



KAW VALLEY ENGINEERING, INC.

# PRELIMINARY STORMWATER REPORT

*for*

## STREETS OF WEST PRYOR

NWQ PRYOR ROAD AND LOWENSTEIN DRIVE  
LEE'S SUMMIT, MISSOURI

### Revisions:

1. Initial Issue: 6/20/2018

Prepared By:

KAW VALLEY ENGINEERING, INC.

2319 N Jackson

Junction City, Kansas 66441

*KVE Project No. A16D7067-1*



Leon Osbourne, P.E.  
Project Manager

William Heatherman, P.E.  
Project Engineer

*Consulting Engineers*

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## INTRODUCTION

This drainage report was prepared to accompany the submittal of the Preliminary Development Plan for the proposed improvements located at NWQ Pryor Road and Lowenstein Drive in Lee's Summit, Missouri. The proposed improvements include approximately 72.7 acres of mixed use commercial development and multi-family and single-family housing.

## DESIGN CRITERIA

- Adopted design Criteria
  - APWA - Division V - Section 5600 – Storm Drainage Systems and Facilities
- Lee's Summit Missouri
  - Preliminary Development Plan Checklist

## PROJECT LOCATION



**Figure 1: Project Location Map**

As seen in Figure 1, the project is located in the NWC of NW Lowenstein Drive and NW Pryor Road. The project site is bound by NW Pryor Road and Summit Woods Crossing shopping center to the East, Lowenstein Park and residential properties to the south and southwest, and by Interstate 470 to the north.

## EXISTING CONDITIONS

The project site is mostly undeveloped with the exception of some single family residential homes that are being removed. The project site is well covered with a low scrubby vegetation interspersed with dense stands of trees. See **APPENDIX A** for existing and proposed drainage area maps.

## FEMA FIRM

The site is currently located on FIRM Map Number 29095C0291F Panel 291 of 6480. The project site is located in Areas determined to be outside 500-year floodplain determined to be outside the 1% and 0.2% annual chance floodplains. See **APPENDIX B** for a FEMA Firmette encompassing the project site.

## Existing Watershed

The project site is located within Cedar Creek and Boggs Hollow Watersheds and discharges in several directions.

The southern subarea discharges to the roadside ditch along Lowenstein Drive and into the drainage way through the City Park. The western portion of the project drains to the west into a roadside ditch and concrete channel that proceeds along Lowenstein Drive and through open ditches to the west towards Clear Creek. Both of these systems are part of the Clear Creek watershed.

The eastern subarea ultimately discharges to crossroad culverts under I-470. A portion of the roadside flow on Pryor, up to the inlet capacities, is directed via storm sewers into the detention pond on the Summit Woods development, which then drains via pipe system under I-470. The remainder of the area, including all overflow beyond inlet capacities on Pryor, drains to the existing MoDOT ditch on I-470 until it reaches the box culvert crossing I-470 and ramps approximately 1,100 feet west of Pryor Road. These areas are tributary to the Boggs Hollow watersheds.

The total pre-project acreages tributary of each of these three primary sub-basins is as follows:

**Table 1: Pre-Project Tributary Areas**

	Subwatershed Area (acres)
<b>East (Boggs Hollow)</b>	23.0
<b>South (Clear Creek)</b>	24.0
<b>West (Clear Creek)</b>	24.9
<b>Total</b>	71.9



The difference between this total and the formal site size of 72.7 acres is attributable to excluding Lowenstein Road right-of-way from the drainage area and the addition of a sliver of the cell tower tract that drains into the west basin.

## Existing Soils

Soils data for the site was obtained from the NRCS soil survey. A summary of the site soils and their properties is shown on the chart below. According to the NRCS, the on-site soils are predominately Type D soils (17%), Type C soils (66%) or Type C/D (17%). The composite CN values used for rainfall mass calculations reflect a conservative estimate of the predominant Type D soils contained onsite.

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
10113	Oska silty clay loam, 5 to 9 percent slopes, eroded	D	5.6	8.2%
10117	Sampsel silty clay loam, 5 to 9 percent slopes	C/D	11.3	16.7%
10120	Sharpsburg silt loam, 2 to 5 percent slopes	C	27.3	40.2%
10128	Sharpsburg-Urban land complex, 2 to 5 percent slopes	D	5.2	7.6%
10141	Snead-Rock outcrop complex, 14 to 30 percent slopes	D	0.6	0.9%
10179	Udarents-Urban land-Oska complex, 5 to 9 percent slopes	C	0.4	0.5%
10181	Udarents-Urban land-Sampsel complex, 5 to 9 percent slopes	C	17.6	25.9%
<b>Totals for Area of Interest</b>			<b>67.9</b>	<b>100.0%</b>

## Existing Stormwater Appurtenances

There are three existing detention basins or ponds on the project that capture and detain an undetermined amount storm water. The existing watersheds discharging to the basins and their respective basin outlet structures have not been investigated as the basins will be removed and larger detention basins will be provided to accommodate the proposed development. There are miscellaneous culverts located on the project site allowing storm water to pass under residential driveways and through other existing features. No other storm water appurtenances are present on the project site.

## Offsite Drainage Areas

The project site sits at the upper portion of the Cedar Creek and Boggs Hollow Watersheds and therefore has minimal offsite drainage areas passing through the project site. The only offsite area is a sliver of land from the cell tower property which drains into the western basin, as shown on the Existing Drainage Area exhibit in **APPENDIX A**.

## **PRE- AND POST-DEVELOPMENT SITE CONDITIONS**

Due to space constraints on the eastern portion of the site, the project proposes to transfer a majority of the flows from the East and South watersheds via storm sewer into the West watershed, where it can be detained in a large regional detention area (the “West Basin”). The basin will capture 49.5 acres, an increase from the 24.9 acres that are tributary to west side now.

To transfer these area, two main trunk lines of storm sewer will pass under the ridge lines to discharge into the West basin. These trunk line and the inlets and lateral pipes leading to them are designed to capture up to the 100-year flow, so that they can be directed into the West basin.

A smaller area of the development located near the relocated intersection of Lowenstein Road and Pryor Avenue will be directed to a basin at the corner of Chipman Road and Pryor Ave (the “South Basin”). This basin captures 10.6 acres.

Cumulatively, the two detention basins capture 60.1 acres. The remaining 11.8 acres is primarily from the perimeter of the East, South and West basins, located along drives or sloped areas that could not be captured due to grading.

Per APWA 5600, pre- and post-development site flows will be analyzed for the 2-, 10-, and 100-year design storms.

### **Pre / Post Site Land use**

The pre-project CN is estimated for preliminary study purposes as 77. The post-project curve number is estimated as 94 for commercial areas, and 83 in the single-family residential portion of the west watershed. The composite CN for the areas to the West Basin was estimated at 91. The composite CN to the South Basin is estimated at 94.

### **Allowable Release Rates by Watershed**

The allowable release rates for three watersheds were calculated using the method outlined in APWA 5608.4. In light of the changes made to watershed boundaries, the allowable release rates were based on pre-project drainage areas to each outlet.

**Table 2: Allowable Release Rates**

Drainage Area	Area (Acres) (Pre-Project)	Design Storm	Allowable Release Rate (cfs/acre)	Total Allowable Release Rate (cfs) from Watershed
West Watershed	24.9	50% (2 yr)	0.5	12.5
		10% (10 yr)	2	49.8
		1% (100 yr)	3	74.7
South Watershed	24	50% (2 yr)	0.5	12
		10% (10 yr)	2	48
		1% (100 yr)	3	72
East Watershed	23	50% (2 yr)	0.5	11.5
		10% (10 yr)	2	46
		1% (100 yr)	3	69

**Actual Detention Pond Release Rates**

The calculation of the actual release rates from each watershed was based on the size of the adjusted watersheds and the proposed detention basins. Runoff from the undetained areas was added to the detention basin outflows to calculate an equivalent total watershed release rate. For the post-project area of the East basin, there is no detention structure, but the total contributory area is much less than before the project.

The detention areas were analyzed using Hydraflow Hydrographs. The detailed calculations are found in **APPENDIX D**. The SCS method was used to generate hydrographs, and then routed through standard methods in each pond. Composite orifice and weir structures were estimated to control the release rate. Storage volumes were approximated from the grading plan. Detailed refinements of each basin will be undertaken during final design. Each basin also contains a wet pond for water feature/amenity, as well as an excess volume above the permanent pool that can be used for the Water Quality Capture requirement (described later).

The West watershed contains a second upper pond that will act as an additional amenity and forebay. It is not intended to be a significant retention structure and will gather water from a smaller subarea. Any effect of the upper pond was neglected in these preliminary calculations.

As shown in the charts below, the proposed extended wet detention basins more than adequately accommodate and reduce post-development storm water flows to APWA required levels. The only exception is in the net release rate from the 2-year storm, which is exceeded slightly. This is unavoidable due to impact from the undetained residual areas. However, in all cases, the net release rate is less than the pre-development flows from the original drainage areas, as can be seen in the data in **APPENDIX D**.

**Table 3: Summary of Discharge Rates**

Watershed	Post-Project Area to Detention (acres)	Post-Project Area Undetained (acres)	Design Storm	Actual Release Rate from Detention Area (cfs)	Total Net Release Rate from Watershed (including undetained area) (cfs)	Allowable Release Rate from Watershed (cfs)
West Watershed	49.5	2.7	50% (2 yr)	7.4	15.5 *	12.5
			10% (10 yr)	9.7	25.6	49.8
			1% (100 yr)	24.8	41.0	74.7
South Watershed	10.6	3.5	50% (2 yr)	3.7	17.4 *	12
			10% (10 yr)	10.1	30.7	48
			1% (100 yr)	28.4	60	72
East Watershed	0	5.6	50% (2 yr)	n/a	23.6 *	11.5
			10% (10 yr)	n/a	38.7	46
			1% (100 yr)	n/a	65.5	69

## PROPOSED STORM SEWER SYSTEM

The proposed storm sewer system is comprised of several general systems that direct site storm sewer flows to the proposed extended wet detention basins located in the west and south watersheds. See **APPENDIX C** for a preliminary layout of the storm sewer system. The proposed storm sewer layout is schematic in nature and inlet size and placement are estimated to accommodate storm sewer flows based on the preliminary grading. The storm sewer arrangement is subject to change and will be adjusted as needed when the final site plan layout is prepared.

A particular feature of the storm sewer system are the two trunk lines needed to carry flows from the East and South watersheds to the West basin for detention. These pipes are sized to carry up to the 100-year flow. Due to the crossing of the ridge line, they become deep in places, with corresponding deep junction structures. See **APPENDIX E** for preliminary sizing and layout of the primary trunk line for this system.

The remaining storm sewers on the west side of the new site ridge line will drain independently in shallower systems. These pipes will only need to be sized for the 10-year storm (per APWA), since overland swale flow can direct the 100-year overflow to each basin.

The pipe system feeding the South basin from north of Lowenstein will also be sized for the 100-year flow, since otherwise any overland swale flow would be intercepted at Lowenstein and bypass the detention area.

## **PROPOSED EXTENDED WET DETENTION**

Wet detention ponds are proposed for the West and South watersheds to reduce the increase in post-development storm water flows and to provide aesthetic water features for the proposed development. The proposed wet detention basin sizes are preliminary in nature and are both currently sized to show that adequate detention is available. The proposed wet detention pond sizes will be adjusted as needed when the final site plan layout is prepared. See **APPENDIX D** for wet detention pond routing. See the information below for preliminary design information. It is assumed that the wet detention ponds will hold water at their design wet pond elevation and storm water detention and water quality treatment will occur above this elevation.

### **West Wet Detention Pond**

Top Elevation = 955.0  
Bottom elevation = 932.0  
Wet Pond Elevation = 942.0  
Storage Volume at Wet Pond Elevation = 591,863 Cubic Feet  
Overflow Structure Elevation = 952.00  
Max 100 yr WSE = 949.1  
Max 100 yr Storage Volume = 1,146,896 Cubic Feet

### **South Wet Detention Pond**

Top Elevation = 980.0  
Bottom elevation = 960.0  
Wet Pond Elevation = 972.0  
Storage Volume at Wet Pond Elevation = 250,487 Cubic Feet  
Overflow Structure Elevation = 977.0  
Max 100 yr WSE = 975.2  
Max 100 yr Storage Volume = 361,151 Cubic Feet



## **MARC/APWA BMP CALCULATIONS**

Per APWA 5608.4, the project site is required to provide 40-hour extended detention of runoff from the local 90% mean annual event (1.37"/24-hour rainfall). As mentioned above, both of the detention basins will be designed as extended wet detention basins (EWDBs) that will be maintained to have a permanent pool elevation. The EWDB's final design will be prepared per the MARC Manual section 8.8.

## **DOWNSTREAM CONDITIONS**

The proposed development will mitigate for changes to the watershed by providing significant detention and addressing the water quality storm. Release rates from detention areas are in line with City standards, except for minor deviation as reported for the 2-year storms. All release rates are significantly below pre-project condition estimates.

## **CONCLUSION**

The proposed development will effectively capture, detain and treat stormwater from the proposed development in accordance with the requirements set forth by the City of Lee's Summit..

## APPENDIX A – EXISTING AND PROPOSED DRAINAGE AREA MAPS

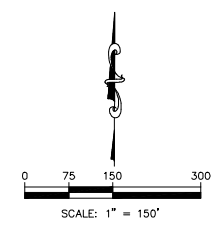
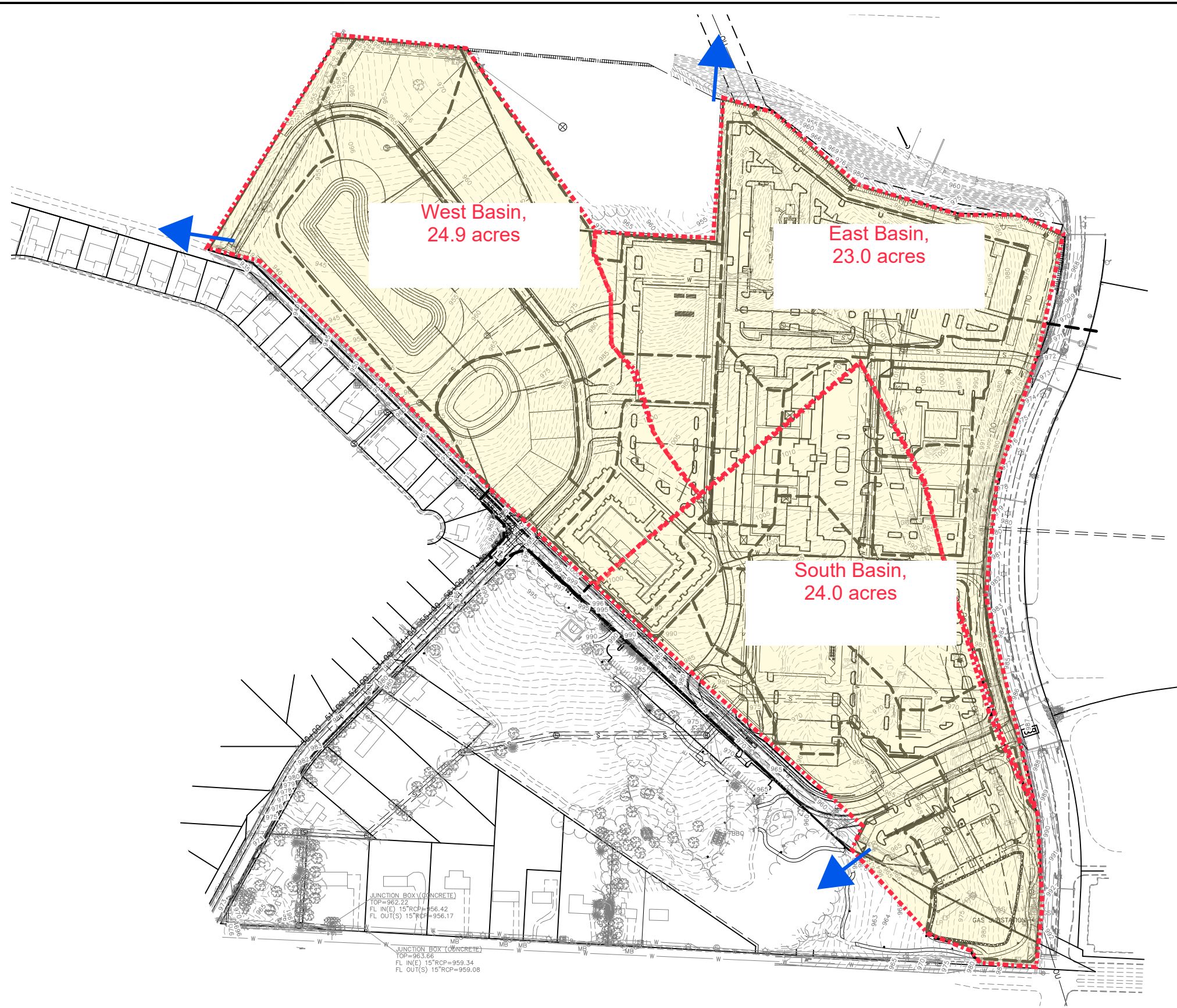


Exhibit: Existing Drainage Areas,  
Streets of West Pryor Site

**DATUM BENCHMARK:**  
VERTICAL DATUM IS NAVD 88 ESTABLISHED USING OPUS PROJECTS ON PROJECT CONTROL.

**BENCHMARKS:**  
BM #1: CHISELED "SQUARE" ON TOP OF CURB POINT OF INTERSECTION OF WEST PARK PARKING LOT AT EAST DRIVE ENTRANCE. ELEV=985.05  
BM #2: CHISELED "SQUARE" ON NORTHWEST CORNER AREA INLET, 25'± EAST OF CURB LINE AND ON-LINE WITH SOUTH CURB OF LOWENSTEIN DRIVE AT 90° BEND IN ROAD. ELEV=971.06

STREETS OF WEST PRYOR NWQ PRYOR ROAD & LOWENSTEIN DRIVE LEE'S SUMMIT, MISSOURI		PROJ. NO. <b>A14-7067</b>	DESIGNER <b>LDO</b>	DRAWN BY <b>JT</b>	CFN <b>7067-IPSDP_DAM</b>	SHEET <b>C-16</b>	REV
PRELIMINARY DEVELOPMENT PLAN DRAINAGE AREA MAP		LEON D. OSBOURN ENGINEER MO # 021726					
2319 N. JACKSON   P.O. BOX 1304 LEE'S SUMMIT, MISSOURI 64086 PH. (785) 782-5040   FAX (785) 762-7744 K@kveeng.com   www.kveeng.com		KAW VALLEY ENGINEERING KAW VALLEY ENGINEERING, INC. IS AUTHORIZED TO OFFER ENGINEERING SERVICES BY MISSOURI STATE CERTIFICATE OF AUTHORITY # 000842. EXPIRES 12/31/18					
		REV	DATE	DESCRIPTION	DSN	DWN	CHK



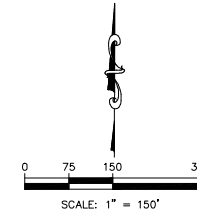


Exhibit: Proposed Drainage Areas,  
Streets of West Pryor Site

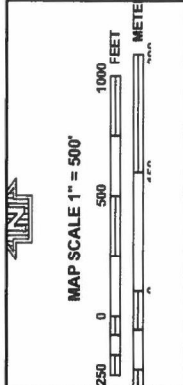
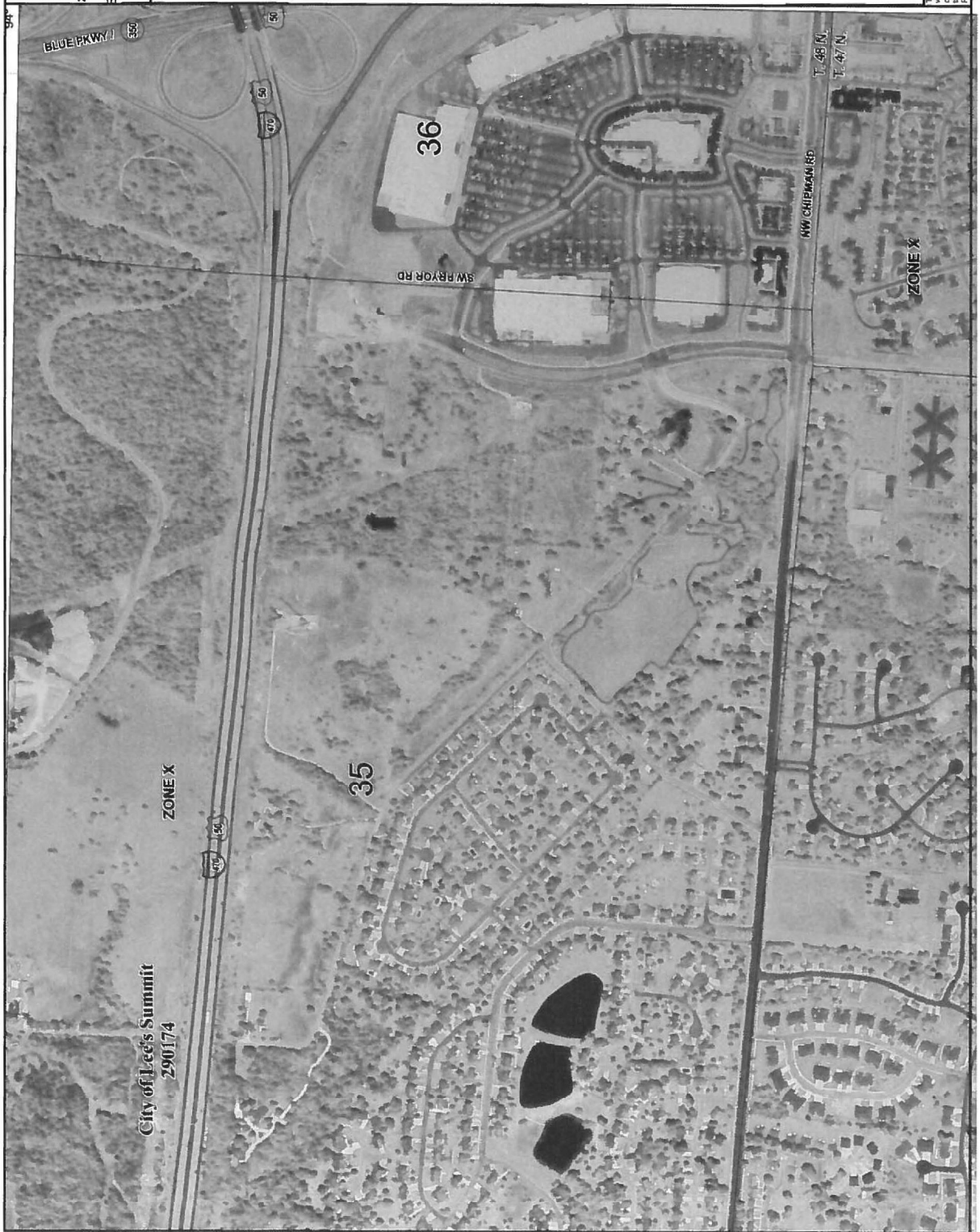
**DATUM BENCHMARK:**  
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BM #2: CHISELED "SQUARE" ON NORTHWEST CORNER AREA INLET, 25'± EAST OF CURB LINE AND ON-LINE WITH SOUTH CURB OF LOWENSTEIN DRIVE AT 90° BEND IN ROAD. ELEV=971.06

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STREETS OF WEST PRYOR NWQ PRYOR ROAD & LOWENSTEIN DRIVE LEE'S SUMMIT, MISSOURI		PRELIMINARY DEVELOPMENT PLAN DRAINAGE AREA MAP		PROJ. NO. <b>A14-7067</b> DESIGNER <b>LDO</b> DRAWN BY <b>JT</b> CFN <b>7067-IPSDP_DAM</b> SHEET <b>C-16</b>	
				REV	CHK
				DATE	DSN
				DESCRIPTION	DWN
					CHK

## APPENDIX B – FEMA FIRMETTE MAP





**NATIONAL FLOOD INSURANCE PROGRAM**

PANEL 0291F

**FIRM**  
FLOOD INSURANCE RATE MAP  
JACKSON COUNTY,  
MISSOURI  
AND INCORPORATED AREAS

PANEL 291 OF 480

(SEE MAP INDEX FOR FROM PANEL LAY OUT)

COMMUNITY  
NAME  
LEE'S SUMMIT,  
CITY OF

MAP NUMBER  
290174

PANEL  
291

SHEET  
F

Indicate User: The Map Number shown below  
should be used in all correspondence with the  
Community Number shown above should be  
used on insurance applications for the subject  
community

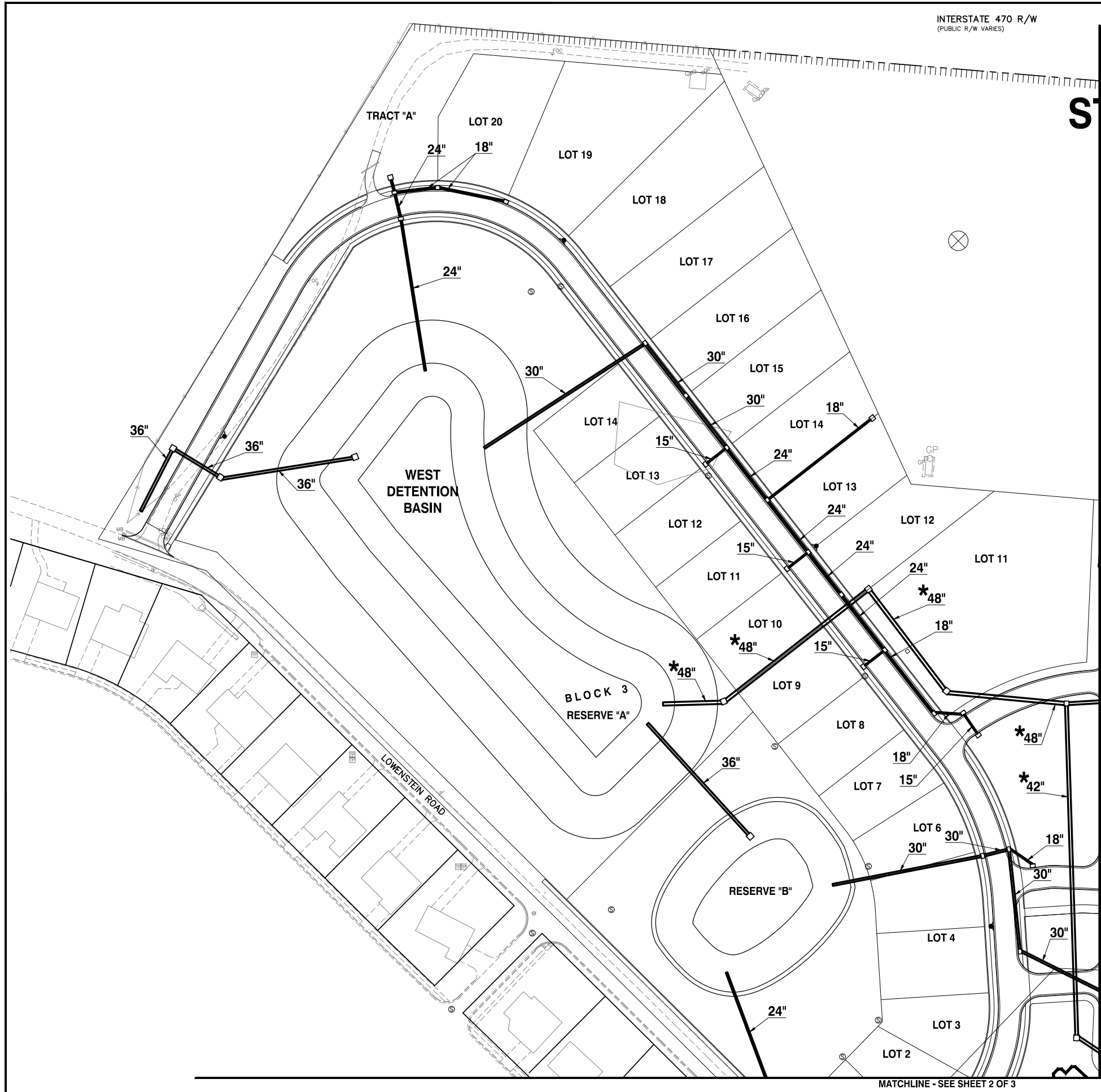


MAP NUMBER  
290174  
EFFECTIVE DATE  
SEPTEMBER 29, 2006

Federal Emergency Management Agency

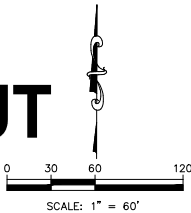
This is an official copy of a portion of the above referenced flood map. It  
is not to be used for any purpose other than the one for which it was  
prepared. Any use of this map for any other purpose without the  
written consent of the Federal Emergency Management Agency is  
prohibited. For the latest product information about National Flood Insurance  
Program flood maps, visit the FEMA Flood Map Store at [www.fema.gov](http://www.fema.gov)

## APPENDIX C – PRELIMINARY STORM SEWER LAYOUT



INTERSTATE 470 R/W  
(PUBLIC R/W VARIES)

# EXHIBIT STORM SEWER LAYOUT



KAW VALLEY ENGINEERING		DSN	DWN	CHK
KAW VALLEY ENGINEERING, INC. IS AUTHORIZED TO OFFER ENGINEERING SERVICES UNDER MISSOURI STATE CERTIFICATE OF AUTHORITY # 000842. EXPIRES 12/31/18		REV	DATE	DESCRIPTION
STREETS OF WEST PRYOR NWQ PRYOR ROAD & LOWENSTEIN DRIVE LEE'S SUMMIT, MISSOURI				
PRELIMINARY DEVELOPMENT PLAN STORM SEWER LAYOUT				
PROJ. NO. A14-7067-1		1 OF 3		
DESIGNER LDO		DRAWN BY JT		
CFN 7067-1EXBM_UP		SHEET REV		

\* DEEP SYSTEM INSTALLED TO CARRY  
FLOWS FROM EAST SUBBASINS TO  
WEST DETENTION BASIN

CONC. EAST BOUND RAMP




SERVICES BY MISSOURI STATE CERTIFICATE OF AUTHORITY # 000842.  
EXPIRES 12/31/18

# PRELIMINARY DEVELOPMENT PLAN STORM SEWER LAYOUT

PROJ. NO.		A14_7067-1	
DESIGNER		DRAWN BY	
LDO		JT	
CFN			
067-1EXBM_UP			
SHEET			REV
2 OF 3			





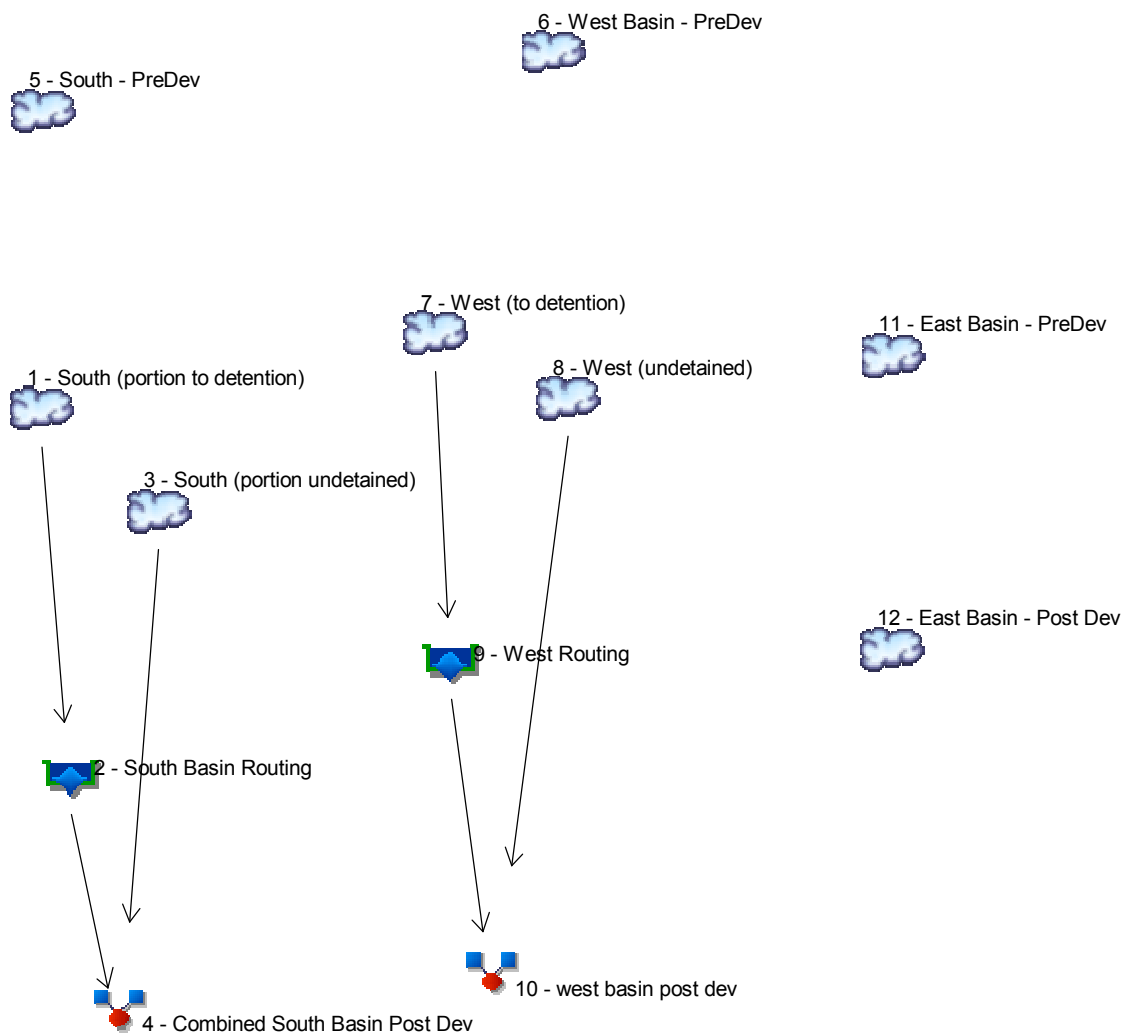
<b>STREETS OF WEST PRYOR</b> NWQ PRYOR ROAD & LOWENSTEIN DRIVE LEE'S SUMMIT, MISSOURI		 <p>2319 N. JOHNSON   P.O. BOX 1304          JOHNSON, MISSOURI 64401          PH. (785) 762-5040   FAX. (785) 762-7744          jck@kvang.com   www.kvang.com</p> <p><b>KAW VALLEY ENGINEERING</b></p> <p>KAW VALLEY ENGINEERING, INC. IS AUTHORIZED TO OFFER ENGINEERING          SERVICES BY MISSOURI STATE CERTIFICATE OF AUTHORITY # 000842.          EXPIRES 12/31/18</p>											
<b>PRELIMINARY DEVELOPMENT PLAN</b> <b>STORM SEWER LAYOUT</b>													
PROJ. NO. <b>A14-7067-1</b>				DESIGNER <b>LDO</b>		DRAWN BY <b>JT</b>							
CFN <b>7067-1EXBM_UP</b>				SHEET <b>3 OF 3</b>		REV		DATE		DESCRIPTION		DSN	
												CHK	



## APPENDIX D –HYDRAFLOW HYDROGRAPH DETENTION CALCULATIONS

# Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3



## Legend

Hyd.	Origin	Description
1	SCS Runoff	South (portion to detention)
2	Reservoir	South Basin Routing
3	SCS Runoff	South (portion undetained)
4	Combine	Combined South Basin Post Dev
5	SCS Runoff	South - PreDev
6	SCS Runoff	West Basin - PreDev
7	SCS Runoff	West (to detention)
8	SCS Runoff	West (undetained)
9	Reservoir	West Routing
10	Combine	west basin post dev
11	SCS Runoff	East Basin - PreDev
12	SCS Runoff	East Basin - Post Dev

# Hydrograph Return Period Recap

Hydrow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

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	-----	13.83	47.90	-----	-----	76.05	-----	-----	126.10	South (portion to detention)
2	Reservoir	1	0.237	3.695	-----	-----	10.14	-----	-----	28.42	South Basin Routing
3	SCS Runoff	-----	4.567	15.82	-----	-----	25.11	-----	-----	41.64	South (portion undetained)
4	Combine	2, 3	4.607	17.40	-----	-----	30.70	-----	-----	59.99	Combined South Basin Post Dev
5	SCS Runoff	-----	4.002	61.16	-----	-----	122.74	-----	-----	239.71	South - PreDev
6	SCS Runoff	-----	3.091	51.11	-----	-----	103.62	-----	-----	203.56	West Basin - PreDev
7	SCS Runoff	-----	42.39	177.29	-----	-----	291.77	-----	-----	494.82	West (to detention)
8	SCS Runoff	-----	2.754	11.37	-----	-----	18.65	-----	-----	31.57	West (undetained)
9	Reservoir	7	1.824	7.461	-----	-----	9.708	-----	-----	24.77	West Routing
10	Combine	8, 9	3.136	15.52	-----	-----	25.56	-----	-----	41.06	west basin post dev
11	SCS Runoff	-----	2.962	48.98	-----	-----	99.30	-----	-----	195.08	East Basin - PreDev
12	SCS Runoff	-----	5.712	23.58	-----	-----	38.69	-----	-----	65.47	East Basin - Post Dev
Proj. file: Streets of West Pryor Detention June 18 Model M.gpw										Monday, 06 / 18 / 2018	

# Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

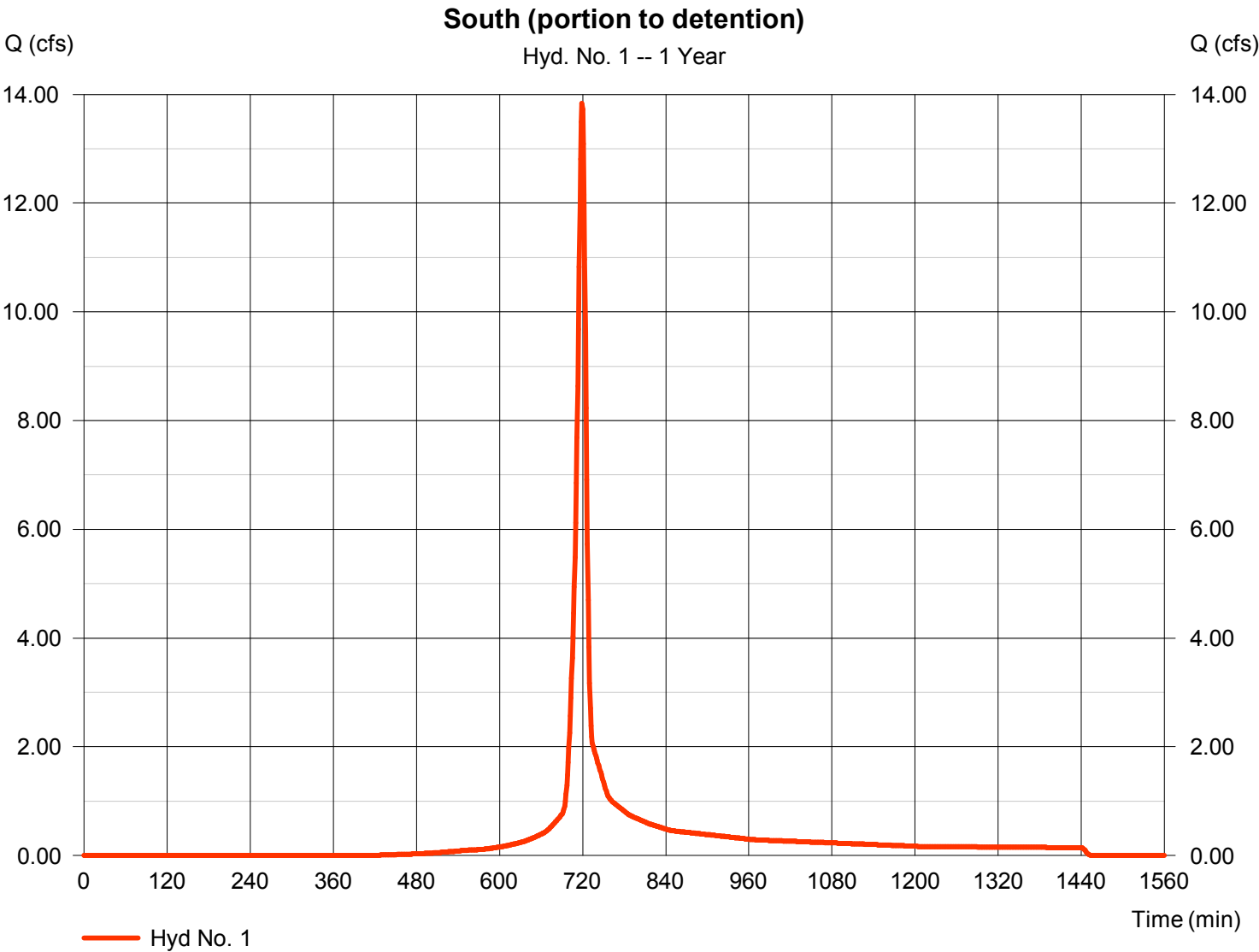
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	13.83	1	719	31,578	-----	-----	-----	South (portion to detention)
2	Reservoir	0.237	1	1072	18,530	1	972.70	273,866	South Basin Routing
3	SCS Runoff	4.567	1	719	10,427	-----	-----	-----	South (portion undetained)
4	Combine	4.607	1	719	28,957	2, 3	-----	-----	Combined South Basin Post Dev
5	SCS Runoff	4.002	1	722	13,830	-----	-----	-----	South - PreDev
6	SCS Runoff	3.091	1	725	13,830	-----	-----	-----	West Basin - PreDev
7	SCS Runoff	42.39	1	722	114,240	-----	-----	-----	West (to detention)
8	SCS Runoff	2.754	1	719	6,231	-----	-----	-----	West (undetained)
9	Reservoir	1.824	1	857	99,337	7	942.74	659,501	West Routing
10	Combine	3.136	1	720	105,568	8, 9	-----	-----	west basin post dev
11	SCS Runoff	2.962	1	725	13,254	-----	-----	-----	East Basin - PreDev
12	SCS Runoff	5.712	1	719	12,924	-----	-----	-----	East Basin - Post Dev
Streets of West Pryor Detention June 18 Model					Runoff Period: 1 Year			Monday, 06 / 18 / 2018	

# Hydrograph Report

## Hyd. No. 1

South (portion to detention)

Hydrograph type	=	SCS Runoff	Peak discharge	=	13.83 cfs
Storm frequency	=	1 yrs	Time to peak	=	719 min
Time interval	=	1 min	Hyd. volume	=	31,578 cuft
Drainage area	=	10.600 ac	Curve number	=	94
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	1.37 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484





# Hydrograph Report

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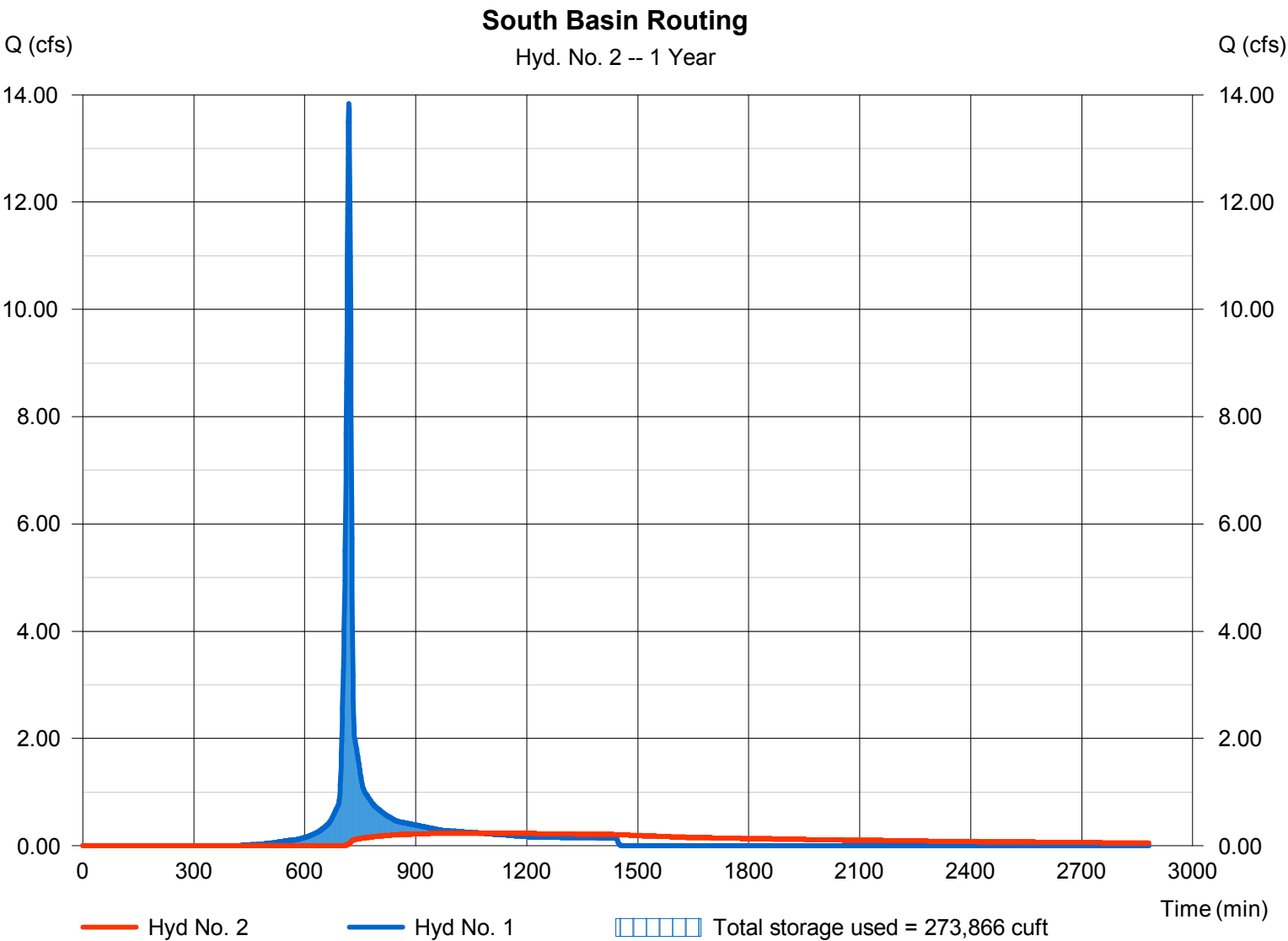
Monday, 06 / 18 / 2018

## Hyd. No. 2

### South Basin Routing

Hydrograph type	= Reservoir	Peak discharge	= 0.237 cfs
Storm frequency	= 1 yrs	Time to peak	= 1072 min
Time interval	= 1 min	Hyd. volume	= 18,530 cuft
Inflow hyd. No.	= 1 - South (portion to detention)	Max. Elevation	= 972.70 ft
Reservoir name	= SouthEast	Max. Storage	= 273,866 cuft

Storage Indication method used. Wet pond routing start elevation = 972.00 ft.



# Pond Report

6

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

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## Pond No. 2 - SouthEast

### Pond Data

**Contours** -User-defined contour areas. Conic method used for volume calculation. Beginning Elevation = 960.00 ft

### Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	960.00	10,984	0	0
2.00	962.00	13,783	24,712	24,712
4.00	964.00	16,924	30,650	55,362
6.00	966.00	20,407	37,273	92,635
8.00	968.00	24,234	44,582	137,217
10.00	970.00	28,632	52,800	190,016
12.00	972.00	31,874	60,471	250,487
14.00	974.00	35,258	67,097	317,584
16.00	976.00	38,788	74,011	391,595
18.00	978.00	42,463	81,215	472,810
20.00	980.00	46,796	89,215	562,025

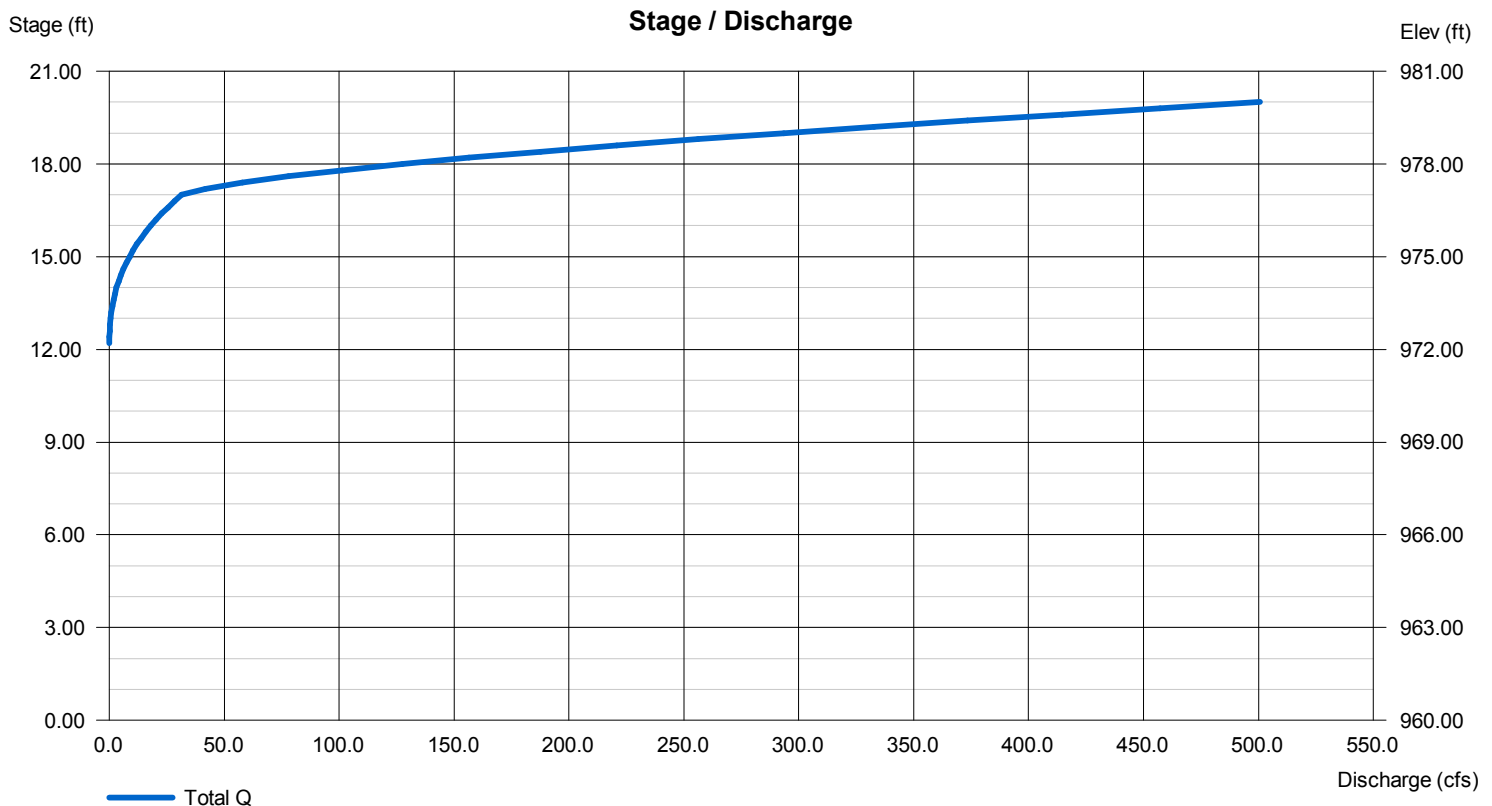
### Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 36.00	0.00	0.00	0.00
Span (in)	= 36.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 965.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

### Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	30.00	0.00	0.00
Crest El. (ft)	= 972.00	977.00	0.00	0.00
Weir Coeff.	= 0.56	2.60	3.33	3.33
Weir Type	= 25 degV	Broad	---	---
Multi-Stage	= Yes	No	No	No
Exfil.(in/hr)	= 0.000 (by Contour)			
TW Elev. (ft)	= 0.00			

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



# Hydrograph Report

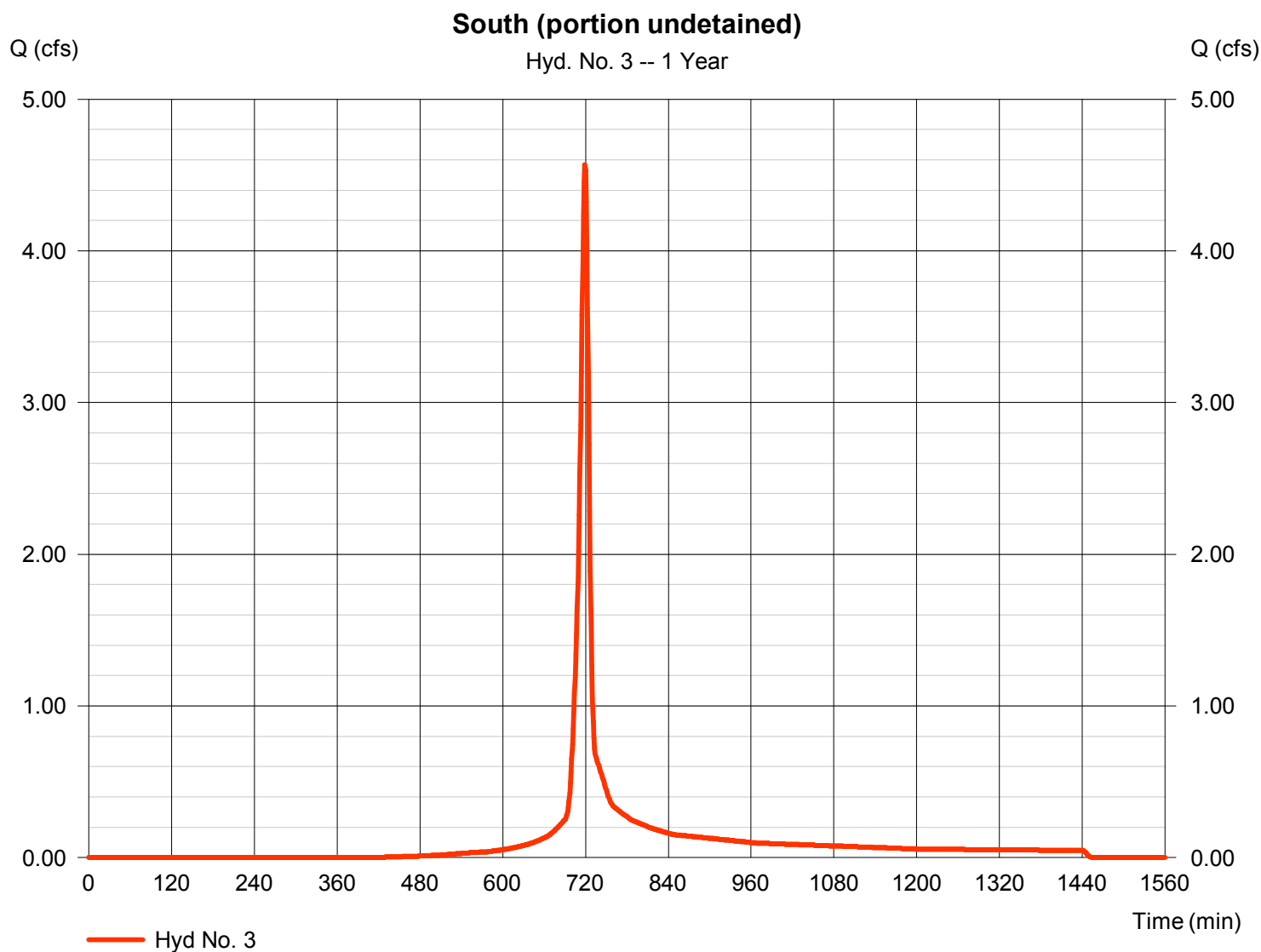
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

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## Hyd. No. 3

South (portion undetained)

Hydrograph type	= SCS Runoff	Peak discharge	= 4.567 cfs
Storm frequency	= 1 yrs	Time to peak	= 719 min
Time interval	= 1 min	Hyd. volume	= 10,427 cuft
Drainage area	= 3.500 ac	Curve number	= 94
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 1.37 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

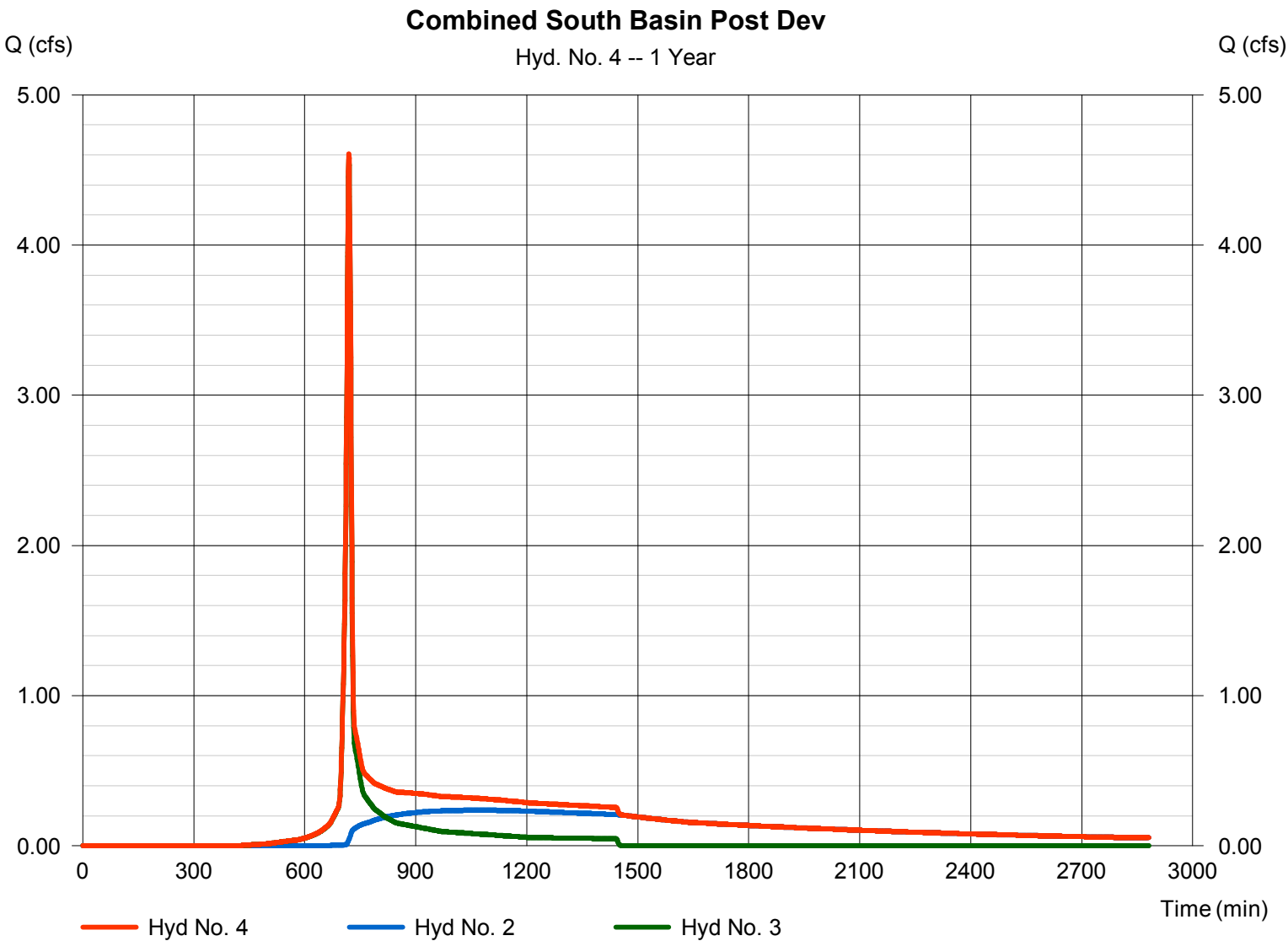


# Hydrograph Report

## Hyd. No. 4

Combined South Basin Post Dev

Hydrograph type	= Combine	Peak discharge	= 4.607 cfs
Storm frequency	= 1 yrs	Time to peak	= 719 min
Time interval	= 1 min	Hyd. volume	= 28,957 cuft
Inflow hyds.	= 2, 3	Contrib. drain. area	= 3.500 ac



# Hydrograph Report

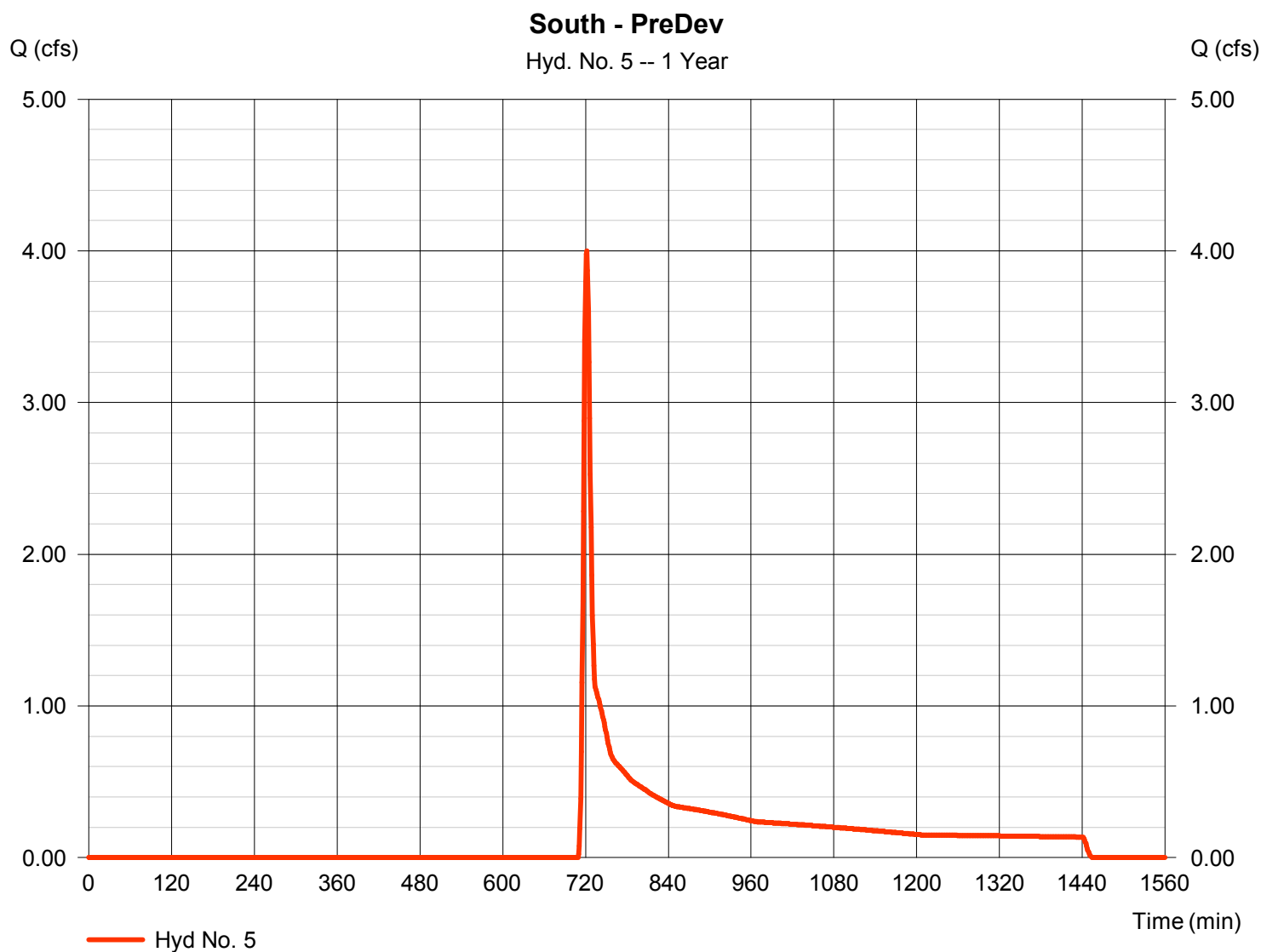
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

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## Hyd. No. 5

South - PreDev

Hydrograph type	= SCS Runoff	Peak discharge	= 4.002 cfs
Storm frequency	= 1 yrs	Time to peak	= 722 min
Time interval	= 1 min	Hyd. volume	= 13,830 cuft
Drainage area	= 24.000 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 1.37 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

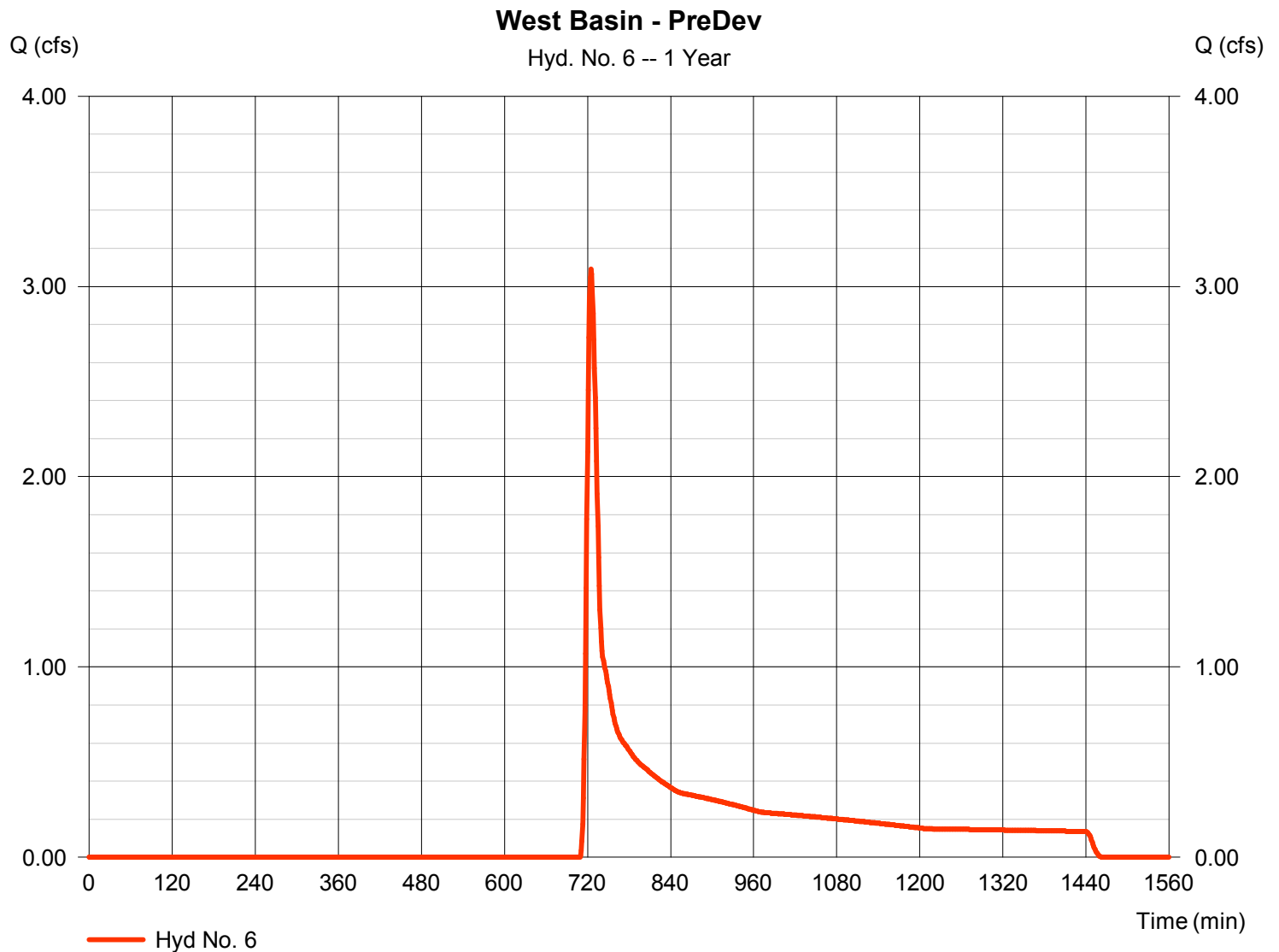
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## Hyd. No. 6

West Basin - PreDev

Hydrograph type	= SCS Runoff	Peak discharge	= 3.091 cfs
Storm frequency	= 1 yrs	Time to peak	= 725 min
Time interval	= 1 min	Hyd. volume	= 13,830 cuft
Drainage area	= 24.000 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 1.37 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

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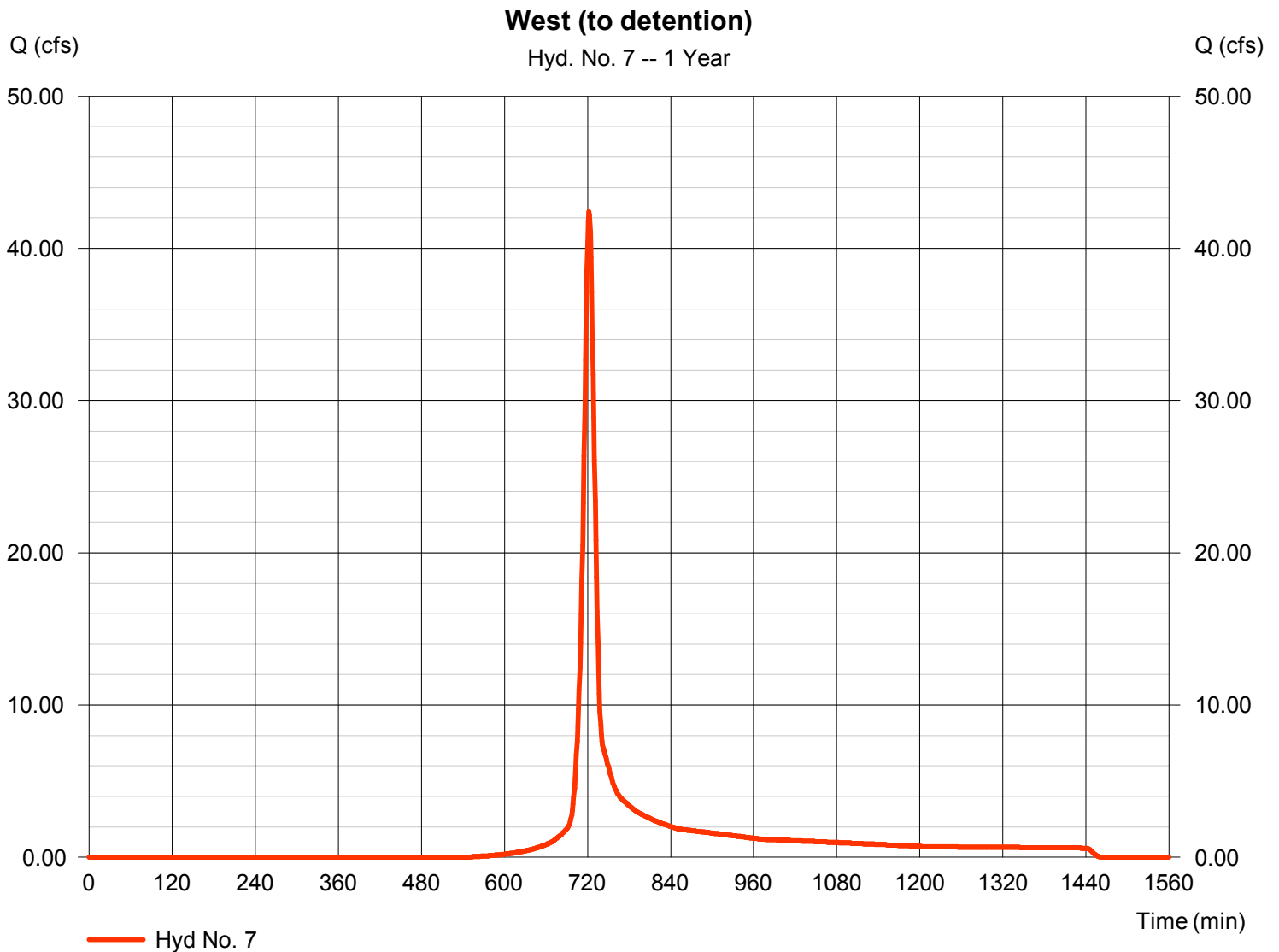
Monday, 06 / 18 / 2018

## Hyd. No. 7

West (to detention)

Hydrograph type = SCS Runoff  
 Storm frequency = 1 yrs  
 Time interval = 1 min  
 Drainage area = 49.500 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 1.37 in  
 Storm duration = 24 hrs

Peak discharge = 42.39 cfs  
 Time to peak = 722 min  
 Hyd. volume = 114,240 cuft  
 Curve number = 91  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 15.00 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

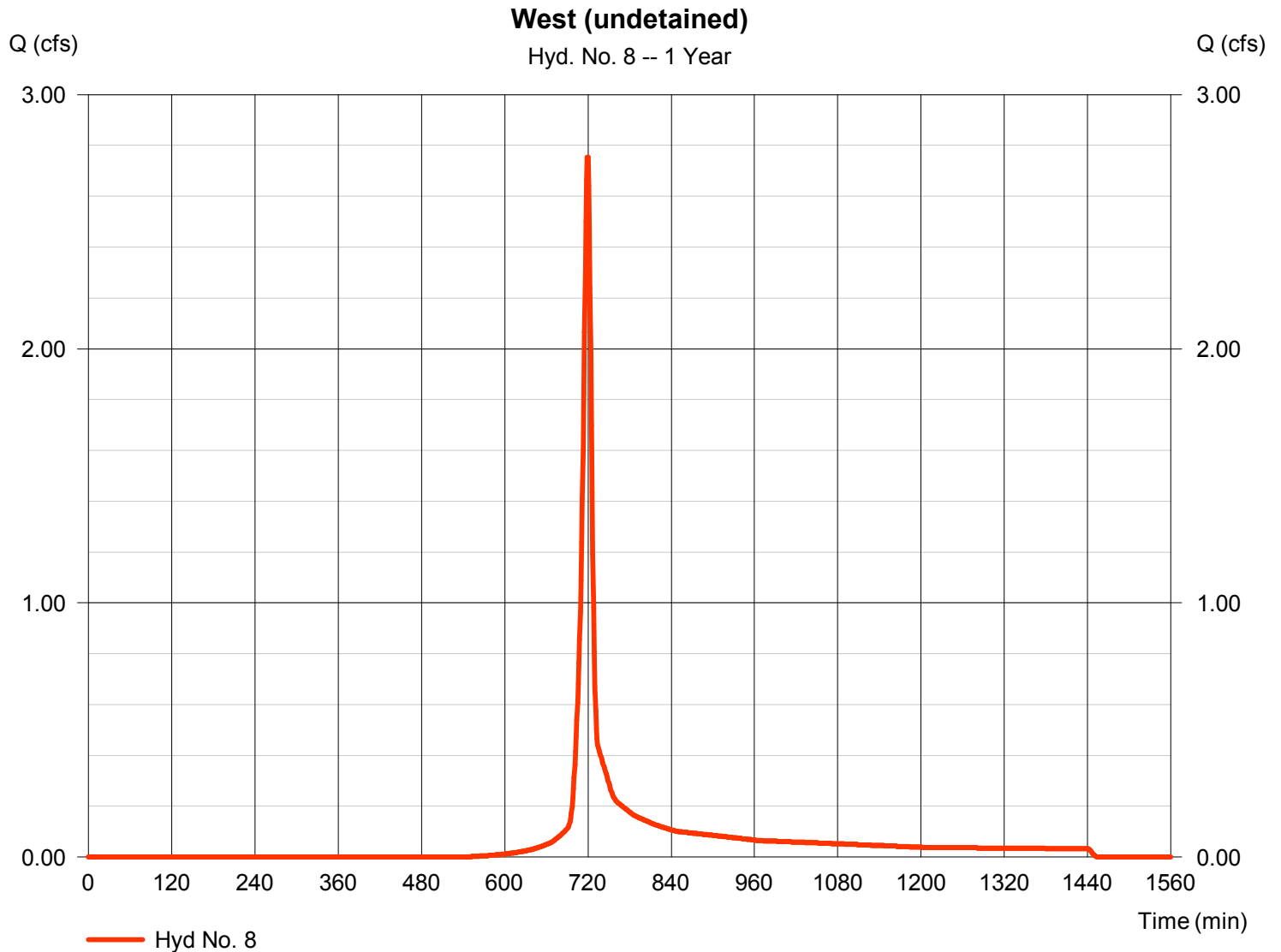
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## Hyd. No. 8

West (undetained)

Hydrograph type	= SCS Runoff	Peak discharge	= 2.754 cfs
Storm frequency	= 1 yrs	Time to peak	= 719 min
Time interval	= 1 min	Hyd. volume	= 6,231 cuft
Drainage area	= 2.700 ac	Curve number	= 91
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 1.37 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484





# Hydrograph Report

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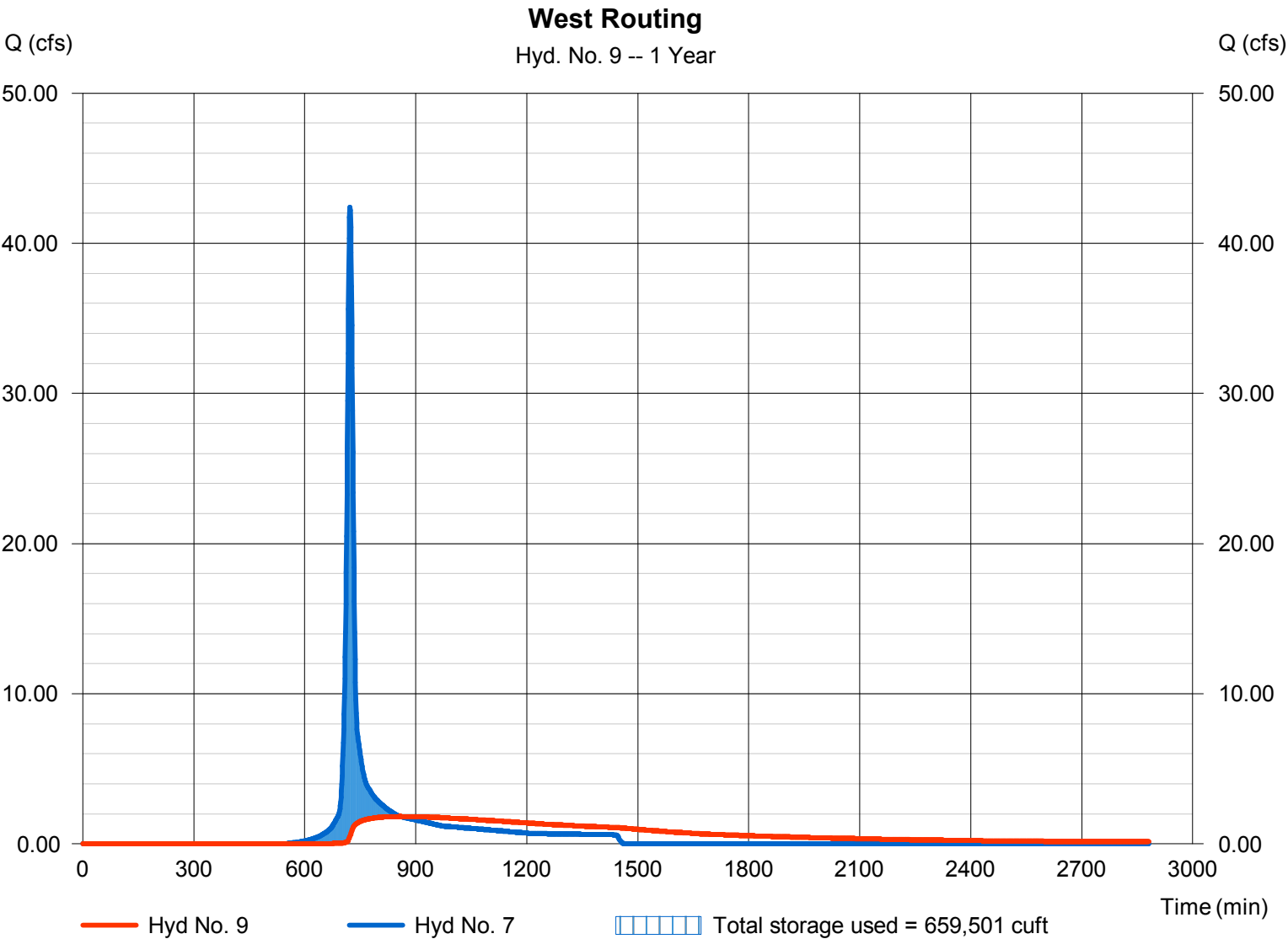
Monday, 06 / 18 / 2018

## Hyd. No. 9

### West Routing

Hydrograph type	= Reservoir	Peak discharge	= 1.824 cfs
Storm frequency	= 1 yrs	Time to peak	= 857 min
Time interval	= 1 min	Hyd. volume	= 99,337 cuft
Inflow hyd. No.	= 7 - West (to detention)	Max. Elevation	= 942.74 ft
Reservoir name	= West Basin	Max. Storage	= 659,501 cuft

Storage Indication method used. Wet pond routing start elevation = 942.00 ft.



## Pond No. 1 - West Basin

### Pond Data

**Contours** -User-defined contour areas. Conic method used for volume calculation. Beginning Elevation = 932.00 ft

### Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	932.00	34,477	0	0
2.00	934.00	43,877	78,158	78,158
4.00	936.00	53,707	97,409	175,566
6.00	938.00	63,964	117,510	293,076
8.00	940.00	74,651	138,464	431,540
10.00	942.00	85,818	160,323	591,863
12.00	944.00	97,317	182,996	774,860
14.00	946.00	19,217	106,509	881,368
16.00	948.00	121,519	126,028	1,007,396
18.00	950.00	134,221	255,609	1,263,005
20.00	952.00	147,325	281,416	1,544,421
22.00	954.00	160,830	308,026	1,852,447
23.00	955.00	167,733	164,253	2,016,700

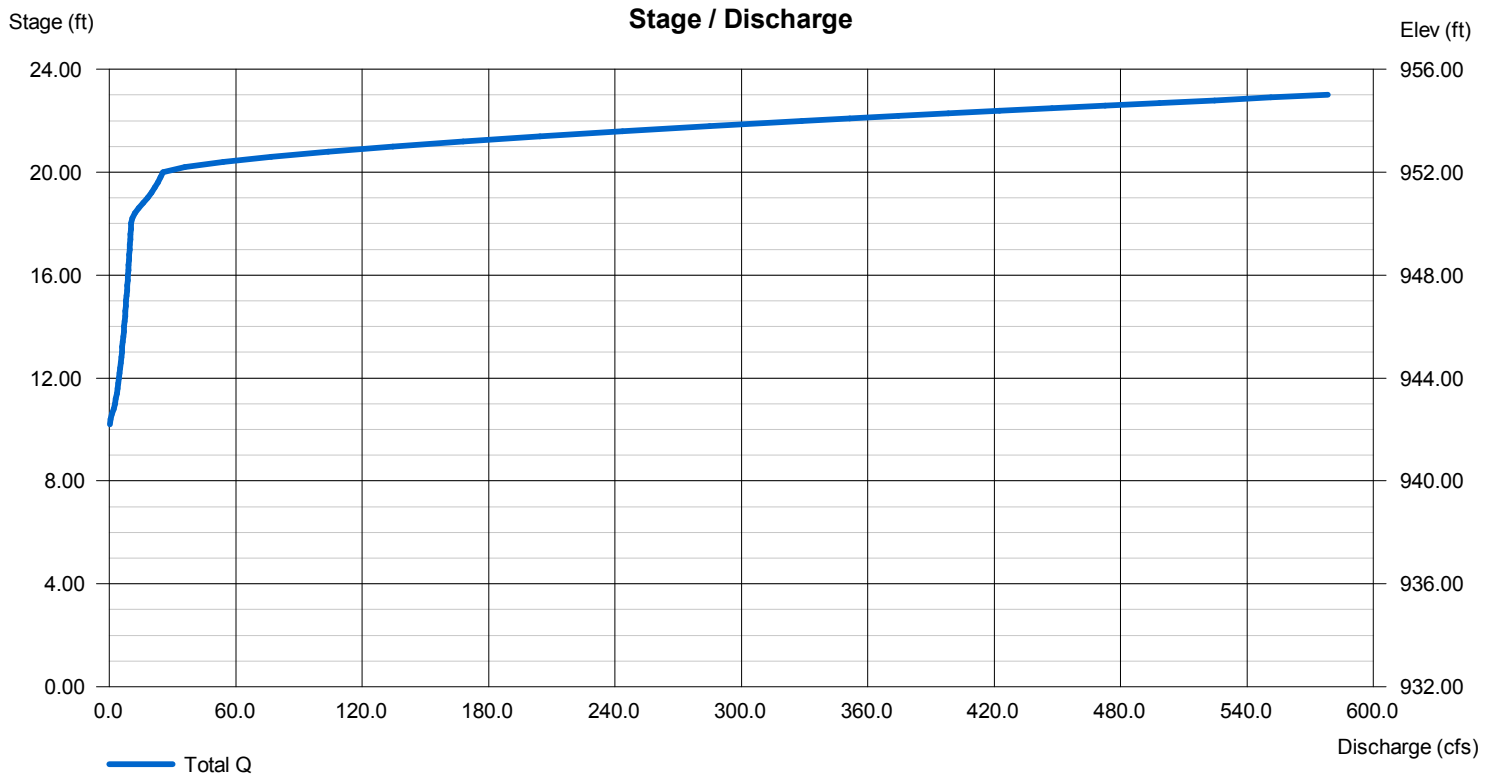
### Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 36.00	12.00	15.00	0.00
Span (in)	= 36.00	12.00	15.00	0.00
No. Barrels	= 2	1	2	0
Invert El. (ft)	= 939.00	942.00	950.00	0.00
Length (ft)	= 100.00	0.00	0.00	0.00
Slope (%)	= 1.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	Yes	No

### Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	Inactive	40.00	0.00	0.00
Crest El. (ft)	= 942.00	952.00	0.00	0.00
Weir Coeff.	= 0.11	2.60	3.33	3.33
Weir Type	= 5 degV	Broad	---	---
Multi-Stage	= Yes	No	No	No
Exfil.(in/hr)	= 0.000 (by Contour)			
TW Elev. (ft)	= 0.00			

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



# Hydrograph Report

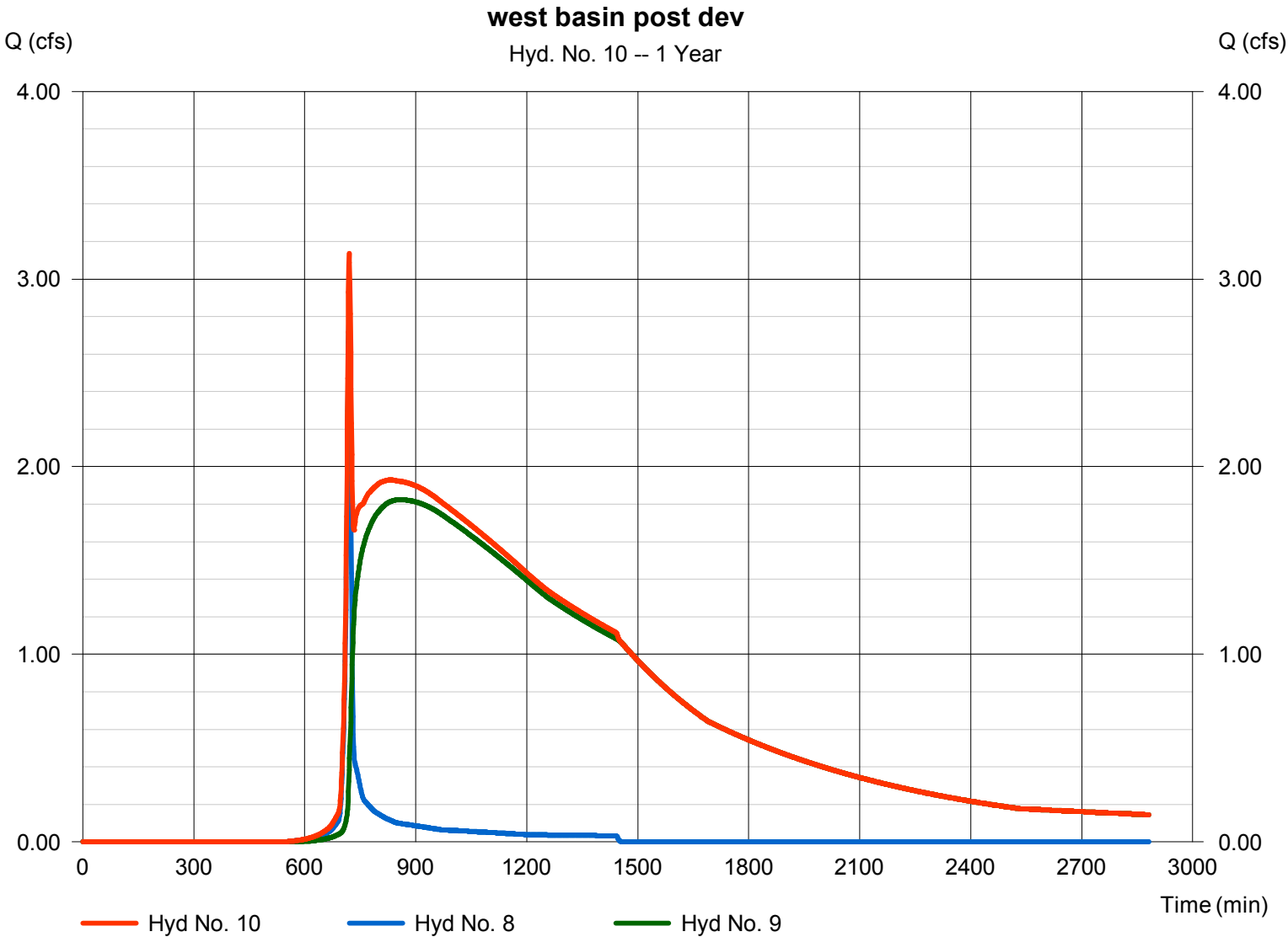
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

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## Hyd. No. 10

west basin post dev

Hydrograph type	= Combine	Peak discharge	= 3.136 cfs
Storm frequency	= 1 yrs	Time to peak	= 720 min
Time interval	= 1 min	Hyd. volume	= 105,568 cuft
Inflow hyds.	= 8, 9	Contrib. drain. area	= 2.700 ac



# Hydrograph Report

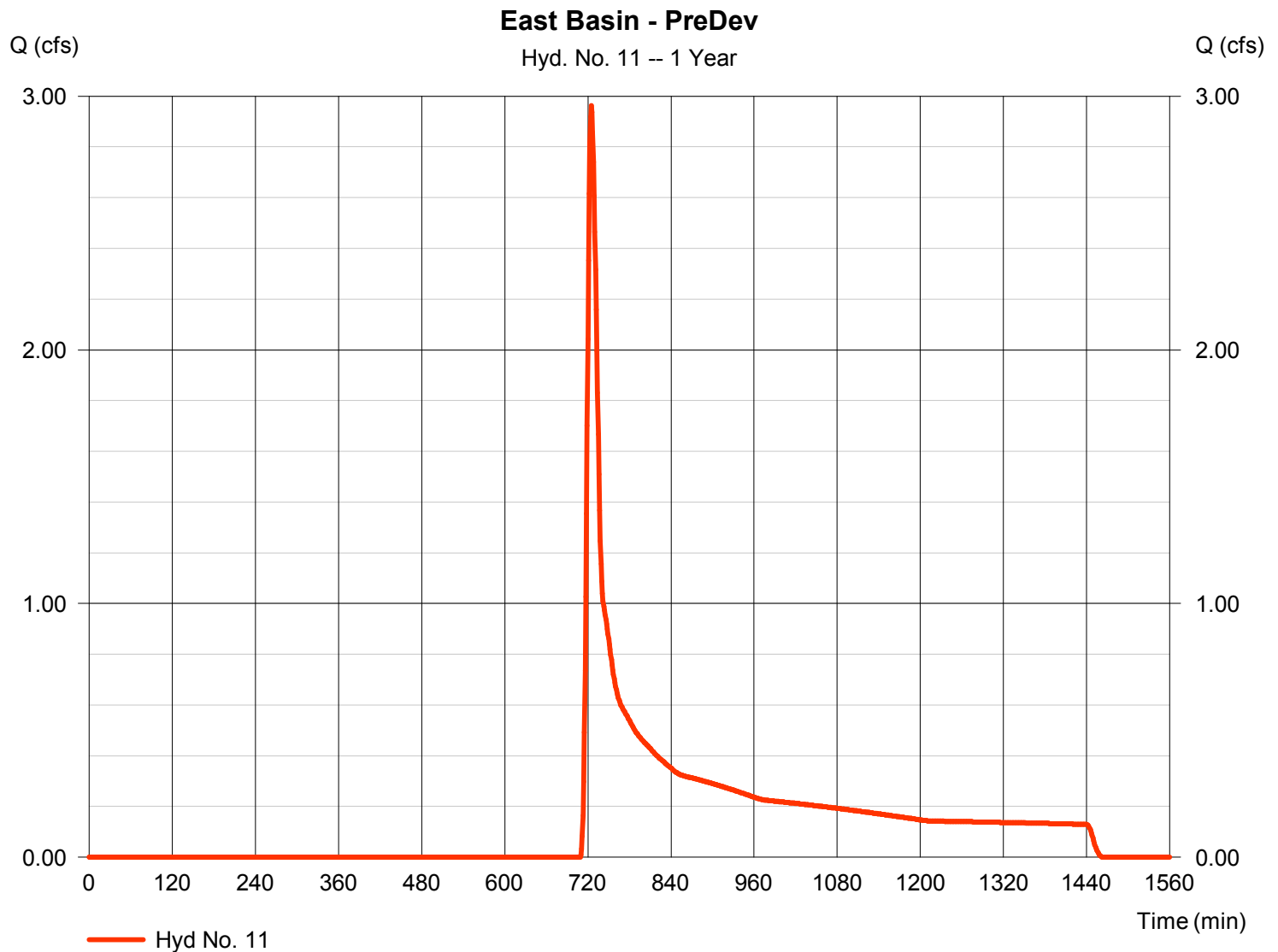
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## Hyd. No. 11

East Basin - PreDev

Hydrograph type	= SCS Runoff	Peak discharge	= 2.962 cfs
Storm frequency	= 1 yrs	Time to peak	= 725 min
Time interval	= 1 min	Hyd. volume	= 13,254 cuft
Drainage area	= 23.000 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 1.37 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

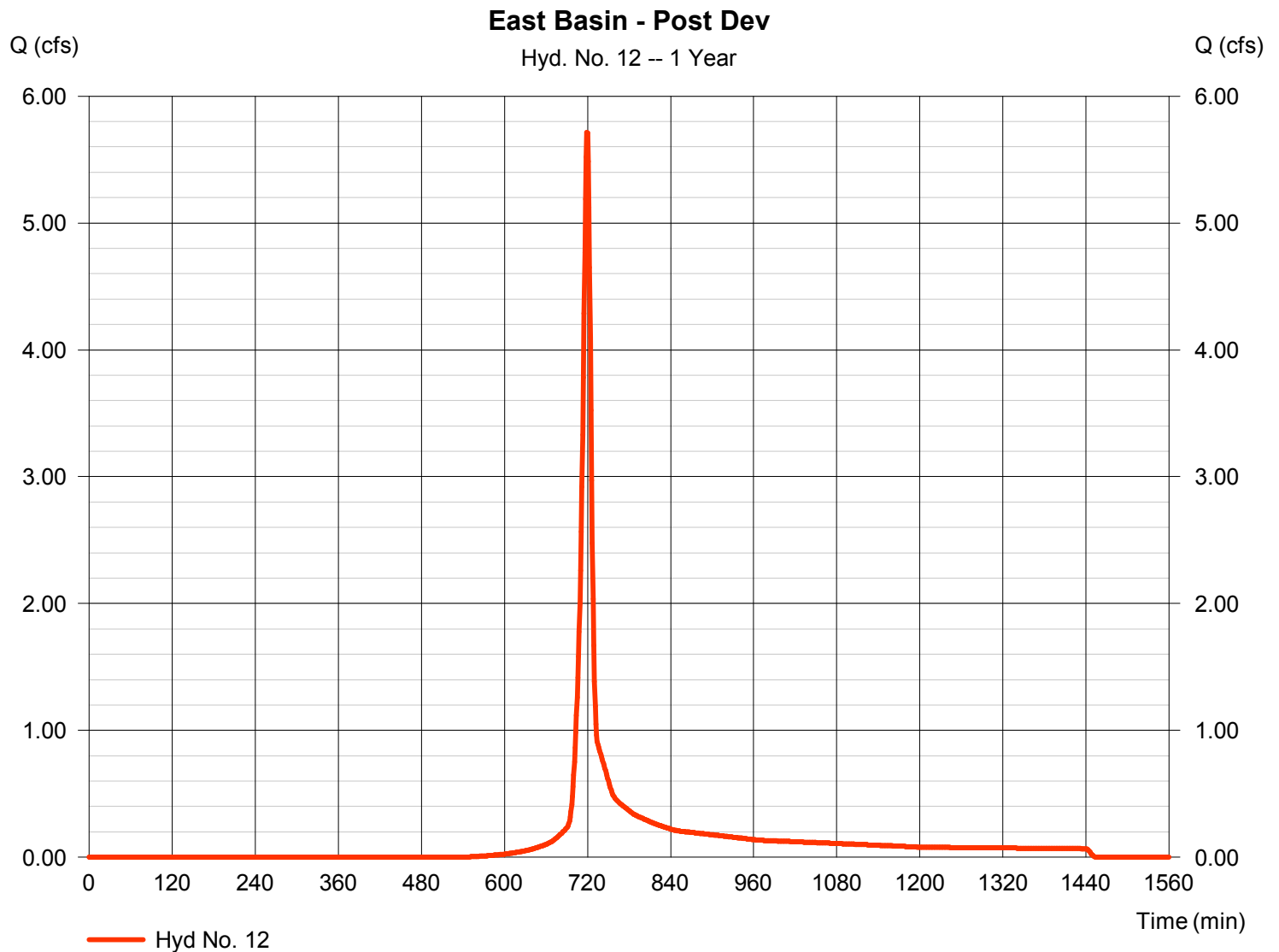
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

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## Hyd. No. 12

### East Basin - Post Dev

Hydrograph type	= SCS Runoff	Peak discharge	= 5.712 cfs
Storm frequency	= 1 yrs	Time to peak	= 719 min
Time interval	= 1 min	Hyd. volume	= 12,924 cuft
Drainage area	= 5.600 ac	Curve number	= 91
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 1.37 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

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	47.90	1	719	116,995	-----	-----	-----	South (portion to detention)
2	Reservoir	3.695	1	755	101,151	1	974.12	321,992	South Basin Routing
3	SCS Runoff	15.82	1	719	38,630	-----	-----	-----	South (portion undetained)
4	Combine	17.40	1	719	139,781	2, 3	-----	-----	Combined South Basin Post Dev
5	SCS Runoff	61.16	1	720	138,376	-----	-----	-----	South - PreDev
6	SCS Runoff	51.11	1	722	138,376	-----	-----	-----	West Basin - PreDev
7	SCS Runoff	177.29	1	722	492,426	-----	-----	-----	West (to detention)
8	SCS Runoff	11.37	1	719	26,860	-----	-----	-----	West (undetained)
9	Reservoir	7.461	1	832	465,738	7	946.39	906,141	West Routing
10	Combine	15.52	1	720	492,598	8, 9	-----	-----	west basin post dev
11	SCS Runoff	48.98	1	722	132,611	-----	-----	-----	East Basin - PreDev
12	SCS Runoff	23.58	1	719	55,709	-----	-----	-----	East Basin - Post Dev
Streets of West Pryor Detention June 18 Model					Runoff Period: 2 Year			Monday, 06 / 18 / 2018	

# Hydrograph Report

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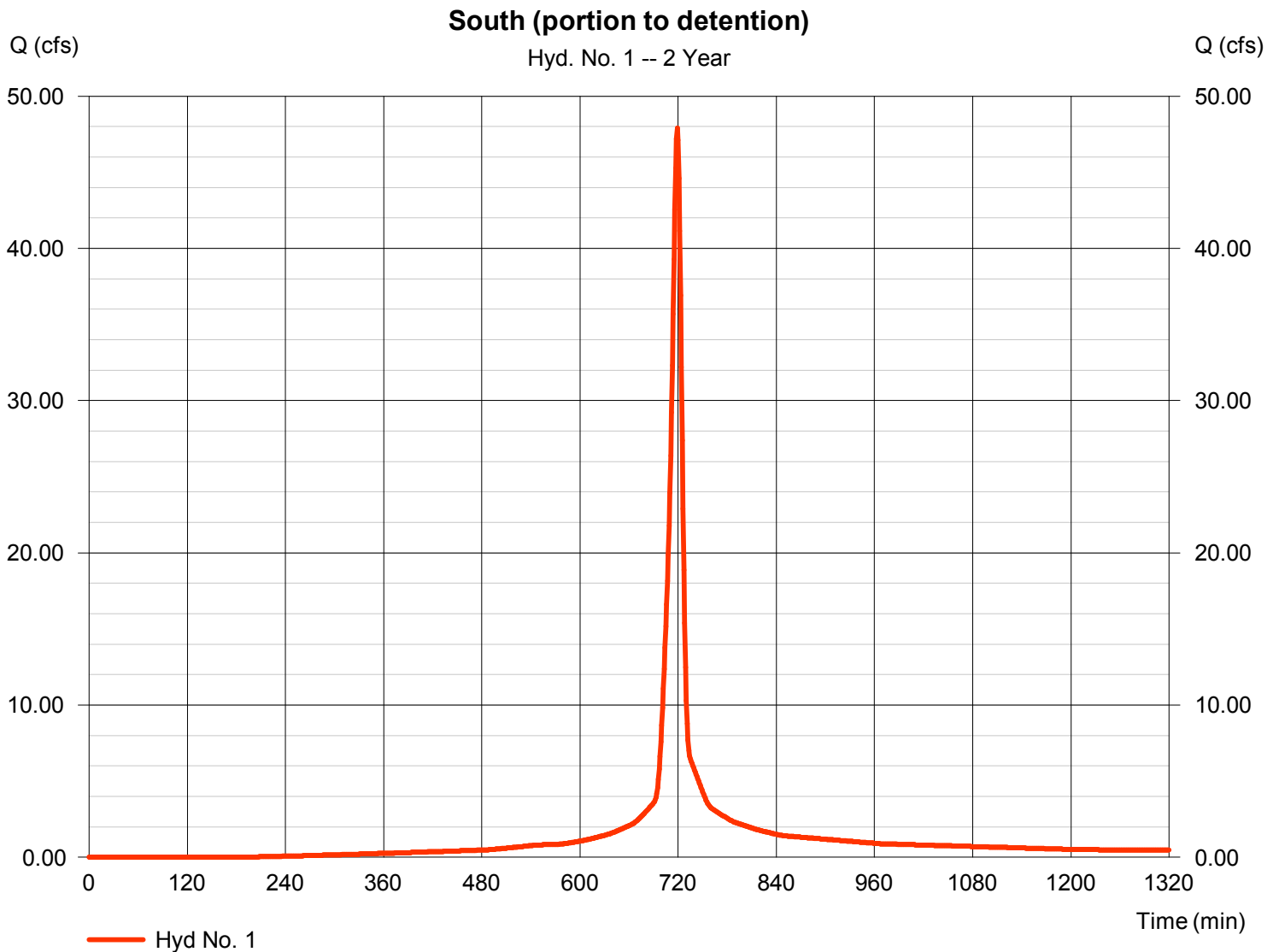
Monday, 06 / 18 / 2018

## Hyd. No. 1

South (portion to detention)

Hydrograph type = SCS Runoff  
 Storm frequency = 2 yrs  
 Time interval = 1 min  
 Drainage area = 10.600 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 3.71 in  
 Storm duration = 24 hrs

Peak discharge = 47.90 cfs  
 Time to peak = 719 min  
 Hyd. volume = 116,995 cuft  
 Curve number = 94  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 10.00 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

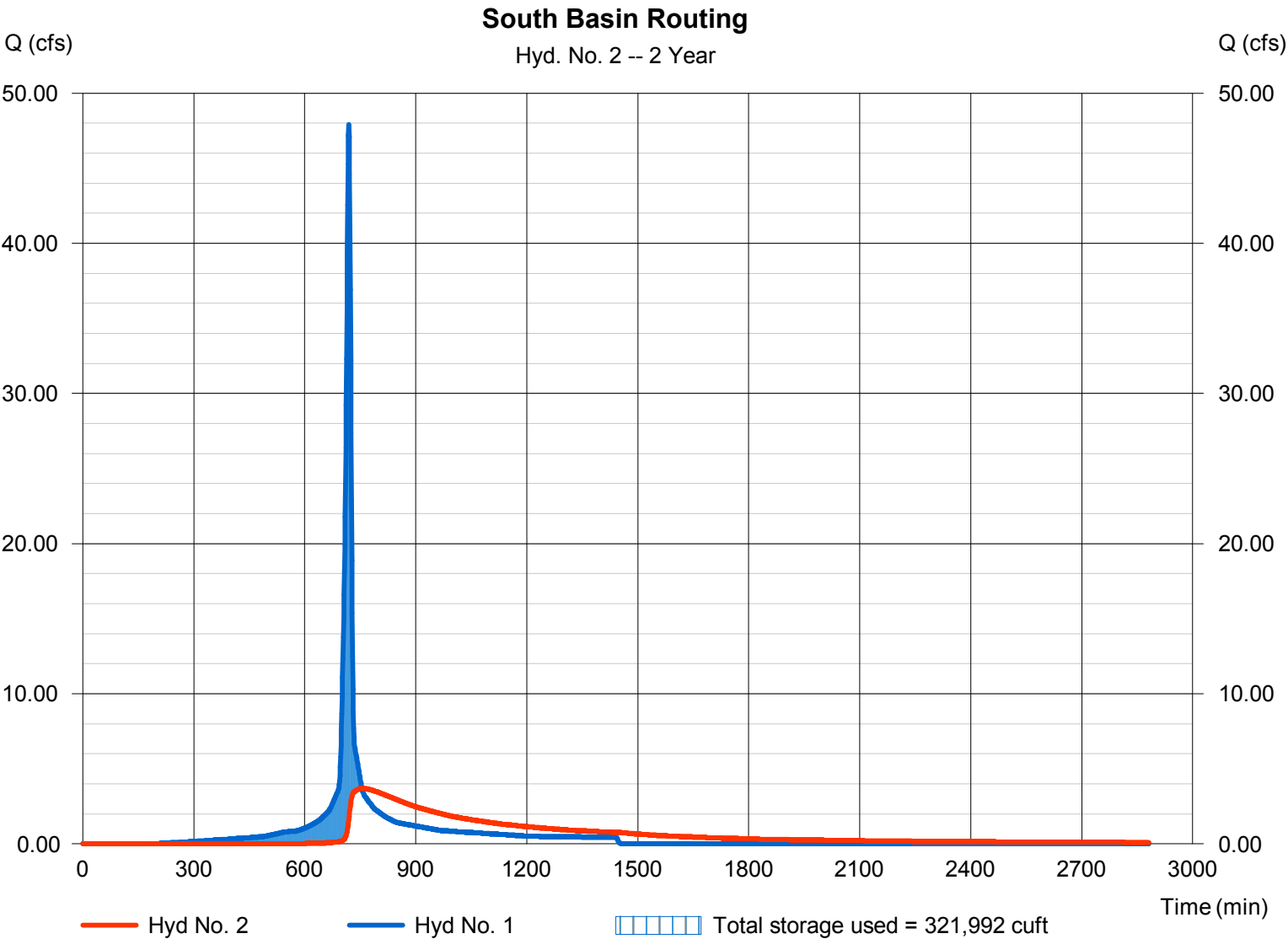
Monday, 06 / 18 / 2018

## Hyd. No. 2

### South Basin Routing

Hydrograph type	= Reservoir	Peak discharge	= 3.695 cfs
Storm frequency	= 2 yrs	Time to peak	= 755 min
Time interval	= 1 min	Hyd. volume	= 101,151 cuft
Inflow hyd. No.	= 1 - South (portion to detention)	Max. Elevation	= 974.12 ft
Reservoir name	= SouthEast	Max. Storage	= 321,992 cuft

Storage Indication method used. Wet pond routing start elevation = 972.00 ft.





# Hydrograph Report

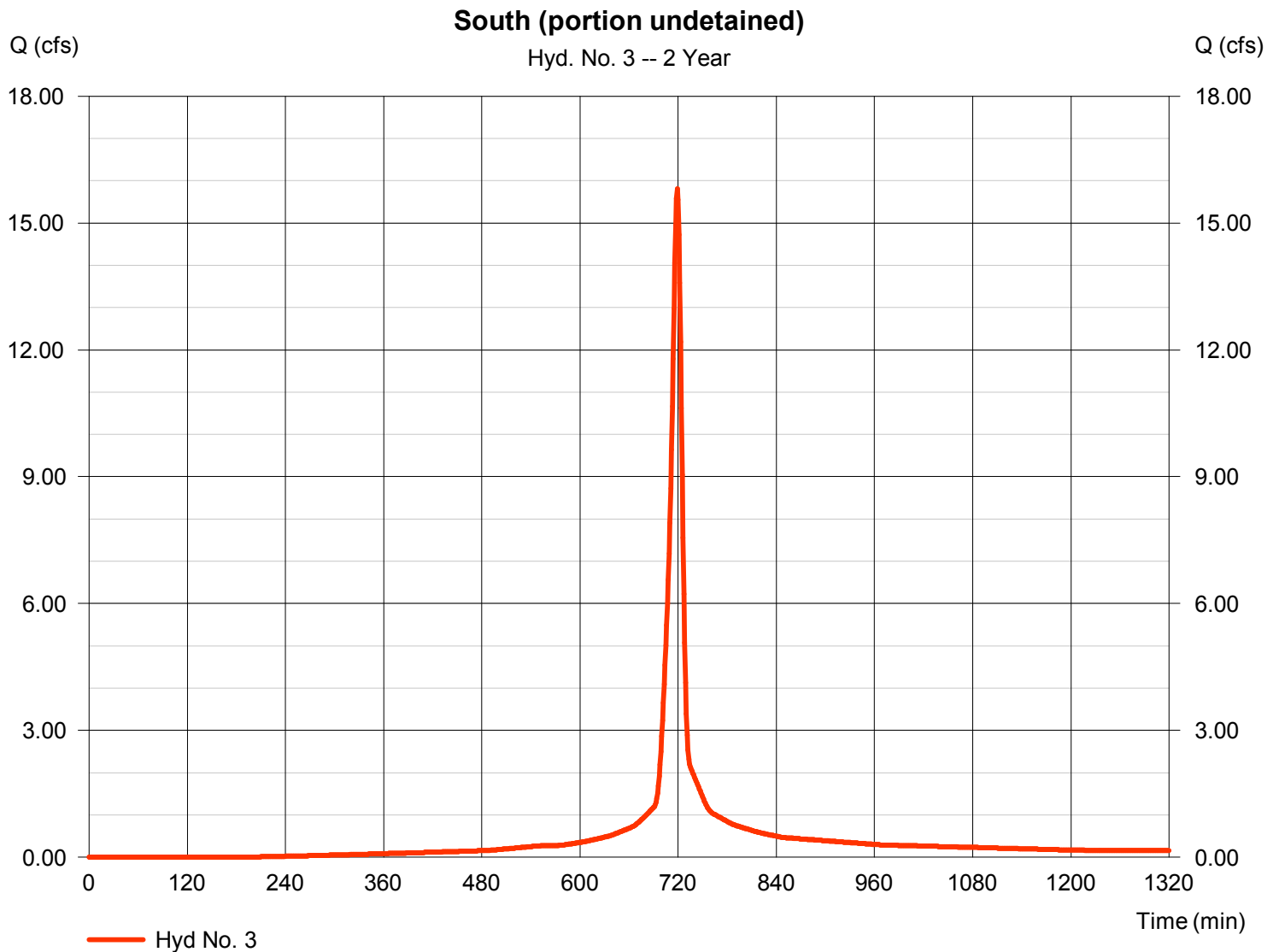
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

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## Hyd. No. 3

South (portion undetained)

Hydrograph type	= SCS Runoff	Peak discharge	= 15.82 cfs
Storm frequency	= 2 yrs	Time to peak	= 719 min
Time interval	= 1 min	Hyd. volume	= 38,630 cuft
Drainage area	= 3.500 ac	Curve number	= 94
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 3.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

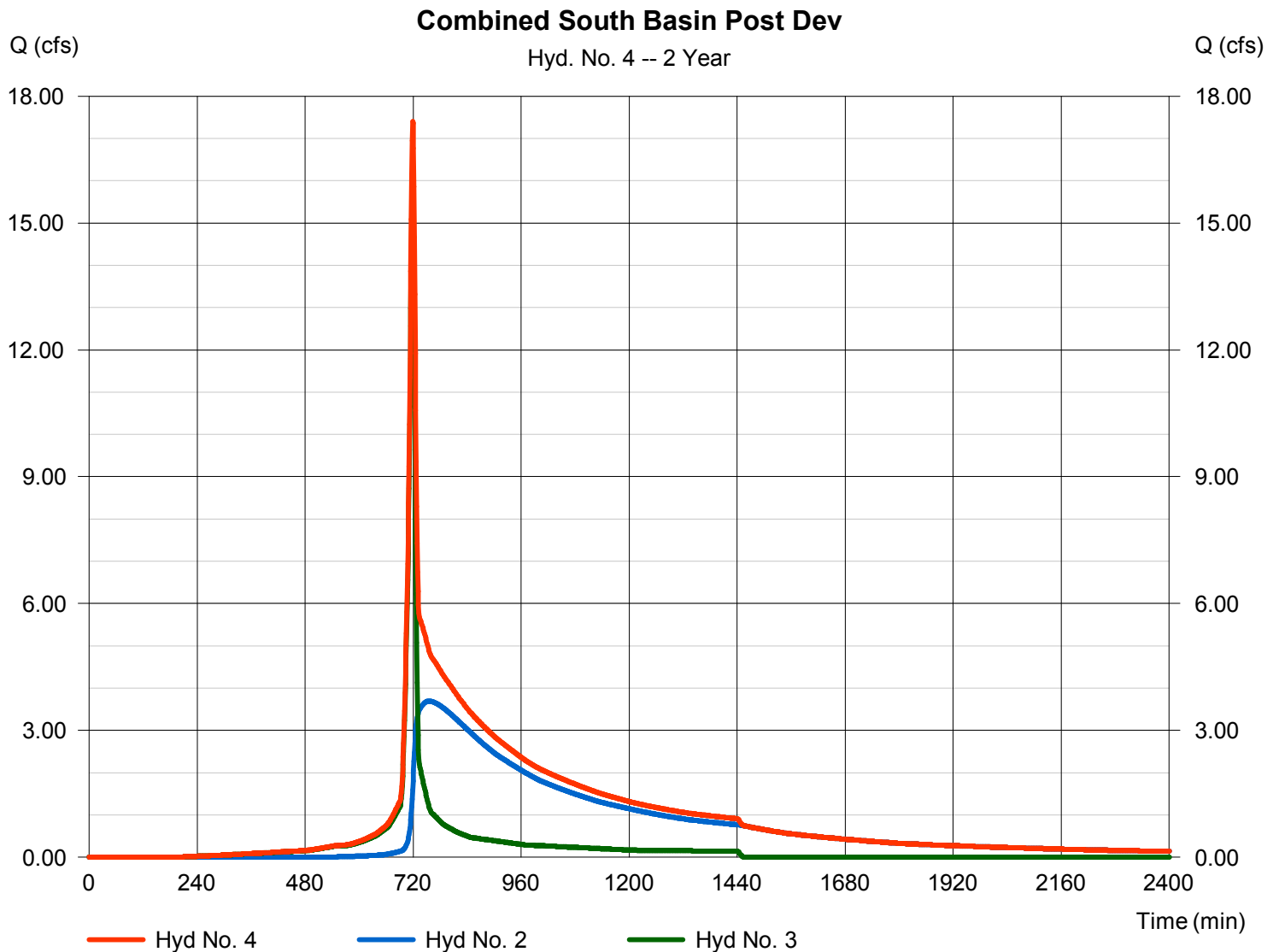
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## Hyd. No. 4

### Combined South Basin Post Dev

Hydrograph type = Combine  
 Storm frequency = 2 yrs  
 Time interval = 1 min  
 Inflow hyds. = 2, 3

Peak discharge = 17.40 cfs  
 Time to peak = 719 min  
 Hyd. volume = 139,781 cuft  
 Contrib. drain. area = 3.500 ac



# Hydrograph Report

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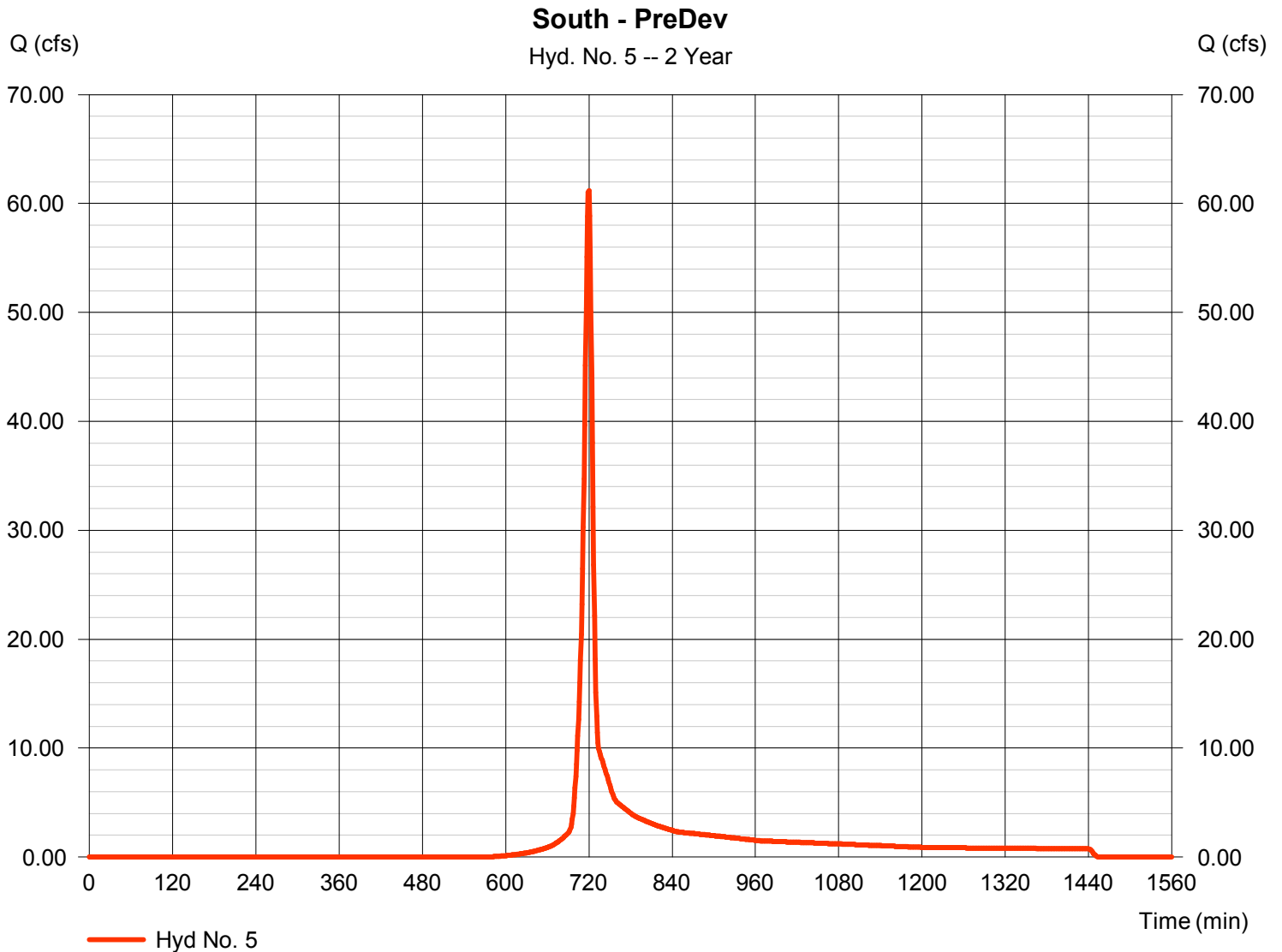
Monday, 06 / 18 / 2018

## Hyd. No. 5

South - PreDev

Hydrograph type = SCS Runoff  
 Storm frequency = 2 yrs  
 Time interval = 1 min  
 Drainage area = 24.000 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 3.71 in  
 Storm duration = 24 hrs

Peak discharge = 61.16 cfs  
 Time to peak = 720 min  
 Hyd. volume = 138,376 cuft  
 Curve number = 77  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 10.00 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

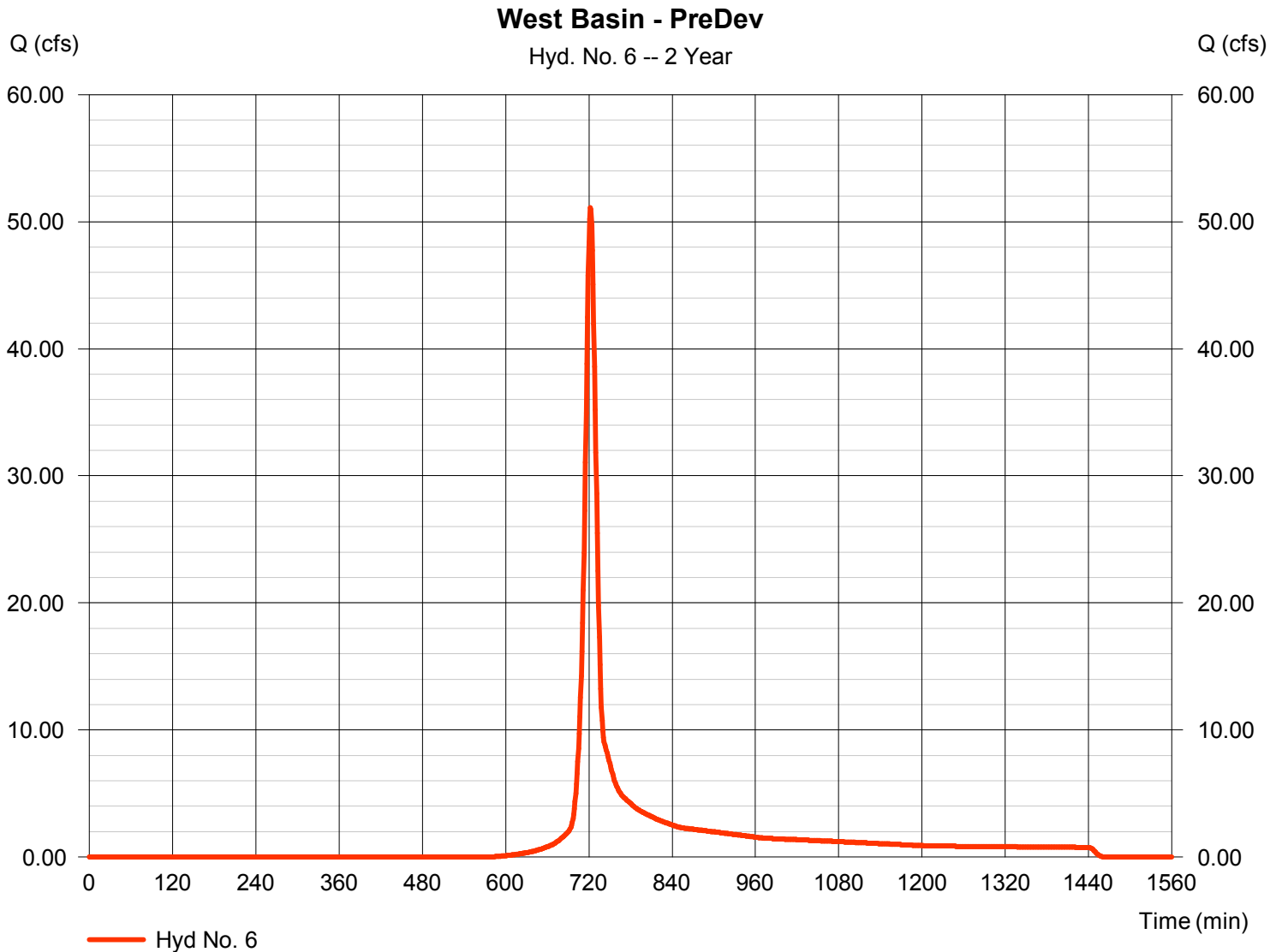
Monday, 06 / 18 / 2018

## Hyd. No. 6

West Basin - PreDev

Hydrograph type = SCS Runoff  
 Storm frequency = 2 yrs  
 Time interval = 1 min  
 Drainage area = 24.000 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 3.71 in  
 Storm duration = 24 hrs

Peak discharge = 51.11 cfs  
 Time to peak = 722 min  
 Hyd. volume = 138,376 cuft  
 Curve number = 77  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 15.00 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

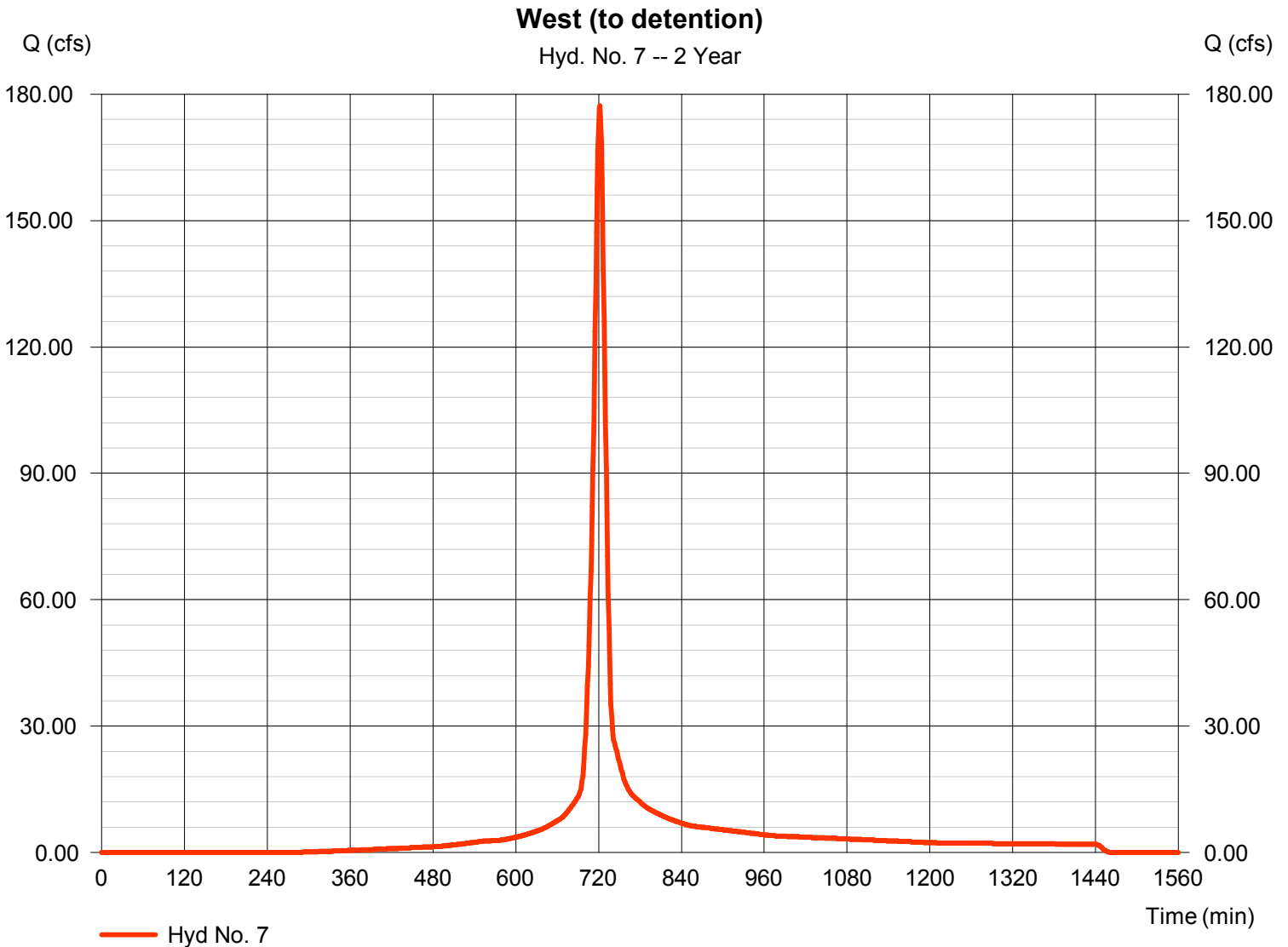
Monday, 06 / 18 / 2018

## Hyd. No. 7

West (to detention)

Hydrograph type = SCS Runoff  
 Storm frequency = 2 yrs  
 Time interval = 1 min  
 Drainage area = 49.500 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 3.71 in  
 Storm duration = 24 hrs

Peak discharge = 177.29 cfs  
 Time to peak = 722 min  
 Hyd. volume = 492,426 cuft  
 Curve number = 91  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 15.00 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

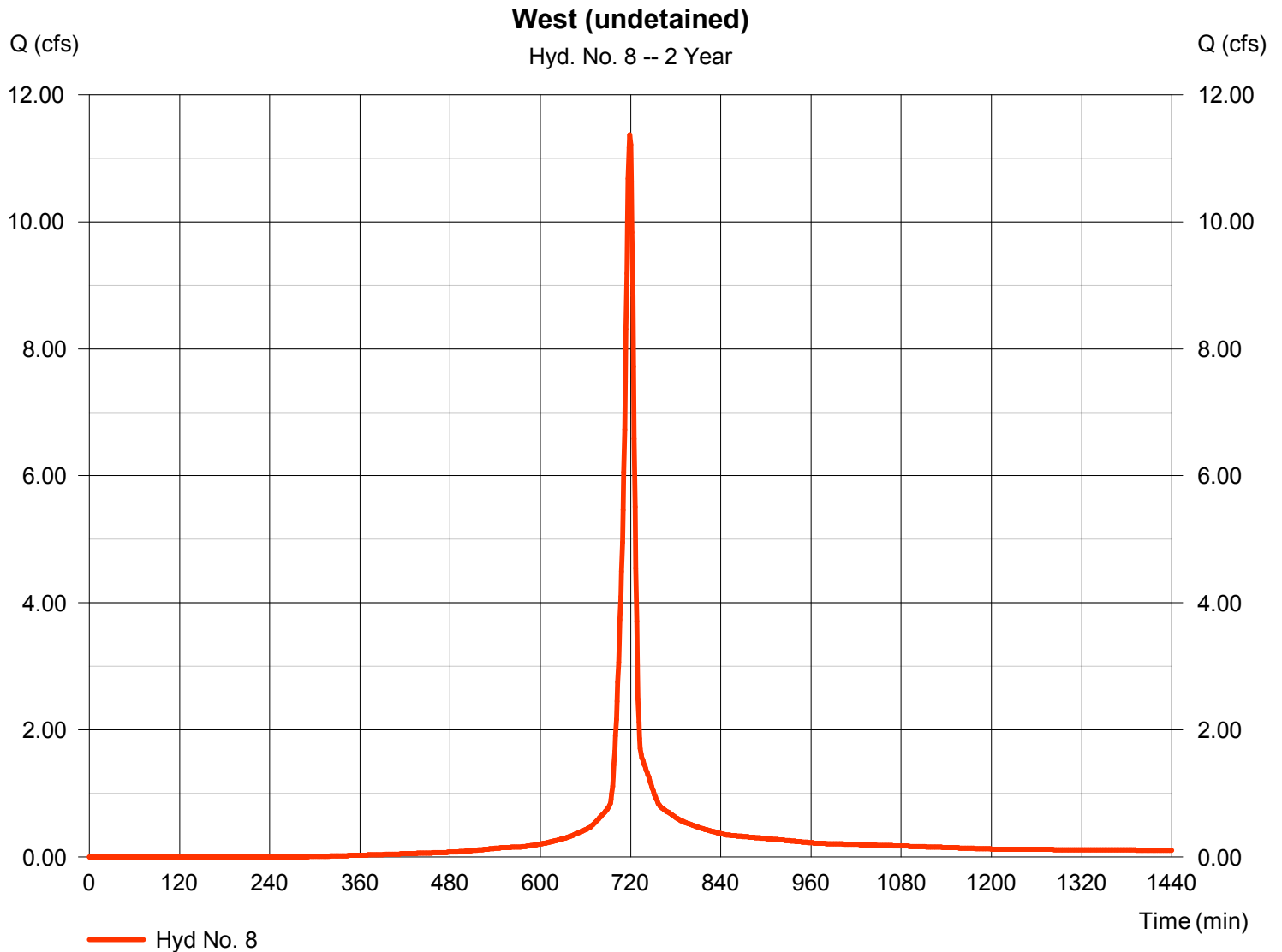
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

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## Hyd. No. 8

West (undetained)

Hydrograph type	= SCS Runoff	Peak discharge	= 11.37 cfs
Storm frequency	= 2 yrs	Time to peak	= 719 min
Time interval	= 1 min	Hyd. volume	= 26,860 cuft
Drainage area	= 2.700 ac	Curve number	= 91
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 3.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

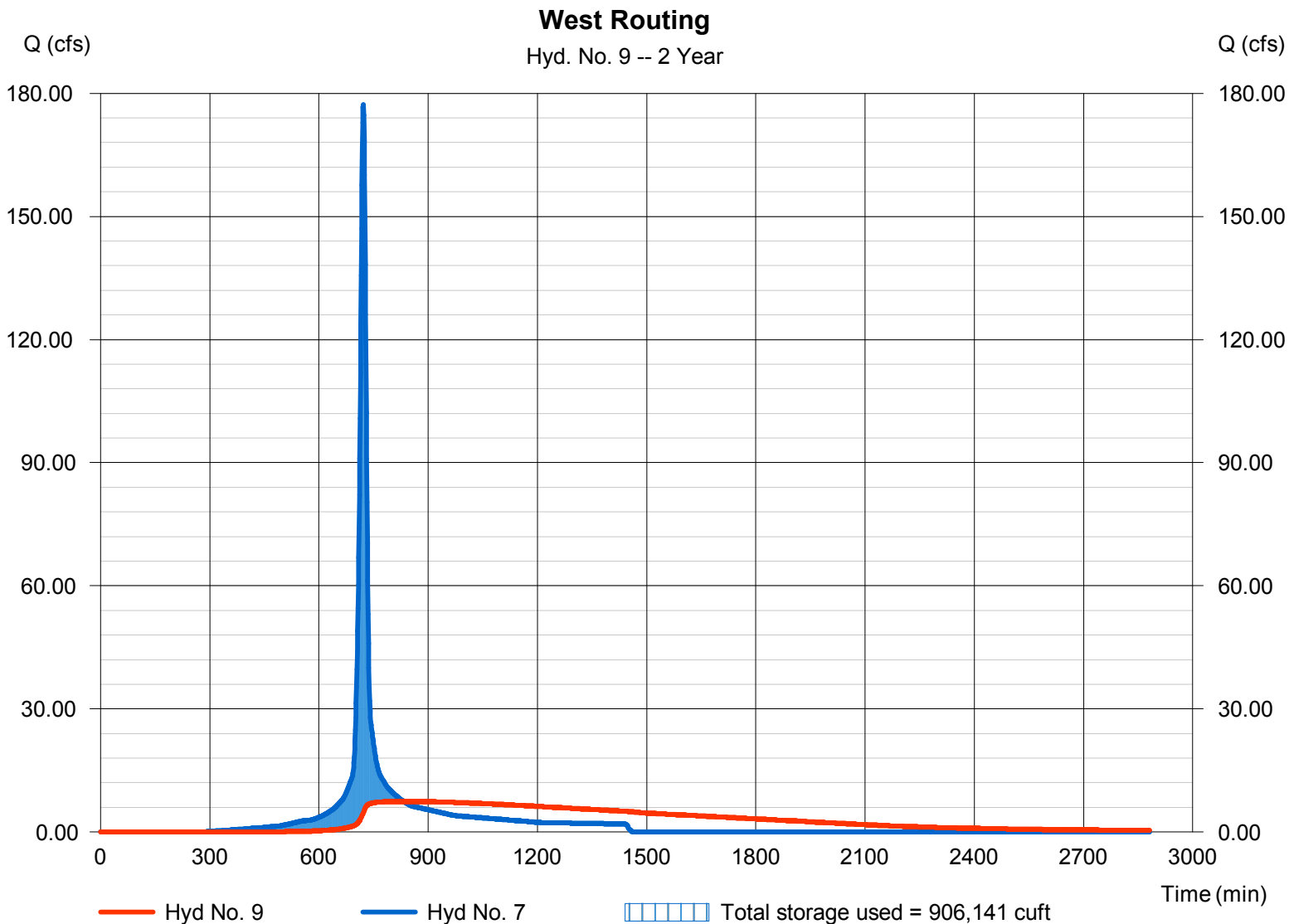
Monday, 06 / 18 / 2018

## Hyd. No. 9

### West Routing

Hydrograph type	= Reservoir	Peak discharge	= 7.461 cfs
Storm frequency	= 2 yrs	Time to peak	= 832 min
Time interval	= 1 min	Hyd. volume	= 465,738 cuft
Inflow hyd. No.	= 7 - West (to detention)	Max. Elevation	= 946.39 ft
Reservoir name	= West Basin	Max. Storage	= 906,141 cuft

Storage Indication method used. Wet pond routing start elevation = 942.00 ft.



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

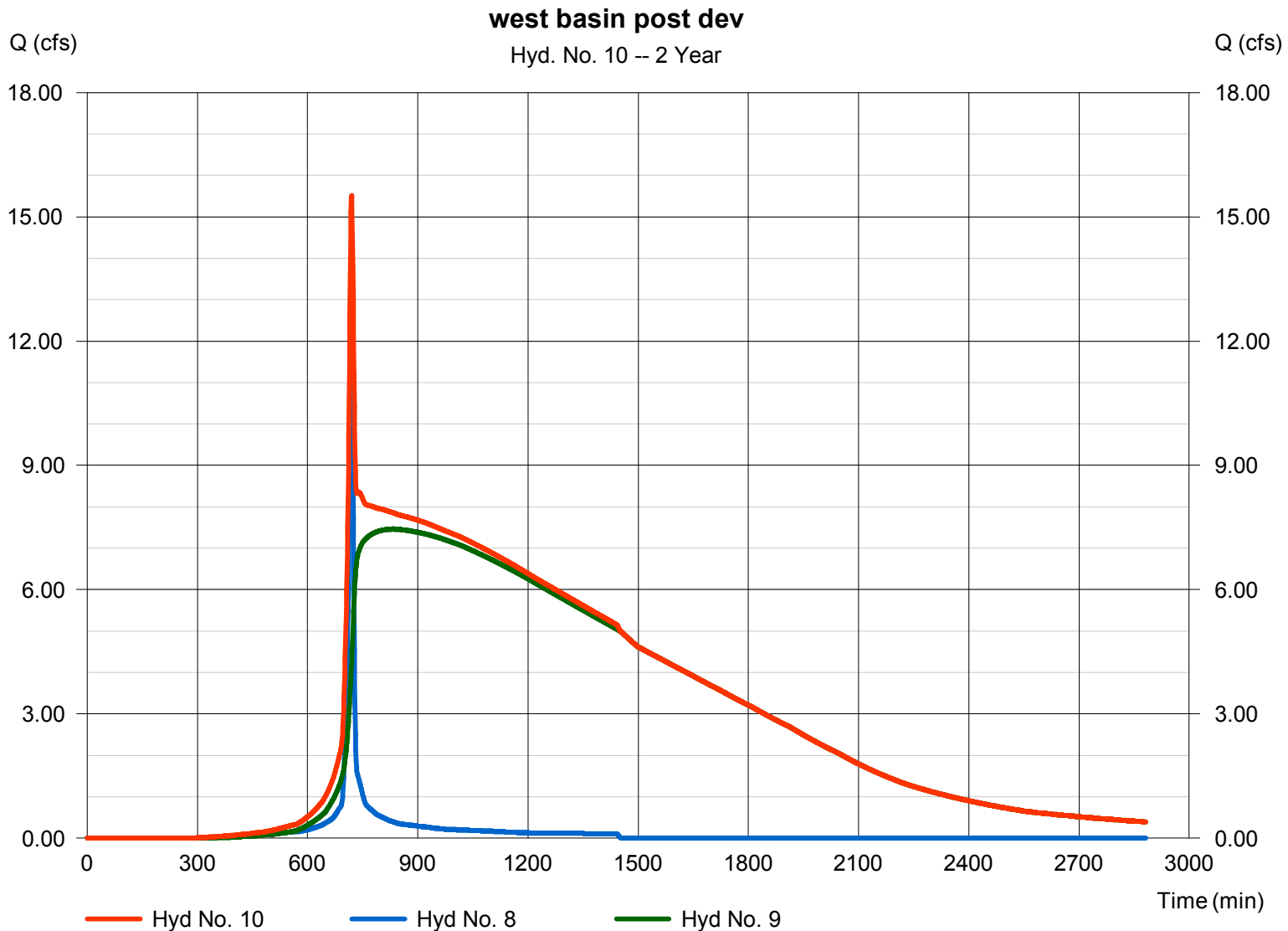
Monday, 06 / 18 / 2018

## Hyd. No. 10

west basin post dev

Hydrograph type = Combine  
Storm frequency = 2 yrs  
Time interval = 1 min  
Inflow hyds. = 8, 9

Peak discharge = 15.52 cfs  
Time to peak = 720 min  
Hyd. volume = 492,598 cuft  
Contrib. drain. area = 2.700 ac





# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

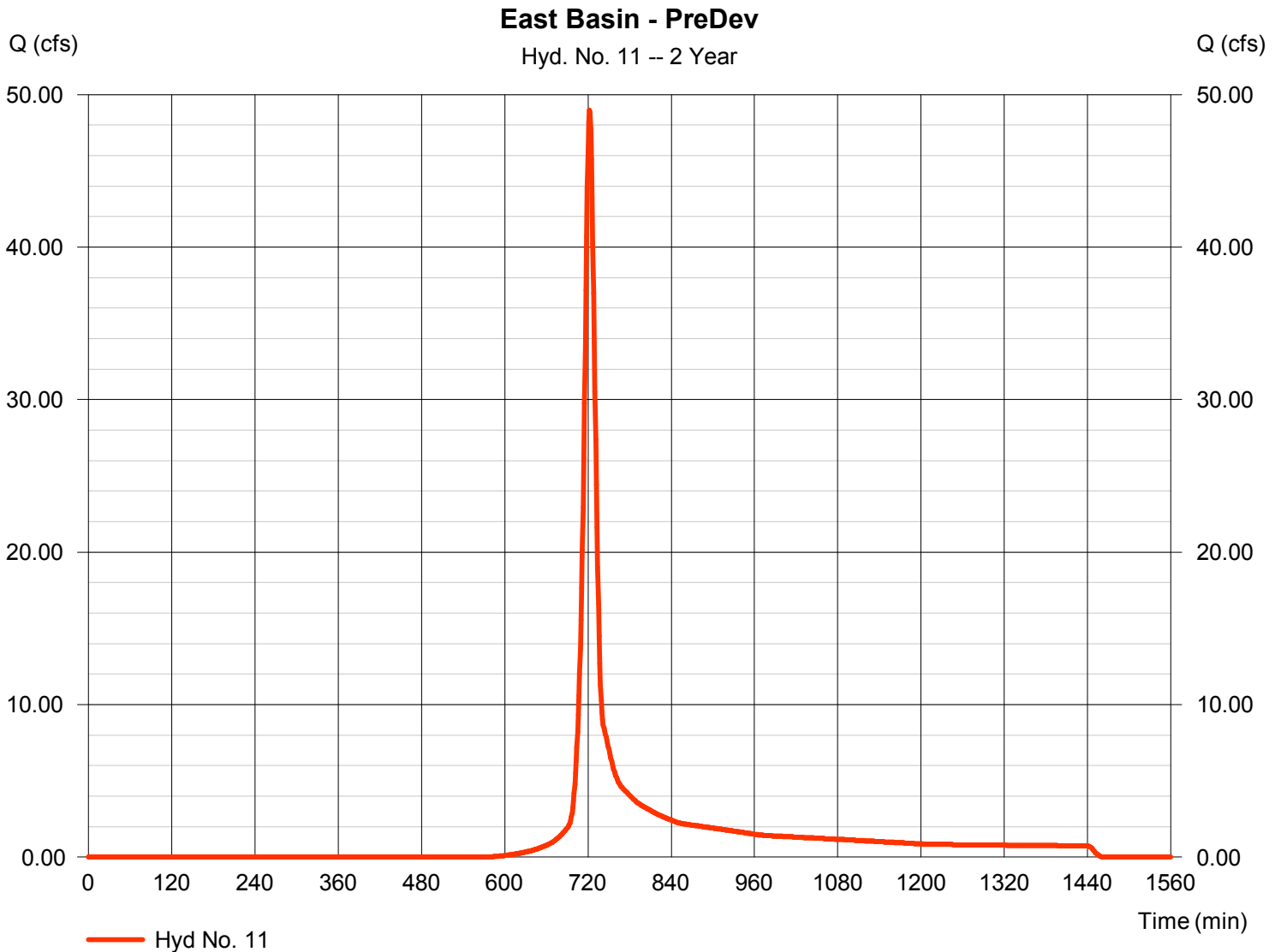
Monday, 06 / 18 / 2018

## Hyd. No. 11

East Basin - PreDev

Hydrograph type = SCS Runoff  
 Storm frequency = 2 yrs  
 Time interval = 1 min  
 Drainage area = 23.000 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 3.71 in  
 Storm duration = 24 hrs

Peak discharge = 48.98 cfs  
 Time to peak = 722 min  
 Hyd. volume = 132,611 cuft  
 Curve number = 77  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 15.00 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

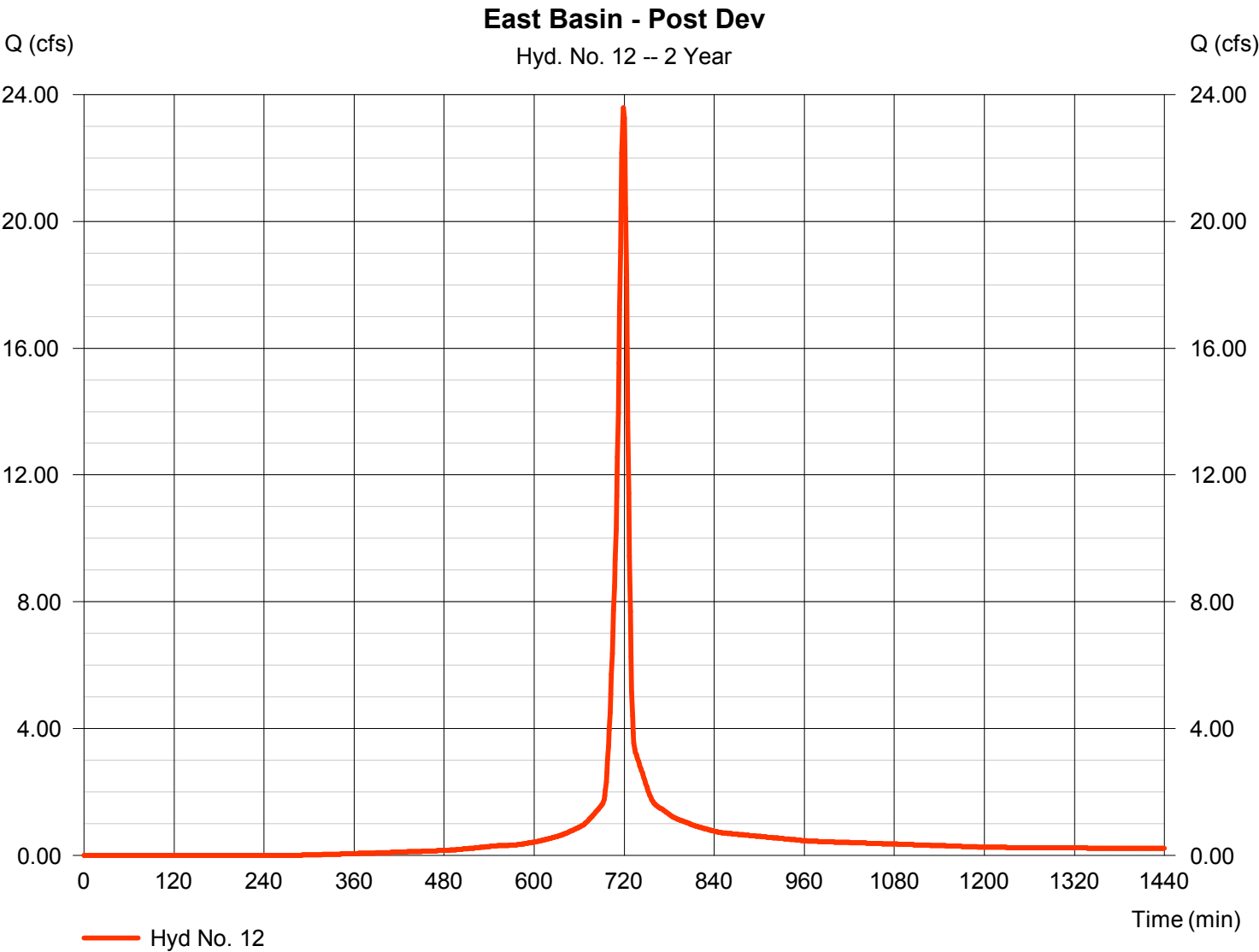
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

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## Hyd. No. 12

East Basin - Post Dev

Hydrograph type	= SCS Runoff	Peak discharge	= 23.58 cfs
Storm frequency	= 2 yrs	Time to peak	= 719 min
Time interval	= 1 min	Hyd. volume	= 55,709 cuft
Drainage area	= 5.600 ac	Curve number	= 91
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 3.71 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

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	76.05	1	719	191,615	-----	-----	-----	South (portion to detention)
2	Reservoir	10.14	1	735	175,202	1	975.18	361,151	South Basin Routing
3	SCS Runoff	25.11	1	719	63,269	-----	-----	-----	South (portion undetained)
4	Combine	30.70	1	720	238,471	2, 3	-----	-----	Combined South Basin Post Dev
5	SCS Runoff	122.74	1	719	278,892	-----	-----	-----	South - PreDev
6	SCS Runoff	103.62	1	722	278,892	-----	-----	-----	West Basin - PreDev
7	SCS Runoff	291.77	1	722	834,519	-----	-----	-----	West (to detention)
8	SCS Runoff	18.65	1	719	45,519	-----	-----	-----	West (undetained)
9	Reservoir	9.708	1	864	790,411	7	949.09	1,146,896	West Routing
10	Combine	25.56	1	719	835,930	8, 9	-----	-----	west basin post dev
11	SCS Runoff	99.30	1	722	267,272	-----	-----	-----	East Basin - PreDev
12	SCS Runoff	38.69	1	719	94,410	-----	-----	-----	East Basin - Post Dev
Streets of West Pryor Detention June 18 Model					Return Period: 10 Year			Monday, 06 / 18 / 2018	

# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

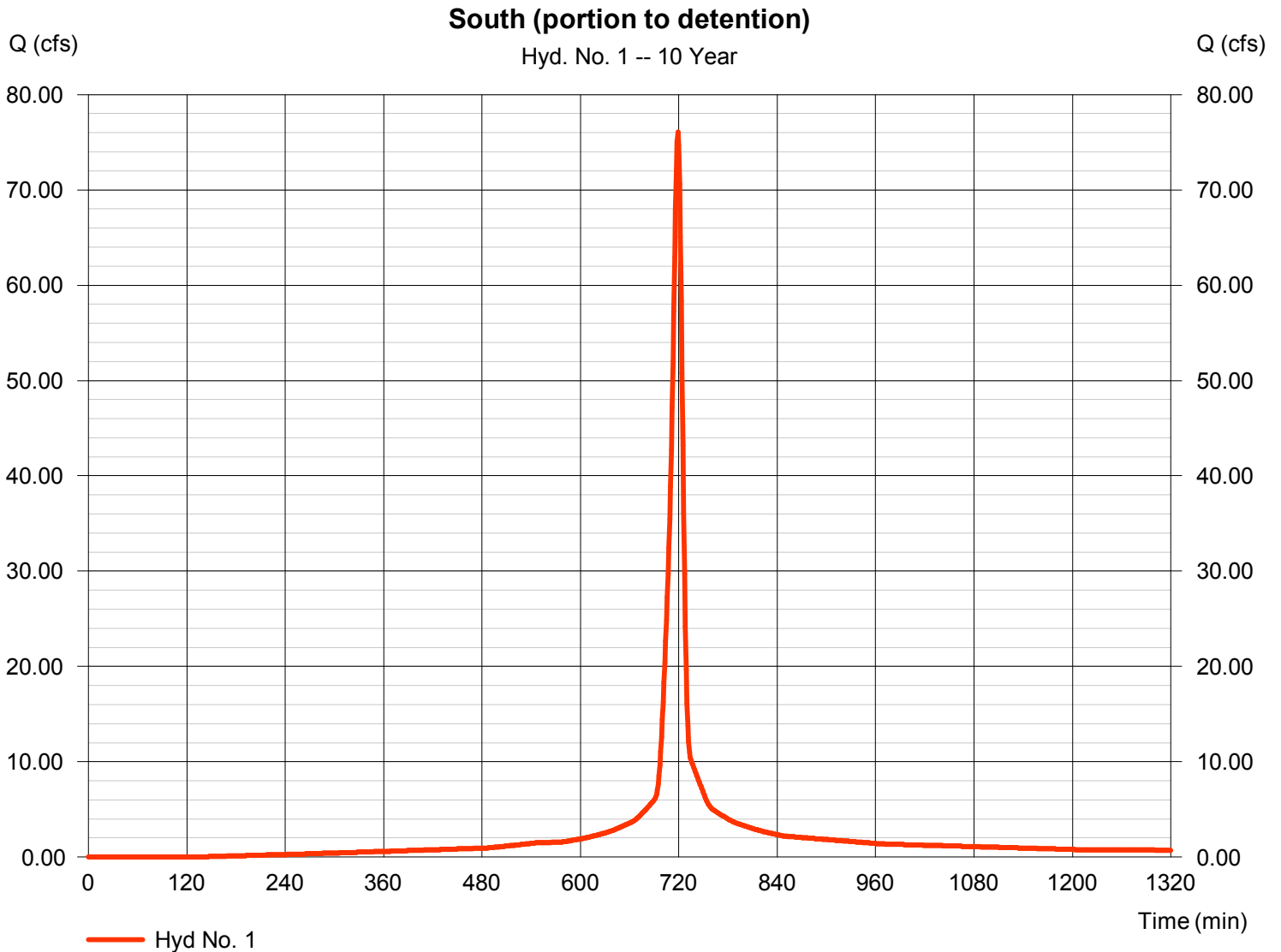
Monday, 06 / 18 / 2018

## Hyd. No. 1

South (portion to detention)

Hydrograph type = SCS Runoff  
 Storm frequency = 10 yrs  
 Time interval = 1 min  
 Drainage area = 10.600 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 5.68 in  
 Storm duration = 24 hrs

Peak discharge = 76.05 cfs  
 Time to peak = 719 min  
 Hyd. volume = 191,615 cuft  
 Curve number = 94  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 10.00 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

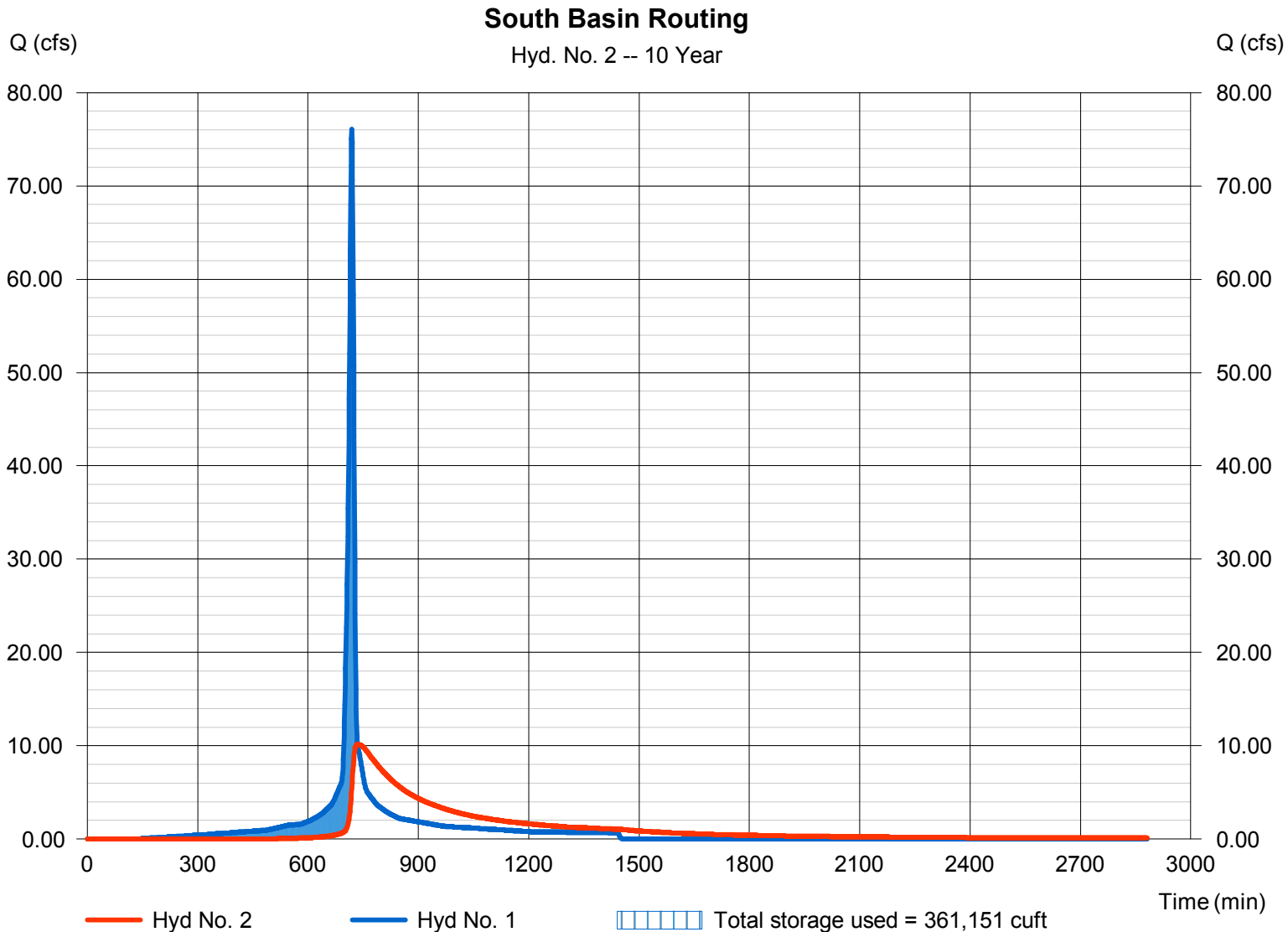
Monday, 06 / 18 / 2018

## Hyd. No. 2

### South Basin Routing

Hydrograph type	= Reservoir	Peak discharge	= 10.14 cfs
Storm frequency	= 10 yrs	Time to peak	= 735 min
Time interval	= 1 min	Hyd. volume	= 175,202 cuft
Inflow hyd. No.	= 1 - South (portion to detention)	Max. Elevation	= 975.18 ft
Reservoir name	= SouthEast	Max. Storage	= 361,151 cuft

Storage Indication method used. Wet pond routing start elevation = 972.00 ft.



# Hydrograph Report

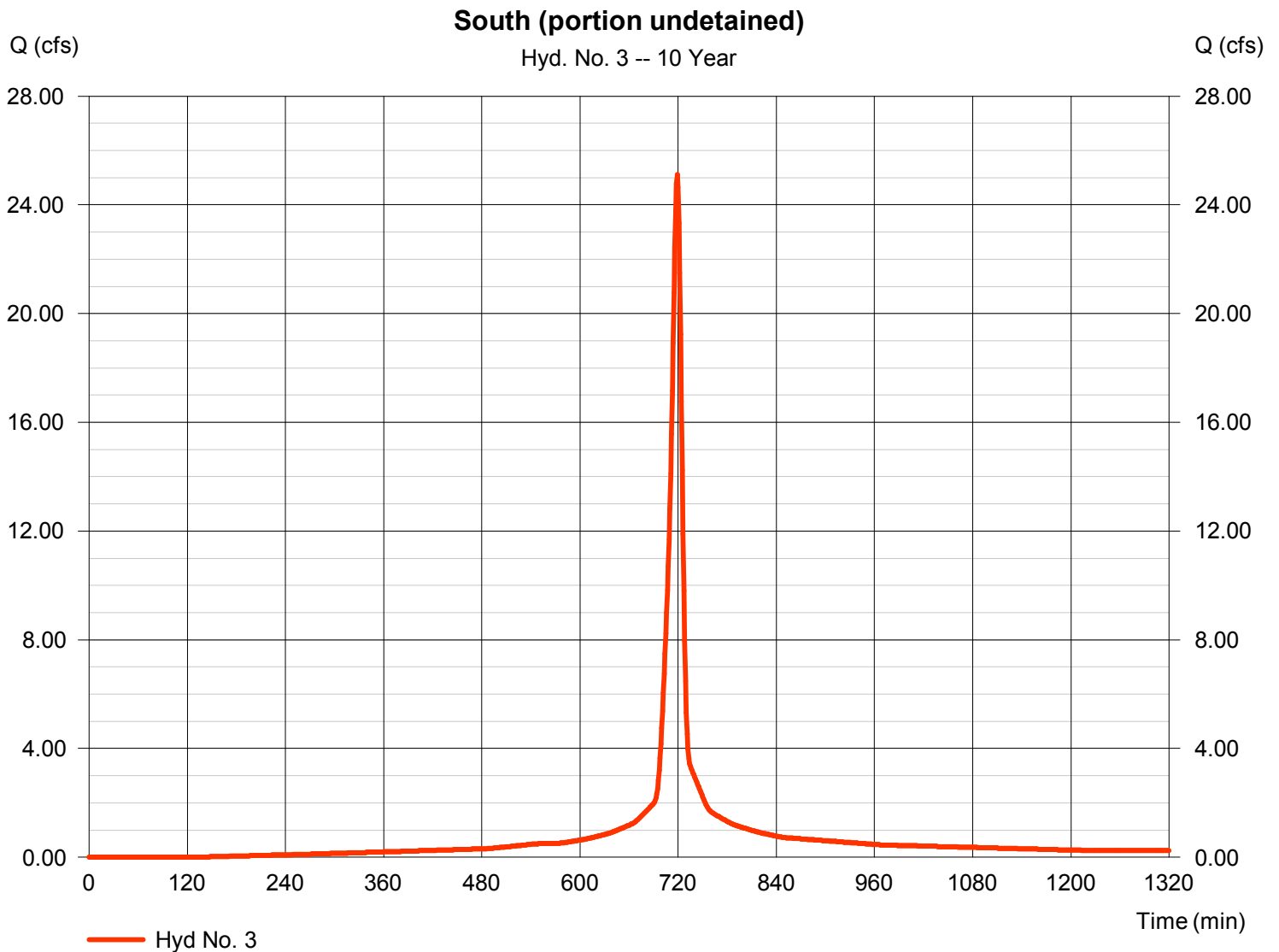
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

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## Hyd. No. 3

South (portion undetained)

Hydrograph type	= SCS Runoff	Peak discharge	= 25.11 cfs
Storm frequency	= 10 yrs	Time to peak	= 719 min
Time interval	= 1 min	Hyd. volume	= 63,269 cuft
Drainage area	= 3.500 ac	Curve number	= 94
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 5.68 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

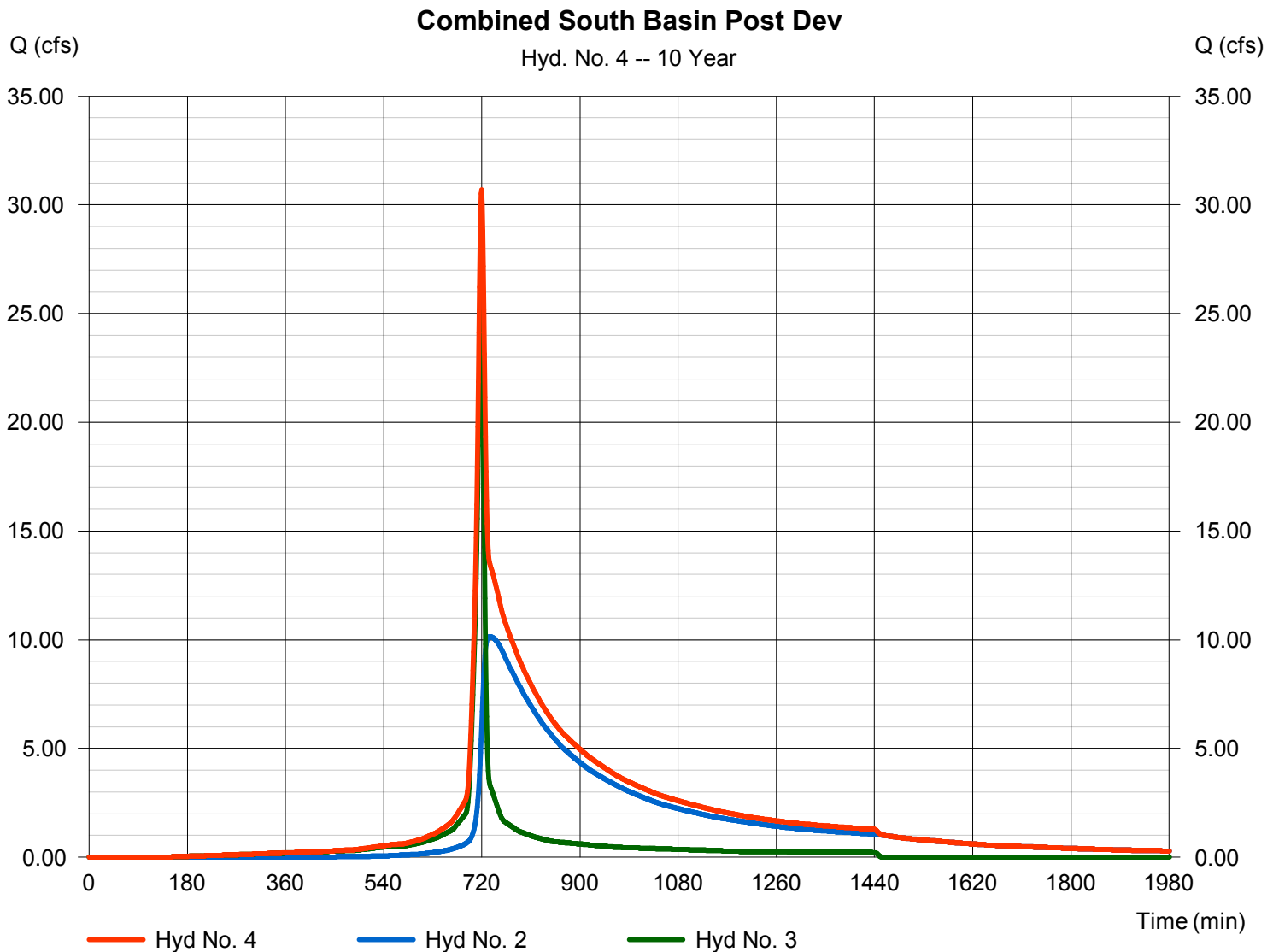
Monday, 06 / 18 / 2018

## Hyd. No. 4

### Combined South Basin Post Dev

Hydrograph type = Combine  
Storm frequency = 10 yrs  
Time interval = 1 min  
Inflow hyds. = 2, 3

Peak discharge = 30.70 cfs  
Time to peak = 720 min  
Hyd. volume = 238,471 cuft  
Contrib. drain. area = 3.500 ac



# Hydrograph Report

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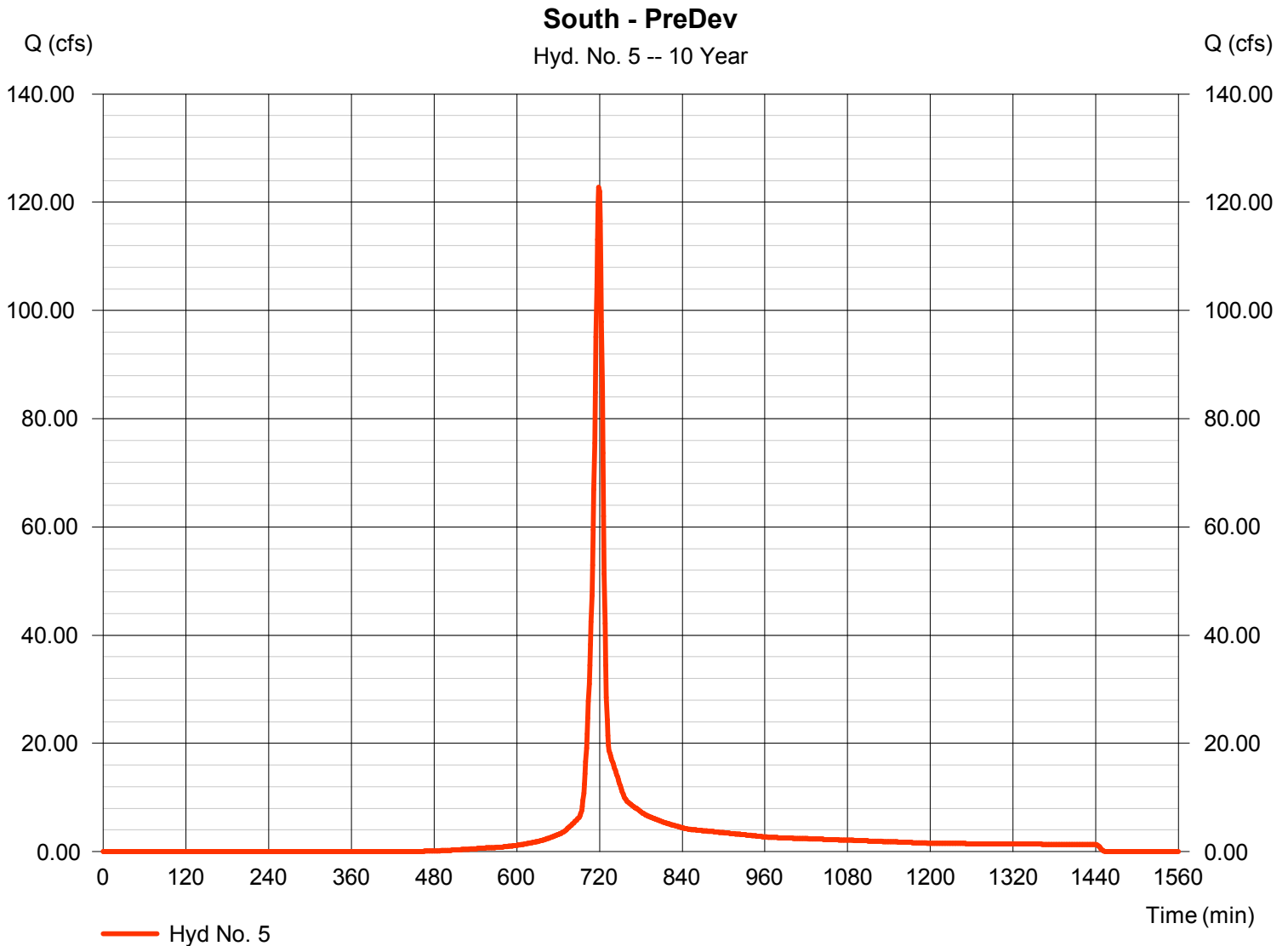
Monday, 06 / 18 / 2018

## Hyd. No. 5

South - PreDev

Hydrograph type = SCS Runoff  
 Storm frequency = 10 yrs  
 Time interval = 1 min  
 Drainage area = 24.000 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 5.68 in  
 Storm duration = 24 hrs

Peak discharge = 122.74 cfs  
 Time to peak = 719 min  
 Hyd. volume = 278,892 cuft  
 Curve number = 77  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 10.00 min  
 Distribution = Type II  
 Shape factor = 484





# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

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## Hyd. No. 6

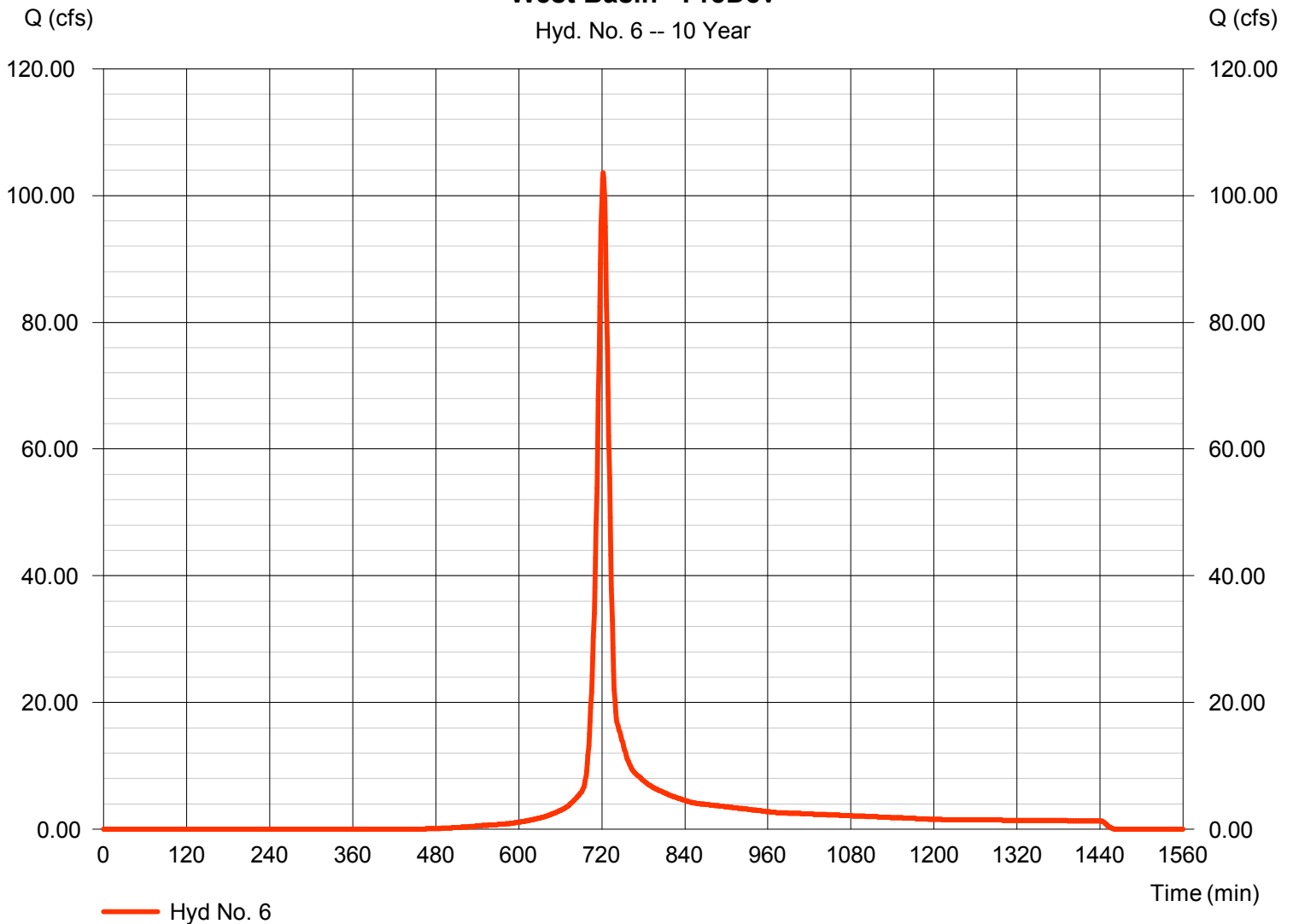
West Basin - PreDev

Hydrograph type = SCS Runoff  
 Storm frequency = 10 yrs  
 Time interval = 1 min  
 Drainage area = 24.000 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 5.68 in  
 Storm duration = 24 hrs

Peak discharge = 103.62 cfs  
 Time to peak = 722 min  
 Hyd. volume = 278,892 cuft  
 Curve number = 77  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 15.00 min  
 Distribution = Type II  
 Shape factor = 484

### West Basin - PreDev

Hyd. No. 6 -- 10 Year



# Hydrograph Report

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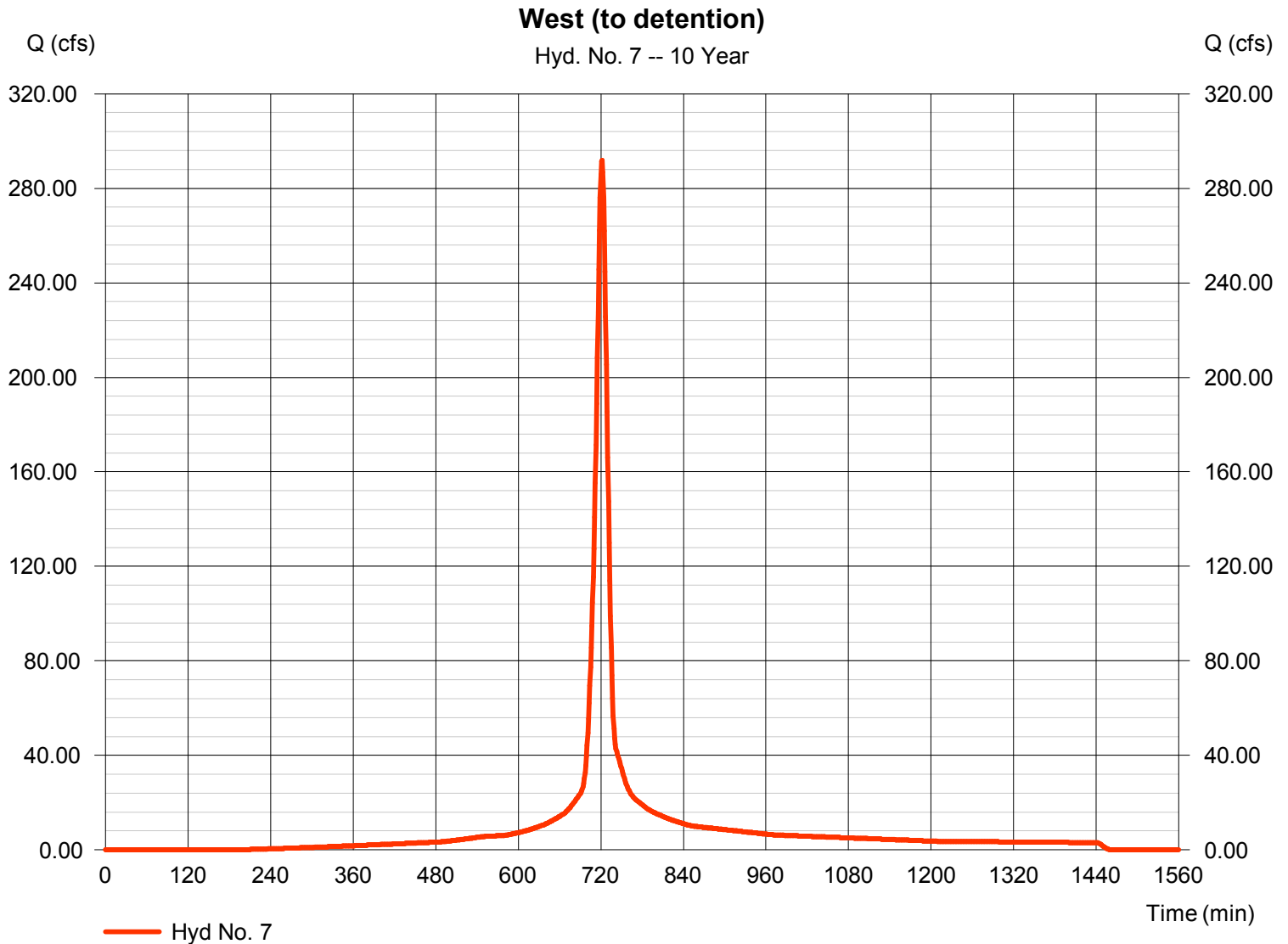
Monday, 06 / 18 / 2018

## Hyd. No. 7

West (to detention)

Hydrograph type = SCS Runoff  
 Storm frequency = 10 yrs  
 Time interval = 1 min  
 Drainage area = 49.500 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 5.68 in  
 Storm duration = 24 hrs

Peak discharge = 291.77 cfs  
 Time to peak = 722 min  
 Hyd. volume = 834,519 cuft  
 Curve number = 91  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 15.00 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

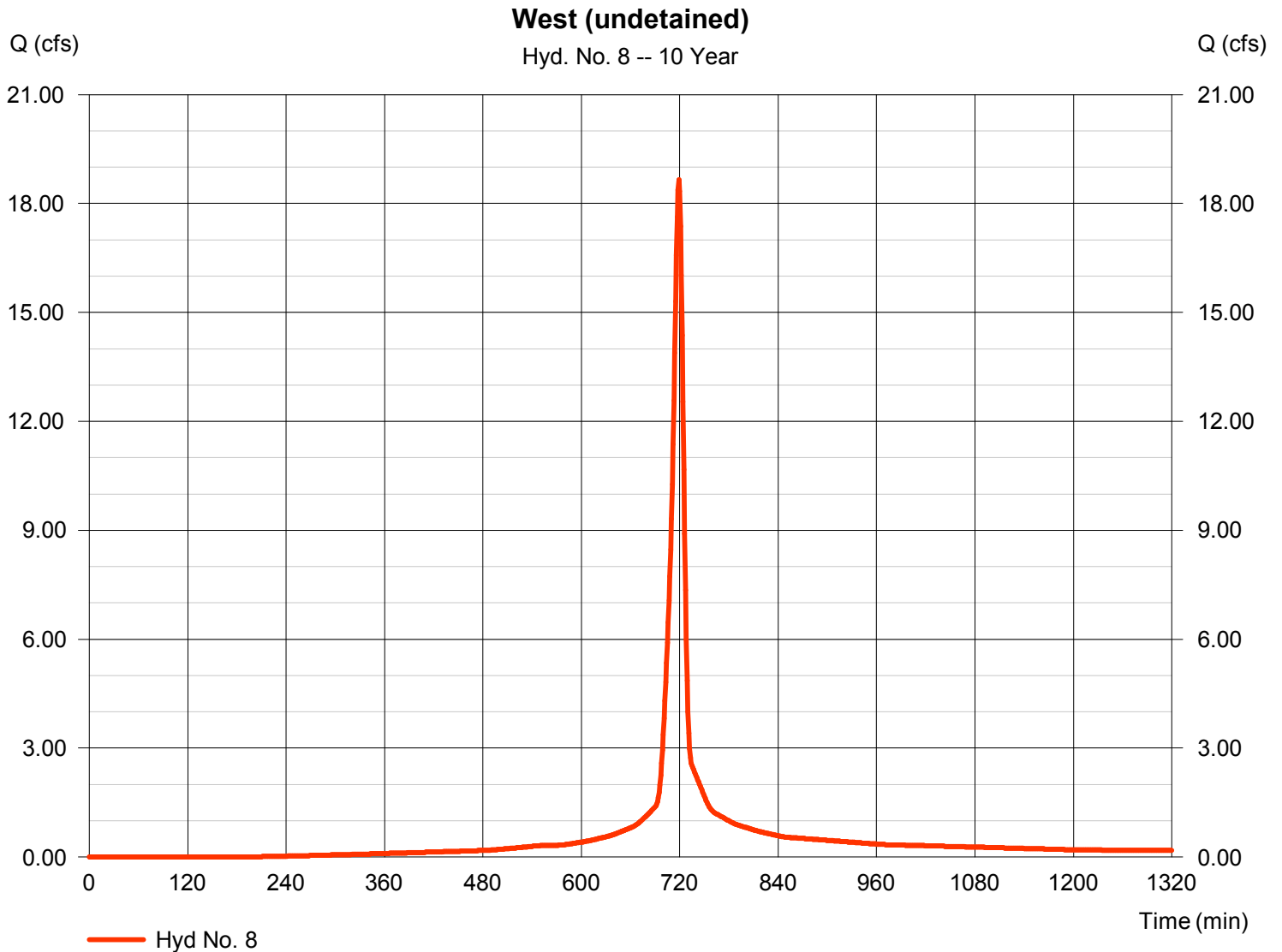
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Monday, 06 / 18 / 2018

## Hyd. No. 8

West (undetained)

Hydrograph type	= SCS Runoff	Peak discharge	= 18.65 cfs
Storm frequency	= 10 yrs	Time to peak	= 719 min
Time interval	= 1 min	Hyd. volume	= 45,519 cuft
Drainage area	= 2.700 ac	Curve number	= 91
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 5.68 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

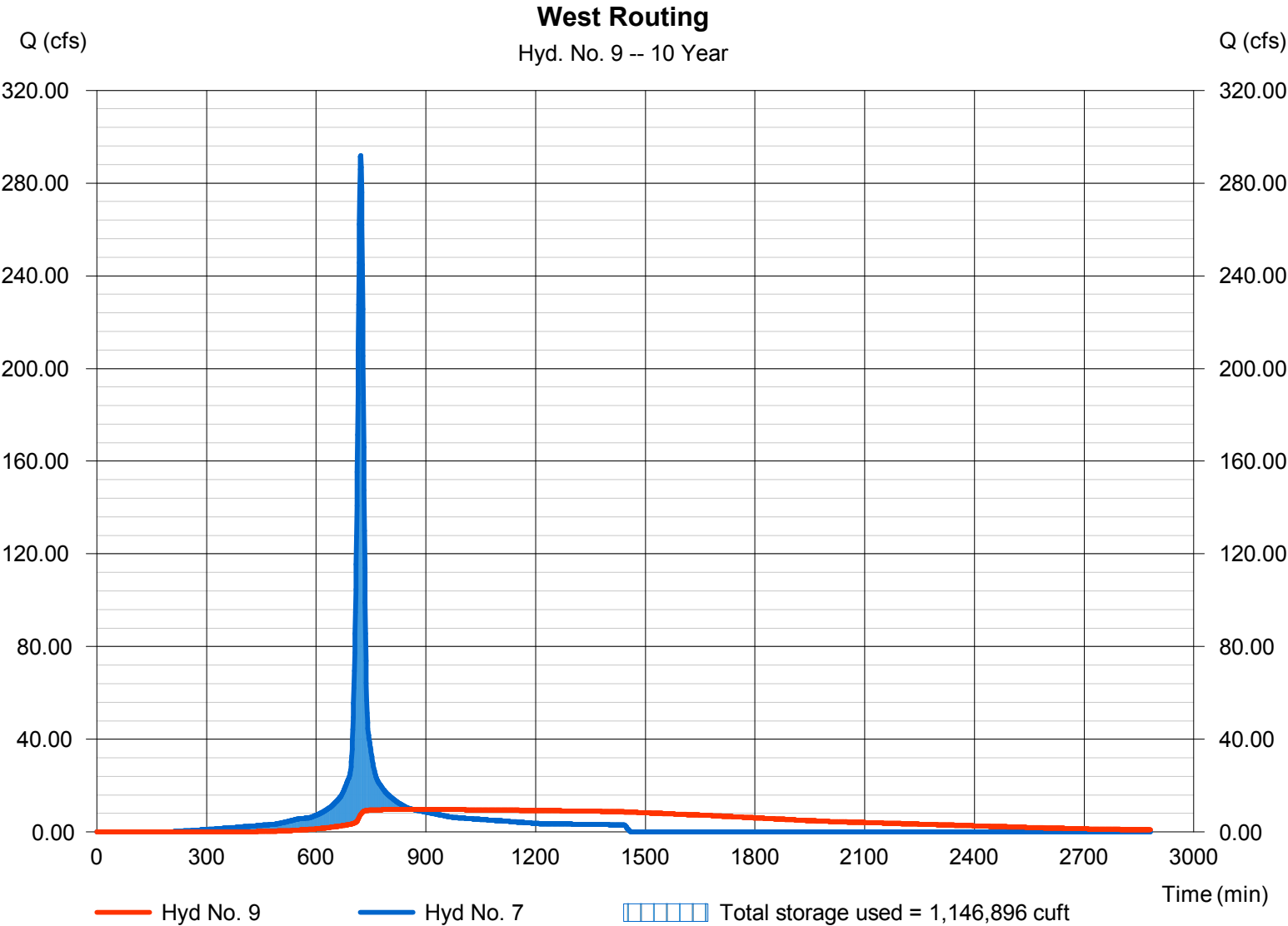
Monday, 06 / 18 / 2018

## Hyd. No. 9

### West Routing

Hydrograph type	= Reservoir	Peak discharge	= 9.708 cfs
Storm frequency	= 10 yrs	Time to peak	= 864 min
Time interval	= 1 min	Hyd. volume	= 790,411 cuft
Inflow hyd. No.	= 7 - West (to detention)	Max. Elevation	= 949.09 ft
Reservoir name	= West Basin	Max. Storage	= 1,146,896 cuft

Storage Indication method used. Wet pond routing start elevation = 942.00 ft.



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

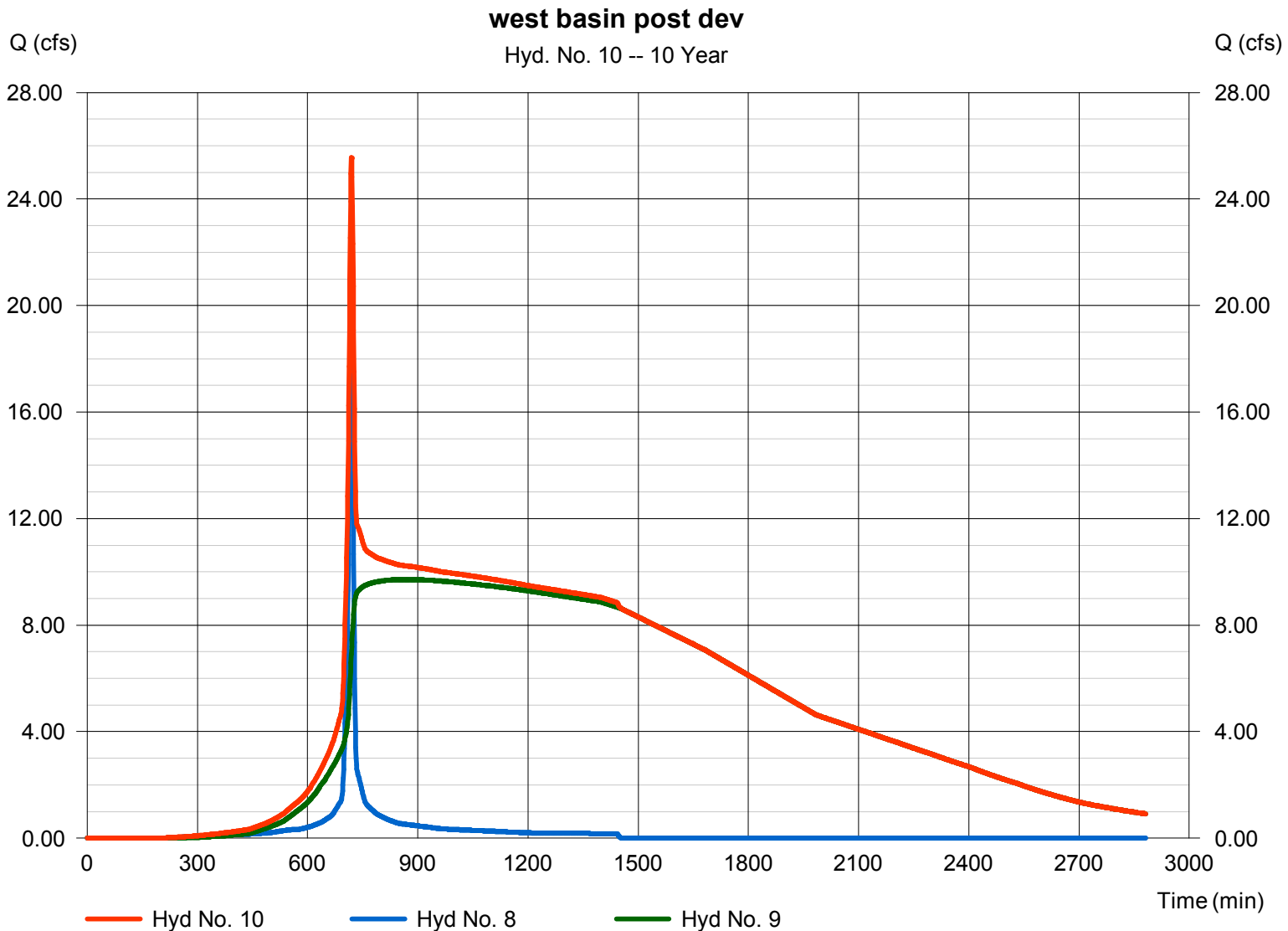
Monday, 06 / 18 / 2018

## Hyd. No. 10

west basin post dev

Hydrograph type = Combine  
Storm frequency = 10 yrs  
Time interval = 1 min  
Inflow hyds. = 8, 9

Peak discharge = 25.56 cfs  
Time to peak = 719 min  
Hyd. volume = 835,930 cuft  
Contrib. drain. area = 2.700 ac



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

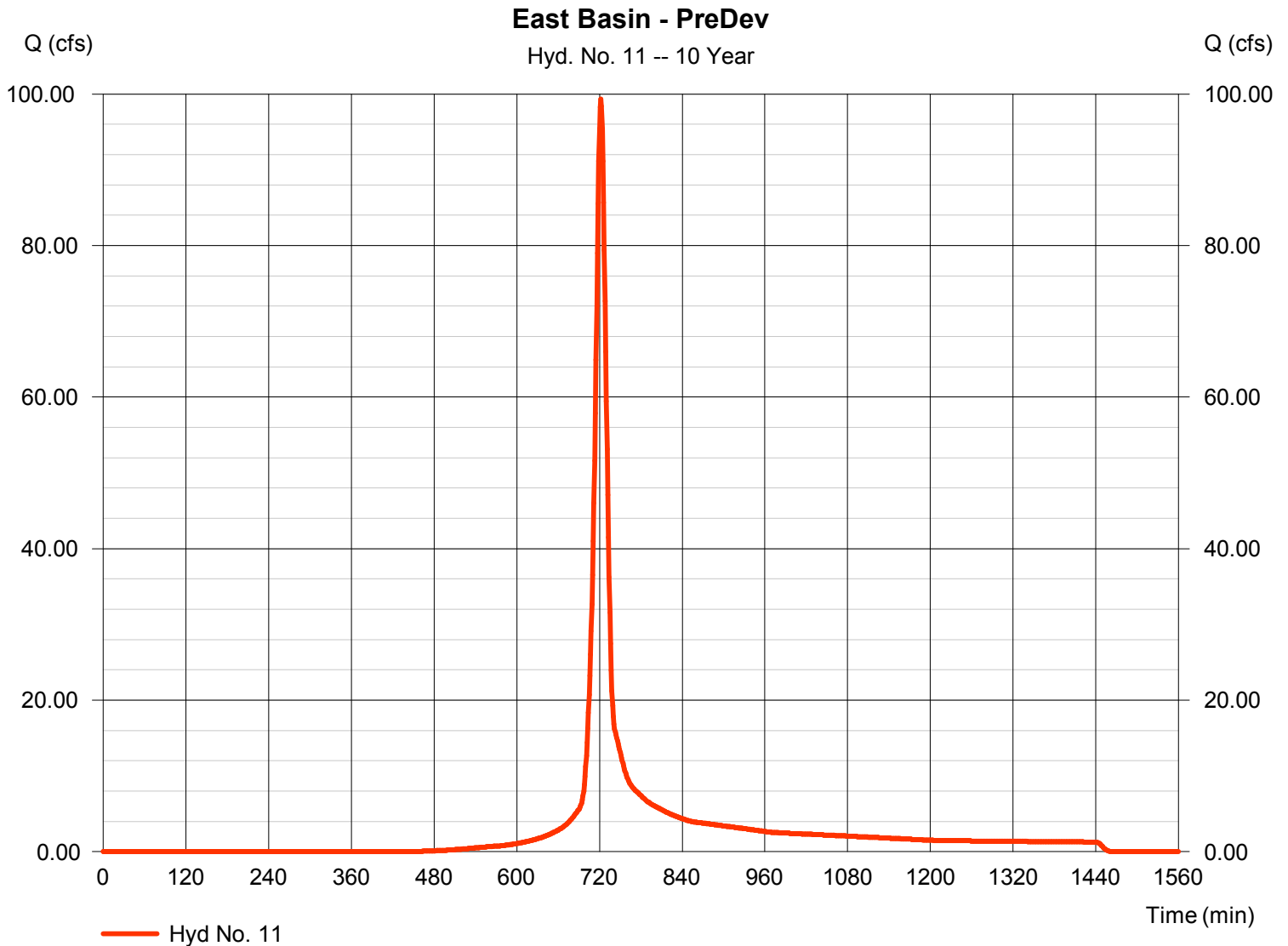
Monday, 06 / 18 / 2018

## Hyd. No. 11

East Basin - PreDev

Hydrograph type = SCS Runoff  
 Storm frequency = 10 yrs  
 Time interval = 1 min  
 Drainage area = 23.000 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 5.68 in  
 Storm duration = 24 hrs

Peak discharge = 99.30 cfs  
 Time to peak = 722 min  
 Hyd. volume = 267,272 cuft  
 Curve number = 77  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 15.00 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

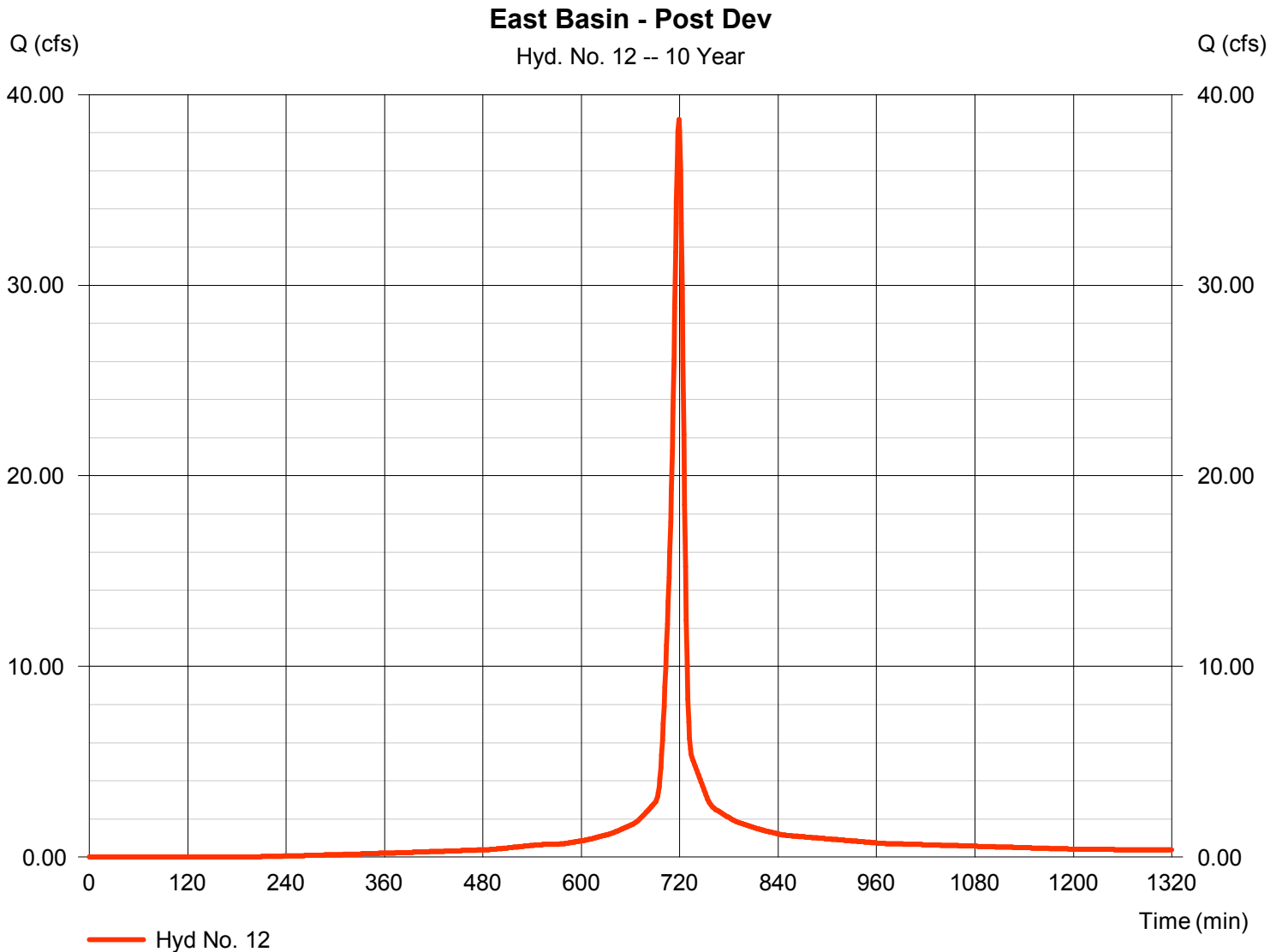
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

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## Hyd. No. 12

### East Basin - Post Dev

Hydrograph type	= SCS Runoff	Peak discharge	= 38.69 cfs
Storm frequency	= 10 yrs	Time to peak	= 719 min
Time interval	= 1 min	Hyd. volume	= 94,410 cuft
Drainage area	= 5.600 ac	Curve number	= 91
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 5.68 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

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	126.10	1	719	327,289	-----	-----	-----	South (portion to detention)
2	Reservoir	28.42	1	730	310,317	1	976.80	424,089	South Basin Routing
3	SCS Runoff	41.64	1	719	108,067	-----	-----	-----	South (portion undetained)
4	Combine	59.99	1	720	418,384	2, 3	-----	-----	Combined South Basin Post Dev
5	SCS Runoff	239.71	1	719	558,740	-----	-----	-----	South - PreDev
6	SCS Runoff	203.56	1	722	558,739	-----	-----	-----	West Basin - PreDev
7	SCS Runoff	494.82	1	721	1,462,778	-----	-----	-----	West (to detention)
8	SCS Runoff	31.57	1	719	79,788	-----	-----	-----	West (undetained)
9	Reservoir	24.77	1	804	1,375,305	7	951.87	1,526,531	West Routing
10	Combine	41.06	1	719	1,455,093	8, 9	-----	-----	west basin post dev
11	SCS Runoff	195.08	1	722	535,459	-----	-----	-----	East Basin - PreDev
12	SCS Runoff	65.47	1	719	165,486	-----	-----	-----	East Basin - Post Dev
Streets of West Pryor Detention June 18 Model					Return Period: 100 Year			Monday, 06 / 18 / 2018	



# Hydrograph Report

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Monday, 06 / 18 / 2018

## Hyd. No. 1

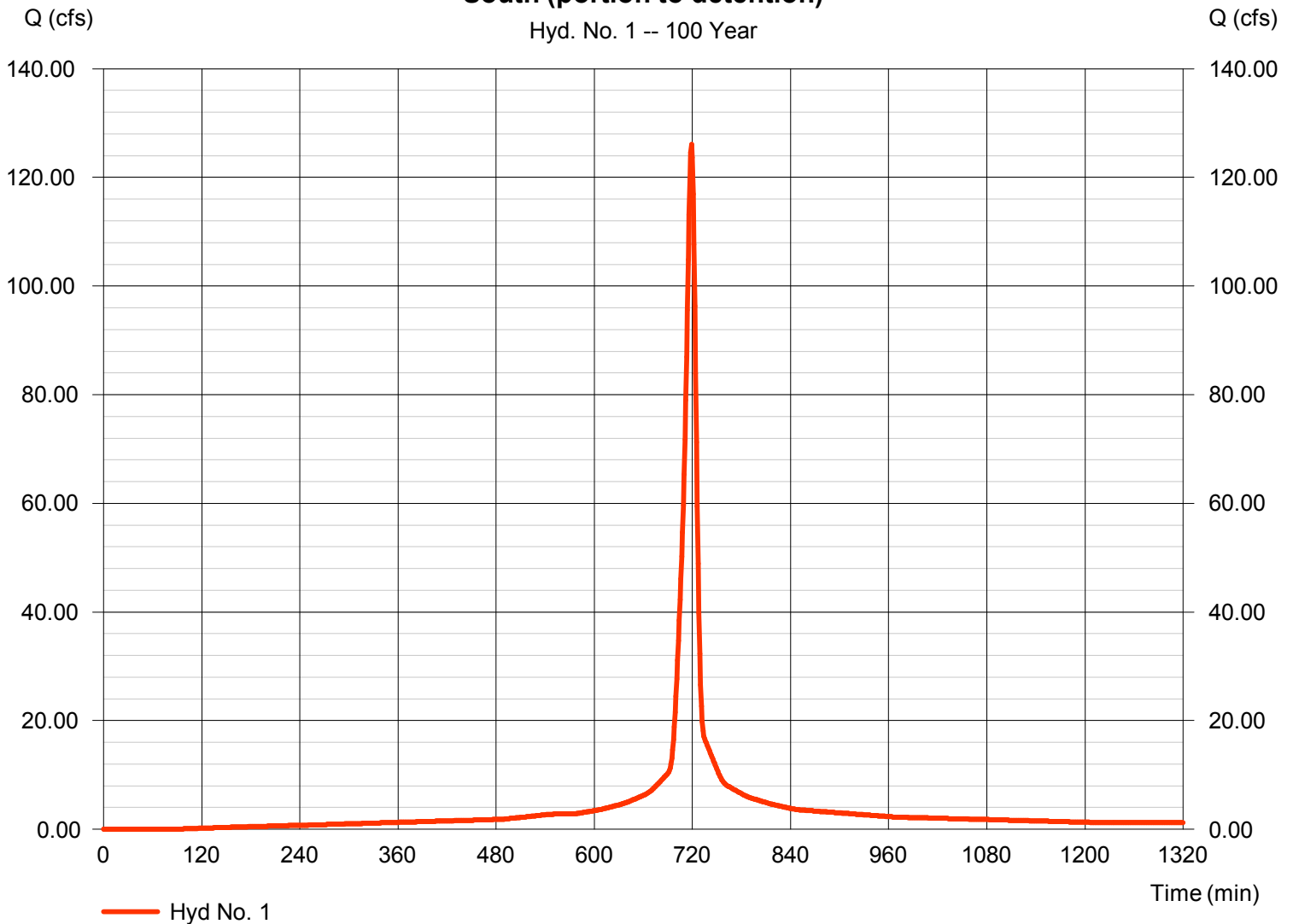
South (portion to detention)

Hydrograph type = SCS Runoff  
 Storm frequency = 100 yrs  
 Time interval = 1 min  
 Drainage area = 10.600 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 9.23 in  
 Storm duration = 24 hrs

Peak discharge = 126.10 cfs  
 Time to peak = 719 min  
 Hyd. volume = 327,289 cuft  
 Curve number = 94  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 10.00 min  
 Distribution = Type II  
 Shape factor = 484

### South (portion to detention)

Hyd. No. 1 -- 100 Year



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

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## Hyd. No. 2

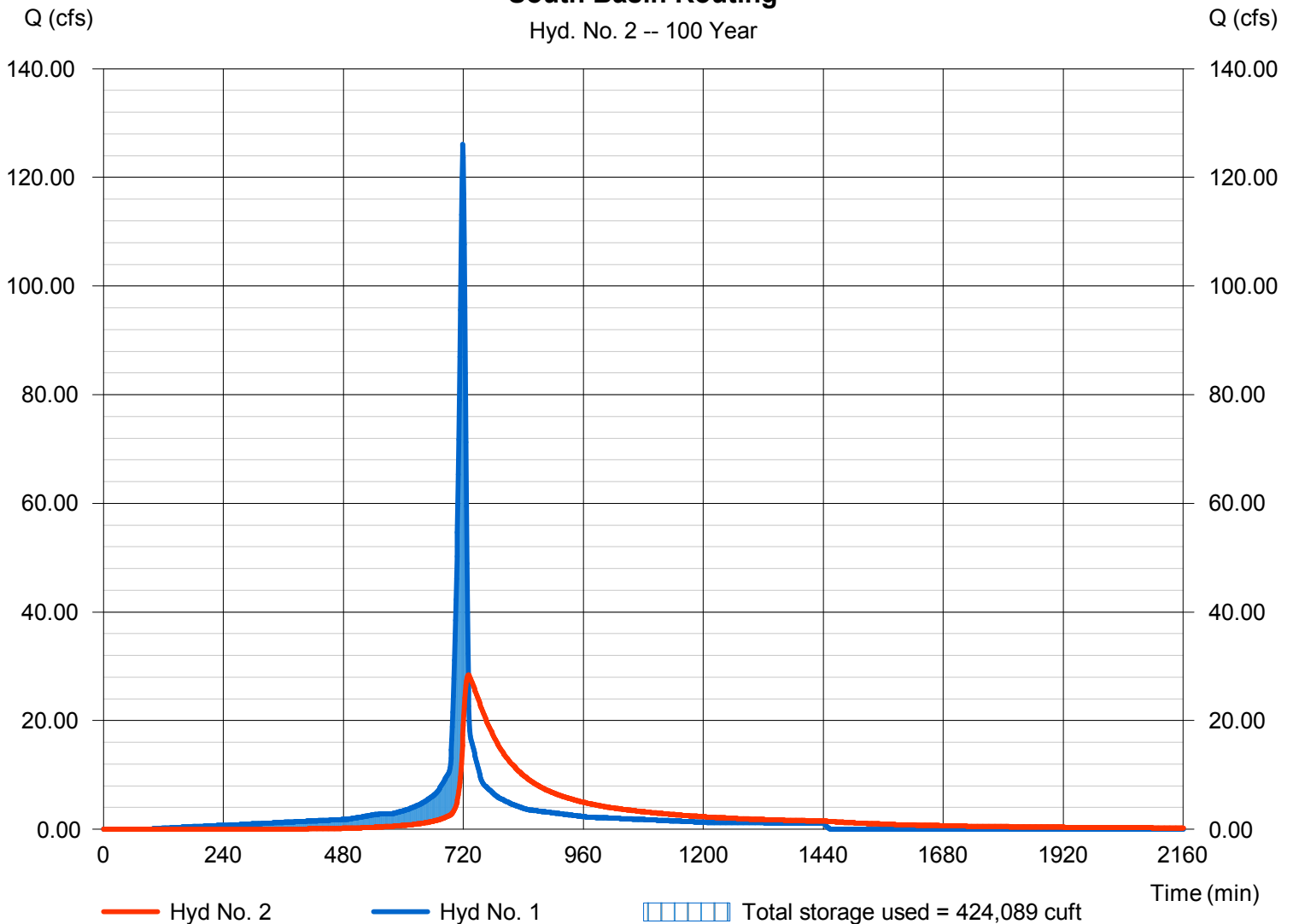
### South Basin Routing

Hydrograph type	= Reservoir	Peak discharge	= 28.42 cfs
Storm frequency	= 100 yrs	Time to peak	= 730 min
Time interval	= 1 min	Hyd. volume	= 310,317 cuft
Inflow hyd. No.	= 1 - South (portion to detention)	Max. Elevation	= 976.80 ft
Reservoir name	= SouthEast	Max. Storage	= 424,089 cuft

Storage Indication method used. Wet pond routing start elevation = 972.00 ft.

### South Basin Routing

Hyd. No. 2 -- 100 Year



# Hydrograph Report

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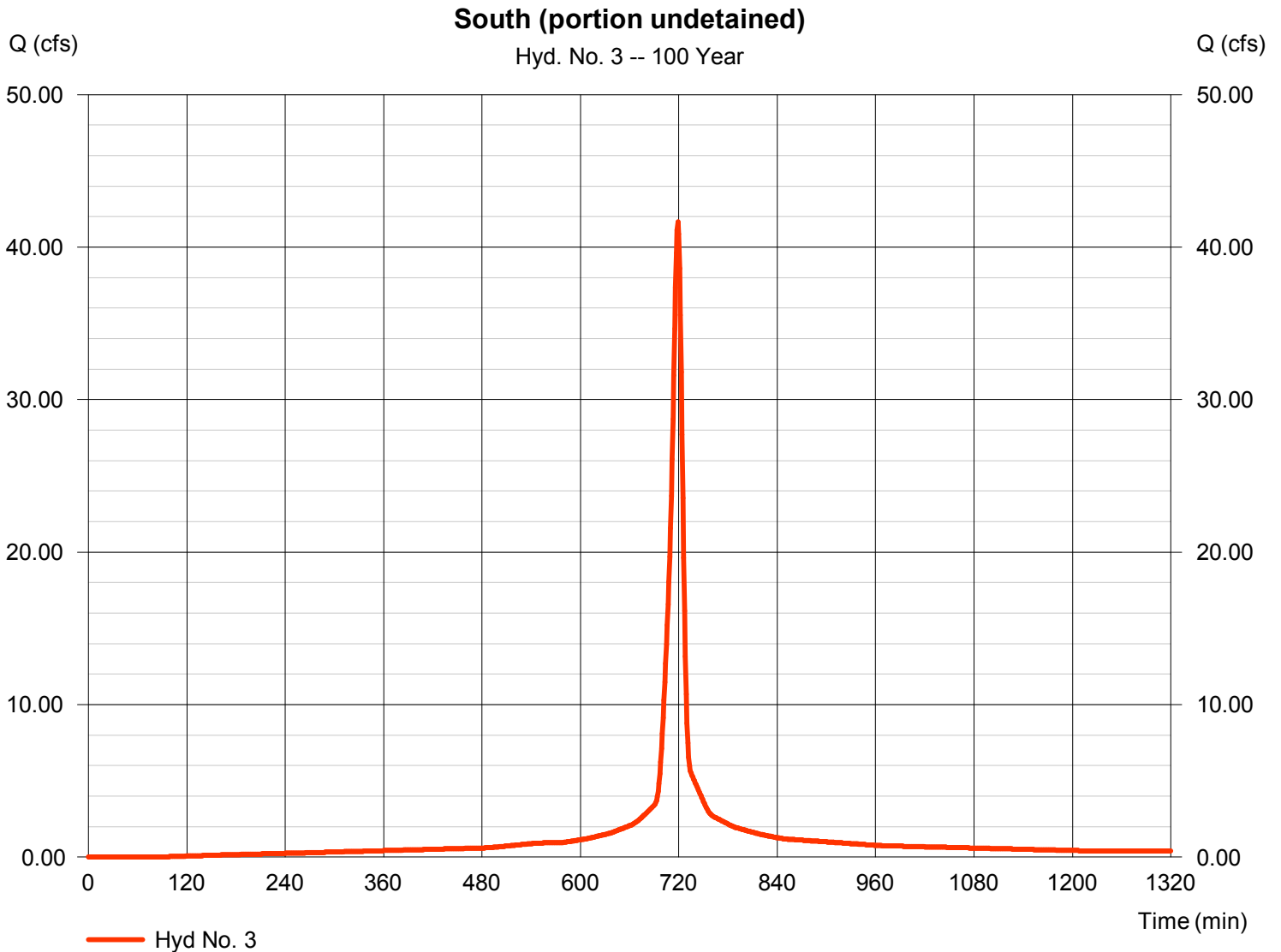
Monday, 06 / 18 / 2018

## Hyd. No. 3

South (portion undetained)

Hydrograph type = SCS Runoff  
 Storm frequency = 100 yrs  
 Time interval = 1 min  
 Drainage area = 3.500 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 9.23 in  
 Storm duration = 24 hrs

Peak discharge = 41.64 cfs  
 Time to peak = 719 min  
 Hyd. volume = 108,067 cuft  
 Curve number = 94  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 10.00 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

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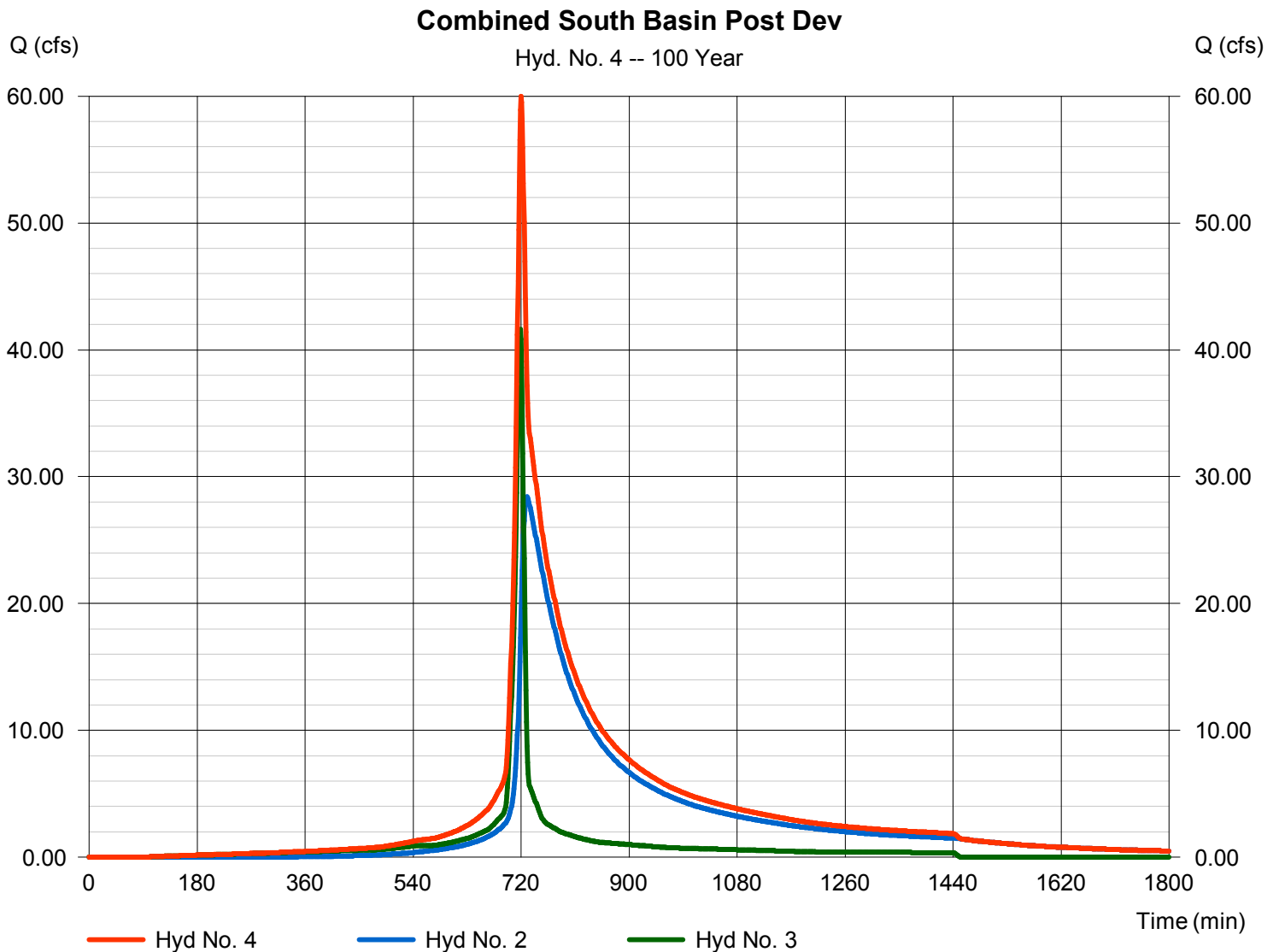
Monday, 06 / 18 / 2018

## Hyd. No. 4

### Combined South Basin Post Dev

Hydrograph type = Combine  
 Storm frequency = 100 yrs  
 Time interval = 1 min  
 Inflow hyds. = 2, 3

Peak discharge = 59.99 cfs  
 Time to peak = 720 min  
 Hyd. volume = 418,384 cuft  
 Contrib. drain. area = 3.500 ac



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

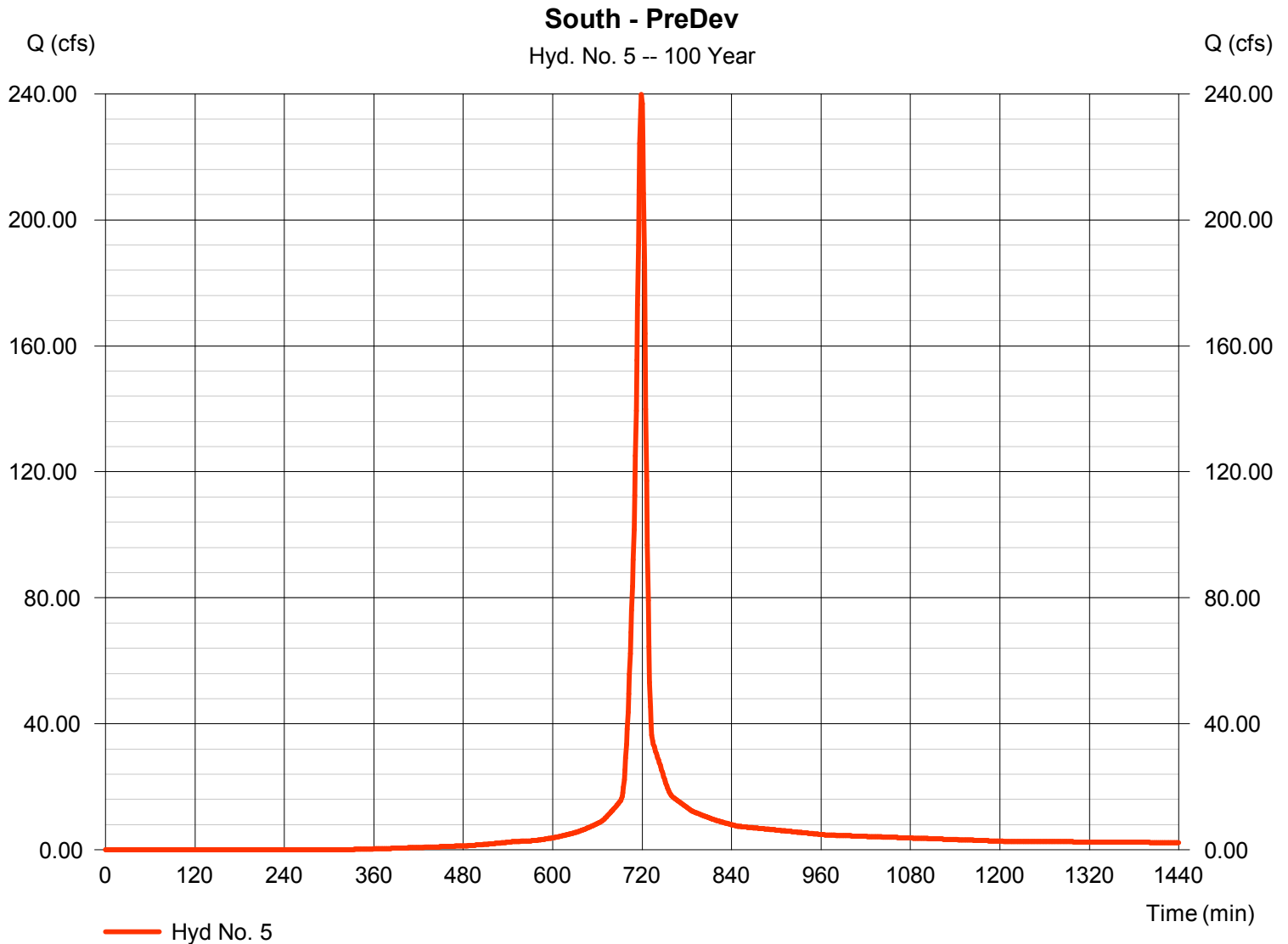
Monday, 06 / 18 / 2018

## Hyd. No. 5

South - PreDev

Hydrograph type = SCS Runoff  
 Storm frequency = 100 yrs  
 Time interval = 1 min  
 Drainage area = 24.000 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 9.23 in  
 Storm duration = 24 hrs

Peak discharge = 239.71 cfs  
 Time to peak = 719 min  
 Hyd. volume = 558,740 cuft  
 Curve number = 77  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 10.00 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

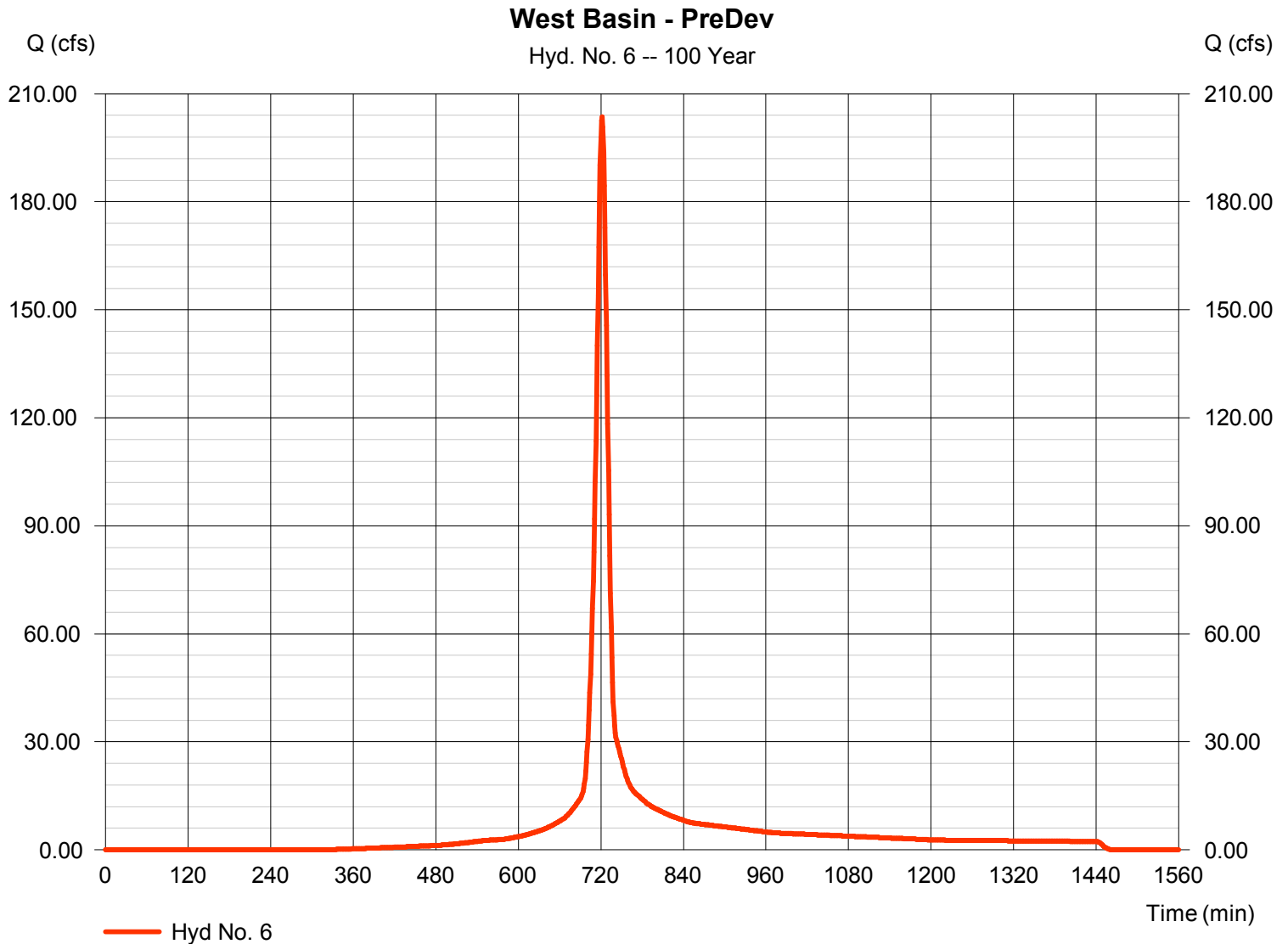
Monday, 06 / 18 / 2018

## Hyd. No. 6

West Basin - PreDev

Hydrograph type = SCS Runoff  
 Storm frequency = 100 yrs  
 Time interval = 1 min  
 Drainage area = 24.000 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 9.23 in  
 Storm duration = 24 hrs

Peak discharge = 203.56 cfs  
 Time to peak = 722 min  
 Hyd. volume = 558,739 cuft  
 Curve number = 77  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 15.00 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

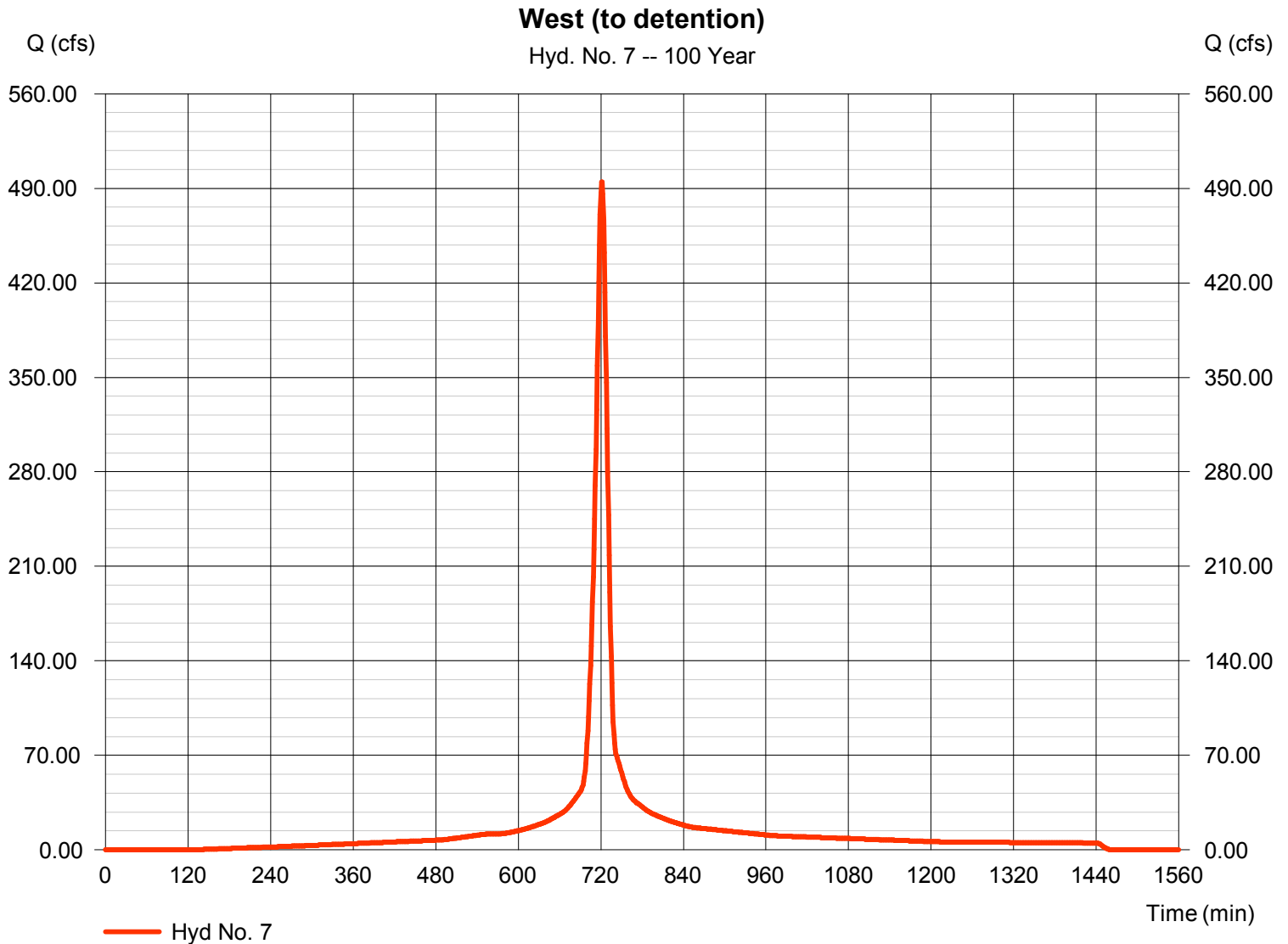
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

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## Hyd. No. 7

West (to detention)

Hydrograph type	= SCS Runoff	Peak discharge	= 494.82 cfs
Storm frequency	= 100 yrs	Time to peak	= 721 min
Time interval	= 1 min	Hyd. volume	= 1,462,778 cuft
Drainage area	= 49.500 ac	Curve number	= 91
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 9.23 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

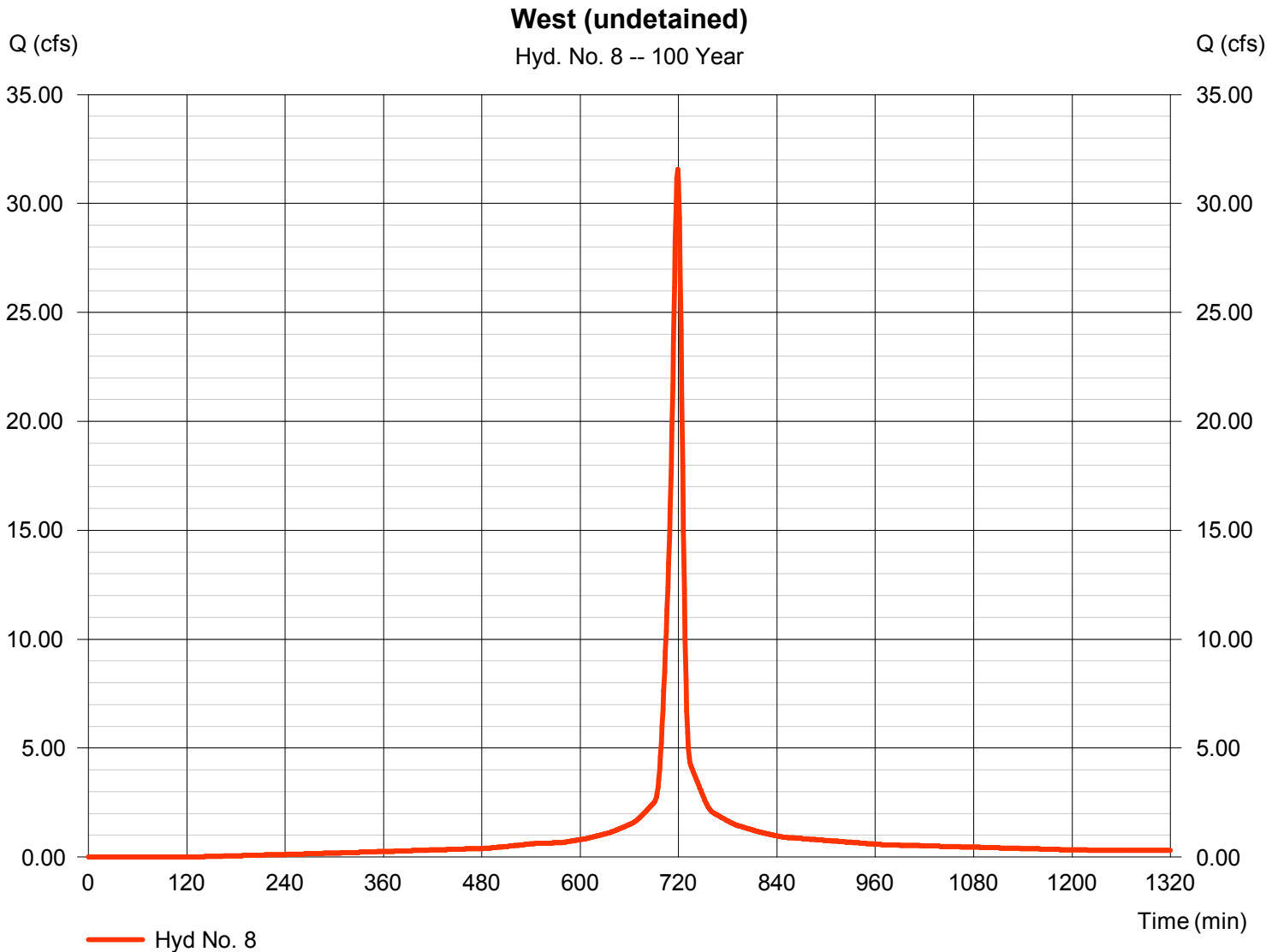
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

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## Hyd. No. 8

West (undetained)

Hydrograph type	= SCS Runoff	Peak discharge	= 31.57 cfs
Storm frequency	= 100 yrs	Time to peak	= 719 min
Time interval	= 1 min	Hyd. volume	= 79,788 cuft
Drainage area	= 2.700 ac	Curve number	= 91
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 9.23 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484





# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

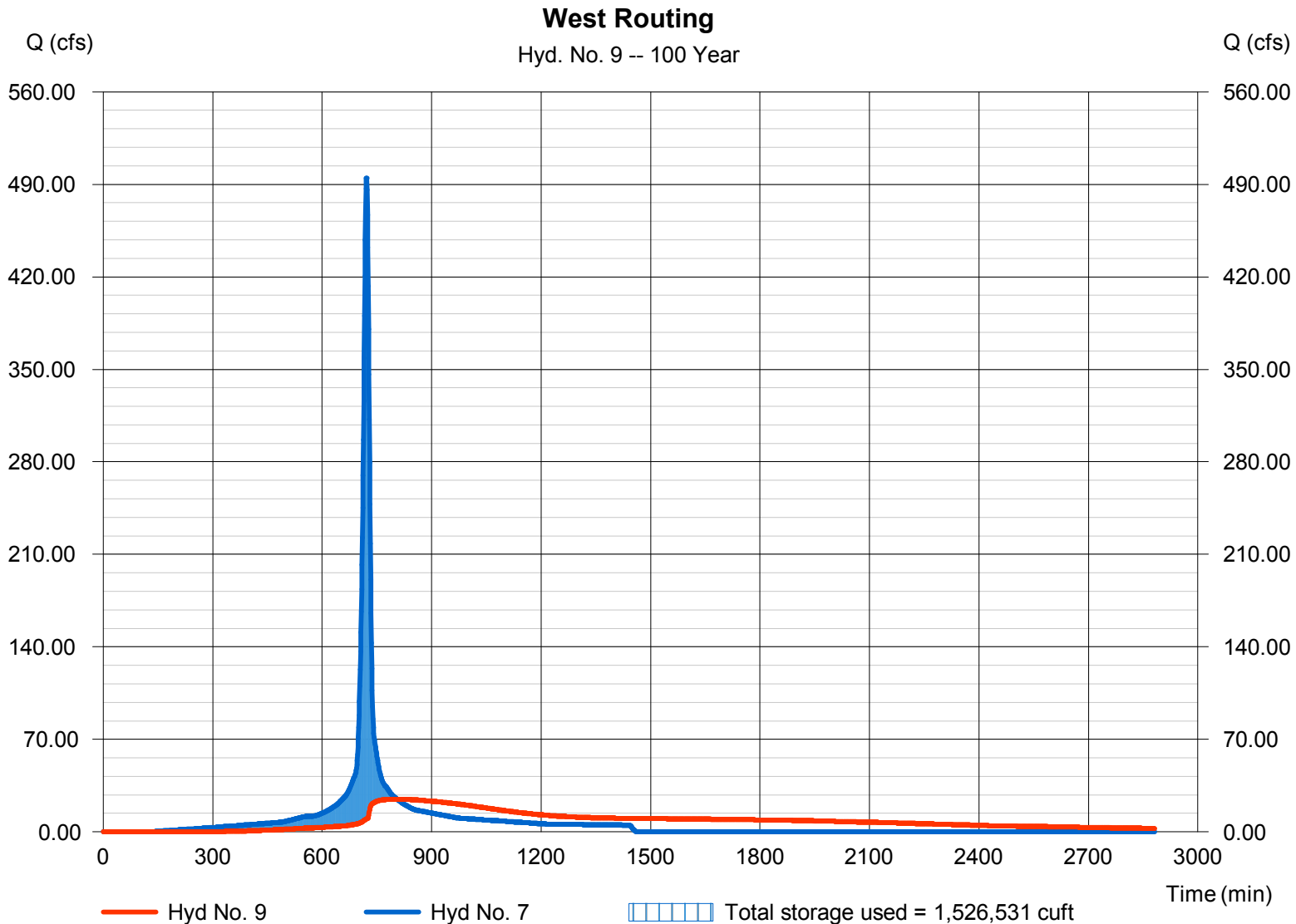
Monday, 06 / 18 / 2018

## Hyd. No. 9

### West Routing

Hydrograph type	= Reservoir	Peak discharge	= 24.77 cfs
Storm frequency	= 100 yrs	Time to peak	= 804 min
Time interval	= 1 min	Hyd. volume	= 1,375,305 cuft
Inflow hyd. No.	= 7 - West (to detention)	Max. Elevation	= 951.87 ft
Reservoir name	= West Basin	Max. Storage	= 1,526,531 cuft

Storage Indication method used. Wet pond routing start elevation = 942.00 ft.



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

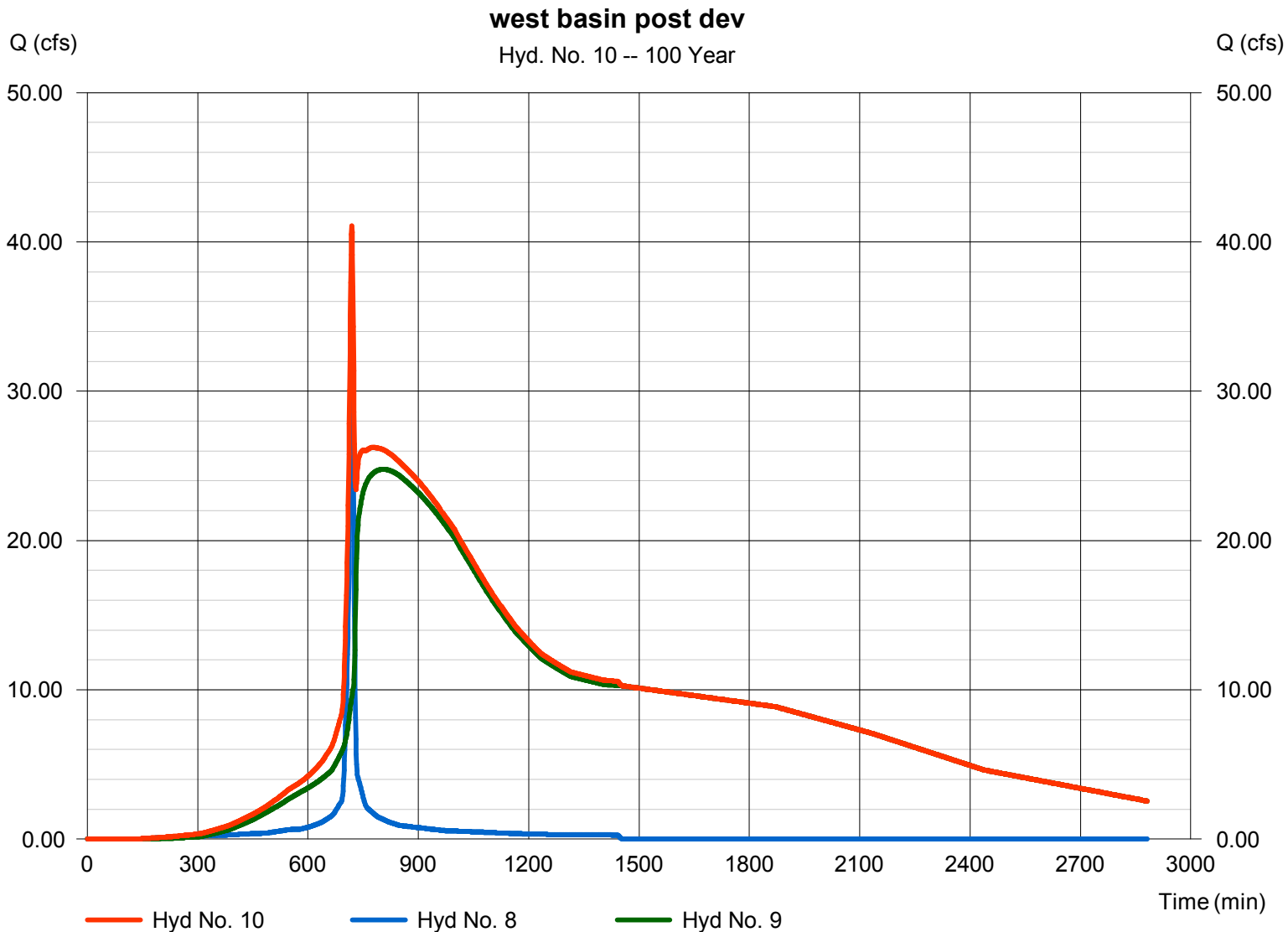
Monday, 06 / 18 / 2018

## Hyd. No. 10

west basin post dev

Hydrograph type = Combine  
 Storm frequency = 100 yrs  
 Time interval = 1 min  
 Inflow hyds. = 8, 9

Peak discharge = 41.06 cfs  
 Time to peak = 719 min  
 Hyd. volume = 1,455,093 cuft  
 Contrib. drain. area = 2.700 ac



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

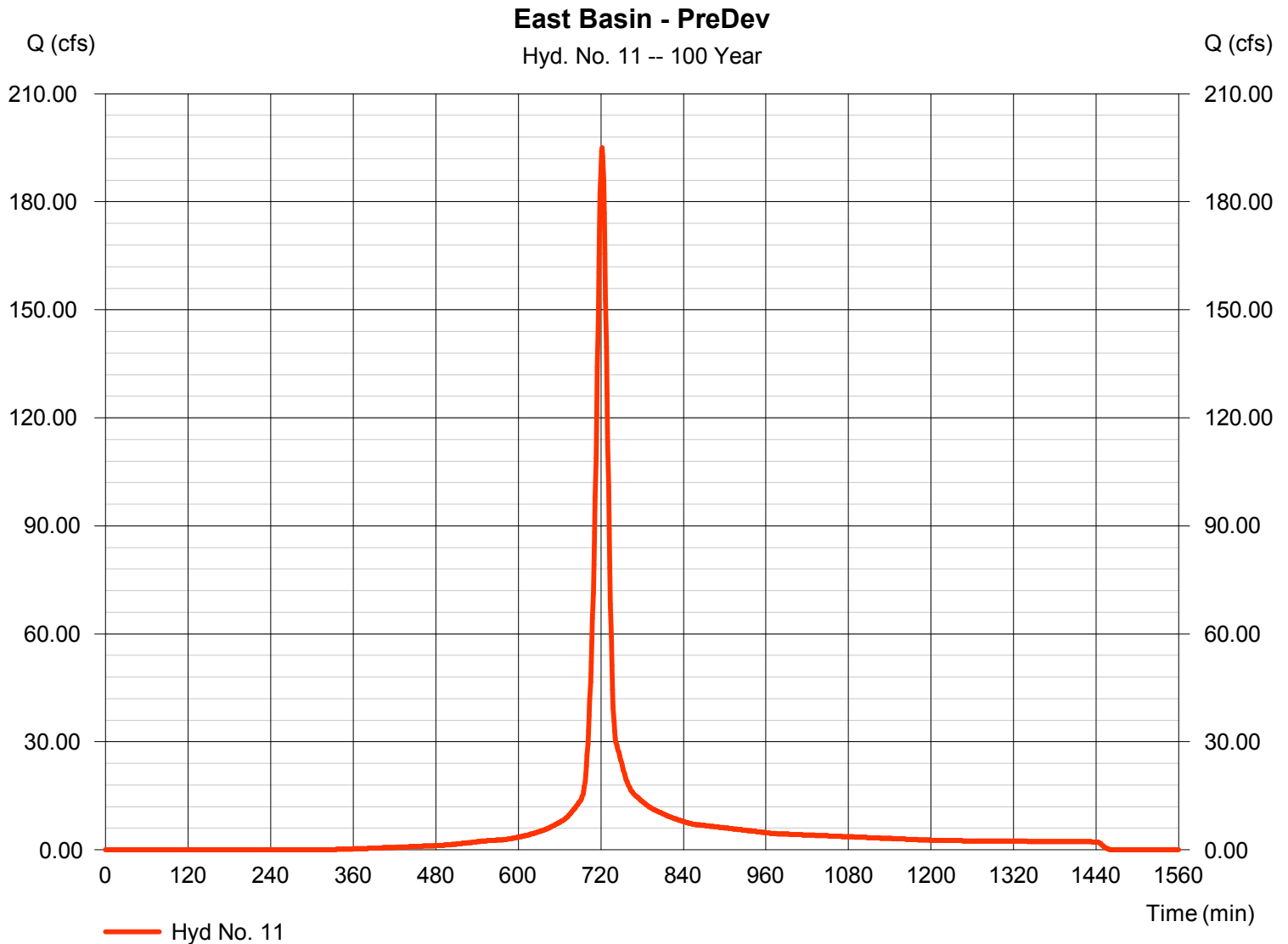
Monday, 06 / 18 / 2018

## Hyd. No. 11

East Basin - PreDev

Hydrograph type = SCS Runoff  
 Storm frequency = 100 yrs  
 Time interval = 1 min  
 Drainage area = 23.000 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 9.23 in  
 Storm duration = 24 hrs

Peak discharge = 195.08 cfs  
 Time to peak = 722 min  
 Hyd. volume = 535,459 cuft  
 Curve number = 77  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 15.00 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

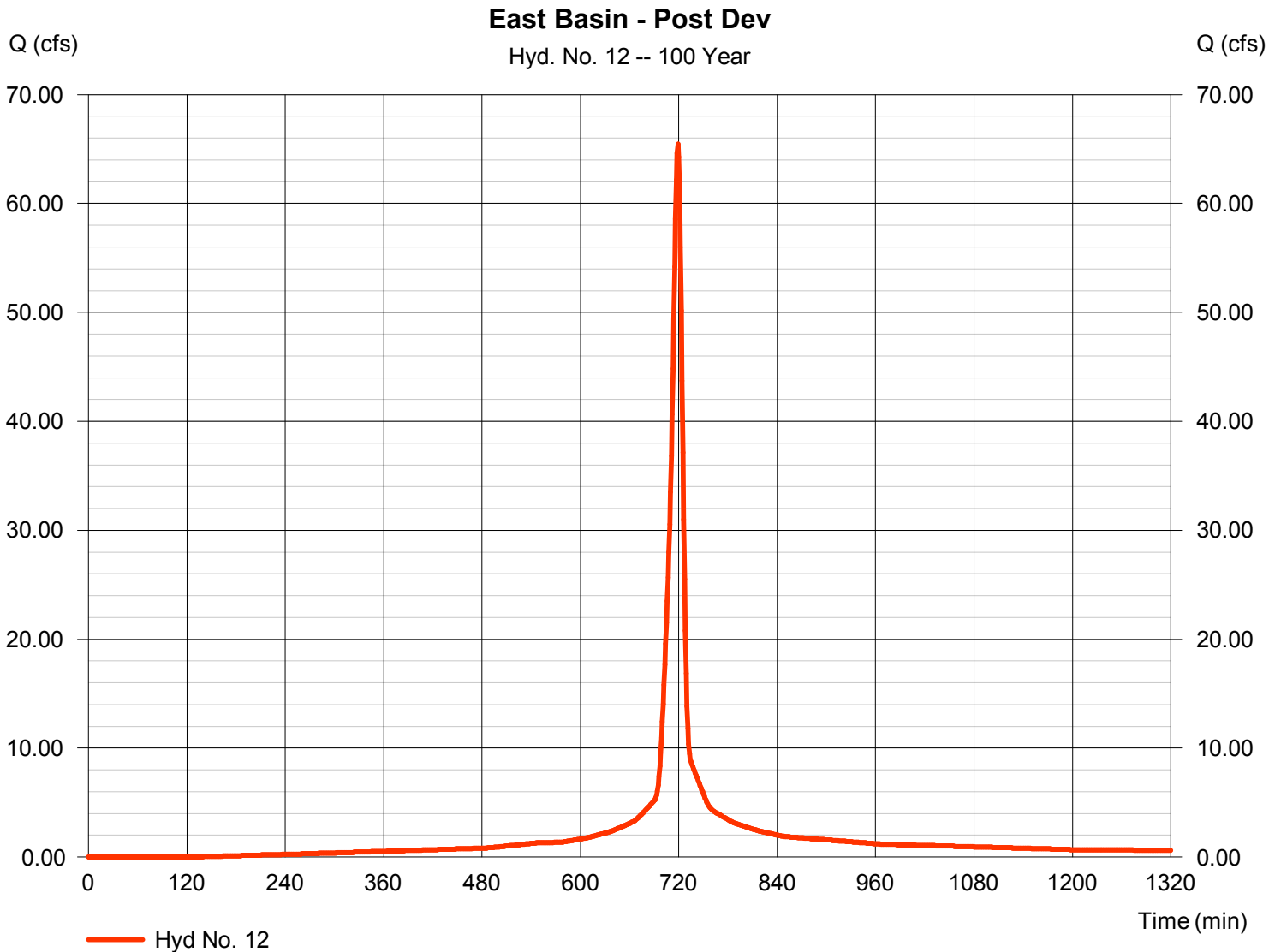
Monday, 06 / 18 / 2018

## Hyd. No. 12

### East Basin - Post Dev

Hydrograph type = SCS Runoff  
 Storm frequency = 100 yrs  
 Time interval = 1 min  
 Drainage area = 5.600 ac  
 Basin Slope = 0.0 %  
 Tc method = User  
 Total precip. = 9.23 in  
 Storm duration = 24 hrs

Peak discharge = 65.47 cfs  
 Time to peak = 719 min  
 Hyd. volume = 165,486 cuft  
 Curve number = 91  
 Hydraulic length = 0 ft  
 Time of conc. (Tc) = 10.00 min  
 Distribution = Type II  
 Shape factor = 484



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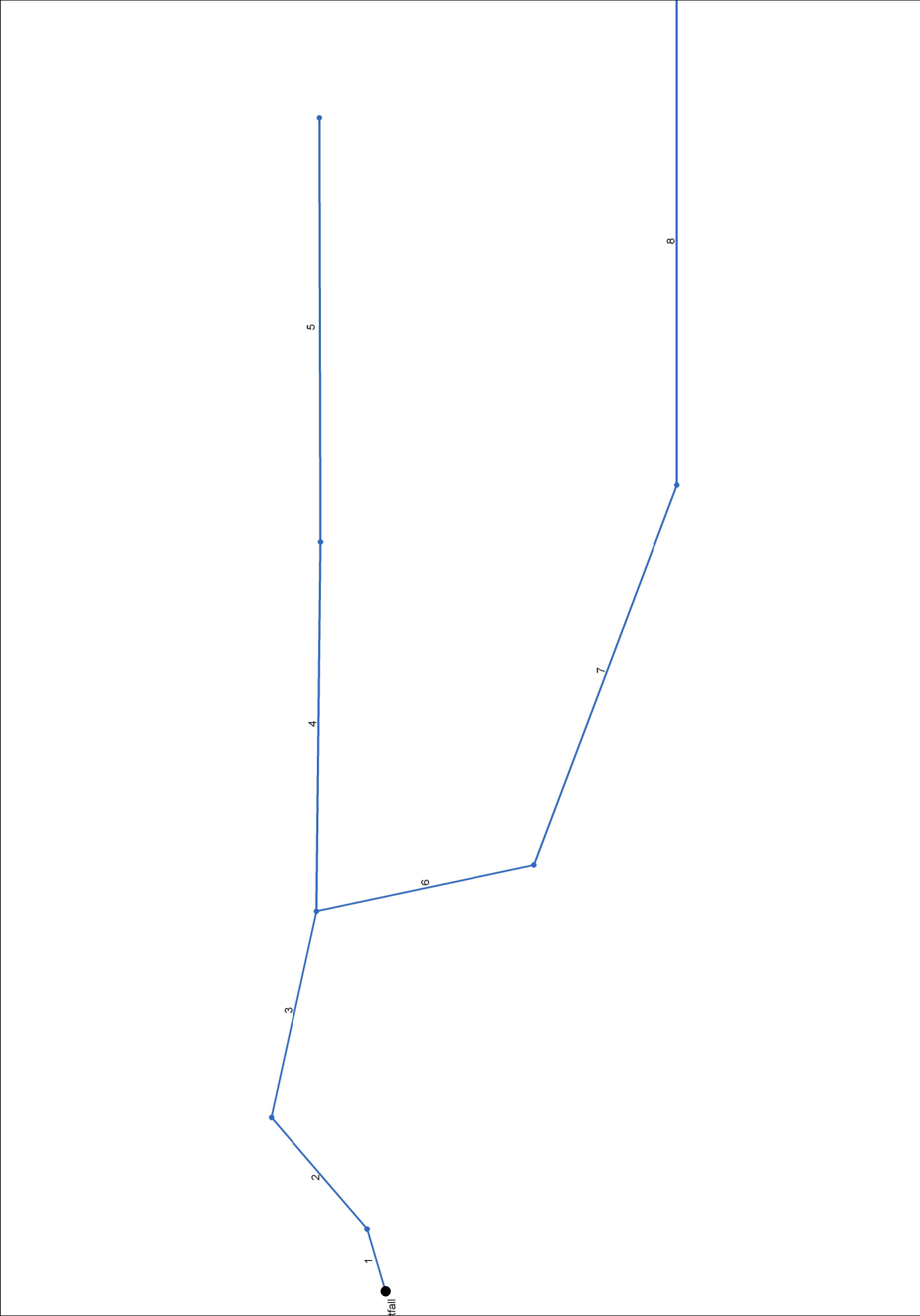
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## APPENDIX E – HYDRAFLOW STORM SEWER CALCULATIONS – SELECT PROFILES







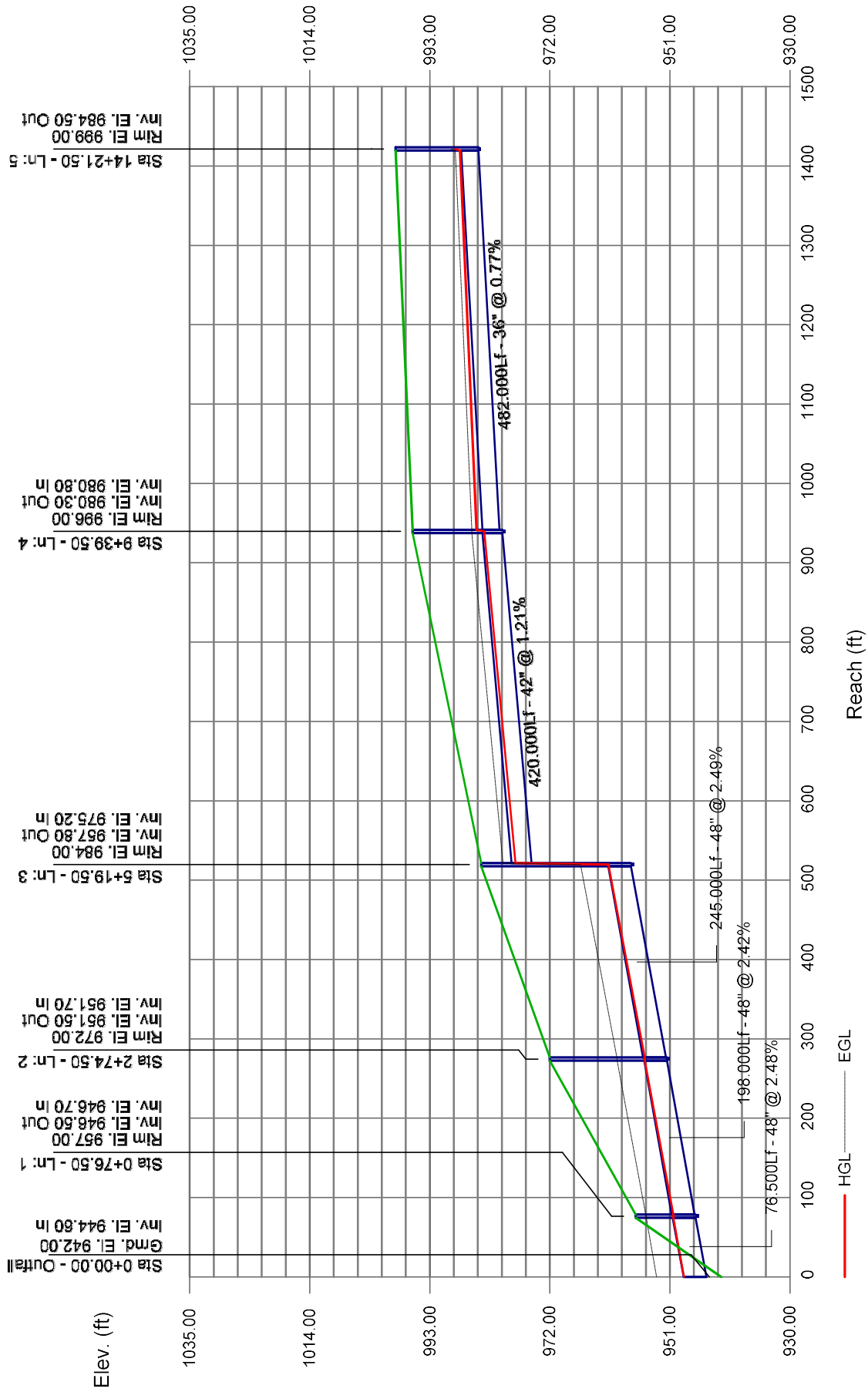
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# Storm Sewer Profile

Proj. file: 7067 Storm Sewer to West.stm



# Storm Sewer Profile

Proj. file: 7067 Storm Sewer to West stn

