



KAW VALLEY ENGINEERING, INC.

**PRELIMINARY PLAT
DRAINAGE REPORT/
STORMWATER MANAGEMENT STUDY**

**PROPOSED
COMMERCIAL DEVELOPMENT**

**(NWC) 29th STREET & GAGE BLVD
TOPEKA, KANSAS**

Revisions:

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KVE Project No. A14_6828



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INTRODUCTION

This drainage report was prepared to accompany the submittal of a preliminary plat for the redevelopment of an existing site. This drainage report falls under the category “A” guidelines for Preliminary Plat Drainage Report Requirements and has been prepared pursuant to Section 1.3.7.1 of the Topeka Design Criteria and Drafting Standards, Pages 1-41 to 1-43.

The project site has also been analyzed to determine the need for any required water quality mitigation pursuant to the Manual of Best Management Practices For Storm water Quality (August 2009)

PROJECT LOCATION

The project site is located on the northwest corner of the intersection of SW 29th Street and SW Gage Boulevard Topeka, Kansas. The project site is bound to the east by SW Gage Boulevard, to the west by existing single family housing, to the north and northeast by SW 28th Terrace and single family residences, and to the south by SW 29th Street.

The property sits on Lots 5-8 and 15-21 of Block C, Westview Heights Estates.



Location Map

DRAINAGE ANALYSIS AND CALCULATIONS

The project site was analyzed and improved pursuant to the Mid-America Regional Council (MARC) Manual of Best Management Practices (BMP's) for Storm Water Quality (August 2009) and the City of Topeka Design Criteria and Drafting Standards (February 2008).

The National Resource Conservation Service and Rational methods were used to determine storm water runoff volumes and peak flows. The composite cumulative "C" and "CN" values were calculated from the percentages of pervious and non-pervious areas taken from aerial imagery and current survey information of the site. The Time of Concentration computational methods were taken from Chapter 6 of the MARC BMP Manual and the Topeka Design Criteria and calculated using the Technical Release 55 (TR-55). Hydraflow Hydrographs and Hydraflow Storm Sewer for AutoCAD Civil 3d 210 were utilized to model the drainage system, storm sewers, and analyze site conditions and flows. The 10 and 100 year storm events were selected to calculate the storm water runoff flow rates for the project site. See Appendix C and D for Hydraulic calculations.

EXISTING SITE DRAINAGE AND STORM WATER APPURTENANCES

The existing site is currently 11 single family residences. Of those 11, 7 are accessed from 29th street or Gage, and 4 are accessed from SW 28th Terrace. 95% of the project site currently drains northwest to SW 28th Terrace. A small drainage area on the east side of the project site drains to Gage Blvd. There are no existing storm water structures or appurtenances on the project site.

PROPOSED ONSITE DRAINAGE

The proposed site will be re-graded with approximately 6-7 feet of fill in the center of the site. Since the redevelopment will increase the amount of impervious material onsite, the majority of the storm water runoff from the proposed improvements will be captured on site and routed to a detention pond in the northeast corner of the property. See the following chart for the existing and proposed land cover types:

Pre / Post Site Land Cover		
	Existing (acres)	Proposed (acres)
Impervious	0.98	1.73
Pervious	2.00	1.25
Totals	2.98	2.98
Composite C Value	0.50	0.66
Composite CN Value	82	88

Pre / Post Site Land use

The following charts holds the pre and post development storm water discharges;

Pre / Post Site Discharges (w/o Detention)		
Design Storm	Existing (cfs)	Proposed (cfs)
50% (2 Year)	3.067	11.04
20% (5 Year)	8.61	14.74
10% (10 Year)	10.85	17.92
4% (25 Year)	14.10	22.46
2% (50 Year)	16.72	26.08
1% (100 Year)	19.43	29.82

Pre / Post Site Runoff

6 curb inlets will capture site flows and direct them to the onsite detention, while two curb inlets will capture small drainage areas in the southeast corner of the site and discharge to an existing inlet on the west side of Gage Blvd. See the following Chart for sub-drainage area calculations and Appendix A for an existing and proposed drainage area maps;

Watershed	Area	Perv %	Imperv %	Perv ac.	Imperv ac.	Composite C		Composite CN	
						0.3	0.9	74	98
A1	0.12	0.00%	100.00%	0.000	0.120	0.90	98		
A2	0.14	0.00%	100.00%	0.000	0.140	0.90	98		
A3	0.26	35.00%	65.00%	0.091	0.169	0.69	90		
A4	0.29	45.00%	55.00%	0.131	0.160	0.63	87		
B1	0.17	0.00%	100.00%	0.000	0.170	0.90	98		
B2	0.26	40.00%	60.00%	0.104	0.156	0.66	88		
C1	0.05	0.00%	100.00%	0.000	0.050	0.90	98		
C2	0.48	16.00%	84.00%	0.077	0.403	0.80	94		
Roof	0.34	0.00%	100.00%	0.000	0.340	0.90	98		
Detention Pond	0.35	100.00%	0.00%	0.350	0.000	0.30	74		
Offsite A	0.32	100.00%	0.00%	0.320	0.000	0.30	74		
Offsite B	0.2	90.00%	10.00%	0.180	0.020	0.36	76		
Totals	2.98	-----	-----	1.252	1.728	0.65	88		

Sub-Drainage Area Calculations

PROPOSED DETENTION POND

The detention pond will discharge to the existing inlet on the west side of Gage Blvd approximately 360 feet to the northeast of the intersection. The existing system along Gage Blvd did not receive any significant flow from the existing project site so the detention pond is limited to discharging no more than the capacity of the existing storm sewer system along Gage Blvd.

The proposed detention pond will have the following characteristics;

Detention Pond	
Top of Pond (ft.)	927
Bottom of Pond (ft.)	922
Available Volume (ft ³)	22,800
Total Volume Used (ft ³)	22,611
Discharge Orifice (in.)	10
Discharge Pipe (in.)	15
Freeboard (ft.)	1.03
Max Side slopes (ft.)	3:1
Max 100 year W.S.E.	925.97

Detention Pond Design

Total Pre and Post development Discharges with Detention						
Design Storm	Predev Site Discharge	Detention Pond Discharges	Undetained Flows to Offsite	Postdev Total Site Discharge	Flow Reduction Pre - Post	Percent Reduction Pre - Post
		(cfs)	(cfs)	(cfs)	(cfs)	(%)
50% (2 Year)	6.067	2.174	1.121	3.013	-3.054	-50.34%
20% (5 Year)	8.607	2.591	1.674	3.989	-4.618	-53.65%
10% (10 Year)	10.85	2.915	2.179	4.764	-6.086	-56.09%
4% (25 Year)	14.1	3.343	2.942	5.876	-8.224	-58.33%
2% (50 Year)	16.72	3.654	3.567	6.756	-9.964	-59.59%
1% (100 Year)	19.43	3.953	4.221	7.651	-11.779	-60.62%

Detention Pond Calculations

The detention pond is designed to reduce the post development flows by a full 50% in the 2 year design storm and 60% in the 100 year design storm to allow the existing system along Gage Blvd to accommodate the proposed flows.

EXISTING STORM SEWER SYSTEM

The existing storm sewer system consists of 3 curb inlets just to the north of the intersection along Gage Blvd and an additional 2 curb inlets approximately 300 feet to the northeast. Each inlet discharge through a 15" CMP into the storm sewer main line consisting of an 18" RCP. As mentioned before, the detention pond will discharge to the existing curb inlet on the west side of Gage at the northeast corner of the property. An additional two small drainage areas will also be discharged to the curb inlet on the west side of Gage on the northwest corner of the intersection. The following charts shows the existing and proposed flows in the storm sewer system along Gage Blvd.

Existing and Proposed Flows - Gage Blvd Storm Sewer			
	10-Year	25-Year	Capacity*
Existing Outflow into 18" Pipe Flowing North (cfs)	5.77	6.62	7.44
Proposed Discharge from Pond to Exist. Inlet (cfs)	3.14	3.63	2.53
Proposed Discharge from the Parking Lot to Exist. Inlet (cfs)	2.14	2.48	4.63
Proposed Discharge into 18" Pipe Flowing North (cfs)	10.57	12.03	7.44
Difference from Existing Discharge to Proposed Discharge	4.8	5.41	--
*Existing Storm sewer is surcharged above pipe crown but the hydraulic grade line does not exceed the top of inlet			

In summing up the results contained in the above charts; the site will shift more of the hydraulic load to the storm sewer along Gage Blvd. The proposed flows will not cause existing system to overflow in the 10 or 25 year storm events. The 50 and 100 year storm events will overflow in inlet that the detention pond is discharging to. The spread in the street will be limited to the short 1200' before the storm sewer system discharges to Shunganunga Creek. The spread in the street will effectively be reduced since the majority of the existing site flows that previously discharged onto SW 28th Terrace and then to Gage Blvd, will now be detained and directed to the underground system along Gage Blvd instead. See Appendix D for the Hydraflow Storm Sewer report pages.

OVERFLOW ACCOMODATIONS AND DOWNSTREAM EFFECTS

As mentioned above, the proposed storm sewer flows will over flow a single existing inlet at the northeast corner of the site in the 50 and 100 year design storms. However, there will be a net reduction in gutter flow on Gage, partly by reducing total site flows by approximately 50% to 60% with the detention pond, and partly by directing those reduced site flows to the storm sewer system along Gage instead of directly onto SW 28th Terrace which eventually discharged to Gage in the first place. Gutter flow calculations will be provided in the final storm water report.

It is also recommended that a small 4" diameter overflow pipe be provided that discharges from the proposed detention pond to the curb along SW 28th Terrace. The overflow pipe would reduce the size of the proposed detention pond, and relieve some of the overflow discharge occurring in the 50 and 100 year storm events along Gage. Any overflow discharge through a 4" overflow would still be a reduction in flow from the pre development condition of the site where almost

the entire site discharge to SW 28th Terrace. The 4" diameter overflow pipe would be designed so that the total post development site discharge would still be below predevelopment levels as well as provide a net reduction in flow to SW 28th Terrace

STORMWATER TREATMENT

The APWA / MARC BMP Manual section 4.2.1 Predevelopment and Postdevelopment Conditions, was used given that the site was already developed. The increase in the onsite impervious area requires that BMP's will need to installed. The calculated LOS came to be 5.3 with a required VR of 10.58. To meet the required VR, the site storm water discharges will be routed through a treatment train consisting of curb inlets equipped with hydrodynamic separators and then to the extended dry detention pond. The following chart holds the proposed BMP's and treatment train calculations.

Acres	BMP Descriptions & Combinations	Water Quality Value	Volume Red.	Temp. Red.	Oils & Floatables Red.	Overall Value Rating	VR x Area
2.11	TT - Cyclone Inlet to Ext. Dry Detention	3	1	0	2	6	12.66
0.35	Extended Dry Detention Footprint	0	0	0	0	0	0.00
0.52	To Offsite	0	0	0	0	0	0.00
2.98						Proposed VR	12.66
						Required VR	10.58

The above BMP configuration is preliminary in nature and further consideration will be given to other possible BMP's as the project proceeds to final design. Natural BMP's will be given preference over mechanical BMP's so the final design may include native plantings and vegetative filter strips if feasible given the site layout and grading.

See Appendix B for MARC BMP calculations.

FEMA FIRM MAP

A small portion on the north side of the proposed property is covered by FIRM map number 20177C0213E, effective September 29, 2011. A FIRMette of the project location is shown in Appendix E and noted on the drainage area maps in Append A

CONCLUSION

The proposed development will improve site conditions by capturing storm water onsite, detaining it in a detention pond, and discharging it to the existing system along Gage Blvd instead of directly to SW 28th Terrace. Storm water street spread will effectively be reduced in both SW 28th Terrace and Gage Blvd. Best Management practices will be implemented by passing storm water through with curb inlets equipped with hydrodynamic separators and through the extended dry detention pond for a reduction in oils, floatables, and silt.

APPENDIX A – DRAINAGE AREA MAPS

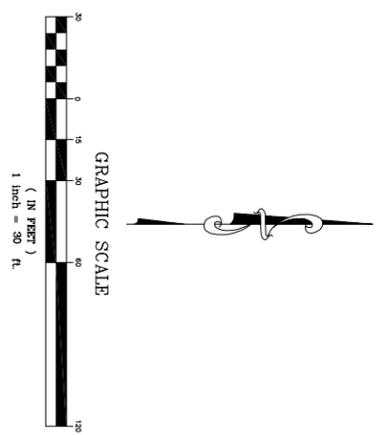
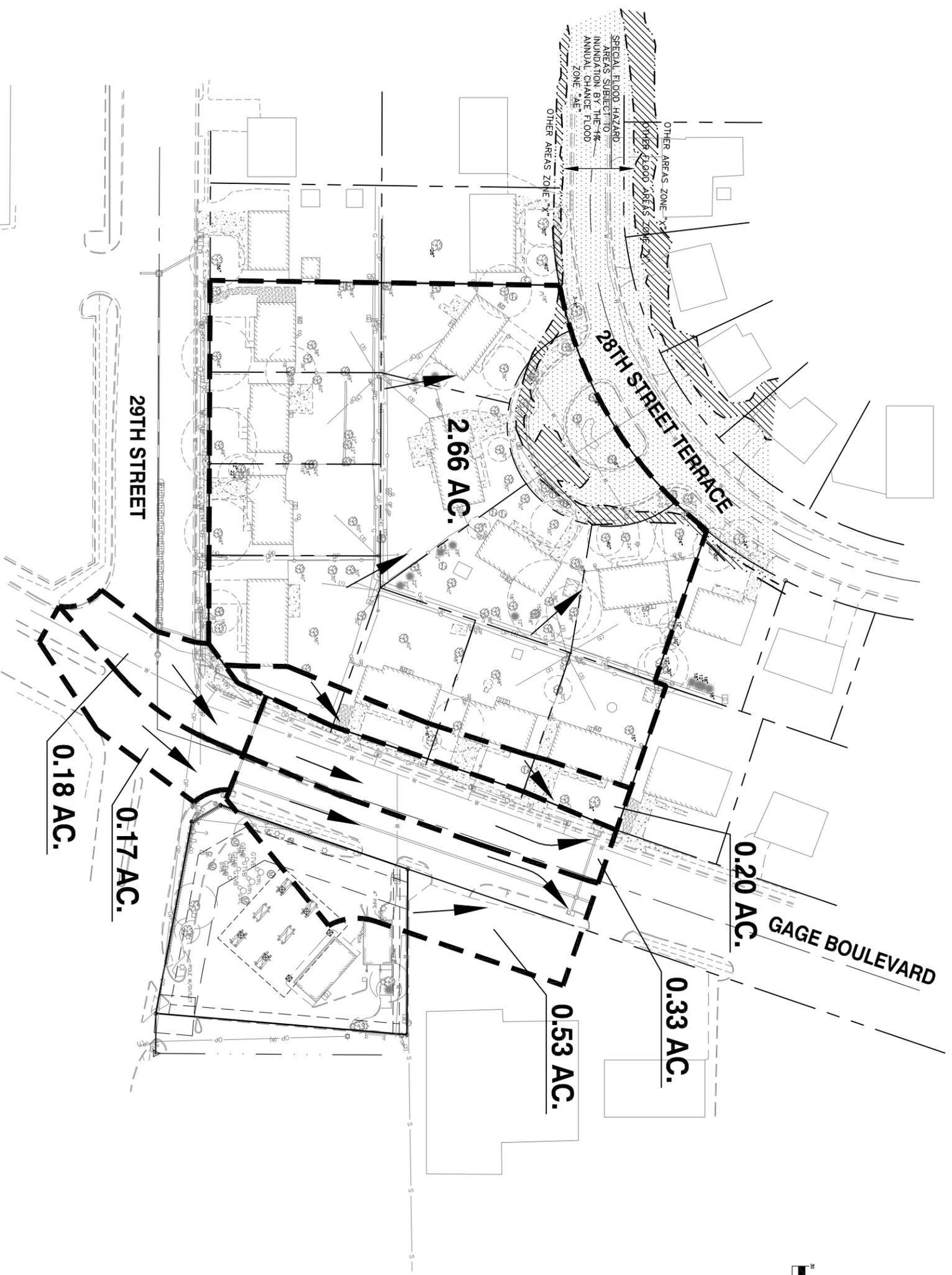
APPENDIX B – MARC BMP CALCULATIONS

APPENDIX C – HYDRAFLOW HYDROGRAPH REPORT PAGES

APPENDIX D – HYDRAFLOW STORM SEWER REPORT PAGES

APPENDIX E – FEMA FIRM MAP

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PROJ. NO.	A14.6828
DESIGNER	JB
DRAWN BY	JT
CEN	JT
REV	
SHEET	0
1 OF 2	

COMMERCIAL DEVELOPMENT
29TH STREET & GAGE BOULEVARD
TOPEKA, KANSAS

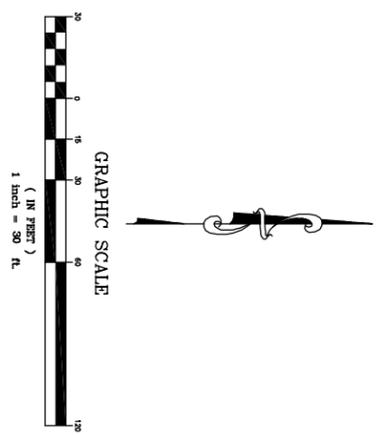
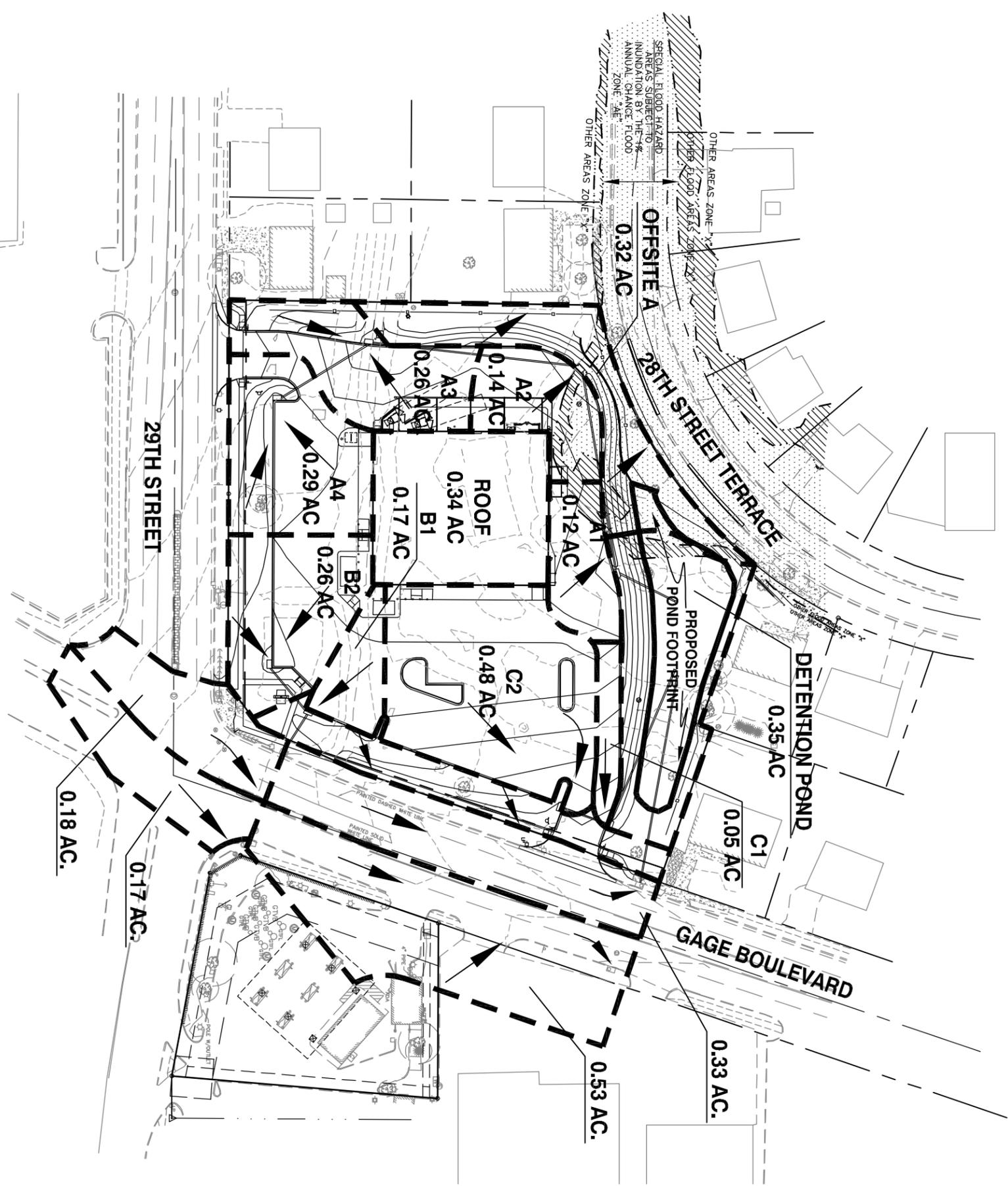
EXISTING DRAINAGE AREA MAP

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JUNCTION CITY, KS | KANSAS CITY, MO | LENEXA, KS | SALINA, KS | EMPORIA, KS

REV	DATE	DESCRIPTION	DSN	DWN	CHK
0	4-30-14	INITIAL ISSUE	JB	JT	BJ

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PROJ. NO.	A14.6828
DESIGNER	JB
DRAWN BY	JT
CHK	JB
REV	
SHEET	1 OF 2

COMMERCIAL DEVELOPMENT
29TH STREET & GAGE BOULEVARD
TOPEKA, KANSAS

PROPOSED DRAINAGE AREA MAP

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REV	DATE	DESCRIPTION	DSN	DWN	CHK	
0	4-30-14	INITIAL ISSUE		JB	JT	BJ

REV	DATE	DESCRIPTION	DSN	DWN	CHK	
0	4-30-14	INITIAL ISSUE		JB	JT	BJ

WORKSHEET 1A: REQUIRED LEVEL OF SERVICE - DEVELOPED SITE

Project: *Proposed Commercial Redevelopment*

By: *Joshua Bizlinski* Date: *4/30/2014*

Location: *SW 29th Street & Gage Blvd*

Checked: _____ Date: _____

1. Required Treatment Area

A. Total Area Disturbed by Redevelopment Activity (ac.)

Disturbed Area Description	Acres
<i>Single Family Residences</i>	<i>2.9793</i>
"1A" Total:	<i>2.9793</i>

B. Existing Impervious Area Inside Disturbed Area (ac.)

Existing Impervious Area Description	Acres
<i>Roofs and Parking</i>	<i>0.9882</i>
"1B" Total:	<i>0.9882</i>

C Required Treatment Area (ac.)

"1A" Total Less "1B" Total "1C" *1.9911*

2. Percent Impervious in Postdevelopment Condition and Level of Service (LS)

A. Total Postdevelopment Impervious Area Inside Disturbed Area (ac.)

Postdevelopment Impervious Area Description	Acres
<i>Proposed Building & Parking Lot</i>	<i>1.7268</i>
"2A" Total:	<i>1.7268</i>

B. Existing Impervious Area Inside Disturbed Area (ac.)

"1B" Total: *0.9882*

C. Net Increase in Impervious Area (ac.)

"2A" Total Less "1B" Total "2C" *0.7386*

D. Percent Impervious

Net Increase in Impervious Area / Required Treatment Area
 "2C"/"1C" x 100 *37* (Round to Integer)

E. Level of Service

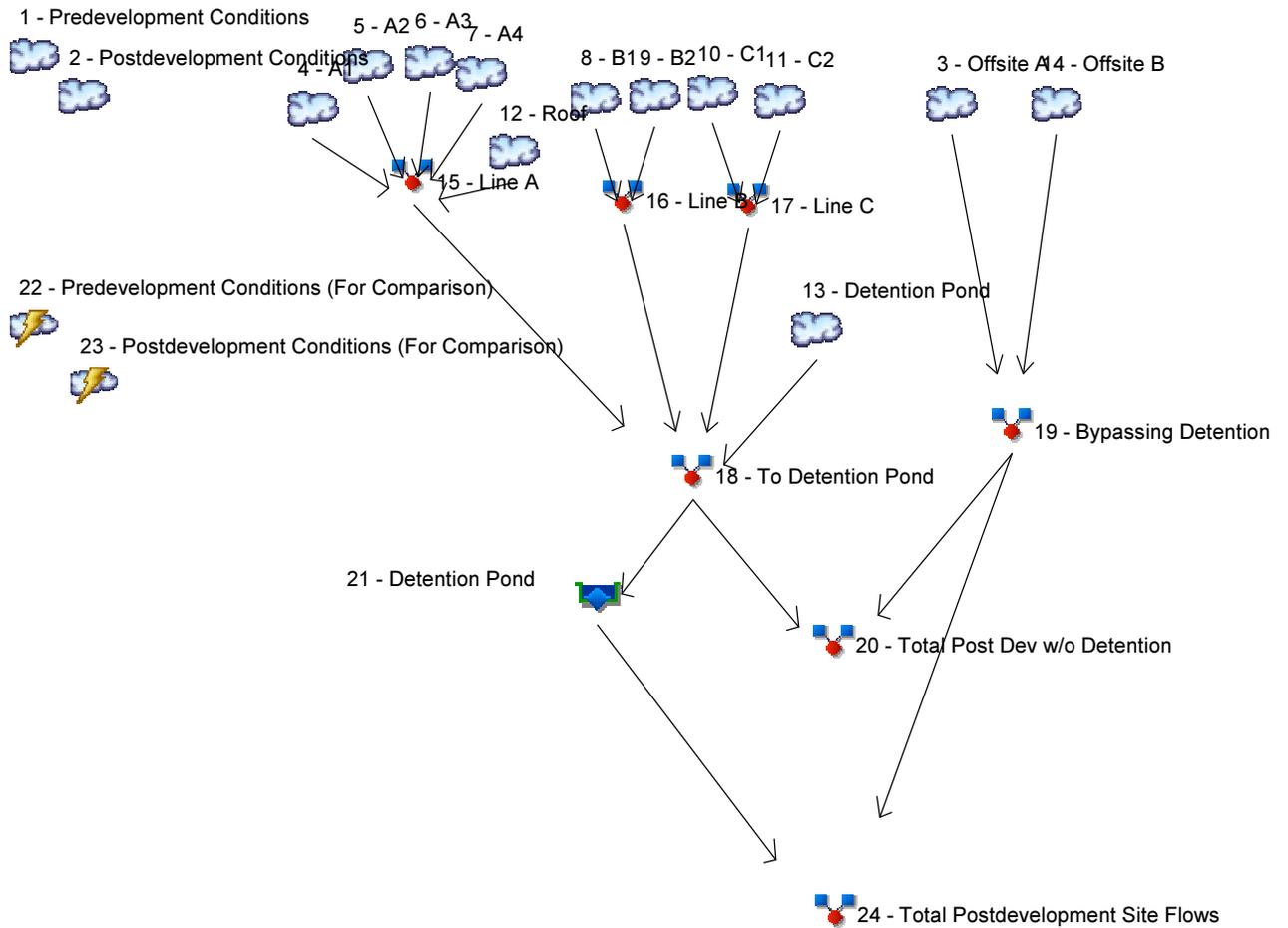
Use Percent Impervious to Enter Table XX LS = *5.3*

3. Minimum Required Total Value Rating of BMP Package

Total Value Rating = LS x Required Treatment Area VR = *10.58*

Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2010 by Autodesk, Inc. v9.25



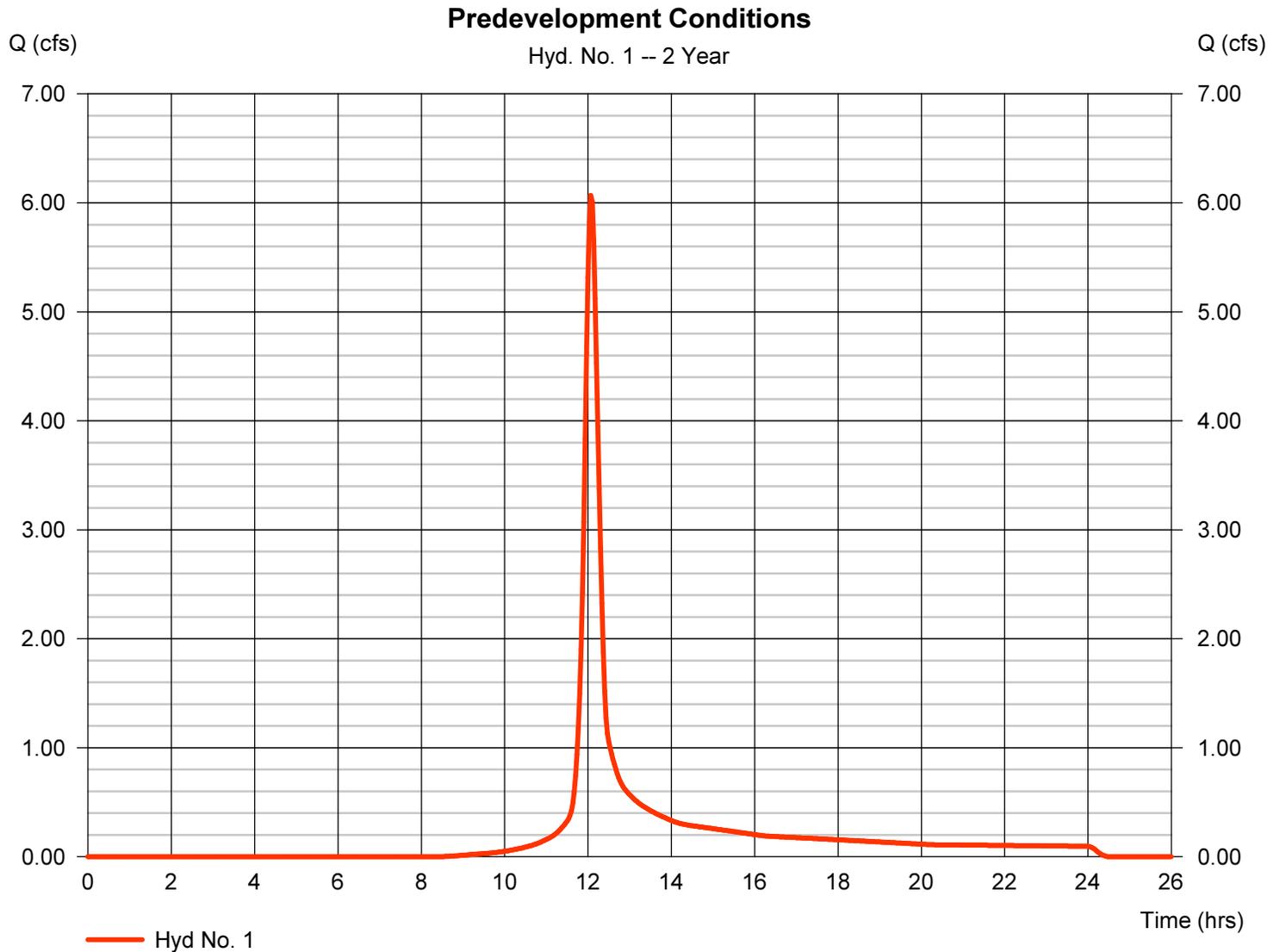
Hydrograph Report

Hyd. No. 1

Predevelopment Conditions

Hydrograph type	= SCS Runoff	Peak discharge	= 6.067 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 19,016 cuft
Drainage area	= 2.980 ac	Curve number	= 82*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 17.00 min
Total precip.	= 3.47 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.980 x 98) + (2.000 x 74)] / 2.980



TR55 Tc Worksheet

Hyd. No. 1

Predevelopment Conditions

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
Sheet Flow				
Manning's n-value	= 0.150	0.011	0.011	
Flow length (ft)	= 280.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.47	0.00	0.00	
Land slope (%)	= 3.57	0.00	0.00	
Travel Time (min)	= 17.01	+ 0.00	+ 0.00	= 17.01
Shallow Concentrated Flow				
Flow length (ft)	= 0.00	0.00	0.00	
Watercourse slope (%)	= 0.00	0.00	0.00	
Surface description	= Paved	Paved	Paved	
Average velocity (ft/s)	=0.00	0.00	0.00	
Travel Time (min)	= 0.00	+ 0.00	+ 0.00	= 0.00
Channel Flow				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	=0.00	0.00	0.00	
Flow length (ft)	0.0	0.0	0.0	
Travel Time (min)	= 0.00	+ 0.00	+ 0.00	= 0.00
Total Travel Time, Tc				17.00 min

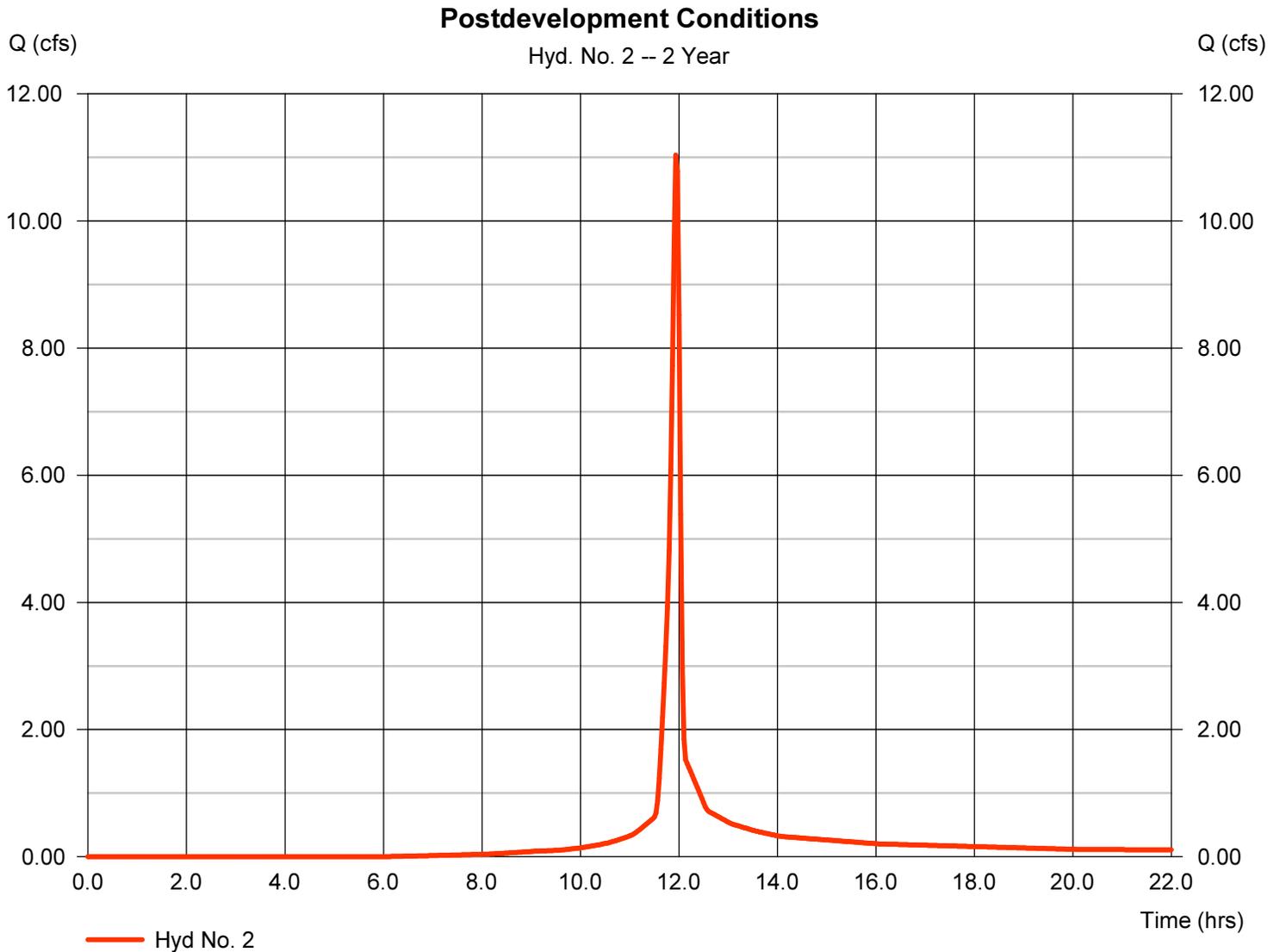
Hydrograph Report

Hyd. No. 2

Postdevelopment Conditions

Hydrograph type	= SCS Runoff	Peak discharge	= 11.04 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 22,730 cuft
Drainage area	= 2.980 ac	Curve number	= 88*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.47 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.730 x 98) + (1.250 x 74)] / 2.980

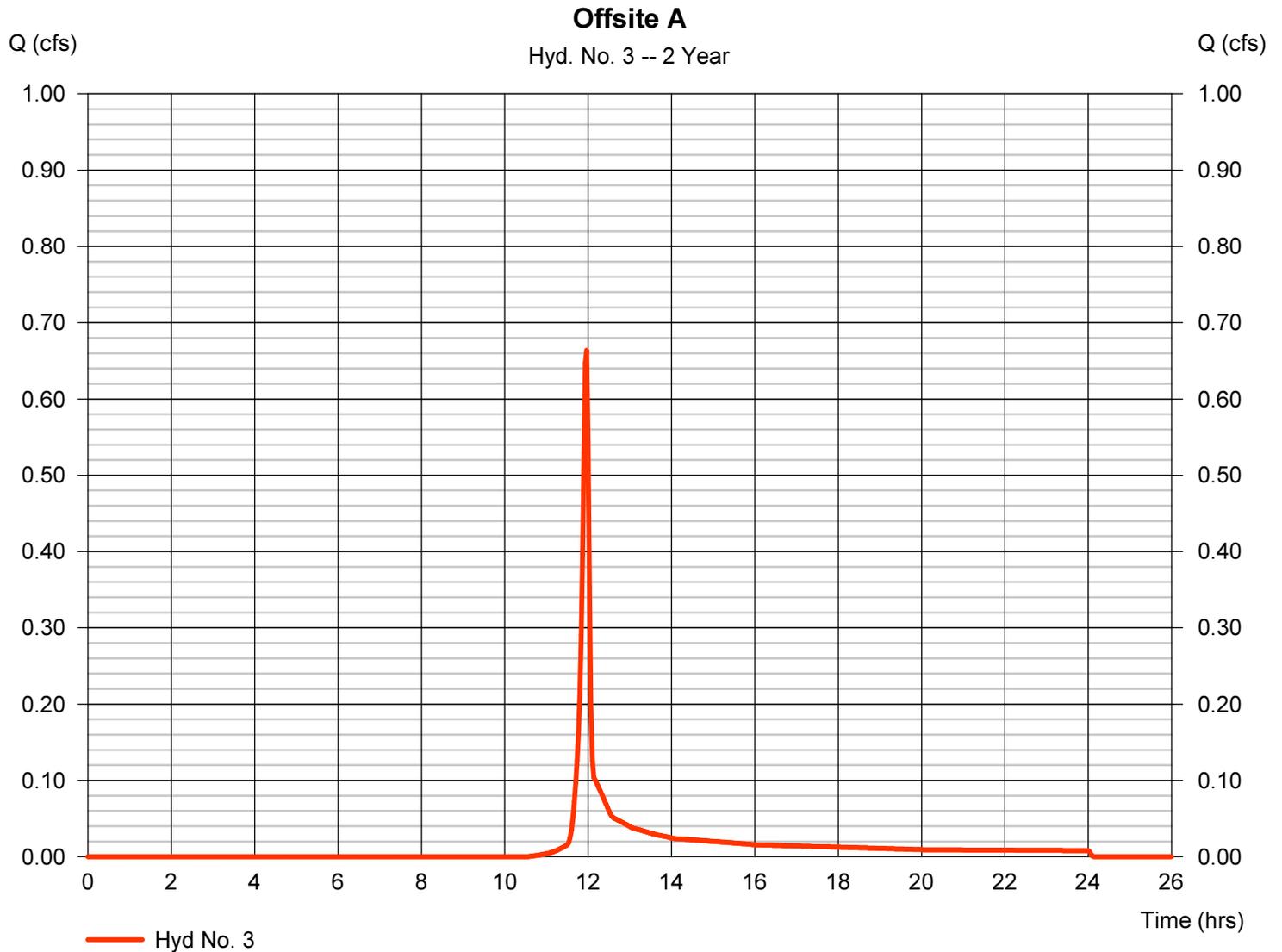


Hydrograph Report

Hyd. No. 3

Offsite A

Hydrograph type	= SCS Runoff	Peak discharge	= 0.664 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 1,328 cuft
Drainage area	= 0.320 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.47 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

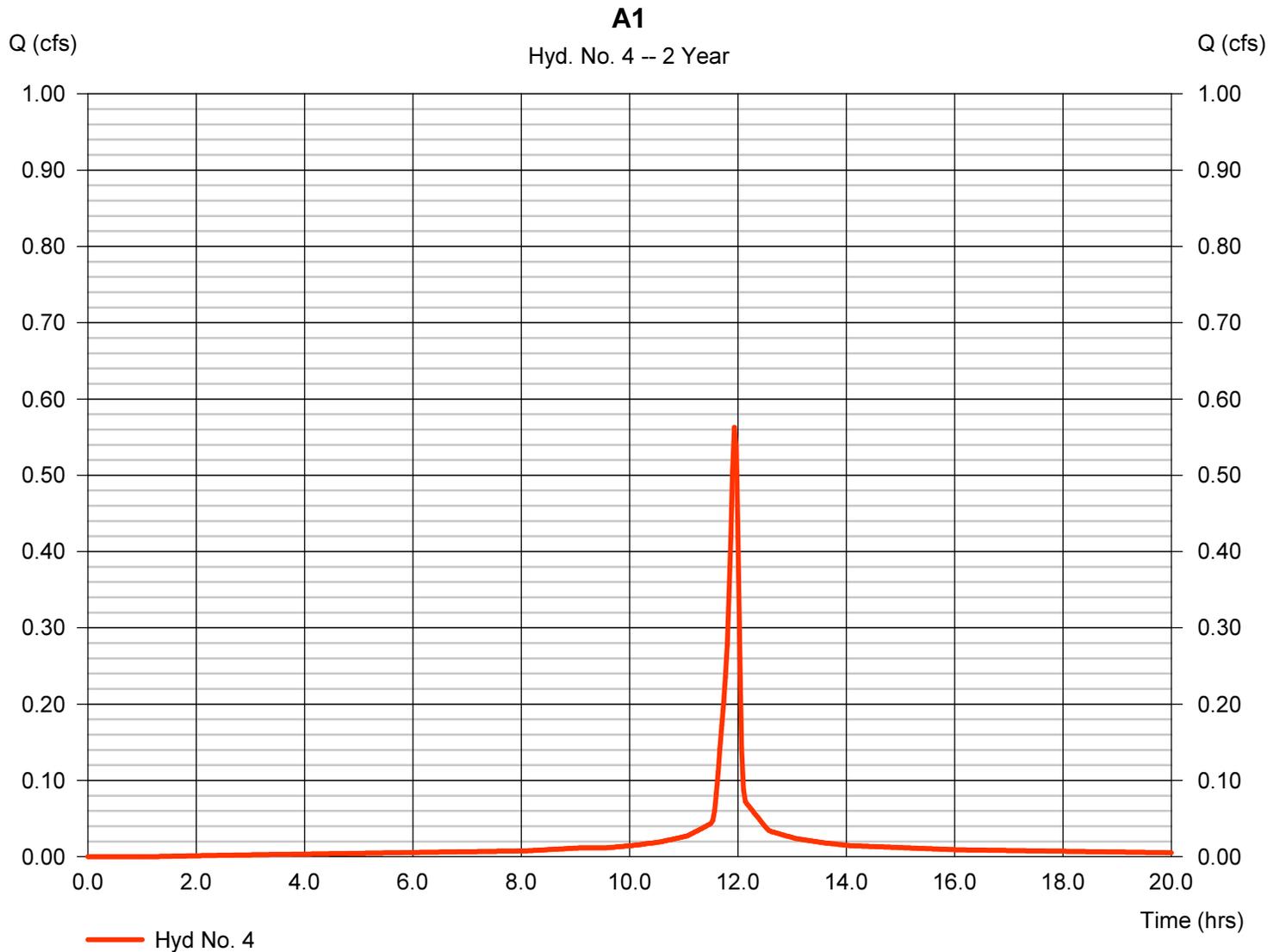
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2010 by Autodesk, Inc. v9.25

Wednesday, Apr 30, 2014

Hyd. No. 4

A1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.563 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 1,322 cuft
Drainage area	= 0.120 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.47 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2010 by Autodesk, Inc. v9.25

Wednesday, Apr 30, 2014

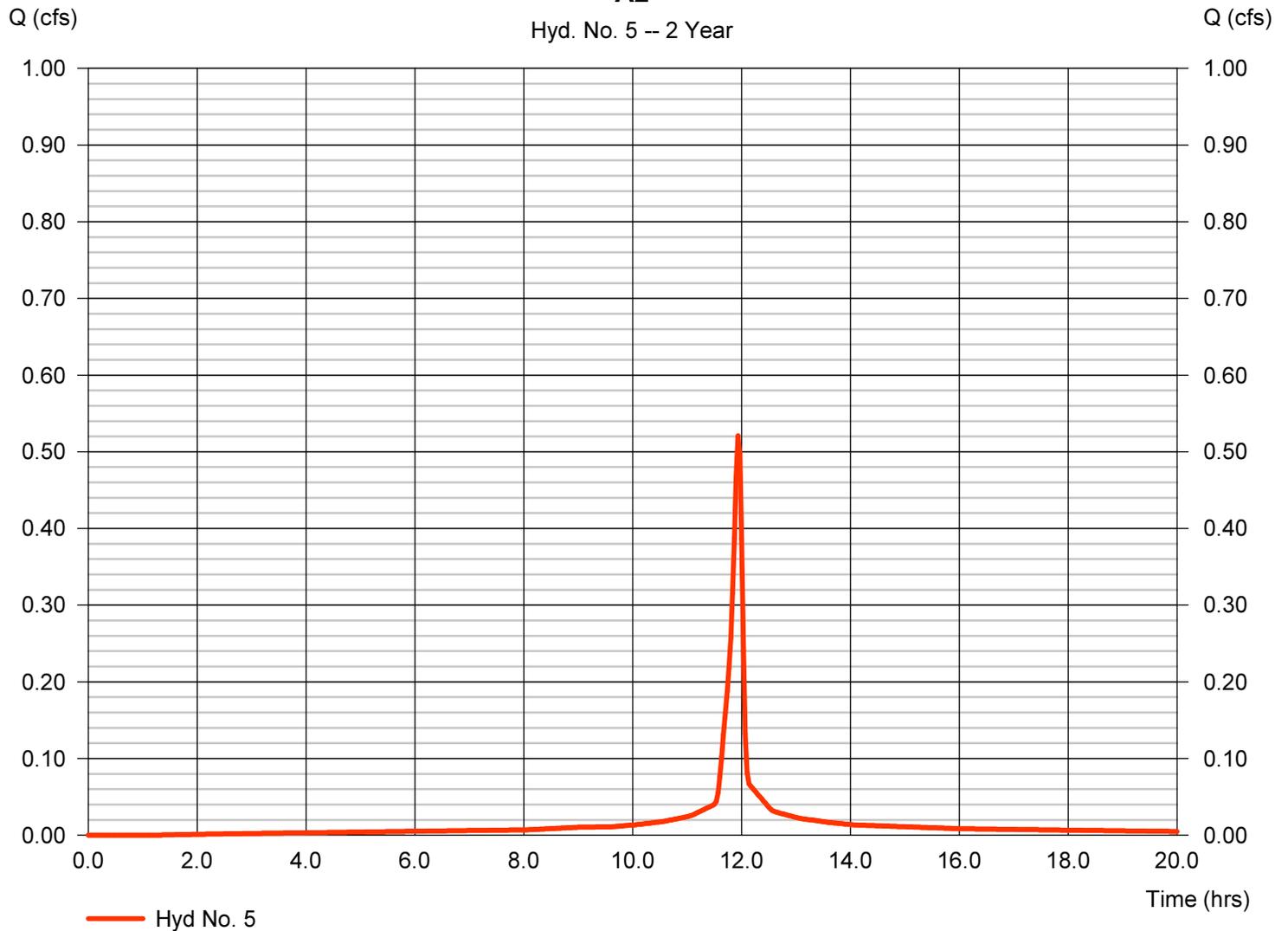
Hyd. No. 5

A2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.521 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 1,223 cuft
Drainage area	= 0.111 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.47 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

A2

Hyd. No. 5 -- 2 Year



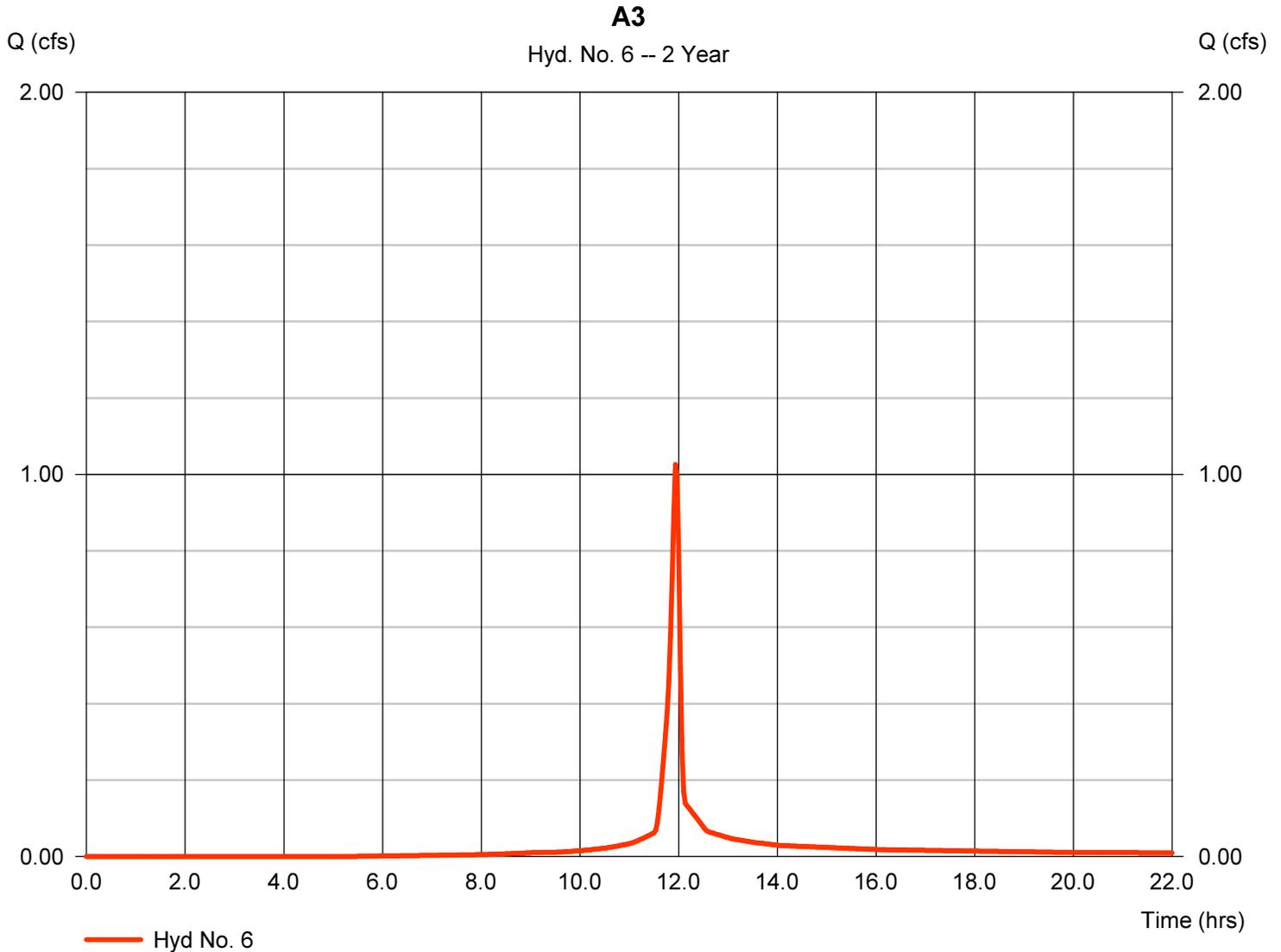
Hydrograph Report

Hyd. No. 6

A3

Hydrograph type	= SCS Runoff	Peak discharge	= 1.026 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 2,141 cuft
Drainage area	= 0.260 ac	Curve number	= 90*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.47 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.091 x 74) + (0.169 x 98)] / 0.260



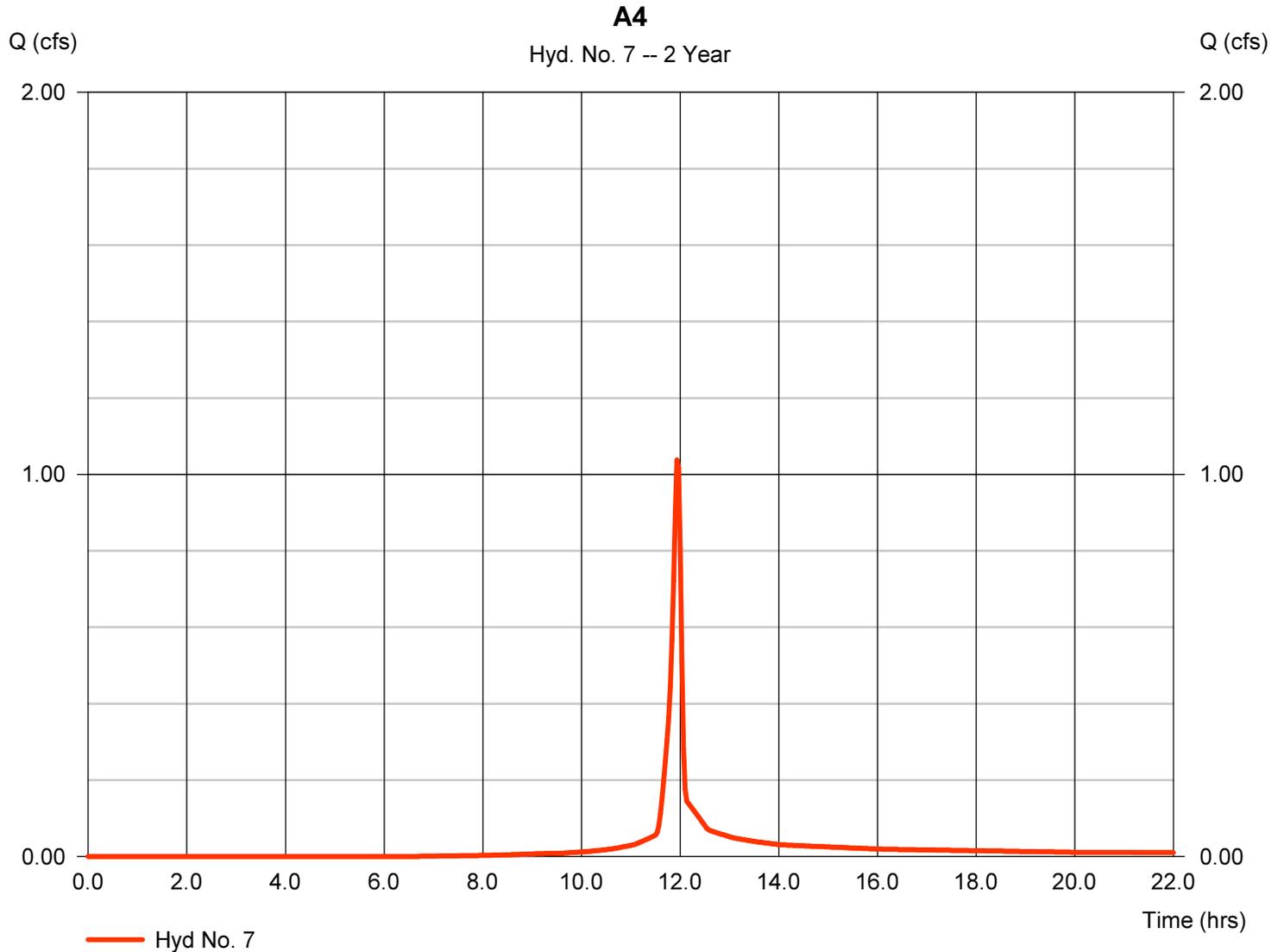
Hydrograph Report

Hyd. No. 7

A4

Hydrograph type	= SCS Runoff	Peak discharge	= 1.038 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 2,127 cuft
Drainage area	= 0.290 ac	Curve number	= 87*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.47 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.131 x 74) + (0.160 x 98)] / 0.290



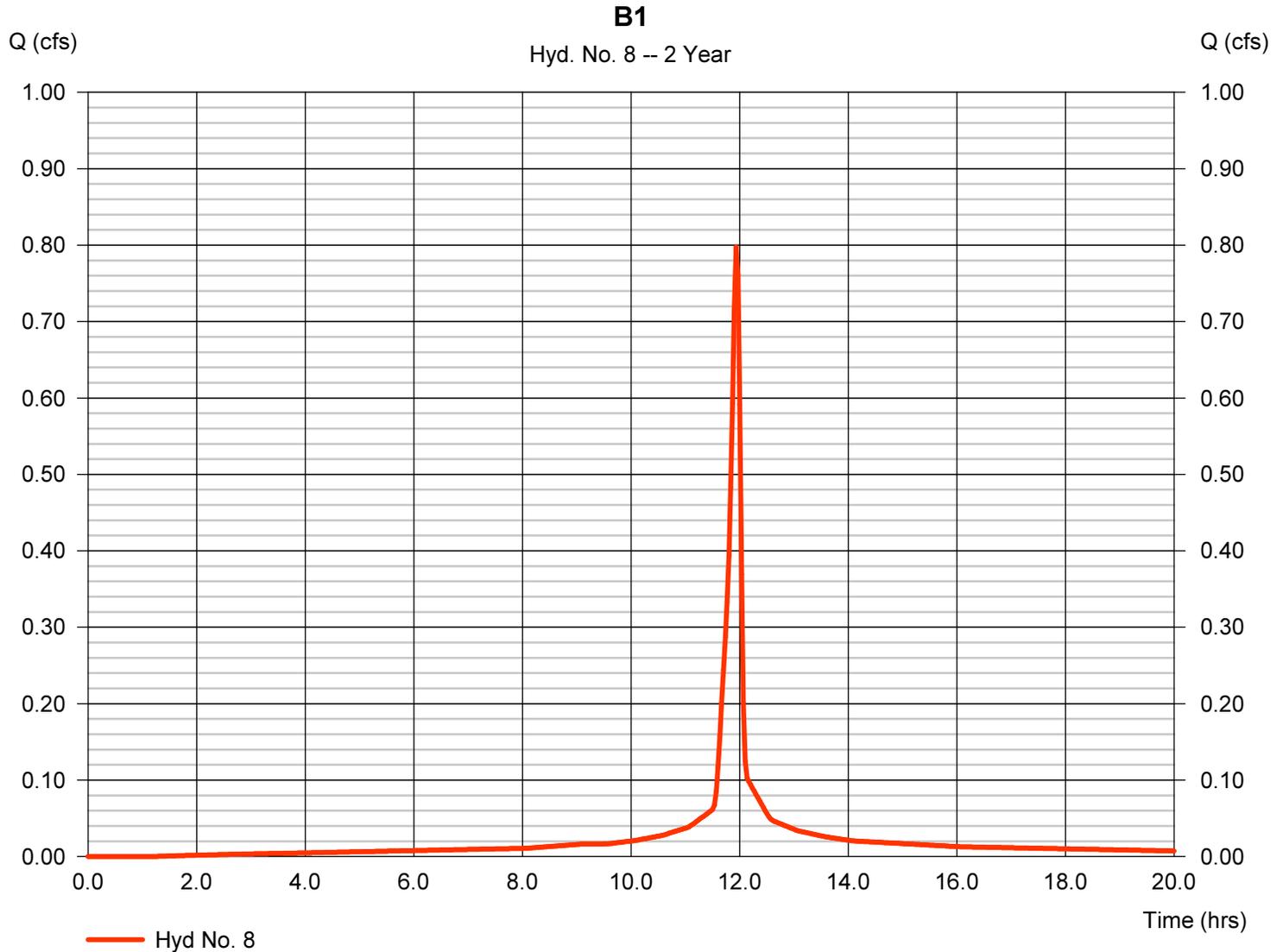
Hydrograph Report

Hyd. No. 8

B1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.797 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 1,872 cuft
Drainage area	= 0.170 ac	Curve number	= 98*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.47 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.170 x 98)] / 0.170



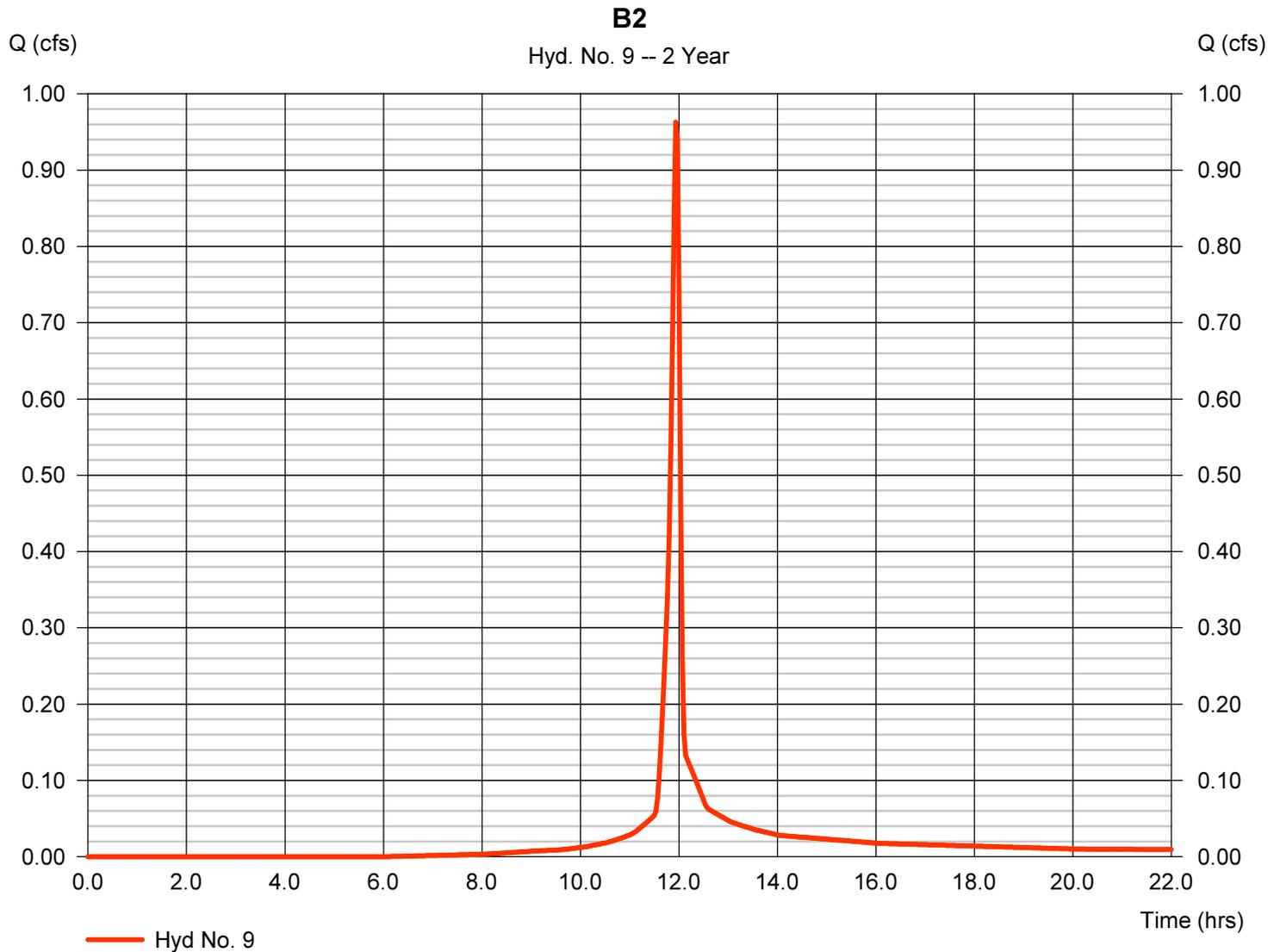
Hydrograph Report

Hyd. No. 9

B2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.963 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 1,983 cuft
Drainage area	= 0.260 ac	Curve number	= 88*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.47 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.104 x 74) + (0.156 x 98)] / 0.260

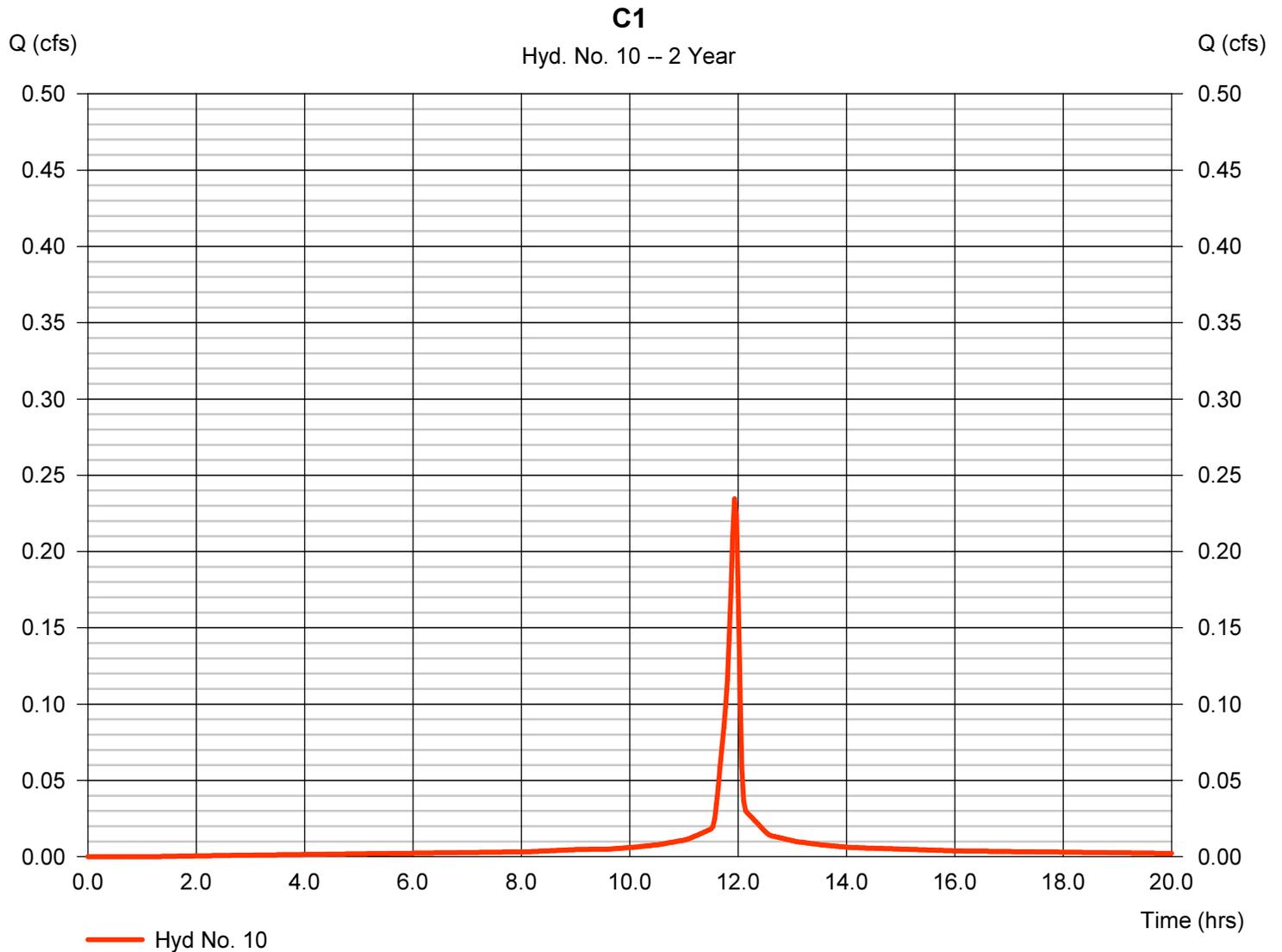


Hydrograph Report

Hyd. No. 10

C1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.235 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 551 cuft
Drainage area	= 0.050 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.47 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



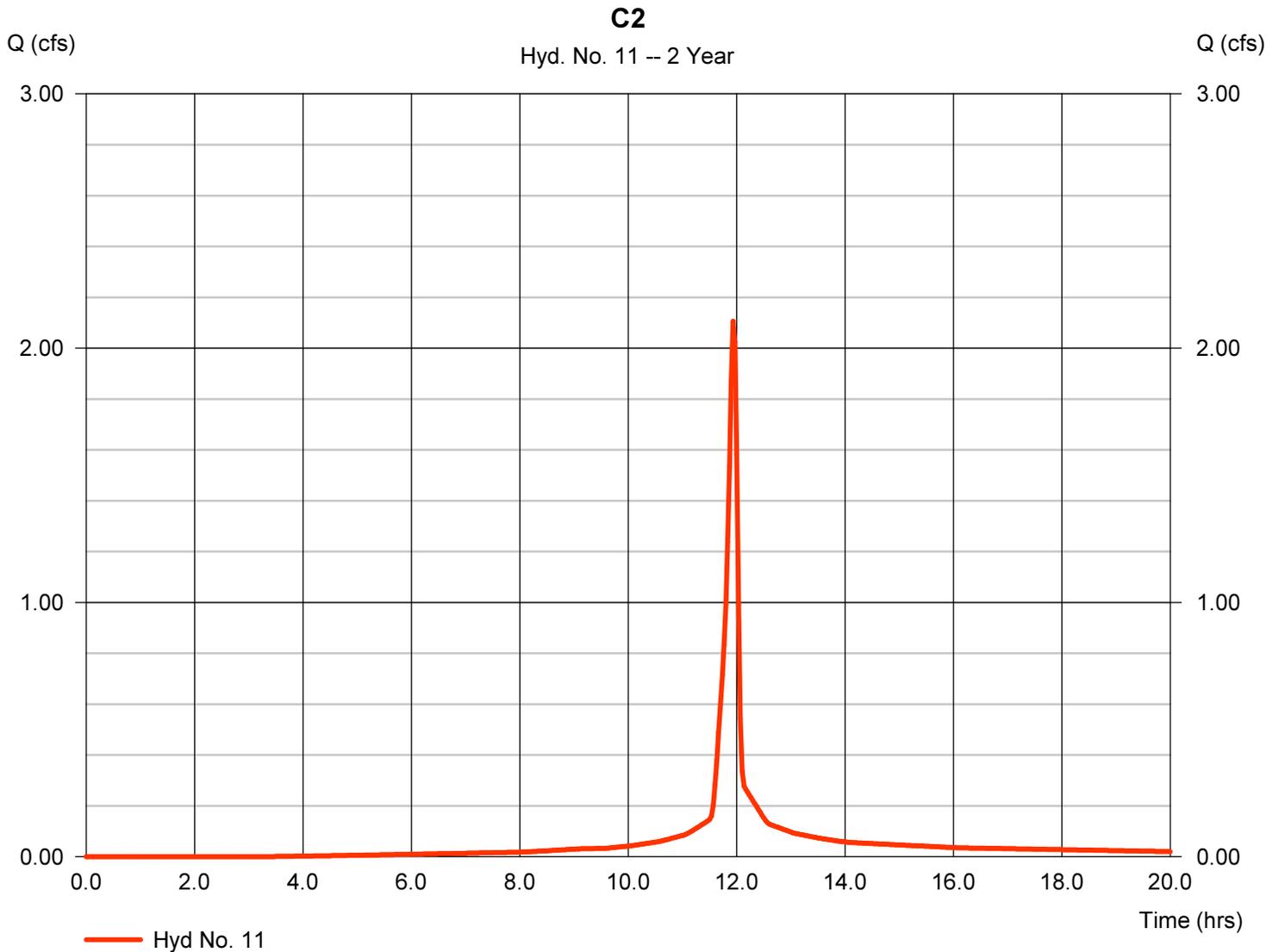
Hydrograph Report

Hyd. No. 11

C2

Hydrograph type	= SCS Runoff	Peak discharge	= 2.105 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 4,584 cuft
Drainage area	= 0.480 ac	Curve number	= 94*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.47 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.077 x 74) + (0.403 x 98)] / 0.480

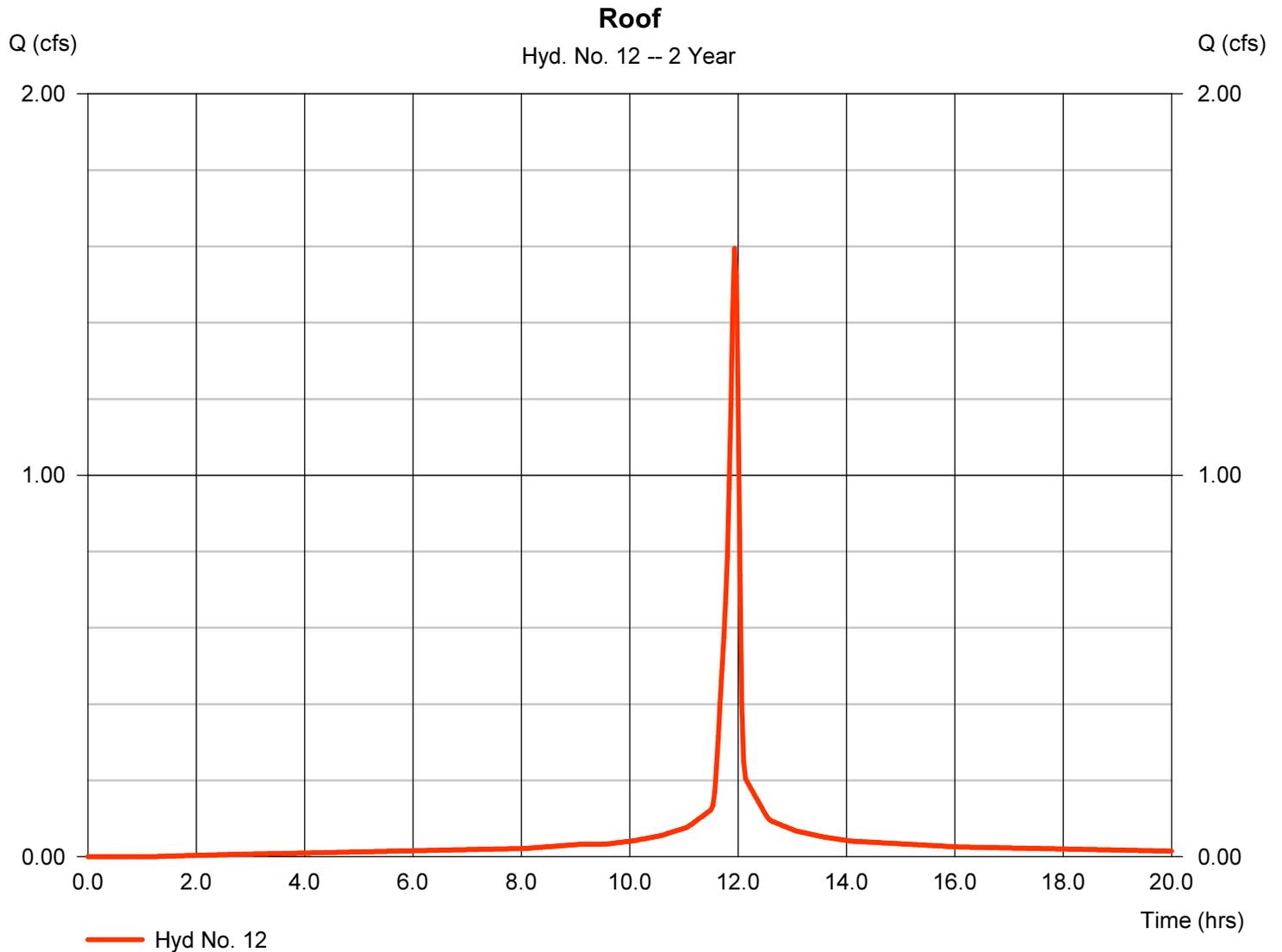


Hydrograph Report

Hyd. No. 12

Roof

Hydrograph type	= SCS Runoff	Peak discharge	= 1.595 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 3,745 cuft
Drainage area	= 0.340 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.47 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

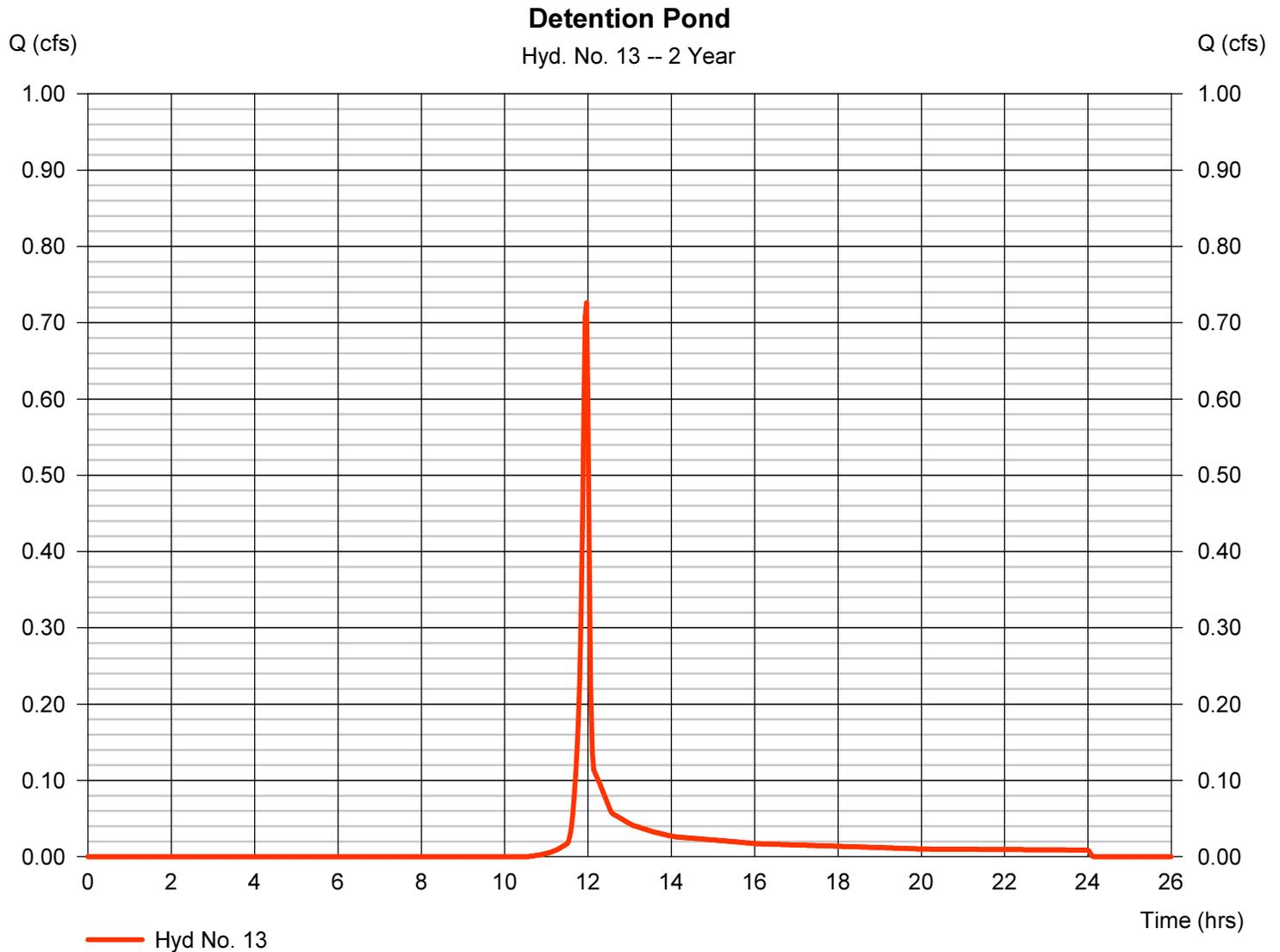


Hydrograph Report

Hyd. No. 13

Detention Pond

Hydrograph type	= SCS Runoff	Peak discharge	= 0.726 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 1,452 cuft
Drainage area	= 0.350 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.47 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



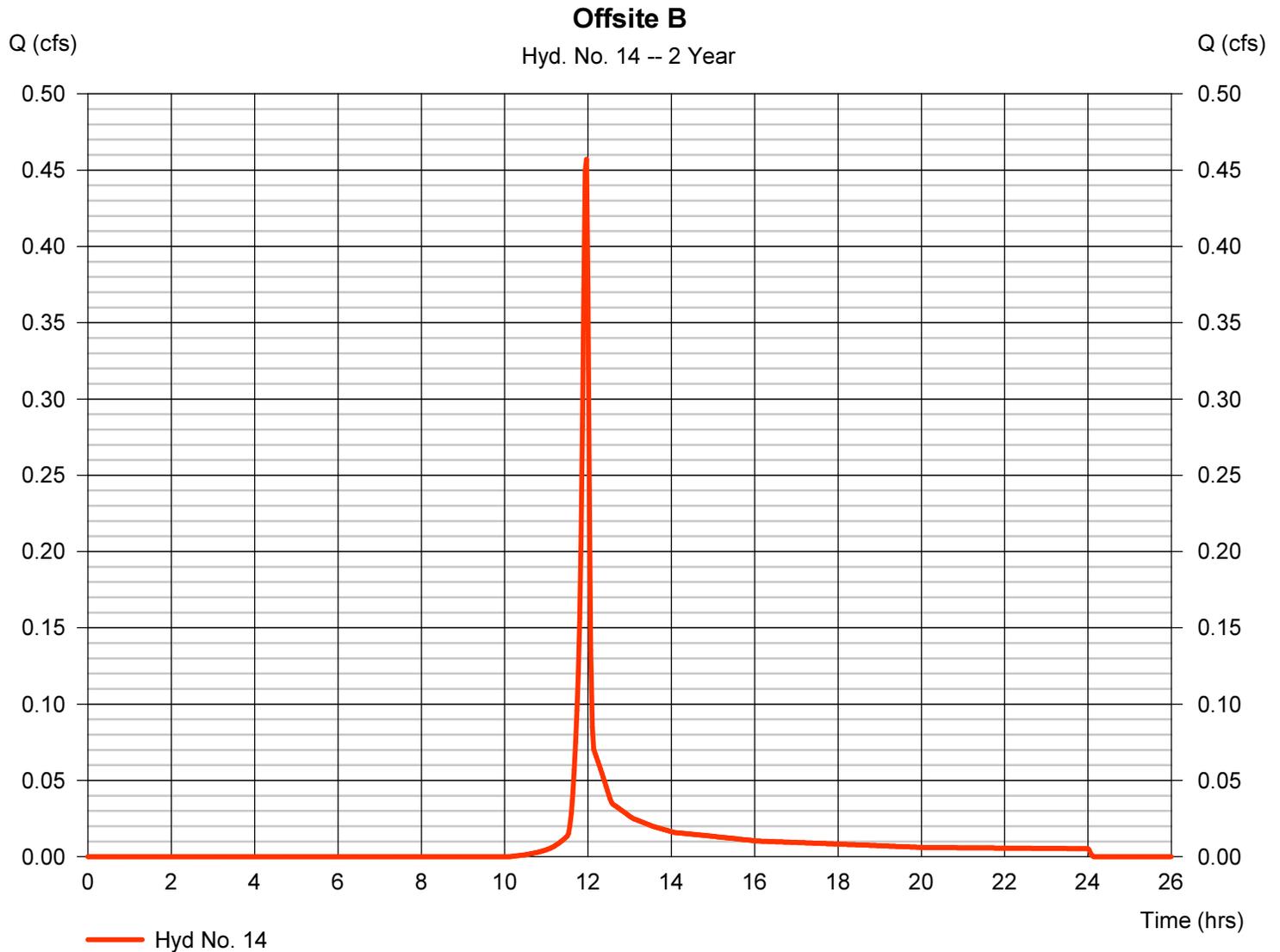
Hydrograph Report

Hyd. No. 14

Offsite B

Hydrograph type	= SCS Runoff	Peak discharge	= 0.457 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 914 cuft
Drainage area	= 0.200 ac	Curve number	= 76*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 3.47 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.180 x 74) + (0.020 x 98)] / 0.200

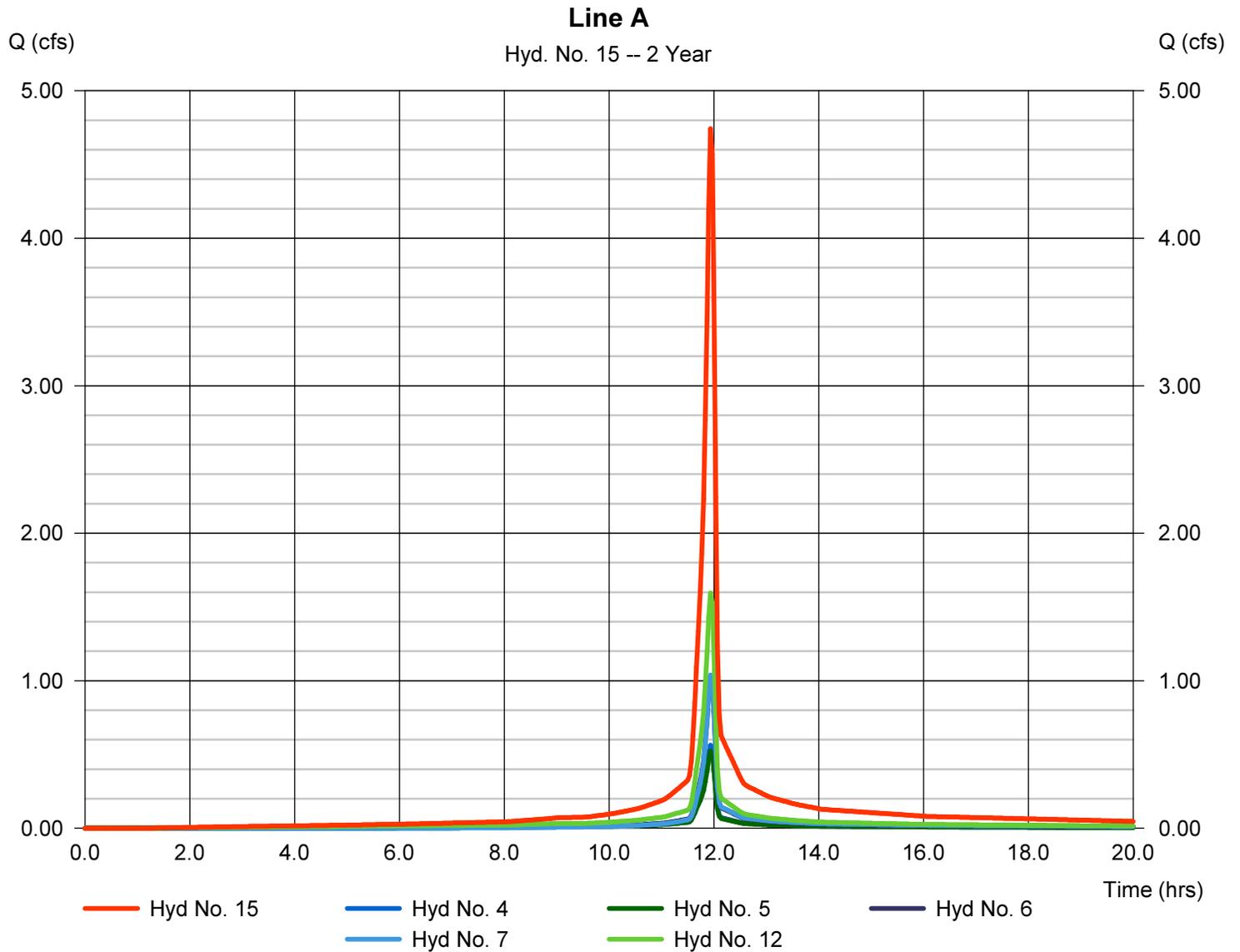


Hydrograph Report

Hyd. No. 15

Line A

Hydrograph type	= Combine	Peak discharge	= 4.743 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 10,558 cuft
Inflow hyds.	= 4, 5, 6, 7, 12	Contrib. drain. area	= 1.121 ac



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2010 by Autodesk, Inc. v9.25

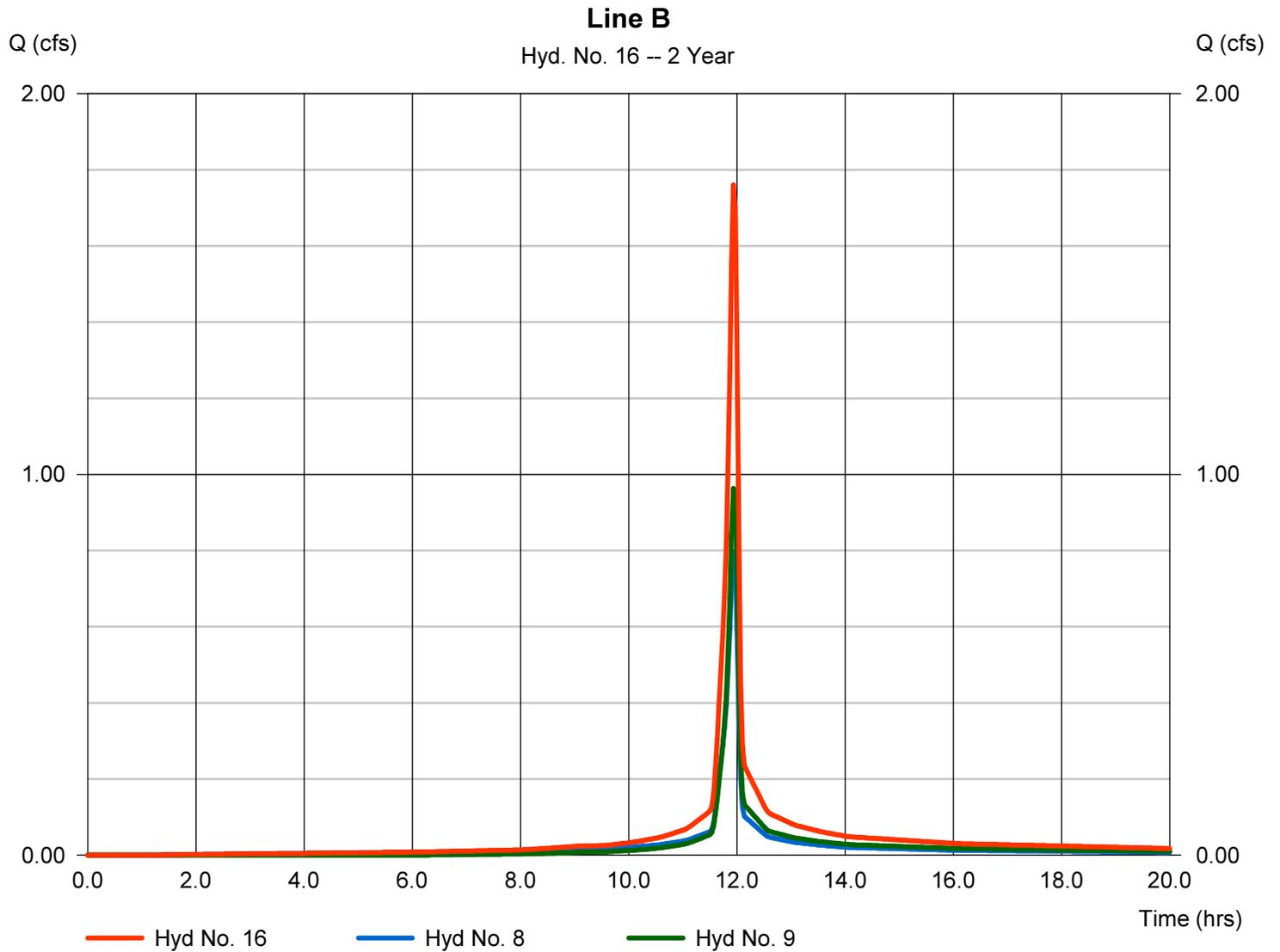
Wednesday, Apr 30, 2014

Hyd. No. 16

Line B

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

Peak discharge = 1.760 cfs
Time to peak = 11.93 hrs
Hyd. volume = 3,856 cuft
Contrib. drain. area = 0.430 ac



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2010 by Autodesk, Inc. v9.25

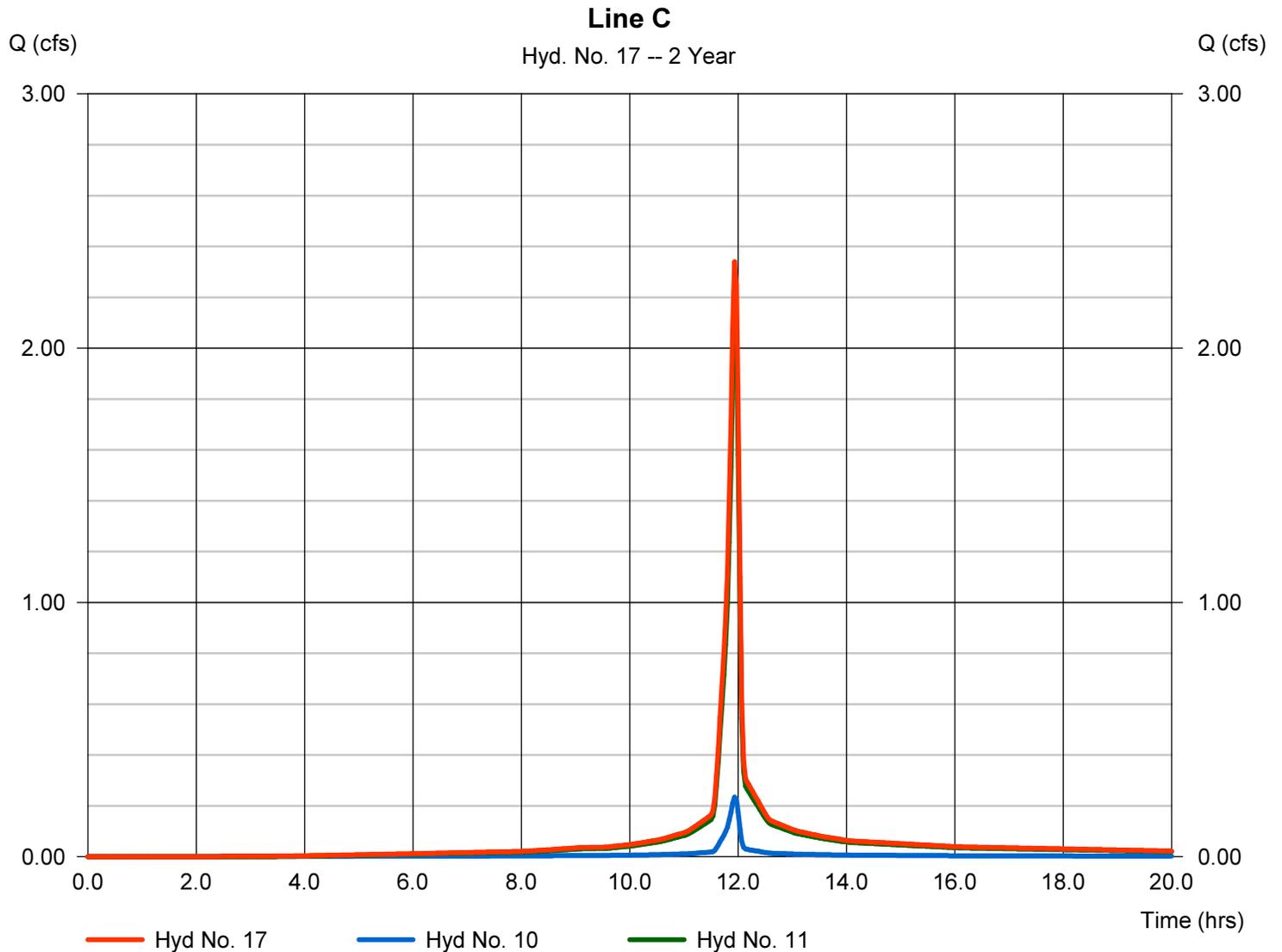
Wednesday, Apr 30, 2014

Hyd. No. 17

Line C

Hydrograph type = Combine
Storm frequency = 2 yrs
Time interval = 2 min
Inflow hyds. = 10, 11

Peak discharge = 2.340 cfs
Time to peak = 11.93 hrs
Hyd. volume = 5,135 cuft
Contrib. drain. area = 0.530 ac



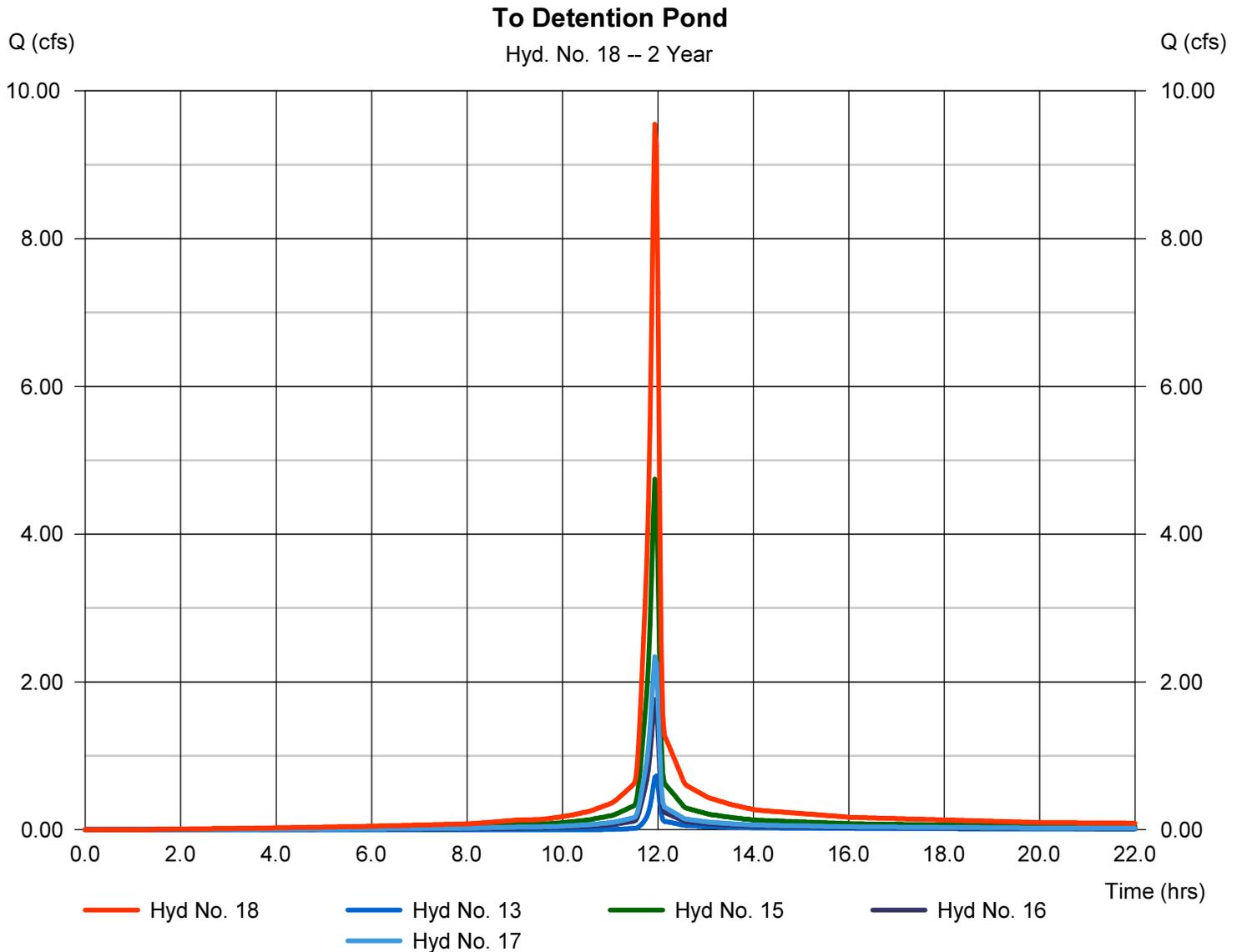
Hydrograph Report

Hyd. No. 18

To Detention Pond

Hydrograph type = Combine
Storm frequency = 2 yrs
Time interval = 2 min
Inflow hyds. = 13, 15, 16, 17

Peak discharge = 9.551 cfs
Time to peak = 11.93 hrs
Hyd. volume = 21,001 cuft
Contrib. drain. area = 0.350 ac



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2010 by Autodesk, Inc. v9.25

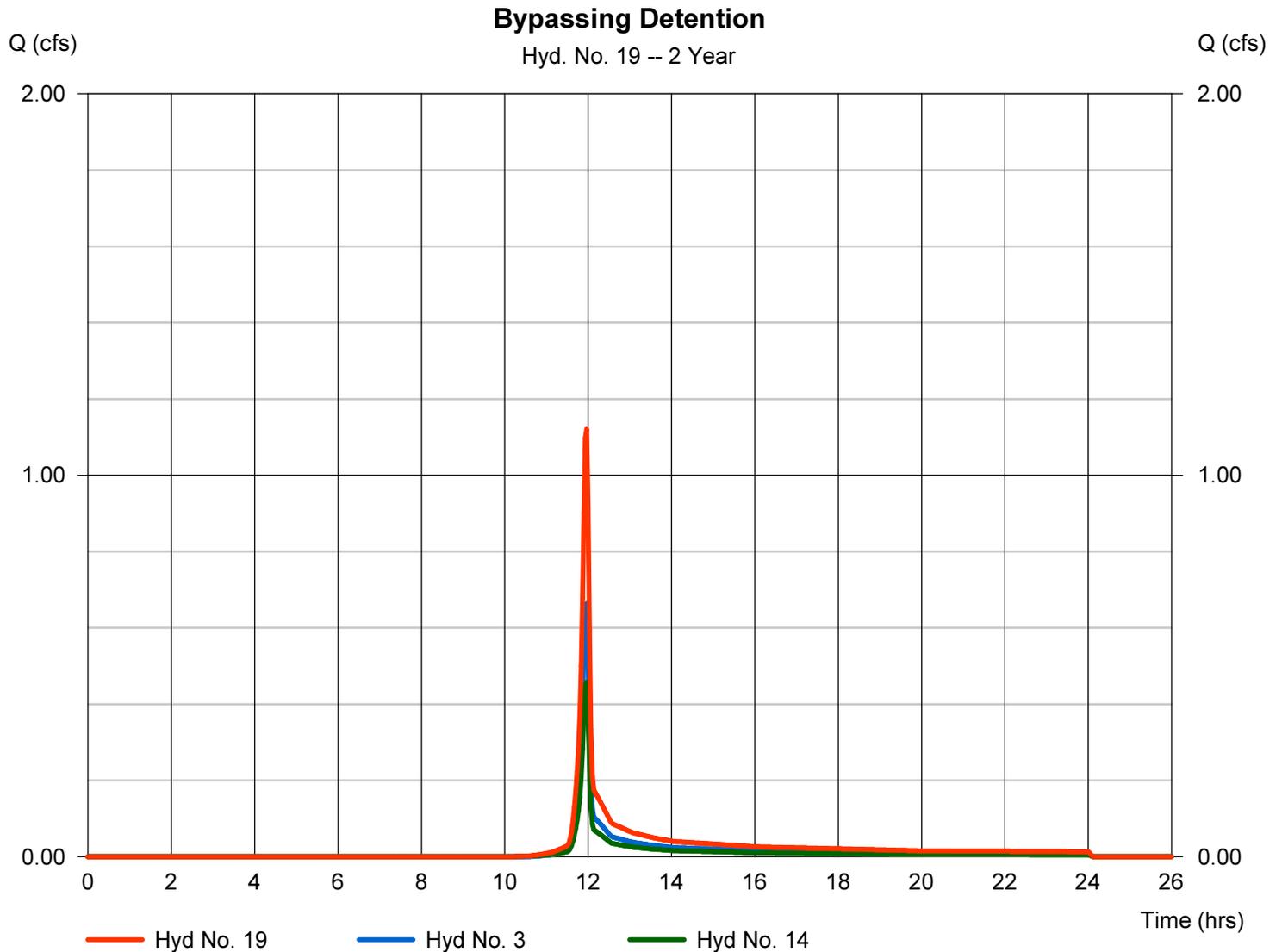
Wednesday, Apr 30, 2014

Hyd. No. 19

Bypassing Detention

Hydrograph type = Combine
Storm frequency = 2 yrs
Time interval = 2 min
Inflow hyds. = 3, 14

Peak discharge = 1.121 cfs
Time to peak = 11.97 hrs
Hyd. volume = 2,242 cuft
Contrib. drain. area = 0.520 ac



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2010 by Autodesk, Inc. v9.25

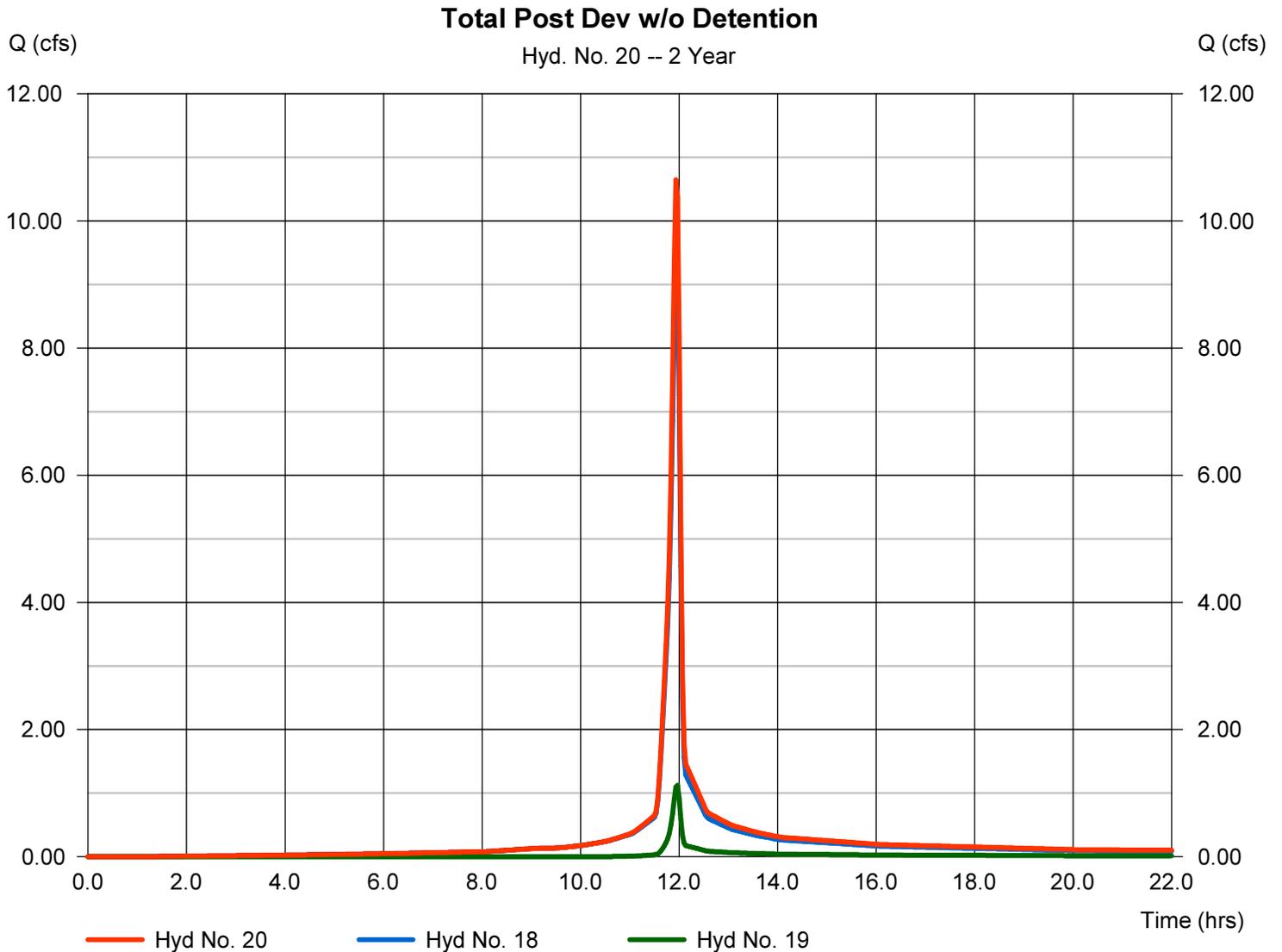
Wednesday, Apr 30, 2014

Hyd. No. 20

Total Post Dev w/o Detention

Hydrograph type = Combine
Storm frequency = 2 yrs
Time interval = 2 min
Inflow hyds. = 18, 19

Peak discharge = 10.65 cfs
Time to peak = 11.93 hrs
Hyd. volume = 23,243 cuft
Contrib. drain. area = 0.000 ac



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2010 by Autodesk, Inc. v9.25

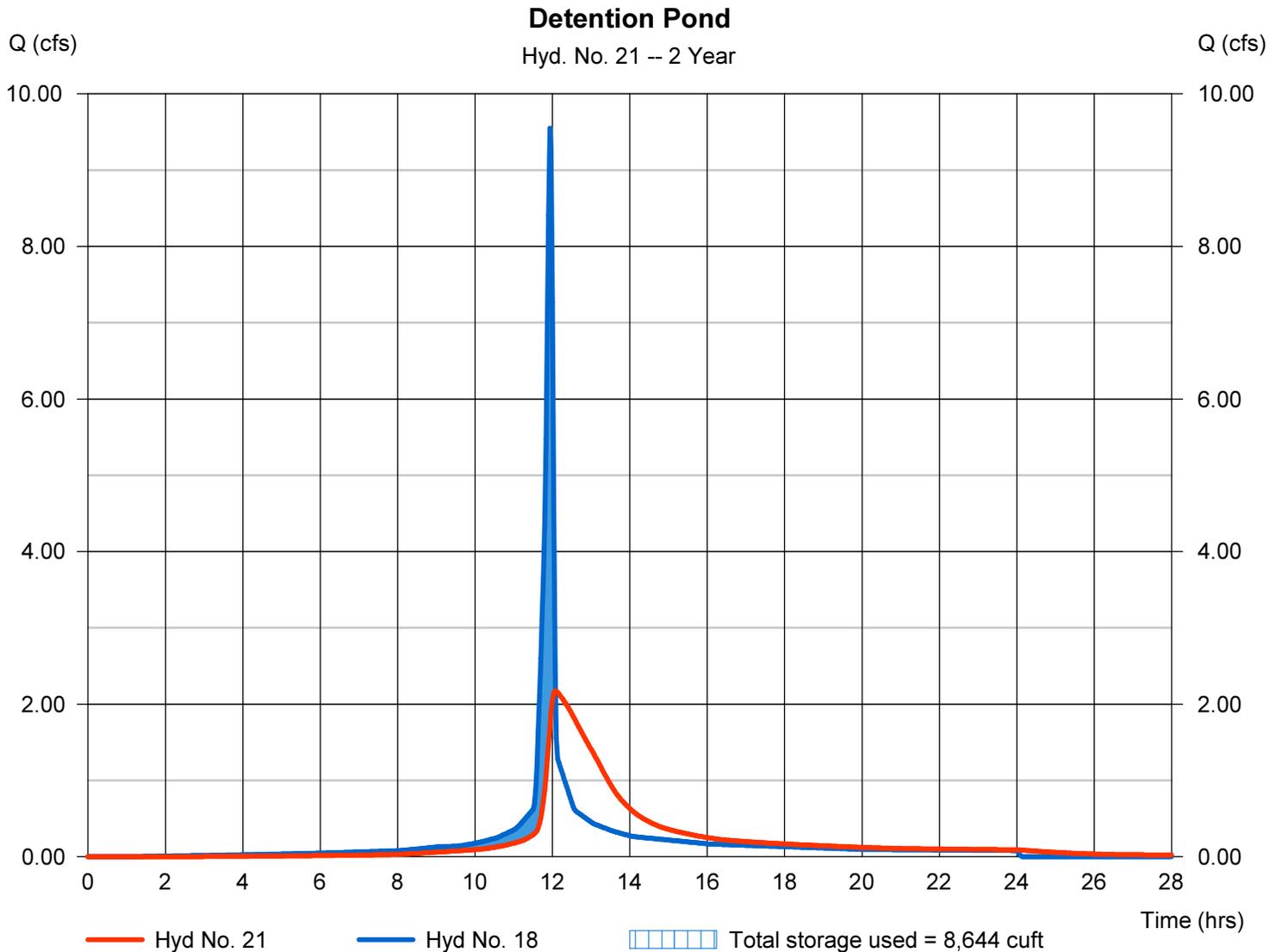
Wednesday, Apr 30, 2014

Hyd. No. 21

Detention Pond

Hydrograph type	= Reservoir	Peak discharge	= 2.174 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 20,980 cuft
Inflow hyd. No.	= 18 - To Detention Pond	Max. Elevation	= 923.52 ft
Reservoir name	= Detention Pond	Max. Storage	= 8,644 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Detention Pond

Pond Data

Contours -User-defined contour areas. Average end area method used for volume calculation. Beginning Elevation = 922.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	922.00	5,700	0	0
1.00	923.00	5,700	5,700	5,700
2.00	924.00	5,700	5,700	11,400
3.00	925.00	5,700	5,700	17,100
4.00	926.00	5,700	5,700	22,800
5.00	927.00	5,700	5,700	28,500

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	10.00	0.00	0.00
Span (in)	= 12.00	10.00	0.00	0.00
No. Barrels	= 10	10	0	0
Invert El. (ft)	= 922.00	922.00	0.00	0.00
Length (ft)	= 50.00	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	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 4.71	0.00	0.00	0.00
Crest El. (ft)	= 926.00	0.00	0.00	0.00
Weir Coeff.	= 3.330.00	3.33	3.33	3.33
Weir Type	= 1	---	---	---
Multi-Stage	= Yes	No	No	No
Exfil.(in/hr)	= 0 (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).

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	922.00	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.10	570	922.10	0.03 ic	0.03 ic	---	---	0.00	---	---	---	---	---	0.028
0.20	1,140	922.20	0.11 ic	0.11 ic	---	---	0.00	---	---	---	---	---	0.106
0.30	1,710	922.30	0.23 ic	0.23 ic	---	---	0.00	---	---	---	---	---	0.226
0.40	2,280	922.40	0.39 ic	0.39 ic	---	---	0.00	---	---	---	---	---	0.388
0.50	2,850	922.50	0.58 ic	0.58 ic	---	---	0.00	---	---	---	---	---	0.579
0.60	3,420	922.60	0.79 ic	0.79 ic	---	---	0.00	---	---	---	---	---	0.788
0.70	3,990	922.70	1.02 ic	1.01 ic	---	---	0.00	---	---	---	---	---	1.013
0.80	4,560	922.80	1.24 ic	1.22 ic	---	---	0.00	---	---	---	---	---	1.221
0.90	5,130	922.90	1.38 ic	1.38 ic	---	---	0.00	---	---	---	---	---	1.384
1.00	5,700	923.00	1.53 ic	1.53 ic	---	---	0.00	---	---	---	---	---	1.528
1.10	6,270	923.10	1.67 ic	1.67 ic	---	---	0.00	---	---	---	---	---	1.666
1.20	6,840	923.20	1.80 ic	1.80 ic	---	---	0.00	---	---	---	---	---	1.798
1.30	7,410	923.30	1.92 ic	1.92 ic	---	---	0.00	---	---	---	---	---	1.924
1.40	7,980	923.40	2.04 ic	2.04 ic	---	---	0.00	---	---	---	---	---	2.044
1.50	8,550	923.50	2.16 ic	2.16 ic	---	---	0.00	---	---	---	---	---	2.157
1.60	9,120	923.60	2.26 ic	2.26 ic	---	---	0.00	---	---	---	---	---	2.263
1.70	9,690	923.70	2.37 ic	2.37 ic	---	---	0.00	---	---	---	---	---	2.368
1.80	10,260	923.80	2.47 ic	2.47 ic	---	---	0.00	---	---	---	---	---	2.466
1.90	10,830	923.90	2.56 ic	2.56 ic	---	---	0.00	---	---	---	---	---	2.560
2.00	11,400	924.00	2.60 oc	2.60 ic	---	---	0.00	---	---	---	---	---	2.600
2.10	11,970	924.10	2.69 oc	2.69 ic	---	---	0.00	---	---	---	---	---	2.686
2.20	12,540	924.20	2.77 oc	2.77 ic	---	---	0.00	---	---	---	---	---	2.768
2.30	13,110	924.30	2.85 oc	2.85 ic	---	---	0.00	---	---	---	---	---	2.849
2.40	13,680	924.40	2.93 oc	2.93 ic	---	---	0.00	---	---	---	---	---	2.927
2.50	14,250	924.50	3.00 oc	3.00 ic	---	---	0.00	---	---	---	---	---	3.003
2.60	14,820	924.60	3.08 oc	3.08 ic	---	---	0.00	---	---	---	---	---	3.077
2.70	15,390	924.70	3.15 oc	3.15 ic	---	---	0.00	---	---	---	---	---	3.149
2.80	15,960	924.80	3.22 oc	3.22 ic	---	---	0.00	---	---	---	---	---	3.220
2.90	16,530	924.90	3.29 oc	3.29 ic	---	---	0.00	---	---	---	---	---	3.289
3.00	17,100	925.00	3.36 oc	3.36 ic	---	---	0.00	---	---	---	---	---	3.357
3.10	17,670	925.10	3.42 oc	3.42 ic	---	---	0.00	---	---	---	---	---	3.424
3.20	18,240	925.20	3.49 oc	3.49 ic	---	---	0.00	---	---	---	---	---	3.489
3.30	18,810	925.30	3.55 oc	3.55 ic	---	---	0.00	---	---	---	---	---	3.553
3.40	19,380	925.40	3.62 oc	3.62 ic	---	---	0.00	---	---	---	---	---	3.616
3.50	19,950	925.50	3.68 oc	3.68 ic	---	---	0.00	---	---	---	---	---	3.678
3.60	20,520	925.60	3.74 oc	3.74 ic	---	---	0.00	---	---	---	---	---	3.738

Continues on next page...

Detention Pond

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
3.70	21,090	925.70	3.80 oc	3.80 ic	---	---	0.00	---	---	---	---	---	3.798
3.80	21,660	925.80	3.86 oc	3.86 ic	---	---	0.00	---	---	---	---	---	3.857
3.90	22,230	925.90	3.92 oc	3.92 ic	---	---	0.00	---	---	---	---	---	3.915
4.00	22,800	926.00	3.97 oc	3.97 ic	---	---	0.00	---	---	---	---	---	3.972
4.10	23,370	926.10	4.35 oc	3.85 ic	---	---	0.50	---	---	---	---	---	4.346
4.20	23,940	926.20	4.95 oc	3.54 ic	---	---	1.40	---	---	---	---	---	4.946
4.30	24,510	926.30	5.64 oc	3.06 ic	---	---	2.58	---	---	---	---	---	5.638
4.40	25,080	926.40	6.34 oc	2.37 ic	---	---	3.97	---	---	---	---	---	6.338
4.50	25,650	926.50	6.87 oc	1.61 ic	---	---	5.26 s	---	---	---	---	---	6.871
4.60	26,220	926.60	7.08 oc	1.30 ic	---	---	5.78 s	---	---	---	---	---	7.084
4.70	26,790	926.70	7.24 oc	1.10 ic	---	---	6.14 s	---	---	---	---	---	7.240
4.80	27,360	926.80	7.37 oc	0.95 ic	---	---	6.42 s	---	---	---	---	---	7.368
4.90	27,930	926.90	7.48 oc	0.83 ic	---	---	6.65 s	---	---	---	---	---	7.482
5.00	28,500	927.00	7.59 oc	0.74 ic	---	---	6.85 s	---	---	---	---	---	7.587

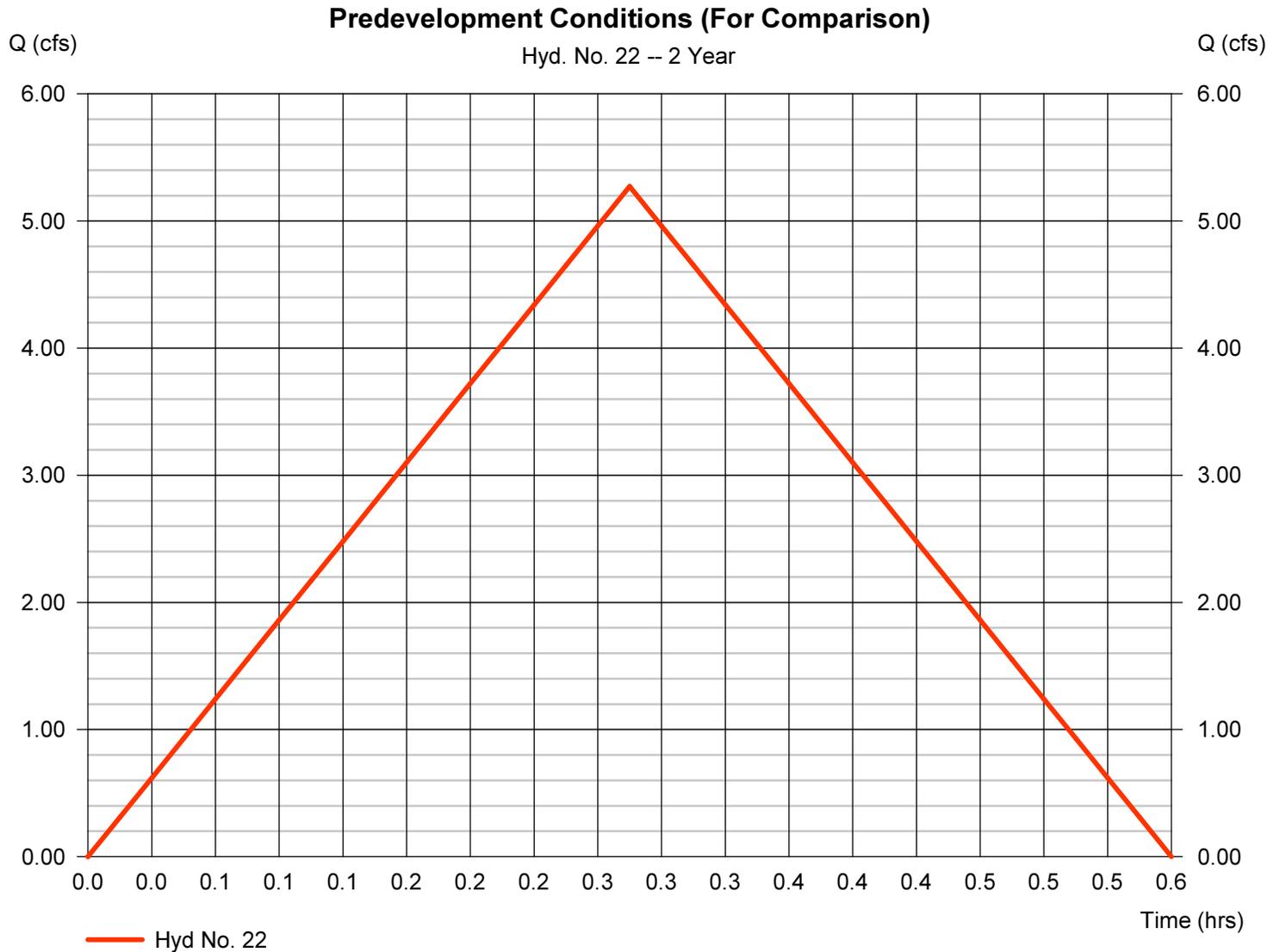
...End

Hydrograph Report

Hyd. No. 22

Predevelopment Conditions (For Comparison)

Hydrograph type	= Rational	Peak discharge	= 5.272 cfs
Storm frequency	= 2 yrs	Time to peak	= 0.28 hrs
Time interval	= 1 min	Hyd. volume	= 5,377 cuft
Drainage area	= 2.980 ac	Runoff coeff.	= 0.5
Intensity	= 3.538 in/hr	Tc by User	= 17.00 min
IDF Curve	= Shawnee County.IDF	Asc/Rec limb fact	= 1/1



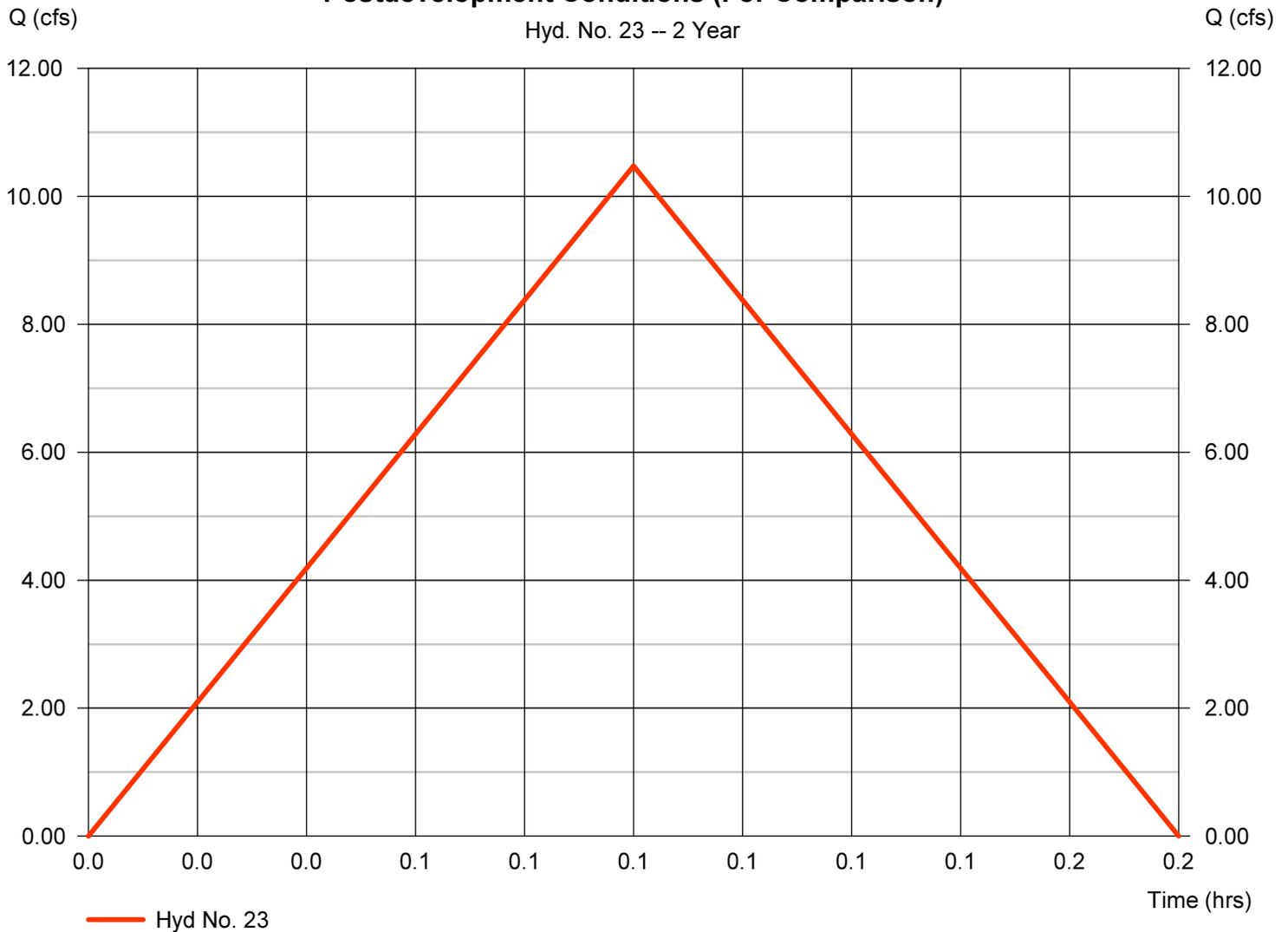
Hydrograph Report

Hyd. No. 23

Postdevelopment Conditions (For Comparison)

Hydrograph type	= Rational	Peak discharge	= 10.47 cfs
Storm frequency	= 2 yrs	Time to peak	= 0.08 hrs
Time interval	= 1 min	Hyd. volume	= 3,142 cuft
Drainage area	= 2.980 ac	Runoff coeff.	= 0.65
Intensity	= 5.407 in/hr	Tc by User	= 5.00 min
IDF Curve	= Shawnee County.IDF	Asc/Rec limb fact	= 1/1

Postdevelopment Conditions (For Comparison)

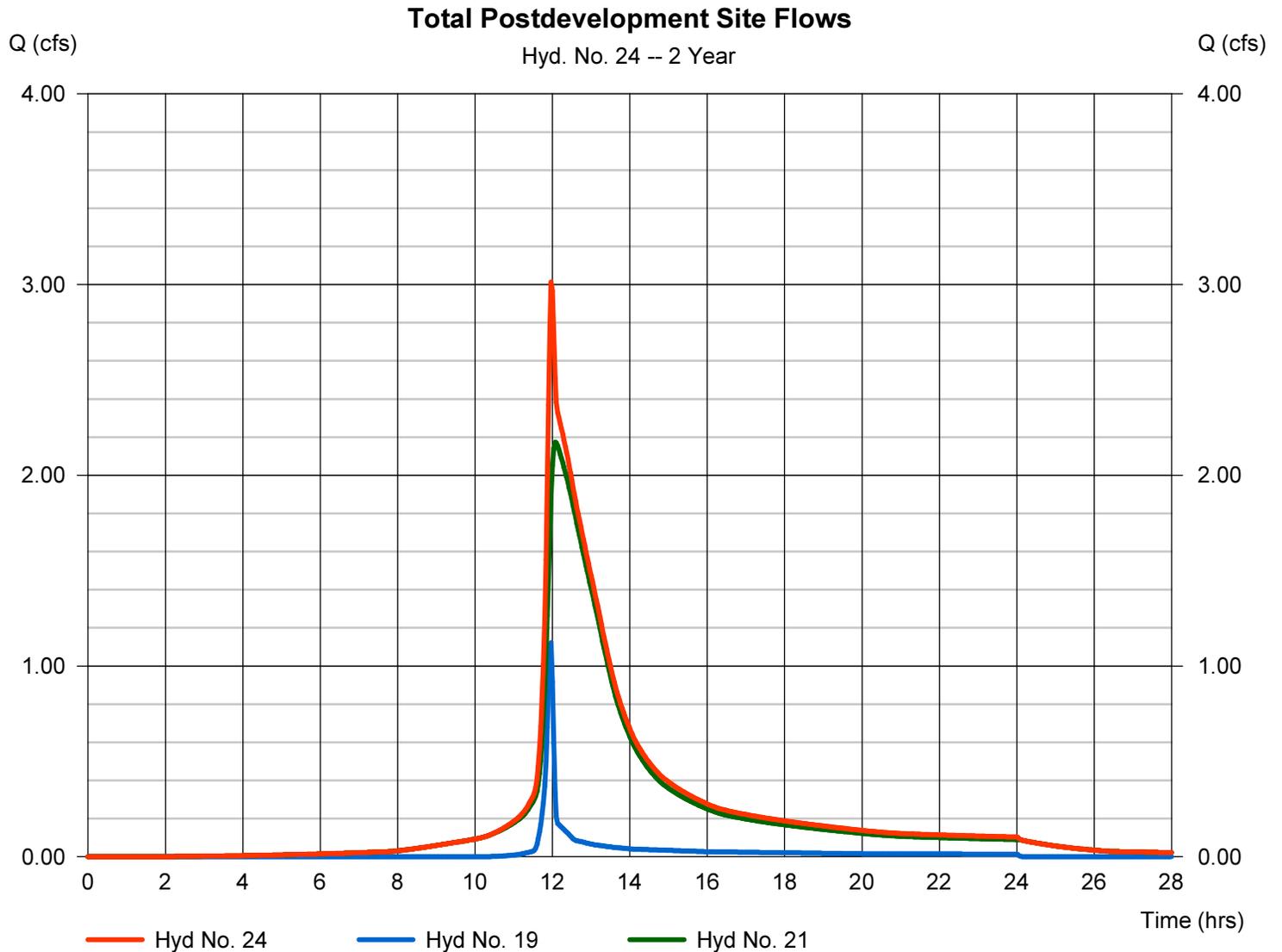


Hydrograph Report

Hyd. No. 24

Total Postdevelopment Site Flows

Hydrograph type	= Combine	Peak discharge	= 3.013 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 23,222 cuft
Inflow hyds.	= 19, 21	Contrib. drain. area	= 0.000 ac



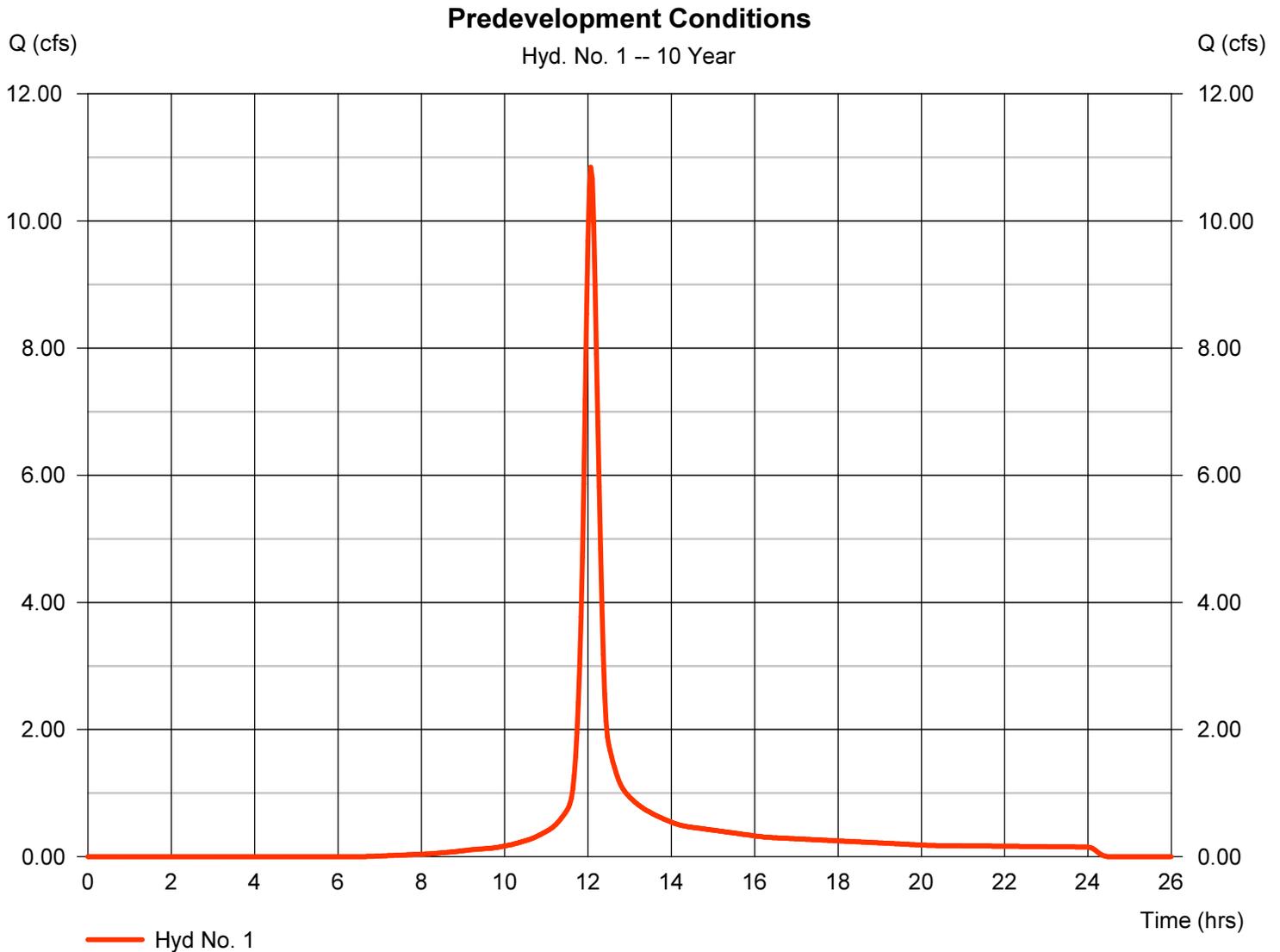
Hydrograph Report

Hyd. No. 1

Predevelopment Conditions

Hydrograph type	= SCS Runoff	Peak discharge	= 10.85 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 33,986 cuft
Drainage area	= 2.980 ac	Curve number	= 82*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 17.00 min
Total precip.	= 5.07 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.980 x 98) + (2.000 x 74)] / 2.980



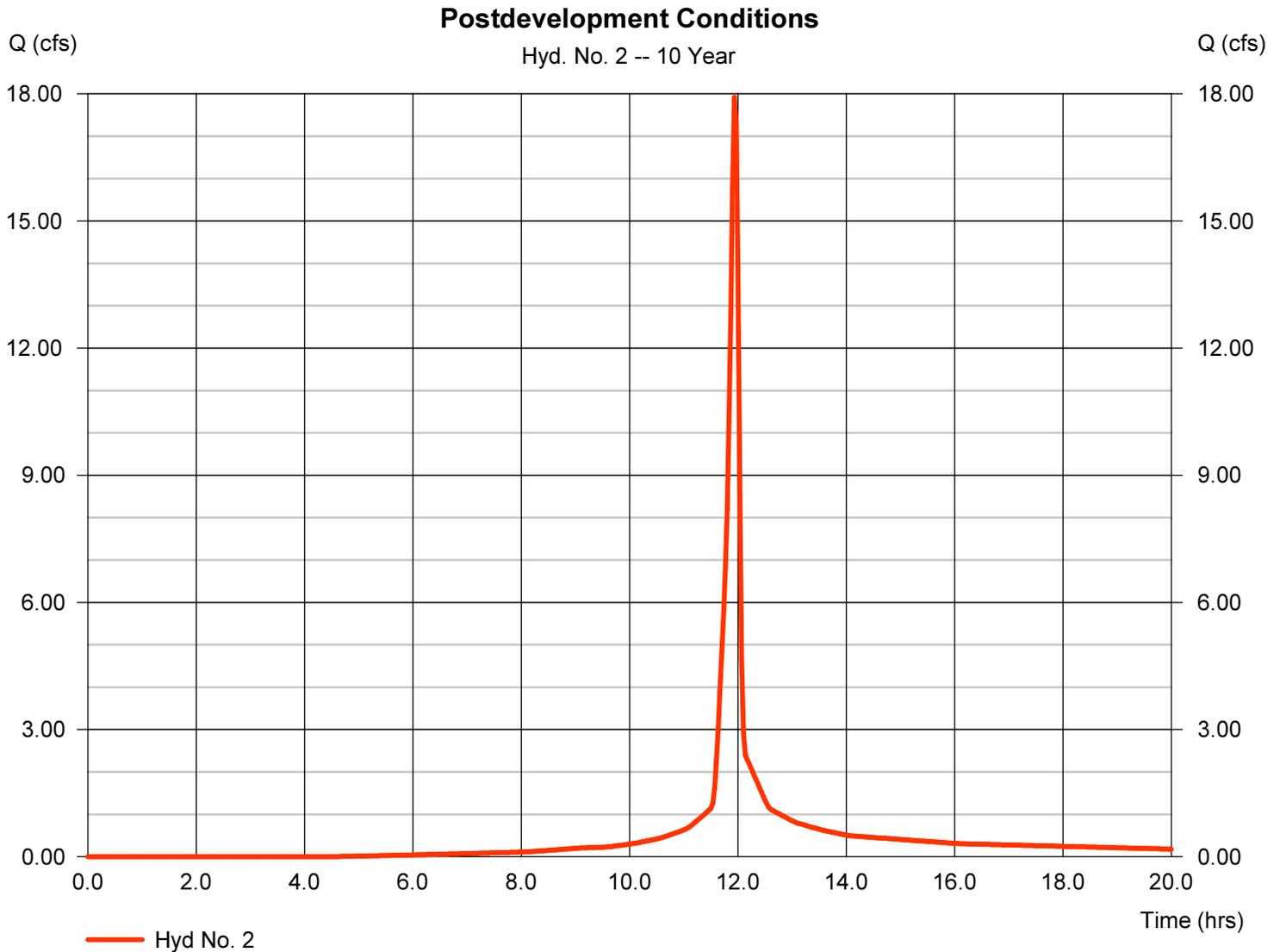
Hydrograph Report

Hyd. No. 2

Postdevelopment Conditions

Hydrograph type	= SCS Runoff	Peak discharge	= 17.92 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 37,882 cuft
Drainage area	= 2.980 ac	Curve number	= 88*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.07 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = $[(1.730 \times 98) + (1.250 \times 74)] / 2.980$

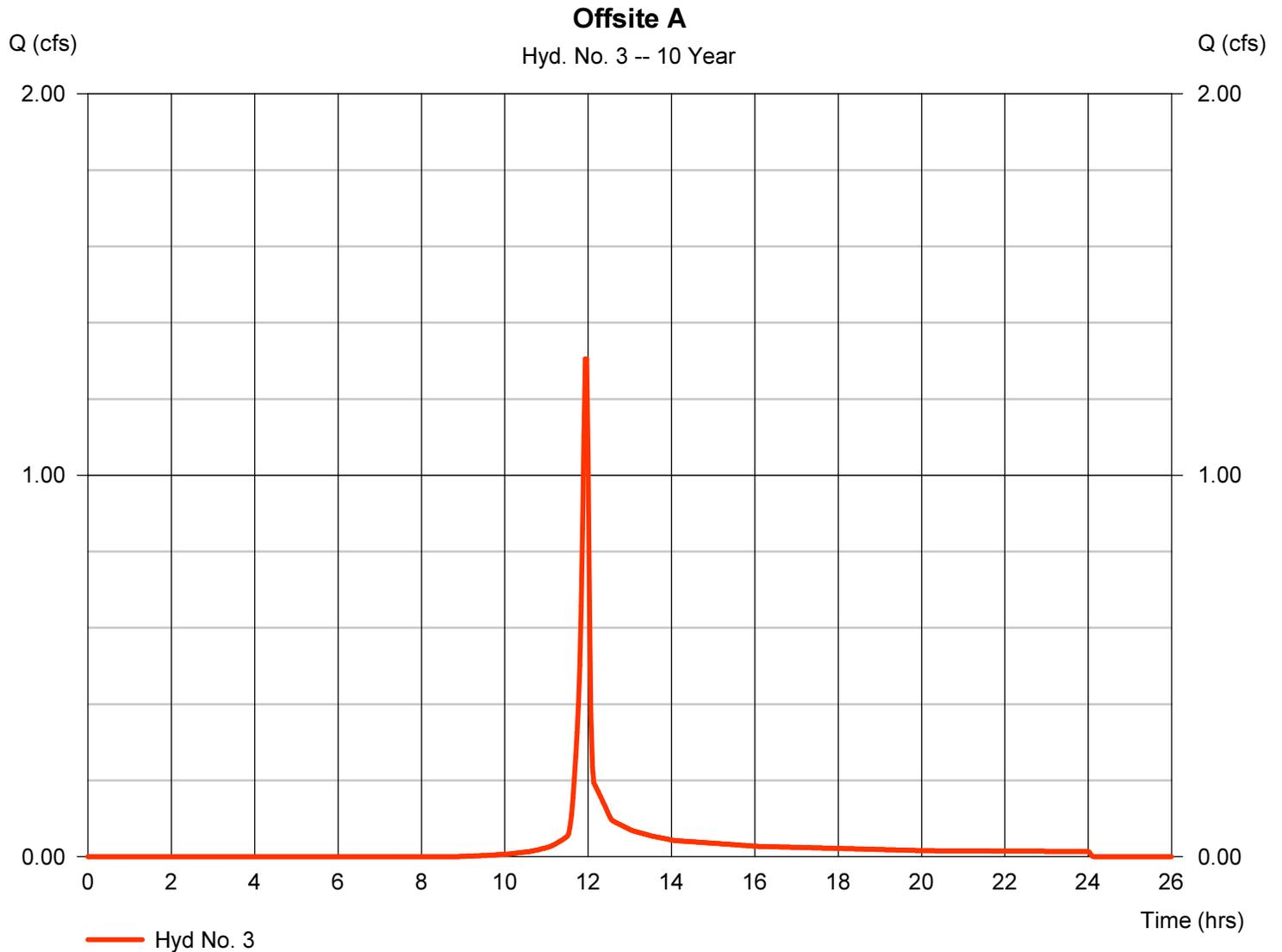


Hydrograph Report

Hyd. No. 3

Offsite A

Hydrograph type	= SCS Runoff	Peak discharge	= 1.305 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 2,636 cuft
Drainage area	= 0.320 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.07 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

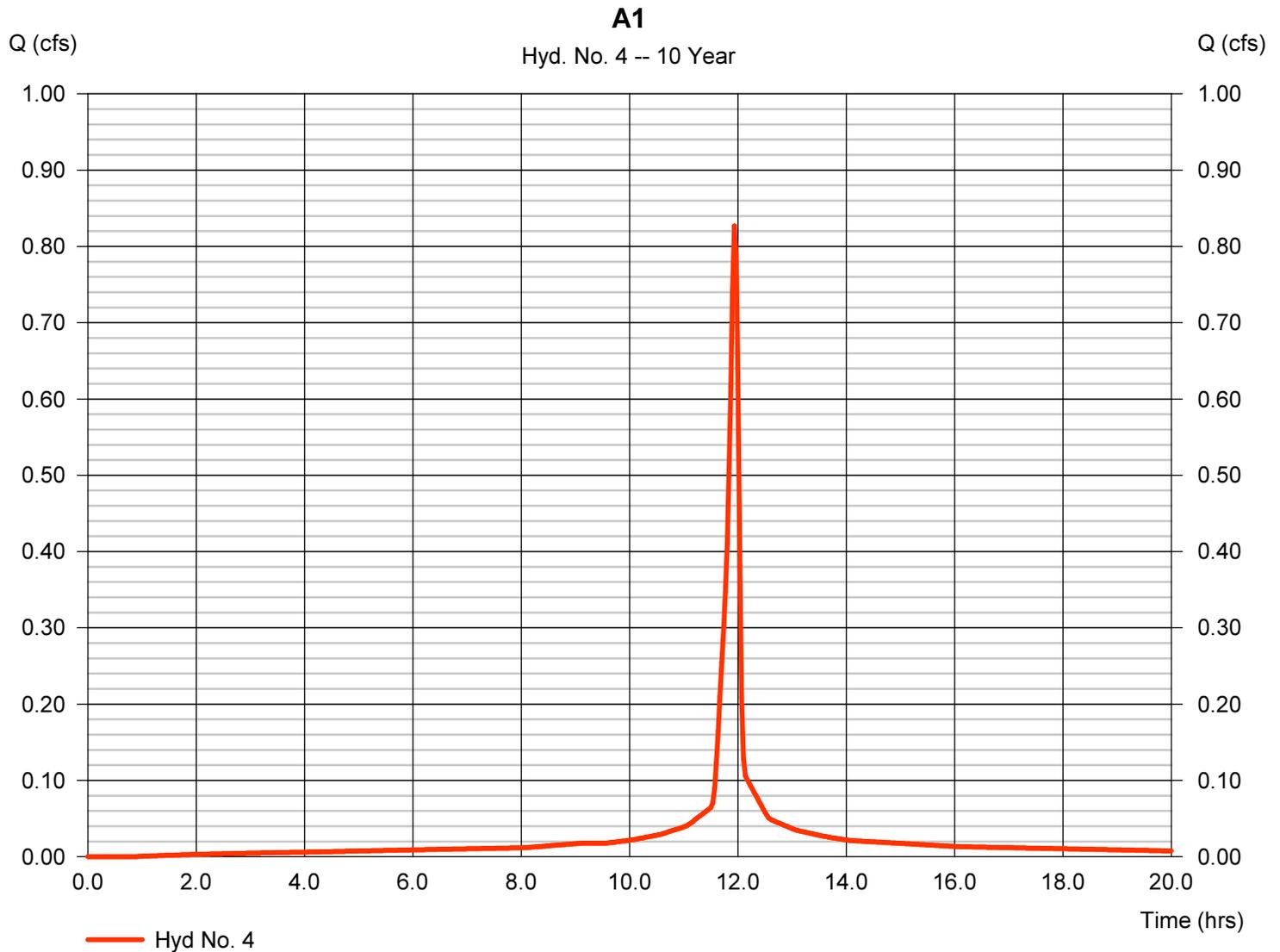
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Hyd. No. 4

A1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.827 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 1,974 cuft
Drainage area	= 0.120 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.07 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2010 by Autodesk, Inc. v9.25

Wednesday, Apr 30, 2014

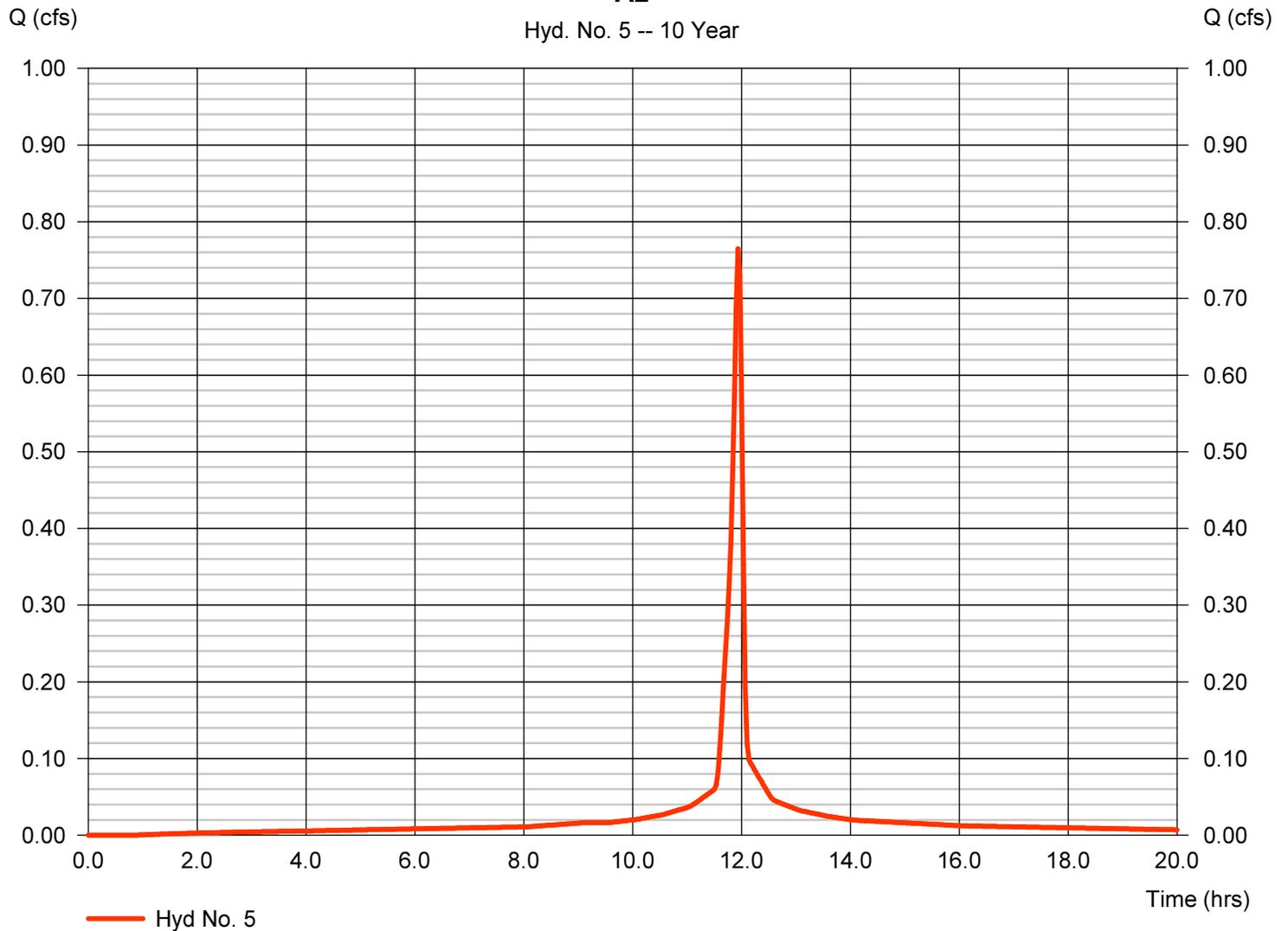
Hyd. No. 5

A2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.765 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 1,826 cuft
Drainage area	= 0.111 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.07 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

A2

Hyd. No. 5 -- 10 Year



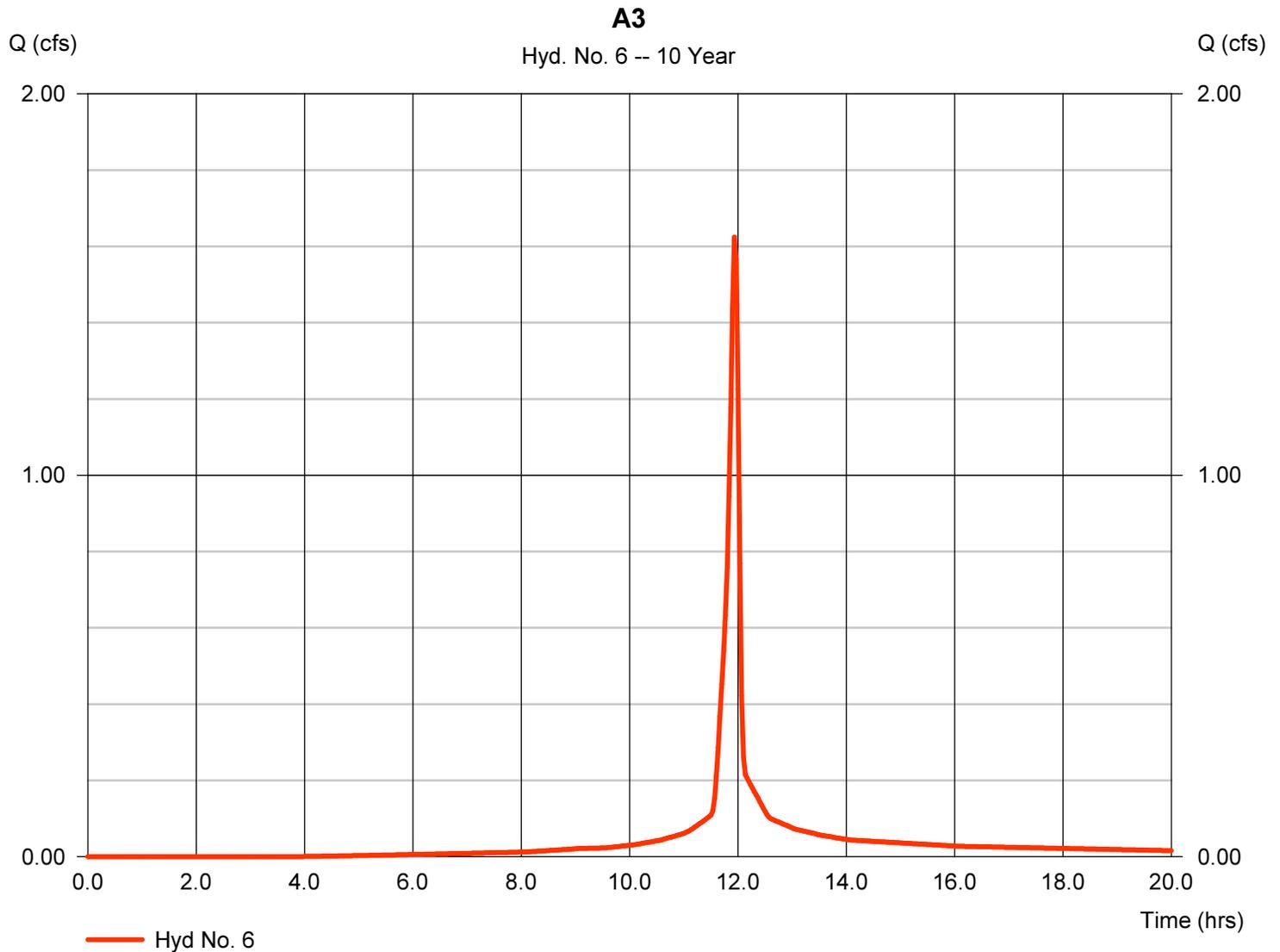
Hydrograph Report

Hyd. No. 6

A3

Hydrograph type	= SCS Runoff	Peak discharge	= 1.625 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 3,490 cuft
Drainage area	= 0.260 ac	Curve number	= 90*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.07 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.091 x 74) + (0.169 x 98)] / 0.260



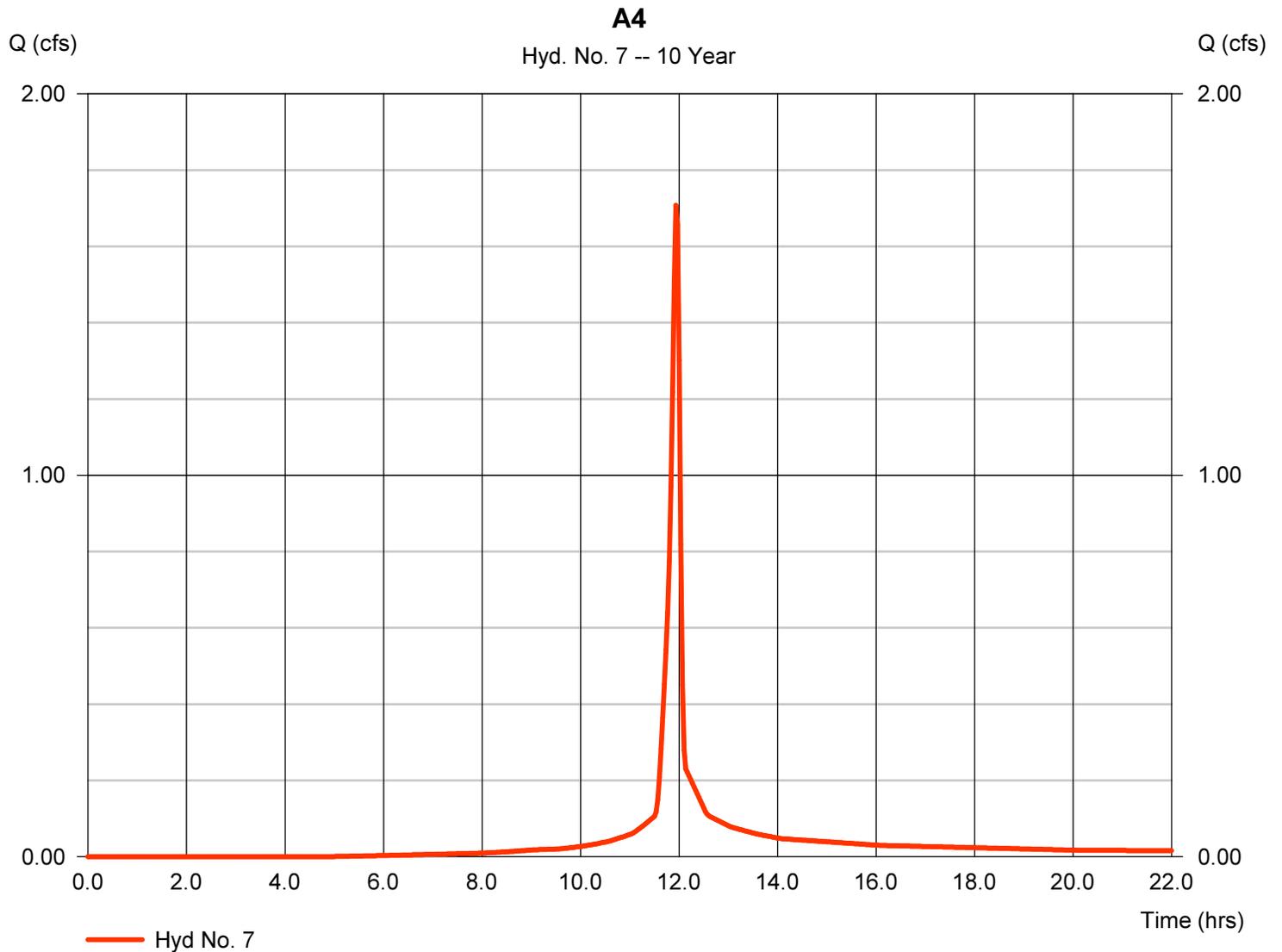
Hydrograph Report

Hyd. No. 7

A4

Hydrograph type	= SCS Runoff	Peak discharge	= 1.708 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 3,586 cuft
Drainage area	= 0.290 ac	Curve number	= 87*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.07 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.131 x 74) + (0.160 x 98)] / 0.290



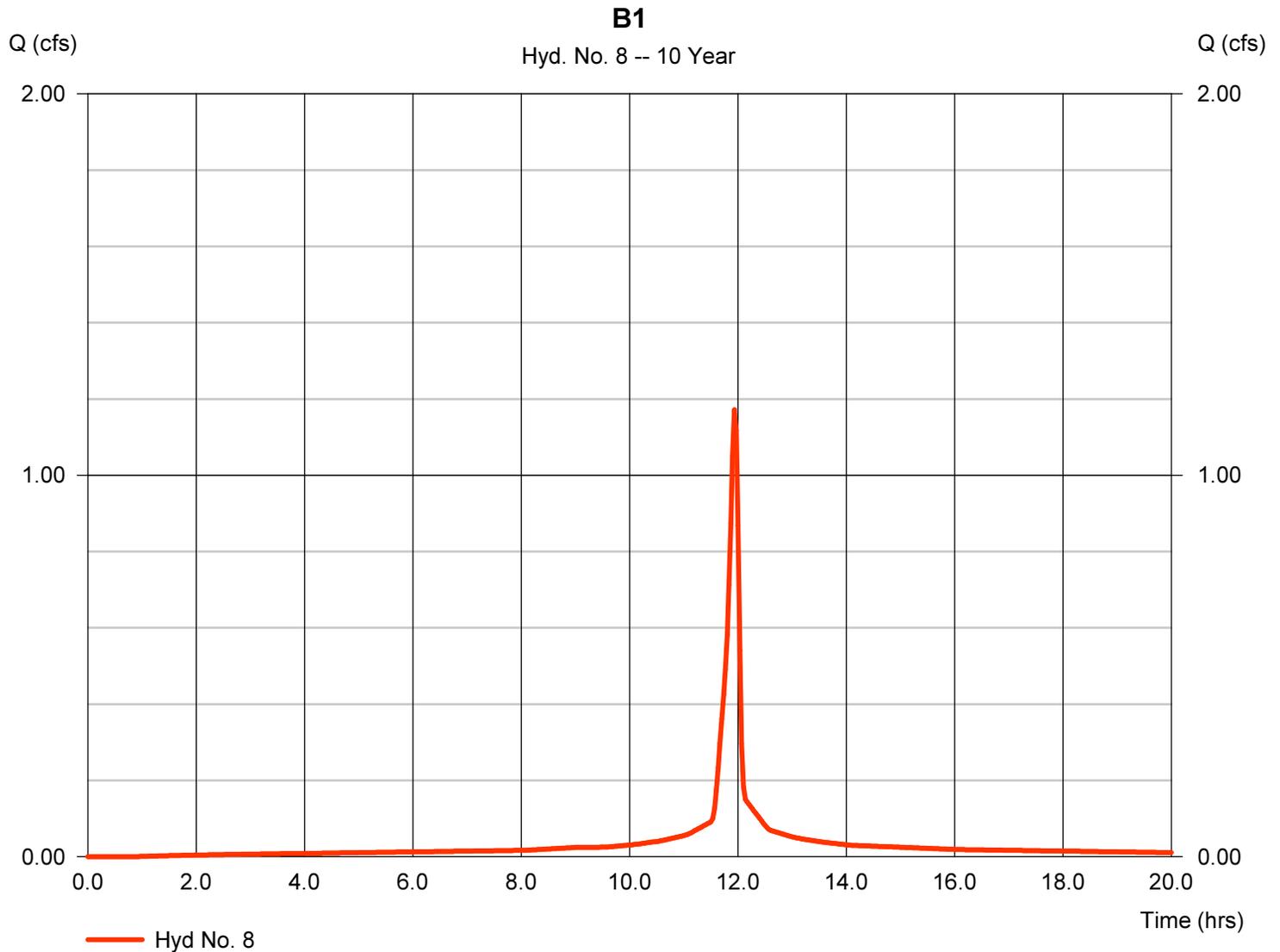
Hydrograph Report

Hyd. No. 8

B1

Hydrograph type	= SCS Runoff	Peak discharge	= 1.172 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 2,796 cuft
Drainage area	= 0.170 ac	Curve number	= 98*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.07 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = $[(0.170 \times 98)] / 0.170$



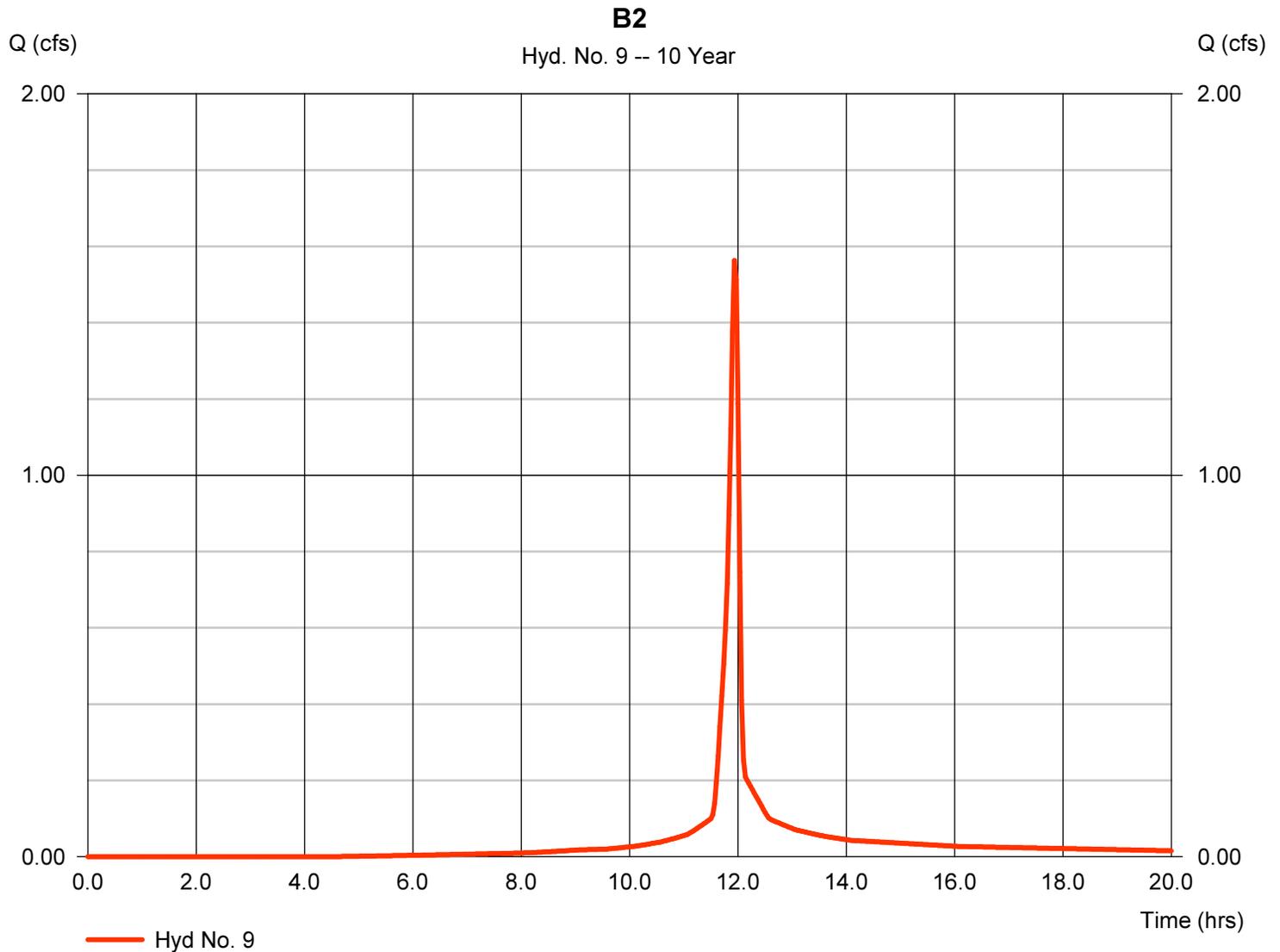
Hydrograph Report

Hyd. No. 9

B2

Hydrograph type	= SCS Runoff	Peak discharge	= 1.563 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 3,305 cuft
Drainage area	= 0.260 ac	Curve number	= 88*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.07 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.104 x 74) + (0.156 x 98)] / 0.260

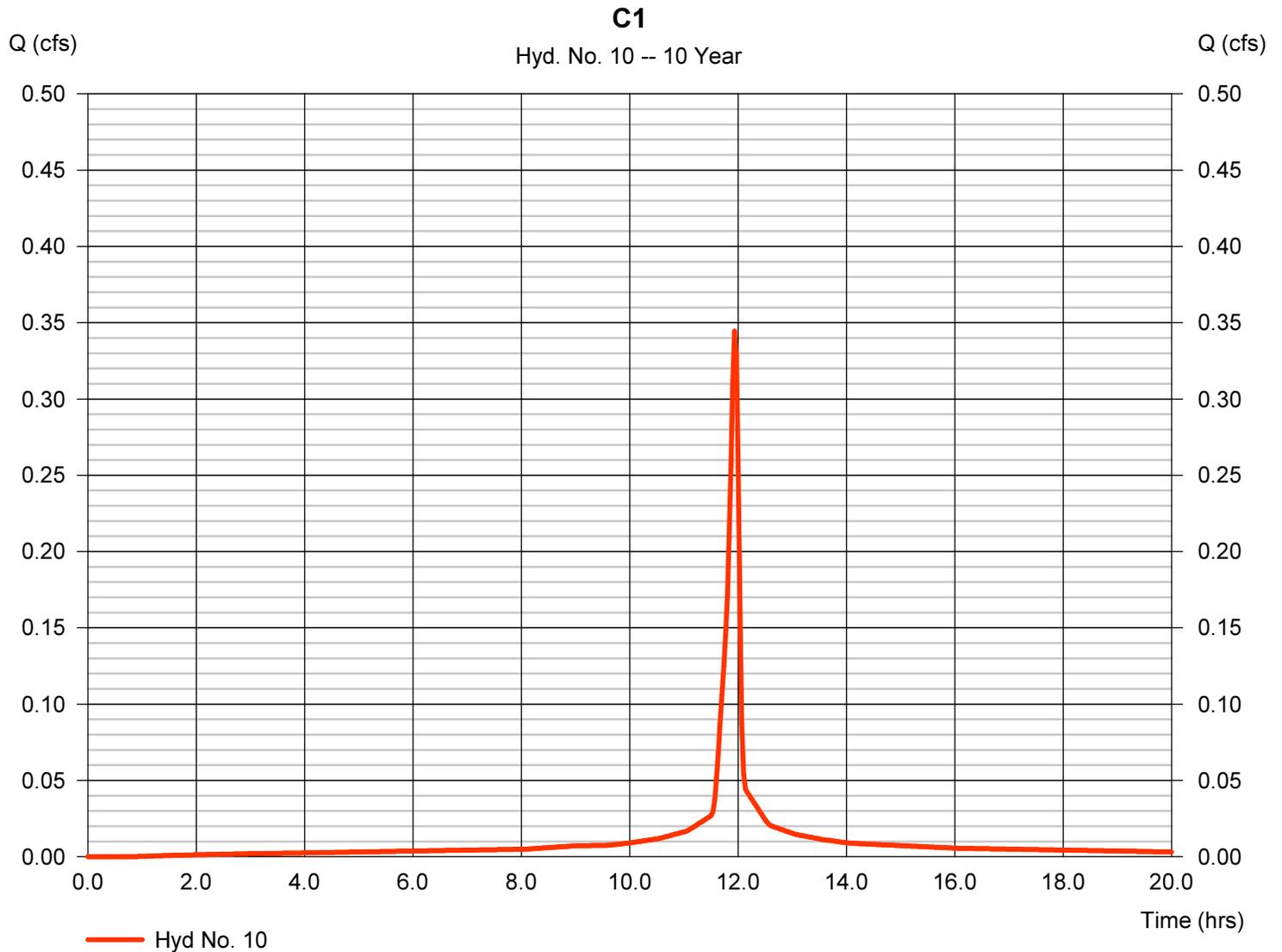


Hydrograph Report

Hyd. No. 10

C1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.345 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 822 cuft
Drainage area	= 0.050 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.07 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2010 by Autodesk, Inc. v9.25

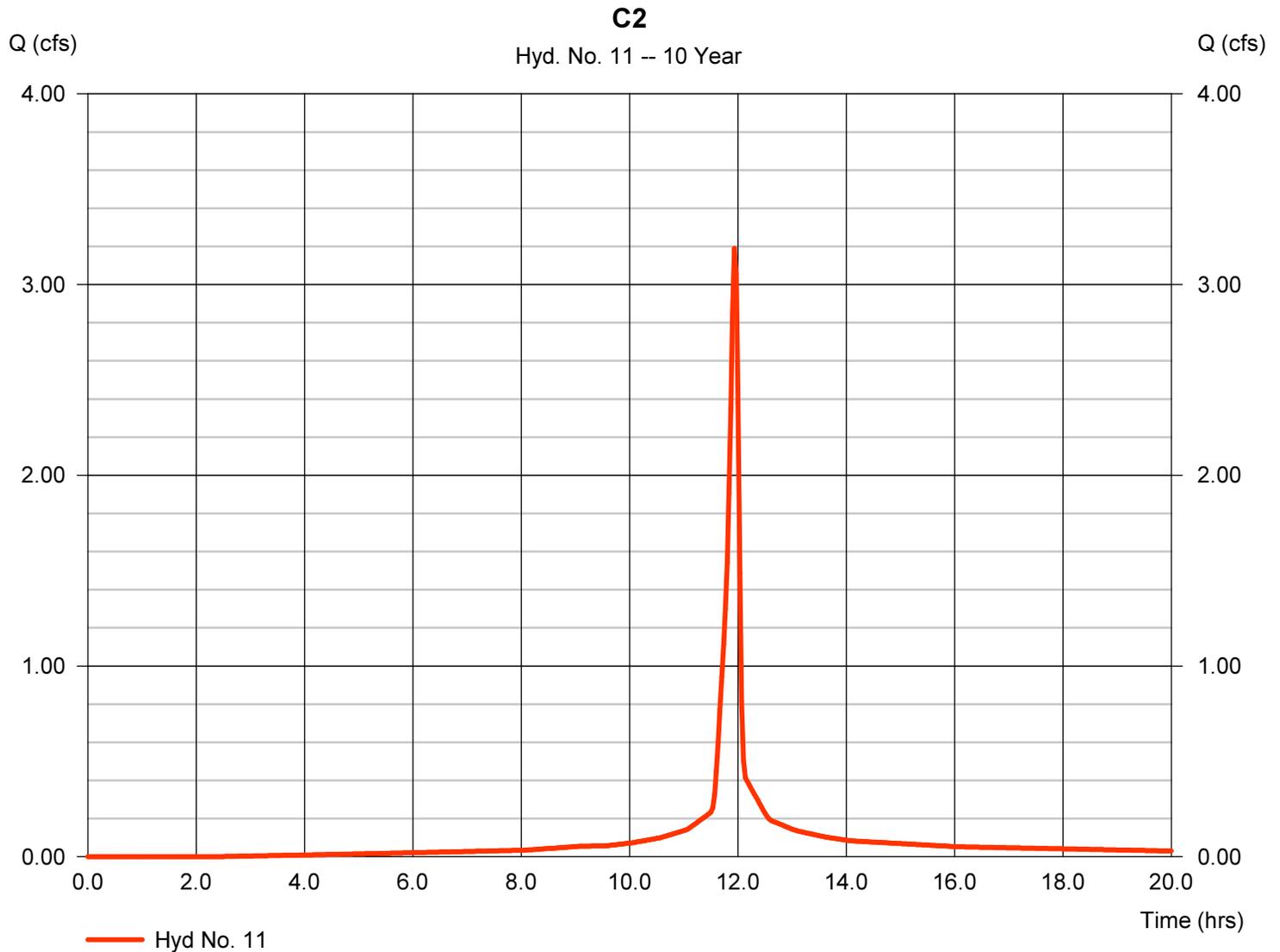
Wednesday, Apr 30, 2014

Hyd. No. 11

C2

Hydrograph type	= SCS Runoff	Peak discharge	= 3.190 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 7,150 cuft
Drainage area	= 0.480 ac	Curve number	= 94*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.07 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.077 x 74) + (0.403 x 98)] / 0.480

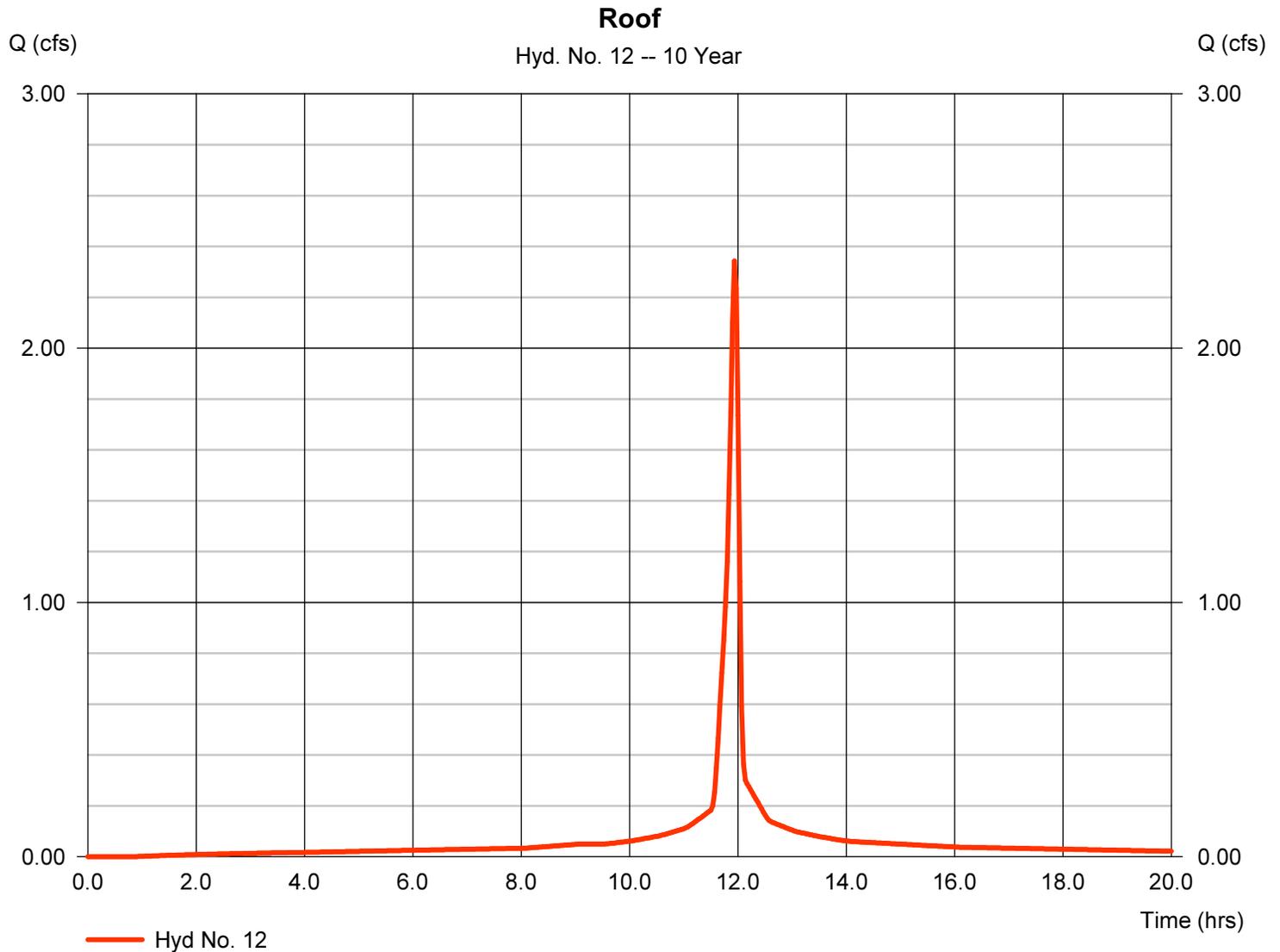


Hydrograph Report

Hyd. No. 12

Roof

Hydrograph type	= SCS Runoff	Peak discharge	= 2.343 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 5,592 cuft
Drainage area	= 0.340 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.07 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

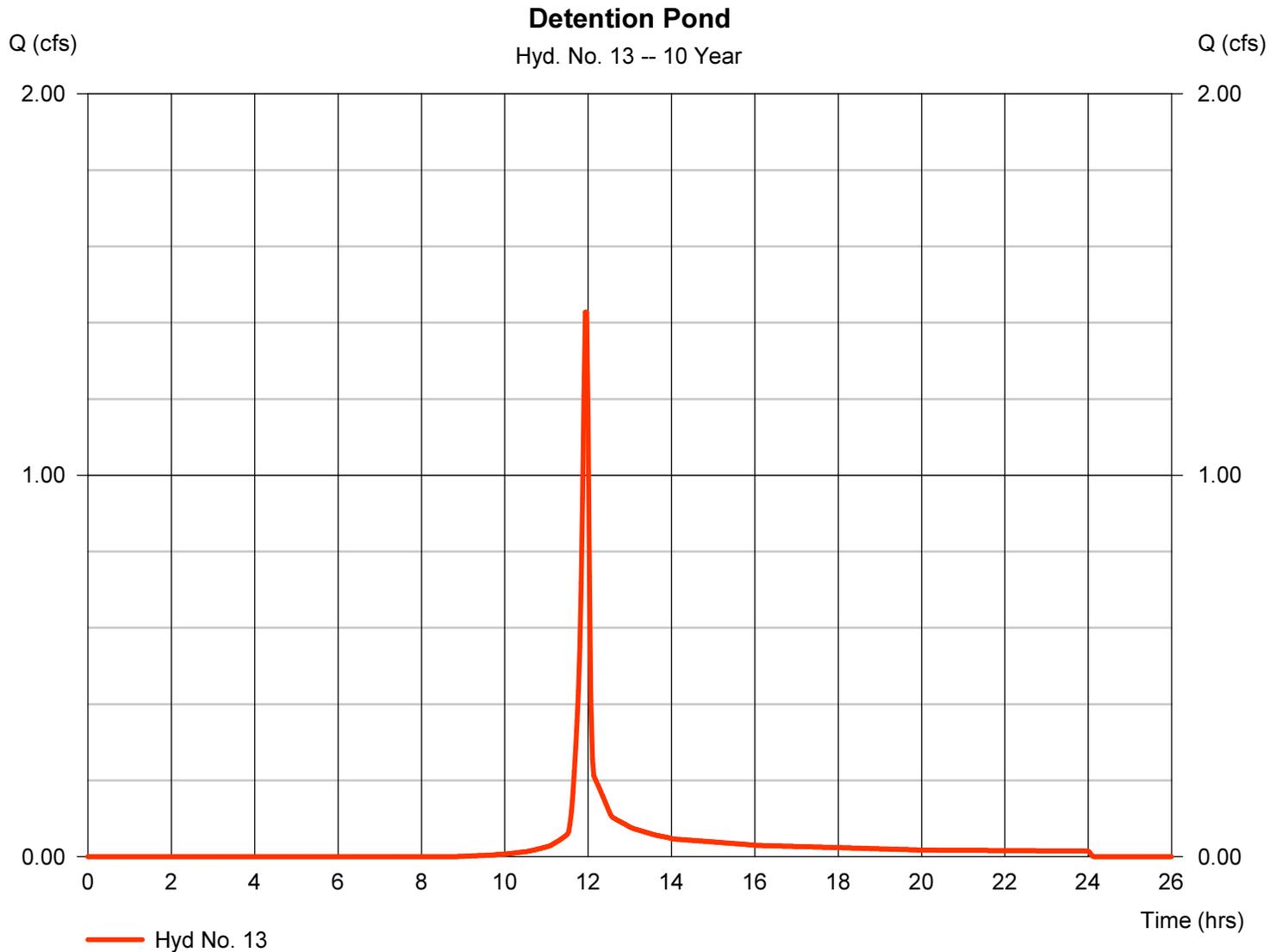


Hydrograph Report

Hyd. No. 13

Detention Pond

Hydrograph type	= SCS Runoff	Peak discharge	= 1.428 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 2,883 cuft
Drainage area	= 0.350 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.07 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



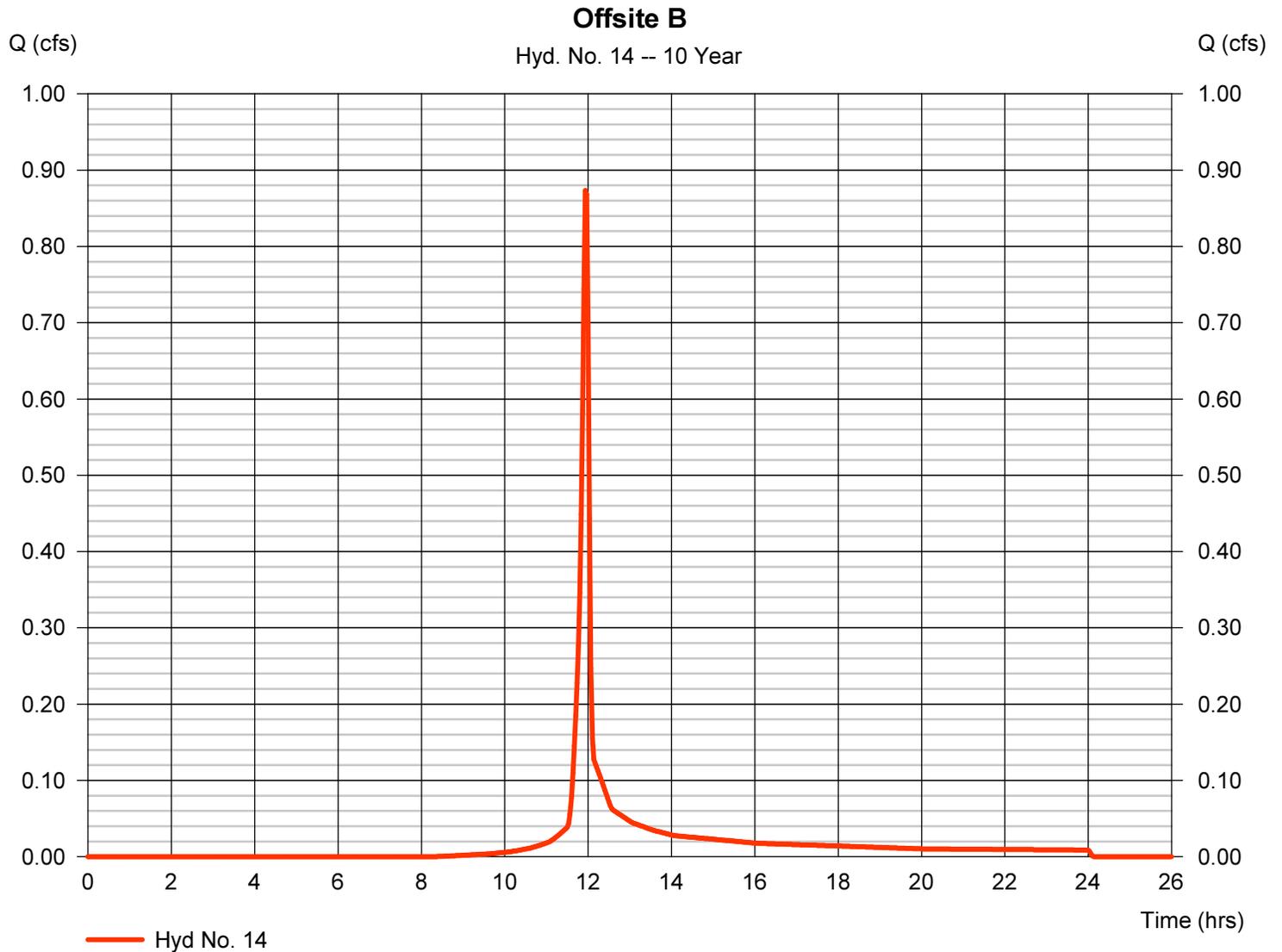
Hydrograph Report

Hyd. No. 14

Offsite B

Hydrograph type	= SCS Runoff	Peak discharge	= 0.873 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 1,765 cuft
Drainage area	= 0.200 ac	Curve number	= 76*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.07 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.180 x 74) + (0.020 x 98)] / 0.200

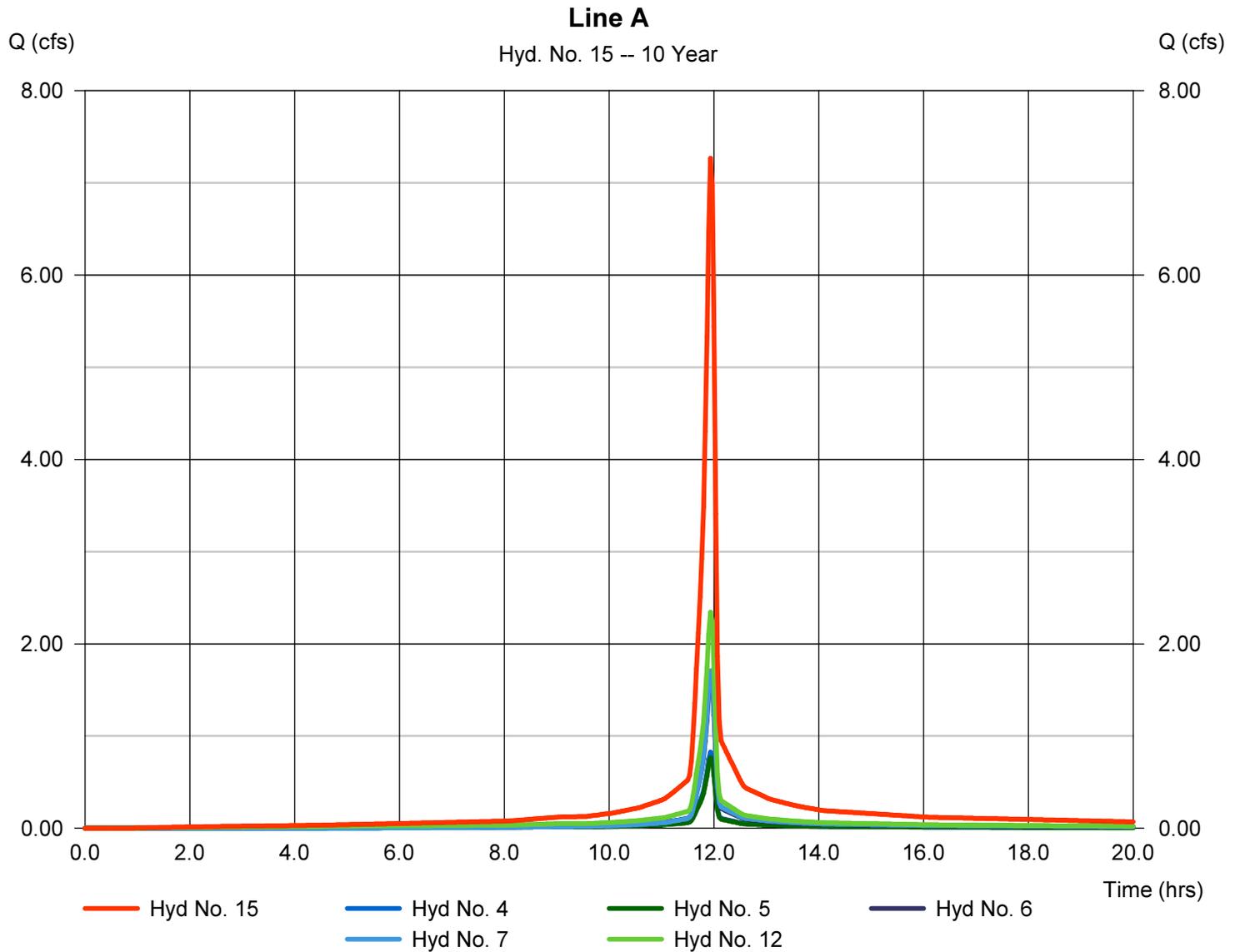


Hydrograph Report

Hyd. No. 15

Line A

Hydrograph type	= Combine	Peak discharge	= 7.267 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 16,467 cuft
Inflow hyds.	= 4, 5, 6, 7, 12	Contrib. drain. area	= 1.121 ac



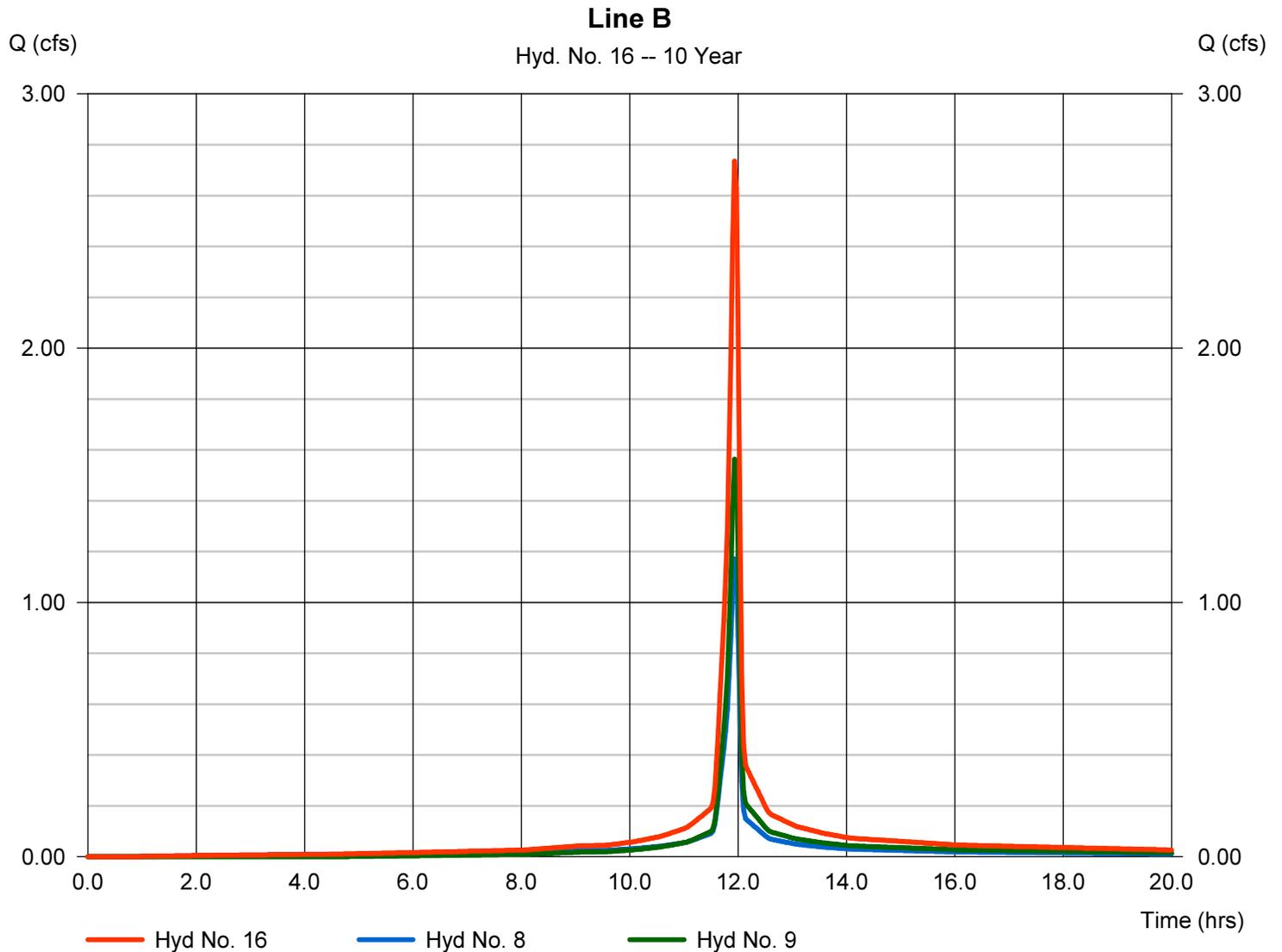
Hydrograph Report

Hyd. No. 16

Line B

Hydrograph type = Combine
Storm frequency = 10 yrs
Time interval = 2 min
Inflow hyds. = 8, 9

Peak discharge = 2.735 cfs
Time to peak = 11.93 hrs
Hyd. volume = 6,101 cuft
Contrib. drain. area = 0.430 ac



Hydrograph Report

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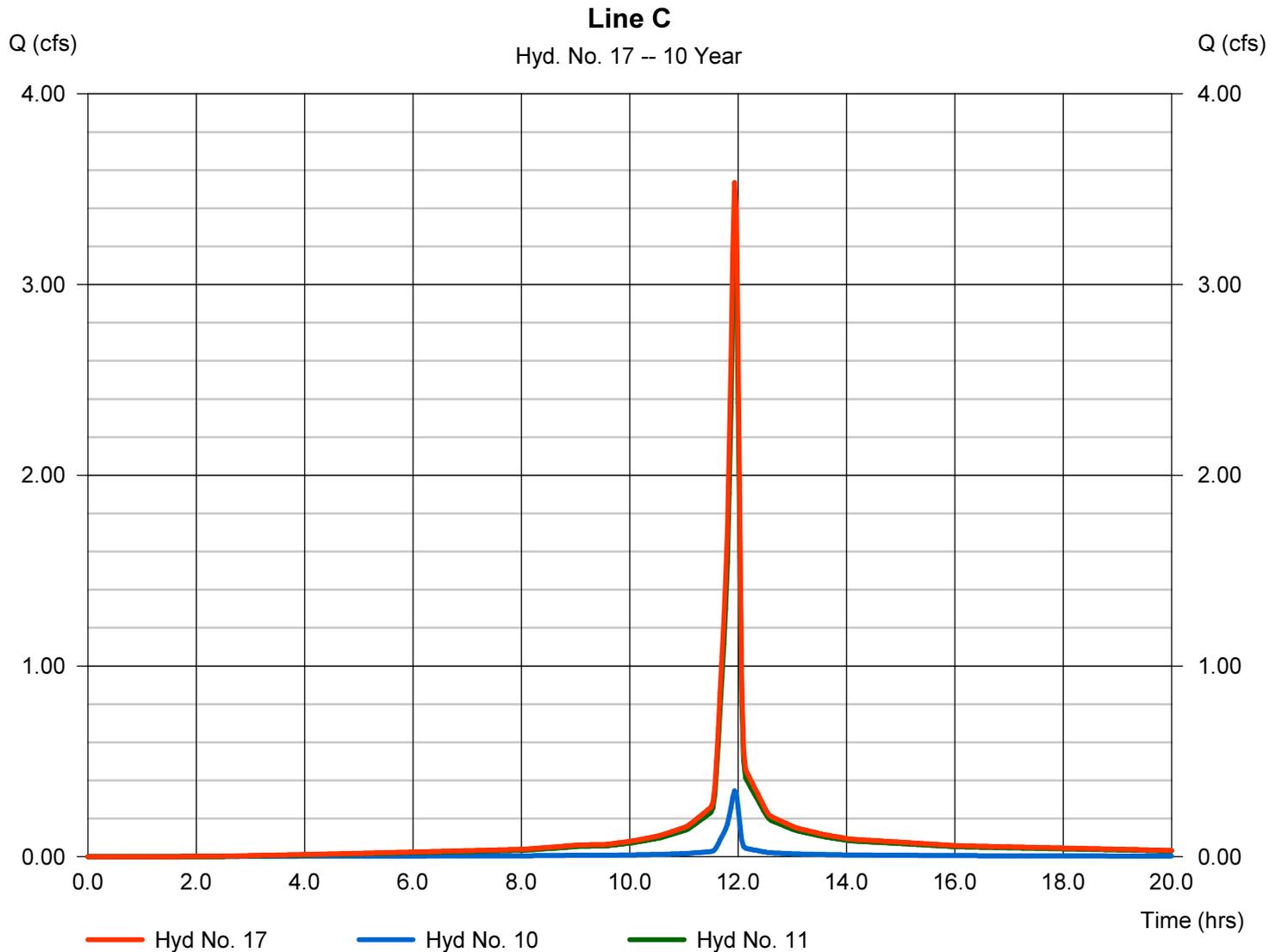
Wednesday, Apr 30, 2014

Hyd. No. 17

Line C

Hydrograph type = Combine
Storm frequency = 10 yrs
Time interval = 2 min
Inflow hyds. = 10, 11

Peak discharge = 3.535 cfs
Time to peak = 11.93 hrs
Hyd. volume = 7,972 cuft
Contrib. drain. area = 0.530 ac



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2010 by Autodesk, Inc. v9.25

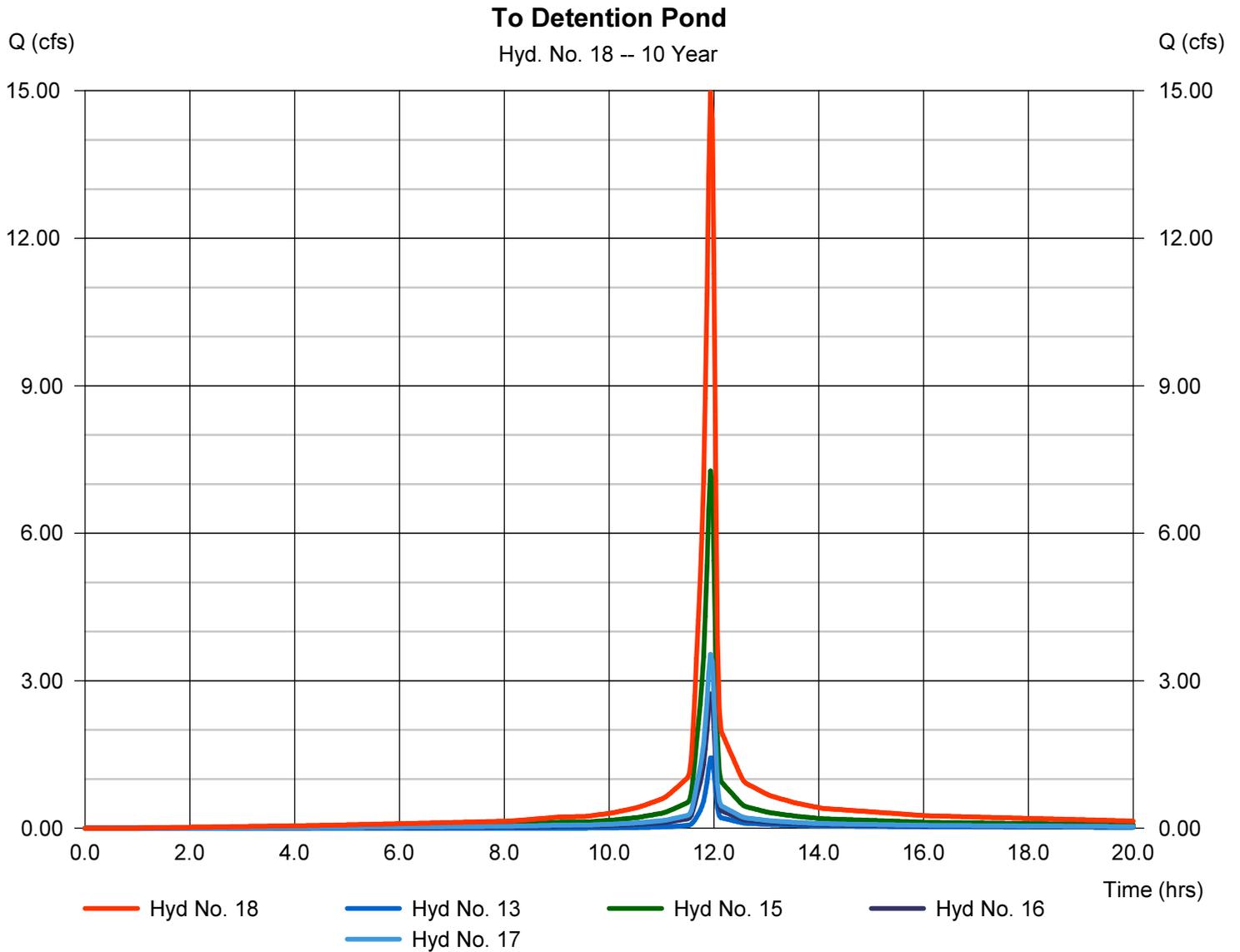
Wednesday, Apr 30, 2014

Hyd. No. 18

To Detention Pond

Hydrograph type = Combine
Storm frequency = 10 yrs
Time interval = 2 min
Inflow hyds. = 13, 15, 16, 17

Peak discharge = 14.96 cfs
Time to peak = 11.93 hrs
Hyd. volume = 33,423 cuft
Contrib. drain. area = 0.350 ac



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2010 by Autodesk, Inc. v9.25

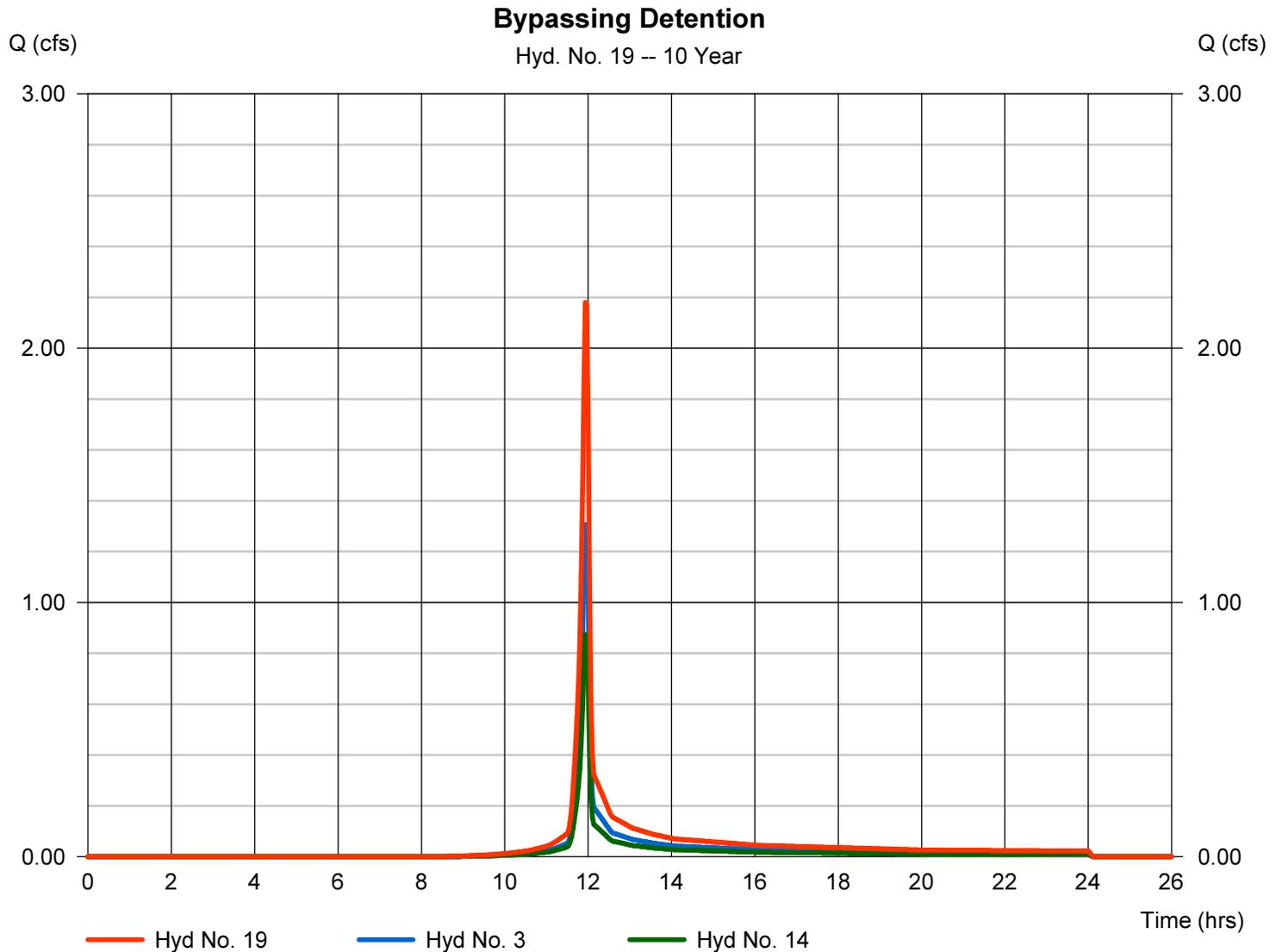
Wednesday, Apr 30, 2014

Hyd. No. 19

Bypassing Detention

Hydrograph type = Combine
Storm frequency = 10 yrs
Time interval = 2 min
Inflow hyds. = 3, 14

Peak discharge = 2.179 cfs
Time to peak = 11.93 hrs
Hyd. volume = 4,401 cuft
Contrib. drain. area = 0.520 ac



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2010 by Autodesk, Inc. v9.25

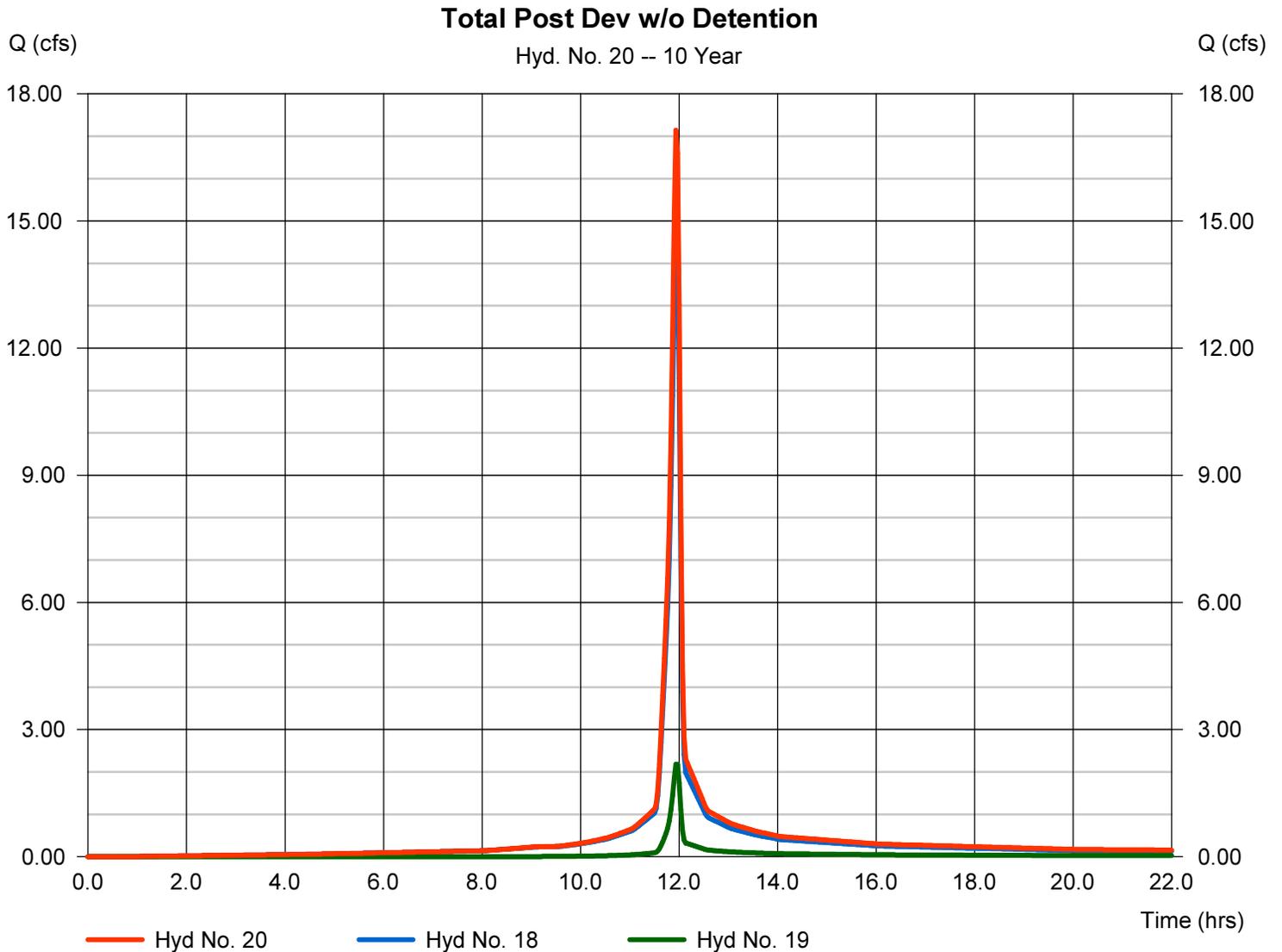
Wednesday, Apr 30, 2014

Hyd. No. 20

Total Post Dev w/o Detention

Hydrograph type = Combine
Storm frequency = 10 yrs
Time interval = 2 min
Inflow hyds. = 18, 19

Peak discharge = 17.14 cfs
Time to peak = 11.93 hrs
Hyd. volume = 37,824 cuft
Contrib. drain. area = 0.000 ac



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2010 by Autodesk, Inc. v9.25

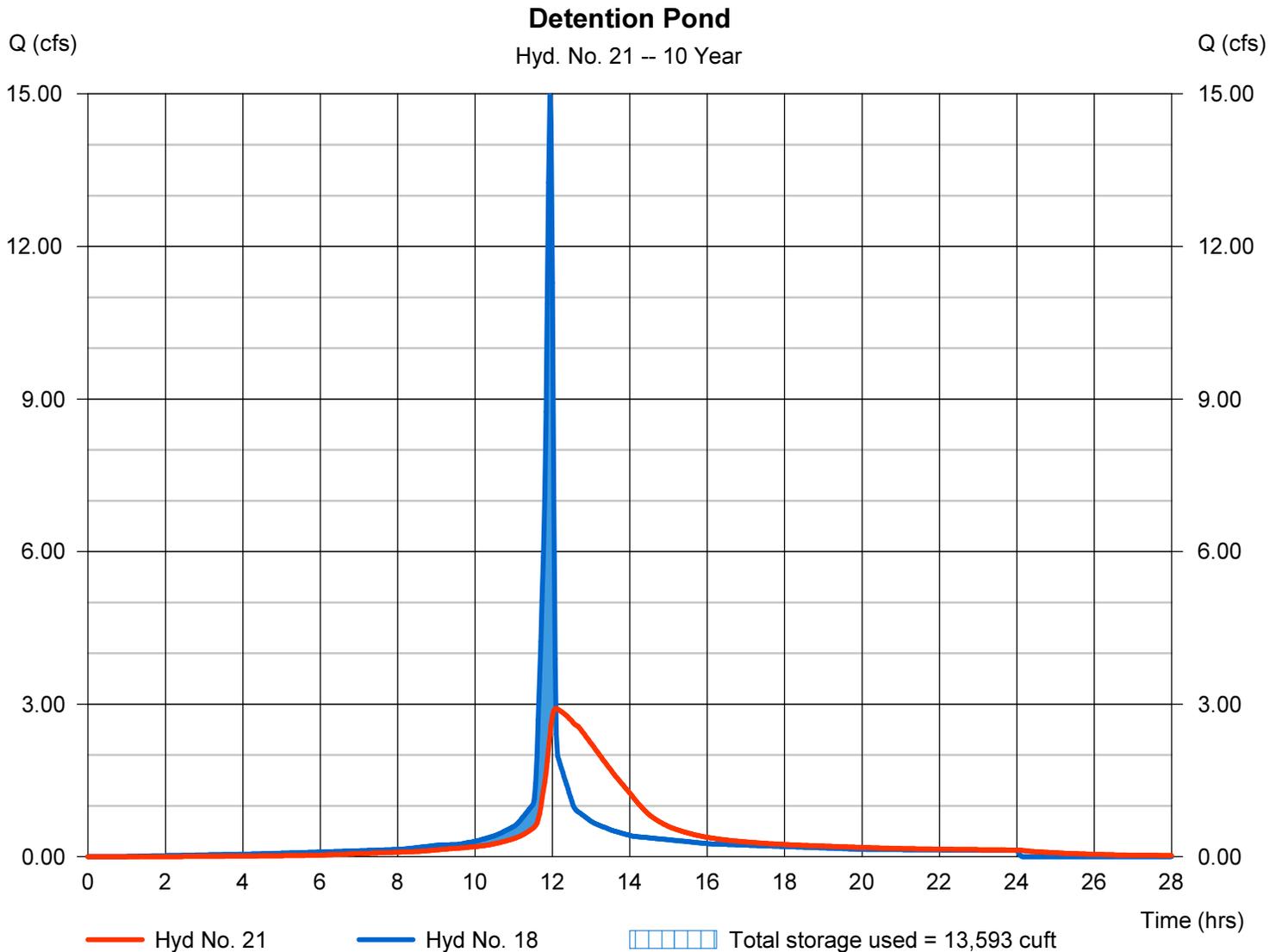
Wednesday, Apr 30, 2014

Hyd. No. 21

Detention Pond

Hydrograph type	= Reservoir	Peak discharge	= 2.915 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.10 hrs
Time interval	= 2 min	Hyd. volume	= 33,403 cuft
Inflow hyd. No.	= 18 - To Detention Pond	Max. Elevation	= 924.39 ft
Reservoir name	= Detention Pond	Max. Storage	= 13,593 cuft

Storage Indication method used.

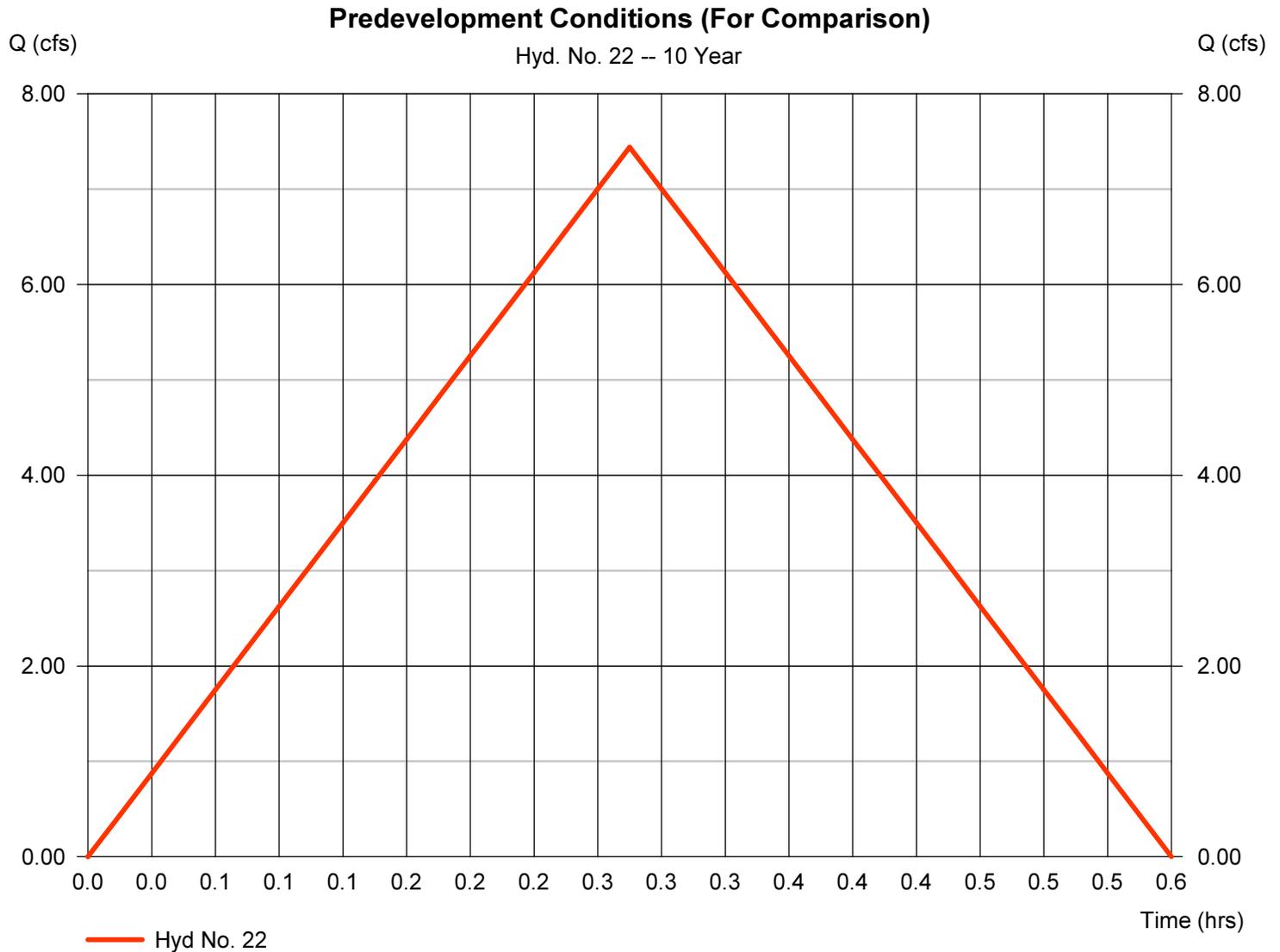


Hydrograph Report

Hyd. No. 22

Predevelopment Conditions (For Comparison)

Hydrograph type	= Rational	Peak discharge	= 7.441 cfs
Storm frequency	= 10 yrs	Time to peak	= 0.28 hrs
Time interval	= 1 min	Hyd. volume	= 7,590 cuft
Drainage area	= 2.980 ac	Runoff coeff.	= 0.5
Intensity	= 4.994 in/hr	Tc by User	= 17.00 min
IDF Curve	= Shawnee County.IDF	Asc/Rec limb fact	= 1/1



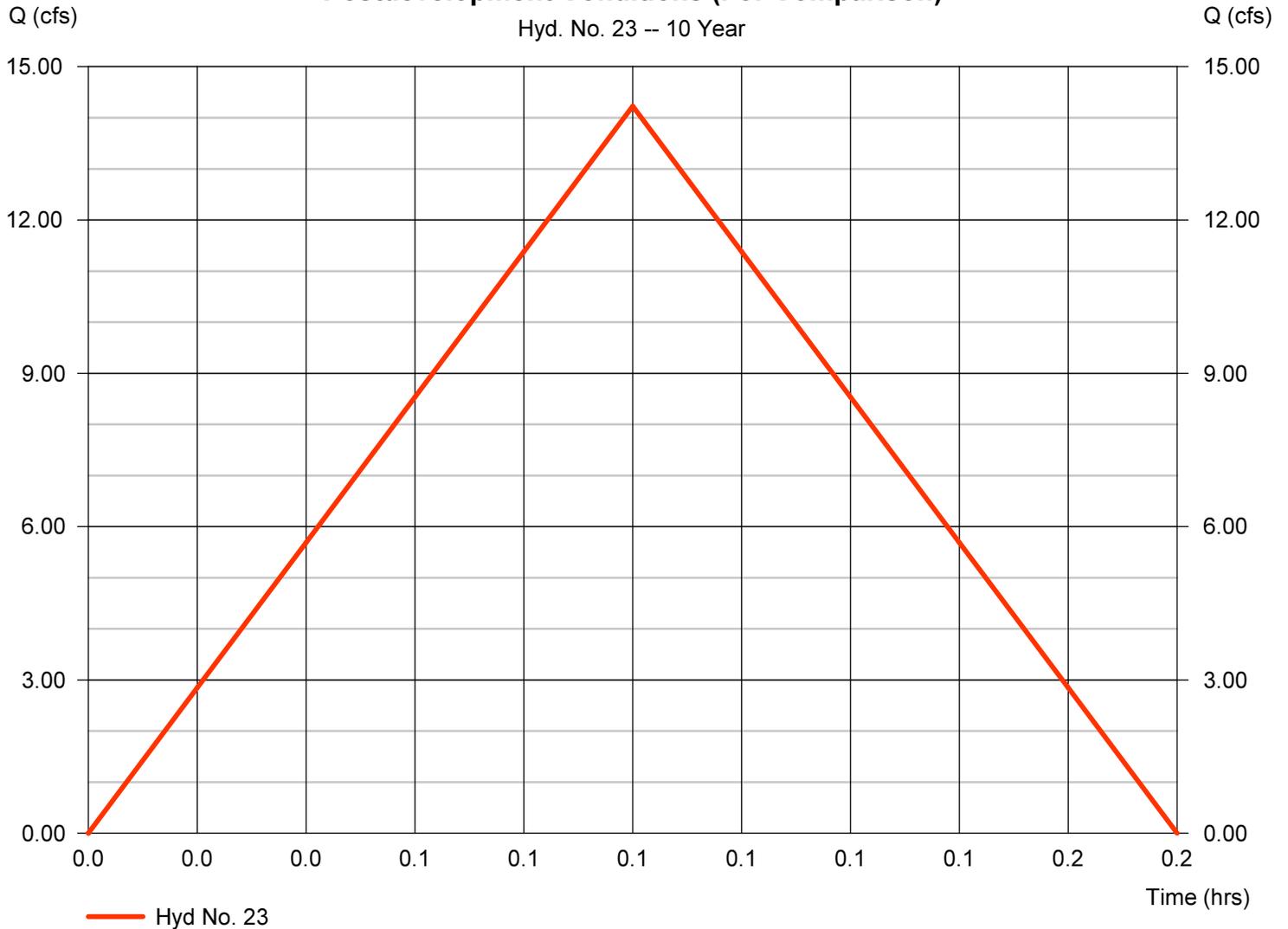
Hydrograph Report

Hyd. No. 23

Postdevelopment Conditions (For Comparison)

Hydrograph type	= Rational	Peak discharge	= 14.23 cfs
Storm frequency	= 10 yrs	Time to peak	= 0.08 hrs
Time interval	= 1 min	Hyd. volume	= 4,268 cuft
Drainage area	= 2.980 ac	Runoff coeff.	= 0.65
Intensity	= 7.344 in/hr	Tc by User	= 5.00 min
IDF Curve	= Shawnee County.IDF	Asc/Rec limb fact	= 1/1

Postdevelopment Conditions (For Comparison)



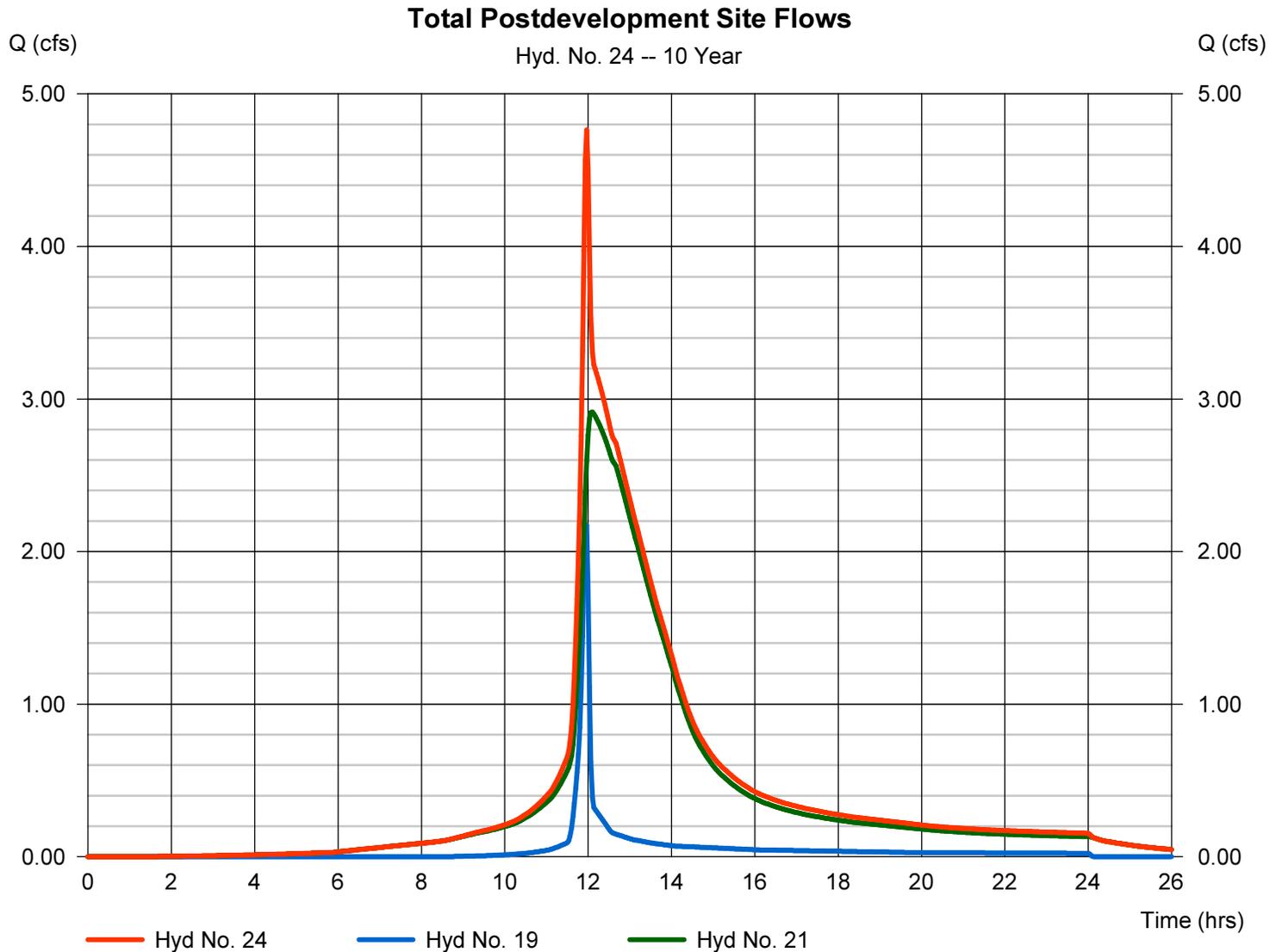
Hydrograph Report

Hyd. No. 24

Total Postdevelopment Site Flows

Hydrograph type = Combine
Storm frequency = 10 yrs
Time interval = 2 min
Inflow hyds. = 19, 21

Peak discharge = 4.764 cfs
Time to peak = 11.97 hrs
Hyd. volume = 37,803 cuft
Contrib. drain. area = 0.000 ac



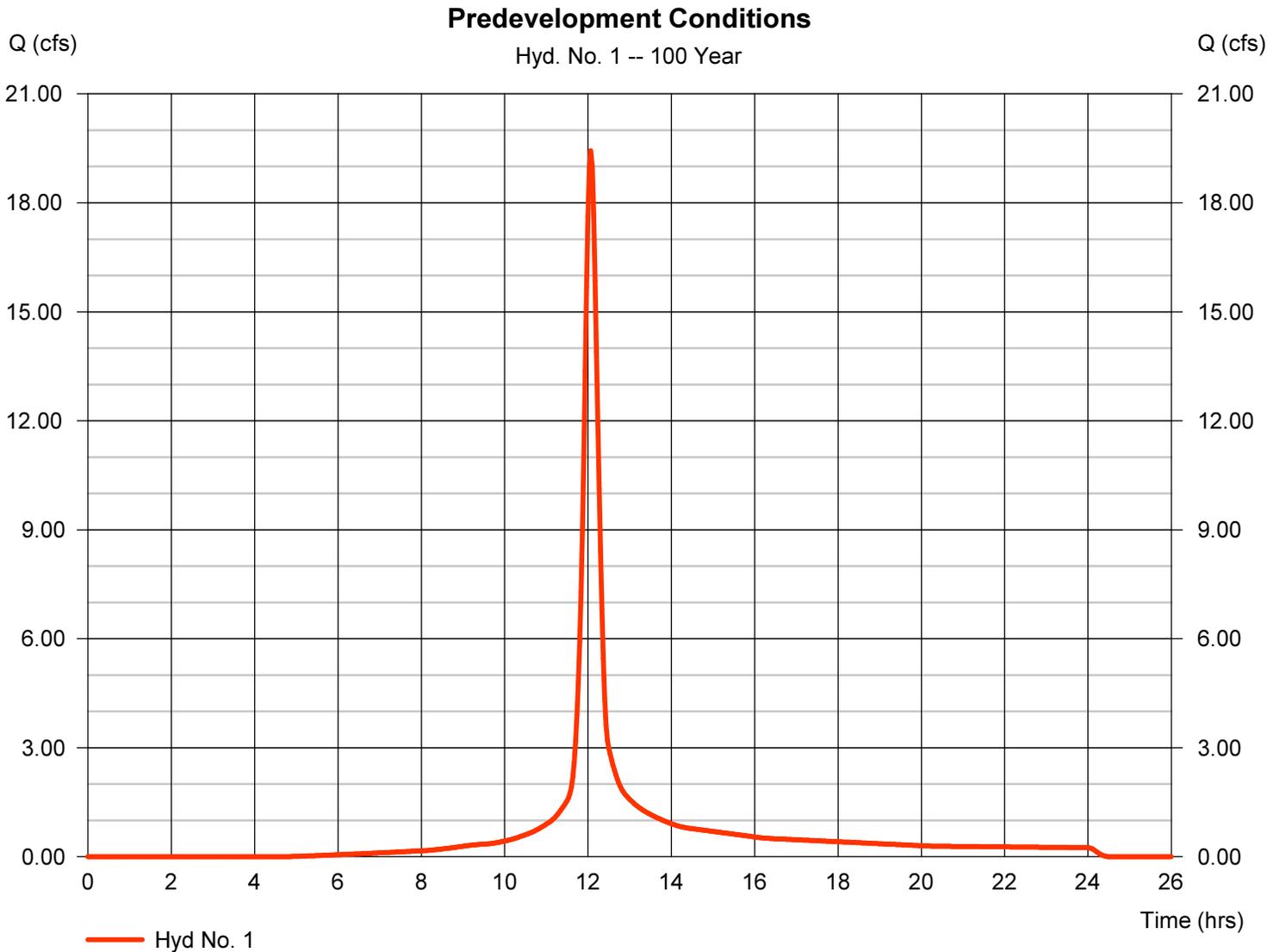
Hydrograph Report

Hyd. No. 1

Predevelopment Conditions

Hydrograph type	= SCS Runoff	Peak discharge	= 19.43 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 61,951 cuft
Drainage area	= 2.980 ac	Curve number	= 82*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 17.00 min
Total precip.	= 7.86 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.980 x 98) + (2.000 x 74)] / 2.980



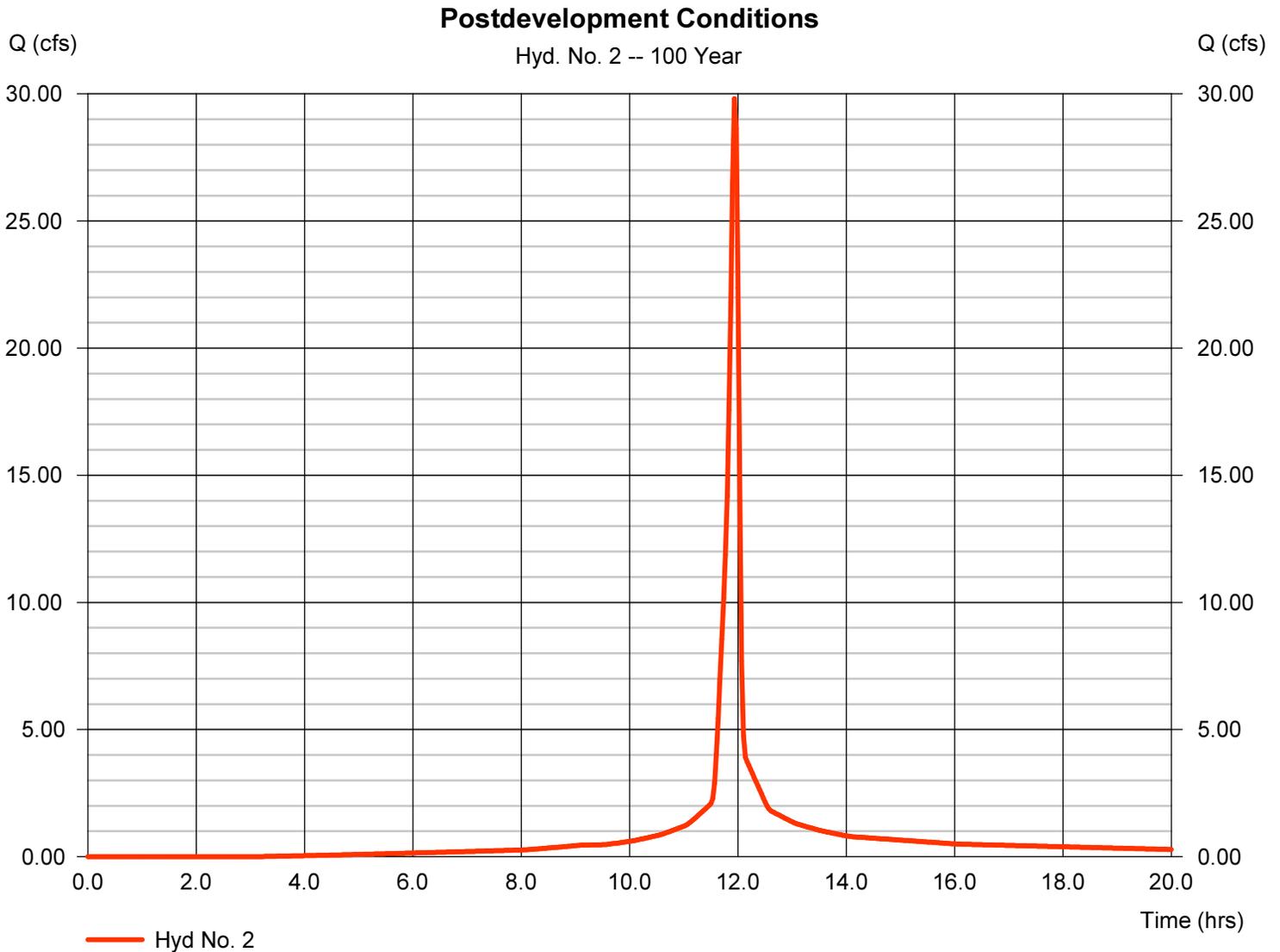
Hydrograph Report

Hyd. No. 2

Postdevelopment Conditions

Hydrograph type	= SCS Runoff	Peak discharge	= 29.82 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 65,223 cuft
Drainage area	= 2.980 ac	Curve number	= 88*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.86 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = $[(1.730 \times 98) + (1.250 \times 74)] / 2.980$

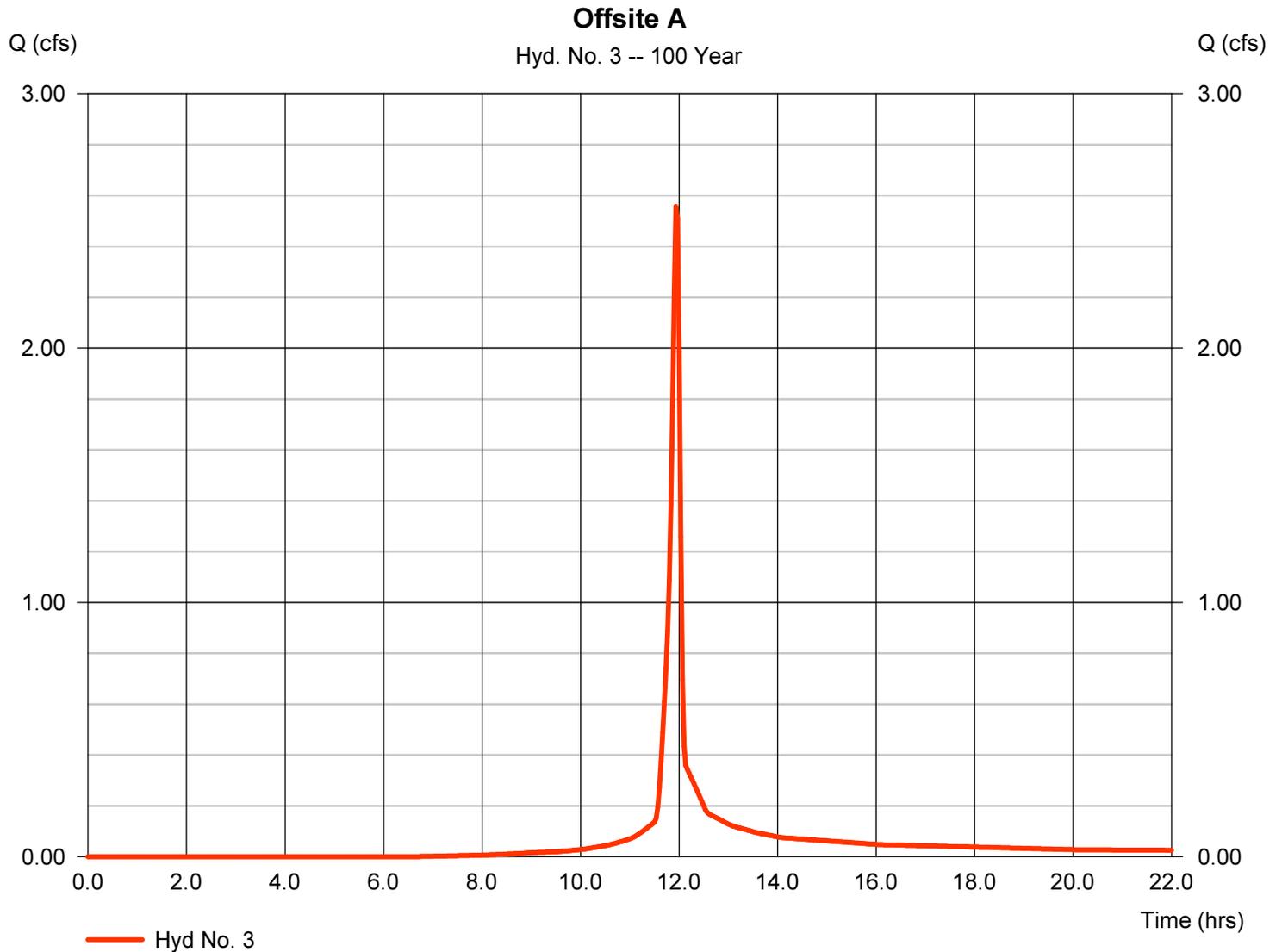


Hydrograph Report

Hyd. No. 3

Offsite A

Hydrograph type	= SCS Runoff	Peak discharge	= 2.557 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 5,228 cuft
Drainage area	= 0.320 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.86 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

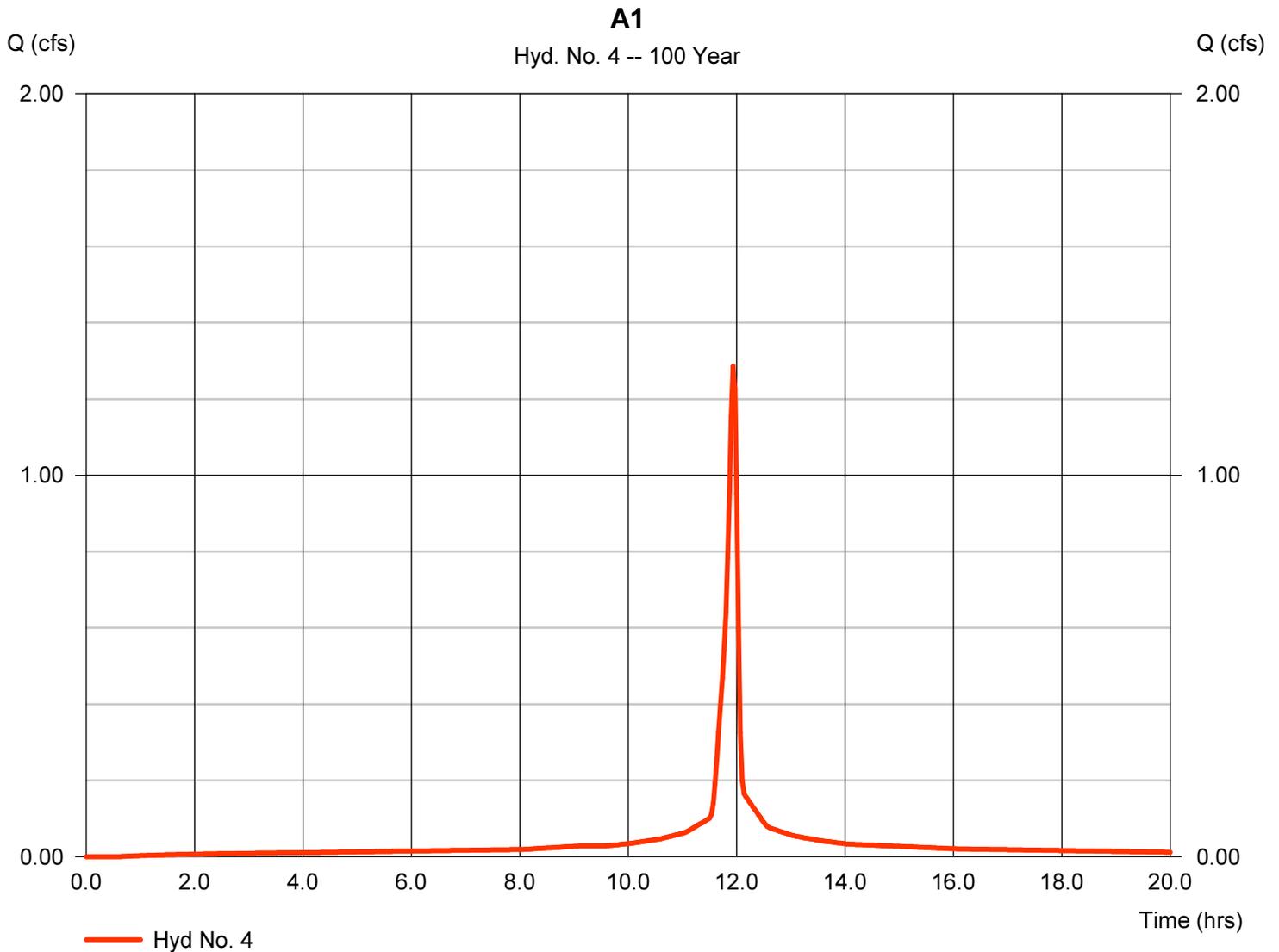
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Hyd. No. 4

A1

Hydrograph type	= SCS Runoff	Peak discharge	= 1.286 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 3,112 cuft
Drainage area	= 0.120 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.86 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

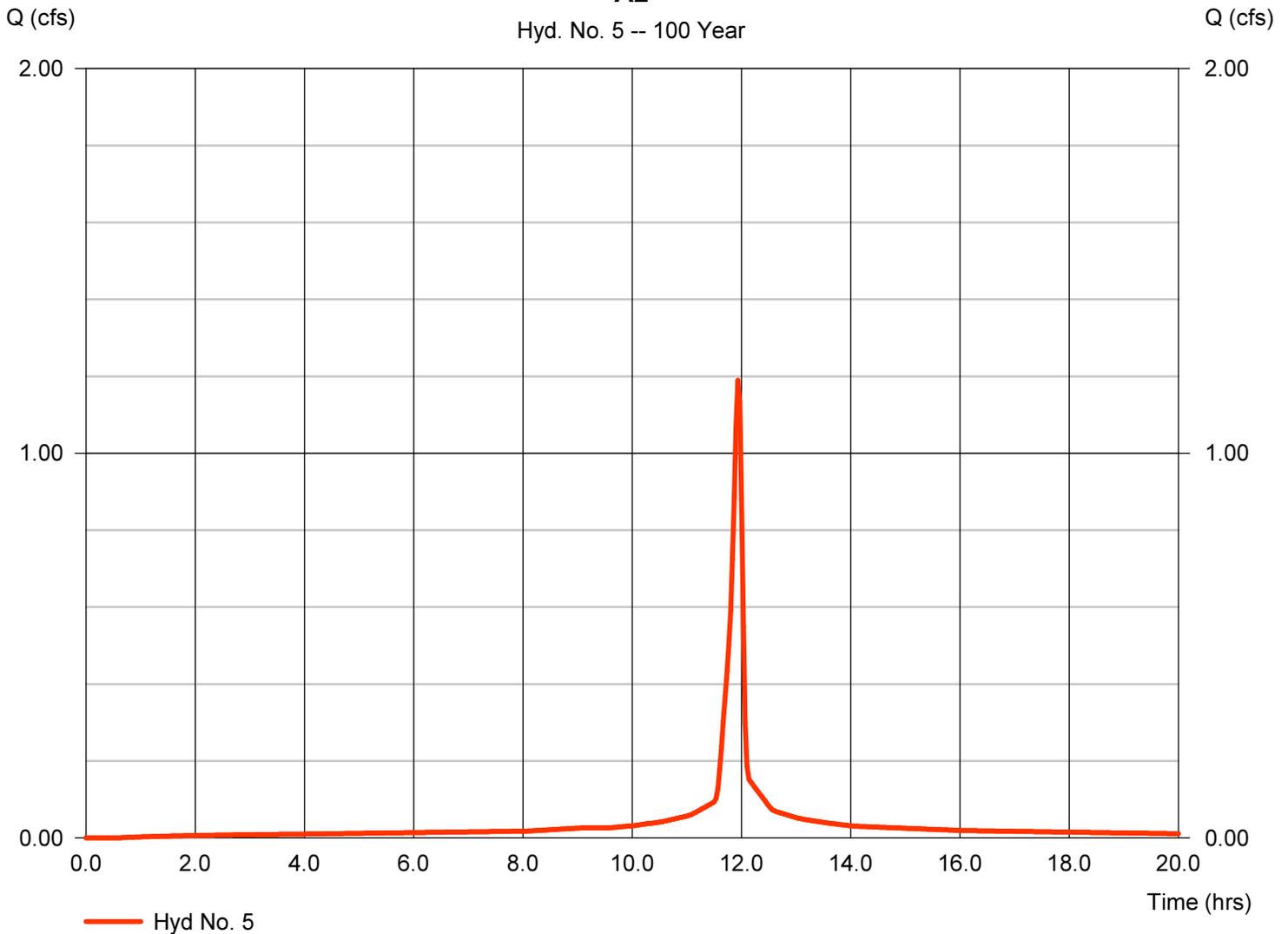
Hyd. No. 5

A2

Hydrograph type	= SCS Runoff	Peak discharge	= 1.189 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 2,879 cuft
Drainage area	= 0.111 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.86 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

A2

Hyd. No. 5 -- 100 Year



Hydrograph Report

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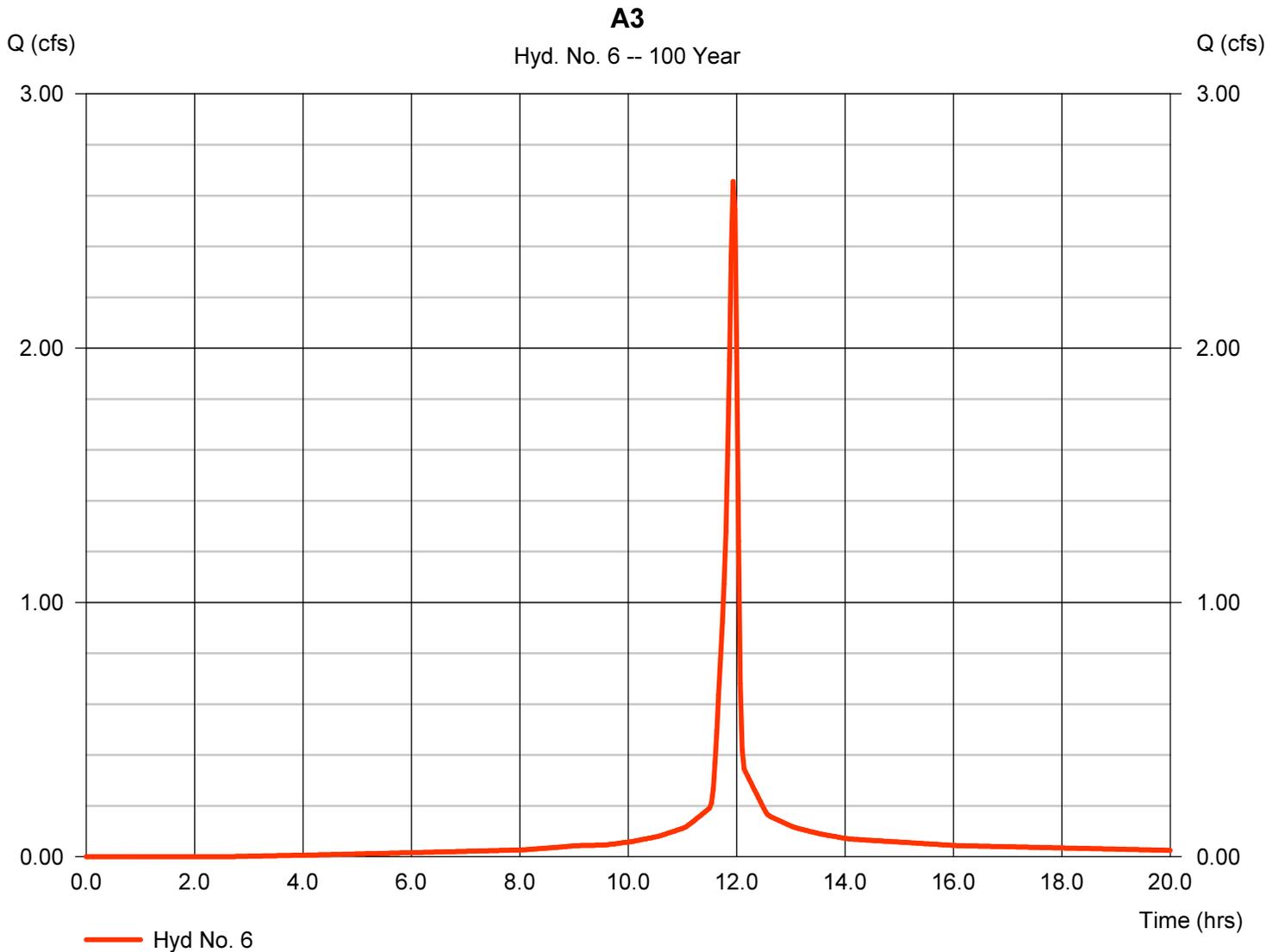
Wednesday, Apr 30, 2014

Hyd. No. 6

A3

Hydrograph type	= SCS Runoff	Peak discharge	= 2.655 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 5,900 cuft
Drainage area	= 0.260 ac	Curve number	= 90*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.86 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = $[(0.091 \times 74) + (0.169 \times 98)] / 0.260$



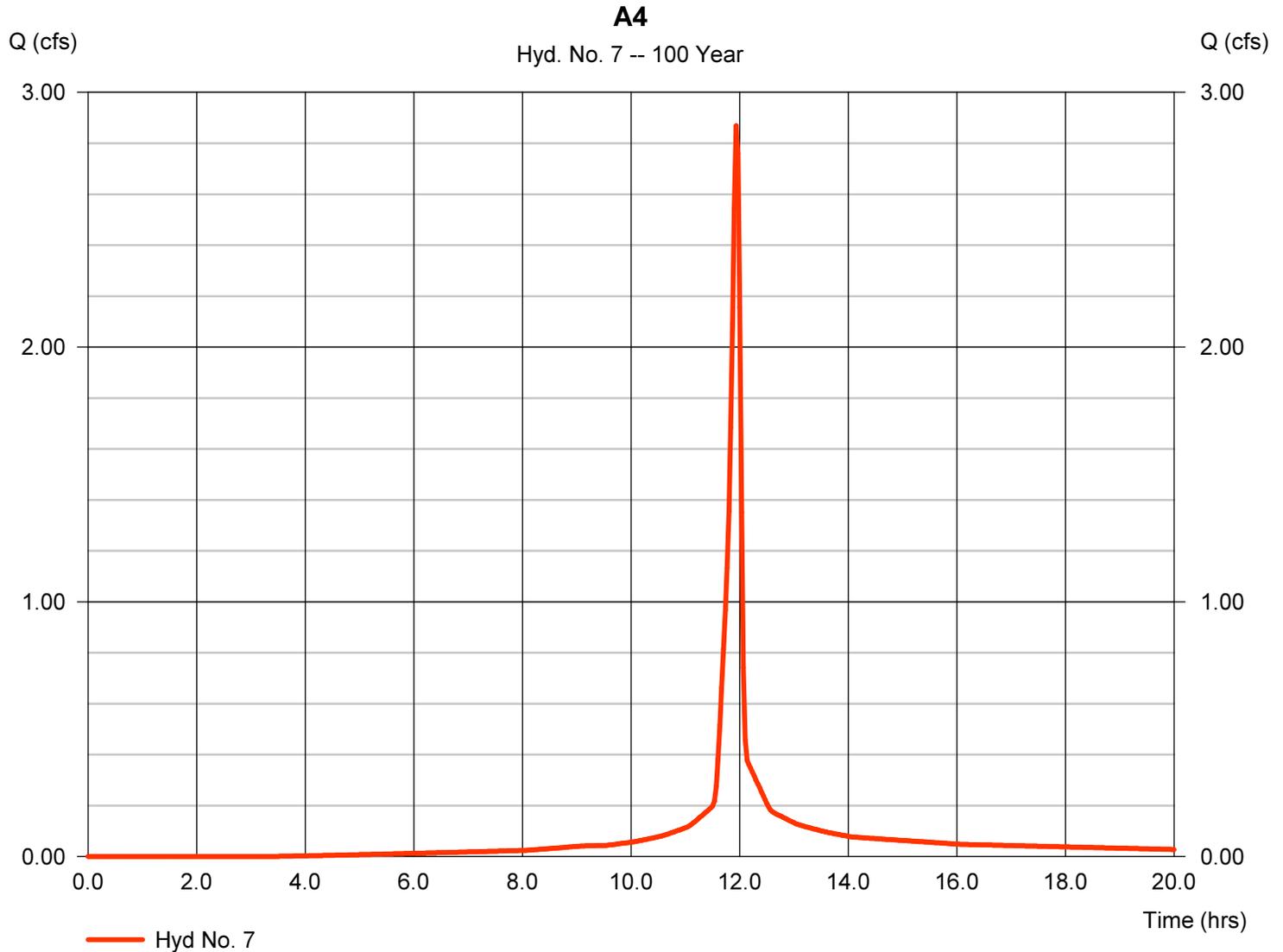
Hydrograph Report

Hyd. No. 7

A4

Hydrograph type	= SCS Runoff	Peak discharge	= 2.869 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 6,231 cuft
Drainage area	= 0.290 ac	Curve number	= 87*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.86 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.131 x 74) + (0.160 x 98)] / 0.290



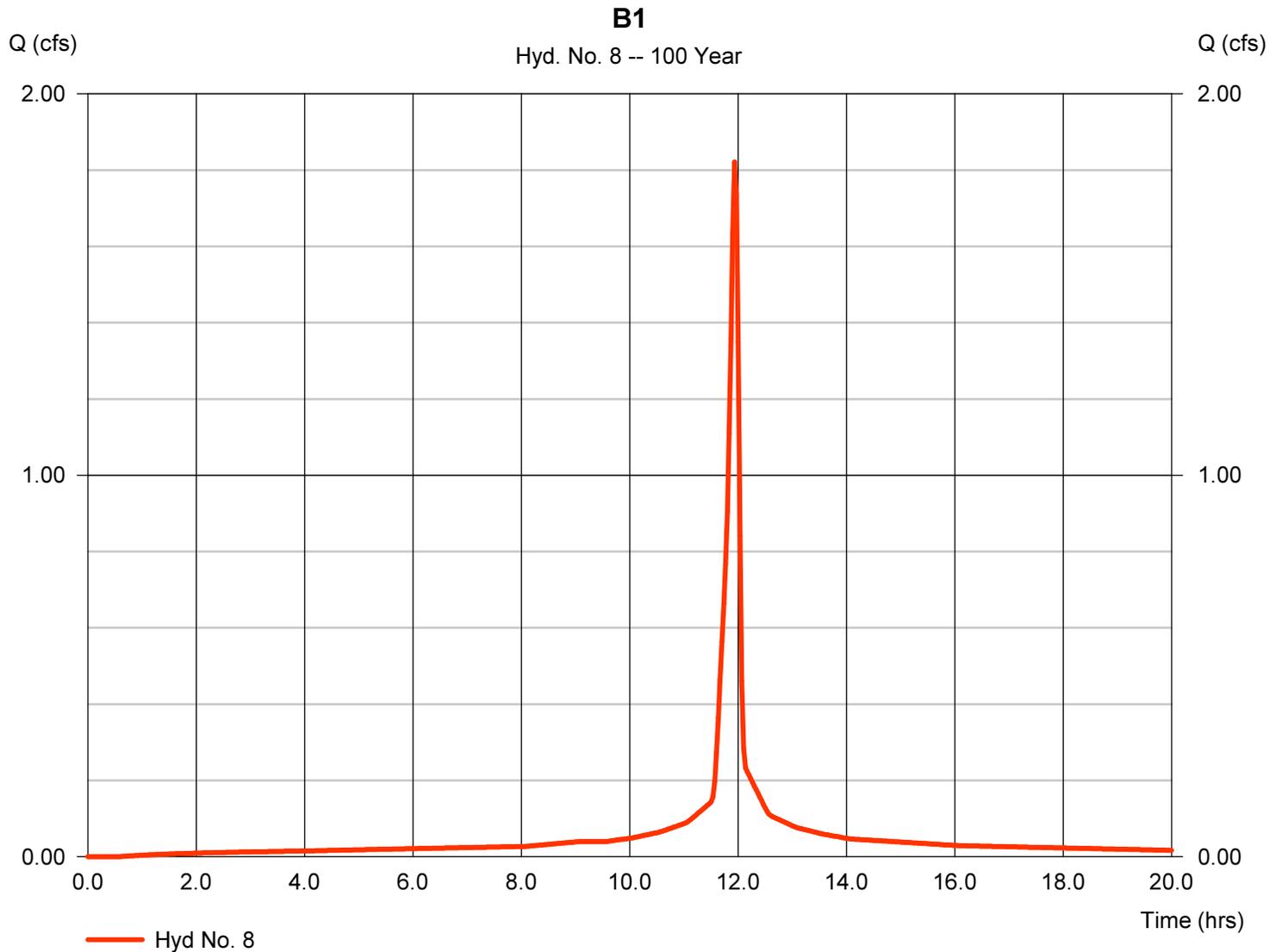
Hydrograph Report

Hyd. No. 8

B1

Hydrograph type	= SCS Runoff	Peak discharge	= 1.822 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 4,409 cuft
Drainage area	= 0.170 ac	Curve number	= 98*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.86 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = $[(0.170 \times 98)] / 0.170$



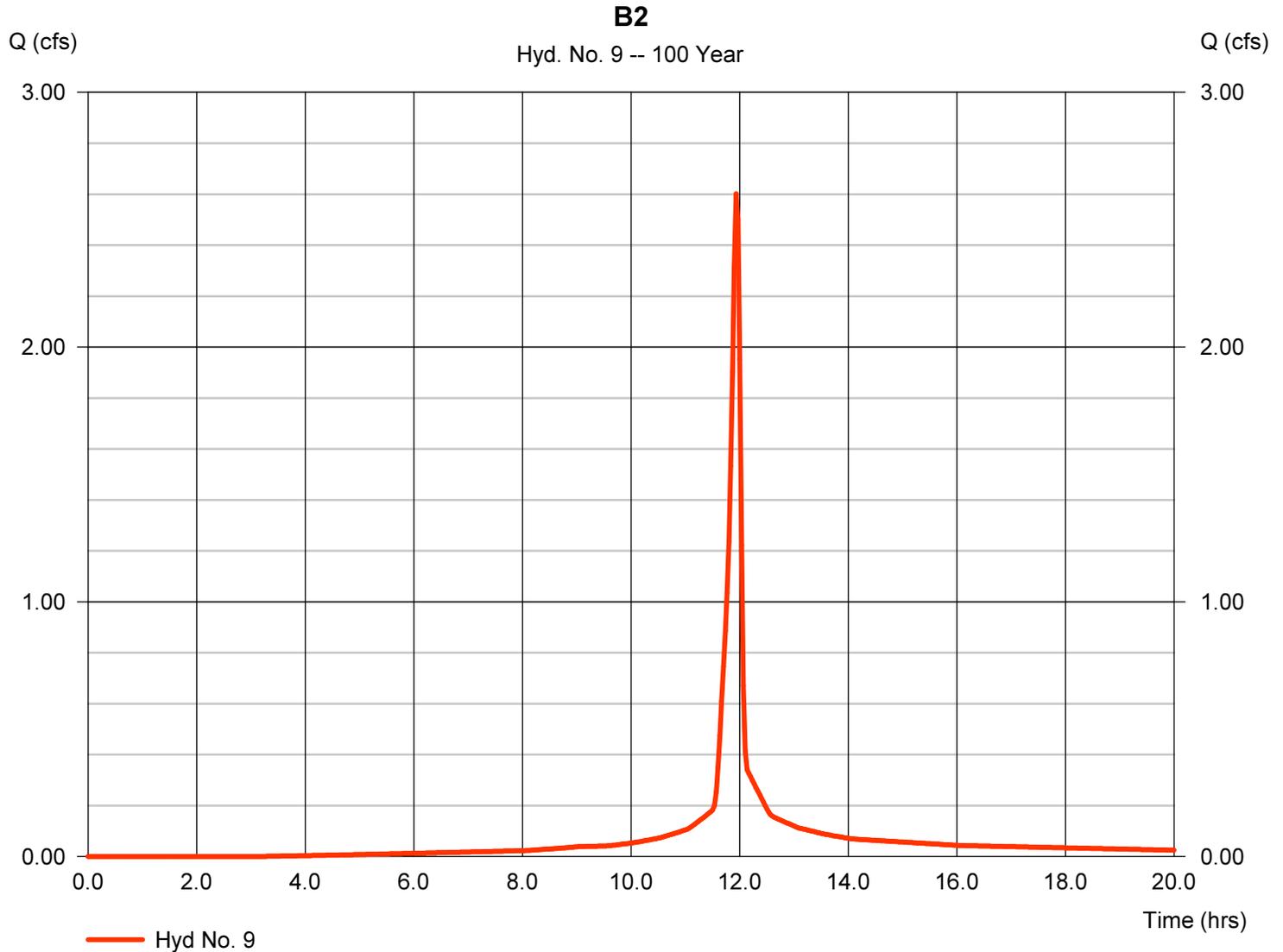
Hydrograph Report

Hyd. No. 9

B2

Hydrograph type	= SCS Runoff	Peak discharge	= 2.601 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 5,691 cuft
Drainage area	= 0.260 ac	Curve number	= 88*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.86 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.104 x 74) + (0.156 x 98)] / 0.260

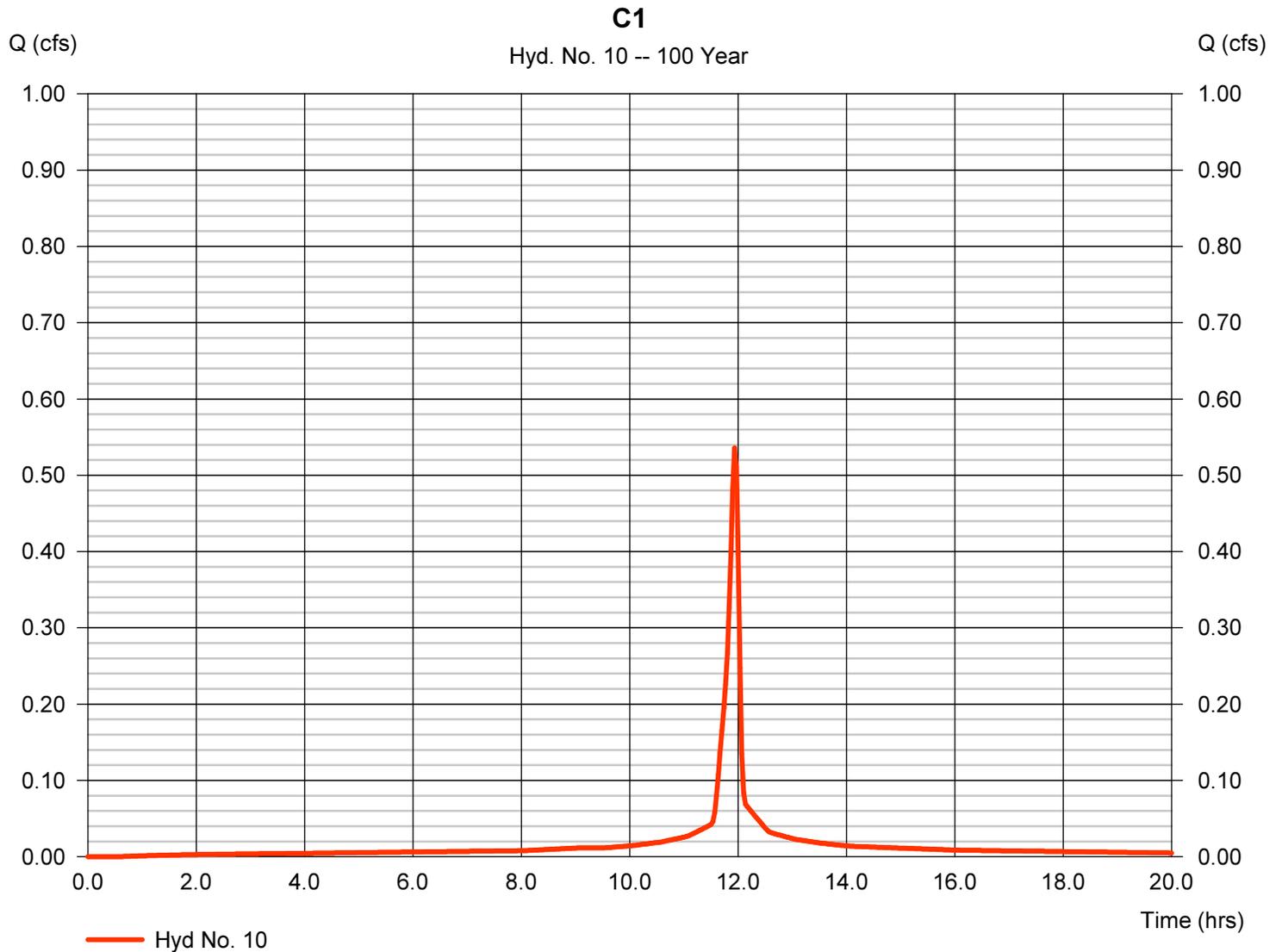


Hydrograph Report

Hyd. No. 10

C1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.536 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 1,297 cuft
Drainage area	= 0.050 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.86 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



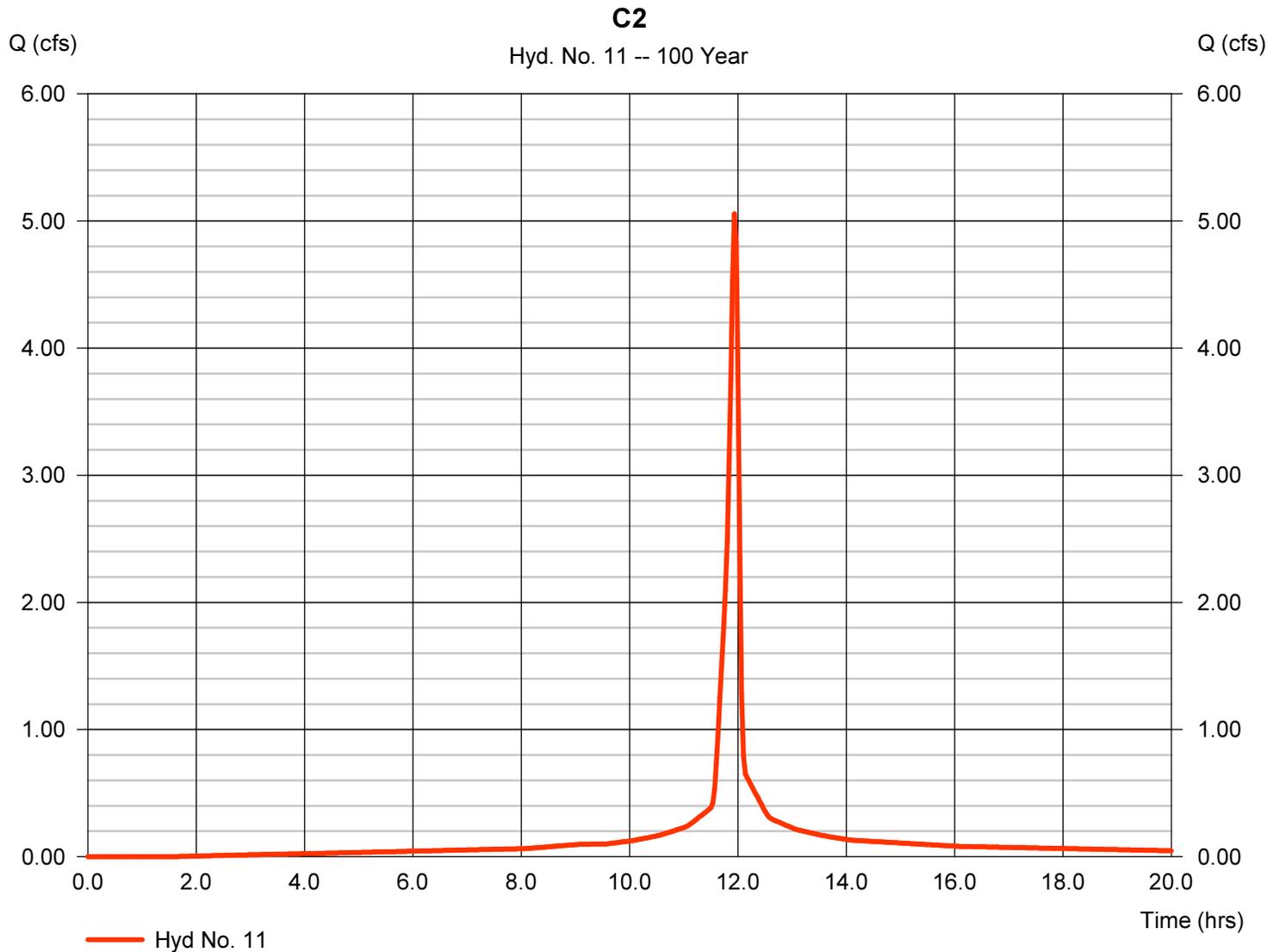
Hydrograph Report

Hyd. No. 11

C2

Hydrograph type	= SCS Runoff	Peak discharge	= 5.057 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 11,668 cuft
Drainage area	= 0.480 ac	Curve number	= 94*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.86 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.077 x 74) + (0.403 x 98)] / 0.480

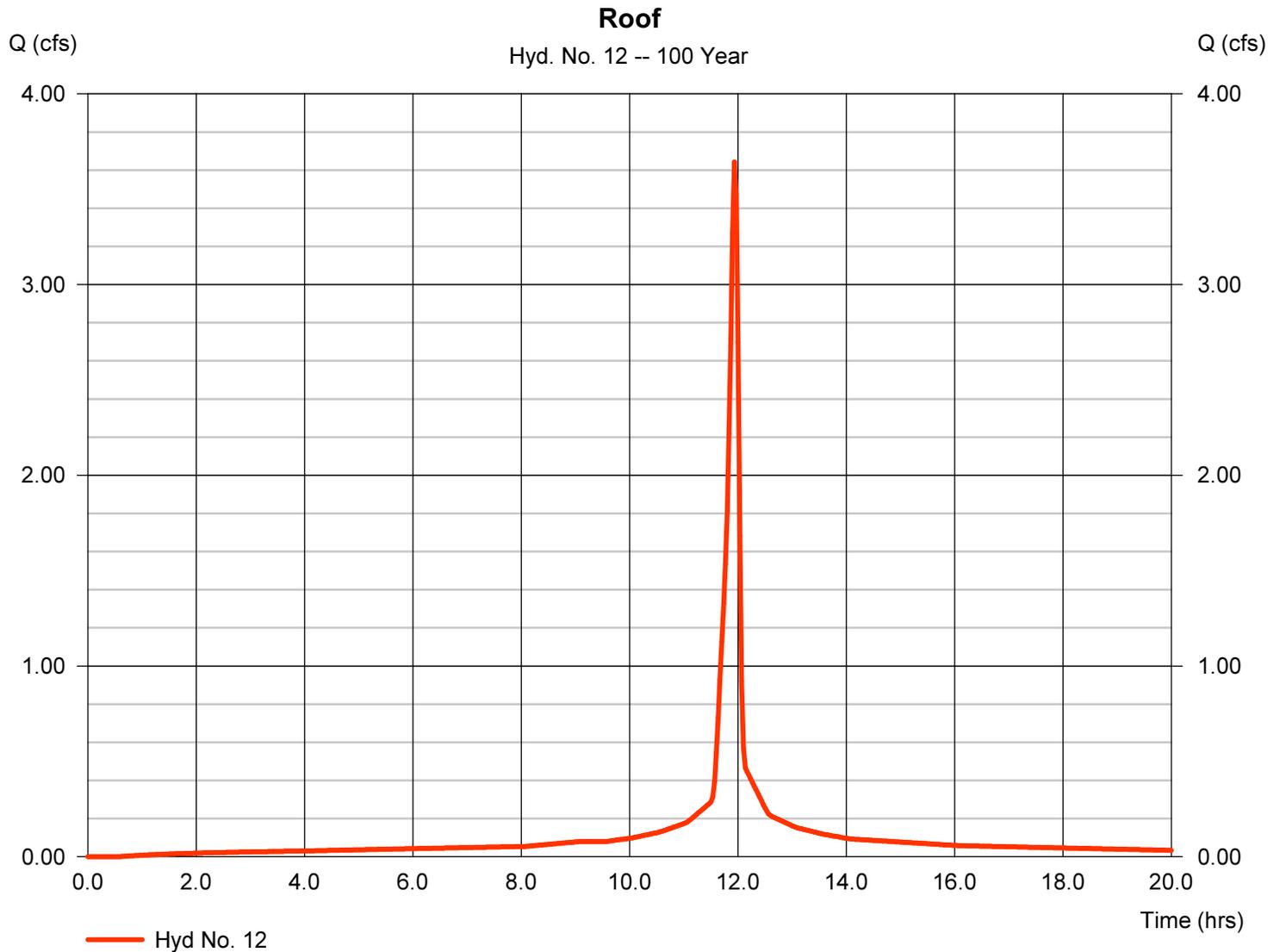


Hydrograph Report

Hyd. No. 12

Roof

Hydrograph type	= SCS Runoff	Peak discharge	= 3.643 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 8,817 cuft
Drainage area	= 0.340 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.86 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

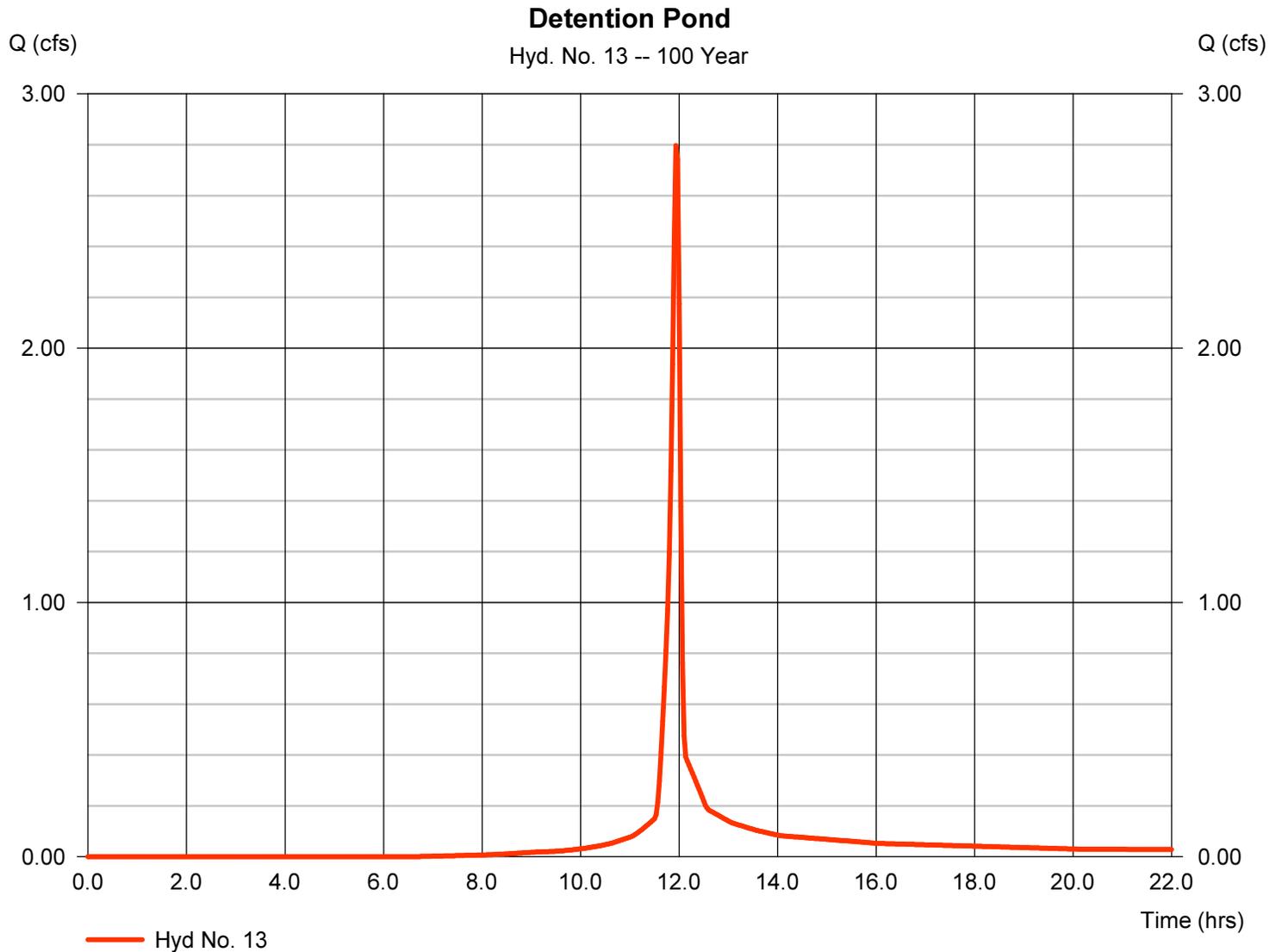


Hydrograph Report

Hyd. No. 13

Detention Pond

Hydrograph type	= SCS Runoff	Peak discharge	= 2.796 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 5,718 cuft
Drainage area	= 0.350 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.86 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



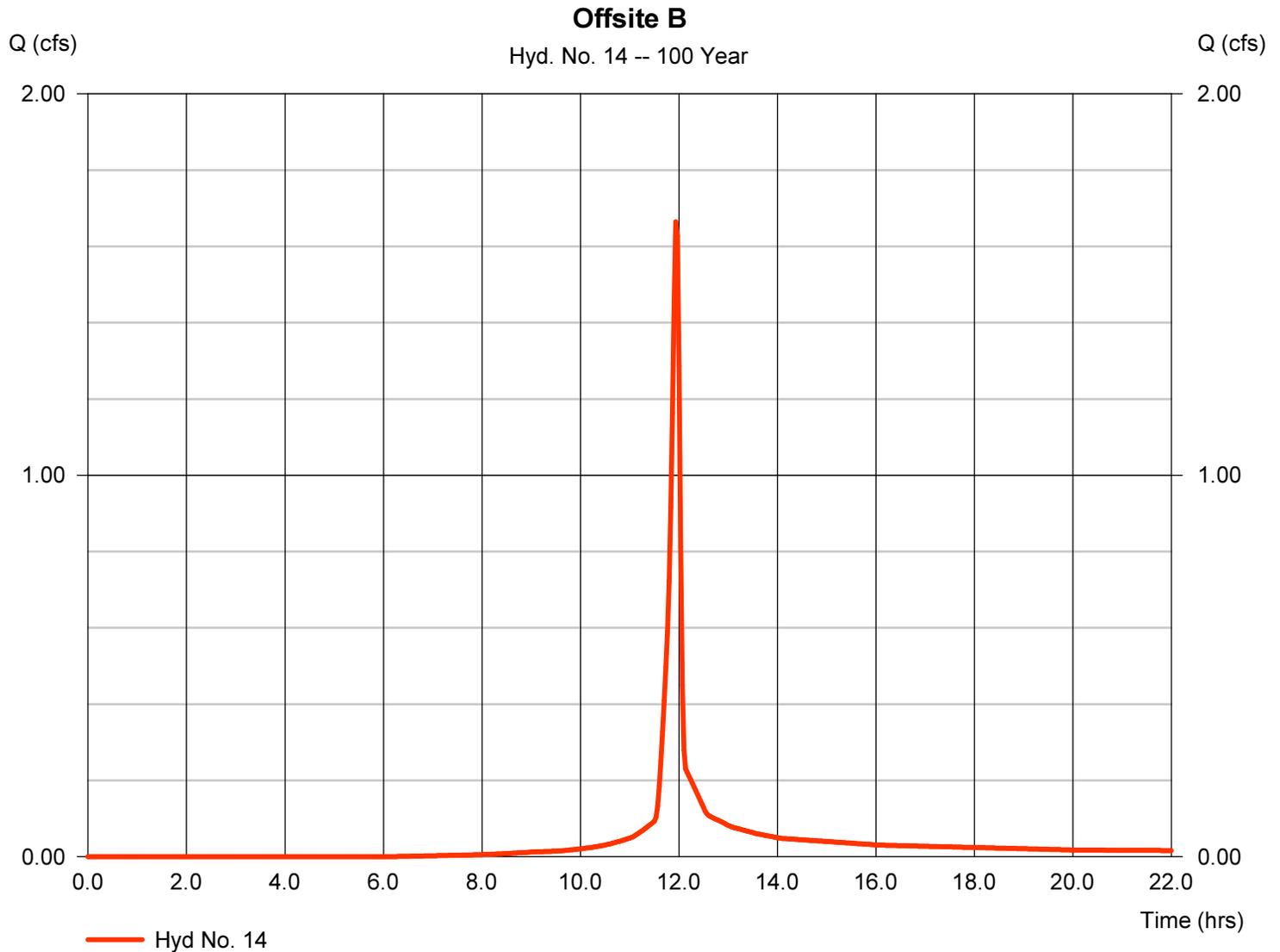
Hydrograph Report

Hyd. No. 14

Offsite B

Hydrograph type	= SCS Runoff	Peak discharge	= 1.665 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 3,424 cuft
Drainage area	= 0.200 ac	Curve number	= 76*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.86 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.180 x 74) + (0.020 x 98)] / 0.200

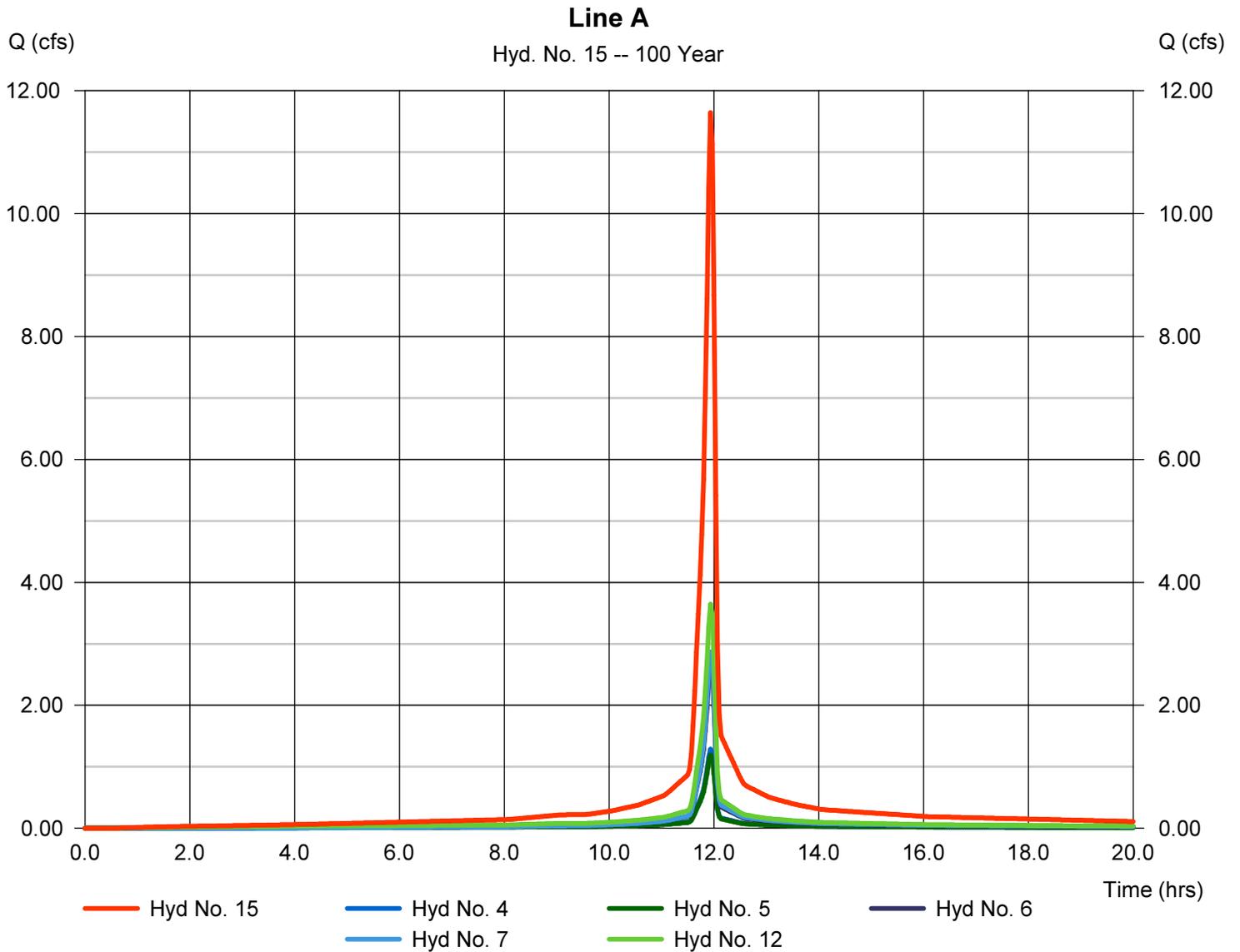


Hydrograph Report

Hyd. No. 15

Line A

Hydrograph type	= Combine	Peak discharge	= 11.64 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 26,938 cuft
Inflow hyds.	= 4, 5, 6, 7, 12	Contrib. drain. area	= 1.121 ac



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2010 by Autodesk, Inc. v9.25

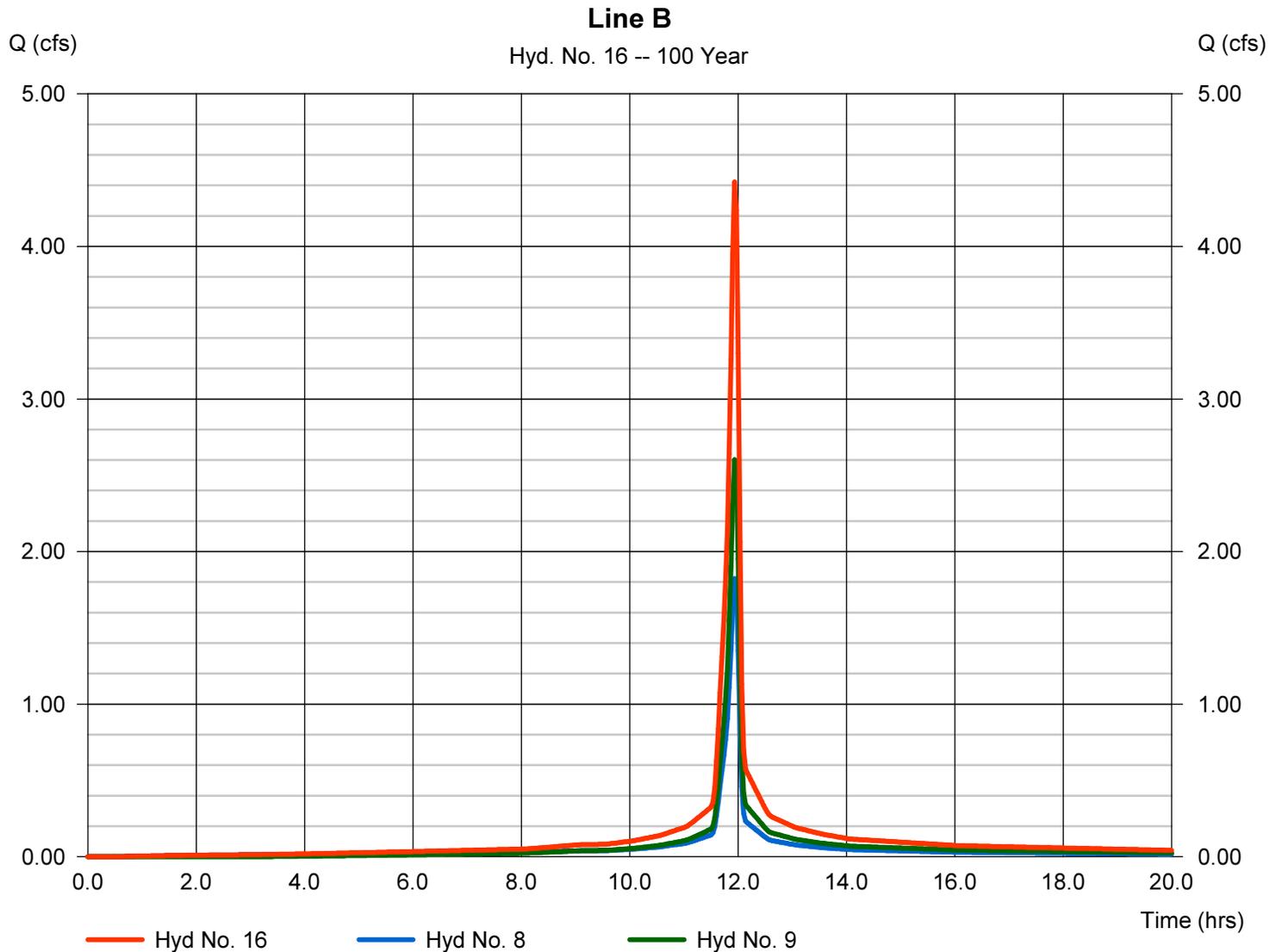
Wednesday, Apr 30, 2014

Hyd. No. 16

Line B

Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 2 min
Inflow hyds. = 8, 9

Peak discharge = 4.423 cfs
Time to peak = 11.93 hrs
Hyd. volume = 10,099 cuft
Contrib. drain. area = 0.430 ac



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2010 by Autodesk, Inc. v9.25

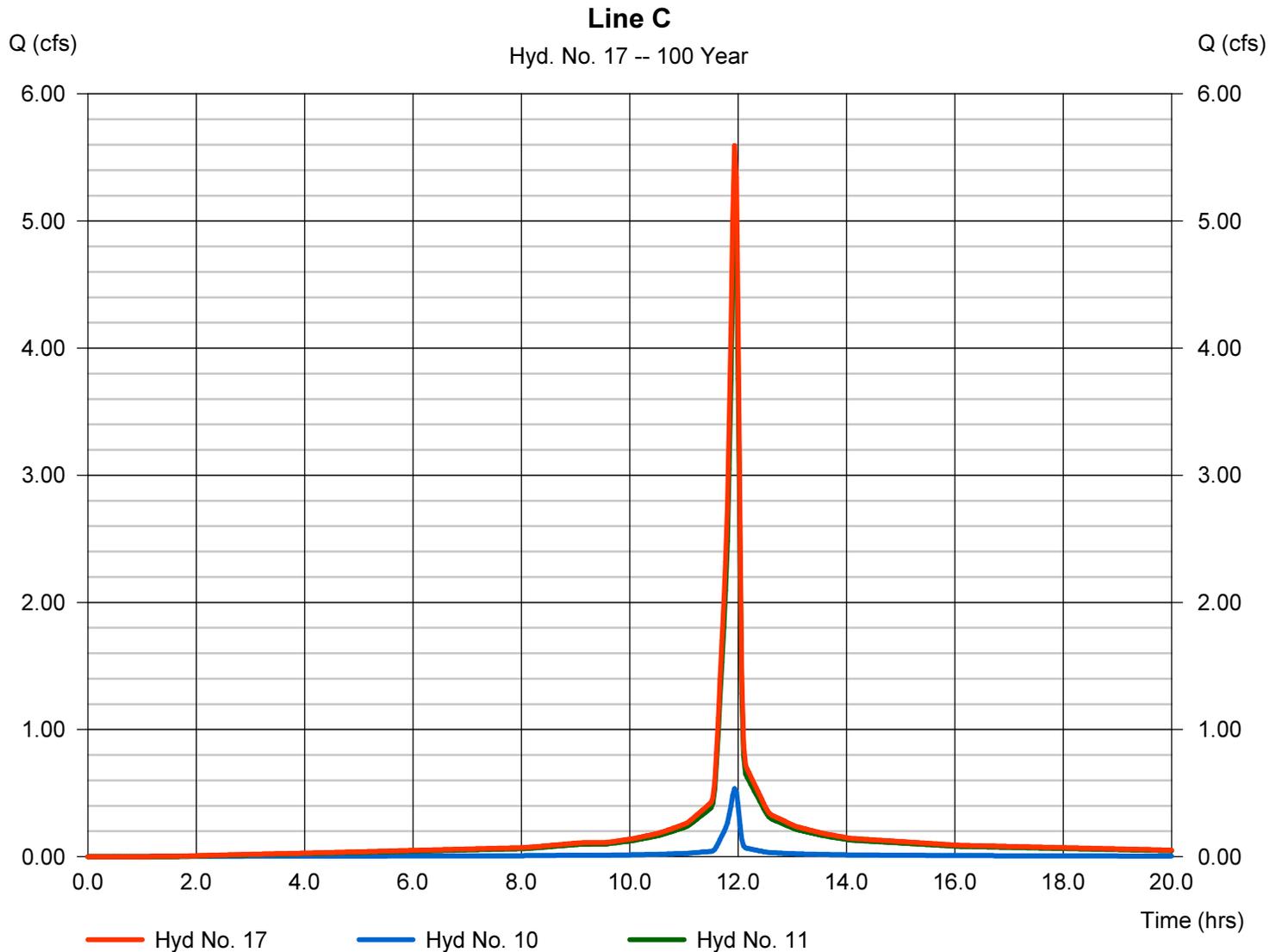
Wednesday, Apr 30, 2014

Hyd. No. 17

Line C

Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 2 min
Inflow hyds. = 10, 11

Peak discharge = 5.593 cfs
Time to peak = 11.93 hrs
Hyd. volume = 12,964 cuft
Contrib. drain. area = 0.530 ac



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2010 by Autodesk, Inc. v9.25

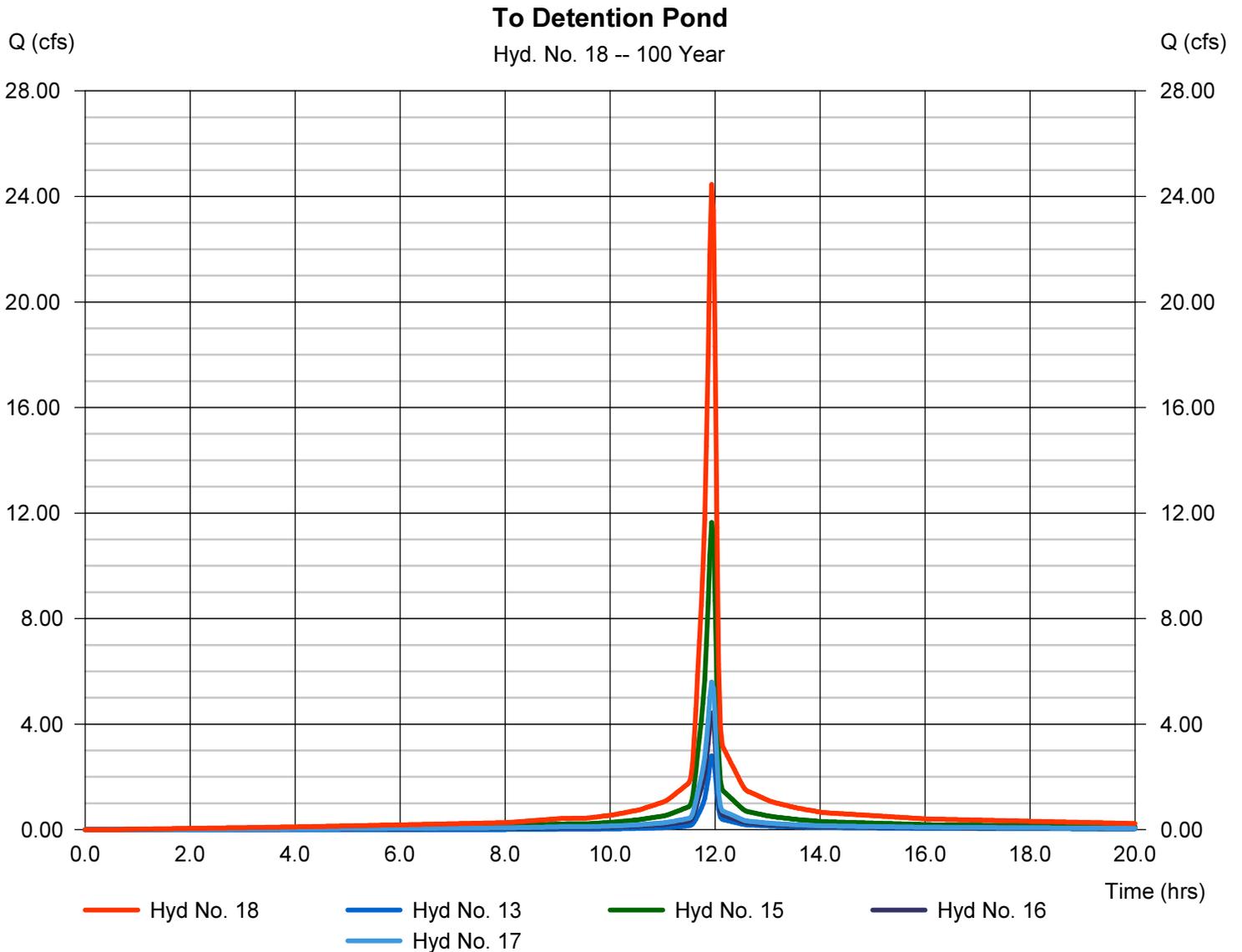
Wednesday, Apr 30, 2014

Hyd. No. 18

To Detention Pond

Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 2 min
Inflow hyds. = 13, 15, 16, 17

Peak discharge = 24.45 cfs
Time to peak = 11.93 hrs
Hyd. volume = 55,720 cuft
Contrib. drain. area = 0.350 ac



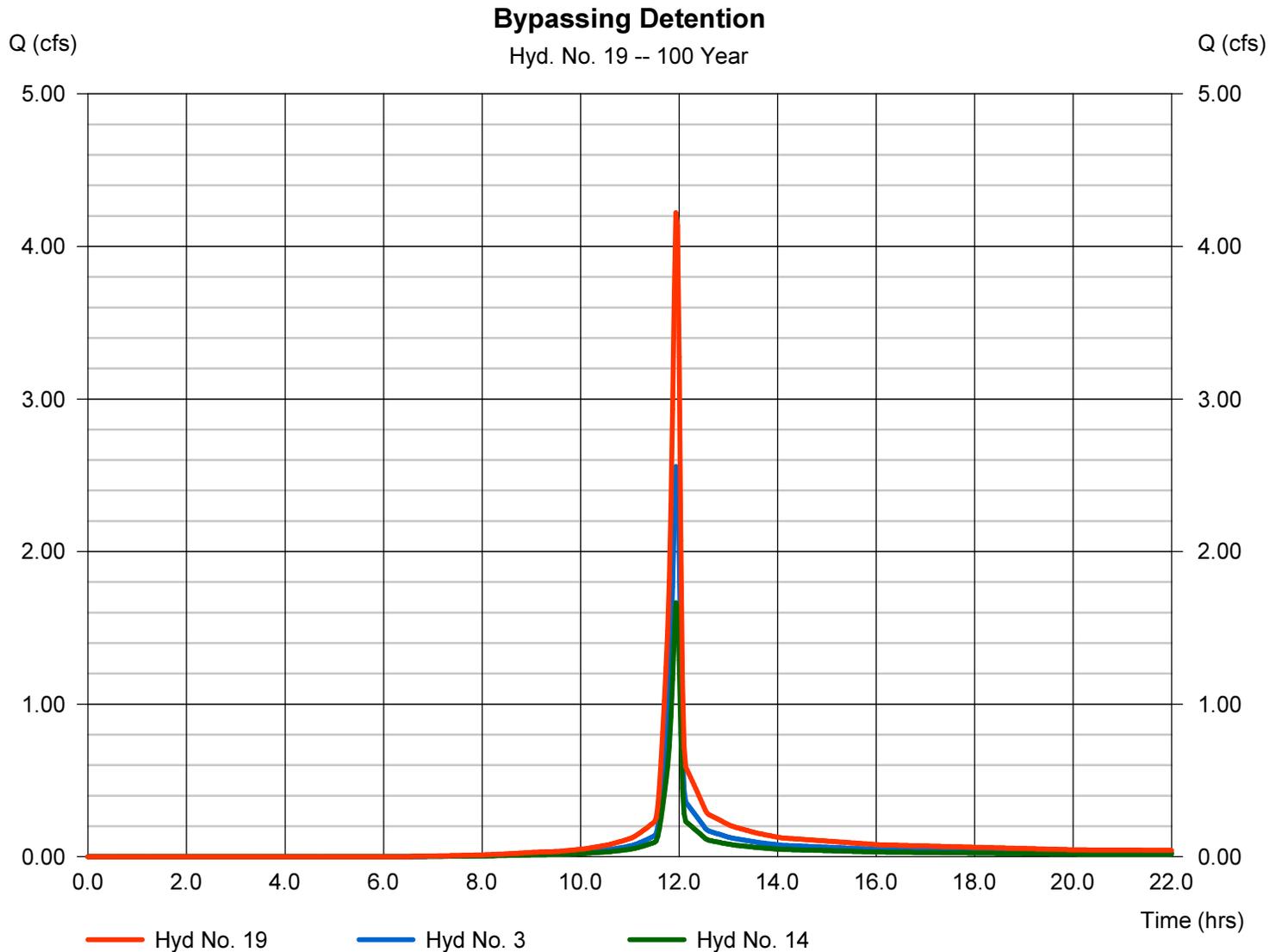
Hydrograph Report

Hyd. No. 19

Bypassing Detention

Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 2 min
Inflow hyds. = 3, 14

Peak discharge = 4.221 cfs
Time to peak = 11.93 hrs
Hyd. volume = 8,652 cuft
Contrib. drain. area = 0.520 ac



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2010 by Autodesk, Inc. v9.25

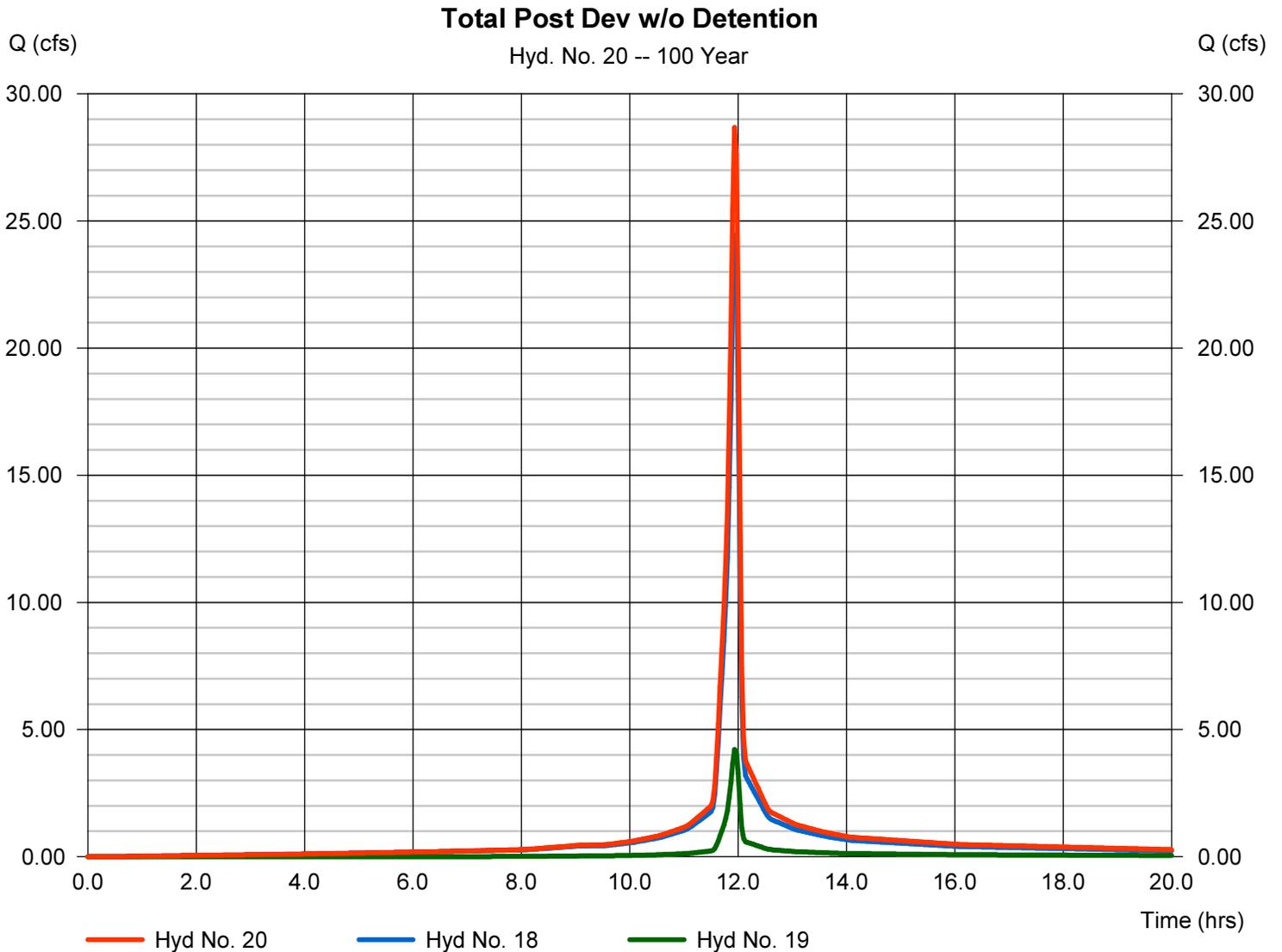
Wednesday, Apr 30, 2014

Hyd. No. 20

Total Post Dev w/o Detention

Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 2 min
Inflow hyds. = 18, 19

Peak discharge = 28.68 cfs
Time to peak = 11.93 hrs
Hyd. volume = 64,372 cuft
Contrib. drain. area = 0.000 ac



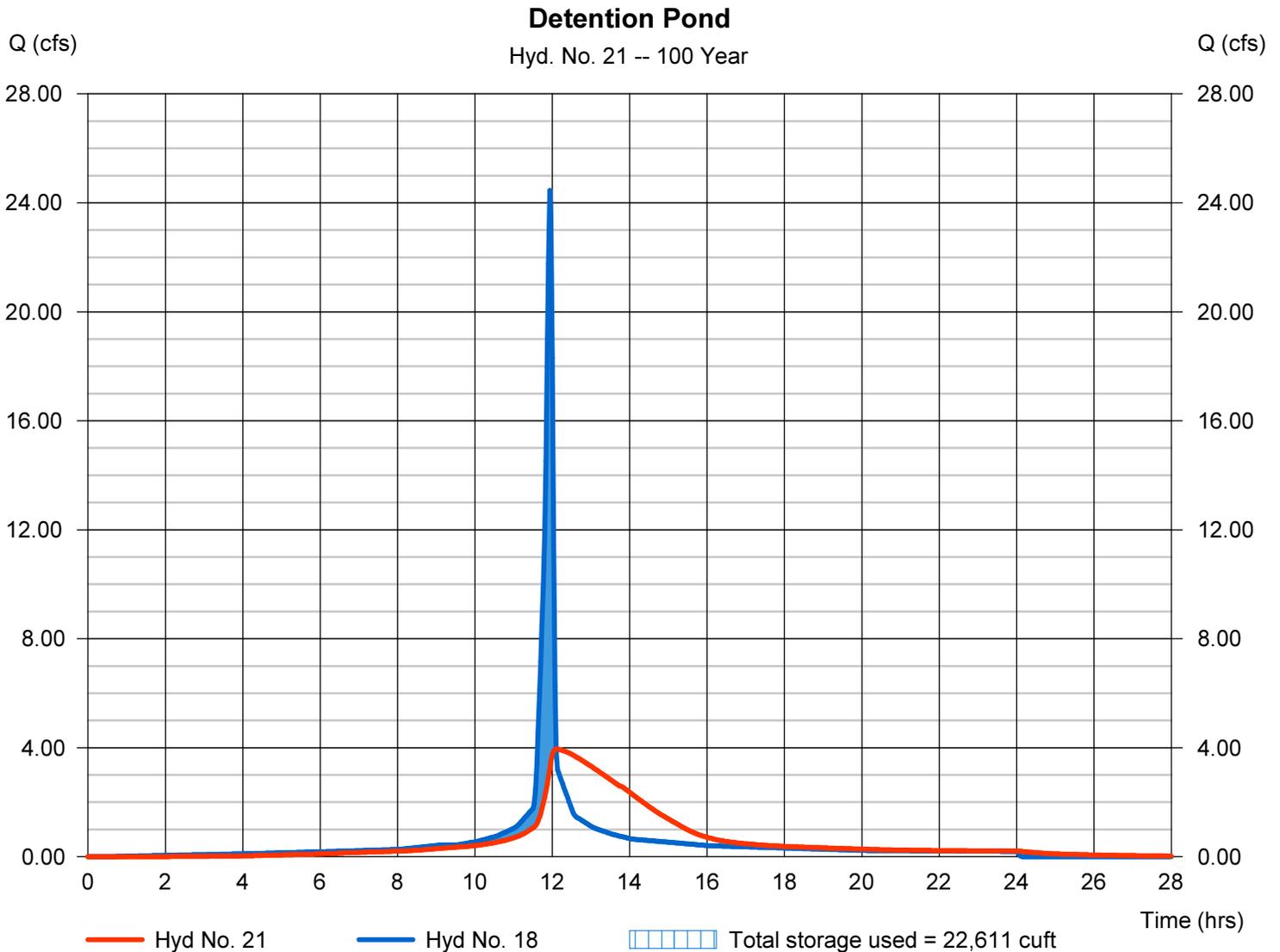
Hydrograph Report

Hyd. No. 21

Detention Pond

Hydrograph type	= Reservoir	Peak discharge	= 3.953 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.10 hrs
Time interval	= 2 min	Hyd. volume	= 55,699 cuft
Inflow hyd. No.	= 18 - To Detention Pond	Max. Elevation	= 925.97 ft
Reservoir name	= Detention Pond	Max. Storage	= 22,611 cuft

Storage Indication method used.

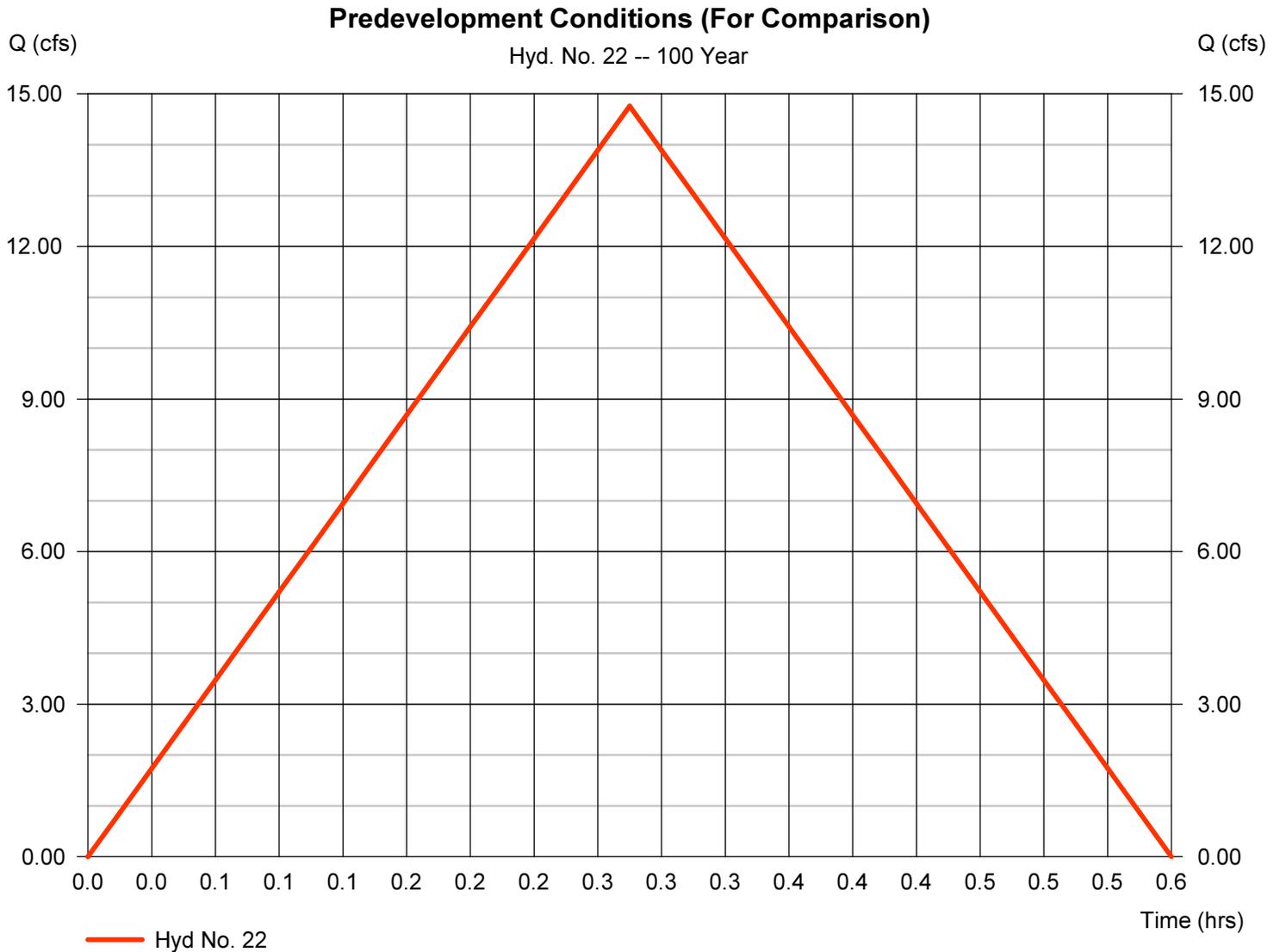


Hydrograph Report

Hyd. No. 22

Predevelopment Conditions (For Comparison)

Hydrograph type	= Rational	Peak discharge	= 14.76 cfs
Storm frequency	= 100 yrs	Time to peak	= 0.28 hrs
Time interval	= 1 min	Hyd. volume	= 15,056 cuft
Drainage area	= 2.980 ac	Runoff coeff.	= 0.5
Intensity	= 9.907 in/hr	Tc by User	= 17.00 min
IDF Curve	= Shawnee County.IDF	Asc/Rec limb fact	= 1/1



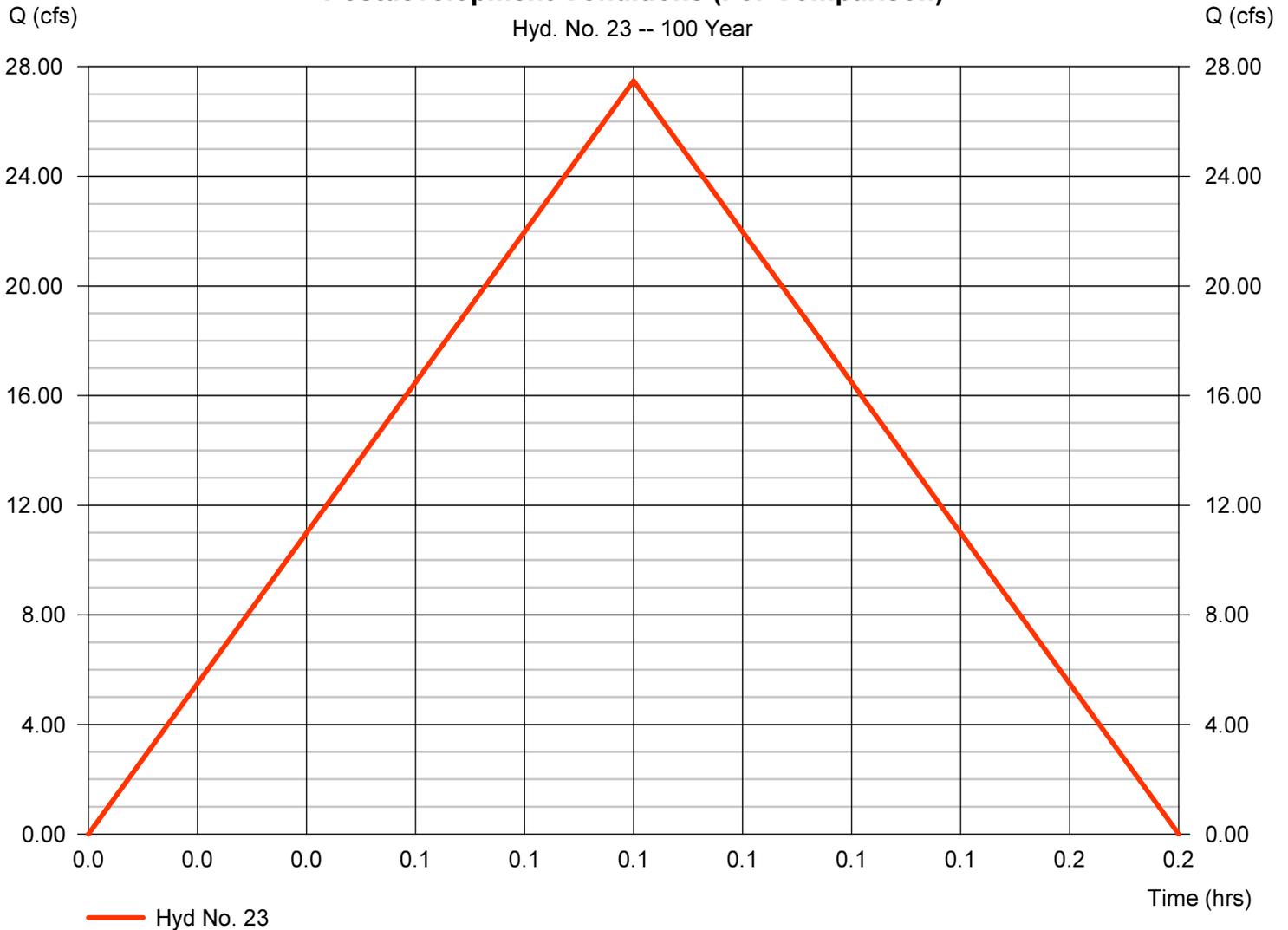
Hydrograph Report

Hyd. No. 23

Postdevelopment Conditions (For Comparison)

Hydrograph type	= Rational	Peak discharge	= 27.48 cfs
Storm frequency	= 100 yrs	Time to peak	= 0.08 hrs
Time interval	= 1 min	Hyd. volume	= 8,243 cuft
Drainage area	= 2.980 ac	Runoff coeff.	= 0.65
Intensity	= 14.185 in/hr	Tc by User	= 5.00 min
IDF Curve	= Shawnee County.IDF	Asc/Rec limb fact	= 1/1

Postdevelopment Conditions (For Comparison)



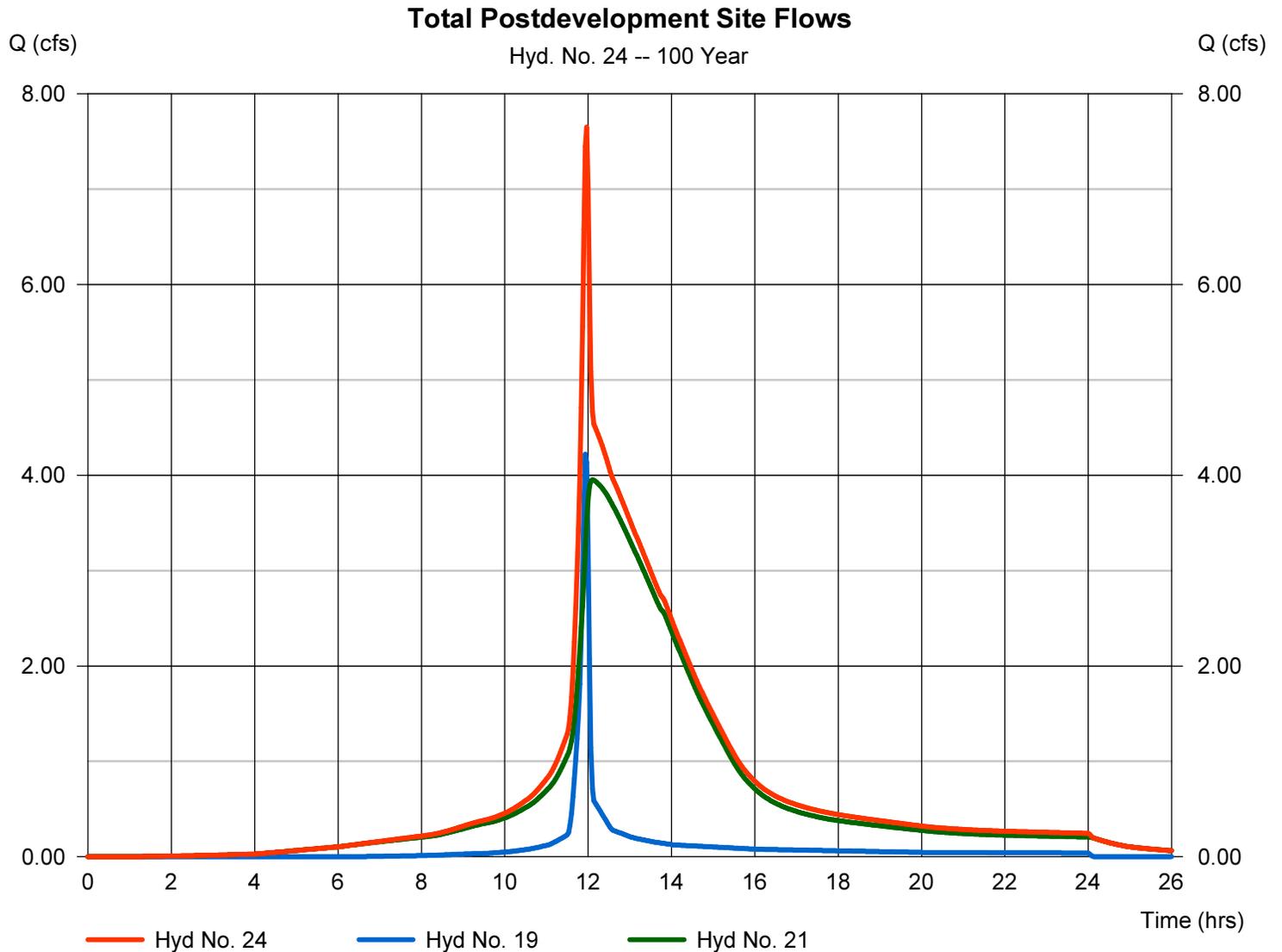
Hydrograph Report

Hyd. No. 24

Total Postdevelopment Site Flows

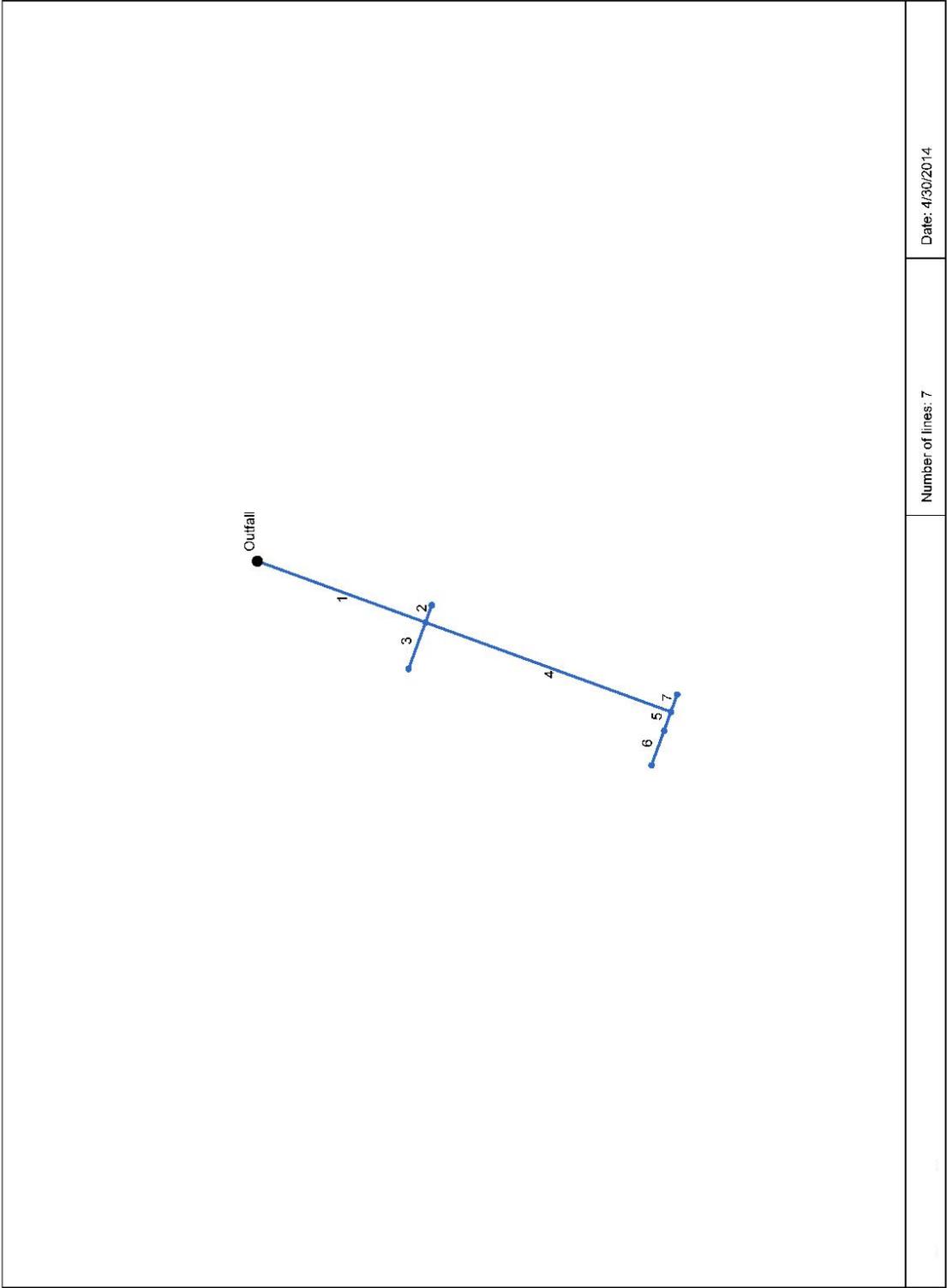
Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 2 min
Inflow hyds. = 19, 21

Peak discharge = 7.651 cfs
Time to peak = 11.97 hrs
Hyd. volume = 64,351 cuft
Contrib. drain. area = 0.000 ac



Existing Storm Sewer Plan View

Hydraflow Storm Sewers Extension for AutoCAD® Civil 3D® 2010 Plan

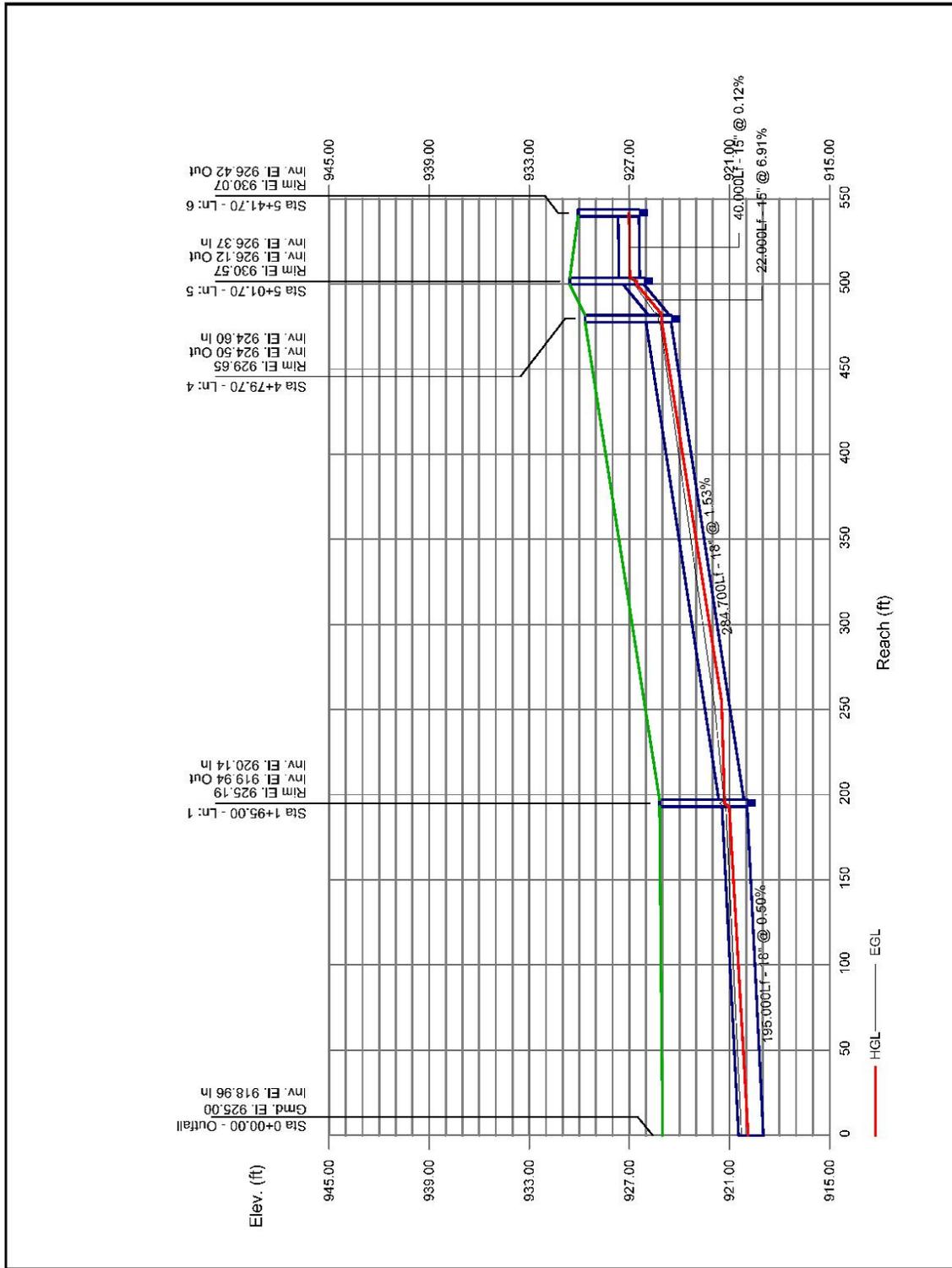


Number of lines: 7

Date: 4/30/2014

Existing Storm Sewer 10-Year Design Storm (Lines 1, 4, 5, & 6)

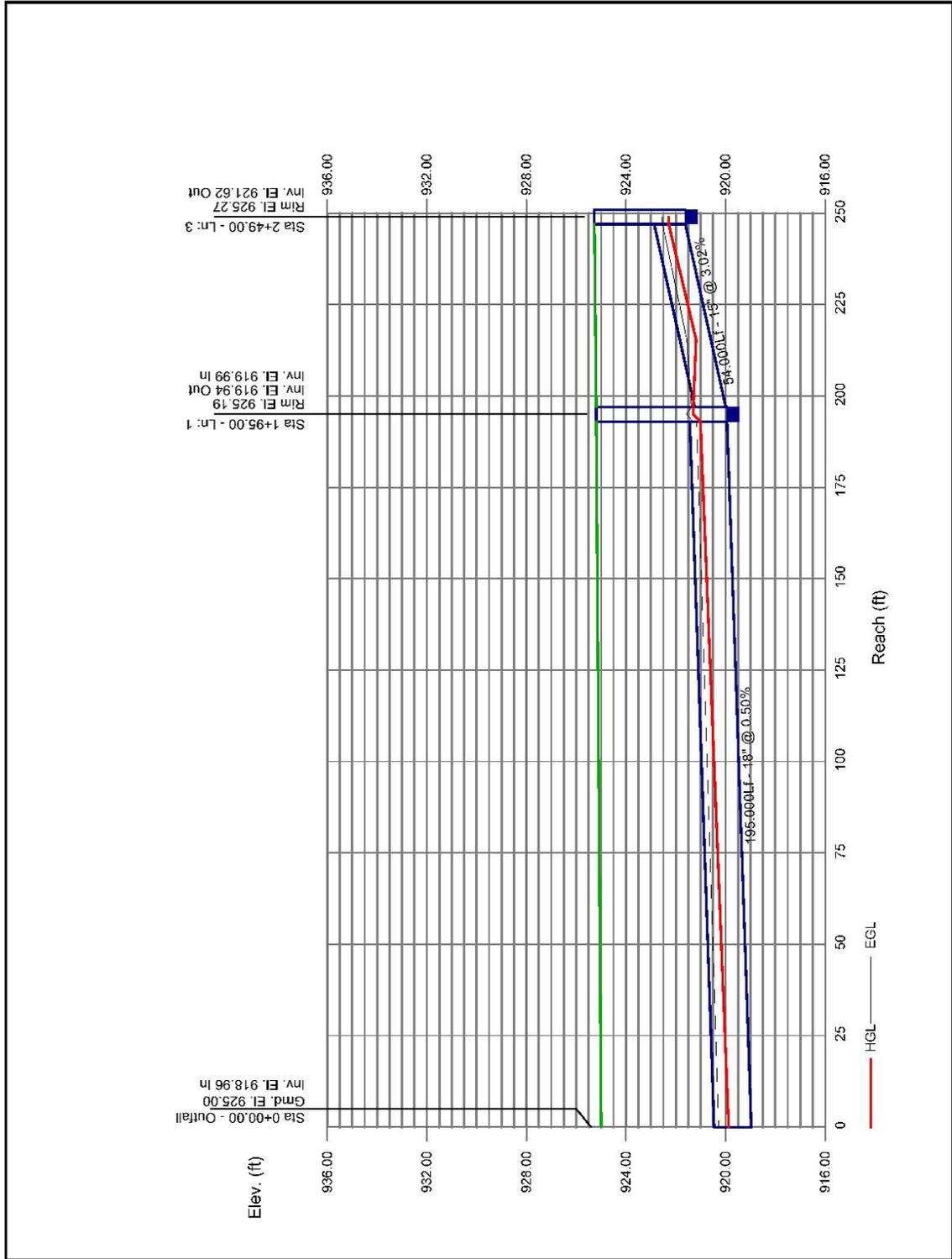
Storm Sewer Profile



Hydraflow Storm Sewers Extension

Existing Storm Sewer 10-Year Design Storm (Lines 1 & 3)

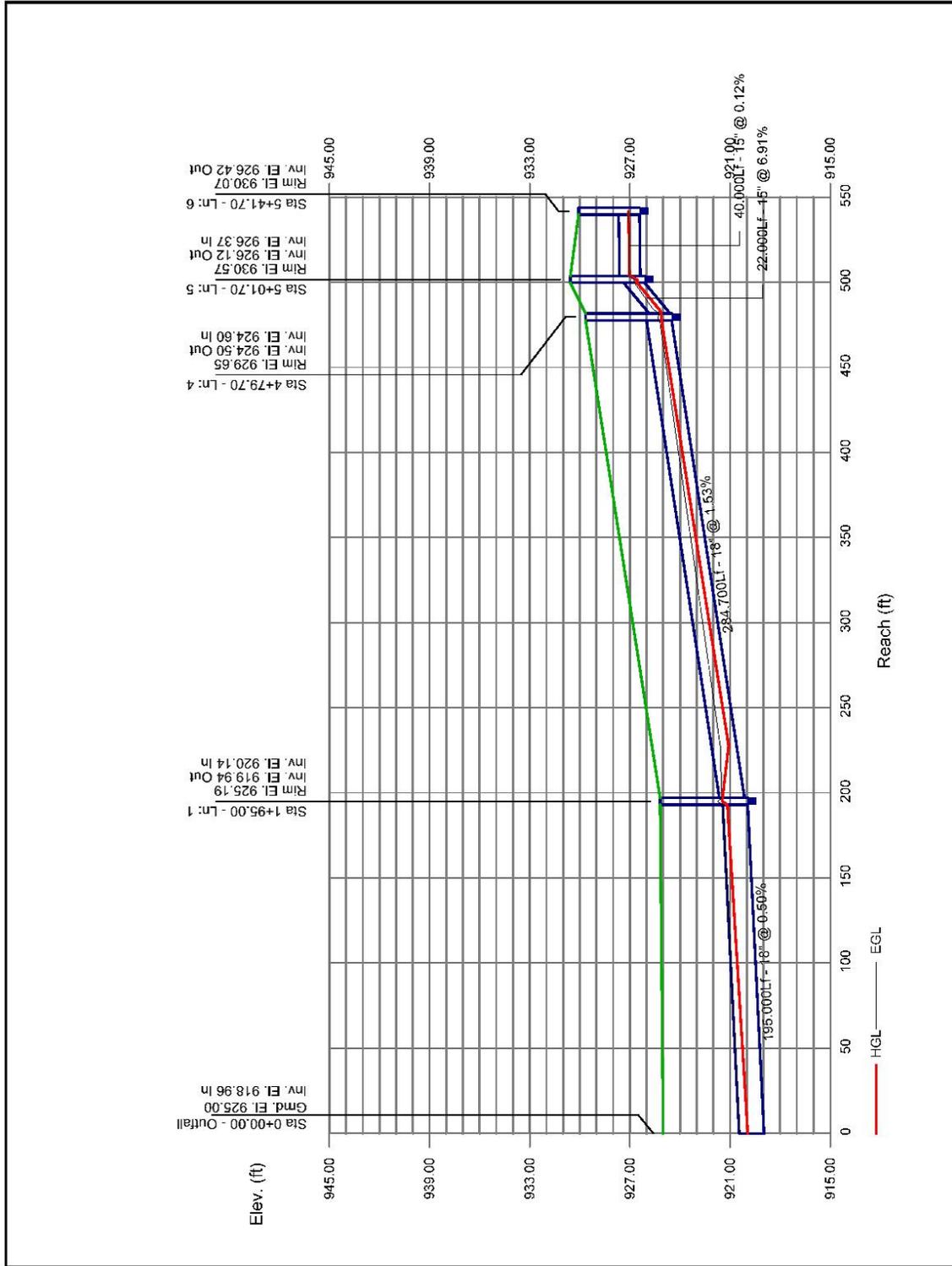
Storm Sewer Profile



Hydraflow Storm Sewers Extension

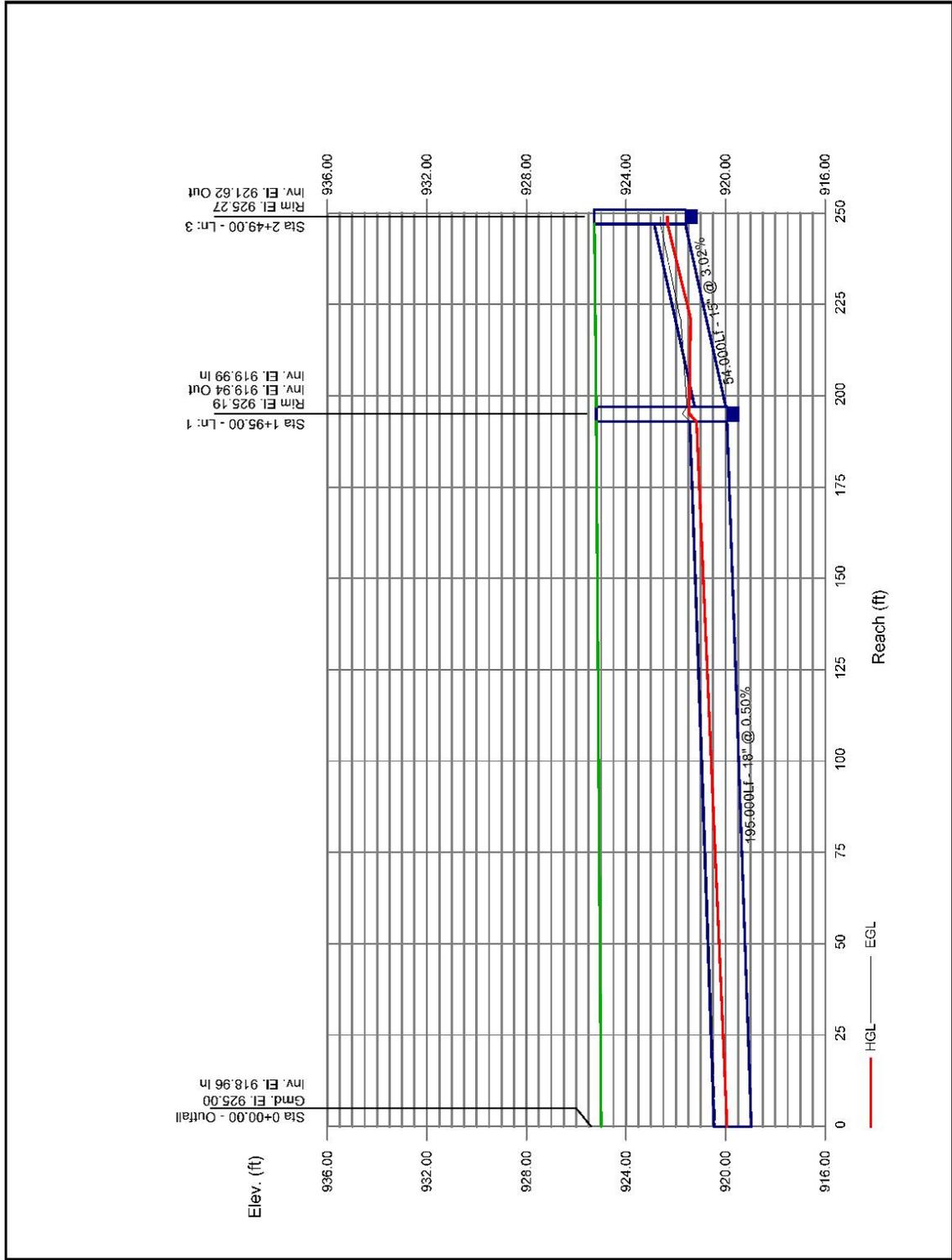
Existing Storm Sewer 25-Year Design Storm (Lines 1, 4, 5, & 6)

Storm Sewer Profile



Existing Storm Sewer 25-Year Design Storm (Lines 1 & 3)

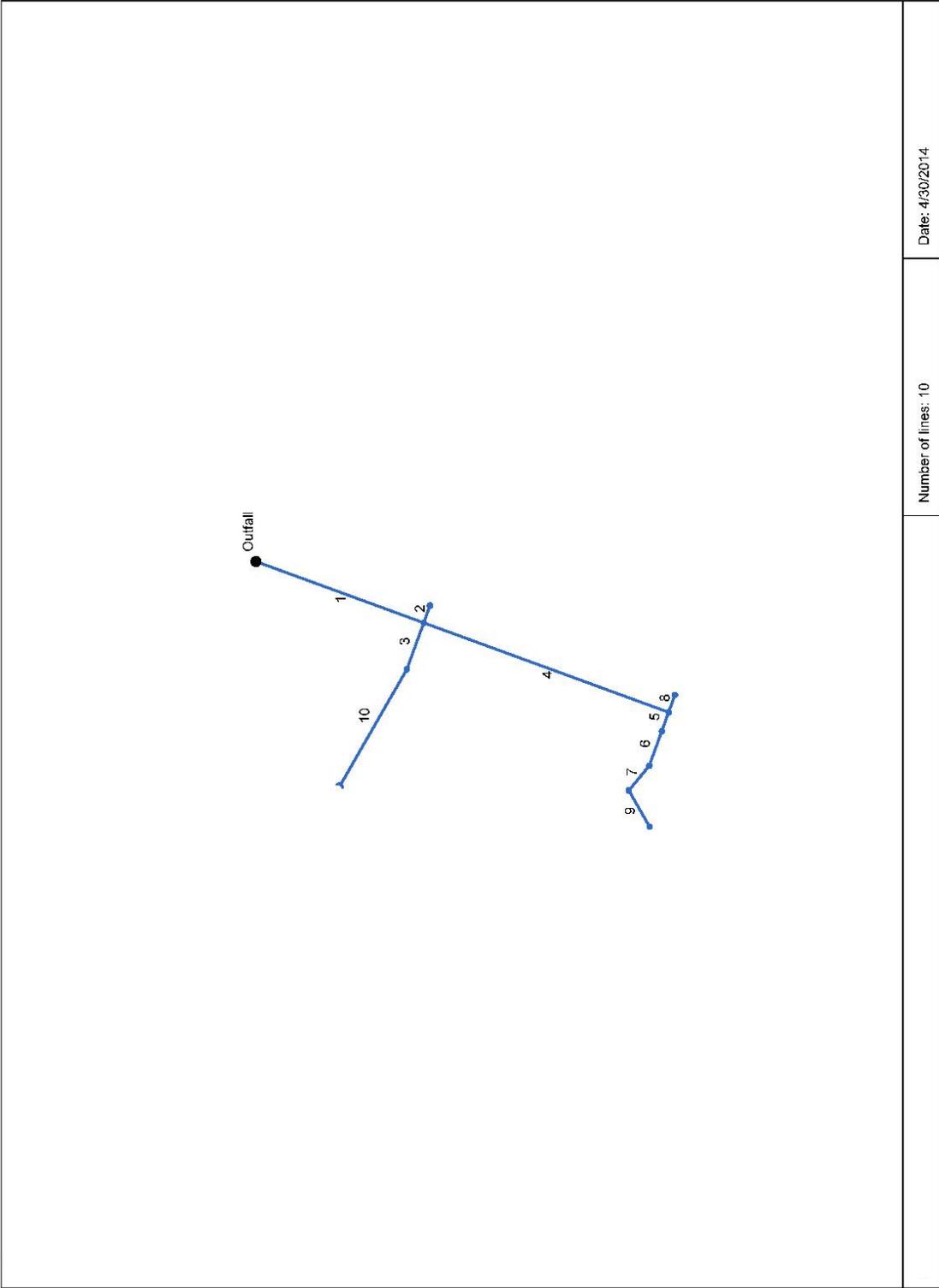
Storm Sewer Profile



Hydraflow Storm Sewers Extension

Proposed Storm Sewer Plan View

Hydraflow Storm Sewers Extension for AutoCAD® Civil 3D® 2010 Plan



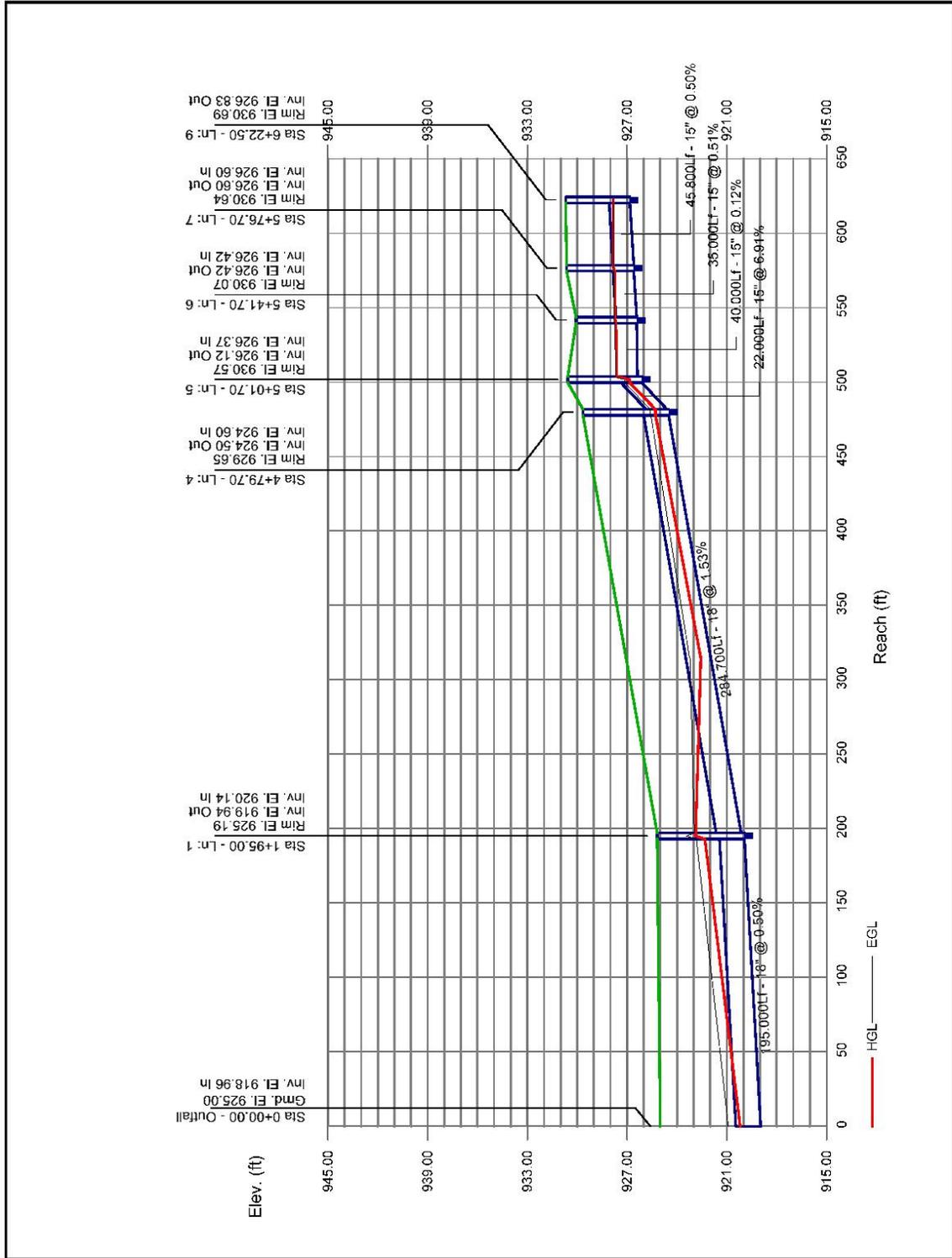
Number of lines: 10

Date: 4/30/2014

Hydraflow Storm Sewers Extension v12.04

Proposed Storm Sewer 10-Year Design Storm (Lines 1, 4, 5, 6, 7, & 9)

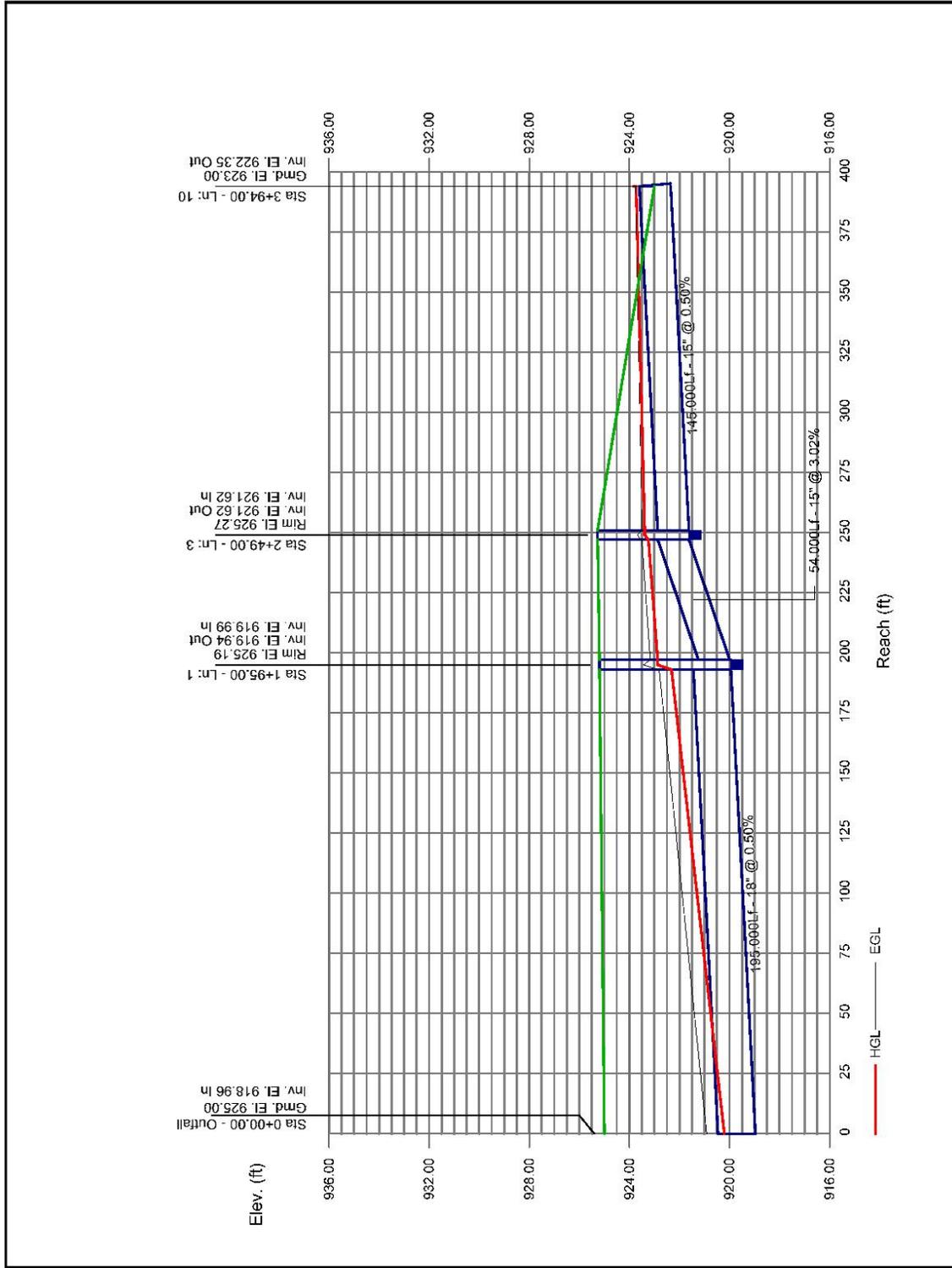
Storm Sewer Profile



Hydraflow Storm Sewers Extension

Proposed Storm Sewer 10-Year Design Storm (Lines 1, 3, & 10)

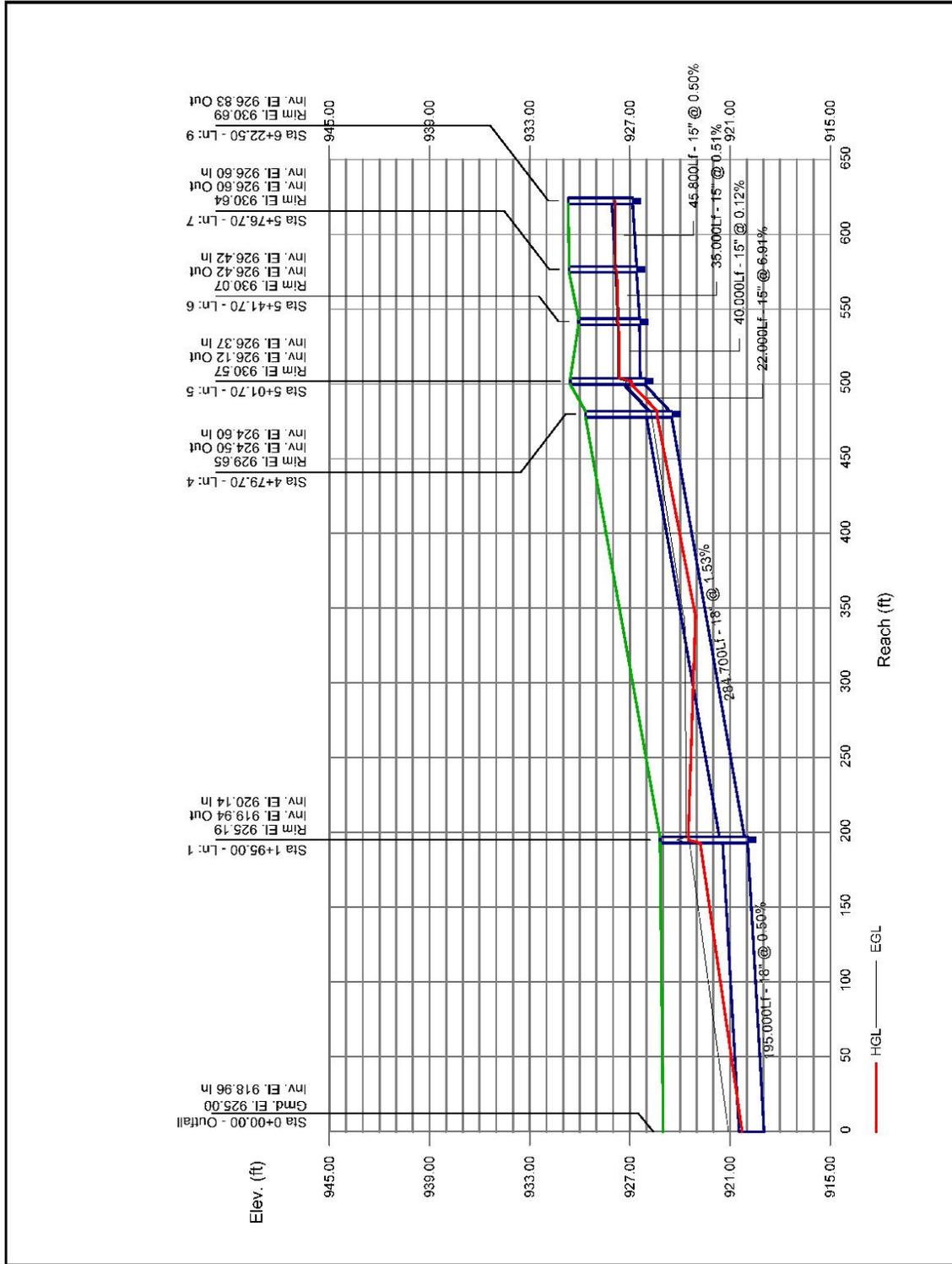
Storm Sewer Profile



Hydraflow Storm Sewers Extension

Proposed Storm Sewer 25-Year Design Storm (Lines 1, 4, 5, 6, 7, & 9)

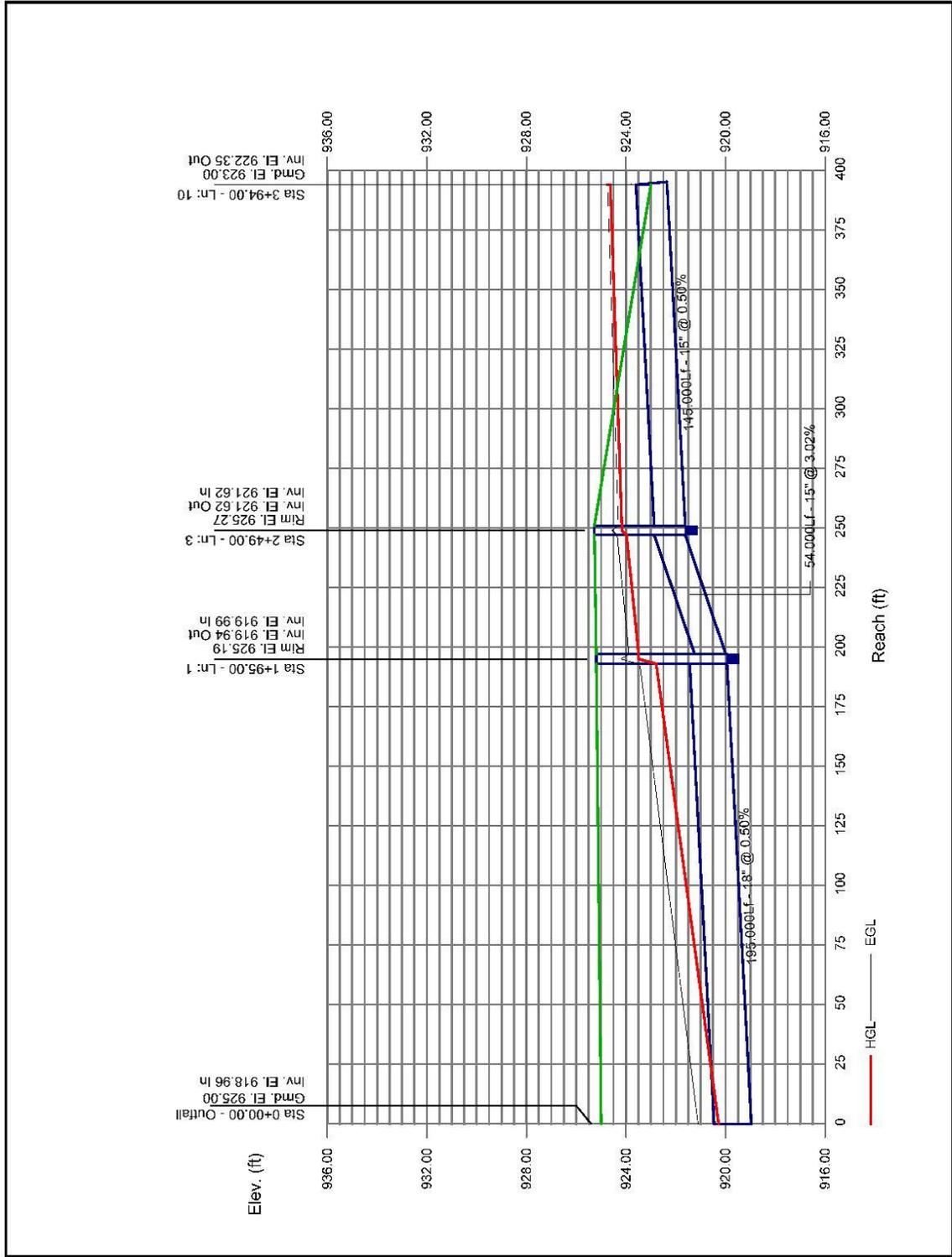
Storm Sewer Profile



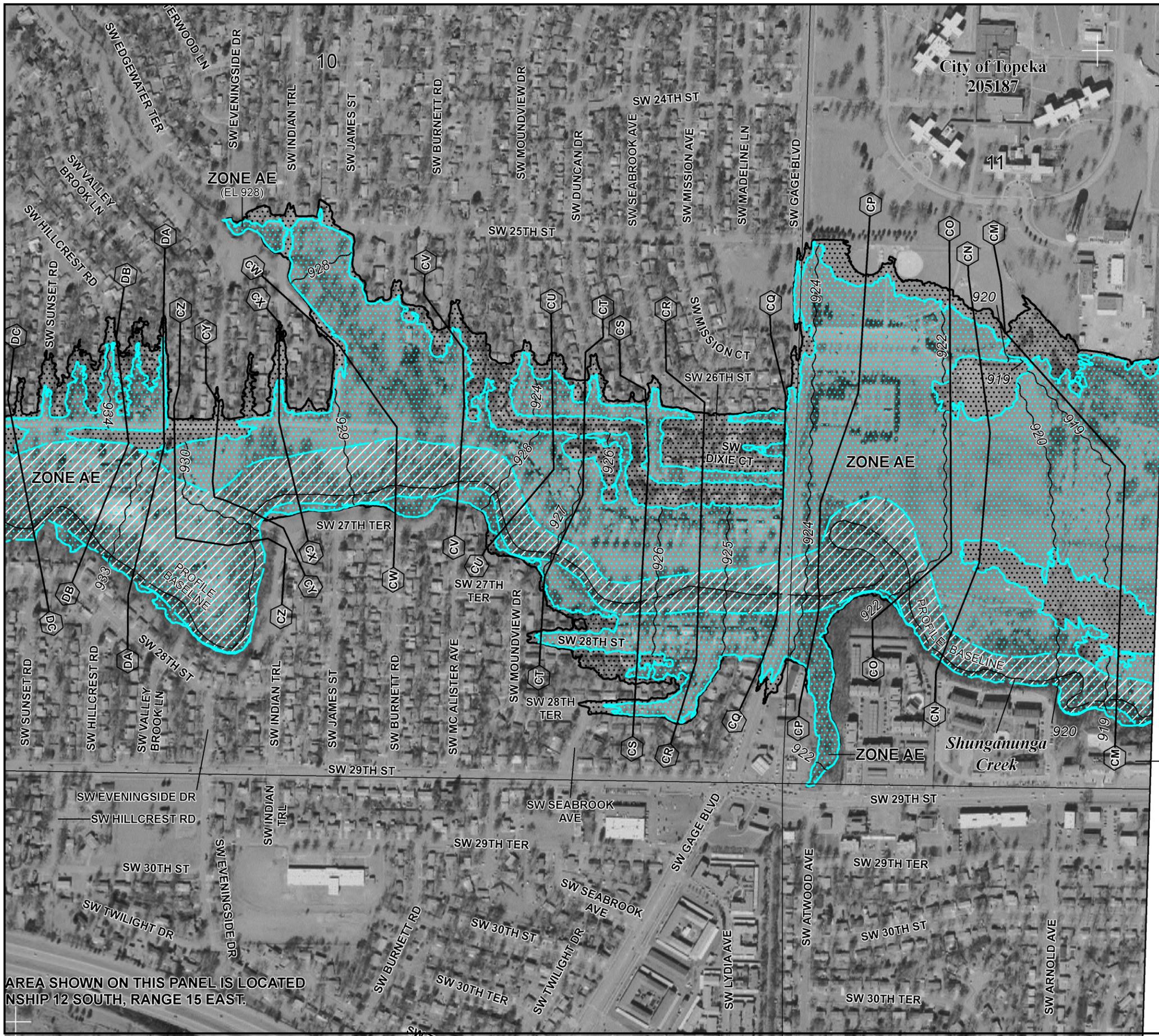
Hydraflow Storm Sewers Extension

Proposed Storm Sewer 25-Year Design Storm (Lines 1, 3, & 10)

Storm Sewer Profile

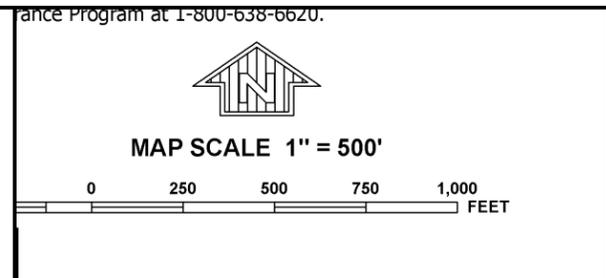


Hydraflow Storm Sewers Extension



AREA SHOWN ON THIS PANEL IS LOCATED
NSHIP 12 SOUTH, RANGE 15 EAST.

JOINS PANEL 0214



ance Program at 1-800-638-6620.

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0213E

FIRM
FLOOD INSURANCE RATE MAP
SHAWNEE COUNTY,
KANSAS
AND INCORPORATED AREAS

PANEL 213 OF 450
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
SHAWNEE COUNTY	200331	0213	E
TOPEKA, CITY OF	205187	0213	E

Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.

MAP NUMBER
20177C0213E

EFFECTIVE DATE
SEPTEMBER 29, 2011

 Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov