parker DESIGN GROUP

30-R AT CRC RESIDENTIAL DEVELOPMENT

Tax No: 317-3 13

PDG # 17-0117

Stormwater Management Concept Calculations For Rezoning Application

February 1, 2018

PREPARED FOR:

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PROJECT NARRATIVE

Project Description

The purpose of this project is the development of 7.03 acres of land into a Planned Residential Development for SAS Builder, Inc. The Site is located in the Town of Blacksburg along Research Center Drive across the road from multiple Knollwood Residential developments.

Existing Site Conditions

The 7.033 undeveloped site is entirely wooded. The site is bound by the research and development properties of Virginia Tech Foundation Inc. and VPI Buildings and Land to the North, Virginia Tech Corporate Research Center Inc (CRC). to the west, and Virginia Tech Corporate Research Center Inc. to the south.

The existing soil information and maps are shown in Appendix A. The existing soils include the following soils:

- 1C: Berks-Clymer complex, 7 to 15 percent slopes
- 19B: Guernsey silt loam, 2 to 7 percent slopes
- 25: McGary and Purdy Soils

Proposed Development Plans

The proposed development will include three multi-family dwellings and amenity areas. The site also proposes an access connection to CRC property and connection to the existing CRC trail network.

During construction the wooded areas will become disturbed and runoff from the site will need to be controlled by temporary erosion and sediment control measures. These measures will adhere to the set forth by the Virginia Erosion and Sediment Control Handbook.

STORMWATER SUMMARY

Pre-Development Conditions

The pre-developed site is divided into three drainage areas. Appendix B contains the pre-developed drainage map and runoff calculations. Existing conditions were evaluated using AutoCAD's Hydraflow Hydrograph's extension and utilizing the SCS method.

Area "A" drains to the front of the property towards Research Center Drive.

Area "B" drains to the southwest side of the property into a natural channel to Kraft Drive then through a manmade channel to a pond on Pratt Drive. The pond (Facility #4) on Pratt Drive is an existing water quality BMP for the CRC sized for a 30 hr drawdown of 2xWQV. The evaluation point for Area "B" is a point just prior to the culvert under Kraft drive.

Area "C" sheet flows towards/across Virginia Tech property and ultimately reaches a roadside ditch.

The following tables are a summary for the Pre-Developed Condition:

Pre-Development Land Coverage			
	Area "A"	Area "B"	Area "C"
Coverage Type	Wooded	Wooded/Grassed	Wooded
Soil Type	B	B/D	B/C
Total Area	1.31	4.53	2.77
Composite CN	55	58	60

Pre-Development Peak Runoff Rates			
	Area "A"	Area "B"	Area "C"
1-Year Storm	0.007 cfs	0.061 cfs	0.095 cfs
2-Year Storm	0.042 cfs	0.40 cfs	0.58 cfs
10-Year Storm	0.77 cfs	3.23 cfs	3.23 cfs
25-Year Storm	1.59 cfs	5.97 cfs	5.5 cfs
100-Year Storm	3.30 cfs	11.50 cfs	9.97 cfs

Existing Facility #4 Verification (CRC Pond)

Ultimately, Area "B" reaches the Facility #4. The CRC provided the Regional Stormwater Management Summary for Virginia Tech CRC Phase 1 dated June 24, 2014, which included information for Facility #4.

The following data from the CRC calculations were utilized to recreate/verify downstream conditions.

Table 1. SCS 24 Hour Rainfall Totals for NOAA Station Blacksburg 3 SE (44-0766)

	1 Year	2 Year	10 Year	25 Year	100 Year
24 Hour Rainfall (in)	2.28	2.76	4.11	5.00	6.54

Table 2. Curve Number Weighting Summary for Predevelopment Area 4

Land Cover	HSG Soil Group	CN	Area	Component CN (CN x A/Total Area)	Predevelopment Area 4
Pasture	B	61	21.85	41.3	
Forest	B	55	2.23	3.8	
Pasture	C	74	3.00	6.9	
Pasture	D	80	5.18	12.9	
			Total	64.9~65	

Predevelopment Storm Runoff - Area 4

TOTAL DRAINAGE AREA 32.26 Acres

TIME OF CONCENTRATION

	c' Factor	Length	Slope	Tc (min)
Overland Flow	0.3	100	3.0%	10.1

	Length	Relief	Tc (min)
Channel Flow	538	34	6.0

	Length	Relief	Tc (min)
Channel Flow	175	6	1.6

	Length	Relief	Tc (min)
Channel Flow	523	16	3.9

	Length	Relief	Tc (min)
Channel Flow	129	6	1.2

	Length	Relief	Tc (min)
Channel Flow	260	10	2.1

Total Time of Concentration 25.0 minutes
(see drainage map)

Table 3. Peak flow for Predevelopment Area 4

Return Period	Peak Flow (cfs)	Predevelopment Area 4
1-Year	3.09	
2-Year	7.56	
10-Year	26.08	
25-Year	41.12	
100-Year	70.41	

Table 4. Curve Number Weighting Summary for Postdevelopment Area 4

Land Cover	HSG Soil Group	CN	Area	Component CN (CN x A/Total Area)	Postdevelopment Area 4
Pasture	B	61	11.11	21.0	
Forest	B	55	2.09	3.6	
Pasture	C	74	1.50	3.4	
Pasture	D	80	3.72	9.2	
Impervious	N/A	98	13.84	42.0	
			Total	79.2~79	

Postdevelopment Storm Runoff - Area 4

TOTAL DRAINAGE AREA 32.26 Acres

TIME OF CONCENTRATION

	c' Factor	Length	Slope	Tc (min)
Overland Flow	0.3	100	3.0%	10.1

	Length	Relief	Tc (min)
Channel Flow	544	32	6.3

	Length	Relief	Tc (min)
Channel Flow	430	16	3.1

	Length	Relief	Tc (min)	
Channel Flow	76	1	0.6	*Pipe Flow

	Length	Relief	Tc (min)
Channel Flow	398	18	2.7

	Length	Relief	Tc (min)
Channel Flow	173	6	1.6

Total Time of Concentration 24.5 minutes
(see drainage map)

Outlet Structure Configuration

Stage 1: Circular Orifice
Invert Elevation = 2101.9 feet
Diameter = 0.25 feet
Discharge Coefficient = 0.6

Stage 2: Grate Inlet
Crest Elevation = 2109.7 feet
Effective Perimeter = 9 feet
Effective Flow Area = 4.5 square feet

Stage 3: Outfall Culvert
Invert Elevation = 2101.77 feet
Pipe Diameter = 3 feet
Pipe Length = 150.69 feet
Pipe Slope = 0.03915 ft/ft
Manning n = 0.013
Entrance Condition = SEH
Number of Barrels = 1

Basin Storage/Elevation Input

Elevation (ft)	Storage (acre-ft)
2101.90	0.0000
2102.00	0.0000
2104.00	0.0430
2106.00	0.2330
2108.00	0.6540
2110.00	1.3900
2112.00	2.5370
2114.00	4.0350

Table 5. Peak flow and Routed Flow Summary for Postdevelopment Area 4

Return Period	Peak Inflow (cfs)	Routed Flow (cfs)	Predevelopment Peak Flow (cfs)	Target Met?	Postdev Area 4
1-Year	17.15	0.65	3.09	Yes	
2-Year	25.84	4.37	7.56	Yes	
10-Year	53.77	25.54	26.08	Yes	
25-Year	73.51	34.37	41.12	Yes	
100-Year	108.76	45.55	70.41	Yes	

Recreated hydrographs and information can be found in Appendix C. Results from the recreated hydrogpraphs were compared to the 2015 calculation package. See summary below compared to Table 5 above.

Verification of Peak Flow and Routed Flow for Post Development Area 4		
	2015 Peak Inflow	2015 Routed Flow
1-Year Storm	20.21 cfs	0.65 cfs
2-Year Storm	30.71 cfs	3.87 cfs
10-Year Storm	64.15 cfs	34.79 cfs
25-Year Storm	87.99 cfs	42.70 cfs
100-Year Storm	130.63 cfs	56.50 cfs

Calculations show differences in the peak inflows and routed flows. However, WSEL elevations for the storm events were comparable. When trying to maintain the hydraulics of Facility #4 in the 2018 Post Developed condition, the routed flows from our software will be utilized.

Post-Development Conditions

The post-developed site is divided into three drainage areas. Appendix D contains the post-developed drainage map and runoff calculations for the three drainage areas. Proposed conditions were evaluated using AutoCAD's Hydraflow Hydrograph's extension and utilizing the SCS method. Min Tc of 6 minutes was used except for Area "C". Tc for Area "C" is also included in the Appendix.

The proposed development will place a maximum of 5.5 acres of impervious area as part of the development. Drainage areas also take into consideration a planned CRC building expansion.

Area "A" from the existing condition is being incorporated into Area "B (to UG Det)".

Area "B (DA to Det Pond @ Kraft) drains to the southwest side of the property into the swale.

Area "C" sheet flows towards/across Virginia Tech property and ultimately reaches a roadside ditch.

The following tables are a summary for the Post-Developed Condition:

Post-Development Land Coverage			
	Area "B (to UG Det)"	Area "B (to Pond @ Kraft"	Area "C"
Coverage Type	Grassed/Impervious	Grassed/Impervious	Wooded/Grass/Impervious
Soil Type	B	B/D	B/C
Total Area	5.35	2.39	0.83
Composite CN	96	85	68

Post-Development Peak Runoff Rates			
	Area "B (to UG Det)"	Area "B (to Pond @ Kraft"	Area "C"
1-Year Storm	15.43 cfs	4.07 cfs	0.28 cfs
2-Year Storm	19.07 cfs	5.59 cfs	0.58 cfs
10-Year Storm	29.20 cfs	10.15 cfs	1.65 cfs
25-Year Storm	35.82 cfs	13.21 cfs	2.47 cfs
100-Year Storm	47.22 cfs	18.53 cfs	4.0 cfs

Quantity Considerations

Due to the increase in peak runoff rates, measures are needed to control stormwater. The plan is install an ADS Storm Tech Chamber system with 60,000 cf of storage on site and an above ground detention pond between the southwest corner of the site and Kraft Drive in the existing drainage swale. There is potential for wetlands in the existing drainage swale and is in the process of being evaluated. Should wetlands be present and the disturbance limit for wetlands is hit other options will be evaluated and/or wetlands will be mitigated.

The Storm Tech Chamber system will collect the majority of the site, detain and discharge to the Pond at Kraft. The Pond at Kraft will collect some additional area from the site and area between the CRC and the site. A potential building addition for the CRC was also taken into consideration.

The evaluation point is the outfall of the Pond at Kraft. Routing calculations between the two ponds show that the 10-year discharge from our site is being met at the outfall point of the Kraft Pond.

The following table is a summary for the Post-Developed Routed Condition:

Summary of Post-Development Routed Peak Flow at Evaluation Point			
	Existing Area "B"	Inflow to Pond @ Kraft	Routed Flow
1-Year Storm	0.061 cfs	4.36 cfs	0.199 cfs
2-Year Storm	0.40 cfs	5.89 cfs	0.35 cfs
10-Year Storm	3.23 cfs	12.26 cfs	3.23 cfs
25-Year Storm	5.97 cfs	17.04 cfs	5.68 cfs
100-Year Storm	11.50 cfs	24.32 cfs	16.41 cfs

Downstream Considerations

The minimum standards of 9VAC25-70-66 have been used to address channel protection and flood protection for this site. For channel protection, discharge is to a manmade channel that drains to the CRC's Facility #4 and the existing 2-yr rate is being met. For flood protection, the existing 10-yr rate is being met.

The outfall from CRC's Facility #4 is to a natural channel. 9VAC25-70-66 requires any development to meet an energy balance equation for the 1-yr storm event. Due to the existing and proposed conditions of the site, the site is allowed a discharge of 0 cfs for the 1-yr storm event. Measures were taken onsite and at the new Kraft Drive pond to reduce the 1-yr storm event to the extend possible.

Considering that the release from the site ultimately reaches the CRC's Facility #4, routing calculations were provided for the 2018 Post Developed Condition. 2018 Post – Development Facility #4 Verification calculations can be found in Appendix F. The calculations show that the existing hydraulics of the pond are being maintained. Since the 1-yr release rate for Facility #4 is not being increase, the development meets the energy balance equation at the point of discharge to a natural channel.

The following table is a summary for the 2018 Post-Developed Routed Condition for Facility #4:

Summary of 2018 Post Development for Facility #4		
	2015 Routed Flow	2018 Routed Flow
1-Year Storm	0.65 cfs	0.63 cfs
2-Year Storm	3.87 cfs	2.24 cfs
10-Year Storm	34.79 cfs	32.92 cfs
25-Year Storm	42.70 cfs	40.10 cfs
100-Year Storm	56.50 cfs	55.60 cfs

Quality Considerations

The VRRM spreadsheet was used to calculate the phosphorous removal requirements for the site. A max of 5.5 acres of impervious area will be placed as part of the development and a maximum disturbance of 9.5 acres. The VRRM spreadsheet shows that 9.9 lbs of phosphorous per year are required to be moved. Since the development stays under 10 lbs of phosphorous, the purchase of nutrient credits are allowed. Appendix G shows the VRRM spreadsheet and a letter of availability for the purchase of 10 lbs of phosphorous credits.

STORM WATER MANAGEMENT MAINTENANCE & INSPECTION PLAN

The Town of Blacksburg requires a formal stormwater maintenance agreement to be provided, reviewed, and recorded at the Montgomery County Courthouse. This plan will be fully developed at time of site plan. All facility inspections and any required maintenance shall be

handled solely by the owner. The following are a minimum list of requirements not representative of the full responsibility of the land owner:

1) The “Operation and Maintenance Checklist” located in Appendix 3B (Checklists – Detention, Retention, and Impoundment BMPs) of the Virginia Stormwater Management Handbook Volume I, should be completed every six months.
2) All outfall structures to shall be inspected after each runoff producing storm event. These structures shall be checked for debris and sediment accumulation that could inhibit the performance of the structure.
3) All underground detention basins require regular maintenance and inspection. These structures shall be checked for debris, sediment accumulation, structural integrity. After runoff producing events the outfall structure of the detention facilities will be inspected for debris and sediment accumulation that could inhibit the performance of the structure.

APPENDICES

Appendix A – Soils/Rainfall Information
- Soil Map
- 1C Soils
- 19B Soils
- 25 Soils
- NOAA Precipitation Data
- Watershed Model Schematic

Appendix B – Pre-Developed Hydrologic Conditions
- Pre-Developed Drainage Map
- Time of Concentration Worksheet
- Pre-A SCS Method (1, 2, 10, 25 & 100-year storms)
- Pre-B SCS Method (1, 2, 10, 25 & 100-year storms)
- Pre-C SCS Method (1, 2, 10, 25 & 100-year storms)

Appendix C – Existing Facility #4 Verification
- Pre Development (1970) SCS Method (1, 2, 10, 25 & 100-year storms)
- Post Development (2015) SCS Method (1, 2, 10, 25 & 100-year storms)
- Facility #4 (2015) Pond Report
- Rte Facility #4 (2015) SCS Method (1, 2, 10, 25 & 100-year storms)

Appendix D – Post Developed Hydrologic Conditions
- Post Developed Drainage Map
- Time of Concentration Worksheet
- Post-B (DA to UG Det) SCS Method (1, 2, 10, 25 & 100-year storms)
- Post-B (DA to Det Pond @ Kraft) SCS Method (1, 2, 10, 25 & 100-year storms)
- Post-C SCS Method (1, 2, 10, 25 & 100-year storms)

Appendix E – Routing Calculations
- UG Det (Storm Tech Chambers) Pond Report
- Rte UG Det SCS Method (1, 2, 10, 25 & 100-year storms)
- Post B (Total to Det Pond @ Kraft) SCS Method (1, 2, 10, 25 & 100-year storms)
- New Det. Pond Report @ Kraft
- Rte Det. Pond @ Kraft (1, 2, 10, 25 & 100-year storms)

Appendix F – 2018 Post Development Facility #4 Verification
- Hyd 13 SCS Method (1, 2, 10, 25 & 100-year storms)
- Hyd 14 SCS Method (1, 2, 10, 25 & 100-year storms)
- Facility #4 (2015) Pond Report
- Rte Facility #4 (2018) SCS Method (1, 2, 10, 25 & 100-year storms)

Appendix G – Virginia Runoff Reduction Calculations
- Site Data Sheet
- Availability Letter

APPENDIX A – SOILS/RAINFALL INFORMATION

(See attached Drawings)

Map Scale: 1:1,110 if printed on B landscape (17" x 11") sheet.

N

Meters: 0 15 30 60 90

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

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: Montgomery County, Virginia
Survey Area Data: Version 10, Oct 3, 2017

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

Date(s) aerial images were photographed: Oct 22, 2012—Feb 5, 2017

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
1C	Berks-Clymer complex, 7 to 15 percent slopes	6.2	86.2%
19B	Guernsey silt loam, 2 to 7 percent slopes	0.9	12.3%
25	McGary and Purdy soils	0.1	1.5%
Totals for Area of Interest		**7.2**	**100.0%**

Montgomery County, Virginia

1C—Berks-Clymer complex, 7 to 15 percent slopes

Map Unit Setting

National map unit symbol: kc2c
Elevation: 1,700 to 3,000 feet
Mean annual precipitation: 30 to 45 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 117 to 185 days
Farmland classification: Not prime farmland

Map Unit Composition

Berks and similar soils: 50 percent
Clymer and similar soils: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Berks

Setting

Landform: Hills
Landform position (two-dimensional): Backslope, summit
Landform position (three-dimensional): Side slope, interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Shale, siltstone, and sandstone residuum

Typical profile

H1 - 0 to 7 inches: channery silt loam
H2 - 7 to 23 inches: very channery silt loam
H3 - 23 to 33 inches: extremely channery silt loam
H4 - 33 to 79 inches: bedrock

Properties and qualities

Slope: 7 to 15 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to high (0.00 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Other vegetative classification: Unnamed (G128XB012VA)
Hydric soil rating: No

Description of Clymer

Setting

Landform: Hills
Landform position (two-dimensional): Backslope, summit
Landform position (three-dimensional): Side slope, interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Sandstone, siltstone, and shale residuum

Typical profile

H1 - 0 to 9 inches: loam
H2 - 9 to 21 inches: clay loam
H3 - 21 to 32 inches: channery sandy clay loam
H4 - 32 to 49 inches: very channery sandy loam
H5 - 49 to 79 inches: bedrock

Properties and qualities

Slope: 7 to 15 percent
Depth to restrictive feature: 40 to 60 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 5.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Other vegetative classification: Unnamed (G128XB004VA)
Hydric soil rating: No

Data Source Information

Soil Survey Area: Montgomery County, Virginia
Survey Area Data: Version 9, Dec 11, 2013

Montgomery County, Virginia

19B—Guernsey silt loam, 2 to 7 percent slopes

Map Unit Setting

National map unit symbol: kc2b
Elevation: 1,300 to 2,200 feet
Mean annual precipitation: 30 to 45 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 117 to 185 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Guernsey and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Guernsey

Setting

Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Limestone, shale, sandstone and crystalline rock alluvium

Typical profile

H1 - 0 to 10 inches: silt loam
H2 - 10 to 20 inches: silty clay loam
H3 - 20 to 53 inches: clay
H4 - 53 to 83 inches: silty clay loam

Properties and qualities

Slope: 2 to 7 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 8.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Other vegetative classification: Unnamed (G128XY000VA)

Hydric soil rating: No

Data Source Information

Soil Survey Area: Montgomery County, Virginia
Survey Area Data: Version 9, Dec 11, 2013

Montgomery County, Virginia

25—McGary and Purdy soils

Map Unit Setting

National map unit symbol: kc2k
Elevation: 1,300 to 2,200 feet
Mean annual precipitation: 30 to 45 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 117 to 185 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Mcgary and similar soils: 40 percent
Purdy and similar soils: 35 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mcgary

Setting

Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Limestone, shale, and sandstone alluvium

Typical profile

H1 - 0 to 9 inches: silt loam
H2 - 9 to 37 inches: silty clay
H3 - 37 to 79 inches: clay

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 12 to 36 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: Moderate (about 8.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: D
Other vegetative classification: Unnamed (G128XY000VA)
Hydric soil rating: No

Description of Purdy

Setting

Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Limestone, shale, and sandstone alluvium

Typical profile

H1 - 0 to 11 inches: loam
H2 - 11 to 34 inches: clay
H3 - 34 to 79 inches: clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water storage in profile: High (about 9.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: C/D
Other vegetative classification: Unnamed (G128XY000VA)
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Montgomery County, Virginia
Survey Area Data: Version 9, Dec 11, 2013

NOAA Atlas 14, Volume 2, Version 3
BLACKSBURG 3 SE
Station ID: 44-0766
Location name: Blacksburg, Virginia, USA*
Latitude: 37.2017°, Longitude: -80.4133°
Elevation:
Elevation (station metadata): 2100 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_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.297** (0.270-0.329)	**0.354** (0.321-0.393)	**0.426** (0.385-0.472)	**0.477** (0.429-0.527)	**0.540** (0.483-0.596)	**0.583** (0.518-0.646)	**0.626** (0.551-0.696)	**0.665** (0.580-0.743)	**0.712** (0.612-0.803)	**0.747** (0.633-0.848)
10-min	**0.475** (0.431-0.525)	**0.567** (0.514-0.628)	**0.682** (0.616-0.755)	**0.763** (0.687-0.843)	**0.860** (0.769-0.950)	**0.929** (0.825-1.03)	**0.995** (0.876-1.11)	**1.06** (0.919-1.18)	**1.13** (0.968-1.27)	**1.18** (0.997-1.34)
15-min	**0.594** (0.538-0.656)	**0.713** (0.646-0.790)	**0.862** (0.779-0.955)	**0.965** (0.869-1.07)	**1.09** (0.975-1.21)	**1.18** (1.04-1.30)	**1.26** (1.11-1.40)	**1.33** (1.16-1.49)	**1.42** (1.22-1.60)	**1.48** (1.25-1.68)
30-min	**0.814** (0.738-0.900)	**0.984** (0.892-1.09)	**1.23** (1.11-1.36)	**1.40** (1.26-1.55)	**1.62** (1.44-1.78)	**1.77** (1.57-1.96)	**1.93** (1.70-2.14)	**2.07** (1.81-2.31)	**2.26** (1.94-2.54)	**2.39** (2.03-2.72)
60-min	**1.01** (0.920-1.12)	**1.24** (1.12-1.37)	**1.57** (1.42-1.74)	**1.82** (1.64-2.01)	**2.15** (1.92-2.38)	**2.40** (2.13-2.66)	**2.65** (2.34-2.95)	**2.91** (2.53-3.25)	**3.24** (2.78-3.65)	**3.49** (2.96-3.96)
2-hr	**1.18** (1.07-1.30)	**1.43** (1.30-1.59)	**1.83** (1.66-2.02)	**2.13** (1.93-2.36)	**2.54** (2.27-2.81)	**2.86** (2.54-3.16)	**3.18** (2.80-3.53)	**3.50** (3.05-3.91)	**3.93** (3.36-4.43)	**4.26** (3.60-4.85)
3-hr	**1.27** (1.15-1.40)	**1.54** (1.40-1.70)	**1.95** (1.77-2.15)	**2.27** (2.06-2.50)	**2.70** (2.43-2.97)	**3.04** (2.71-3.35)	**3.38** (2.99-3.75)	**3.74** (3.26-4.16)	**4.21** (3.61-4.74)	**4.58** (3.86-5.21)
6-hr	**1.55** (1.43-1.69)	**1.87** (1.72-2.04)	**2.34** (2.15-2.56)	**2.73** (2.49-2.98)	**3.26** (2.95-3.57)	**3.69** (3.31-4.05)	**4.14** (3.67-4.56)	**4.62** (4.04-5.11)	**5.29** (4.51-5.91)	**5.82** (4.87-6.56)
12-hr	**1.87** (1.73-2.05)	**2.25** (2.08-2.46)	**2.82** (2.59-3.08)	**3.29** (3.01-3.59)	**3.96** (3.59-4.32)	**4.53** (4.06-4.95)	**5.14** (4.54-5.63)	**5.80** (5.03-6.40)	**6.76** (5.71-7.55)	**7.55** (6.24-8.52)
24-hr	**2.28** (2.12-2.46)	**2.76** (2.56-2.98)	**3.51** (3.25-3.78)	**4.11** (3.80-4.43)	**5.00** (4.60-5.38)	**5.74** (5.24-6.17)	**6.54** (5.93-7.02)	**7.40** (6.66-7.95)	**8.66** (7.68-9.33)	**9.70** (8.52-10.5)
2-day	**2.71** (2.52-2.92)	**3.28** (3.05-3.54)	**4.14** (3.84-4.46)	**4.84** (4.47-5.20)	**5.83** (5.36-6.26)	**6.65** (6.09-7.14)	**7.52** (6.85-8.09)	**8.46** (7.64-9.10)	**9.79** (8.75-10.6)	**10.9** (9.62-11.8)
3-day	**2.88** (2.69-3.10)	**3.48** (3.24-3.75)	**4.39** (4.08-4.72)	**5.11** (4.75-5.49)	**6.15** (5.68-6.59)	**7.00** (6.43-7.51)	**7.90** (7.22-8.48)	**8.86** (8.03-9.52)	**10.2** (9.16-11.0)	**11.4** (10.1-12.3)
4-day	**3.05** (2.85-3.28)	**3.69** (3.44-3.96)	**4.63** (4.32-4.97)	**5.39** (5.02-5.78)	**6.47** (5.99-6.93)	**7.35** (6.77-7.87)	**8.29** (7.59-8.88)	**9.27** (8.42-9.94)	**10.7** (9.58-11.5)	**11.8** (10.5-12.8)
7-day	**3.55** (3.31-3.81)	**4.27** (3.99-4.59)	**5.31** (4.95-5.70)	**6.13** (5.70-6.58)	**7.27** (6.73-7.79)	**8.19** (7.55-8.77)	**9.14** (8.39-9.81)	**10.1** (9.24-10.9)	**11.5** (10.4-12.4)	**12.6** (11.3-13.6)
10-day	**4.09** (3.83-4.37)	**4.91** (4.60-5.24)	**6.00** (5.61-6.41)	**6.85** (6.39-7.30)	**7.99** (7.43-8.51)	**8.87** (8.22-9.46)	**9.77** (9.02-10.4)	**10.7** (9.81-11.4)	**11.9** (10.9-12.8)	**12.9** (11.7-13.8)
20-day	**5.56** (5.24-5.89)	**6.61** (6.24-7.01)	**7.92** (7.47-8.40)	**8.94** (8.42-9.47)	**10.3** (9.68-10.9)	**11.4** (10.6-12.0)	**12.5** (11.6-13.2)	**13.5** (12.5-14.4)	**15.0** (13.8-15.9)	**16.1** (14.7-17.2)
30-day	**6.90** (6.52-7.30)	**8.17** (7.71-8.63)	**9.60** (9.06-10.1)	**10.7** (10.1-11.3)	**12.1** (11.4-12.8)	**13.2** (12.3-13.9)	**14.2** (13.3-15.0)	**15.2** (14.1-16.1)	**16.5** (15.3-17.5)	**17.5** (16.1-18.6)
45-day	**8.75** (8.30-9.22)	**10.3** (9.76-10.8)	**11.9** (11.3-12.5)	**13.1** (12.4-13.8)	**14.7** (13.8-15.4)	**15.8** (14.9-16.6)	**16.9** (15.8-17.8)	**17.9** (16.8-18.9)	**19.2** (17.9-20.3)	**20.1** (18.7-21.3)
60-day	**10.5** (10.0-11.1)	**12.3** (11.7-13.0)	**14.1** (13.4-14.8)	**15.3** (14.6-16.1)	**16.9** (16.1-17.8)	**18.1** (17.1-19.0)	**19.1** (18.1-20.1)	**20.1** (19.0-21.2)	**21.3** (20.0-22.5)	**22.1** (20.8-23.4)

[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

Watershed Model Schematic

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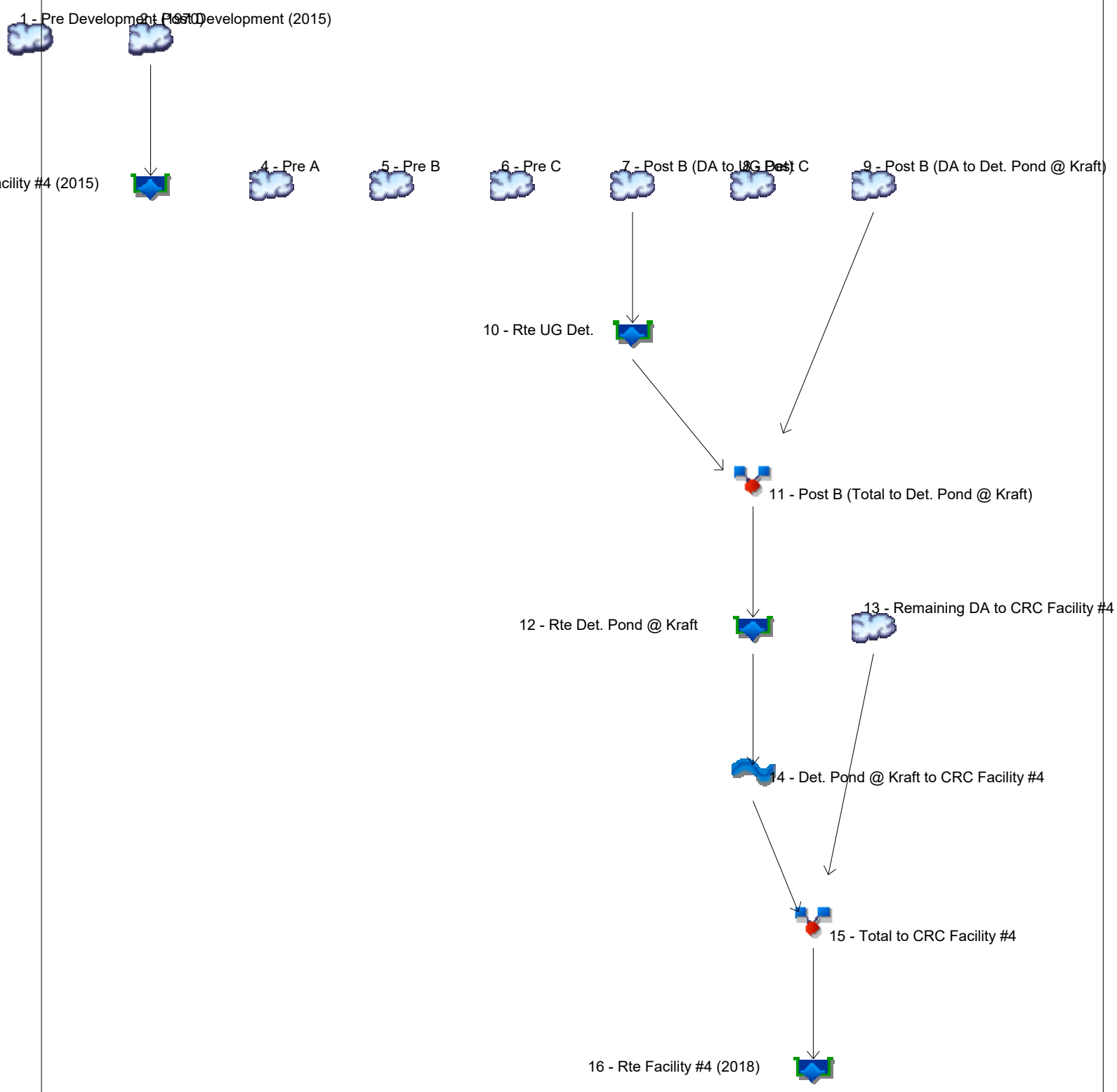
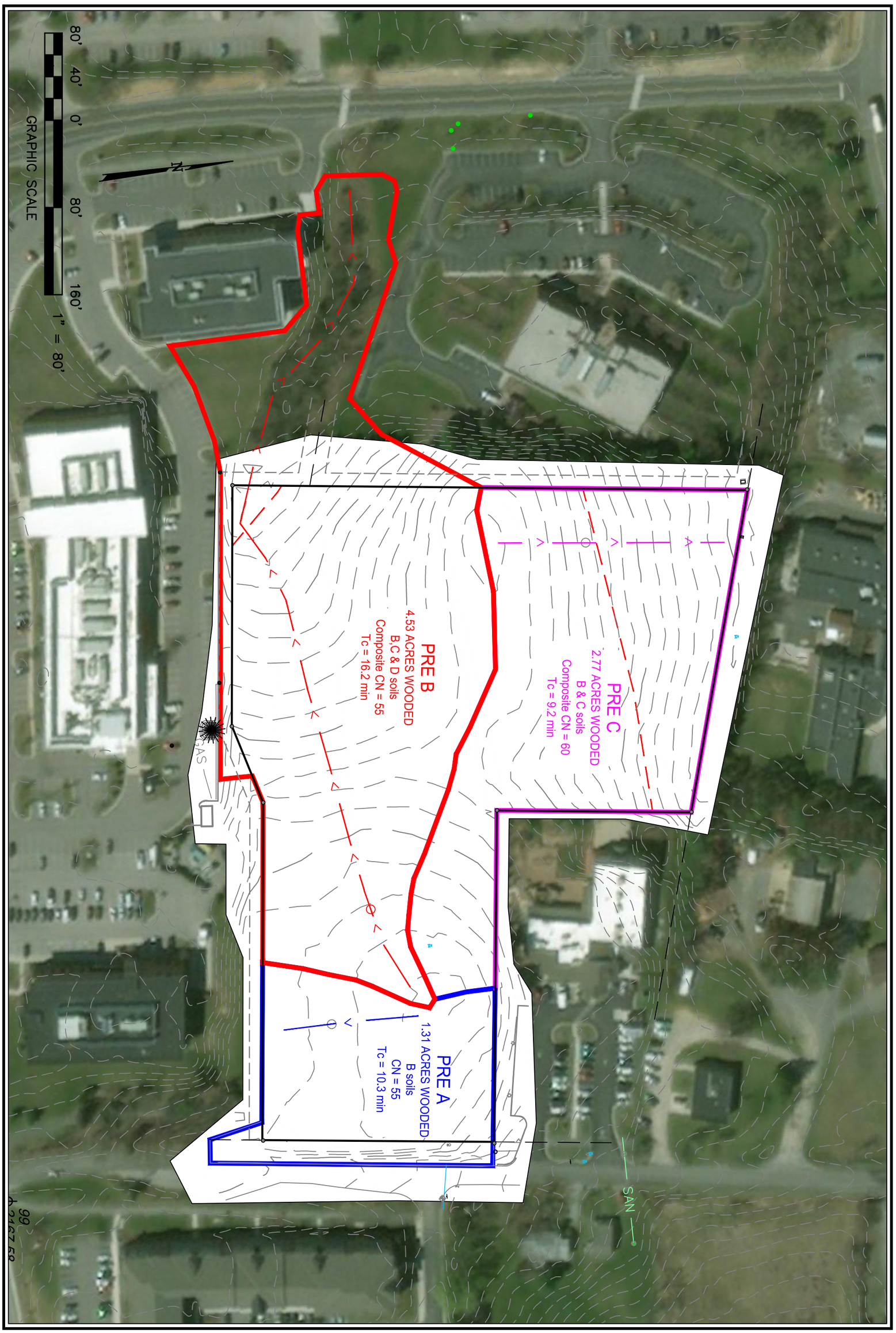


APPENDIX B – PRE DEVELOPED HYDROLOGIC CONDITIONS

(See attached Drawings)



SCALE: 1" = 80'
PROJECT NO. 17-0117
DATE: 02/01/2018
APPENDIX C.2

30-R at CRC Residential Development
Stormwater Concept Plan
On-Site Pre-Development Drainage Map
Town of Blacksburg, VA

2122 Carolina Avenue, S.W.
Roanoke, Virginia 24014
Phone: 540-387-1153
Fax: 540-389-5767
www.parkerdg.com
parker DESIGN GROUP, INC.
ENGINEERS * SURVEYORS * PLANNERS * LANDSCAPE ARCHITECTS

Pre Development Area A

Time of Concentration				
100	ft OLF@	4	% =	9.56 min
60	ft CF @	4	% =	0.69 min
0	ft CF @	0	% =	0.00 min
			Tc =	10.26 min
User defined				
C factor for OLF=			0.30	

Pre Development Area B

Time of Concentration				
100	ft OLF@	3	% =	10.10 min
475	ft CF @	6.3	% =	2.76 min
416	ft CF @	2.9	% =	3.35 min
			Tc =	16.21 min
User defined				
C factor for OLF=			0.30	

Pre Development Area C

Time of Concentration				
100	ft OLF@	9	% =	8.20 min
160	ft CF @	11	% =	0.99 min
0	ft CF @	0	% =	0.00 min
			Tc =	9.19 min
User defined				
C factor for OLF=			0.30	

Hydrograph Report

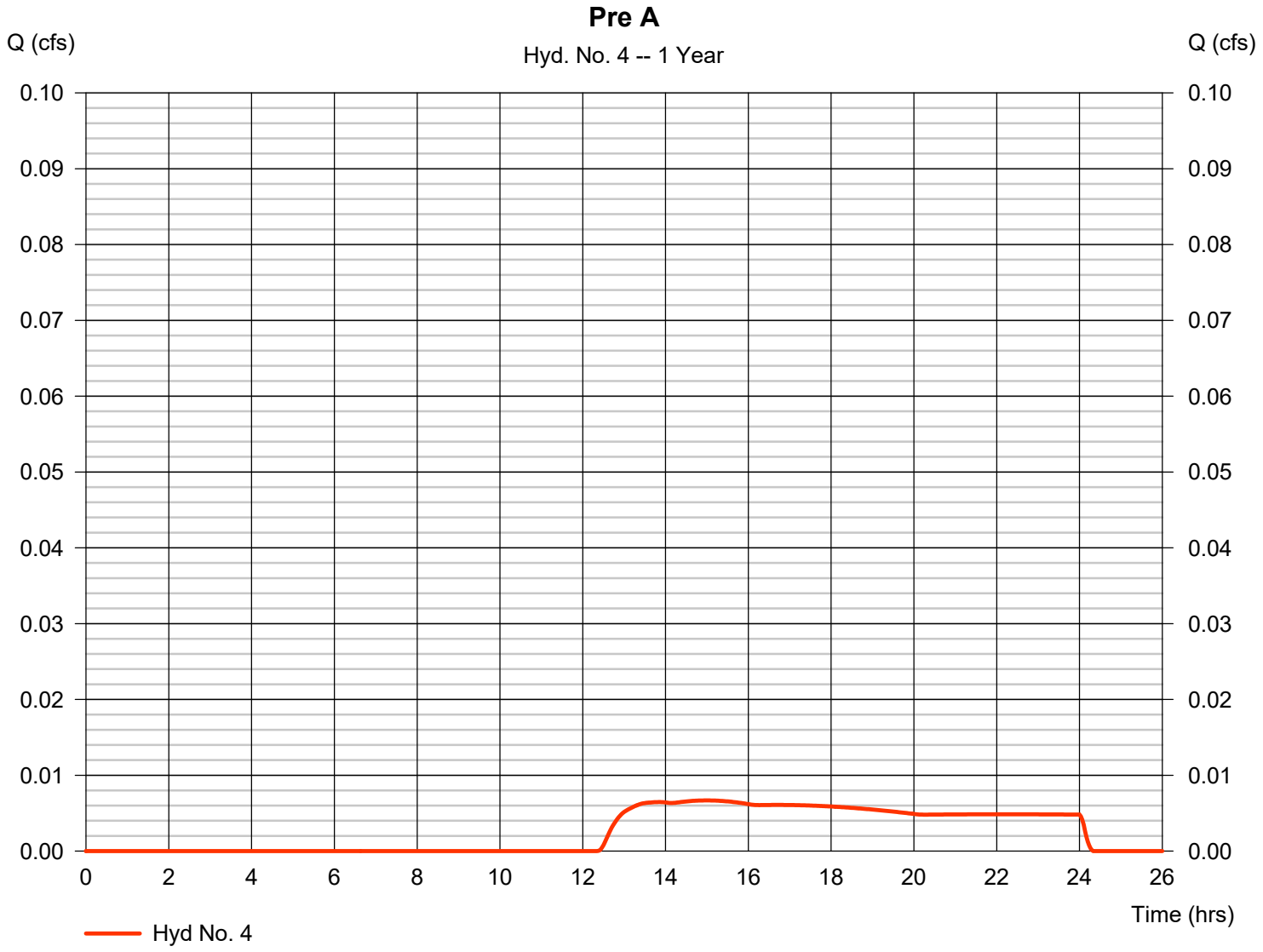
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 01 / 31 / 2018

Hyd. No. 4

Pre A

Hydrograph type	= SCS Runoff	Peak discharge	= 0.007 cfs
Storm frequency	= 1 yrs	Time to peak	= 15.00 hrs
Time interval	= 2 min	Hyd. volume	= 230 cuft
Drainage area	= 1.310 ac	Curve number	= 55*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.30 min
Total precip.	= 2.28 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.310 x 55)] / 1.310



Hydrograph Report

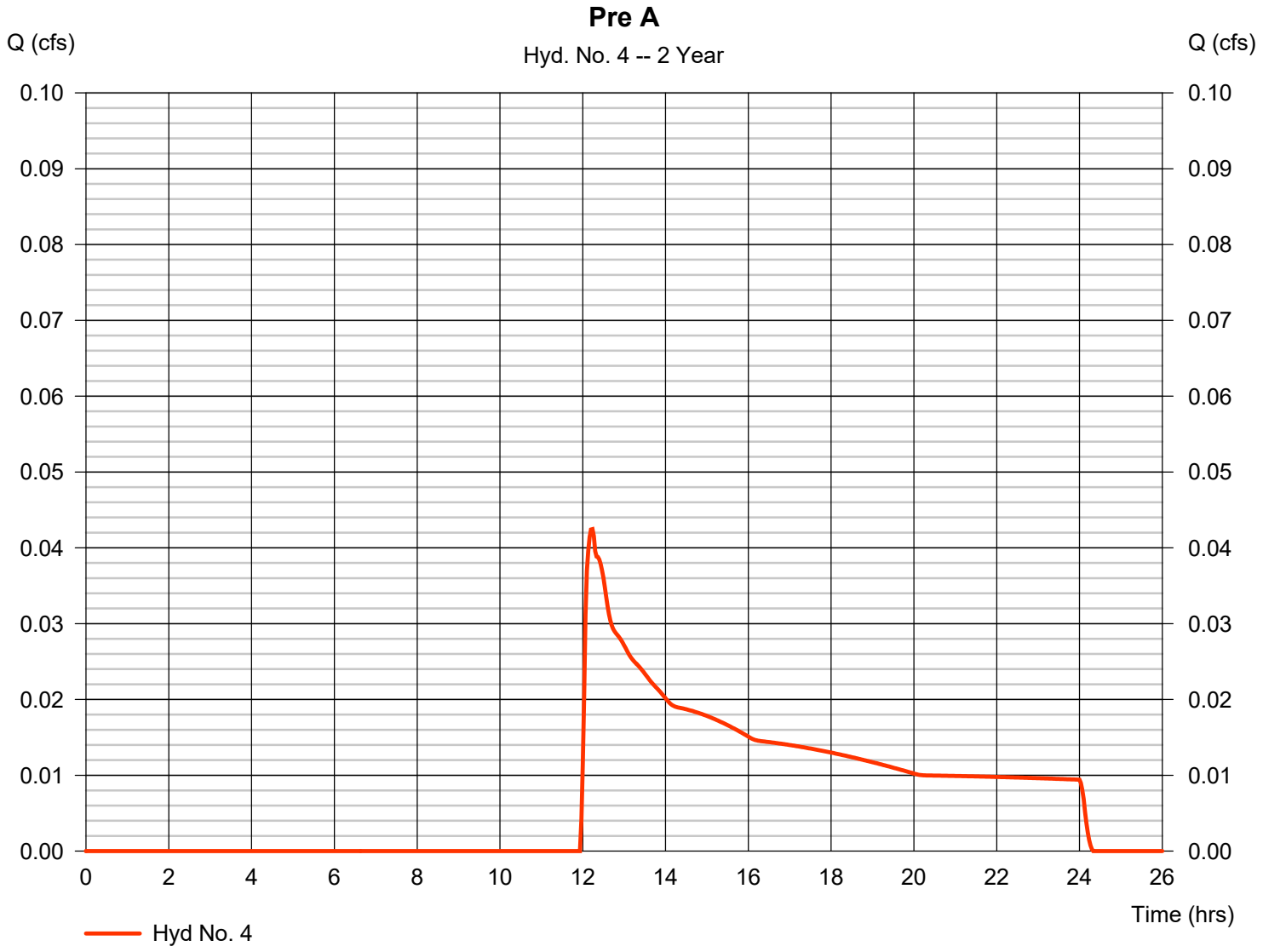
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 01 / 31 / 2018

Hyd. No. 4

Pre A

Hydrograph type	= SCS Runoff	Peak discharge	= 0.042 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.23 hrs
Time interval	= 2 min	Hyd. volume	= 663 cuft
Drainage area	= 1.310 ac	Curve number	= 55*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.30 min
Total precip.	= 2.76 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.310 x 55)] / 1.310



Hydrograph Report

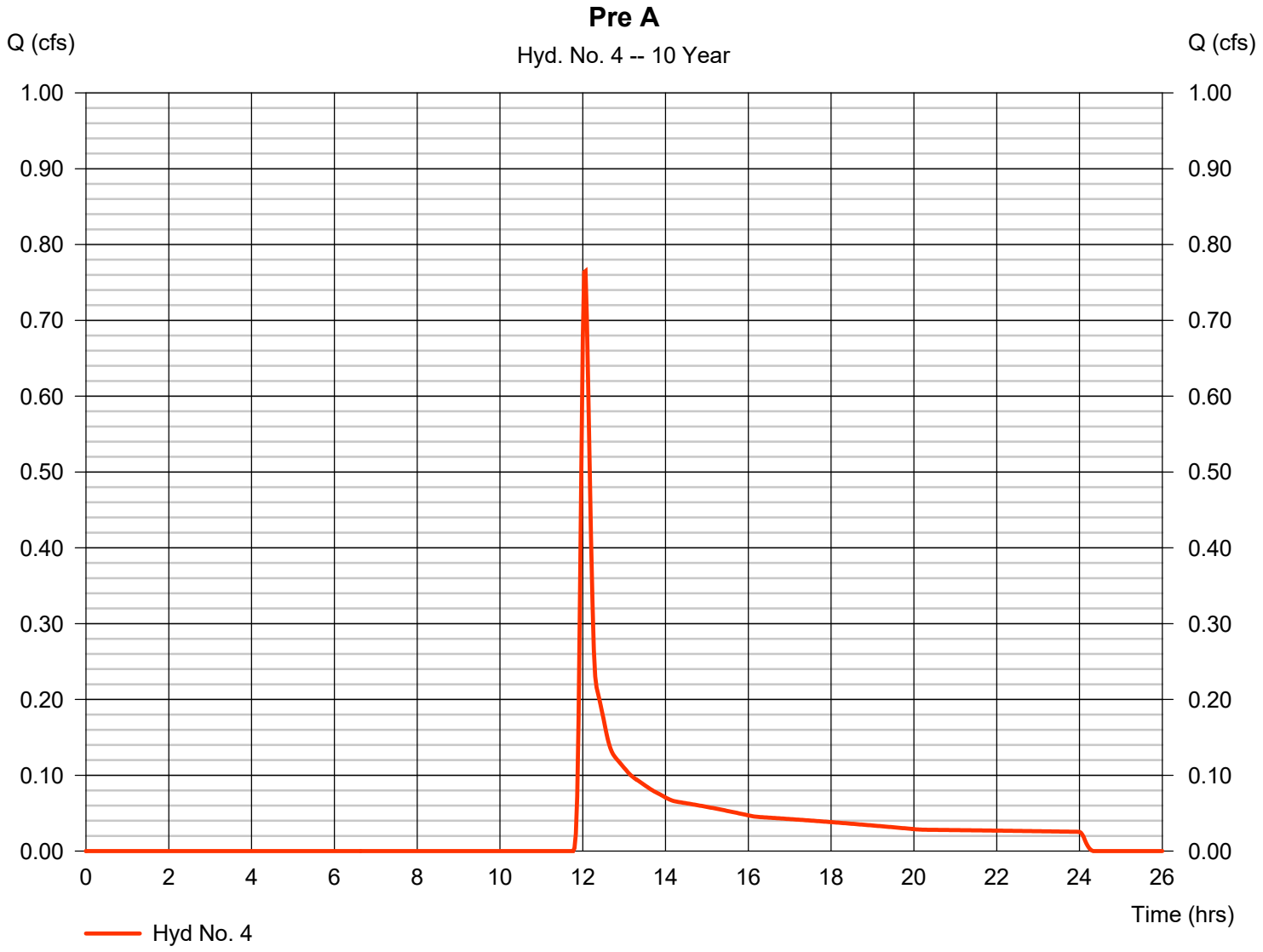
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 01 / 31 / 2018

Hyd. No. 4

Pre A

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.765 cfs
Storm frequency	=	10 yrs	Time to peak	=	12.07 hrs
Time interval	=	2 min	Hyd. volume	=	2,816 cuft
Drainage area	=	1.310 ac	Curve number	=	55*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.30 min
Total precip.	=	4.11 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(1.310 x 55)] / 1.310



Hydrograph Report

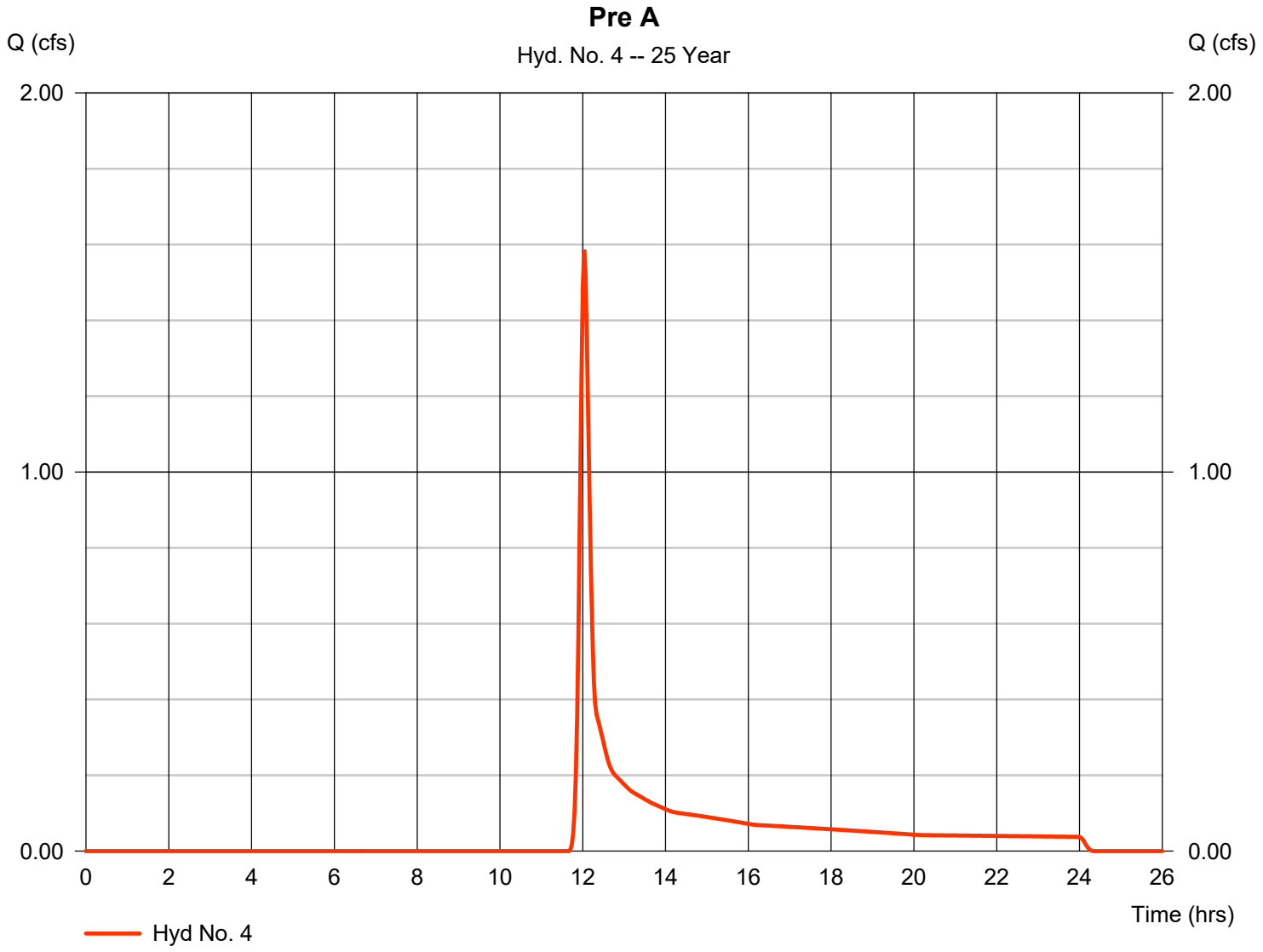
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 01 / 31 / 2018

Hyd. No. 4

Pre A

Hydrograph type	= SCS Runoff	Peak discharge	= 1.587 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 4,805 cuft
Drainage area	= 1.310 ac	Curve number	= 55*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.30 min
Total precip.	= 5.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.310 x 55)] / 1.310



Hydrograph Report

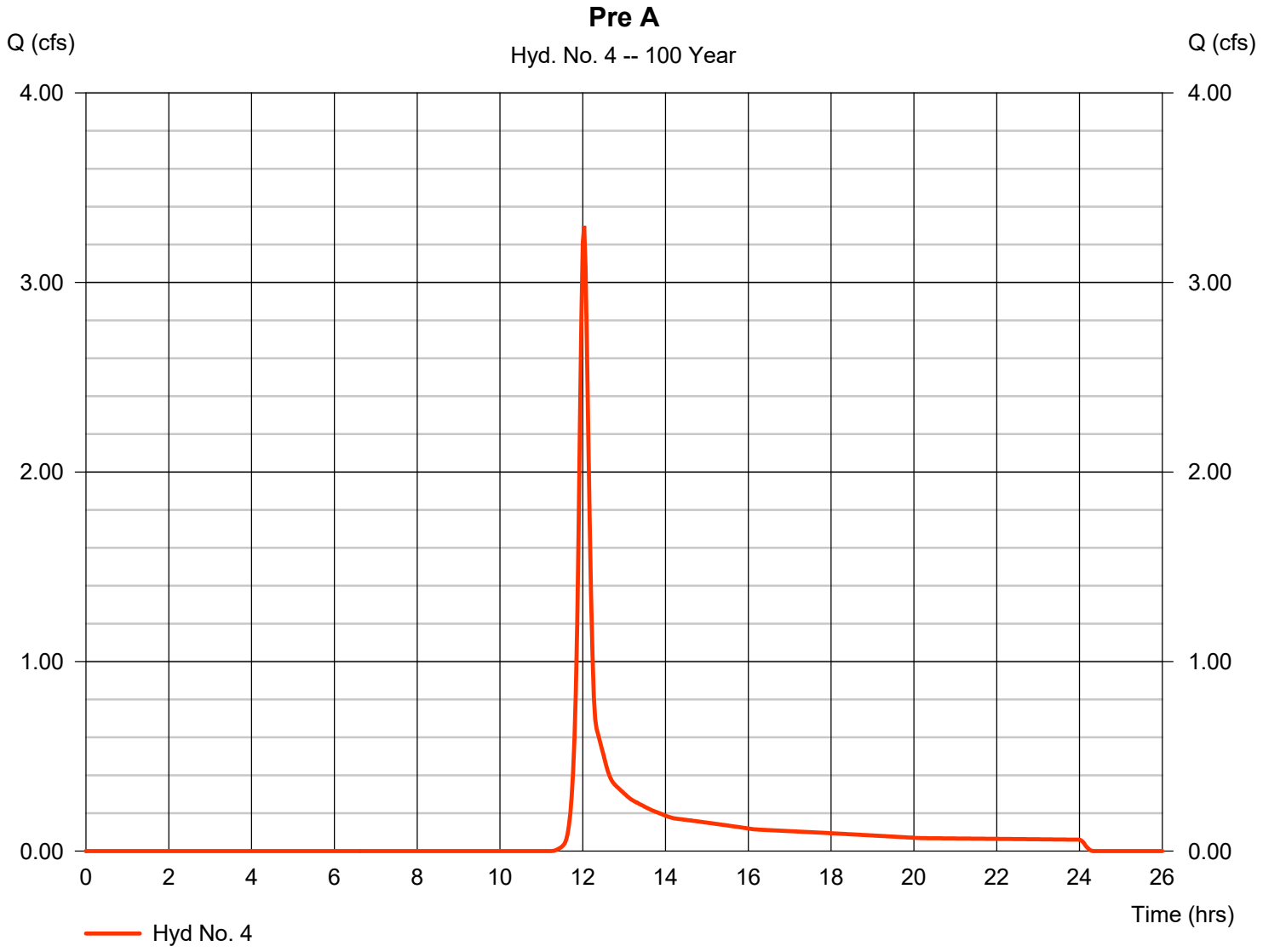
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 01 / 31 / 2018

Hyd. No. 4

Pre A

Hydrograph type	= SCS Runoff	Peak discharge	= 3.298 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 9,011 cuft
Drainage area	= 1.310 ac	Curve number	= 55*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.30 min
Total precip.	= 6.54 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.310 x 55)] / 1.310



Hydrograph Report

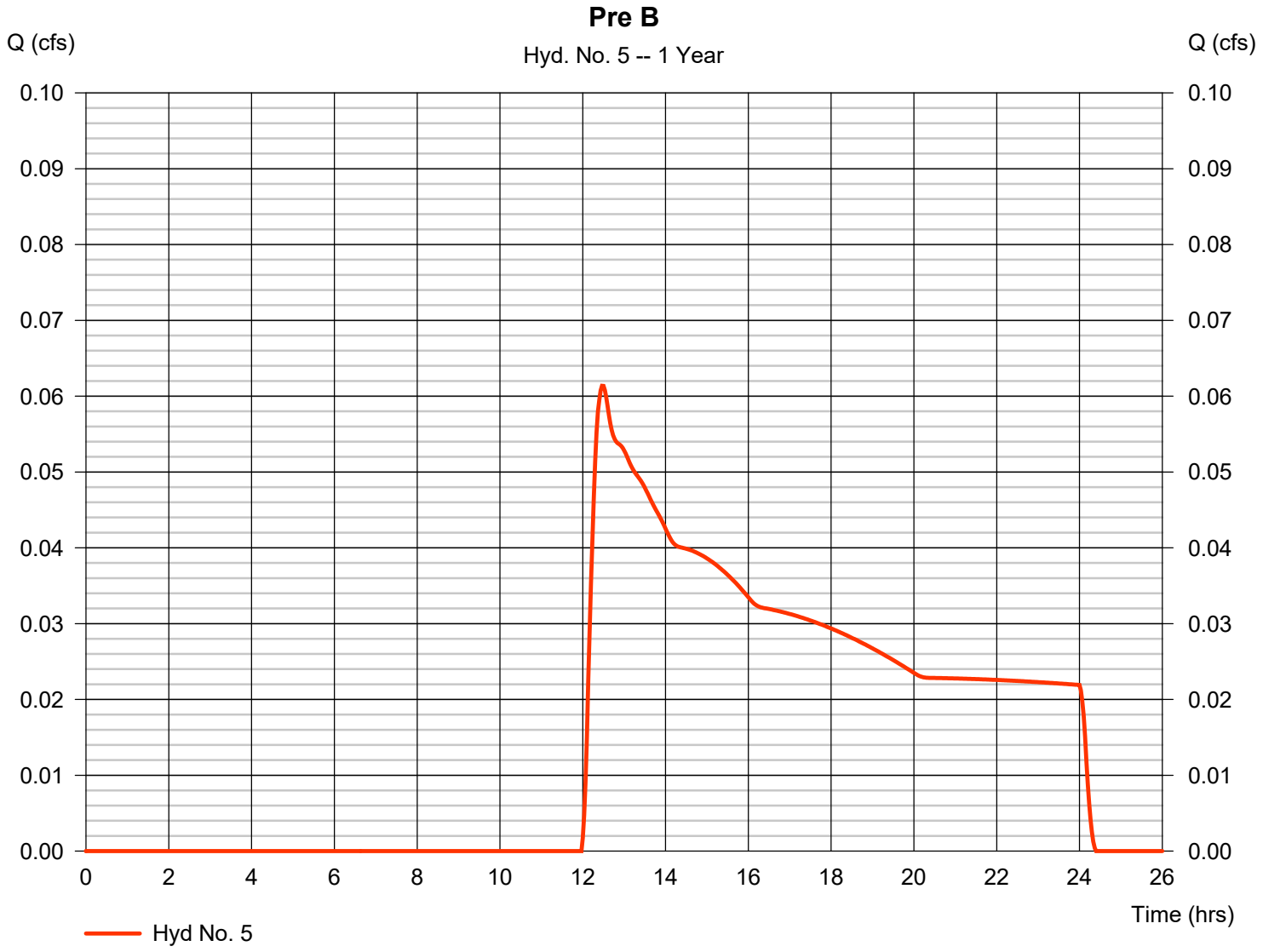
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 01 / 31 / 2018

Hyd. No. 5

Pre B

Hydrograph type	= SCS Runoff	Peak discharge	= 0.061 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.47 hrs
Time interval	= 2 min	Hyd. volume	= 1,372 cuft
Drainage area	= 4.530 ac	Curve number	= 58*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 16.20 min
Total precip.	= 2.28 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(3.480 x 55) + (0.550 x 77) + (0.500 x 61)] / 4.530



Hydrograph Report

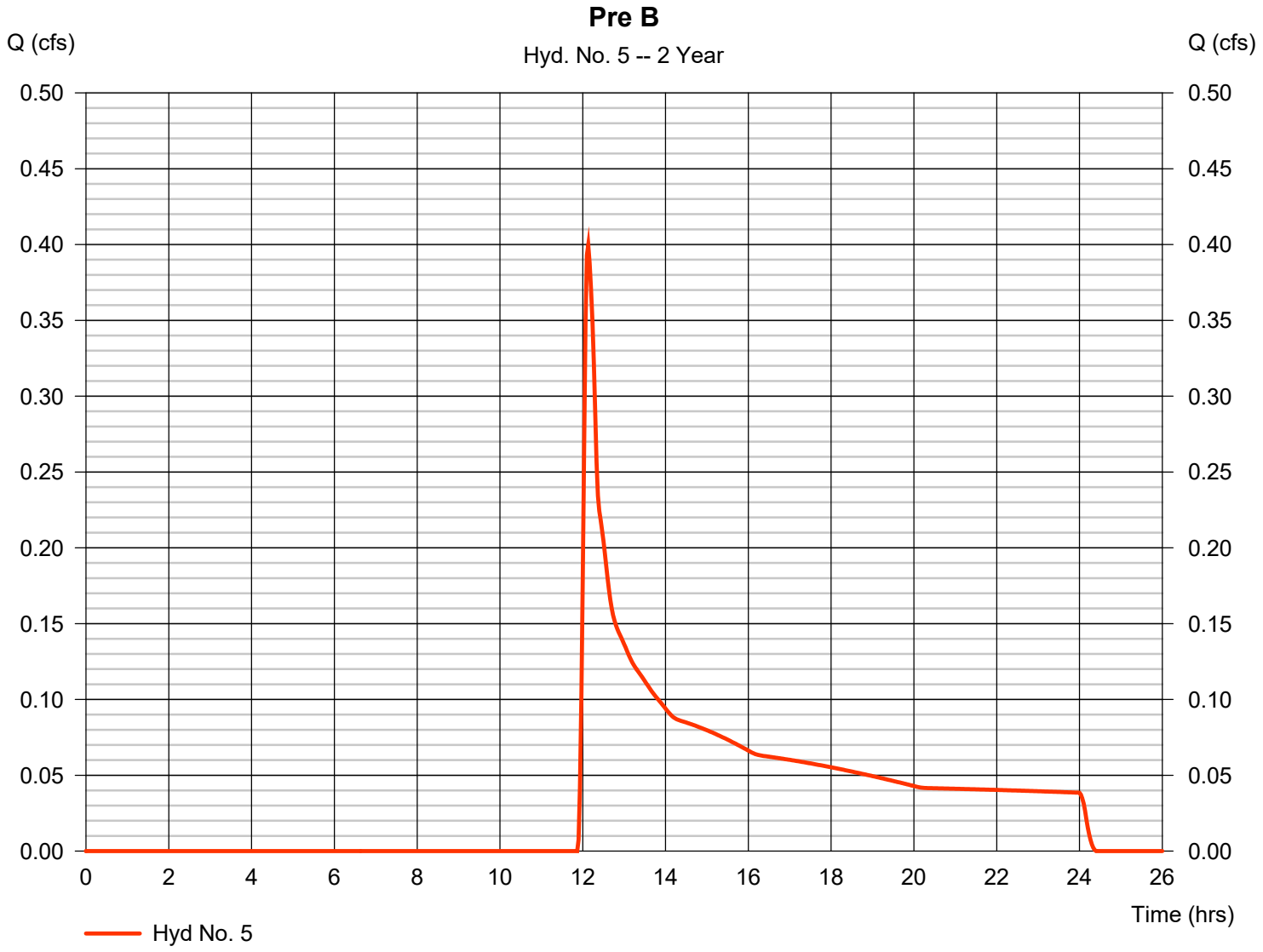
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 01 / 31 / 2018

Hyd. No. 5

Pre B

Hydrograph type	= SCS Runoff	Peak discharge	= 0.400 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.13 hrs
Time interval	= 2 min	Hyd. volume	= 3,224 cuft
Drainage area	= 4.530 ac	Curve number	= 58*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 16.20 min
Total precip.	= 2.76 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(3.480 x 55) + (0.550 x 77) + (0.500 x 61)] / 4.530



Hydrograph Report

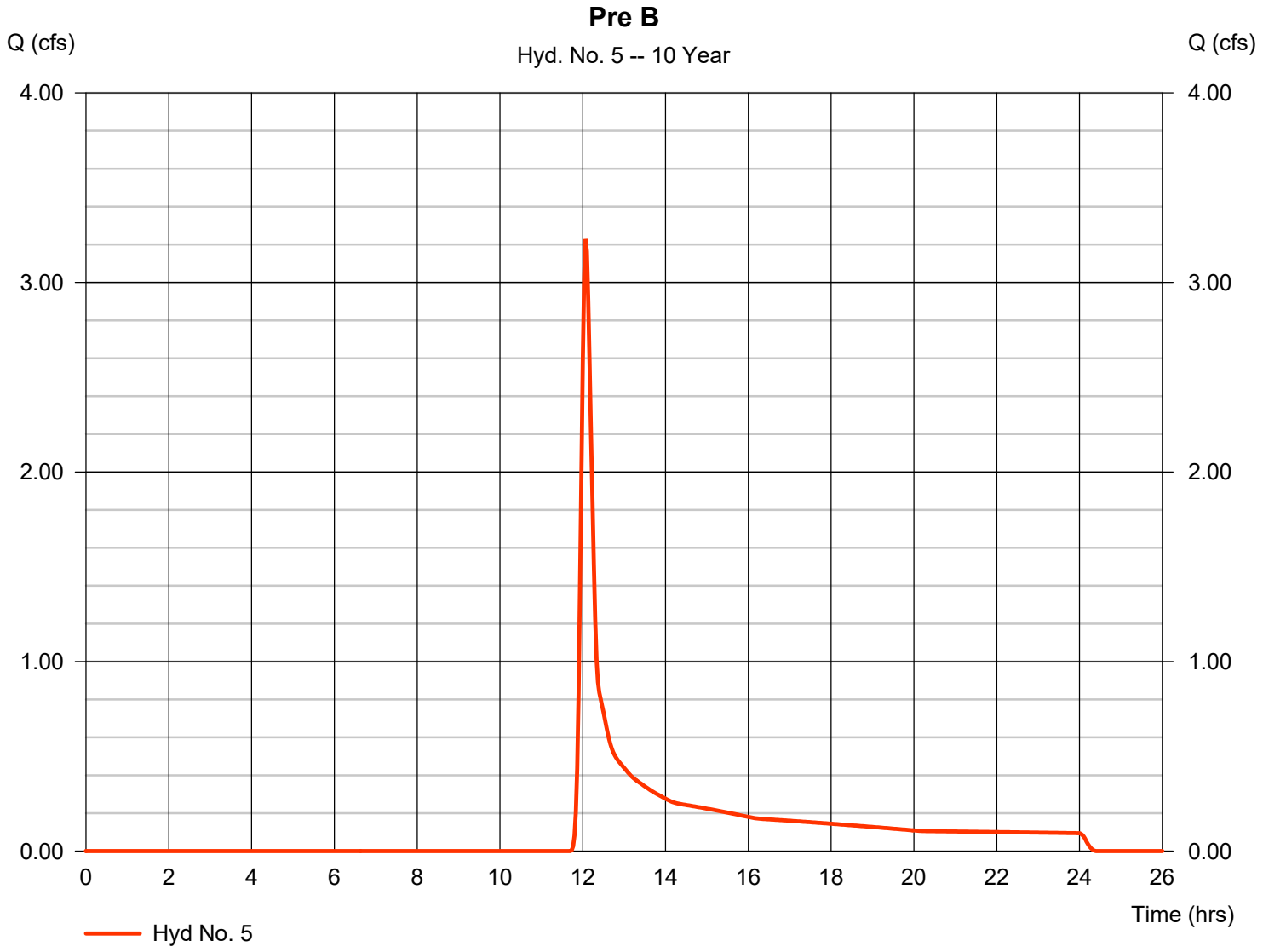
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 01 / 31 / 2018

Hyd. No. 5

Pre B

Hydrograph type	= SCS Runoff	Peak discharge	= 3.229 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 11,470 cuft
Drainage area	= 4.530 ac	Curve number	= 58*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 16.20 min
Total precip.	= 4.11 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(3.480 x 55) + (0.550 x 77) + (0.500 x 61)] / 4.530



Hydrograph Report

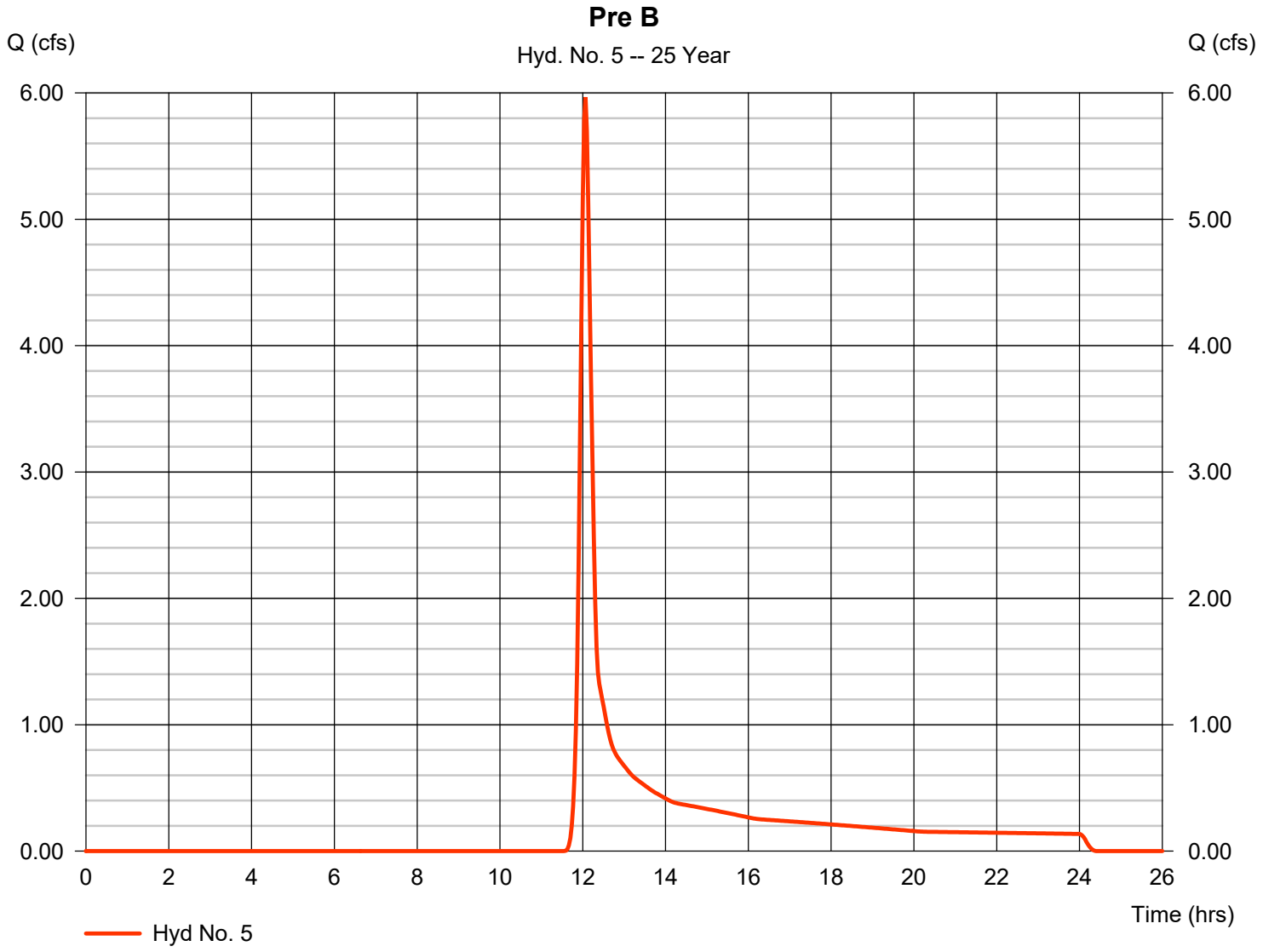
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 01 / 31 / 2018

Hyd. No. 5

Pre B

Hydrograph type	= SCS Runoff	Peak discharge	= 5.966 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 18,739 cuft
Drainage area	= 4.530 ac	Curve number	= 58*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 16.20 min
Total precip.	= 5.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(3.480 x 55) + (0.550 x 77) + (0.500 x 61)] / 4.530



Hydrograph Report

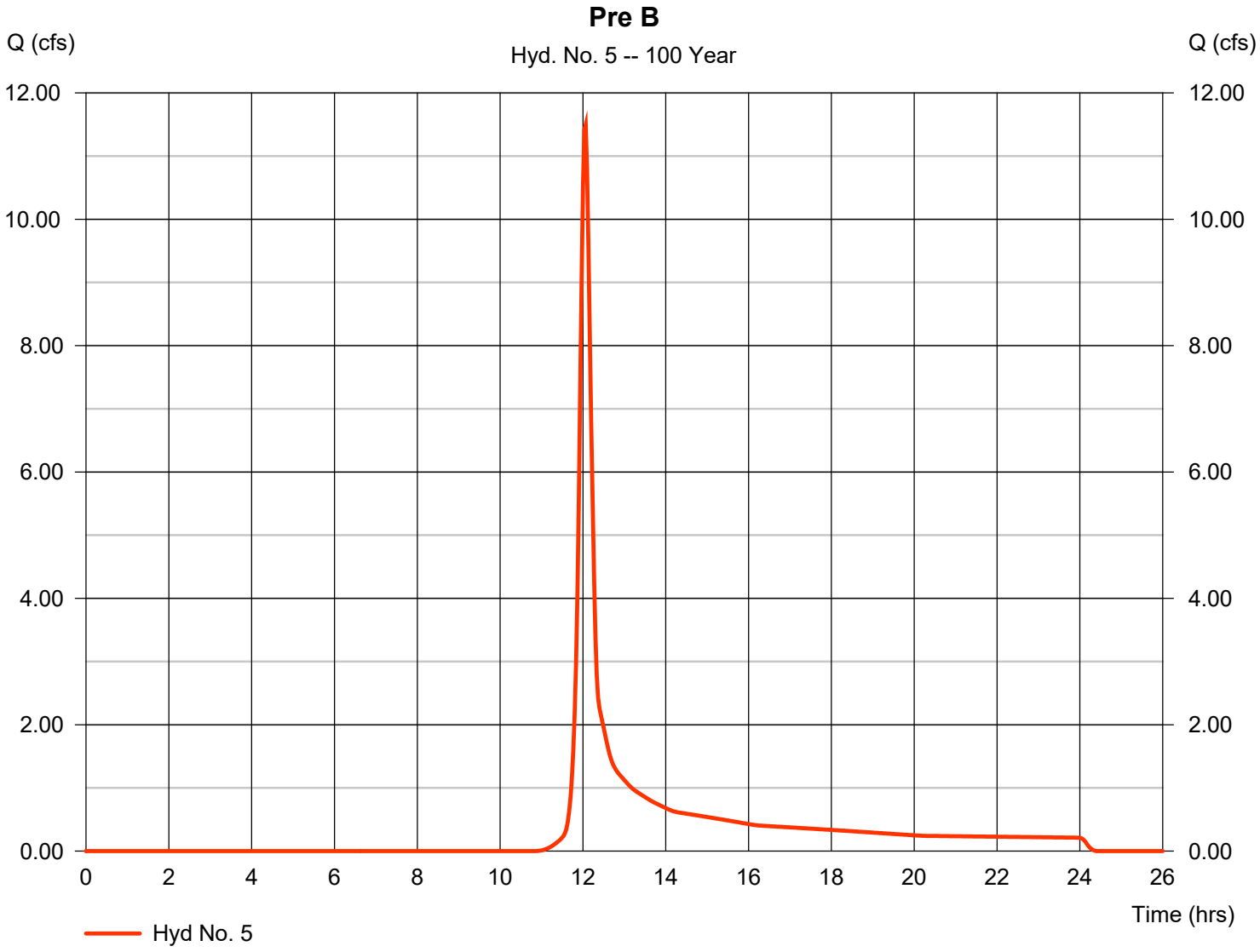
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 01 / 31 / 2018

Hyd. No. 5

Pre B

Hydrograph type	= SCS Runoff	Peak discharge	= 11.50 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 33,703 cuft
Drainage area	= 4.530 ac	Curve number	= 58*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 16.20 min
Total precip.	= 6.54 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(3.480 x 55) + (0.550 x 77) + (0.500 x 61)] / 4.530



Hydrograph Report

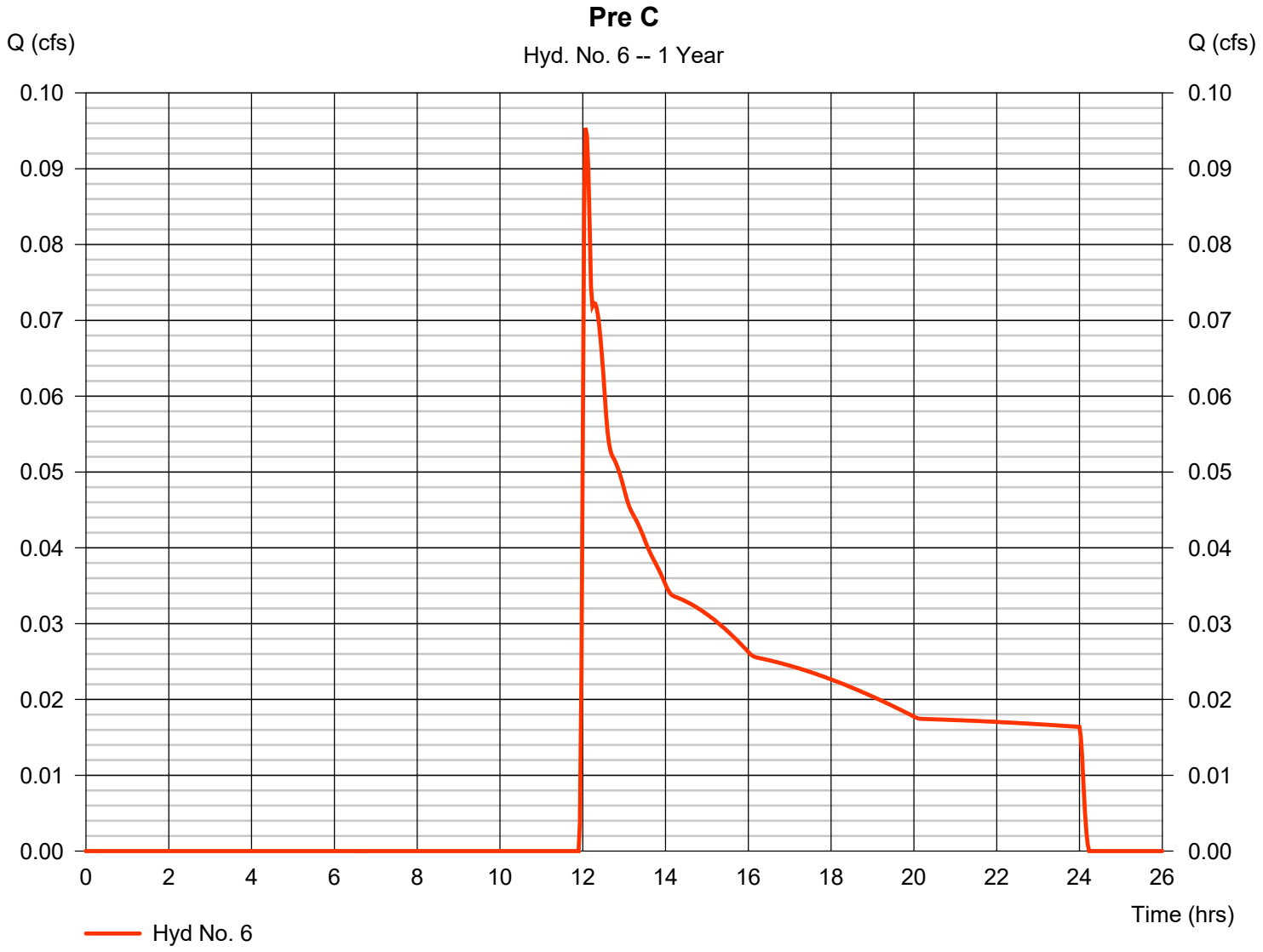
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 01 / 31 / 2018

Hyd. No. 6

Pre C

Hydrograph type	= SCS Runoff	Peak discharge	= 0.095 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 1,181 cuft
Drainage area	= 2.770 ac	Curve number	= 60*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 9.20 min
Total precip.	= 2.28 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.820 x 55) + (0.950 x 70)] / 2.770



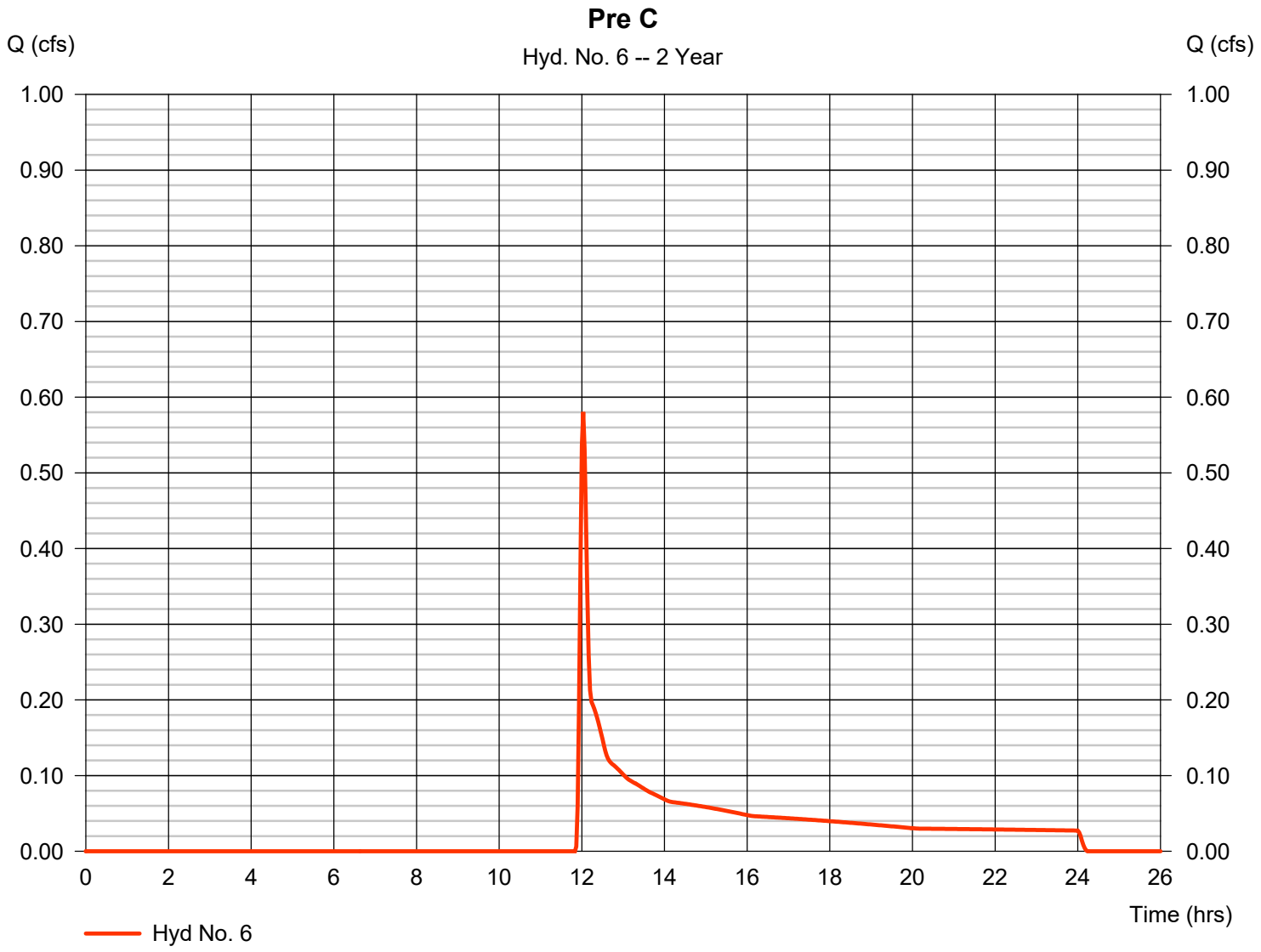
Hydrograph Report

Hyd. No. 6

Pre C

Hydrograph type	= SCS Runoff	Peak discharge	= 0.580 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 2,526 cuft
Drainage area	= 2.770 ac	Curve number	= 60*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 9.20 min
Total precip.	= 2.76 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.820 x 55) + (0.950 x 70)] / 2.770



Hydrograph Report

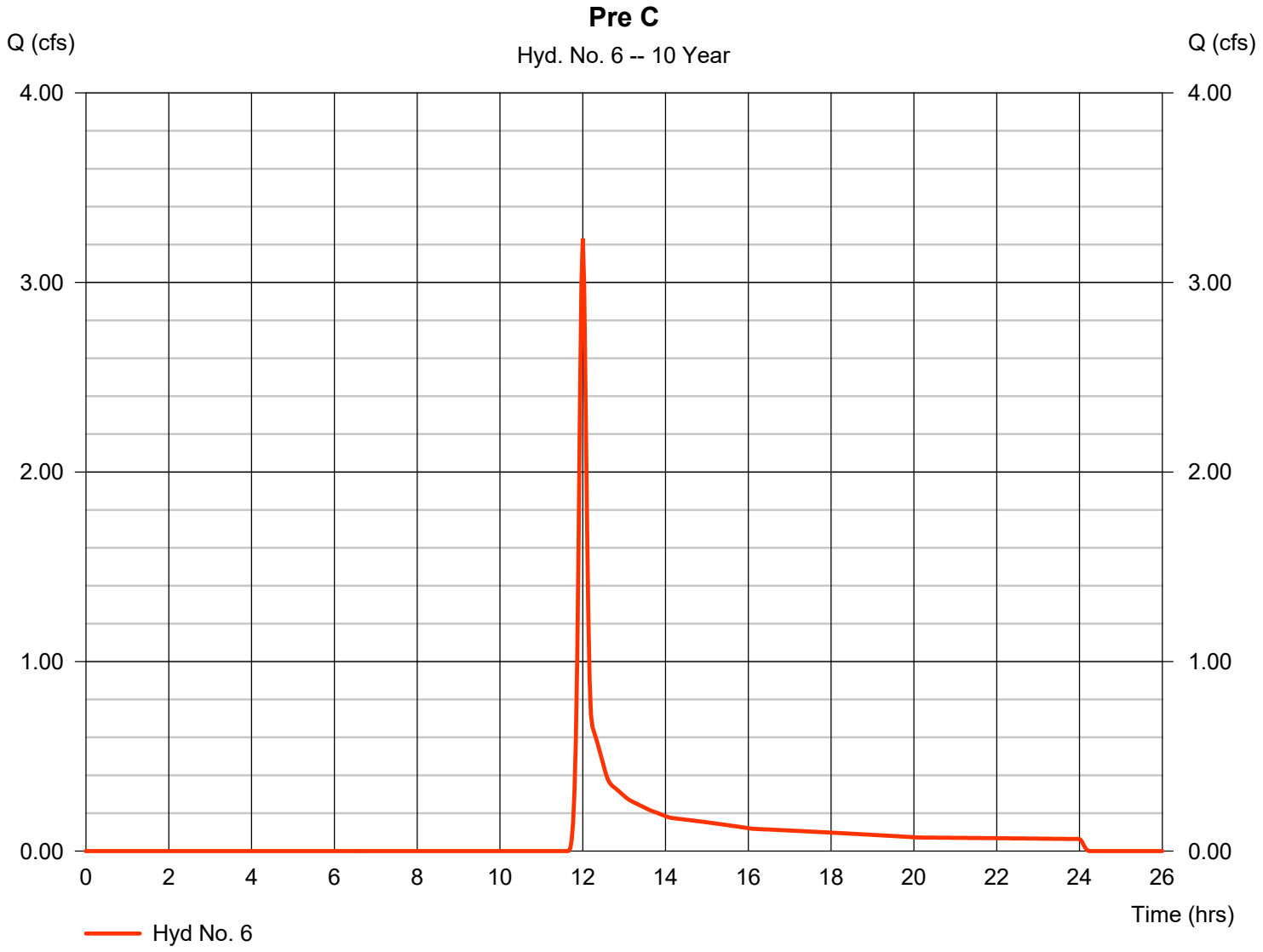
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 01 / 31 / 2018

Hyd. No. 6

Pre C

Hydrograph type	= SCS Runoff	Peak discharge	= 3.232 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 8,209 cuft
Drainage area	= 2.770 ac	Curve number	= 60*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 9.20 min
Total precip.	= 4.11 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.820 x 55) + (0.950 x 70)] / 2.770



Hydrograph Report

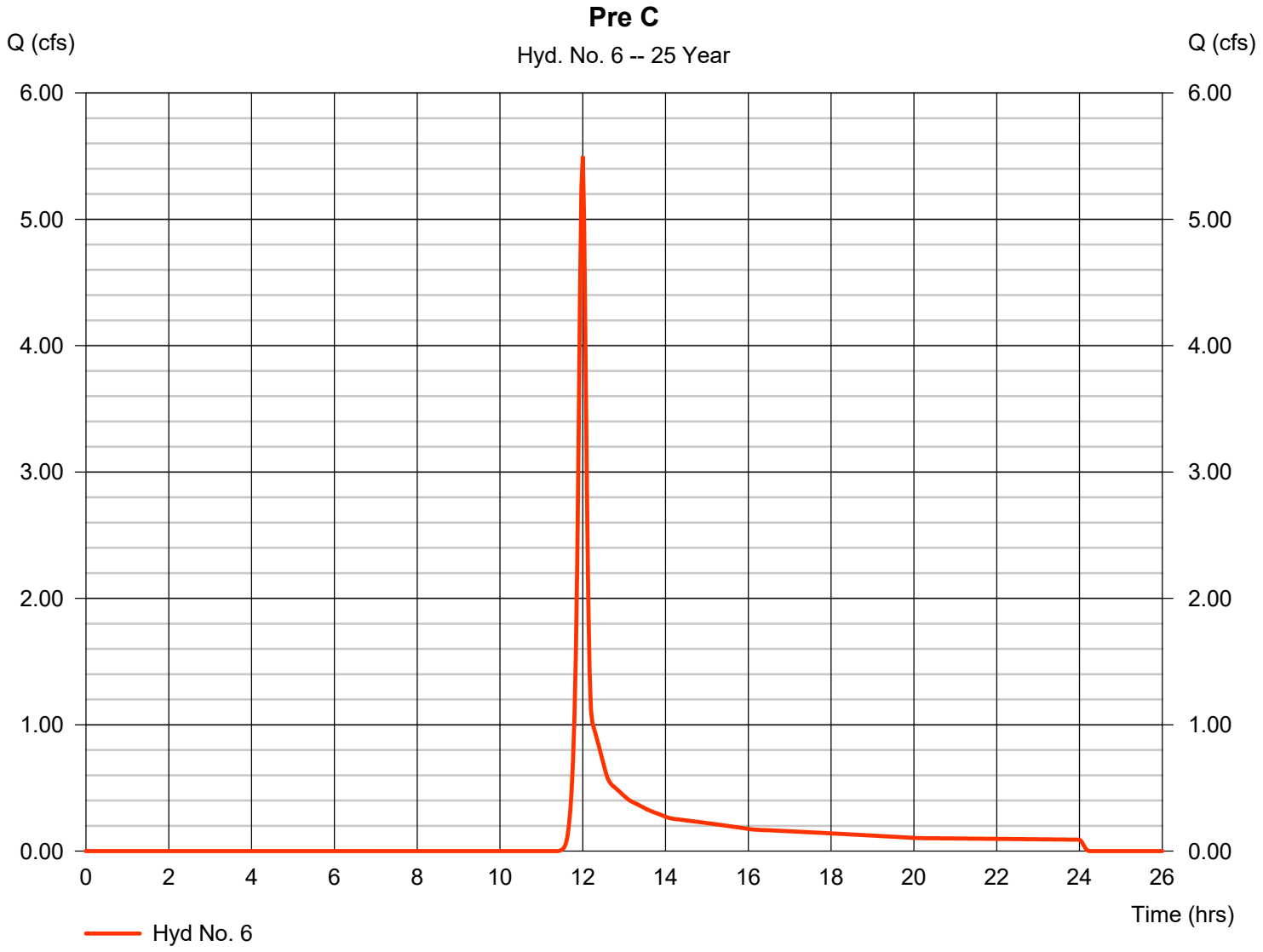
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 01 / 31 / 2018

Hyd. No. 6

Pre C

Hydrograph type	=	SCS Runoff	Peak discharge	=	5.498 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.00 hrs
Time interval	=	2 min	Hyd. volume	=	13,082 cuft
Drainage area	=	2.770 ac	Curve number	=	60*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	9.20 min
Total precip.	=	5.00 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(1.820 x 55) + (0.950 x 70)] / 2.770



Hydrograph Report

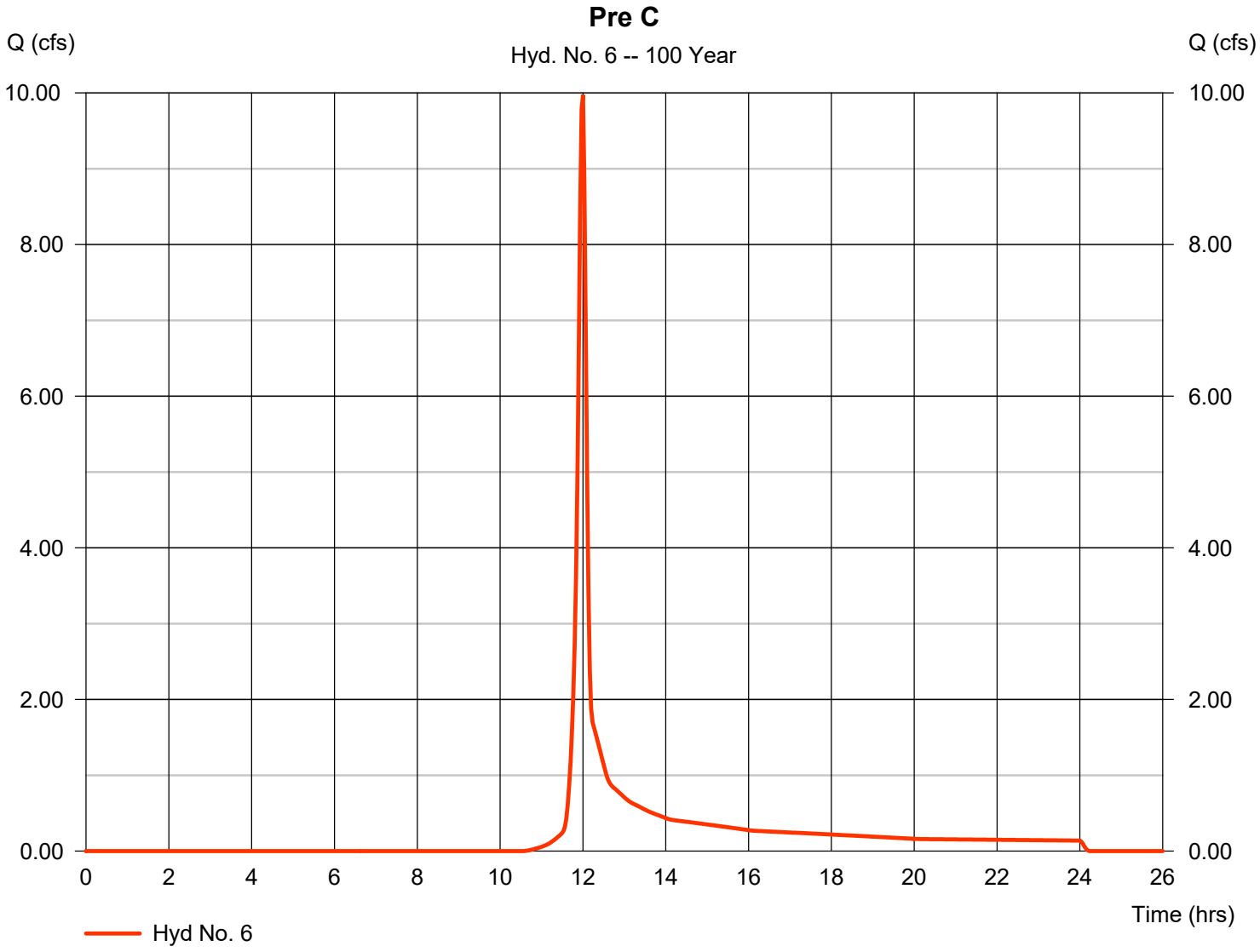
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 01 / 31 / 2018

Hyd. No. 6

Pre C

Hydrograph type	= SCS Runoff	Peak discharge	= 9.973 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 22,958 cuft
Drainage area	= 2.770 ac	Curve number	= 60*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 9.20 min
Total precip.	= 6.54 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.820 x 55) + (0.950 x 70)] / 2.770



APPENDIX C – EXISTING FACILITY #4 VERIFICATION

(See attached Drawings)

Hydrograph Report

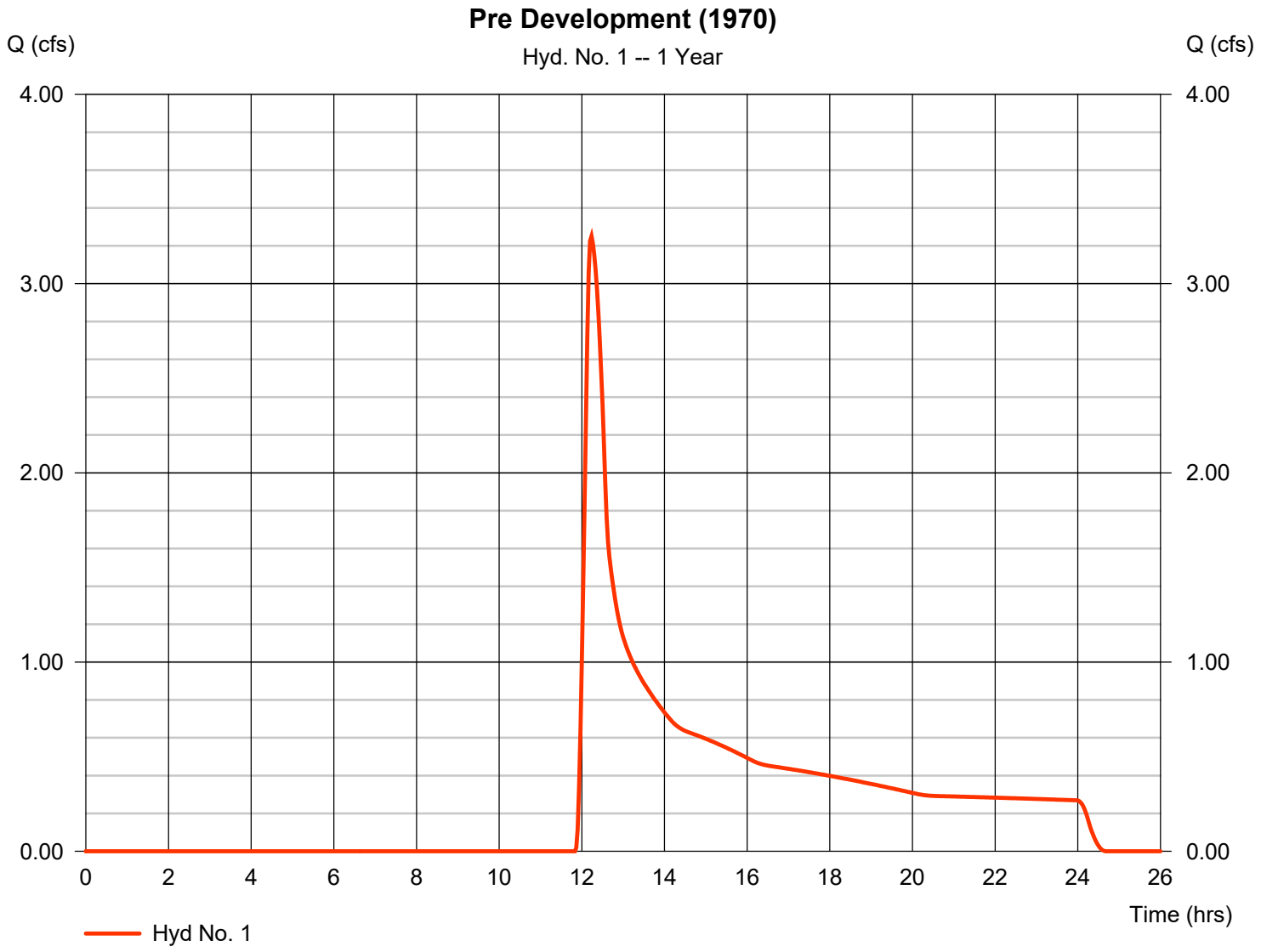
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 01 / 31 / 2018

Hyd. No. 1

Pre Development (1970)

Hydrograph type	= SCS Runoff	Peak discharge	= 3.251 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.23 hrs
Time interval	= 2 min	Hyd. volume	= 25,326 cuft
Drainage area	= 32.260 ac	Curve number	= 65*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 25.00 min
Total precip.	= 2.28 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(21.850 x 61) + (2.230 x 55) + (3.000 x 74) + (5.180 x 80)] / 32.260



Hydrograph Report

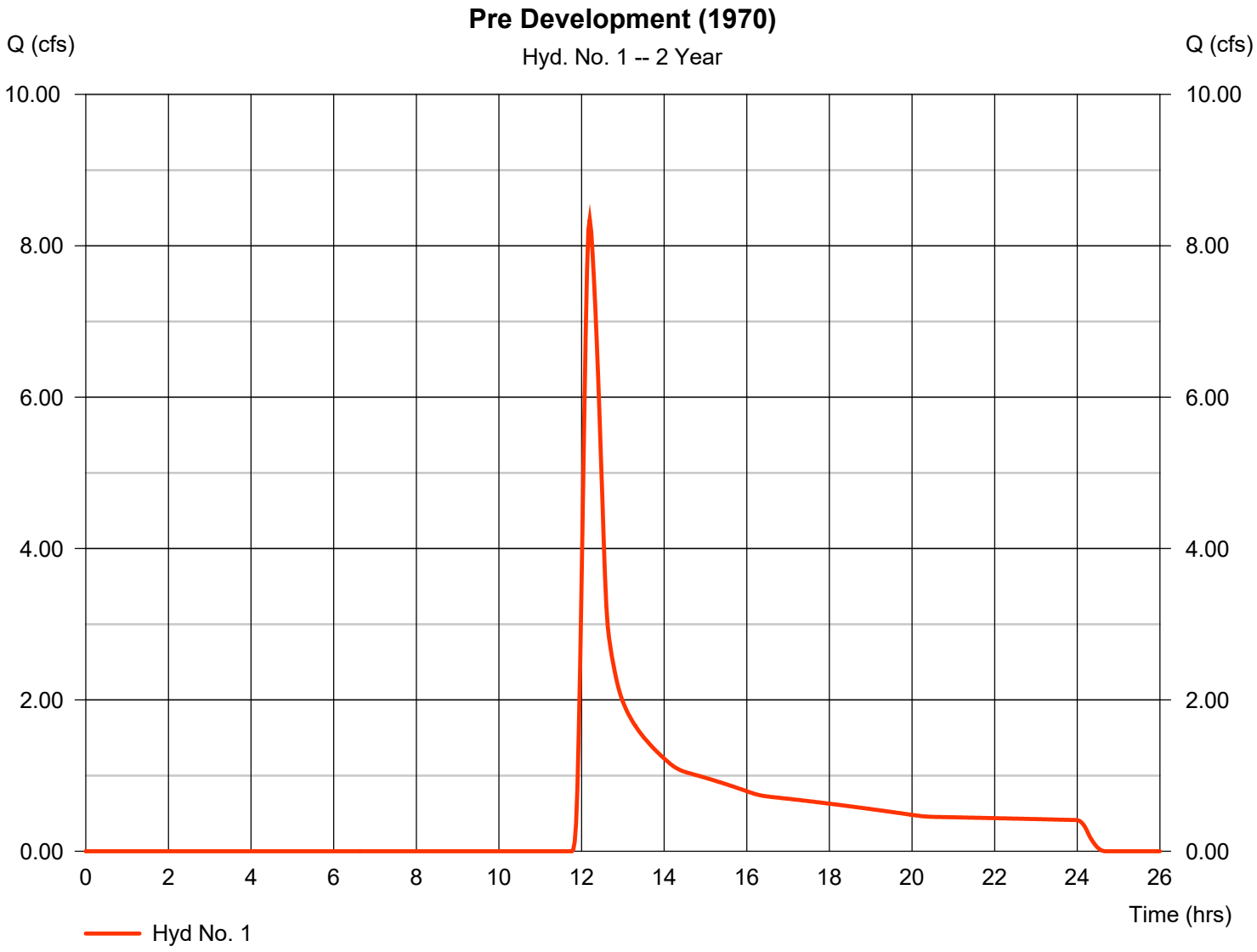
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 01 / 31 / 2018

Hyd. No. 1

Pre Development (1970)

Hydrograph type	= SCS Runoff	Peak discharge	= 8.347 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.20 hrs
Time interval	= 2 min	Hyd. volume	= 46,188 cuft
Drainage area	= 32.260 ac	Curve number	= 65*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 25.00 min
Total precip.	= 2.76 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(21.850 x 61) + (2.230 x 55) + (3.000 x 74) + (5.180 x 80)] / 32.260



Hydrograph Report

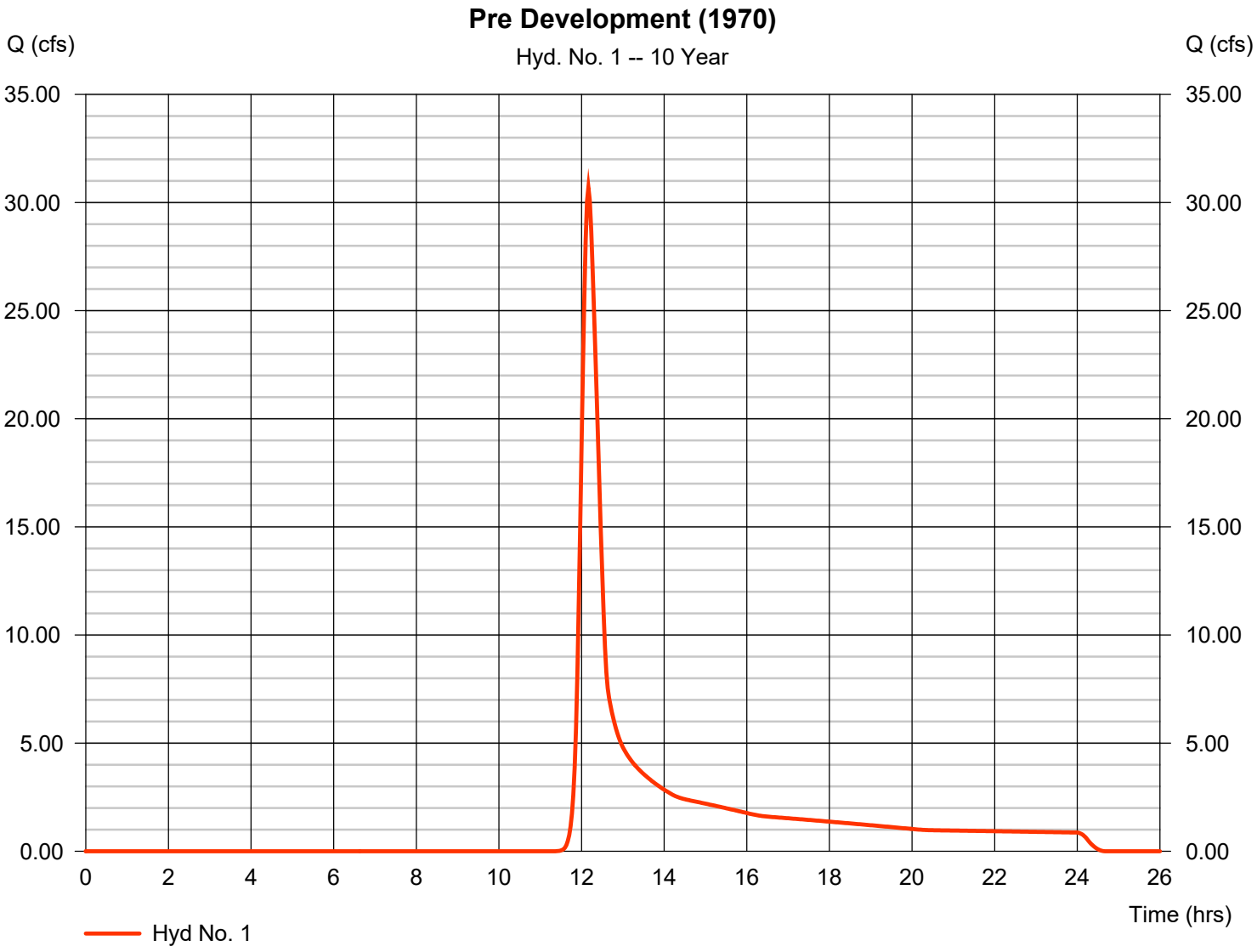
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 01 / 31 / 2018

Hyd. No. 1

Pre Development (1970)

Hydrograph type	= SCS Runoff	Peak discharge	= 30.69 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.17 hrs
Time interval	= 2 min	Hyd. volume	= 125,981 cuft
Drainage area	= 32.260 ac	Curve number	= 65*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 25.00 min
Total precip.	= 4.11 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(21.850 x 61) + (2.230 x 55) + (3.000 x 74) + (5.180 x 80)] / 32.260



Hydrograph Report

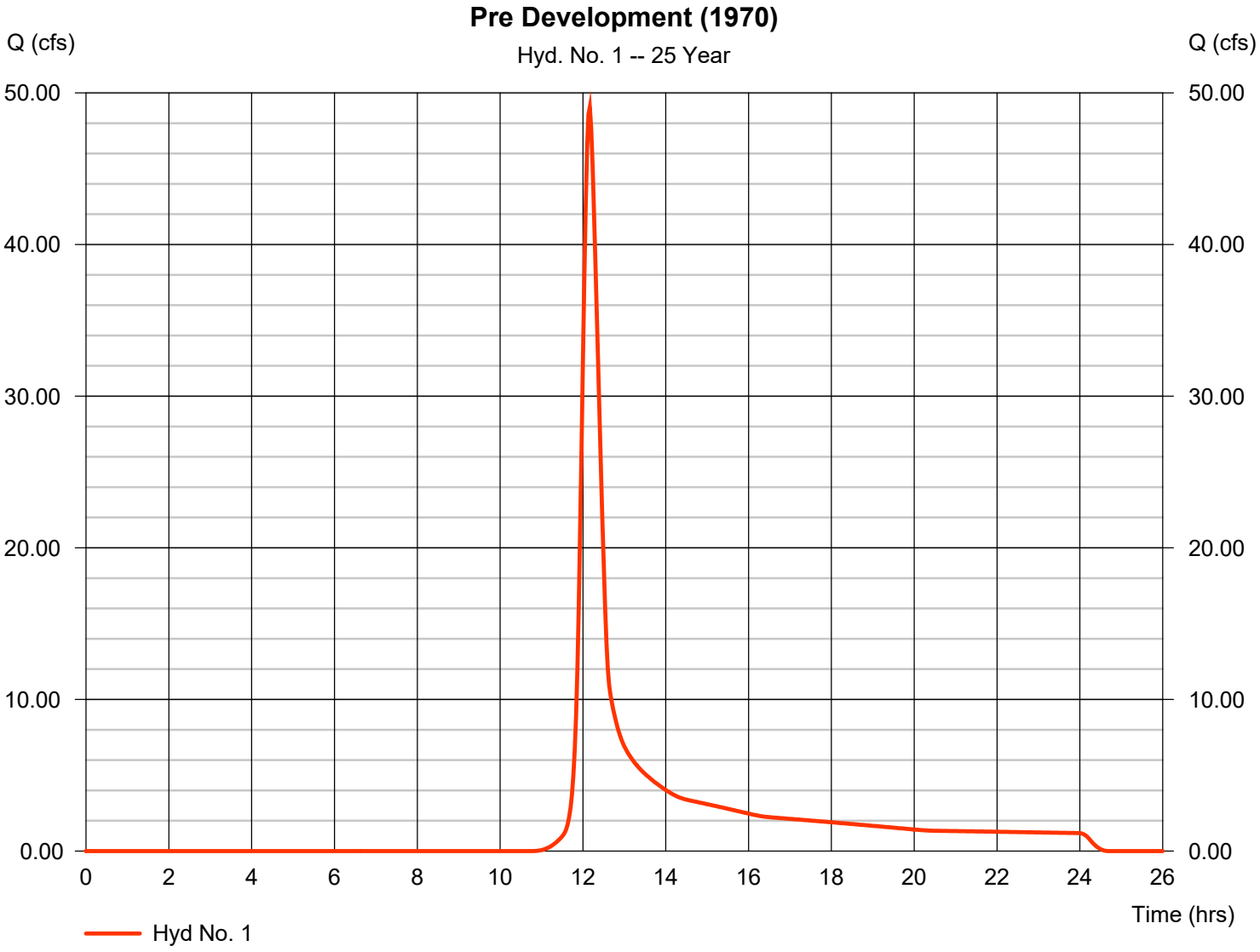
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 01 / 31 / 2018

Hyd. No. 1

Pre Development (1970)

Hydrograph type	= SCS Runoff	Peak discharge	= 49.05 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.17 hrs
Time interval	= 2 min	Hyd. volume	= 190,609 cuft
Drainage area	= 32.260 ac	Curve number	= 65*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 25.00 min
Total precip.	= 5.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(21.850 x 61) + (2.230 x 55) + (3.000 x 74) + (5.180 x 80)] / 32.260



Hydrograph Report

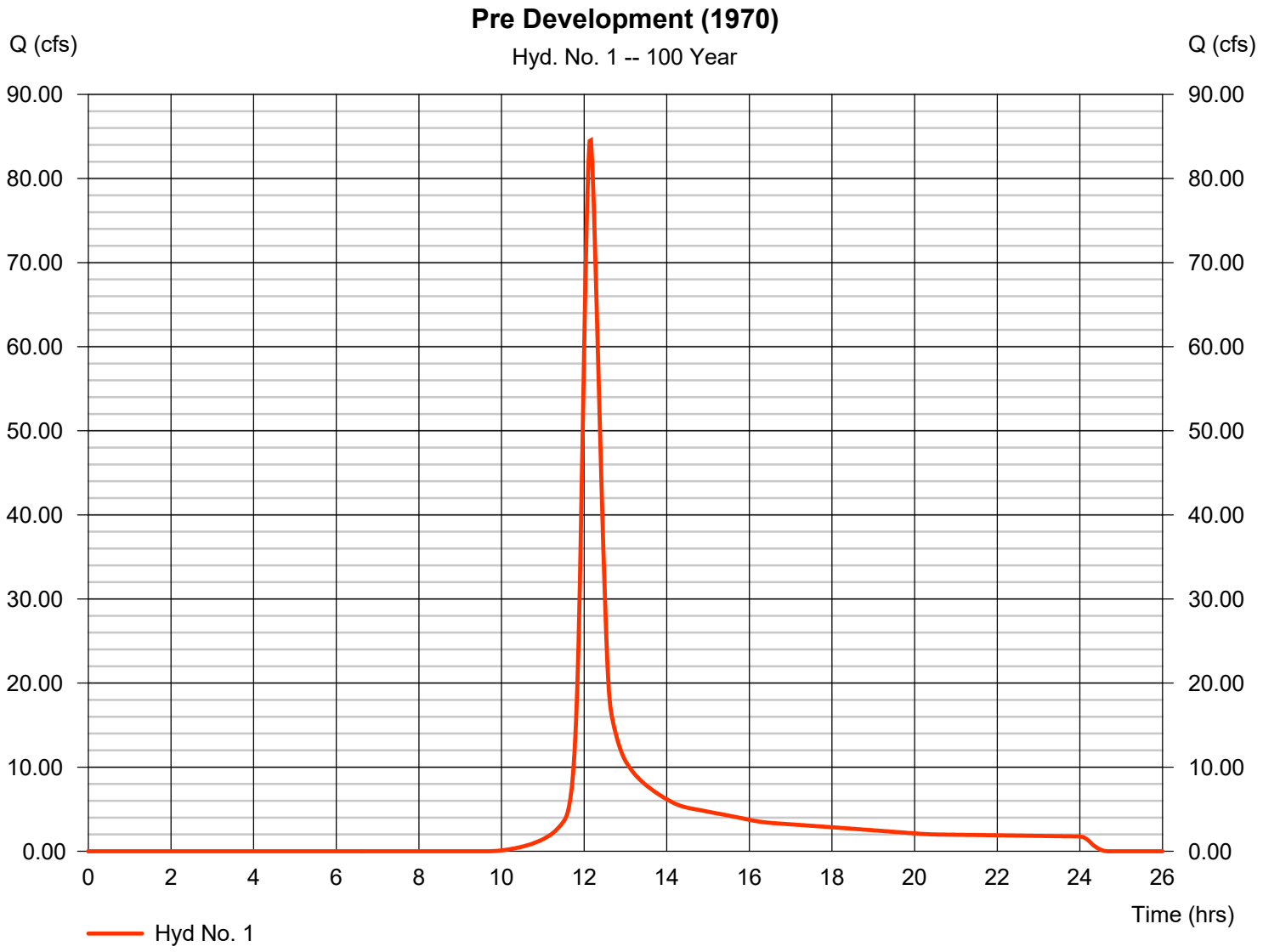
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 01 / 31 / 2018

Hyd. No. 1

Pre Development (1970)

Hydrograph type	=	SCS Runoff	Peak discharge	=	84.55 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.17 hrs
Time interval	=	2 min	Hyd. volume	=	317,153 cuft
Drainage area	=	32.260 ac	Curve number	=	65*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	25.00 min
Total precip.	=	6.54 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(21.850 x 61) + (2.230 x 55) + (3.000 x 74) + (5.180 x 80)] / 32.260



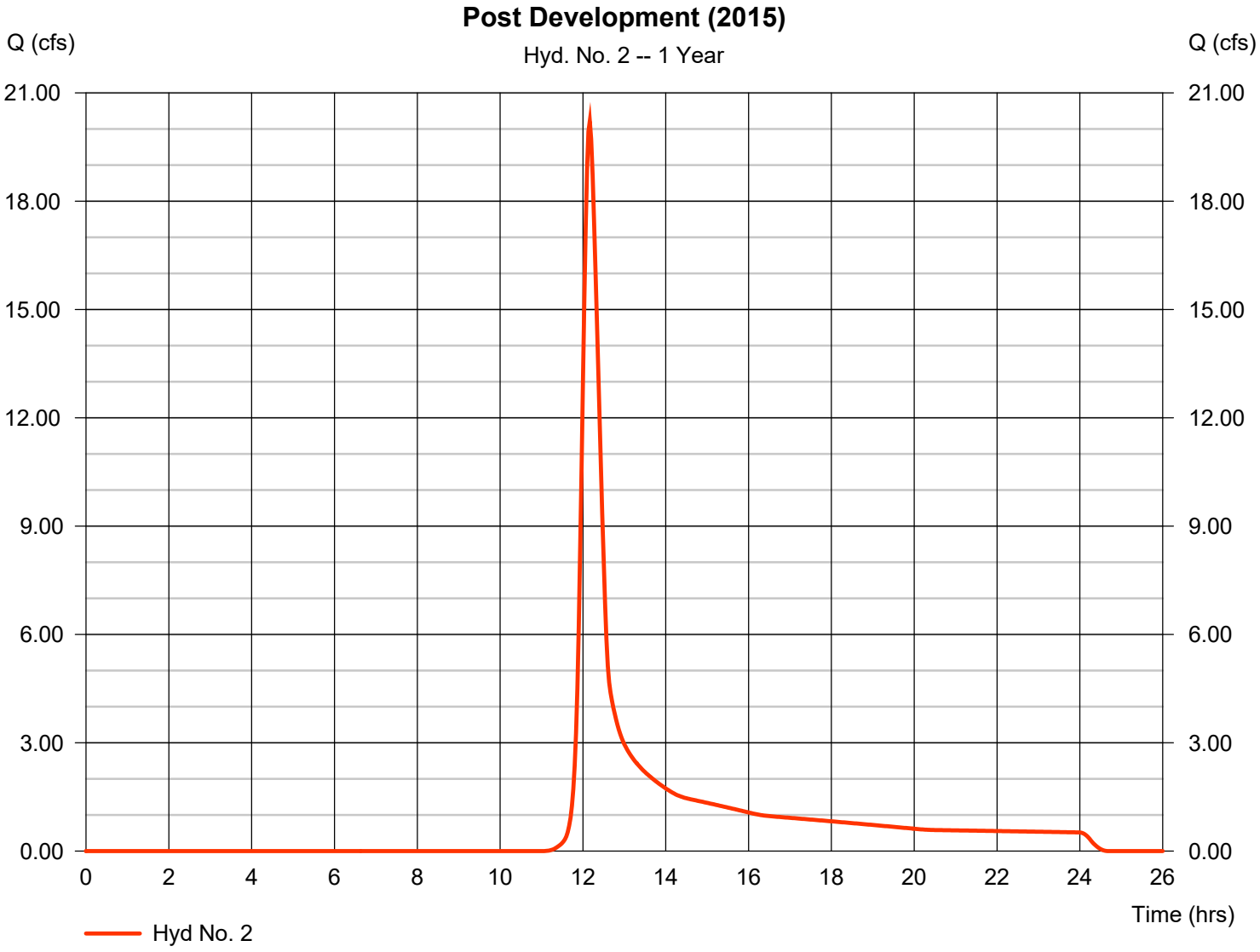
Hydrograph Report

Hyd. No. 2

Post Development (2015)

Hydrograph type	= SCS Runoff	Peak discharge	= 20.21 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.17 hrs
Time interval	= 2 min	Hyd. volume	= 79,963 cuft
Drainage area	= 32.260 ac	Curve number	= 79*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 24.50 min
Total precip.	= 2.28 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(11.110 x 61) + (2.090 x 55) + (1.500 x 74) + (3.720 x 80) + (13.840 x 98)] / 32.260



Hydrograph Report

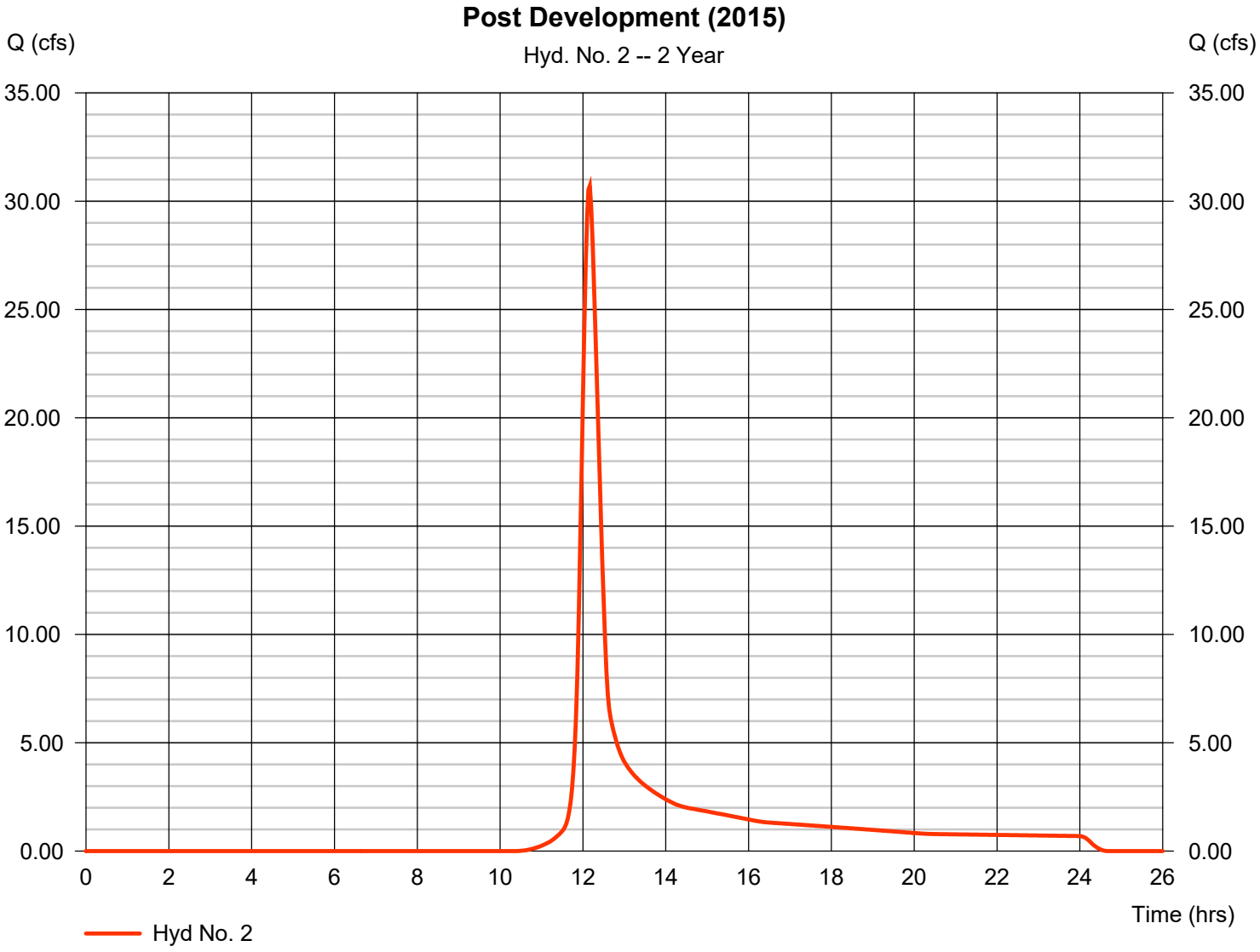
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 01 / 31 / 2018

Hyd. No. 2

Post Development (2015)

Hydrograph type	= SCS Runoff	Peak discharge	= 30.71 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.17 hrs
Time interval	= 2 min	Hyd. volume	= 117,137 cuft
Drainage area	= 32.260 ac	Curve number	= 79*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 24.50 min
Total precip.	= 2.76 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(11.110 x 61) + (2.090 x 55) + (1.500 x 74) + (3.720 x 80) + (13.840 x 98)] / 32.260



Hydrograph Report

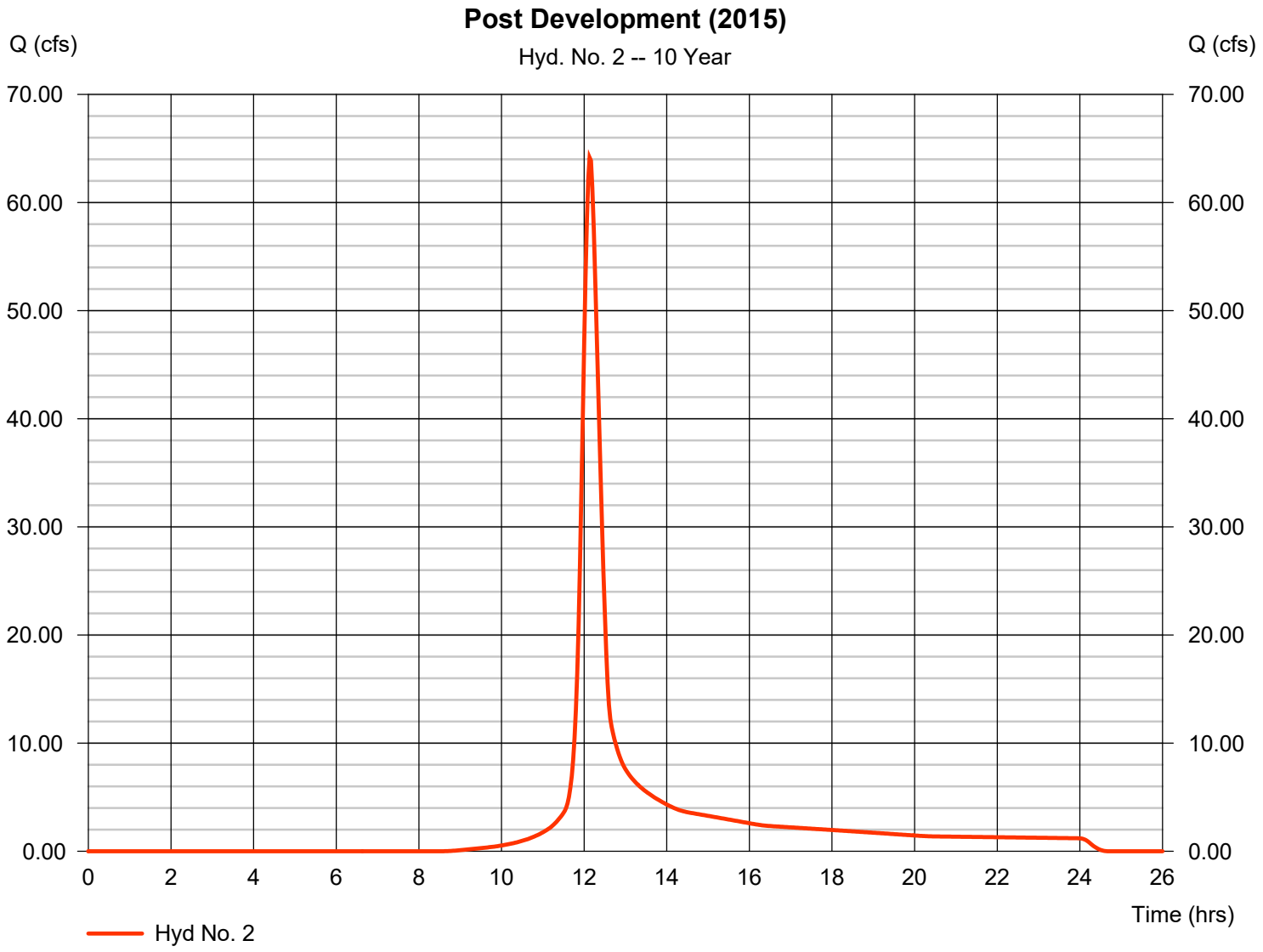
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 01 / 31 / 2018

Hyd. No. 2

Post Development (2015)

Hydrograph type	= SCS Runoff	Peak discharge	= 64.15 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.13 hrs
Time interval	= 2 min	Hyd. volume	= 236,675 cuft
Drainage area	= 32.260 ac	Curve number	= 79*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 24.50 min
Total precip.	= 4.11 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(11.110 x 61) + (2.090 x 55) + (1.500 x 74) + (3.720 x 80) + (13.840 x 98)] / 32.260



Hydrograph Report

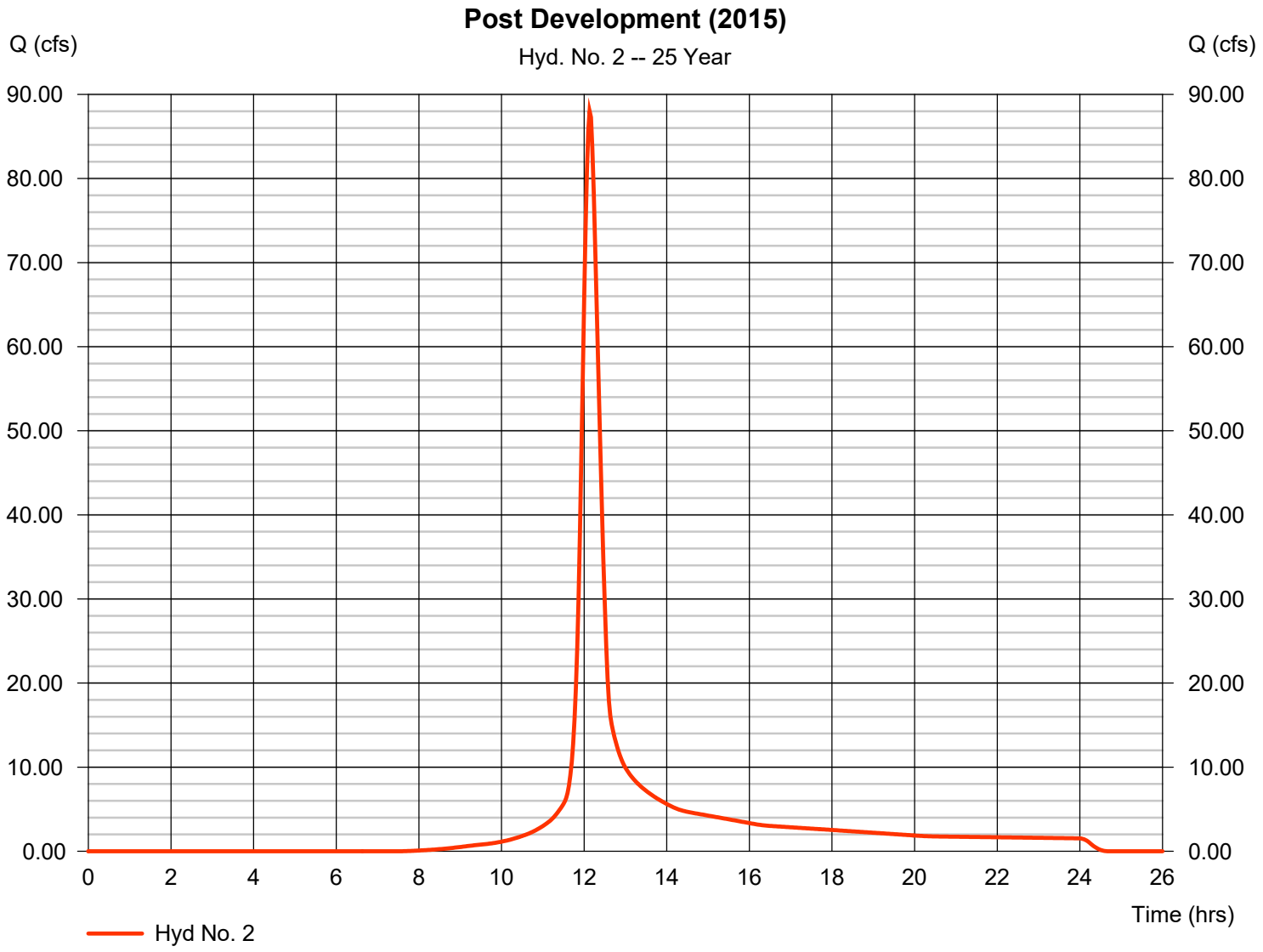
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 01 / 31 / 2018

Hyd. No. 2

Post Development (2015)

Hydrograph type	= SCS Runoff	Peak discharge	= 87.99 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.13 hrs
Time interval	= 2 min	Hyd. volume	= 322,958 cuft
Drainage area	= 32.260 ac	Curve number	= 79*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 24.50 min
Total precip.	= 5.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(11.110 x 61) + (2.090 x 55) + (1.500 x 74) + (3.720 x 80) + (13.840 x 98)] / 32.260



Hydrograph Report

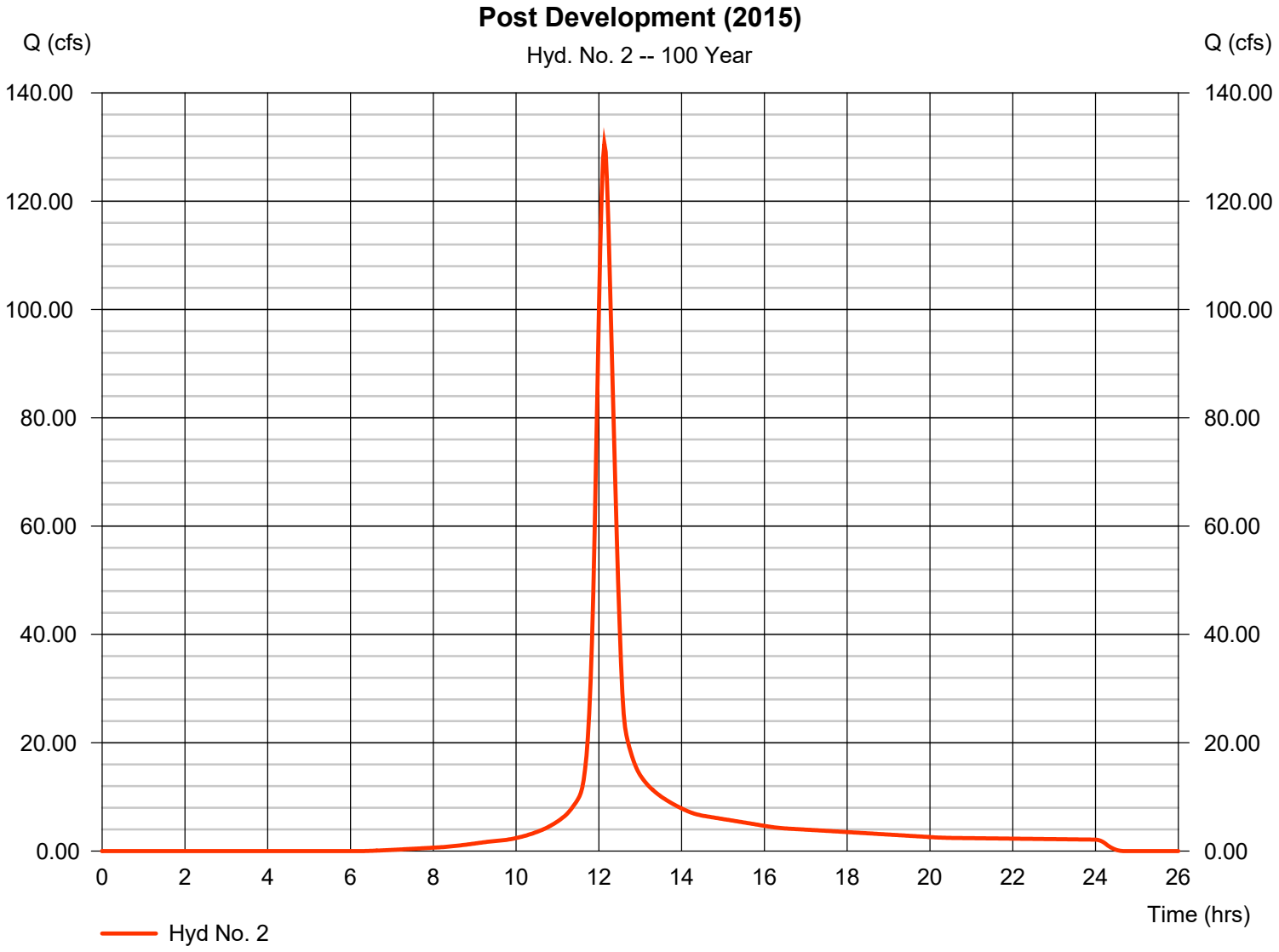
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 01 / 31 / 2018

Hyd. No. 2

Post Development (2015)

Hydrograph type	=	SCS Runoff	Peak discharge	=	130.63 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.13 hrs
Time interval	=	2 min	Hyd. volume	=	480,170 cuft
Drainage area	=	32.260 ac	Curve number	=	79*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	24.50 min
Total precip.	=	6.54 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(11.110 x 61) + (2.090 x 55) + (1.500 x 74) + (3.720 x 80) + (13.840 x 98)] / 32.260



Pond Report

Pond No. 1 - Facility #4 (2015)

Pond Data

Pond storage is based on user-defined values.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	2101.90	n/a	0	0
2.10	2104.00	n/a	1,873	1,873
4.10	2106.00	n/a	8,276	10,149
6.10	2108.00	n/a	18,339	28,488
8.10	2110.00	n/a	32,060	60,548
10.10	2112.00	n/a	49,963	110,511
12.10	2114.00	n/a	65,253	175,764

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 36.00	3.00	0.00	0.00
Span (in)	= 36.00	3.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 2101.77	2101.90	0.00	0.00
Length (ft)	= 150.69	0.10	0.00	0.00
Slope (%)	= 3.90	0.10	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 9.00	0.00	0.00	0.00
Crest El. (ft)	= 2109.70	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	---	---	---
Multi-Stage	= Yes	No	No	No

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

TW Elev. (ft) = 0.00

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

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	2101.90	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.21	187	2102.11	0.14 ic	0.07 ic	---	---	0.00	---	---	---	---	---	0.069
0.42	375	2102.32	0.14 ic	0.13 ic	---	---	0.00	---	---	---	---	---	0.128
0.63	562	2102.53	0.18 ic	0.17 ic	---	---	0.00	---	---	---	---	---	0.168
0.84	749	2102.74	0.20 ic	0.20 ic	---	---	0.00	---	---	---	---	---	0.200
1.05	937	2102.95	0.23 ic	0.23 ic	---	---	0.00	---	---	---	---	---	0.227
1.26	1,124	2103.16	0.26 ic	0.25 ic	---	---	0.00	---	---	---	---	---	0.252
1.47	1,311	2103.37	0.29 ic	0.27 ic	---	---	0.00	---	---	---	---	---	0.274
1.68	1,498	2103.58	0.29 ic	0.29 ic	---	---	0.00	---	---	---	---	---	0.295
1.89	1,686	2103.79	0.33 ic	0.31 ic	---	---	0.00	---	---	---	---	---	0.314
2.10	1,873	2104.00	0.33 ic	0.33 ic	---	---	0.00	---	---	---	---	---	0.332
2.30	2,701	2104.20	0.37 ic	0.35 ic	---	---	0.00	---	---	---	---	---	0.349
2.50	3,528	2104.40	0.37 ic	0.36 ic	---	---	0.00	---	---	---	---	---	0.364
2.70	4,356	2104.60	0.41 ic	0.38 ic	---	---	0.00	---	---	---	---	---	0.379
2.90	5,183	2104.80	0.41 ic	0.39 ic	---	---	0.00	---	---	---	---	---	0.394
3.10	6,011	2105.00	0.41 ic	0.41 ic	---	---	0.00	---	---	---	---	---	0.408
3.30	6,839	2105.20	0.45 ic	0.42 ic	---	---	0.00	---	---	---	---	---	0.421
3.50	7,666	2105.40	0.45 ic	0.43 ic	---	---	0.00	---	---	---	---	---	0.434
3.70	8,494	2105.60	0.45 ic	0.45 ic	---	---	0.00	---	---	---	---	---	0.447
3.90	9,321	2105.80	0.46 ic	0.46 ic	---	---	0.00	---	---	---	---	---	0.459
4.10	10,149	2106.00	0.50 ic	0.47 ic	---	---	0.00	---	---	---	---	---	0.471
4.30	11,983	2106.20	0.50 ic	0.48 ic	---	---	0.00	---	---	---	---	---	0.483
4.50	13,817	2106.40	0.50 ic	0.49 ic	---	---	0.00	---	---	---	---	---	0.494
4.70	15,651	2106.60	0.51 ic	0.51 ic	---	---	0.00	---	---	---	---	---	0.505
4.90	17,485	2106.80	0.55 ic	0.52 ic	---	---	0.00	---	---	---	---	---	0.516
5.10	19,319	2107.00	0.55 ic	0.53 ic	---	---	0.00	---	---	---	---	---	0.527
5.30	21,152	2107.20	0.55 ic	0.54 ic	---	---	0.00	---	---	---	---	---	0.537
5.50	22,986	2107.40	0.55 ic	0.55 ic	---	---	0.00	---	---	---	---	---	0.548
5.70	24,820	2107.60	0.56 ic	0.56 ic	---	---	0.00	---	---	---	---	---	0.558
5.90	26,654	2107.80	0.57 ic	0.57 ic	---	---	0.00	---	---	---	---	---	0.567
6.10	28,488	2108.00	0.61 ic	0.58 ic	---	---	0.00	---	---	---	---	---	0.577
6.30	31,694	2108.20	0.61 ic	0.59 ic	---	---	0.00	---	---	---	---	---	0.586
6.50	34,900	2108.40	0.61 ic	0.60 ic	---	---	0.00	---	---	---	---	---	0.596
6.70	38,106	2108.60	0.61 ic	0.61 ic	---	---	0.00	---	---	---	---	---	0.605
6.90	41,312	2108.80	0.61 ic	0.61 ic	---	---	0.00	---	---	---	---	---	0.614
7.10	44,518	2109.00	0.62 ic	0.62 ic	---	---	0.00	---	---	---	---	---	0.623
7.30	47,724	2109.20	0.67 ic	0.63 ic	---	---	0.00	---	---	---	---	---	0.632

Continues on next page...

Facility #4 (2015)

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
7.50	50,930	2109.40	0.67 ic	0.64 ic	---	---	0.00	---	---	---	---	---	0.640
7.70	54,136	2109.60	0.67 ic	0.65 ic	---	---	0.00	---	---	---	---	---	0.649
7.90	57,342	2109.80	1.64 ic	0.65 ic	---	---	0.95	---	---	---	---	---	1.600
8.10	60,548	2110.00	5.74 ic	0.64 ic	---	---	4.93	---	---	---	---	---	5.566
8.30	65,544	2110.20	11.49 ic	0.63 ic	---	---	10.60	---	---	---	---	---	11.23
8.50	70,541	2110.40	18.43 ic	0.62 ic	---	---	17.55	---	---	---	---	---	18.17
8.70	75,537	2110.60	26.28 ic	0.61 ic	---	---	25.60	---	---	---	---	---	26.21
8.90	80,533	2110.80	35.20 ic	0.60 ic	---	---	34.58	---	---	---	---	---	35.18
9.10	85,529	2111.00	34.93 ic	0.61 ic	---	---	31.04 ic	---	---	---	---	---	31.65
9.30	90,526	2111.20	34.66 ic	0.62 ic	---	---	33.34 ic	---	---	---	---	---	33.96
9.50	95,522	2111.40	36.12 ic	0.63 ic	---	---	35.49 ic	---	---	---	---	---	36.12
9.70	100,518	2111.60	38.15 ic	0.63 ic	---	---	37.52 ic	---	---	---	---	---	38.15
9.90	105,515	2111.80	40.08 ic	0.63 ic	---	---	39.45 ic	---	---	---	---	---	40.08
10.10	110,511	2112.00	41.92 ic	0.63 ic	---	---	41.28 ic	---	---	---	---	---	41.92
10.30	117,036	2112.20	43.68 ic	0.64 ic	---	---	43.04 ic	---	---	---	---	---	43.68
10.50	123,562	2112.40	45.37 ic	0.64 ic	---	---	44.73 ic	---	---	---	---	---	45.37
10.70	130,087	2112.60	47.00 ic	0.64 ic	---	---	46.35 ic	---	---	---	---	---	47.00
10.90	136,612	2112.80	48.57 ic	0.65 ic	---	---	47.93 ic	---	---	---	---	---	48.57
11.10	143,138	2113.00	50.10 ic	0.65 ic	---	---	49.45 ic	---	---	---	---	---	50.10
11.30	149,663	2113.20	51.58 ic	0.65 ic	---	---	50.92 ic	---	---	---	---	---	51.58
11.50	156,188	2113.40	53.01 ic	0.66 ic	---	---	52.36 ic	---	---	---	---	---	53.01
11.70	162,713	2113.60	54.42 ic	0.66 ic	---	---	53.76 ic	---	---	---	---	---	54.41
11.90	169,239	2113.80	55.78 ic	0.66 ic	---	---	55.12 ic	---	---	---	---	---	55.78
12.10	175,764	2114.00	57.11 ic	0.66 ic	---	---	56.44 ic	---	---	---	---	---	57.11

...End

Hydrograph Report

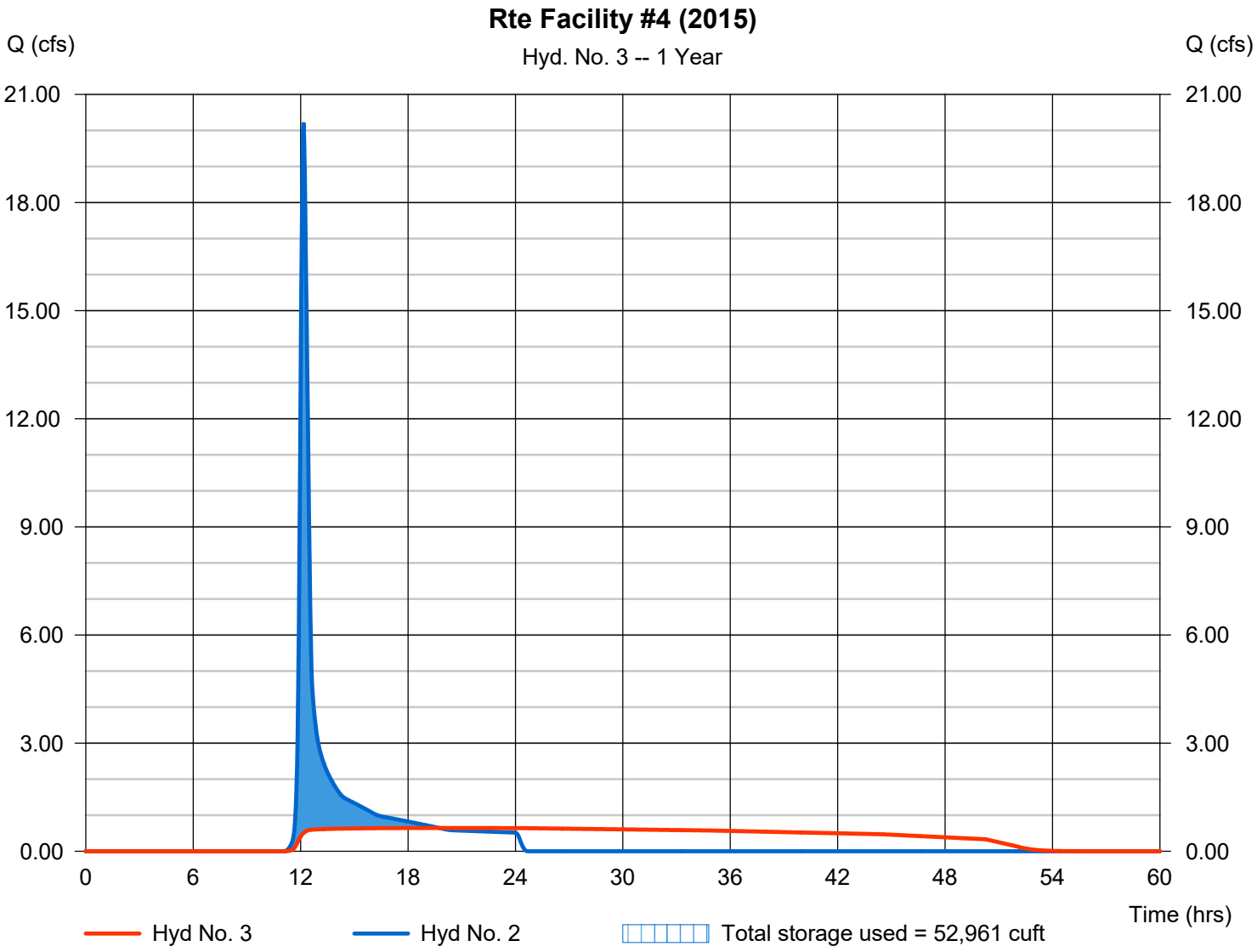
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 01 / 31 / 2018

Hyd. No. 3

Rte Facility #4 (2015)

Hydrograph type	=	Reservoir	Peak discharge	=	0.646 cfs
Storm frequency	=	1 yrs	Time to peak	=	19.73 hrs
Time interval	=	2 min	Hyd. volume	=	79,960 cuft
Inflow hyd. No.	=	2 - Post Development (2015)	Max. Elevation	=	2109.53 ft
Reservoir name	=	Facility #4 (2015)	Max. Storage	=	52,961 cuft

Storage Indication method used.



Hydrograph Report

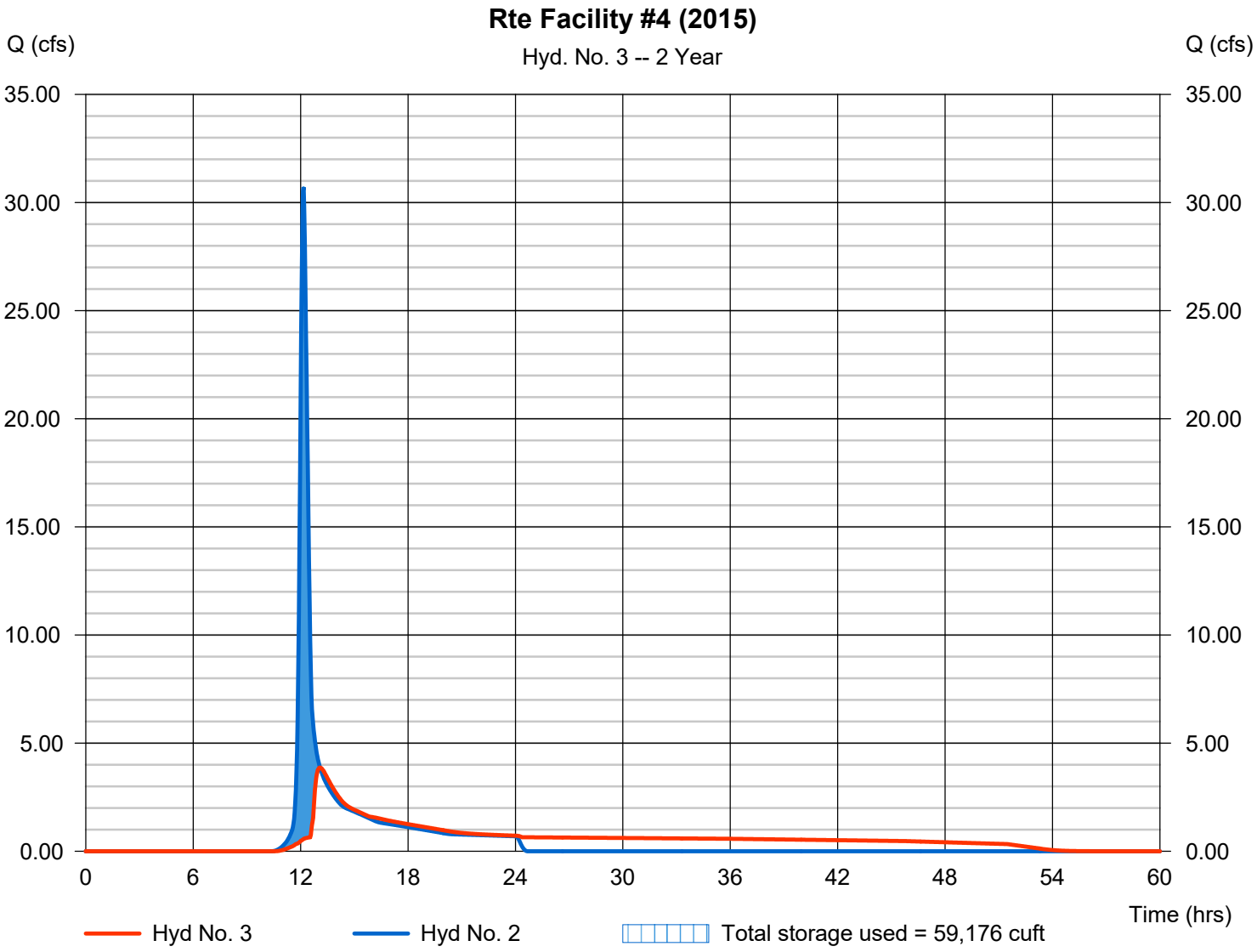
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 01 / 31 / 2018

Hyd. No. 3

Rte Facility #4 (2015)

Hydrograph type	=	Reservoir	Peak discharge	=	3.869 cfs
Storm frequency	=	2 yrs	Time to peak	=	13.10 hrs
Time interval	=	2 min	Hyd. volume	=	117,134 cuft
Inflow hyd. No.	=	2 - Post Development (2015)	Max. Elevation	=	2109.91 ft
Reservoir name	=	Facility #4 (2015)	Max. Storage	=	59,176 cuft

Storage Indication method used.



Hydrograph Report

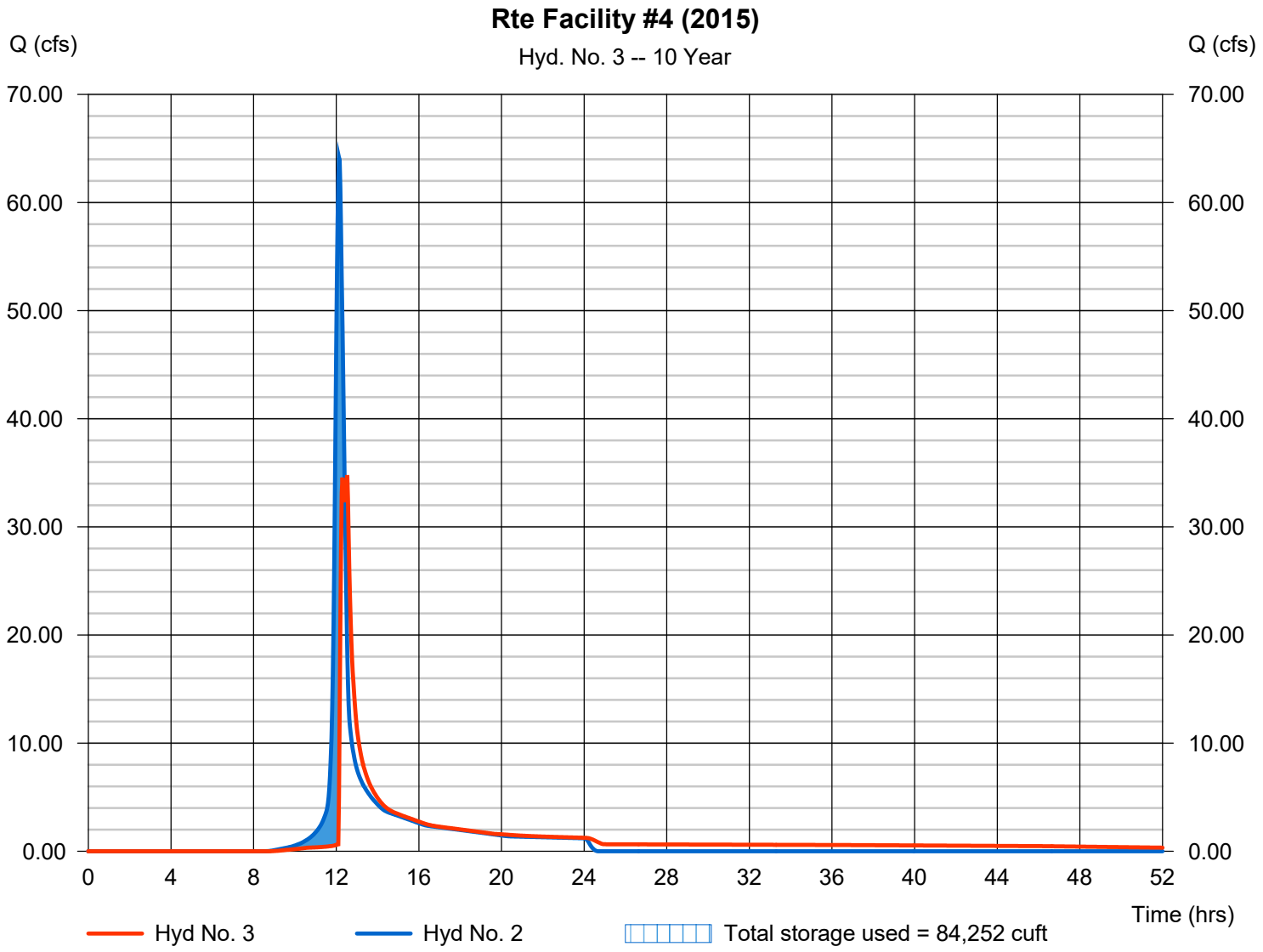
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 01 / 31 / 2018

Hyd. No. 3

Rte Facility #4 (2015)

Hydrograph type	= Reservoir	Peak discharge	= 34.79 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.53 hrs
Time interval	= 2 min	Hyd. volume	= 236,672 cuft
Inflow hyd. No.	= 2 - Post Development (2015)	Max. Elevation	= 2110.96 ft
Reservoir name	= Facility #4 (2015)	Max. Storage	= 84,252 cuft

Storage Indication method used.



Hydrograph Report

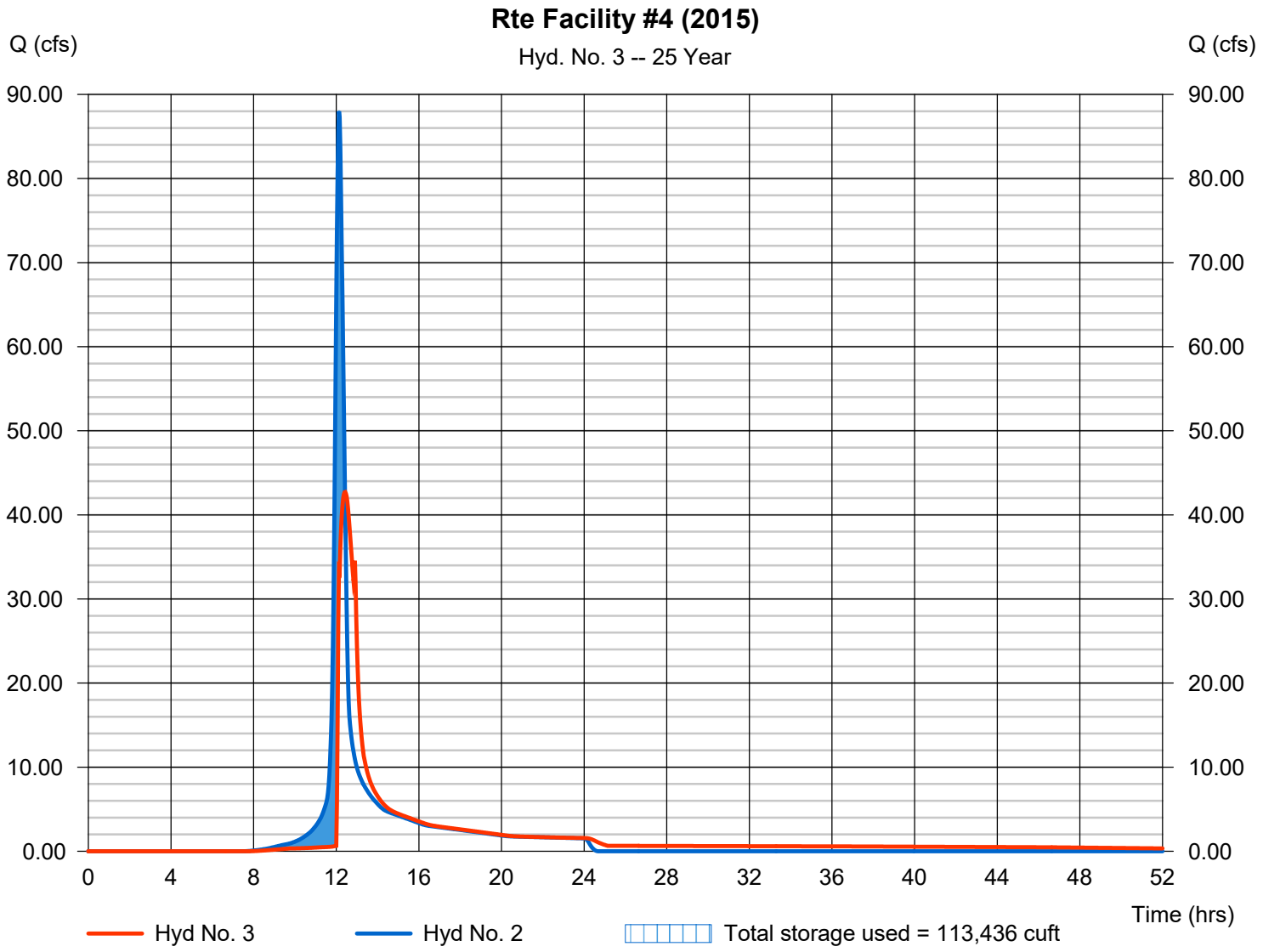
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 01 / 31 / 2018

Hyd. No. 3

Rte Facility #4 (2015)

Hydrograph type	=	Reservoir	Peak discharge	=	42.70 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.43 hrs
Time interval	=	2 min	Hyd. volume	=	322,955 cuft
Inflow hyd. No.	=	2 - Post Development (2015)	Max. Elevation	=	2112.09 ft
Reservoir name	=	Facility #4 (2015)	Max. Storage	=	113,436 cuft

Storage Indication method used.



Hydrograph Report

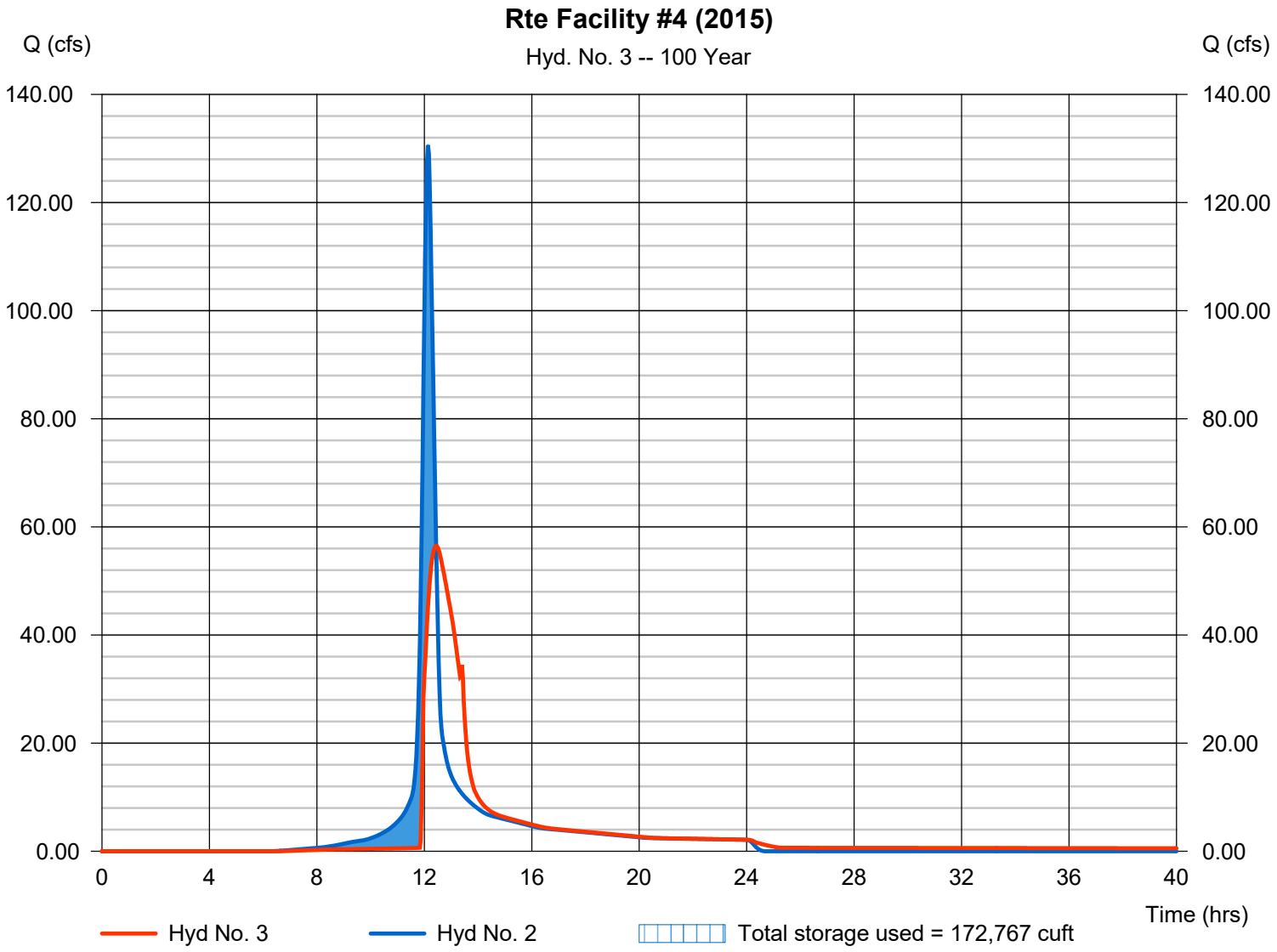
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 01 / 31 / 2018

Hyd. No. 3

Rte Facility #4 (2015)

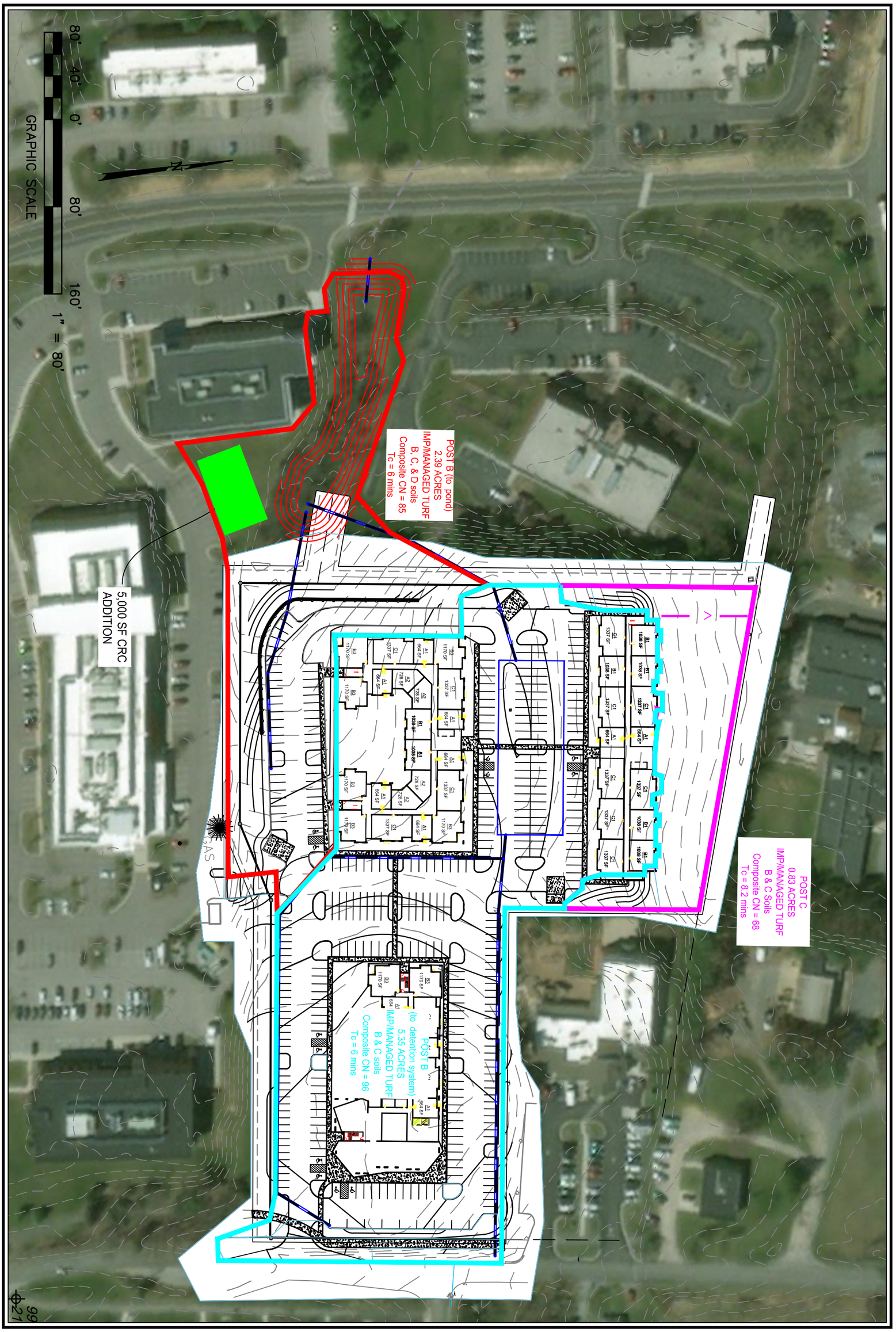
Hydrograph type	= Reservoir	Peak discharge	= 56.50 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.43 hrs
Time interval	= 2 min	Hyd. volume	= 480,167 cuft
Inflow hyd. No.	= 2 - Post Development (2015)	Max. Elevation	= 2113.91 ft
Reservoir name	= Facility #4 (2015)	Max. Storage	= 172,767 cuft

Storage Indication method used.



APPENDIX D – POST-DEVELOPMENT HYDROLOGIC CONDITIONS

(See attached Drawings)



SCALE: 1" = 80'
PROJECT NO. 17-0117
DATE: 02/01/2018
APPENDIX C.2

30-R at CRC Residential Development
Re-Zoning Application
Post Development Drainage Map
Town of Blacksburg, VA

2122 Carolina Avenue, S.W.
Roanoke, Virginia 24014
Phone: 540-387-1153
Fax: 540-389-5767
www.parkerdg.com
parker DESIGN GROUP, INC.
ENGINEERS * SURVEYORS * PLANNERS * LANDSCAPE ARCHITECTS

Post Development Area C

Time of Concentration				
100	ft OLF@	9	% =	8.20 min
0	ft CF @	0	% =	0.00 min
0	ft CF @	0	% =	0.00 min
			Tc =	8.20 min
User defined				
C factor for OLF=			0.30	

Hydrograph Report

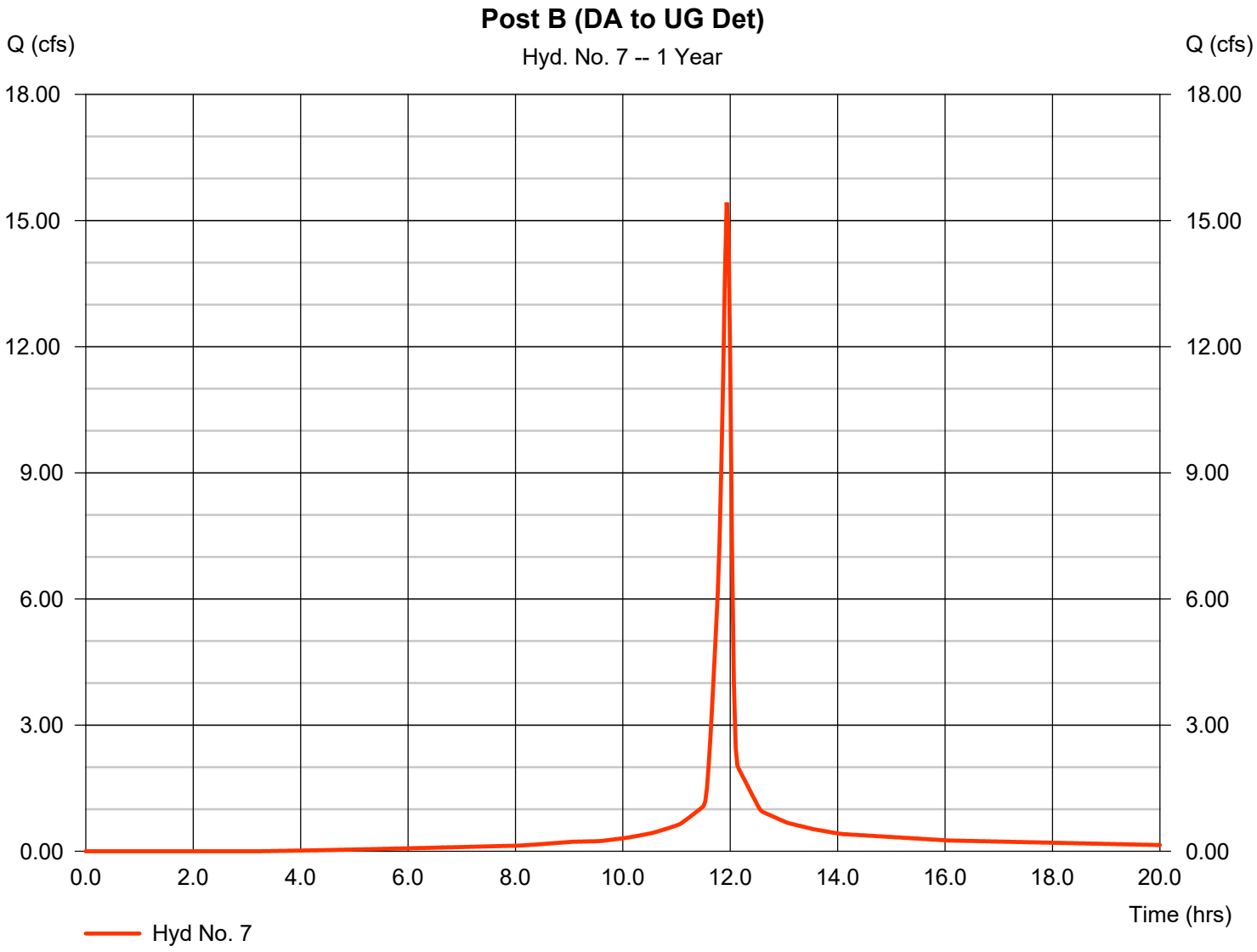
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 01 / 31 / 2018

Hyd. No. 7

Post B (DA to UG Det)

Hydrograph type	= SCS Runoff	Peak discharge	= 15.43 cfs
Storm frequency	= 1 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 33,617 cuft
Drainage area	= 5.350 ac	Curve number	= 96*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 2.28 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(5.100 x 98) + (0.250 x 61)] / 5.350



Hydrograph Report

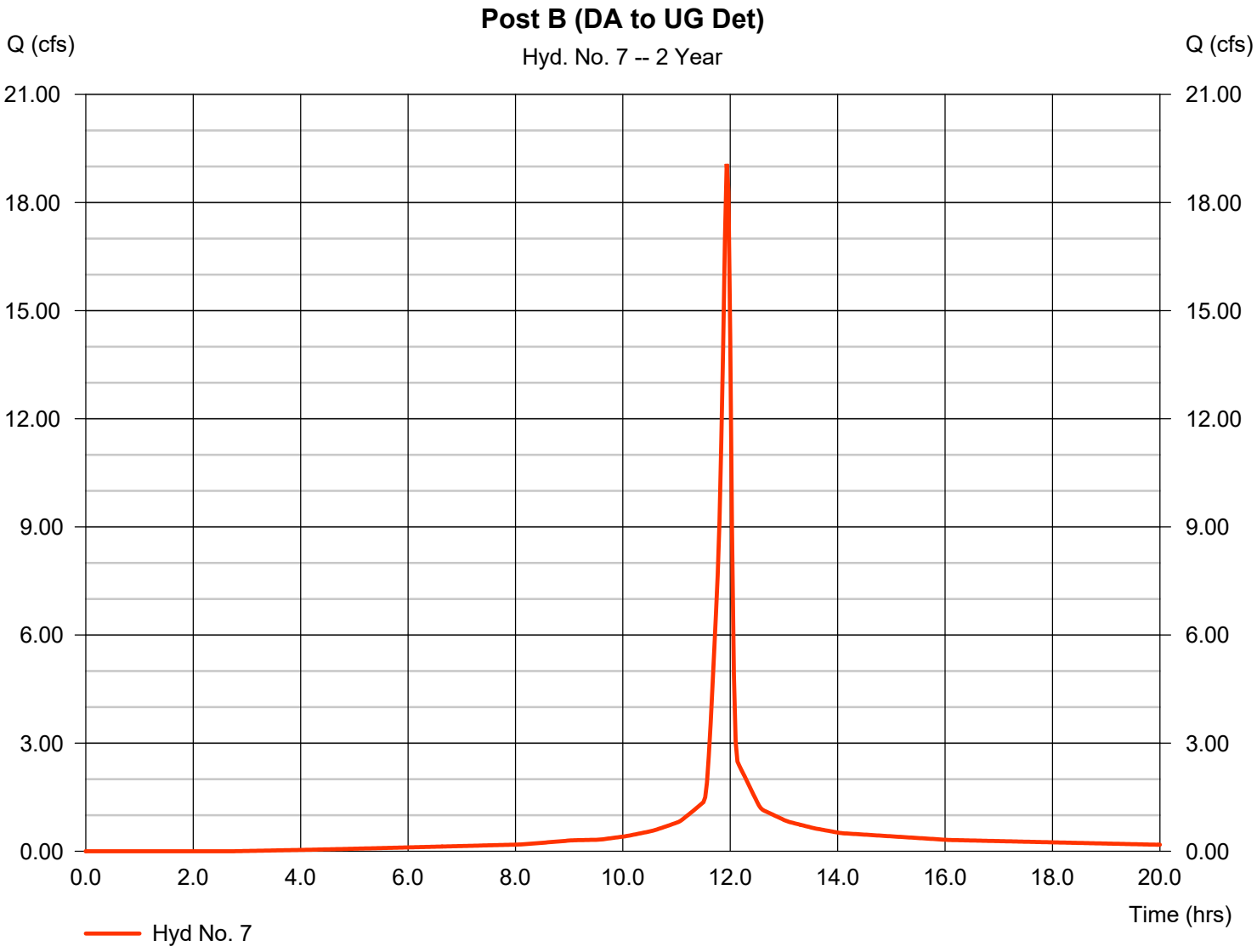
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 01 / 31 / 2018

Hyd. No. 7

Post B (DA to UG Det)

Hydrograph type	= SCS Runoff	Peak discharge	= 19.07 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 42,169 cuft
Drainage area	= 5.350 ac	Curve number	= 96*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 2.76 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(5.100 x 98) + (0.250 x 61)] / 5.350



Hydrograph Report

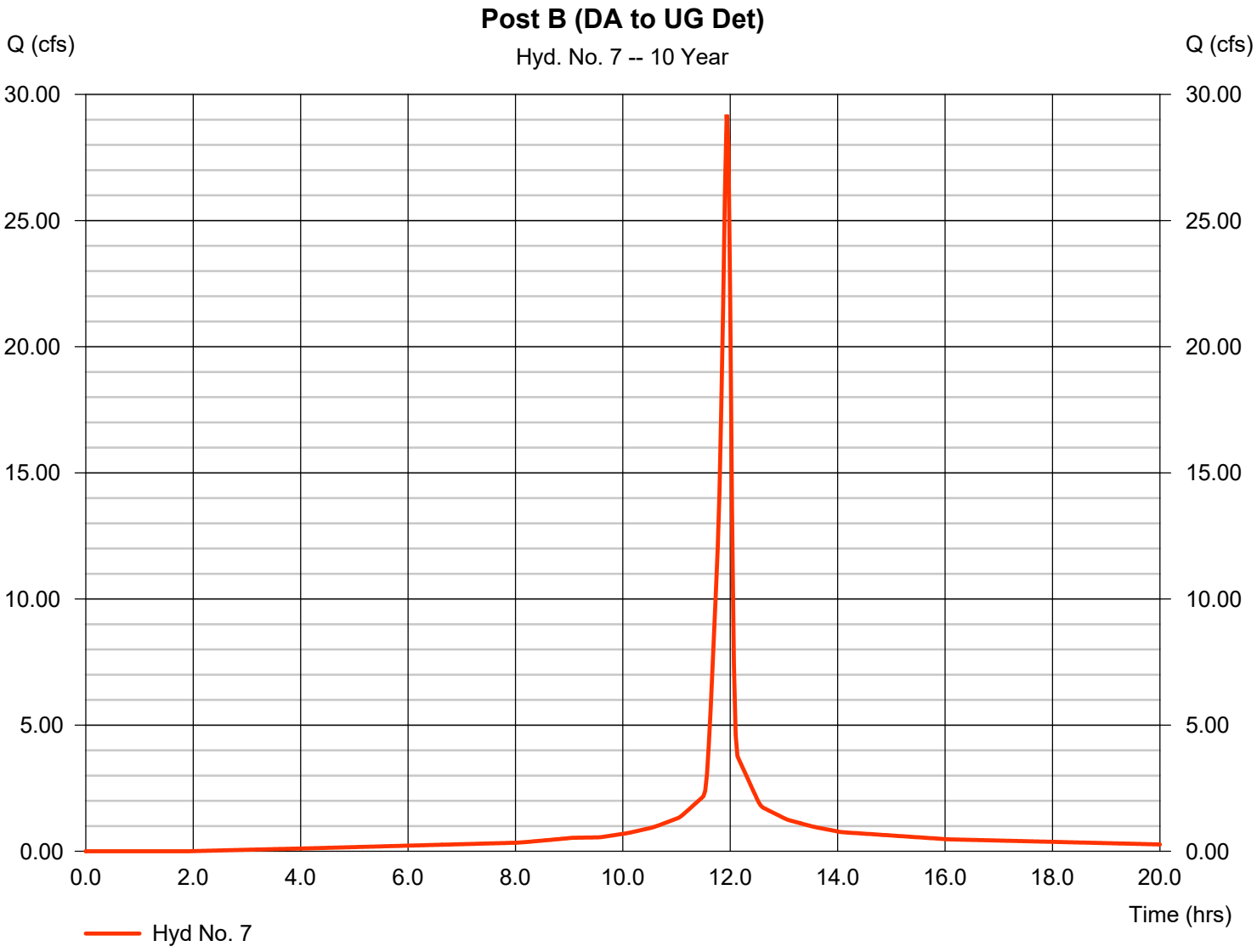
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 01 / 31 / 2018

Hyd. No. 7

Post B (DA to UG Det)

Hydrograph type	= SCS Runoff	Peak discharge	= 29.20 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 66,438 cuft
Drainage area	= 5.350 ac	Curve number	= 96*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 4.11 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(5.100 x 98) + (0.250 x 61)] / 5.350



Hydrograph Report

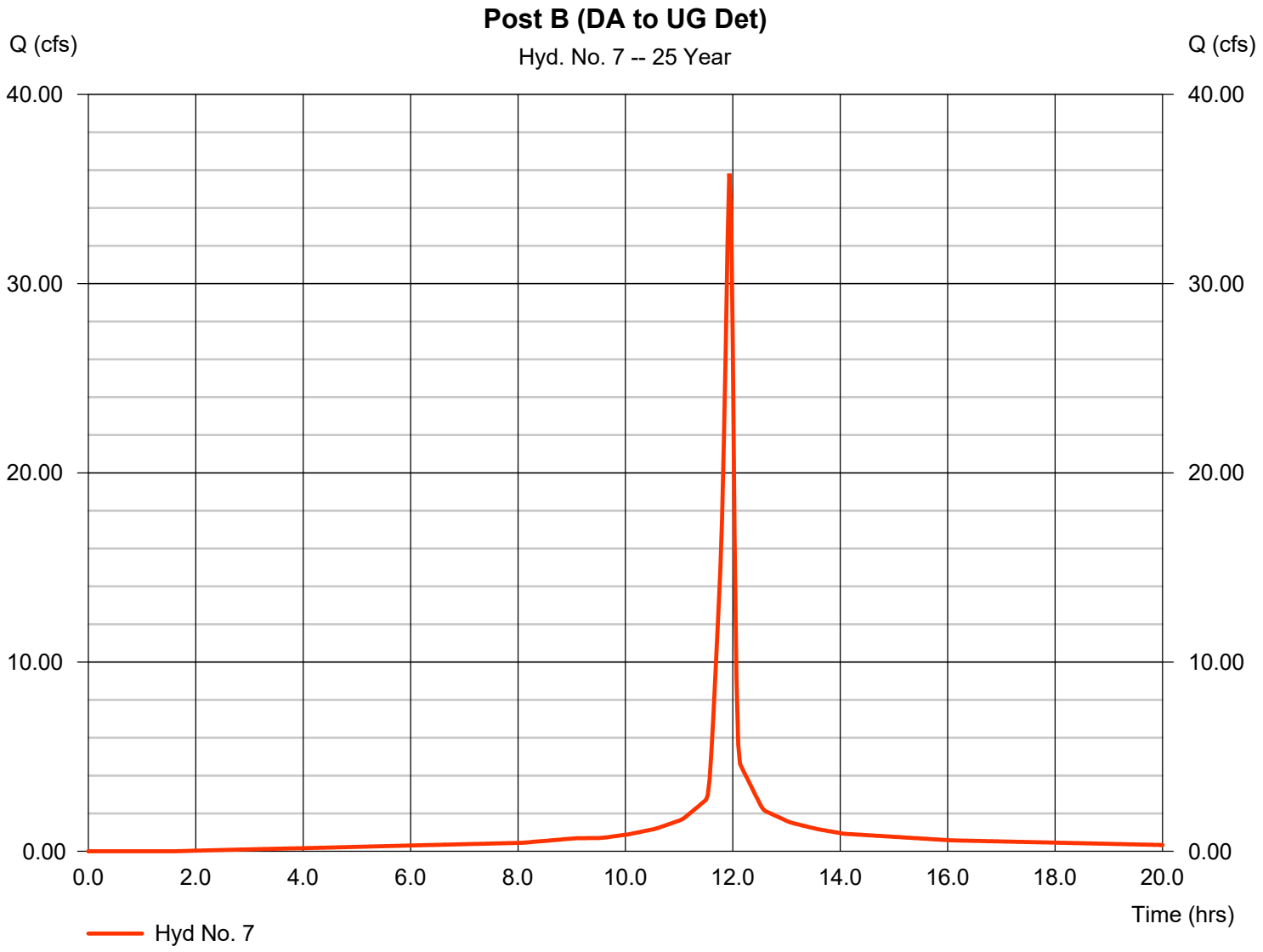
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 01 / 31 / 2018

Hyd. No. 7

Post B (DA to UG Det)

Hydrograph type	= SCS Runoff	Peak discharge	= 35.82 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 82,523 cuft
Drainage area	= 5.350 ac	Curve number	= 96*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(5.100 x 98) + (0.250 x 61)] / 5.350



Hydrograph Report

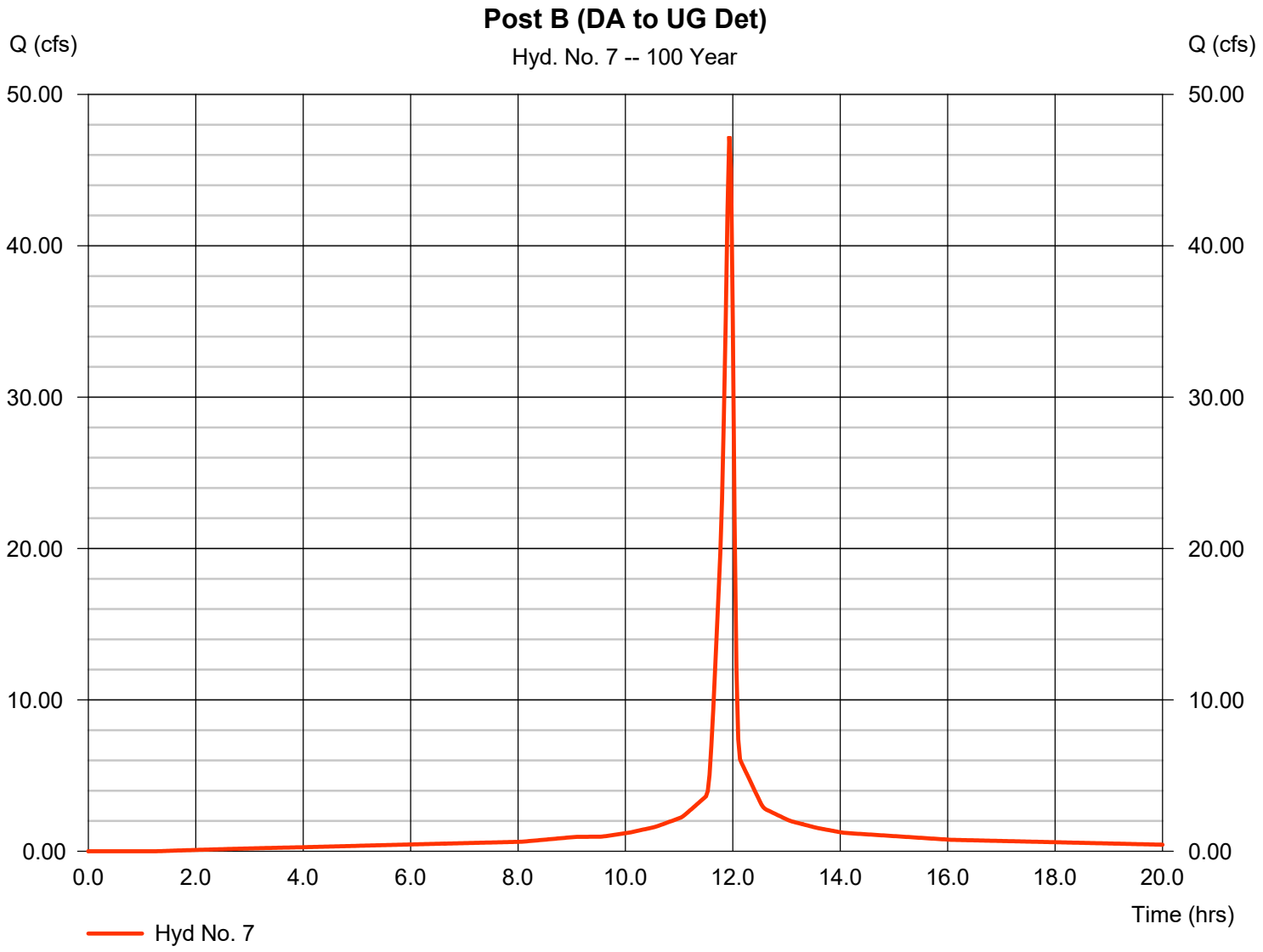
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 01 / 31 / 2018

Hyd. No. 7

Post B (DA to UG Det)

Hydrograph type	= SCS Runoff	Peak discharge	= 47.22 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 110,428 cuft
Drainage area	= 5.350 ac	Curve number	= 96*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 6.54 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(5.100 x 98) + (0.250 x 61)] / 5.350



Hydrograph Report

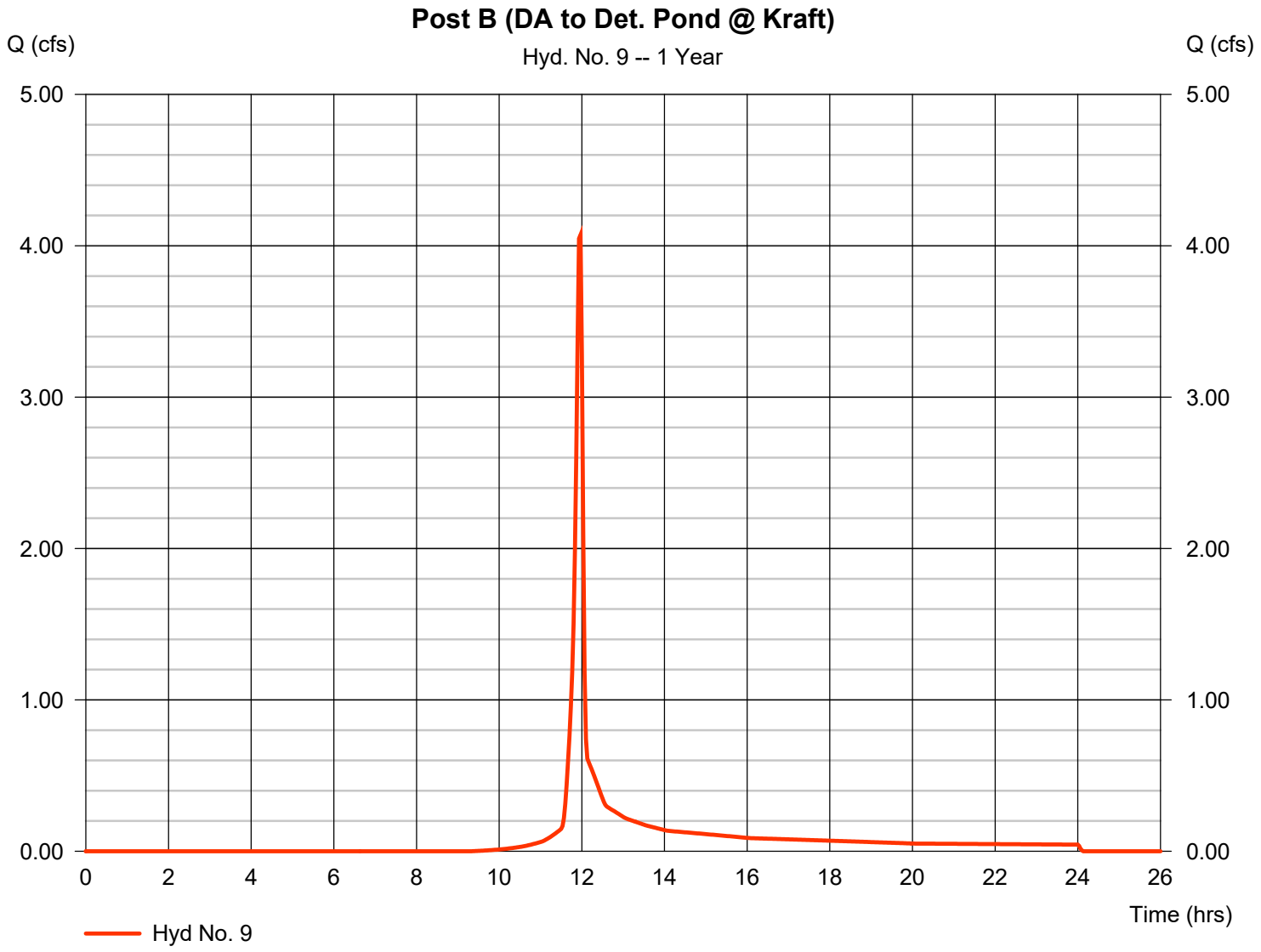
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 01 / 31 / 2018

Hyd. No. 9

Post B (DA to Det. Pond @ Kraft)

Hydrograph type	= SCS Runoff	Peak discharge	= 4.072 cfs
Storm frequency	= 1 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 8,181 cuft
Drainage area	= 2.390 ac	Curve number	= 85*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 2.28 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.620 x 98) + (1.770 x 80)] / 2.390



Hydrograph Report

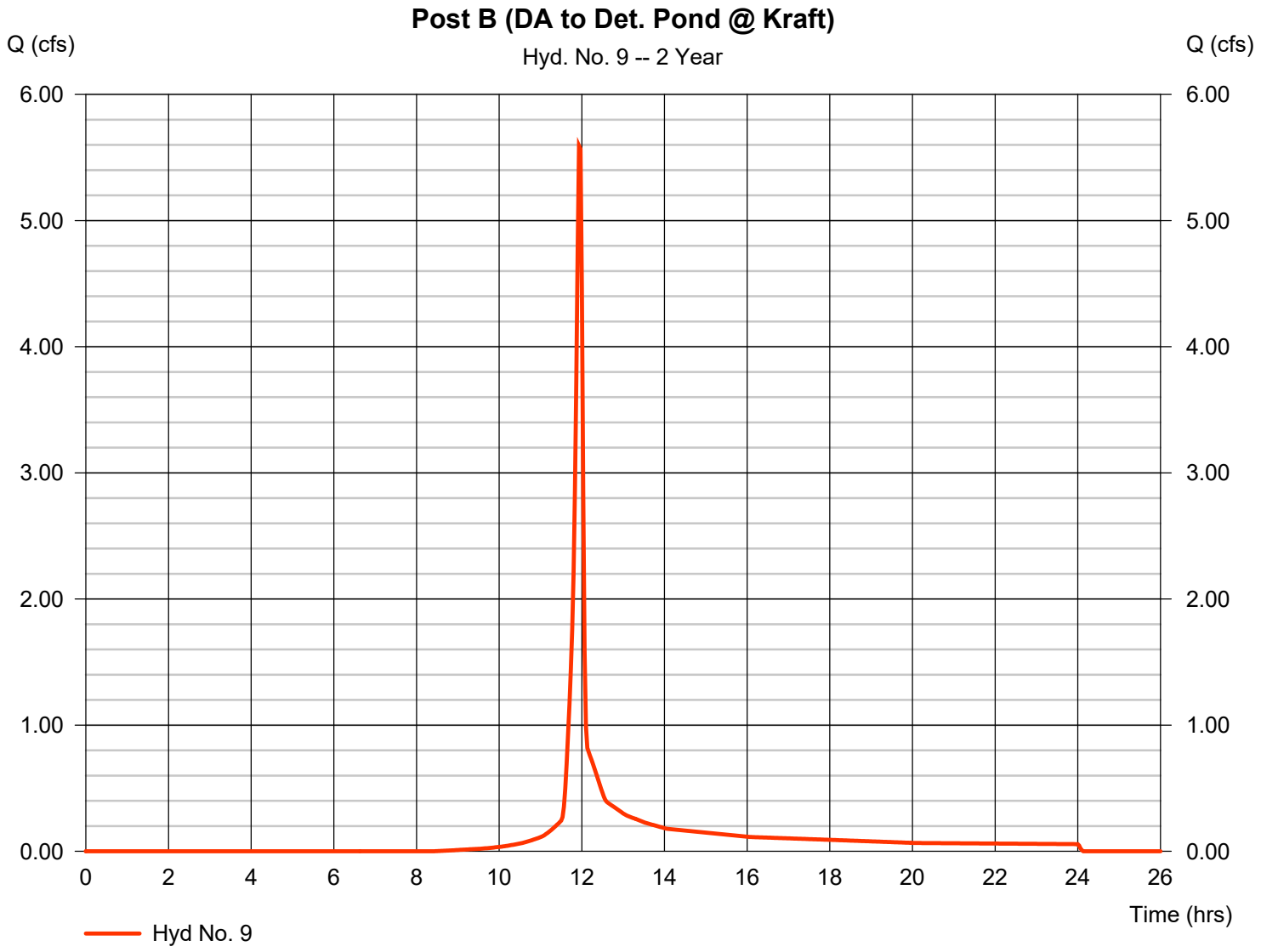
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 01 / 31 / 2018

Hyd. No. 9

Post B (DA to Det. Pond @ Kraft)

Hydrograph type	= SCS Runoff	Peak discharge	= 5.592 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 11,296 cuft
Drainage area	= 2.390 ac	Curve number	= 85*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 2.76 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.620 x 98) + (1.770 x 80)] / 2.390



Hydrograph Report

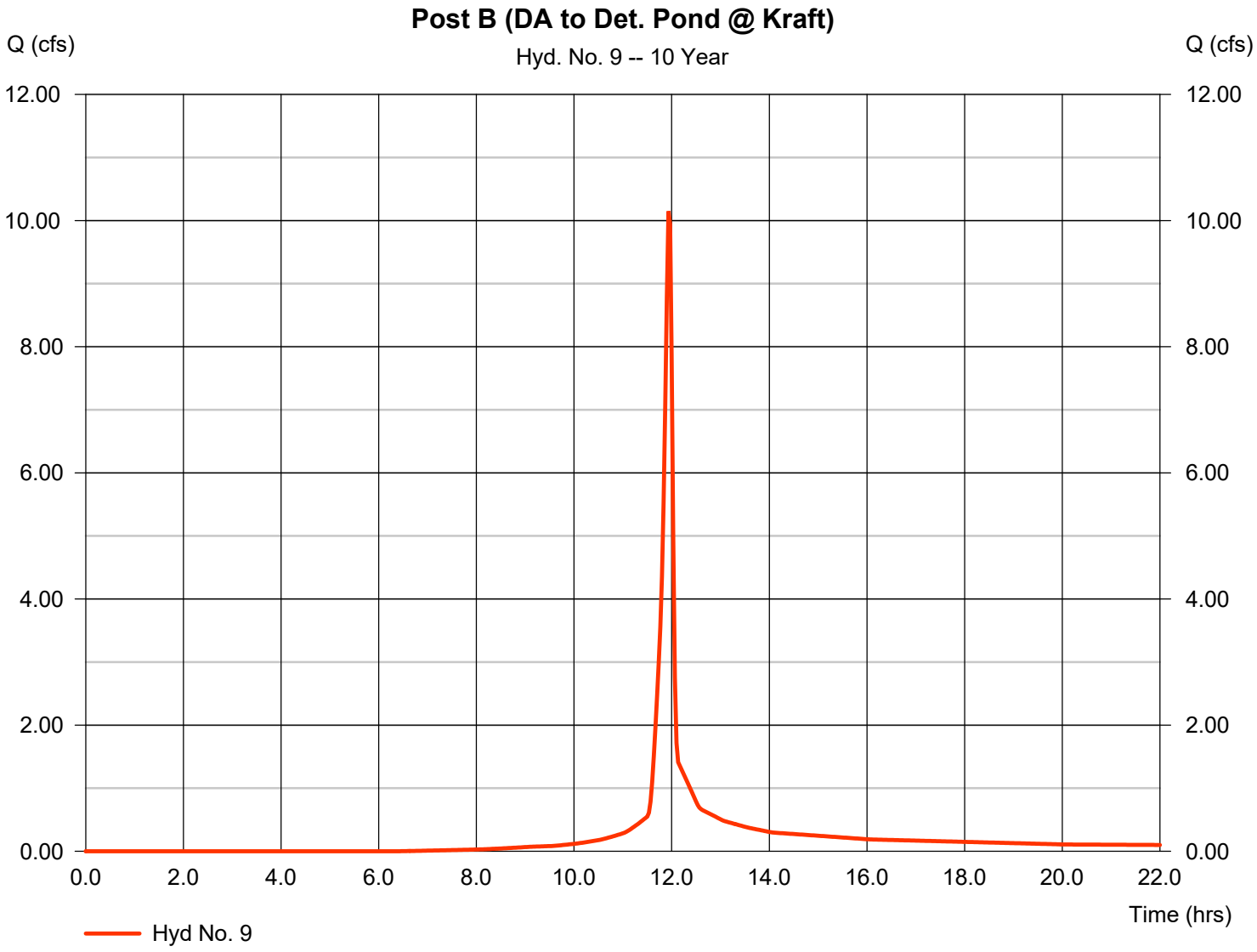
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 01 / 31 / 2018

Hyd. No. 9

Post B (DA to Det. Pond @ Kraft)

Hydrograph type	= SCS Runoff	Peak discharge	= 10.15 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 20,792 cuft
Drainage area	= 2.390 ac	Curve number	= 85*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 4.11 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.620 x 98) + (1.770 x 80)] / 2.390



Hydrograph Report

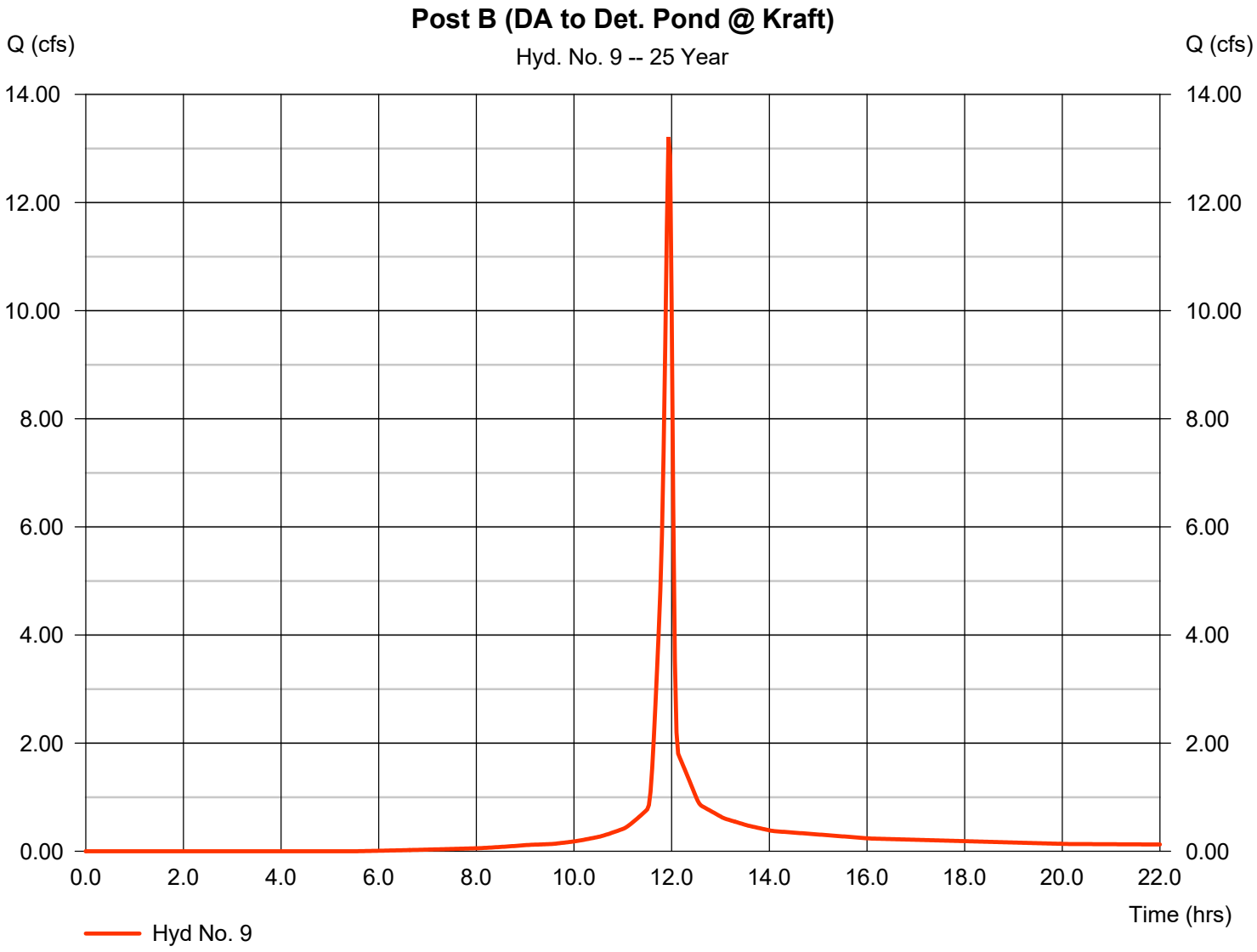
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 01 / 31 / 2018

Hyd. No. 9

Post B (DA to Det. Pond @ Kraft)

Hydrograph type	= SCS Runoff	Peak discharge	= 13.21 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 27,394 cuft
Drainage area	= 2.390 ac	Curve number	= 85*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 5.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.620 x 98) + (1.770 x 80)] / 2.390



Hydrograph Report

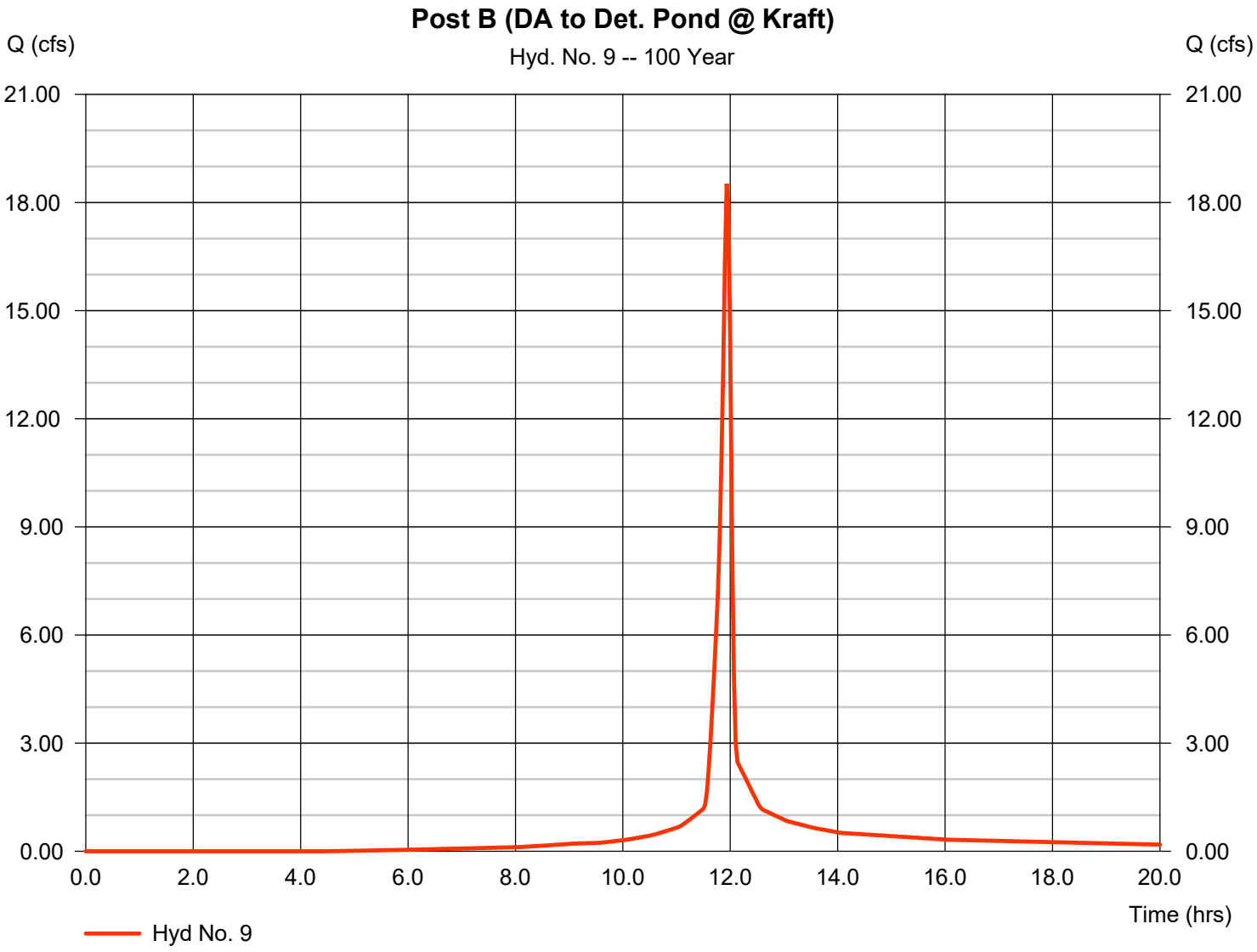
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 01 / 31 / 2018

Hyd. No. 9

Post B (DA to Det. Pond @ Kraft)

Hydrograph type	= SCS Runoff	Peak discharge	= 18.53 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 39,154 cuft
Drainage area	= 2.390 ac	Curve number	= 85*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 6.54 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.620 x 98) + (1.770 x 80)] / 2.390



Hydrograph Report

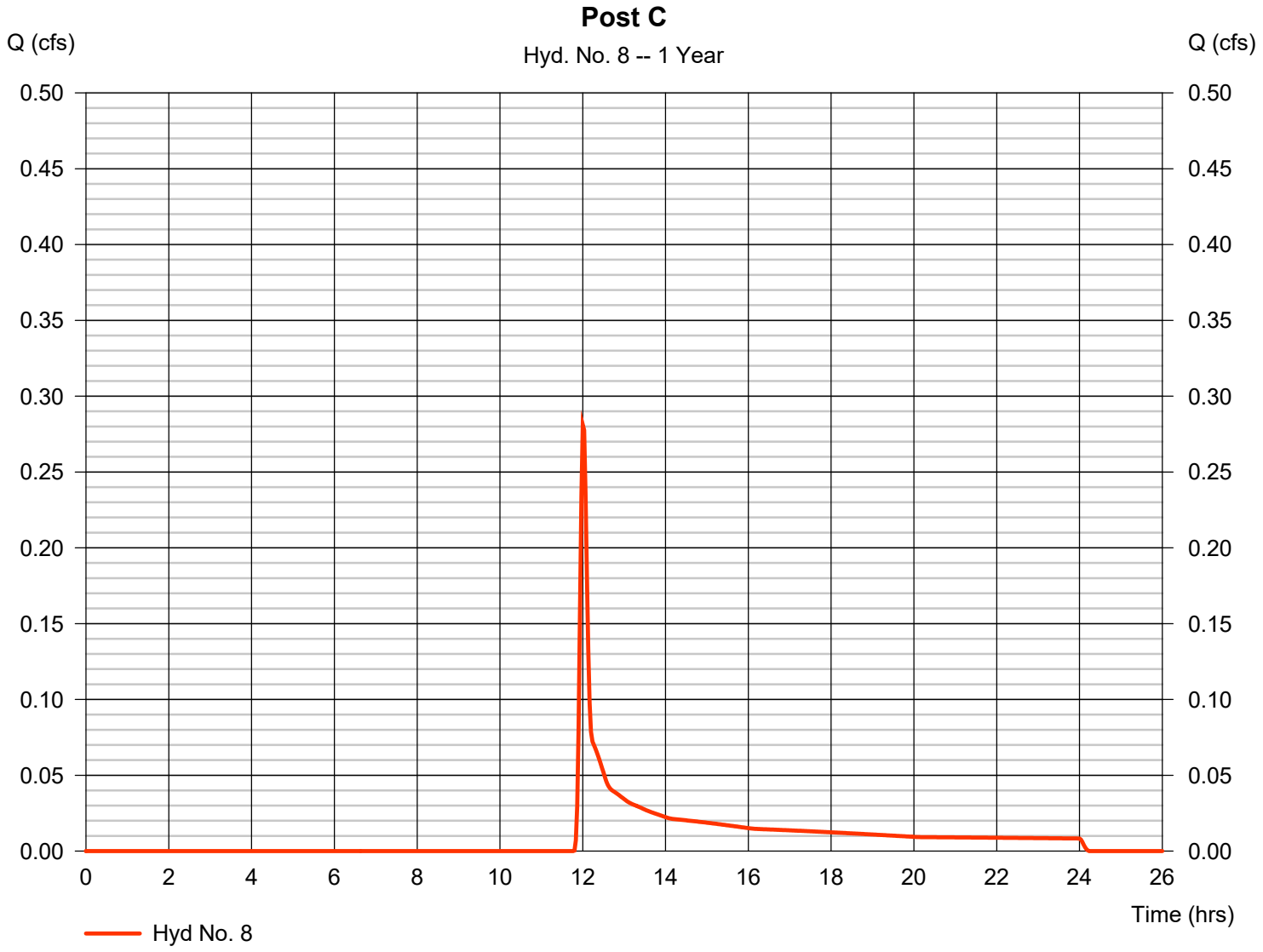
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 01 / 31 / 2018

Hyd. No. 8

Post C

Hydrograph type	= SCS Runoff	Peak discharge	= 0.281 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 893 cuft
Drainage area	= 0.830 ac	Curve number	= 68*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 8.20 min
Total precip.	= 2.28 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.390 x 61) + (0.420 x 74) + (0.020 x 98)] / 0.830



Hydrograph Report

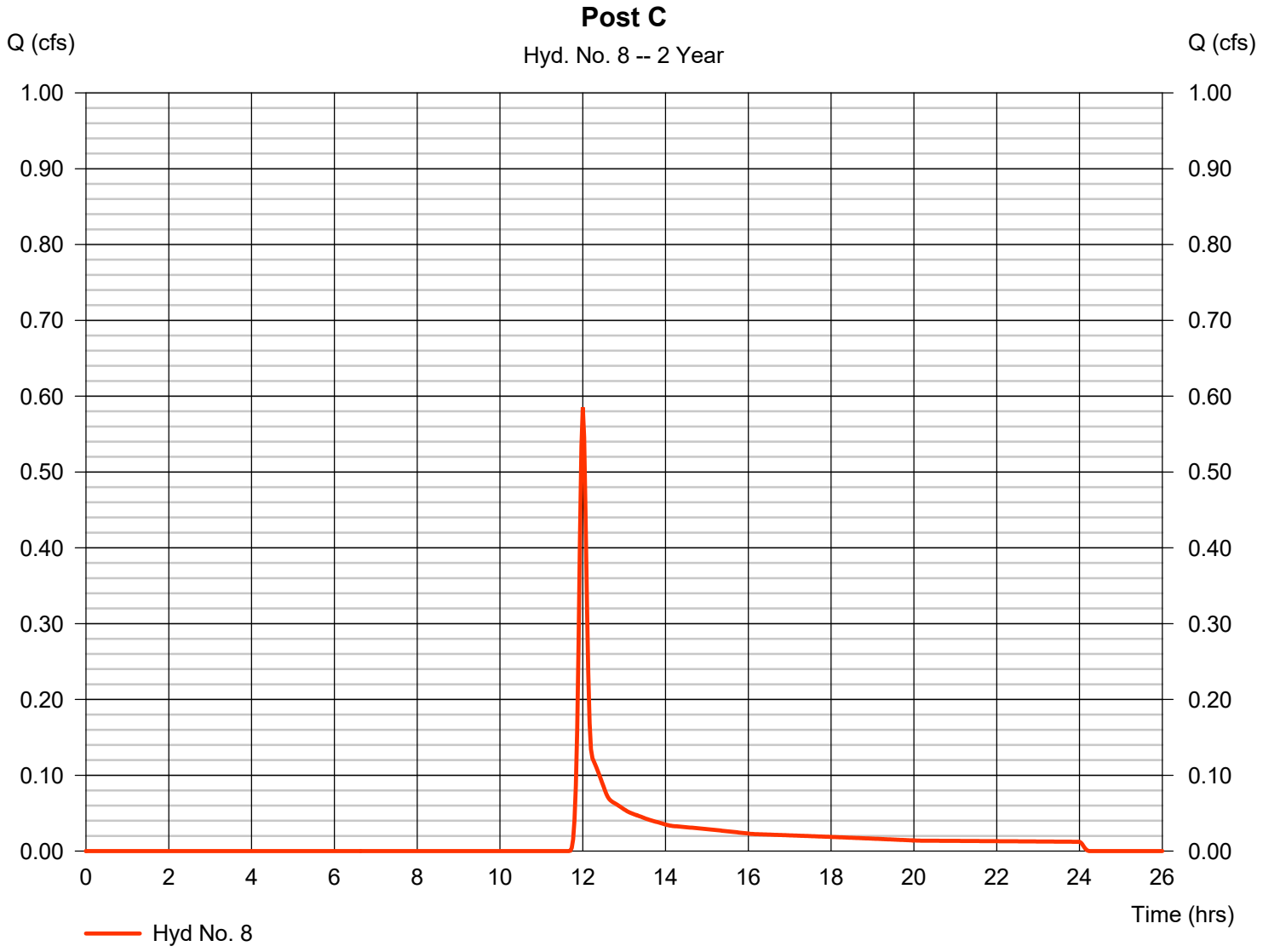
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 01 / 31 / 2018

Hyd. No. 8

Post C

Hydrograph type	= SCS Runoff	Peak discharge	= 0.585 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 1,527 cuft
Drainage area	= 0.830 ac	Curve number	= 68*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 8.20 min
Total precip.	= 2.76 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.390 x 61) + (0.420 x 74) + (0.020 x 98)] / 0.830



Hydrograph Report

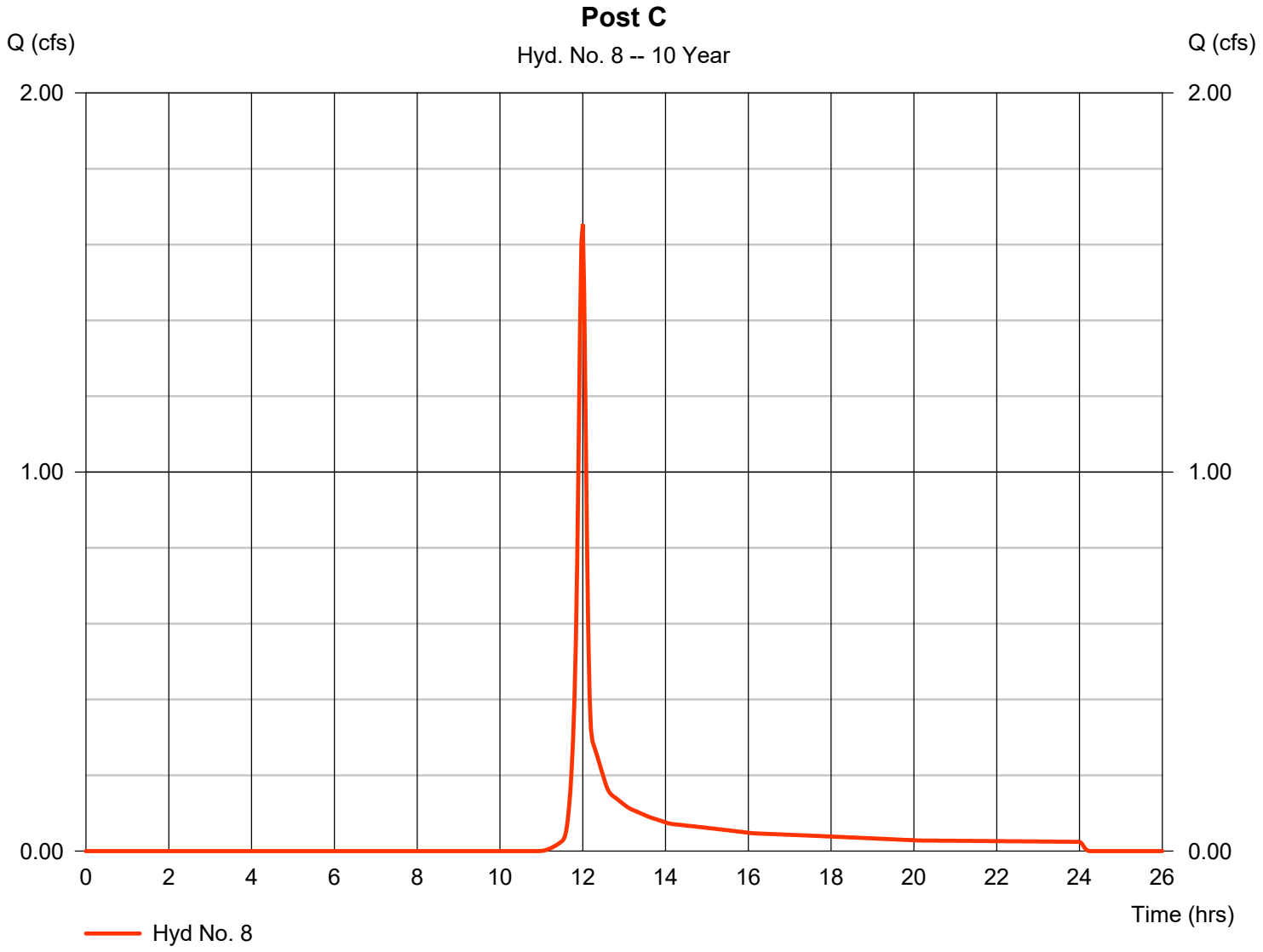
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 01 / 31 / 2018

Hyd. No. 8

Post C

Hydrograph type	= SCS Runoff	Peak discharge	= 1.653 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 3,842 cuft
Drainage area	= 0.830 ac	Curve number	= 68*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 8.20 min
Total precip.	= 4.11 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.390 x 61) + (0.420 x 74) + (0.020 x 98)] / 0.830



Hydrograph Report

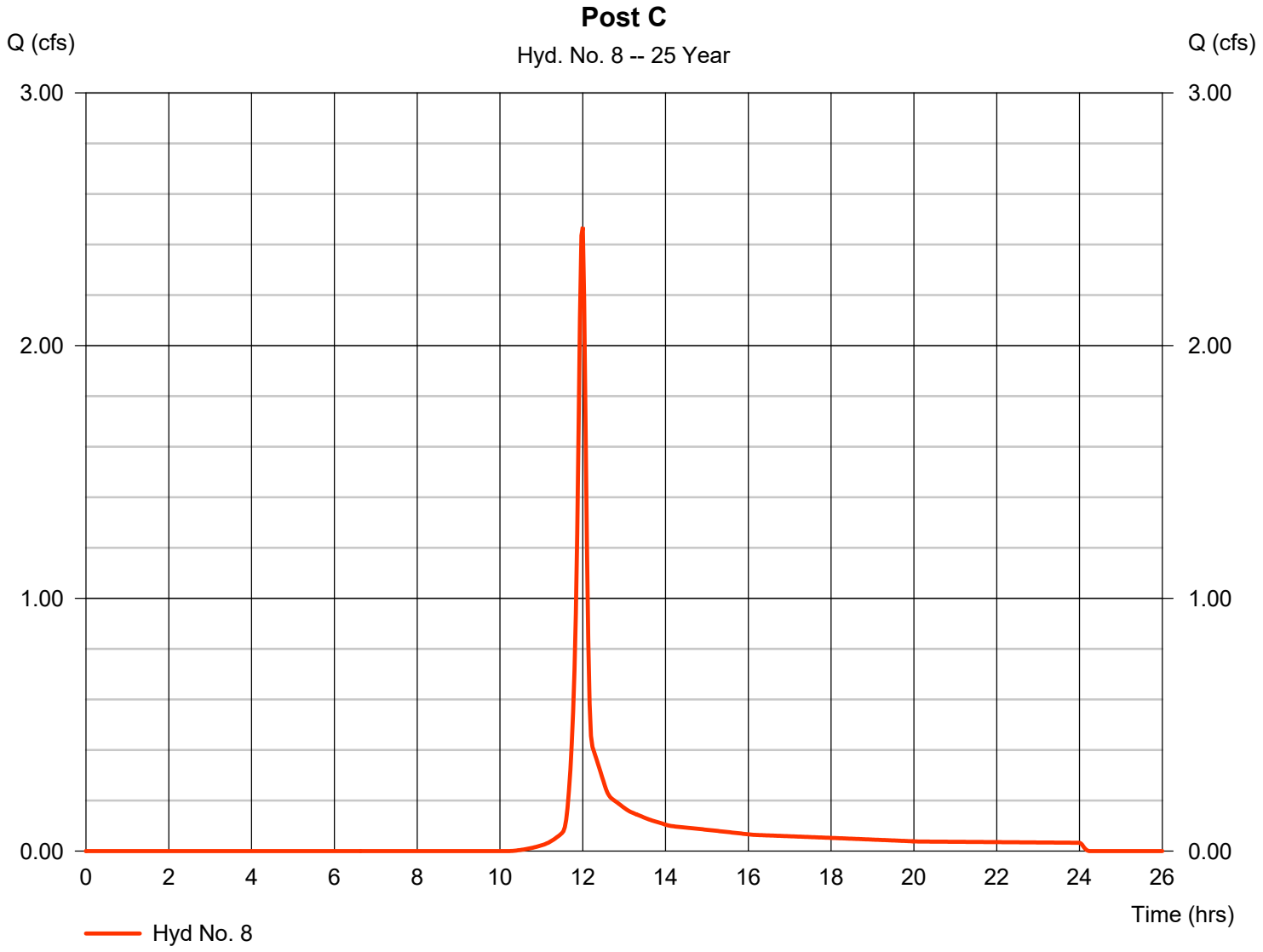
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 01 / 31 / 2018

Hyd. No. 8

Post C

Hydrograph type	= SCS Runoff	Peak discharge	= 2.469 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 5,663 cuft
Drainage area	= 0.830 ac	Curve number	= 68*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 8.20 min
Total precip.	= 5.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.390 x 61) + (0.420 x 74) + (0.020 x 98)] / 0.830



Hydrograph Report

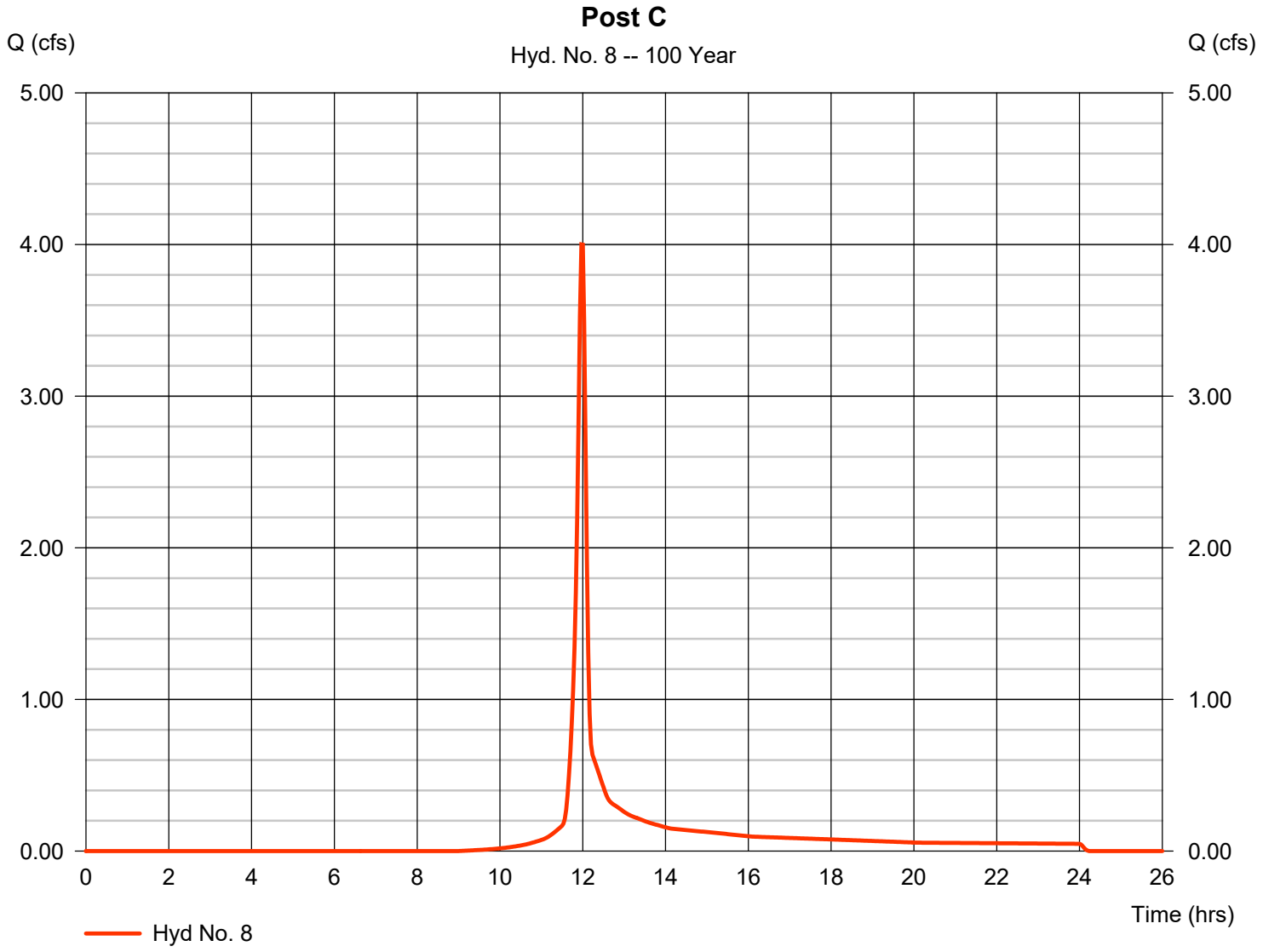
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 01 / 31 / 2018

Hyd. No. 8

Post C

Hydrograph type	= SCS Runoff	Peak discharge	= 4.001 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 9,165 cuft
Drainage area	= 0.830 ac	Curve number	= 68*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 8.20 min
Total precip.	= 6.54 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.390 x 61) + (0.420 x 74) + (0.020 x 98)] / 0.830



APPENDIX E – ROUTING CALCULATIONS

(See attached Drawings)

Pond Report

Pond No. 5 - UG Det. (Storm Tech Chambers)

Pond Data

Pond storage is based on user-defined values.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	2152.00	n/a	0	0
0.50	2152.50	n/a	2,785	2,785
1.00	2153.00	n/a	4,381	7,166
1.50	2153.50	n/a	5,921	13,087
2.00	2154.00	n/a	5,824	18,911
2.50	2154.50	n/a	5,695	24,605
3.00	2155.00	n/a	5,530	30,135
3.50	2155.50	n/a	5,324	35,459
4.00	2156.00	n/a	5,065	40,525
4.50	2156.50	n/a	4,735	45,259
5.00	2157.00	n/a	4,194	49,453
5.50	2157.50	n/a	3,566	53,019
6.00	2158.00	n/a	2,852	55,871
6.50	2158.50	n/a	2,785	58,656
7.00	2159.00	n/a	1,392	60,048

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	3.00	12.00	0.00
Span (in)	= 24.00	3.00	12.00	0.00
No. Barrels	= 1	1	1	0
Invert El. (ft)	= 2152.00	2152.00	2154.30	0.00
Length (ft)	= 50.00	0.10	0.10	0.00
Slope (%)	= 2.00	0.10	0.10	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	Yes	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 4.00	0.00	0.00	0.00
Crest El. (ft)	= 2157.50	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= Yes	No	No	No

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

TW Elev. (ft) = 0.00

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

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	2152.00	0.00	0.00	0.00	---	0.00	---	---	---	---	---	0.000
0.05	278	2152.05	0.01 ic	0.01 ic	0.00	---	0.00	---	---	---	---	---	0.005
0.10	557	2152.10	0.02 ic	0.02 ic	0.00	---	0.00	---	---	---	---	---	0.019
0.15	835	2152.15	0.04 ic	0.04 ic	0.00	---	0.00	---	---	---	---	---	0.040
0.20	1,114	2152.20	0.06 ic	0.06 ic	0.00	---	0.00	---	---	---	---	---	0.065
0.25	1,392	2152.25	0.08 ic	0.08 ic	0.00	---	0.00	---	---	---	---	---	0.084
0.30	1,671	2152.30	0.11 ic	0.10 ic	0.00	---	0.00	---	---	---	---	---	0.099
0.35	1,949	2152.35	0.12 ic	0.11 ic	0.00	---	0.00	---	---	---	---	---	0.111
0.40	2,228	2152.40	0.12 ic	0.12 ic	0.00	---	0.00	---	---	---	---	---	0.121
0.45	2,506	2152.45	0.13 ic	0.13 ic	0.00	---	0.00	---	---	---	---	---	0.132
0.50	2,785	2152.50	0.15 ic	0.14 ic	0.00	---	0.00	---	---	---	---	---	0.140
0.55	3,223	2152.55	0.15 ic	0.15 ic	0.00	---	0.00	---	---	---	---	---	0.149
0.60	3,661	2152.60	0.16 ic	0.16 ic	0.00	---	0.00	---	---	---	---	---	0.158
0.65	4,099	2152.65	0.17 ic	0.17 ic	0.00	---	0.00	---	---	---	---	---	0.166
0.70	4,537	2152.70	0.18 ic	0.17 ic	0.00	---	0.00	---	---	---	---	---	0.173
0.75	4,975	2152.75	0.18 ic	0.18 ic	0.00	---	0.00	---	---	---	---	---	0.181
0.80	5,414	2152.80	0.20 ic	0.19 ic	0.00	---	0.00	---	---	---	---	---	0.187
0.85	5,852	2152.85	0.20 ic	0.19 ic	0.00	---	0.00	---	---	---	---	---	0.194
0.90	6,290	2152.90	0.20 ic	0.20 ic	0.00	---	0.00	---	---	---	---	---	0.202
0.95	6,728	2152.95	0.22 ic	0.21 ic	0.00	---	0.00	---	---	---	---	---	0.207
1.00	7,166	2153.00	0.22 ic	0.21 ic	0.00	---	0.00	---	---	---	---	---	0.214
1.05	7,758	2153.05	0.22 ic	0.22 ic	0.00	---	0.00	---	---	---	---	---	0.220
1.10	8,350	2153.10	0.23 ic	0.23 ic	0.00	---	0.00	---	---	---	---	---	0.226
1.15	8,942	2153.15	0.24 ic	0.23 ic	0.00	---	0.00	---	---	---	---	---	0.231
1.20	9,534	2153.20	0.24 ic	0.24 ic	0.00	---	0.00	---	---	---	---	---	0.237
1.25	10,127	2153.25	0.24 ic	0.24 ic	0.00	---	0.00	---	---	---	---	---	0.243
1.30	10,719	2153.30	0.25 ic	0.25 ic	0.00	---	0.00	---	---	---	---	---	0.248
1.35	11,311	2153.35	0.27 ic	0.25 ic	0.00	---	0.00	---	---	---	---	---	0.253
1.40	11,903	2153.40	0.27 ic	0.26 ic	0.00	---	0.00	---	---	---	---	---	0.259

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UG Det. (Storm Tech Chambers)

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
1.45	12,495	2153.45	0.27 ic	0.26 ic	0.00	---	0.00	---	---	---	---	---	0.264
1.50	13,087	2153.50	0.27 ic	0.27 ic	0.00	---	0.00	---	---	---	---	---	0.269
1.55	13,669	2153.55	0.27 ic	0.27 ic	0.00	---	0.00	---	---	---	---	---	0.274
1.60	14,252	2153.60	0.29 ic	0.28 ic	0.00	---	0.00	---	---	---	---	---	0.279
1.65	14,834	2153.65	0.29 ic	0.28 ic	0.00	---	0.00	---	---	---	---	---	0.284
1.70	15,416	2153.70	0.29 ic	0.29 ic	0.00	---	0.00	---	---	---	---	---	0.288
1.75	15,999	2153.75	0.29 ic	0.29 ic	0.00	---	0.00	---	---	---	---	---	0.293
1.80	16,581	2153.80	0.30 ic	0.30 ic	0.00	---	0.00	---	---	---	---	---	0.297
1.85	17,163	2153.85	0.32 ic	0.30 ic	0.00	---	0.00	---	---	---	---	---	0.302
1.90	17,746	2153.90	0.32 ic	0.31 ic	0.00	---	0.00	---	---	---	---	---	0.306
1.95	18,328	2153.95	0.32 ic	0.31 ic	0.00	---	0.00	---	---	---	---	---	0.311
2.00	18,911	2154.00	0.32 ic	0.32 ic	0.00	---	0.00	---	---	---	---	---	0.315
2.05	19,480	2154.05	0.32 ic	0.32 ic	0.00	---	0.00	---	---	---	---	---	0.320
2.10	20,050	2154.10	0.32 ic	0.32 ic	0.00	---	0.00	---	---	---	---	---	0.324
2.15	20,619	2154.15	0.35 ic	0.33 ic	0.00	---	0.00	---	---	---	---	---	0.328
2.20	21,189	2154.20	0.35 ic	0.33 ic	0.00	---	0.00	---	---	---	---	---	0.332
2.25	21,758	2154.25	0.35 ic	0.34 ic	0.00	---	0.00	---	---	---	---	---	0.336
2.30	22,327	2154.30	0.35 ic	0.34 ic	0.00 ic	---	0.00	---	---	---	---	---	0.340
2.35	22,897	2154.35	0.35 ic	0.34 ic	0.01 ic	---	0.00	---	---	---	---	---	0.355
2.40	23,466	2154.40	0.41 ic	0.35 ic	0.05 ic	---	0.00	---	---	---	---	---	0.394
2.45	24,036	2154.45	0.45 ic	0.35 ic	0.10 ic	---	0.00	---	---	---	---	---	0.449
2.50	24,605	2154.50	0.56 ic	0.35 ic	0.18 ic	---	0.00	---	---	---	---	---	0.529
2.55	25,158	2154.55	0.64 ic	0.35 ic	0.26 ic	---	0.00	---	---	---	---	---	0.618
2.60	25,711	2154.60	0.73 ic	0.36 ic	0.37 ic	---	0.00	---	---	---	---	---	0.727
2.65	26,264	2154.65	0.89 ic	0.36 ic	0.50 ic	---	0.00	---	---	---	---	---	0.856
2.70	26,817	2154.70	1.01 ic	0.36 ic	0.65 ic	---	0.00	---	---	---	---	---	1.004
2.75	27,370	2154.75	1.20 ic	0.36 ic	0.79 ic	---	0.00	---	---	---	---	---	1.149
2.80	27,923	2154.80	1.34 ic	0.36 ic	0.96 ic	---	0.00	---	---	---	---	---	1.326
2.85	28,476	2154.85	1.49 ic	0.36 ic	1.13 ic	---	0.00	---	---	---	---	---	1.493
2.90	29,029	2154.90	1.73 ic	0.36 ic	1.30 ic	---	0.00	---	---	---	---	---	1.665
2.95	29,582	2154.95	1.90 ic	0.37 ic	1.50 ic	---	0.00	---	---	---	---	---	1.861
3.00	30,135	2155.00	2.08 ic	0.37 ic	1.69 ic	---	0.00	---	---	---	---	---	2.055
3.05	30,668	2155.05	2.28 ic	0.37 ic	1.87 ic	---	0.00	---	---	---	---	---	2.243
3.10	31,200	2155.10	2.48 ic	0.37 ic	2.05 ic	---	0.00	---	---	---	---	---	2.422
3.15	31,733	2155.15	2.61 ic	0.37 ic	2.24 ic	---	0.00	---	---	---	---	---	2.613
3.20	32,265	2155.20	2.81 ic	0.37 ic	2.41 ic	---	0.00	---	---	---	---	---	2.788
3.25	32,797	2155.25	2.94 ic	0.38 ic	2.56 ic	---	0.00	---	---	---	---	---	2.938
3.30	33,330	2155.30	3.05 ic	0.38 ic	2.67 ic	---	0.00	---	---	---	---	---	3.053
3.35	33,862	2155.35	3.27 ic	0.38 ic	2.80 ic	---	0.00	---	---	---	---	---	3.186
3.40	34,395	2155.40	3.39 ic	0.38 ic	2.93 ic	---	0.00	---	---	---	---	---	3.313
3.45	34,927	2155.45	3.52 ic	0.39 ic	3.05 ic	---	0.00	---	---	---	---	---	3.435
3.50	35,459	2155.50	3.64 ic	0.39 ic	3.16 ic	---	0.00	---	---	---	---	---	3.552
3.55	35,966	2155.55	3.67 ic	0.39 ic	3.27 ic	---	0.00	---	---	---	---	---	3.666
3.60	36,472	2155.60	3.78 ic	0.39 ic	3.38 ic	---	0.00	---	---	---	---	---	3.777
3.65	36,979	2155.65	3.90 ic	0.40 ic	3.49 ic	---	0.00	---	---	---	---	---	3.883
3.70	37,485	2155.70	4.03 ic	0.40 ic	3.59 ic	---	0.00	---	---	---	---	---	3.987
3.75	37,992	2155.75	4.17 ic	0.40 ic	3.69 ic	---	0.00	---	---	---	---	---	4.088
3.80	38,499	2155.80	4.19 ic	0.40 ic	3.78 ic	---	0.00	---	---	---	---	---	4.186
3.85	39,005	2155.85	4.30 ic	0.41 ic	3.88 ic	---	0.00	---	---	---	---	---	4.283
3.90	39,512	2155.90	4.44 ic	0.41 ic	3.97 ic	---	0.00	---	---	---	---	---	4.376
3.95	40,018	2155.95	4.47 ic	0.41 ic	4.06 ic	---	0.00	---	---	---	---	---	4.468
4.00	40,525	2156.00	4.58 ic	0.42 ic	4.14 ic	---	0.00	---	---	---	---	---	4.558
4.05	40,998	2156.05	4.72 ic	0.42 ic	4.23 ic	---	0.00	---	---	---	---	---	4.646
4.10	41,472	2156.10	4.73 ic	0.42 ic	4.31 ic	---	0.00	---	---	---	---	---	4.732
4.15	41,945	2156.15	4.87 ic	0.42 ic	4.39 ic	---	0.00	---	---	---	---	---	4.817
4.20	42,418	2156.20	4.90 ic	0.43 ic	4.47 ic	---	0.00	---	---	---	---	---	4.900
4.25	42,892	2156.25	5.01 ic	0.43 ic	4.55 ic	---	0.00	---	---	---	---	---	4.983
4.30	43,365	2156.30	5.16 ic	0.43 ic	4.63 ic	---	0.00	---	---	---	---	---	5.063
4.35	43,839	2156.35	5.16 ic	0.43 ic	4.71 ic	---	0.00	---	---	---	---	---	5.143
4.40	44,312	2156.40	5.31 ic	0.44 ic	4.78 ic	---	0.00	---	---	---	---	---	5.220
4.45	44,786	2156.45	5.31 ic	0.44 ic	4.86 ic	---	0.00	---	---	---	---	---	5.298
4.50	45,259	2156.50	5.46 ic	0.44 ic	4.93 ic	---	0.00	---	---	---	---	---	5.372
4.55	45,679	2156.55	5.46 ic	0.45 ic	5.00 ic	---	0.00	---	---	---	---	---	5.447
4.60	46,098	2156.60	5.61 ic	0.45 ic	5.07 ic	---	0.00	---	---	---	---	---	5.521
4.65	46,517	2156.65	5.61 ic	0.45 ic	5.14 ic	---	0.00	---	---	---	---	---	5.594
4.70	46,937	2156.70	5.76 ic	0.45 ic	5.21 ic	---	0.00	---	---	---	---	---	5.665
4.75	47,356	2156.75	5.76 ic	0.46 ic	5.28 ic	---	0.00	---	---	---	---	---	5.736
4.80	47,775	2156.80	5.91 ic	0.46 ic	5.35 ic	---	0.00	---	---	---	---	---	5.806
4.85	48,195	2156.85	5.91 ic	0.46 ic	5.41 ic	---	0.00	---	---	---	---	---	5.875
4.90	48,614	2156.90	5.94 ic	0.46 ic	5.48 ic	---	0.00	---	---	---	---	---	5.943
4.95	49,033	2156.95	6.06 ic	0.47 ic	5.54 ic	---	0.00	---	---	---	---	---	6.011
5.00	49,453	2157.00	6.08 ic	0.47 ic	5.61 ic	---	0.00	---	---	---	---	---	6.077

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UG Det. (Storm Tech Chambers)

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
5.05	49,809	2157.05	6.22 ic	0.47 ic	5.67 ic	---	0.00	---	---	---	---	---	6.143
5.10	50,166	2157.10	6.22 ic	0.47 ic	5.73 ic	---	0.00	---	---	---	---	---	6.208
5.15	50,523	2157.15	6.37 ic	0.48 ic	5.80 ic	---	0.00	---	---	---	---	---	6.273
5.20	50,879	2157.20	6.37 ic	0.48 ic	5.86 ic	---	0.00	---	---	---	---	---	6.337
5.25	51,236	2157.25	6.40 ic	0.48 ic	5.92 ic	---	0.00	---	---	---	---	---	6.400
5.30	51,593	2157.30	6.53 ic	0.48 ic	5.98 ic	---	0.00	---	---	---	---	---	6.463
5.35	51,949	2157.35	6.53 ic	0.49 ic	6.04 ic	---	0.00	---	---	---	---	---	6.525
5.40	52,306	2157.40	6.69 ic	0.49 ic	6.10 ic	---	0.00	---	---	---	---	---	6.586
5.45	52,663	2157.45	6.69 ic	0.49 ic	6.16 ic	---	0.00	---	---	---	---	---	6.647
5.50	53,019	2157.50	6.71 ic	0.49 ic	6.21 ic	---	0.00	---	---	---	---	---	6.707
5.55	53,304	2157.55	7.00 ic	0.50 ic	6.27 ic	---	0.15	---	---	---	---	---	6.915
5.60	53,590	2157.60	7.32 ic	0.50 ic	6.33 ic	---	0.42	---	---	---	---	---	7.245
5.65	53,875	2157.65	7.66 ic	0.50 ic	6.38 ic	---	0.77	---	---	---	---	---	7.656
5.70	54,160	2157.70	8.13 ic	0.50 ic	6.44 ic	---	1.19	---	---	---	---	---	8.130
5.75	54,445	2157.75	8.76 ic	0.50 ic	6.49 ic	---	1.67	---	---	---	---	---	8.659
5.80	54,730	2157.80	9.24 ic	0.50 ic	6.55 ic	---	2.19	---	---	---	---	---	9.239
5.85	55,016	2157.85	9.86 ic	0.50 ic	6.60 ic	---	2.76	---	---	---	---	---	9.863
5.90	55,301	2157.90	10.59 ic	0.50 ic	6.66 ic	---	3.37	---	---	---	---	---	10.53
5.95	55,586	2157.95	11.29 ic	0.50 ic	6.71 ic	---	4.03	---	---	---	---	---	11.23
6.00	55,871	2158.00	11.97 ic	0.49 ic	6.76 ic	---	4.71	---	---	---	---	---	11.97
6.05	56,150	2158.05	12.77 ic	0.49 ic	6.82 ic	---	5.43	---	---	---	---	---	12.74
6.10	56,428	2158.10	13.56 ic	0.49 ic	6.87 ic	---	6.19	---	---	---	---	---	13.55
6.15	56,707	2158.15	14.39 ic	0.49 ic	6.92 ic	---	6.98	---	---	---	---	---	14.39
6.20	56,985	2158.20	15.26 ic	0.48 ic	6.97 ic	---	7.80	---	---	---	---	---	15.26
6.25	57,264	2158.25	16.16 ic	0.48 ic	7.02 ic	---	8.66	---	---	---	---	---	16.16
6.30	57,542	2158.30	17.09 ic	0.47 ic	7.07 ic	---	9.54	---	---	---	---	---	17.08
6.35	57,820	2158.35	18.04 ic	0.47 ic	7.12 ic	---	10.44	---	---	---	---	---	18.04
6.40	58,099	2158.40	19.02 ic	0.46 ic	7.17 ic	---	11.38	---	---	---	---	---	19.02
6.45	58,377	2158.45	20.02 ic	0.45 ic	7.22 ic	---	12.34	---	---	---	---	---	20.02
6.50	58,656	2158.50	20.93 ic	0.45 ic	7.16 ic	---	13.32	---	---	---	---	---	20.93
6.55	58,795	2158.55	21.82 ic	0.44 ic	7.04 ic	---	14.33	---	---	---	---	---	21.82
6.60	58,934	2158.60	22.72 ic	0.43 ic	6.91 ic	---	15.37	---	---	---	---	---	22.72
6.65	59,074	2158.65	23.63 ic	0.42 ic	6.77 ic	---	16.43	---	---	---	---	---	23.63
6.70	59,213	2158.70	24.55 ic	0.41 ic	6.62 ic	---	17.51	---	---	---	---	---	24.55
6.75	59,352	2158.75	25.48 ic	0.40 ic	6.45 ic	---	18.62	---	---	---	---	---	25.48
6.80	59,491	2158.80	26.41 ic	0.39 ic	6.27 ic	---	19.75	---	---	---	---	---	26.41
6.85	59,631	2158.85	27.35 ic	0.38 ic	6.07 ic	---	20.90	---	---	---	---	---	27.35
6.90	59,770	2158.90	28.30 ic	0.37 ic	5.86 ic	---	22.07	---	---	---	---	---	28.30
6.95	59,909	2158.95	29.24 ic	0.35 ic	5.62 ic	---	23.27	---	---	---	---	---	29.24
7.00	60,048	2159.00	30.18 ic	0.34 ic	5.37 ic	---	24.47	---	---	---	---	---	30.18

...End

Hydrograph Report

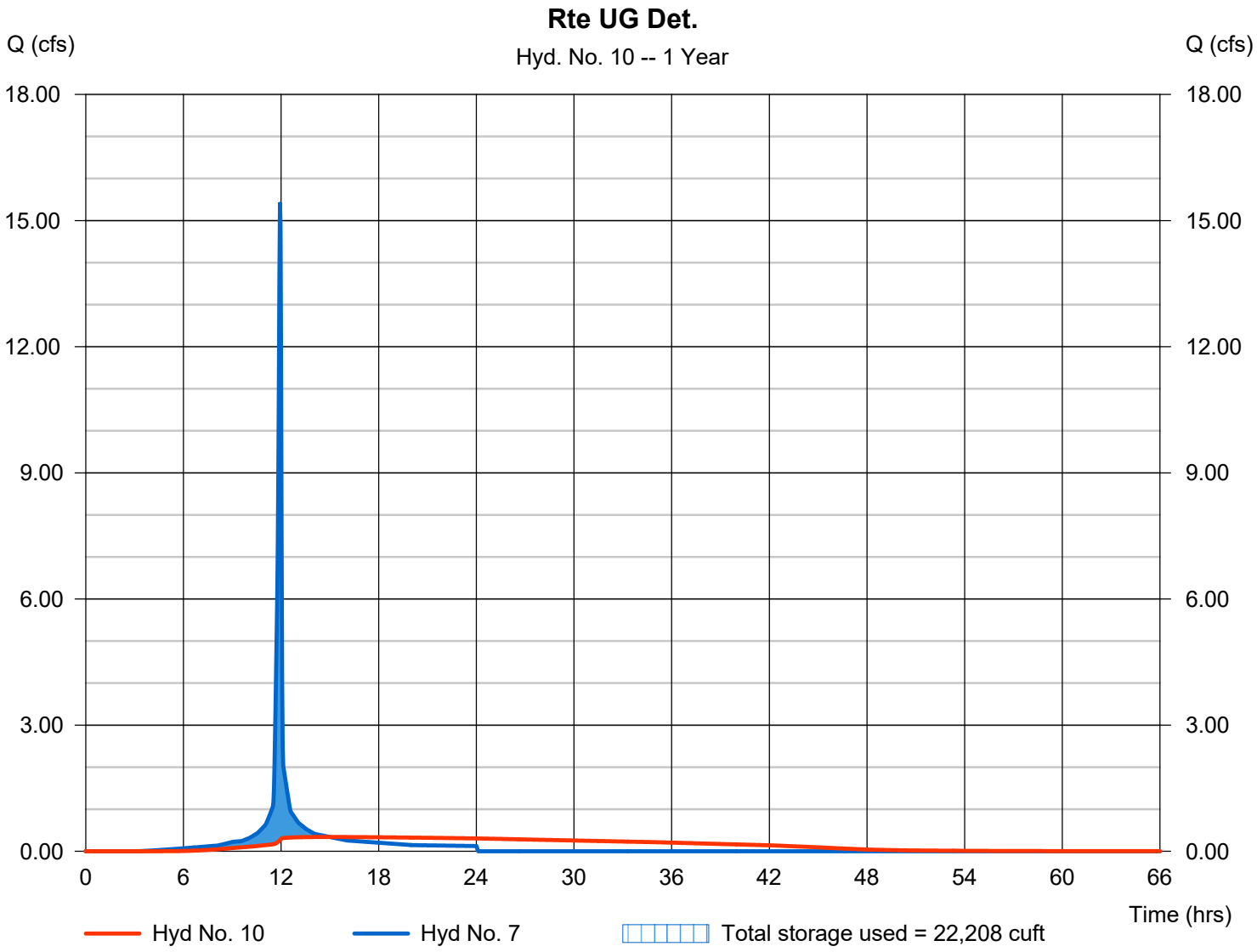
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 01 / 31 / 2018

Hyd. No. 10

Rte UG Det.

Hydrograph type	=	Reservoir	Peak discharge	=	0.339 cfs
Storm frequency	=	1 yrs	Time to peak	=	15.00 hrs
Time interval	=	2 min	Hyd. volume	=	33,564 cuft
Inflow hyd. No.	=	7 - Post B (DA to UG Det)	Max. Elevation	=	2154.29 ft
Reservoir name	=	UG Det. (Storm Tech Chambers)	Max. Storage	=	22,208 cuft

Storage Indication method used.



Hydrograph Report

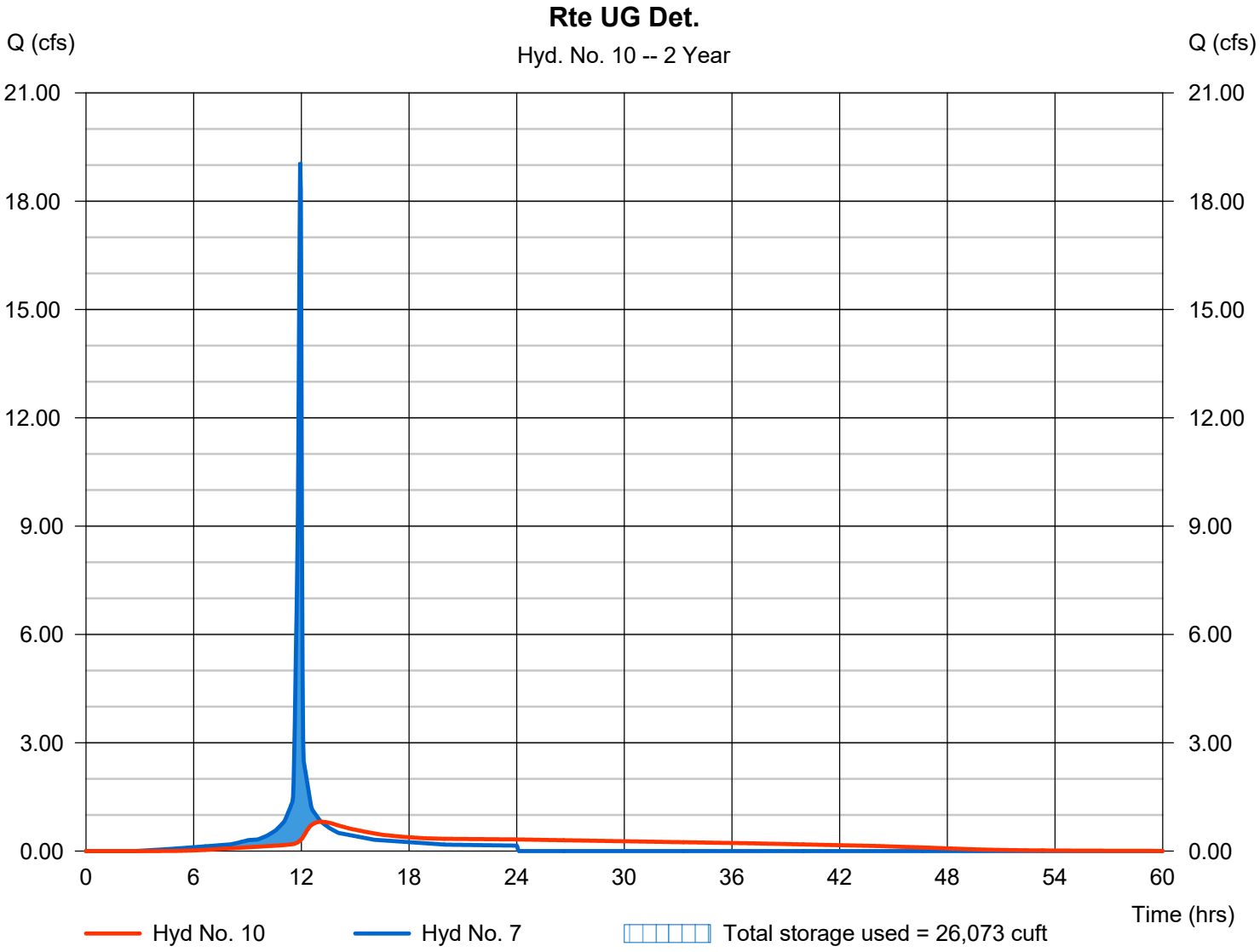
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 01 / 31 / 2018

Hyd. No. 10

Rte UG Det.

Hydrograph type	= Reservoir	Peak discharge	= 0.811 cfs
Storm frequency	= 2 yrs	Time to peak	= 13.10 hrs
Time interval	= 2 min	Hyd. volume	= 42,116 cuft
Inflow hyd. No.	= 7 - Post B (DA to UG Det)	Max. Elevation	= 2154.63 ft
Reservoir name	= UG Det. (Storm Tech Chambers)	Max. Storage	= 26,073 cuft

Storage Indication method used.



Hydrograph Report

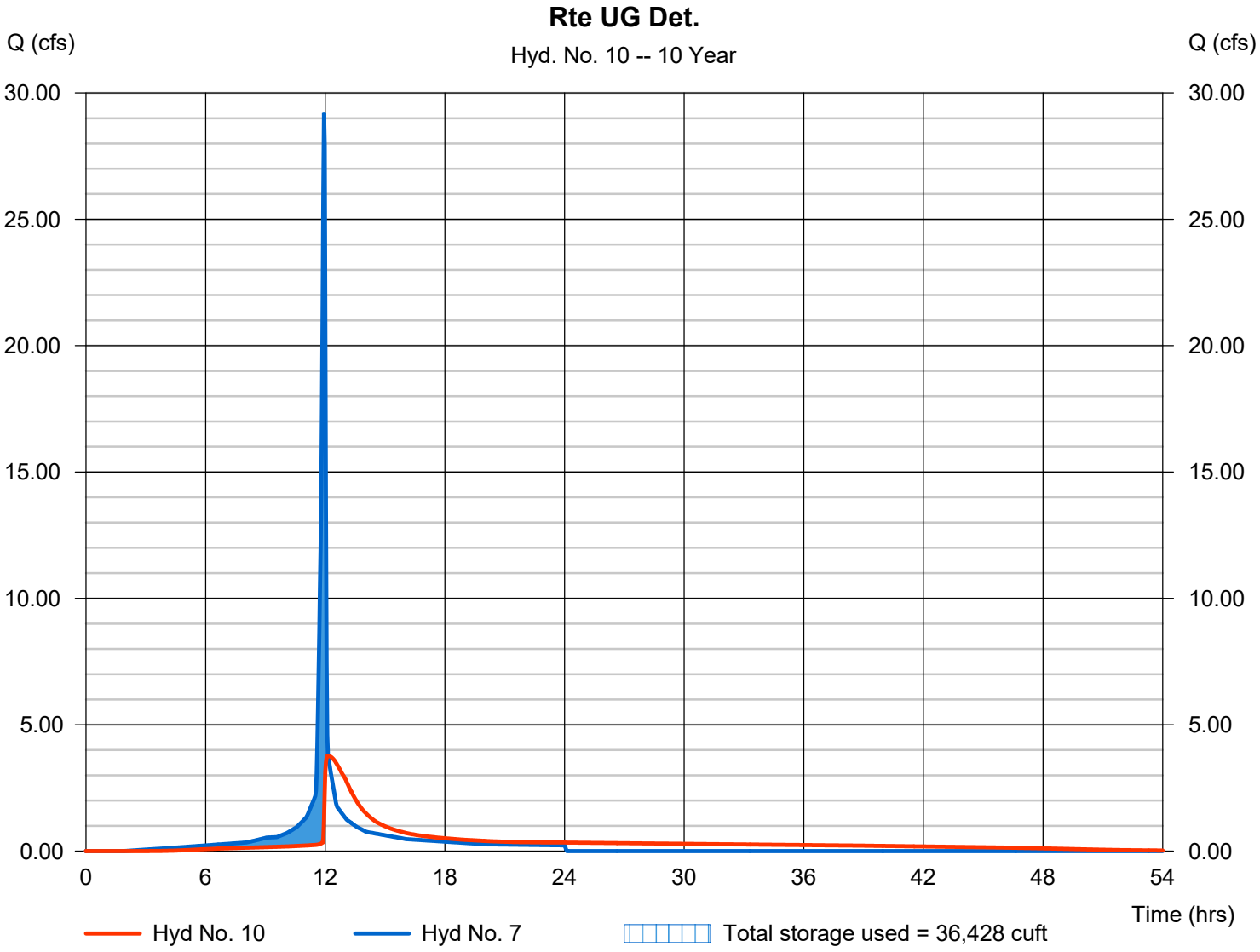
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 01 / 31 / 2018

Hyd. No. 10

Rte UG Det.

Hydrograph type	= Reservoir	Peak discharge	= 3.767 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.13 hrs
Time interval	= 2 min	Hyd. volume	= 66,385 cuft
Inflow hyd. No.	= 7 - Post B (DA to UG Det)	Max. Elevation	= 2155.60 ft
Reservoir name	= UG Det. (Storm Tech Chambers)	Max. Storage	= 36,428 cuft

Storage Indication method used.



Hydrograph Report

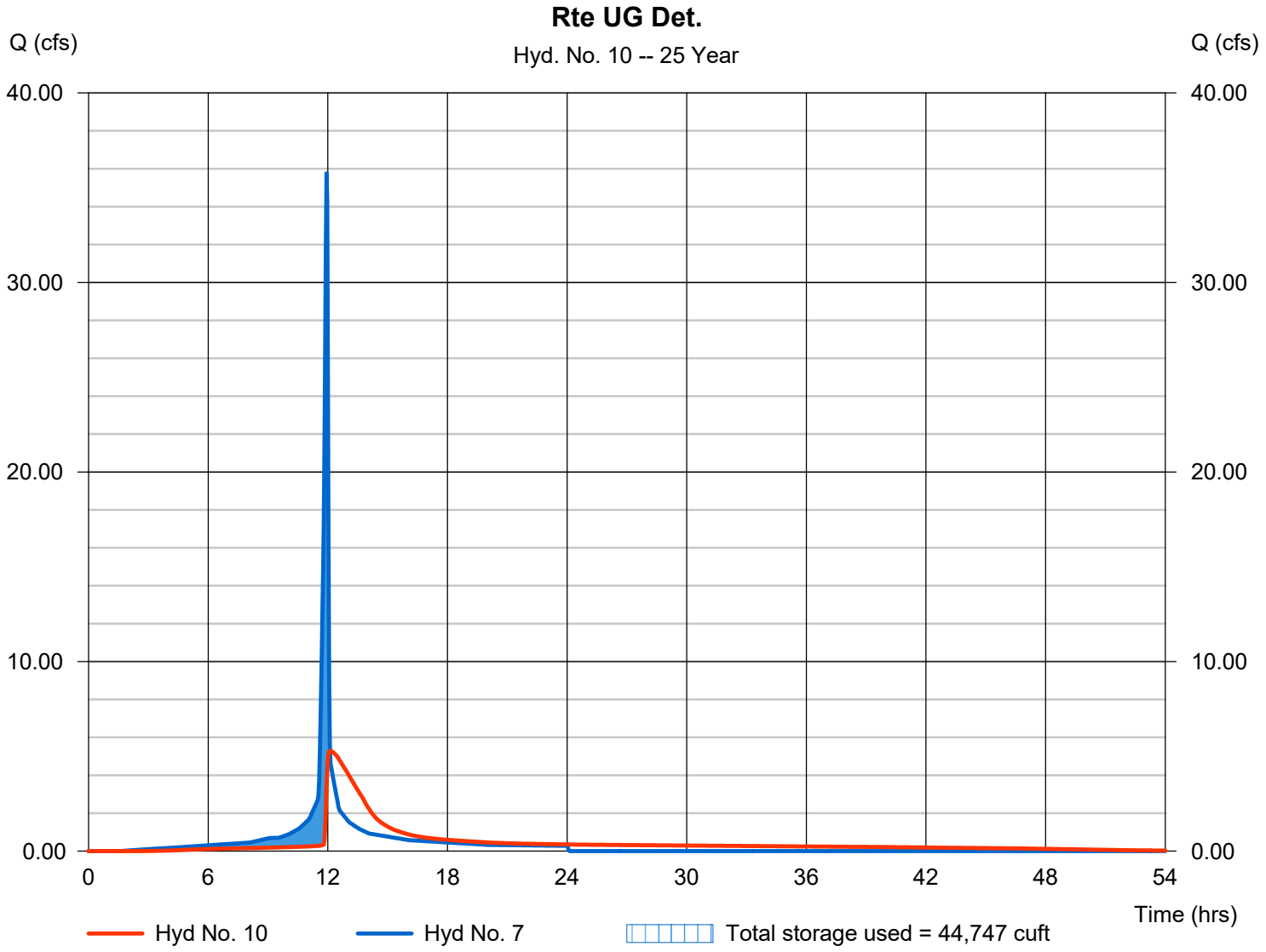
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 01 / 31 / 2018

Hyd. No. 10

Rte UG Det.

Hydrograph type	= Reservoir	Peak discharge	= 5.291 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.10 hrs
Time interval	= 2 min	Hyd. volume	= 82,470 cuft
Inflow hyd. No.	= 7 - Post B (DA to UG Det)	Max. Elevation	= 2156.45 ft
Reservoir name	= UG Det. (Storm Tech Chambers)	Max. Storage	= 44,747 cuft

Storage Indication method used.



Hydrograph Report

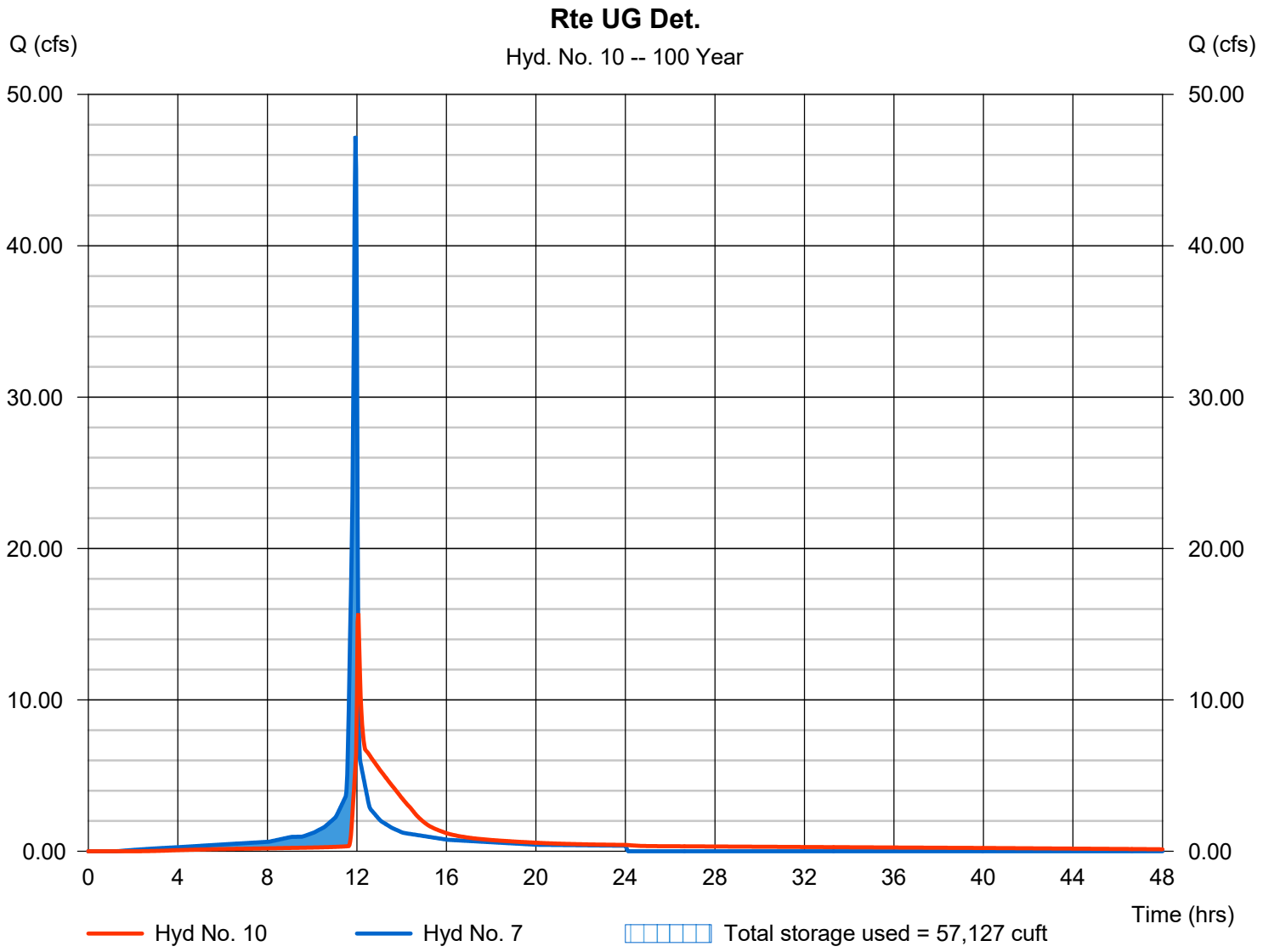
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 01 / 31 / 2018

Hyd. No. 10

Rte UG Det.

Hydrograph type	= Reservoir	Peak discharge	= 15.72 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 110,375 cuft
Inflow hyd. No.	= 7 - Post B (DA to UG Det)	Max. Elevation	= 2158.27 ft
Reservoir name	= UG Det. (Storm Tech Chambers)	Max. Storage	= 57,127 cuft

Storage Indication method used.



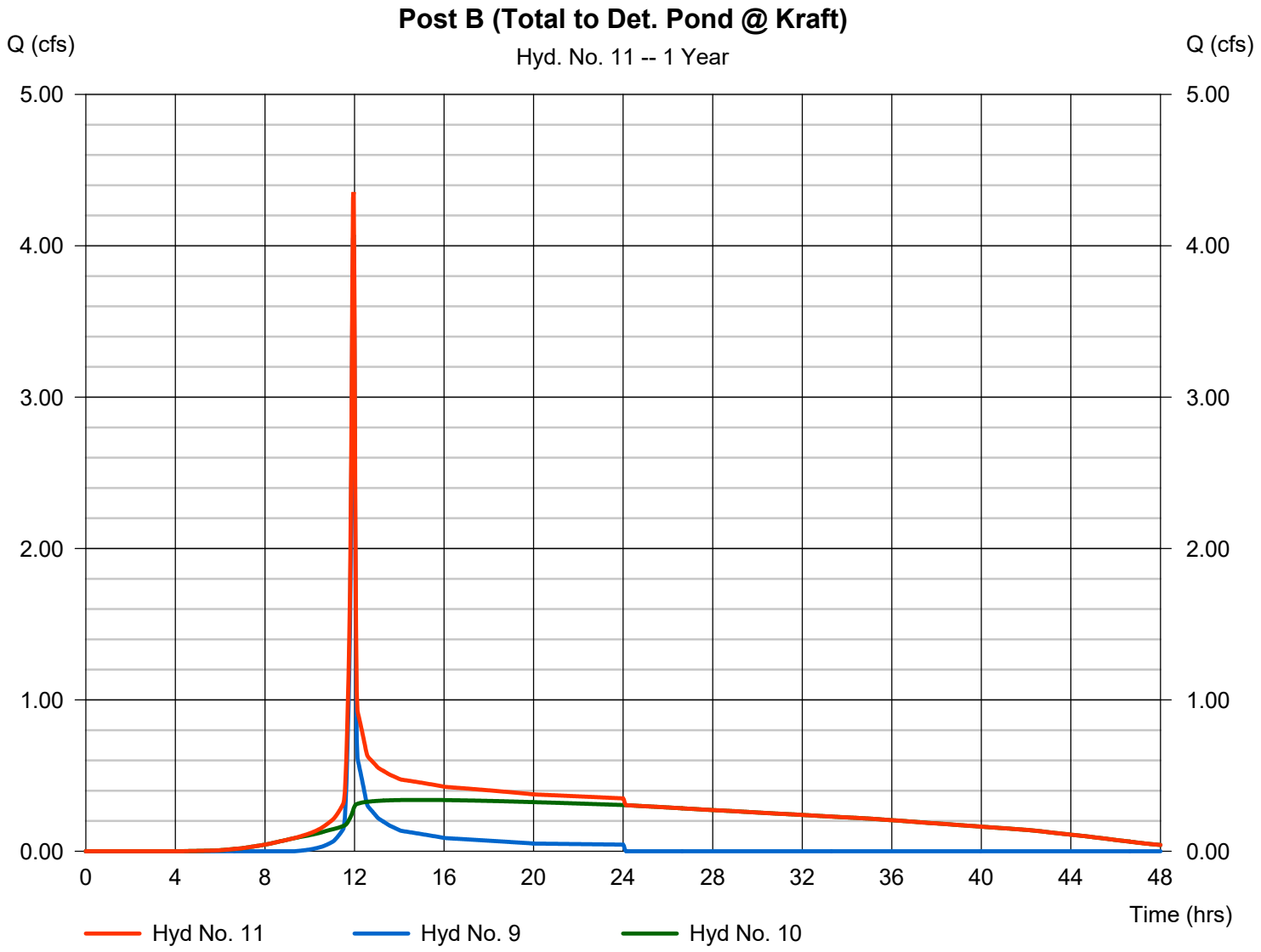
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 01 / 31 / 2018

Hyd. No. 11

Post B (Total to Det. Pond @ Kraft)

Hydrograph type	= Combine	Peak discharge	= 4.355 cfs
Storm frequency	= 1 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 41,746 cuft
Inflow hyds.	= 9, 10	Contrib. drain. area	= 2.390 ac



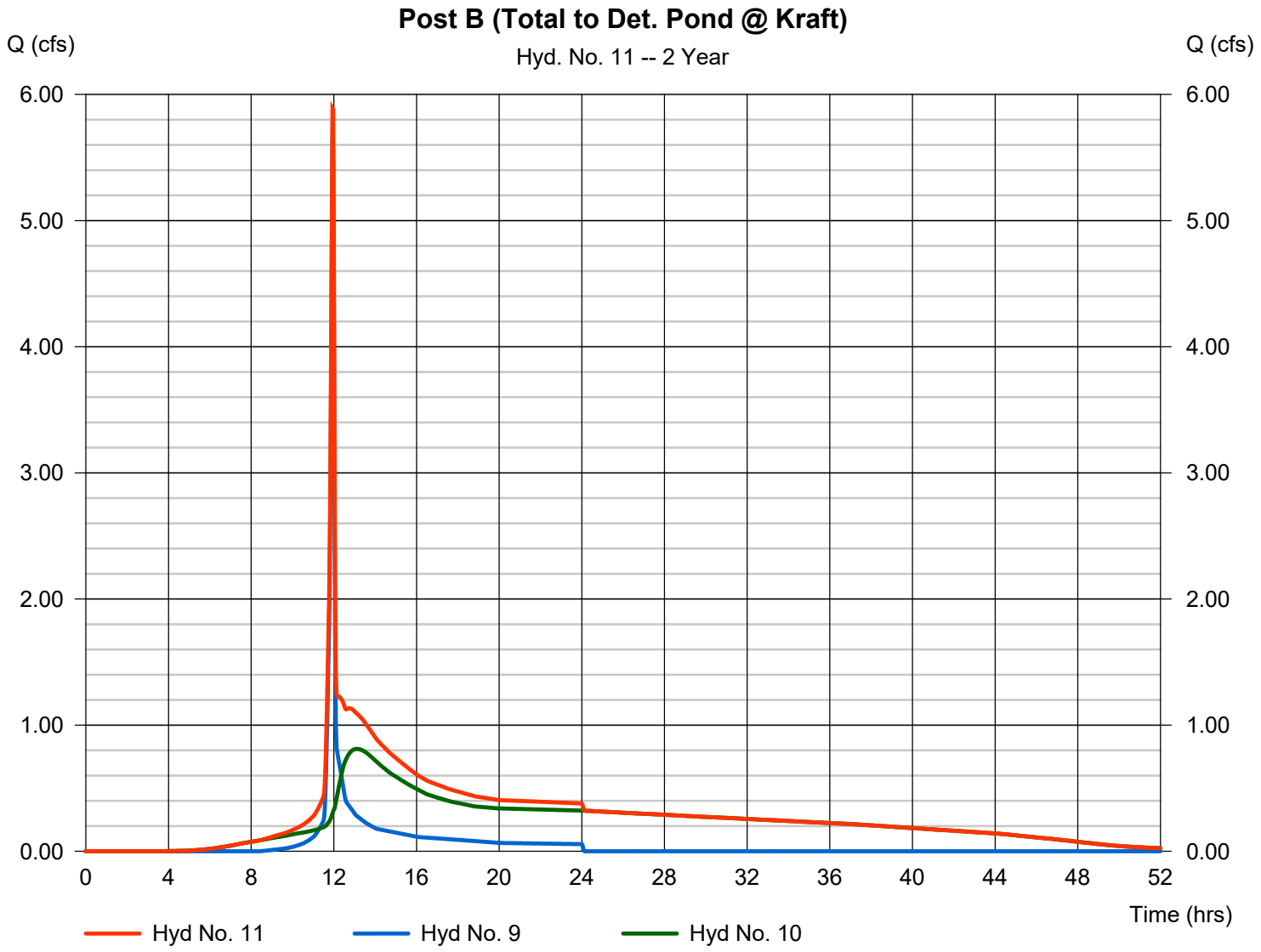
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 01 / 31 / 2018

Hyd. No. 11

Post B (Total to Det. Pond @ Kraft)

Hydrograph type	= Combine	Peak discharge	= 5.891 cfs
Storm frequency	= 2 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 53,412 cuft
Inflow hyds.	= 9, 10	Contrib. drain. area	= 2.390 ac



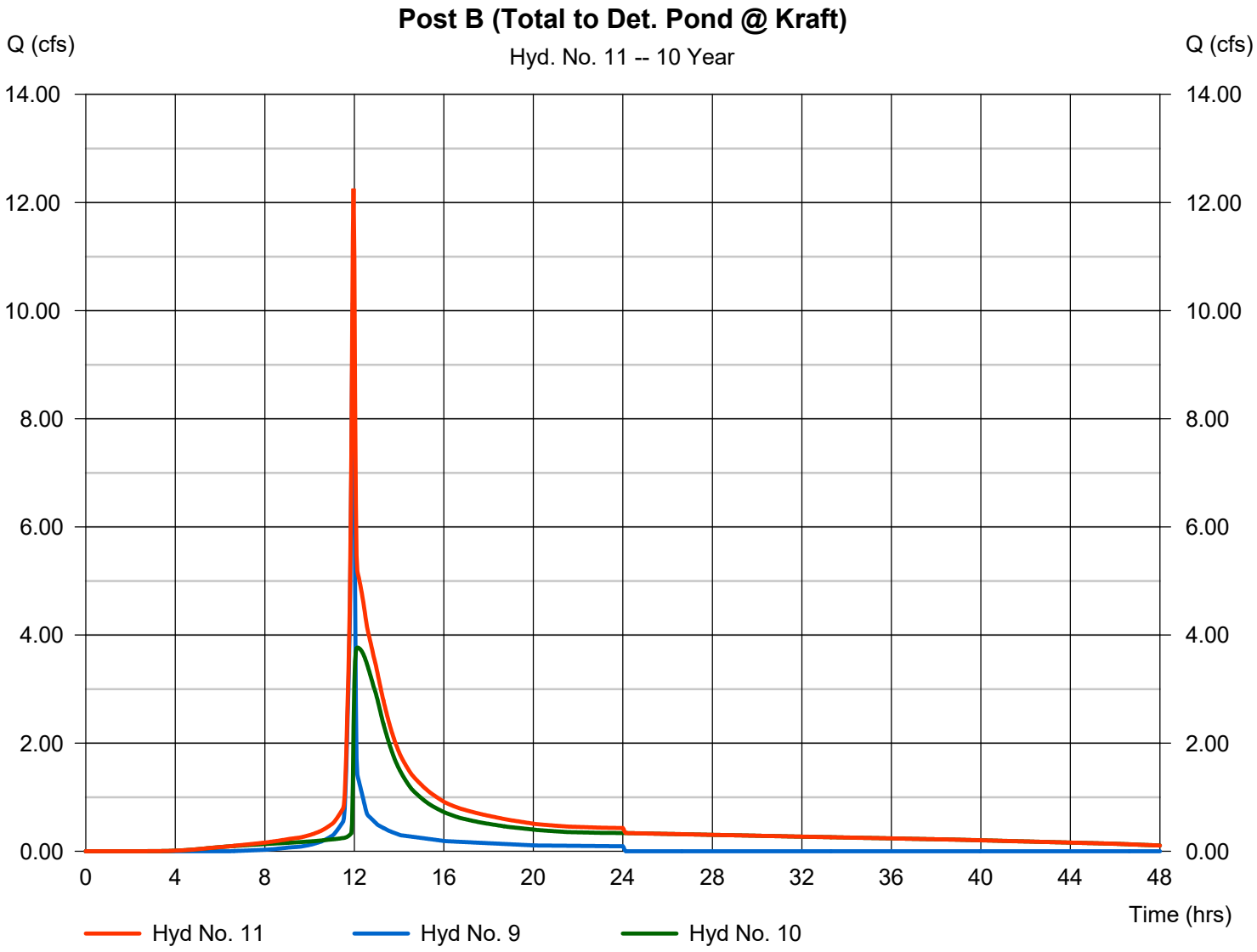
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 01 / 31 / 2018

Hyd. No. 11

Post B (Total to Det. Pond @ Kraft)

Hydrograph type	= Combine	Peak discharge	= 12.26 cfs
Storm frequency	= 10 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 87,176 cuft
Inflow hyds.	= 9, 10	Contrib. drain. area	= 2.390 ac



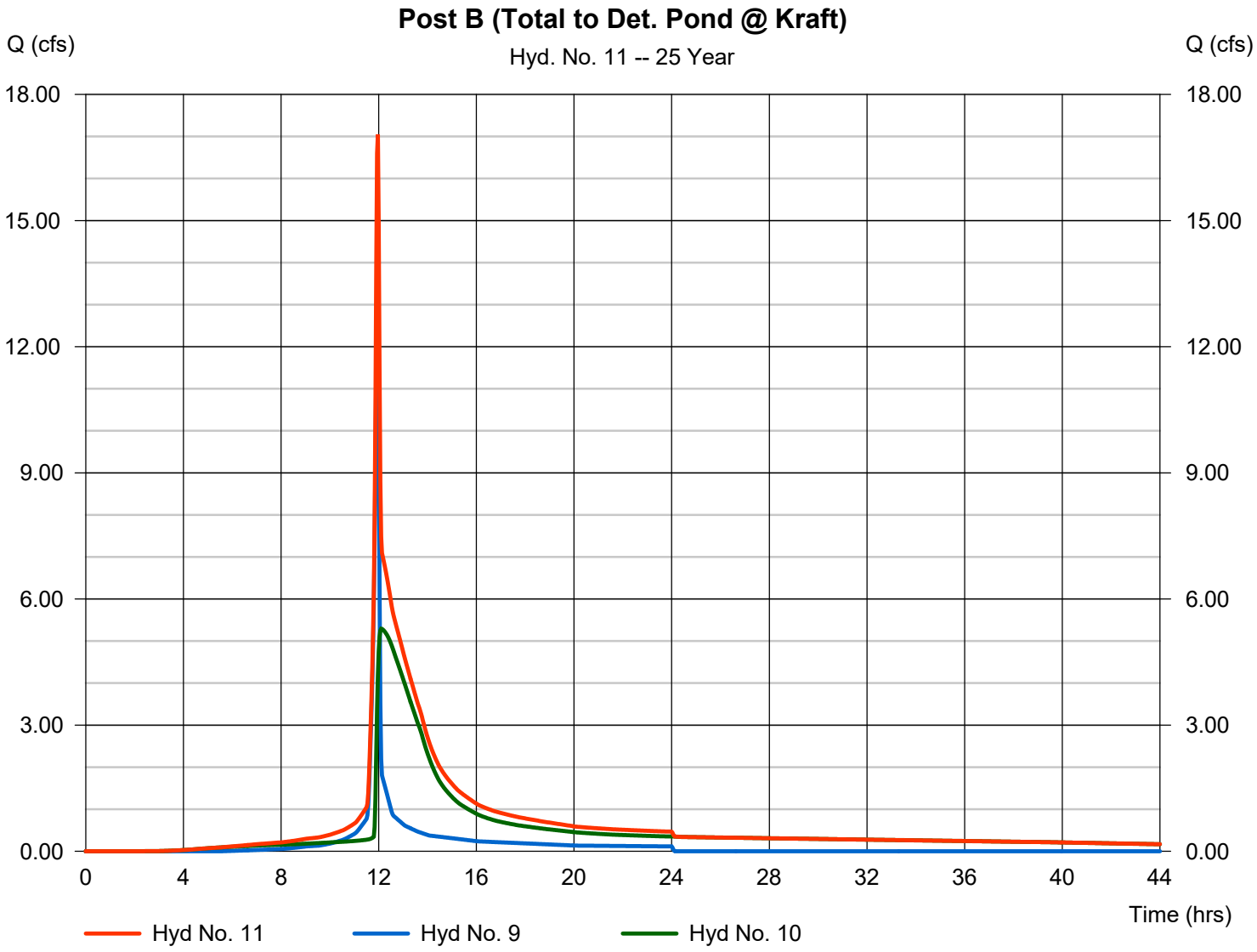
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 01 / 31 / 2018

Hyd. No. 11

Post B (Total to Det. Pond @ Kraft)

Hydrograph type	= Combine	Peak discharge	= 17.04 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 109,864 cuft
Inflow hyds.	= 9, 10	Contrib. drain. area	= 2.390 ac

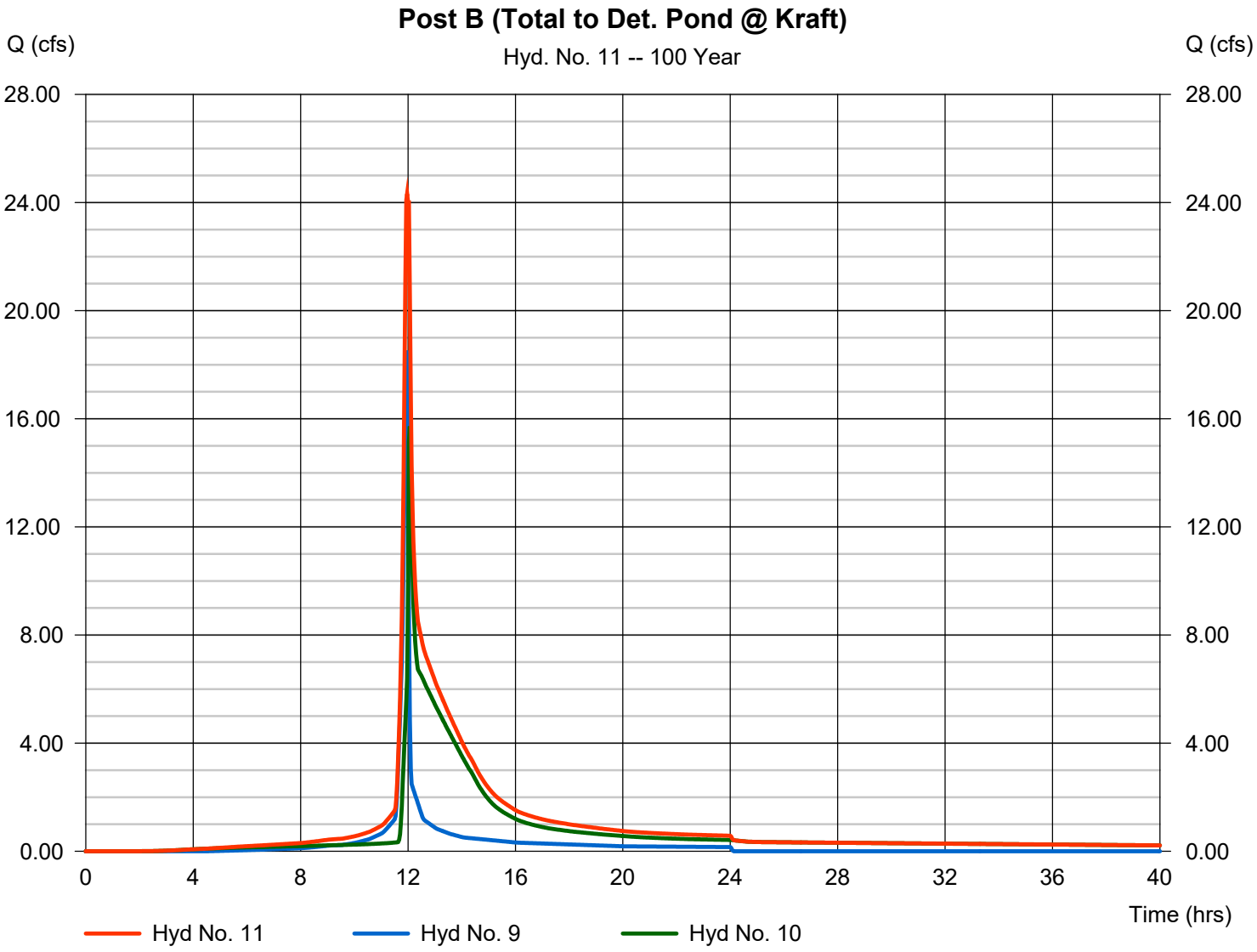


Hydrograph Report

Hyd. No. 11

Post B (Total to Det. Pond @ Kraft)

Hydrograph type	= Combine	Peak discharge	= 24.32 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 149,530 cuft
Inflow hyds.	= 9, 10	Contrib. drain. area	= 2.390 ac



Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Thursday, 02 / 1 / 2018

Pond No. 3 - New Det. Pond @ Kraft

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 2426.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	2426.00	2,060	0	0
2.00	2428.00	4,747	6,622	6,622
4.00	2430.00	9,682	14,138	20,760
6.00	2432.00	13,625	23,193	43,952

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	2.00	4.00	0.00
Span (in)	= 24.00	2.00	4.00	0.00
No. Barrels	= 1	1	1	0
Invert El. (ft)	= 2426.00	2426.00	2429.80	0.00
Length (ft)	= 20.00	0.10	0.10	0.00
Slope (%)	= 1.00	0.10	0.10	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	Yes	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 12.56	0.00	0.00	0.00
Crest El. (ft)	= 2430.30	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	---	---	---
Multi-Stage	= Yes	No	No	No

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

TW Elev. (ft) = 0.00

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

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	2426.00	0.00	0.00	0.00	---	0.00	---	---	---	---	---	0.000
0.20	662	2426.20	0.04 ic	0.04 ic	0.00	---	0.00	---	---	---	---	---	0.036
0.40	1,324	2426.40	0.06 ic	0.06 ic	0.00	---	0.00	---	---	---	---	---	0.058
0.60	1,987	2426.60	0.07 ic	0.07 ic	0.00	---	0.00	---	---	---	---	---	0.074
0.80	2,649	2426.80	0.09 ic	0.09 ic	0.00	---	0.00	---	---	---	---	---	0.087
1.00	3,311	2427.00	0.11 ic	0.10 ic	0.00	---	0.00	---	---	---	---	---	0.098
1.20	3,973	2427.20	0.12 ic	0.11 ic	0.00	---	0.00	---	---	---	---	---	0.109
1.40	4,635	2427.40	0.12 ic	0.12 ic	0.00	---	0.00	---	---	---	---	---	0.118
1.60	5,298	2427.60	0.13 ic	0.13 ic	0.00	---	0.00	---	---	---	---	---	0.127
1.80	5,960	2427.80	0.14 ic	0.14 ic	0.00	---	0.00	---	---	---	---	---	0.135
2.00	6,622	2428.00	0.15 ic	0.14 ic	0.00	---	0.00	---	---	---	---	---	0.143
2.20	8,036	2428.20	0.15 ic	0.15 ic	0.00	---	0.00	---	---	---	---	---	0.150
2.40	9,450	2428.40	0.16 ic	0.16 ic	0.00	---	0.00	---	---	---	---	---	0.157
2.60	10,863	2428.60	0.16 ic	0.16 ic	0.00	---	0.00	---	---	---	---	---	0.164
2.80	12,277	2428.80	0.18 ic	0.17 ic	0.00	---	0.00	---	---	---	---	---	0.171
3.00	13,691	2429.00	0.18 ic	0.18 ic	0.00	---	0.00	---	---	---	---	---	0.177
3.20	15,105	2429.20	0.18 ic	0.18 ic	0.00	---	0.00	---	---	---	---	---	0.183
3.40	16,518	2429.40	0.20 ic	0.19 ic	0.00	---	0.00	---	---	---	---	---	0.189
3.60	17,932	2429.60	0.20 ic	0.19 ic	0.00	---	0.00	---	---	---	---	---	0.194
3.80	19,346	2429.80	0.20 ic	0.20 ic	0.00	---	0.00	---	---	---	---	---	0.200
4.00	20,760	2430.00	0.29 ic	0.20 ic	0.08 ic	---	0.00	---	---	---	---	---	0.288
4.20	23,079	2430.20	0.41 ic	0.21 ic	0.20 ic	---	0.00	---	---	---	---	---	0.412
4.40	25,398	2430.40	1.81 ic	0.21 ic	0.28 ic	---	1.32	---	---	---	---	---	1.802
4.60	27,717	2430.60	7.44 oc	0.18 ic	0.33 ic	---	6.87	---	---	---	---	---	7.391
4.80	30,037	2430.80	15.33 oc	0.16 ic	0.38 ic	---	14.79	---	---	---	---	---	15.33
5.00	32,356	2431.00	25.04 ic	0.12 ic	0.43 ic	---	24.49	---	---	---	---	---	25.04
5.20	34,675	2431.20	29.47 ic	0.07 ic	0.27 ic	---	29.14 s	---	---	---	---	---	29.47
5.40	36,994	2431.40	30.86 ic	0.05 ic	0.20 ic	---	30.60 s	---	---	---	---	---	30.85
5.60	39,314	2431.60	31.88 ic	0.04 ic	0.17 ic	---	31.67 s	---	---	---	---	---	31.88
5.80	41,633	2431.80	32.76 ic	0.03 ic	0.14 ic	---	32.57 s	---	---	---	---	---	32.75
6.00	43,952	2432.00	33.55 ic	0.03 ic	0.12 ic	---	33.40 s	---	---	---	---	---	33.54

Hydrograph Report

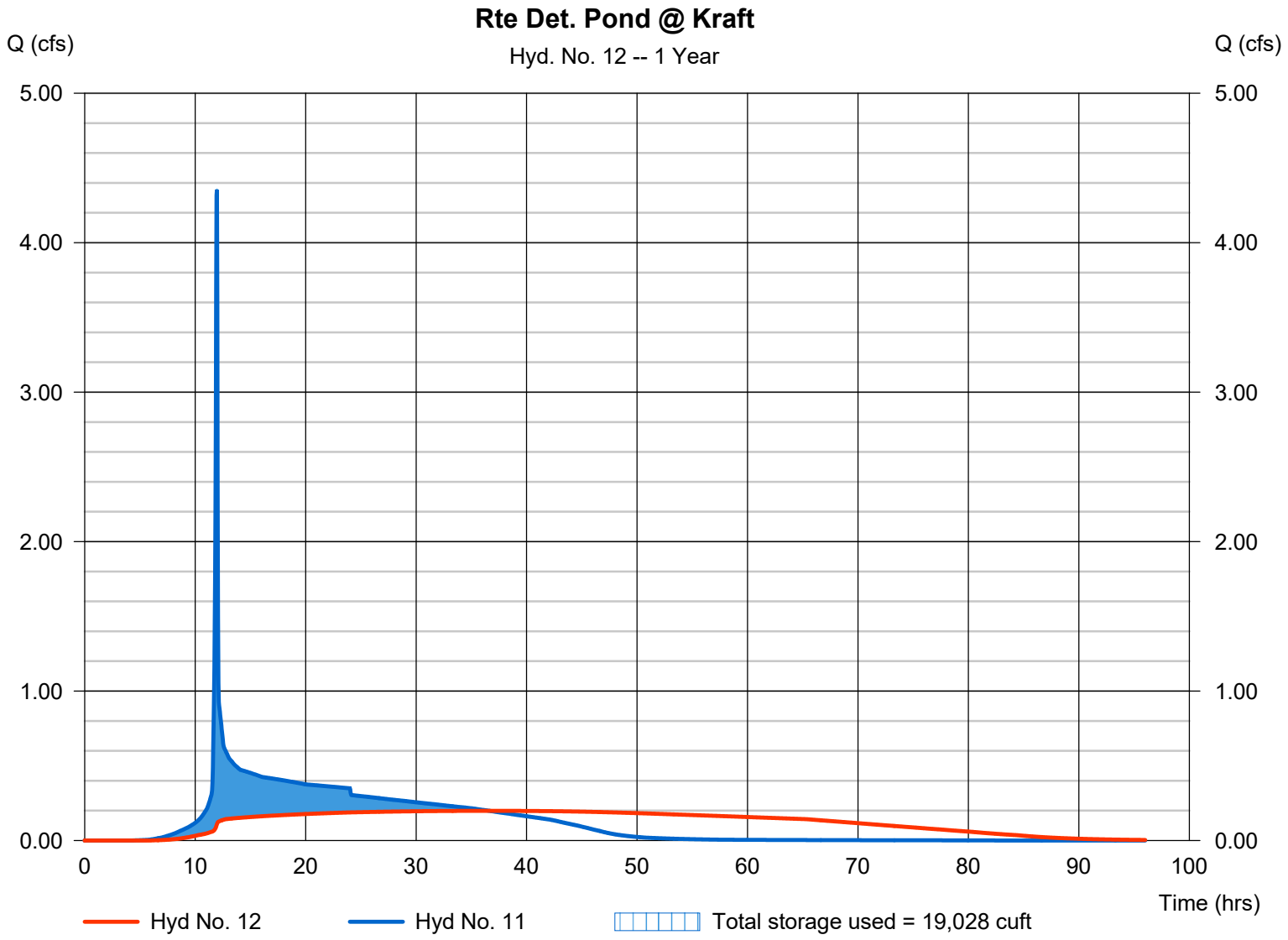
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Thursday, 02 / 1 / 2018

Hyd. No. 12

Rte Det. Pond @ Kraft

Hydrograph type	=	Reservoir	Peak discharge	=	0.199 cfs
Storm frequency	=	1 yrs	Time to peak	=	36.63 hrs
Time interval	=	2 min	Hyd. volume	=	41,677 cuft
Inflow hyd. No.	=	11 - Post B (Total to Det. Pond @ Kraft)	Max. Elevation	=	2429.76 ft
Reservoir name	=	New Det. Pond @ Kraft	Max. Storage	=	19,028 cuft

Storage Indication method used.



Hydrograph Report

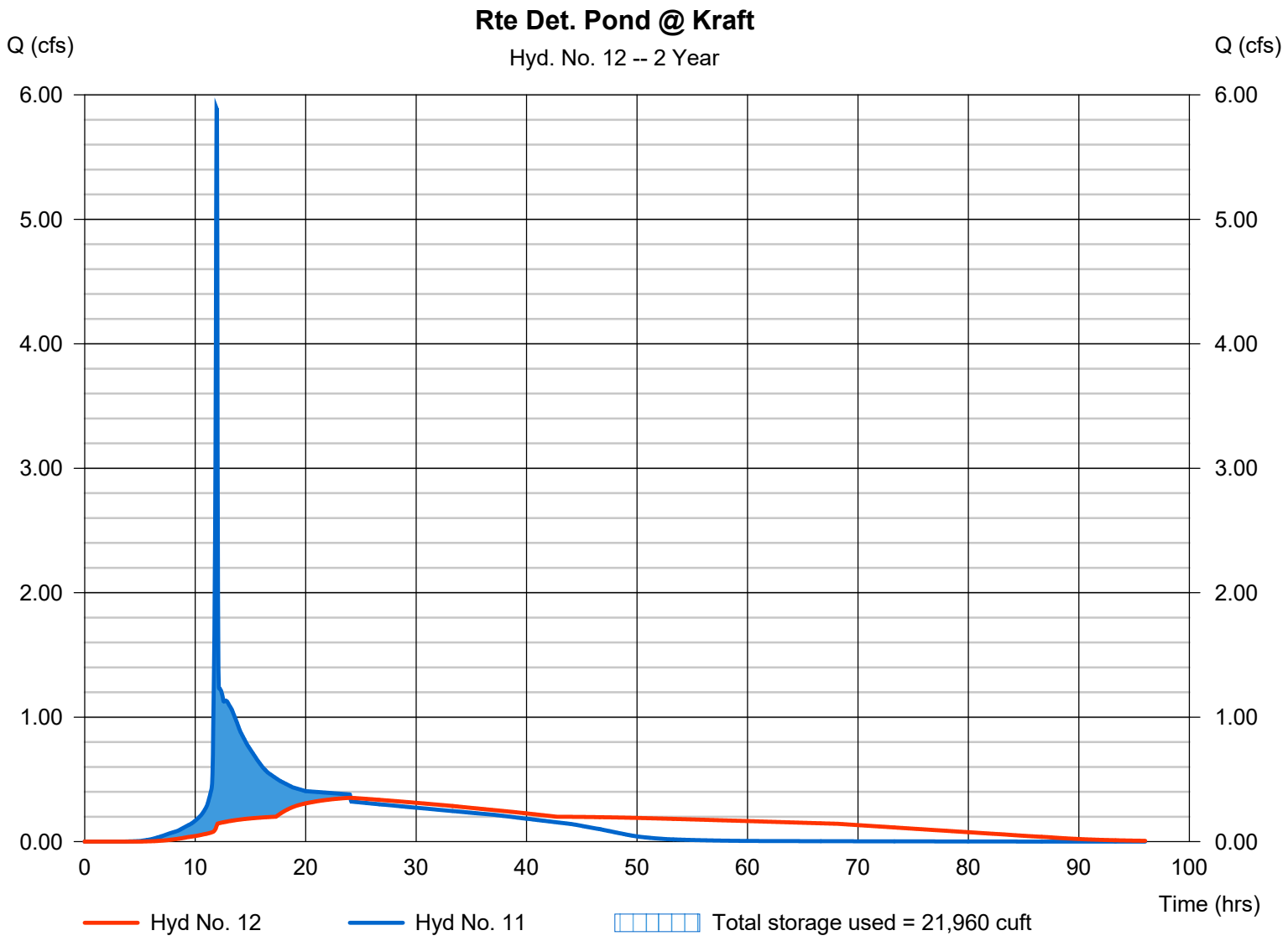
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Thursday, 02 / 1 / 2018

Hyd. No. 12

Rte Det. Pond @ Kraft

Hydrograph type	=	Reservoir	Peak discharge	=	0.352 cfs
Storm frequency	=	2 yrs	Time to peak	=	24.07 hrs
Time interval	=	2 min	Hyd. volume	=	53,293 cuft
Inflow hyd. No.	=	11 - Post B (Total to Det. Pond @ Kraft)	Max. Elevation	=	2430.10 ft
Reservoir name	=	New Det. Pond @ Kraft	Max. Storage	=	21,960 cuft

Storage Indication method used.



Hydrograph Report

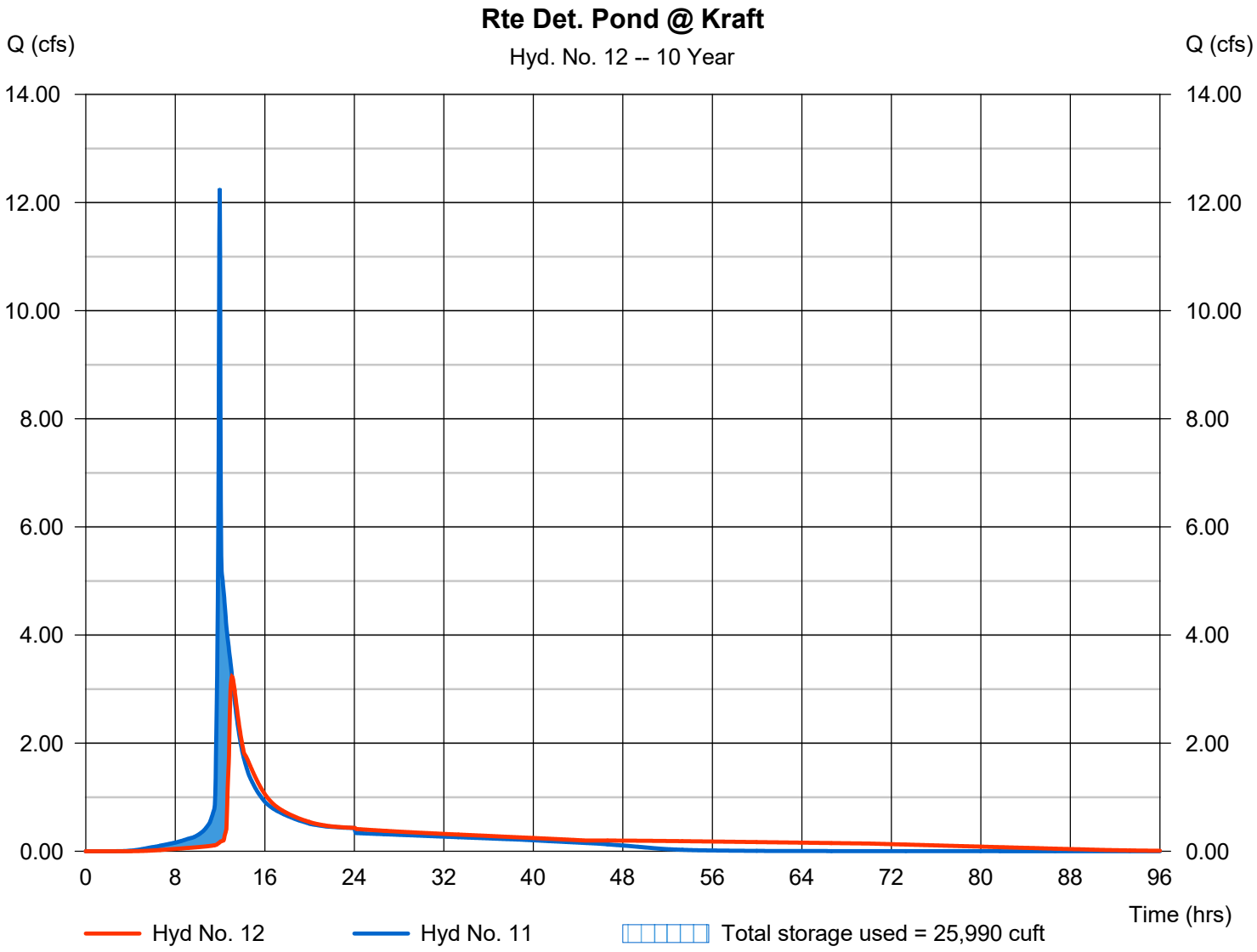
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Thursday, 02 / 1 / 2018

Hyd. No. 12

Rte Det. Pond @ Kraft

Hydrograph type	=	Reservoir	Peak discharge	=	3.229 cfs
Storm frequency	=	10 yrs	Time to peak	=	13.07 hrs
Time interval	=	2 min	Hyd. volume	=	87,008 cuft
Inflow hyd. No.	=	11 - Post B (Total to Det. Pond @ Kraft)	Max. Elevation	=	2430.45 ft
Reservoir name	=	New Det. Pond @ Kraft	Max. Storage	=	25,990 cuft

Storage Indication method used.



Hydrograph Report

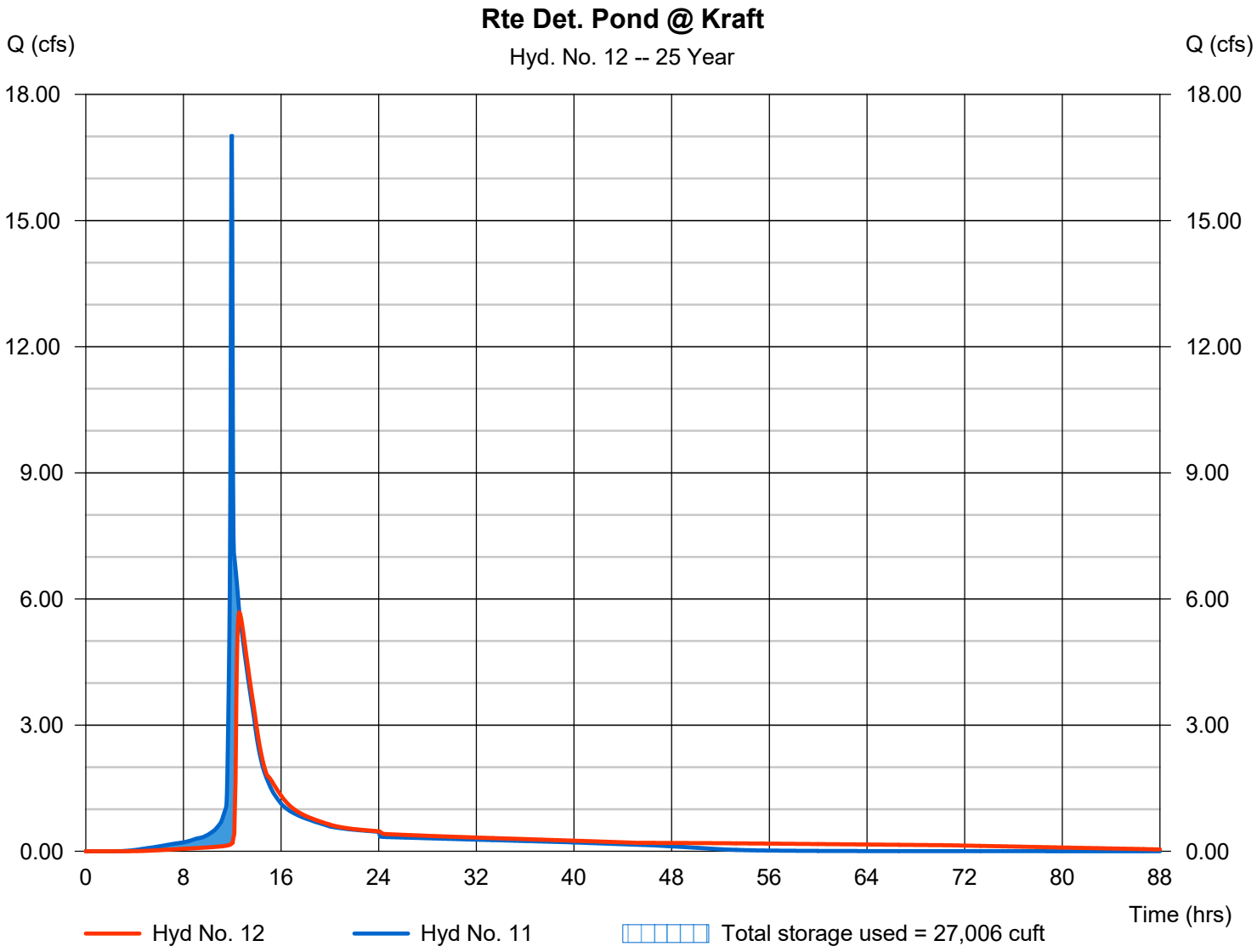
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Thursday, 02 / 1 / 2018

Hyd. No. 12

Rte Det. Pond @ Kraft

Hydrograph type	=	Reservoir	Peak discharge	=	5.676 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.57 hrs
Time interval	=	2 min	Hyd. volume	=	109,671 cuft
Inflow hyd. No.	=	11 - Post B (Total to Det. Pond @ Kraft)	Max. Elevation	=	2430.54 ft
Reservoir name	=	New Det. Pond @ Kraft	Max. Storage	=	27,006 cuft

Storage Indication method used.



Hydrograph Report

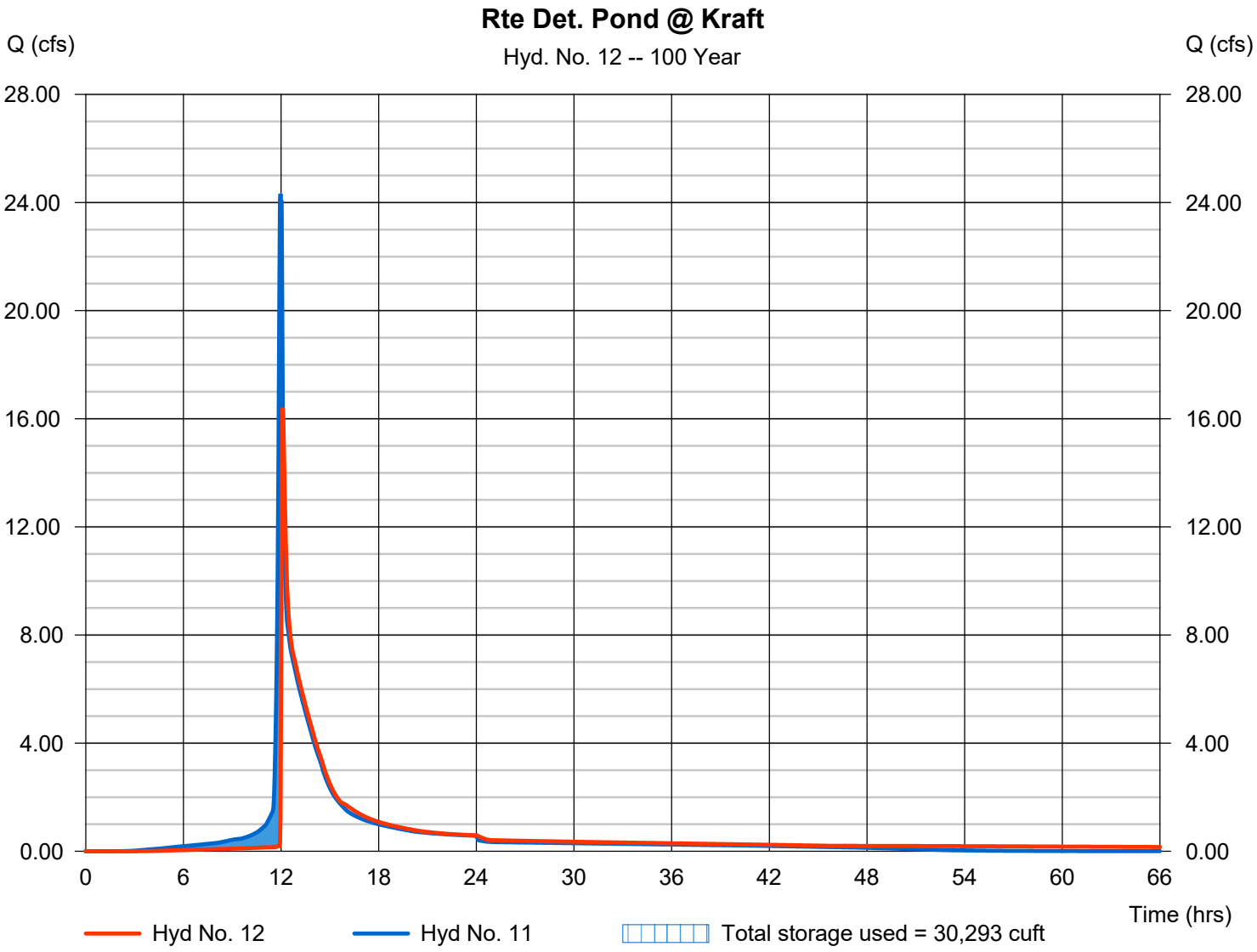
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Thursday, 02 / 1 / 2018

Hyd. No. 12

Rte Det. Pond @ Kraft

Hydrograph type	=	Reservoir	Peak discharge	=	16.41 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.10 hrs
Time interval	=	2 min	Hyd. volume	=	149,310 cuft
Inflow hyd. No.	=	11 - Post B (Total to Det. Pond @ Kraft)	Max. Elevation	=	2430.82 ft
Reservoir name	=	New Det. Pond @ Kraft	Max. Storage	=	30,293 cuft

Storage Indication method used.



APPENDIX F – 2018 POST DEVELOPMENT FACILITY #4 VERIFICATION

(See attached Drawings)

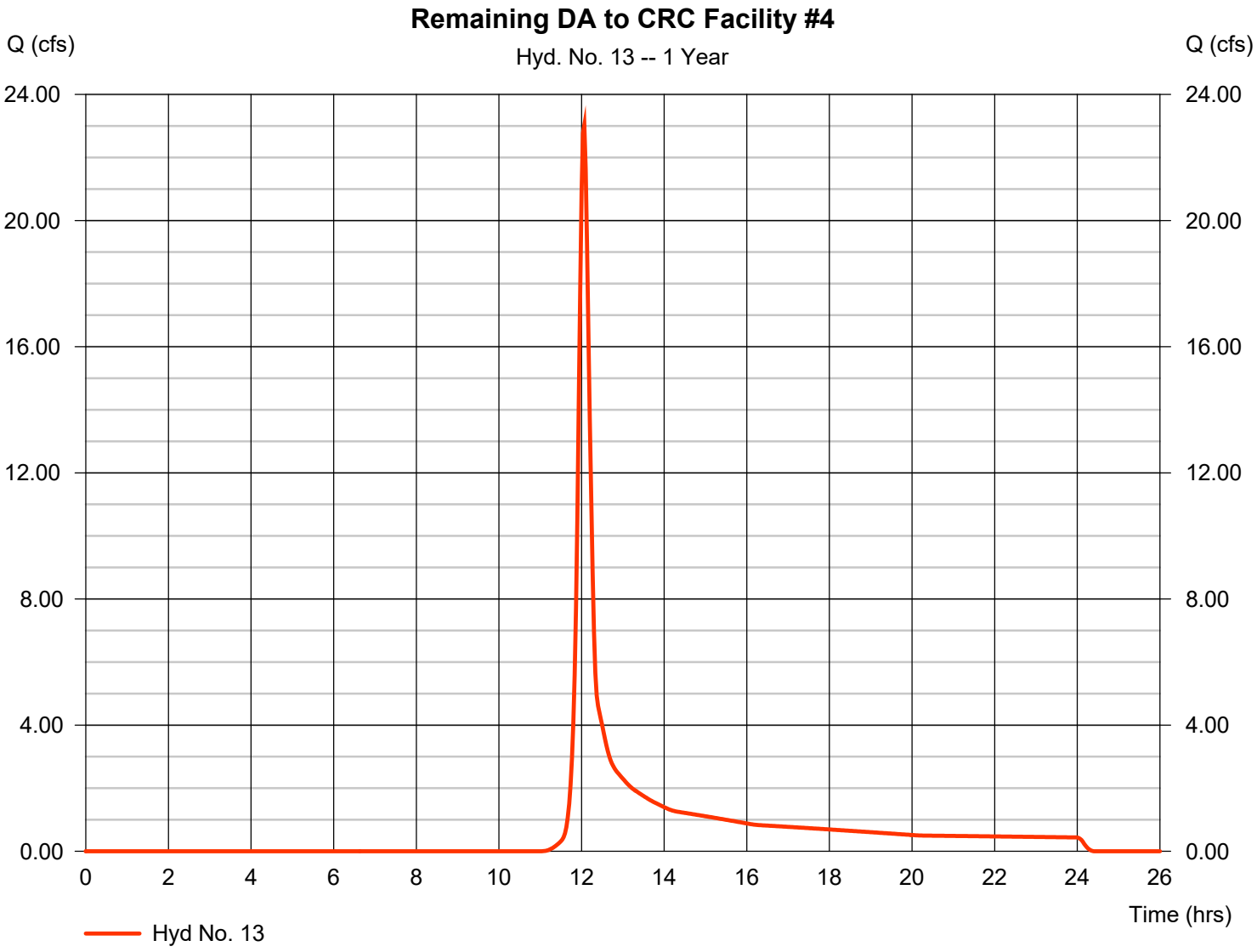
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 01 / 31 / 2018

Hyd. No. 13

Remaining DA to CRC Facility #4

Hydrograph type	= SCS Runoff	Peak discharge	= 23.02 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 68,055 cuft
Drainage area	= 27.720 ac	Curve number	= 79
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 14.00 min
Total precip.	= 2.28 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



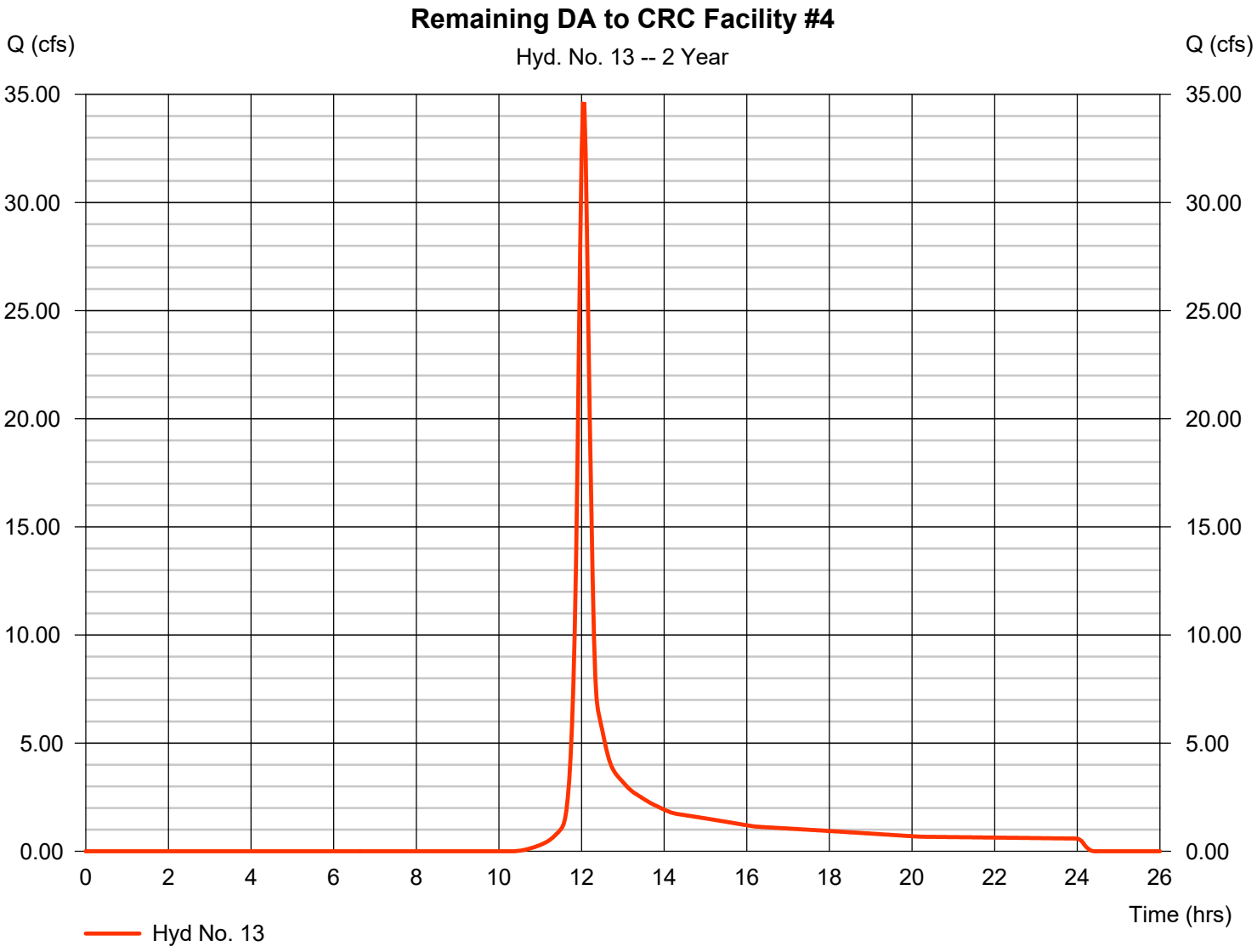
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 01 / 31 / 2018

Hyd. No. 13

Remaining DA to CRC Facility #4

Hydrograph type	= SCS Runoff	Peak discharge	= 34.57 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 99,694 cuft
Drainage area	= 27.720 ac	Curve number	= 79
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 14.00 min
Total precip.	= 2.76 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



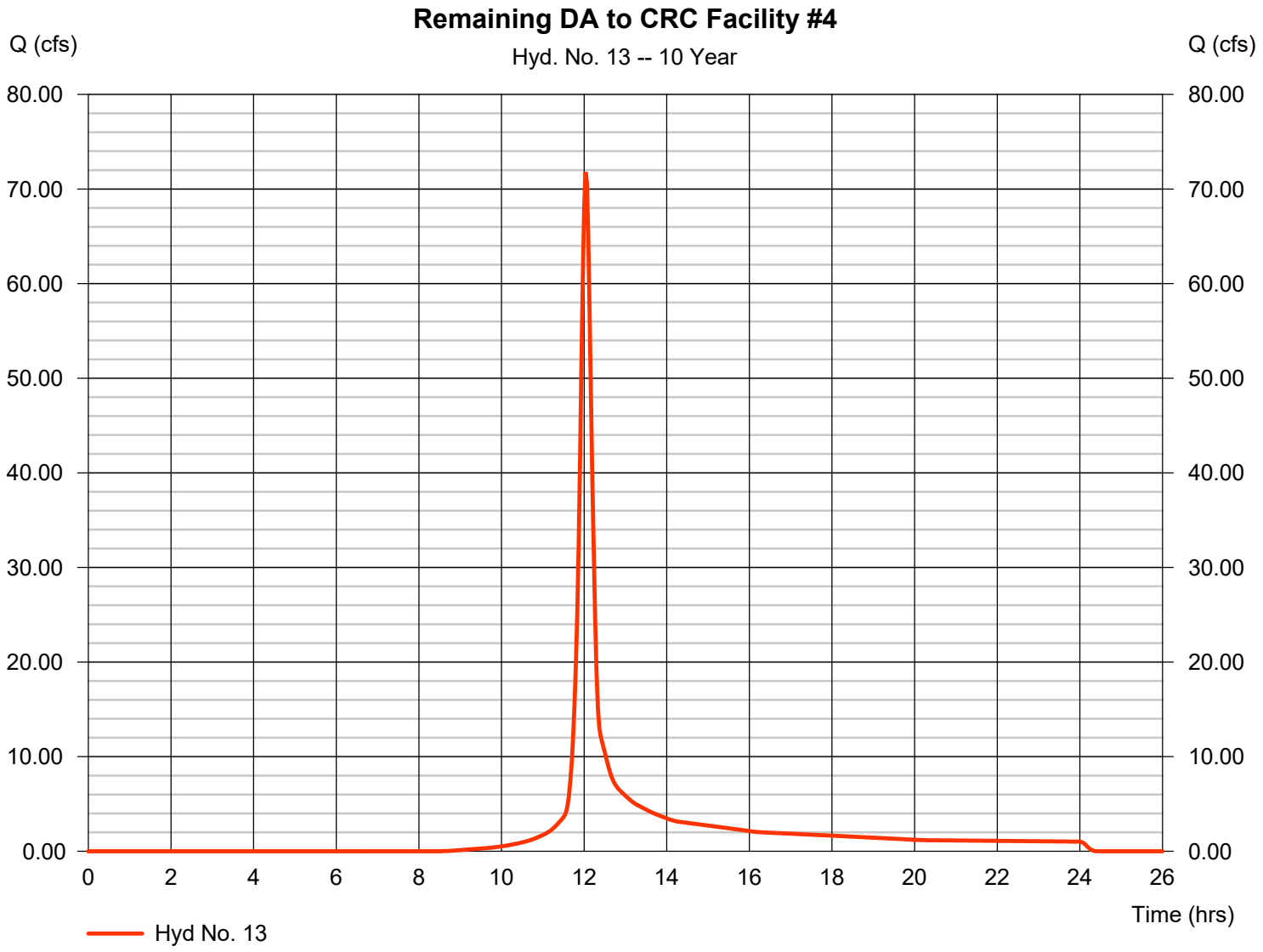
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 01 / 31 / 2018

Hyd. No. 13

Remaining DA to CRC Facility #4

Hydrograph type	= SCS Runoff	Peak discharge	= 71.77 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 201,430 cuft
Drainage area	= 27.720 ac	Curve number	= 79
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 14.00 min
Total precip.	= 4.11 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



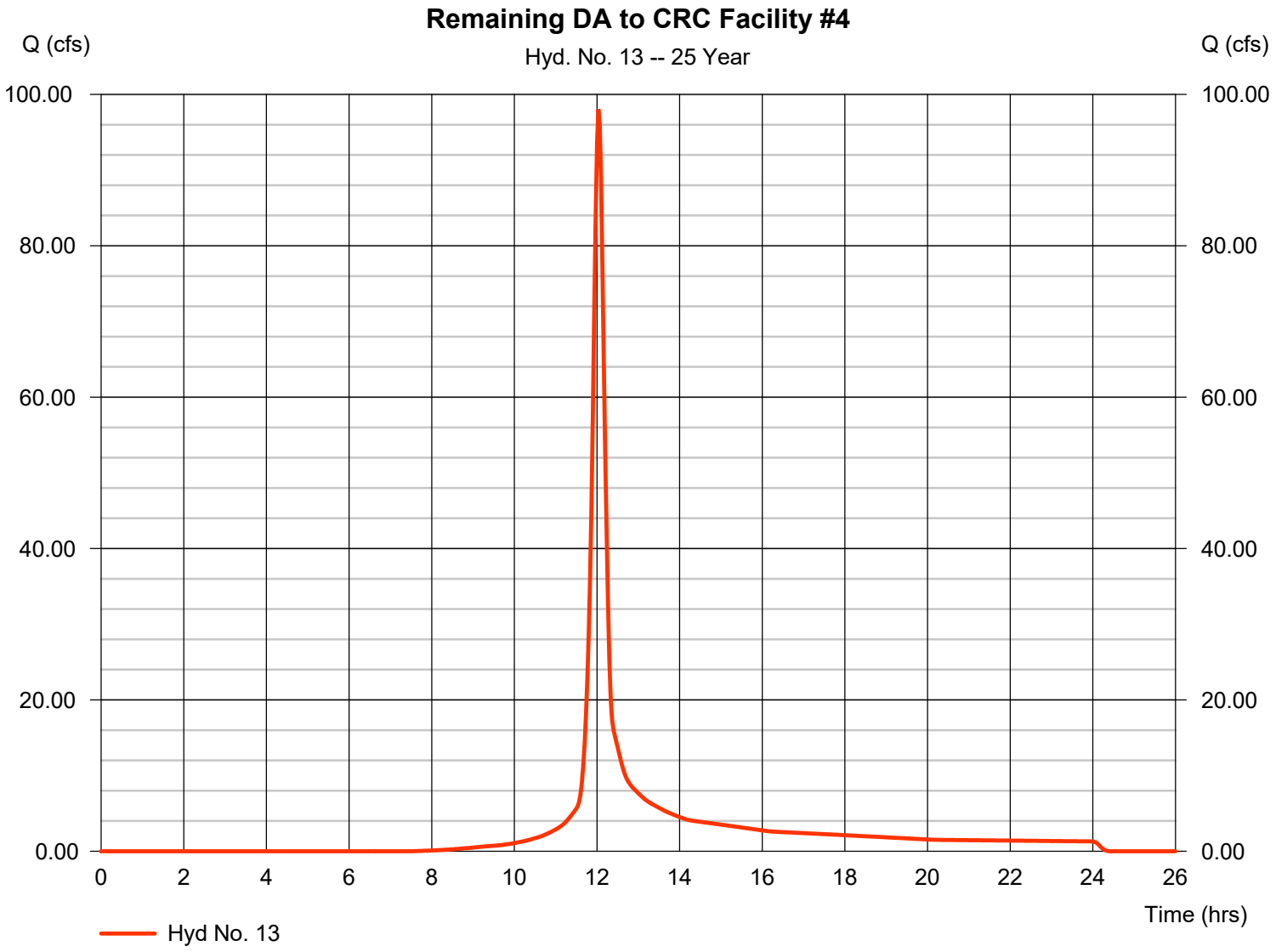
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 01 / 31 / 2018

Hyd. No. 13

Remaining DA to CRC Facility #4

Hydrograph type	= SCS Runoff	Peak discharge	= 98.04 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 274,864 cuft
Drainage area	= 27.720 ac	Curve number	= 79
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 14.00 min
Total precip.	= 5.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

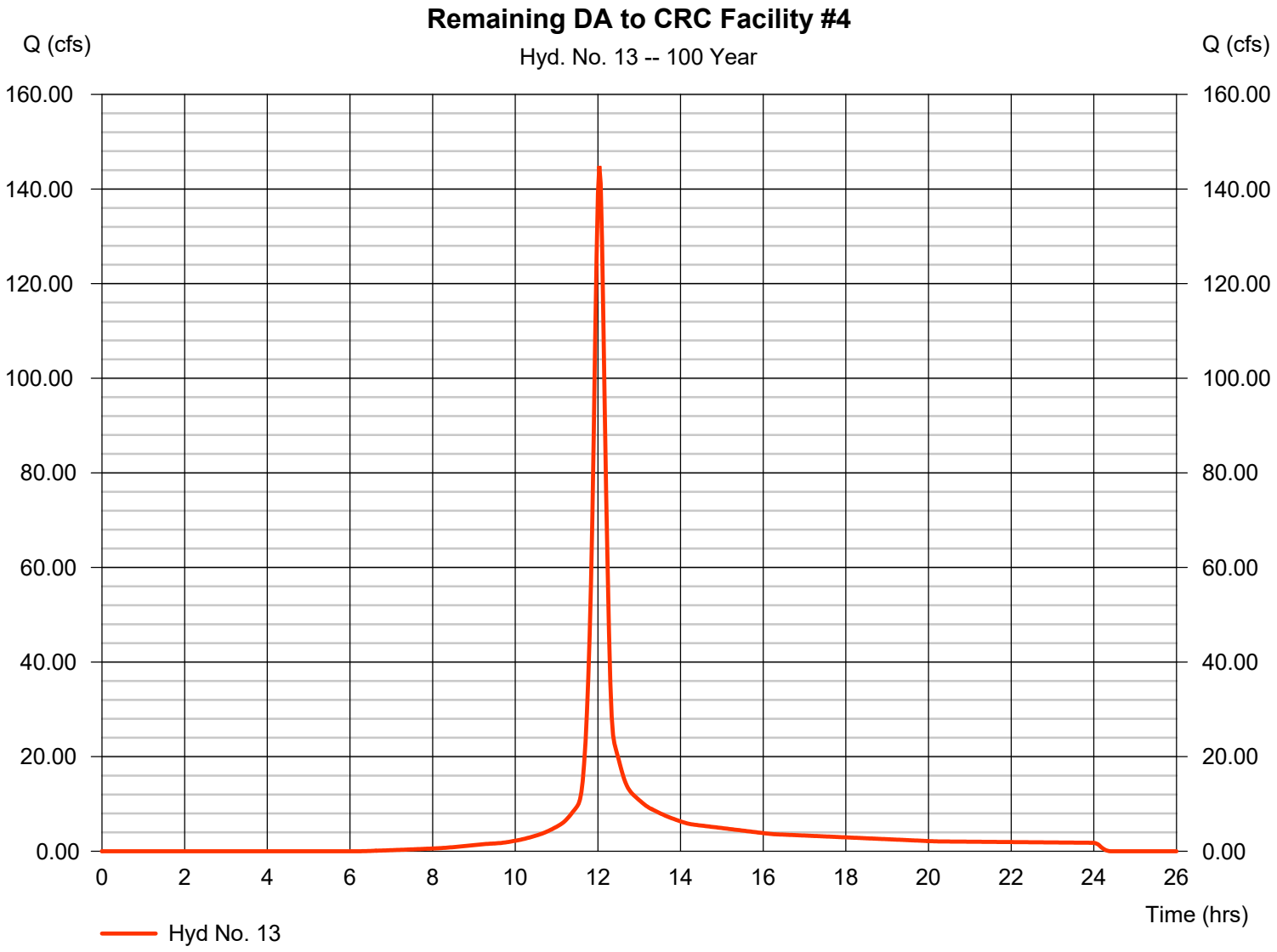


Hydrograph Report

Hyd. No. 13

Remaining DA to CRC Facility #4

Hydrograph type	= SCS Runoff	Peak discharge	= 144.84 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 408,665 cuft
Drainage area	= 27.720 ac	Curve number	= 79
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 14.00 min
Total precip.	= 6.54 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

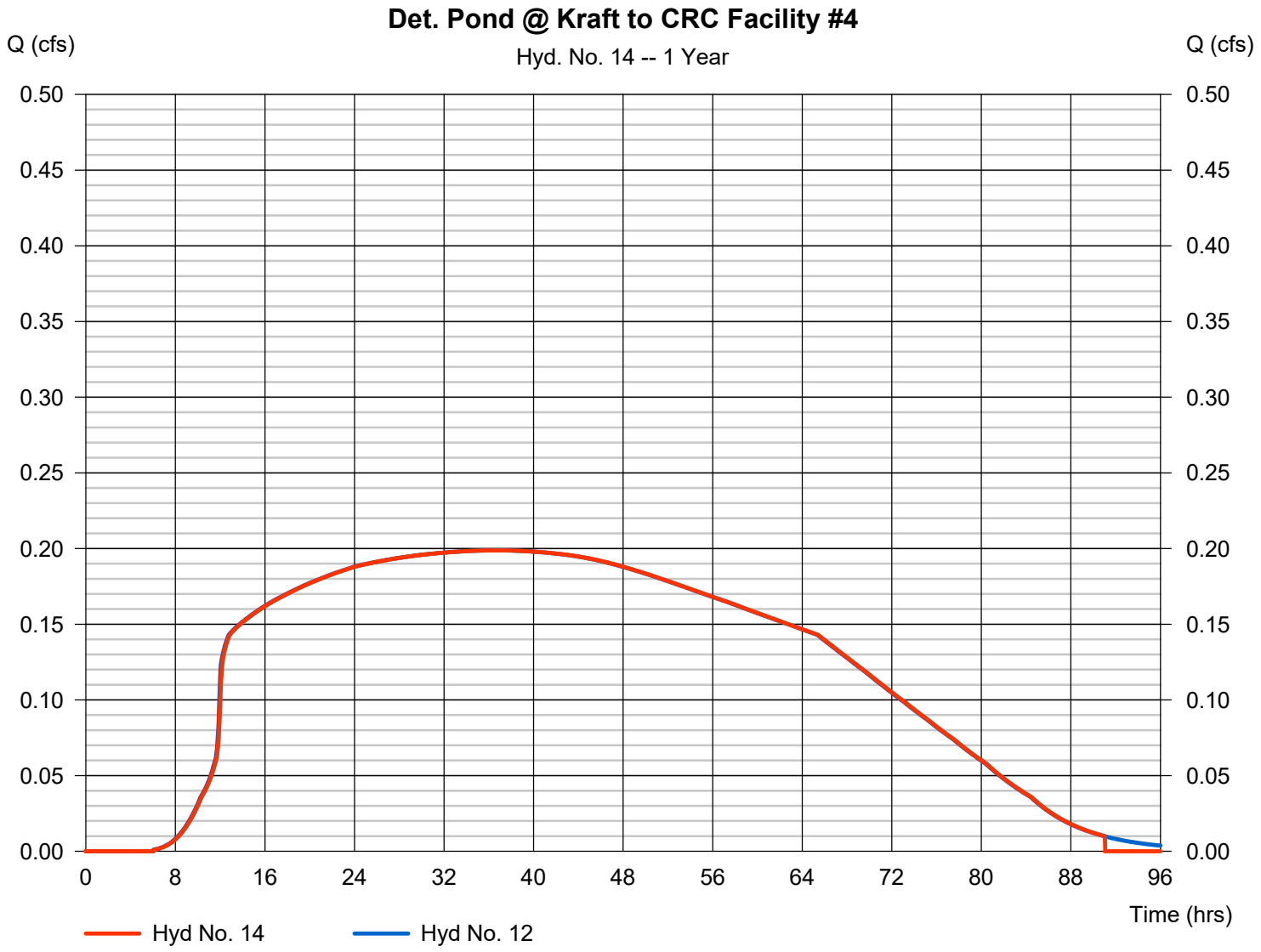
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 01 / 31 / 2018

Hyd. No. 14

Det. Pond @ Kraft to CRC Facility #4

Hydrograph type	=	Reach	Peak discharge	=	0.199 cfs
Storm frequency	=	1 yrs	Time to peak	=	36.73 hrs
Time interval	=	2 min	Hyd. volume	=	41,562 cuft
Inflow hyd. No.	=	12 - Rte Det. Pond @ Kraft	Section type	=	Trapezoidal
Reach length	=	425.0 ft	Channel slope	=	2.5 %
Manning's n	=	0.025	Bottom width	=	10.0 ft
Side slope	=	4.0:1	Max. depth	=	1.5 ft
Rating curve x	=	2.029	Rating curve m	=	1.315
Ave. velocity	=	1.16 ft/s	Routing coeff.	=	0.3552

Modified Att-Kin routing method used.



Hydrograph Report

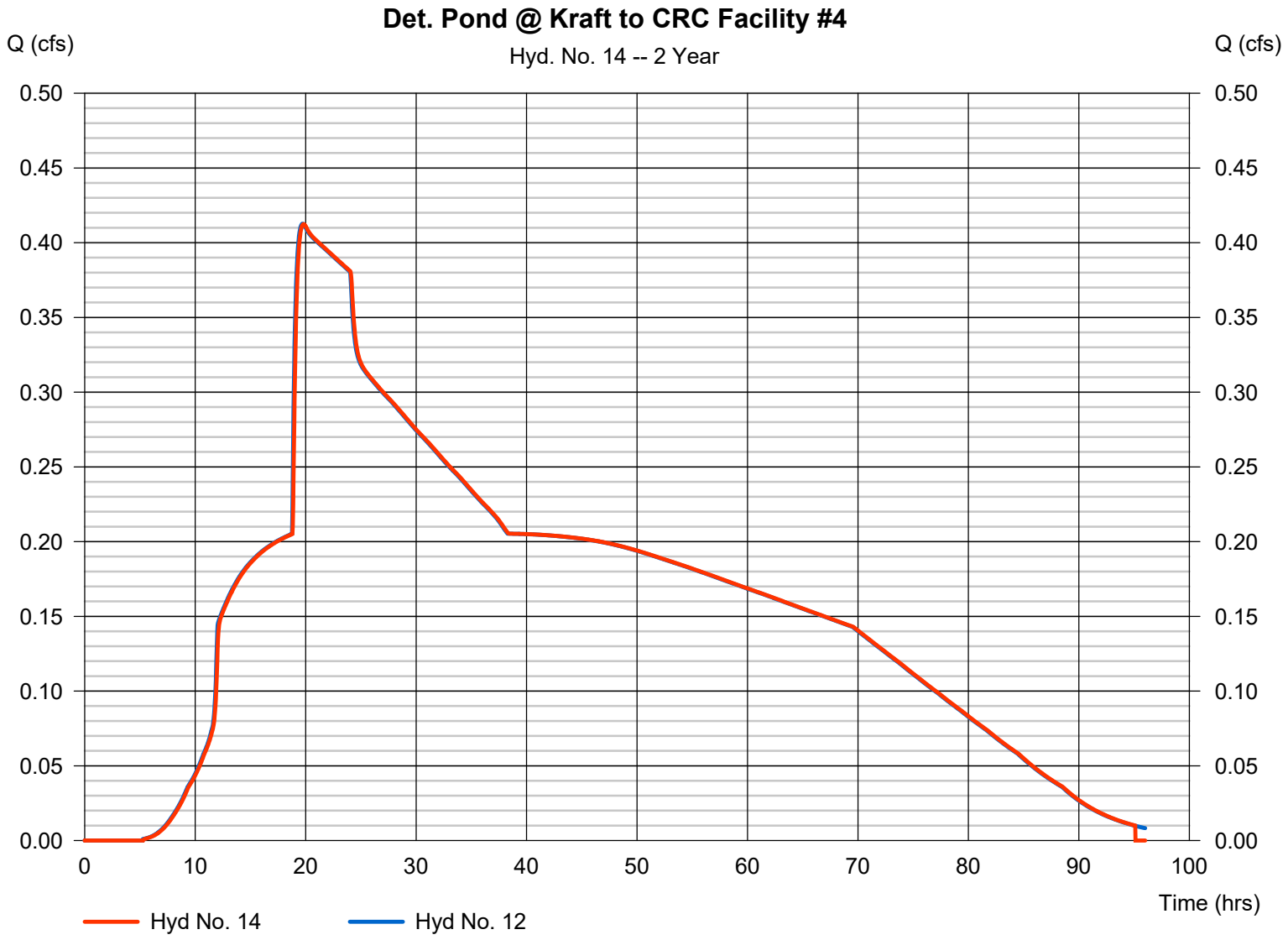
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 01 / 31 / 2018

Hyd. No. 14

Det. Pond @ Kraft to CRC Facility #4

Hydrograph type	= Reach	Peak discharge	= 0.412 cfs
Storm frequency	= 2 yrs	Time to peak	= 19.80 hrs
Time interval	= 2 min	Hyd. volume	= 53,228 cuft
Inflow hyd. No.	= 12 - Rte Det. Pond @ Kraft	Section type	= Trapezoidal
Reach length	= 425.0 ft	Channel slope	= 2.5 %
Manning's n	= 0.025	Bottom width	= 10.0 ft
Side slope	= 4.0:1	Max. depth	= 1.5 ft
Rating curve x	= 2.029	Rating curve m	= 1.315
Ave. velocity	= 1.39 ft/s	Routing coeff.	= 0.4092

Modified Att-Kin routing method used.



Hydrograph Report

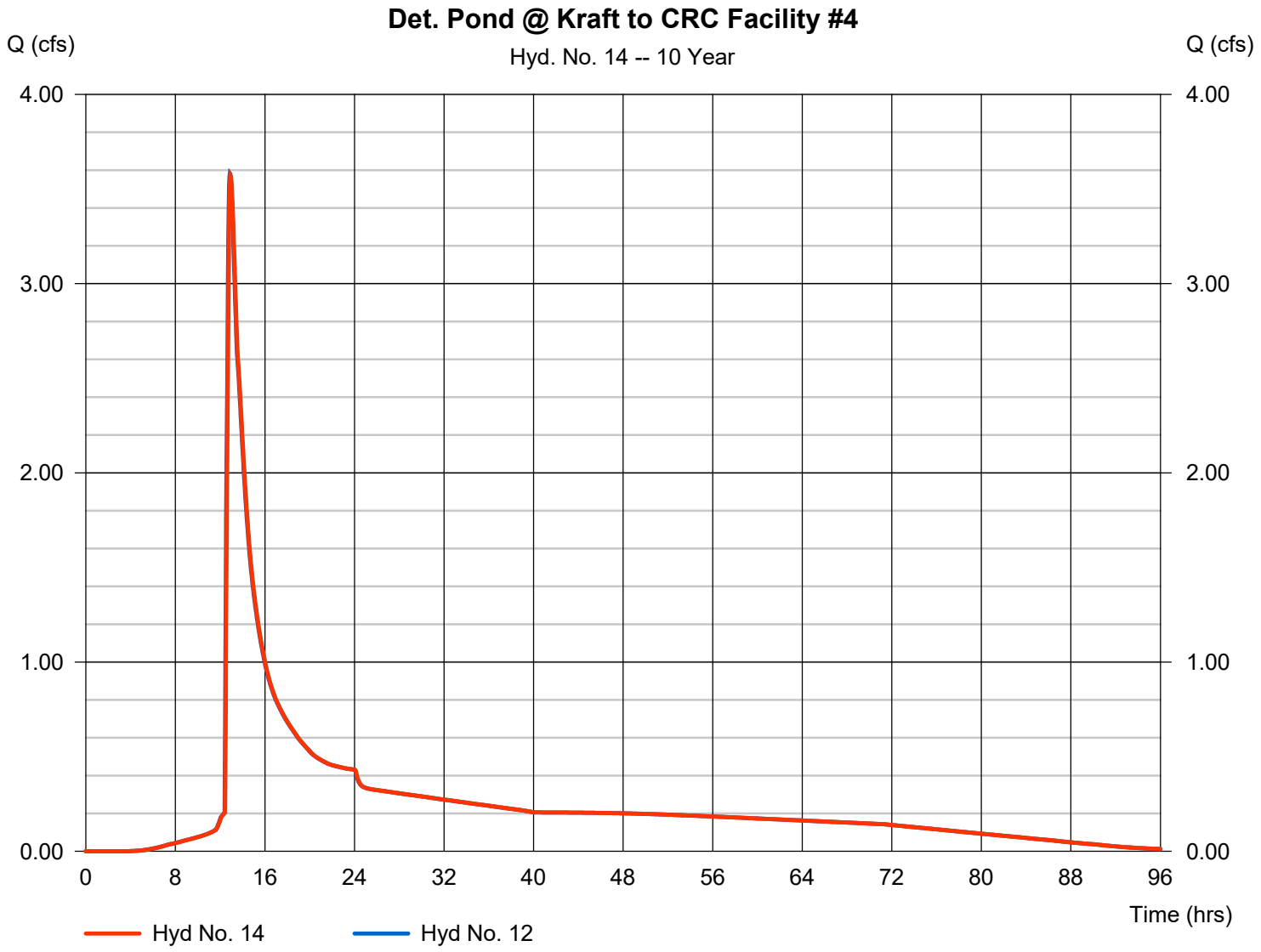
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 — Wednesday, 01 / 31 / 2018

Hyd. No. 14

Det. Pond @ Kraft to CRC Facility #4

Hydrograph type	= Reach	Peak discharge	= 3.570 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.93 hrs
Time interval	= 2 min	Hyd. volume	= 86,959 cuft
Inflow hyd. No.	= 12 - Rte Det. Pond @ Kraft	Section type	= Trapezoidal
Reach length	= 425.0 ft	Channel slope	= 2.5 %
Manning's n	= 0.025	Bottom width	= 10.0 ft
Side slope	= 4.0:1	Max. depth	= 1.5 ft
Rating curve x	= 2.029	Rating curve m	= 1.315
Ave. velocity	= 2.32 ft/s	Routing coeff.	= 0.6028

Modified Att-Kin routing method used.



Hydrograph Report

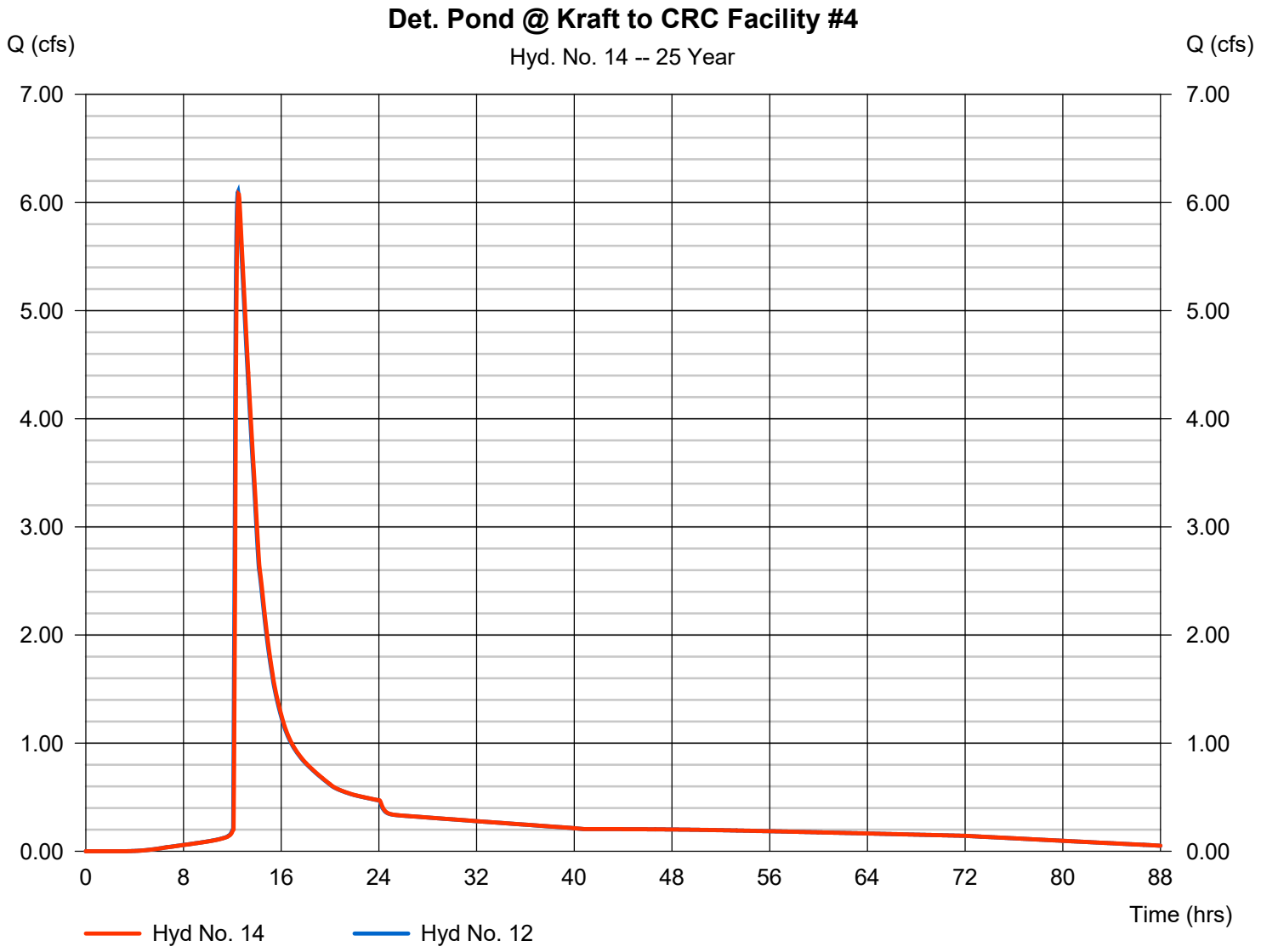
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 01 / 31 / 2018

Hyd. No. 14

Det. Pond @ Kraft to CRC Facility #4

Hydrograph type	= Reach	Peak discharge	= 6.080 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.50 hrs
Time interval	= 2 min	Hyd. volume	= 109,616 cuft
Inflow hyd. No.	= 12 - Rte Det. Pond @ Kraft	Section type	= Trapezoidal
Reach length	= 425.0 ft	Channel slope	= 2.5 %
Manning's n	= 0.025	Bottom width	= 10.0 ft
Side slope	= 4.0:1	Max. depth	= 1.5 ft
Rating curve x	= 2.029	Rating curve m	= 1.315
Ave. velocity	= 2.64 ft/s	Routing coeff.	= 0.6577

Modified Att-Kin routing method used.



Hydrograph Report

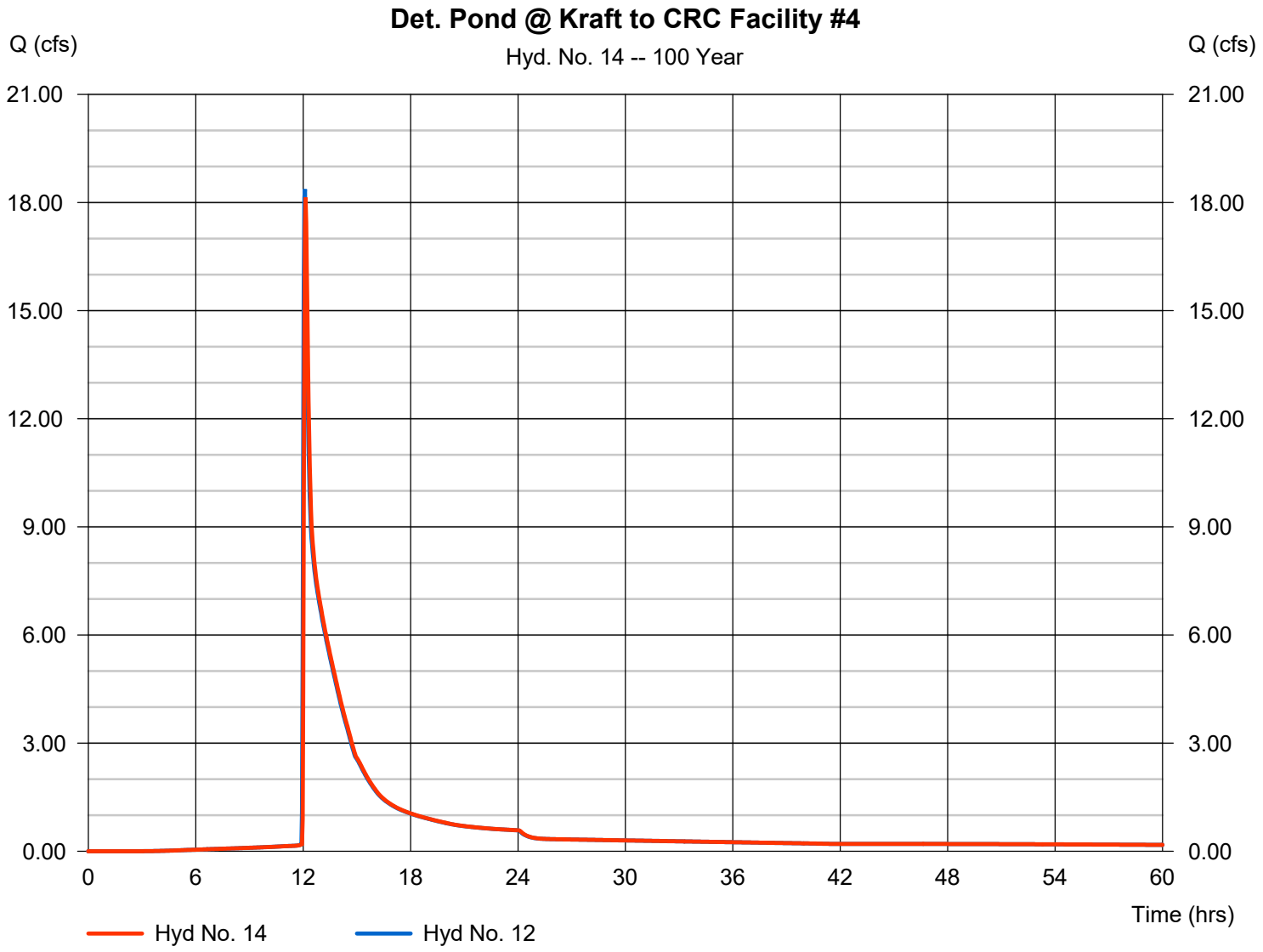
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 01 / 31 / 2018

Hyd. No. 14

Det. Pond @ Kraft to CRC Facility #4

Hydrograph type	= Reach	Peak discharge	= 18.13 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.13 hrs
Time interval	= 2 min	Hyd. volume	= 149,247 cuft
Inflow hyd. No.	= 12 - Rte Det. Pond @ Kraft	Section type	= Trapezoidal
Reach length	= 425.0 ft	Channel slope	= 2.5 %
Manning's n	= 0.025	Bottom width	= 10.0 ft
Side slope	= 4.0:1	Max. depth	= 1.5 ft
Rating curve x	= 2.029	Rating curve m	= 1.315
Ave. velocity	= 3.44 ft/s	Routing coeff.	= 0.7790

Modified Att-Kin routing method used.



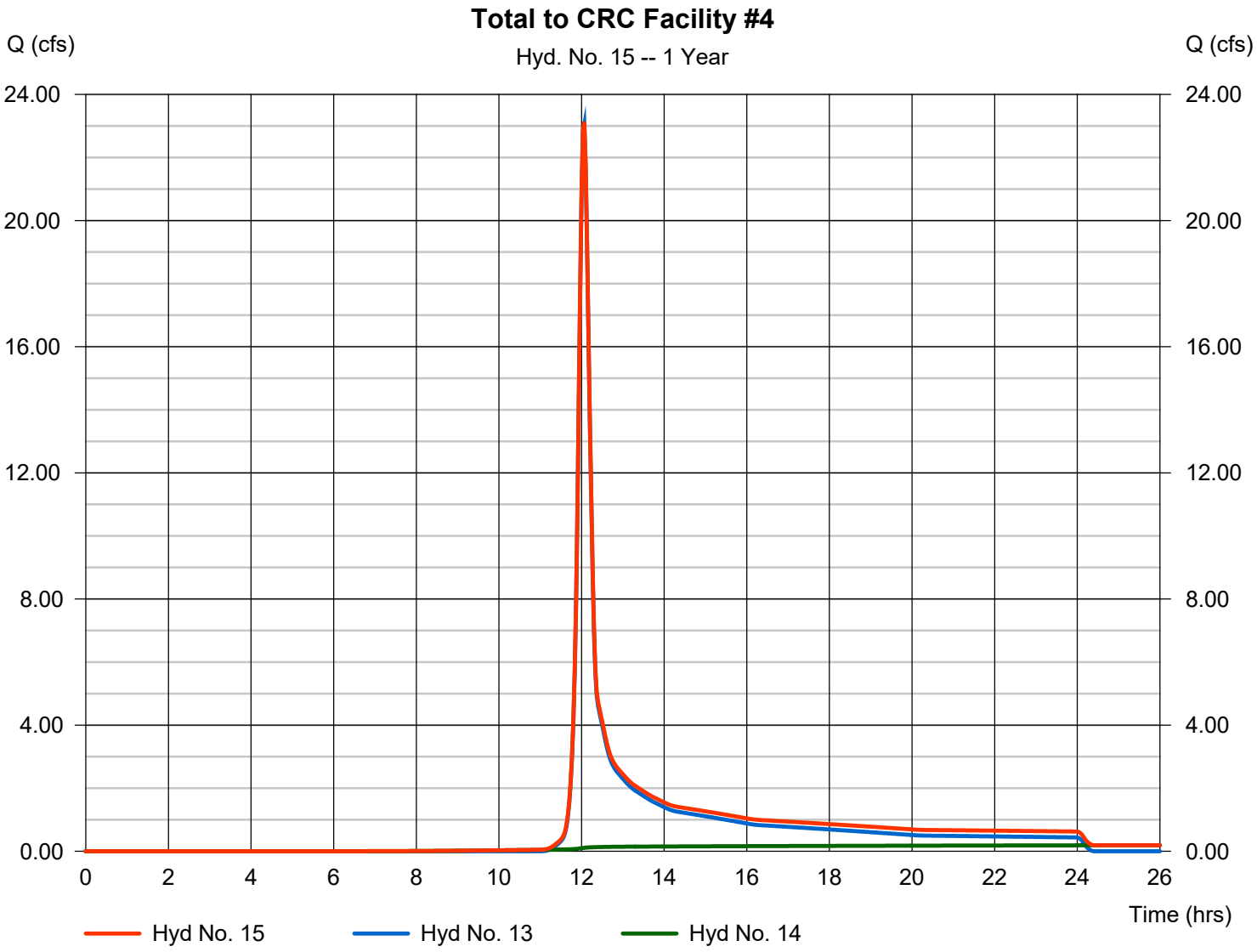
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 01 / 31 / 2018

Hyd. No. 15

Total to CRC Facility #4

Hydrograph type	= Combine	Peak discharge	= 23.13 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 109,617 cuft
Inflow hyds.	= 13, 14	Contrib. drain. area	= 27.720 ac



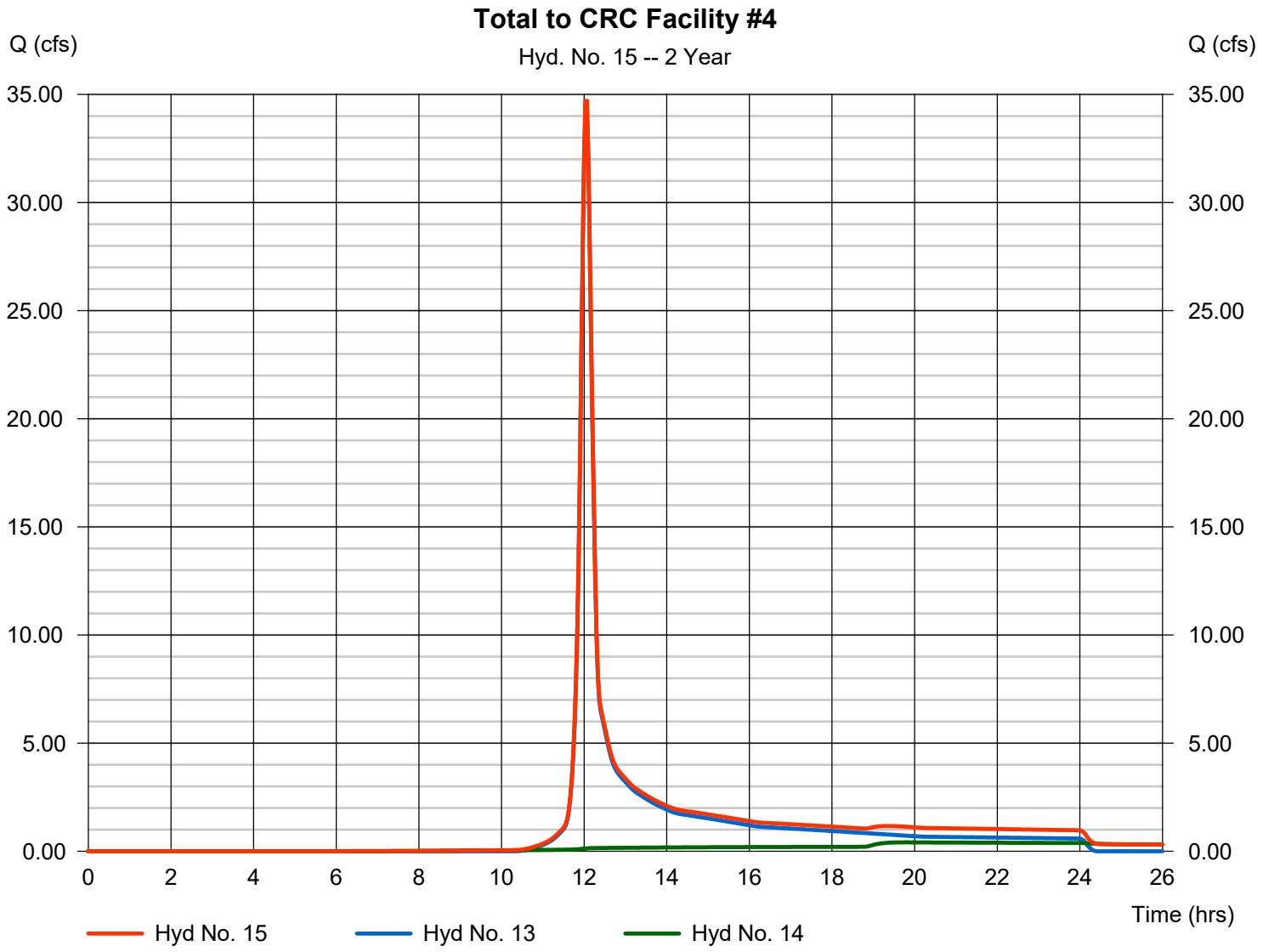
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 01 / 31 / 2018

Hyd. No. 15

Total to CRC Facility #4

Hydrograph type	= Combine	Peak discharge	= 34.70 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 152,921 cuft
Inflow hyds.	= 13, 14	Contrib. drain. area	= 27.720 ac

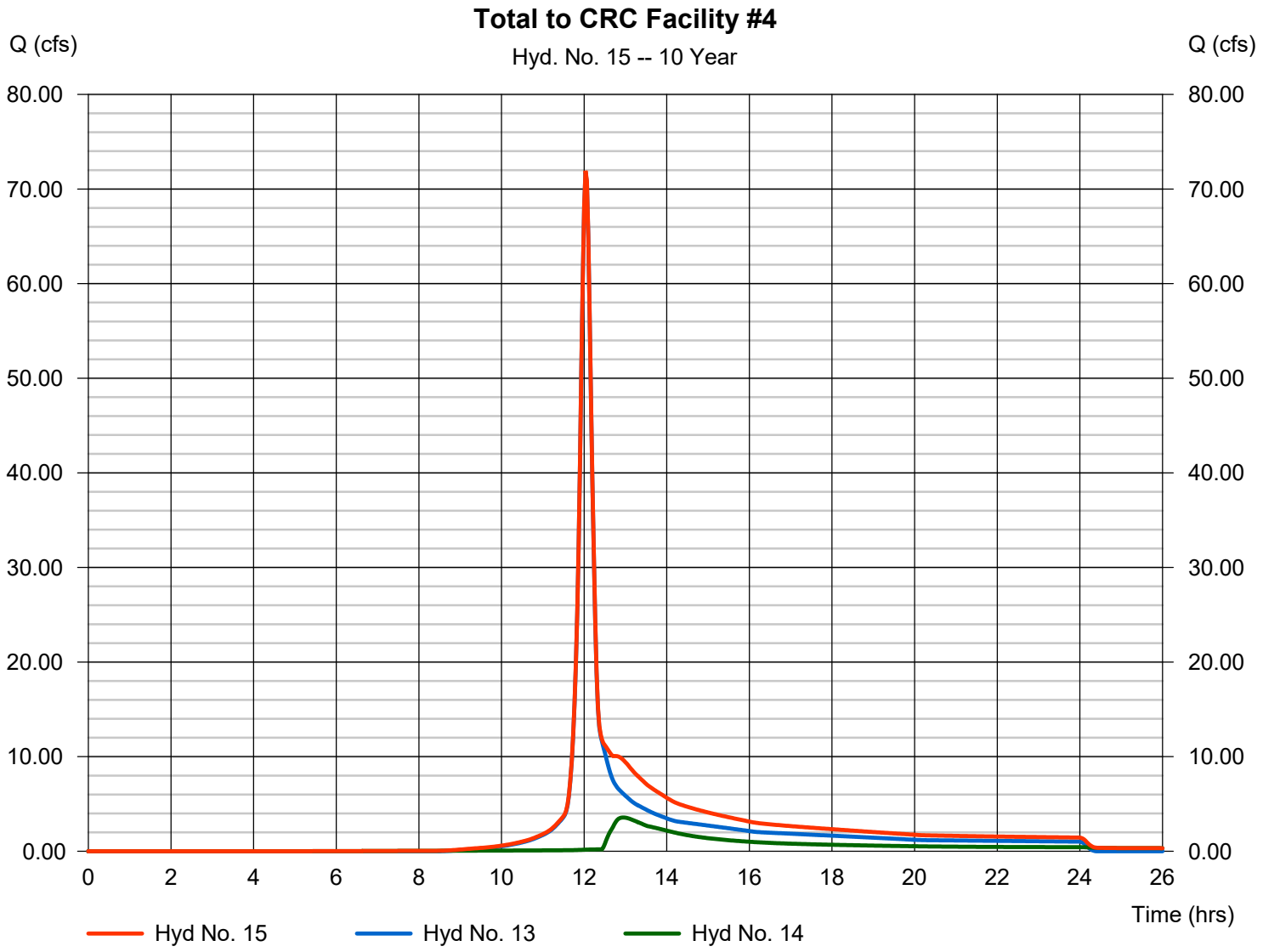


Hydrograph Report

Hyd. No. 15

Total to CRC Facility #4

Hydrograph type	= Combine	Peak discharge	= 71.94 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 288,389 cuft
Inflow hyds.	= 13, 14	Contrib. drain. area	= 27.720 ac



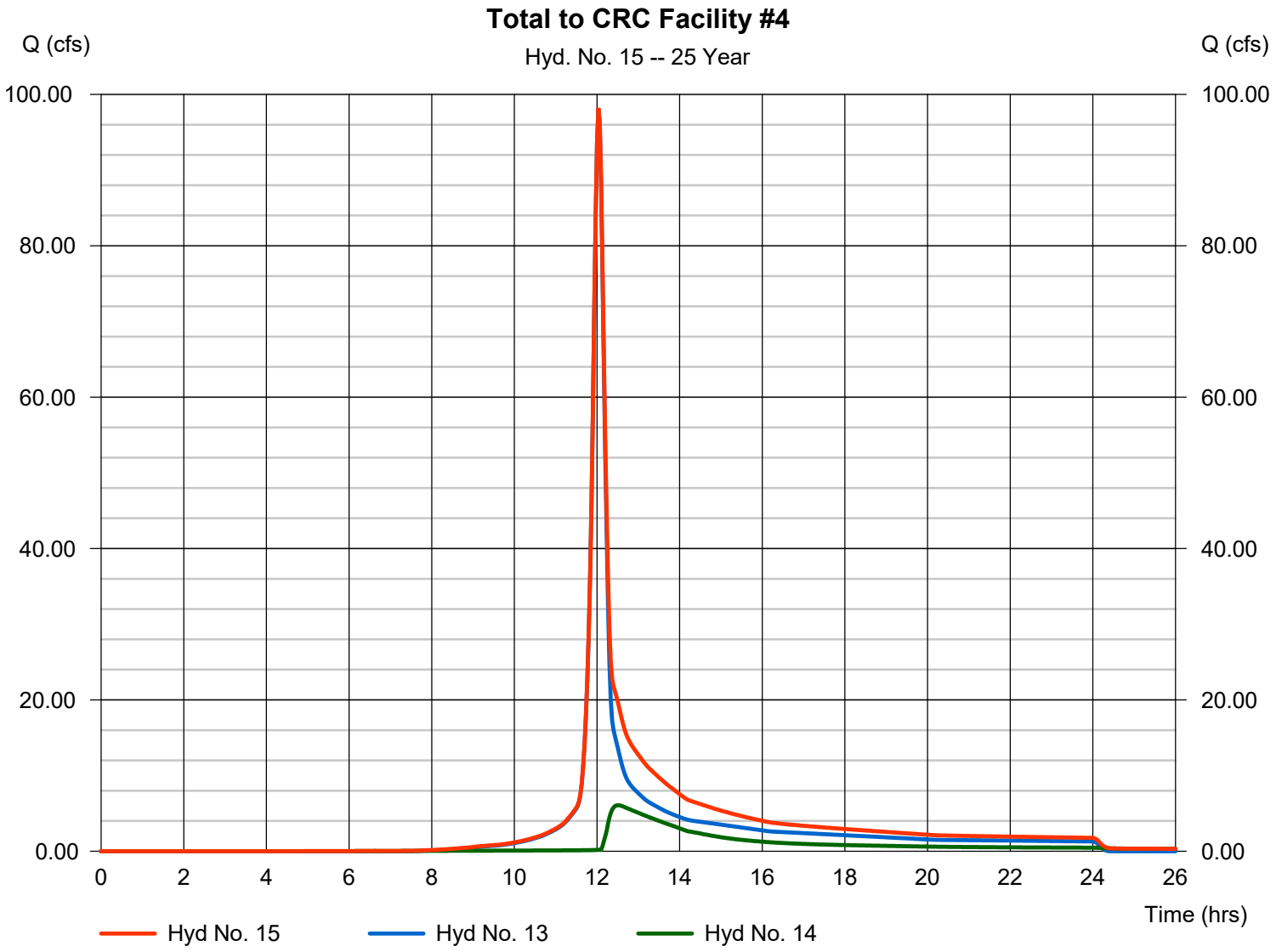
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 01 / 31 / 2018

Hyd. No. 15

Total to CRC Facility #4

Hydrograph type	= Combine	Peak discharge	= 98.23 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 384,481 cuft
Inflow hyds.	= 13, 14	Contrib. drain. area	= 27.720 ac



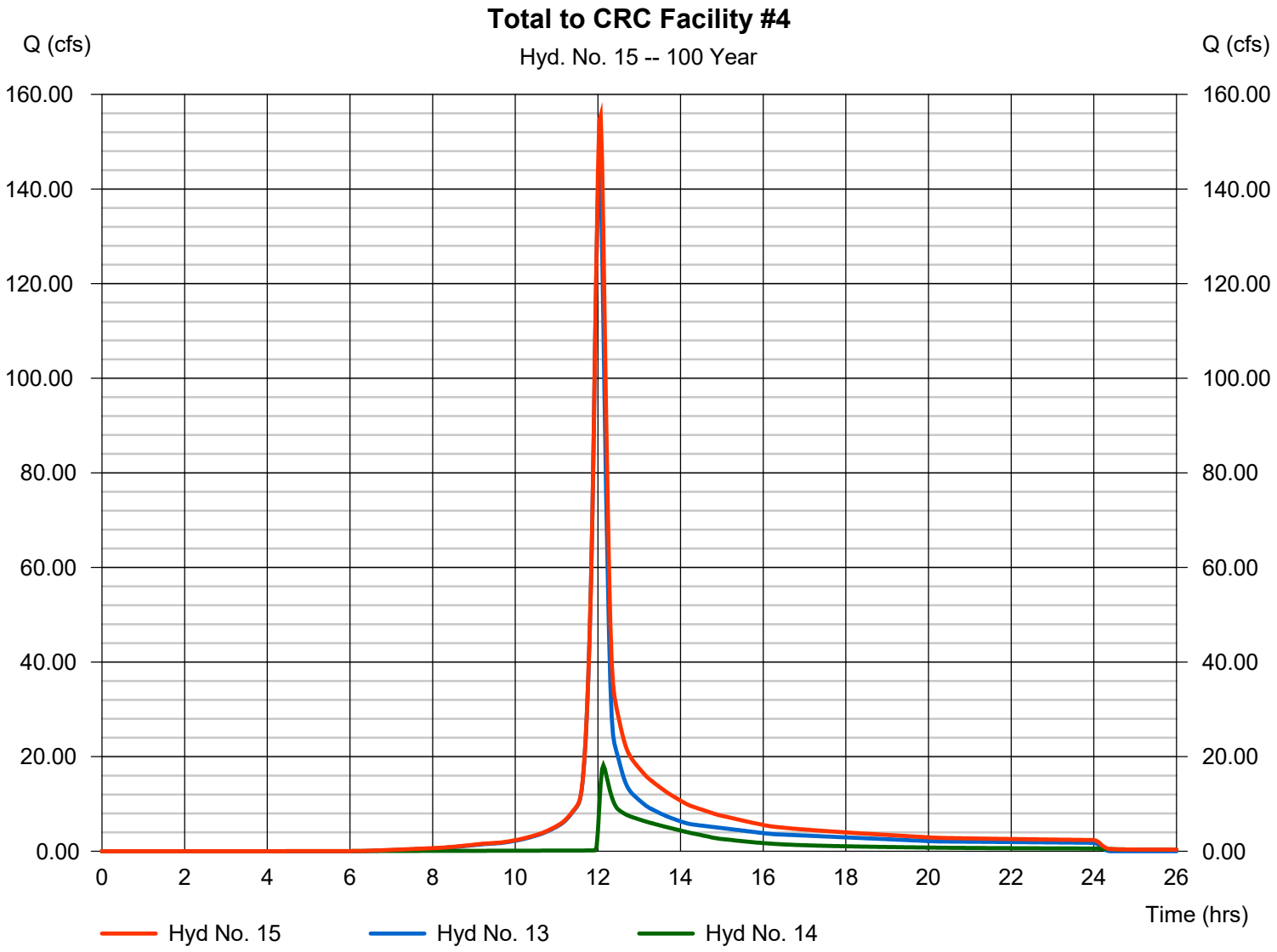
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 01 / 31 / 2018

Hyd. No. 15

Total to CRC Facility #4

Hydrograph type	= Combine	Peak discharge	= 155.52 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 557,913 cuft
Inflow hyds.	= 13, 14	Contrib. drain. area	= 27.720 ac



Pond Report

Pond No. 1 - Facility #4 (2015)

Pond Data

Pond storage is based on user-defined values.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	2101.90	n/a	0	0
2.10	2104.00	n/a	1,873	1,873
4.10	2106.00	n/a	8,276	10,149
6.10	2108.00	n/a	18,339	28,488
8.10	2110.00	n/a	32,060	60,548
10.10	2112.00	n/a	49,963	110,511
12.10	2114.00	n/a	65,253	175,764

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 36.00	3.00	0.00	0.00
Span (in)	= 36.00	3.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 2101.77	2101.90	0.00	0.00
Length (ft)	= 150.69	0.10	0.00	0.00
Slope (%)	= 3.90	0.10	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 9.00	0.00	0.00	0.00
Crest El. (ft)	= 2109.70	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	---	---	---
Multi-Stage	= Yes	No	No	No

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

TW Elev. (ft) = 0.00

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

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	2101.90	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.21	187	2102.11	0.14 ic	0.07 ic	---	---	0.00	---	---	---	---	---	0.069
0.42	375	2102.32	0.14 ic	0.13 ic	---	---	0.00	---	---	---	---	---	0.128
0.63	562	2102.53	0.18 ic	0.17 ic	---	---	0.00	---	---	---	---	---	0.168
0.84	749	2102.74	0.20 ic	0.20 ic	---	---	0.00	---	---	---	---	---	0.200
1.05	937	2102.95	0.23 ic	0.23 ic	---	---	0.00	---	---	---	---	---	0.227
1.26	1,124	2103.16	0.26 ic	0.25 ic	---	---	0.00	---	---	---	---	---	0.252
1.47	1,311	2103.37	0.29 ic	0.27 ic	---	---	0.00	---	---	---	---	---	0.274
1.68	1,498	2103.58	0.29 ic	0.29 ic	---	---	0.00	---	---	---	---	---	0.295
1.89	1,686	2103.79	0.33 ic	0.31 ic	---	---	0.00	---	---	---	---	---	0.314
2.10	1,873	2104.00	0.33 ic	0.33 ic	---	---	0.00	---	---	---	---	---	0.332
2.30	2,701	2104.20	0.37 ic	0.35 ic	---	---	0.00	---	---	---	---	---	0.349
2.50	3,528	2104.40	0.37 ic	0.36 ic	---	---	0.00	---	---	---	---	---	0.364
2.70	4,356	2104.60	0.41 ic	0.38 ic	---	---	0.00	---	---	---	---	---	0.379
2.90	5,183	2104.80	0.41 ic	0.39 ic	---	---	0.00	---	---	---	---	---	0.394
3.10	6,011	2105.00	0.41 ic	0.41 ic	---	---	0.00	---	---	---	---	---	0.408
3.30	6,839	2105.20	0.45 ic	0.42 ic	---	---	0.00	---	---	---	---	---	0.421
3.50	7,666	2105.40	0.45 ic	0.43 ic	---	---	0.00	---	---	---	---	---	0.434
3.70	8,494	2105.60	0.45 ic	0.45 ic	---	---	0.00	---	---	---	---	---	0.447
3.90	9,321	2105.80	0.46 ic	0.46 ic	---	---	0.00	---	---	---	---	---	0.459
4.10	10,149	2106.00	0.50 ic	0.47 ic	---	---	0.00	---	---	---	---	---	0.471
4.30	11,983	2106.20	0.50 ic	0.48 ic	---	---	0.00	---	---	---	---	---	0.483
4.50	13,817	2106.40	0.50 ic	0.49 ic	---	---	0.00	---	---	---	---	---	0.494
4.70	15,651	2106.60	0.51 ic	0.51 ic	---	---	0.00	---	---	---	---	---	0.505
4.90	17,485	2106.80	0.55 ic	0.52 ic	---	---	0.00	---	---	---	---	---	0.516
5.10	19,319	2107.00	0.55 ic	0.53 ic	---	---	0.00	---	---	---	---	---	0.527
5.30	21,152	2107.20	0.55 ic	0.54 ic	---	---	0.00	---	---	---	---	---	0.537
5.50	22,986	2107.40	0.55 ic	0.55 ic	---	---	0.00	---	---	---	---	---	0.548
5.70	24,820	2107.60	0.56 ic	0.56 ic	---	---	0.00	---	---	---	---	---	0.558
5.90	26,654	2107.80	0.57 ic	0.57 ic	---	---	0.00	---	---	---	---	---	0.567
6.10	28,488	2108.00	0.61 ic	0.58 ic	---	---	0.00	---	---	---	---	---	0.577
6.30	31,694	2108.20	0.61 ic	0.59 ic	---	---	0.00	---	---	---	---	---	0.586
6.50	34,900	2108.40	0.61 ic	0.60 ic	---	---	0.00	---	---	---	---	---	0.596
6.70	38,106	2108.60	0.61 ic	0.61 ic	---	---	0.00	---	---	---	---	---	0.605
6.90	41,312	2108.80	0.61 ic	0.61 ic	---	---	0.00	---	---	---	---	---	0.614
7.10	44,518	2109.00	0.62 ic	0.62 ic	---	---	0.00	---	---	---	---	---	0.623
7.30	47,724	2109.20	0.67 ic	0.63 ic	---	---	0.00	---	---	---	---	---	0.632

Continues on next page...

Facility #4 (2015)

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
7.50	50,930	2109.40	0.67 ic	0.64 ic	---	---	0.00	---	---	---	---	---	0.640
7.70	54,136	2109.60	0.67 ic	0.65 ic	---	---	0.00	---	---	---	---	---	0.649
7.90	57,342	2109.80	1.64 ic	0.65 ic	---	---	0.95	---	---	---	---	---	1.600
8.10	60,548	2110.00	5.74 ic	0.64 ic	---	---	4.93	---	---	---	---	---	5.566
8.30	65,544	2110.20	11.49 ic	0.63 ic	---	---	10.60	---	---	---	---	---	11.23
8.50	70,541	2110.40	18.43 ic	0.62 ic	---	---	17.55	---	---	---	---	---	18.17
8.70	75,537	2110.60	26.28 ic	0.61 ic	---	---	25.60	---	---	---	---	---	26.21
8.90	80,533	2110.80	35.20 ic	0.60 ic	---	---	34.58	---	---	---	---	---	35.18
9.10	85,529	2111.00	34.93 ic	0.61 ic	---	---	31.04 ic	---	---	---	---	---	31.65
9.30	90,526	2111.20	34.66 ic	0.62 ic	---	---	33.34 ic	---	---	---	---	---	33.96
9.50	95,522	2111.40	36.12 ic	0.63 ic	---	---	35.49 ic	---	---	---	---	---	36.12
9.70	100,518	2111.60	38.15 ic	0.63 ic	---	---	37.52 ic	---	---	---	---	---	38.15
9.90	105,515	2111.80	40.08 ic	0.63 ic	---	---	39.45 ic	---	---	---	---	---	40.08
10.10	110,511	2112.00	41.92 ic	0.63 ic	---	---	41.28 ic	---	---	---	---	---	41.92
10.30	117,036	2112.20	43.68 ic	0.64 ic	---	---	43.04 ic	---	---	---	---	---	43.68
10.50	123,562	2112.40	45.37 ic	0.64 ic	---	---	44.73 ic	---	---	---	---	---	45.37
10.70	130,087	2112.60	47.00 ic	0.64 ic	---	---	46.35 ic	---	---	---	---	---	47.00
10.90	136,612	2112.80	48.57 ic	0.65 ic	---	---	47.93 ic	---	---	---	---	---	48.57
11.10	143,138	2113.00	50.10 ic	0.65 ic	---	---	49.45 ic	---	---	---	---	---	50.10
11.30	149,663	2113.20	51.58 ic	0.65 ic	---	---	50.92 ic	---	---	---	---	---	51.58
11.50	156,188	2113.40	53.01 ic	0.66 ic	---	---	52.36 ic	---	---	---	---	---	53.01
11.70	162,713	2113.60	54.42 ic	0.66 ic	---	---	53.76 ic	---	---	---	---	---	54.41
11.90	169,239	2113.80	55.78 ic	0.66 ic	---	---	55.12 ic	---	---	---	---	---	55.78
12.10	175,764	2114.00	57.11 ic	0.66 ic	---	---	56.44 ic	---	---	---	---	---	57.11

...End

Hydrograph Report

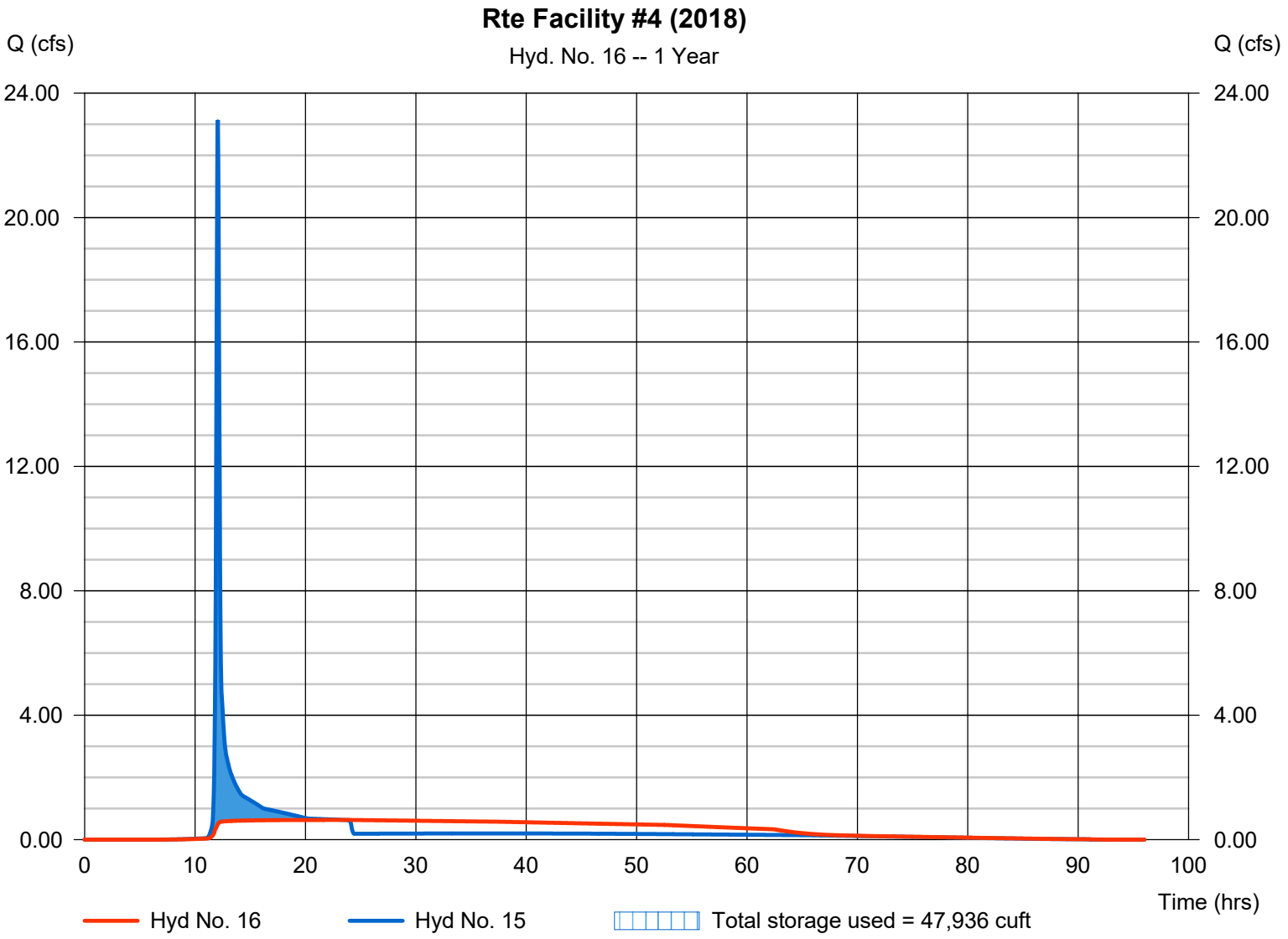
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 01 / 31 / 2018

Hyd. No. 16

Rte Facility #4 (2018)

Hydrograph type	= Reservoir	Peak discharge	= 0.632 cfs
Storm frequency	= 1 yrs	Time to peak	= 23.53 hrs
Time interval	= 2 min	Hyd. volume	= 109,614 cuft
Inflow hyd. No.	= 15 - Total to CRC Facility #4	Max. Elevation	= 2109.21 ft
Reservoir name	= Facility #4 (2015)	Max. Storage	= 47,936 cuft

Storage Indication method used.



Hydrograph Report

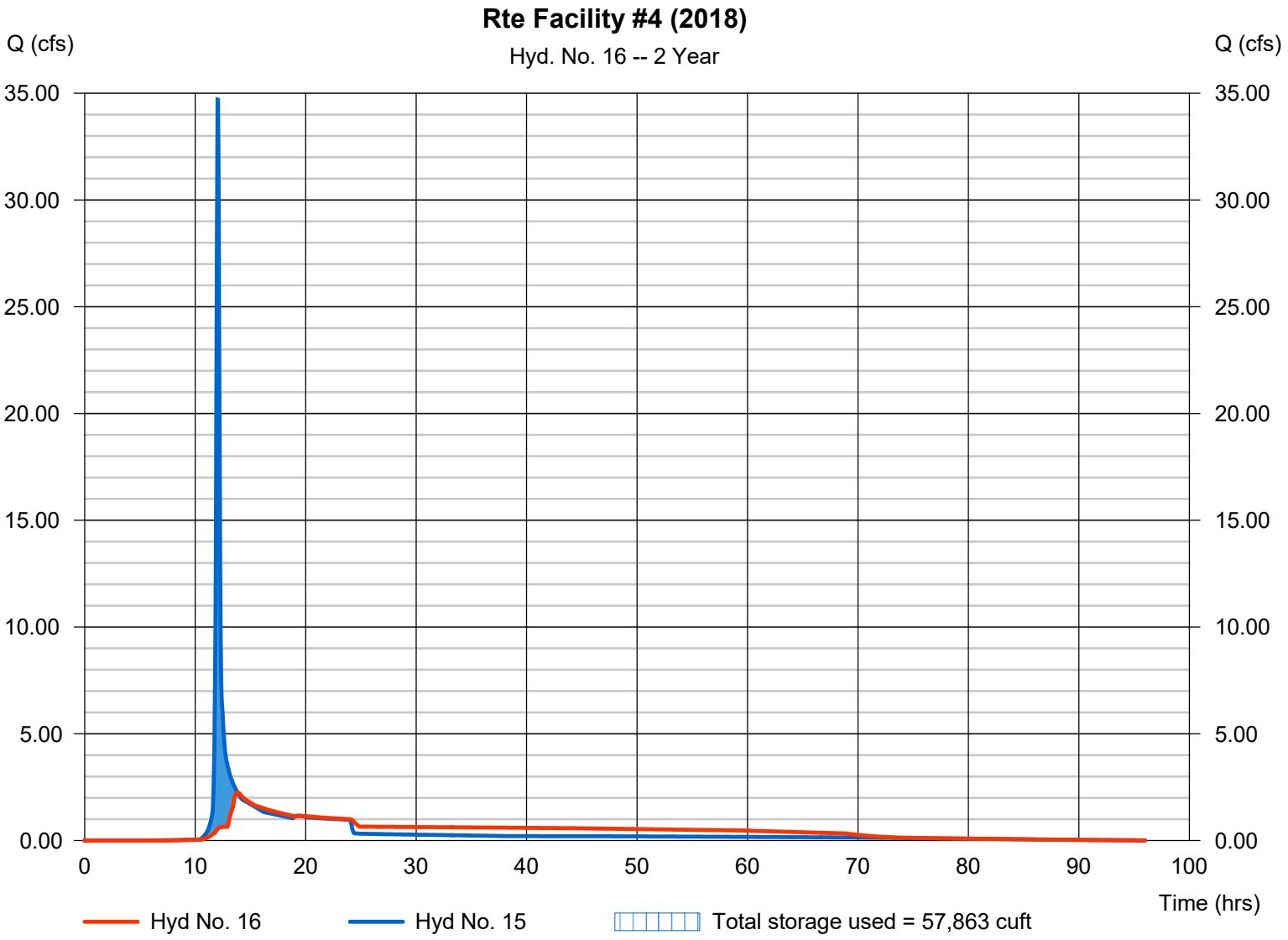
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 01 / 31 / 2018

Hyd. No. 16

Rte Facility #4 (2018)

Hydrograph type	= Reservoir	Peak discharge	= 2.244 cfs
Storm frequency	= 2 yrs	Time to peak	= 13.83 hrs
Time interval	= 2 min	Hyd. volume	= 152,912 cuft
Inflow hyd. No.	= 15 - Total to CRC Facility #4	Max. Elevation	= 2109.83 ft
Reservoir name	= Facility #4 (2015)	Max. Storage	= 57,863 cuft

Storage Indication method used.



Hydrograph Report

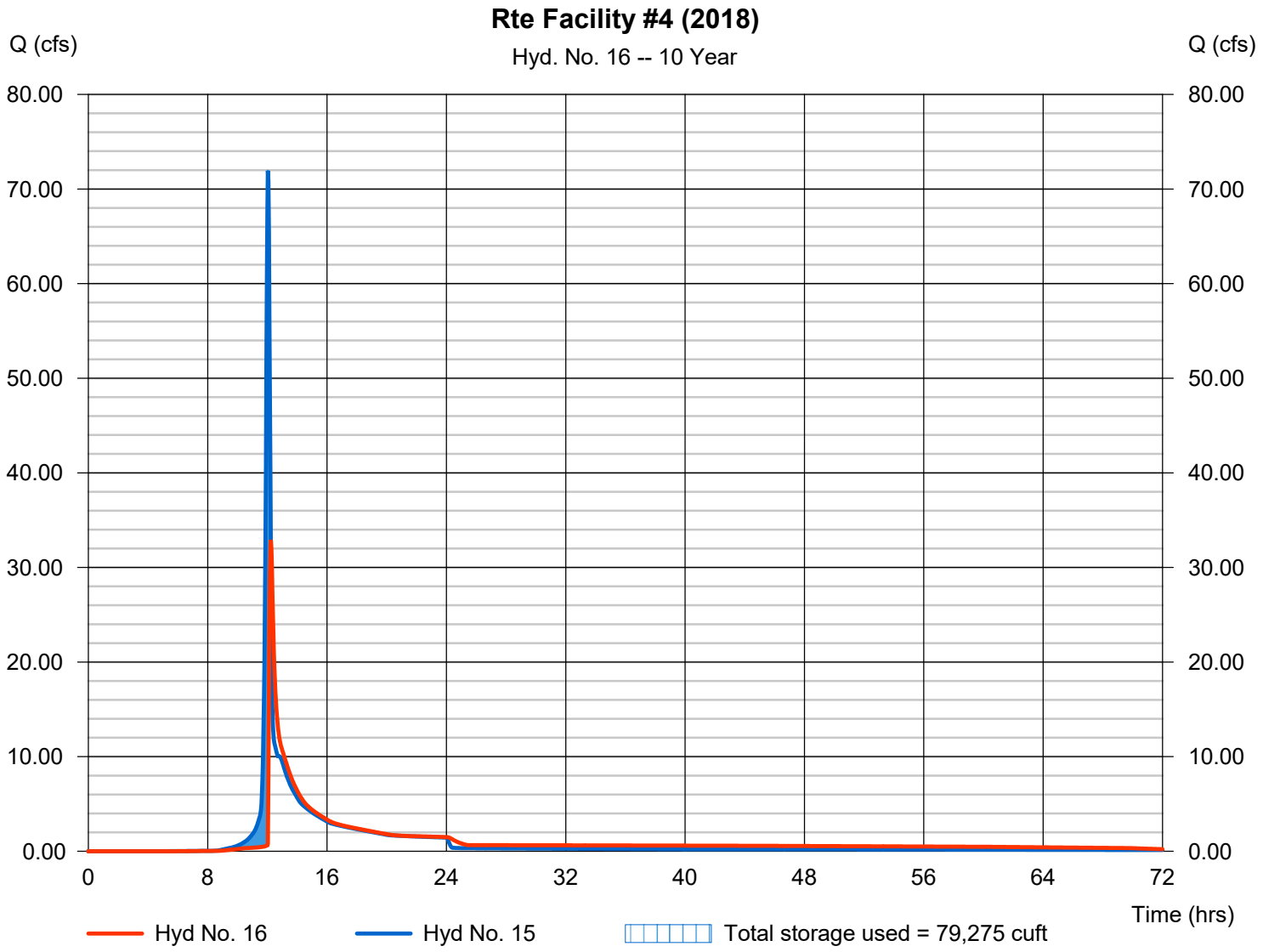
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 01 / 31 / 2018

Hyd. No. 16

Rte Facility #4 (2018)

Hydrograph type	= Reservoir	Peak discharge	= 32.92 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.23 hrs
Time interval	= 2 min	Hyd. volume	= 288,352 cuft
Inflow hyd. No.	= 15 - Total to CRC Facility #4	Max. Elevation	= 2110.75 ft
Reservoir name	= Facility #4 (2015)	Max. Storage	= 79,275 cuft

Storage Indication method used.



Hydrograph Report

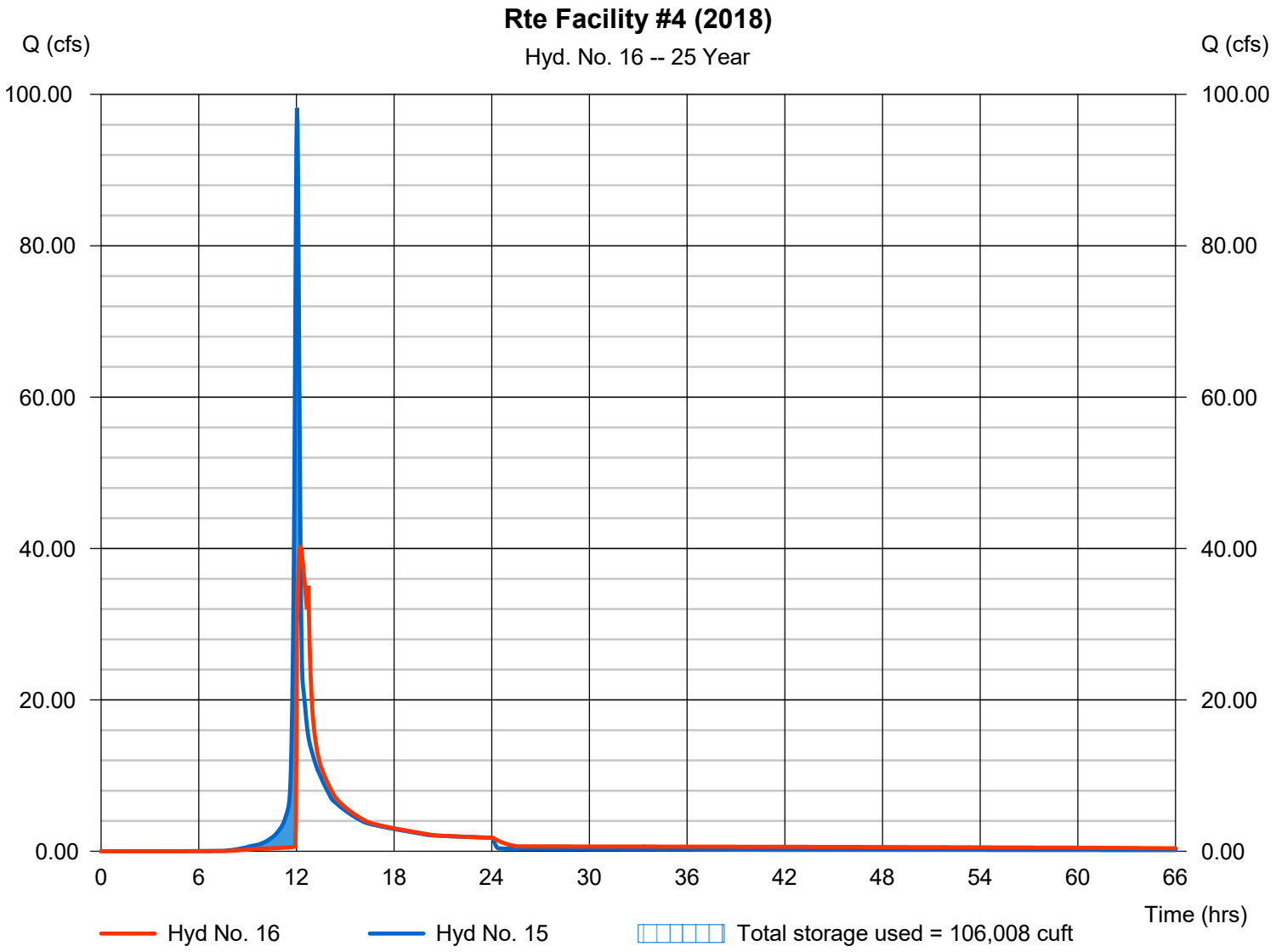
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 01 / 31 / 2018

Hyd. No. 16

Rte Facility #4 (2018)

Hydrograph type	= Reservoir	Peak discharge	= 40.26 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 384,437 cuft
Inflow hyd. No.	= 15 - Total to CRC Facility #4	Max. Elevation	= 2111.83 ft
Reservoir name	= Facility #4 (2015)	Max. Storage	= 106,008 cuft

Storage Indication method used.



Hydrograph Report

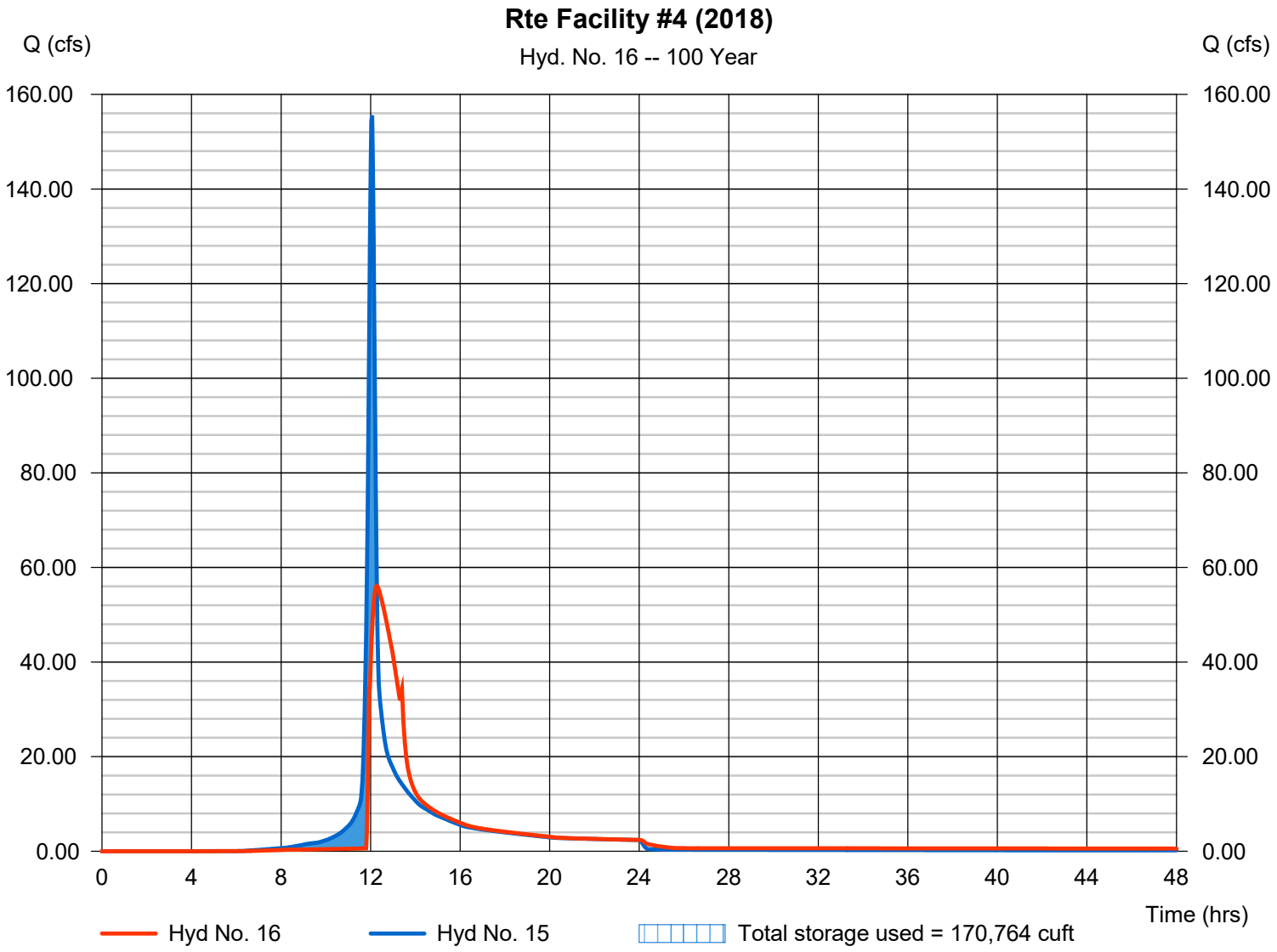
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v12 Wednesday, 01 / 31 / 2018

Hyd. No. 16

Rte Facility #4 (2018)

Hydrograph type	= Reservoir	Peak discharge	= 56.09 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 557,864 cuft
Inflow hyd. No.	= 15 - Total to CRC Facility #4	Max. Elevation	= 2113.85 ft
Reservoir name	= Facility #4 (2015)	Max. Storage	= 170,764 cuft

Storage Indication method used.



APPENDIX G – VIRGINIA RUNOFF REDUCTION METHOD CALCULATIONS

(See attached Drawings)

DEQ Virginia Runoff Reduction Method New Development Compliance Spreadsheet - Version 3.0

☐ 2011 BMP Standards and Specifications ☑ 2013 Draft BMP Standards and Specifications

Project Name: 30R @ CRC
Date: 8/10/2017
BMP Design Specifications List: 2013 Draft Stds & Specs

CLEAR ALL

data input cells
constant values
calculation cells
final results

Site Information

Post-Development Project (Treatment Volume and Loads)

Land Cover (acres)

	A Soils	B Soils	C Soils	D Soils	Totals
Forest/Open Space (acres) -- undisturbed, protected forest/open space or reforested land					0.00
Managed Turf (acres) -- disturbed, graded for yards or other turf to be mowed/managed		3.05	0.85	0.10	4.00
Impervious Cover (acres)		5.30	0.25		5.55
					9.55

Constants

Annual Rainfall (inches)	43
Target Rainfall Event (inches)	1.00
Total Phosphorus (TP) EMC (mg/L)	0.26
Total Nitrogen (TN) EMC (mg/L)	1.86
Target TP Load (lb/acre/yr)	0.41
Pj (unitless correction factor)	0.90

Runoff Coefficients (Rv)

	A Soils	B Soils	C Soils	D Soils
Forest/Open Space	0.02	0.03	0.04	0.05
Managed Turf	0.15	0.20	0.22	0.25
Impervious Cover	0.95	0.95	0.95	0.95

Post-Development Requirement for Site Area

TP Load Reduction Required (lb/yr)	**9.98**

LAND COVER SUMMARY -- POST DEVELOPMENT

Land Cover Summary	
Forest/Open Space Cover (acres)	0.00
Weighted Rv (forest)	0.00
% Forest	0%
Managed Turf Cover (acres)	4.00
Weighted Rv (turf)	0.21
% Managed Turf	42%
Impervious Cover (acres)	5.55
Rv (impervious)	0.95
% Impervious	58%
Site Area (acres)	**9.55**
Site Rv	**0.64**

Treatment Volume and Nutrient Loads	
Treatment Volume (acre-ft)	0.5079
Treatment Volume (cubic feet)	22,123
TP Load (lb/yr)	13.90
TN Load (lb/yr) (Informational Purposes Only)	99.44

P.O. Box 142 Penn Laird, VA 22846 · (540) 908-1679 · www.VirginiaNutrientBank.com

January 15, 2018

Simon L Rutrough, PE
Parker Design Group, Inc.
2122 Carolina Avenue, SW
Roanoke, VA 24014

Re: Nutrient Credit Availability – Olver Property - Blacksburg

Mr. Rutrough,

The Virginia Nutrient Bank (VNB) is pleased to preliminary reserve approximately 10± pounds per year of phosphorus offsets (nutrient credits) for the Olver Property in Blacksburg. The project is located in the Upper New River Basin.

VNB has approval from the Virginia Department of Environmental Quality (VDEQ) for Nonpoint Source Offset Generation Certification. VNB is approved to transfer nutrient credits in accordance with the Chesapeake Bay Watershed Nutrient Credit Exchange Program (VA Code 62.1-44.19:14 et seq). These offsets are also transferable in accordance with the Virginia stormwater offset program (VA Code 62.1-44.15:35) and the Virginia Soil and Water Conservation Board's Guidance Document on Stormwater Nonpoint Nutrient Offsets approved on July 23, 2009, to those regulator entities qualifying for nutrient offsets.

VNB manages the Hiwassee Nutrient Bank located near Hiwassee in Pulaski County that will generate roughly 68 pounds of phosphorus reduction and roughly 318 pounds of nitrogen reduction per. Upon final approval and closing, VNB will retire 10± pounds of phosphorus credits in accordance with the Nutrient Offset Certification regulations.

Respectfully,
Virginia Nutrient Bank, LLC

Nathan W. Blackwell, PE
540-908-1679
Owner - Conservation Director