

North Union

TETRA TECH, INC.

By: RH Date: 11/3/2016 Subject: North Union Street
Checked By: JB Date: 11/7/2016 PCSM Design and Evaluation

PURPOSE:

The purpose of these calculations is to design a Post-Construction Stormwater Management (PCSM) Plan for the North Union Street block valve as part of the Sunoco Pipeline L.P. Pennsylvania Pipeline Project. The site is located within Lower Swatara/Middletown Borough, Dauphin County, Pennsylvania. Permanent stormwater controls will be developed to satisfy PADEP and Dauphin County's approved Act 167 Plan.

PCSM DESIGN REQUIREMENTS:

The PCSM design for this project follows the PA Department of Environmental Protection's (PADEP) Pennsylvania Stormwater Best Management Practices Manual (BMP Manual), December 2006; and the standard design criteria from PA Title 25, Chapter 102.8.(g)(2) and (3). The design criteria evaluated for the site are summarized below.

Act 167 Consistency

The PCSM design at the North Union Street block valve has been designed for consistency with Dauphin County's approved Act 167 Plan. By designing in accordance with PADEP's Stormwater BMP Manual, the requirements outlined in Dauphin County's Act 167 Plan will be fulfilled. North Union Street block valve is within an area governed by a 100% release rate.

Recommended Volume Control Guideline

Use of Control Guideline 1 is recommended where site conditions offer the opportunity to reduce the increase in runoff volume as follows:

- Do not increase the post-development total runoff volume for all storms equal to or less than the two-year/24-hour event;
- Existing (pre-development) non-forested pervious areas must be considered meadow (good condition) or its equivalent; and
- 20 percent of existing impervious area, when present, shall be considered meadow (good condition) or its equivalent.

This site will utilize two infiltration berms to manage the two-year/24-hour volume increase.

Recommended Peak Rate Control Guideline

The recommended control guideline for peak rate control is:

- Do not increase the peak rate of discharge for the 2-year through 100-year events (at minimum); as necessary, provide additional peak rate control as required by applicable and approved Act 167 plan.
- The North Union Road block valve site is located in the Swatara Creek watershed, which has requirements of 100% release rates.

This site will utilize two infiltration berms to manage the 2-year through 100-year peak rate increases. These volume-reducing BMPs will also help to increase the post-development time of concentration within the drainage area.

Recommended Water Quality Control Guideline

Control Guideline 1 will provide water quality control and stream channel protection as well as flood control protection.

Infiltration

Infiltration rates for the PCSM BMPs have been determined from site infiltration testing conducted in accordance of the PA BMP Manual. Documentation for infiltration testing and design infiltration rates can be found in Attachment 5 of the Site Restoration/Post Construction Stormwater Management Plan. Infiltration test locations and recommended design rates are also labeled on the PCSM Plan Drawings in Attachment 6.

During the onsite infiltration tests, the depth to seasonal high groundwater and shallow bedrock or another confining layer were evaluated. The post-construction stormwater management facility for the site has been designed to maintain 2 feet of separation between the ponding elevation of the facility and the seasonal high water table and bedrock.

The post-construction stormwater management design will utilize onsite infiltration to meet Volume Control Guideline 1.

Loading Ratio

Loading ratios have been considered for the design of infiltration BMPs. In general, the following Loading Ratio guidelines are recommended:

- Maximum Impervious Loading Ratio of 5:1 relating impervious drainage area to infiltration area.
- Maximum Drainage Area Loading Ratio of 8:1 relating total drainage area to infiltration area.

The maximum impervious loading ratio of 5:1 has been met. The impervious loading ratio for drainage area 1 is 3.1:1. The impervious loading ratio for drainage area 2 is 3.5:1.

The drainage area loading ratio for drainage area 1 is 9.6:1. The drainage area loading ratio for drainage area 2 is 14.5:1. Although it exceeds the recommended guideline of 8:1, all other design considerations for infiltration BMPs have been met. In addition, infiltration berms encourage relatively broad and shallow infiltration. It is not anticipated that the infiltration facilities will be overwhelmed by the contributory drainage area.

Disturbed Area

To meet Standard Worksheet 10 guidelines, 90% of the disturbed area is detained by the proposed infiltration berms and soil amendment along the access road.

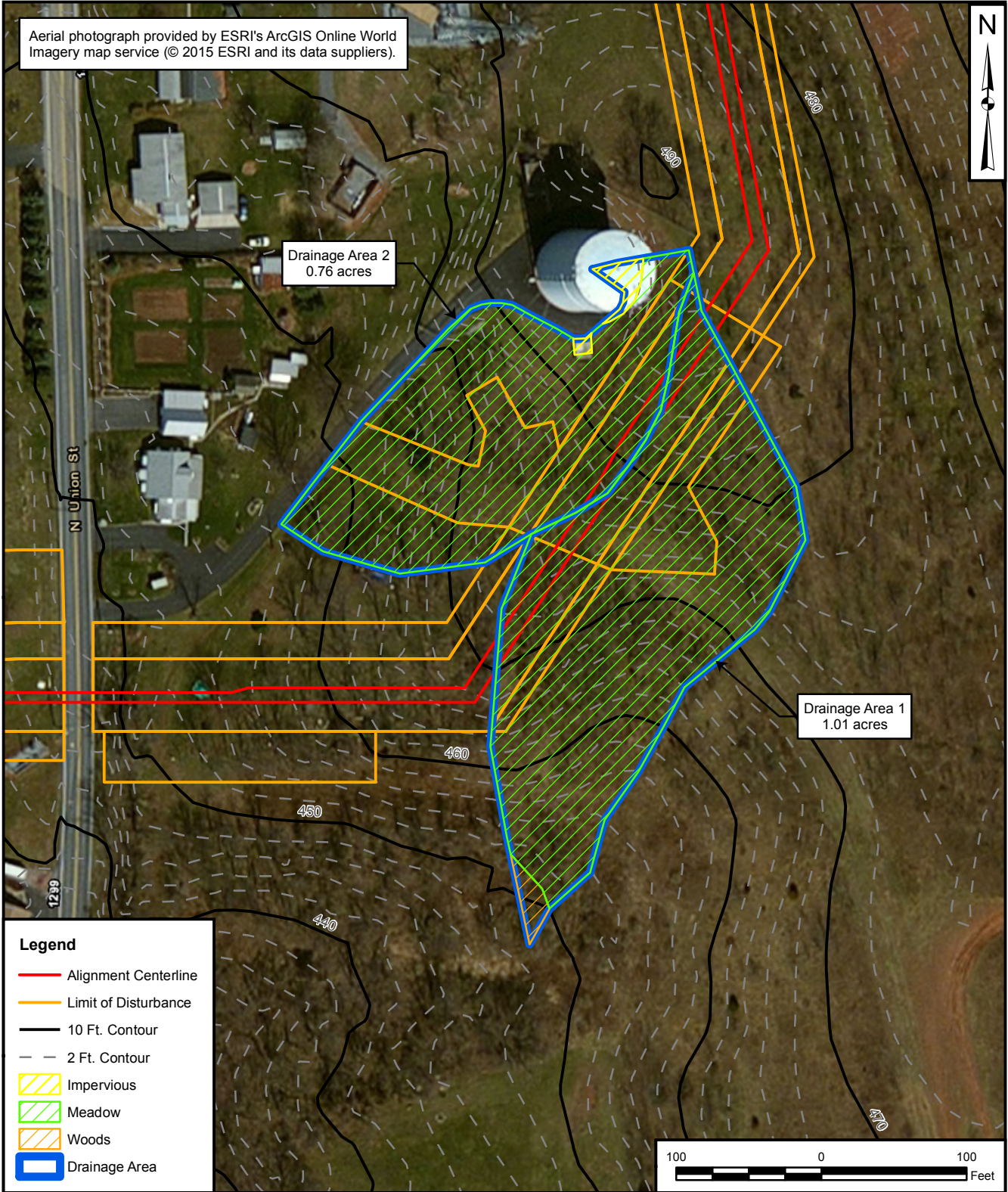
Karst Topography

The North Union Street block valve is not located in an area of karst terrain.

Special Protection Watershed

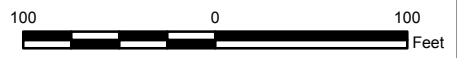
North Union Street block valve is not located within a special protection watershed, so antidegradation requirements do not apply.

Aerial photograph provided by ESRI's ArcGIS Online World Imagery map service (© 2015 ESRI and its data suppliers).



Legend

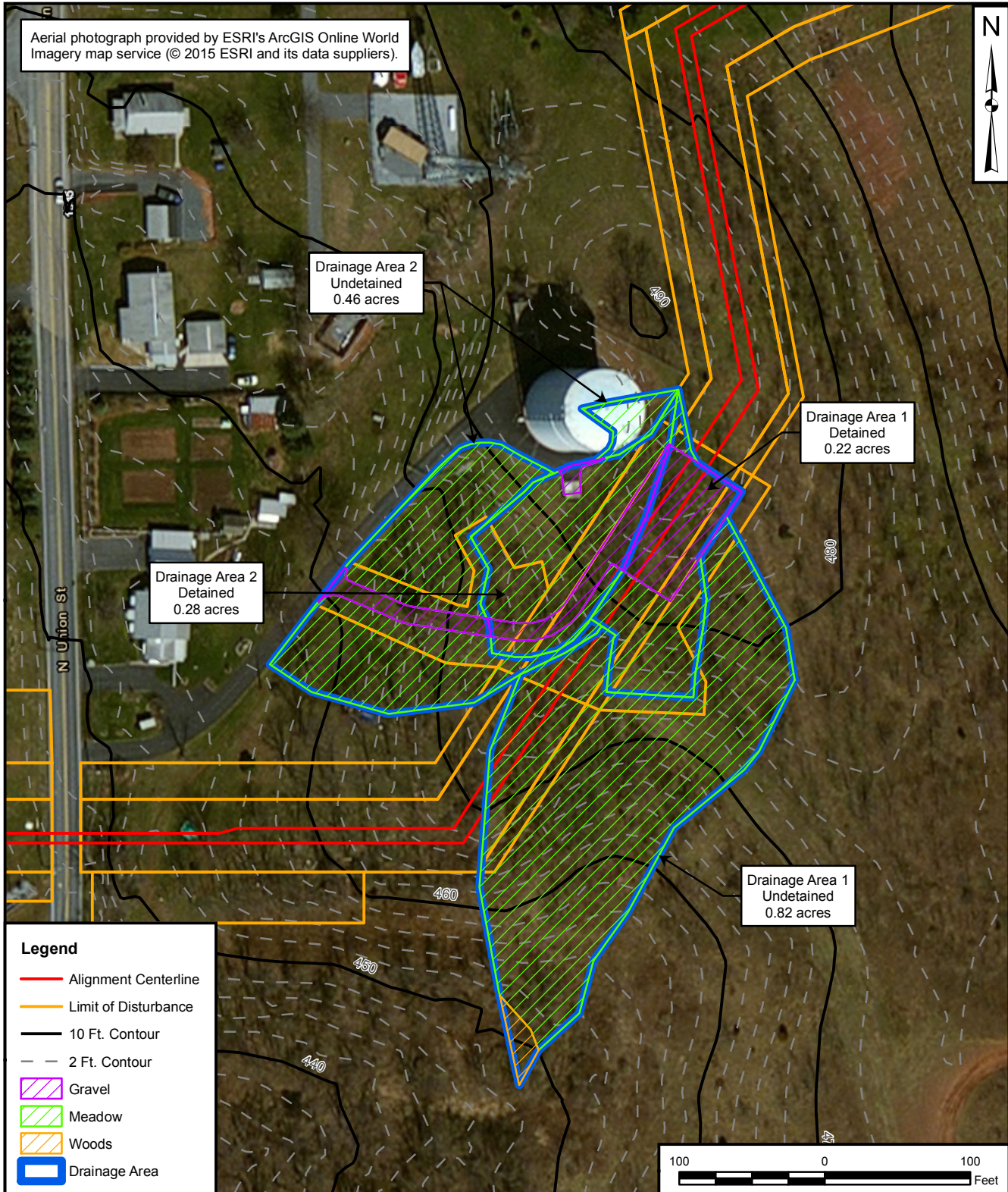
- Alignment Centerline
- Limit of Disturbance
- 10 Ft. Contour
- 2 Ft. Contour
- Impervious
- Meadow
- Woods
- Drainage Area



PRE-DEVELOPMENT DRAINAGE AREA MAP
N. UNION STREET
PENNSYLVANIA PIPELINE PROJECT
SUNOCO LOGISTICS, L.P.
DAUPHIN COUNTY, PENNSYLVANIA

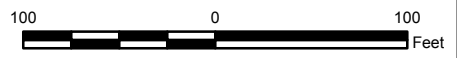
DRAWN BY: J. HERNING 05/05/15	
CHECKED BY: J. BRODY 11/09/16	
APPROVED BY:	
CONTRACT NUMBER: 112IC05958	
FIGURE NUMBER	REV
1	0

Aerial photograph provided by ESRI's ArcGIS Online World Imagery map service (© 2015 ESRI and its data suppliers).



Legend

- Alignment Centerline
- Limit of Disturbance
- 10 Ft. Contour
- - 2 Ft. Contour
- Gravel
- Meadow
- Woods
- Drainage Area



POST-DEVELOPMENT DRAINAGE AREA MAP
N. UNION STREET
PENNSYLVANIA PIPELINE PROJECT
SUNOCO LOGISTICS, L.P.
DAUPHIN COUNTY, PENNSYLVANIA

DRAWN BY: J. HERNING 05/05/15
 CHECKED BY: J. BRODY 11/09/16

APPROVED BY:

CONTRACT NUMBER: 112IC05958

FIGURE NUMBER	REV
2	0

WORKSHEET 1. GENERAL SITE INFORMATION

Date: November 11, 2016

Project Name: N. Union Street

Municipality: Lower Swatara/Middletown Borough

County: Dauphin

Total Area (acres): DA-1: 1.01 acres

Major River Basin: Susquehanna River

Watershed: Little Swatara and Quittapahilla Creeks

Sub Basin: Swatara Creek

Nearest Surface Water to Receive Runoff: Trib 09363 To Swatara Creek

Chapter 93 - Designated Water Use: WWF

Impaired according to Chapter 303(d) list? YES
List Causes of Impairment: NO

Is Project Subject to, or Part of:

Municipal Separate Storm Sewer System (MS4) Requirements YES

NO

Existing or Planned drinking water supply? YES

NO

If yes, distance from proposed discharge (miles): _____

Approved Act 167 Plan? YES

NO

Existing River Conservation Plan? YES

NO

Worksheet 2. Sensitive Natural Resources

INSTRUCTIONS

1. Provide Sensitive Resources Map according to non-structural BMP 5.4.1 in Chapter 5. This map should identify wetlands, woodlands, natural drainage ways, steep slopes, and other sensitive natural areas.

See pre-development drainage area map

2. Summarize the existing extent of each sensitive resource in the Existing Sensitive Resources Table (below, using Acres). If none present, insert 0.

Woodlands - 0.37 acres

3. Summarize Total Protected Area as defined under BMPs in Chapter 5.

0.00 acres

4. Do not count any area twice. For example, an area that is both a floodplain and a wetland may only be considered once.

EXISTING NATURAL SENSITIVE RESOURCE	MAPPED? Yes/no/n/a	TOTAL AREA (Ac.)	PROTECTED AREA (Ac.)
Waterbodies	N/A		
Floodplains	N/A		
Riparian Areas	N/A		
Wetlands	N/A		
Woodlands	Yes	0.37	
Natural Drainage Ways	N/A		
Steep Slopes, 15% - 25%	N/A		
Steep Slopes, over 25%	N/A		
Other:			
Other:			
TOTAL EXISTING:		0.37	0.00

Worksheet 3. Nonstructural BMP Credits

PROTECTED AREA

1.1 Area of Protected Sensitive/Special Value Features (see WS 2)	0.00 Ac.
1.2 Area of Riparian Forest Buffer Protection	0.00 Ac.
3.1 Area of Minimum Disturbance/Reduced Grading	0.00 Ac
TOTAL	0.00 Ac

Site Area	Minus	Protected Area	=	Stormwater Management Area
0.37	-	0	=	0.37
				This is the area that requires stormwater management

VOLUME CREDITS

3.1 Minimum Soil Compaction (See Chapter 8, page 22 – SW BMP Manual)

Lawn _____ ft² x 1/4" x 1/12 = _____ ft³

Meadow _____ ft² x 1/3" x 1/12 = _____ ft³

3.3 Protect Existing Trees (See Chapter 8, page 23 – SW BMP Manual)

For Trees within 100 feet of impervious area:

Tree Canopy _____ ft² x 1/2" x 1/12 = _____ ft³

5.1 Disconnect Roof Leaders to Vegetated Areas (See Chapter 8 page 25 – SW BMP Manual)

For runoff directed to areas protected under 5.8.1 and 5.8.2

Roof Area _____ ft² x 1/3" x 1/12 = _____ ft³

For all other disconnected roof areas

Roof Area _____ ft² x 1/4" x 1/12 = _____ ft³

5.2 Disconnect Non-Roof impervious to Vegetated Areas (See Chapter 8, page 26 – SW BMP Manual)

For Runoff directed to areas protected under 5.8.1 and 5.8.2

Impervious Area _____ ft² x 1/3" x 1/12 = _____ ft³

For all other disconnected roof areas

Impervious Area _____ ft² x 1/4" x 1/12 = _____ ft³

TOTAL NON-STRUCTURAL VOLUME CREDIT* _____ ft³

*For use on Worksheet 5

WORKSHEET 4. CHANGE IN RUNOFF VOLUME FOR 2-YR STORM EVENT

PROJECT: N. Union Street DA-1
 Drainage Area: 1.01 acres
 2-Year Rainfall: 2.90 in

Total Site Area: 0.37 acres
 Protected Site Area: N/A acres
 Managed Site Area: 0.37 acres

Existing Conditions

Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff ¹ (in)	Runoff Volume ³ (ft ³)
Impervious	-	0	0.00	98	0.20	0.04	2.67	0
Woods	A	16,117	0.37	30	23.33	4.67	0.14	194
Meadow	A	0	0.00	30	23.33	4.67	0.14	0
TOTAL:		16,117	0.37					194

Developed Conditions

Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff ¹ (in)	Runoff Volume ³ (ft ³)
Impervious - Gravel	A	3,049	0.07	76	3.16	0.63	0.95	241
Meadow	A	13,068	0.30	30	23.33	4.67	0.14	158
TOTAL:		16,117	0.37					399

2-Year Volume Increase (ft ³):	204
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2-Year Volume Increase = Developed Conditions Runoff Volume - Existing Conditions Runoff Volume

- Runoff (in) = $Q = (P - 0.2S) / (P + 0.8S)$ where
 P = 2-Year Rainfall (in)
 S = $(1000/CN) - 10$
- Runoff Volume (CF) = $Q \times \text{Area} \times 1/12$
 Q = Runoff (in)
 Area = Land use area (sq. ft.)

Note: Runoff Volume must be calculated for EACH land use type/condition and HSGI. The use of a weighted CN value for volume calculations is not acceptable.

WORKSHEET 4. CHANGE IN RUNOFF VOLUME FOR 2-YR STORM EVENT

PROJECT: N. Union Street
 2-Year Rainfall: 2.90 in

Existing Conditions

Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff ¹ (in)	Runoff Volume ³ (ft ³)
Impervious-Gravel	A	3,485	0.08	76	3.16	0.63	0.95	275
Woods	A	0	0.00	30	23.33	4.67	0.14	0
Meadow	A	6,534	0.15	30	23.33	4.67	0.14	79
TOTAL:		10,019	0.23					354

1. Runoff (in) = $Q = (P - 0.2S) / (P + 0.8S)$ where
 P = 2-Year Rainfall (in)
 S = $(1000/CN) - 10$

2. Runoff Volume (CF) = $Q \times \text{Area} \times 1/12$
 Q = Runoff (in)
 Area = Land use area (sq. ft.)

Note: Runoff Volume must be calculated for EACH land use type/condition and HSGI. The use of a weighted CN value for volume calculations is not acceptable.

Worksheet 5. Structural BMP Volume Credits

PROJECT: N. Union Street
 SUB-BASIN: DA-1

Required Control Volume (ft³) - from Worksheet 4:	204
Non-structural Volume Credit (ft³) - from Worksheet 3: (maximum is 25% of required volume)	N/A
Structural Volume Reqmt (ft³) <i>(Required Control Volume minus Non-structural Credit)</i>	204

Proposed BMPs from PA Stormwater Best Management Practices Manual Chapter 6	Area (ft ²)	Volume Reduction Permanently Removed (ft ³)
6.4.1 Porous Pavement		
6.4.2 Infiltration Basin		
6.4.3 Infiltration Bed		
6.4.4 Infiltration Trench		
6.4.5 Rain Garden/Bioretenion		
6.4.6 Dry Well/Seepage Pit		
6.4.7 Constructed Filter		
6.4.8 Vegetated Swale		
6.4.9 Vegetated Filter Strip		
6.4.10 Berm	395	354
6.5.1 Vegetated Roof		
6.5.2 Capture and Re-Use		
6.6.1 Constructed Wetlands		
6.6.2 Wet Pond/Retention Basin		
6.7.1 Riparian Buffer/Riparian Forest Buffer Restoration		
6.7.2 Landscape Restoration/Reforestation		
6.7.3 Soil Amendment		
6.8.1 Level Spreader		
6.8.2 Special Storage Areas		
Other:		
Total Structural Volume (ft³):		354
Structural Volume Requirement (ft³):		204
DIFFERENCE:		-150

VOLUME CREDIT DETERMINATION

- 1 Detained area runoff vol. from 2-year/24-hr storm = 354 cf
- 2 Storage volume of the BMP = 1,020 cf
- 3 Infiltrated volume within 72 hours after the 2-yr/24-hr event
(Infiltration Rate/12) x Infiltration Area x 72 hrs = 354 cf

Potential infiltrated volume = 3,060 cf. Since this is greater than the storage volume, only the storage volume can be used and assumed to infiltrate within 72 hours.

WORKSHEET 10. WATER QUALITY COMPLIANCE FOR NITRATE

Does the site design incorporate the following BMPs to address nitrate pollution? A summary "yes" rating is achieved if at least 2 Primary BMPs for nitrate are provided across the site or 4 secondary BMPs for nitrate are provided across the site (or the

PRIMARY BMPs FOR NITRATE:

	YES	NO
NS BMP 5.4.2 - Protect / Conserve / Enhance Riparian Buffers	<input type="checkbox"/>	<input type="checkbox"/>
NS BMP 5.5.4 - Cluster Uses at Each Site	<input type="checkbox"/>	<input type="checkbox"/>
NS BMP 5.6.1 - Minimize Total Disturbed Area	<input checked="" type="checkbox"/>	<input type="checkbox"/>
NS BMP 5.6.3 - Re-Vegetate / Re-Forest Disturbed Areas (Native Species)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
NS BMP 5.9.1 - Street Sweeping / Vacuuming	<input type="checkbox"/>	<input type="checkbox"/>
Structural BMP 6.7.1 - Riparian Buffer Restoration	<input type="checkbox"/>	<input type="checkbox"/>
Structural BMP 6.7.2 - Landscape Restoration	<input type="checkbox"/>	<input type="checkbox"/>

SECONDARY BMPs FOR NITRATE:

NS BMP 5.4.1 - Protect Sensitive / Special Value Features	<input type="checkbox"/>	<input type="checkbox"/>
NS BMP 5.4.3 - Protect / Utilize Natural Drainage Features	<input type="checkbox"/>	<input type="checkbox"/>
NS BMP 5.6.2 - Minimize Soil Compaction	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Structural BMP 6.4.5 - Rain Garden / Bioretention	<input type="checkbox"/>	<input type="checkbox"/>
Structural BMP 6.4.8 - Vegetated Swale	<input type="checkbox"/>	<input type="checkbox"/>
Structural BMP 6.4.9 - Vegetated Filter Strip	<input type="checkbox"/>	<input type="checkbox"/>
Structural BMP 6.6.1 - Constructed Wetland	<input type="checkbox"/>	<input type="checkbox"/>
Structural BMP 6.7.1 - Riparian Buffer Restoration	<input type="checkbox"/>	<input type="checkbox"/>
Structural BMP 6.7.2 - Landscape Restoration	<input type="checkbox"/>	<input type="checkbox"/>
Structural BMP 6.7.3 - Soils Amendment/Restoration	<input checked="" type="checkbox"/>	<input type="checkbox"/>

TIME OF CONCENTRATION ADJUSTMENT

POST CONSTRUCTION TC TO BMP (DETAINED TC) BEFORE ADJUSTMENT 8.7 MIN

STRUCTURAL VOLUME PROVIDED BY BMP 1,020 CF

RATES OF RUNOFF TO THE BMP (FROM HYDRAFLOW REPORT)

Storm Event	Q (CFS)
2 YR/24 HR	-
10 YR/24 HR	0.025
50 YR/24 HR	0.27
100 YR/24 HR	0.46

ADDITIONAL RESIDENCE TIME (MIN) = (STRUCTURAL VOLUME PROVIDED BY BMP / RATE OF RUNOFF TO BMP) / 60

Storm Event	Q (CFS)	Additional Residence Time (min.)
2 YR/24 HR	-	-
10 YR/24 HR	0.025	680.000
50 YR/24 HR	0.270	62.963
100 YR/24 HR	0.460	36.957

ADJUSTED TC = POST CONSTRUCTION TC TO BMP BEFORE ADJUSTMENT + ADDITIONAL RESIDENCE TIME

Storm Event	Q (CFS)	Additional Residence Time (min.)	Adjusted Time of Concentration (min.)
2 YR/24 HR	-	-	8.700
10 YR/24 HR	0.025	680.000	688.700
50 YR/24 HR	0.270	62.963	71.663
100 YR/24 HR	0.460	36.957	45.657

INFILTRATION BERM DEWATERING CALCULATION

SITE NAME: N. Union Street

DA 1

STORAGE VOLUME 1,020 CF
DESIGN INFILTRATION RATE 0.5 IN/HR BASED ON IT-0A AND IT-04
INFILTRATION AREA 1,000 SF

DEWATERING TIME = STORAGE VOLUME / ((DESIGN INFILTRATION RATE /12) * INFILTRATION AREA)

DEWATERING TIME = 24.5 HOURS

WORKSHEET 1. GENERAL SITE INFORMATION

Date: November 11, 2016

Project Name: N. Union Street

Municipality: Lower Swatara/Middletown Borough

County: Dauphin

Total Area (acres): DA-2: 0.76 acres

Major River Basin: Susquehanna River

Watershed: Little Swatara and Quittapahilla Creeks

Sub Basin: Swatara Creek

Nearest Surface Water to Receive Runoff: Trib 09363 To Swatara Creek

Chapter 93 - Designated Water Use: WWF

Impaired according to Chapter 303(d) list? YES
List Causes of Impairment: NO

Is Project Subject to, or Part of:

Municipal Separate Storm Sewer System (MS4) Requirements YES

NO

Existing or Planned drinking water supply? YES

NO

If yes, distance from proposed discharge (miles): _____

Approved Act 167 Plan? YES

NO

Existing River Conservation Plan? YES

NO

Worksheet 2. Sensitive Natural Resources

INSTRUCTIONS

1. Provide Sensitive Resources Map according to non-structural BMP 5.4.1 in Chapter 5. This map should identify wetlands, woodlands, natural drainage ways, steep slopes, and other sensitive natural areas.

See pre-development drainage area map

2. Summarize the existing extent of each sensitive resource in the Existing Sensitive Resources Table (below, using Acres). If none present, insert 0.

0.00 acres

3. Summarize Total Protected Area as defined under BMPs in Chapter 5.

0.00 acres

4. Do not count any area twice. For example, an area that is both a floodplain and a wetland may only be considered once.

EXISTING NATURAL SENSITIVE RESOURCE	MAPPED? Yes/no/n/a	TOTAL AREA (Ac.)	PROTECTED AREA (Ac.)
Waterbodies	N/A		
Floodplains	N/A		
Riparian Areas	N/A		
Wetlands	N/A		
Woodlands	N/A		
Natural Drainage Ways	N/A		
Steep Slopes, 15% - 25%	N/A		
Steep Slopes, over 25%	N/A		
Other:			
Other:			
TOTAL EXISTING:		0.00	0.00

Worksheet 3. Nonstructural BMP Credits

PROTECTED AREA

1.1 Area of Protected Sensitive/Special Value Features (see WS 2)	0.00 Ac.
1.2 Area of Riparian Forest Buffer Protection	0.00 Ac.
3.1 Area of Minimum Disturbance/Reduced Grading	0.00 Ac
TOTAL	0.00 Ac

Site Area	Minus	Protected Area	=	Stormwater Management Area
0.34	-	0	=	0.34
				This is the area that requires stormwater management

VOLUME CREDITS

3.1 Minimum Soil Compaction (See Chapter 8, page 22 – SW BMP Manual)

Lawn	_____ ft ²	x 1/4" x 1/12	=	_____ ft ³

Meadow	_____ ft ²	x 1/3" x 1/12	=	_____ ft ³

3.3 Protect Existing Trees (See Chapter 8, page 23 – SW BMP Manual)

For Trees within 100 feet of impervious area:

Tree Canopy	_____ ft ²	x 1/2" x 1/12	=	_____ ft ³

5.1 Disconnect Roof Leaders to Vegetated Areas (See Chapter 8 page 25 – SW BMP Manual)

For runoff directed to areas protected under 5.8.1 and 5.8.2

Roof Area	_____ ft ²	x 1/3" x 1/12	=	_____ ft ³
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For all other disconnected roof areas

Roof Area	_____ ft ²	x 1/4" x 1/12	=	_____ ft ³
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5.2 Disconnect Non-Roof impervious to Vegetated Areas (See Chapter 8, page 26 – SW BMP Manual)

For Runoff directed to areas protected under 5.8.1 and 5.8.2

Impervious Area	_____ ft ²	x 1/3" x 1/12	=	_____ ft ³
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For all other disconnected roof areas

Impervious Area	_____ ft ²	x 1/4" x 1/12	=	_____ ft ³
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TOTAL NON-STRUCTURAL VOLUME CREDIT* _____ ft³

**For use on Worksheet 5*

WORKSHEET 4. CHANGE IN RUNOFF VOLUME FOR 2-YR STORM EVENT

PROJECT: N. Union Street DA-2
 Drainage Area: 0.76 acres
 2-Year Rainfall: 2.90 in

Total Site Area: 0.34 acres
 Protected Site Area: N/A acres
 Managed Site Area: 0.34 acres

Existing Conditions

Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff ¹ (in)	Runoff Volume ³ (ft ³)
Impervious	-	0	0.00	98	0.20	0.04	2.67	0
Woods	A	0	0.00	30	23.33	4.67	0.14	0
Meadow	A	14,810	0.34	30	23.33	4.67	0.14	179
TOTAL:		14,810	0.34					179

Developed Conditions

Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff ¹ (in)	Runoff Volume ³ (ft ³)
Impervious - Gravel	A	3,049	0.07	76	3.16	0.63	0.95	241
Meadow	A	11,761	0.27	30	23.33	4.67	0.14	142
TOTAL:		14,810	0.34					383

2-Year Volume Increase (ft ³):	204
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2-Year Volume Increase = Developed Conditions Runoff Volume - Existing Conditions Runoff Volume

- Runoff (in) = $Q = (P - 0.2S) / (P + 0.8S)$ where
 P = 2-Year Rainfall (in)
 S = $(1000/CN) - 10$
- Runoff Volume (CF) = $Q \times \text{Area} \times 1/12$
 Q = Runoff (in)
 Area = Land use area (sq. ft.)

Note: Runoff Volume must be calculated for EACH land use type/condition and HSGI. The use of a weighted CN value for volume calculations is not acceptable.

WORKSHEET 4. CHANGE IN RUNOFF VOLUME FOR 2-YR STORM EVENT

PROJECT: N. Union Street DA-2
 2-Year Rainfall: 2.90 in

Existing Conditions

Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	la (0.2*S)	Q Runoff ¹ (in)	Runoff Volume ³ (ft ³)
Impervious-Gravel	A	3,049	0.07	76	3.16	0.63	0.95	241
Woods	A	0	0.00	30	23.33	4.67	0.14	0
Meadow	A	9,583	0.22	30	23.33	4.67	0.14	116
TOTAL:		12,632	0.29					357

1. Runoff (in) = $Q = (P - 0.2S) / (P + 0.8S)$ where
 P = 2-Year Rainfall (in)
 S = $(1000/CN) - 10$

2. Runoff Volume (CF) = $Q \times \text{Area} \times 1/12$
 Q = Runoff (in)
 Area = Land use area (sq. ft.)

Note: Runoff Volume must be calculated for EACH land use type/condition and HSGI. The use of a weighted CN value for volume calculations is not acceptable.

Worksheet 5. Structural BMP Volume Credits

PROJECT: N. Union Street
 SUB-BASIN: DA-2

Required Control Volume (ft³) - from Worksheet 4:	<u>204</u>
Non-structural Volume Credit (ft³) - from Worksheet 3: (maximum is 25% of required volume)	<u>N/A</u>
Structural Volume Reqmt (ft³) <i>(Required Control Volume minus Non-structural Credit)</i>	<u>204</u>

Proposed BMPs from PA Stormwater Best Management Practices Manual Chapter 6	Area (ft ²)	Volume Reduction Permanently Removed (ft ³)
6.4.1 Porous Pavement		
6.4.2 Infiltration Basin		
6.4.3 Infiltration Bed		
6.4.4 Infiltration Trench		
6.4.5 Rain Garden/Bioretenion		
6.4.6 Dry Well/Seepage Pit		
6.4.7 Constructed Filter		
6.4.8 Vegetated Swale		
6.4.9 Vegetated Filter Strip		
6.4.10 Berm	402	357
6.5.1 Vegetated Roof		
6.5.2 Capture and Re-Use		
6.6.1 Constructed Wetlands		
6.6.2 Wet Pond/Retention Basin		
6.7.1 Riparian Buffer/Riparian Forest Buffer Restoration		
6.7.2 Landscape Restoration/Reforestation		
6.7.3 Soil Amendment		
6.8.1 Level Spreader		
6.8.2 Special Storage Areas		
Other: Geoweb		375
Total Structural Volume (ft³):		357
Structural Volume Requirement (ft³):		204
DIFFERENCE:		-153

VOLUME CREDIT DETERMINATION DETAINED 1

- 1 Detained area runoff volume to BMP = 357 cf
- 2 Storage volume of the BMP = 750 cf
- 3 Infiltrated volume within 72 hours after the 2-yr/24-hr event
(Infiltration Rate/12) x Infiltration Area x 72 hrs = 357 cf

Potential infiltrated volume = 2,607 cf. Since this is greater than the storage volume, only the storage volume can be used and assumed to infiltrate within 72 hours.

WORKSHEET 10. WATER QUALITY COMPLIANCE FOR NITRATE

Does the site design incorporate the following BMPs to address nitrate pollution? A summary "yes" rating is achieved if at least 2 Primary BMPs for nitrate are provided across the site or 4 secondary BMPs for nitrate are provided across the site (or the

PRIMARY BMPs FOR NITRATE:

	YES	NO
NS BMP 5.4.2 - Protect / Conserve / Enhance Riparian Buffers	<input type="checkbox"/>	<input type="checkbox"/>
NS BMP 5.5.4 - Cluster Uses at Each Site	<input type="checkbox"/>	<input type="checkbox"/>
NS BMP 5.6.1 - Minimize Total Disturbed Area	<input checked="" type="checkbox"/>	<input type="checkbox"/>
NS BMP 5.6.3 - Re-Vegetate / Re-Forest Disturbed Areas (Native Species)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
NS BMP 5.9.1 - Street Sweeping / Vacuuming	<input type="checkbox"/>	<input type="checkbox"/>
Structural BMP 6.7.1 - Riparian Buffer Restoration	<input type="checkbox"/>	<input type="checkbox"/>
Structural BMP 6.7.2 - Landscape Restoration	<input type="checkbox"/>	<input type="checkbox"/>

SECONDARY BMPs FOR NITRATE:

NS BMP 5.4.1 - Protect Sensitive / Special Value Features	<input type="checkbox"/>	<input type="checkbox"/>
NS BMP 5.4.3 - Protect / Utilize Natural Drainage Features	<input type="checkbox"/>	<input type="checkbox"/>
NS BMP 5.6.2 - Minimize Soil Compaction	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Structural BMP 6.4.5 - Rain Garden / Bioretention	<input type="checkbox"/>	<input type="checkbox"/>
Structural BMP 6.4.8 - Vegetated Swale	<input type="checkbox"/>	<input type="checkbox"/>
Structural BMP 6.4.9 - Vegetated Filter Strip	<input type="checkbox"/>	<input type="checkbox"/>
Structural BMP 6.6.1 - Constructed Wetland	<input type="checkbox"/>	<input type="checkbox"/>
Structural BMP 6.7.1 - Riparian Buffer Restoration	<input type="checkbox"/>	<input type="checkbox"/>
Structural BMP 6.7.2 - Landscape Restoration	<input type="checkbox"/>	<input type="checkbox"/>
Structural BMP 6.7.3 - Soils Amendment/Restoration	<input checked="" type="checkbox"/>	<input type="checkbox"/>

TIME OF CONCENTRATION ADJUSTMENT BERM B

POST CONSTRUCTION TC TO BMP (DETAINED TC) BEFORE ADJUSTMENT 6.5 MIN

STRUCTURAL VOLUME PROVIDED BY BMP 750 CF

RATES OF RUNOFF TO THE BMP (FROM HYDRAFLOW REPORT)

Storm Event	Q (CFS)
2 YR/24 HR	-
10 YR/24 HR	0.005
50 YR/24 HR	0.235
100 YR/24 HR	0.468

ADDITIONAL RESIDENCE TIME (MIN) = (STRUCTURAL VOLUME PROVIDED BY BMP / RATE OF RUNOFF TO BMP) / 60

Storm Event	Q (CFS)	Additional Residence Time (min.)
2 YR/24 HR	-	n/a - detained
10 YR/24 HR	0.005	2500.000
50 YR/24 HR	0.235	53.191
100 YR/24 HR	0.468	26.709

ADJUSTED TC = POST CONSTRUCTION TC TO BMP BEFORE ADJUSTMENT + ADDITIONAL RESIDENCE TIME

Storm Event	Q (CFS)	Additional Residence Time (min.)	Adjusted Time of Concentration (min.)
2 YR/24 HR	-	n/a - detained	6.300
10 YR/24 HR	0.005	2500.000	2506.500
50 YR/24 HR	0.235	53.191	59.691
100 YR/24 HR	0.468	26.709	33.209

INFILTRATION BERM DEWATERING CALCULATION

SITE NAME: N. Union Street

DA 2

STORAGE VOLUME 750 CF
DESIGN INFILTRATION RATE 0.5 IN/HR BASED ON IT-01, IT-2 and IT-A
INFILTRATION AREA 869 SF

DEWATERING TIME = STORAGE VOLUME / ((DESIGN INFILTRATION RATE /12) * INFILTRATION AREA)

DEWATERING TIME = 20.7 HOURS

UNDERDRAIN DISCHAGE

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.012	
Channel Slope	0.05500	ft/ft
Normal Depth	0.25	ft
Diameter	0.25	ft
Discharge	0.22	ft ³ /s

Results

Discharge	0.22	ft ³ /s
Normal Depth	0.25	ft
Flow Area	0.05	ft ²
Wetted Perimeter	0.79	ft
Hydraulic Radius	0.06	ft
Top Width	0.00	ft
Critical Depth	0.24	ft
Percent Full	100.0	%
Critical Slope	0.04896	ft/ft
Velocity	4.57	ft/s
Velocity Head	0.33	ft
Specific Energy	0.58	ft
Froude Number	0.00	
Maximum Discharge	0.24	ft ³ /s
Discharge Full	0.22	ft ³ /s
Slope Full	0.05500	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%

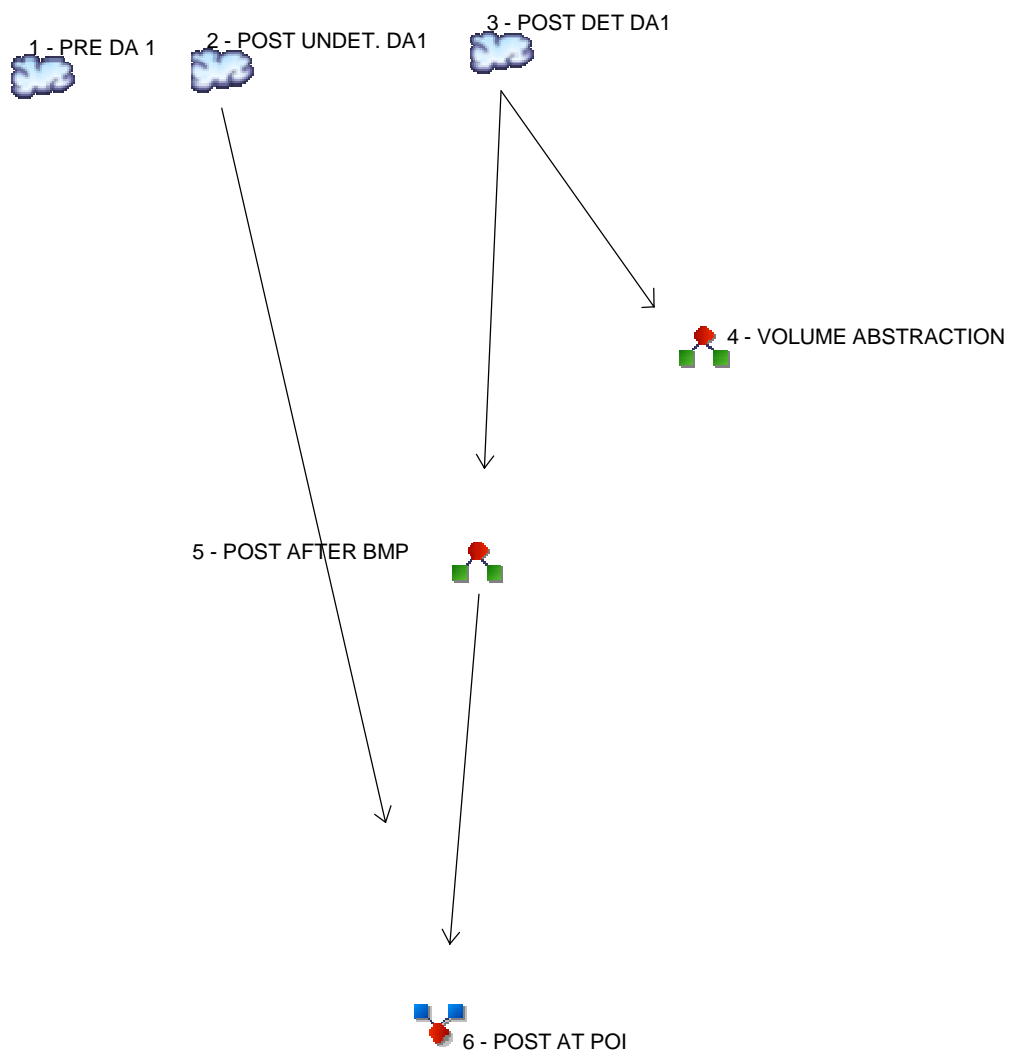
UNDERDRAIN DISCHAGE

GVF Output Data

Normal Depth Over Rise	100.00	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.25	ft
Critical Depth	0.24	ft
Channel Slope	0.05500	ft/ft
Critical Slope	0.04896	ft/ft

Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4



Legend

Hyd. Origin	Description
1	SCS Runoff PRE DA 1
2	SCS Runoff POST UNDET. DA1
3	SCS Runoff POST DET DA1
4	Diversion1 VOLUME ABSTRACTION
5	Diversion2 POST AFTER BMP
6	Combine POST AT POI

Hydrograph Return Period Recap

Hydroflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	-----	-----	0.000	-----	-----	0.000	-----	0.013	0.055	PRE DA 1
2	SCS Runoff	-----	-----	0.000	-----	-----	0.000	-----	0.010	0.045	POST UNDET. DA1
3	SCS Runoff	-----	-----	0.000	-----	-----	0.025	-----	0.270	0.460	POST DET DA1
4	Diversion1	3	-----	0.000	-----	-----	0.025	-----	0.270	0.460	VOLUME ABSTRACTION
5	Diversion2	3	-----	0.000	-----	-----	0.000	-----	0.000	0.011	POST AFTER BMP
6	Combine	2, 5	-----	0.000	-----	-----	0.000	-----	0.010	0.045	POST AT POI

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description	
1	SCS Runoff	0.000	2	n/a	0	-----	-----	-----	PRE DA 1	
2	SCS Runoff	0.000	2	n/a	0	-----	-----	-----	POST UNDET. DA1	
3	SCS Runoff	0.000	2	1440	13	-----	-----	-----	POST DET DA1	
4	Diversion1	0.000	2	1440	13	3	-----	-----	VOLUME ABSTRACTION	
5	Diversion2	0.000	2	n/a	0	3	-----	-----	POST AFTER BMP	
6	Combine	0.000	2	n/a	0	2, 5	-----	-----	POST AT POI	
NUnion DA1.gpw					Return Period: 2 Year			Thursday, 10 / 27 / 2016		

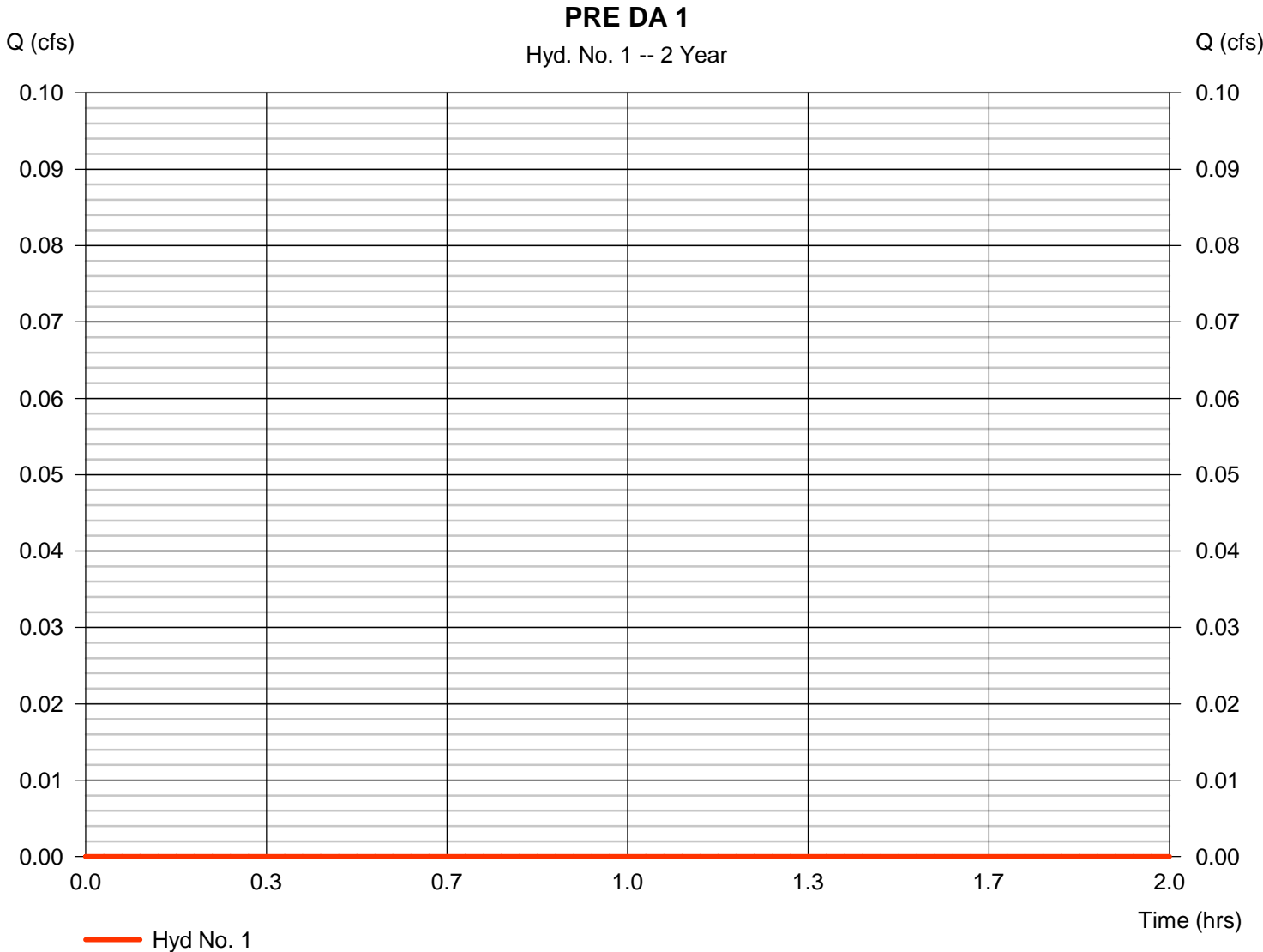
Hydrograph Report

Hyd. No. 1

PRE DA 1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Drainage area	= 1.010 ac	Curve number	= 30*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 6.80 min
Total precip.	= 2.90 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.000 x 30) + (0.010 x 30)] / 1.010



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No. 1

PRE DA 1

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
Sheet Flow				
Manning's n-value	= 0.240	0.011	0.011	
Flow length (ft)	= 50.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 2.90	0.00	0.00	
Land slope (%)	= 6.00	0.00	0.00	
Travel Time (min)	= 5.55	+ 0.00	+ 0.00	= 5.55
Shallow Concentrated Flow				
Flow length (ft)	= 370.00	0.00	0.00	
Watercourse slope (%)	= 8.90	0.00	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	=4.81	0.00	0.00	
Travel Time (min)	= 1.28	+ 0.00	+ 0.00	= 1.28
Channel Flow				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	=0.00	0.00	0.00	
Flow length (ft)	{{0}}0.0	0.0	0.0	
Travel Time (min)	= 0.00	+ 0.00	+ 0.00	= 0.00
Total Travel Time, Tc				6.80 min

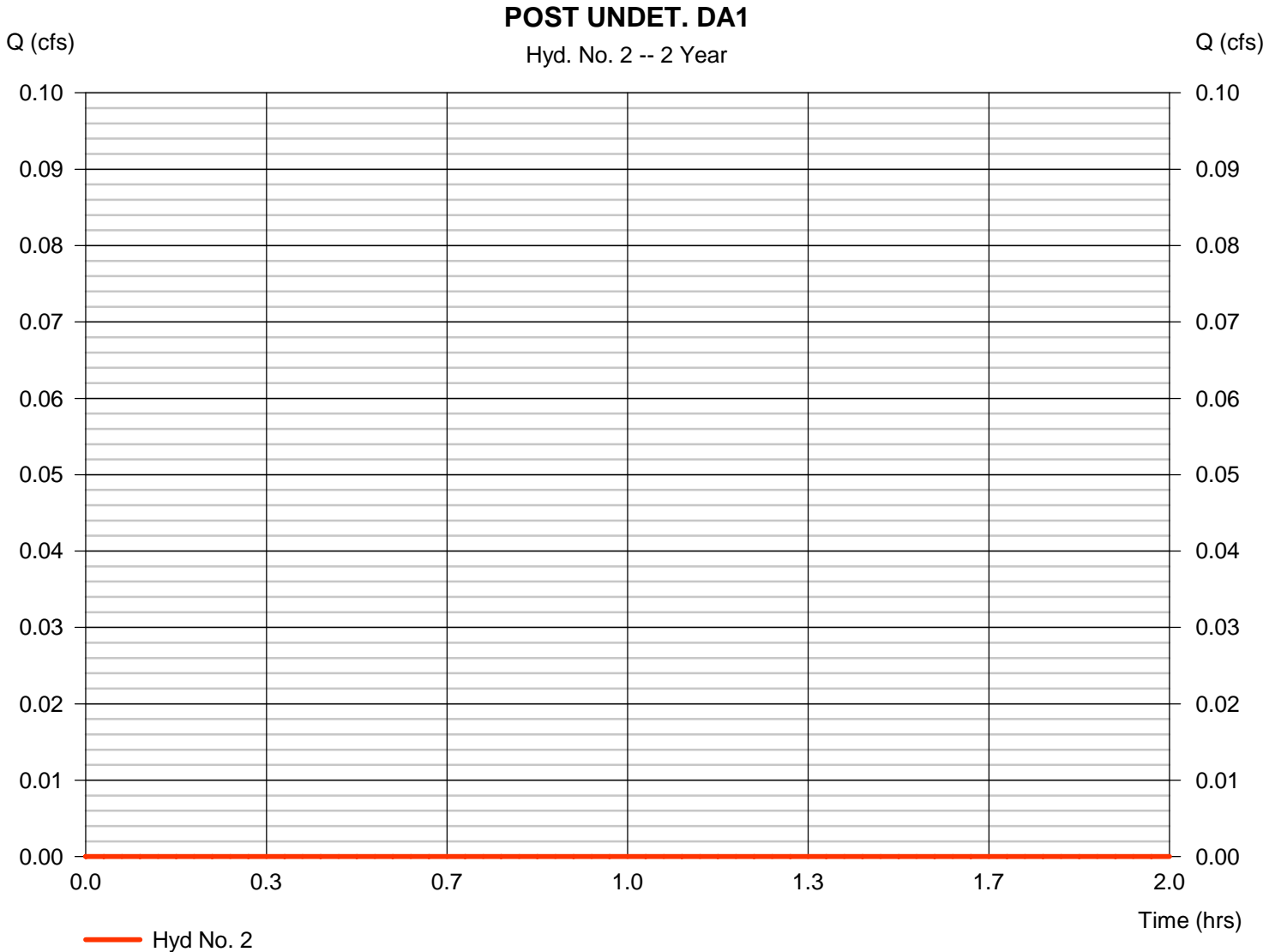
Hydrograph Report

Hyd. No. 2

POST UNDET. DA1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Drainage area	= 0.820 ac	Curve number	= 30*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 6.80 min
Total precip.	= 2.90 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.820 x 30)] / 0.820



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No. 2

POST UNDET. DA1

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
Sheet Flow				
Manning's n-value	= 0.240	0.011	0.011	
Flow length (ft)	= 50.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 2.90	0.00	0.00	
Land slope (%)	= 6.00	0.00	0.00	
Travel Time (min)	= 5.55	+ 0.00	+ 0.00	= 5.55
Shallow Concentrated Flow				
Flow length (ft)	= 370.00	0.00	0.00	
Watercourse slope (%)	= 8.90	0.00	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	=4.81	0.00	0.00	
Travel Time (min)	= 1.28	+ 0.00	+ 0.00	= 1.28
Channel Flow				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	=0.00	0.00	0.00	
Flow length (ft)	0.0	0.0	0.0	
Travel Time (min)	= 0.00	+ 0.00	+ 0.00	= 0.00
Total Travel Time, Tc				6.80 min

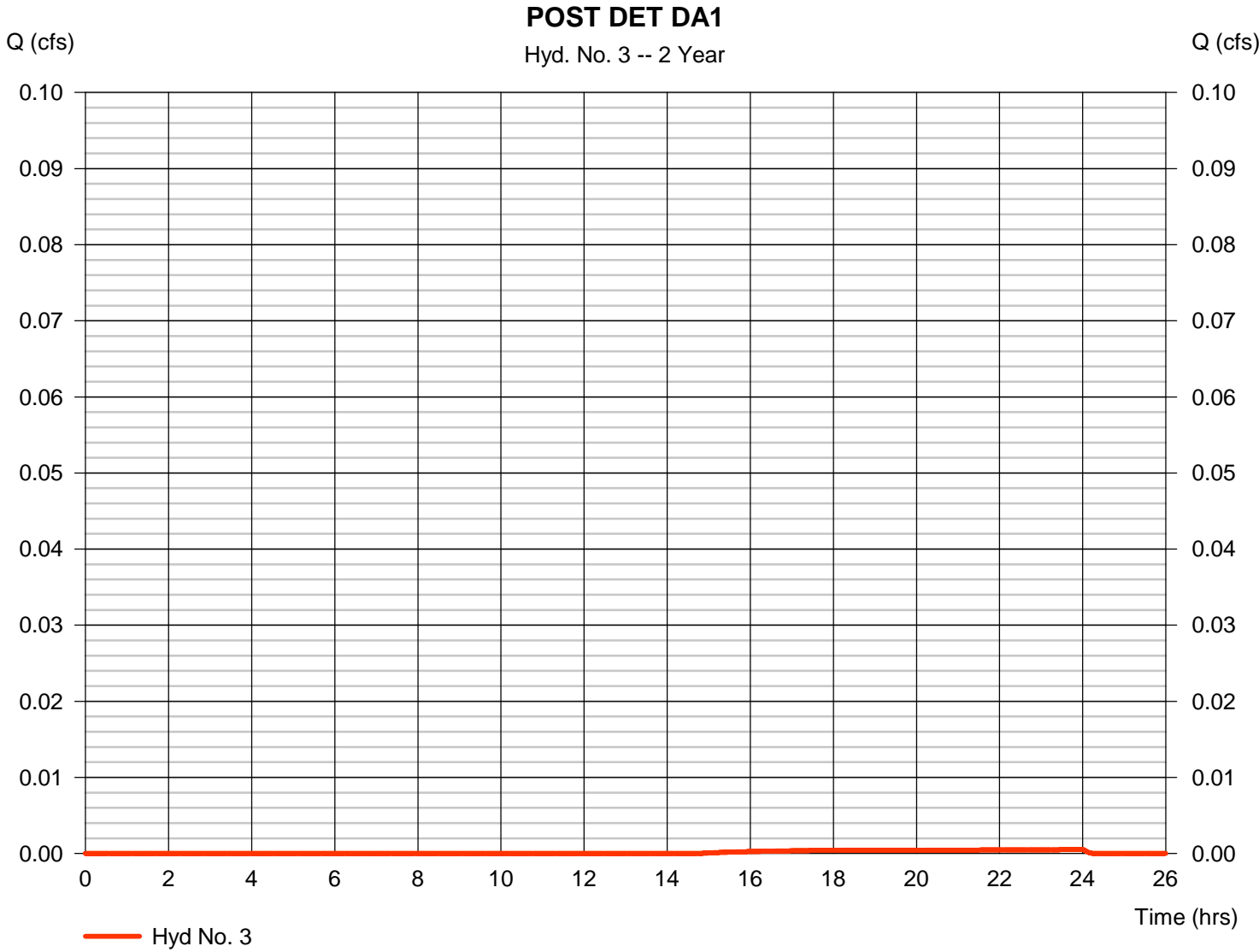
Hydrograph Report

Hyd. No. 3

POST DET DA1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= 24.00 hrs
Time interval	= 2 min	Hyd. volume	= 13 cuft
Drainage area	= 0.220 ac	Curve number	= 45*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.70 min
Total precip.	= 2.90 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.070 x 76) + (0.150 x 30)] / 0.220



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No. 3

POST DET DA1

<u>Description</u>	<u>A</u>		<u>B</u>		<u>C</u>	<u>Totals</u>
Sheet Flow						
Manning's n-value	= 0.240		0.011		0.011	
Flow length (ft)	= 50.0		0.0		0.0	
Two-year 24-hr precip. (in)	= 2.90		0.00		0.00	
Land slope (%)	= 2.40		0.00		0.00	
Travel Time (min)	= 8.00	+	0.00	+	0.00	= 8.00
Shallow Concentrated Flow						
Flow length (ft)	= 40.00		43.00		0.00	
Watercourse slope (%)	= 2.50		11.60		0.00	
Surface description	= Paved		Unpaved		Paved	
Average velocity (ft/s)	=3.21		5.50		0.00	
Travel Time (min)	= 0.21	+	0.13	+	0.00	= 0.34
Channel Flow						
X sectional flow area (sqft)	= 0.05		0.00		0.00	
Wetted perimeter (ft)	= 0.79		0.00		0.00	
Channel slope (%)	= 5.50		0.00		0.00	
Manning's n-value	= 0.012		0.015		0.015	
Velocity (ft/s)	=4.58		0.00		0.00	
Flow length (ft)	{{0}}110.0		0.0		0.0	
Travel Time (min)	= 0.40	+	0.00	+	0.00	= 0.40
Total Travel Time, Tc						8.70 min

Hydrograph Report

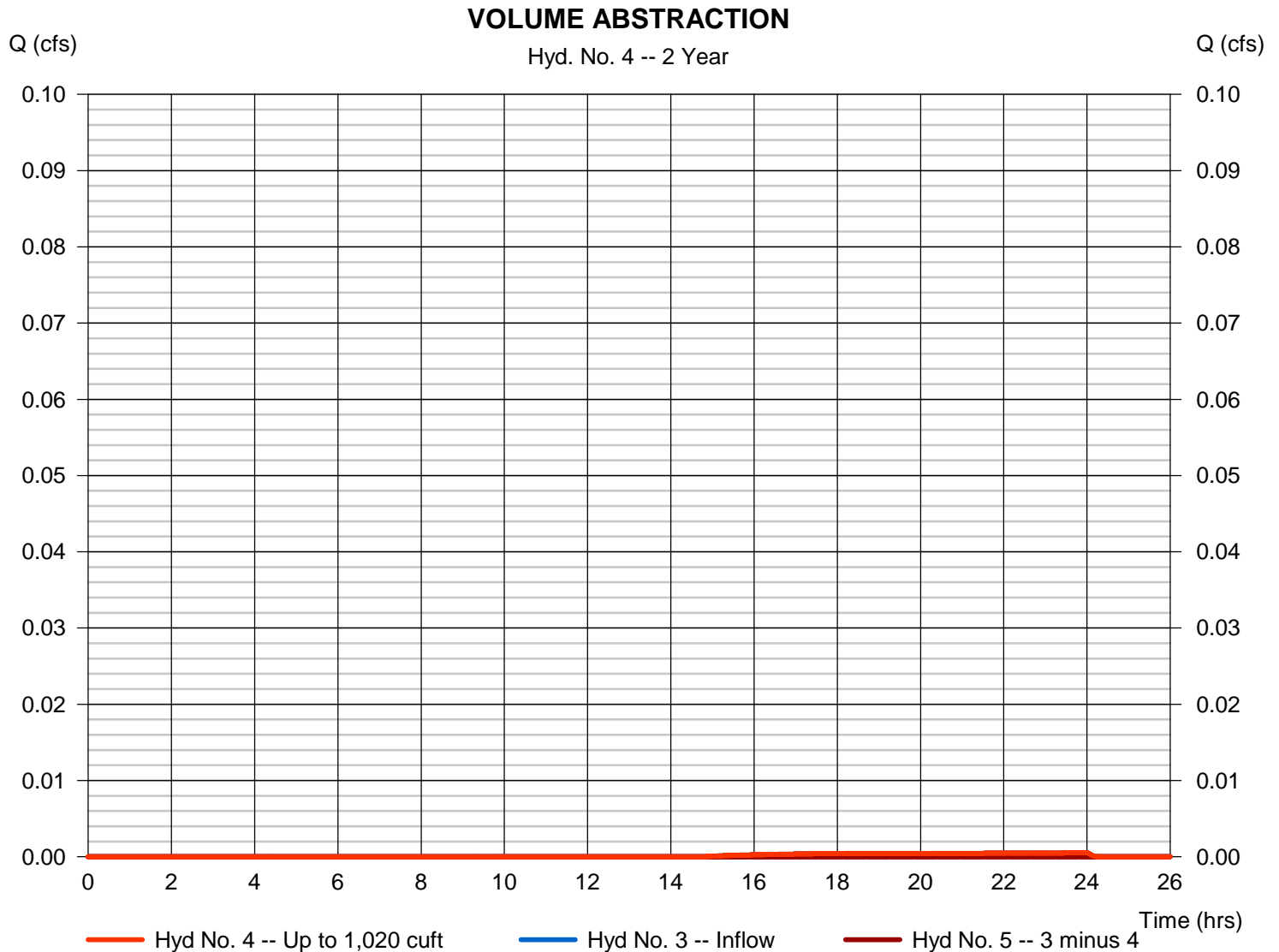
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Thursday, 10 / 27 / 2016

Hyd. No. 4

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= 24.00 hrs
Time interval	= 2 min	Hyd. volume	= 13 cuft
Inflow hydrograph	= 3 - POST DET DA1	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 1,020 cuft



Hydrograph Report

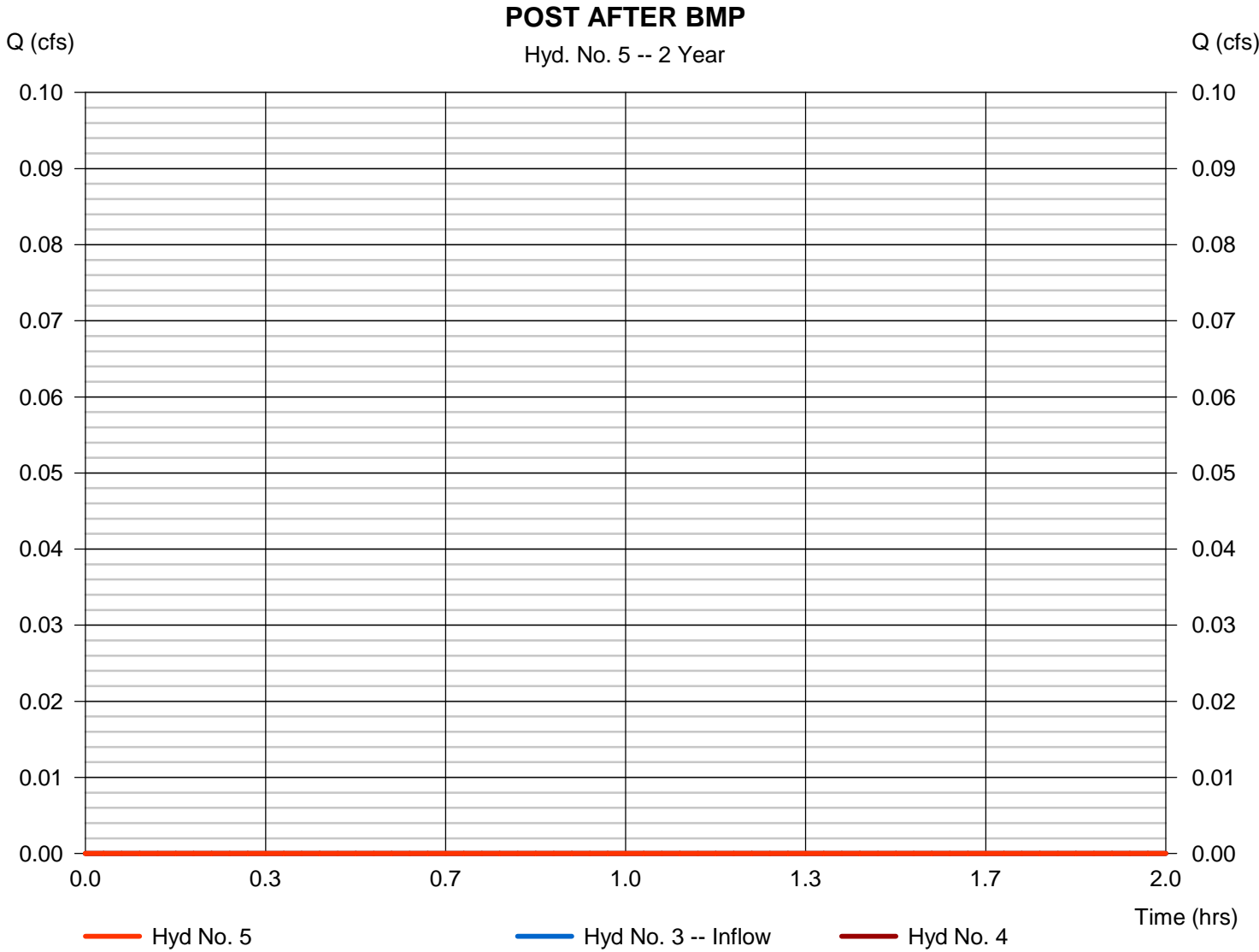
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Thursday, 10 / 27 / 2016

Hyd. No. 5

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hydrograph	= 3 - POST DET DA1	2nd diverted hyd.	= 4
Diversion method	= First Flush Volume	Volume Up To	= 1,020 cuft



Hydrograph Report

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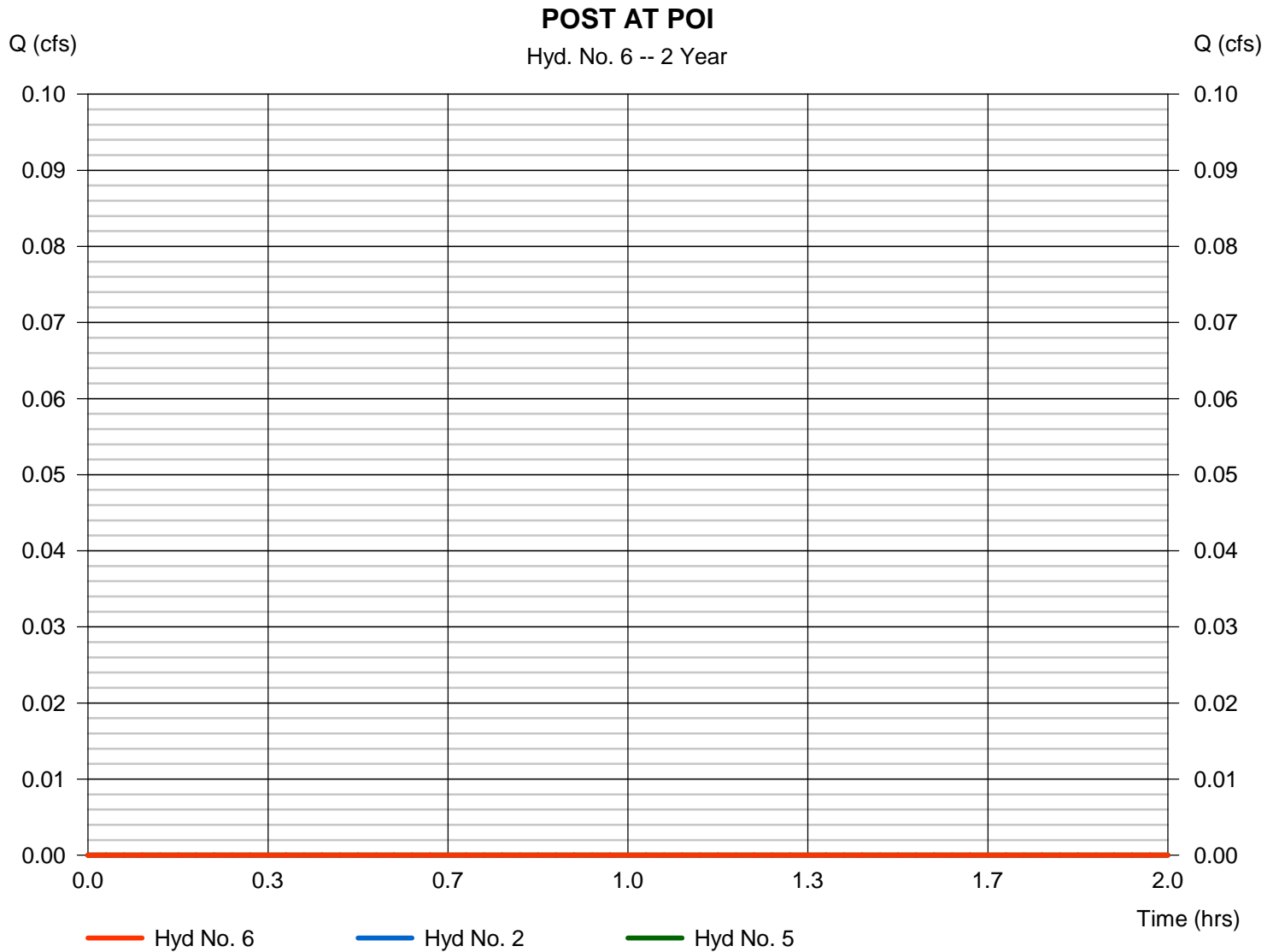
Thursday, 10 / 27 / 2016

Hyd. No. 6

POST AT POI

Hydrograph type = Combine
Storm frequency = 2 yrs
Time interval = 2 min
Inflow hyds. = 2, 5

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 0.820 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description	
1	SCS Runoff	0.000	2	n/a	0	-----	-----	-----	PRE DA 1	
2	SCS Runoff	0.000	2	n/a	0	-----	-----	-----	POST UNDET. DA1	
3	SCS Runoff	0.025	2	724	211	-----	-----	-----	POST DET DA1	
4	Diversion1	0.025	2	724	211	3	-----	-----	VOLUME ABSTRACTION	
5	Diversion2	0.000	2	n/a	0	3	-----	-----	POST AFTER BMP	
6	Combine	0.000	2	n/a	0	2, 5	-----	-----	POST AT POI	
UNion DA1.gpw					Return Period: 10 Year			Thursday, 10 / 27 / 2016		

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

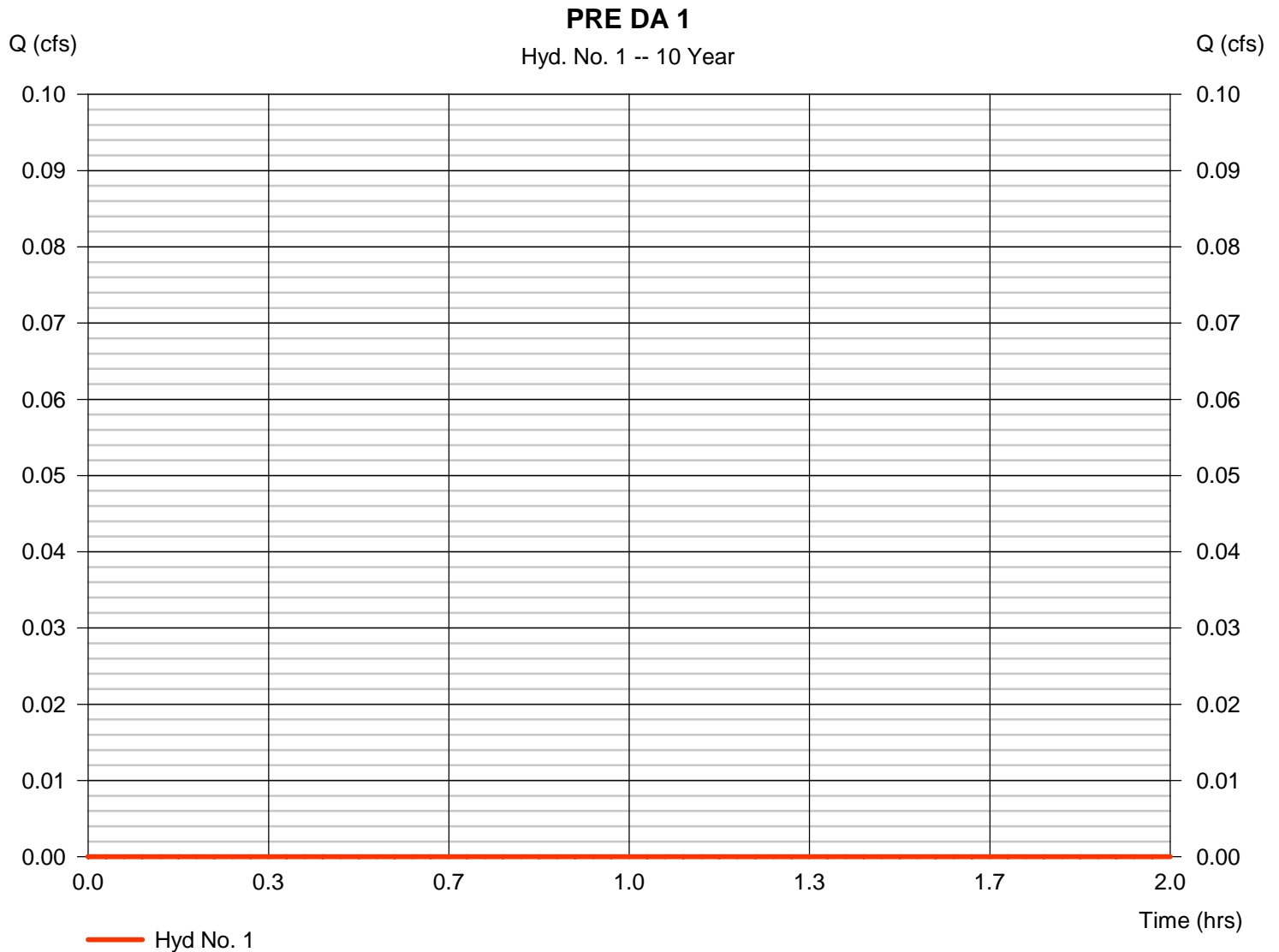
Thursday, 10 / 27 / 2016

Hyd. No. 1

PRE DA 1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 10 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Drainage area	= 1.010 ac	Curve number	= 30*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 6.80 min
Total precip.	= 4.38 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.000 x 30) + (0.010 x 30)] / 1.010



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

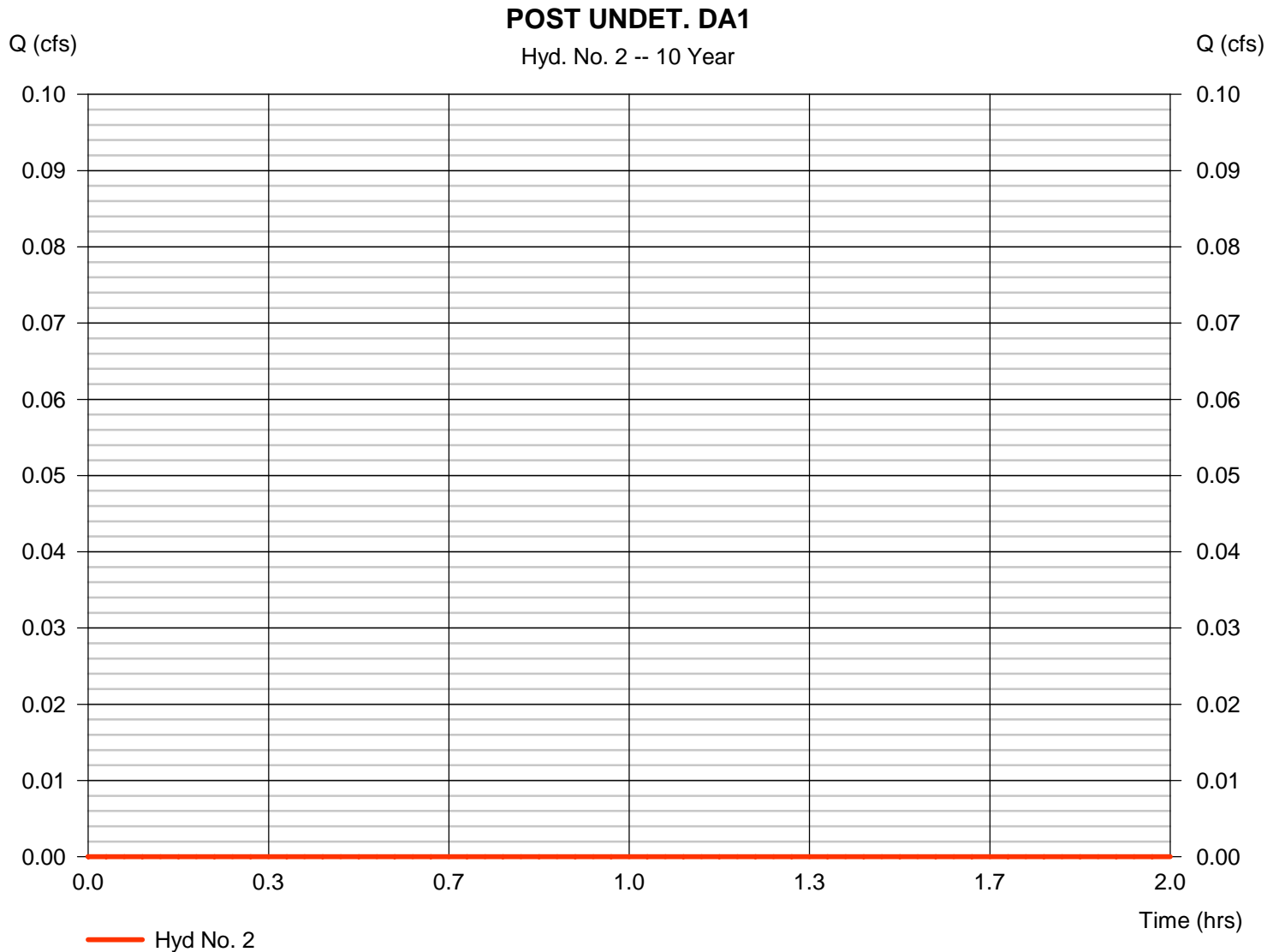
Thursday, 10 / 27 / 2016

Hyd. No. 2

POST UNDET. DA1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 10 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Drainage area	= 0.820 ac	Curve number	= 30*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 6.80 min
Total precip.	= 4.38 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.820 x 30)] / 0.820



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

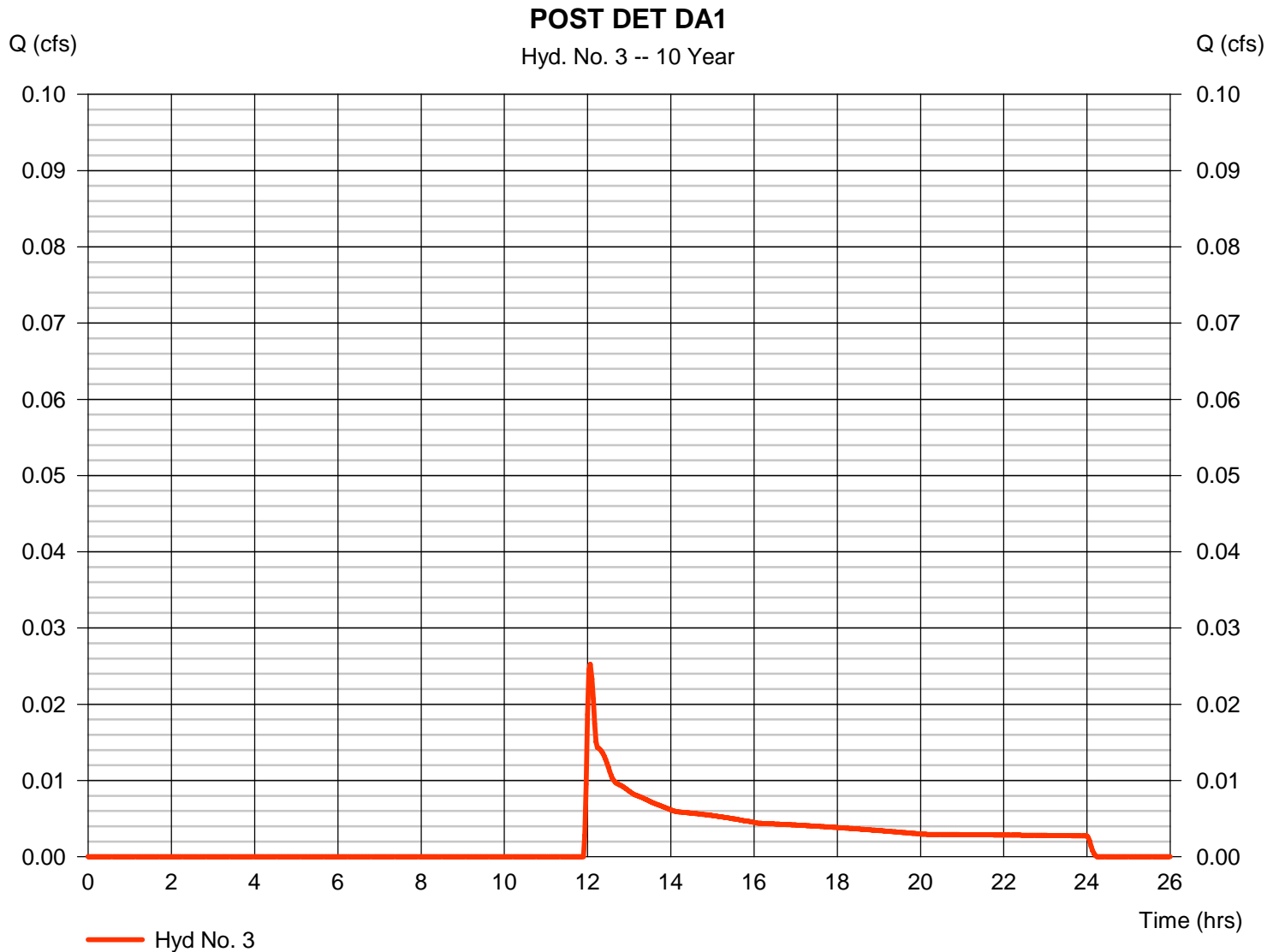
Thursday, 10 / 27 / 2016

Hyd. No. 3

POST DET DA1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.025 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 211 cuft
Drainage area	= 0.220 ac	Curve number	= 45*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.70 min
Total precip.	= 4.38 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.070 x 76) + (0.150 x 30)] / 0.220



Hydrograph Report

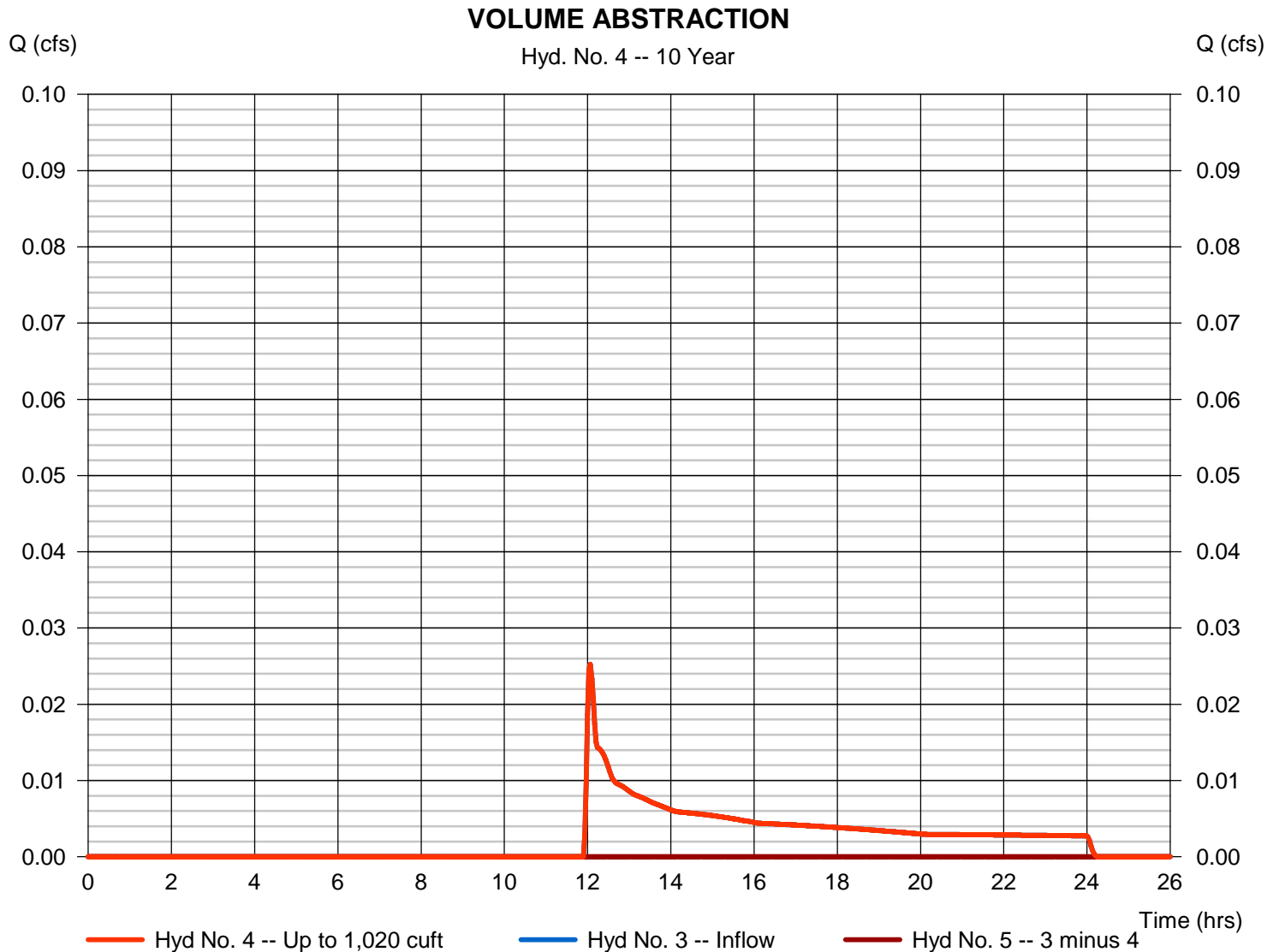
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Thursday, 10 / 27 / 2016

Hyd. No. 4

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 0.025 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 211 cuft
Inflow hydrograph	= 3 - POST DET DA1	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 1,020 cuft



Hydrograph Report

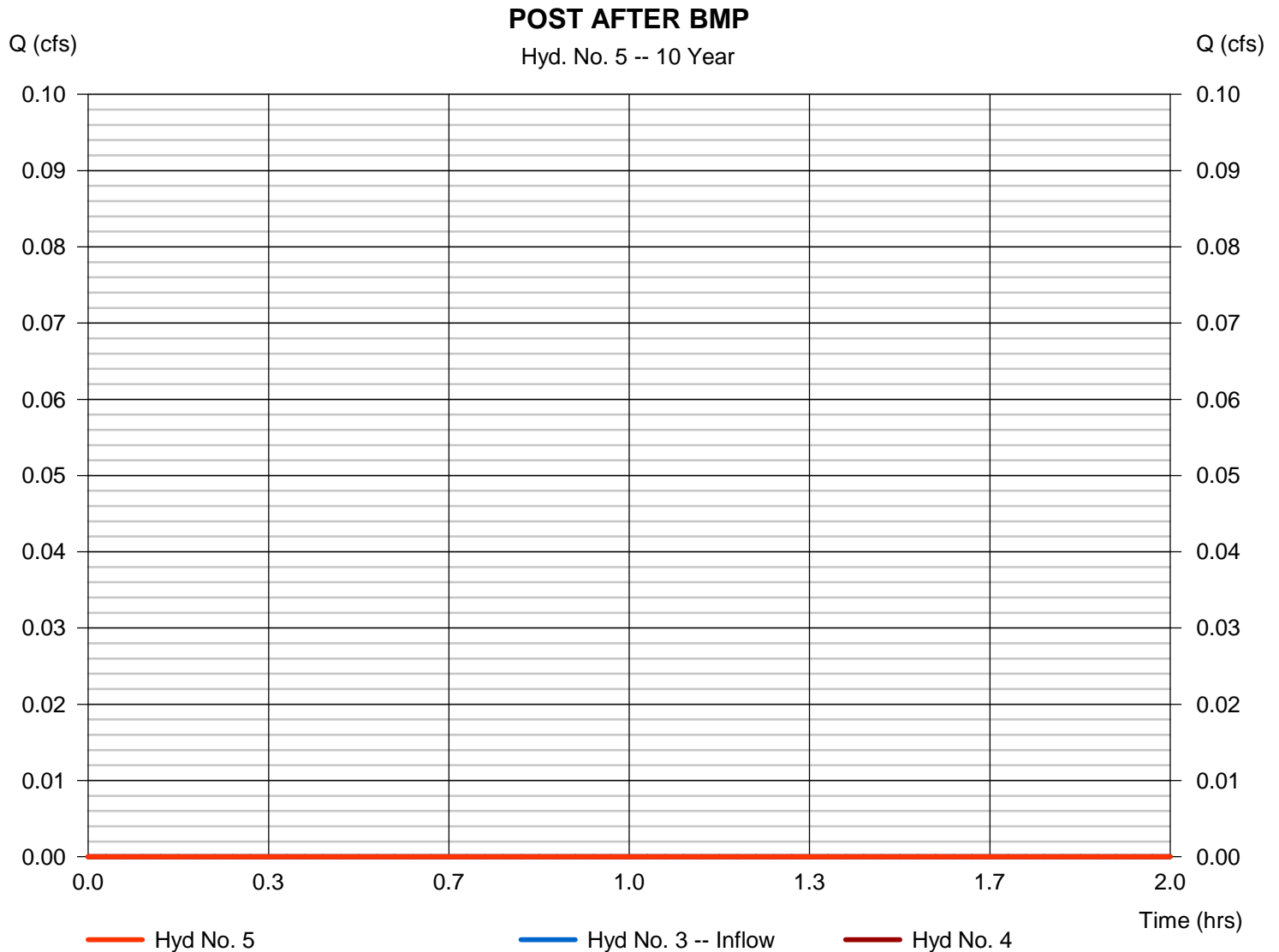
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Thursday, 10 / 27 / 2016

Hyd. No. 5

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 0.000 cfs
Storm frequency	= 10 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hydrograph	= 3 - POST DET DA1	2nd diverted hyd.	= 4
Diversion method	= First Flush Volume	Volume Up To	= 1,020 cuft



Hydrograph Report

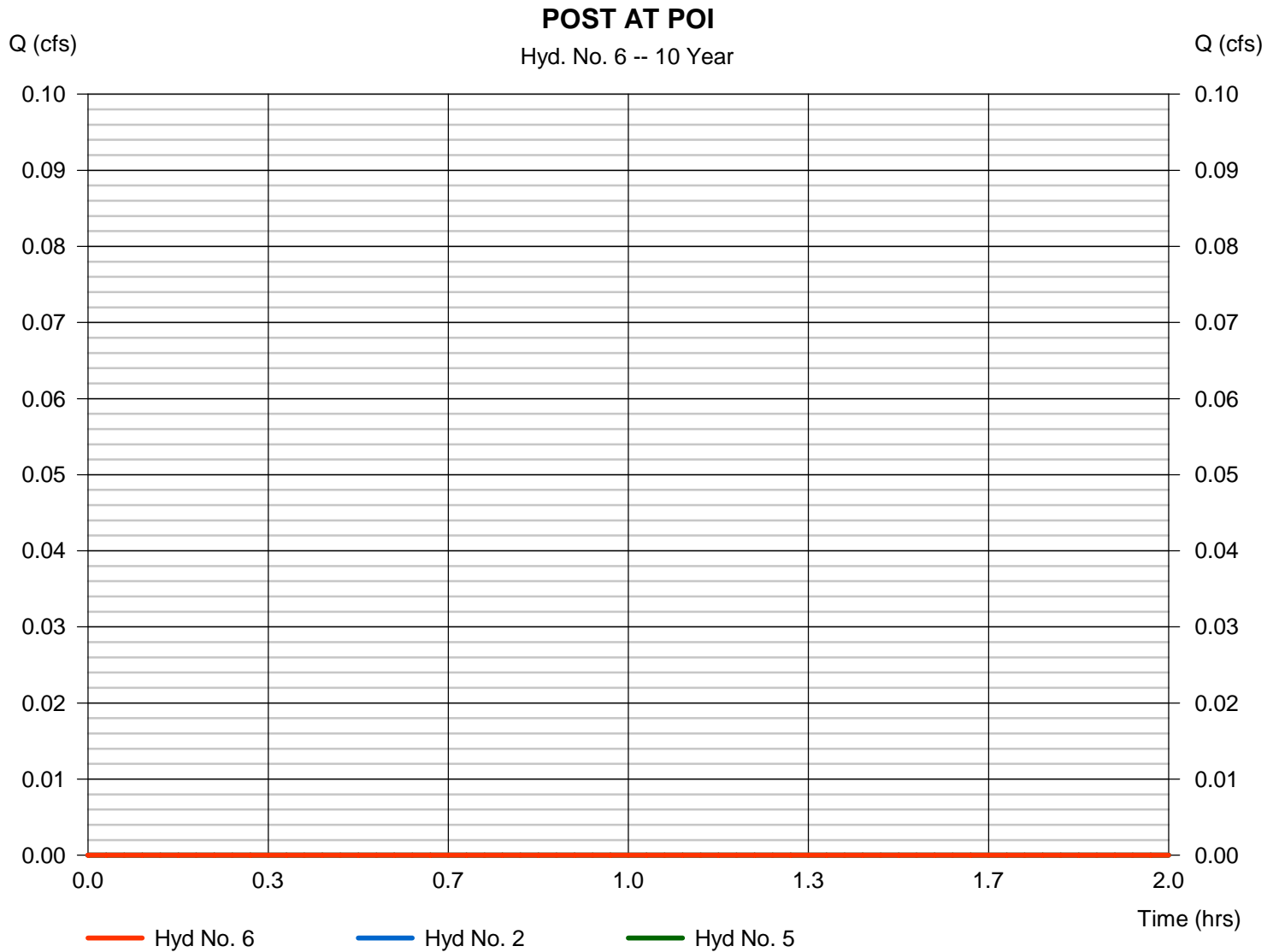
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Thursday, 10 / 27 / 2016

Hyd. No. 6

POST AT POI

Hydrograph type	= Combine	Peak discharge	= 0.000 cfs
Storm frequency	= 10 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyds.	= 2, 5	Contrib. drain. area	= 0.820 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description	
1	SCS Runoff	0.013	2	904	439	-----	-----	-----	PRE DA 1	
2	SCS Runoff	0.010	2	904	357	-----	-----	-----	POST UNDET. DA1	
3	SCS Runoff	0.270	2	720	772	-----	-----	-----	POST DET DA1	
4	Diversion1	0.270	2	720	772	3	-----	-----	VOLUME ABSTRACTION	
5	Diversion2	0.000	2	n/a	0	3	-----	-----	POST AFTER BMP	
6	Combine	0.010	2	904	357	2, 5	-----	-----	POST AT POI	
NUnion DA1.gpw					Return Period: 50 Year			Thursday, 10 / 27 / 2016		

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

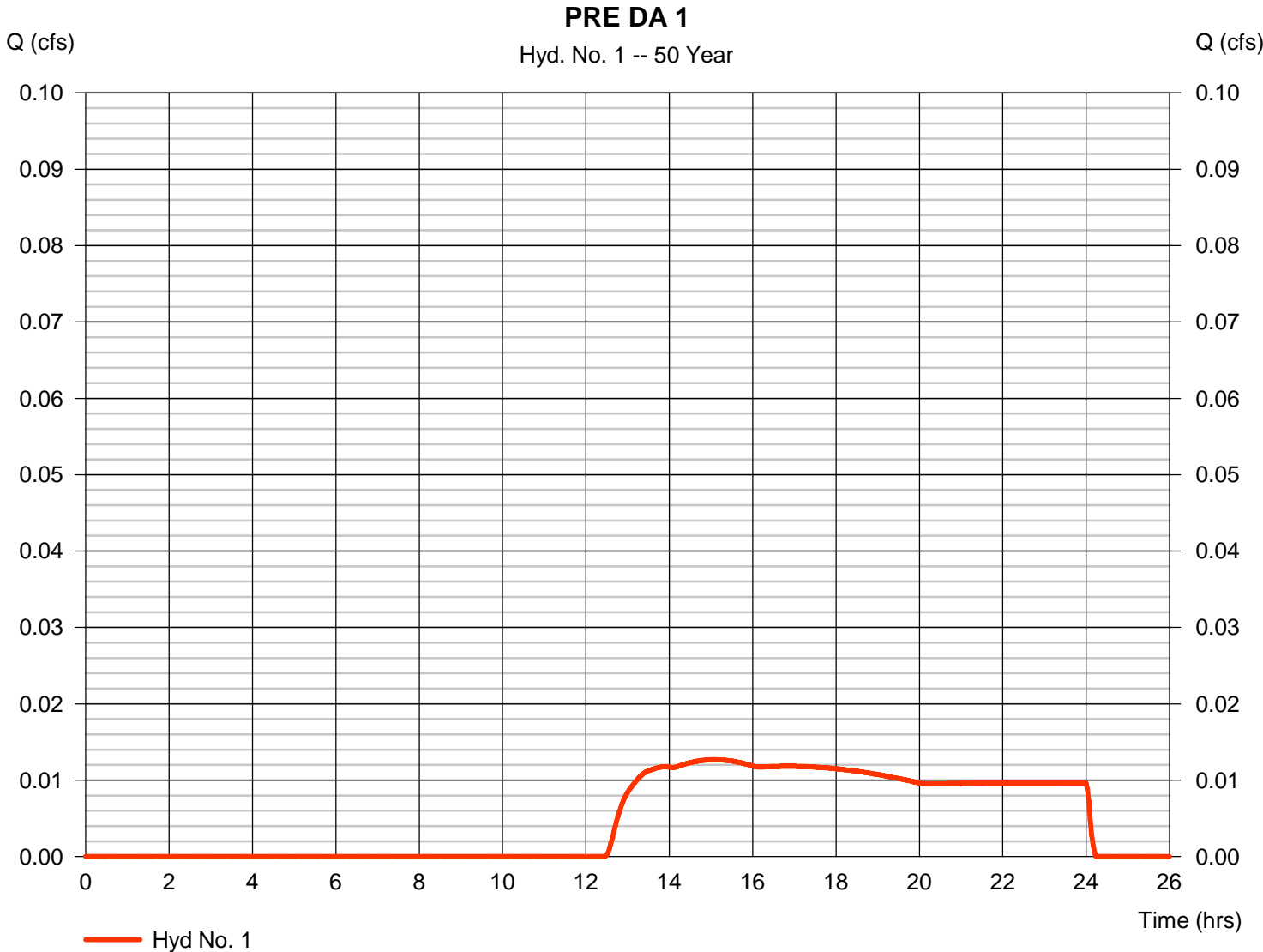
Thursday, 10 / 27 / 2016

Hyd. No. 1

PRE DA 1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.013 cfs
Storm frequency	= 50 yrs	Time to peak	= 15.07 hrs
Time interval	= 2 min	Hyd. volume	= 439 cuft
Drainage area	= 1.010 ac	Curve number	= 30*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 6.80 min
Total precip.	= 6.40 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.000 x 30) + (0.010 x 30)] / 1.010



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

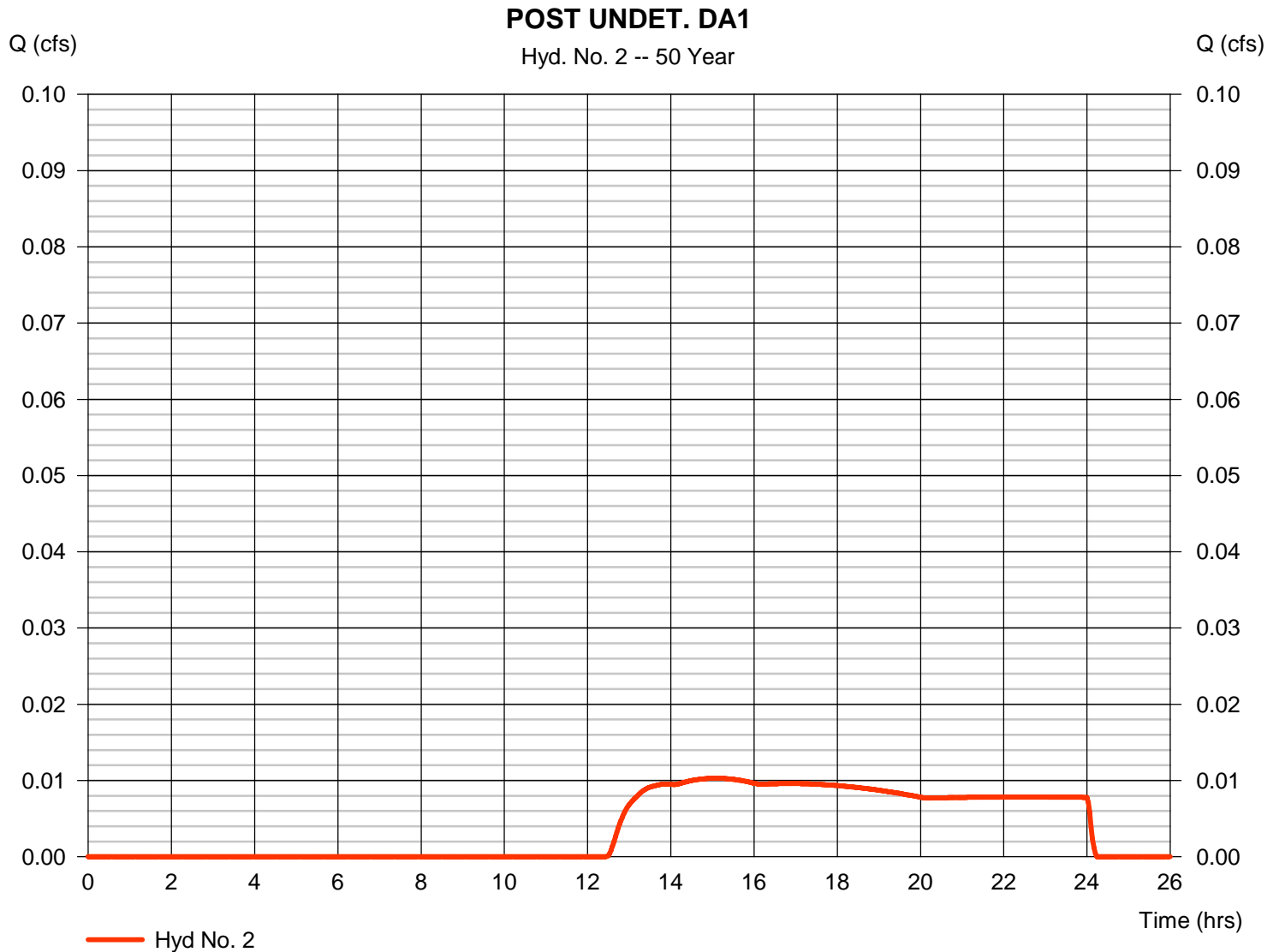
Thursday, 10 / 27 / 2016

Hyd. No. 2

POST UNDET. DA1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.010 cfs
Storm frequency	= 50 yrs	Time to peak	= 15.07 hrs
Time interval	= 2 min	Hyd. volume	= 357 cuft
Drainage area	= 0.820 ac	Curve number	= 30*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 6.80 min
Total precip.	= 6.40 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.820 x 30)] / 0.820



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

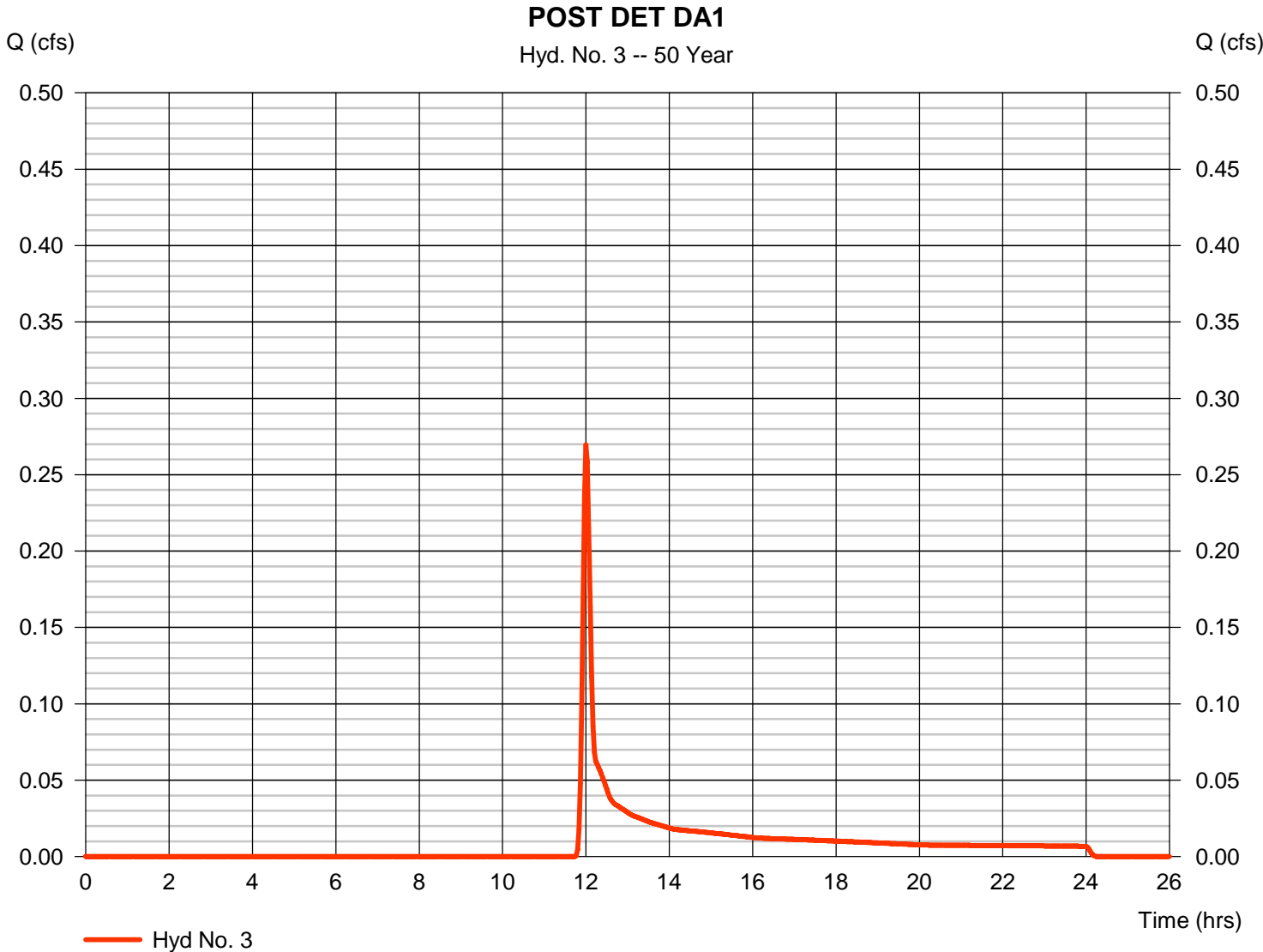
Thursday, 10 / 27 / 2016

Hyd. No. 3

POST DET DA1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.270 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 772 cuft
Drainage area	= 0.220 ac	Curve number	= 45*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.70 min
Total precip.	= 6.40 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.070 x 76) + (0.150 x 30)] / 0.220



Hydrograph Report

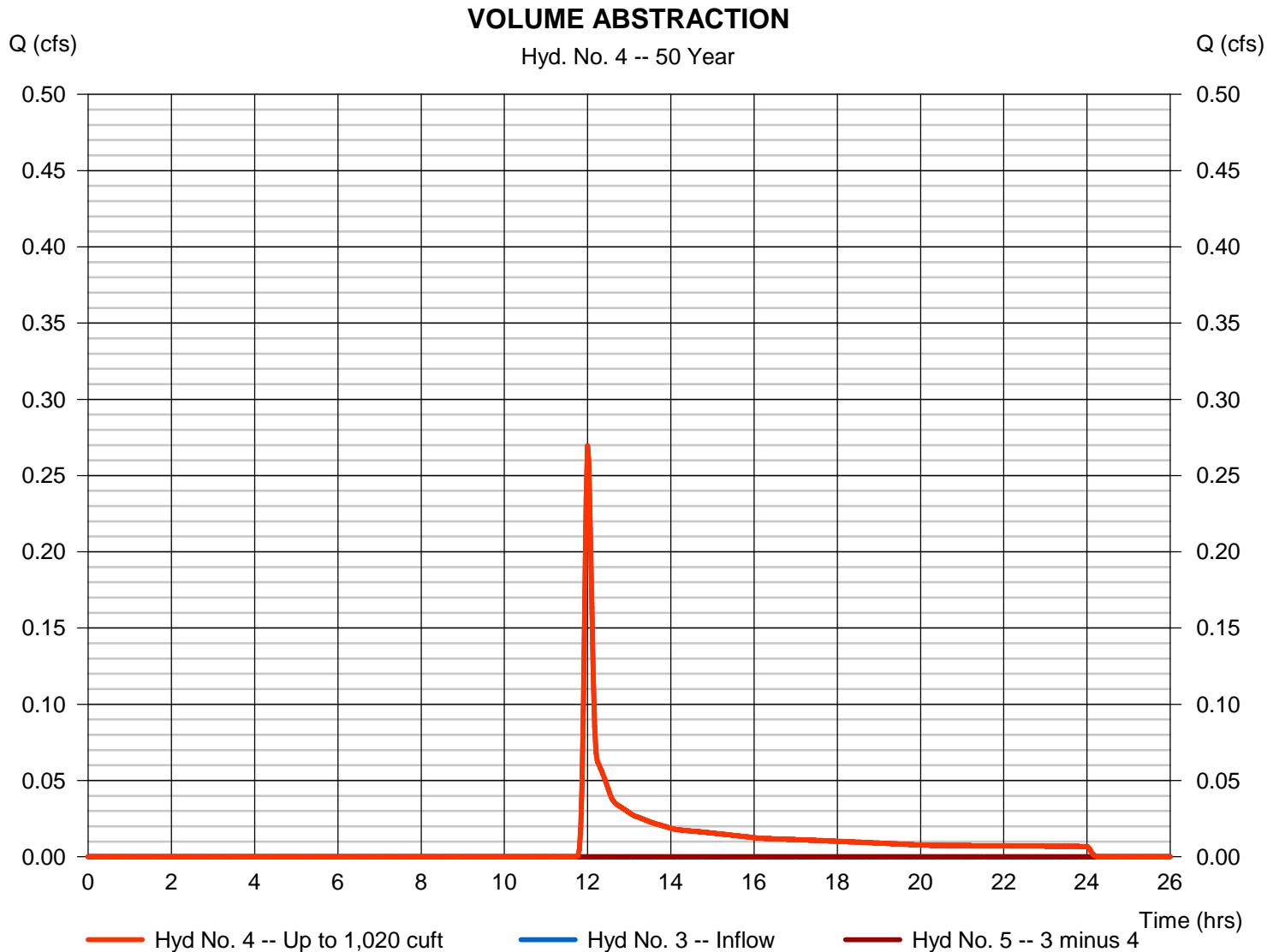
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Thursday, 10 / 27 / 2016

Hyd. No. 4

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 0.270 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 772 cuft
Inflow hydrograph	= 3 - POST DET DA1	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 1,020 cuft



Hydrograph Report

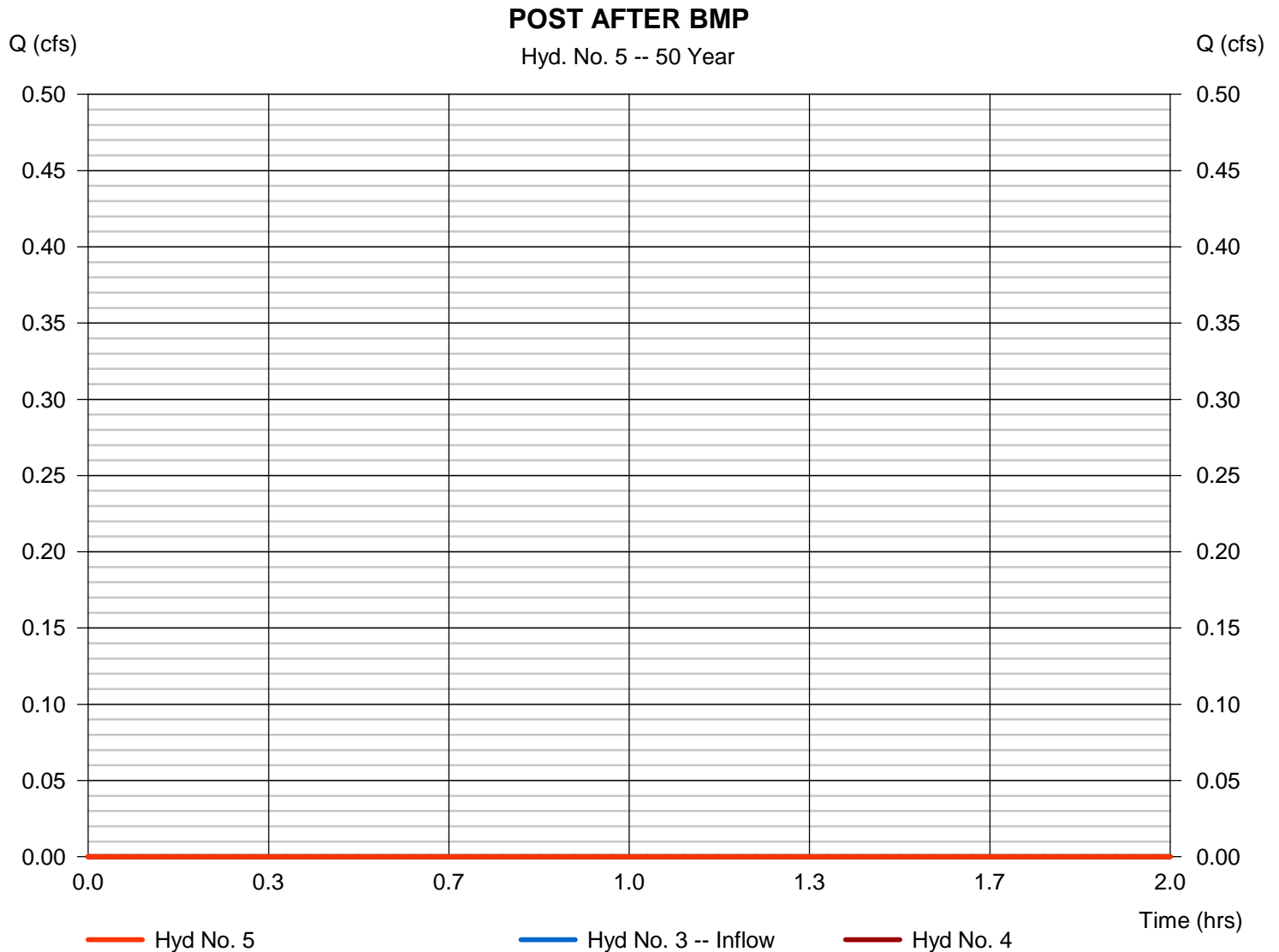
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Thursday, 10 / 27 / 2016

Hyd. No. 5

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 0.000 cfs
Storm frequency	= 50 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hydrograph	= 3 - POST DET DA1	2nd diverted hyd.	= 4
Diversion method	= First Flush Volume	Volume Up To	= 1,020 cuft



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

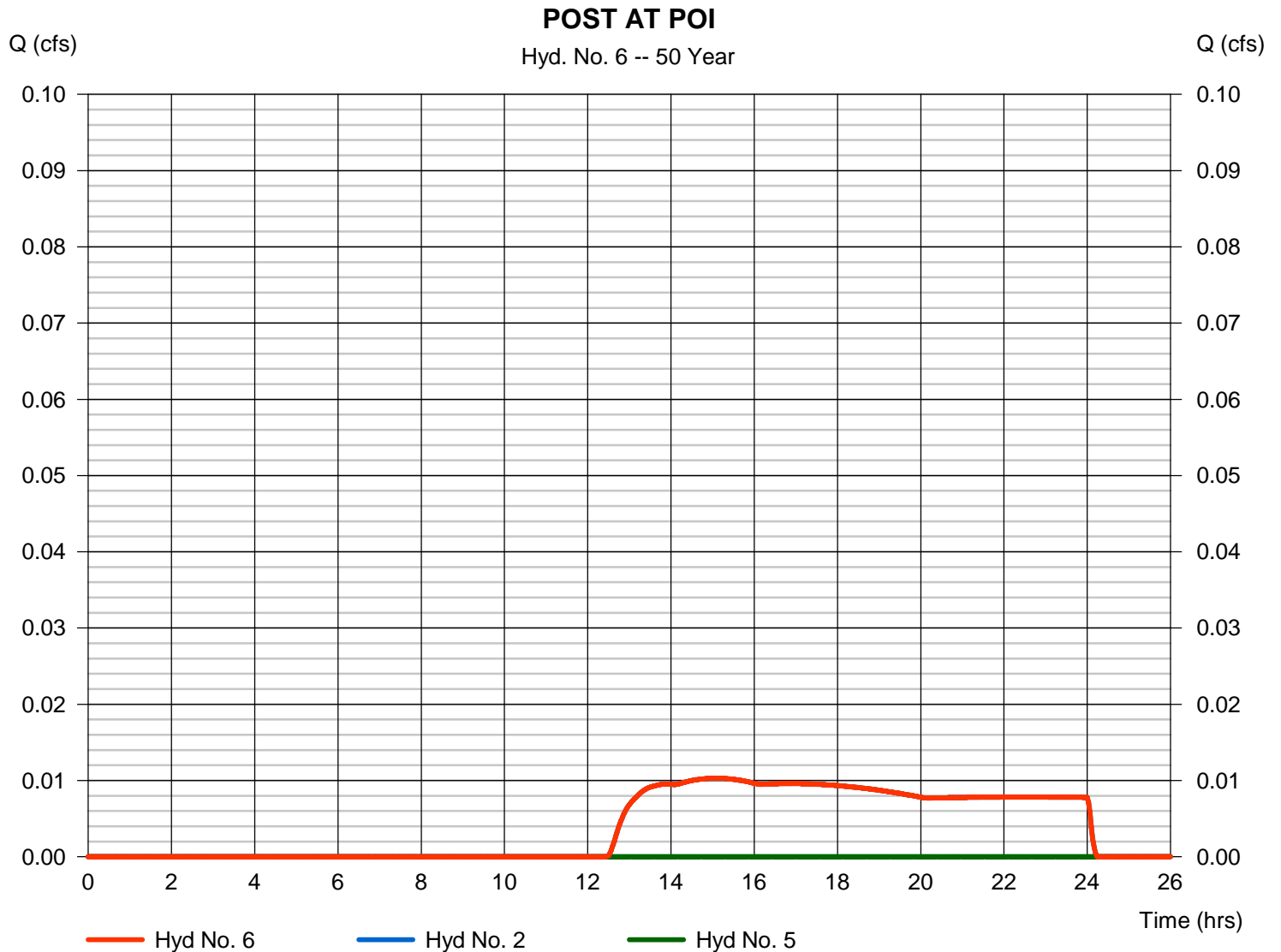
Thursday, 10 / 27 / 2016

Hyd. No. 6

POST AT POI

Hydrograph type = Combine
Storm frequency = 50 yrs
Time interval = 2 min
Inflow hyds. = 2, 5

Peak discharge = 0.010 cfs
Time to peak = 15.07 hrs
Hyd. volume = 357 cuft
Contrib. drain. area = 0.820 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description	
1	SCS Runoff	0.055	2	742	1,109	-----	-----	-----	PRE DA 1	
2	SCS Runoff	0.045	2	742	901	-----	-----	-----	POST UNDET. DA1	
3	SCS Runoff	0.460	2	720	1,173	-----	-----	-----	POST DET DA1	
4	Diversion1	0.460	2	720	1,021	3	-----	-----	VOLUME ABSTRACTION	
5	Diversion2	0.011	2	1188	152	3	-----	-----	POST AFTER BMP	
6	Combine	0.045	2	742	1,053	2, 5	-----	-----	POST AT POI	
NUnion DA1.gpw					Return Period: 100 Year			Thursday, 10 / 27 / 2016		

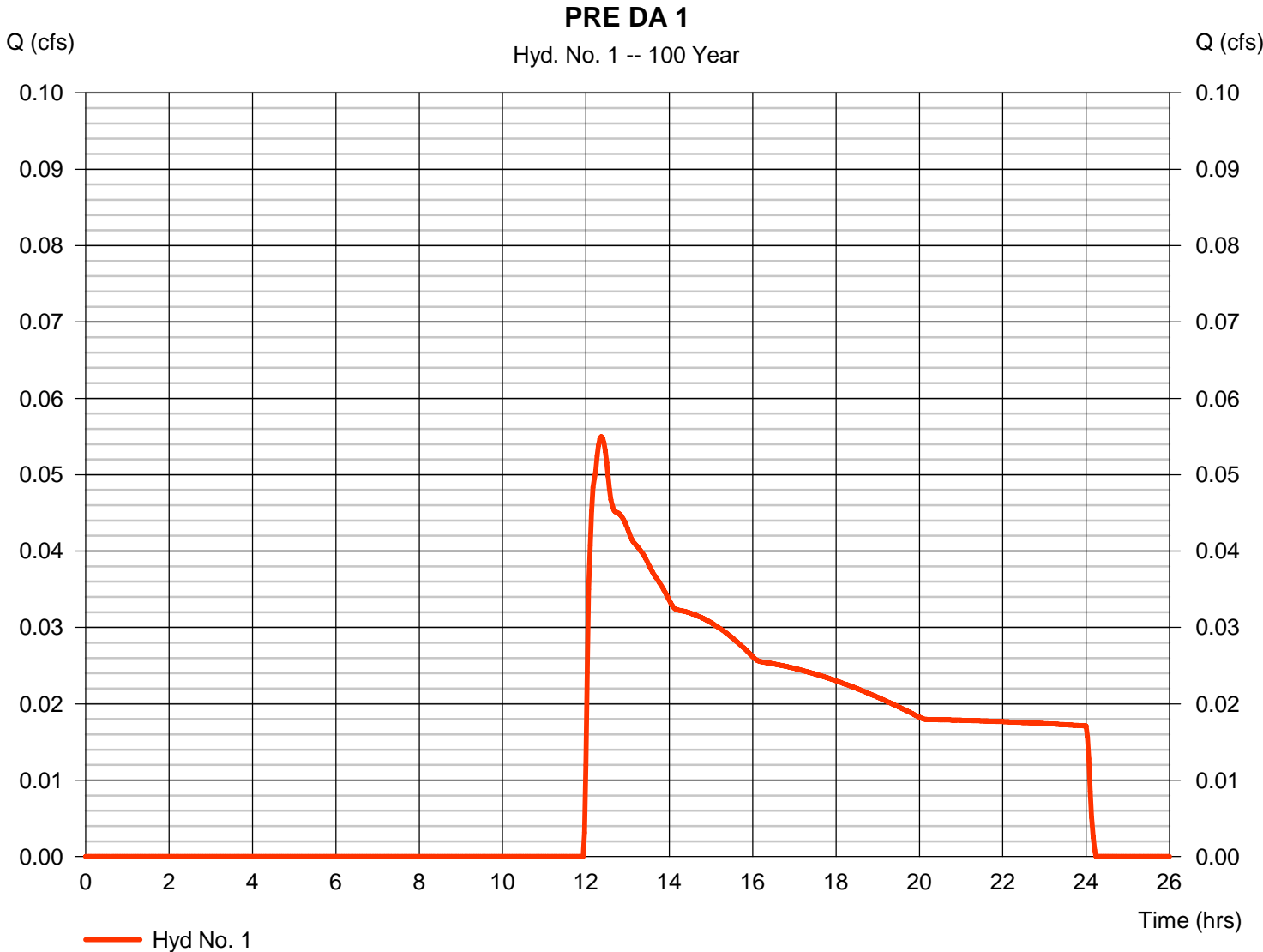
Hydrograph Report

Hyd. No. 1

PRE DA 1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.055 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.37 hrs
Time interval	= 2 min	Hyd. volume	= 1,109 cuft
Drainage area	= 1.010 ac	Curve number	= 30*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 6.80 min
Total precip.	= 7.48 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.000 x 30) + (0.010 x 30)] / 1.010



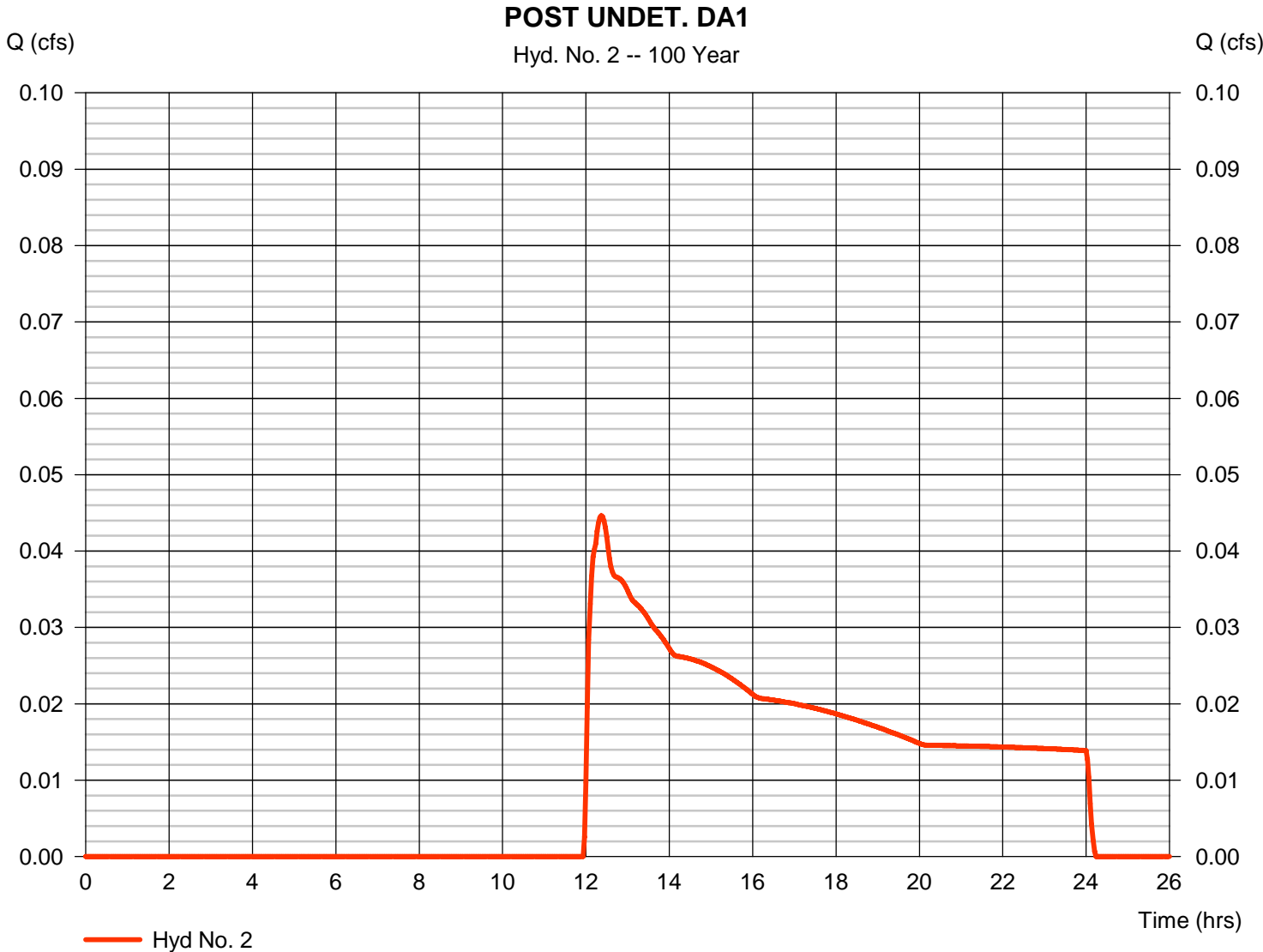
Hydrograph Report

Hyd. No. 2

POST UNDET. DA1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.045 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.37 hrs
Time interval	= 2 min	Hyd. volume	= 901 cuft
Drainage area	= 0.820 ac	Curve number	= 30*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 6.80 min
Total precip.	= 7.48 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.820 x 30)] / 0.820



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

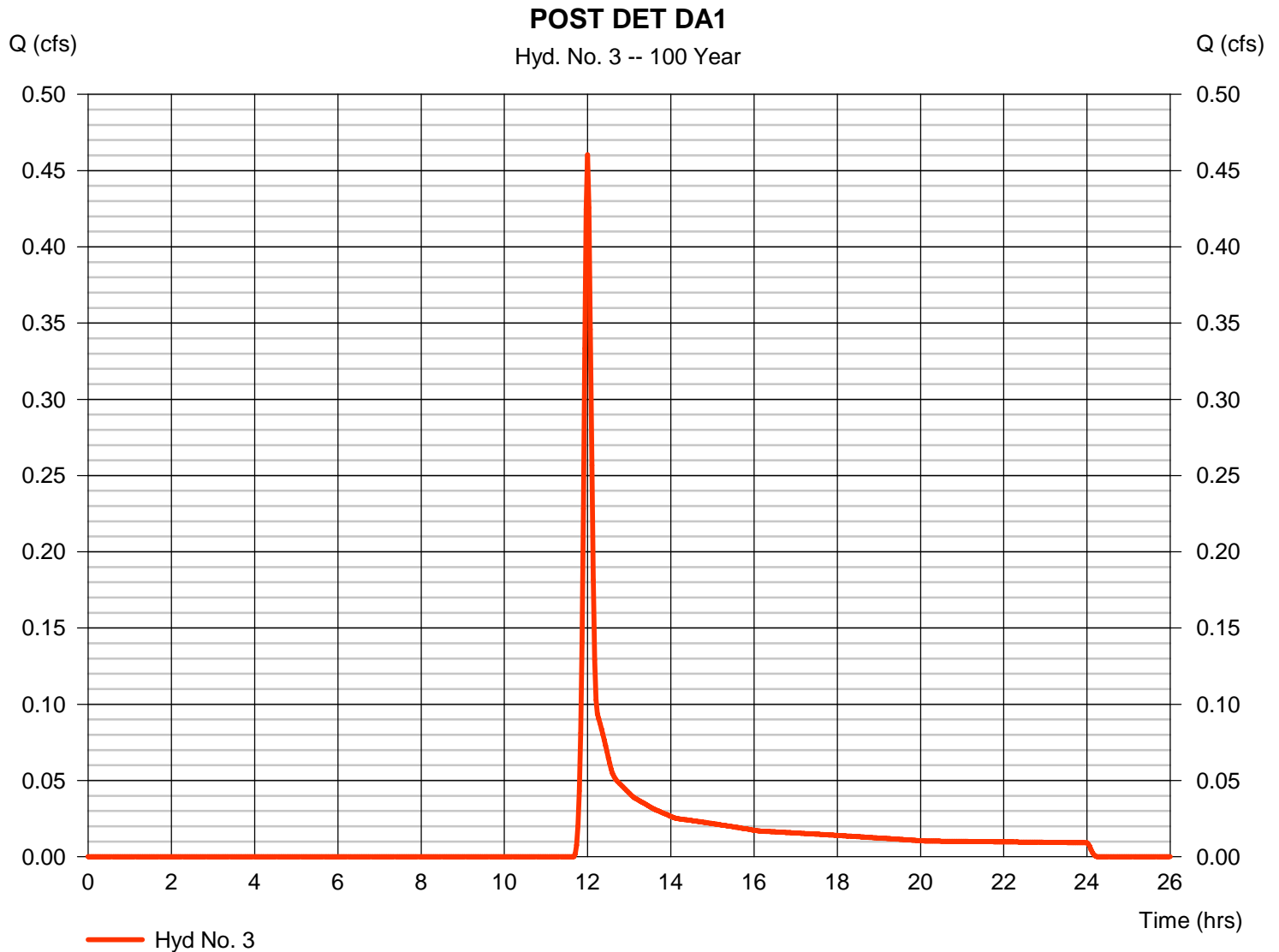
Thursday, 10 / 27 / 2016

Hyd. No. 3

POST DET DA1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.460 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 1,173 cuft
Drainage area	= 0.220 ac	Curve number	= 45*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.70 min
Total precip.	= 7.48 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.070 x 76) + (0.150 x 30)] / 0.220



Hydrograph Report

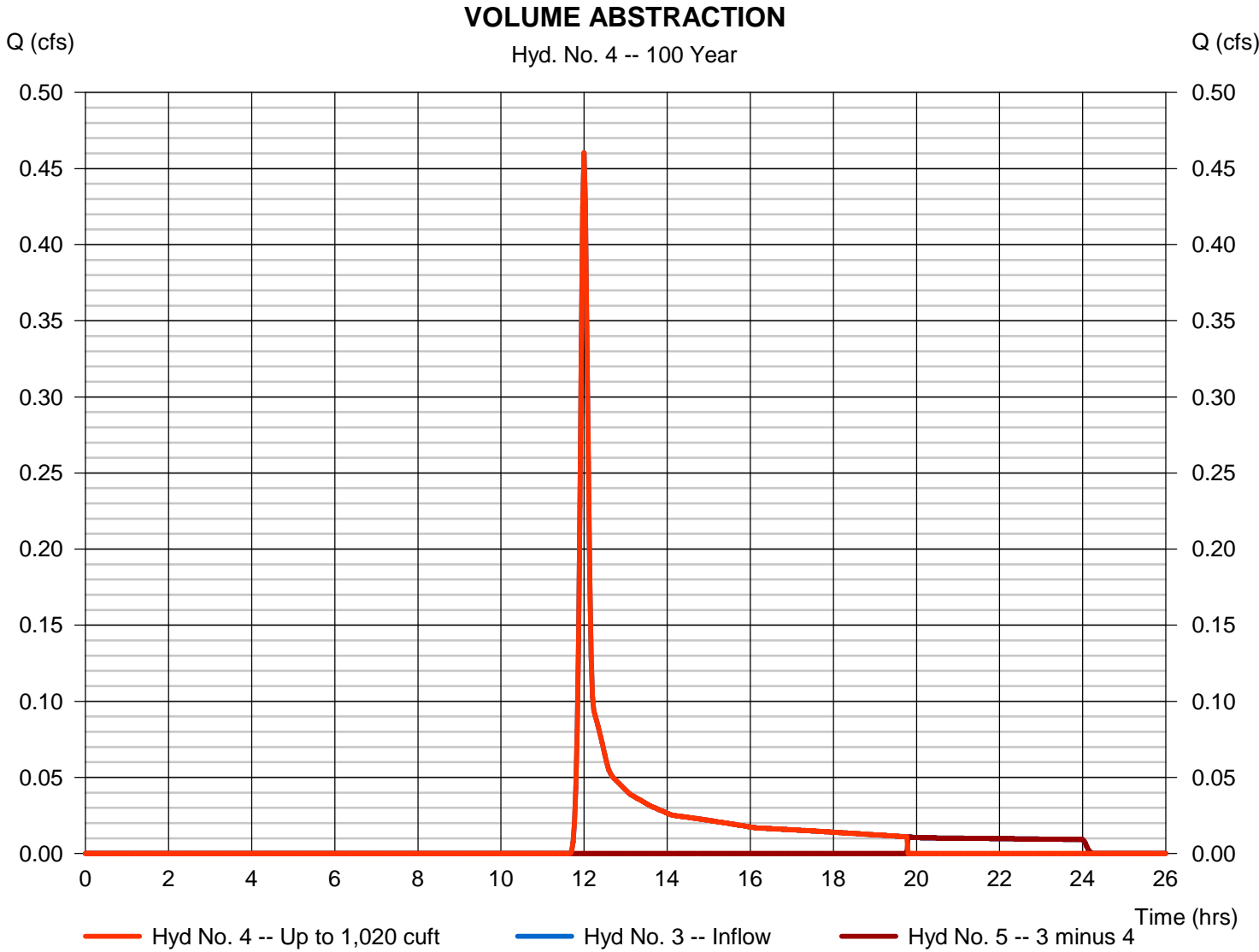
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Thursday, 10 / 27 / 2016

Hyd. No. 4

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 0.460 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 1,021 cuft
Inflow hydrograph	= 3 - POST DET DA1	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 1,020 cuft



Hydrograph Report

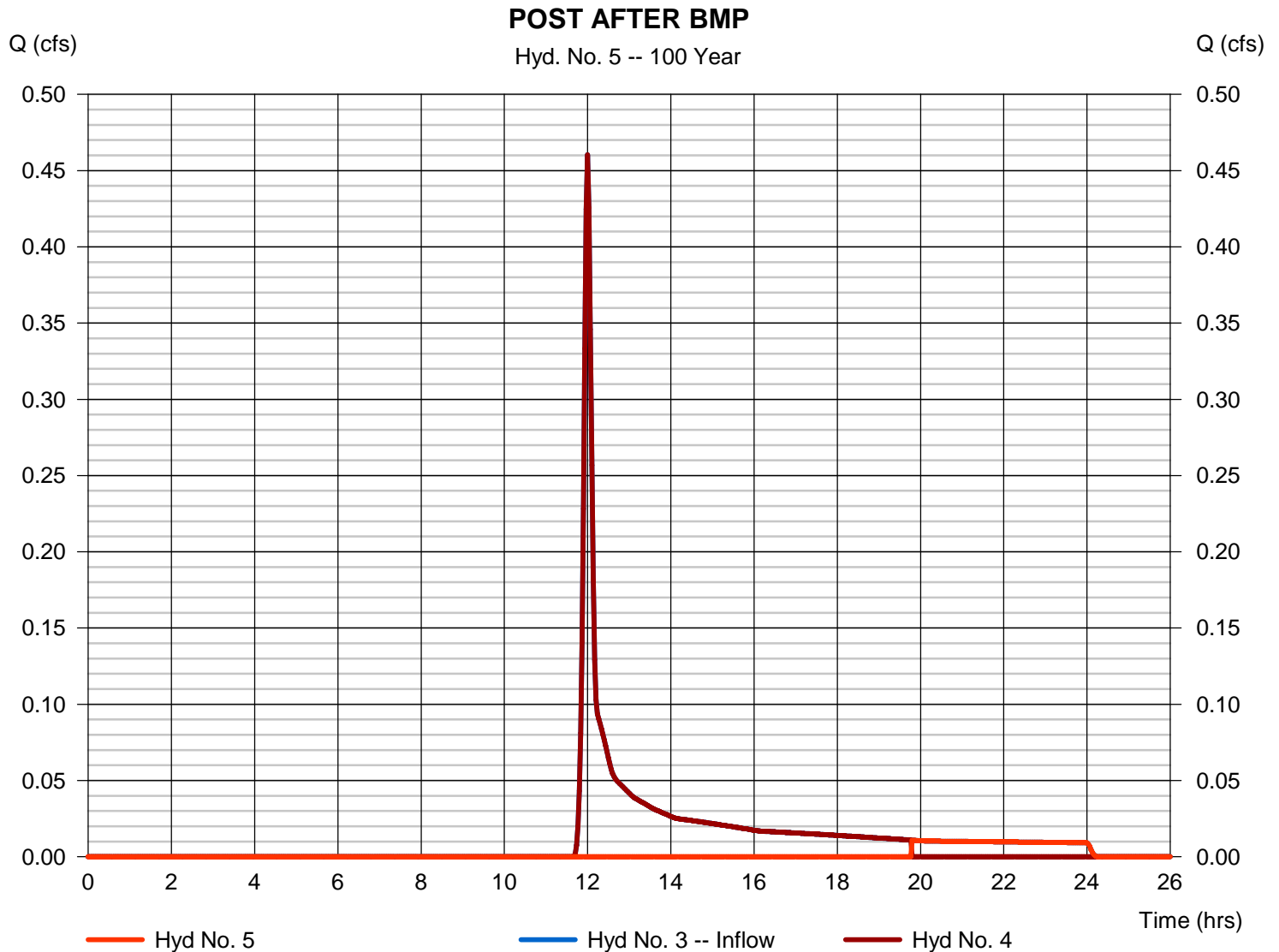
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Thursday, 10 / 27 / 2016

Hyd. No. 5

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 0.011 cfs
Storm frequency	= 100 yrs	Time to peak	= 19.80 hrs
Time interval	= 2 min	Hyd. volume	= 152 cuft
Inflow hydrograph	= 3 - POST DET DA1	2nd diverted hyd.	= 4
Diversion method	= First Flush Volume	Volume Up To	= 1,020 cuft



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

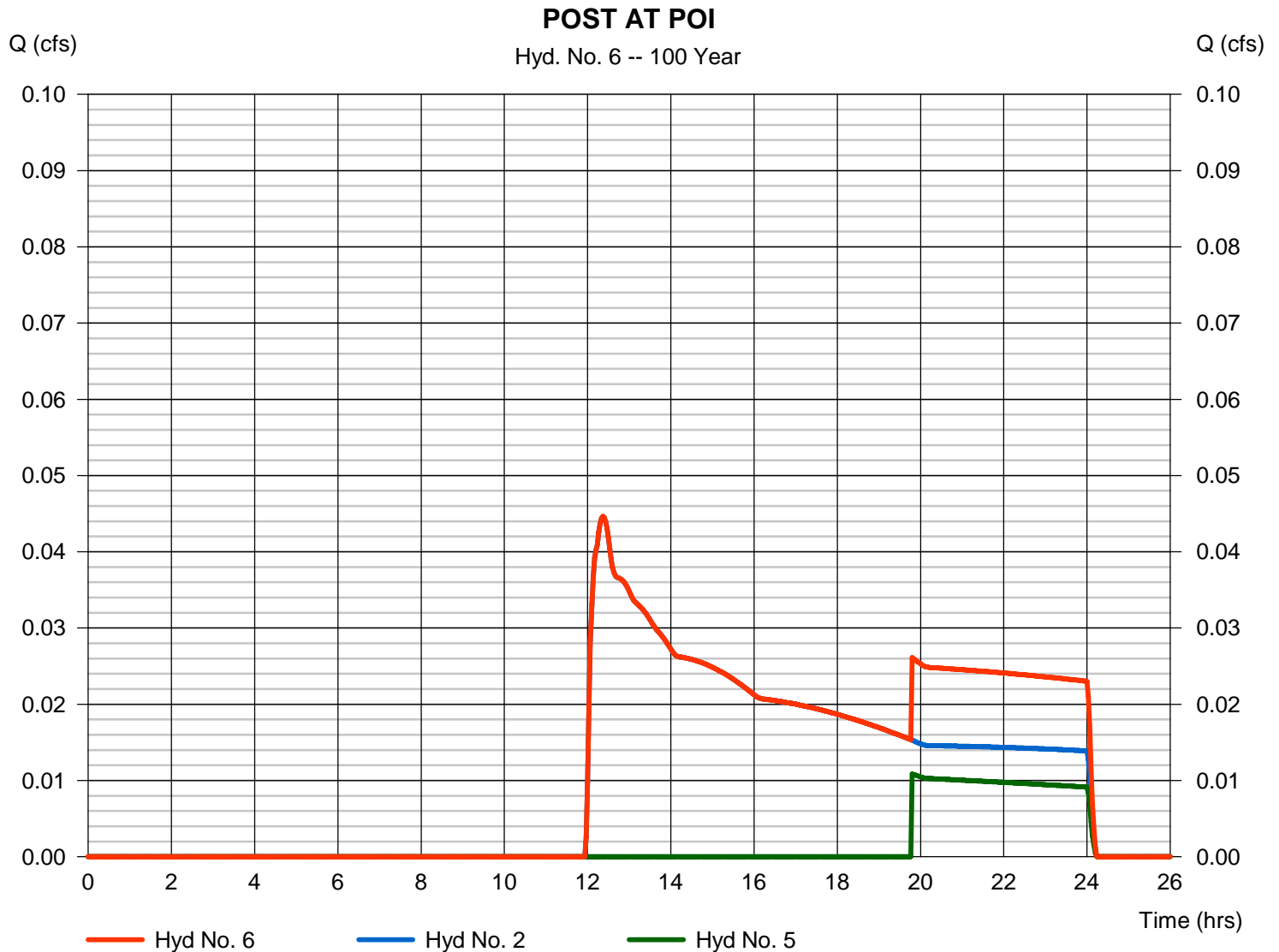
Thursday, 10 / 27 / 2016

Hyd. No. 6

POST AT POI

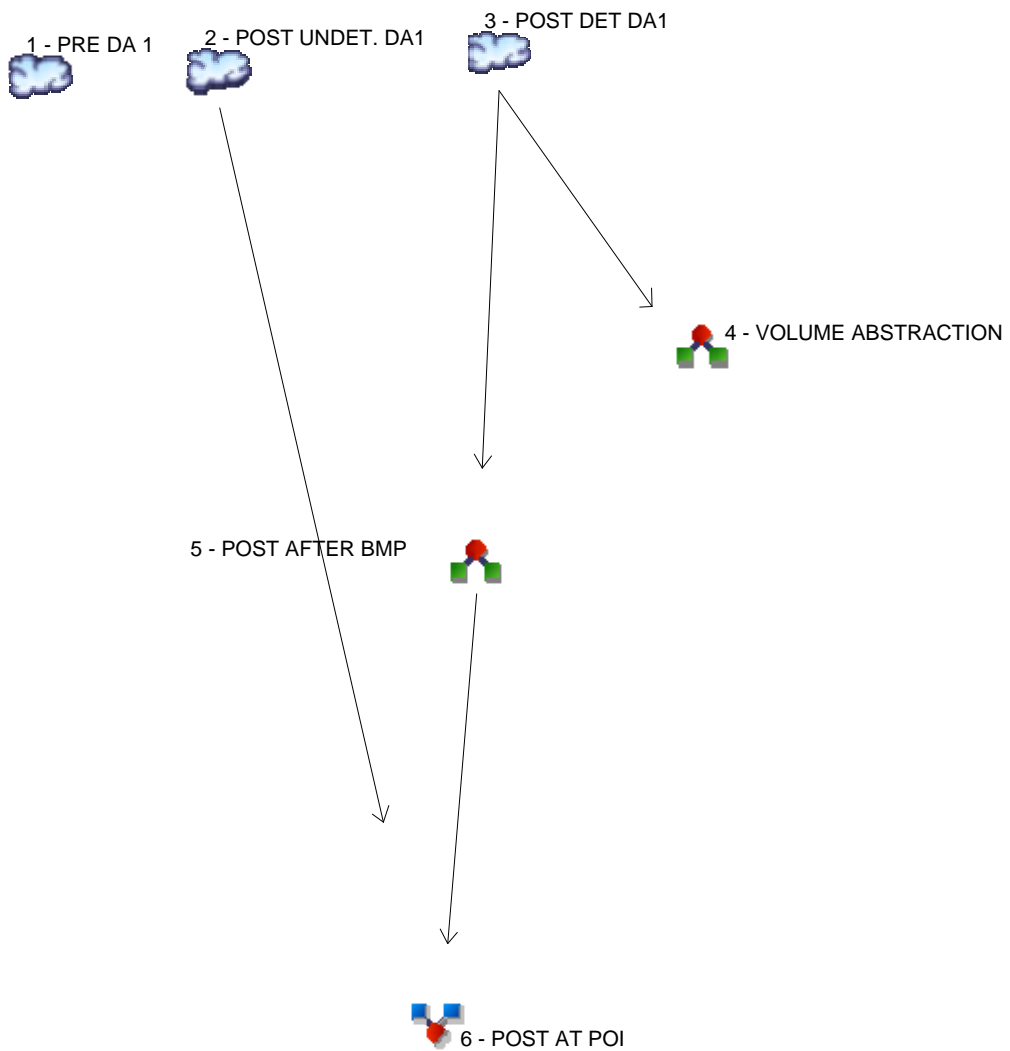
Hydrograph type = Combine
 Storm frequency = 100 yrs
 Time interval = 2 min
 Inflow hyds. = 2, 5

Peak discharge = 0.045 cfs
 Time to peak = 12.37 hrs
 Hyd. volume = 1,053 cuft
 Contrib. drain. area = 0.820 ac



Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4



Legend

Hyd. Origin	Description
1	SCS Runoff PRE DA 1
2	SCS Runoff POST UNDET. DA1
3	SCS Runoff POST DET DA1
4	Diversion1 VOLUME ABSTRACTION
5	Diversion2 POST AFTER BMP
6	Combine POST AT POI

Hydrograph Return Period Recap

Hydranow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	-----	-----	0.000	-----	-----	-----	-----	-----	-----	PRE DA 1
2	SCS Runoff	-----	-----	0.000	-----	-----	-----	-----	-----	-----	POST UNDET. DA1
3	SCS Runoff	-----	-----	0.000	-----	-----	-----	-----	-----	-----	POST DET DA1
4	Diversion1	3	-----	0.000	-----	-----	-----	-----	-----	-----	VOLUME ABSTRACTION
5	Diversion2	3	-----	0.000	-----	-----	-----	-----	-----	-----	POST AFTER BMP
6	Combine	2, 5	-----	0.000	-----	-----	-----	-----	-----	-----	POST AT POI

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

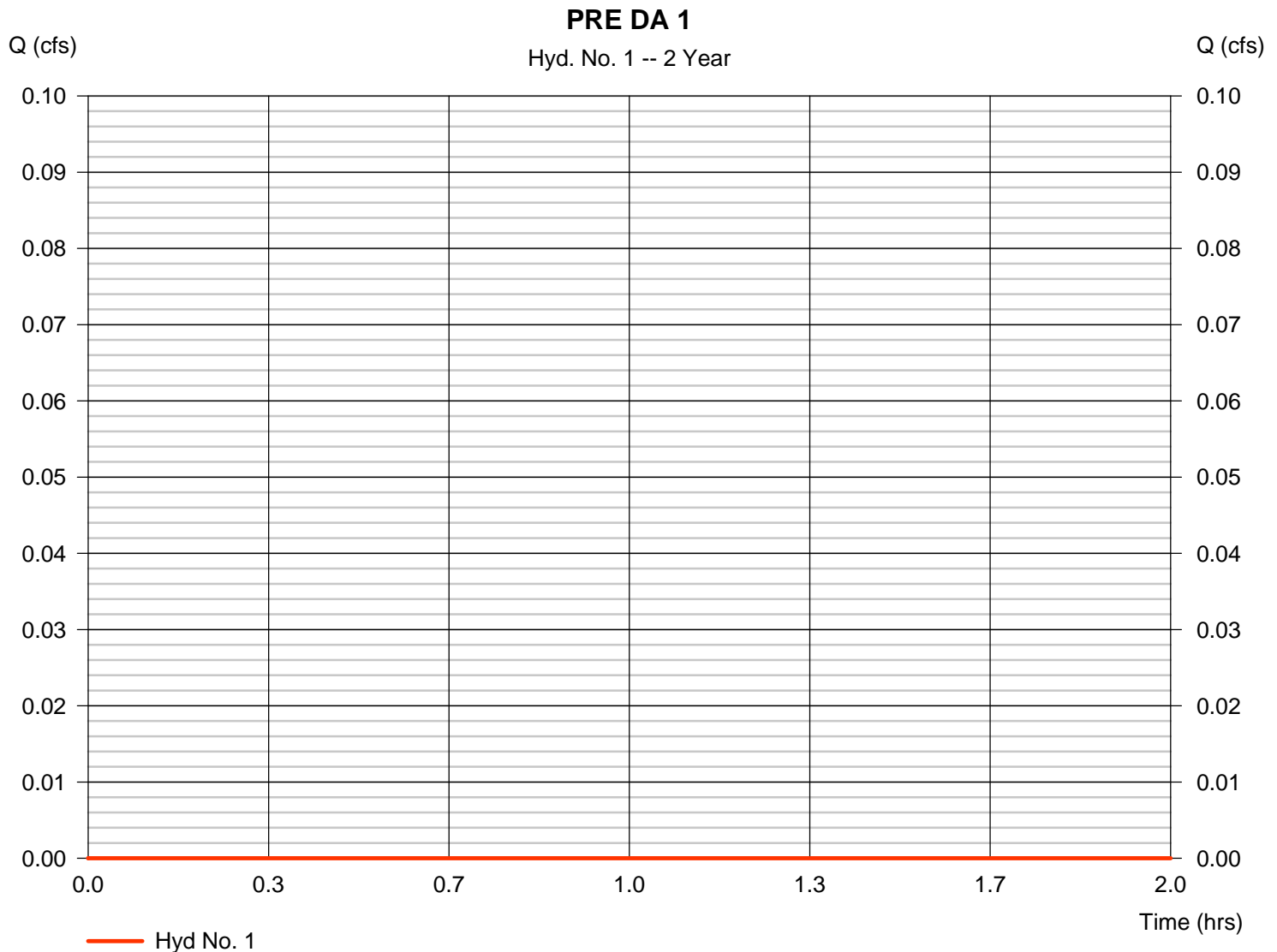
Thursday, 10 / 27 / 2016

Hyd. No. 1

PRE DA 1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Drainage area	= 1.010 ac	Curve number	= 30*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 6.80 min
Total precip.	= 2.90 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.000 x 30) + (0.010 x 30)] / 1.010



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No. 1

PRE DA 1

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
Sheet Flow				
Manning's n-value	= 0.240	0.011	0.011	
Flow length (ft)	= 50.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 2.90	0.00	0.00	
Land slope (%)	= 6.00	0.00	0.00	
Travel Time (min)	= 5.55	+ 0.00	+ 0.00	= 5.55
Shallow Concentrated Flow				
Flow length (ft)	= 370.00	0.00	0.00	
Watercourse slope (%)	= 8.90	0.00	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	=4.81	0.00	0.00	
Travel Time (min)	= 1.28	+ 0.00	+ 0.00	= 1.28
Channel Flow				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	=0.00	0.00	0.00	
Flow length (ft)	0.0	0.0	0.0	
Travel Time (min)	= 0.00	+ 0.00	+ 0.00	= 0.00
Total Travel Time, Tc				6.80 min

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

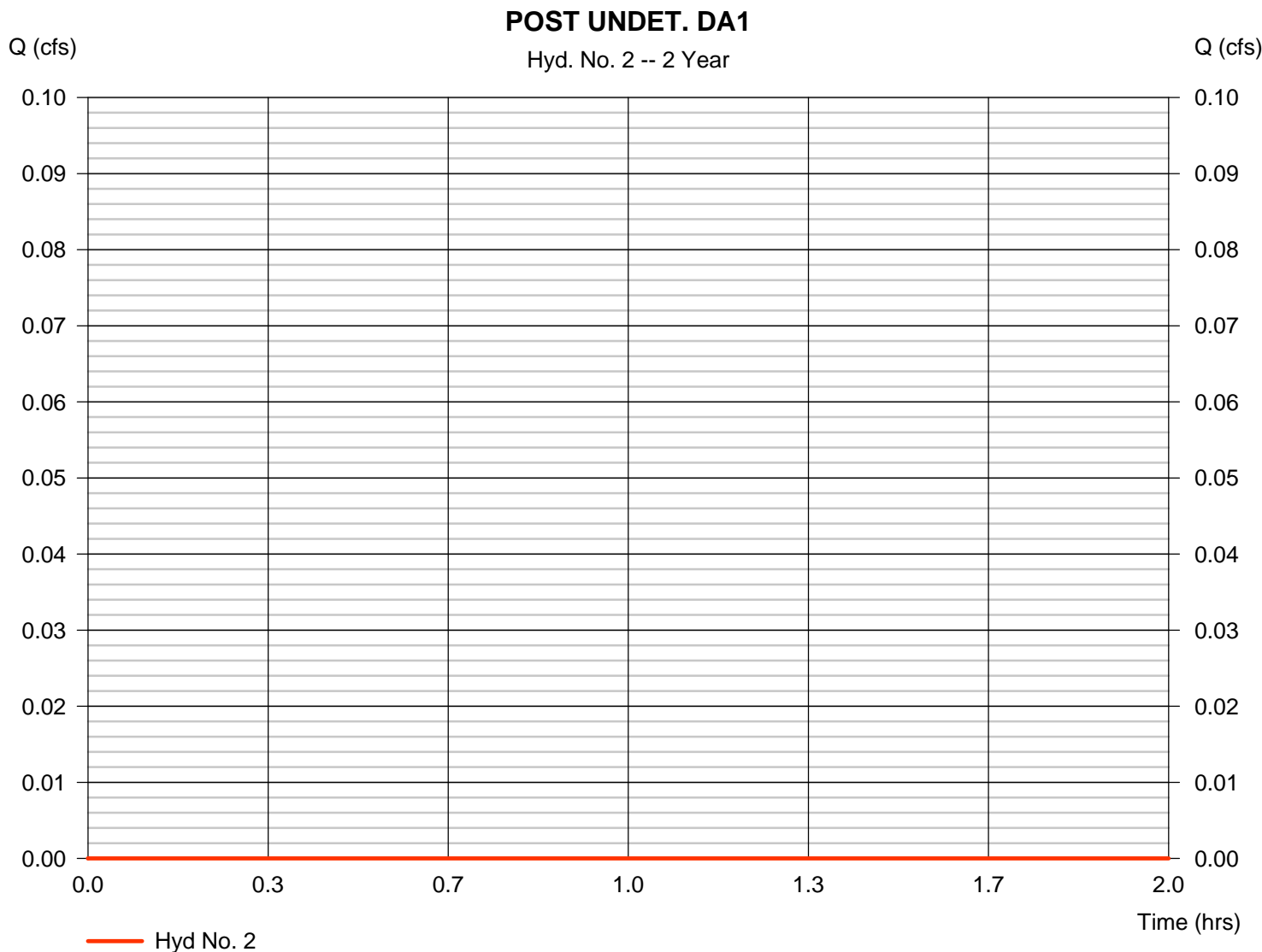
Thursday, 10 / 27 / 2016

Hyd. No. 2

POST UNDET. DA1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Drainage area	= 0.820 ac	Curve number	= 30*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 6.80 min
Total precip.	= 2.90 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.820 x 30)] / 0.820



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No. 2

POST UNDET. DA1

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
Sheet Flow				
Manning's n-value	= 0.240	0.011	0.011	
Flow length (ft)	= 50.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 2.90	0.00	0.00	
Land slope (%)	= 6.00	0.00	0.00	
Travel Time (min)	= 5.55	+ 0.00	+ 0.00	= 5.55
Shallow Concentrated Flow				
Flow length (ft)	= 370.00	0.00	0.00	
Watercourse slope (%)	= 8.90	0.00	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	=4.81	0.00	0.00	
Travel Time (min)	= 1.28	+ 0.00	+ 0.00	= 1.28
Channel Flow				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	=0.00	0.00	0.00	
Flow length (ft)	{{0}}0.0	0.0	0.0	
Travel Time (min)	= 0.00	+ 0.00	+ 0.00	= 0.00
Total Travel Time, Tc				6.80 min

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

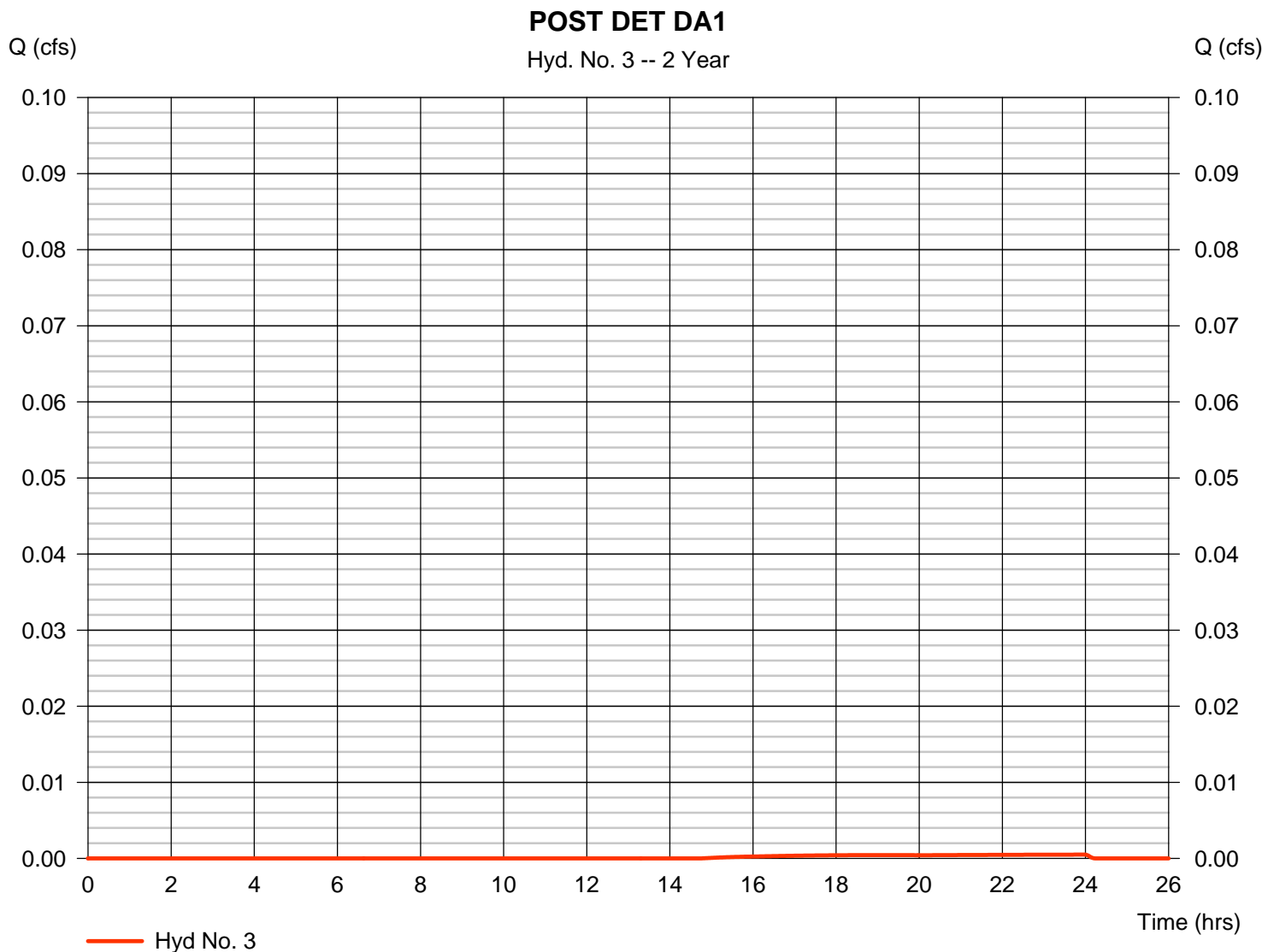
Thursday, 10 / 27 / 2016

Hyd. No. 3

POST DET DA1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= 24.00 hrs
Time interval	= 2 min	Hyd. volume	= 13 cuft
Drainage area	= 0.220 ac	Curve number	= 45*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.70 min
Total precip.	= 2.90 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.070 x 76) + (0.150 x 30)] / 0.220



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No. 3

POST DET DA1

<u>Description</u>	<u>A</u>		<u>B</u>		<u>C</u>	<u>Totals</u>
Sheet Flow						
Manning's n-value	= 0.240		0.011		0.011	
Flow length (ft)	= 50.0		0.0		0.0	
Two-year 24-hr precip. (in)	= 2.90		0.00		0.00	
Land slope (%)	= 2.40		0.00		0.00	
Travel Time (min)	= 8.00	+	0.00	+	0.00	= 8.00
Shallow Concentrated Flow						
Flow length (ft)	= 40.00		43.00		0.00	
Watercourse slope (%)	= 2.50		11.60		0.00	
Surface description	= Paved		Unpaved		Paved	
Average velocity (ft/s)	=3.21		5.50		0.00	
Travel Time (min)	= 0.21	+	0.13	+	0.00	= 0.34
Channel Flow						
X sectional flow area (sqft)	= 0.05		0.00		0.00	
Wetted perimeter (ft)	= 0.79		0.00		0.00	
Channel slope (%)	= 5.50		0.00		0.00	
Manning's n-value	= 0.012		0.015		0.015	
Velocity (ft/s)	=4.58		0.00		0.00	
Flow length (ft)	{{0}}110.0		0.0		0.0	
Travel Time (min)	= 0.40	+	0.00	+	0.00	= 0.40
Total Travel Time, Tc						8.70 min

Hydrograph Report

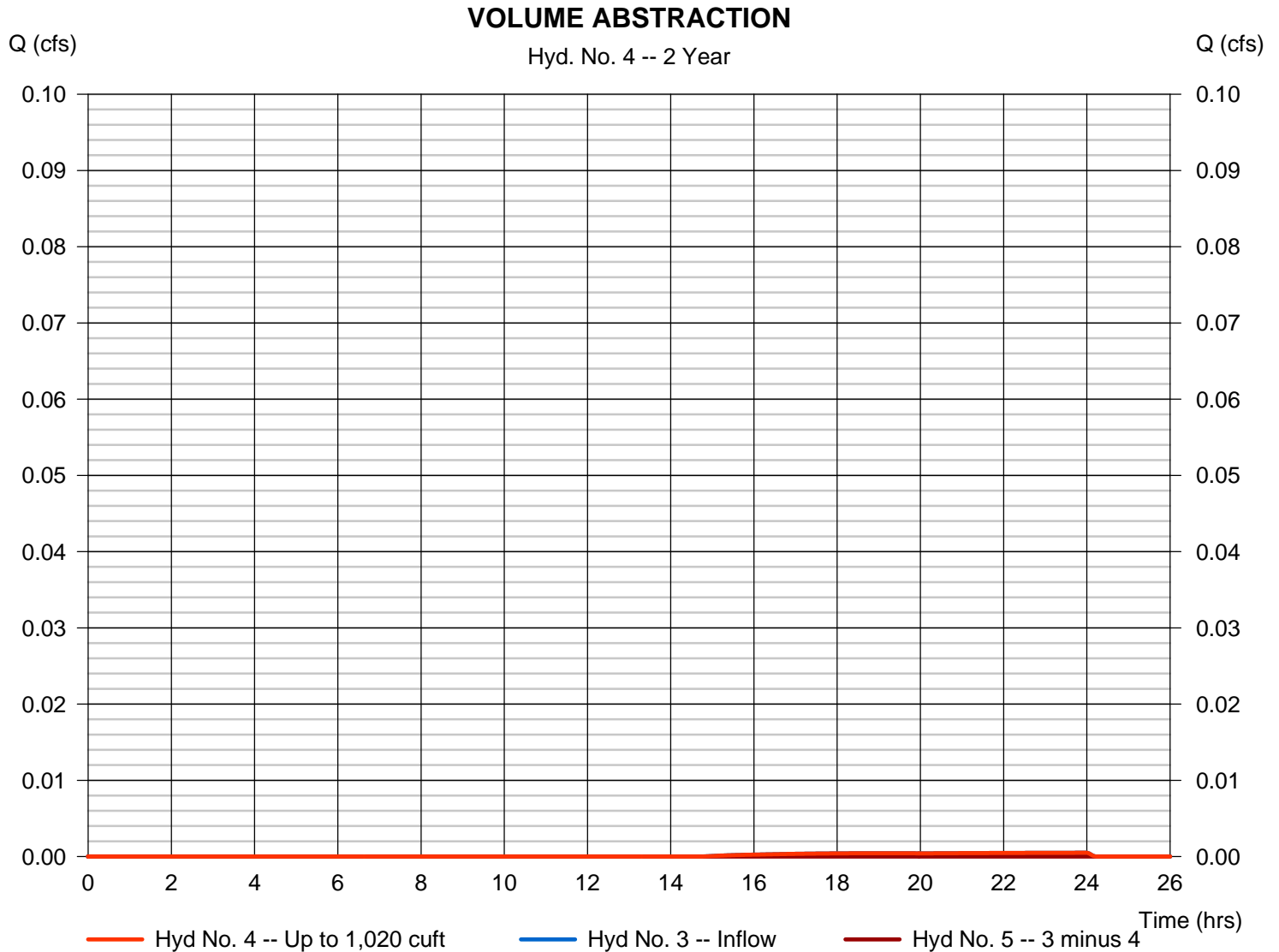
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Thursday, 10 / 27 / 2016

Hyd. No. 4

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= 24.00 hrs
Time interval	= 2 min	Hyd. volume	= 13 cuft
Inflow hydrograph	= 3 - POST DET DA1	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 1,020 cuft



Hydrograph Report

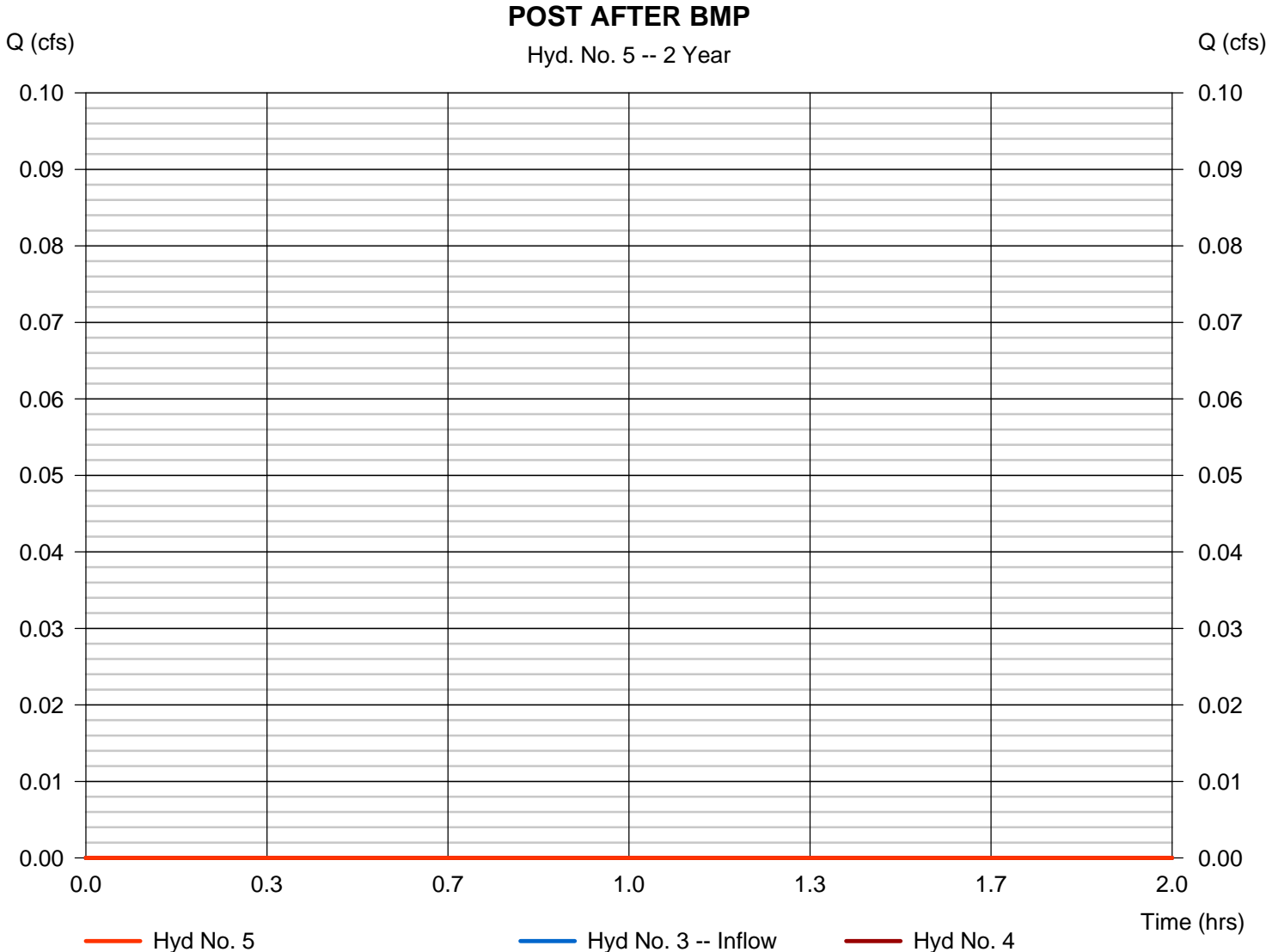
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Thursday, 10 / 27 / 2016

Hyd. No. 5

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hydrograph	= 3 - POST DET DA1	2nd diverted hyd.	= 4
Diversion method	= First Flush Volume	Volume Up To	= 1,020 cuft



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

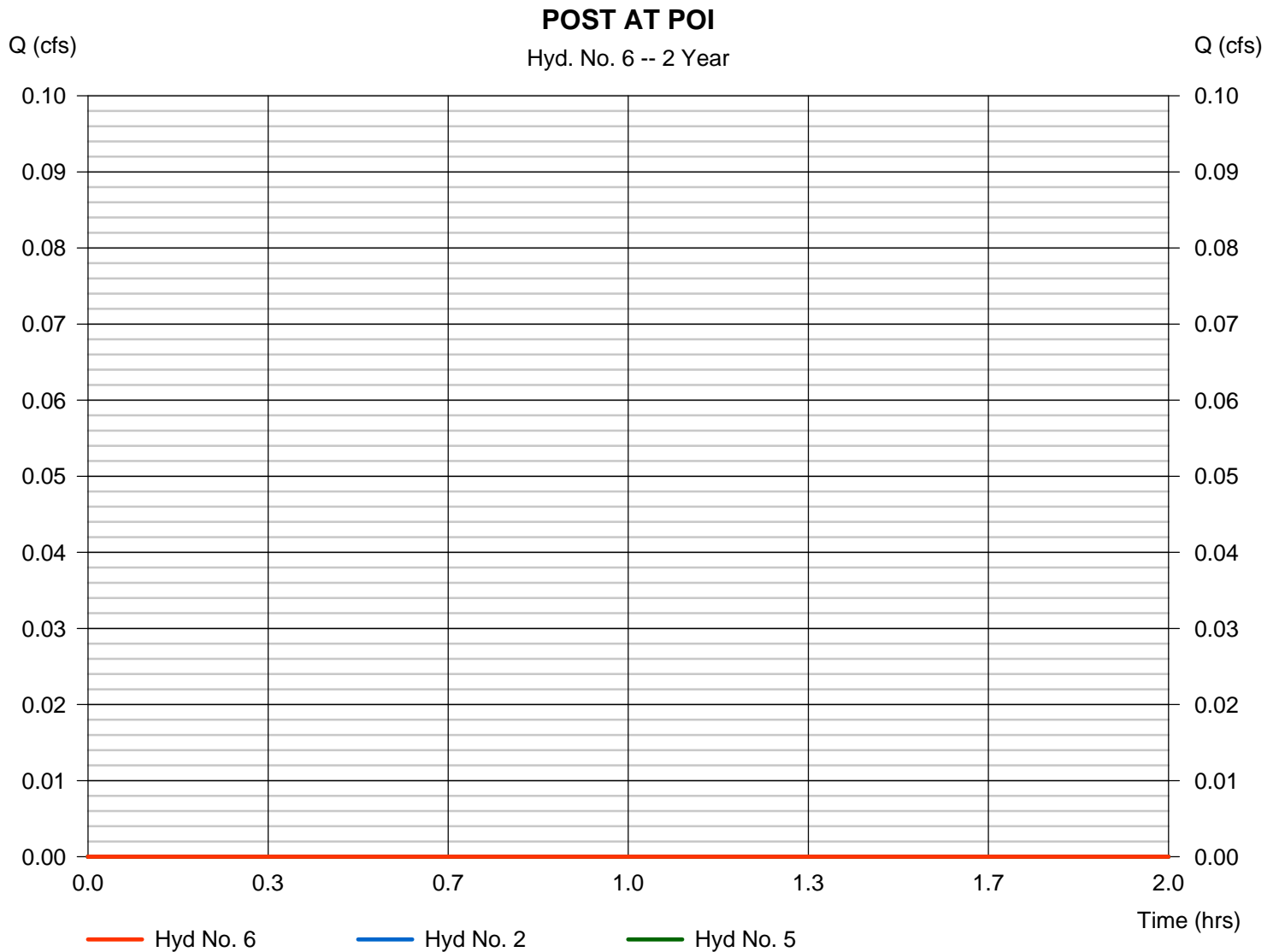
Thursday, 10 / 27 / 2016

Hyd. No. 6

POST AT POI

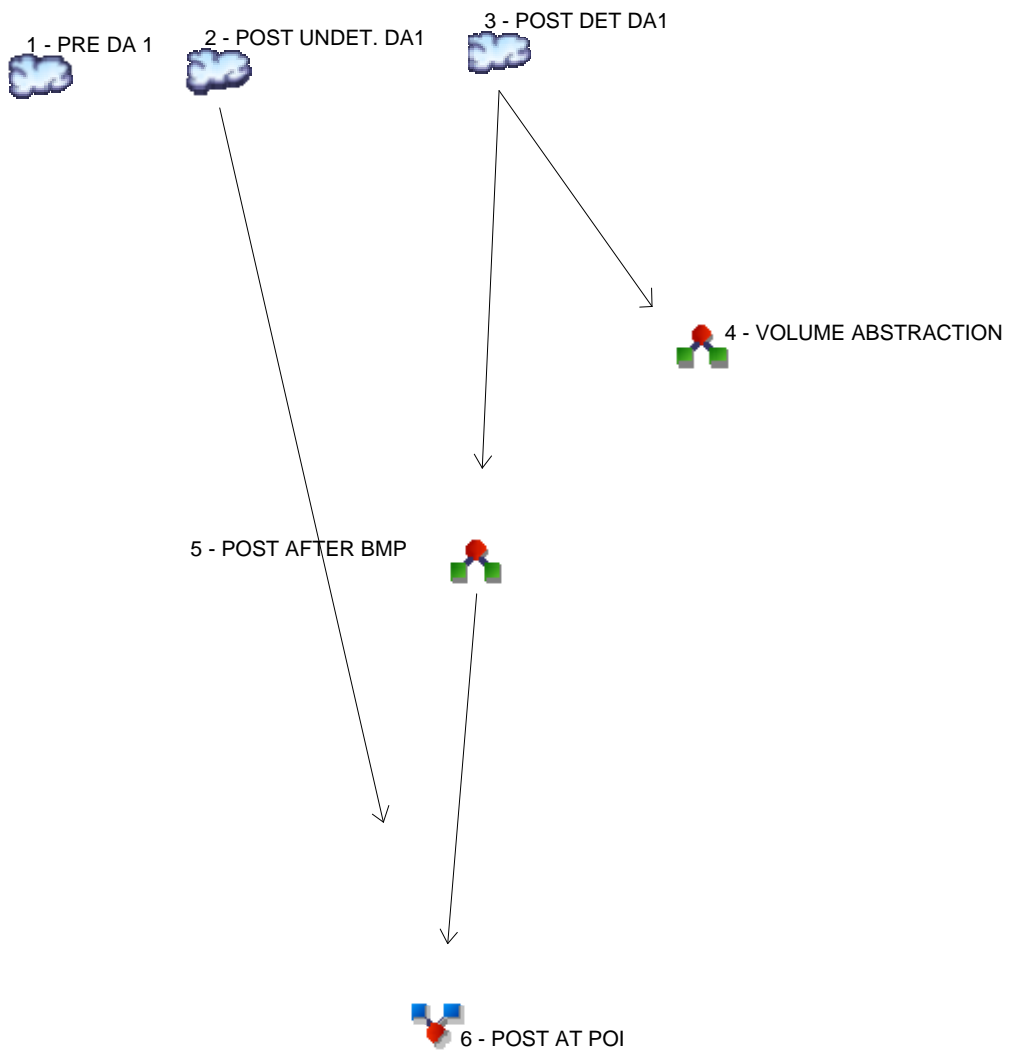
Hydrograph type = Combine
Storm frequency = 2 yrs
Time interval = 2 min
Inflow hyds. = 2, 5

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 0.820 ac



Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4



Legend

Hyd. Origin	Description
1	SCS Runoff PRE DA 1
2	SCS Runoff POST UNDET. DA1
3	SCS Runoff POST DET DA1
4	Diversion1 VOLUME ABSTRACTION
5	Diversion2 POST AFTER BMP
6	Combine POST AT POI

Hydrograph Return Period Recap

Hydroflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	-----	-----	-----	-----	-----	0.000	-----	-----	-----	PRE DA 1
2	SCS Runoff	-----	-----	-----	-----	-----	0.000	-----	-----	-----	POST UNDET. DA1
3	SCS Runoff	-----	-----	-----	-----	-----	0.004	-----	-----	-----	POST DET DA1
4	Diversion1	3	-----	-----	-----	-----	0.004	-----	-----	-----	VOLUME ABSTRACTION
5	Diversion2	3	-----	-----	-----	-----	0.000	-----	-----	-----	POST AFTER BMP
6	Combine	2, 5	-----	-----	-----	-----	0.000	-----	-----	-----	POST AT POI

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	0.000	2	n/a	0	-----	-----	-----	PRE DA 1
2	SCS Runoff	0.000	2	n/a	0	-----	-----	-----	POST UNDET. DA1
3	SCS Runoff	0.004	2	1416	211	-----	-----	-----	POST DET DA1
4	Diversion1	0.004	2	1416	211	3	-----	-----	VOLUME ABSTRACTION
5	Diversion2	0.000	2	n/a	0	3	-----	-----	POST AFTER BMP
6	Combine	0.000	2	n/a	0	2, 5	-----	-----	POST AT POI

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

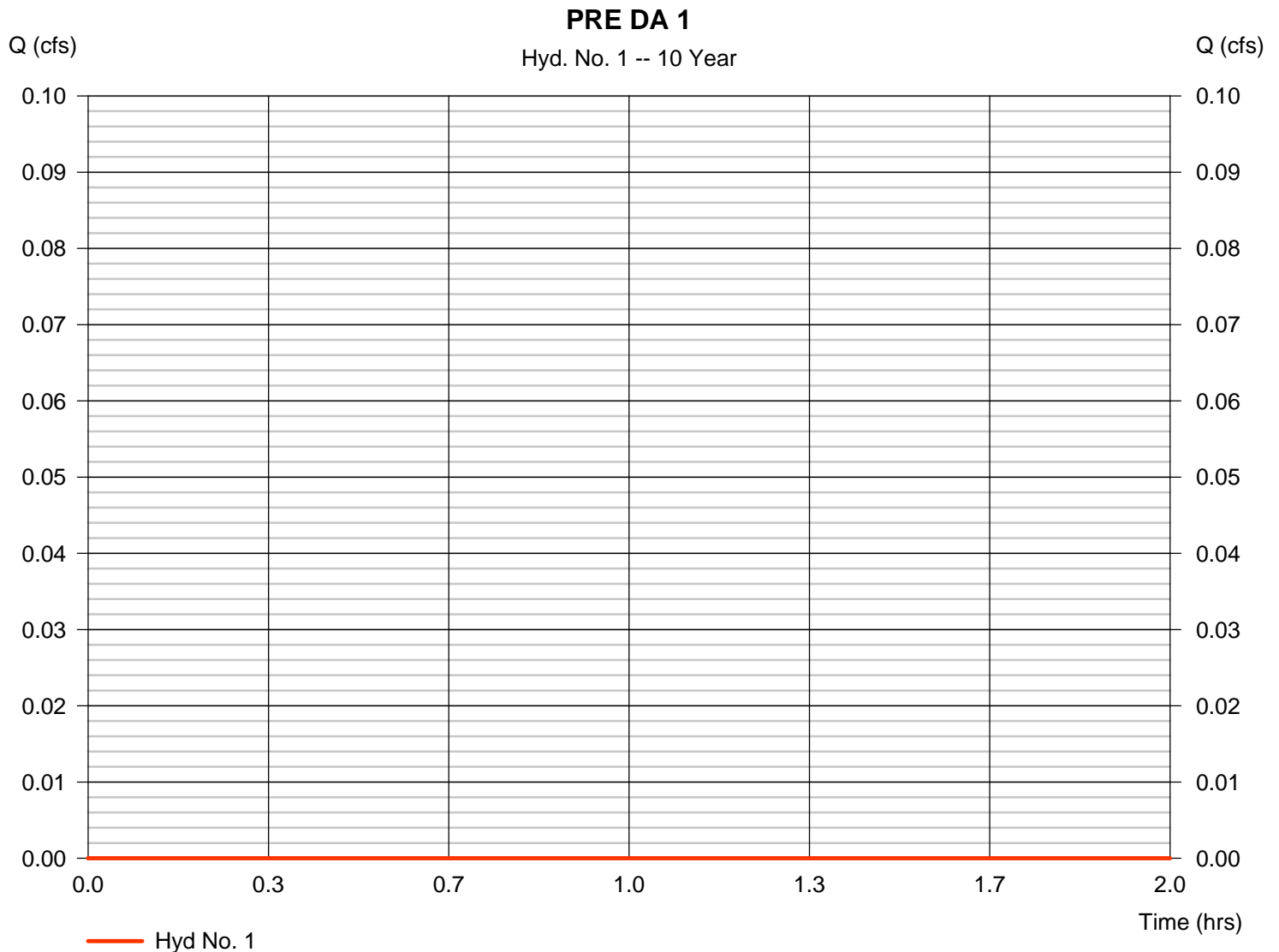
Thursday, 10 / 27 / 2016

Hyd. No. 1

PRE DA 1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 10 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Drainage area	= 1.010 ac	Curve number	= 30*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 6.80 min
Total precip.	= 4.38 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.000 x 30) + (0.010 x 30)] / 1.010



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No. 1

PRE DA 1

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
Sheet Flow				
Manning's n-value	= 0.240	0.011	0.011	
Flow length (ft)	= 50.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 2.90	0.00	0.00	
Land slope (%)	= 6.00	0.00	0.00	
Travel Time (min)	= 5.55	+ 0.00	+ 0.00	= 5.55
Shallow Concentrated Flow				
Flow length (ft)	= 370.00	0.00	0.00	
Watercourse slope (%)	= 8.90	0.00	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	=4.81	0.00	0.00	
Travel Time (min)	= 1.28	+ 0.00	+ 0.00	= 1.28
Channel Flow				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	=0.00	0.00	0.00	
Flow length (ft)	0.0	0.0	0.0	
Travel Time (min)	= 0.00	+ 0.00	+ 0.00	= 0.00
Total Travel Time, Tc				6.80 min

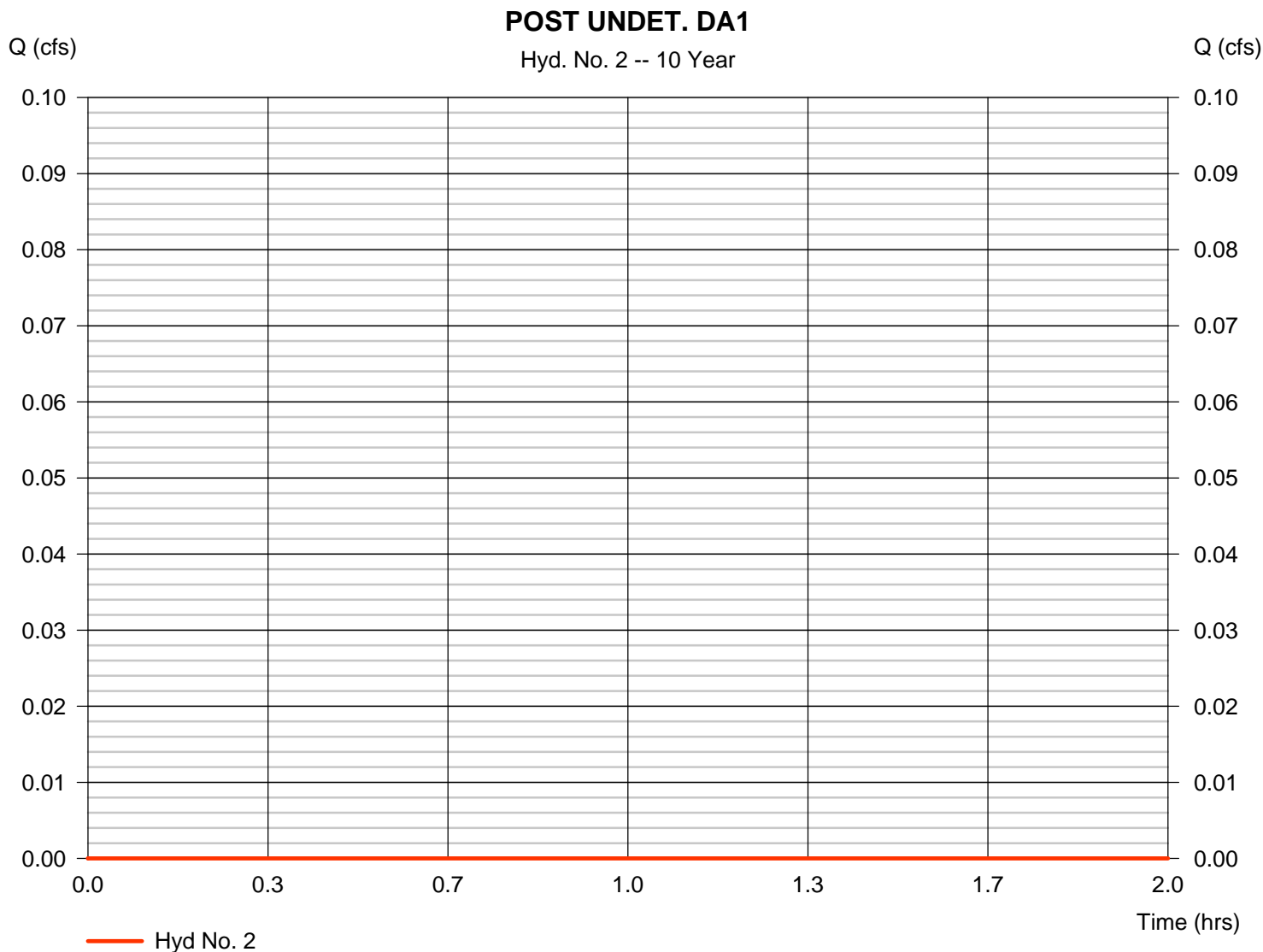
Hydrograph Report

Hyd. No. 2

POST UNDET. DA1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 10 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Drainage area	= 0.820 ac	Curve number	= 30*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 6.80 min
Total precip.	= 4.38 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.820 x 30)] / 0.820



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No. 2

POST UNDET. DA1

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
Sheet Flow				
Manning's n-value	= 0.240	0.011	0.011	
Flow length (ft)	= 50.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 2.90	0.00	0.00	
Land slope (%)	= 6.00	0.00	0.00	
Travel Time (min)	= 5.55	+ 0.00	+ 0.00	= 5.55
Shallow Concentrated Flow				
Flow length (ft)	= 370.00	0.00	0.00	
Watercourse slope (%)	= 8.90	0.00	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	=4.81	0.00	0.00	
Travel Time (min)	= 1.28	+ 0.00	+ 0.00	= 1.28
Channel Flow				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	=0.00	0.00	0.00	
Flow length (ft)	({0})0.0	0.0	0.0	
Travel Time (min)	= 0.00	+ 0.00	+ 0.00	= 0.00
Total Travel Time, Tc				6.80 min

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

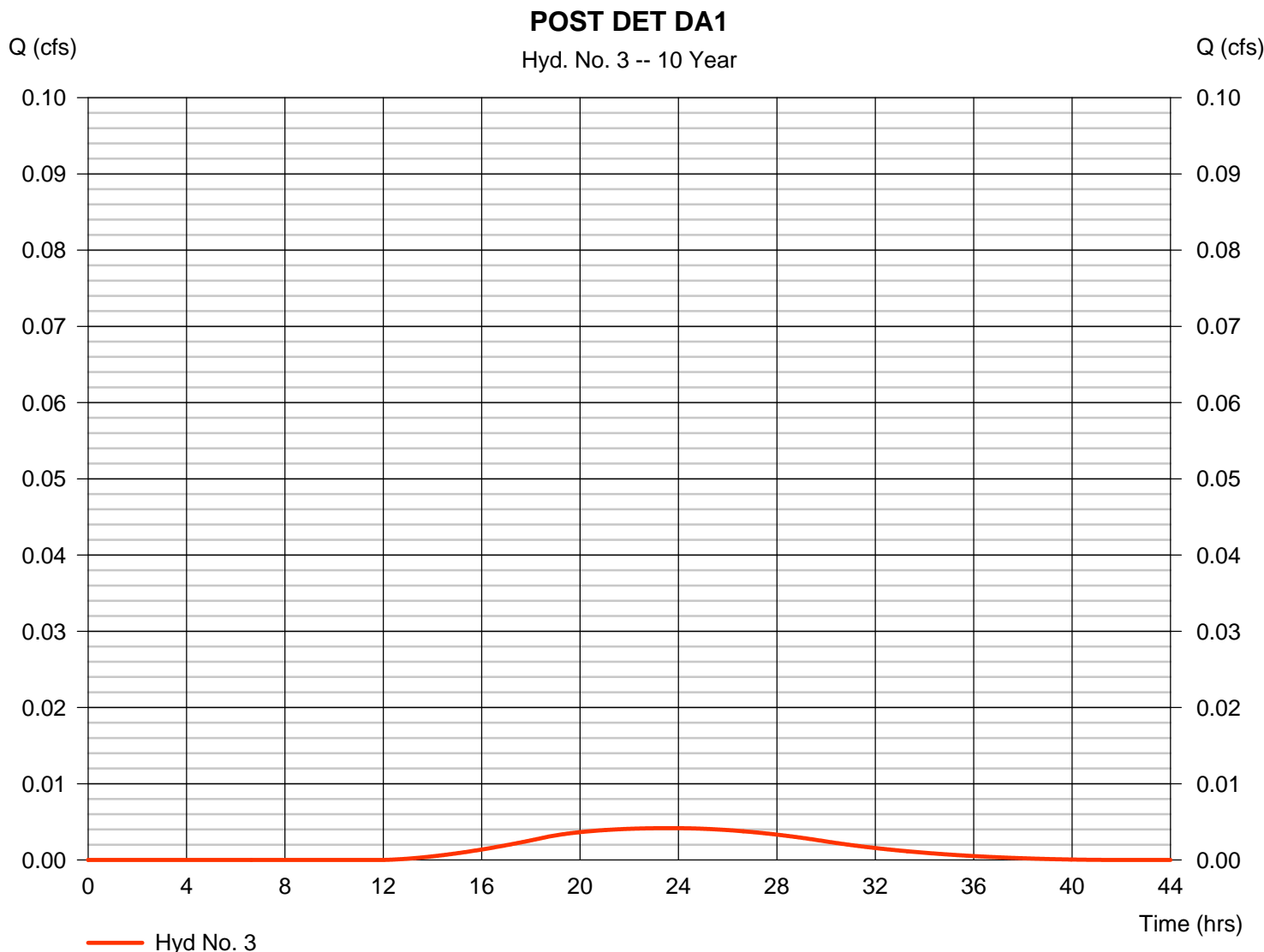
Thursday, 10 / 27 / 2016

Hyd. No. 3

POST DET DA1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.004 cfs
Storm frequency	= 10 yrs	Time to peak	= 23.60 hrs
Time interval	= 2 min	Hyd. volume	= 211 cuft
Drainage area	= 0.220 ac	Curve number	= 45*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 688.70 min
Total precip.	= 4.38 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.070 x 76) + (0.150 x 30)] / 0.220



Hydrograph Report

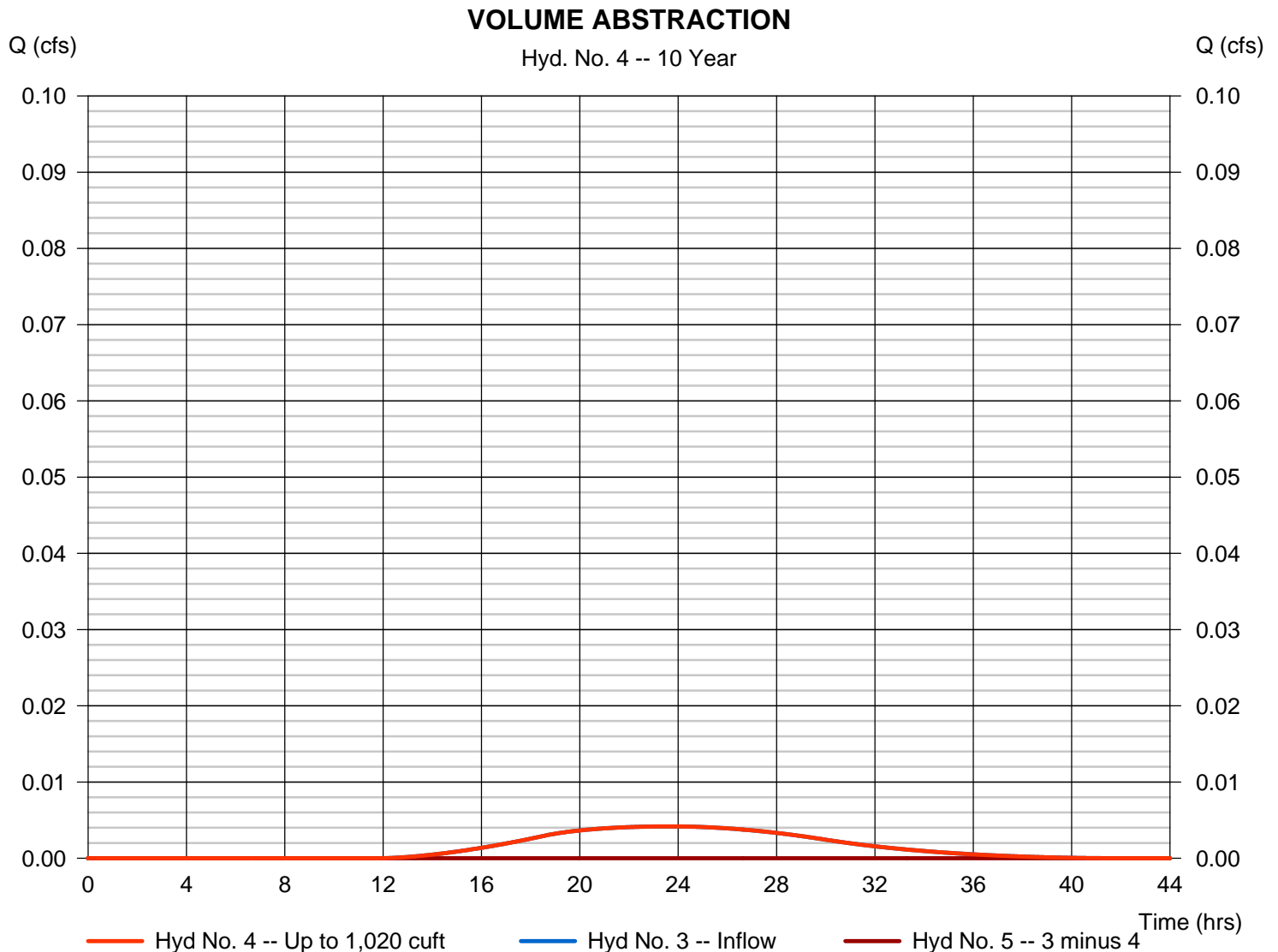
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

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Hyd. No. 4

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 0.004 cfs
Storm frequency	= 10 yrs	Time to peak	= 23.60 hrs
Time interval	= 2 min	Hyd. volume	= 211 cuft
Inflow hydrograph	= 3 - POST DET DA1	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 1,020 cuft

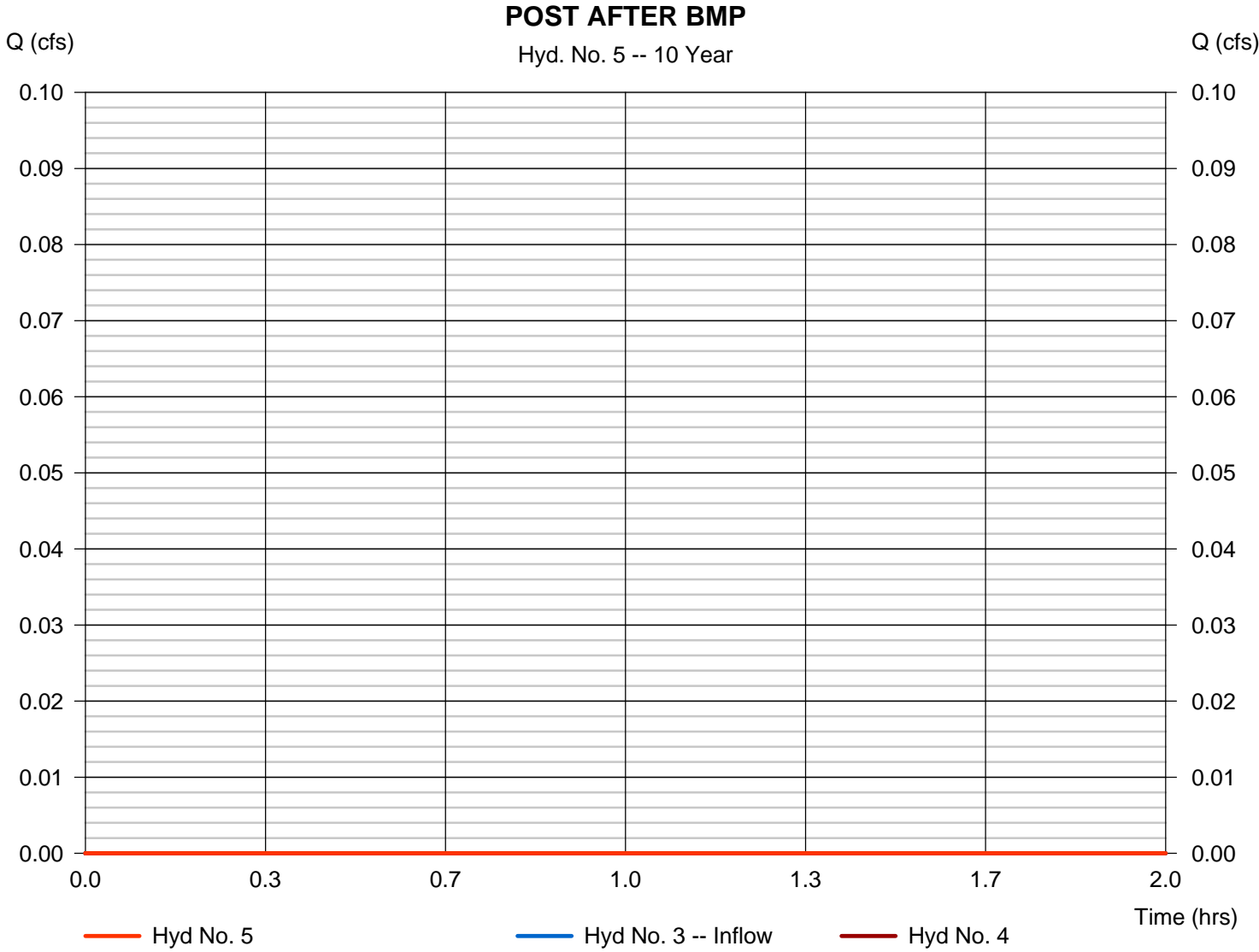


Hydrograph Report

Hyd. No. 5

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 0.000 cfs
Storm frequency	= 10 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hydrograph	= 3 - POST DET DA1	2nd diverted hyd.	= 4
Diversion method	= First Flush Volume	Volume Up To	= 1,020 cuft

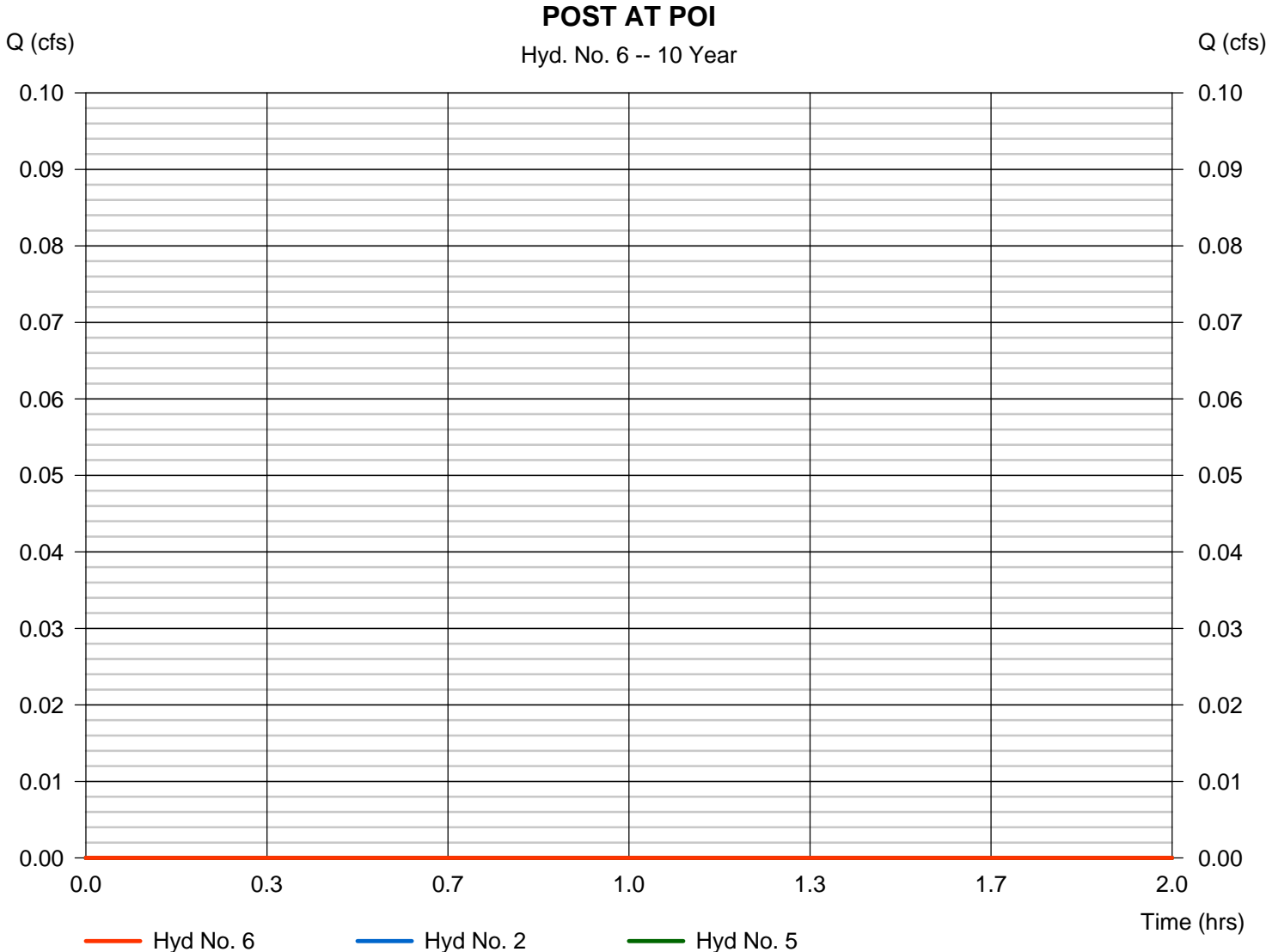


Hydrograph Report

Hyd. No. 6

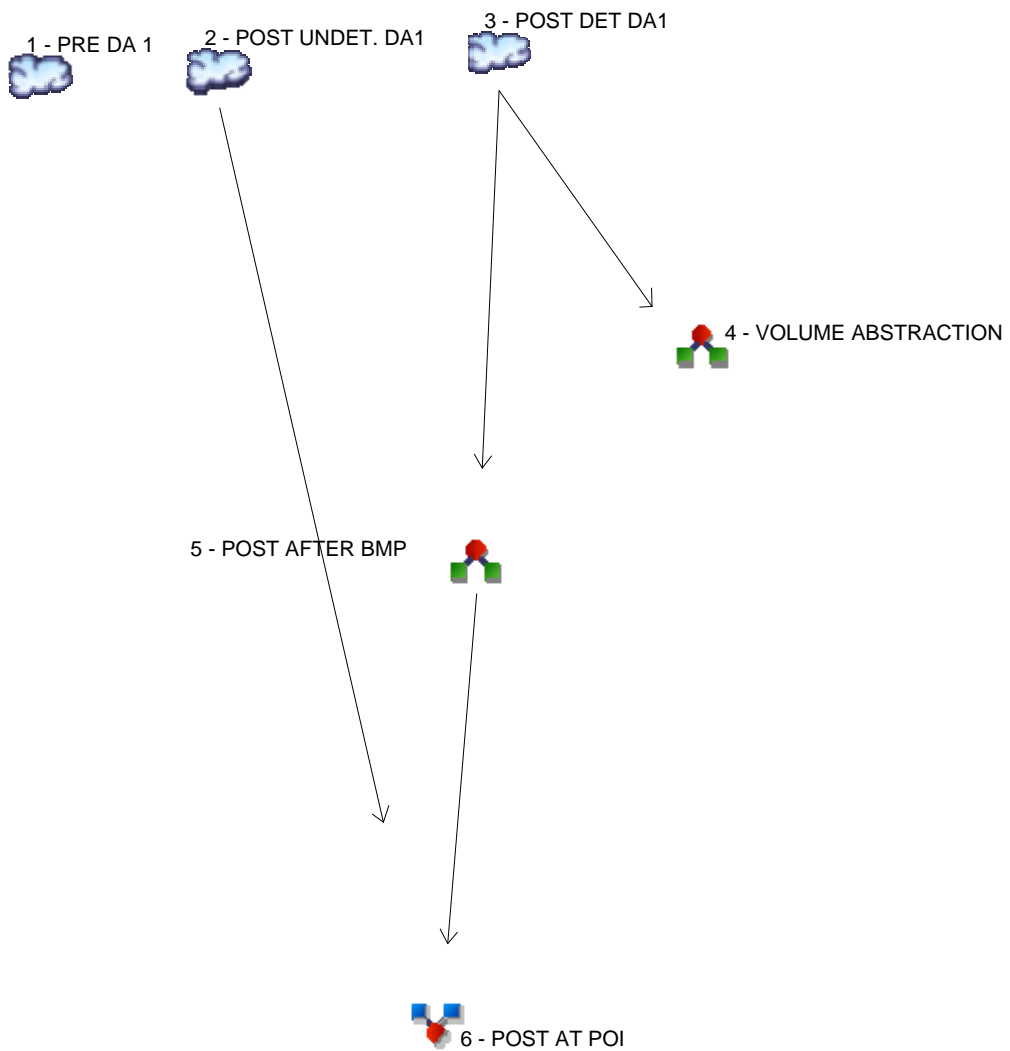
POST AT POI

Hydrograph type	= Combine	Peak discharge	= 0.000 cfs
Storm frequency	= 10 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyds.	= 2, 5	Contrib. drain. area	= 0.820 ac



Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4



Legend

Hyd. Origin	Description
1	SCS Runoff PRE DA 1
2	SCS Runoff POST UNDET. DA1
3	SCS Runoff POST DET DA1
4	Diversion1 VOLUME ABSTRACTION
5	Diversion2 POST AFTER BMP
6	Combine POST AT POI

Hydrograph Return Period Recap

Hydranow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	-----	-----	-----	-----	-----	-----	-----	0.013	-----	PRE DA 1
2	SCS Runoff	-----	-----	-----	-----	-----	-----	-----	0.010	-----	POST UNDET. DA1
3	SCS Runoff	-----	-----	-----	-----	-----	-----	-----	0.069	-----	POST DET DA1
4	Diversion1	3	-----	-----	-----	-----	-----	-----	0.069	-----	VOLUME ABSTRACTION
5	Diversion2	3	-----	-----	-----	-----	-----	-----	0.000	-----	POST AFTER BMP
6	Combine	2, 5	-----	-----	-----	-----	-----	-----	0.010	-----	POST AT POI

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	0.013	2	904	439	-----	-----	-----	PRE DA 1
2	SCS Runoff	0.010	2	904	357	-----	-----	-----	POST UNDET. DA1
3	SCS Runoff	0.069	2	766	777	-----	-----	-----	POST DET DA1
4	Diversion1	0.069	2	766	777	3	-----	-----	VOLUME ABSTRACTION
5	Diversion2	0.000	2	n/a	0	3	-----	-----	POST AFTER BMP
6	Combine	0.010	2	904	357	2, 5	-----	-----	POST AT POI

\\nuss010fp2\shared\Marcellus_M-Z - Mark S... 50 Year (SXL)\112105584\Map One 2 EA OPP... (Base 2)\ESCGP-2\PPP\02 S...

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

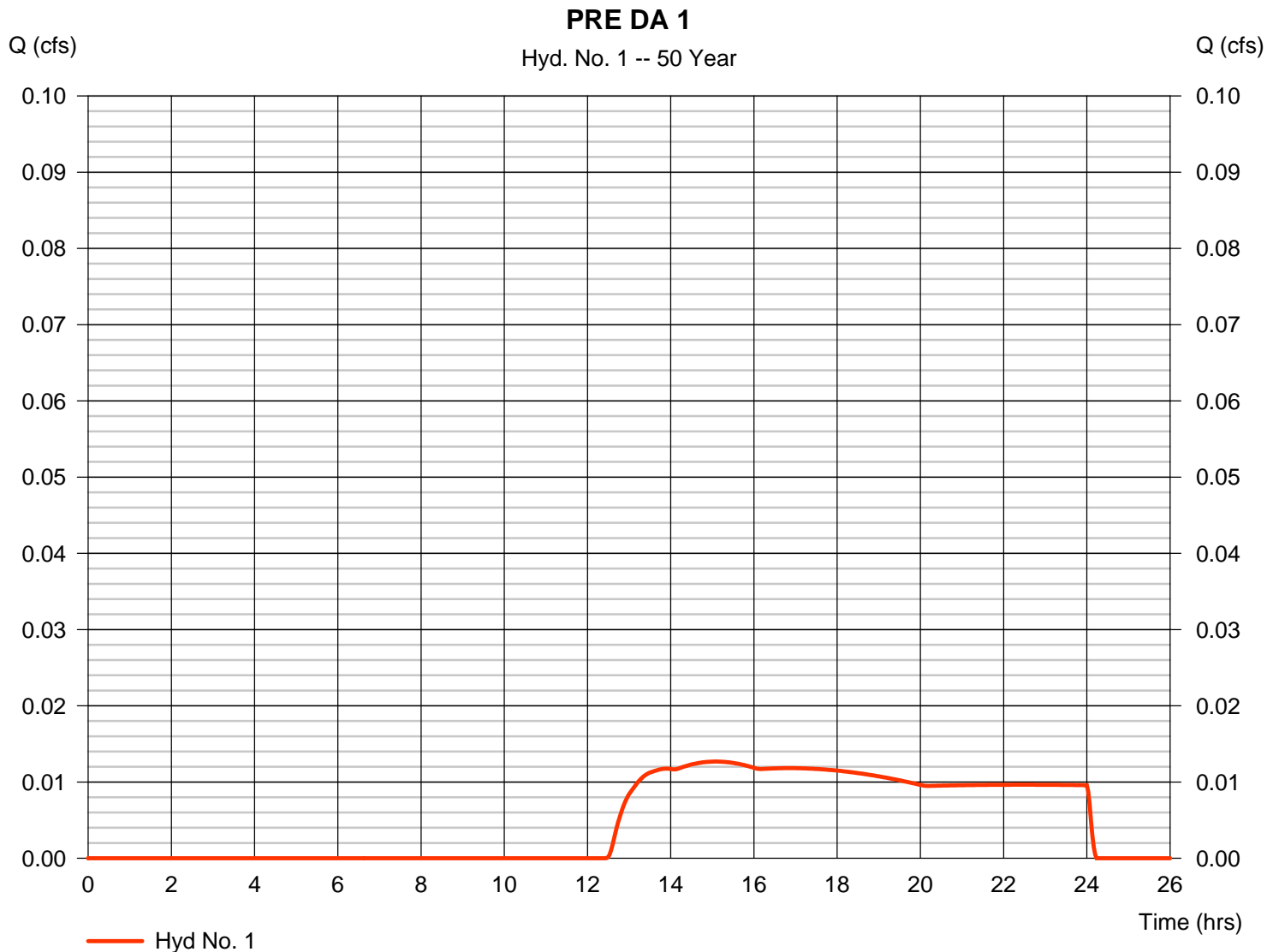
Thursday, 10 / 27 / 2016

Hyd. No. 1

PRE DA 1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.013 cfs
Storm frequency	= 50 yrs	Time to peak	= 15.07 hrs
Time interval	= 2 min	Hyd. volume	= 439 cuft
Drainage area	= 1.010 ac	Curve number	= 30*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 6.80 min
Total precip.	= 6.40 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.000 x 30) + (0.010 x 30)] / 1.010



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No. 1

PRE DA 1

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
Sheet Flow				
Manning's n-value	= 0.240	0.011	0.011	
Flow length (ft)	= 50.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 2.90	0.00	0.00	
Land slope (%)	= 6.00	0.00	0.00	
Travel Time (min)	= 5.55	+ 0.00	+ 0.00	= 5.55
Shallow Concentrated Flow				
Flow length (ft)	= 370.00	0.00	0.00	
Watercourse slope (%)	= 8.90	0.00	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	=4.81	0.00	0.00	
Travel Time (min)	= 1.28	+ 0.00	+ 0.00	= 1.28
Channel Flow				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	=0.00	0.00	0.00	
Flow length (ft)	{{0}}0.0	0.0	0.0	
Travel Time (min)	= 0.00	+ 0.00	+ 0.00	= 0.00
Total Travel Time, Tc				6.80 min

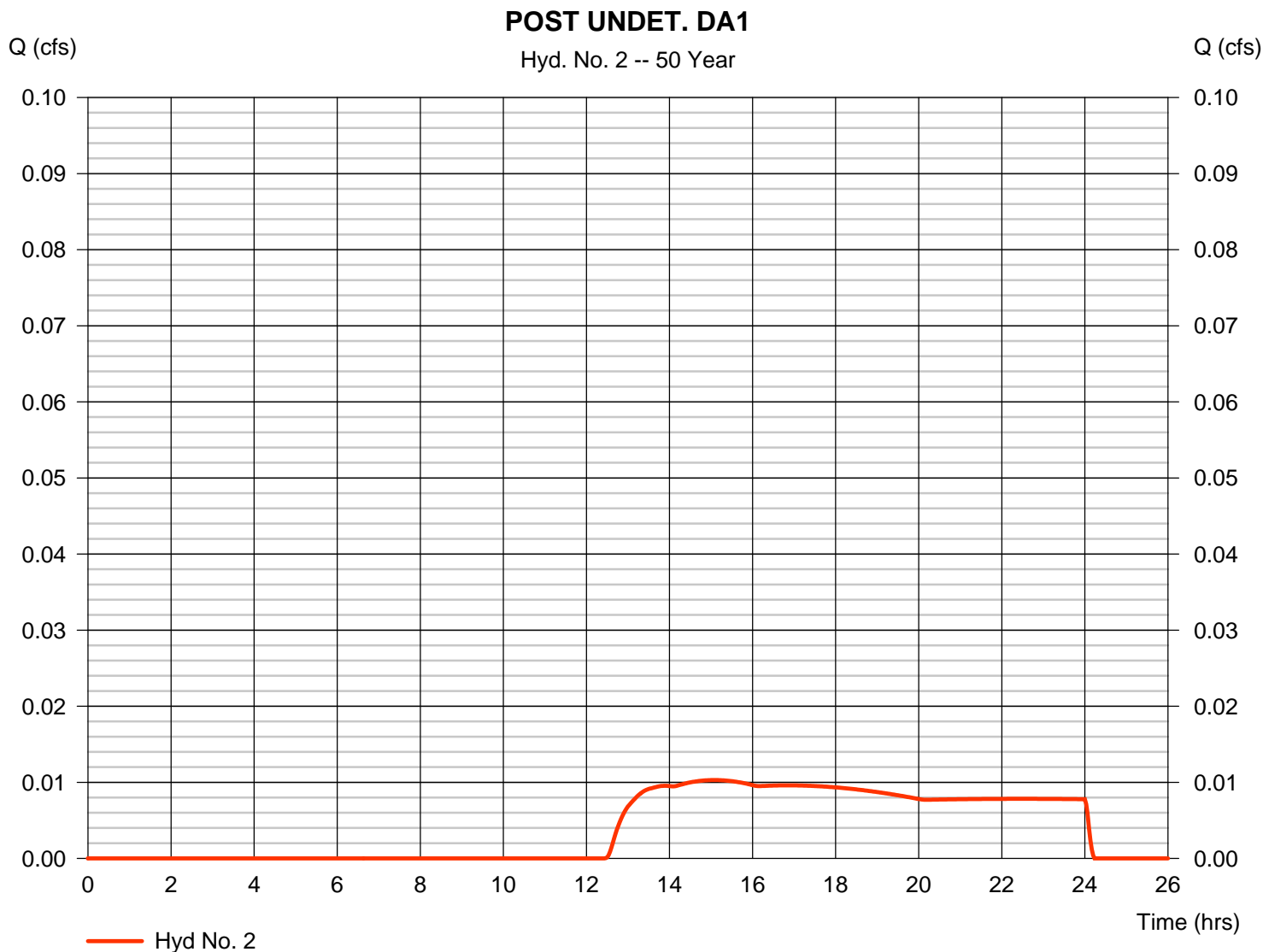
Hydrograph Report

Hyd. No. 2

POST UNDET. DA1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.010 cfs
Storm frequency	= 50 yrs	Time to peak	= 15.07 hrs
Time interval	= 2 min	Hyd. volume	= 357 cuft
Drainage area	= 0.820 ac	Curve number	= 30*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 6.80 min
Total precip.	= 6.40 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.820 x 30)] / 0.820



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No. 2

POST UNDET. DA1

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
Sheet Flow				
Manning's n-value	= 0.240	0.011	0.011	
Flow length (ft)	= 50.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 2.90	0.00	0.00	
Land slope (%)	= 6.00	0.00	0.00	
Travel Time (min)	= 5.55	+ 0.00	+ 0.00	= 5.55
Shallow Concentrated Flow				
Flow length (ft)	= 370.00	0.00	0.00	
Watercourse slope (%)	= 8.90	0.00	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	=4.81	0.00	0.00	
Travel Time (min)	= 1.28	+ 0.00	+ 0.00	= 1.28
Channel Flow				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	=0.00	0.00	0.00	
Flow length (ft)	{{0}}0.0	0.0	0.0	
Travel Time (min)	= 0.00	+ 0.00	+ 0.00	= 0.00
Total Travel Time, Tc				6.80 min

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

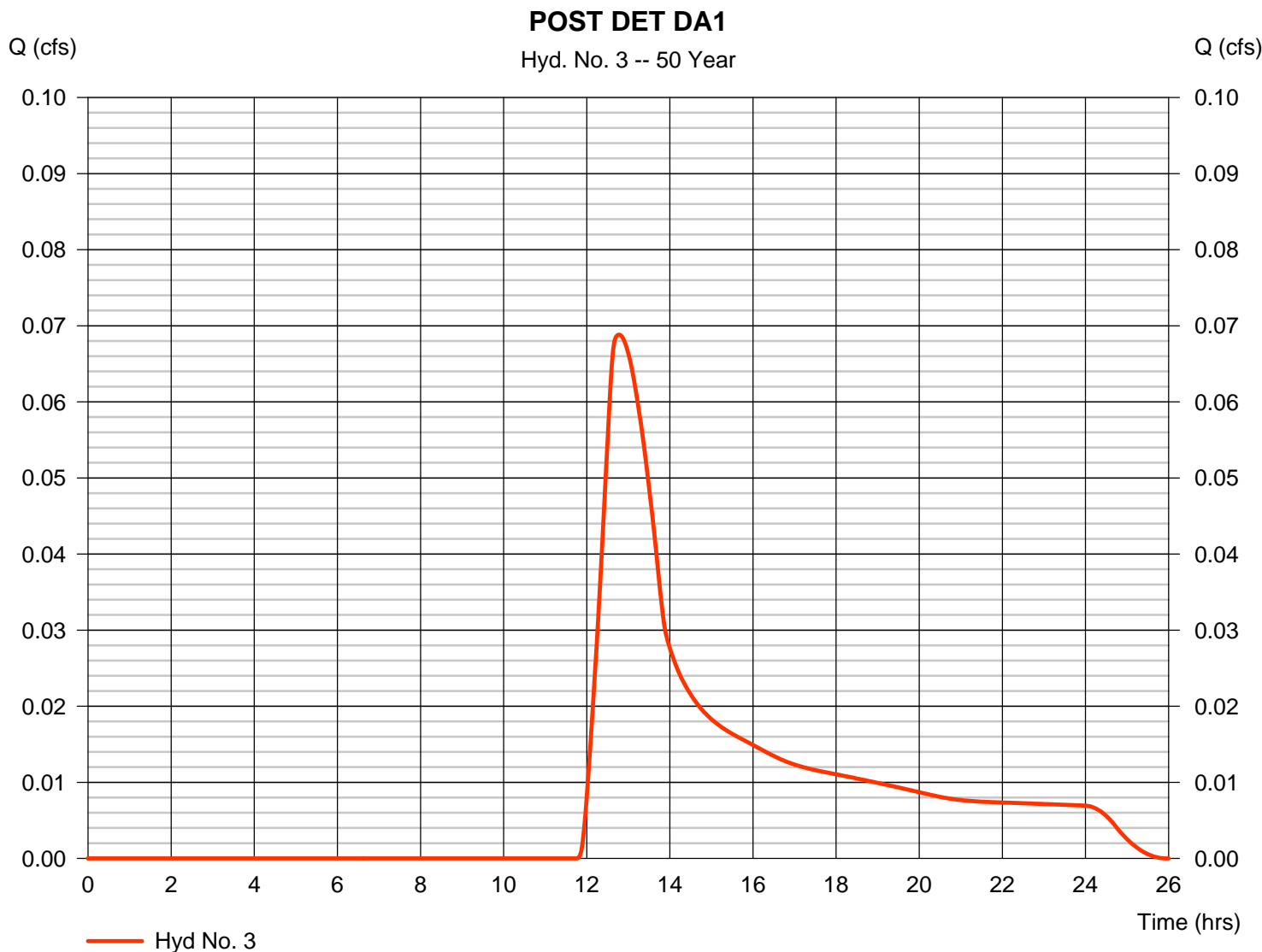
Thursday, 10 / 27 / 2016

Hyd. No. 3

POST DET DA1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.069 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.77 hrs
Time interval	= 2 min	Hyd. volume	= 777 cuft
Drainage area	= 0.220 ac	Curve number	= 45*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 71.66 min
Total precip.	= 6.40 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.070 x 76) + (0.150 x 30)] / 0.220



Hydrograph Report

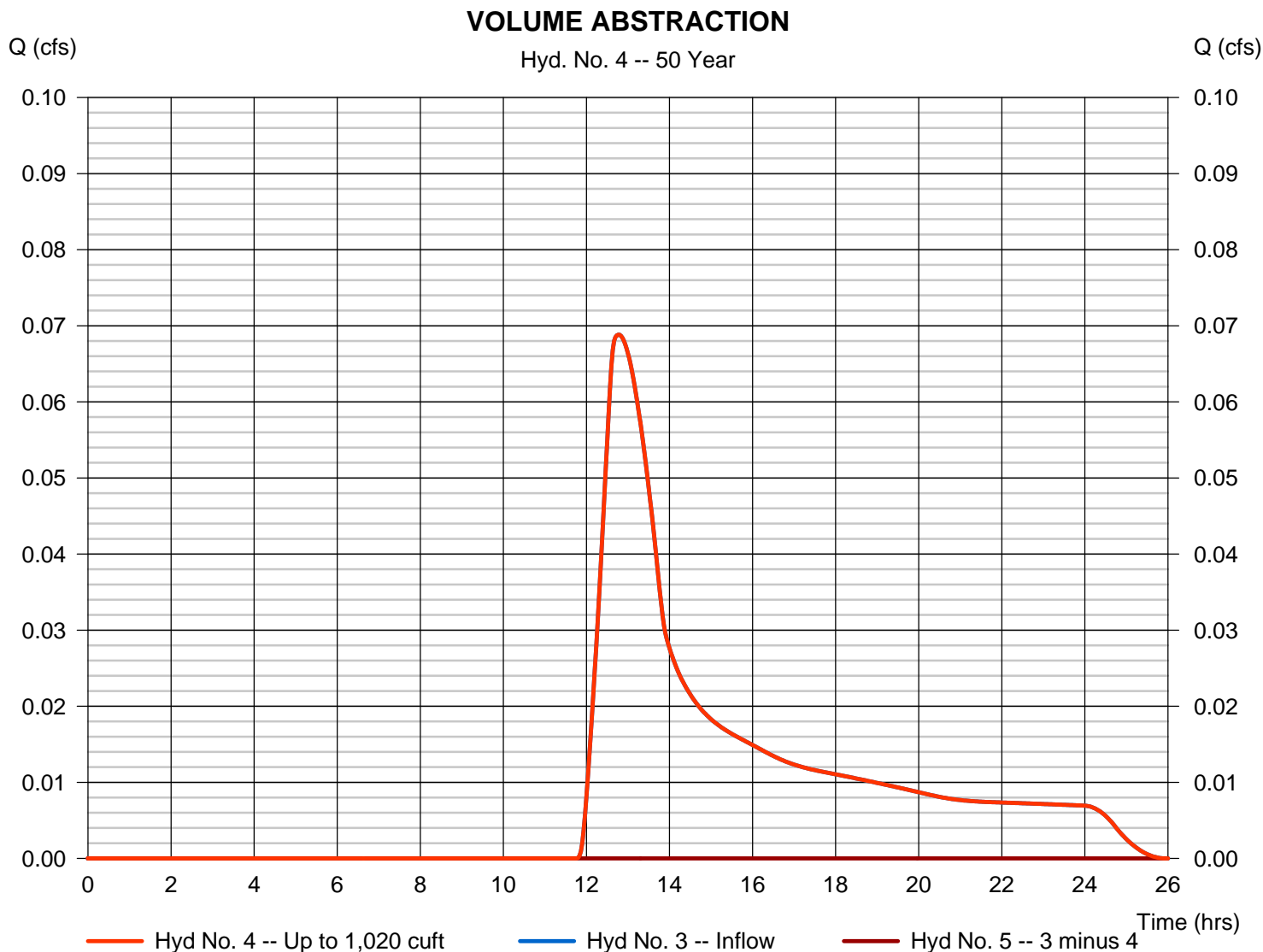
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Thursday, 10 / 27 / 2016

Hyd. No. 4

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 0.069 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.77 hrs
Time interval	= 2 min	Hyd. volume	= 777 cuft
Inflow hydrograph	= 3 - POST DET DA1	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 1,020 cuft



Hydrograph Report

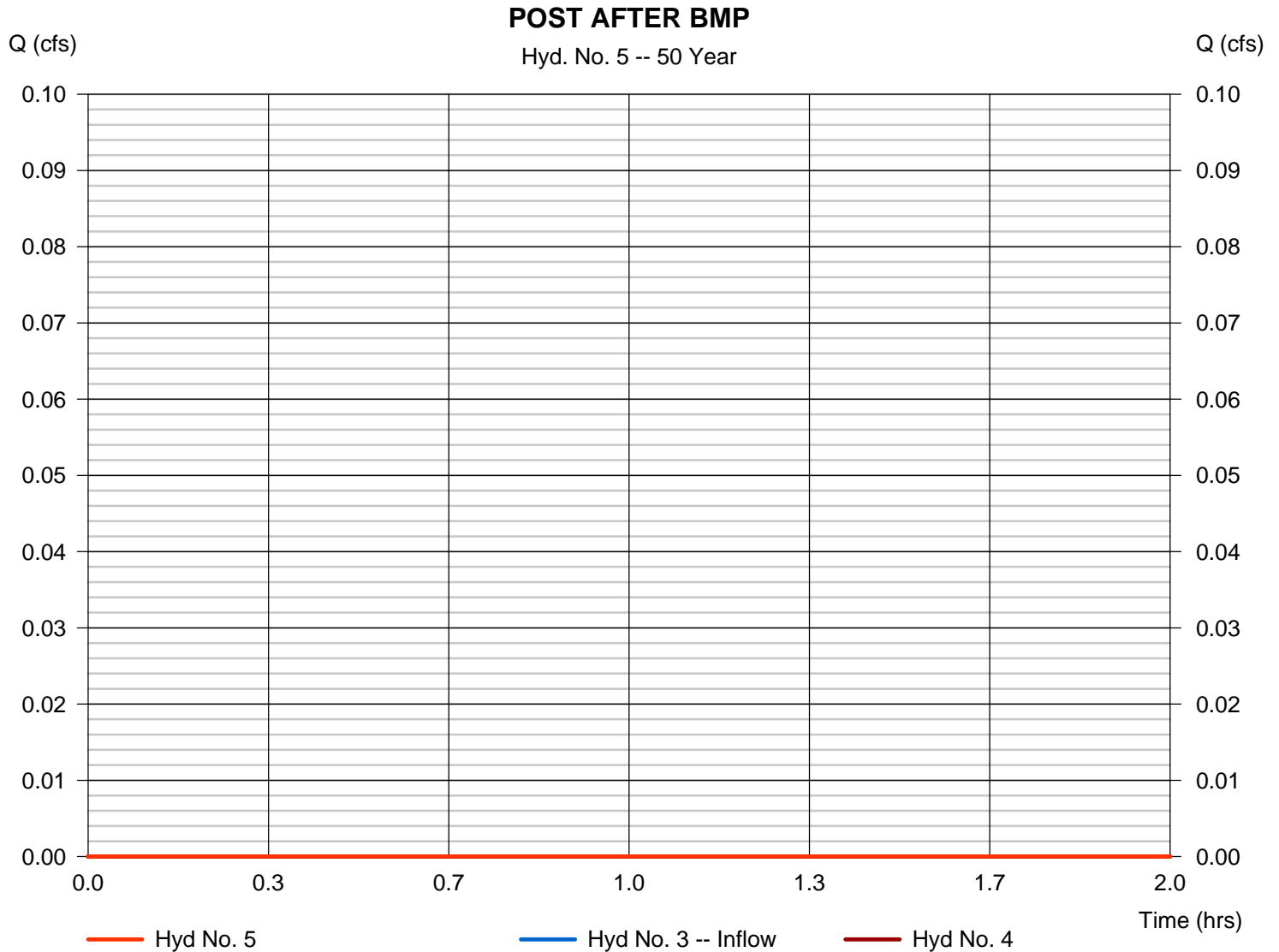
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Thursday, 10 / 27 / 2016

Hyd. No. 5

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 0.000 cfs
Storm frequency	= 50 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hydrograph	= 3 - POST DET DA1	2nd diverted hyd.	= 4
Diversion method	= First Flush Volume	Volume Up To	= 1,020 cuft



Hydrograph Report

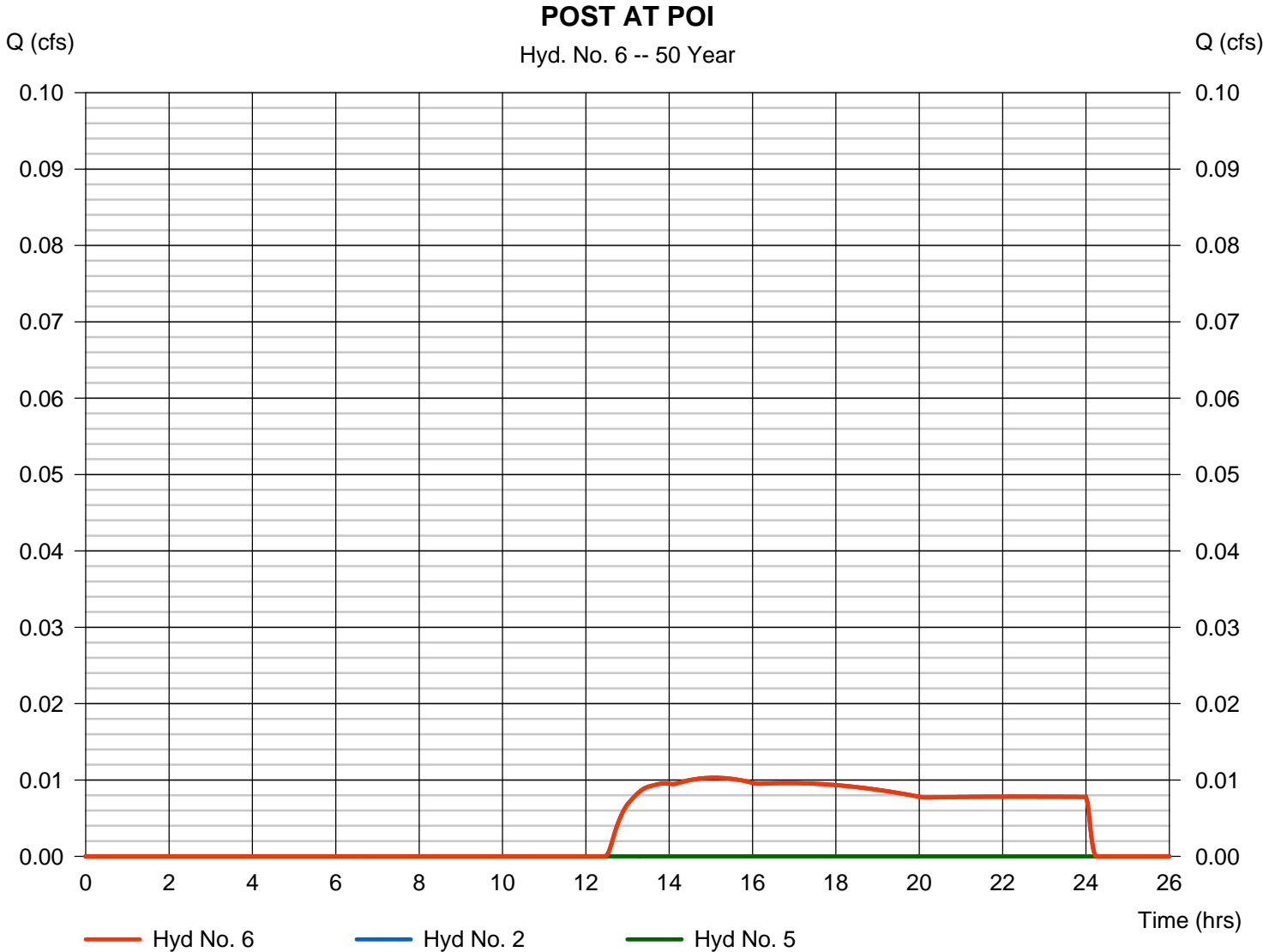
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

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Hyd. No. 6

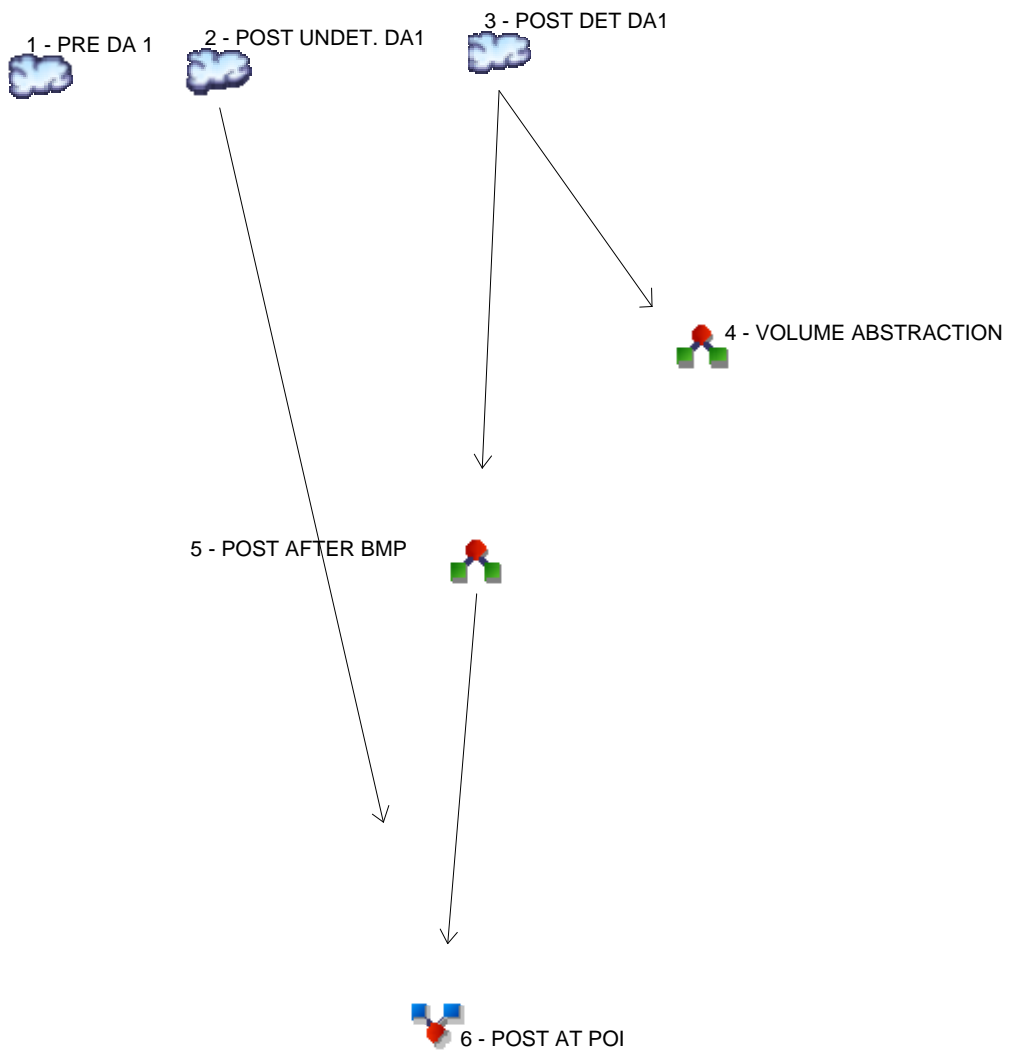
POST AT POI

Hydrograph type	= Combine	Peak discharge	= 0.010 cfs
Storm frequency	= 50 yrs	Time to peak	= 15.07 hrs
Time interval	= 2 min	Hyd. volume	= 357 cuft
Inflow hyds.	= 2, 5	Contrib. drain. area	= 0.820 ac



Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4



Legend

Hyd. Origin	Description
1	SCS Runoff PRE DA 1
2	SCS Runoff POST UNDET. DA1
3	SCS Runoff POST DET DA1
4	Diversion1 VOLUME ABSTRACTION
5	Diversion2 POST AFTER BMP
6	Combine POST AT POI

Hydrograph Return Period Recap

Hydranow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	-----	-----	-----	-----	-----	-----	-----	-----	0.055	PRE DA 1
2	SCS Runoff	-----	-----	-----	-----	-----	-----	-----	-----	0.045	POST UNDET. DA1
3	SCS Runoff	-----	-----	-----	-----	-----	-----	-----	-----	0.166	POST DET DA1
4	Diversion1	3	-----	-----	-----	-----	-----	-----	-----	0.166	VOLUME ABSTRACTION
5	Diversion2	3	-----	-----	-----	-----	-----	-----	-----	0.010	POST AFTER BMP
6	Combine	2, 5	-----	-----	-----	-----	-----	-----	-----	0.045	POST AT POI

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	0.055	2	742	1,109	-----	-----	-----	PRE DA 1
2	SCS Runoff	0.045	2	742	901	-----	-----	-----	POST UNDET. DA1
3	SCS Runoff	0.166	2	744	1,163	-----	-----	-----	POST DET DA1
4	Diversion1	0.166	2	744	1,020	3	-----	-----	VOLUME ABSTRACTION
5	Diversion2	0.010	2	1228	142	3	-----	-----	POST AFTER BMP
6	Combine	0.045	2	742	1,043	2, 5	-----	-----	POST AT POI

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

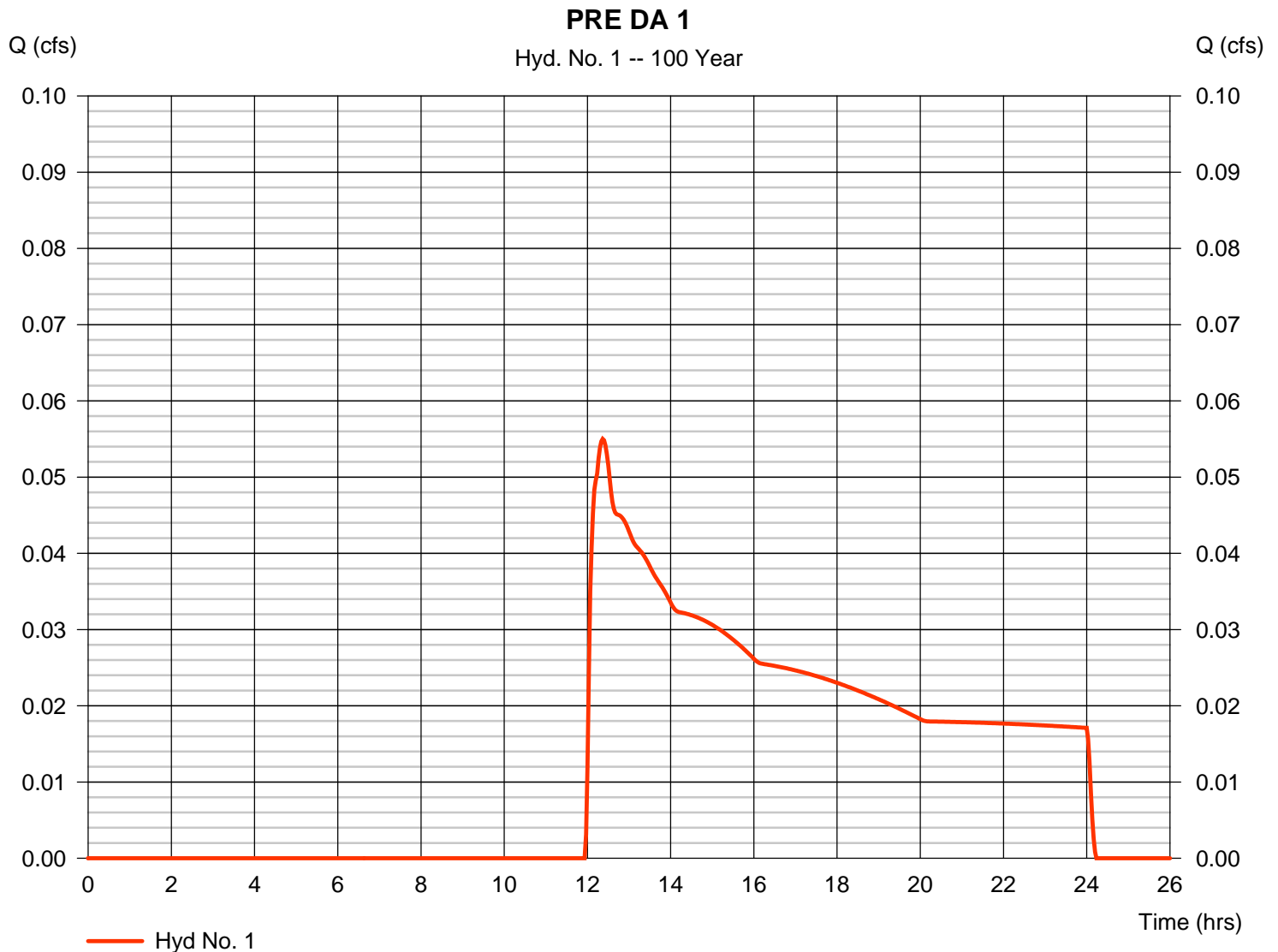
Thursday, 10 / 27 / 2016

Hyd. No. 1

PRE DA 1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.055 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.37 hrs
Time interval	= 2 min	Hyd. volume	= 1,109 cuft
Drainage area	= 1.010 ac	Curve number	= 30*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 6.80 min
Total precip.	= 7.48 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.000 x 30) + (0.010 x 30)] / 1.010



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No. 1

PRE DA 1

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
Sheet Flow				
Manning's n-value	= 0.240	0.011	0.011	
Flow length (ft)	= 50.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 2.90	0.00	0.00	
Land slope (%)	= 6.00	0.00	0.00	
Travel Time (min)	= 5.55	+ 0.00	+ 0.00	= 5.55
Shallow Concentrated Flow				
Flow length (ft)	= 370.00	0.00	0.00	
Watercourse slope (%)	= 8.90	0.00	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	=4.81	0.00	0.00	
Travel Time (min)	= 1.28	+ 0.00	+ 0.00	= 1.28
Channel Flow				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	=0.00	0.00	0.00	
Flow length (ft)	0.0	0.0	0.0	
Travel Time (min)	= 0.00	+ 0.00	+ 0.00	= 0.00
Total Travel Time, Tc				6.80 min

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

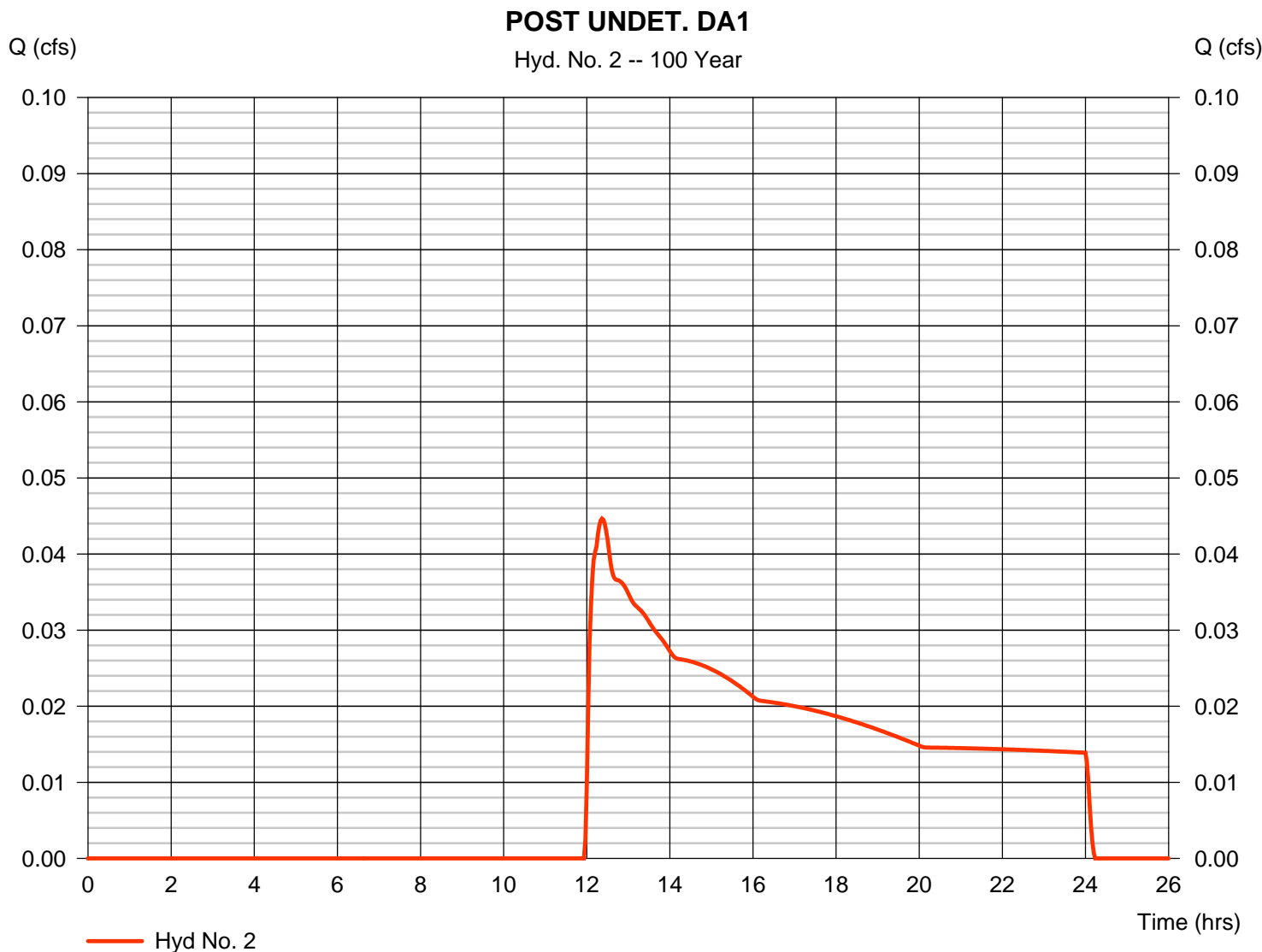
Thursday, 10 / 27 / 2016

Hyd. No. 2

POST UNDET. DA1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.045 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.37 hrs
Time interval	= 2 min	Hyd. volume	= 901 cuft
Drainage area	= 0.820 ac	Curve number	= 30*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 6.80 min
Total precip.	= 7.48 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.820 x 30)] / 0.820



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No. 2

POST UNDET. DA1

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
Sheet Flow				
Manning's n-value	= 0.240	0.011	0.011	
Flow length (ft)	= 50.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 2.90	0.00	0.00	
Land slope (%)	= 6.00	0.00	0.00	
Travel Time (min)	= 5.55	+ 0.00	+ 0.00	= 5.55
Shallow Concentrated Flow				
Flow length (ft)	= 370.00	0.00	0.00	
Watercourse slope (%)	= 8.90	0.00	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	=4.81	0.00	0.00	
Travel Time (min)	= 1.28	+ 0.00	+ 0.00	= 1.28
Channel Flow				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	=0.00	0.00	0.00	
Flow length (ft)	{{0}}0.0	0.0	0.0	
Travel Time (min)	= 0.00	+ 0.00	+ 0.00	= 0.00
Total Travel Time, Tc				6.80 min

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

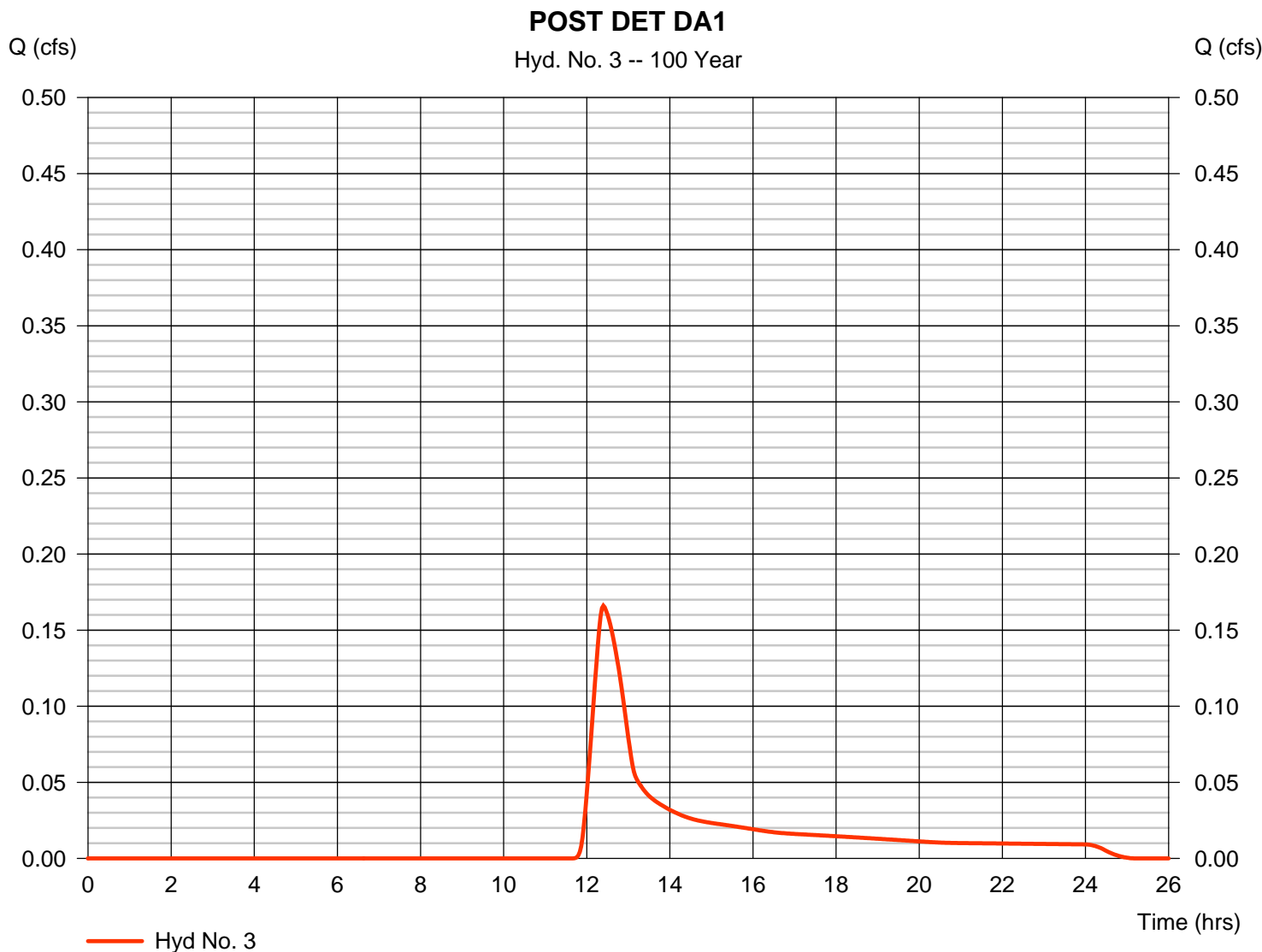
Thursday, 10 / 27 / 2016

Hyd. No. 3

POST DET DA1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.166 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.40 hrs
Time interval	= 2 min	Hyd. volume	= 1,163 cuft
Drainage area	= 0.220 ac	Curve number	= 45*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 45.66 min
Total precip.	= 7.48 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.070 x 76) + (0.150 x 30)] / 0.220



Hydrograph Report

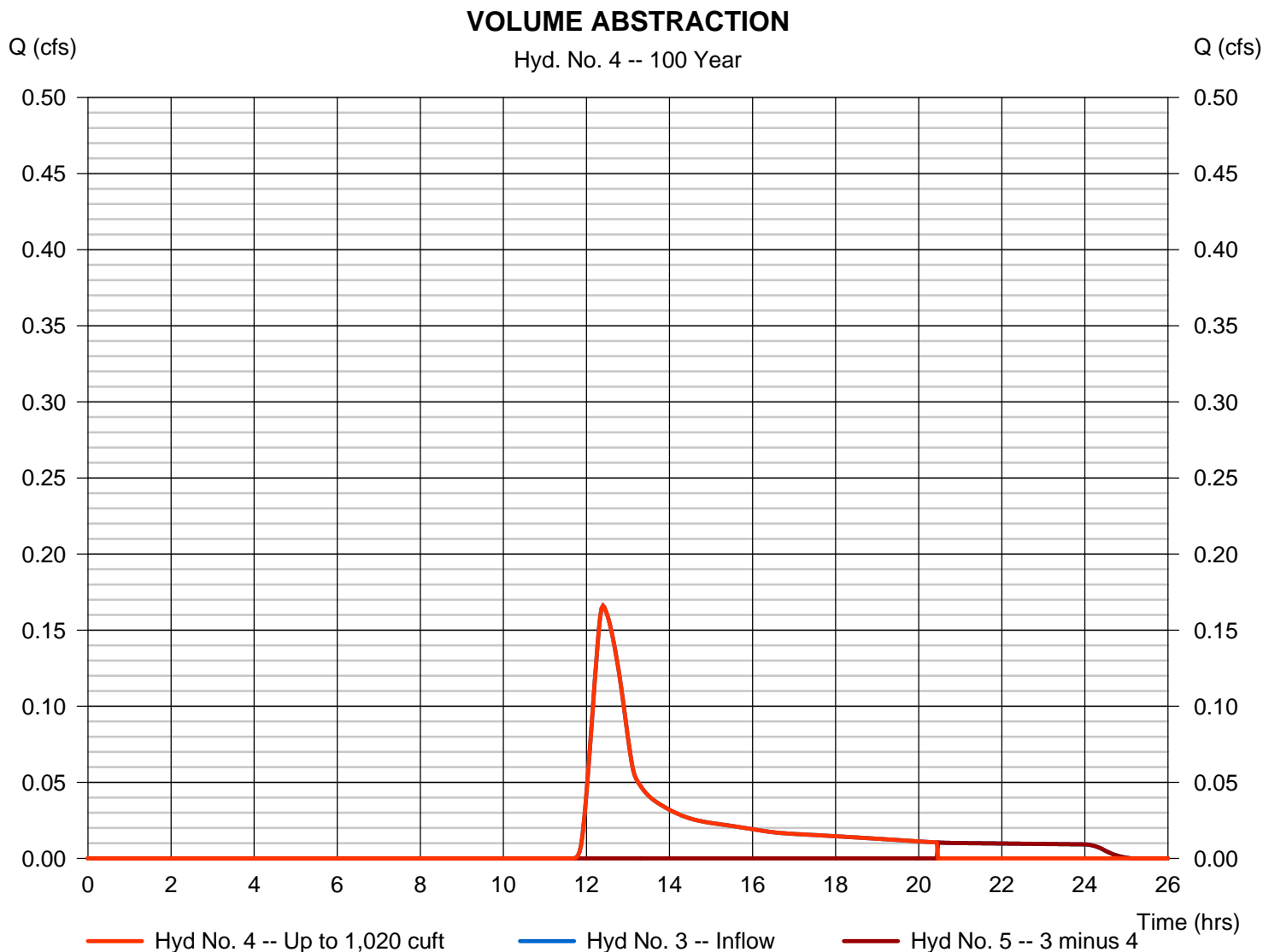
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Thursday, 10 / 27 / 2016

Hyd. No. 4

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 0.166 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.40 hrs
Time interval	= 2 min	Hyd. volume	= 1,020 cuft
Inflow hydrograph	= 3 - POST DET DA1	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 1,020 cuft



Hydrograph Report

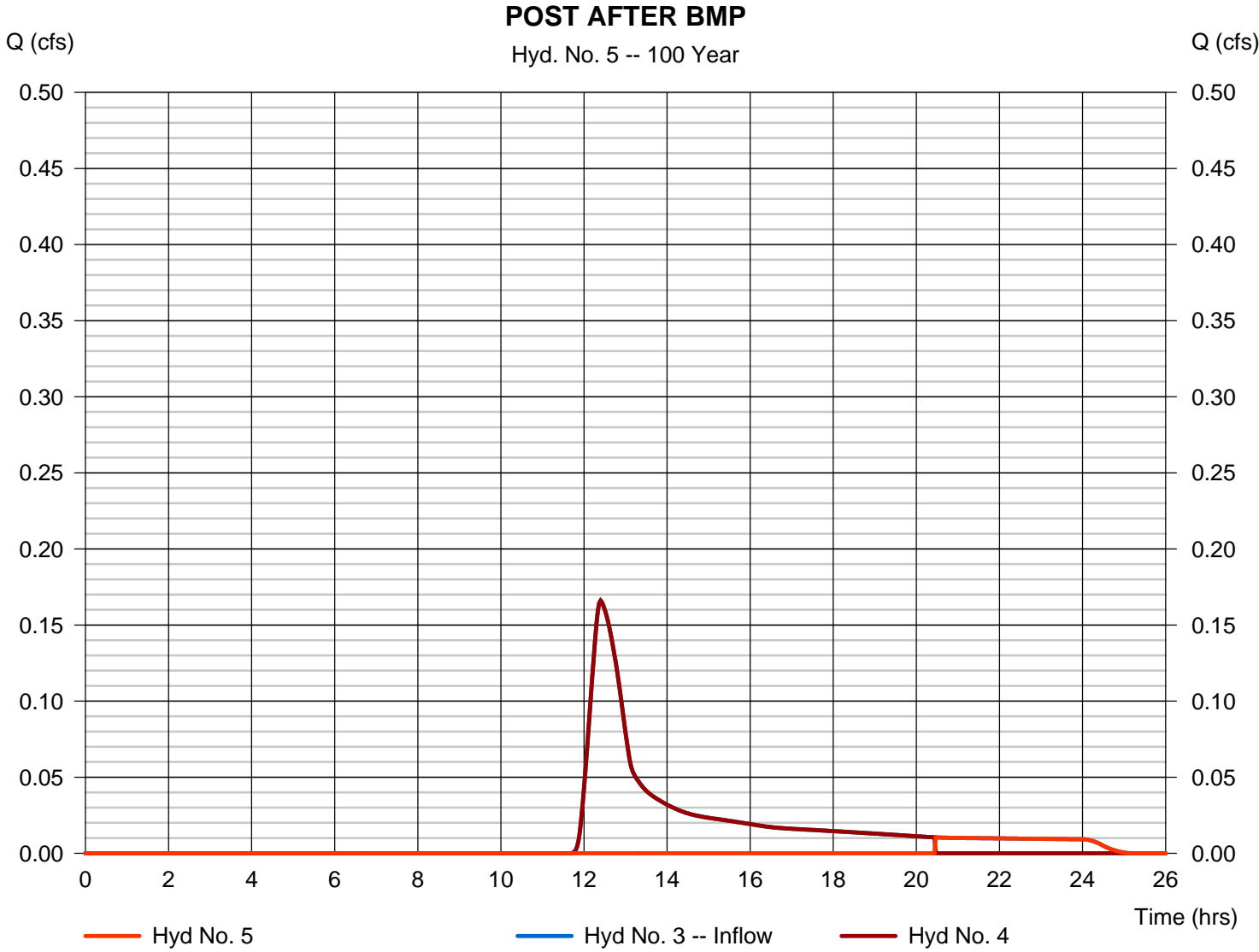
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Thursday, 10 / 27 / 2016

Hyd. No. 5

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 0.010 cfs
Storm frequency	= 100 yrs	Time to peak	= 20.47 hrs
Time interval	= 2 min	Hyd. volume	= 142 cuft
Inflow hydrograph	= 3 - POST DET DA1	2nd diverted hyd.	= 4
Diversion method	= First Flush Volume	Volume Up To	= 1,020 cuft



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

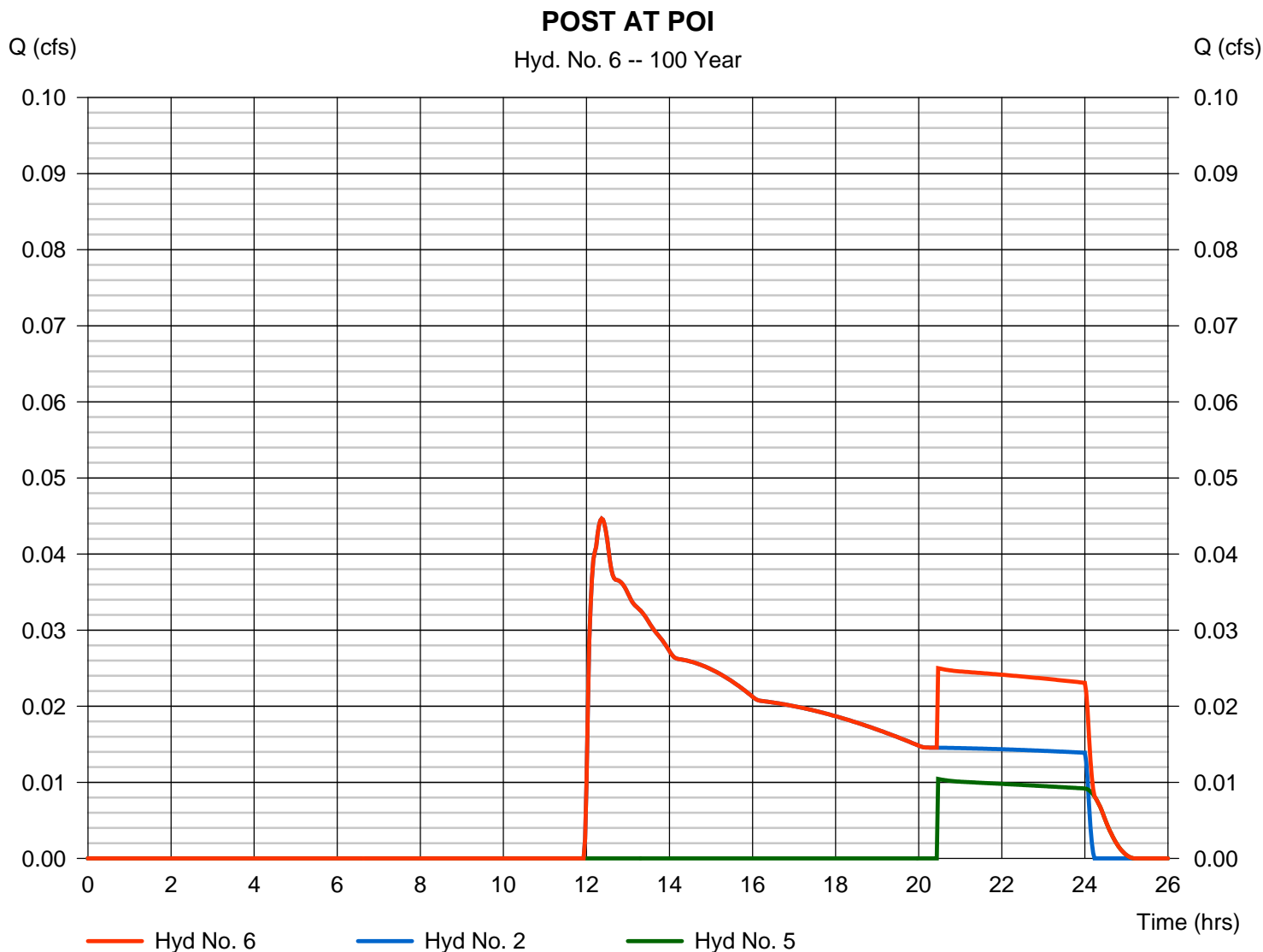
Thursday, 10 / 27 / 2016

Hyd. No. 6

POST AT POI

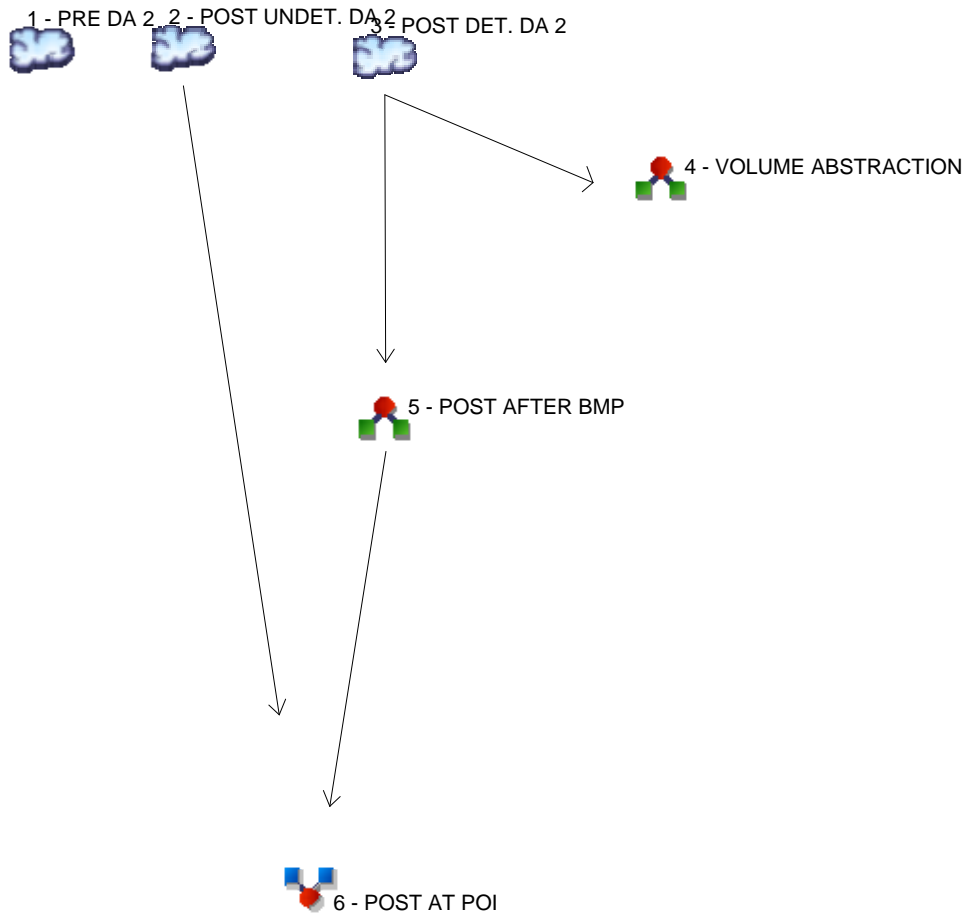
Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 2 min
Inflow hyds. = 2, 5

Peak discharge = 0.045 cfs
Time to peak = 12.37 hrs
Hyd. volume = 1,043 cuft
Contrib. drain. area = 0.820 ac



Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4



Legend

Hyd. Origin	Description
1	SCS Runoff PRE DA 2
2	SCS Runoff POST UNDET. DA 2
3	SCS Runoff POST DET. DA 2
4	Diversion1 VOLUME ABSTRACTION
5	Diversion2 POST AFTER BMP
6	Combine POST AT POI

Hydrograph Return Period Recap

Hydranow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	-----	-----	0.000	-----	-----	0.000	-----	0.012	0.081	PRE DA 2
2	SCS Runoff	-----	-----	0.000	-----	-----	0.000	-----	0.008	0.050	POST UNDET. DA 2
3	SCS Runoff	-----	-----	0.000	-----	-----	0.005	-----	0.235	0.468	POST DET. DA 2
4	Diversion1	3	-----	0.000	-----	-----	0.005	-----	0.235	0.468	VOLUME ABSTRACTION
5	Diversion2	3	-----	0.000	-----	-----	0.000	-----	0.000	0.017	POST AFTER BMP
6	Combine	2, 5	-----	0.000	-----	-----	0.000	-----	0.008	0.050	POST AT POI

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	0.000	2	n/a	0	-----	-----	-----	PRE DA 2
2	SCS Runoff	0.000	2	n/a	0	-----	-----	-----	POST UNDET. DA 2
3	SCS Runoff	0.000	2	1440	0	-----	-----	-----	POST DET. DA 2
4	Diversion1	0.000	2	1440	0	3	-----	-----	VOLUME ABSTRACTION
5	Diversion2	0.000	2	n/a	0	3	-----	-----	POST AFTER BMP
6	Combine	0.000	2	n/a	0	2, 5	-----	-----	POST AT POI
NUnion DA2.gpw					Return Period: 2 Year			Thursday, 10 / 27 / 2016	

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

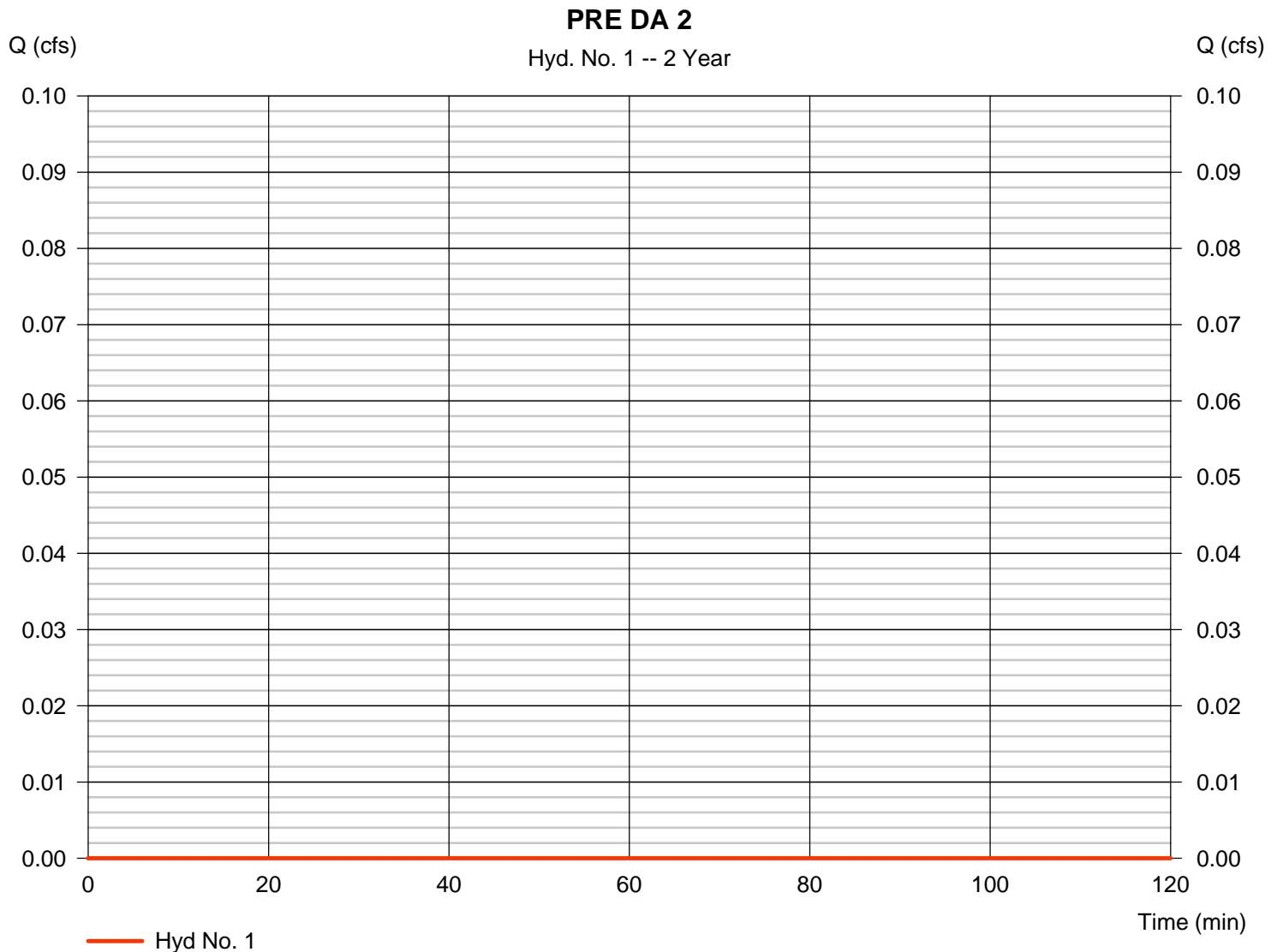
Thursday, 10 / 27 / 2016

Hyd. No. 1

PRE DA 2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Drainage area	= 0.760 ac	Curve number	= 31*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 5.40 min
Total precip.	= 2.90 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.010 x 98) + (0.750 x 30)] / 0.760



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No. 1

PRE DA 2

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
Sheet Flow				
Manning's n-value	= 0.240	0.011	0.011	
Flow length (ft)	= 50.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 2.90	0.00	0.00	
Land slope (%)	= 12.00	0.00	0.00	
Travel Time (min)	= 4.20	+ 0.00	+ 0.00	= 4.20
Shallow Concentrated Flow				
Flow length (ft)	= 231.00	30.00	52.00	
Watercourse slope (%)	= 10.40	3.30	3.90	
Surface description	= Unpaved	Paved	Unpaved	
Average velocity (ft/s)	=5.20	3.69	3.19	
Travel Time (min)	= 0.74	+ 0.14	+ 0.27	= 1.15
Channel Flow				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	=0.00	0.00	0.00	
Flow length (ft)	{{0}}0.0	0.0	0.0	
Travel Time (min)	= 0.00	+ 0.00	+ 0.00	= 0.00
Total Travel Time, Tc				5.40 min

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

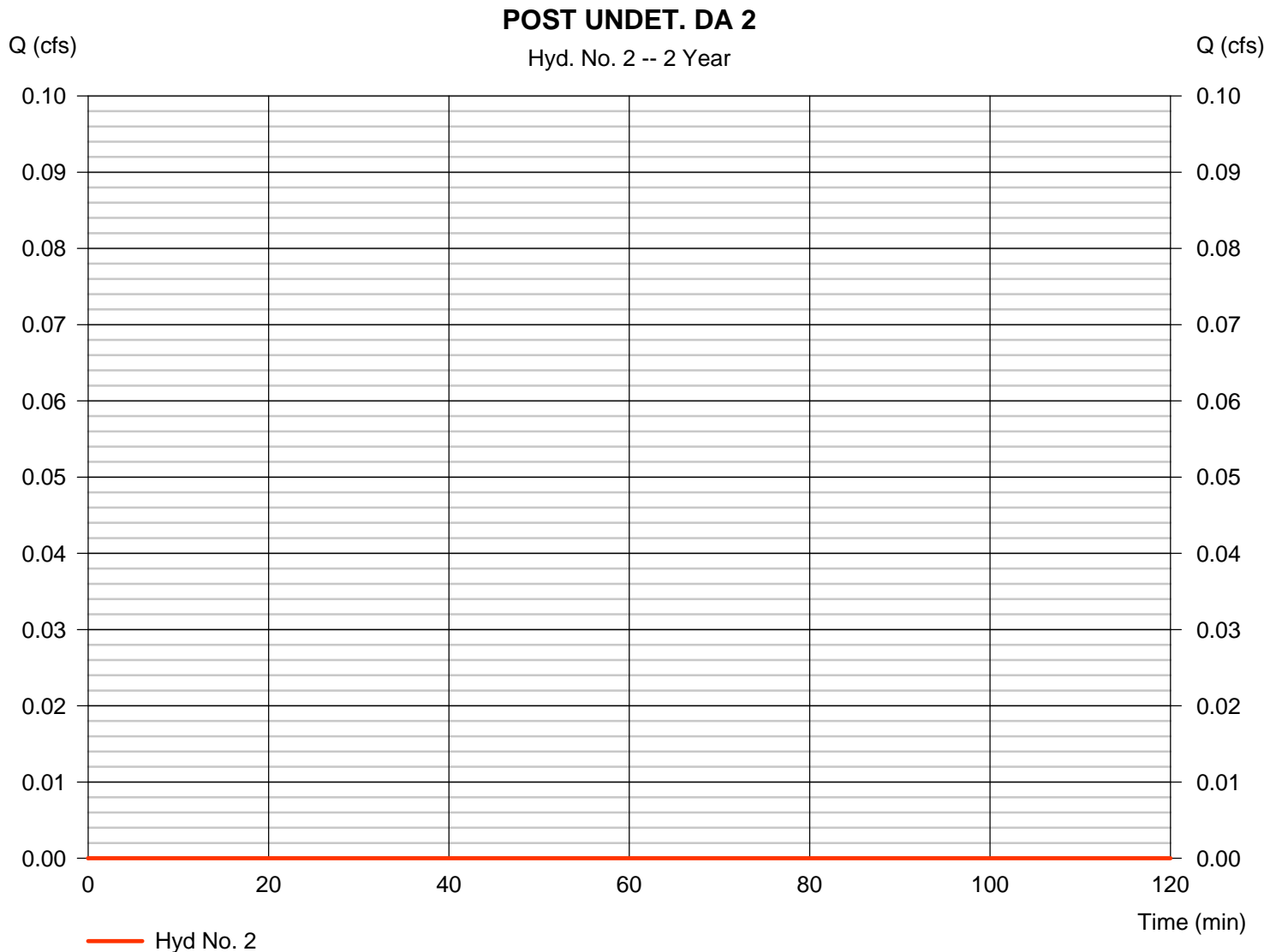
Thursday, 10 / 27 / 2016

Hyd. No. 2

POST UNDET. DA 2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Drainage area	= 0.470 ac	Curve number	= 31*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 5.40 min
Total precip.	= 2.90 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.010 x 98) + (0.460 x 30)] / 0.470



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No. 2

POST UNDET. DA 2

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
Sheet Flow				
Manning's n-value	= 0.240	0.011	0.011	
Flow length (ft)	= 50.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 2.90	0.00	0.00	
Land slope (%)	= 12.00	0.00	0.00	
Travel Time (min)	= 4.20	+ 0.00	+ 0.00	= 4.20
Shallow Concentrated Flow				
Flow length (ft)	= 231.00	30.00	52.00	
Watercourse slope (%)	= 10.40	3.30	3.90	
Surface description	= Unpaved	Paved	Unpaved	
Average velocity (ft/s)	=5.20	3.69	3.19	
Travel Time (min)	= 0.74	+ 0.14	+ 0.27	= 1.15
Channel Flow				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	=0.00	0.00	0.00	
Flow length (ft)	0.0	0.0	0.0	
Travel Time (min)	= 0.00	+ 0.00	+ 0.00	= 0.00
Total Travel Time, Tc				5.40 min

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

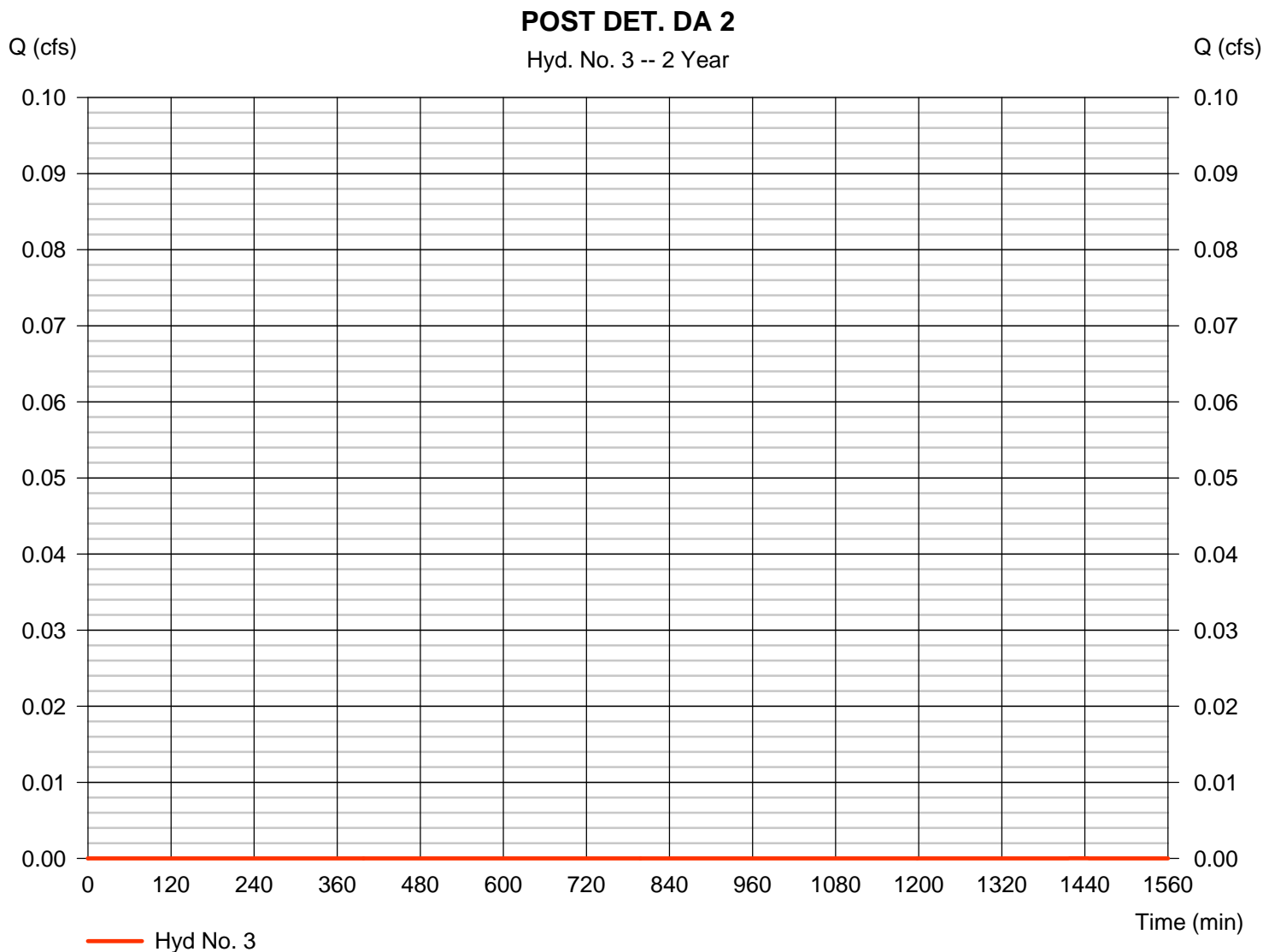
Thursday, 10 / 27 / 2016

Hyd. No. 3

POST DET. DA 2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= 1440 min
Time interval	= 2 min	Hyd. volume	= 0 cuft
Drainage area	= 0.290 ac	Curve number	= 41*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 6.50 min
Total precip.	= 2.90 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.070 x 76) + (0.220 x 30)] / 0.290



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No. 3

POST DET. DA 2

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
Sheet Flow				
Manning's n-value	= 0.240	0.011	0.011	
Flow length (ft)	= 50.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 2.90	0.00	0.00	
Land slope (%)	= 5.60	0.00	0.00	
Travel Time (min)	= 5.70	+ 0.00	+ 0.00	= 5.70
Shallow Concentrated Flow				
Flow length (ft)	= 190.00	23.00	16.00	
Watercourse slope (%)	= 8.40	8.70	12.50	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	=4.68	6.00	7.19	
Travel Time (min)	= 0.68	+ 0.06	+ 0.04	= 0.78
Channel Flow				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	=0.00	0.00	0.00	
Flow length (ft)	{{0}}0.0	0.0	0.0	
Travel Time (min)	= 0.00	+ 0.00	+ 0.00	= 0.00
Total Travel Time, Tc				6.50 min

Hydrograph Report

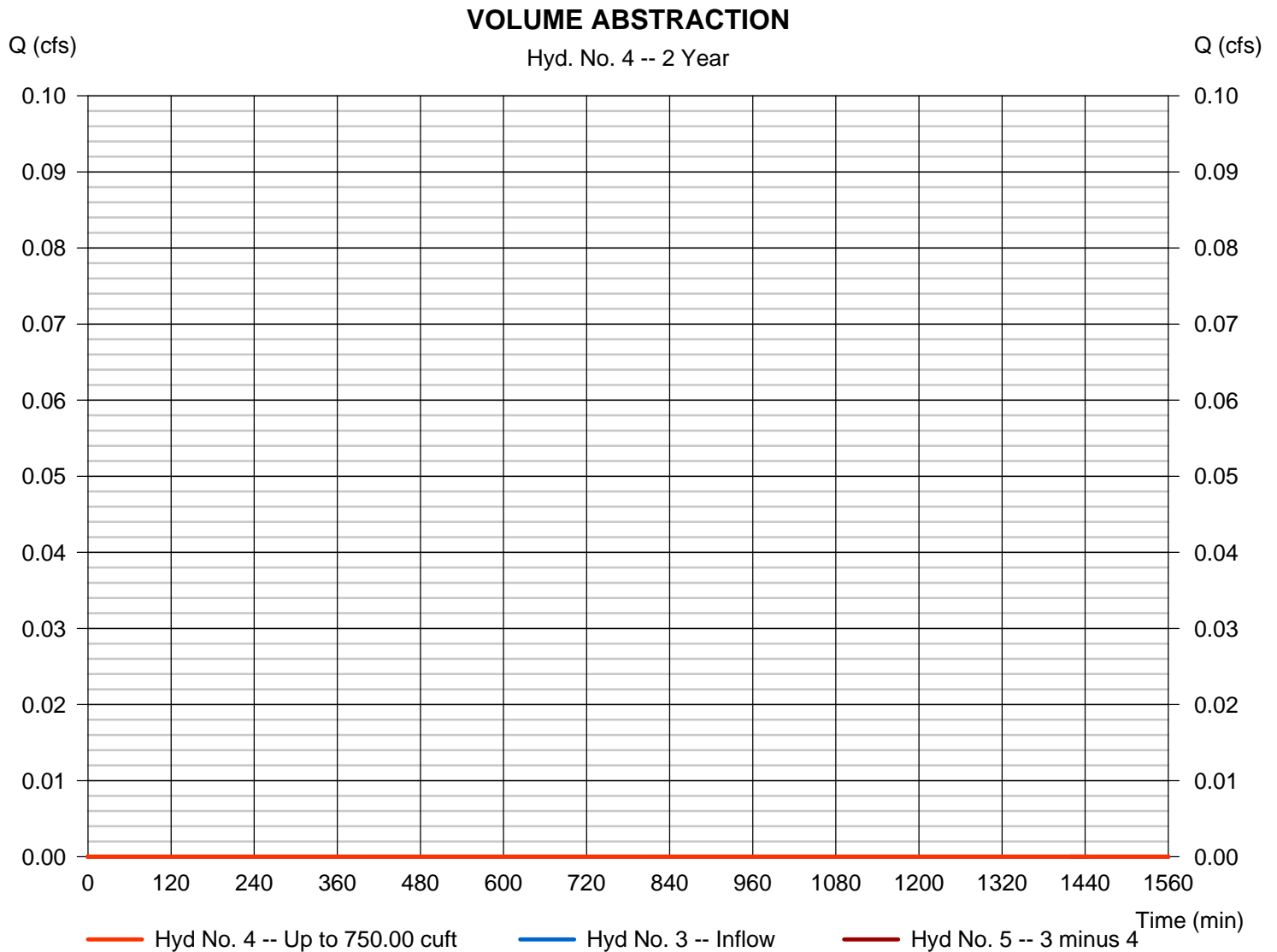
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Thursday, 10 / 27 / 2016

Hyd. No. 4

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= 1440 min
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hydrograph	= 3 - POST DET. DA 2	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 750.00 cuft

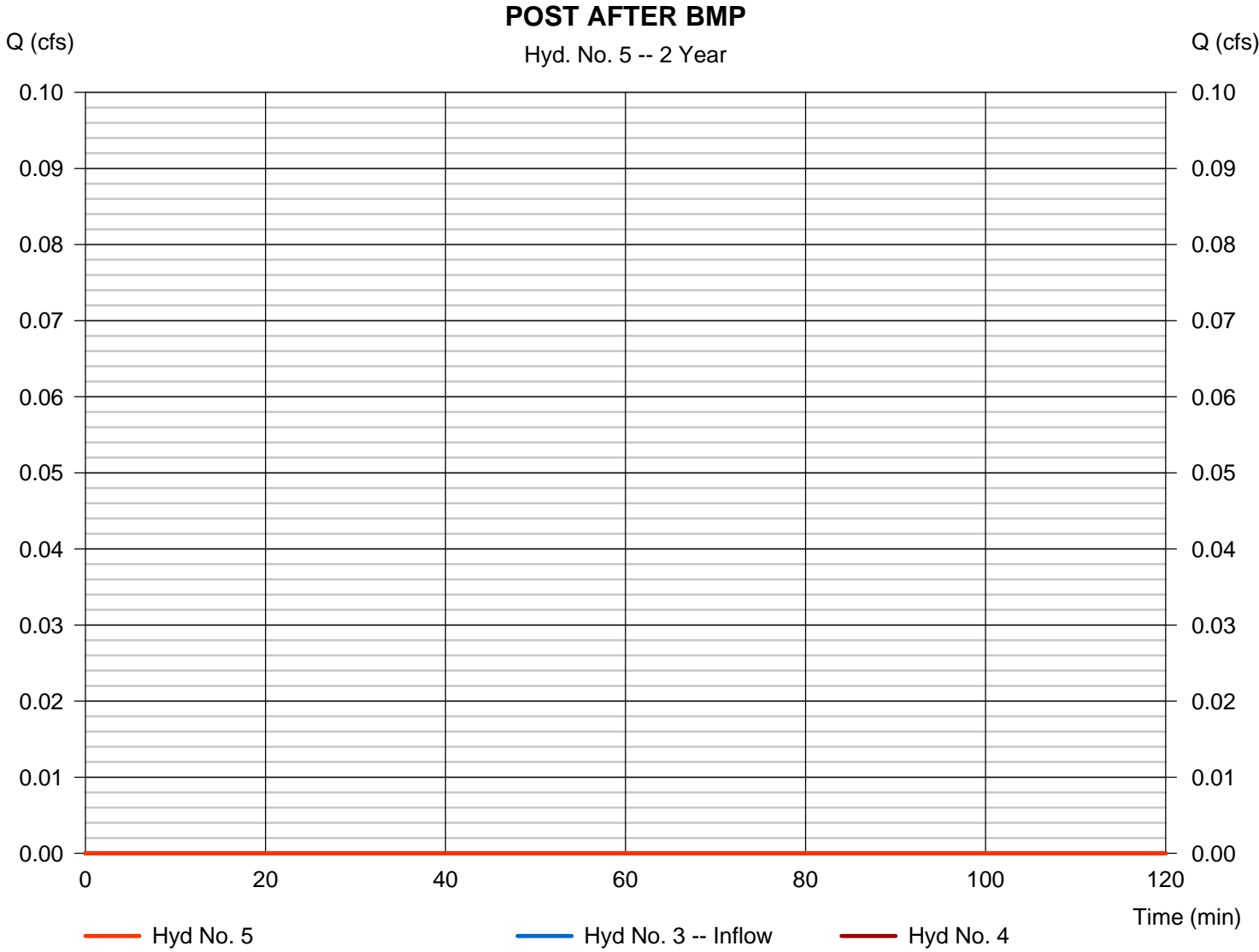


Hydrograph Report

Hyd. No. 5

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hydrograph	= 3 - POST DET. DA 2	2nd diverted hyd.	= 4
Diversion method	= First Flush Volume	Volume Up To	= 750.00 cuft



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

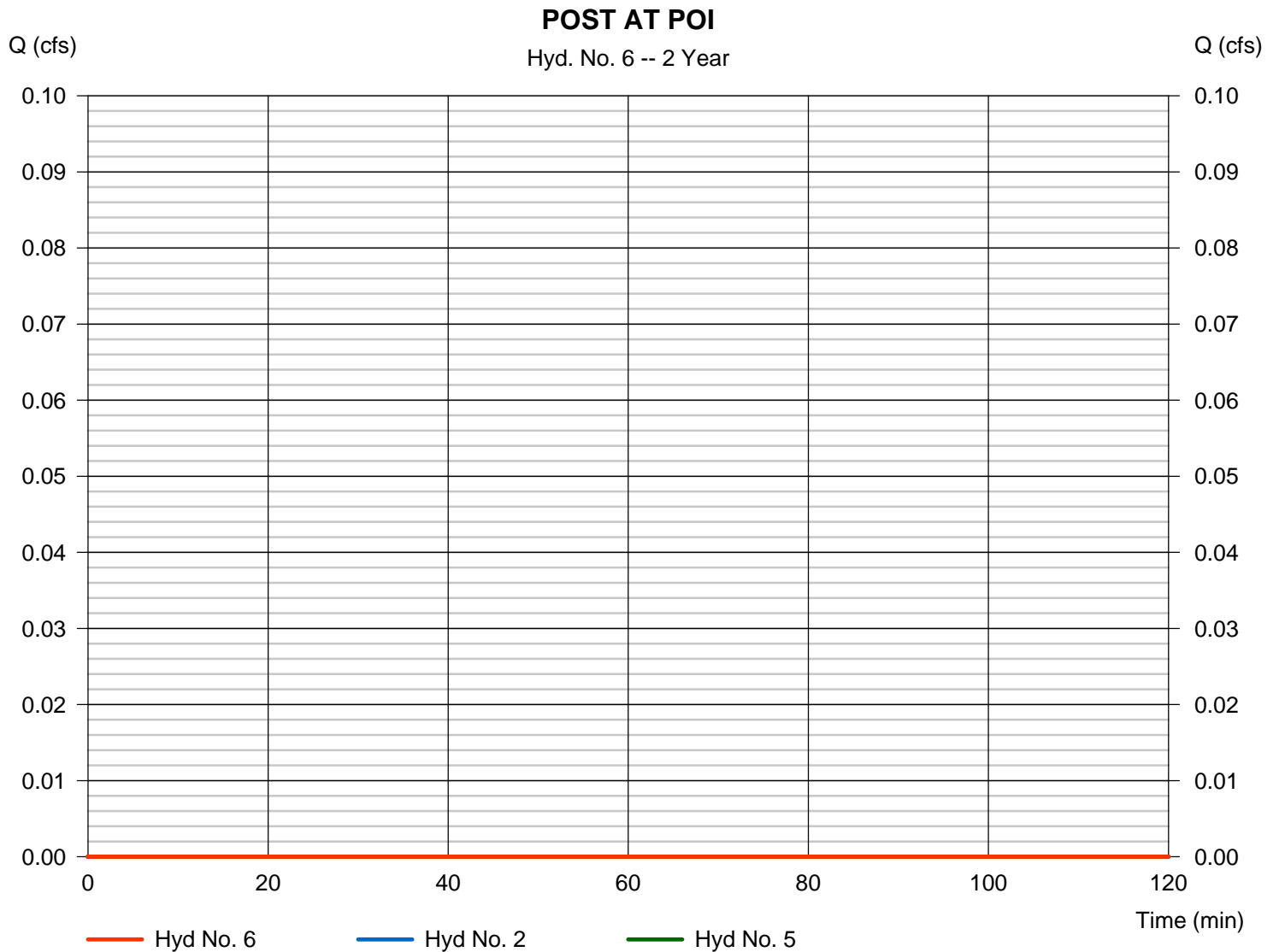
Thursday, 10 / 27 / 2016

Hyd. No. 6

POST AT POI

Hydrograph type = Combine
Storm frequency = 2 yrs
Time interval = 2 min
Inflow hyds. = 2, 5

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 0.470 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	0.000	2	n/a	0	-----	-----	-----	PRE DA 2
2	SCS Runoff	0.000	2	n/a	0	-----	-----	-----	POST UNDET. DA 2
3	SCS Runoff	0.005	2	744	140	-----	-----	-----	POST DET. DA 2
4	Diversion1	0.005	2	744	140	3	-----	-----	VOLUME ABSTRACTION
5	Diversion2	0.000	2	n/a	0	3	-----	-----	POST AFTER BMP
6	Combine	0.000	2	n/a	0	2, 5	-----	-----	POST AT POI
NUnion DA2.gpw					Return Period: 10 Year			Thursday, 10 / 27 / 2016	

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

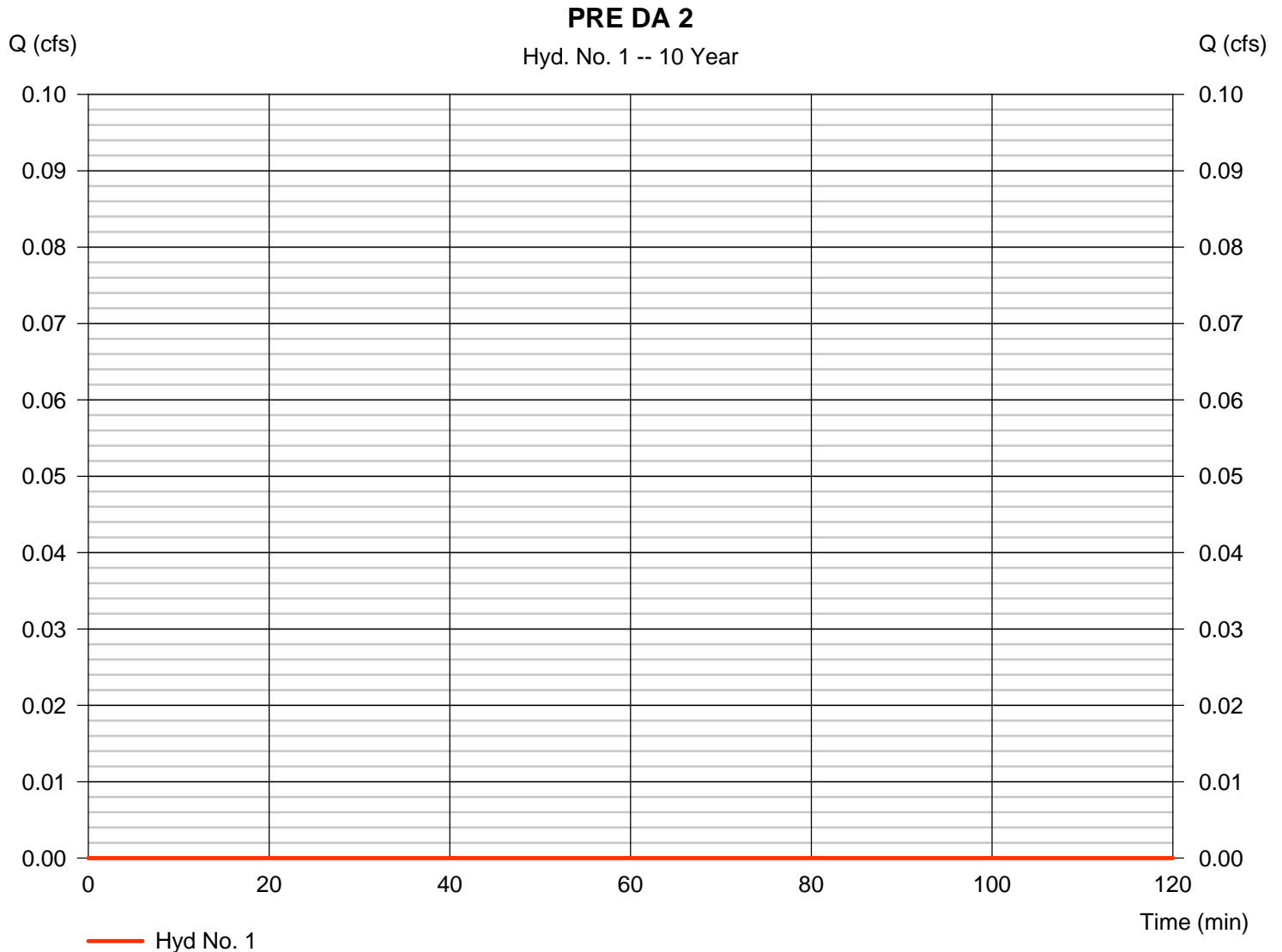
Thursday, 10 / 27 / 2016

Hyd. No. 1

PRE DA 2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 10 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Drainage area	= 0.760 ac	Curve number	= 31*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 5.40 min
Total precip.	= 4.38 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.010 x 98) + (0.750 x 30)] / 0.760



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

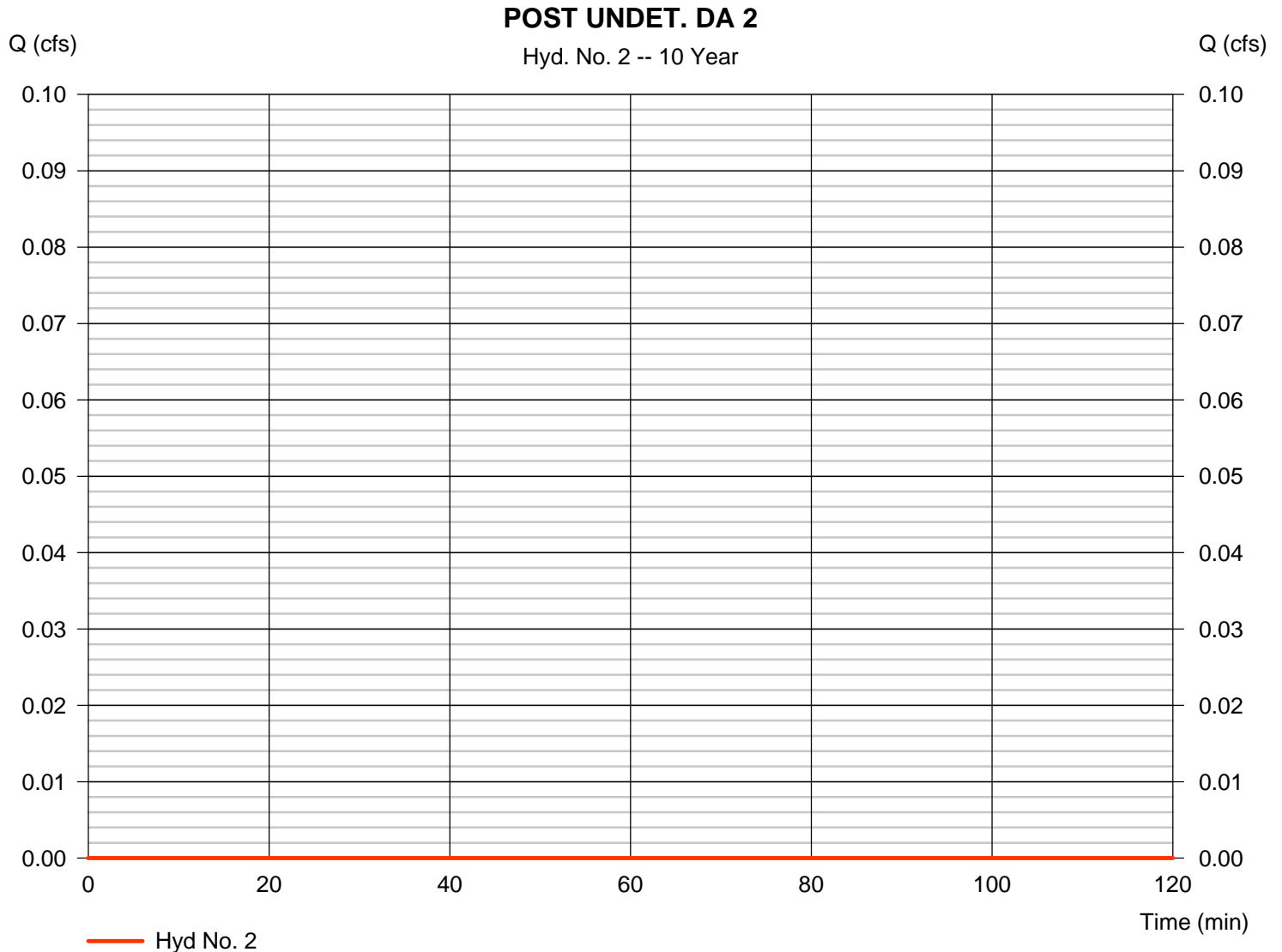
Thursday, 10 / 27 / 2016

Hyd. No. 2

POST UNDET. DA 2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 10 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Drainage area	= 0.470 ac	Curve number	= 31*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 5.40 min
Total precip.	= 4.38 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.010 x 98) + (0.460 x 30)] / 0.470



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

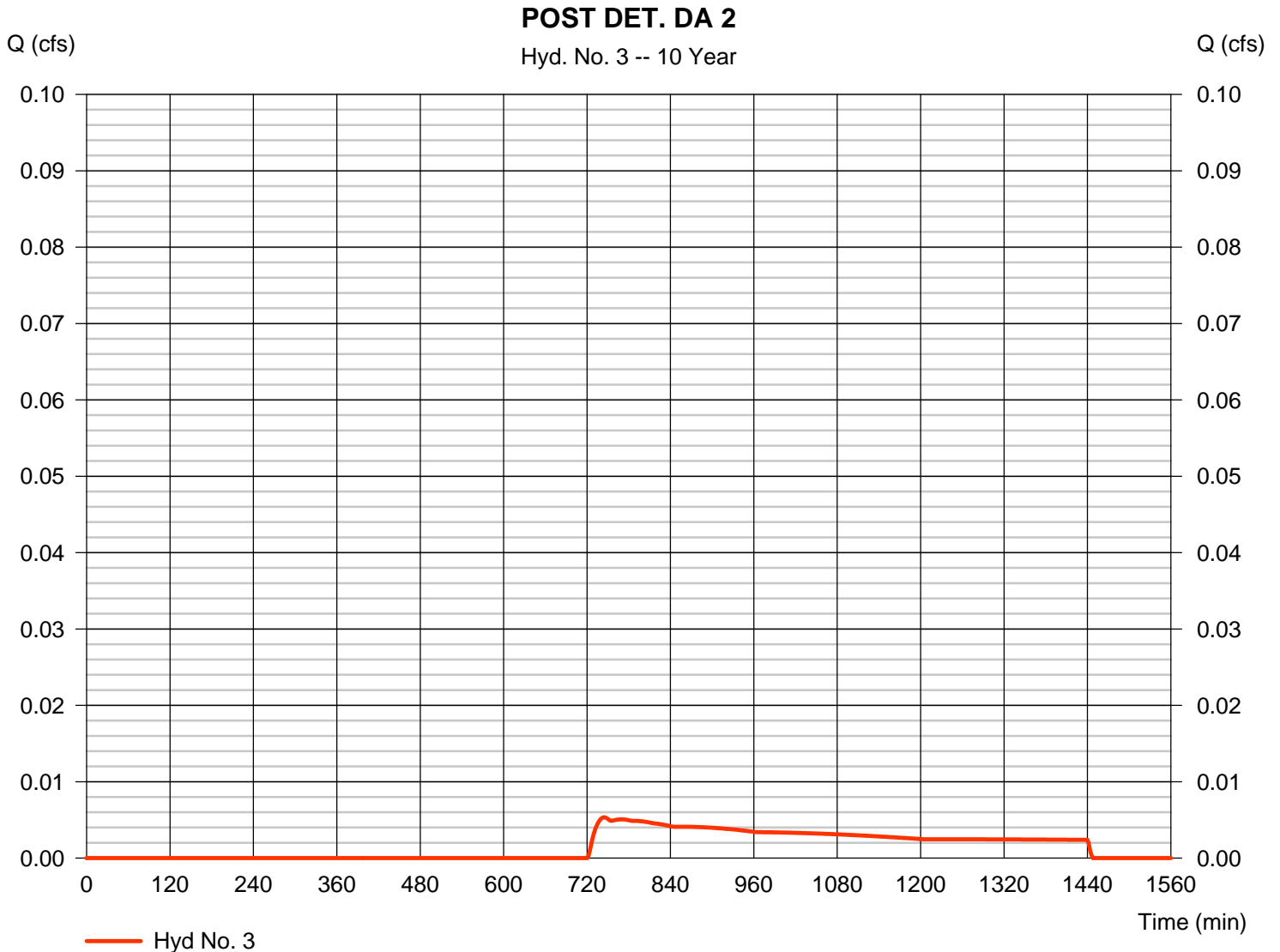
Thursday, 10 / 27 / 2016

Hyd. No. 3

POST DET. DA 2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.005 cfs
Storm frequency	= 10 yrs	Time to peak	= 744 min
Time interval	= 2 min	Hyd. volume	= 140 cuft
Drainage area	= 0.290 ac	Curve number	= 41*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 6.50 min
Total precip.	= 4.38 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.070 x 76) + (0.220 x 30)] / 0.290



Hydrograph Report

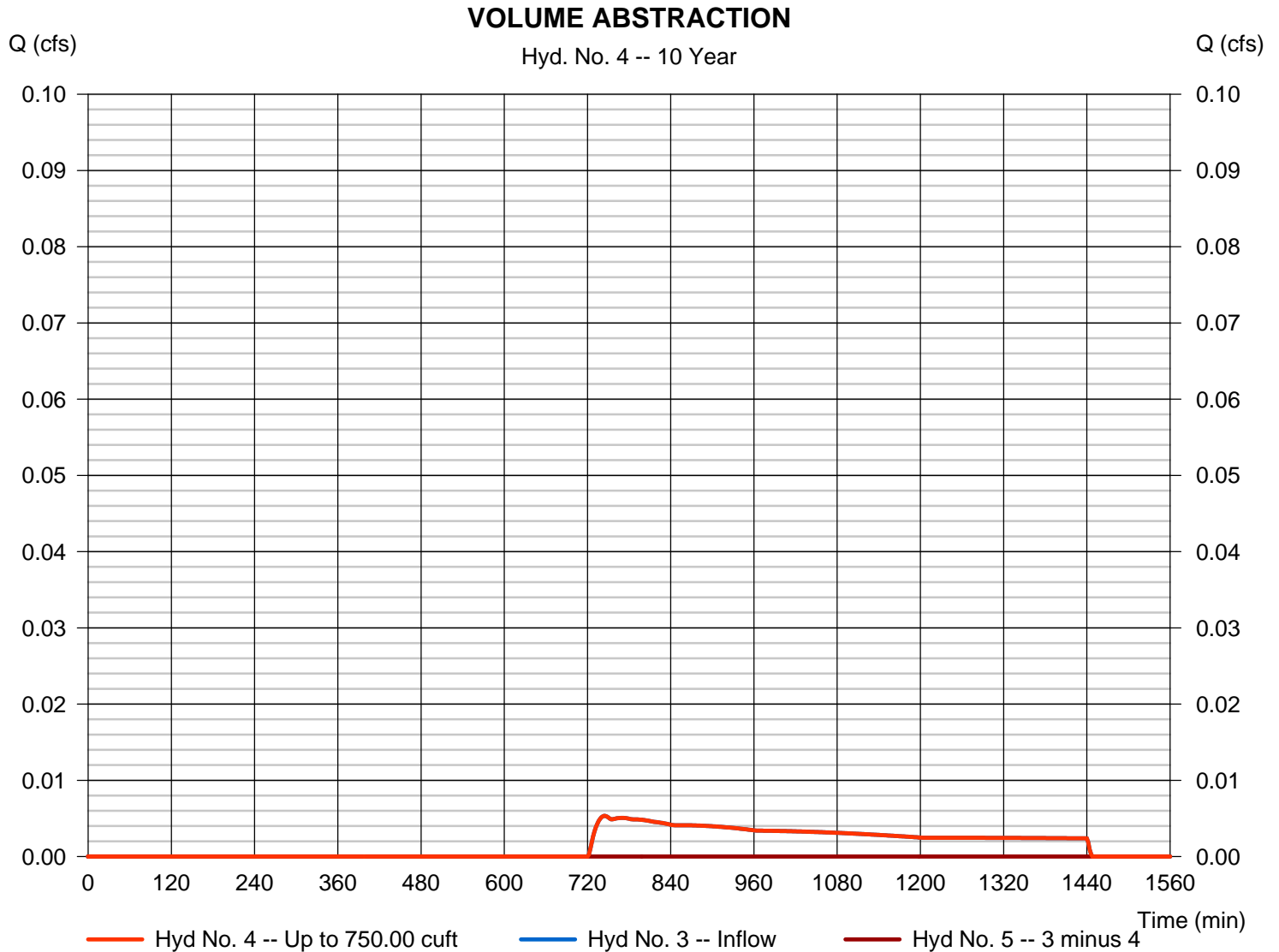
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Thursday, 10 / 27 / 2016

Hyd. No. 4

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 0.005 cfs
Storm frequency	= 10 yrs	Time to peak	= 744 min
Time interval	= 2 min	Hyd. volume	= 140 cuft
Inflow hydrograph	= 3 - POST DET. DA 2	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 750.00 cuft



Hydrograph Report

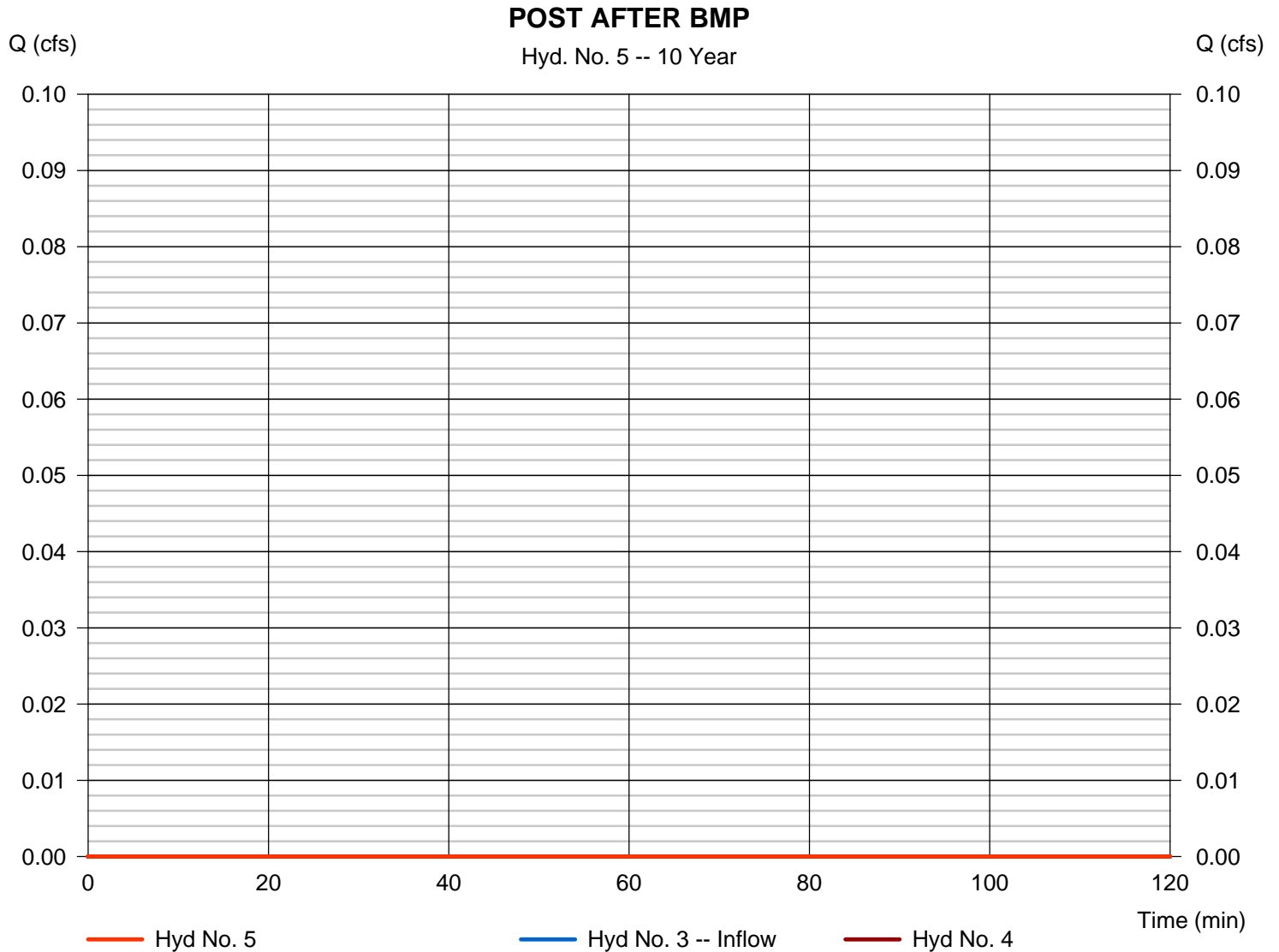
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Thursday, 10 / 27 / 2016

Hyd. No. 5

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 0.000 cfs
Storm frequency	= 10 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hydrograph	= 3 - POST DET. DA 2	2nd diverted hyd.	= 4
Diversion method	= First Flush Volume	Volume Up To	= 750.00 cuft



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

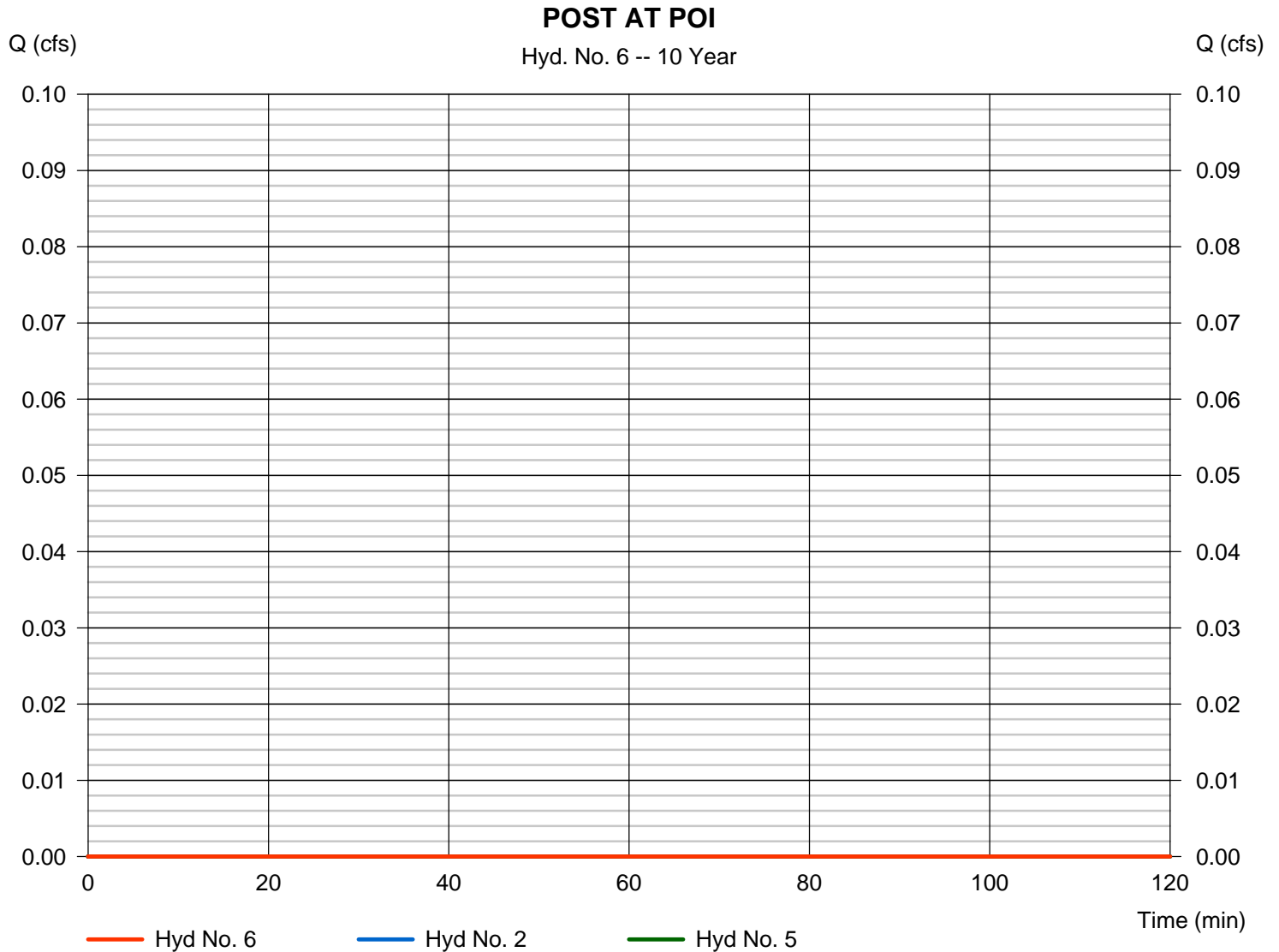
Thursday, 10 / 27 / 2016

Hyd. No. 6

POST AT POI

Hydrograph type = Combine
Storm frequency = 10 yrs
Time interval = 2 min
Inflow hyds. = 2, 5

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 0.470 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description	
1	SCS Runoff	0.012	2	802	406	-----	-----	-----	PRE DA 2	
2	SCS Runoff	0.008	2	802	251	-----	-----	-----	POST UNDET. DA 2	
3	SCS Runoff	0.235	2	718	682	-----	-----	-----	POST DET. DA 2	
4	Diversion1	0.235	2	718	682	3	-----	-----	VOLUME ABSTRACTION	
5	Diversion2	0.000	2	n/a	0	3	-----	-----	POST AFTER BMP	
6	Combine	0.008	2	802	251	2, 5	-----	-----	POST AT POI	
NUnion DA2.gpw					Return Period: 50 Year			Thursday, 10 / 27 / 2016		

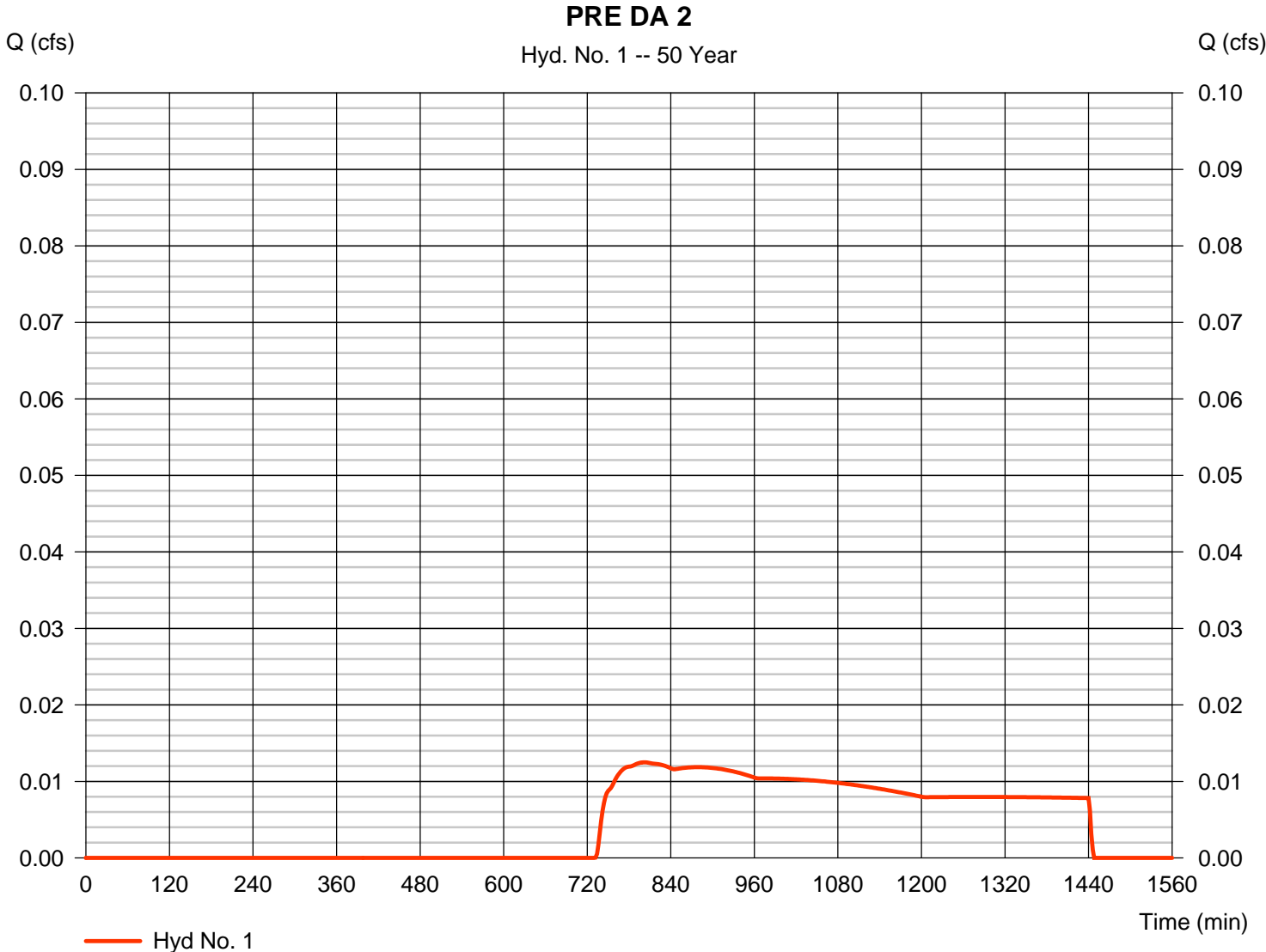
Hydrograph Report

Hyd. No. 1

PRE DA 2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.012 cfs
Storm frequency	= 50 yrs	Time to peak	= 802 min
Time interval	= 2 min	Hyd. volume	= 406 cuft
Drainage area	= 0.760 ac	Curve number	= 31*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 5.40 min
Total precip.	= 6.40 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.010 x 98) + (0.750 x 30)] / 0.760



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

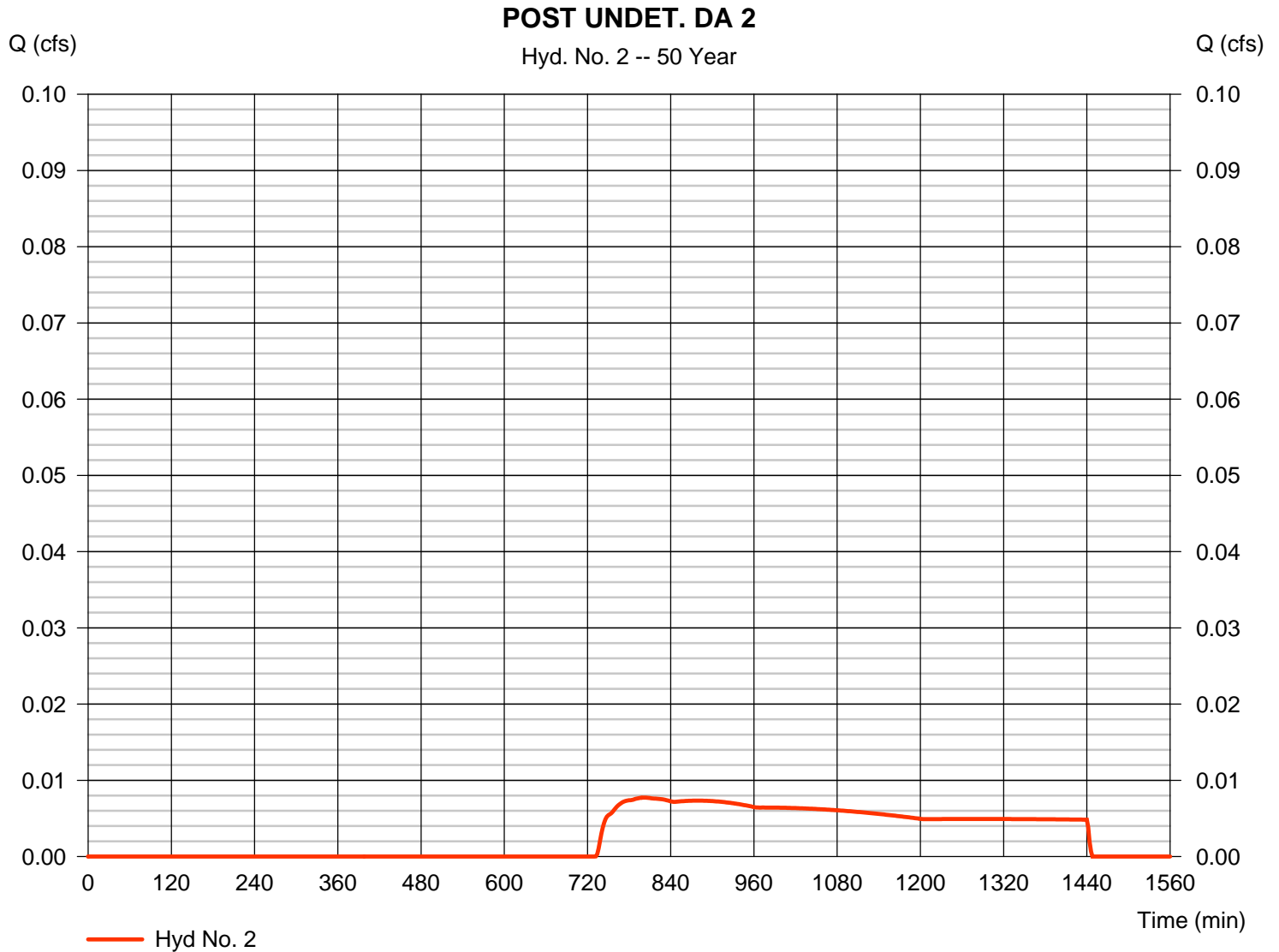
Thursday, 10 / 27 / 2016

Hyd. No. 2

POST UNDET. DA 2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.008 cfs
Storm frequency	= 50 yrs	Time to peak	= 802 min
Time interval	= 2 min	Hyd. volume	= 251 cuft
Drainage area	= 0.470 ac	Curve number	= 31*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 5.40 min
Total precip.	= 6.40 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.010 x 98) + (0.460 x 30)] / 0.470



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

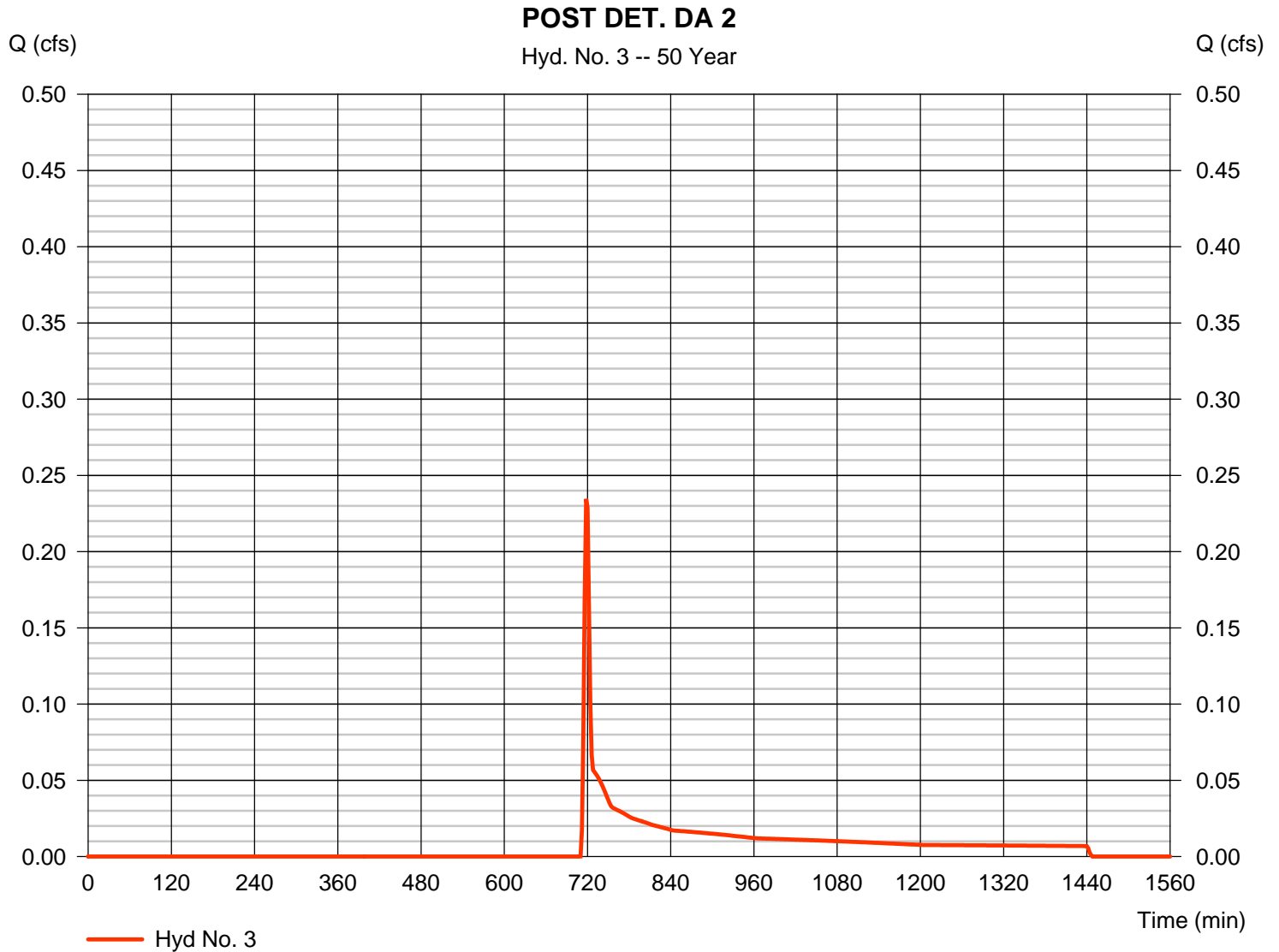
Thursday, 10 / 27 / 2016

Hyd. No. 3

POST DET. DA 2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.235 cfs
Storm frequency	= 50 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 682 cuft
Drainage area	= 0.290 ac	Curve number	= 41*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 6.50 min
Total precip.	= 6.40 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.070 x 76) + (0.220 x 30)] / 0.290



Hydrograph Report

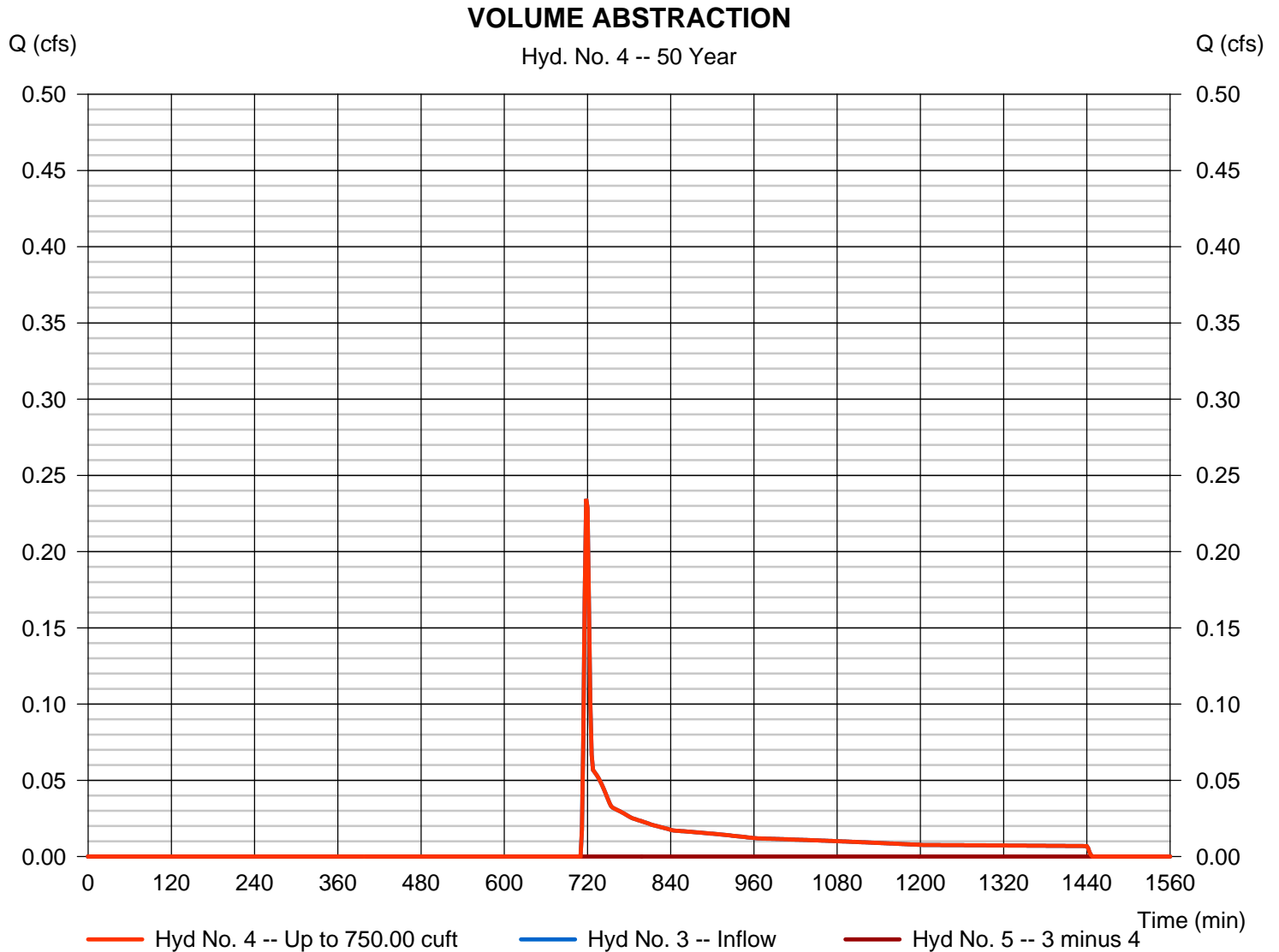
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Thursday, 10 / 27 / 2016

Hyd. No. 4

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 0.235 cfs
Storm frequency	= 50 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 682 cuft
Inflow hydrograph	= 3 - POST DET. DA 2	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 750.00 cuft



Hydrograph Report

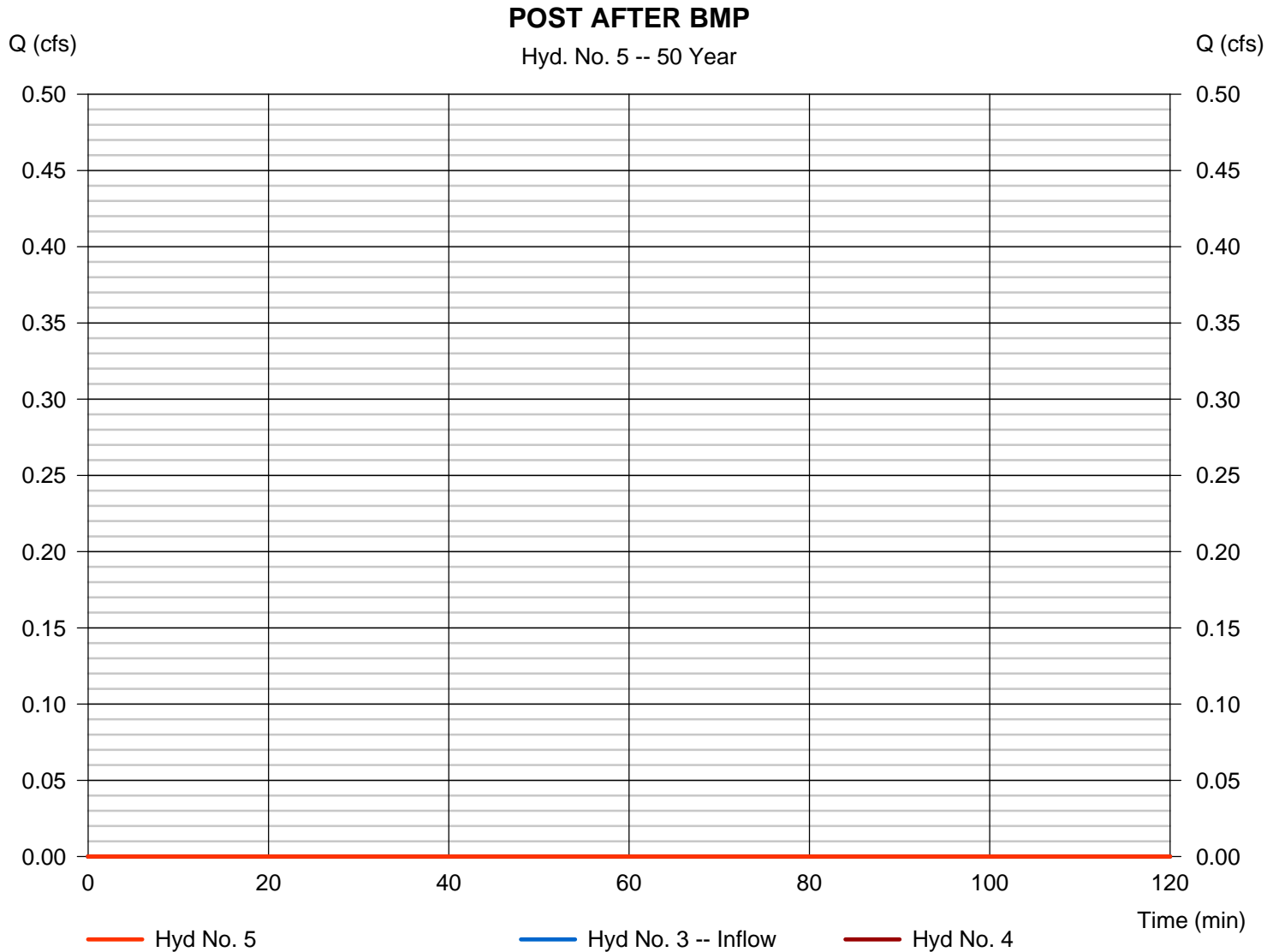
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Thursday, 10 / 27 / 2016

Hyd. No. 5

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 0.000 cfs
Storm frequency	= 50 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hydrograph	= 3 - POST DET. DA 2	2nd diverted hyd.	= 4
Diversion method	= First Flush Volume	Volume Up To	= 750.00 cuft



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

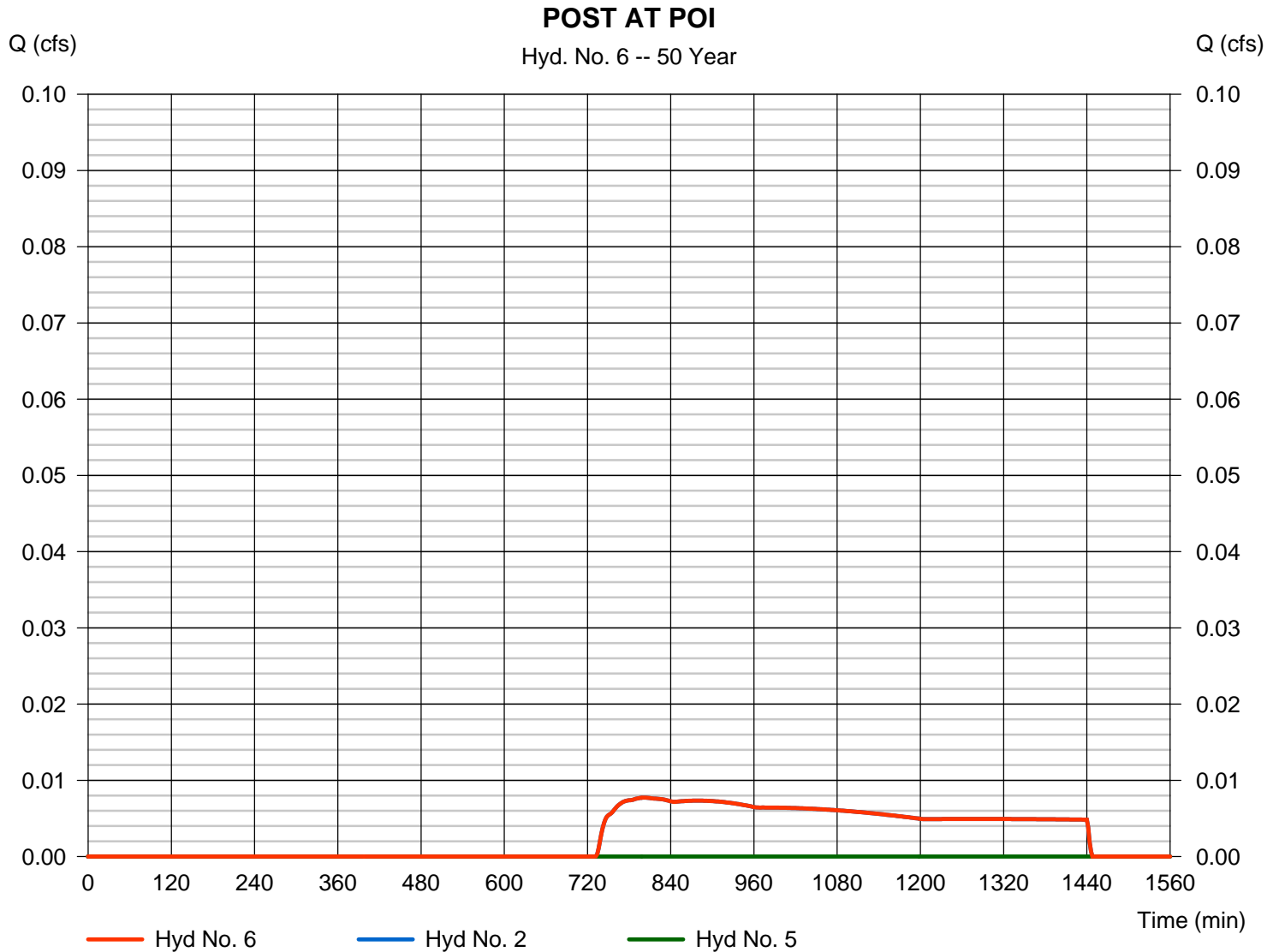
Thursday, 10 / 27 / 2016

Hyd. No. 6

POST AT POI

Hydrograph type = Combine
Storm frequency = 50 yrs
Time interval = 2 min
Inflow hyds. = 2, 5

Peak discharge = 0.008 cfs
Time to peak = 802 min
Hyd. volume = 251 cuft
Contrib. drain. area = 0.470 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description	
1	SCS Runoff	0.081	2	722	935	-----	-----	-----	PRE DA 2	
2	SCS Runoff	0.050	2	722	578	-----	-----	-----	POST UNDET. DA 2	
3	SCS Runoff	0.468	2	718	1,100	-----	-----	-----	POST DET. DA 2	
4	Diversion1	0.468	2	718	752	3	-----	-----	VOLUME ABSTRACTION	
5	Diversion2	0.017	2	968	349	3	-----	-----	POST AFTER BMP	
6	Combine	0.050	2	722	927	2, 5	-----	-----	POST AT POI	
NUnion DA2.gpw					Return Period: 100 Year			Thursday, 10 / 27 / 2016		

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

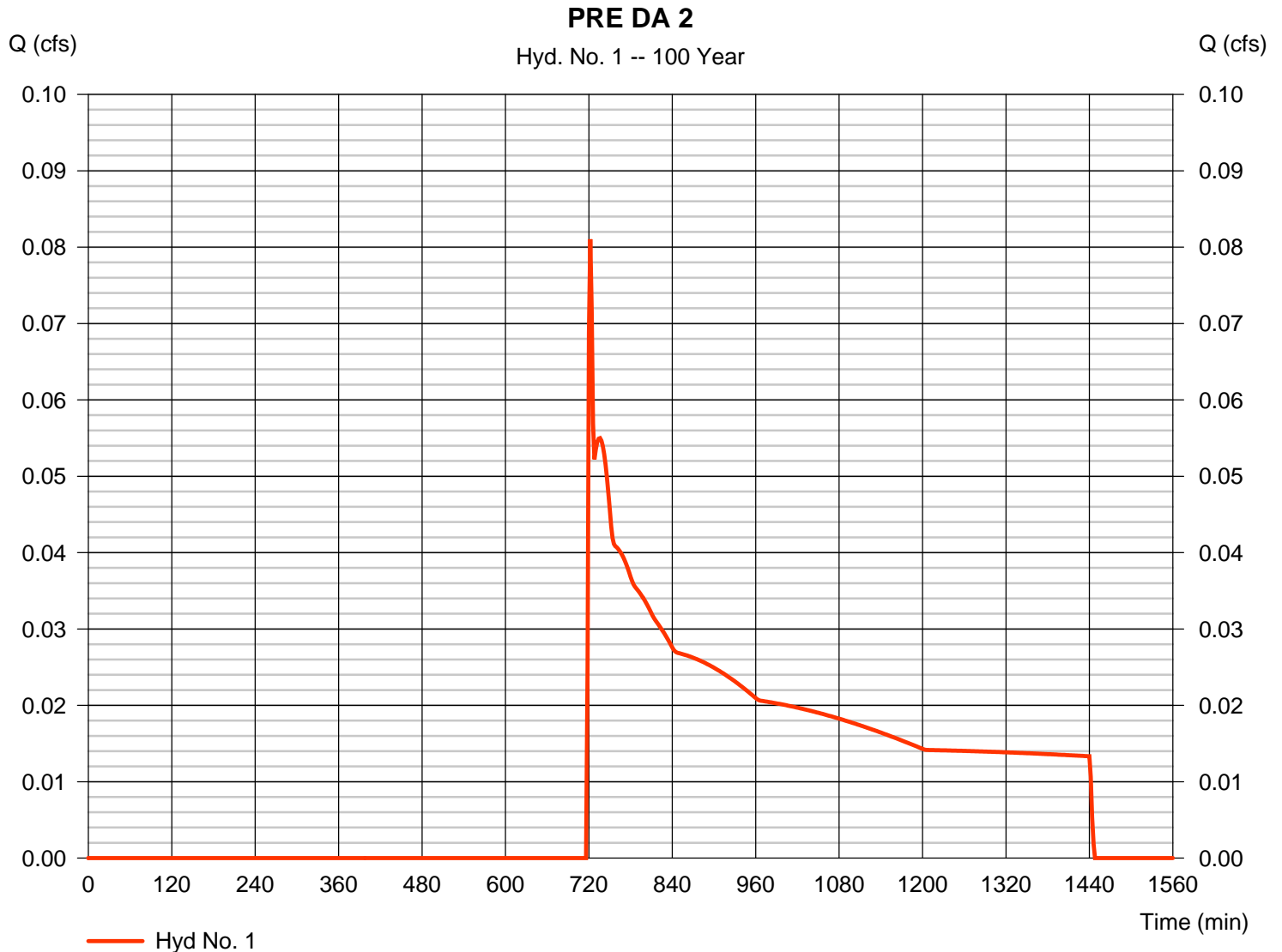
Thursday, 10 / 27 / 2016

Hyd. No. 1

PRE DA 2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.081 cfs
Storm frequency	= 100 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 935 cuft
Drainage area	= 0.760 ac	Curve number	= 31*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 5.40 min
Total precip.	= 7.48 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.010 x 98) + (0.750 x 30)] / 0.760



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

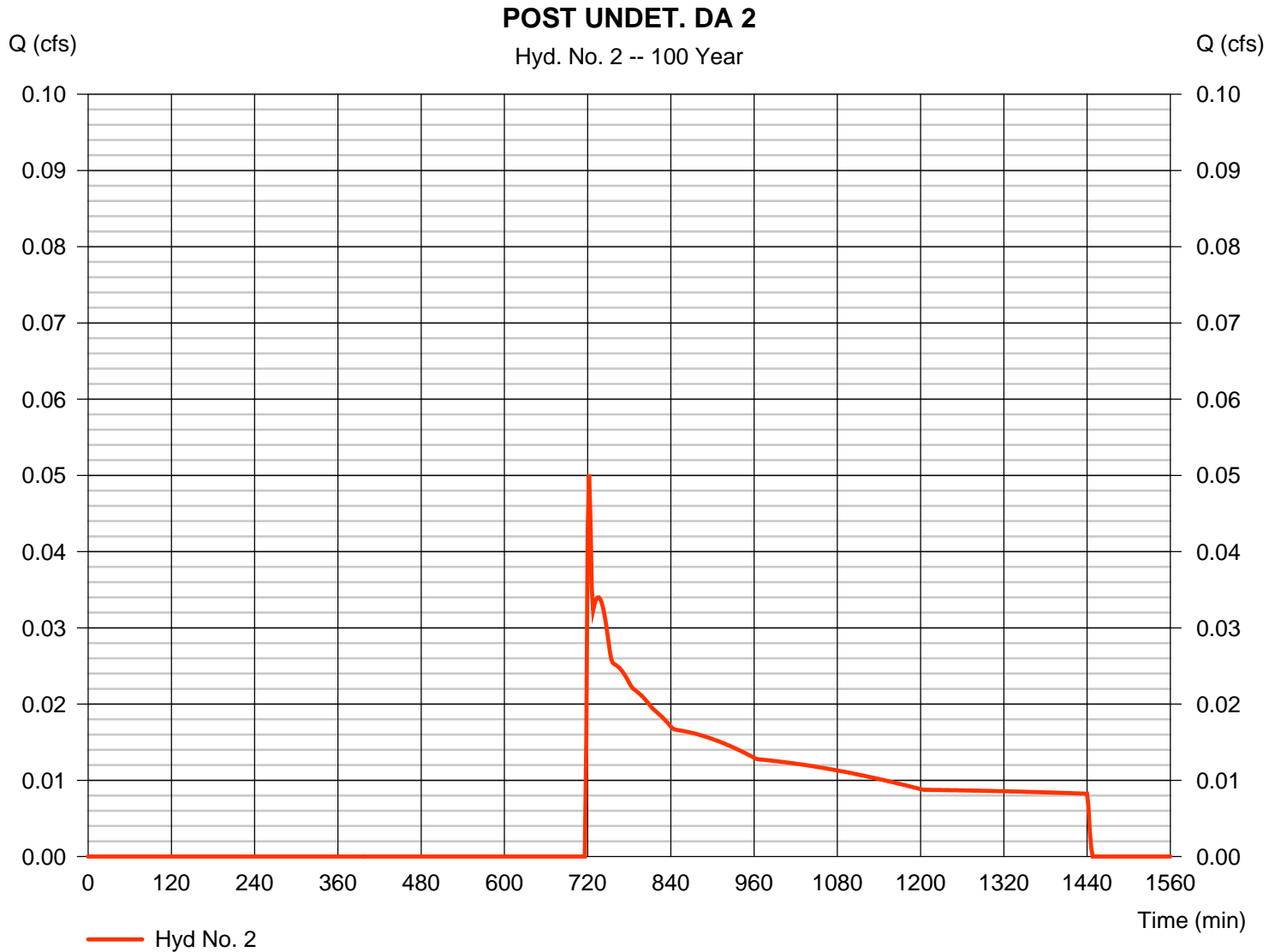
Thursday, 10 / 27 / 2016

Hyd. No. 2

POST UNDET. DA 2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.050 cfs
Storm frequency	= 100 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 578 cuft
Drainage area	= 0.470 ac	Curve number	= 31*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 5.40 min
Total precip.	= 7.48 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.010 x 98) + (0.460 x 30)] / 0.470



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

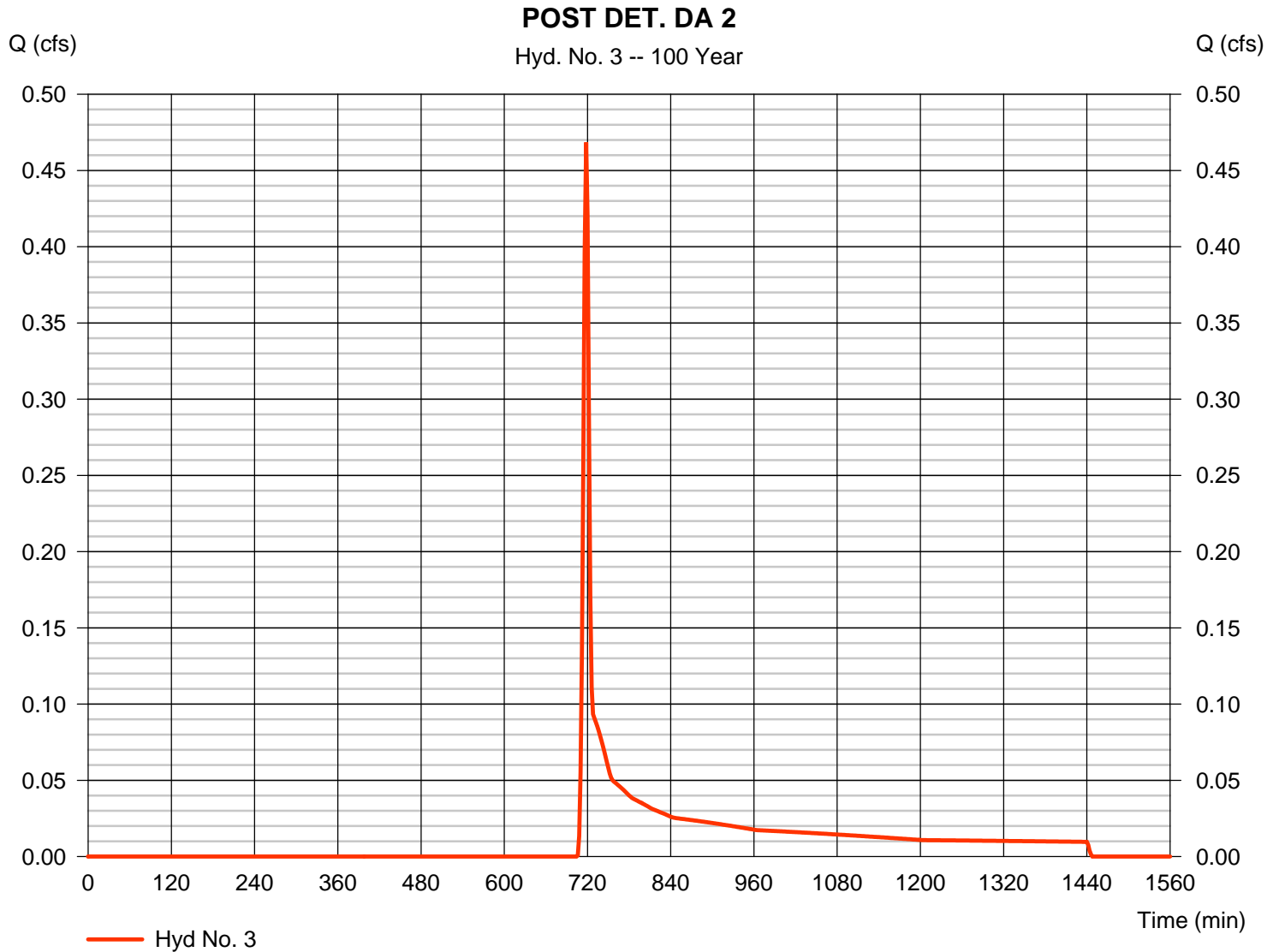
Thursday, 10 / 27 / 2016

Hyd. No. 3

POST DET. DA 2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.468 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 1,100 cuft
Drainage area	= 0.290 ac	Curve number	= 41*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 6.50 min
Total precip.	= 7.48 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.070 x 76) + (0.220 x 30)] / 0.290



Hydrograph Report

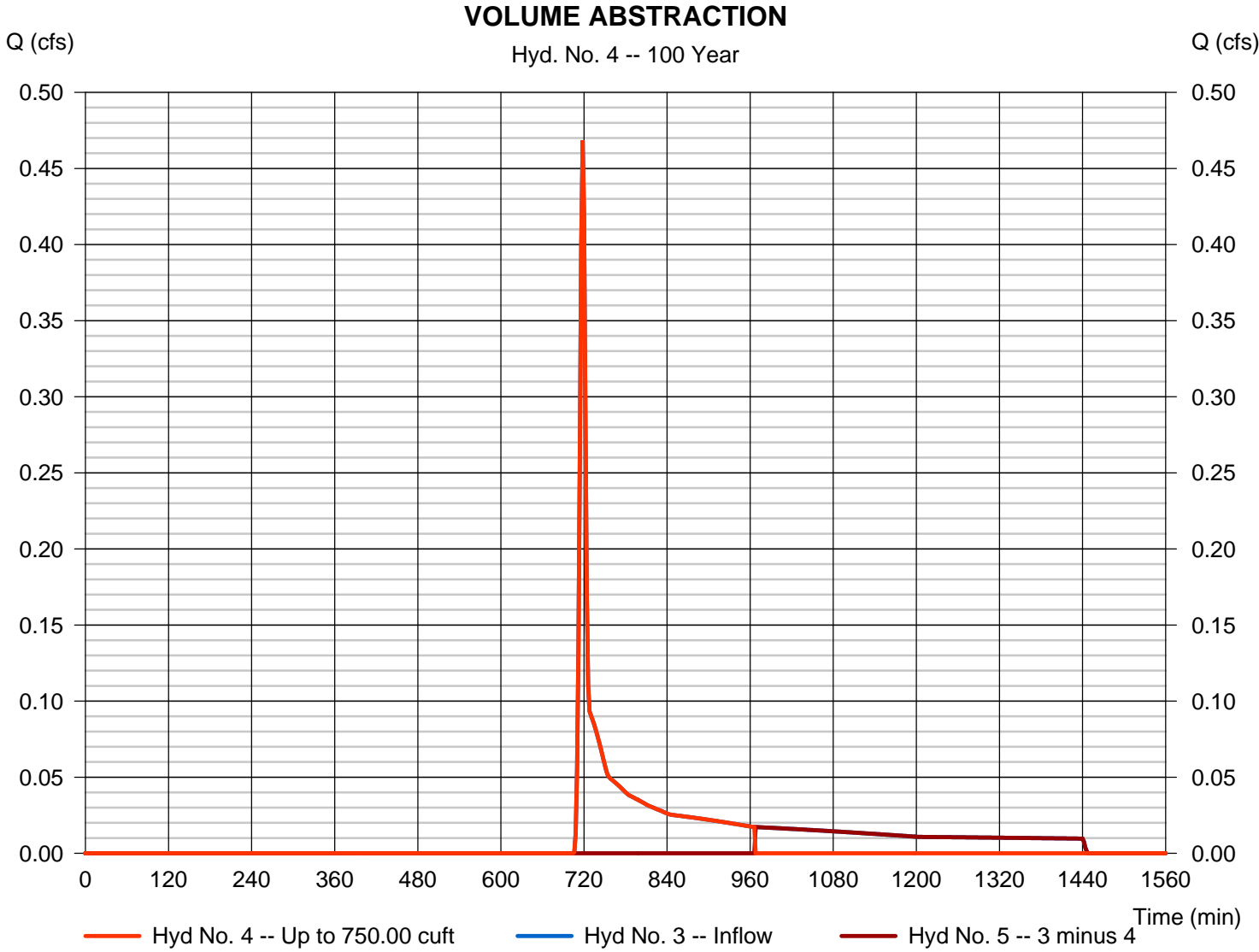
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Thursday, 10 / 27 / 2016

Hyd. No. 4

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 0.468 cfs
Storm frequency	= 100 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 752 cuft
Inflow hydrograph	= 3 - POST DET. DA 2	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 750.00 cuft



Hydrograph Report

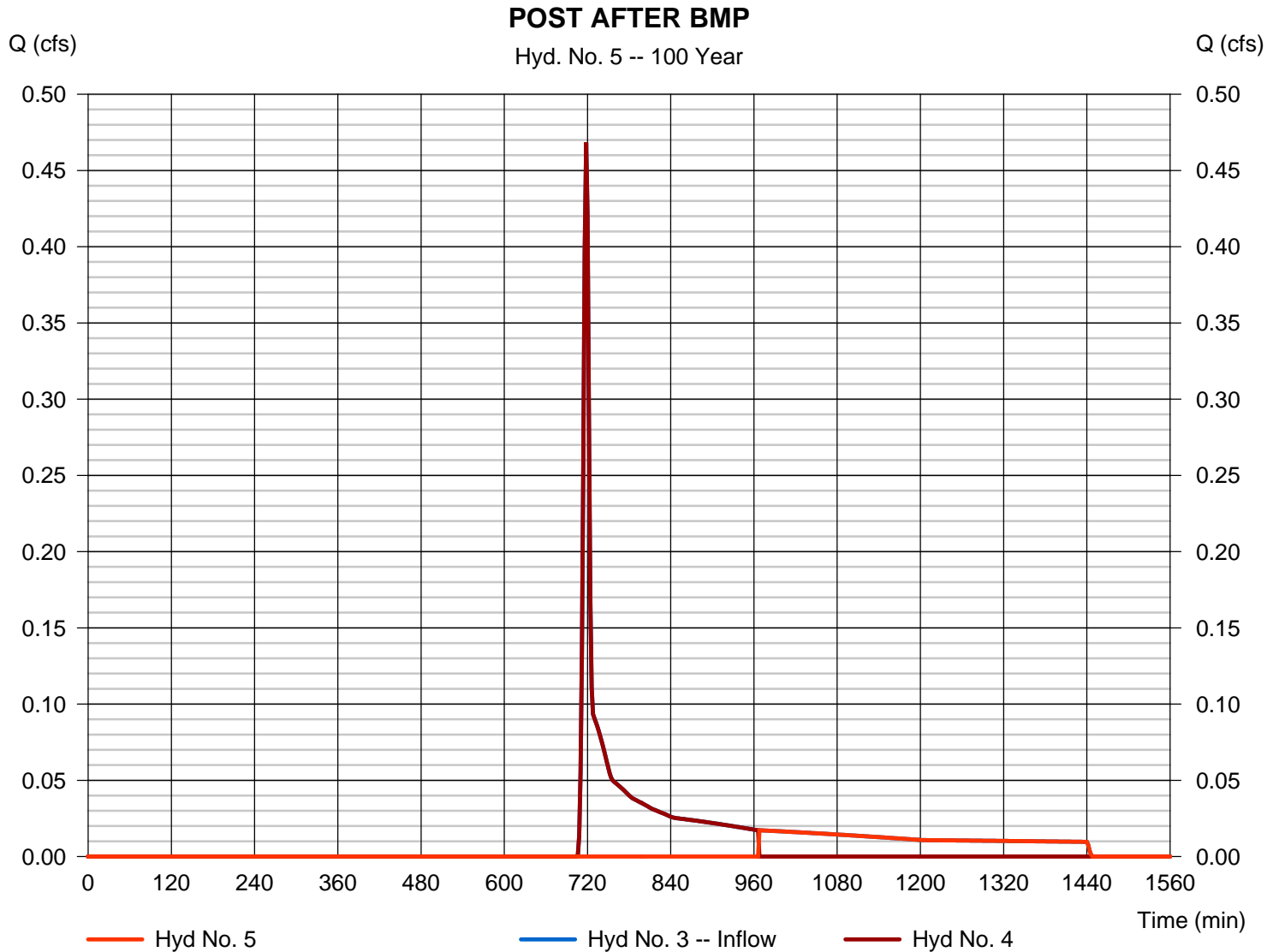
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Thursday, 10 / 27 / 2016

Hyd. No. 5

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 0.017 cfs
Storm frequency	= 100 yrs	Time to peak	= 968 min
Time interval	= 2 min	Hyd. volume	= 349 cuft
Inflow hydrograph	= 3 - POST DET. DA 2	2nd diverted hyd.	= 4
Diversion method	= First Flush Volume	Volume Up To	= 750.00 cuft



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

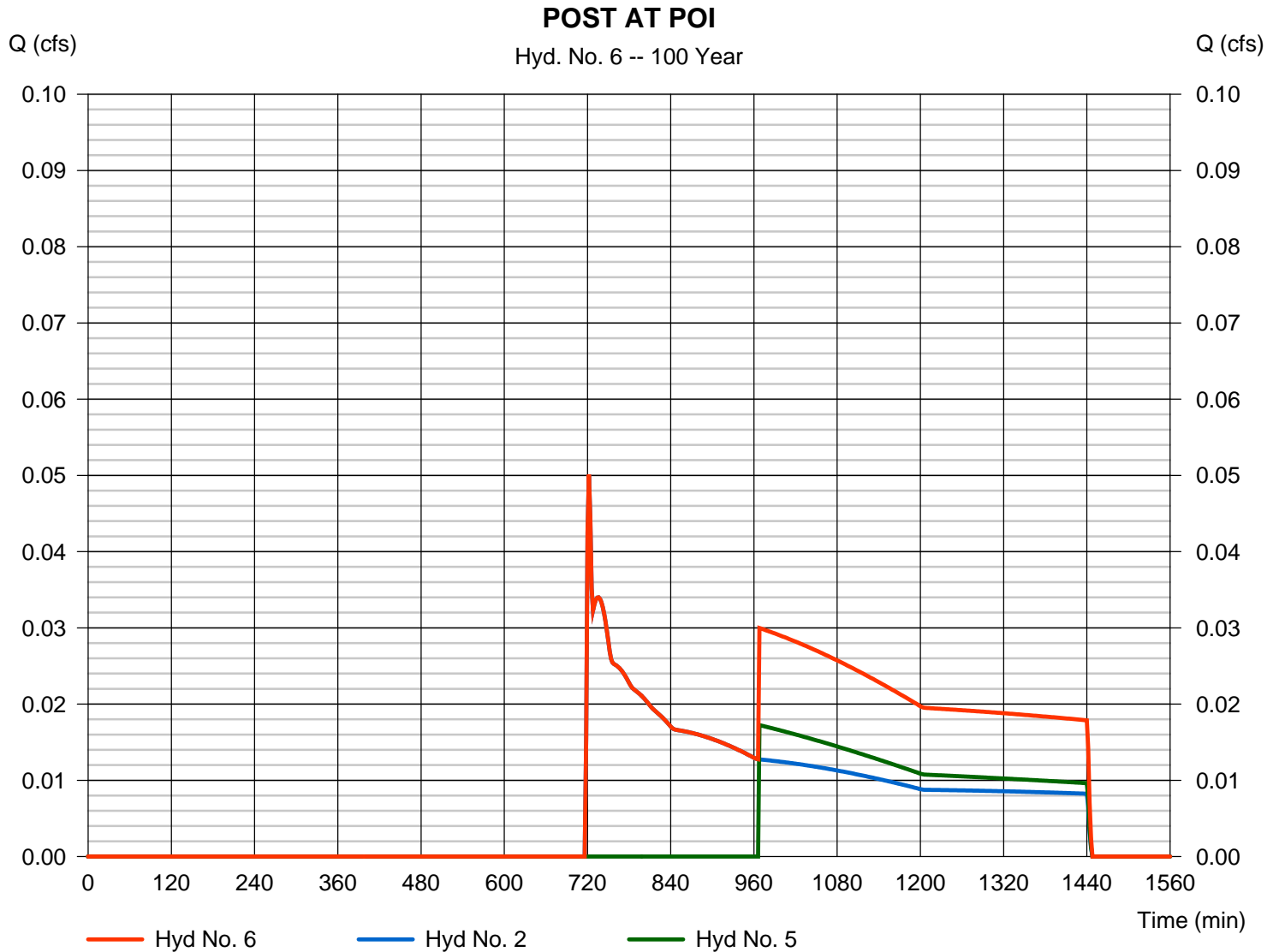
Thursday, 10 / 27 / 2016

Hyd. No. 6

POST AT POI

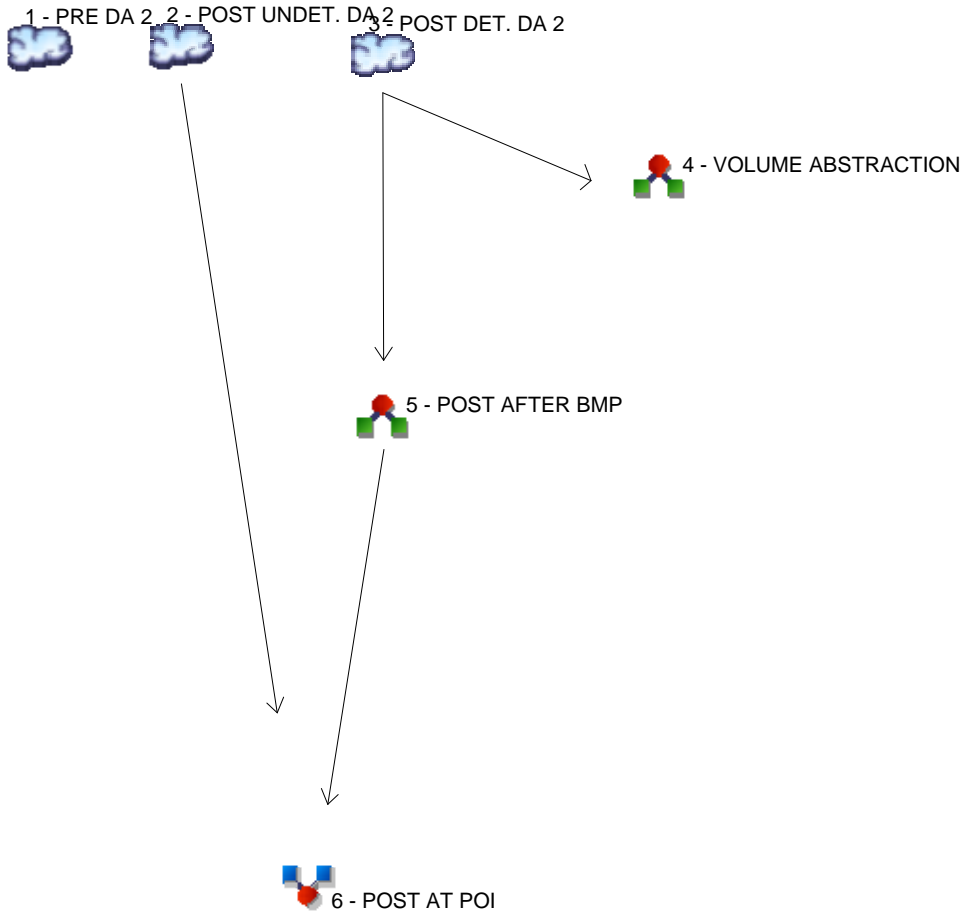
Hydrograph type = Combine
 Storm frequency = 100 yrs
 Time interval = 2 min
 Inflow hyds. = 2, 5

Peak discharge = 0.050 cfs
 Time to peak = 722 min
 Hyd. volume = 927 cuft
 Contrib. drain. area = 0.470 ac



Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4



Legend

Hyd. Origin	Description
1	SCS Runoff PRE DA 2
2	SCS Runoff POST UNDET. DA 2
3	SCS Runoff POST DET. DA 2
4	Diversion1 VOLUME ABSTRACTION
5	Diversion2 POST AFTER BMP
6	Combine POST AT POI

Hydrograph Return Period Recap

Hydranow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	-----	-----	0.000	-----	-----	-----	-----	-----	-----	PRE DA 2
2	SCS Runoff	-----	-----	0.000	-----	-----	-----	-----	-----	-----	POST UNDET. DA 2
3	SCS Runoff	-----	-----	0.000	-----	-----	-----	-----	-----	-----	POST DET. DA 2
4	Diversion1	3	-----	0.000	-----	-----	-----	-----	-----	-----	VOLUME ABSTRACTION
5	Diversion2	3	-----	0.000	-----	-----	-----	-----	-----	-----	POST AFTER BMP
6	Combine	2, 5	-----	0.000	-----	-----	-----	-----	-----	-----	POST AT POI

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	0.000	2	n/a	0	-----	-----	-----	PRE DA 2
2	SCS Runoff	0.000	2	n/a	0	-----	-----	-----	POST UNDET. DA 2
3	SCS Runoff	0.000	2	1440	0	-----	-----	-----	POST DET. DA 2
4	Diversion1	0.000	2	1440	0	3	-----	-----	VOLUME ABSTRACTION
5	Diversion2	0.000	2	n/a	0	3	-----	-----	POST AFTER BMP
6	Combine	0.000	2	n/a	0	2, 5	-----	-----	POST AT POI

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

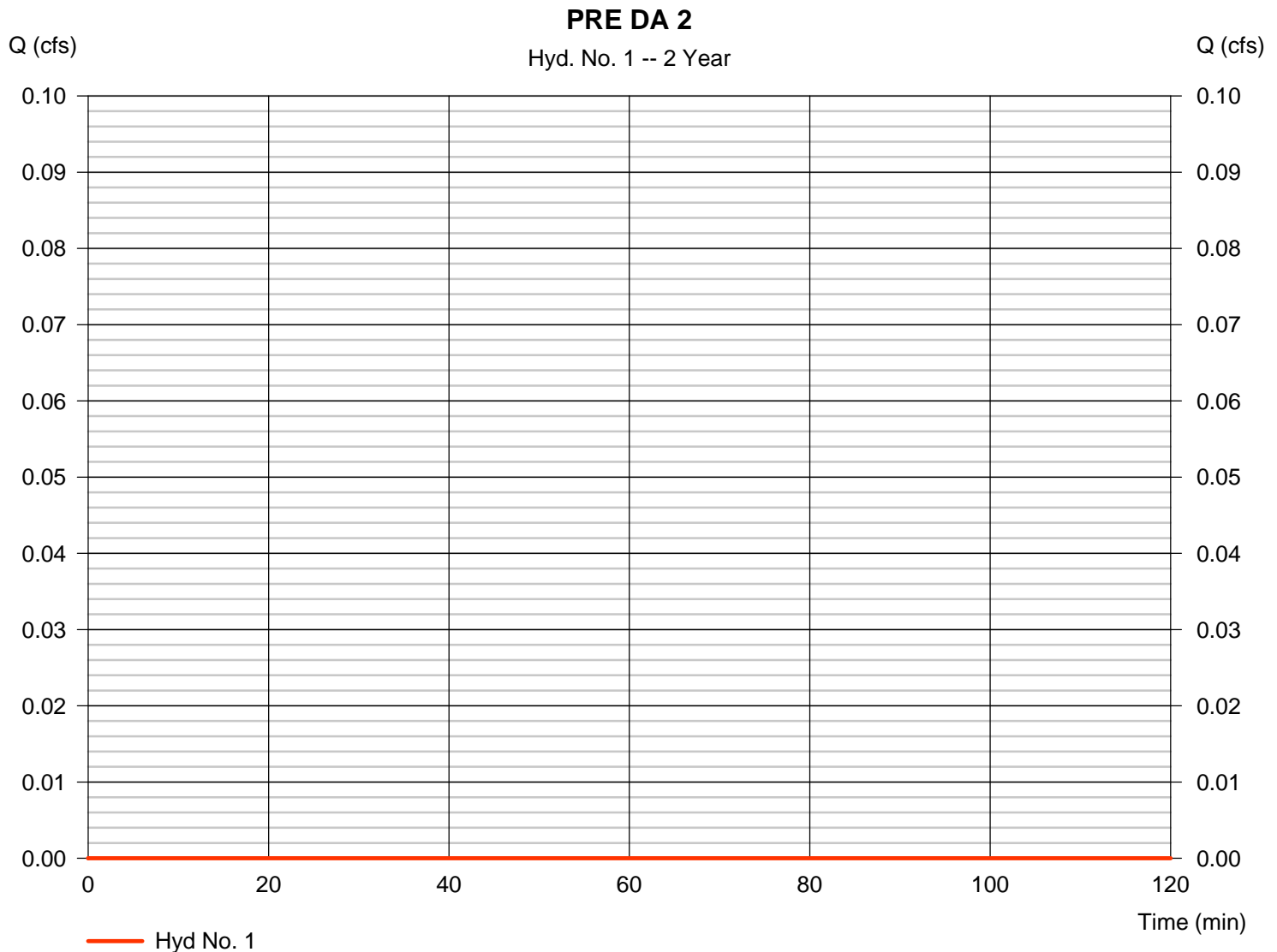
Thursday, 10 / 27 / 2016

Hyd. No. 1

PRE DA 2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Drainage area	= 0.760 ac	Curve number	= 31*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 5.40 min
Total precip.	= 2.90 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.010 x 98) + (0.750 x 30)] / 0.760



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No. 1

PRE DA 2

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
Sheet Flow				
Manning's n-value	= 0.240	0.011	0.011	
Flow length (ft)	= 50.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 2.90	0.00	0.00	
Land slope (%)	= 12.00	0.00	0.00	
Travel Time (min)	= 4.20	+ 0.00	+ 0.00	= 4.20
Shallow Concentrated Flow				
Flow length (ft)	= 231.00	30.00	52.00	
Watercourse slope (%)	= 10.40	3.30	3.90	
Surface description	= Unpaved	Paved	Unpaved	
Average velocity (ft/s)	=5.20	3.69	3.19	
Travel Time (min)	= 0.74	+ 0.14	+ 0.27	= 1.15
Channel Flow				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	=0.00	0.00	0.00	
Flow length (ft)	{{0}}0.0	0.0	0.0	
Travel Time (min)	= 0.00	+ 0.00	+ 0.00	= 0.00
Total Travel Time, Tc				5.40 min

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

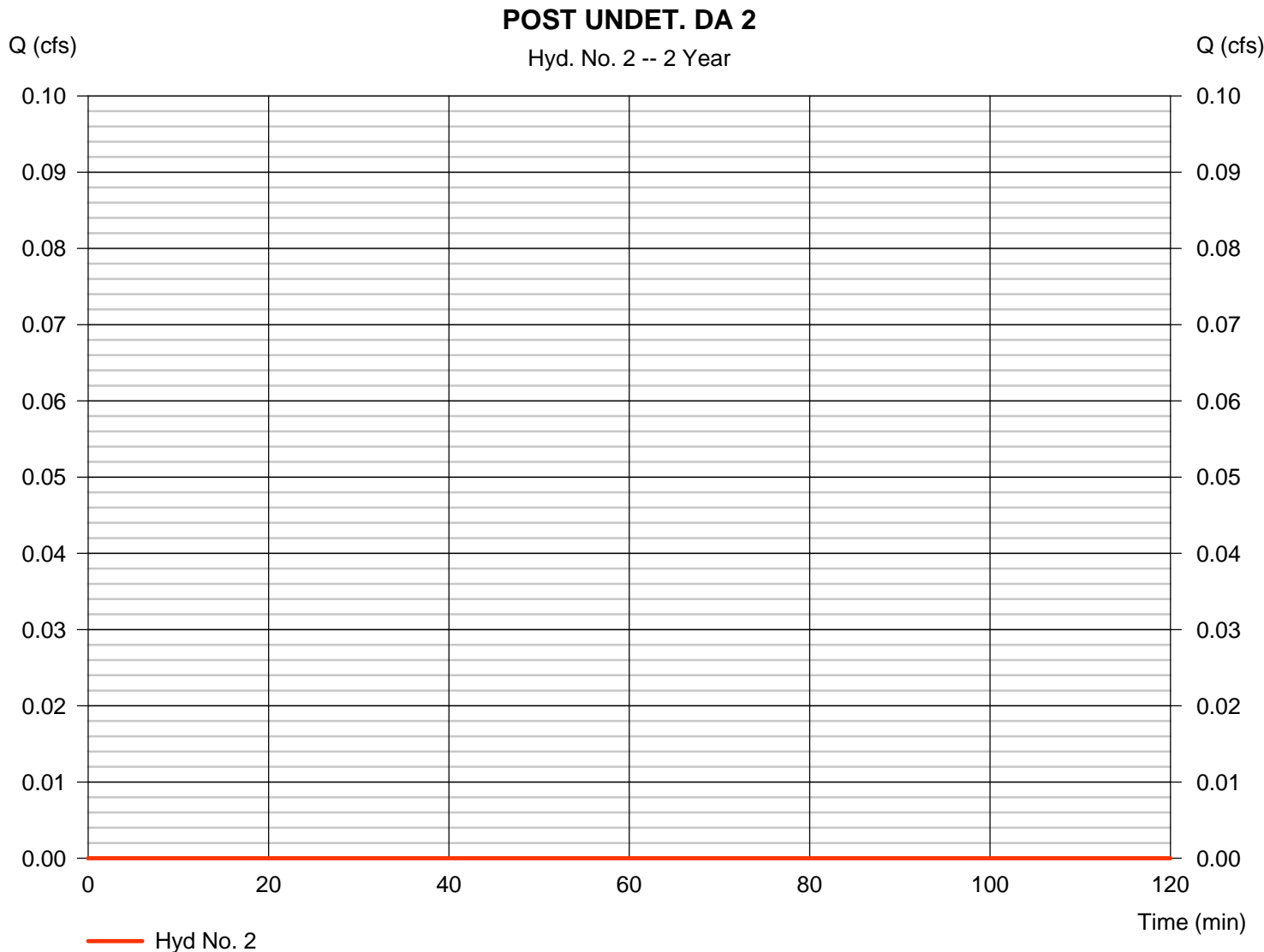
Thursday, 10 / 27 / 2016

Hyd. No. 2

POST UNDET. DA 2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Drainage area	= 0.470 ac	Curve number	= 31*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 5.40 min
Total precip.	= 2.90 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.010 x 98) + (0.460 x 30)] / 0.470



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No. 2

POST UNDET. DA 2

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
Sheet Flow				
Manning's n-value	= 0.240	0.011	0.011	
Flow length (ft)	= 50.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 2.90	0.00	0.00	
Land slope (%)	= 12.00	0.00	0.00	
Travel Time (min)	= 4.20	+ 0.00	+ 0.00	= 4.20
Shallow Concentrated Flow				
Flow length (ft)	= 231.00	30.00	52.00	
Watercourse slope (%)	= 10.40	3.30	3.90	
Surface description	= Unpaved	Paved	Unpaved	
Average velocity (ft/s)	=5.20	3.69	3.19	
Travel Time (min)	= 0.74	+ 0.14	+ 0.27	= 1.15
Channel Flow				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	=0.00	0.00	0.00	
Flow length (ft)	{{0}}0.0	0.0	0.0	
Travel Time (min)	= 0.00	+ 0.00	+ 0.00	= 0.00
Total Travel Time, Tc				5.40 min

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

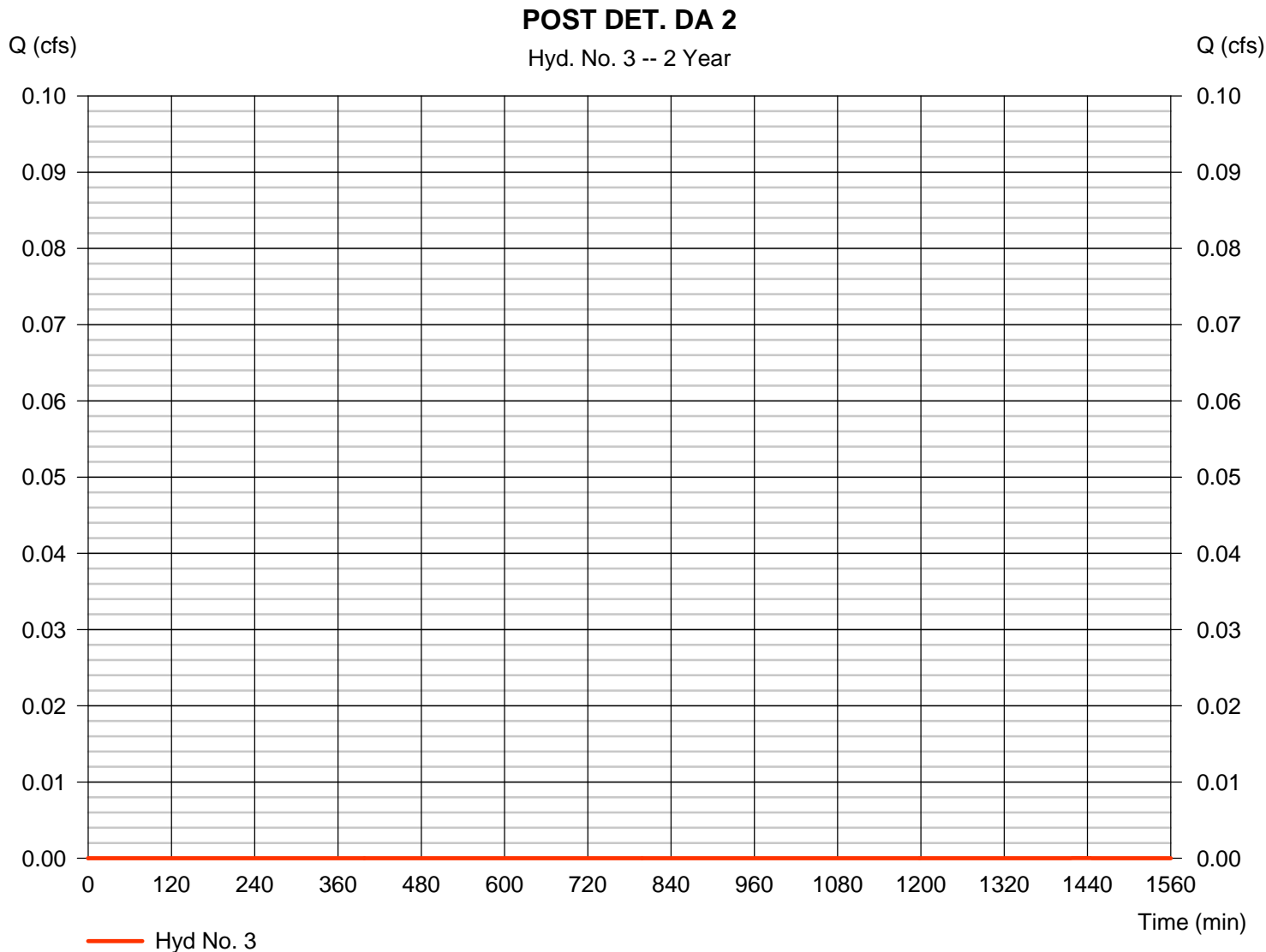
Thursday, 10 / 27 / 2016

Hyd. No. 3

POST DET. DA 2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= 1440 min
Time interval	= 2 min	Hyd. volume	= 0 cuft
Drainage area	= 0.290 ac	Curve number	= 41*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.30 min
Total precip.	= 2.90 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.070 x 76) + (0.220 x 30)] / 0.290

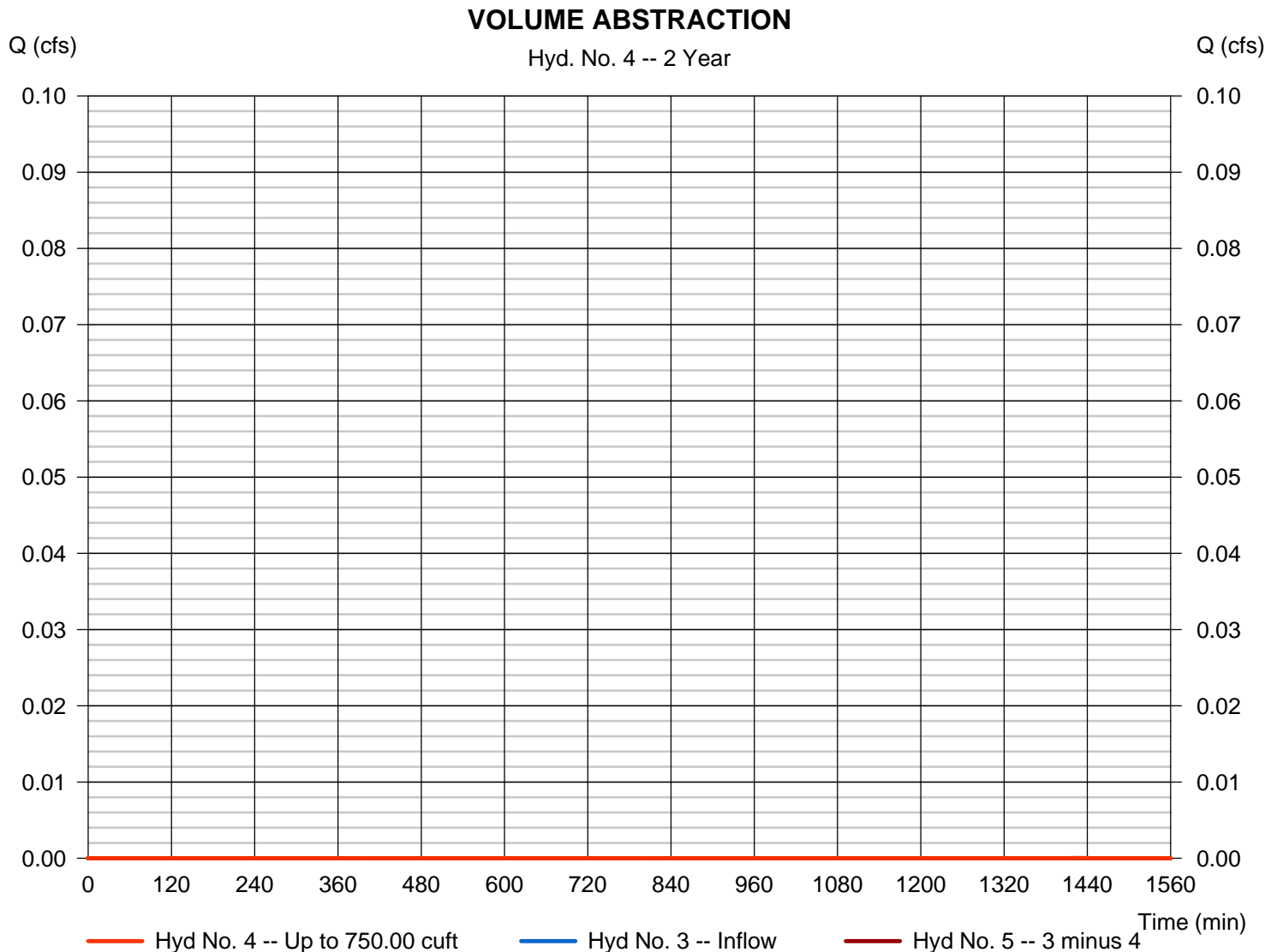


Hydrograph Report

Hyd. No. 4

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= 1440 min
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hydrograph	= 3 - POST DET. DA 2	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 750.00 cuft



Hydrograph Report

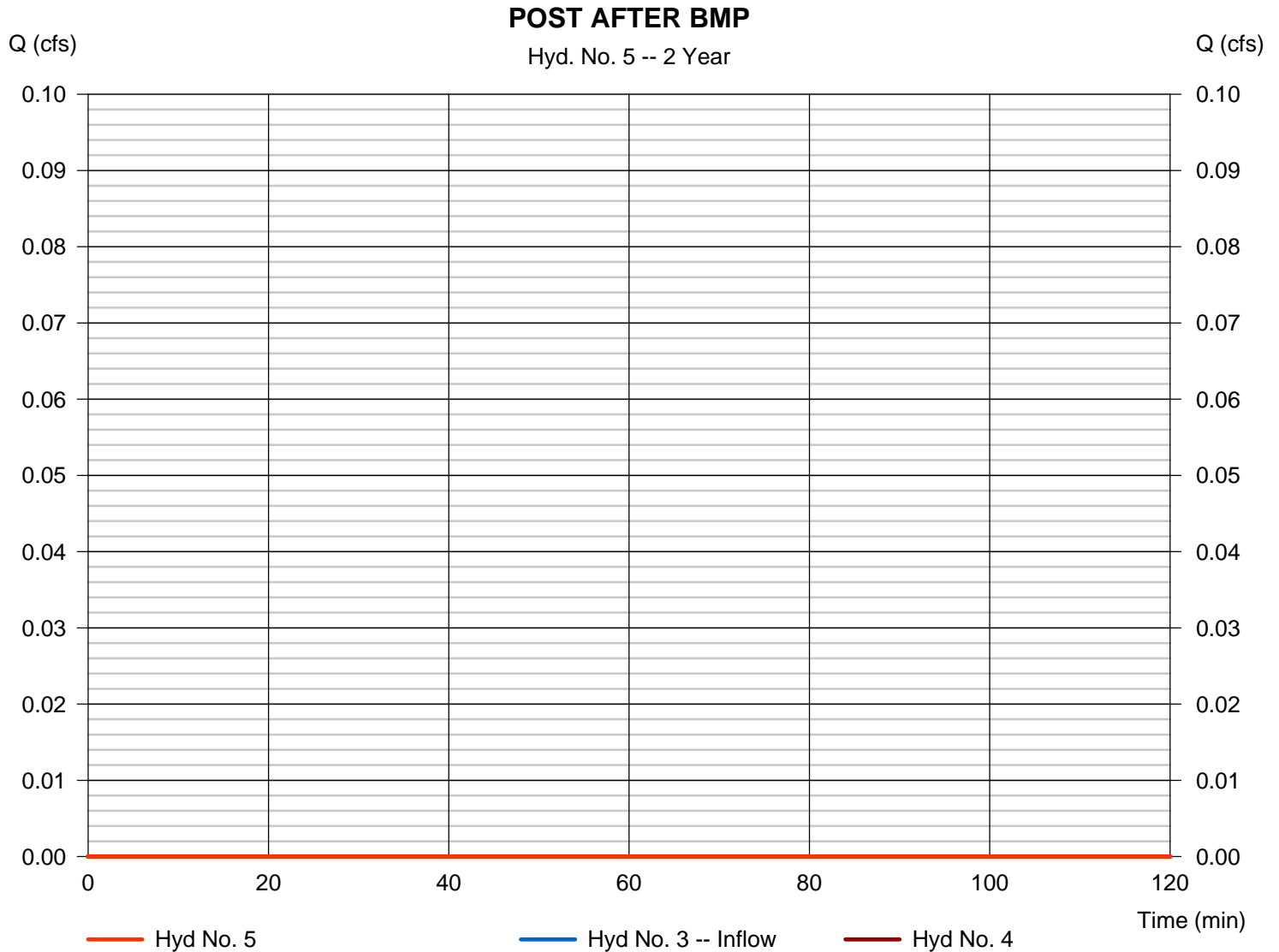
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Thursday, 10 / 27 / 2016

Hyd. No. 5

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hydrograph	= 3 - POST DET. DA 2	2nd diverted hyd.	= 4
Diversion method	= First Flush Volume	Volume Up To	= 750.00 cuft



Hydrograph Report

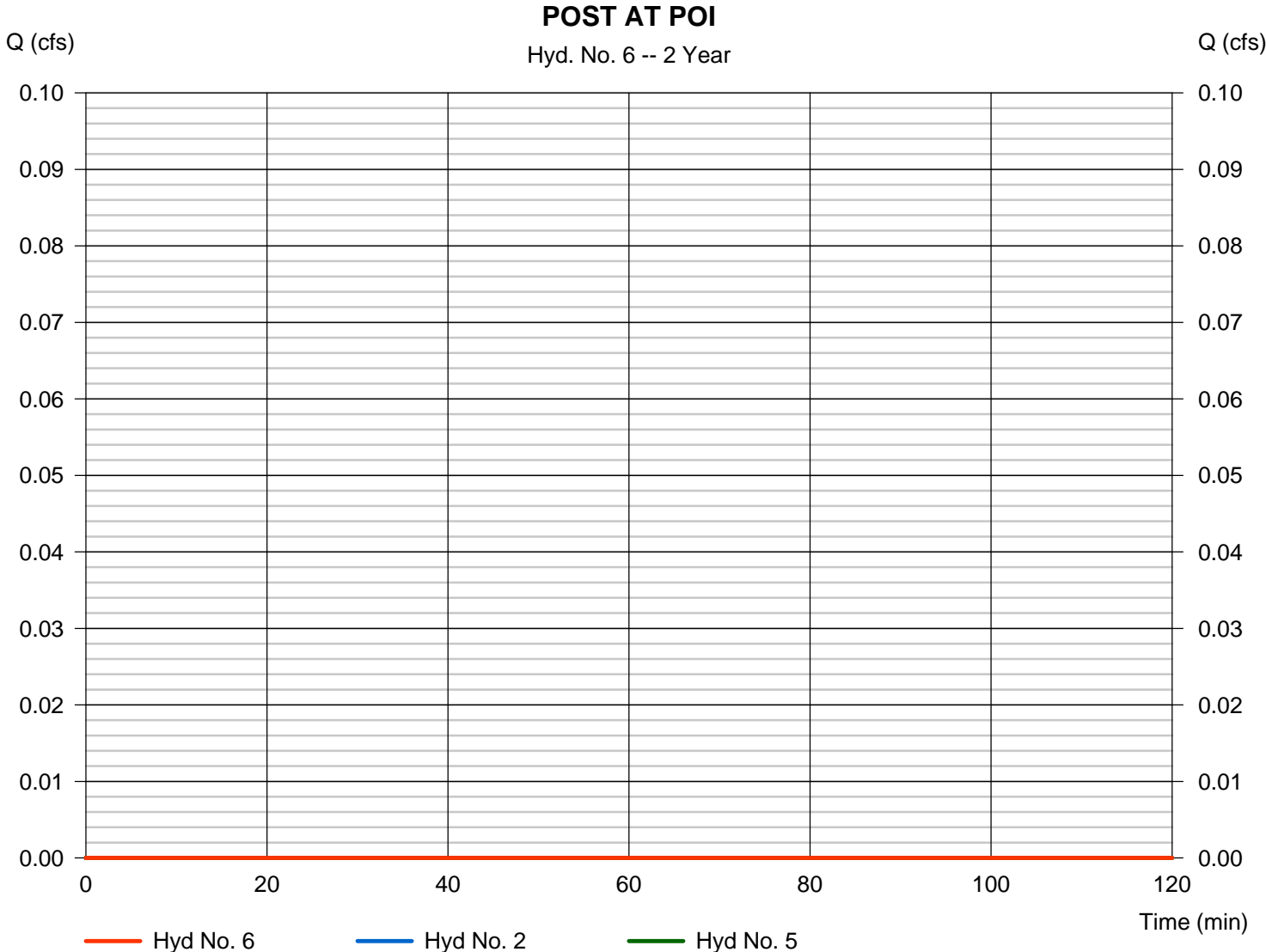
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Thursday, 10 / 27 / 2016

Hyd. No. 6

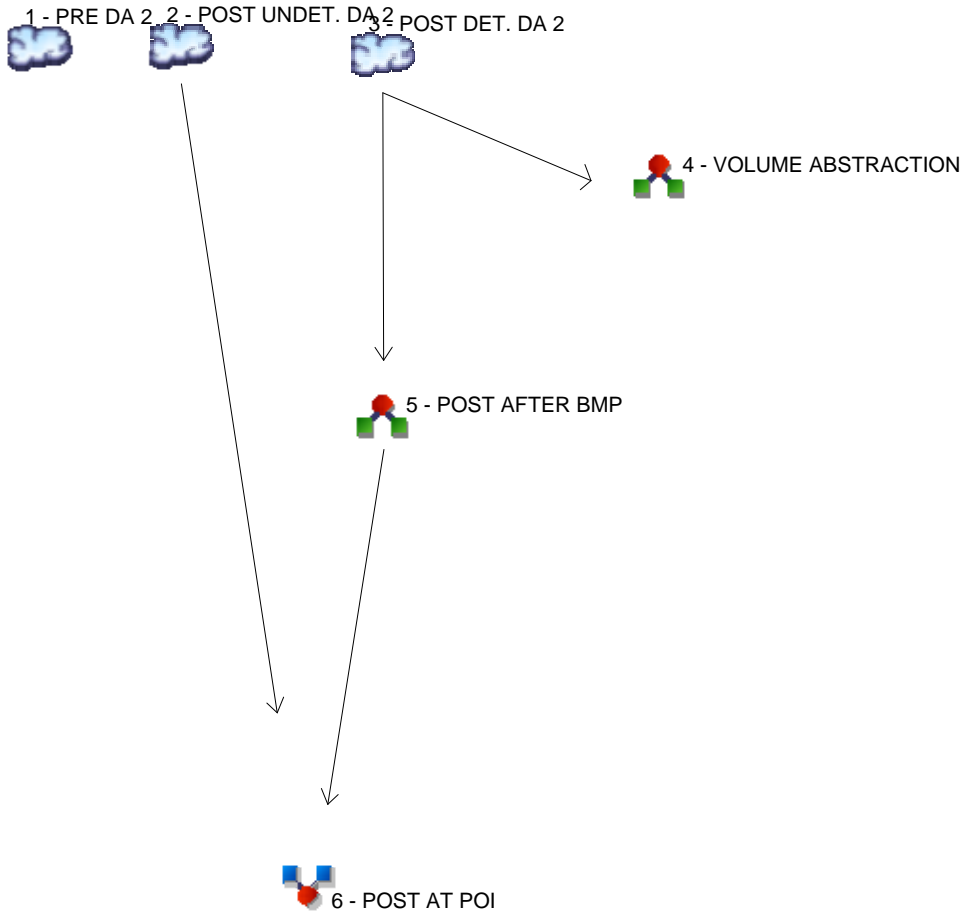
POST AT POI

Hydrograph type	= Combine	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyds.	= 2, 5	Contrib. drain. area	= 0.470 ac



Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4



Legend

Hyd. Origin	Description
1	SCS Runoff PRE DA 2
2	SCS Runoff POST UNDET. DA 2
3	SCS Runoff POST DET. DA 2
4	Diversion1 VOLUME ABSTRACTION
5	Diversion2 POST AFTER BMP
6	Combine POST AT POI

Hydrograph Return Period Recap

Hydroflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	-----	-----	-----	-----	-----	0.000	-----	-----	-----	PRE DA 2
2	SCS Runoff	-----	-----	-----	-----	-----	0.000	-----	-----	-----	POST UNDET. DA 2
3	SCS Runoff	-----	-----	-----	-----	-----	0.001	-----	-----	-----	POST DET. DA 2
4	Diversion1	3	-----	-----	-----	-----	0.001	-----	-----	-----	VOLUME ABSTRACTION
5	Diversion2	3	-----	-----	-----	-----	0.000	-----	-----	-----	POST AFTER BMP
6	Combine	2, 5	-----	-----	-----	-----	0.000	-----	-----	-----	POST AT POI

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	0.000	2	n/a	0	-----	-----	-----	PRE DA 2
2	SCS Runoff	0.000	2	n/a	0	-----	-----	-----	POST UNDET. DA 2
3	SCS Runoff	0.001	2	2570	149	-----	-----	-----	POST DET. DA 2
4	Diversion1	0.001	2	2570	149	3	-----	-----	VOLUME ABSTRACTION
5	Diversion2	0.000	2	n/a	0	3	-----	-----	POST AFTER BMP
6	Combine	0.000	2	n/a	0	2, 5	-----	-----	POST AT POI

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

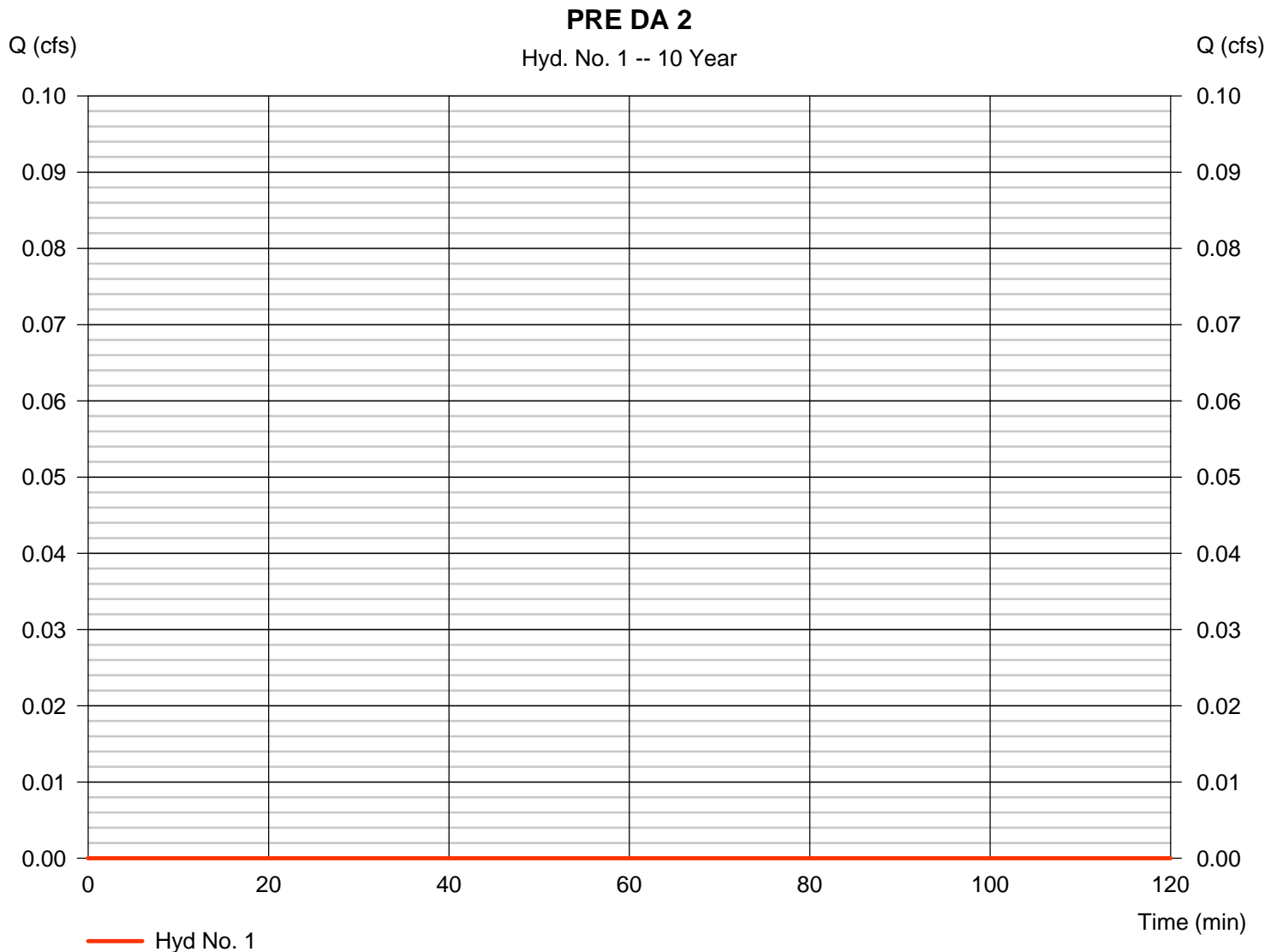
Thursday, 10 / 27 / 2016

Hyd. No. 1

PRE DA 2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 10 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Drainage area	= 0.760 ac	Curve number	= 31*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 5.40 min
Total precip.	= 4.38 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.010 x 98) + (0.750 x 30)] / 0.760



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No. 1

PRE DA 2

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
Sheet Flow				
Manning's n-value	= 0.240	0.011	0.011	
Flow length (ft)	= 50.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 2.90	0.00	0.00	
Land slope (%)	= 12.00	0.00	0.00	
Travel Time (min)	= 4.20	+ 0.00	+ 0.00	= 4.20
Shallow Concentrated Flow				
Flow length (ft)	= 231.00	30.00	52.00	
Watercourse slope (%)	= 10.40	3.30	3.90	
Surface description	= Unpaved	Paved	Unpaved	
Average velocity (ft/s)	=5.20	3.69	3.19	
Travel Time (min)	= 0.74	+ 0.14	+ 0.27	= 1.15
Channel Flow				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	=0.00	0.00	0.00	
Flow length (ft)	0.0	0.0	0.0	
Travel Time (min)	= 0.00	+ 0.00	+ 0.00	= 0.00
Total Travel Time, Tc				5.40 min

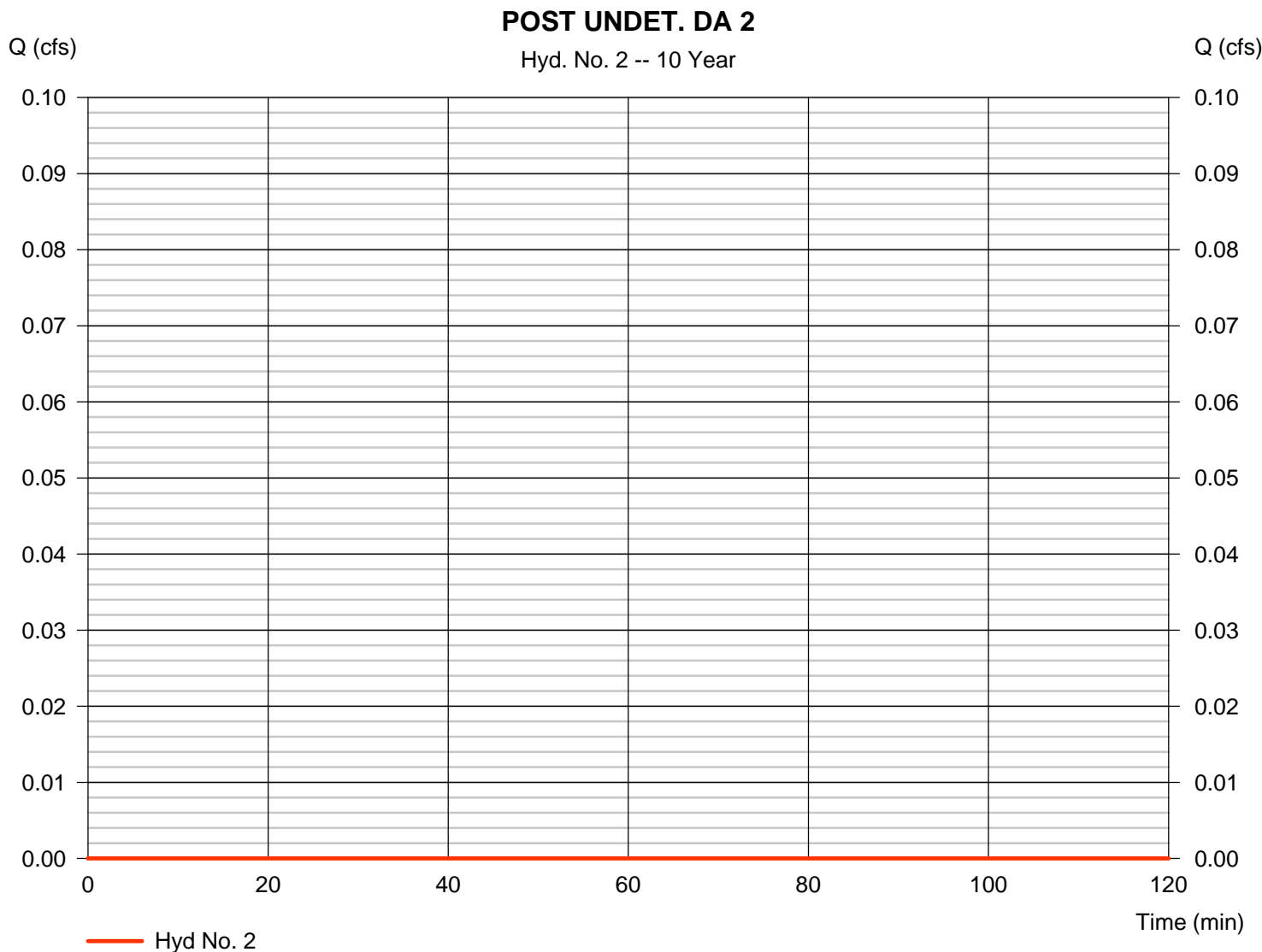
Hydrograph Report

Hyd. No. 2

POST UNDET. DA 2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 10 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Drainage area	= 0.470 ac	Curve number	= 31*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 5.40 min
Total precip.	= 4.38 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.010 x 98) + (0.460 x 30)] / 0.470



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No. 2

POST UNDET. DA 2

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
Sheet Flow				
Manning's n-value	= 0.240	0.011	0.011	
Flow length (ft)	= 50.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 2.90	0.00	0.00	
Land slope (%)	= 12.00	0.00	0.00	
Travel Time (min)	= 4.20	+ 0.00	+ 0.00	= 4.20
Shallow Concentrated Flow				
Flow length (ft)	= 231.00	30.00	52.00	
Watercourse slope (%)	= 10.40	3.30	3.90	
Surface description	= Unpaved	Paved	Unpaved	
Average velocity (ft/s)	=5.20	3.69	3.19	
Travel Time (min)	= 0.74	+ 0.14	+ 0.27	= 1.15
Channel Flow				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	=0.00	0.00	0.00	
Flow length (ft)	{{0}}0.0	0.0	0.0	
Travel Time (min)	= 0.00	+ 0.00	+ 0.00	= 0.00
Total Travel Time, Tc				5.40 min

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

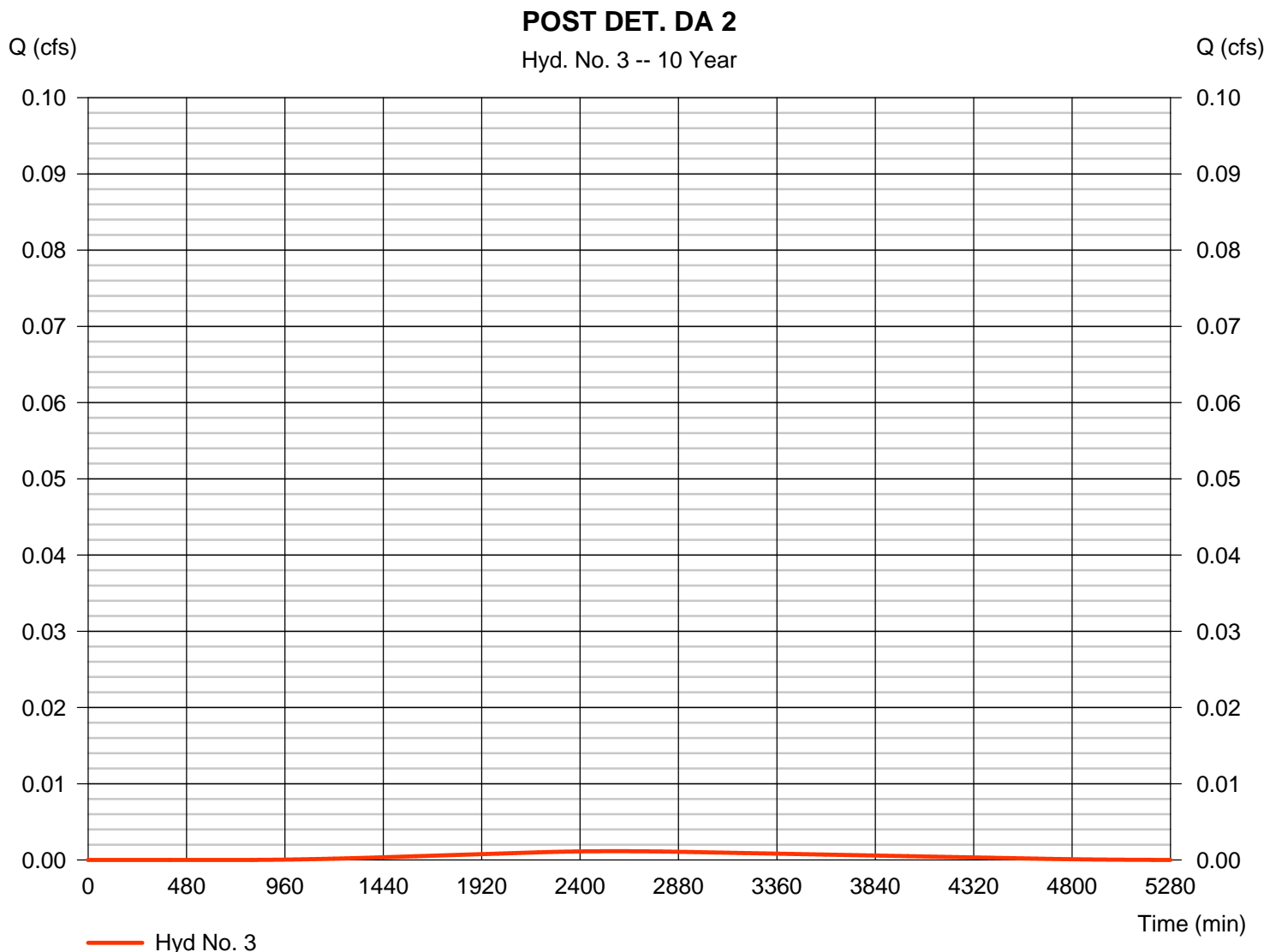
Thursday, 10 / 27 / 2016

Hyd. No. 3

POST DET. DA 2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.001 cfs
Storm frequency	= 10 yrs	Time to peak	= 2570 min
Time interval	= 2 min	Hyd. volume	= 149 cuft
Drainage area	= 0.290 ac	Curve number	= 41*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 2507.00 min
Total precip.	= 4.38 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.070 x 76) + (0.220 x 30)] / 0.290



Hydrograph Report

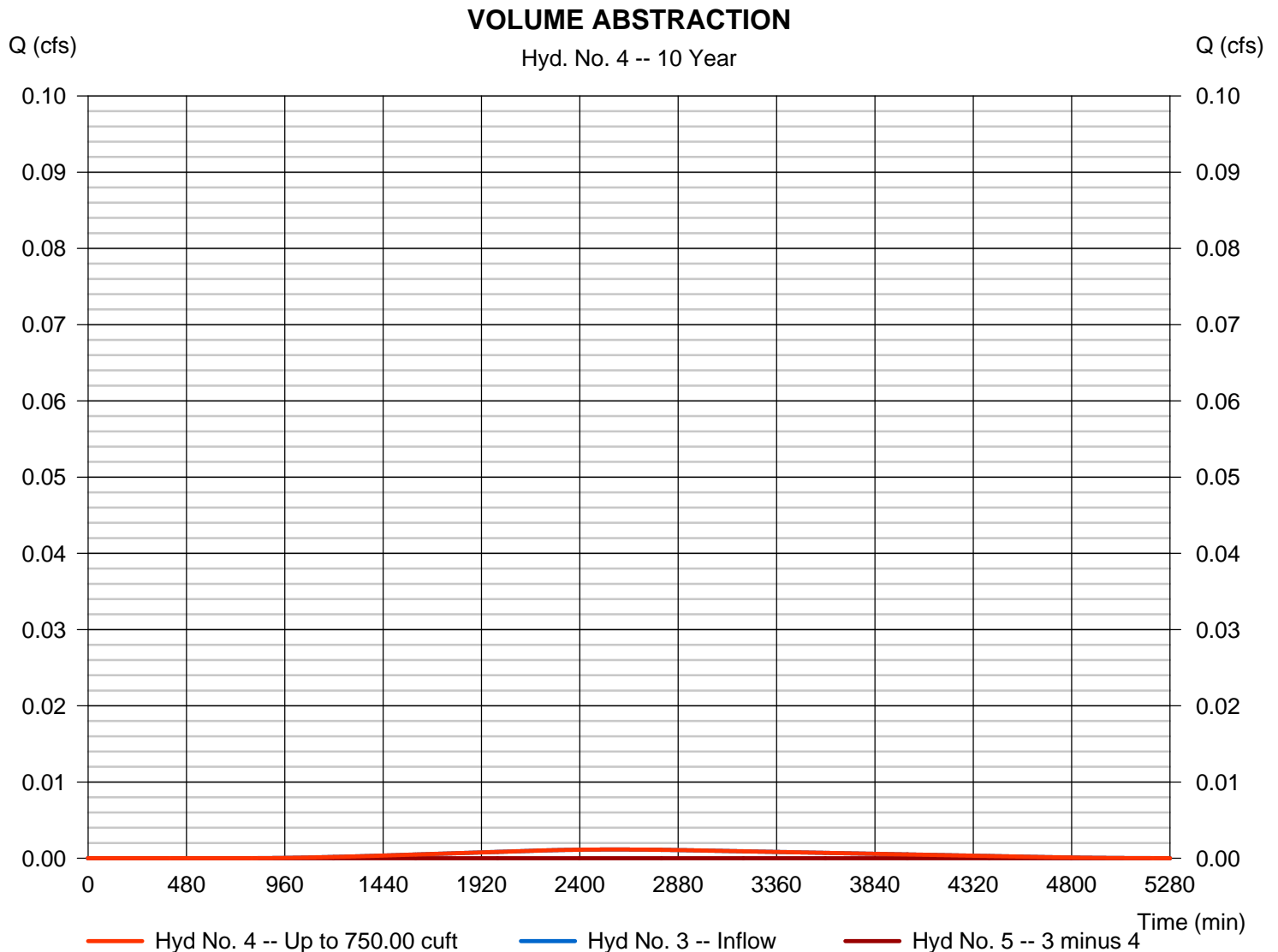
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Thursday, 10 / 27 / 2016

Hyd. No. 4

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 0.001 cfs
Storm frequency	= 10 yrs	Time to peak	= 2570 min
Time interval	= 2 min	Hyd. volume	= 149 cuft
Inflow hydrograph	= 3 - POST DET. DA 2	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 750.00 cuft



Hydrograph Report

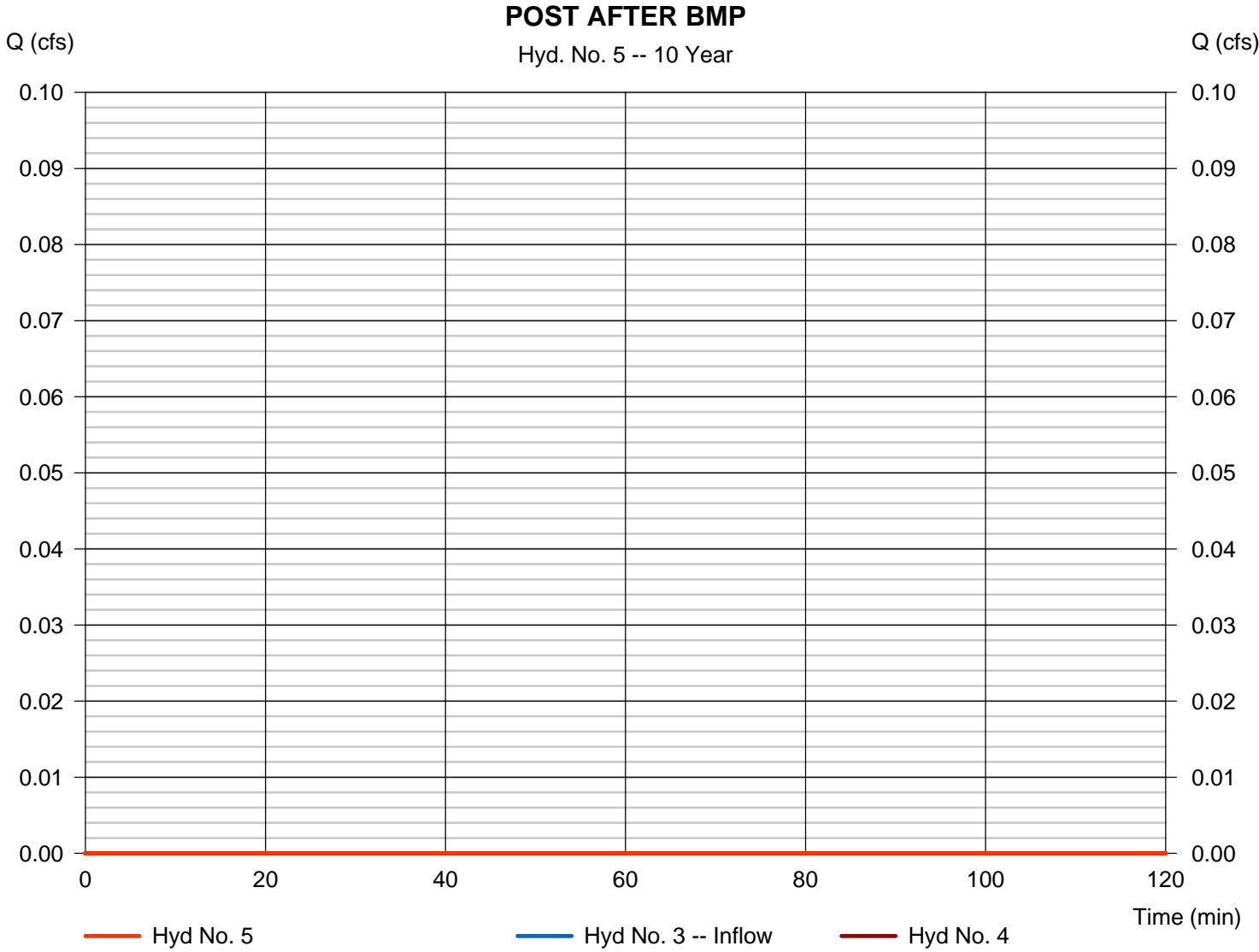
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Thursday, 10 / 27 / 2016

Hyd. No. 5

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 0.000 cfs
Storm frequency	= 10 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hydrograph	= 3 - POST DET. DA 2	2nd diverted hyd.	= 4
Diversion method	= First Flush Volume	Volume Up To	= 750.00 cuft



Hydrograph Report

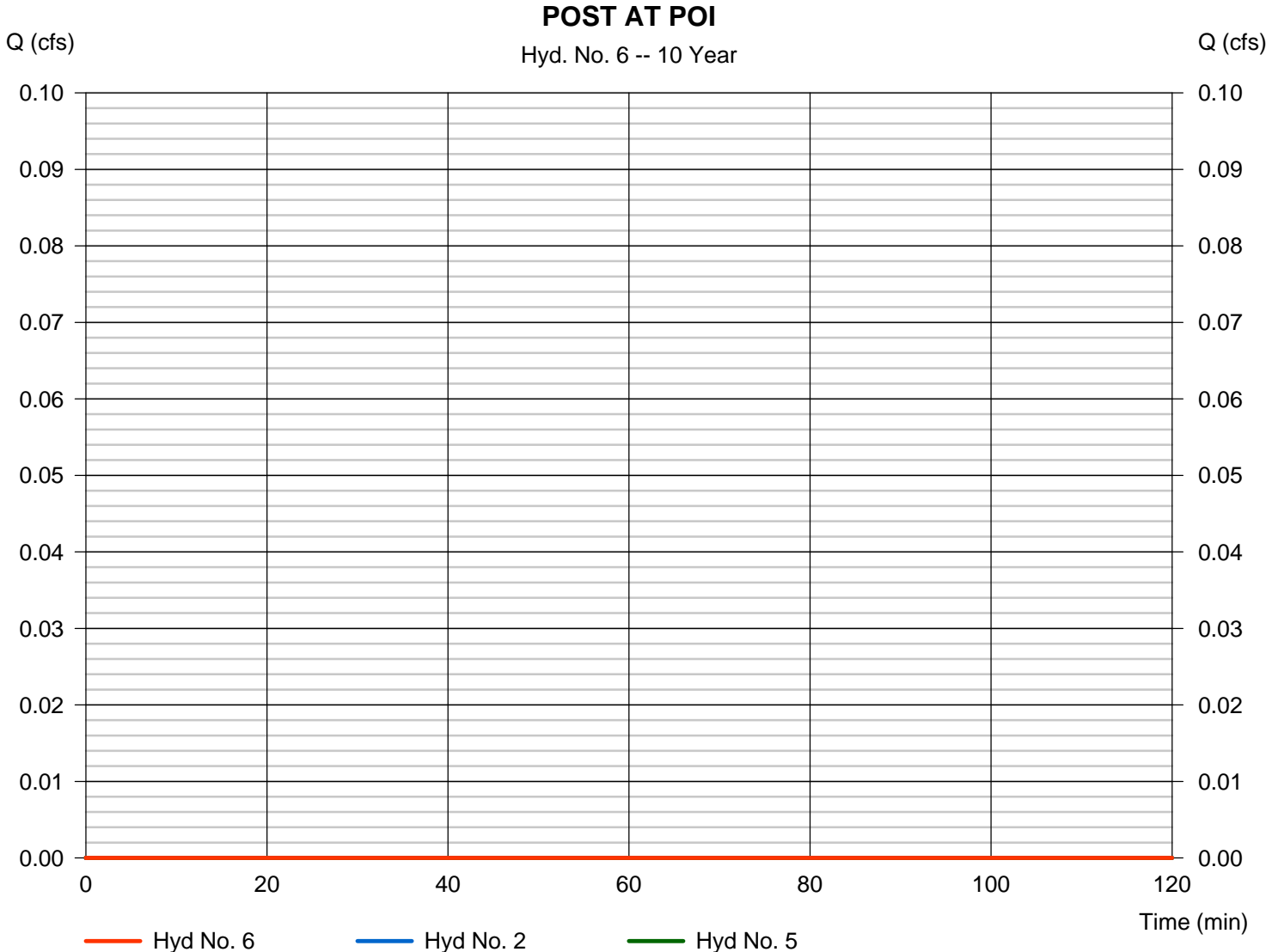
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Thursday, 10 / 27 / 2016

Hyd. No. 6

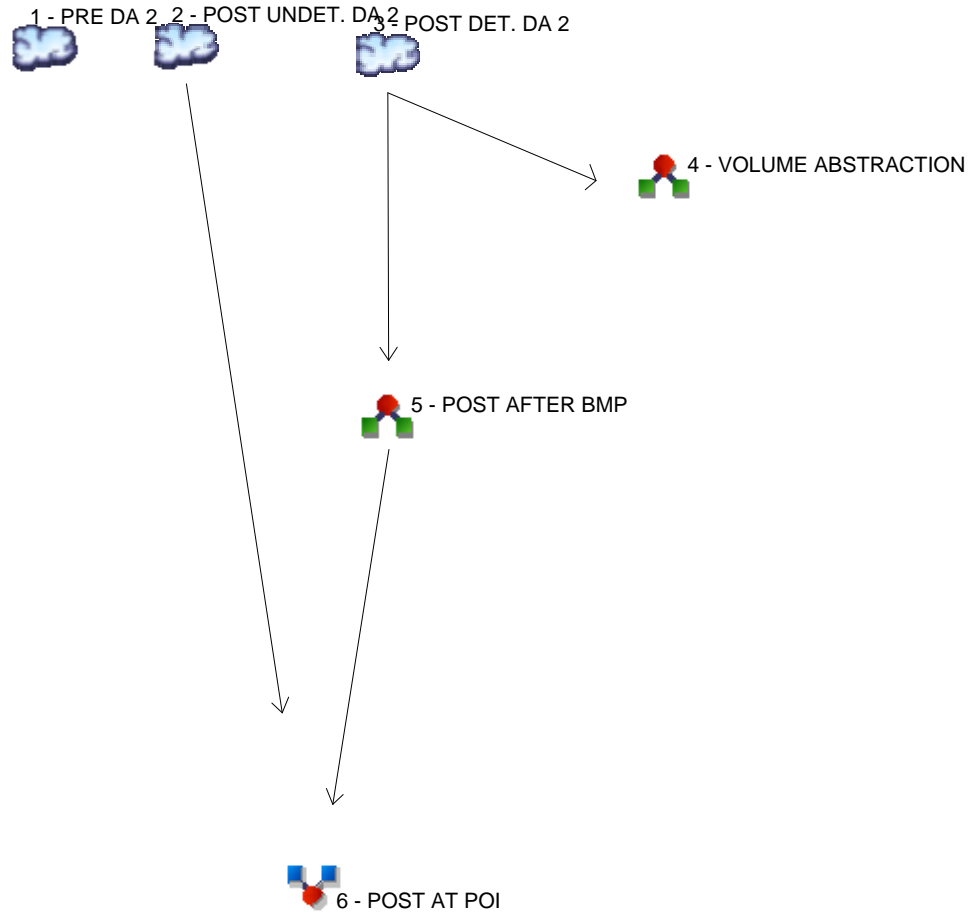
POST AT POI

Hydrograph type	= Combine	Peak discharge	= 0.000 cfs
Storm frequency	= 10 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyds.	= 2, 5	Contrib. drain. area	= 0.470 ac



Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4



Legend

Hyd. Origin	Description
1	SCS Runoff PRE DA 2
2	SCS Runoff POST UNDET. DA 2
3	SCS Runoff POST DET. DA 2
4	Diversion1 VOLUME ABSTRACTION
5	Diversion2 POST AFTER BMP
6	Combine POST AT POI

Hydrograph Return Period Recap

Hydranow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	-----	-----	-----	-----	-----	-----	-----	0.012	-----	PRE DA 2
2	SCS Runoff	-----	-----	-----	-----	-----	-----	-----	0.008	-----	POST UNDET. DA 2
3	SCS Runoff	-----	-----	-----	-----	-----	-----	-----	0.061	-----	POST DET. DA 2
4	Diversion1	3	-----	-----	-----	-----	-----	-----	0.061	-----	VOLUME ABSTRACTION
5	Diversion2	3	-----	-----	-----	-----	-----	-----	0.000	-----	POST AFTER BMP
6	Combine	2, 5	-----	-----	-----	-----	-----	-----	0.008	-----	POST AT POI

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	0.012	2	802	406	-----	-----	-----	PRE DA 2
2	SCS Runoff	0.008	2	802	251	-----	-----	-----	POST UNDET. DA 2
3	SCS Runoff	0.061	2	762	728	-----	-----	-----	POST DET. DA 2
4	Diversion1	0.061	2	762	728	3	-----	-----	VOLUME ABSTRACTION
5	Diversion2	0.000	2	n/a	0	3	-----	-----	POST AFTER BMP
6	Combine	0.008	2	802	251	2, 5	-----	-----	POST AT POI
NUnion DA2 50 year.gpw					Return Period: 50 Year			Thursday, 10 / 27 / 2016	

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

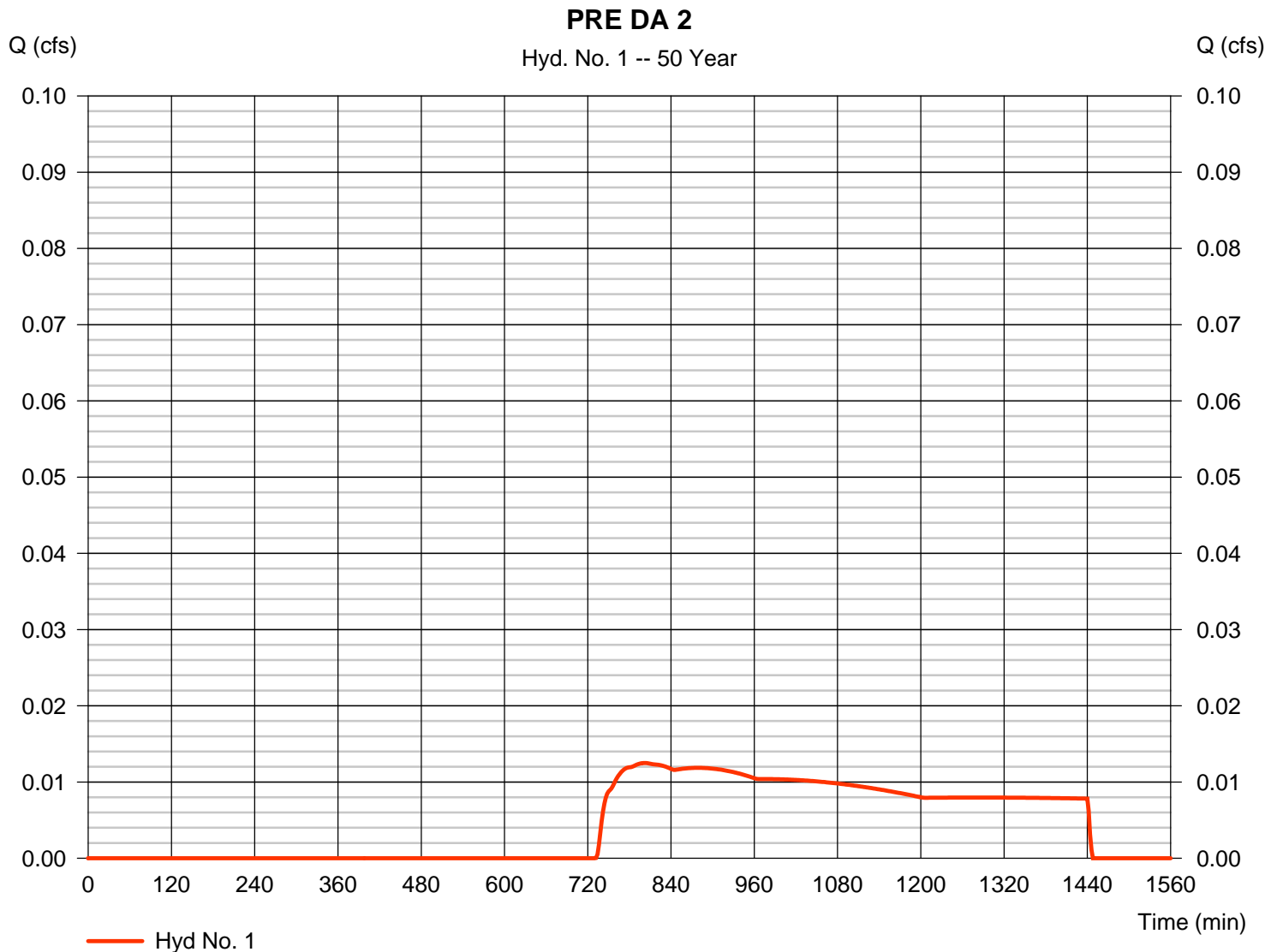
Thursday, 10 / 27 / 2016

Hyd. No. 1

PRE DA 2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.012 cfs
Storm frequency	= 50 yrs	Time to peak	= 802 min
Time interval	= 2 min	Hyd. volume	= 406 cuft
Drainage area	= 0.760 ac	Curve number	= 31*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 5.40 min
Total precip.	= 6.40 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.010 x 98) + (0.750 x 30)] / 0.760



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No. 1

PRE DA 2

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
Sheet Flow				
Manning's n-value	= 0.240	0.011	0.011	
Flow length (ft)	= 50.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 2.90	0.00	0.00	
Land slope (%)	= 12.00	0.00	0.00	
Travel Time (min)	= 4.20	+ 0.00	+ 0.00	= 4.20
Shallow Concentrated Flow				
Flow length (ft)	= 231.00	30.00	52.00	
Watercourse slope (%)	= 10.40	3.30	3.90	
Surface description	= Unpaved	Paved	Unpaved	
Average velocity (ft/s)	=5.20	3.69	3.19	
Travel Time (min)	= 0.74	+ 0.14	+ 0.27	= 1.15
Channel Flow				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	=0.00	0.00	0.00	
Flow length (ft)	{{0}}0.0	0.0	0.0	
Travel Time (min)	= 0.00	+ 0.00	+ 0.00	= 0.00
Total Travel Time, Tc				5.40 min

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

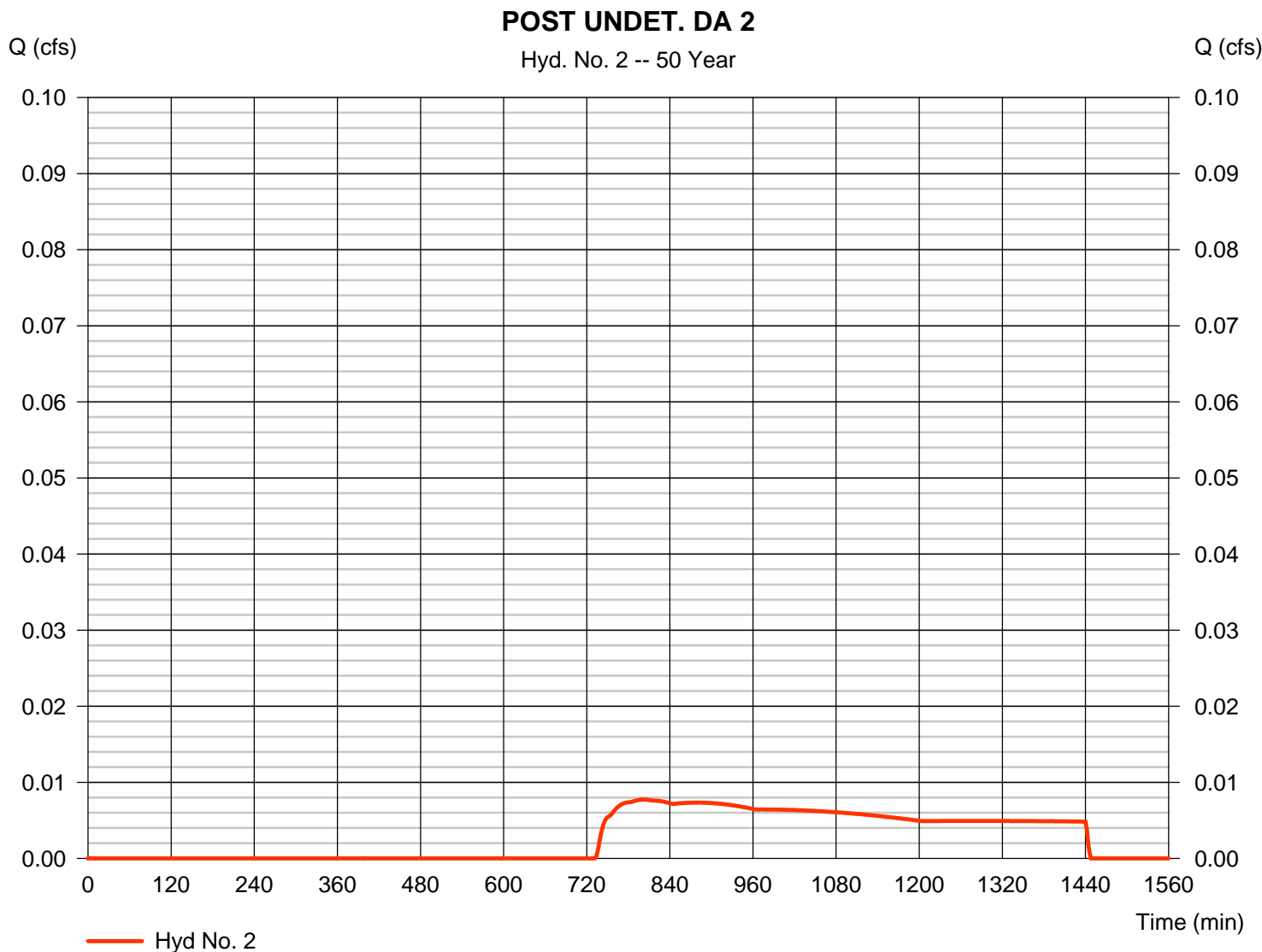
Thursday, 10 / 27 / 2016

Hyd. No. 2

POST UNDET. DA 2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.008 cfs
Storm frequency	= 50 yrs	Time to peak	= 802 min
Time interval	= 2 min	Hyd. volume	= 251 cuft
Drainage area	= 0.470 ac	Curve number	= 31*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 5.40 min
Total precip.	= 6.40 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.010 x 98) + (0.460 x 30)] / 0.470



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No. 2

POST UNDET. DA 2

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
Sheet Flow				
Manning's n-value	= 0.240	0.011	0.011	
Flow length (ft)	= 50.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 2.90	0.00	0.00	
Land slope (%)	= 12.00	0.00	0.00	
Travel Time (min)	= 4.20	+ 0.00	+ 0.00	= 4.20
Shallow Concentrated Flow				
Flow length (ft)	= 231.00	30.00	52.00	
Watercourse slope (%)	= 10.40	3.30	3.90	
Surface description	= Unpaved	Paved	Unpaved	
Average velocity (ft/s)	=5.20	3.69	3.19	
Travel Time (min)	= 0.74	+ 0.14	+ 0.27	= 1.15
Channel Flow				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	=0.00	0.00	0.00	
Flow length (ft)	{{0}}0.0	0.0	0.0	
Travel Time (min)	= 0.00	+ 0.00	+ 0.00	= 0.00
Total Travel Time, Tc				5.40 min

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

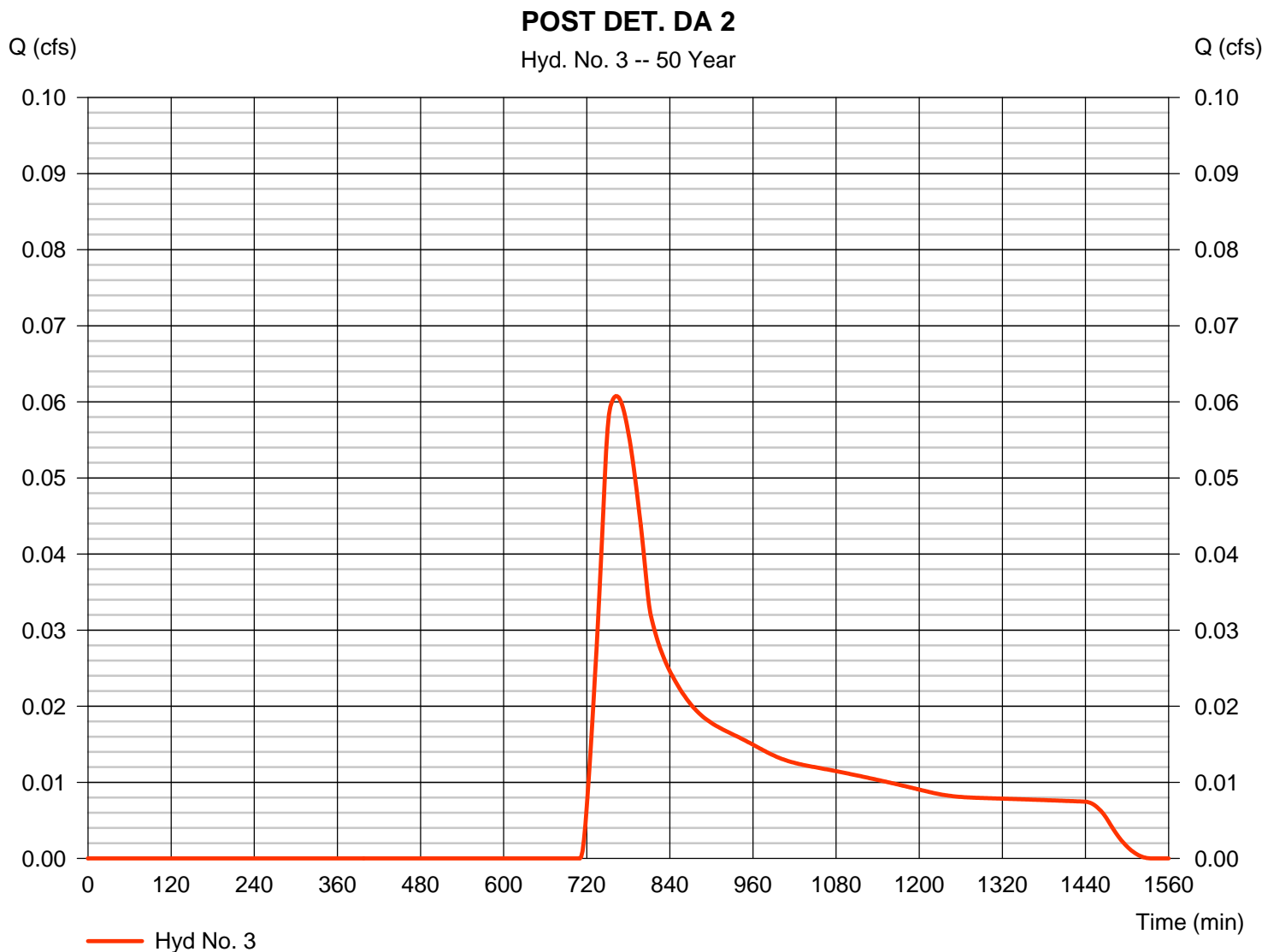
Thursday, 10 / 27 / 2016

Hyd. No. 3

POST DET. DA 2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.061 cfs
Storm frequency	= 50 yrs	Time to peak	= 762 min
Time interval	= 2 min	Hyd. volume	= 728 cuft
Drainage area	= 0.290 ac	Curve number	= 41*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 59.69 min
Total precip.	= 6.40 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.070 x 76) + (0.220 x 30)] / 0.290



Hydrograph Report

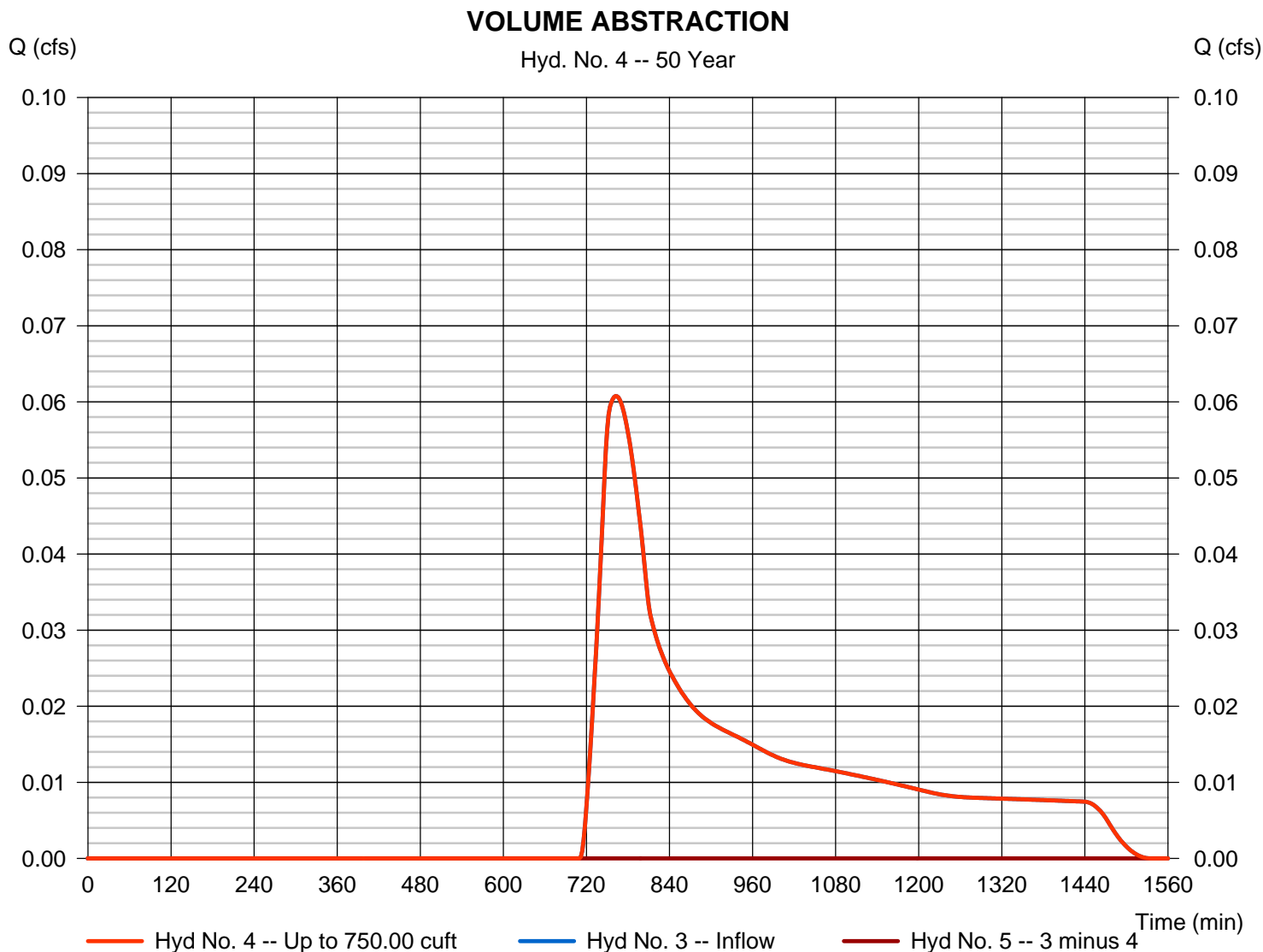
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Thursday, 10 / 27 / 2016

Hyd. No. 4

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 0.061 cfs
Storm frequency	= 50 yrs	Time to peak	= 762 min
Time interval	= 2 min	Hyd. volume	= 728 cuft
Inflow hydrograph	= 3 - POST DET. DA 2	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 750.00 cuft

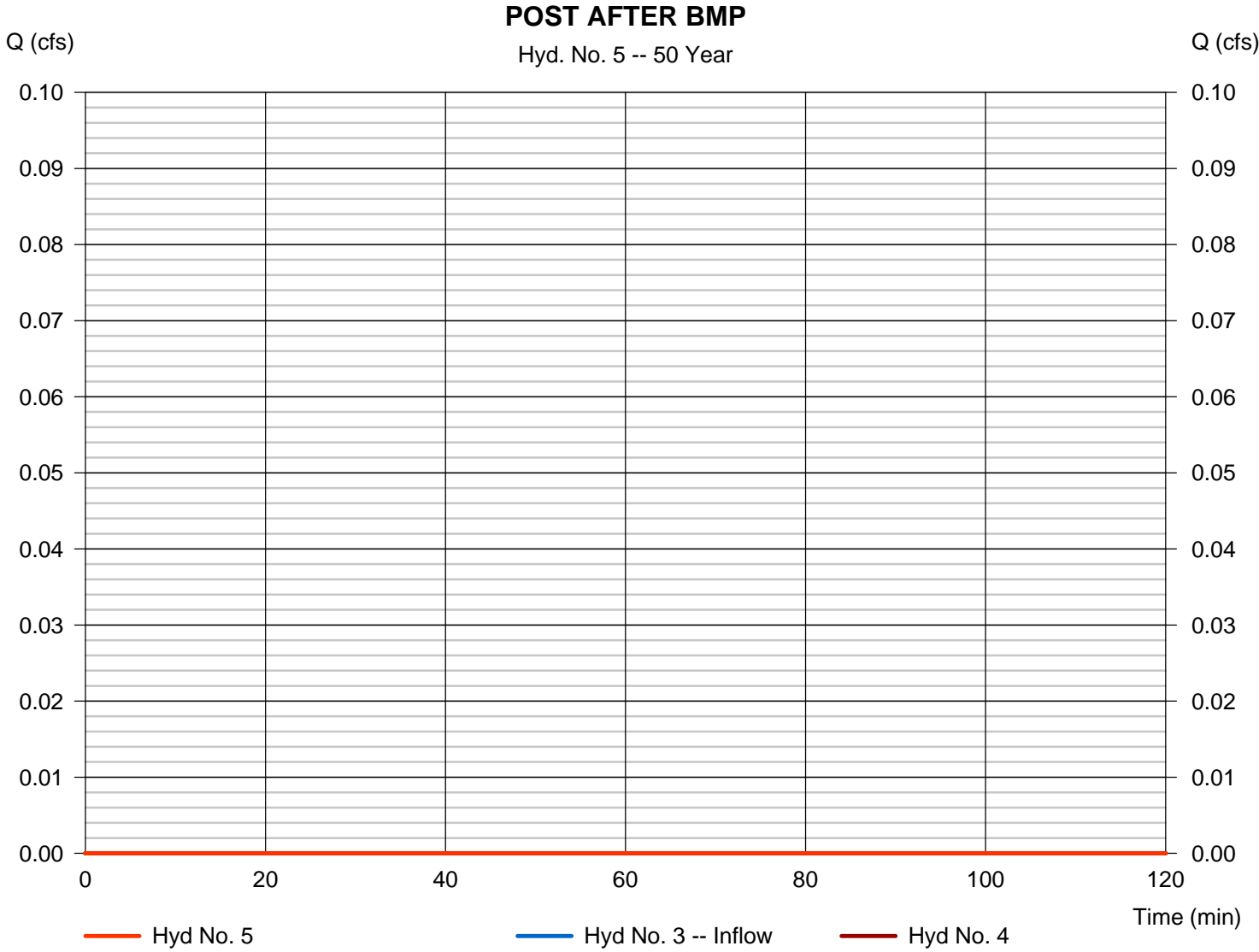


Hydrograph Report

Hyd. No. 5

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 0.000 cfs
Storm frequency	= 50 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hydrograph	= 3 - POST DET. DA 2	2nd diverted hyd.	= 4
Diversion method	= First Flush Volume	Volume Up To	= 750.00 cuft



Hydrograph Report

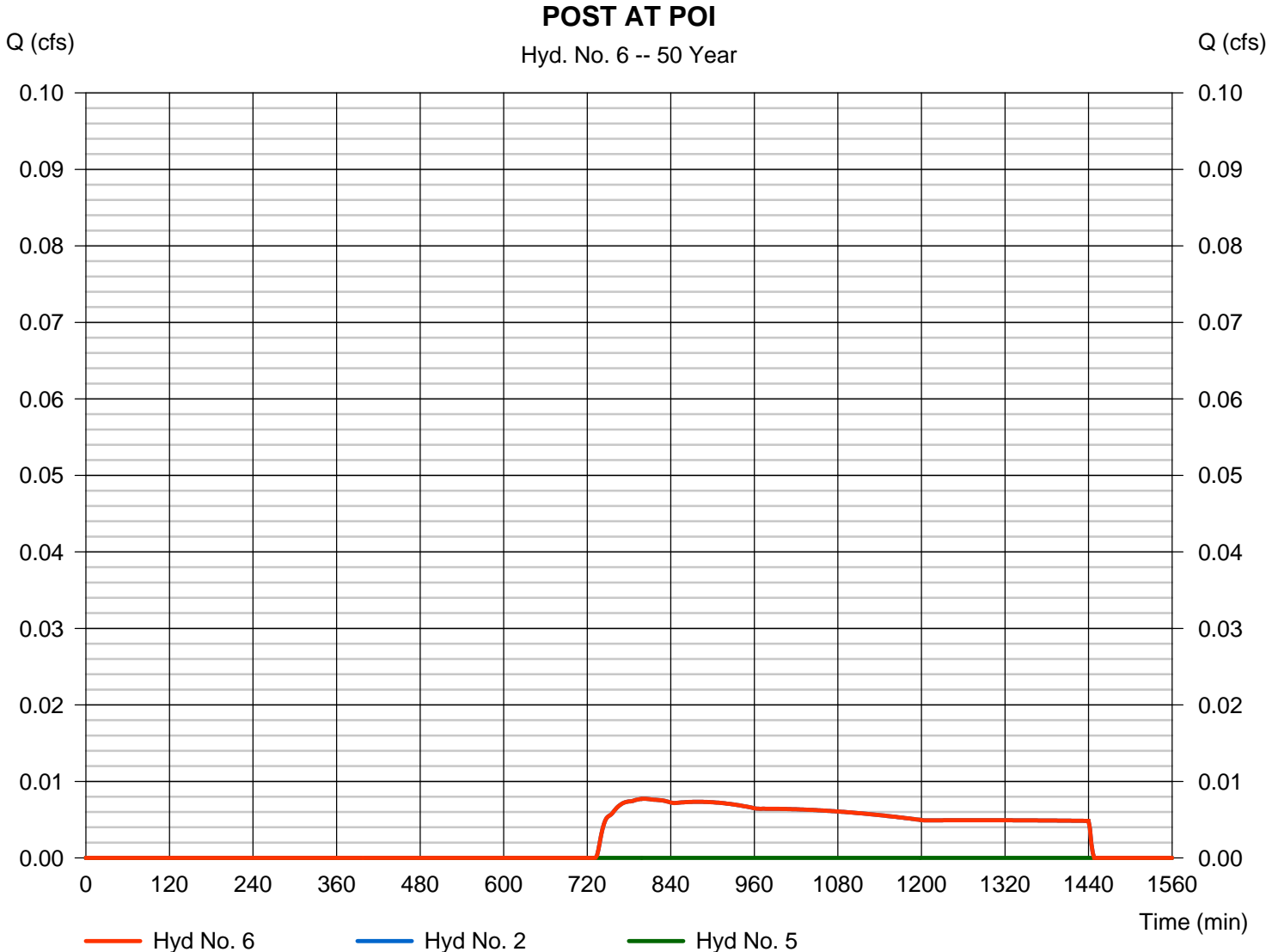
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Thursday, 10 / 27 / 2016

Hyd. No. 6

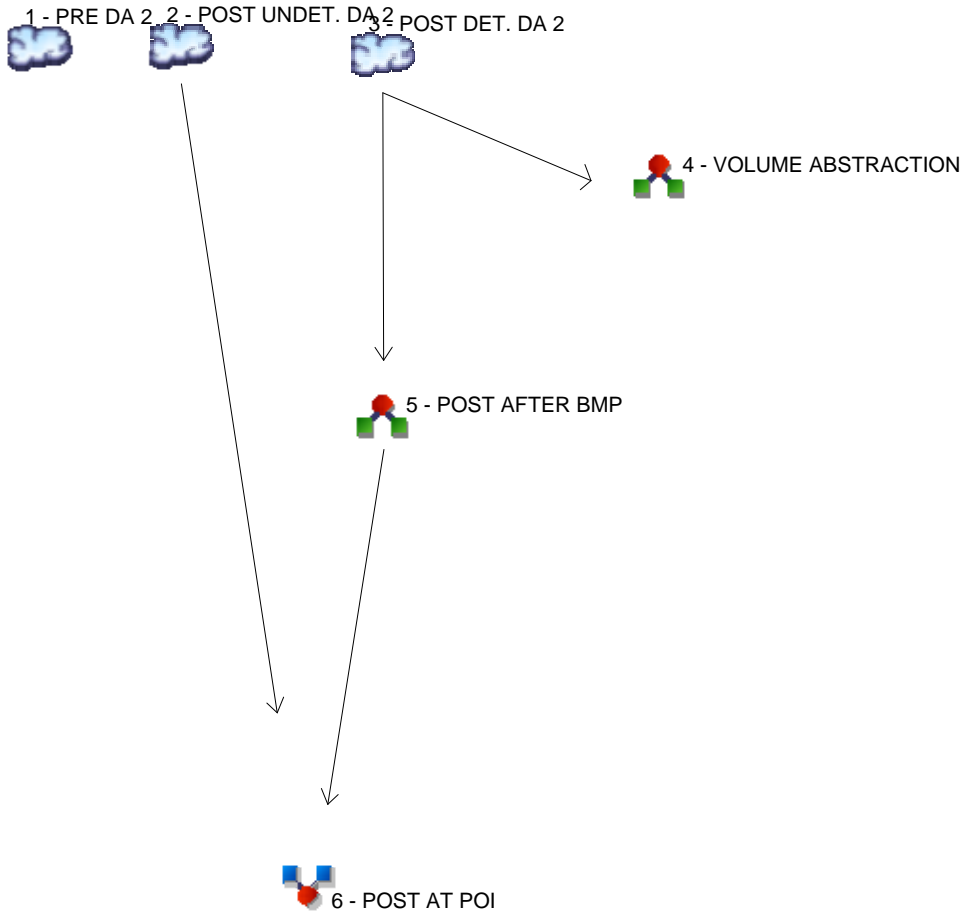
POST AT POI

Hydrograph type	= Combine	Peak discharge	= 0.008 cfs
Storm frequency	= 50 yrs	Time to peak	= 802 min
Time interval	= 2 min	Hyd. volume	= 251 cuft
Inflow hyds.	= 2, 5	Contrib. drain. area	= 0.470 ac



Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4



Legend

Hyd. Origin	Description
1	SCS Runoff PRE DA 2
2	SCS Runoff POST UNDET. DA 2
3	SCS Runoff POST DET. DA 2
4	Diversion1 VOLUME ABSTRACTION
5	Diversion2 POST AFTER BMP
6	Combine POST AT POI

Hydrograph Return Period Recap

Hydranow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description	
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr		
1	SCS Runoff	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.081	PRE DA 2
2	SCS Runoff	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.050	POST UNDET. DA 2
3	SCS Runoff	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.182	POST DET. DA 2
4	Diversion1	3	-----	-----	-----	-----	-----	-----	-----	-----	0.182	VOLUME ABSTRACTION
5	Diversion2	3	-----	-----	-----	-----	-----	-----	-----	-----	0.022	POST AFTER BMP
6	Combine	2, 5	-----	-----	-----	-----	-----	-----	-----	-----	0.050	POST AT POI

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	0.081	2	722	935	-----	-----	-----	PRE DA 2
2	SCS Runoff	0.050	2	722	578	-----	-----	-----	POST UNDET. DA 2
3	SCS Runoff	0.182	2	736	1,188	-----	-----	-----	POST DET. DA 2
4	Diversion1	0.182	2	736	753	3	-----	-----	VOLUME ABSTRACTION
5	Diversion2	0.022	2	940	436	3	-----	-----	POST AFTER BMP
6	Combine	0.050	2	722	1,014	2, 5	-----	-----	POST AT POI

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

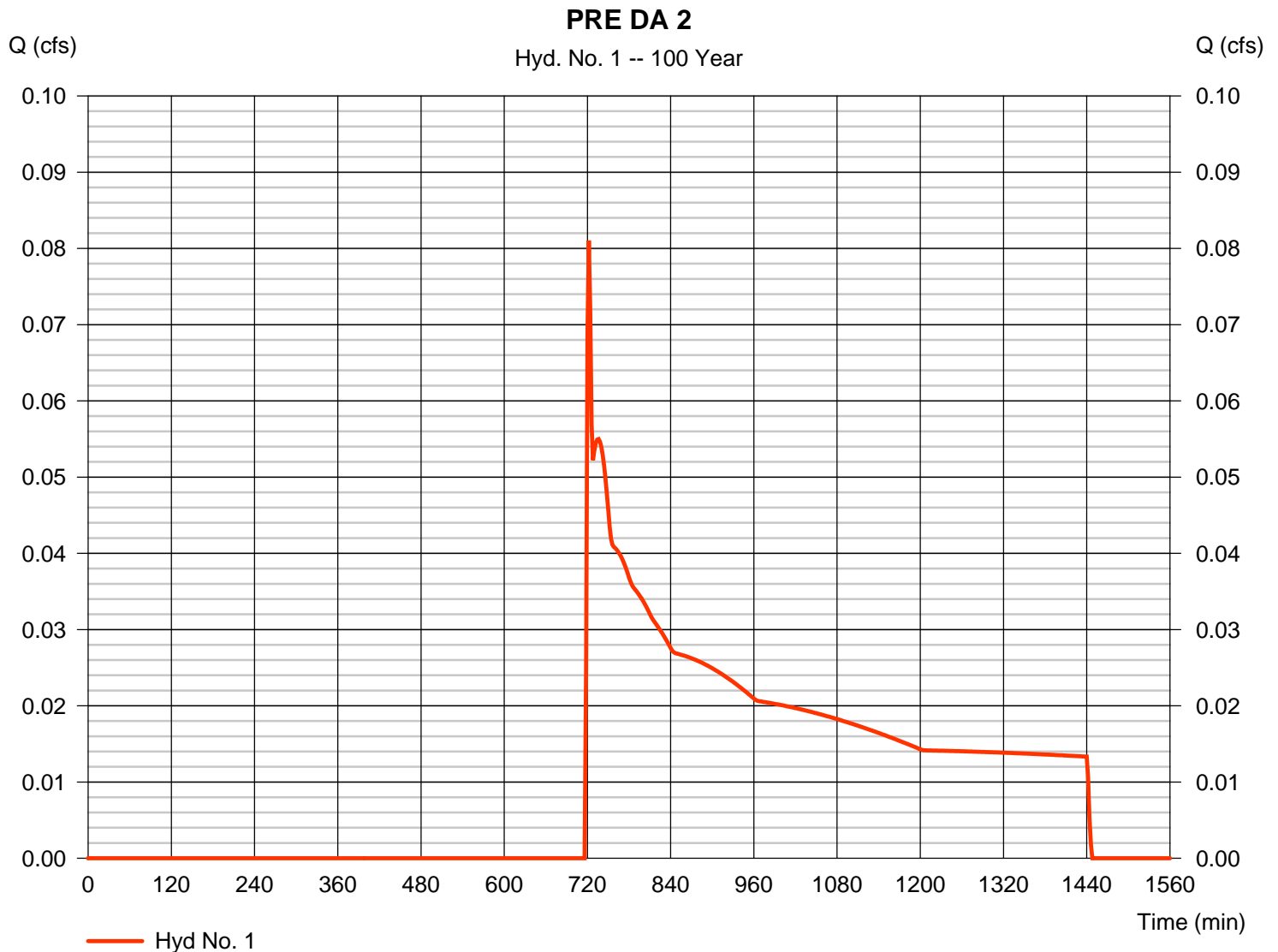
Thursday, 10 / 27 / 2016

Hyd. No. 1

PRE DA 2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.081 cfs
Storm frequency	= 100 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 935 cuft
Drainage area	= 0.760 ac	Curve number	= 31*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 5.40 min
Total precip.	= 7.48 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.010 x 98) + (0.750 x 30)] / 0.760



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No. 1

PRE DA 2

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
Sheet Flow				
Manning's n-value	= 0.240	0.011	0.011	
Flow length (ft)	= 50.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 2.90	0.00	0.00	
Land slope (%)	= 12.00	0.00	0.00	
Travel Time (min)	= 4.20	+ 0.00	+ 0.00	= 4.20
Shallow Concentrated Flow				
Flow length (ft)	= 231.00	30.00	52.00	
Watercourse slope (%)	= 10.40	3.30	3.90	
Surface description	= Unpaved	Paved	Unpaved	
Average velocity (ft/s)	=5.20	3.69	3.19	
Travel Time (min)	= 0.74	+ 0.14	+ 0.27	= 1.15
Channel Flow				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	=0.00	0.00	0.00	
Flow length (ft)	0.0	0.0	0.0	
Travel Time (min)	= 0.00	+ 0.00	+ 0.00	= 0.00
Total Travel Time, Tc				5.40 min

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

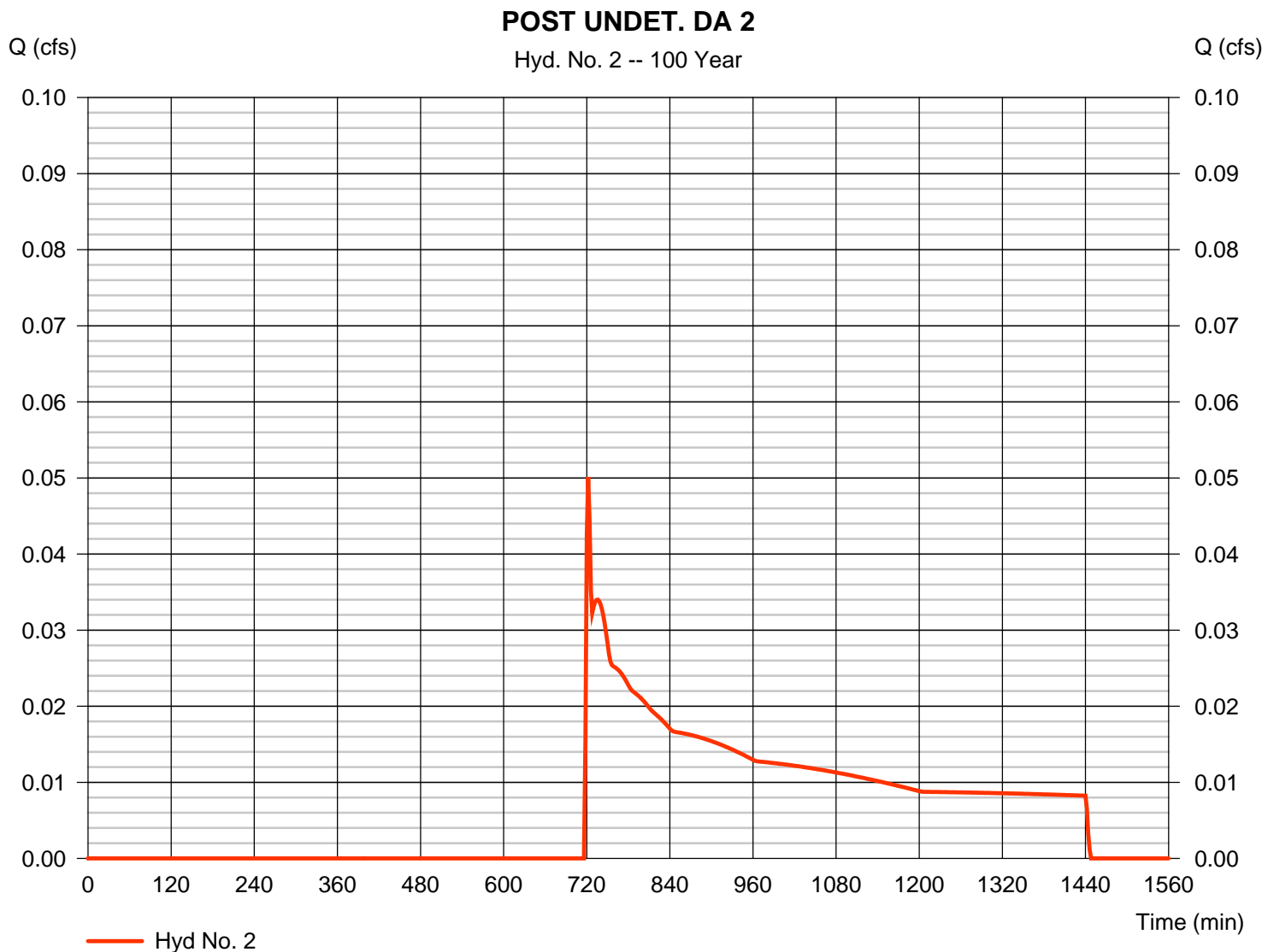
Thursday, 10 / 27 / 2016

Hyd. No. 2

POST UNDET. DA 2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.050 cfs
Storm frequency	= 100 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 578 cuft
Drainage area	= 0.470 ac	Curve number	= 31*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 5.40 min
Total precip.	= 7.48 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.010 x 98) + (0.460 x 30)] / 0.470



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Hyd. No. 2

POST UNDET. DA 2

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>
Sheet Flow				
Manning's n-value	= 0.240	0.011	0.011	
Flow length (ft)	= 50.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 2.90	0.00	0.00	
Land slope (%)	= 12.00	0.00	0.00	
Travel Time (min)	= 4.20	+ 0.00	+ 0.00	= 4.20
Shallow Concentrated Flow				
Flow length (ft)	= 231.00	30.00	52.00	
Watercourse slope (%)	= 10.40	3.30	3.90	
Surface description	= Unpaved	Paved	Unpaved	
Average velocity (ft/s)	=5.20	3.69	3.19	
Travel Time (min)	= 0.74	+ 0.14	+ 0.27	= 1.15
Channel Flow				
X sectional flow area (sqft)	= 0.00	0.00	0.00	
Wetted perimeter (ft)	= 0.00	0.00	0.00	
Channel slope (%)	= 0.00	0.00	0.00	
Manning's n-value	= 0.015	0.015	0.015	
Velocity (ft/s)	=0.00	0.00	0.00	
Flow length (ft)	0.0	0.0	0.0	
Travel Time (min)	= 0.00	+ 0.00	+ 0.00	= 0.00
Total Travel Time, Tc				5.40 min

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

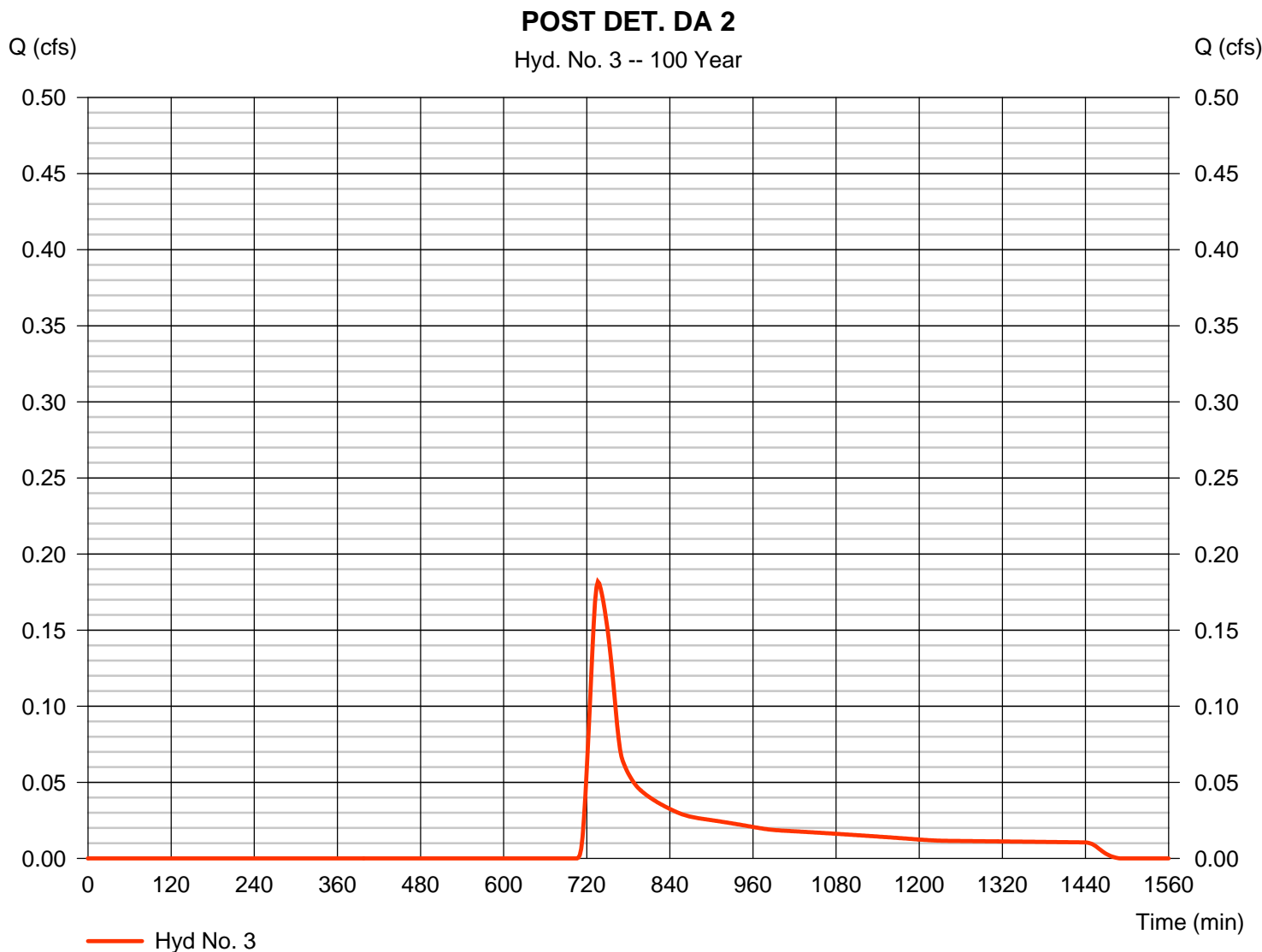
Thursday, 10 / 27 / 2016

Hyd. No. 3

POST DET. DA 2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.182 cfs
Storm frequency	= 100 yrs	Time to peak	= 736 min
Time interval	= 2 min	Hyd. volume	= 1,188 cuft
Drainage area	= 0.290 ac	Curve number	= 41*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 33.21 min
Total precip.	= 7.48 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.070 x 76) + (0.220 x 30)] / 0.290



Hydrograph Report

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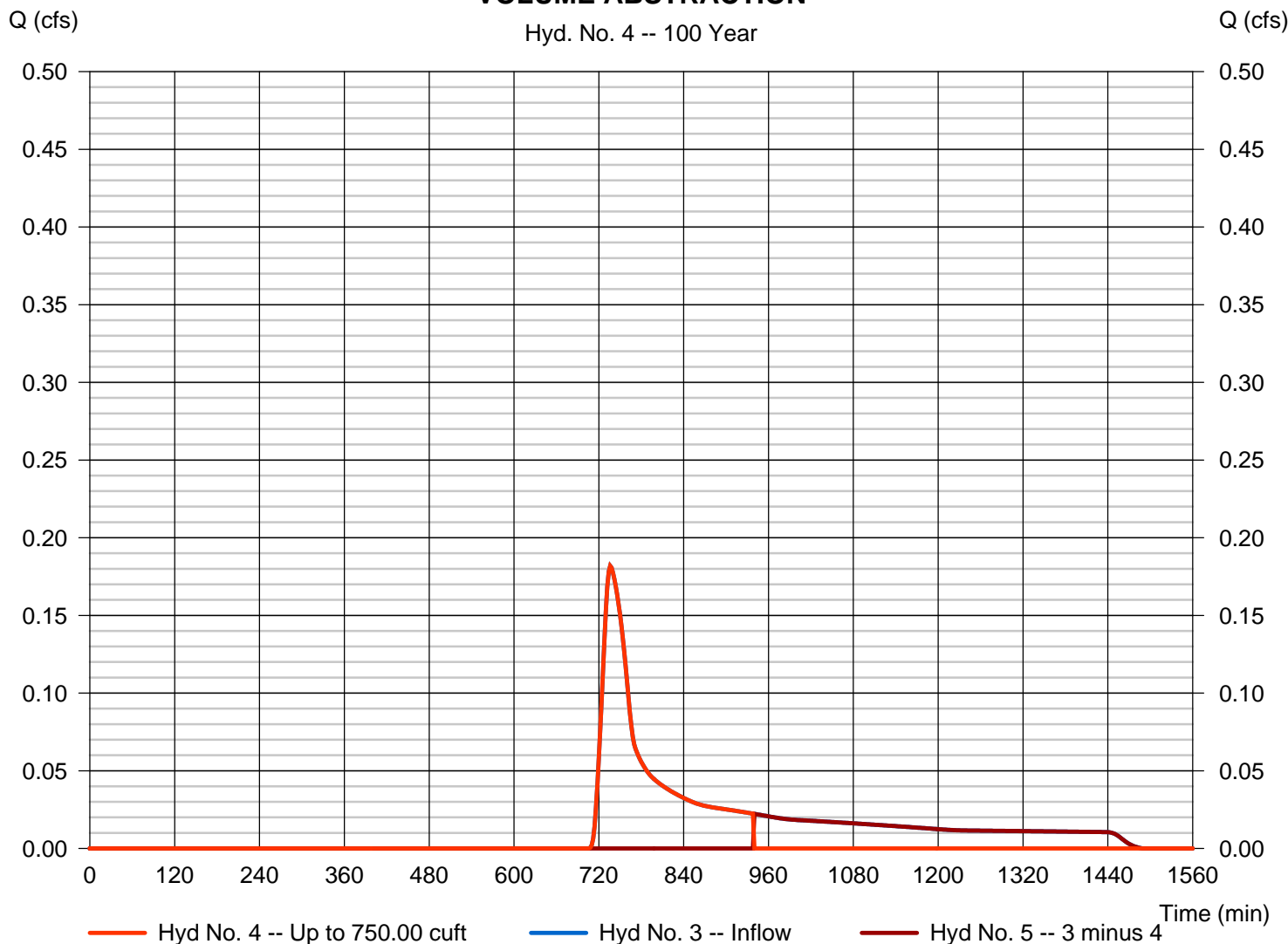
Thursday, 10 / 27 / 2016

Hyd. No. 4

VOLUME ABSTRACTION

Hydrograph type	= Diversion1	Peak discharge	= 0.182 cfs
Storm frequency	= 100 yrs	Time to peak	= 736 min
Time interval	= 2 min	Hyd. volume	= 753 cuft
Inflow hydrograph	= 3 - POST DET. DA 2	2nd diverted hyd.	= 5
Diversion method	= First Flush Volume	Volume Up To	= 750.00 cuft

VOLUME ABSTRACTION



Hydrograph Report

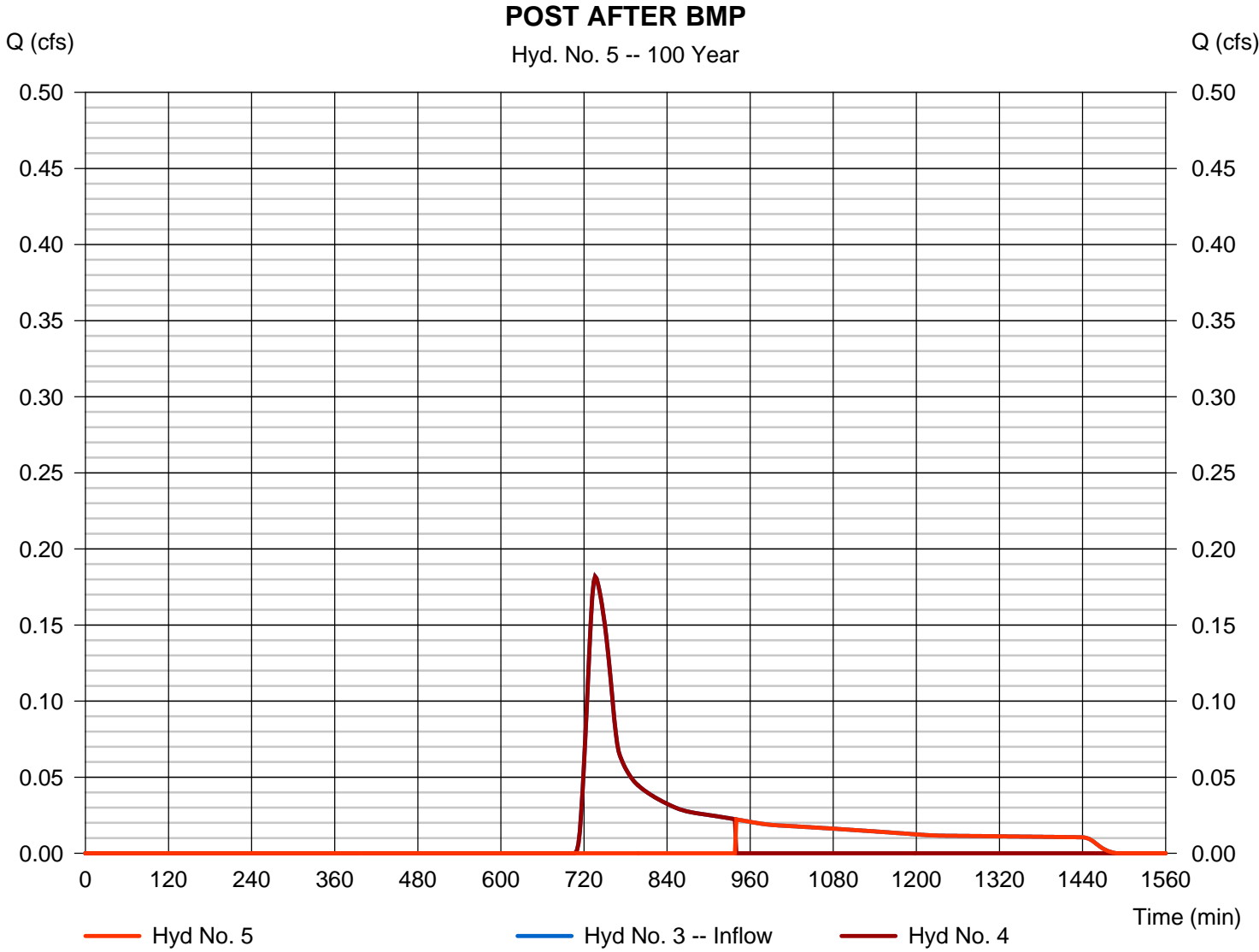
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Thursday, 10 / 27 / 2016

Hyd. No. 5

POST AFTER BMP

Hydrograph type	= Diversion2	Peak discharge	= 0.022 cfs
Storm frequency	= 100 yrs	Time to peak	= 940 min
Time interval	= 2 min	Hyd. volume	= 436 cuft
Inflow hydrograph	= 3 - POST DET. DA 2	2nd diverted hyd.	= 4
Diversion method	= First Flush Volume	Volume Up To	= 750.00 cuft



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Thursday, 10 / 27 / 2016

Hyd. No. 6

POST AT POI

Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 2 min
Inflow hyds. = 2, 5

Peak discharge = 0.050 cfs
Time to peak = 722 min
Hyd. volume = 1,014 cuft
Contrib. drain. area = 0.470 ac

