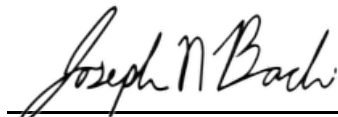


Stormwater Management Report

For

Tax Lot 24 Block 110
Borough of Keyport
Monmouth County, New Jersey

March 13, 2023

A handwritten signature in black ink, reading "Joseph N. Bachi". The signature is written in a cursive style with a horizontal line underneath it.

Joseph N. Bachi, PE
NJ License No. 24GE05325200
EKA Associates, P.A.
Project No. 844934

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STORMWATER MANAGEMENT NARRATIVE

APPENDIX A – FIGURES & REFERENCES

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Introduction

The subject of this report is a 0.34 acre site located at 105 NJ Route 35 in the Borough of Keyport, Monmouth County, New Jersey (Keyport Borough Tax Block 110, Lot 24). The site is bound to the north and west by a shopping center with an asphalt paved parking lot abutting the site, to the east by a multi-family residential complex, to the south and west by NJ Route 35.

The site is currently vacant and consists of grass covered open space with remnant concrete slab foundations of recently demolished buildings. The topography across the site varies from an elevation of approximately 103 feet at the southeast corner of the site to elevation of 99.5 feet at the northwest property line. The soils on site have been identified as Udorthents, consisting of loam and loamy sand and have a Hydrologic Soil Group Ratings of 'D.'

The proposed development consists of construction of a one-story commercial building with a 14-space parking lot with ancillary site improvements such as grading, walkways, and lighting.

Existing Hydraulic Conditions

The hydrologic analysis of the existing conditions was modeled using one drainage area encompassing the entire site, as shown on the enclosed Existing Drainage Area Map. The runoff generated on site currently flows overland to the north towards an existing neighboring parking lot. The point of analysis is identified at POA-1.

Proposed Hydraulic Conditions

Under proposed conditions, new commercial building with an asphalt paved parking lot will be constructed. Runoff from the proposed parking lot will be collected and detained in a proposed subgrade stone matrix reservoir. Runoff from the proposed building will flow overland undetained. All runoff will be routed to POA-1.

The development will result in an on-site land disturbance of 0.34 acres and a total net increase in impervious cover of 0.15 acres. Based on these parameters, this project is not classified as major development and is therefore exempt from the enhanced stormwater regulations promulgated by the State of New Jersey. However, in order to mitigate any potential adverse impacts from the new impervious surfaces, a stormwater management design has been prepared to ensure that no adjacent property is negatively impacted by this development. The intent of this analysis is to retain (or reduce) all pre-development runoff discharge rates to all points of analyses in the post-development condition.

The hydrologic analysis of the proposed conditions was modeled using a single drainage area (PD-1), separated into two sub-drainage areas representing the undetained runoff (PD-1U) and the detained runoff (PD-1D), as shown on the enclosed Proposed Drainage Area Map. PD-1 is complimentary to ED-1.

Methodology & Quantity Control

The stormwater runoff associated with the existing and proposed conditions is calculated utilizing the Modified Rational Method with Hydraflow Hydrographs software.

Peak discharges for the pre and post developed drainage areas were calculated using the following runoff coefficients in accordance with NJDEP standards.

Type of Surface	Hydrologic “D” Soils
Impervious	0.99
Grass/Open Space	0.65

The stormwater runoff generated by a majority of the proposed parking lot is to be collected via inlets and routed to the proposed stone matrix reservoir. The runoff collected in the reservoir is collected by a 6-inch diameter perforated PVC underdrain pipe, routed through a Type E inlet, and metered out with a 6-inch orifice to a proposed scour hole. The system does not rely on infiltration and any storage volume associated with the stone bedding of the systems has been ignored since this area cannot drain via gravity.

The stormwater runoff discharge to the point of analysis has been reduced in the post development condition, as shown in the summary table below.

Total Site Runoff

Storm Event	Existing Discharge (cfs)	Proposed Discharge (cfs)
2	0.974	0.757
10	1.307	0.910
100	1.720	1.269

APPENDIX A

FIGURES & REFERENCES

Soil Map—Monmouth County, New Jersey



MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features



Blowout



Borrow Pit



Clay Spot



Closed Depression



Gravel Pit



Gravelly Spot



Landfill



Lava Flow



Marsh or swamp



Mine or Quarry



Miscellaneous Water



Perennial Water



Rock Outcrop



Saline Spot



Sandy Spot



Severely Eroded Spot



Sinkhole



Slide or Slip



Sodic Spot



Spoil Area



Stony Spot



Very Stony Spot



Wet Spot



Other



Special Line Features

Water Features



Streams and Canals

Transportation



Rails



Interstate Highways



US Routes



Major Roads



Local Roads

Background



Aerial Photography

MAP INFORMATION

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

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

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

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

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Monmouth County, New Jersey

Survey Area Data: Version 16, Aug 30, 2022

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

Date(s) aerial images were photographed: Sep 14, 2020—Oct 8, 2020

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
UdaB	Udorthents, 0 to 8 percent slopes	0.4	100.0%
Totals for Area of Interest		0.4	100.0%

Monmouth County, New Jersey

UdaB—Udorthents, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 1j1jk

Elevation: 400 to 1,500 feet

Mean annual precipitation: 30 to 64 inches

Mean annual air temperature: 46 to 79 degrees F

Frost-free period: 131 to 178 days

Farmland classification: Not prime farmland

Map Unit Composition

Udorthents and similar soils: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents

Setting

Landform: Low hills

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Fill and/or disturbed original soil material

Typical profile

A - 0 to 12 inches: loam

C - 12 to 72 inches: loamy sand

Properties and qualities

Slope: 0 to 8 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Very low

Capacity of the most limiting layer to transmit water

(Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water supply, 0 to 60 inches: Moderate (about 6.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3w

Hydrologic Soil Group: D

Hydric soil rating: No

Data Source Information

Soil Survey Area: Monmouth County, New Jersey
Survey Area Data: Version 16, Aug 30, 2022



NOAA Atlas 14, Volume 2, Version 3
Location name: Keyport, New Jersey, USA*
Latitude: 40.4245°, Longitude: -74.1972°
Elevation: m/ft**
* source: ESRI Maps
** source: USGS



POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M. Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

[PF_tabular](#) | [PF_graphical](#) | [Maps & aerals](#)

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour) ¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	4.02 (3.62-4.46)	4.80 (4.33-5.33)	5.69 (5.12-6.32)	6.35 (5.70-7.04)	7.19 (6.43-7.97)	7.78 (6.91-8.60)	8.35 (7.39-9.28)	8.89 (7.82-9.90)	9.58 (8.33-10.7)	10.1 (8.71-11.3)
10-min	3.21 (2.90-3.56)	3.85 (3.47-4.27)	4.57 (4.11-5.07)	5.09 (4.57-5.65)	5.72 (5.11-6.34)	6.18 (5.49-6.85)	6.63 (5.87-7.36)	7.04 (6.19-7.83)	7.56 (6.58-8.45)	7.94 (6.85-8.90)
15-min	2.68 (2.42-2.97)	3.22 (2.90-3.57)	3.84 (3.46-4.27)	4.28 (3.84-4.75)	4.83 (4.32-5.36)	5.21 (4.63-5.78)	5.58 (4.94-6.20)	5.92 (5.20-6.58)	6.34 (5.51-7.09)	6.64 (5.72-7.45)
30-min	1.83 (1.66-2.04)	2.22 (2.00-2.47)	2.73 (2.46-3.03)	3.10 (2.78-3.44)	3.57 (3.19-3.96)	3.92 (3.48-4.34)	4.27 (3.78-4.74)	4.60 (4.04-5.11)	5.03 (4.38-5.63)	5.36 (4.63-6.02)
60-min	1.14 (1.03-1.27)	1.39 (1.26-1.55)	1.75 (1.58-1.94)	2.02 (1.81-2.24)	2.38 (2.13-2.64)	2.65 (2.36-2.94)	2.94 (2.60-3.26)	3.22 (2.83-3.59)	3.61 (3.14-4.04)	3.91 (3.38-4.39)
2-hr	0.702 (0.631-0.783)	0.856 (0.770-0.953)	1.09 (0.976-1.21)	1.26 (1.13-1.41)	1.51 (1.34-1.68)	1.71 (1.51-1.90)	1.92 (1.68-2.13)	2.13 (1.86-2.37)	2.43 (2.09-2.72)	2.67 (2.28-3.00)
3-hr	0.517 (0.467-0.576)	0.630 (0.570-0.703)	0.802 (0.722-0.893)	0.934 (0.839-1.04)	1.12 (0.999-1.24)	1.27 (1.13-1.41)	1.43 (1.26-1.59)	1.60 (1.39-1.77)	1.83 (1.57-2.04)	2.01 (1.71-2.26)
6-hr	0.332 (0.298-0.372)	0.404 (0.363-0.451)	0.511 (0.458-0.569)	0.598 (0.534-0.665)	0.723 (0.639-0.803)	0.827 (0.727-0.917)	0.938 (0.816-1.04)	1.06 (0.911-1.18)	1.23 (1.04-1.37)	1.37 (1.15-1.54)
12-hr	0.200 (0.180-0.224)	0.243 (0.218-0.272)	0.309 (0.277-0.345)	0.365 (0.325-0.407)	0.447 (0.395-0.497)	0.518 (0.454-0.575)	0.595 (0.515-0.661)	0.680 (0.581-0.757)	0.806 (0.676-0.899)	0.914 (0.754-1.02)
24-hr	0.115 (0.105-0.128)	0.140 (0.127-0.155)	0.180 (0.163-0.199)	0.214 (0.194-0.237)	0.266 (0.239-0.293)	0.312 (0.278-0.343)	0.363 (0.320-0.398)	0.420 (0.366-0.461)	0.506 (0.434-0.556)	0.580 (0.490-0.640)
2-day	0.067 (0.061-0.075)	0.081 (0.074-0.091)	0.104 (0.094-0.116)	0.124 (0.112-0.138)	0.153 (0.137-0.170)	0.178 (0.158-0.197)	0.205 (0.181-0.228)	0.236 (0.205-0.262)	0.281 (0.241-0.313)	0.319 (0.270-0.357)
3-day	0.047 (0.043-0.052)	0.058 (0.052-0.063)	0.074 (0.067-0.081)	0.087 (0.079-0.096)	0.107 (0.096-0.117)	0.123 (0.111-0.136)	0.142 (0.126-0.156)	0.162 (0.143-0.179)	0.192 (0.167-0.212)	0.217 (0.186-0.241)
4-day	0.038 (0.035-0.041)	0.046 (0.042-0.050)	0.058 (0.053-0.064)	0.068 (0.063-0.075)	0.084 (0.076-0.091)	0.096 (0.087-0.105)	0.110 (0.099-0.120)	0.125 (0.111-0.137)	0.147 (0.129-0.161)	0.166 (0.144-0.182)
7-day	0.025 (0.023-0.027)	0.030 (0.028-0.033)	0.038 (0.035-0.041)	0.044 (0.041-0.048)	0.053 (0.049-0.057)	0.061 (0.055-0.066)	0.069 (0.062-0.074)	0.078 (0.070-0.084)	0.090 (0.080-0.098)	0.101 (0.088-0.110)
10-day	0.020 (0.018-0.021)	0.024 (0.022-0.026)	0.029 (0.027-0.031)	0.034 (0.031-0.036)	0.040 (0.037-0.043)	0.045 (0.042-0.049)	0.051 (0.047-0.055)	0.057 (0.052-0.062)	0.066 (0.059-0.071)	0.073 (0.064-0.079)
20-day	0.013 (0.013-0.014)	0.016 (0.015-0.017)	0.019 (0.018-0.020)	0.021 (0.020-0.023)	0.025 (0.023-0.026)	0.027 (0.026-0.029)	0.030 (0.028-0.032)	0.033 (0.030-0.035)	0.037 (0.033-0.039)	0.040 (0.036-0.042)
30-day	0.011 (0.010-0.012)	0.013 (0.012-0.014)	0.015 (0.015-0.016)	0.017 (0.016-0.018)	0.019 (0.018-0.021)	0.021 (0.020-0.022)	0.023 (0.022-0.024)	0.025 (0.023-0.026)	0.027 (0.025-0.029)	0.029 (0.026-0.031)
45-day	0.009 (0.009-0.010)	0.011 (0.010-0.012)	0.013 (0.012-0.013)	0.014 (0.013-0.015)	0.016 (0.015-0.017)	0.017 (0.016-0.018)	0.018 (0.017-0.019)	0.020 (0.018-0.021)	0.021 (0.020-0.022)	0.022 (0.021-0.024)
60-day	0.008 (0.008-0.009)	0.010 (0.009-0.010)	0.011 (0.011-0.012)	0.012 (0.012-0.013)	0.014 (0.013-0.014)	0.015 (0.014-0.015)	0.016 (0.015-0.016)	0.017 (0.016-0.017)	0.018 (0.017-0.019)	0.018 (0.017-0.019)

¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.
Please refer to NOAA Atlas 14 document for more information.

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PF graphical

Table 5-3: Runoff Coefficients for the Rational Method

Land Use	Description	Hydrologic Soils Group			
		A	B	C	D
Cultivated Land	without conservation treatment	0.49	0.67	0.81	0.88
	with conservation treatment	0.27	0.43	0.67	0.67
Pasture or Range Land Meadow	poor condition	0.38	0.63	0.78	0.84
	good condition	---	0.25	0.51	0.65
	good condition	---	---	0.41	0.61
Wood or Forest Land	thin stand, poor cover, no mulch	---	0.34	0.59	0.70
	good cover	---	---	0.45	0.59
Open Spaces, Lawns, Parks, Golf Courses, Cemeteries Good Condition Fair Condition	grass cover on 75% or more	---	0.25	0.51	0.65
	grass cover on 50% to 75%	---	0.45	0.63	0.74
Commercial and Business Area	85% impervious	0.84	0.90	0.93	0.96
Industrial Districts	72% impervious	0.67	0.81	0.88	0.92
Residential Average Lot Size (acres)	average % impervious				
1/8	65	0.59	0.76	0.86	0.90
1/4	38	0.29	0.55	0.70	0.80
1/3	30	---	0.49	0.67	0.78
1/2	25	---	0.45	0.65	0.76
1	20	---	0.41	0.63	0.74
Paved Areas	parking lots, roofs, driveways, etc.	0.99	0.99	0.99	0.99
Streets and Roads	paved with curbs & storm sewers	0.99	0.99	0.99	0.99
	gravel	0.57	0.76	0.84	0.88
	dirt	0.49	0.69	0.80	0.84

Source: New Jersey Department of Environmental Protection, Land Use Management Program. 1988. Technical Manual for Land Use Regulation Program, Bureau of Inland and Coastal Regulations, NJDEP Flood Hazard Area Permits.

Drainage Area Size and Land Cover Limitations

As previously mentioned on Page 9, there are some basic assumptions when applying the Rational Method. The maximum size limit for a drainage area is 20 ac. The drainage area must also have homogeneous land cover and topography, meaning the same runoff coefficient and slope apply to the entire drainage area. Furthermore, the rainfall distribution on a drainage area is assumed to be uniform over the entire drainage area.

APPENDIX B

HYDRAFLOW CALCULATIONS

Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

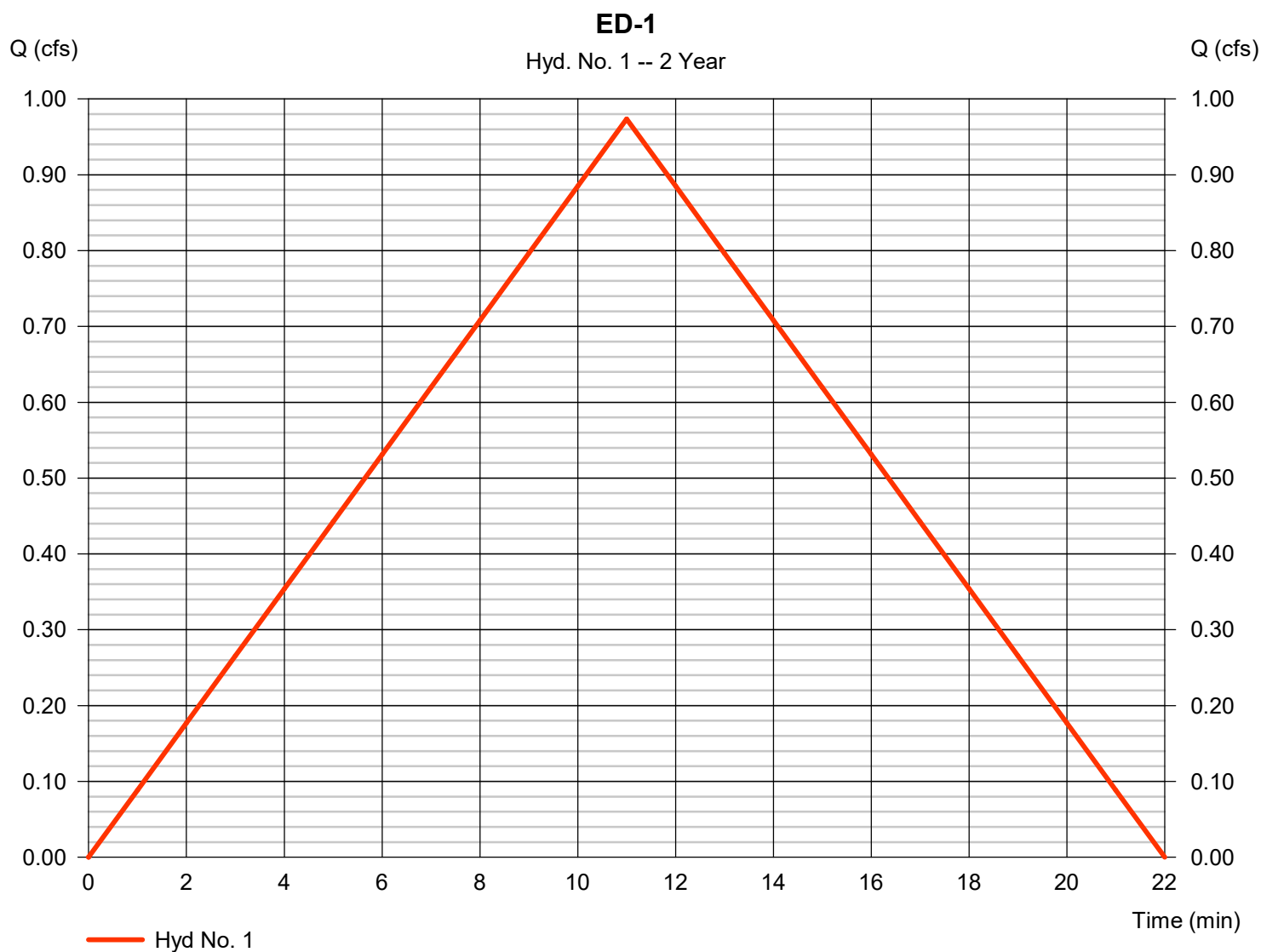
Monday, 03 / 13 / 2023

Hyd. No. 1

ED-1

Hydrograph type	= Rational	Peak discharge	= 0.974 cfs
Storm frequency	= 2 yrs	Time to peak	= 11 min
Time interval	= 1 min	Hyd. volume	= 643 cuft
Drainage area	= 0.340 ac	Runoff coeff.	= 0.77*
Intensity	= 3.719 in/hr	Tc by TR55	= 11.00 min
IDF Curve	= keyport.IDF	Asc/Rec limb fact	= 1/1

* Composite (Area/C) = $[(0.120 \times 0.99) + (0.220 \times 0.65)] / 0.340$



Hydrograph Report

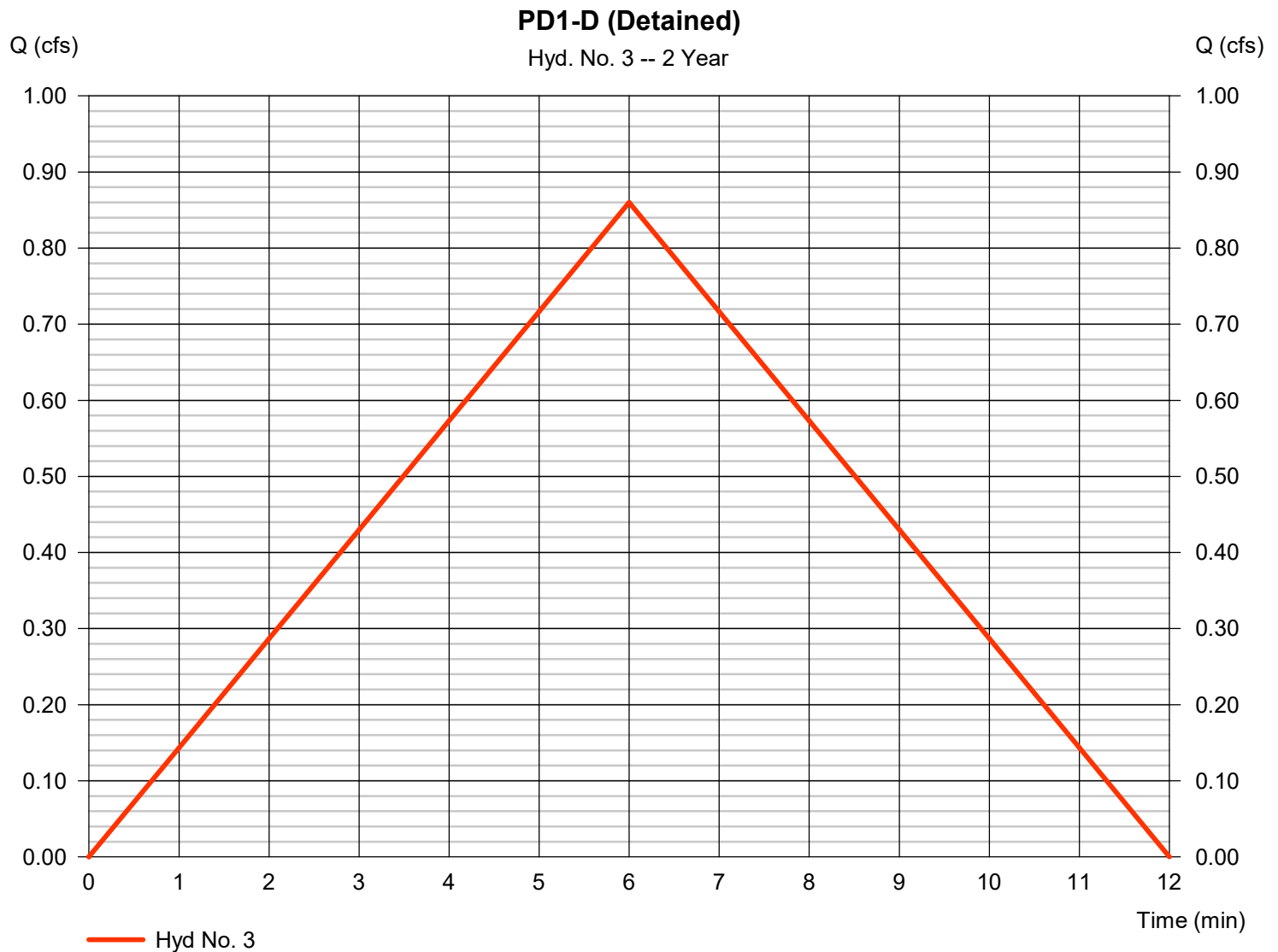
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Monday, 03 / 13 / 2023

Hyd. No. 3

PD1-D (Detained)

Hydrograph type	= Rational	Peak discharge	= 0.860 cfs
Storm frequency	= 2 yrs	Time to peak	= 6 min
Time interval	= 1 min	Hyd. volume	= 310 cuft
Drainage area	= 0.190 ac	Runoff coeff.	= 0.99
Intensity	= 4.572 in/hr	Tc by User	= 6.00 min
IDF Curve	= keyport.IDF	Asc/Rec limb fact	= 1/1



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

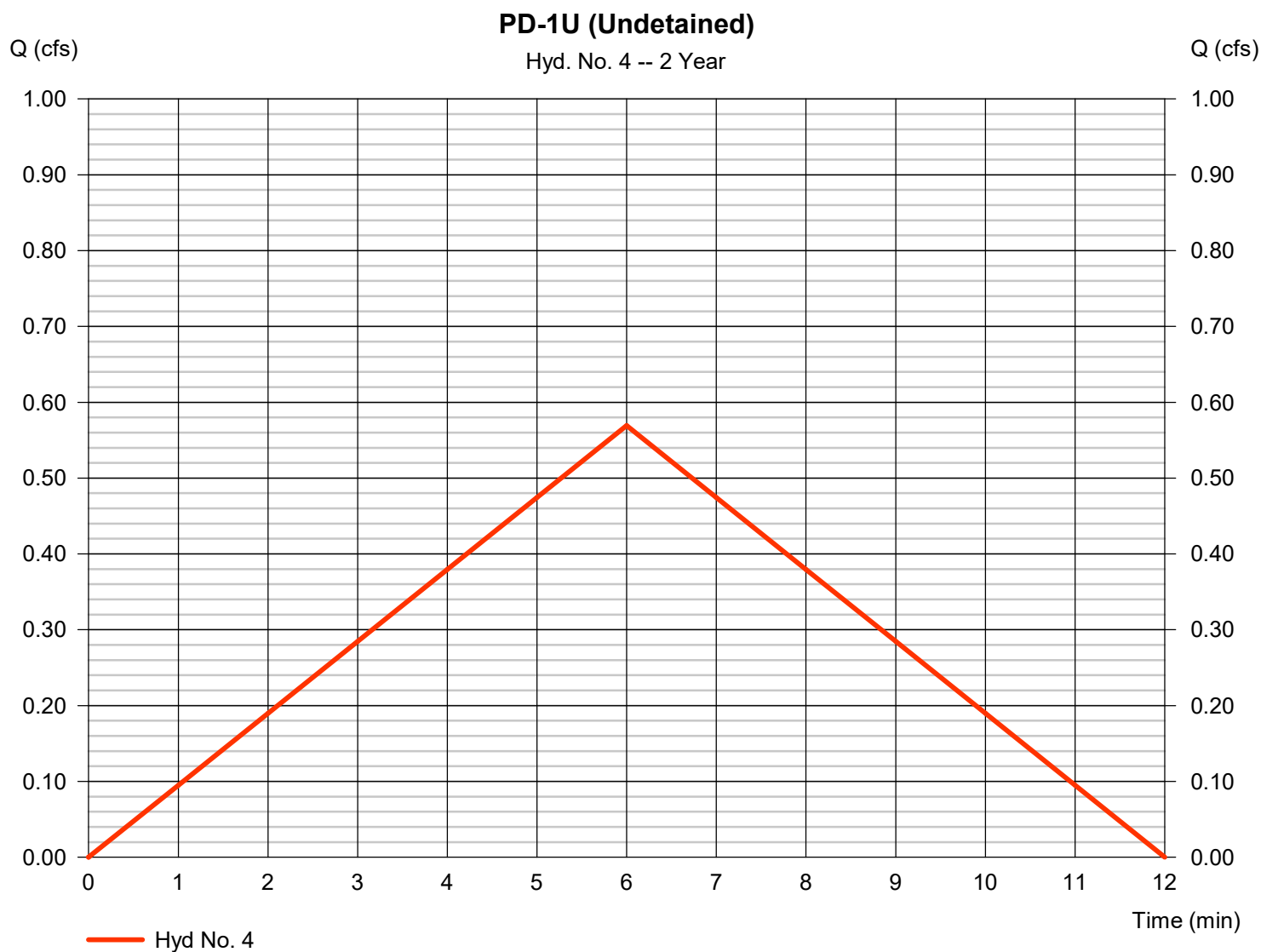
Monday, 03 / 13 / 2023

Hyd. No. 4

PD-1U (Undetained)

Hydrograph type	= Rational	Peak discharge	= 0.569 cfs
Storm frequency	= 2 yrs	Time to peak	= 6 min
Time interval	= 1 min	Hyd. volume	= 205 cuft
Drainage area	= 0.150 ac	Runoff coeff.	= 0.83*
Intensity	= 4.572 in/hr	Tc by User	= 6.00 min
IDF Curve	= keyport.IDF	Asc/Rec limb fact	= 1/1

* Composite (Area/C) = $[(0.080 \times 0.99) + (0.070 \times 0.65)] / 0.150$

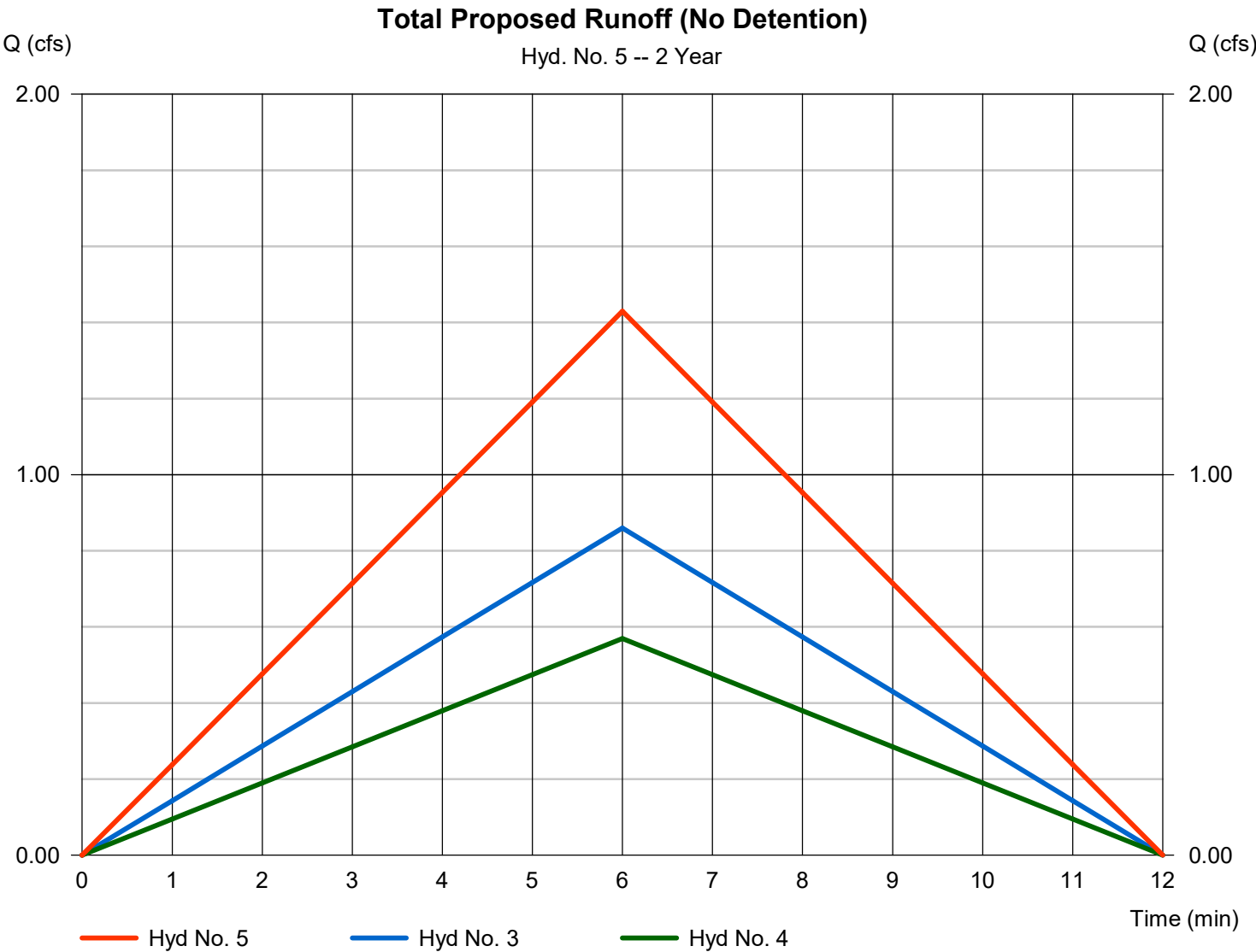


Hydrograph Report

Hyd. No. 5

Total Proposed Runoff (No Detention)

Hydrograph type	= Combine	Peak discharge	= 1.429 cfs
Storm frequency	= 2 yrs	Time to peak	= 6 min
Time interval	= 1 min	Hyd. volume	= 515 cuft
Inflow hyds.	= 3, 4	Contrib. drain. area	= 0.340 ac

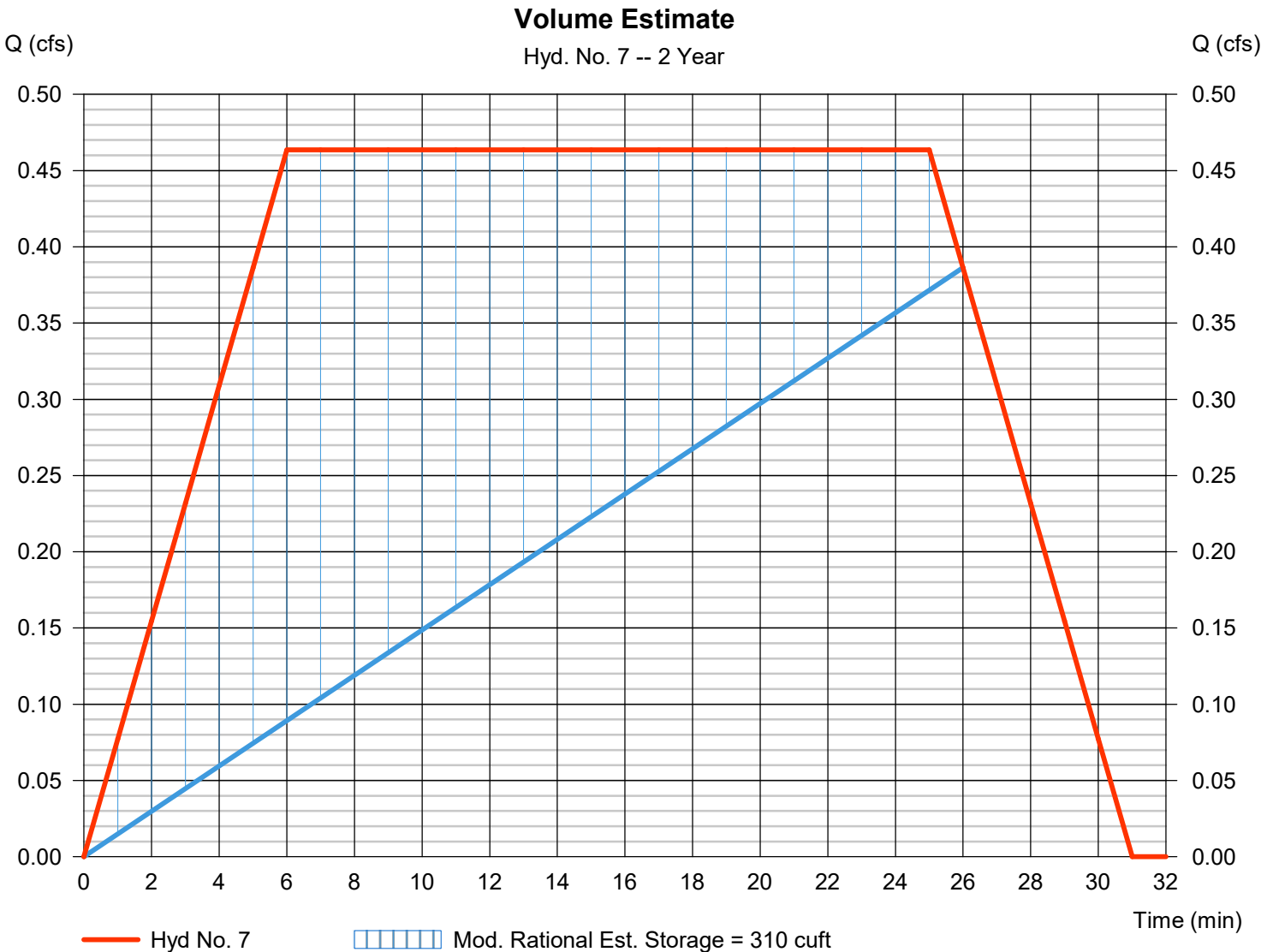


Hydrograph Report

Hyd. No. 7

Volume Estimate

Hydrograph type	= Mod. Rational	Peak discharge	= 0.464 cfs
Storm frequency	= 2 yrs	Time to peak	= 6 min
Time interval	= 1 min	Hyd. volume	= 701 cuft
Drainage area	= 0.190 ac	Runoff coeff.	= 0.99
Intensity	= 2.465 in/hr	Tc by User	= 6.00 min
IDF Curve	= keyport.IDF	Storm duration	= 4.2 x Tc
Target Q	=0.405 cfs	Est. Req'd Storage	=310 cuft



Hydrograph Report

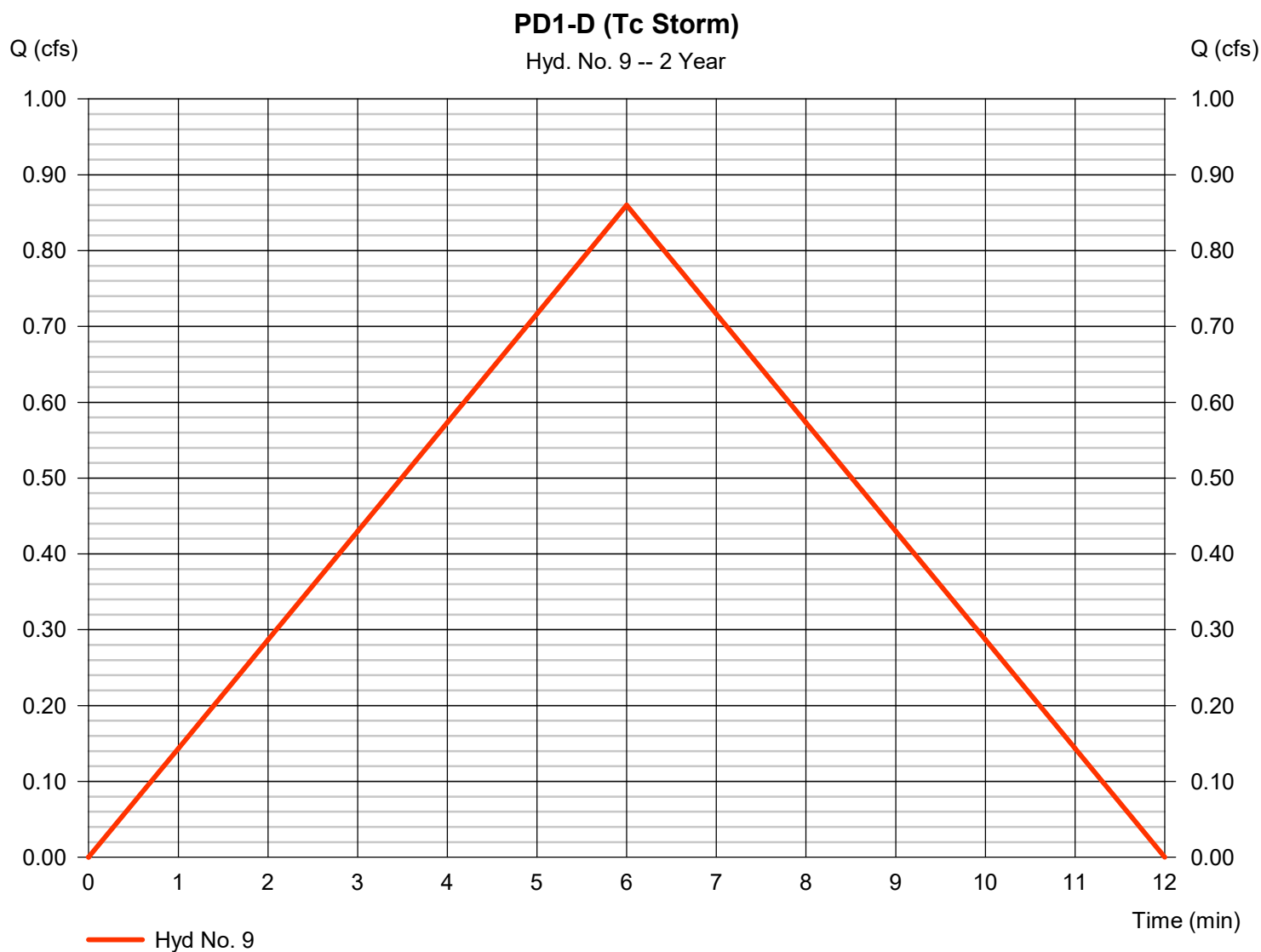
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Monday, 03 / 13 / 2023

Hyd. No. 9

PD1-D (Tc Storm)

Hydrograph type	= Rational	Peak discharge	= 0.860 cfs
Storm frequency	= 2 yrs	Time to peak	= 6 min
Time interval	= 1 min	Hyd. volume	= 310 cuft
Drainage area	= 0.190 ac	Runoff coeff.	= 0.99
Intensity	= 4.572 in/hr	Tc by User	= 6.00 min
IDF Curve	= keyport.IDF	Asc/Rec limb fact	= 1/1

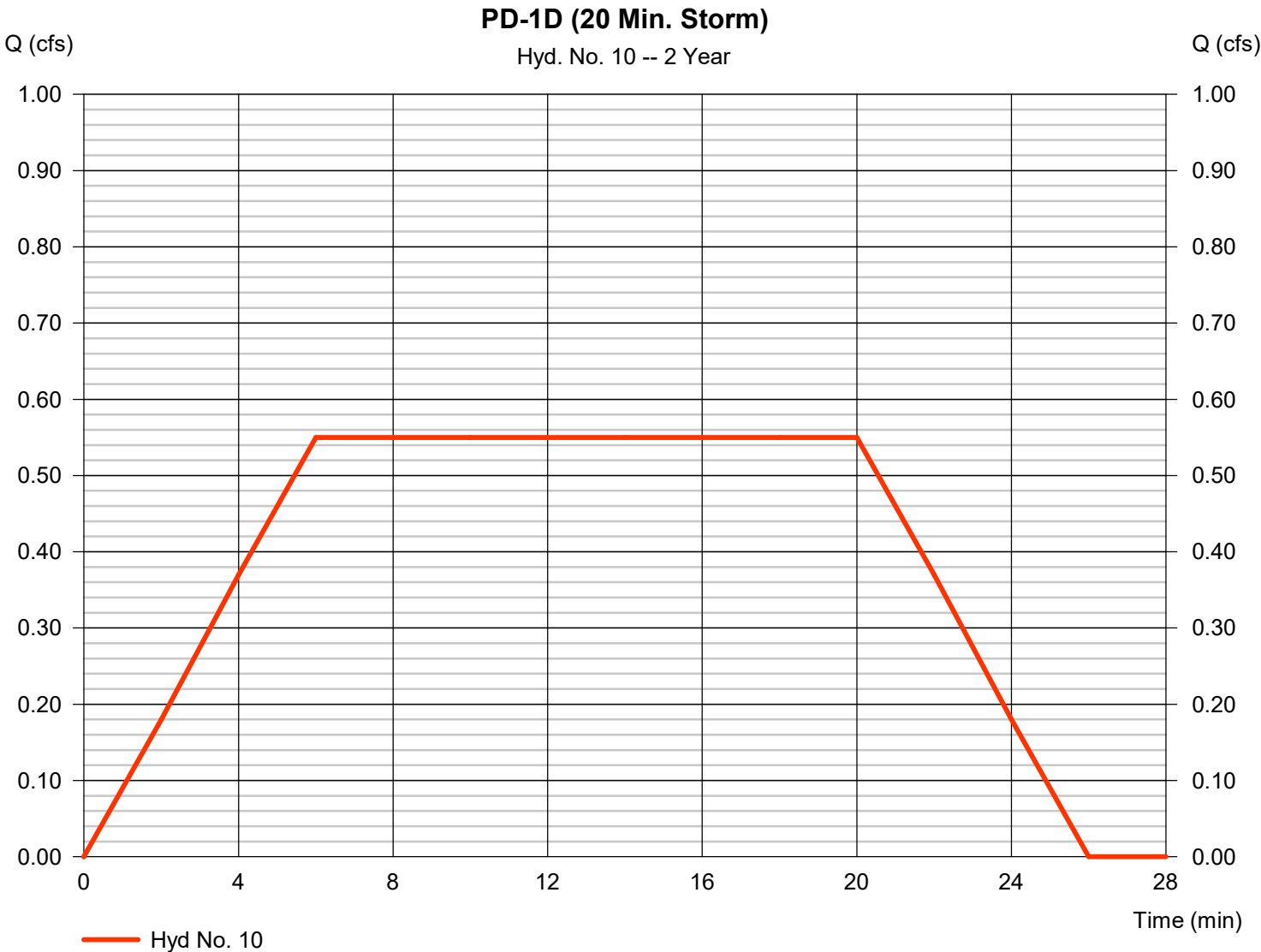


Hydrograph Report

Hyd. No. 10

PD-1D (20 Min. Storm)

Hydrograph type	= Manual	Peak discharge	= 0.550 cfs
Storm frequency	= 2 yrs	Time to peak	= 6 min
Time interval	= 2 min	Hyd. volume	= 660 cuft

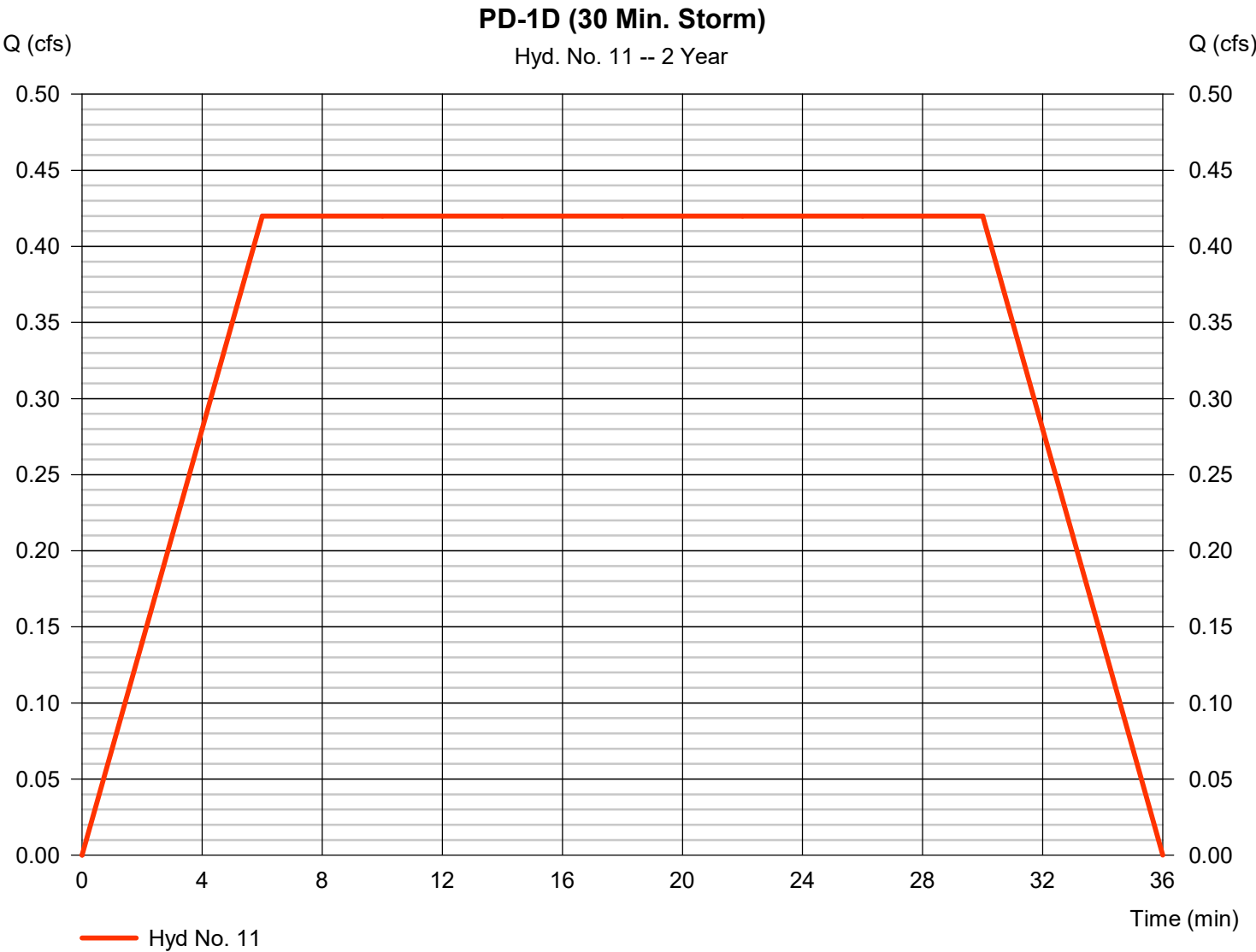


Hydrograph Report

Hyd. No. 11

PD-1D (30 Min. Storm)

Hydrograph type	= Manual	Peak discharge	= 0.420 cfs
Storm frequency	= 2 yrs	Time to peak	= 6 min
Time interval	= 2 min	Hyd. volume	= 756 cuft



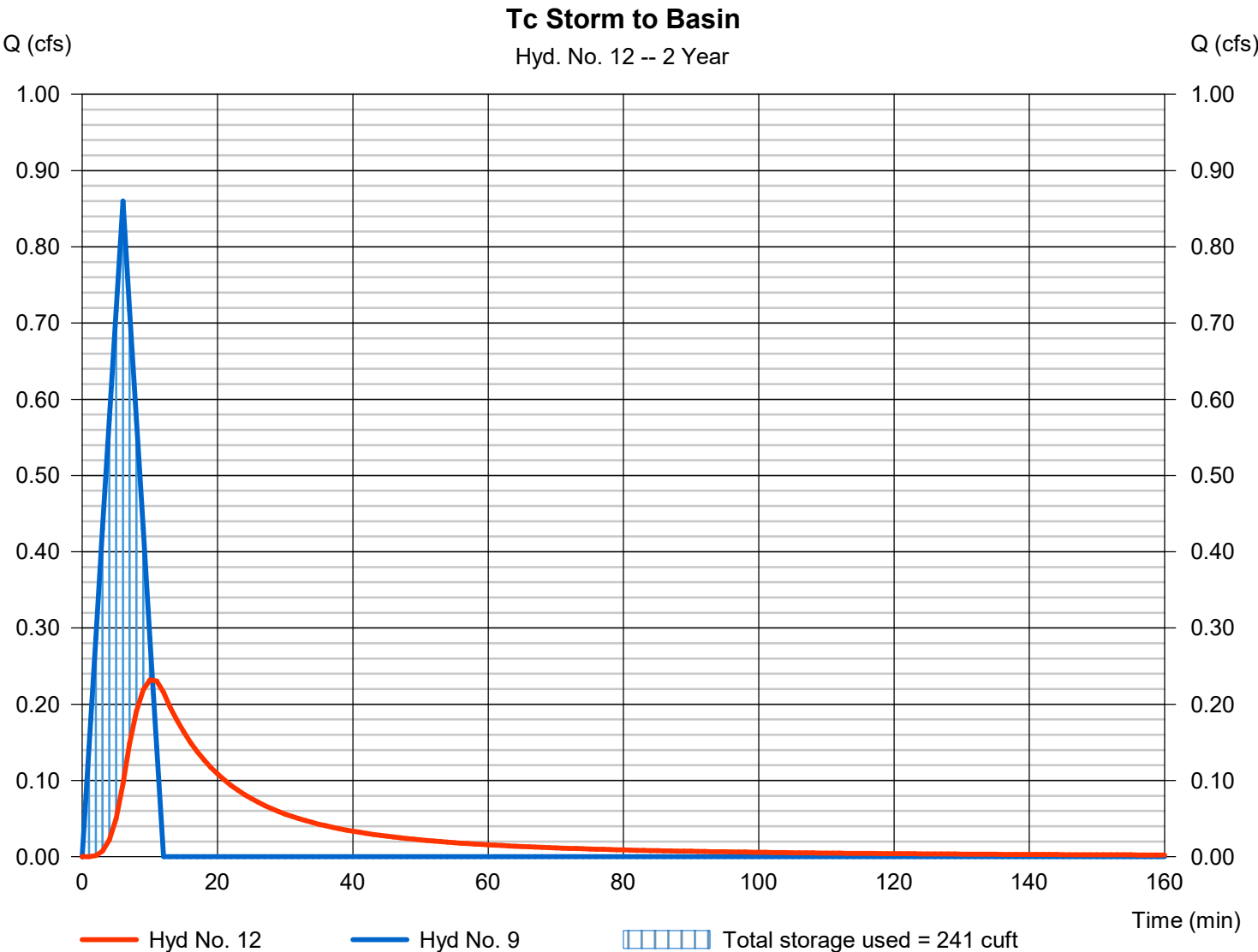
Hydrograph Report

Hyd. No. 12

Tc Storm to Basin

Hydrograph type	= Reservoir	Peak discharge	= 0.232 cfs
Storm frequency	= 2 yrs	Time to peak	= 10 min
Time interval	= 1 min	Hyd. volume	= 296 cuft
Inflow hyd. No.	= 9 - PD1-D (Tc Storm)	Max. Elevation	= 100.25 ft
Reservoir name	= Stone Reservoir	Max. Storage	= 241 cuft

Storage Indication method used.



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

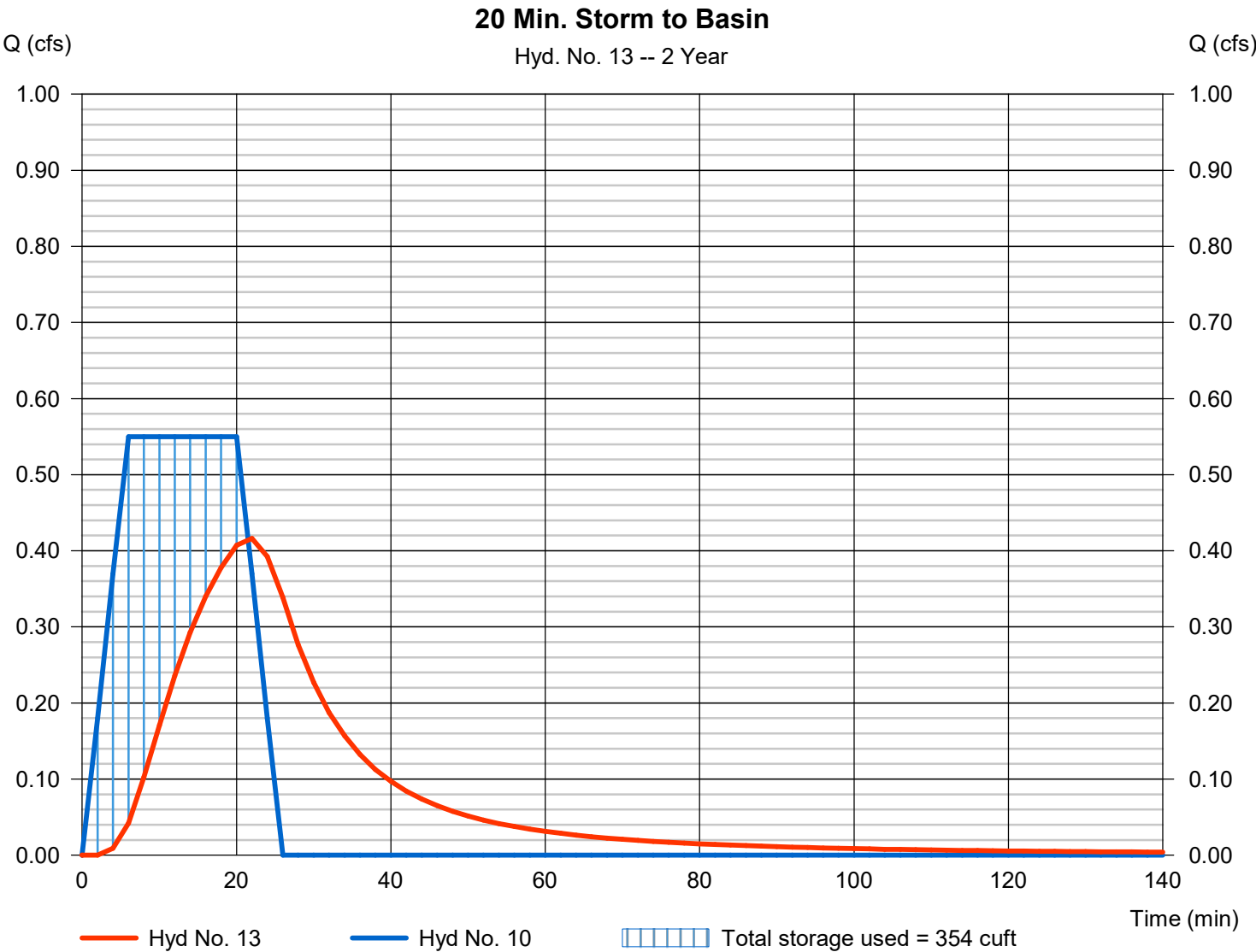
Monday, 03 / 13 / 2023

Hyd. No. 13

20 Min. Storm to Basin

Hydrograph type	= Reservoir	Peak discharge	= 0.416 cfs
Storm frequency	= 2 yrs	Time to peak	= 22 min
Time interval	= 2 min	Hyd. volume	= 646 cuft
Inflow hyd. No.	= 10 - PD-1D (20 Min. Storm)	Max. Elevation	= 100.40 ft
Reservoir name	= Stone Reservoir	Max. Storage	= 354 cuft

Storage Indication method used.



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

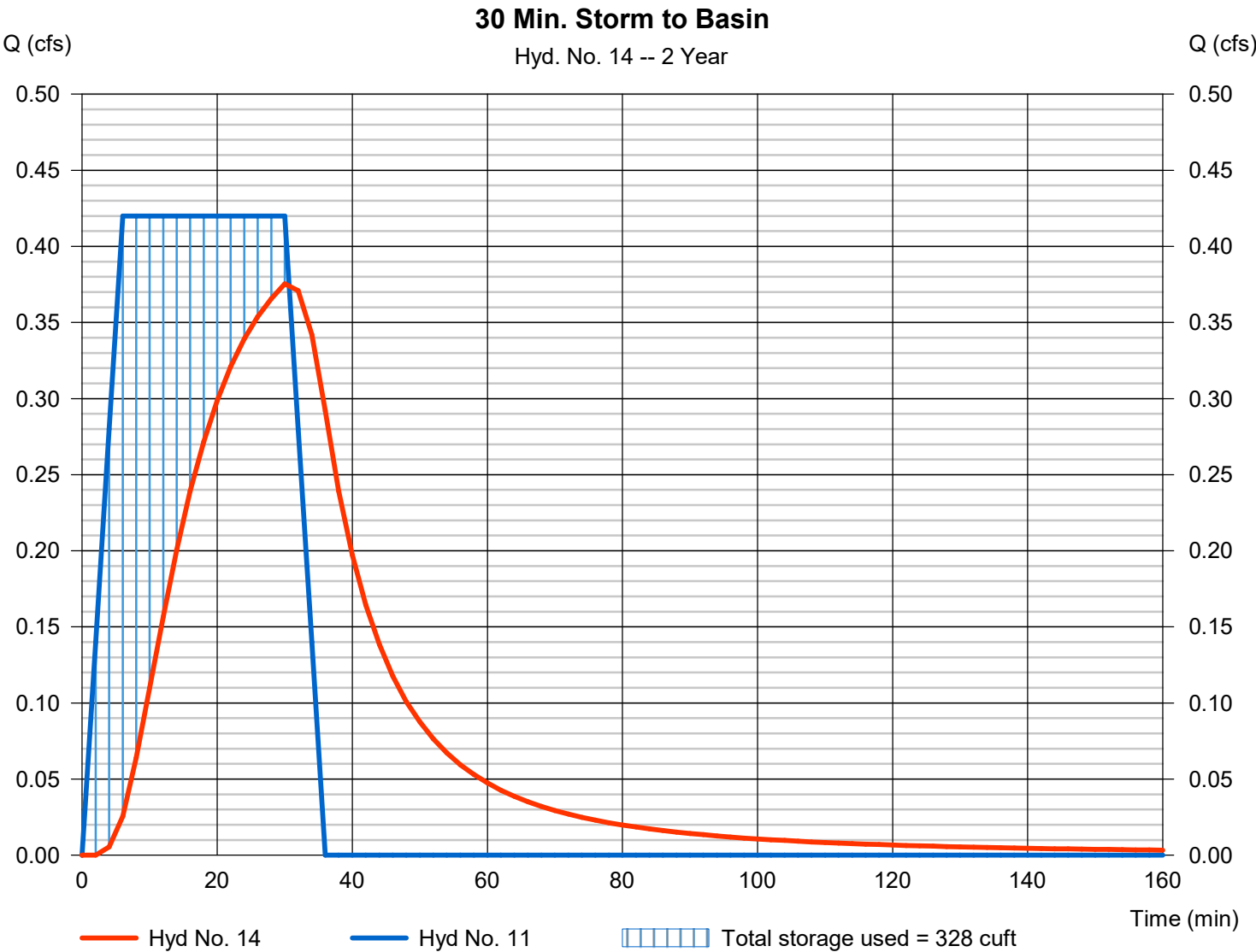
Monday, 03 / 13 / 2023

Hyd. No. 14

30 Min. Storm to Basin

Hydrograph type	= Reservoir	Peak discharge	= 0.375 cfs
Storm frequency	= 2 yrs	Time to peak	= 30 min
Time interval	= 2 min	Hyd. volume	= 742 cuft
Inflow hyd. No.	= 11 - PD-1D (30 Min. Storm)	Max. Elevation	= 100.36 ft
Reservoir name	= Stone Reservoir	Max. Storage	= 328 cuft

Storage Indication method used.



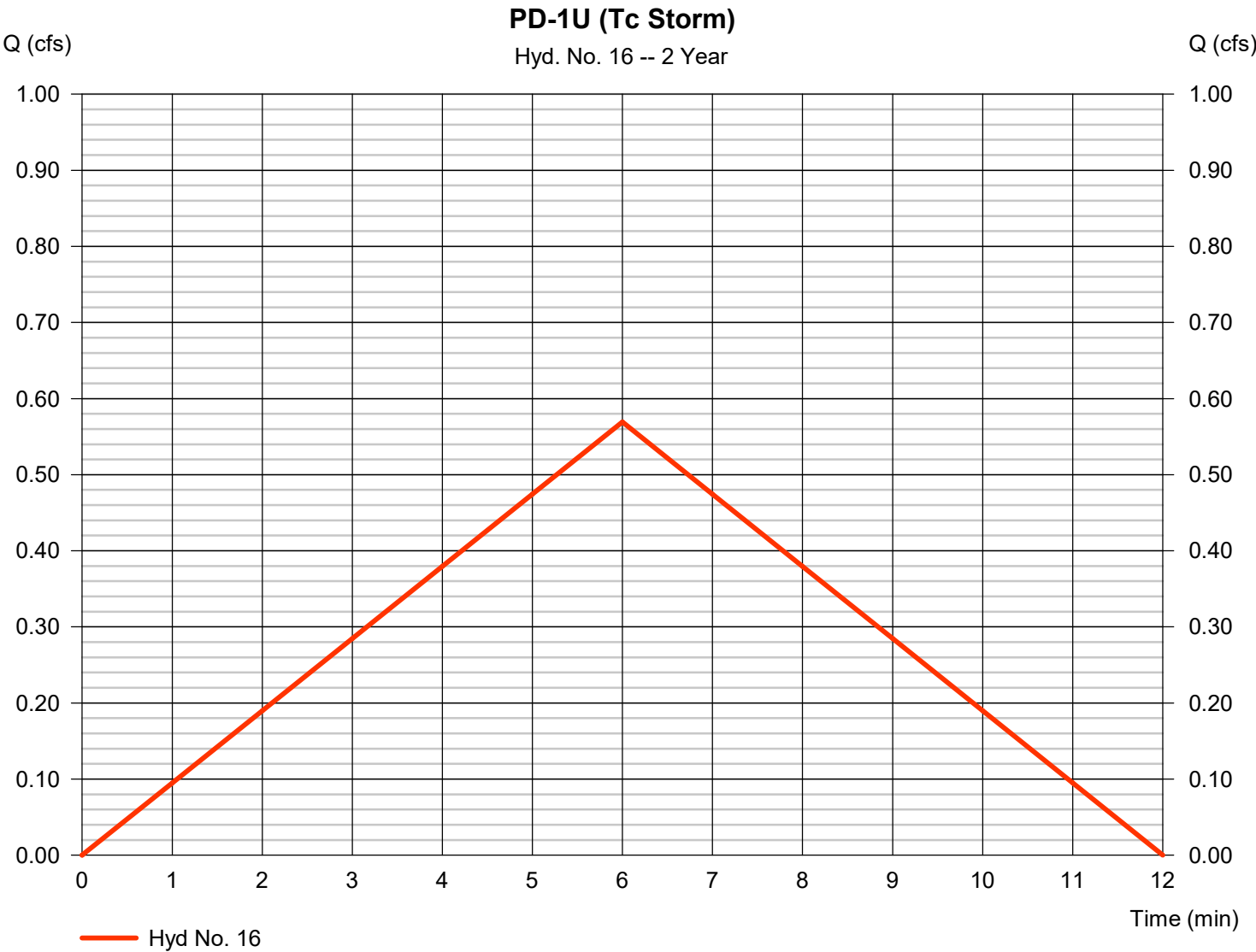
Hydrograph Report

Hyd. No. 16

PD-1U (Tc Storm)

Hydrograph type	= Rational	Peak discharge	= 0.569 cfs
Storm frequency	= 2 yrs	Time to peak	= 6 min
Time interval	= 1 min	Hyd. volume	= 205 cuft
Drainage area	= 0.150 ac	Runoff coeff.	= 0.83*
Intensity	= 4.572 in/hr	Tc by User	= 6.00 min
IDF Curve	= keyport.IDF	Asc/Rec limb fact	= 1/1

* Composite (Area/C) = [(0.080 x 0.99) + (0.070 x 0.65)] / 0.150

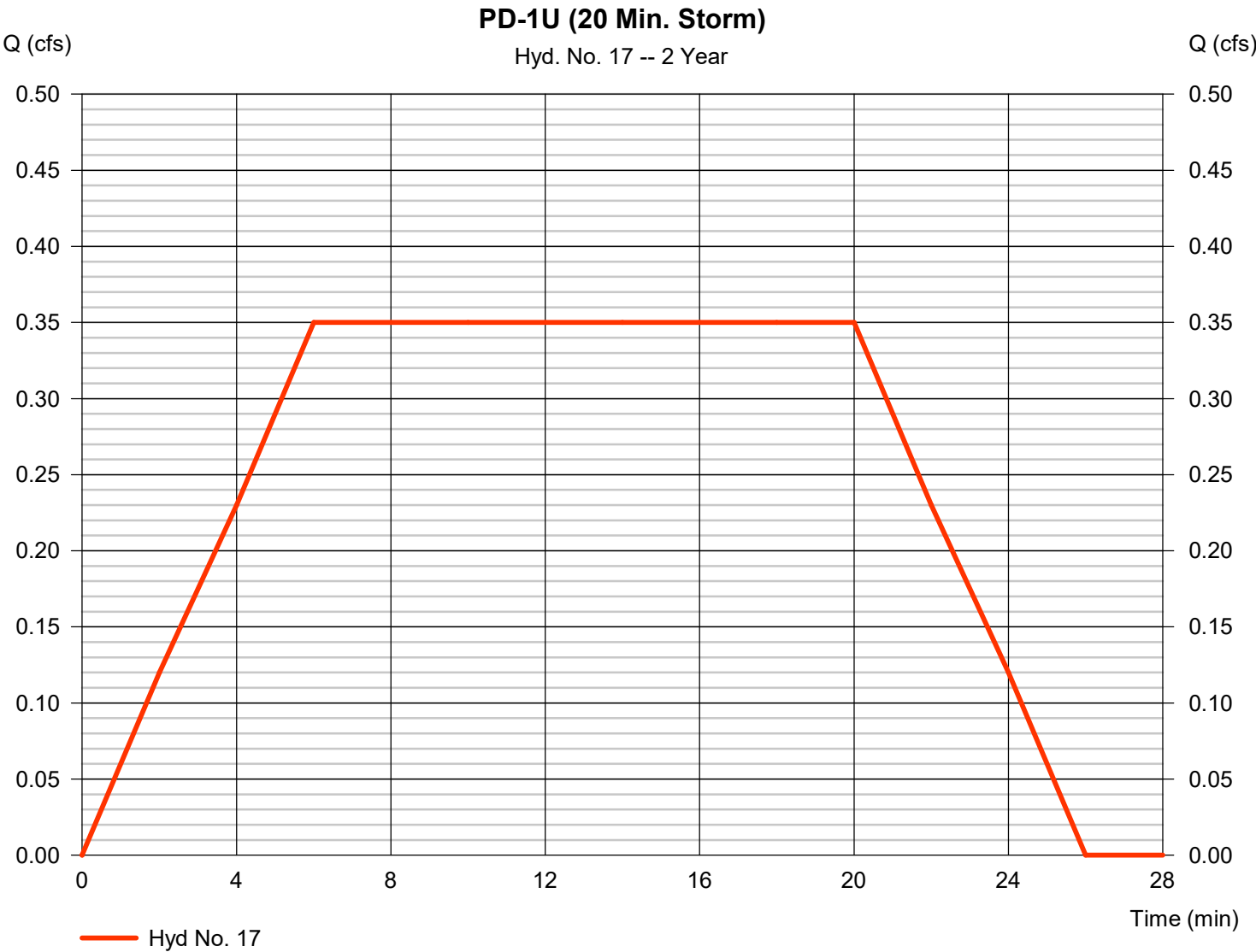


Hydrograph Report

Hyd. No. 17

PD-1U (20 Min. Storm)

Hydrograph type	= Manual	Peak discharge	= 0.350 cfs
Storm frequency	= 2 yrs	Time to peak	= 6 min
Time interval	= 2 min	Hyd. volume	= 420 cuft



Hydrograph Report

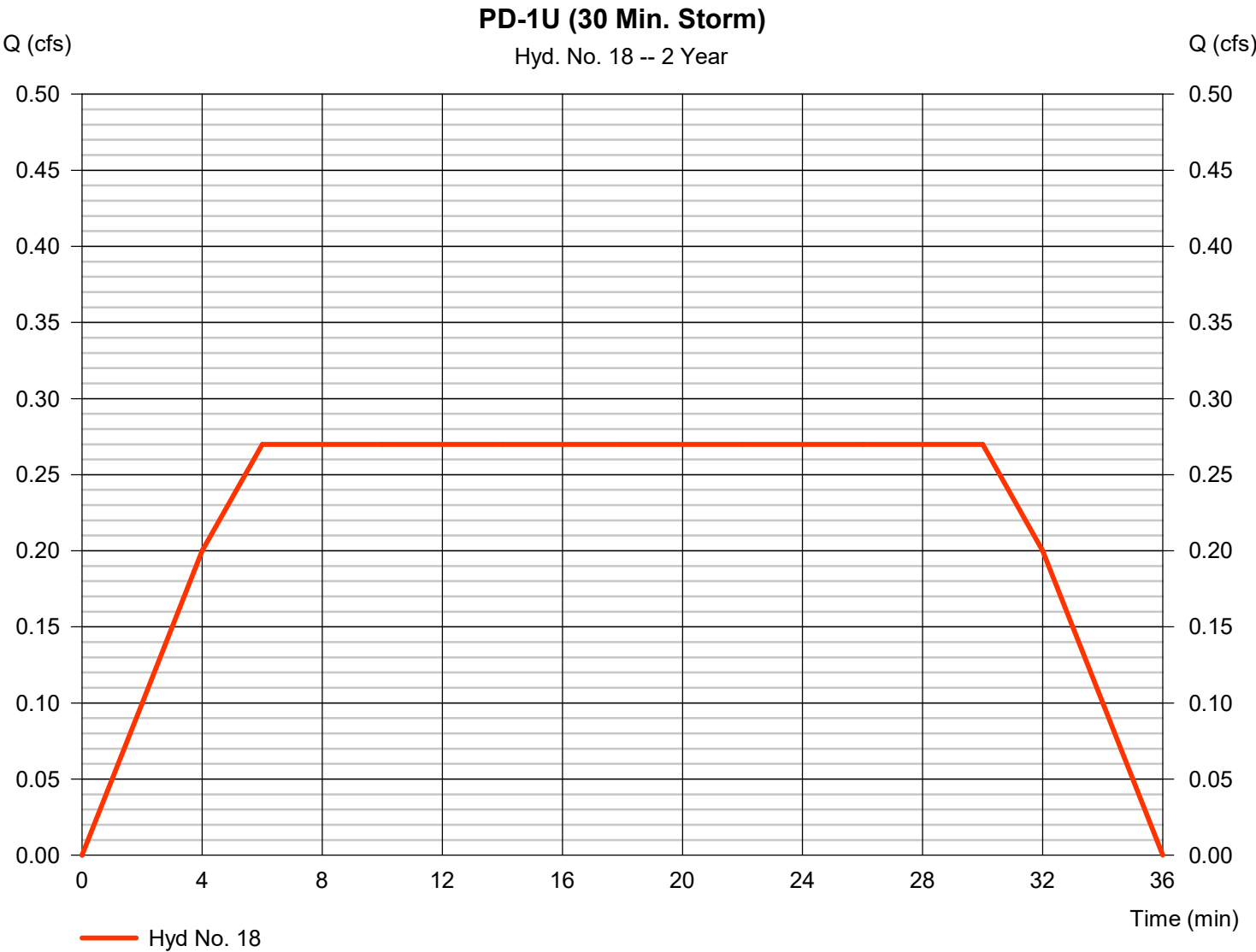
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Monday, 03 / 13 / 2023

Hyd. No. 18

PD-1U (30 Min. Storm)

Hydrograph type	= Manual	Peak discharge	= 0.270 cfs
Storm frequency	= 2 yrs	Time to peak	= 6 min
Time interval	= 2 min	Hyd. volume	= 493 cuft



Hydrograph Report

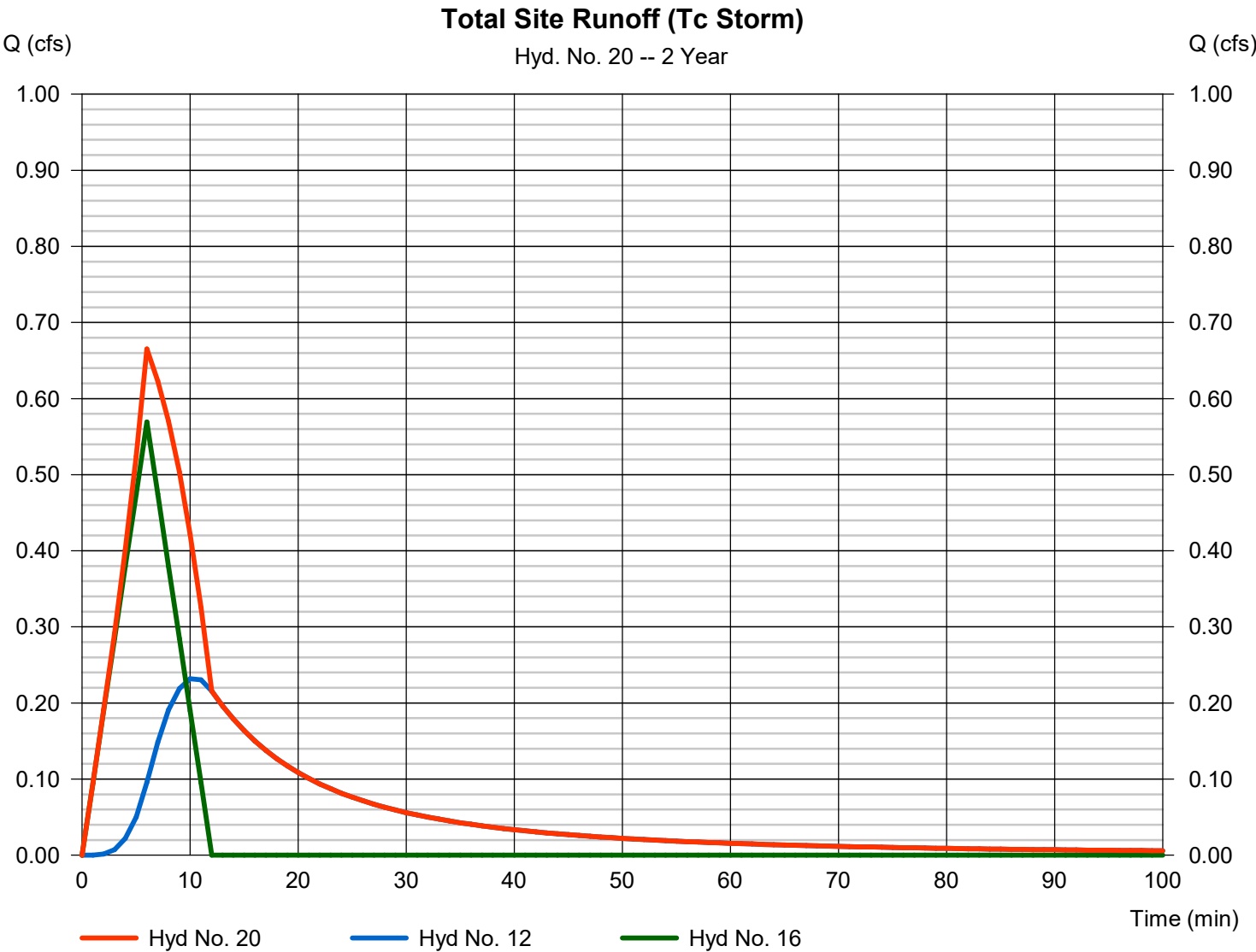
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Monday, 03 / 13 / 2023

Hyd. No. 20

Total Site Runoff (Tc Storm)

Hydrograph type	= Combine	Peak discharge	= 0.665 cfs
Storm frequency	= 2 yrs	Time to peak	= 6 min
Time interval	= 1 min	Hyd. volume	= 501 cuft
Inflow hyds.	= 12, 16	Contrib. drain. area	= 0.150 ac



Hydrograph Report

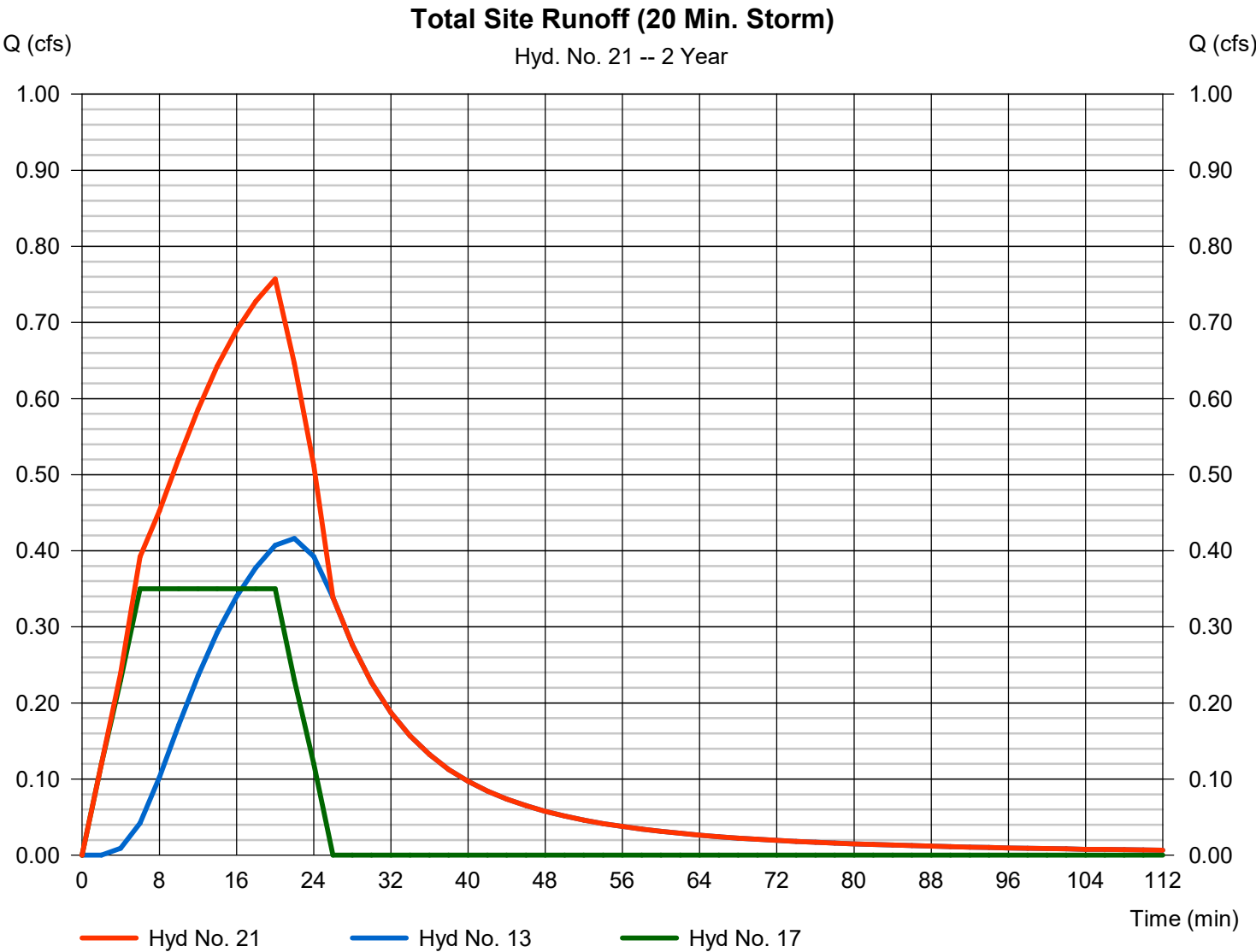
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Monday, 03 / 13 / 2023

Hyd. No. 21

Total Site Runoff (20 Min. Storm)

Hydrograph type	= Combine	Peak discharge	= 0.757 cfs
Storm frequency	= 2 yrs	Time to peak	= 20 min
Time interval	= 2 min	Hyd. volume	= 1,066 cuft
Inflow hyds.	= 13, 17	Contrib. drain. area	= 0.000 ac

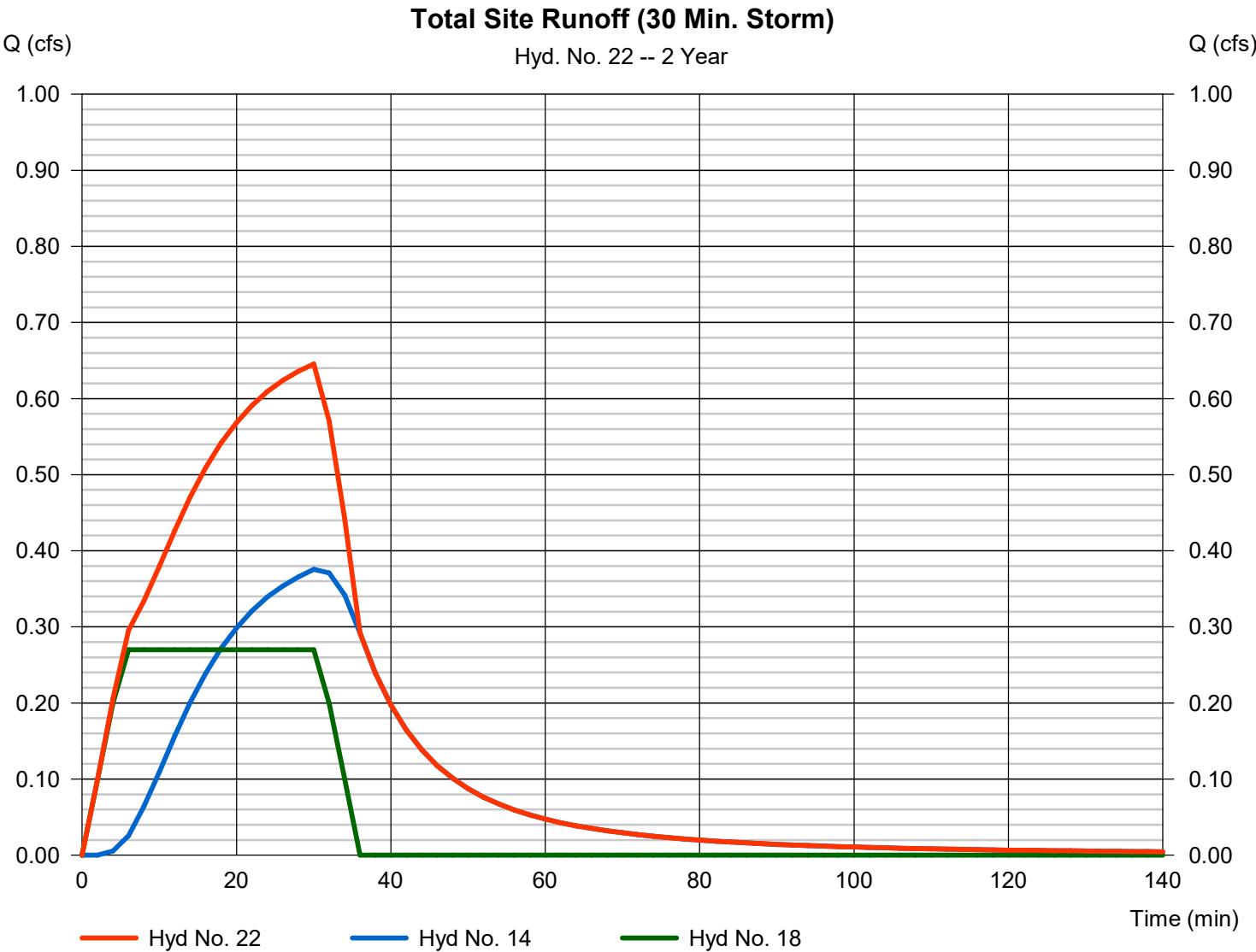


Hydrograph Report

Hyd. No. 22

Total Site Runoff (30 Min. Storm)

Hydrograph type	= Combine	Peak discharge	= 0.645 cfs
Storm frequency	= 2 yrs	Time to peak	= 30 min
Time interval	= 2 min	Hyd. volume	= 1,236 cuft
Inflow hyds.	= 14, 18	Contrib. drain. area	= 0.000 ac



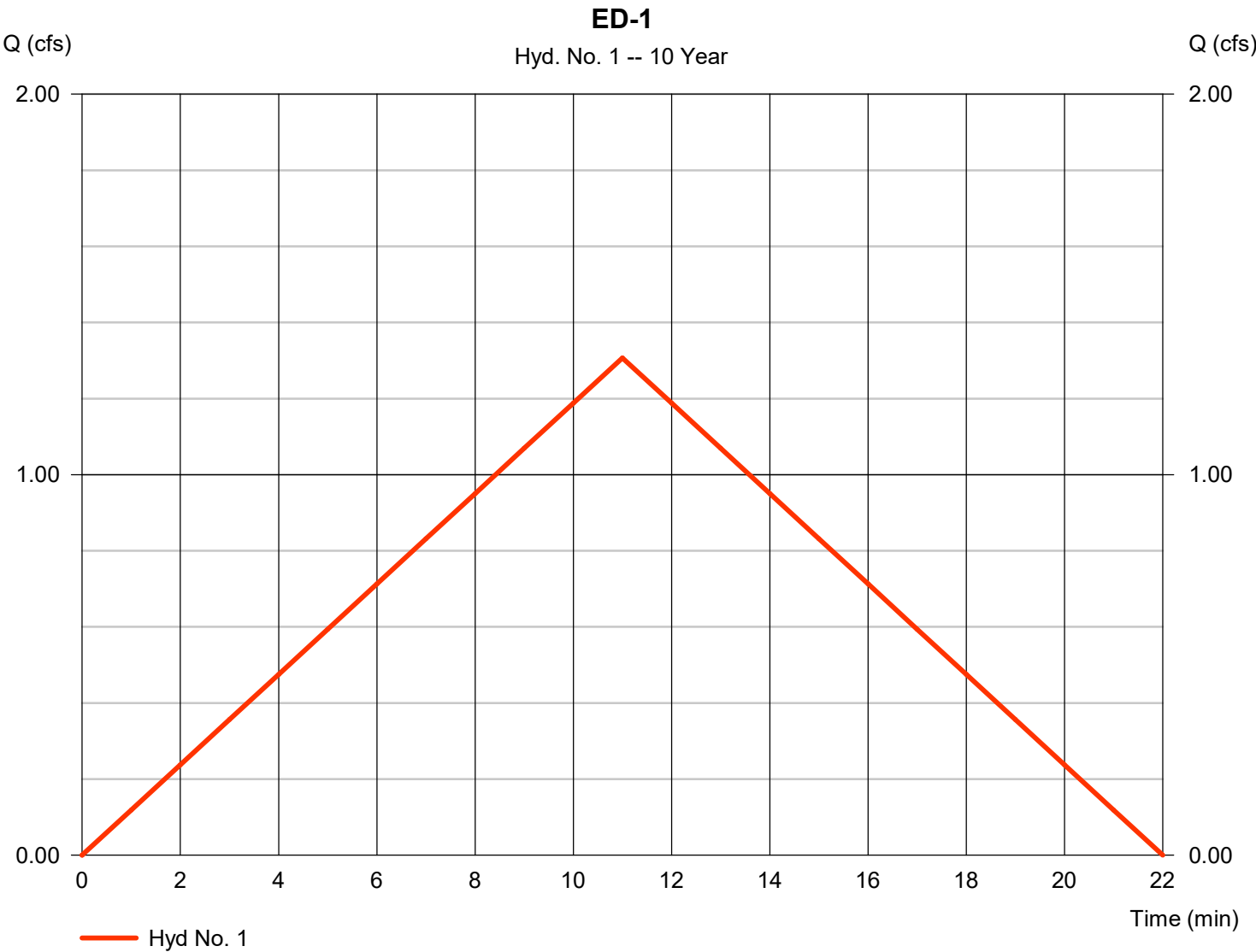
Hydrograph Report

Hyd. No. 1

ED-1

Hydrograph type	= Rational	Peak discharge	= 1.307 cfs
Storm frequency	= 10 yrs	Time to peak	= 11 min
Time interval	= 1 min	Hyd. volume	= 863 cuft
Drainage area	= 0.340 ac	Runoff coeff.	= 0.77*
Intensity	= 4.992 in/hr	Tc by TR55	= 11.00 min
IDF Curve	= keyport.IDF	Asc/Rec limb fact	= 1/1

* Composite (Area/C) = [(0.120 x 0.99) + (0.220 x 0.65)] / 0.340

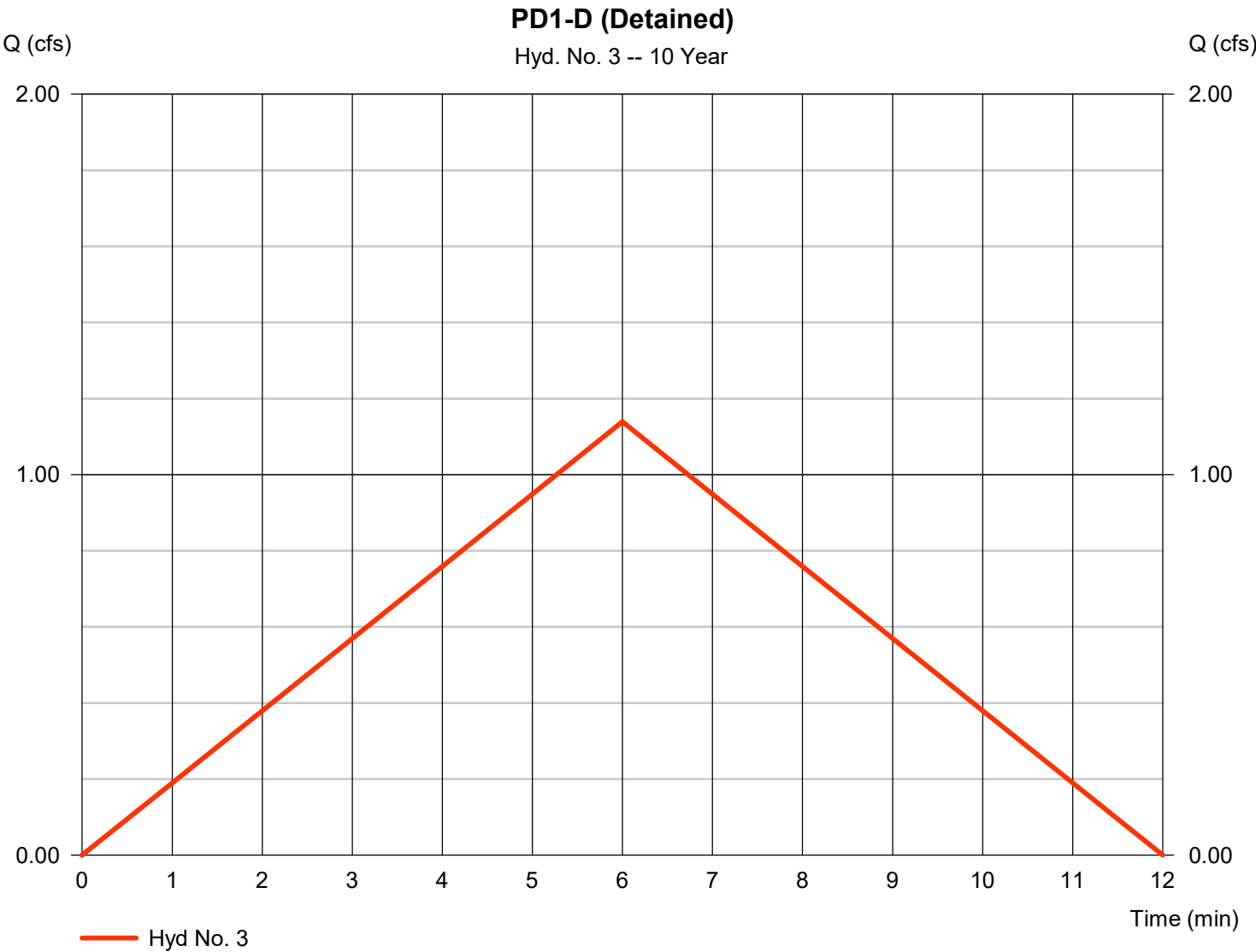


Hydrograph Report

Hyd. No. 3

PD1-D (Detained)

Hydrograph type	= Rational	Peak discharge	= 1.139 cfs
Storm frequency	= 10 yrs	Time to peak	= 6 min
Time interval	= 1 min	Hyd. volume	= 410 cuft
Drainage area	= 0.190 ac	Runoff coeff.	= 0.99
Intensity	= 6.055 in/hr	Tc by User	= 6.00 min
IDF Curve	= keyport.IDF	Asc/Rec limb fact	= 1/1



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

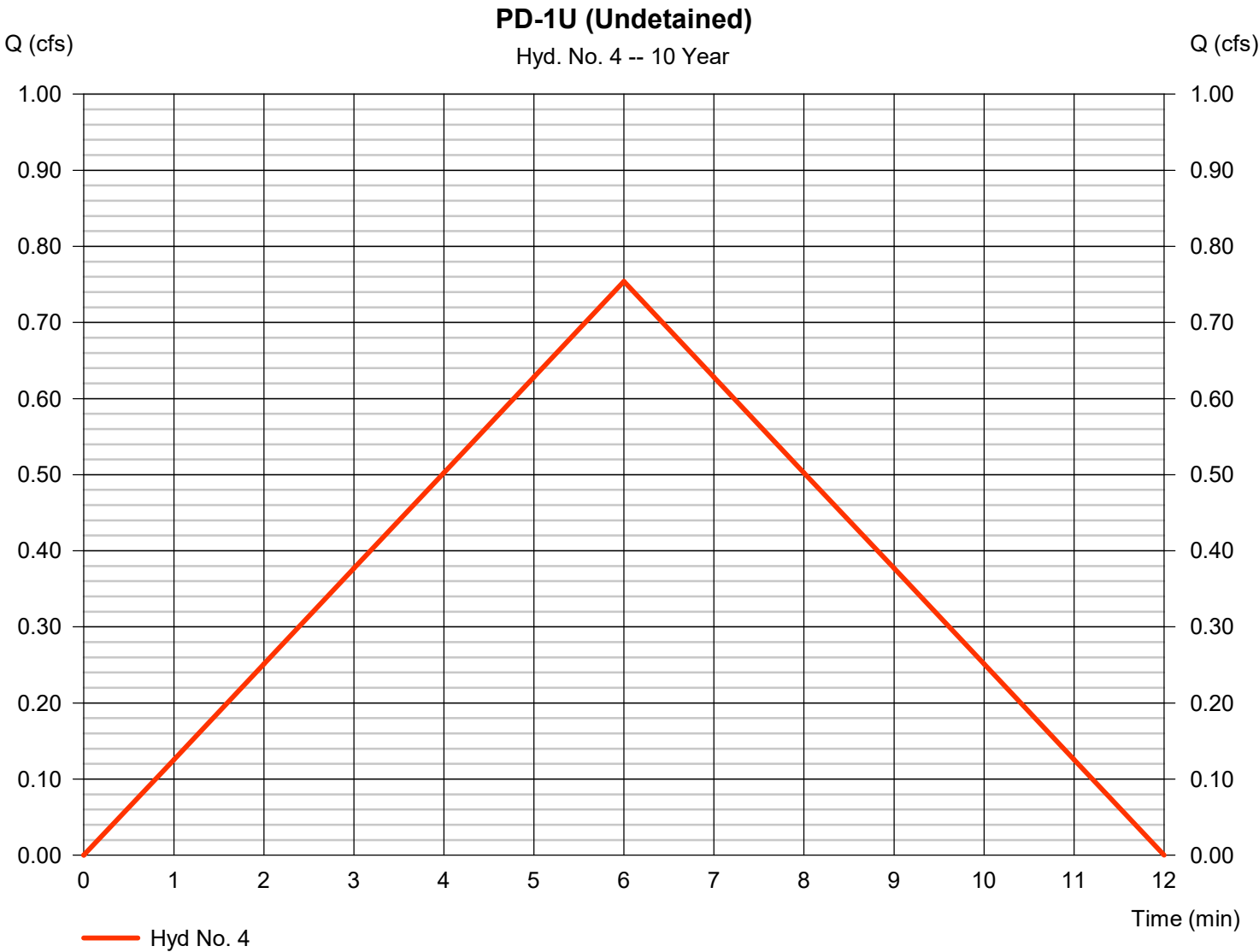
Monday, 03 / 13 / 2023

Hyd. No. 4

PD-1U (Undetained)

Hydrograph type	= Rational	Peak discharge	= 0.754 cfs
Storm frequency	= 10 yrs	Time to peak	= 6 min
Time interval	= 1 min	Hyd. volume	= 271 cuft
Drainage area	= 0.150 ac	Runoff coeff.	= 0.83*
Intensity	= 6.055 in/hr	Tc by User	= 6.00 min
IDF Curve	= keyport.IDF	Asc/Rec limb fact	= 1/1

* Composite (Area/C) = [(0.080 x 0.99) + (0.070 x 0.65)] / 0.150

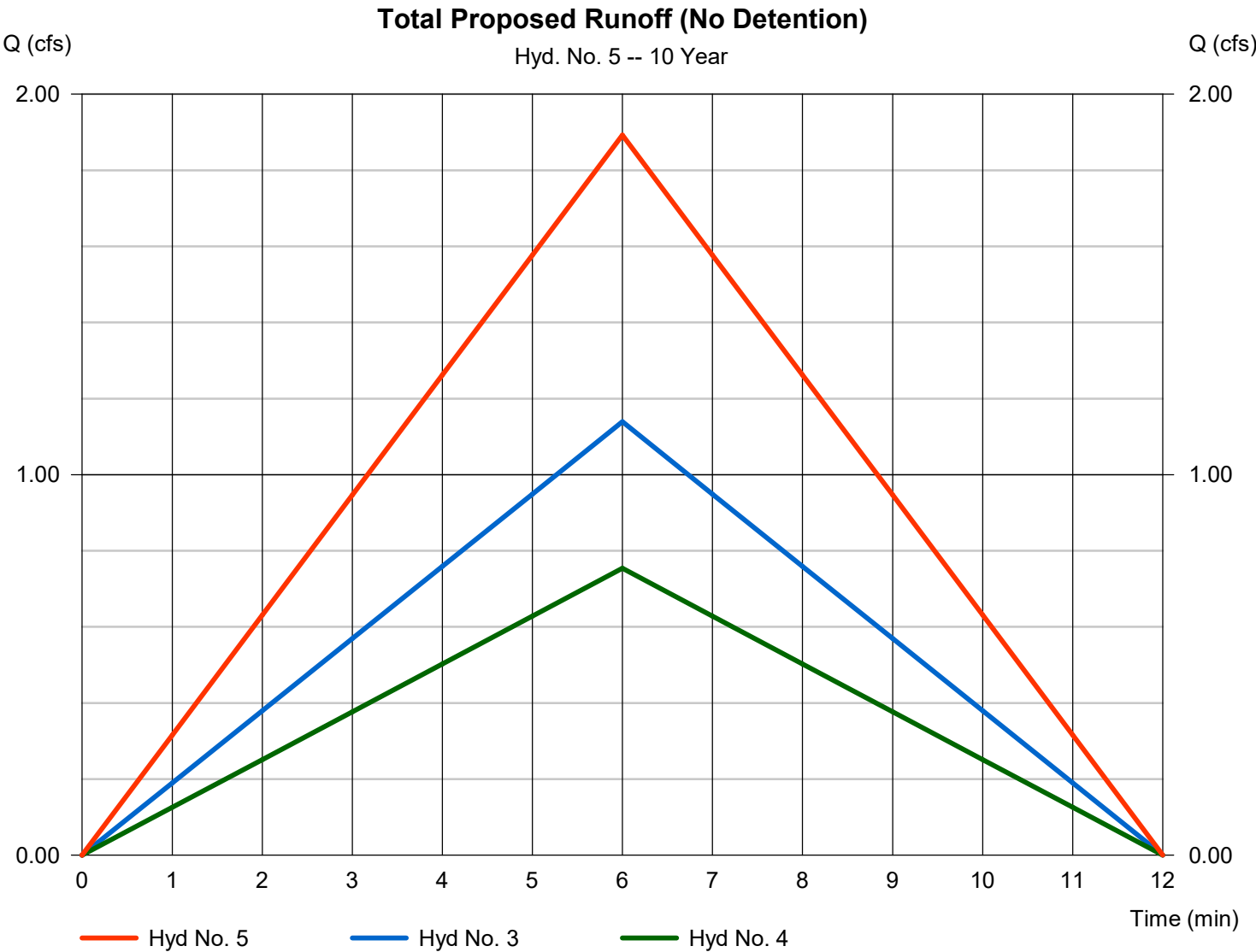


Hydrograph Report

Hyd. No. 5

Total Proposed Runoff (No Detention)

Hydrograph type	= Combine	Peak discharge	= 1.893 cfs
Storm frequency	= 10 yrs	Time to peak	= 6 min
Time interval	= 1 min	Hyd. volume	= 681 cuft
Inflow hyds.	= 3, 4	Contrib. drain. area	= 0.340 ac



Hydrograph Report

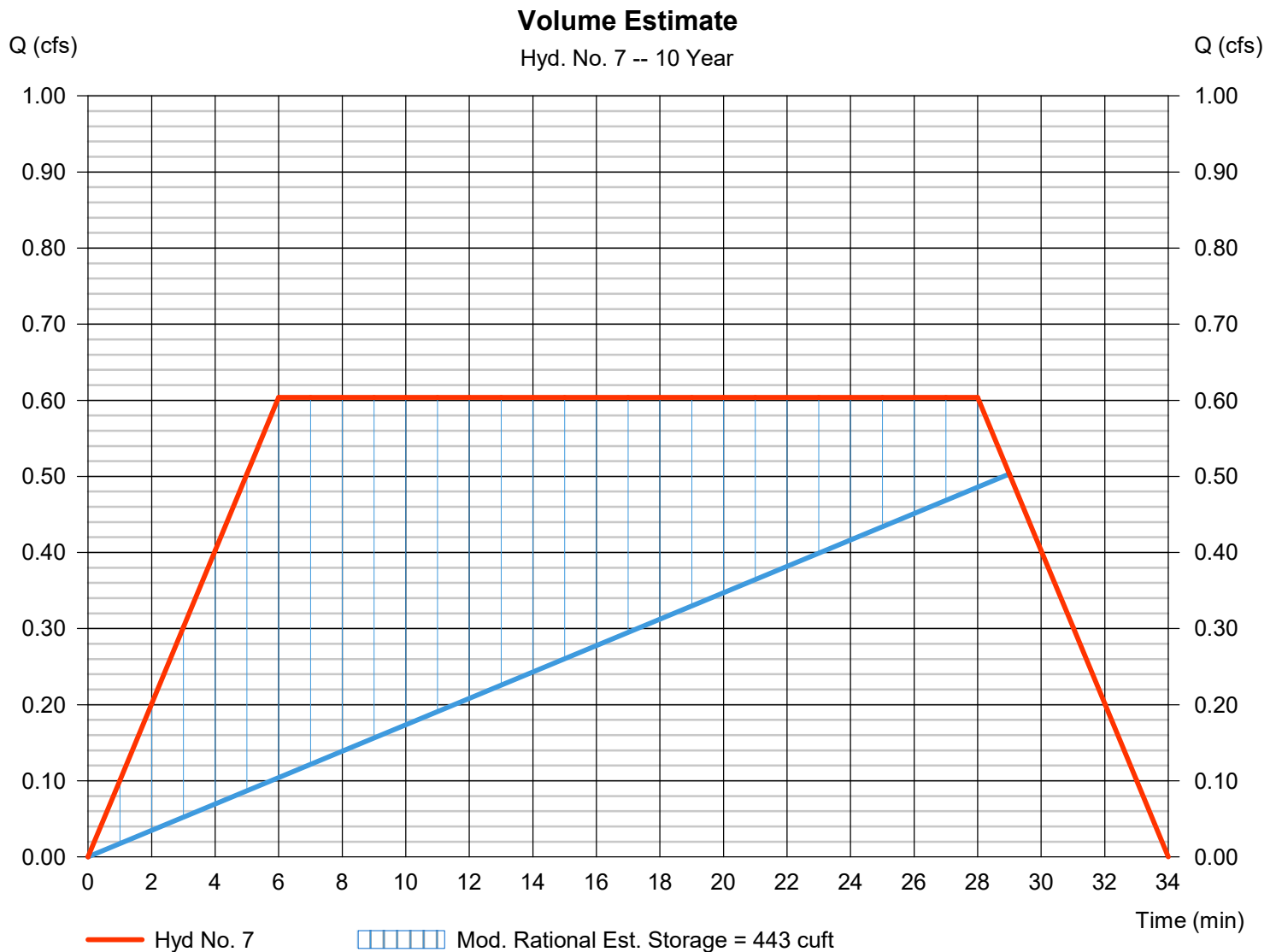
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

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Hyd. No. 7

Volume Estimate

Hydrograph type	= Mod. Rational	Peak discharge	= 0.604 cfs
Storm frequency	= 10 yrs	Time to peak	= 6 min
Time interval	= 1 min	Hyd. volume	= 1,022 cuft
Drainage area	= 0.190 ac	Runoff coeff.	= 0.99
Intensity	= 3.210 in/hr	Tc by User	= 6.00 min
IDF Curve	= keyport.IDF	Storm duration	= 4.7 x Tc
Target Q	=0.553 cfs	Est. Req'd Storage	=443 cuft

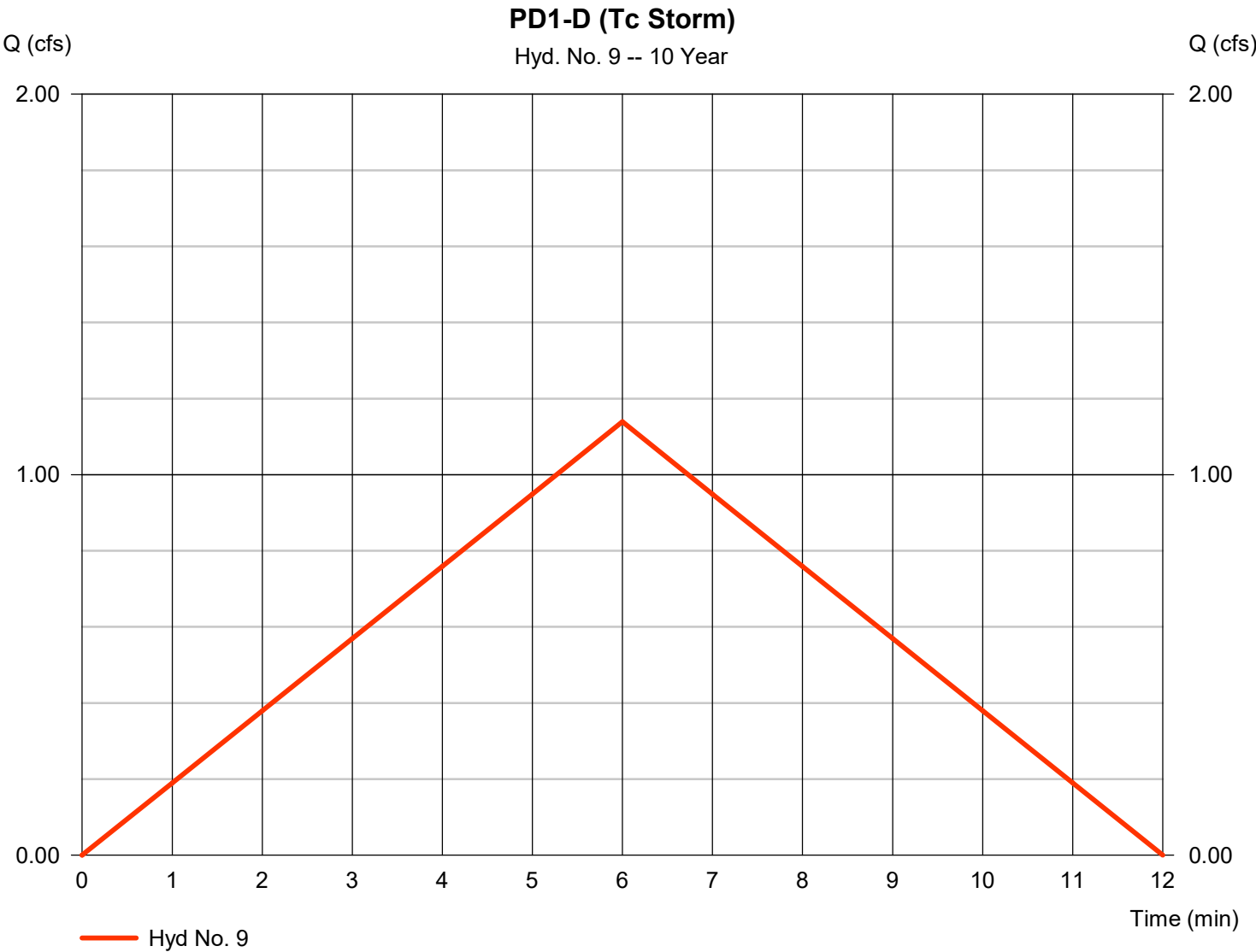


Hydrograph Report

Hyd. No. 9

PD1-D (Tc Storm)

Hydrograph type	= Rational	Peak discharge	= 1.139 cfs
Storm frequency	= 10 yrs	Time to peak	= 6 min
Time interval	= 1 min	Hyd. volume	= 410 cuft
Drainage area	= 0.190 ac	Runoff coeff.	= 0.99
Intensity	= 6.055 in/hr	Tc by User	= 6.00 min
IDF Curve	= keyport.IDF	Asc/Rec limb fact	= 1/1

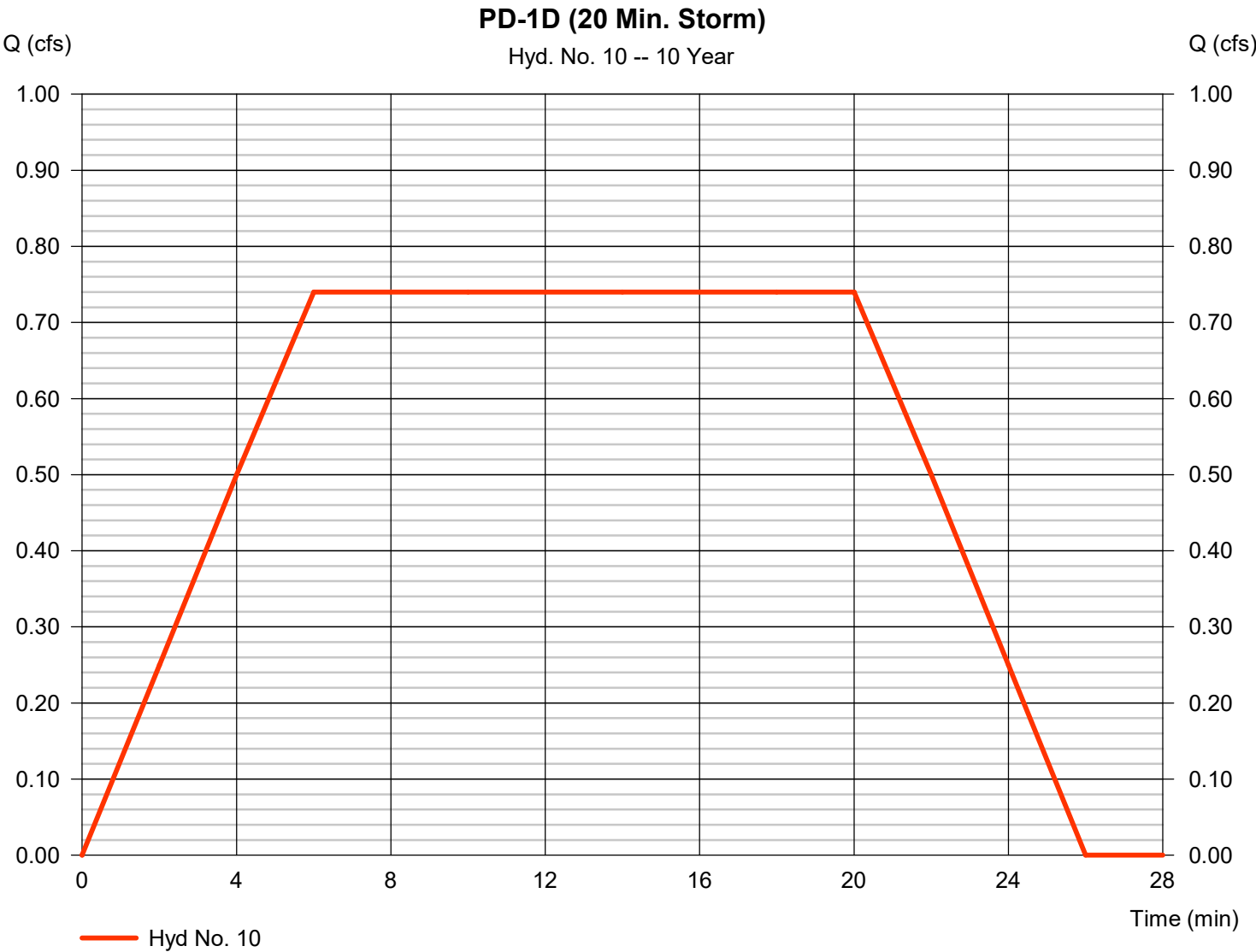


Hydrograph Report

Hyd. No. 10

PD-1D (20 Min. Storm)

Hydrograph type	= Manual	Peak discharge	= 0.740 cfs
Storm frequency	= 10 yrs	Time to peak	= 6 min
Time interval	= 2 min	Hyd. volume	= 890 cuft

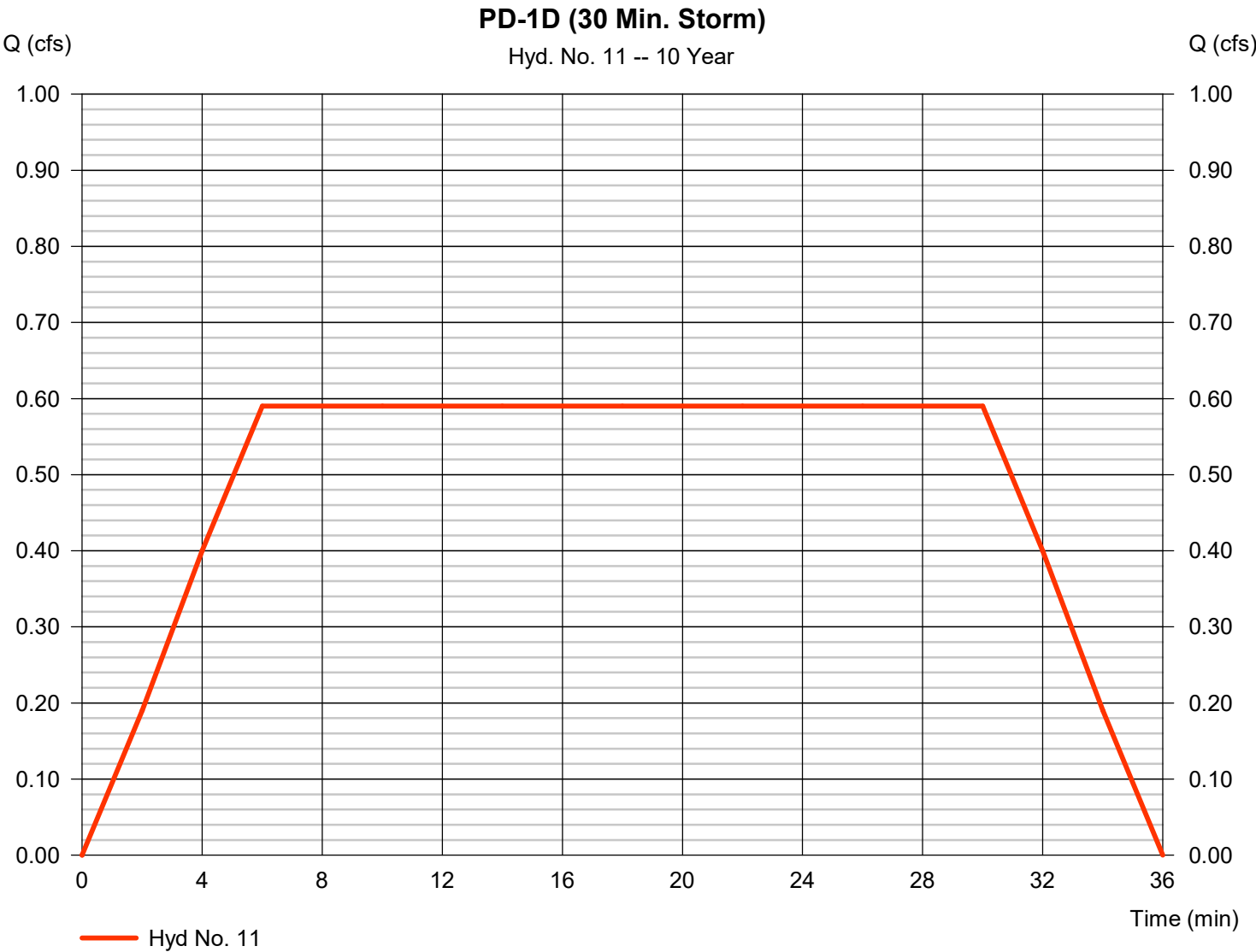


Hydrograph Report

Hyd. No. 11

PD-1D (30 Min. Storm)

Hydrograph type	= Manual	Peak discharge	= 0.590 cfs
Storm frequency	= 10 yrs	Time to peak	= 6 min
Time interval	= 2 min	Hyd. volume	= 1,062 cuft



Hydrograph Report

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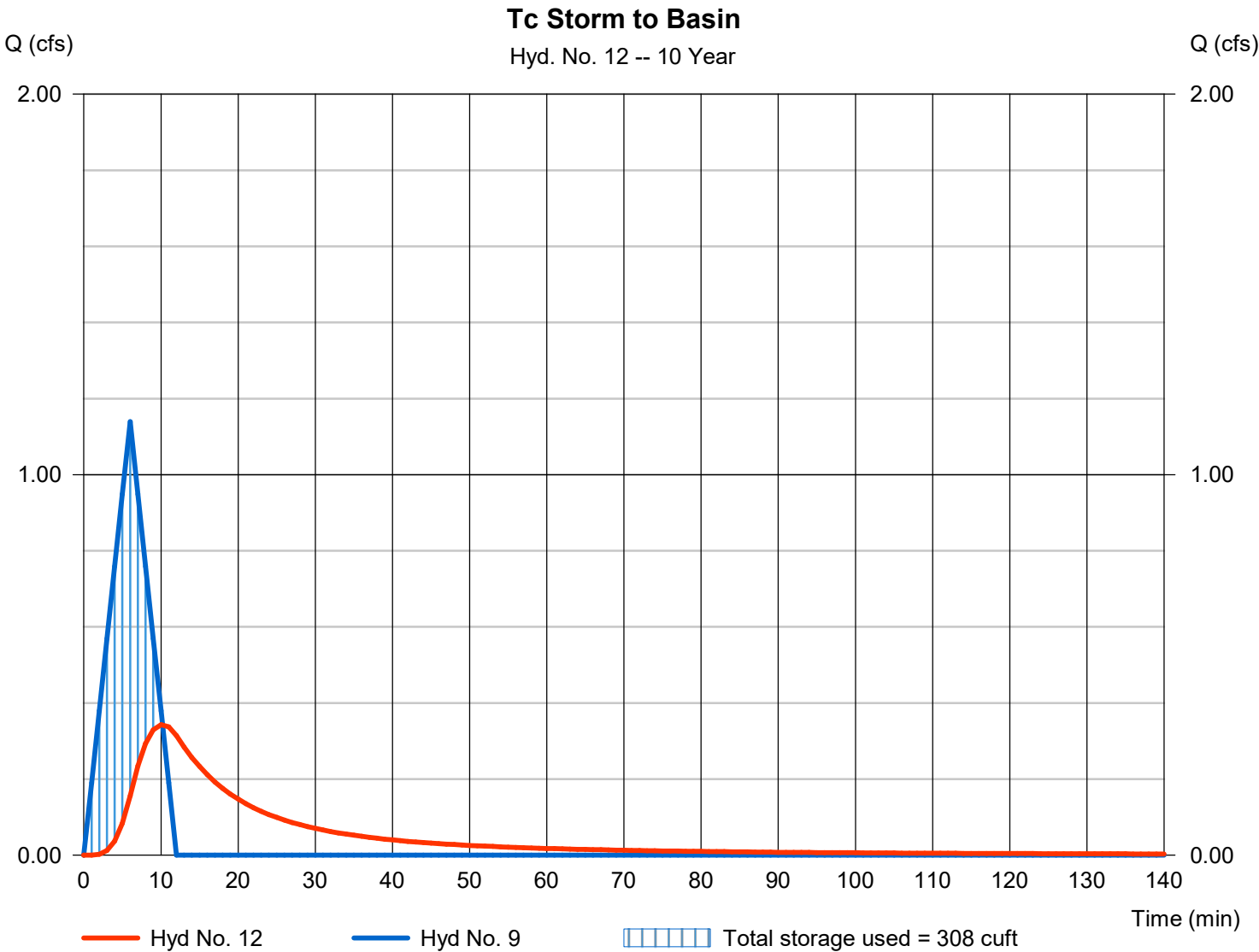
Monday, 03 / 13 / 2023

Hyd. No. 12

Tc Storm to Basin

Hydrograph type	= Reservoir	Peak discharge	= 0.343 cfs
Storm frequency	= 10 yrs	Time to peak	= 10 min
Time interval	= 1 min	Hyd. volume	= 396 cuft
Inflow hyd. No.	= 9 - PD1-D (Tc Storm)	Max. Elevation	= 100.34 ft
Reservoir name	= Stone Reservoir	Max. Storage	= 308 cuft

Storage Indication method used.



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

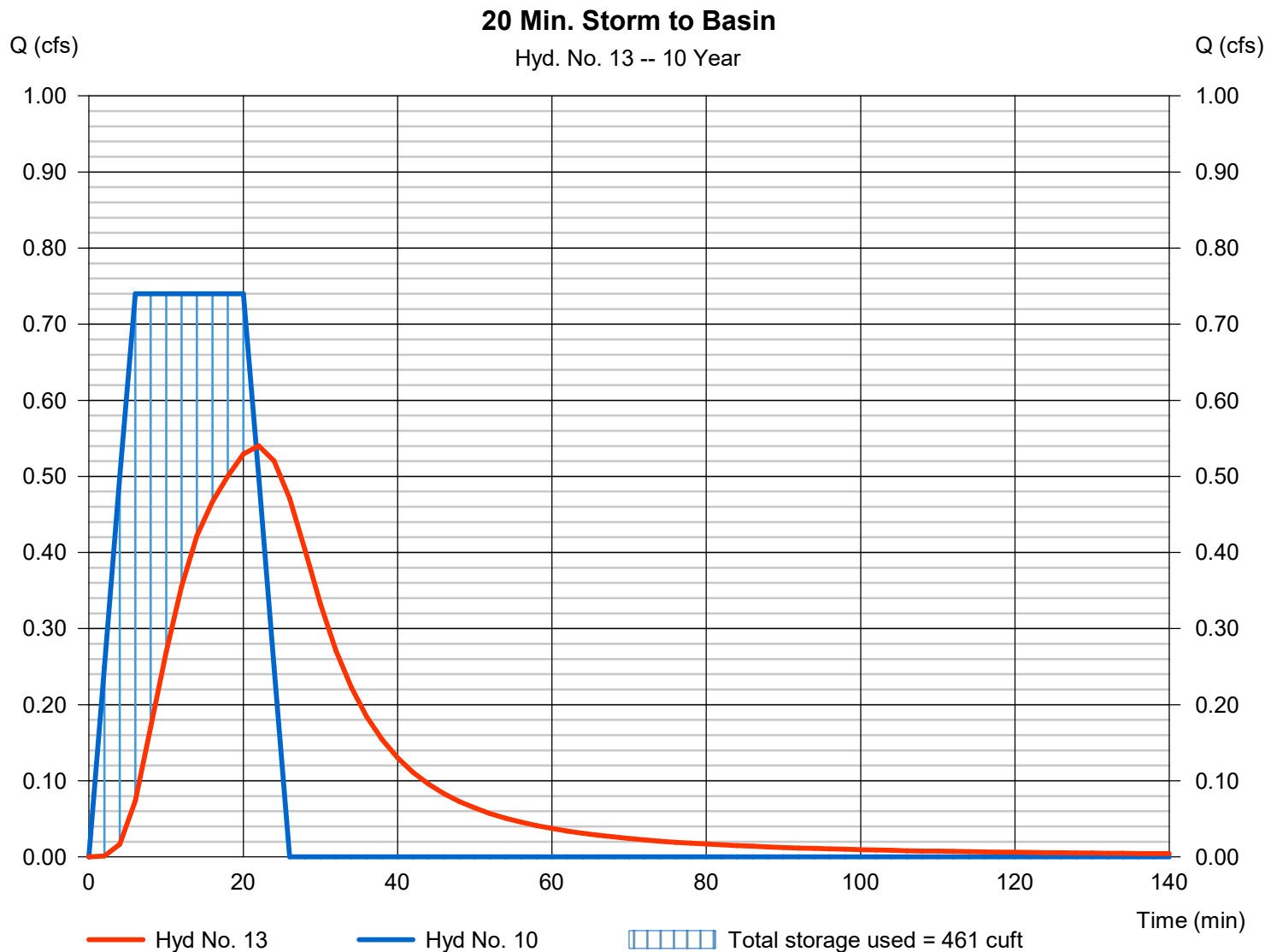
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Hyd. No. 13

20 Min. Storm to Basin

Hydrograph type	= Reservoir	Peak discharge	= 0.540 cfs
Storm frequency	= 10 yrs	Time to peak	= 22 min
Time interval	= 2 min	Hyd. volume	= 877 cuft
Inflow hyd. No.	= 10 - PD-1D (20 Min. Storm)	Max. Elevation	= 100.53 ft
Reservoir name	= Stone Reservoir	Max. Storage	= 461 cuft

Storage Indication method used.



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

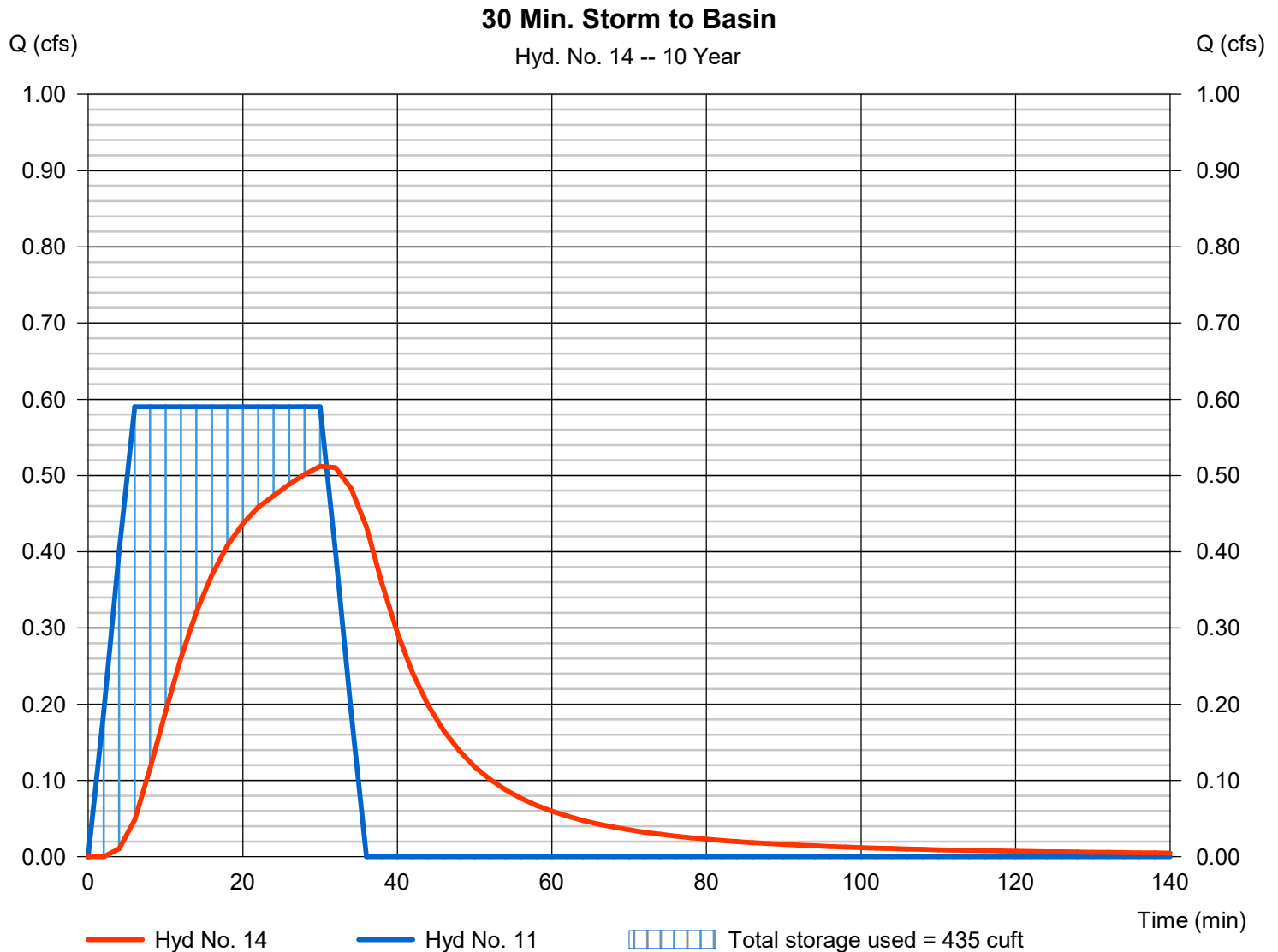
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Hyd. No. 14

30 Min. Storm to Basin

Hydrograph type	= Reservoir	Peak discharge	= 0.512 cfs
Storm frequency	= 10 yrs	Time to peak	= 30 min
Time interval	= 2 min	Hyd. volume	= 1,048 cuft
Inflow hyd. No.	= 11 - PD-1D (30 Min. Storm)	Max. Elevation	= 100.50 ft
Reservoir name	= Stone Reservoir	Max. Storage	= 435 cuft

Storage Indication method used.



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

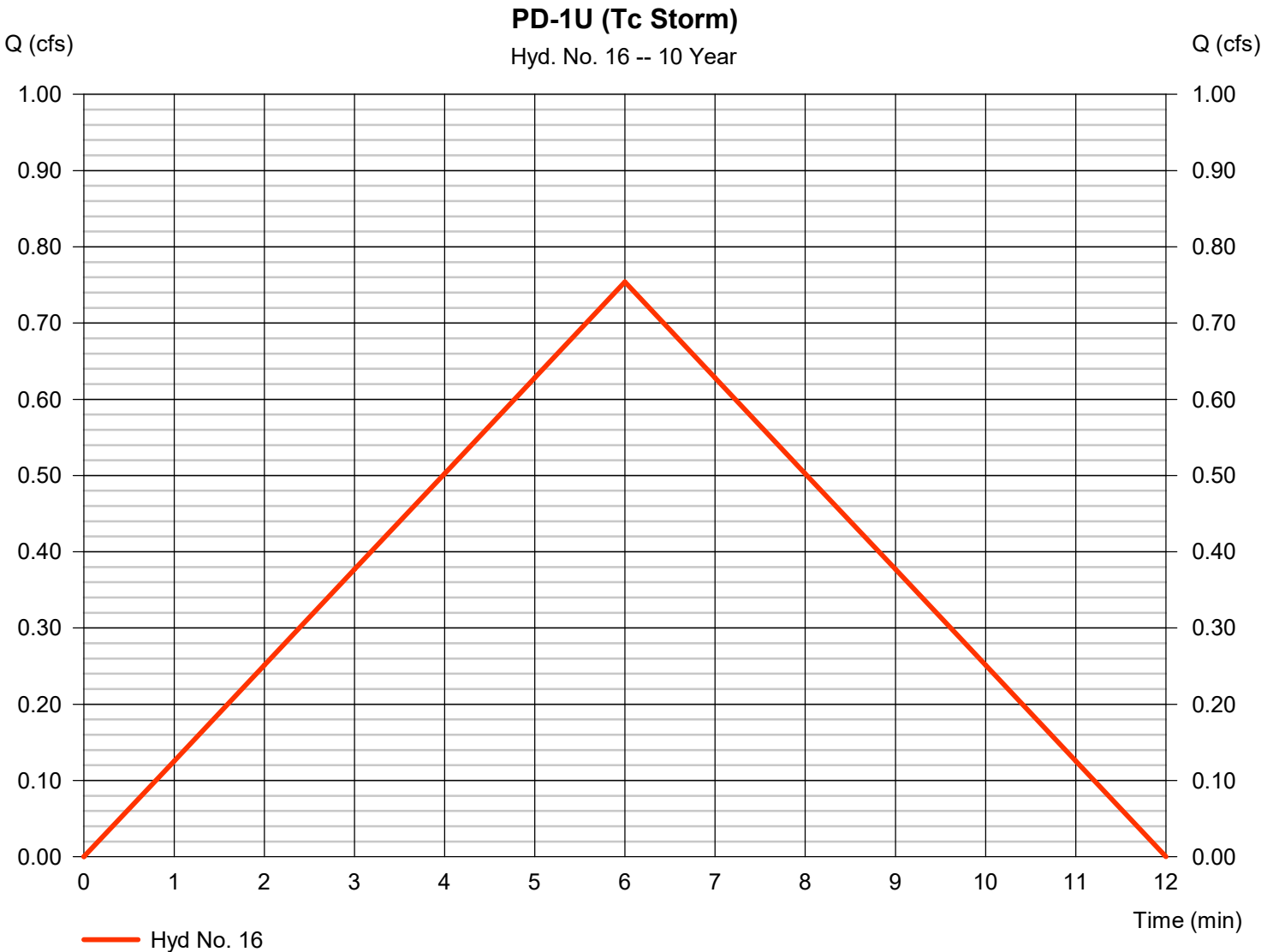
Monday, 03 / 13 / 2023

Hyd. No. 16

PD-1U (Tc Storm)

Hydrograph type	= Rational	Peak discharge	= 0.754 cfs
Storm frequency	= 10 yrs	Time to peak	= 6 min
Time interval	= 1 min	Hyd. volume	= 271 cuft
Drainage area	= 0.150 ac	Runoff coeff.	= 0.83*
Intensity	= 6.055 in/hr	Tc by User	= 6.00 min
IDF Curve	= keyport.IDF	Asc/Rec limb fact	= 1/1

* Composite (Area/C) = [(0.080 x 0.99) + (0.070 x 0.65)] / 0.150



Hydrograph Report

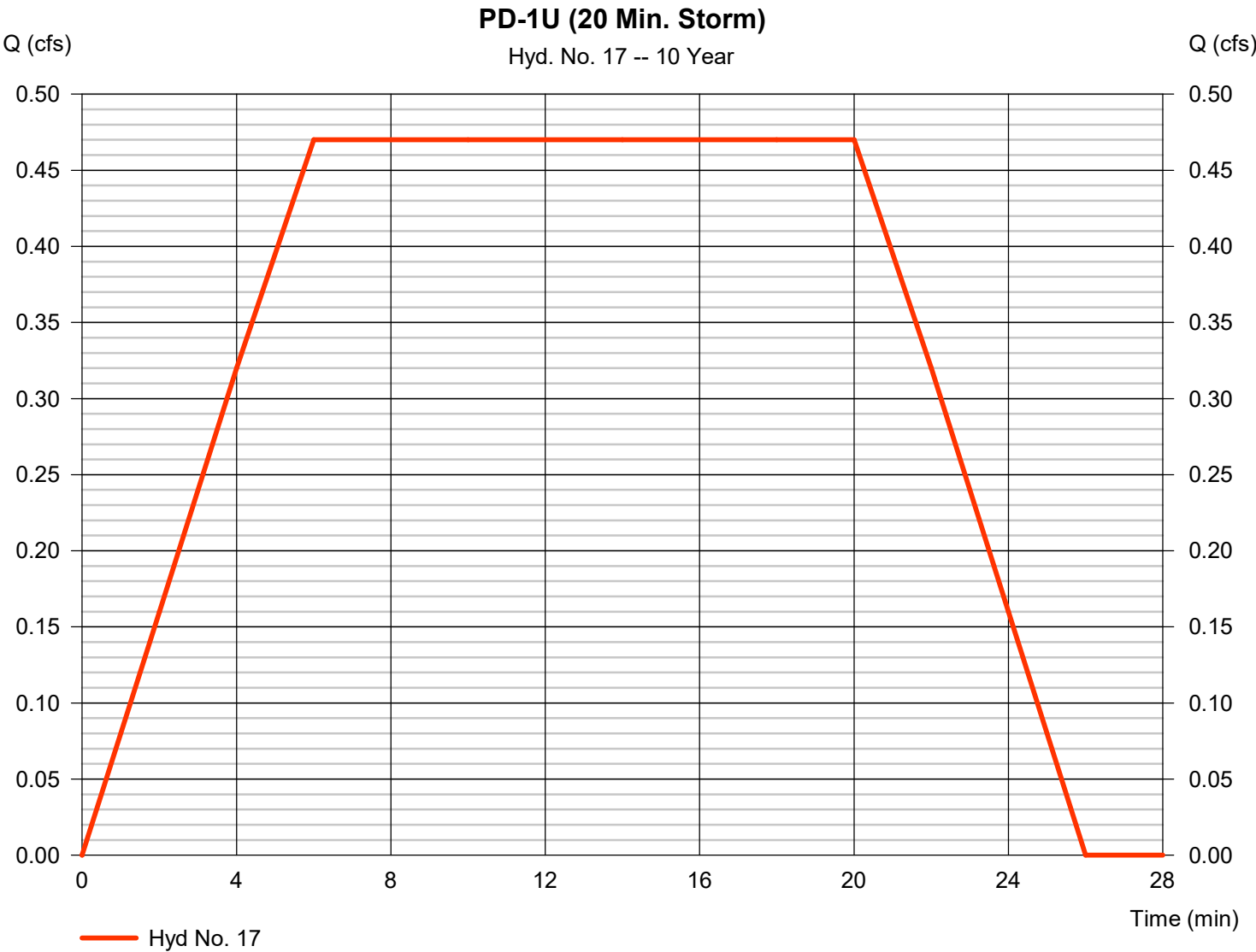
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

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Hyd. No. 17

PD-1U (20 Min. Storm)

Hydrograph type	= Manual	Peak discharge	= 0.470 cfs
Storm frequency	= 10 yrs	Time to peak	= 6 min
Time interval	= 2 min	Hyd. volume	= 566 cuft

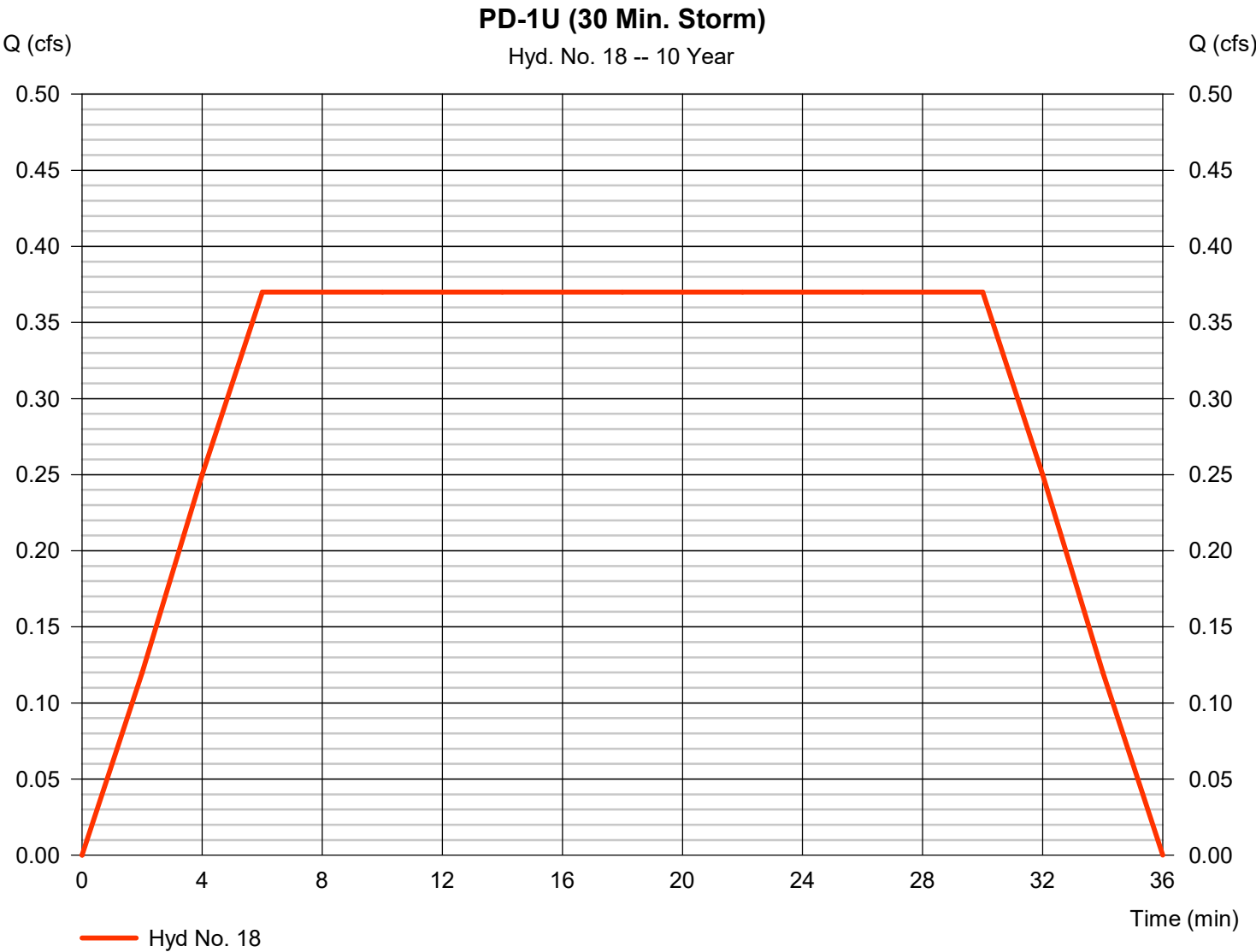


Hydrograph Report

Hyd. No. 18

PD-1U (30 Min. Storm)

Hydrograph type	= Manual	Peak discharge	= 0.370 cfs
Storm frequency	= 10 yrs	Time to peak	= 6 min
Time interval	= 2 min	Hyd. volume	= 666 cuft



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

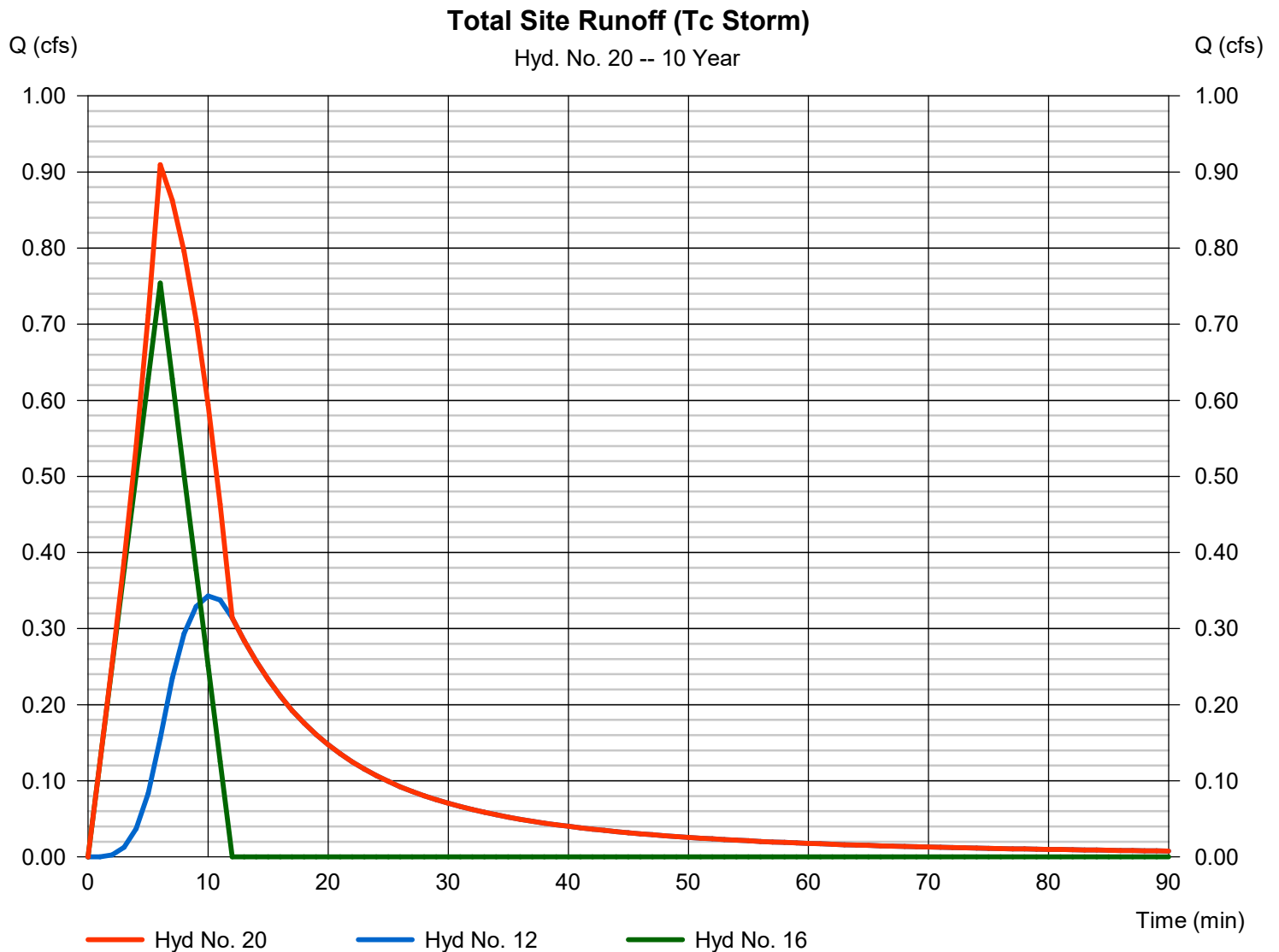
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Hyd. No. 20

Total Site Runoff (Tc Storm)

Hydrograph type = Combine
 Storm frequency = 10 yrs
 Time interval = 1 min
 Inflow hyds. = 12, 16

Peak discharge = 0.910 cfs
 Time to peak = 6 min
 Hyd. volume = 668 cuft
 Contrib. drain. area = 0.150 ac

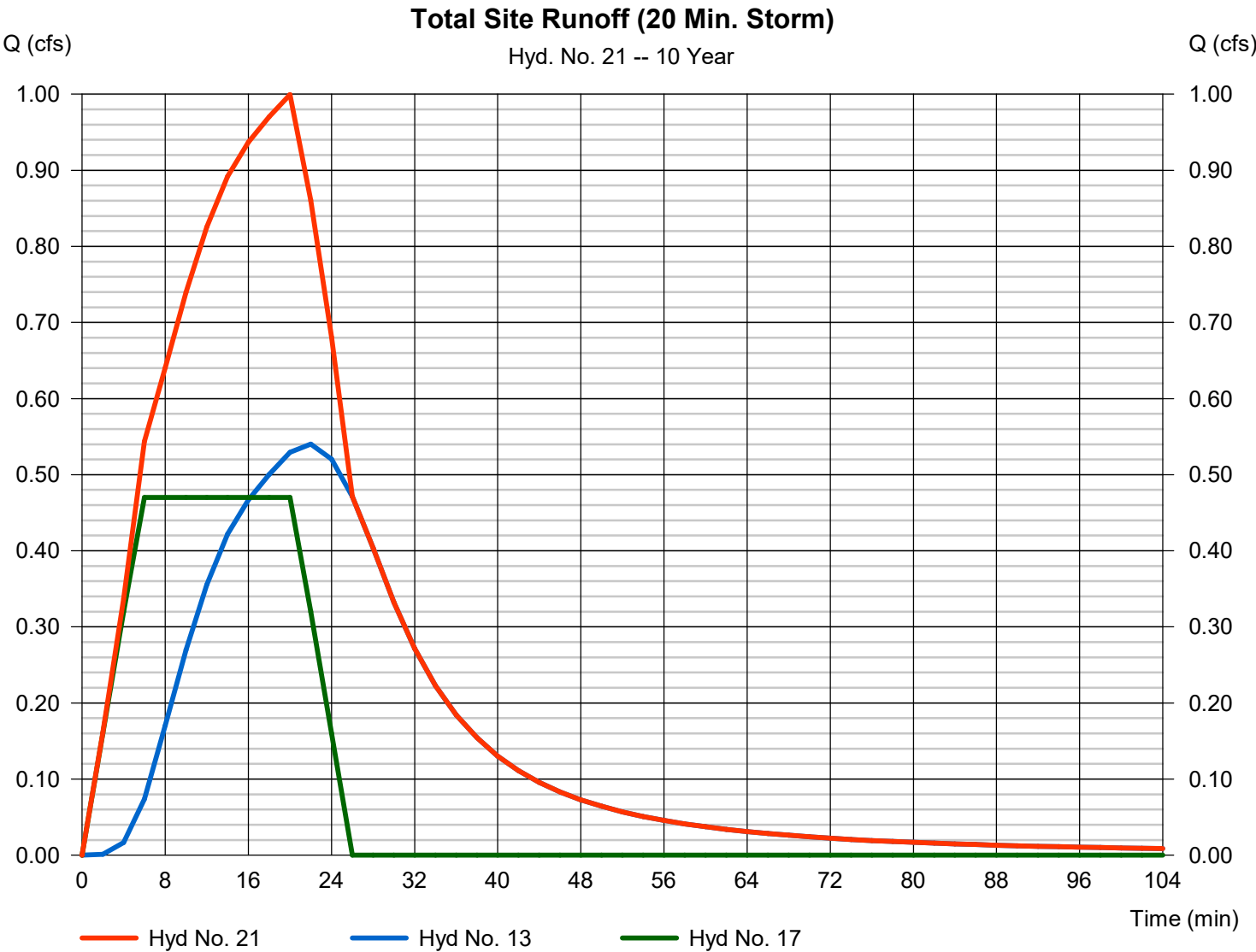


Hydrograph Report

Hyd. No. 21

Total Site Runoff (20 Min. Storm)

Hydrograph type	= Combine	Peak discharge	= 1.000 cfs
Storm frequency	= 10 yrs	Time to peak	= 20 min
Time interval	= 2 min	Hyd. volume	= 1,443 cuft
Inflow hyds.	= 13, 17	Contrib. drain. area	= 0.000 ac

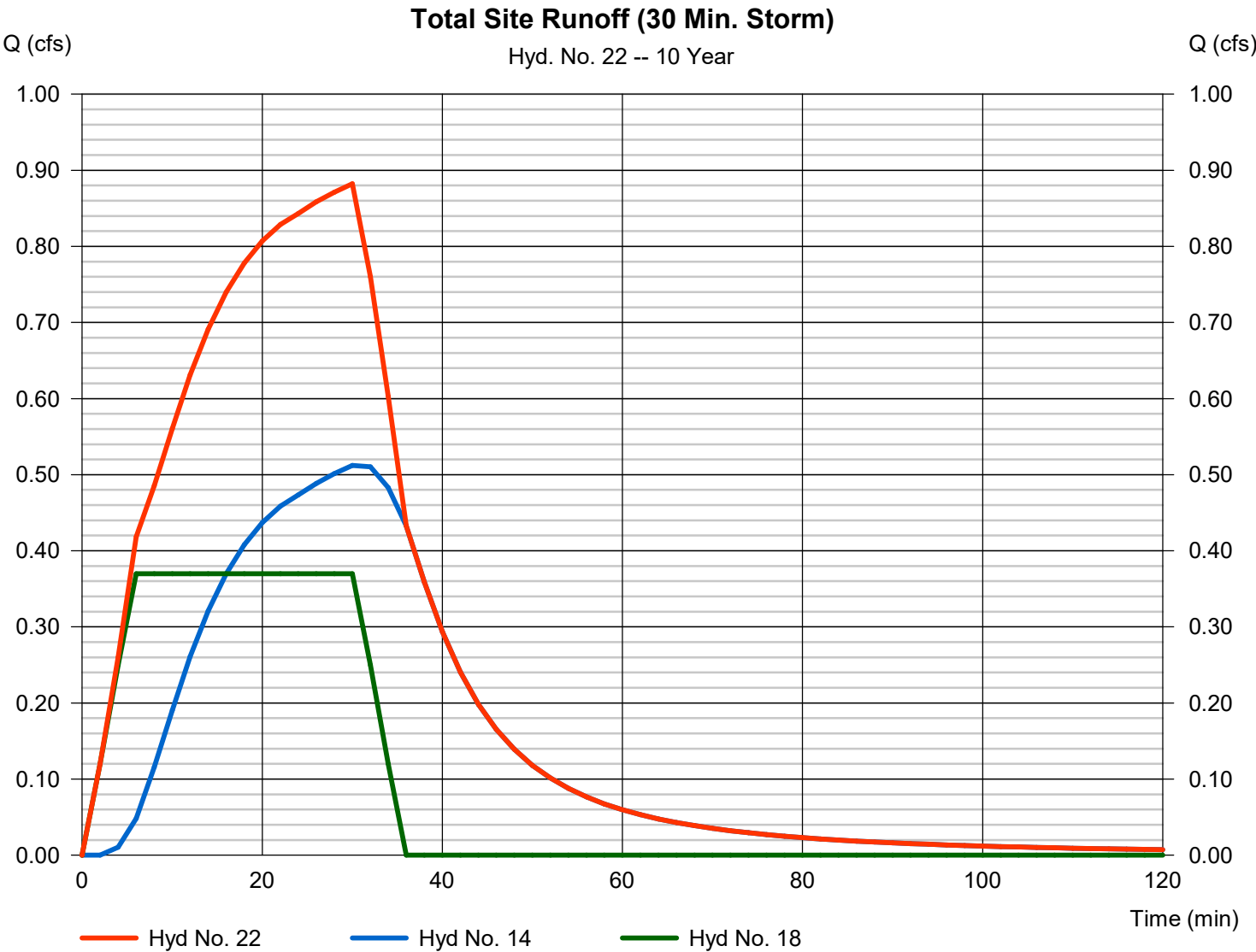


Hydrograph Report

Hyd. No. 22

Total Site Runoff (30 Min. Storm)

Hydrograph type	= Combine	Peak discharge	= 0.882 cfs
Storm frequency	= 10 yrs	Time to peak	= 30 min
Time interval	= 2 min	Hyd. volume	= 1,714 cuft
Inflow hyds.	= 14, 18	Contrib. drain. area	= 0.000 ac



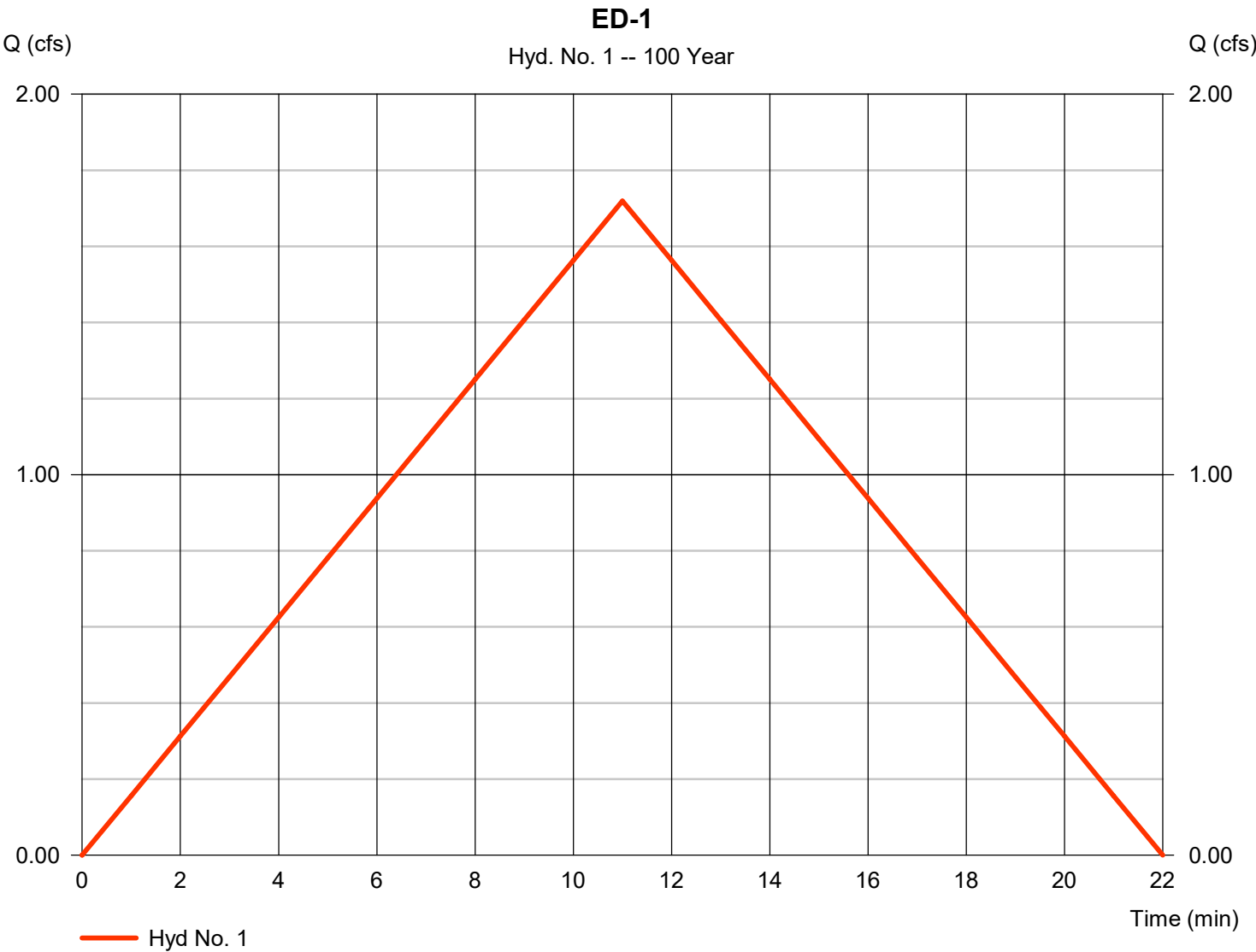
Hydrograph Report

Hyd. No. 1

ED-1

Hydrograph type	= Rational	Peak discharge	= 1.720 cfs
Storm frequency	= 100 yrs	Time to peak	= 11 min
Time interval	= 1 min	Hyd. volume	= 1,135 cuft
Drainage area	= 0.340 ac	Runoff coeff.	= 0.77*
Intensity	= 6.568 in/hr	Tc by TR55	= 11.00 min
IDF Curve	= keyport.IDF	Asc/Rec limb fact	= 1/1

* Composite (Area/C) = [(0.120 x 0.99) + (0.220 x 0.65)] / 0.340

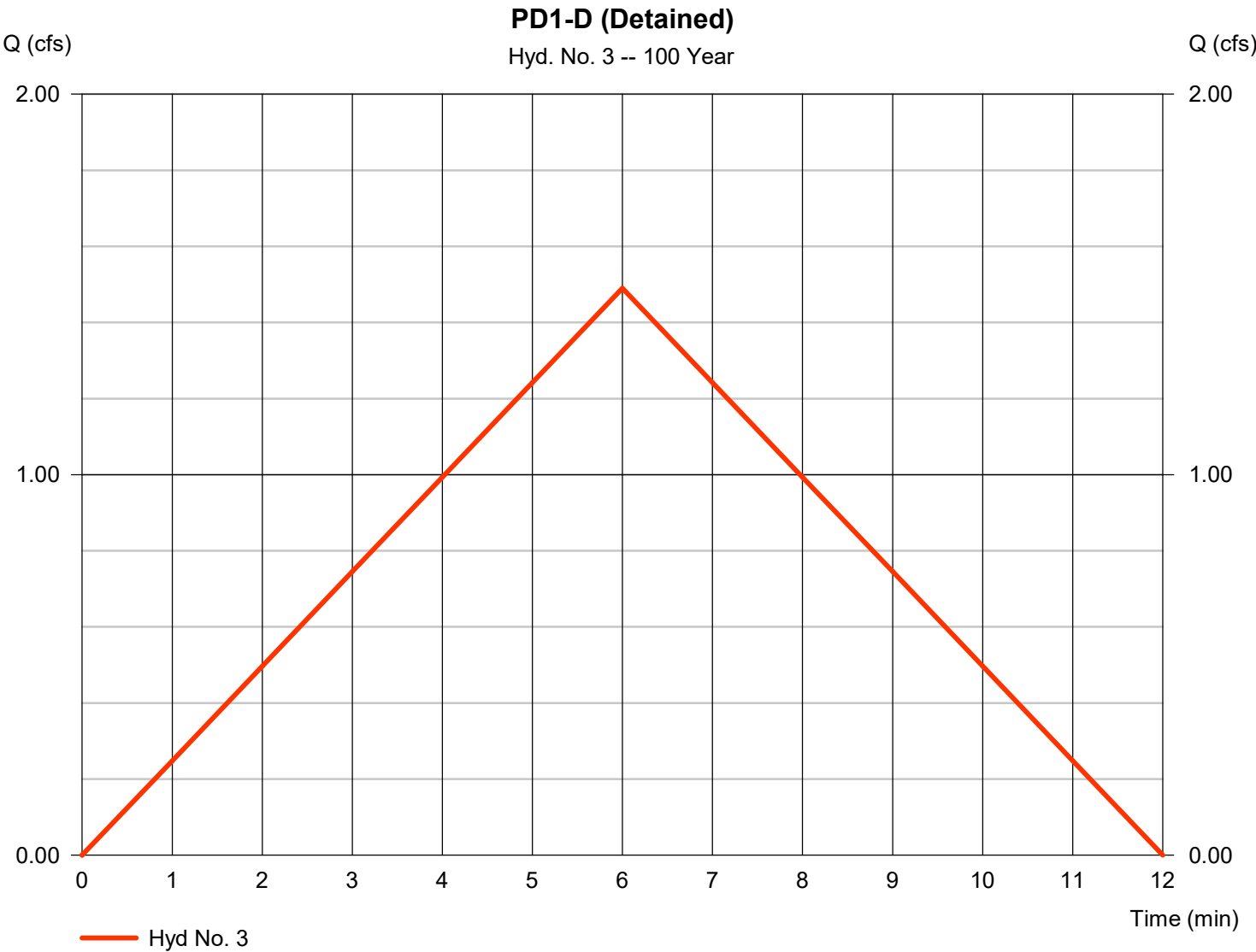


Hydrograph Report

Hyd. No. 3

PD1-D (Detained)

Hydrograph type	= Rational	Peak discharge	= 1.490 cfs
Storm frequency	= 100 yrs	Time to peak	= 6 min
Time interval	= 1 min	Hyd. volume	= 537 cuft
Drainage area	= 0.190 ac	Runoff coeff.	= 0.99
Intensity	= 7.923 in/hr	Tc by User	= 6.00 min
IDF Curve	= keyport.IDF	Asc/Rec limb fact	= 1/1



Hydrograph Report

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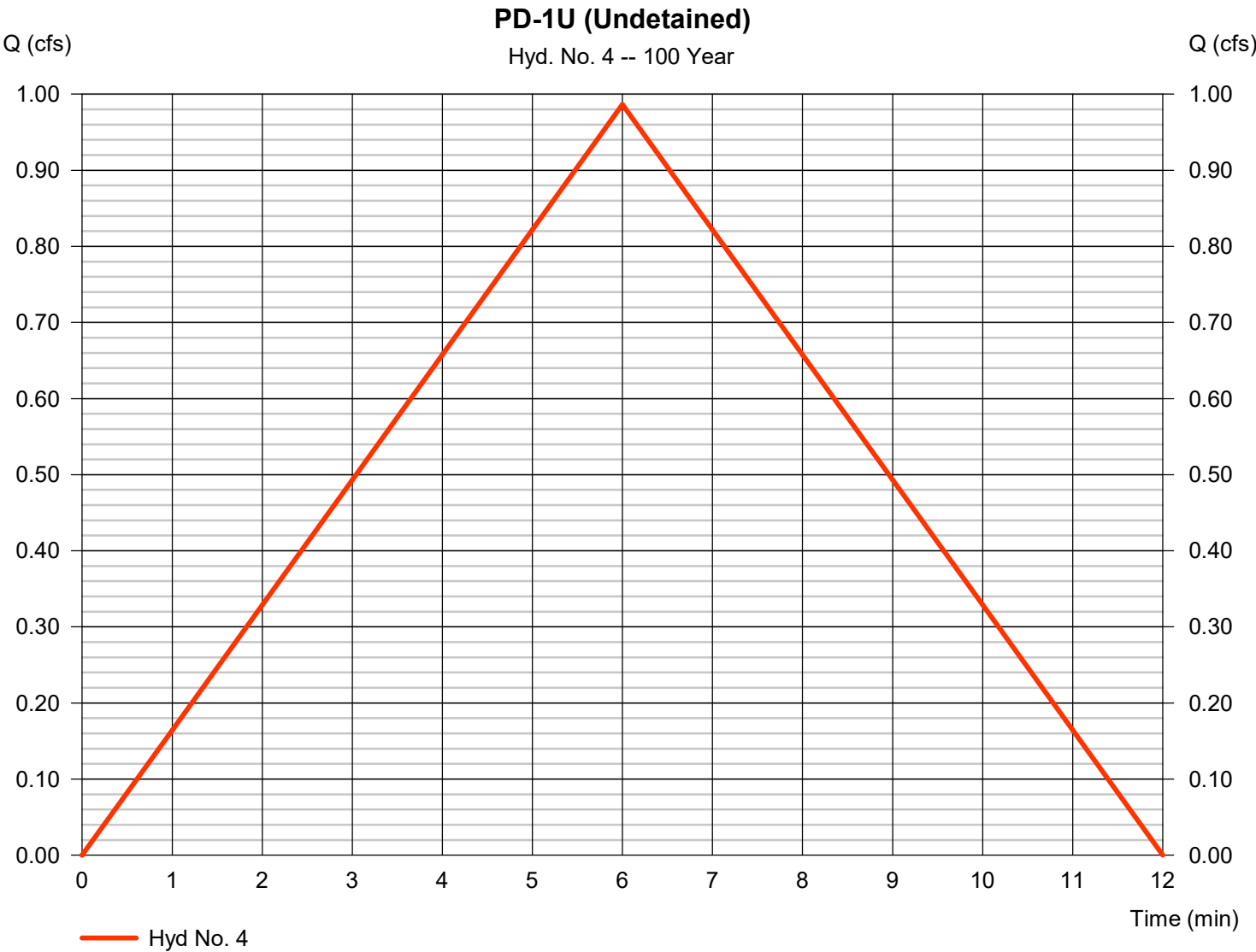
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Hyd. No. 4

PD-1U (Undetained)

Hydrograph type	= Rational	Peak discharge	= 0.986 cfs
Storm frequency	= 100 yrs	Time to peak	= 6 min
Time interval	= 1 min	Hyd. volume	= 355 cuft
Drainage area	= 0.150 ac	Runoff coeff.	= 0.83*
Intensity	= 7.923 in/hr	Tc by User	= 6.00 min
IDF Curve	= keyport.IDF	Asc/Rec limb fact	= 1/1

* Composite (Area/C) = [(0.080 x 0.99) + (0.070 x 0.65)] / 0.150



Hydrograph Report

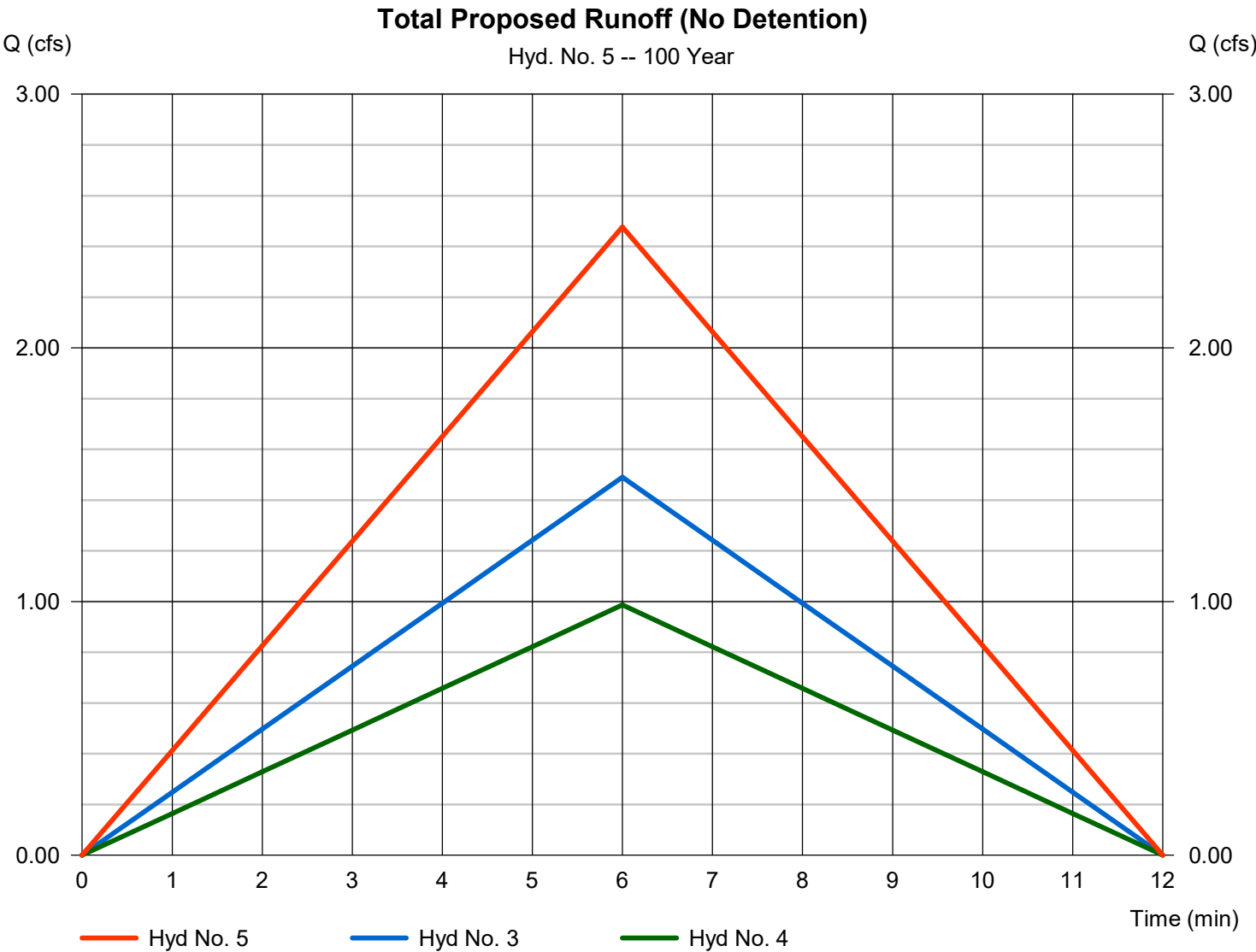
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Hyd. No. 5

Total Proposed Runoff (No Detention)

Hydrograph type	= Combine	Peak discharge	= 2.477 cfs
Storm frequency	= 100 yrs	Time to peak	= 6 min
Time interval	= 1 min	Hyd. volume	= 892 cuft
Inflow hyds.	= 3, 4	Contrib. drain. area	= 0.340 ac



Hydrograph Report

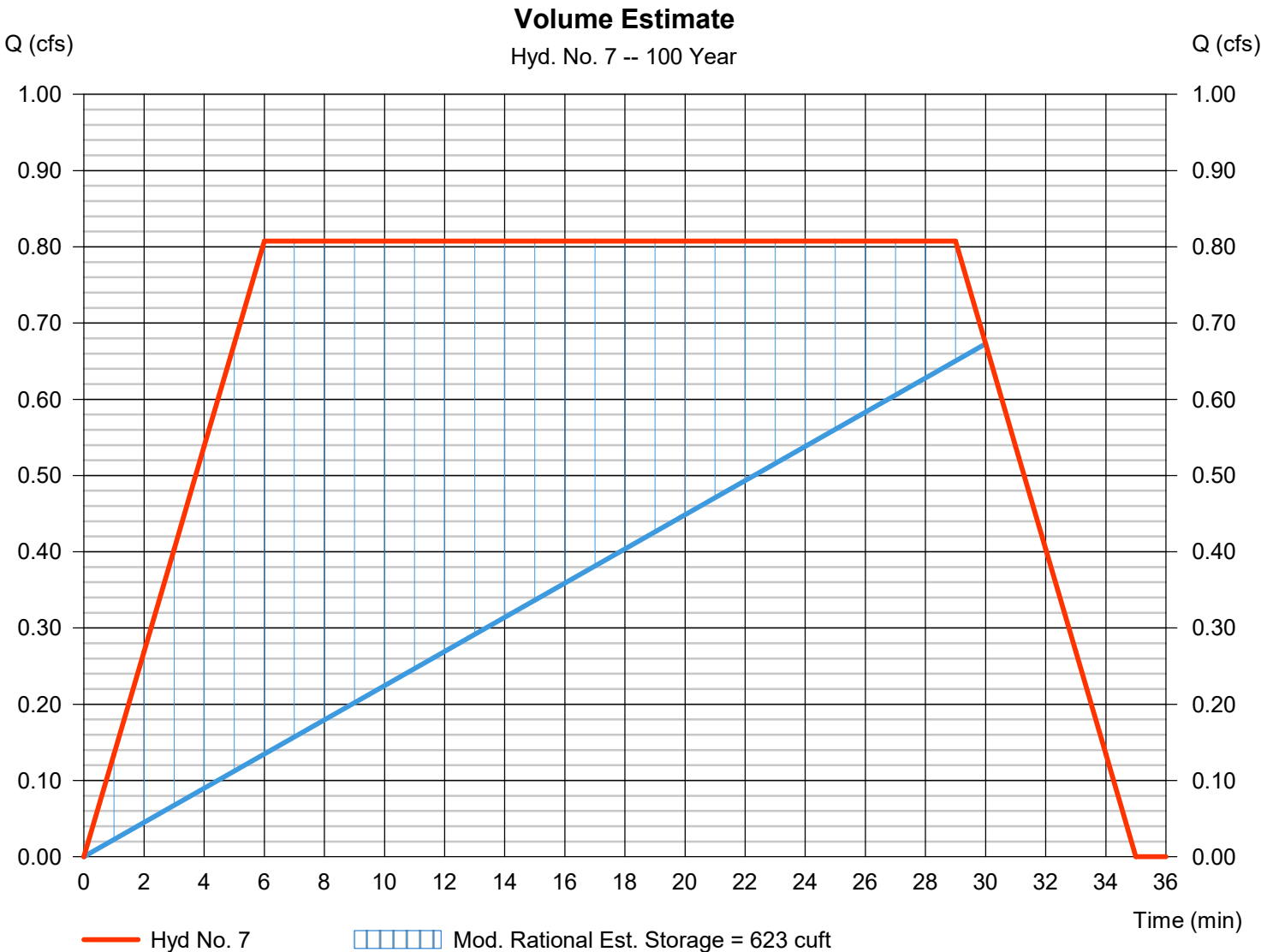
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

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Hyd. No. 7

Volume Estimate

Hydrograph type	= Mod. Rational	Peak discharge	= 0.808 cfs
Storm frequency	= 100 yrs	Time to peak	= 6 min
Time interval	= 1 min	Hyd. volume	= 1,425 cuft
Drainage area	= 0.190 ac	Runoff coeff.	= 0.99
Intensity	= 4.293 in/hr	Tc by User	= 6.00 min
IDF Curve	= keyport.IDF	Storm duration	= 4.9 x Tc
Target Q	=0.734 cfs	Est. Req'd Storage	=623 cuft

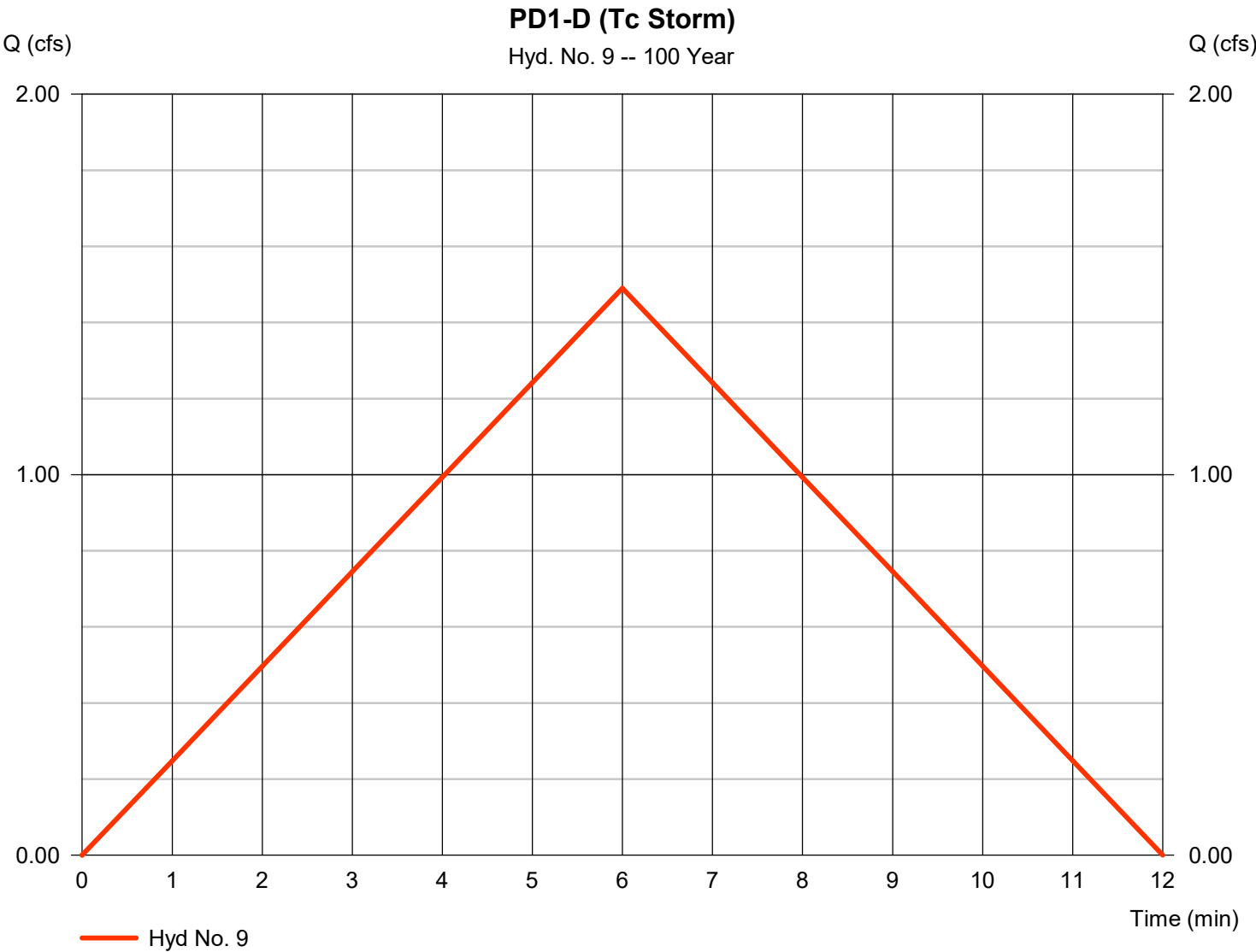


Hydrograph Report

Hyd. No. 9

PD1-D (Tc Storm)

Hydrograph type	= Rational	Peak discharge	= 1.490 cfs
Storm frequency	= 100 yrs	Time to peak	= 6 min
Time interval	= 1 min	Hyd. volume	= 537 cuft
Drainage area	= 0.190 ac	Runoff coeff.	= 0.99
Intensity	= 7.923 in/hr	Tc by User	= 6.00 min
IDF Curve	= keyport.IDF	Asc/Rec limb fact	= 1/1



Hydrograph Report

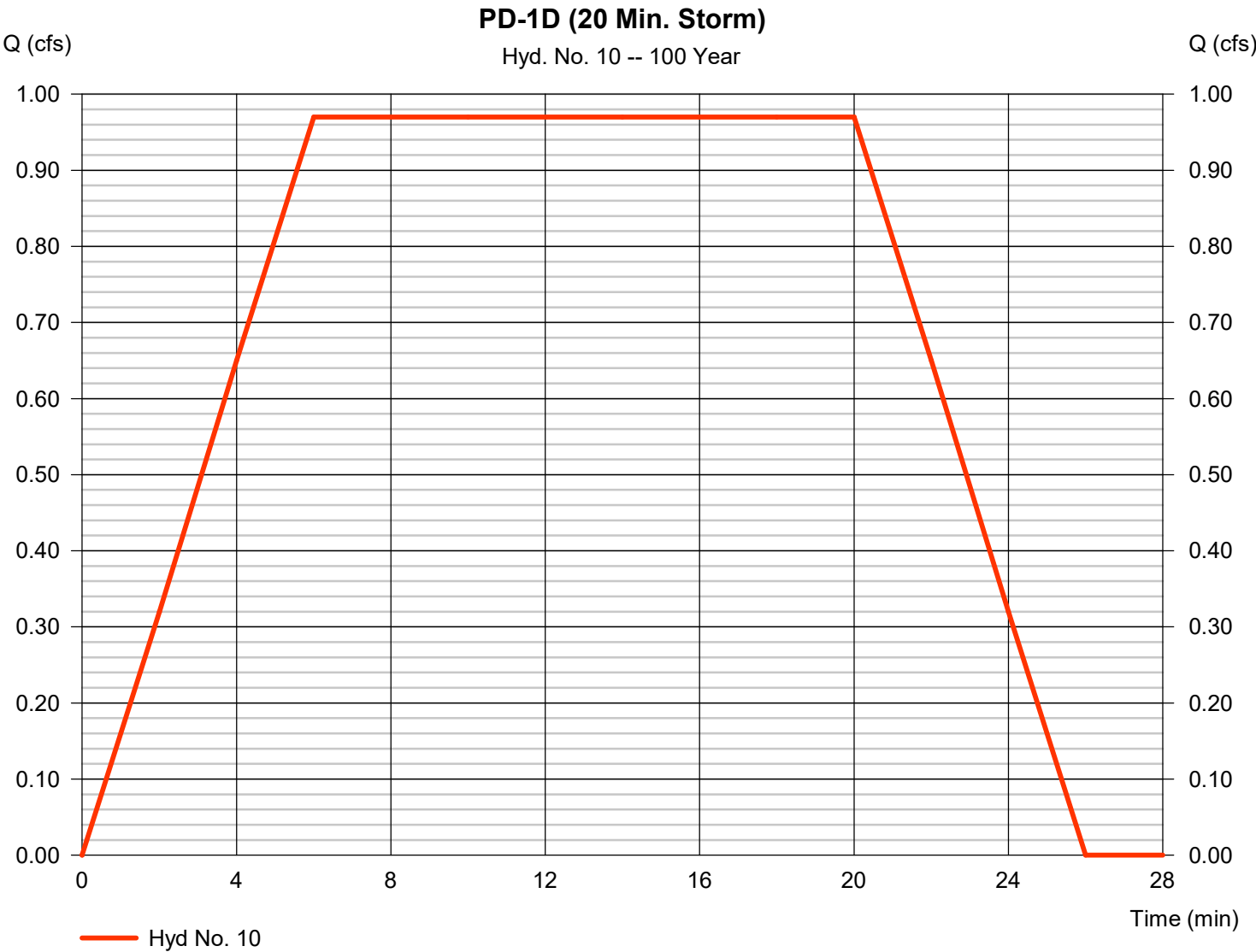
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Hyd. No. 10

PD-1D (20 Min. Storm)

Hydrograph type	= Manual	Peak discharge	= 0.970 cfs
Storm frequency	= 100 yrs	Time to peak	= 6 min
Time interval	= 2 min	Hyd. volume	= 1,164 cuft

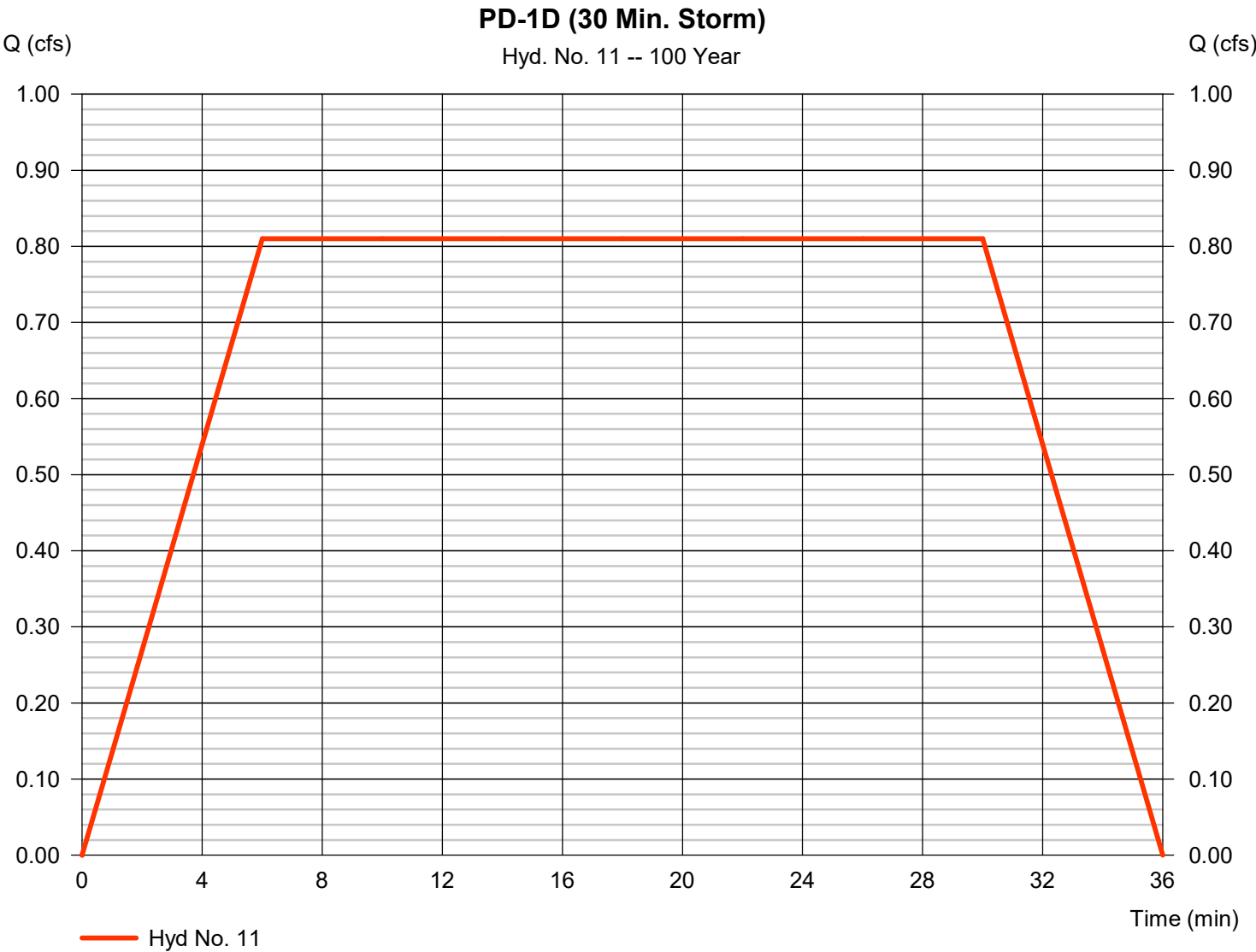


Hydrograph Report

Hyd. No. 11

PD-1D (30 Min. Storm)

Hydrograph type	= Manual	Peak discharge	= 0.810 cfs
Storm frequency	= 100 yrs	Time to peak	= 6 min
Time interval	= 2 min	Hyd. volume	= 1,458 cuft



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

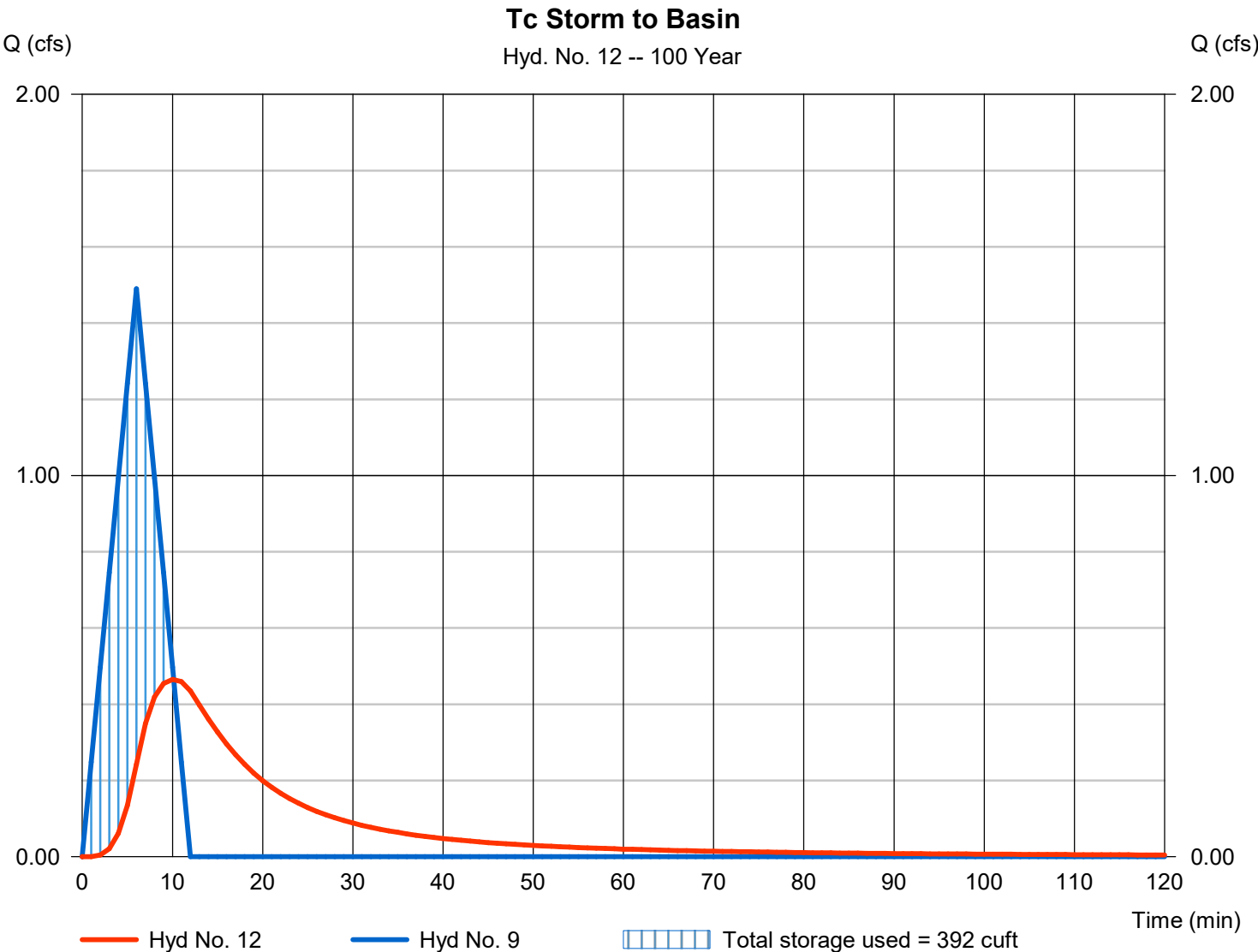
Monday, 03 / 13 / 2023

Hyd. No. 12

Tc Storm to Basin

Hydrograph type	= Reservoir	Peak discharge	= 0.465 cfs
Storm frequency	= 100 yrs	Time to peak	= 10 min
Time interval	= 1 min	Hyd. volume	= 523 cuft
Inflow hyd. No.	= 9 - PD1-D (Tc Storm)	Max. Elevation	= 100.44 ft
Reservoir name	= Stone Reservoir	Max. Storage	= 392 cuft

Storage Indication method used.



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

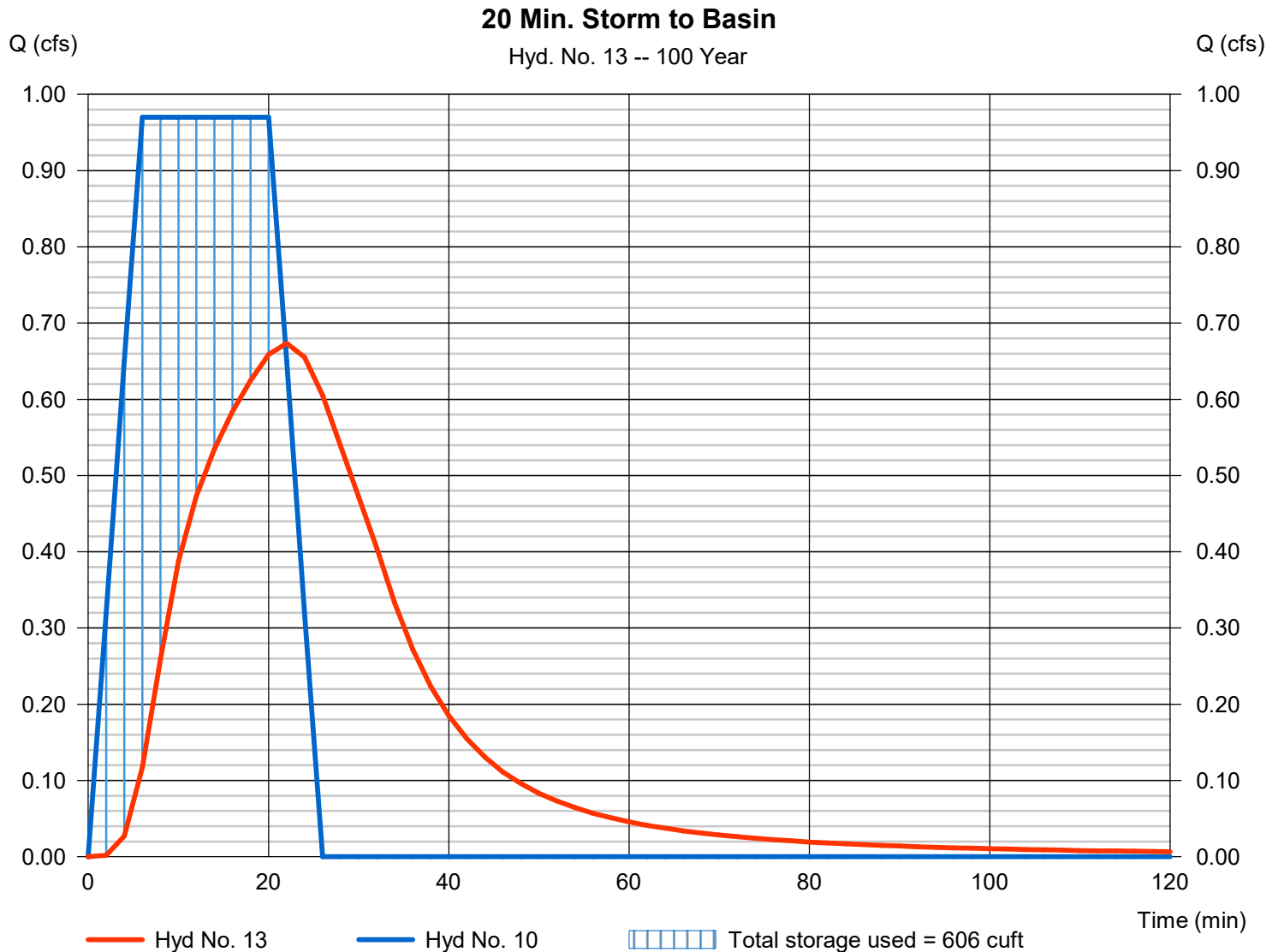
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Hyd. No. 13

20 Min. Storm to Basin

Hydrograph type	= Reservoir	Peak discharge	= 0.673 cfs
Storm frequency	= 100 yrs	Time to peak	= 22 min
Time interval	= 2 min	Hyd. volume	= 1,150 cuft
Inflow hyd. No.	= 10 - PD-1D (20 Min. Storm)	Max. Elevation	= 100.71 ft
Reservoir name	= Stone Reservoir	Max. Storage	= 606 cuft

Storage Indication method used.



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

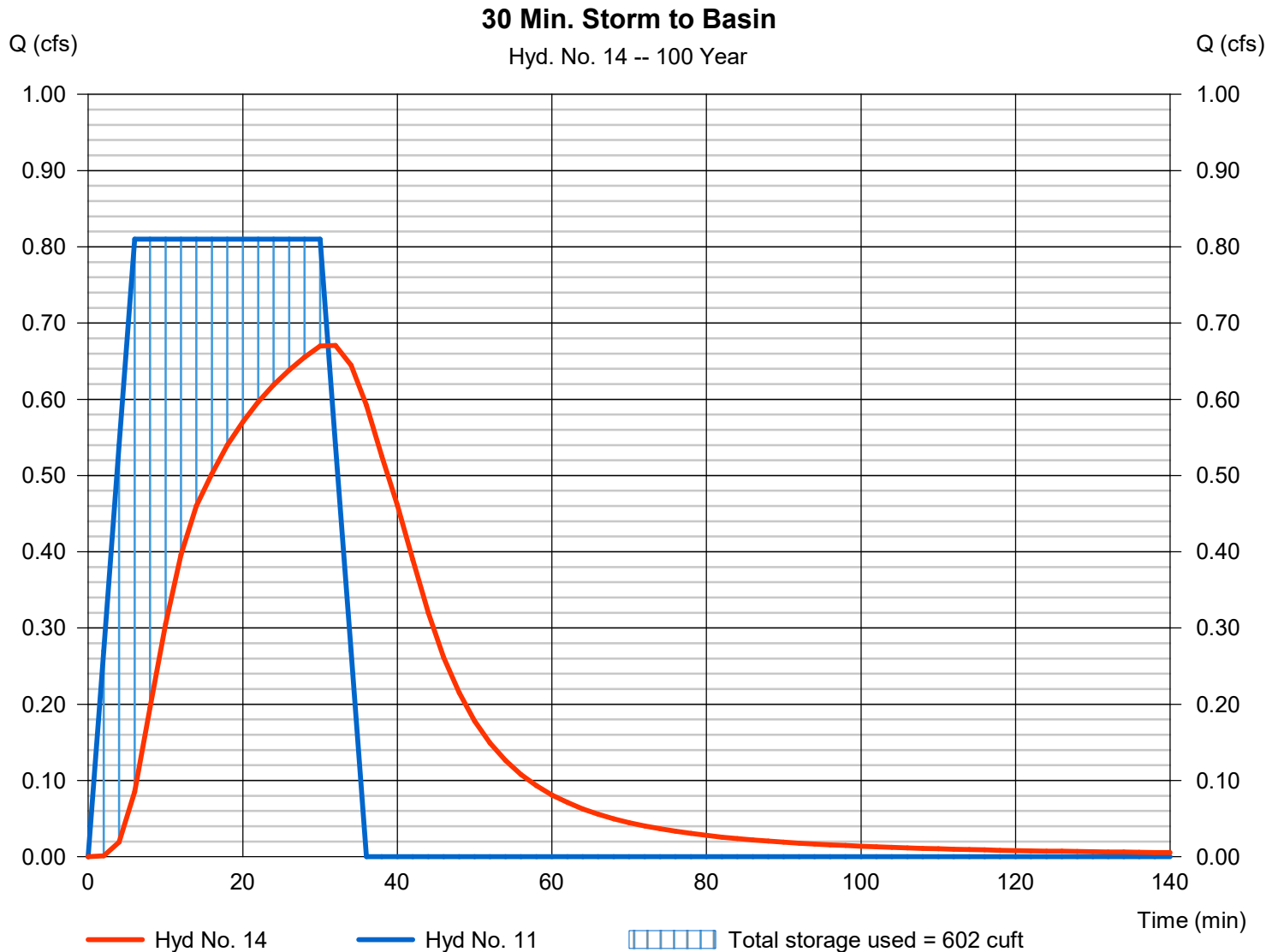
Monday, 03 / 13 / 2023

Hyd. No. 14

30 Min. Storm to Basin

Hydrograph type	= Reservoir	Peak discharge	= 0.670 cfs
Storm frequency	= 100 yrs	Time to peak	= 32 min
Time interval	= 2 min	Hyd. volume	= 1,444 cuft
Inflow hyd. No.	= 11 - PD-1D (30 Min. Storm)	Max. Elevation	= 100.71 ft
Reservoir name	= Stone Reservoir	Max. Storage	= 602 cuft

Storage Indication method used.



Hydrograph Report

Hyd. No. 16

PD-1U (Tc Storm)

Hydrograph type	= Rational	Peak discharge	= 0.986 cfs
Storm frequency	= 100 yrs	Time to peak	= 6 min
Time interval	= 1 min	Hyd. volume	= 355 cuft
Drainage area	= 0.150 ac	Runoff coeff.	= 0.83*
Intensity	= 7.923 in/hr	Tc by User	= 6.00 min
IDF Curve	= keyport.IDF	Asc/Rec limb fact	= 1/1

* Composite (Area/C) = [(0.080 x 0.99) + (0.070 x 0.65)] / 0.150

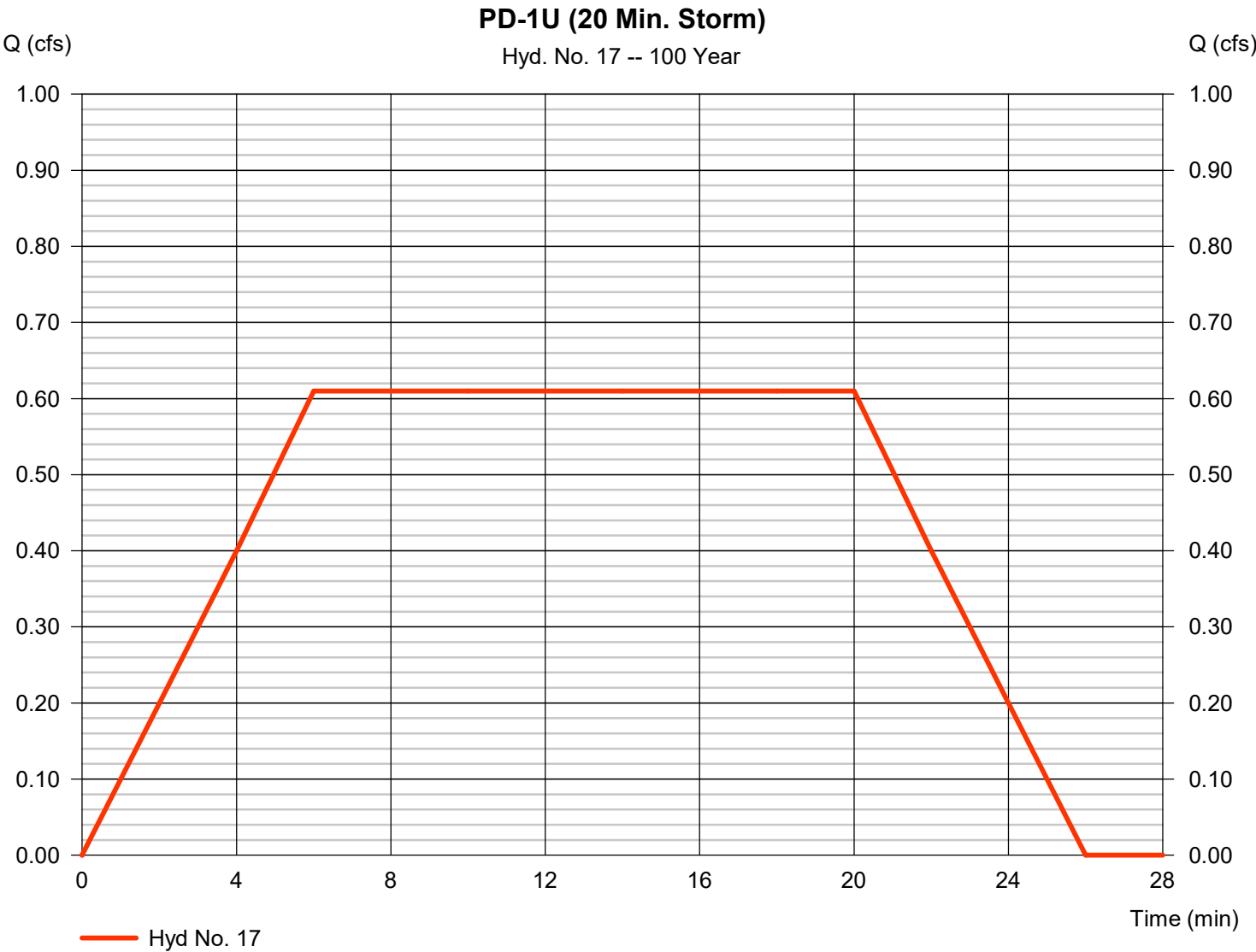


Hydrograph Report

Hyd. No. 17

PD-1U (20 Min. Storm)

Hydrograph type	= Manual	Peak discharge	= 0.610 cfs
Storm frequency	= 100 yrs	Time to peak	= 6 min
Time interval	= 2 min	Hyd. volume	= 730 cuft

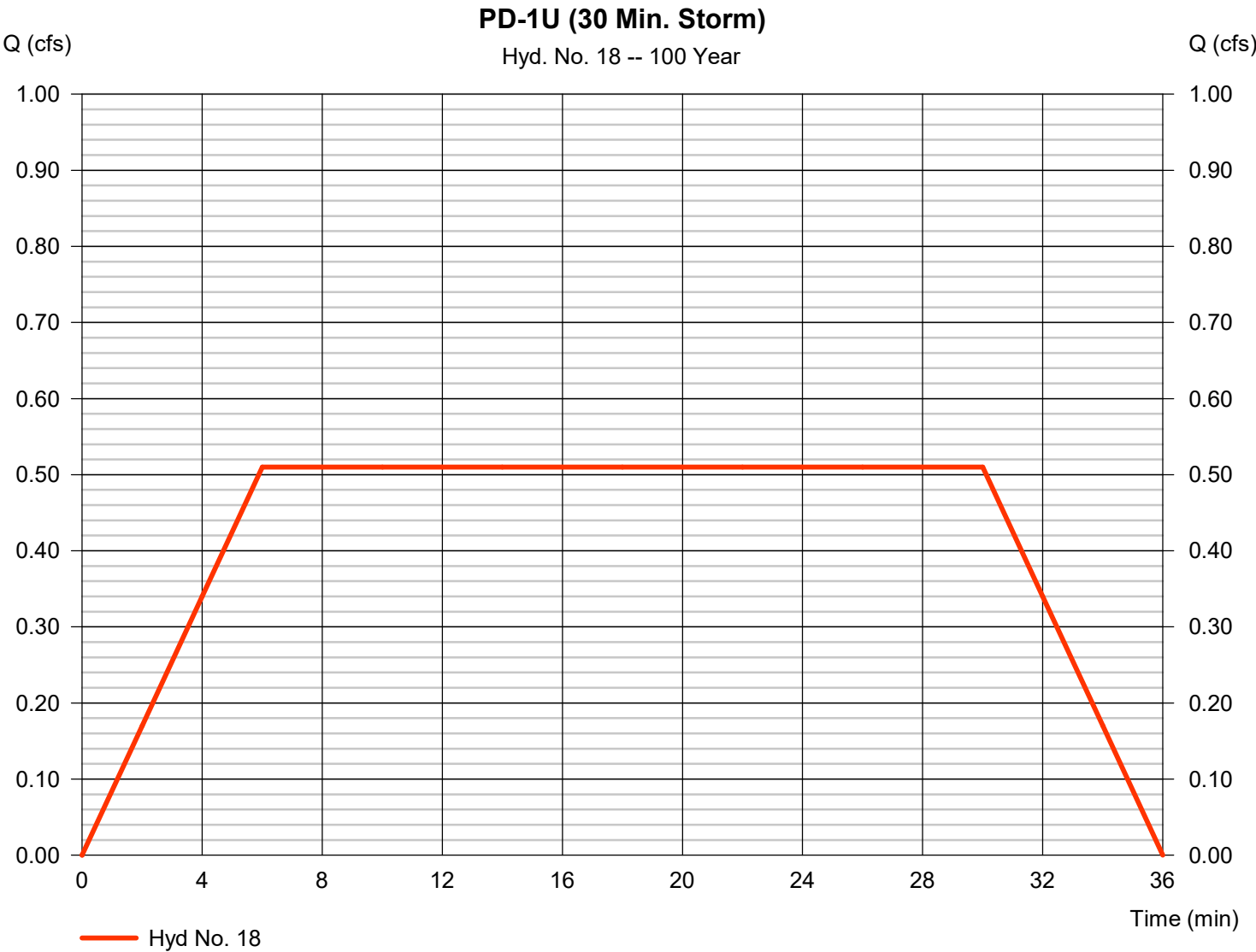


Hydrograph Report

Hyd. No. 18

PD-1U (30 Min. Storm)

Hydrograph type	= Manual	Peak discharge	= 0.510 cfs
Storm frequency	= 100 yrs	Time to peak	= 6 min
Time interval	= 2 min	Hyd. volume	= 918 cuft



Hydrograph Report

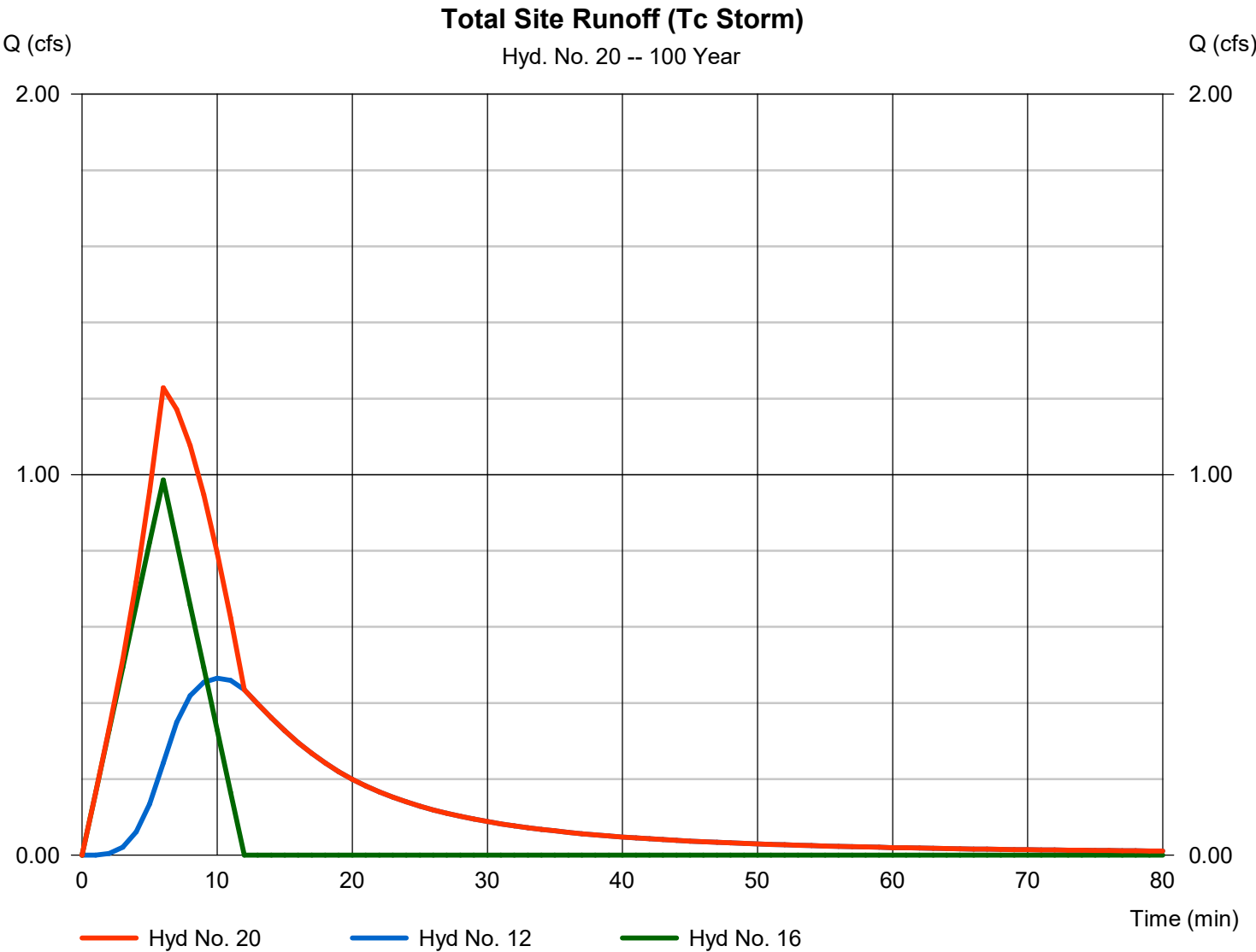
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021

Monday, 03 / 13 / 2023

Hyd. No. 20

Total Site Runoff (Tc Storm)

Hydrograph type	= Combine	Peak discharge	= 1.229 cfs
Storm frequency	= 100 yrs	Time to peak	= 6 min
Time interval	= 1 min	Hyd. volume	= 878 cuft
Inflow hyds.	= 12, 16	Contrib. drain. area	= 0.150 ac

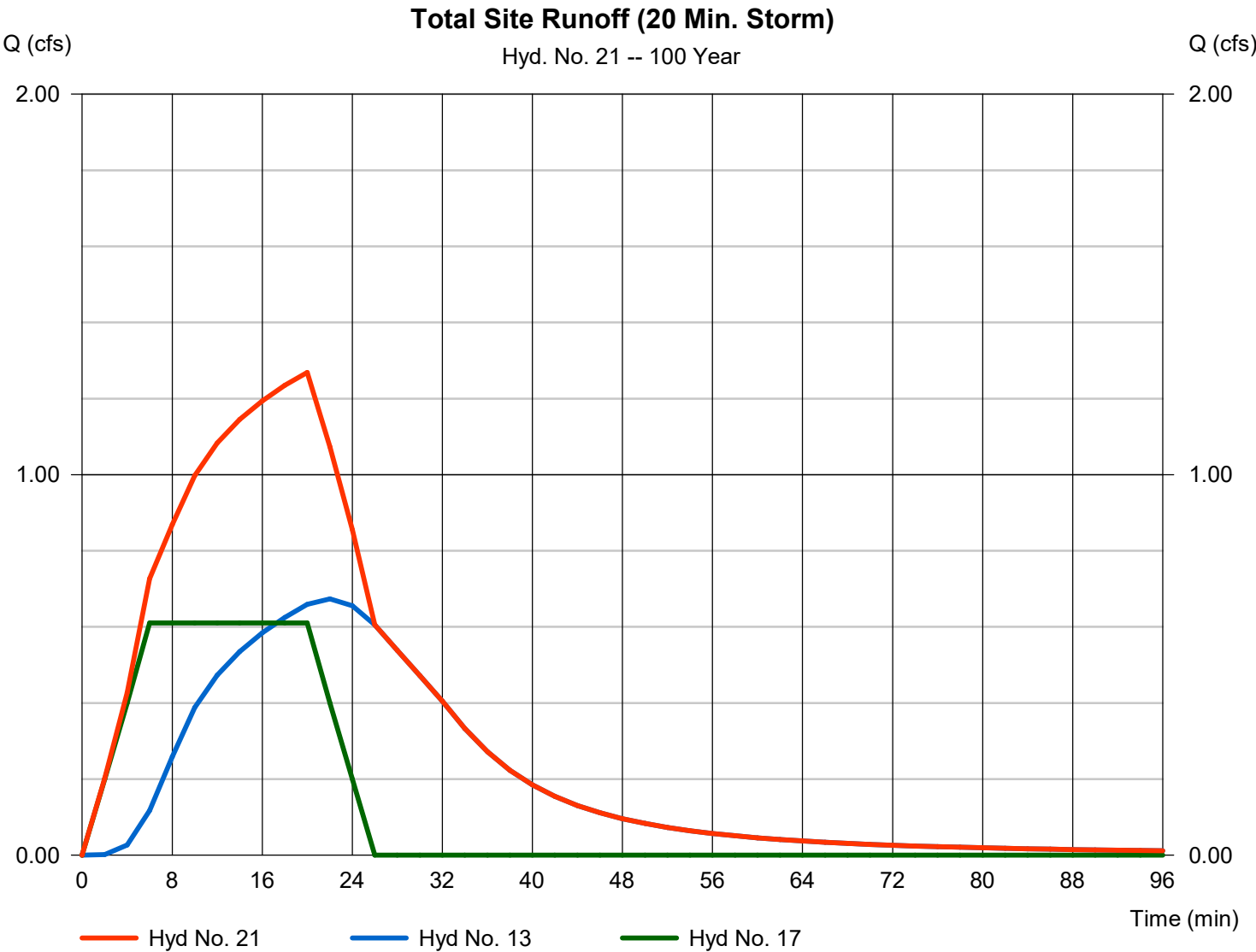


Hydrograph Report

Hyd. No. 21

Total Site Runoff (20 Min. Storm)

Hydrograph type	= Combine	Peak discharge	= 1.269 cfs
Storm frequency	= 100 yrs	Time to peak	= 20 min
Time interval	= 2 min	Hyd. volume	= 1,880 cuft
Inflow hyds.	= 13, 17	Contrib. drain. area	= 0.000 ac

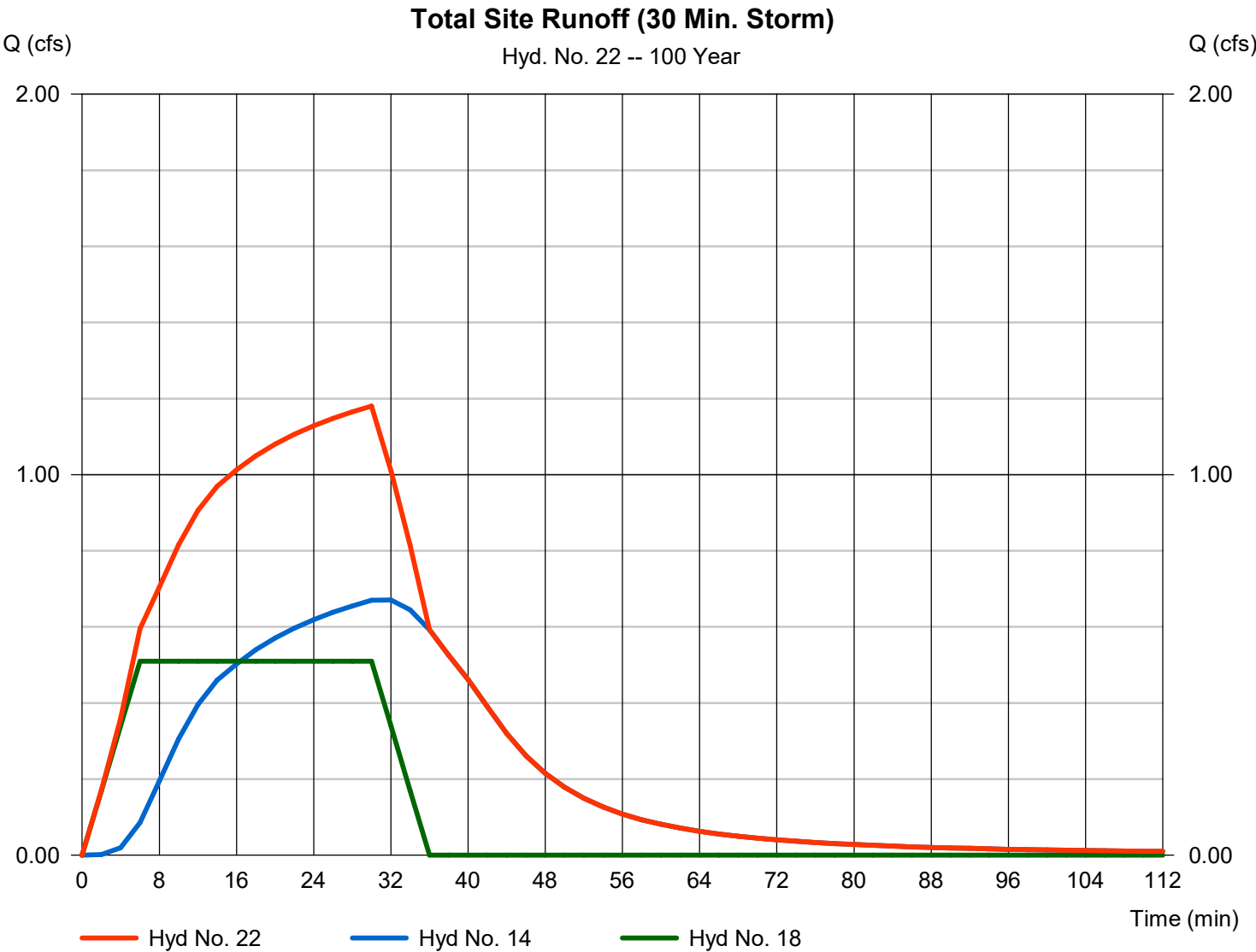


Hydrograph Report

Hyd. No. 22

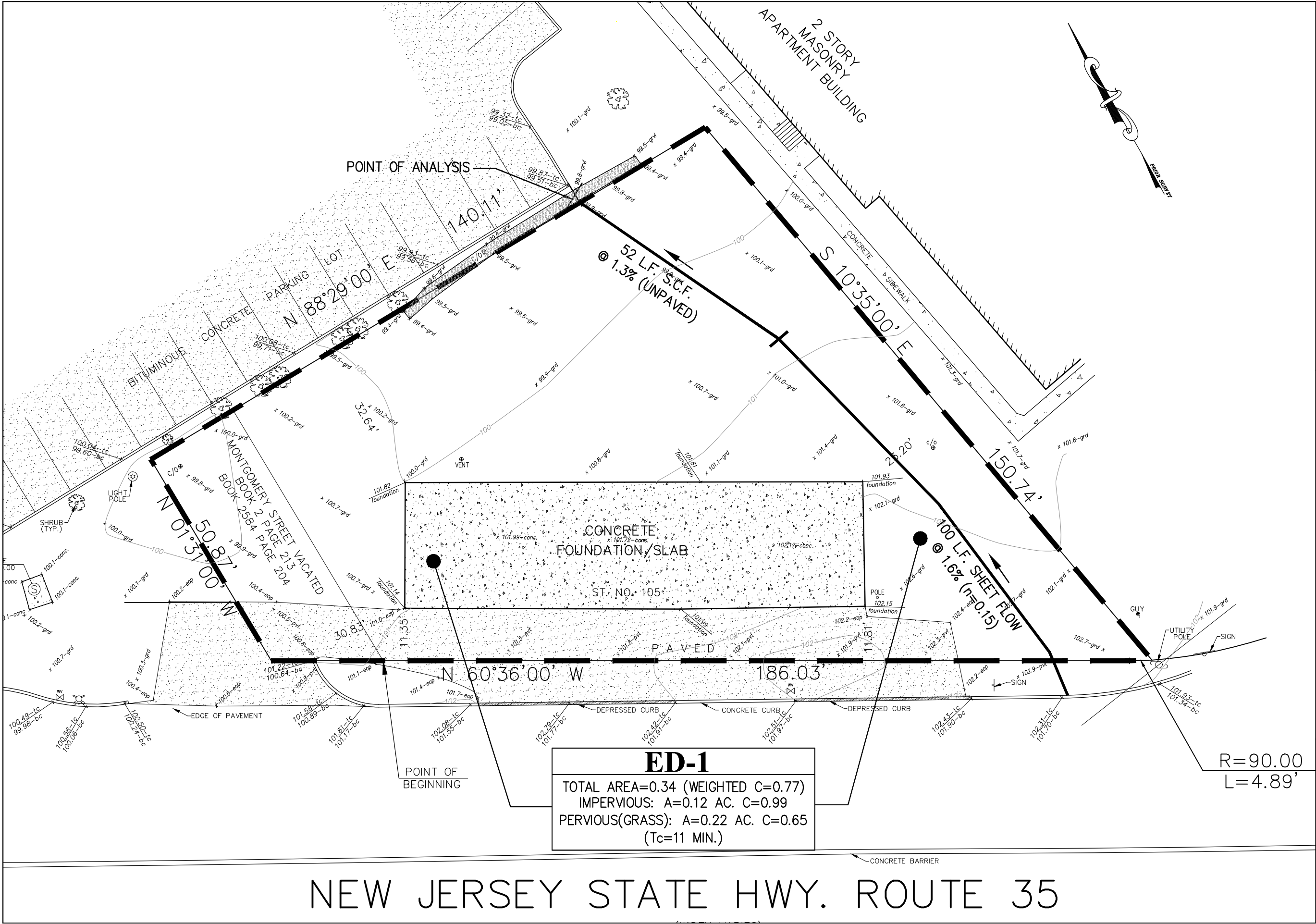
Total Site Runoff (30 Min. Storm)

Hydrograph type	= Combine	Peak discharge	= 1.180 cfs
Storm frequency	= 100 yrs	Time to peak	= 30 min
Time interval	= 2 min	Hyd. volume	= 2,362 cuft
Inflow hyds.	= 14, 18	Contrib. drain. area	= 0.000 ac



APPENDIX C

DRAINAGE AREA MAPS



EKA ASSOCIATES, P.A.

Engineers • Surveyors • Planners
328 Park Avenue, Scotch Plains, N.J. 07076
908-322-2030

EXISTING DRAINAGE AREA MAP
TAX LOT 24 BLOCK 110
BOROUGH OF KEYPORT, MONMOUTH COUNTY, NEW JERSEY

