

Shade Valley

TETRA TECH, INC.

By: RH Date: 11/8/2016 Subject: Shade Valley Road
Checked By: JB Date: 11/11/2016 PCSM Design and Evaluation

PURPOSE:

The purpose of these calculations is to design a Post-Construction Stormwater Management (PCSM) Plan for the Shade Valley Road block valve site as part of the Sunoco Pipeline L.P. Pennsylvania Pipeline Project. The site is located within Tell Township, Huntingdon County, Pennsylvania. Permanent stormwater controls will be developed to satisfy PADEP requirements.

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

Huntingdon County does not have an approved Act 167 Stormwater Management Plan, therefore, the county has adopted the PADEP Chapter 102 regulations as their county-wide stormwater guidance.

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 three 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).

This site will utilize five infiltration berms to manage the two-year through 100-year peak rate increases. These BMPs will also help to increase the time of concentration for the drainage area encompassing the block valve.

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 1.9:1. The impervious loading ratio for Drainage Area 2 is 1.2:1.

The maximum Drainage Area loading ratio of 8:1 has been met in both drainage areas. The drainage area loading ratio for Drainage Area 1 is 5.7:1, and the drainage area loading ratio for Drainage Area 2 is 7.9:1.

Disturbed Area

To meet Standard Worksheet 10 guidelines, 90% of the disturbed area is contained by the proposed PCSM BMPs.

Karst Topography

Shade Valley Road block valve is located in an area of karst terrain. Several design principles were incorporated to minimize the risk of sinkholes to the maximum extent practicable, including reducing the proposed impervious area to the maximum extent practicable.

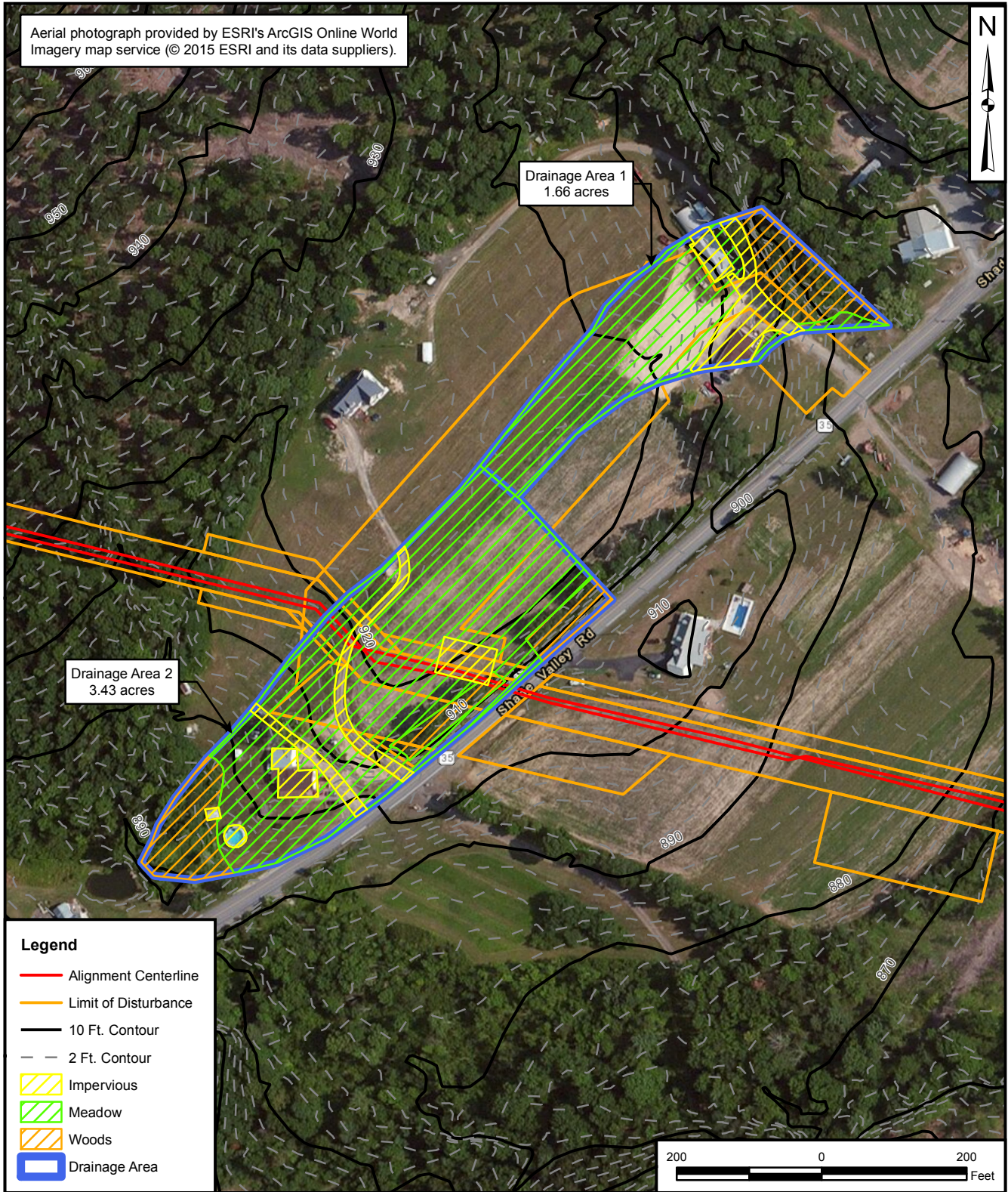
Stormwater runoff from the site is being spread out over a relatively large area. The site will achieve a 1.9:1 and 1.2:1 impervious loading ratio in Drainage Area 1 and Drainage Area 2, respectively, by directing stormwater runoff into infiltration berms. The infiltration berms will avoid concentrating stormwater runoff and will encourage relatively shallow and broad ponding areas. Additional post-construction inspection and

maintenance will be required onsite as documented in the Sinkhole Repair Plan in Attachment 2. In areas of known karst terrain, stormwater BMPs shall be inspected at regular intervals of at least once every quarter for the first two years following installation and then at regular periods thereafter. Inspections shall also be made after every storm event greater than 1 inch during the establishment period. Inspections shall consist of an examination of any noticeable subsidence, surface depressions, or sinkholes. Inspections shall include an evaluation of all inlet and outlet structures and document any areas to be cleaned, maintained, or repaired.

Special Protection Watershed

Shade Valley Road 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

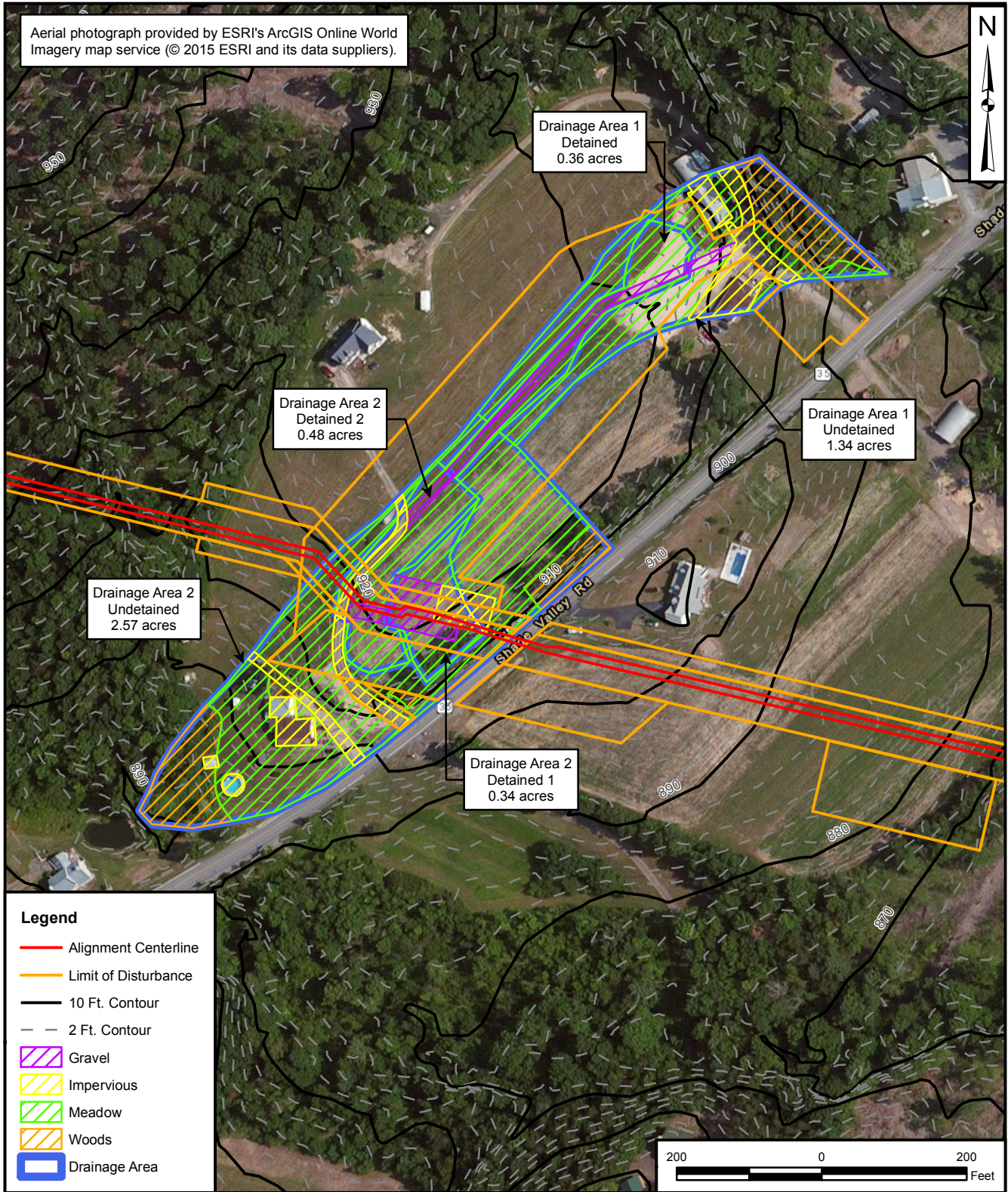
- Alignment Centerline
- Limit of Disturbance
- 10 Ft. Contour
- 2 Ft. Contour
- Impervious
- Meadow
- Woods
- Drainage Area



PRE-DEVELOPMENT DRAINAGE AREA MAP
SHADE VALLEY ROAD
PENNSYLVANIA PIPELINE PROJECT
SUNOCO LOGISTICS, L.P.
HUNTINGDON COUNTY, PENNSYLVANIA

| | |
|-------------------------------|-----|
| DRAWN BY: S. PAXTON 05/22/16 | |
| CHECKED BY: J. BRODY 11/16/16 | |
| APPROVED BY: | |
| CONTRACT NUMBER: 112IC05958 | |
| FIGURE NUMBER | REV |
| 1 | 0 |

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Legend

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



POST-DEVELOPMENT DRAINAGE AREA MAP
SHADE VALLEY ROAD
PENNSYLVANIA PIPELINE PROJECT
SUNOCO LOGISTICS, L.P.
HUNTINGDON COUNTY, PENNSYLVANIA

DRAWN BY: S. PAXTON 05/22/16
 CHECKED BY: J. BRODY 11/16/16

APPROVED BY:

CONTRACT NUMBER: 112IC05958

| | |
|---------------|-----|
| FIGURE NUMBER | REV |
| 2 | 0 |



NOAA Atlas 14, Volume 2, Version 3
Location name: Tell Twp, Pennsylvania, USA*
Latitude: 40.3137°, Longitude: -77.7529°
Elevation: 913.85 ft**
 * source: ESRI Maps
 ** source: USGS



POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

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

PF tabular

| PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)¹ | | | | | | | | | | |
|--|--|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|------------------------------|-----------------------------|
| Duration | Average recurrence interval (years) | | | | | | | | | |
| | 1 | 2 | 5 | 10 | 25 | 50 | 100 | 200 | 500 | 1000 |
| 5-min | 0.319 (0.280-0.365) | 0.380 (0.335-0.434) | 0.463 (0.406-0.528) | 0.528 (0.462-0.602) | 0.618 (0.539-0.702) | 0.689 (0.597-0.782) | 0.762 (0.657-0.863) | 0.841 (0.720-0.950) | 0.952 (0.807-1.07) | 1.04 (0.875-1.17) |
| 10-min | 0.496 (0.436-0.567) | 0.593 (0.523-0.678) | 0.720 (0.630-0.821) | 0.816 (0.714-0.929) | 0.945 (0.824-1.07) | 1.04 (0.905-1.19) | 1.15 (0.989-1.30) | 1.25 (1.07-1.42) | 1.40 (1.19-1.58) | 1.51 (1.27-1.71) |
| 15-min | 0.608 (0.534-0.695) | 0.725 (0.639-0.829) | 0.883 (0.774-1.01) | 1.00 (0.878-1.14) | 1.17 (1.02-1.33) | 1.29 (1.12-1.47) | 1.43 (1.23-1.61) | 1.56 (1.34-1.76) | 1.75 (1.48-1.97) | 1.89 (1.59-2.13) |
| 30-min | 0.804 (0.707-0.919) | 0.971 (0.856-1.11) | 1.21 (1.06-1.38) | 1.39 (1.22-1.59) | 1.65 (1.44-1.87) | 1.85 (1.60-2.10) | 2.06 (1.77-2.33) | 2.28 (1.95-2.57) | 2.59 (2.19-2.92) | 2.84 (2.39-3.19) |
| 60-min | 0.982 (0.863-1.12) | 1.19 (1.05-1.36) | 1.52 (1.33-1.73) | 1.77 (1.55-2.02) | 2.14 (1.86-2.43) | 2.44 (2.11-2.76) | 2.75 (2.37-3.12) | 3.09 (2.65-3.49) | 3.58 (3.03-4.04) | 3.98 (3.35-4.49) |
| 2-hr | 1.12 (0.977-1.29) | 1.35 (1.19-1.56) | 1.72 (1.51-1.99) | 2.03 (1.77-2.34) | 2.47 (2.14-2.84) | 2.85 (2.45-3.26) | 3.27 (2.79-3.72) | 3.73 (3.16-4.24) | 4.43 (3.72-5.02) | 5.02 (4.17-5.69) |
| 3-hr | 1.21 (1.06-1.40) | 1.46 (1.28-1.69) | 1.84 (1.62-2.14) | 2.16 (1.89-2.50) | 2.63 (2.29-3.03) | 3.03 (2.62-3.47) | 3.48 (2.99-3.98) | 3.98 (3.39-4.54) | 4.74 (3.98-5.38) | 5.39 (4.48-6.12) |
| 6-hr | 1.51 (1.35-1.73) | 1.82 (1.62-2.08) | 2.26 (2.01-2.58) | 2.65 (2.35-3.01) | 3.21 (2.82-3.63) | 3.69 (3.22-4.16) | 4.22 (3.66-4.74) | 4.81 (4.14-5.39) | 5.71 (4.86-6.38) | 6.48 (5.45-7.24) |
| 12-hr | 1.89 (1.68-2.13) | 2.26 (2.01-2.55) | 2.81 (2.48-3.15) | 3.27 (2.89-3.67) | 3.97 (3.48-4.44) | 4.58 (3.99-5.10) | 5.27 (4.55-5.85) | 6.04 (5.16-6.68) | 7.22 (6.09-7.97) | 8.25 (6.87-9.08) |
| 24-hr | 2.28 (2.07-2.52) | 2.74 (2.49-3.03) | 3.40 (3.08-3.76) | 3.96 (3.58-4.37) | 4.79 (4.31-5.27) | 5.52 (4.93-6.05) | 6.33 (5.62-6.92) | 7.23 (6.36-7.88) | 8.62 (7.48-9.36) | 9.82 (8.44-10.6) |
| 2-day | 2.64 (2.41-2.90) | 3.16 (2.89-3.48) | 3.93 (3.58-4.32) | 4.58 (4.16-5.03) | 5.57 (5.02-6.10) | 6.43 (5.75-7.02) | 7.41 (6.57-8.06) | 8.51 (7.47-9.23) | 10.2 (8.82-11.0) | 11.7 (9.97-12.6) |
| 3-day | 2.81 (2.58-3.08) | 3.36 (3.09-3.69) | 4.16 (3.81-4.56) | 4.83 (4.42-5.29) | 5.85 (5.31-6.39) | 6.73 (6.06-7.33) | 7.71 (6.90-8.39) | 8.81 (7.81-9.57) | 10.5 (9.17-11.4) | 11.9 (10.3-13.0) |
| 4-day | 2.98 (2.75-3.26) | 3.56 (3.29-3.90) | 4.39 (4.04-4.80) | 5.09 (4.67-5.56) | 6.13 (5.59-6.68) | 7.03 (6.38-7.64) | 8.01 (7.23-8.71) | 9.12 (8.15-9.91) | 10.8 (9.52-11.7) | 12.2 (10.7-13.3) |
| 7-day | 3.50 (3.24-3.80) | 4.17 (3.87-4.54) | 5.09 (4.71-5.52) | 5.84 (5.40-6.33) | 6.94 (6.38-7.51) | 7.86 (7.20-8.50) | 8.87 (8.07-9.59) | 9.96 (8.99-10.8) | 11.6 (10.3-12.5) | 13.0 (11.5-14.0) |
| 10-day | 4.03 (3.74-4.36) | 4.79 (4.45-5.19) | 5.75 (5.34-6.23) | 6.55 (6.07-7.08) | 7.69 (7.10-8.30) | 8.64 (7.94-9.32) | 9.66 (8.83-10.4) | 10.8 (9.77-11.6) | 12.4 (11.1-13.4) | 13.7 (12.2-14.8) |
| 20-day | 5.50 (5.17-5.87) | 6.48 (6.10-6.92) | 7.58 (7.12-8.08) | 8.45 (7.93-9.01) | 9.65 (9.04-10.3) | 10.6 (9.91-11.3) | 11.6 (10.8-12.4) | 12.6 (11.7-13.5) | 14.1 (13.0-15.0) | 15.3 (13.9-16.3) |
| 30-day | 6.83 (6.45-7.25) | 8.00 (7.56-8.51) | 9.21 (8.68-9.77) | 10.2 (9.56-10.8) | 11.4 (10.7-12.1) | 12.4 (11.7-13.2) | 13.5 (12.6-14.3) | 14.5 (13.5-15.4) | 15.9 (14.8-16.9) | 17.0 (15.7-18.1) |
| 45-day | 8.62 (8.17-9.12) | 10.1 (9.55-10.7) | 11.4 (10.8-12.1) | 12.5 (11.8-13.2) | 13.8 (13.1-14.6) | 14.9 (14.0-15.7) | 15.9 (14.9-16.8) | 16.9 (15.9-17.9) | 18.2 (17.1-19.3) | 19.3 (18.0-20.4) |
| 60-day | 10.3 (9.84-10.9) | 12.1 (11.5-12.7) | 13.6 (12.9-14.3) | 14.7 (13.9-15.4) | 16.1 (15.3-17.0) | 17.2 (16.3-18.1) | 18.3 (17.3-19.3) | 19.3 (18.3-20.4) | 20.7 (19.5-21.8) | 21.8 (20.4-23.0) |

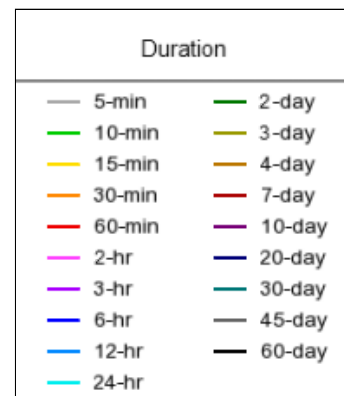
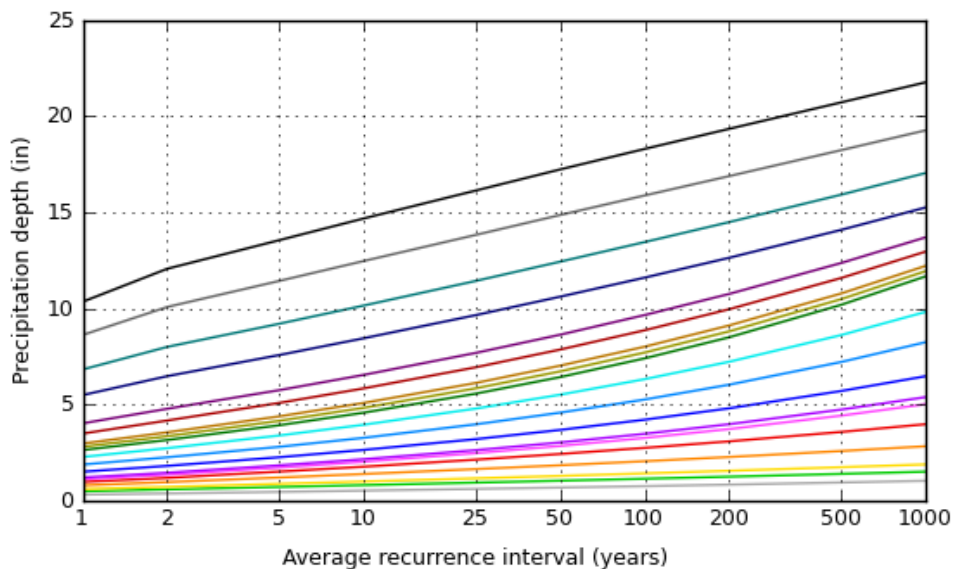
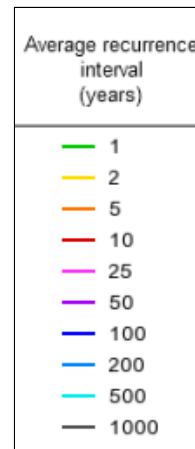
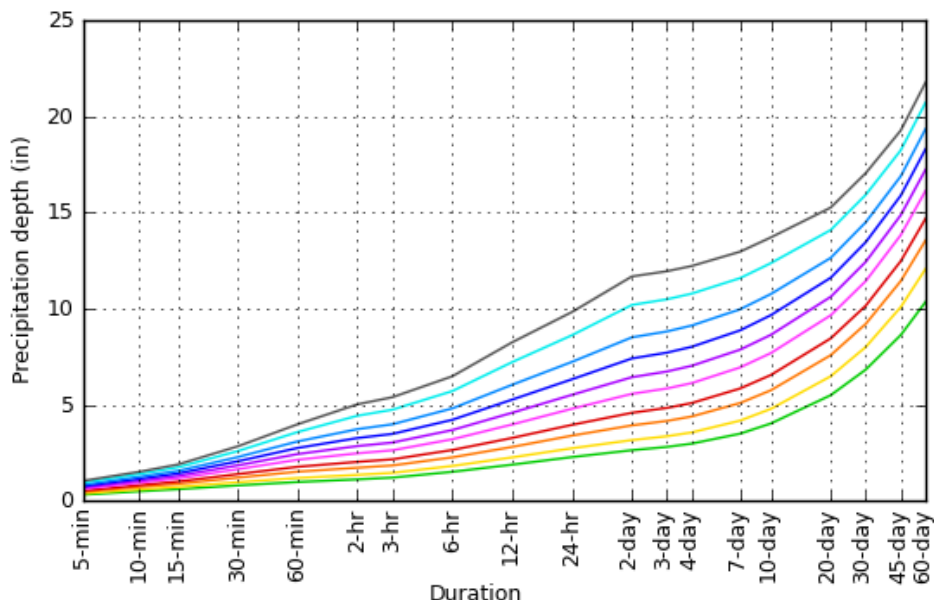
¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average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

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PF graphical

PDS-based depth-duration-frequency (DDF) curves

Latitude: 40.3137°, Longitude: -77.7529°

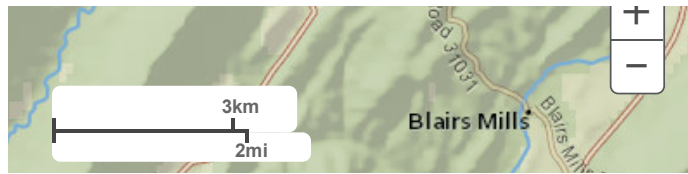


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Maps & aerials

Small scale terrain

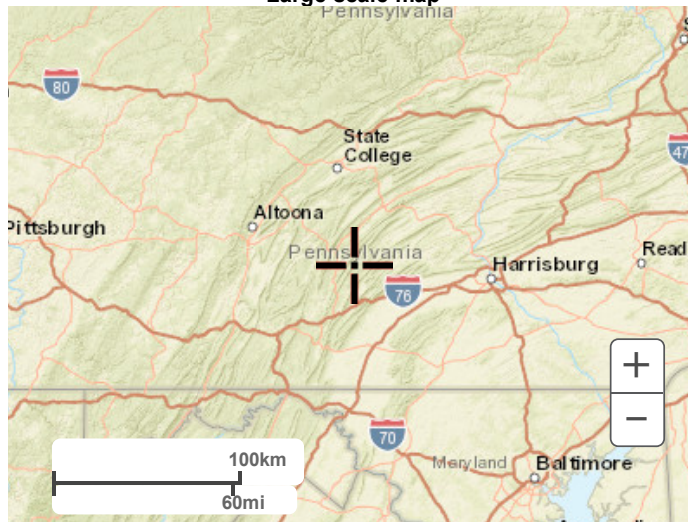




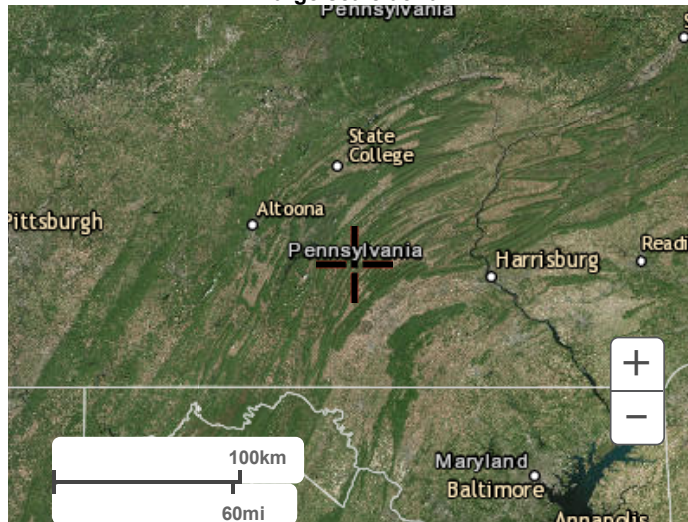
Large scale terrain



Large scale map



Large scale aerial



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WORKSHEET 1. GENERAL SITE INFORMATION

Date: November 17, 2016

Project Name: Shade Valley

Municipality: Tell

County: Huntingdon

Total Area (acres): DA1 - 1.66 acres (pre), 1.70 acres (post)

Major River Basin: Susquehanna River

Watershed: Juniata River

Sub Basin: Tuscarora Creek

Nearest Surface Water to Receive Runoff: George Creek

Chapter 93 - Designated Water Use: Cold Water Fishes (CWF)

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 - 0.04 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 | 0.04 | |
| Natural Drainage Ways | N/A | | |
| Steep Slopes, 15% - 25% | N/A | | |
| Steep Slopes, over 25% | N/A | | |
| Other: | | | |
| Other: | | | |
| TOTAL EXISTING: | | 0.04 | 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 |
| 1.07 | - | 0 | = | 1.07 |
| | | | | 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: Shade Valley - DA1
 Drainage Area: 1.66 acres (pre; 1.70 acres post)
 2-Year Rainfall: 2.74 in

Total Site Area: 1.03 acres (pre; 1.07 acres post)
 Protected Site Area: N/A acres
 Managed Site Area: 1.03 acres (pre; 1.07 acres post)

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) |
|----------------------------|-----------|---------------|-------------|----|------|------------|----------------------------|---|
| Meadow | B | 37,026 | 0.85 | 58 | 7.24 | 1.45 | 0.20 | 603 |
| Meadow | D | 3,049 | 0.07 | 78 | 2.82 | 0.56 | 0.95 | 241 |
| Impervious | - | 2,614 | 0.06 | 98 | 0.20 | 0.04 | 2.51 | 547 |
| Impervious - 20% as meadow | D | 436 | 0.01 | 78 | 2.82 | 0.56 | 0.95 | 34 |
| Woods | D | 1,742 | 0.04 | 77 | 2.99 | 0.60 | 0.89 | 130 |
| TOTAL: | | 44,867 | 1.03 | | | | | 1,555 |

Developed 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) |
|----------------------|-----------|---------------|-------------|----|------|------------|----------------------------|---|
| Meadow | B | 33,106 | 0.76 | 58 | 7.24 | 1.45 | 0.20 | 539 |
| Meadow | D | 4,356 | 0.10 | 78 | 2.82 | 0.56 | 0.95 | 344 |
| Gravel | B | 5,663 | 0.13 | 85 | 1.76 | 0.35 | 1.37 | 648 |
| Gravel | D | 436 | 0.01 | 91 | 0.99 | 0.20 | 1.83 | 66 |
| Impervious | D | 3,049 | 0.07 | 98 | 0.20 | 0.04 | 2.51 | 638 |
| Woods | D | 0 | 0.00 | 77 | 2.99 | 0.60 | 0.89 | 0 |
| TOTAL: | | 46,609 | 1.07 | | | | | 2,235 |

| | |
|--|------------|
| 2-Year Volume Increase (ft ³): | 680 |
|--|------------|

2-Year Volume Increase = Developed Conditions Runoff Volume - Existing Conditions Runoff Volume

- Runoff (in) = $Q = (P - 0.2S)^2 / (P + 0.8S)$ 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: Shade Valley DA1
 2-Year Rainfall: 2.74 in

RUNOFF TO BERM (DA 1 DETAINED)

| 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 | B | 5,314 | 0.12 | 85 | 1.76 | 0.35 | 1.37 | 608 |
| Meadow | B | 10,454 | 0.24 | 58 | 7.24 | 1.45 | 0.20 | 170 |
| TOTAL: | | 15,769 | 0.36 | | | | | 778 |

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: Shade Valley
 SUB-BASIN: _____

| | |
|---|-----|
| Required Control Volume (ft³) - from Worksheet 4: | 680 |
| 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> | 680 |

| 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 | 948 | 778 |
| 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): | | 778 |
| Structural Volume Requirement (ft³): | | 680 |
| DIFFERENCE: | | -98 |

VOLUME CREDIT DETERMINATION

- 1 Detained area runoff volume from calculation = 778 cf
- 2 Storage volume of the BMP = 3,081 cf
- 3 Infiltrated volume within 72 hours after the 2-yr/24-hr event
(Infiltration Rate/12) x Infiltration Area x 72 hrs = 778 cf

Potential infiltrated volume = 47,989 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 - DA1

POST CONSTRUCTION TC TO BMP (DETAINED TC) BEFORE ADJUSTMENT

4.2 MIN

STRUCTURAL VOLUME PROVIDED BY BMP

580 CF FOR 2-YR/24-HR EVENT
1,411 CF FOR 10-YR/24-HR EVENT
2,737 CF FOR 50-YR/24-HR EVENT
3,081 CF FOR 100-YR/24-HR EVENT

RATES OF RUNOFF TO THE BMP (FROM HYDRAFLOW REPORT)

| Storm Event | Q (CFS) |
|--------------|---------|
| 2 YR/24 HR | 0.259 |
| 10 YR/24 HR | 0.698 |
| 50 YR/24 HR | 1.368 |
| 100 YR/24 HR | 1.743 |

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 | 0.259 | 37.323 |
| 10 YR/24 HR | 0.698 | 33.691 |
| 50 YR/24 HR | 1.368 | 33.346 |
| 100 YR/24 HR | 1.743 | 29.461 |

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 | 0.259 | 37.323 | 41.523 |
| 10 YR/24 HR | 0.698 | 33.691 | 37.891 |
| 50 YR/24 HR | 1.368 | 33.346 | 37.546 |
| 100 YR/24 HR | 1.743 | 29.461 | 33.661 |

INFILTRATION BERM DEWATERING CALCULATION

SITE NAME: Shade Valley

DA 1

STORAGE VOLUME 3,081 CF
DESIGN INFILTRATION RATE 2.9 IN/HR BASED ON IT-D
INFILTRATION AREA 2,758 SF

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

DEWATERING TIME = 4.6 HOURS

WORKSHEET 1. GENERAL SITE INFORMATION

Date: November 11, 2016

Project Name: Shade Valley

Municipality: Tell

County: Huntingdon

Total Area (acres): DA2 - 3.43 acres (pre), 3.40 acres (post)

Major River Basin: Susquehanna River

Watershed: Juniata River

Sub Basin: Tuscarora Creek

Nearest Surface Water to Receive Runoff: George Creek

Chapter 93 - Designated Water Use: Cold Water Fishes (CWF)

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 - 0.09 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 | 0.09 | |
| Natural Drainage Ways | N/A | | |
| Steep Slopes, 15% - 25% | N/A | | |
| Steep Slopes, over 25% | N/A | | |
| Other: | | | |
| Other: | | | |
| TOTAL EXISTING: | | 0.09 | 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 |
| 1.78 | - | 0 | = | 1.78 |
| 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: Shade Valley - DA2
 Drainage Area: 3.43 acres (pre; 3.40 acres post)
 2-Year Rainfall: 2.74 in

Total Site Area: 1.77 acres (pre; 1.74 acres post)
 Protected Site Area: N/A acres
 Managed Site Area: 1.77 acres (pre; 1.74 acres post)

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) |
|----------------------------|-----------|---------------|-------------|----|------|------------|----------------------------|---|
| Meadow | B | 59,677 | 1.37 | 58 | 7.24 | 1.45 | 0.20 | 972 |
| Meadow | D | 4,356 | 0.10 | 78 | 2.82 | 0.56 | 0.95 | 344 |
| Impervious | - | 7,405 | 0.17 | 98 | 0.20 | 0.04 | 2.51 | 1,549 |
| Impervious - 20% as meadow | D | 1,742 | 0.04 | 78 | 2.82 | 0.56 | 0.95 | 138 |
| Woods | B | 0 | 0.00 | 55 | 8.18 | 1.64 | 0.13 | 0 |
| Woods | D | 3,920 | 0.09 | 77 | 2.99 | 0.60 | 0.89 | 292 |
| TOTAL: | | 77,101 | 1.77 | | | | | 3,295 |

Developed 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) |
|----------------------|-----------|---------------|-------------|----|------|------------|----------------------------|---|
| Meadow | B | 50,965 | 1.17 | 58 | 7.24 | 1.45 | 0.20 | 830 |
| Meadow | D | 8,276 | 0.19 | 78 | 2.82 | 0.56 | 0.95 | 654 |
| Impervious | - | 9,148 | 0.21 | 98 | 0.20 | 0.04 | 2.51 | 1,913 |
| Impervious - Gravel | B | 7,405 | 0.17 | 85 | 1.76 | 0.35 | 1.37 | 847 |
| Impervious - Gravel | D | 0 | 0.00 | 91 | 0.99 | 0.20 | 1.83 | 0 |
| TOTAL: | | 75,794 | 1.74 | | | | | 4,244 |

| | |
|--|------------|
| 2-Year Volume Increase (ft ³): | 949 |
|--|------------|

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 5. Structural BMP Volume Credits

PROJECT: Shade Valley
 SUB-BASIN: _____

| | |
|---|-----|
| Required Control Volume (ft³) - from Worksheet 4: | 949 |
| 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> | 949 |

| 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 | 1,423 | 1,642 |
| 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): | | 1,642 |
| Structural Volume Requirement (ft³): | | 949 |
| DIFFERENCE: | | -693 |

VOLUME CREDIT DETERMINATION - BERM A

- 1 Detained area runoff volume from Hydraflow = 1,001 cf
- 2 Storage volume of the BMP = 2,704 cf
- 3 Infiltrated volume within 72 hours after the 2-yr/24-hr event
(Infiltration Rate/12) x Infiltration Area x 72 hrs = 1001 cf

Potential infiltrated volume = 32,789 cf. Since this is greater than the storage volume, only the storage volume can be used and assumed to infiltrate within 72 hours.

VOLUME CREDIT DETERMINATION - BERM B

- 1 Detained area runoff volume from Hydraflow = 641 cf
- 2 Storage volume of the BMP = 2,530 cf
- 3 Infiltrated volume within 72 hours after the 2-yr/24-hr event
(Infiltration Rate/12) x Infiltration Area x 72 hrs = 641 cf

Potential infiltrated volume = 11,567 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 A

POST CONSTRUCTION TC TO BMP (DETAINED TC) BEFORE ADJUSTMENT

9.7 MIN

STRUCTURAL VOLUME PROVIDED BY BMP

1,001 CF FOR 2-YR/24-HR EVENT
2,079 CF FOR 10-YR/24-HR EVENT
2,704 CF FOR ALL OTHER STORM EVENTS

RATES OF RUNOFF TO THE BMP (FROM HYDRAFLOW REPORT)

| Storm Event | Q (CFS) |
|--------------|---------|
| 2 YR/24 HR | 0.431 |
| 10 YR/24 HR | 0.909 |
| 50 YR/24 HR | 1.598 |
| 100 YR/24 HR | 1.975 |

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 | 0.431 | 38.708 |
| 10 YR/24 HR | 0.909 | 38.119 |
| 50 YR/24 HR | 1.598 | 28.202 |
| 100 YR/24 HR | 1.975 | 22.819 |

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 | 0.431 | 38.708 | 48.408 |
| 10 YR/24 HR | 0.909 | 38.119 | 47.819 |
| 50 YR/24 HR | 1.598 | 28.202 | 37.902 |
| 100 YR/24 HR | 1.975 | 22.819 | 32.519 |

TIME OF CONCENTRATION ADJUSTMENT - BERM B

POST CONSTRUCTION TC TO BMP (DETAINED TC) BEFORE ADJUSTMENT

3.4 MIN

STRUCTURAL VOLUME PROVIDED BY BMP

641 CF FOR 2-YR/24-HR EVENT
1,642 CF FOR 10-YR/24-HR EVENT
2,530 CF FOR ALL OTHER EVENTS

RATES OF RUNOFF TO THE BMP (FROM HYDRAFLOW REPORT)

| Storm Event | Q (CFS) |
|--------------|---------|
| 2 YR/24 HR | 0.268 |
| 10 YR/24 HR | 0.804 |
| 50 YR/24 HR | 1.641 |
| 100 YR/24 HR | 2.115 |

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 | 0.268 | 39.863 |
| 10 YR/24 HR | 0.804 | 34.038 |
| 50 YR/24 HR | 1.641 | 25.696 |
| 100 YR/24 HR | 2.115 | 19.937 |

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 | 0.268 | 39.863 | 43.263 |
| 10 YR/24 HR | 0.804 | 34.038 | 37.438 |
| 50 YR/24 HR | 1.641 | 25.696 | 29.096 |
| 100 YR/24 HR | 2.115 | 19.937 | 23.337 |

INFILTRATION BERM DEWATERING CALCULATION

SITE NAME: Shade Valley

BERM A

DA 2

STORAGE VOLUME 2,704 CF
DESIGN INFILTRATION RATE 2.3 IN/HR BASED ON IT-02 AND IT-A
INFILTRATION AREA 2,376 SF

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

DEWATERING TIME = 5.9 HOURS

INFILTRATION BERM DEWATERING CALCULATION

SITE NAME: Shade Valley

BERM B

DA 2

STORAGE VOLUME 2,530 CF
DESIGN INFILTRATION RATE 0.9 IN/HR BASED ON IT-01 AND IT-B
INFILTRATION AREA 2,142 SF

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

DEWATERING TIME = 15.7 HOURS

Worksheet for Circular Pipe - 1

Project Description

| | |
|-----------------|--------------------|
| Friction Method | Manning Formula |
| Solve For | Full Flow Capacity |

Input Data

| | | |
|-----------------------|---------|--------------------|
| Roughness Coefficient | 0.012 | |
| Channel Slope | 0.06000 | ft/ft |
| Normal Depth | 0.25 | ft |
| Diameter | 0.25 | ft |
| Discharge | 0.23 | ft ³ /s |

Results

| | | |
|-------------------|-------------|--------------------|
| Discharge | 0.23 | 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 | 0.25 | ft |
| Percent Full | 100.0 | % |
| Critical Slope | 0.05379 | ft/ft |
| Velocity | 4.78 | ft/s |
| Velocity Head | 0.35 | ft |
| Specific Energy | 0.60 | ft |
| Froude Number | 0.00 | |
| Maximum Discharge | 0.25 | ft ³ /s |
| Discharge Full | 0.23 | ft ³ /s |
| Slope Full | 0.06000 | 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 | % |

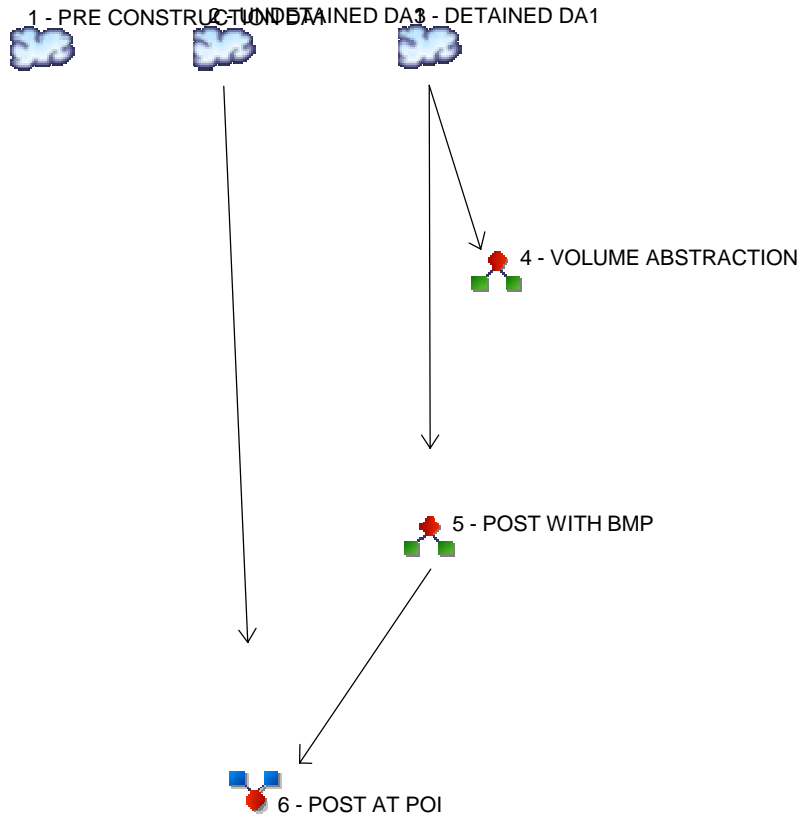
Worksheet for Circular Pipe - 1

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 | 0.25 | ft |
| Channel Slope | 0.06000 | ft/ft |
| Critical Slope | 0.05379 | 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 CONSTRUCTION DA1 |
| 2 | SCS Runoff UNDETAINED DA1 |
| 3 | SCS Runoff DETAINED DA1 |
| 4 | Diversion1 VOLUME ABSTRACTION |
| 5 | Diversion2 POST WITH 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 | ----- | ----- | 1.210 | ----- | ----- | 3.035 | ----- | 5.782 | 7.344 | PRE CONSTRUCTION DA1 |
| 2 | SCS Runoff | ----- | ----- | 0.970 | ----- | ----- | 2.432 | ----- | 4.632 | 5.884 | UNDETAINED DA1 |
| 3 | SCS Runoff | ----- | ----- | 0.259 | ----- | ----- | 0.698 | ----- | 1.368 | 1.743 | DETAINED DA1 |
| 4 | Diversion1 | 3 | ----- | 0.259 | ----- | ----- | 0.698 | ----- | 1.368 | 1.743 | VOLUME ABSTRACTION |
| 5 | Diversion2 | 3 | ----- | 0.000 | ----- | ----- | 0.000 | ----- | 0.000 | 0.027 | POST WITH BMP |
| 6 | Combine | 2, 5 | ----- | 0.970 | ----- | ----- | 2.432 | ----- | 4.632 | 5.884 | 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 | 1.210 | 2 | 722 | 3,571 | ----- | ----- | ----- | PRE CONSTRUCTION DA1 | |
| 2 | SCS Runoff | 0.970 | 2 | 722 | 2,861 | ----- | ----- | ----- | UNDETAINED DA1 | |
| 3 | SCS Runoff | 0.259 | 2 | 718 | 580 | ----- | ----- | ----- | DETAINED DA1 | |
| 4 | Diversion1 | 0.259 | 2 | 718 | 580 | 3 | ----- | ----- | VOLUME ABSTRACTION | |
| 5 | Diversion2 | 0.000 | 2 | n/a | 0 | 3 | ----- | ----- | POST WITH BMP | |
| 6 | Combine | 0.970 | 2 | 722 | 2,861 | 2, 5 | ----- | ----- | POST AT POI | |
| Shade Valley DA1.gpw | | | | | Return Period: 2 Year | | | Thursday, 11 / 17 / 2016 | | |

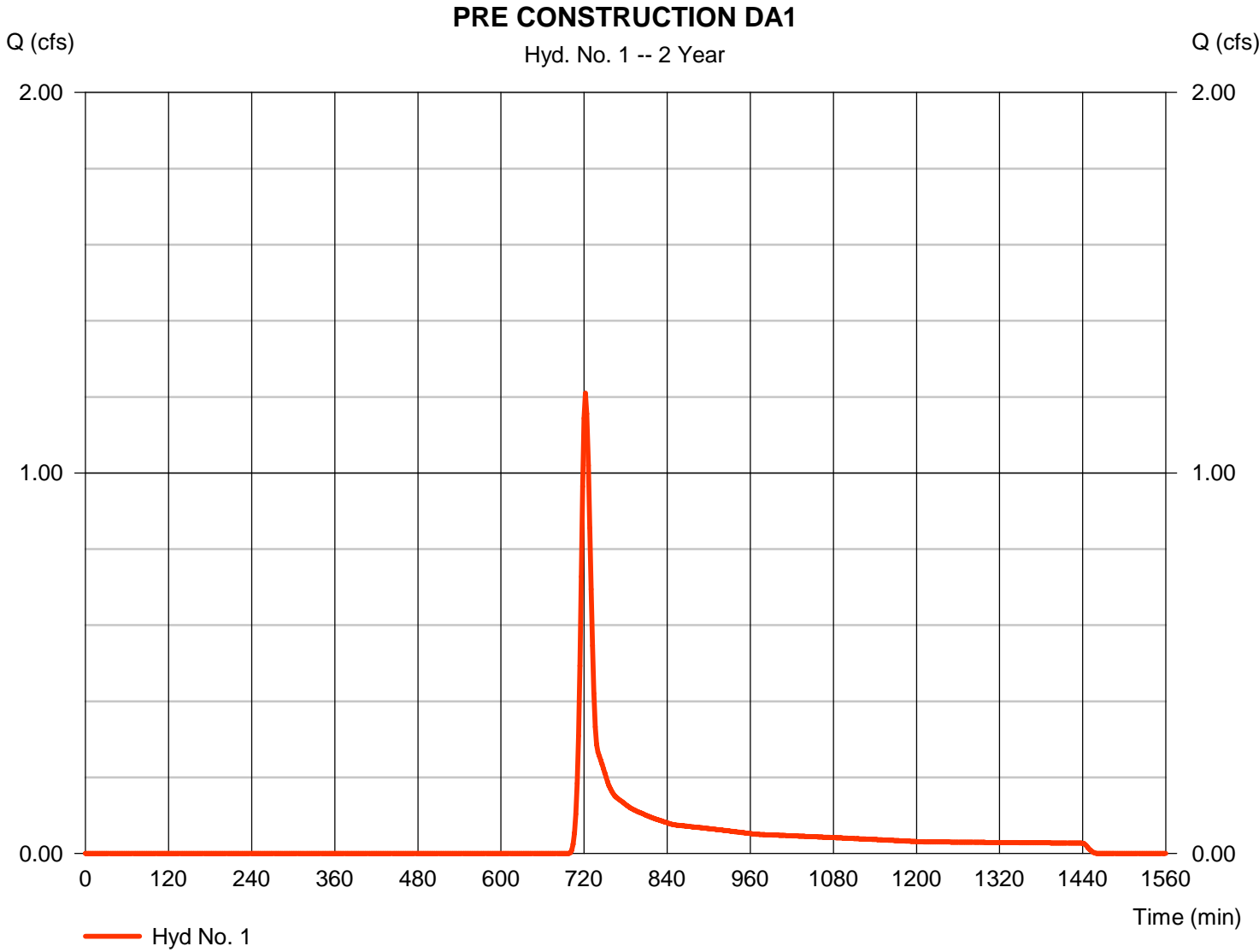
Hydrograph Report

Hyd. No. 1

PRE CONSTRUCTION DA1

| | | | |
|-----------------|--------------|--------------------|--------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 1.210 cfs |
| Storm frequency | = 2 yrs | Time to peak | = 722 min |
| Time interval | = 2 min | Hyd. volume | = 3,571 cuft |
| Drainage area | = 1.660 ac | Curve number | = 70* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = TR55 | Time of conc. (Tc) | = 11.10 min |
| Total precip. | = 2.74 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = + (0.320 x 77) + (0.890 x 58) + (0.170 x 78) + (0.280 x 98)] / 1.660



TR55 Tc Worksheet

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

Hyd. No. 1

PRE CONSTRUCTION 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) | = 2.74 | 0.00 | 0.00 | |
| Land slope (%) | = 2.00 | 0.00 | 0.00 | |
| Travel Time (min) | = 8.86 | + 0.00 | + 0.00 | = 8.86 |
| Shallow Concentrated Flow | | | | |
| Flow length (ft) | = 572.00 | 0.00 | 0.00 | |
| Watercourse slope (%) | = 7.20 | 0.00 | 0.00 | |
| Surface description | = Unpaved | Paved | Paved | |
| Average velocity (ft/s) | =4.33 | 0.00 | 0.00 | |
| Travel Time (min) | = 2.20 | + 0.00 | + 0.00 | = 2.20 |
| 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 | = 0.000 | 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 | | | | 11.10 min |

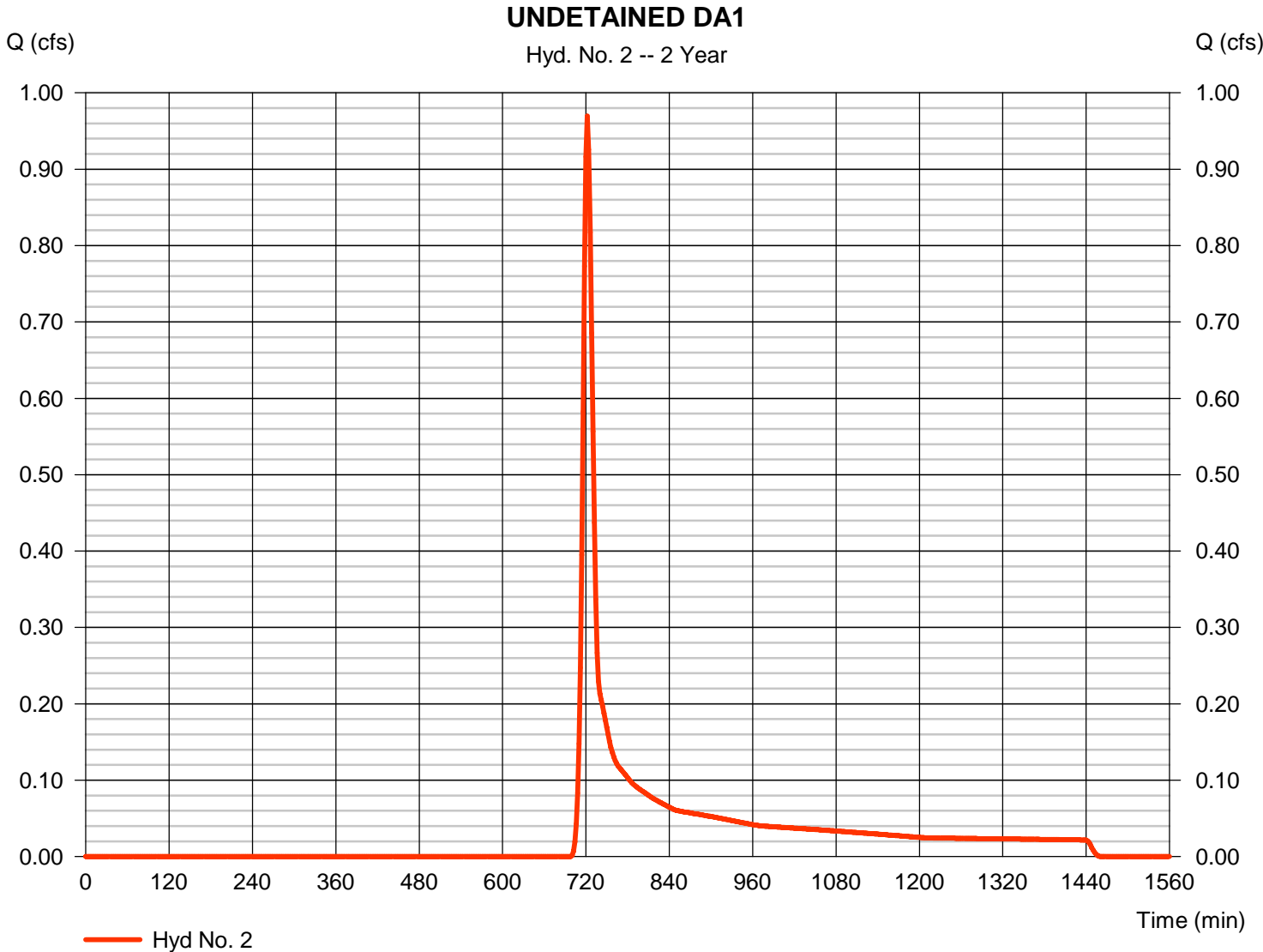
Hydrograph Report

Hyd. No. 2

UNDETAINED DA1

| | | | |
|-----------------|--------------|--------------------|--------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 0.970 cfs |
| Storm frequency | = 2 yrs | Time to peak | = 722 min |
| Time interval | = 2 min | Hyd. volume | = 2,861 cuft |
| Drainage area | = 1.330 ac | Curve number | = 70* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = User | Time of conc. (Tc) | = 11.30 min |
| Total precip. | = 2.74 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = [(0.580 x 58) + (0.190 x 78) + (0.270 x 98) + (0.010 x 85) + (0.010 x 91) + (0.270 x 77)] / 1.330



Hydrograph Report

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

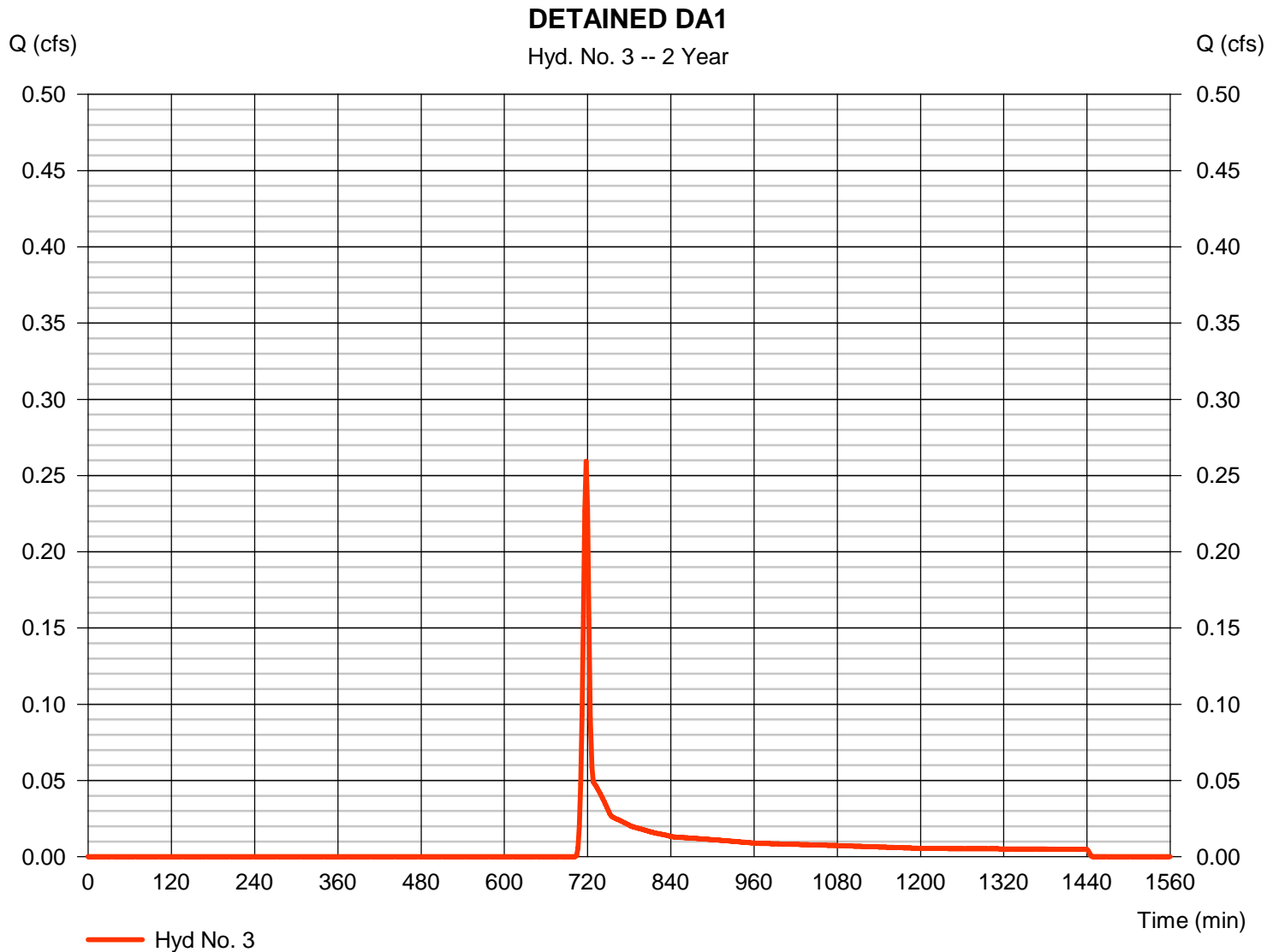
Thursday, 11 / 17 / 2016

Hyd. No. 3

DETAINED DA1

| | | | |
|-----------------|--------------|--------------------|-------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 0.259 cfs |
| Storm frequency | = 2 yrs | Time to peak | = 718 min |
| Time interval | = 2 min | Hyd. volume | = 580 cuft |
| Drainage area | = 0.370 ac | Curve number | = 67* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = TR55 | Time of conc. (Tc) | = 4.20 min |
| Total precip. | = 2.74 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = [(0.120 x 85) + (0.250 x 58)] / 0.370



TR55 Tc Worksheet

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

Hyd. No. 3

DETAINED DA1

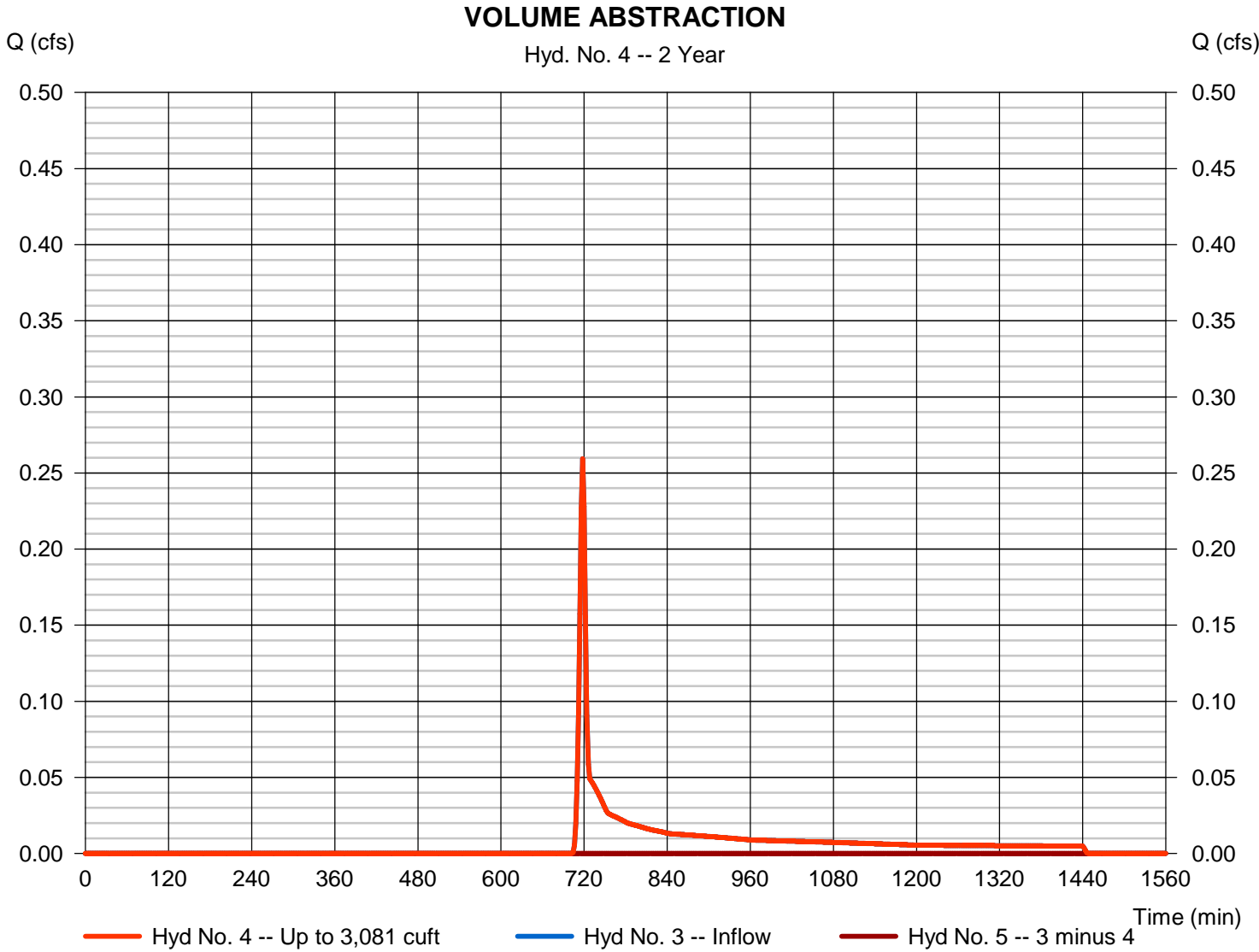
| <u>Description</u> | <u>A</u> | | <u>B</u> | | <u>C</u> | | <u>Totals</u> |
|------------------------------------|---------------|----------|-------------|----------|-------------|----------|-----------------|
| Sheet Flow | | | | | | | |
| Manning's n-value | = 0.240 | | 0.011 | | 0.011 | | |
| Flow length (ft) | = 18.0 | | 0.0 | | 0.0 | | |
| Two-year 24-hr precip. (in) | = 2.74 | | 0.00 | | 0.00 | | |
| Land slope (%) | = 5.60 | | 0.00 | | 0.00 | | |
| Travel Time (min) | = 2.59 | + | 0.00 | + | 0.00 | = | 2.59 |
| Shallow Concentrated Flow | | | | | | | |
| Flow length (ft) | = 421.00 | | 0.00 | | 0.00 | | |
| Watercourse slope (%) | = 4.80 | | 0.00 | | 0.00 | | |
| Surface description | = Paved | | Paved | | Paved | | |
| Average velocity (ft/s) | =4.45 | | 0.00 | | 0.00 | | |
| Travel Time (min) | = 1.58 | + | 0.00 | + | 0.00 | = | 1.58 |
| 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 | | | | | | | 4.20 min |

Hydrograph Report

Hyd. No. 4

VOLUME ABSTRACTION

| | | | |
|-------------------|----------------------|-------------------|--------------|
| Hydrograph type | = Diversion1 | Peak discharge | = 0.259 cfs |
| Storm frequency | = 2 yrs | Time to peak | = 718 min |
| Time interval | = 2 min | Hyd. volume | = 580 cuft |
| Inflow hydrograph | = 3 - DETAINED DA1 | 2nd diverted hyd. | = 5 |
| Diversion method | = First Flush Volume | Volume Up To | = 3,081 cuft |



Hydrograph Report

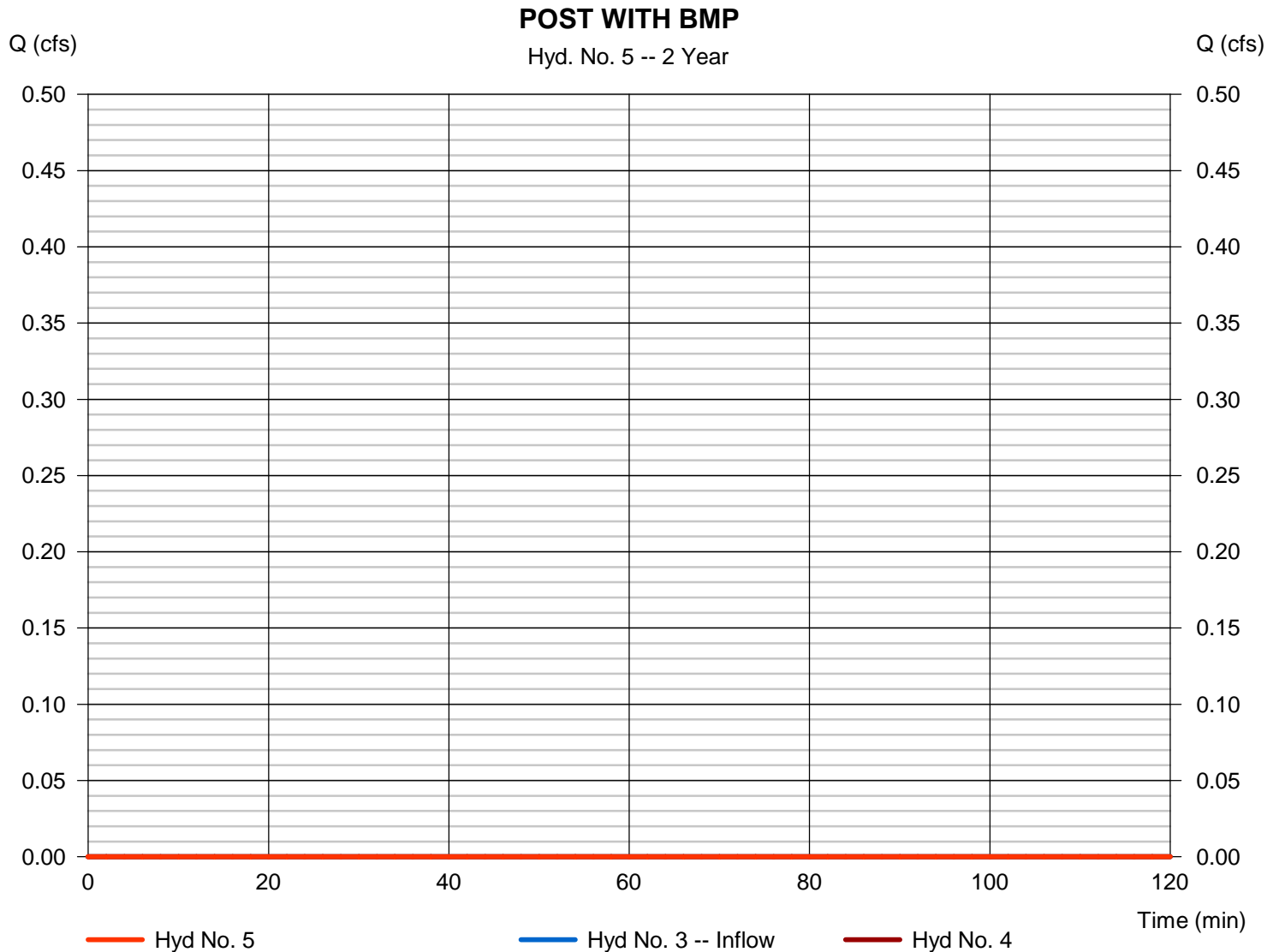
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Thursday, 11 / 17 / 2016

Hyd. No. 5

POST WITH 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 - DETAINED DA1 | 2nd diverted hyd. | = 4 |
| Diversion method | = First Flush Volume | Volume Up To | = 3,081 cuft |



Hydrograph Report

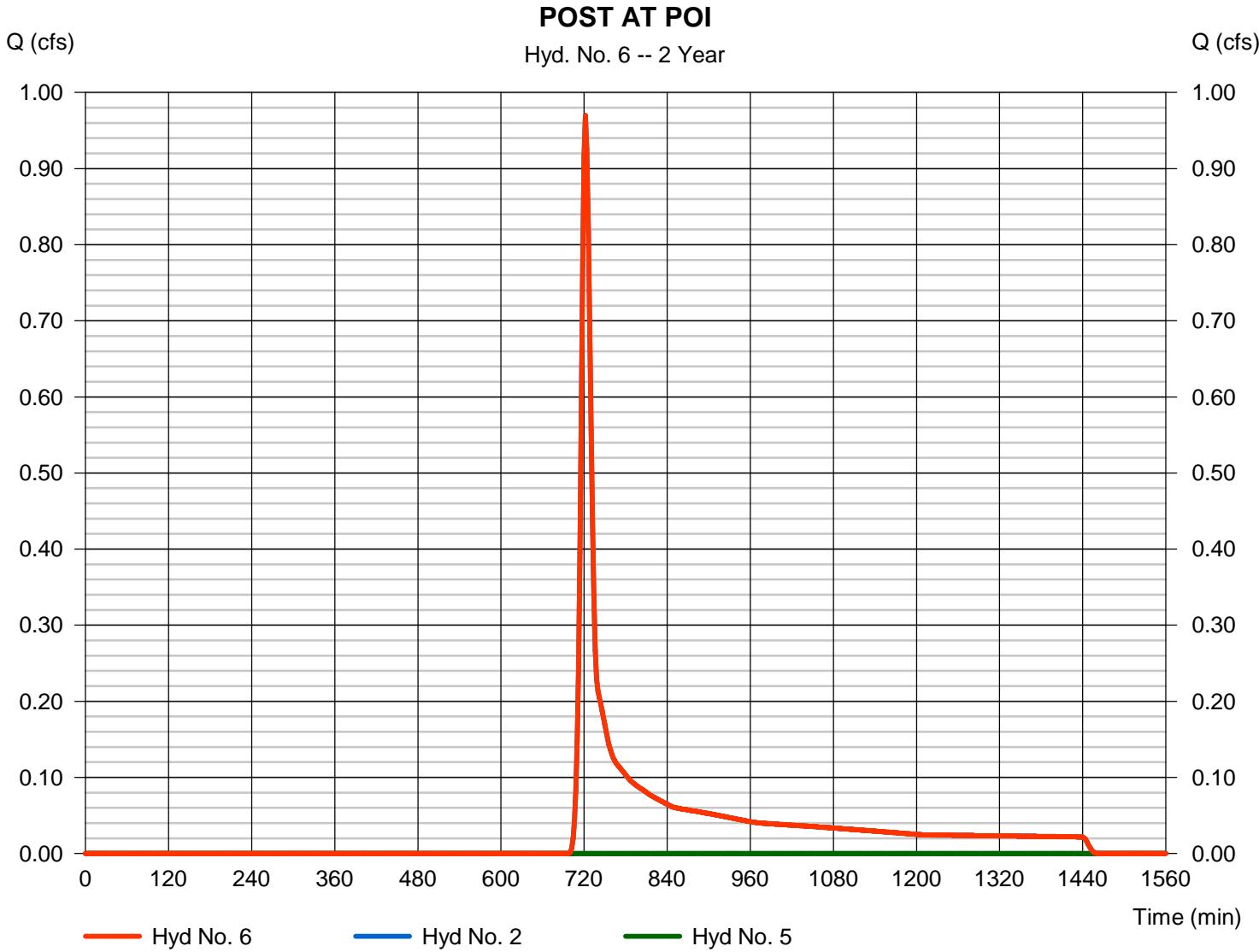
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Thursday, 11 / 17 / 2016

Hyd. No. 6

POST AT POI

| | | | |
|-----------------|-----------|----------------------|--------------|
| Hydrograph type | = Combine | Peak discharge | = 0.970 cfs |
| Storm frequency | = 2 yrs | Time to peak | = 722 min |
| Time interval | = 2 min | Hyd. volume | = 2,861 cuft |
| Inflow hyds. | = 2, 5 | Contrib. drain. area | = 1.330 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 | 3.035 | 2 | 722 | 8,097 | ----- | ----- | ----- | PRE CONSTRUCTION DA1 | |
| 2 | SCS Runoff | 2.432 | 2 | 722 | 6,488 | ----- | ----- | ----- | UNDETAINED DA1 | |
| 3 | SCS Runoff | 0.698 | 2 | 718 | 1,411 | ----- | ----- | ----- | DETAINED DA1 | |
| 4 | Diversion1 | 0.698 | 2 | 718 | 1,411 | 3 | ----- | ----- | VOLUME ABSTRACTION | |
| 5 | Diversion2 | 0.000 | 2 | n/a | 0 | 3 | ----- | ----- | POST WITH BMP | |
| 6 | Combine | 2.432 | 2 | 722 | 6,488 | 2, 5 | ----- | ----- | POST AT POI | |
| Shade Valley DA1.gpw | | | | | Return Period: 10 Year | | | Thursday, 11 / 17 / 2016 | | |

Hydrograph Report

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

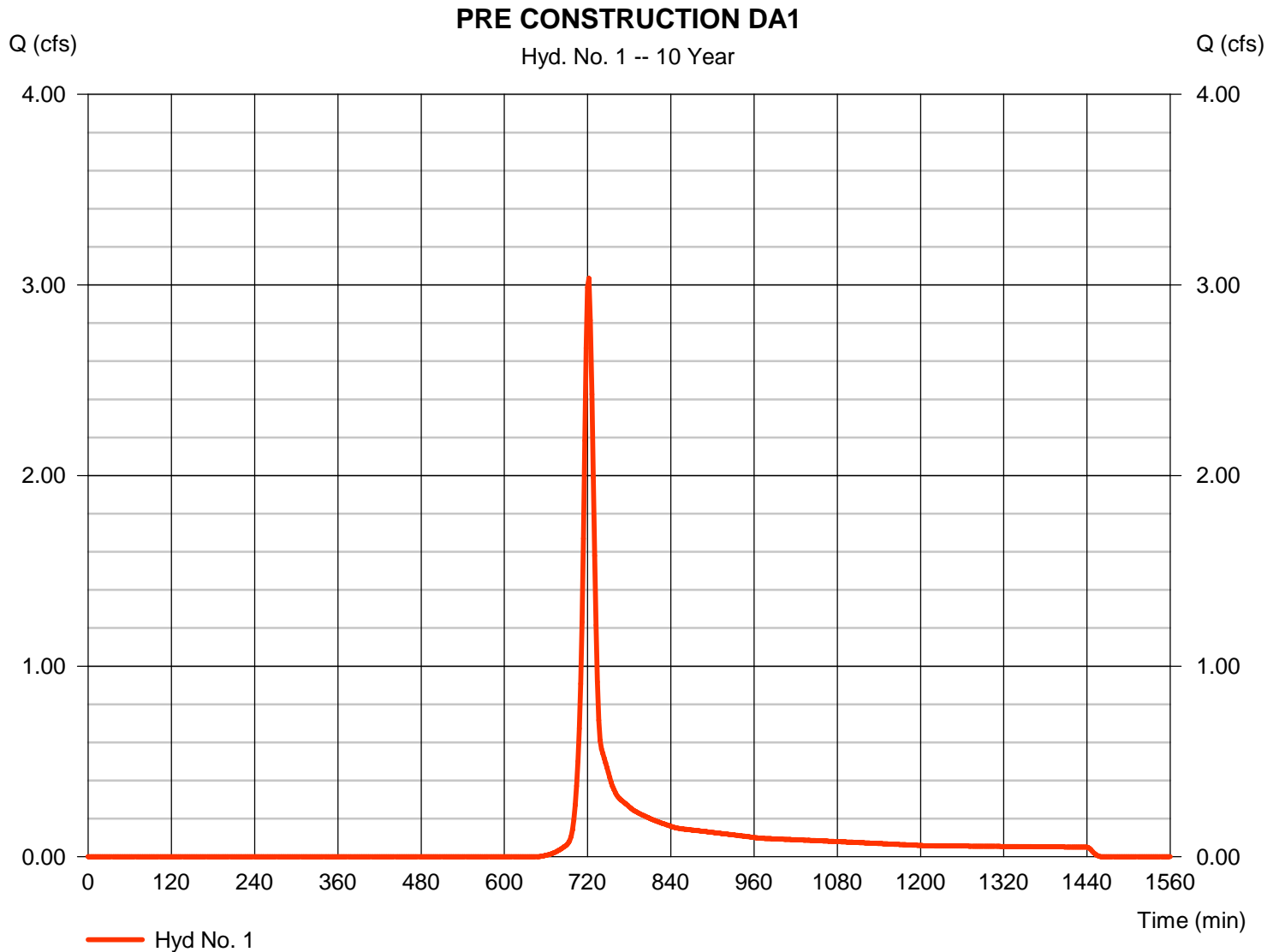
Thursday, 11 / 17 / 2016

Hyd. No. 1

PRE CONSTRUCTION DA1

| | | | |
|-----------------|--------------|--------------------|--------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 3.035 cfs |
| Storm frequency | = 10 yrs | Time to peak | = 722 min |
| Time interval | = 2 min | Hyd. volume | = 8,097 cuft |
| Drainage area | = 1.660 ac | Curve number | = 70* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = TR55 | Time of conc. (Tc) | = 11.10 min |
| Total precip. | = 3.96 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = + (0.320 x 77) + (0.890 x 58) + (0.170 x 78) + (0.280 x 98)] / 1.660



Hydrograph Report

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

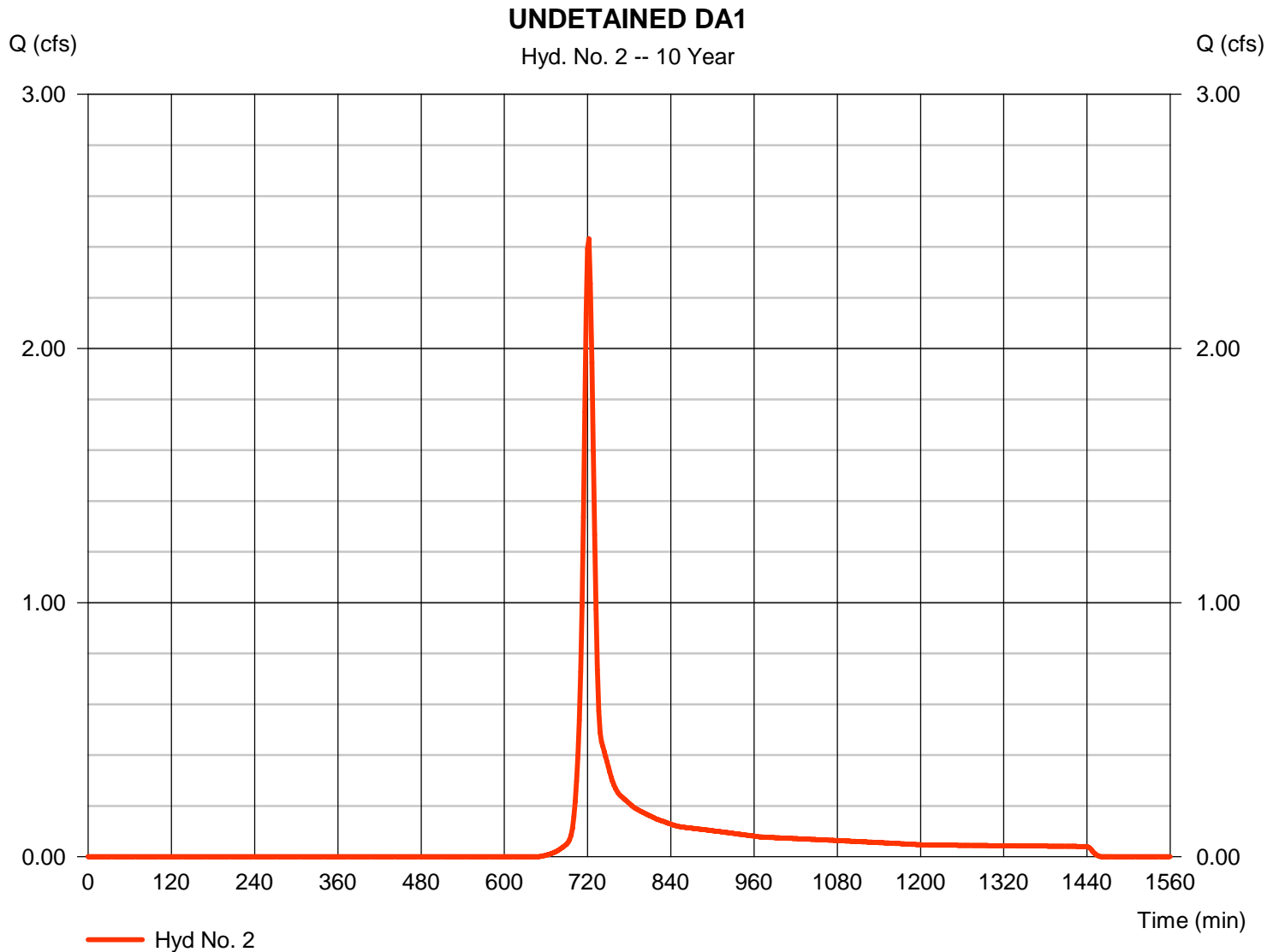
Thursday, 11 / 17 / 2016

Hyd. No. 2

UNDETAINED DA1

| | | | |
|-----------------|--------------|--------------------|--------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 2.432 cfs |
| Storm frequency | = 10 yrs | Time to peak | = 722 min |
| Time interval | = 2 min | Hyd. volume | = 6,488 cuft |
| Drainage area | = 1.330 ac | Curve number | = 70* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = User | Time of conc. (Tc) | = 11.30 min |
| Total precip. | = 3.96 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = [(0.580 x 58) + (0.190 x 78) + (0.270 x 98) + (0.010 x 85) + (0.010 x 91) + (0.270 x 77)] / 1.330



Hydrograph Report

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

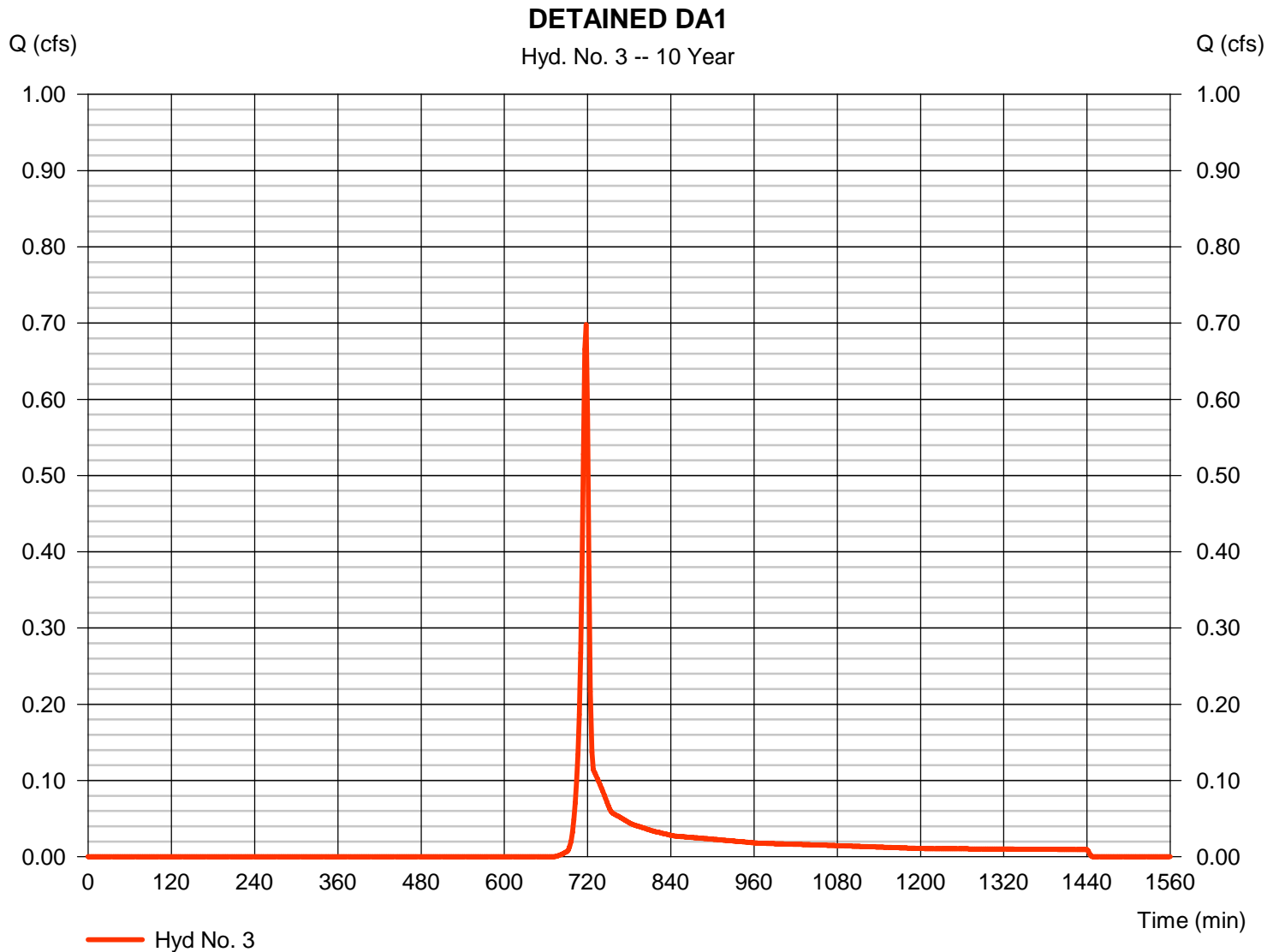
Thursday, 11 / 17 / 2016

Hyd. No. 3

DETAINED DA1

| | | | |
|-----------------|--------------|--------------------|--------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 0.698 cfs |
| Storm frequency | = 10 yrs | Time to peak | = 718 min |
| Time interval | = 2 min | Hyd. volume | = 1,411 cuft |
| Drainage area | = 0.370 ac | Curve number | = 67* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = TR55 | Time of conc. (Tc) | = 4.20 min |
| Total precip. | = 3.96 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = [(0.120 x 85) + (0.250 x 58)] / 0.370



Hydrograph Report

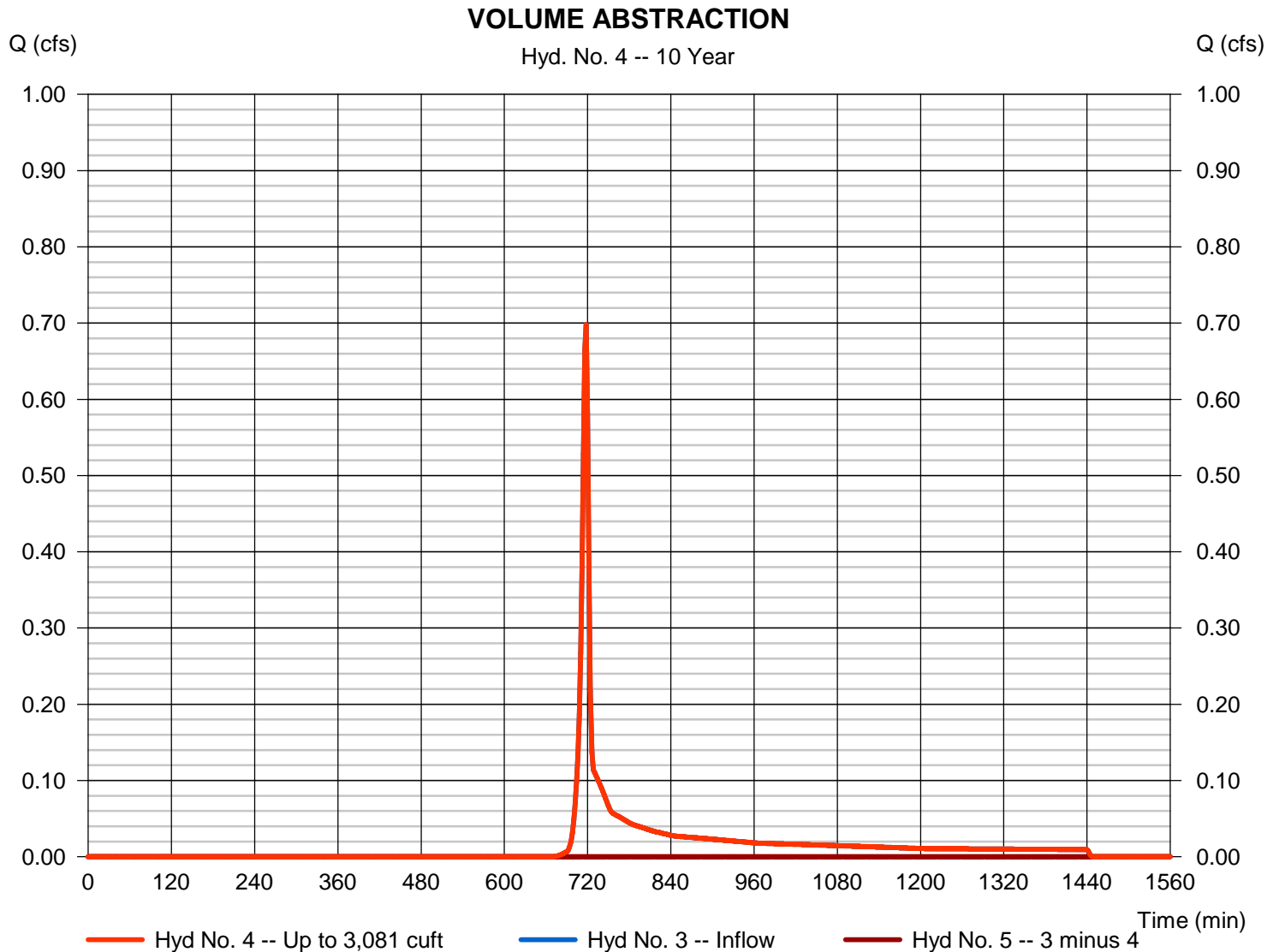
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Thursday, 11 / 17 / 2016

Hyd. No. 4

VOLUME ABSTRACTION

| | | | |
|-------------------|----------------------|-------------------|--------------|
| Hydrograph type | = Diversion1 | Peak discharge | = 0.698 cfs |
| Storm frequency | = 10 yrs | Time to peak | = 718 min |
| Time interval | = 2 min | Hyd. volume | = 1,411 cuft |
| Inflow hydrograph | = 3 - DETAINED DA1 | 2nd diverted hyd. | = 5 |
| Diversion method | = First Flush Volume | Volume Up To | = 3,081 cuft |



Hydrograph Report

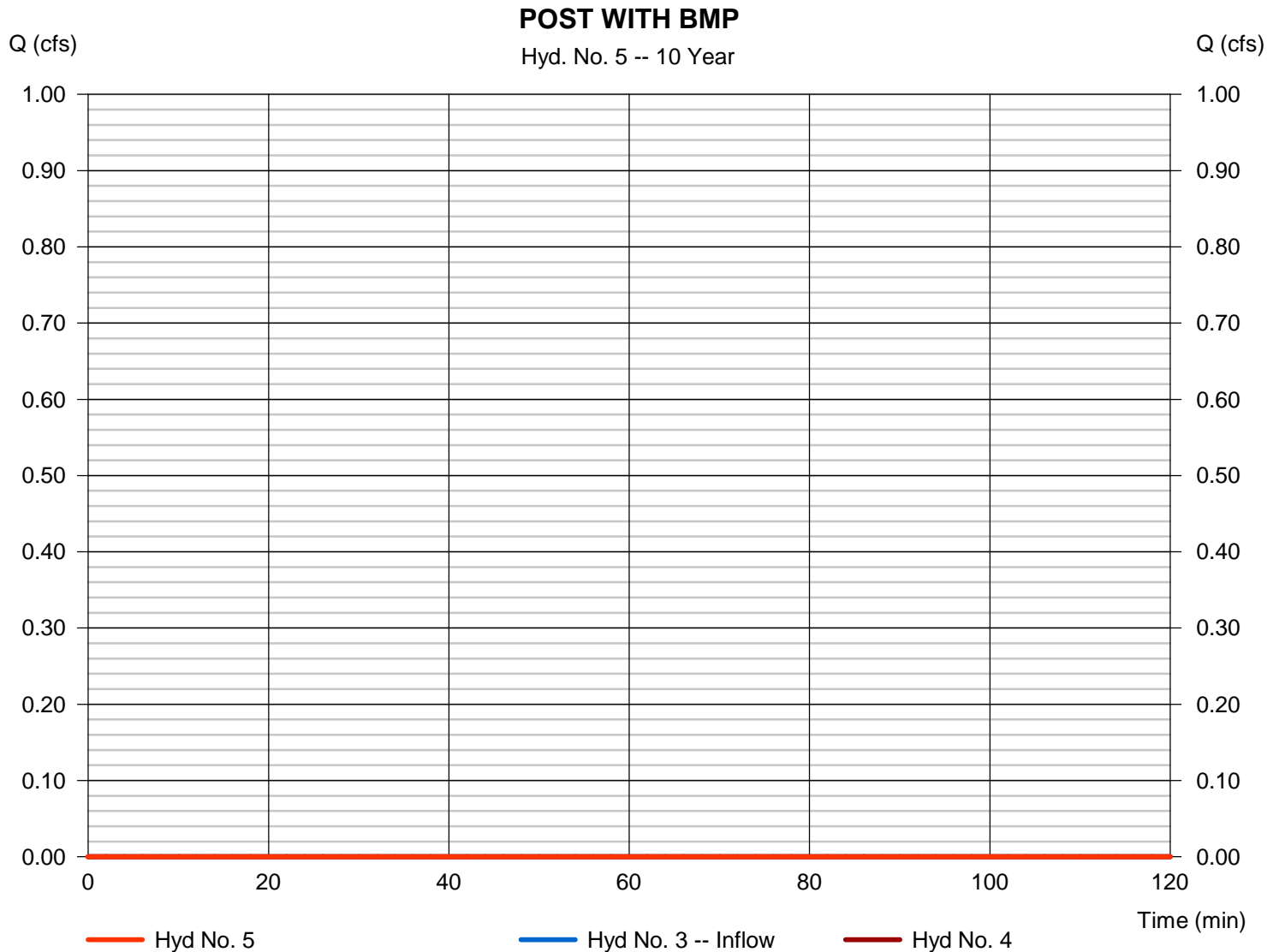
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Thursday, 11 / 17 / 2016

Hyd. No. 5

POST WITH 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 - DETAINED DA1 | 2nd diverted hyd. | = 4 |
| Diversion method | = First Flush Volume | Volume Up To | = 3,081 cuft |



Hydrograph Report

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

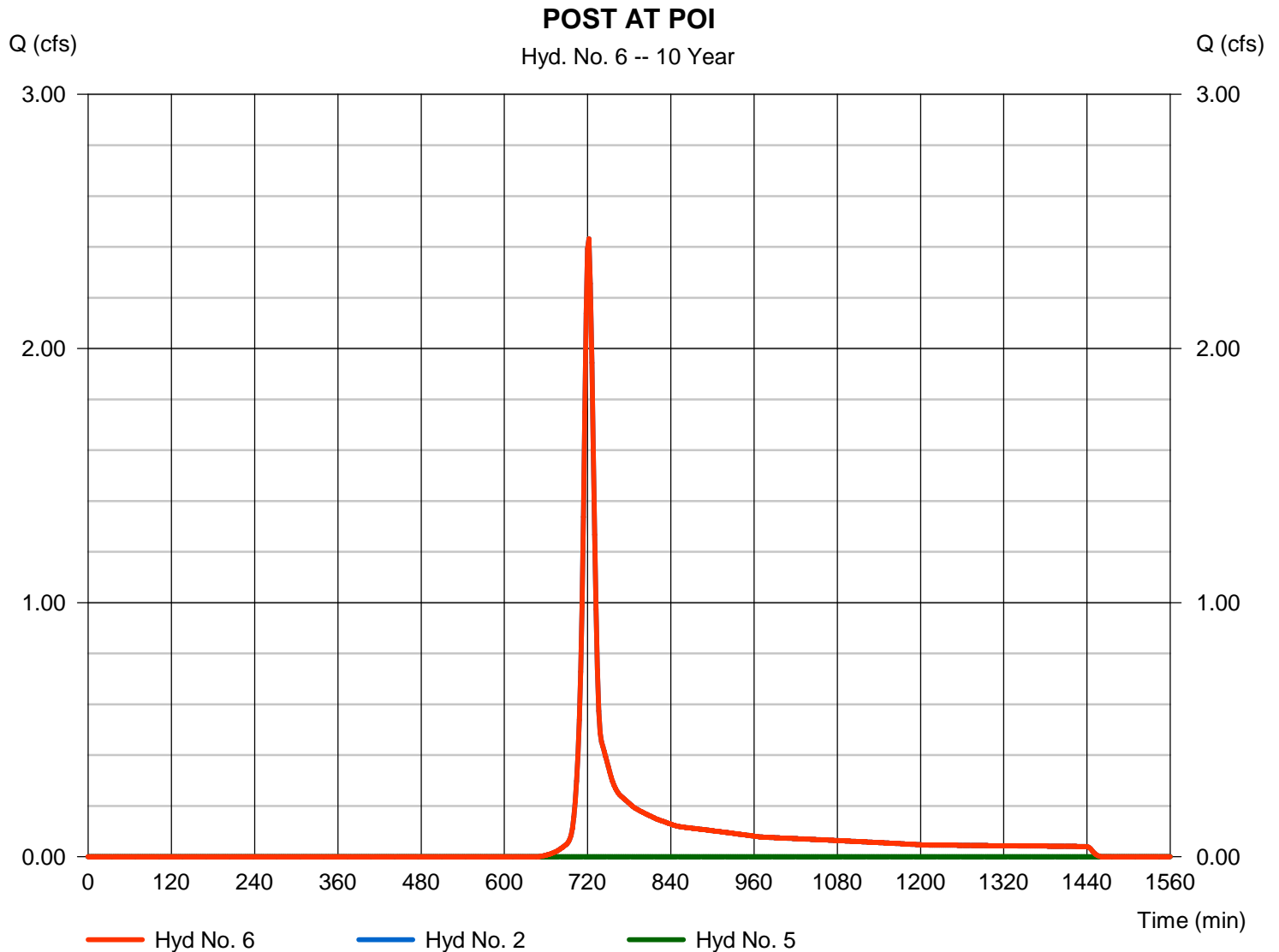
Thursday, 11 / 17 / 2016

Hyd. No. 6

POST AT POI

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

Peak discharge = 2.432 cfs
 Time to peak = 722 min
 Hyd. volume = 6,488 cuft
 Contrib. drain. area = 1.330 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 | 5.782 | 2 | 720 | 15,098 | ----- | ----- | ----- | PRE CONSTRUCTION DA1 | |
| 2 | SCS Runoff | 4.632 | 2 | 720 | 12,097 | ----- | ----- | ----- | UNDETAINED DA1 | |
| 3 | SCS Runoff | 1.368 | 2 | 718 | 2,737 | ----- | ----- | ----- | DETAINED DA1 | |
| 4 | Diversion1 | 1.368 | 2 | 718 | 2,737 | 3 | ----- | ----- | VOLUME ABSTRACTION | |
| 5 | Diversion2 | 0.000 | 2 | n/a | 0 | 3 | ----- | ----- | POST WITH BMP | |
| 6 | Combine | 4.632 | 2 | 720 | 12,097 | 2, 5 | ----- | ----- | POST AT POI | |
| Shade Valley DA1.gpw | | | | | Return Period: 50 Year | | | Thursday, 11 / 17 / 2016 | | |

Hydrograph Report

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

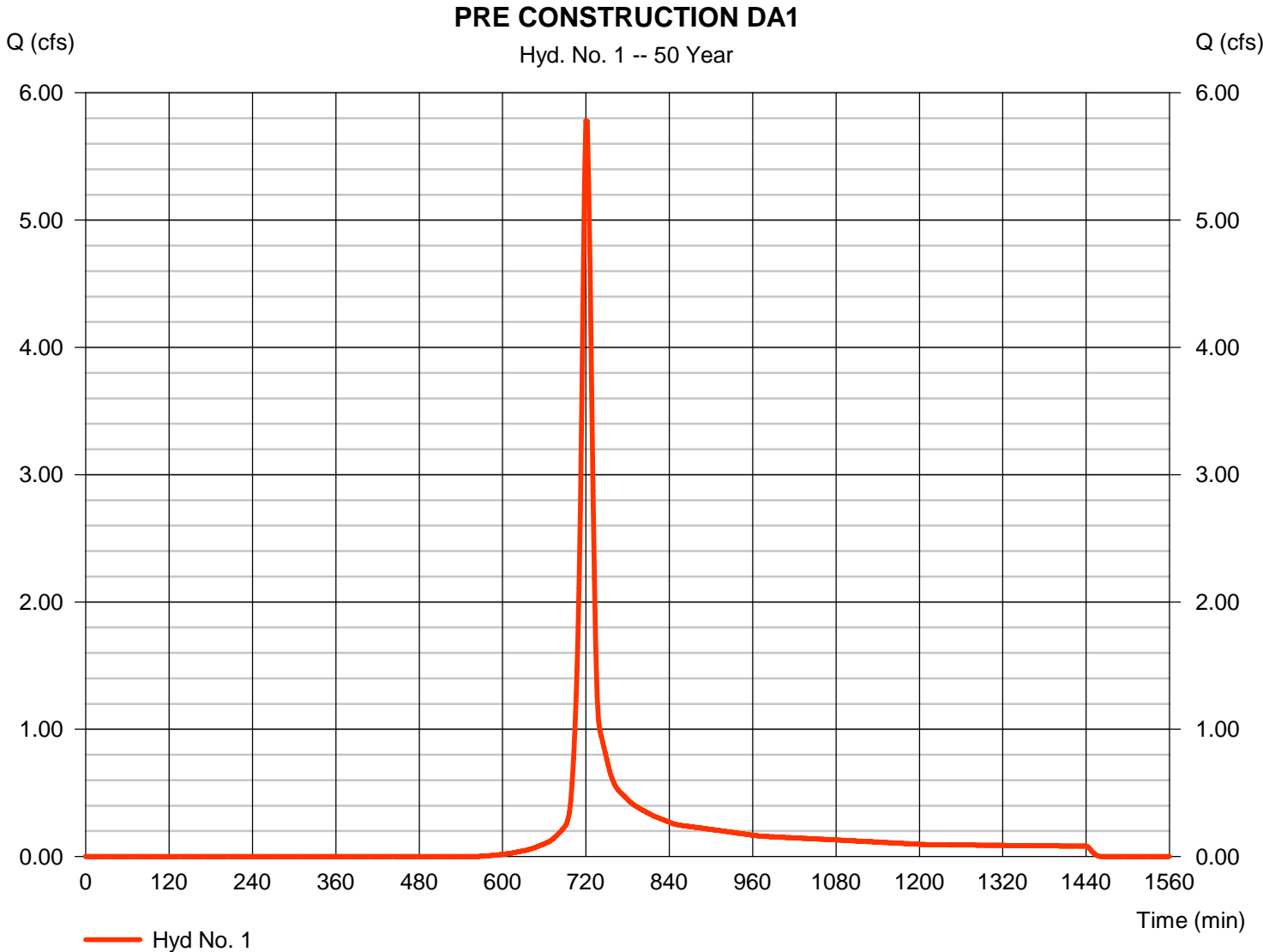
Thursday, 11 / 17 / 2016

Hyd. No. 1

PRE CONSTRUCTION DA1

| | | | |
|-----------------|--------------|--------------------|---------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 5.782 cfs |
| Storm frequency | = 50 yrs | Time to peak | = 720 min |
| Time interval | = 2 min | Hyd. volume | = 15,098 cuft |
| Drainage area | = 1.660 ac | Curve number | = 70* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = TR55 | Time of conc. (Tc) | = 11.10 min |
| Total precip. | = 5.52 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = + (0.320 x 77) + (0.890 x 58) + (0.170 x 78) + (0.280 x 98)] / 1.660



Hydrograph Report

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

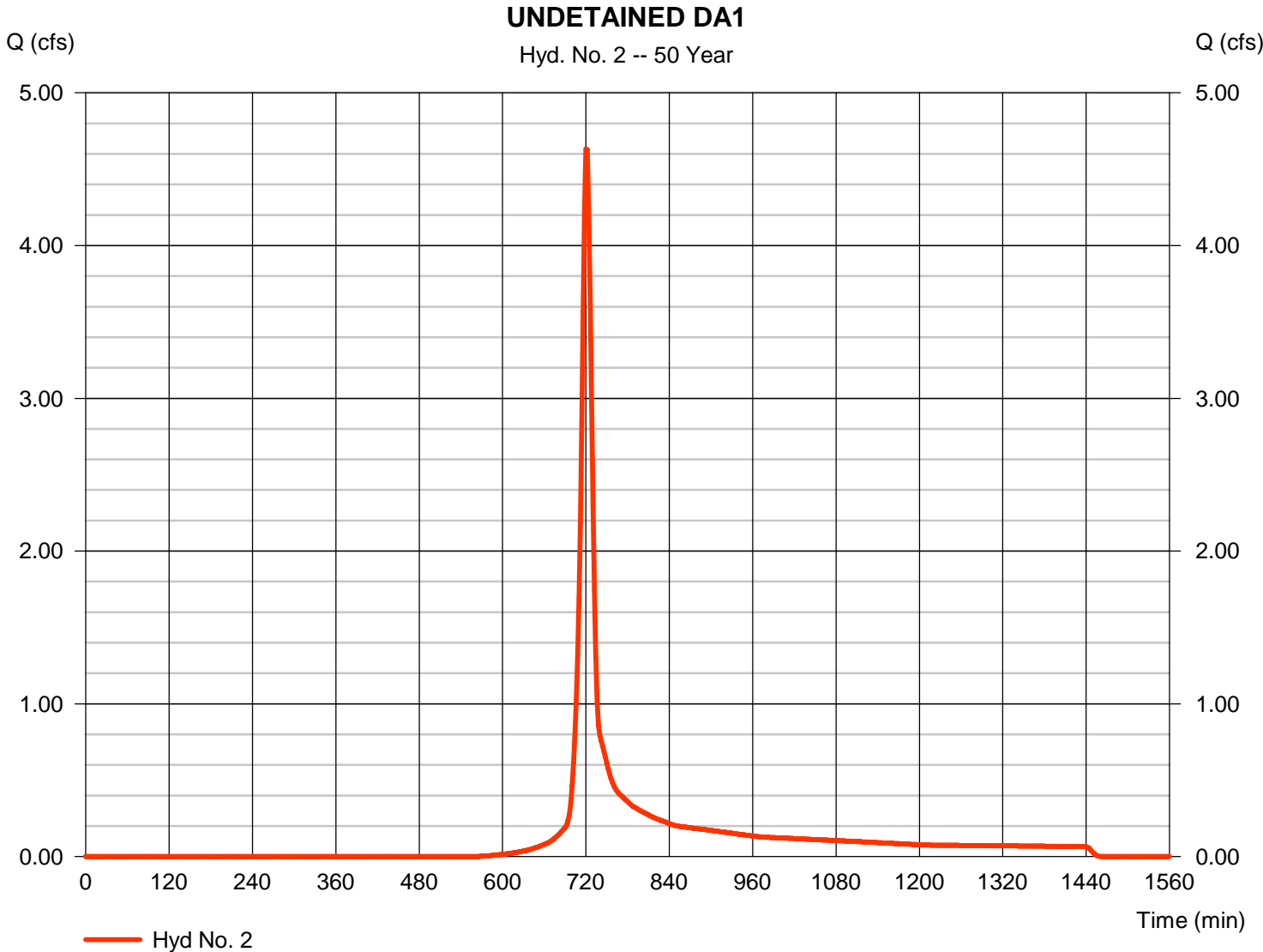
Thursday, 11 / 17 / 2016

Hyd. No. 2

UNDETAINED DA1

| | | | |
|-----------------|--------------|--------------------|---------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 4.632 cfs |
| Storm frequency | = 50 yrs | Time to peak | = 720 min |
| Time interval | = 2 min | Hyd. volume | = 12,097 cuft |
| Drainage area | = 1.330 ac | Curve number | = 70* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = User | Time of conc. (Tc) | = 11.30 min |
| Total precip. | = 5.52 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = [(0.580 x 58) + (0.190 x 78) + (0.270 x 98) + (0.010 x 85) + (0.010 x 91) + (0.270 x 77)] / 1.330



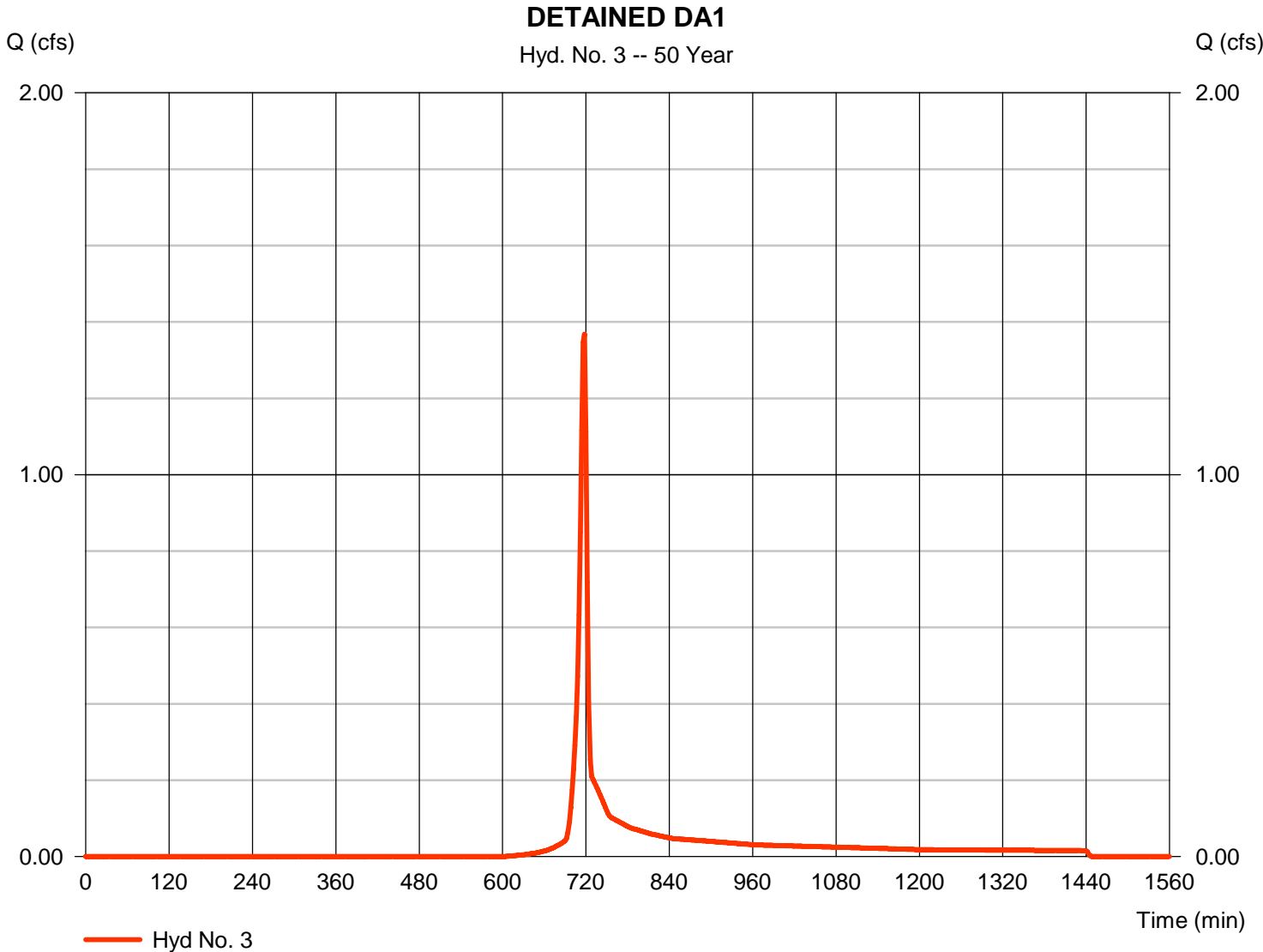
Hydrograph Report

Hyd. No. 3

DETAINED DA1

| | | | |
|-----------------|--------------|--------------------|--------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 1.368 cfs |
| Storm frequency | = 50 yrs | Time to peak | = 718 min |
| Time interval | = 2 min | Hyd. volume | = 2,737 cuft |
| Drainage area | = 0.370 ac | Curve number | = 67* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = TR55 | Time of conc. (Tc) | = 4.20 min |
| Total precip. | = 5.52 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = [(0.120 x 85) + (0.250 x 58)] / 0.370



Hydrograph Report

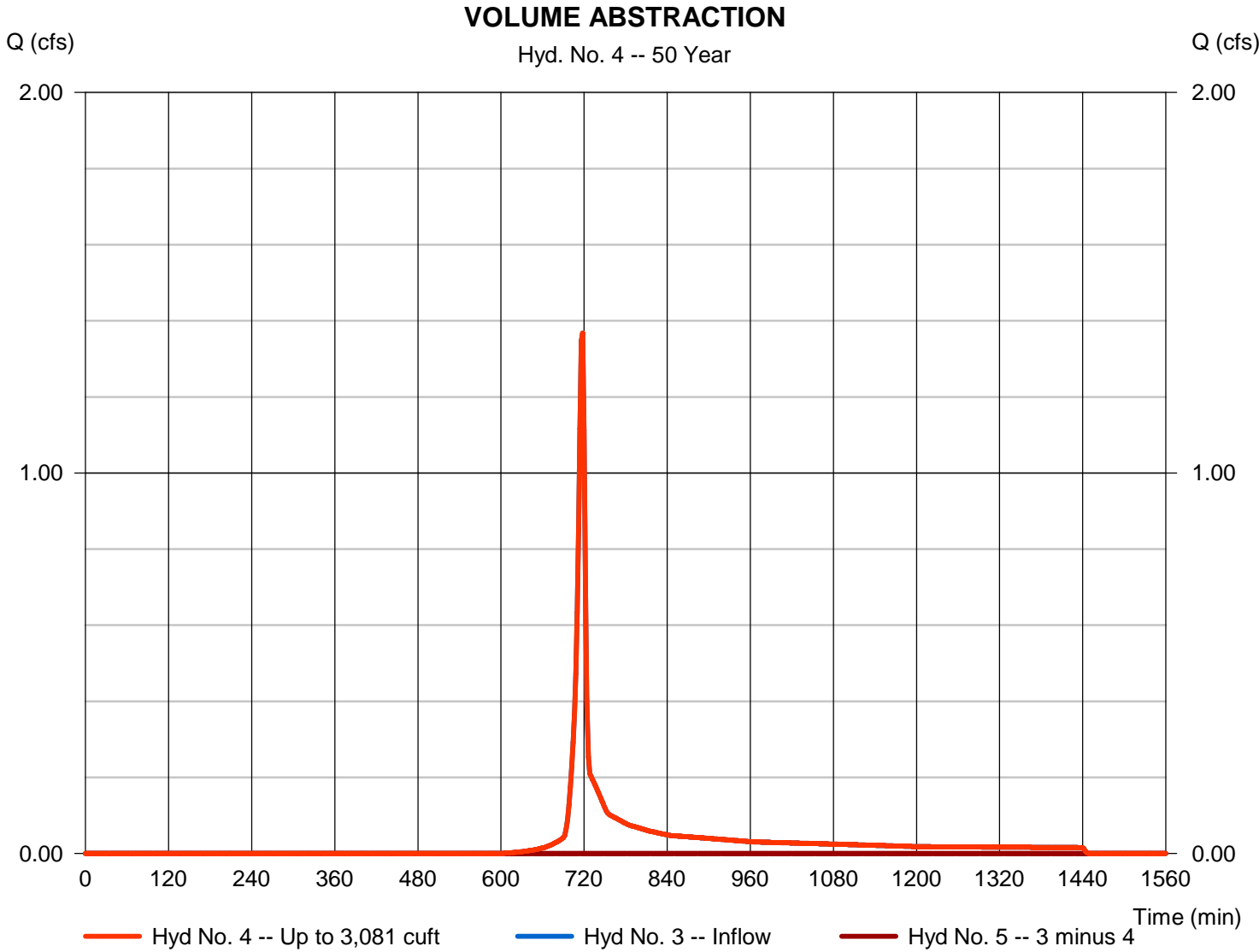
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Thursday, 11 / 17 / 2016

Hyd. No. 4

VOLUME ABSTRACTION

| | | | |
|-------------------|----------------------|-------------------|--------------|
| Hydrograph type | = Diversion1 | Peak discharge | = 1.368 cfs |
| Storm frequency | = 50 yrs | Time to peak | = 718 min |
| Time interval | = 2 min | Hyd. volume | = 2,737 cuft |
| Inflow hydrograph | = 3 - DETAINED DA1 | 2nd diverted hyd. | = 5 |
| Diversion method | = First Flush Volume | Volume Up To | = 3,081 cuft |



Hydrograph Report

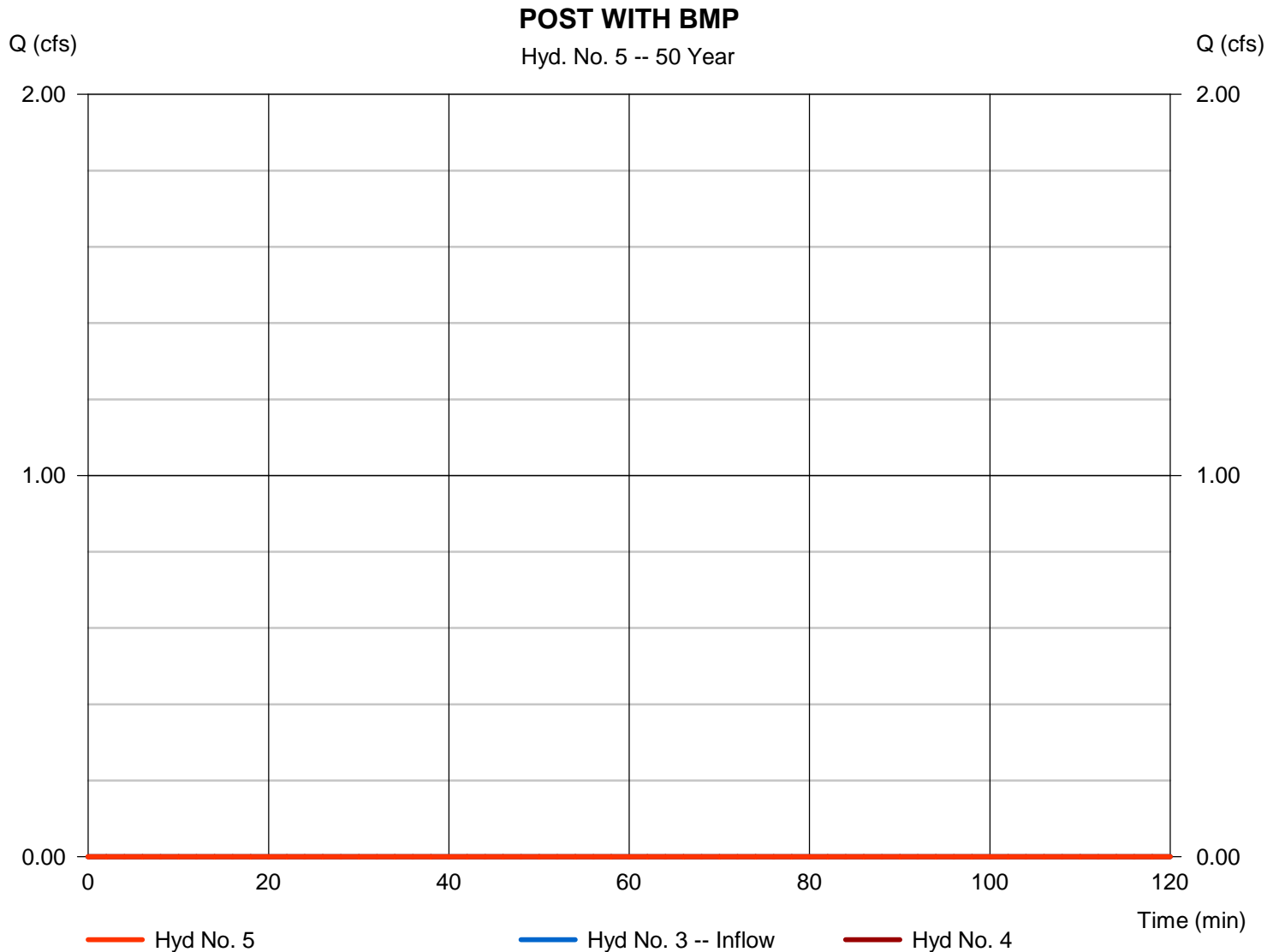
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Thursday, 11 / 17 / 2016

Hyd. No. 5

POST WITH 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 - DETAINED DA1 | 2nd diverted hyd. | = 4 |
| Diversion method | = First Flush Volume | Volume Up To | = 3,081 cuft |



Hydrograph Report

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

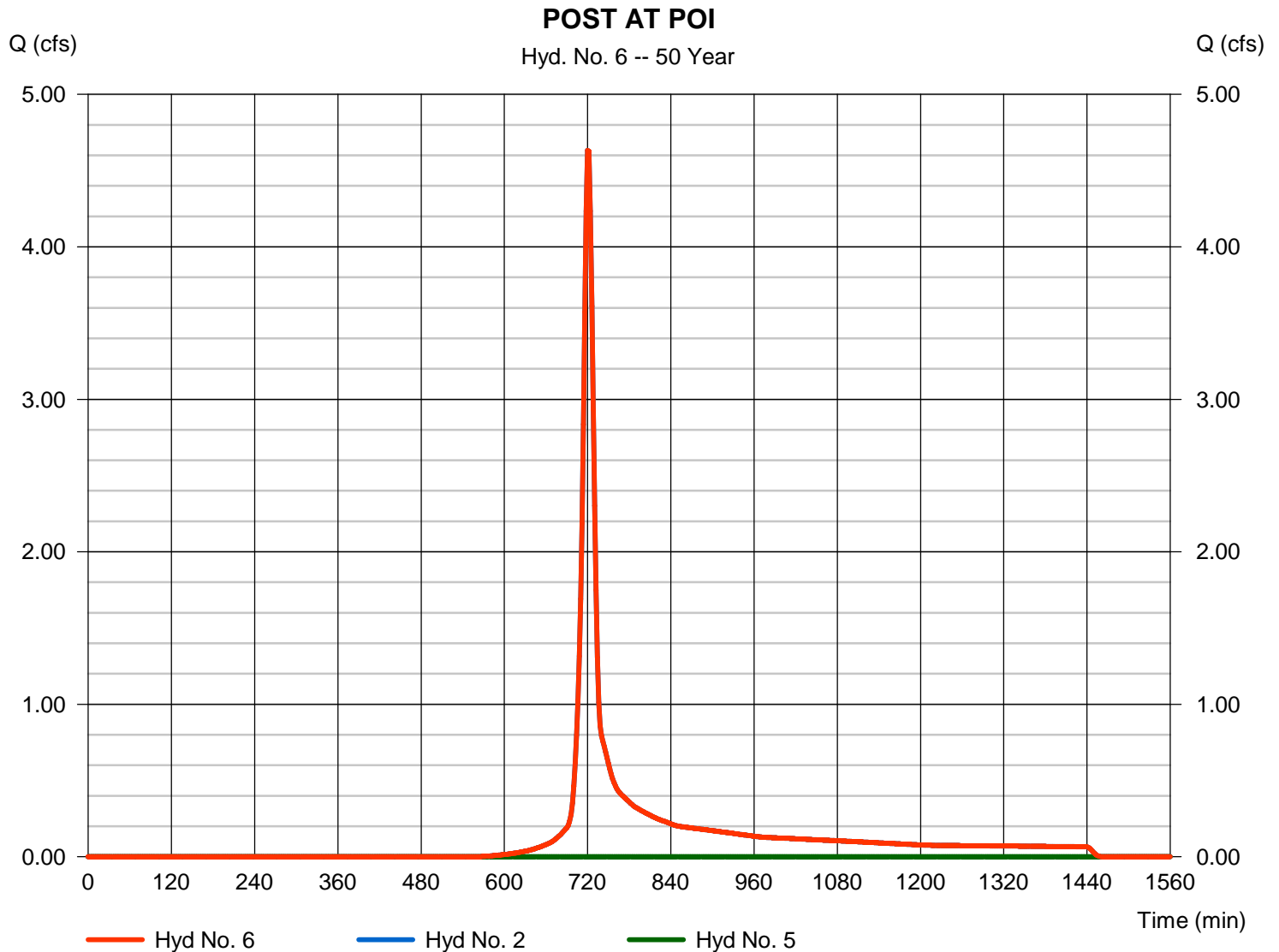
Thursday, 11 / 17 / 2016

Hyd. No. 6

POST AT POI

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

Peak discharge = 4.632 cfs
Time to peak = 720 min
Hyd. volume = 12,097 cuft
Contrib. drain. area = 1.330 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 | 7.344 | 2 | 720 | 19,073 | ----- | ----- | ----- | PRE CONSTRUCTION DA1 | |
| 2 | SCS Runoff | 5.884 | 2 | 720 | 15,281 | ----- | ----- | ----- | UNDETAINED DA1 | |
| 3 | SCS Runoff | 1.743 | 2 | 718 | 3,503 | ----- | ----- | ----- | DETAINED DA1 | |
| 4 | Diversion1 | 1.743 | 2 | 718 | 3,082 | 3 | ----- | ----- | VOLUME ABSTRACTION | |
| 5 | Diversion2 | 0.027 | 2 | 1118 | 420 | 3 | ----- | ----- | POST WITH BMP | |
| 6 | Combine | 5.884 | 2 | 720 | 15,702 | 2, 5 | ----- | ----- | POST AT POI | |
| Shade Valley DA1.gpw | | | | | Return Period: 100 Year | | | Thursday, 11 / 17 / 2016 | | |

Hydrograph Report

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

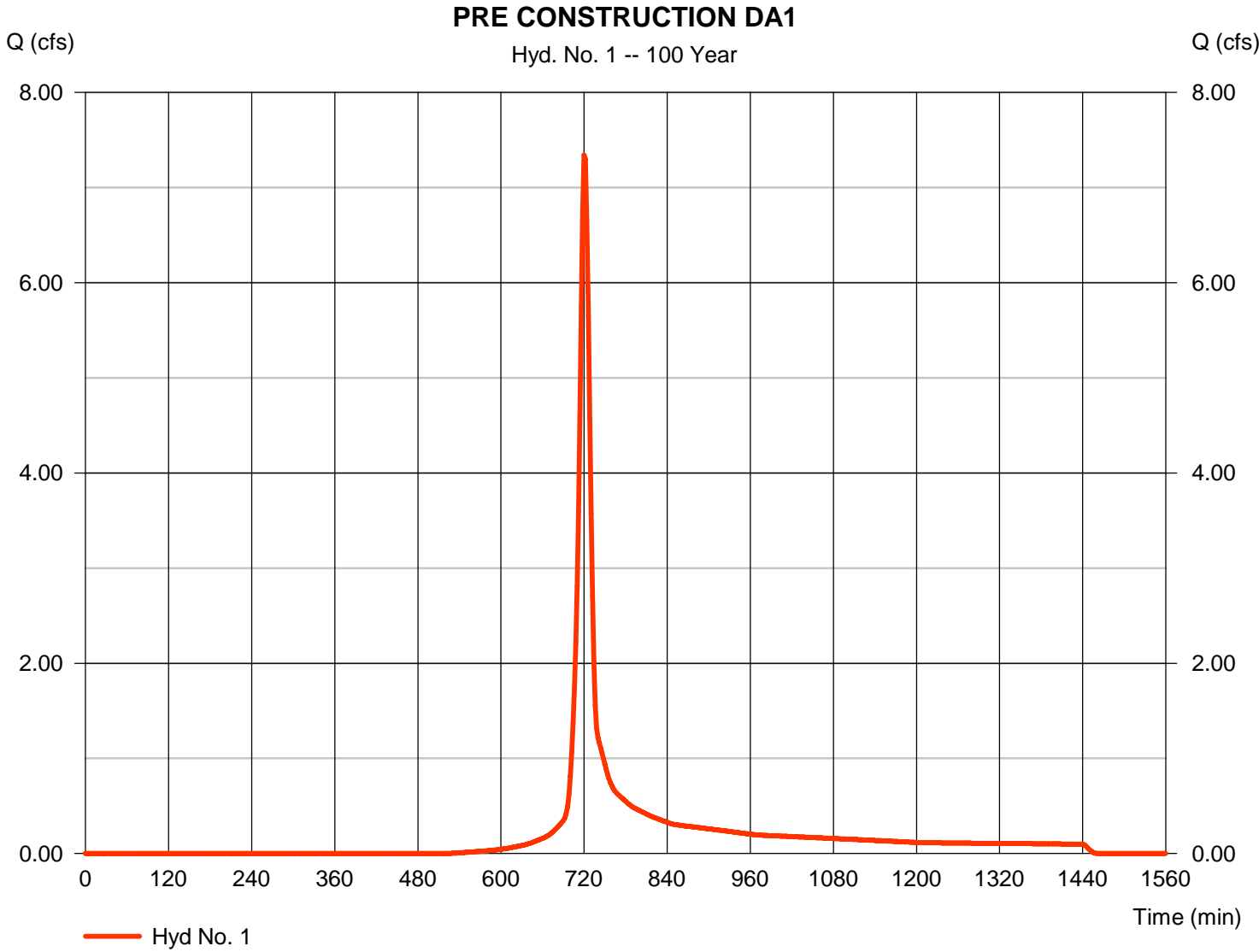
Thursday, 11 / 17 / 2016

Hyd. No. 1

PRE CONSTRUCTION DA1

| | | | |
|-----------------|--------------|--------------------|---------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 7.344 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 720 min |
| Time interval | = 2 min | Hyd. volume | = 19,073 cuft |
| Drainage area | = 1.660 ac | Curve number | = 70* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = TR55 | Time of conc. (Tc) | = 11.10 min |
| Total precip. | = 6.33 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = + (0.320 x 77) + (0.890 x 58) + (0.170 x 78) + (0.280 x 98)] / 1.660



Hydrograph Report

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

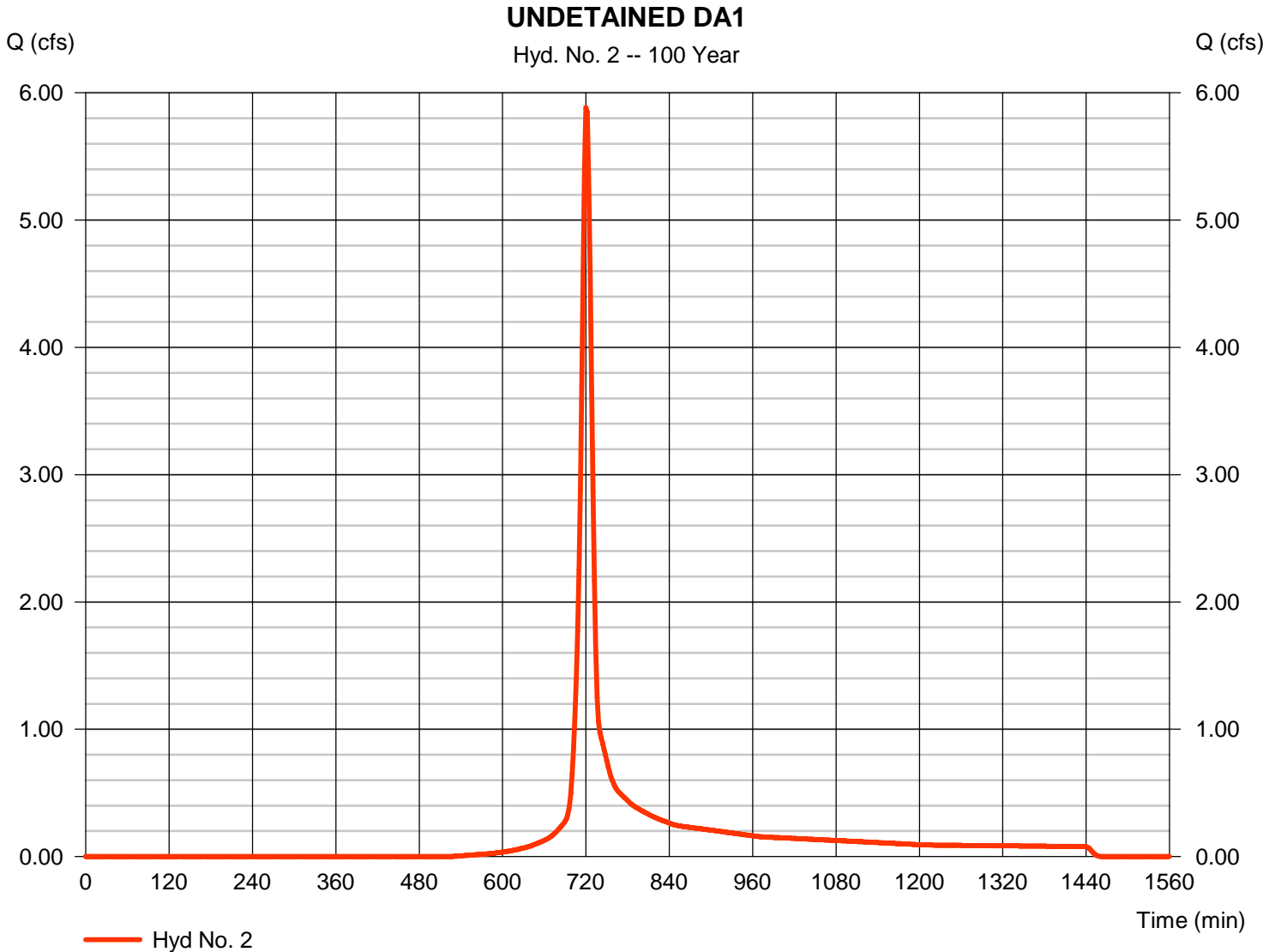
Thursday, 11 / 17 / 2016

Hyd. No. 2

UNDETAINED DA1

| | | | |
|-----------------|--------------|--------------------|---------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 5.884 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 720 min |
| Time interval | = 2 min | Hyd. volume | = 15,281 cuft |
| Drainage area | = 1.330 ac | Curve number | = 70* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = User | Time of conc. (Tc) | = 11.30 min |
| Total precip. | = 6.33 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = [(0.580 x 58) + (0.190 x 78) + (0.270 x 98) + (0.010 x 85) + (0.010 x 91) + (0.270 x 77)] / 1.330



Hydrograph Report

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

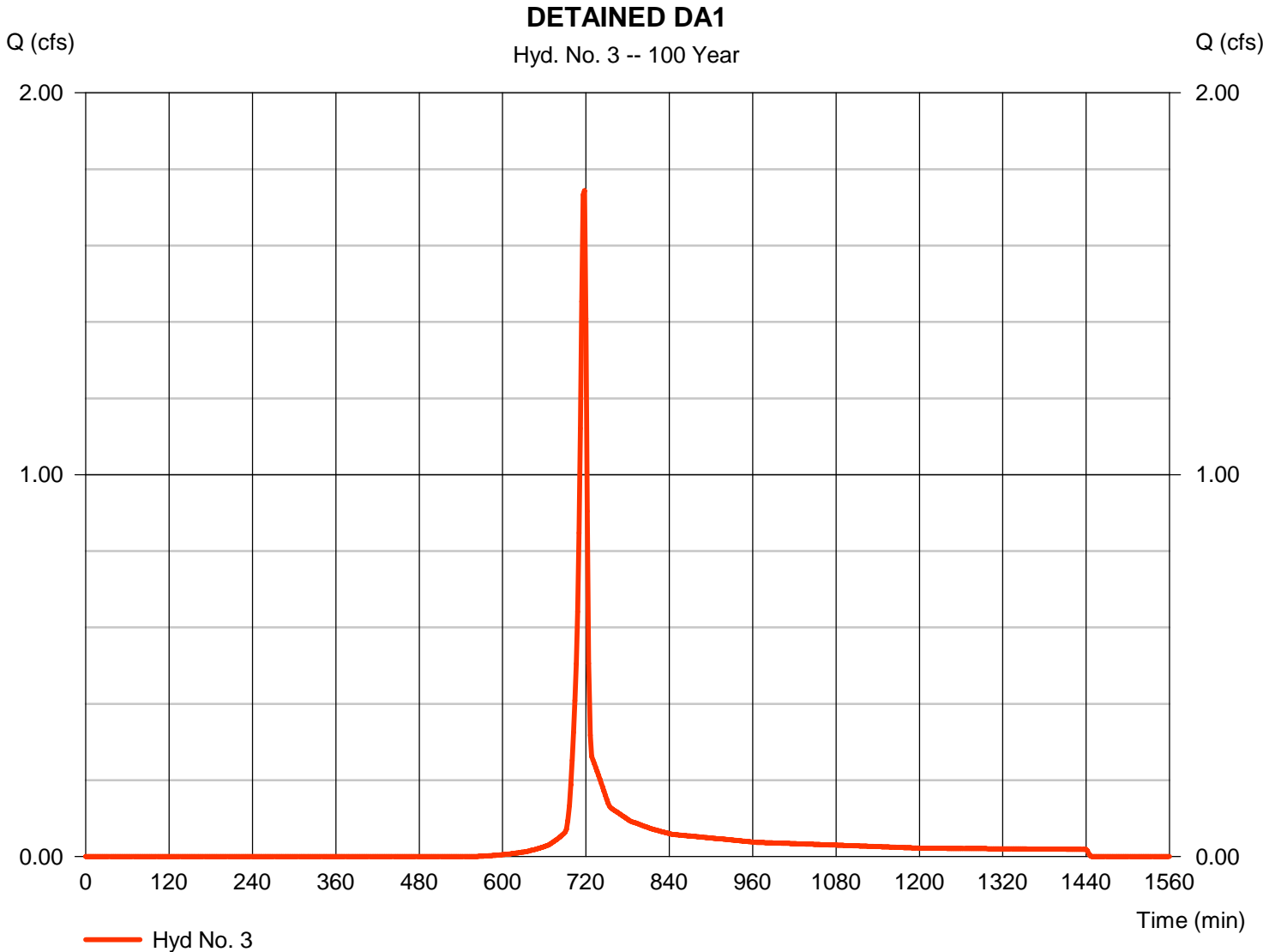
Thursday, 11 / 17 / 2016

Hyd. No. 3

DETAINED DA1

| | | | |
|-----------------|--------------|--------------------|--------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 1.743 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 718 min |
| Time interval | = 2 min | Hyd. volume | = 3,503 cuft |
| Drainage area | = 0.370 ac | Curve number | = 67* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = TR55 | Time of conc. (Tc) | = 4.20 min |
| Total precip. | = 6.33 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = [(0.120 x 85) + (0.250 x 58)] / 0.370



Hydrograph Report

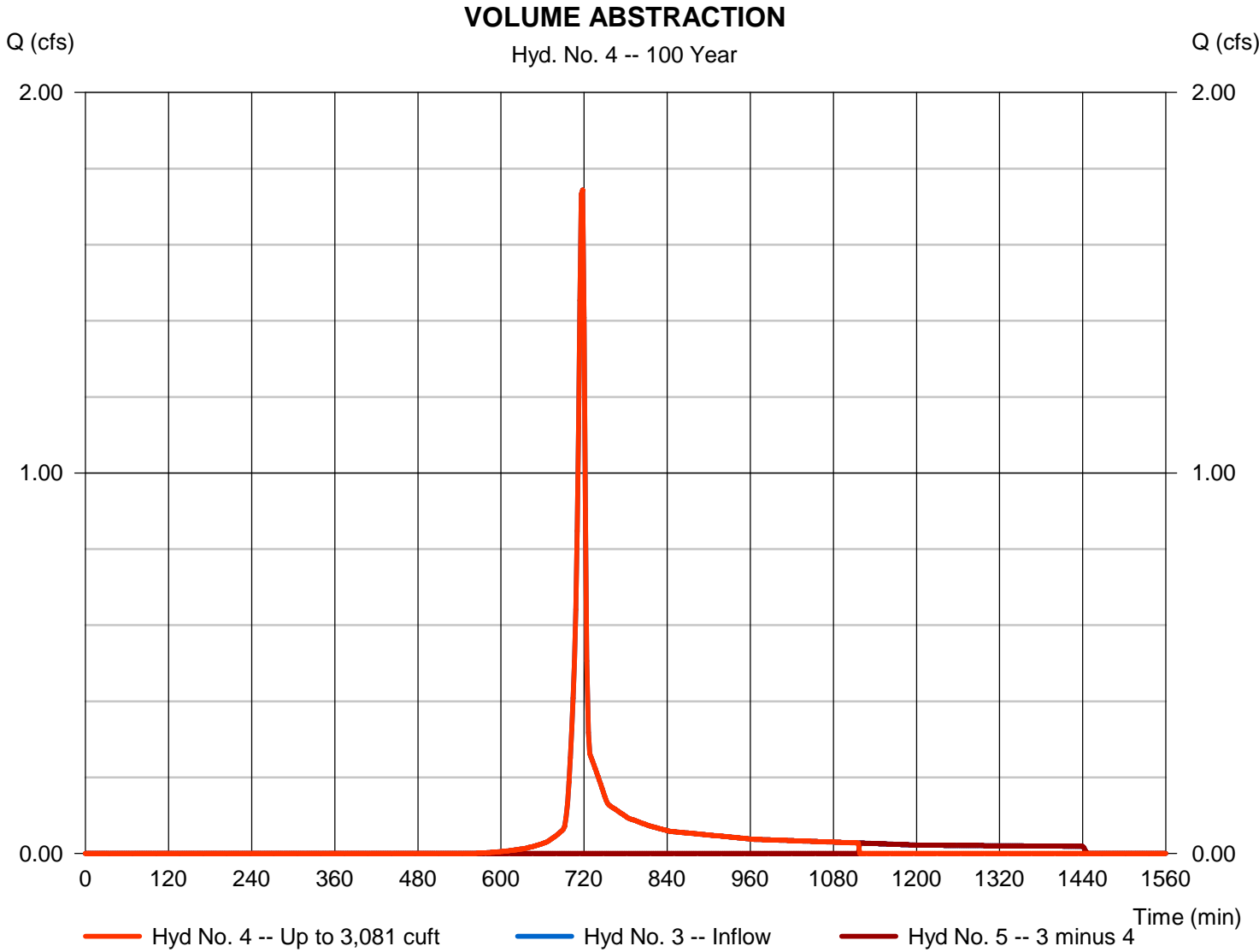
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Thursday, 11 / 17 / 2016

Hyd. No. 4

VOLUME ABSTRACTION

| | | | |
|-------------------|----------------------|-------------------|--------------|
| Hydrograph type | = Diversion1 | Peak discharge | = 1.743 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 718 min |
| Time interval | = 2 min | Hyd. volume | = 3,082 cuft |
| Inflow hydrograph | = 3 - DETAINED DA1 | 2nd diverted hyd. | = 5 |
| Diversion method | = First Flush Volume | Volume Up To | = 3,081 cuft |



Hydrograph Report

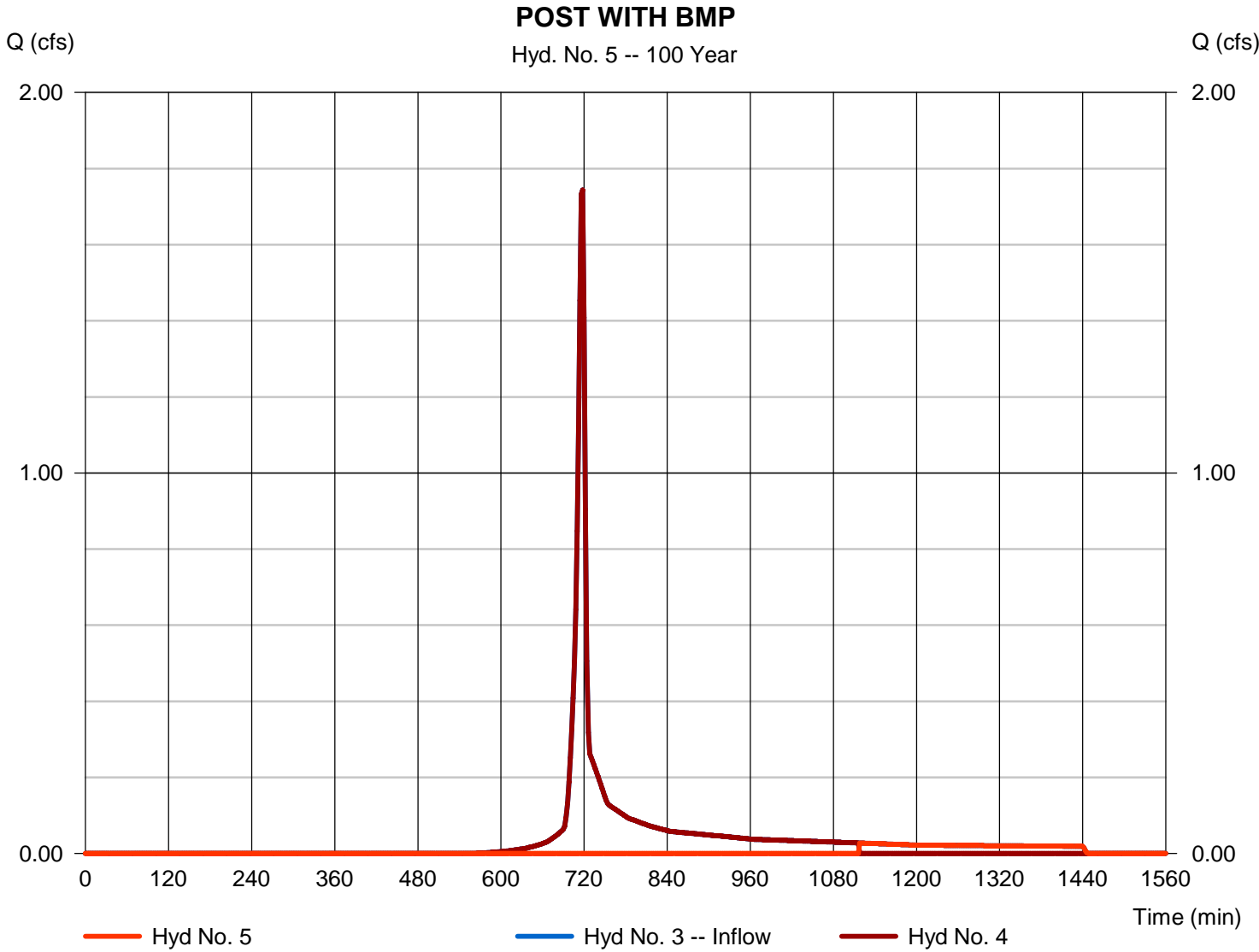
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Thursday, 11 / 17 / 2016

Hyd. No. 5

POST WITH BMP

| | | | |
|-------------------|----------------------|-------------------|--------------|
| Hydrograph type | = Diversion2 | Peak discharge | = 0.027 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 1118 min |
| Time interval | = 2 min | Hyd. volume | = 420 cuft |
| Inflow hydrograph | = 3 - DETAINED DA1 | 2nd diverted hyd. | = 4 |
| Diversion method | = First Flush Volume | Volume Up To | = 3,081 cuft |



Hydrograph Report

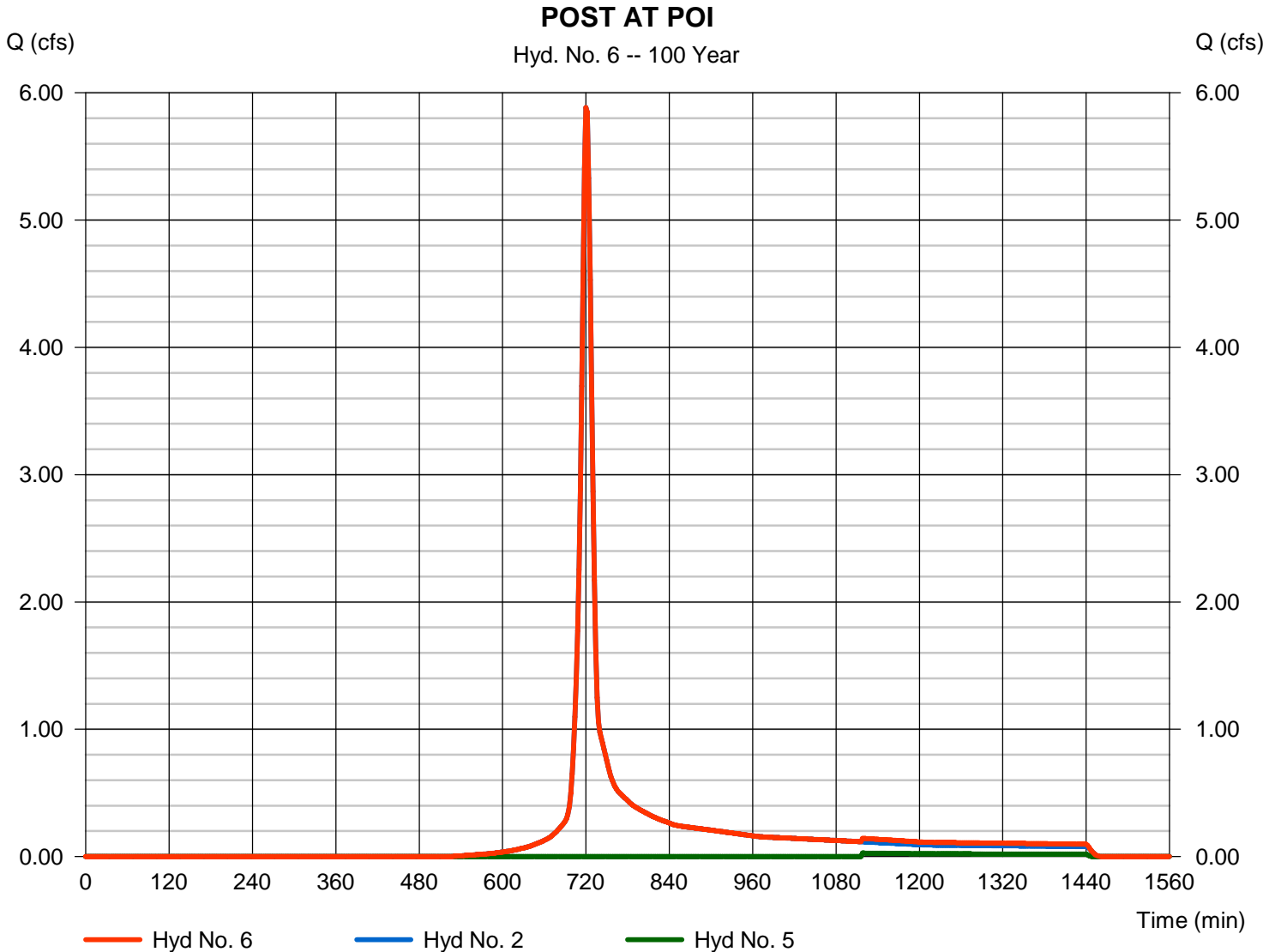
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Thursday, 11 / 17 / 2016

Hyd. No. 6

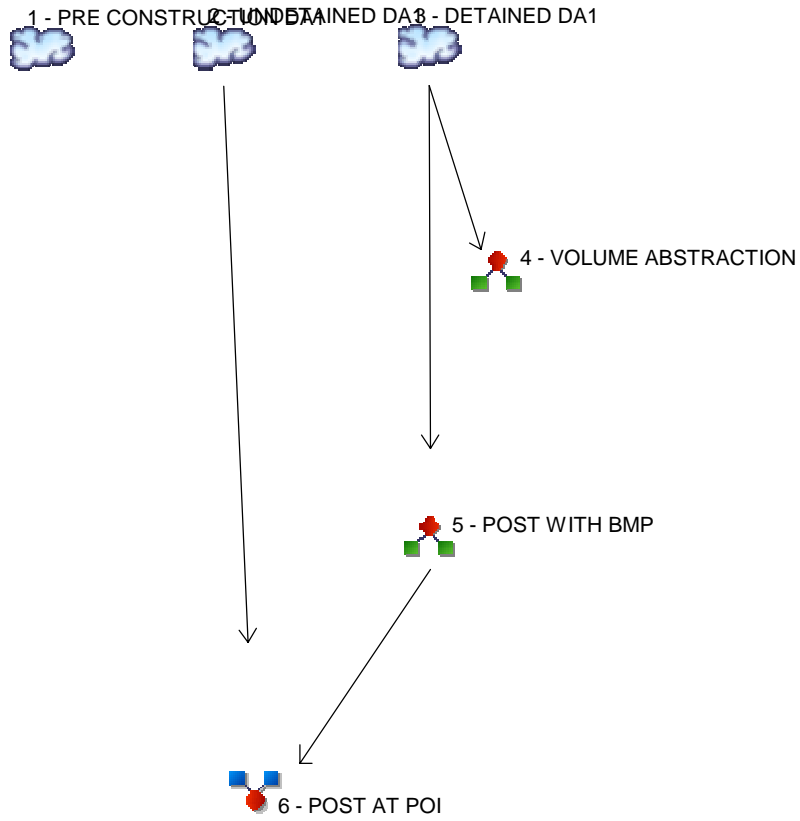
POST AT POI

| | | | |
|-----------------|-----------|----------------------|---------------|
| Hydrograph type | = Combine | Peak discharge | = 5.884 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 720 min |
| Time interval | = 2 min | Hyd. volume | = 15,702 cuft |
| Inflow hyds. | = 2, 5 | Contrib. drain. area | = 1.330 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 CONSTRUCTION DA1 |
| 2 | SCS Runoff UNDETAINED DA1 |
| 3 | SCS Runoff DETAINED DA1 |
| 4 | Diversion1 VOLUME ABSTRACTION |
| 5 | Diversion2 POST WITH 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 | ----- | ----- | 1.210 | ----- | ----- | ----- | ----- | ----- | ----- | PRE CONSTRUCTION DA1 |
| 2 | SCS Runoff | ----- | ----- | 0.970 | ----- | ----- | ----- | ----- | ----- | ----- | UNDETAINED DA1 |
| 3 | SCS Runoff | ----- | ----- | 0.085 | ----- | ----- | ----- | ----- | ----- | ----- | DETAINED DA1 |
| 4 | Diversion1 | 3 | ----- | 0.085 | ----- | ----- | ----- | ----- | ----- | ----- | VOLUME ABSTRACTION |
| 5 | Diversion2 | 3 | ----- | 0.000 | ----- | ----- | ----- | ----- | ----- | ----- | POST WITH BMP |
| 6 | Combine | 2, 5 | ----- | 0.970 | ----- | ----- | ----- | ----- | ----- | ----- | 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 | 1.210 | 2 | 722 | 3,571 | ----- | ----- | ----- | PRE CONSTRUCTION DA1 |
| 2 | SCS Runoff | 0.970 | 2 | 722 | 2,861 | ----- | ----- | ----- | UNDETAINED DA1 |
| 3 | SCS Runoff | 0.085 | 2 | 742 | 625 | ----- | ----- | ----- | DETAINED DA1 |
| 4 | Diversion1 | 0.085 | 2 | 742 | 625 | 3 | ----- | ----- | VOLUME ABSTRACTION |
| 5 | Diversion2 | 0.000 | 2 | n/a | 0 | 3 | ----- | ----- | POST WITH BMP |
| 6 | Combine | 0.970 | 2 | 722 | 2,861 | 2, 5 | ----- | ----- | POST AT POI |

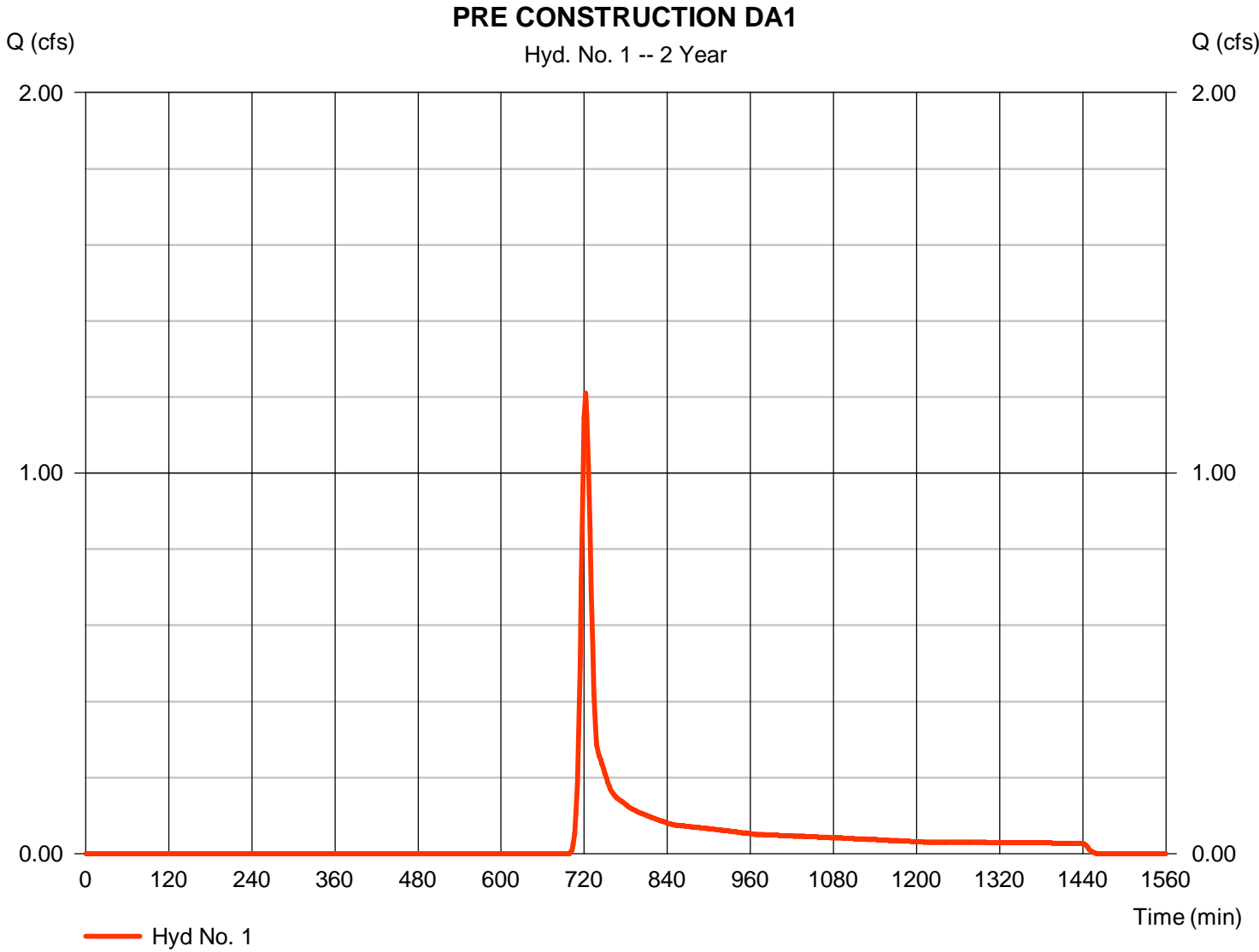
Hydrograph Report

Hyd. No. 1

PRE CONSTRUCTION DA1

| | | | |
|-----------------|--------------|--------------------|--------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 1.210 cfs |
| Storm frequency | = 2 yrs | Time to peak | = 722 min |
| Time interval | = 2 min | Hyd. volume | = 3,571 cuft |
| Drainage area | = 1.660 ac | Curve number | = 70* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = TR55 | Time of conc. (Tc) | = 11.10 min |
| Total precip. | = 2.74 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = + (0.320 x 77) + (0.890 x 58) + (0.170 x 78) + (0.280 x 98)] / 1.660



TR55 Tc Worksheet

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

Hyd. No. 1

PRE CONSTRUCTION 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) | = 2.74 | 0.00 | 0.00 | |
| Land slope (%) | = 2.00 | 0.00 | 0.00 | |
| Travel Time (min) | = 8.86 | + 0.00 | + 0.00 | = 8.86 |
| Shallow Concentrated Flow | | | | |
| Flow length (ft) | = 572.00 | 0.00 | 0.00 | |
| Watercourse slope (%) | = 7.20 | 0.00 | 0.00 | |
| Surface description | = Unpaved | Paved | Paved | |
| Average velocity (ft/s) | =4.33 | 0.00 | 0.00 | |
| Travel Time (min) | = 2.20 | + 0.00 | + 0.00 | = 2.20 |
| 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 | = 0.000 | 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 | | | | 11.10 min |

Hydrograph Report

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

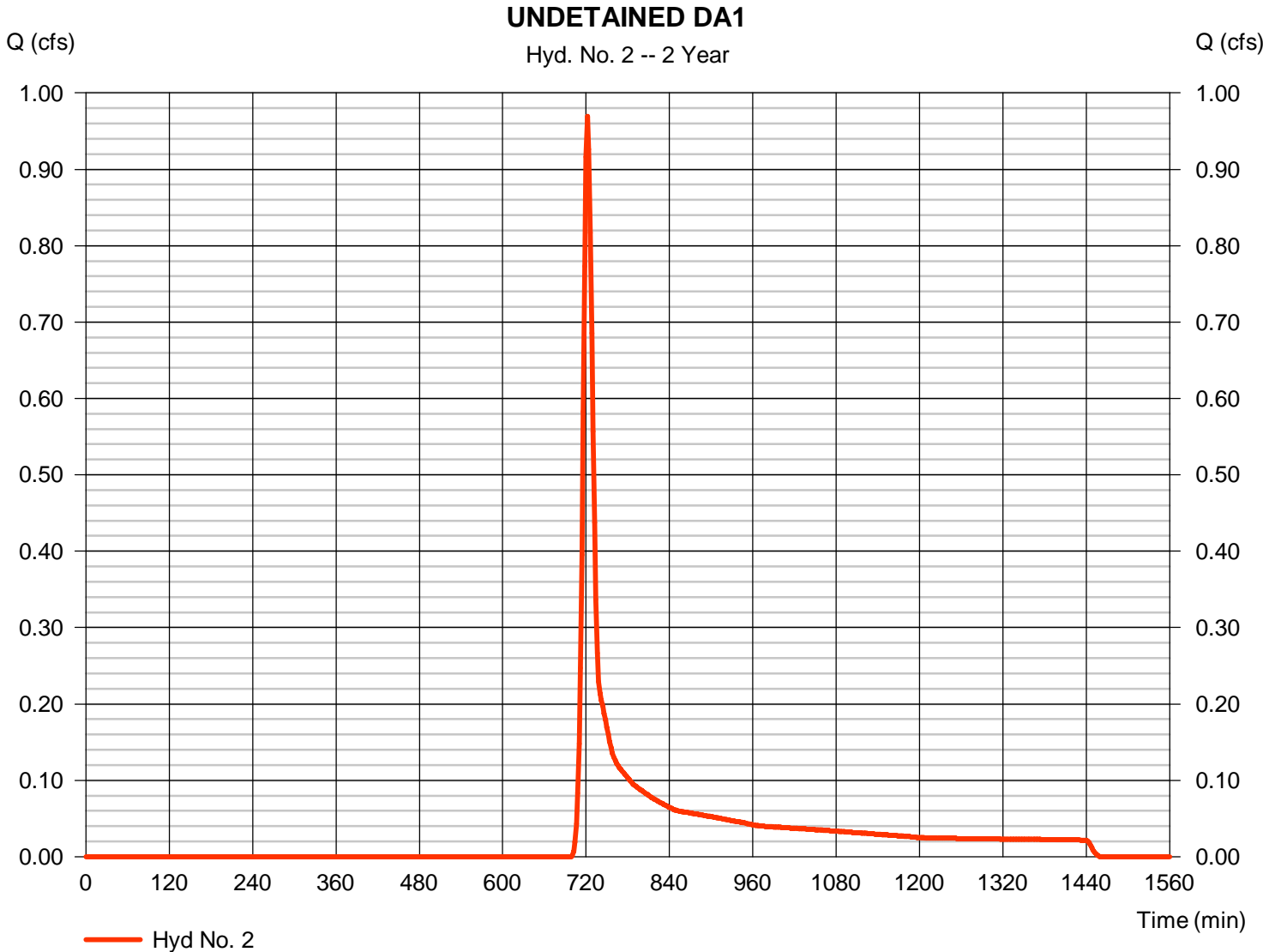
Thursday, 11 / 17 / 2016

Hyd. No. 2

UNDETAINED DA1

| | | | |
|-----------------|--------------|--------------------|--------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 0.970 cfs |
| Storm frequency | = 2 yrs | Time to peak | = 722 min |
| Time interval | = 2 min | Hyd. volume | = 2,861 cuft |
| Drainage area | = 1.330 ac | Curve number | = 70* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = User | Time of conc. (Tc) | = 11.30 min |
| Total precip. | = 2.74 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = [(0.580 x 58) + (0.190 x 78) + (0.270 x 98) + (0.010 x 85) + (0.010 x 91) + (0.270 x 77)] / 1.330



Hydrograph Report

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

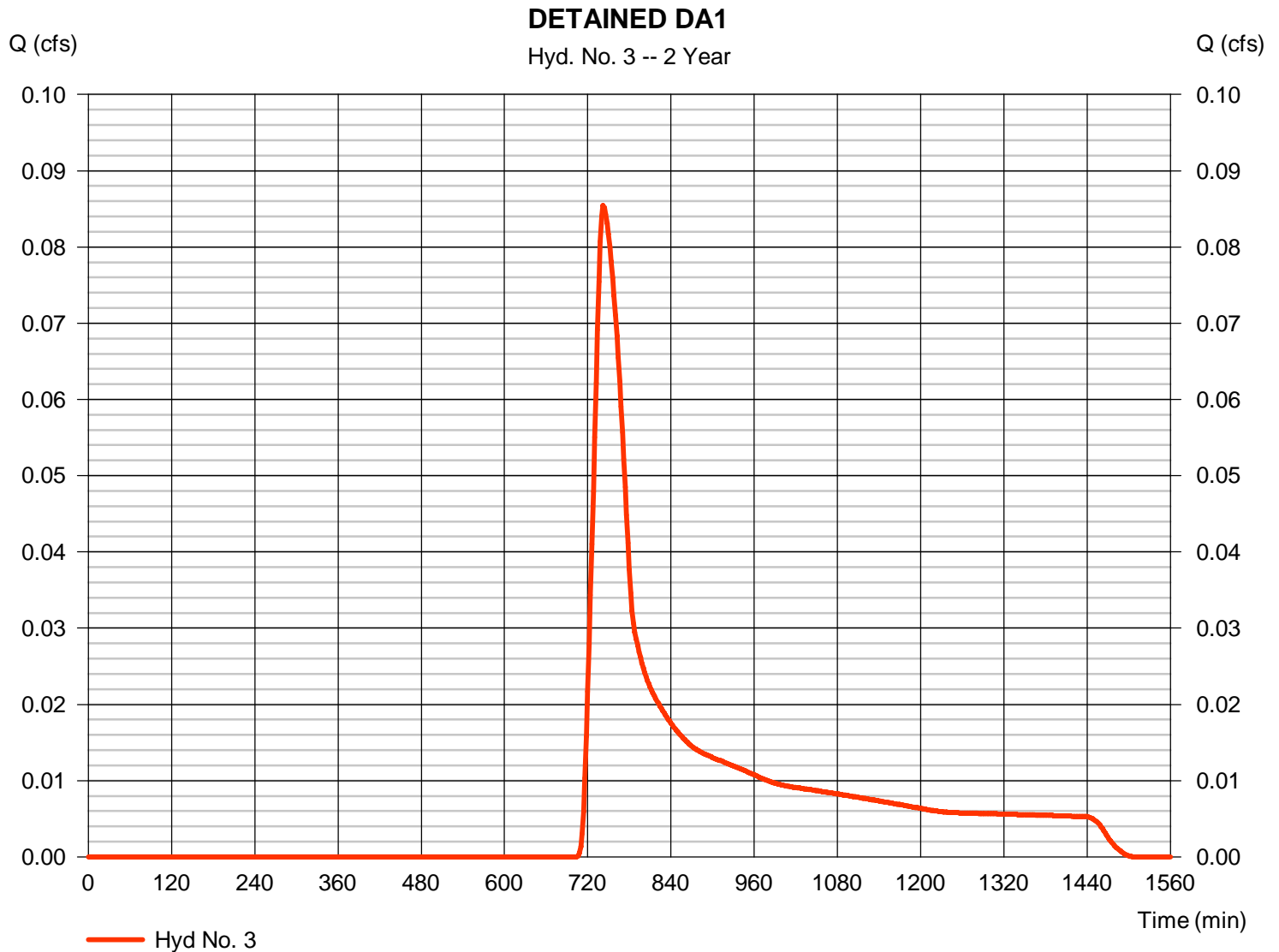
Thursday, 11 / 17 / 2016

Hyd. No. 3

DETAINED DA1

| | | | |
|-----------------|--------------|--------------------|-------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 0.085 cfs |
| Storm frequency | = 2 yrs | Time to peak | = 742 min |
| Time interval | = 2 min | Hyd. volume | = 625 cuft |
| Drainage area | = 0.370 ac | Curve number | = 67* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = User | Time of conc. (Tc) | = 41.50 min |
| Total precip. | = 2.74 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = [(0.120 x 85) + (0.250 x 58)] / 0.370



Hydrograph Report

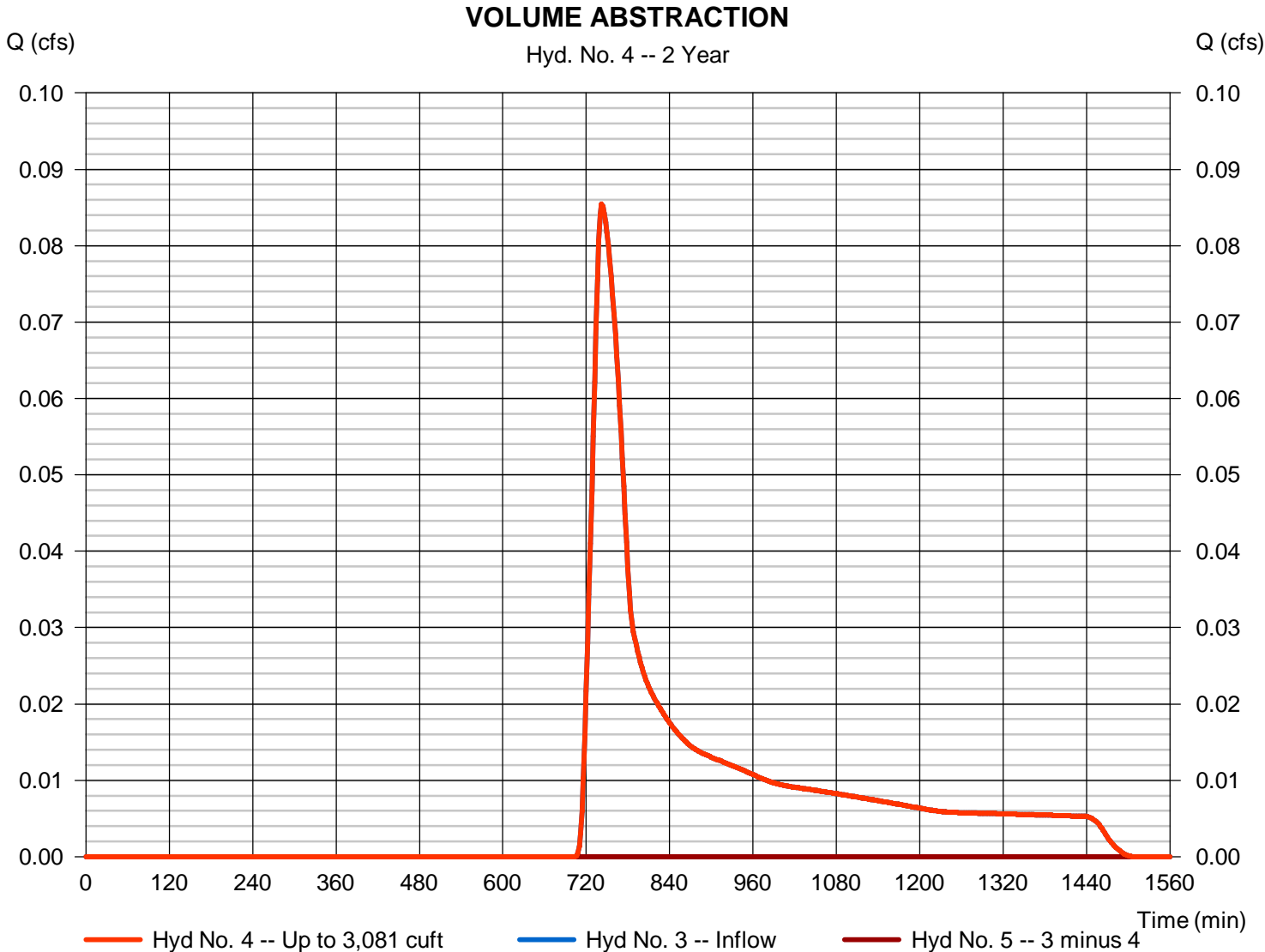
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Thursday, 11 / 17 / 2016

Hyd. No. 4

VOLUME ABSTRACTION

| | | | |
|-------------------|----------------------|-------------------|--------------|
| Hydrograph type | = Diversion1 | Peak discharge | = 0.085 cfs |
| Storm frequency | = 2 yrs | Time to peak | = 742 min |
| Time interval | = 2 min | Hyd. volume | = 625 cuft |
| Inflow hydrograph | = 3 - DETAINED DA1 | 2nd diverted hyd. | = 5 |
| Diversion method | = First Flush Volume | Volume Up To | = 3,081 cuft |

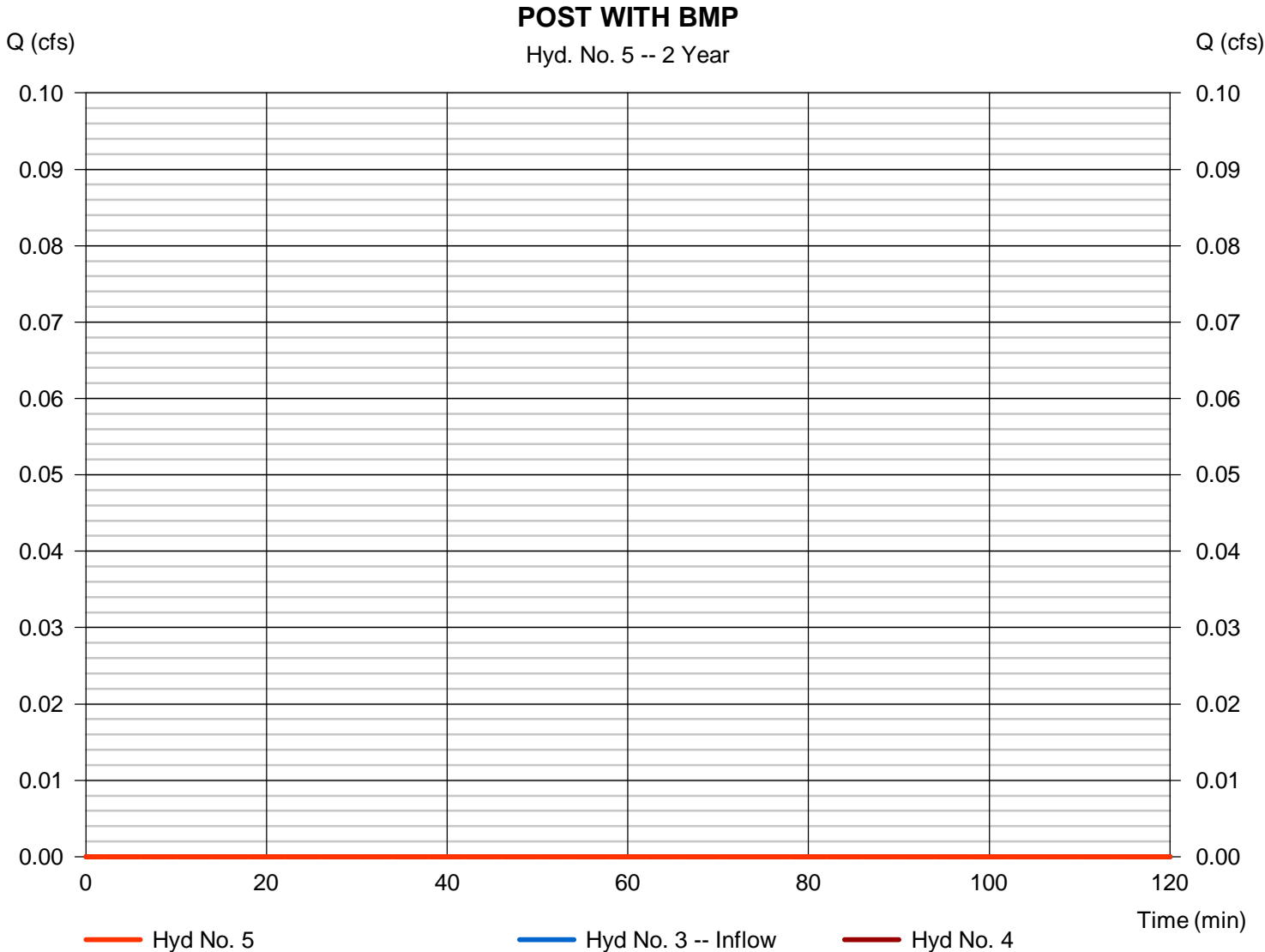


Hydrograph Report

Hyd. No. 5

POST WITH 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 - DETAINED DA1 | 2nd diverted hyd. | = 4 |
| Diversion method | = First Flush Volume | Volume Up To | = 3,081 cuft |



Hydrograph Report

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

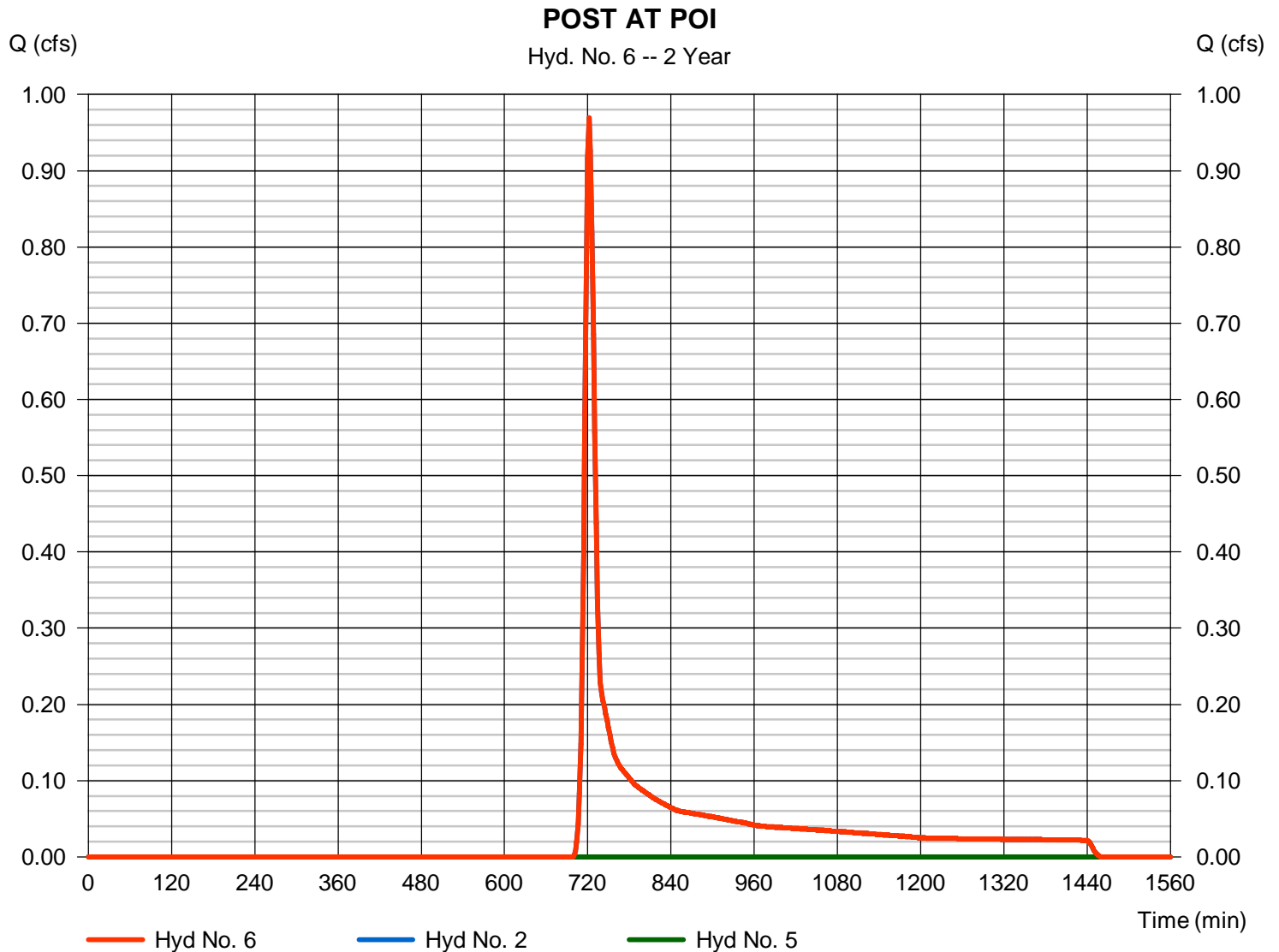
Thursday, 11 / 17 / 2016

Hyd. No. 6

POST AT POI

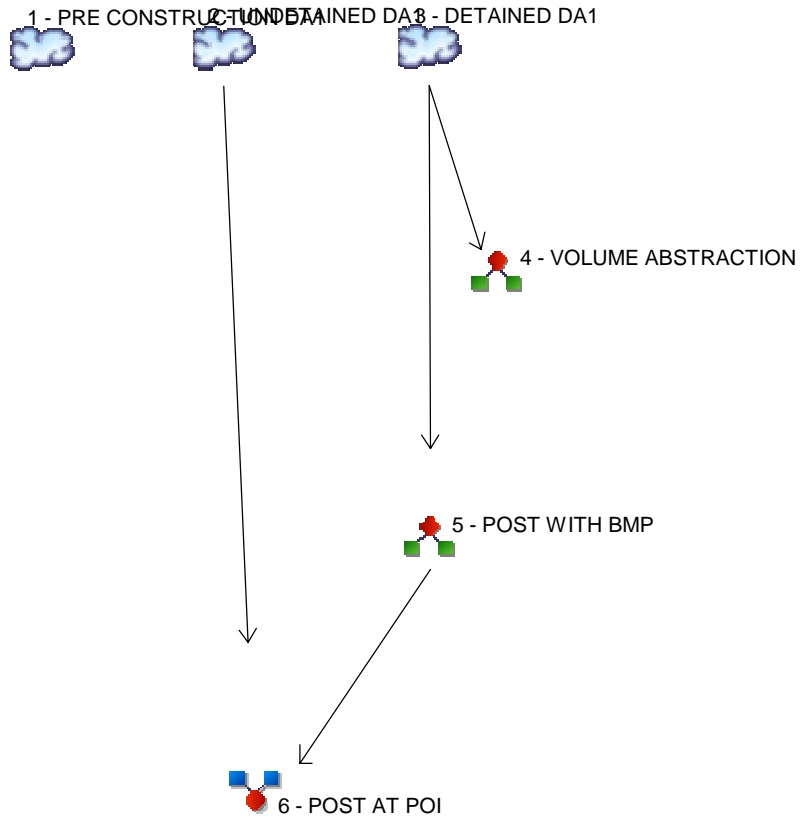
Hydrograph type = Combine
Storm frequency = 2 yrs
Time interval = 2 min
Inflow hyds. = 2, 5

Peak discharge = 0.970 cfs
Time to peak = 722 min
Hyd. volume = 2,861 cuft
Contrib. drain. area = 1.330 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 CONSTRUCTION DA1 |
| 2 | SCS Runoff UNDETAINED DA1 |
| 3 | SCS Runoff DETAINED DA1 |
| 4 | Diversion1 VOLUME ABSTRACTION |
| 5 | Diversion2 POST WITH 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 | ----- | ----- | ----- | ----- | ----- | 3.035 | ----- | ----- | ----- | PRE CONSTRUCTION DA1 |
| 2 | SCS Runoff | ----- | ----- | ----- | ----- | ----- | 2.432 | ----- | ----- | ----- | UNDETAINED DA1 |
| 3 | SCS Runoff | ----- | ----- | ----- | ----- | ----- | 0.277 | ----- | ----- | ----- | DETAINED DA1 |
| 4 | Diversion1 | 3 | ----- | ----- | ----- | ----- | 0.277 | ----- | ----- | ----- | VOLUME ABSTRACTION |
| 5 | Diversion2 | 3 | ----- | ----- | ----- | ----- | 0.000 | ----- | ----- | ----- | POST WITH BMP |
| 6 | Combine | 2, 5 | ----- | ----- | ----- | ----- | 2.432 | ----- | ----- | ----- | 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 | 3.035 | 2 | 722 | 8,097 | ----- | ----- | ----- | PRE CONSTRUCTION DA1 |
| 2 | SCS Runoff | 2.432 | 2 | 722 | 6,488 | ----- | ----- | ----- | UNDETAINED DA1 |
| 3 | SCS Runoff | 0.277 | 2 | 738 | 1,505 | ----- | ----- | ----- | DETAINED DA1 |
| 4 | Diversion1 | 0.277 | 2 | 738 | 1,505 | 3 | ----- | ----- | VOLUME ABSTRACTION |
| 5 | Diversion2 | 0.000 | 2 | n/a | 0 | 3 | ----- | ----- | POST WITH BMP |
| 6 | Combine | 2.432 | 2 | 722 | 6,488 | 2, 5 | ----- | ----- | POST AT POI |

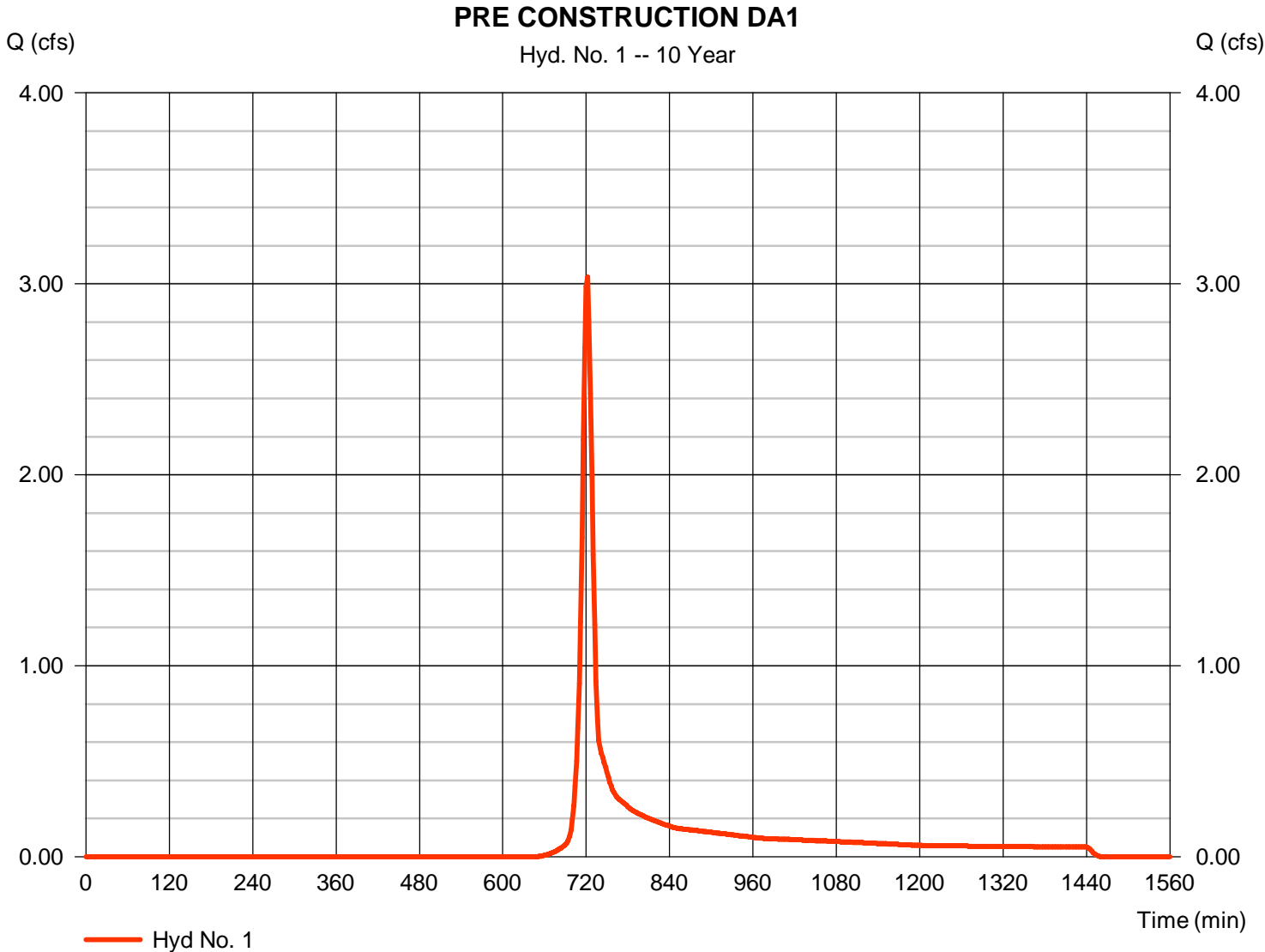
Hydrograph Report

Hyd. No. 1

PRE CONSTRUCTION DA1

| | | | |
|-----------------|--------------|--------------------|--------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 3.035 cfs |
| Storm frequency | = 10 yrs | Time to peak | = 722 min |
| Time interval | = 2 min | Hyd. volume | = 8,097 cuft |
| Drainage area | = 1.660 ac | Curve number | = 70* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = TR55 | Time of conc. (Tc) | = 11.10 min |
| Total precip. | = 3.96 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = + (0.320 x 77) + (0.890 x 58) + (0.170 x 78) + (0.280 x 98)] / 1.660



TR55 Tc Worksheet

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

Hyd. No. 1

PRE CONSTRUCTION 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) | = 2.74 | 0.00 | 0.00 | |
| Land slope (%) | = 2.00 | 0.00 | 0.00 | |
| Travel Time (min) | = 8.86 | + 0.00 | + 0.00 | = 8.86 |
| Shallow Concentrated Flow | | | | |
| Flow length (ft) | = 572.00 | 0.00 | 0.00 | |
| Watercourse slope (%) | = 7.20 | 0.00 | 0.00 | |
| Surface description | = Unpaved | Paved | Paved | |
| Average velocity (ft/s) | =4.33 | 0.00 | 0.00 | |
| Travel Time (min) | = 2.20 | + 0.00 | + 0.00 | = 2.20 |
| 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 | = 0.000 | 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 | | | | 11.10 min |

Hydrograph Report

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

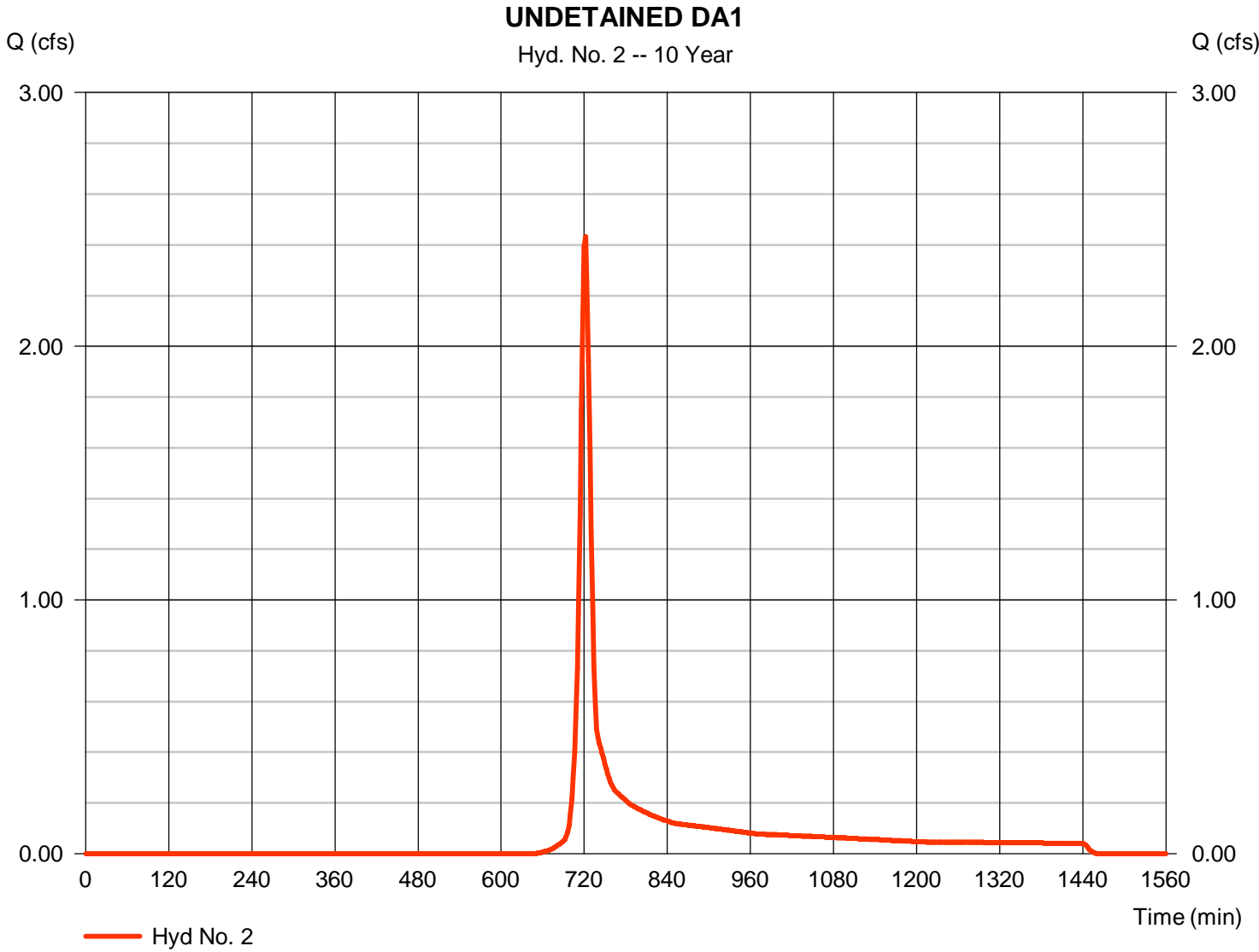
Thursday, 11 / 17 / 2016

Hyd. No. 2

UNDETAINED DA1

| | | | |
|-----------------|--------------|--------------------|--------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 2.432 cfs |
| Storm frequency | = 10 yrs | Time to peak | = 722 min |
| Time interval | = 2 min | Hyd. volume | = 6,488 cuft |
| Drainage area | = 1.330 ac | Curve number | = 70* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = User | Time of conc. (Tc) | = 11.30 min |
| Total precip. | = 3.96 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = [(0.580 x 58) + (0.190 x 78) + (0.270 x 98) + (0.010 x 85) + (0.010 x 91) + (0.270 x 77)] / 1.330



Hydrograph Report

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

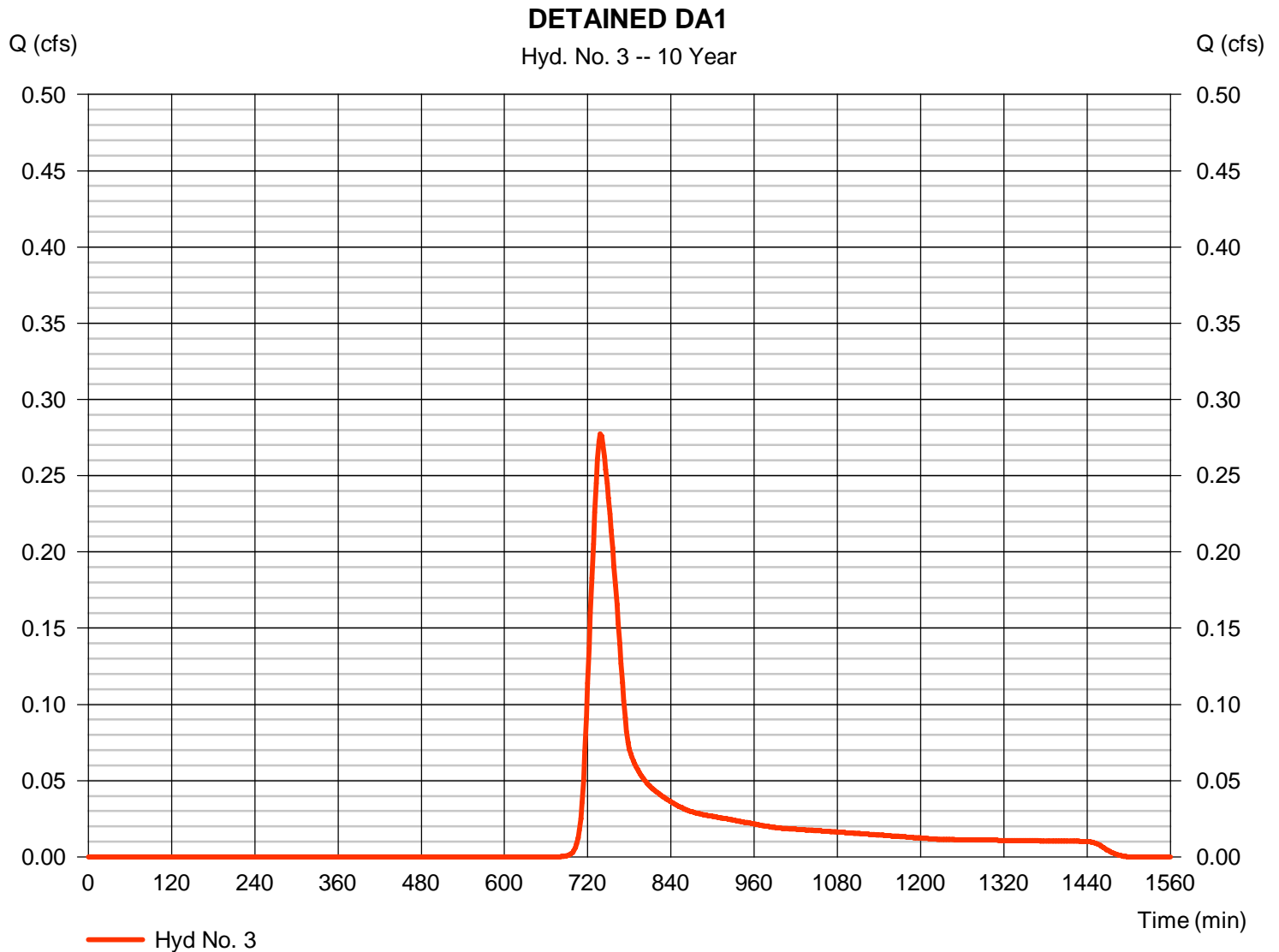
Thursday, 11 / 17 / 2016

Hyd. No. 3

DETAINED DA1

| | | | |
|-----------------|--------------|--------------------|--------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 0.277 cfs |
| Storm frequency | = 10 yrs | Time to peak | = 738 min |
| Time interval | = 2 min | Hyd. volume | = 1,505 cuft |
| Drainage area | = 0.370 ac | Curve number | = 67* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = User | Time of conc. (Tc) | = 37.89 min |
| Total precip. | = 3.96 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = [(0.120 x 85) + (0.250 x 58)] / 0.370



Hydrograph Report

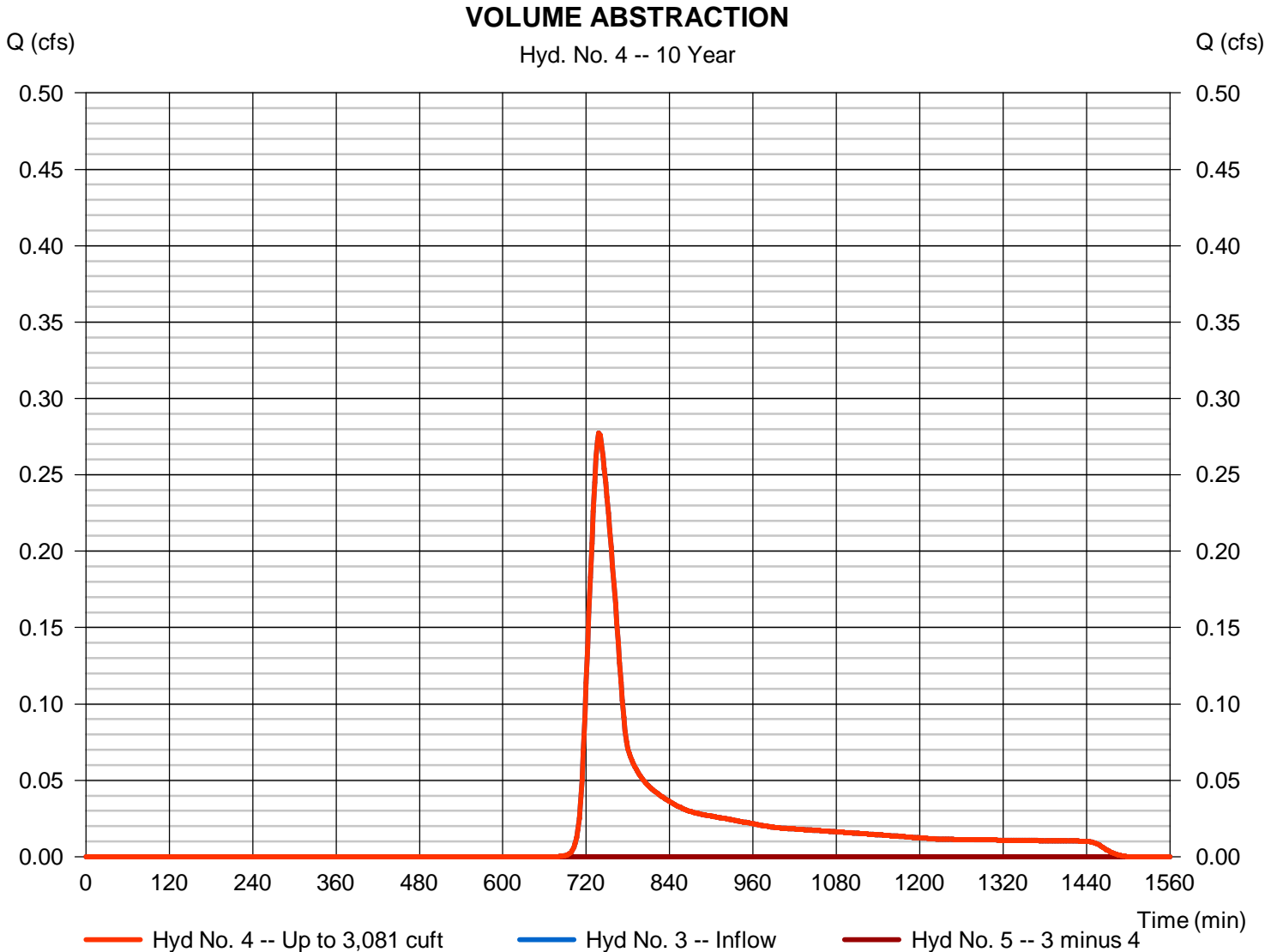
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Thursday, 11 / 17 / 2016

Hyd. No. 4

VOLUME ABSTRACTION

| | | | |
|-------------------|----------------------|-------------------|--------------|
| Hydrograph type | = Diversion1 | Peak discharge | = 0.277 cfs |
| Storm frequency | = 10 yrs | Time to peak | = 738 min |
| Time interval | = 2 min | Hyd. volume | = 1,505 cuft |
| Inflow hydrograph | = 3 - DETAINED DA1 | 2nd diverted hyd. | = 5 |
| Diversion method | = First Flush Volume | Volume Up To | = 3,081 cuft |



Hydrograph Report

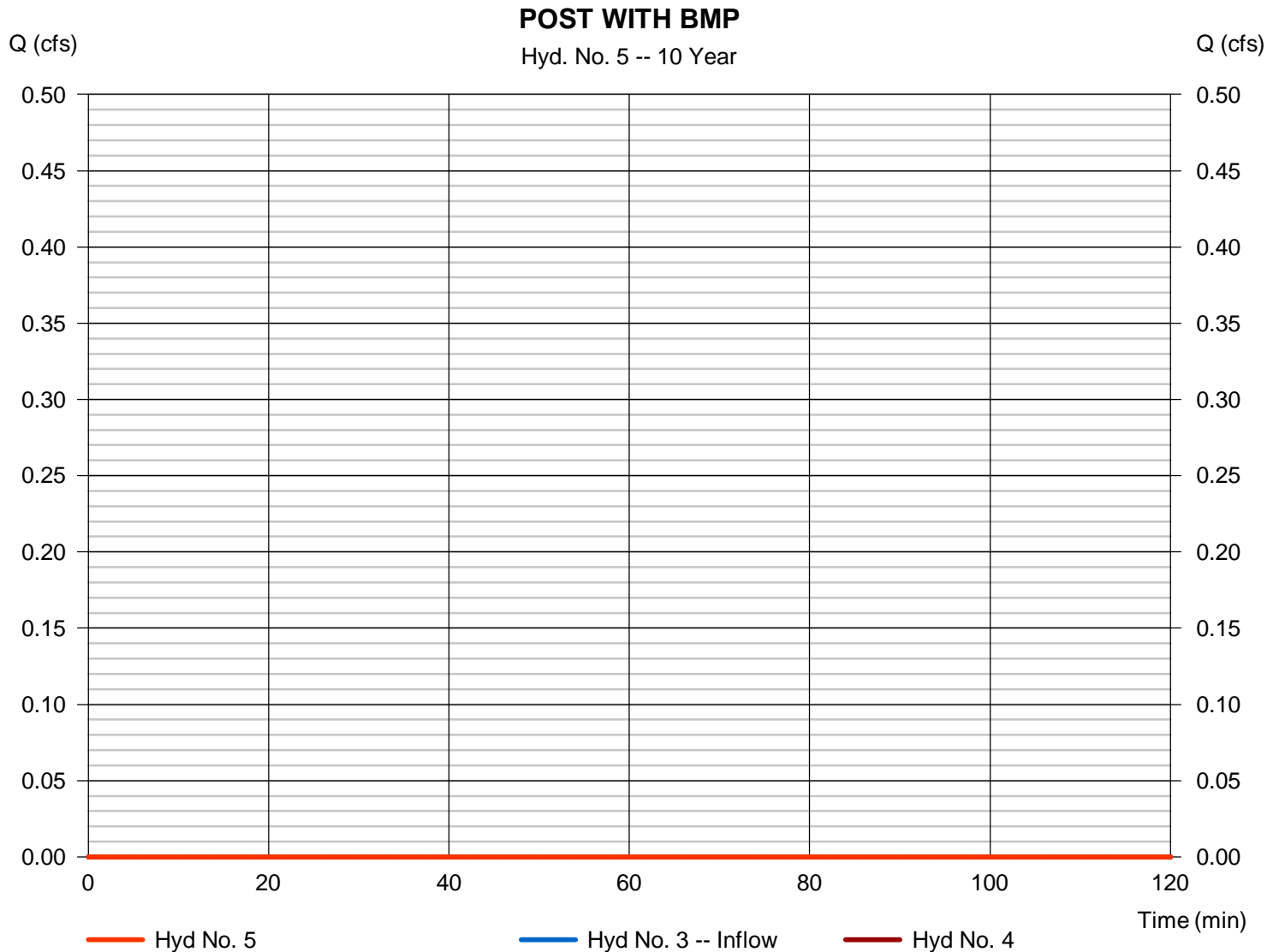
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Thursday, 11 / 17 / 2016

Hyd. No. 5

POST WITH 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 - DETAINED DA1 | 2nd diverted hyd. | = 4 |
| Diversion method | = First Flush Volume | Volume Up To | = 3,081 cuft |



Hydrograph Report

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

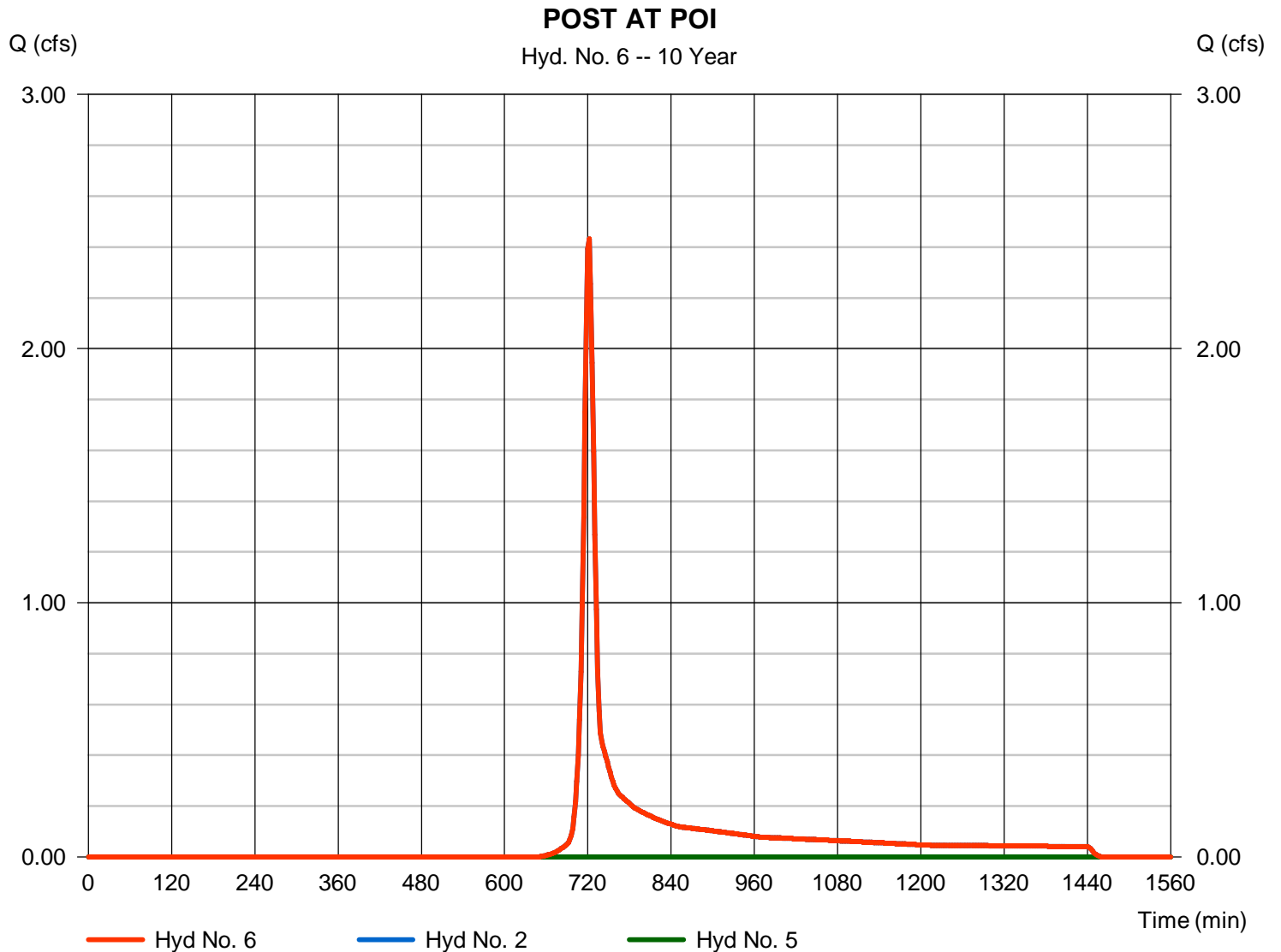
Thursday, 11 / 17 / 2016

Hyd. No. 6

POST AT POI

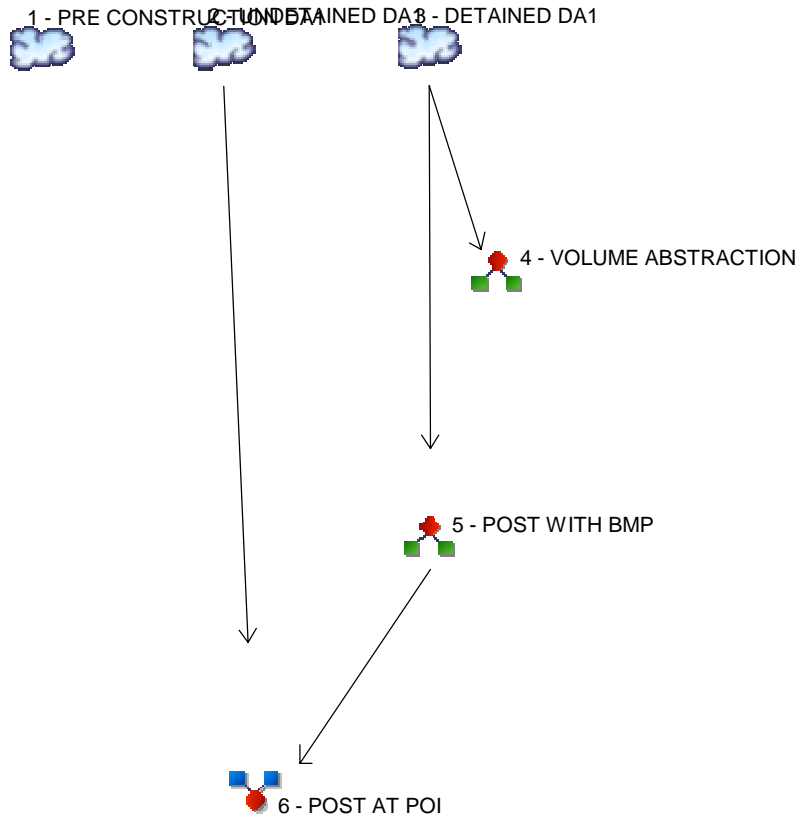
Hydrograph type = Combine
Storm frequency = 10 yrs
Time interval = 2 min
Inflow hyds. = 2, 5

Peak discharge = 2.432 cfs
Time to peak = 722 min
Hyd. volume = 6,488 cuft
Contrib. drain. area = 1.330 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 CONSTRUCTION DA1 |
| 2 | SCS Runoff UNDETAINED DA1 |
| 3 | SCS Runoff DETAINED DA1 |
| 4 | Diversion1 VOLUME ABSTRACTION |
| 5 | Diversion2 POST WITH 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 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 5.782 | ----- | PRE CONSTRUCTION DA1 |
| 2 | SCS Runoff | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 4.632 | ----- | UNDETAINED DA1 |
| 3 | SCS Runoff | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.582 | ----- | DETAINED DA1 |
| 4 | Diversion1 | 3 | ----- | ----- | ----- | ----- | ----- | ----- | 0.582 | ----- | VOLUME ABSTRACTION |
| 5 | Diversion2 | 3 | ----- | ----- | ----- | ----- | ----- | ----- | 0.000 | ----- | POST WITH BMP |
| 6 | Combine | 2, 5 | ----- | ----- | ----- | ----- | ----- | ----- | 4.632 | ----- | 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 | 5.782 | 2 | 720 | 15,098 | ----- | ----- | ----- | PRE CONSTRUCTION DA1 |
| 2 | SCS Runoff | 4.632 | 2 | 720 | 12,097 | ----- | ----- | ----- | UNDETAINED DA1 |
| 3 | SCS Runoff | 0.582 | 2 | 738 | 2,920 | ----- | ----- | ----- | DETAINED DA1 |
| 4 | Diversion1 | 0.582 | 2 | 738 | 2,920 | 3 | ----- | ----- | VOLUME ABSTRACTION |
| 5 | Diversion2 | 0.000 | 2 | n/a | 0 | 3 | ----- | ----- | POST WITH BMP |
| 6 | Combine | 4.632 | 2 | 720 | 12,097 | 2, 5 | ----- | ----- | POST AT POI |

Hydrograph Report

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

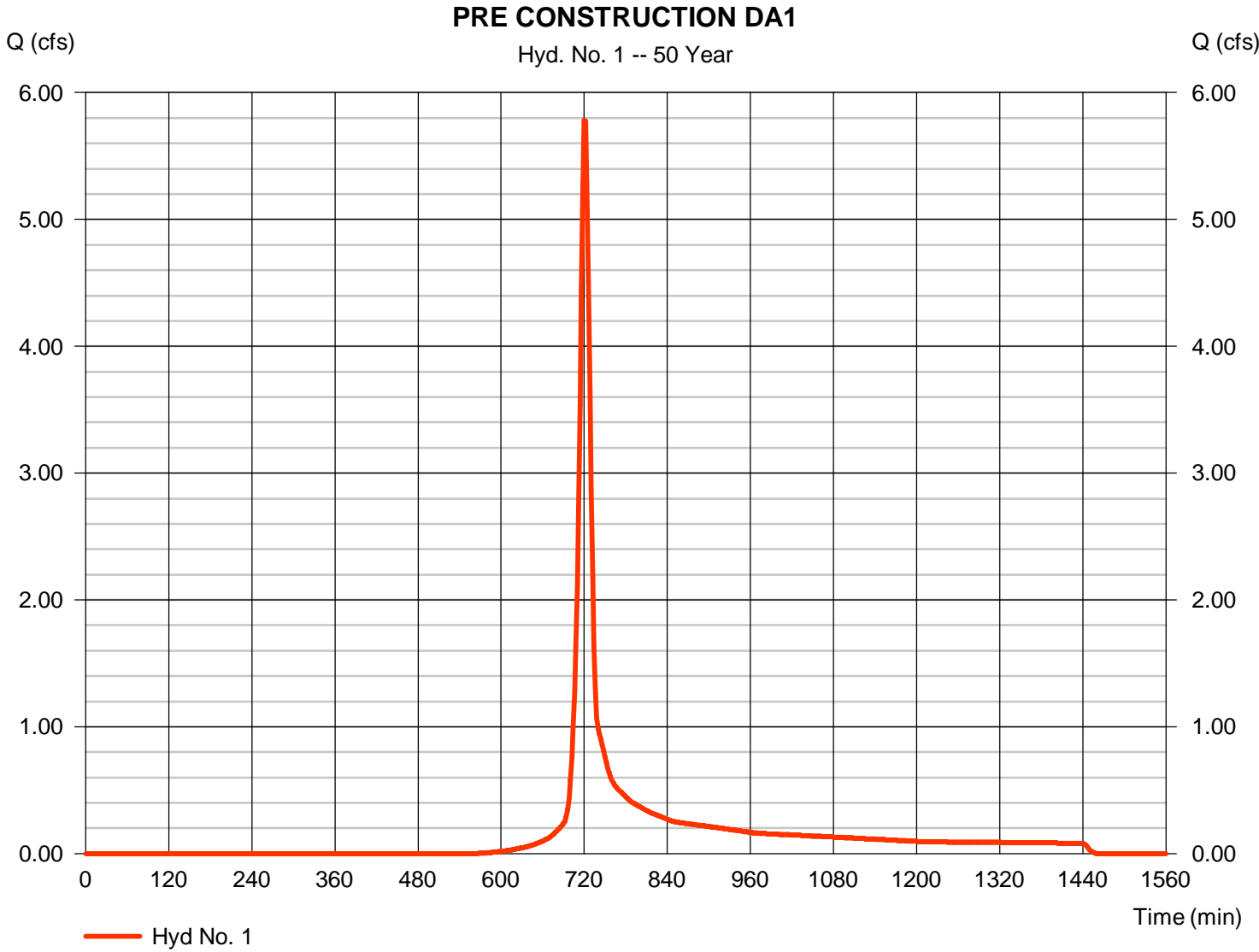
Thursday, 11 / 17 / 2016

Hyd. No. 1

PRE CONSTRUCTION DA1

| | | | |
|-----------------|--------------|--------------------|---------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 5.782 cfs |
| Storm frequency | = 50 yrs | Time to peak | = 720 min |
| Time interval | = 2 min | Hyd. volume | = 15,098 cuft |
| Drainage area | = 1.660 ac | Curve number | = 70* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = TR55 | Time of conc. (Tc) | = 11.10 min |
| Total precip. | = 5.52 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = + (0.320 x 77) + (0.890 x 58) + (0.170 x 78) + (0.280 x 98)] / 1.660



TR55 Tc Worksheet

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

Hyd. No. 1

PRE CONSTRUCTION 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) | = 2.74 | 0.00 | 0.00 | |
| Land slope (%) | = 2.00 | 0.00 | 0.00 | |
| Travel Time (min) | = 8.86 | + 0.00 | + 0.00 | = 8.86 |
| Shallow Concentrated Flow | | | | |
| Flow length (ft) | = 572.00 | 0.00 | 0.00 | |
| Watercourse slope (%) | = 7.20 | 0.00 | 0.00 | |
| Surface description | = Unpaved | Paved | Paved | |
| Average velocity (ft/s) | =4.33 | 0.00 | 0.00 | |
| Travel Time (min) | = 2.20 | + 0.00 | + 0.00 | = 2.20 |
| 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 | = 0.000 | 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 | | | | 11.10 min |

Hydrograph Report

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

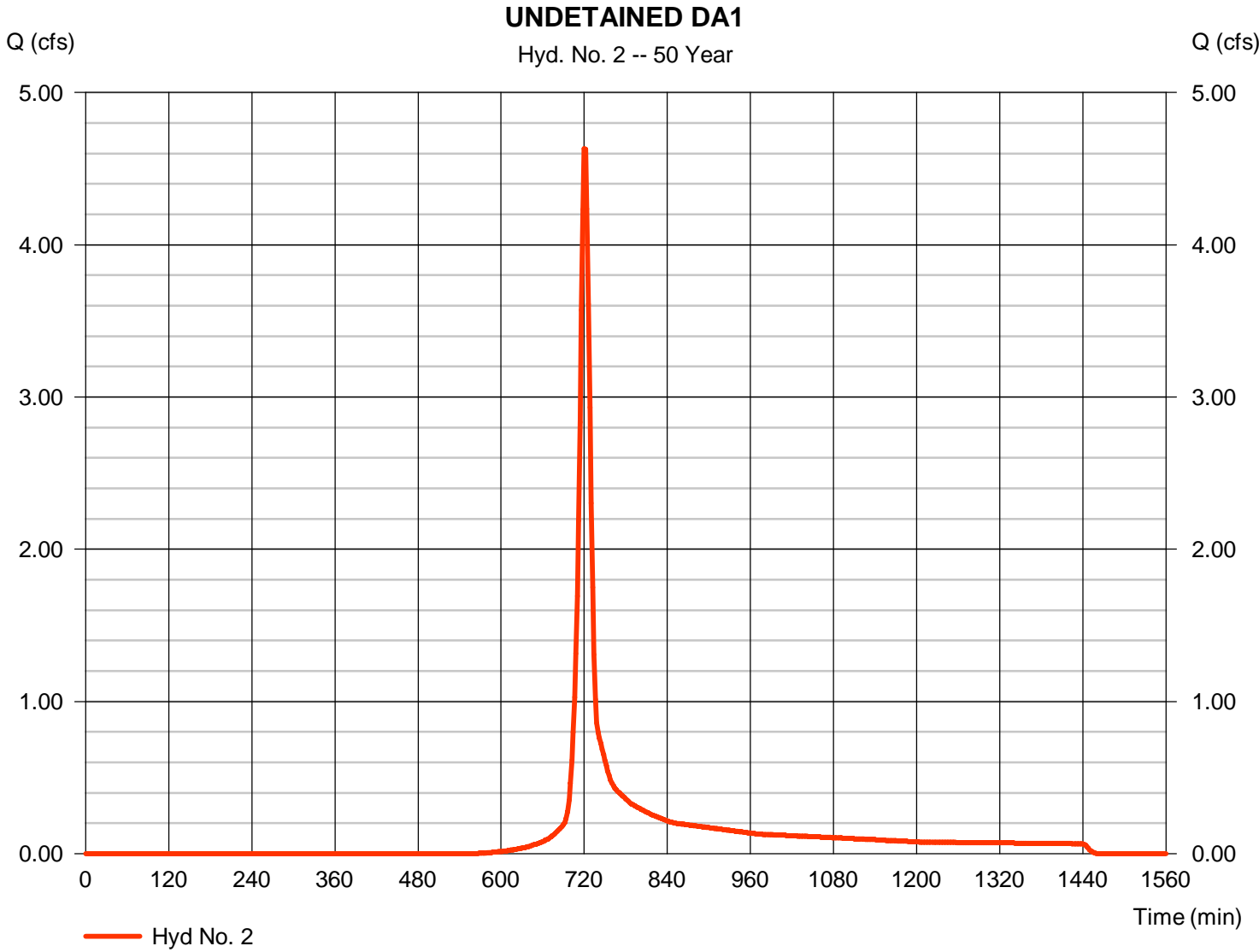
Thursday, 11 / 17 / 2016

Hyd. No. 2

UNDETAINED DA1

| | | | |
|-----------------|--------------|--------------------|---------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 4.632 cfs |
| Storm frequency | = 50 yrs | Time to peak | = 720 min |
| Time interval | = 2 min | Hyd. volume | = 12,097 cuft |
| Drainage area | = 1.330 ac | Curve number | = 70* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = User | Time of conc. (Tc) | = 11.30 min |
| Total precip. | = 5.52 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = [(0.580 x 58) + (0.190 x 78) + (0.270 x 98) + (0.010 x 85) + (0.010 x 91) + (0.270 x 77)] / 1.330



Hydrograph Report

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

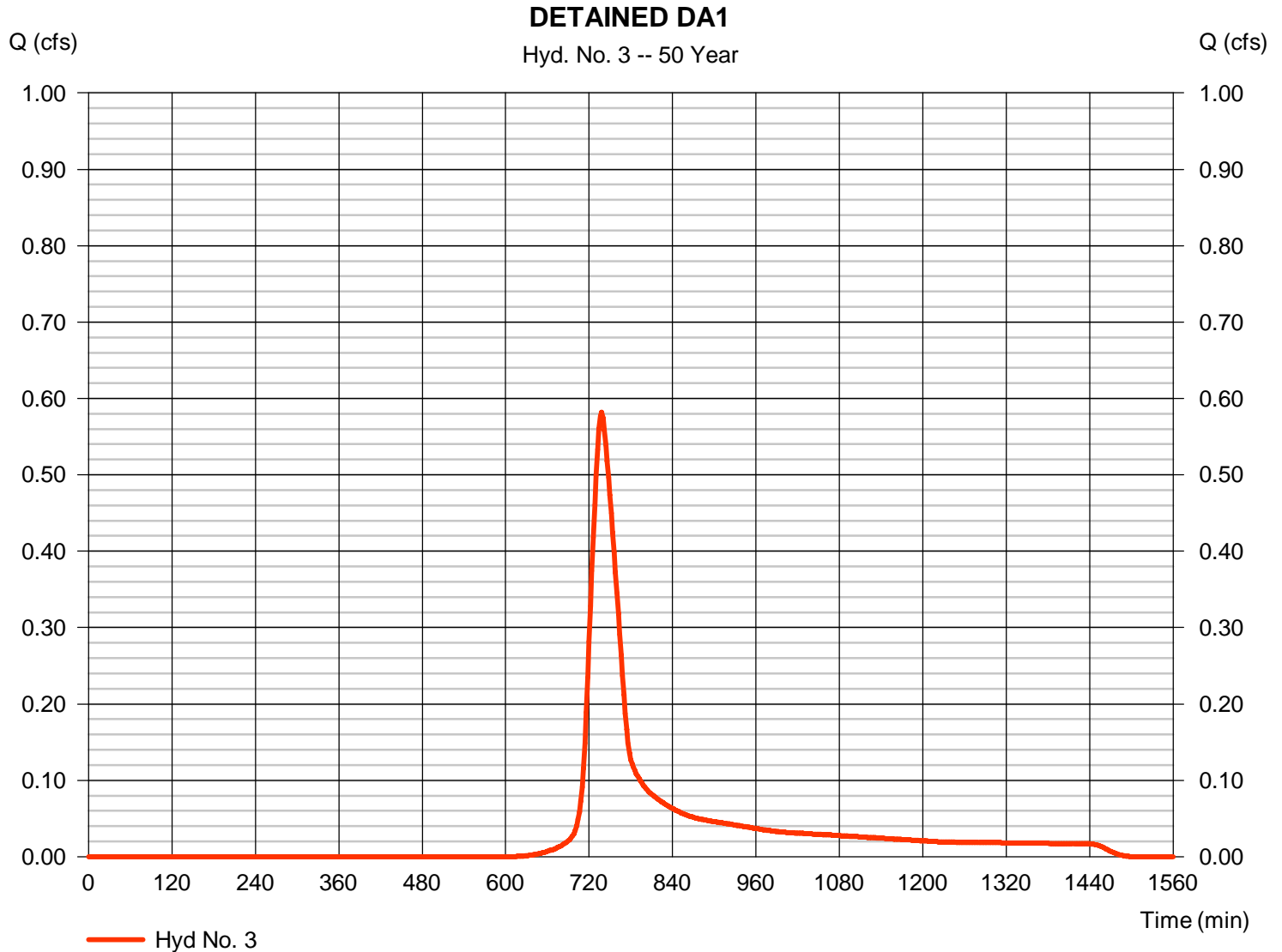
Thursday, 11 / 17 / 2016

Hyd. No. 3

DETAINED DA1

| | | | |
|-----------------|--------------|--------------------|--------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 0.582 cfs |
| Storm frequency | = 50 yrs | Time to peak | = 738 min |
| Time interval | = 2 min | Hyd. volume | = 2,920 cuft |
| Drainage area | = 0.370 ac | Curve number | = 67* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = User | Time of conc. (Tc) | = 37.55 min |
| Total precip. | = 5.52 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = [(0.120 x 85) + (0.250 x 58)] / 0.370



Hydrograph Report

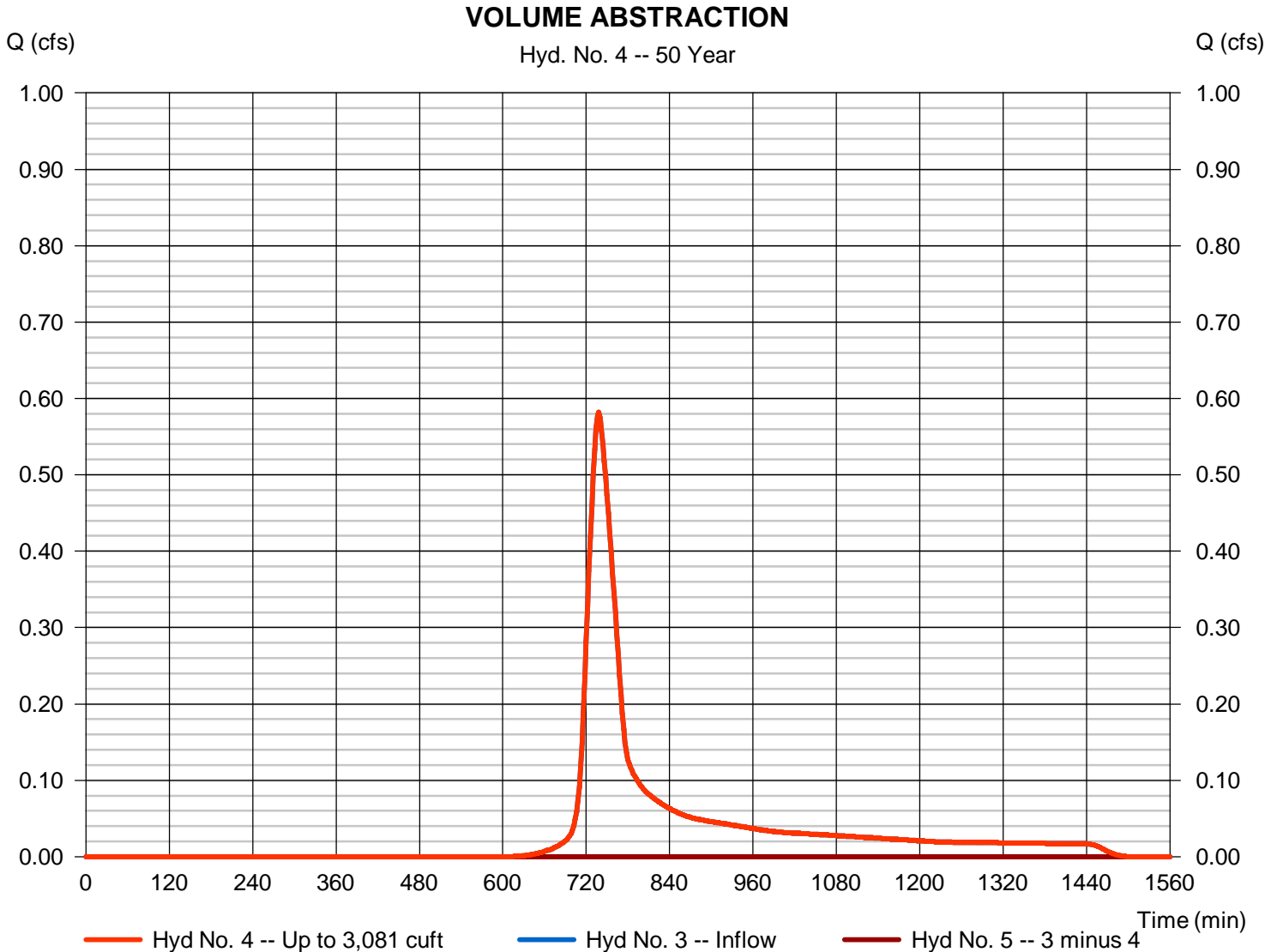
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Thursday, 11 / 17 / 2016

Hyd. No. 4

VOLUME ABSTRACTION

| | | | |
|-------------------|----------------------|-------------------|--------------|
| Hydrograph type | = Diversion1 | Peak discharge | = 0.582 cfs |
| Storm frequency | = 50 yrs | Time to peak | = 738 min |
| Time interval | = 2 min | Hyd. volume | = 2,920 cuft |
| Inflow hydrograph | = 3 - DETAINED DA1 | 2nd diverted hyd. | = 5 |
| Diversion method | = First Flush Volume | Volume Up To | = 3,081 cuft |



Hydrograph Report

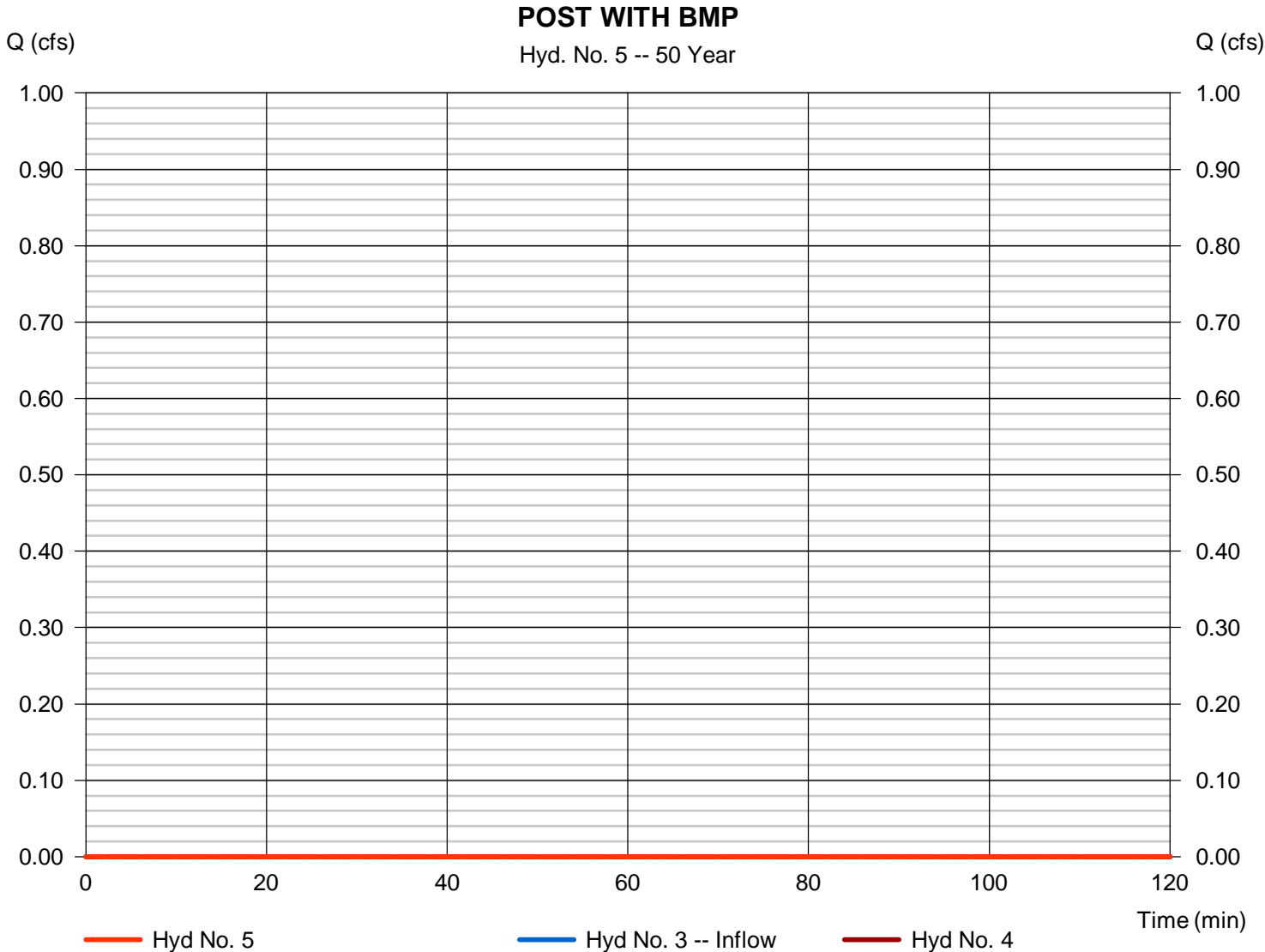
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Thursday, 11 / 17 / 2016

Hyd. No. 5

POST WITH 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 - DETAINED DA1 | 2nd diverted hyd. | = 4 |
| Diversion method | = First Flush Volume | Volume Up To | = 3,081 cuft |



Hydrograph Report

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

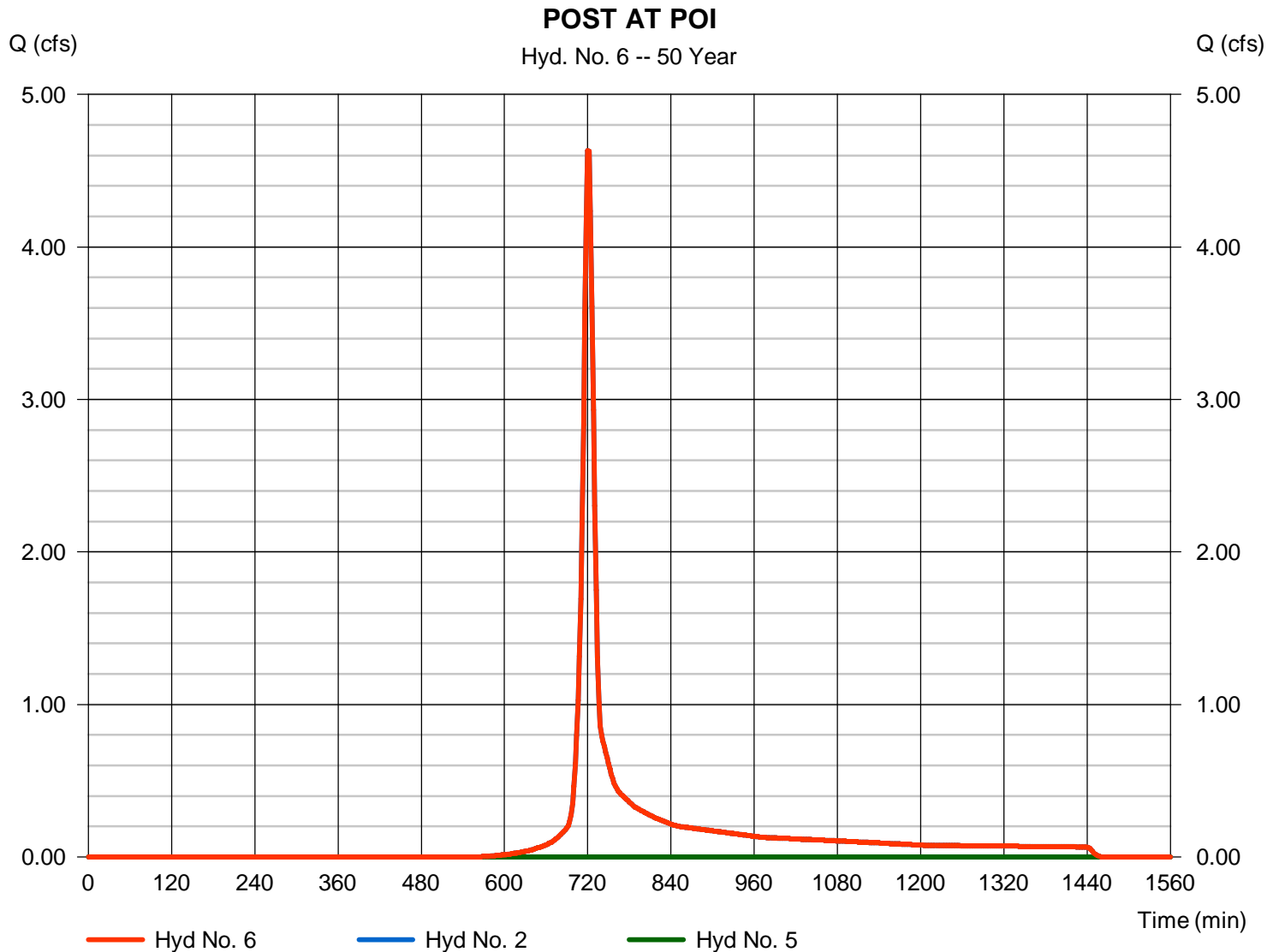
Thursday, 11 / 17 / 2016

Hyd. No. 6

POST AT POI

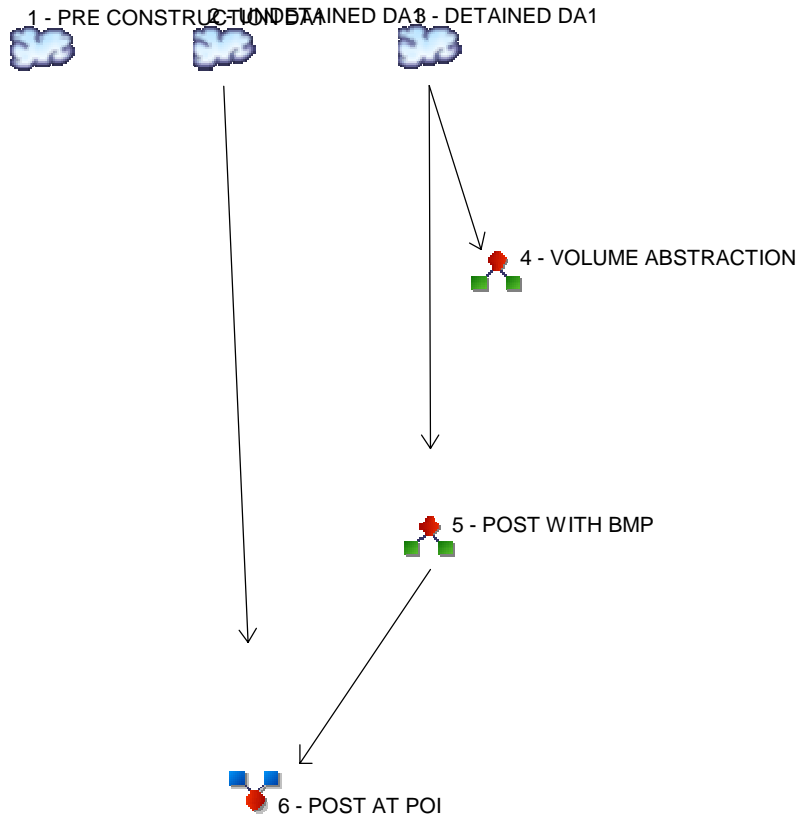
Hydrograph type = Combine
Storm frequency = 50 yrs
Time interval = 2 min
Inflow hyds. = 2, 5

Peak discharge = 4.632 cfs
Time to peak = 720 min
Hyd. volume = 12,097 cuft
Contrib. drain. area = 1.330 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 CONSTRUCTION DA1 |
| 2 | SCS Runoff UNDETAINED DA1 |
| 3 | SCS Runoff DETAINED DA1 |
| 4 | Diversion1 VOLUME ABSTRACTION |
| 5 | Diversion2 POST WITH 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 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 7.344 | PRE CONSTRUCTION DA1 |
| 2 | SCS Runoff | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 5.884 | UNDETAINED DA1 |
| 3 | SCS Runoff | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.860 | DETAINED DA1 |
| 4 | Diversion1 | 3 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.860 | VOLUME ABSTRACTION |
| 5 | Diversion2 | 3 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.038 | POST WITH BMP |
| 6 | Combine | 2, 5 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 5.884 | 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 | 7.344 | 2 | 720 | 19,073 | ----- | ----- | ----- | PRE CONSTRUCTION DA1 |
| 2 | SCS Runoff | 5.884 | 2 | 720 | 15,281 | ----- | ----- | ----- | UNDETAINED DA1 |
| 3 | SCS Runoff | 0.860 | 2 | 734 | 3,783 | ----- | ----- | ----- | DETAINED DA1 |
| 4 | Diversion1 | 0.860 | 2 | 734 | 3,084 | 3 | ----- | ----- | VOLUME ABSTRACTION |
| 5 | Diversion2 | 0.038 | 2 | 1018 | 698 | 3 | ----- | ----- | POST WITH BMP |
| 6 | Combine | 5.884 | 2 | 720 | 15,980 | 2, 5 | ----- | ----- | POST AT POI |

Hydrograph Report

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

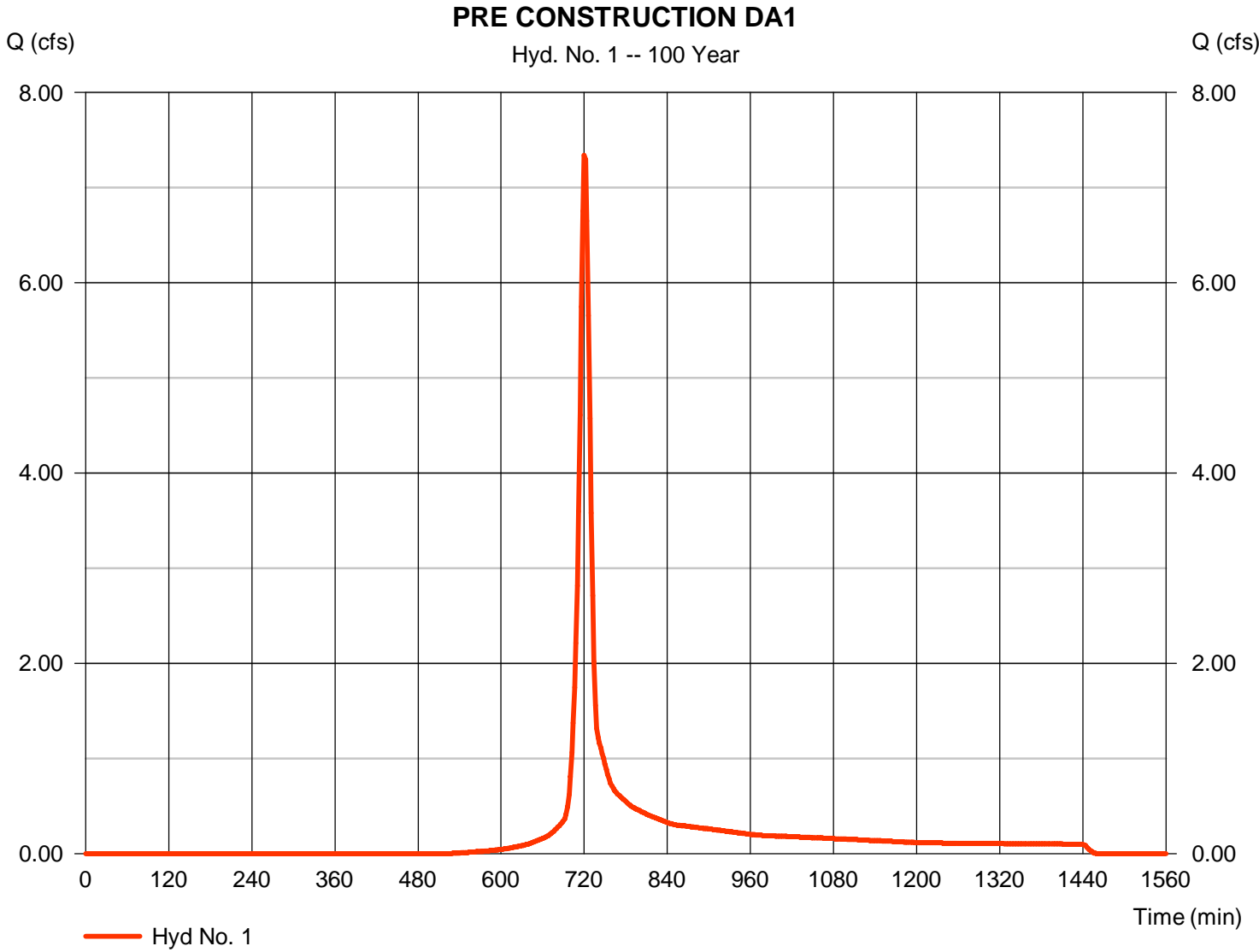
Thursday, 11 / 17 / 2016

Hyd. No. 1

PRE CONSTRUCTION DA1

| | | | |
|-----------------|--------------|--------------------|---------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 7.344 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 720 min |
| Time interval | = 2 min | Hyd. volume | = 19,073 cuft |
| Drainage area | = 1.660 ac | Curve number | = 70* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = TR55 | Time of conc. (Tc) | = 11.10 min |
| Total precip. | = 6.33 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = + (0.320 x 77) + (0.890 x 58) + (0.170 x 78) + (0.280 x 98)] / 1.660



TR55 Tc Worksheet

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

Hyd. No. 1

PRE CONSTRUCTION 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) | = 2.74 | 0.00 | 0.00 | |
| Land slope (%) | = 2.00 | 0.00 | 0.00 | |
| Travel Time (min) | = 8.86 | + 0.00 | + 0.00 | = 8.86 |
| Shallow Concentrated Flow | | | | |
| Flow length (ft) | = 572.00 | 0.00 | 0.00 | |
| Watercourse slope (%) | = 7.20 | 0.00 | 0.00 | |
| Surface description | = Unpaved | Paved | Paved | |
| Average velocity (ft/s) | =4.33 | 0.00 | 0.00 | |
| Travel Time (min) | = 2.20 | + 0.00 | + 0.00 | = 2.20 |
| 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 | = 0.000 | 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 | | | | 11.10 min |

Hydrograph Report

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

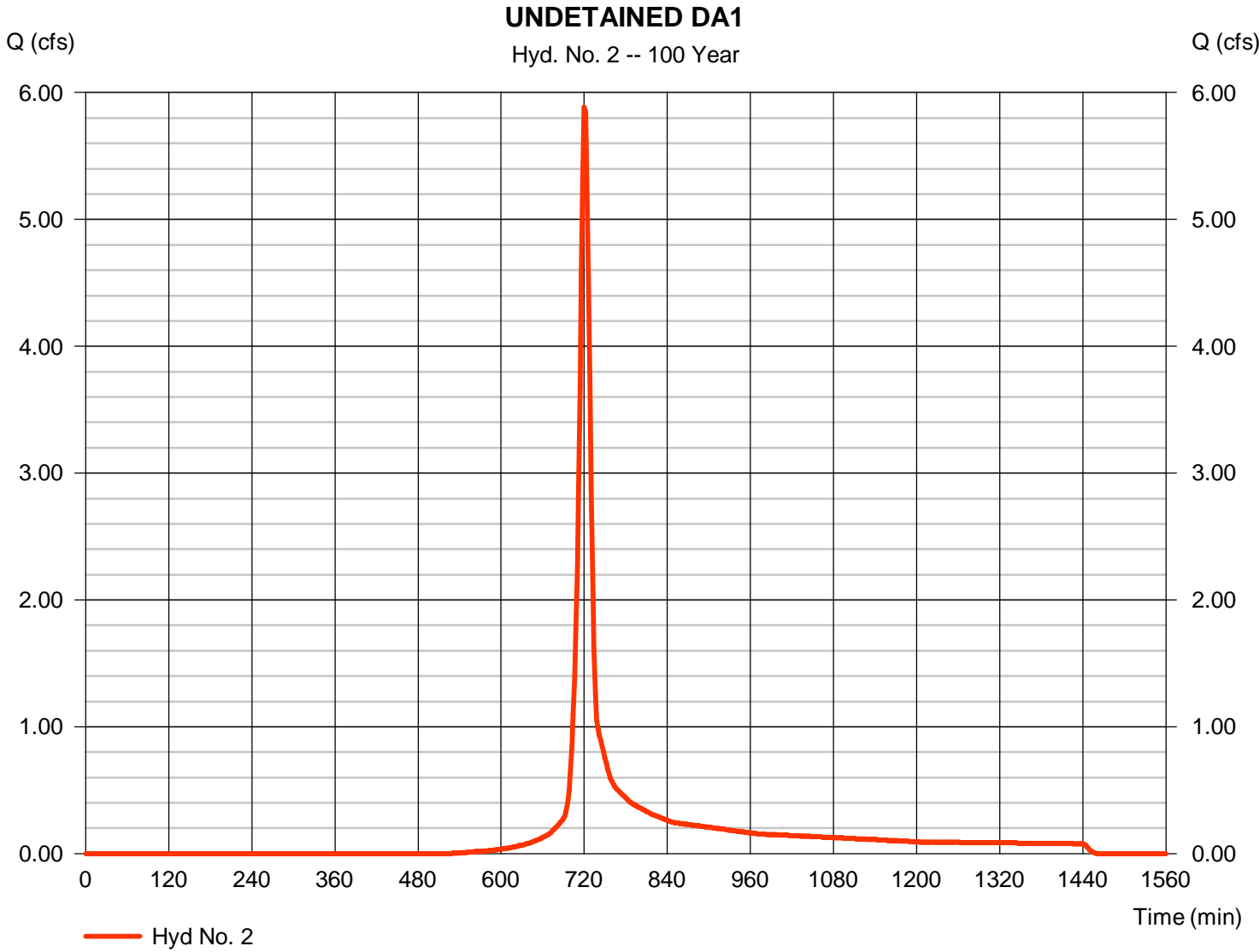
Thursday, 11 / 17 / 2016

Hyd. No. 2

UNDETAINED DA1

| | | | |
|-----------------|--------------|--------------------|---------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 5.884 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 720 min |
| Time interval | = 2 min | Hyd. volume | = 15,281 cuft |
| Drainage area | = 1.330 ac | Curve number | = 70* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = User | Time of conc. (Tc) | = 11.30 min |
| Total precip. | = 6.33 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = [(0.580 x 58) + (0.190 x 78) + (0.270 x 98) + (0.010 x 85) + (0.010 x 91) + (0.270 x 77)] / 1.330



Hydrograph Report

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

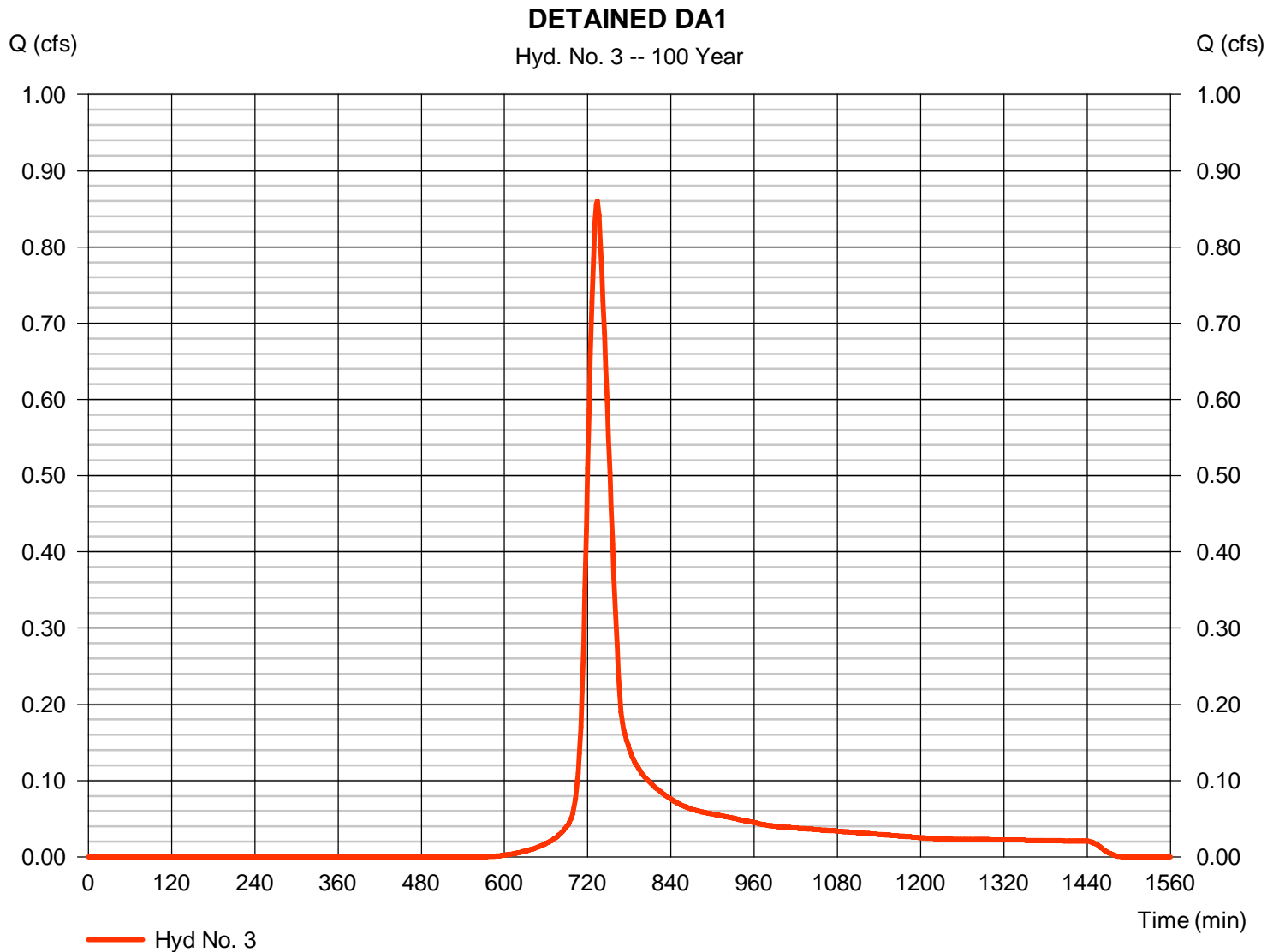
Thursday, 11 / 17 / 2016

Hyd. No. 3

DETAINED DA1

| | | | |
|-----------------|--------------|--------------------|--------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 0.860 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 734 min |
| Time interval | = 2 min | Hyd. volume | = 3,783 cuft |
| Drainage area | = 0.370 ac | Curve number | = 67* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = User | Time of conc. (Tc) | = 33.66 min |
| Total precip. | = 6.33 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = [(0.120 x 85) + (0.250 x 58)] / 0.370



Hydrograph Report

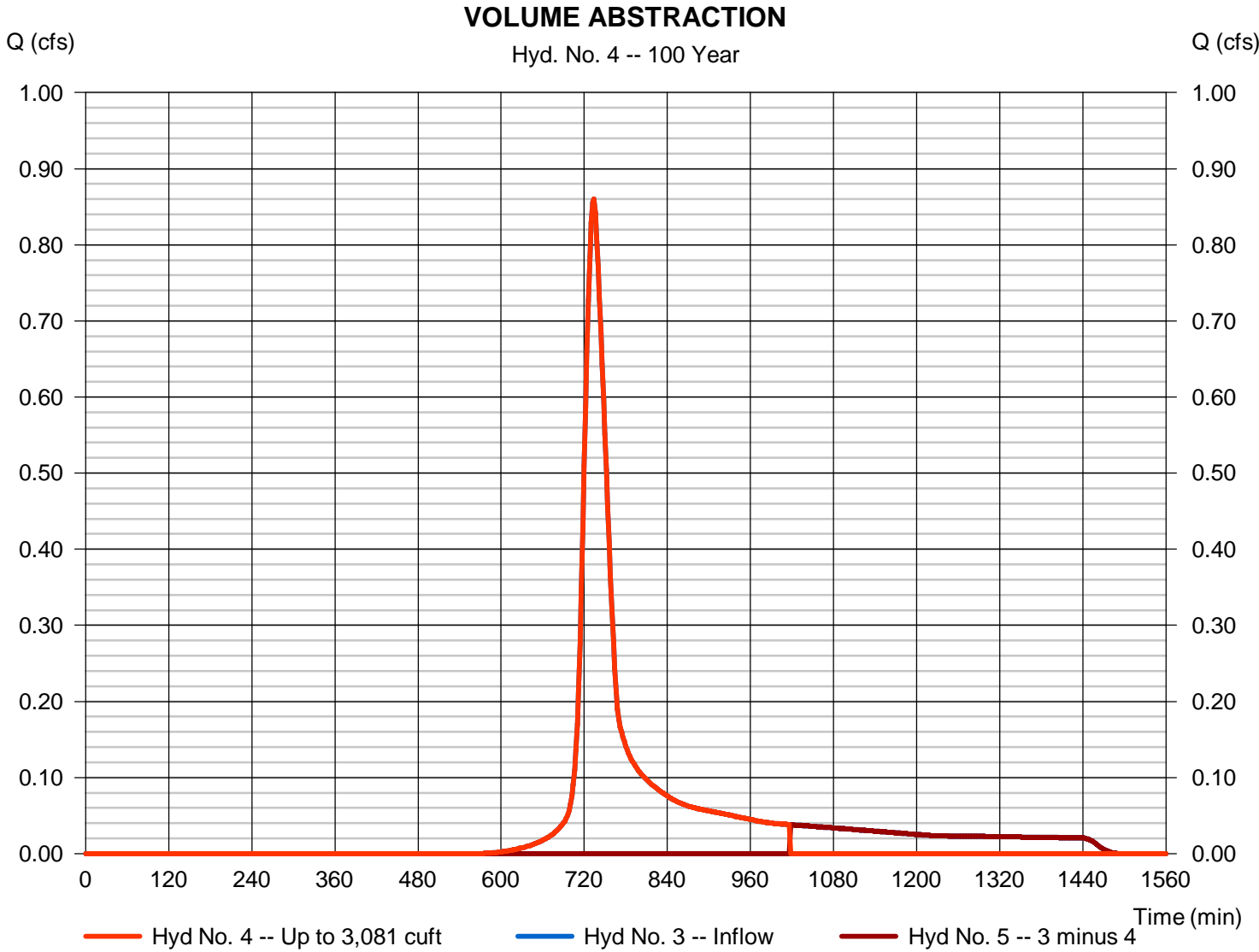
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Thursday, 11 / 17 / 2016

Hyd. No. 4

VOLUME ABSTRACTION

| | | | |
|-------------------|----------------------|-------------------|--------------|
| Hydrograph type | = Diversion1 | Peak discharge | = 0.860 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 734 min |
| Time interval | = 2 min | Hyd. volume | = 3,084 cuft |
| Inflow hydrograph | = 3 - DETAINED DA1 | 2nd diverted hyd. | = 5 |
| Diversion method | = First Flush Volume | Volume Up To | = 3,081 cuft |

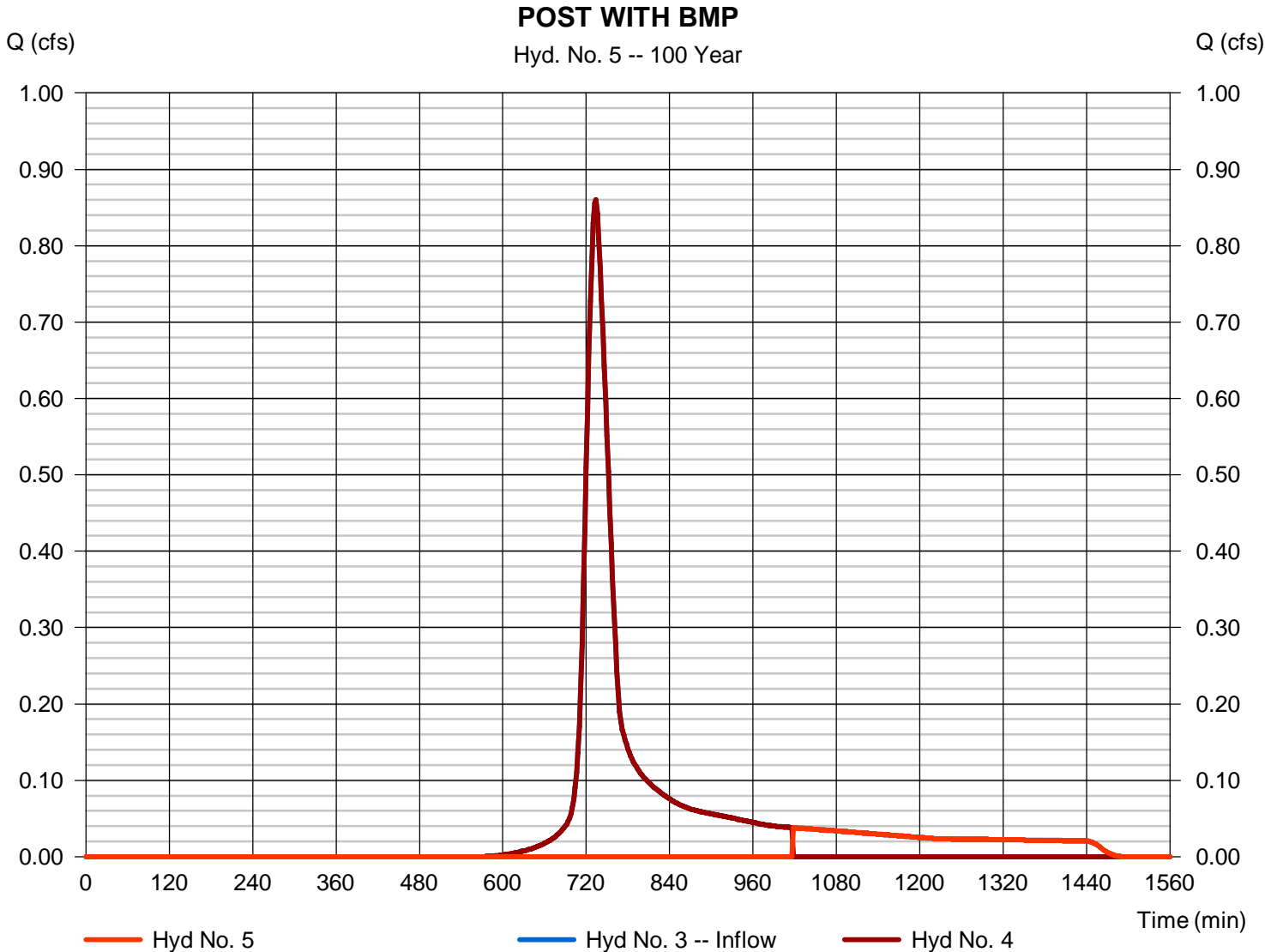


Hydrograph Report

Hyd. No. 5

POST WITH BMP

| | | | |
|-------------------|----------------------|-------------------|--------------|
| Hydrograph type | = Diversion2 | Peak discharge | = 0.038 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 1018 min |
| Time interval | = 2 min | Hyd. volume | = 698 cuft |
| Inflow hydrograph | = 3 - DETAINED DA1 | 2nd diverted hyd. | = 4 |
| Diversion method | = First Flush Volume | Volume Up To | = 3,081 cuft |



Hydrograph Report

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

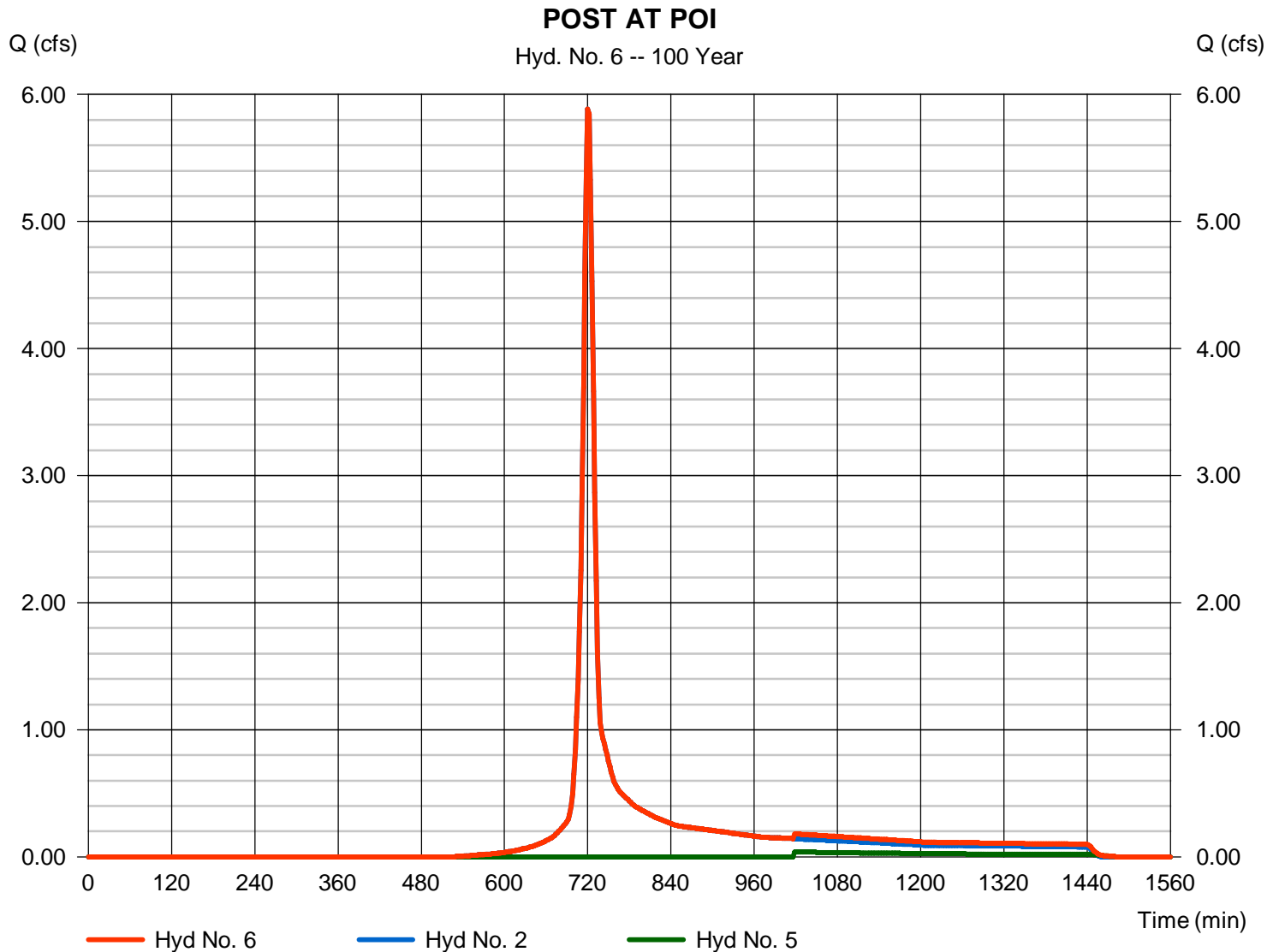
Thursday, 11 / 17 / 2016

Hyd. No. 6

POST AT POI

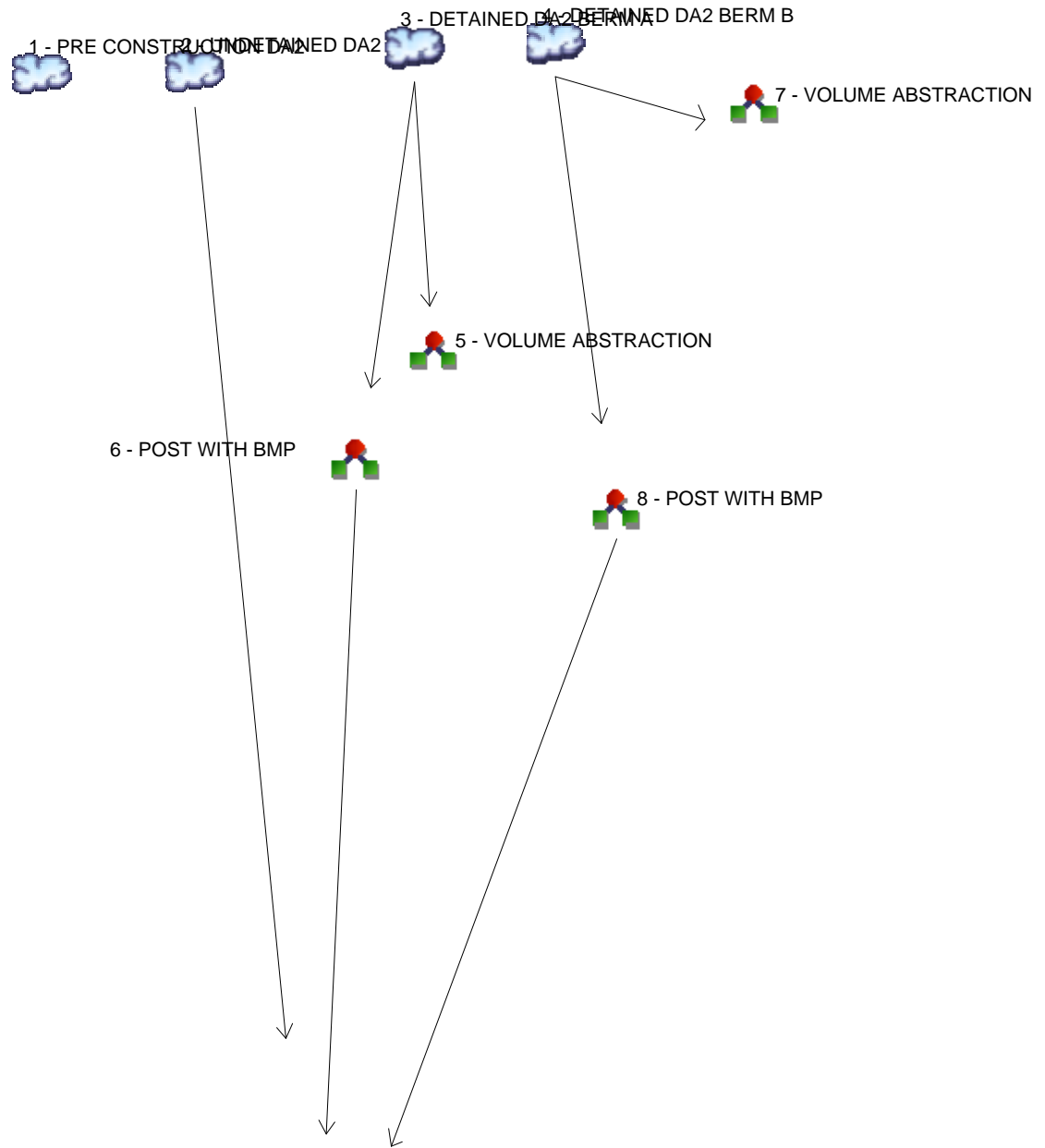
Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 2 min
Inflow hyds. = 2, 5

Peak discharge = 5.884 cfs
Time to peak = 720 min
Hyd. volume = 15,980 cuft
Contrib. drain. area = 1.330 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 CONSTRUCTION DA2 |
| 2 | SCS Runoff | UNDETAINED DA2 |
| 3 | SCS Runoff | DETAINED DA2 BERM A |
| 4 | SCS Runoff | DETAINED DA2 BERM B |
| 5 | Diversion1 | VOLUME ABSTRACTION |
| 6 | Diversion2 | POST WITH BMP |
| 7 | Diversion1 | VOLUME ABSTRACTION |
| 8 | Diversion2 | POST WITH BMP |
| 9 | 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 | ----- | ----- | 2.266 | ----- | ----- | 5.933 | ----- | 11.50 | 14.68 | PRE CONSTRUCTION DA2 |
| 2 | SCS Runoff | ----- | ----- | 2.053 | ----- | ----- | 4.955 | ----- | 9.295 | 11.74 | UNDETAINED DA2 |
| 3 | SCS Runoff | ----- | ----- | 0.431 | ----- | ----- | 0.909 | ----- | 1.598 | 1.975 | DETAINED DA2 BERM A |
| 4 | SCS Runoff | ----- | ----- | 0.268 | ----- | ----- | 0.804 | ----- | 1.641 | 2.115 | DETAINED DA2 BERM B |
| 5 | Diversion1 | 3 | ----- | 0.431 | ----- | ----- | 0.909 | ----- | 1.598 | 1.975 | VOLUME ABSTRACTION |
| 6 | Diversion2 | 3 | ----- | 0.000 | ----- | ----- | 0.000 | ----- | 0.053 | 0.172 | POST WITH BMP |
| 7 | Diversion1 | 4 | ----- | 0.268 | ----- | ----- | 0.804 | ----- | 1.641 | 2.115 | VOLUME ABSTRACTION |
| 8 | Diversion2 | 4 | ----- | 0.000 | ----- | ----- | 0.000 | ----- | 0.039 | 0.124 | POST WITH BMP |
| 9 | Combine | 2, 6, 8 | ----- | 2.053 | ----- | ----- | 4.955 | ----- | 9.295 | 11.74 | 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 | 2.266 | 2 | 722 | 6,872 | ----- | ----- | ----- | PRE CONSTRUCTION DA2 | |
| 2 | SCS Runoff | 2.053 | 2 | 722 | 5,922 | ----- | ----- | ----- | UNDETAINED DA2 | |
| 3 | SCS Runoff | 0.431 | 2 | 720 | 1,010 | ----- | ----- | ----- | DETAINED DA2 BERM A | |
| 4 | SCS Runoff | 0.268 | 2 | 718 | 641 | ----- | ----- | ----- | DETAINED DA2 BERM B | |
| 5 | Diversion1 | 0.431 | 2 | 720 | 1,010 | 3 | ----- | ----- | VOLUME ABSTRACTION | |
| 6 | Diversion2 | 0.000 | 2 | n/a | 0 | 3 | ----- | ----- | POST WITH BMP | |
| 7 | Diversion1 | 0.268 | 2 | 718 | 641 | 4 | ----- | ----- | VOLUME ABSTRACTION | |
| 8 | Diversion2 | 0.000 | 2 | n/a | 0 | 4 | ----- | ----- | POST WITH BMP | |
| 9 | Combine | 2.053 | 2 | 722 | 5,922 | 2, 6, 8 | ----- | ----- | POST AT POI | |
| Shade Valley DA2.gpw | | | | | Return Period: 2 Year | | | Friday, 11 / 11 / 2016 | | |

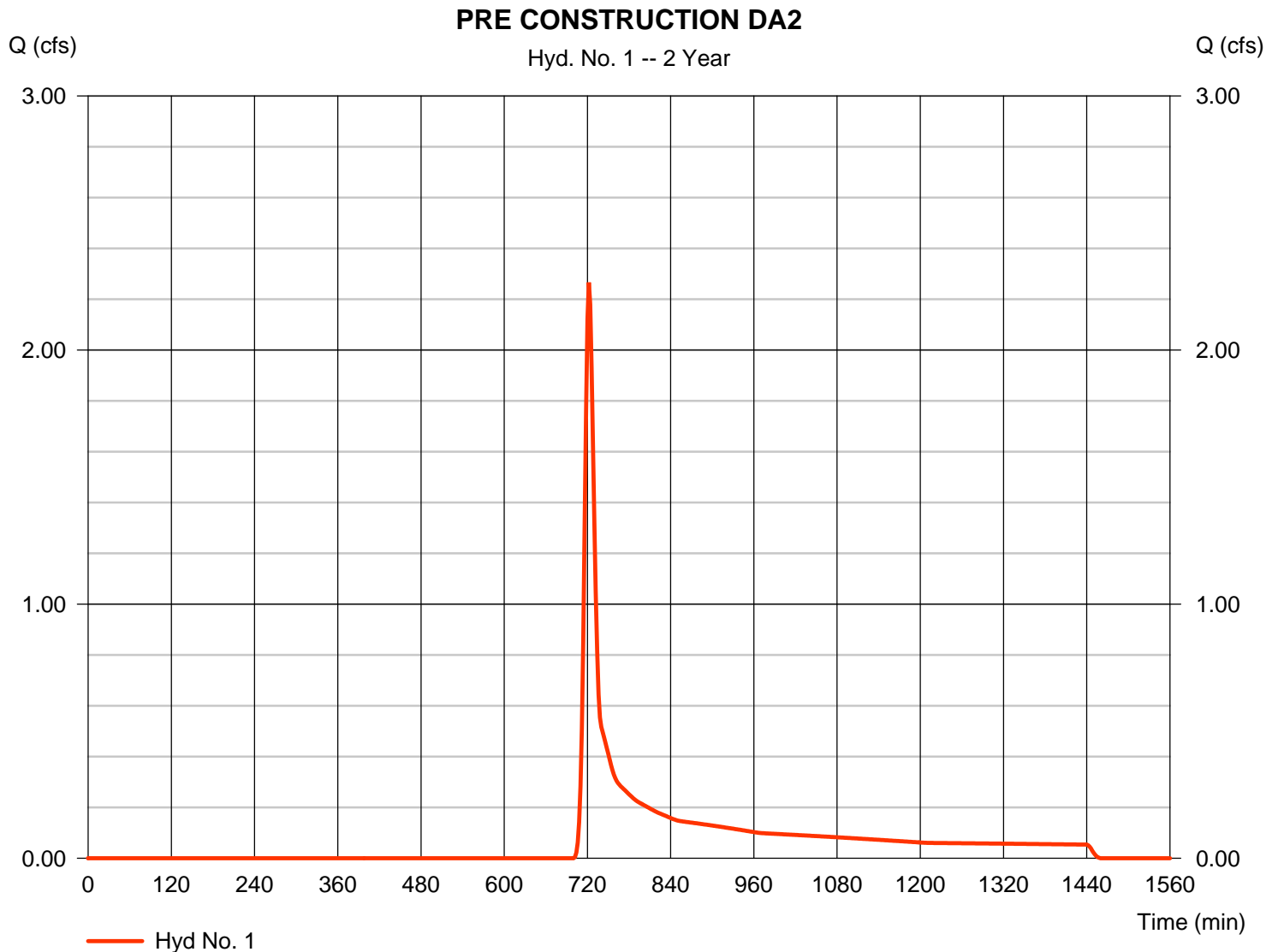
Hydrograph Report

Hyd. No. 1

PRE CONSTRUCTION DA2

| | | | |
|-----------------|--------------|--------------------|--------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 2.266 cfs |
| Storm frequency | = 2 yrs | Time to peak | = 722 min |
| Time interval | = 2 min | Hyd. volume | = 6,872 cuft |
| Drainage area | = 3.430 ac | Curve number | = 69* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = TR55 | Time of conc. (Tc) | = 11.50 min |
| Total precip. | = 2.74 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = [(1.800 x 58) + (0.780 x 78) + (0.050 x 55) + (0.490 x 77) + (0.310 x 98)] / 3.430



TR55 Tc Worksheet

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

Hyd. No. 1

PRE CONSTRUCTION DA2

| <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) | = 2.74 | 0.00 | 0.00 | |
| Land slope (%) | = 2.50 | 0.00 | 0.00 | |
| Travel Time (min) | = 8.10 | + 0.00 | + 0.00 | = 8.10 |
| Shallow Concentrated Flow | | | | |
| Flow length (ft) | = 85.00 | 0.00 | 0.00 | |
| Watercourse slope (%) | = 3.50 | 0.00 | 0.00 | |
| Surface description | = Unpaved | Paved | Paved | |
| Average velocity (ft/s) | =3.02 | 0.00 | 0.00 | |
| Travel Time (min) | = 0.47 | + 0.00 | + 0.00 | = 0.47 |
| Channel Flow | | | | |
| X sectional flow area (sqft) | = 2.00 | 0.00 | 0.00 | |
| Wetted perimeter (ft) | = 4.47 | 0.00 | 0.00 | |
| Channel slope (%) | = 2.10 | 0.00 | 0.00 | |
| Manning's n-value | = 0.030 | 0.015 | 0.015 | |
| Velocity (ft/s) | =4.20 | 0.00 | 0.00 | |
| Flow length (ft) | {{0}}747.0 | 0.0 | 0.0 | |
| Travel Time (min) | = 2.96 | + 0.00 | + 0.00 | = 2.96 |
| Total Travel Time, Tc | | | | 11.50 min |

Hydrograph Report

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

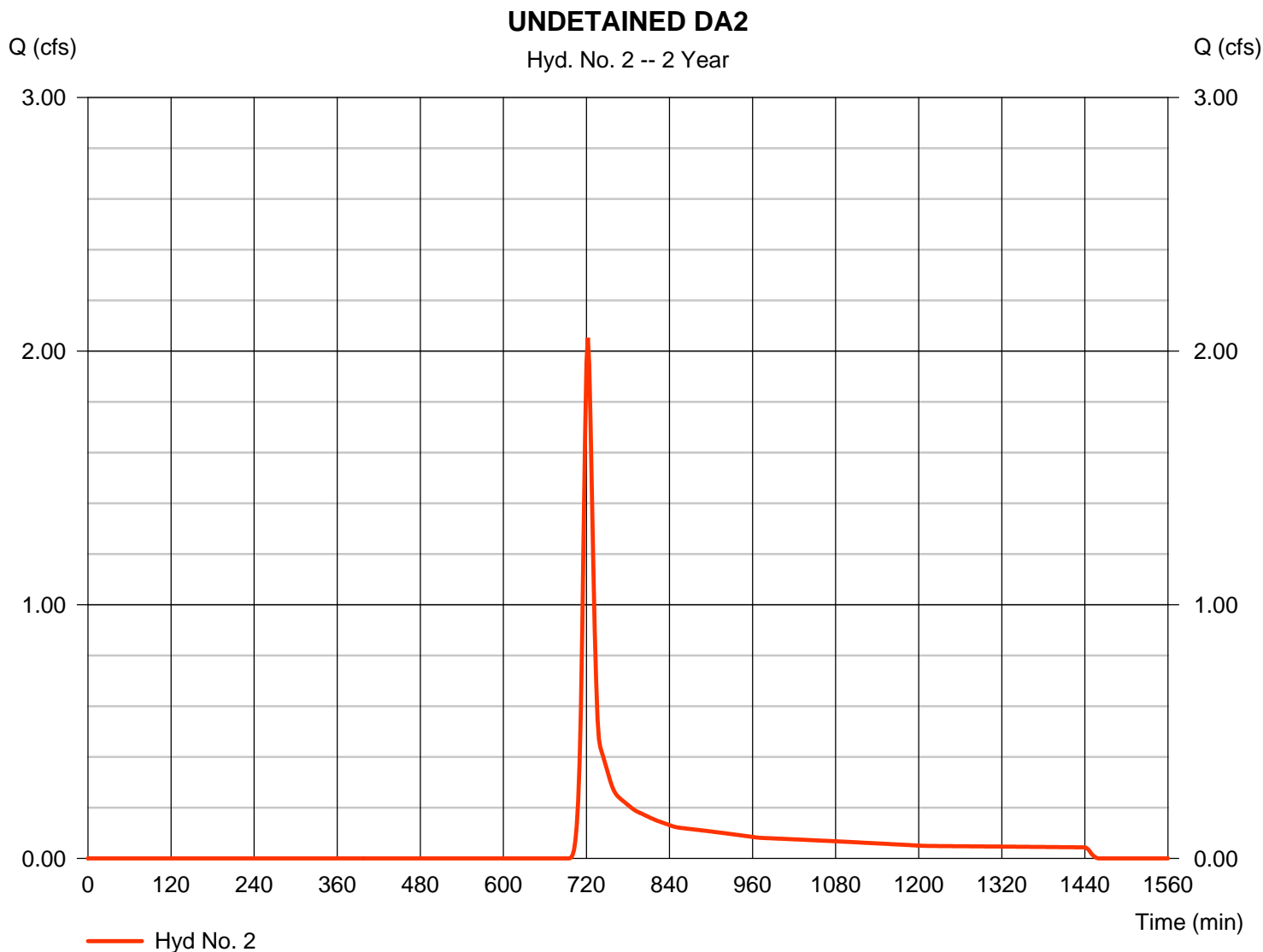
Friday, 11 / 11 / 2016

Hyd. No. 2

UNDETAINED DA2

| | | | |
|-----------------|--------------|--------------------|--------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 2.053 cfs |
| Storm frequency | = 2 yrs | Time to peak | = 722 min |
| Time interval | = 2 min | Hyd. volume | = 5,922 cuft |
| Drainage area | = 2.570 ac | Curve number | = 71* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = TR55 | Time of conc. (Tc) | = 11.50 min |
| Total precip. | = 2.74 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = [(1.080 x 58) + (0.830 x 78) + (0.210 x 98) + (0.050 x 55) + (0.400 x 77)] / 2.570



TR55 Tc Worksheet

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

Hyd. No. 2

UNDETAINED DA2

| <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) | = 2.74 | | 0.00 | | 0.00 | | |
| Land slope (%) | = 2.50 | | 0.00 | | 0.00 | | |
| Travel Time (min) | = 8.10 | + | 0.00 | + | 0.00 | = | 8.10 |
| Shallow Concentrated Flow | | | | | | | |
| Flow length (ft) | = 85.00 | | 0.00 | | 0.00 | | |
| Watercourse slope (%) | = 3.50 | | 0.00 | | 0.00 | | |
| Surface description | = Unpaved | | Paved | | Paved | | |
| Average velocity (ft/s) | =3.02 | | 0.00 | | 0.00 | | |
| Travel Time (min) | = 0.47 | + | 0.00 | + | 0.00 | = | 0.47 |
| Channel Flow | | | | | | | |
| X sectional flow area (sqft) | = 2.00 | | 0.00 | | 0.00 | | |
| Wetted perimeter (ft) | = 4.47 | | 0.00 | | 0.00 | | |
| Channel slope (%) | = 2.10 | | 0.00 | | 0.00 | | |
| Manning's n-value | = 0.030 | | 0.015 | | 0.015 | | |
| Velocity (ft/s) | =4.20 | | 0.00 | | 0.00 | | |
| Flow length (ft) | {{0}}747.0 | | 0.0 | | 0.0 | | |
| Travel Time (min) | = 2.96 | + | 0.00 | + | 0.00 | = | 2.96 |
| Total Travel Time, Tc | | | | | | | 11.50 min |

Hydrograph Report

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

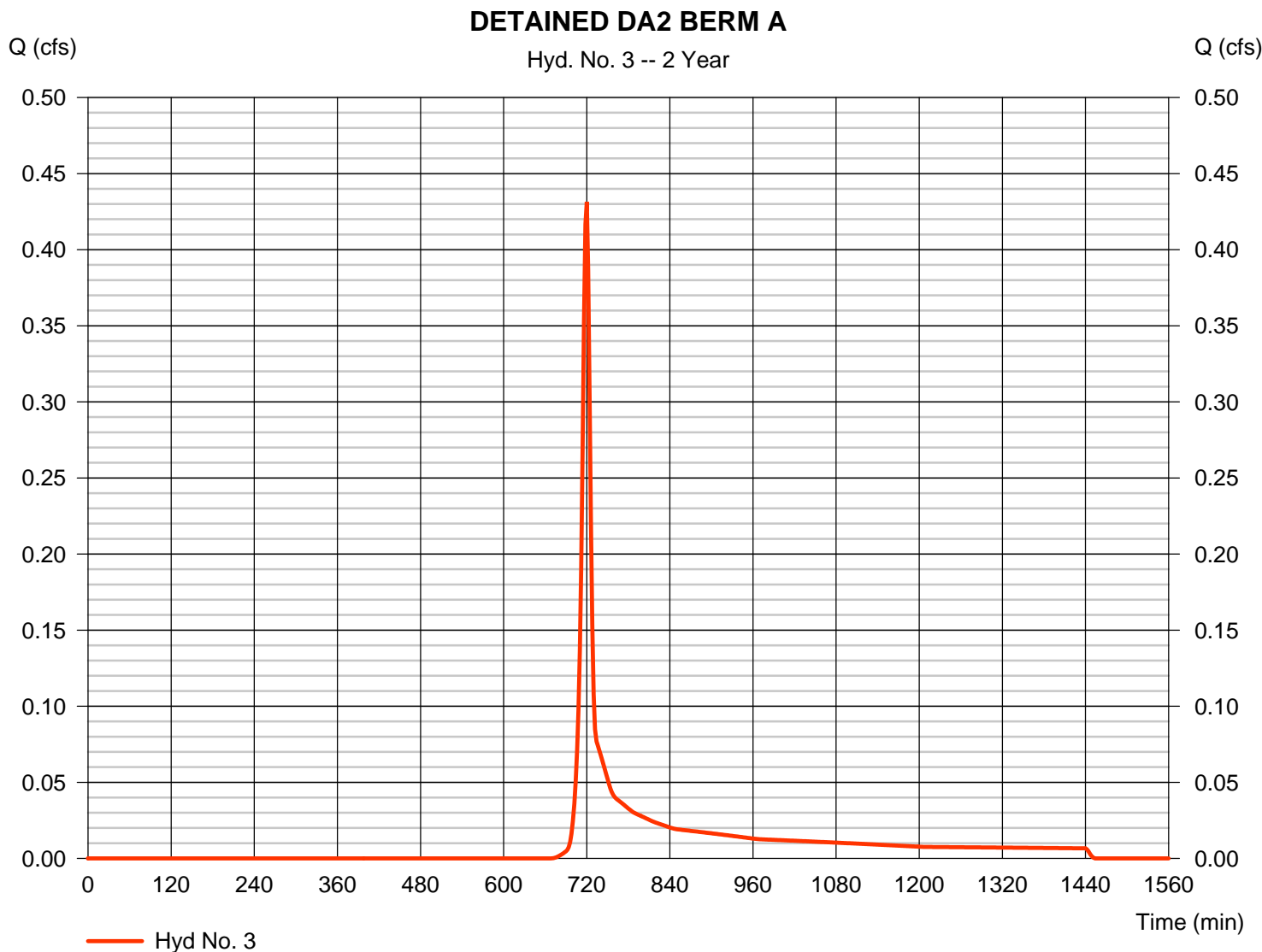
Friday, 11 / 11 / 2016

Hyd. No. 3

DETAINED DA2 BERM A

| | | | |
|-----------------|--------------|--------------------|--------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 0.431 cfs |
| Storm frequency | = 2 yrs | Time to peak | = 720 min |
| Time interval | = 2 min | Hyd. volume | = 1,010 cuft |
| Drainage area | = 0.350 ac | Curve number | = 75* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = TR55 | Time of conc. (Tc) | = 9.70 min |
| Total precip. | = 2.74 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = [(0.120 x 85) + (0.140 x 58) + (0.040 x 78) + (0.050 x 98)] / 0.350



TR55 Tc Worksheet

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

Hyd. No. 3

DETAINED DA2 BERM A

| <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) | = 2.74 | 0.00 | 0.00 | |
| Land slope (%) | = 2.00 | 0.00 | 0.00 | |
| Travel Time (min) | = 8.86 | + 0.00 | + 0.00 | = 8.86 |
| Shallow Concentrated Flow | | | | |
| Flow length (ft) | = 85.00 | 77.00 | 0.00 | |
| Watercourse slope (%) | = 3.50 | 7.80 | 0.00 | |
| Surface description | = Unpaved | Paved | Paved | |
| Average velocity (ft/s) | =3.02 | 5.68 | 0.00 | |
| Travel Time (min) | = 0.47 | + 0.23 | + 0.00 | = 0.70 |
| Channel Flow | | | | |
| X sectional flow area (sqft) | = 0.05 | 0.00 | 0.00 | |
| Wetted perimeter (ft) | = 0.79 | 0.00 | 0.00 | |
| Channel slope (%) | = 6.00 | 0.00 | 0.00 | |
| Manning's n-value | = 0.012 | 0.015 | 0.015 | |
| Velocity (ft/s) | =4.79 | 0.00 | 0.00 | |
| Flow length (ft) | {{0}}50.0 | 0.0 | 0.0 | |
| Travel Time (min) | = 0.17 | + 0.00 | + 0.00 | = 0.17 |
| Total Travel Time, Tc | | | | 9.70 min |

Hydrograph Report

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

Friday, 11 / 11 / 2016

Hyd. No. 4

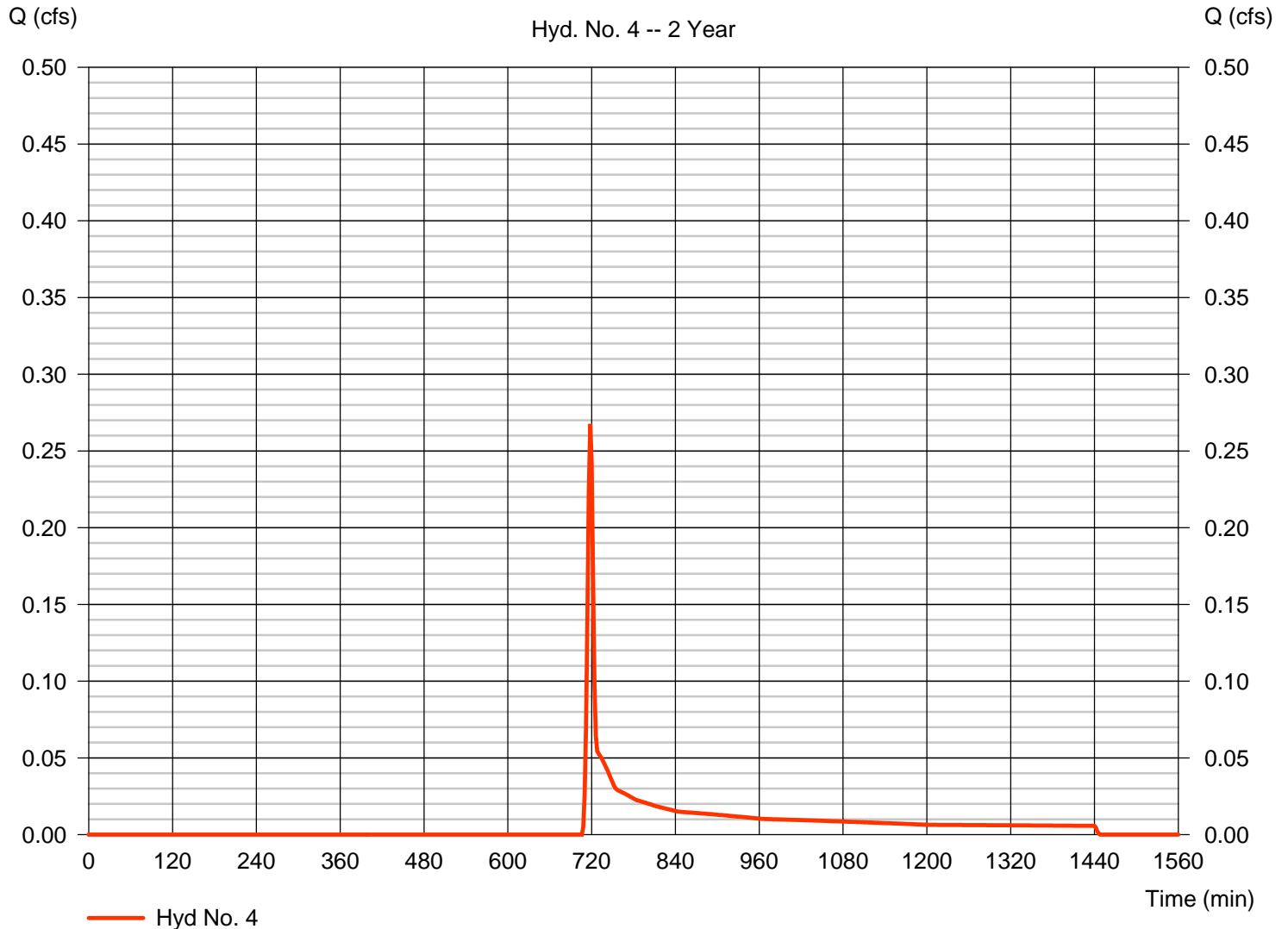
DETAINED DA2 BERM B

| | | | |
|-----------------|--------------|--------------------|-------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 0.268 cfs |
| Storm frequency | = 2 yrs | Time to peak | = 718 min |
| Time interval | = 2 min | Hyd. volume | = 641 cuft |
| Drainage area | = 0.480 ac | Curve number | = 65* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = TR55 | Time of conc. (Tc) | = 3.40 min |
| Total precip. | = 2.74 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = [(0.050 x 98) + (0.380 x 58) + (0.050 x 85)] / 0.480

DETAINED DA2 BERM B

Hyd. No. 4 -- 2 Year



TR55 Tc Worksheet

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

Hyd. No. 4

DETAINED DA2 BERM B

| <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) | = 16.0 | | 0.0 | | 0.0 | | |
| Two-year 24-hr precip. (in) | = 2.74 | | 0.00 | | 0.00 | | |
| Land slope (%) | = 6.30 | | 0.00 | | 0.00 | | |
| Travel Time (min) | = 2.25 | + | 0.00 | + | 0.00 | = | 2.25 |
| Shallow Concentrated Flow | | | | | | | |
| Flow length (ft) | = 243.00 | | 33.00 | | 0.00 | | |
| Watercourse slope (%) | = 4.10 | | 3.00 | | 0.00 | | |
| Surface description | = Paved | | Unpaved | | Paved | | |
| Average velocity (ft/s) | =4.12 | | 2.79 | | 0.00 | | |
| Travel Time (min) | = 0.98 | + | 0.20 | + | 0.00 | = | 1.18 |
| 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 | = 0.012 | | 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 | | | | | | | 3.40 min |

Hydrograph Report

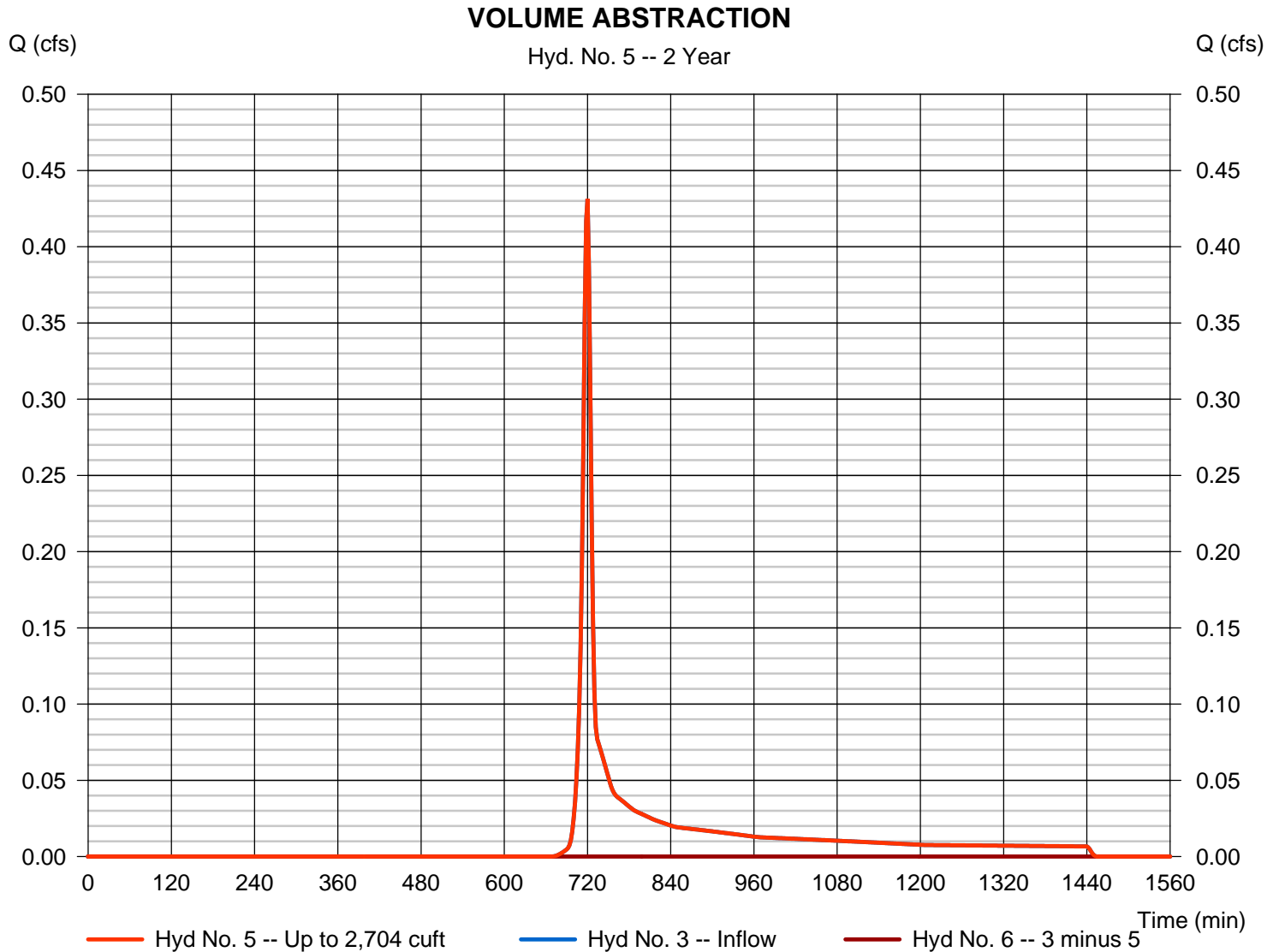
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 11 / 11 / 2016

Hyd. No. 5

VOLUME ABSTRACTION

| | | | |
|-------------------|---------------------------|-------------------|--------------|
| Hydrograph type | = Diversion1 | Peak discharge | = 0.431 cfs |
| Storm frequency | = 2 yrs | Time to peak | = 720 min |
| Time interval | = 2 min | Hyd. volume | = 1,010 cuft |
| Inflow hydrograph | = 3 - DETAINED DA2 BERM A | 2nd diverted hyd. | = 6 |
| Diversion method | = First Flush Volume | Volume Up To | = 2,704 cuft |



Hydrograph Report

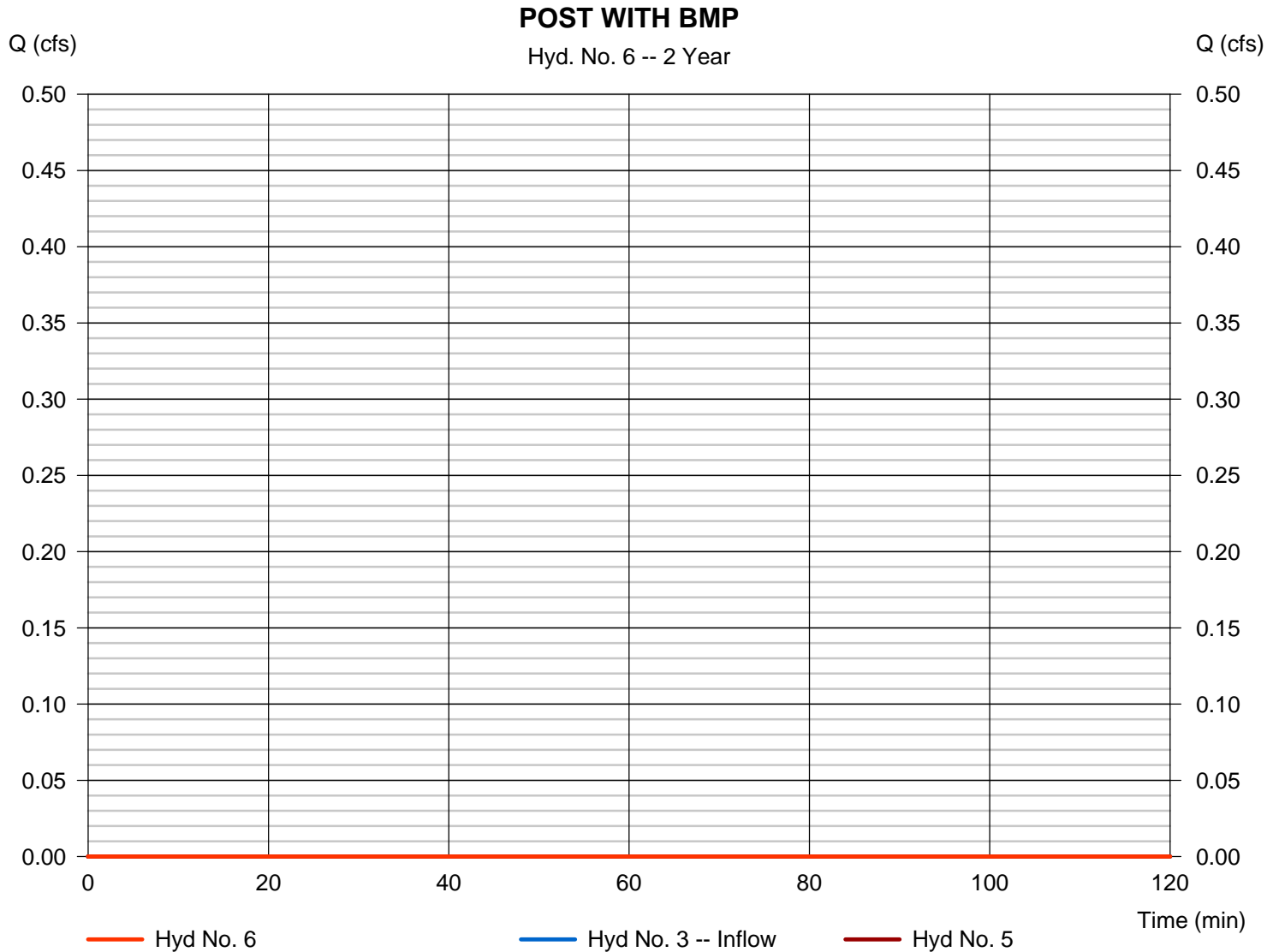
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 11 / 11 / 2016

Hyd. No. 6

POST WITH 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 - DETAINED DA2 BERM A | 2nd diverted hyd. | = 5 |
| Diversion method | = First Flush Volume | Volume Up To | = 2,704 cuft |



Hydrograph Report

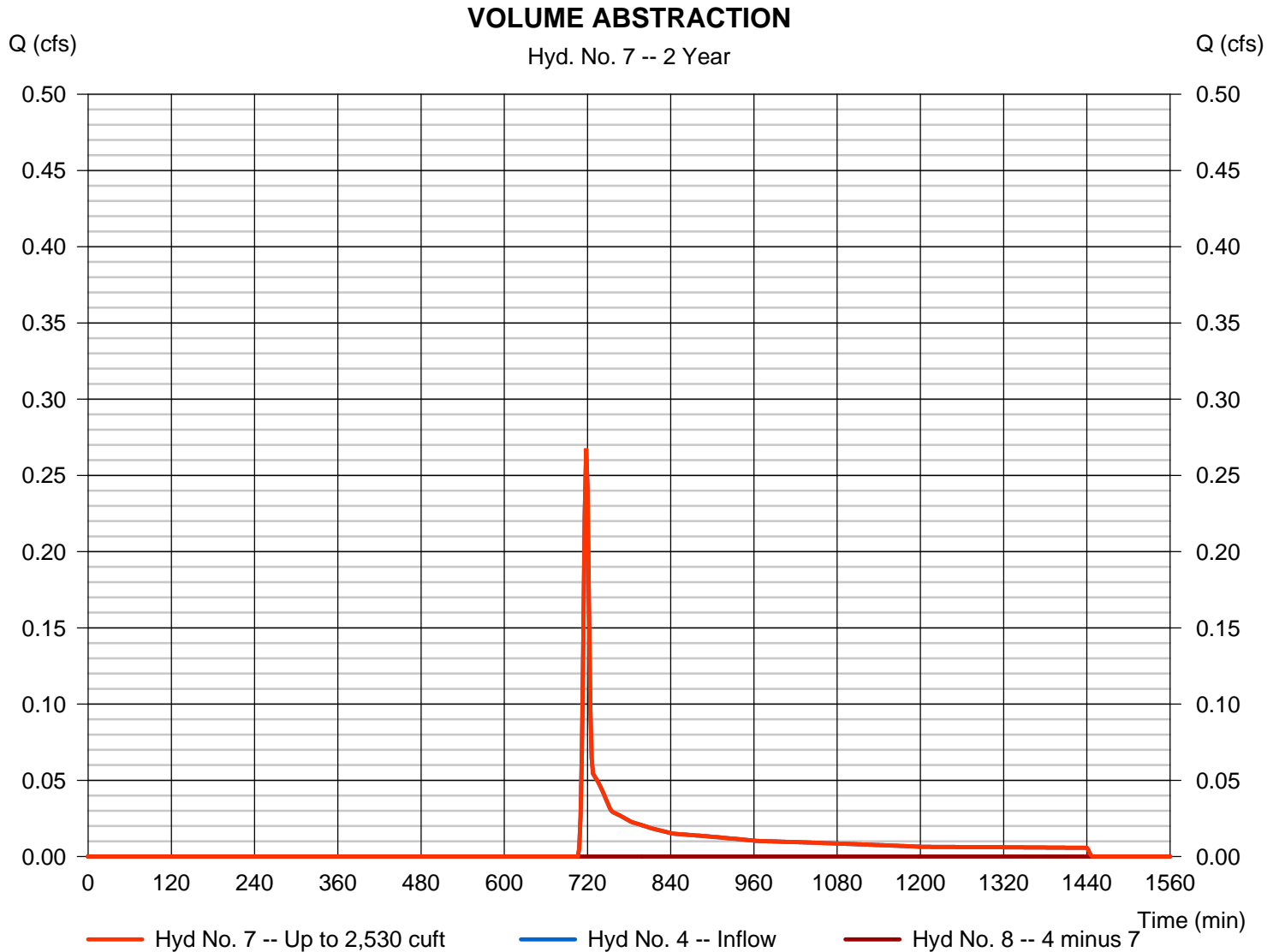
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 11 / 11 / 2016

Hyd. No. 7

VOLUME ABSTRACTION

| | | | |
|-------------------|---------------------------|-------------------|--------------|
| Hydrograph type | = Diversion1 | Peak discharge | = 0.268 cfs |
| Storm frequency | = 2 yrs | Time to peak | = 718 min |
| Time interval | = 2 min | Hyd. volume | = 641 cuft |
| Inflow hydrograph | = 4 - DETAINED DA2 BERM B | 2nd diverted hyd. | = 8 |
| Diversion method | = First Flush Volume | Volume Up To | = 2,530 cuft |



Hydrograph Report

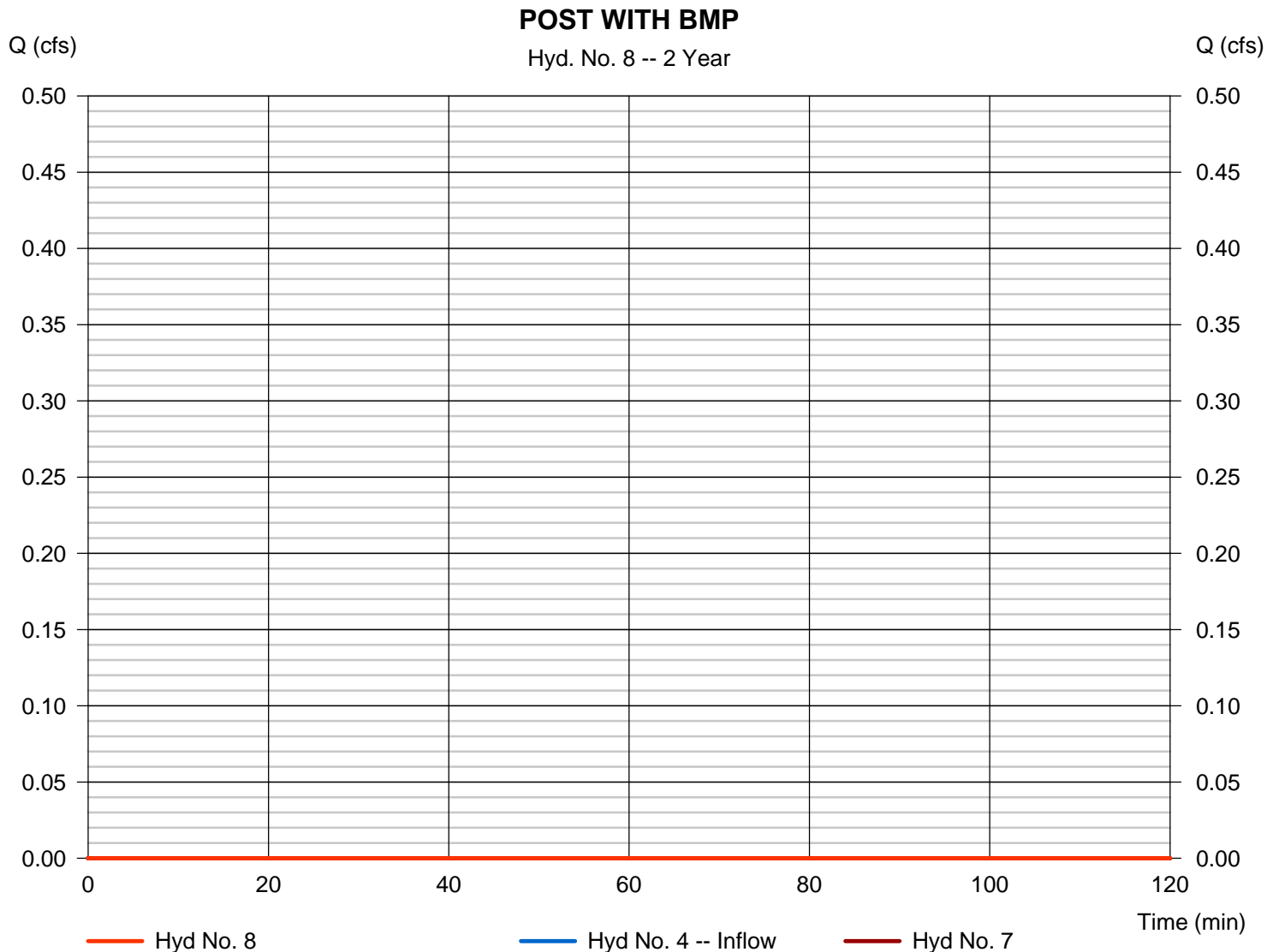
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 11 / 11 / 2016

Hyd. No. 8

POST WITH 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 | = 4 - DETAINED DA2 BERM B | 2nd diverted hyd. | = 7 |
| Diversion method | = First Flush Volume | Volume Up To | = 2,530 cuft |



Hydrograph Report

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

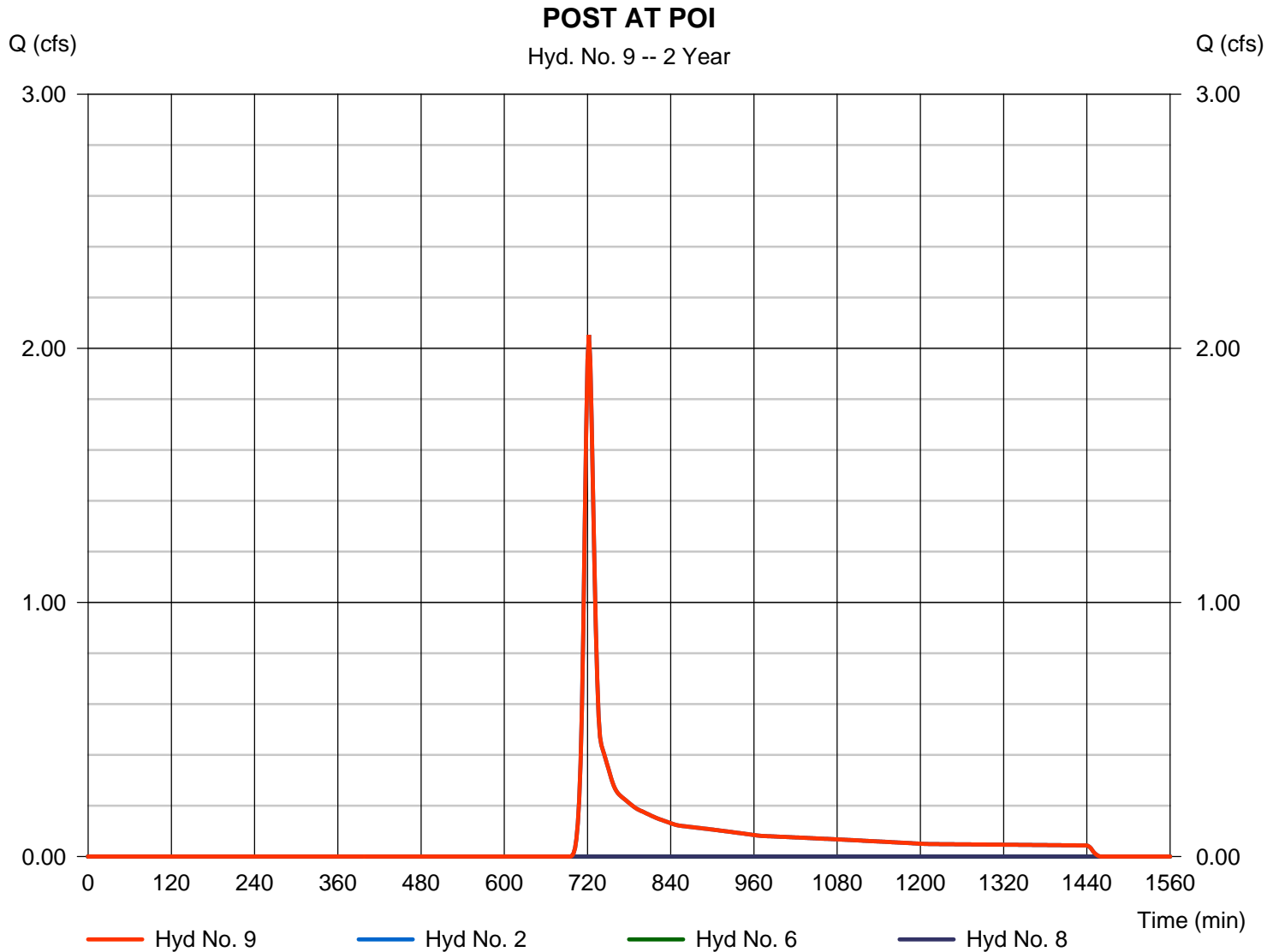
Friday, 11 / 11 / 2016

Hyd. No. 9

POST AT POI

Hydrograph type = Combine
Storm frequency = 2 yrs
Time interval = 2 min
Inflow hyds. = 2, 6, 8

Peak discharge = 2.053 cfs
Time to peak = 722 min
Hyd. volume = 5,922 cuft
Contrib. drain. area = 2.570 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 | 5.933 | 2 | 722 | 15,930 | ----- | ----- | ----- | PRE CONSTRUCTION DA2 |
| 2 | SCS Runoff | 4.955 | 2 | 722 | 13,150 | ----- | ----- | ----- | UNDETAINED DA2 |
| 3 | SCS Runoff | 0.909 | 2 | 720 | 2,079 | ----- | ----- | ----- | DETAINED DA2 BERM A |
| 4 | SCS Runoff | 0.804 | 2 | 718 | 1,642 | ----- | ----- | ----- | DETAINED DA2 BERM B |
| 5 | Diversion1 | 0.909 | 2 | 720 | 2,079 | 3 | ----- | ----- | VOLUME ABSTRACTION |
| 6 | Diversion2 | 0.000 | 2 | n/a | 0 | 3 | ----- | ----- | POST WITH BMP |
| 7 | Diversion1 | 0.804 | 2 | 718 | 1,642 | 4 | ----- | ----- | VOLUME ABSTRACTION |
| 8 | Diversion2 | 0.000 | 2 | n/a | 0 | 4 | ----- | ----- | POST WITH BMP |
| 9 | Combine | 4.955 | 2 | 722 | 13,150 | 2, 6, 8 | ----- | ----- | POST AT POI |
| Shade Valley DA2.gpw | | | | | Return Period: 10 Year | | | Friday, 11 / 11 / 2016 | |

Hydrograph Report

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

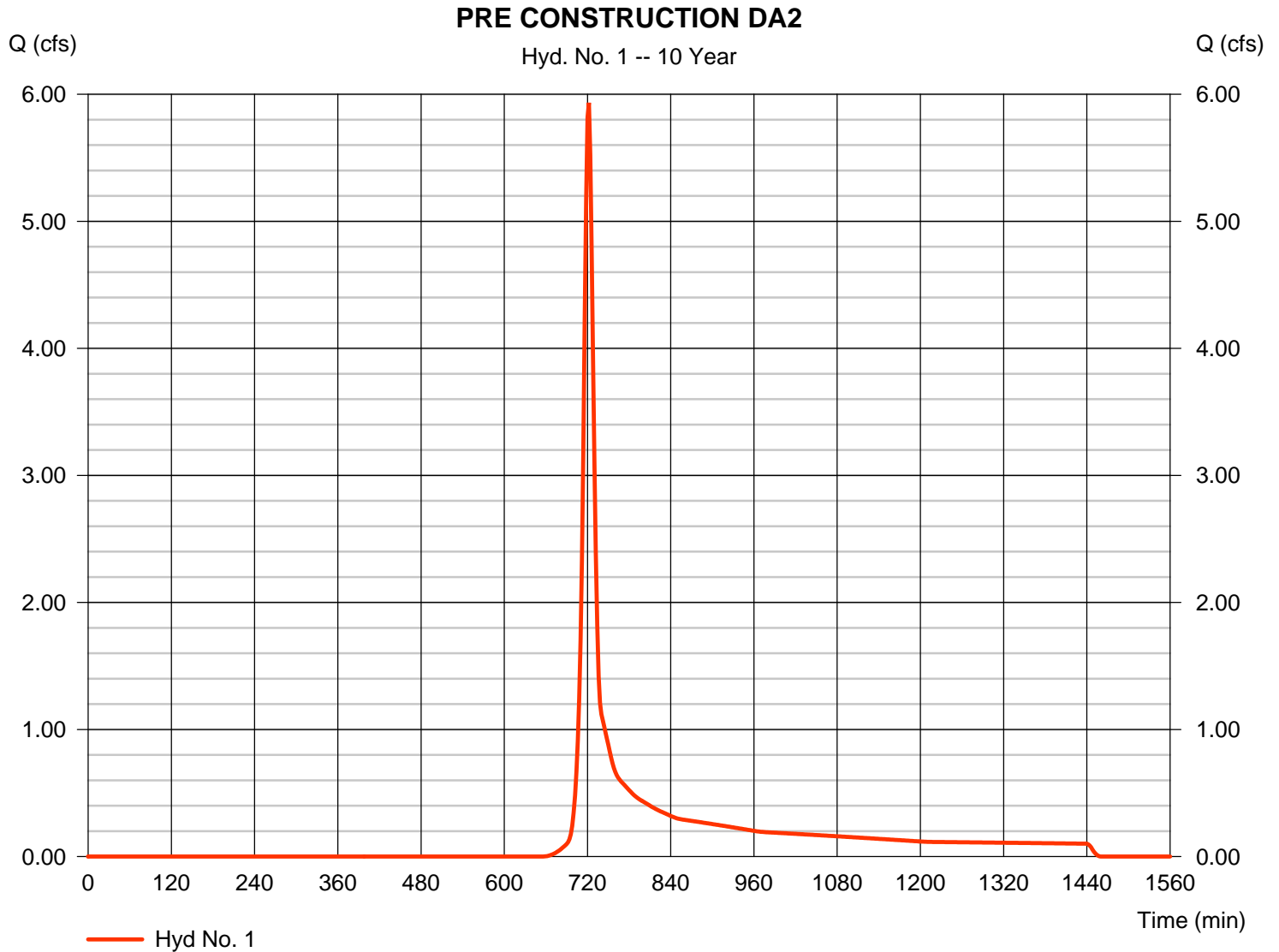
Friday, 11 / 11 / 2016

Hyd. No. 1

PRE CONSTRUCTION DA2

| | | | |
|-----------------|--------------|--------------------|---------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 5.933 cfs |
| Storm frequency | = 10 yrs | Time to peak | = 722 min |
| Time interval | = 2 min | Hyd. volume | = 15,930 cuft |
| Drainage area | = 3.430 ac | Curve number | = 69* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = TR55 | Time of conc. (Tc) | = 11.50 min |
| Total precip. | = 3.96 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = [(1.800 x 58) + (0.780 x 78) + (0.050 x 55) + (0.490 x 77) + (0.310 x 98)] / 3.430



Hydrograph Report

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

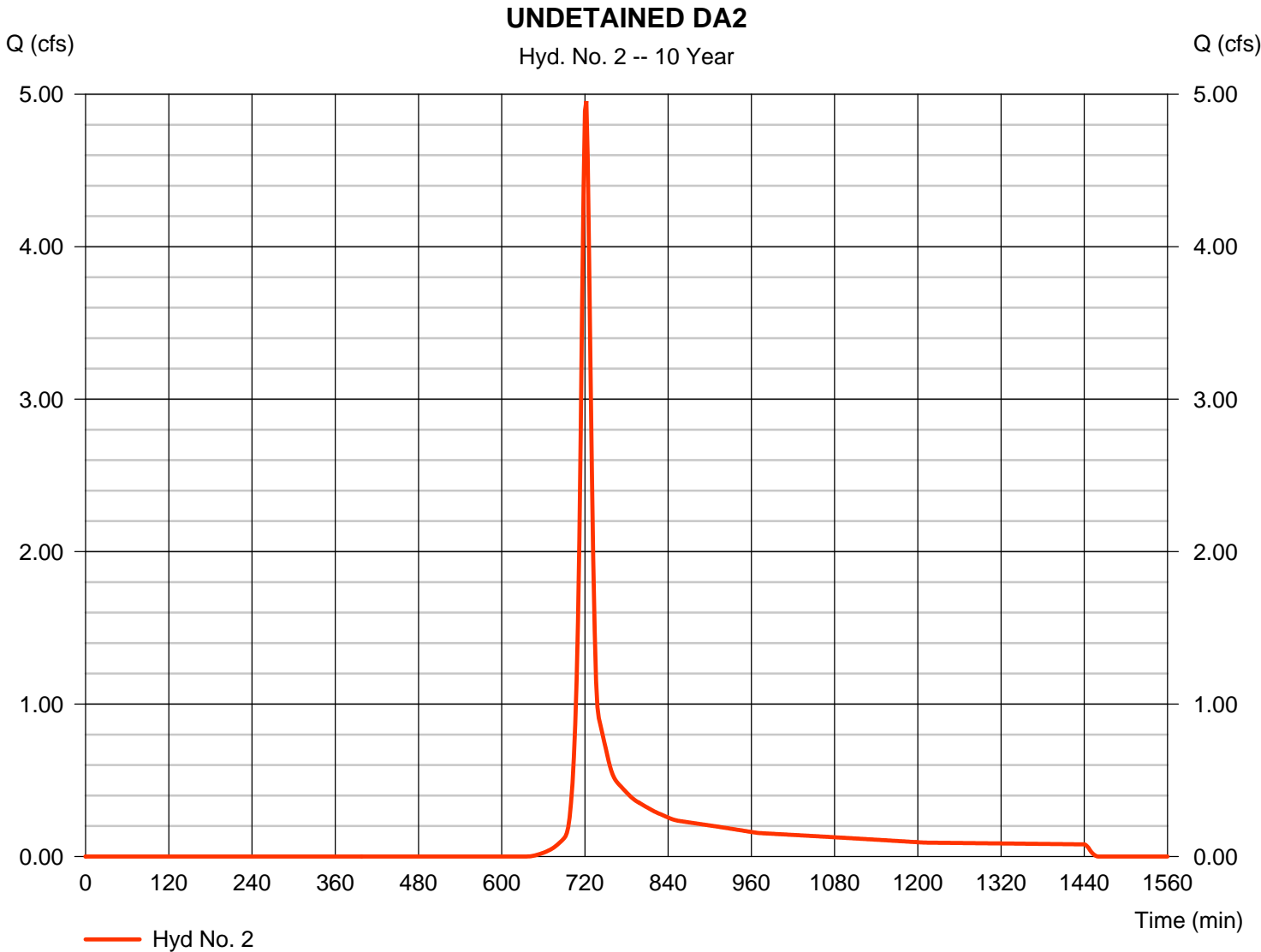
Friday, 11 / 11 / 2016

Hyd. No. 2

UNDETAINED DA2

| | | | |
|-----------------|--------------|--------------------|---------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 4.955 cfs |
| Storm frequency | = 10 yrs | Time to peak | = 722 min |
| Time interval | = 2 min | Hyd. volume | = 13,150 cuft |
| Drainage area | = 2.570 ac | Curve number | = 71* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = TR55 | Time of conc. (Tc) | = 11.50 min |
| Total precip. | = 3.96 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = [(1.080 x 58) + (0.830 x 78) + (0.210 x 98) + (0.050 x 55) + (0.400 x 77)] / 2.570



Hydrograph Report

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

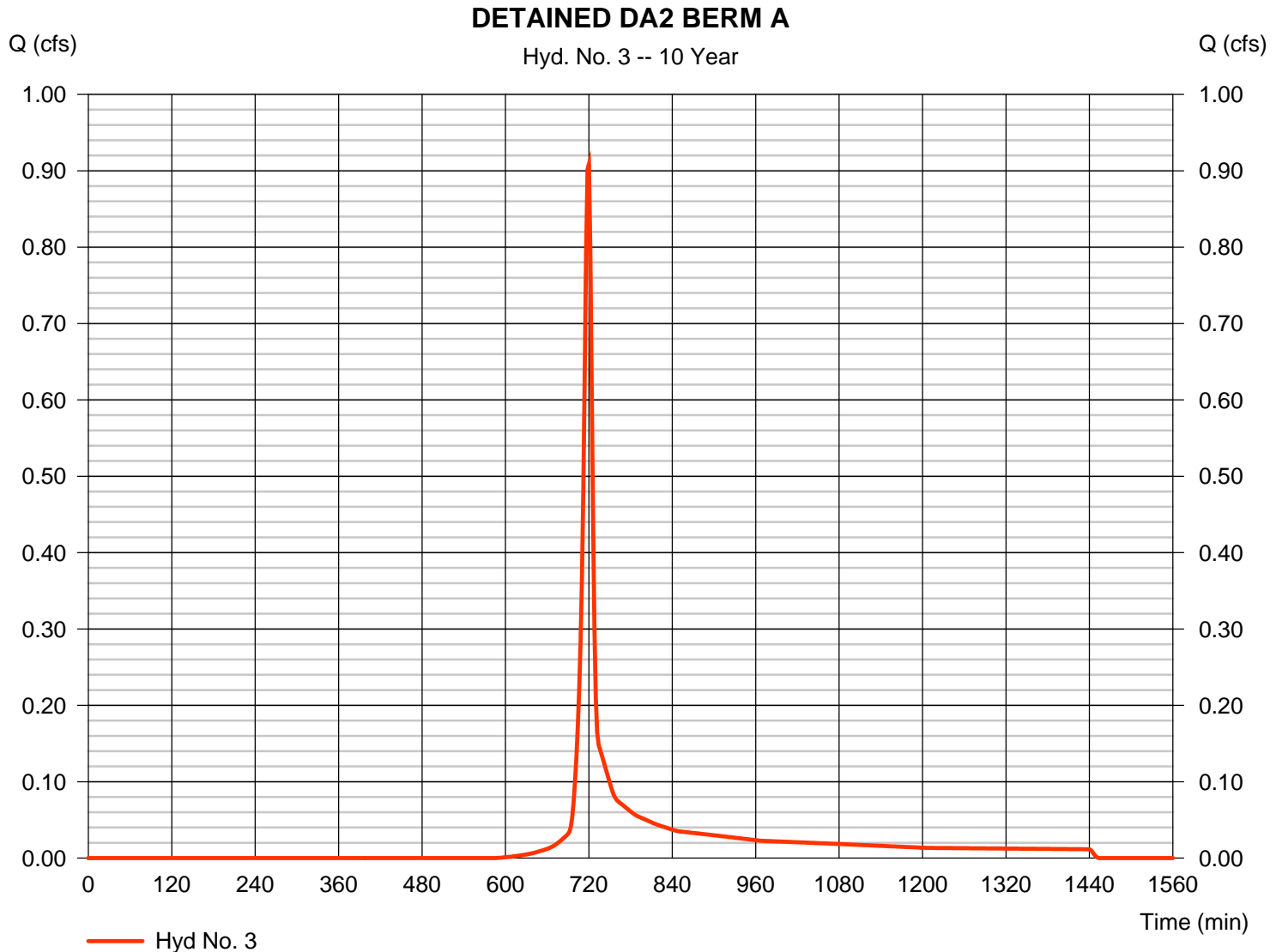
Friday, 11 / 11 / 2016

Hyd. No. 3

DETAINED DA2 BERM A

| | | | |
|-----------------|--------------|--------------------|--------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 0.909 cfs |
| Storm frequency | = 10 yrs | Time to peak | = 720 min |
| Time interval | = 2 min | Hyd. volume | = 2,079 cuft |
| Drainage area | = 0.350 ac | Curve number | = 75* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = TR55 | Time of conc. (Tc) | = 9.70 min |
| Total precip. | = 3.96 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = [(0.120 x 85) + (0.140 x 58) + (0.040 x 78) + (0.050 x 98)] / 0.350



Hydrograph Report

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

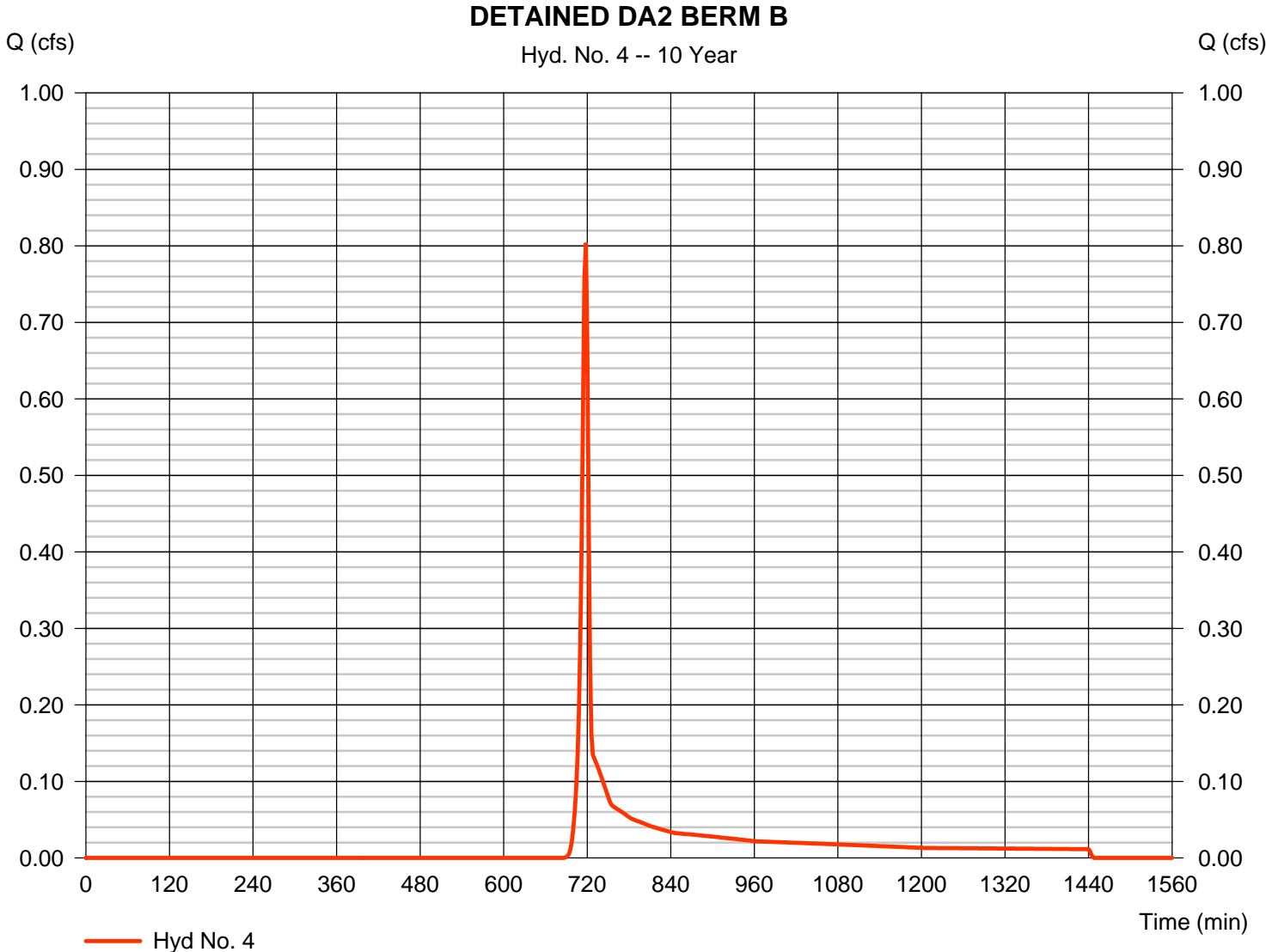
Friday, 11 / 11 / 2016

Hyd. No. 4

DETAINED DA2 BERM B

| | | | |
|-----------------|--------------|--------------------|--------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 0.804 cfs |
| Storm frequency | = 10 yrs | Time to peak | = 718 min |
| Time interval | = 2 min | Hyd. volume | = 1,642 cuft |
| Drainage area | = 0.480 ac | Curve number | = 65* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = TR55 | Time of conc. (Tc) | = 3.40 min |
| Total precip. | = 3.96 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = [(0.050 x 98) + (0.380 x 58) + (0.050 x 85)] / 0.480



Hydrograph Report

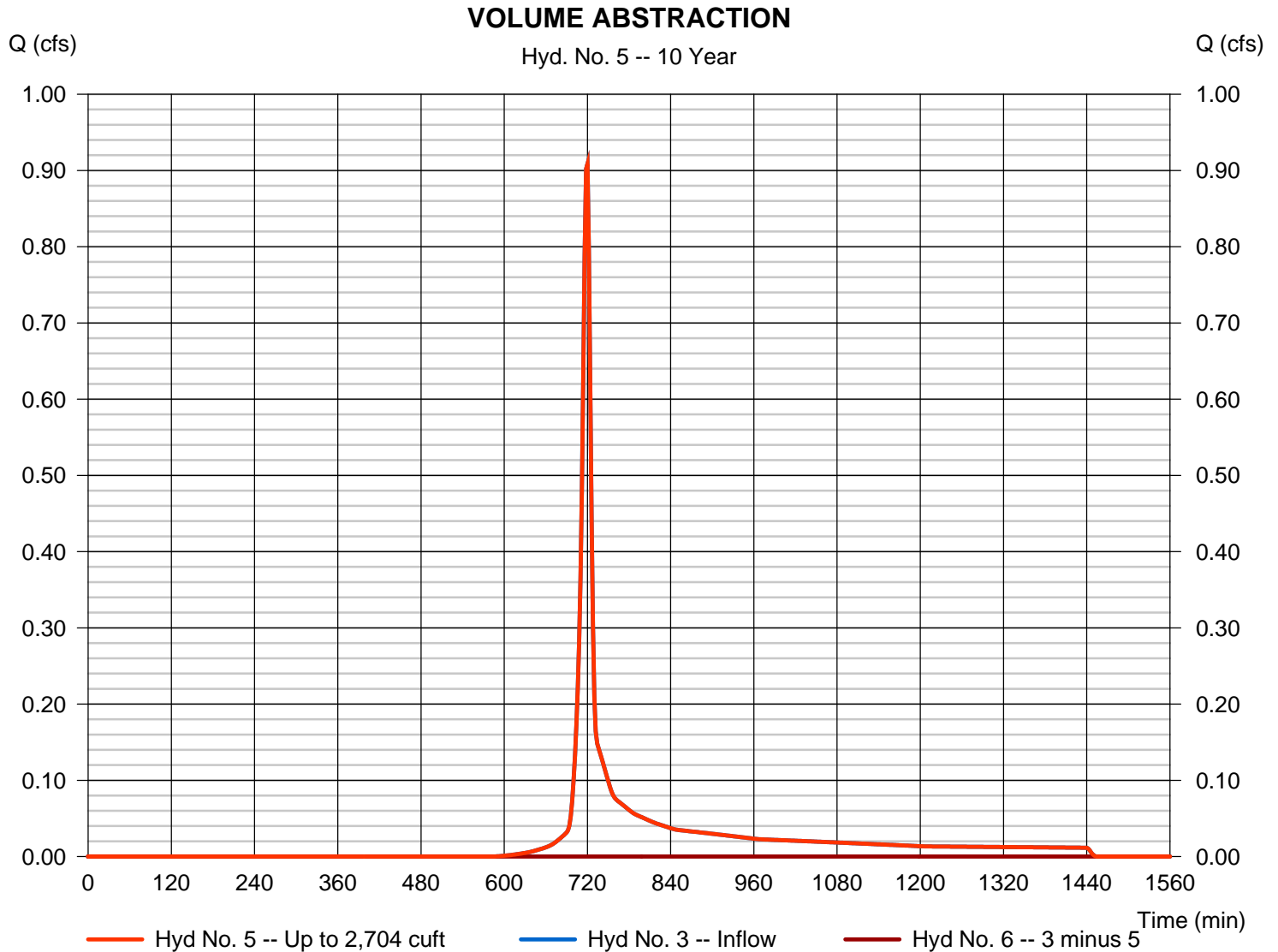
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 11 / 11 / 2016

Hyd. No. 5

VOLUME ABSTRACTION

| | | | |
|-------------------|---------------------------|-------------------|--------------|
| Hydrograph type | = Diversion1 | Peak discharge | = 0.909 cfs |
| Storm frequency | = 10 yrs | Time to peak | = 720 min |
| Time interval | = 2 min | Hyd. volume | = 2,079 cuft |
| Inflow hydrograph | = 3 - DETAINED DA2 BERM A | 2nd diverted hyd. | = 6 |
| Diversion method | = First Flush Volume | Volume Up To | = 2,704 cuft |



Hydrograph Report

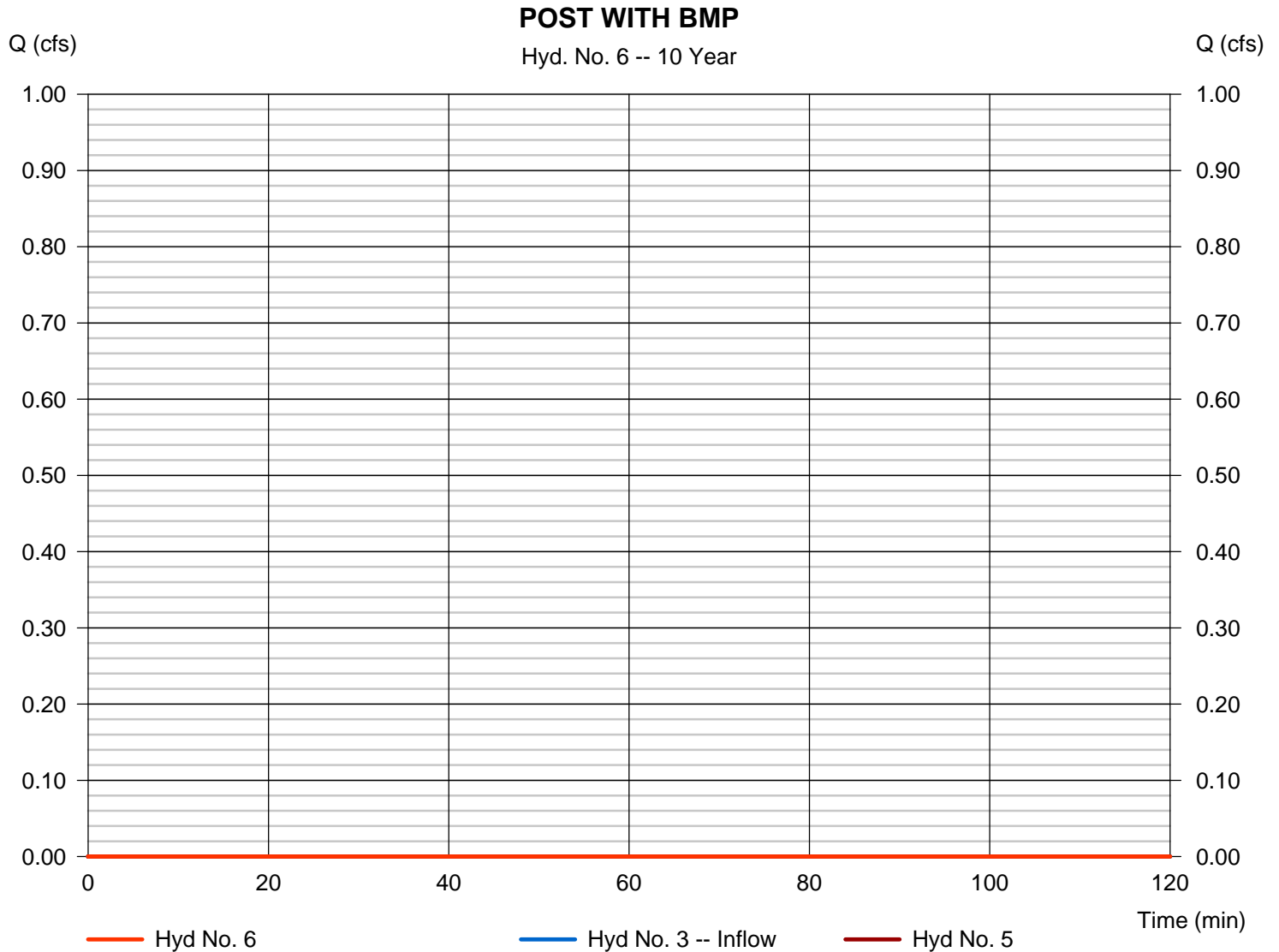
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 11 / 11 / 2016

Hyd. No. 6

POST WITH 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 - DETAINED DA2 BERM A | 2nd diverted hyd. | = 5 |
| Diversion method | = First Flush Volume | Volume Up To | = 2,704 cuft |



Hydrograph Report

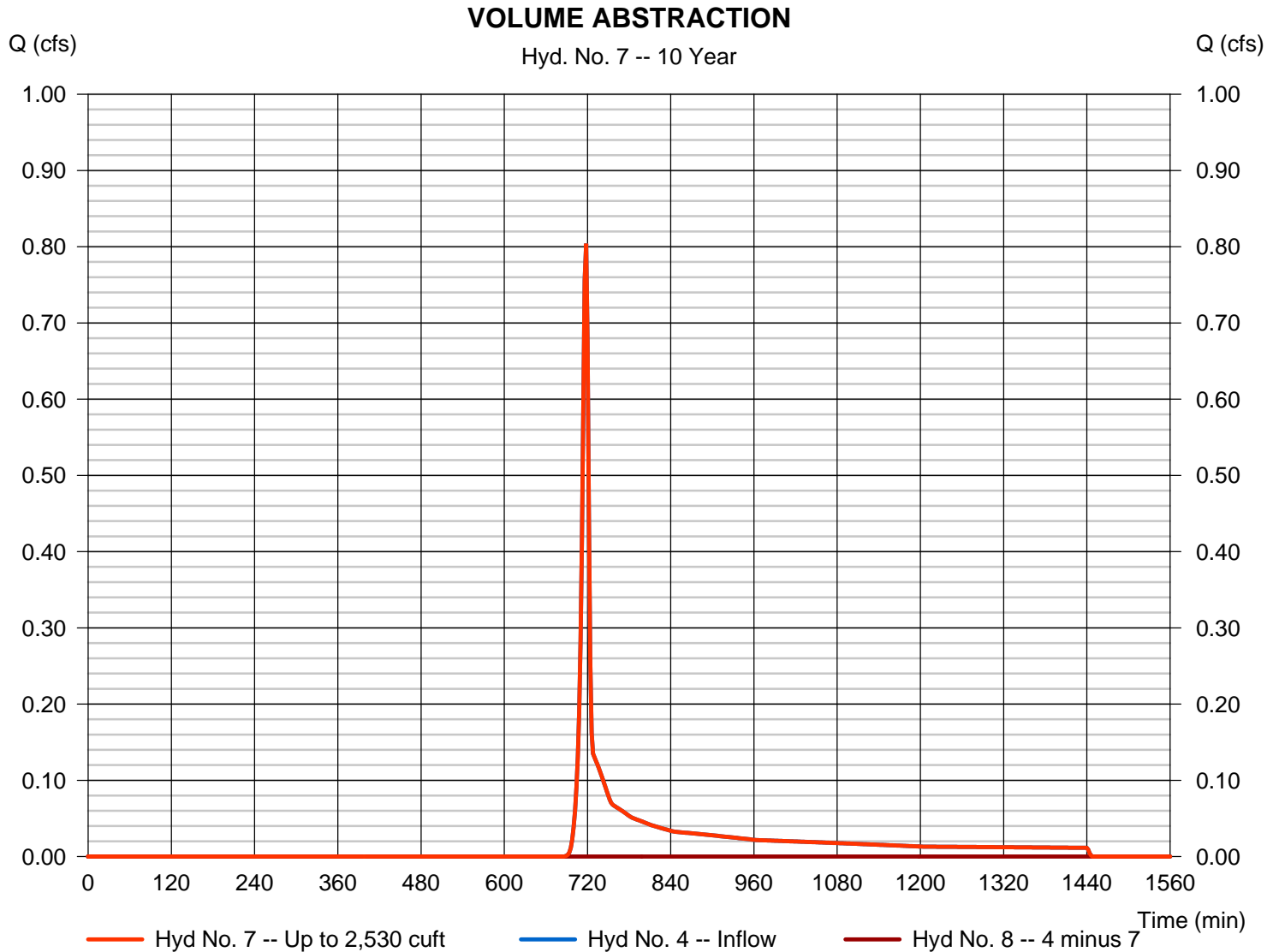
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 11 / 11 / 2016

Hyd. No. 7

VOLUME ABSTRACTION

| | | | |
|-------------------|---------------------------|-------------------|--------------|
| Hydrograph type | = Diversion1 | Peak discharge | = 0.804 cfs |
| Storm frequency | = 10 yrs | Time to peak | = 718 min |
| Time interval | = 2 min | Hyd. volume | = 1,642 cuft |
| Inflow hydrograph | = 4 - DETAINED DA2 BERM B | 2nd diverted hyd. | = 8 |
| Diversion method | = First Flush Volume | Volume Up To | = 2,530 cuft |



Hydrograph Report

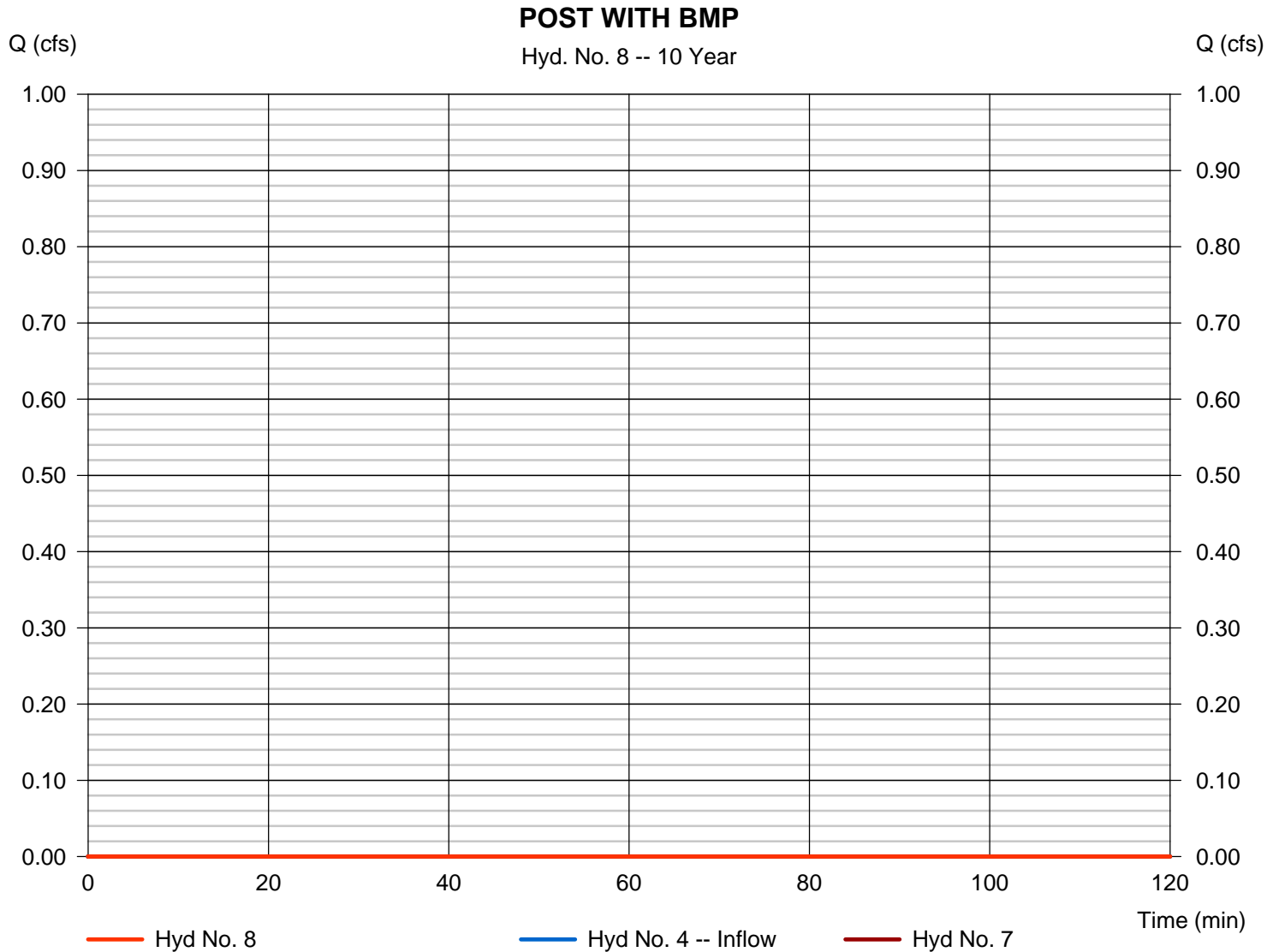
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 11 / 11 / 2016

Hyd. No. 8

POST WITH 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 | = 4 - DETAINED DA2 BERM B | 2nd diverted hyd. | = 7 |
| Diversion method | = First Flush Volume | Volume Up To | = 2,530 cuft |



Hydrograph Report

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

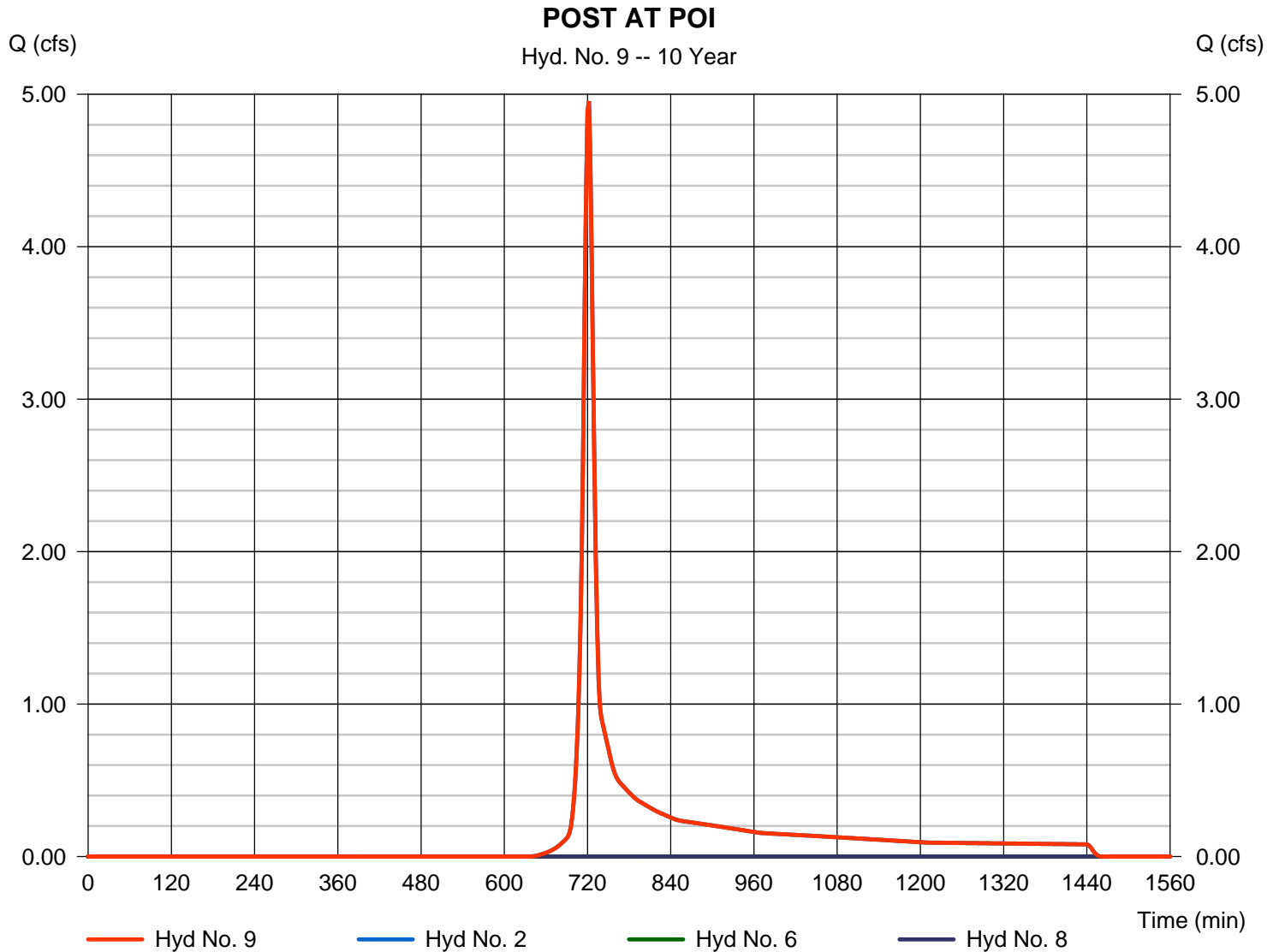
Friday, 11 / 11 / 2016

Hyd. No. 9

POST AT POI

Hydrograph type = Combine
Storm frequency = 10 yrs
Time interval = 2 min
Inflow hyds. = 2, 6, 8

Peak discharge = 4.955 cfs
Time to peak = 722 min
Hyd. volume = 13,150 cuft
Contrib. drain. area = 2.570 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 | 11.50 | 2 | 722 | 30,089 | ----- | ----- | ----- | PRE CONSTRUCTION DA2 | |
| 2 | SCS Runoff | 9.295 | 2 | 720 | 24,216 | ----- | ----- | ----- | UNDETAINED DA2 | |
| 3 | SCS Runoff | 1.598 | 2 | 718 | 3,656 | ----- | ----- | ----- | DETAINED DA2 BERM A | |
| 4 | SCS Runoff | 1.641 | 2 | 718 | 3,281 | ----- | ----- | ----- | DETAINED DA2 BERM B | |
| 5 | Diversion1 | 1.598 | 2 | 718 | 2,706 | 3 | ----- | ----- | VOLUME ABSTRACTION | |
| 6 | Diversion2 | 0.053 | 2 | 870 | 950 | 3 | ----- | ----- | POST WITH BMP | |
| 7 | Diversion1 | 1.641 | 2 | 718 | 2,532 | 4 | ----- | ----- | VOLUME ABSTRACTION | |
| 8 | Diversion2 | 0.039 | 2 | 958 | 749 | 4 | ----- | ----- | POST WITH BMP | |
| 9 | Combine | 9.295 | 2 | 720 | 25,915 | 2, 6, 8 | ----- | ----- | POST AT POI | |
| Shade Valley DA2.gpw | | | | | Return Period: 50 Year | | | Friday, 11 / 11 / 2016 | | |

Hydrograph Report

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

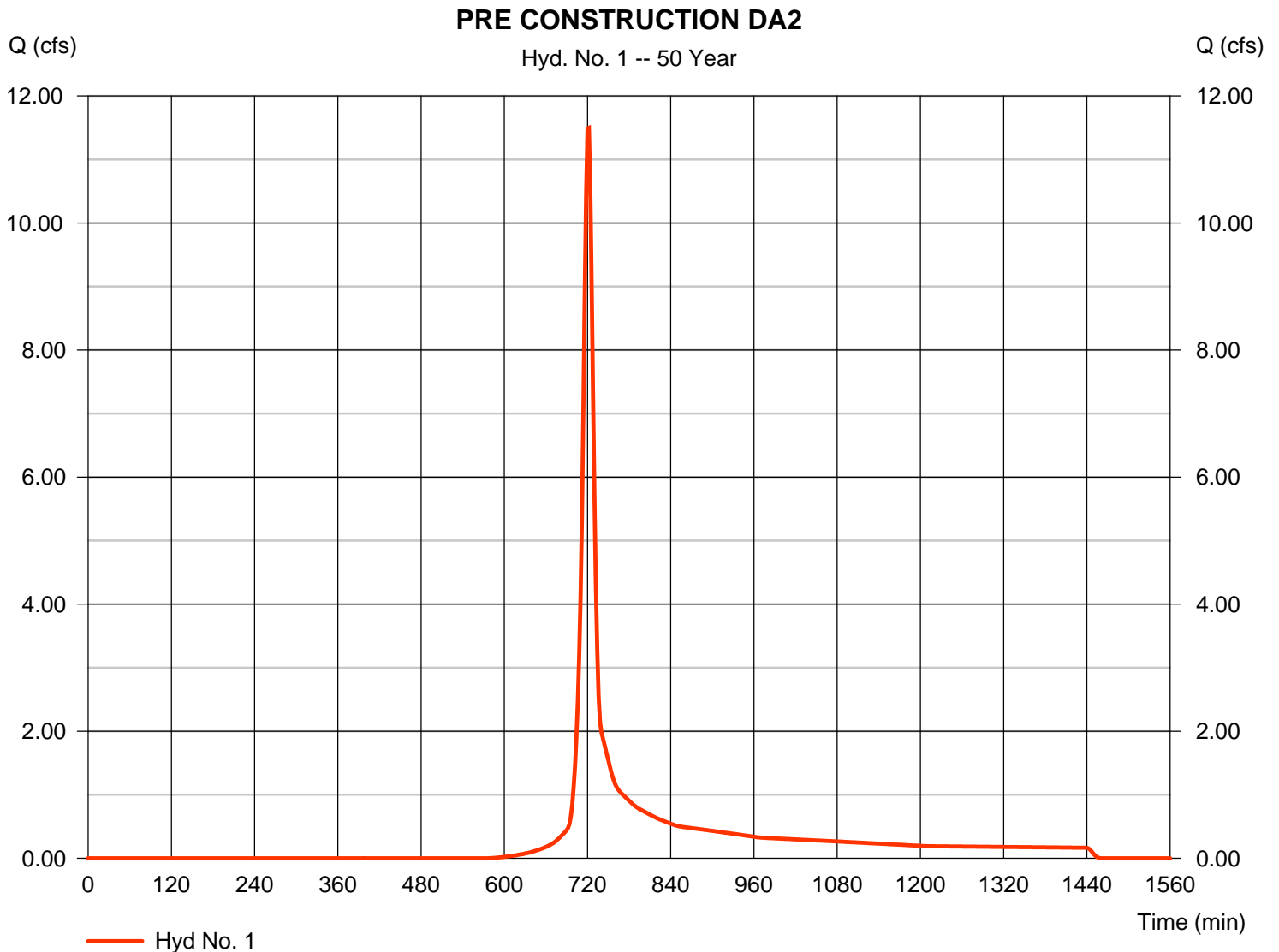
Friday, 11 / 11 / 2016

Hyd. No. 1

PRE CONSTRUCTION DA2

| | | | |
|-----------------|--------------|--------------------|---------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 11.50 cfs |
| Storm frequency | = 50 yrs | Time to peak | = 722 min |
| Time interval | = 2 min | Hyd. volume | = 30,089 cuft |
| Drainage area | = 3.430 ac | Curve number | = 69* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = TR55 | Time of conc. (Tc) | = 11.50 min |
| Total precip. | = 5.52 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = [(1.800 x 58) + (0.780 x 78) + (0.050 x 55) + (0.490 x 77) + (0.310 x 98)] / 3.430



Hydrograph Report

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

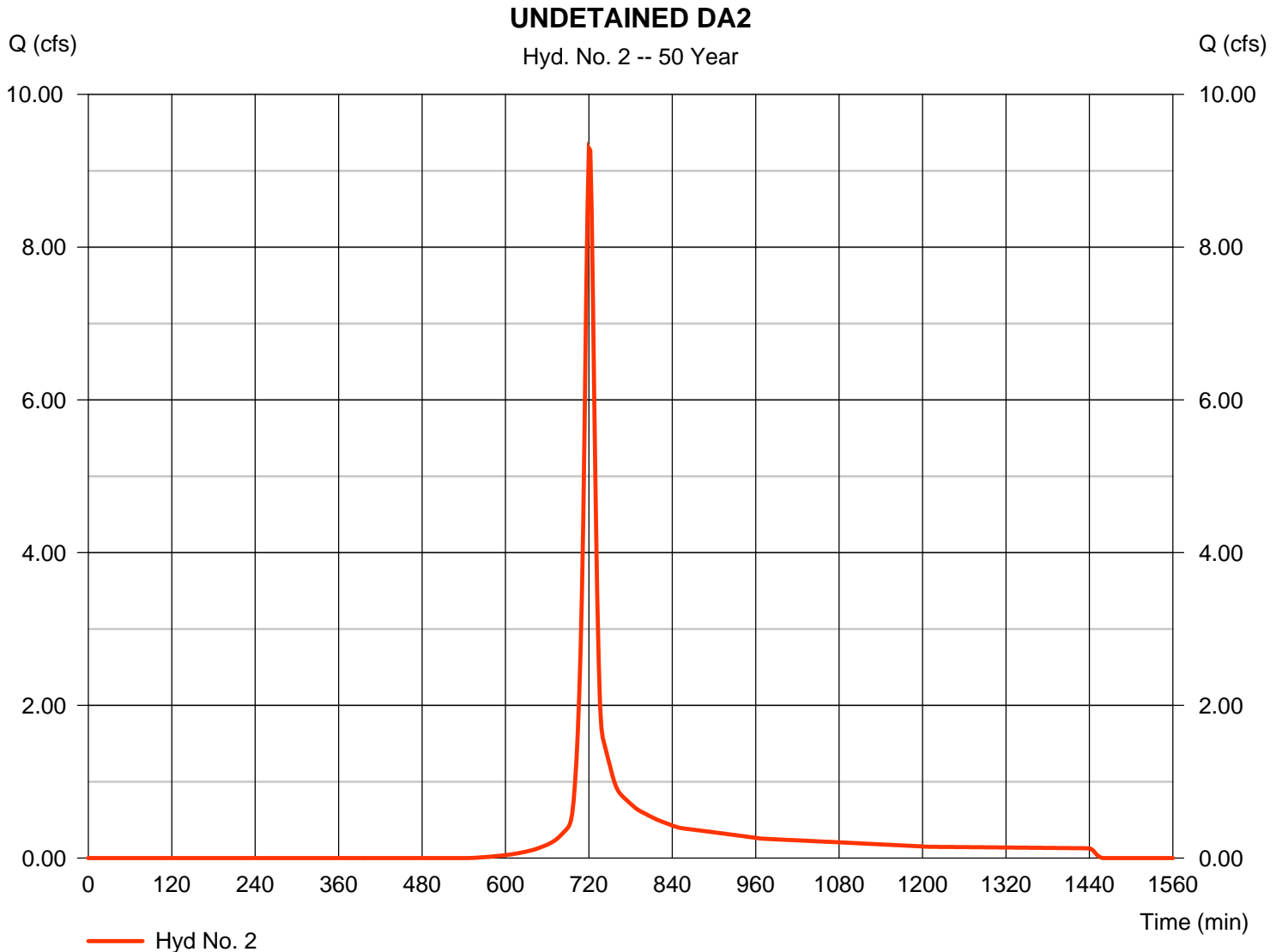
Friday, 11 / 11 / 2016

Hyd. No. 2

UNDETAINED DA2

| | | | |
|-----------------|--------------|--------------------|---------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 9.295 cfs |
| Storm frequency | = 50 yrs | Time to peak | = 720 min |
| Time interval | = 2 min | Hyd. volume | = 24,216 cuft |
| Drainage area | = 2.570 ac | Curve number | = 71* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = TR55 | Time of conc. (Tc) | = 11.50 min |
| Total precip. | = 5.52 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = [(1.080 x 58) + (0.830 x 78) + (0.210 x 98) + (0.050 x 55) + (0.400 x 77)] / 2.570



Hydrograph Report

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

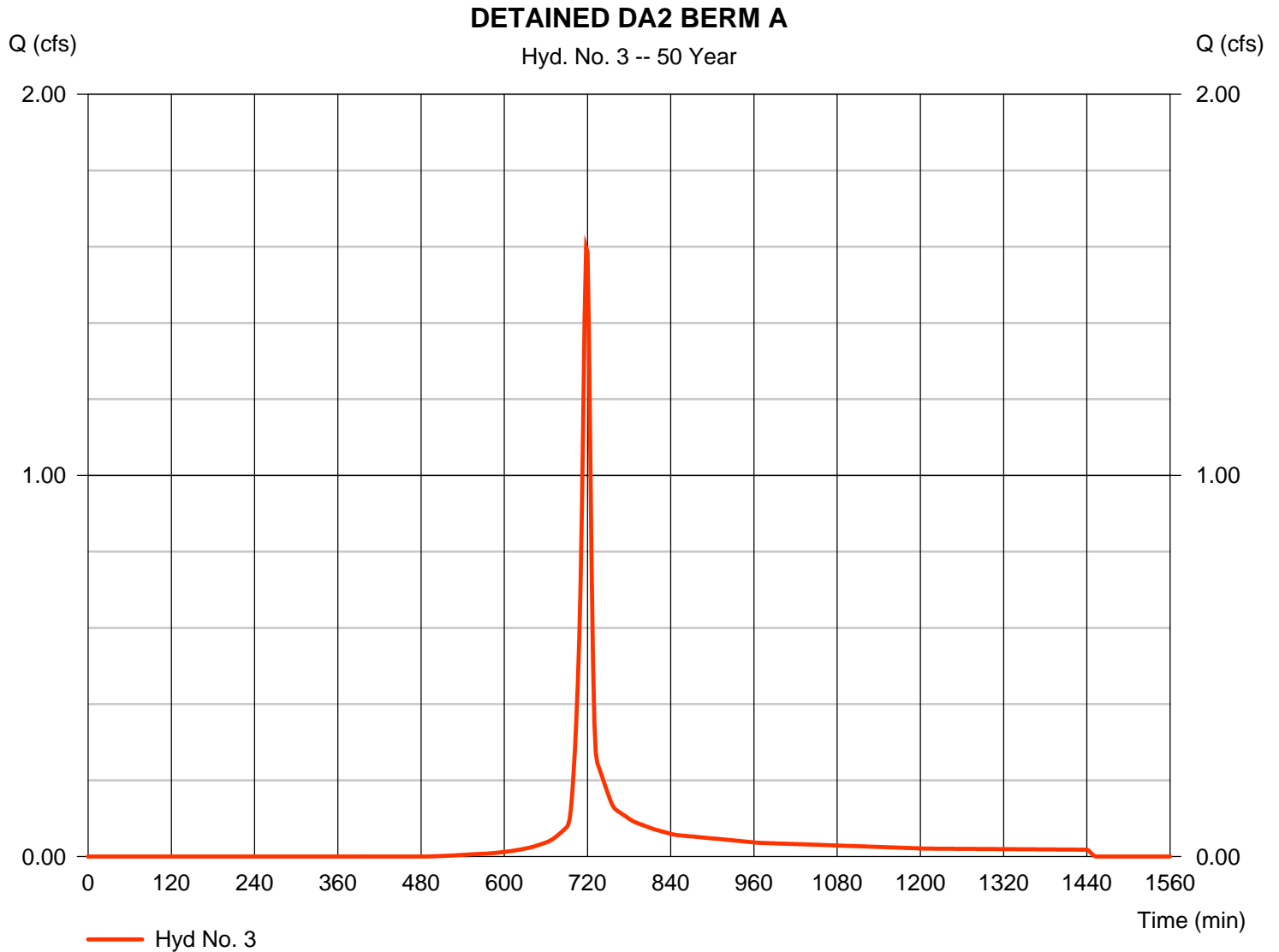
Friday, 11 / 11 / 2016

Hyd. No. 3

DETAINED DA2 BERM A

| | | | |
|-----------------|--------------|--------------------|--------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 1.598 cfs |
| Storm frequency | = 50 yrs | Time to peak | = 718 min |
| Time interval | = 2 min | Hyd. volume | = 3,656 cuft |
| Drainage area | = 0.350 ac | Curve number | = 75* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = TR55 | Time of conc. (Tc) | = 9.70 min |
| Total precip. | = 5.52 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = [(0.120 x 85) + (0.140 x 58) + (0.040 x 78) + (0.050 x 98)] / 0.350



Hydrograph Report

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

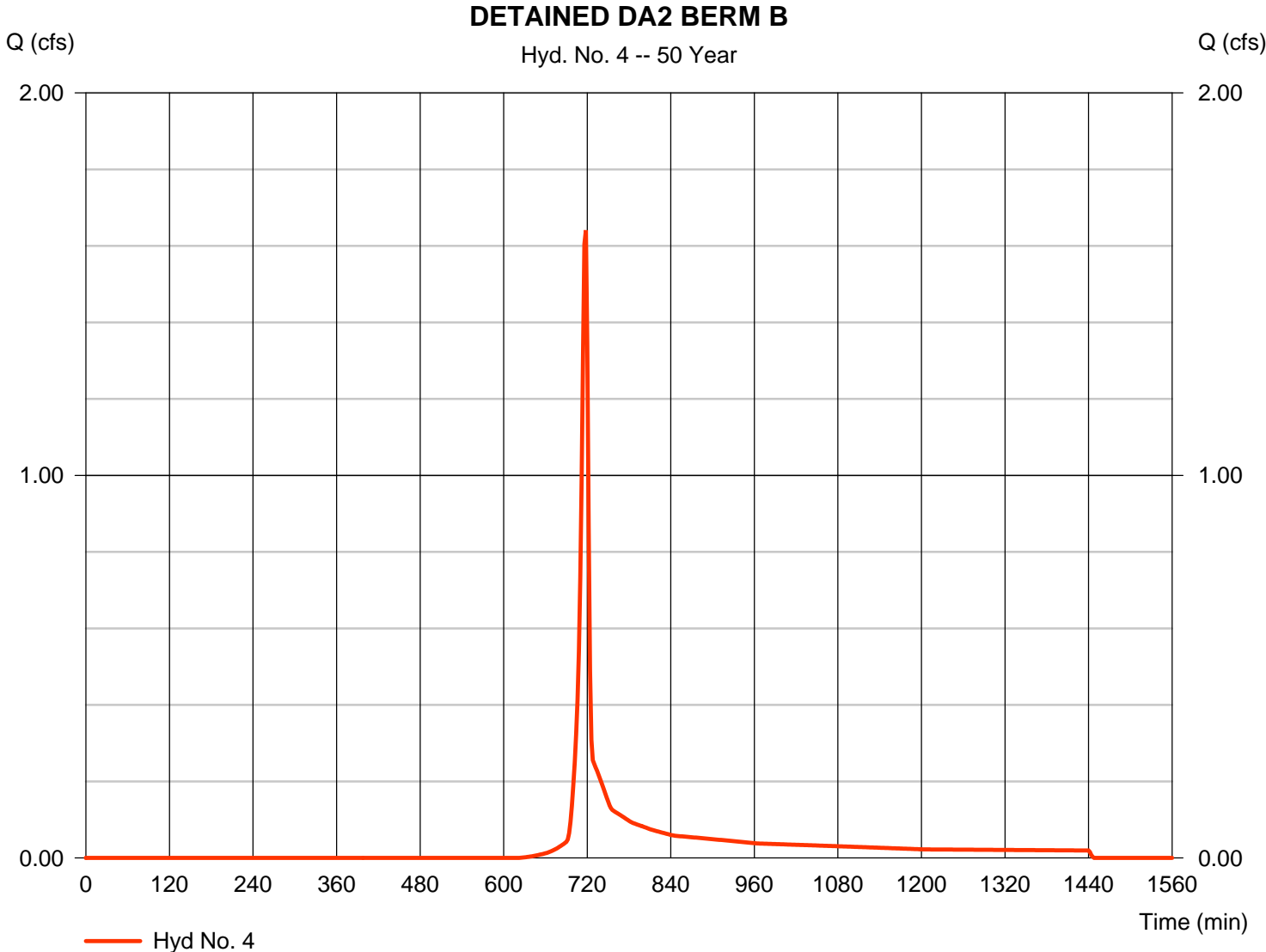
Friday, 11 / 11 / 2016

Hyd. No. 4

DETAINED DA2 BERM B

| | | | |
|-----------------|--------------|--------------------|--------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 1.641 cfs |
| Storm frequency | = 50 yrs | Time to peak | = 718 min |
| Time interval | = 2 min | Hyd. volume | = 3,281 cuft |
| Drainage area | = 0.480 ac | Curve number | = 65* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = TR55 | Time of conc. (Tc) | = 3.40 min |
| Total precip. | = 5.52 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = [(0.050 x 98) + (0.380 x 58) + (0.050 x 85)] / 0.480



Hydrograph Report

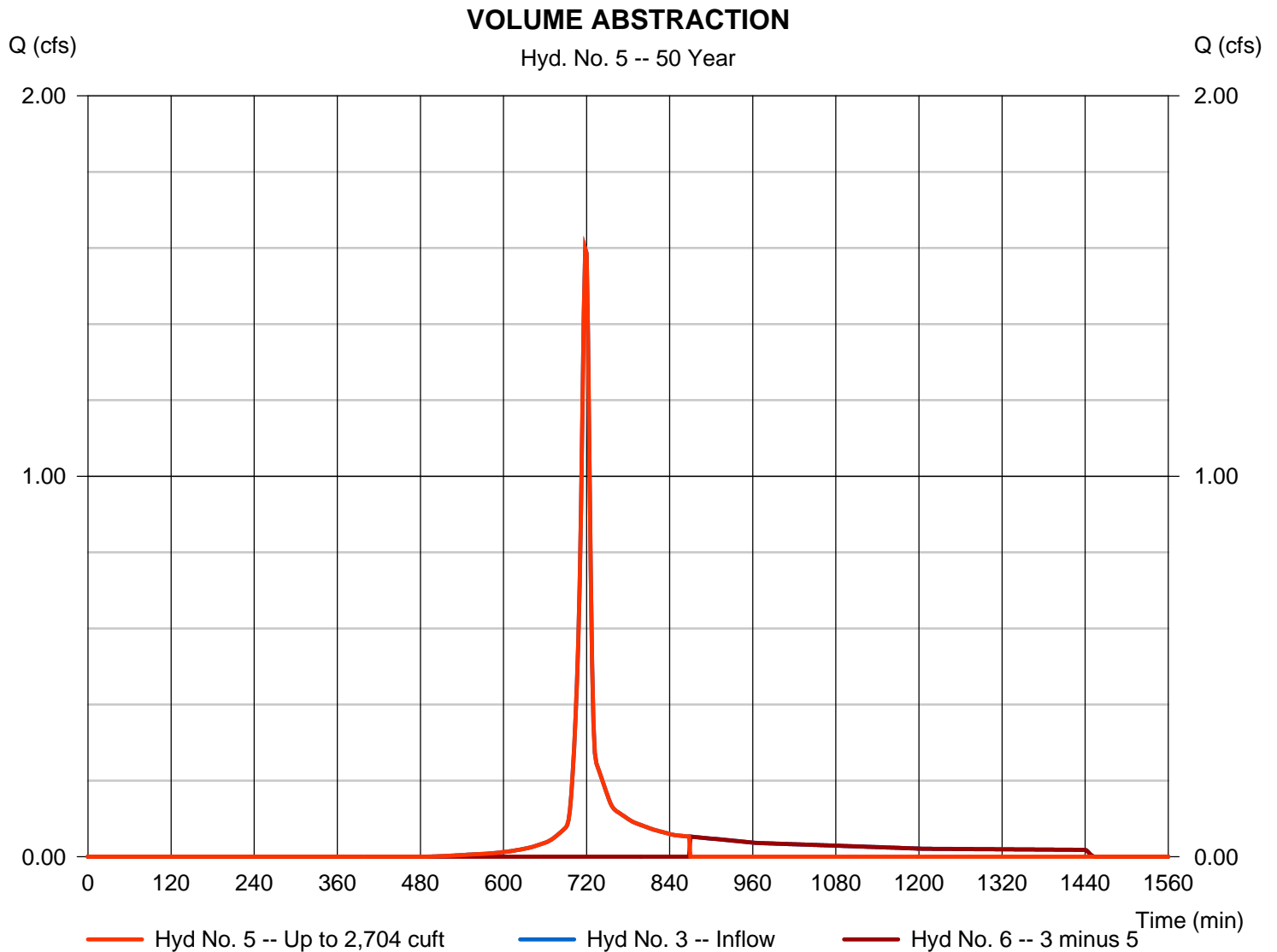
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 11 / 11 / 2016

Hyd. No. 5

VOLUME ABSTRACTION

| | | | |
|-------------------|---------------------------|-------------------|--------------|
| Hydrograph type | = Diversion1 | Peak discharge | = 1.598 cfs |
| Storm frequency | = 50 yrs | Time to peak | = 718 min |
| Time interval | = 2 min | Hyd. volume | = 2,706 cuft |
| Inflow hydrograph | = 3 - DETAINED DA2 BERM A | 2nd diverted hyd. | = 6 |
| Diversion method | = First Flush Volume | Volume Up To | = 2,704 cuft |



Hydrograph Report

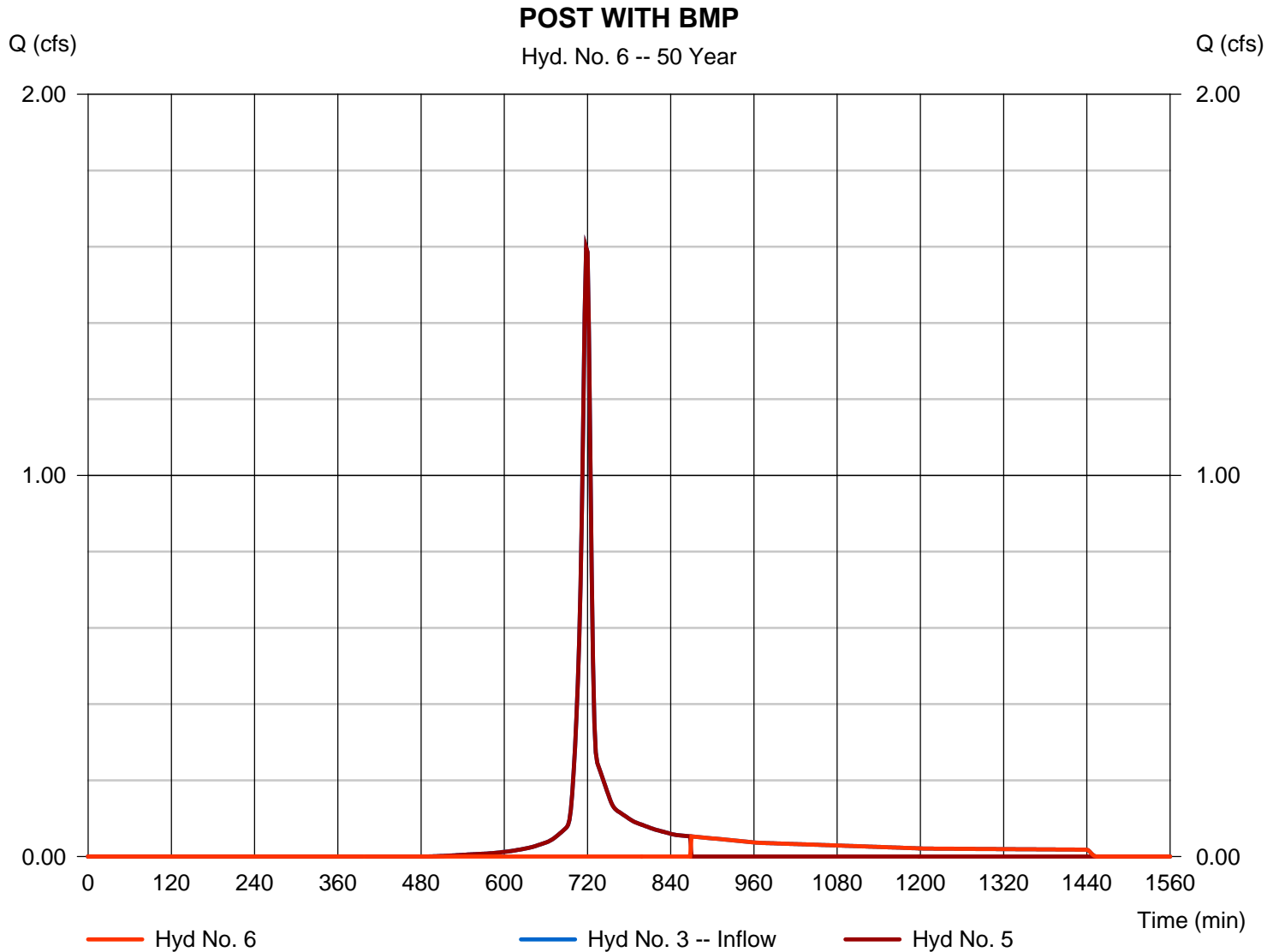
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 11 / 11 / 2016

Hyd. No. 6

POST WITH BMP

| | | | |
|-------------------|---------------------------|-------------------|--------------|
| Hydrograph type | = Diversion2 | Peak discharge | = 0.053 cfs |
| Storm frequency | = 50 yrs | Time to peak | = 870 min |
| Time interval | = 2 min | Hyd. volume | = 950 cuft |
| Inflow hydrograph | = 3 - DETAINED DA2 BERM A | 2nd diverted hyd. | = 5 |
| Diversion method | = First Flush Volume | Volume Up To | = 2,704 cuft |



Hydrograph Report

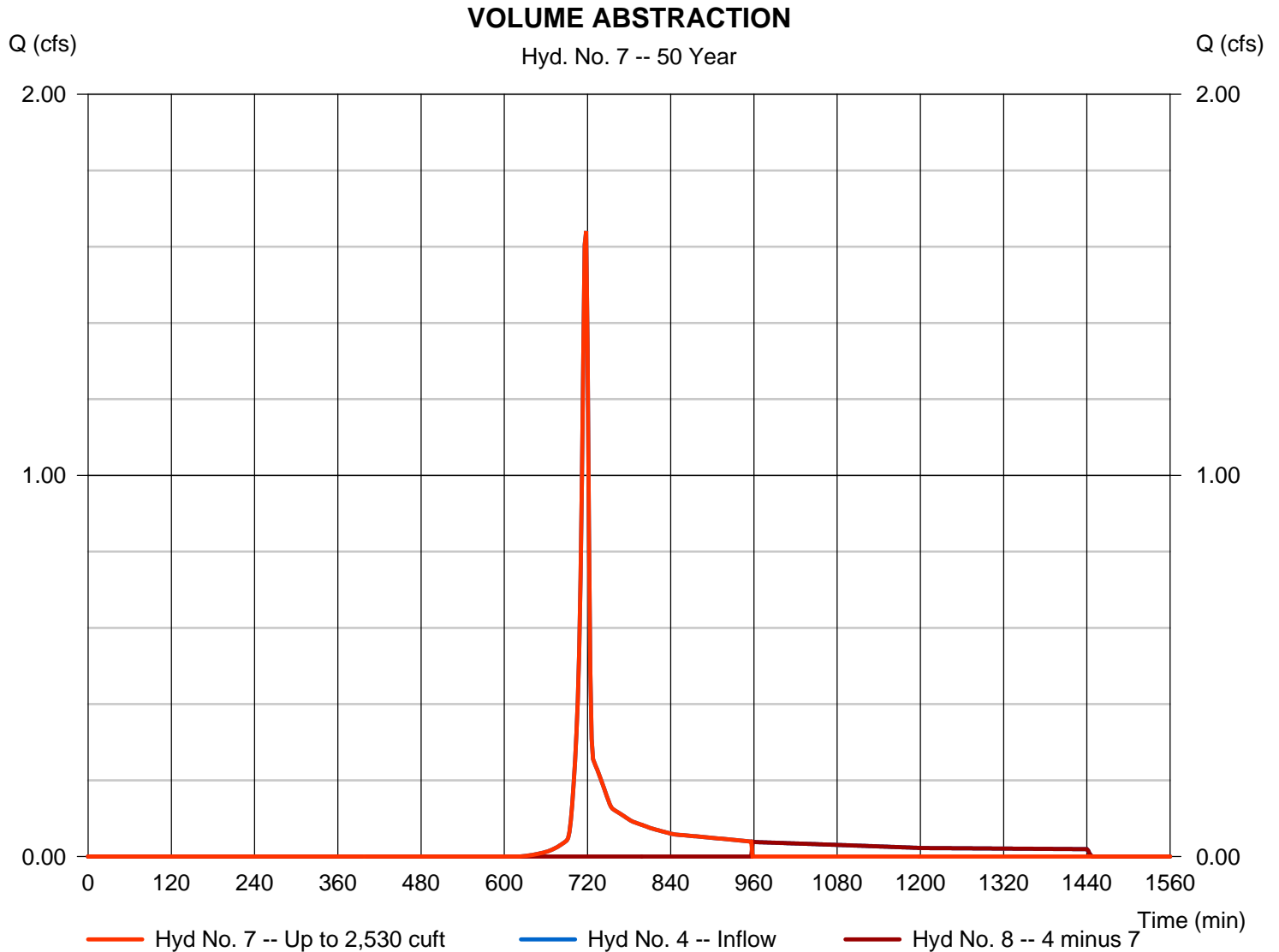
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 11 / 11 / 2016

Hyd. No. 7

VOLUME ABSTRACTION

| | | | |
|-------------------|---------------------------|-------------------|--------------|
| Hydrograph type | = Diversion1 | Peak discharge | = 1.641 cfs |
| Storm frequency | = 50 yrs | Time to peak | = 718 min |
| Time interval | = 2 min | Hyd. volume | = 2,532 cuft |
| Inflow hydrograph | = 4 - DETAINED DA2 BERM B | 2nd diverted hyd. | = 8 |
| Diversion method | = First Flush Volume | Volume Up To | = 2,530 cuft |



Hydrograph Report

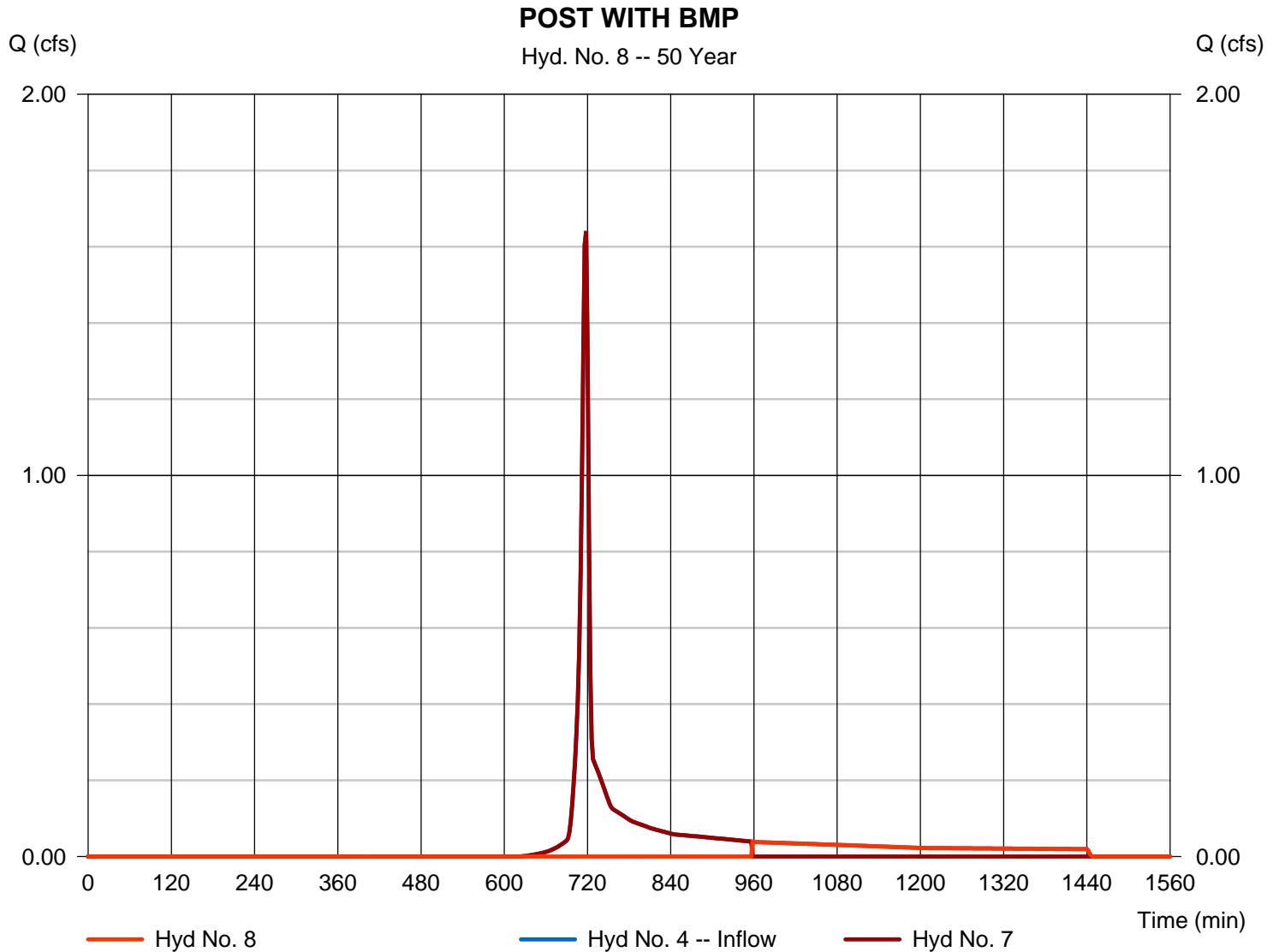
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 11 / 11 / 2016

Hyd. No. 8

POST WITH BMP

| | | | |
|-------------------|---------------------------|-------------------|--------------|
| Hydrograph type | = Diversion2 | Peak discharge | = 0.039 cfs |
| Storm frequency | = 50 yrs | Time to peak | = 958 min |
| Time interval | = 2 min | Hyd. volume | = 749 cuft |
| Inflow hydrograph | = 4 - DETAINED DA2 BERM B | 2nd diverted hyd. | = 7 |
| Diversion method | = First Flush Volume | Volume Up To | = 2,530 cuft |



Hydrograph Report

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

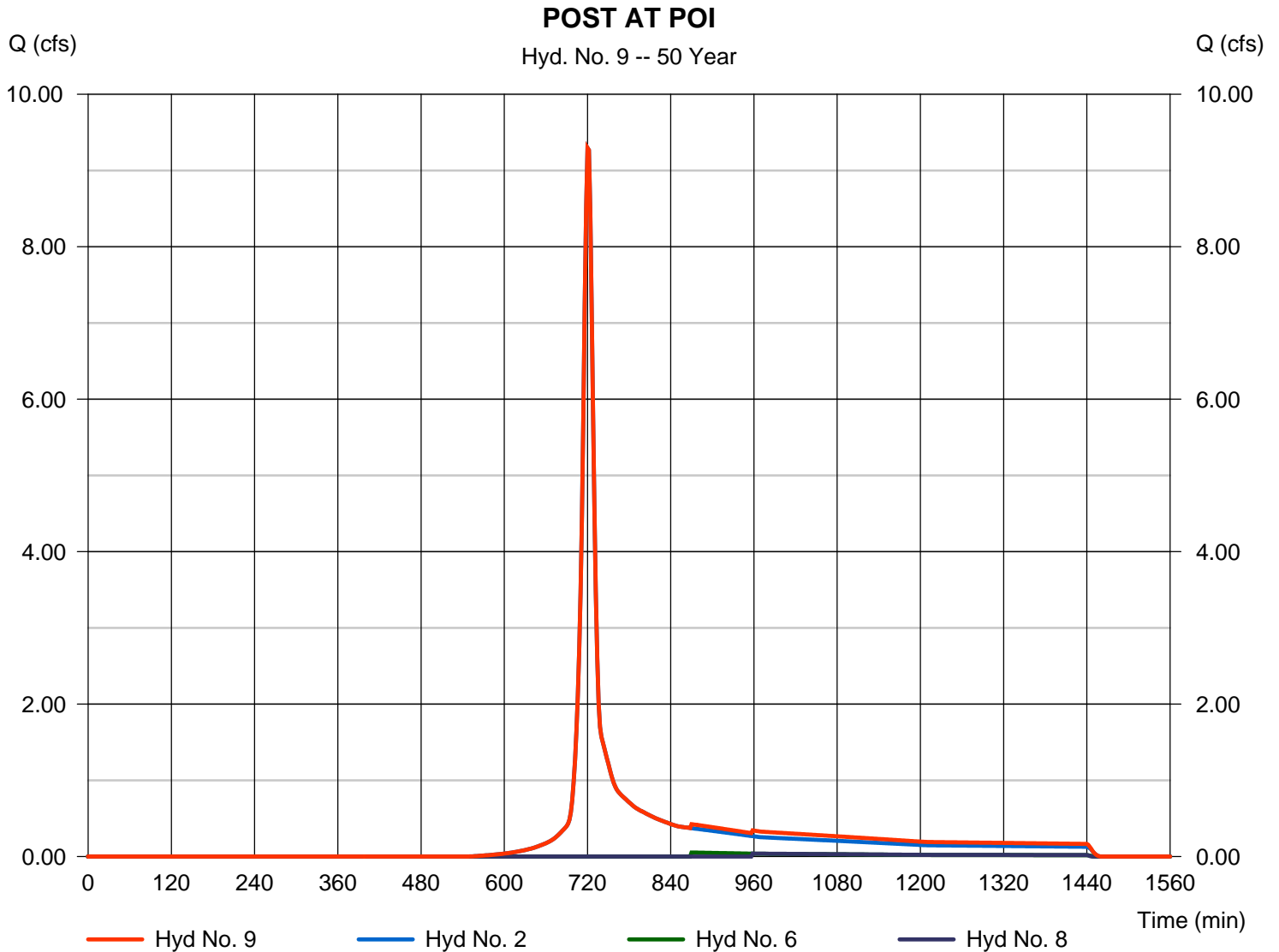
Friday, 11 / 11 / 2016

Hyd. No. 9

POST AT POI

Hydrograph type = Combine
Storm frequency = 50 yrs
Time interval = 2 min
Inflow hyds. = 2, 6, 8

Peak discharge = 9.295 cfs
Time to peak = 720 min
Hyd. volume = 25,915 cuft
Contrib. drain. area = 2.570 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 | 14.68 | 2 | 720 | 38,168 | ----- | ----- | ----- | PRE CONSTRUCTION DA2 | |
| 2 | SCS Runoff | 11.74 | 2 | 720 | 30,467 | ----- | ----- | ----- | UNDETAINED DA2 | |
| 3 | SCS Runoff | 1.975 | 2 | 718 | 4,529 | ----- | ----- | ----- | DETAINED DA2 BERM A | |
| 4 | SCS Runoff | 2.115 | 2 | 718 | 4,237 | ----- | ----- | ----- | DETAINED DA2 BERM B | |
| 5 | Diversion1 | 1.975 | 2 | 718 | 2,723 | 3 | ----- | ----- | VOLUME ABSTRACTION | |
| 6 | Diversion2 | 0.172 | 2 | 754 | 1,807 | 3 | ----- | ----- | POST WITH BMP | |
| 7 | Diversion1 | 2.115 | 2 | 718 | 2,530 | 4 | ----- | ----- | VOLUME ABSTRACTION | |
| 8 | Diversion2 | 0.124 | 2 | 778 | 1,707 | 4 | ----- | ----- | POST WITH BMP | |
| 9 | Combine | 11.74 | 2 | 720 | 33,981 | 2, 6, 8 | ----- | ----- | POST AT POI | |
| Shade Valley DA2.gpw | | | | | Return Period: 100 Year | | | Friday, 11 / 11 / 2016 | | |

Hydrograph Report

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

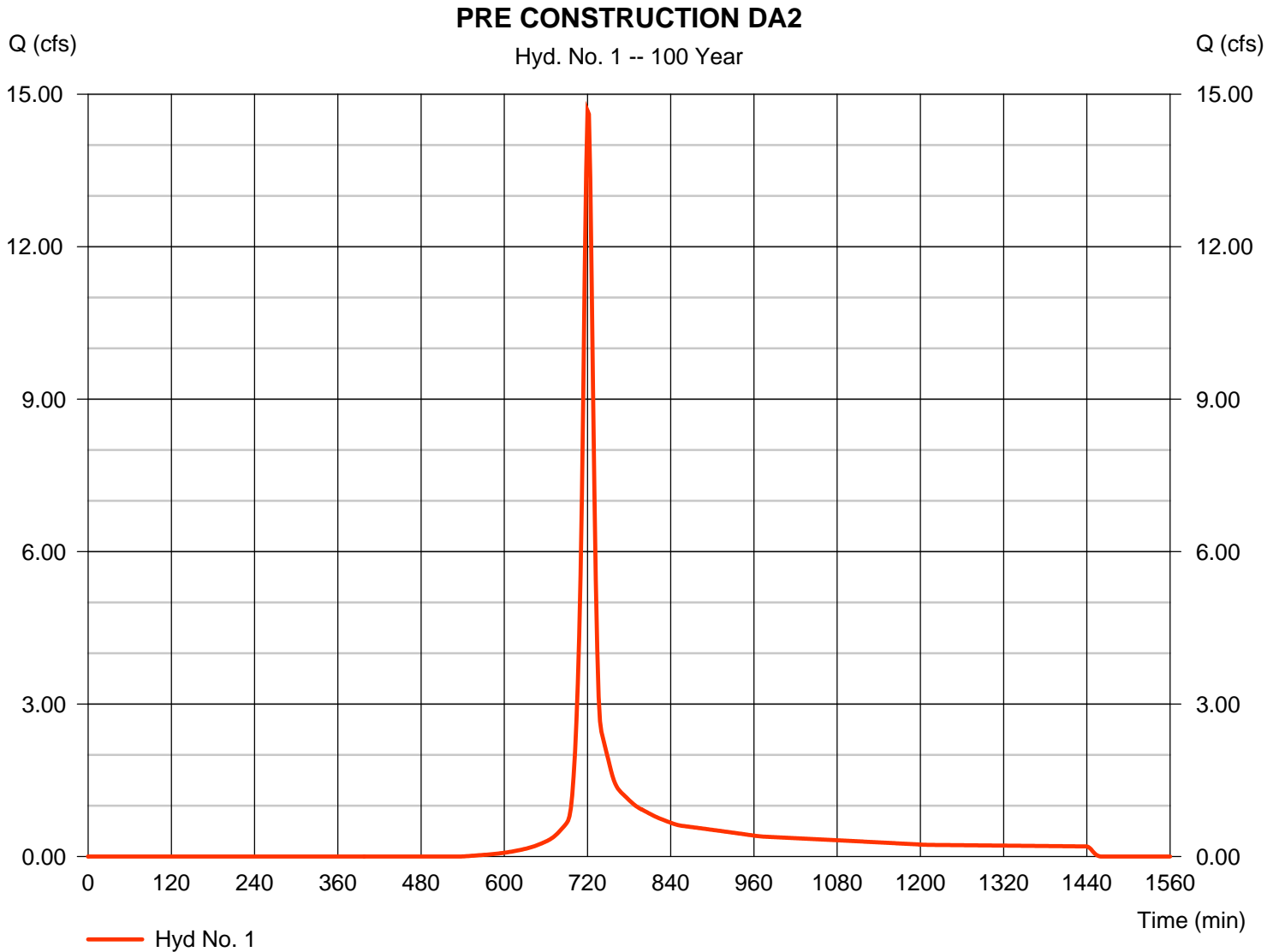
Friday, 11 / 11 / 2016

Hyd. No. 1

PRE CONSTRUCTION DA2

| | | | |
|-----------------|--------------|--------------------|---------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 14.68 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 720 min |
| Time interval | = 2 min | Hyd. volume | = 38,168 cuft |
| Drainage area | = 3.430 ac | Curve number | = 69* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = TR55 | Time of conc. (Tc) | = 11.50 min |
| Total precip. | = 6.33 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = [(1.800 x 58) + (0.780 x 78) + (0.050 x 55) + (0.490 x 77) + (0.310 x 98)] / 3.430



Hydrograph Report

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

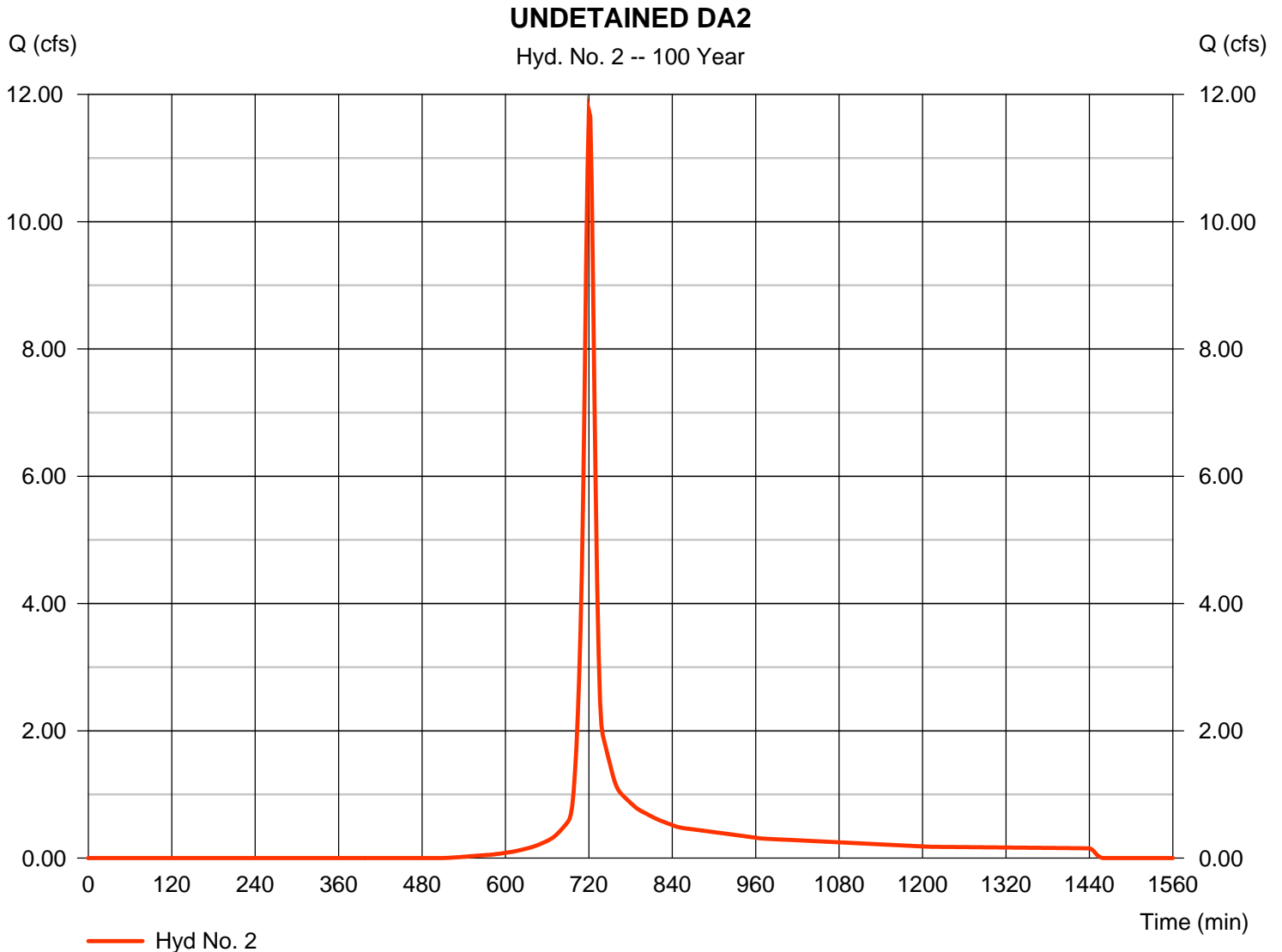
Friday, 11 / 11 / 2016

Hyd. No. 2

UNDETAINED DA2

| | | | |
|-----------------|--------------|--------------------|---------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 11.74 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 720 min |
| Time interval | = 2 min | Hyd. volume | = 30,467 cuft |
| Drainage area | = 2.570 ac | Curve number | = 71* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = TR55 | Time of conc. (Tc) | = 11.50 min |
| Total precip. | = 6.33 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = [(1.080 x 58) + (0.830 x 78) + (0.210 x 98) + (0.050 x 55) + (0.400 x 77)] / 2.570



Hydrograph Report

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

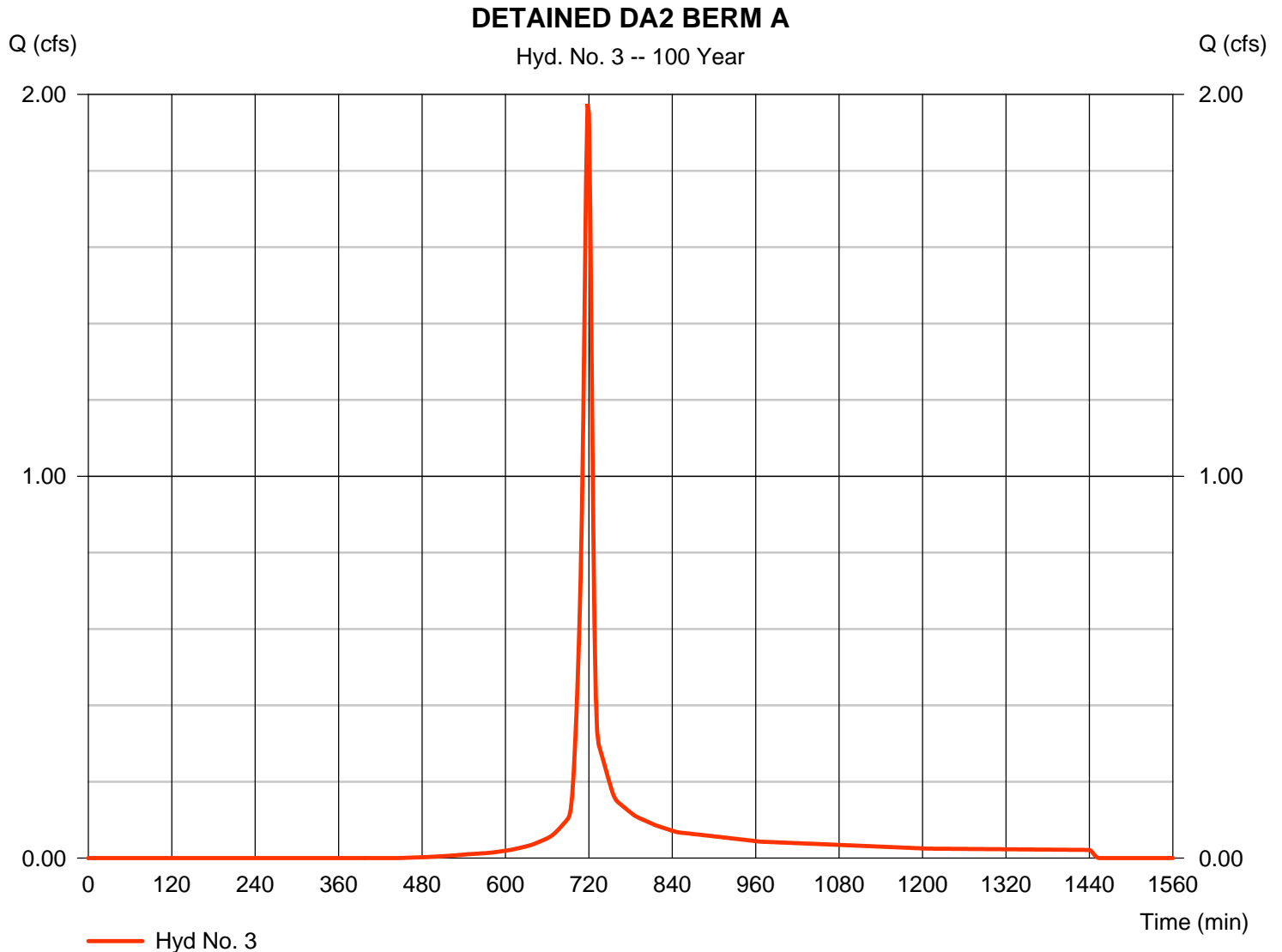
Friday, 11 / 11 / 2016

Hyd. No. 3

DETAINED DA2 BERM A

| | | | |
|-----------------|--------------|--------------------|--------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 1.975 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 718 min |
| Time interval | = 2 min | Hyd. volume | = 4,529 cuft |
| Drainage area | = 0.350 ac | Curve number | = 75* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = TR55 | Time of conc. (Tc) | = 9.70 min |
| Total precip. | = 6.33 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = [(0.120 x 85) + (0.140 x 58) + (0.040 x 78) + (0.050 x 98)] / 0.350



Hydrograph Report

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

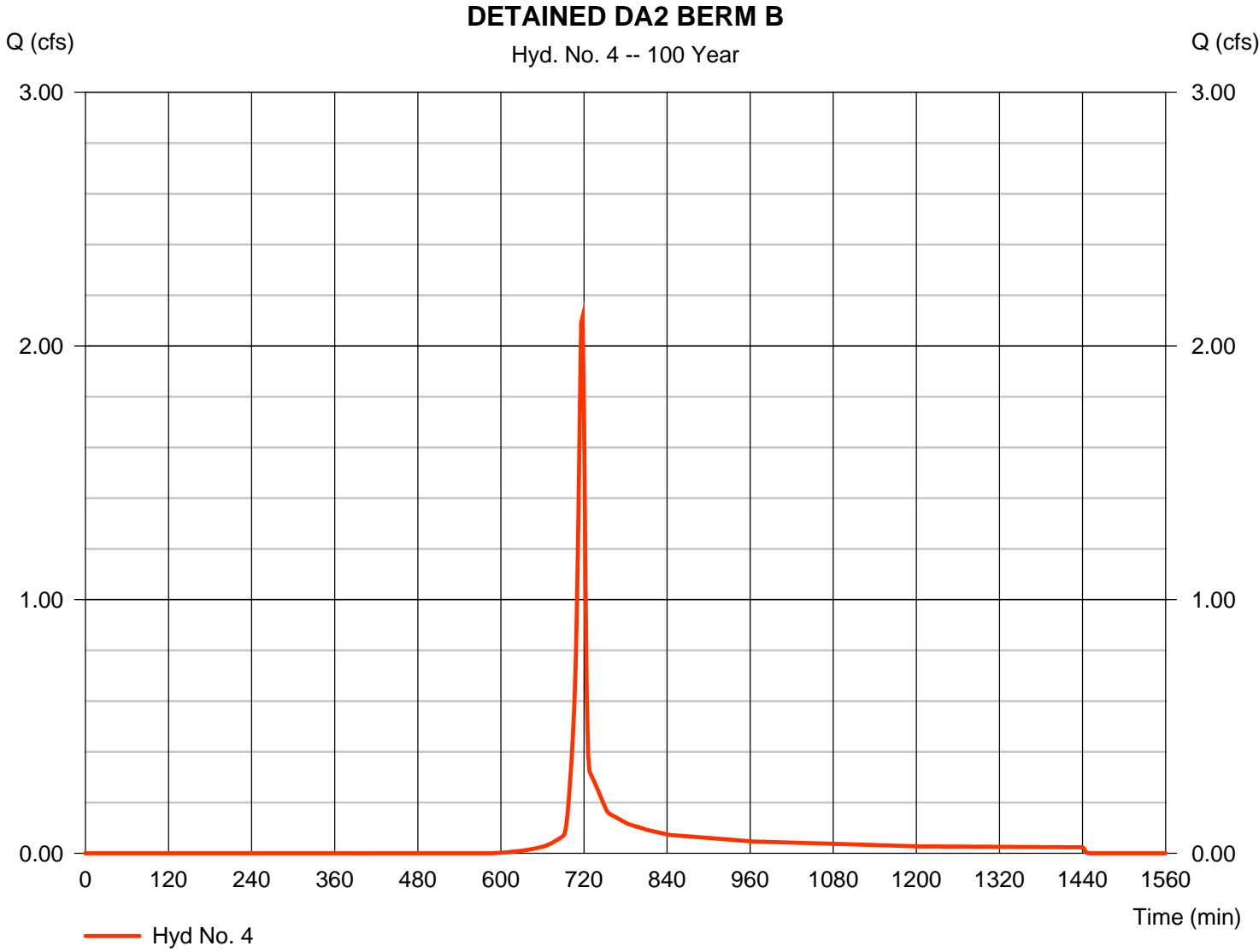
Friday, 11 / 11 / 2016

Hyd. No. 4

DETAINED DA2 BERM B

| | | | |
|-----------------|--------------|--------------------|--------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 2.115 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 718 min |
| Time interval | = 2 min | Hyd. volume | = 4,237 cuft |
| Drainage area | = 0.480 ac | Curve number | = 65* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = TR55 | Time of conc. (Tc) | = 3.40 min |
| Total precip. | = 6.33 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = [(0.050 x 98) + (0.380 x 58) + (0.050 x 85)] / 0.480



Hydrograph Report

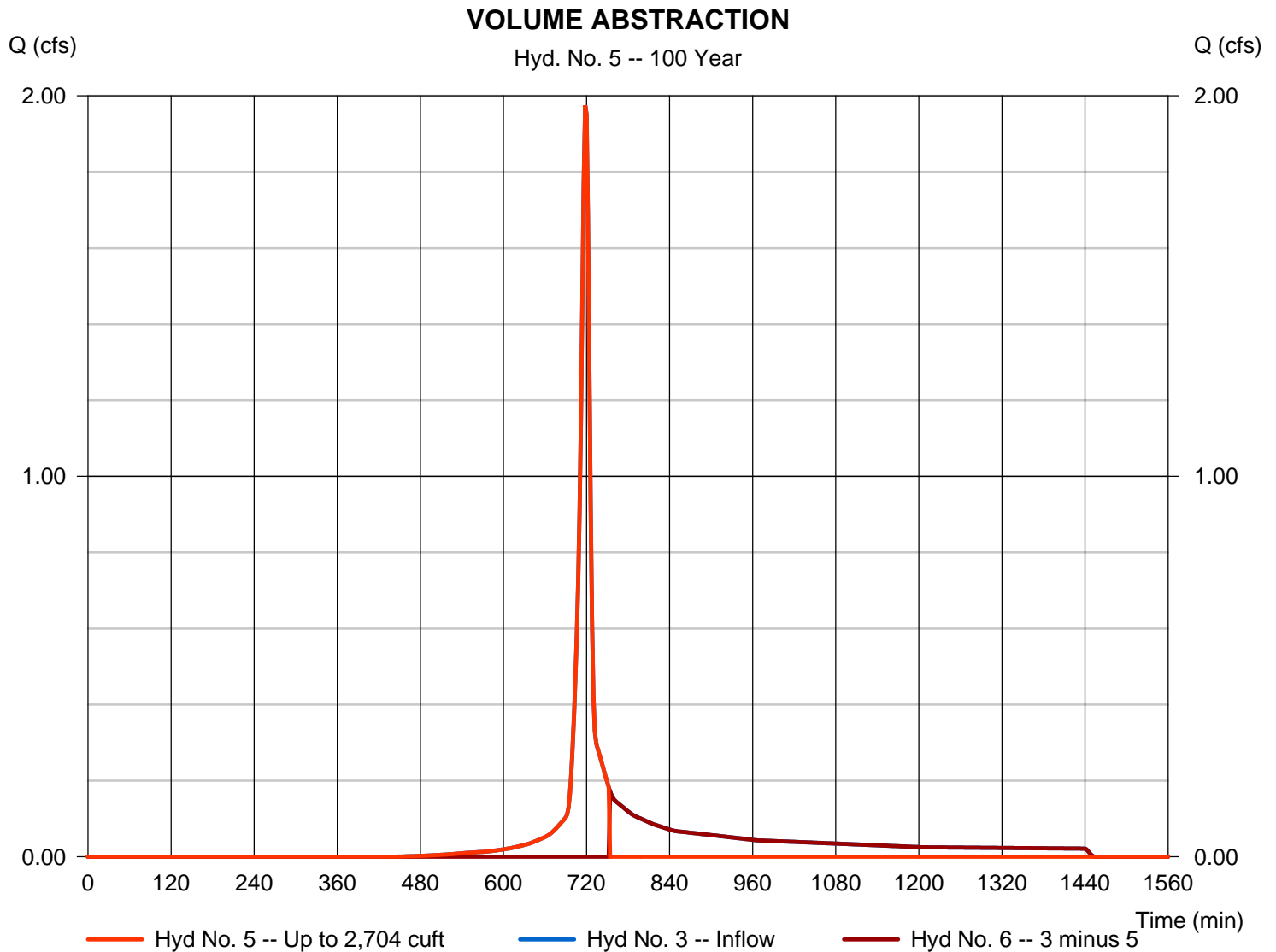
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 11 / 11 / 2016

Hyd. No. 5

VOLUME ABSTRACTION

| | | | |
|-------------------|---------------------------|-------------------|--------------|
| Hydrograph type | = Diversion1 | Peak discharge | = 1.975 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 718 min |
| Time interval | = 2 min | Hyd. volume | = 2,723 cuft |
| Inflow hydrograph | = 3 - DETAINED DA2 BERM A | 2nd diverted hyd. | = 6 |
| Diversion method | = First Flush Volume | Volume Up To | = 2,704 cuft |



Hydrograph Report

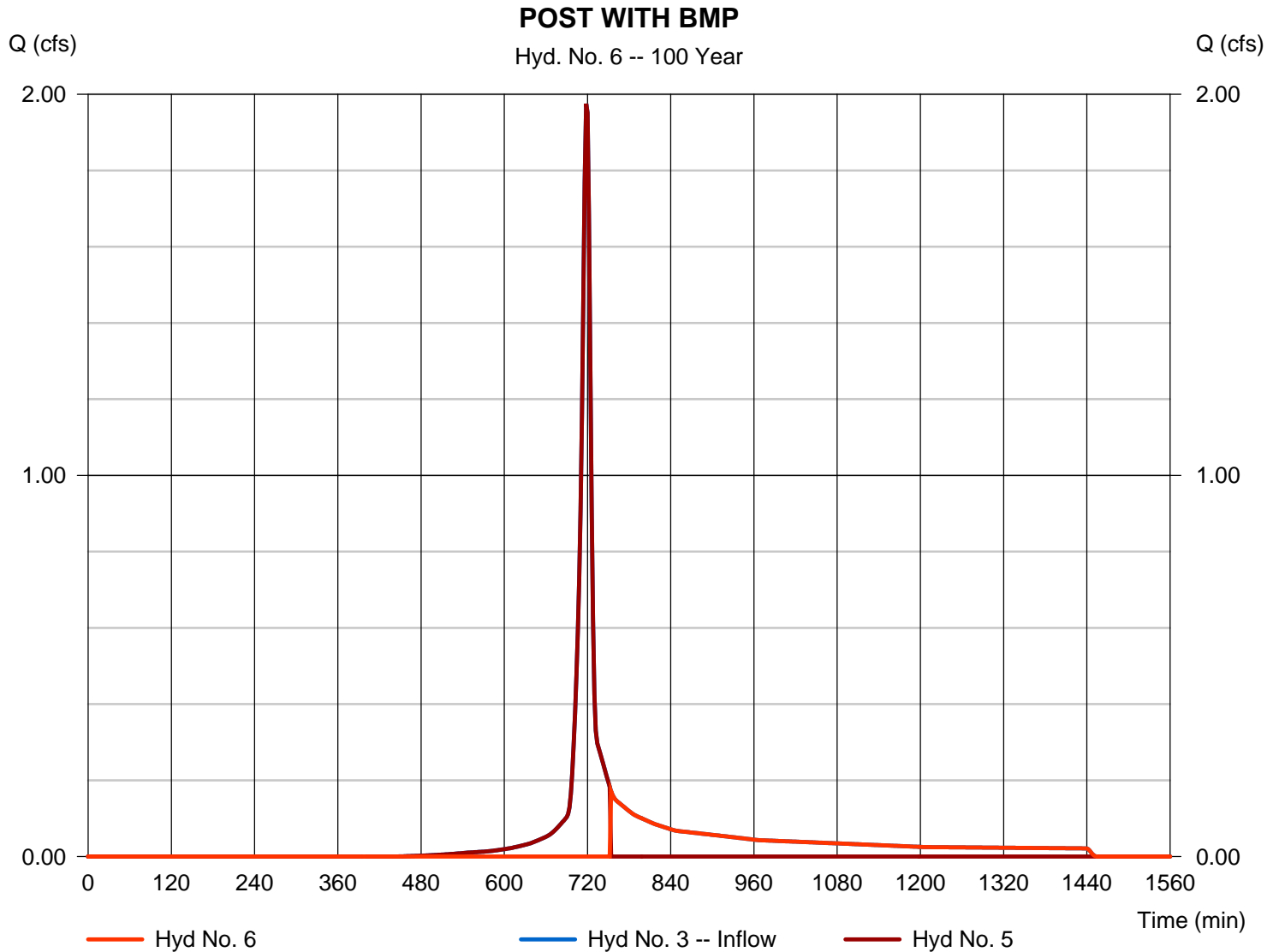
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 11 / 11 / 2016

Hyd. No. 6

POST WITH BMP

| | | | |
|-------------------|---------------------------|-------------------|--------------|
| Hydrograph type | = Diversion2 | Peak discharge | = 0.172 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 754 min |
| Time interval | = 2 min | Hyd. volume | = 1,807 cuft |
| Inflow hydrograph | = 3 - DETAINED DA2 BERM A | 2nd diverted hyd. | = 5 |
| Diversion method | = First Flush Volume | Volume Up To | = 2,704 cuft |



Hydrograph Report

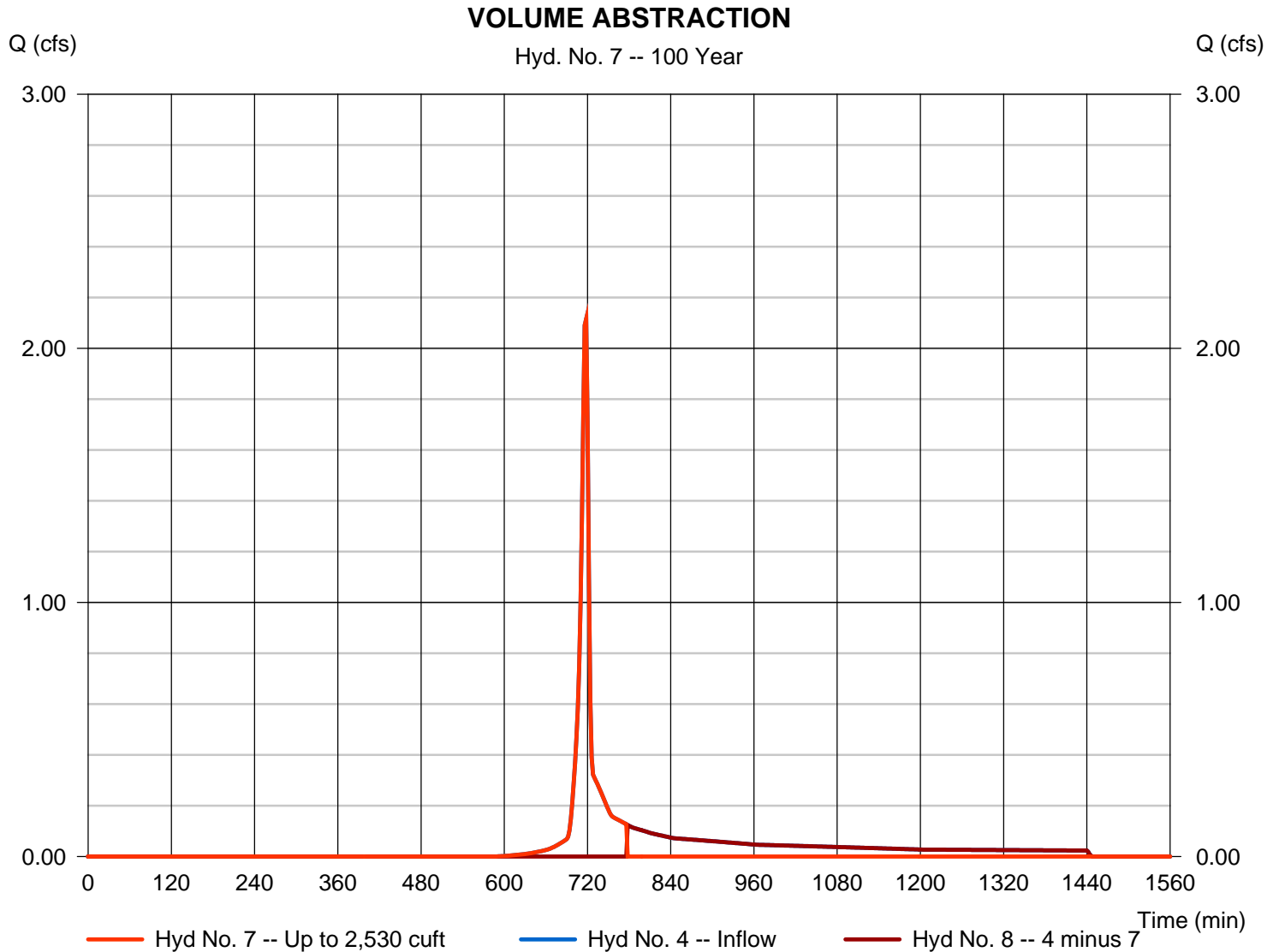
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 11 / 11 / 2016

Hyd. No. 7

VOLUME ABSTRACTION

| | | | |
|-------------------|---------------------------|-------------------|--------------|
| Hydrograph type | = Diversion1 | Peak discharge | = 2.115 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 718 min |
| Time interval | = 2 min | Hyd. volume | = 2,530 cuft |
| Inflow hydrograph | = 4 - DETAINED DA2 BERM B | 2nd diverted hyd. | = 8 |
| Diversion method | = First Flush Volume | Volume Up To | = 2,530 cuft |



Hydrograph Report

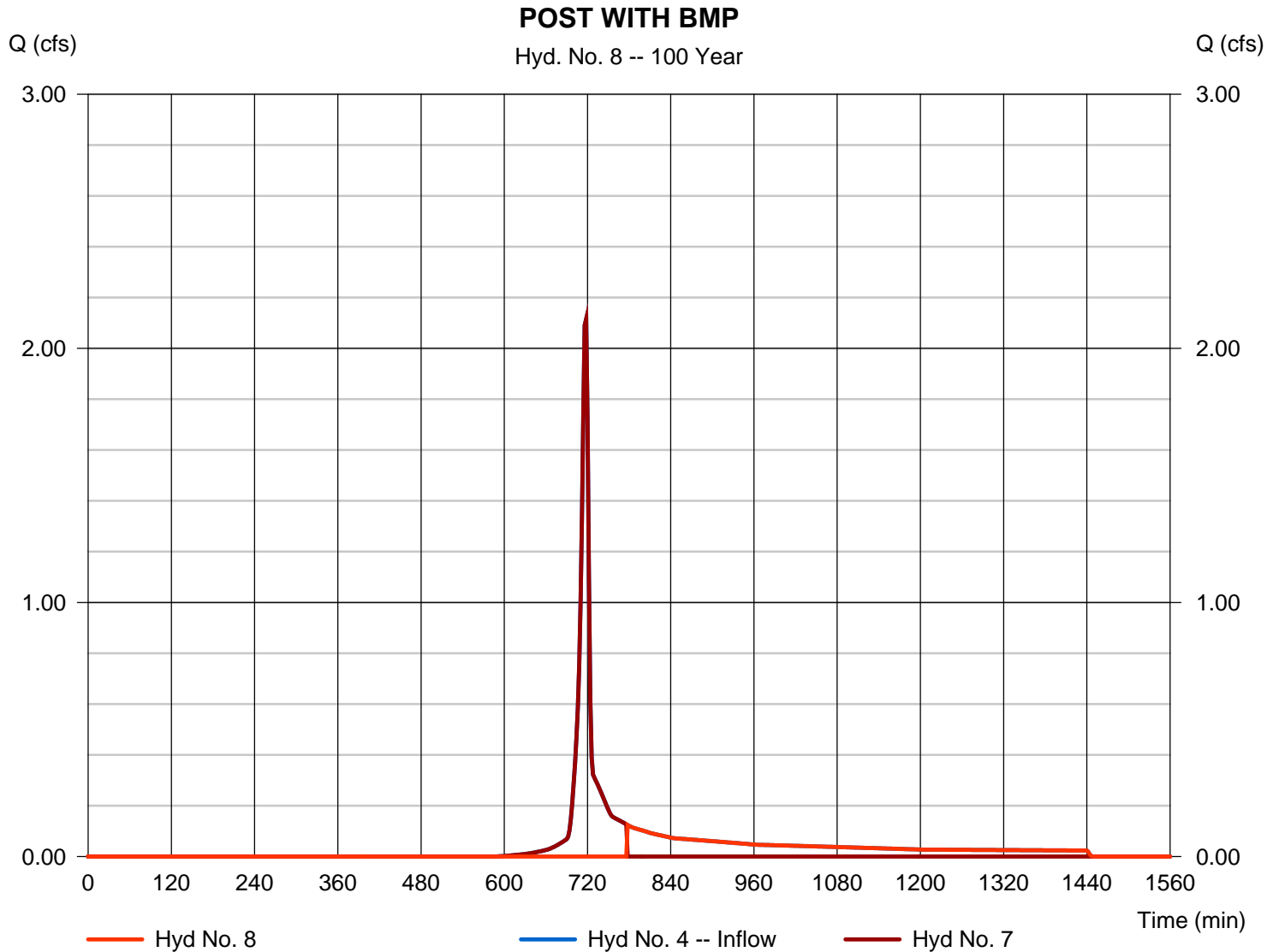
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 11 / 11 / 2016

Hyd. No. 8

POST WITH BMP

| | | | |
|-------------------|---------------------------|-------------------|--------------|
| Hydrograph type | = Diversion2 | Peak discharge | = 0.124 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 778 min |
| Time interval | = 2 min | Hyd. volume | = 1,707 cuft |
| Inflow hydrograph | = 4 - DETAINED DA2 BERM B | 2nd diverted hyd. | = 7 |
| Diversion method | = First Flush Volume | Volume Up To | = 2,530 cuft |



Hydrograph Report

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

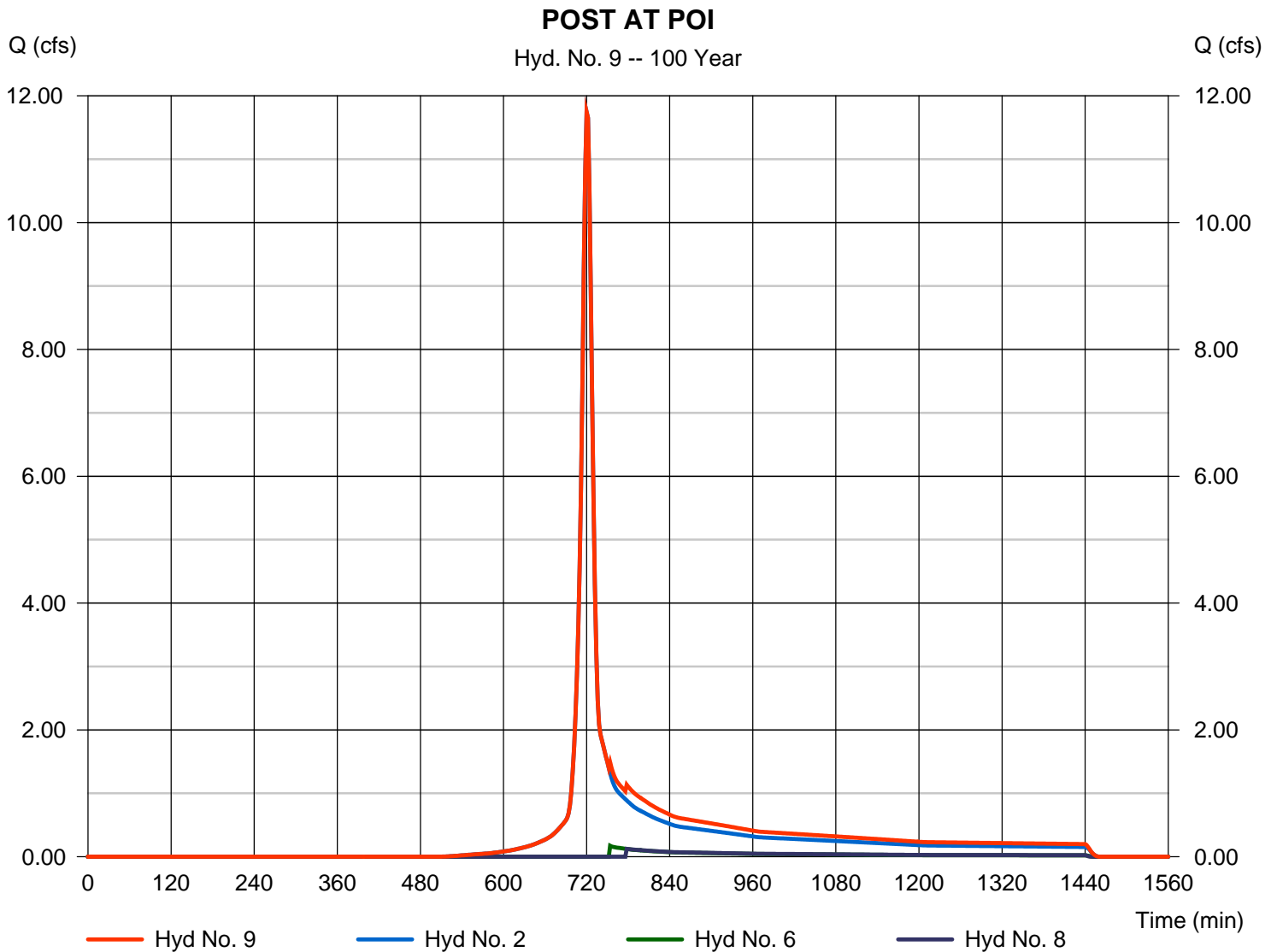
Friday, 11 / 11 / 2016

Hyd. No. 9

POST AT POI

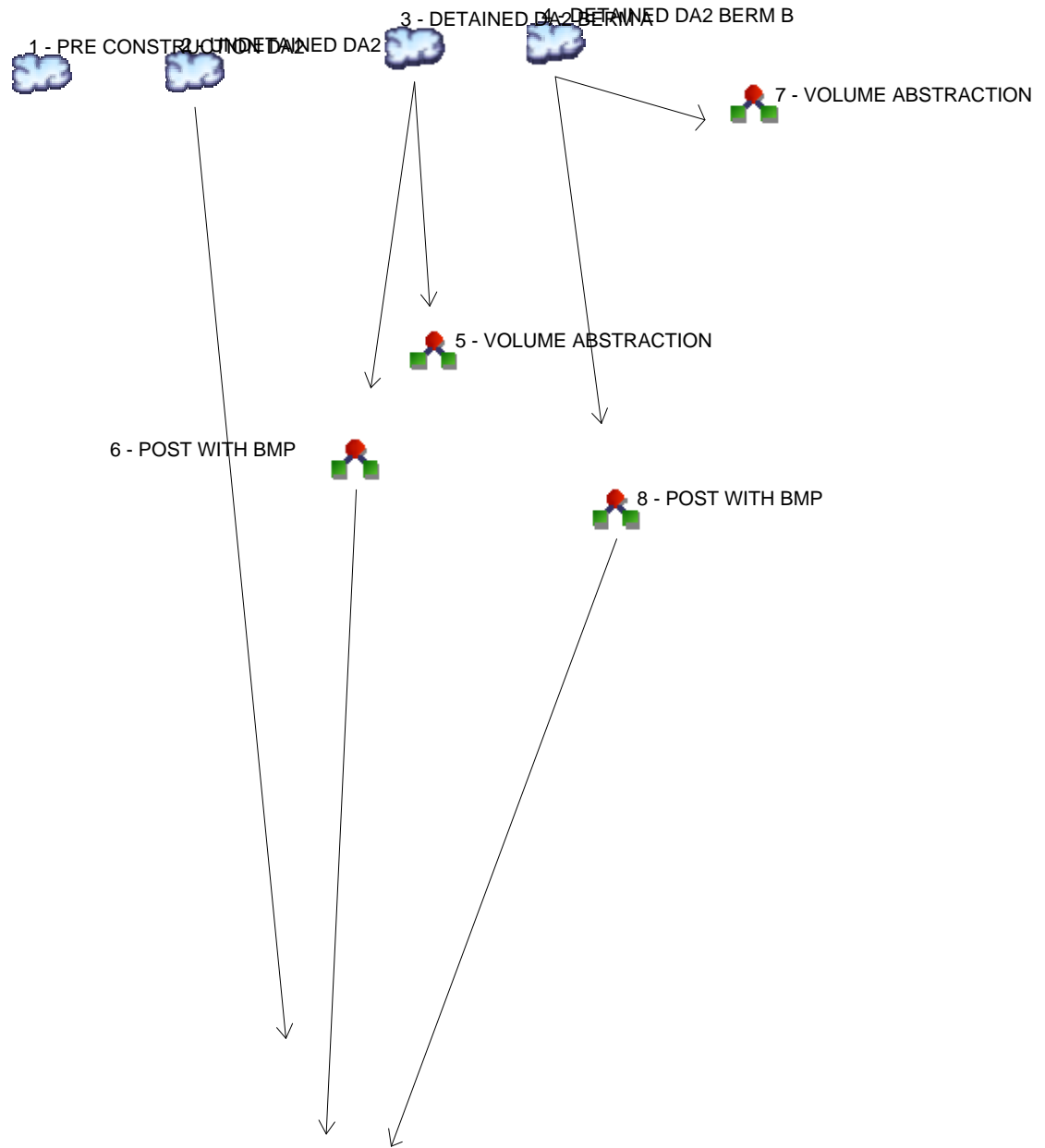
Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 2 min
Inflow hyds. = 2, 6, 8

Peak discharge = 11.74 cfs
Time to peak = 720 min
Hyd. volume = 33,981 cuft
Contrib. drain. area = 2.570 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 CONSTRUCTION DA2 |
| 2 | SCS Runoff | UNDETAINED DA2 |
| 3 | SCS Runoff | DETAINED DA2 BERM A |
| 4 | SCS Runoff | DETAINED DA2 BERM B |
| 5 | Diversion1 | VOLUME ABSTRACTION |
| 6 | Diversion2 | POST WITH BMP |
| 7 | Diversion1 | VOLUME ABSTRACTION |
| 8 | Diversion2 | POST WITH BMP |
| 9 | 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 | ----- | ----- | 2.266 | ----- | ----- | ----- | ----- | ----- | ----- | PRE CONSTRUCTION DA2 |
| 2 | SCS Runoff | ----- | ----- | 2.053 | ----- | ----- | ----- | ----- | ----- | ----- | UNDETAINED DA2 |
| 3 | SCS Runoff | ----- | ----- | 0.159 | ----- | ----- | ----- | ----- | ----- | ----- | DETAINED DA2 BERM A |
| 4 | SCS Runoff | ----- | ----- | 0.086 | ----- | ----- | ----- | ----- | ----- | ----- | DETAINED DA2 BERM B |
| 5 | Diversion1 | 3 | ----- | 0.159 | ----- | ----- | ----- | ----- | ----- | ----- | VOLUME ABSTRACTION |
| 6 | Diversion2 | 3 | ----- | 0.000 | ----- | ----- | ----- | ----- | ----- | ----- | POST WITH BMP |
| 7 | Diversion1 | 4 | ----- | 0.086 | ----- | ----- | ----- | ----- | ----- | ----- | VOLUME ABSTRACTION |
| 8 | Diversion2 | 4 | ----- | 0.000 | ----- | ----- | ----- | ----- | ----- | ----- | POST WITH BMP |
| 9 | Combine | 2, 6, 8 | ----- | 2.053 | ----- | ----- | ----- | ----- | ----- | ----- | POST AT POI |

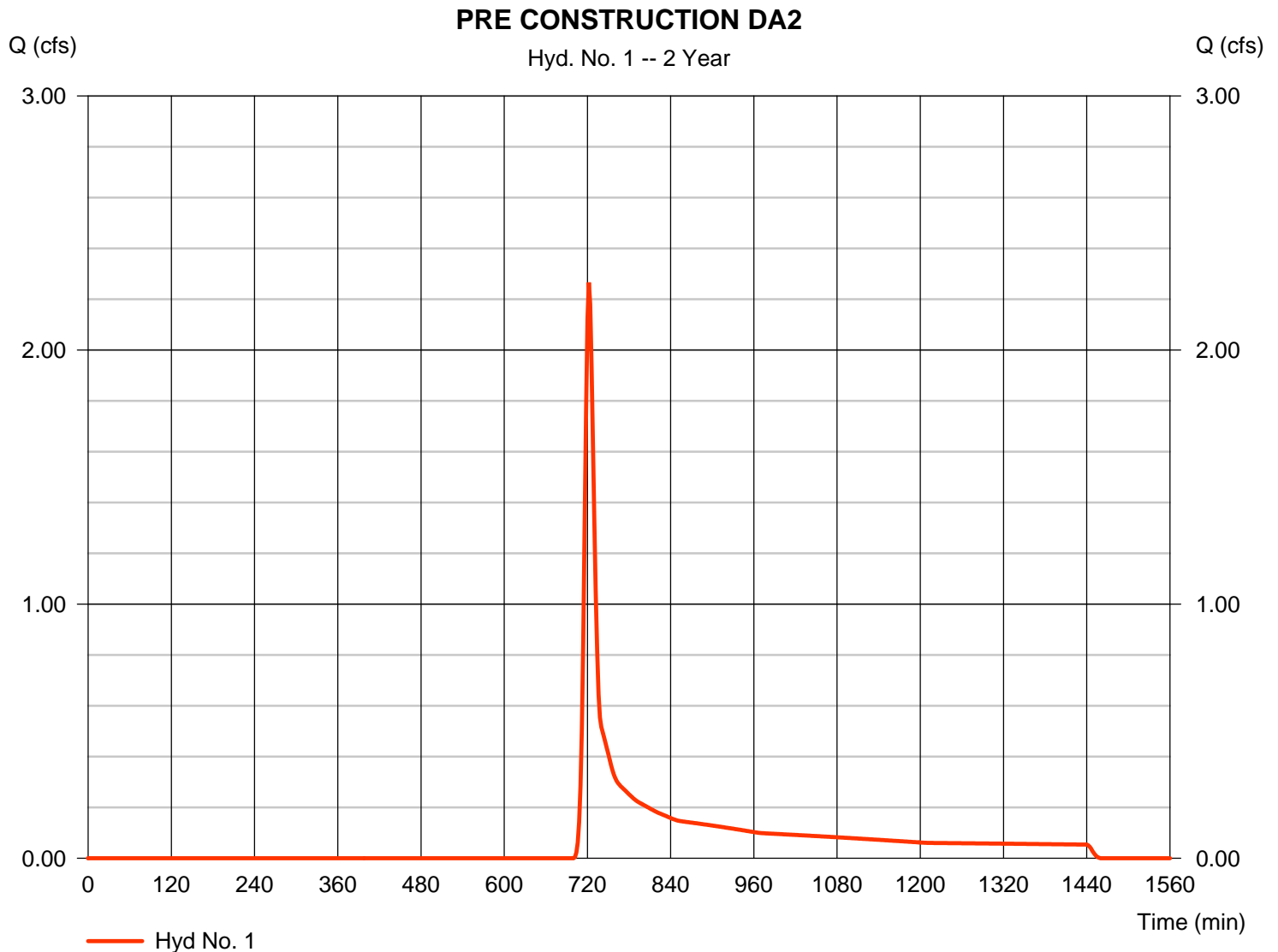
Hydrograph Report

Hyd. No. 1

PRE CONSTRUCTION DA2

| | | | |
|-----------------|--------------|--------------------|--------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 2.266 cfs |
| Storm frequency | = 2 yrs | Time to peak | = 722 min |
| Time interval | = 2 min | Hyd. volume | = 6,872 cuft |
| Drainage area | = 3.430 ac | Curve number | = 69* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = TR55 | Time of conc. (Tc) | = 11.50 min |
| Total precip. | = 2.74 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = [(1.800 x 58) + (0.780 x 78) + (0.050 x 55) + (0.490 x 77) + (0.310 x 98)] / 3.430



TR55 Tc Worksheet

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

Hyd. No. 1

PRE CONSTRUCTION DA2

| <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) | = 2.74 | 0.00 | 0.00 | |
| Land slope (%) | = 2.50 | 0.00 | 0.00 | |
| Travel Time (min) | = 8.10 | + 0.00 | + 0.00 | = 8.10 |
| Shallow Concentrated Flow | | | | |
| Flow length (ft) | = 85.00 | 0.00 | 0.00 | |
| Watercourse slope (%) | = 3.50 | 0.00 | 0.00 | |
| Surface description | = Unpaved | Paved | Paved | |
| Average velocity (ft/s) | =3.02 | 0.00 | 0.00 | |
| Travel Time (min) | = 0.47 | + 0.00 | + 0.00 | = 0.47 |
| Channel Flow | | | | |
| X sectional flow area (sqft) | = 2.00 | 0.00 | 0.00 | |
| Wetted perimeter (ft) | = 4.47 | 0.00 | 0.00 | |
| Channel slope (%) | = 2.10 | 0.00 | 0.00 | |
| Manning's n-value | = 0.030 | 0.015 | 0.015 | |
| Velocity (ft/s) | =4.20 | 0.00 | 0.00 | |
| Flow length (ft) | 747.0 | 0.0 | 0.0 | |
| Travel Time (min) | = 2.96 | + 0.00 | + 0.00 | = 2.96 |
| Total Travel Time, Tc | | | | 11.50 min |

Hydrograph Report

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

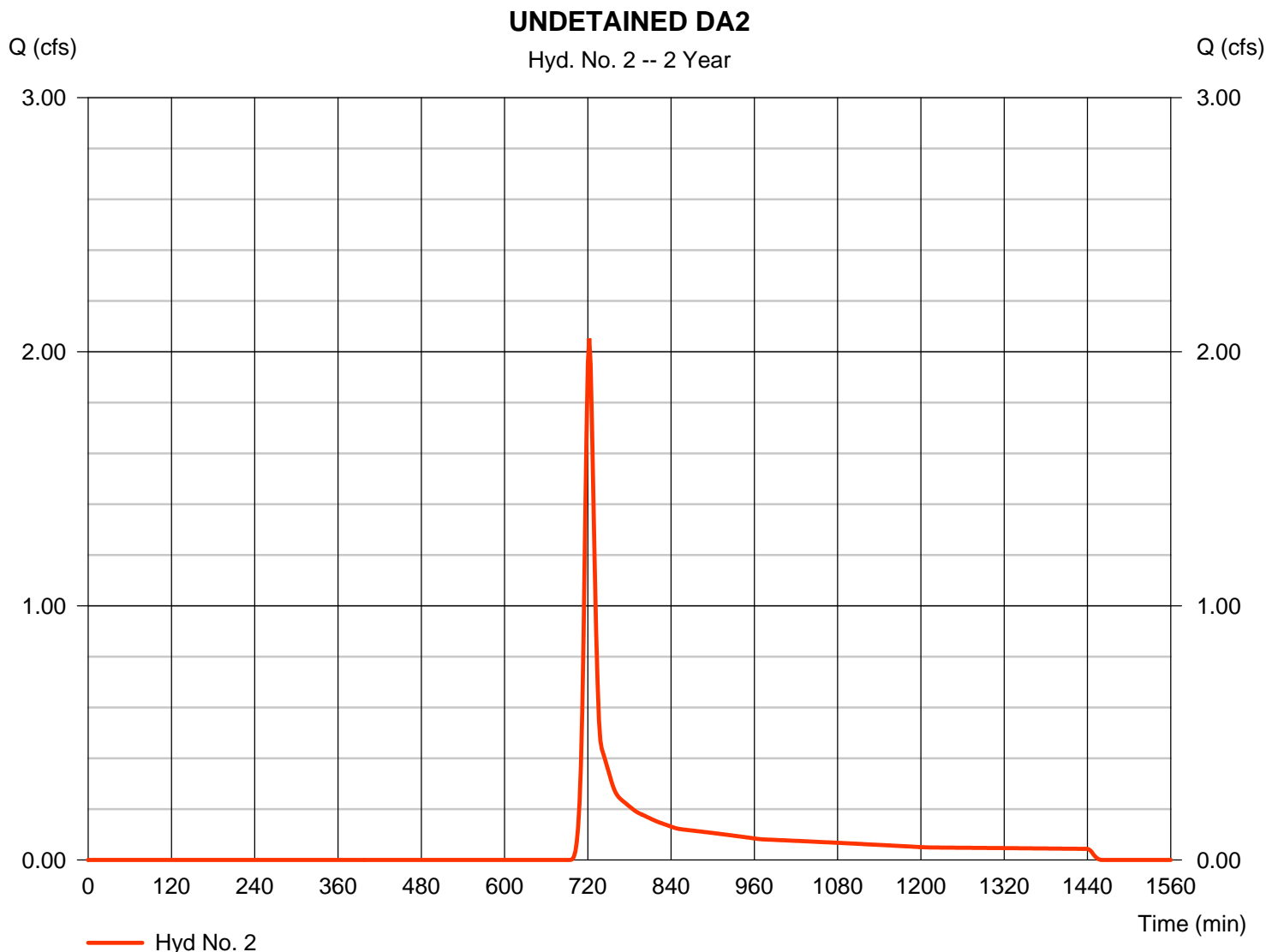
Friday, 11 / 11 / 2016

Hyd. No. 2

UNDETAINED DA2

| | | | |
|-----------------|--------------|--------------------|--------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 2.053 cfs |
| Storm frequency | = 2 yrs | Time to peak | = 722 min |
| Time interval | = 2 min | Hyd. volume | = 5,922 cuft |
| Drainage area | = 2.570 ac | Curve number | = 71* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = TR55 | Time of conc. (Tc) | = 11.50 min |
| Total precip. | = 2.74 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = [(1.080 x 58) + (0.830 x 78) + (0.210 x 98) + (0.050 x 55) + (0.400 x 77)] / 2.570



TR55 Tc Worksheet

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

Hyd. No. 2

UNDETAINED DA2

| <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) | = 2.74 | 0.00 | 0.00 | |
| Land slope (%) | = 2.50 | 0.00 | 0.00 | |
| Travel Time (min) | = 8.10 | + 0.00 | + 0.00 | = 8.10 |
| Shallow Concentrated Flow | | | | |
| Flow length (ft) | = 85.00 | 0.00 | 0.00 | |
| Watercourse slope (%) | = 3.50 | 0.00 | 0.00 | |
| Surface description | = Unpaved | Paved | Paved | |
| Average velocity (ft/s) | =3.02 | 0.00 | 0.00 | |
| Travel Time (min) | = 0.47 | + 0.00 | + 0.00 | = 0.47 |
| Channel Flow | | | | |
| X sectional flow area (sqft) | = 2.00 | 0.00 | 0.00 | |
| Wetted perimeter (ft) | = 4.47 | 0.00 | 0.00 | |
| Channel slope (%) | = 2.10 | 0.00 | 0.00 | |
| Manning's n-value | = 0.030 | 0.015 | 0.015 | |
| Velocity (ft/s) | =4.20 | 0.00 | 0.00 | |
| Flow length (ft) | 747.0 | 0.0 | 0.0 | |
| Travel Time (min) | = 2.96 | + 0.00 | + 0.00 | = 2.96 |
| Total Travel Time, Tc | | | | 11.50 min |

Hydrograph Report

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

Friday, 11 / 11 / 2016

Hyd. No. 3

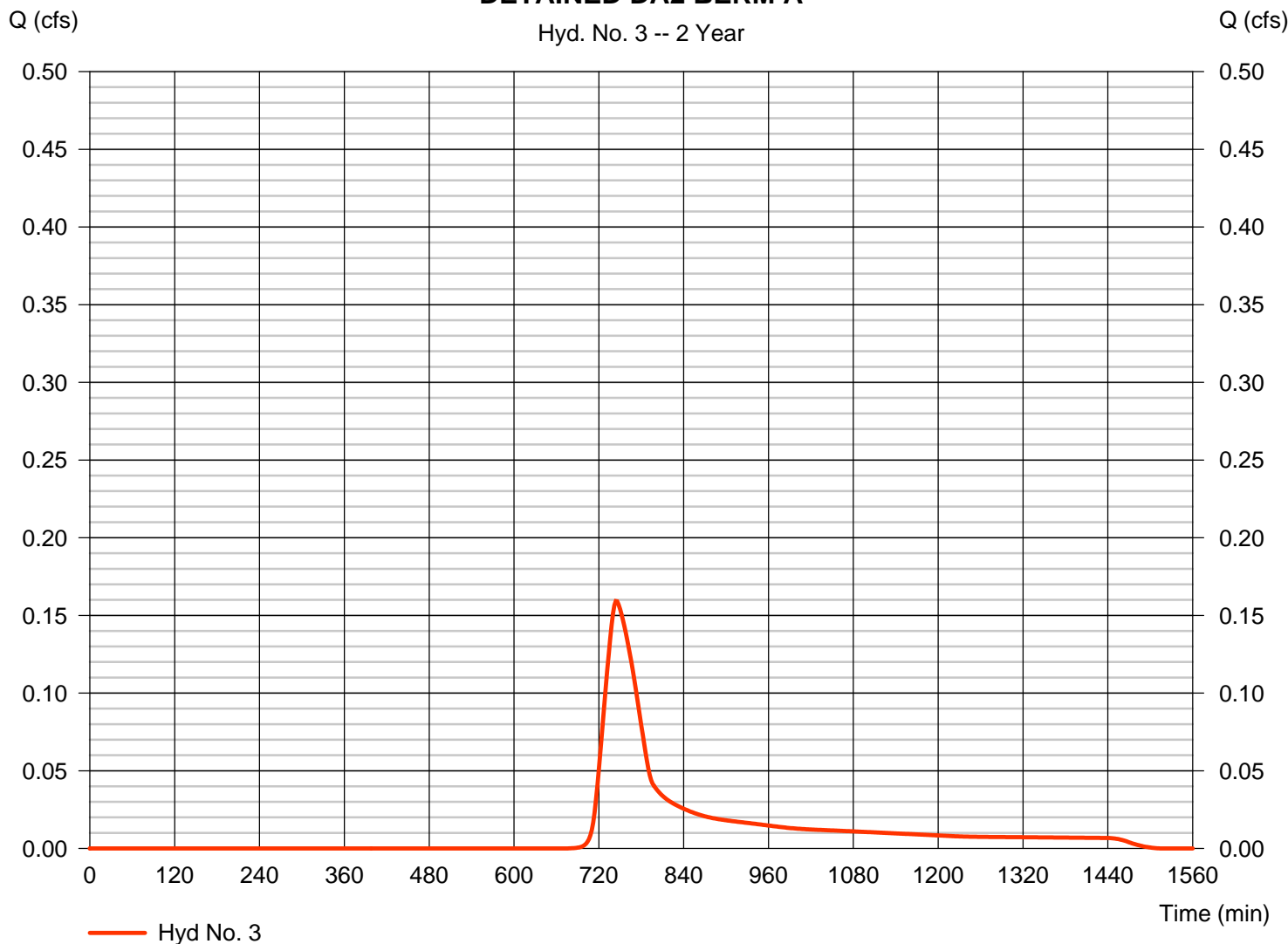
DETAINED DA2 BERM A

| | | | |
|-----------------|--------------|--------------------|--------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 0.159 cfs |
| Storm frequency | = 2 yrs | Time to peak | = 744 min |
| Time interval | = 2 min | Hyd. volume | = 1,010 cuft |
| Drainage area | = 0.350 ac | Curve number | = 75* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = User | Time of conc. (Tc) | = 48.41 min |
| Total precip. | = 2.74 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = [(0.120 x 85) + (0.140 x 58) + (0.040 x 78) + (0.050 x 98)] / 0.350

DETAINED DA2 BERM A

Hyd. No. 3 -- 2 Year



Hydrograph Report

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

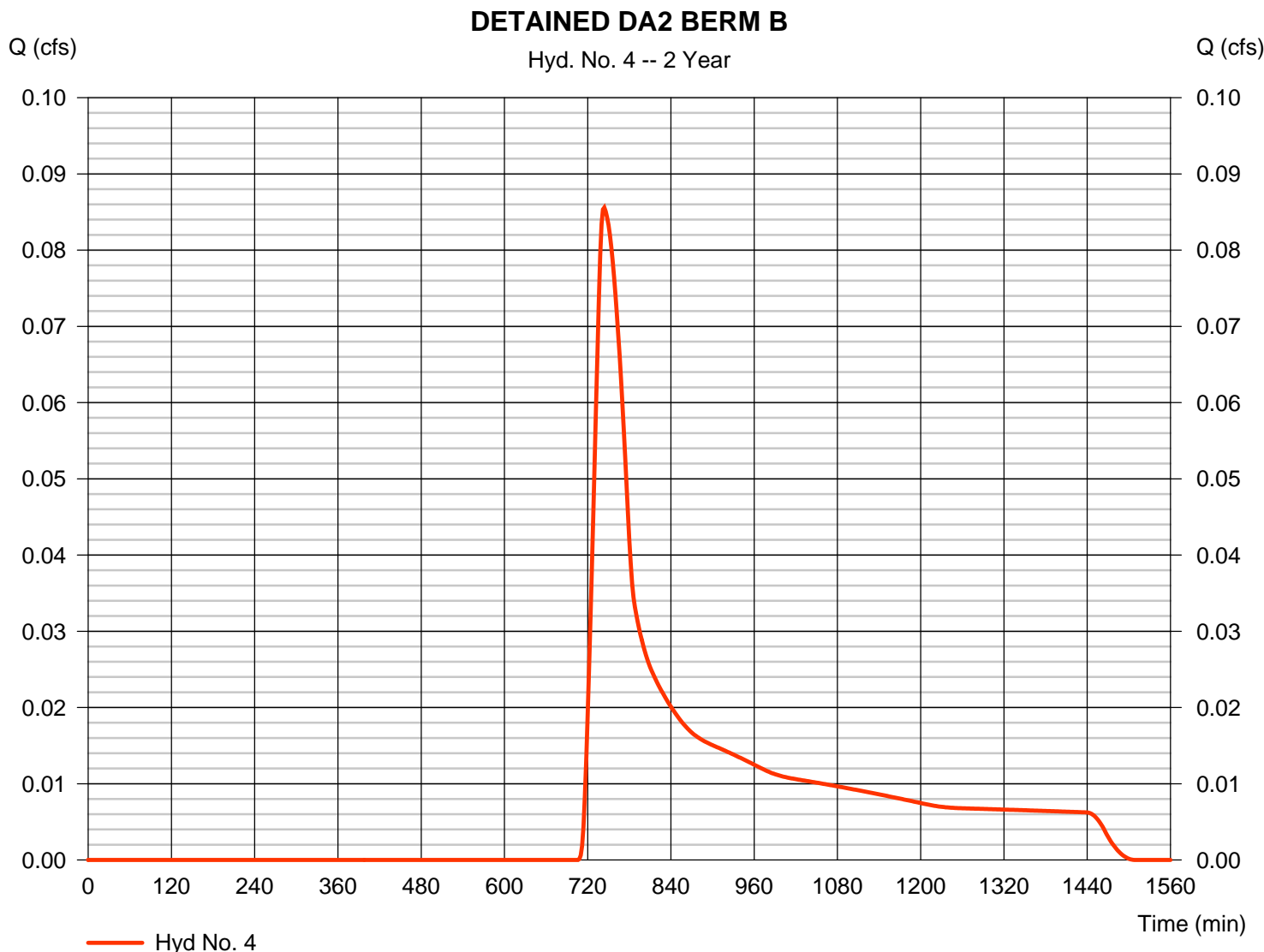
Friday, 11 / 11 / 2016

Hyd. No. 4

DETAINED DA2 BERM B

| | | | |
|-----------------|--------------|--------------------|-------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 0.086 cfs |
| Storm frequency | = 2 yrs | Time to peak | = 744 min |
| Time interval | = 2 min | Hyd. volume | = 690 cuft |
| Drainage area | = 0.480 ac | Curve number | = 65* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = User | Time of conc. (Tc) | = 43.26 min |
| Total precip. | = 2.74 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = [(0.050 x 98) + (0.380 x 58) + (0.050 x 85)] / 0.480



Hydrograph Report

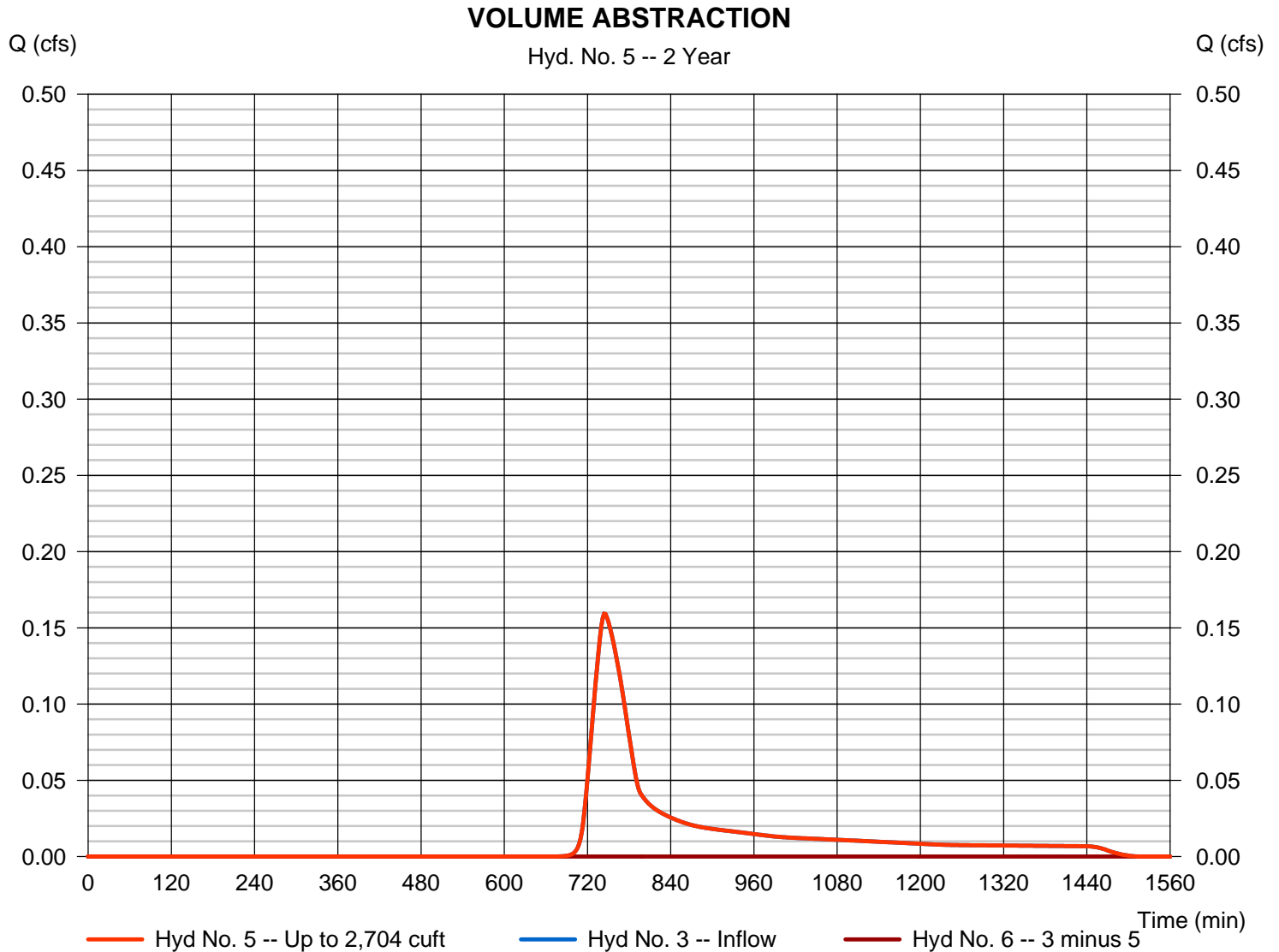
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 11 / 11 / 2016

Hyd. No. 5

VOLUME ABSTRACTION

| | | | |
|-------------------|---------------------------|-------------------|--------------|
| Hydrograph type | = Diversion1 | Peak discharge | = 0.159 cfs |
| Storm frequency | = 2 yrs | Time to peak | = 744 min |
| Time interval | = 2 min | Hyd. volume | = 1,010 cuft |
| Inflow hydrograph | = 3 - DETAINED DA2 BERM A | 2nd diverted hyd. | = 6 |
| Diversion method | = First Flush Volume | Volume Up To | = 2,704 cuft |

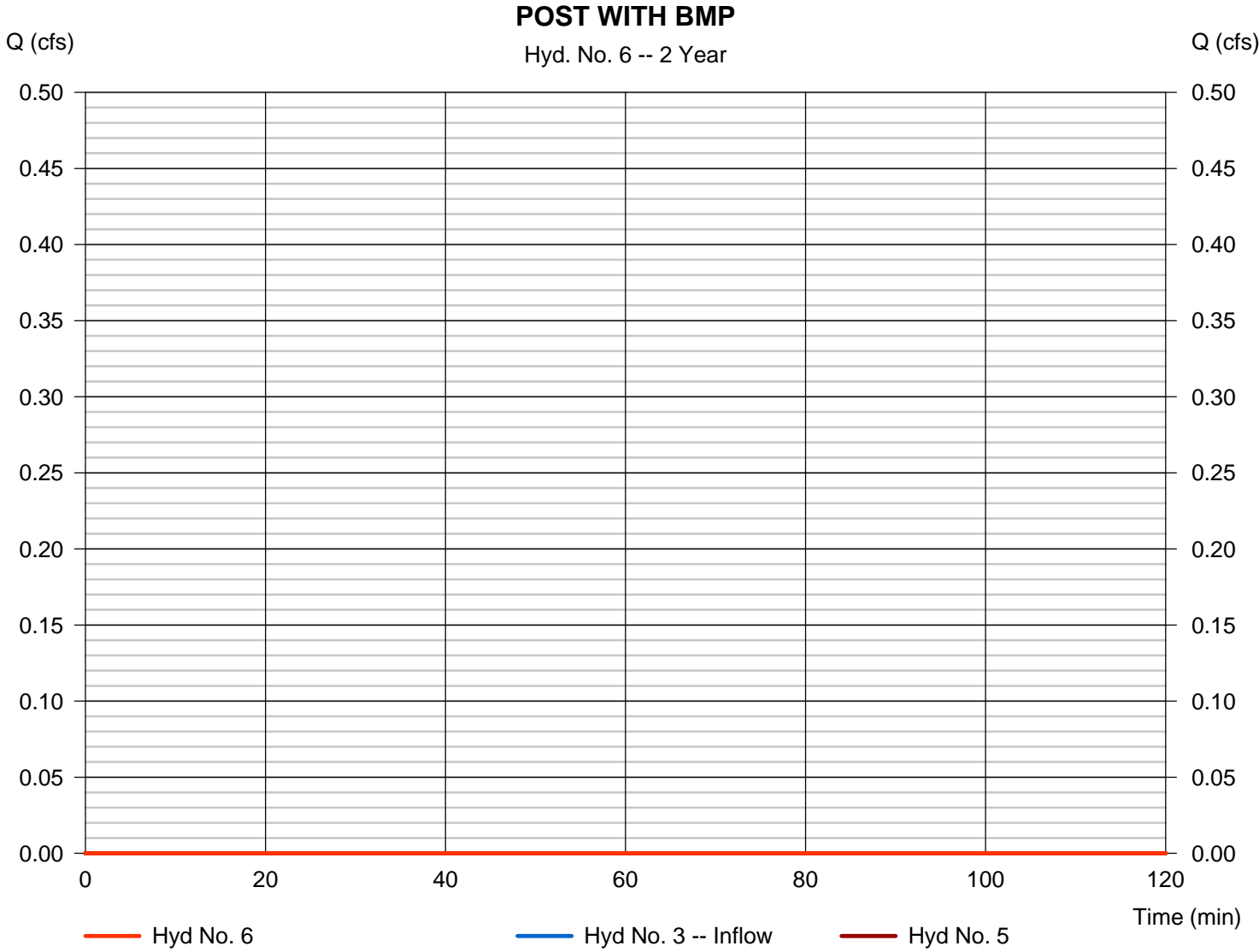


Hydrograph Report

Hyd. No. 6

POST WITH 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 - DETAINED DA2 BERM A | 2nd diverted hyd. | = 5 |
| Diversion method | = First Flush Volume | Volume Up To | = 2,704 cuft |



Hydrograph Report

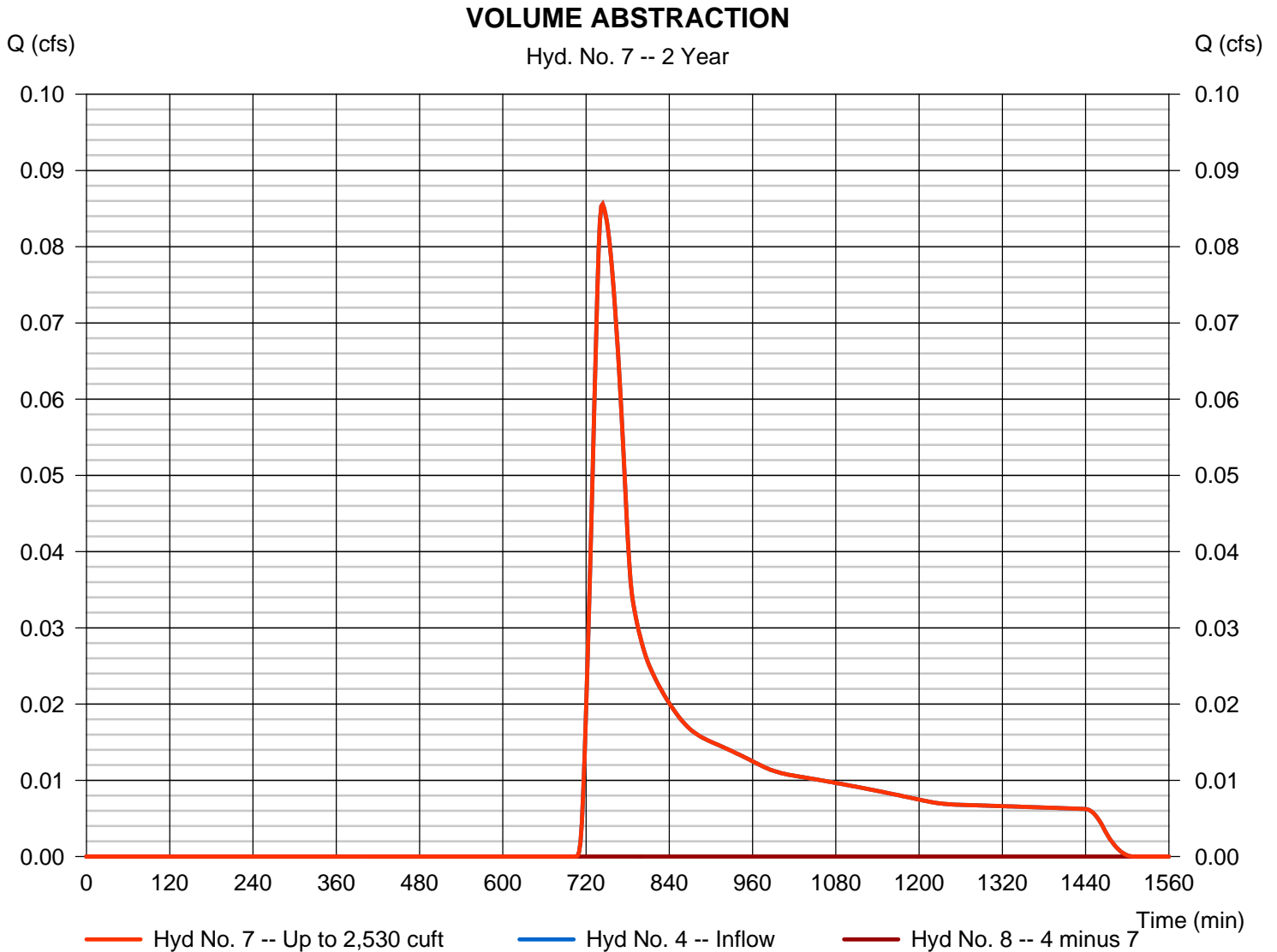
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 11 / 11 / 2016

Hyd. No. 7

VOLUME ABSTRACTION

| | | | |
|-------------------|---------------------------|-------------------|--------------|
| Hydrograph type | = Diversion1 | Peak discharge | = 0.086 cfs |
| Storm frequency | = 2 yrs | Time to peak | = 744 min |
| Time interval | = 2 min | Hyd. volume | = 690 cuft |
| Inflow hydrograph | = 4 - DETAINED DA2 BERM B | 2nd diverted hyd. | = 8 |
| Diversion method | = First Flush Volume | Volume Up To | = 2,530 cuft |



Hydrograph Report

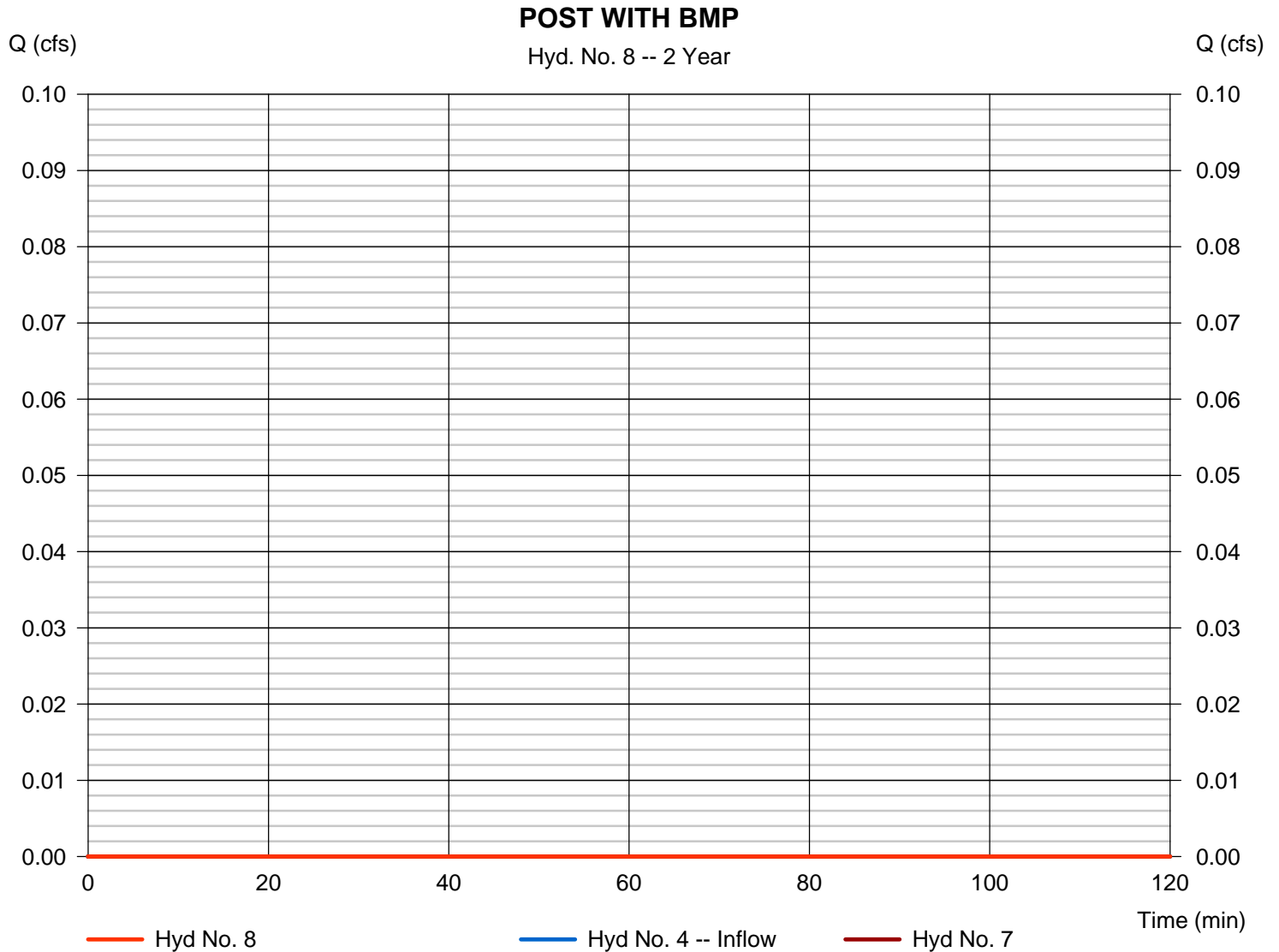
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 11 / 11 / 2016

Hyd. No. 8

POST WITH 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 | = 4 - DETAINED DA2 BERM B | 2nd diverted hyd. | = 7 |
| Diversion method | = First Flush Volume | Volume Up To | = 2,530 cuft |



Hydrograph Report

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

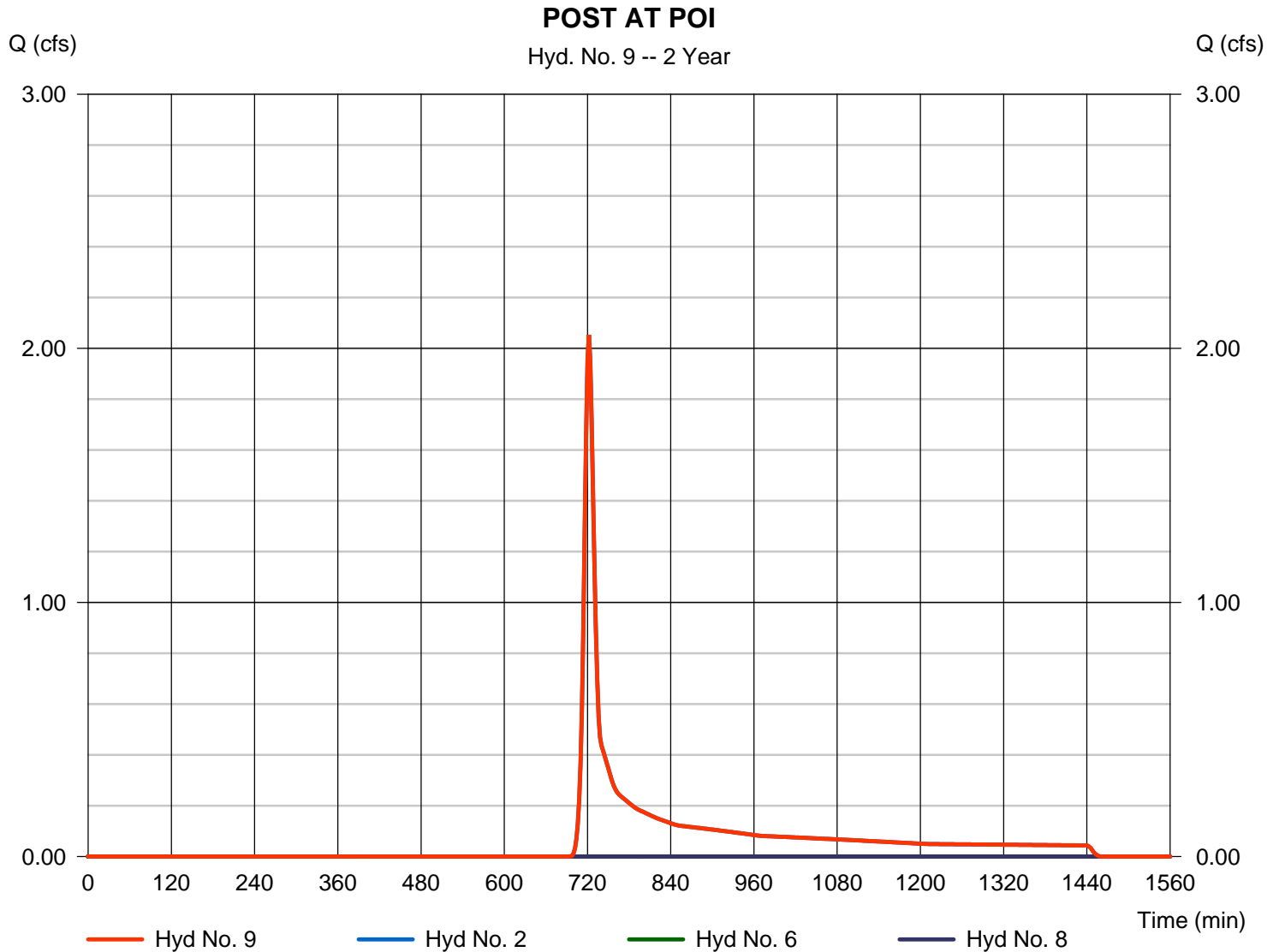
Friday, 11 / 11 / 2016

Hyd. No. 9

POST AT POI

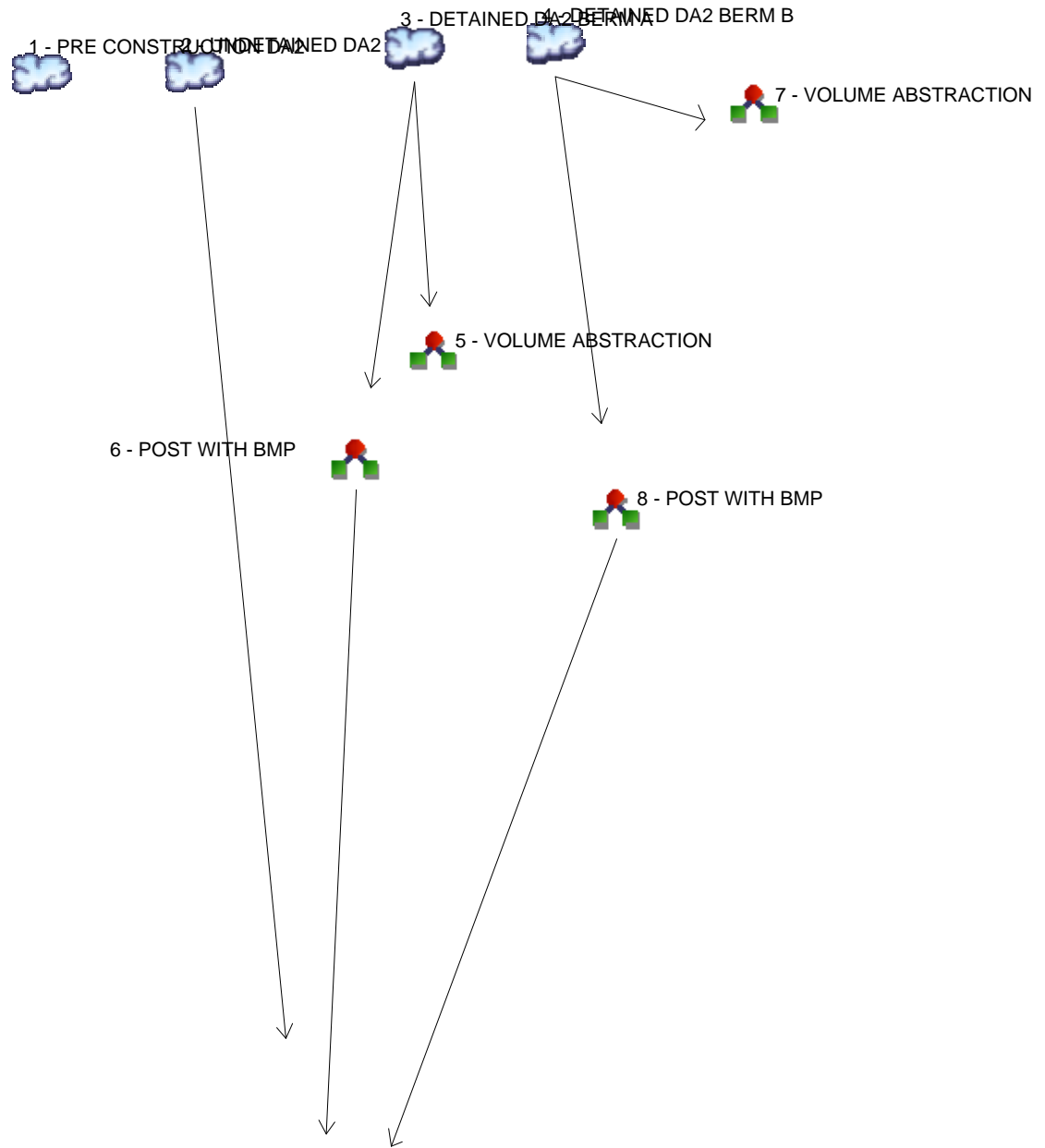
Hydrograph type = Combine
Storm frequency = 2 yrs
Time interval = 2 min
Inflow hyds. = 2, 6, 8

Peak discharge = 2.053 cfs
Time to peak = 722 min
Hyd. volume = 5,922 cuft
Contrib. drain. area = 2.570 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 CONSTRUCTION DA2 |
| 2 | SCS Runoff | UNDETAINED DA2 |
| 3 | SCS Runoff | DETAINED DA2 BERM A |
| 4 | SCS Runoff | DETAINED DA2 BERM B |
| 5 | Diversion1 | VOLUME ABSTRACTION |
| 6 | Diversion2 | POST WITH BMP |
| 7 | Diversion1 | VOLUME ABSTRACTION |
| 8 | Diversion2 | POST WITH BMP |
| 9 | Combine | POST AT POI |



Hydrograph Return Period Recap

Hydrow 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 | ----- | ----- | ----- | ----- | ----- | 5.933 | ----- | ----- | ----- | PRE CONSTRUCTION DA2 |
| 2 | SCS Runoff | ----- | ----- | ----- | ----- | ----- | 4.955 | ----- | ----- | ----- | UNDETAINED DA2 |
| 3 | SCS Runoff | ----- | ----- | ----- | ----- | ----- | 0.356 | ----- | ----- | ----- | DETAINED DA2 BERM A |
| 4 | SCS Runoff | ----- | ----- | ----- | ----- | ----- | 0.310 | ----- | ----- | ----- | DETAINED DA2 BERM B |
| 5 | Diversion1 | 3 | ----- | ----- | ----- | ----- | 0.356 | ----- | ----- | ----- | VOLUME ABSTRACTION |
| 6 | Diversion2 | 3 | ----- | ----- | ----- | ----- | 0.000 | ----- | ----- | ----- | POST WITH BMP |
| 7 | Diversion1 | 4 | ----- | ----- | ----- | ----- | 0.310 | ----- | ----- | ----- | VOLUME ABSTRACTION |
| 8 | Diversion2 | 4 | ----- | ----- | ----- | ----- | 0.000 | ----- | ----- | ----- | POST WITH BMP |
| 9 | Combine | 2, 6, 8 | ----- | ----- | ----- | ----- | 4.955 | ----- | ----- | ----- | POST AT POI |

Hydrograph Report

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

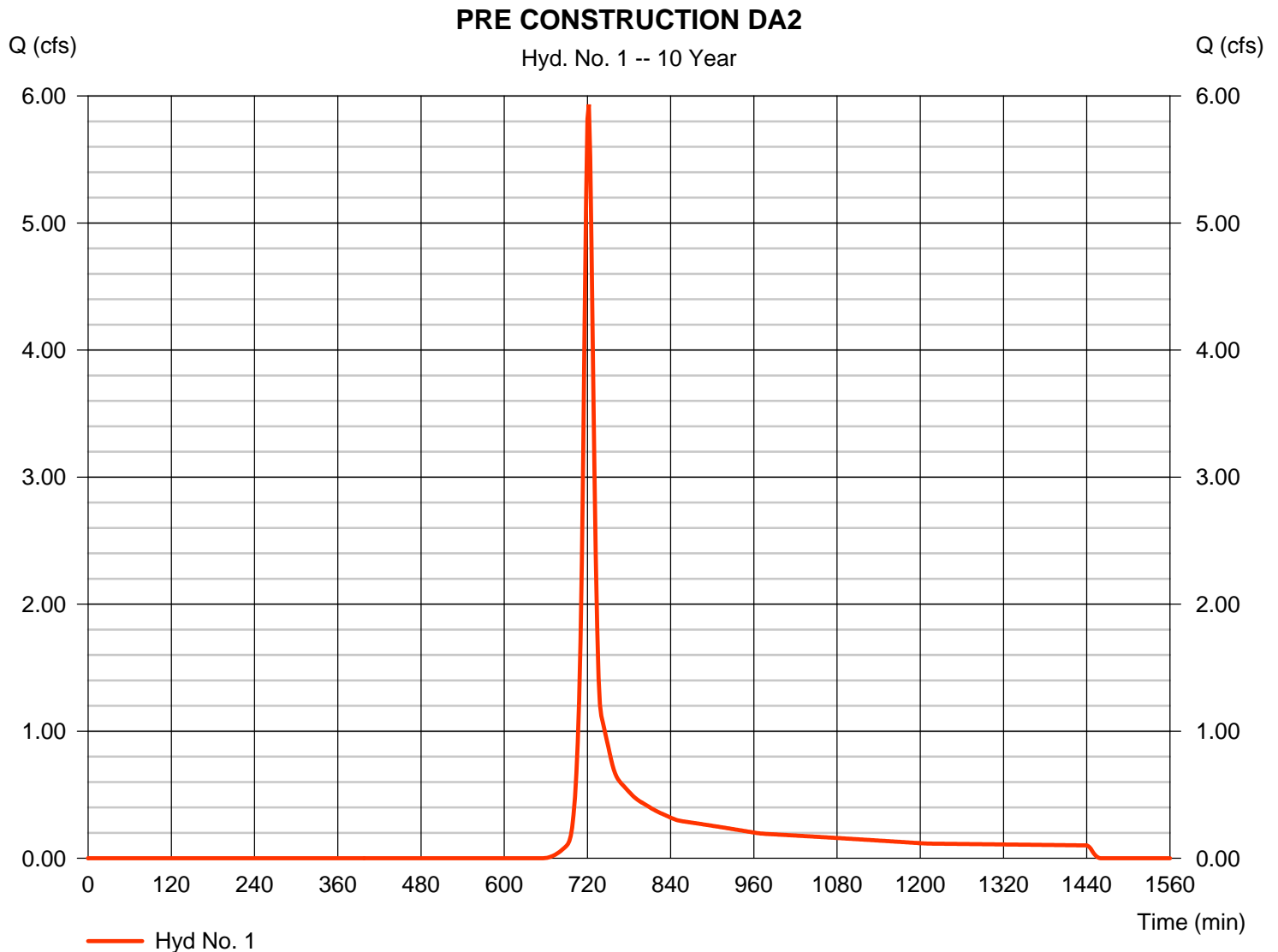
Friday, 11 / 11 / 2016

Hyd. No. 1

PRE CONSTRUCTION DA2

| | | | |
|-----------------|--------------|--------------------|---------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 5.933 cfs |
| Storm frequency | = 10 yrs | Time to peak | = 722 min |
| Time interval | = 2 min | Hyd. volume | = 15,930 cuft |
| Drainage area | = 3.430 ac | Curve number | = 69* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = TR55 | Time of conc. (Tc) | = 11.50 min |
| Total precip. | = 3.96 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = [(1.800 x 58) + (0.780 x 78) + (0.050 x 55) + (0.490 x 77) + (0.310 x 98)] / 3.430



TR55 Tc Worksheet

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

Hyd. No. 1

PRE CONSTRUCTION DA2

| <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) | = 2.74 | 0.00 | 0.00 | |
| Land slope (%) | = 2.50 | 0.00 | 0.00 | |
| Travel Time (min) | = 8.10 | + 0.00 | + 0.00 | = 8.10 |
| Shallow Concentrated Flow | | | | |
| Flow length (ft) | = 85.00 | 0.00 | 0.00 | |
| Watercourse slope (%) | = 3.50 | 0.00 | 0.00 | |
| Surface description | = Unpaved | Paved | Paved | |
| Average velocity (ft/s) | =3.02 | 0.00 | 0.00 | |
| Travel Time (min) | = 0.47 | + 0.00 | + 0.00 | = 0.47 |
| Channel Flow | | | | |
| X sectional flow area (sqft) | = 2.00 | 0.00 | 0.00 | |
| Wetted perimeter (ft) | = 4.47 | 0.00 | 0.00 | |
| Channel slope (%) | = 2.10 | 0.00 | 0.00 | |
| Manning's n-value | = 0.030 | 0.015 | 0.015 | |
| Velocity (ft/s) | =4.20 | 0.00 | 0.00 | |
| Flow length (ft) | {{0}}747.0 | 0.0 | 0.0 | |
| Travel Time (min) | = 2.96 | + 0.00 | + 0.00 | = 2.96 |
| Total Travel Time, Tc | | | | 11.50 min |

Hydrograph Report

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

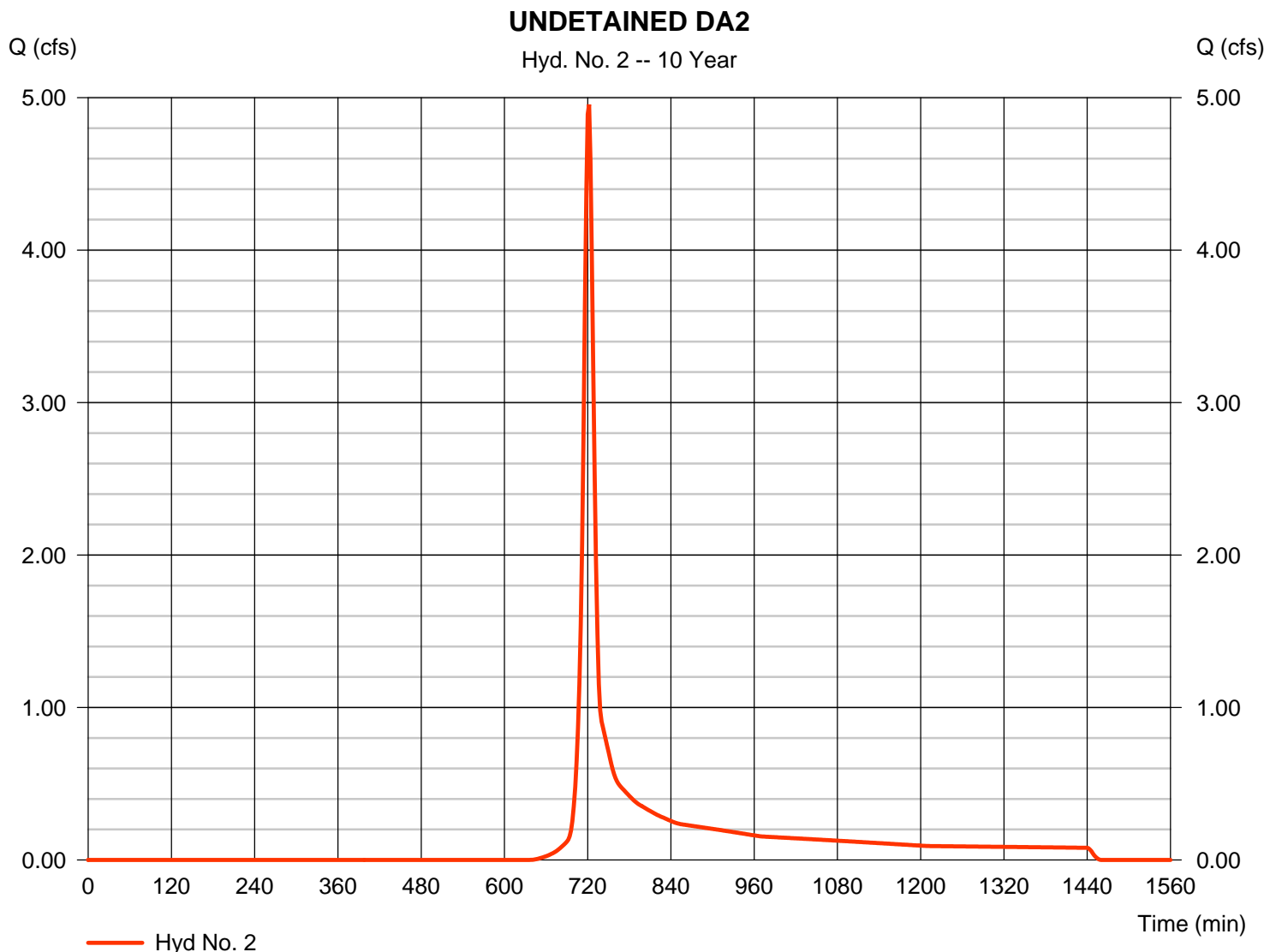
Friday, 11 / 11 / 2016

Hyd. No. 2

UNDETAINED DA2

| | | | |
|-----------------|--------------|--------------------|---------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 4.955 cfs |
| Storm frequency | = 10 yrs | Time to peak | = 722 min |
| Time interval | = 2 min | Hyd. volume | = 13,150 cuft |
| Drainage area | = 2.570 ac | Curve number | = 71* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = TR55 | Time of conc. (Tc) | = 11.50 min |
| Total precip. | = 3.96 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = [(1.080 x 58) + (0.830 x 78) + (0.210 x 98) + (0.050 x 55) + (0.400 x 77)] / 2.570



TR55 Tc Worksheet

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

Hyd. No. 2

UNDETAINED DA2

| <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) | = 2.74 | | 0.00 | | 0.00 | |
| Land slope (%) | = 2.50 | | 0.00 | | 0.00 | |
| Travel Time (min) | = 8.10 | + | 0.00 | + | 0.00 | = 8.10 |
| Shallow Concentrated Flow | | | | | | |
| Flow length (ft) | = 85.00 | | 0.00 | | 0.00 | |
| Watercourse slope (%) | = 3.50 | | 0.00 | | 0.00 | |
| Surface description | = Unpaved | | Paved | | Paved | |
| Average velocity (ft/s) | =3.02 | | 0.00 | | 0.00 | |
| Travel Time (min) | = 0.47 | + | 0.00 | + | 0.00 | = 0.47 |
| Channel Flow | | | | | | |
| X sectional flow area (sqft) | = 2.00 | | 0.00 | | 0.00 | |
| Wetted perimeter (ft) | = 4.47 | | 0.00 | | 0.00 | |
| Channel slope (%) | = 2.10 | | 0.00 | | 0.00 | |
| Manning's n-value | = 0.030 | | 0.015 | | 0.015 | |
| Velocity (ft/s) | =4.20 | | 0.00 | | 0.00 | |
| Flow length (ft) | {{0}}747.0 | | 0.0 | | 0.0 | |
| Travel Time (min) | = 2.96 | + | 0.00 | + | 0.00 | = 2.96 |
| Total Travel Time, Tc | | | | | | 11.50 min |

Hydrograph Report

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

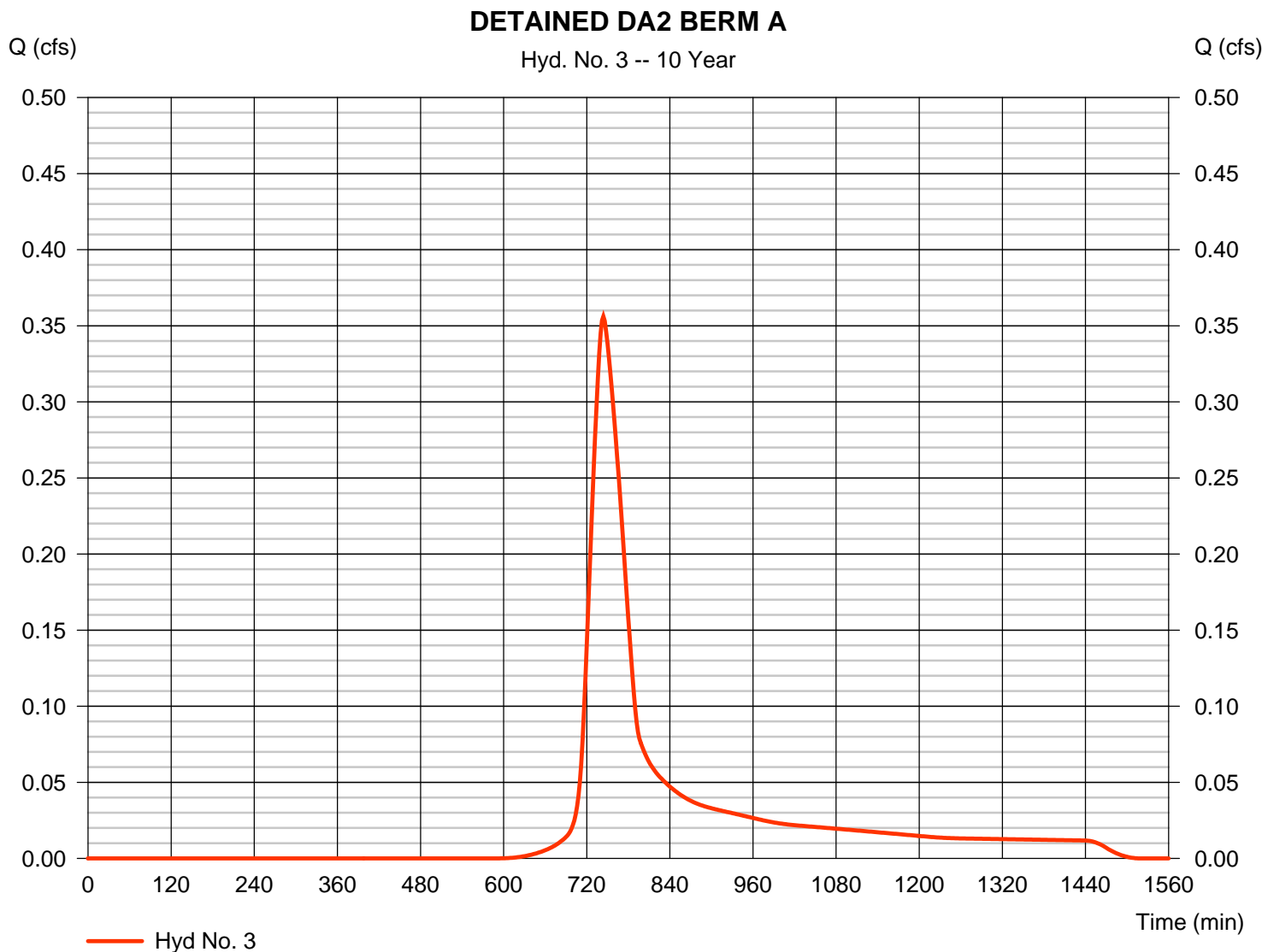
Friday, 11 / 11 / 2016

Hyd. No. 3

DETAINED DA2 BERM A

| | | | |
|-----------------|--------------|--------------------|--------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 0.356 cfs |
| Storm frequency | = 10 yrs | Time to peak | = 744 min |
| Time interval | = 2 min | Hyd. volume | = 2,079 cuft |
| Drainage area | = 0.350 ac | Curve number | = 75* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = User | Time of conc. (Tc) | = 47.82 min |
| Total precip. | = 3.96 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = [(0.120 x 85) + (0.140 x 58) + (0.040 x 78) + (0.050 x 98)] / 0.350



Hydrograph Report

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

Friday, 11 / 11 / 2016

Hyd. No. 4

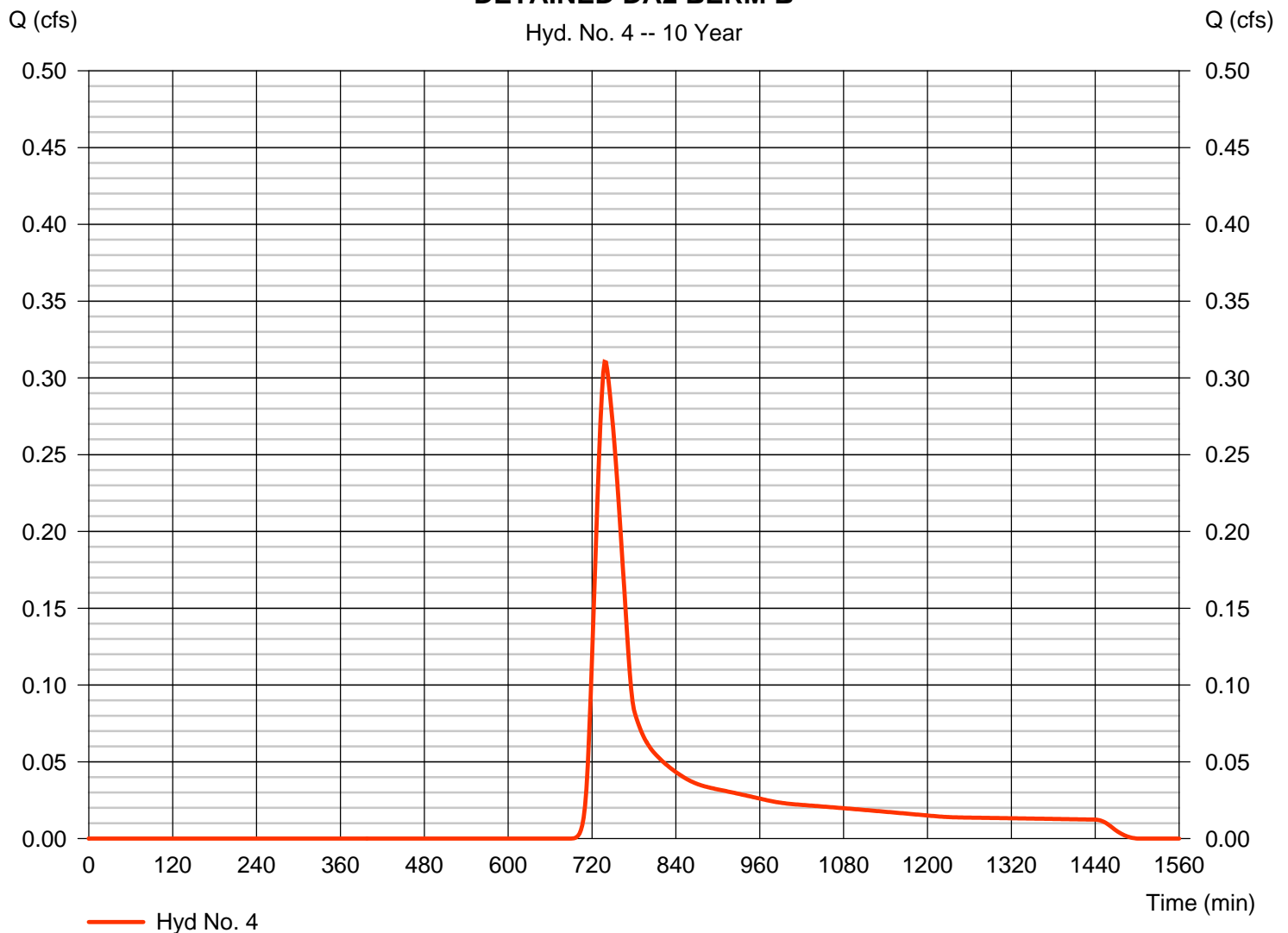
DETAINED DA2 BERM B

| | | | |
|-----------------|--------------|--------------------|--------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 0.310 cfs |
| Storm frequency | = 10 yrs | Time to peak | = 738 min |
| Time interval | = 2 min | Hyd. volume | = 1,752 cuft |
| Drainage area | = 0.480 ac | Curve number | = 65* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = User | Time of conc. (Tc) | = 37.44 min |
| Total precip. | = 3.96 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = [(0.050 x 98) + (0.380 x 58) + (0.050 x 85)] / 0.480

DETAINED DA2 BERM B

Hyd. No. 4 -- 10 Year



Hydrograph Report

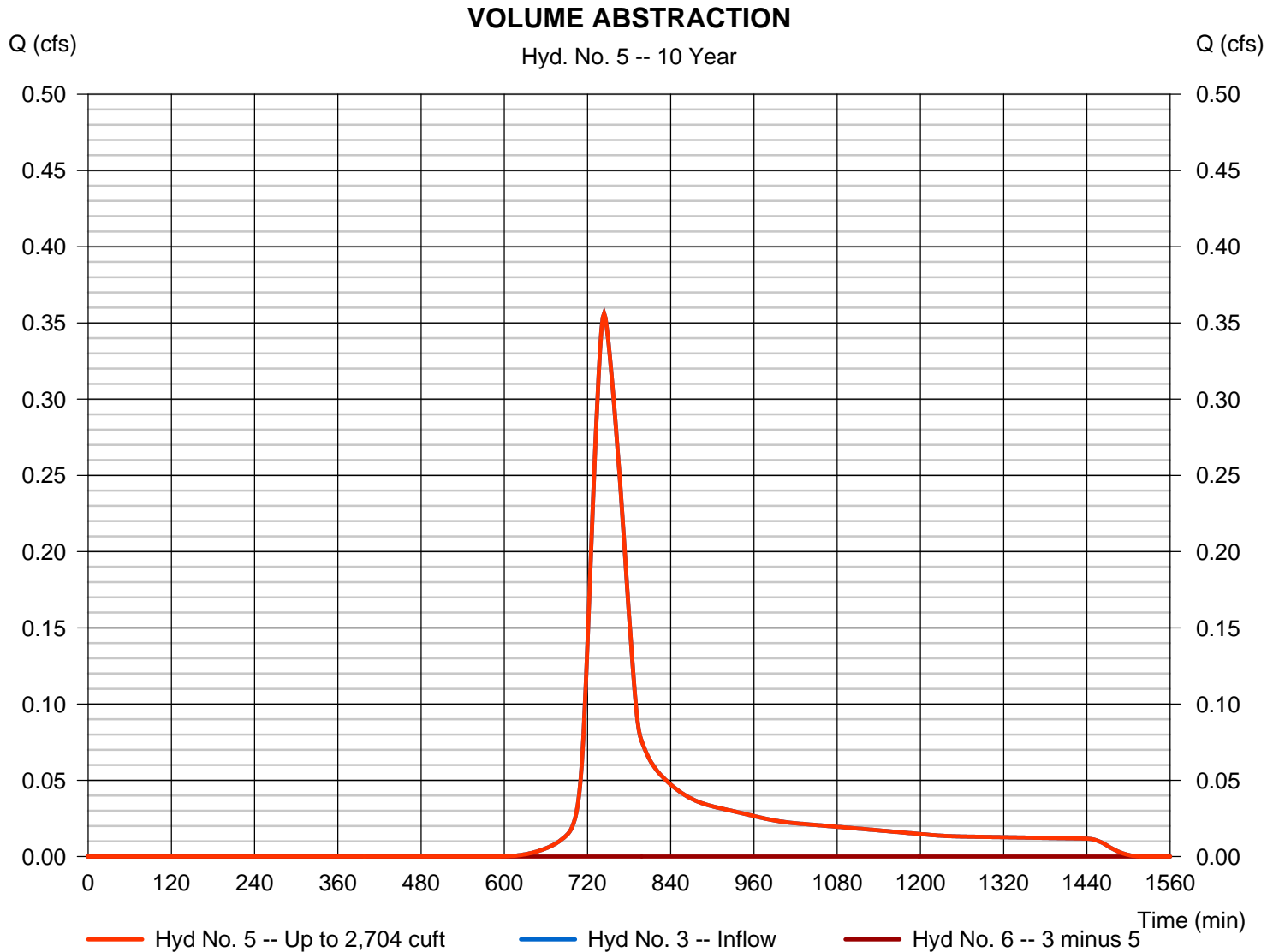
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 11 / 11 / 2016

Hyd. No. 5

VOLUME ABSTRACTION

| | | | |
|-------------------|---------------------------|-------------------|--------------|
| Hydrograph type | = Diversion1 | Peak discharge | = 0.356 cfs |
| Storm frequency | = 10 yrs | Time to peak | = 744 min |
| Time interval | = 2 min | Hyd. volume | = 2,079 cuft |
| Inflow hydrograph | = 3 - DETAINED DA2 BERM A | 2nd diverted hyd. | = 6 |
| Diversion method | = First Flush Volume | Volume Up To | = 2,704 cuft |

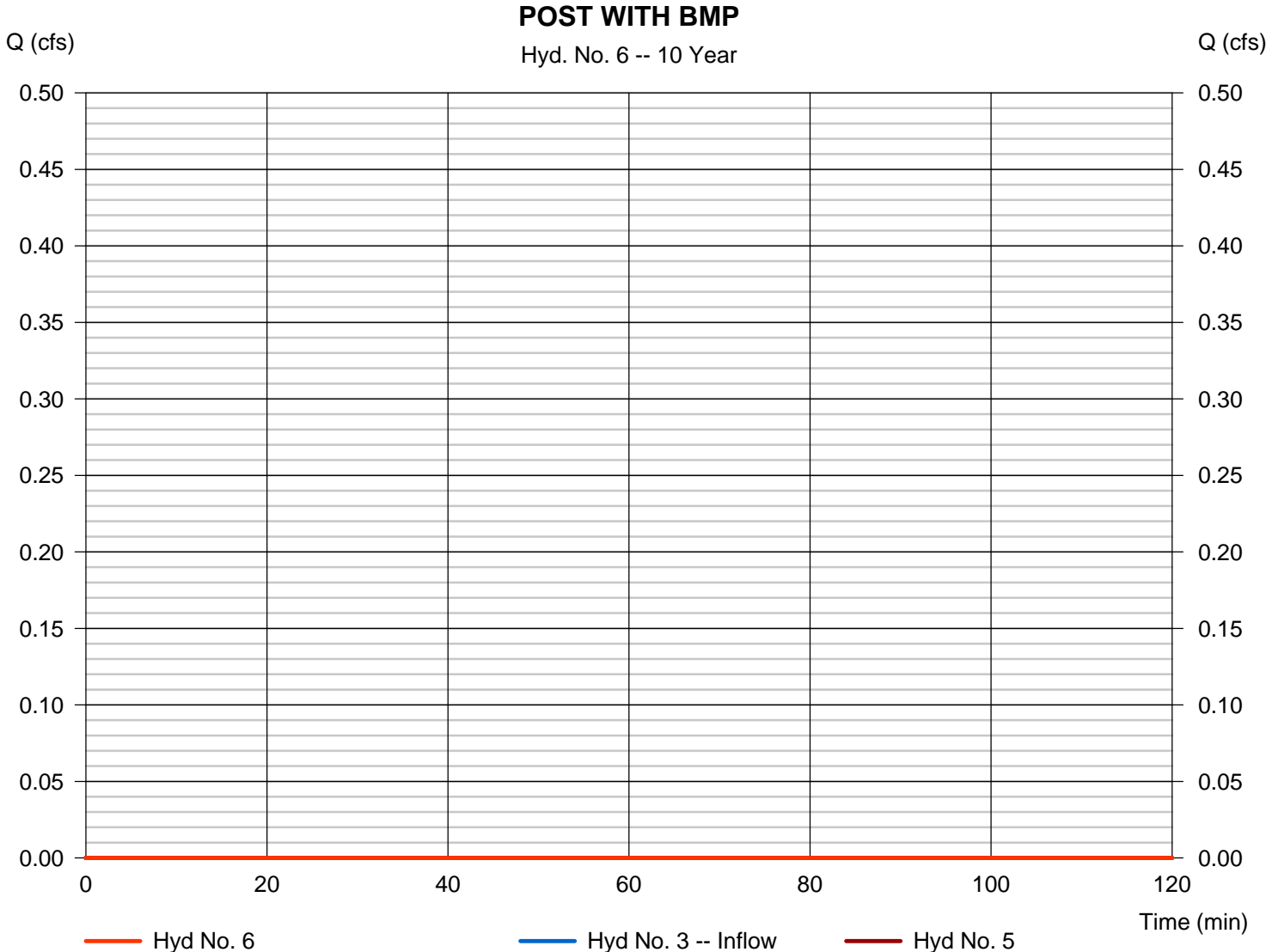


Hydrograph Report

Hyd. No. 6

POST WITH 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 - DETAINED DA2 BERM A | 2nd diverted hyd. | = 5 |
| Diversion method | = First Flush Volume | Volume Up To | = 2,704 cuft |



Hydrograph Report

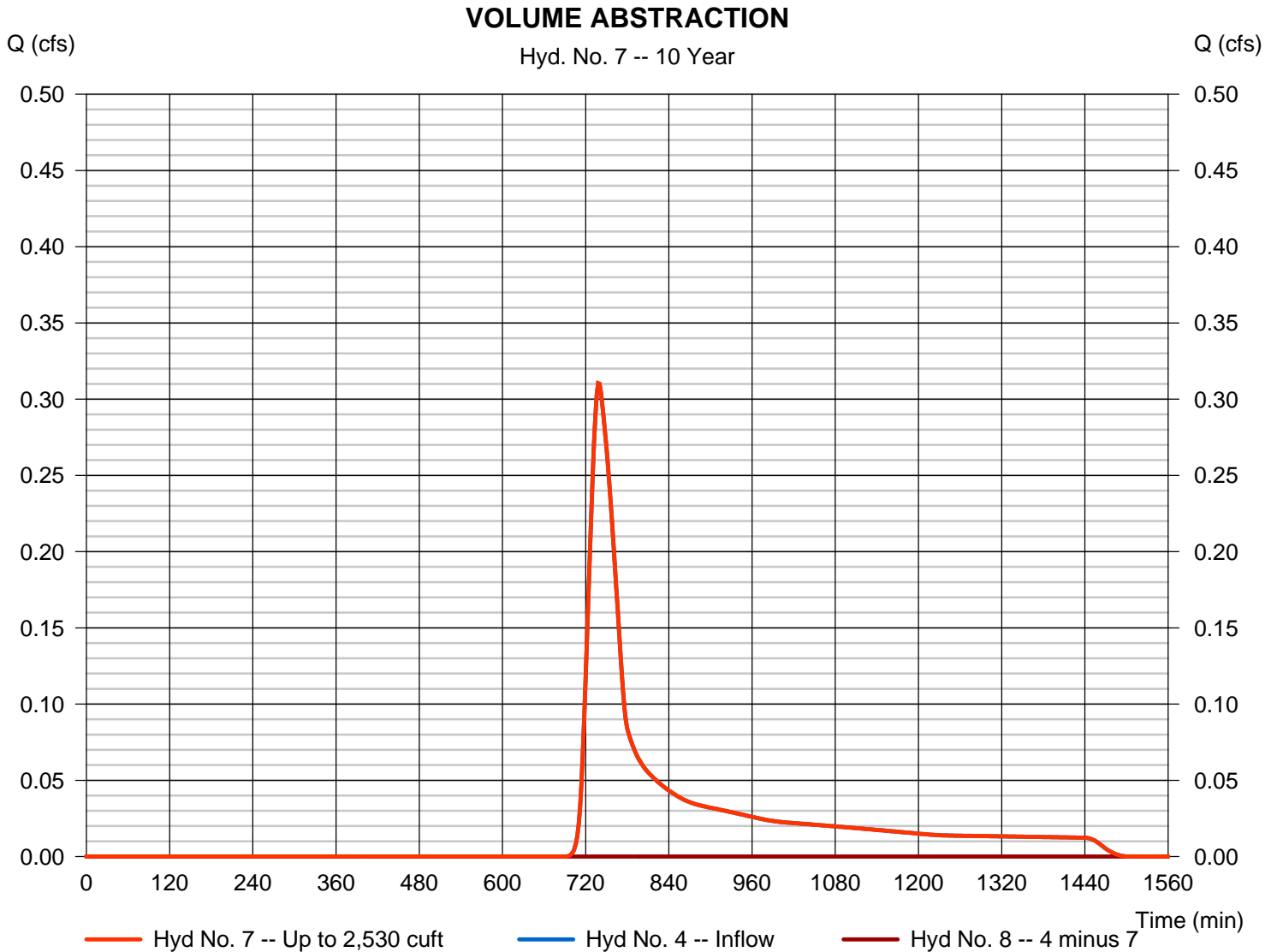
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 11 / 11 / 2016

Hyd. No. 7

VOLUME ABSTRACTION

| | | | |
|-------------------|---------------------------|-------------------|--------------|
| Hydrograph type | = Diversion1 | Peak discharge | = 0.310 cfs |
| Storm frequency | = 10 yrs | Time to peak | = 738 min |
| Time interval | = 2 min | Hyd. volume | = 1,752 cuft |
| Inflow hydrograph | = 4 - DETAINED DA2 BERM B | 2nd diverted hyd. | = 8 |
| Diversion method | = First Flush Volume | Volume Up To | = 2,530 cuft |



Hydrograph Report

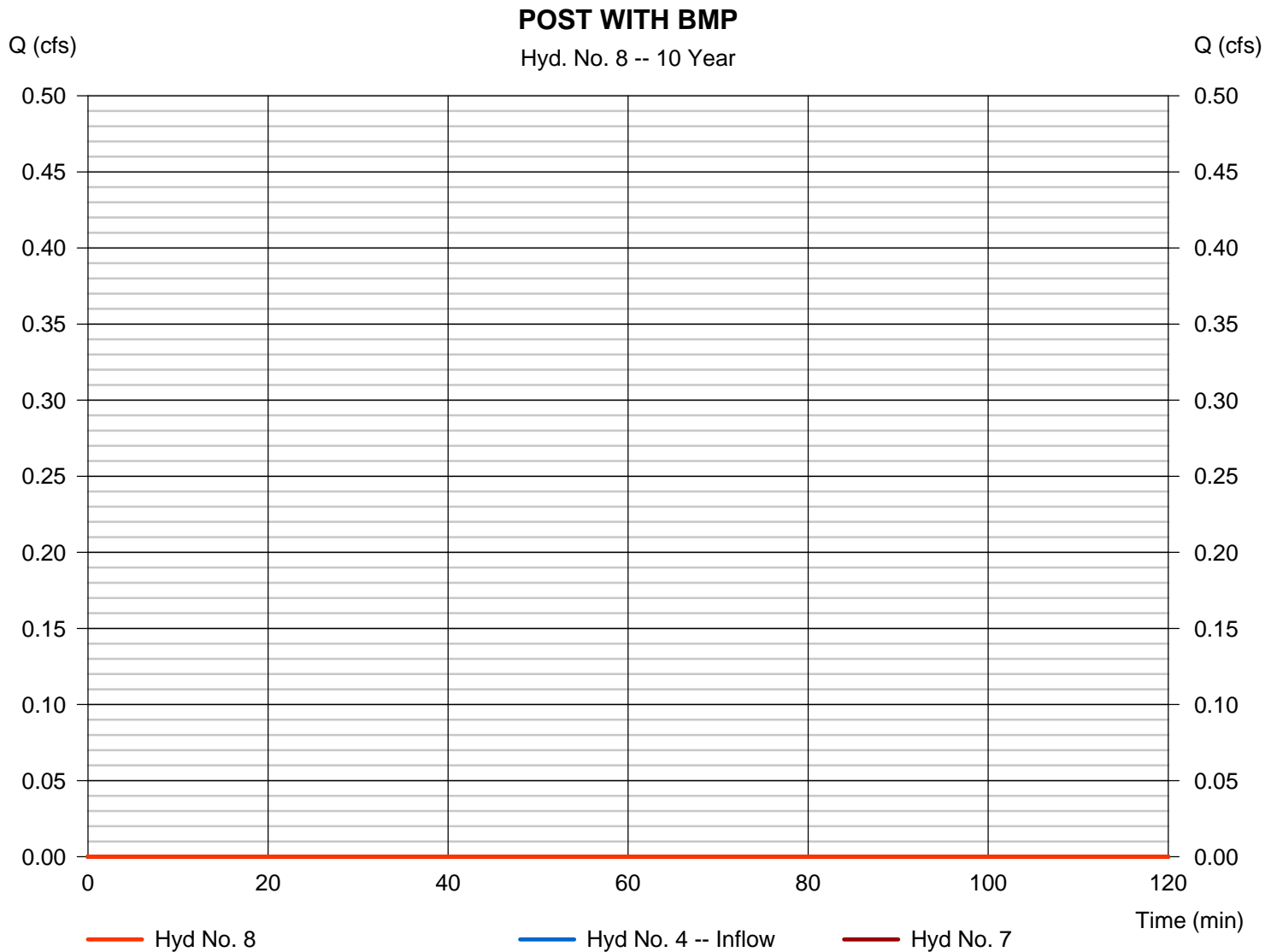
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 11 / 11 / 2016

Hyd. No. 8

POST WITH 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 | = 4 - DETAINED DA2 BERM B | 2nd diverted hyd. | = 7 |
| Diversion method | = First Flush Volume | Volume Up To | = 2,530 cuft |



Hydrograph Report

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

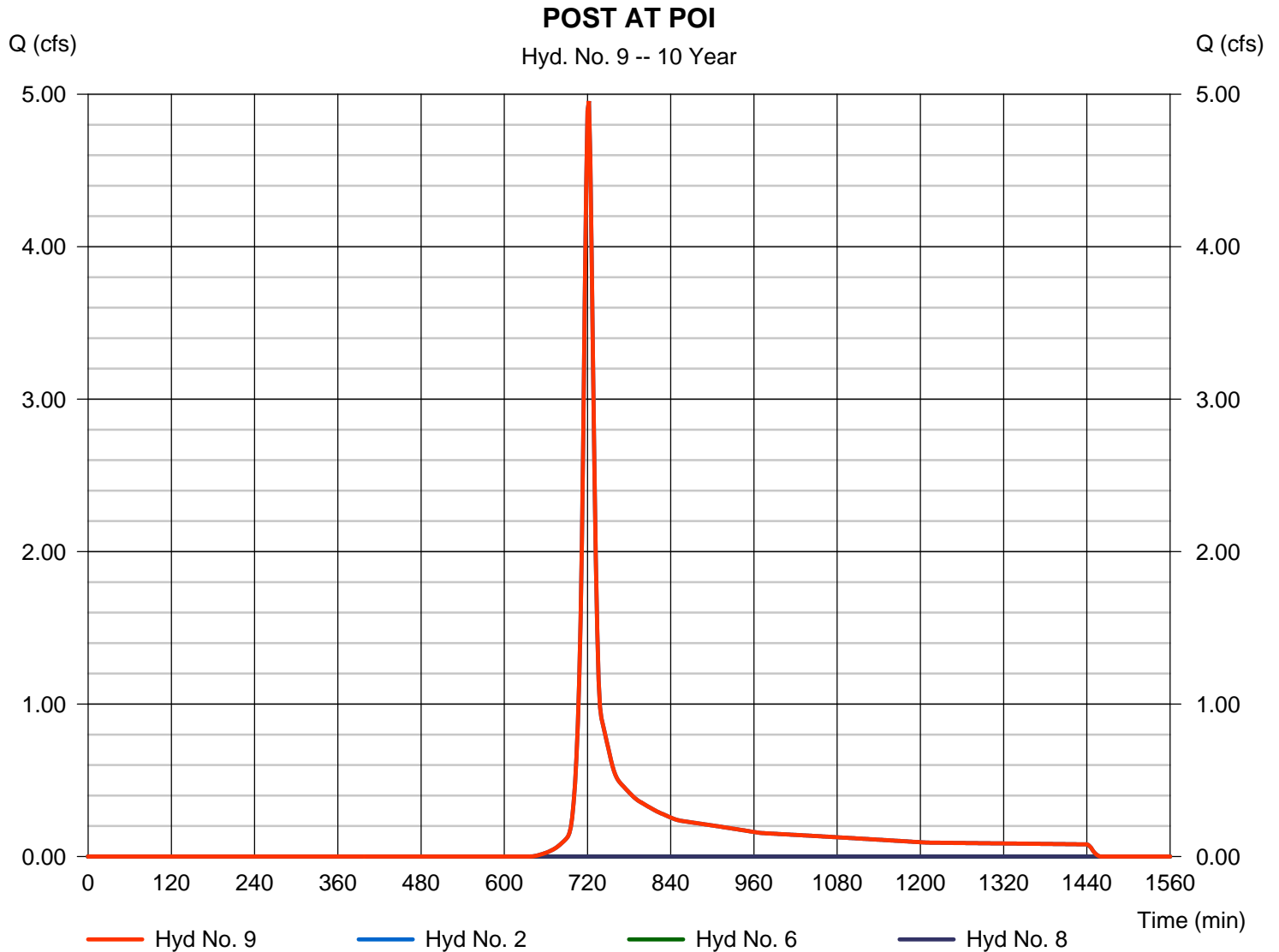
Friday, 11 / 11 / 2016

Hyd. No. 9

POST AT POI

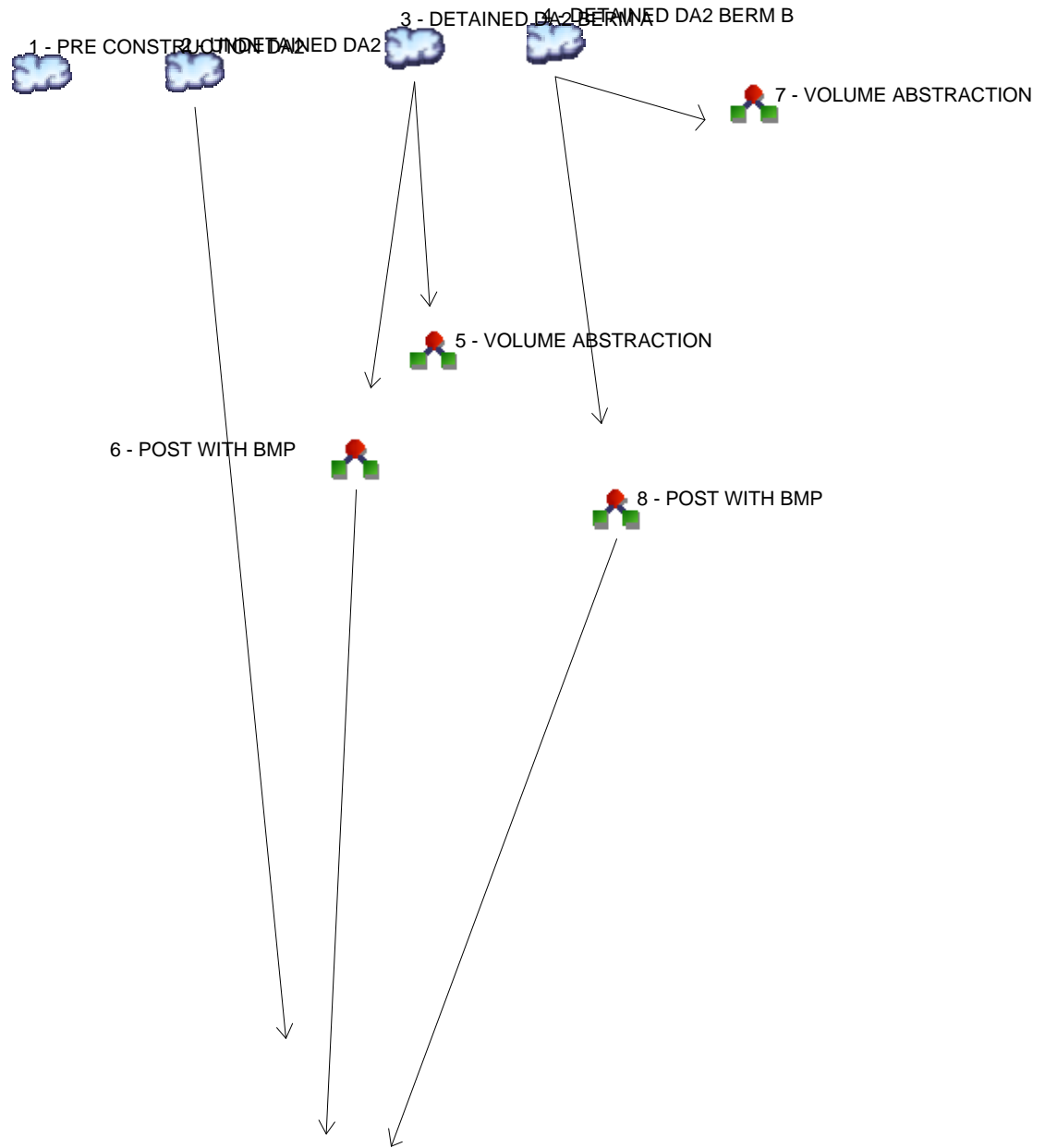
Hydrograph type = Combine
Storm frequency = 10 yrs
Time interval = 2 min
Inflow hyds. = 2, 6, 8

Peak discharge = 4.955 cfs
Time to peak = 722 min
Hyd. volume = 13,150 cuft
Contrib. drain. area = 2.570 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 CONSTRUCTION DA2 |
| 2 | SCS Runoff | UNDETAINED DA2 |
| 3 | SCS Runoff | DETAINED DA2 BERM A |
| 4 | SCS Runoff | DETAINED DA2 BERM B |
| 5 | Diversion1 | VOLUME ABSTRACTION |
| 6 | Diversion2 | POST WITH BMP |
| 7 | Diversion1 | VOLUME ABSTRACTION |
| 8 | Diversion2 | POST WITH BMP |
| 9 | Combine | POST AT POI |



Hydrograph Return Period Recap

Hydrow 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 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 11.50 | ----- | PRE CONSTRUCTION DA2 |
| 2 | SCS Runoff | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 9.295 | ----- | UNDETAINED DA2 |
| 3 | SCS Runoff | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.751 | ----- | DETAINED DA2 BERM A |
| 4 | SCS Runoff | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.839 | ----- | DETAINED DA2 BERM B |
| 5 | Diversion1 | 3 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.751 | ----- | VOLUME ABSTRACTION |
| 6 | Diversion2 | 3 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.053 | ----- | POST WITH BMP |
| 7 | Diversion1 | 4 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.839 | ----- | VOLUME ABSTRACTION |
| 8 | Diversion2 | 4 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.052 | ----- | POST WITH BMP |
| 9 | Combine | 2, 6, 8 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 9.295 | ----- | POST AT POI |

Hydrograph Report

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

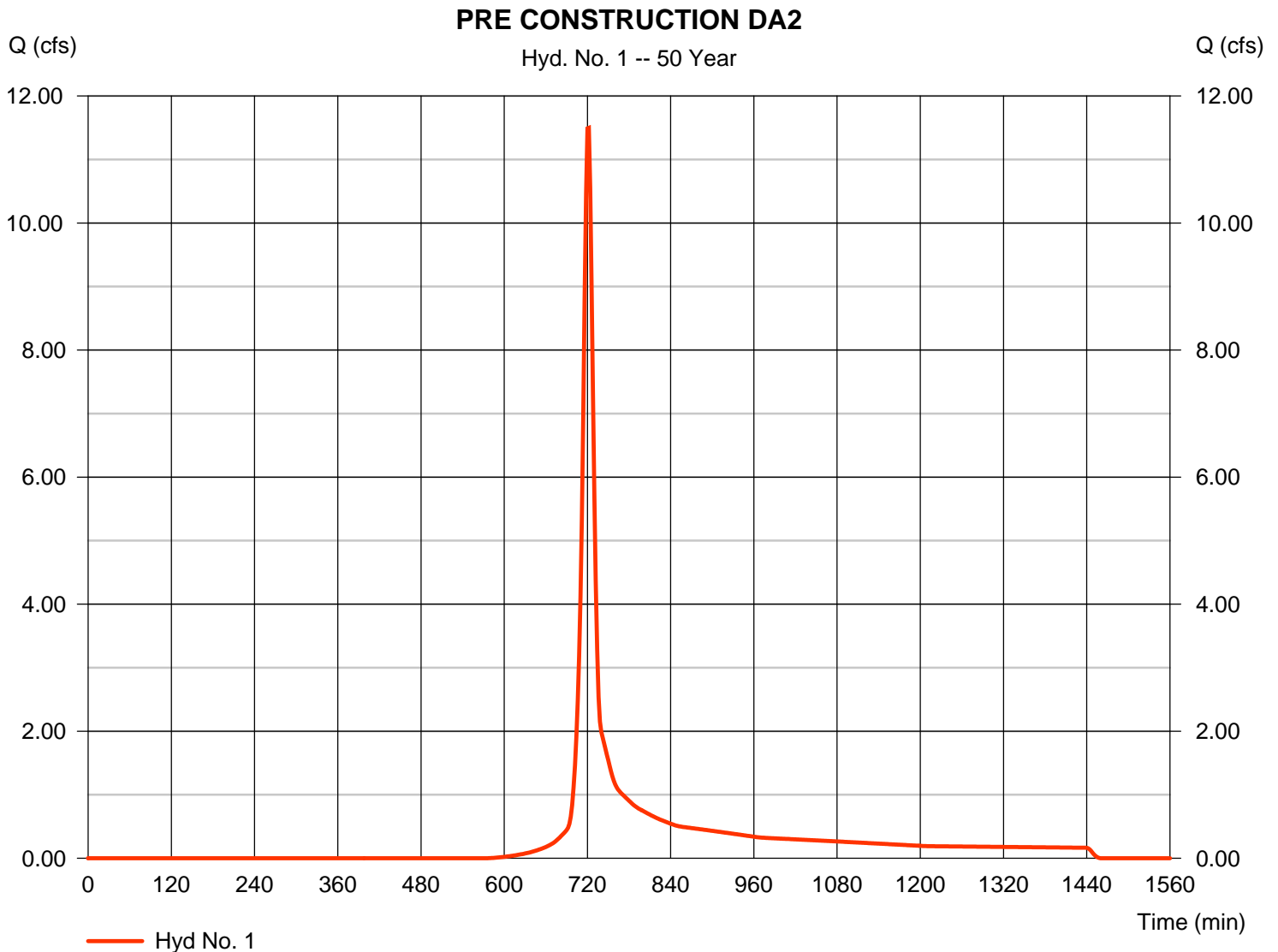
Friday, 11 / 11 / 2016

Hyd. No. 1

PRE CONSTRUCTION DA2

| | | | |
|-----------------|--------------|--------------------|---------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 11.50 cfs |
| Storm frequency | = 50 yrs | Time to peak | = 722 min |
| Time interval | = 2 min | Hyd. volume | = 30,089 cuft |
| Drainage area | = 3.430 ac | Curve number | = 69* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = TR55 | Time of conc. (Tc) | = 11.50 min |
| Total precip. | = 5.52 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = [(1.800 x 58) + (0.780 x 78) + (0.050 x 55) + (0.490 x 77) + (0.310 x 98)] / 3.430



TR55 Tc Worksheet

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

Hyd. No. 1

PRE CONSTRUCTION DA2

| <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) | = 2.74 | 0.00 | 0.00 | |
| Land slope (%) | = 2.50 | 0.00 | 0.00 | |
| Travel Time (min) | = 8.10 | + 0.00 | + 0.00 | = 8.10 |
| Shallow Concentrated Flow | | | | |
| Flow length (ft) | = 85.00 | 0.00 | 0.00 | |
| Watercourse slope (%) | = 3.50 | 0.00 | 0.00 | |
| Surface description | = Unpaved | Paved | Paved | |
| Average velocity (ft/s) | =3.02 | 0.00 | 0.00 | |
| Travel Time (min) | = 0.47 | + 0.00 | + 0.00 | = 0.47 |
| Channel Flow | | | | |
| X sectional flow area (sqft) | = 2.00 | 0.00 | 0.00 | |
| Wetted perimeter (ft) | = 4.47 | 0.00 | 0.00 | |
| Channel slope (%) | = 2.10 | 0.00 | 0.00 | |
| Manning's n-value | = 0.030 | 0.015 | 0.015 | |
| Velocity (ft/s) | =4.20 | 0.00 | 0.00 | |
| Flow length (ft) | {{0}}747.0 | 0.0 | 0.0 | |
| Travel Time (min) | = 2.96 | + 0.00 | + 0.00 | = 2.96 |
| Total Travel Time, Tc | | | | 11.50 min |

Hydrograph Report

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

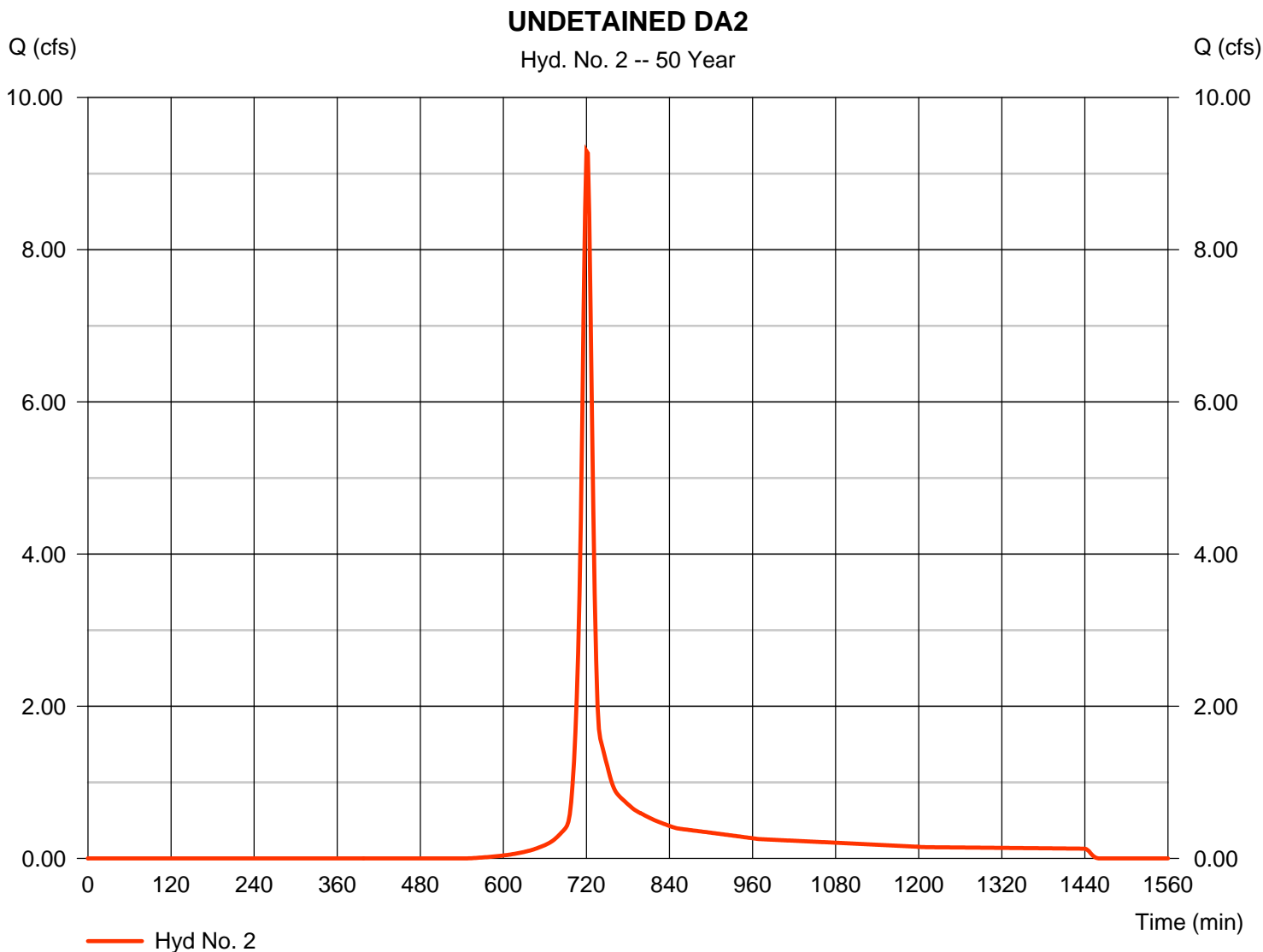
Friday, 11 / 11 / 2016

Hyd. No. 2

UNDETAINED DA2

| | | | |
|-----------------|--------------|--------------------|---------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 9.295 cfs |
| Storm frequency | = 50 yrs | Time to peak | = 720 min |
| Time interval | = 2 min | Hyd. volume | = 24,216 cuft |
| Drainage area | = 2.570 ac | Curve number | = 71* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = TR55 | Time of conc. (Tc) | = 11.50 min |
| Total precip. | = 5.52 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = [(1.080 x 58) + (0.830 x 78) + (0.210 x 98) + (0.050 x 55) + (0.400 x 77)] / 2.570



TR55 Tc Worksheet

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

Hyd. No. 2

UNDETAINED DA2

| <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) | = 2.74 | 0.00 | 0.00 | |
| Land slope (%) | = 2.50 | 0.00 | 0.00 | |
| Travel Time (min) | = 8.10 | + 0.00 | + 0.00 | = 8.10 |
| Shallow Concentrated Flow | | | | |
| Flow length (ft) | = 85.00 | 0.00 | 0.00 | |
| Watercourse slope (%) | = 3.50 | 0.00 | 0.00 | |
| Surface description | = Unpaved | Paved | Paved | |
| Average velocity (ft/s) | =3.02 | 0.00 | 0.00 | |
| Travel Time (min) | = 0.47 | + 0.00 | + 0.00 | = 0.47 |
| Channel Flow | | | | |
| X sectional flow area (sqft) | = 2.00 | 0.00 | 0.00 | |
| Wetted perimeter (ft) | = 4.47 | 0.00 | 0.00 | |
| Channel slope (%) | = 2.10 | 0.00 | 0.00 | |
| Manning's n-value | = 0.030 | 0.015 | 0.015 | |
| Velocity (ft/s) | =4.20 | 0.00 | 0.00 | |
| Flow length (ft) | 747.0 | 0.0 | 0.0 | |
| Travel Time (min) | = 2.96 | + 0.00 | + 0.00 | = 2.96 |
| Total Travel Time, Tc | | | | 11.50 min |

Hydrograph Report

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

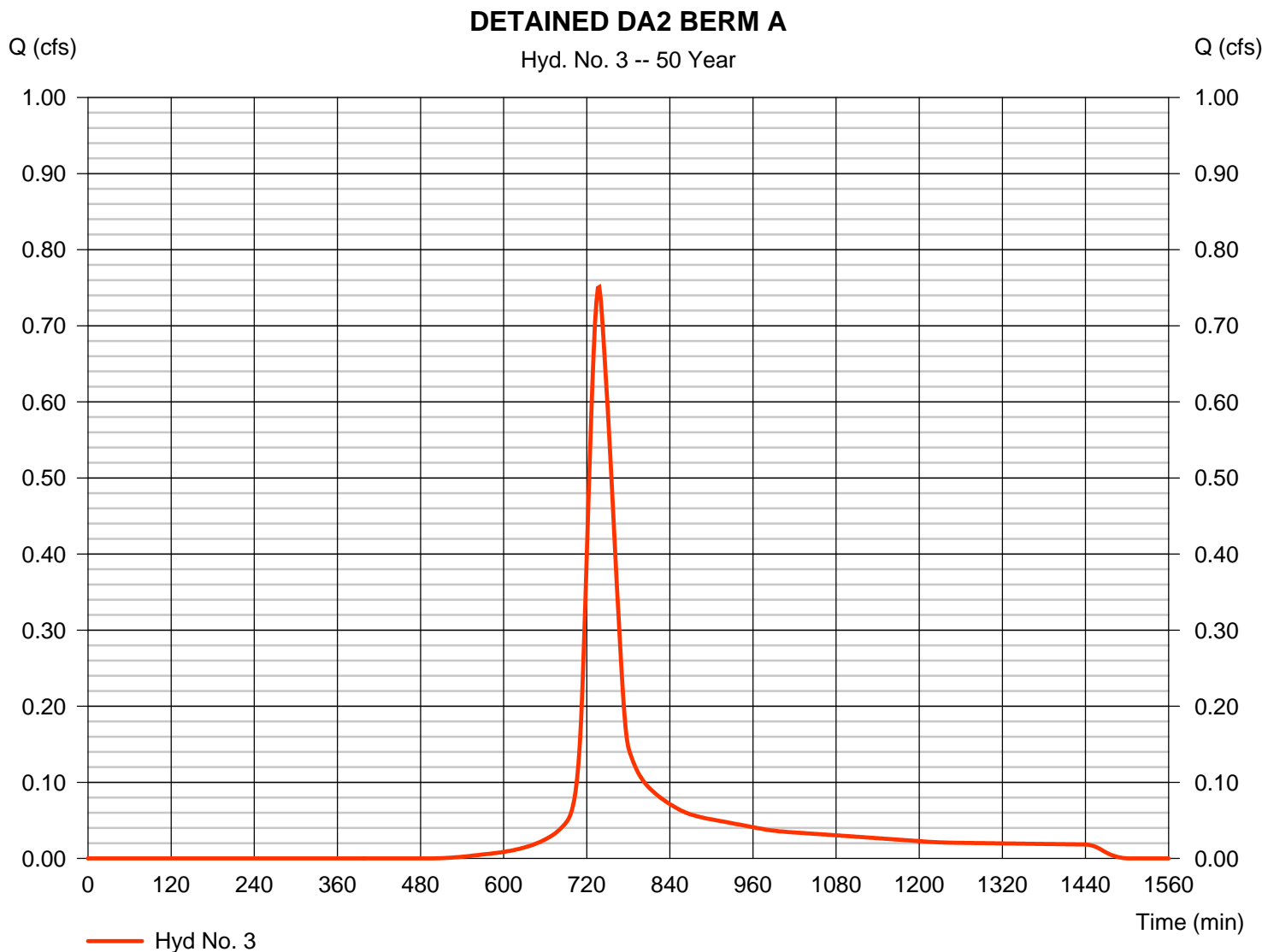
Friday, 11 / 11 / 2016

Hyd. No. 3

DETAINED DA2 BERM A

| | | | |
|-----------------|--------------|--------------------|--------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 0.751 cfs |
| Storm frequency | = 50 yrs | Time to peak | = 738 min |
| Time interval | = 2 min | Hyd. volume | = 3,656 cuft |
| Drainage area | = 0.350 ac | Curve number | = 75* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = User | Time of conc. (Tc) | = 37.90 min |
| Total precip. | = 5.52 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = [(0.120 x 85) + (0.140 x 58) + (0.040 x 78) + (0.050 x 98)] / 0.350



Hydrograph Report

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

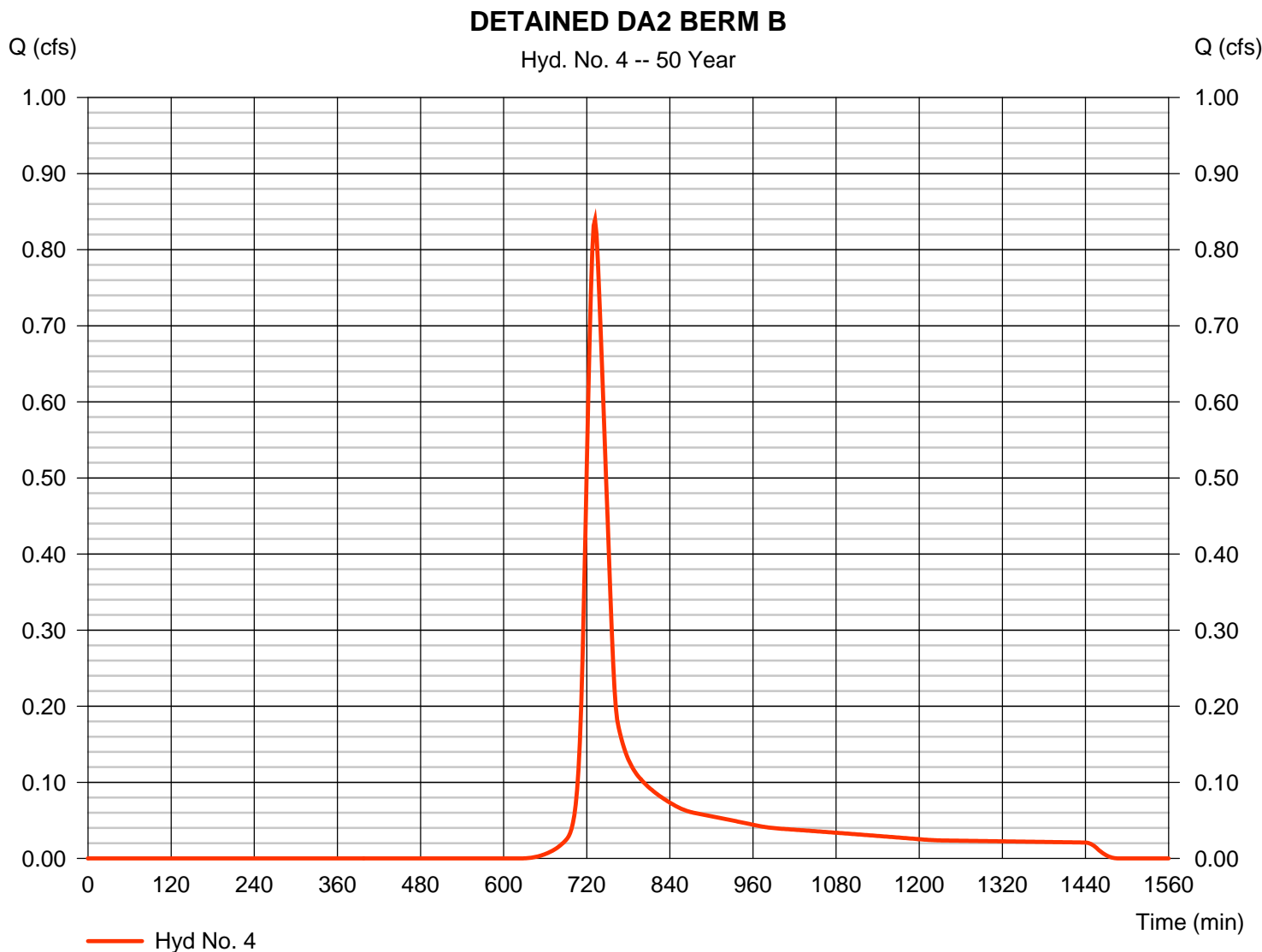
Friday, 11 / 11 / 2016

Hyd. No. 4

DETAINED DA2 BERM B

| | | | |
|-----------------|--------------|--------------------|--------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 0.839 cfs |
| Storm frequency | = 50 yrs | Time to peak | = 732 min |
| Time interval | = 2 min | Hyd. volume | = 3,500 cuft |
| Drainage area | = 0.480 ac | Curve number | = 65* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = User | Time of conc. (Tc) | = 29.10 min |
| Total precip. | = 5.52 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = [(0.050 x 98) + (0.380 x 58) + (0.050 x 85)] / 0.480



Hydrograph Report

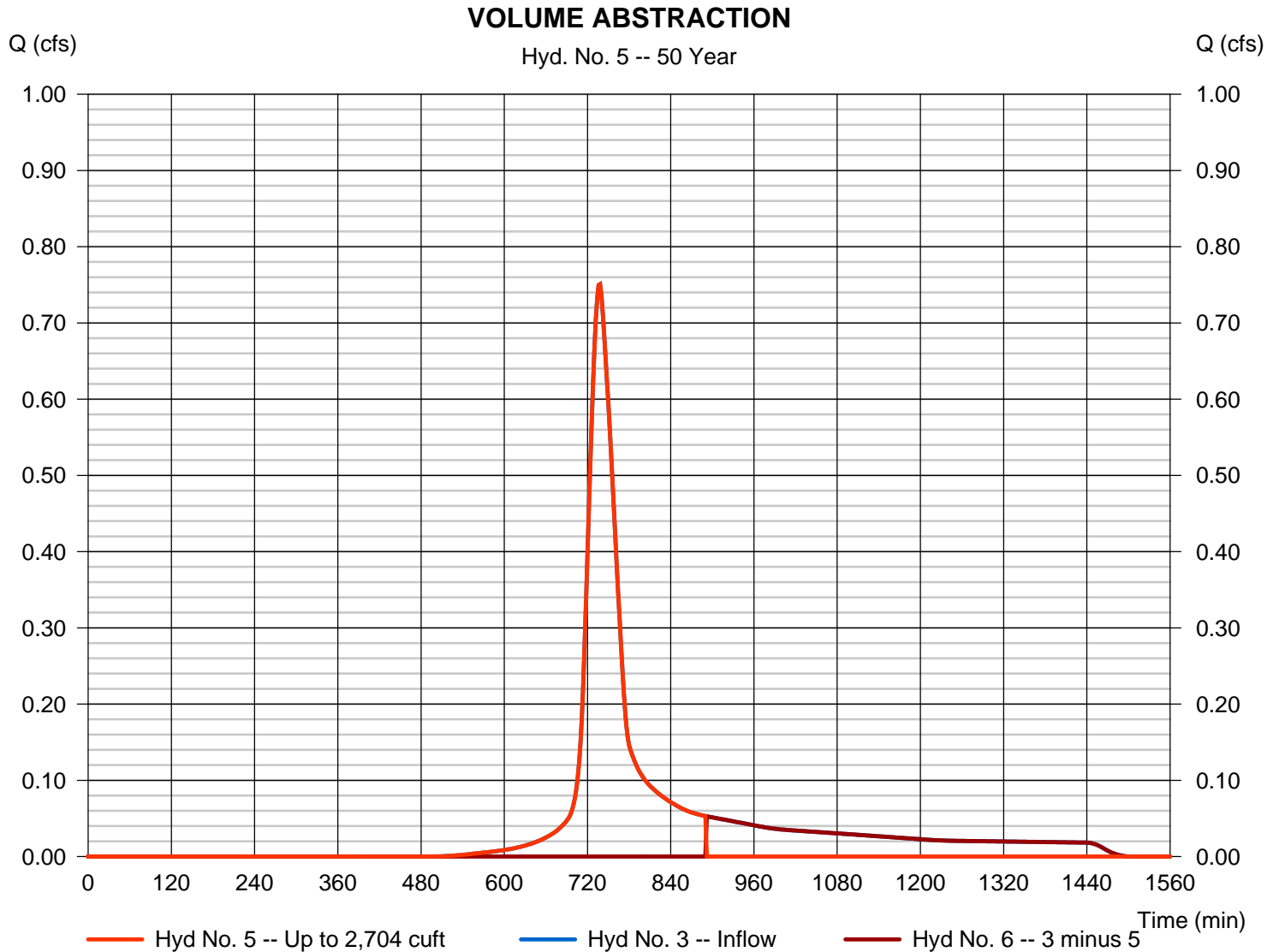
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 11 / 11 / 2016

Hyd. No. 5

VOLUME ABSTRACTION

| | | | |
|-------------------|---------------------------|-------------------|--------------|
| Hydrograph type | = Diversion1 | Peak discharge | = 0.751 cfs |
| Storm frequency | = 50 yrs | Time to peak | = 738 min |
| Time interval | = 2 min | Hyd. volume | = 2,705 cuft |
| Inflow hydrograph | = 3 - DETAINED DA2 BERM A | 2nd diverted hyd. | = 6 |
| Diversion method | = First Flush Volume | Volume Up To | = 2,704 cuft |



Hydrograph Report

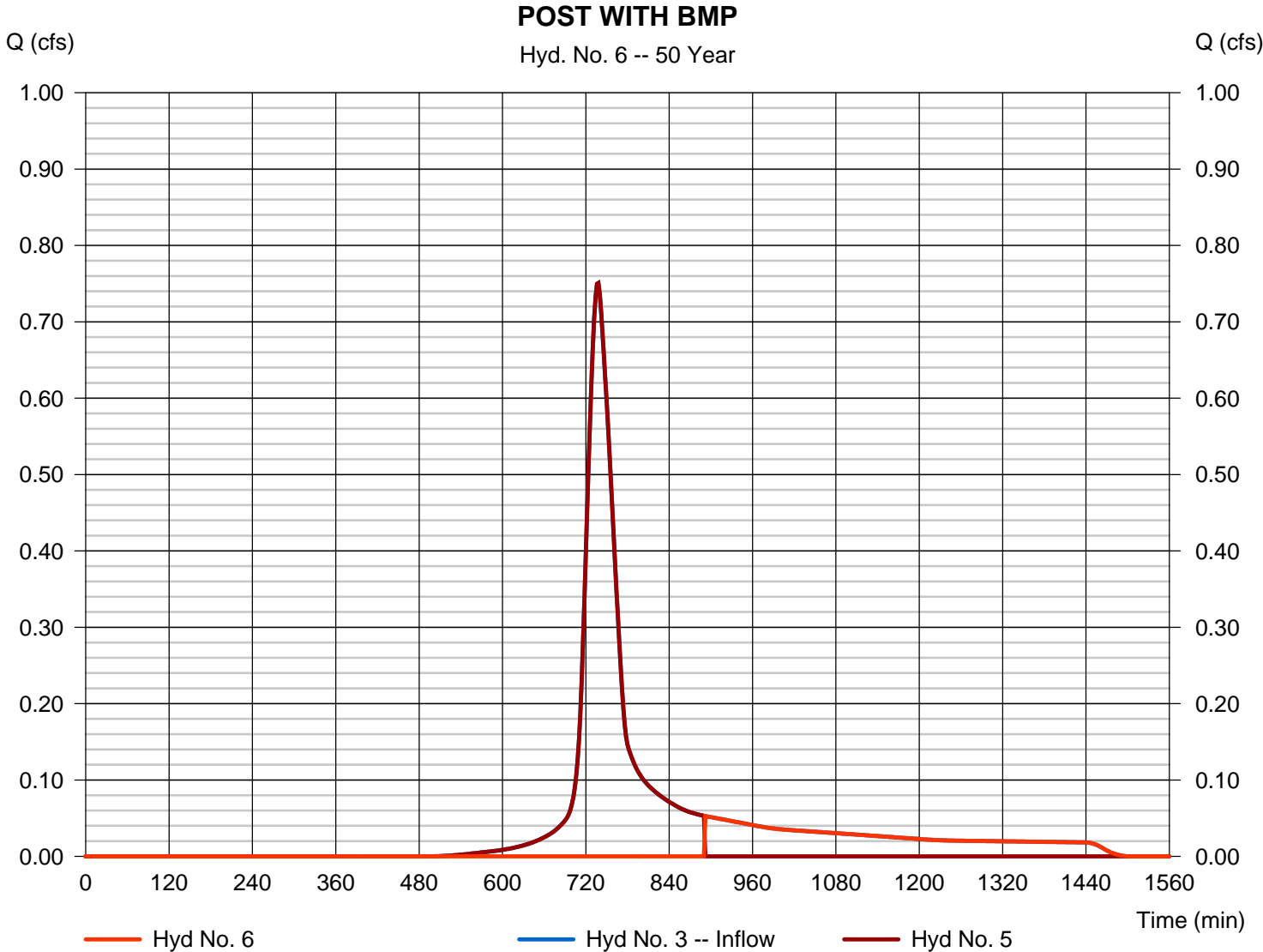
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 11 / 11 / 2016

Hyd. No. 6

POST WITH BMP

| | | | |
|-------------------|---------------------------|-------------------|--------------|
| Hydrograph type | = Diversion2 | Peak discharge | = 0.053 cfs |
| Storm frequency | = 50 yrs | Time to peak | = 892 min |
| Time interval | = 2 min | Hyd. volume | = 951 cuft |
| Inflow hydrograph | = 3 - DETAINED DA2 BERM A | 2nd diverted hyd. | = 5 |
| Diversion method | = First Flush Volume | Volume Up To | = 2,704 cuft |



Hydrograph Report

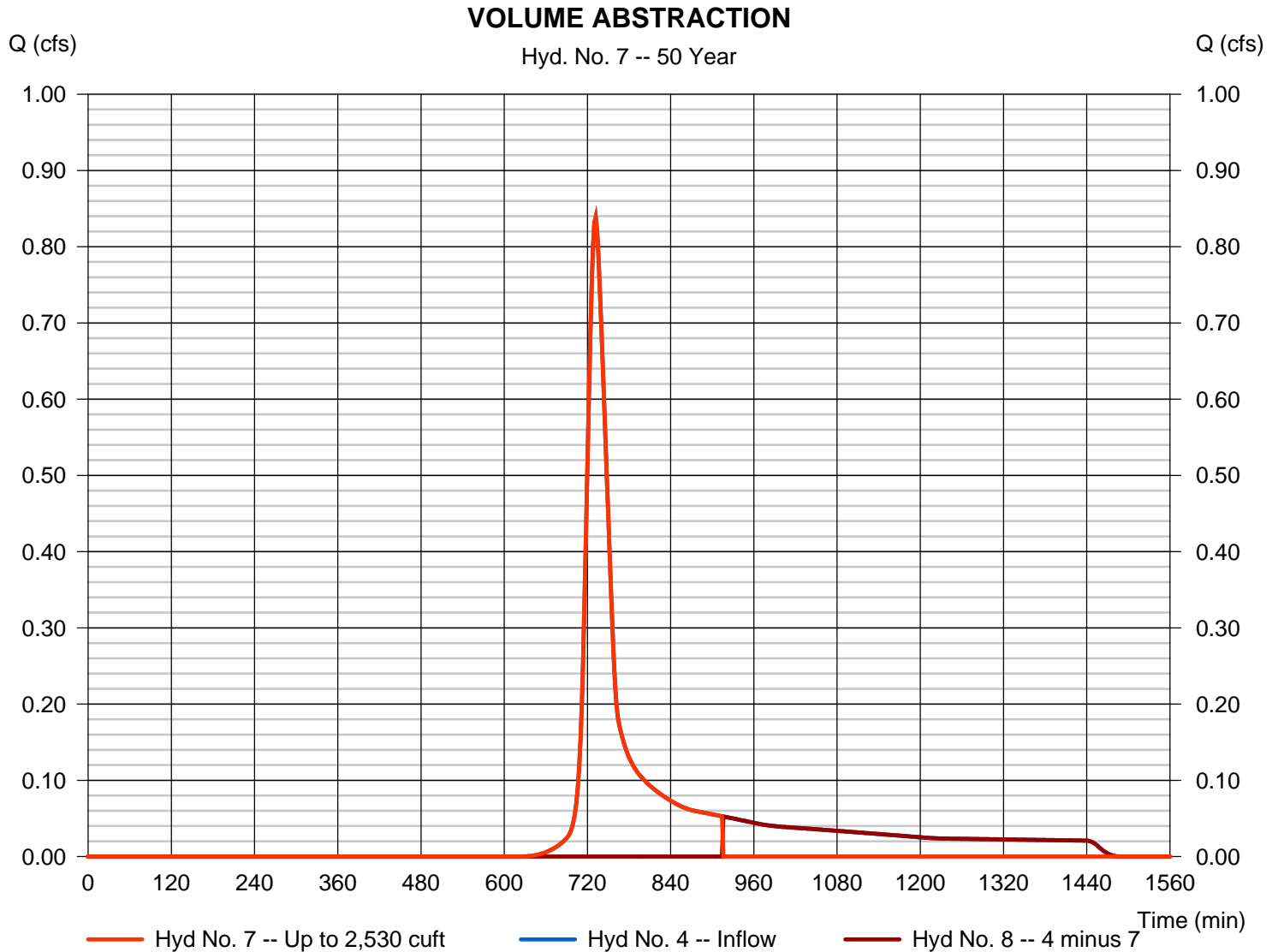
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 11 / 11 / 2016

Hyd. No. 7

VOLUME ABSTRACTION

| | | | |
|-------------------|---------------------------|-------------------|--------------|
| Hydrograph type | = Diversion1 | Peak discharge | = 0.839 cfs |
| Storm frequency | = 50 yrs | Time to peak | = 732 min |
| Time interval | = 2 min | Hyd. volume | = 2,533 cuft |
| Inflow hydrograph | = 4 - DETAINED DA2 BERM B | 2nd diverted hyd. | = 8 |
| Diversion method | = First Flush Volume | Volume Up To | = 2,530 cuft |



Hydrograph Report

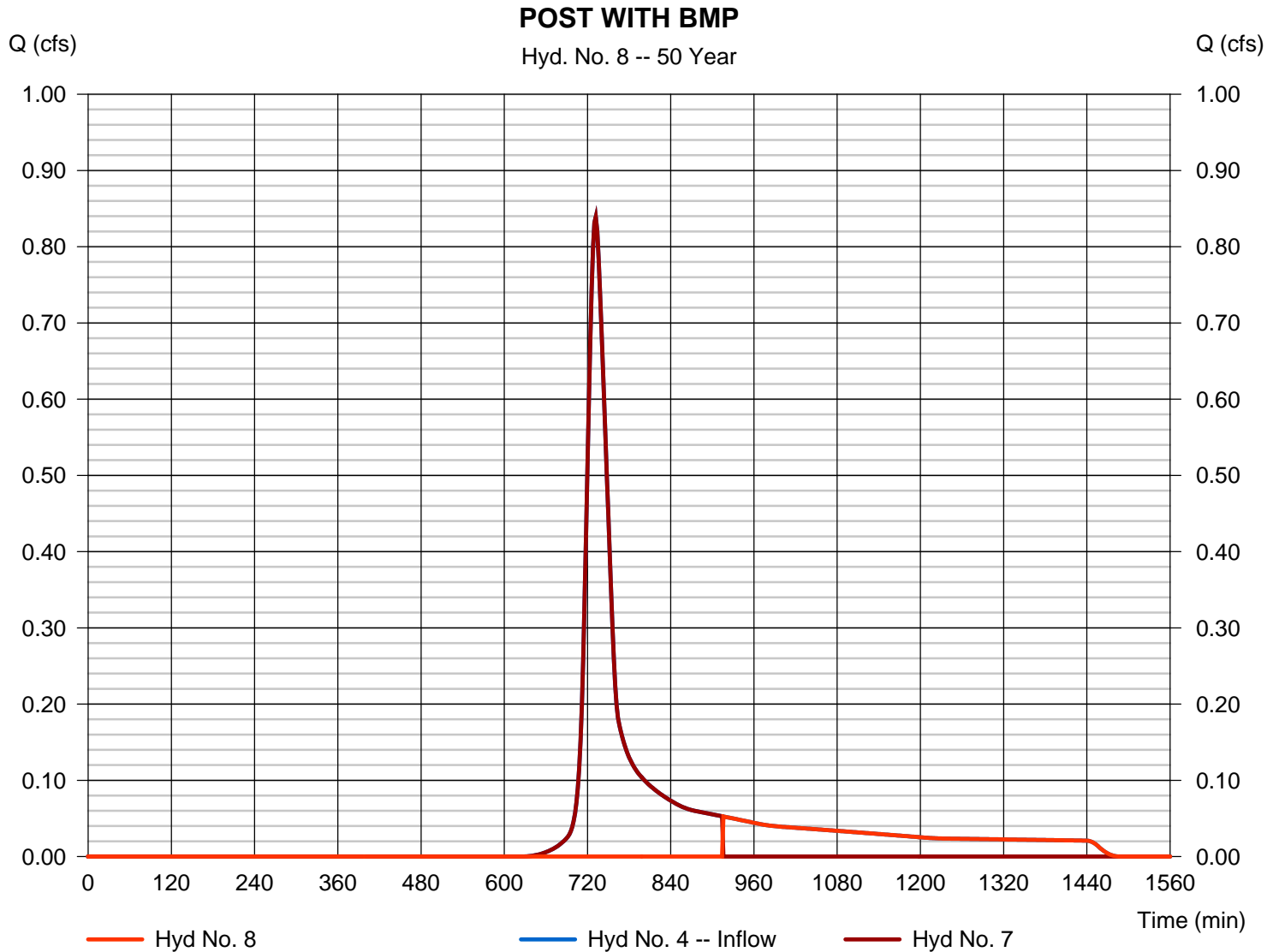
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4

Friday, 11 / 11 / 2016

Hyd. No. 8

POST WITH BMP

| | | | |
|-------------------|---------------------------|-------------------|--------------|
| Hydrograph type | = Diversion2 | Peak discharge | = 0.052 cfs |
| Storm frequency | = 50 yrs | Time to peak | = 916 min |
| Time interval | = 2 min | Hyd. volume | = 967 cuft |
| Inflow hydrograph | = 4 - DETAINED DA2 BERM B | 2nd diverted hyd. | = 7 |
| Diversion method | = First Flush Volume | Volume Up To | = 2,530 cuft |



Hydrograph Report

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

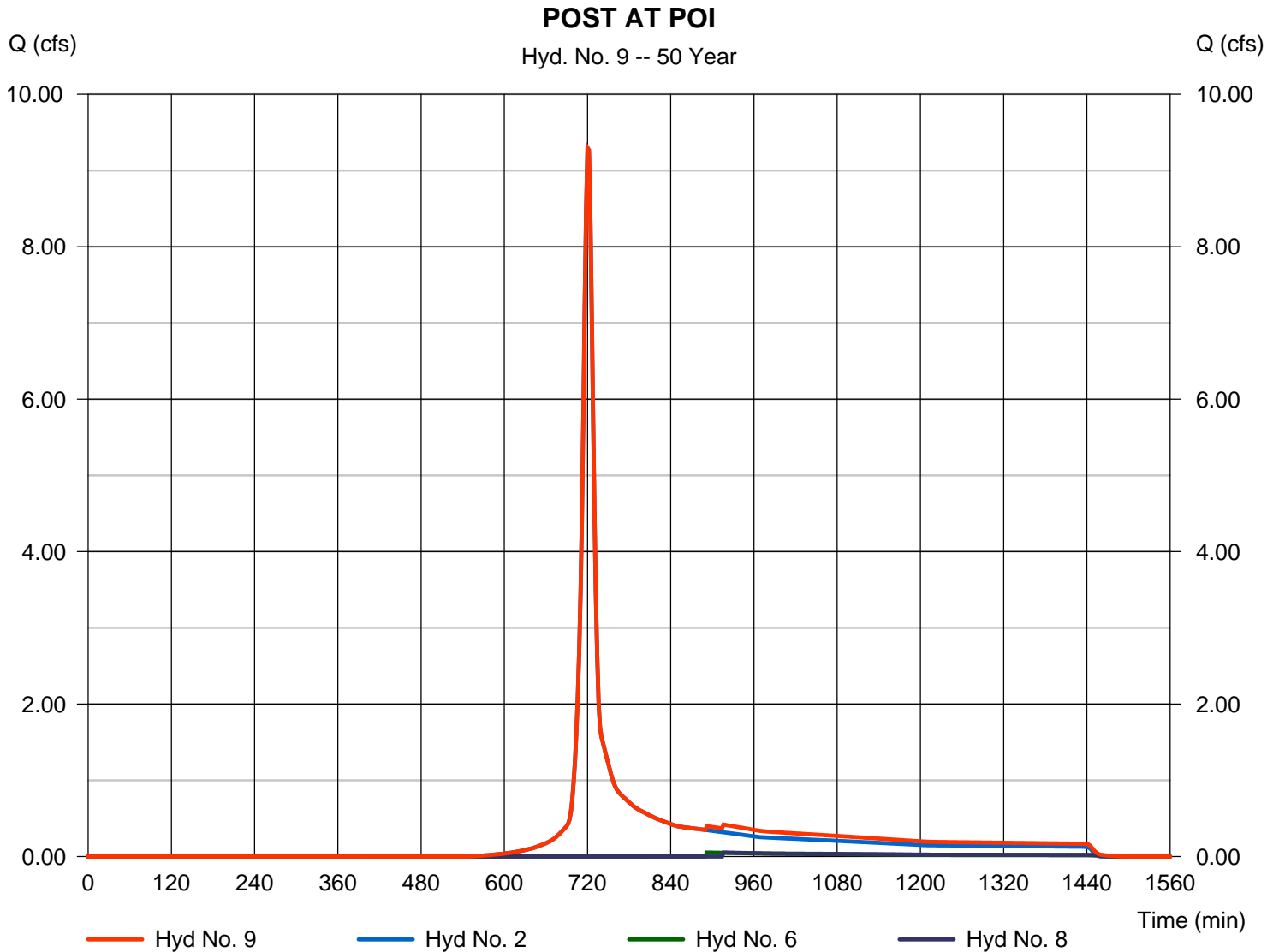
Friday, 11 / 11 / 2016

Hyd. No. 9

POST AT POI

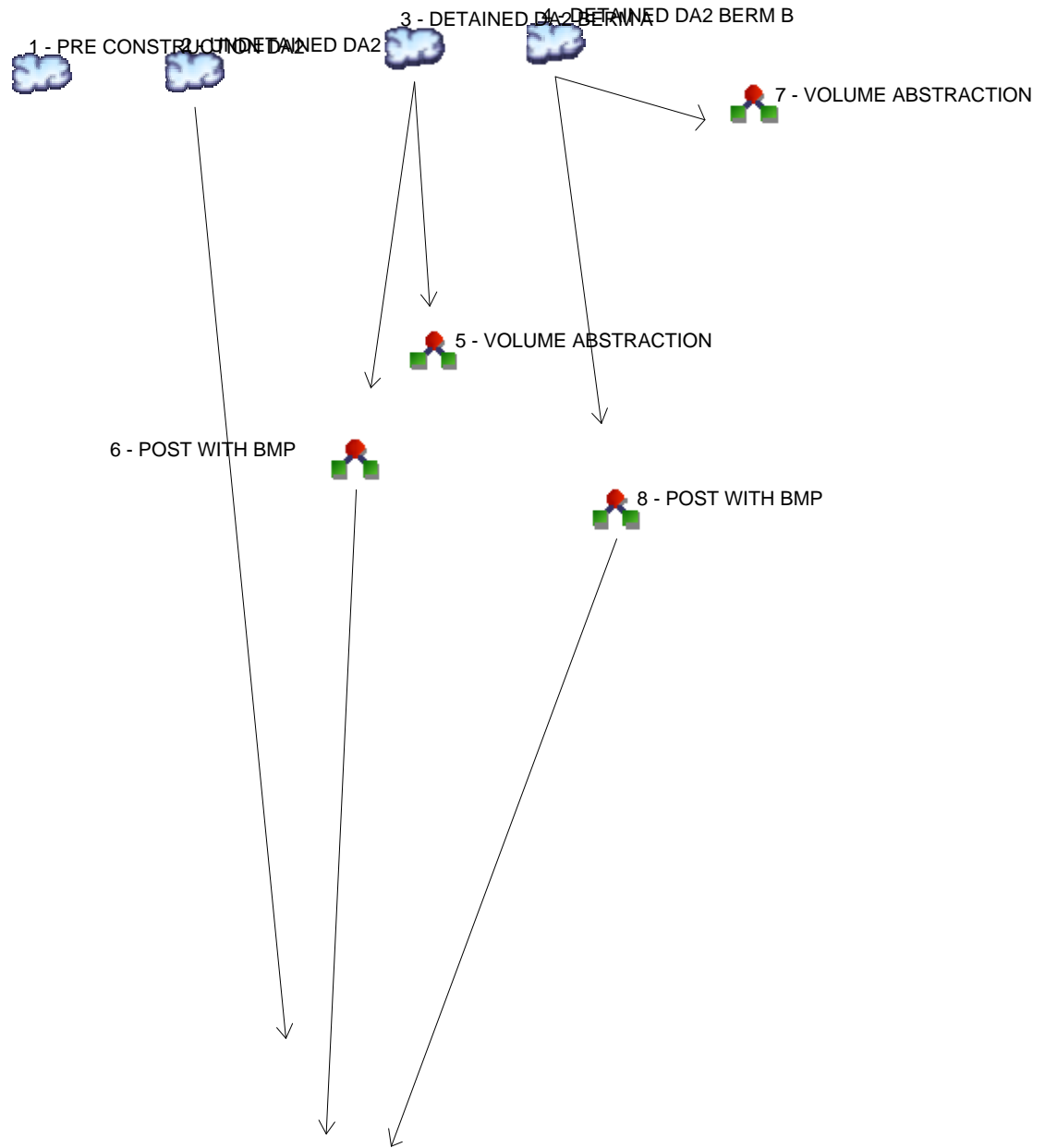
Hydrograph type = Combine
Storm frequency = 50 yrs
Time interval = 2 min
Inflow hyds. = 2, 6, 8

Peak discharge = 9.295 cfs
Time to peak = 720 min
Hyd. volume = 26,134 cuft
Contrib. drain. area = 2.570 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 CONSTRUCTION DA2 |
| 2 | SCS Runoff | UNDETAINED DA2 |
| 3 | SCS Runoff | DETAINED DA2 BERM A |
| 4 | SCS Runoff | DETAINED DA2 BERM B |
| 5 | Diversion1 | VOLUME ABSTRACTION |
| 6 | Diversion2 | POST WITH BMP |
| 7 | Diversion1 | VOLUME ABSTRACTION |
| 8 | Diversion2 | POST WITH BMP |
| 9 | 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 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 14.68 | PRE CONSTRUCTION DA2 |
| 2 | SCS Runoff | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 11.74 | UNDETAINED DA2 |
| 3 | SCS Runoff | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.060 | DETAINED DA2 BERM A |
| 4 | SCS Runoff | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.303 | DETAINED DA2 BERM B |
| 5 | Diversion1 | 3 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.060 | VOLUME ABSTRACTION |
| 6 | Diversion2 | 3 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.196 | POST WITH BMP |
| 7 | Diversion1 | 4 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 1.303 | VOLUME ABSTRACTION |
| 8 | Diversion2 | 4 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 0.178 | POST WITH BMP |
| 9 | Combine | 2, 6, 8 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 11.74 | 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 | 14.68 | 2 | 720 | 38,168 | ----- | ----- | ----- | PRE CONSTRUCTION DA2 |
| 2 | SCS Runoff | 11.74 | 2 | 720 | 30,467 | ----- | ----- | ----- | UNDETAINED DA2 |
| 3 | SCS Runoff | 1.060 | 2 | 732 | 4,586 | ----- | ----- | ----- | DETAINED DA2 BERM A |
| 4 | SCS Runoff | 1.303 | 2 | 728 | 4,601 | ----- | ----- | ----- | DETAINED DA2 BERM B |
| 5 | Diversion1 | 1.060 | 2 | 732 | 2,723 | 3 | ----- | ----- | VOLUME ABSTRACTION |
| 6 | Diversion2 | 0.196 | 2 | 770 | 1,863 | 3 | ----- | ----- | POST WITH BMP |
| 7 | Diversion1 | 1.303 | 2 | 728 | 2,552 | 4 | ----- | ----- | VOLUME ABSTRACTION |
| 8 | Diversion2 | 0.178 | 2 | 770 | 2,049 | 4 | ----- | ----- | POST WITH BMP |
| 9 | Combine | 11.74 | 2 | 720 | 34,378 | 2, 6, 8 | ----- | ----- | POST AT POI |

Hydrograph Report

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

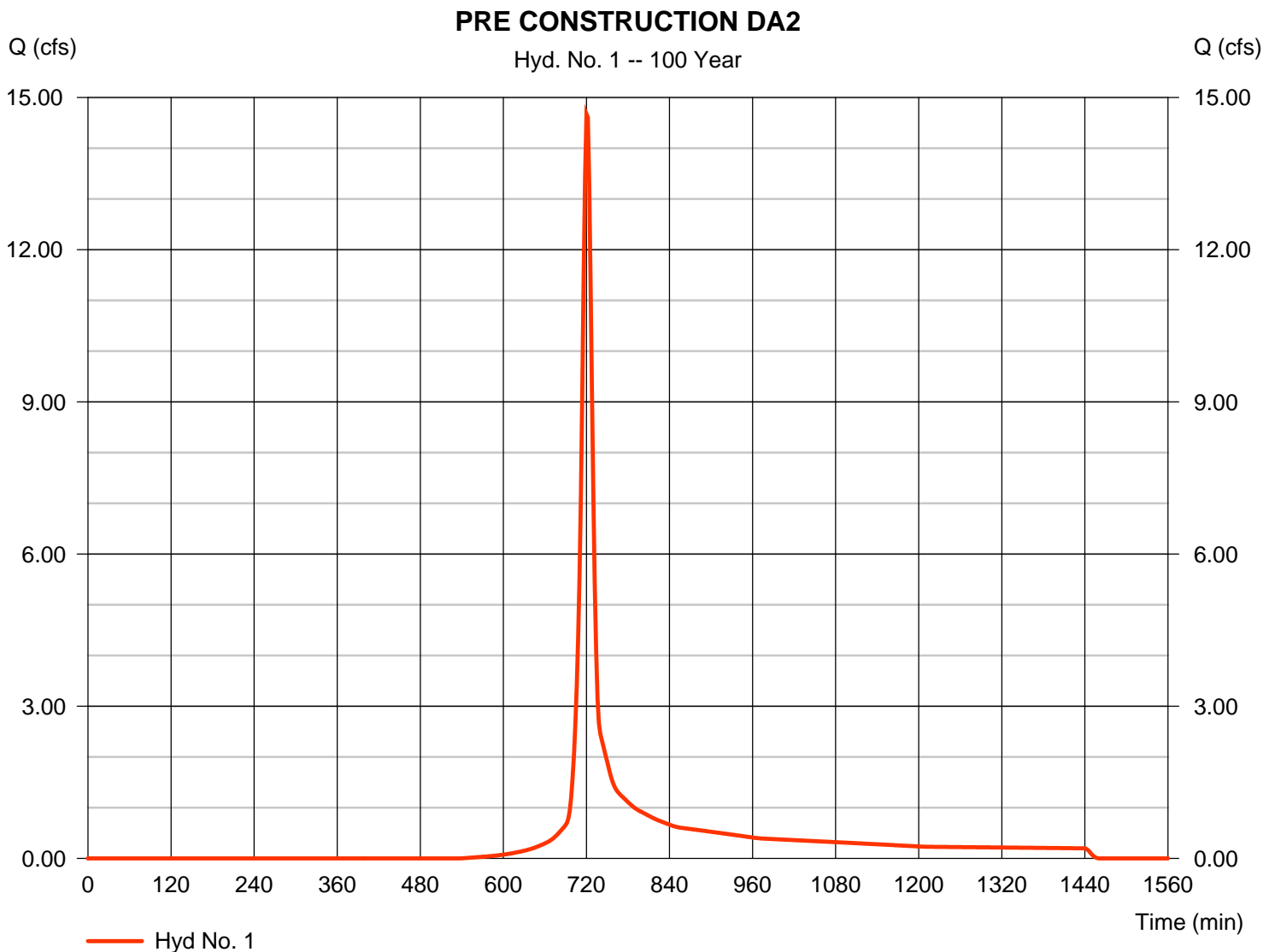
Friday, 11 / 11 / 2016

Hyd. No. 1

PRE CONSTRUCTION DA2

| | | | |
|-----------------|--------------|--------------------|---------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 14.68 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 720 min |
| Time interval | = 2 min | Hyd. volume | = 38,168 cuft |
| Drainage area | = 3.430 ac | Curve number | = 69* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = TR55 | Time of conc. (Tc) | = 11.50 min |
| Total precip. | = 6.33 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = [(1.800 x 58) + (0.780 x 78) + (0.050 x 55) + (0.490 x 77) + (0.310 x 98)] / 3.430



TR55 Tc Worksheet

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

Hyd. No. 1

PRE CONSTRUCTION DA2

| <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) | = 2.74 | 0.00 | 0.00 | |
| Land slope (%) | = 2.50 | 0.00 | 0.00 | |
| Travel Time (min) | = 8.10 | + 0.00 | + 0.00 | = 8.10 |
| Shallow Concentrated Flow | | | | |
| Flow length (ft) | = 85.00 | 0.00 | 0.00 | |
| Watercourse slope (%) | = 3.50 | 0.00 | 0.00 | |
| Surface description | = Unpaved | Paved | Paved | |
| Average velocity (ft/s) | =3.02 | 0.00 | 0.00 | |
| Travel Time (min) | = 0.47 | + 0.00 | + 0.00 | = 0.47 |
| Channel Flow | | | | |
| X sectional flow area (sqft) | = 2.00 | 0.00 | 0.00 | |
| Wetted perimeter (ft) | = 4.47 | 0.00 | 0.00 | |
| Channel slope (%) | = 2.10 | 0.00 | 0.00 | |
| Manning's n-value | = 0.030 | 0.015 | 0.015 | |
| Velocity (ft/s) | =4.20 | 0.00 | 0.00 | |
| Flow length (ft) | {{0}}747.0 | 0.0 | 0.0 | |
| Travel Time (min) | = 2.96 | + 0.00 | + 0.00 | = 2.96 |
| Total Travel Time, Tc | | | | 11.50 min |

Hydrograph Report

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

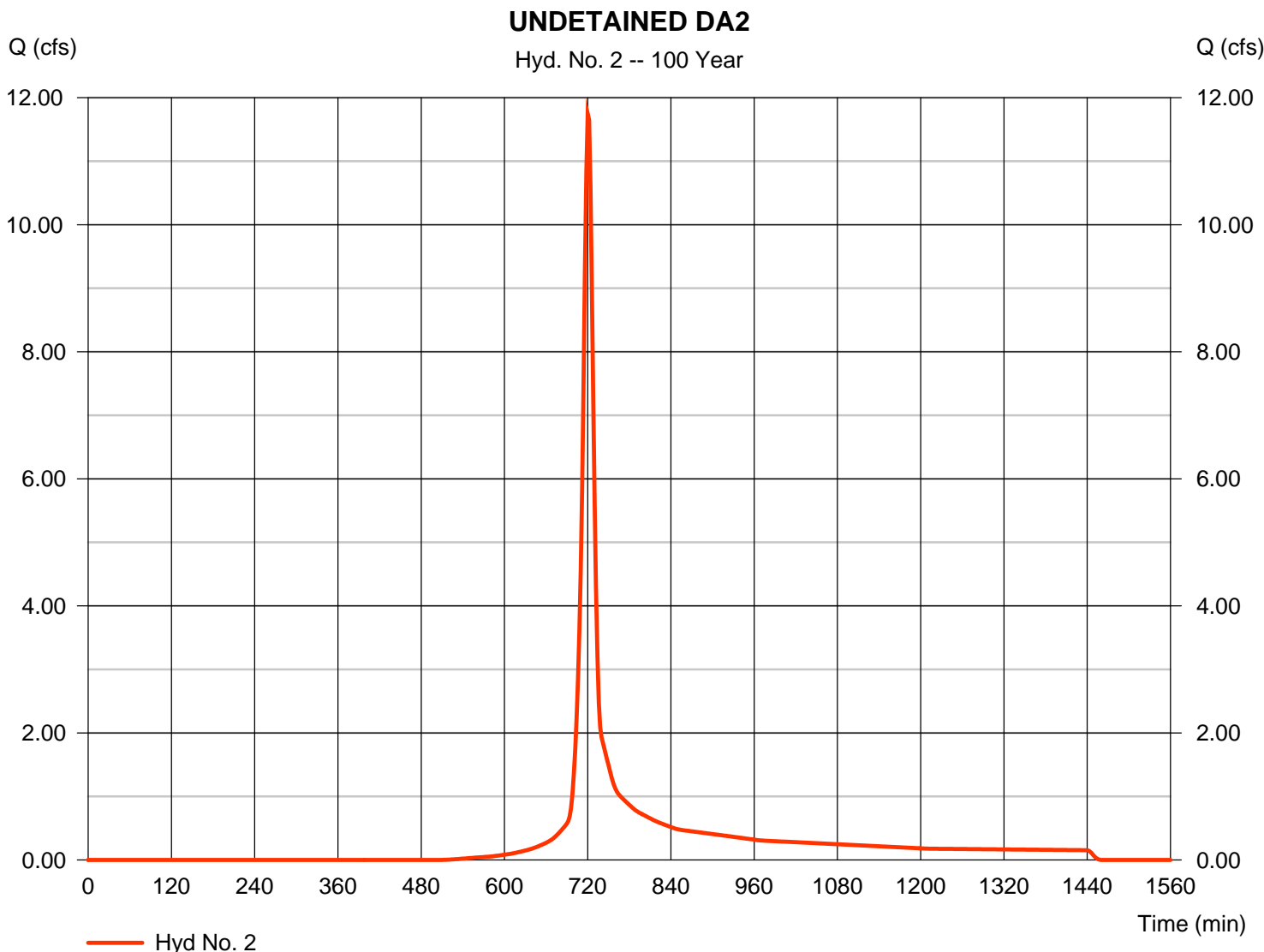
Friday, 11 / 11 / 2016

Hyd. No. 2

UNDETAINED DA2

| | | | |
|-----------------|--------------|--------------------|---------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 11.74 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 720 min |
| Time interval | = 2 min | Hyd. volume | = 30,467 cuft |
| Drainage area | = 2.570 ac | Curve number | = 71* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = TR55 | Time of conc. (Tc) | = 11.50 min |
| Total precip. | = 6.33 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = [(1.080 x 58) + (0.830 x 78) + (0.210 x 98) + (0.050 x 55) + (0.400 x 77)] / 2.570



TR55 Tc Worksheet

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Hyd. No. 2

UNDETAINED DA2

| <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) | = 2.74 | | 0.00 | | 0.00 | |
| Land slope (%) | = 2.50 | | 0.00 | | 0.00 | |
| Travel Time (min) | = 8.10 | + | 0.00 | + | 0.00 | = 8.10 |
| Shallow Concentrated Flow | | | | | | |
| Flow length (ft) | = 85.00 | | 0.00 | | 0.00 | |
| Watercourse slope (%) | = 3.50 | | 0.00 | | 0.00 | |
| Surface description | = Unpaved | | Paved | | Paved | |
| Average velocity (ft/s) | =3.02 | | 0.00 | | 0.00 | |
| Travel Time (min) | = 0.47 | + | 0.00 | + | 0.00 | = 0.47 |
| Channel Flow | | | | | | |
| X sectional flow area (sqft) | = 2.00 | | 0.00 | | 0.00 | |
| Wetted perimeter (ft) | = 4.47 | | 0.00 | | 0.00 | |
| Channel slope (%) | = 2.10 | | 0.00 | | 0.00 | |
| Manning's n-value | = 0.030 | | 0.015 | | 0.015 | |
| Velocity (ft/s) | =4.20 | | 0.00 | | 0.00 | |
| Flow length (ft) | {{0}}747.0 | | 0.0 | | 0.0 | |
| Travel Time (min) | = 2.96 | + | 0.00 | + | 0.00 | = 2.96 |
| Total Travel Time, Tc | | | | | | 11.50 min |

Hydrograph Report

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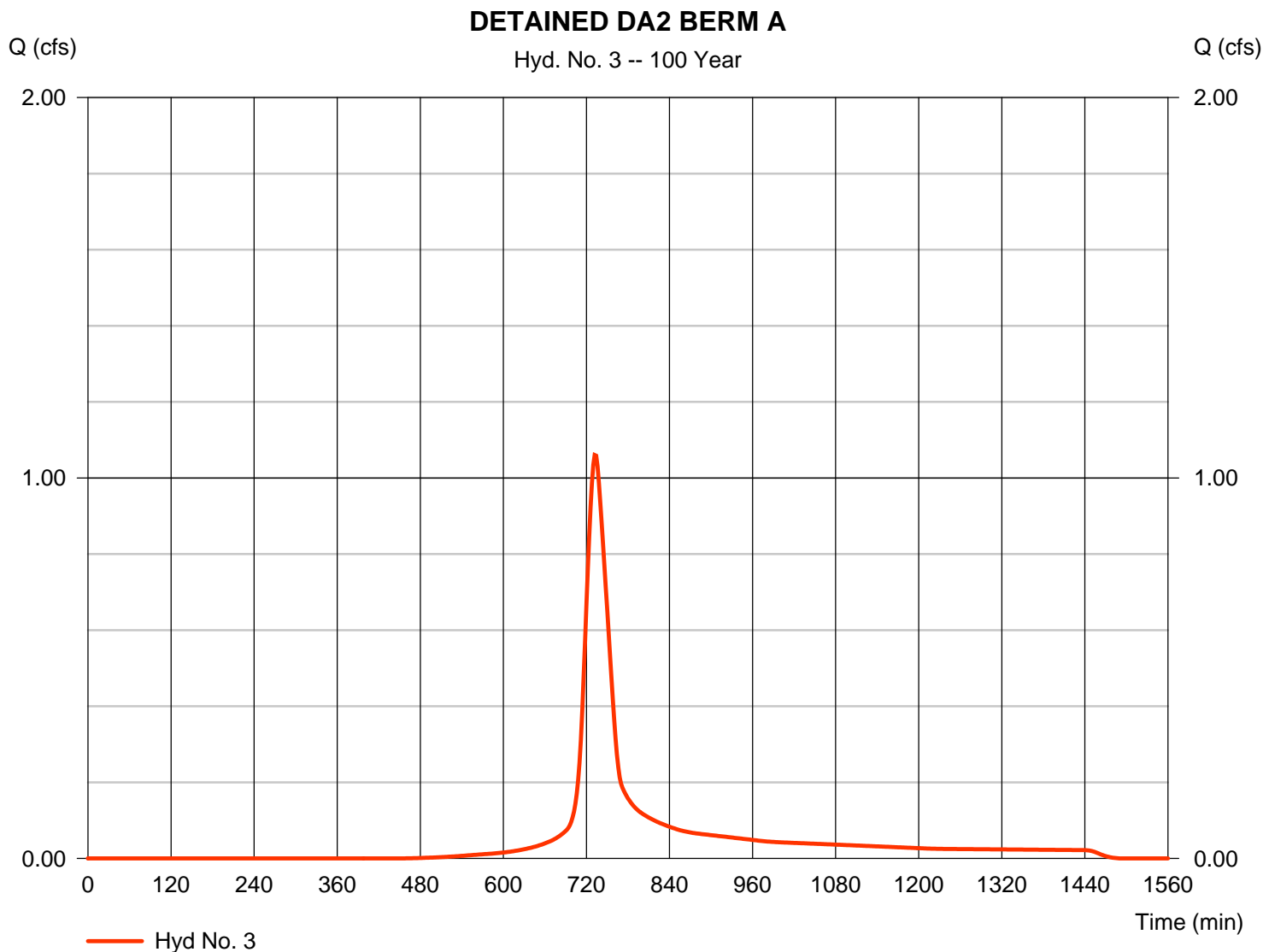
Friday, 11 / 11 / 2016

Hyd. No. 3

DETAINED DA2 BERM A

| | | | |
|-----------------|--------------|--------------------|--------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 1.060 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 732 min |
| Time interval | = 2 min | Hyd. volume | = 4,586 cuft |
| Drainage area | = 0.350 ac | Curve number | = 75* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = User | Time of conc. (Tc) | = 32.52 min |
| Total precip. | = 6.33 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = [(0.120 x 85) + (0.140 x 58) + (0.040 x 78) + (0.050 x 98)] / 0.350



Hydrograph Report

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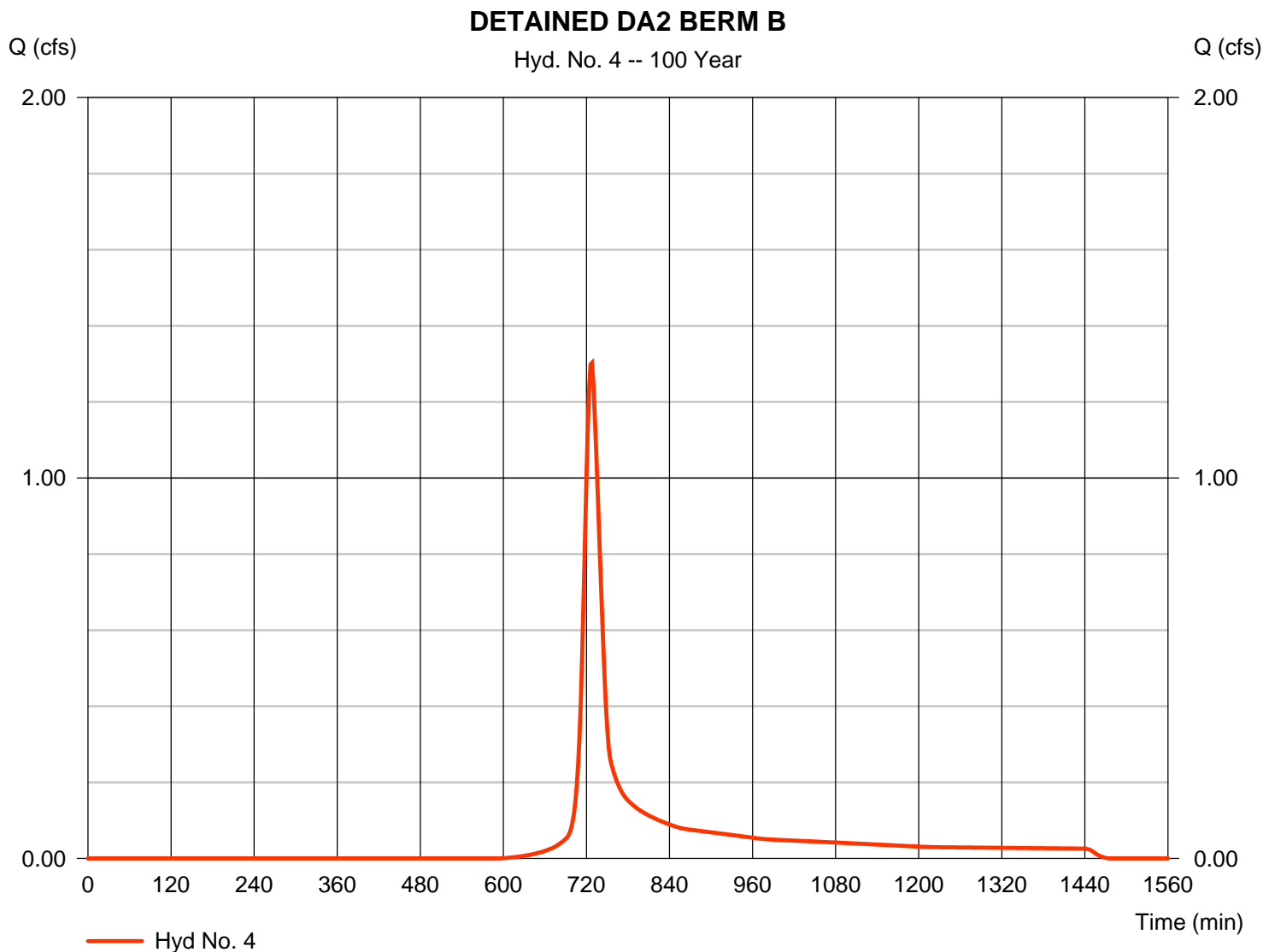
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Hyd. No. 4

DETAINED DA2 BERM B

| | | | |
|-----------------|--------------|--------------------|--------------|
| Hydrograph type | = SCS Runoff | Peak discharge | = 1.303 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 728 min |
| Time interval | = 2 min | Hyd. volume | = 4,601 cuft |
| Drainage area | = 0.480 ac | Curve number | = 65* |
| Basin Slope | = 0.0 % | Hydraulic length | = 0 ft |
| Tc method | = User | Time of conc. (Tc) | = 23.34 min |
| Total precip. | = 6.33 in | Distribution | = Type II |
| Storm duration | = 24 hrs | Shape factor | = 484 |

* Composite (Area/CN) = [(0.050 x 98) + (0.380 x 58) + (0.050 x 85)] / 0.480



Hydrograph Report

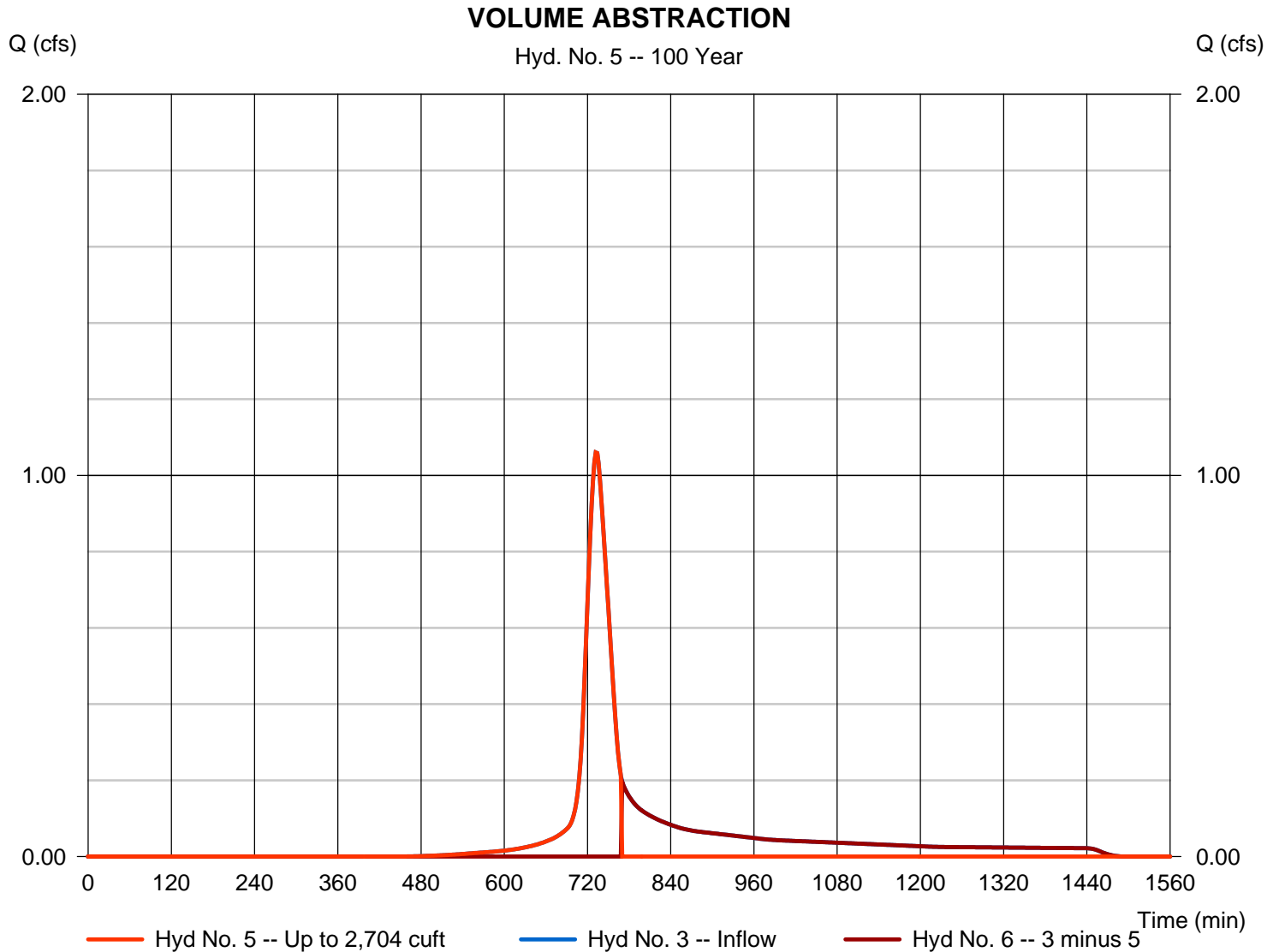
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Hyd. No. 5

VOLUME ABSTRACTION

| | | | |
|-------------------|---------------------------|-------------------|--------------|
| Hydrograph type | = Diversion1 | Peak discharge | = 1.060 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 732 min |
| Time interval | = 2 min | Hyd. volume | = 2,723 cuft |
| Inflow hydrograph | = 3 - DETAINED DA2 BERM A | 2nd diverted hyd. | = 6 |
| Diversion method | = First Flush Volume | Volume Up To | = 2,704 cuft |

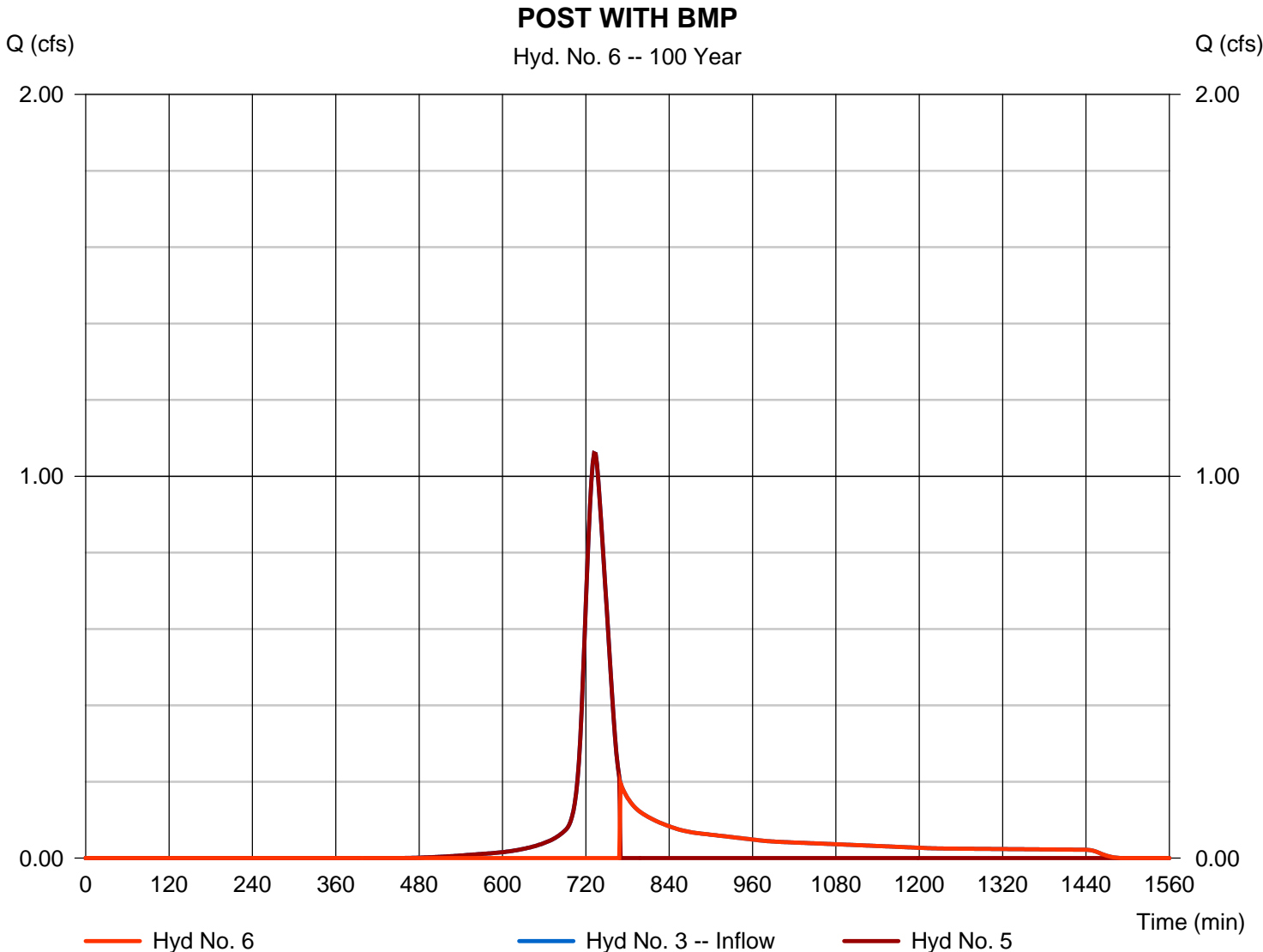


Hydrograph Report

Hyd. No. 6

POST WITH BMP

| | | | |
|-------------------|---------------------------|-------------------|--------------|
| Hydrograph type | = Diversion2 | Peak discharge | = 0.196 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 770 min |
| Time interval | = 2 min | Hyd. volume | = 1,863 cuft |
| Inflow hydrograph | = 3 - DETAINED DA2 BERM A | 2nd diverted hyd. | = 5 |
| Diversion method | = First Flush Volume | Volume Up To | = 2,704 cuft |



Hydrograph Report

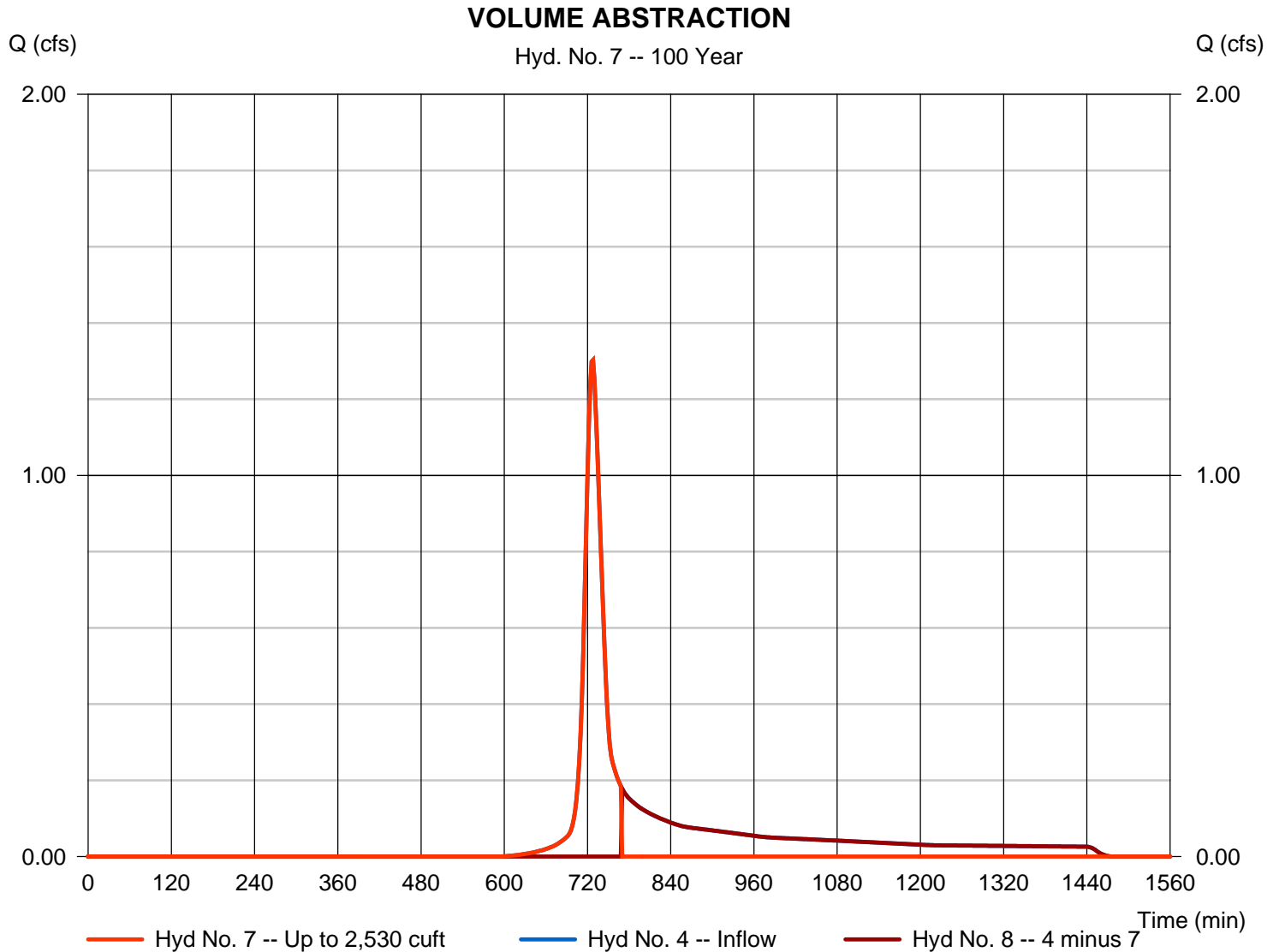
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Hyd. No. 7

VOLUME ABSTRACTION

| | | | |
|-------------------|---------------------------|-------------------|--------------|
| Hydrograph type | = Diversion1 | Peak discharge | = 1.303 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 728 min |
| Time interval | = 2 min | Hyd. volume | = 2,552 cuft |
| Inflow hydrograph | = 4 - DETAINED DA2 BERM B | 2nd diverted hyd. | = 8 |
| Diversion method | = First Flush Volume | Volume Up To | = 2,530 cuft |



Hydrograph Report

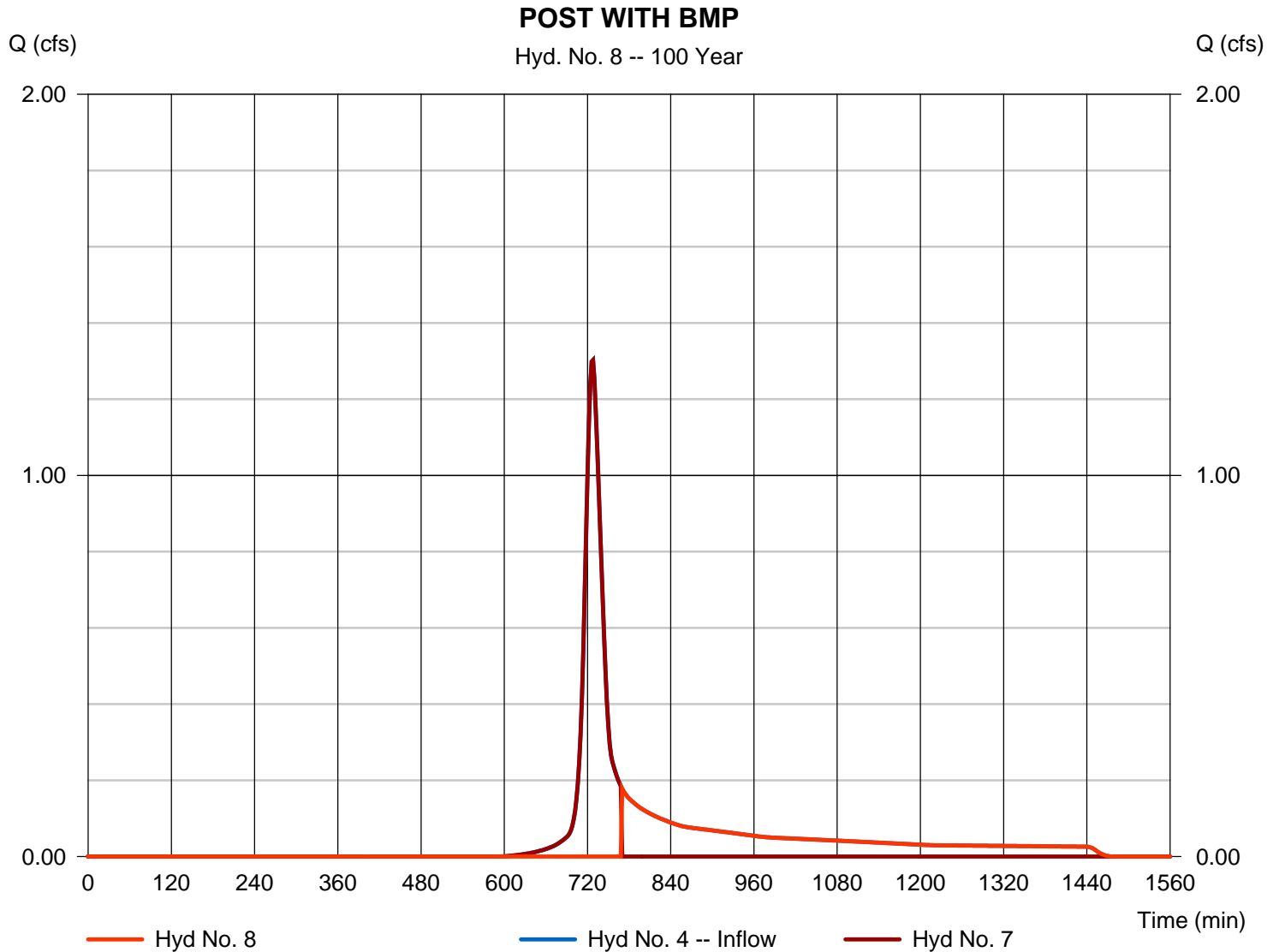
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Hyd. No. 8

POST WITH BMP

| | | | |
|-------------------|---------------------------|-------------------|--------------|
| Hydrograph type | = Diversion2 | Peak discharge | = 0.178 cfs |
| Storm frequency | = 100 yrs | Time to peak | = 770 min |
| Time interval | = 2 min | Hyd. volume | = 2,049 cuft |
| Inflow hydrograph | = 4 - DETAINED DA2 BERM B | 2nd diverted hyd. | = 7 |
| Diversion method | = First Flush Volume | Volume Up To | = 2,530 cuft |



Hydrograph Report

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

Friday, 11 / 11 / 2016

Hyd. No. 9

POST AT POI

Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 2 min
Inflow hyds. = 2, 6, 8

Peak discharge = 11.74 cfs
Time to peak = 720 min
Hyd. volume = 34,378 cuft
Contrib. drain. area = 2.570 ac

