GMI PARKING ADDITION
550 INTERNATIONAL DRIVE

COMMERCIAL SITE

550 International Drive
City of Franklin
Franklin Township, Johnson County, Indiana

TABLE OF CONTENTS

SECTION

1) PROFESSIONAL CERTIFICATION

2) DRAINAGE SUMMARY

3) PRE DEVELOPMENT BASINS INFORMATION

4) PRE DEVELOPMENT BASIN "A" 2, 10,& 100 YEAR STORMS

5) PRE DEVELOPMENT BASIN "B" 2, 10,& 100 YEAR STORMS

6) POST DEVELOPMENT BASINS INFORMATION

7) POST DEVELOPMENT BASIN "A" 2, 10, 25, & 100 YEAR STORMS

8) POST DEVELOPMENT BASIN "B" 2, 10, 25, & 100 YEAR STORMS

GMI PARKING ADDITION

550 INTERNATIONAL DRIVE

Commercial Site Plan

Franklin Township, Johnson County, Indiana

"Final Drainage Study"

PROFESSIONAL CERTIFICATION

The following report and accompanying computations have been completed by me or under my direct supervision.

Date: March 18, 2015

Paul Maurer
Professional Land Surveyor
Registration Number: 880006
Maurer Surveying, Inc.

GMI PARKING ADDITION
550 INTERNATIONAL DRIVE
DRAINAGE SUMMARY

Current Site Conditions

The existing site is a vacant parcel that is bond by Industrial Buildings and Parcels all around it. The Lot is Lot 3 of an Industrial Subdivision called R.S. Bacon Veneer Subdivision. The existing business, GMI, East of this lot is expanding their parking area to accommodate an increase in employees, due to the business expanding into the existing building that is Northeast of this lot. The only items located on the lot are power poles with overhead electric and a swale for drainage, both of which are located along the North property line in a 30 Drainage and Utility Easement.

The existing site drains both to the North and South. The majority of the site flows to the North into the swale which flows Easterly into two 18" pipes under the gravel drive. The swale then continues Easterly and Southerly around the East adjoining parcel and outlets into the main swale the flows Easterly along International Drive. Included in this report is an Overall Basin map of what flows to the two 18" pipes. As shown on an enclosed aerial map, there is approximately 5.7 acres of runoff flowing to the pipes. The remaining site flows Southeasterly into a concrete swale which flows Southerly and outlets into the same swale along International Drive.

Proposed Site Conditions

The proposed site is a parking lot for the employees of the GMI building to the East and also for the building to the Northeast. As in the existing condition, the majority of the proposed parking lot's stormwater runoff will flow Northerly into the regraded swale. The design will divert some of the runoff that flowed southerly to flow Northerly. The small proton that follows Southerly will continue to flow into the concrete swale to the Southeast of the parking lot.

The drainage calculations included in this report will show slight increases in the runoff due to the parking lot adding impervious area. The parking lot will be curbed on all sides except of the most Northern edge and Southern edge to allow the drainage to sheet flow off into the grass.

The runoff flowing to the north will sheet flow into the regraded swale and continue on and around to the swale along International Drive. There is no detention being proposed due to the surrounding sites' elevations. The low slope of the swale will allow for some storage of runoff. The entire area is very flat and the buildings are not built up enough to provide any detention. The finish floor of the existing GMI building is less than 1 foot higher than the 18" pipes that flow under the drive. If the pipes were choked down to provide detention, the water would start flowing towards the building after it gets to be about 0.5 foot deep. The water would also back up onto the adjoiners property to the North at these same elevations. There is also the condition of over 5 acres of land to the West draining through these pipes that would also make it very hard to provide detention. There is no way to make this drainage bypass these pipes.

Therefore, we would like to respectfully request that detention requirements be waived for this parking lot expansion. The slight increases of runoff to the 2 different basins should add no flooding affect to the area.

SUMMARY OF RESULTS

Basin "A"
2 yr. pre vs. 2 yr. post
0.258 cfs < 0.859 cfs

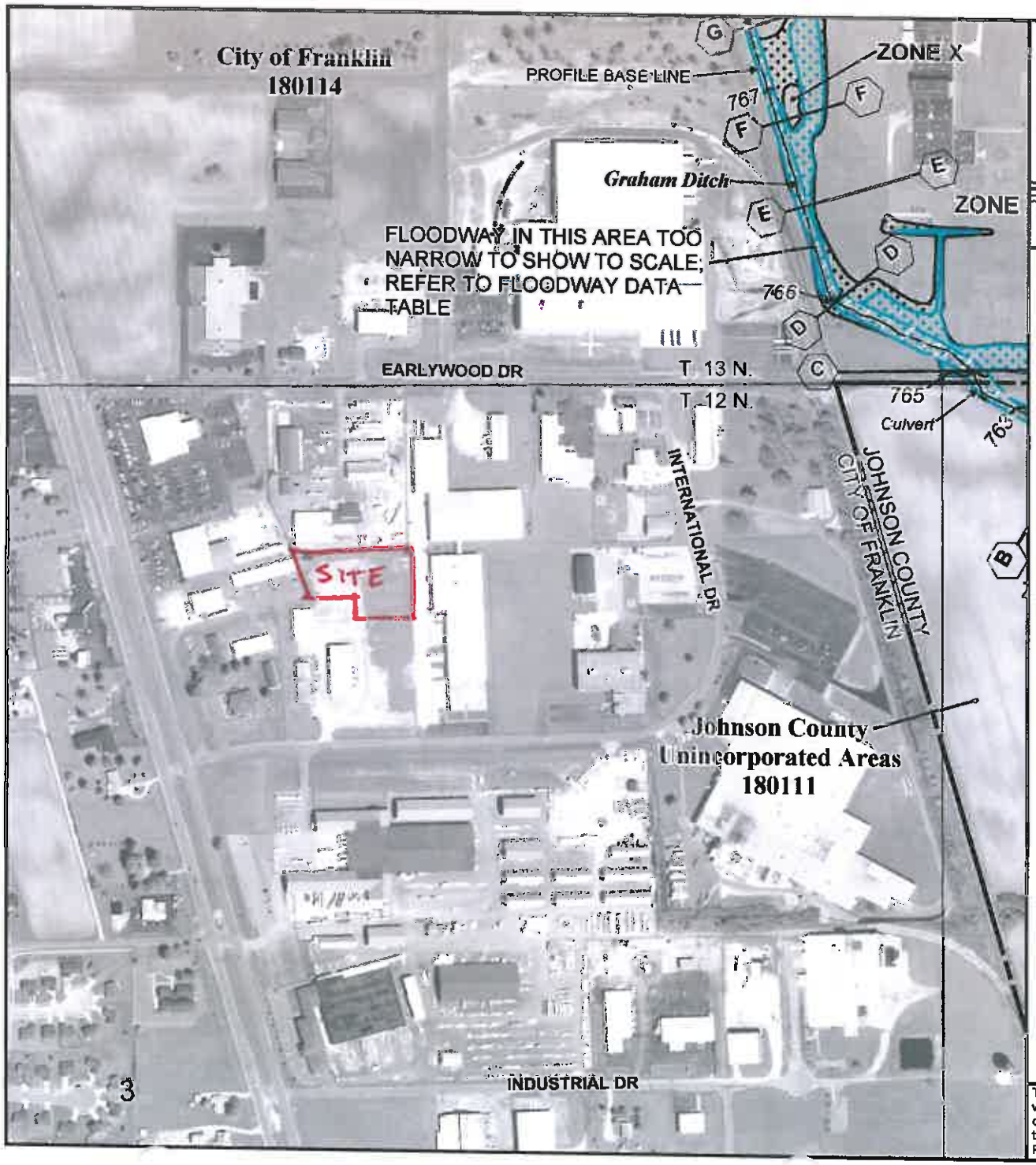
10 yr. pre vs. 10 yr. post
0.892 cfs < 2.086 cfs

100 yr. pre vs. 100 yr. post
2.053 cfs < 3.996 cfs

Basin "B"
2 yr. pre vs. 2 yr. post
0.200 cfs < 0.344 cfs

10 yr. pre vs. 10 yr. post
0.679 cfs < 0.862 cfs

100 yr. pre vs. 100 yr. post
1.566 cfs < 1.696 cfs



MAP SCALE 1" = 500'

250 0 500 1000 FEET

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0139D

FIRM

FLOOD INSURANCE RATE MAP

JOHNSON COUNTY, INDIANA

AND INCORPORATED AREAS

PANEL 139 OF 352

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
FRANKLIN, CITY OF	180114	0139	D
JOHNSON COUNTY	180111	0139	D

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
18081C0139D

EFFECTIVE DATE
AUGUST 2, 2007

Federal Emergency Management Agency

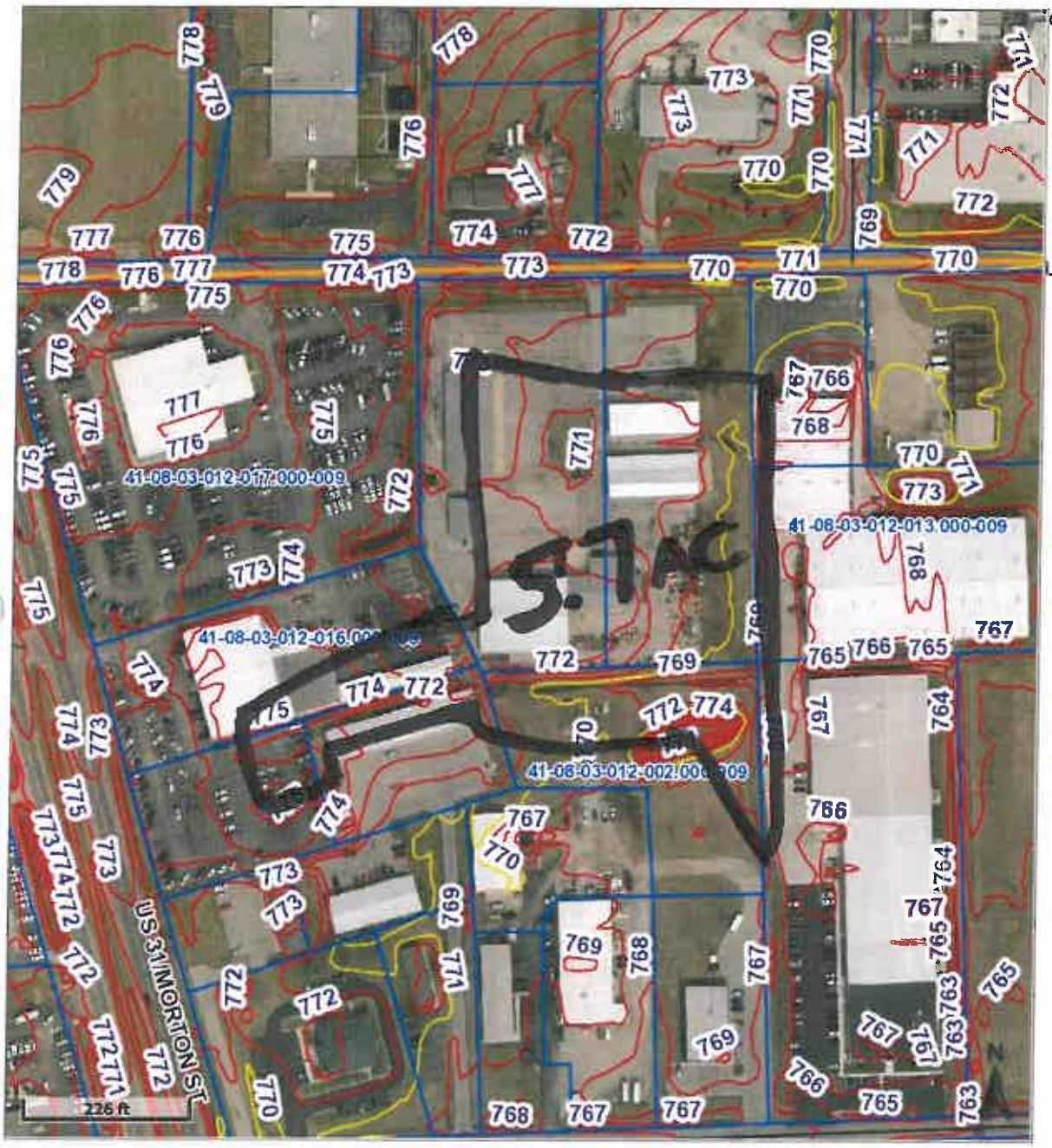
This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program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

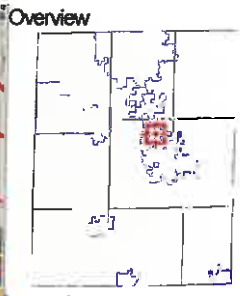
Johnson County, IN

beacon™

OVERALL BASIN TO 2-18" PIPES

Date Created: 3/20/2015





Legend

- Cities
- Townships
- Parcels

Roads

- ACCESS RAMP
- INTERSTATE
- LOCAL
- MAJOR ARTERIAL
- MAJOR COLLECTOR
- MINOR ARTERIAL
- MINOR COLLECTOR
- PRIVATE ROAD

Contours

- 10
- 2
- 20

Last Data Upload: 3/20/2015 4:09:00 AM

DISCLAIMER: Johnson County maintains this World Wide Web site to enhance public access to information. This site is continually under development and therefore subject to change without notice. While we endeavor to provide timely and accurate information, we make no guarantees. Johnson County makes no warranty, express or implied, including warranties of merchantability and fitness for a particular purpose. Use of the information is the sole responsibility of the user. The material on this site comes from a variety of sources. We do not control or guarantee the accuracy, relevance, timeliness or completeness of any outside information. Further, the inclusion of pointers to particular items is not intended to reflect their importance nor is it an endorsement of any of the views expressed or products or services offered. Maps and data are provided for informational purposes only.

Schneider

developed by
The Schneider Corporation
www.schneidercorp.com

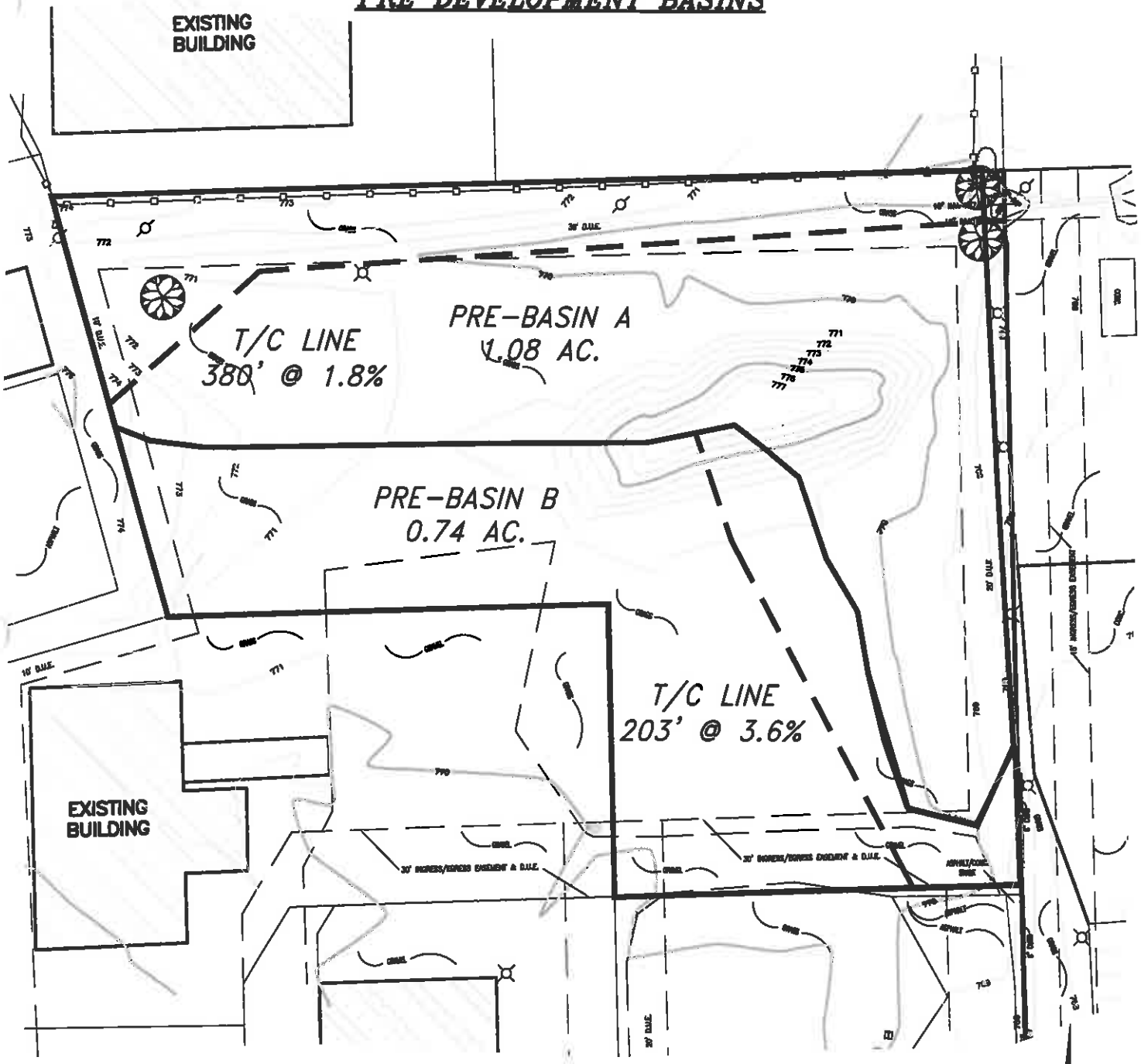
PRE-DEVELOPMENT

BASINS

INFORMATION

GMI PARKING ADDITION
550 INTERNATIONAL DRIVE

PRE DEVELOPMENT BASINS



SCALE : 1"=60'

N

MAURER SURVEYING, INC.
4800 W. SMITH VALLEY ROAD, SUITE P, GREENWOOD INDIANA 46142
OFFICE - 317-881-3898 www.MaurerSurveying.com

Worksheet 2: Runoff curve number and runoff

Project	By	Date
GMI PARKING ADDITION	A. BARKOCY	3/18/15
Location	**Checked**	**Date**
550 INTERNATIONAL DR.	A. BARKOCY	3/18/15

Check one: ☒ Present ☐ Developed PRE - BASIN "A"

1. Runoff curve number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Figure 2-3	CN 1/ Figure 2-4	Area ☒ acres ☐ mi² ☐ %	Product of CN x area
CrA (.)	GRASS FAIR	79			1.08	85.32

1/ Use only one CN source per line

Totals ➡ 1.08 | 85.32

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{85.32}{1.08} = 79$; **Use CN** ➡ 79

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency	yr			
Rainfall, P (24-hour)	in			
Runoff, Q	in			

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Hyd. No. 1

PRE-BASIN A 0.5 HR

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.64		0.00		0.00		
Land slope (%)	= 1.80		0.00		0.00		
Travel Time (min)	**= 11.25**	**+**	**0.00**	**+**	**0.00**	**=**	**11.25**
Shallow Concentrated Flow							
Flow length (ft)	= 280.00		0.00		0.00		
Watercourse slope (%)	= 1.80		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.16		0.00		0.00		
Travel Time (min)	**= 2.16**	**+**	**0.00**	**+**	**0.00**	**=**	**2.16**
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		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 13.41 min

Worksheet 2: Runoff curve number and runoff

Project	By	Date
GMI PARKING ADDITION	A. BARKOCY	3/18/15
Location	**Checked**	**Date**
550 INTERNATIONAL DR.	A. BARKOCY	3/18/15

Check one: ☒ Present ☐ Developed PRE-BASIN "B"

1. Runoff curve number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN [1/] Table 2-2	CN [1/] Figure 2-3	CN [1/] Figure 2-4	Area ☒ acres ☐ mi² ☐ %	Product of CN x area
Gr A	GRAVEL	87			0.04	3.48
" "	GRASS FAIR	79			0.69	54.51
Br	GRASS FAIR	84			0.01	0.84

[1/] Use only one CN source per line

Totals ➡ 0.74 | 58.83

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{58.83}{0.74} = 79.5$; **Use CN** ➡ 80

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency	yr			
Rainfall, P (24-hour)	in			
Runoff, Q	in			

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Hyd. No. 1

PRE-BASIN B 0.5 HR

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.64		0.00		0.00		
Land slope (%)	= 3.60		0.00		0.00		
Travel Time (min)	**= 8.53**	**+**	**0.00**	**+**	**0.00**	**=**	**8.53**
Shallow Concentrated Flow							
Flow length (ft)	= 103.00		0.00		0.00		
Watercourse slope (%)	= 3.60		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=3.06		0.00		0.00		
Travel Time (min)	**= 0.56**	**+**	**0.00**	**+**	**0.00**	**=**	**0.56**
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		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 9.09 min

PRE-DEVELOPMENT

BASIN "A"

2, 10, & 100 YEAR

STORMS

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

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	0.191	3	27	264	-----	-----	-----	PRE-BASIN A 0.5 HR
2	SCS Runoff	0.258	3	30	599	-----	-----	-----	PRE-BASIN A 1 HR
3	SCS Runoff	0.255	3	42	1,049	-----	-----	-----	PRE-BASIN A 2 HR
4	SCS Runoff	0.233	3	51	1,357	-----	-----	-----	PRE-BASIN A 3 HR
5	SCS Runoff	0.187	3	93	2,002	-----	-----	-----	PRE-BASIN A 6 HR
6	SCS Runoff	0.210	3	324	3,023	-----	-----	-----	PRE-BASIN A 12 HR
7	SCS Runoff	0.169	3	936	3,656	-----	-----	-----	PRE-BASIN 24 HR

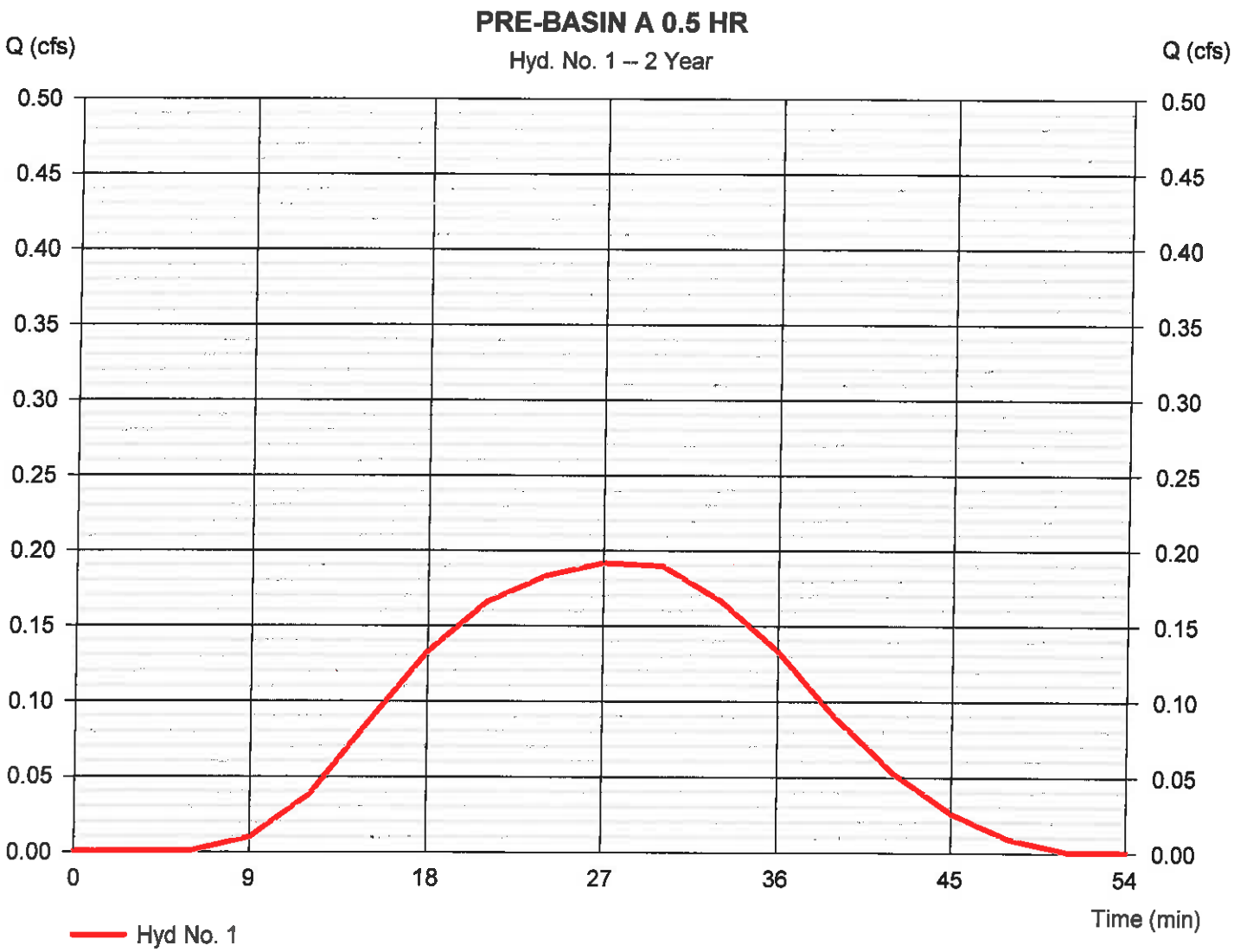
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 1

PRE-BASIN A 0.5 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.191 cfs
Storm frequency	= 2 yrs	Time to peak	= 27 min
Time interval	= 3 min	Hyd. volume	= 264 cuft
Drainage area	= 1.080 ac	Curve number	= 79
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.40 min
Total precip.	= 0.99 in	Distribution	= Huff-1st
Storm duration	= 0.50 hrs	Shape factor	= 484



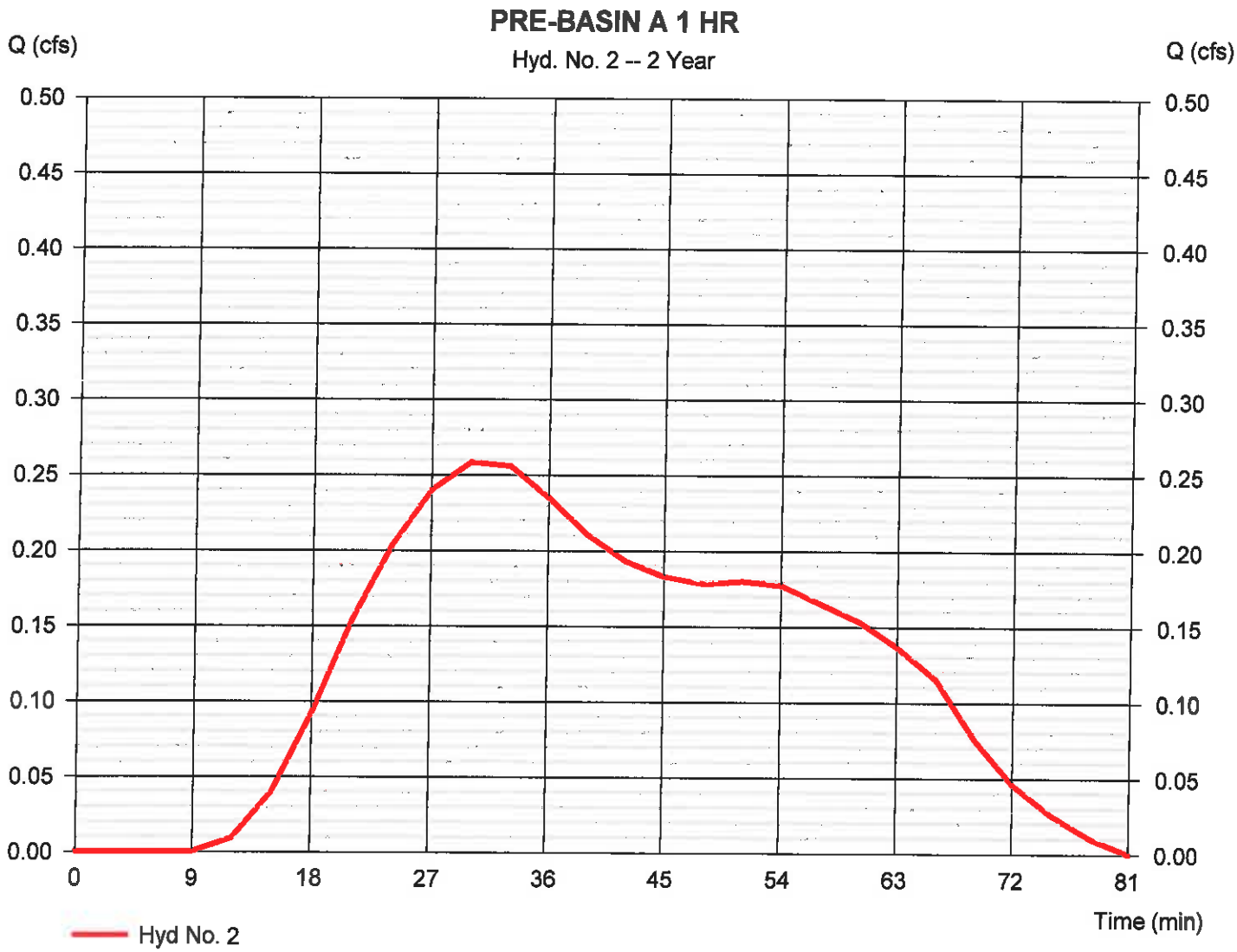
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 2

PRE-BASIN A 1 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.258 cfs
Storm frequency	= 2 yrs	Time to peak	= 30 min
Time interval	= 3 min	Hyd. volume	= 599 cuft
Drainage area	= 1.080 ac	Curve number	= 79
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.40 min
Total precip.	= 1.25 in	Distribution	= Huff-1st
Storm duration	= 1.00 hrs	Shape factor	= 484



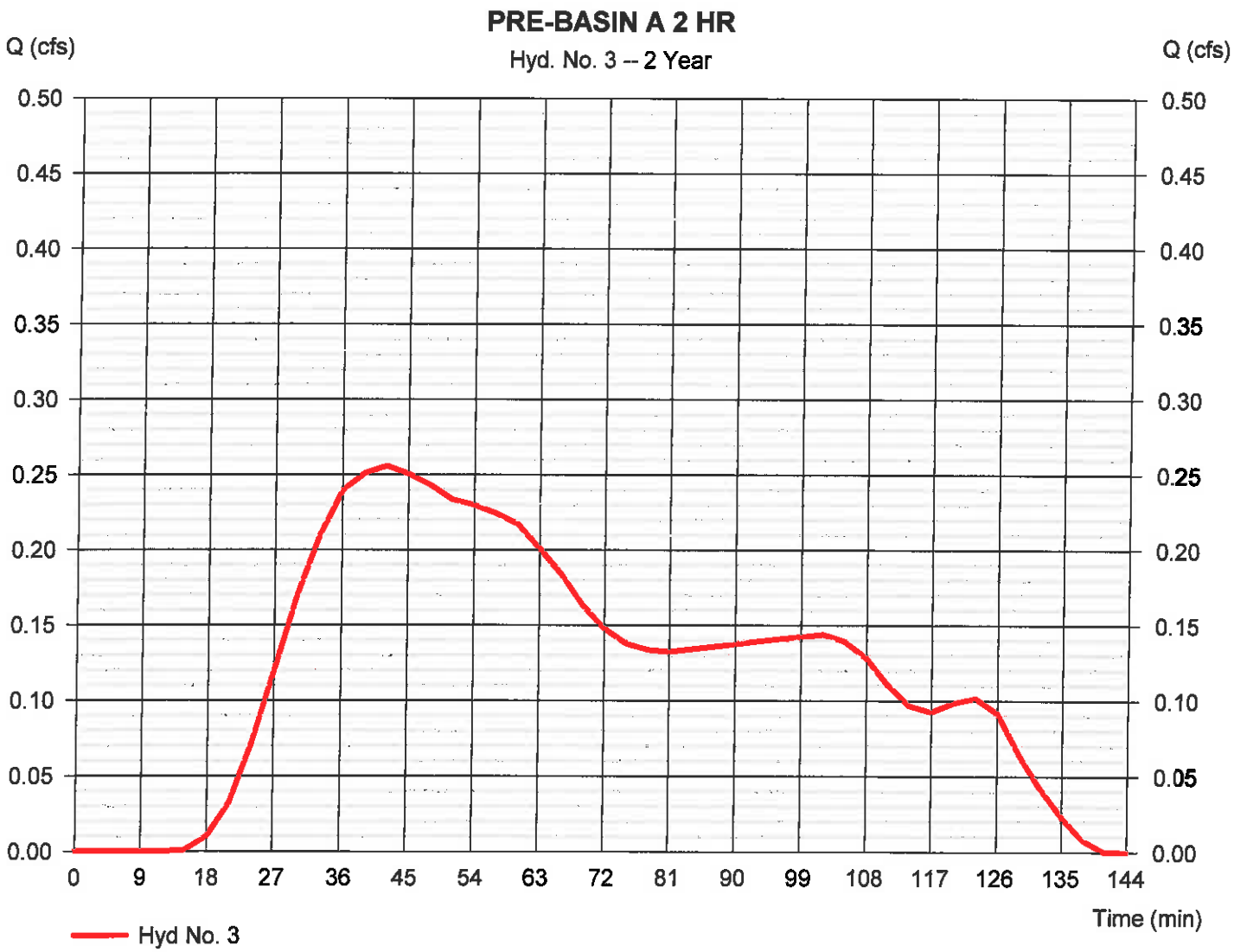
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 3

PRE-BASIN A 2 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.255 cfs
Storm frequency	= 2 yrs	Time to peak	= 42 min
Time interval	= 3 min	Hyd. volume	= 1,049 cuft
Drainage area	= 1.080 ac	Curve number	= 79
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.40 min
Total precip.	= 1.52 in	Distribution	= Huff-1st
Storm duration	= 2.00 hrs	Shape factor	= 484



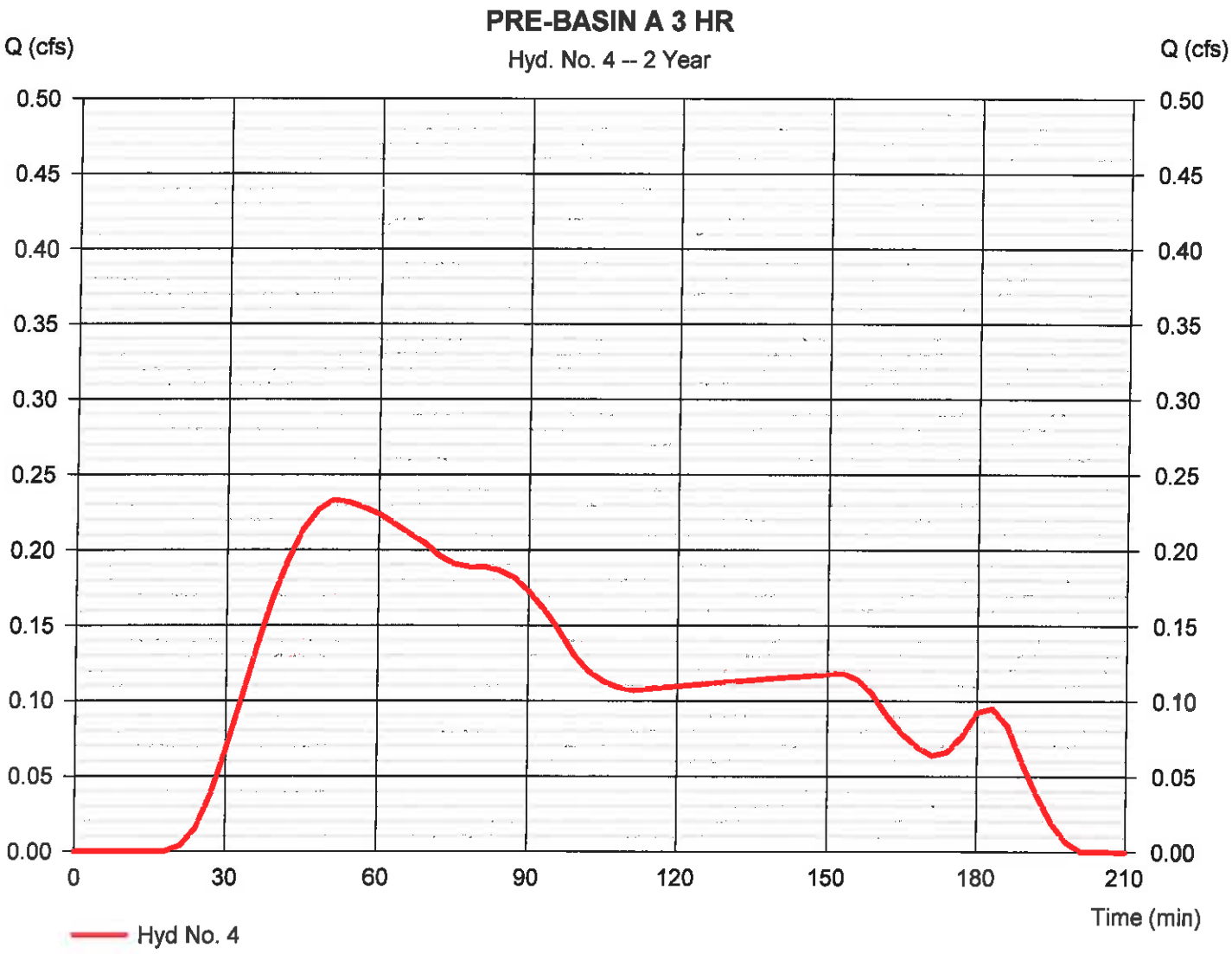
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 4

PRE-BASIN A 3 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.233 cfs
Storm frequency	= 2 yrs	Time to peak	= 51 min
Time interval	= 3 min	Hyd. volume	= 1,357 cuft
Drainage area	= 1.080 ac	Curve number	= 79
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.40 min
Total precip.	= 1.68 in	Distribution	= Huff-1st
Storm duration	= 3.00 hrs	Shape factor	= 484



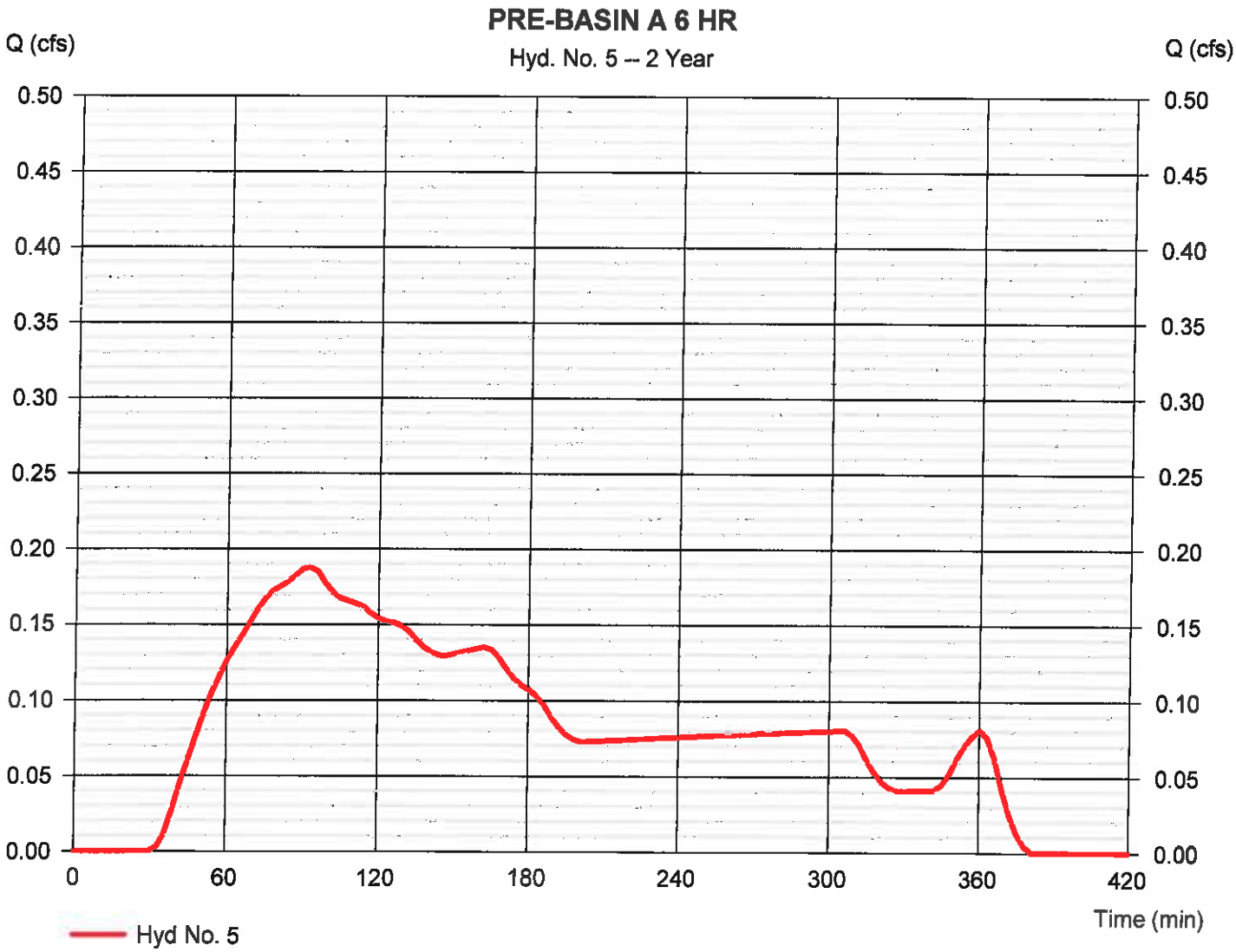
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 5

PRE-BASIN A 6 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.187 cfs
Storm frequency	= 2 yrs	Time to peak	= 93 min
Time interval	= 3 min	Hyd. volume	= 2,002 cuft
Drainage area	= 1.080 ac	Curve number	= 79
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.40 min
Total precip.	= 1.98 in	Distribution	= Huff-1st
Storm duration	= 6.00 hrs	Shape factor	= 484



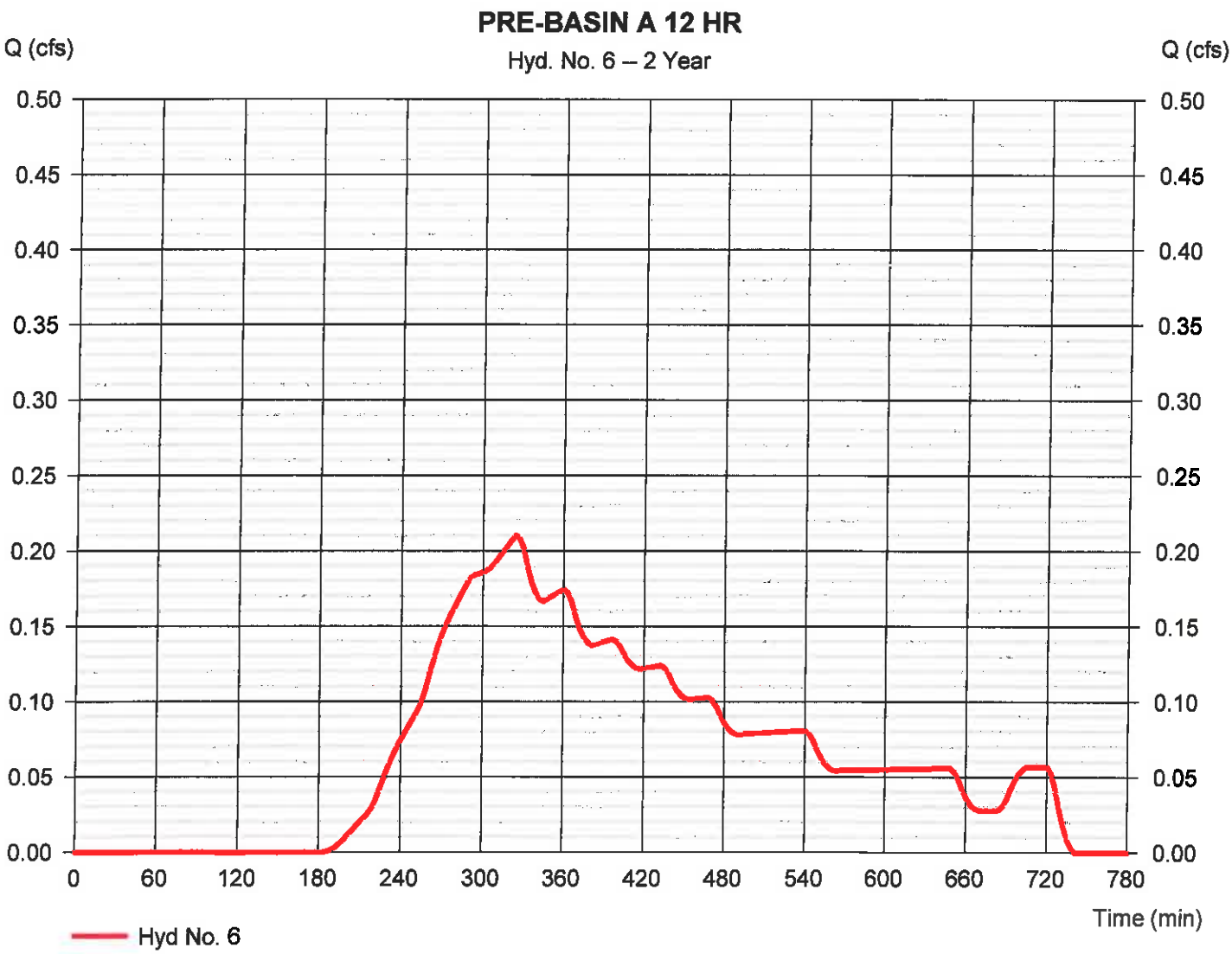
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 6

PRE-BASIN A 12 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.210 cfs
Storm frequency	= 2 yrs	Time to peak	= 324 min
Time interval	= 3 min	Hyd. volume	= 3,023 cuft
Drainage area	= 1.080 ac	Curve number	= 79
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.40 min
Total precip.	= 2.40 in	Distribution	= Huff-2nd
Storm duration	= 12.00 hrs	Shape factor	= 484



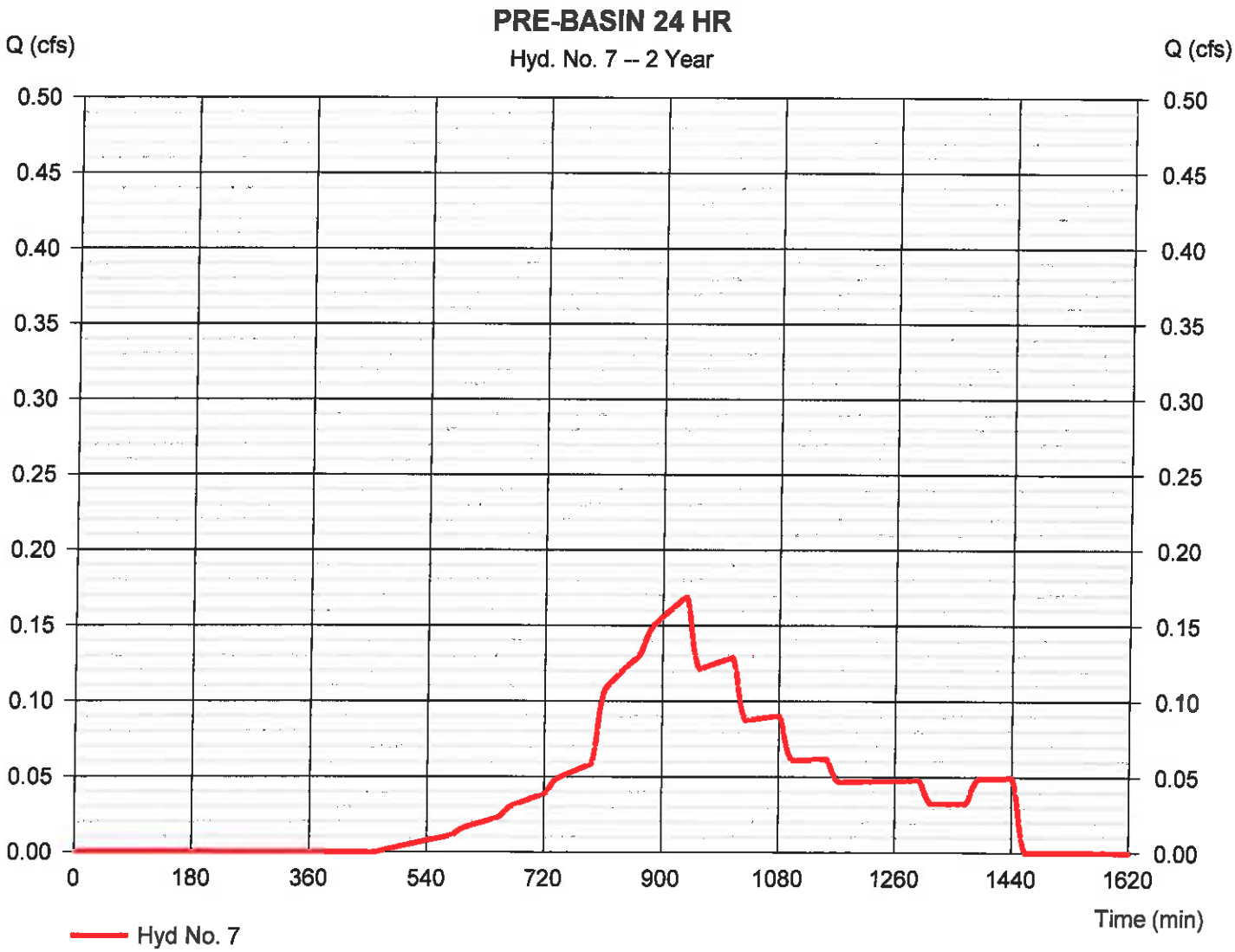
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 7

PRE-BASIN 24 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.169 cfs
Storm frequency	= 2 yrs	Time to peak	= 936 min
Time interval	= 3 min	Hyd. volume	= 3,656 cuft
Drainage area	= 1.080 ac	Curve number	= 79
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.40 min
Total precip.	= 2.64 in	Distribution	= Huff-3rd
Storm duration	= 24.00 hrs	Shape factor	= 484



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

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	0.770	3	21	1,106	-----	-----	-----	PRE-BASIN A 0.5 HR
2	SCS Runoff	0.892	3	27	1,938	-----	-----	-----	PRE-BASIN A 1 HR
3	SCS Runoff	0.807	3	36	3,019	-----	-----	-----	PRE-BASIN A 2 HR
4	SCS Runoff	0.679	3	48	3,654	-----	-----	-----	PRE-BASIN A 3 HR
5	SCS Runoff	0.480	3	90	5,005	-----	-----	-----	PRE-BASIN A 6 HR
6	SCS Runoff	0.438	3	324	6,445	-----	-----	-----	PRE-BASIN A 12 HR
7	SCS Runoff	0.340	3	936	7,953	-----	-----	-----	PRE-BASIN 24 HR

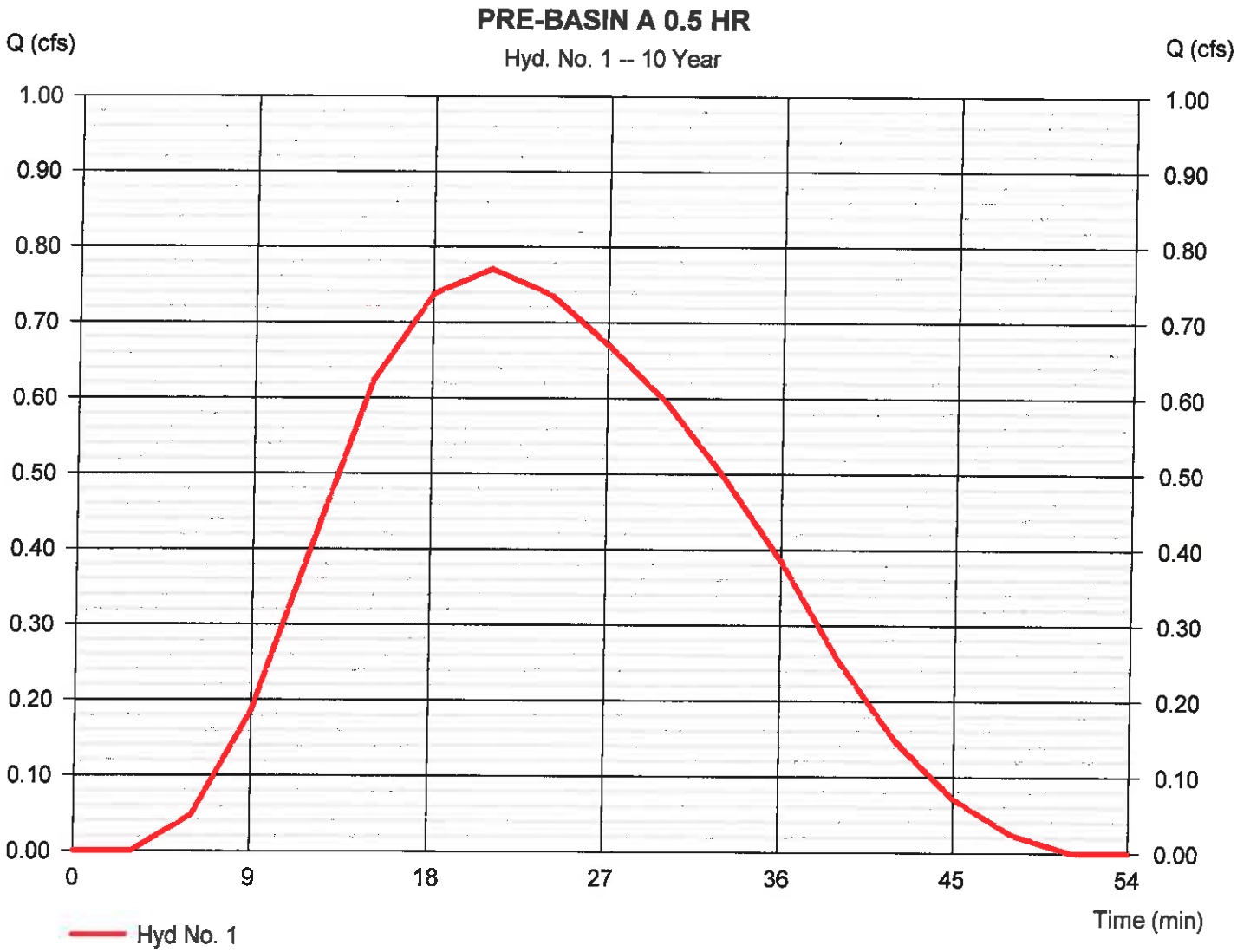
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 1

PRE-BASIN A 0.5 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.770 cfs
Storm frequency	= 10 yrs	Time to peak	= 21 min
Time interval	= 3 min	Hyd. volume	= 1,106 cuft
Drainage area	= 1.080 ac	Curve number	= 79
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.40 min
Total precip.	= 1.55 in	Distribution	= Huff-1st
Storm duration	= 0.50 hrs	Shape factor	= 484



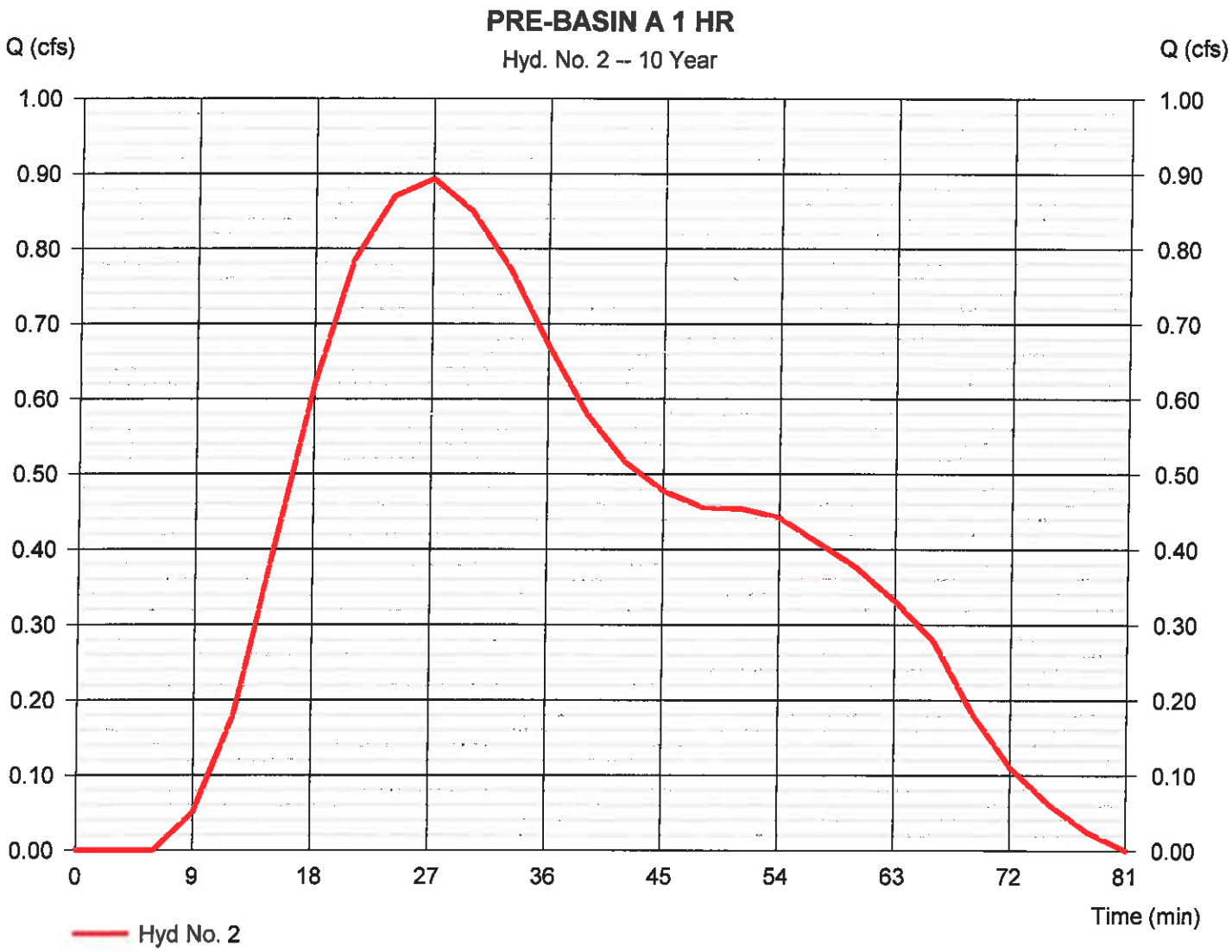
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 2

PRE-BASIN A 1 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.892 cfs
Storm frequency	= 10 yrs	Time to peak	= 27 min
Time interval	= 3 min	Hyd. volume	= 1,938 cuft
Drainage area	= 1.080 ac	Curve number	= 79
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.40 min
Total precip.	= 1.96 in	Distribution	= Huff-1st
Storm duration	= 1.00 hrs	Shape factor	= 484



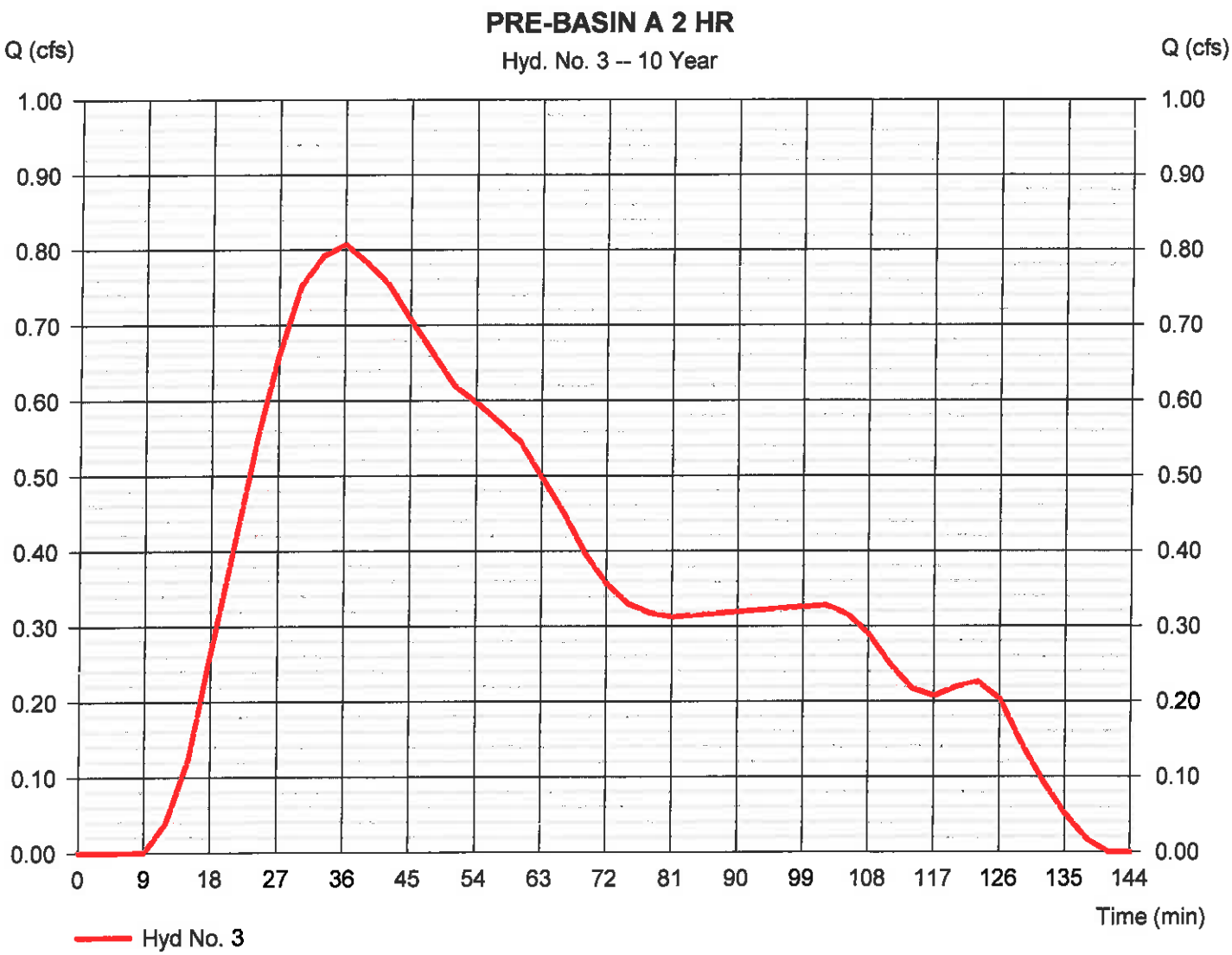
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 3

PRE-BASIN A 2 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.807 cfs
Storm frequency	= 10 yrs	Time to peak	= 36 min
Time interval	= 3 min	Hyd. volume	= 3,019 cuft
Drainage area	= 1.080 ac	Curve number	= 79
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.40 min
Total precip.	= 2.40 in	Distribution	= Huff-1st
Storm duration	= 2.00 hrs	Shape factor	= 484



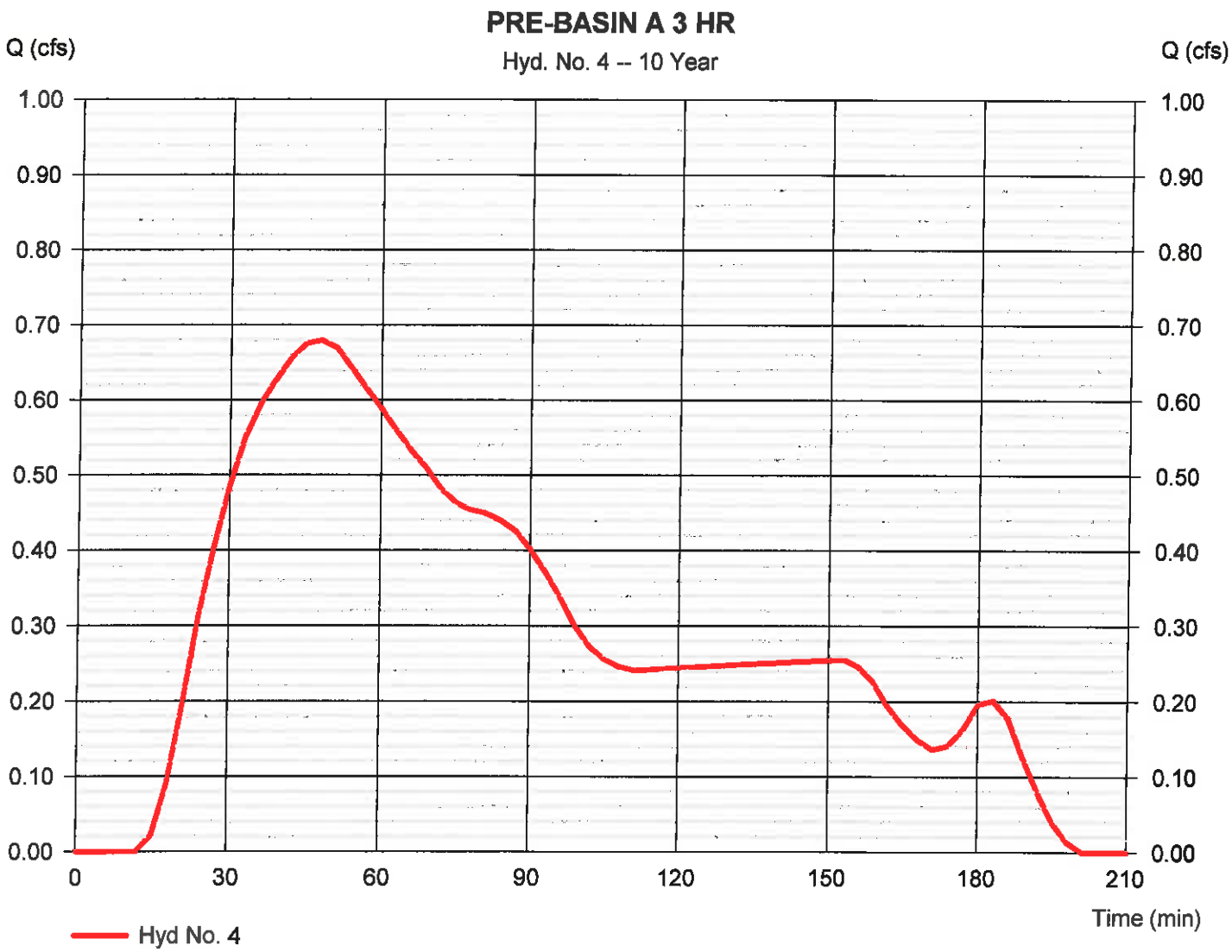
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 4

PRE-BASIN A 3 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.679 cfs
Storm frequency	= 10 yrs	Time to peak	= 48 min
Time interval	= 3 min	Hyd. volume	= 3,654 cuft
Drainage area	= 1.080 ac	Curve number	= 79
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.40 min
Total precip.	= 2.64 in	Distribution	= Huff-1st
Storm duration	= 3.00 hrs	Shape factor	= 484



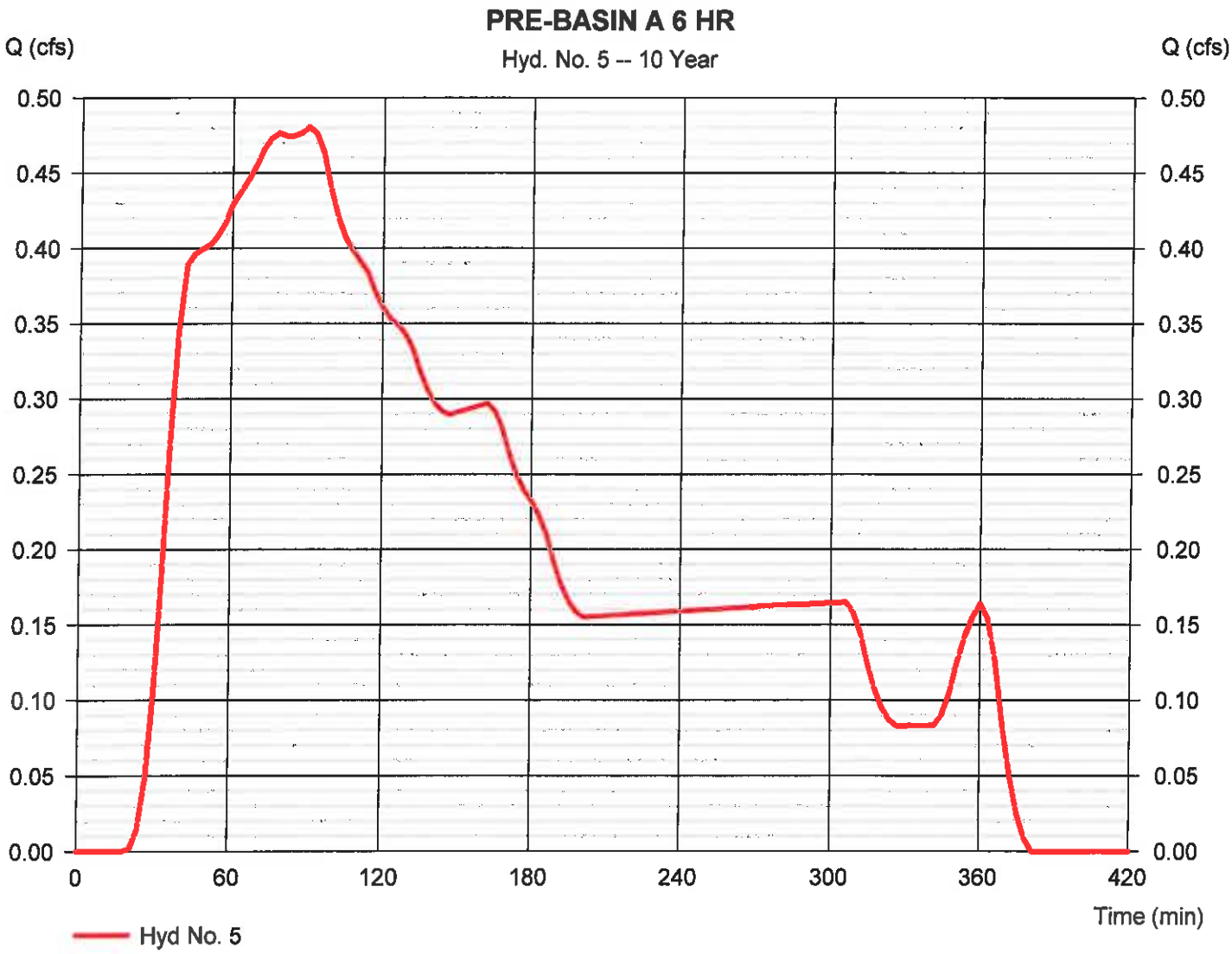
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 5

PRE-BASIN A 6 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.480 cfs
Storm frequency	= 10 yrs	Time to peak	= 90 min
Time interval	= 3 min	Hyd. volume	= 5,005 cuft
Drainage area	= 1.080 ac	Curve number	= 79
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.40 min
Total precip.	= 3.12 in	Distribution	= Huff-1st
Storm duration	= 6.00 hrs	Shape factor	= 484



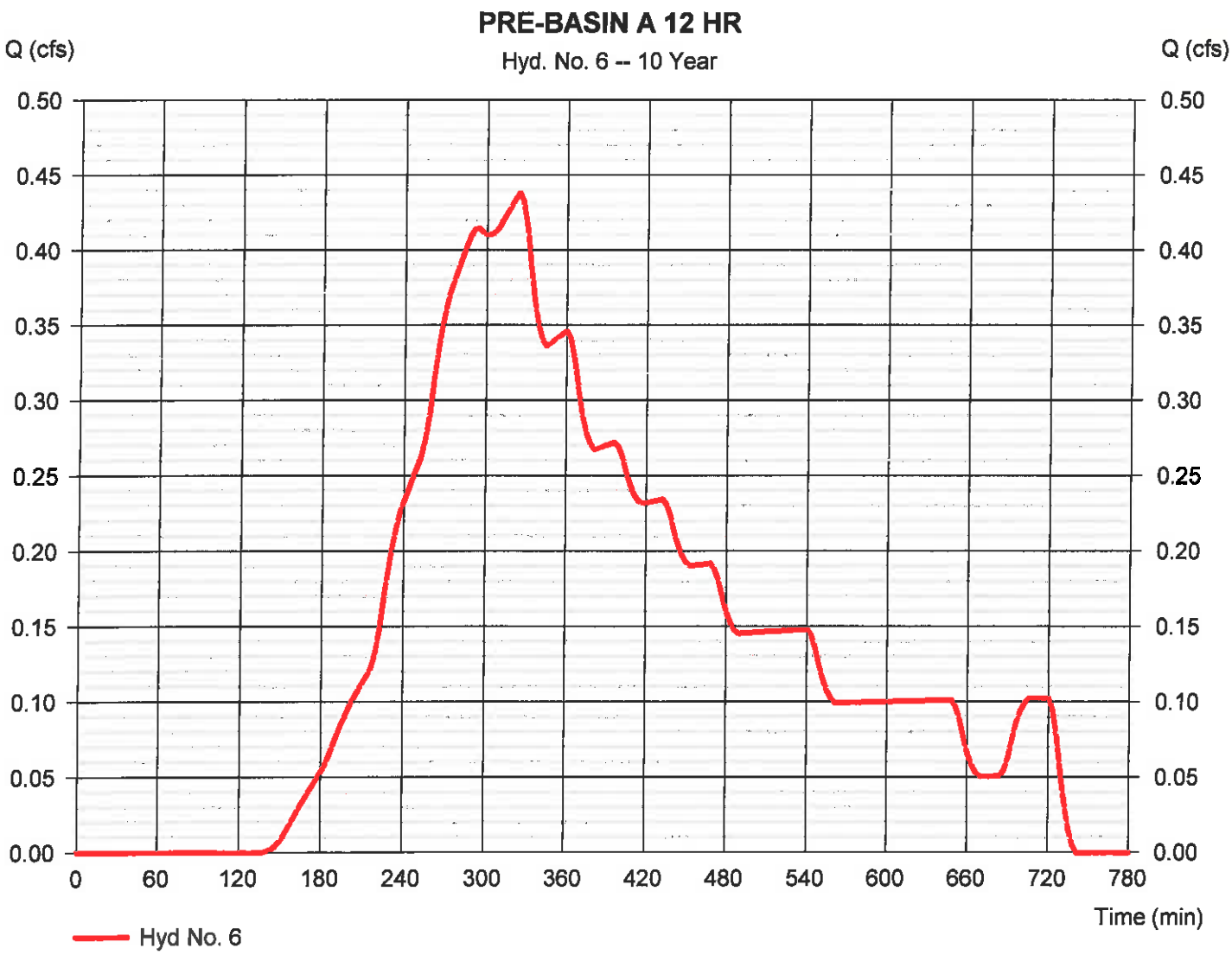
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 6

PRE-BASIN A 12 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.438 cfs
Storm frequency	= 10 yrs	Time to peak	= 324 min
Time interval	= 3 min	Hyd. volume	= 6,445 cuft
Drainage area	= 1.080 ac	Curve number	= 79
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.40 min
Total precip.	= 3.60 in	Distribution	= Huff-2nd
Storm duration	= 12.00 hrs	Shape factor	= 484



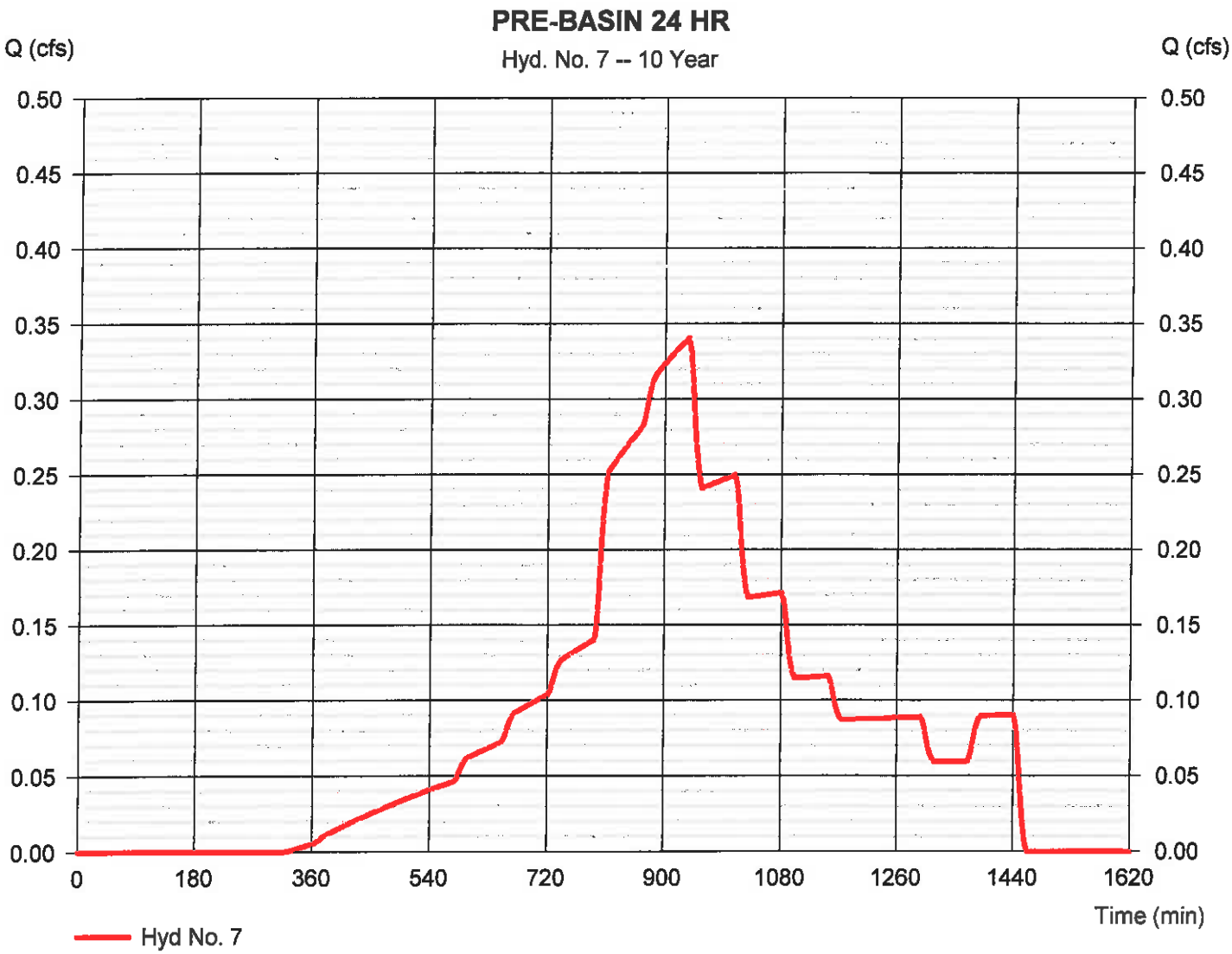
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 7

PRE-BASIN 24 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.340 cfs
Storm frequency	= 10 yrs	Time to peak	= 936 min
Time interval	= 3 min	Hyd. volume	= 7,953 cuft
Drainage area	= 1.080 ac	Curve number	= 79
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.40 min
Total precip.	= 4.08 in	Distribution	= Huff-3rd
Storm duration	= 24.00 hrs	Shape factor	= 484



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

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	1.879	3	18	2,645	-----	-----	-----	PRE-BASIN A 0.5 HR
2	SCS Runoff	2.053	3	24	4,318	-----	-----	-----	PRE-BASIN A 1 HR
3	SCS Runoff	1.706	3	30	6,138	-----	-----	-----	PRE-BASIN A 2 HR
4	SCS Runoff	1.387	3	45	7,275	-----	-----	-----	PRE-BASIN A 3 HR
5	SCS Runoff	0.978	3	42	9,313	-----	-----	-----	PRE-BASIN A 6 HR
6	SCS Runoff	0.758	3	324	11,526	-----	-----	-----	PRE-BASIN A 12 HR
7	SCS Runoff	0.579	3	936	14,426	-----	-----	-----	PRE-BASIN 24 HR

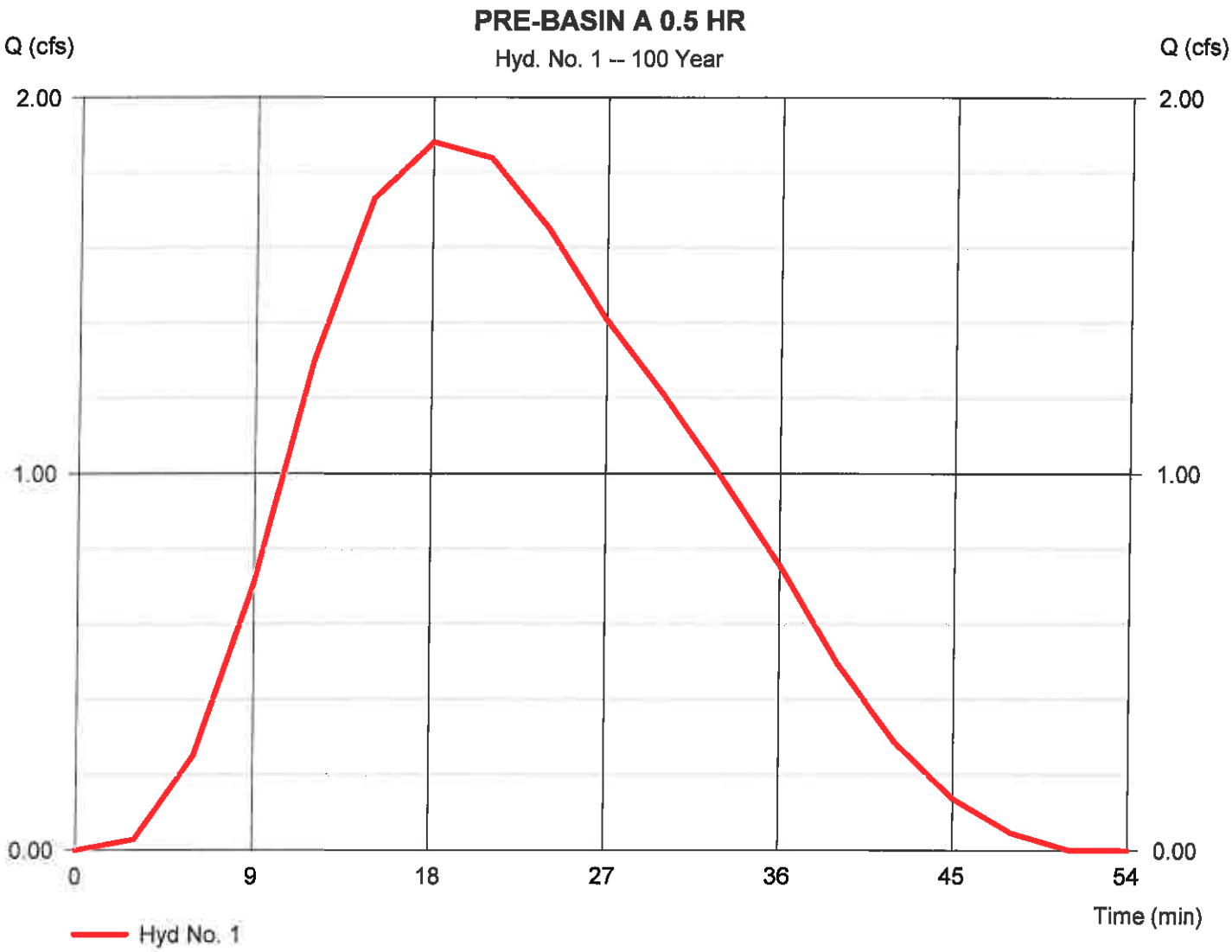
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 1

PRE-BASIN A 0.5 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 1.879 cfs
Storm frequency	= 100 yrs	Time to peak	= 18 min
Time interval	= 3 min	Hyd. volume	= 2,645 cuft
Drainage area	= 1.080 ac	Curve number	= 79
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.40 min
Total precip.	= 2.25 in	Distribution	= Huff-1st
Storm duration	= 0.50 hrs	Shape factor	= 484



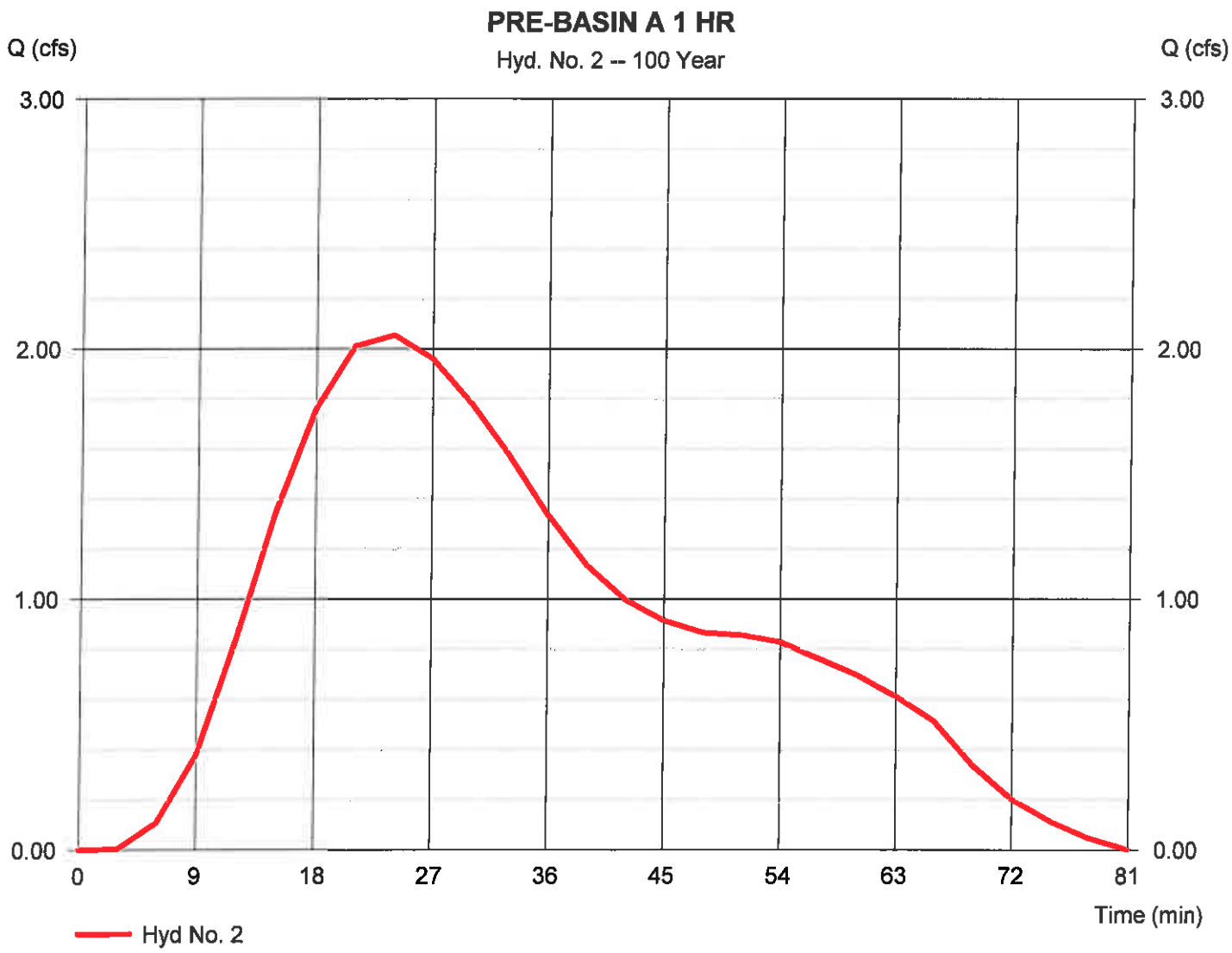
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 2

PRE-BASIN A 1 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 2.053 cfs
Storm frequency	= 100 yrs	Time to peak	= 24 min
Time interval	= 3 min	Hyd. volume	= 4,318 cuft
Drainage area	= 1.080 ac	Curve number	= 79
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.40 min
Total precip.	= 2.88 in	Distribution	= Huff-1st
Storm duration	= 1.00 hrs	Shape factor	= 484



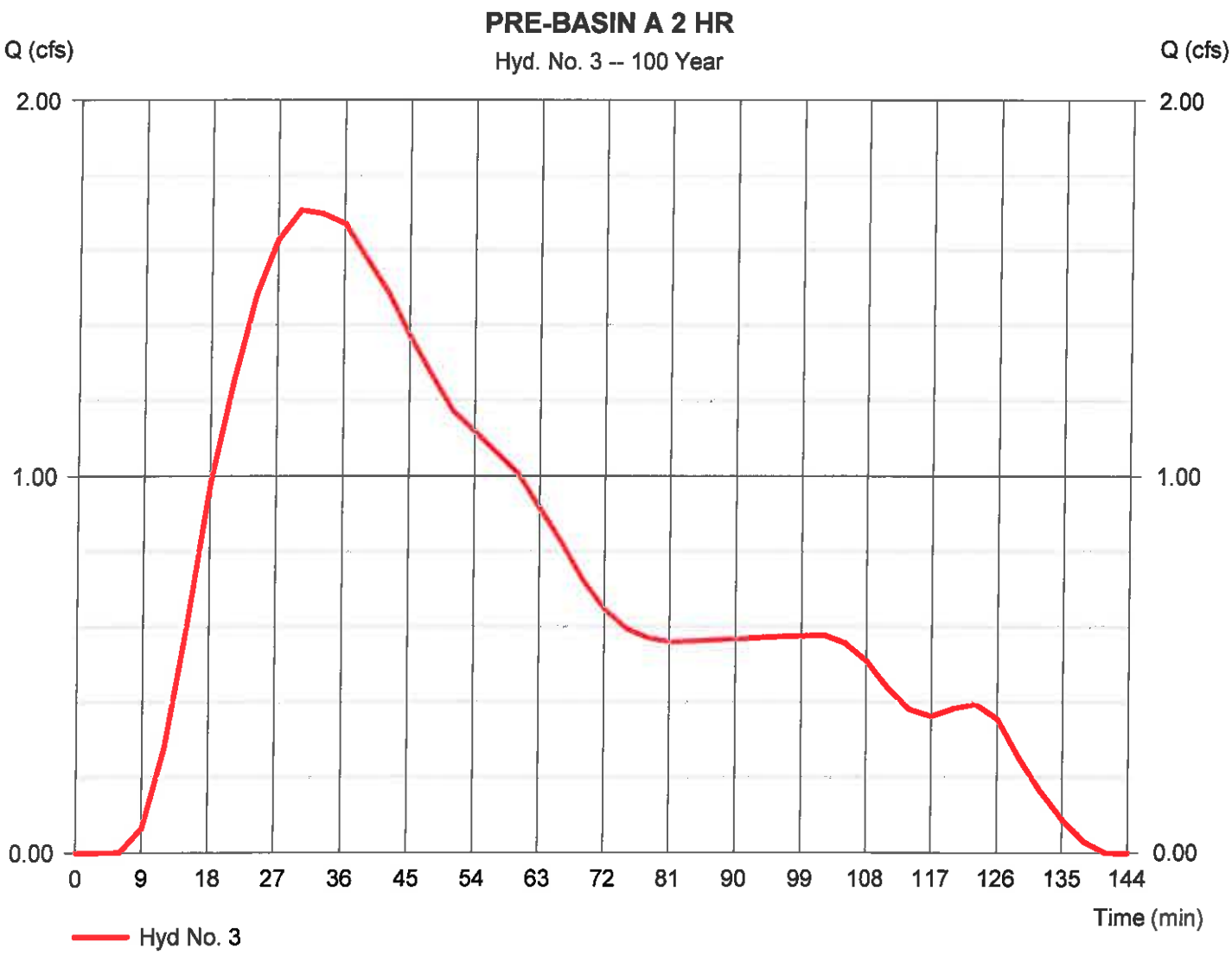
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 3

PRE-BASIN A 2 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 1.706 cfs
Storm frequency	= 100 yrs	Time to peak	= 30 min
Time interval	= 3 min	Hyd. volume	= 6,138 cuft
Drainage area	= 1.080 ac	Curve number	= 79
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.40 min
Total precip.	= 3.50 in	Distribution	= Huff-1st
Storm duration	= 2.00 hrs	Shape factor	= 484



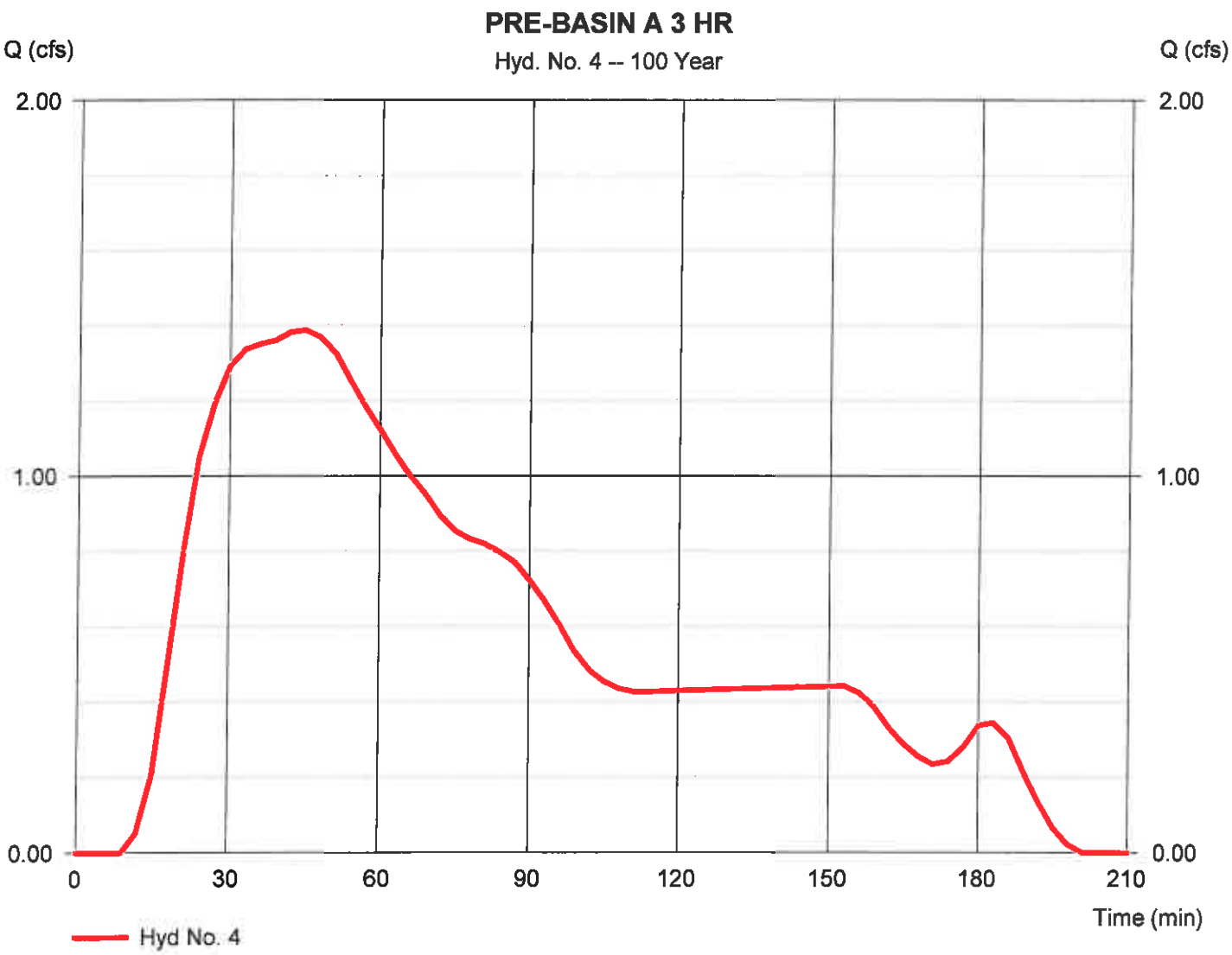
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 4

PRE-BASIN A 3 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 1.387 cfs
Storm frequency	= 100 yrs	Time to peak	= 45 min
Time interval	= 3 min	Hyd. volume	= 7,275 cuft
Drainage area	= 1.080 ac	Curve number	= 79
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.40 min
Total precip.	= 3.87 in	Distribution	= Huff-1st
Storm duration	= 3.00 hrs	Shape factor	= 484



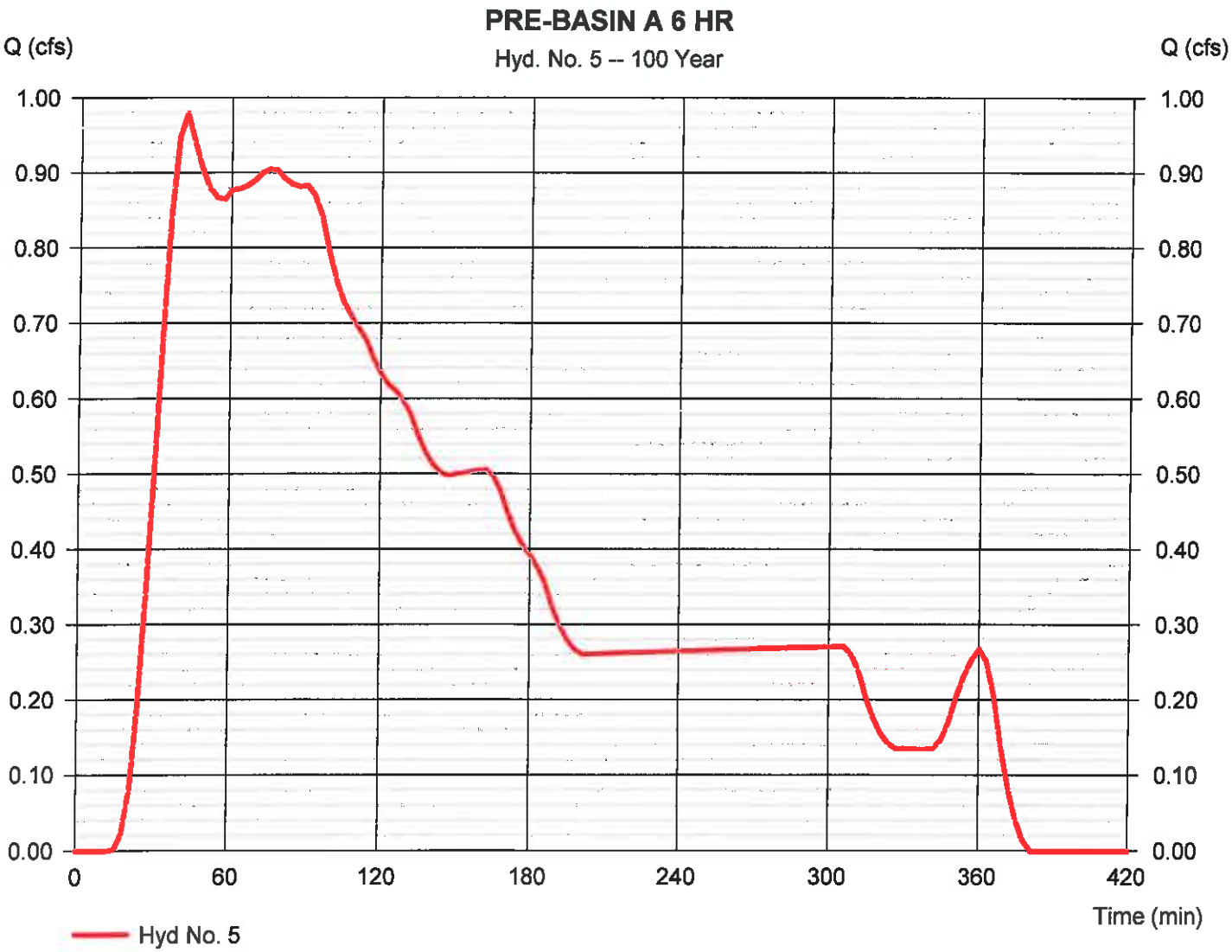
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 5

PRE-BASIN A 6 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.978 cfs
Storm frequency	= 100 yrs	Time to peak	= 42 min
Time interval	= 3 min	Hyd. volume	= 9,313 cuft
Drainage area	= 1.080 ac	Curve number	= 79
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.40 min
Total precip.	= 4.50 in	Distribution	= Huff-1st
Storm duration	= 6.00 hrs	Shape factor	= 484



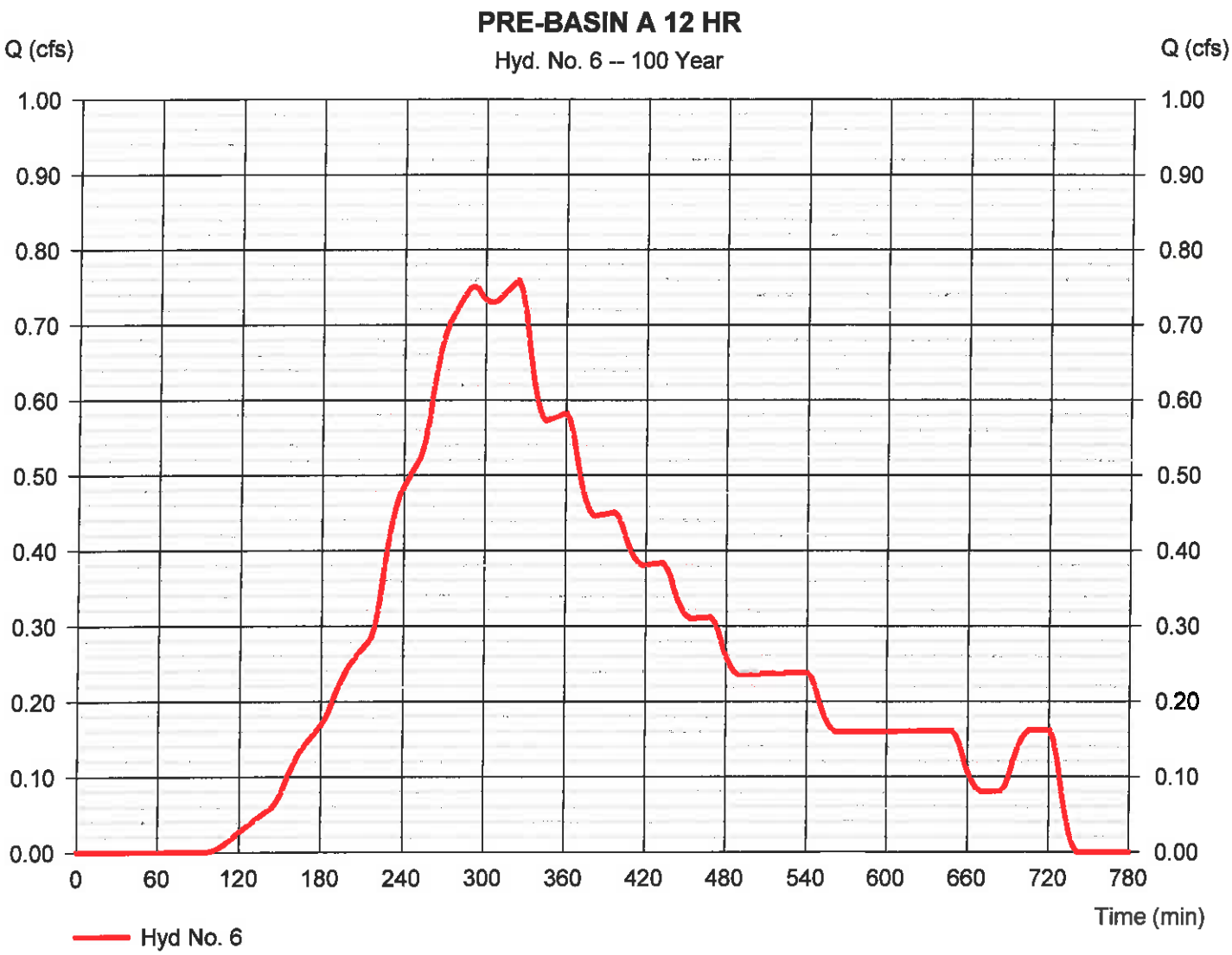
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 6

PRE-BASIN A 12 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.758 cfs
Storm frequency	= 100 yrs	Time to peak	= 324 min
Time interval	= 3 min	Hyd. volume	= 11,525 cuft
Drainage area	= 1.080 ac	Curve number	= 79
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.40 min
Total precip.	= 5.16 in	Distribution	= Huff-2nd
Storm duration	= 12.00 hrs	Shape factor	= 484



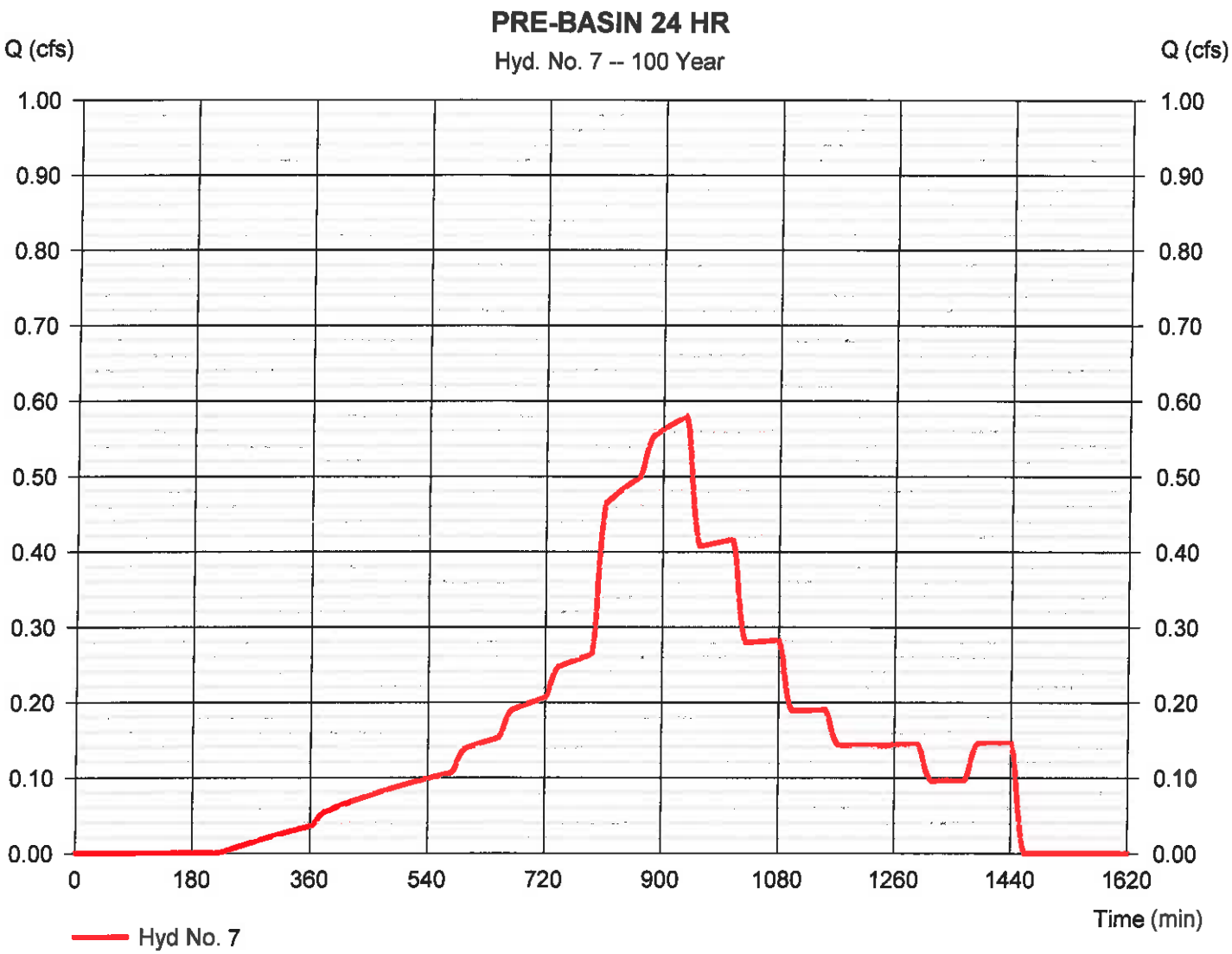
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 7

PRE-BASIN 24 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.579 cfs
Storm frequency	= 100 yrs	Time to peak	= 936 min
Time interval	= 3 min	Hyd. volume	= 14,426 cuft
Drainage area	= 1.080 ac	Curve number	= 79
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.40 min
Total precip.	= 6.00 in	Distribution	= Huff-3rd
Storm duration	= 24.00 hrs	Shape factor	= 484



PRE-DEVELOPMENT

BASIN "B"

2, 10, & 100 YEAR

STORMS

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

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	0.161	3	18	202	-----	-----	-----	PRE-BASIN B 0.5 HR
2	SCS Runoff	0.200	3	24	434	-----	-----	-----	PRE-BASIN B 1 HR
3	SCS Runoff	0.190	3	33	744	-----	-----	-----	PRE-BASIN B 2 HR
4	SCS Runoff	0.172	3	48	951	-----	-----	-----	PRE-BASIN B 3 HR
5	SCS Runoff	0.135	3	90	1,386	-----	-----	-----	PRE-BASIN B 6 HR
6	SCS Runoff	0.146	3	324	2,066	-----	-----	-----	PRE-BASIN B 12 HR
7	SCS Runoff	0.114	3	936	2,486	-----	-----	-----	PRE-BASIN B 24 HR

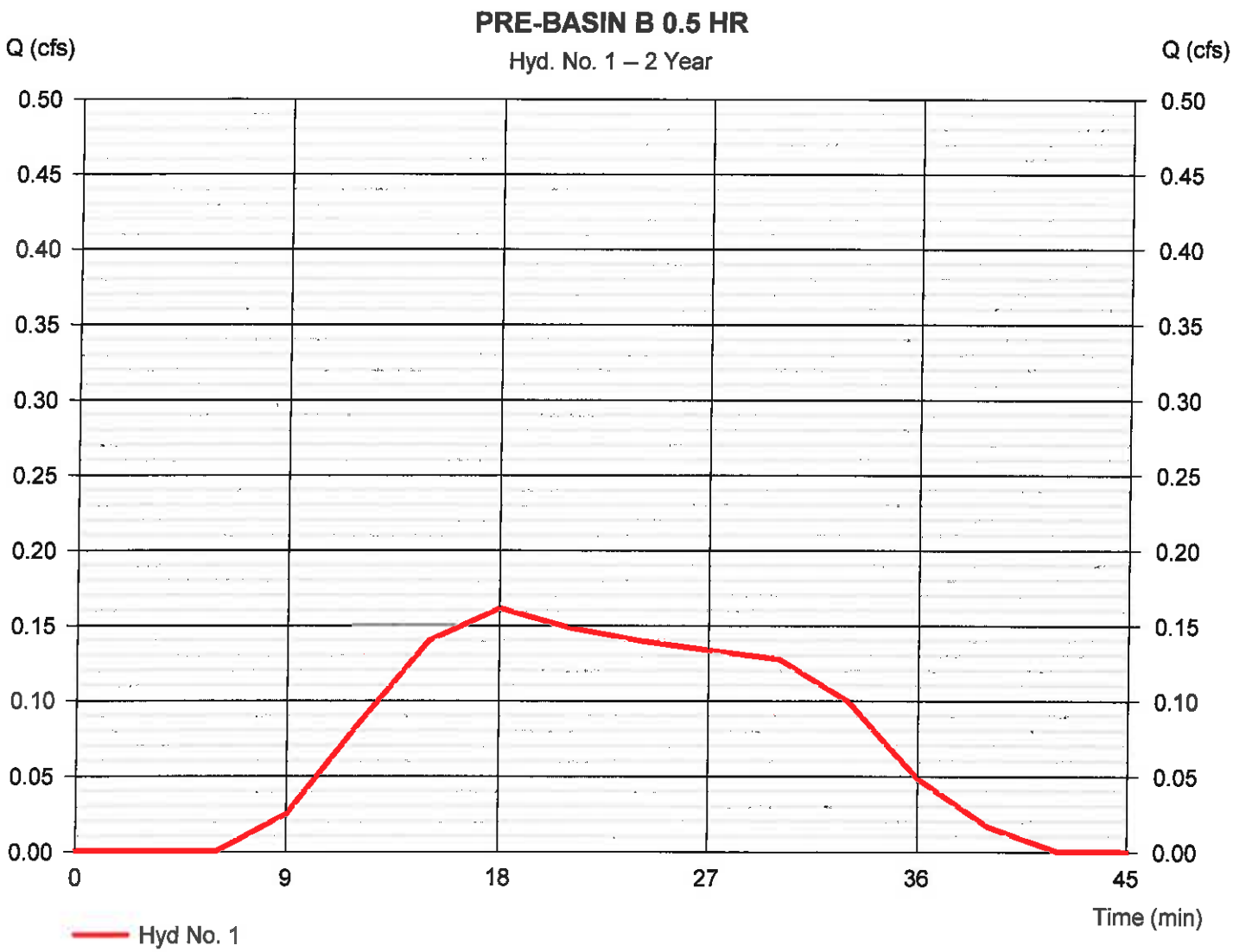
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 1

PRE-BASIN B 0.5 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.161 cfs
Storm frequency	= 2 yrs	Time to peak	= 18 min
Time interval	= 3 min	Hyd. volume	= 202 cuft
Drainage area	= 0.740 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 9.10 min
Total precip.	= 0.99 in	Distribution	= Huff-1st
Storm duration	= 0.50 hrs	Shape factor	= 484



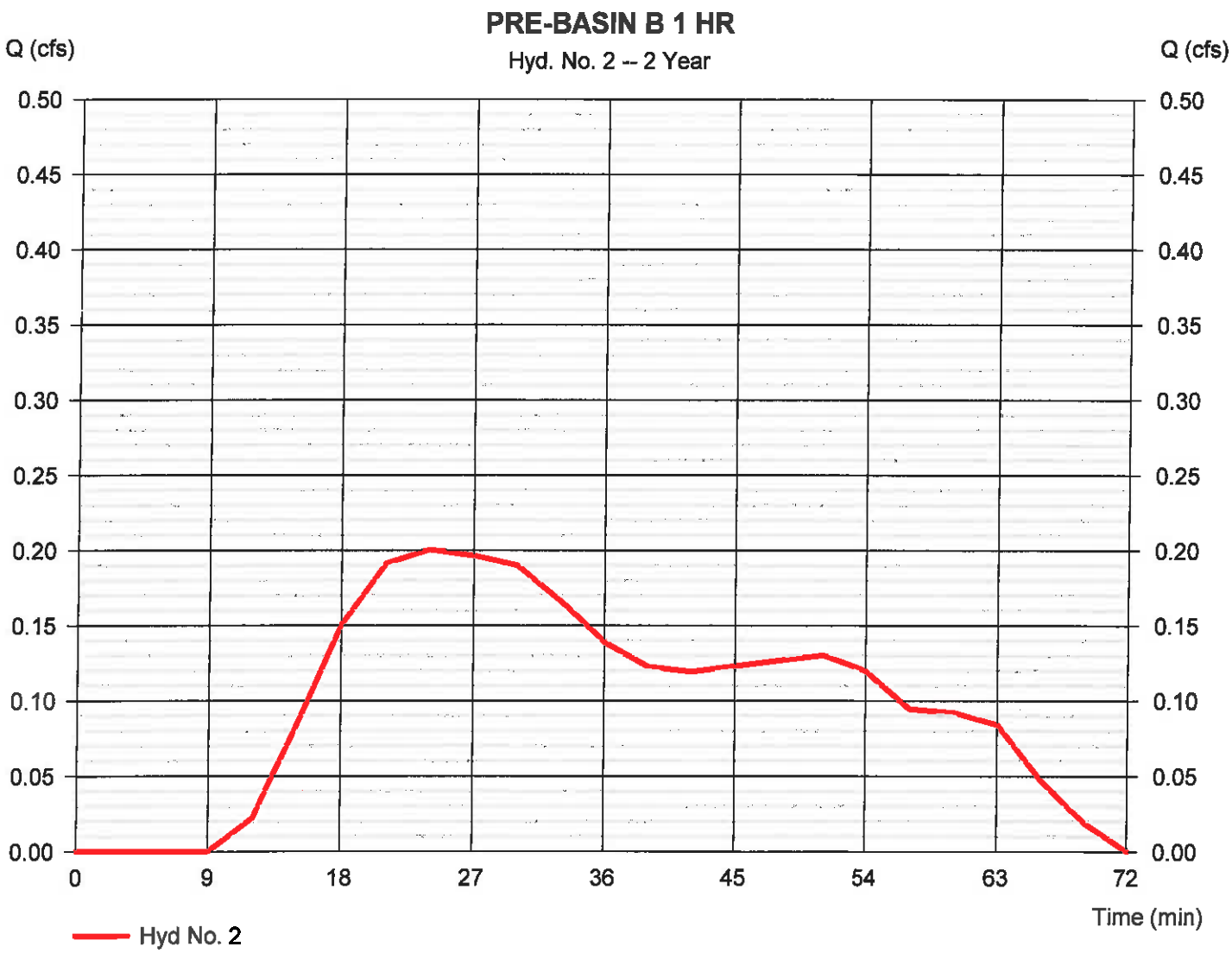
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 2

PRE-BASIN B 1 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.200 cfs
Storm frequency	= 2 yrs	Time to peak	= 24 min
Time interval	= 3 min	Hyd. volume	= 434 cuft
Drainage area	= 0.740 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 9.10 min
Total precip.	= 1.25 in	Distribution	= Huff-1st
Storm duration	= 1.00 hrs	Shape factor	= 484



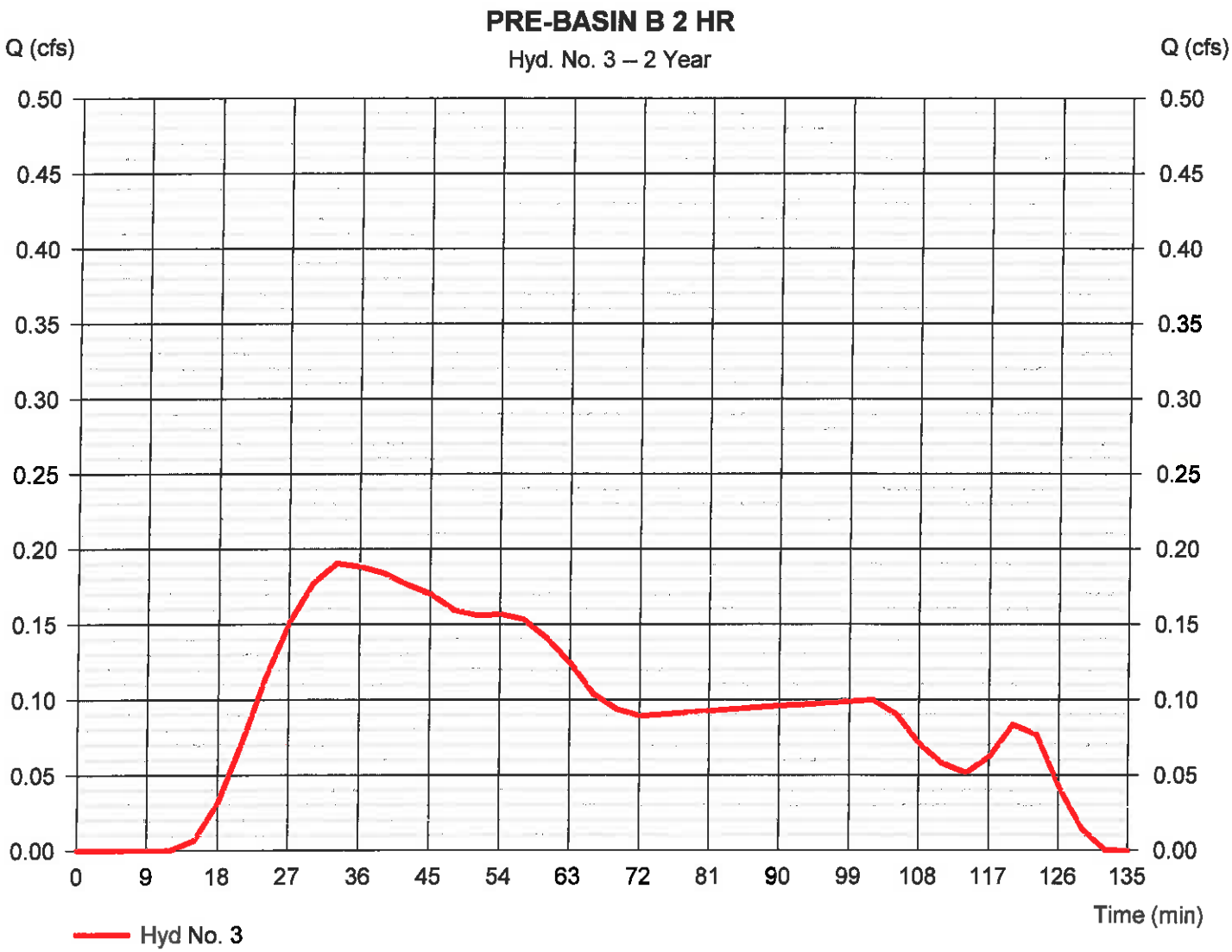
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 3

PRE-BASIN B 2 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.190 cfs
Storm frequency	= 2 yrs	Time to peak	= 33 min
Time interval	= 3 min	Hyd. volume	= 744 cuft
Drainage area	= 0.740 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 9.10 min
Total precip.	= 1.52 in	Distribution	= Huff-1st
Storm duration	= 2.00 hrs	Shape factor	= 484



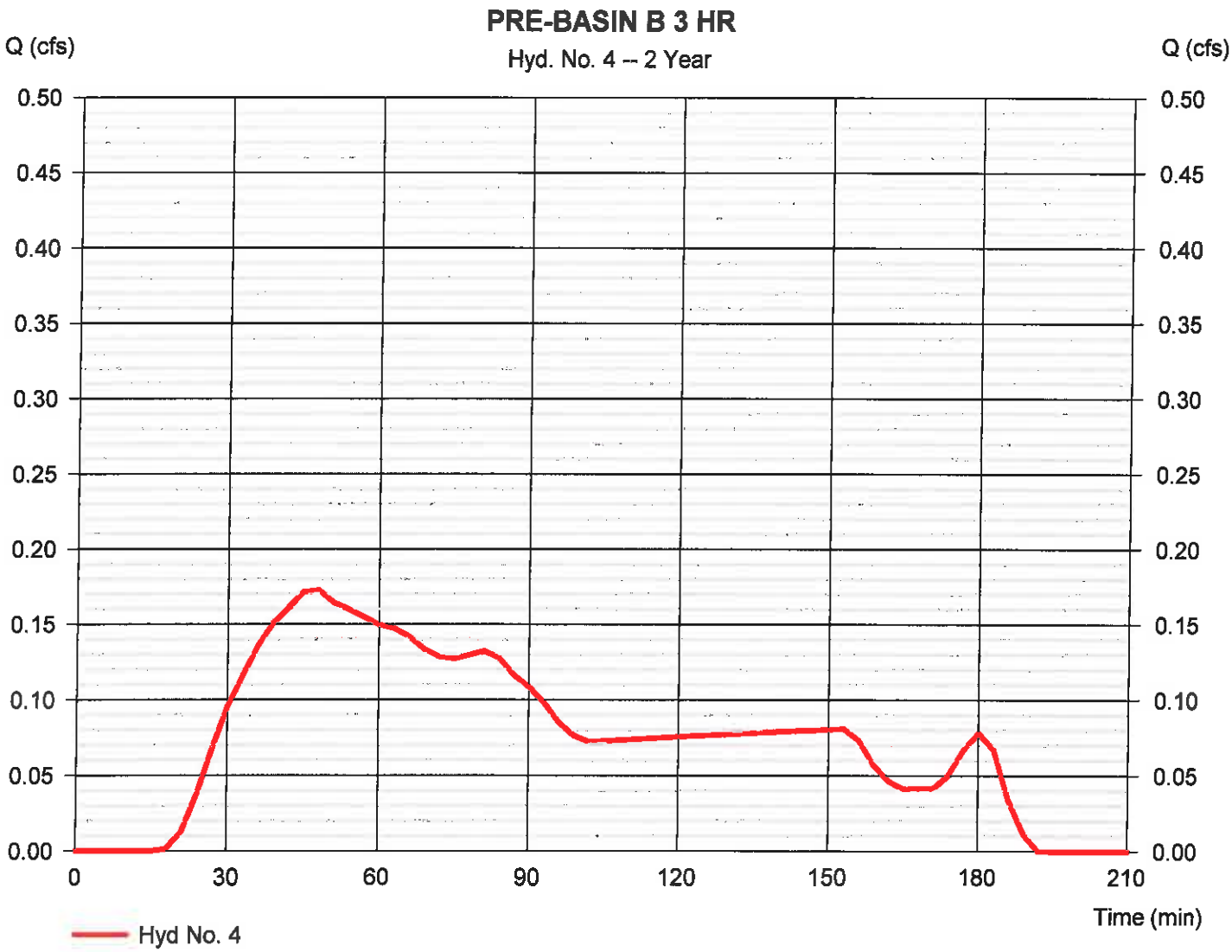
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 4

PRE-BASIN B 3 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.172 cfs
Storm frequency	= 2 yrs	Time to peak	= 48 min
Time interval	= 3 min	Hyd. volume	= 951 cuft
Drainage area	= 0.740 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 9.10 min
Total precip.	= 1.68 in	Distribution	= Huff-1st
Storm duration	= 3.00 hrs	Shape factor	= 484



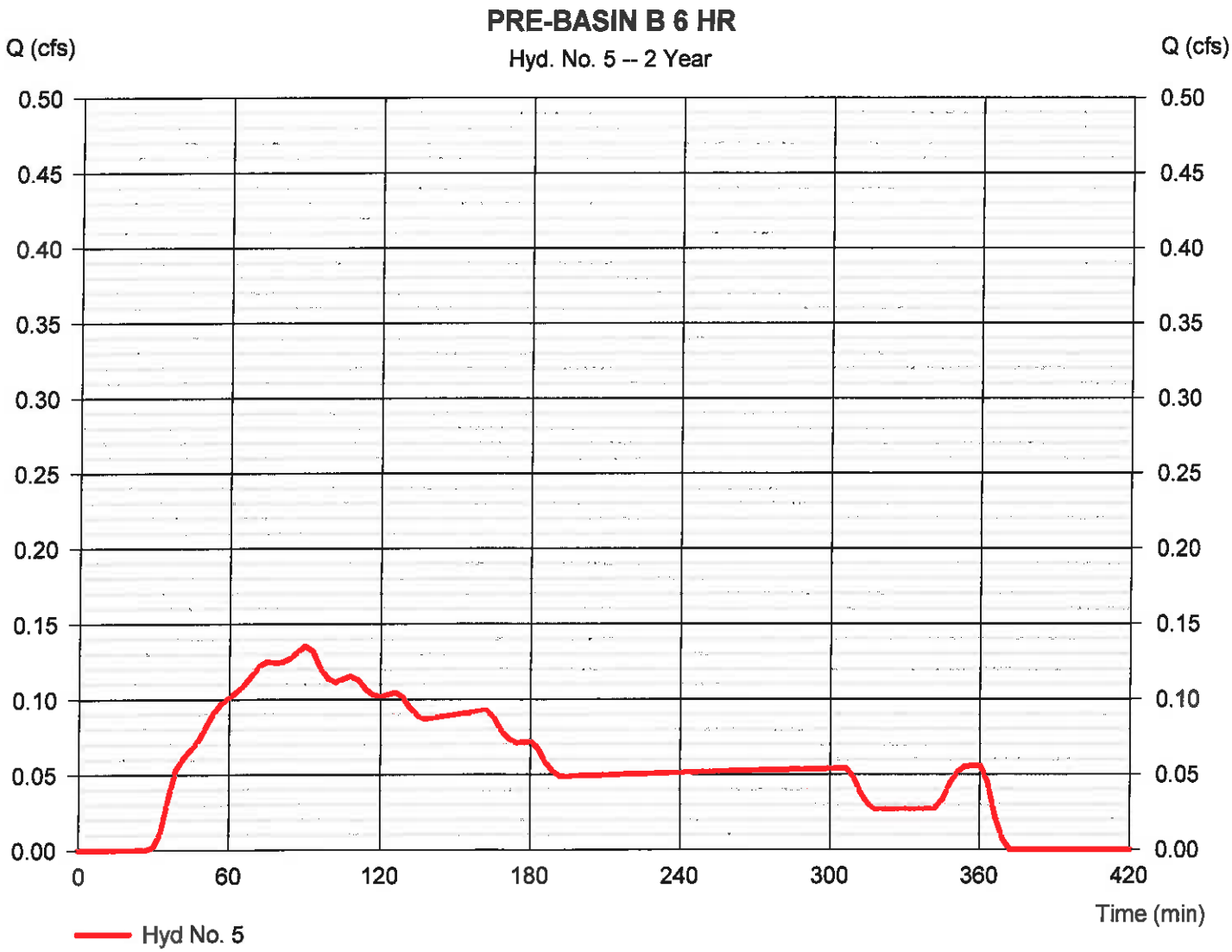
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 5

PRE-BASIN B 6 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.135 cfs
Storm frequency	= 2 yrs	Time to peak	= 90 min
Time interval	= 3 min	Hyd. volume	= 1,386 cuft
Drainage area	= 0.740 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 9.10 min
Total precip.	= 1.98 in	Distribution	= Huff-1st
Storm duration	= 6.00 hrs	Shape factor	= 484



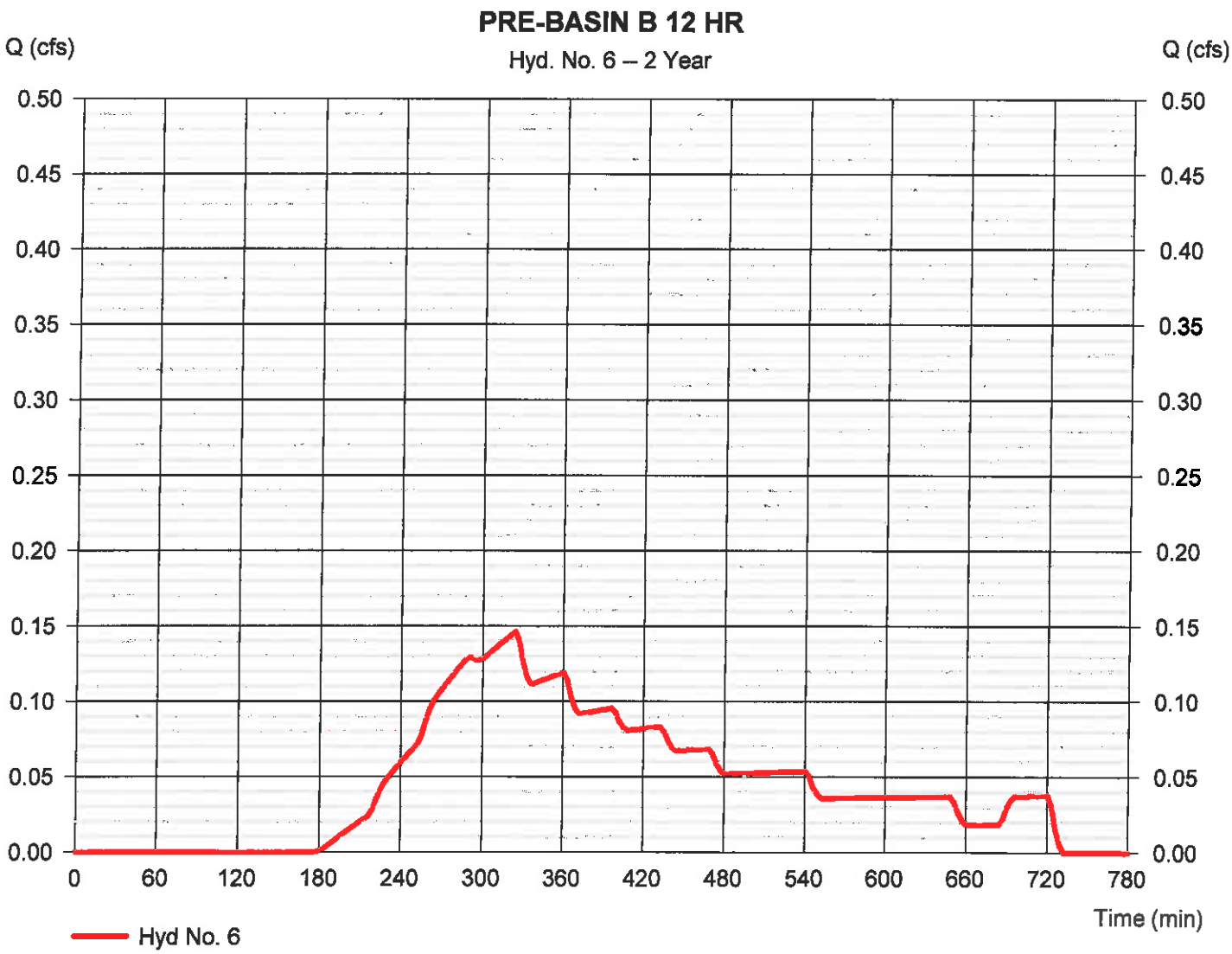
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 6

PRE-BASIN B 12 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.146 cfs
Storm frequency	= 2 yrs	Time to peak	= 324 min
Time interval	= 3 min	Hyd. volume	= 2,066 cuft
Drainage area	= 0.740 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 9.10 min
Total precip.	= 2.40 in	Distribution	= Huff-2nd
Storm duration	= 12.00 hrs	Shape factor	= 484



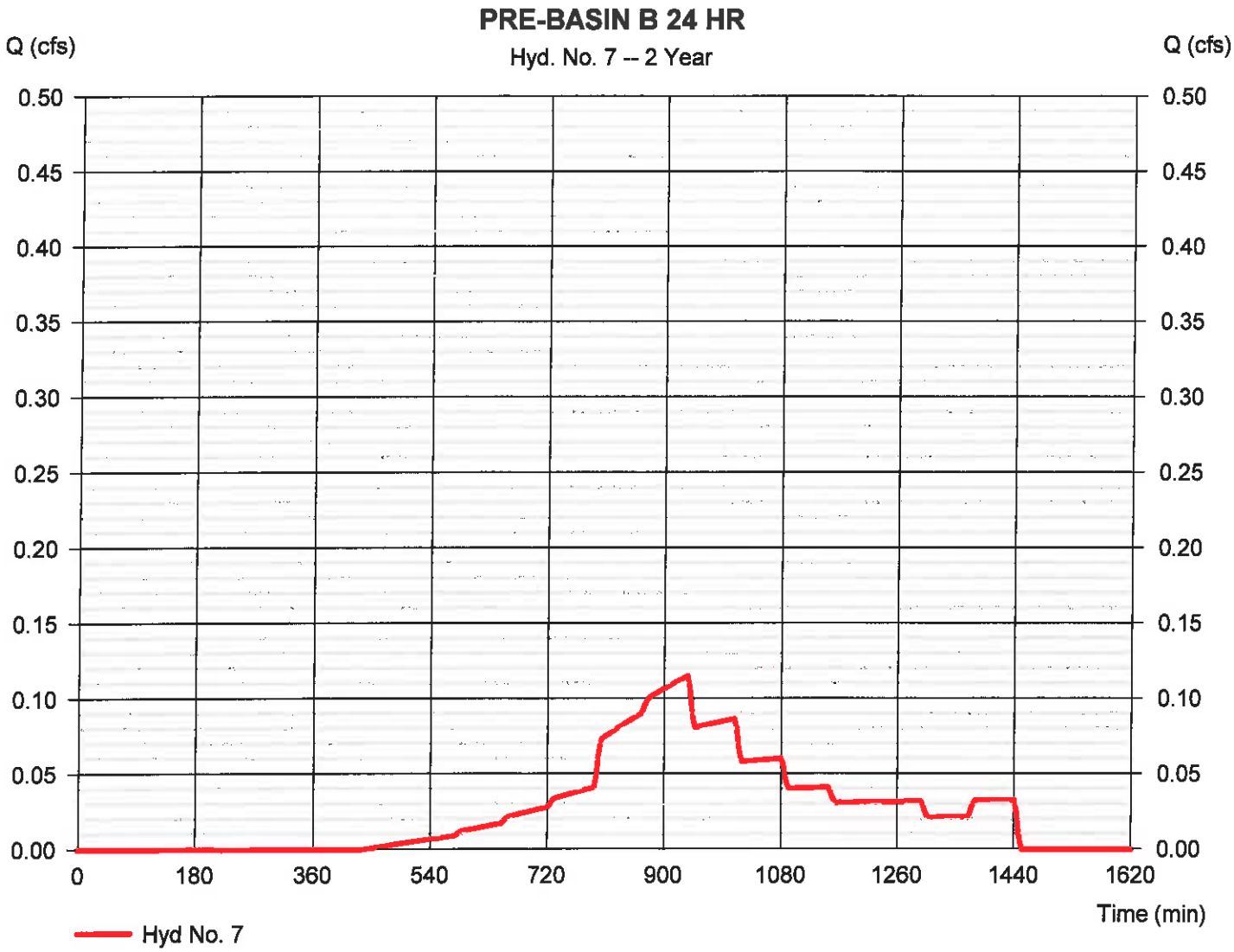
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 7

PRE-BASIN B 24 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.114 cfs
Storm frequency	= 2 yrs	Time to peak	= 936 min
Time interval	= 3 min	Hyd. volume	= 2,486 cuft
Drainage area	= 0.740 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 9.10 min
Total precip.	= 2.64 in	Distribution	= Huff-3rd
Storm duration	= 24.00 hrs	Shape factor	= 484



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

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	0.666	3	15	782	-----	-----	-----	PRE-BASIN B 0.5 HR
2	SCS Runoff	0.679	3	21	1,335	-----	-----	-----	PRE-BASIN B 1 HR
3	SCS Runoff	0.576	3	30	2,059	-----	-----	-----	PRE-BASIN B 2 HR
4	SCS Runoff	0.476	3	45	2,480	-----	-----	-----	PRE-BASIN B 3 HR
5	SCS Runoff	0.329	3	90	3,376	-----	-----	-----	PRE-BASIN B 6 HR
6	SCS Runoff	0.296	3	324	4,322	-----	-----	-----	PRE-BASIN B 12 HR
7	SCS Runoff	0.226	3	936	5,309	-----	-----	-----	PRE-BASIN B 24 HR

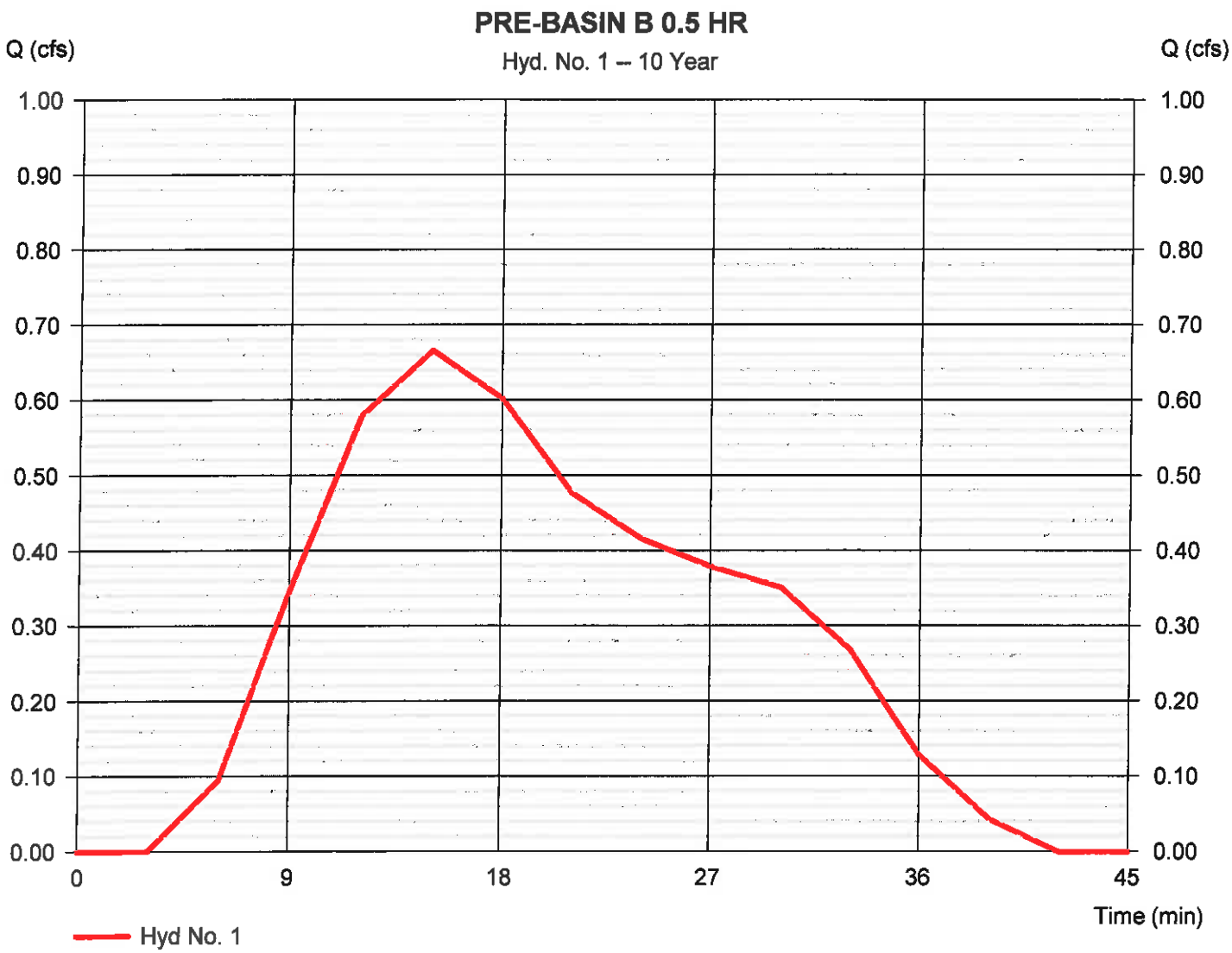
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 1

PRE-BASIN B 0.5 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.666 cfs
Storm frequency	= 10 yrs	Time to peak	= 15 min
Time interval	= 3 min	Hyd. volume	= 782 cuft
Drainage area	= 0.740 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 9.10 min
Total precip.	= 1.55 in	Distribution	= Huff-1st
Storm duration	= 0.50 hrs	Shape factor	= 484



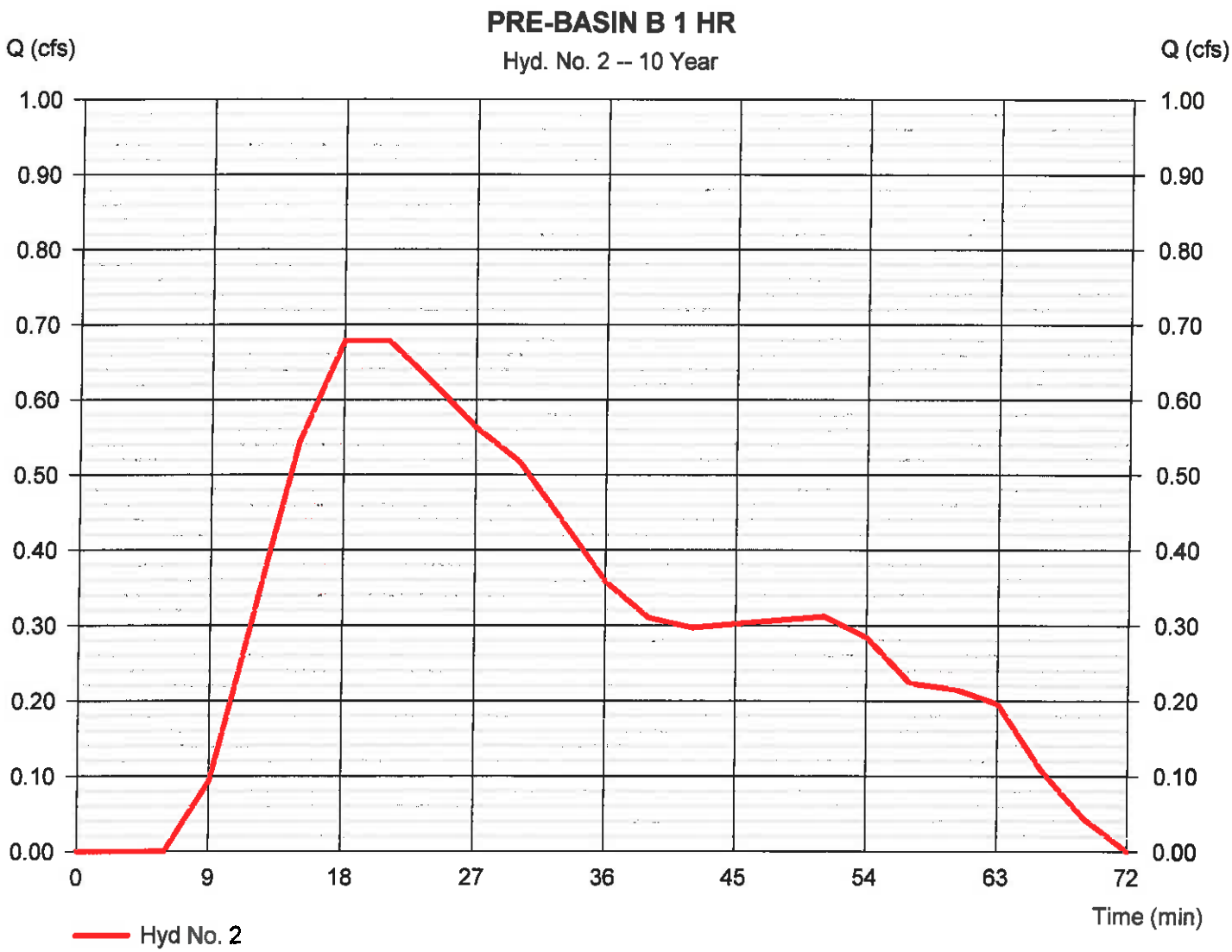
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 2

PRE-BASIN B 1 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.679 cfs
Storm frequency	= 10 yrs	Time to peak	= 21 min
Time interval	= 3 min	Hyd. volume	= 1,335 cuft
Drainage area	= 0.740 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 9.10 min
Total precip.	= 1.96 in	Distribution	= Huff-1st
Storm duration	= 1.00 hrs	Shape factor	= 484



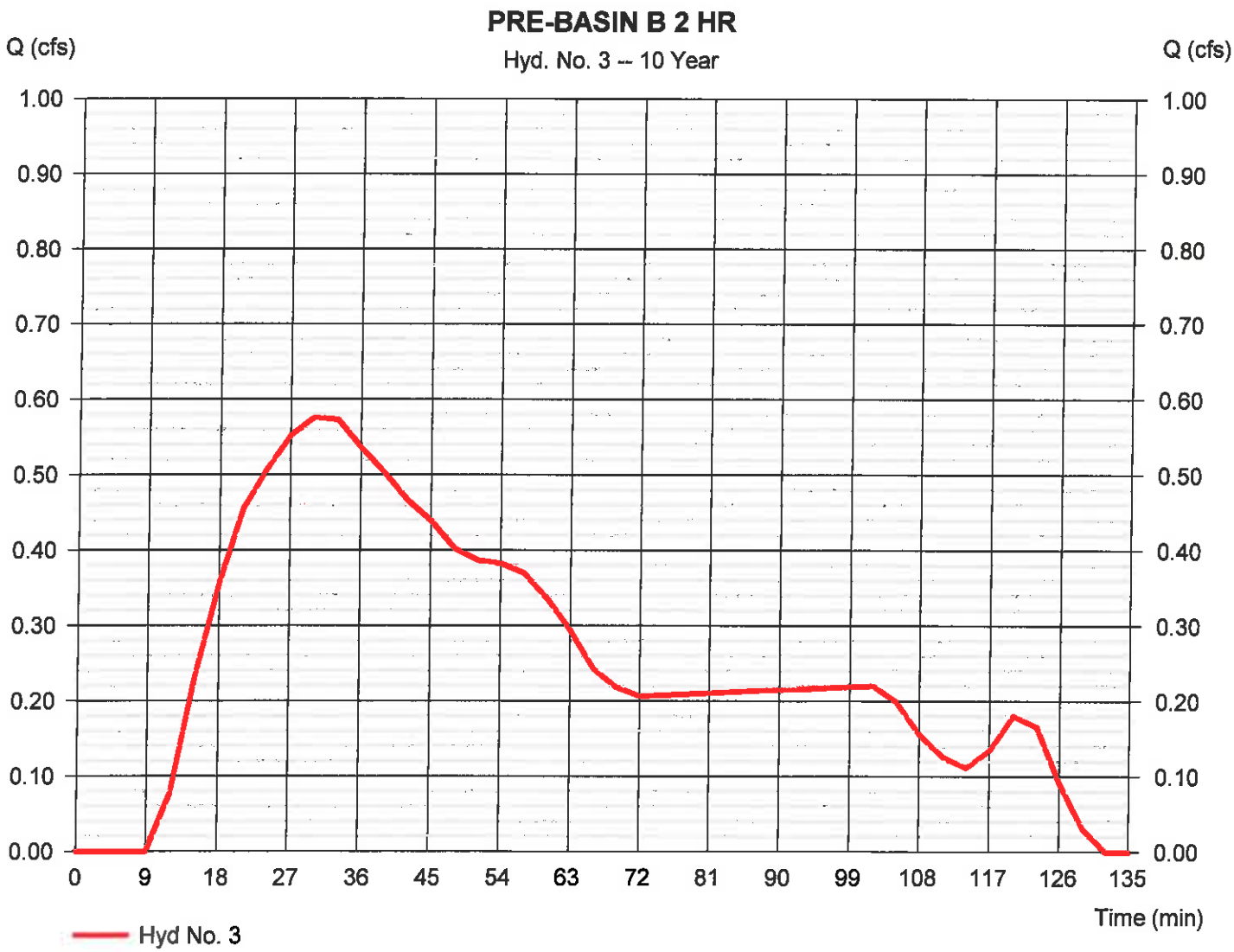
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 3

PRE-BASIN B 2 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.576 cfs
Storm frequency	= 10 yrs	Time to peak	= 30 min
Time interval	= 3 min	Hyd. volume	= 2,059 cuft
Drainage area	= 0.740 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 9.10 min
Total precip.	= 2.40 in	Distribution	= Huff-1st
Storm duration	= 2.00 hrs	Shape factor	= 484



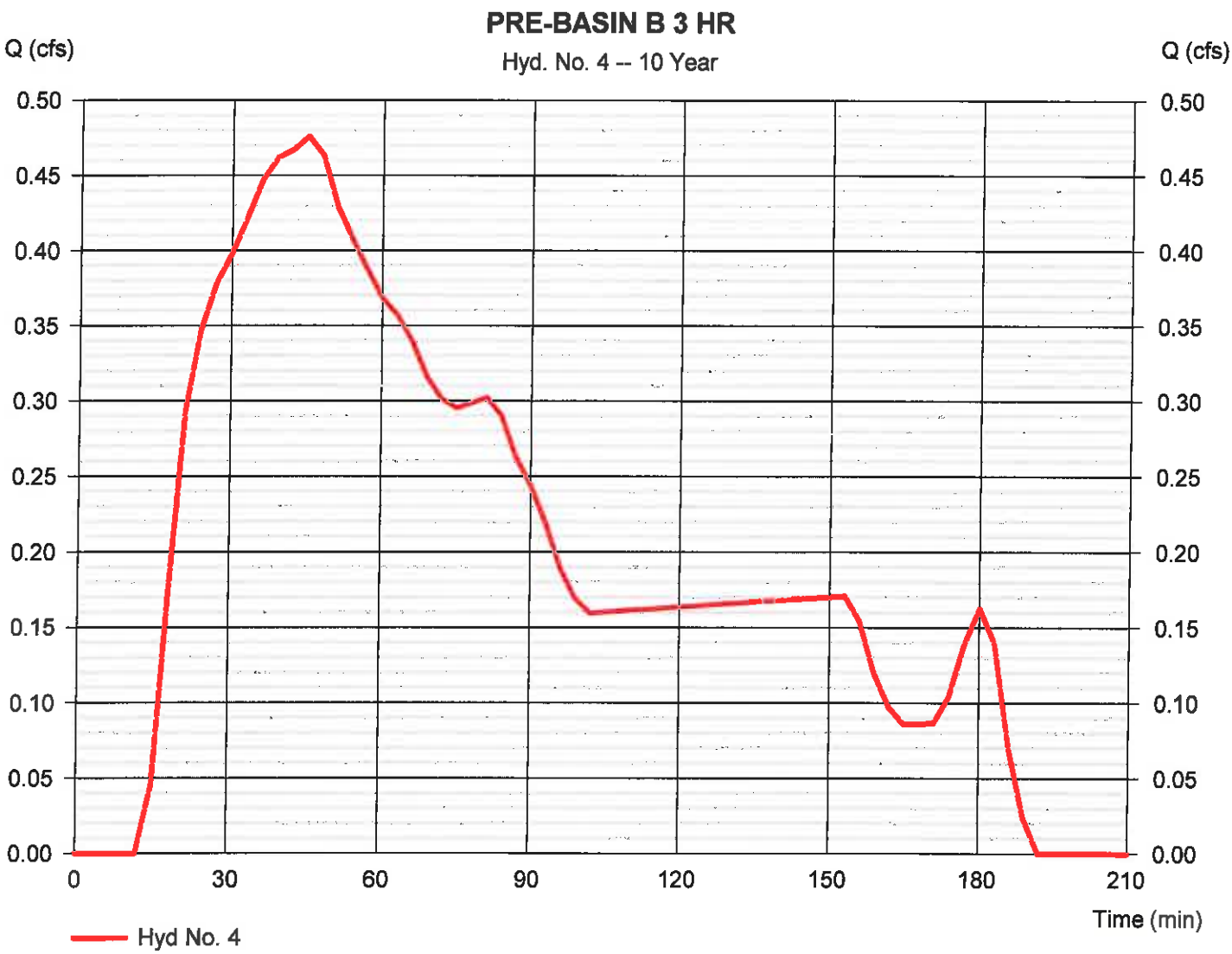
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 4

PRE-BASIN B 3 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.476 cfs
Storm frequency	= 10 yrs	Time to peak	= 45 min
Time interval	= 3 min	Hyd. volume	= 2,480 cuft
Drainage area	= 0.740 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 9.10 min
Total precip.	= 2.64 in	Distribution	= Huff-1st
Storm duration	= 3.00 hrs	Shape factor	= 484



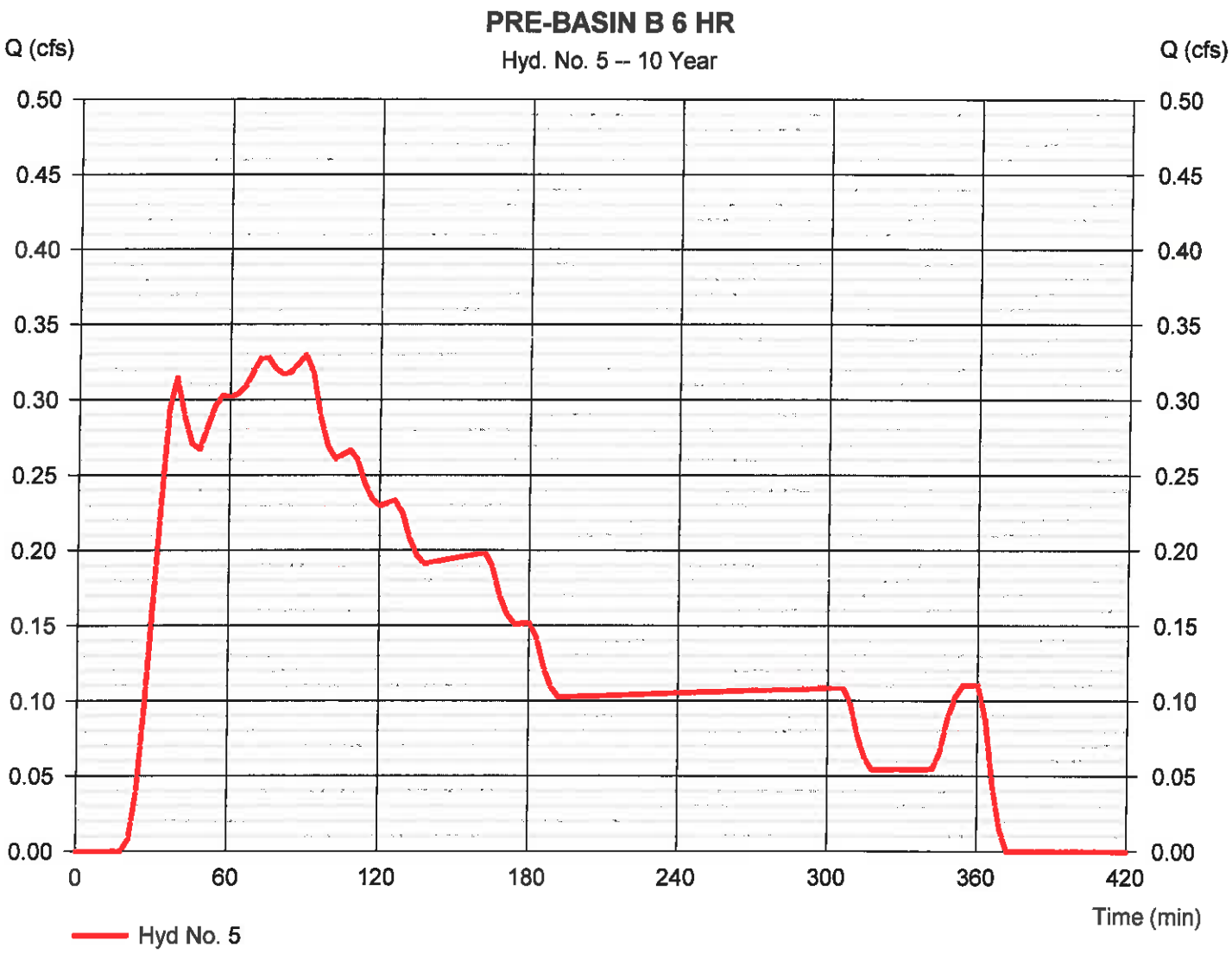
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 5

PRE-BASIN B 6 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.329 cfs
Storm frequency	= 10 yrs	Time to peak	= 90 min
Time interval	= 3 min	Hyd. volume	= 3,376 cuft
Drainage area	= 0.740 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 9.10 min
Total precip.	= 3.12 in	Distribution	= Huff-1st
Storm duration	= 6.00 hrs	Shape factor	= 484



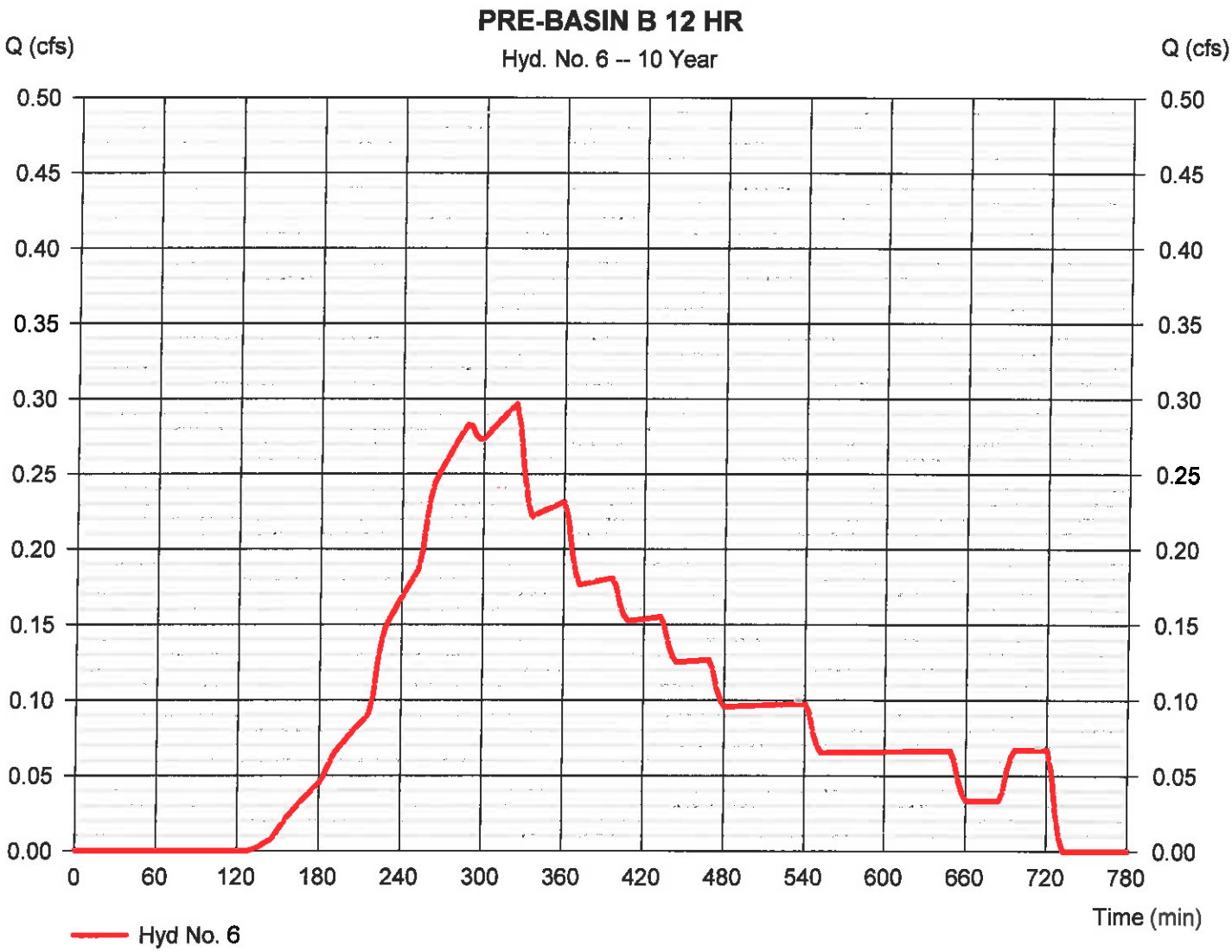
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 6

PRE-BASIN B 12 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.296 cfs
Storm frequency	= 10 yrs	Time to peak	= 324 min
Time interval	= 3 min	Hyd. volume	= 4,322 cuft
Drainage area	= 0.740 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 9.10 min
Total precip.	= 3.60 in	Distribution	= Huff-2nd
Storm duration	= 12.00 hrs	Shape factor	= 484



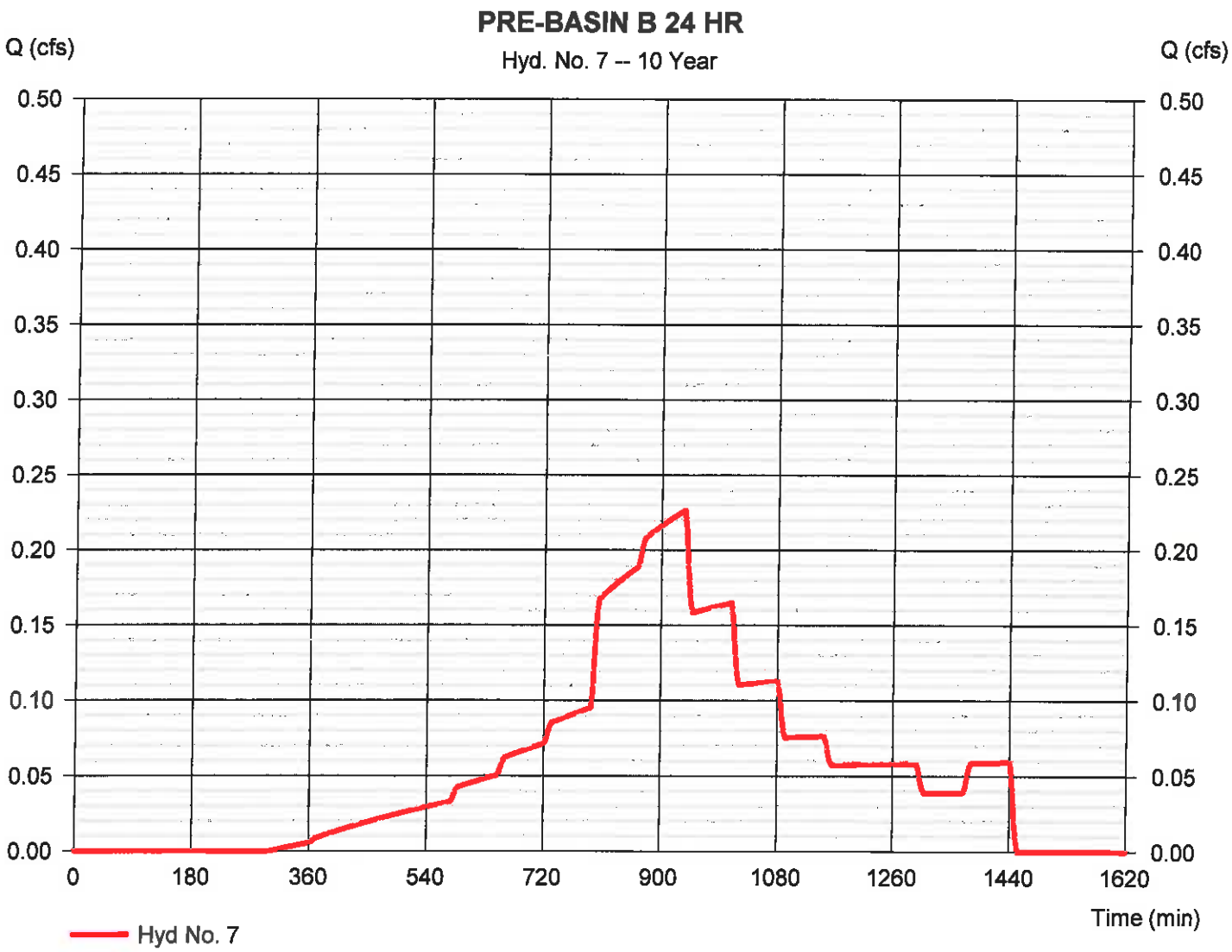
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 7

PRE-BASIN B 24 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.226 cfs
Storm frequency	= 10 yrs	Time to peak	= 936 min
Time interval	= 3 min	Hyd. volume	= 5,309 cuft
Drainage area	= 0.740 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 9.10 min
Total precip.	= 4.08 in	Distribution	= Huff-3rd
Storm duration	= 24.00 hrs	Shape factor	= 484



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

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	1.563	3	15	1,815	-----	-----	-----	PRE-BASIN B 0.5 HR
2	SCS Runoff	1.566	3	18	2,923	-----	-----	-----	PRE-BASIN B 1 HR
3	SCS Runoff	1.177	3	30	4,117	-----	-----	-----	PRE-BASIN B 2 HR
4	SCS Runoff	0.938	3	39	4,864	-----	-----	-----	PRE-BASIN B 3 HR
5	SCS Runoff	0.728	3	39	6,199	-----	-----	-----	PRE-BASIN B 6 HR
6	SCS Runoff	0.503	3	324	7,638	-----	-----	-----	PRE-BASIN B 12 HR
7	SCS Runoff	0.379	3	936	9,522	-----	-----	-----	PRE-BASIN B 24 HR

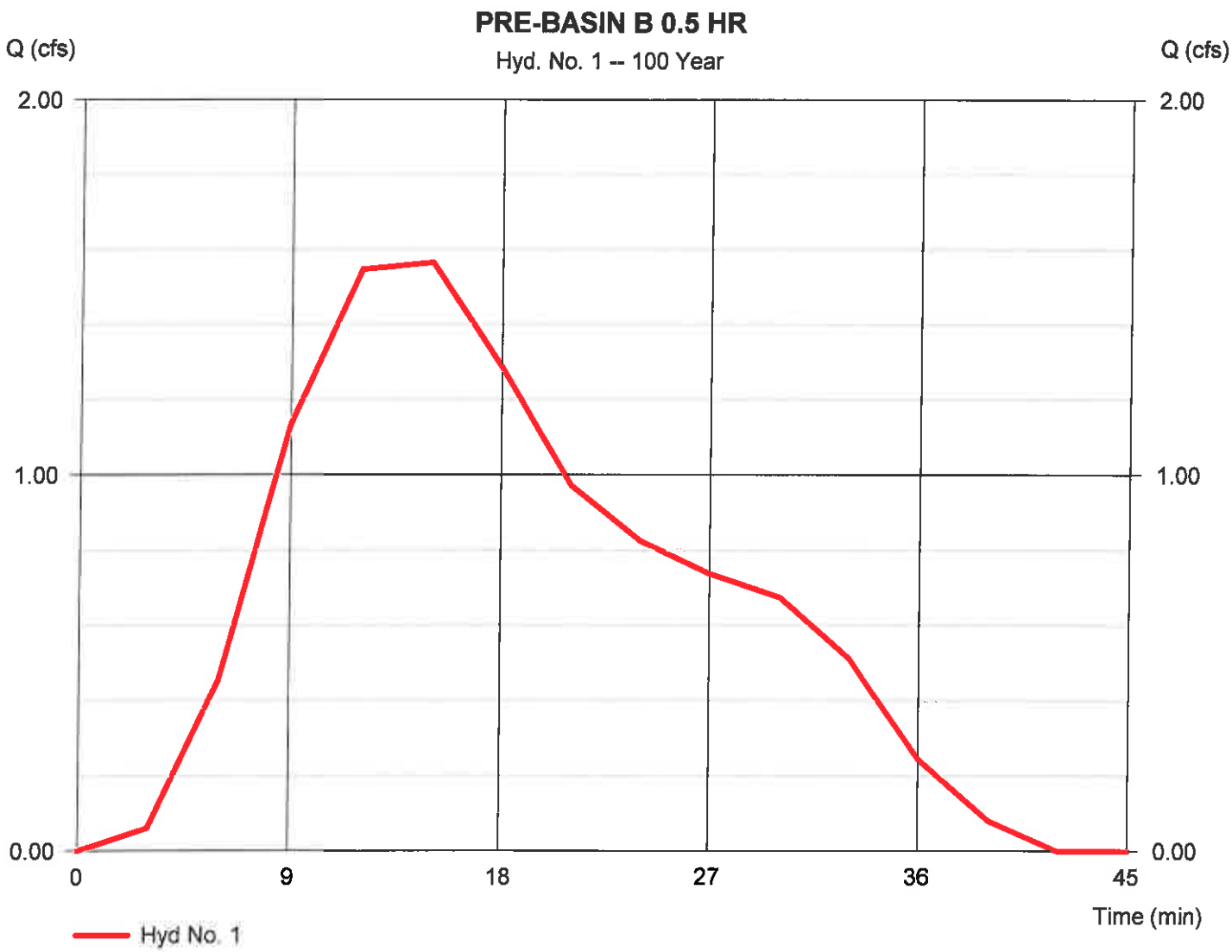
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 1

PRE-BASIN B 0.5 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 1.563 cfs
Storm frequency	= 100 yrs	Time to peak	= 15 min
Time interval	= 3 min	Hyd. volume	= 1,815 cuft
Drainage area	= 0.740 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 9.10 min
Total precip.	= 2.25 in	Distribution	= Huff-1st
Storm duration	= 0.50 hrs	Shape factor	= 484



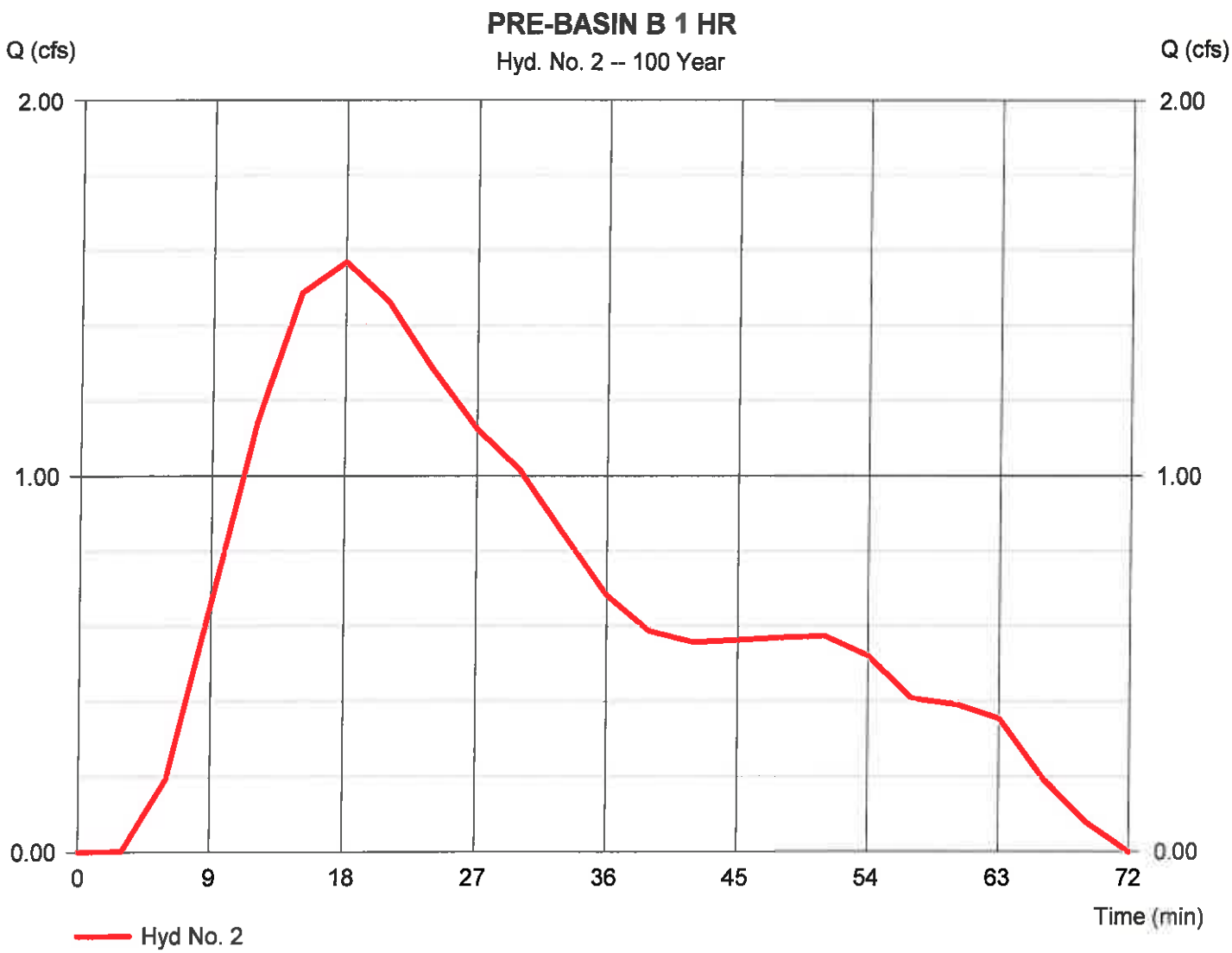
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 2

PRE-BASIN B 1 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 1.566 cfs
Storm frequency	= 100 yrs	Time to peak	= 18 min
Time interval	= 3 min	Hyd. volume	= 2,923 cuft
Drainage area	= 0.740 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 9.10 min
Total precip.	= 2.88 in	Distribution	= Huff-1st
Storm duration	= 1.00 hrs	Shape factor	= 484



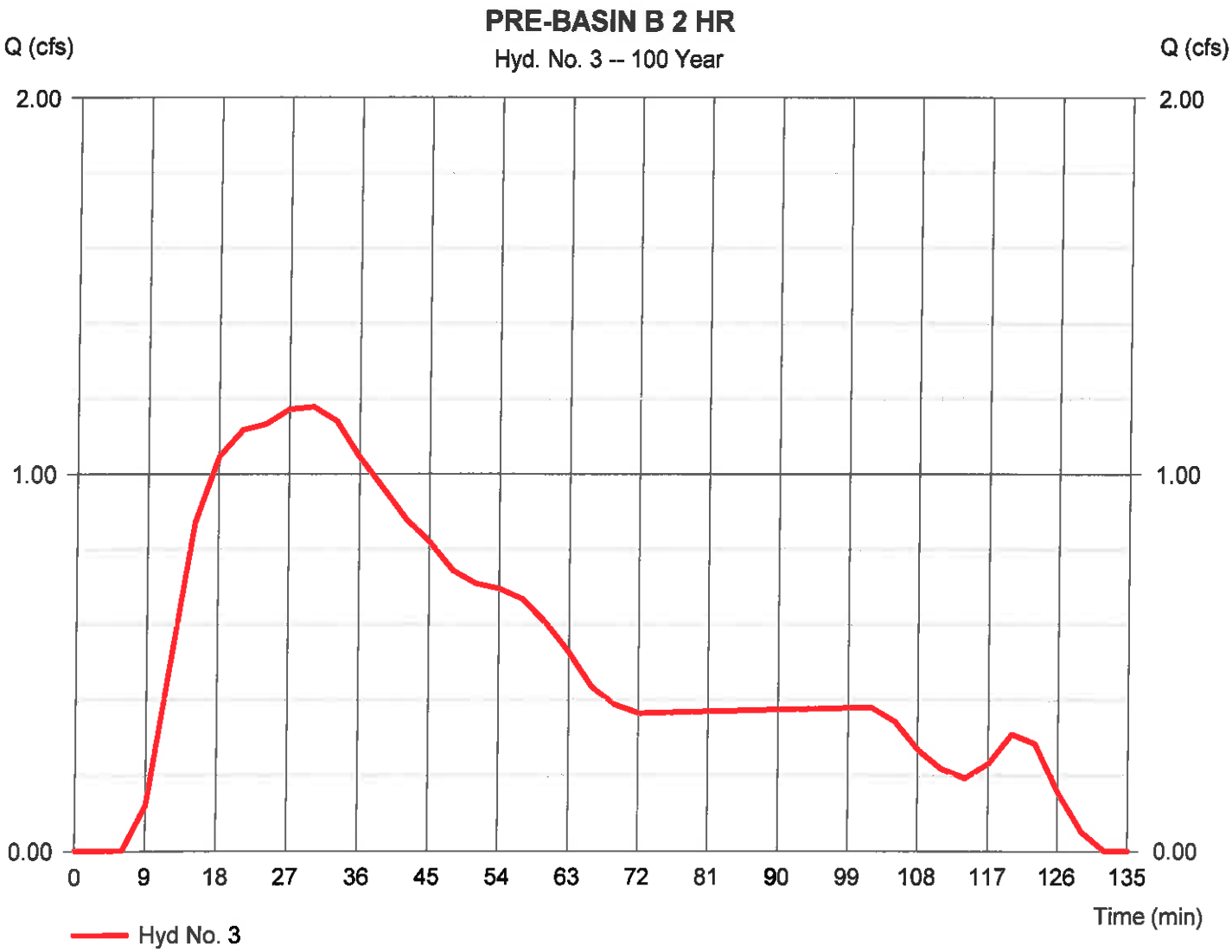
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 3

PRE-BASIN B 2 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 1.177 cfs
Storm frequency	= 100 yrs	Time to peak	= 30 min
Time interval	= 3 min	Hyd. volume	= 4,117 cuft
Drainage area	= 0.740 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 9.10 min
Total precip.	= 3.50 in	Distribution	= Huff-1st
Storm duration	= 2.00 hrs	Shape factor	= 484



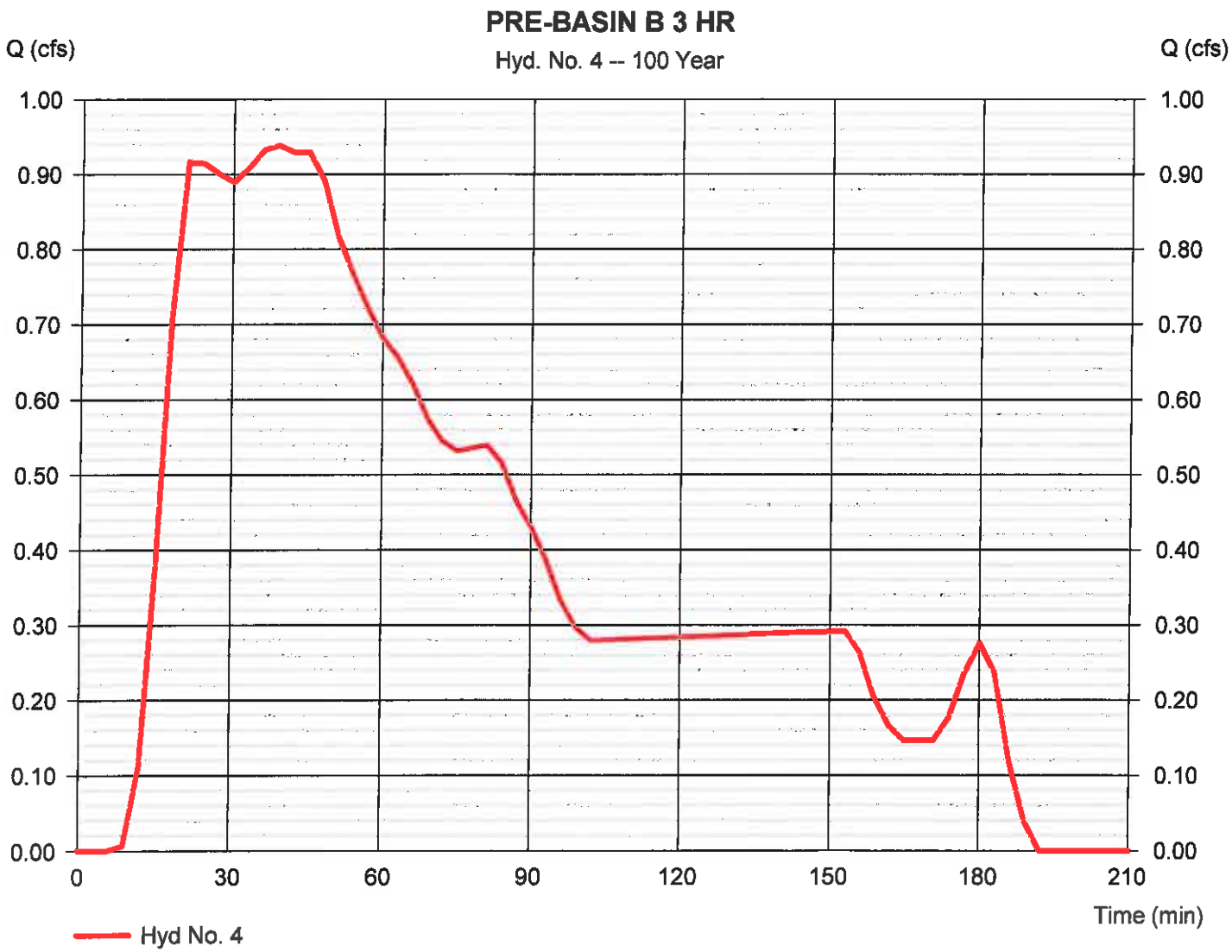
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 4

PRE-BASIN B 3 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.938 cfs
Storm frequency	= 100 yrs	Time to peak	= 39 min
Time interval	= 3 min	Hyd. volume	= 4,864 cuft
Drainage area	= 0.740 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 9.10 min
Total precip.	= 3.87 in	Distribution	= Huff-1st
Storm duration	= 3.00 hrs	Shape factor	= 484



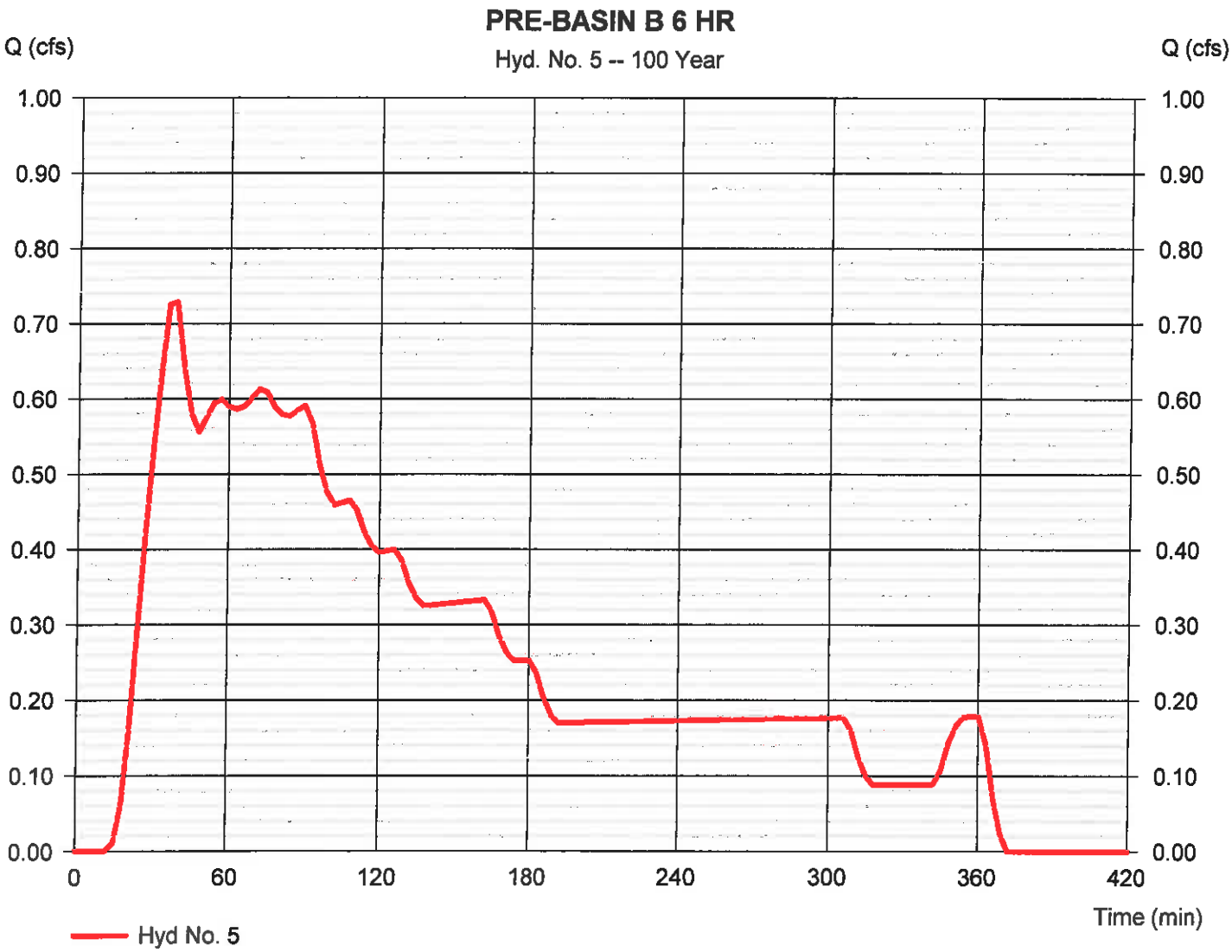
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 5

PRE-BASIN B 6 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.728 cfs
Storm frequency	= 100 yrs	Time to peak	= 39 min
Time interval	= 3 min	Hyd. volume	= 6,199 cuft
Drainage area	= 0.740 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 9.10 min
Total precip.	= 4.50 in	Distribution	= Huff-1st
Storm duration	= 6.00 hrs	Shape factor	= 484



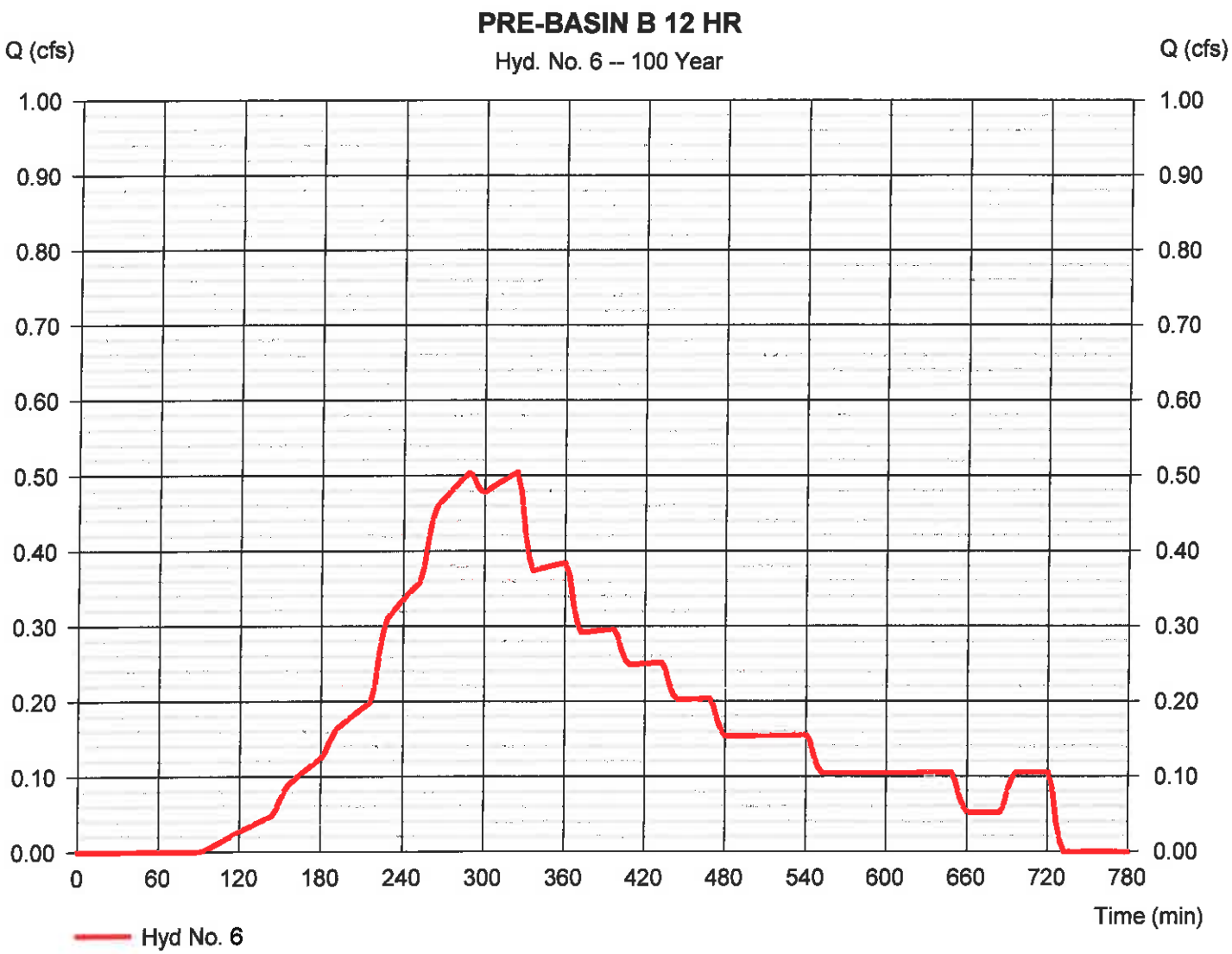
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 6

PRE-BASIN B 12 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.503 cfs
Storm frequency	= 100 yrs	Time to peak	= 324 min
Time interval	= 3 min	Hyd. volume	= 7,638 cuft
Drainage area	= 0.740 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 9.10 min
Total precip.	= 5.16 in	Distribution	= Huff-2nd
Storm duration	= 12.00 hrs	Shape factor	= 484



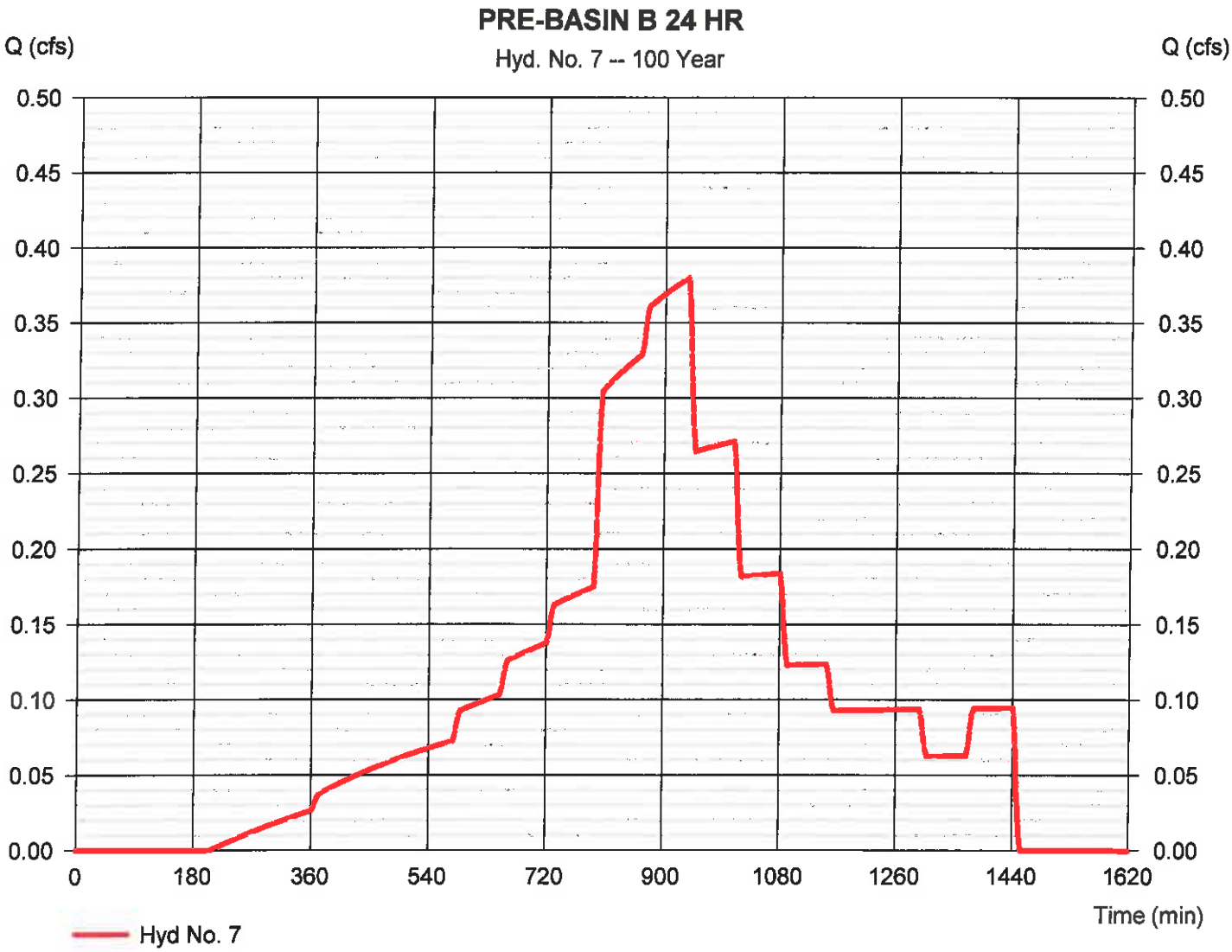
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 7

PRE-BASIN B 24 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.379 cfs
Storm frequency	= 100 yrs	Time to peak	= 936 min
Time interval	= 3 min	Hyd. volume	= 9,522 cuft
Drainage area	= 0.740 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 9.10 min
Total precip.	= 6.00 in	Distribution	= Huff-3rd
Storm duration	= 24.00 hrs	Shape factor	= 484



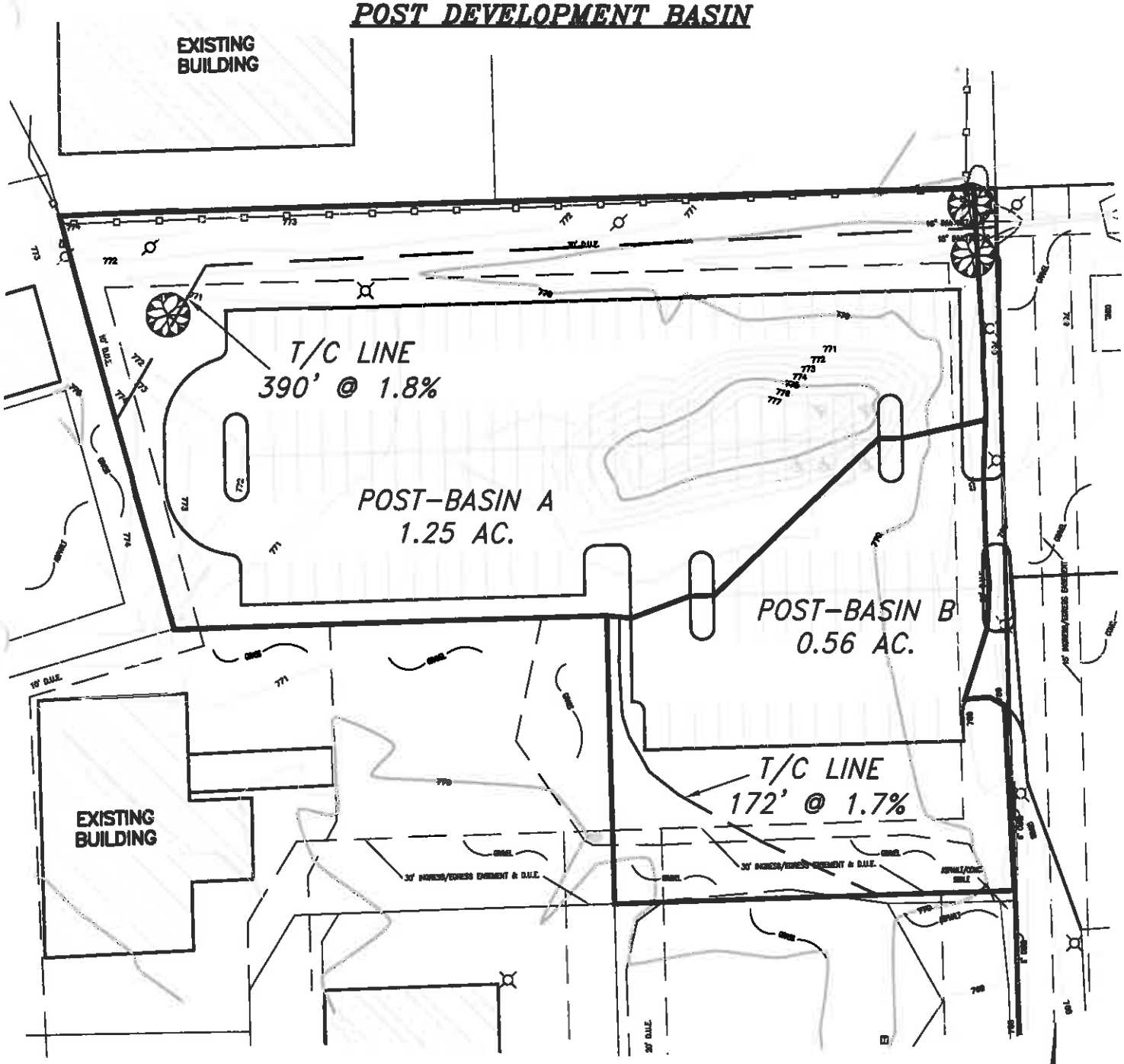
POST-DEVELOPMENT

BASINS

INFORMATION

GMI PARKING ADDITION
550 INTERNATIONAL DRIVE

POST DEVELOPMENT BASIN



SCALE : 1"=60'

N

MAURER SURVEYING, INC.
4800 W. SMITH VALLEY ROAD, SUITE P, GREENWOOD INDIANA 46142
OFFICE - 317-881-3898 www.MaurerSurveying.com

Worksheet 2: Runoff curve number and runoff

Project	By	Date
GMI PARKING ADDITION	A. BARKOCY	3/18/15
Location	**Checked**	**Date**
550 INTERNATIONAL DR.	A. BARKOCY	3/18/15

Check one: ☐ Present ☒ Developed POST-BASIN "A"

1. Runoff curve number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Figure 2-3	CN 1/ Figure 2-4	Area ☒ acres ☐ mi² ☐ %	Product of CN x area
C, A (c)	ASPHALT	98			0.75	73.5
" "	GRASS GOOD	74			0.50	37

1/ Use only one CN source per line

Totals ➡ 1.25 | 110.5

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{110.5}{1.25} = 88.4$; **Use CN** ➡ 88

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency	yr			
Rainfall, P (24-hour)	in			
Runoff, Q	in			

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Hyd. No. 7

POST BASIN 24 HR

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.64		0.00		0.00		
Land slope (%)	= 1.80		0.00		0.00		
Travel Time (min)	**= 11.25**	**+**	**0.00**	**+**	**0.00**	**=**	**11.25**
Shallow Concentrated Flow							
Flow length (ft)	= 290.00		0.00		0.00		
Watercourse slope (%)	= 1.80		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.16		0.00		0.00		
Travel Time (min)	**= 2.23**	**+**	**0.00**	**+**	**0.00**	**=**	**2.23**
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		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 13.48 min

Worksheet 2: Runoff curve number and runoff

Project	By	Date
GMI PARKING ADDITION	A. BARKOCY	3/18/15
Location	**Checked**	**Date**
550 INTERNATIONAL DR.	A. BARKOCY	3/18/15

Check one: ☐ Present ☒ Developed POST-BASIN B

1. Runoff curve number

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN [1/] Table 2-2	CN [1/] Figure 2-3	CN [1/] Figure 2-4	Area ☒ acres ☐ mi² ☐ %	Product of CN x area
C, A (c)	ASPHALT	98			0.29	28.42
" "	GRASS GOOD	74			0.26	19.24
B, (B/D)	GRASS GOOD	80			0.01	0.8

[1/] Use only one CN source per line

Totals ➡ 0.56 | 48.46

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{48.46}{0.56} = 86.5$; **Use CN** ➡ 87

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency	yr			
Rainfall, P (24-hour)	in			
Runoff, Q	in			

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Hyd. No. 1

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 100.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.64		0.00		0.00		
Land slope (%)	= 1.70		0.00		0.00		
Travel Time (min)	**= 11.51**	**+**	**0.00**	**+**	**0.00**	**=**	**11.51**
Shallow Concentrated Flow							
Flow length (ft)	= 72.00		0.00		0.00		
Watercourse slope (%)	= 1.70		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.10		0.00		0.00		
Travel Time (min)	**= 0.57**	**+**	**0.00**	**+**	**0.00**	**=**	**0.57**
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		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 12.08 min

POST-DEVELOPMENT

BASIN "A"

2, 10, & 100 YEAR

STORMS

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

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	0.783	3	21	1,122	-----	-----	-----	POST BASIN 0.5 HR
2	SCS Runoff	0.859	3	24	1,851	-----	-----	-----	POST BASIN 1 HR
3	SCS Runoff	0.738	3	33	2,711	-----	-----	-----	POST BASIN 2 HR
4	SCS Runoff	0.612	3	45	3,243	-----	-----	-----	POST BASIN 3 HR
5	SCS Runoff	0.416	3	78	4,307	-----	-----	-----	POST BASIN 6 HR
6	SCS Runoff	0.391	3	324	5,882	-----	-----	-----	POST BASIN 12 HR
7	SCS Runoff	0.280	3	936	6,816	-----	-----	-----	POST BASIN 24 HR

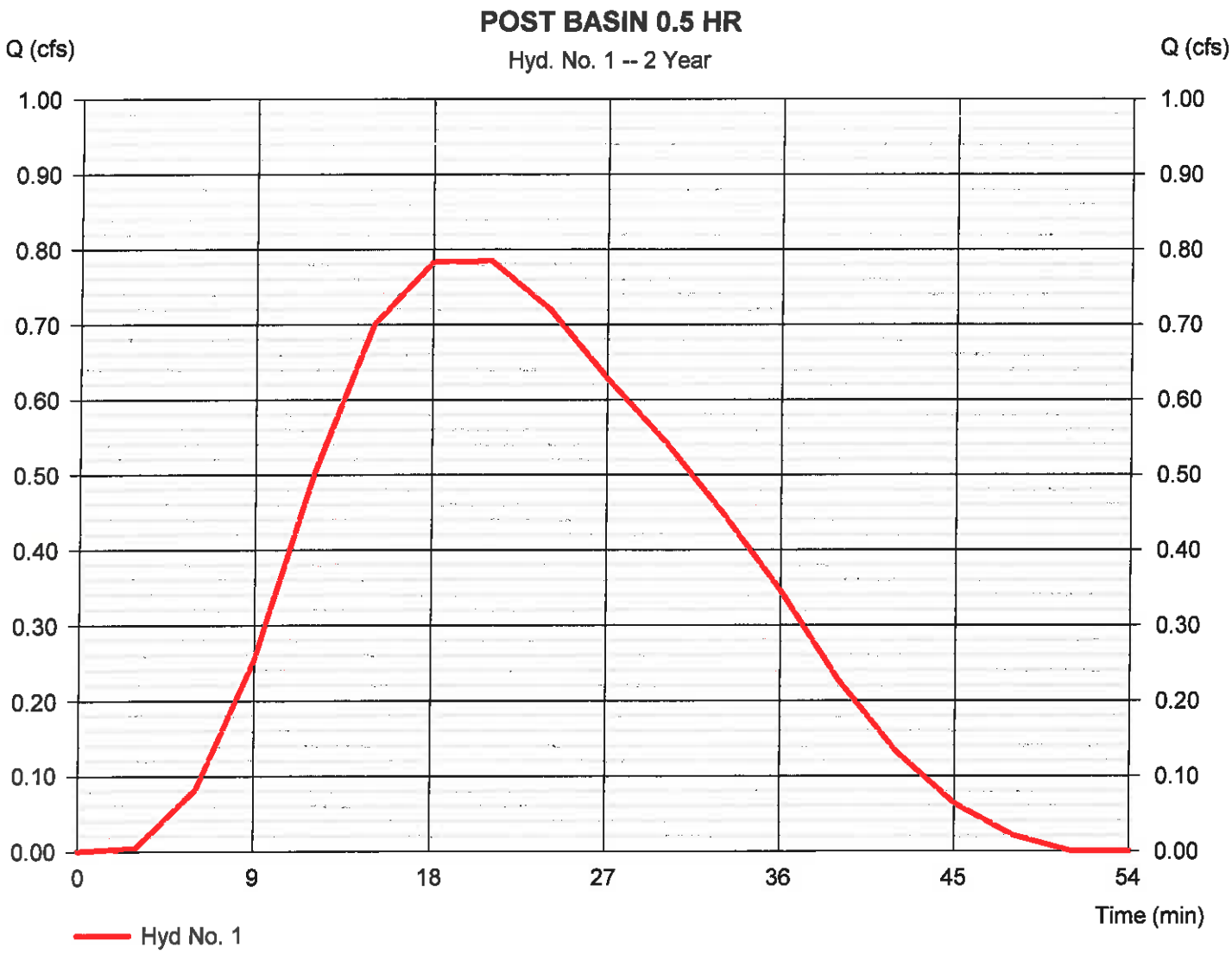
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 1

POST BASIN 0.5 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.783 cfs
Storm frequency	= 2 yrs	Time to peak	= 21 min
Time interval	= 3 min	Hyd. volume	= 1,122 cuft
Drainage area	= 1.250 ac	Curve number	= 88
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.50 min
Total precip.	= 0.99 in	Distribution	= Huff-1st
Storm duration	= 0.50 hrs	Shape factor	= 484



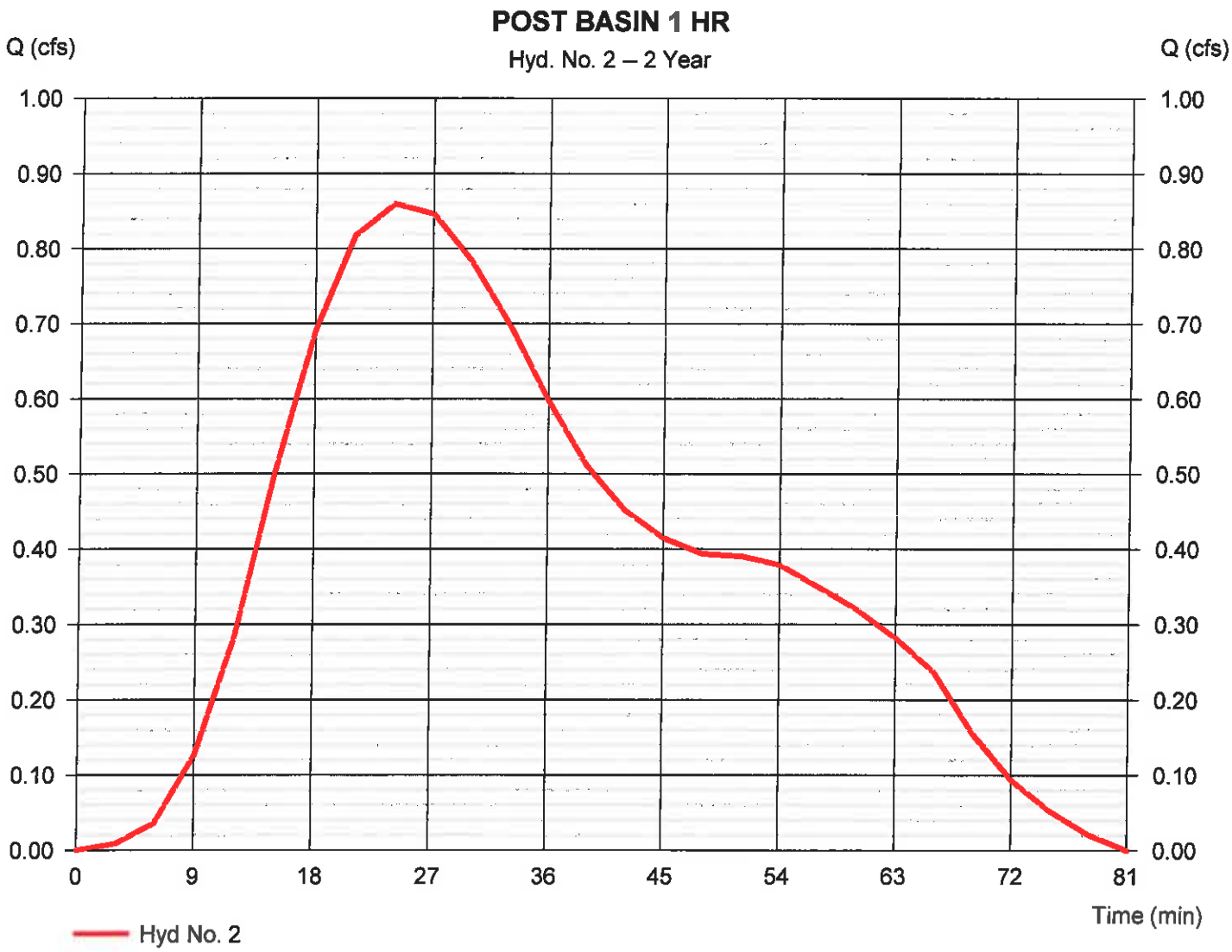
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 2

POST BASIN 1 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.859 cfs
Storm frequency	= 2 yrs	Time to peak	= 24 min
Time interval	= 3 min	Hyd. volume	= 1,851 cuft
Drainage area	= 1.250 ac	Curve number	= 88
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.50 min
Total precip.	= 1.25 in	Distribution	= Huff-1st
Storm duration	= 1.00 hrs	Shape factor	= 484



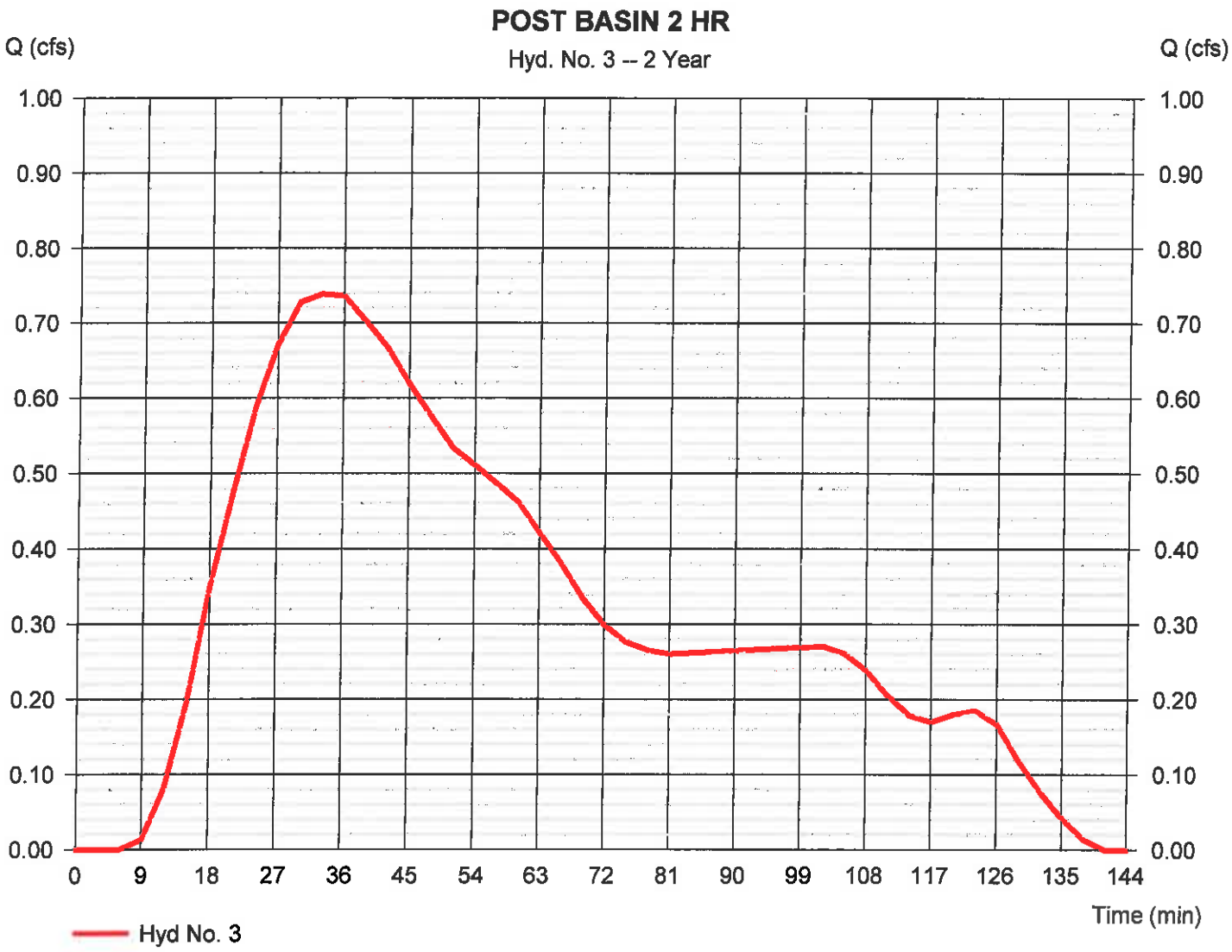
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 3

POST BASIN 2 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.738 cfs
Storm frequency	= 2 yrs	Time to peak	= 33 min
Time interval	= 3 min	Hyd. volume	= 2,711 cuft
Drainage area	= 1.255 ac	Curve number	= 88
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.50 min
Total precip.	= 1.52 in	Distribution	= Huff-1st
Storm duration	= 2.00 hrs	Shape factor	= 484



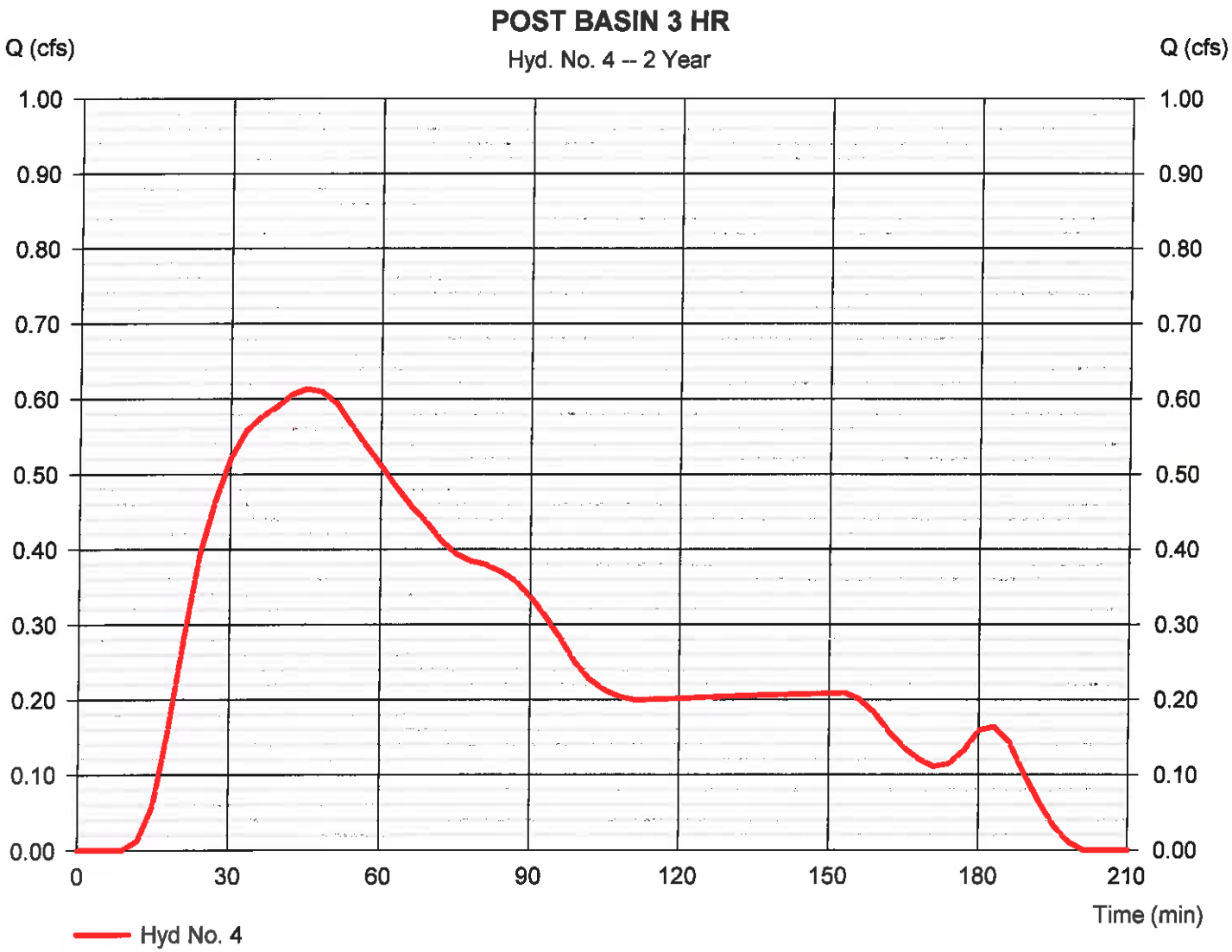
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 4

POST BASIN 3 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.612 cfs
Storm frequency	= 2 yrs	Time to peak	= 45 min
Time interval	= 3 min	Hyd. volume	= 3,243 cuft
Drainage area	= 1.250 ac	Curve number	= 88
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.50 min
Total precip.	= 1.68 in	Distribution	= Huff-1st
Storm duration	= 3.00 hrs	Shape factor	= 484



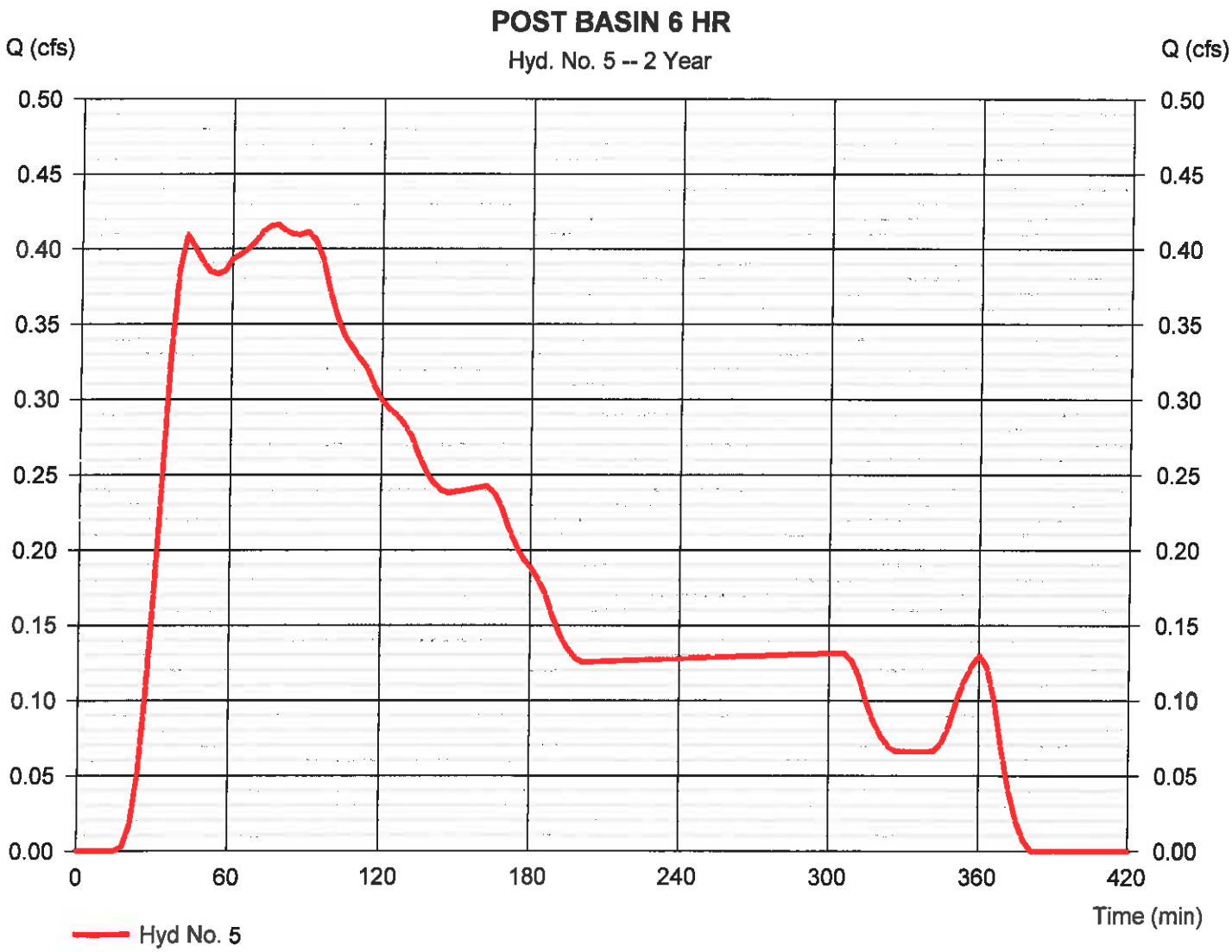
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 5

POST BASIN 6 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.416 cfs
Storm frequency	= 2 yrs	Time to peak	= 78 min
Time interval	= 3 min	Hyd. volume	= 4,307 cuft
Drainage area	= 1.250 ac	Curve number	= 88
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.50 min
Total precip.	= 1.98 in	Distribution	= Huff-1st
Storm duration	= 6.00 hrs	Shape factor	= 484



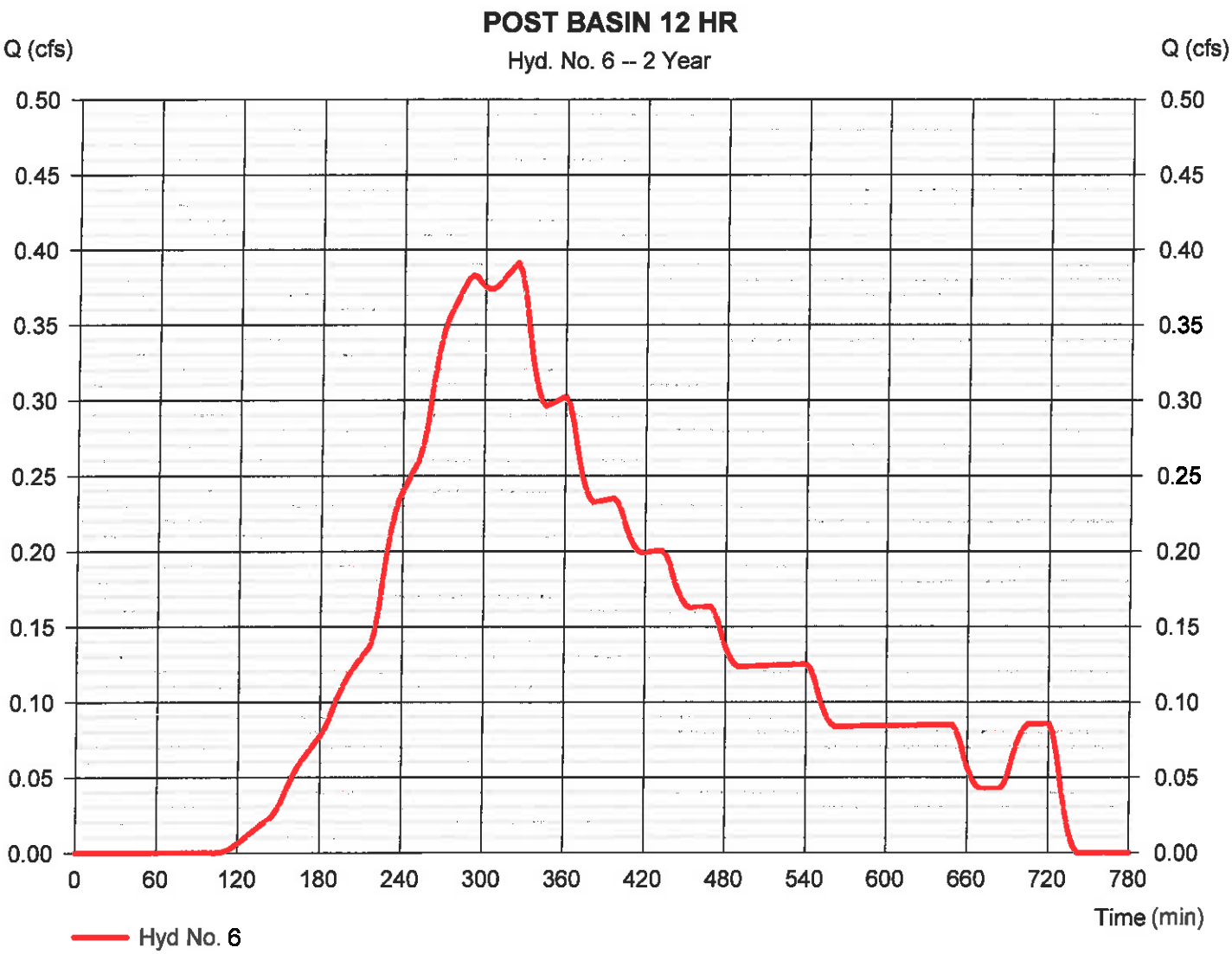
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 6

POST BASIN 12 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.391 cfs
Storm frequency	= 2 yrs	Time to peak	= 324 min
Time interval	= 3 min	Hyd. volume	= 5,882 cuft
Drainage area	= 1.250 ac	Curve number	= 88
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.50 min
Total precip.	= 2.40 in	Distribution	= Huff-2nd
Storm duration	= 12.00 hrs	Shape factor	= 484



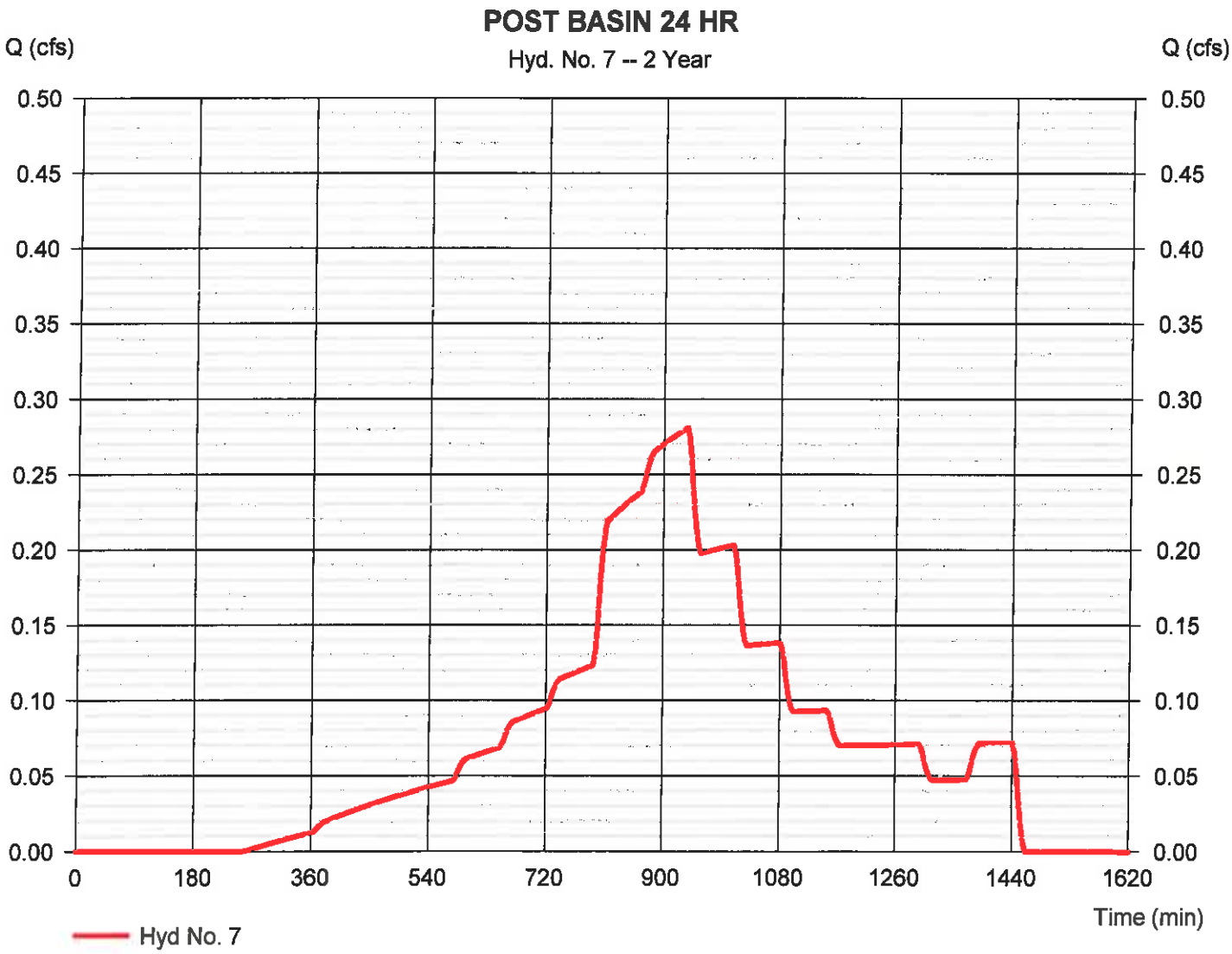
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 7

POST BASIN 24 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.280 cfs
Storm frequency	= 2 yrs	Time to peak	= 936 min
Time interval	= 3 min	Hyd. volume	= 6,816 cuft
Drainage area	= 1.250 ac	Curve number	= 88
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.50 min
Total precip.	= 2.64 in	Distribution	= Huff-3rd
Storm duration	= 24.00 hrs	Shape factor	= 484



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

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	2.029	3	18	2,803	-----	-----	-----	POST BASIN 0.5 HR
2	SCS Runoff	2.086	3	21	4,234	-----	-----	-----	POST BASIN 1 HR
3	SCS Runoff	1.703	3	30	5,897	-----	-----	-----	POST BASIN 2 HR
4	SCS Runoff	1.353	3	30	6,815	-----	-----	-----	POST BASIN 3 HR
5	SCS Runoff	1.050	3	42	8,734	-----	-----	-----	POST BASIN 6 HR
6	SCS Runoff	0.694	3	291	10,709	-----	-----	-----	POST BASIN 12 HR
7	SCS Runoff	0.488	3	936	12,720	-----	-----	-----	POST BASIN 24 HR

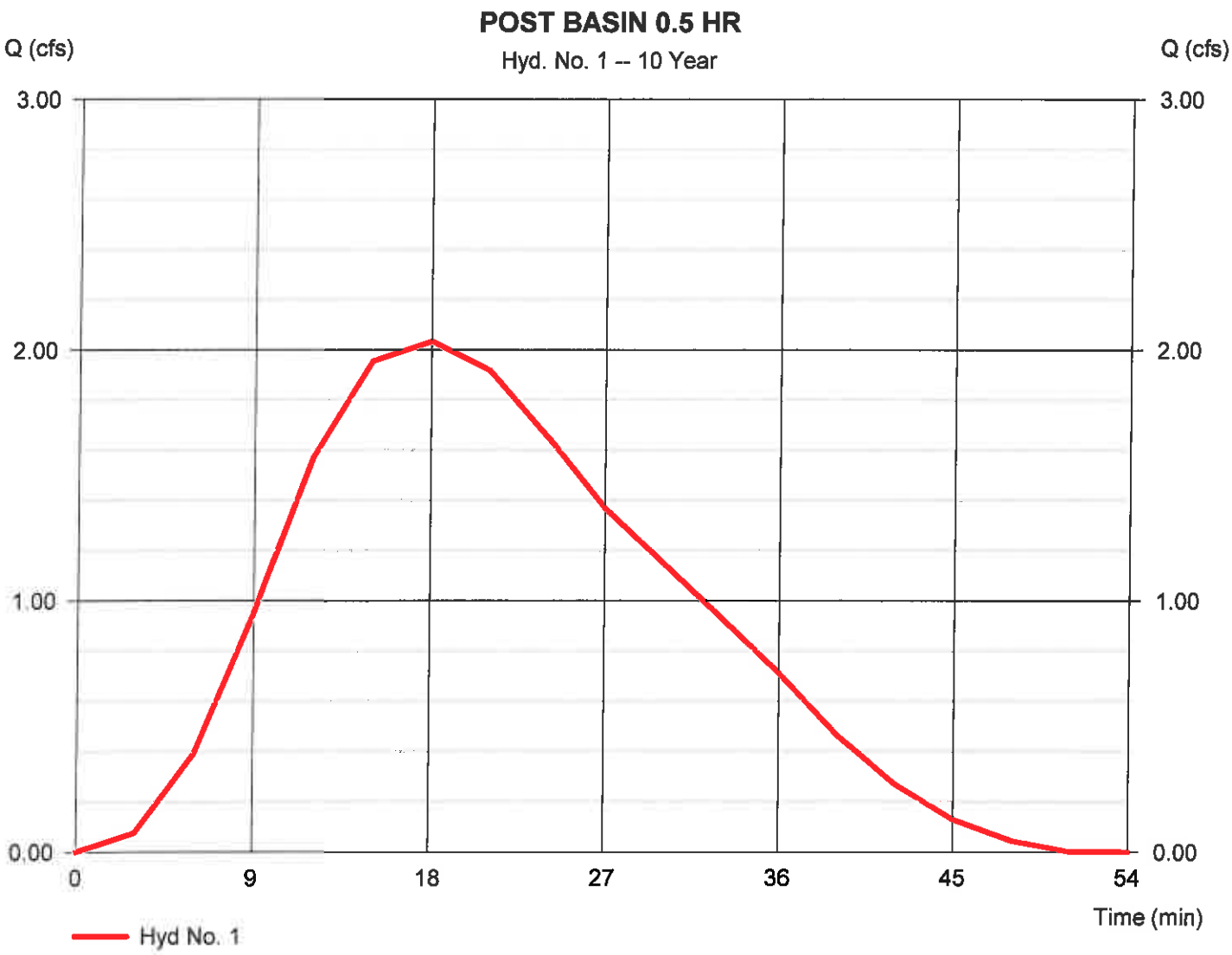
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 1

POST BASIN 0.5 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 2.029 cfs
Storm frequency	= 10 yrs	Time to peak	= 18 min
Time interval	= 3 min	Hyd. volume	= 2,803 cuft
Drainage area	= 1.250 ac	Curve number	= 88
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.50 min
Total precip.	= 1.55 in	Distribution	= Huff-1st
Storm duration	= 0.50 hrs	Shape factor	= 484



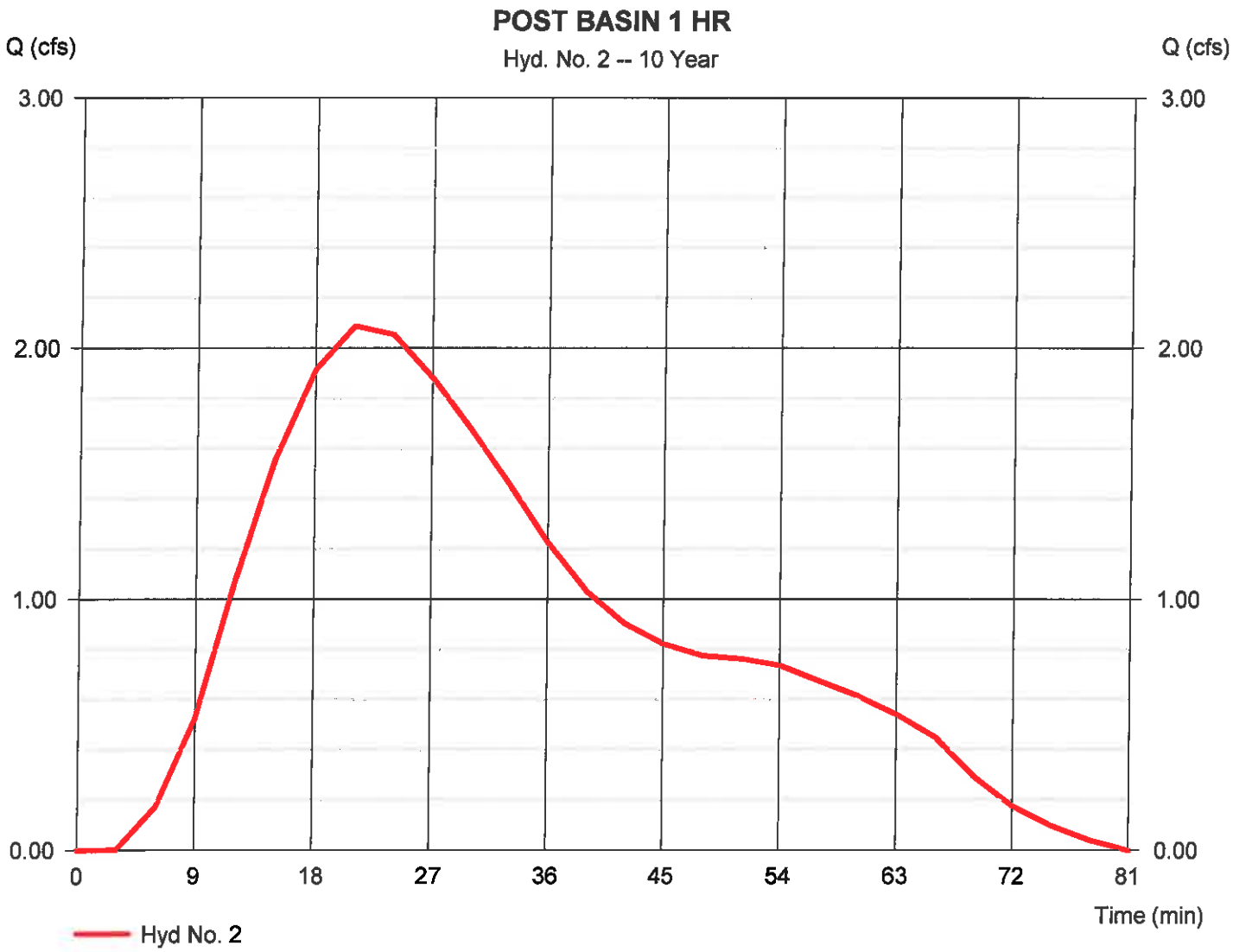
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 2

POST BASIN 1 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 2.086 cfs
Storm frequency	= 10 yrs	Time to peak	= 21 min
Time interval	= 3 min	Hyd. volume	= 4,234 cuft
Drainage area	= 1.250 ac	Curve number	= 88
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.50 min
Total precip.	= 1.96 in	Distribution	= Huff-1st
Storm duration	= 1.00 hrs	Shape factor	= 484



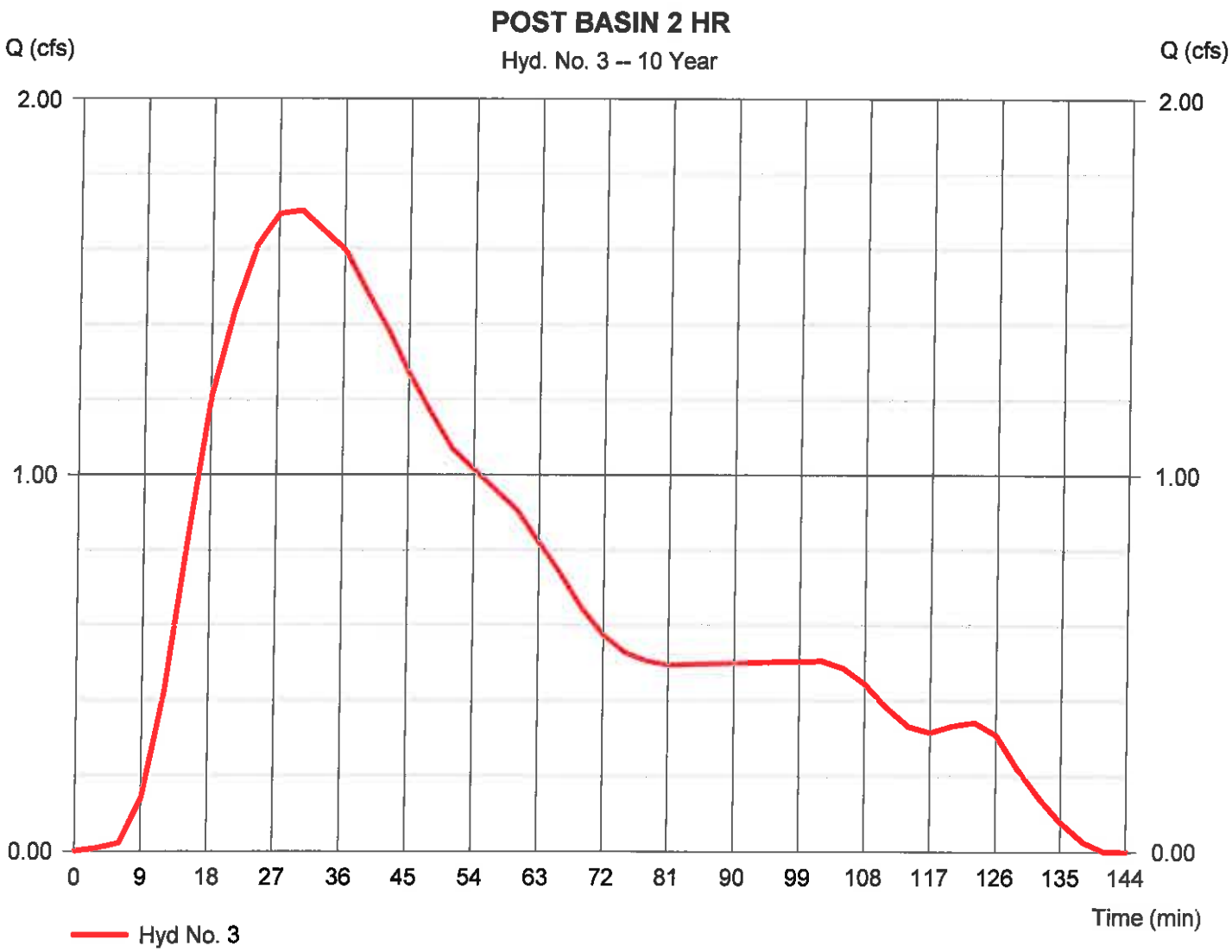
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 3

POST BASIN 2 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 1.703 cfs
Storm frequency	= 10 yrs	Time to peak	= 30 min
Time interval	= 3 min	Hyd. volume	= 5,897 cuft
Drainage area	= 1.255 ac	Curve number	= 88
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.50 min
Total precip.	= 2.40 in	Distribution	= Huff-1st
Storm duration	= 2.00 hrs	Shape factor	= 484



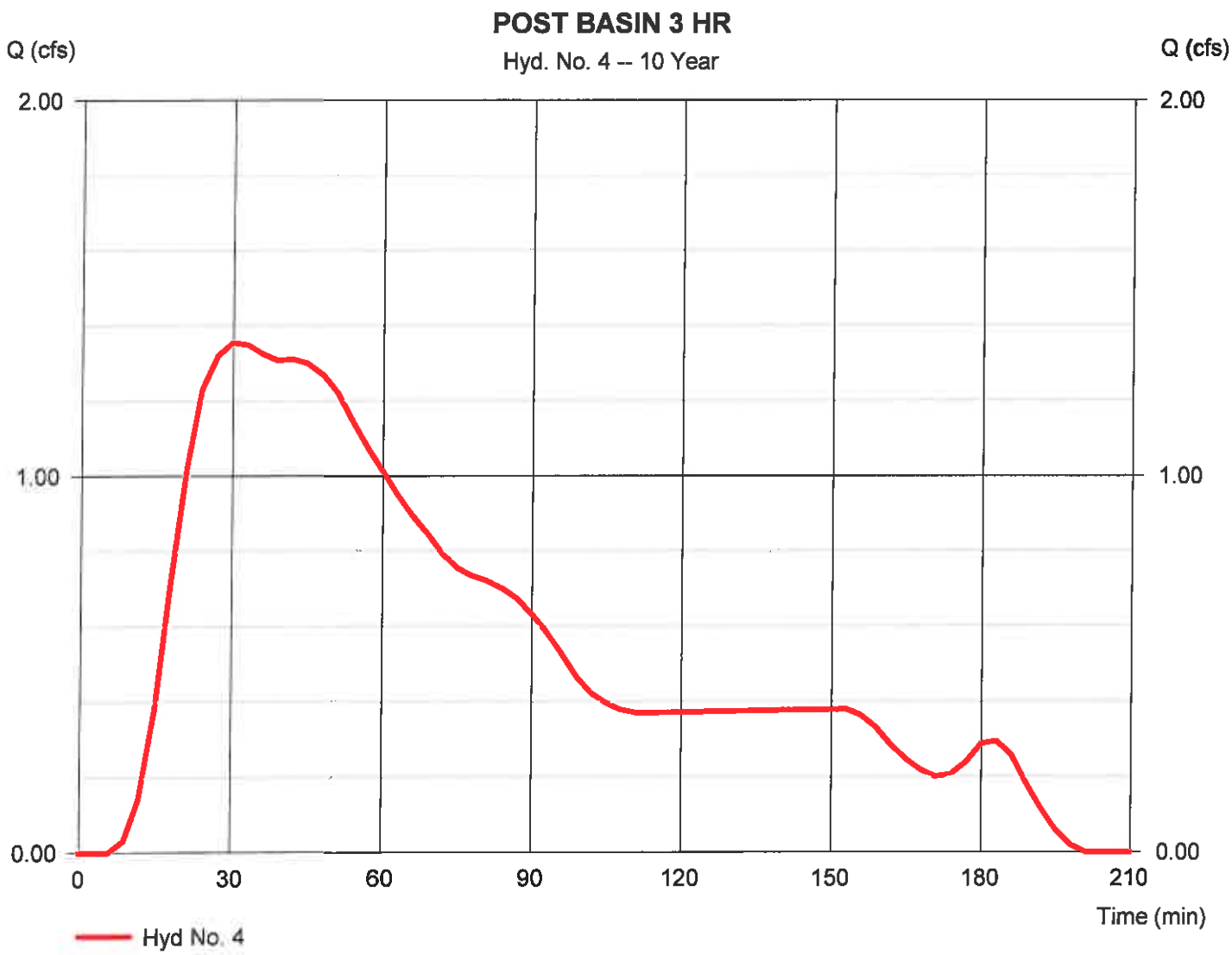
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 4

POST BASIN 3 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 1.353 cfs
Storm frequency	= 10 yrs	Time to peak	= 30 min
Time interval	= 3 min	Hyd. volume	= 6,815 cuft
Drainage area	= 1.250 ac	Curve number	= 88
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.50 min
Total precip.	= 2.64 in	Distribution	= Huff-1st
Storm duration	= 3.00 hrs	Shape factor	= 484



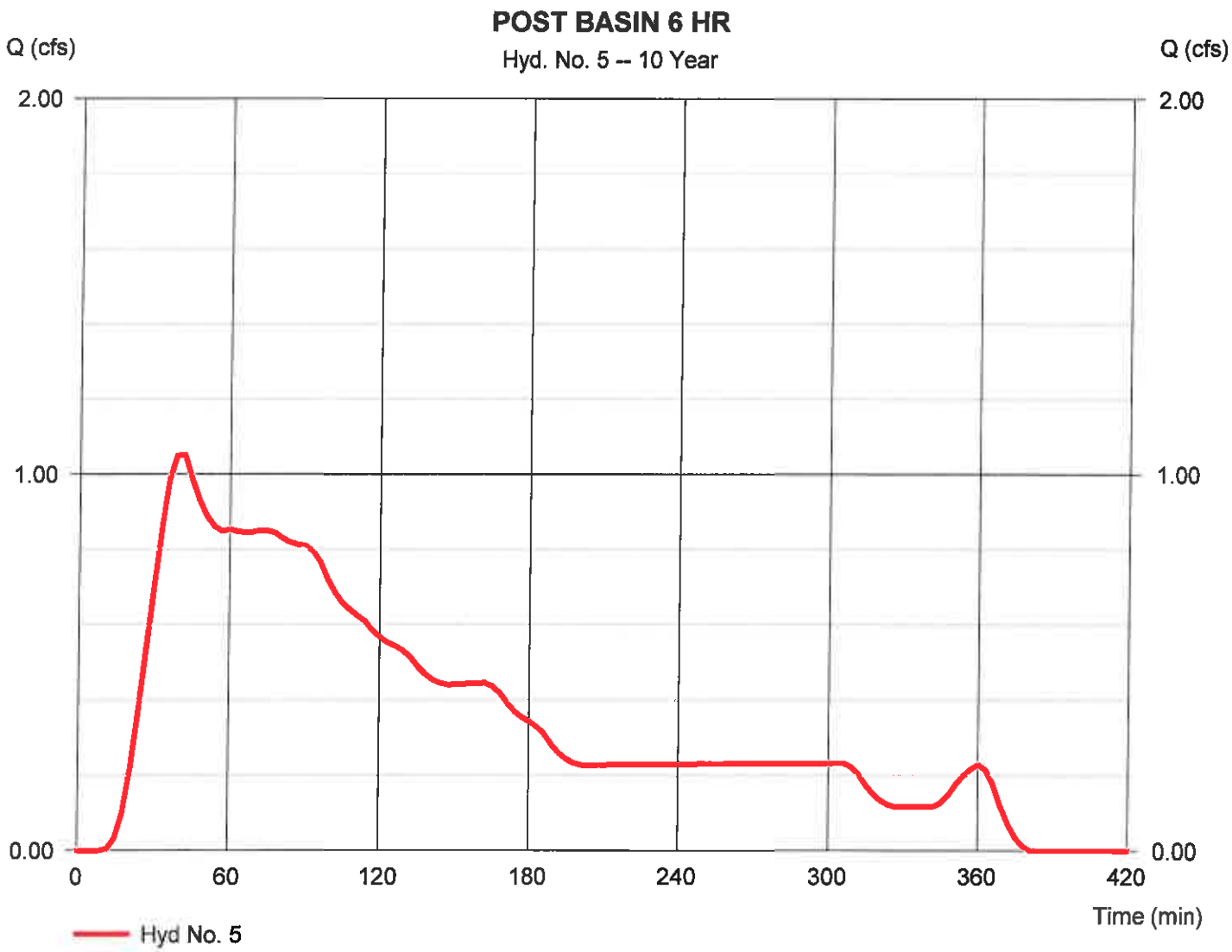
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 5

POST BASIN 6 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 1.050 cfs
Storm frequency	= 10 yrs	Time to peak	= 42 min
Time interval	= 3 min	Hyd. volume	= 8,734 cuft
Drainage area	= 1.250 ac	Curve number	= 88
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.50 min
Total precip.	= 3.12 in	Distribution	= Huff-1st
Storm duration	= 6.00 hrs	Shape factor	= 484



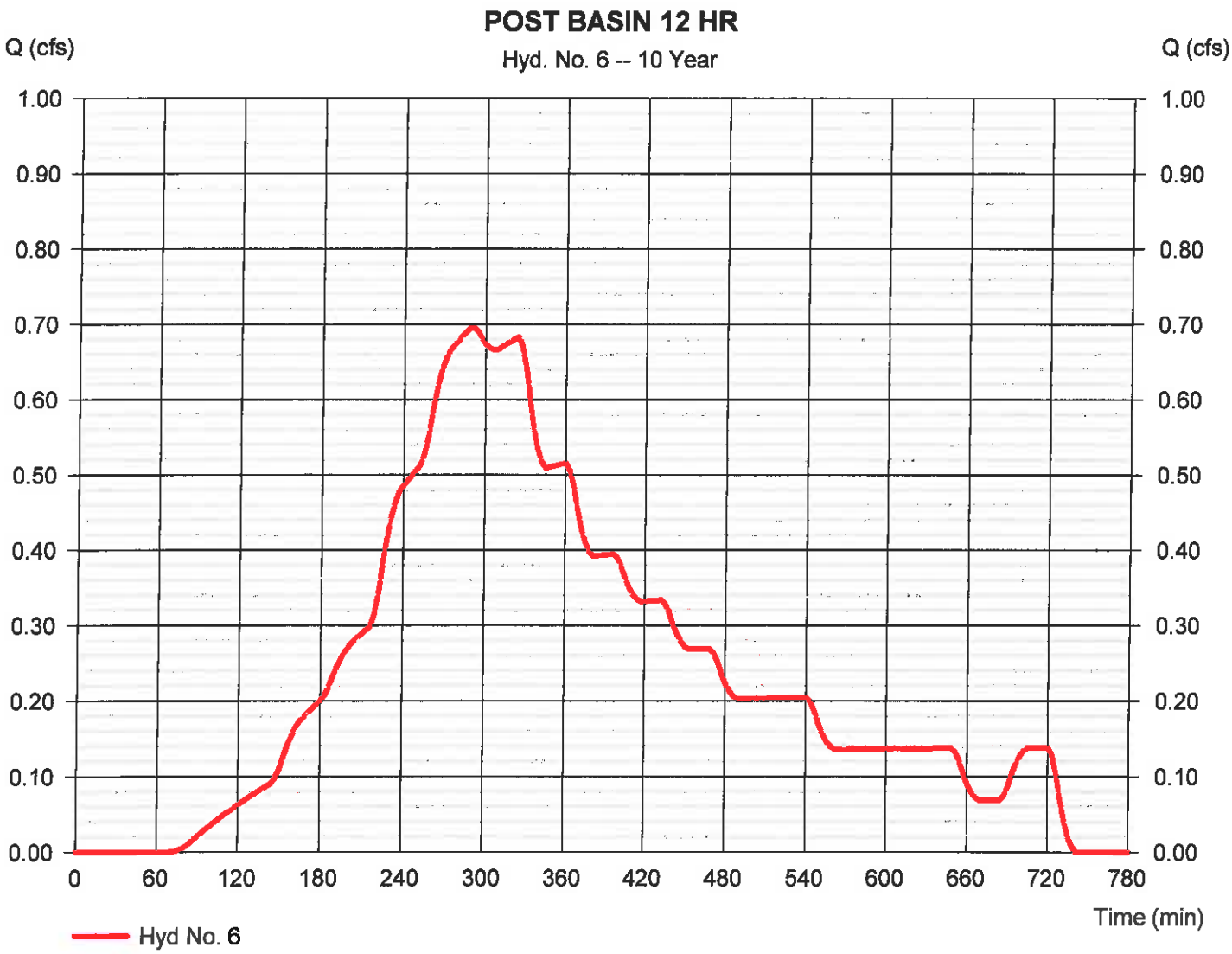
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 6

POST BASIN 12 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.694 cfs
Storm frequency	= 10 yrs	Time to peak	= 291 min
Time interval	= 3 min	Hyd. volume	= 10,709 cuft
Drainage area	= 1.250 ac	Curve number	= 88
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.50 min
Total precip.	= 3.60 in	Distribution	= Huff-2nd
Storm duration	= 12.00 hrs	Shape factor	= 484



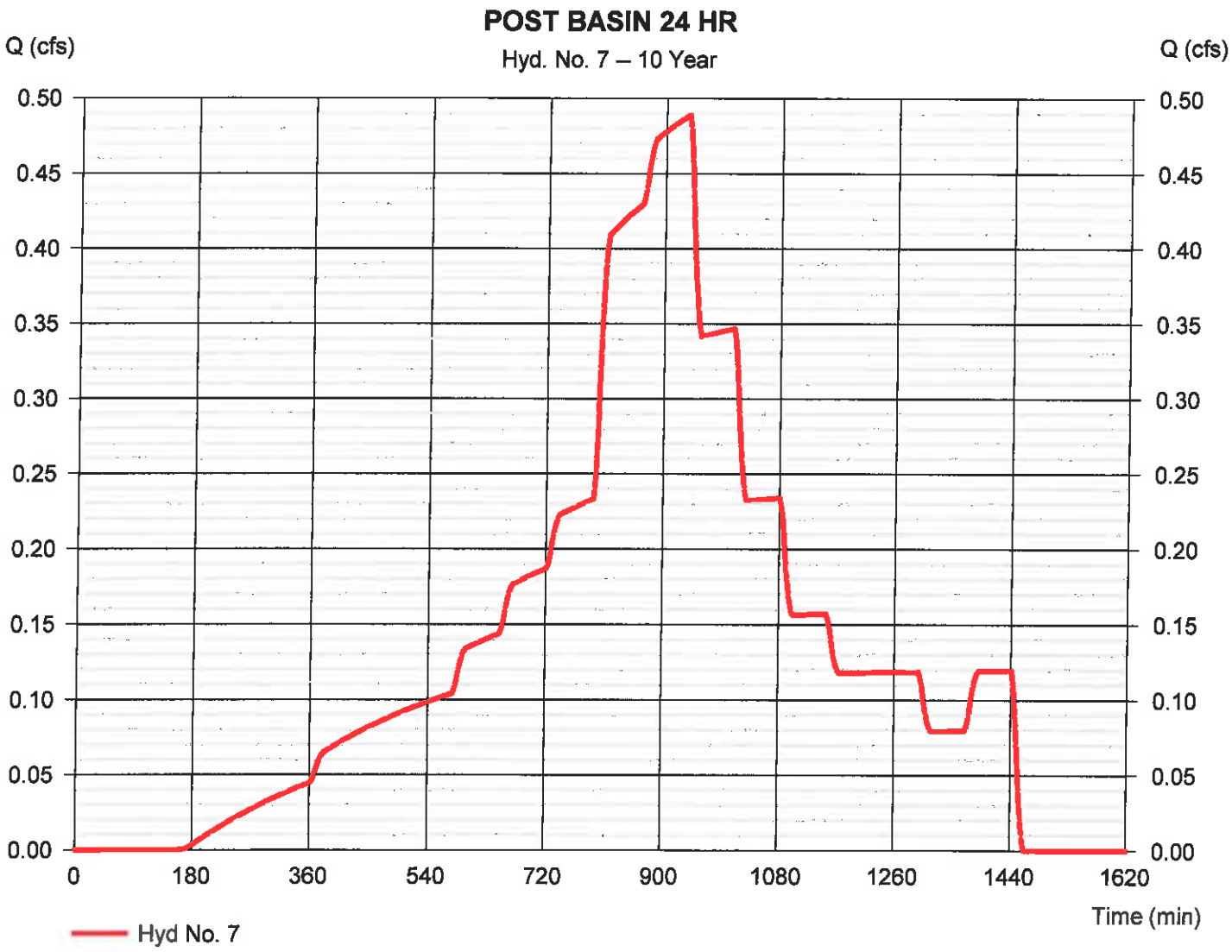
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 7

POST BASIN 24 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.488 cfs
Storm frequency	= 10 yrs	Time to peak	= 936 min
Time interval	= 3 min	Hyd. volume	= 12,720 cuft
Drainage area	= 1.250 ac	Curve number	= 88
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.50 min
Total precip.	= 4.08 in	Distribution	= Huff-3rd
Storm duration	= 24.00 hrs	Shape factor	= 484



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

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	3.881	3	18	5,310	-----	-----	-----	POST BASIN 0.5 HR
2	SCS Runoff	3.996	3	21	7,768	-----	-----	-----	POST BASIN 1 HR
3	SCS Runoff	3.140	3	24	10,335	-----	-----	-----	POST BASIN 2 HR
4	SCS Runoff	2.619	3	27	11,836	-----	-----	-----	POST BASIN 3 HR
5	SCS Runoff	1.973	3	39	14,499	-----	-----	-----	POST BASIN 6 HR
6	SCS Runoff	1.109	3	288	17,338	-----	-----	-----	POST BASIN 12 HR
7	SCS Runoff	0.763	3	936	20,990	-----	-----	-----	POST BASIN 24 HR

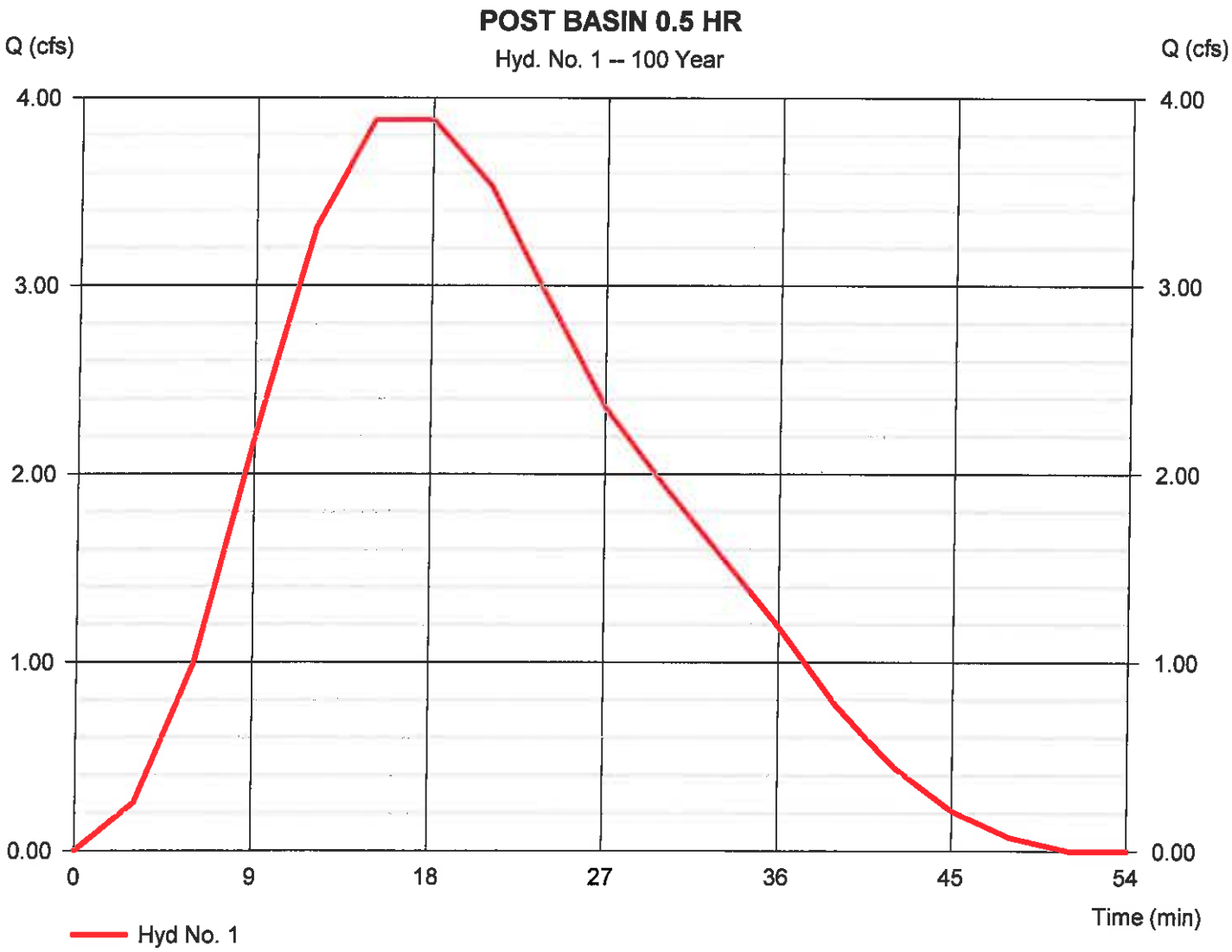
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 1

POST BASIN 0.5 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 3.881 cfs
Storm frequency	= 100 yrs	Time to peak	= 18 min
Time interval	= 3 min	Hyd. volume	= 5,310 cuft
Drainage area	= 1.250 ac	Curve number	= 88
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.50 min
Total precip.	= 2.25 in	Distribution	= Huff-1st
Storm duration	= 0.50 hrs	Shape factor	= 484



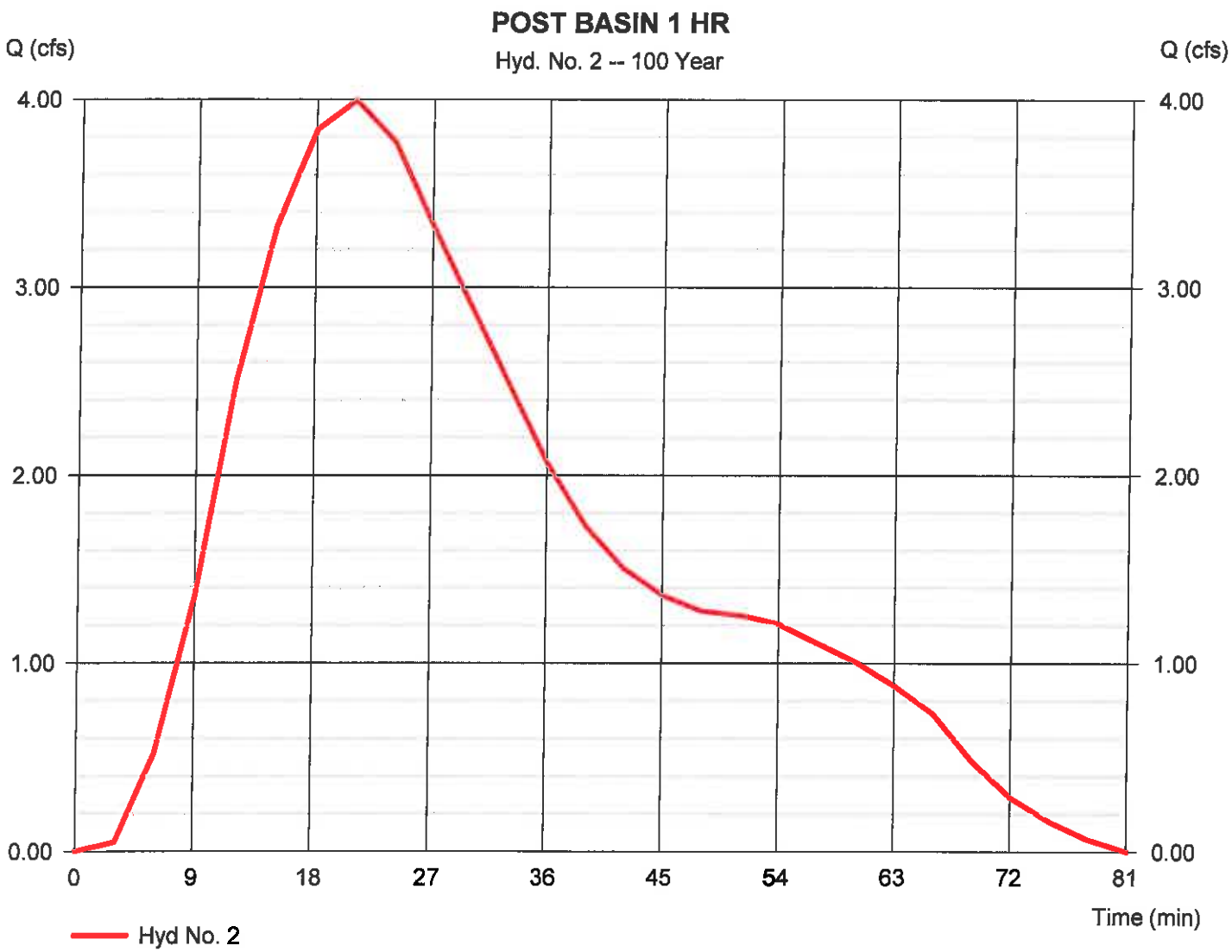
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 2

POST BASIN 1 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 3.996 cfs
Storm frequency	= 100 yrs	Time to peak	= 21 min
Time interval	= 3 min	Hyd. volume	= 7,768 cuft
Drainage area	= 1.250 ac	Curve number	= 88
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.50 min
Total precip.	= 2.88 in	Distribution	= Huff-1st
Storm duration	= 1.00 hrs	Shape factor	= 484



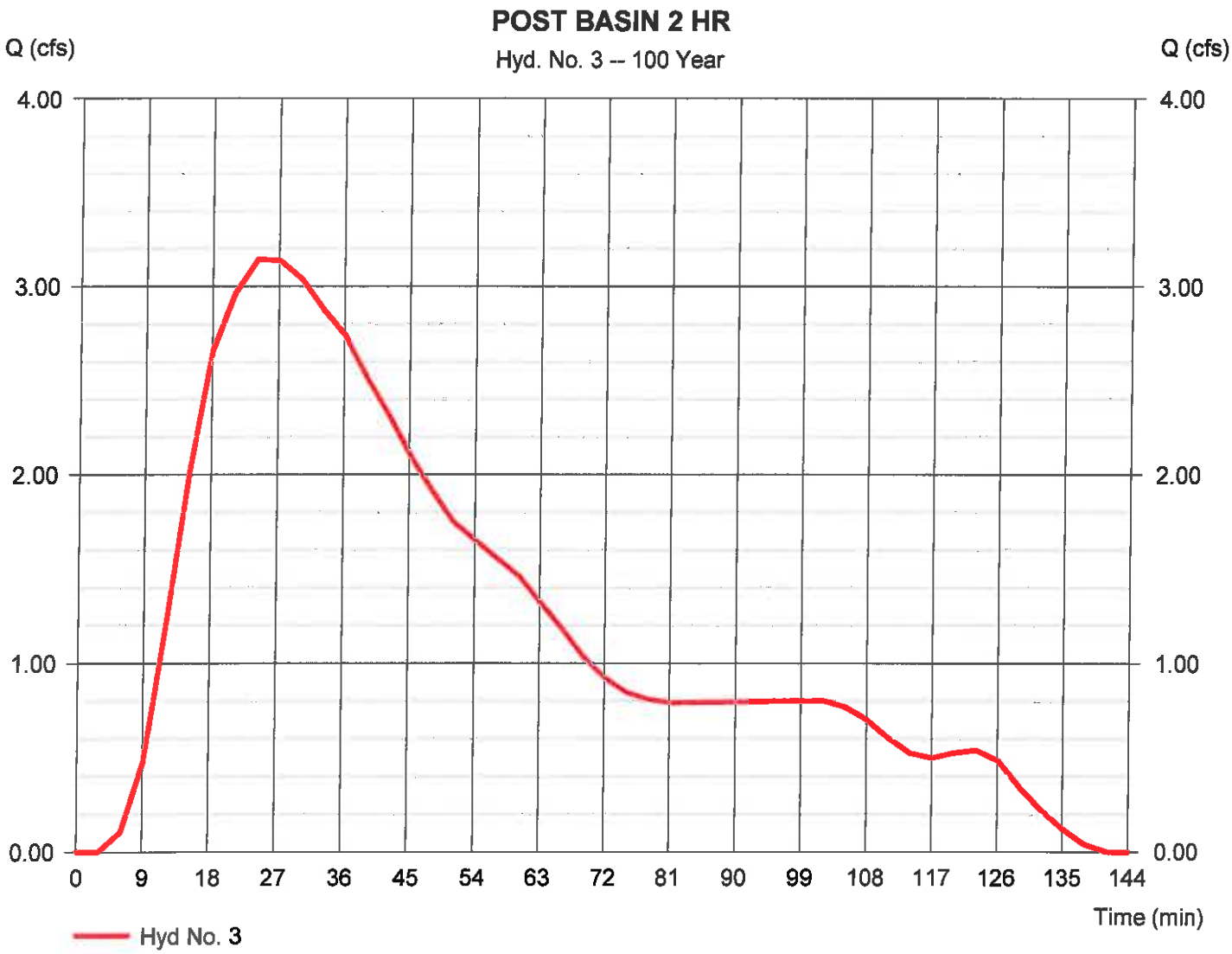
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 3

POST BASIN 2 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 3.140 cfs
Storm frequency	= 100 yrs	Time to peak	= 24 min
Time interval	= 3 min	Hyd. volume	= 10,335 cuft
Drainage area	= 1.255 ac	Curve number	= 88
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.50 min
Total precip.	= 3.50 in	Distribution	= Huff-1st
Storm duration	= 2.00 hrs	Shape factor	= 484



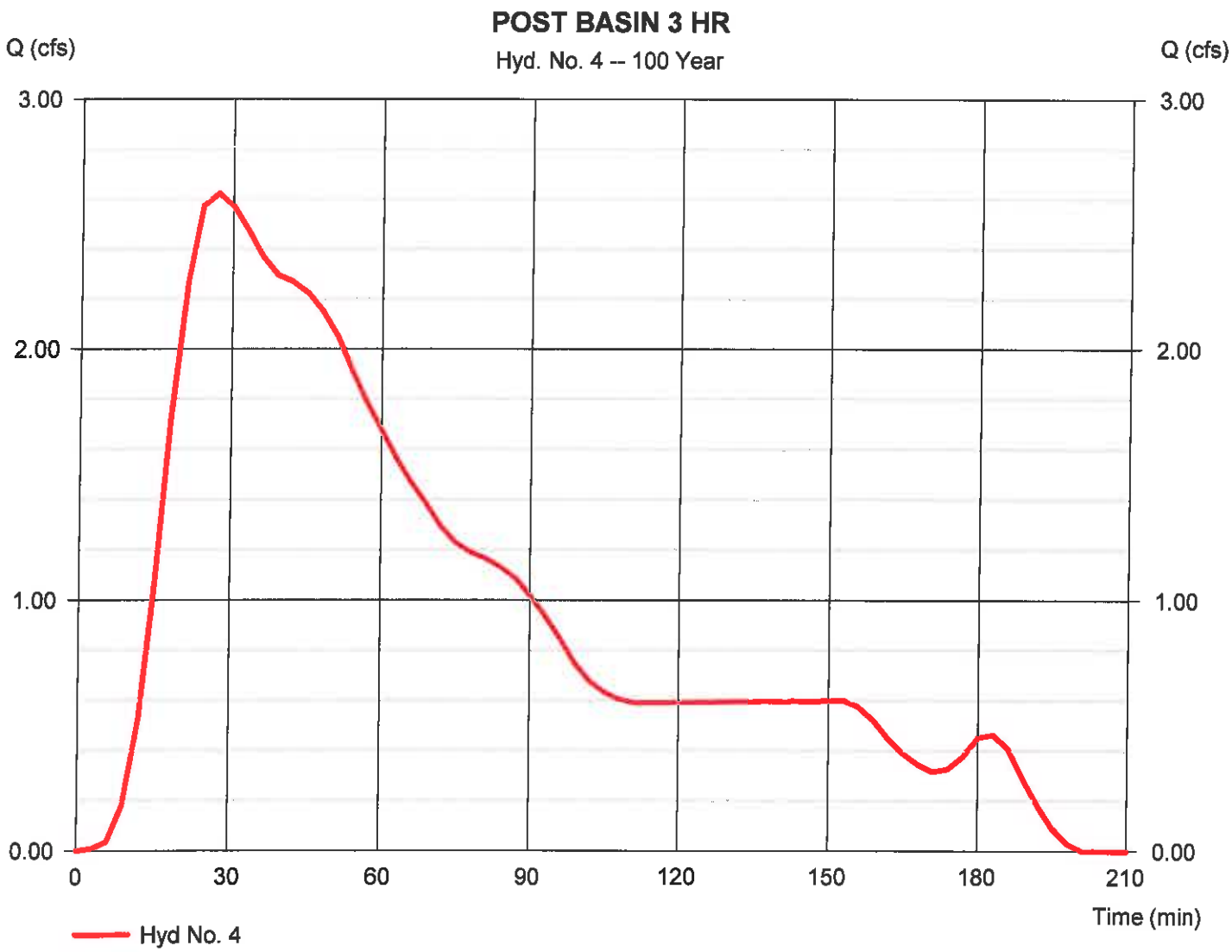
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 4

POST BASIN 3 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 2.619 cfs
Storm frequency	= 100 yrs	Time to peak	= 27 min
Time interval	= 3 min	Hyd. volume	= 11,836 cuft
Drainage area	= 1.250 ac	Curve number	= 88
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.50 min
Total precip.	= 3.87 in	Distribution	= Huff-1st
Storm duration	= 3.00 hrs	Shape factor	= 484



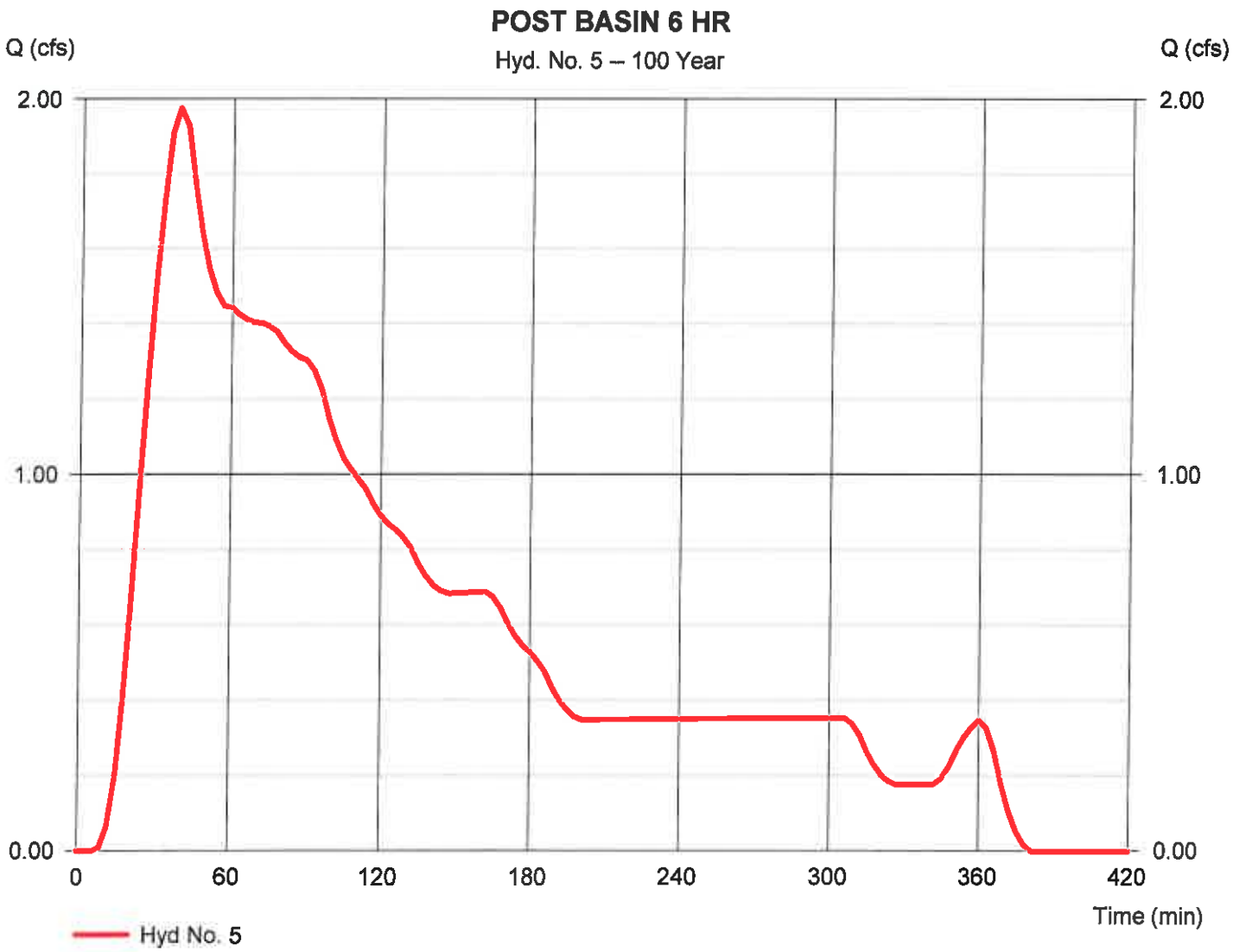
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 5

POST BASIN 6 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 1.973 cfs
Storm frequency	= 100 yrs	Time to peak	= 39 min
Time interval	= 3 min	Hyd. volume	= 14,499 cuft
Drainage area	= 1.250 ac	Curve number	= 88
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.50 min
Total precip.	= 4.50 in	Distribution	= Huff-1st
Storm duration	= 6.00 hrs	Shape factor	= 484



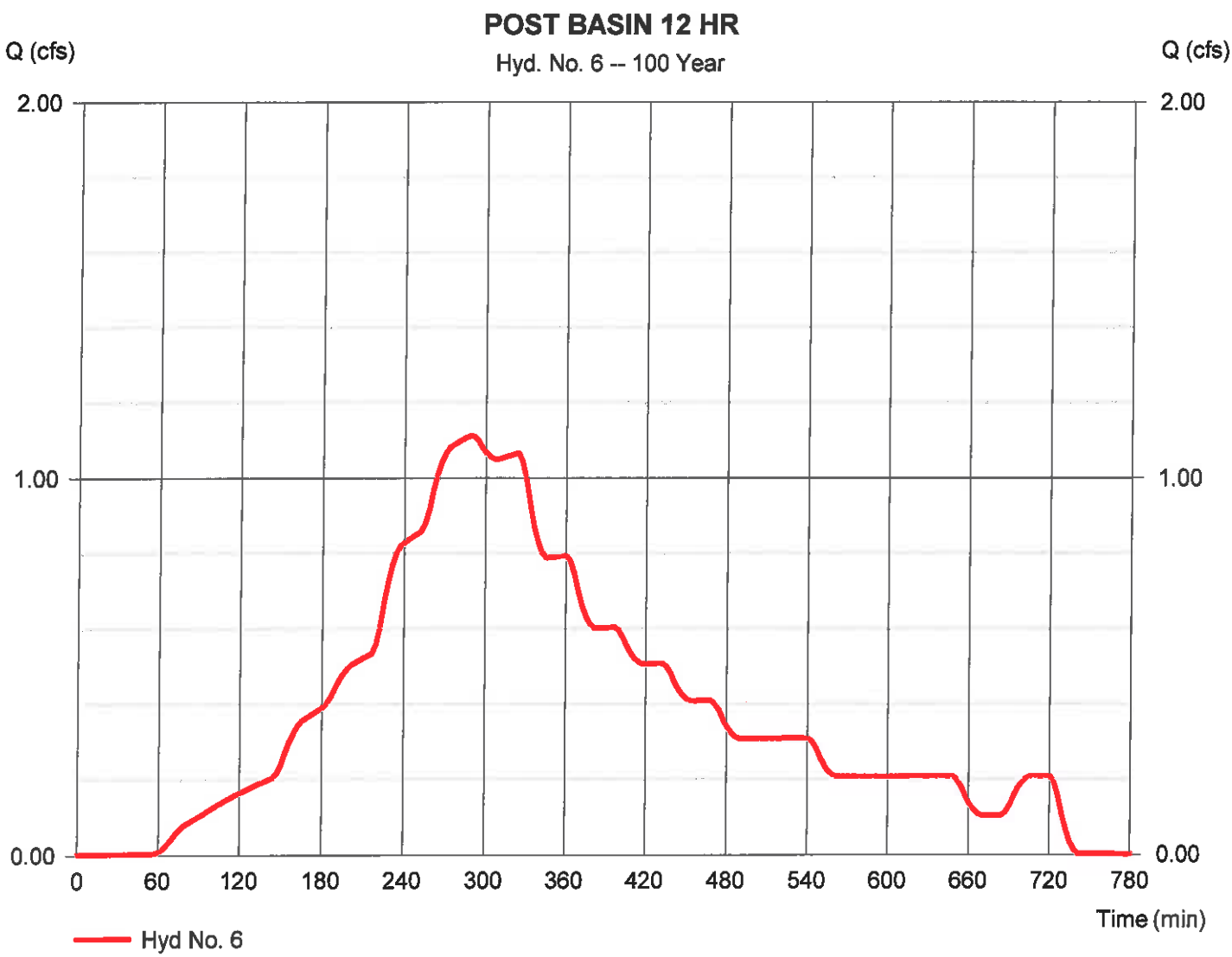
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 6

POST BASIN 12 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 1.109 cfs
Storm frequency	= 100 yrs	Time to peak	= 288 min
Time interval	= 3 min	Hyd. volume	= 17,338 cuft
Drainage area	= 1.250 ac	Curve number	= 88
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.50 min
Total precip.	= 5.16 in	Distribution	= Huff-2nd
Storm duration	= 12.00 hrs	Shape factor	= 484



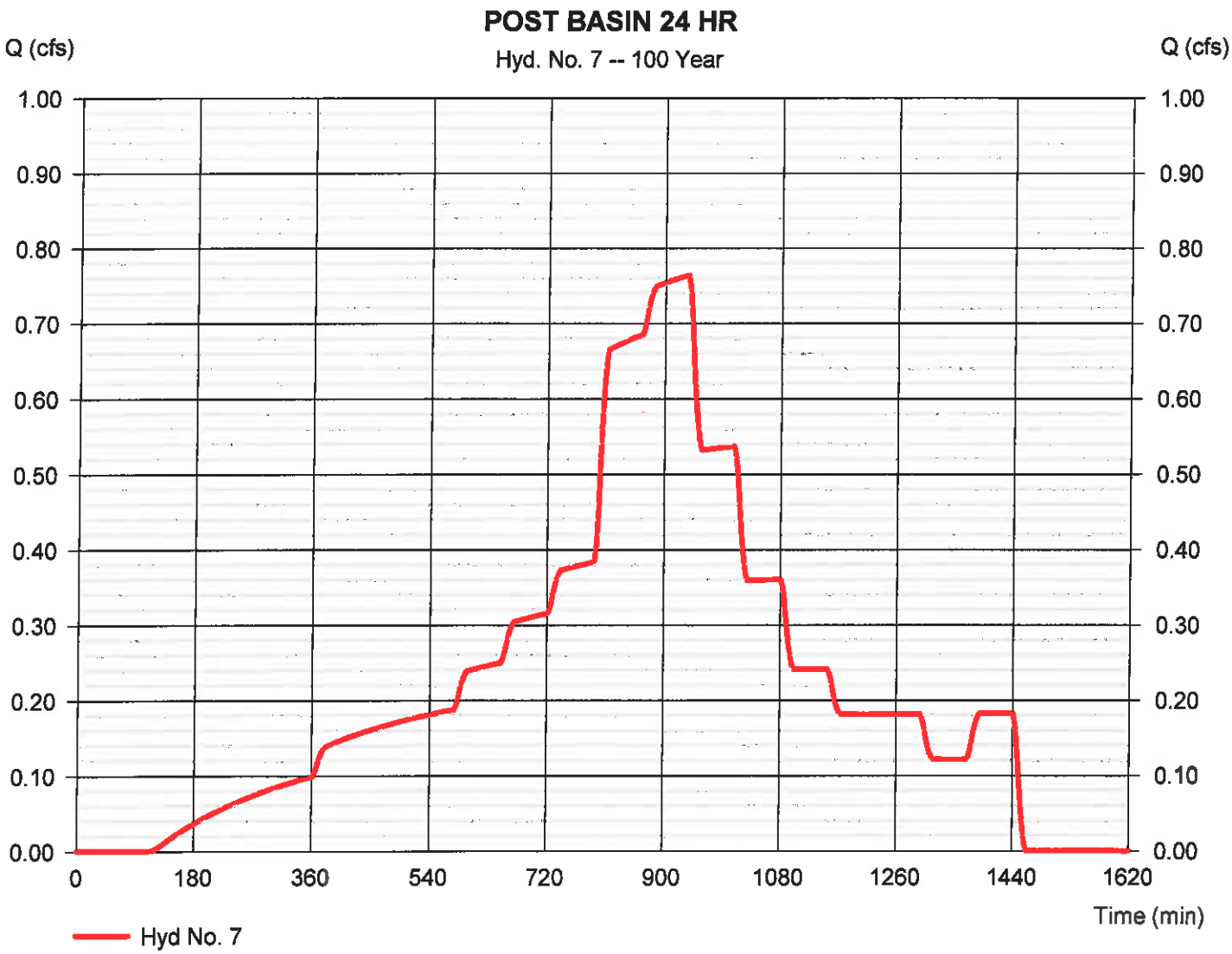
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 7

POST BASIN 24 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.763 cfs
Storm frequency	= 100 yrs	Time to peak	= 936 min
Time interval	= 3 min	Hyd. volume	= 20,990 cuft
Drainage area	= 1.250 ac	Curve number	= 88
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.50 min
Total precip.	= 6.00 in	Distribution	= Huff-3rd
Storm duration	= 24.00 hrs	Shape factor	= 484



POST-DEVELOPMENT

BASIN "B"

2, 10, & 100 YEAR

STORMS

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

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	0.310	3	21	444	-----	-----	-----	POST BASIN B 0.5 HR
2	SCS Runoff	0.344	3	27	740	-----	-----	-----	POST BASIN B 1 HR
3	SCS Runoff	0.301	3	36	1,112	-----	-----	-----	POST BASIN B 2 HR
4	SCS Runoff	0.253	3	45	1,347	-----	-----	-----	POST BASIN B 3 HR
5	SCS Runoff	0.174	3	78	1,809	-----	-----	-----	POST BASIN B 6 HR
6	SCS Runoff	0.167	3	324	2,496	-----	-----	-----	POST BASIN B 12 HR
7	SCS Runoff	0.121	3	936	2,905	-----	-----	-----	POST BASIN B 24 HR

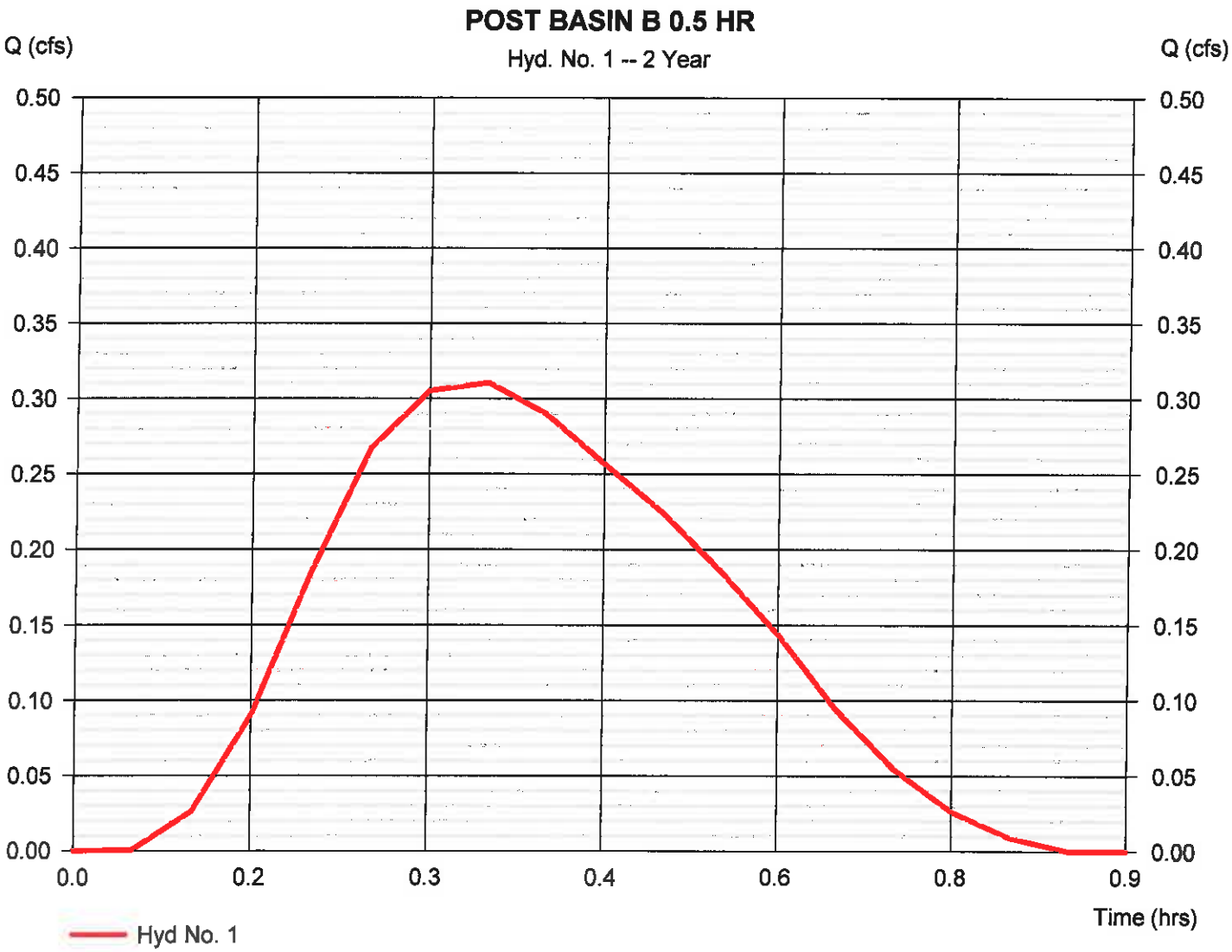
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 1

POST BASIN B 0.5 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.310 cfs
Storm frequency	= 2 yrs	Time to peak	= 0.35 hrs
Time interval	= 3 min	Hyd. volume	= 444 cuft
Drainage area	= 0.560 ac	Curve number	= 87
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.10 min
Total precip.	= 0.99 in	Distribution	= Huff-1st
Storm duration	= 0.50 hrs	Shape factor	= 484



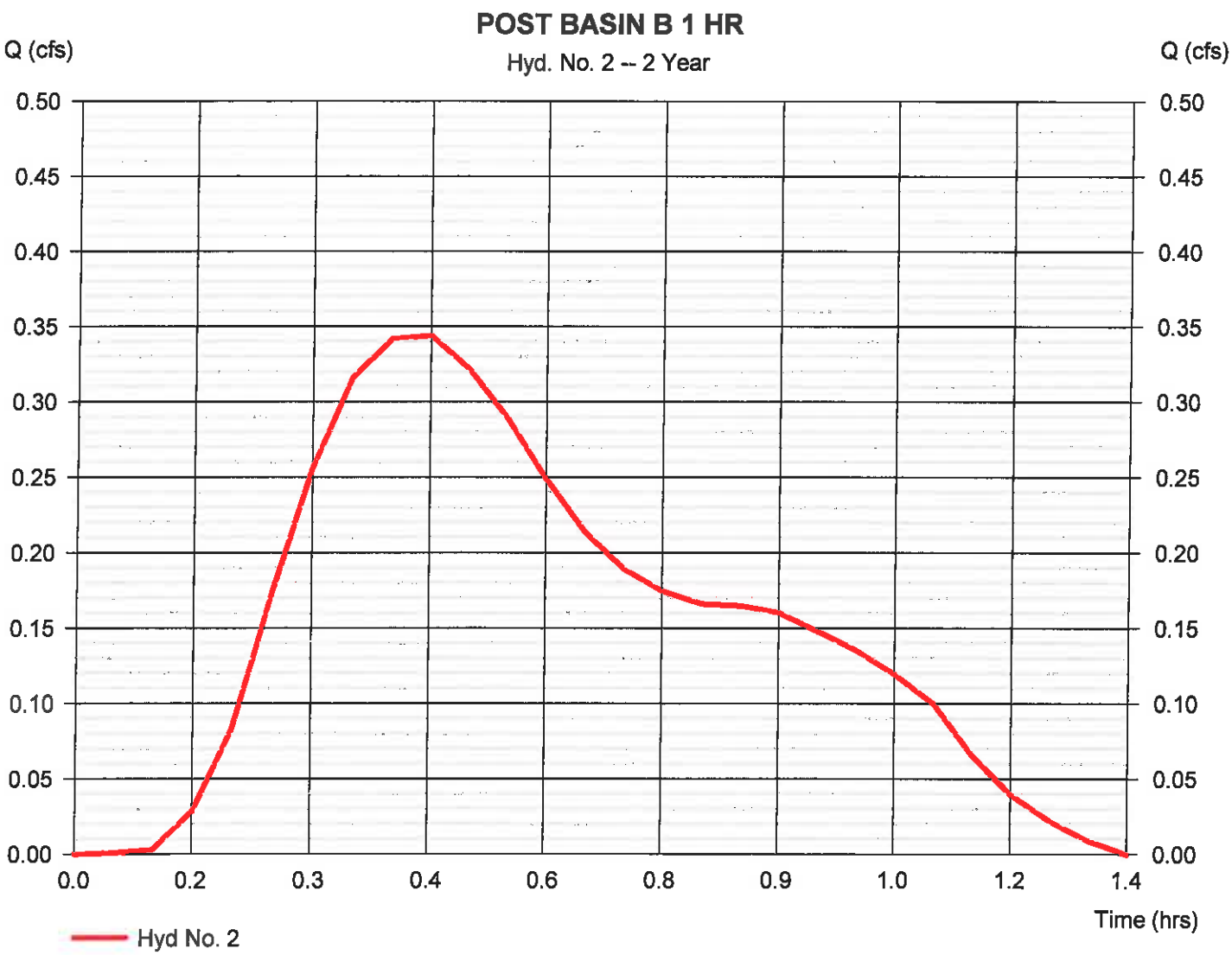
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 2

POST BASIN B 1 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.344 cfs
Storm frequency	= 2 yrs	Time to peak	= 0.45 hrs
Time interval	= 3 min	Hyd. volume	= 740 cuft
Drainage area	= 0.560 ac	Curve number	= 87
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.10 min
Total precip.	= 1.25 in	Distribution	= Huff-1st
Storm duration	= 1.00 hrs	Shape factor	= 484



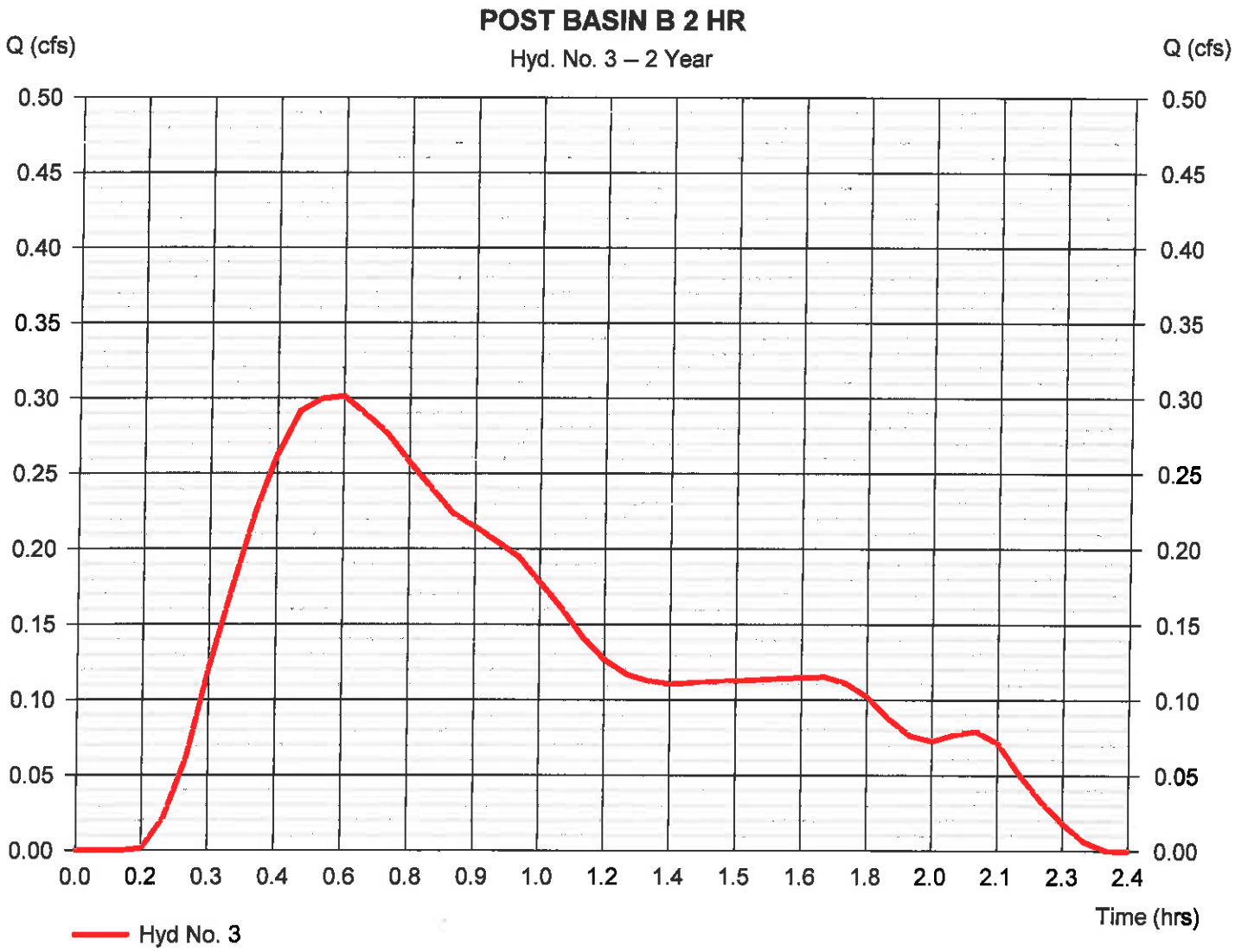
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 3

POST BASIN B 2 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.301 cfs
Storm frequency	= 2 yrs	Time to peak	= 0.60 hrs
Time interval	= 3 min	Hyd. volume	= 1,112 cuft
Drainage area	= 0.560 ac	Curve number	= 87
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.10 min
Total precip.	= 1.52 in	Distribution	= Huff-1st
Storm duration	= 2.00 hrs	Shape factor	= 484



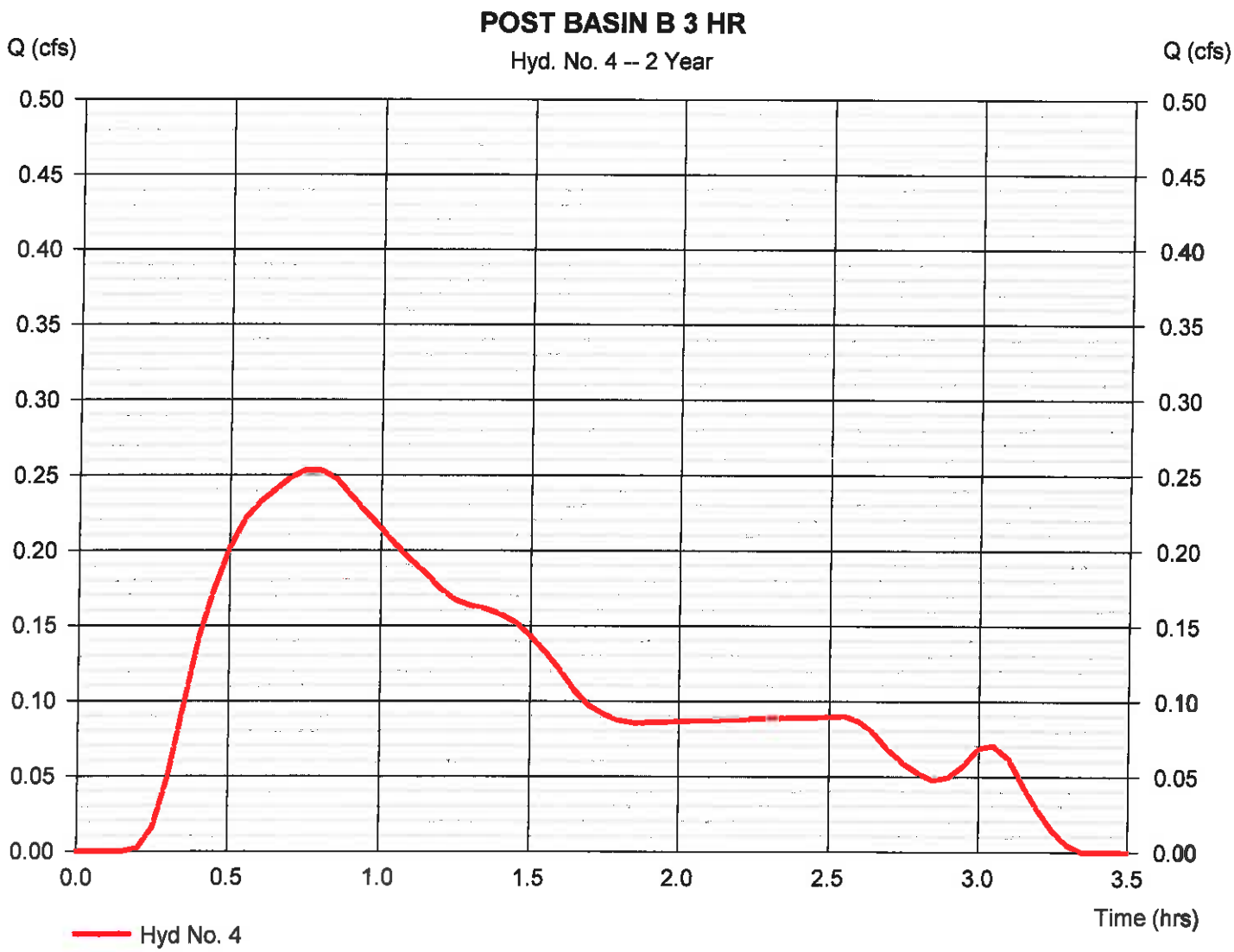
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 4

POST BASIN B 3 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.253 cfs
Storm frequency	= 2 yrs	Time to peak	= 0.75 hrs
Time interval	= 3 min	Hyd. volume	= 1,347 cuft
Drainage area	= 0.560 ac	Curve number	= 87
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.10 min
Total precip.	= 1.68 in	Distribution	= Huff-1st
Storm duration	= 3.00 hrs	Shape factor	= 484



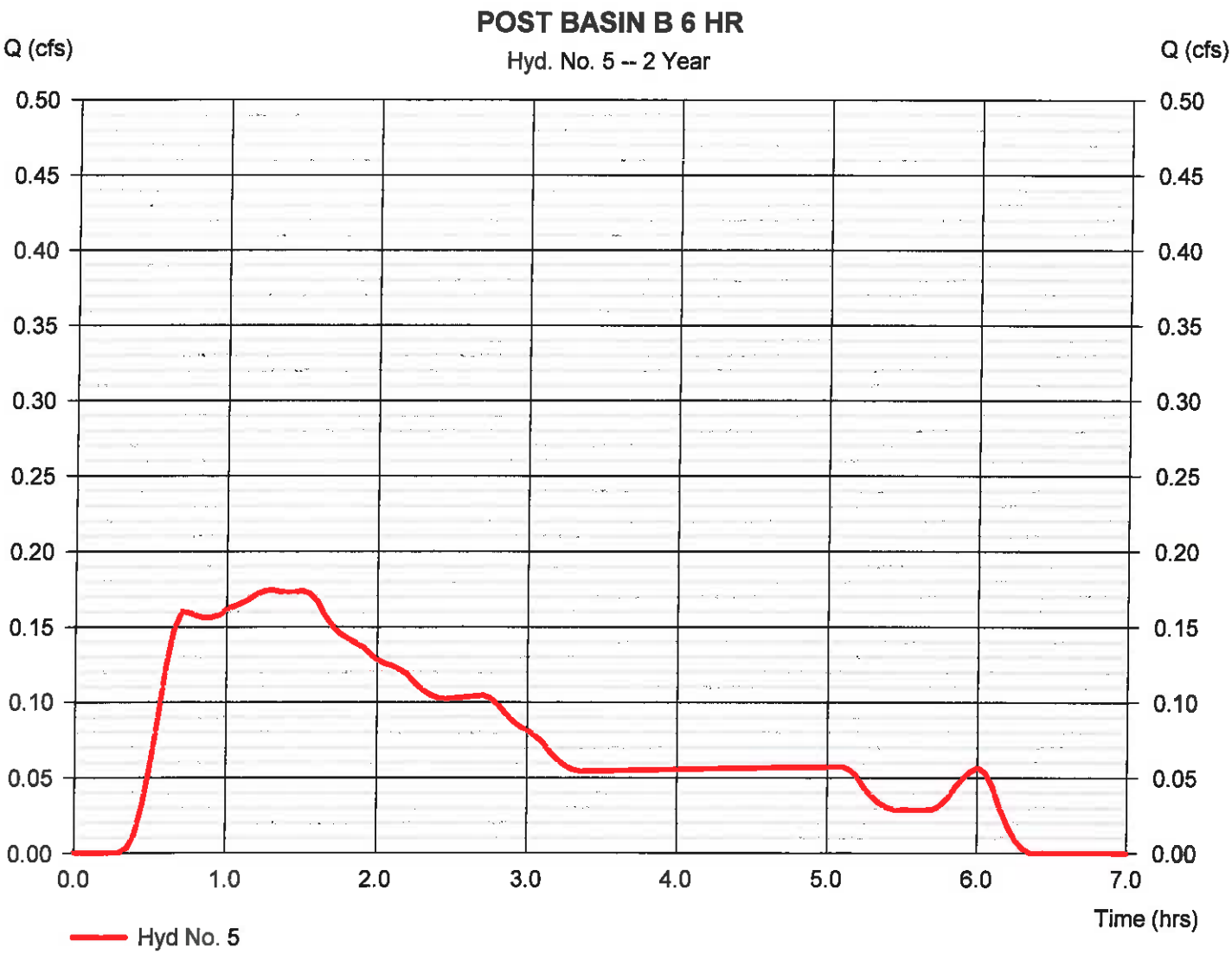
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 5

POST BASIN B 6 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.174 cfs
Storm frequency	= 2 yrs	Time to peak	= 1.30 hrs
Time interval	= 3 min	Hyd. volume	= 1,809 cuft
Drainage area	= 0.560 ac	Curve number	= 87
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.10 min
Total precip.	= 1.98 in	Distribution	= Huff-1st
Storm duration	= 6.00 hrs	Shape factor	= 484



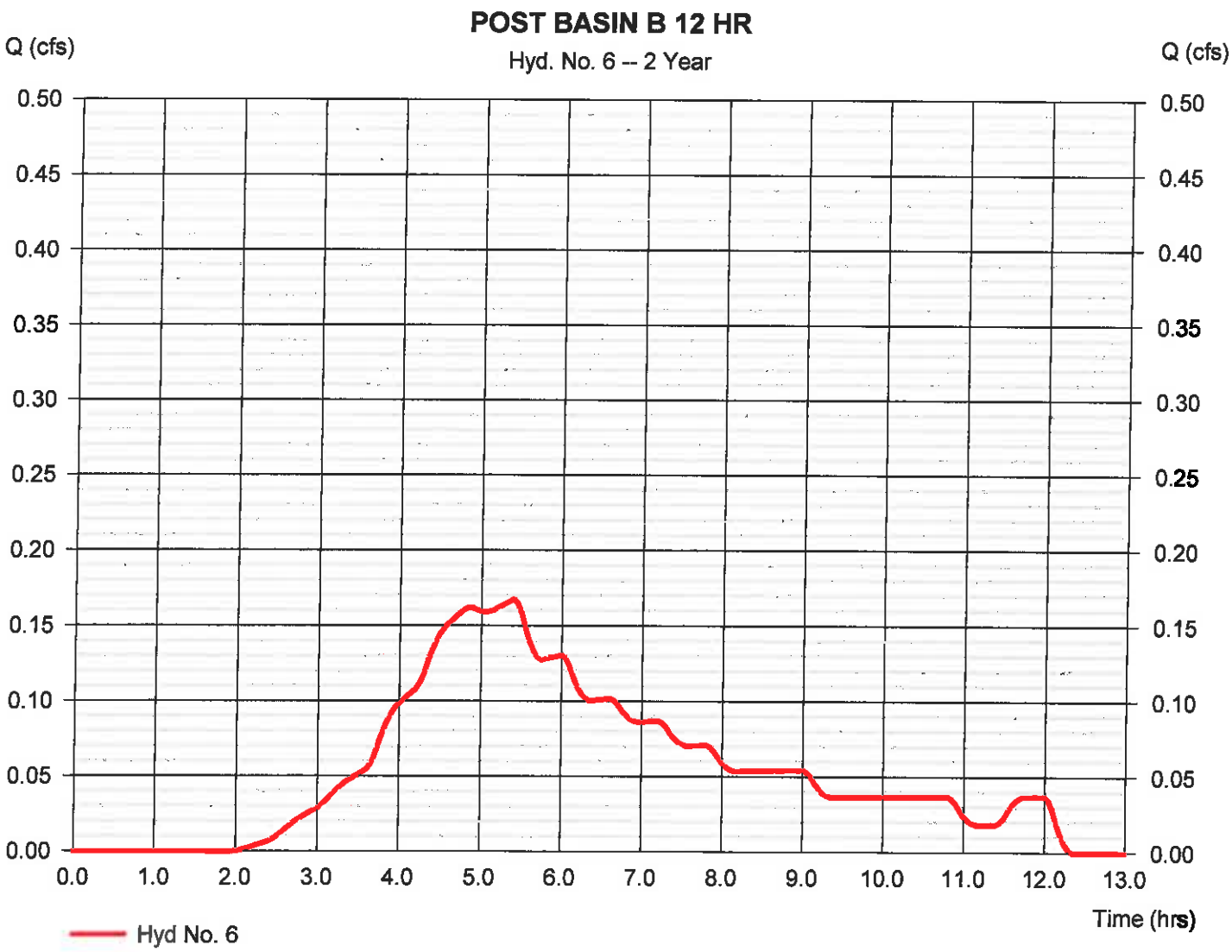
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 6

POST BASIN B 12 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.167 cfs
Storm frequency	= 2 yrs	Time to peak	= 5.40 hrs
Time interval	= 3 min	Hyd. volume	= 2,496 cuft
Drainage area	= 0.560 ac	Curve number	= 87
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.10 min
Total precip.	= 2.40 in	Distribution	= Huff-2nd
Storm duration	= 12.00 hrs	Shape factor	= 484



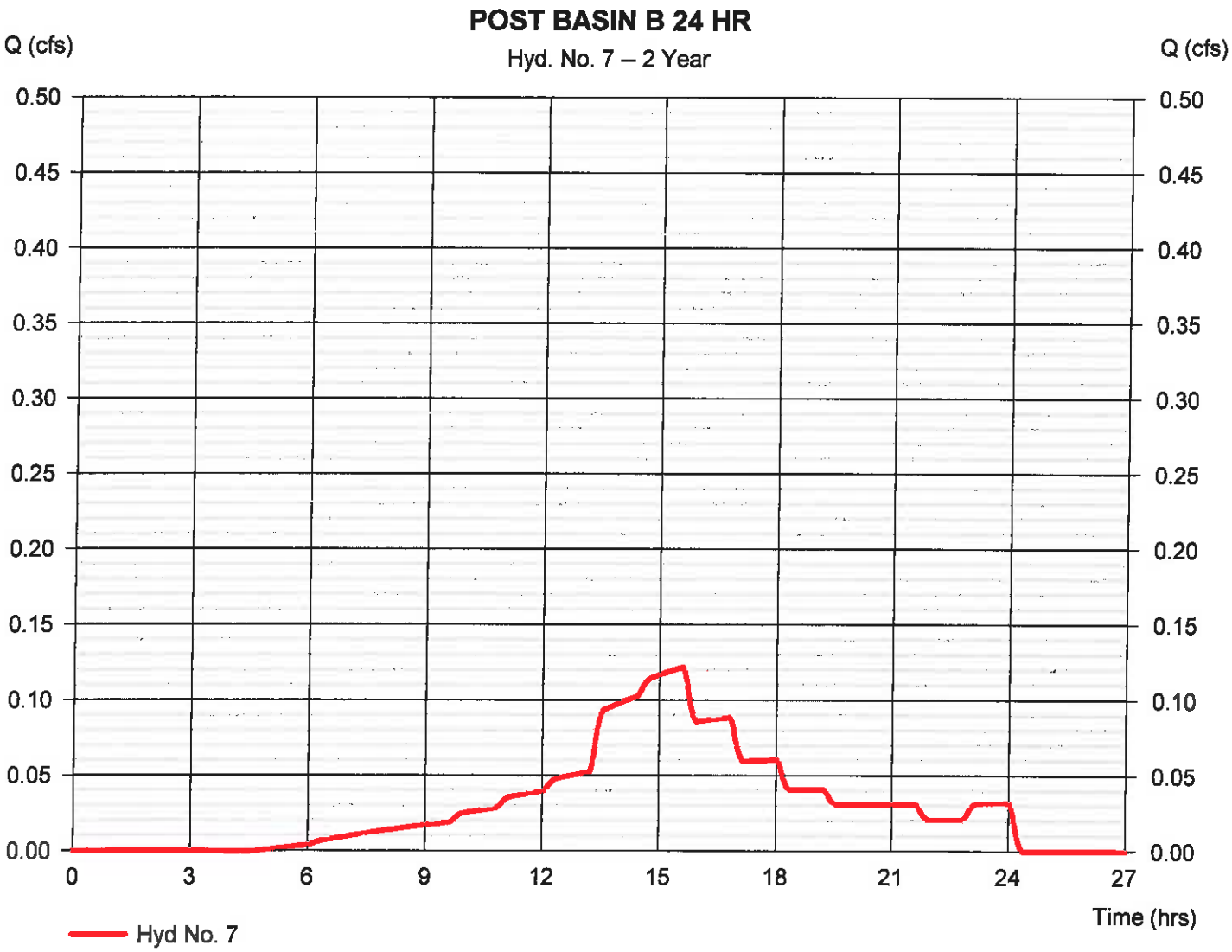
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 7

POST BASIN B 24 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.121 cfs
Storm frequency	= 2 yrs	Time to peak	= 15.60 hrs
Time interval	= 3 min	Hyd. volume	= 2,905 cuft
Drainage area	= 0.560 ac	Curve number	= 87
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.10 min
Total precip.	= 2.64 in	Distribution	= Huff-3rd
Storm duration	= 24.00 hrs	Shape factor	= 484



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

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	0.835	3	18	1,159	-----	-----	-----	POST BASIN B 0.5 HR
2	SCS Runoff	0.862	3	21	1,778	-----	-----	-----	POST BASIN B 1 HR
3	SCS Runoff	0.713	3	30	2,487	-----	-----	-----	POST BASIN B 2 HR
4	SCS Runoff	0.563	3	33	2,905	-----	-----	-----	POST BASIN B 3 HR
5	SCS Runoff	0.435	3	42	3,748	-----	-----	-----	POST BASIN B 6 HR
6	SCS Runoff	0.300	3	291	4,620	-----	-----	-----	POST BASIN B 12 HR
7	SCS Runoff	0.214	3	936	5,509	-----	-----	-----	POST BASIN B 24 HR

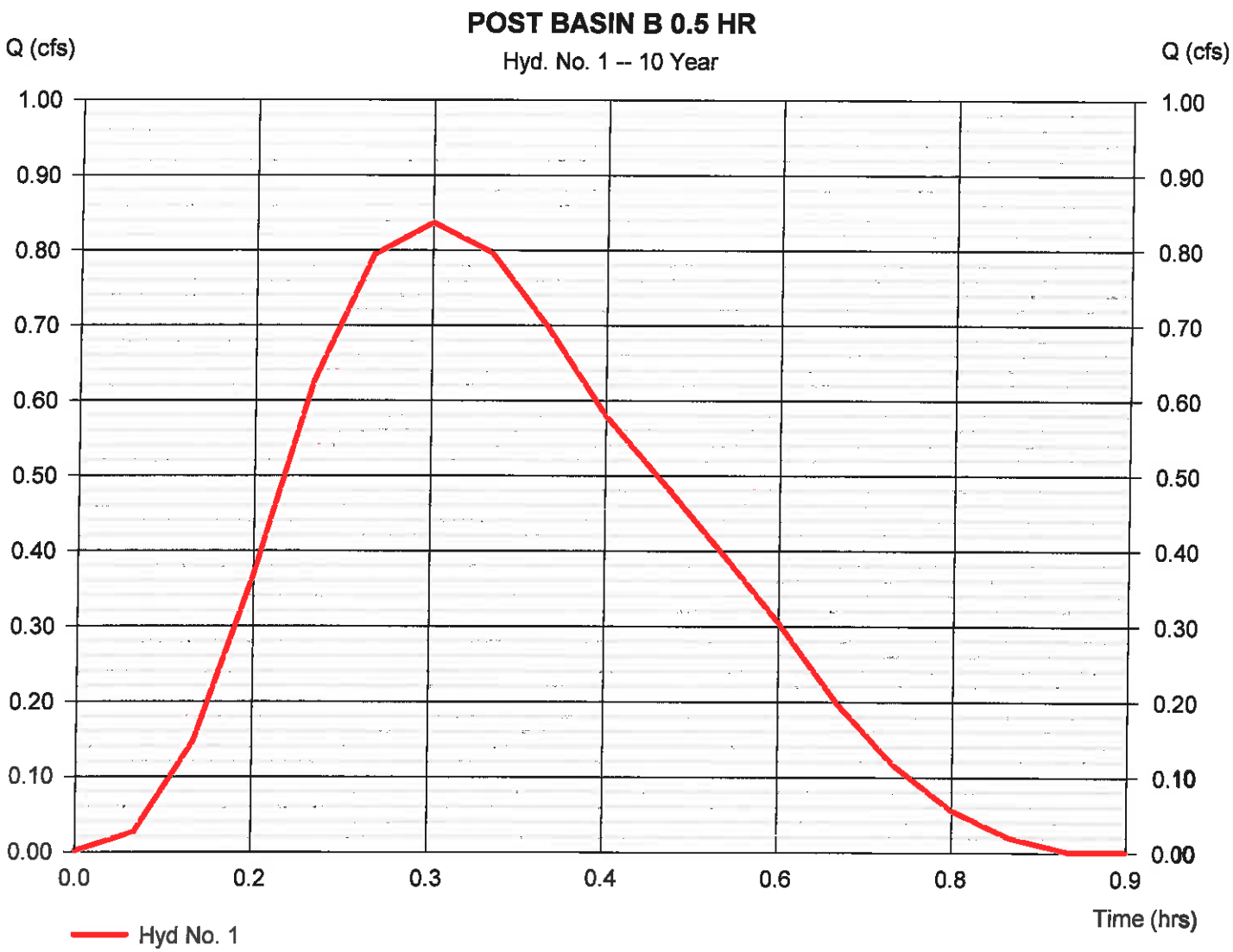
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 1

POST BASIN B 0.5 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.835 cfs
Storm frequency	= 10 yrs	Time to peak	= 0.30 hrs
Time interval	= 3 min	Hyd. volume	= 1,159 cuft
Drainage area	= 0.560 ac	Curve number	= 87
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.10 min
Total precip.	= 1.55 in	Distribution	= Huff-1st
Storm duration	= 0.50 hrs	Shape factor	= 484



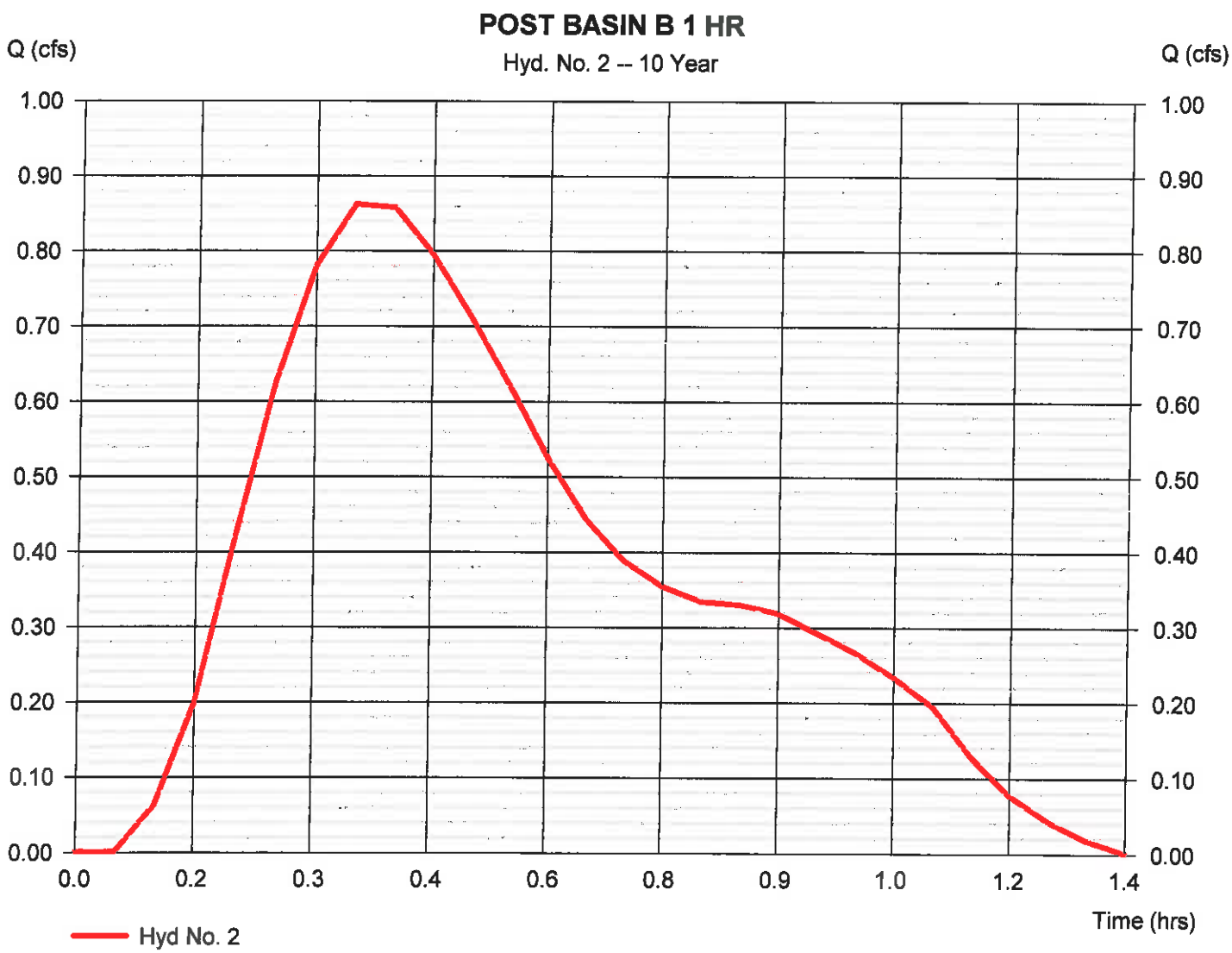
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 2

POST BASIN B 1 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.862 cfs
Storm frequency	= 10 yrs	Time to peak	= 0.35 hrs
Time interval	= 3 min	Hyd. volume	= 1,778 cuft
Drainage area	= 0.560 ac	Curve number	= 87
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.10 min
Total precip.	= 1.96 in	Distribution	= Huff-1st
Storm duration	= 1.00 hrs	Shape factor	= 484



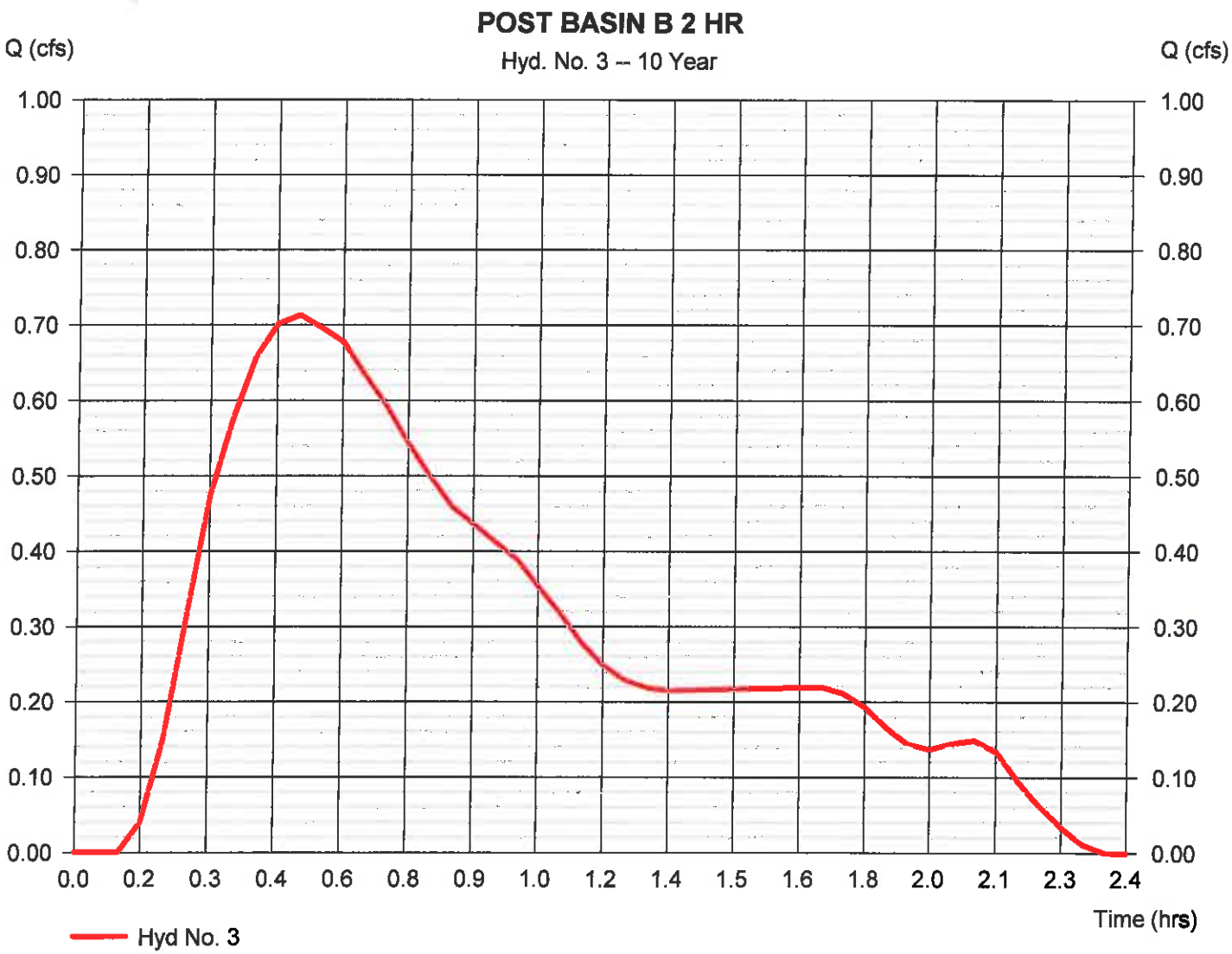
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 3

POST BASIN B 2 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.713 cfs
Storm frequency	= 10 yrs	Time to peak	= 0.50 hrs
Time interval	= 3 min	Hyd. volume	= 2,487 cuft
Drainage area	= 0.560 ac	Curve number	= 87
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.10 min
Total precip.	= 2.40 in	Distribution	= Huff-1st
Storm duration	= 2.00 hrs	Shape factor	= 484



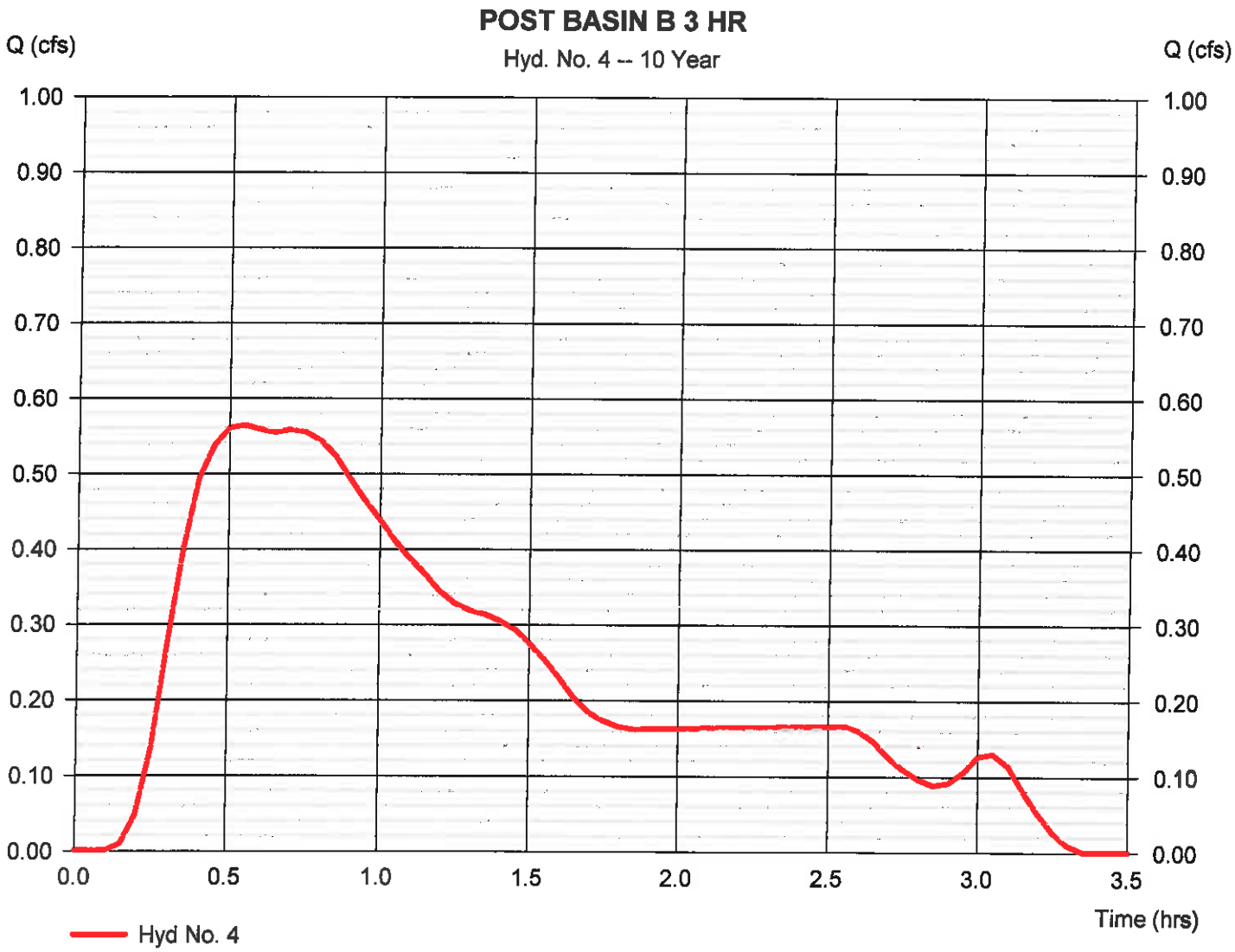
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 4

POST BASIN B 3 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.563 cfs
Storm frequency	= 10 yrs	Time to peak	= 0.55 hrs
Time interval	= 3 min	Hyd. volume	= 2,905 cuft
Drainage area	= 0.560 ac	Curve number	= 87
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.10 min
Total precip.	= 2.64 in	Distribution	= Huff-1st
Storm duration	= 3.00 hrs	Shape factor	= 484



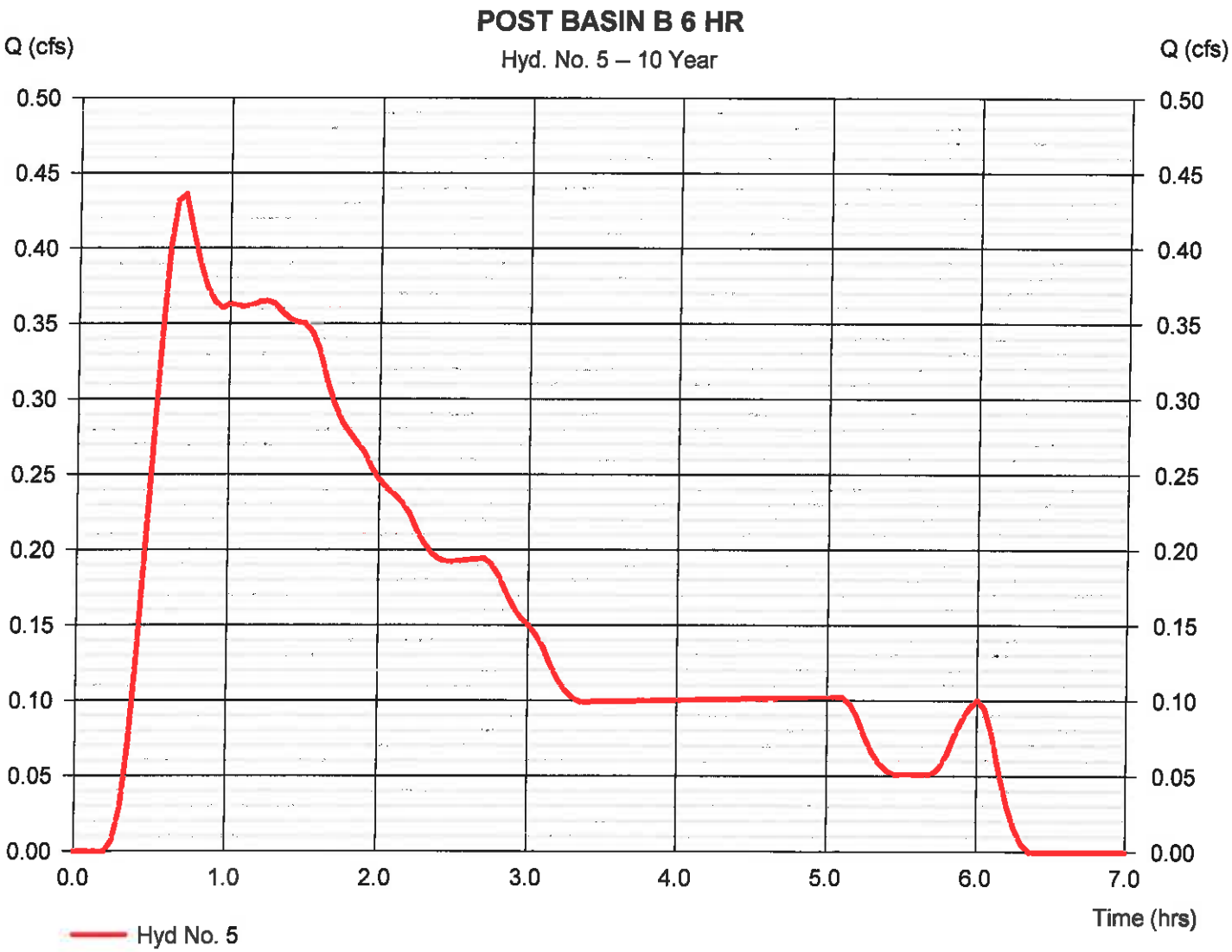
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 5

POST BASIN B 6 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.435 cfs
Storm frequency	= 10 yrs	Time to peak	= 0.70 hrs
Time interval	= 3 min	Hyd. volume	= 3,748 cuft
Drainage area	= 0.560 ac	Curve number	= 87
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.10 min
Total precip.	= 3.12 in	Distribution	= Huff-1st
Storm duration	= 6.00 hrs	Shape factor	= 484



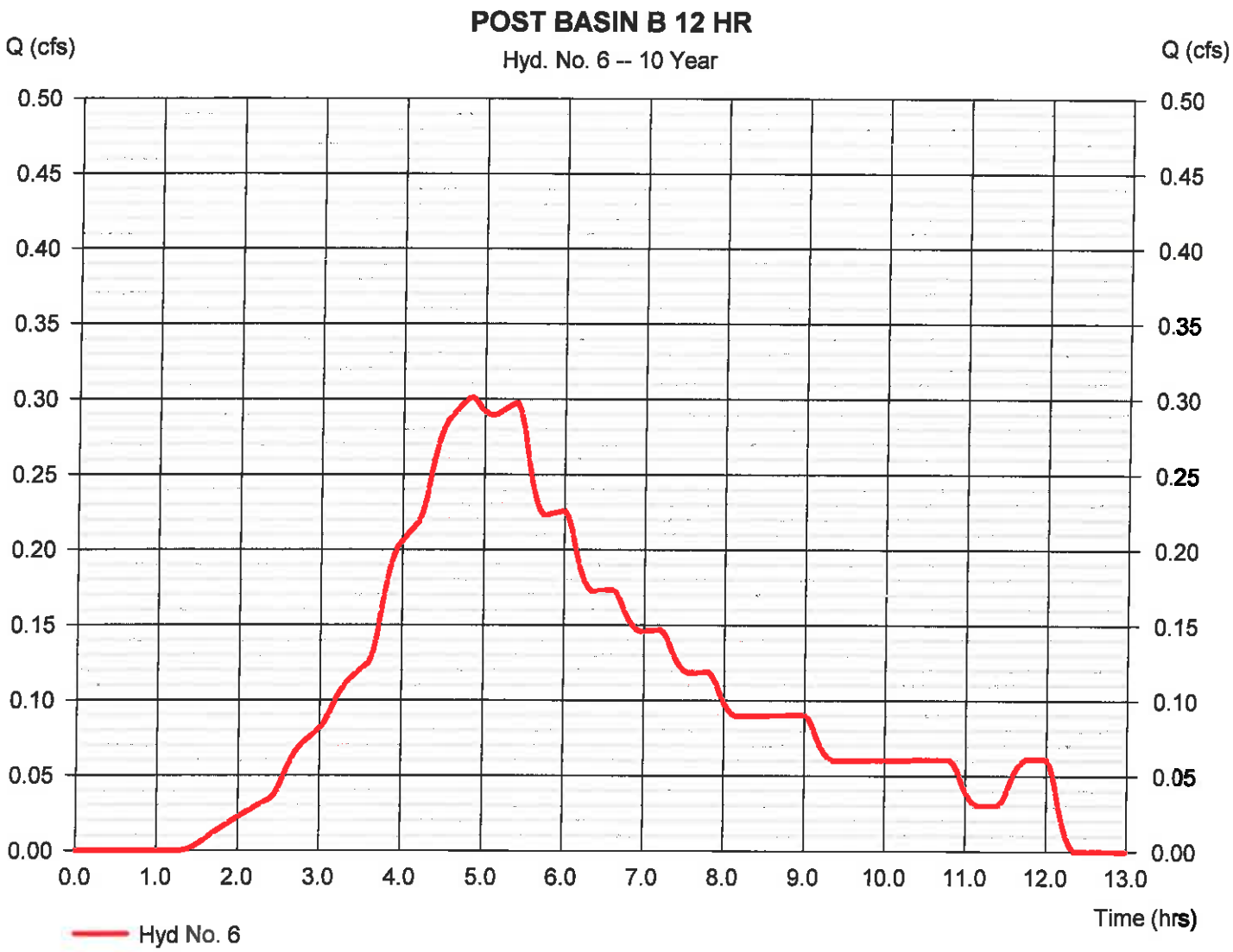
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 6

POST BASIN B 12 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.300 cfs
Storm frequency	= 10 yrs	Time to peak	= 4.85 hrs
Time interval	= 3 min	Hyd. volume	= 4,620 cuft
Drainage area	= 0.560 ac	Curve number	= 87
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.10 min
Total precip.	= 3.60 in	Distribution	= Huff-2nd
Storm duration	= 12.00 hrs	Shape factor	= 484



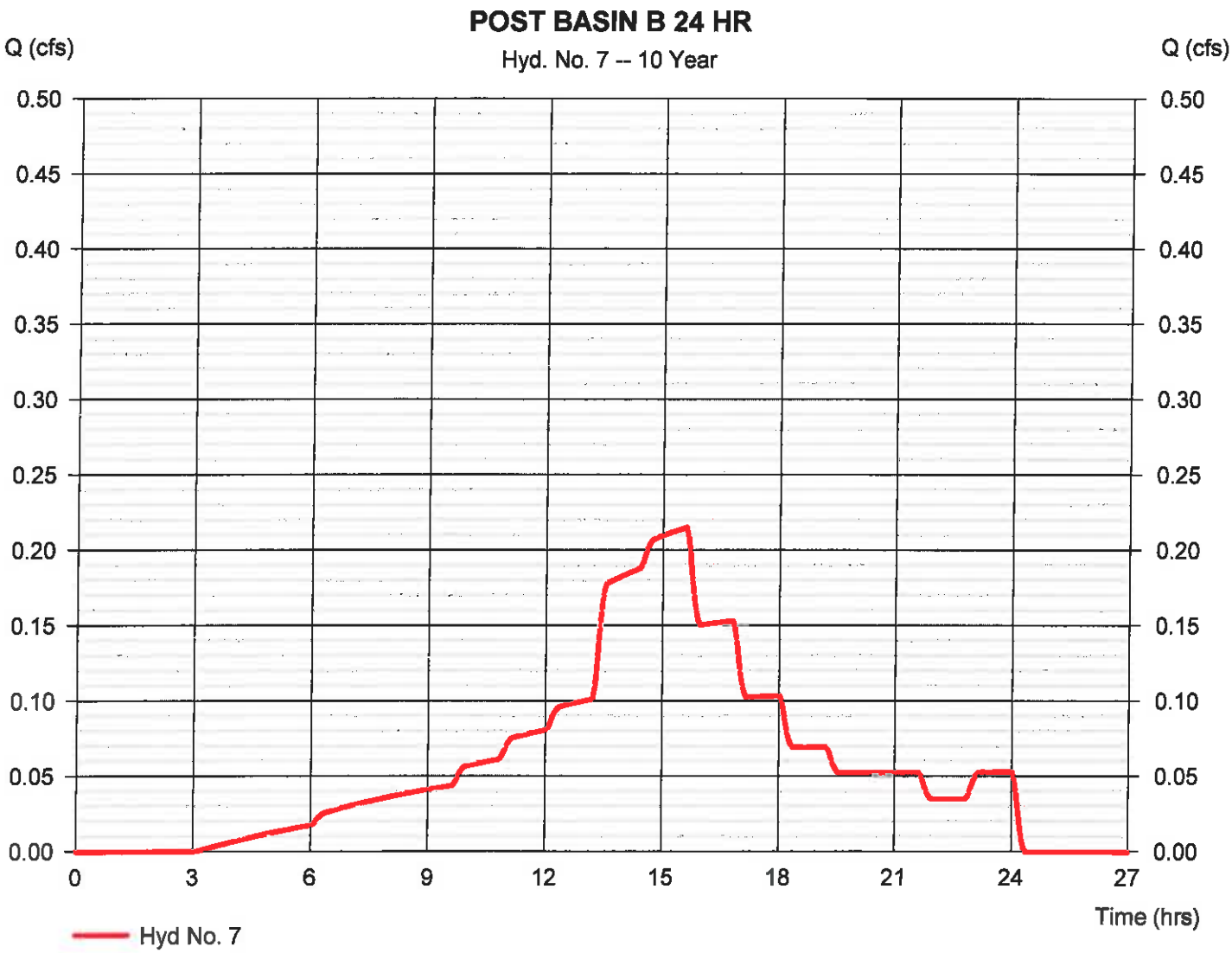
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 7

POST BASIN B 24 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.214 cfs
Storm frequency	= 10 yrs	Time to peak	= 15.60 hrs
Time interval	= 3 min	Hyd. volume	= 5,509 cuft
Drainage area	= 0.560 ac	Curve number	= 87
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.10 min
Total precip.	= 4.08 in	Distribution	= Huff-3rd
Storm duration	= 24.00 hrs	Shape factor	= 484



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

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	1.639	3	18	2,246	-----	-----	-----	POST BASIN B 0.5 HR
2	SCS Runoff	1.696	3	21	3,323	-----	-----	-----	POST BASIN B 1 HR
3	SCS Runoff	1.332	3	27	4,436	-----	-----	-----	POST BASIN B 2 HR
4	SCS Runoff	1.103	3	27	5,110	-----	-----	-----	POST BASIN B 3 HR
5	SCS Runoff	0.835	3	39	6,295	-----	-----	-----	POST BASIN B 6 HR
6	SCS Runoff	0.486	3	288	7,558	-----	-----	-----	POST BASIN B 12 HR
7	SCS Runoff	0.338	3	936	9,183	-----	-----	-----	POST BASIN B 24 HR

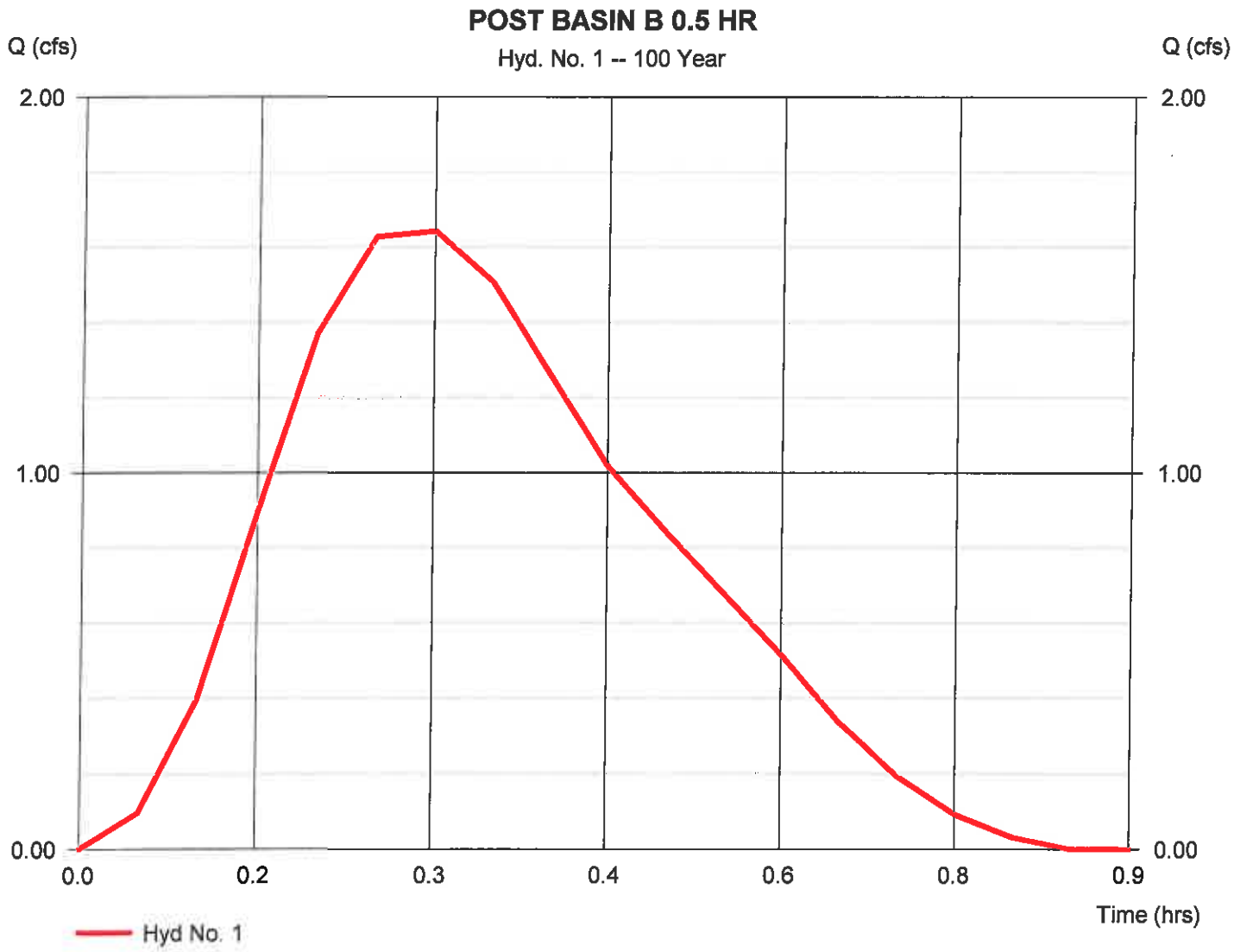
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 1

POST BASIN B 0.5 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 1.639 cfs
Storm frequency	= 100 yrs	Time to peak	= 0.30 hrs
Time interval	= 3 min	Hyd. volume	= 2,246 cuft
Drainage area	= 0.560 ac	Curve number	= 87
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.10 min
Total precip.	= 2.25 in	Distribution	= Huff-1st
Storm duration	= 0.50 hrs	Shape factor	= 484



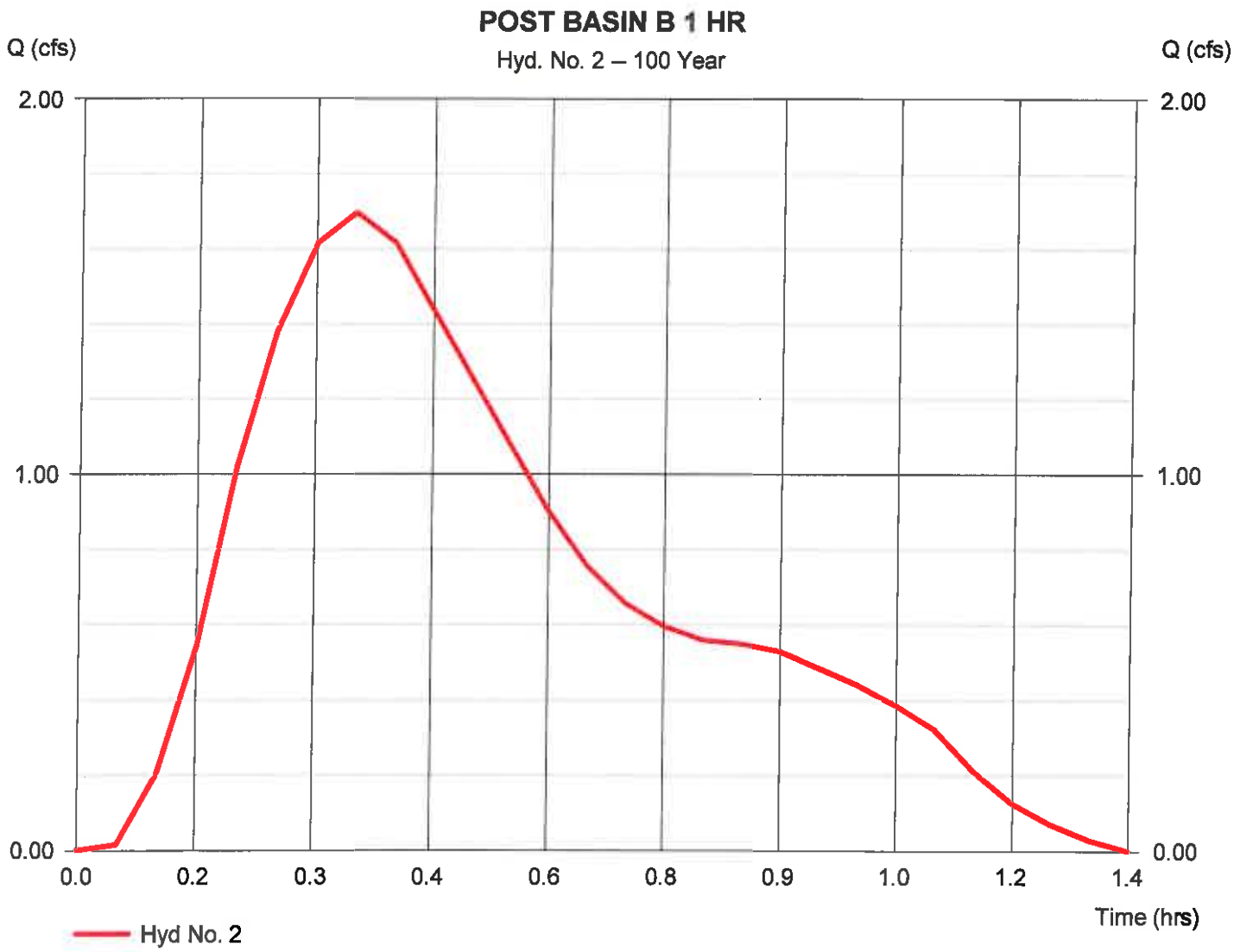
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 2

POST BASIN B 1 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 1.696 cfs
Storm frequency	= 100 yrs	Time to peak	= 0.35 hrs
Time interval	= 3 min	Hyd. volume	= 3,323 cuft
Drainage area	= 0.560 ac	Curve number	= 87
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.10 min
Total precip.	= 2.88 in	Distribution	= Huff-1st
Storm duration	= 1.00 hrs	Shape factor	= 484



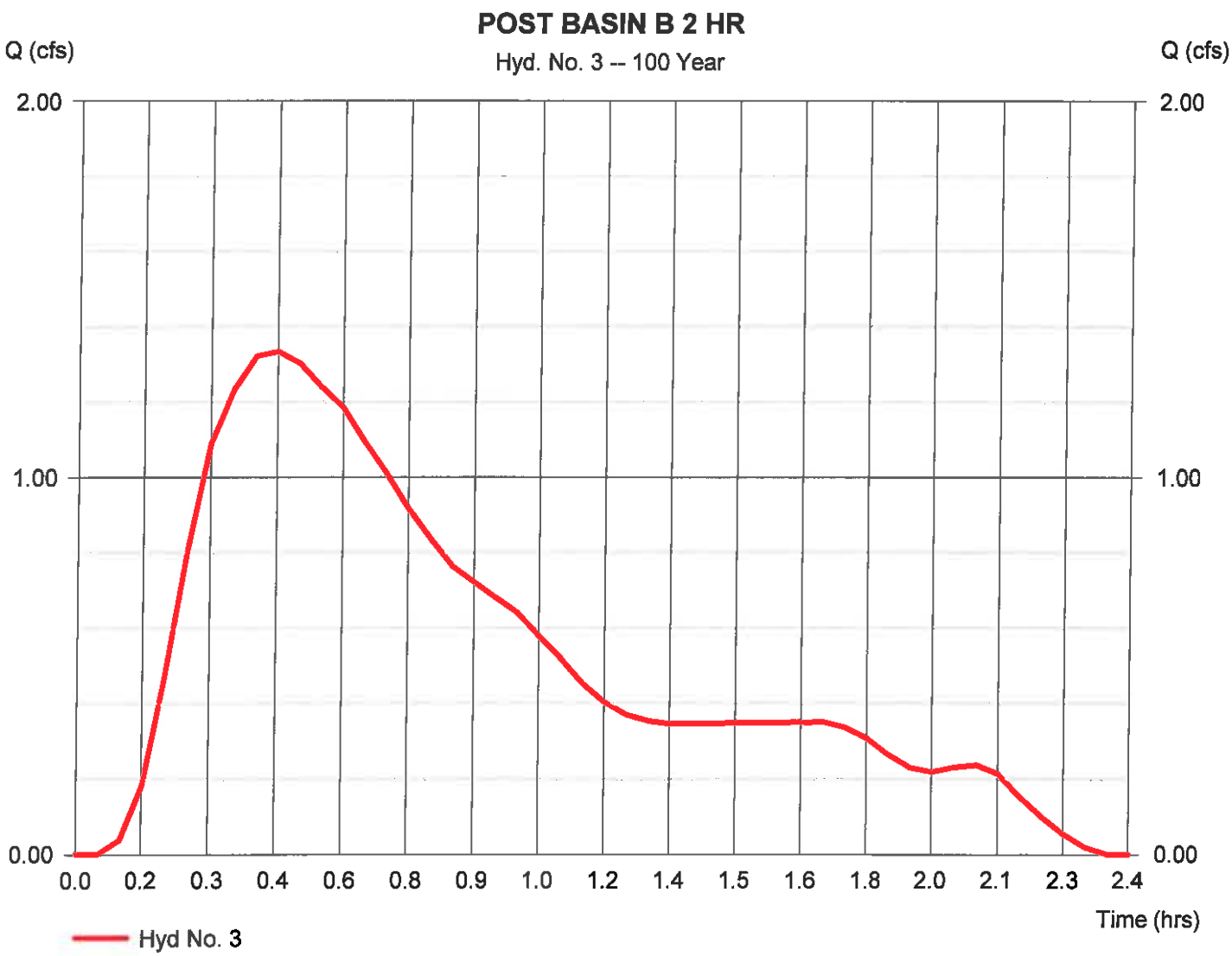
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 3

POST BASIN B 2 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 1.332 cfs
Storm frequency	= 100 yrs	Time to peak	= 0.45 hrs
Time interval	= 3 min	Hyd. volume	= 4,436 cuft
Drainage area	= 0.560 ac	Curve number	= 87
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.10 min
Total precip.	= 3.50 in	Distribution	= Huff-1st
Storm duration	= 2.00 hrs	Shape factor	= 484



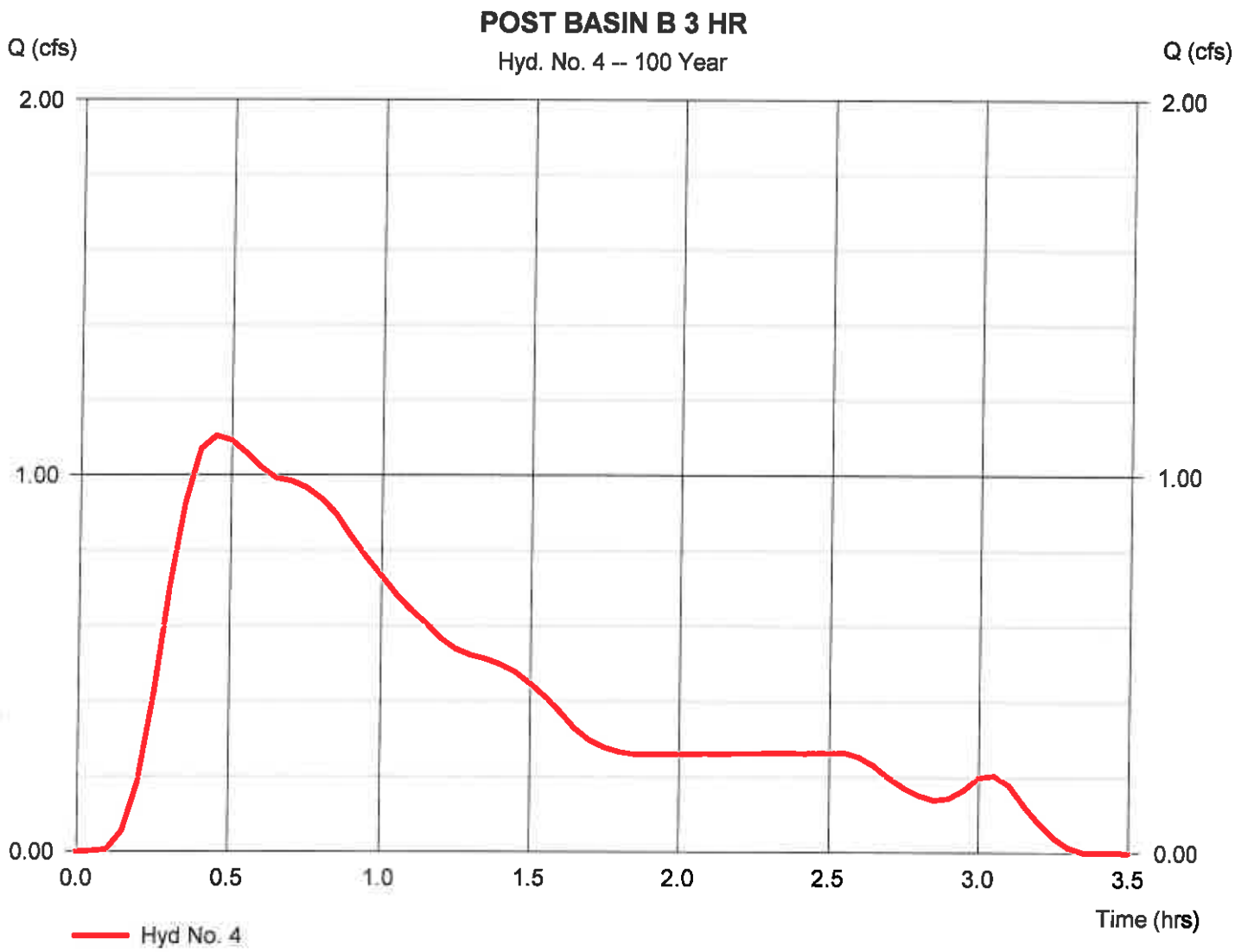
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 4

POST BASIN B 3 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 1.103 cfs
Storm frequency	= 100 yrs	Time to peak	= 0.45 hrs
Time interval	= 3 min	Hyd. volume	= 5,110 cuft
Drainage area	= 0.560 ac	Curve number	= 87
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.10 min
Total precip.	= 3.87 in	Distribution	= Huff-1st
Storm duration	= 3.00 hrs	Shape factor	= 484



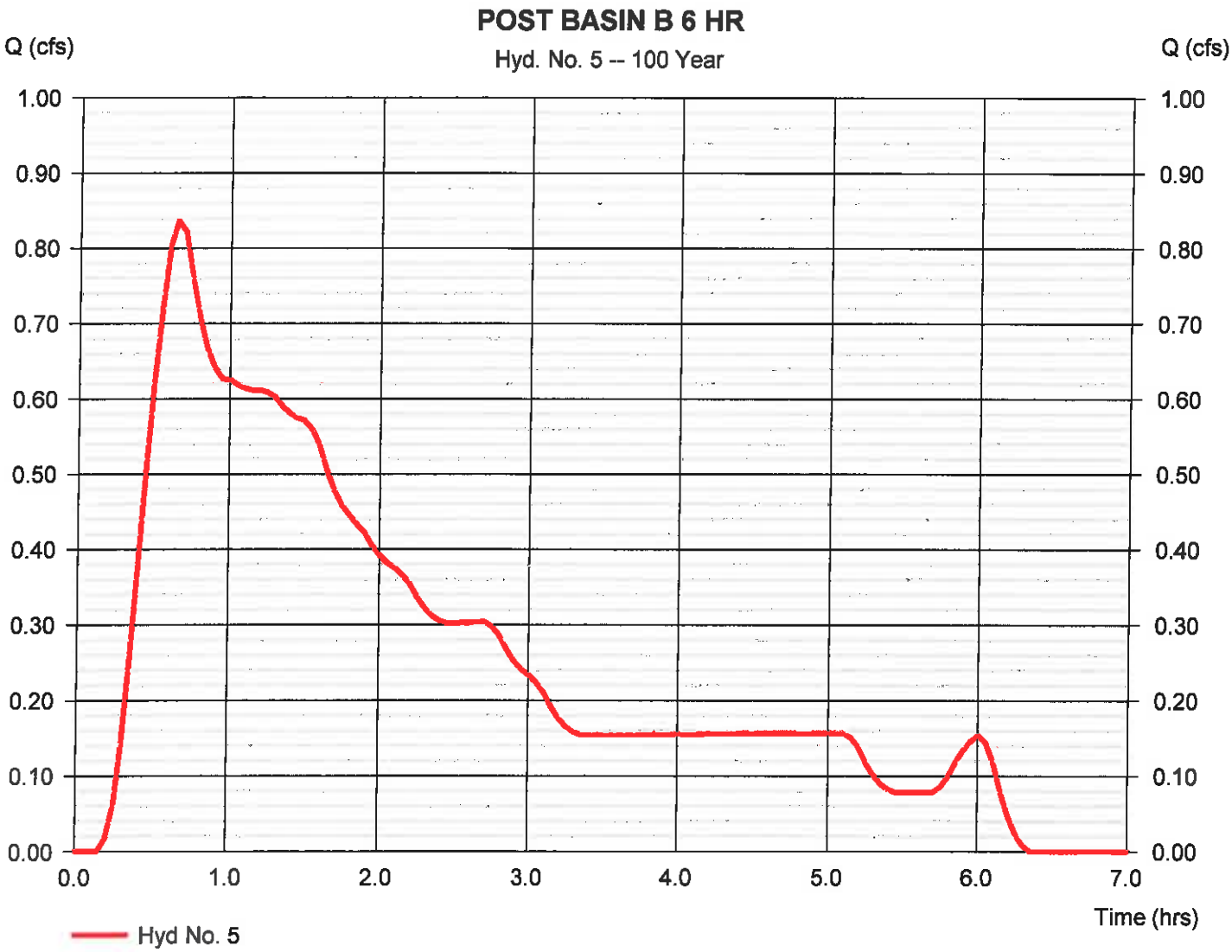
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 5

POST BASIN B 6 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.835 cfs
Storm frequency	= 100 yrs	Time to peak	= 0.65 hrs
Time interval	= 3 min	Hyd. volume	= 6,295 cuft
Drainage area	= 0.560 ac	Curve number	= 87
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.10 min
Total precip.	= 4.50 in	Distribution	= Huff-1st
Storm duration	= 6.00 hrs	Shape factor	= 484



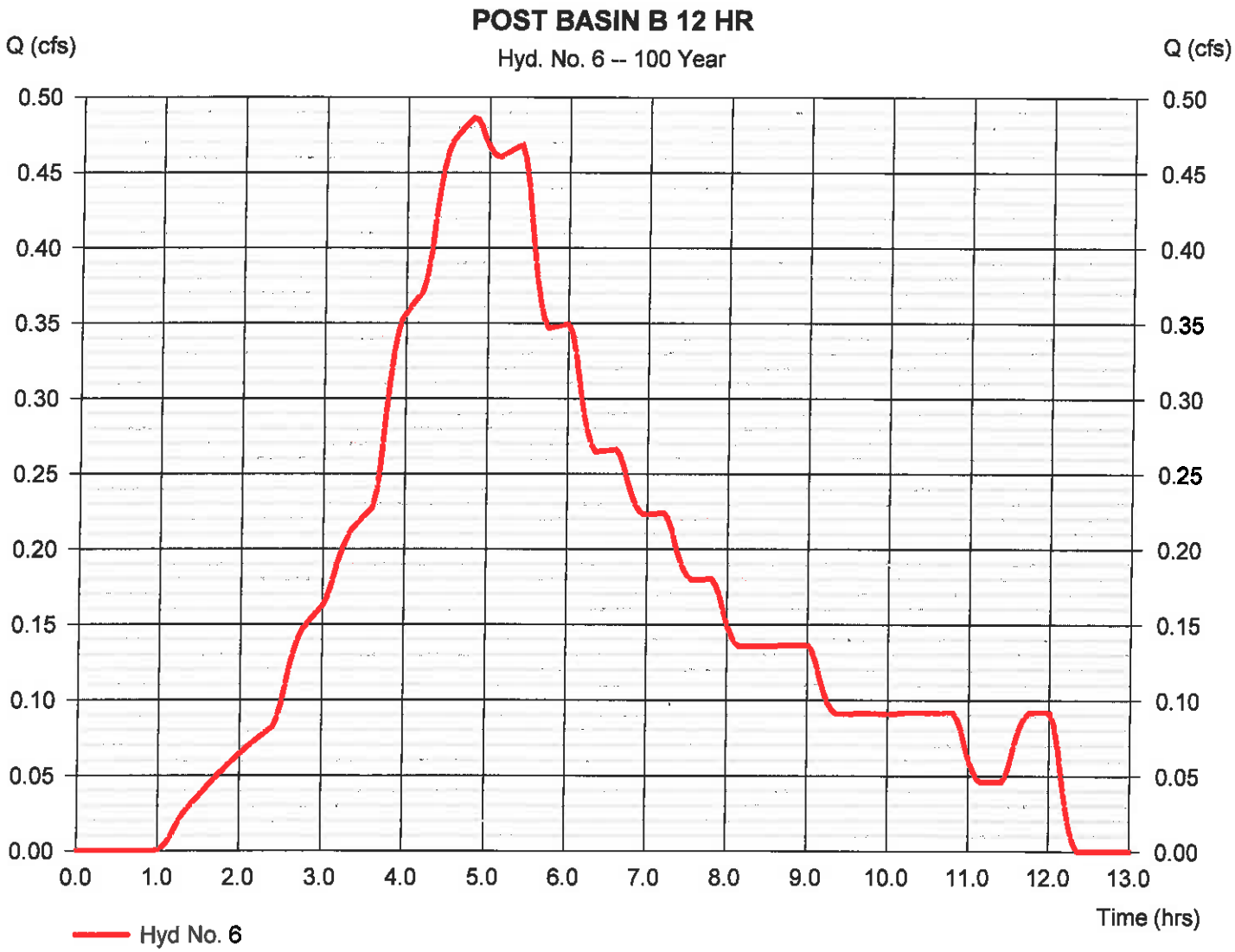
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 6

POST BASIN B 12 HR

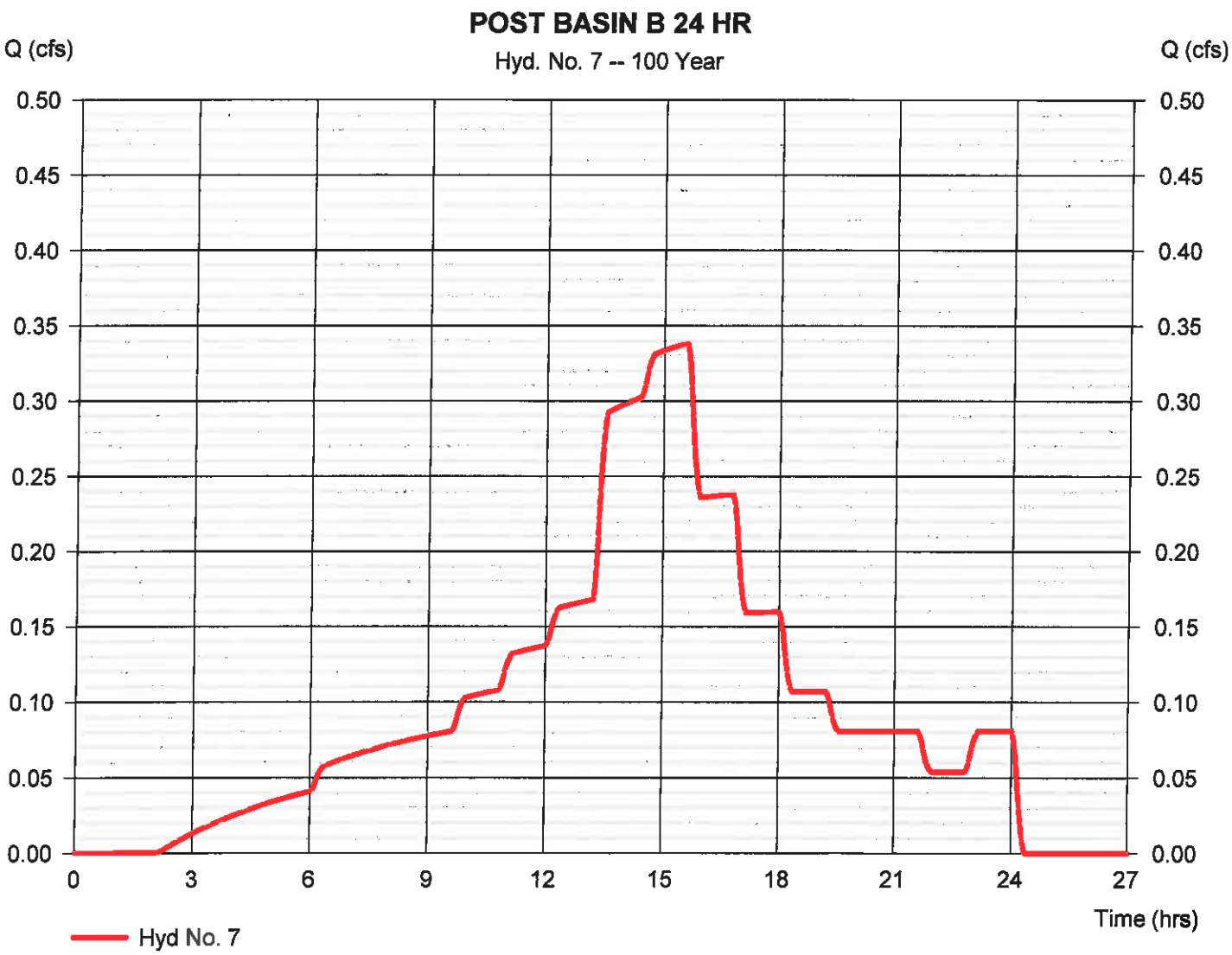
Hydrograph type	= SCS Runoff	Peak discharge	= 0.486 cfs
Storm frequency	= 100 yrs	Time to peak	= 4.80 hrs
Time interval	= 3 min	Hyd. volume	= 7,558 cuft
Drainage area	= 0.560 ac	Curve number	= 87
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.10 min
Total precip.	= 5.16 in	Distribution	= Huff-2nd
Storm duration	= 12.00 hrs	Shape factor	= 484



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 19 / 2015

Hyd. No. 7

POST BASIN B 24 HR

Hydrograph type	= SCS Runoff	Peak discharge	= 0.338 cfs
Storm frequency	= 100 yrs	Time to peak	= 15.60 hrs
Time interval	= 3 min	Hyd. volume	= 9,183 cuft
Drainage area	= 0.560 ac	Curve number	= 87
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 12.10 min
Total precip.	= 6.00 in	Distribution	= Huff-3rd
Storm duration	= 24.00 hrs	Shape factor	= 484