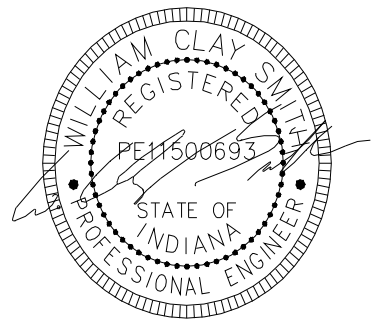


KOENIG EQUIPMENT  
STORM WATER MANAGEMENT MANUAL  
NEW STORM WATER DETENTION BASIN



Owner: KOENIG EQUIPMENT, INC.  
P.O. BOX 549  
BOTKINS, OHIO 45306

## **TABLE OF CONTENTS**

INTRODUCTION .....	3
BACKGROUND DATA .....	3
STORMWATER SUMMARY.....	3
MAINTENANCE CHECKLIST .....	4
DRAINAGE MAP.. .....	5
FEMA'S NATIONAL FLOOD HAZARD MAP.....	6
STORM WATER CALCULATIONS DETENTION BASIN.....	7-28

## **INTRODUCTION**

Koenig Equipment Inc. is planning to construct a new facility at the north east corner of US 31 and Sloan Drive in the City of Franklin, Johnson County, Indiana. Koenig Equipment is a Dealership for John Deere Equipment and lawn care service products. The existing property is a 5.00 acre site that is currently a farm field. Approximately 4.91 acres of the 5.00 acres site will be disturbed of which 2.84 acre will be new impervious area and the remaining area will be new green space. The new impervious areas will require storm water detention by adding a new detention basin on the west side of the property to detain the additional storm water run off.

## **BACKGROUND DATA**

The existing property drains west to a 30" RCP culvert pipe that drains east to west under US 31. Silt fencing and other sediment controls shall be installed before any site grading shall proceed. The detention basin outlet will reduce the rate of storm water runoff to meet the City of Franklin requirements. Storm water calculations were completed using Hydraflow Hydrographs Extension for Autodesk Civil 3D 2019 using the SCS Curve Number Method with rainfall data from NOAA.

## **STORMWATER SUMMARY**

Table 1-Allowable Release Rates  
West Detention Basin

Storm Event (Year)	Existing Peak Flow Rate (cfs)	Developed Peak Flow Rate (cfs)
1	2.054	0.934
2	3.160	1.138
5	6.103	1.618
10	8.352	1.816
25	11.500	2.048
50	13.990	2.248
100	16.640	2.868

## **CONCLUSION**

The 5.00 acre site has a predeveloped CN of 72 with the existing farm field; the proposed developed site will have a CN of 73 with the new impervious areas of the new facility and new permeable areas of the new green space surrounding the new facility.

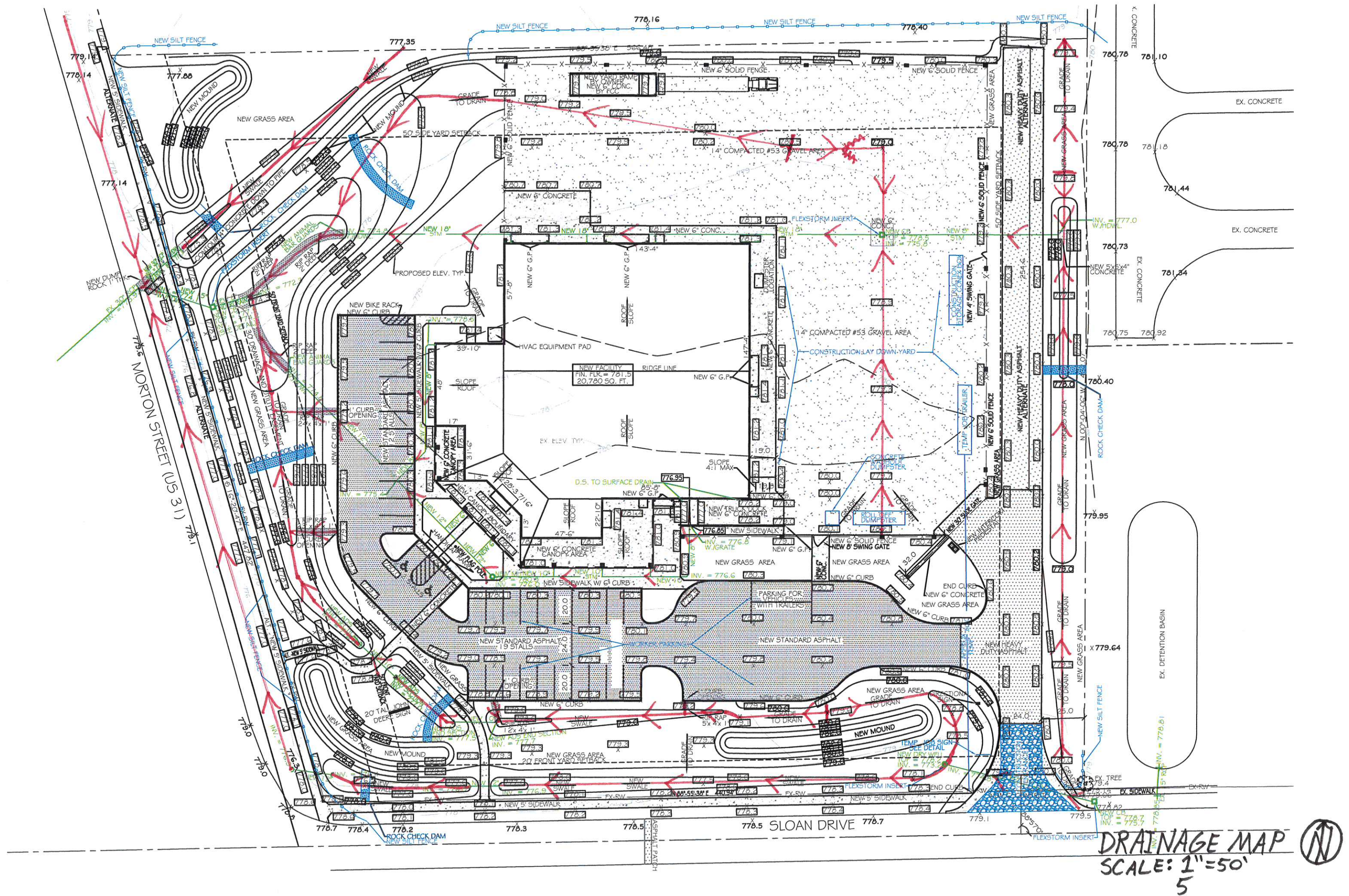
The New Detention Basin will have a maximum storage capacity of 35,938 Cu. Ft. which is the top bank overflow elevation of 778.5 of the detention basin. The 100 year storm will bring the new detention basin to an elevation of 777.57 with a storage capacity of 20,985 Cu. Ft. The new detention basin will reduce the 100 year storm runoff rate of the site to 2.868 CFS which is less than the 2 year storm of the predeveloped site at 3.160 CFS.

## **Stormwater Management Maintenance**

### **Checklist**

1. Check for embankment erosion on side slopes. Fill erosion areas and seed.
2. Check and remove any trash buildup at outlet and bottom of catch basins.
3. Check for any bare soil areas and seed accordingly.
4. Water and fertilize plantings. Remove and replace any plantings that have died.
5. Weed and remove any evasive plants.



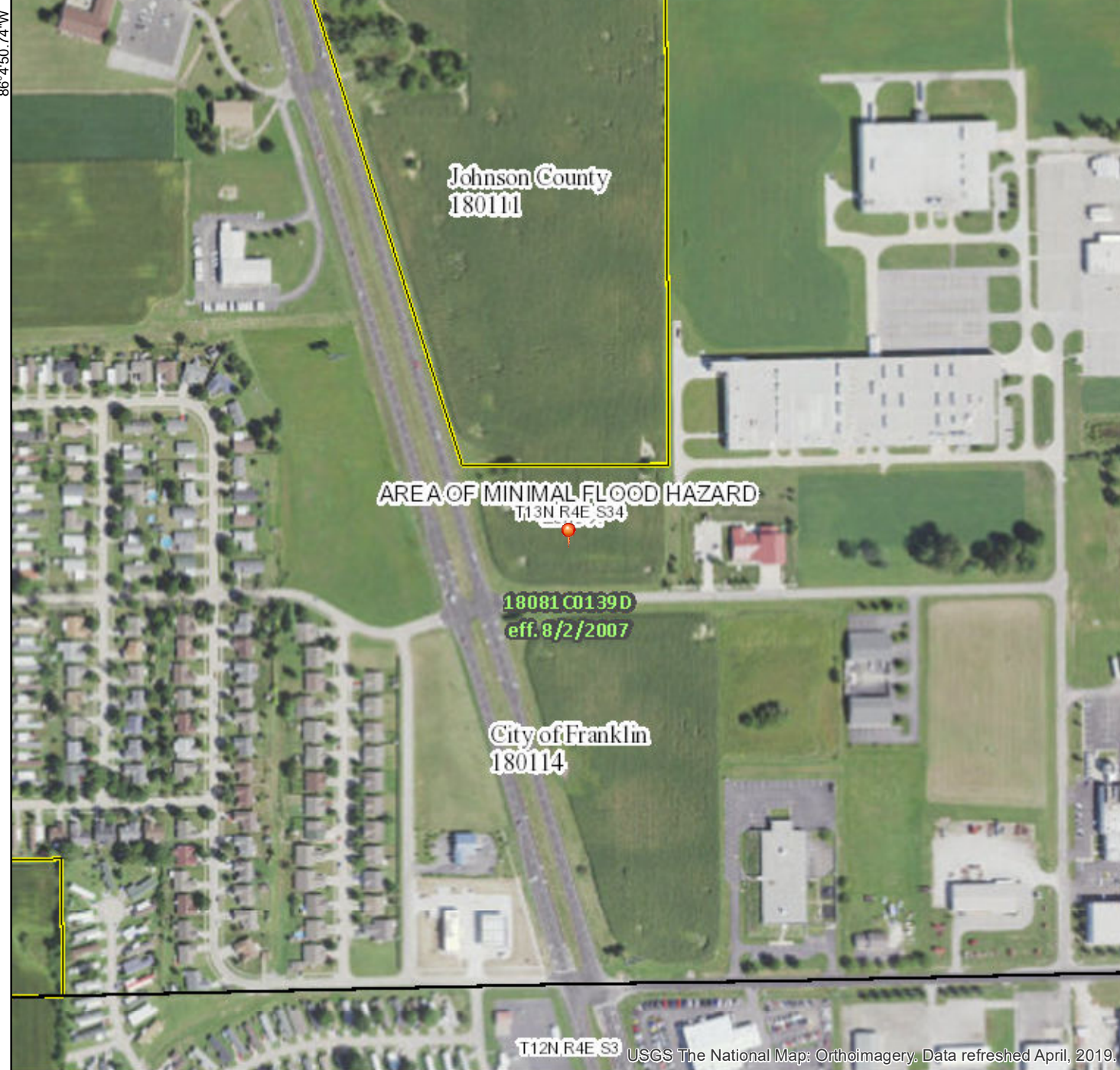




# National Flood Hazard Layer FIRMette



39°31'39.15"N



0 250 500 1,000 1,500 2,000 Feet 1:6,000

USGS The National Map: Orthoimagery, Data refreshed April, 2019.

## Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS		Without Base Flood Elevation (BFE) Zone A, V, A99
		With BFE or Depth Zone AE, AO, AH, VE, AR
		Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD		0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
		Future Conditions 1% Annual Chance Flood Hazard Zone X
		Area with Reduced Flood Risk due to Levee. See Notes. Zone X
		Area with Flood Risk due to Levee Zone D
OTHER AREAS		NO SCREEN Area of Minimal Flood Hazard Zone X
		Effective LOMRs
		Area of Undetermined Flood Hazard Zone D
GENERAL STRUCTURES		Channel, Culvert, or Storm Sewer
		Levee, Dike, or Floodwall
OTHER FEATURES		20.2 Cross Sections with 1% Annual Chance Water Surface Elevation
		17.5
		Coastal Transect
		Base Flood Elevation Line (BFE)
		Limit of Study
		Jurisdiction Boundary
		Coastal Transect Baseline
MAP PANELS		Digital Data Available
		No Digital Data Available
		Unmapped



The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on **6/4/2020 at 10:01:12 AM** and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

86°41'32.8"W

39°31'11.40"N

# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

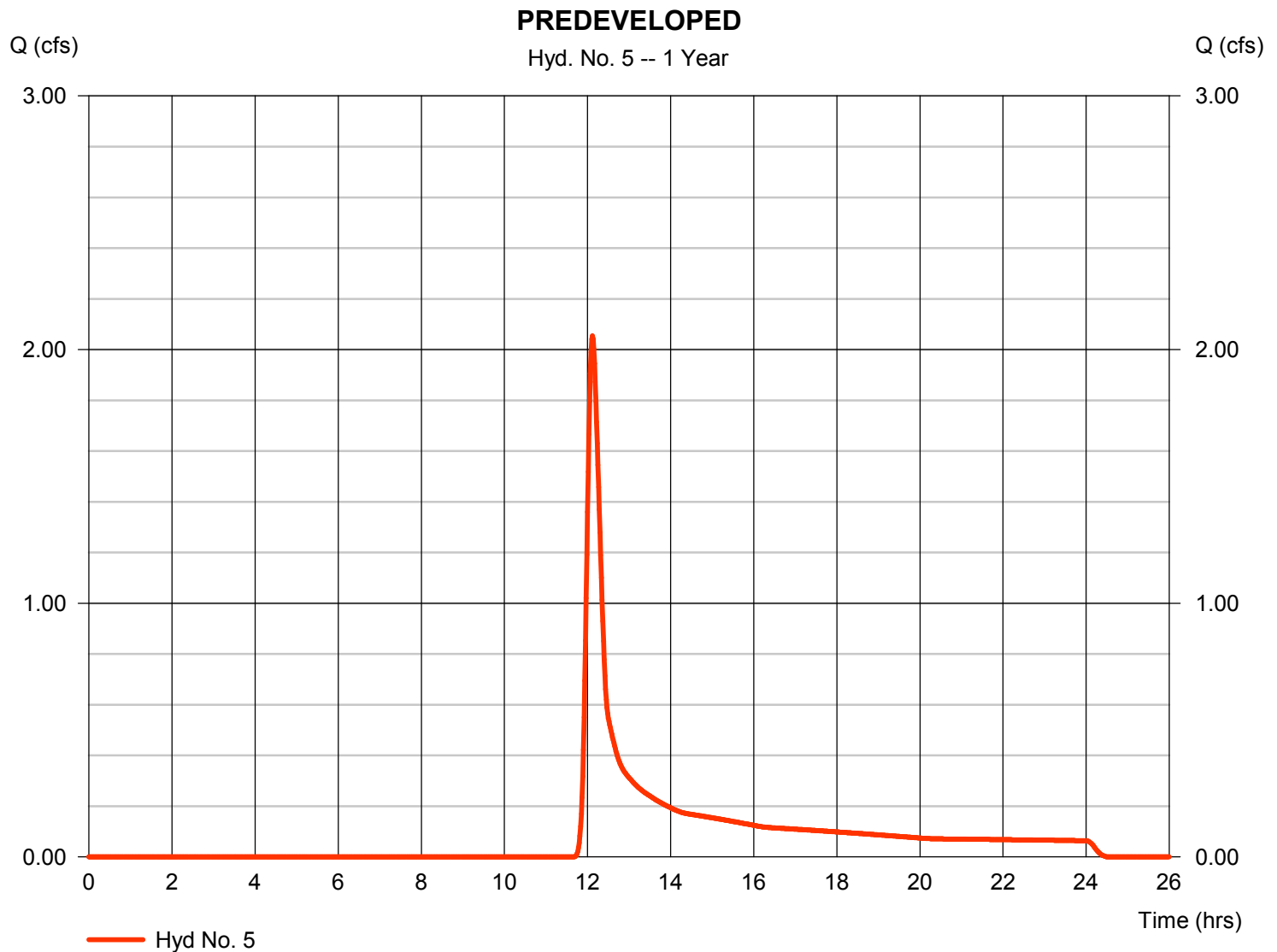
Friday, 06 / 5 / 2020

## Hyd. No. 5

### PREDEVELOPED

Hydrograph type = SCS Runoff  
 Storm frequency = 1 yrs  
 Time interval = 1 min  
 Drainage area = 5.000 ac  
 Basin Slope = 1.0 %  
 Tc method = LAG  
 Total precip. = 2.33 in  
 Storm duration = 24 hrs

Peak discharge = 2.054 cfs  
 Time to peak = 12.12 hrs  
 Hyd. volume = 8,037 cuft  
 Curve number = 72  
 Hydraulic length = 380 ft  
 Time of conc. (Tc) = 18.55 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

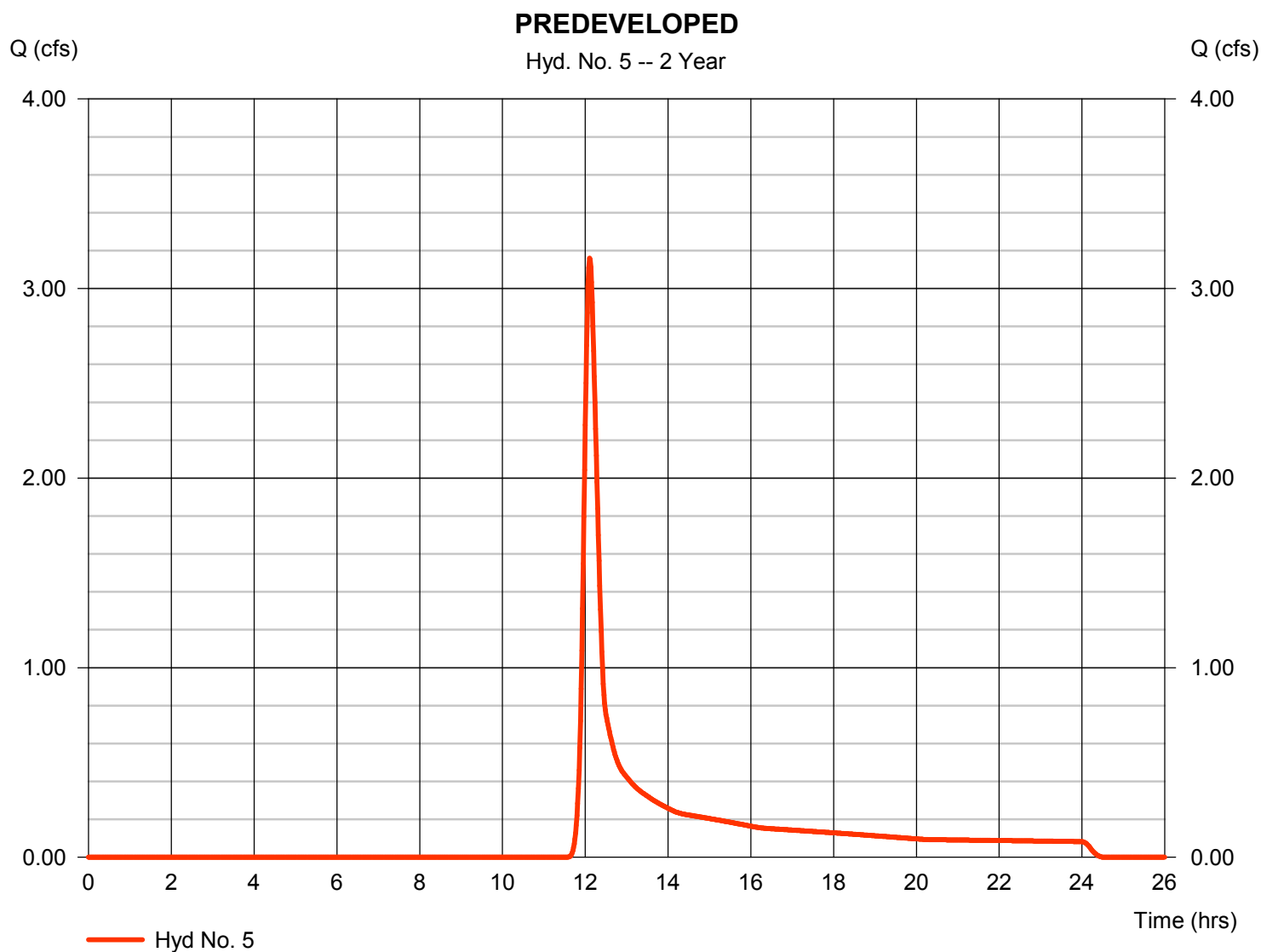
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Friday, 06 / 5 / 2020

## Hyd. No. 5

### PREDEVELOPED

Hydrograph type	= SCS Runoff	Peak discharge	= 3.160 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.10 hrs
Time interval	= 1 min	Hyd. volume	= 11,341 cuft
Drainage area	= 5.000 ac	Curve number	= 72
Basin Slope	= 1.0 %	Hydraulic length	= 380 ft
Tc method	= LAG	Time of conc. (Tc)	= 18.55 min
Total precip.	= 2.68 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484





# Hydrograph Report

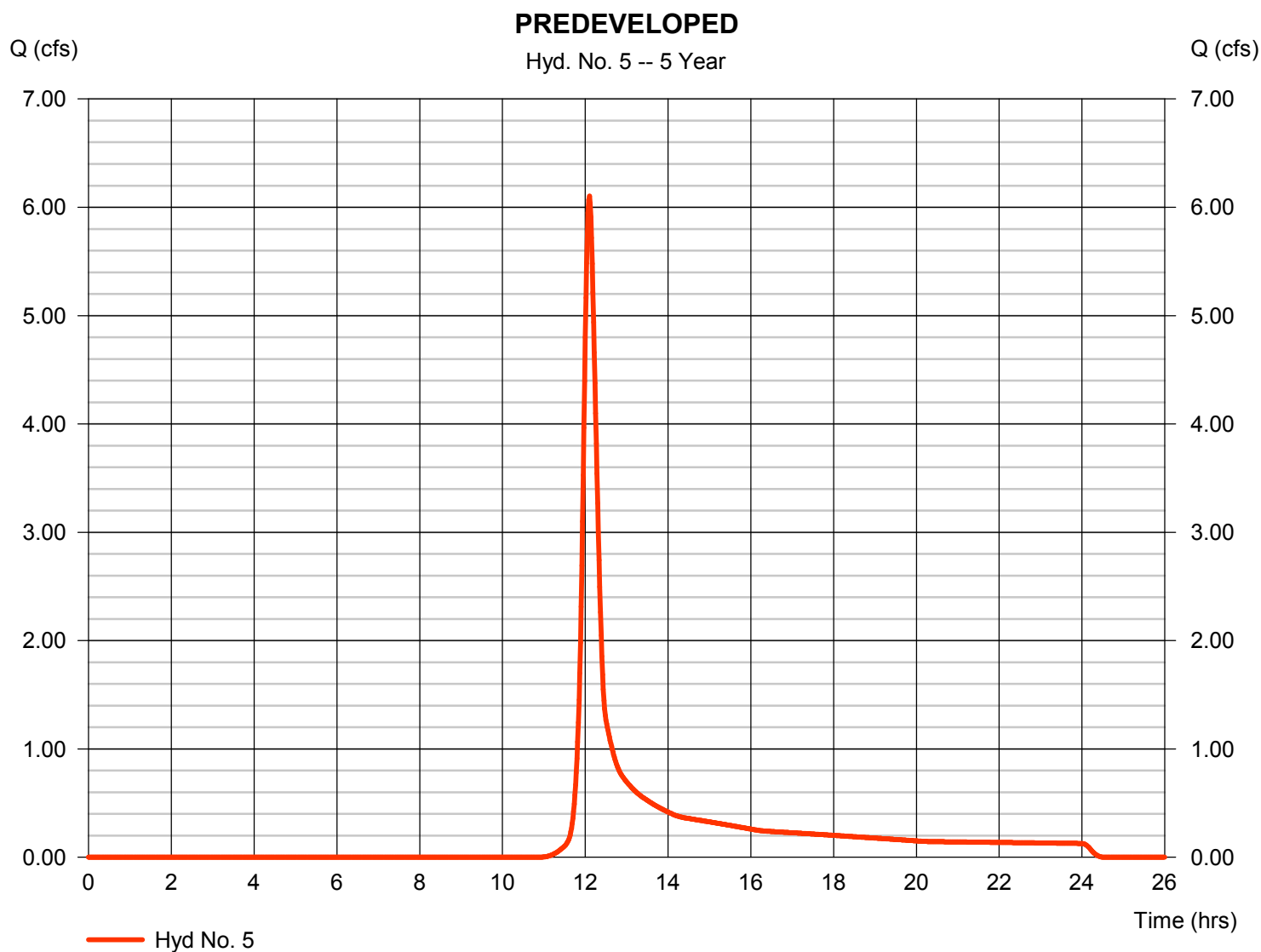
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Friday, 06 / 5 / 2020

## Hyd. No. 5

### PREDEVELOPED

Hydrograph type	= SCS Runoff	Peak discharge	= 6.103 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.10 hrs
Time interval	= 1 min	Hyd. volume	= 20,108 cuft
Drainage area	= 5.000 ac	Curve number	= 72
Basin Slope	= 1.0 %	Hydraulic length	= 380 ft
Tc method	= LAG	Time of conc. (Tc)	= 18.55 min
Total precip.	= 3.48 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

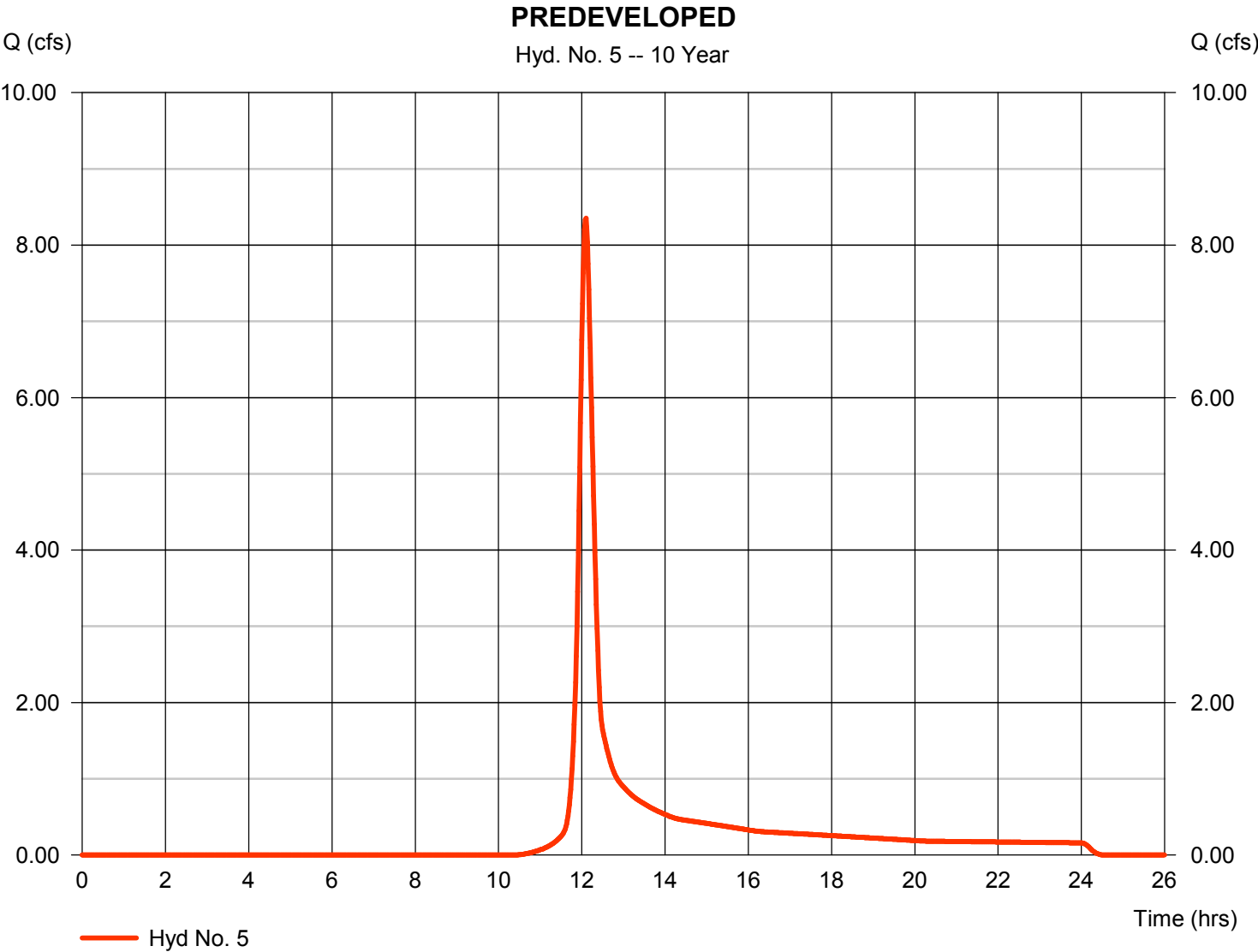
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Friday, 06 / 5 / 2020

## Hyd. No. 5

### PREDEVELOPED

Hydrograph type	= SCS Runoff	Peak discharge	= 8.352 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.10 hrs
Time interval	= 1 min	Hyd. volume	= 26,883 cuft
Drainage area	= 5.000 ac	Curve number	= 72
Basin Slope	= 1.0 %	Hydraulic length	= 380 ft
Tc method	= LAG	Time of conc. (Tc)	= 18.55 min
Total precip.	= 4.03 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

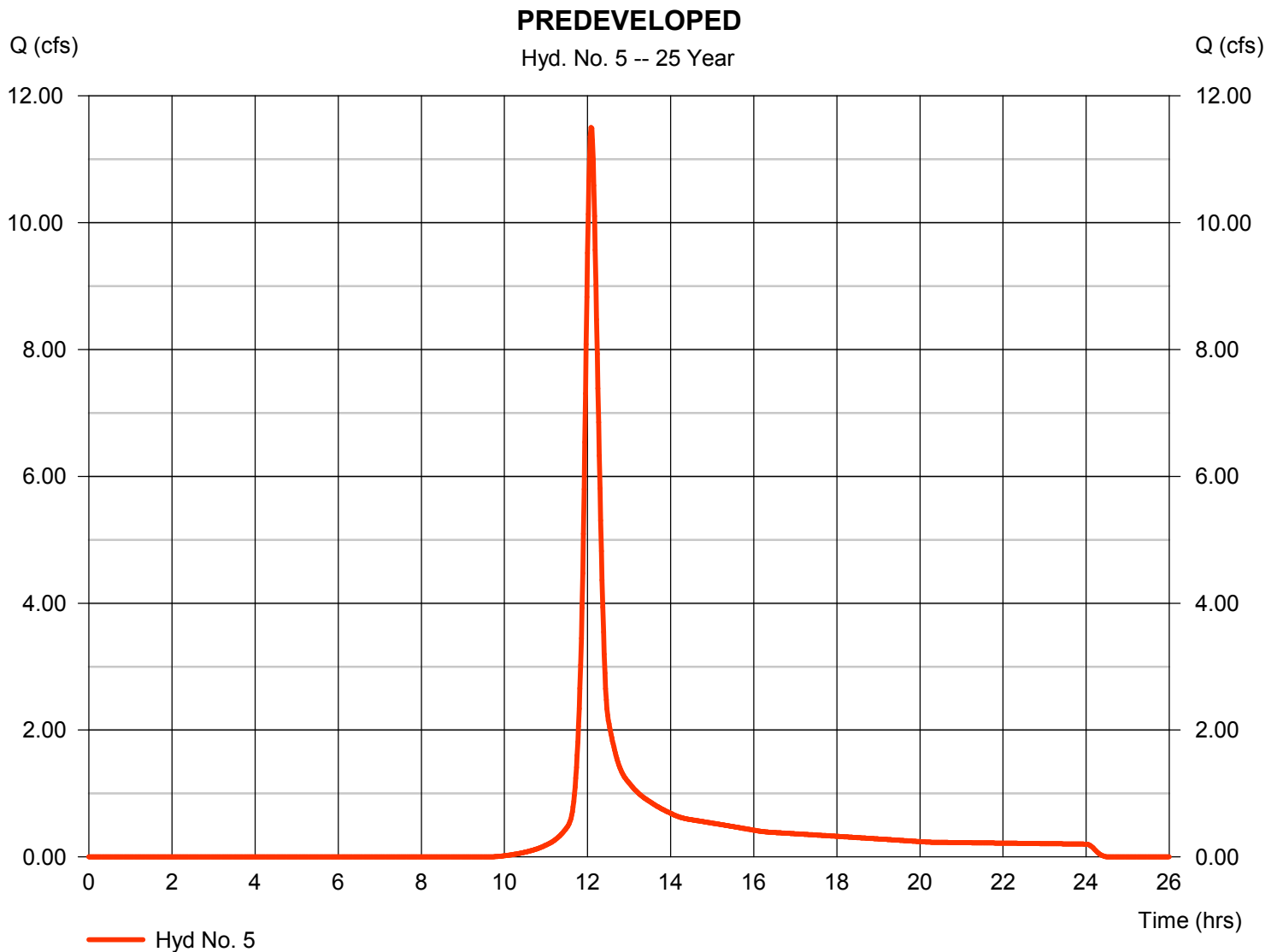
Friday, 06 / 5 / 2020

## Hyd. No. 5

### PREDEVELOPED

Hydrograph type = SCS Runoff  
 Storm frequency = 25 yrs  
 Time interval = 1 min  
 Drainage area = 5.000 ac  
 Basin Slope = 1.0 %  
 Tc method = LAG  
 Total precip. = 4.75 in  
 Storm duration = 24 hrs

Peak discharge = 11.50 cfs  
 Time to peak = 12.08 hrs  
 Hyd. volume = 36,430 cuft  
 Curve number = 72  
 Hydraulic length = 380 ft  
 Time of conc. (Tc) = 18.55 min  
 Distribution = Type II  
 Shape factor = 484





# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

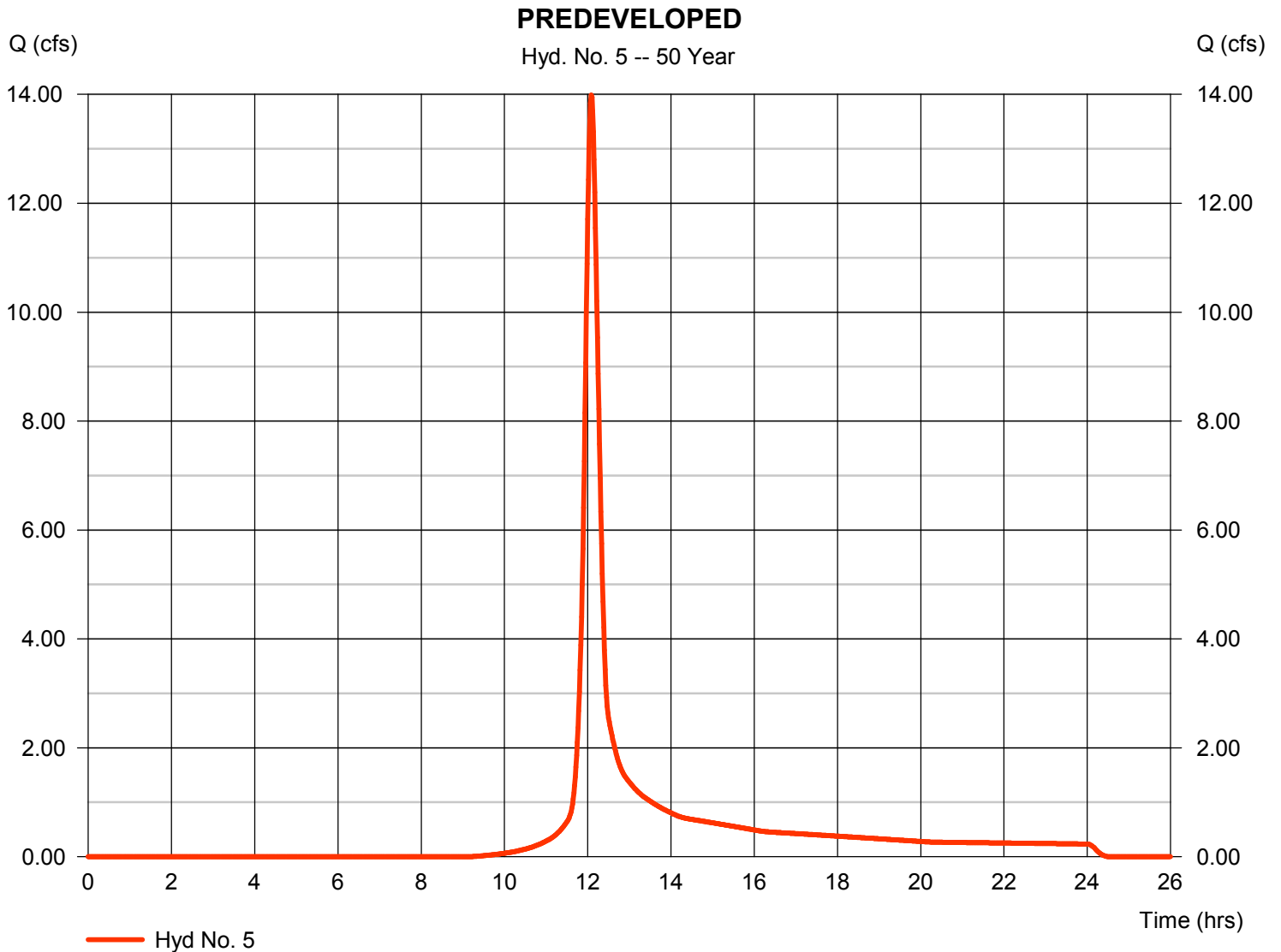
Friday, 06 / 5 / 2020

## Hyd. No. 5

### PREDEVELOPED

Hydrograph type = SCS Runoff  
 Storm frequency = 50 yrs  
 Time interval = 1 min  
 Drainage area = 5.000 ac  
 Basin Slope = 1.0 %  
 Tc method = LAG  
 Total precip. = 5.29 in  
 Storm duration = 24 hrs

Peak discharge = 13.99 cfs  
 Time to peak = 12.08 hrs  
 Hyd. volume = 43,987 cuft  
 Curve number = 72  
 Hydraulic length = 380 ft  
 Time of conc. (Tc) = 18.55 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

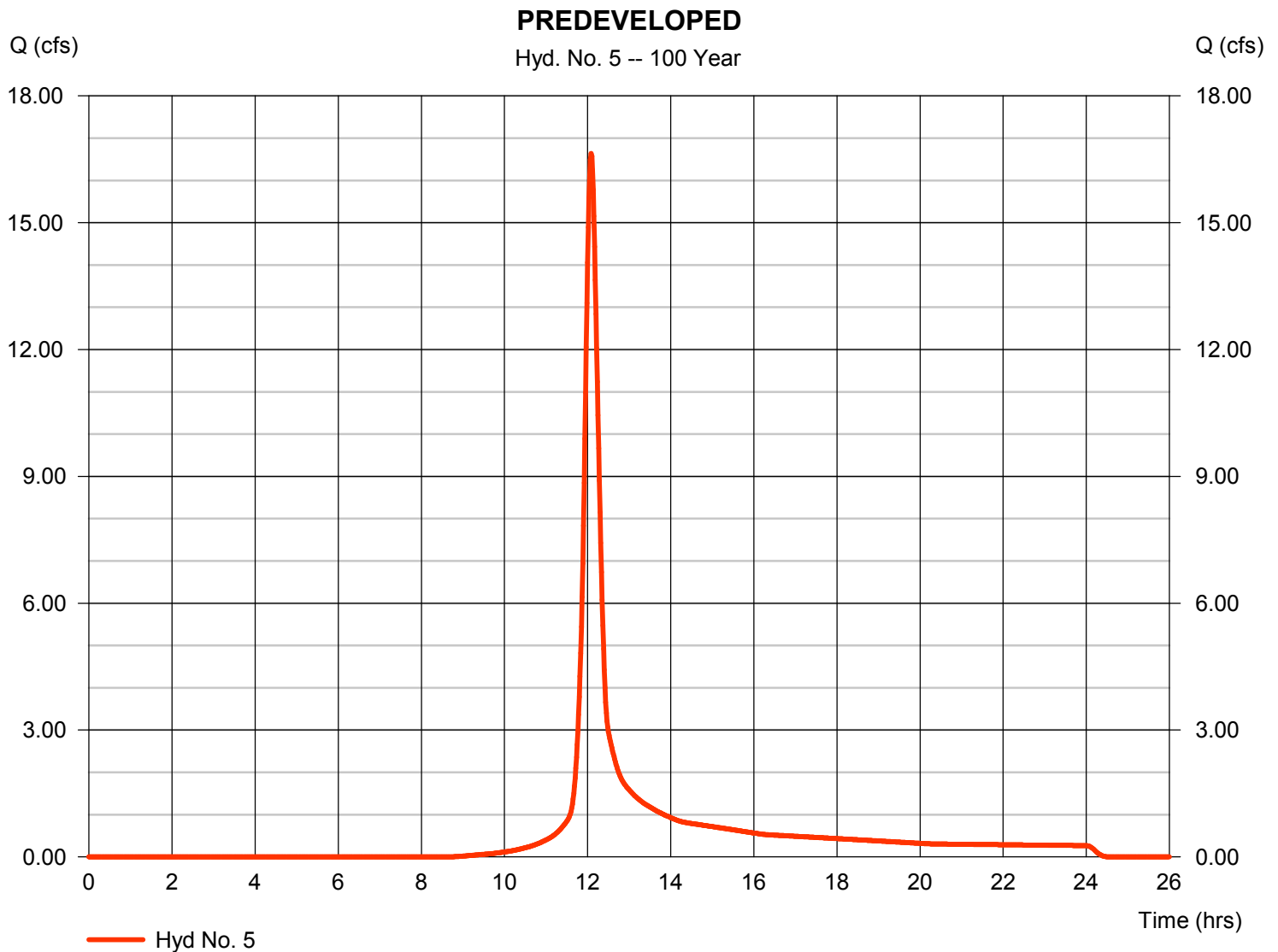
Friday, 06 / 5 / 2020

## Hyd. No. 5

### PREDEVELOPED

Hydrograph type = SCS Runoff  
 Storm frequency = 100 yrs  
 Time interval = 1 min  
 Drainage area = 5.000 ac  
 Basin Slope = 1.0 %  
 Tc method = LAG  
 Total precip. = 5.85 in  
 Storm duration = 24 hrs

Peak discharge = 16.64 cfs  
 Time to peak = 12.08 hrs  
 Hyd. volume = 52,109 cuft  
 Curve number = 72  
 Hydraulic length = 380 ft  
 Time of conc. (Tc) = 18.55 min  
 Distribution = Type II  
 Shape factor = 484



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

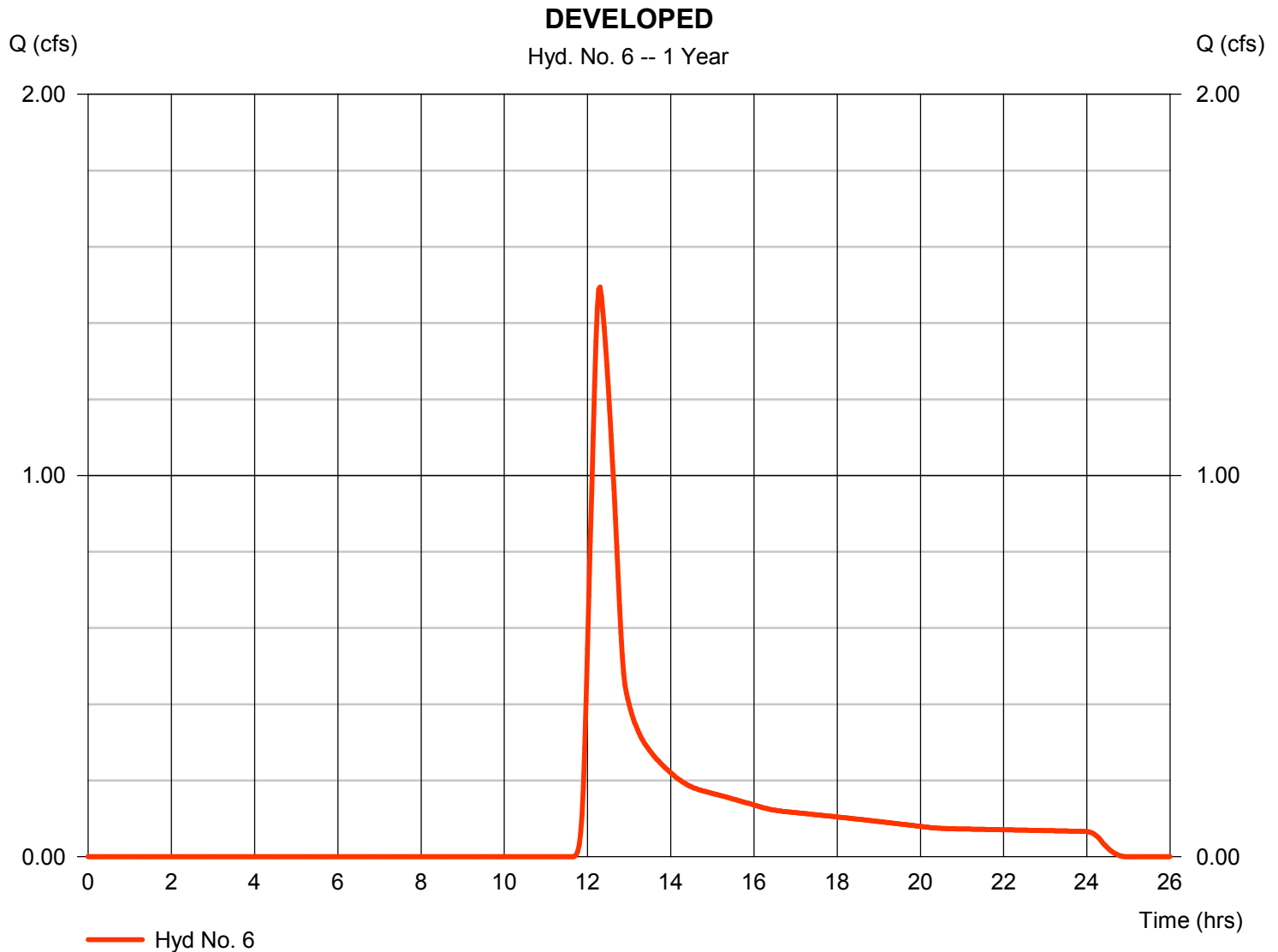
Friday, 06 / 5 / 2020

## Hyd. No. 6

### DEVELOPED

Hydrograph type	= SCS Runoff	Peak discharge	= 1.494 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.30 hrs
Time interval	= 2 min	Hyd. volume	= 8,580 cuft
Drainage area	= 5.000 ac	Curve number	= 73*
Basin Slope	= 0.9 %	Hydraulic length	= 780 ft
Tc method	= LAG	Time of conc. (Tc)	= 34.39 min
Total precip.	= 2.33 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) =  $[(2.840 \times 98) + (2.160 \times 39)] / 5.000$





# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Friday, 06 / 5 / 2020

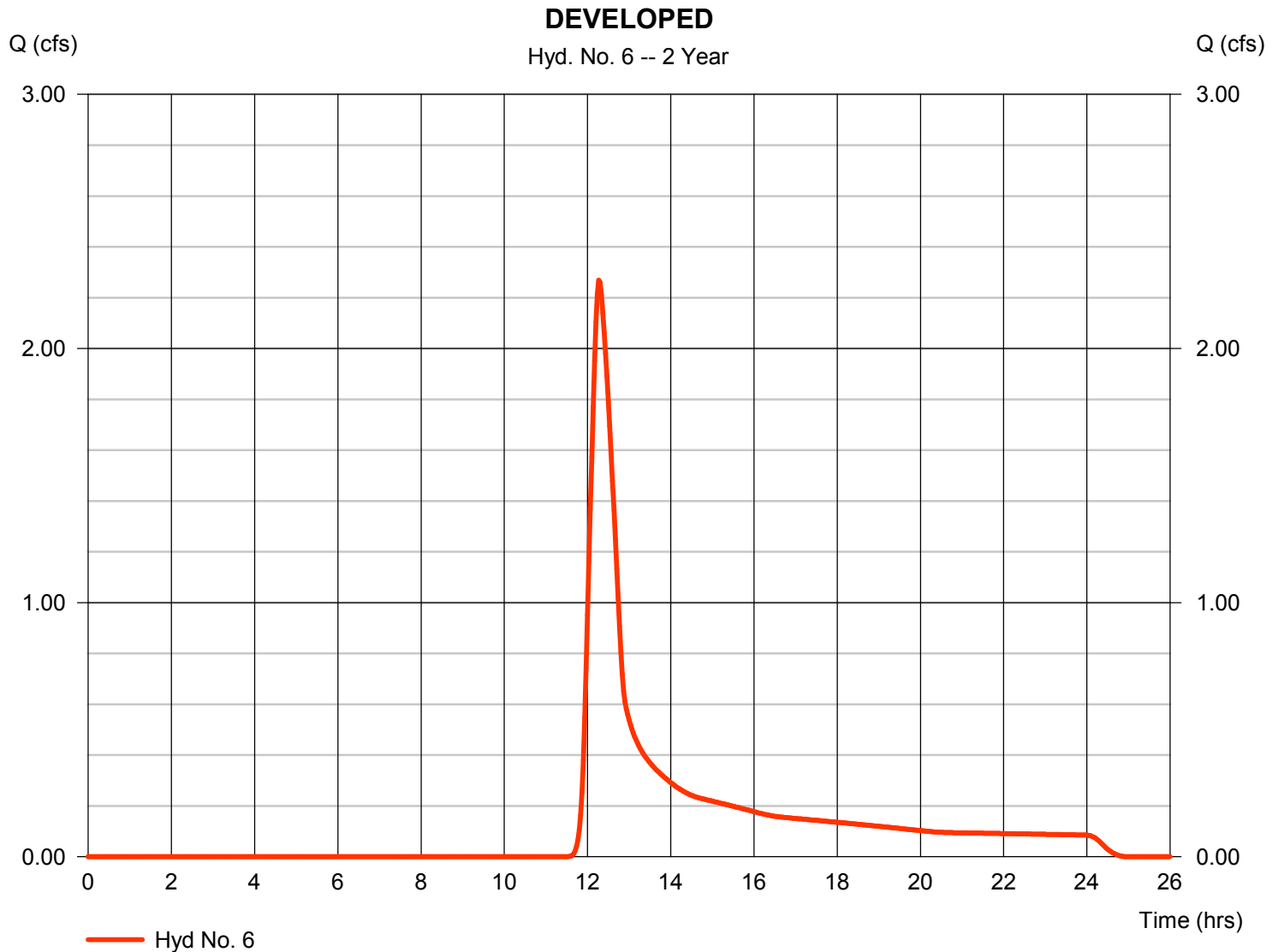
## Hyd. No. 6

### DEVELOPED

Hydrograph type = SCS Runoff  
 Storm frequency = 2 yrs  
 Time interval = 2 min  
 Drainage area = 5.000 ac  
 Basin Slope = 0.9 %  
 Tc method = LAG  
 Total precip. = 2.68 in  
 Storm duration = 24 hrs

Peak discharge = 2.268 cfs  
 Time to peak = 12.27 hrs  
 Hyd. volume = 11,980 cuft  
 Curve number = 73\*  
 Hydraulic length = 780 ft  
 Time of conc. (Tc) = 34.39 min  
 Distribution = Type II  
 Shape factor = 484

\* Composite (Area/CN) =  $[(2.840 \times 98) + (2.160 \times 39)] / 5.000$



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

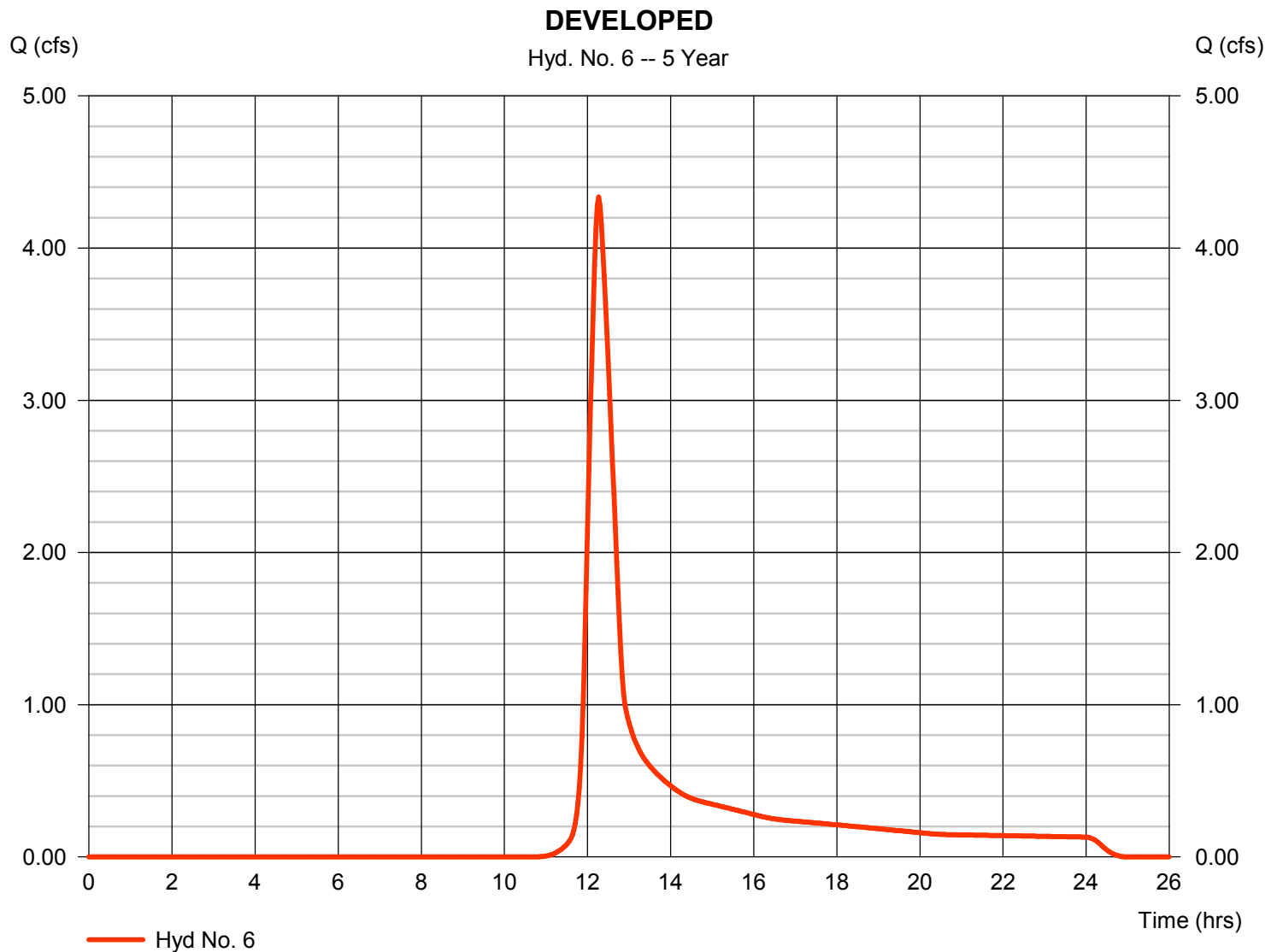
Friday, 06 / 5 / 2020

## Hyd. No. 6

### DEVELOPED

Hydrograph type	= SCS Runoff	Peak discharge	= 4.336 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 20,926 cuft
Drainage area	= 5.000 ac	Curve number	= 73*
Basin Slope	= 0.9 %	Hydraulic length	= 780 ft
Tc method	= LAG	Time of conc. (Tc)	= 34.39 min
Total precip.	= 3.48 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) =  $[(2.840 \times 98) + (2.160 \times 39)] / 5.000$



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

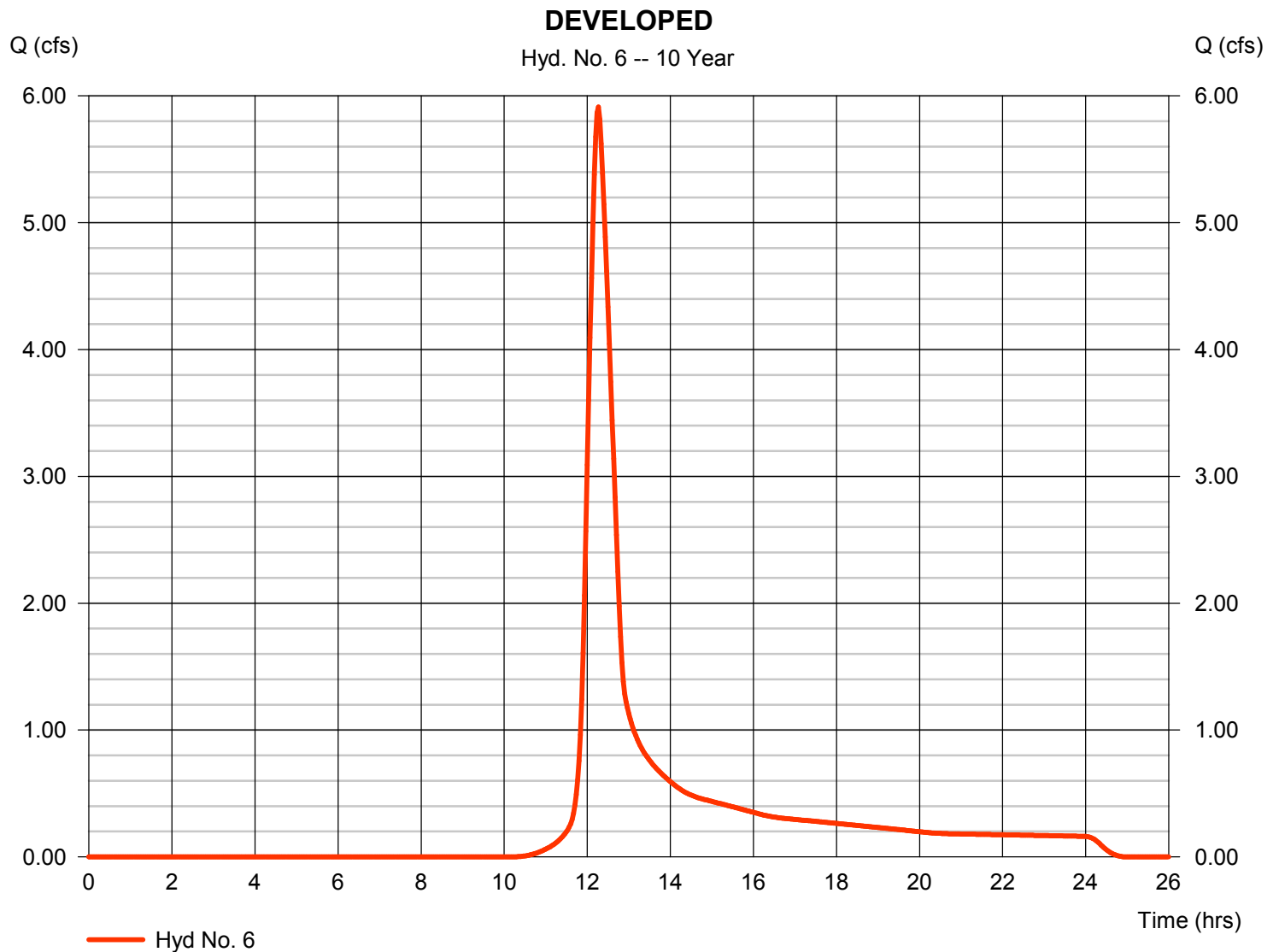
Friday, 06 / 5 / 2020

## Hyd. No. 6

### DEVELOPED

Hydrograph type	= SCS Runoff	Peak discharge	= 5.912 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 27,795 cuft
Drainage area	= 5.000 ac	Curve number	= 73*
Basin Slope	= 0.9 %	Hydraulic length	= 780 ft
Tc method	= LAG	Time of conc. (Tc)	= 34.39 min
Total precip.	= 4.03 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) =  $[(2.840 \times 98) + (2.160 \times 39)] / 5.000$





# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

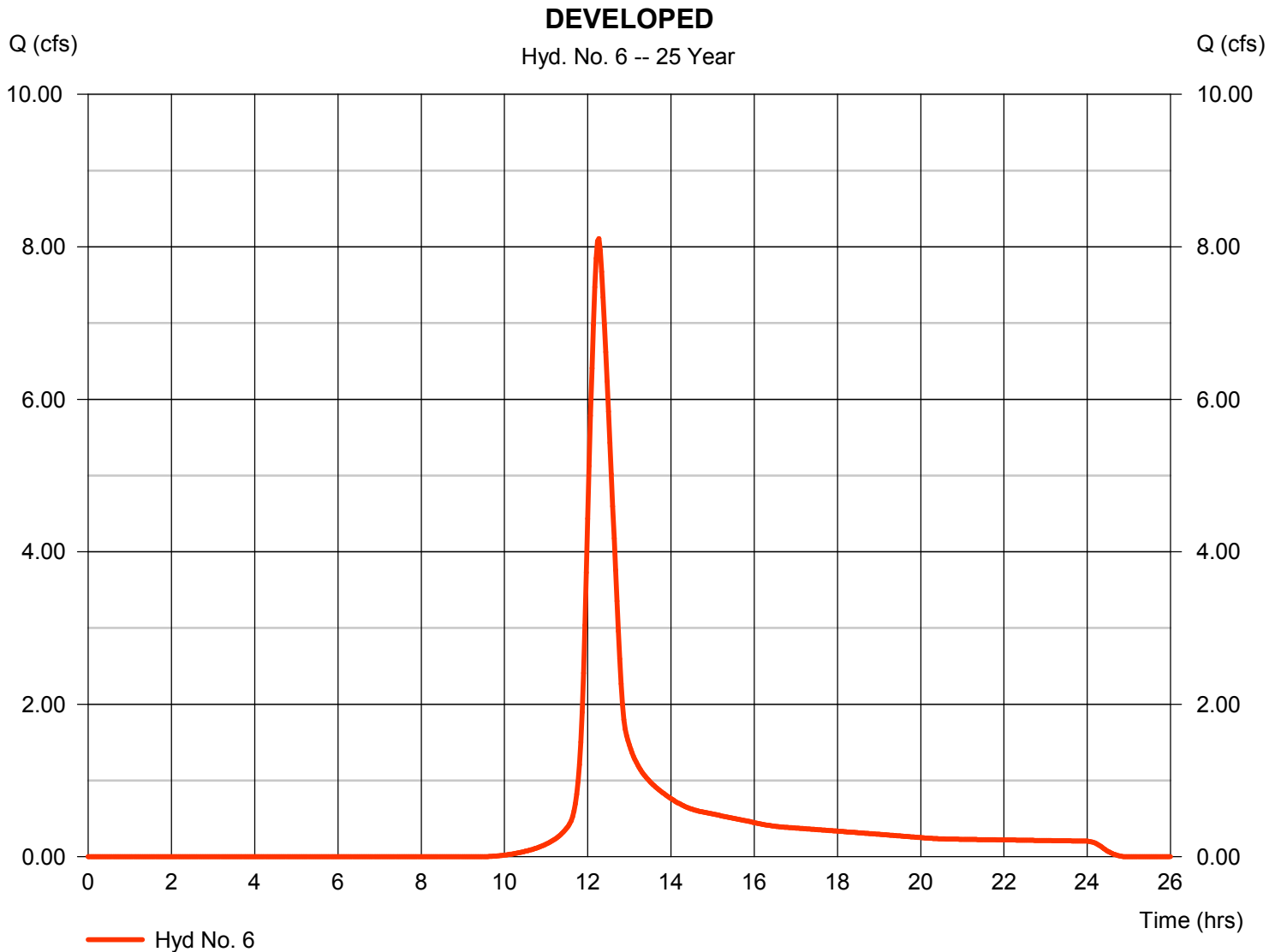
Friday, 06 / 5 / 2020

## Hyd. No. 6

### DEVELOPED

Hydrograph type	= SCS Runoff	Peak discharge	= 8.109 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 37,434 cuft
Drainage area	= 5.000 ac	Curve number	= 73*
Basin Slope	= 0.9 %	Hydraulic length	= 780 ft
Tc method	= LAG	Time of conc. (Tc)	= 34.39 min
Total precip.	= 4.75 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) =  $[(2.840 \times 98) + (2.160 \times 39)] / 5.000$



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

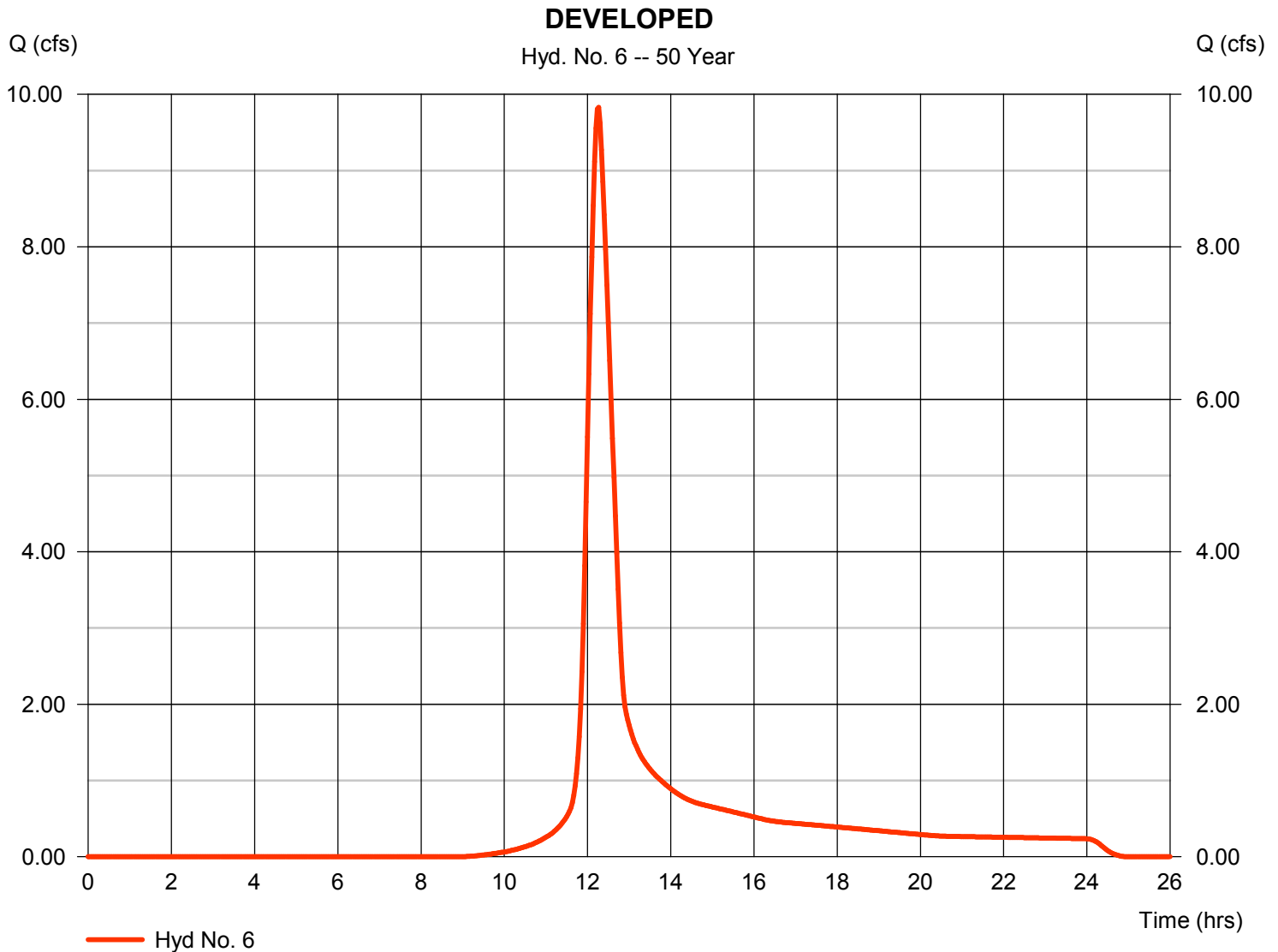
Friday, 06 / 5 / 2020

## Hyd. No. 6

### DEVELOPED

Hydrograph type	= SCS Runoff	Peak discharge	= 9.830 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 45,039 cuft
Drainage area	= 5.000 ac	Curve number	= 73*
Basin Slope	= 0.9 %	Hydraulic length	= 780 ft
Tc method	= LAG	Time of conc. (Tc)	= 34.39 min
Total precip.	= 5.29 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) =  $[(2.840 \times 98) + (2.160 \times 39)] / 5.000$



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

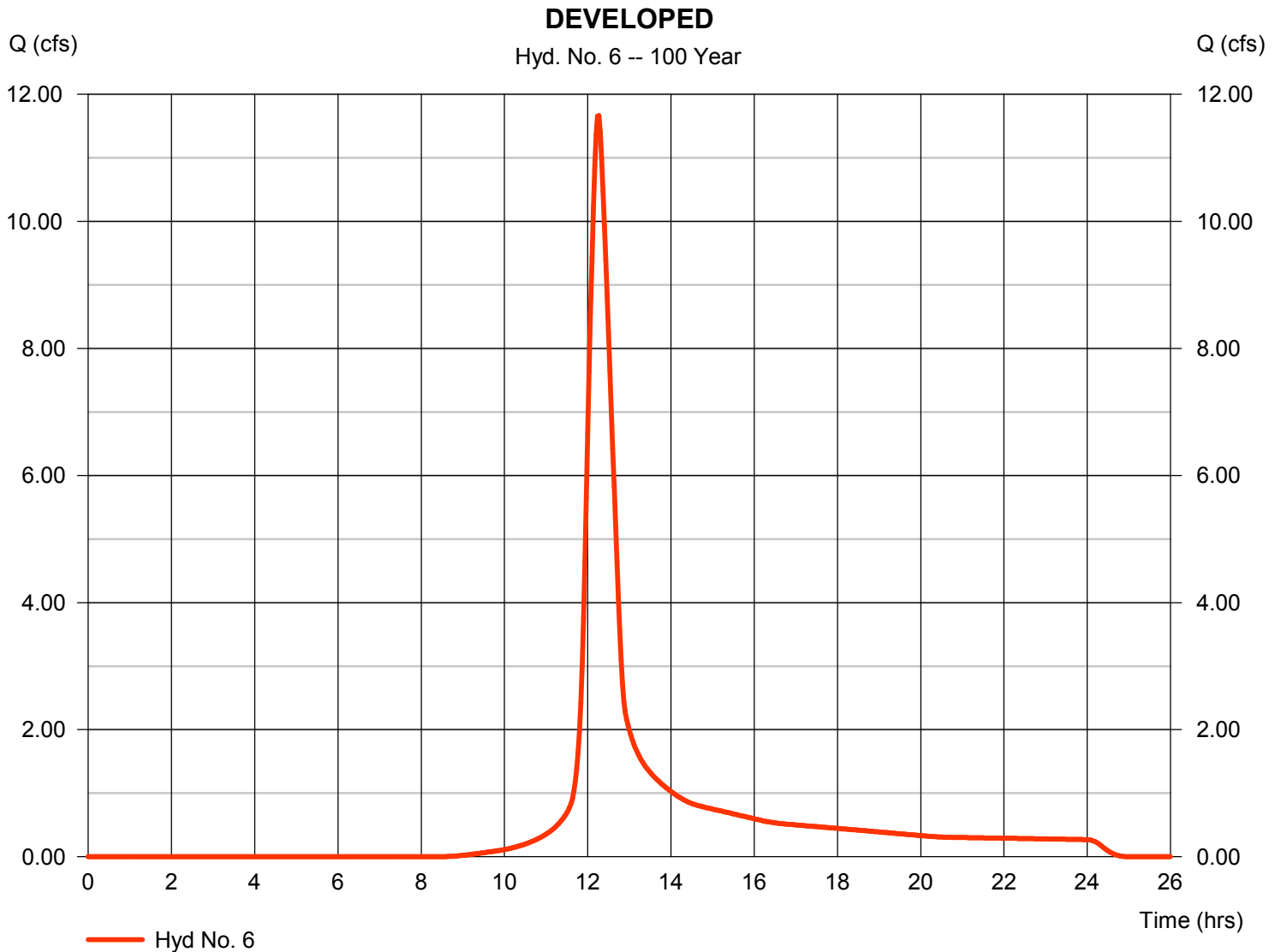
Friday, 06 / 5 / 2020

## Hyd. No. 6

### DEVELOPED

Hydrograph type	= SCS Runoff	Peak discharge	= 11.66 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 53,196 cuft
Drainage area	= 5.000 ac	Curve number	= 73*
Basin Slope	= 0.9 %	Hydraulic length	= 780 ft
Tc method	= LAG	Time of conc. (Tc)	= 34.39 min
Total precip.	= 5.85 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

\* Composite (Area/CN) =  $[(2.840 \times 98) + (2.160 \times 39)] / 5.000$



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

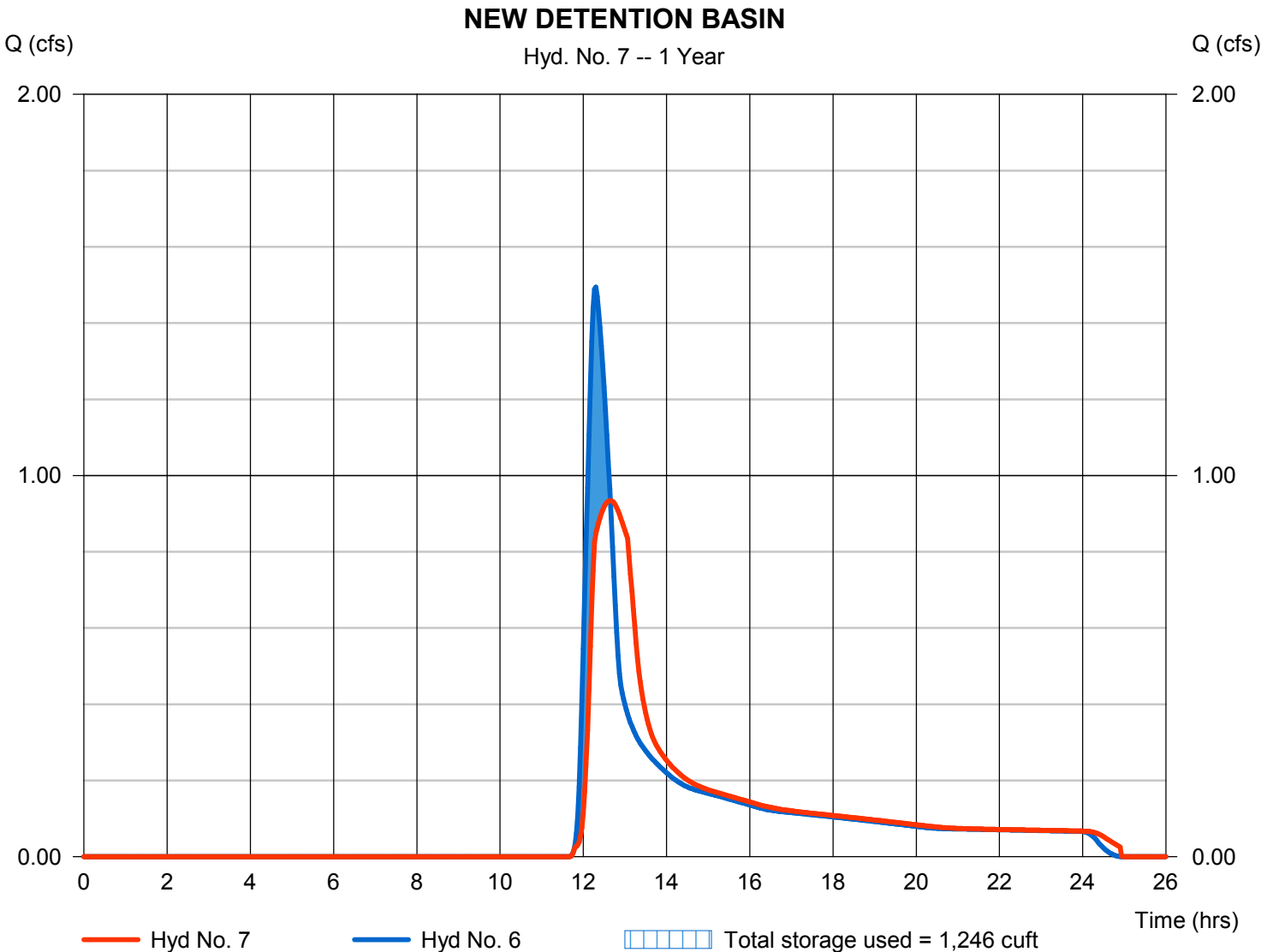
Friday, 06 / 5 / 2020

## Hyd. No. 7

### NEW DETENTION BASIN

Hydrograph type	= Reservoir	Peak discharge	= 0.934 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.63 hrs
Time interval	= 2 min	Hyd. volume	= 8,580 cuft
Inflow hyd. No.	= 6 - DEVELOPED	Max. Elevation	= 775.11 ft
Reservoir name	= NEW DETENTION BASIN	Max. Storage	= 1,246 cuft

Storage Indication method used.



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

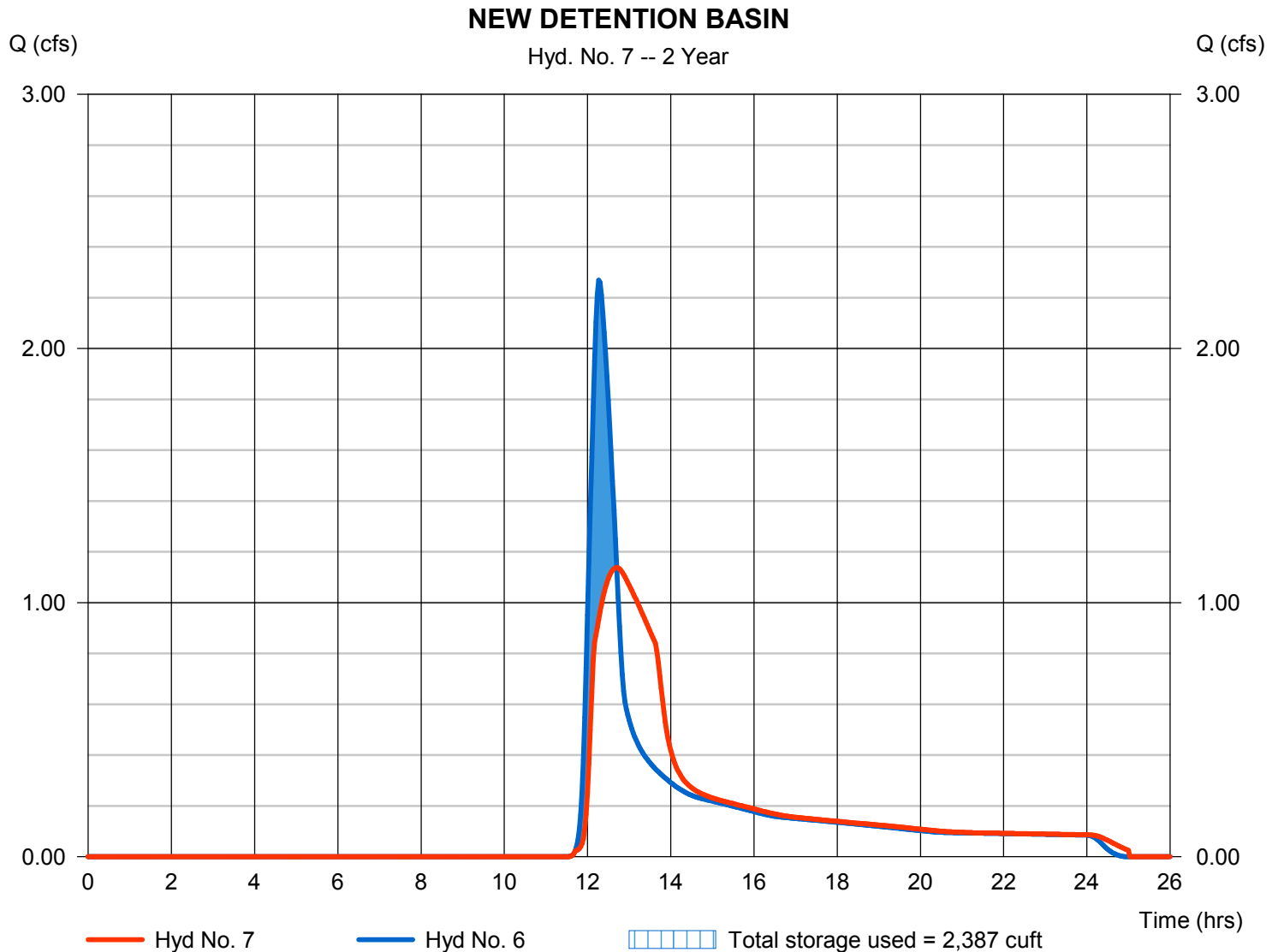
Friday, 06 / 5 / 2020

## Hyd. No. 7

### NEW DETENTION BASIN

Hydrograph type	= Reservoir	Peak discharge	= 1.138 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.70 hrs
Time interval	= 2 min	Hyd. volume	= 11,980 cuft
Inflow hyd. No.	= 6 - DEVELOPED	Max. Elevation	= 775.35 ft
Reservoir name	= NEW DETENTION BASIN	Max. Storage	= 2,387 cuft

Storage Indication method used.



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

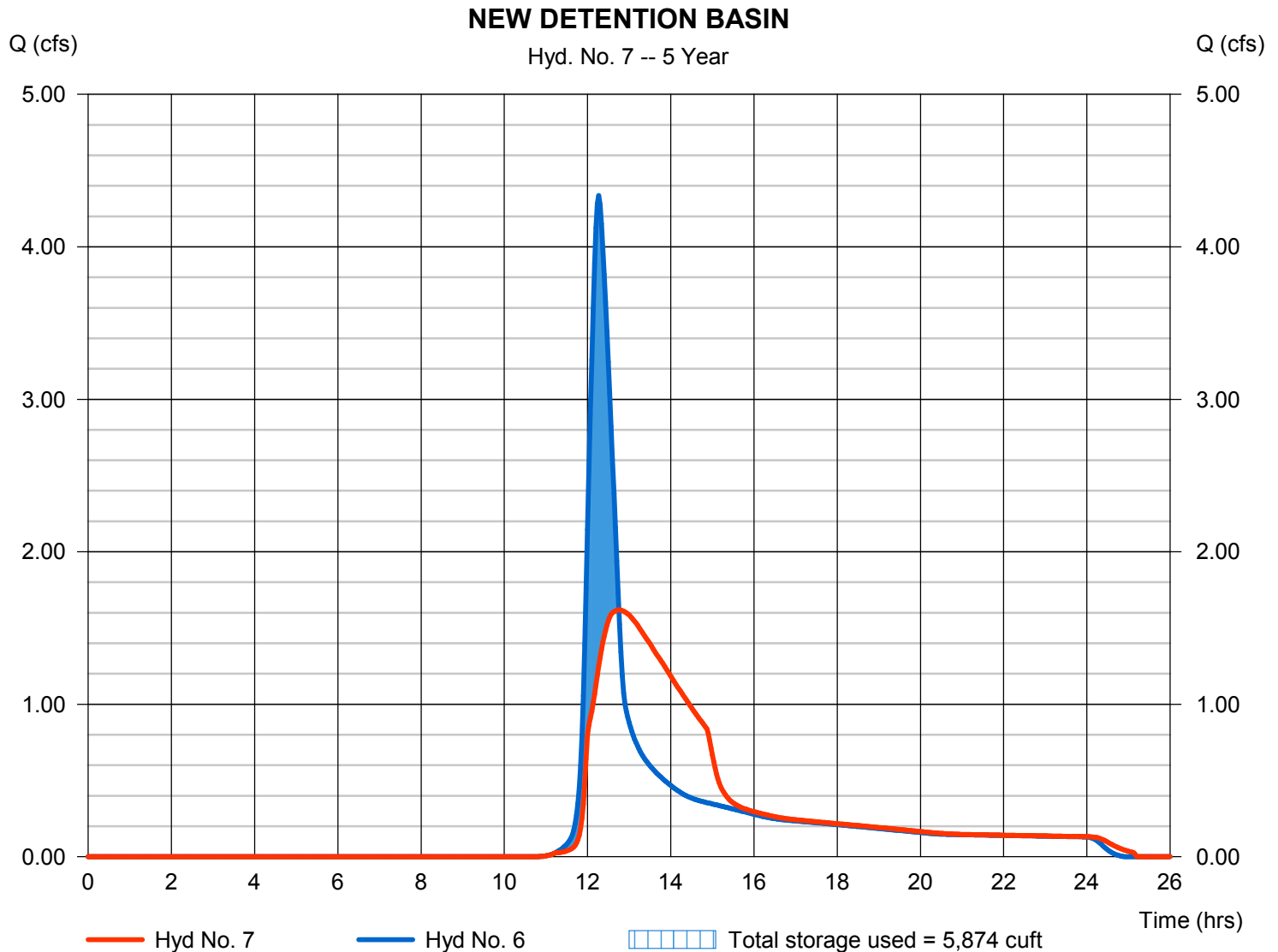
Friday, 06 / 5 / 2020

## Hyd. No. 7

### NEW DETENTION BASIN

Hydrograph type	= Reservoir	Peak discharge	= 1.618 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.77 hrs
Time interval	= 2 min	Hyd. volume	= 20,926 cuft
Inflow hyd. No.	= 6 - DEVELOPED	Max. Elevation	= 776.05 ft
Reservoir name	= NEW DETENTION BASIN	Max. Storage	= 5,874 cuft

Storage Indication method used.





# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

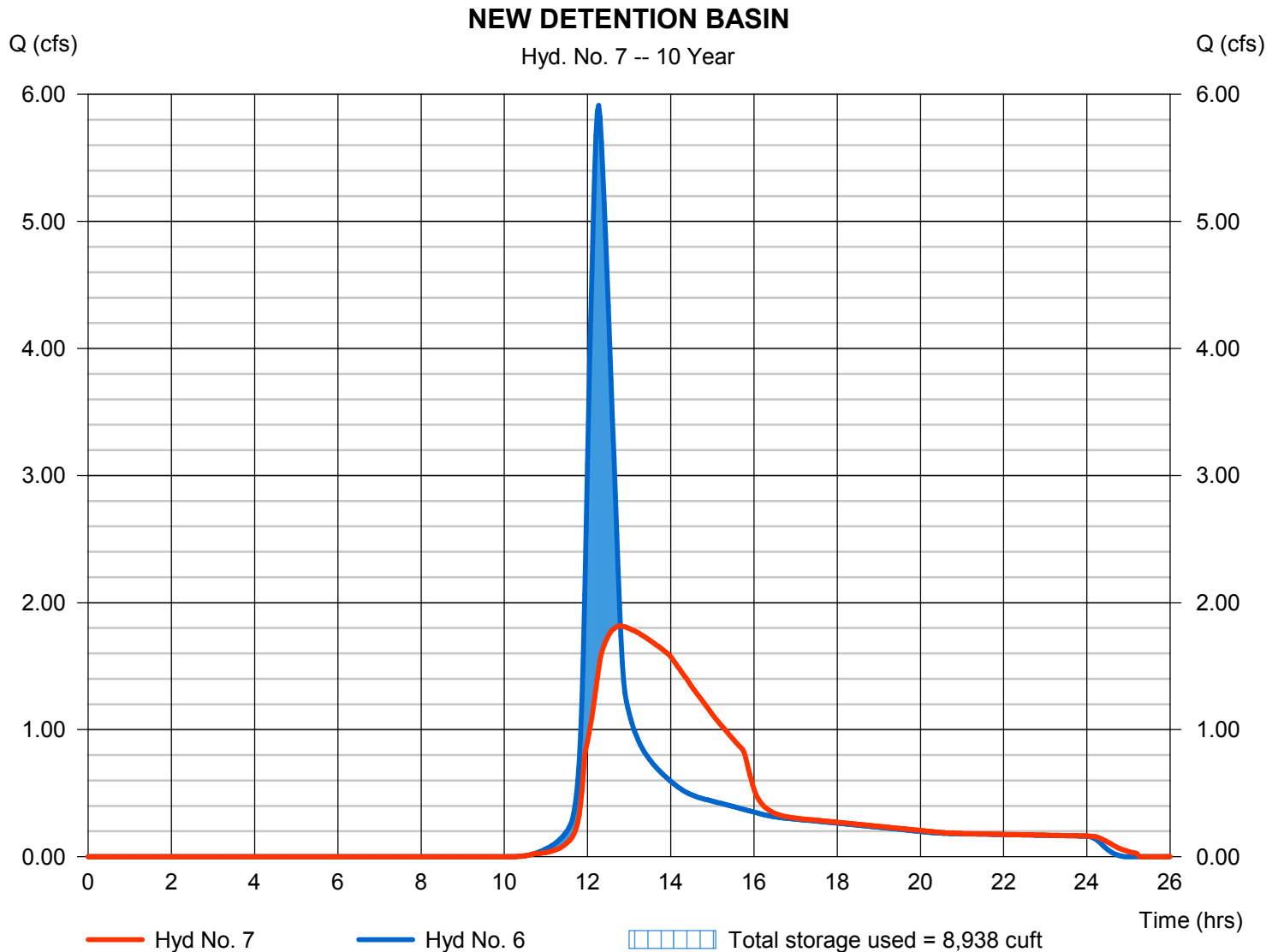
Friday, 06 / 5 / 2020

## Hyd. No. 7

### NEW DETENTION BASIN

Hydrograph type	= Reservoir	Peak discharge	= 1.816 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.80 hrs
Time interval	= 2 min	Hyd. volume	= 27,795 cuft
Inflow hyd. No.	= 6 - DEVELOPED	Max. Elevation	= 776.41 ft
Reservoir name	= NEW DETENTION BASIN	Max. Storage	= 8,938 cuft

Storage Indication method used.



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

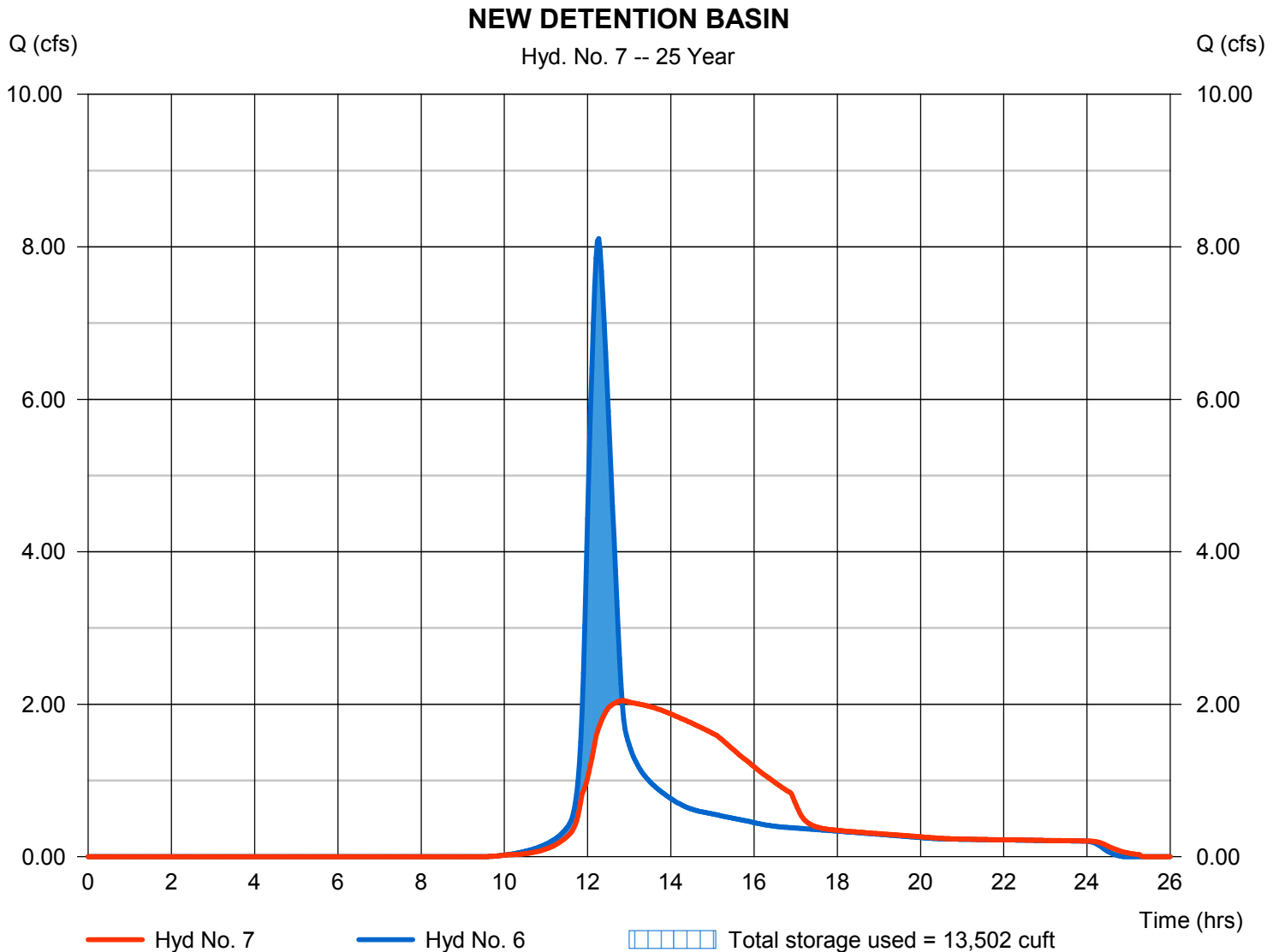
Friday, 06 / 5 / 2020

## Hyd. No. 7

### NEW DETENTION BASIN

Hydrograph type	= Reservoir	Peak discharge	= 2.048 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.83 hrs
Time interval	= 2 min	Hyd. volume	= 37,434 cuft
Inflow hyd. No.	= 6 - DEVELOPED	Max. Elevation	= 776.94 ft
Reservoir name	= NEW DETENTION BASIN	Max. Storage	= 13,502 cuft

Storage Indication method used.



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

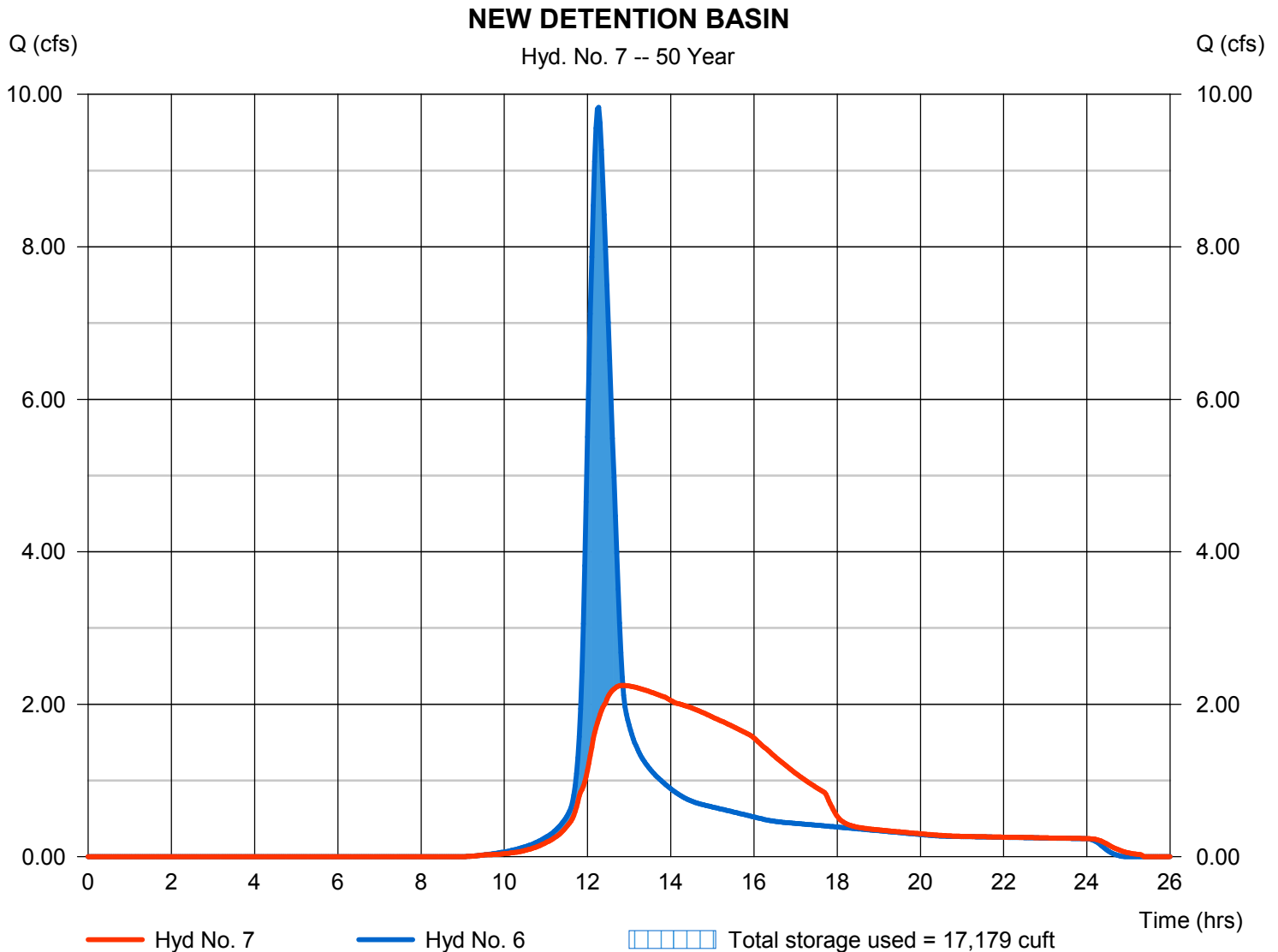
Friday, 06 / 5 / 2020

## Hyd. No. 7

### NEW DETENTION BASIN

Hydrograph type	= Reservoir	Peak discharge	= 2.248 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.83 hrs
Time interval	= 2 min	Hyd. volume	= 45,040 cuft
Inflow hyd. No.	= 6 - DEVELOPED	Max. Elevation	= 777.27 ft
Reservoir name	= NEW DETENTION BASIN	Max. Storage	= 17,179 cuft

Storage Indication method used.



# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

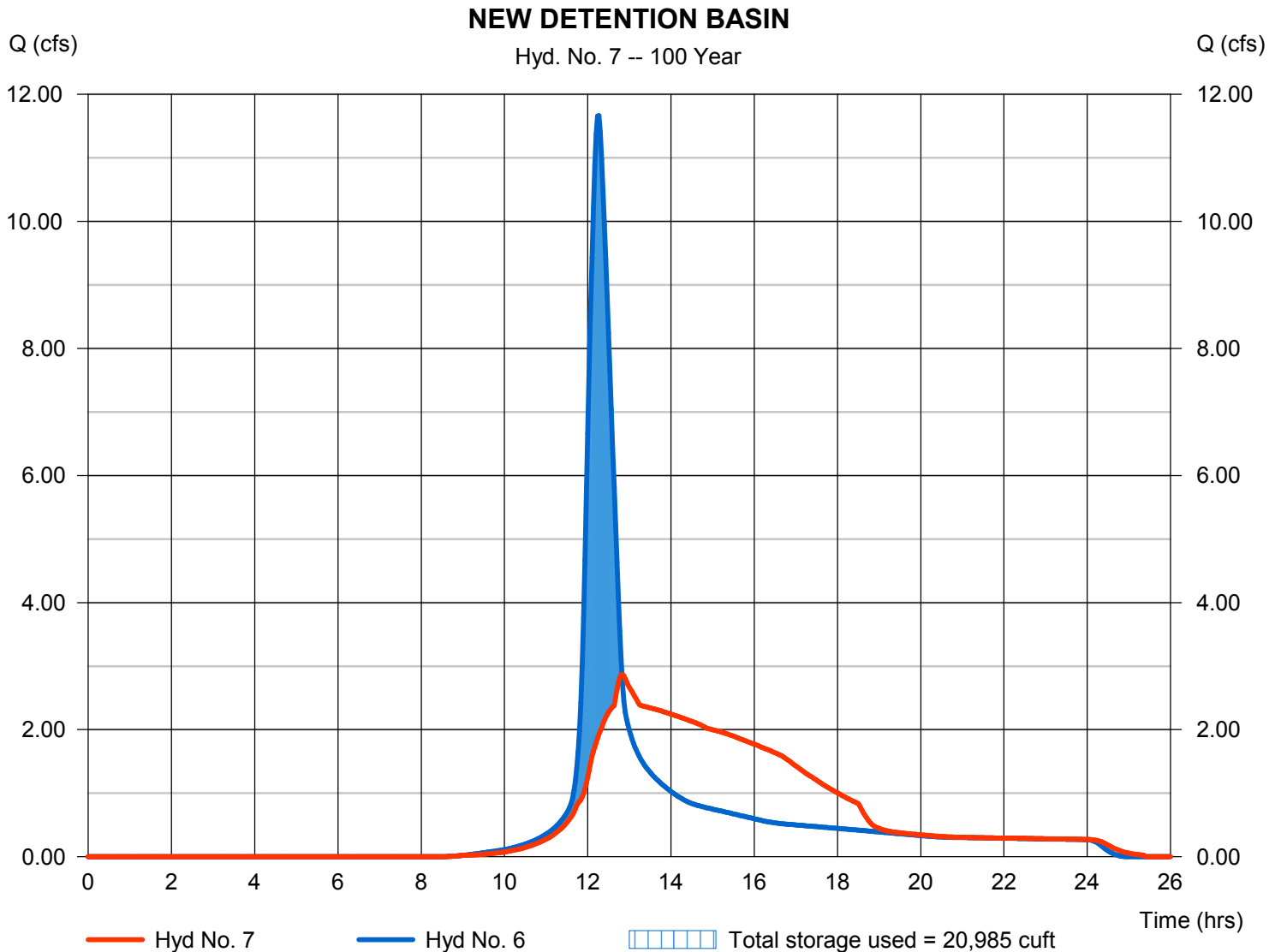
Friday, 06 / 5 / 2020

## Hyd. No. 7

### NEW DETENTION BASIN

Hydrograph type	= Reservoir	Peak discharge	= 2.868 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.83 hrs
Time interval	= 2 min	Hyd. volume	= 53,197 cuft
Inflow hyd. No.	= 6 - DEVELOPED	Max. Elevation	= 777.57 ft
Reservoir name	= NEW DETENTION BASIN	Max. Storage	= 20,985 cuft

Storage Indication method used.



## Pond No. 1 - NEW DETENTION BASIN

### Pond Data

**Contours** -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 774.20 ft

### Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	774.20	04	0	0
0.10	774.30	10	1	1
0.80	775.00	2,986	739	740
1.80	776.00	6,652	4,698	5,438
2.80	777.00	10,618	8,557	13,995
3.30	777.50	13,442	6,001	19,996
3.80	778.00	16,270	7,416	27,412
4.30	778.50	17,853	8,527	35,938

### Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 15.00	8.00	Inactive	Inactive
Span (in)	= 15.00	8.00	0.00	0.00
No. Barrels	= 1	1	1	0
Invert El. (ft)	= 774.20	774.20	0.00	0.00
Length (ft)	= 27.22	0.10	0.00	0.00
Slope (%)	= 0.31	1.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

### Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 8.00	Inactive	Inactive	Inactive
Crest El. (ft)	= 777.50	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 Contour)			
TW Elev. (ft)	= 0.00			

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

