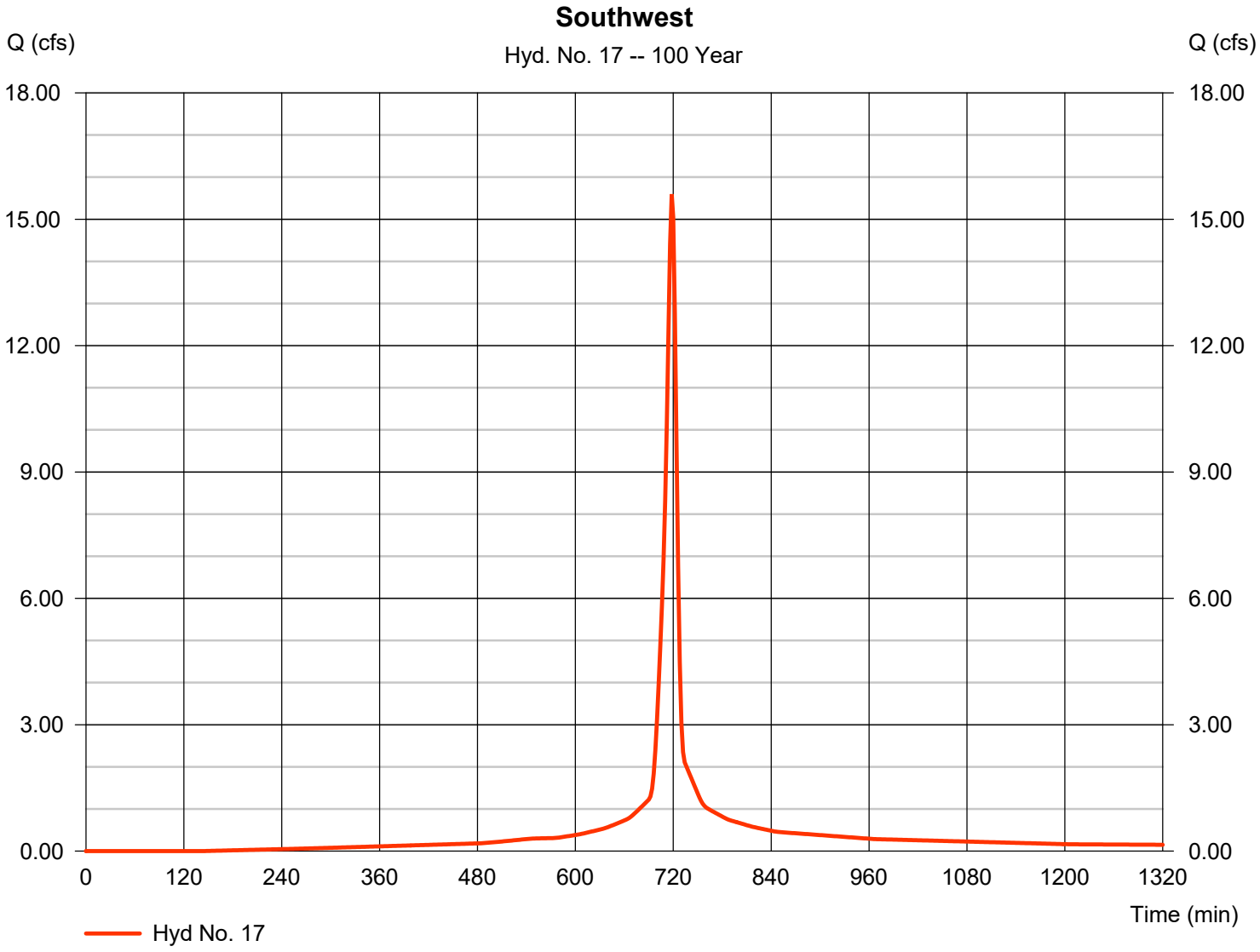
Hydrograph Report

Hyd. No. 17

Southwest

Hydrograph type	=	SCS Runoff	Peak discharge	=	15.60 cfs
Storm frequency	=	100 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	39,071 cuft
Drainage area	=	1.600 ac	Curve number	=	91*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	6.60 min
Total precip.	=	7.80 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

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



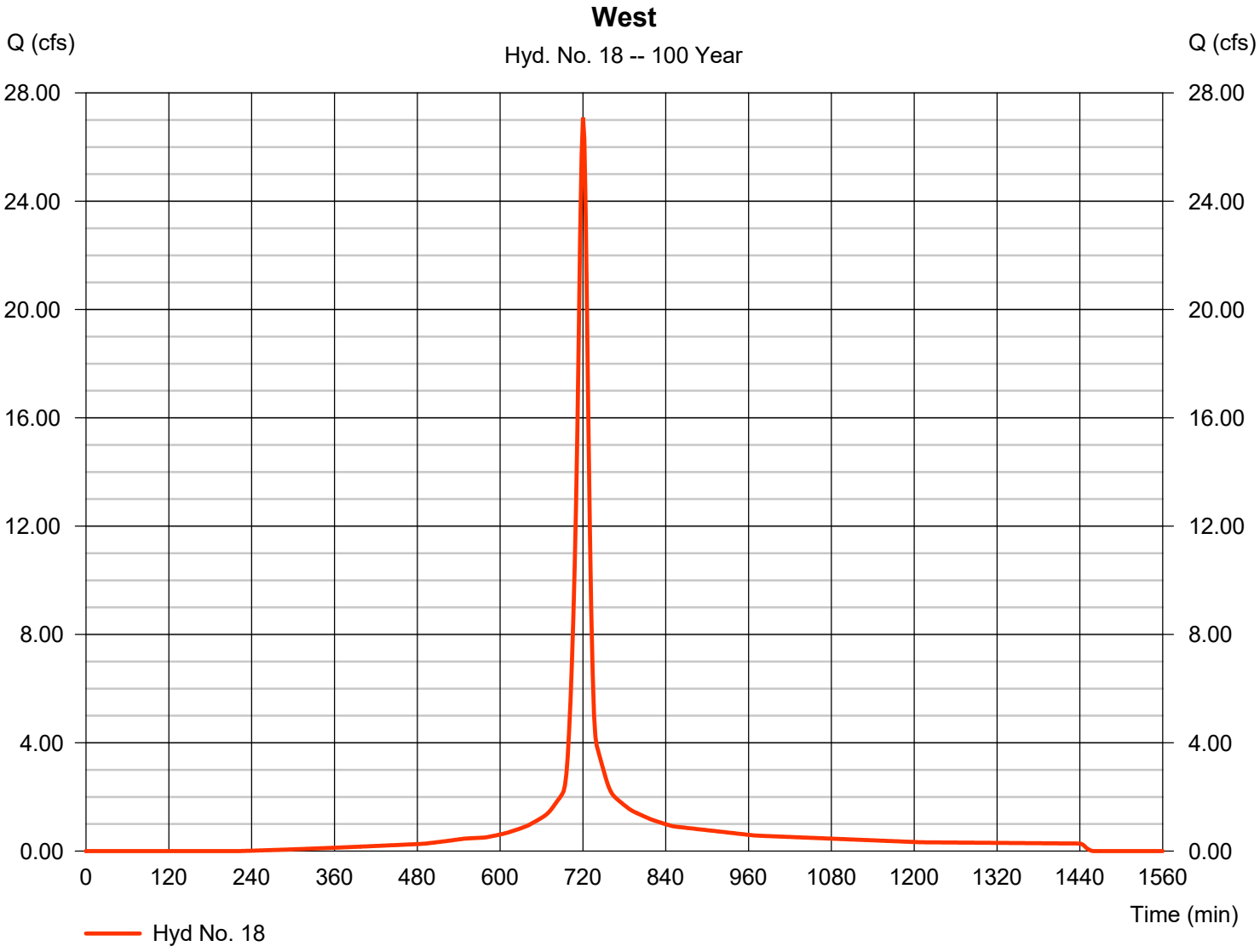
Hydrograph Report

Hyd. No. 18

West

Hydrograph type	=	SCS Runoff	Peak discharge	=	27.10 cfs
Storm frequency	=	100 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	73,523 cuft
Drainage area	=	3.200 ac	Curve number	=	86*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	12.40 min
Total precip.	=	7.80 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

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



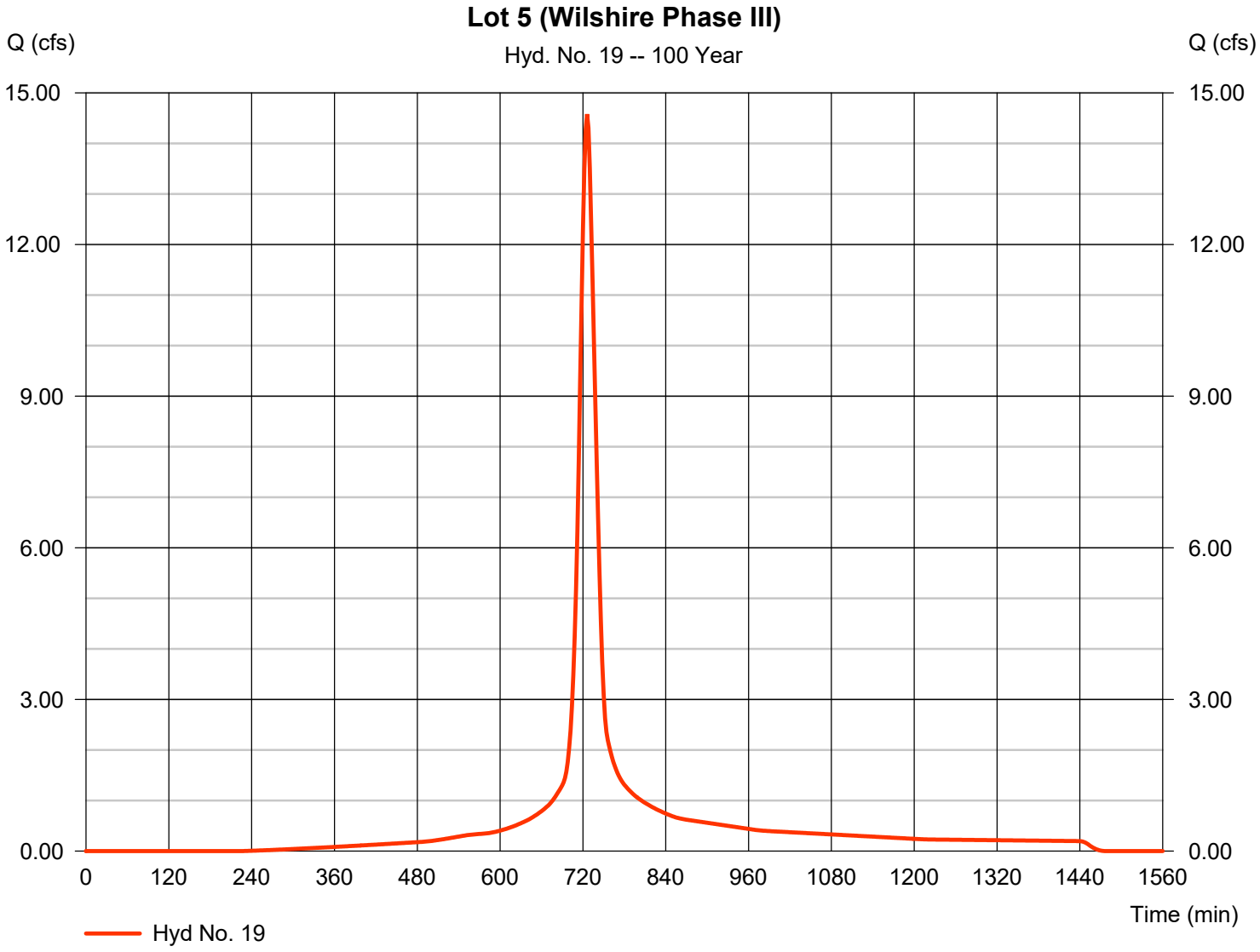
Hydrograph Report

Hyd. No. 19

Lot 5 (Wilshire Phase III)

Hydrograph type	=	SCS Runoff	Peak discharge	=	14.58 cfs
Storm frequency	=	100 yrs	Time to peak	=	726 min
Time interval	=	2 min	Hyd. volume	=	51,932 cuft
Drainage area	=	2.290 ac	Curve number	=	86*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	20.60 min
Total precip.	=	7.80 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

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



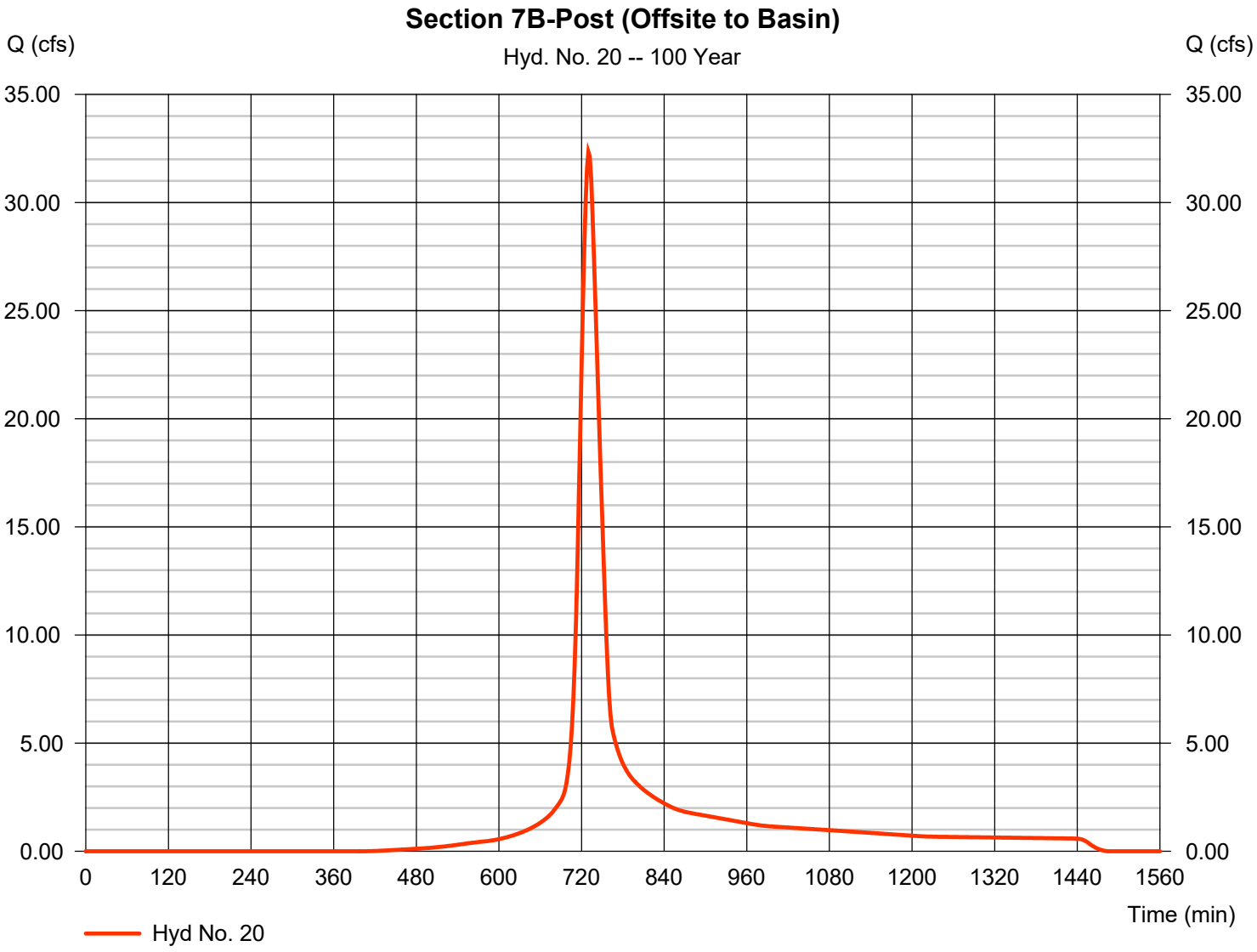
Hydrograph Report

Hyd. No. 20

Section 7B-Post (Offsite to Basin)

Hydrograph type	=	SCS Runoff	Peak discharge	=	32.34 cfs
Storm frequency	=	100 yrs	Time to peak	=	730 min
Time interval	=	2 min	Hyd. volume	=	129,243 cuft
Drainage area	=	7.500 ac	Curve number	=	74*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	28.30 min
Total precip.	=	7.80 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(13.900 x 74)] / 7.500



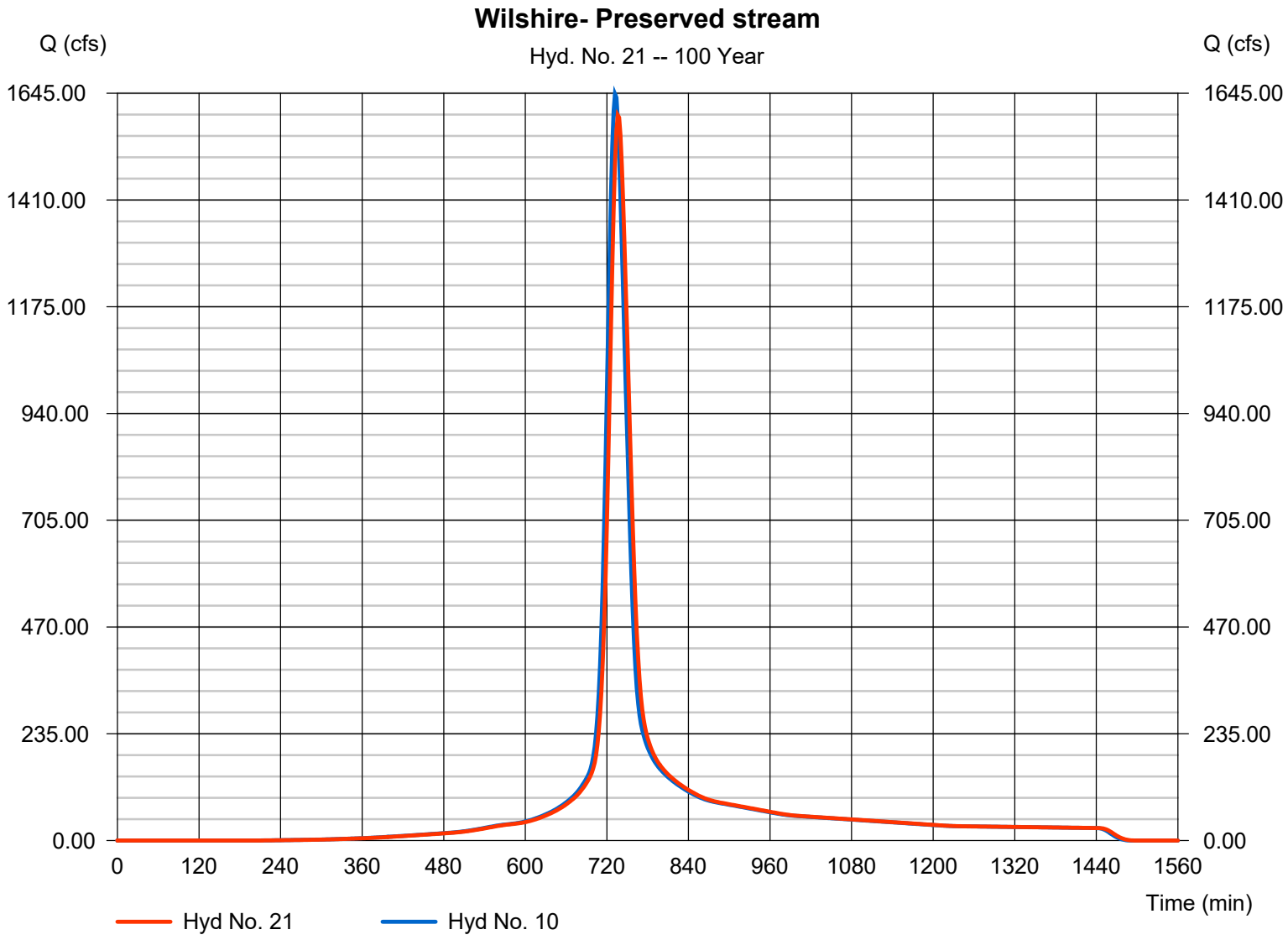
Hydrograph Report

Hyd. No. 21

Wilshire- Preserved stream

Hydrograph type	=	Reach	Peak discharge	=	1596.55 cfs
Storm frequency	=	100 yrs	Time to peak	=	736 min
Time interval	=	2 min	Hyd. volume	=	6,730,439 cuft
Inflow hyd. No.	=	10 - Strother Road Culvert	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	=	1.94 ft/s	Routing coeff.	=	0.4698

Modified Att-Kin routing method used.

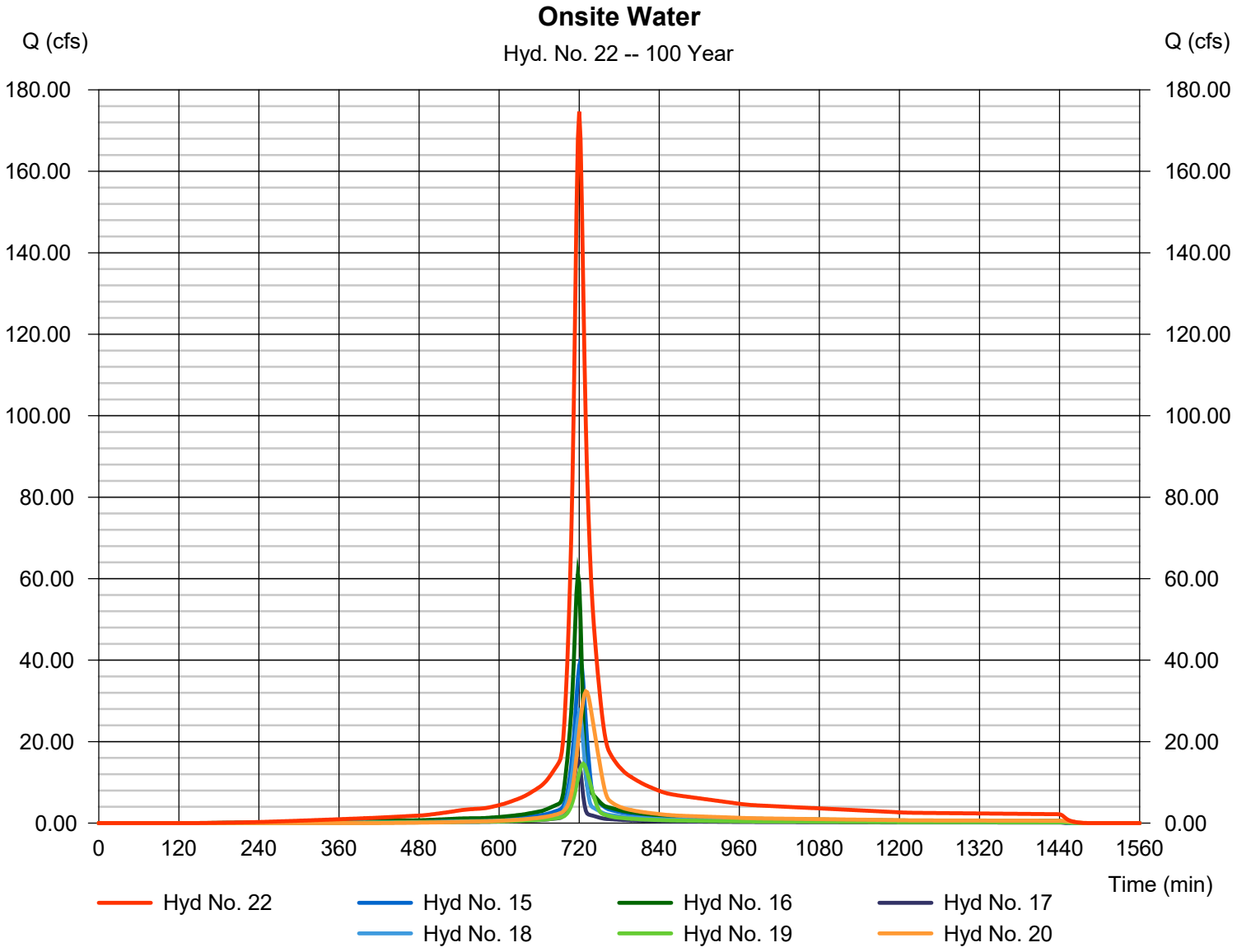


Hydrograph Report

Hyd. No. 22

Onsite Water

Hydrograph type	= Combine	Peak discharge	= 174.64 cfs
Storm frequency	= 100 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 563,527 cuft
Inflow hyds.	= 15, 16, 17, 18, 19, 20	Contrib. drain. area	= 26.230 ac



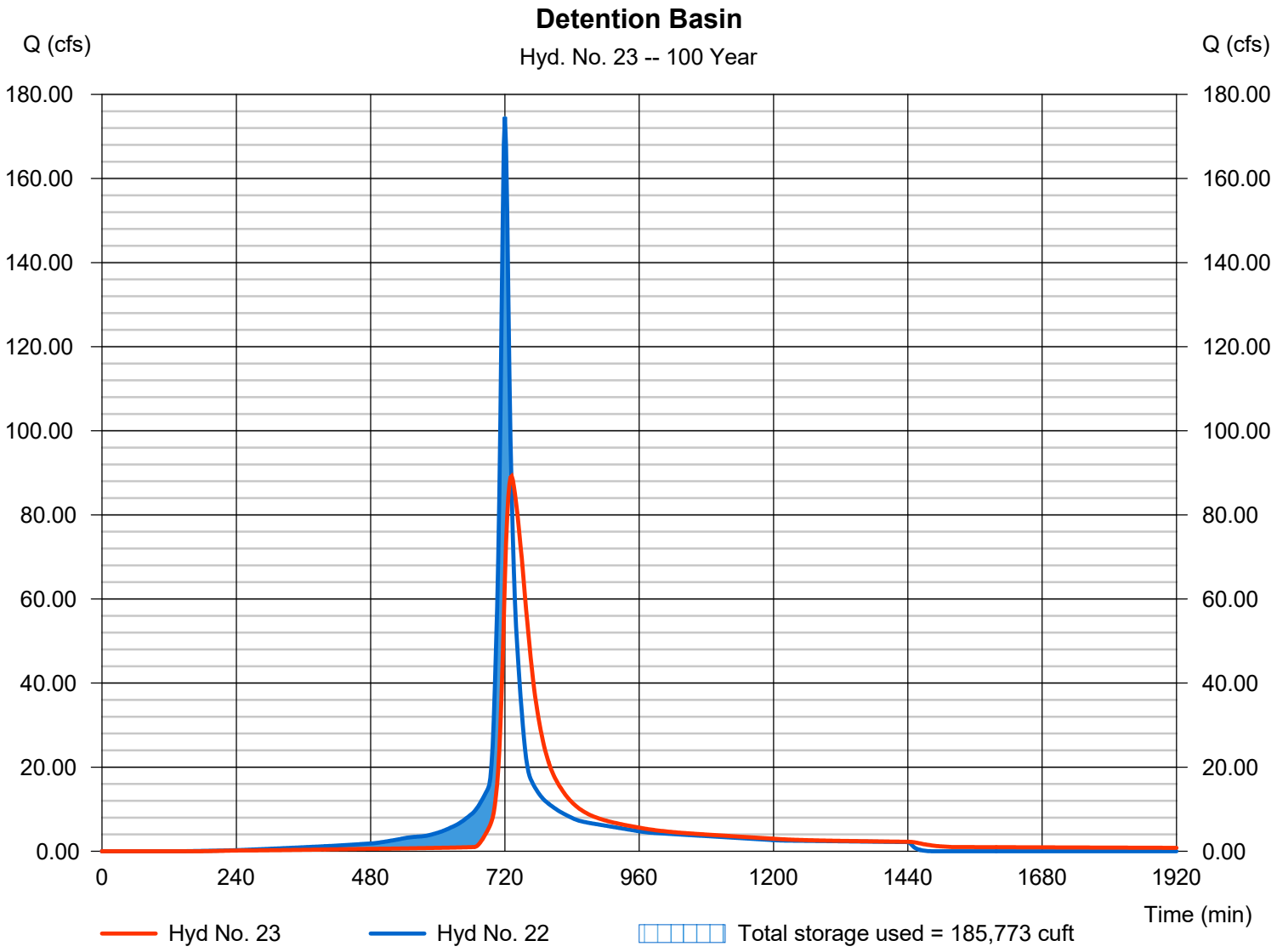
Hydrograph Report

Hyd. No. 23

Detention Basin

Hydrograph type	=	Reservoir	Peak discharge	=	89.20 cfs
Storm frequency	=	100 yrs	Time to peak	=	732 min
Time interval	=	2 min	Hyd. volume	=	563,512 cuft
Inflow hyd. No.	=	22 - Onsite Water	Max. Elevation	=	921.00 ft
Reservoir name	=	Detention Basin	Max. Storage	=	185,773 cuft

Storage Indication method used.

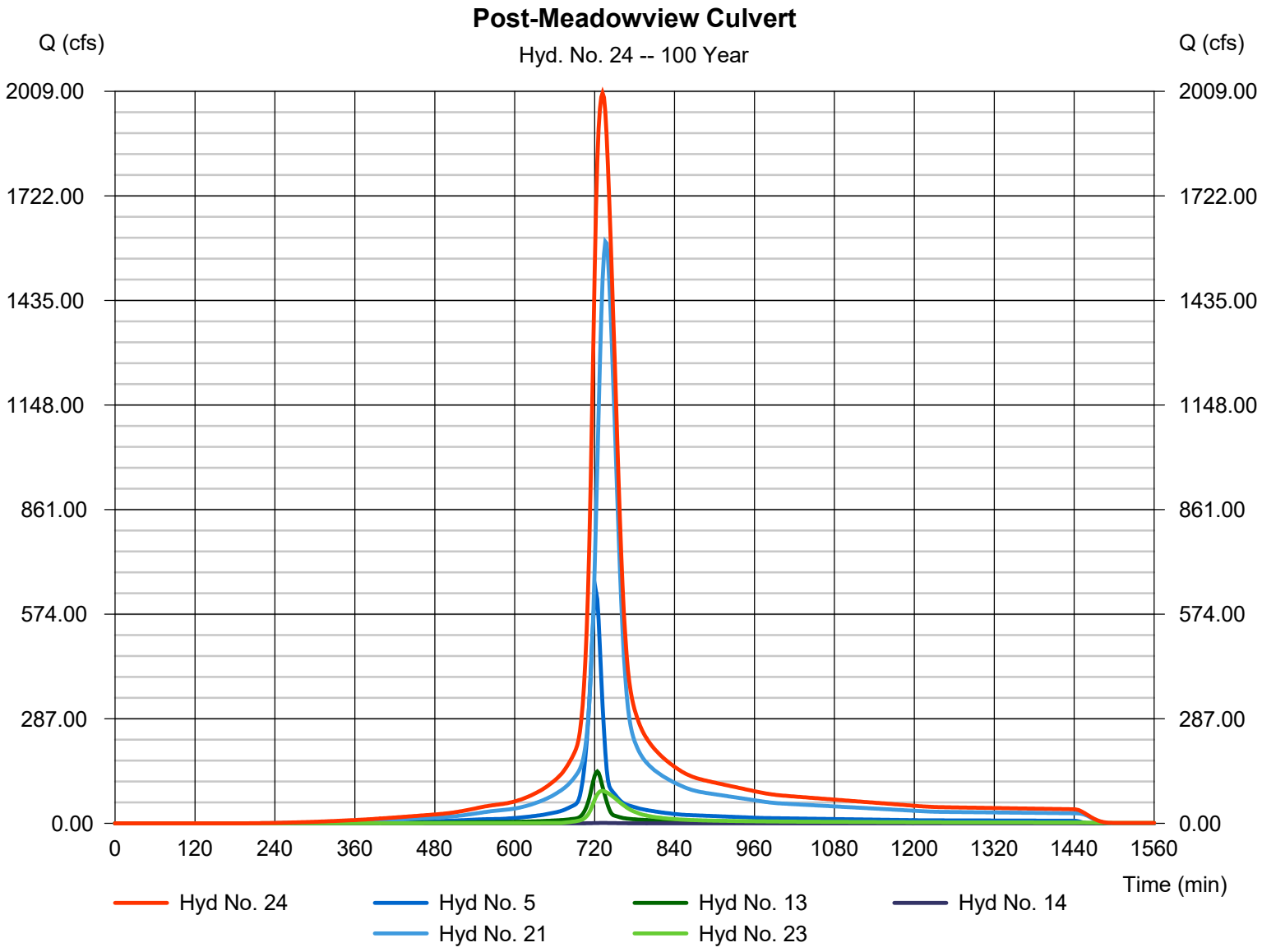


Hydrograph Report

Hyd. No. 24

Post-Meadowview Culvert

Hydrograph type	=	Combine	Peak discharge	=	2004.22 cfs
Storm frequency	=	100 yrs	Time to peak	=	732 min
Time interval	=	2 min	Hyd. volume	=	9,618,901 cuft
Inflow hyds.	=	5, 13, 14, 21, 23	Contrib. drain. area	=	107.050 ac



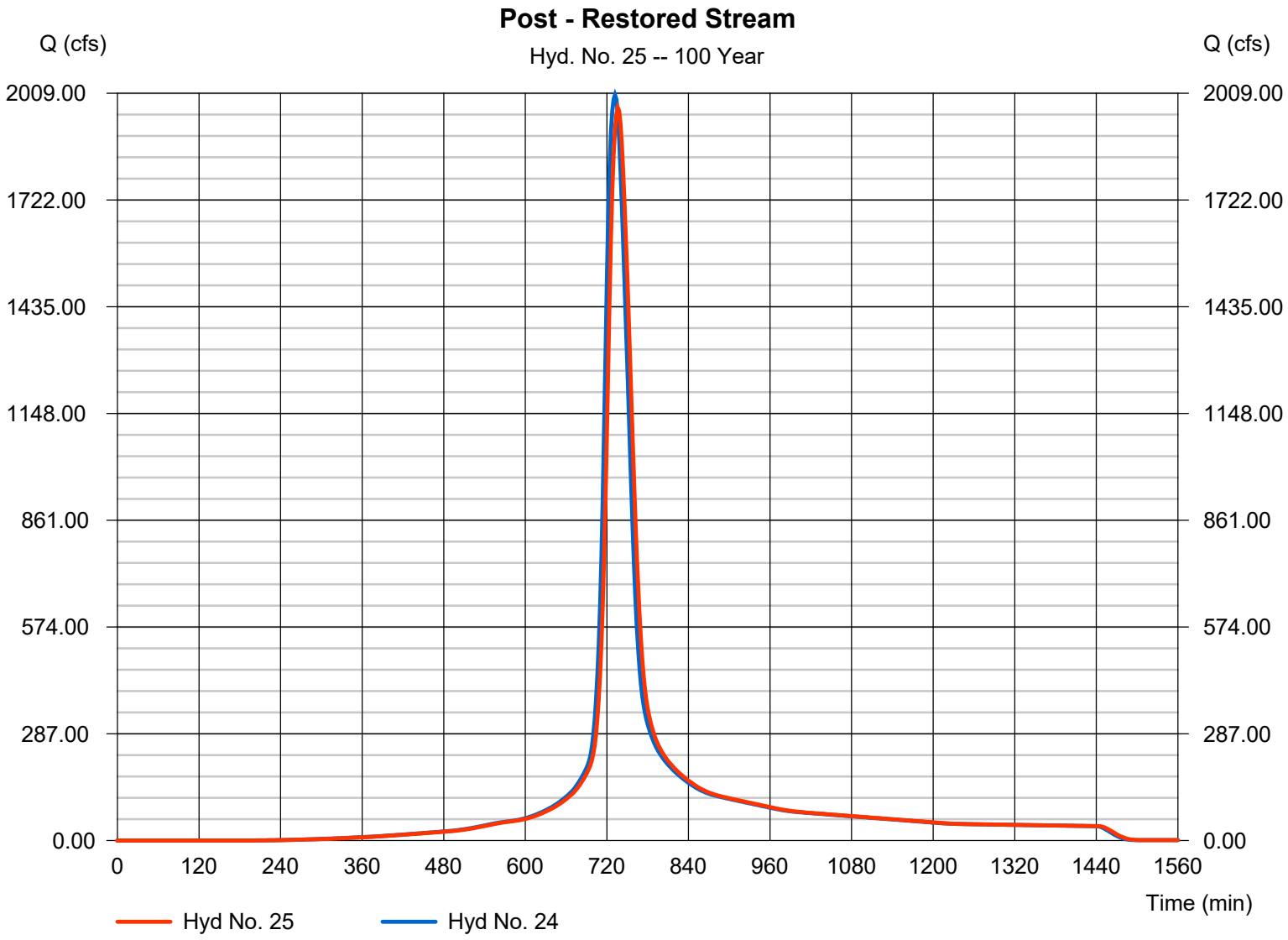
Hydrograph Report

Hyd. No. 25

Post - Restored Stream

Hydrograph type	=	Reach	Peak discharge	=	1970.08 cfs
Storm frequency	=	100 yrs	Time to peak	=	736 min
Time interval	=	2 min	Hyd. volume	=	9,618,877 cuft
Inflow hyd. No.	=	24 - 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	=	4.78 ft/s	Routing coeff.	=	0.4472

Modified Att-Kin routing method used.



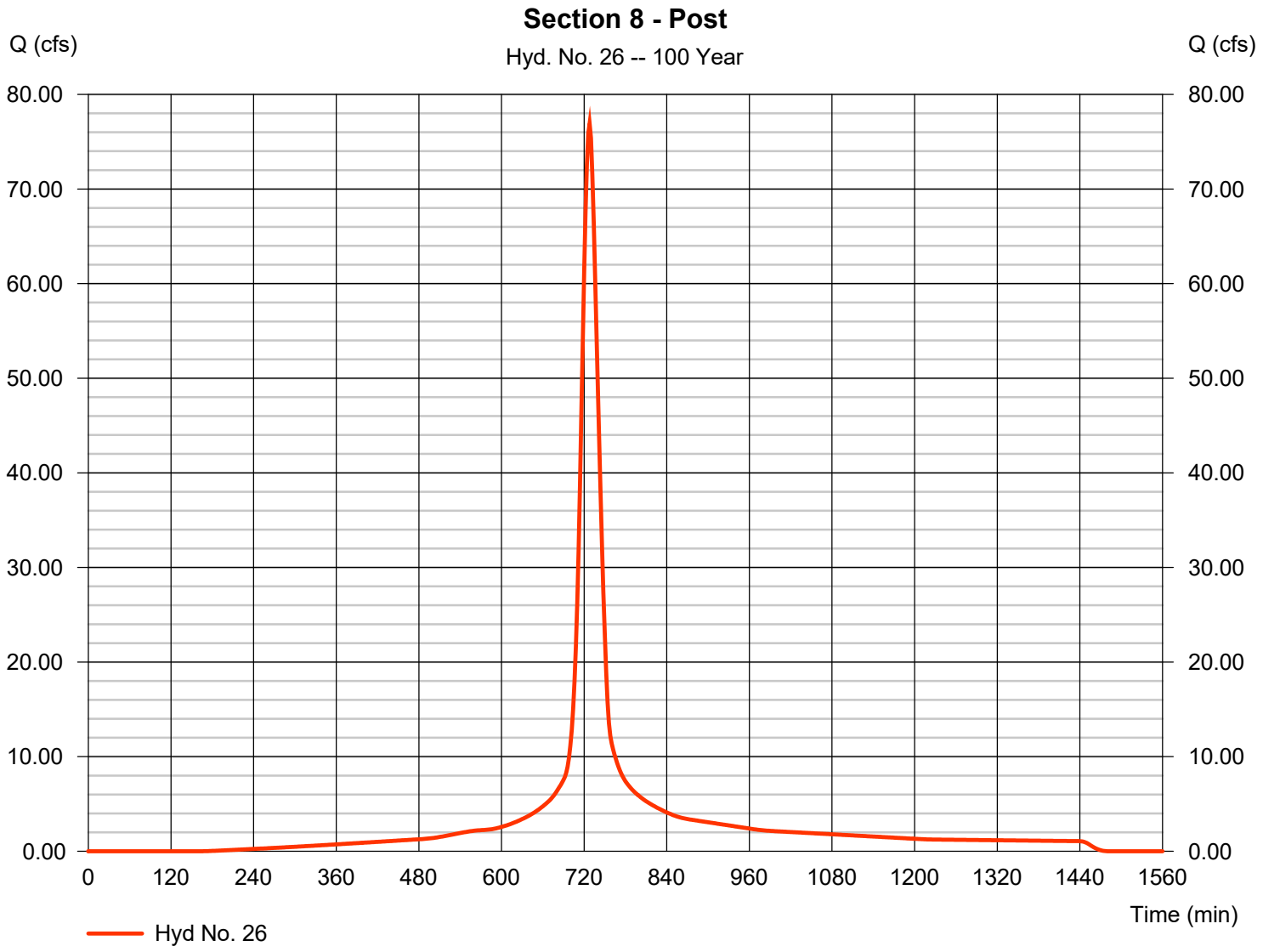
Hydrograph Report

Hyd. No. 26

Section 8 - Post

Hydrograph type	=	SCS Runoff	Peak discharge	=	76.90 cfs
Storm frequency	=	100 yrs	Time to peak	=	728 min
Time interval	=	2 min	Hyd. volume	=	297,548 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

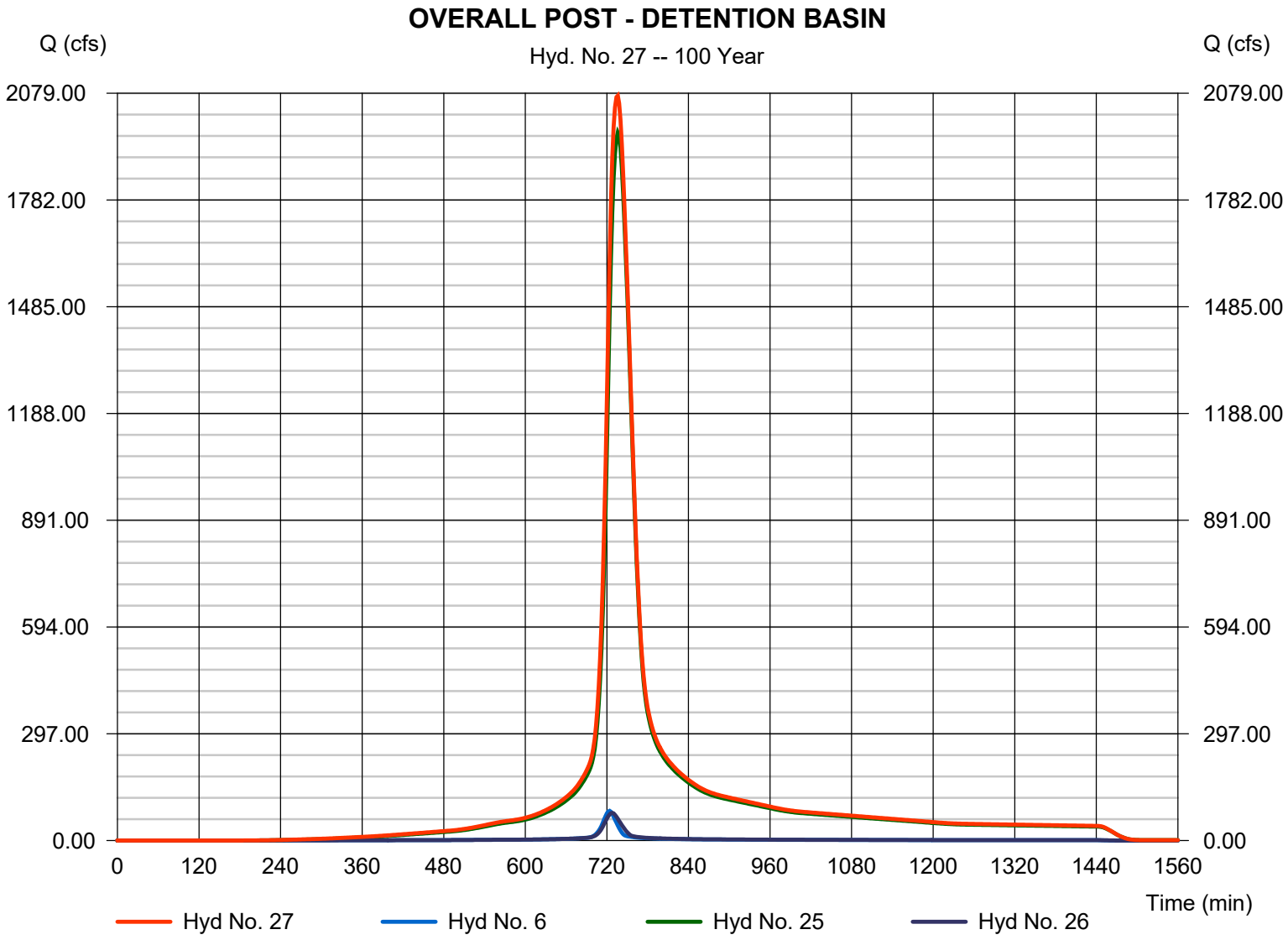


Hydrograph Report

Hyd. No. 27

OVERALL POST - DETENTION BASIN

Hydrograph type	= Combine	Peak discharge	= 2072.34 cfs
Storm frequency	= 100 yrs	Time to peak	= 736 min
Time interval	= 2 min	Hyd. volume	= 10,192,359 cuft
Inflow hyds.	= 6, 25, 26	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

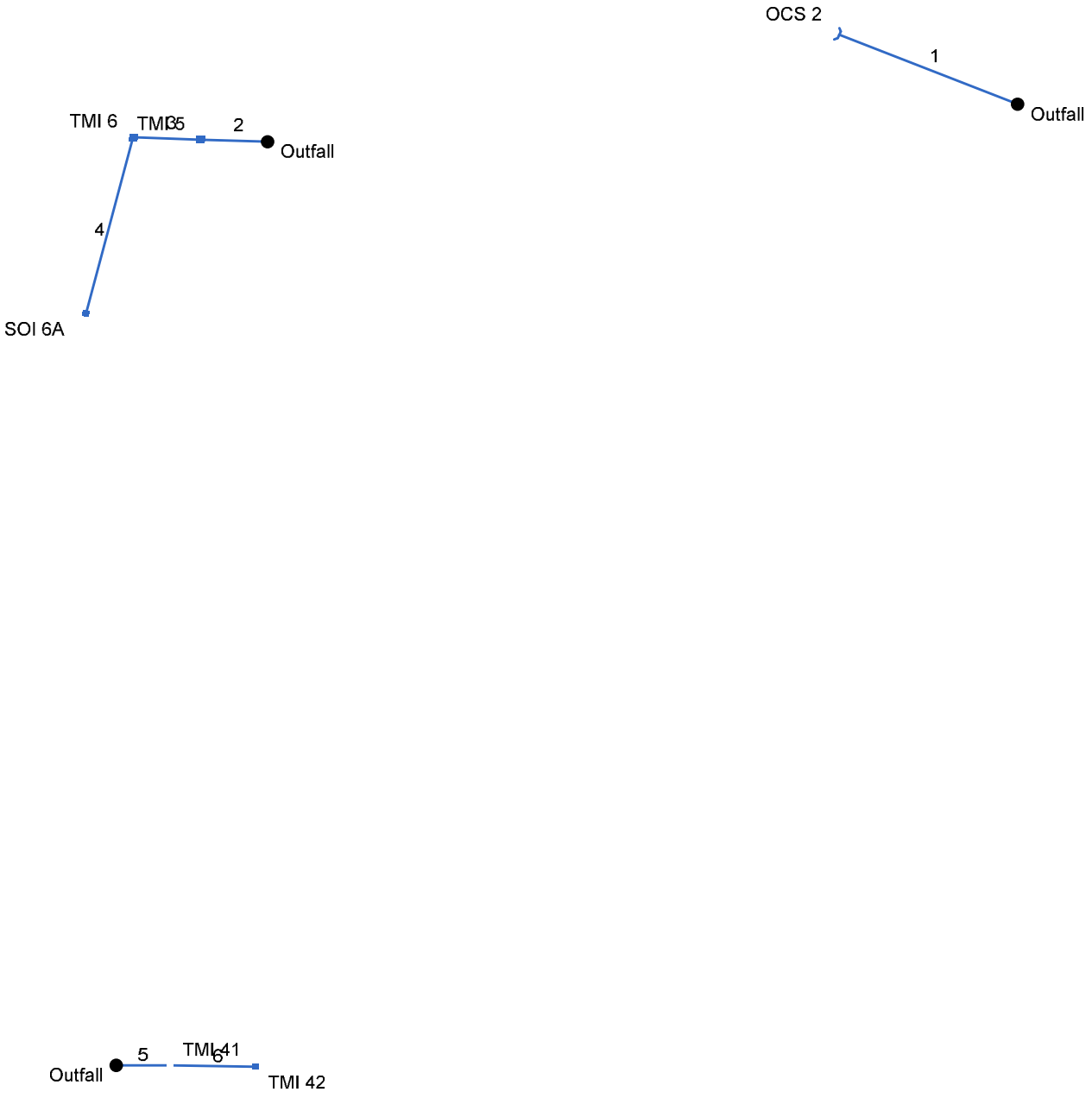
Tc = time in minutes. Values may exceed 60.

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

APPENDIX F:
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

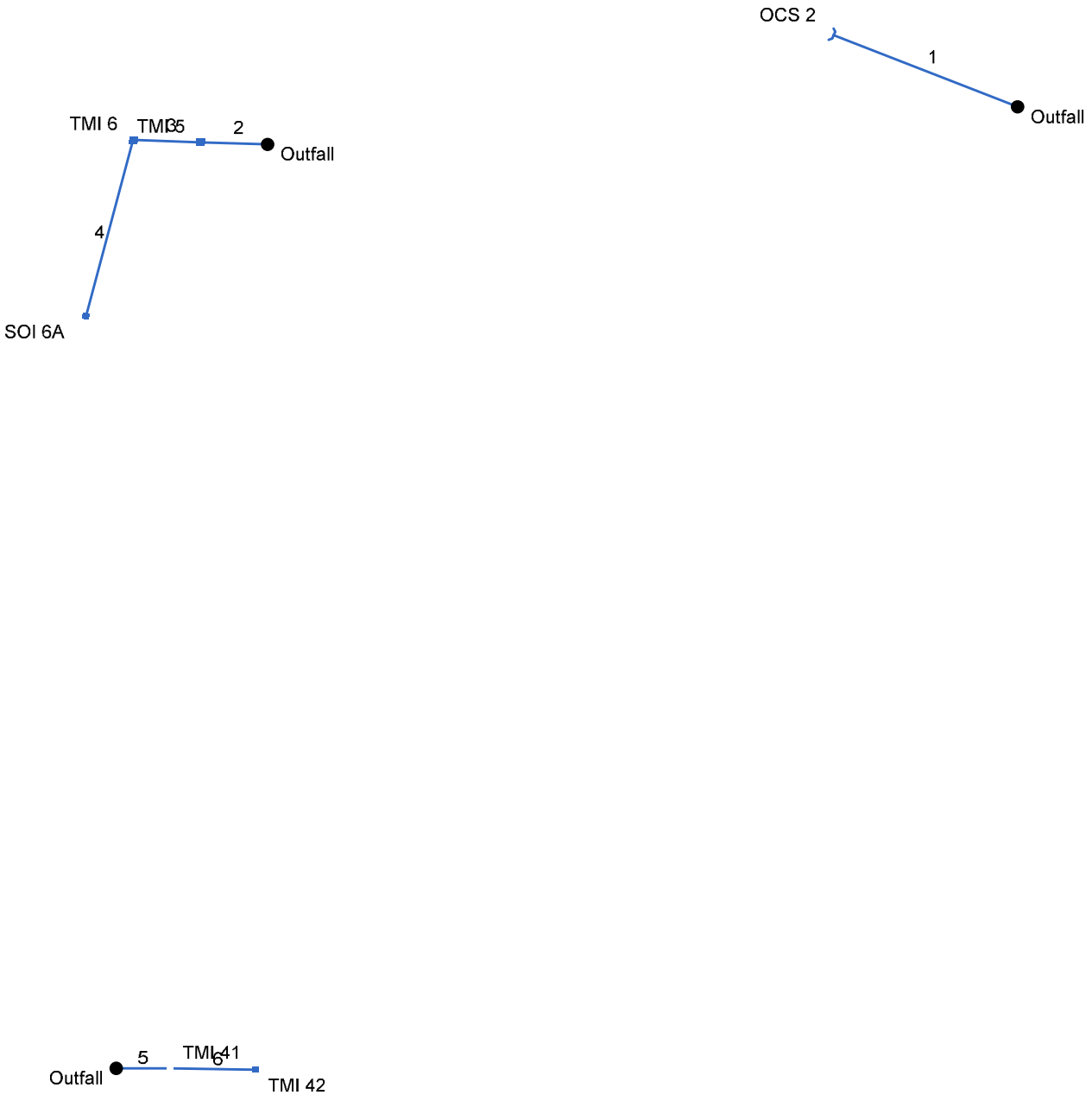
Hydraulic Grade Line Computations

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

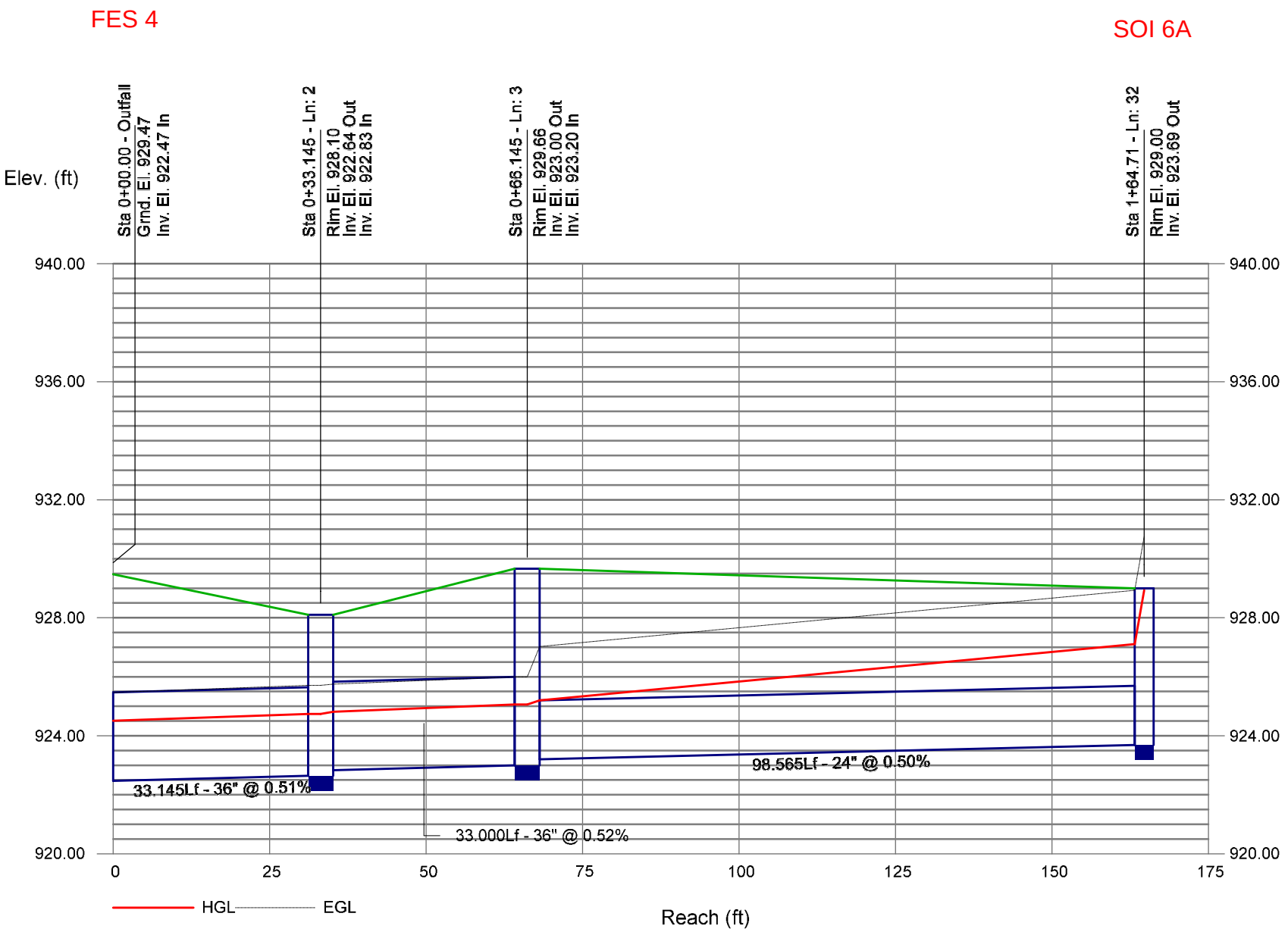
Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf		Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf	Ave Sf	Enrgy loss		
	(in)	(cfs)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(ft)	(ft)	(ft)	(ft)	(sqft)	(ft/s)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

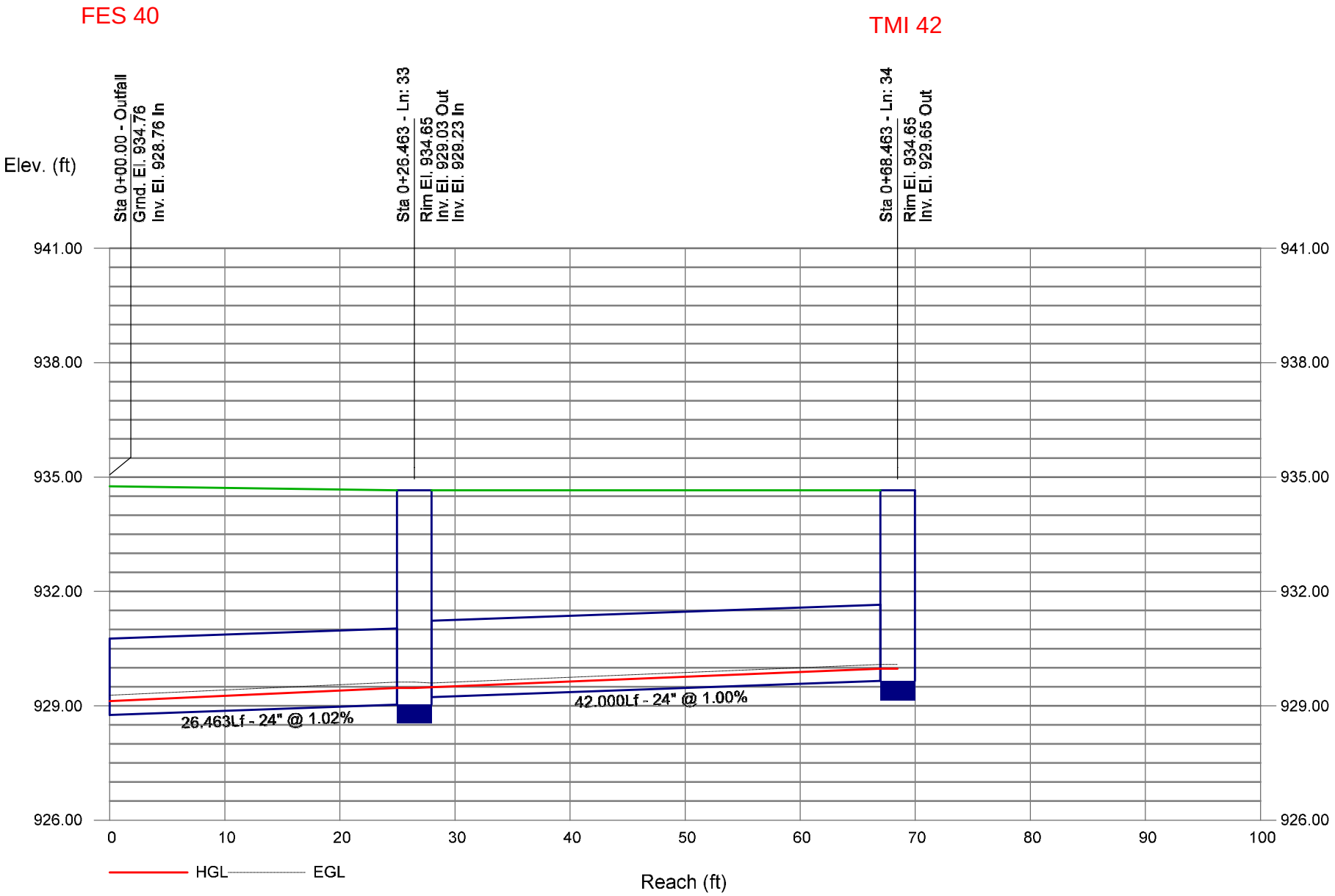
Storm Sewer Profile

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



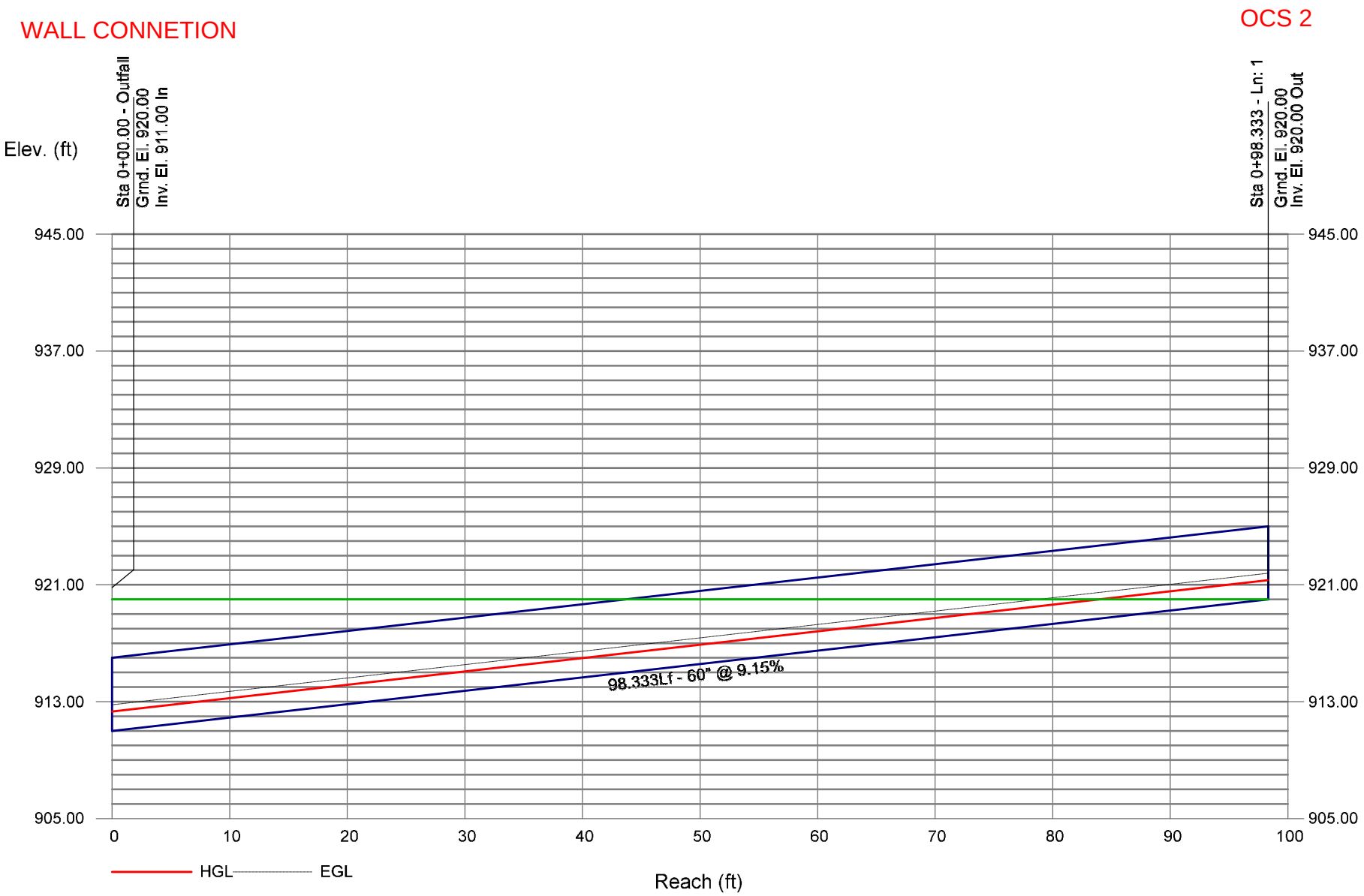
Storm Sewer Profile

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

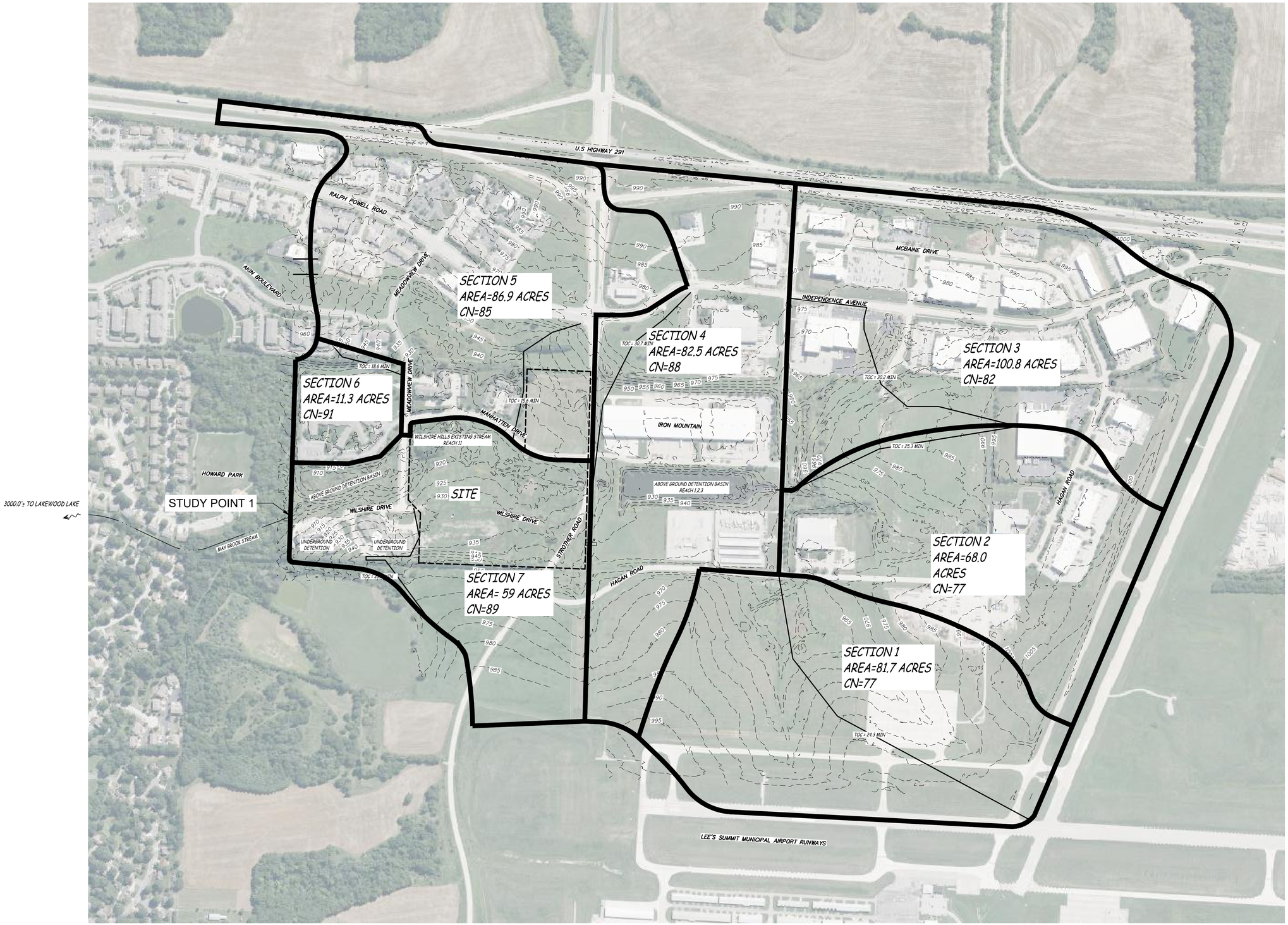


Storm Sewer Profile

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



APPENDIX G:
DRAINAGE AREA MAP(S)



\\192.168.0.99\PROJECTS\GENERAL PROJECTS\15925E--JES--WILSHIRE--HILLS--3--ENG\CAD\15925 DAM.DWG 2/16/2024

Engineering Surveys & Services
DELIVERING YOUR VISION ™

1113 Fay Street, Columbia, MO 65201
573 - 449 - 2646

802 El Dorado Drive, Jefferson City, MO 65101
573-636-3303

1775 West Main Street, Sedalia, MO 65301
660-826-8618

www.ess-inc.com

MO Engineering Corp. # 2004005018

N

0 1"
SCALE: 1" = 300'

WILSHIRE HILLS PHASE III

STREET ADDRESS
LEE'S SUMMIT JACKSON COUNTY, MISSOURI

2/16/2024

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

MATTHEW A. KRIETE
PROFESSIONAL ENGINEER
PE-2007002811

IF ORIGINAL SIGNATURE OR DIGITAL AUTHENTICATION IS NOT PRESENT THIS MEDIA SHOULD NOT BE CONSIDERED A CERTIFIED DOCUMENT.

Date
NOVEMBER 28, 2023

Revised
4 FEBRUARY 16, 2024

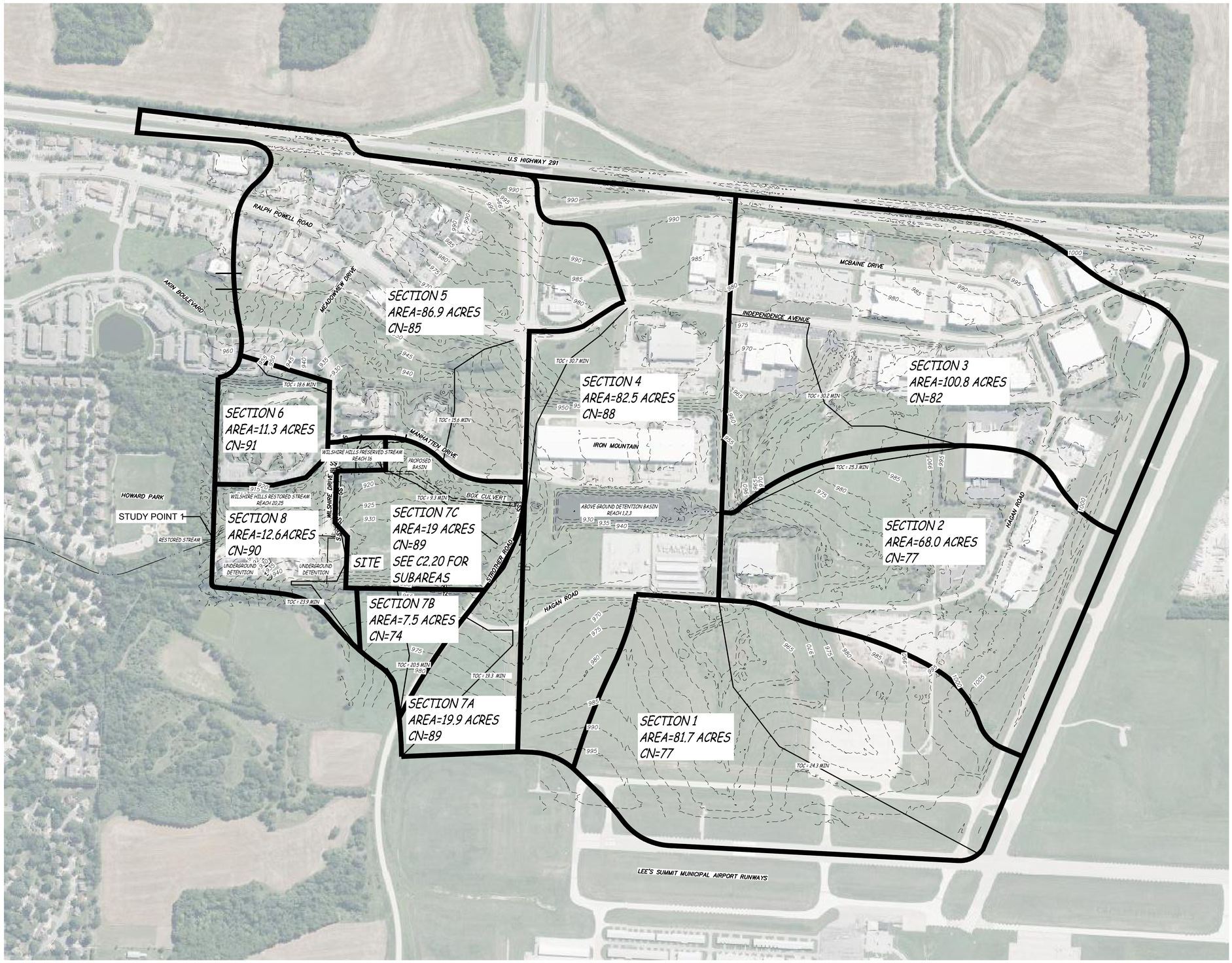
Design: ST Drawn: ST

PRE DOWNSTREAM ANALYSIS MAP

Sheet
C2.18

ES&S PROJECT NO. 15925

CONSTRUCTION DOCUMENTS



\\192.168.0.99\PROJECTS\GENERAL PROJECTS\15925E—JES- WILSHIRE HILLS—3-ENG\CAD\15925 DAM.DWG 4/17/2024

Engineering Surveys & Services
DELIVERING YOUR VISION ™
1113 Fay Street, Columbia, MO 65201
573 - 449 - 2646
802 El Dorado Drive, Jefferson City, MO 65101
573-636-3303
1775 West Main Street, Sedalia, MO 65301
660-826-8818
www.ess-inc.com
MO Engineering Corp. # 2004005018

N

0 1"
SCALE: 1" = 300'

WILSHIRE HILLS PHASE III

STREET ADDRESS
LEE'S SUMMIT JACKSON COUNTY, MISSOURI

4/16/2024

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

MATTHEW A. KRIETE
PROFESSIONAL ENGINEER
PE-2007002811

IF ORIGINAL SIGNATURE OR DIGITAL AUTHENTICATION IS NOT PRESENT THIS MEDIA SHOULD NOT BE CONSIDERED A CERTIFIED DOCUMENT.

Date
NOVEMBER 28, 2023

Revised
4 FEBRUARY 16, 2024
6 APRIL 16, 2024

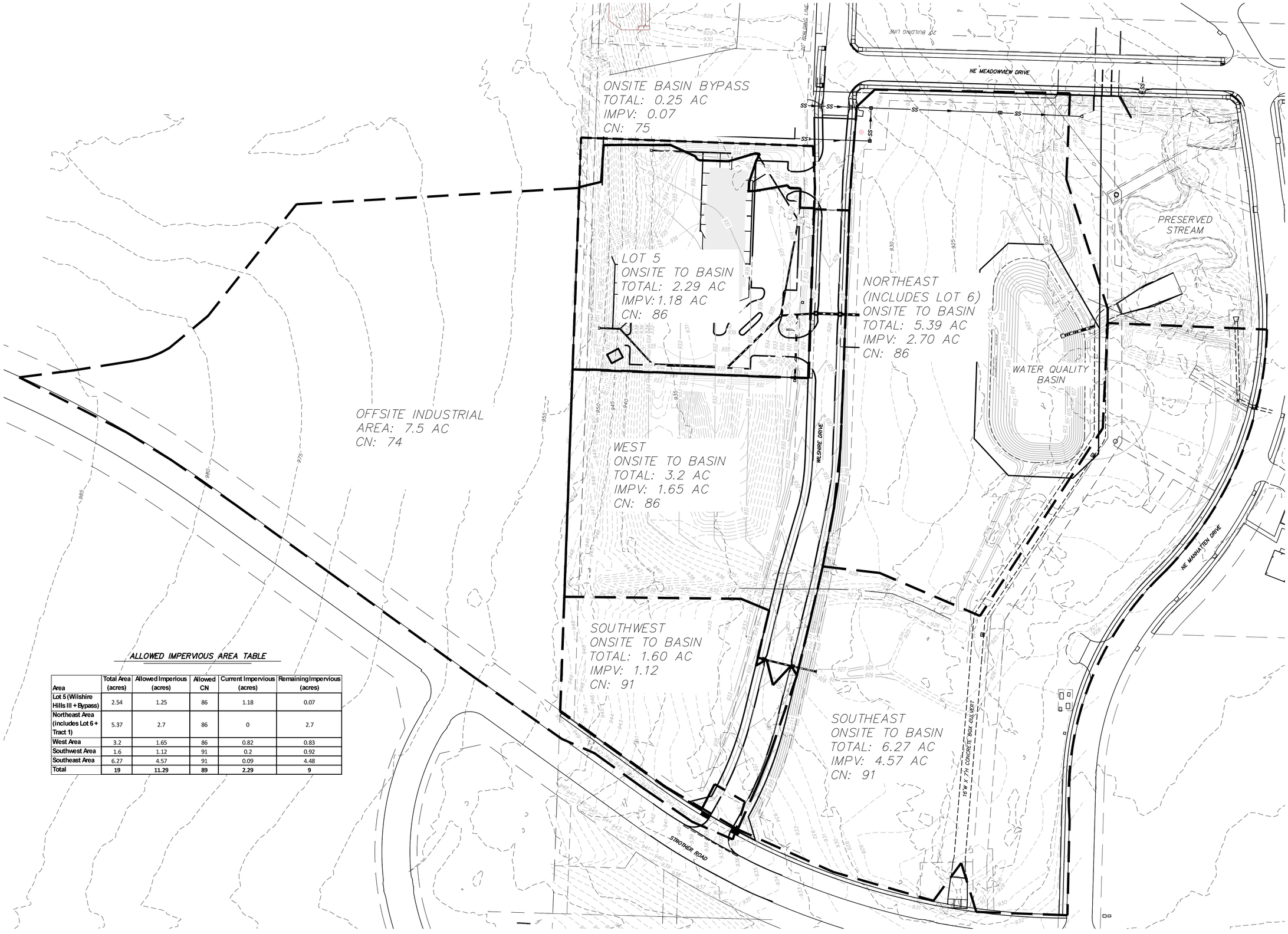
Design: ST Drawn: ST

CONSTRUCTION DOCUMENTS

POST DOWNSTREAM ANALYSIS MAP

Sheet
C2.19

ES&S PROJECT NO. 15925



ALLOWED IMPERVIOUS AREA TABLE

Area	Total Area (acres)	Allowed Imperious (acres)	Allowed CN	Current Impervious (acres)	Remaining Impervious (acres)
Lot 5 (Wilshire Hills III + Bypass)	2.54	1.25	86	1.18	0.07
Northeast Area (includes Lot 6 + Tract 1)	5.37	2.7	86	0	2.7
West Area	3.2	1.65	86	0.82	0.83
Southwest Area	1.6	1.12	91	0.2	0.92
Southeast Area	6.27	4.57	91	0.09	4.48
Total	**19**	**11.29**	**89**	**2.29**	**9**

Engineering Surveys & Services
DELIVERING YOUR VISION ™
1113 Fay Street, Columbia, MO 65201
573 - 449 - 2646
802 El Dorado Drive, Jefferson City, MO 65101
573-636-3303
1775 West Main Street, Sedalia, MO 65301
660-826-8618
www.ess-inc.com
MO Engineering Corp. # 2004005018

N

0 1"
SCALE: 1" = 60'

WILSHIRE HILLS PHASE III
3200 NE MANHATTAN DR
LEE'S SUMMIT JACKSON COUNTY, MISSOURI

3/27/2024
STATE OF MISSOURI
MATTHEW AARON KRIETE
NUMBER PE-2007002811
PROFESSIONAL ENGINEER

MATTHEW A. KRIETE
PROFESSIONAL ENGINEER
PE-2007002811

IF ORIGINAL SIGNATURE OR DIGITAL AUTHENTICATION IS NOT PRESENT THIS MEDIA SHOULD NOT BE CONSIDERED A CERTIFIED DOCUMENT.

Date
JUNE 30, 2023

Revised
2 NOVEMBER 28, 2023
4 FEBRUARY 16, 2024
5 MARCH 27, 2024

Design: ST Drawn: ST

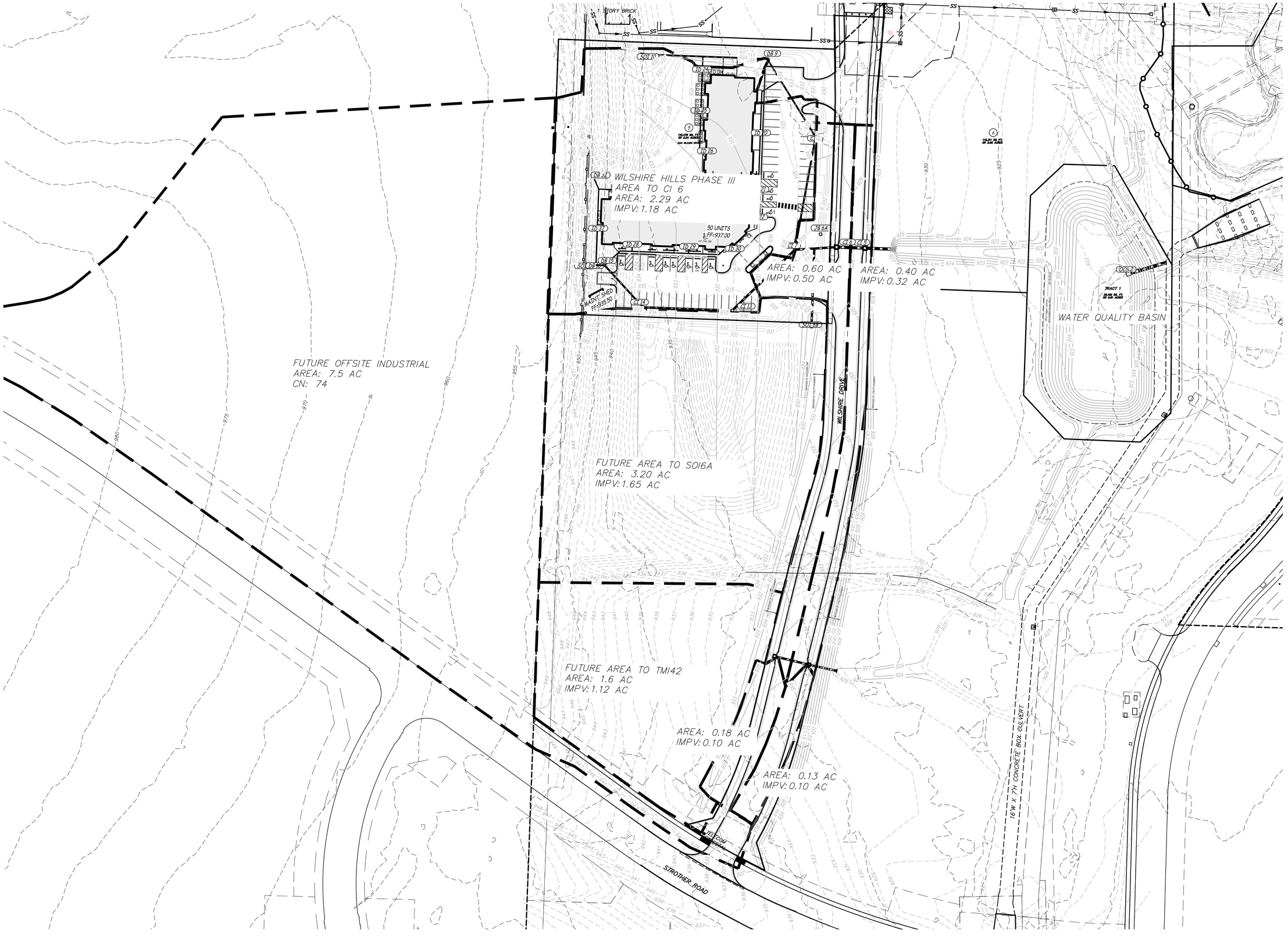
POST DEVELOPMENT DRAINAGE AREA MAP

Sheet
C2.20

ES&S PROJECT NO. 15925

CONSTRUCTION DOCUMENTS

P:\GENERAL PROJECTS\15925E--ES--WILSHIRE--HILLS--3--ENG\CAD\15925 DAM.DWG 3/29/2024



Engineering Surveys & Services
DELIVERING YOUR VISION ™

1113 Fay Street, Columbia, MO 65201
573 - 449 - 2646

802 El Dorado Drive, Jefferson City, MO 65101
573-636-3303

1775 West Main Street, Sedalia, MO 65301
660-826-8818

www.ess-inc.com

MO Engineering Corp. # 2004005018

N

0 1"
SCALE: 1" = 50'

WILSHIRE HILLS PHASE III

3200 NE MANHATTAN DR
LEE'S SUMMIT JACKSON COUNTY, MISSOURI

3/27/2024

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

MATTHEW A. KRIETE
PROFESSIONAL ENGINEER
PE-2007002811

IF ORIGINAL SIGNATURE OR DIGITAL AUTHENTICATION IS NOT PRESENT THIS MEDIA SHOULD NOT BE CONSIDERED A CERTIFIED DOCUMENT.

Date
JUNE 30, 2023

Revised
2 OCTOBER 12, 2023
4 FEBRUARY 16, 2024
5 MARCH 27, 2024

Design: ST Drawn: ST

STORM SEWER DRAINAGE AREA MAP

Sheet
C2.21

ES&S PROJECT NO. 15925

CONSTRUCTION DOCUMENTS

P:\GENERAL PROJECTS\15925E--JES--WILSHIRE--HILLS--3--ENG\CAD\15925 DAM.DWG 3/29/2024

Engineering Surveys & Services

DELIVERING YOUR VISION ™

COLUMBIA ♦ JEFFERSON CITY ♦ SEDALIA