Locke Mountain

TETRA TECH, INC.

By: RH Date: 1/30/2017 Subject: Locke Mountain Road
Checked By: JB Date: 2/1/2017 PCSM Design and Evaluation

PURPOSE:

The purpose of these calculations is to design a Post-Construction Stormwater Management (PCSM) Plan for the Locke Mountain Road block valve site as part of the Sunoco Pipeline L.P. Pennsylvania Pipeline Project. The site is located within Frankstown Township, Blair 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

Blair 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.

Due to the presence of shallow redoximorphic features in soil logs surrounding the Locke Mountain Road block valve site, it is not possible to infiltrate the 2-year/24-hour stormwater runoff volume increase while maintaining a 2-foot separation to the seasonal high groundwater table. Volume reducing BMPs in the PADEP Stormwater BMP Manual were analyzed on a case-by-case basis but did not meet their respective requirements. As a result, two slow-release BMPs have been proposed.

Recommended Peak Rate Control Guideline

The recommended control guideline for peak rate control is:

- Do not increase the peak rate of discharge for the 2-year through 100-year events (at minimum); as necessary, provide additional peak rate control as required by the applicable and approved Act 167 plan.

- Blair County does not have an approved Act 167 Plan. Therefore, no additional peak rate control is required under the Act 167 Plan.

This site will utilize two slow-release BMPs with a downslope compacted berm to manage the two-year through 100-year peak rate increases. The proposed BMP will increase the post-construction 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. The use of a slow-release BMP has been approved by PADEP as an appropriate way to meet the requirements of Control Guideline 1 when onsite infiltration is not feasible.

Infiltration

Onsite infiltration testing was 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. Due to the presence of shallow redoximorphic features which can be indicative of a shallow seasonal high groundwater table, it is not possible to maintain 2 feet of separation between a volume-reducing BMP and the seasonal high groundwater table.

The post-construction stormwater management design utilizes two slow-release BMPs to manage runoff volume due to the presence of shallow seasonal high groundwater.

Loading Ratio

Loading ratio guidelines do not apply because the design does not propose an infiltration BMP.

Disturbed Area

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

Karst Topography

Locke Mountain Road is not located within an area of karst terrain.

Special Protection Watershed

Locke Mountain Road is not located within a special protection watershed, so antidegradation requirements do not apply.

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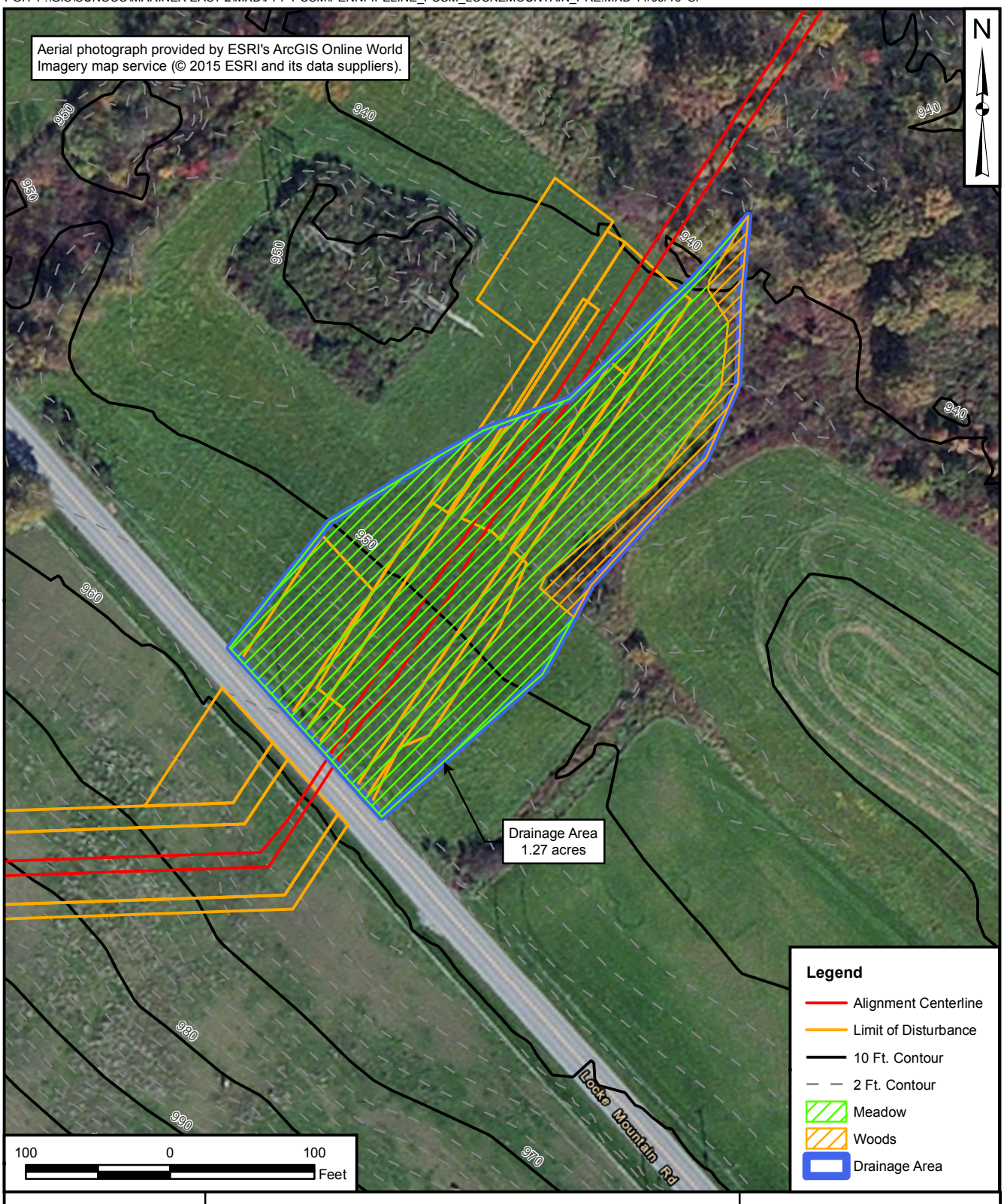

TETRA TECH

PRE-DEVELOPMENT DRAINAGE AREA MAP
LOCKE MOUNTAIN ROAD
PENNSYLVANIA PIPELINE PROJECT
SUNOCO LOGISTICS, L.P.
BLAIR COUNTY, PENNSYLVANIA

DRAWN BY: S. PAXTON 05/19/16
CHECKED BY: J. BRODY 11/09/16
APPROVED BY:

CONTRACT NUMBER: 112IC05958

FIGURE NUMBER	REV
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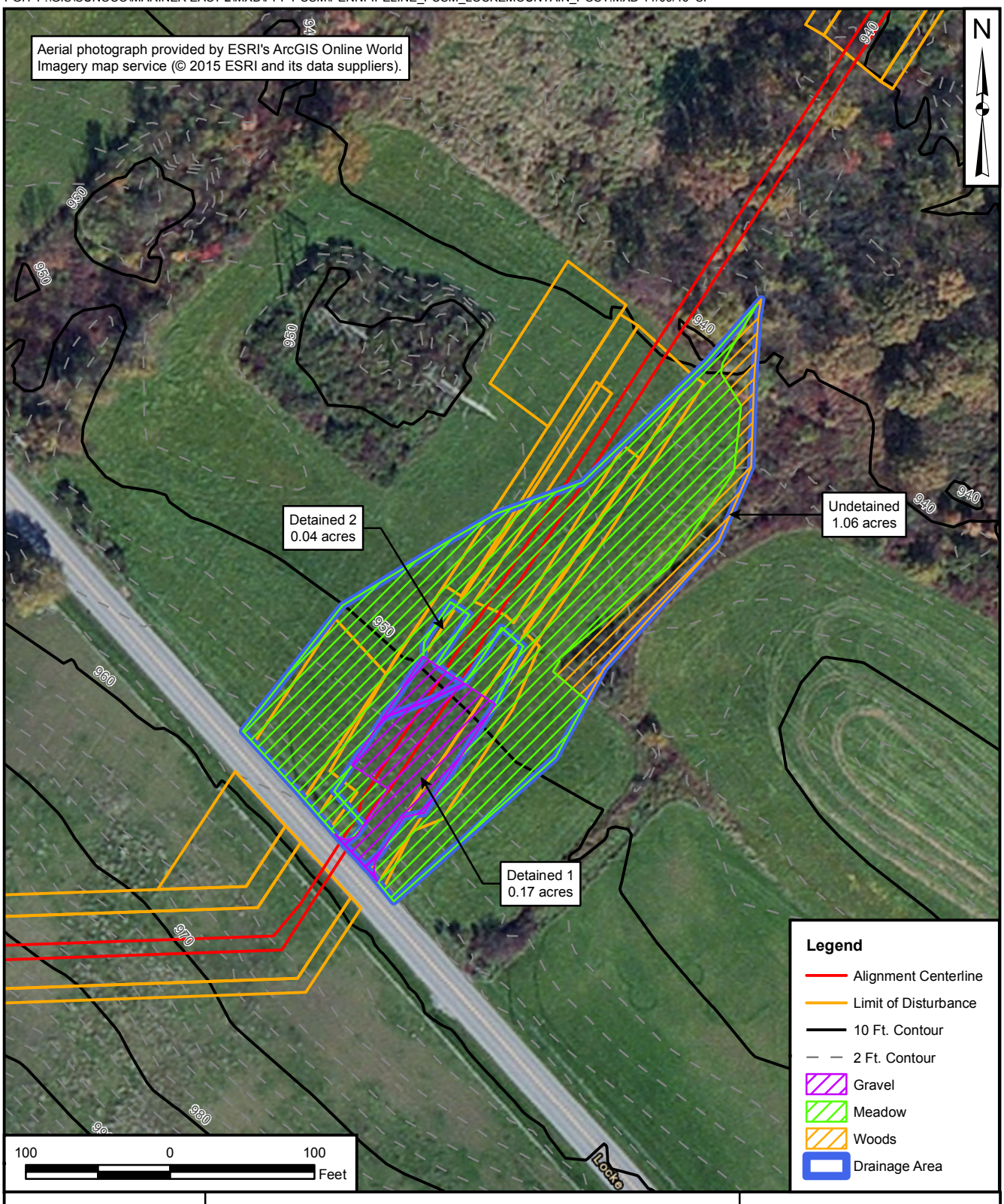

TETRA TECH

POST-DEVELOPMENT DRAINAGE AREA MAP
LOCKE MOUNTAIN ROAD
PENNSYLVANIA PIPELINE PROJECT
SUNOCO LOGISTICS, L.P.
BLAIR COUNTY, PENNSYLVANIA

DRAWN BY: S. PAXTON 05/20/16
CHECKED BY: J. BRODY 11/09/16
APPROVED BY:

CONTRACT NUMBER: 112IC05958

FIGURE NUMBER	REV
2	0

NOAA Atlas 14, Volume 2, Version 3
Location name: Frankstown Twp, Pennsylvania, USA*
Latitude: 40.4314°, Longitude: -78.336°
Elevation: 950.1 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.308** (0.279-0.343)	**0.369** (0.334-0.410)	**0.450** (0.405-0.499)	**0.513** (0.460-0.568)	**0.596** (0.532-0.658)	**0.662** (0.587-0.729)	**0.727** (0.641-0.799)	**0.794** (0.696-0.872)	**0.888** (0.771-0.973)	**0.958** (0.824-1.05)
10-min	**0.479** (0.433-0.533)	**0.577** (0.521-0.640)	**0.700** (0.630-0.775)	**0.792** (0.711-0.877)	**0.912** (0.813-1.01)	**1.00** (0.890-1.10)	**1.09** (0.965-1.20)	**1.19** (1.04-1.30)	**1.31** (1.13-1.43)	**1.40** (1.20-1.52)
15-min	**0.587** (0.530-0.654)	**0.705** (0.637-0.783)	**0.859** (0.773-0.952)	**0.975** (0.874-1.08)	**1.13** (1.00-1.24)	**1.24** (1.10-1.37)	**1.36** (1.20-1.50)	**1.48** (1.29-1.62)	**1.63** (1.41-1.78)	**1.74** (1.50-1.91)
30-min	**0.777** (0.702-0.865)	**0.944** (0.852-1.05)	**1.18** (1.06-1.30)	**1.35** (1.21-1.50)	**1.59** (1.42-1.76)	**1.77** (1.57-1.95)	**1.96** (1.73-2.16)	**2.15** (1.89-2.36)	**2.41** (2.10-2.64)	**2.61** (2.25-2.86)
60-min	**0.949** (0.857-1.06)	**1.16** (1.05-1.29)	**1.48** (1.33-1.64)	**1.72** (1.54-1.91)	**2.06** (1.84-2.28)	**2.34** (2.07-2.58)	**2.63** (2.31-2.89)	**2.92** (2.56-3.21)	**3.34** (2.90-3.66)	**3.67** (3.16-4.01)
2-hr	**1.09** (0.979-1.23)	**1.32** (1.19-1.48)	**1.69** (1.51-1.89)	**1.98** (1.76-2.21)	**2.40** (2.11-2.66)	**2.73** (2.39-3.03)	**3.09** (2.69-3.42)	**3.47** (3.00-3.83)	**4.01** (3.43-4.43)	**4.45** (3.77-4.92)
3-hr	**1.18** (1.06-1.32)	**1.43** (1.29-1.59)	**1.80** (1.62-2.01)	**2.11** (1.89-2.35)	**2.55** (2.27-2.82)	**2.91** (2.57-3.21)	**3.30** (2.89-3.64)	**3.71** (3.23-4.08)	**4.31** (3.70-4.72)	**4.79** (4.07-5.25)
6-hr	**1.47** (1.33-1.65)	**1.78** (1.60-1.98)	**2.22** (2.00-2.47)	**2.58** (2.31-2.87)	**3.10** (2.76-3.43)	**3.54** (3.13-3.90)	**4.00** (3.50-4.40)	**4.49** (3.90-4.94)	**5.20** (4.47-5.70)	**5.78** (4.92-6.33)
12-hr	**1.82** (1.65-2.04)	**2.19** (1.98-2.45)	**2.72** (2.45-3.03)	**3.16** (2.84-3.52)	**3.81** (3.39-4.23)	**4.35** (3.84-4.82)	**4.94** (4.33-5.45)	**5.58** (4.84-6.15)	**6.50** (5.57-7.15)	**7.27** (6.16-7.99)
24-hr	**2.23** (2.04-2.44)	**2.67** (2.45-2.93)	**3.33** (3.05-3.64)	**3.86** (3.53-4.22)	**4.64** (4.21-5.06)	**5.28** (4.78-5.75)	**5.97** (5.37-6.49)	**6.71** (5.99-7.29)	**7.78** (6.87-8.46)	**8.66** (7.57-9.41)
2-day	**2.53** (2.33-2.77)	**3.04** (2.79-3.33)	**3.77** (3.46-4.12)	**4.37** (4.00-4.78)	**5.24** (4.78-5.72)	**5.97** (5.40-6.50)	**6.75** (6.07-7.35)	**7.58** (6.76-8.25)	**8.77** (7.74-9.56)	**9.75** (8.52-10.6)
3-day	**2.69** (2.48-2.93)	**3.22** (2.97-3.51)	**3.98** (3.66-4.33)	**4.60** (4.23-5.01)	**5.51** (5.04-5.98)	**6.26** (5.69-6.79)	**7.05** (6.38-7.65)	**7.91** (7.10-8.58)	**9.13** (8.10-9.92)	**10.1** (8.89-11.0)
4-day	**2.84** (2.63-3.08)	**3.39** (3.14-3.69)	**4.18** (3.87-4.54)	**4.83** (4.46-5.24)	**5.77** (5.30-6.24)	**6.54** (5.98-7.08)	**7.36** (6.69-7.96)	**8.24** (7.44-8.92)	**9.48** (8.46-10.3)	**10.5** (9.27-11.4)
7-day	**3.36** (3.13-3.62)	**4.01** (3.74-4.32)	**4.88** (4.55-5.26)	**5.58** (5.19-6.01)	**6.55** (6.07-7.04)	**7.33** (6.75-7.87)	**8.13** (7.46-8.73)	**8.96** (8.17-9.64)	**10.1** (9.14-10.9)	**11.0** (9.87-11.9)
10-day	**3.92** (3.66-4.20)	**4.65** (4.35-4.99)	**5.58** (5.22-5.98)	**6.33** (5.91-6.78)	**7.35** (6.84-7.87)	**8.16** (7.57-8.74)	**8.99** (8.30-9.63)	**9.84** (9.03-10.6)	**11.0** (10.0-11.8)	**11.9** (10.8-12.8)
20-day	**5.36** (5.08-5.67)	**6.32** (5.98-6.69)	**7.38** (6.98-7.81)	**8.20** (7.74-8.67)	**9.26** (8.72-9.79)	**10.1** (9.46-10.7)	**10.8** (10.2-11.5)	**11.6** (10.9-12.3)	**12.6** (11.7-13.4)	**13.3** (12.3-14.1)
30-day	**6.70** (6.35-7.06)	**7.85** (7.44-8.27)	**9.01** (8.54-9.49)	**9.91** (9.38-10.4)	**11.0** (10.4-11.6)	**11.9** (11.2-12.5)	**12.7** (12.0-13.4)	**13.5** (12.7-14.2)	**14.4** (13.5-15.2)	**15.1** (14.1-16.0)
45-day	**8.48** (8.06-8.92)	**9.92** (9.43-10.4)	**11.3** (10.7-11.8)	**12.2** (11.6-12.9)	**13.4** (12.8-14.1)	**14.3** (13.6-15.0)	**15.1** (14.3-15.8)	**15.8** (14.9-16.6)	**16.6** (15.7-17.5)	**17.2** (16.2-18.2)
60-day	**10.2** (9.75-10.7)	**11.9** (11.4-12.5)	**13.4** (12.8-14.0)	**14.4** (13.8-15.1)	**15.7** (15.0-16.4)	**16.5** (15.8-17.3)	**17.3** (16.5-18.1)	**18.0** (17.2-18.9)	**18.8** (17.9-19.7)	**19.3** (18.4-20.3)

[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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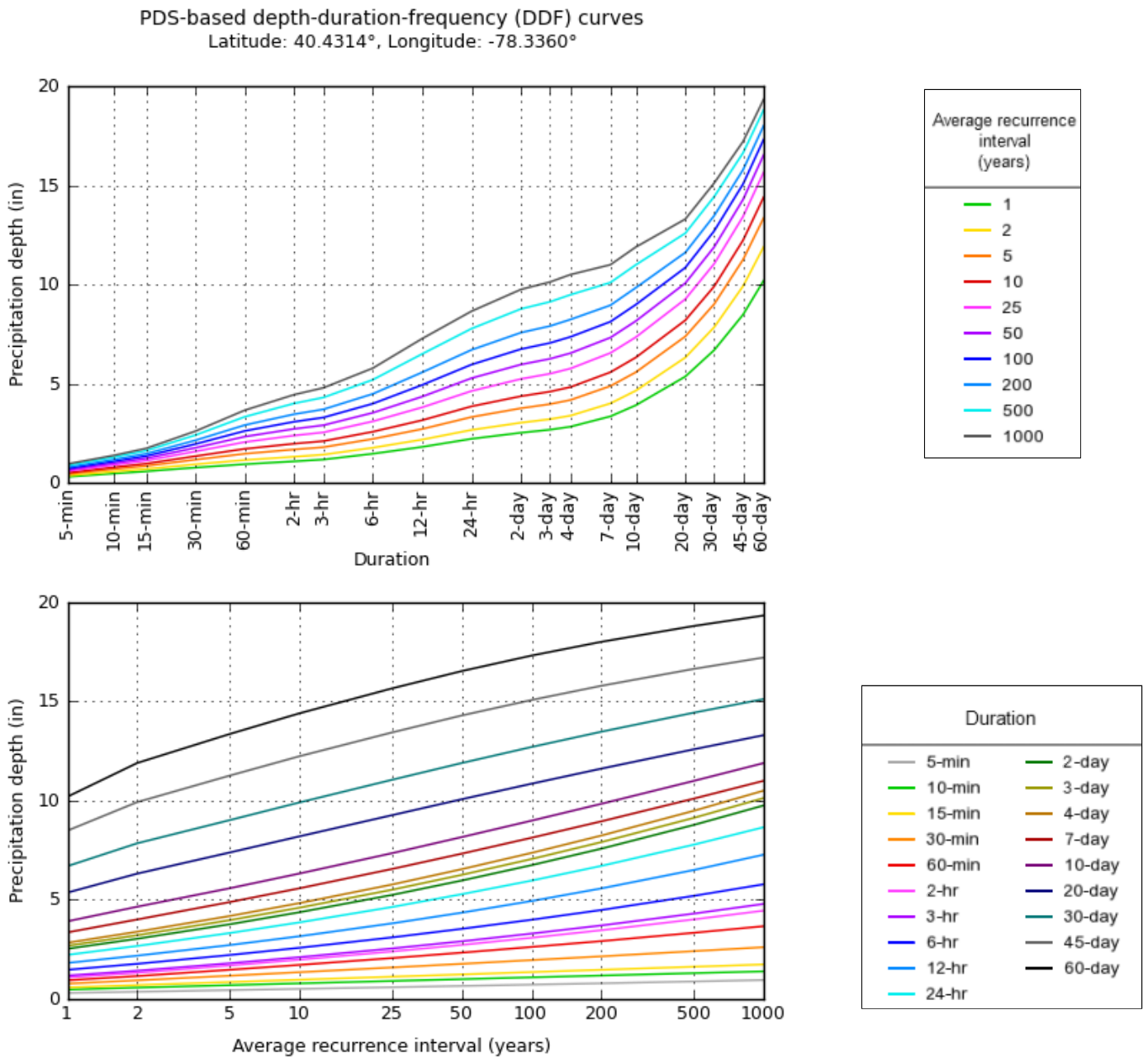
PF graphical



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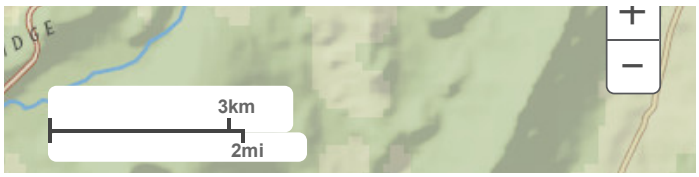
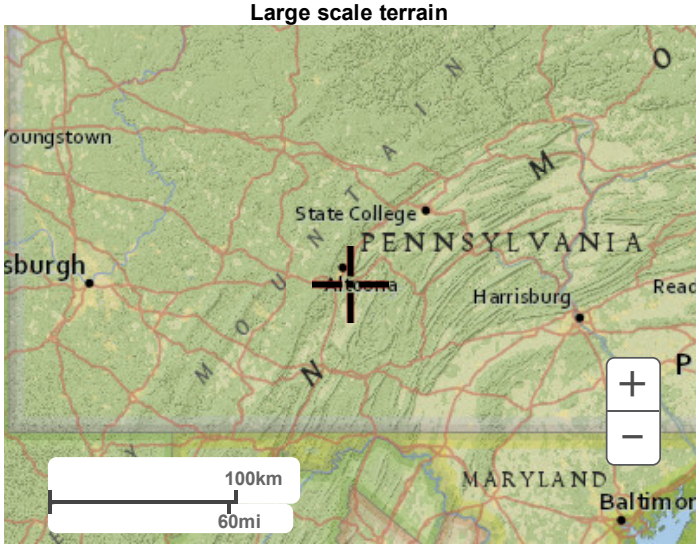
Maps & aerials

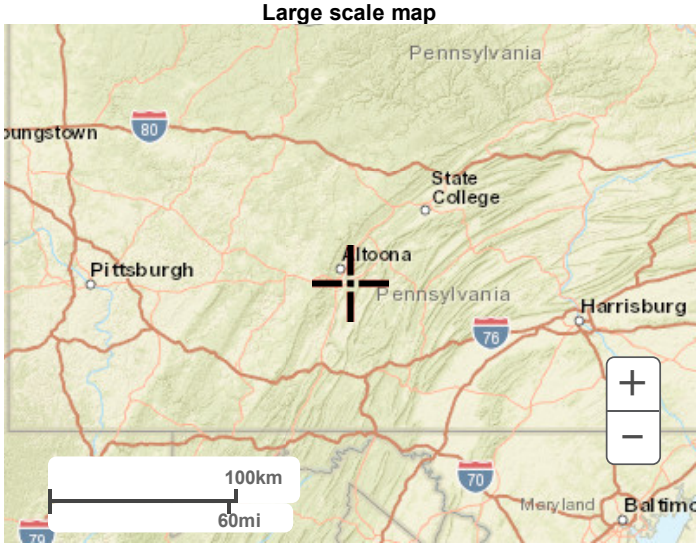
Small scale terrain



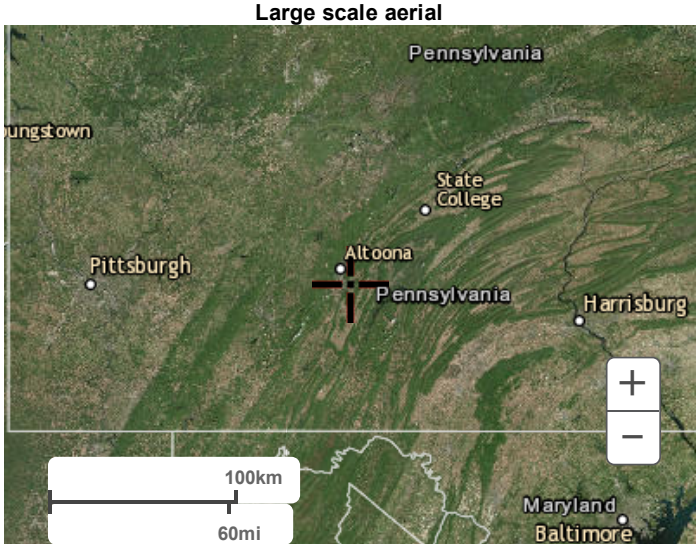
Large scale terrain



Large scale map



Large scale aerial



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WORKSHEET 1. GENERAL SITE INFORMATION

Date: November 11, 2016

Project Name: Locke Mountain Road

Municipality: Frankstown

County: Blair

Total Area (acres): 1.27

Major River Basin: Susquehanna River

Watershed: Frankstown Branch Juniata River

Sub Basin: Little Juniata River

Nearest Surface Water to Receive Runoff: Tributary #16298 to Robinson Run

Chapter 93 - Designated Water Use: Warm Water Fishes (WWF)

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

Is Project Subject to, or Part of:

Municipal Separate Storm Sewer System (MS4) Requirements	YES	X
	NO	
Existing or Planned drinking water supply?	YES	
	NO	X
If yes, distance from proposed discharge (miles):		
Approved Act 167 Plan?	YES	
	NO	X
Existing River Conservation Plan?	YES	X
	NO	

Worksheet 2. Sensitive Natural Resources

INSTRUCTIONS

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

   See pre-development drainage area map

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

   0.00 acres

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

   0.00 acres

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

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

Worksheet 3. Nonstructural BMP Credits

PROTECTED AREA

1.1 Area of Protected Sensitive/Special Value Features (see WS 2) 0.00 **Ac.**

1.2 Area of Riparian Forest Buffer Protection 0.00 **Ac.**

3.1 Area of Minimum Disturbance/Reduced Grading 0.00 **Ac**

TOTAL 0.00 **Ac**

Site Area	Minus	Protected Area	=	Stormwater Management Area
0.70	-	0	=	0.70

This is the area that requires stormwater management

VOLUME CREDITS

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

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

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

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

For Trees within 100 feet of impervious area:

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

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

For runoff directed to areas protected under 5.8.1 and 5.8.2

Roof Area _____ ft^2 x 1/3" x 1/12 = _____ ft^3

For all other disconnected roof areas

Roof Area _____ ft^2 x 1/4" x 1/12 = _____ ft^3

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

For Runoff directed to areas protected under 5.8.1 and 5.8.2

Impervious Area _____ ft^2 x 1/3" x 1/12 = _____ ft^3

For all other disconnected roof areas

Impervious Area _____ ft^2 x 1/4" x 1/12 = _____ ft^3

TOTAL NON-STRUCTURAL VOLUME CREDIT* _____ ft^3

**For use on Worksheet 5*

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

PROJECT: Locke Mountain Road
Drainage Area: 1.27 acres
2-Year Rainfall: 2.67 in

Total Site Area: 0.70 acres
Protected Site Area: N/A acres
Managed Site Area: 0.70 acres

Existing Conditions

Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff[1] (in)	Runoff Volume[3] (ft^3)
Meadow	C	6,970	0.16	71	4.08	0.82	0.58	336
Meadow	D	23,522	0.54	78	2.82	0.56	0.90	1,765
TOTAL:		**30,492**	**0.70**					**2,100**

Developed Conditions

Cover Type/Condition	Soil Type	Area (sf)	Area (ac)	CN	S	Ia (0.2*S)	Q Runoff[1] (in)	Runoff Volume[3] (ft^3)
Meadow	C	5,227	0.12	71	4.08	0.82	0.58	252
Meadow	D	18,731	0.43	78	2.82	0.56	0.90	1,405
Impervious - Gravel	C	1,742	0.04	89	1.24	0.25	1.60	233
Impervious - Gravel	D	4,792	0.11	91	0.99	0.20	1.77	705
TOTAL:		**30,492**	**0.70**					**2,595**

2-Year Volume Increase (ft^3):	**495**

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

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

2. Runoff Volume (CF) = Q x Area x 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: Locke Mountain Road
SUB-BASIN:

Required Control Volume (ft^3) - *from Worksheet 4:* 495

Non-structural Volume Credit (ft^3) - *from Worksheet 3:* N/A
(maximum is 25% of required volume)

Structural Volume Reqmt (ft^3): 495
(Required Control Volume minus Non-structural Credit)

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/Bioretention		
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		
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:	Slow Release Concept	108	719
		Total Structural Volume (ft^3):	**719**
		Structural Volume Requirement (ft^3):	**495**
		DIFFERENCE:	**-224**

VOLUME CREDIT DETERMINATION DETAINED 1

1 Detained area runoff volume from Hydraflow = 800 cf

2 Storage volume of the BMP = 540 cf

VOLUME CREDIT DETERMINATION DETAINED 2

1 Detained area runoff volume from Hydraflow = 179 cf

2 Storage volume of the BMP = 432 cf

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		
NS BMP 5.5.4 - Cluster Uses at Each Site		
NS BMP 5.6.1 - Minimize Total Disturbed Area	X	
NS BMP 5.6.3 - Re-Vegetate / Re-Forest Disturbed Areas (Native Species)	X	
NS BMP 5.9.1 - Street Sweeping / Vacuuming		
Structural BMP 6.7.1 - Riparian Buffer Restoration		
Structural BMP 6.7.2 - Landscape Restoration		

SECONDARY BMPs FOR NITRATE:

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

Underdrain Dewatering Rate Calculation

Project: Locke Mtn **BMP:** 1

Filter Media				
Layer	**Media**	**Thickness - T (ft)**	**Min. Infiltration Rate - K (ft/min)[1]**	**Flow Rate (cfs)[2]**
1	Clean Gravel	N/A	2	N/A
2	Coarse Sand	1	0.02	0.04
3	Fine Sand	1	0.002	0.00400
4	Other[3]	N/A	N/A	N/A
			Minimum Flow Rate (cfs)	**0.004**

1. From Principles of Geotechnical Engineering Third Edition, Braja Das, 1994
2. Q=KA(Hm+T/T)
   A = Area (square feet) = 60
   Hm = Head above media (feet) = 2
3. Infiltration rate measured in field or laboratory

Perforated Pipe				
Pipe	**Perforation Area (square inch)[4]**	**# Perforations per Foot - N**	**Pipe Length - L (ft)**	**Flow Rate (cfs)[5]**
1	1.00	1	20	0.98
2	N/A	N/A	N/A	N/A
			Total Flow Rate (cfs)	**0.98**

4. Reference: PVC: certainteed.com HDPE: ads-pipe.com
5. Q= N*L*cAo√(2GH)
   c = Orifice Coefficient = 0.6
   Ao= Perforation Area (sq. ft.) 0.007
   G= Grav. Accel. (ft/sec^2) 32.2
   H= Average Head (ft) = 3.5

Pipe Discharge				
Pipe	**Pipe Diameter - D (in)**	**Pipe Roughness Coefficient -n**	**Pipe Slope - S[6]**	**Flow Rate (cfs)[7]**
1	4	0.012	0.016666667	0.27
2	N/A	N/A	N/A	N/A
			Total Flow Rate (cfs)	**0.27**

6. For flat pipe, use hydraulic grade (pipe diameter/pipe length) for the pipe slope
7. From Manning's equation (attach separate calculation worksheet)

Limiting flow rate from combined underdrain system - Ql (cfs) =	**0.004**
Berm Ponding Volume (cu-ft) =	**540**
Total Dewatering Volume including volume in voids(cu-ft) =	**588**
Dewatering Time (sec) = 2HA/Ql =	**147,000**
Dewatering Time (hrs) =	**40.83**

TIME OF CONCENTRATION ADJUSTMENT DETAINED 1

POST CONSTRUCTION TC TO BMP (DETAINED TC) BEFORE ADJUSTMENT 6.1 MIN

STRUCTURAL VOLUME PROVIDED BY BMP 540 CF

RATES OF RUNOFF TO THE BMP (FROM HYDRAFLOW REPORT)

Storm Event	Q (CFS)
2 YR/24 HR	0.396
10 YR/24 HR	0.683
50 YR/24 HR	1.031
100 YR/24 HR	1.2

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	0.396	22.727
10 YR/24 HR	0.683	13.177
50 YR/24 HR	1.031	8.729
100 YR/24 HR	1.200	7.500

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	0.396	22.727	28.827
10 YR/24 HR	0.683	13.177	19.277
50 YR/24 HR	1.031	8.729	14.829
100 YR/24 HR	1.200	7.500	13.600

Underdrain Dewatering Rate Calculation

Project: Locke Mtn **BMP:** 2

Filter Media				
Layer	**Media**	**Thickness - T (ft)**	**Min. Infiltration Rate - K (ft/min)[1]**	**Flow Rate (cfs)[2]**
1	Clean Gravel	N/A	2	N/A
2	Coarse Sand	N/A	0.02	N/A
3	Fine Sand	2	0.002	0.00160
4	Other[3]	N/A	N/A	N/A
			Minimum Flow Rate (cfs)	**0.002**

1. From Principles of Geotechnical Engineering Third Edition, Braja Das, 1994
2. Q=KA(Hm+T/T)
   A = Area (square feet) = 48
   Hm = Head above media (feet) = 2
3. Infiltration rate measured in field or laboratory

Perforated Pipe				
Pipe	**Perforation Area (square inch)[4]**	**# Perforations per Foot - N**	**Pipe Length - L (ft)**	**Flow Rate (cfs)[5]**
1	1.00	1	16	0.79
2	N/A	N/A	N/A	N/A
			Total Flow Rate (cfs)	**0.79**

4. Reference: PVC: certainteed.com HDPE: ads-pipe.com
5. Q= N*L*cAo√(2GH)
   c = Orifice Coefficient = 0.6
   Ao= Perforation Area (sq. ft.) 0.007
   G= Grav. Accel. (ft/sec^2) 32.2
   H= Average Head (ft) = 3.5

Pipe Discharge				
Pipe	**Pipe Diameter - D (in)**	**Pipe Roughness Coefficient -n**	**Pipe Slope - S[6]**	**Flow Rate (cfs)[7]**
1	4	0.012	0.020833333	0.30
2	N/A	N/A	N/A	N/A
			Total Flow Rate (cfs)	**0.30**

6. For flat pipe, use hydraulic grade (pipe diameter/pipe length) for the pipe slope
7. From Manning's equation (attach separate calculation worksheet)

Limiting flow rate from combined underdrain system - Ql (cfs) =	**0.002**
Detained volume based on 2-year/24-hour storm (cu-ft) =	**179**
Total Dewatering Volume including volume in voids(cu-ft) =	**217**
Dewatering Time (sec) = 2HA/Ql =	**135,875**
Dewatering Time (hrs) =	**37.74**

TIME OF CONCENTRATION ADJUSTMENT DETAINED 2

POST CONSTRUCTION TC TO BMP (DETAINED TC) BEFORE ADJUSTMENT 5.4 MIN

STRUCTURAL VOLUME PROVIDED BY BMP 179 CF

RATES OF RUNOFF TO THE BMP (FROM HYDRAFLOW REPORT)

Storm Event	Q (CFS)
2 YR/24 HR	0.089
10 YR/24 HR	0.155
50 YR/24 HR	0.237
100 YR/24 HR	0.277

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	0.089	33.521
10 YR/24 HR	0.155	19.247
50 YR/24 HR	0.237	12.588
100 YR/24 HR	0.277	10.770

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	0.089	33.521	38.921
10 YR/24 HR	0.155	19.247	24.647
50 YR/24 HR	0.237	12.588	17.988
100 YR/24 HR	0.277	10.770	16.170

Underdrain Report

Label	Solve For	Friction Method	Roughness Coefficient
Circular Pipe - 1	Full Flow Capacity	Manning Formula	0.012

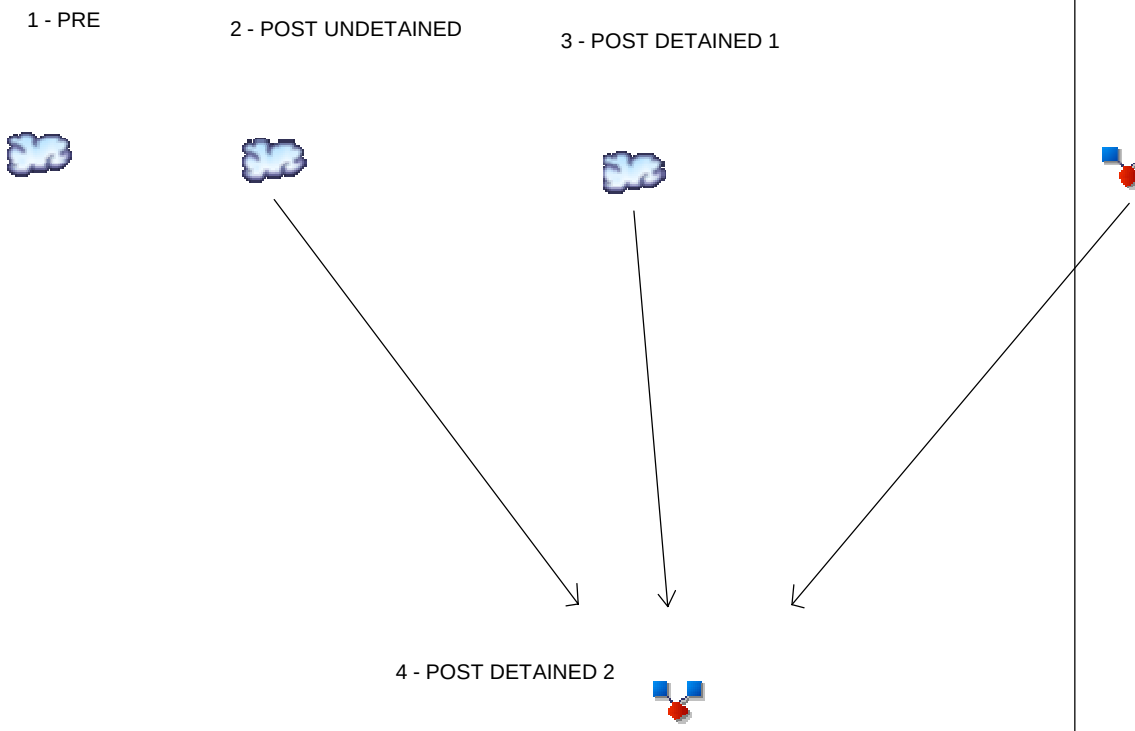
Channel Slope (ft/ft)	Normal Depth (ft)	Diameter (ft)	Discharge (ft^3/s)
0.08600	0.33	0.33	0.60

Flow Area (ft^2)	Wetted Perimeter (ft)	Hydraulic Radius (ft)	Top Width (ft)
0.09	1.05	0.08	0.00

Critical Depth (ft)	Percent Full (%)	Critical Slope (ft/ft)	Velocity (ft/s)
0.33	100.0	0.07993	6.93

Watershed Model Schematic

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



Legend

Hyd.	Origin	Description
1	SCS Runoff	PRE
2	SCS Runoff	POST UNDETAINED
3	SCS Runoff	POST DETAINED 1
4	SCS Runoff	POST DETAINED 2
5	Combine	POST AT POI

Hydrograph Return Period Recap

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	------	-------	1.688	-------	-------	3.430	-------	5.756	6.933	PRE
2	SCS Runoff	------	-------	1.409	-------	-------	2.863	-------	4.805	5.786	POST UNDETAINED
3	SCS Runoff	------	-------	0.396	-------	-------	0.683	-------	1.031	1.200	POST DETAINED 1
4	SCS Runoff	------	-------	0.089	-------	-------	0.155	-------	0.237	0.277	POST DETAINED 2
5	Combine	2, 3, 4	-------	1.854	-------	-------	3.676	-------	6.036	7.217	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	1.688	2	720	3,914	------	------	------	PRE
2	SCS Runoff	1.409	2	720	3,267	------	------	------	POST UNDETAINED
3	SCS Runoff	0.396	2	716	800	------	------	------	POST DETAINED 1
4	SCS Runoff	0.089	2	716	179	------	------	------	POST DETAINED 2
5	Combine	1.854	2	718	4,246	2, 3, 4	------	------	POST AT POI

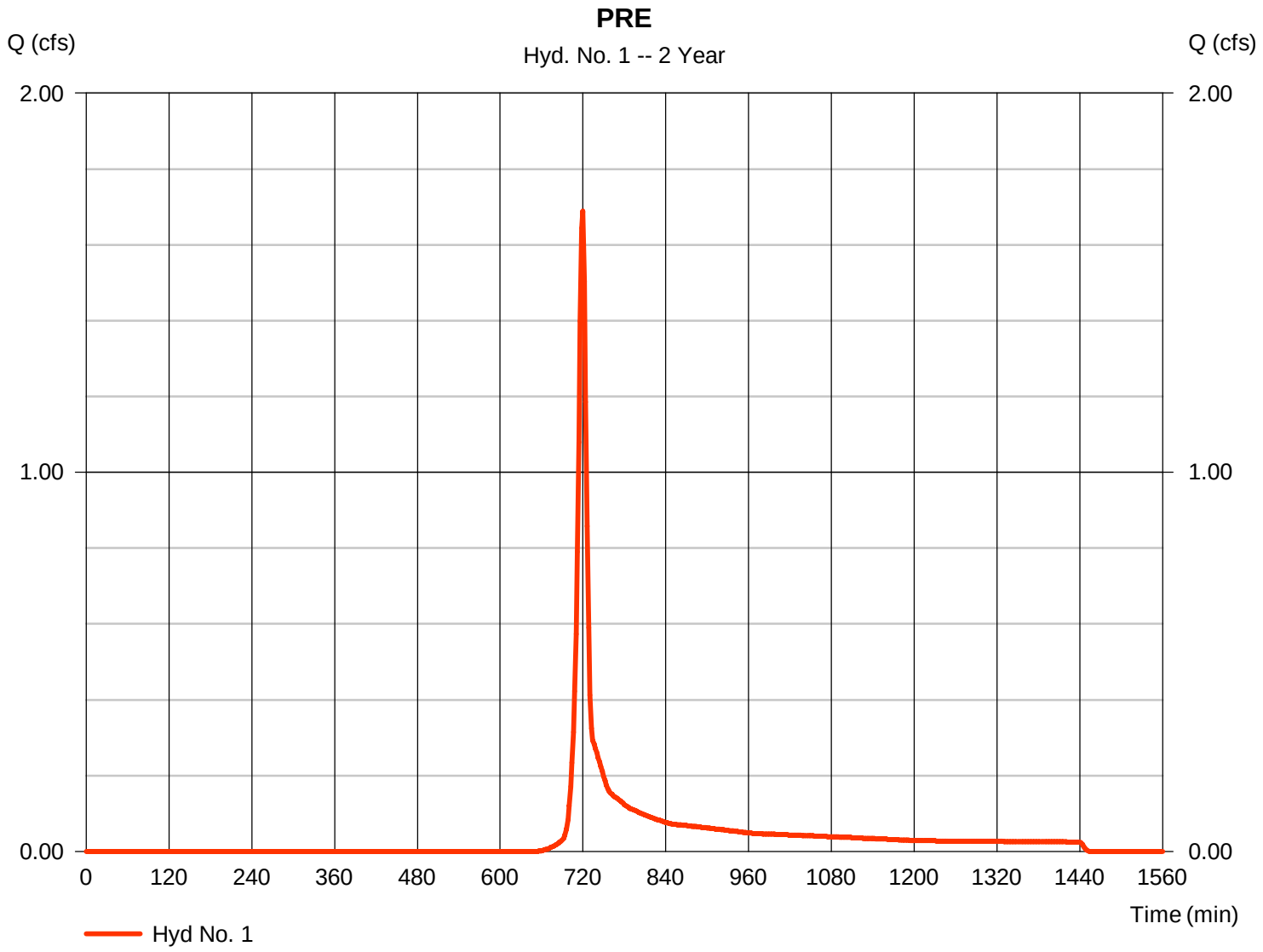
Hydrograph Report

Hyd. No. 1

PRE

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.688 cfs
Storm frequency	=	2 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	3,914 cuft
Drainage area	=	1.270 ac	Curve number	=	77*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	7.20 min
Total precip.	=	2.67 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.200 x 71) + (0.950 x 78) + (0.120 x 77)] / 1.270



TR55 Tc Worksheet

Hyd. No. 1

PRE

Description	A		B		C		Totals
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)	= 2.67		0.00		0.00		
Land slope (%)	= 8.00		0.00		0.00		
Travel Time (min)	**= 5.15**	**+**	**0.00**	**+**	**0.00**	**=**	**5.15**
Shallow Concentrated Flow							
Flow length (ft)	= 343.00		0.00		0.00		
Watercourse slope (%)	= 2.90		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.75		0.00		0.00		
Travel Time (min)	**= 2.08**	**+**	**0.00**	**+**	**0.00**	**=**	**2.08**
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 ..... 7.20 min

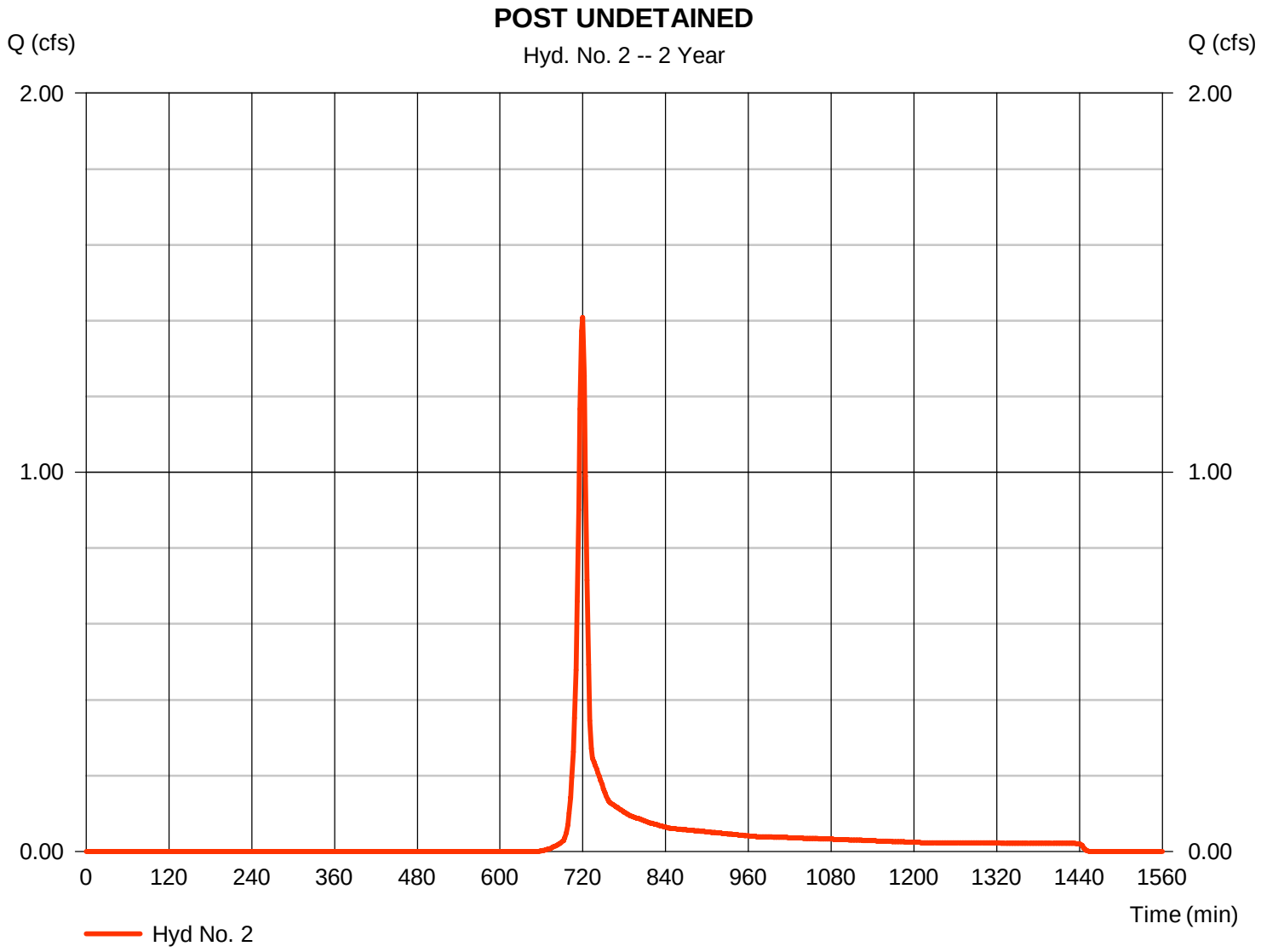
Hydrograph Report

Hyd. No. 2

POST UNDETAINED

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.409 cfs
Storm frequency	=	2 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	3,267 cuft
Drainage area	=	1.060 ac	Curve number	=	77*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	7.20 min
Total precip.	=	2.67 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.140 x 71) + (0.800 x 78) + (0.110 x 77) + (0.010 x 89)] / 1.060



TR55 Tc Worksheet

Hyd. No. 2

POST UNDETAINED

Description	A		B		C		Totals
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)	= 2.67		0.00		0.00		
Land slope (%)	= 8.00		0.00		0.00		
Travel Time (min)	**= 5.15**	**+**	**0.00**	**+**	**0.00**	**=**	**5.15**
Shallow Concentrated Flow							
Flow length (ft)	= 343.00		0.00		0.00		
Watercourse slope (%)	= 2.90		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.75		0.00		0.00		
Travel Time (min)	**= 2.08**	**+**	**0.00**	**+**	**0.00**	**=**	**2.08**
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 ..... 7.20 min

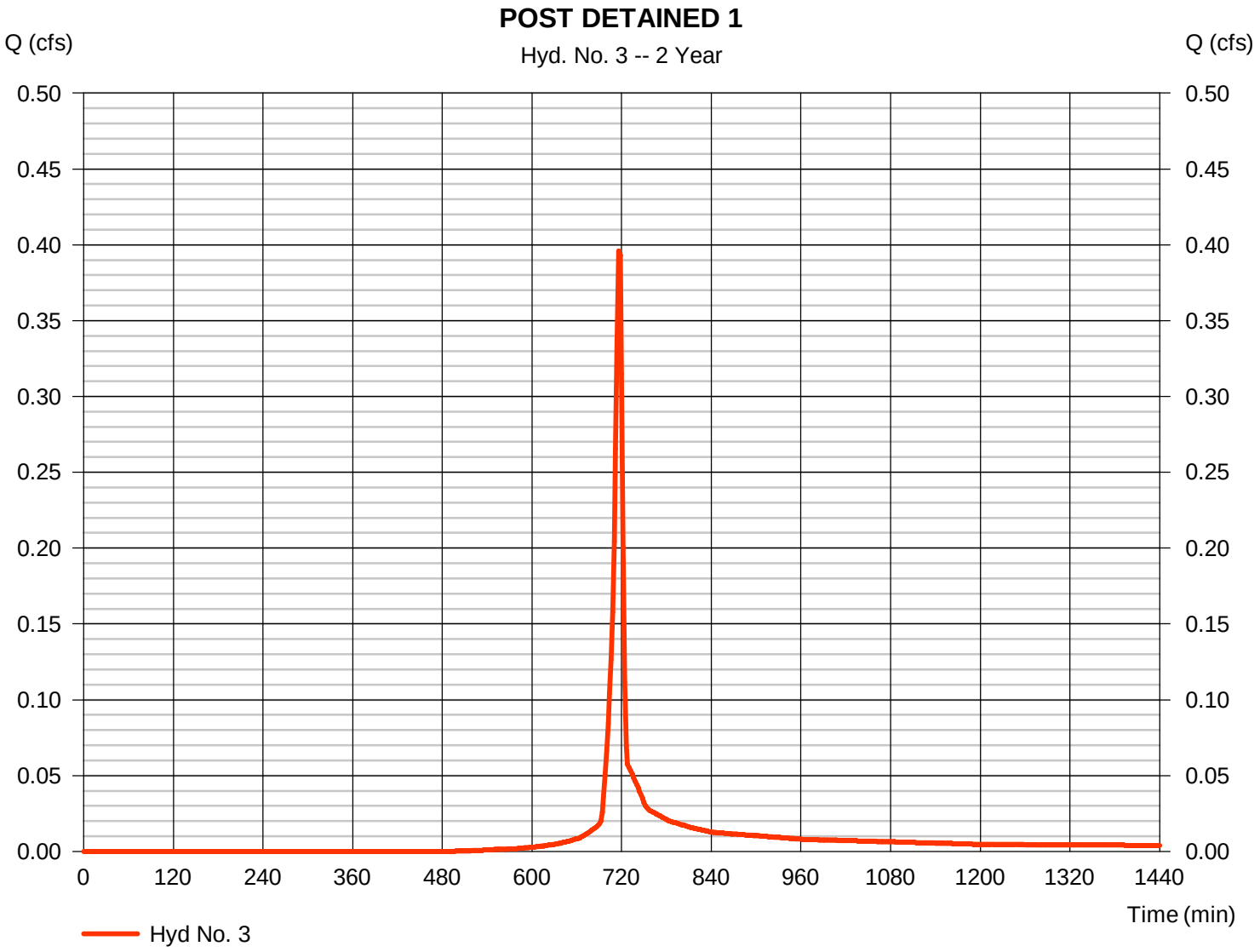
Hydrograph Report

Hyd. No. 3

POST DETAINED 1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.396 cfs
Storm frequency	= 2 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 800 cuft
Drainage area	= 0.170 ac	Curve number	= 86*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 6.10 min
Total precip.	= 2.67 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.030 x 71) + (0.020 x 78) + (0.030 x 89) + (0.090 x 91)] / 0.170



TR55 Tc Worksheet

Hyd. No. 3

POST DETAINED 1

Description	A		B		C		Totals
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)	= 2.67		0.00		0.00		
Land slope (%)	= 7.00		0.00		0.00		
Travel Time (min)	**= 5.44**	**+**	**0.00**	**+**	**0.00**	**=**	**5.44**
Shallow Concentrated Flow							
Flow length (ft)	= 90.00		30.00		0.00		
Watercourse slope (%)	= 2.20		3.30		0.00		
Surface description	= Paved		Unpaved		Paved		
Average velocity (ft/s)	=3.02		2.93		0.00		
Travel Time (min)	**= 0.50**	**+**	**0.17**	**+**	**0.00**	**=**	**0.67**
Channel Flow							
X sectional flow area (sqft)	= 0.09		0.00		0.00		
Wetted perimeter (ft)	= 1.05		0.00		0.00		
Channel slope (%)	= 13.60		0.00		0.00		
Manning's n-value	= 0.012		0.015		0.015		
Velocity (ft/s)	=8.83						
			0.00				
					0.00		
Flow length (ft)	({0})22.0		0.0		0.0		
Travel Time (min)	**= 0.04**	**+**	**0.00**	**+**	**0.00**	**=**	**0.04**

Total Travel Time, Tc ..... 6.10 min

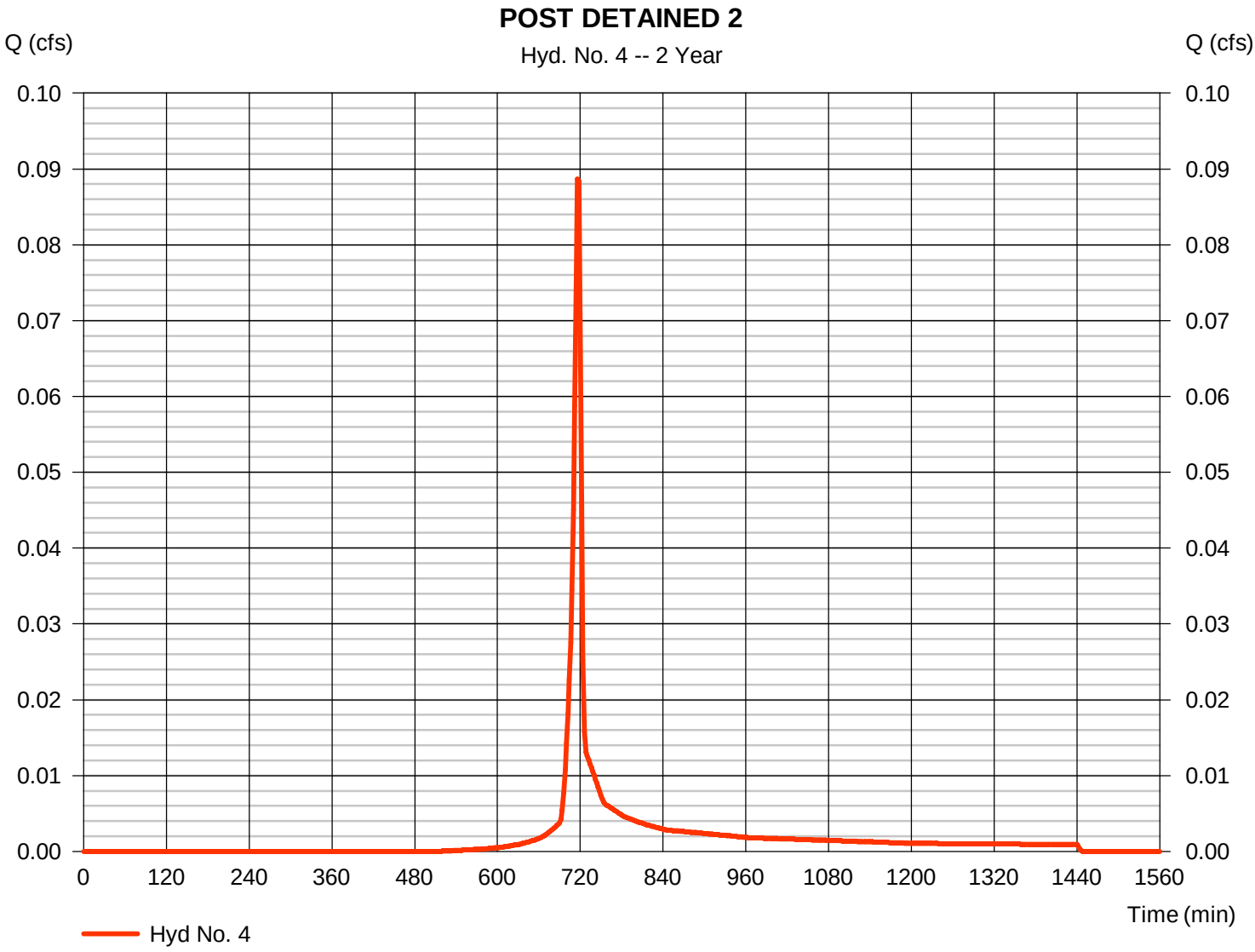
Hydrograph Report

Hyd. No. 4

POST DETAINED 2

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.089 cfs
Storm frequency	=	2 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	179 cuft
Drainage area	=	0.040 ac	Curve number	=	85*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	5.40 min
Total precip.	=	2.67 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.020 x 91) + (0.020 x 78)] / 0.040



TR55 Tc Worksheet

Hyd. No. 4

POST DETAINED 2

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.011		0.011		
Flow length (ft)	= 50.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.67		0.00		0.00		
Land slope (%)	= 3.00		0.00		0.00		
Travel Time (min)	**= 5.24**	**+**	**0.00**	**+**	**0.00**	**=**	**5.24**
Shallow Concentrated Flow							
Flow length (ft)	= 28.00		0.00		0.00		
Watercourse slope (%)	= 3.60		0.00		0.00		
Surface description	= Paved		Unpaved		Paved		
Average velocity (ft/s)	=3.86		0.00		0.00		
Travel Time (min)	**= 0.12**	**+**	**0.00**	**+**	**0.00**	**=**	**0.12**
Channel Flow							
X sectional flow area (sqft)	= 0.09		0.00		0.00		
Wetted perimeter (ft)	= 1.05		0.00		0.00		
Channel slope (%)	= 8.60		0.00		0.00		
Manning's n-value	= 0.012		0.015		0.015		
Velocity (ft/s)	=7.02						
			0.00				
					0.00		
Flow length (ft)	({0})35.0		0.0		0.0		
Travel Time (min)	**= 0.08**	**+**	**0.00**	**+**	**0.00**	**=**	**0.08**

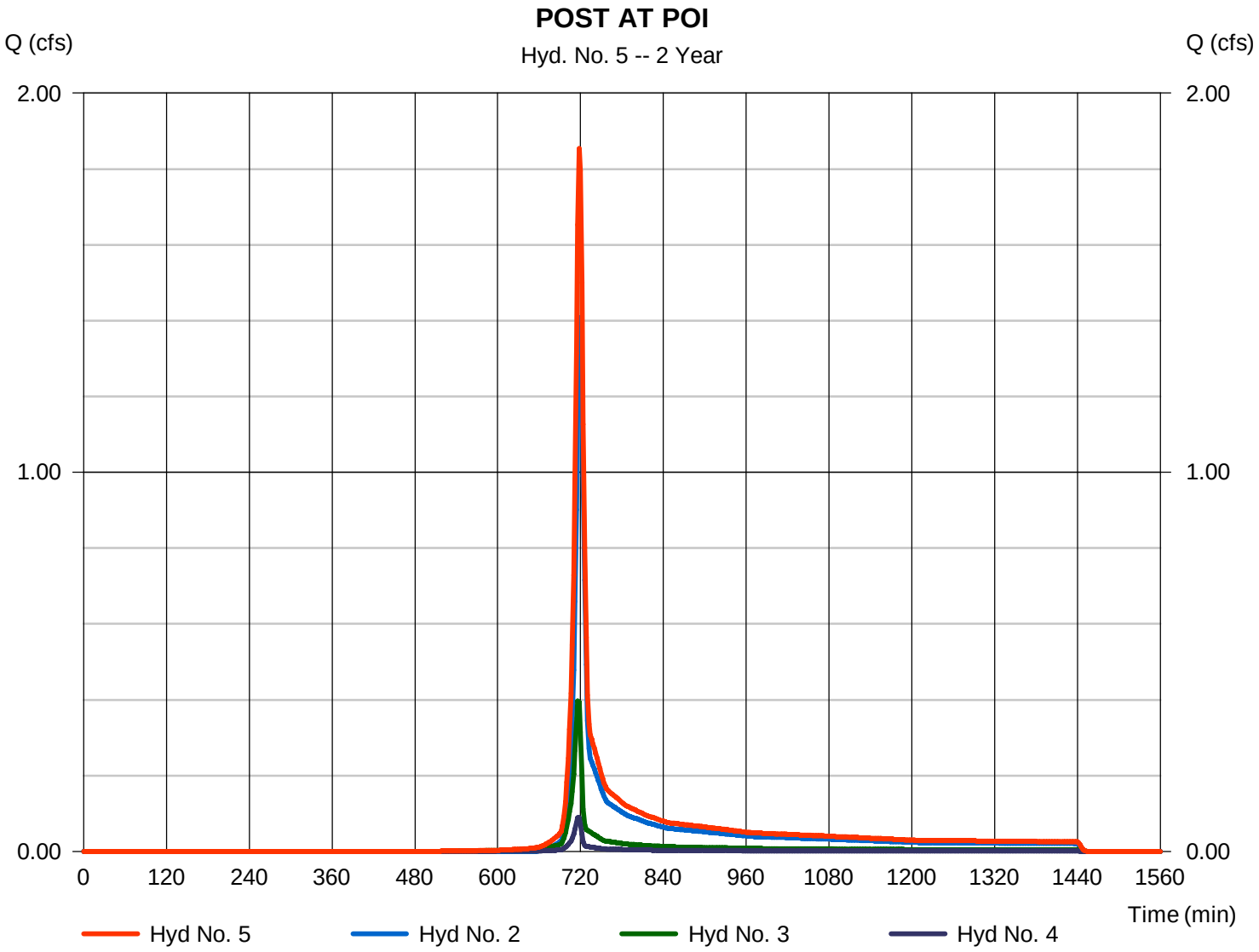
Total Travel Time, Tc ..... 5.40 min

Hydrograph Report

Hyd. No. 5

POST AT POI

Hydrograph type	= Combine	Peak discharge	= 1.854 cfs
Storm frequency	= 2 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 4,246 cuft
Inflow hyds.	= 2, 3, 4	Contrib. drain. area	= 1.270 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	3.430	2	720	7,852	------	------	------	PRE
2	SCS Runoff	2.863	2	720	6,554	------	------	------	POST UNDETAINED
3	SCS Runoff	0.683	2	716	1,400	------	------	------	POST DETAINED 1
4	SCS Runoff	0.155	2	716	318	------	------	------	POST DETAINED 2
5	Combine	3.676	2	718	8,271	2, 3, 4	------	------	POST AT POI

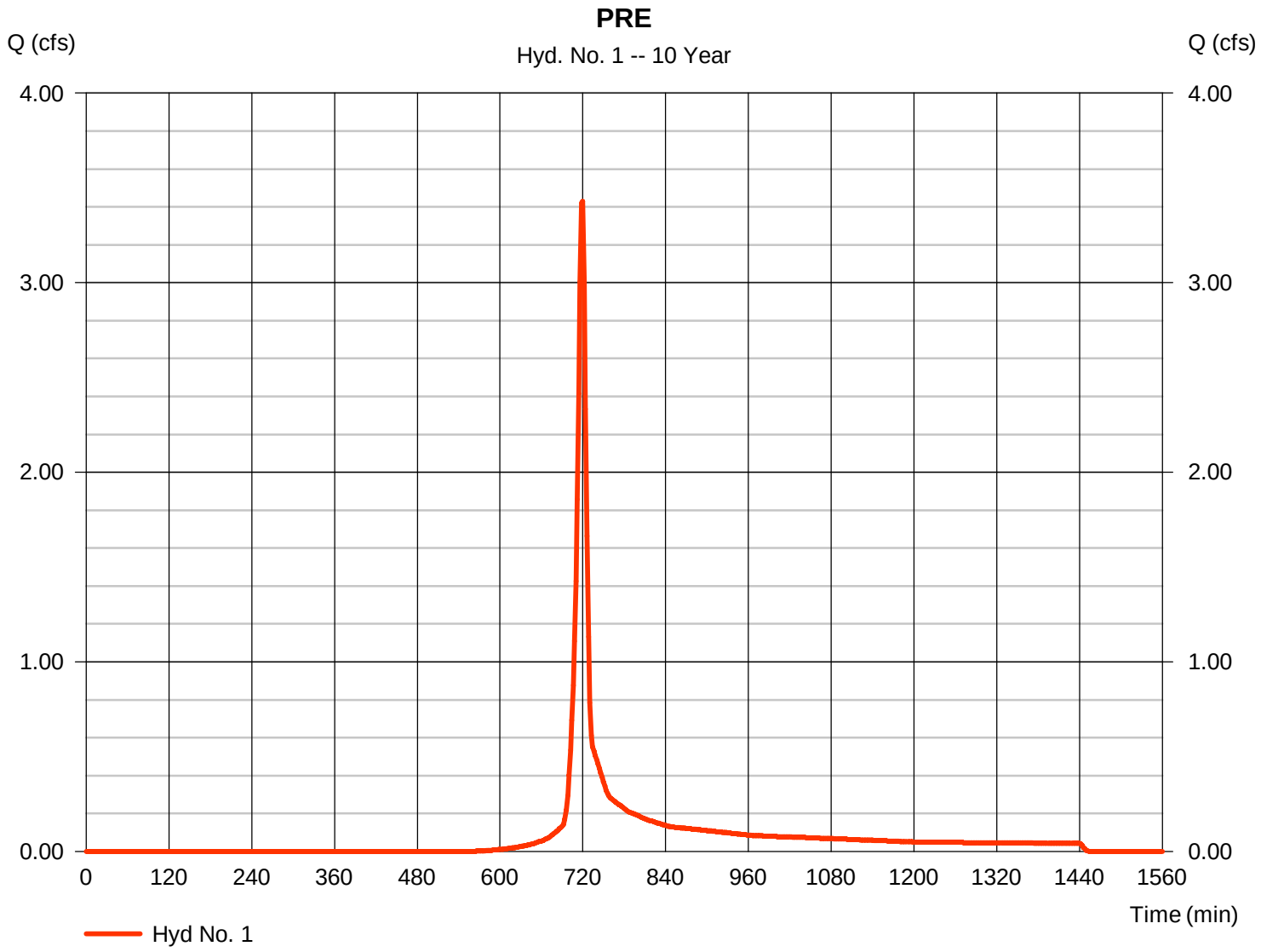
Hydrograph Report

Hyd. No. 1

PRE

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.430 cfs
Storm frequency	=	10 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	7,852 cuft
Drainage area	=	1.270 ac	Curve number	=	77*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	7.20 min
Total precip.	=	3.86 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.200 x 71) + (0.950 x 78) + (0.120 x 77)] / 1.270



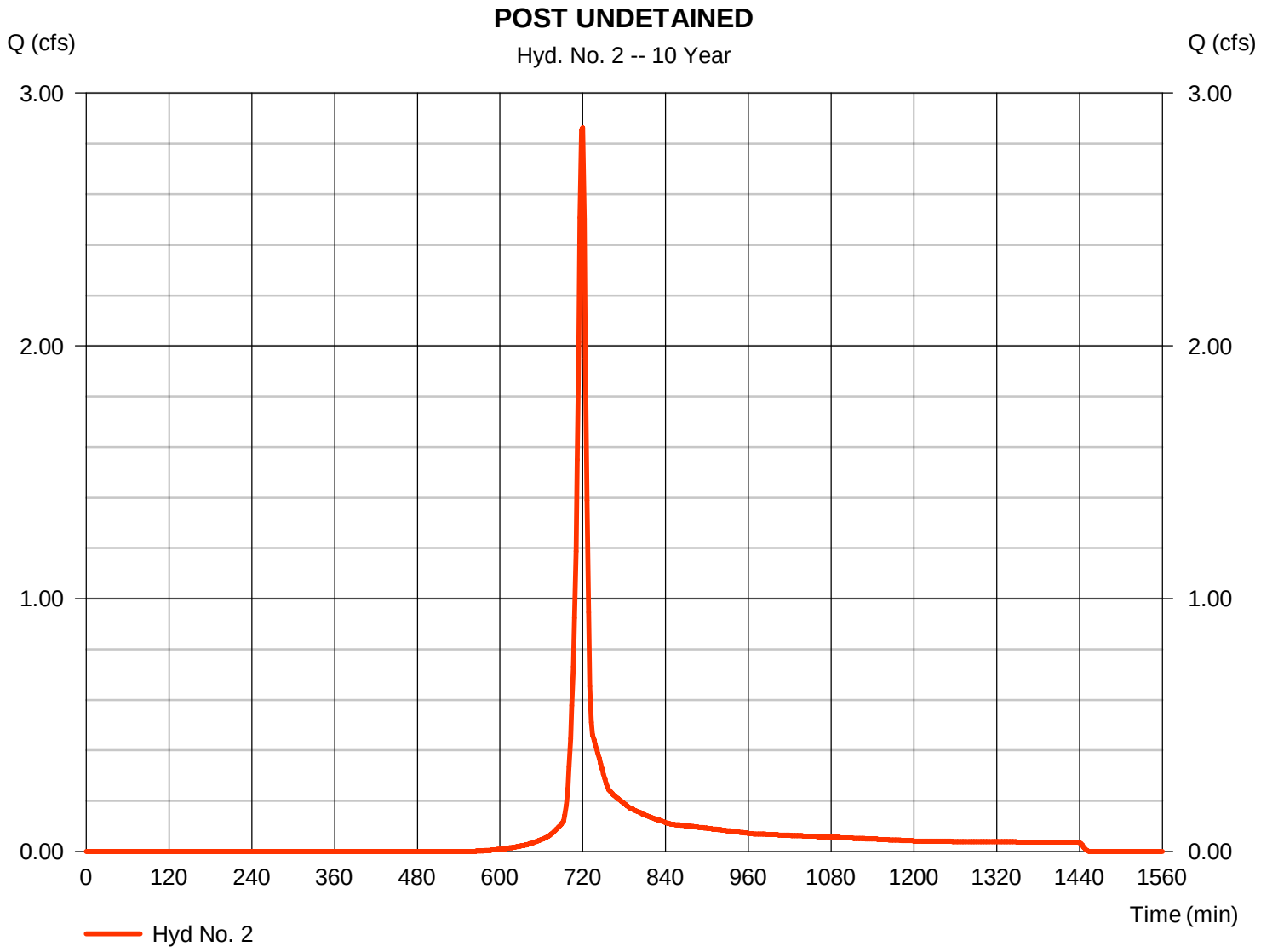
Hydrograph Report

Hyd. No. 2

POST UNDETAINED

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.863 cfs
Storm frequency	=	10 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	6,554 cuft
Drainage area	=	1.060 ac	Curve number	=	77*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	7.20 min
Total precip.	=	3.86 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.140 x 71) + (0.800 x 78) + (0.110 x 77) + (0.010 x 89)] / 1.060



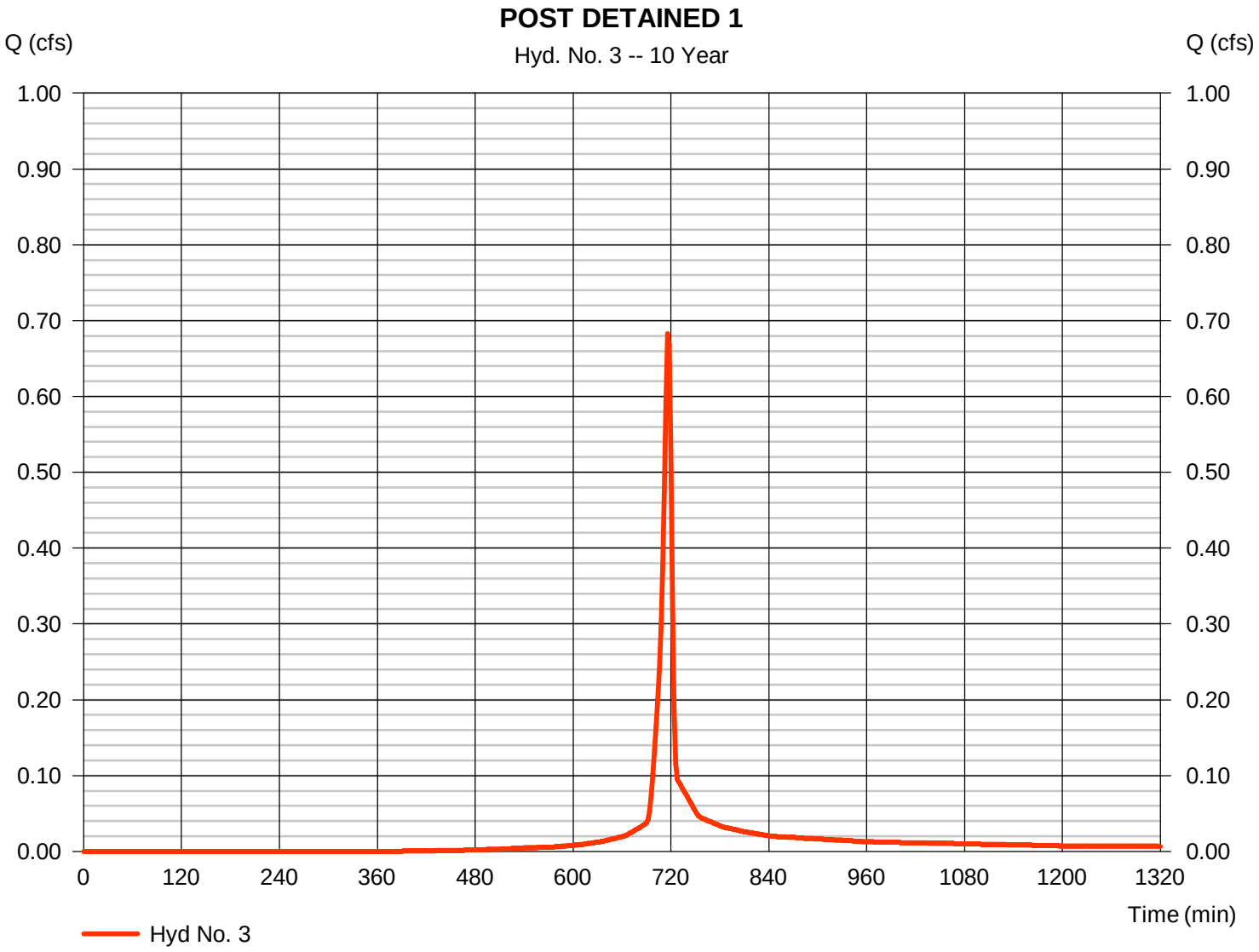
Hydrograph Report

Hyd. No. 3

POST DETAINED 1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.683 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 1,400 cuft
Drainage area	= 0.170 ac	Curve number	= 86*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 6.10 min
Total precip.	= 3.86 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.030 x 71) + (0.020 x 78) + (0.030 x 89) + (0.090 x 91)] / 0.170



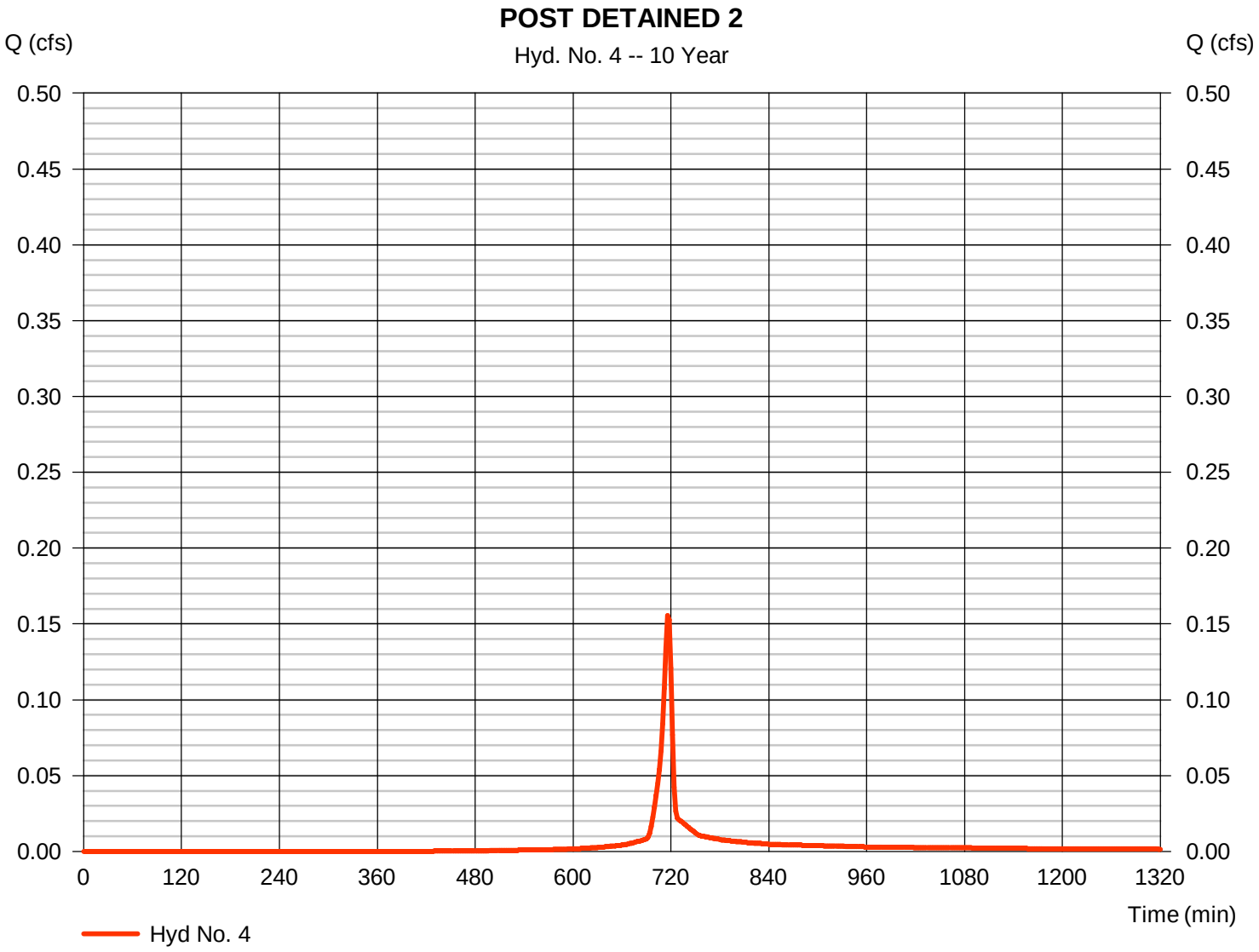
Hydrograph Report

Hyd. No. 4

POST DETAINED 2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.155 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 318 cuft
Drainage area	= 0.040 ac	Curve number	= 85*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 5.40 min
Total precip.	= 3.86 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.020 x 91) + (0.020 x 78)] / 0.040

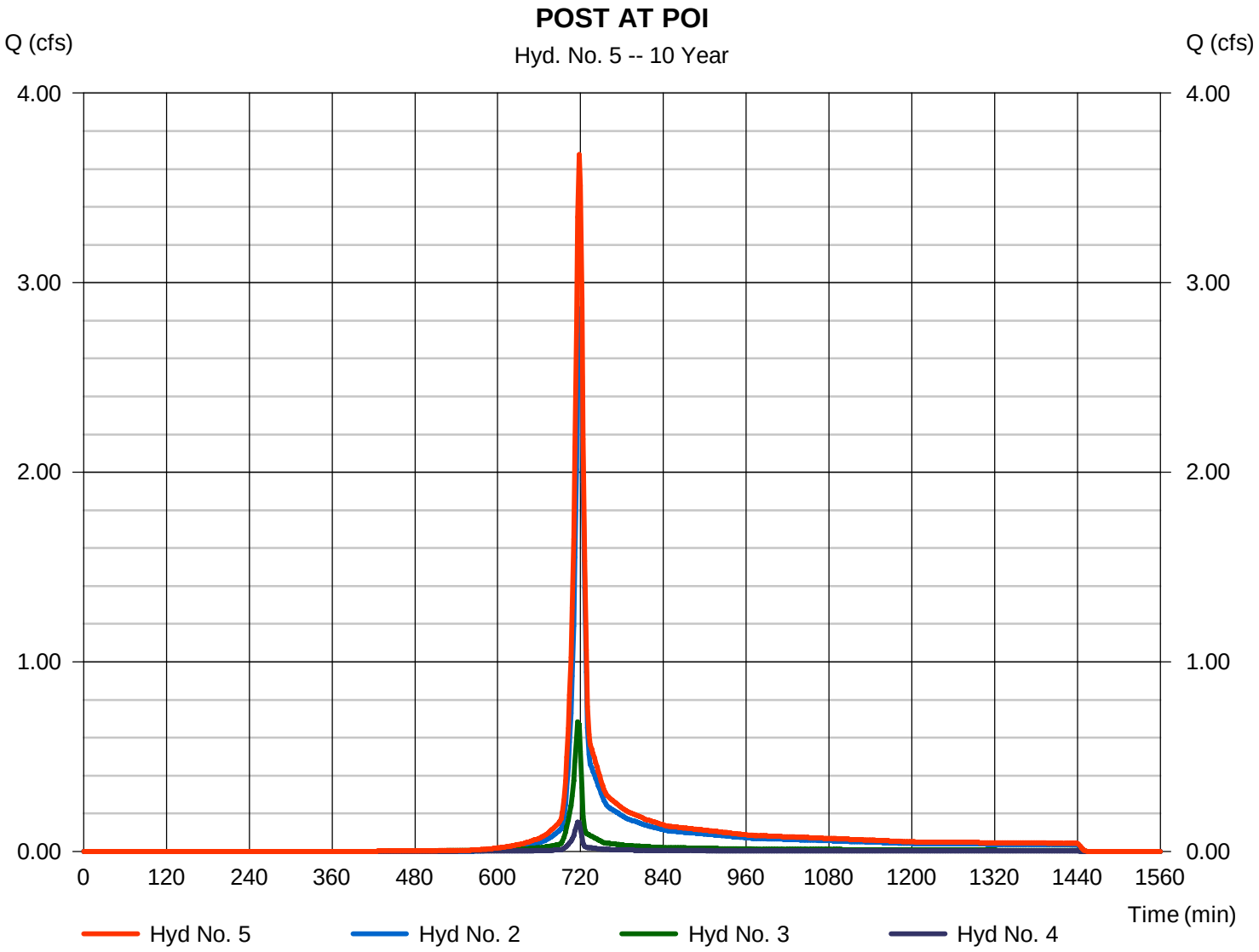


Hydrograph Report

Hyd. No. 5

POST AT POI

Hydrograph type	= Combine	Peak discharge	= 3.676 cfs
Storm frequency	= 10 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 8,271 cuft
Inflow hyds.	= 2, 3, 4	Contrib. drain. area	= 1.270 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	5.756	2	718	13,180	------	------	------	PRE
2	SCS Runoff	4.805	2	718	11,001	------	------	------	POST UNDETAINED
3	SCS Runoff	1.031	2	716	2,157	------	------	------	POST DETAINED 1
4	SCS Runoff	0.237	2	716	494	------	------	------	POST DETAINED 2
5	Combine	6.036	2	718	13,652	2, 3, 4	------	------	POST AT POI

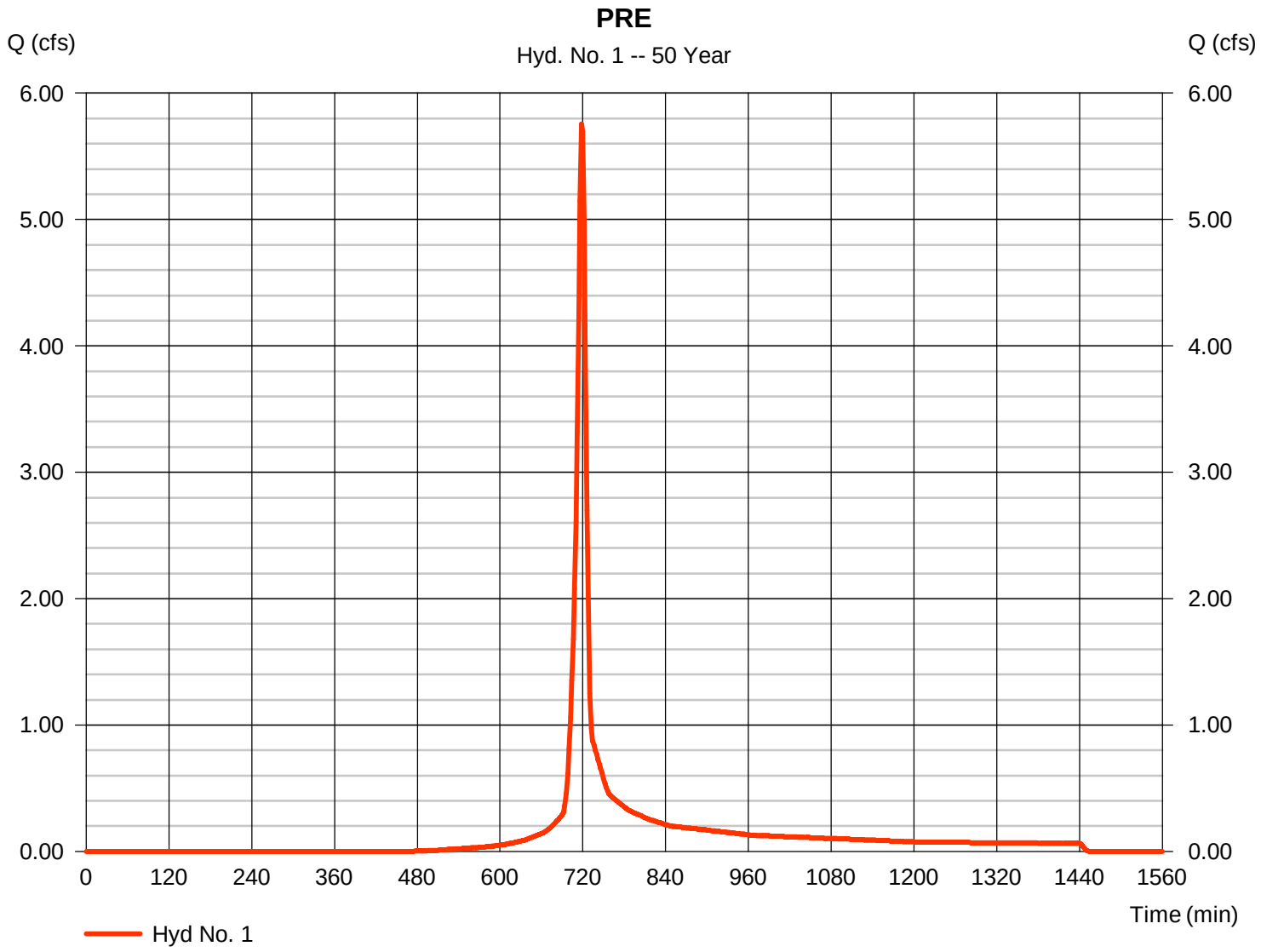
Hydrograph Report

Hyd. No. 1

PRE

Hydrograph type	=	SCS Runoff	Peak discharge	=	5.756 cfs
Storm frequency	=	50 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	13,180 cuft
Drainage area	=	1.270 ac	Curve number	=	77*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	7.20 min
Total precip.	=	5.28 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.200 x 71) + (0.950 x 78) + (0.120 x 77)] / 1.270



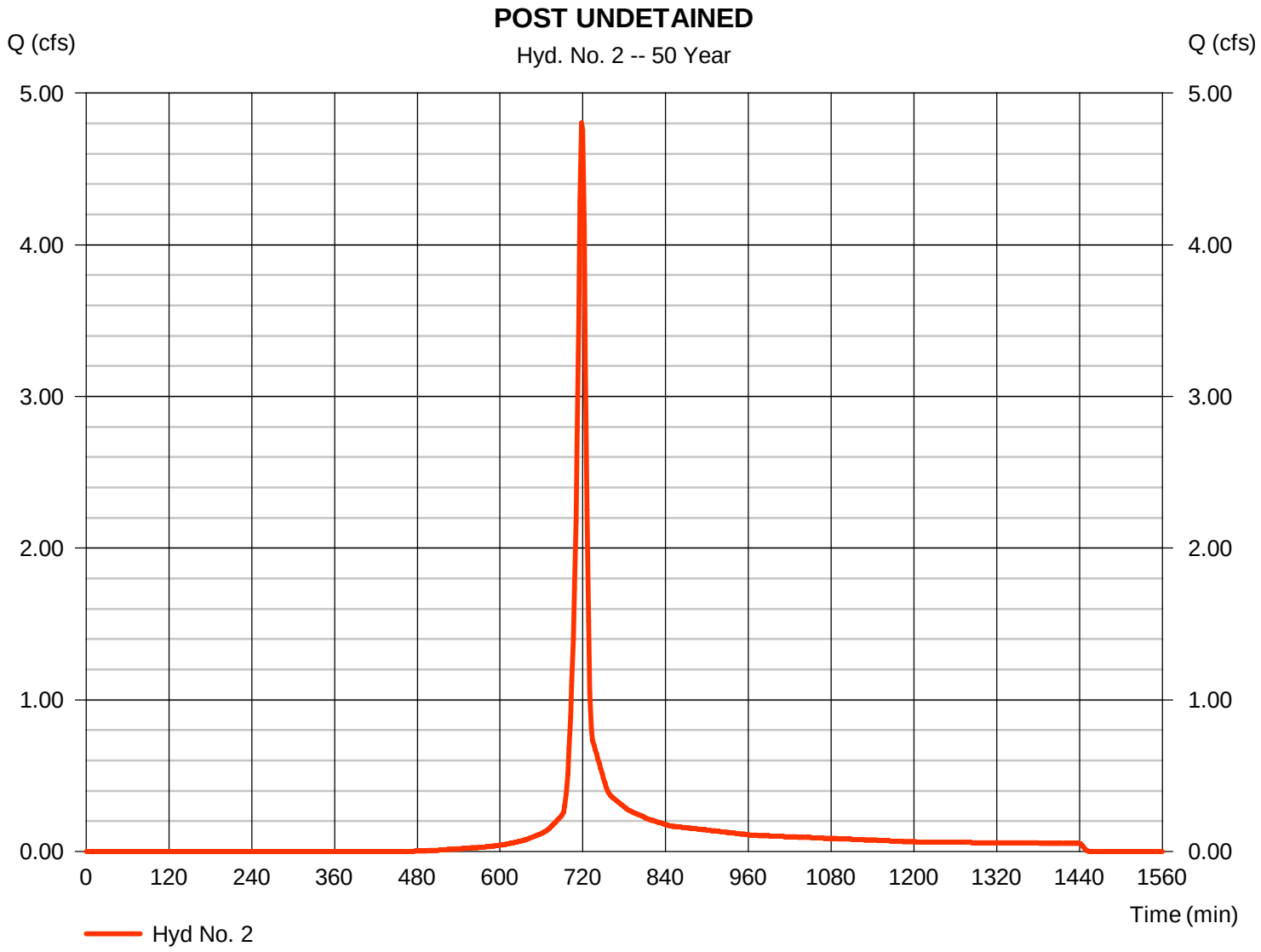
Hydrograph Report

Hyd. No. 2

POST UNDETAINED

Hydrograph type	=	SCS Runoff	Peak discharge	=	4.805 cfs
Storm frequency	=	50 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	11,001 cuft
Drainage area	=	1.060 ac	Curve number	=	77*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	7.20 min
Total precip.	=	5.28 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.140 x 71) + (0.800 x 78) + (0.110 x 77) + (0.010 x 89)] / 1.060



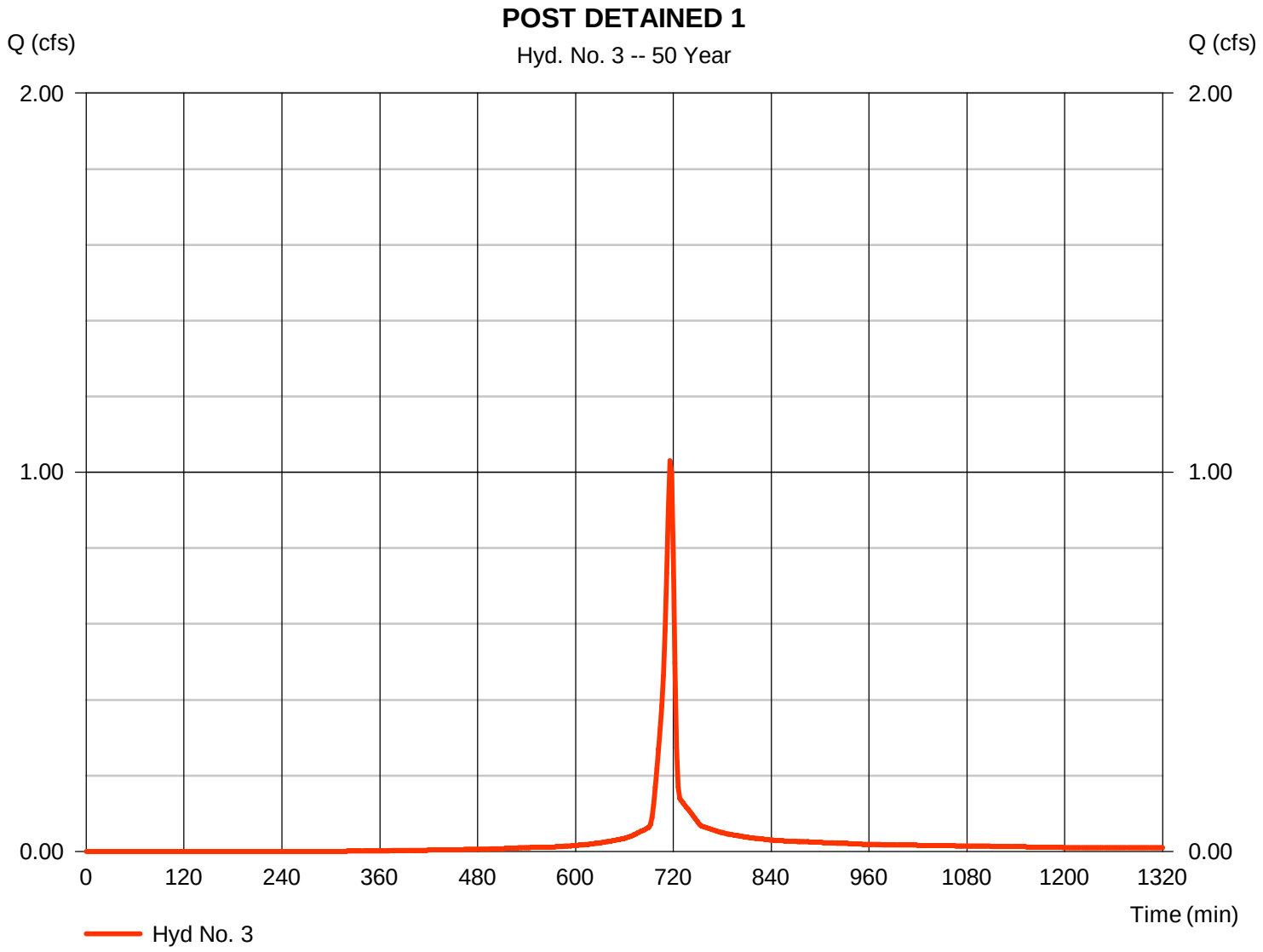
Hydrograph Report

Hyd. No. 3

POST DETAINED 1

Hydrograph type	= SCS Runoff	Peak discharge	= 1.031 cfs
Storm frequency	= 50 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 2,157 cuft
Drainage area	= 0.170 ac	Curve number	= 86*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 6.10 min
Total precip.	= 5.28 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.030 x 71) + (0.020 x 78) + (0.030 x 89) + (0.090 x 91)] / 0.170



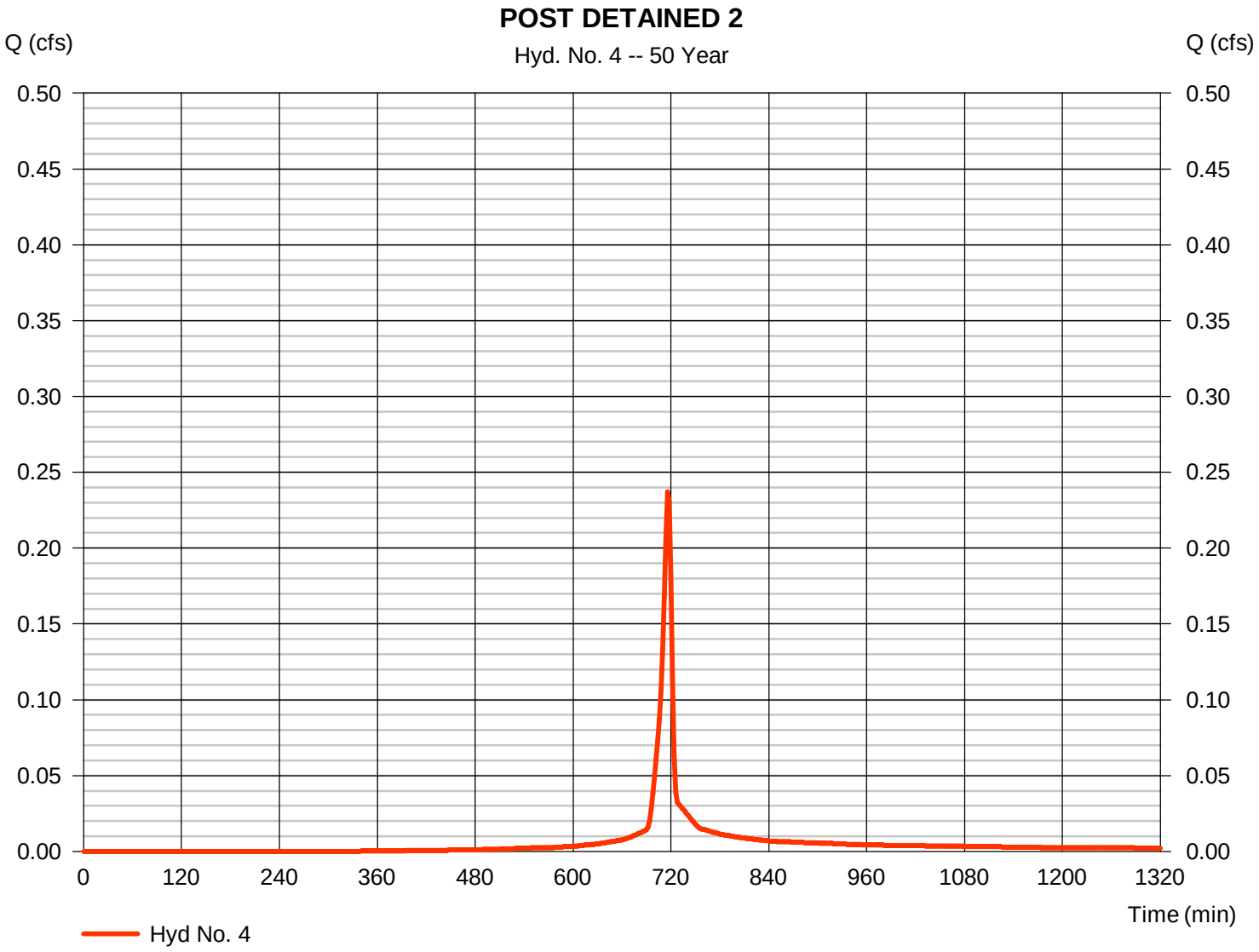
Hydrograph Report

Hyd. No. 4

POST DETAINED 2

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.237 cfs
Storm frequency	=	50 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	494 cuft
Drainage area	=	0.040 ac	Curve number	=	85*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	5.40 min
Total precip.	=	5.28 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.020 x 91) + (0.020 x 78)] / 0.040

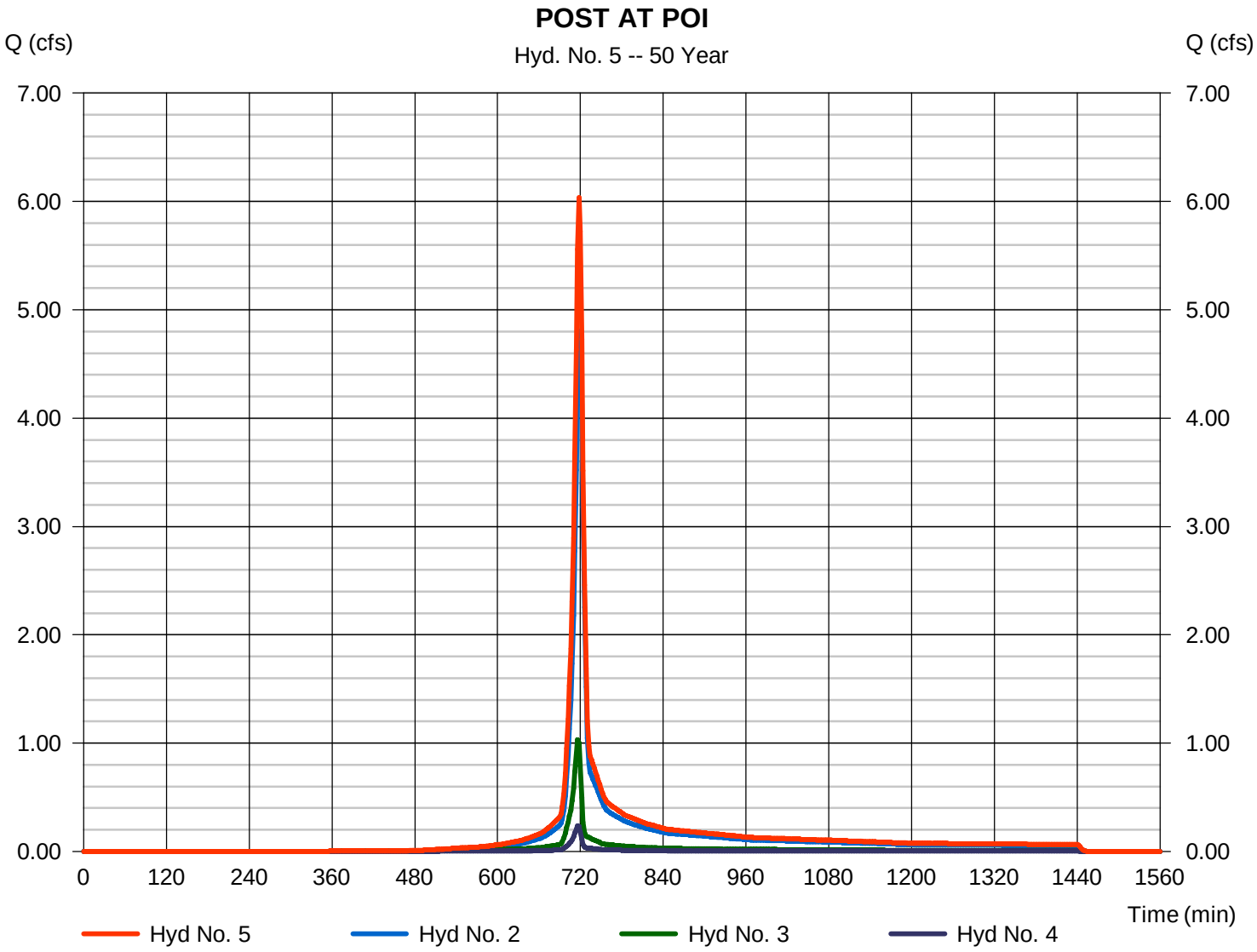


Hydrograph Report

Hyd. No. 5

POST AT POI

Hydrograph type	= Combine	Peak discharge	= 6.036 cfs
Storm frequency	= 50 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 13,652 cuft
Inflow hyds.	= 2, 3, 4	Contrib. drain. area	= 1.270 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	6.933	2	718	15,918	------	------	------	PRE
2	SCS Runoff	5.786	2	718	13,286	------	------	------	POST UNDETAINED
3	SCS Runoff	1.200	2	716	2,534	------	------	------	POST DETAINED 1
4	SCS Runoff	0.277	2	716	582	------	------	------	POST DETAINED 2
5	Combine	7.217	2	718	16,402	2, 3, 4	------	------	POST AT POI

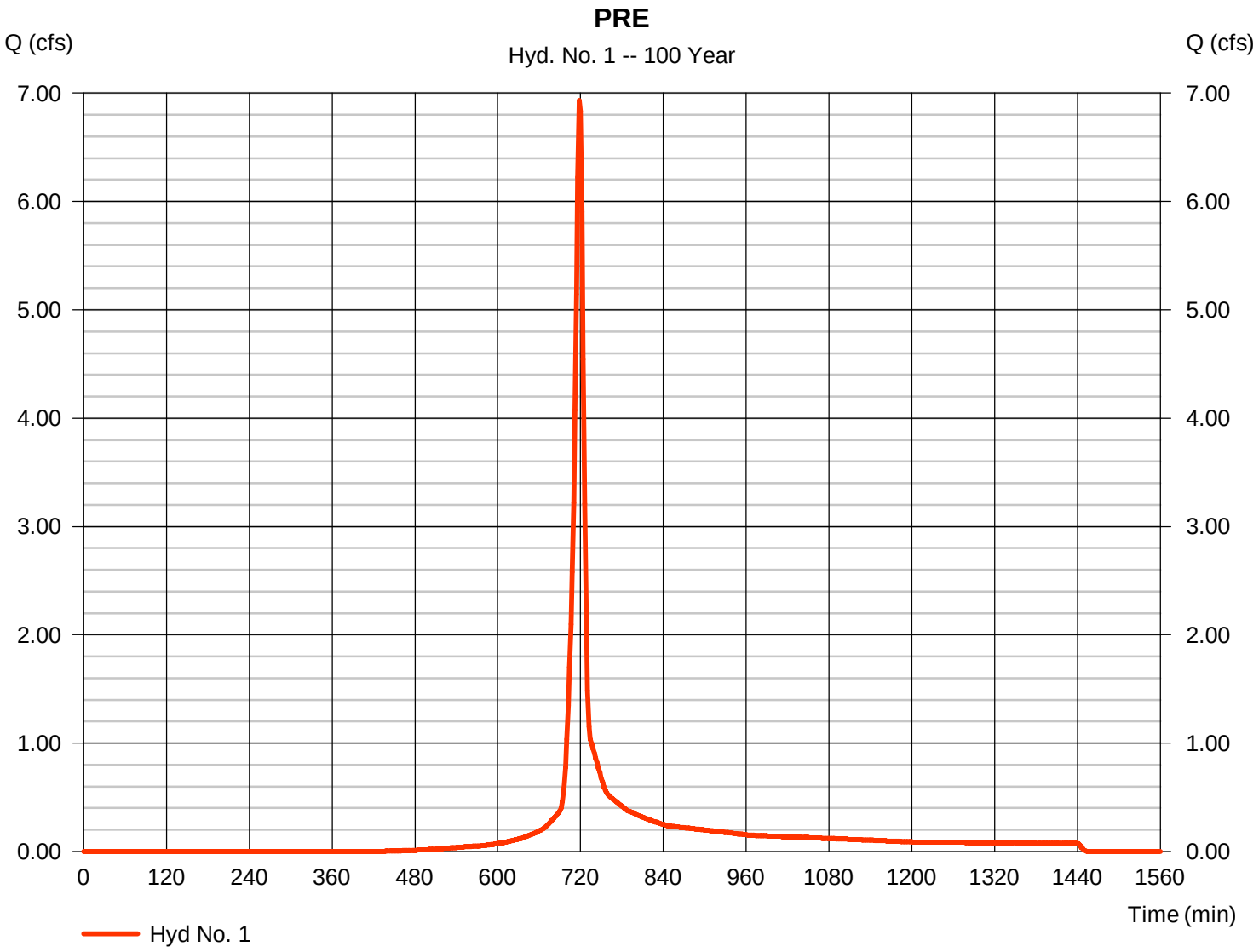
Hydrograph Report

Hyd. No. 1

PRE

Hydrograph type	=	SCS Runoff	Peak discharge	=	6.933 cfs
Storm frequency	=	100 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	15,918 cuft
Drainage area	=	1.270 ac	Curve number	=	77*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	7.20 min
Total precip.	=	5.97 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.200 x 71) + (0.950 x 78) + (0.120 x 77)] / 1.270



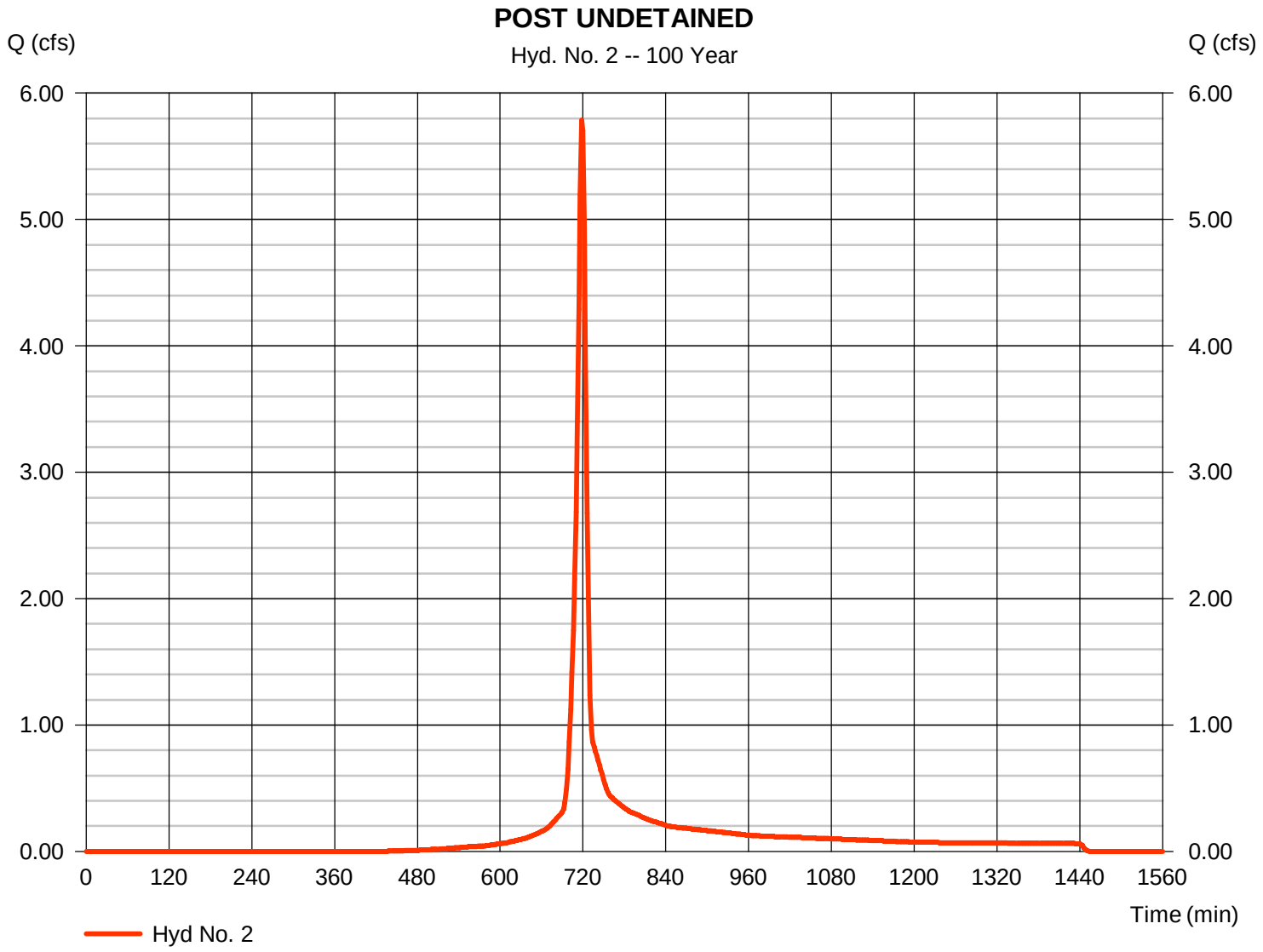
Hydrograph Report

Hyd. No. 2

POST UNDETAINED

Hydrograph type	=	SCS Runoff	Peak discharge	=	5.786 cfs
Storm frequency	=	100 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	13,286 cuft
Drainage area	=	1.060 ac	Curve number	=	77*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	7.20 min
Total precip.	=	5.97 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.140 x 71) + (0.800 x 78) + (0.110 x 77) + (0.010 x 89)] / 1.060



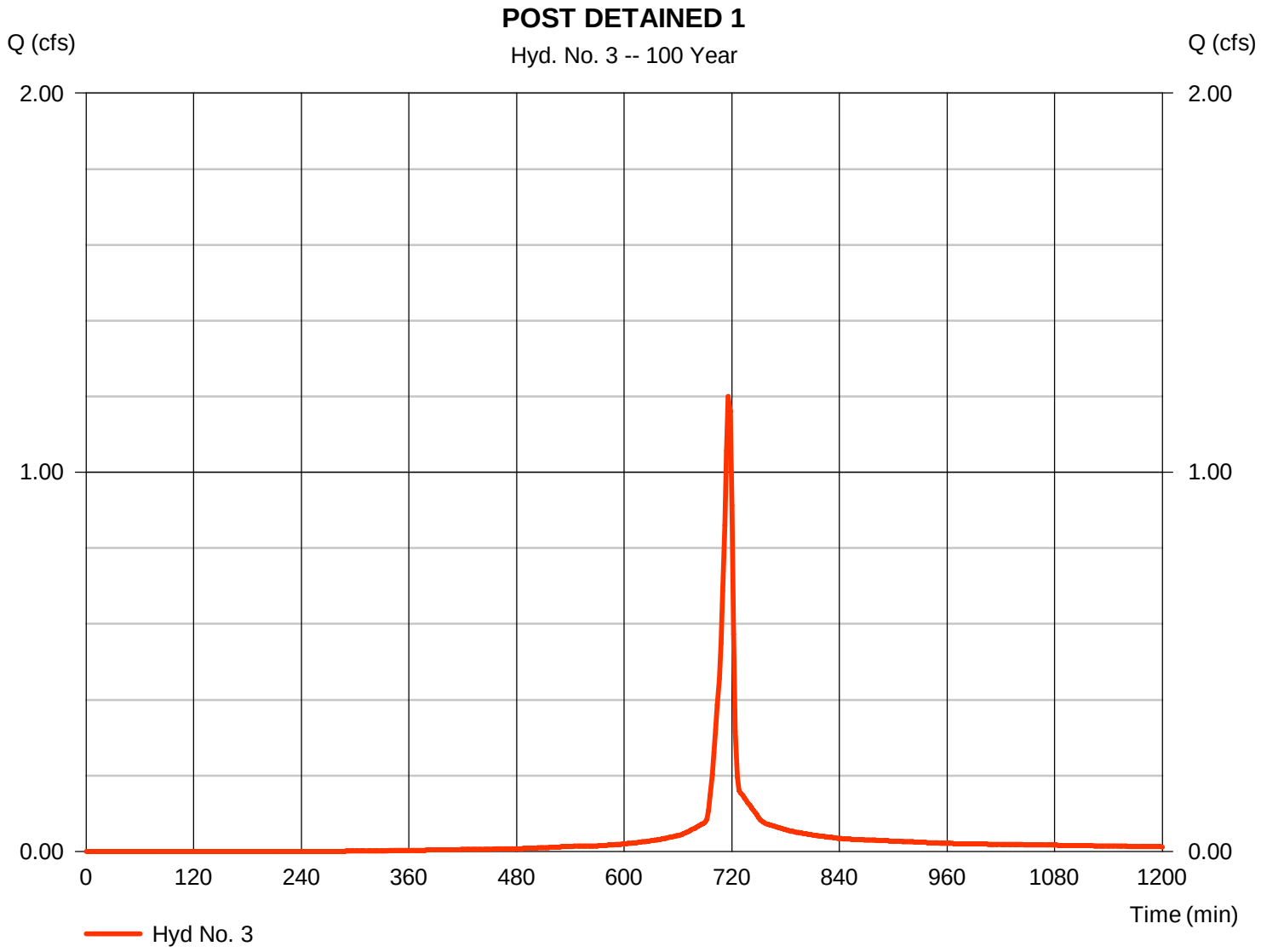
Hydrograph Report

Hyd. No. 3

POST DETAINED 1

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.200 cfs
Storm frequency	=	100 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	2,534 cuft
Drainage area	=	0.170 ac	Curve number	=	86*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	6.10 min
Total precip.	=	5.97 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.030 x 71) + (0.020 x 78) + (0.030 x 89) + (0.090 x 91)] / 0.170



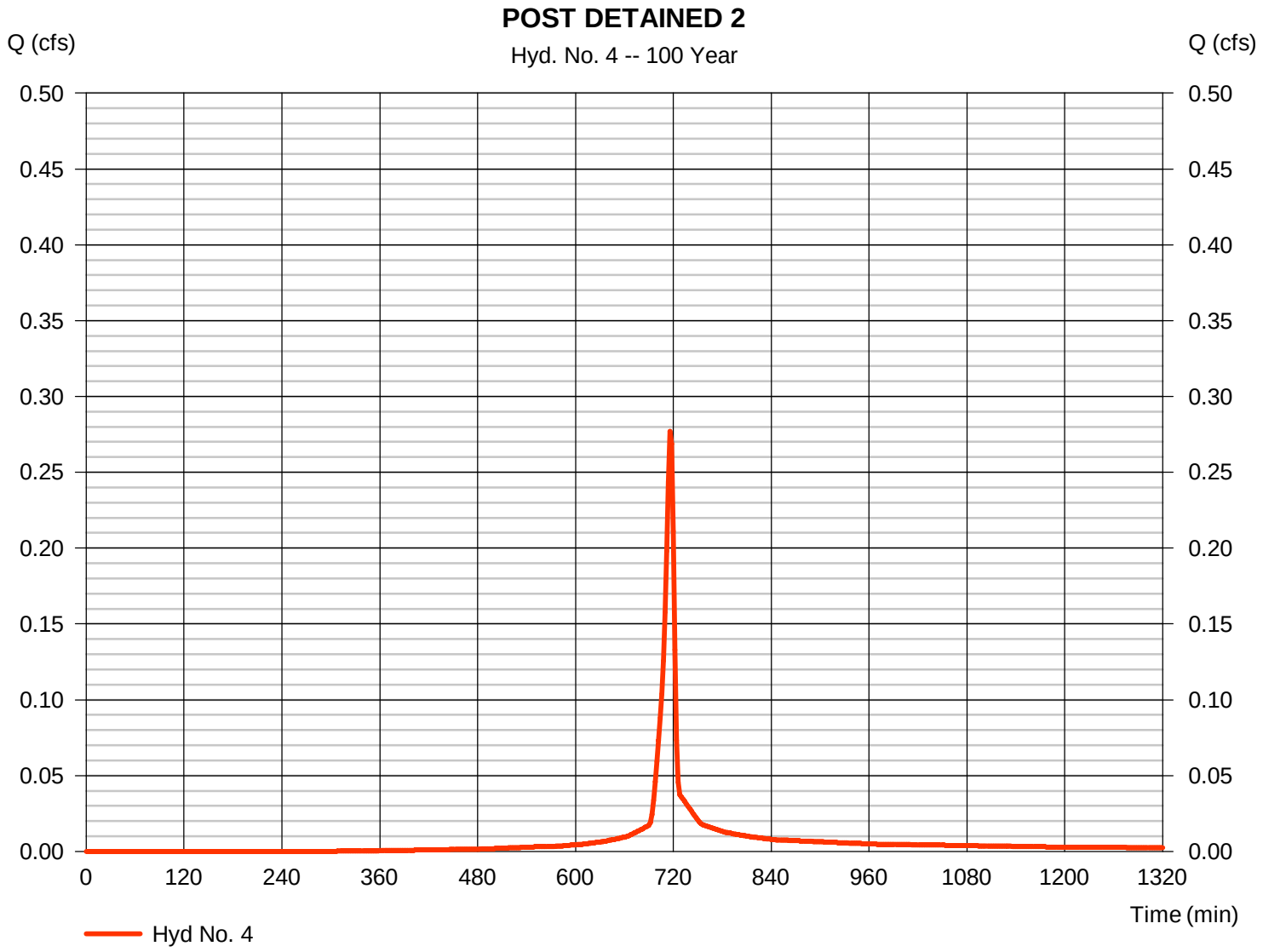
Hydrograph Report

Hyd. No. 4

POST DETAINED 2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.277 cfs
Storm frequency	= 100 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 582 cuft
Drainage area	= 0.040 ac	Curve number	= 85*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 5.40 min
Total precip.	= 5.97 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.020 x 91) + (0.020 x 78)] / 0.040

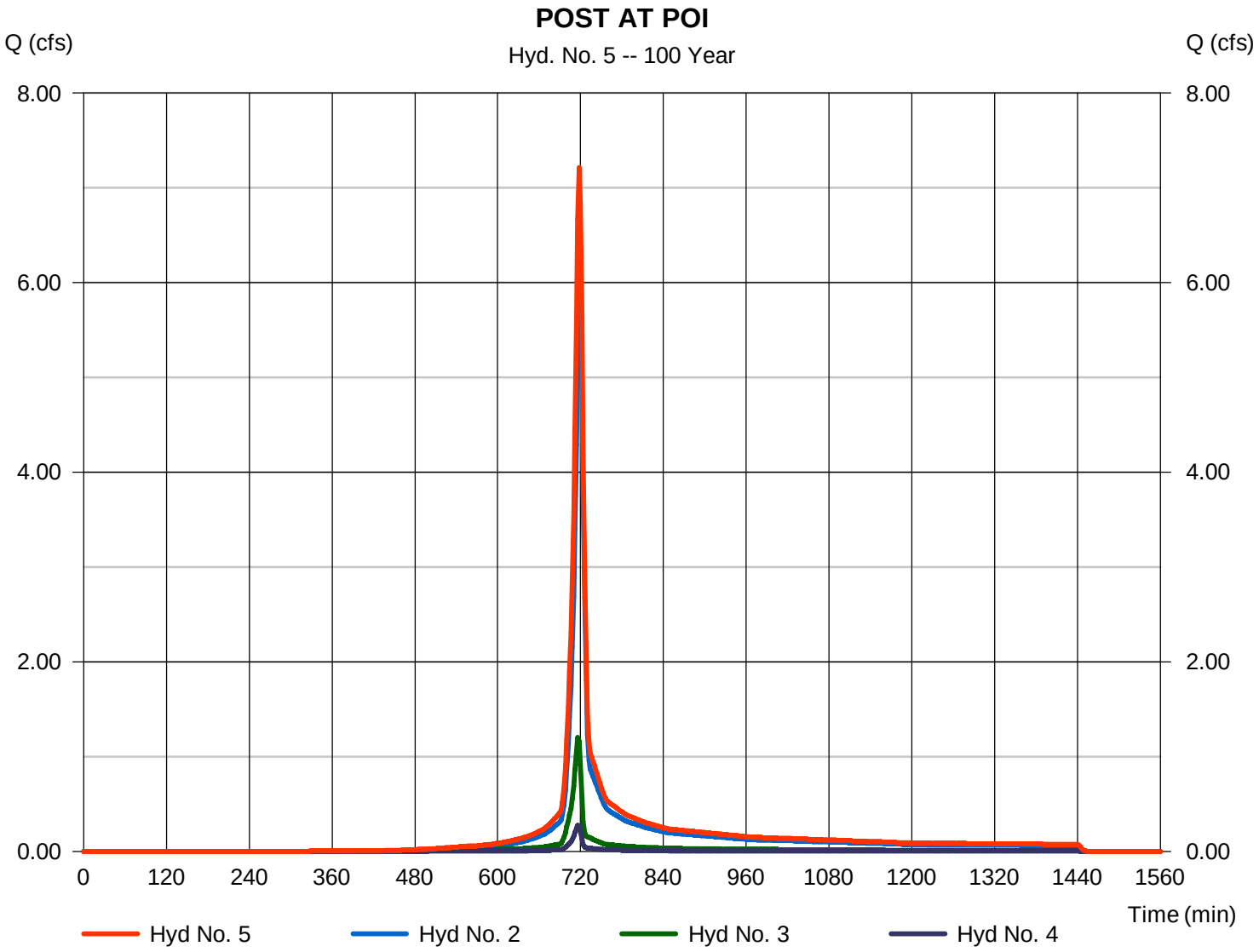


Hydrograph Report

Hyd. No. 5

POST AT POI

Hydrograph type	=	Combine	Peak discharge	=	7.217 cfs
Storm frequency	=	100 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	16,402 cuft
Inflow hyds.	=	2, 3, 4	Contrib. drain. area	=	1.270 ac



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	39.7793	9.9000	0.8796	--------
2	47.2145	10.1000	0.8721	--------
3	0.0000	0.0000	0.0000	--------
5	49.1407	9.5000	0.8258	--------
10	46.6495	8.4000	0.7811	--------
25	46.5911	7.6000	0.7402	--------
50	41.2057	6.1000	0.6844	--------
100	39.5863	5.3000	0.6488	--------

File name: Locke IDF.IDF

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	3.70	2.87	2.35	2.00	1.75	1.55	1.40	1.28	1.17	1.09	1.01	0.95
2	4.42	3.45	2.84	2.42	2.12	1.89	1.70	1.55	1.43	1.33	1.24	1.16
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	5.40	4.23	3.50	3.00	2.64	2.36	2.14	1.96	1.81	1.68	1.57	1.48
10	6.14	4.80	3.98	3.42	3.01	2.70	2.45	2.25	2.09	1.95	1.83	1.72
25	7.14	5.58	4.64	4.00	3.53	3.18	2.90	2.67	2.48	2.32	2.18	2.06
50	7.93	6.15	5.11	4.42	3.92	3.54	3.24	2.99	2.79	2.62	2.47	2.34
100	8.72	6.74	5.61	4.87	4.33	3.92	3.60	3.33	3.12	2.93	2.77	2.63

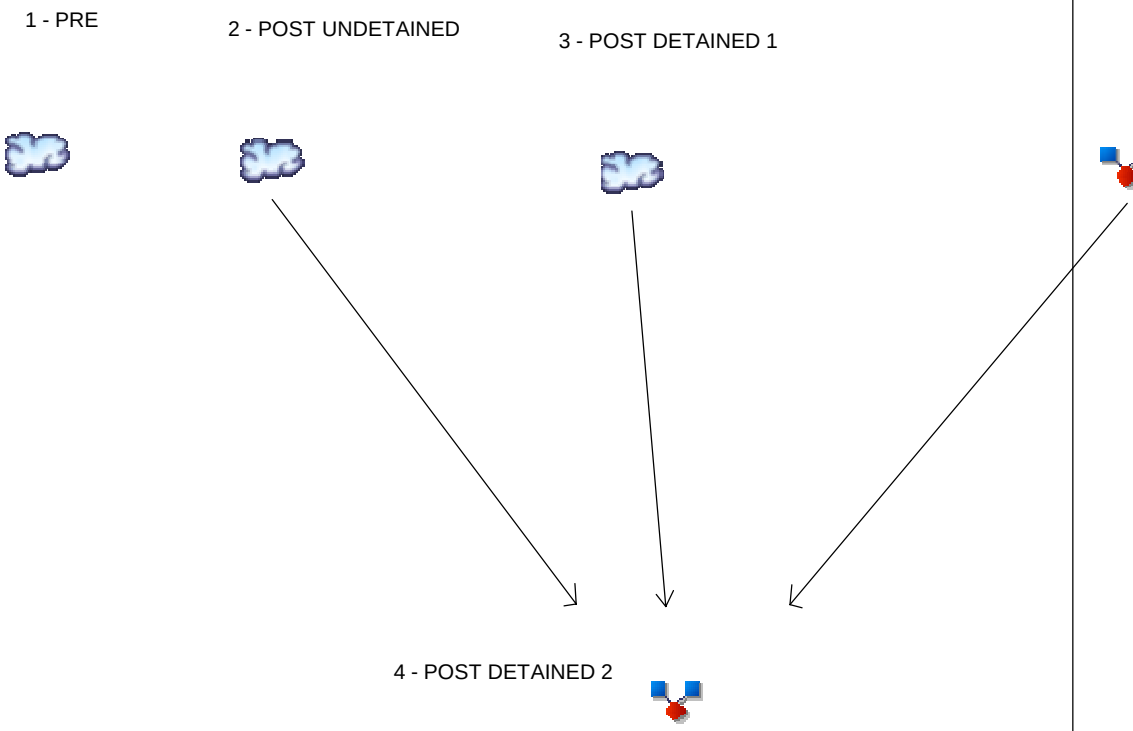
Tc = time in minutes. Values may exceed 60.

CGP-2\PPP\02 SCRO\07 PCSM\Attach 4 Stormwater Calcs\Locke Mountain Road\Hydraflow Rev 1\Locke Precip.pc

Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	2.23	2.67	0.00	3.33	3.86	4.64	5.28	5.97
SCS 6-Hr	1.47	1.78	0.00	2.22	2.58	3.10	3.54	4.00
Huff-1st	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Watershed Model Schematic

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



Legend

Hyd.	Origin	Description
1	SCS Runoff	PRE
2	SCS Runoff	POST UNDETAINED
3	SCS Runoff	POST DETAINED 1
4	SCS Runoff	POST DETAINED 2
5	Combine	POST AT POI

Hydrograph Return Period Recap

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	------	-------	1.688	-------	-------	-------	-------	-------	-------	PRE
2	SCS Runoff	------	-------	1.409	-------	-------	-------	-------	-------	-------	POST UNDETAINED
3	SCS Runoff	------	-------	0.213	-------	-------	-------	-------	-------	-------	POST DETAINED 1
4	SCS Runoff	------	-------	0.039	-------	-------	-------	-------	-------	-------	POST DETAINED 2
5	Combine	2, 3, 4	-------	1.573	-------	-------	-------	-------	-------	-------	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	1.688	2	720	3,914	------	------	------	PRE
2	SCS Runoff	1.409	2	720	3,267	------	------	------	POST UNDETAINED
3	SCS Runoff	0.213	2	730	854	------	------	------	POST DETAINED 1
4	SCS Runoff	0.039	2	738	191	------	------	------	POST DETAINED 2
5	Combine	1.573	2	720	4,312	2, 3, 4	------	------	POST AT POI

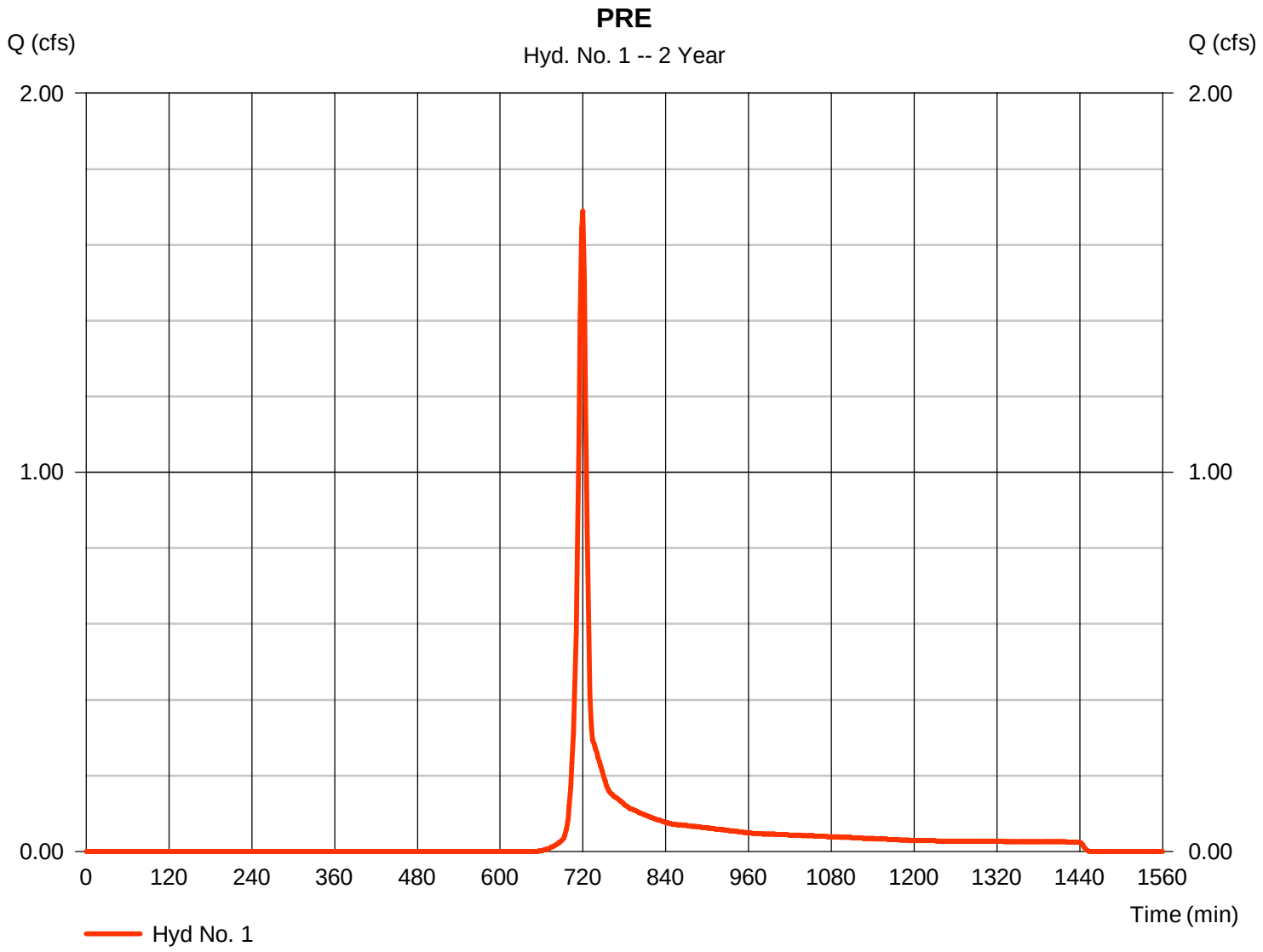
Hydrograph Report

Hyd. No. 1

PRE

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.688 cfs
Storm frequency	=	2 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	3,914 cuft
Drainage area	=	1.270 ac	Curve number	=	77*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	7.20 min
Total precip.	=	2.67 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.200 x 71) + (0.950 x 78) + (0.120 x 77)] / 1.270



TR55 Tc Worksheet

Hyd. No. 1

PRE

Description	A		B		C		Totals
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)	= 2.67		0.00		0.00		
Land slope (%)	= 8.00		0.00		0.00		
Travel Time (min)	**= 5.15**	**+**	**0.00**	**+**	**0.00**	**=**	**5.15**
Shallow Concentrated Flow							
Flow length (ft)	= 343.00		0.00		0.00		
Watercourse slope (%)	= 2.90		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.75		0.00		0.00		
Travel Time (min)	**= 2.08**	**+**	**0.00**	**+**	**0.00**	**=**	**2.08**
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 ..... 7.20 min

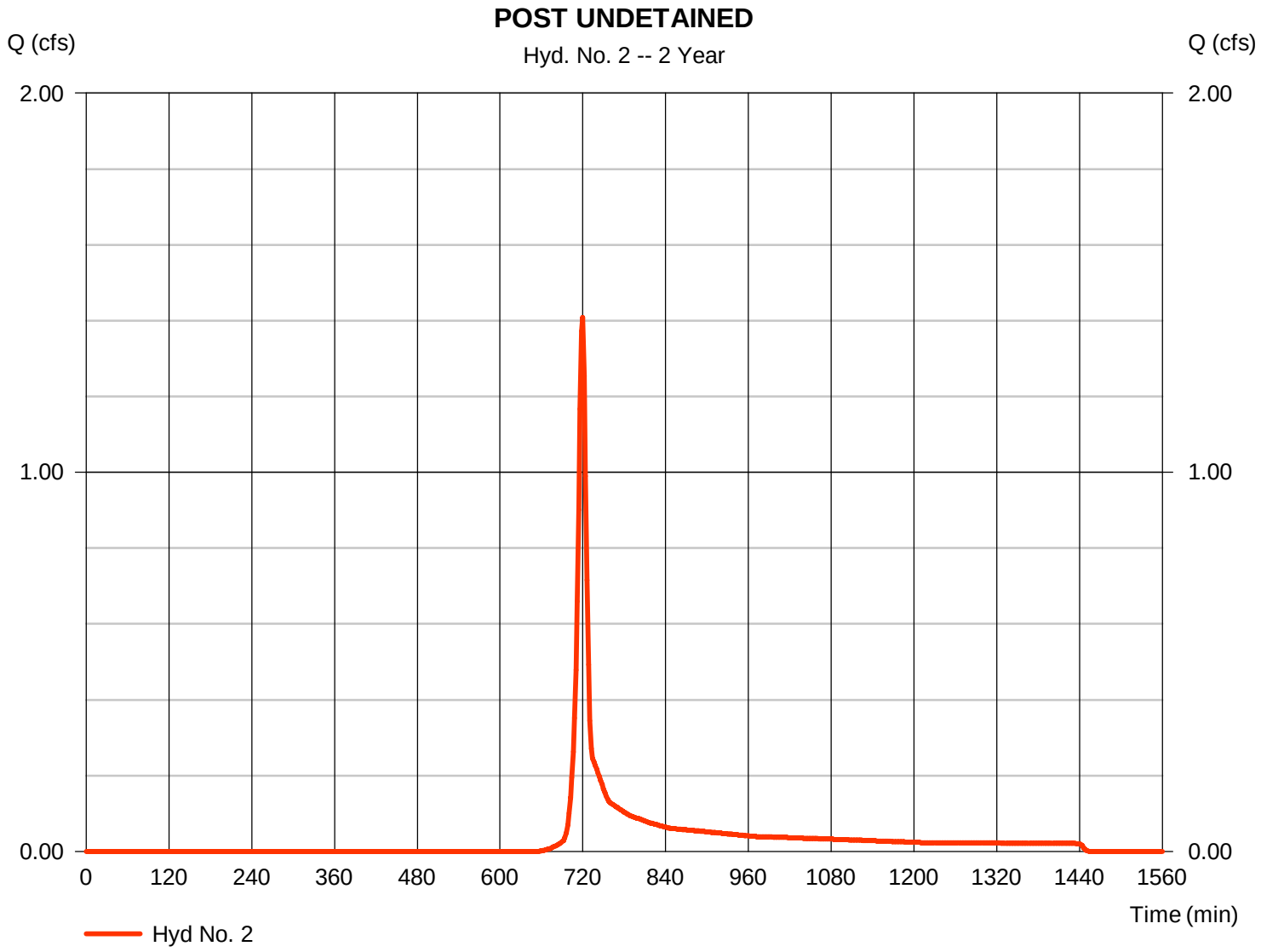
Hydrograph Report

Hyd. No. 2

POST UNDETAINED

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.409 cfs
Storm frequency	=	2 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	3,267 cuft
Drainage area	=	1.060 ac	Curve number	=	77*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	7.20 min
Total precip.	=	2.67 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.140 x 71) + (0.800 x 78) + (0.110 x 77) + (0.010 x 89)] / 1.060



TR55 Tc Worksheet

Hyd. No. 2

POST UNDETAINED

Description	A		B		C		Totals
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)	= 2.67		0.00		0.00		
Land slope (%)	= 8.00		0.00		0.00		
Travel Time (min)	**= 5.15**	**+**	**0.00**	**+**	**0.00**	**=**	**5.15**
Shallow Concentrated Flow							
Flow length (ft)	= 343.00		0.00		0.00		
Watercourse slope (%)	= 2.90		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.75		0.00		0.00		
Travel Time (min)	**= 2.08**	**+**	**0.00**	**+**	**0.00**	**=**	**2.08**
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 ..... 7.20 min

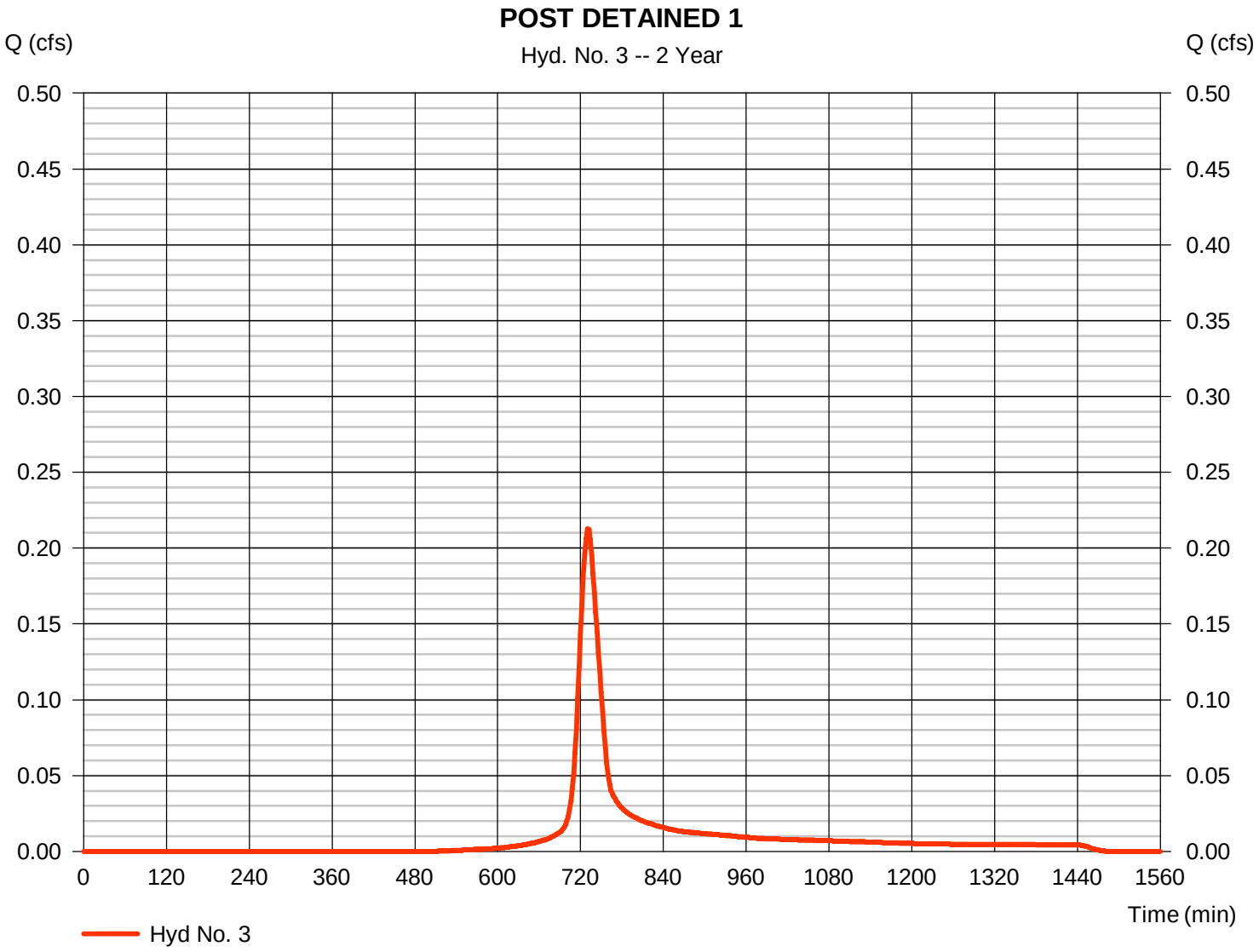
Hydrograph Report

Hyd. No. 3

POST DETAINED 1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.213 cfs
Storm frequency	= 2 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 854 cuft
Drainage area	= 0.170 ac	Curve number	= 86*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 28.83 min
Total precip.	= 2.67 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.030 x 71) + (0.020 x 78) + (0.030 x 89) + (0.090 x 91)] / 0.170



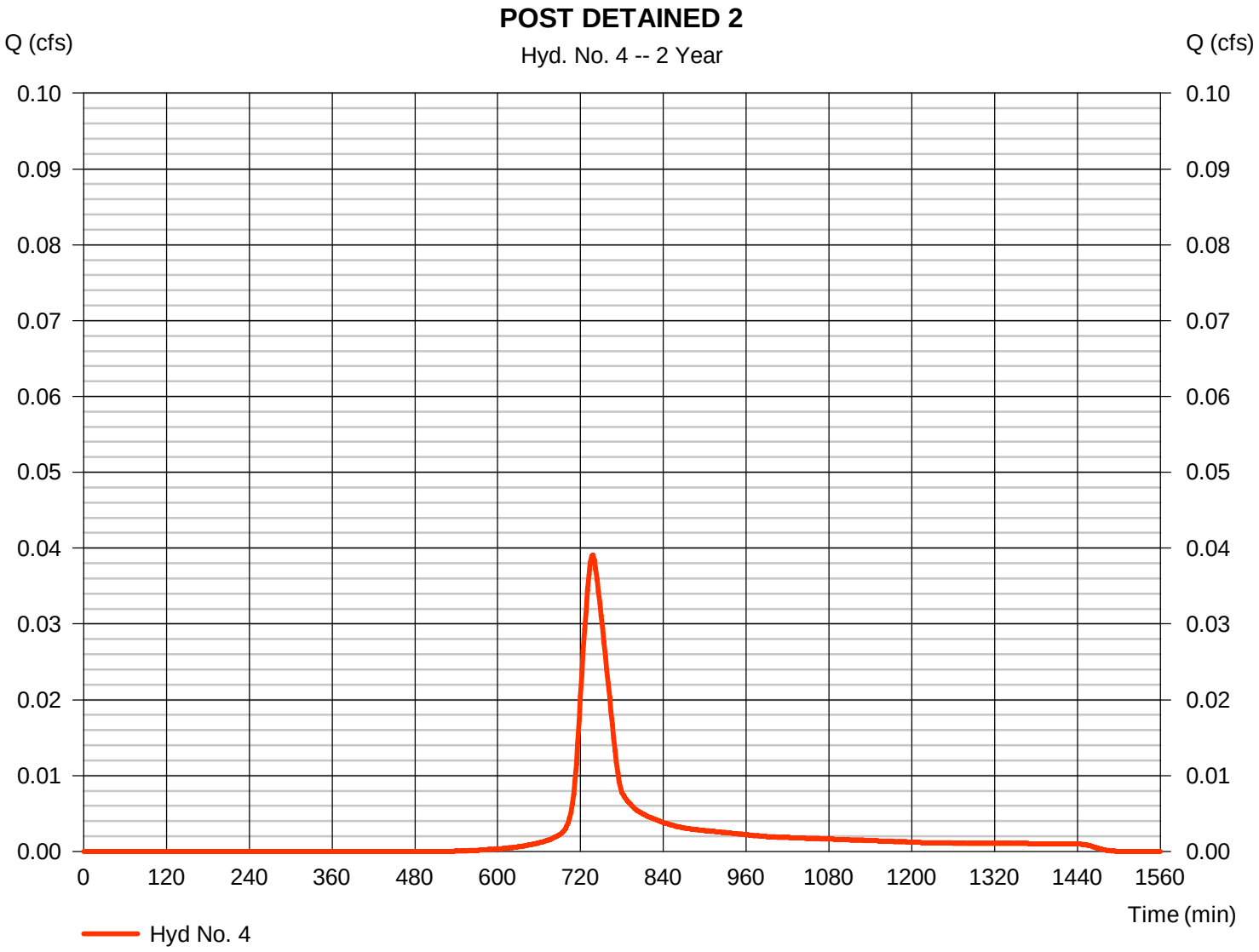
Hydrograph Report

Hyd. No. 4

POST DETAINED 2

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.039 cfs
Storm frequency	=	2 yrs	Time to peak	=	738 min
Time interval	=	2 min	Hyd. volume	=	191 cuft
Drainage area	=	0.040 ac	Curve number	=	85*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	38.92 min
Total precip.	=	2.67 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.020 x 91) + (0.020 x 78)] / 0.040

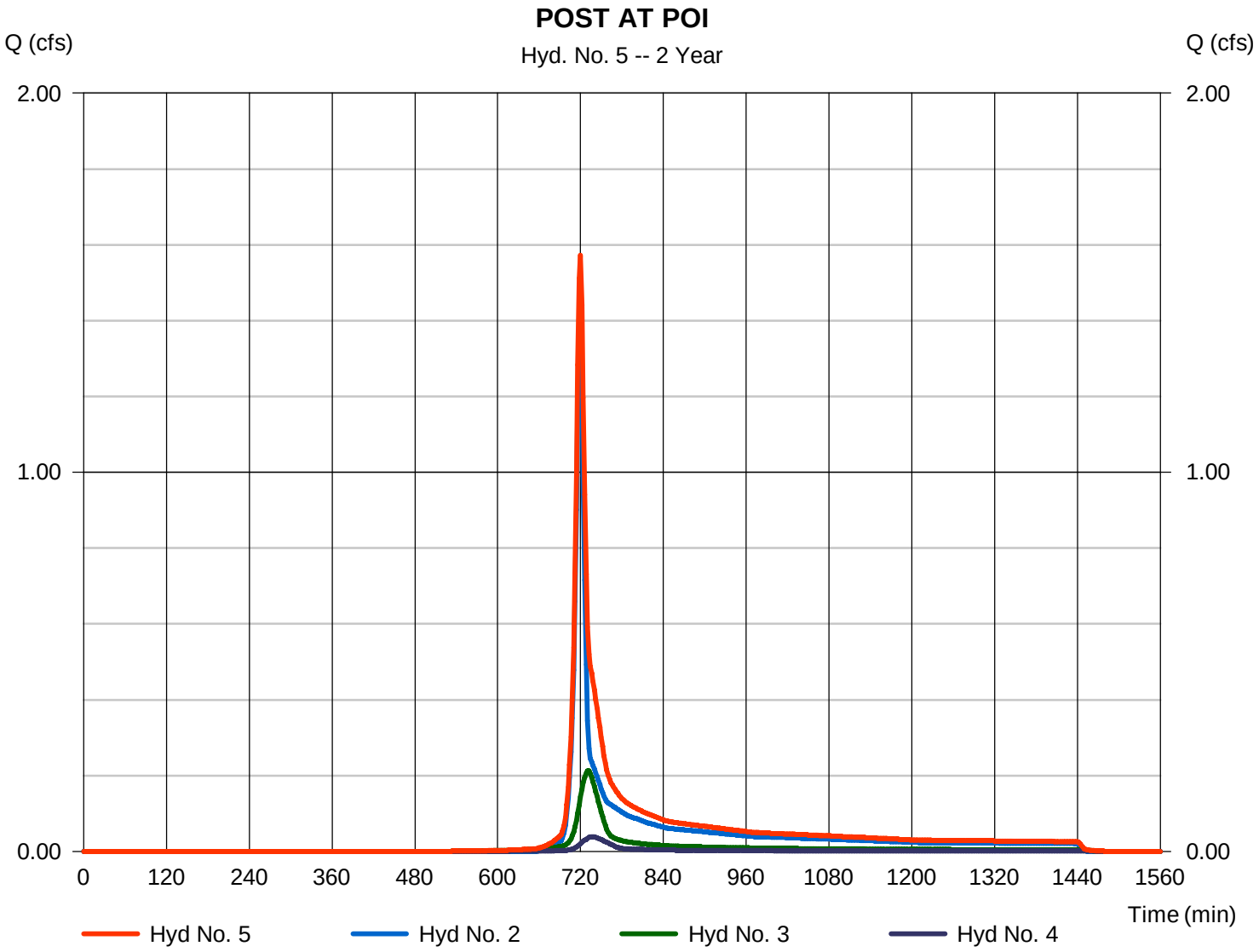


Hydrograph Report

Hyd. No. 5

POST AT POI

Hydrograph type	= Combine	Peak discharge	= 1.573 cfs
Storm frequency	= 2 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 4,312 cuft
Inflow hyds.	= 2, 3, 4	Contrib. drain. area	= 1.270 ac



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	39.7793	9.9000	0.8796	--------
2	47.2145	10.1000	0.8721	--------
3	0.0000	0.0000	0.0000	--------
5	49.1407	9.5000	0.8258	--------
10	46.6495	8.4000	0.7811	--------
25	46.5911	7.6000	0.7402	--------
50	41.2057	6.1000	0.6844	--------
100	39.5863	5.3000	0.6488	--------

File name: Locke IDF.IDF

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	3.70	2.87	2.35	2.00	1.75	1.55	1.40	1.28	1.17	1.09	1.01	0.95
2	4.42	3.45	2.84	2.42	2.12	1.89	1.70	1.55	1.43	1.33	1.24	1.16
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	5.40	4.23	3.50	3.00	2.64	2.36	2.14	1.96	1.81	1.68	1.57	1.48
10	6.14	4.80	3.98	3.42	3.01	2.70	2.45	2.25	2.09	1.95	1.83	1.72
25	7.14	5.58	4.64	4.00	3.53	3.18	2.90	2.67	2.48	2.32	2.18	2.06
50	7.93	6.15	5.11	4.42	3.92	3.54	3.24	2.99	2.79	2.62	2.47	2.34
100	8.72	6.74	5.61	4.87	4.33	3.92	3.60	3.33	3.12	2.93	2.77	2.63

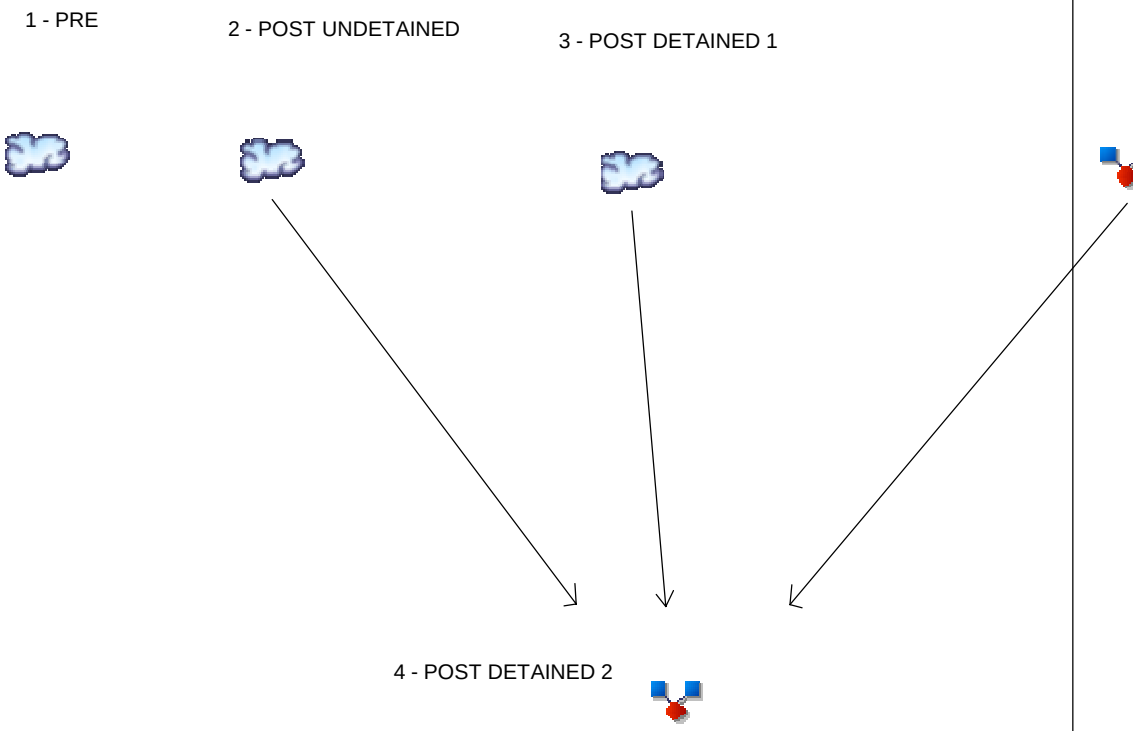
Tc = time in minutes. Values may exceed 60.

CGP-2\PPP\02 SCRO\07 PCSM\Attach 4 Stormwater Calcs\Locke Mountain Road\Hydraflow Rev 1\Locke Precip.pc

Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	2.23	2.67	0.00	3.33	3.86	4.64	5.28	5.97
SCS 6-Hr	1.47	1.78	0.00	2.22	2.58	3.10	3.54	4.00
Huff-1st	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Watershed Model Schematic

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



Legend

Hyd.	Origin	Description
1	SCS Runoff	PRE
2	SCS Runoff	POST UNDETAINED
3	SCS Runoff	POST DETAINED 1
4	SCS Runoff	POST DETAINED 2
5	Combine	POST AT POI

Hydrograph Return Period Recap

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	------	-------	-------	-------	-------	3.430	-------	-------	-------	PRE
2	SCS Runoff	------	-------	-------	-------	-------	2.863	-------	-------	-------	POST UNDETAINED
3	SCS Runoff	------	-------	-------	-------	-------	0.476	-------	-------	-------	POST DETAINED 1
4	SCS Runoff	------	-------	-------	-------	-------	0.091	-------	-------	-------	POST DETAINED 2
5	Combine	2, 3, 4	-------	-------	-------	-------	3.357	-------	-------	-------	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	3.430	2	720	7,852	------	------	------	PRE
2	SCS Runoff	2.863	2	720	6,554	------	------	------	POST UNDETAINED
3	SCS Runoff	0.476	2	724	1,493	------	------	------	POST DETAINED 1
4	SCS Runoff	0.091	2	728	333	------	------	------	POST DETAINED 2
5	Combine	3.357	2	720	8,380	2, 3, 4	------	------	POST AT POI

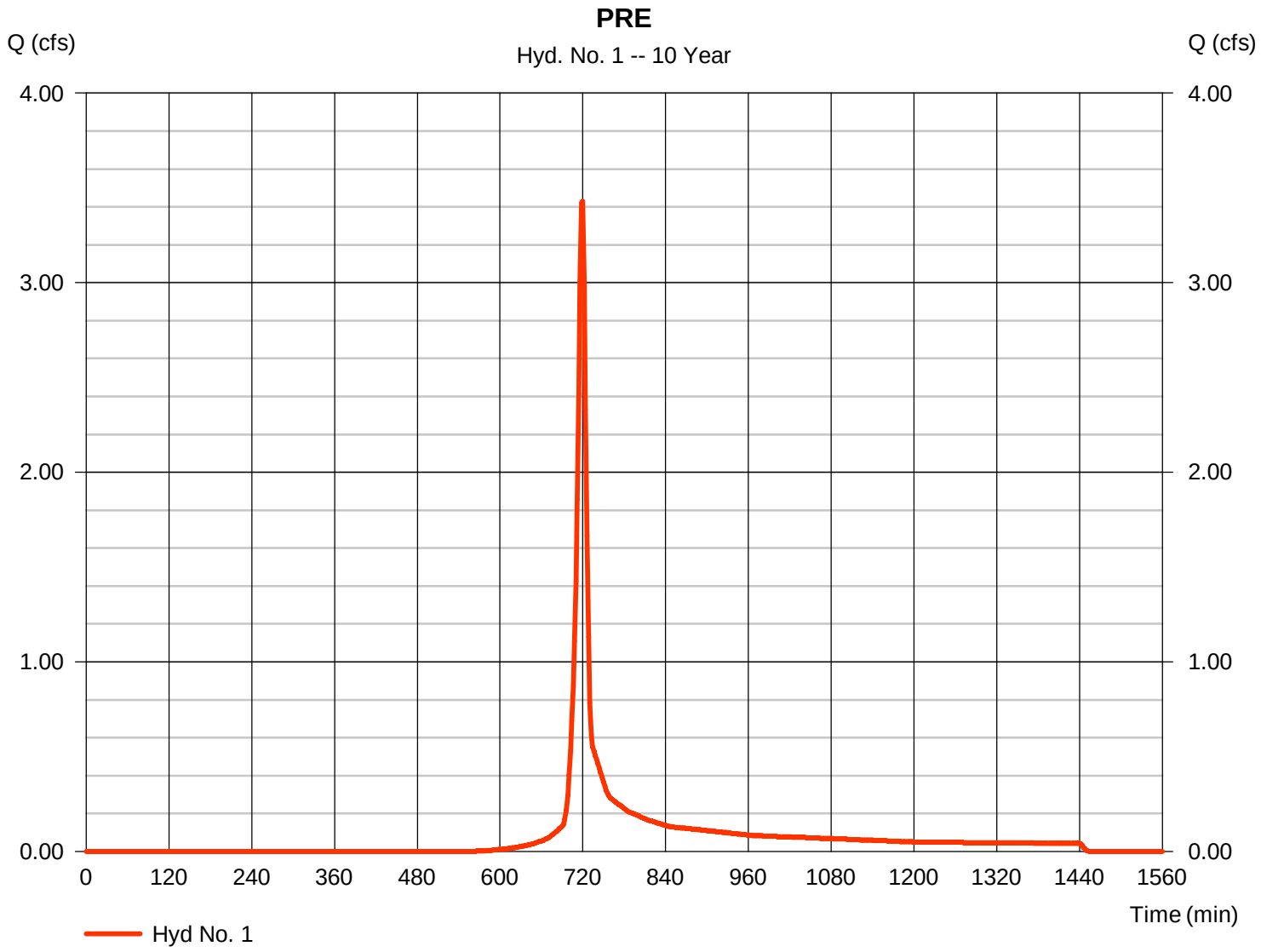
Hydrograph Report

Hyd. No. 1

PRE

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.430 cfs
Storm frequency	=	10 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	7,852 cuft
Drainage area	=	1.270 ac	Curve number	=	77*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	7.20 min
Total precip.	=	3.86 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.200 x 71) + (0.950 x 78) + (0.120 x 77)] / 1.270



TR55 Tc Worksheet

Hyd. No. 1

PRE

Description	A		B		C		Totals
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)	= 2.67		0.00		0.00		
Land slope (%)	= 8.00		0.00		0.00		
Travel Time (min)	**= 5.15**	**+**	**0.00**	**+**	**0.00**	**=**	**5.15**
Shallow Concentrated Flow							
Flow length (ft)	= 343.00		0.00		0.00		
Watercourse slope (%)	= 2.90		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.75		0.00		0.00		
Travel Time (min)	**= 2.08**	**+**	**0.00**	**+**	**0.00**	**=**	**2.08**
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 ..... 7.20 min

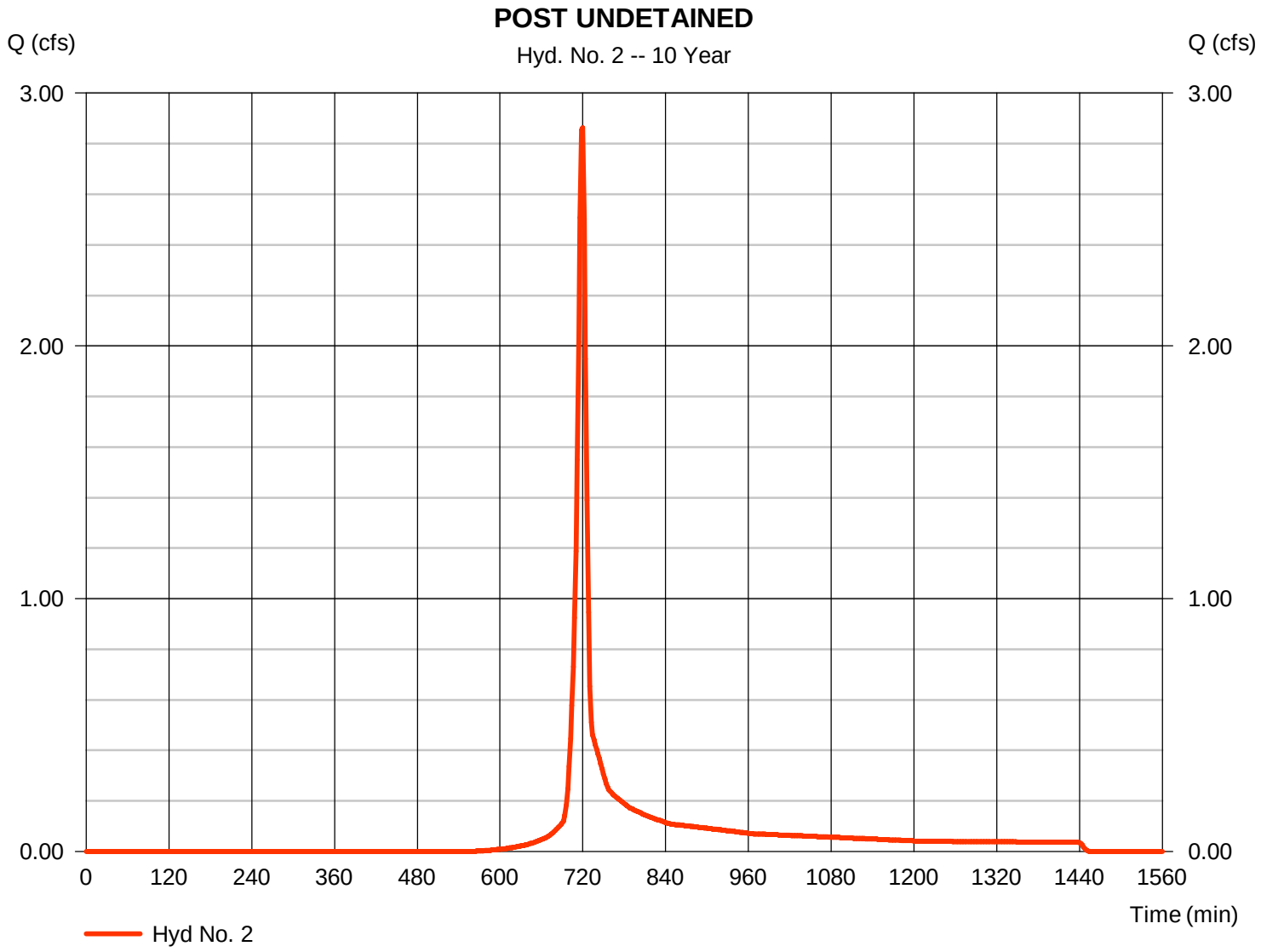
Hydrograph Report

Hyd. No. 2

POST UNDETAINED

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.863 cfs
Storm frequency	=	10 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	6,554 cuft
Drainage area	=	1.060 ac	Curve number	=	77*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	7.20 min
Total precip.	=	3.86 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.140 x 71) + (0.800 x 78) + (0.110 x 77) + (0.010 x 89)] / 1.060



TR55 Tc Worksheet

Hyd. No. 2

POST UNDETAINED

Description	A		B		C		Totals
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)	= 2.67		0.00		0.00		
Land slope (%)	= 8.00		0.00		0.00		
Travel Time (min)	**= 5.15**	**+**	**0.00**	**+**	**0.00**	**=**	**5.15**
Shallow Concentrated Flow							
Flow length (ft)	= 343.00		0.00		0.00		
Watercourse slope (%)	= 2.90		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.75		0.00		0.00		
Travel Time (min)	**= 2.08**	**+**	**0.00**	**+**	**0.00**	**=**	**2.08**
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 ..... 7.20 min

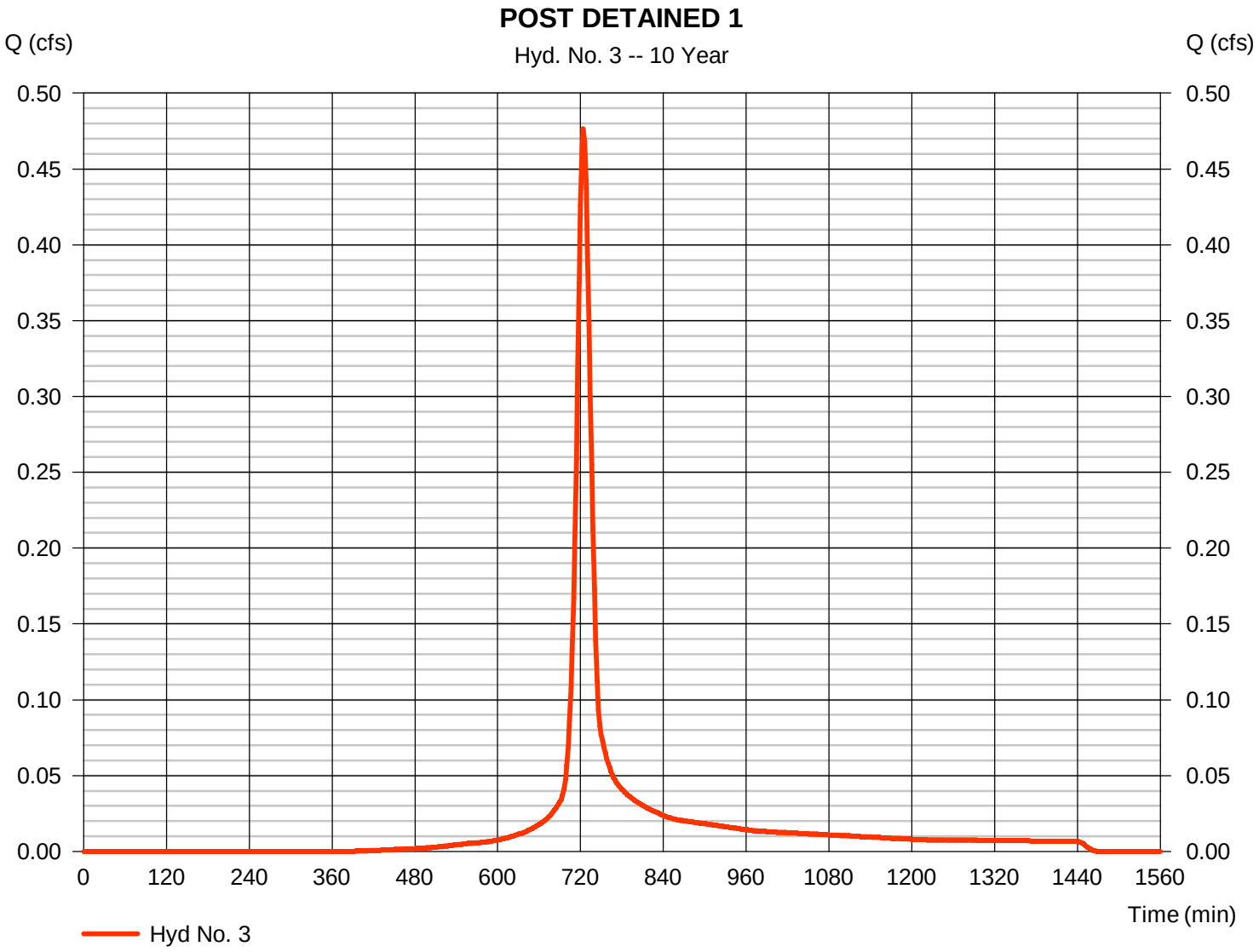
Hydrograph Report

Hyd. No. 3

POST DETAINED 1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.476 cfs
Storm frequency	= 10 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 1,493 cuft
Drainage area	= 0.170 ac	Curve number	= 86*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 19.28 min
Total precip.	= 3.86 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.030 x 71) + (0.020 x 78) + (0.030 x 89) + (0.090 x 91)] / 0.170



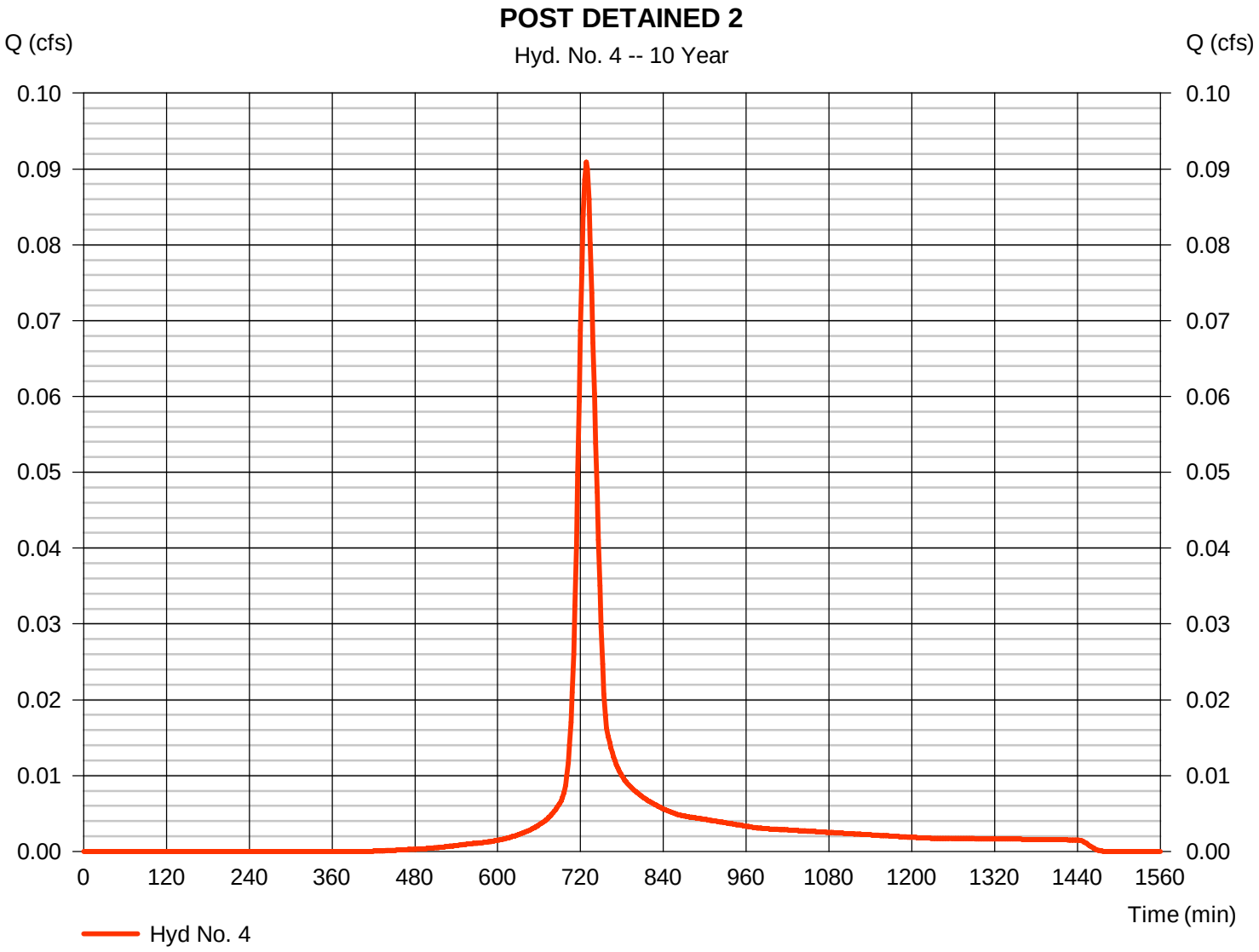
Hydrograph Report

Hyd. No. 4

POST DETAINED 2

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.091 cfs
Storm frequency	=	10 yrs	Time to peak	=	728 min
Time interval	=	2 min	Hyd. volume	=	333 cuft
Drainage area	=	0.040 ac	Curve number	=	85*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	24.65 min
Total precip.	=	3.86 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.020 x 91) + (0.020 x 78)] / 0.040

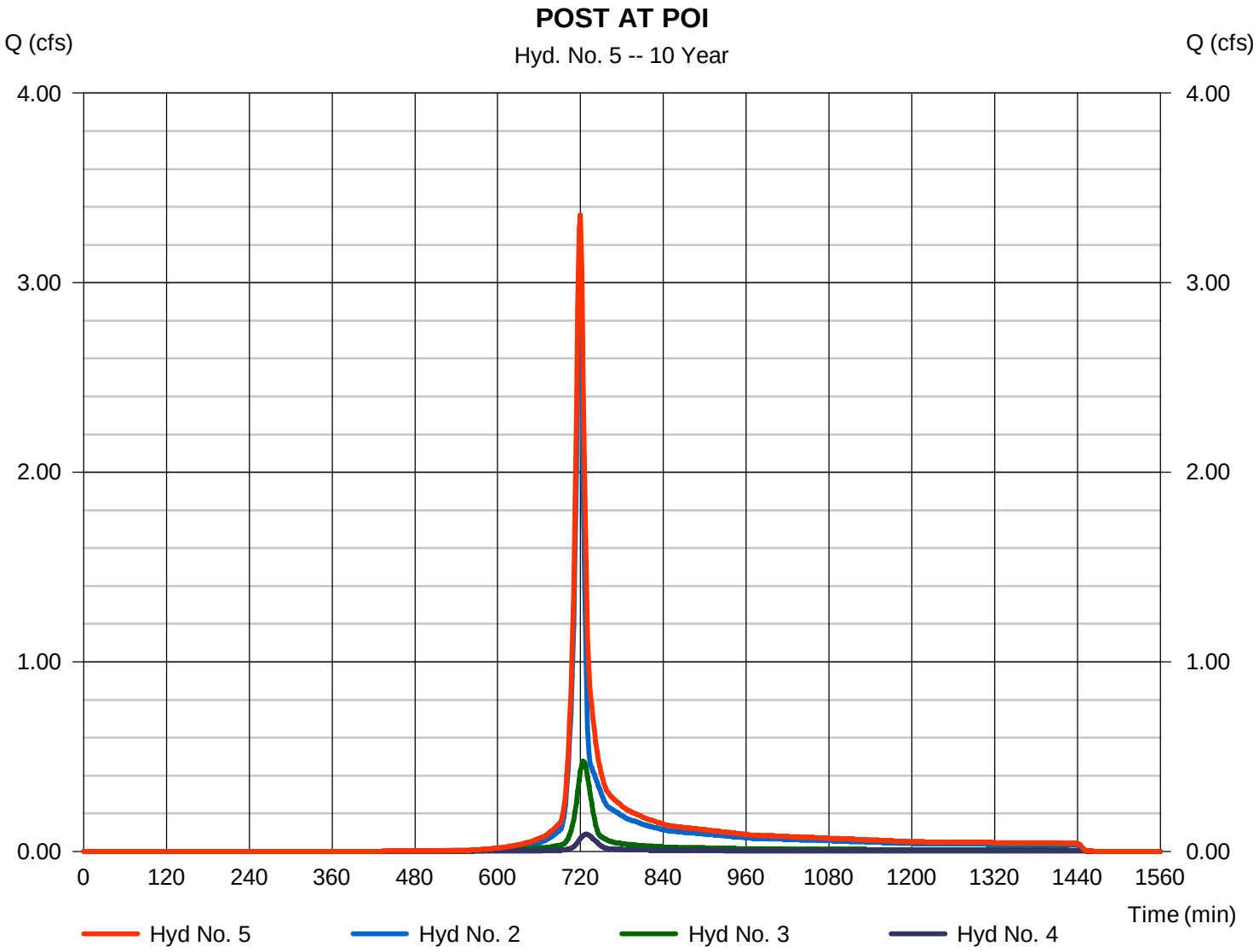


Hydrograph Report

Hyd. No. 5

POST AT POI

Hydrograph type	= Combine	Peak discharge	= 3.357 cfs
Storm frequency	= 10 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 8,380 cuft
Inflow hyds.	= 2, 3, 4	Contrib. drain. area	= 1.270 ac



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	39.7793	9.9000	0.8796	--------
2	47.2145	10.1000	0.8721	--------
3	0.0000	0.0000	0.0000	--------
5	49.1407	9.5000	0.8258	--------
10	46.6495	8.4000	0.7811	--------
25	46.5911	7.6000	0.7402	--------
50	41.2057	6.1000	0.6844	--------
100	39.5863	5.3000	0.6488	--------

File name: Locke IDF.IDF

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	3.70	2.87	2.35	2.00	1.75	1.55	1.40	1.28	1.17	1.09	1.01	0.95
2	4.42	3.45	2.84	2.42	2.12	1.89	1.70	1.55	1.43	1.33	1.24	1.16
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	5.40	4.23	3.50	3.00	2.64	2.36	2.14	1.96	1.81	1.68	1.57	1.48
10	6.14	4.80	3.98	3.42	3.01	2.70	2.45	2.25	2.09	1.95	1.83	1.72
25	7.14	5.58	4.64	4.00	3.53	3.18	2.90	2.67	2.48	2.32	2.18	2.06
50	7.93	6.15	5.11	4.42	3.92	3.54	3.24	2.99	2.79	2.62	2.47	2.34
100	8.72	6.74	5.61	4.87	4.33	3.92	3.60	3.33	3.12	2.93	2.77	2.63

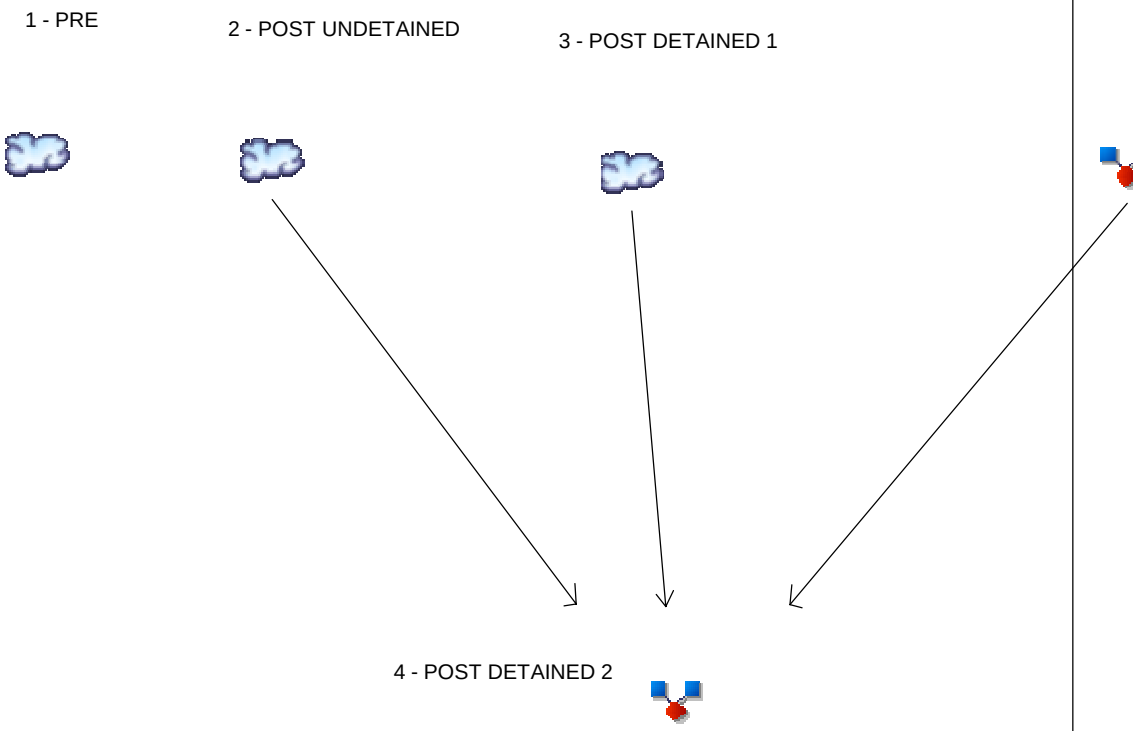
Tc = time in minutes. Values may exceed 60.

CGP-2\PPP\02 SCRO\07 PCSM\Attach 4 Stormwater Calcs\Locke Mountain Road\Hydraflow Rev 1\Locke Precip.pc

Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	2.23	2.67	0.00	3.33	3.86	4.64	5.28	5.97
SCS 6-Hr	1.47	1.78	0.00	2.22	2.58	3.10	3.54	4.00
Huff-1st	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Watershed Model Schematic

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



Legend

Hyd.	Origin	Description
1	SCS Runoff	PRE
2	SCS Runoff	POST UNDETAINED
3	SCS Runoff	POST DETAINED 1
4	SCS Runoff	POST DETAINED 2
5	Combine	POST AT POI

Hydrograph Return Period Recap

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	------	-------	-------	-------	-------	-------	-------	5.756	-------	PRE
2	SCS Runoff	------	-------	-------	-------	-------	-------	-------	4.805	-------	POST UNDETAINED
3	SCS Runoff	------	-------	-------	-------	-------	-------	-------	0.785	-------	POST DETAINED 1
4	SCS Runoff	------	-------	-------	-------	-------	-------	-------	0.167	-------	POST DETAINED 2
5	Combine	2, 3, 4	-------	-------	-------	-------	-------	-------	5.666	-------	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	5.756	2	718	13,180	------	------	------	PRE
2	SCS Runoff	4.805	2	718	11,001	------	------	------	POST UNDETAINED
3	SCS Runoff	0.785	2	722	2,244	------	------	------	POST DETAINED 1
4	SCS Runoff	0.167	2	724	527	------	------	------	POST DETAINED 2
5	Combine	5.666	2	720	13,771	2, 3, 4	------	------	POST AT POI

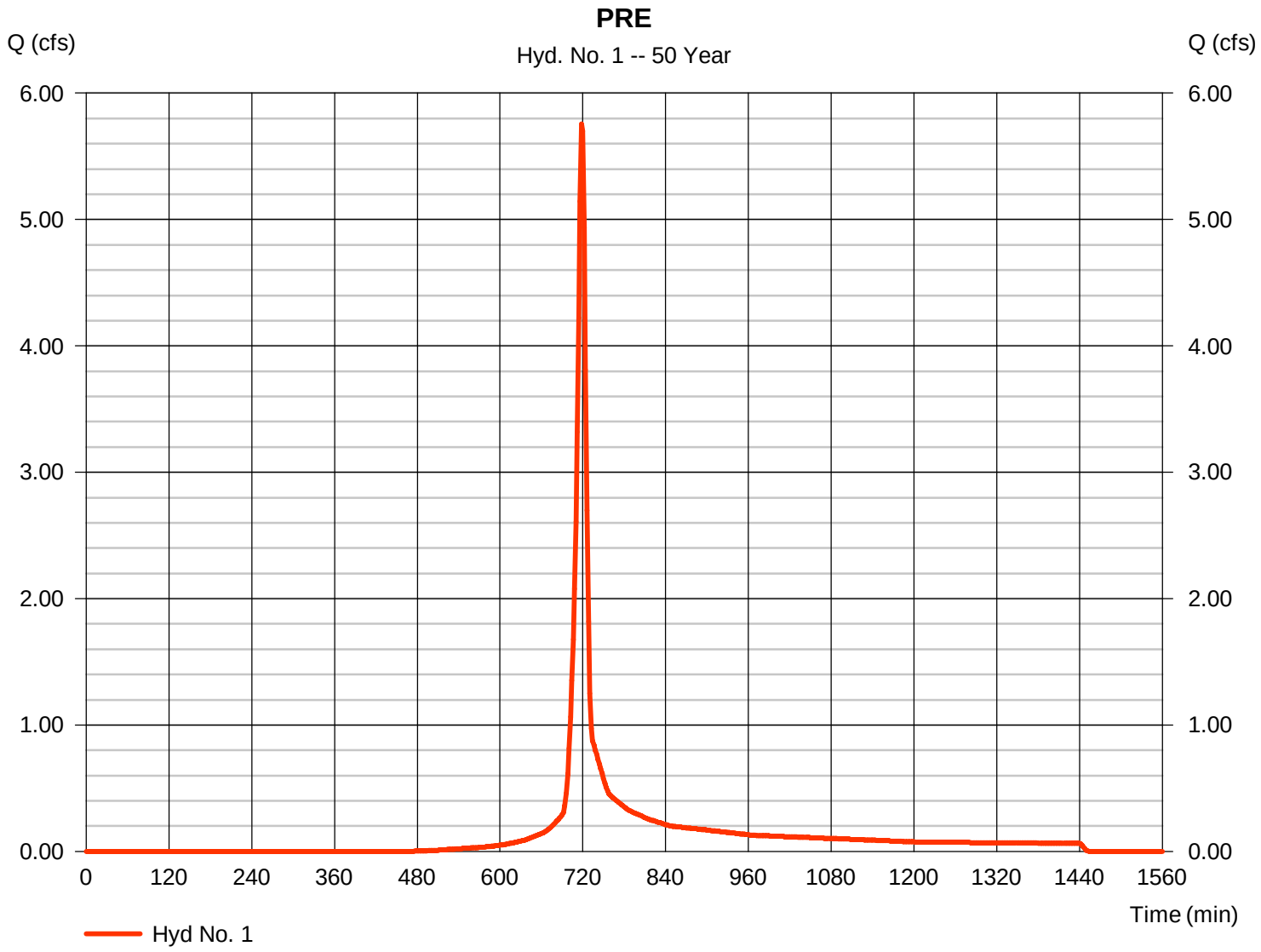
Hydrograph Report

Hyd. No. 1

PRE

Hydrograph type	=	SCS Runoff	Peak discharge	=	5.756 cfs
Storm frequency	=	50 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	13,180 cuft
Drainage area	=	1.270 ac	Curve number	=	77*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	7.20 min
Total precip.	=	5.28 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.200 x 71) + (0.950 x 78) + (0.120 x 77)] / 1.270



TR55 Tc Worksheet

Hyd. No. 1

PRE

Description	A		B		C		Totals
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)	= 2.67		0.00		0.00		
Land slope (%)	= 8.00		0.00		0.00		
Travel Time (min)	**= 5.15**	**+**	**0.00**	**+**	**0.00**	**=**	**5.15**
Shallow Concentrated Flow							
Flow length (ft)	= 343.00		0.00		0.00		
Watercourse slope (%)	= 2.90		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.75		0.00		0.00		
Travel Time (min)	**= 2.08**	**+**	**0.00**	**+**	**0.00**	**=**	**2.08**
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 ..... 7.20 min

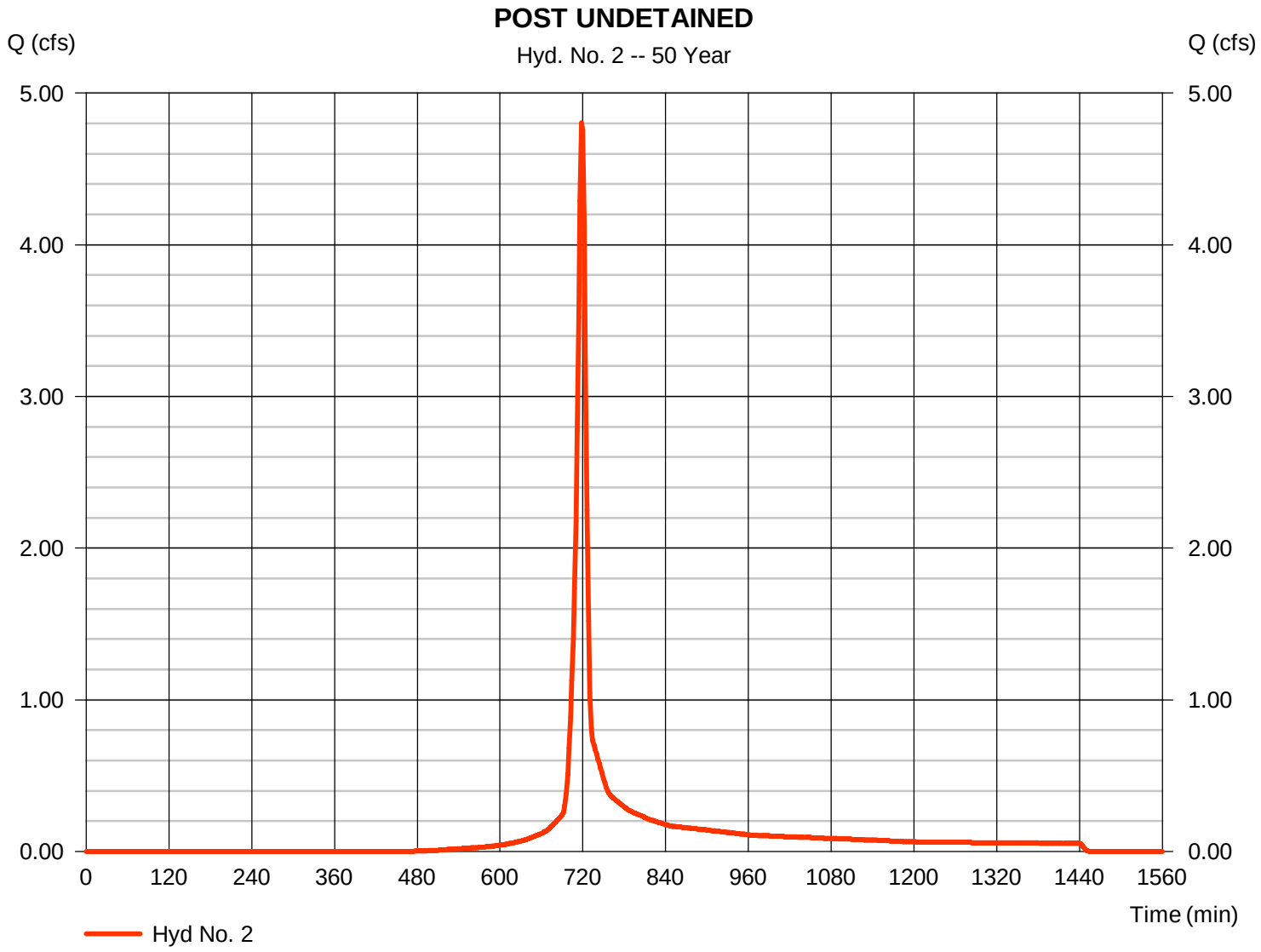
Hydrograph Report

Hyd. No. 2

POST UNDETAINED

Hydrograph type	=	SCS Runoff	Peak discharge	=	4.805 cfs
Storm frequency	=	50 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	11,001 cuft
Drainage area	=	1.060 ac	Curve number	=	77*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	7.20 min
Total precip.	=	5.28 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.140 x 71) + (0.800 x 78) + (0.110 x 77) + (0.010 x 89)] / 1.060



TR55 Tc Worksheet

Hyd. No. 2

POST UNDETAINED

Description	A		B		C		Totals
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)	= 2.67		0.00		0.00		
Land slope (%)	= 8.00		0.00		0.00		
Travel Time (min)	**= 5.15**	**+**	**0.00**	**+**	**0.00**	**=**	**5.15**
Shallow Concentrated Flow							
Flow length (ft)	= 343.00		0.00		0.00		
Watercourse slope (%)	= 2.90		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.75		0.00		0.00		
Travel Time (min)	**= 2.08**	**+**	**0.00**	**+**	**0.00**	**=**	**2.08**
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 ..... 7.20 min

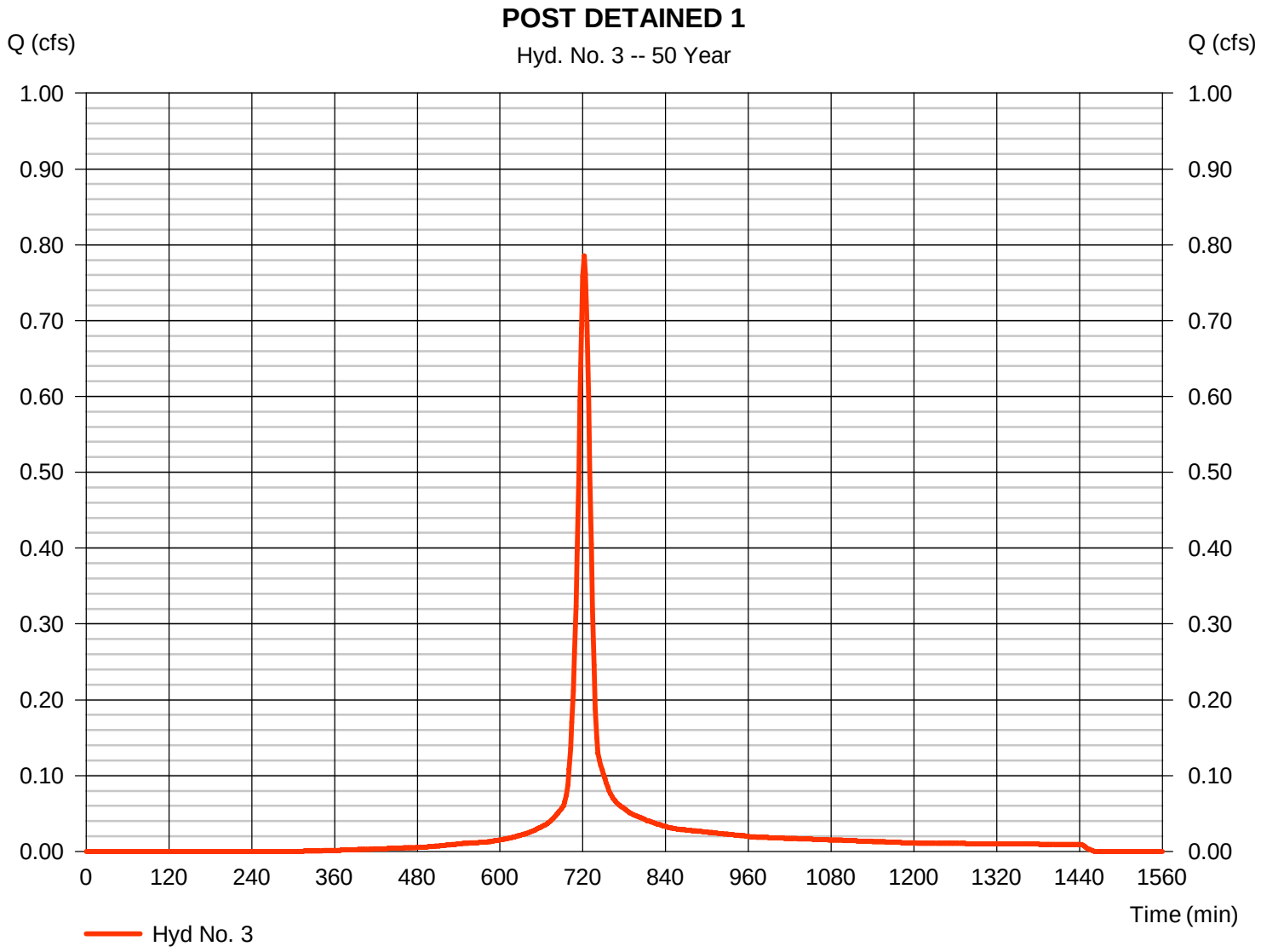
Hydrograph Report

Hyd. No. 3

POST DETAINED 1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.785 cfs
Storm frequency	= 50 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 2,244 cuft
Drainage area	= 0.170 ac	Curve number	= 86*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 14.83 min
Total precip.	= 5.28 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.030 x 71) + (0.020 x 78) + (0.030 x 89) + (0.090 x 91)] / 0.170



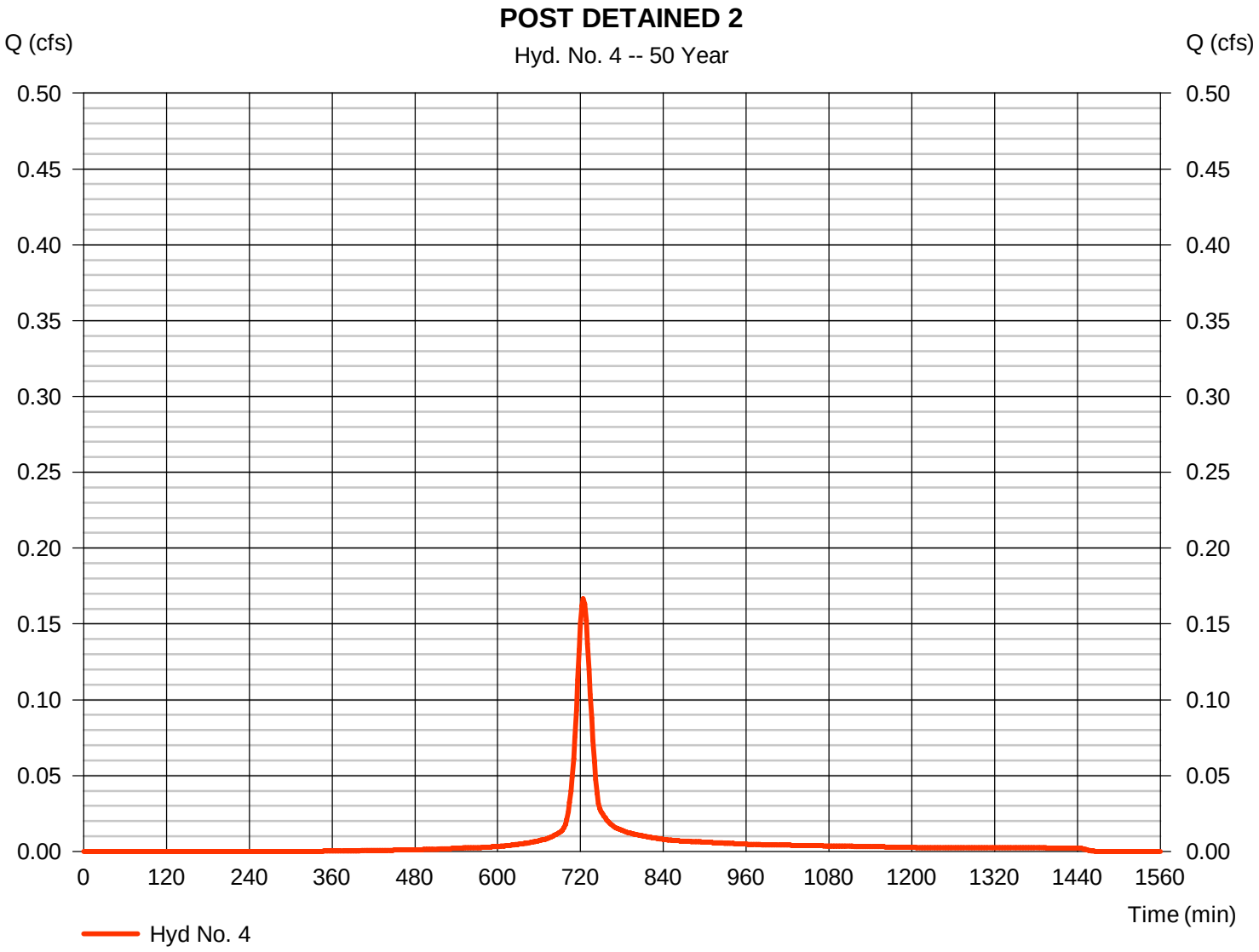
Hydrograph Report

Hyd. No. 4

POST DETAINED 2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.167 cfs
Storm frequency	= 50 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 527 cuft
Drainage area	= 0.040 ac	Curve number	= 85*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 17.99 min
Total precip.	= 5.28 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.020 x 91) + (0.020 x 78)] / 0.040

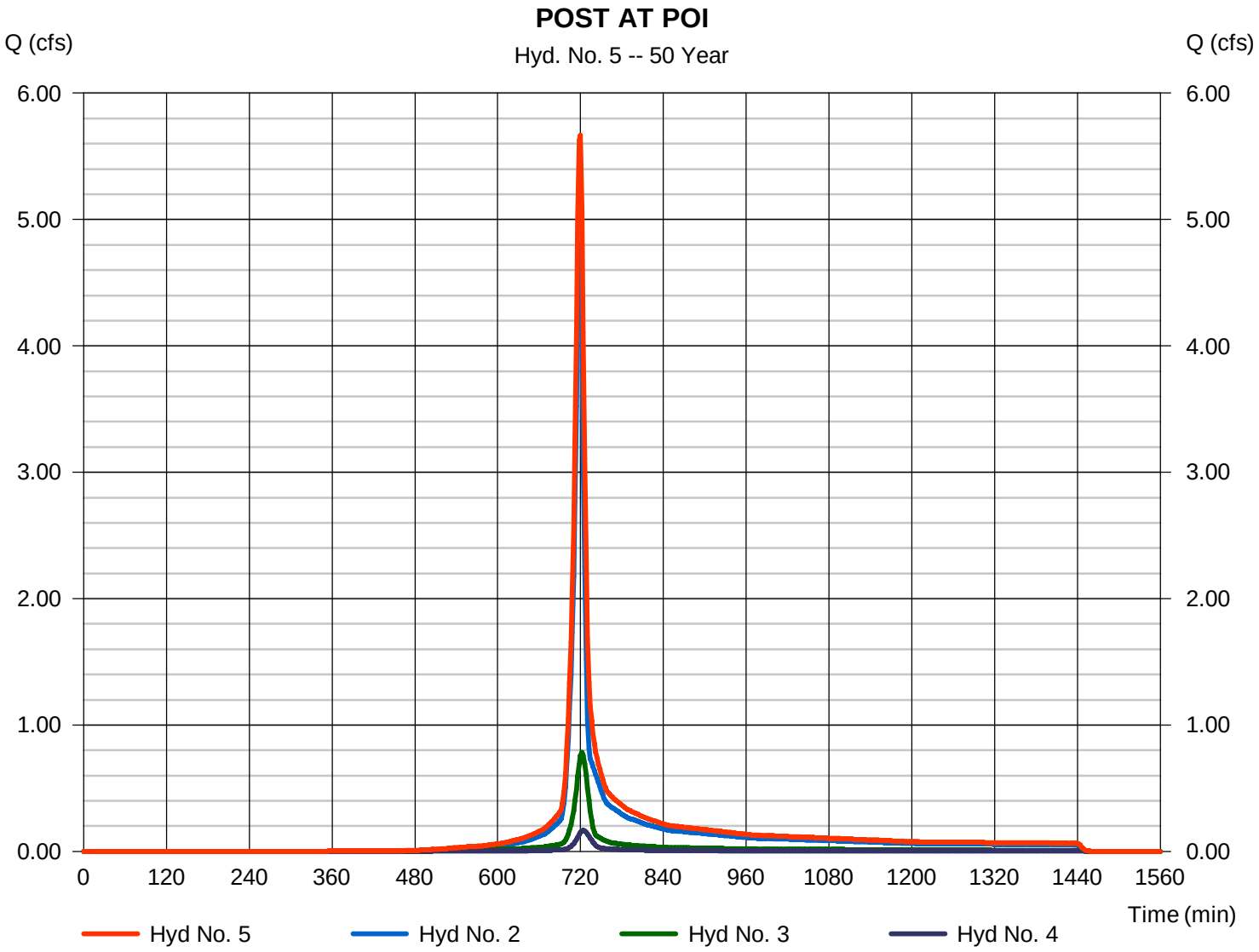


Hydrograph Report

Hyd. No. 5

POST AT POI

Hydrograph type	= Combine	Peak discharge	= 5.666 cfs
Storm frequency	= 50 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 13,771 cuft
Inflow hyds.	= 2, 3, 4	Contrib. drain. area	= 1.270 ac



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	39.7793	9.9000	0.8796	--------
2	47.2145	10.1000	0.8721	--------
3	0.0000	0.0000	0.0000	--------
5	49.1407	9.5000	0.8258	--------
10	46.6495	8.4000	0.7811	--------
25	46.5911	7.6000	0.7402	--------
50	41.2057	6.1000	0.6844	--------
100	39.5863	5.3000	0.6488	--------

File name: Locke IDF.IDF

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	3.70	2.87	2.35	2.00	1.75	1.55	1.40	1.28	1.17	1.09	1.01	0.95
2	4.42	3.45	2.84	2.42	2.12	1.89	1.70	1.55	1.43	1.33	1.24	1.16
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	5.40	4.23	3.50	3.00	2.64	2.36	2.14	1.96	1.81	1.68	1.57	1.48
10	6.14	4.80	3.98	3.42	3.01	2.70	2.45	2.25	2.09	1.95	1.83	1.72
25	7.14	5.58	4.64	4.00	3.53	3.18	2.90	2.67	2.48	2.32	2.18	2.06
50	7.93	6.15	5.11	4.42	3.92	3.54	3.24	2.99	2.79	2.62	2.47	2.34
100	8.72	6.74	5.61	4.87	4.33	3.92	3.60	3.33	3.12	2.93	2.77	2.63

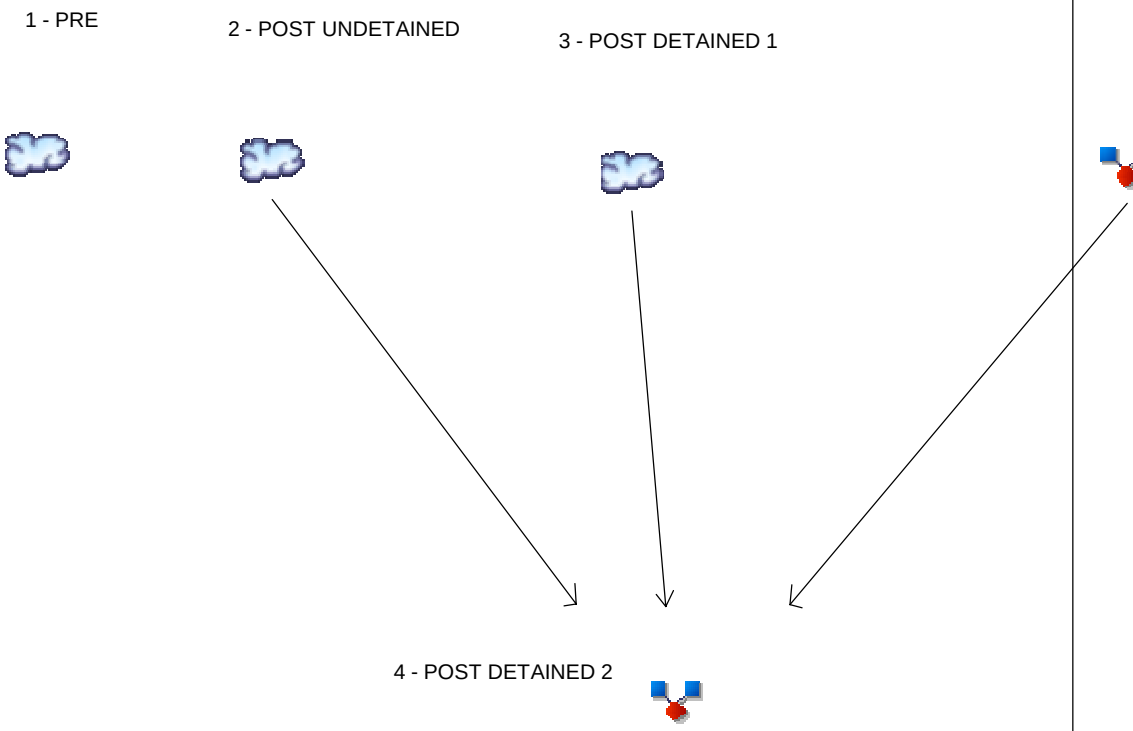
Tc = time in minutes. Values may exceed 60.

CGP-2\PPP\02 SCRO\07 PCSM\Attach 4 Stormwater Calcs\Locke Mountain Road\Hydraflow Rev 1\Locke Precip.pc

Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	2.23	2.67	0.00	3.33	3.86	4.64	5.28	5.97
SCS 6-Hr	1.47	1.78	0.00	2.22	2.58	3.10	3.54	4.00
Huff-1st	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Watershed Model Schematic

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



Legend

Hyd.	Origin	Description
1	SCS Runoff	PRE
2	SCS Runoff	POST UNDETAINED
3	SCS Runoff	POST DETAINED 1
4	SCS Runoff	POST DETAINED 2
5	Combine	POST AT POI

Hydrograph Return Period Recap

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	------	-------	-------	-------	-------	-------	-------	-------	6.933	PRE
2	SCS Runoff	------	-------	-------	-------	-------	-------	-------	-------	5.786	POST UNDETAINED
3	SCS Runoff	------	-------	-------	-------	-------	-------	-------	-------	0.916	POST DETAINED 1
4	SCS Runoff	------	-------	-------	-------	-------	-------	-------	-------	0.211	POST DETAINED 2
5	Combine	2, 3, 4	-------	-------	-------	-------	-------	-------	-------	6.797	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	6.933	2	718	15,918	------	------	------	PRE
2	SCS Runoff	5.786	2	718	13,286	------	------	------	POST UNDETAINED
3	SCS Runoff	0.916	2	722	2,636	------	------	------	POST DETAINED 1
4	SCS Runoff	0.211	2	722	605	------	------	------	POST DETAINED 2
5	Combine	6.797	2	720	16,527	2, 3, 4	------	------	POST AT POI

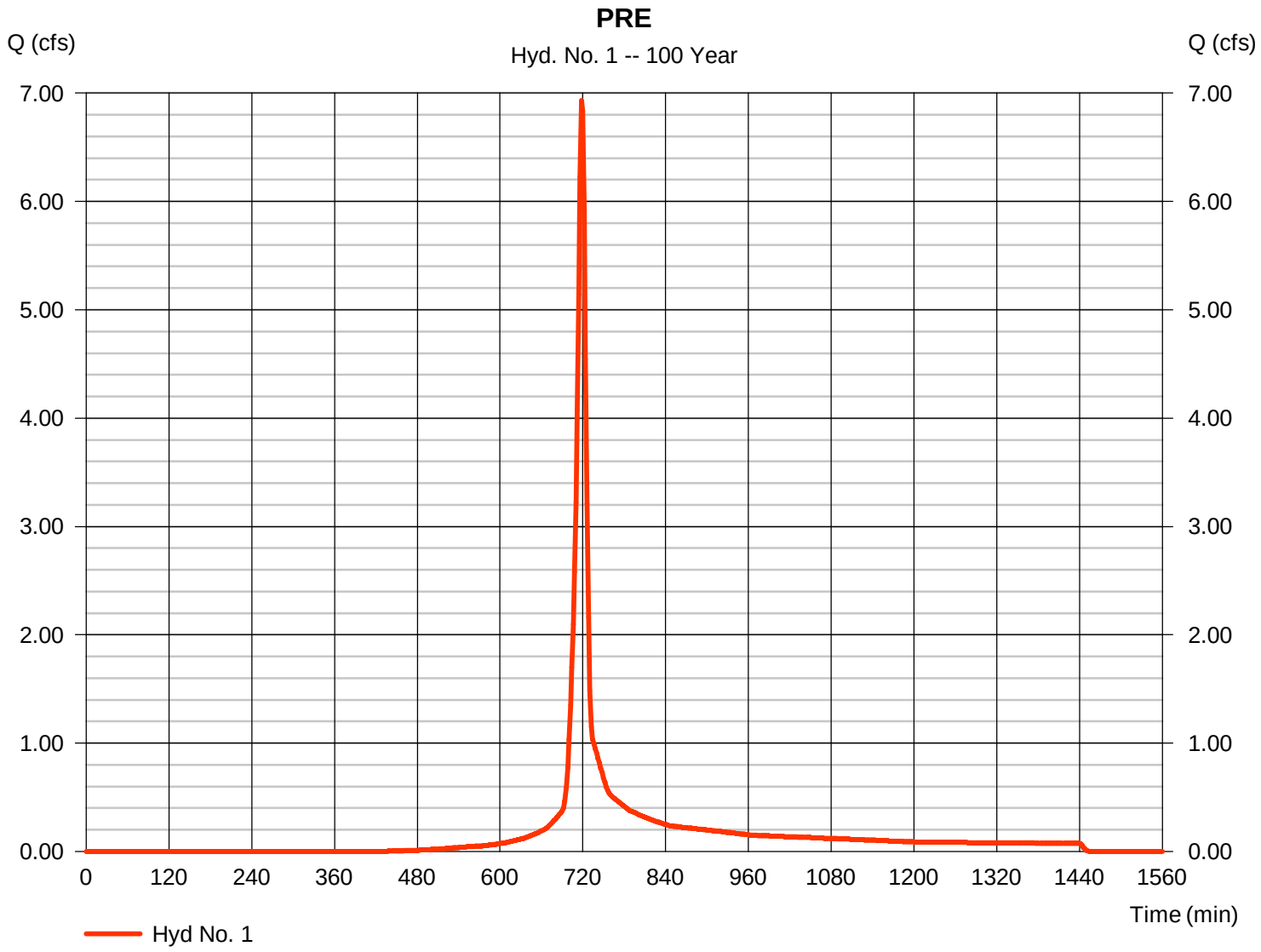
Hydrograph Report

Hyd. No. 1

PRE

Hydrograph type	=	SCS Runoff	Peak discharge	=	6.933 cfs
Storm frequency	=	100 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	15,918 cuft
Drainage area	=	1.270 ac	Curve number	=	77*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	7.20 min
Total precip.	=	5.97 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.200 x 71) + (0.950 x 78) + (0.120 x 77)] / 1.270



TR55 Tc Worksheet

Hyd. No. 1

PRE

Description	A		B		C		Totals
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)	= 2.67		0.00		0.00		
Land slope (%)	= 8.00		0.00		0.00		
Travel Time (min)	**= 5.15**	**+**	**0.00**	**+**	**0.00**	**=**	**5.15**
Shallow Concentrated Flow							
Flow length (ft)	= 343.00		0.00		0.00		
Watercourse slope (%)	= 2.90		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.75		0.00		0.00		
Travel Time (min)	**= 2.08**	**+**	**0.00**	**+**	**0.00**	**=**	**2.08**
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 ..... 7.20 min

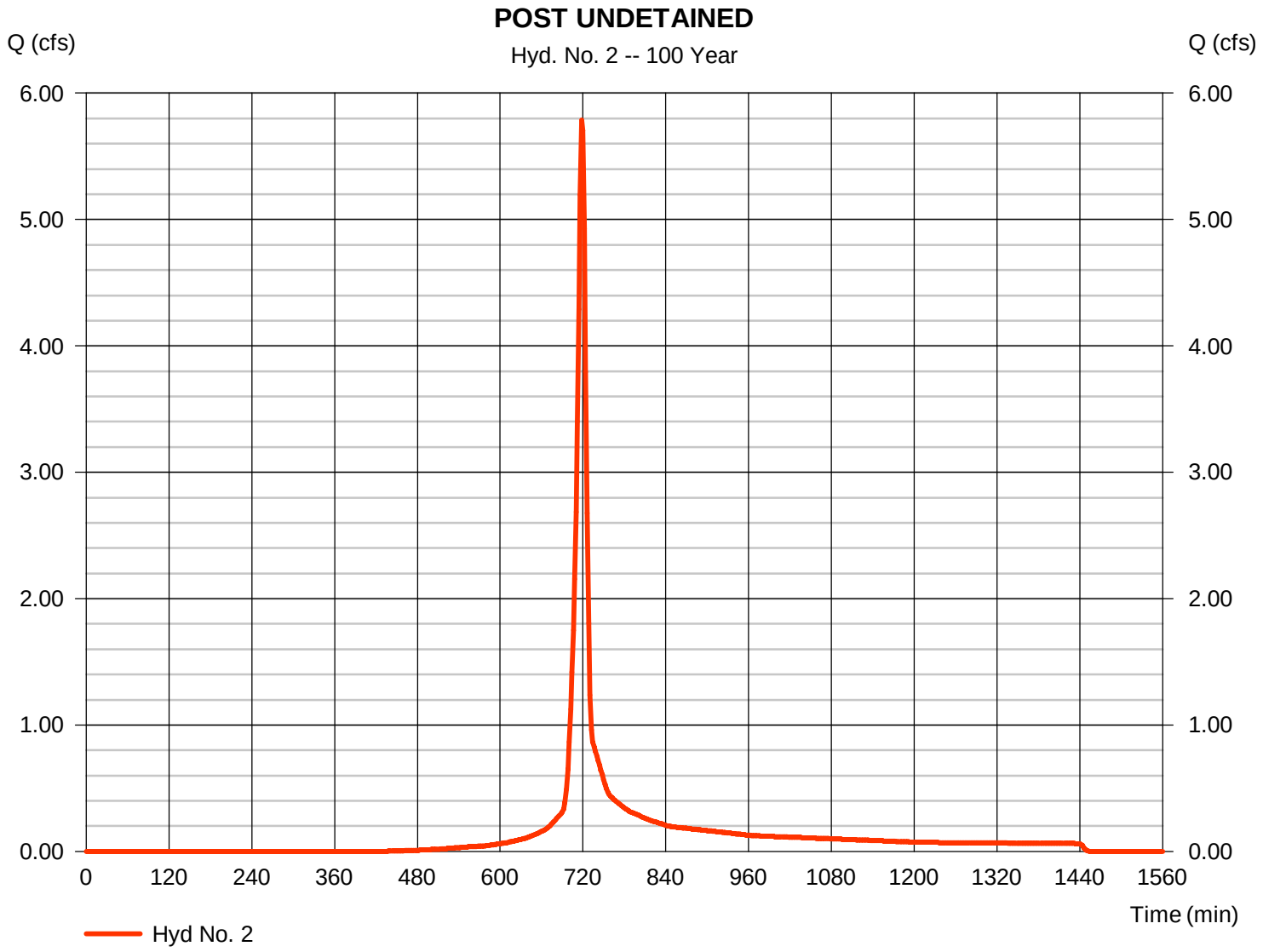
Hydrograph Report

Hyd. No. 2

POST UNDETAINED

Hydrograph type	=	SCS Runoff	Peak discharge	=	5.786 cfs
Storm frequency	=	100 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	13,286 cuft
Drainage area	=	1.060 ac	Curve number	=	77*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	7.20 min
Total precip.	=	5.97 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(0.140 x 71) + (0.800 x 78) + (0.110 x 77) + (0.010 x 89)] / 1.060



TR55 Tc Worksheet

Hyd. No. 2

POST UNDETAINED

Description	A		B		C		Totals
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)	= 2.67		0.00		0.00		
Land slope (%)	= 8.00		0.00		0.00		
Travel Time (min)	**= 5.15**	**+**	**0.00**	**+**	**0.00**	**=**	**5.15**
Shallow Concentrated Flow							
Flow length (ft)	= 343.00		0.00		0.00		
Watercourse slope (%)	= 2.90		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.75		0.00		0.00		
Travel Time (min)	**= 2.08**	**+**	**0.00**	**+**	**0.00**	**=**	**2.08**
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 ..... 7.20 min

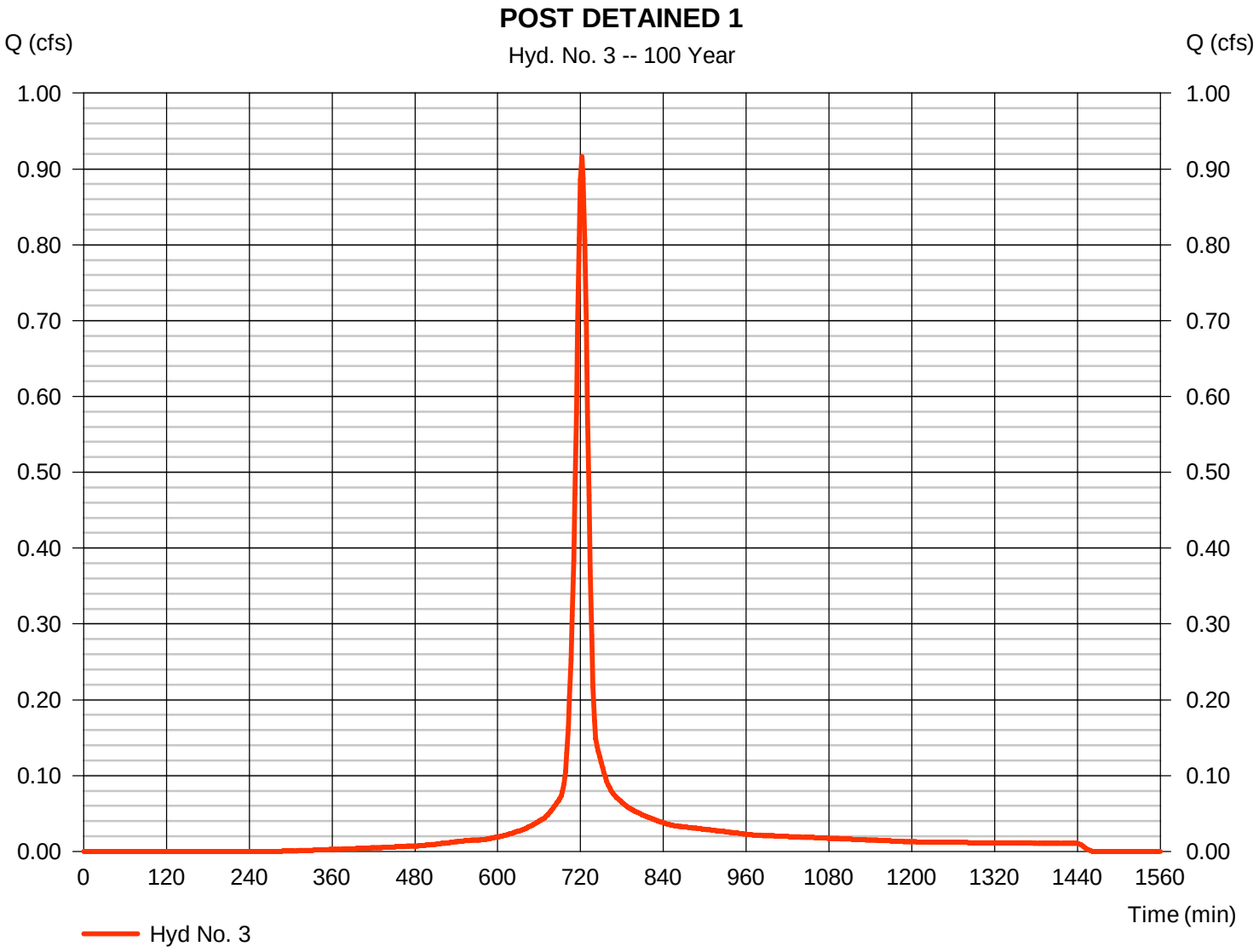
Hydrograph Report

Hyd. No. 3

POST DETAINED 1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.916 cfs
Storm frequency	= 100 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 2,636 cuft
Drainage area	= 0.170 ac	Curve number	= 86*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 13.60 min
Total precip.	= 5.97 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.030 x 71) + (0.020 x 78) + (0.030 x 89) + (0.090 x 91)] / 0.170



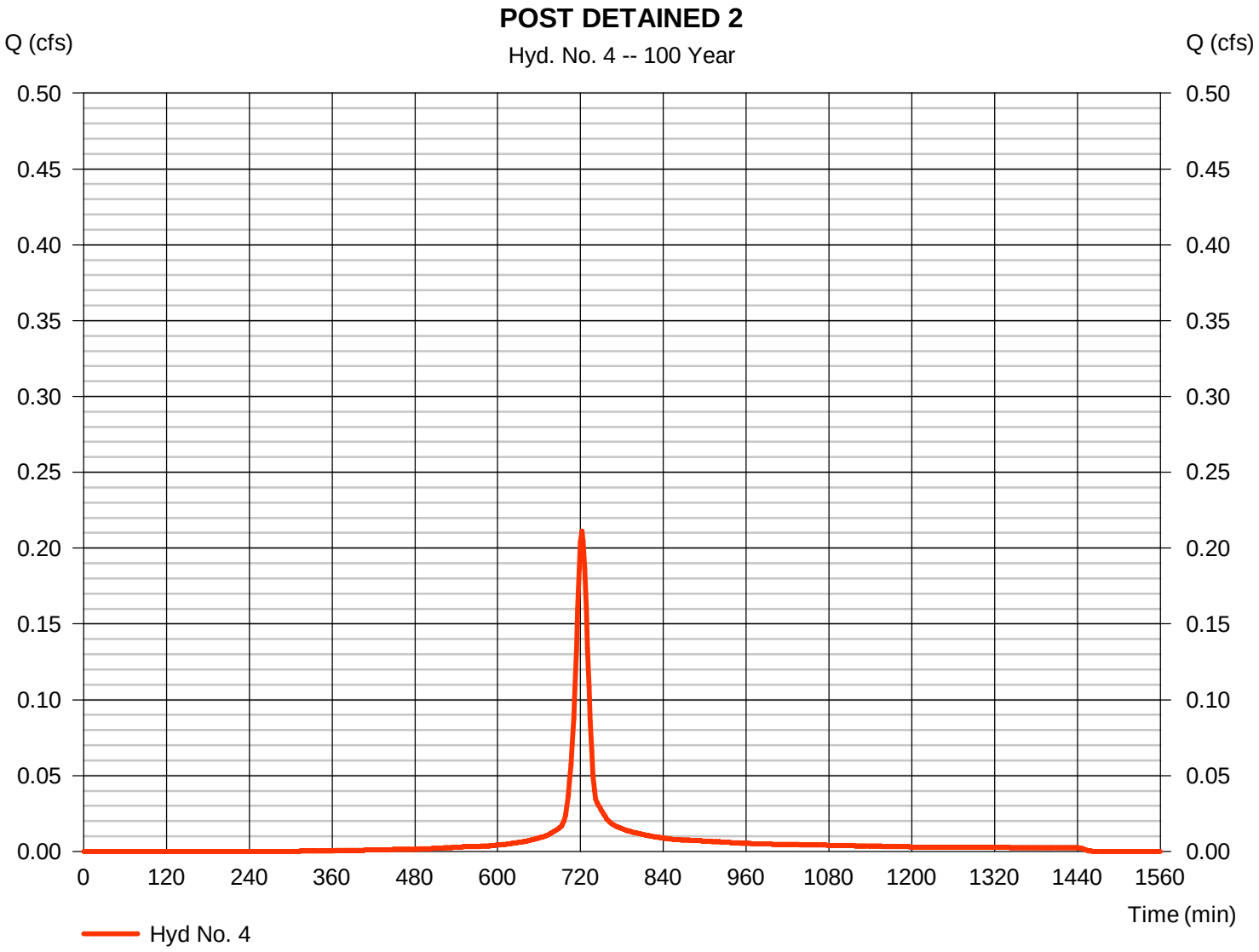
Hydrograph Report

Hyd. No. 4

POST DETAINED 2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.211 cfs
Storm frequency	= 100 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 605 cuft
Drainage area	= 0.040 ac	Curve number	= 85*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 16.17 min
Total precip.	= 5.97 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.020 x 91) + (0.020 x 78)] / 0.040

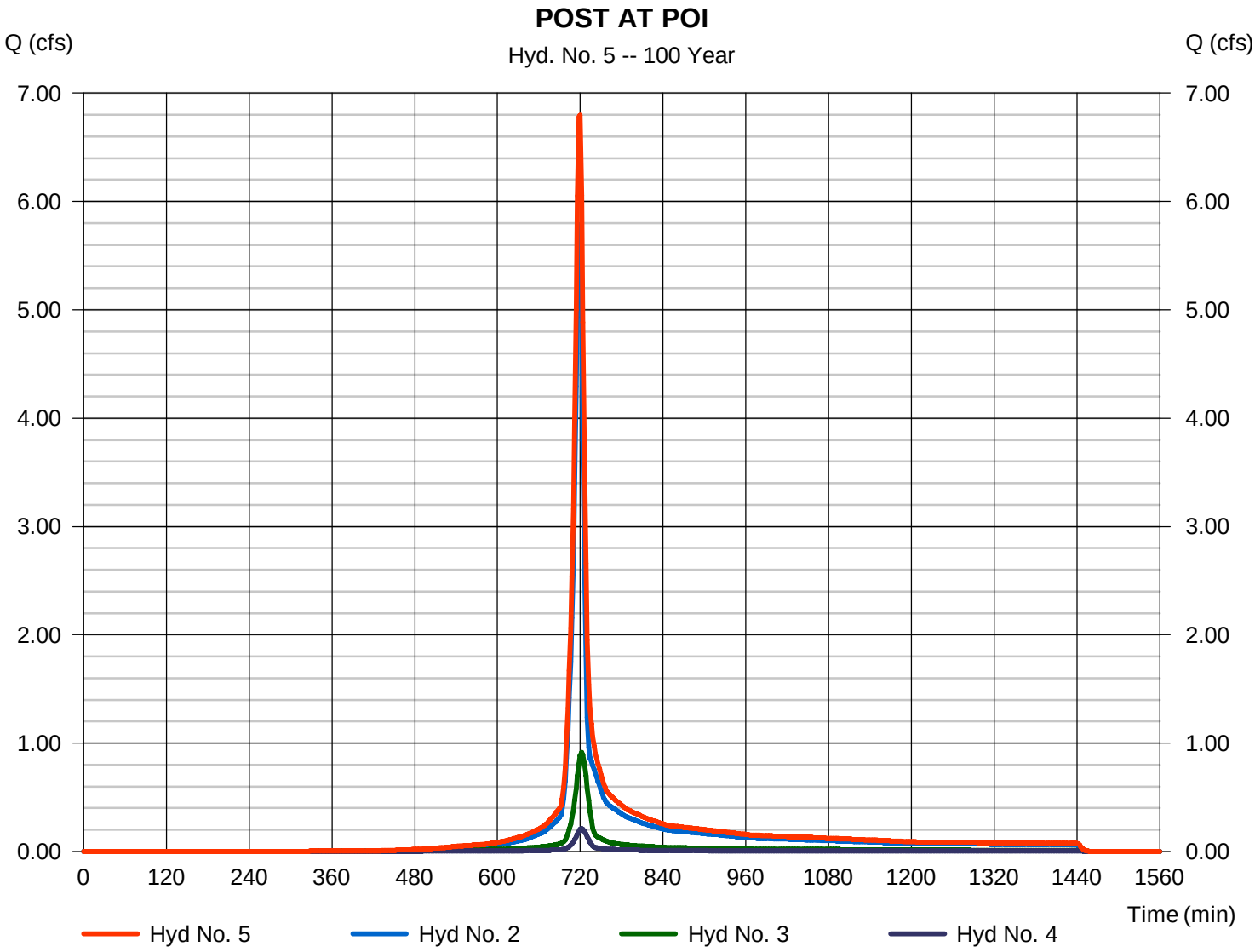


Hydrograph Report

Hyd. No. 5

POST AT POI

Hydrograph type	= Combine	Peak discharge	= 6.797 cfs
Storm frequency	= 100 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 16,527 cuft
Inflow hyds.	= 2, 3, 4	Contrib. drain. area	= 1.270 ac



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	39.7793	9.9000	0.8796	--------
2	47.2145	10.1000	0.8721	--------
3	0.0000	0.0000	0.0000	--------
5	49.1407	9.5000	0.8258	--------
10	46.6495	8.4000	0.7811	--------
25	46.5911	7.6000	0.7402	--------
50	41.2057	6.1000	0.6844	--------
100	39.5863	5.3000	0.6488	--------

File name: Locke IDF.IDF

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	3.70	2.87	2.35	2.00	1.75	1.55	1.40	1.28	1.17	1.09	1.01	0.95
2	4.42	3.45	2.84	2.42	2.12	1.89	1.70	1.55	1.43	1.33	1.24	1.16
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	5.40	4.23	3.50	3.00	2.64	2.36	2.14	1.96	1.81	1.68	1.57	1.48
10	6.14	4.80	3.98	3.42	3.01	2.70	2.45	2.25	2.09	1.95	1.83	1.72
25	7.14	5.58	4.64	4.00	3.53	3.18	2.90	2.67	2.48	2.32	2.18	2.06
50	7.93	6.15	5.11	4.42	3.92	3.54	3.24	2.99	2.79	2.62	2.47	2.34
100	8.72	6.74	5.61	4.87	4.33	3.92	3.60	3.33	3.12	2.93	2.77	2.63

Tc = time in minutes. Values may exceed 60.

CGP-2\PPP\02 SCRO\07 PCSM\Attach 4 Stormwater Calcs\Locke Mountain Road\Hydraflow Rev 1\Locke Precip.pc

Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	2.23	2.67	0.00	3.33	3.86	4.64	5.28	5.97
SCS 6-Hr	1.47	1.78	0.00	2.22	2.58	3.10	3.54	4.00
Huff-1st	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00