SHIPYARD VILLAGE APARTMENTS

CITY OF WILMINGTON, NC

STORMWATER MANAGEMENT
DESIGN NARRATIVE

Prepared for:

SHIPYARD VILLAGE WILMINGTON, LLC

2100-D Cornwallis Drive
Greensboro, North Carolina 27408

Prepared by:

McKIM & CREED

243 North Front Street
Wilmington, NC 28401
(910)343-1048

Project #7010-0001 (40)

March 2016
Resubmittal #1 – June 24, 2016
Resubmittal #2 – September 9, 2016
Resubmittal #3 – October 14, 2016

[redacted]

SHIPYARD VILLAGE APARTMENTS

CITY OF WILMINGTON, NORTH CAROLINA

Project #7010-0001 (40)

Table of Contents

DESIGN NARRATIVE

Project Description

Shipyard Village Apartments, LLC is proposing a 96-unit multifamily apartment development within its 7.19-acre parcel. Impervious areas will cover approximately 3.35 acres of the project area. Stormwater will be treated using three infiltration basins and one infiltration trench.

Clearing and grubbing within the roadway right of ways, building sites and infiltration trenches locations will consist of a total disturbed area of 5.92 acres.

Existing Site

The proposed project is located at 2821 Carolina Beach Road (PIDs: R06506-008-020-000, R06506-008-029-000, and R06506-008-032-000). The site is bounded to the north by Victoria Village subdivision (a single family neighborhood), to the west by Carolina Beach Road/UPS Freight/Calvary Chapel of Wilmington, to the south by Hanover Heights subdivision (a single family neighborhood), and to the east by The Pines of Wilmington (an existing multifamily development).

There are no wetlands on the subject site. There are no flood hazard areas present on the site according to the flood insurance rate map for New Hanover County (Community Panel No. 372031-2600-J, effective 4/3/2006). The site drains generally towards the southwest, towards the UPS Freight commercial business.

A survey of the site was completed by McKim and Creed, Inc. in April 2014. The proposed project tract and subsequent project boundary is 7.19 acres and located within the City of Wilmington's Multiple Family Residential District-Medium Density (MF-M) zoning district. The receiving water body is Cape Fear River and is classified as SC, Index-No.18-(71).

Based on the USGS National Resources Conservation Service, the underlying soils within the project area are primarily Wakulla sand (Wa), with small amounts of Borrow pits (Bp), Leon sand (Le), and Rimini sand (Rm). A geotechnical investigation including exploration of seasonal high water table and infiltration rate was conducted on January 2016 by ECS Carolinas, LLP (ECS) and results are provided within the attached appendix.

Proposed Improvements

The stormwater management design plans are found in the enclosed plans, including:

- DA1 – Pre/Post Development Drainage Area Map
- DA2 – Inlet Drainage Area Map
- CG-101 – Storm Drainage and Grading Plan

- CG-501 – Storm Drainage Details
- CN-501 – Stormwater Management Details
- CN-502 – Stormwater Management Details

The total property area/stormwater project area for Shipyard Village is 313,133 sf (7.19 ac). All of the stormwater project area will be conveyed through stormwater pipe systems to various stormwater control measures (SCMs). Roof drainage will be conveyed to the shown structures via a roof drainage header system. There are four (4) proposed SCMs for this site. SCMs 1, 2, and 3 are proposed infiltration basins and SCM 4 is a proposed infiltration trench.

Built-upon-area totals were determined for proposed conditions using the design information.

Table 1 – Proposed Built-Upon-Area - Onsite

Built-Upon-Area		
Parking/Roadways	77,929	sf
Pervious	*0*	*sf*
Impervious	*77,929*	*sf*
Buildings	46,207	sf
Sidewalk	19,866	sf
Pervious	*0*	*sf*
Impervious	*19,866*	*sf*
Other – Drains Offsite to Carolina Beach Road	2,385	sf
Future	0	sf
Total	**146,387**	**sf**

Drainage Areas

The onsite drainage areas were delineated as part of the stormwater management plan into pre-development site drainage areas. Based upon proposed topography and design information, the onsite post development drainage area was delineated into four (4) sub-drainage areas that flow to each SCM in the proposed plan. Each watershed was delineated into individual sub-drainage areas that flow to catch basins and drop inlets as shown in the drainage plan.

Stormwater Control Measures (SCM)

The proposed project will be permitted as a high-density project utilizing three infiltration basins and one infiltration trench for stormwater treatment. All of the runoff will be piped to these stormwater facilities using a systematic conveyance system. The proposed water quality SCMs are sized to treat, at a minimum, the first 1.5-inch of runoff from the contributing drainage areas.

area will be piped to these stormwater facilities using a systematic conveyance system. The proposed water quality SCMs are sized to treat, at a minimum, the first 1.5-inch of runoff from the contributing drainage areas.

The proposed storm drainage pipe system was modeled using Bentley's CivilStorm to ensure that the drainage pipes are sized to convey the 10-year return event within the proposed pipes and to check for flooding during the 50-year return event.

The stormwater management SCMs were modeled using Hydraflow software to calculate existing and proposed peak discharges. Four (4) post development outfalls were identified for the project area. A routing analysis is attached that details SCM performance for the 2-, 10-, and 25-yr storm events. Results for routing of larger storms are also included in the enclosed calculations.

Table 2 – Pre/Post Development Flows

Peak Discharge (ft^3/s)

	Return Event		
	2-yr	10-yr	25-yr
Pre-Development	0.031	1.000	2.280
Post-Development	0.212	0.389	0.901
Meets Pre vs Post Development Criteria	No**	Yes	Yes

** Post development runoff exceeds pre development runoff in the 2-year storm event due to the 2,385 SF of proposed impervious surface (street apron) draining from on-site to off-site into the existing Carolina Beach Road storm drainage system. It is transmitted via 2'-6" concrete curb and gutter.

Maintenance

The facility shall be routinely checked for and cleared of all accumulation of debris and the infiltration trench outlet structure cleared of any blockage.

Storm drainage pipes and structures shall be periodically inspected for debris and sediment build-up. They shall be cleaned as necessary to provide for the conveyance of storm water as designed.

The pipes and stone installed to provide infiltration shall be kept free of sediment build-up. The infiltration facility shall be maintained in accordance with the Stormwater Management Plan approved by the City and on file in the office of the City Engineer. The pipe shall be inspected on a regular basis but not less than every six months. Debris and sedimentation shall be removed if:

a) The infiltration capacity is impaired and/or,

b) The sediment and/or debris restrict the free flow of storm water into the infiltration system and surrounding soils.

The infiltration system shall be removed and replaced with new material when the system no longer permits the stormwater to freely infiltrate into the surrounding soils.

ATTACHMENT 1 – SUPPORTING DOCUMENTATION

I. PARCEL DEED

II. SOILS INFORMATION

III. INFILTRATION BASIN CALCULATIONS

IV. INFILTRATION TRENCH CALCULATIONS

V. HYDRAFLOW CALCULATIONS

VI. STORM PIPES/STRUCTURES

VII. RIPRAP APRON CALCULATIONS

I. PARCEL DEED

Yg 1650 PAs

2009008700

FOR REGISTRATION REGISTER OF DEEDS
JENNIFER H MACNEISH
NEW HANOVER COUNTY, NC
2009 MAR 13 02:55:27 PM
BK:5387 PG:329-335 FEE:$29.00
NC REV STAMP:$1,650.00
INSTRUMENT # 2009008700

NC $1650.00 BARR

Prepared by: SMITH MOORE LEATHERWOOD, LLP (MVL)

Tax Parcel ID #: 3126-18-31-7042 and PT of RO6506-008-021-000 & RO6506-008-028-000

NORTH CAROLINA

NEW HANOVER COUNTY

Return to Schell Bray Aycock Abel & Livingston P.O. Box 21847 Greensboro NC 27420

SPECIAL WARRANTY DEED

THIS DEED, made this 12th day of March, 2009, by DEFFET RENTALS, INC., an Ohio corporation , (the "Grantor"); to CARR-POWELL PROPERTIES, LLC, a North Carolina limited liability company, as to a 1/3 undivided interest as tenant-in-common, PATRICK G. PARR and wife, KELLY E. PARR, as to a 1/3 undivided interest as tenant-in-common, and CAROLINA HEALTHCARE INITIATIVES, LLC, a North Carolina limited liability company, as to a 1/3 undivided interest as tenant-in-common (collectively, the "Grantee"), whose address is: 2100-D W. Cornwallis Drive, P. O. Box 31108, Greensboro, North Carolina 27429.

WITNESSETH:

That Grantor, for a valuable consideration paid by Grantee, the receipt of which is hereby acknowledged, has sold, and by these presents, does grant, bargain, sell and convey unto Grantee, its successors and assigns, that parcel of land lying and being in New Hanover County, North Carolina, and more particularly described on EXHIBIT A attached hereto and incorporated herein by reference.

This property was conveyed to Grantor by Deeds recorded in the New Hanover County Registry in Book 959, Page 803 and Book 5358, Page 1884.

TO HAVE AND TO HOLD the aforesaid parcel of land and all privileges and appurtenances thereto belonging to the Grantee in fee simple.

And the Grantor covenants with the Grantee that Grantor has done nothing to impair such title as Grantor received, and Grantor will warrant and defend the title against the lawful claims of all persons claiming by, under or through Grantor, subject to valid and enforceable easements, rights-of-way and restrictions of record, if any, and a pro rata share of the current year's ad valorem property taxes and such additional exceptions as may be hereinafter stated. Title to the property hereinabove described is subject to additional exceptions as shown on EXHIBIT B attached hereto.

The designation Grantor and Grantee as used herein shall include said parties, their heirs, successors and assigns, and shall include singular, plural, masculine, feminine or neuter as required by context.

[SIGNATURE PAGE ATTACHED HERETO]

IN WITNESS WHEREOF, the Grantor has hereunto set its hand and seal the day and year first above written.

DEFFET RENTALS, INC., an Ohio corporation

BY: Rose K. Deffet
Name: Rose K. Deffet
Title: President

State of OHIO

County of FRANKLIN

I certify that the following person(s) *personally appeared* before me this day, each acknowledging to me that he or she *voluntarily* signed the foregoing document for the purpose stated therein and in the *capacity indicated*: ROSE K. DEFFET, as President of Deffet Rentals, Inc.

Date: 3/12/2009

Notary Public
Printed Name: NICHOLAS M. GROVES

NICHOLAS M. GROVES
Notary Public, State of Ohio
My Commission Expires 12-08-2010
Recorded in Franklin County

My commission expires: 12/8/2010

080884-00002

EXHIBIT A

TRACT 1:

BEGINNING at a concrete monument in the southern right of way line of Shipyard Boulevard (SR #1101) (65.0 feet from the centerline thereof), said monument being at the northeastern corner of Victoria Village as recorded in Map Book 4, at Page 98; of the New Hanover County Registry, running thence from said beginning point and along the southern right of way line of said Shipyard Boulevard, North 80 degrees 34 minutes East 500.0 feet to an iron pipe; running thence South 22 degrees 19 minutes West 743.0 feet to an iron pipe; running thence Sough 9 degrees 21 minutes East 251.8 feet to an iron pipe at the northwestern corner of Lot 12, Block 1, Hanover Heights, as recorded in Map Book 5, at Page 82 of the New Hanover County Registry; running thence along the northwestern line of said Hanover Heights, South 43 degrees 0 minutes West 409.5 feet to a granite stone marked "WDP"; running thence along the northwestern line of said Hanover Heights, South 43 degrees 34 minutes West 1122.41 feet to an old iron pipe a corner of the Terminal City Oil Company Property; running thence along the eastern line of said Terminal City Oil Company Property and along the eastern line of Overnite Transportation Property, North 21 degrees 54 minutes West 716.1 feet to an old iron pipe in the southern line of aforementioned Victoria Village, said point being the northeastern corner of a tract of land conveyed to said Overnite Transportation Company; running thence along the said southern line of said Victoria Village, North 89 degrees 11 minutes East 260.02 feet to a concrete monument; running thence along the southern line of said Victoria Village, North 61 degrees 58 minutes East 485.0 feet to a concrete monument; running thence along the eastern line of said Victoria Village North 19 degrees 33 minutes East 1135.5 feet to the point of beginning, containing 21.559 acres, and being a portion of that property conveyed or intended to be conveyed by deed from David B. Gaither and wife to Greenlawn Memorial Park, Inc,, by deed recorded in Book 409 at Page 405 of the New Hanover County Registry; together with an easement or right of way for the purpose of ingress and egress over and upon the following described lands, to wit: Beginning at the northwestern corner of a tract of land conveyed by Greenlawn Memorial Park, Inc. to Terminal City Transport, Inc. by deed dated June 21, 1960, and duly recorded in Book 664 at Page 539 of the New Hanover County Registry, and running thence North 21 degrees 56 minutes West 60 feet; running thence North 68 degrees 4 minutes East at right angles to U.S. Highway No. 421, 363.8 feet to the westerly line of the tract of land conveyed to parties of the second part as hereinabove described; running thence South 21 degrees 54 minutes East with said westerly line 60 feet; running thence South 68 degrees 4 minutes West 363.8 feet to the point of beginning; excepting therefrom Tract 1, Tract 2 and Tract 3.

TRACT 2:

BEING all of that certain parcel of land situated in Wilmington township, New Hanover County, North Carolina, being more particularly described as follows:

Beginning at a Monument "Overnite", said point having NC grid, NAD 83 coordinates of Northing 161004.6977 and Easting 2323010.8887; thence North 20°04'23" West, a distance of 129.12 feet to an iron pipe found; thence North 85°02'44" East, a distance of 390.10 feet to a rebar set, near the Northeast corner of the Overnite shipping company 5' chain link fence; thence with said fence South 26°03'04" East, a distance of 331.98 feet to a rebar set, said point being the true Point of Beginning:

Thence from the Point of Beginning South 26°03'04" East, a distance of 60.00 feet to a 1.5" open top iron pipe found; thence continuing South 26°03'04" East, a distance of 12.25 feet to a rebar set; thence South 64°07'58" West, a distance of 46.78 feet to a rebar set; thence with a curve to the right having a cord bearing of South 75°23'48" West, a radius of 131.50 feet an arc length of 51.70 feet and a chord distance of 51.37 feet to a rebar set; thence with a curve to the left having a cord bearing of South 84°28'51" West, a radius of 68.50 feet an arc length of 5.21 feet and a chord distance of 5.21 feet to a rebar set; thence South 63°54'23" West, a distance of 174.90 feet to a rebar set; thence North 39°29'45" East, a distance of 145.18 feet to a rebar set; thence North 63°54'23" East, a distance of 144.75 feet to the Point of Beginning. Containing 13,659 sq. ft. or 0.31 ACRES, more or less.

And being shown as Tract A on a map prepared by McKim & Creed titled "Boundary Survey for Deffet Rentals Inc." recorded in Map Book 53, Page 277, New Hanover County Registry.

SUBJECT TO that Encroachment And Access Agreement recorded in Book 5358 at Page 1888 of the New Hanover County Register of Deeds.

EXHIBIT B

Exceptions to Title

AS TO BOTH TRACTS:

1. 2009 and subsequent years' ad valorem taxes, not yet due and payable.

AS TO TRACT 1:

1. Easement to Carolina Power and Light Company recorded in Book 1001 at Page 112.
2. Any encroachment, encumbrance, violation, variation, or adverse circumstance affecting the title that would be disclosed by an accurate and complete land survey.
3. Any inaccuracy in the area, square footage, or acreage of land described in Exhibit A Incorporated herein.

AS TO TRACT 2:

1. Plat recorded in Map Book 34 at Page 370, Map Book 35 at Page 343 and Map Book 53 at Page 277.
2. Any right or interest of the spouse, if any, of Astor Vincent Bolden.
3. Encroachment and Access Agreement recorded in Book 5358 at Page 1888.
4. Plat of survey by David L. Jones, Jr., P.L.S., dated November 4, 2008, shows encroachment of metal building located on adjacent property 2.3 feet over property line of the land.

JENNIFER H. MACNEISH
REGISTER OF DEEDS, NEW HANOVER
216 NORTH SECOND STREET

WILMINGTON, NC 28401

****

Filed For Registration:	**03/13/2009 02:55:27 PM**
Book:	**RE 5387 Page: 329-335**
Document No.:	**2009008700**
	DEED 7 PGS $29.00
NC REAL ESTATE EXCISE TAX:	**$1,650.00**
Recorder:	**CRESWELL, ANDREA**

State of North Carolina, County of New Hanover

YELLOW PROBATE SHEET IS A VITAL PART OF YOUR RECORDED DOCUMENT. PLEASE RETAIN WITH ORIGINAL DOCUMENT AND SUBMIT FOR RE-RECORDING.

2009008700

2009008700

6 20 0

2014011717

FOR REGISTRATION REGISTER OF DEEDS
TAMMY THEUSCH BEASLEY
NEW HANOVER COUNTY, NC
2014 MAY 13 11 51 13 AM
BK 5813 PG 1822-1828 FEE $26 00

INSTRUMENT # 2014011717

QUITCLAIM DEED

Excise Tax NTC
Prepared by. Schell Bray PLLC (TPH)

Return to: Schell Bray PLLC, 230 N Elm Street, Suite 1500, Greensboro, NC 27401

THIS QUITCLAIM DEED made as of this 30th day of April 2014, by and between

GRANTOR	GRANTEE
Terminal City Transport, Inc.; and **William E. Sisson, Jr.; and** **Estate of Alice Moore Sisson; and** **Penelope Sisson Rushmore** 4706 Oleander Dr Wilmington NC 28403	**Carr-Powell Properties, LLC**, a North Carolina limited liability company as to a 1/3 undivided interest as tenant-in-common **Patrick G. Parr and wife, Kelly E. Parr**, as to a 1/3 undivided interest as tenant-in-common **Carolina Healthcare Initiatives, LLC**, a North Carolina limited liability company, as to a 1/3 undivided interest as tenant-in-common P O Box 29169 Greensboro, North Carolina 27429

The designation Grantor and Grantee as used herein shall include said parties, their heirs, successors, and assigns, and shall include singular, plural, masculine, feminine or neuter as required by context

WHEREAS, Terminal City Transport, Inc., a North Carolina corporation, was vested with title to that certain tract or parcel of land described on **Exhibit A** attached hereto by that certain deed from Greenlawn Memorial Park, Inc , dated June 21, 1960, recorded in Deed Book 664, Page 539, New Hanover County Registry; and

WHEREAS, Terminal City Transport, Inc ceased its operations around 1968; and

WHEREAS, W E Sisson was President of Terminal City Transport, Inc and W E Sisson and Alice Moore Sisson were the shareholders of Terminal City Transport, Inc., and

WHEREAS, W E. Sisson died in 1997 and was survived by his wife, Alice Moore Sisson, and their children William E Sisson, Jr. and Penelope Sisson Rushmore; and

WHEREAS, Alice Moore Sisson is deceased and William E Sisson, Jr is the Executor of the Estate of Alice Moore Sisson, and

NOW, THEREFORE, that the Grantor, for good and valuable consideration, the receipt of which is hereby acknowledged, Grantor has and by these presents has and by these presents does remise, release, forever quitclaim, and convey unto Grantee, its heirs, successors and assigns, all of Grantor's right, title, claim and interest in any and all rights of Grantor in and to that, all of that certain lot or parcel of land situated in New Hanover County, North Carolina and more particularly described on **Exhibit A** attached hereto and incorporated herein by reference.

TO HAVE AND TO HOLD said real property, with all privileges, and appurtenances thereunto belonging, to the said Grantee, their heirs, successors, and assigns forever, free and discharged from all right, title, claim, or interest of the Grantor, without warranty

The property described herein is not the personal residence of the Grantor.

[signature pages follow]

IN WITNESS WHEREOF, the Grantor has duly executed the foregoing as of the day and year first above written

GRANTOR:

TERMINAL CITY TRANSPORT, INC.

By: _____
Name: William E Sisson, Jr. Executor of Estate of W E. Sisson and Alice Moore Sisson

_____
William E. Sisson, Jr., Executor of the Estate of Alice Moore Sisson

_____
William E. Sisson, Jr

Marilyn J. Miller joins in the execution of this deed in her individual capacity to remise, release and quitclaim any interest (marital and otherwise) that she might have in the Property.

_____
Marilyn J Miller

New Hanover County, North Carolina

I certify that the following persons personally appeared before me this day, each acknowledging to me that he or she signed the foregoing document **William E. Sisson, Jr. and Marilyn J. Miller.**

Date: May 8, 2014

_____
Official Signature of Notary

Official Seal
OFFICIAL SEAL
Notary Public - North Carolina
NEW HANOVER COUNTY
JOYCE P. CHRISTMAS

Joyce P. Christmas, Notary Public
Printed or typed name

My commission expires. 2/28/2019

384909v1

IN WITNESS WHEREOF, the Grantor has duly executed the foregoing as of the day and year first above written.

Penelope Sisson Rushmore

Dean F. Rushmore joins in the execution of this deed in his individual capacity to remise, release and quitclaim any interest (marital and otherwise) that he might have in the Property.

Dean F. Rushmore

State of Ohio, County of Union

I certify that the following persons personally appeared before me this day, each acknowledging to me that he or she signed the foregoing document: **Penelope Sisson Rushmore and Dean F Rushmore.**

Date. May 2, 2014

Melanie K. Blumenschein
Official Signature of Notary

(Official Seal)

Melanie K Blumenschein, Notary Public
State of Ohio
My Commission Expires 10/3/15

Melanie K. Blumenschein, Notary Public
Printed or typed name

My commission expires 10-3-15

384909v1

Exhibit A

LEGAL DESCRIPTION

BEGINNING AT A POINT, said point being an iron rod at the southwestern corner of Tract A, as shown on a map prepared by McKim & Creed titled "Boundary Survey for Deffet Rentals, Inc ", recorded in Map Book 53, Page 277, Guilford County Registry (the "Plat"), said Tract A being owned by Carr-Powell Properties, LLC, a North Carolina limited liability company, Patrick G. Parr and wife, Kelly E. Parr, and Carolina Healthcare Initiatives, LLC, a North Carolina limited liability company, said iron rod also being located on the southern line of that 60' foot road way described in that certain deed from Greenlawn Memorial Park, Inc., dated June 21, 1960, recorded in Deed Book 664, Page 539, New Hanover County Registry and that certain deed from Terminal City Transport, Inc. to Greenlawn Memorial Park, Inc., dated June 21, 1960, recorded in Deed Book 664, Page 538, New Hanover County Registry, said iron rod also being located on the northern line of property now or formerly owned by Astor Holdings, LLC (deed book 3927, page 264), Thence with said line South 63°54'23" West 87.22 feet to an iron pipe on the eastern line of US HWY 421/Carolina Beach Road, a 100" public right-of-way; Thence with said eastern line of US HWY 421/Carolina Beach Road, a 100" public right-of-way North 26°01'57" West 60 feet to an iron rod on the eastern line of US HWY 421/Carolina Beach Road, a 100" public right-of-way, said iron rod also being the southwestern corner of that tract or parcel of land now or formerly owned by Overnite Transportation Co (deed book 664, page 516), Thence leaving said right-of-way line and following the southern boundary line of Overnite and the northern boundary line of that 60' foot road way described in that certain deed from Greenlawn Memorial Park, Inc , dated June 21, 1960, recorded in Deed Book 664, Page 539, New Hanover County Registry and that certain deed from Terminal City Transport, Inc to Greenlawn Memorial Park, Inc., dated June 21, 1960, recorded in Deed Book 664, Page 538, New Hanover County Registry, North 63°54'23" East 219 36 feet to an iron rod in the northwestern corner of Tract A as shown on the Plat, Thence following the western line of said Tract A South 39°29'45" East 145.18 feet to the POINT OF BEGINNING. The above-described property also being labeled on the Plat as "Deffett Rentals, Inc. DB 959, Page 803, 60' Ingress and Egress

EXHIBIT A-1

Attached to Quitclaim Deed from Terminal City Transport, Inc., William E Sisson, Jr., Estate of Alice Moore Sisson and Penelope Sisson Rushmore to Carr-Powell Properties, LLC, Patrick G Parr and wife, Kelly E. Parr and Carolina Healthcare Initiatives, LLC.

Property described herein is a portion of the following parcels:

R06506-008-019-000 2815 Carolina Beach Road, Wilmington, NC; and

R06506-008-029-000 2831 Carolina Beach Road, Wilmington, NC

TAMMY THEUSCH BEASLEY
REGISTER OF DEEDS, NEW HANOVER
216 NORTH SECOND STREET

WILMINGTON, NC 28401

****

Filed For Registration: 05/13/2014 11:51:13 AM

Book: RE 5813 Page: 1822-1828

Document No.: 2014011717

7 PGS $26.00

Recorder: CRESWELL, ANDREA

State of North Carolina, County of New Hanover

PLEASE RETAIN YELLOW TRAILER PAGE WITH ORIGINAL DOCUMENT.

2014011717

2014011717

II. SOILS INFORMATION

Soil Map—New Hanover County, North Carolina
(Shipyard Village)

Map Scale: 1:2,210 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 30 60 120 180

Feet
0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: New Hanover County, North Carolina
Survey Area Data: Version 16, Sep 29, 2015

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

Date(s) aerial images were photographed: Data not available.

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

New Hanover County, North Carolina (NC129)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
Bp	Borrow pits	0.9	12.7%
Le	Leon sand	0.2	2.8%
Rm	Rimini sand, 1 to 6 percent slopes	0.3	4.3%
Wa	Wakulla sand, 1 to 8 percent slopes	5.8	80.3%
Totals for Area of Interest		**7.2**	**100.0%**

III. INFILTRATION BASIN CALCULATIONS

Shipyard Village

City of Wilmington Retention Requirements

Basin #1

Site Data

Total DA	0.74	ACRE	*Value from CAD*
On-Site Drainage Area	0.74	ACRE	*Value from CAD*
Off-Site Drainage Area	0.00	ACRE	*Value from CAD*
Impervious	0.49	ACRE	*Value from CAD*
Buildings	9,236	SF	*Value from CAD*
Sidewalks	2,644	SF	*Value from CAD*
Streets	0	SF	*Value from CAD*
Parking	9,284	SF	*Value from CAD*
Future	0	SF	
Offsite	0	SF	
Impervious Cover	66.10%		*Impervious Cover=(Impervious Drainage Area)/(Total Drainage Area)*100%*

Treatment Volume

Runoff Coefficient, Rv	0.645	IN/IN	*Rv=0.05+0.009*(% Impervious)*
Required 1.5" Runoff Volume	2,581	CF	*1.5 inch*Rv*1ftt/12 in*(Total DA)*
Provided Treatment Volume	5,261	CF	*Volume between permanent pool & next-highest orifice*

Infiltration Basin

Bottom of Pond Elevation	53.25	FT	*Value selected by designer*
Temporary Pool Elevation	56.73	FT	*Elevation of the next-highest outlet*

Drawdown

Infiltration Rate	12.70	IN/HR	*1/2 Value Reported by Geotechnical Report*
Area of Bottom Contour	712	SF	*Total elevation head above center of orifice*
SHWT Separation	2.05	FT	*1/3 of total elevation head*
Q, Drawdown	0.21	CFS	*Q=Infiltration Rate/3600/12*Bottom Area*
Drawdown Time	0.29	DAYS	*1.5" Runoff Volume/Flowrate through Bottom/86400*

Shipyard Village

City of Wilmington Retention Requirements

Basin #2

Site Data

Total DA	1.82	ACRE	*Value from CAD*
On-Site Drainage Area	1.82	ACRE	*Value from CAD*
Off-Site Drainage Area	0.00	ACRE	*Value from CAD*
Impervious	1.02	ACRE	*Value from CAD*
Buildings	13,993	SF	*Value from CAD*
Sidewalks	8,997	SF	*Value from CAD*
Streets	7,667	SF	*Value from CAD*
Parking	13,991	SF	*Value from CAD*
Future	0	SF	
Offsite	0	SF	
Impervious Cover	56.46%		*Impervious Cover=(Impervious Drainage Area)/(Total Drainage Area)*100%*

Treatment Volume

Runoff Coefficient, Rv	0.558	IN/IN	*Rv=0.05+0.009*(% Impervious)*
Required 1.5" Runoff Volume	5,517	CF	*1.5 inch*Rv*1ftt/12 in*(Total DA)*
Provided Treatment Volume	18,407	CF	*Volume between permanent pool & next-highest orifice*

Infiltration Basin

Bottom of Pond Elevation	51.0	FT	*Value selected by designer*
Temporary Pool Elevation	54.50	FT	*Top of Basin, no outlets proposed*

Drawdown

Infiltration Rate	11.30	IN/HR	*1/2 Value Reported by Geotechnical Report*
Area of Bottom Contour	3786	SF	*Total elevation head above center of orifice*
SHWT Separation	2.00	FT	*1/3 of total elevation head*
Q, Drawdown	0.99	CFS	*Q=Infiltration Rate/3600/12*Bottom Area*
Drawdown Time	0.22	DAYS	*1.5" Runoff Volume/Flowrate through Bottom/86400*

Shipyard Village

City of Wilmington Retention Requirements

Basin #3

Site Data

Total DA	0.75	ACRE	*Value from CAD*
On-Site Drainage Area	0.75	ACRE	*Value from CAD*
Off-Site Drainage Area	0.00	ACRE	*Value from CAD*
Impervious	0.59	ACRE	*Value from CAD*
Buildings	4,468	SF	*Value from CAD*
Sidewalks	1,610	SF	*Value from CAD*
Streets	7,163	SF	*Value from CAD*
Parking	12,557	SF	*Value from CAD*
Future	0	SF	
Offsite	0	SF	
Impervious Cover	79.26%		*Impervious Cover=(Impervious Drainage Area)/(Total Drainage Area)*100%*

Treatment Volume

Runoff Coefficient, Rv	0.763	IN/IN	*Rv=0.05+0.009*(% Impervious)*
Required 1.5" Runoff Volume	3,106	CF	*1.5 inch*Rv*1ftt/12 in*(Total DA)*
Provided Treatment Volume	8,851	CF	*Volume between permanent pool & next-highest orifice*

Infiltration Basin

Bottom of Pond Elevation	50.5	FT	*Value selected by designer*
Temporary Pool Elevation	53.40	FT	*Elevation of the next-highest outlet*

Drawdown

Infiltration Rate	9.25	IN/HR	*1/2 Value Reported by Geotechnical Report*
Area of Bottom Contour	3052	SF	*Total elevation head above center of orifice*
SHWT Separation	2.00	FT	*1/3 of total elevation head*
Q, Drawdown	0.65	CFS	*Q=Infiltration Rate/3600/12*Bottom Area*
Drawdown Time	0.16	DAYS	*1.5" Runoff Volume/Flowrate through Bottom/86400*

Shipyard Village

Stage-Storage Calculations

Basin #1

Stage/Storage Above Permanent Pool

Contour	Contour Area (SF)	Incremental Volume (CF)	Cumulative Volume, S (CF)	
53.25	712	0	0	←**Bottom of Pond**
54.25	1,132	922	922	
55.25	1,609	1,370	2,293	
56.08	2,051	1,519	3,812	
56.25	2,142	356	4,168	
56.73	2,412	1,093	5,261	←**Temporary Pool**
56.90	2,519	419	5,680	←**Top of Pond**

Basin #2

Stage/Storage Above Permanent Pool

Contour	Contour Area (SF)	Incremental Volume (CF)	Cumulative Volume, S (CF)	
51.0	3,786	0	0	←**Bottom of Pond**
52.0	4,578	4,182	4,182	
53.0	5,441	5,010	9,192	
53.2	5,604	994	10,186	
54.00	6,374	4,911	15,097	
54.50	6,867	3,310	18,407	←**Top of Pond**

Basin #3

Stage/Storage Above Permanent Pool

Contour	Contour Area (SF)	Incremental Volume (CF)	Cumulative Volume, S (CF)	
50.5	3,052	0	0	←**Bottom of Pond**
51.0	3,052	1,526	1,526	
52.0	3,052	3,052	4,578	
53.0	3,052	3,052	7,630	
53.4	3,052	1,221	8,851	←**Temporary Pool**
53.7	3,052	916	9,766	←**Top of Pond**

IV. INFILTRATION TRENCH CALCULATIONS

Shipyard Village

City of Wilmington Retention Requirements

Trench #1

Site Data

Total DA	1.80	ACRE	*Value from CAD*
On-Site Drainage Area	1.80	ACRE	*Value from CAD*
Off-Site Drainage Area	0.00	ACRE	*Value from CAD*
Impervious	1.20	ACRE	*Value from CAD*
Buildings	18,510	SF	*Value from CAD*
Sidewalks	6,615	SF	*Value from CAD*
Streets	0	SF	*Value from CAD*
Parking	27,267	SF	*Value from CAD*
Future	0	SF	
Offsite	0	SF	
Impervious Cover	66.98%		*Impervious Cover=(Impervious Drainage Area)/(Total Drainage Area)*100%*

Treatment Volume

Runoff Coefficient, Rv	0.653	IN/IN	*Rv=0.05+0.009*(% Impervious)*
Required 1.5" Runoff Volume	6,383	CF	*1.5 inch*Rv*1ftt/12 in*(Total DA)*
Provided Treatment Volume	7,700	CF	*Volume between permanent pool & next-highest orifice*

Infiltration Basin

Bottom of Pond Elevation	50.5	FT	*Value selected by designer*
Temporary Pool Elevation	52.53	FT	*10-year Storm Elevation*

Drawdown

Infiltration Rate	8.30	IN/HR	*1/2 Value Reported by Geotechnical Report*
Area of Bottom Contour	3900	SF	
SHWT Separation	2.00	FT	
Q, Drawdown	0.75	CFS	*Q=Infiltration Rate/3600/12*Bottom Area*
Drawdown Time	0.12	DAYS	*1.5" Runoff Volume/Flowrate through Bottom/86400*

DYODS™
Design Your Own Detention System

CONTECH CMP DETENTION SYSTEMS

CONTECH CONSTRUCTION PRODUCTS INC.

For design assistance, drawings,
and pricing send completed worksheet to:
dyods@contech-cpi.com

Project Summary

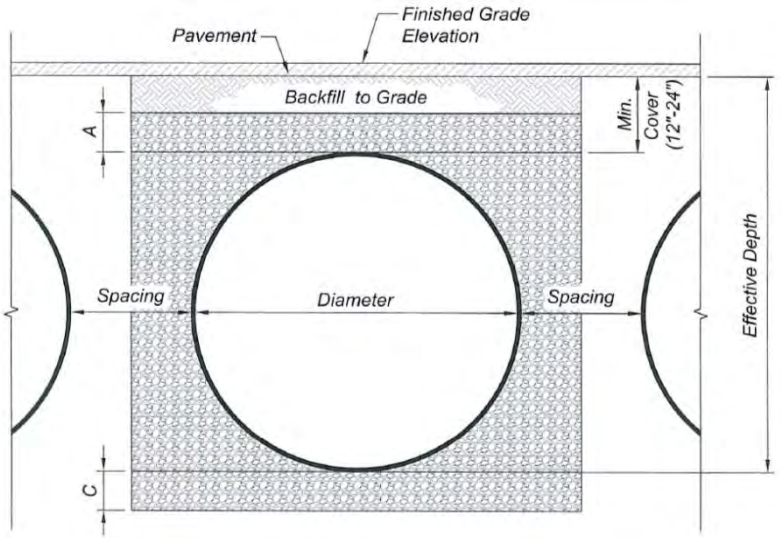
Date:	10/14/2016
Project Name:	Shipyard Village
City / County:	Wilmington
State:	North Carolina
Designed By:	Tamara Murphy, PE
Company:	McKim & Creed, Inc.
Telephone:	910-343-1048

Enter Information in Blue Cells

Corrugated Metal Pipe Calculator

Storage Volume Required (cf):	10,688
Limiting Width (ft):	40.00
Effective Depth Below Asphalt (ft):	5.00
Solid or Perforated Pipe:	Perforated
Shape Or Diameter:	42
Spacing between Barrels (ft):	1.75
Stone Width Around Perimeter of System (ft):	2
Depth A: Porous Stone Above Pipe (in):	6
Depth C: Porous Stone Below Pipe (in):	6
Stone Porosity (0 to 40%):	40

9.62 ft^2 Pipe Area



System Sizing

Use Custom Layout (at right) for layout adjustment

Pipe Storage:	6,465	cf	
Porous Stone Storage:	4,434	cf	
Total Storage Provided:	10,899	cf	102.0% Of Required Storage
Number of Barrels:	7	barrels	
Length Per Barrel:	96.00	ft	
Rectangular Footprint (W x L):	39. ft x 100.	ft	

CONTECH Materials

Total CMP Footage:	672	ft
Approximate Total Pieces:	28	pcs
Approximate Coupling Bands:	21	bands
Approximate Truckloads:	4	trucks

Construction Quantities**

Total Excavation:	723	cy
Porous Stone Backfill For Storage:	411	cy Stone
Backfill to Grade Excluding Stone:	73	cy Fill

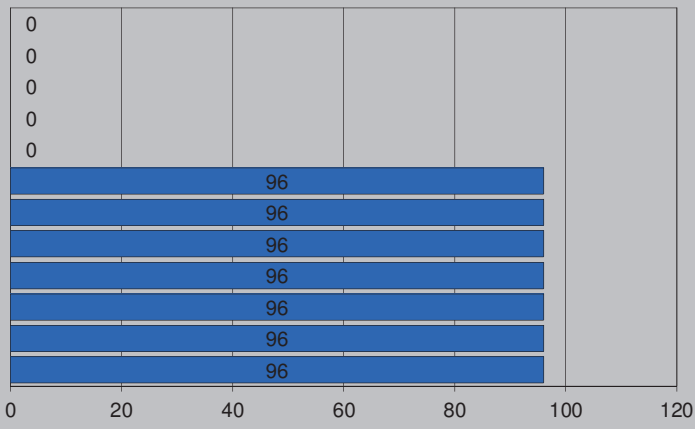
***Construction quantities are approximate and should be verified upon final design*

Custom Layout

To adjust layout, enter desired barrel length in the light blue boxes below.

Excess Footage = 0

Barrel 12	0
Barrel 11	0
Barrel 10	0
Barrel 9	0
Barrel 8	0
Barrel 7	96
Barrel 6	96
Barrel 5	96
Barrel 4	96
Barrel 3	96
Barrel 2	96
Barrel 1	96



V. HYDRAFLOW CALCULATIONS

Project Name: Shipyard Village
County: New Hanover
Project Number: 7010-0001

Soil Symbols	Soil Names	HSG		
Bp	Borrow pits	B		0%
Le	Leon sand	A		0%
Rm	Rimini sand	A		0%
Wa	Wakulla sand	A	32018	100%

Post-Development Drainage Area #1

Basin: Drainage area= 0.74 acres = 0.001 mi^2

Curve Number

	HSG:	**A**	**B**	**C**	**D**	Sum
	% of Basin	100				100.0
Land Use	**% of Basin**	**CN A**	**CN B**	**CN C**	**CN D**	**Weighted CN**
Impervious Area						
Pavements, Roofs	66.10	98	98	98	98	64.78
						0.00
Open Space						
Good Condition	33.90	39	61	74	80	13.22
	0.0					0.00
	0.0					0.00
	0.0					0.00
	0.0					0.00
Sum:	100.0				Sum:	78.00

Curve numbers taken from: TR-55 **Use: 78**

Project Name: Shipyard Village
County: New Hanover
Project Number: 7010-0001

Soil Symbols	Soil Names	HSG		
Bp	Borrow pits	B	39677	39%
Le	Leon sand	A	2195	2%
Rm	Rimini sand	A	6165.6	8%
Wa	Wakulla sand	A	31045	51%

Post-Development Drainage Area #2

Basin: Drainage area= 1.82 acres = 0.003 mi^2

Curve Number

	HSG:	**A**	**B**	**C**	**D**	Sum
	% of Basin	61	39			100.0
Land Use	**% of Basin**	**CN A**	**CN B**	**CN C**	**CN D**	**Weighted CN**
Impervious Area						
Pavements, Roofs	56.46	98	98	98	98	55.33
						0.00
Open Space						
Good Condition	43.54	39	61	74	80	20.72
	0.0					0.00
	0.0					0.00
	0.0					0.00
	0.0					0.00
Sum:	100.0				Sum:	76.05

Curve numbers taken from: TR-55 **Use: 77**

Project Name: Shipyard Village
County: New Hanover
Project Number: 7010-0001

Soil Symbols	Soil Names	HSG		
Bp	Borrow pits	B		0%
Le	Leon sand	A	934	3%
Rm	Rimini sand	A	3849.5	12%
Wa	Wakulla sand	A	26833	82%

Post-Development Drainage Area #3

Basin: Drainage area= 0.75 acres = 0.001 mi^2

Curve Number

	HSG:	**A**	**B**	**C**	**D**	Sum
	% of Basin	100				100.0
Land Use	**% of Basin**	**CN A**	**CN B**	**CN C**	**CN D**	**Weighted CN**
Impervious Area						
Pavements, Roofs	78.92	98	98	98	98	77.34
						0.00
Open Space						
Good Condition	21.08	39	61	74	80	8.22
	0.0					0.00
	0.0					0.00
	0.0					0.00
	0.0					0.00
Sum:	100.0				Sum:	85.56

Curve numbers taken from: TR-55 **Use:** **86**

Project Name: Shipyard Village
County: New Hanover
Project Number: 7010-0001

Soil Symbols	Soil Names	HSG		
Bp	Borrow pits	B		0%
Le	Leon sand	A		0%
Rm	Rimini sand	A		0%
Wa	Wakulla sand	A	78216	100%

Post-Development Drainage Area #4

Basin: Drainage area= 1.80 acres = 0.003 mi^2

Curve Number

	HSG:	**A**	**B**	**C**	**D**	Sum
	% of Basin	100				100.0
Land Use	**% of Basin**	**CN A**	**CN B**	**CN C**	**CN D**	**Weighted CN**
Impervious Area						
Pavements, Roofs	66.98	98	98	98	98	65.64
						0.00
Open Space						
Good Condition	33.02	39	61	74	80	12.88
	0.0					0.00
	0.0					0.00
	0.0					0.00
	0.0					0.00
Sum:	100.0				Sum:	78.52

Curve numbers taken from: TR-55 **Use:** **79**

Project Name: Shipyard Village
County: New Hanover
Project Number: 7010-0001

Soil Symbols	Soil Names	HSG		
Bp	Borrow pits	B		0%
Le	Leon sand	A		0%
Rm	Rimini sand	A		0%
Wa	Wakulla sand	A	88427	100%

Post-Development Drainage Area #5

Basin: Drainage area= 2.03 acres = 0.003 mi^2

Curve Number

	HSG:	**A**	**B**	**C**	**D**	Sum
	% of Basin	100				100.0
Land Use	**% of Basin**	**CN A**	**CN B**	**CN C**	**CN D**	**Weighted CN**
Impervious Area						
Pavements, Roofs	0.00	98	98	98	98	0.00
						0.00
Open Space						
Good Condition	100.00	39	61	74	80	39.00
	0.0					0.00
	0.0					0.00
	0.0					0.00
	0.0					0.00
Sum:	100.0				Sum:	39.00

Curve numbers taken from: TR-55 **Use:** **39**

Project Name: Shipyard Village
County: New Hanover
Project Number: 7010-0001

Soil Symbols	Soil Names	HSG		
Bp	Borrow pits	B		0%
Le	Leon sand	A	2385	100%
Rm	Rimini sand	A		0%
Wa	Wakulla sand	A		0%

Post-Development Drainage Area #OS

Basin: Drainage area= 0.05 acres = 0.000 mi^2

Curve Number

	HSG:	**A**	**B**	**C**	**D**	Sum
	% of Basin	100				100.0
Land Use	**% of Basin**	**CN A**	**CN B**	**CN C**	**CN D**	**Weighted CN**
Impervious Area						
Pavements, Roofs	100.00	98	98	98	98	98.00
						0.00
Open Space						
Good Condition	0.00	39	61	74	80	0.00
	0.0					0.00
	0.0					0.00
	0.0					0.00
	0.0					0.00
Sum:	100.0				Sum:	98.00

Curve numbers taken from: TR-55 **Use: 98**

Hydraflow Table of Contents

2 - Year

10 - Year

25 - Year

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

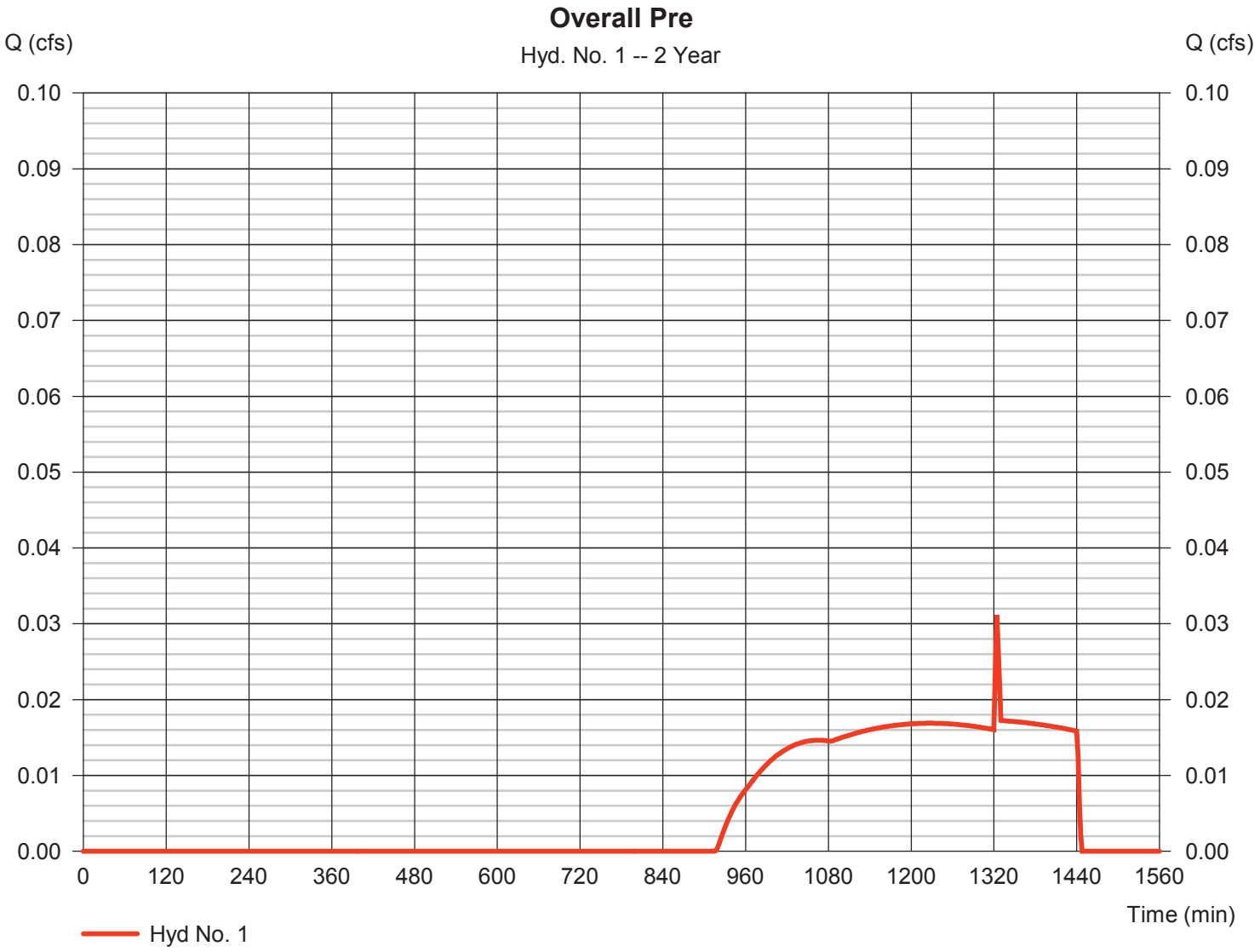
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	0.031	2	1324	466	------	------	------	Overall Pre
3	SCS Runoff	12.02	2	724	37,497	------	------	------	Overall Post
5	SCS Runoff	0.003	2	1324	48	------	------	------	DA 1 PRE
7	SCS Runoff	1.931	2	724	5,774	------	------	------	DA 1 POST
9	Reservoir	0.000	2	712	0	7	54.96	1,886	IB #1
11	SCS Runoff	0.008	2	1324	118	------	------	------	DA 2 PRE
13	SCS Runoff	4.572	2	724	13,692	------	------	------	DA 2 POST
15	Reservoir	0.000	2	822	0	13	52.04	4,388	IB #2
17	SCS Runoff	0.003	2	1324	49	------	------	------	DA #3 PRE
19	SCS Runoff	2.535	2	724	7,665	------	------	------	DA #3 POST
21	Reservoir	0.000	2	822	0	19	51.25	2,302	IB #3
23	SCS Runoff	0.008	2	1324	117	------	------	------	DA #4 PRE
25	SCS Runoff	4.870	2	724	14,557	------	------	------	DA #4 POST
27	Reservoir	0.000	2	800	0	25	51.33	2,628	IT #1
29	SCS Runoff	0.009	2	1324	132	------	------	------	REMAINDER OF PARCEL POST
30	SCS Runoff	0.212	2	724	726	------	------	------	DA-OS
31	Combine	0.212	2	724	857	9, 15, 21, 27, 29, 30	------	------	ENT PARCEL POST DEV

Hydrograph Report

Hyd. No. 1

Overall Pre

Hydrograph type	= SCS Runoff	Peak discharge	= 0.031 cfs
Storm frequency	= 2 yrs	Time to peak	= 1324 min
Time interval	= 2 min	Hyd. volume	= 466 cuft
Drainage area	= 7.190 ac	Curve number	= 34
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



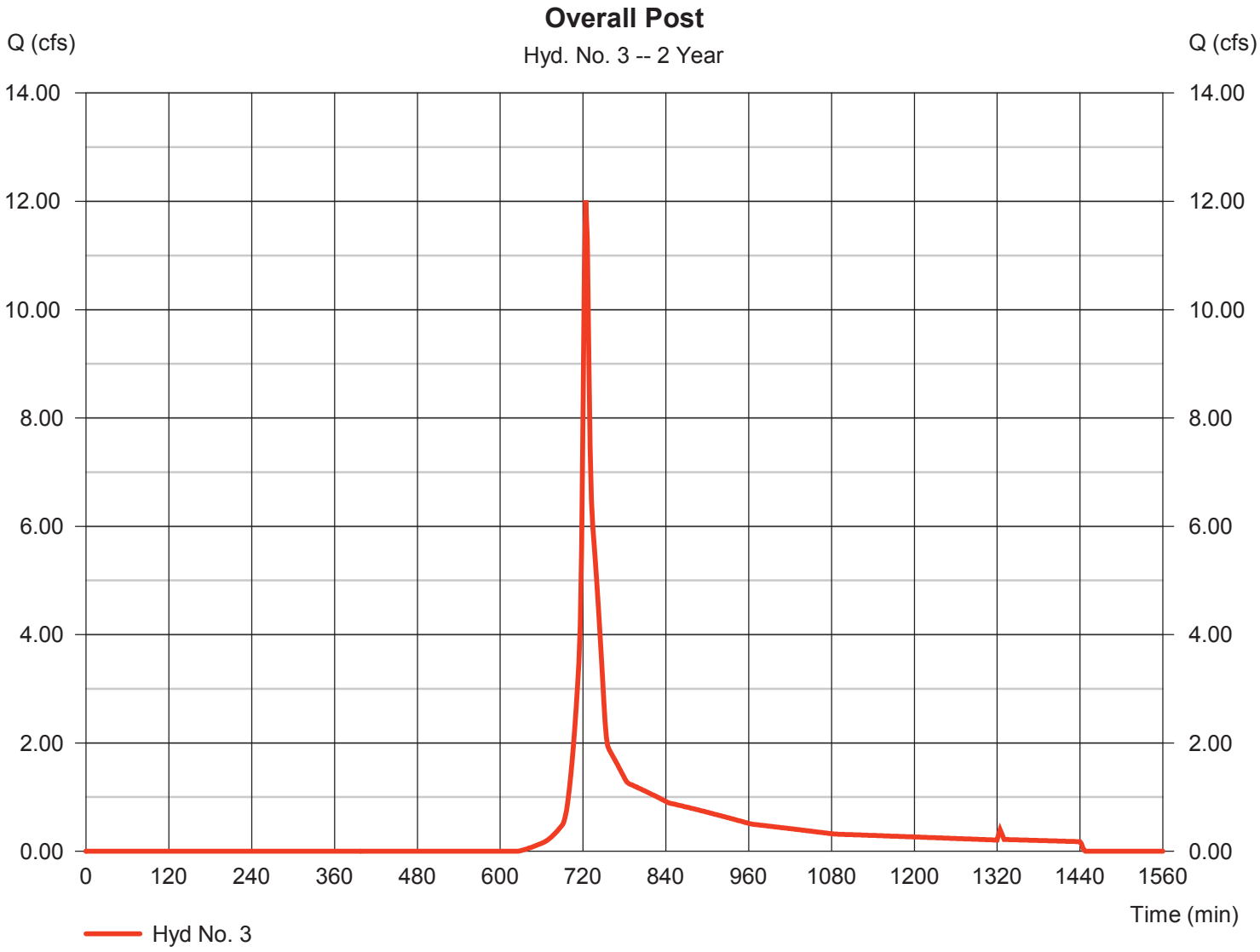
Hydrograph Report

Hyd. No. 3

Overall Post

Hydrograph type	= SCS Runoff	Peak discharge	= 12.02 cfs
Storm frequency	= 2 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 37,497 cuft
Drainage area	= 7.190 ac	Curve number	= 68*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.740 x 78) + (1.820 x 77) + (0.750 x 86) + (1.800 x 79) + (2.030 x 39) + (0.050 x 98)] / 7.190

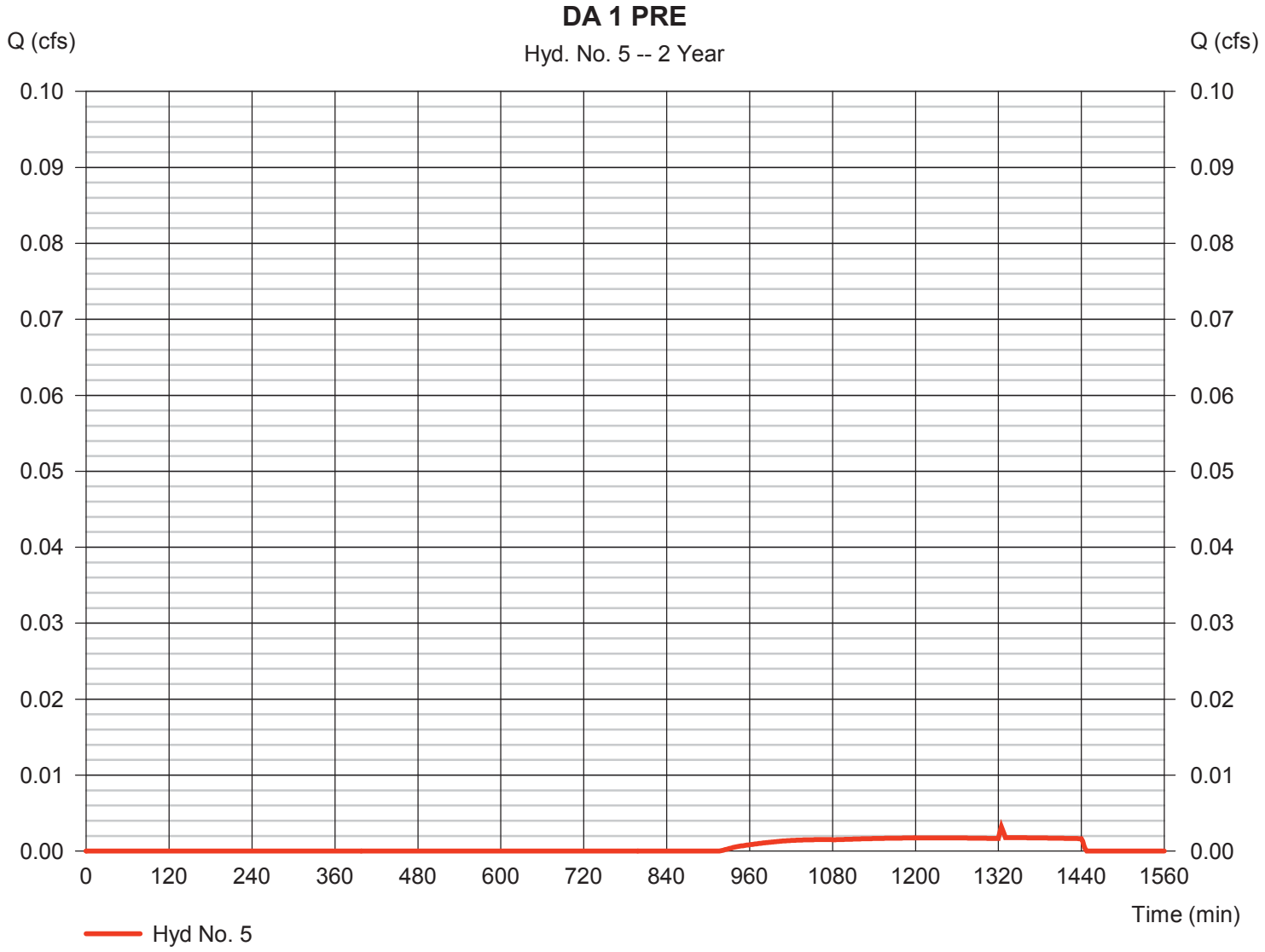


Hydrograph Report

Hyd. No. 5

DA 1 PRE

Hydrograph type	= SCS Runoff	Peak discharge	= 0.003 cfs
Storm frequency	= 2 yrs	Time to peak	= 1324 min
Time interval	= 2 min	Hyd. volume	= 48 cuft
Drainage area	= 0.740 ac	Curve number	= 34
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

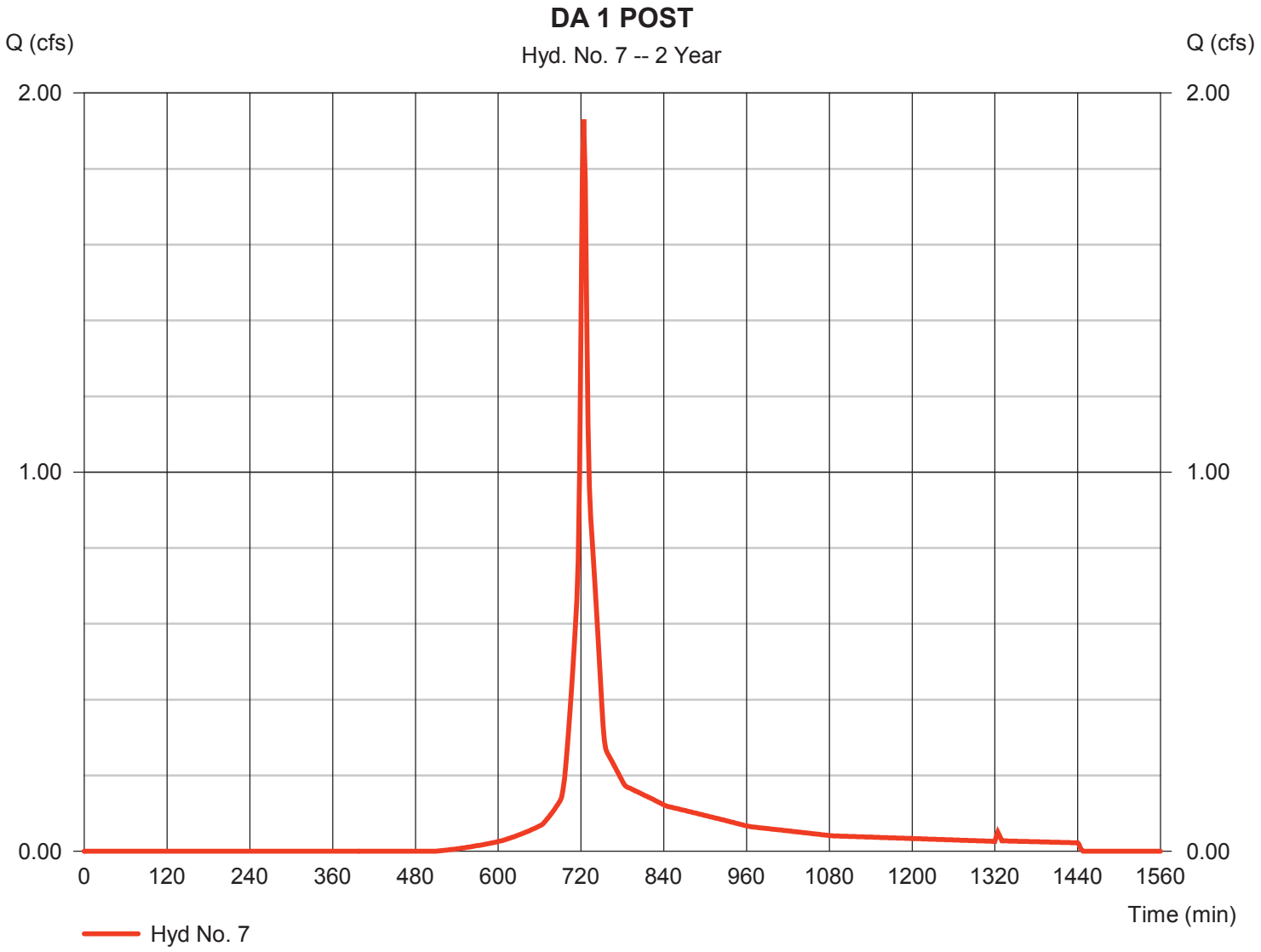


Hydrograph Report

Hyd. No. 7

DA 1 POST

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.931 cfs
Storm frequency	=	2 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	5,774 cuft
Drainage area	=	0.740 ac	Curve number	=	78
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	4.50 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



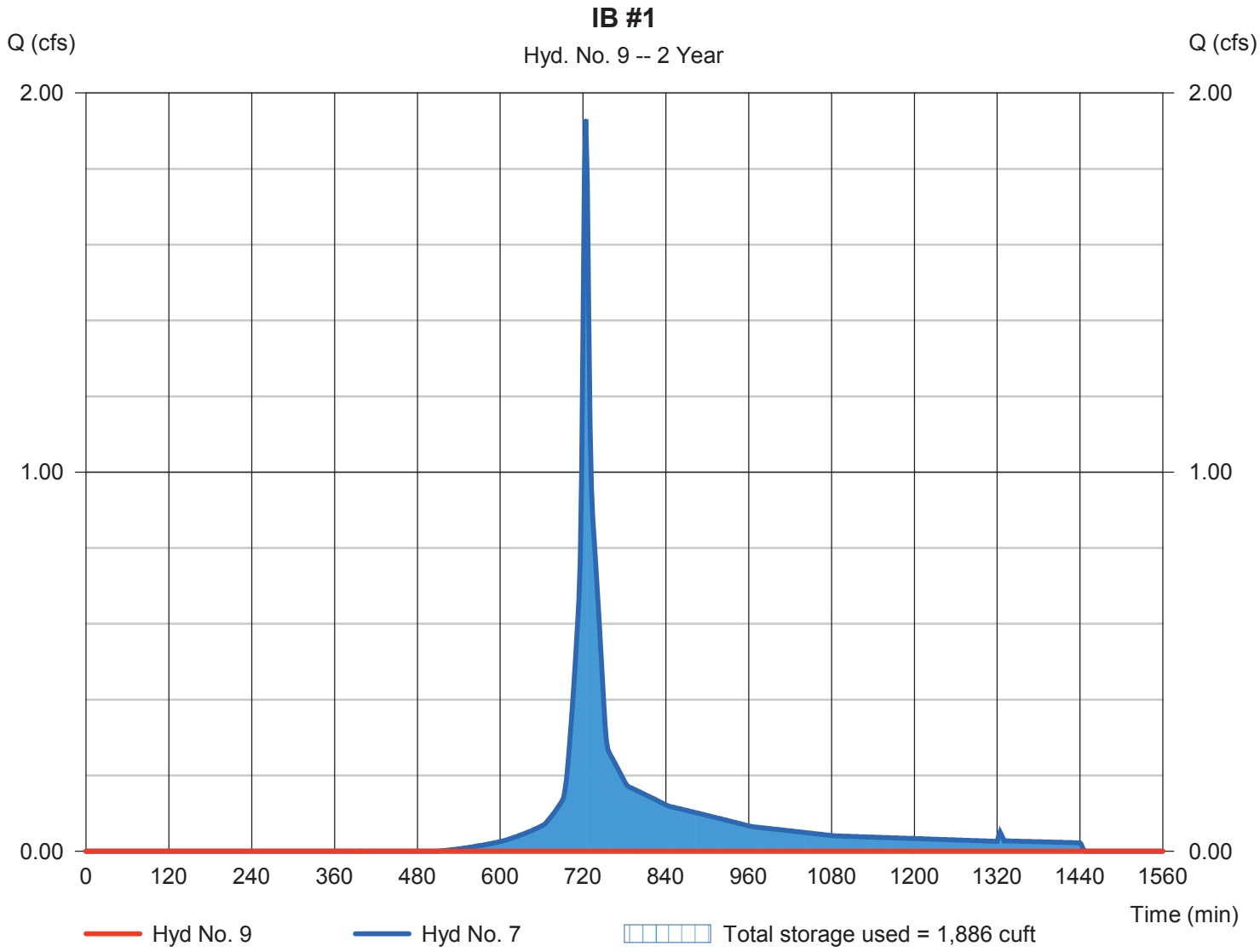
Hydrograph Report

Hyd. No. 9

IB #1

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= 712 min
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 7 - DA 1 POST	Max. Elevation	= 54.96 ft
Reservoir name	= IB #1	Max. Storage	= 1,886 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Pond Report

Pond No. 1 - IB #1

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 53.25 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	53.25	712	0	0
1.00	54.25	1,132	914	914
2.00	55.25	1,609	1,363	2,277
3.00	56.25	2,142	1,869	4,146
3.50	56.75	2,430	1,142	5,288
3.65	56.90	2,519	371	5,659

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

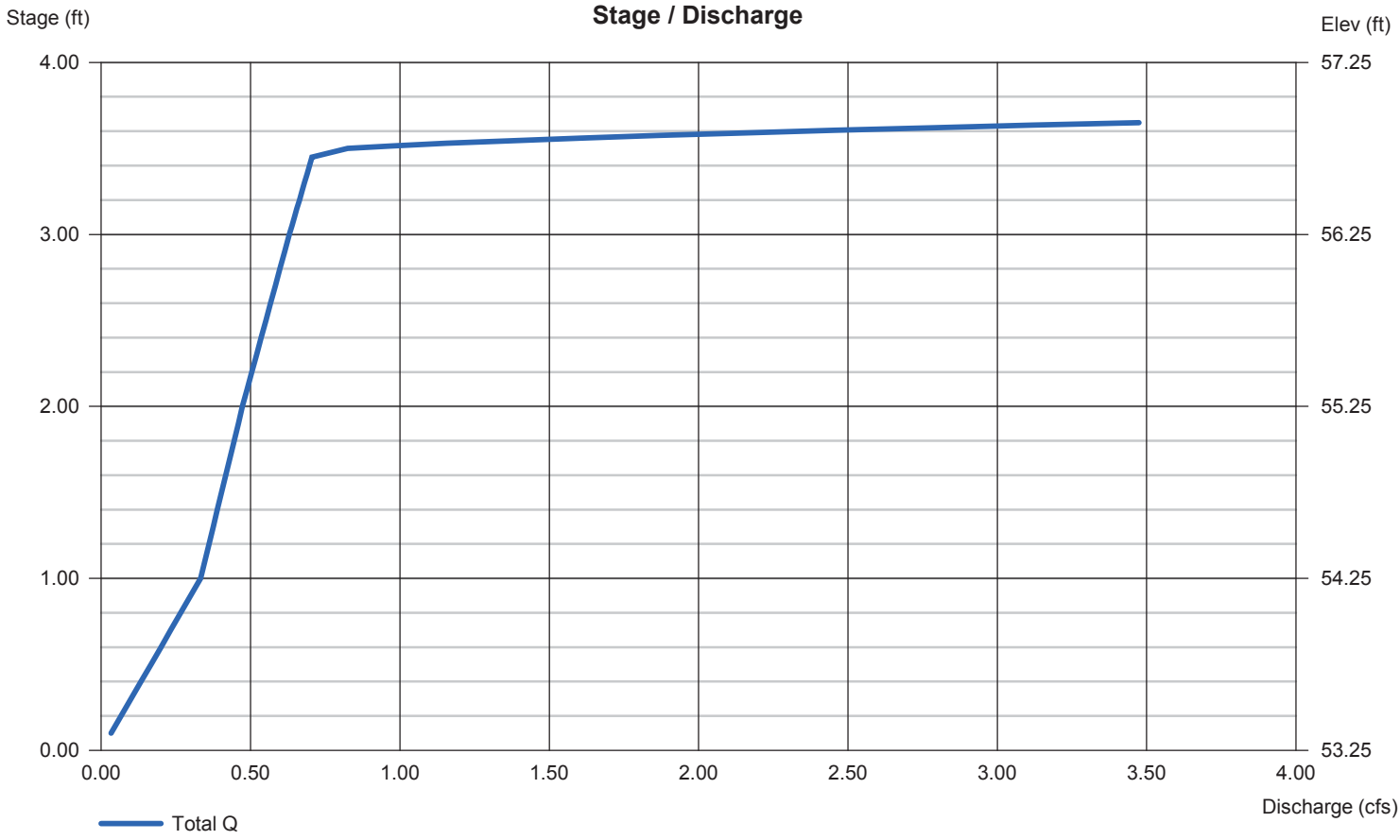
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 15.00	0.00	0.00	0.00
Crest El. (ft)	= 56.73	0.00	0.00	0.00
Weir Coeff.	= 2.60	3.33	3.33	3.33
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 12.700 (by Contour)

TW Elev. (ft) = 0.00

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

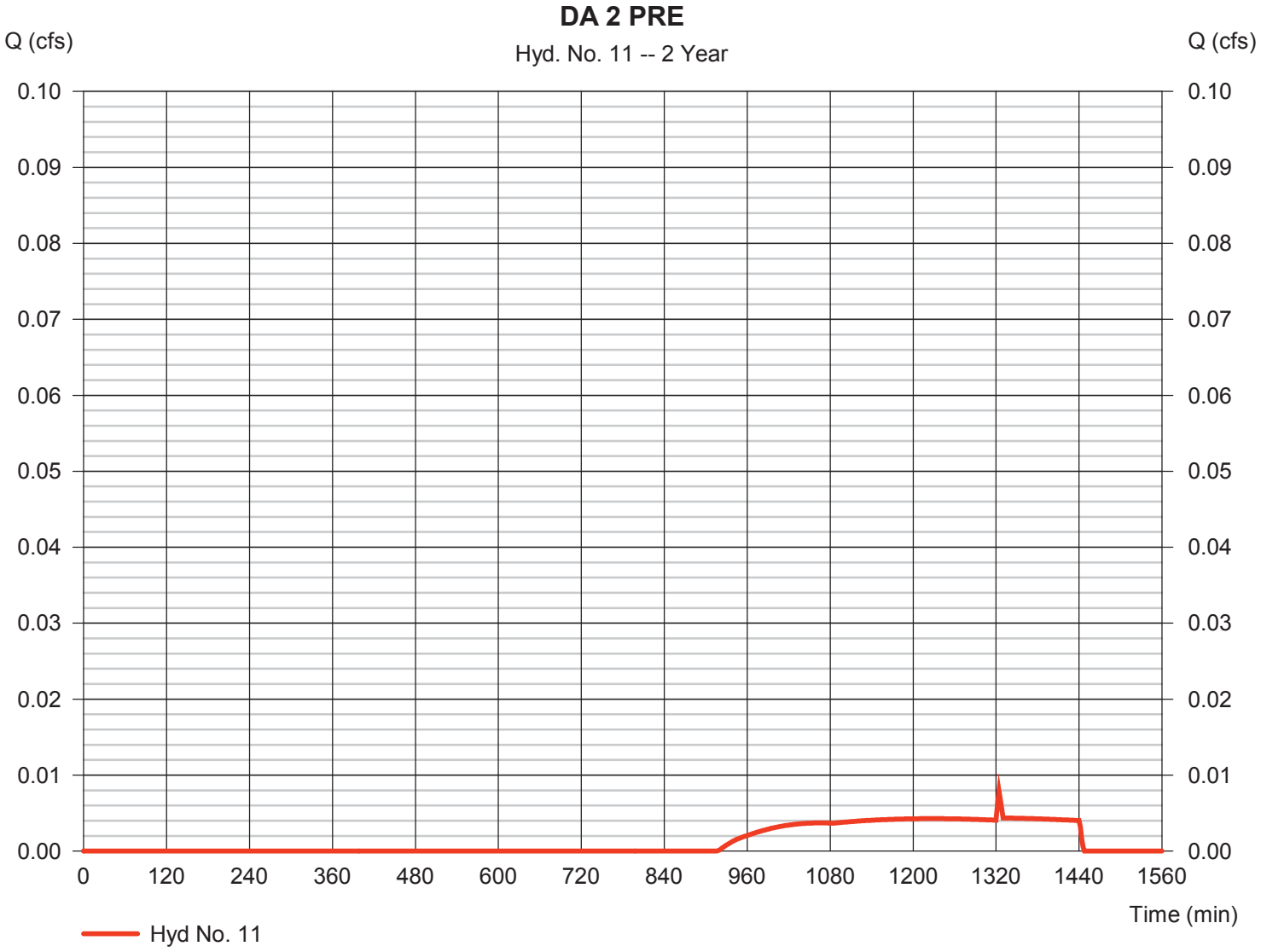


Hydrograph Report

Hyd. No. 11

DA 2 PRE

Hydrograph type	= SCS Runoff	Peak discharge	= 0.008 cfs
Storm frequency	= 2 yrs	Time to peak	= 1324 min
Time interval	= 2 min	Hyd. volume	= 118 cuft
Drainage area	= 1.820 ac	Curve number	= 34
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

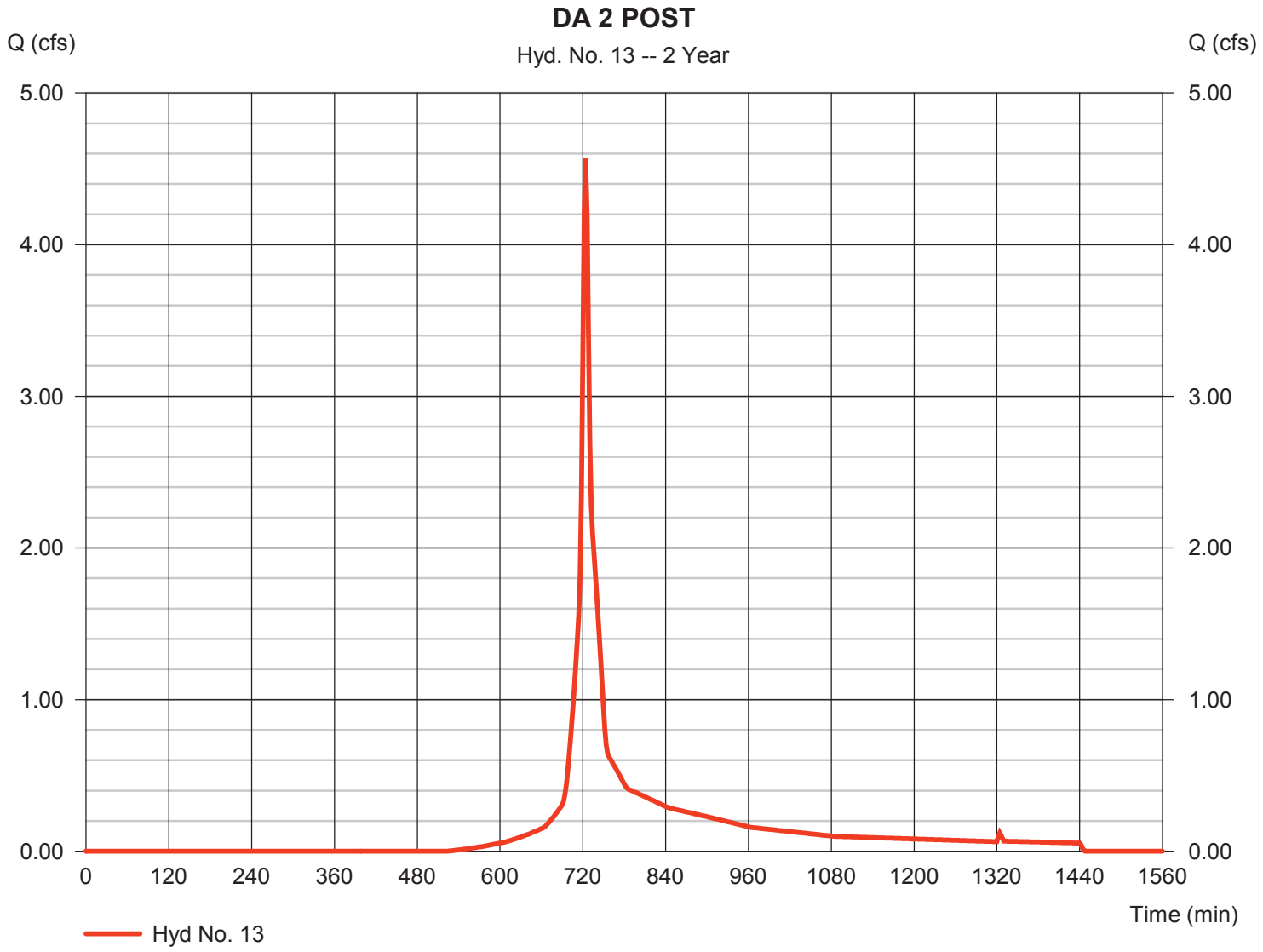


Hydrograph Report

Hyd. No. 13

DA 2 POST

Hydrograph type	= SCS Runoff	Peak discharge	= 4.572 cfs
Storm frequency	= 2 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 13,692 cuft
Drainage area	= 1.820 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



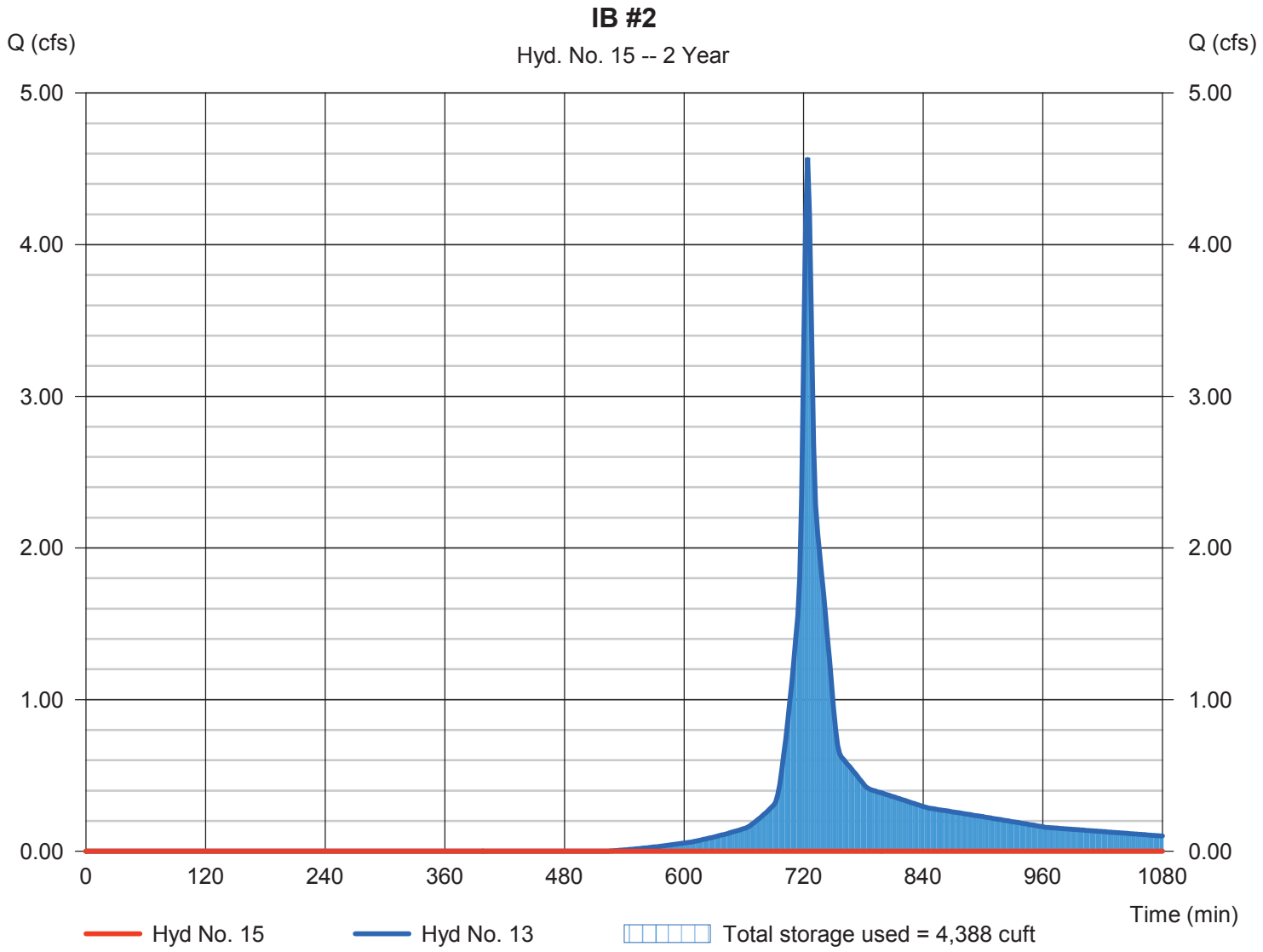
Hydrograph Report

Hyd. No. 15

IB #2

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= 822 min
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 13 - DA 2 POST	Max. Elevation	= 52.04 ft
Reservoir name	= IB #2	Max. Storage	= 4,388 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Pond Report

Pond No. 3 - IB #2

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 51.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	51.00	3,786	0	0
1.00	52.00	4,578	4,175	4,175
2.00	53.00	5,441	5,003	9,178
3.00	54.00	6,374	5,901	15,079
3.50	54.50	6,867	3,309	18,388

Culvert / Orifice Structures

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

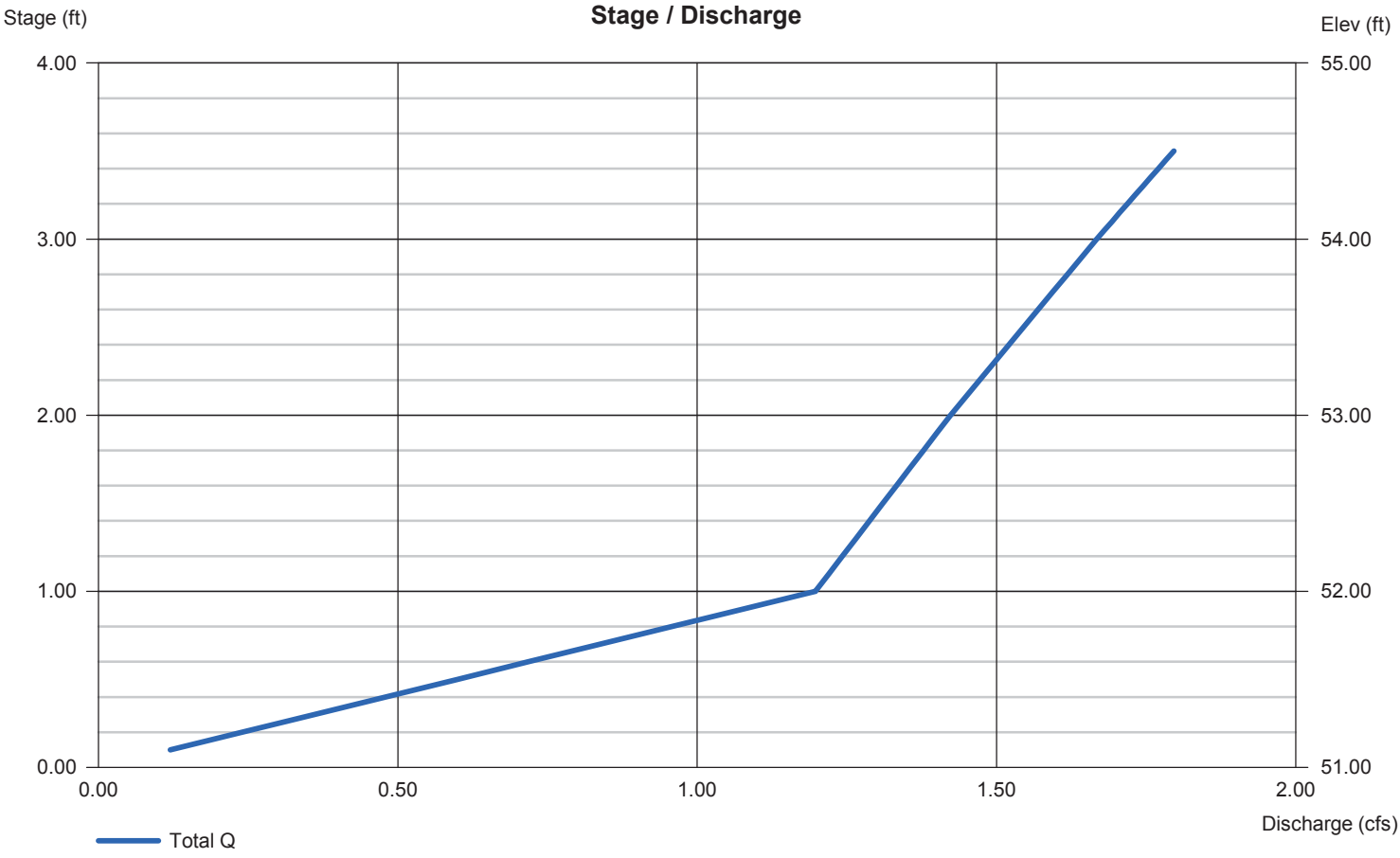
Weir Structures

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

Exfil.(in/hr) = 11.300 (by Contour)

TW Elev. (ft) = 0.00

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

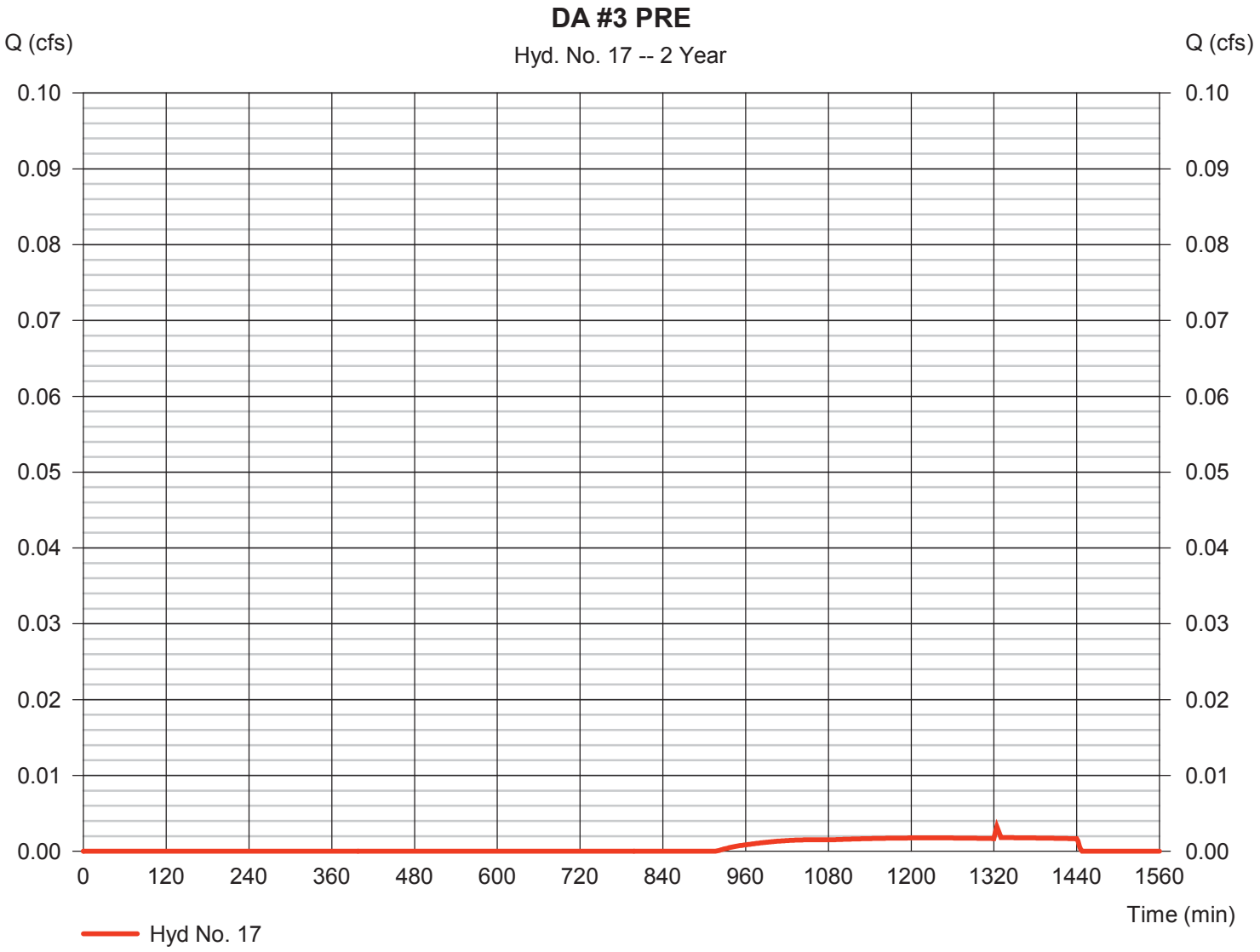


Hydrograph Report

Hyd. No. 17

DA #3 PRE

Hydrograph type	= SCS Runoff	Peak discharge	= 0.003 cfs
Storm frequency	= 2 yrs	Time to peak	= 1324 min
Time interval	= 2 min	Hyd. volume	= 49 cuft
Drainage area	= 0.750 ac	Curve number	= 34
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

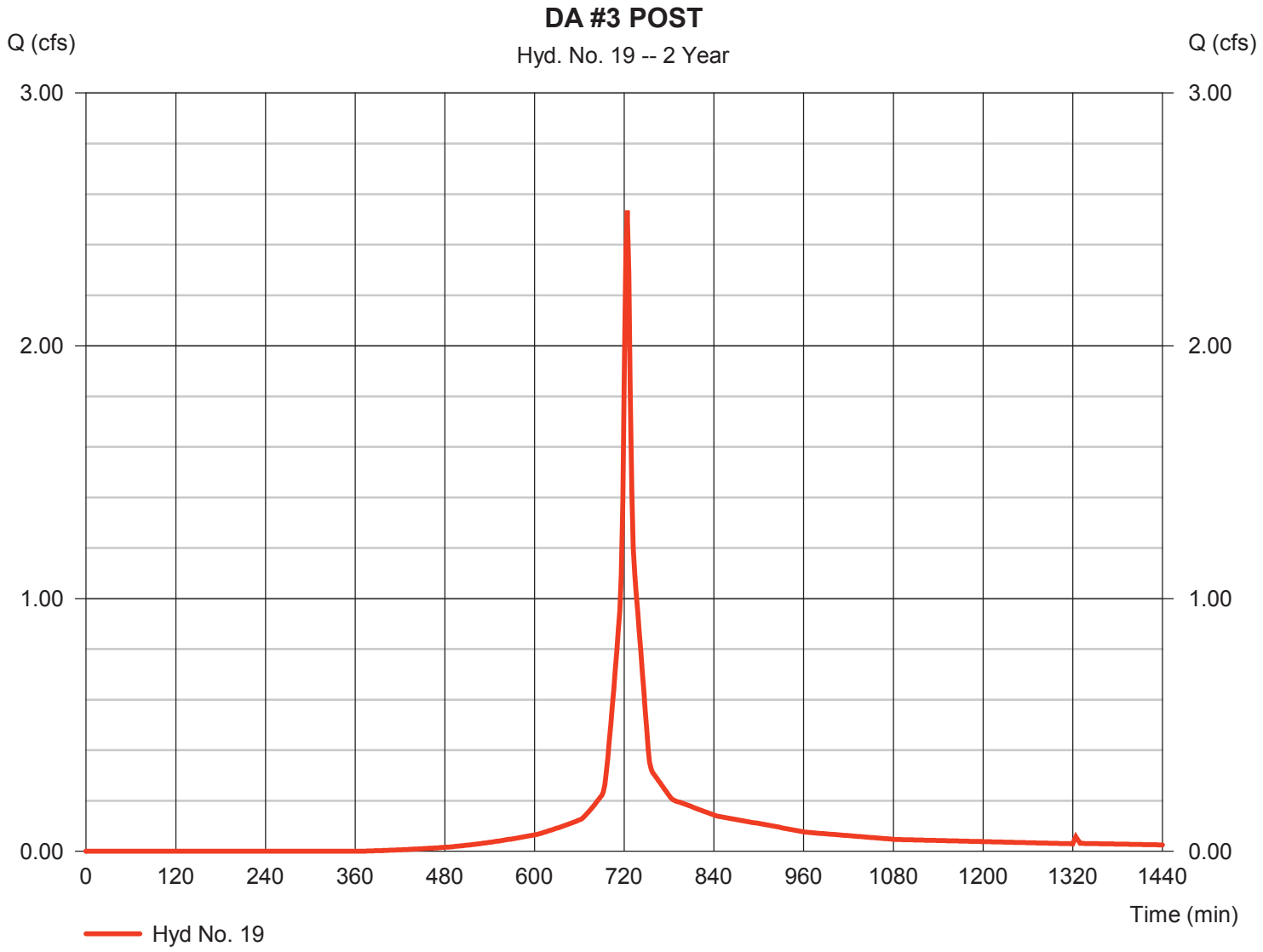


Hydrograph Report

Hyd. No. 19

DA #3 POST

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.535 cfs
Storm frequency	=	2 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	7,665 cuft
Drainage area	=	0.750 ac	Curve number	=	86
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	4.50 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



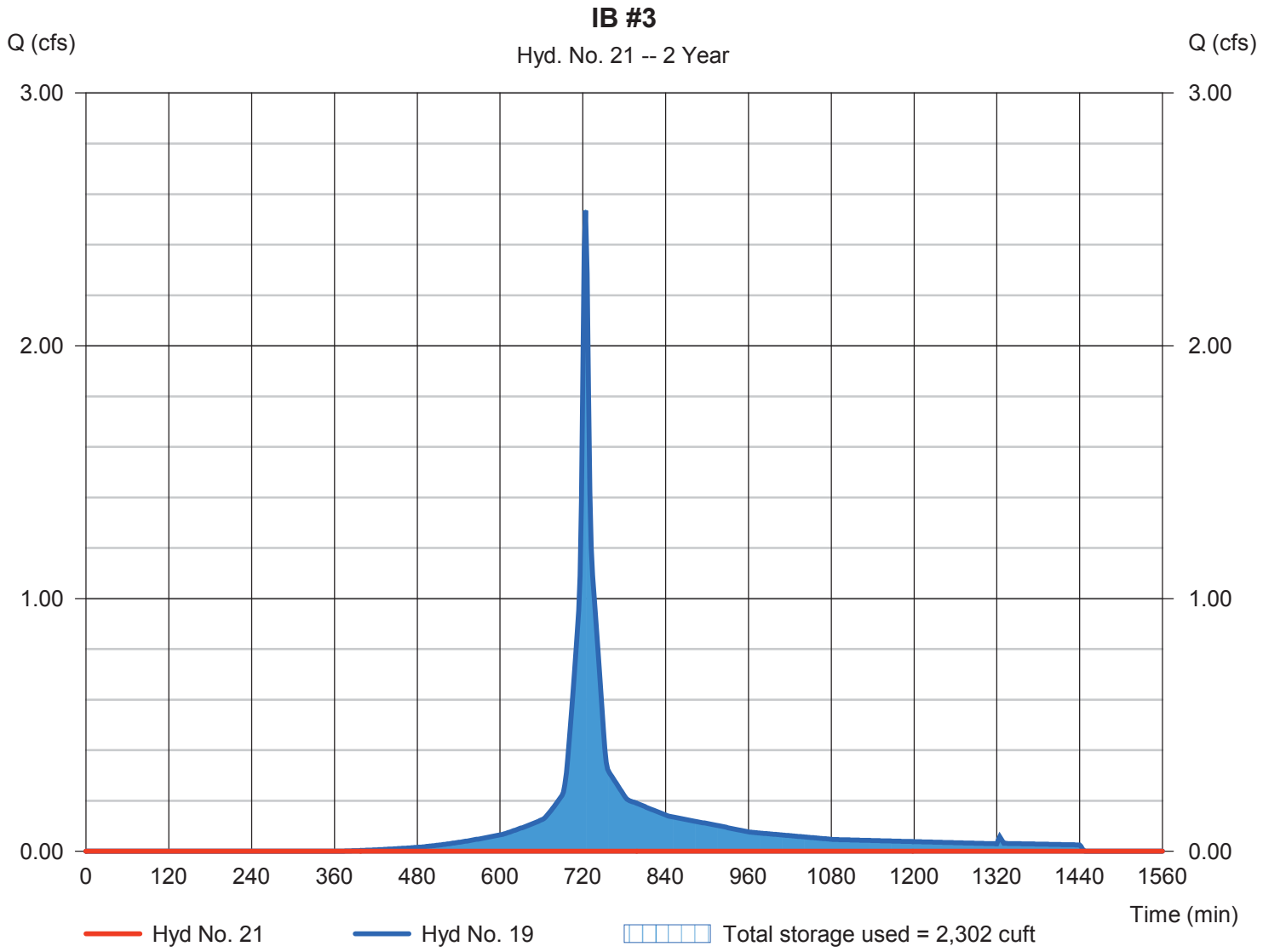
Hydrograph Report

Hyd. No. 21

IB #3

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	2 yrs	Time to peak	=	822 min
Time interval	=	2 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	19 - DA #3 POST	Max. Elevation	=	51.25 ft
Reservoir name	=	IB #3	Max. Storage	=	2,302 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Wednesday, 10 / 19 / 2016

Pond No. 5 - IB #3

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 50.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	50.50	3,052	0	0
0.50	51.00	3,052	1,526	1,526
1.00	51.50	3,052	1,526	3,052
1.50	52.00	3,052	1,526	4,578
2.00	52.50	3,052	1,526	6,103
2.50	53.00	3,052	1,526	7,629
3.00	53.50	3,052	1,526	9,155
3.20	53.70	3,052	610	9,765

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	Inactive	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 2.60	3.33	3.33	3.33
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 9.250 (by Contour)

TW Elev. (ft) = 0.00

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

Stage / Storage / Discharge Table

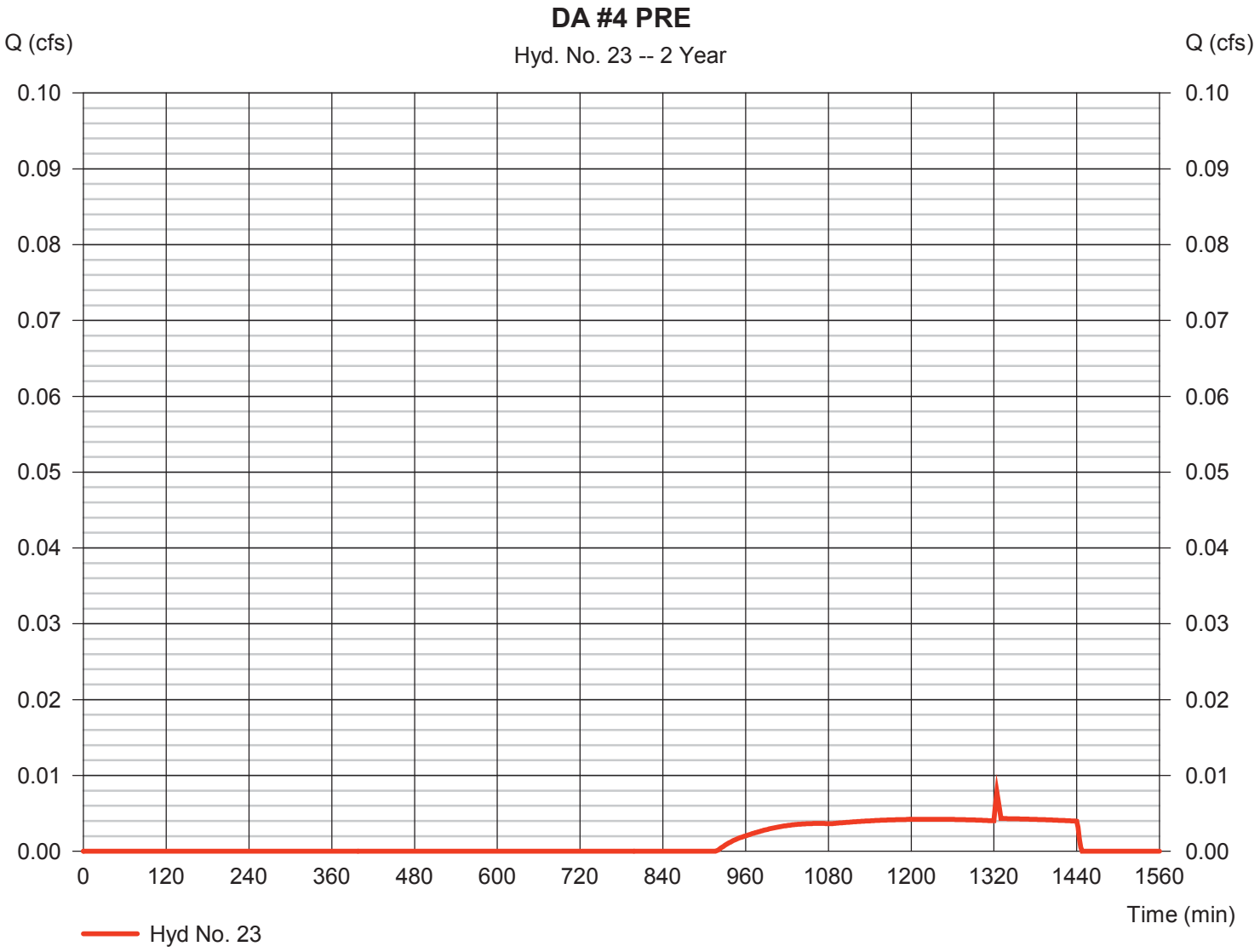
Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	50.50	---	---	---	---	---	---	---	---	0.000	---	0.000
0.50	1,526	51.00	---	---	---	---	---	---	---	---	0.653	---	0.653
1.00	3,052	51.50	---	---	---	---	---	---	---	---	0.653	---	0.653
1.50	4,578	52.00	---	---	---	---	---	---	---	---	0.653	---	0.653
2.00	6,103	52.50	---	---	---	---	---	---	---	---	0.653	---	0.653
2.50	7,629	53.00	---	---	---	---	---	---	---	---	0.653	---	0.653
3.00	9,155	53.50	---	---	---	---	---	---	---	---	0.653	---	0.653
3.20	9,765	53.70	---	---	---	---	---	---	---	---	0.653	---	0.653

Hydrograph Report

Hyd. No. 23

DA #4 PRE

Hydrograph type	= SCS Runoff	Peak discharge	= 0.008 cfs
Storm frequency	= 2 yrs	Time to peak	= 1324 min
Time interval	= 2 min	Hyd. volume	= 117 cuft
Drainage area	= 1.800 ac	Curve number	= 34
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

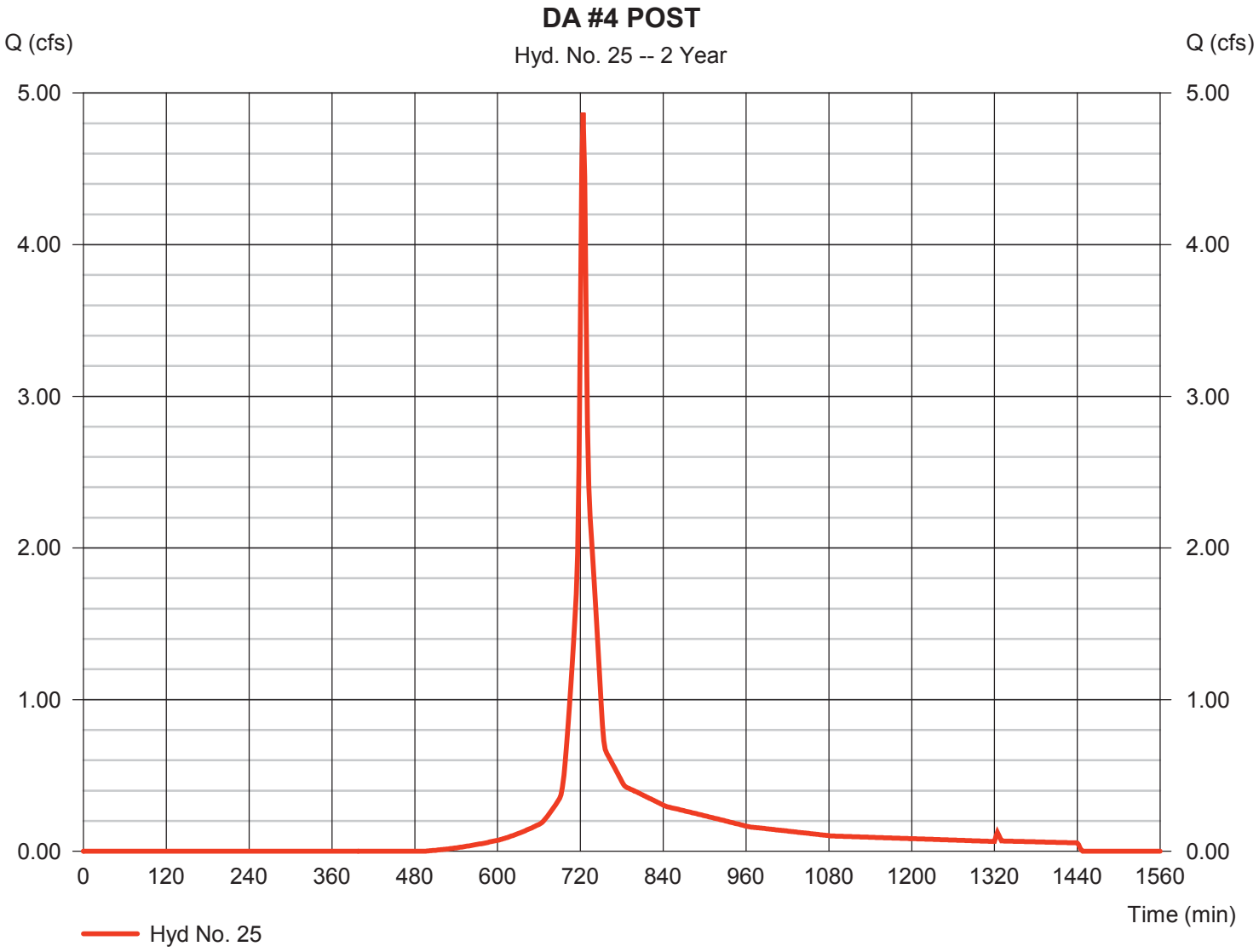


Hydrograph Report

Hyd. No. 25

DA #4 POST

Hydrograph type	= SCS Runoff	Peak discharge	= 4.870 cfs
Storm frequency	= 2 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 14,557 cuft
Drainage area	= 1.800 ac	Curve number	= 79
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



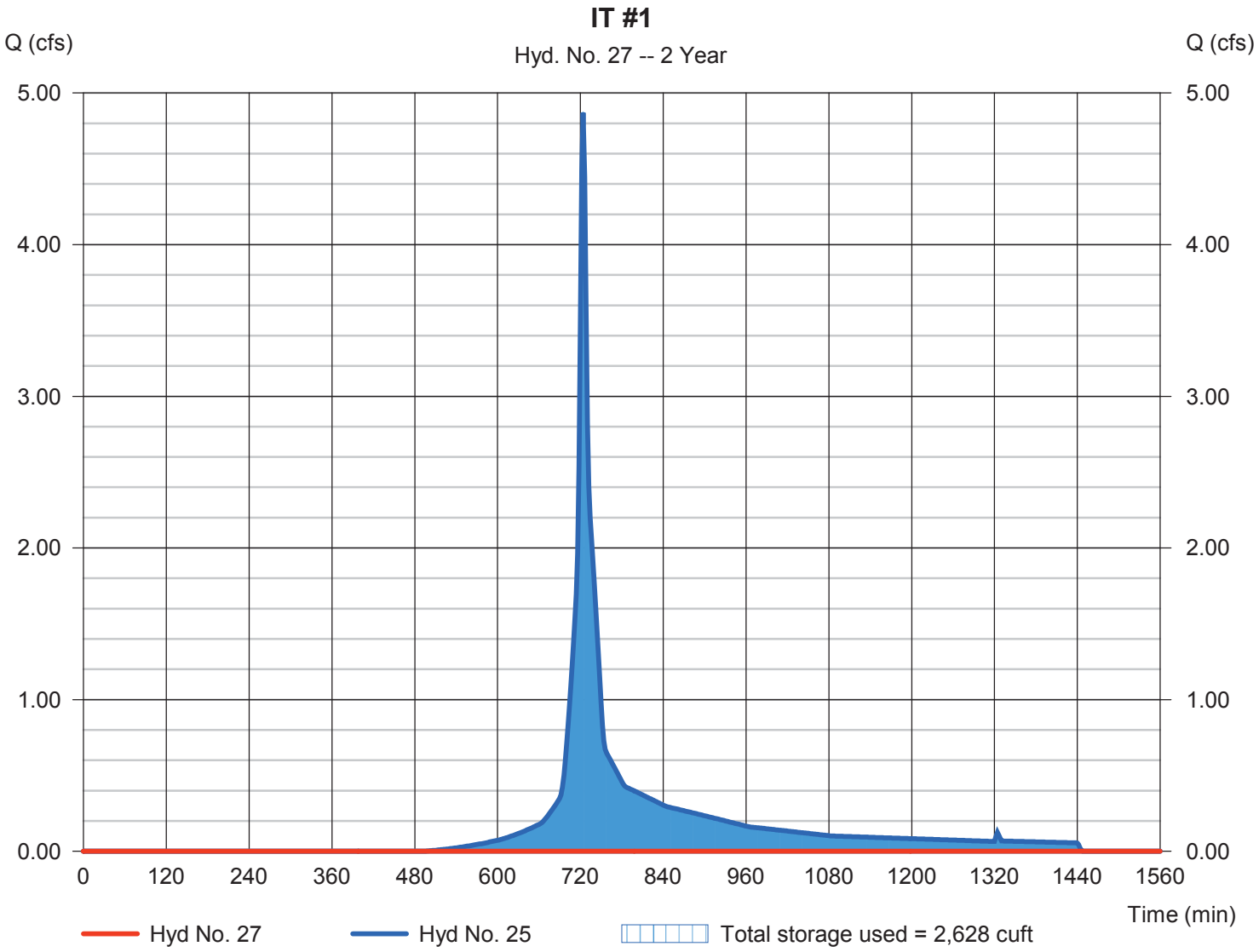
Hydrograph Report

Hyd. No. 27

IT #1

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= 800 min
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 25 - DA #4 POST	Max. Elevation	= 51.33 ft
Reservoir name	= IT #1	Max. Storage	= 2,628 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Pond Report

Pond No. 7 - IT #1

Pond Data

UG Chambers -Invert elev. = 51.00 ft, Rise x Span = 3.50 x 3.50 ft, Barrel Len = 96.00 ft, No. Barrels = 7, Slope = 0.00%, Headers = Yes
Encasement -Invert elev. = 50.50 ft, Width = 9.00 ft, Height = 4.50 ft, Voids = 40.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	50.50	n/a	0	0
0.45	50.95	n/a	1,293	1,293
0.90	51.40	n/a	1,585	2,878
1.35	51.85	n/a	1,867	4,744
1.80	52.30	n/a	1,986	6,730
2.25	52.75	n/a	2,039	8,769
2.70	53.20	n/a	2,039	10,808
3.15	53.65	n/a	1,987	12,795
3.60	54.10	n/a	1,865	14,660
4.05	54.55	n/a	1,585	16,244
4.50	55.00	n/a	1,293	17,537

Culvert / Orifice Structures

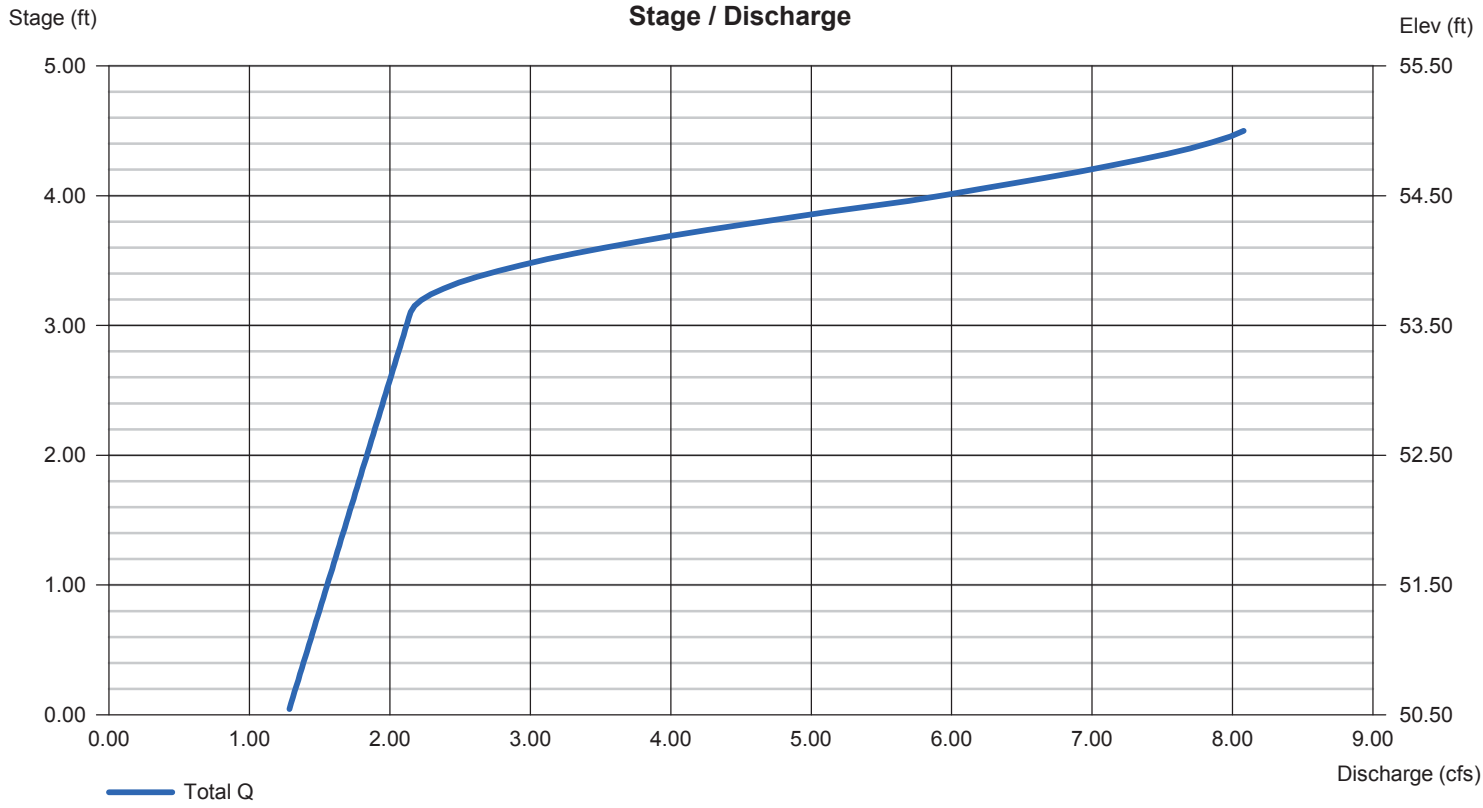
	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 18.00	0.00	0.00	0.00
Span (in)	= 18.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 53.60	0.00	0.00	0.00
Length (ft)	= 86.00	0.00	0.00	0.00
Slope (%)	= 0.52	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

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

Exfil.(in/hr) = 8.300 (by Wet area)
TW Elev. (ft) = 0.00

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

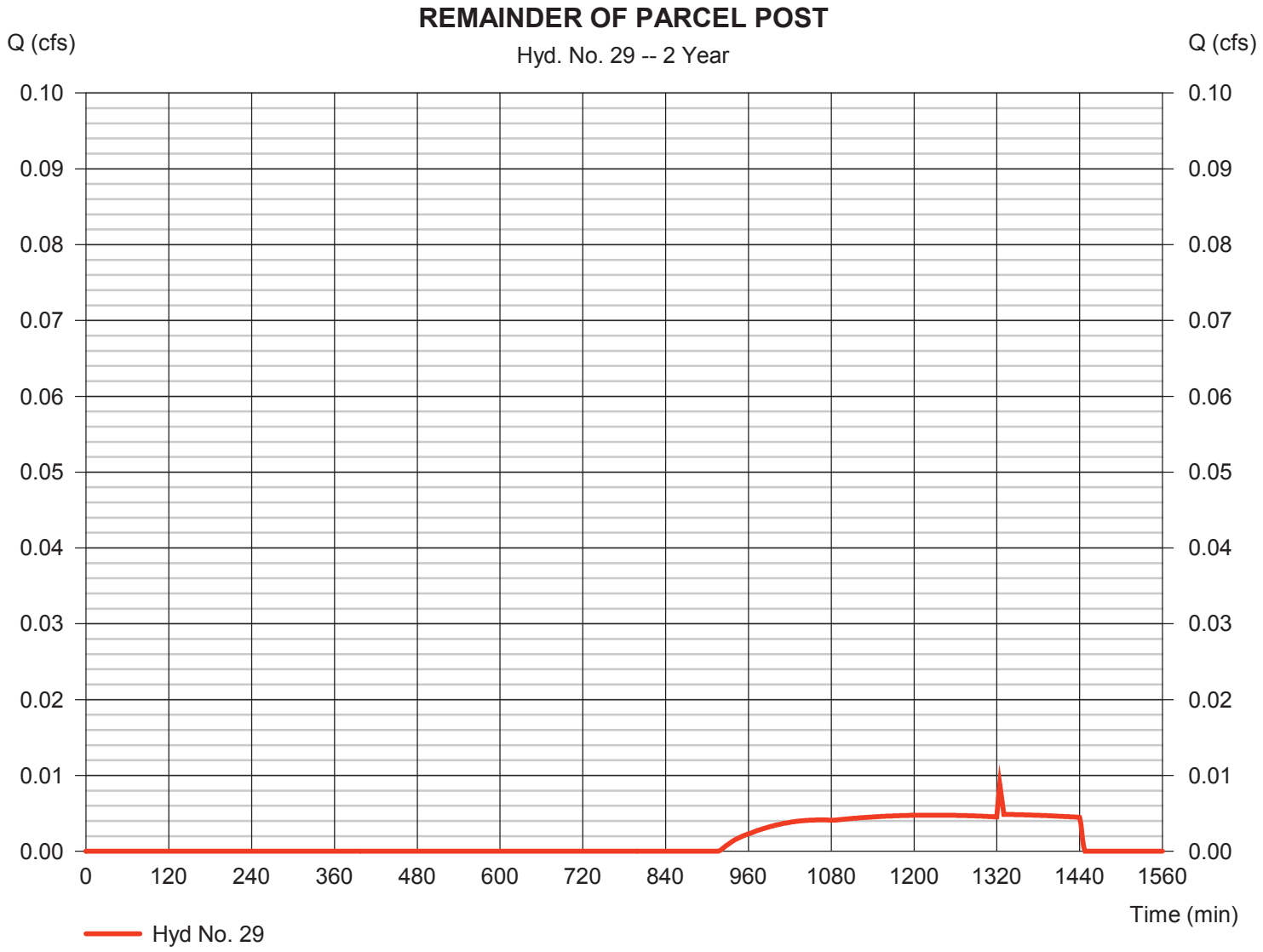


Hydrograph Report

Hyd. No. 29

REMAINDER OF PARCEL POST

Hydrograph type	= SCS Runoff	Peak discharge	= 0.009 cfs
Storm frequency	= 2 yrs	Time to peak	= 1324 min
Time interval	= 2 min	Hyd. volume	= 132 cuft
Drainage area	= 2.030 ac	Curve number	= 34
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

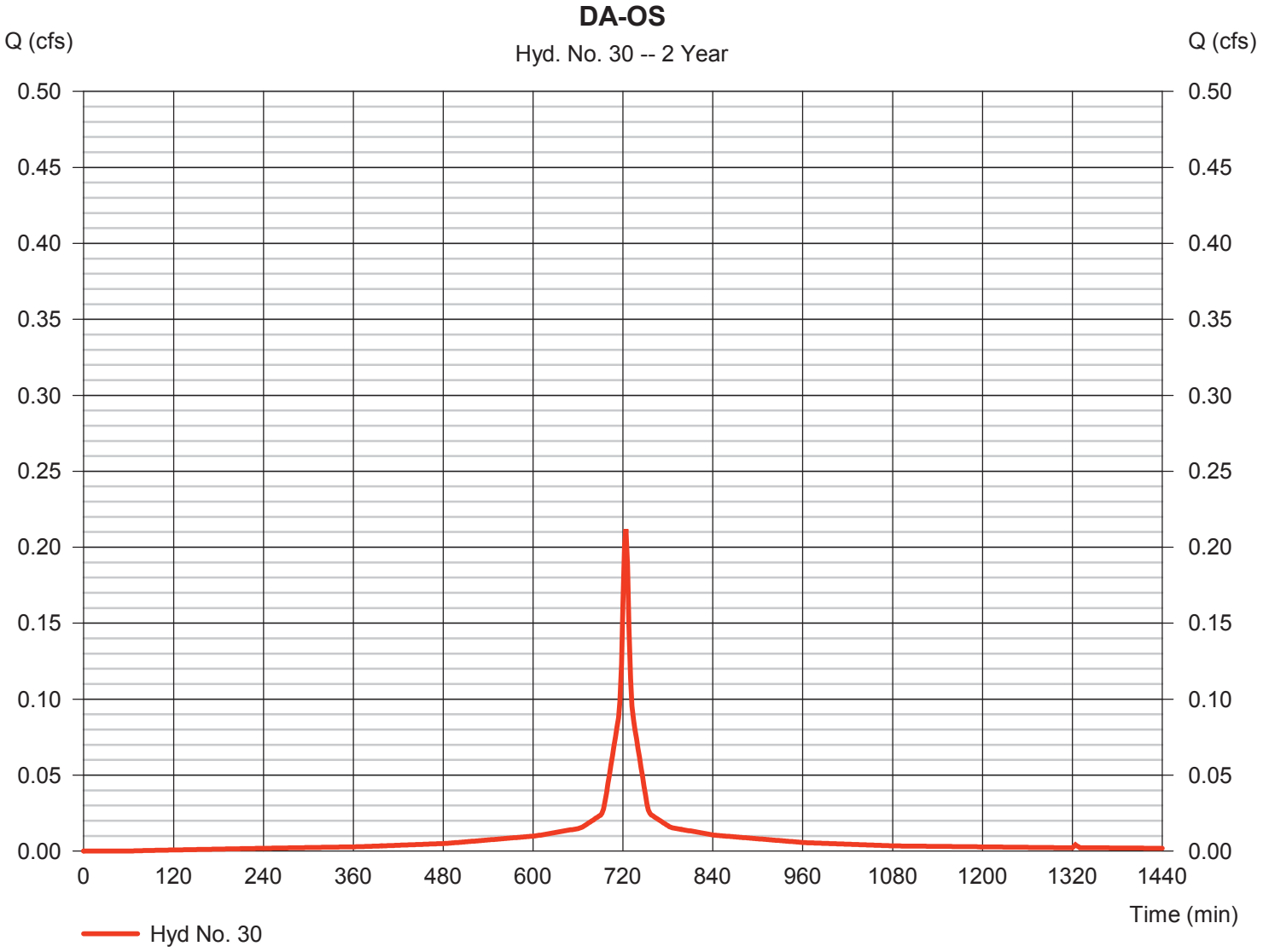


Hydrograph Report

Hyd. No. 30

DA-OS

Hydrograph type	= SCS Runoff	Peak discharge	= 0.212 cfs
Storm frequency	= 2 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 726 cuft
Drainage area	= 0.050 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

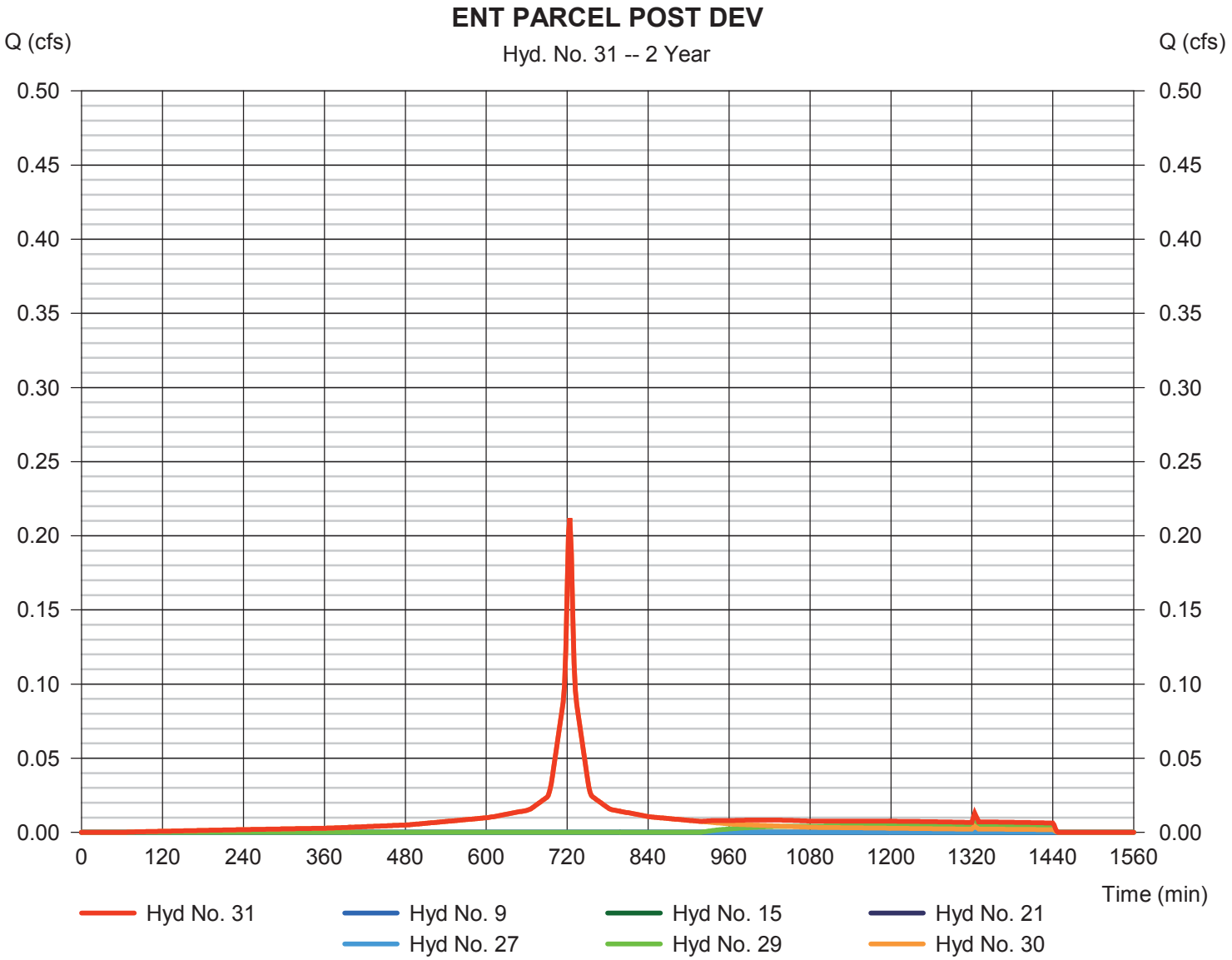


Hydrograph Report

Hyd. No. 31

ENT PARCEL POST DEV

Hydrograph type	= Combine	Peak discharge	= 0.212 cfs
Storm frequency	= 2 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 857 cuft
Inflow hyds.	= 9, 15, 21, 27, 29, 30	Contrib. drain. area	= 2.080 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

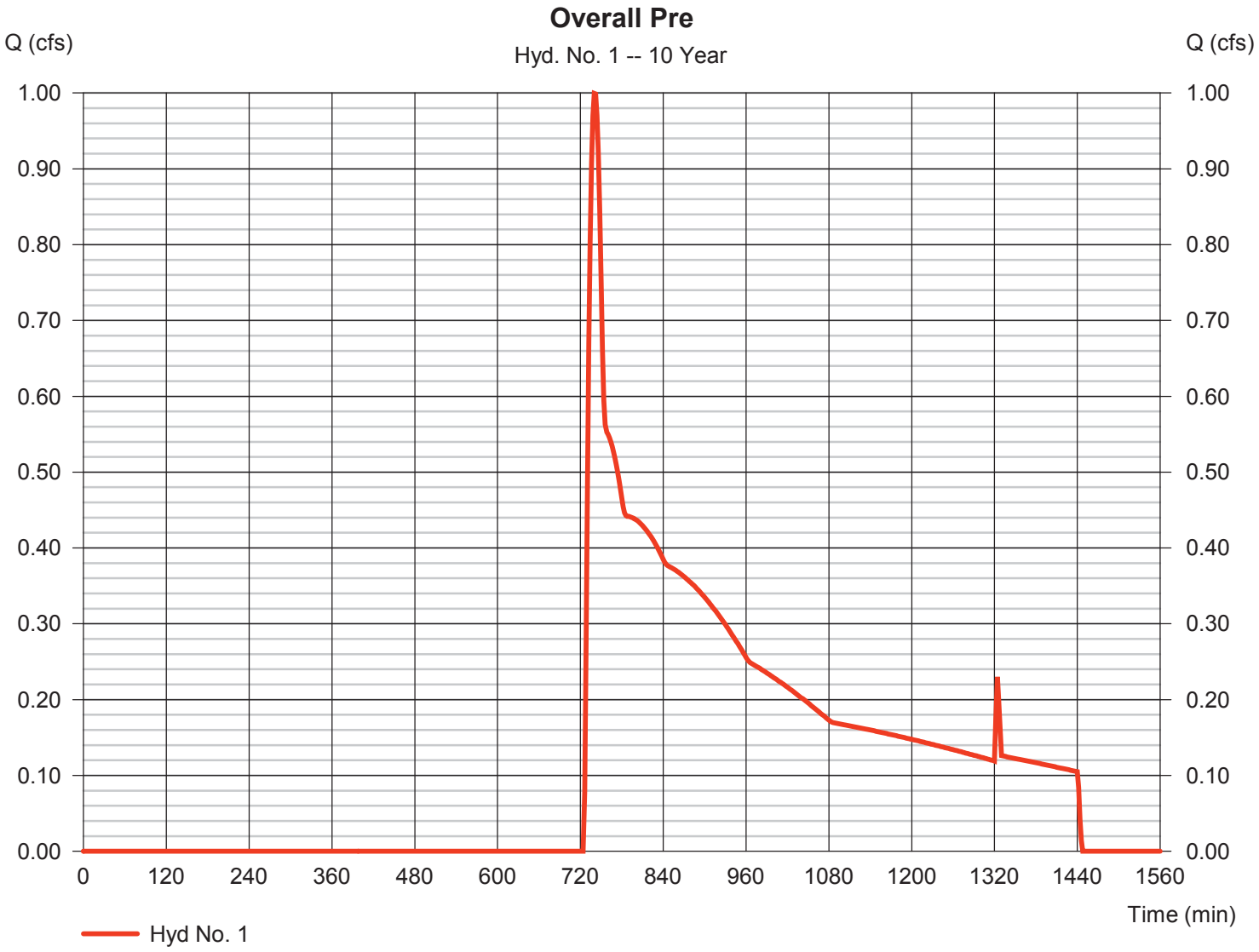
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	1.000	2	740	10,551	------	------	------	Overall Pre
3	SCS Runoff	27.86	2	724	83,441	------	------	------	Overall Post
5	SCS Runoff	0.103	2	740	1,086	------	------	------	DA 1 PRE
7	SCS Runoff	3.743	2	724	11,269	------	------	------	DA 1 POST
9	Reservoir	0.000	2	866	0	7	56.27	4,182	IB #1
11	SCS Runoff	0.253	2	740	2,671	------	------	------	DA 2 PRE
13	SCS Runoff	9.001	2	724	27,040	------	------	------	DA 2 POST
15	Reservoir	0.000	2	686	0	13	53.18	10,212	IB #2
17	SCS Runoff	0.104	2	740	1,101	------	------	------	DA #3 PRE
19	SCS Runoff	4.412	2	724	13,695	------	------	------	DA #3 POST
21	Reservoir	0.000	2	700	0	19	52.11	4,909	IB #3
23	SCS Runoff	0.250	2	740	2,641	------	------	------	DA #4 PRE
25	SCS Runoff	9.306	2	724	28,082	------	------	------	DA #4 POST
27	Reservoir	0.000	2	684	0	25	52.53	7,753	IT #1
29	SCS Runoff	0.282	2	740	2,979	------	------	------	REMAINDER OF PARCEL POST
30	SCS Runoff	0.331	2	724	1,150	------	------	------	DA-OS
31	Combine	0.389	2	738	4,129	9, 15, 21, 27, 29, 30	------	------	ENT PARCEL POST DEV

Hydrograph Report

Hyd. No. 1

Overall Pre

Hydrograph type	= SCS Runoff	Peak discharge	= 1.000 cfs
Storm frequency	= 10 yrs	Time to peak	= 740 min
Time interval	= 2 min	Hyd. volume	= 10,551 cuft
Drainage area	= 7.190 ac	Curve number	= 34
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



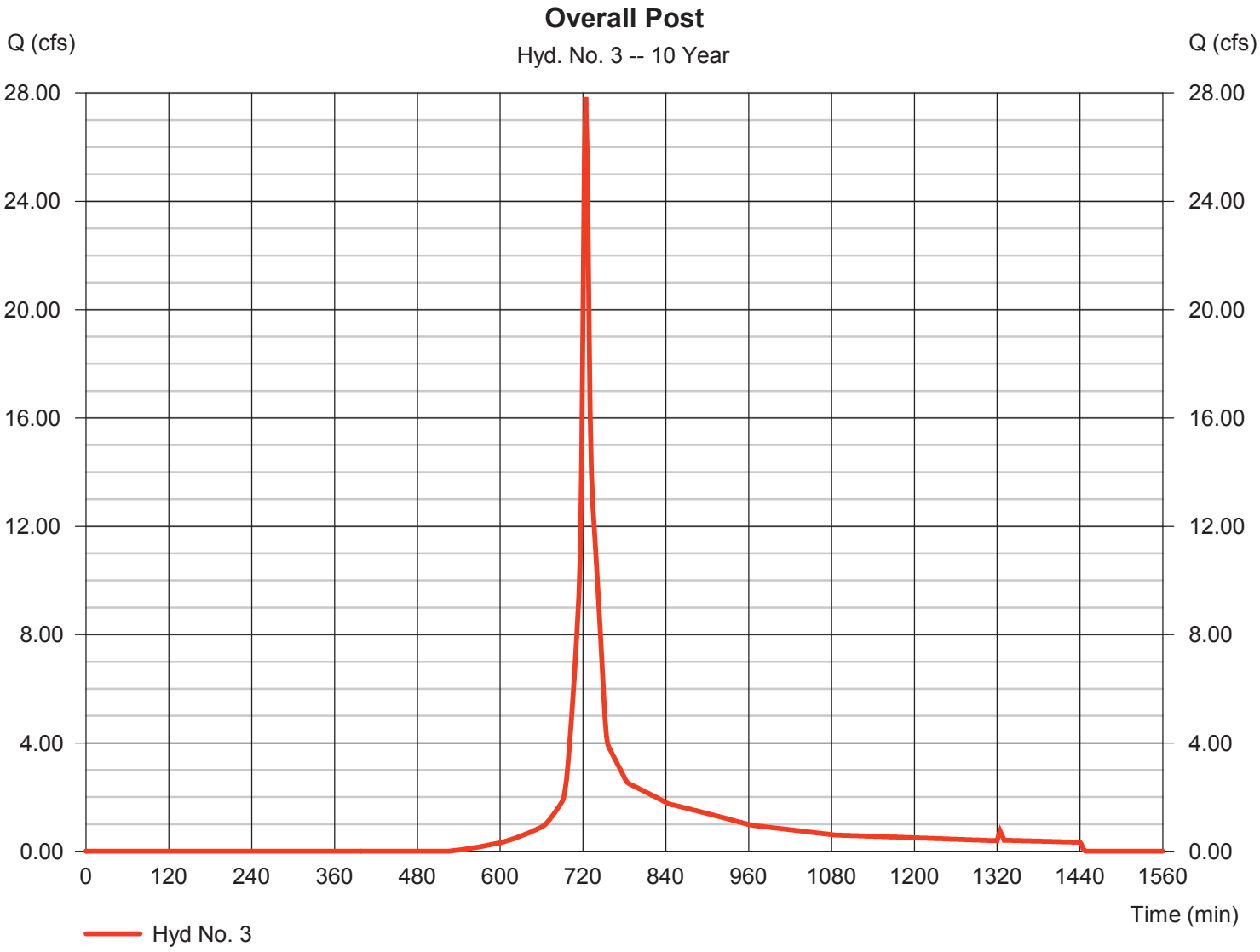
Hydrograph Report

Hyd. No. 3

Overall Post

Hydrograph type	= SCS Runoff	Peak discharge	= 27.86 cfs
Storm frequency	= 10 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 83,441 cuft
Drainage area	= 7.190 ac	Curve number	= 68*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.740 x 78) + (1.820 x 77) + (0.750 x 86) + (1.800 x 79) + (2.030 x 39) + (0.050 x 98)] / 7.190

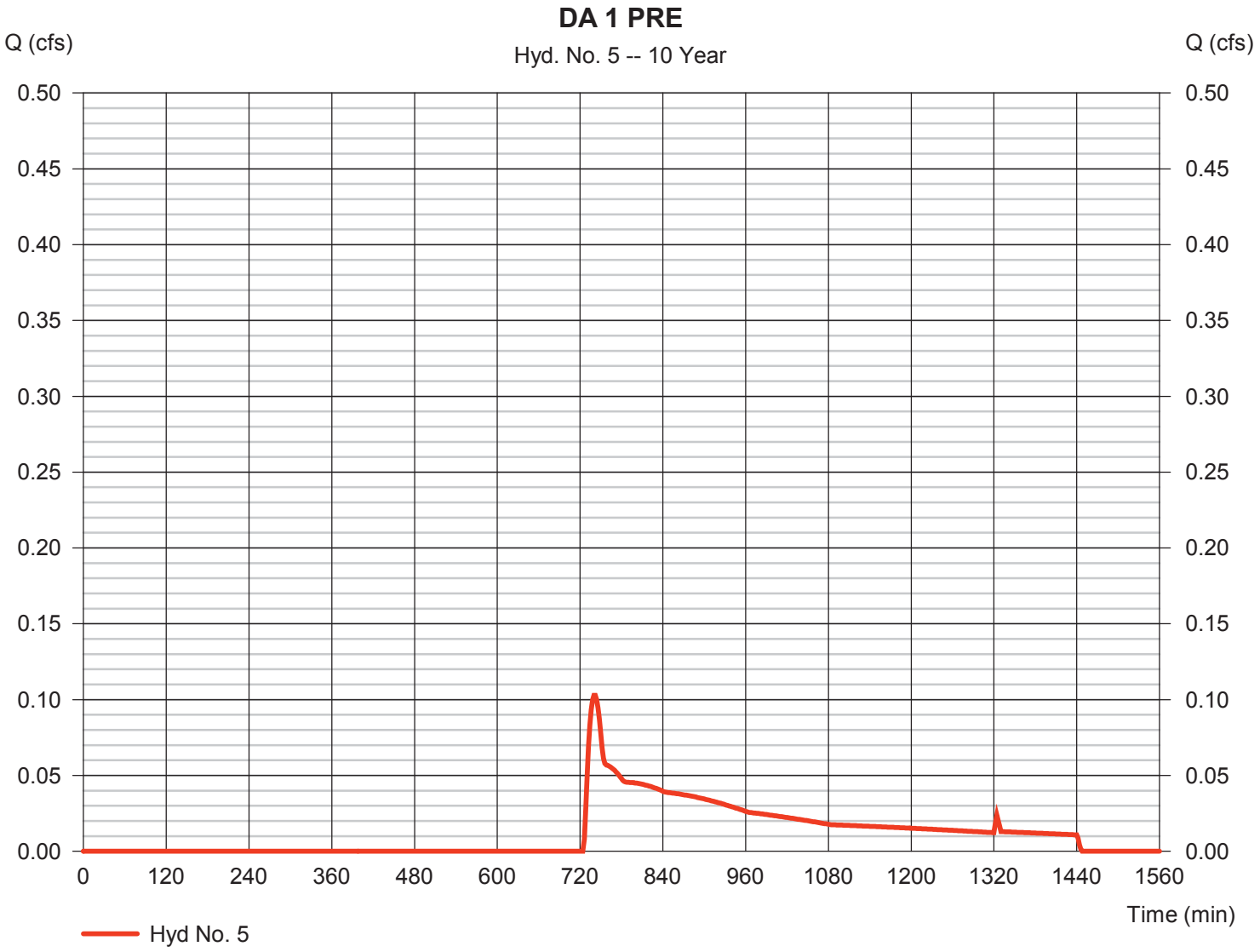


Hydrograph Report

Hyd. No. 5

DA 1 PRE

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.103 cfs
Storm frequency	=	10 yrs	Time to peak	=	740 min
Time interval	=	2 min	Hyd. volume	=	1,086 cuft
Drainage area	=	0.740 ac	Curve number	=	34
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	7.00 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

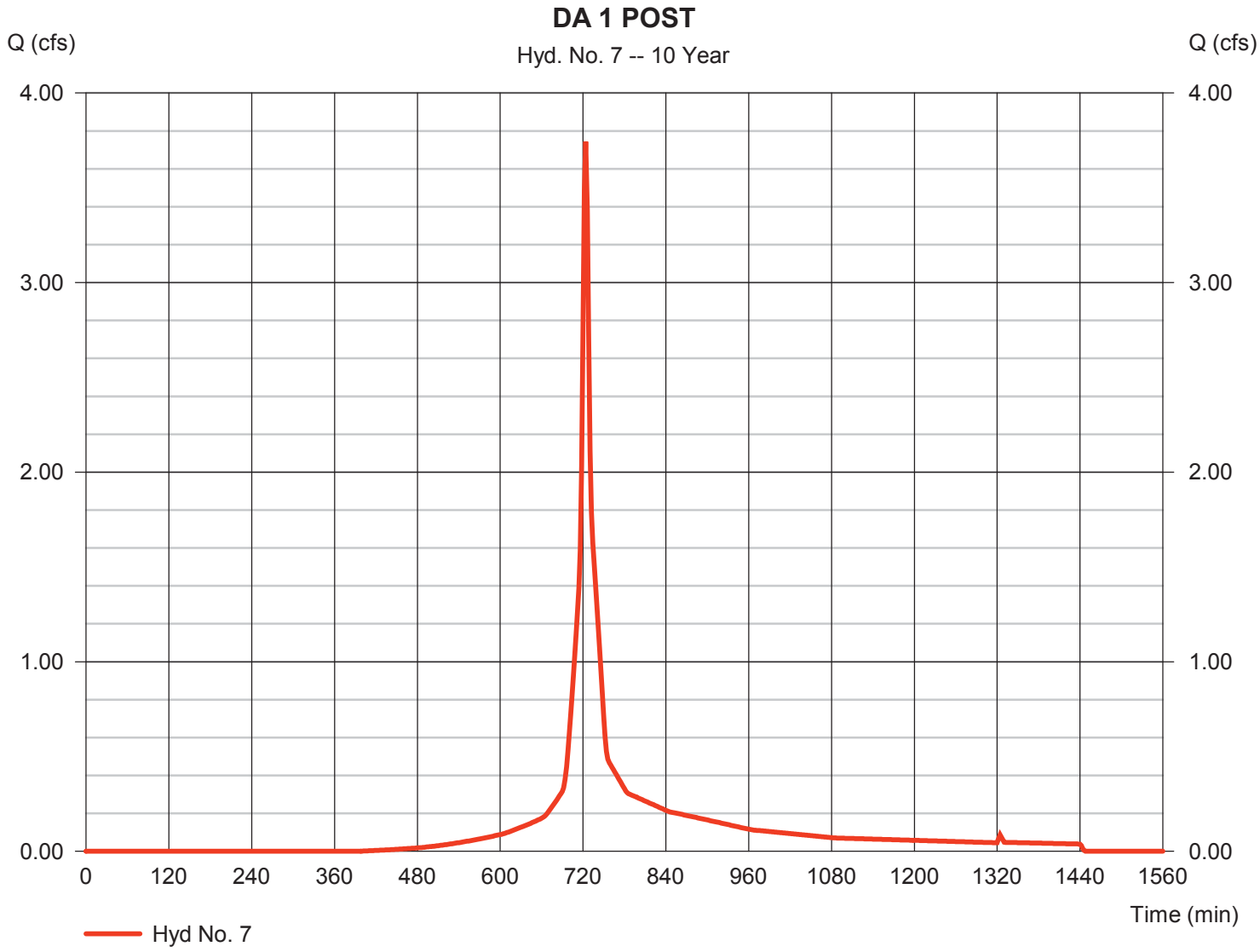


Hydrograph Report

Hyd. No. 7

DA 1 POST

Hydrograph type	= SCS Runoff	Peak discharge	= 3.743 cfs
Storm frequency	= 10 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 11,269 cuft
Drainage area	= 0.740 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



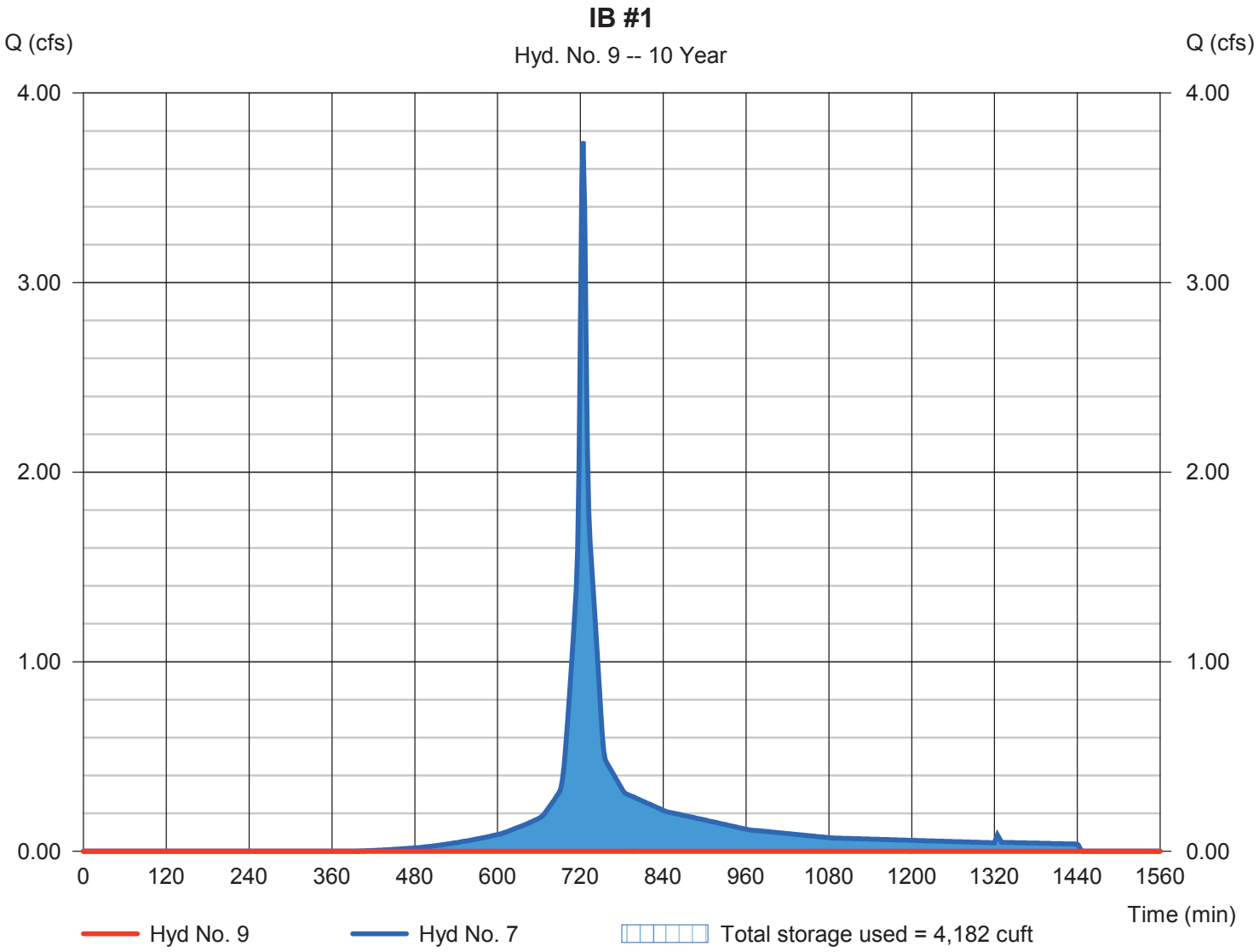
Hydrograph Report

Hyd. No. 9

IB #1

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	10 yrs	Time to peak	=	866 min
Time interval	=	2 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	7 - DA 1 POST	Max. Elevation	=	56.27 ft
Reservoir name	=	IB #1	Max. Storage	=	4,182 cuft

Storage Indication method used. Exfiltration extracted from Outflow.

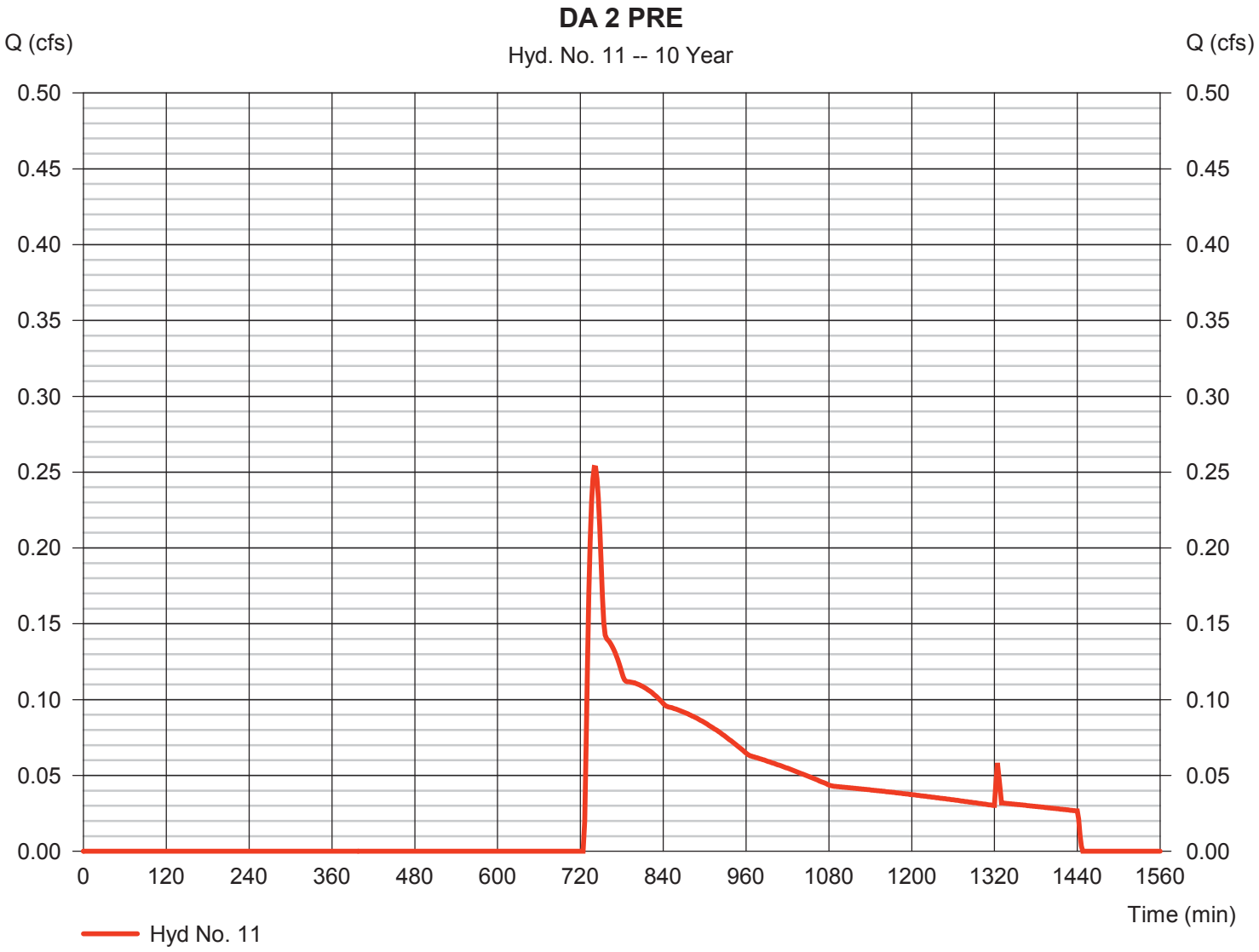


Hydrograph Report

Hyd. No. 11

DA 2 PRE

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.253 cfs
Storm frequency	=	10 yrs	Time to peak	=	740 min
Time interval	=	2 min	Hyd. volume	=	2,671 cuft
Drainage area	=	1.820 ac	Curve number	=	34
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	7.00 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

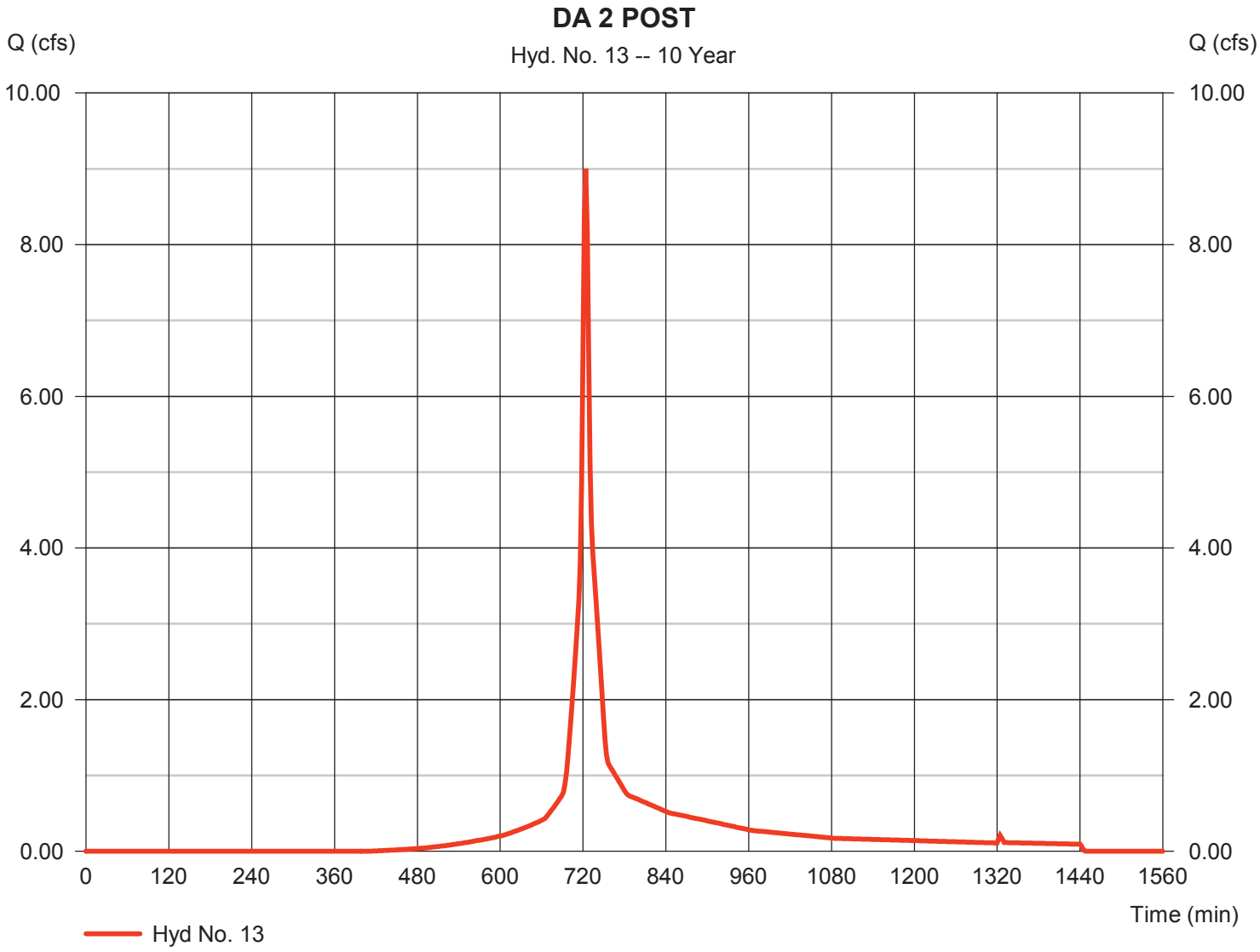


Hydrograph Report

Hyd. No. 13

DA 2 POST

Hydrograph type	= SCS Runoff	Peak discharge	= 9.001 cfs
Storm frequency	= 10 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 27,040 cuft
Drainage area	= 1.820 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



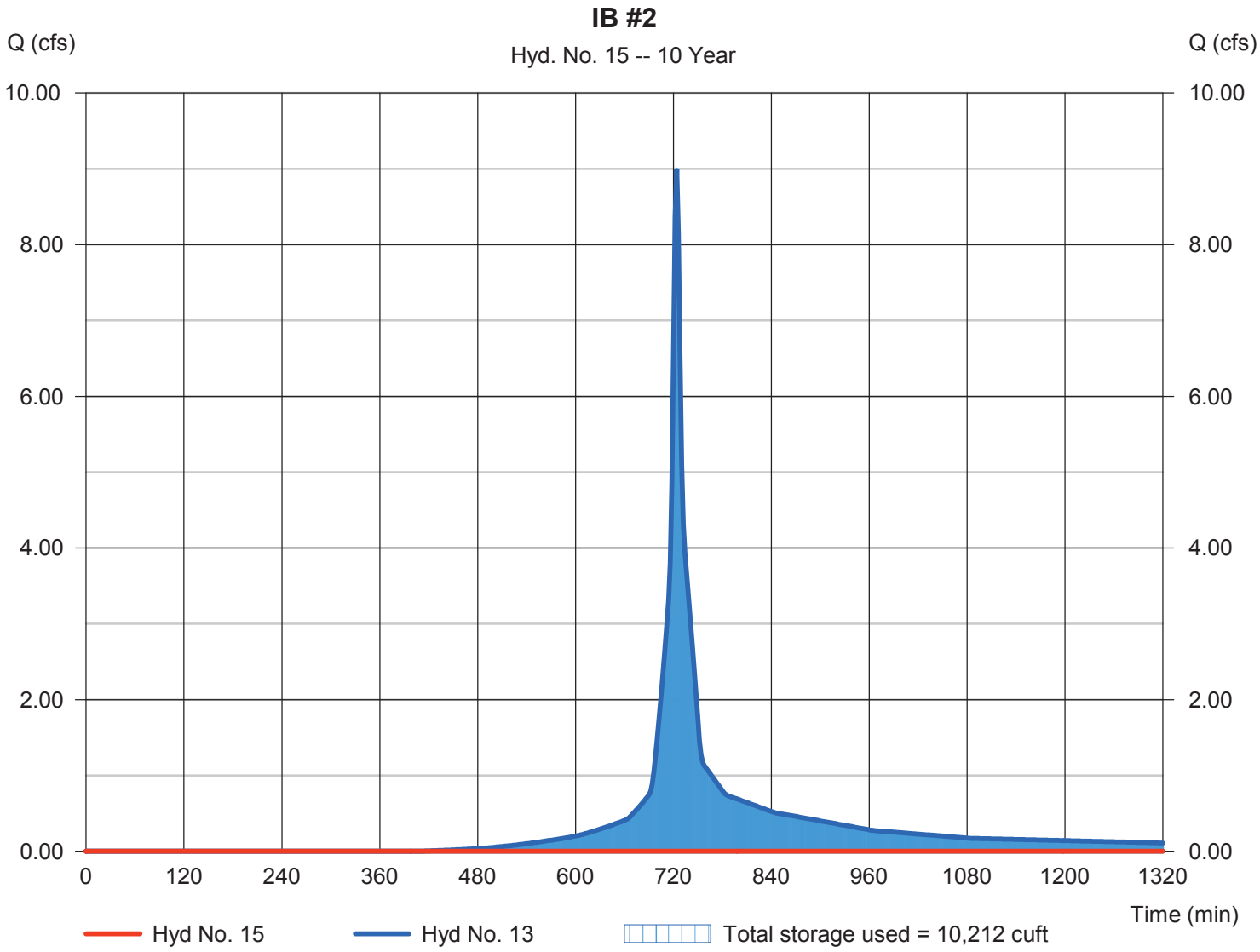
Hydrograph Report

Hyd. No. 15

IB #2

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 10 yrs	Time to peak	= 686 min
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 13 - DA 2 POST	Max. Elevation	= 53.18 ft
Reservoir name	= IB #2	Max. Storage	= 10,212 cuft

Storage Indication method used. Exfiltration extracted from Outflow.

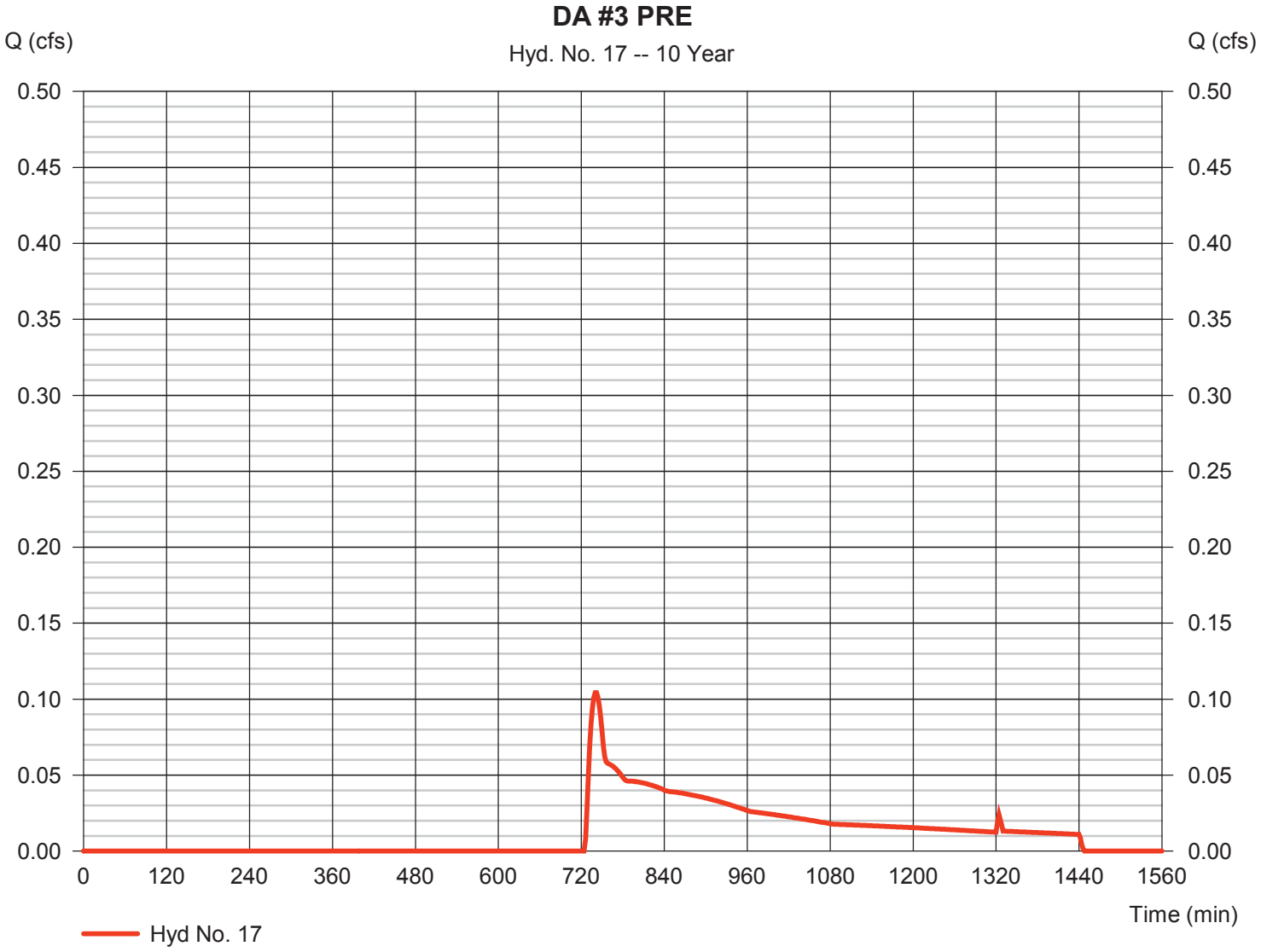


Hydrograph Report

Hyd. No. 17

DA #3 PRE

Hydrograph type	= SCS Runoff	Peak discharge	= 0.104 cfs
Storm frequency	= 10 yrs	Time to peak	= 740 min
Time interval	= 2 min	Hyd. volume	= 1,101 cuft
Drainage area	= 0.750 ac	Curve number	= 34
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

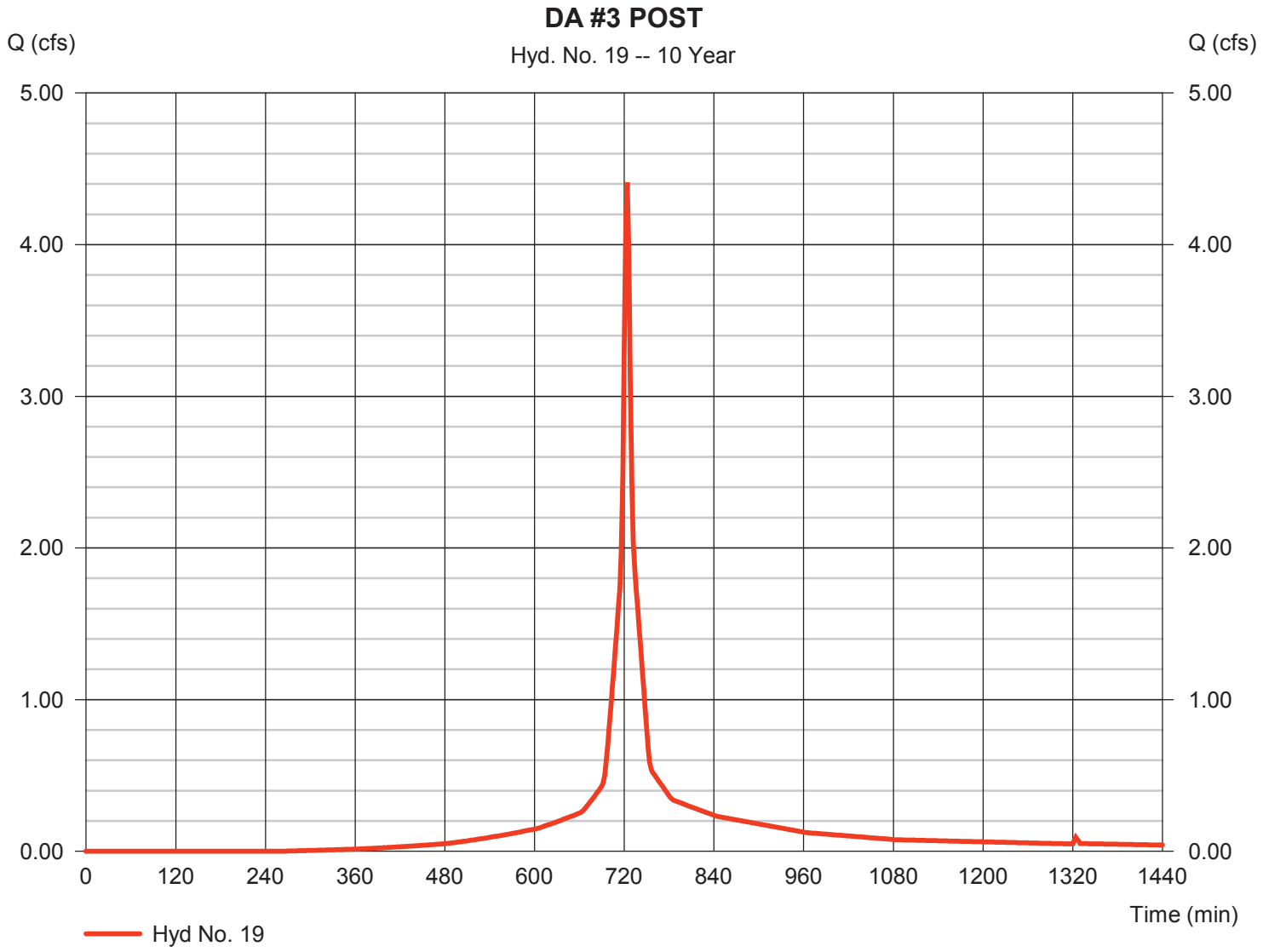


Hydrograph Report

Hyd. No. 19

DA #3 POST

Hydrograph type	= SCS Runoff	Peak discharge	= 4.412 cfs
Storm frequency	= 10 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 13,695 cuft
Drainage area	= 0.750 ac	Curve number	= 86
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



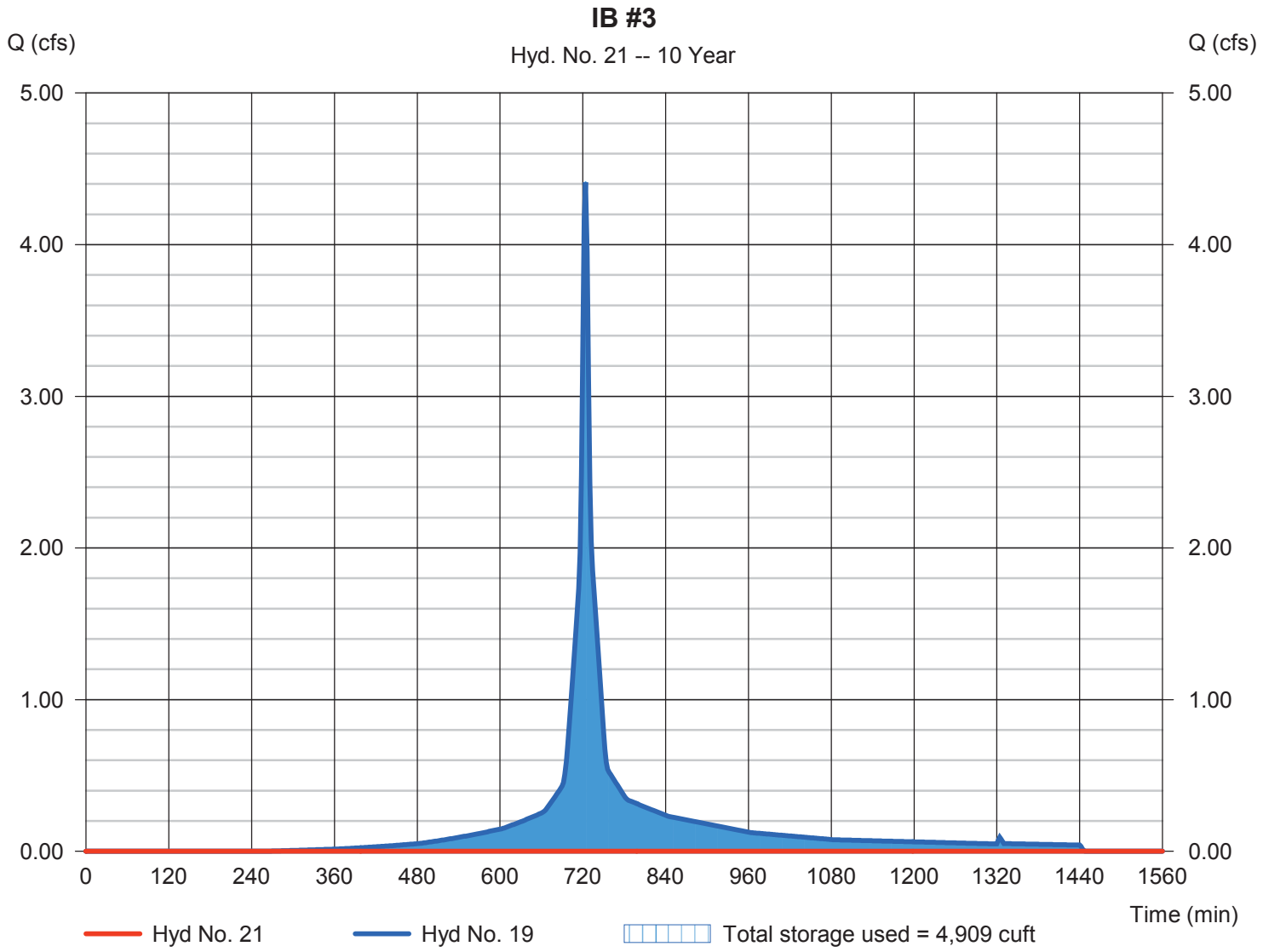
Hydrograph Report

Hyd. No. 21

IB #3

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	10 yrs	Time to peak	=	700 min
Time interval	=	2 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	19 - DA #3 POST	Max. Elevation	=	52.11 ft
Reservoir name	=	IB #3	Max. Storage	=	4,909 cuft

Storage Indication method used. Exfiltration extracted from Outflow.

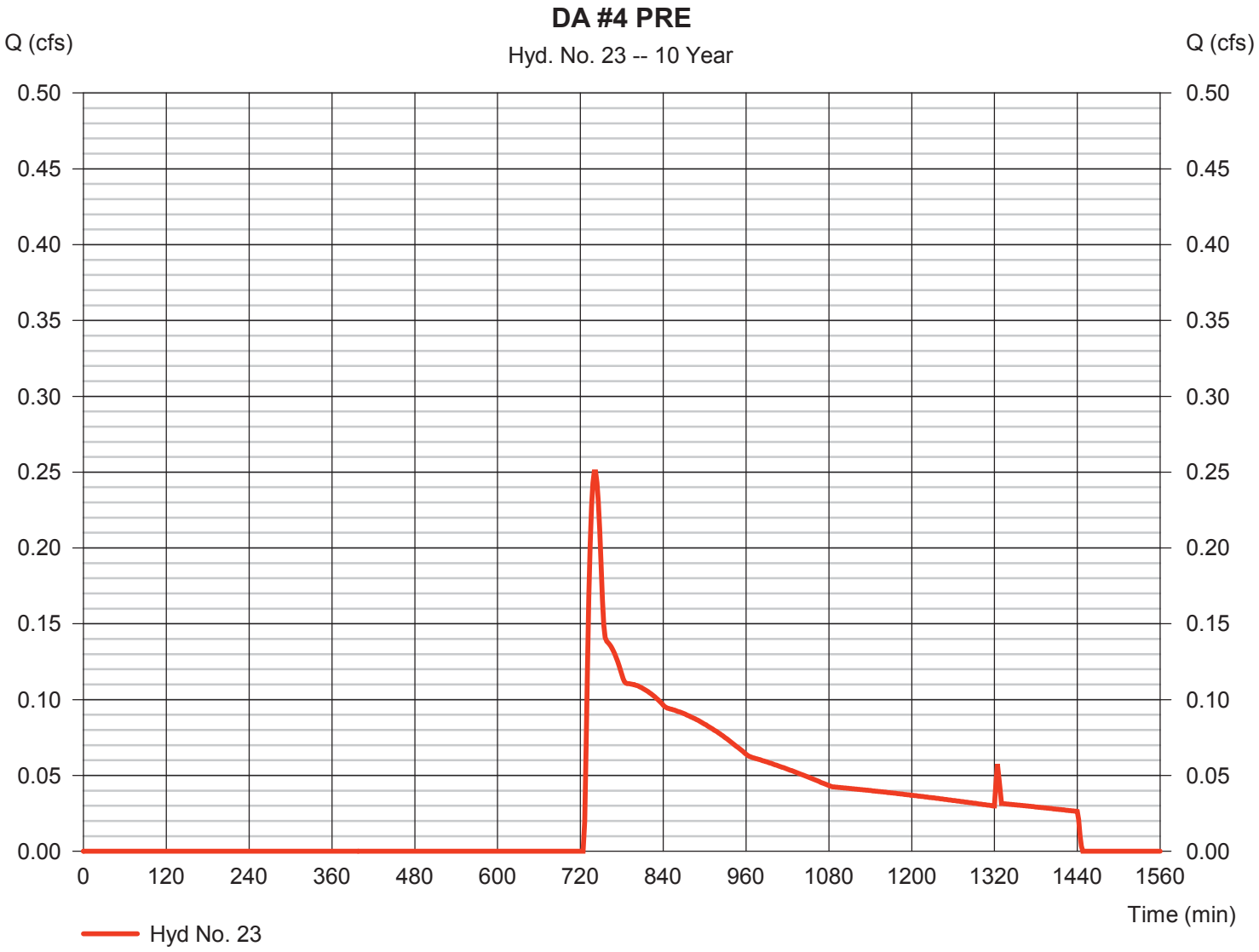


Hydrograph Report

Hyd. No. 23

DA #4 PRE

Hydrograph type	= SCS Runoff	Peak discharge	= 0.250 cfs
Storm frequency	= 10 yrs	Time to peak	= 740 min
Time interval	= 2 min	Hyd. volume	= 2,641 cuft
Drainage area	= 1.800 ac	Curve number	= 34
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

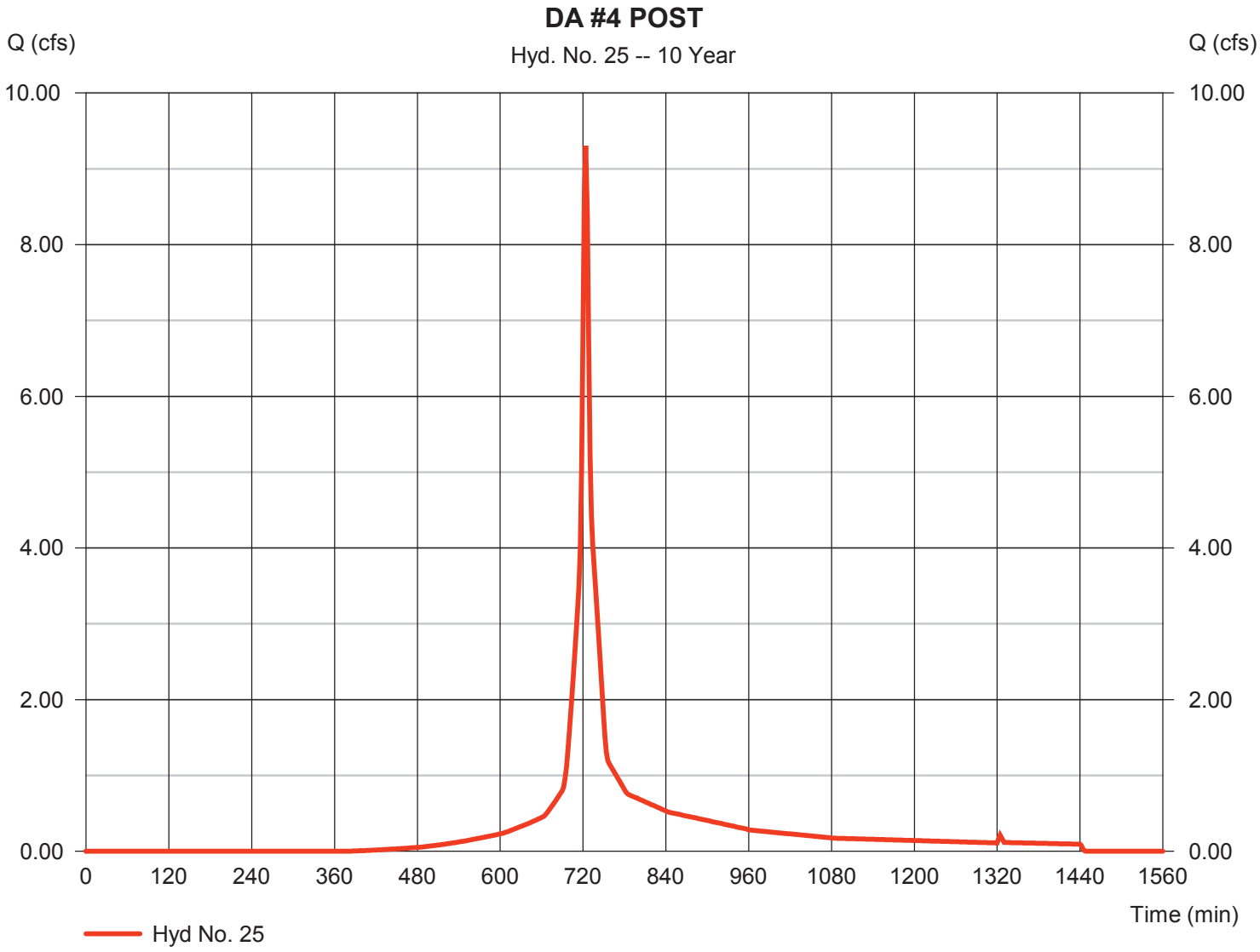


Hydrograph Report

Hyd. No. 25

DA #4 POST

Hydrograph type	= SCS Runoff	Peak discharge	= 9.306 cfs
Storm frequency	= 10 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 28,082 cuft
Drainage area	= 1.800 ac	Curve number	= 79
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



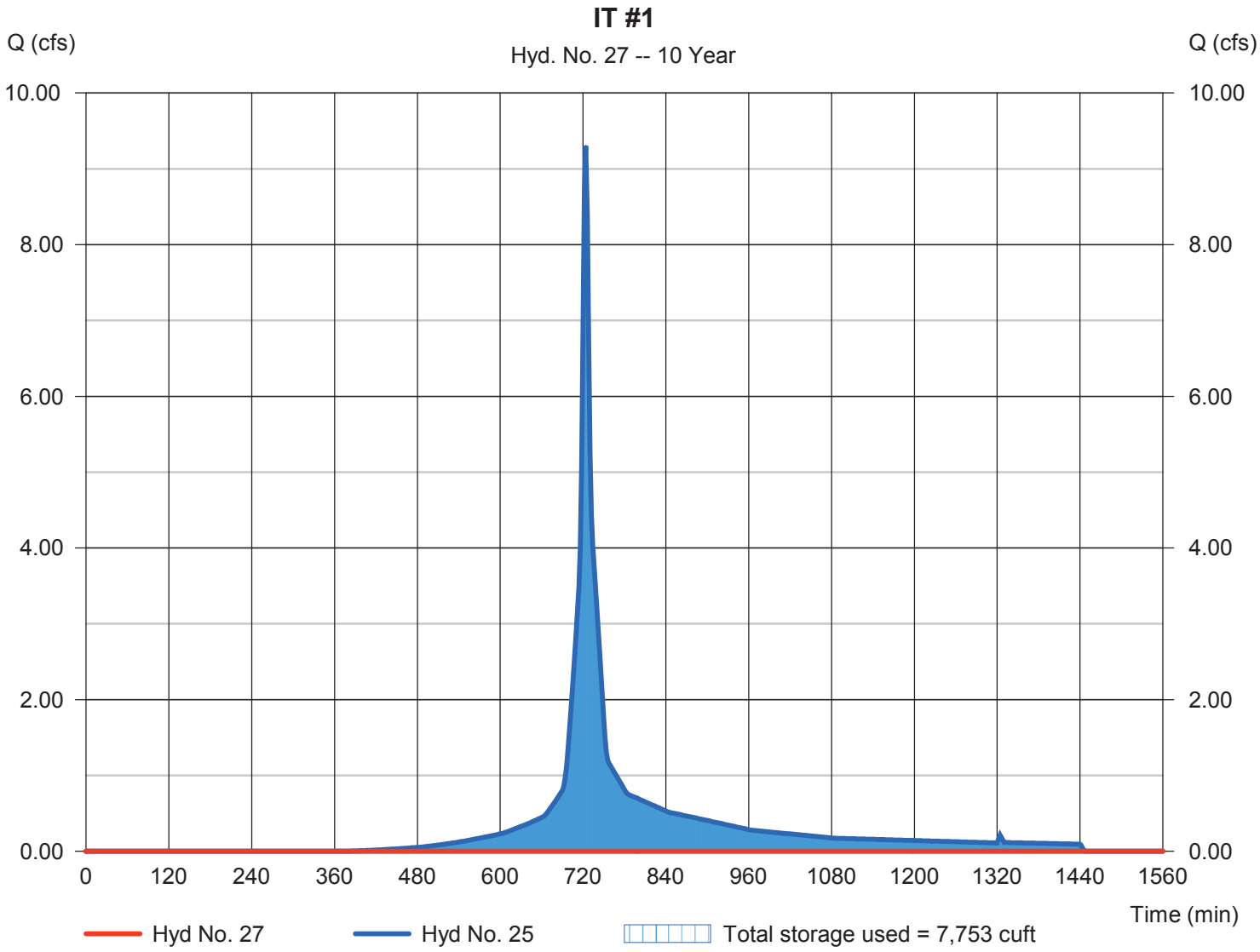
Hydrograph Report

Hyd. No. 27

IT #1

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 10 yrs	Time to peak	= 684 min
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 25 - DA #4 POST	Max. Elevation	= 52.53 ft
Reservoir name	= IT #1	Max. Storage	= 7,753 cuft

Storage Indication method used. Exfiltration extracted from Outflow.

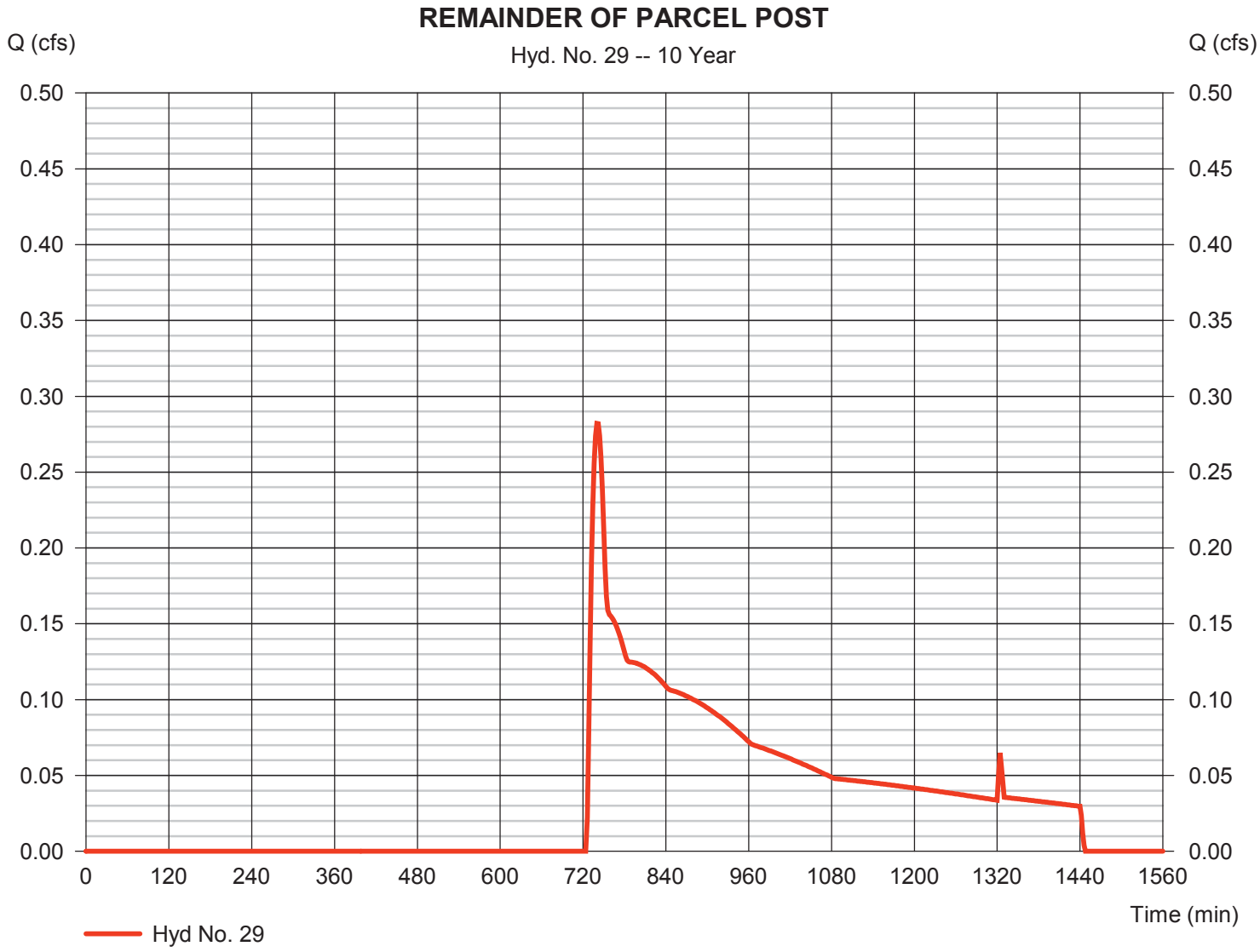


Hydrograph Report

Hyd. No. 29

REMAINDER OF PARCEL POST

Hydrograph type	= SCS Runoff	Peak discharge	= 0.282 cfs
Storm frequency	= 10 yrs	Time to peak	= 740 min
Time interval	= 2 min	Hyd. volume	= 2,979 cuft
Drainage area	= 2.030 ac	Curve number	= 34
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

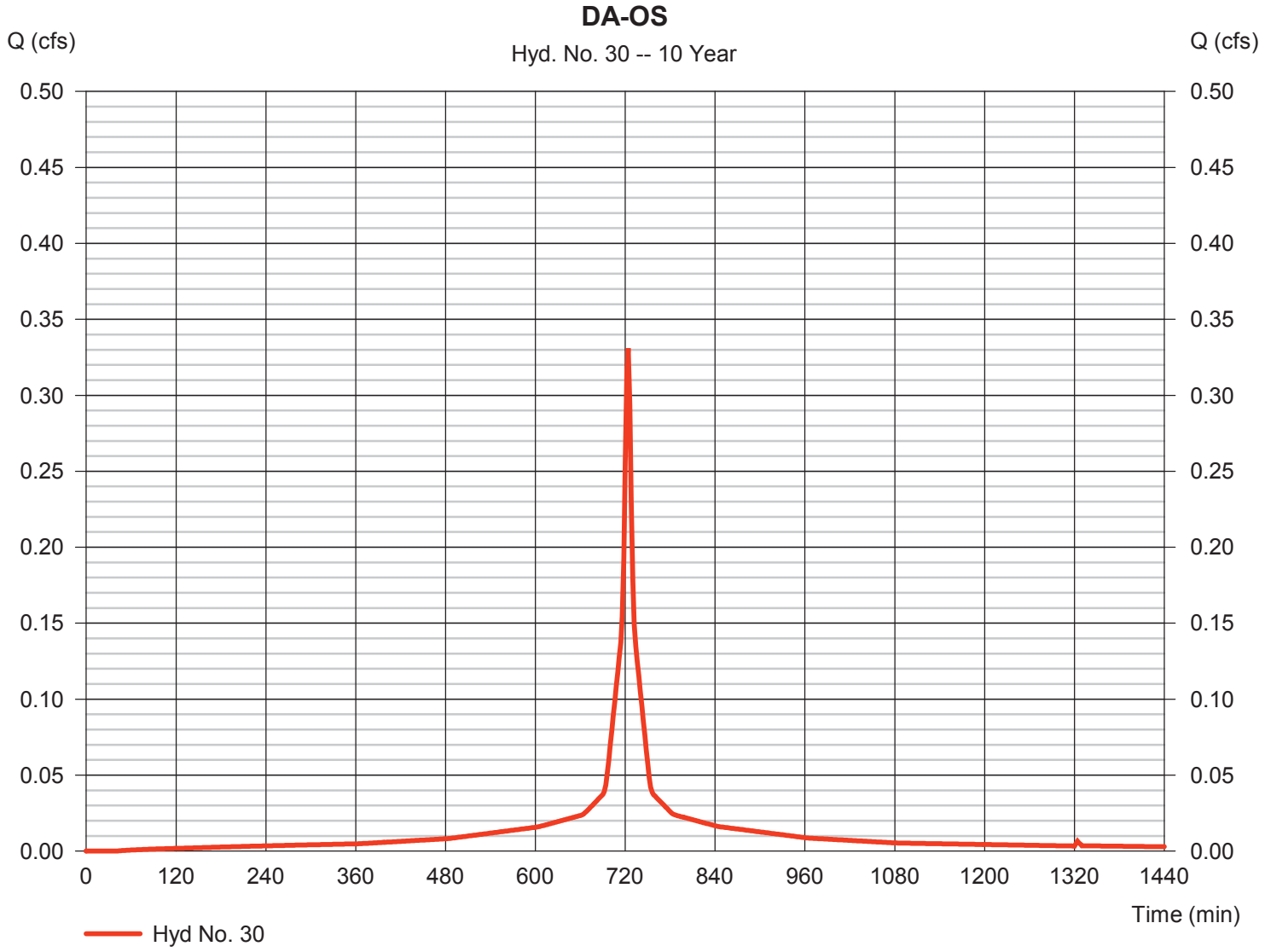


Hydrograph Report

Hyd. No. 30

DA-OS

Hydrograph type	= SCS Runoff	Peak discharge	= 0.331 cfs
Storm frequency	= 10 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 1,150 cuft
Drainage area	= 0.050 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 7.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

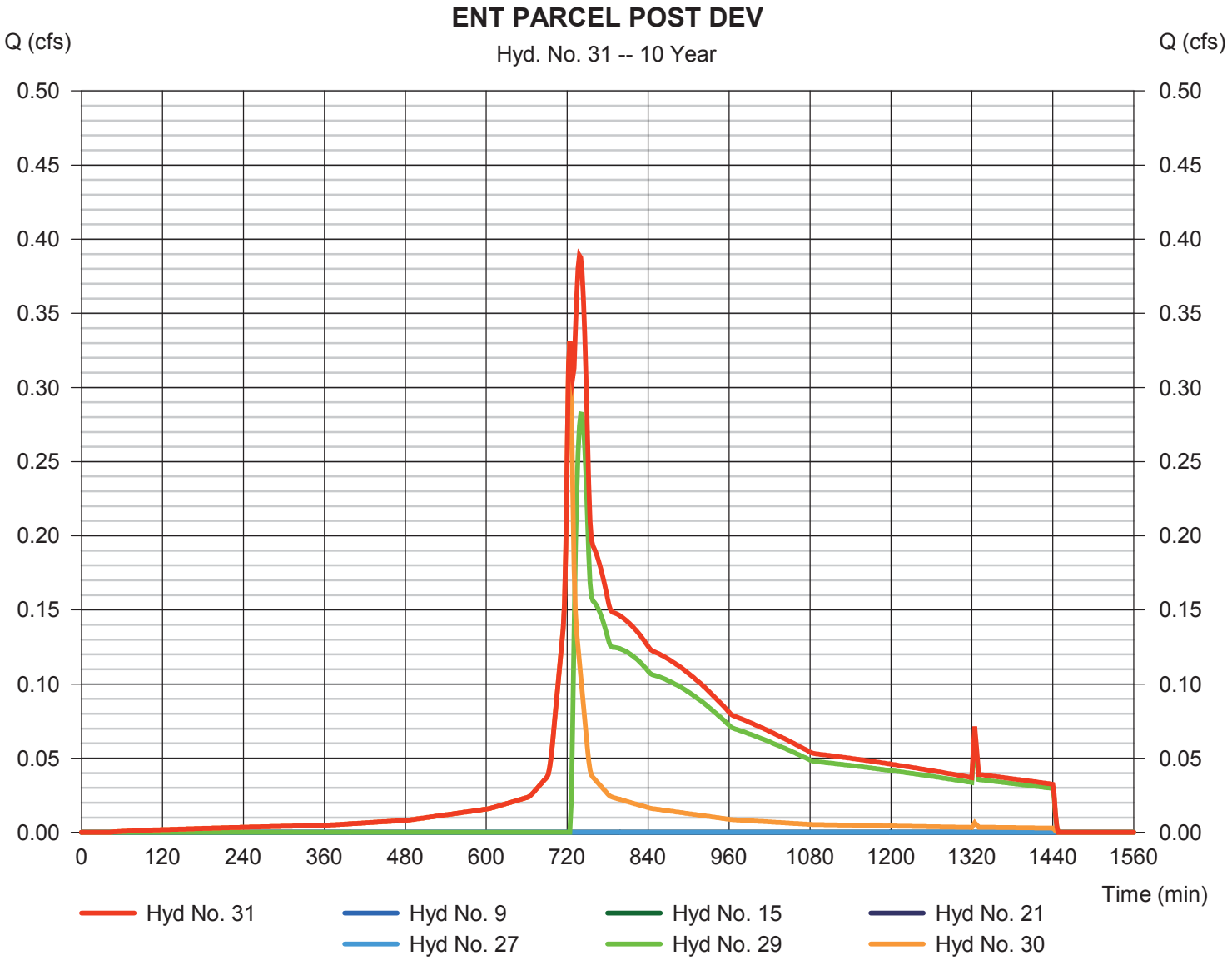


Hydrograph Report

Hyd. No. 31

ENT PARCEL POST DEV

Hydrograph type	= Combine	Peak discharge	= 0.389 cfs
Storm frequency	= 10 yrs	Time to peak	= 738 min
Time interval	= 2 min	Hyd. volume	= 4,129 cuft
Inflow hyds.	= 9, 15, 21, 27, 29, 30	Contrib. drain. area	= 2.080 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

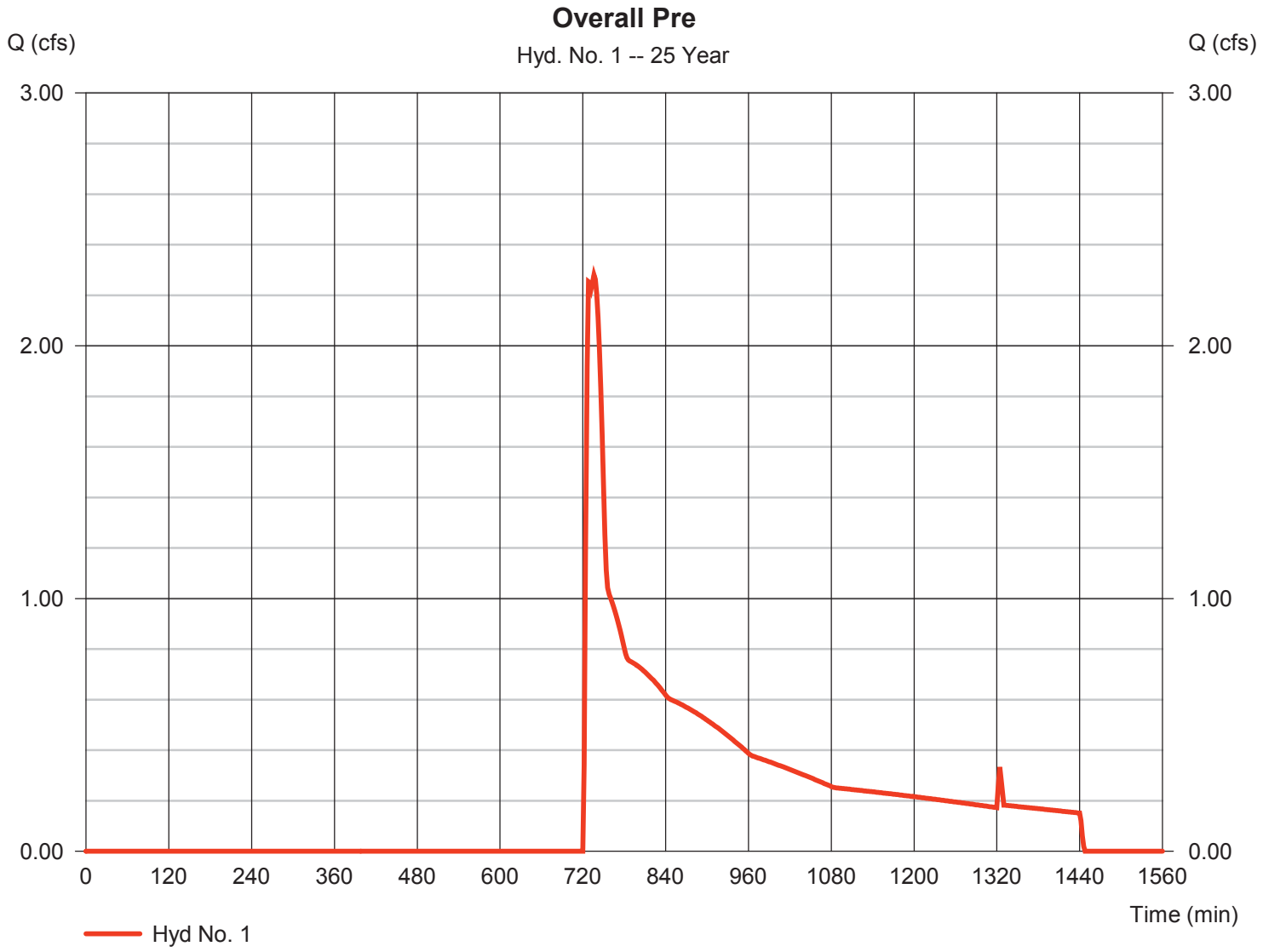
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	2.280	2	736	17,998	------	------	------	Overall Pre
3	SCS Runoff	35.02	2	724	104,660	------	------	------	Overall Post
5	SCS Runoff	0.235	2	736	1,852	------	------	------	DA 1 PRE
7	SCS Runoff	4.521	2	724	13,693	------	------	------	DA 1 POST
9	Reservoir	0.044	2	752	19	7	56.72	5,219	IB #1
11	SCS Runoff	0.577	2	736	4,556	------	------	------	DA 2 PRE
13	SCS Runoff	10.91	2	724	32,952	------	------	------	DA 2 POST
15	Reservoir	0.000	2	1010	0	13	53.63	12,909	IB #2
17	SCS Runoff	0.238	2	736	1,877	------	------	------	DA #3 PRE
19	SCS Runoff	5.196	2	724	16,284	------	------	------	DA #3 POST
21	Reservoir	0.000	2	696	0	19	52.50	6,093	IB #3
23	SCS Runoff	0.571	2	736	4,506	------	------	------	DA #4 PRE
25	SCS Runoff	11.20	2	724	34,025	------	------	------	DA #4 POST
27	Reservoir	0.000	2	692	0	25	53.05	10,116	IT #1
29	SCS Runoff	0.644	2	736	5,082	------	------	------	REMAINDER OF PARCEL POST
30	SCS Runoff	0.381	2	724	1,329	------	------	------	DA-OS
31	Combine	0.901	2	728	6,430	9, 15, 21, 27, 29, 30	------	------	ENT PARCEL POST DEV

Hydrograph Report

Hyd. No. 1

Overall Pre

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.280 cfs
Storm frequency	=	25 yrs	Time to peak	=	736 min
Time interval	=	2 min	Hyd. volume	=	17,998 cuft
Drainage area	=	7.190 ac	Curve number	=	34
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	8.05 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



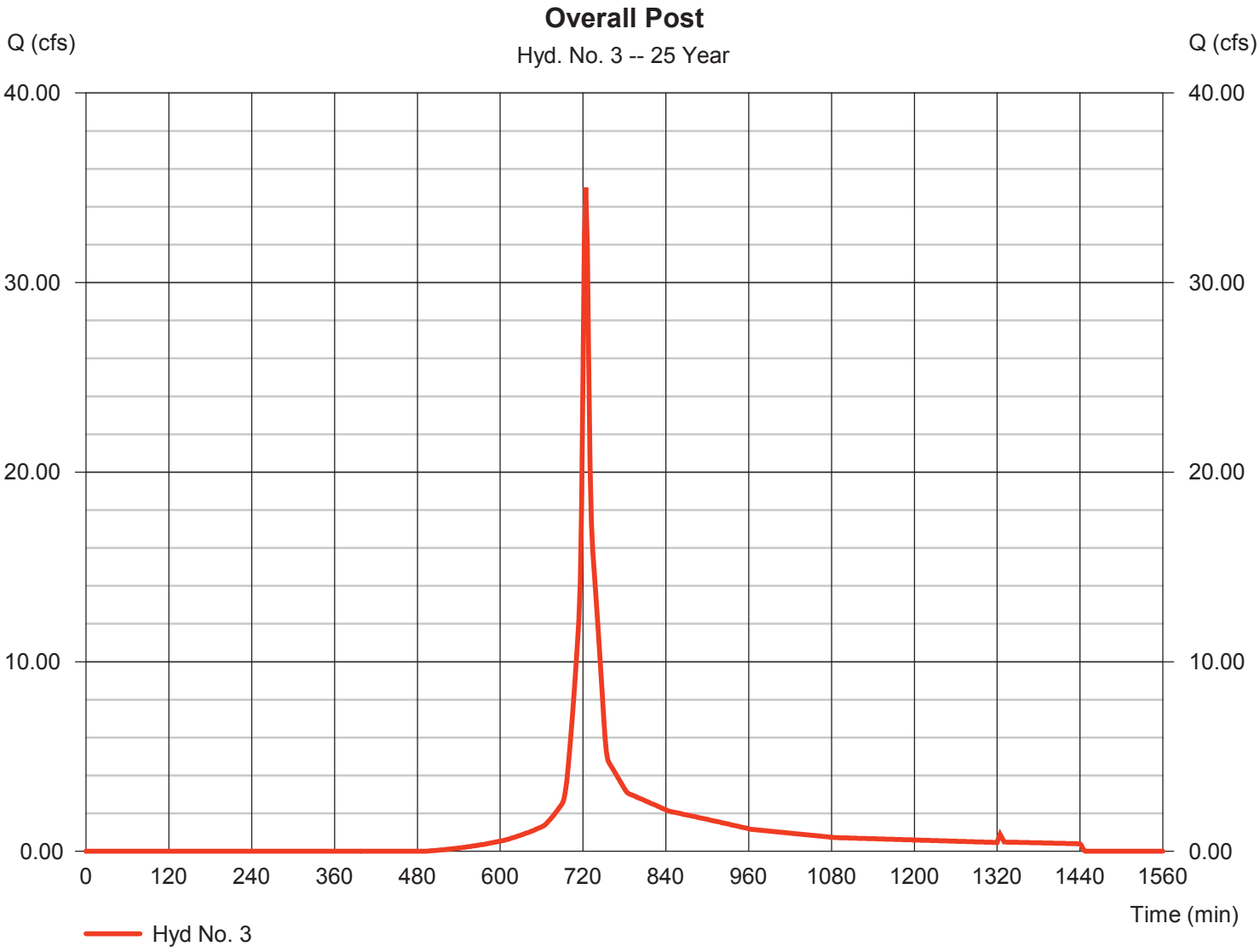
Hydrograph Report

Hyd. No. 3

Overall Post

Hydrograph type	= SCS Runoff	Peak discharge	= 35.02 cfs
Storm frequency	= 25 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 104,660 cuft
Drainage area	= 7.190 ac	Curve number	= 68*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 8.05 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.740 x 78) + (1.820 x 77) + (0.750 x 86) + (1.800 x 79) + (2.030 x 39) + (0.050 x 98)] / 7.190

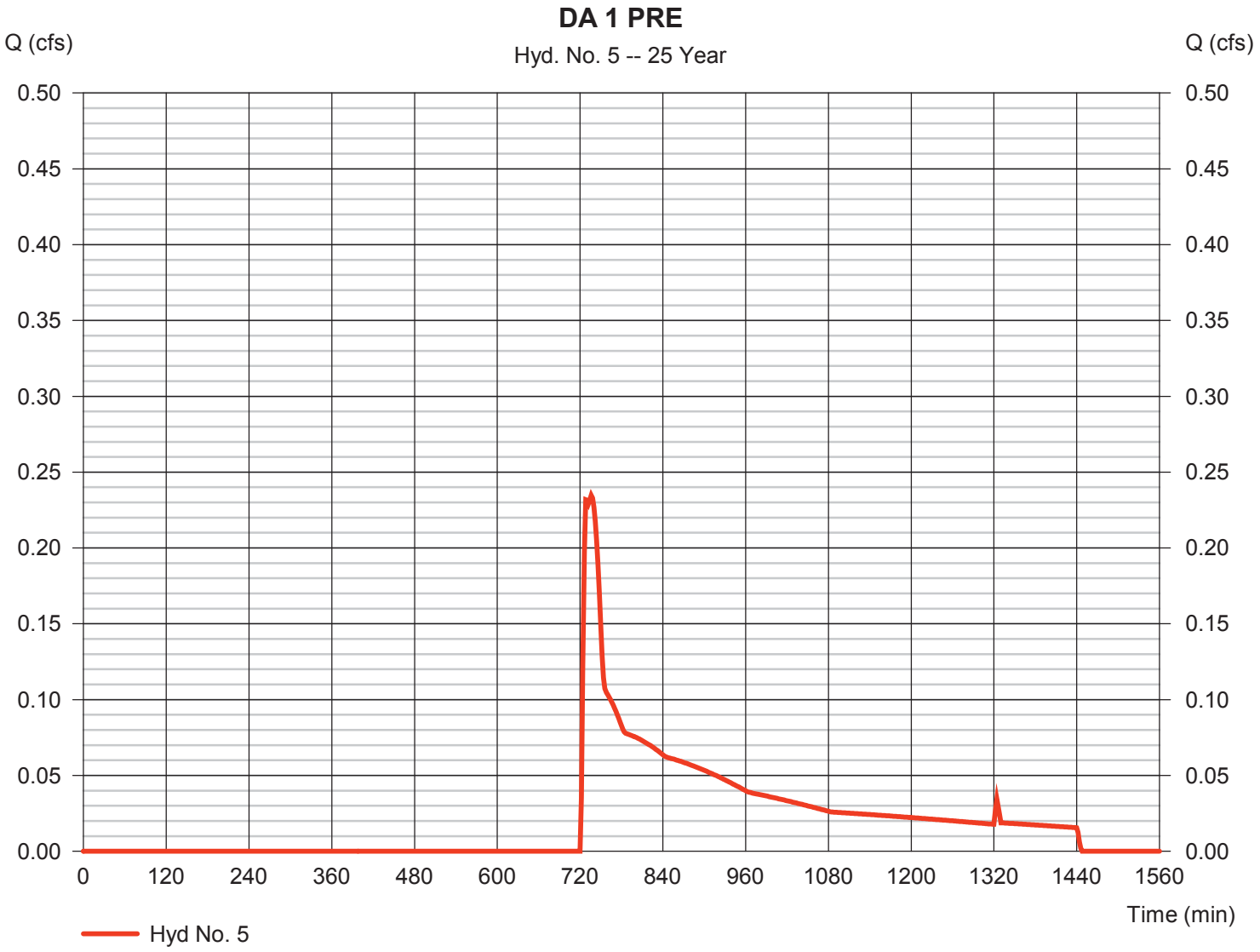


Hydrograph Report

Hyd. No. 5

DA 1 PRE

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.235 cfs
Storm frequency	=	25 yrs	Time to peak	=	736 min
Time interval	=	2 min	Hyd. volume	=	1,852 cuft
Drainage area	=	0.740 ac	Curve number	=	34
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	8.05 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

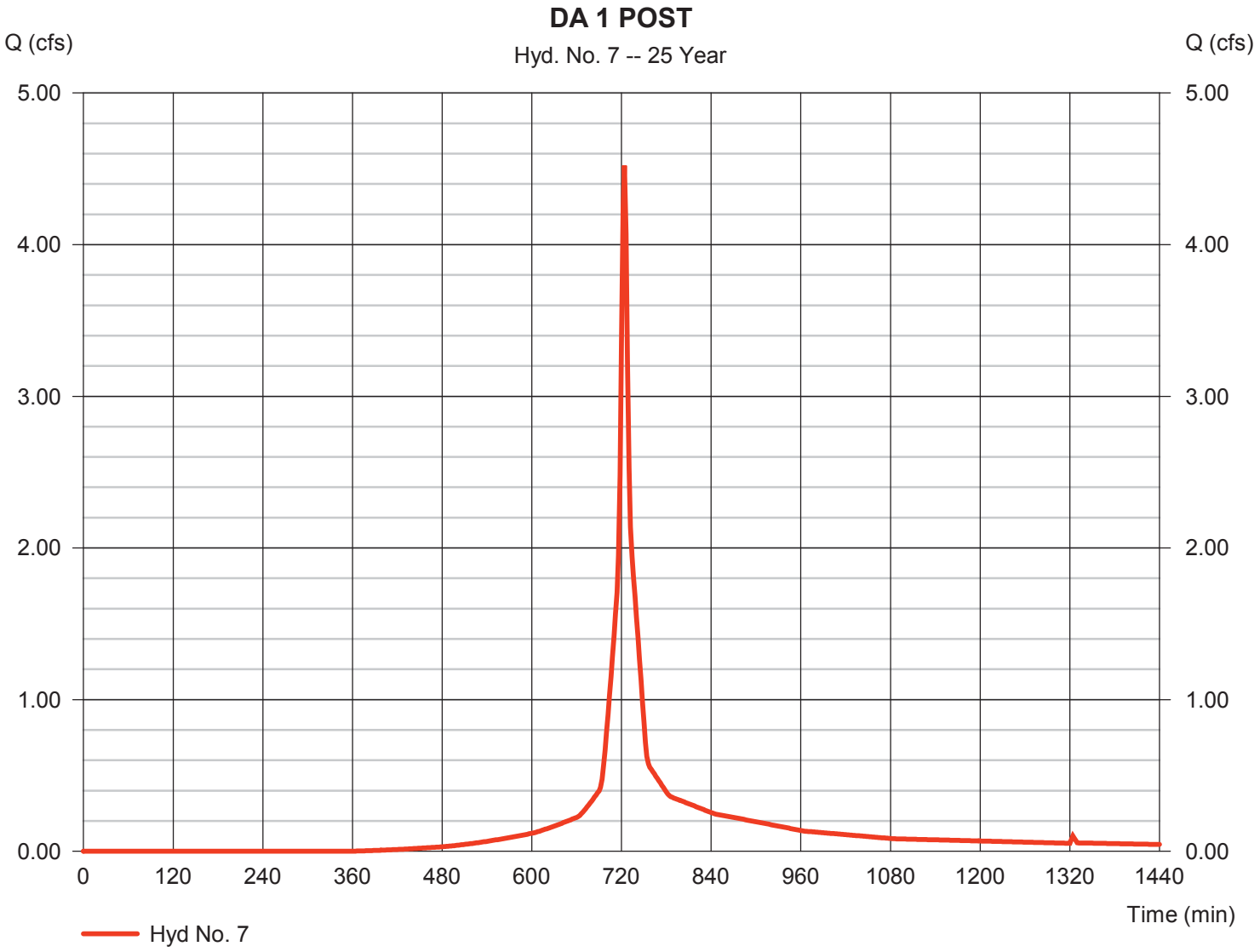


Hydrograph Report

Hyd. No. 7

DA 1 POST

Hydrograph type	=	SCS Runoff	Peak discharge	=	4.521 cfs
Storm frequency	=	25 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	13,693 cuft
Drainage area	=	0.740 ac	Curve number	=	78
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	8.05 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



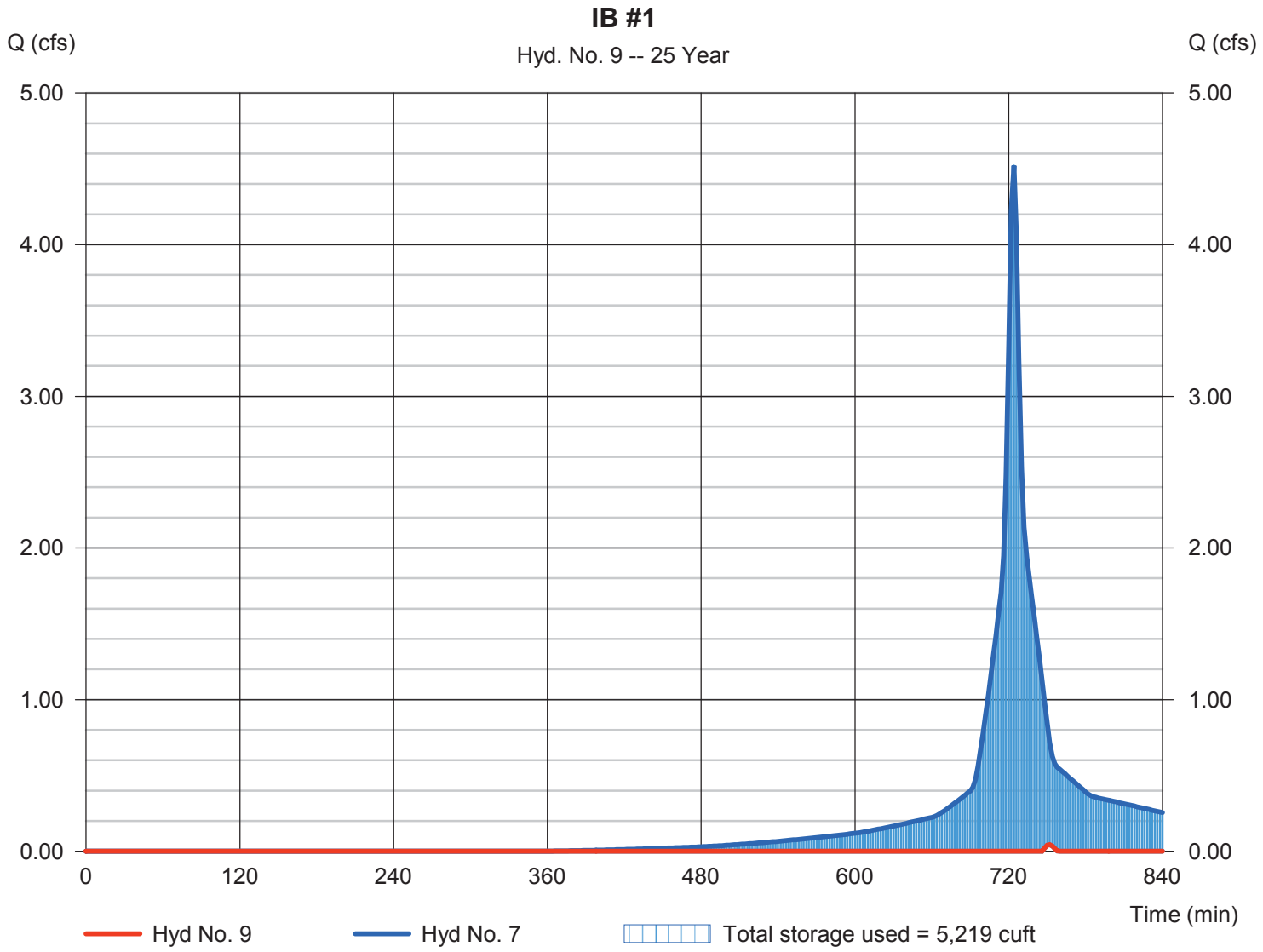
Hydrograph Report

Hyd. No. 9

IB #1

Hydrograph type	= Reservoir	Peak discharge	= 0.044 cfs
Storm frequency	= 25 yrs	Time to peak	= 752 min
Time interval	= 2 min	Hyd. volume	= 19 cuft
Inflow hyd. No.	= 7 - DA 1 POST	Max. Elevation	= 56.72 ft
Reservoir name	= IB #1	Max. Storage	= 5,219 cuft

Storage Indication method used. Exfiltration extracted from Outflow.

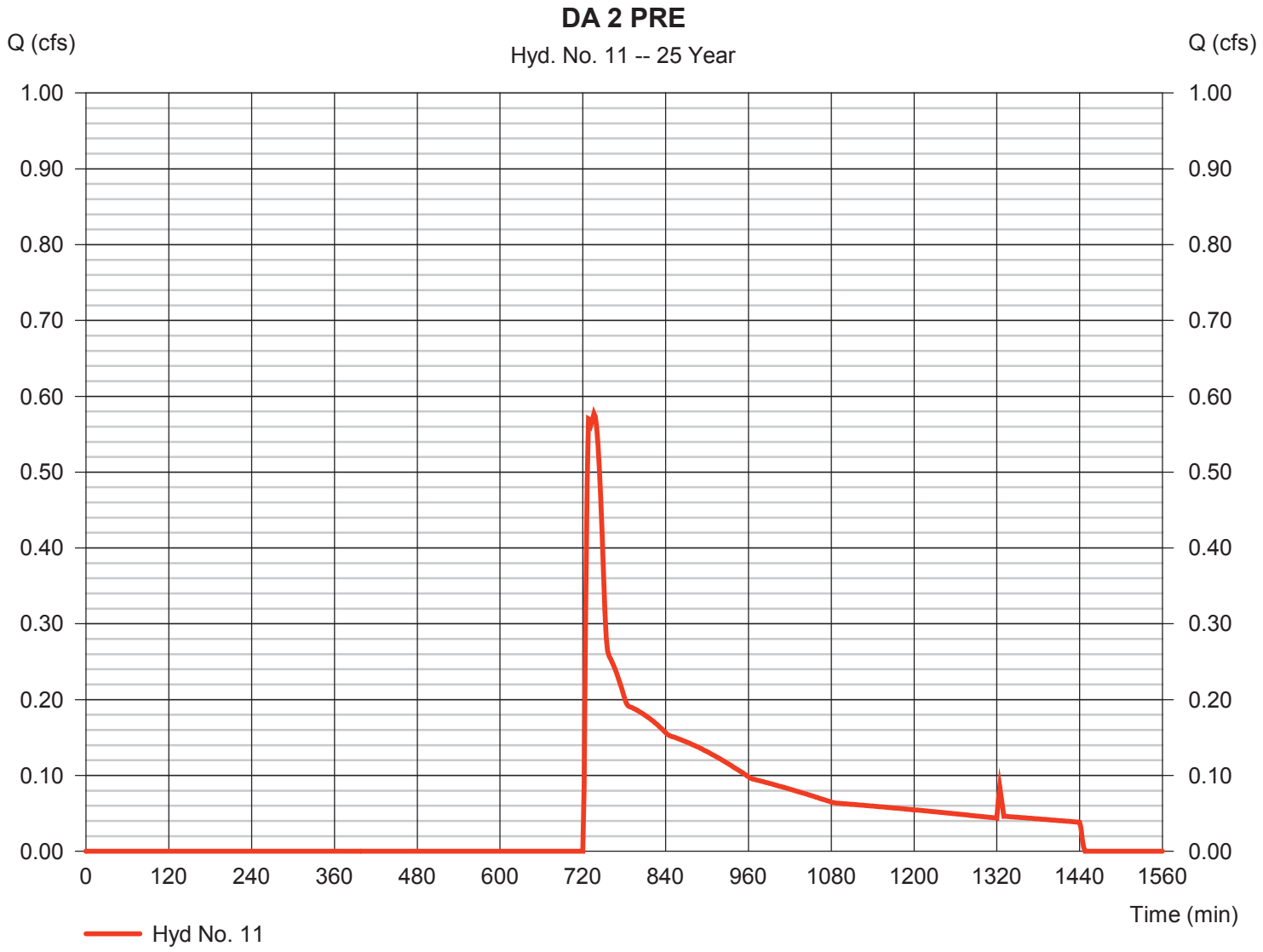


Hydrograph Report

Hyd. No. 11

DA 2 PRE

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.577 cfs
Storm frequency	=	25 yrs	Time to peak	=	736 min
Time interval	=	2 min	Hyd. volume	=	4,556 cuft
Drainage area	=	1.820 ac	Curve number	=	34
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	8.05 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

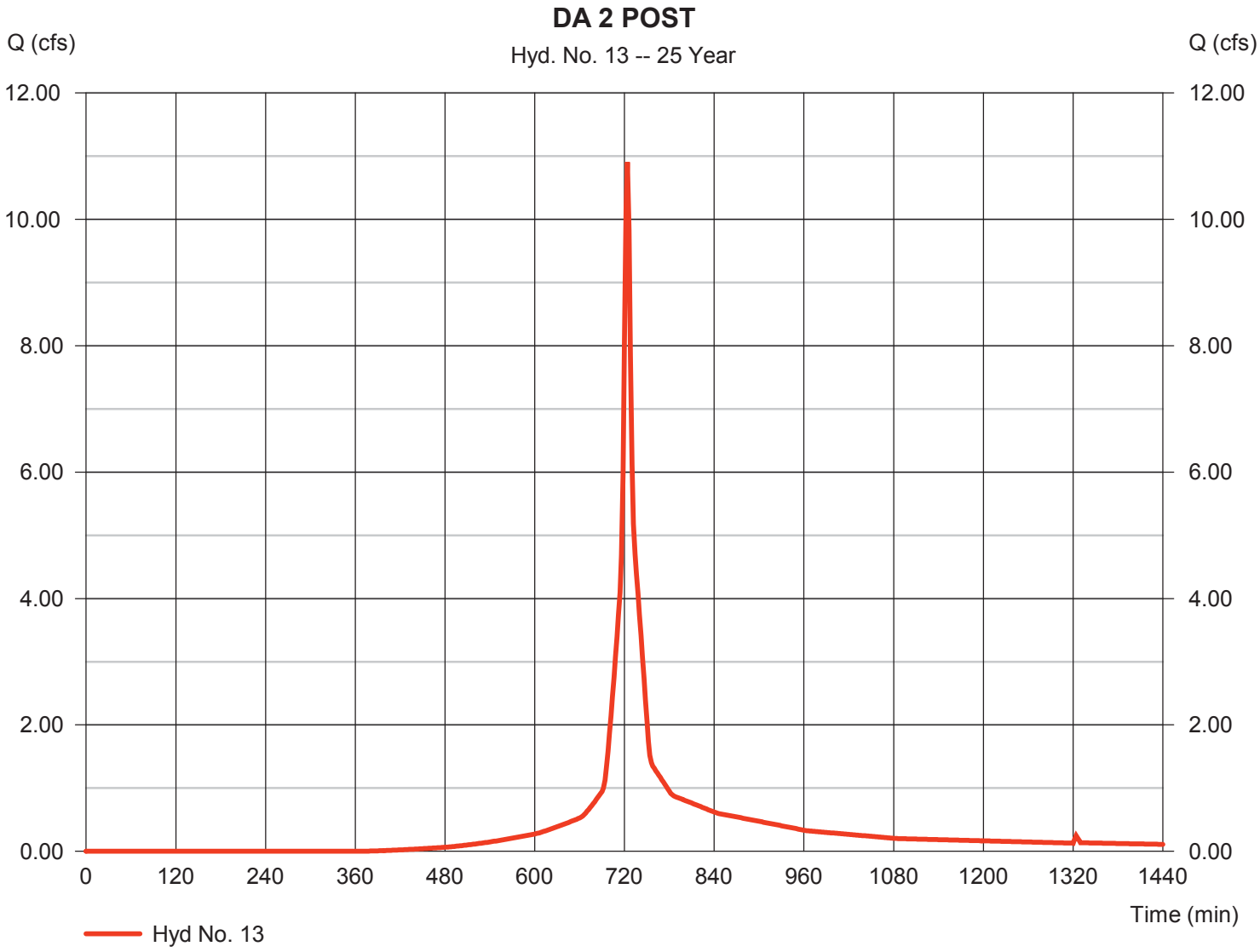


Hydrograph Report

Hyd. No. 13

DA 2 POST

Hydrograph type	=	SCS Runoff	Peak discharge	=	10.91 cfs
Storm frequency	=	25 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	32,952 cuft
Drainage area	=	1.820 ac	Curve number	=	77
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	8.05 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



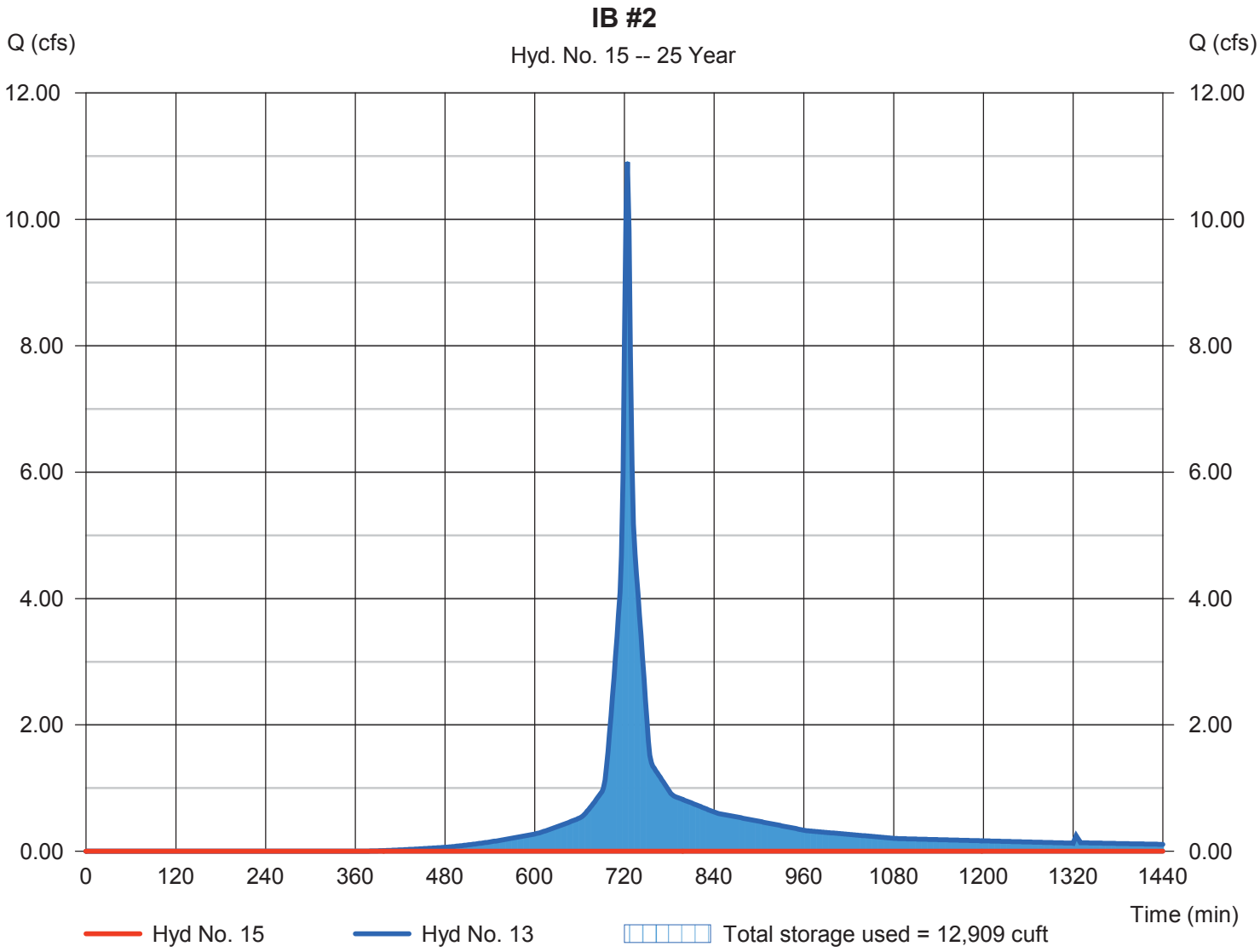
Hydrograph Report

Hyd. No. 15

IB #2

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 25 yrs	Time to peak	= 1010 min
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 13 - DA 2 POST	Max. Elevation	= 53.63 ft
Reservoir name	= IB #2	Max. Storage	= 12,909 cuft

Storage Indication method used. Exfiltration extracted from Outflow.

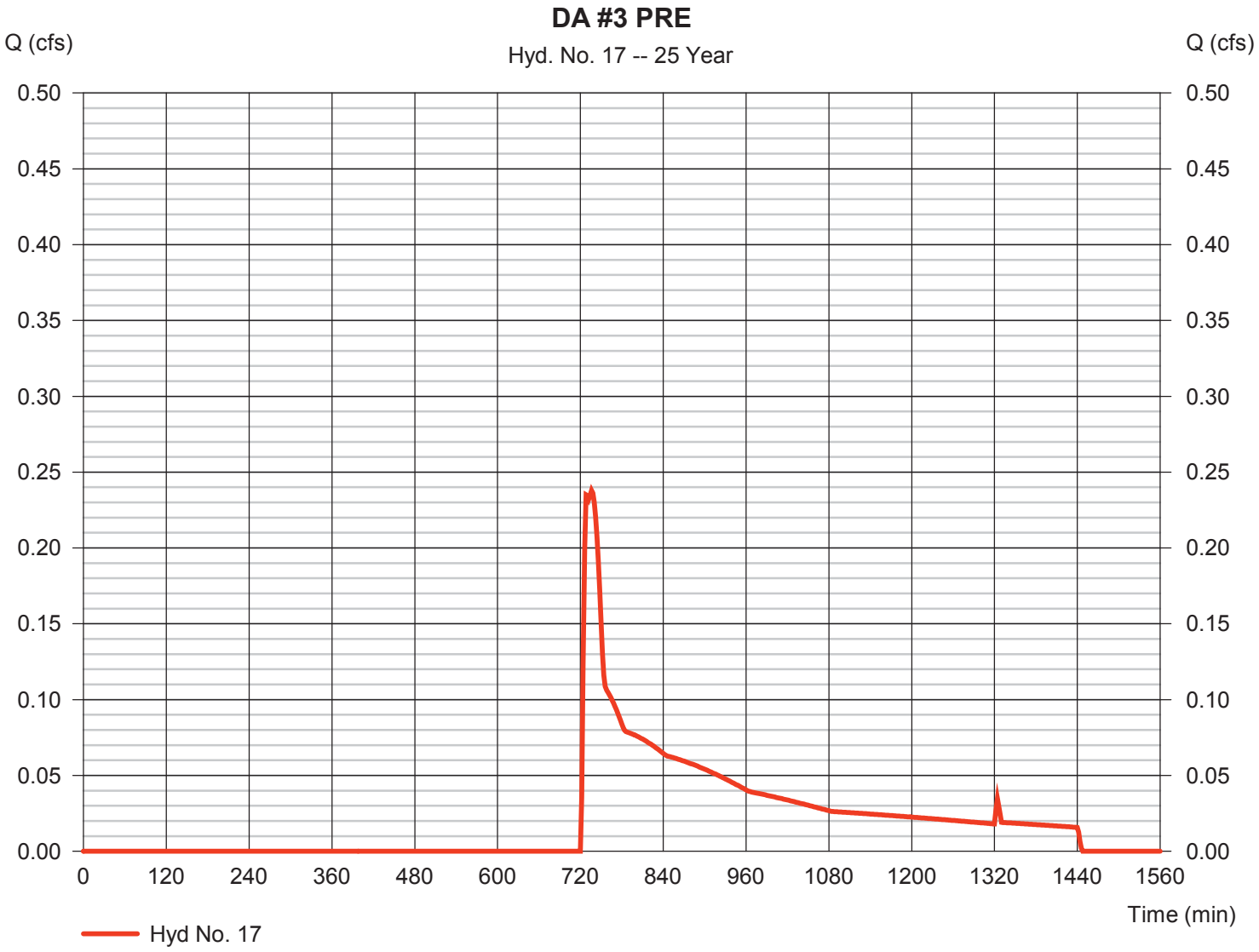


Hydrograph Report

Hyd. No. 17

DA #3 PRE

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.238 cfs
Storm frequency	=	25 yrs	Time to peak	=	736 min
Time interval	=	2 min	Hyd. volume	=	1,877 cuft
Drainage area	=	0.750 ac	Curve number	=	34
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	8.05 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

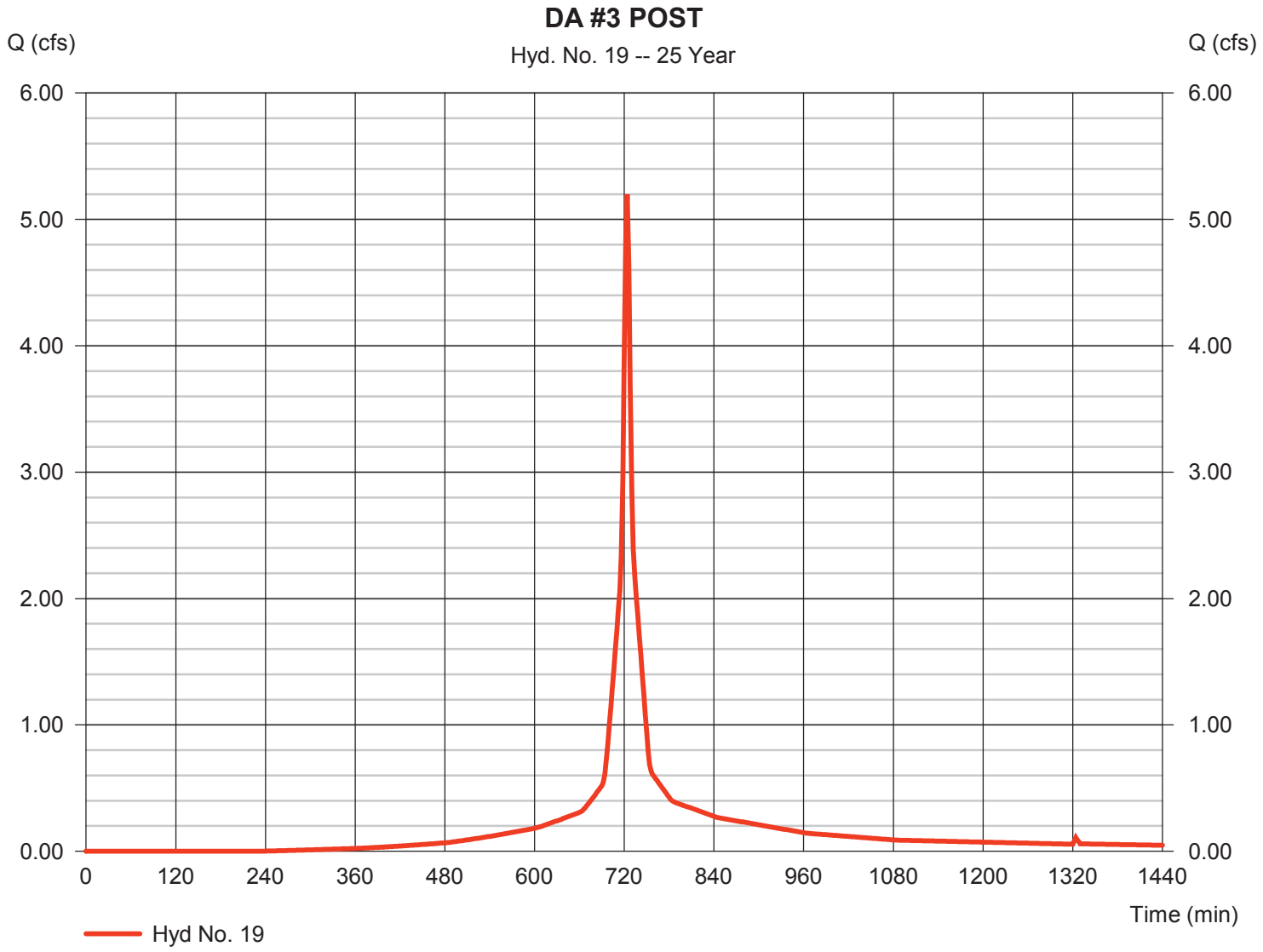


Hydrograph Report

Hyd. No. 19

DA #3 POST

Hydrograph type	= SCS Runoff	Peak discharge	= 5.196 cfs
Storm frequency	= 25 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 16,284 cuft
Drainage area	= 0.750 ac	Curve number	= 86
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 8.05 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



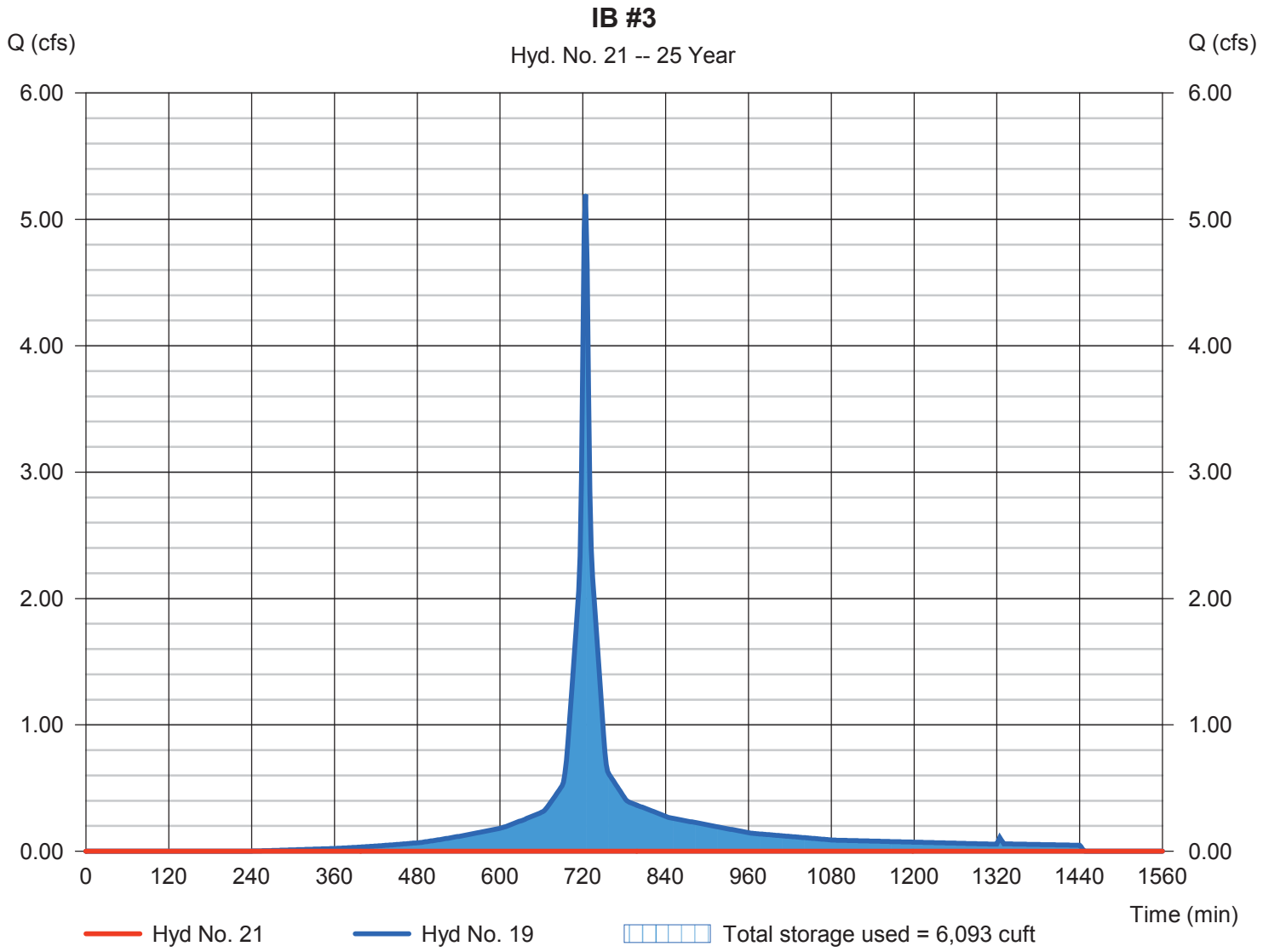
Hydrograph Report

Hyd. No. 21

IB #3

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	25 yrs	Time to peak	=	696 min
Time interval	=	2 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	19 - DA #3 POST	Max. Elevation	=	52.50 ft
Reservoir name	=	IB #3	Max. Storage	=	6,093 cuft

Storage Indication method used. Exfiltration extracted from Outflow.

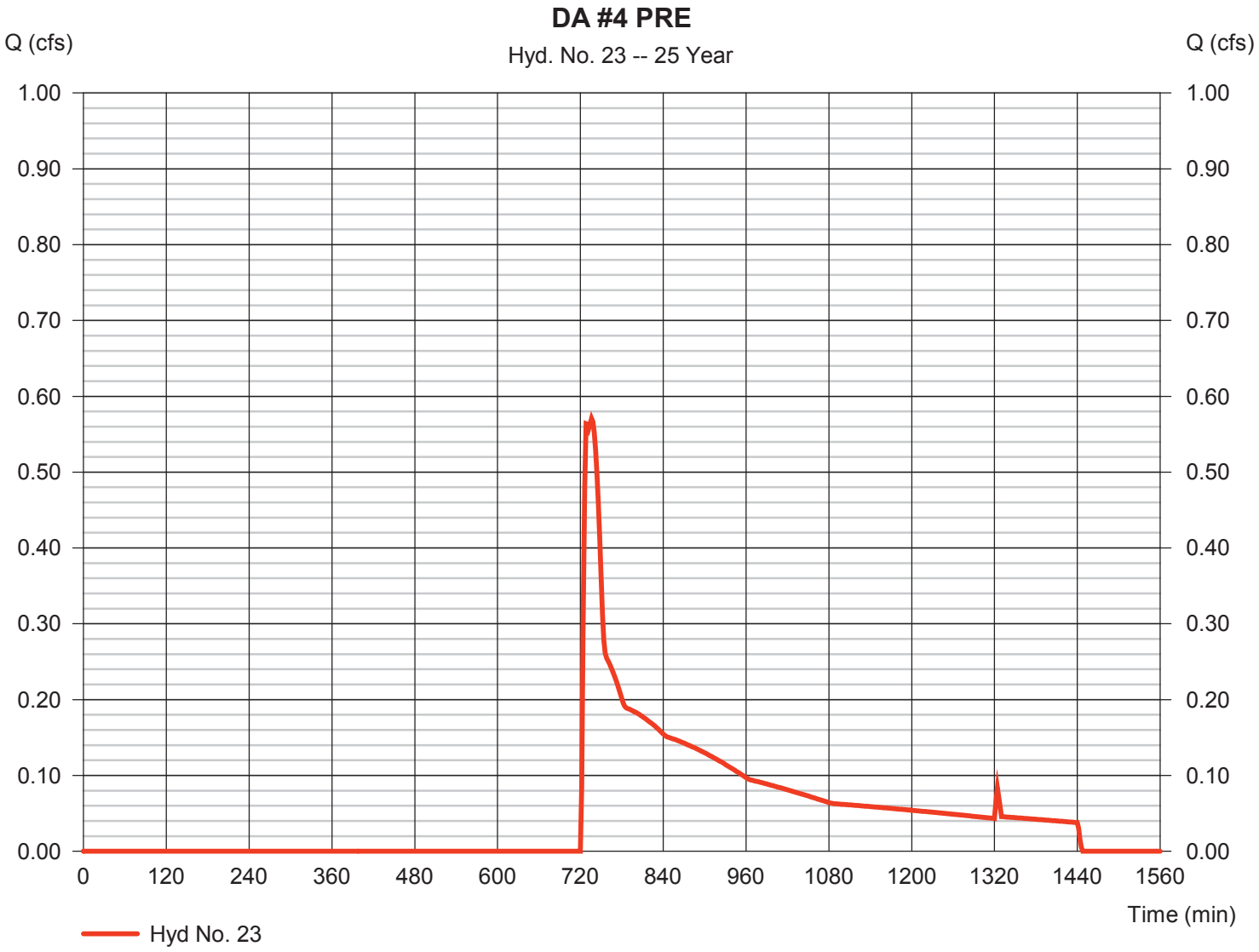


Hydrograph Report

Hyd. No. 23

DA #4 PRE

Hydrograph type	= SCS Runoff	Peak discharge	= 0.571 cfs
Storm frequency	= 25 yrs	Time to peak	= 736 min
Time interval	= 2 min	Hyd. volume	= 4,506 cuft
Drainage area	= 1.800 ac	Curve number	= 34
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 8.05 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

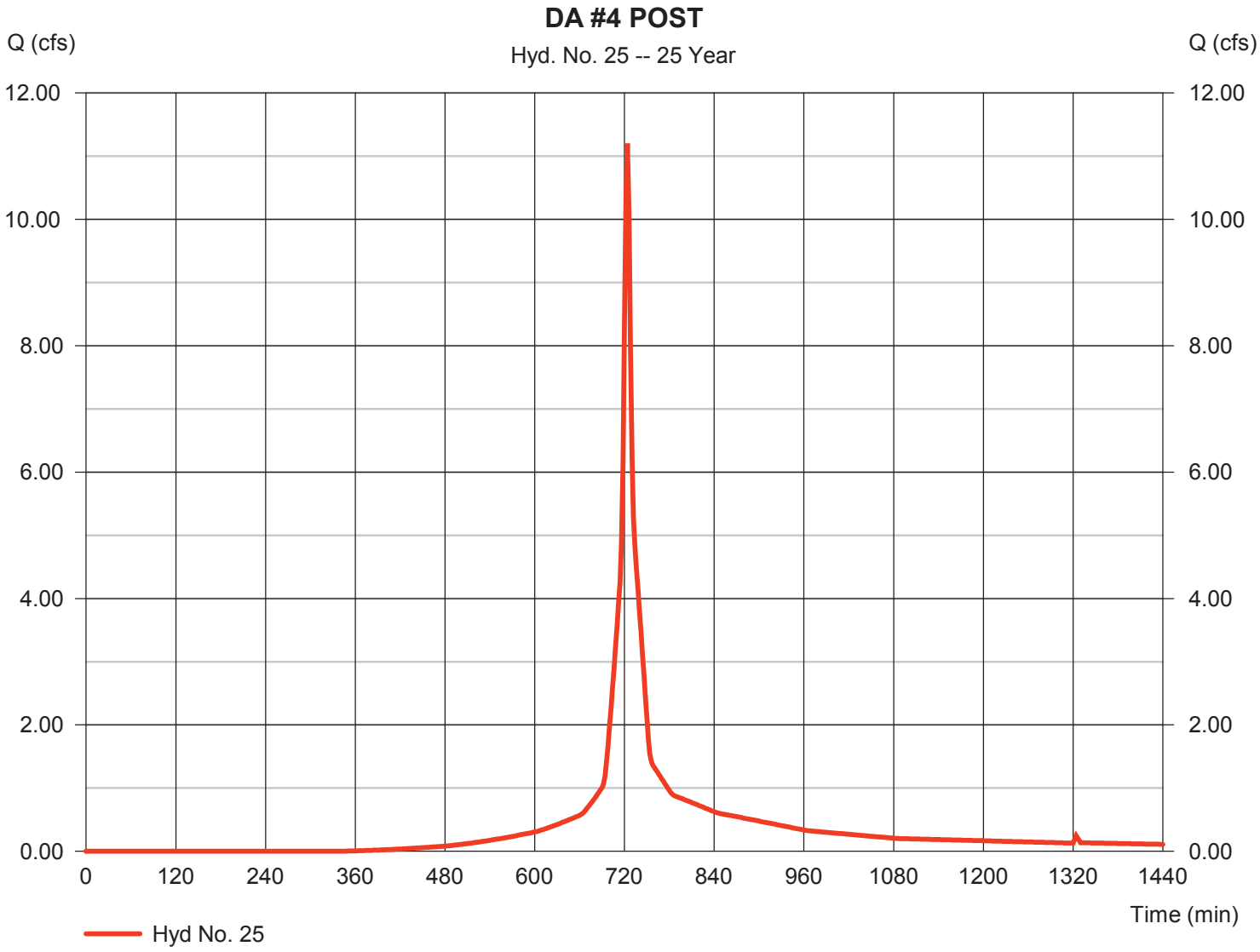


Hydrograph Report

Hyd. No. 25

DA #4 POST

Hydrograph type	=	SCS Runoff	Peak discharge	=	11.20 cfs
Storm frequency	=	25 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	34,025 cuft
Drainage area	=	1.800 ac	Curve number	=	79
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	8.05 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



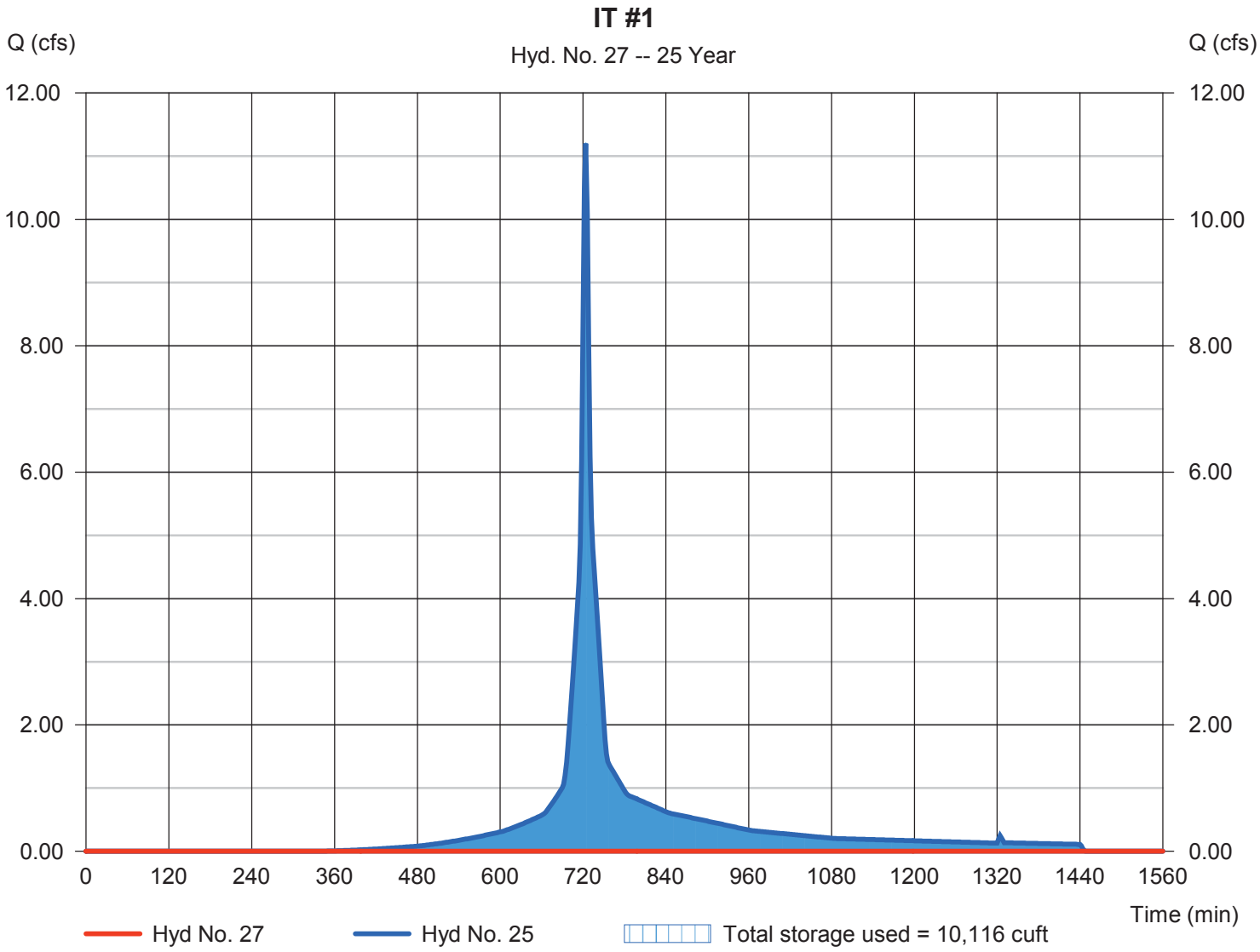
Hydrograph Report

Hyd. No. 27

IT #1

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 25 yrs	Time to peak	= 692 min
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 25 - DA #4 POST	Max. Elevation	= 53.05 ft
Reservoir name	= IT #1	Max. Storage	= 10,116 cuft

Storage Indication method used. Exfiltration extracted from Outflow.

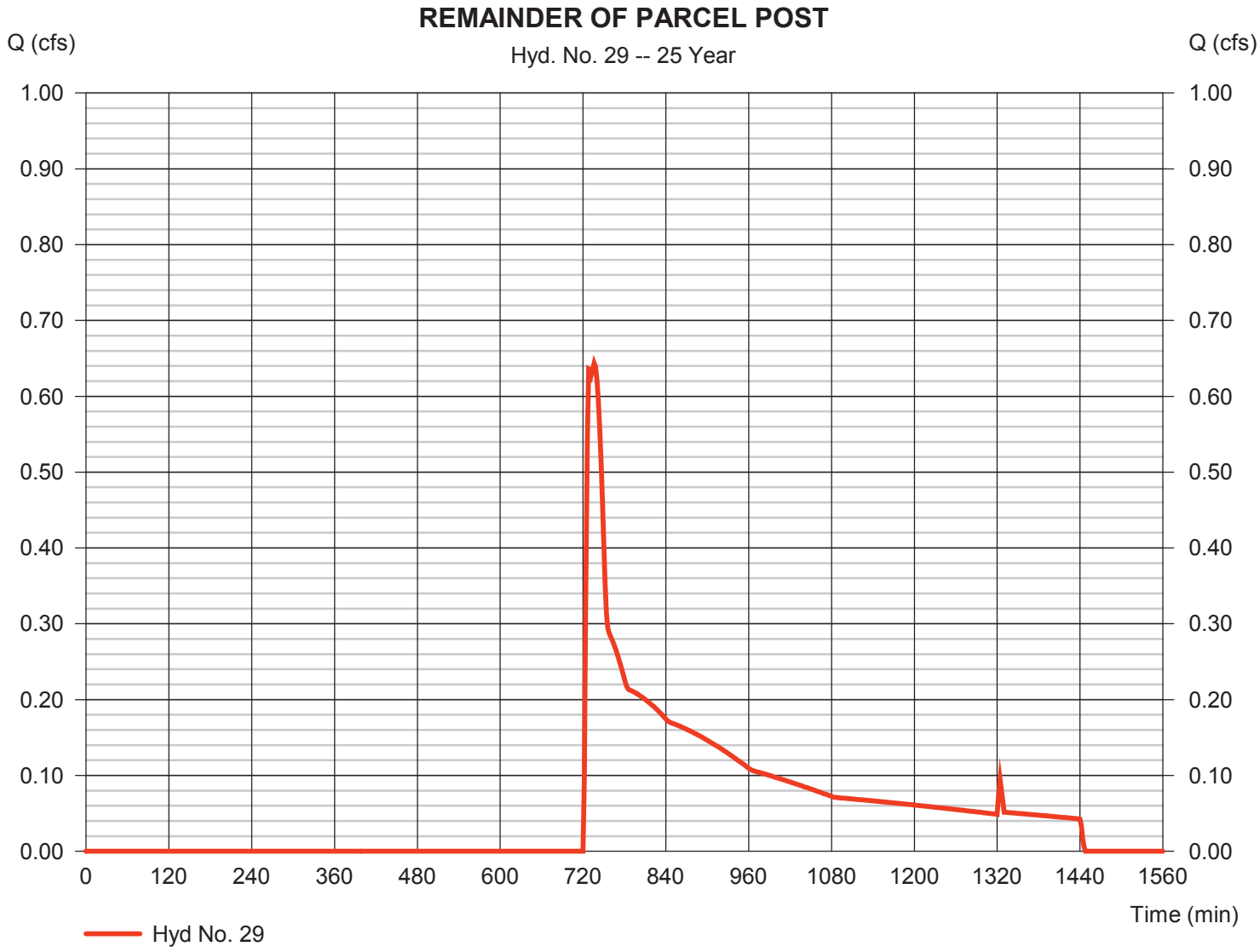


Hydrograph Report

Hyd. No. 29

REMAINDER OF PARCEL POST

Hydrograph type	= SCS Runoff	Peak discharge	= 0.644 cfs
Storm frequency	= 25 yrs	Time to peak	= 736 min
Time interval	= 2 min	Hyd. volume	= 5,082 cuft
Drainage area	= 2.030 ac	Curve number	= 34
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 8.05 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

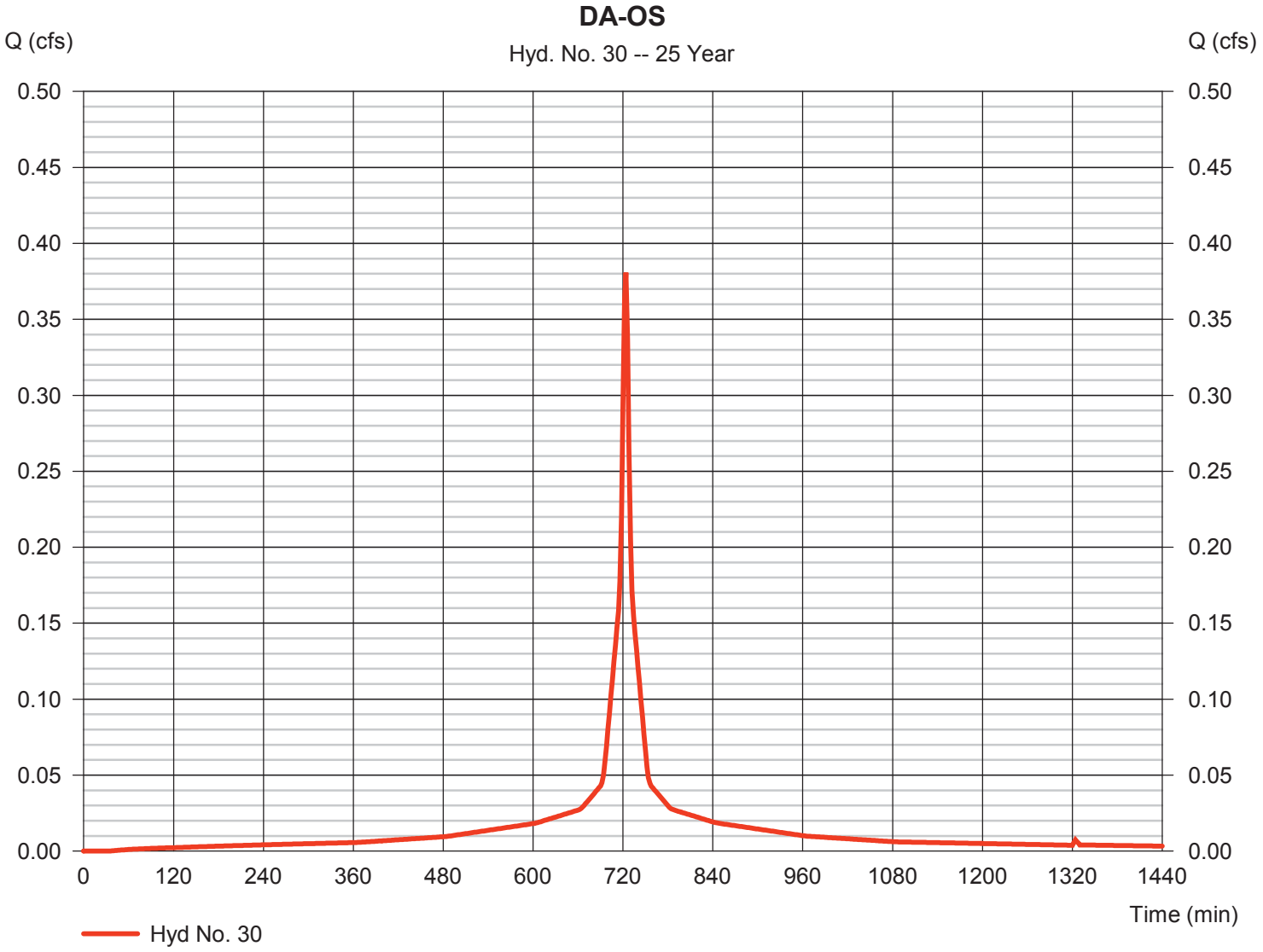


Hydrograph Report

Hyd. No. 30

DA-OS

Hydrograph type	= SCS Runoff	Peak discharge	= 0.381 cfs
Storm frequency	= 25 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 1,329 cuft
Drainage area	= 0.050 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 8.05 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

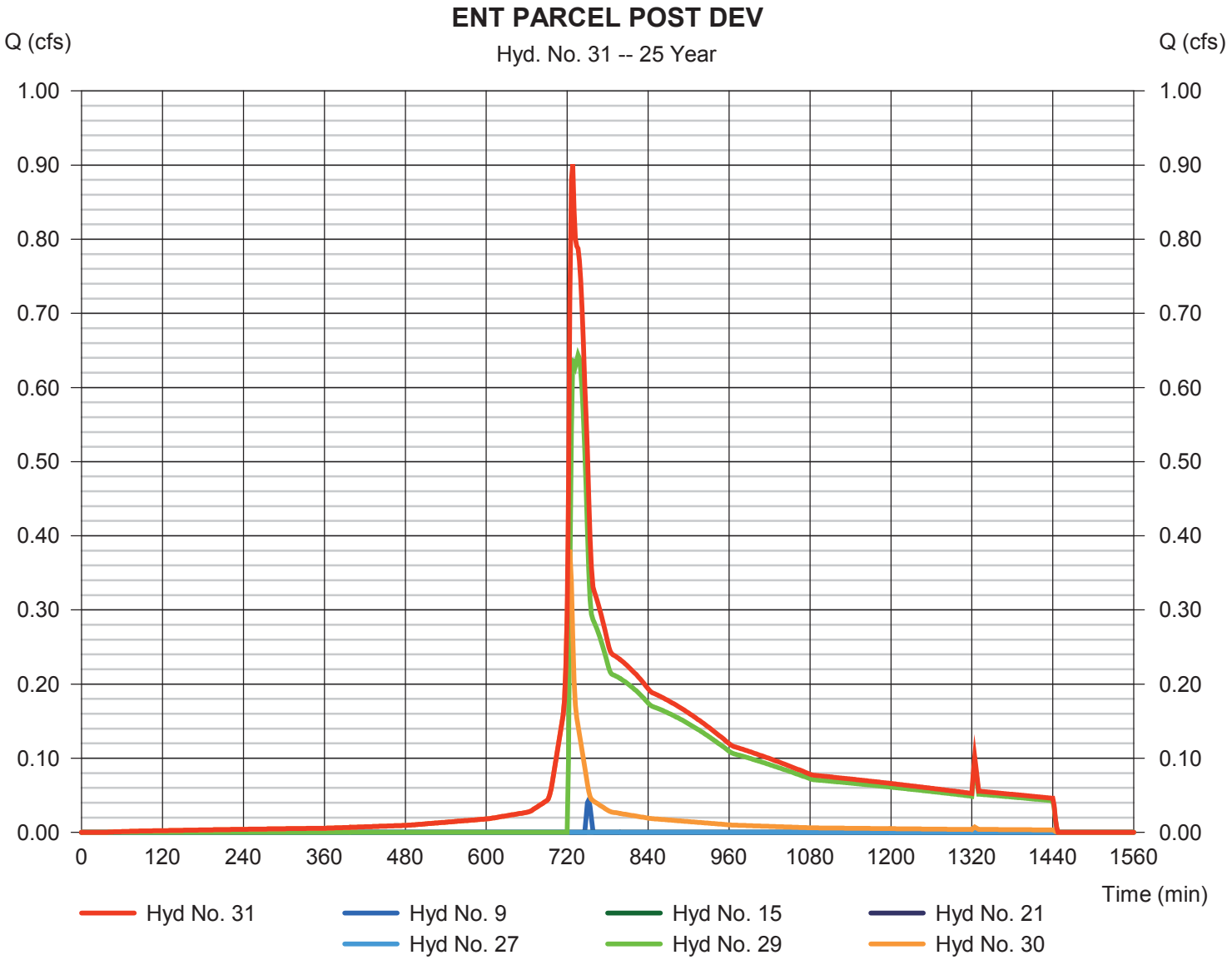


Hydrograph Report

Hyd. No. 31

ENT PARCEL POST DEV

Hydrograph type	= Combine	Peak discharge	= 0.901 cfs
Storm frequency	= 25 yrs	Time to peak	= 728 min
Time interval	= 2 min	Hyd. volume	= 6,430 cuft
Inflow hyds.	= 9, 15, 21, 27, 29, 30	Contrib. drain. area	= 2.080 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

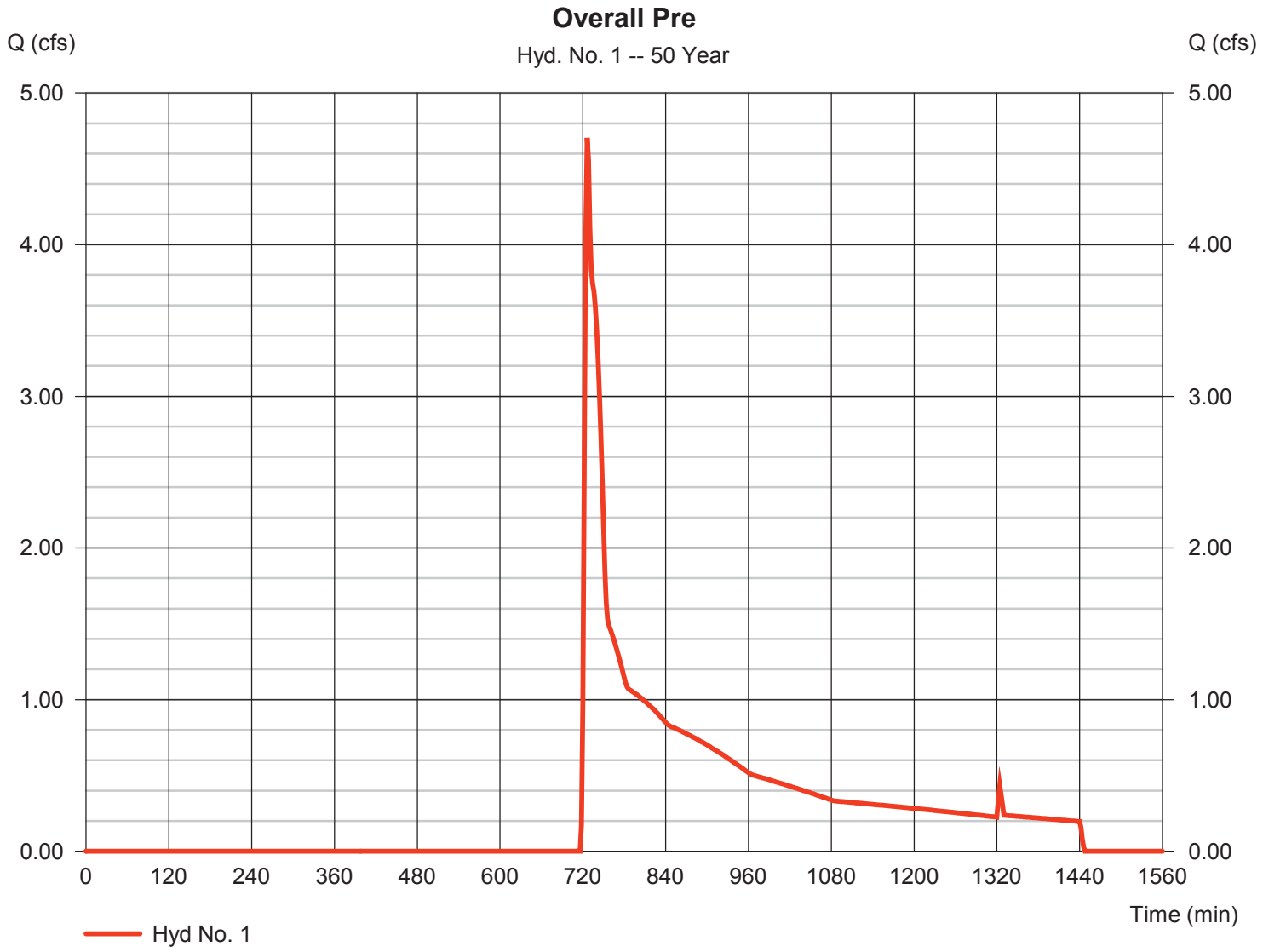
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	4.704	2	726	26,123	------	------	------	Overall Pre
3	SCS Runoff	41.64	2	724	124,491	------	------	------	Overall Post
5	SCS Runoff	0.484	2	726	2,689	------	------	------	DA 1 PRE
7	SCS Runoff	5.226	2	724	15,921	------	------	------	DA 1 POST
9	Reservoir	1.131	2	738	989	7	56.83	5,472	IB #1
11	SCS Runoff	1.191	2	726	6,613	------	------	------	DA 2 PRE
13	SCS Runoff	12.64	2	724	38,394	------	------	------	DA 2 POST
15	Reservoir	0.000	2	696	0	13	54.05	15,427	IB #2
17	SCS Runoff	0.491	2	726	2,725	------	------	------	DA #3 PRE
19	SCS Runoff	5.903	2	724	18,642	------	------	------	DA #3 POST
21	Reservoir	0.000	2	682	0	19	52.86	7,204	IB #3
23	SCS Runoff	1.178	2	726	6,540	------	------	------	DA #4 PRE
25	SCS Runoff	12.91	2	724	39,481	------	------	------	DA #4 POST
27	Reservoir	0.000	2	684	0	25	53.54	12,300	IT #1
29	SCS Runoff	1.328	2	726	7,376	------	------	------	REMAINDER OF PARCEL POST
30	SCS Runoff	0.426	2	724	1,491	------	------	------	DA-OS
31	Combine	2.292	2	738	9,855	9, 15, 21, 27, 29, 30	------	------	ENT PARCEL POST DEV

Hydrograph Report

Hyd. No. 1

Overall Pre

Hydrograph type	= SCS Runoff	Peak discharge	= 4.704 cfs
Storm frequency	= 50 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 26,123 cuft
Drainage area	= 7.190 ac	Curve number	= 34
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 9.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



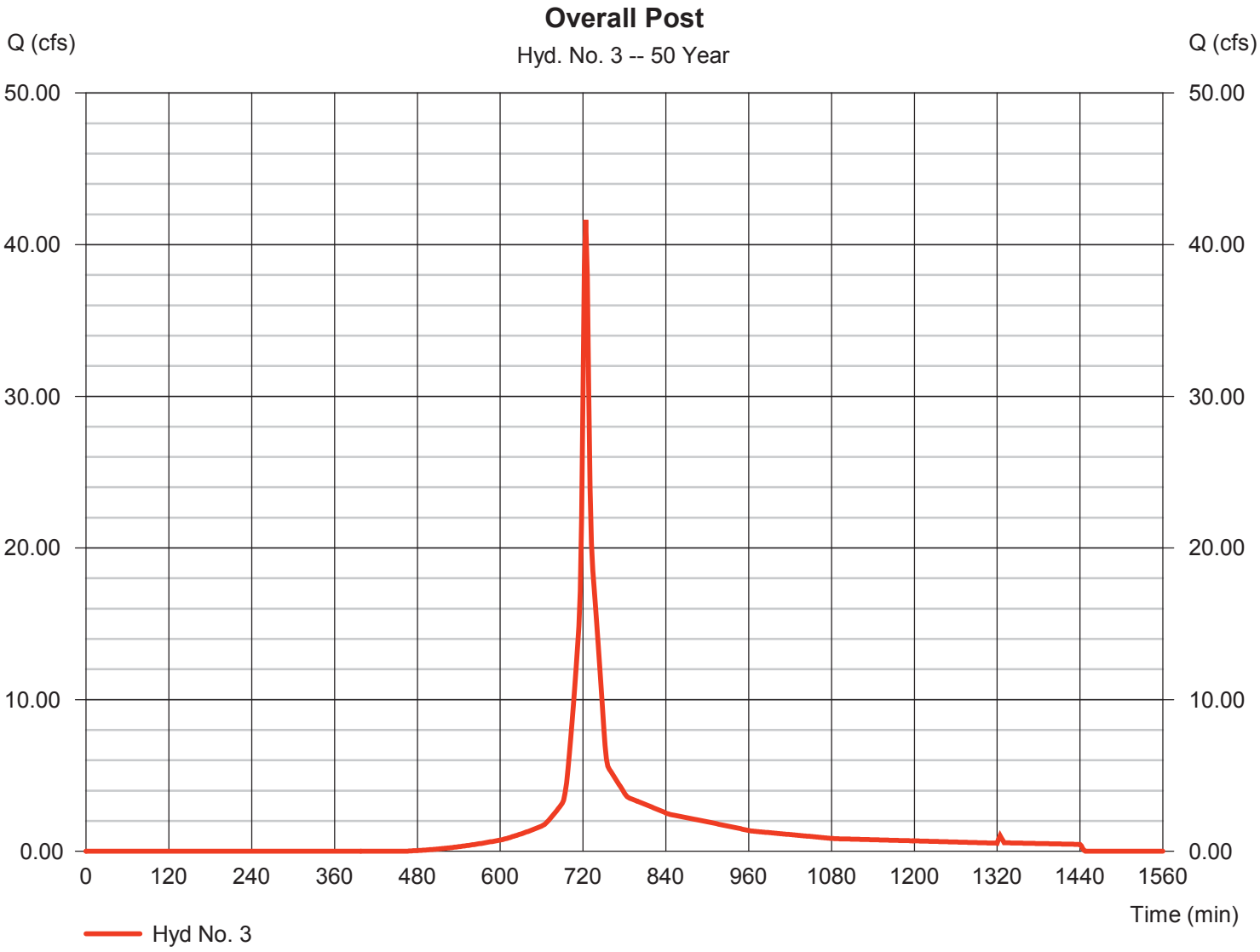
Hydrograph Report

Hyd. No. 3

Overall Post

Hydrograph type	= SCS Runoff	Peak discharge	= 41.64 cfs
Storm frequency	= 50 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 124,491 cuft
Drainage area	= 7.190 ac	Curve number	= 68*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 9.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.740 x 78) + (1.820 x 77) + (0.750 x 86) + (1.800 x 79) + (2.030 x 39) + (0.050 x 98)] / 7.190

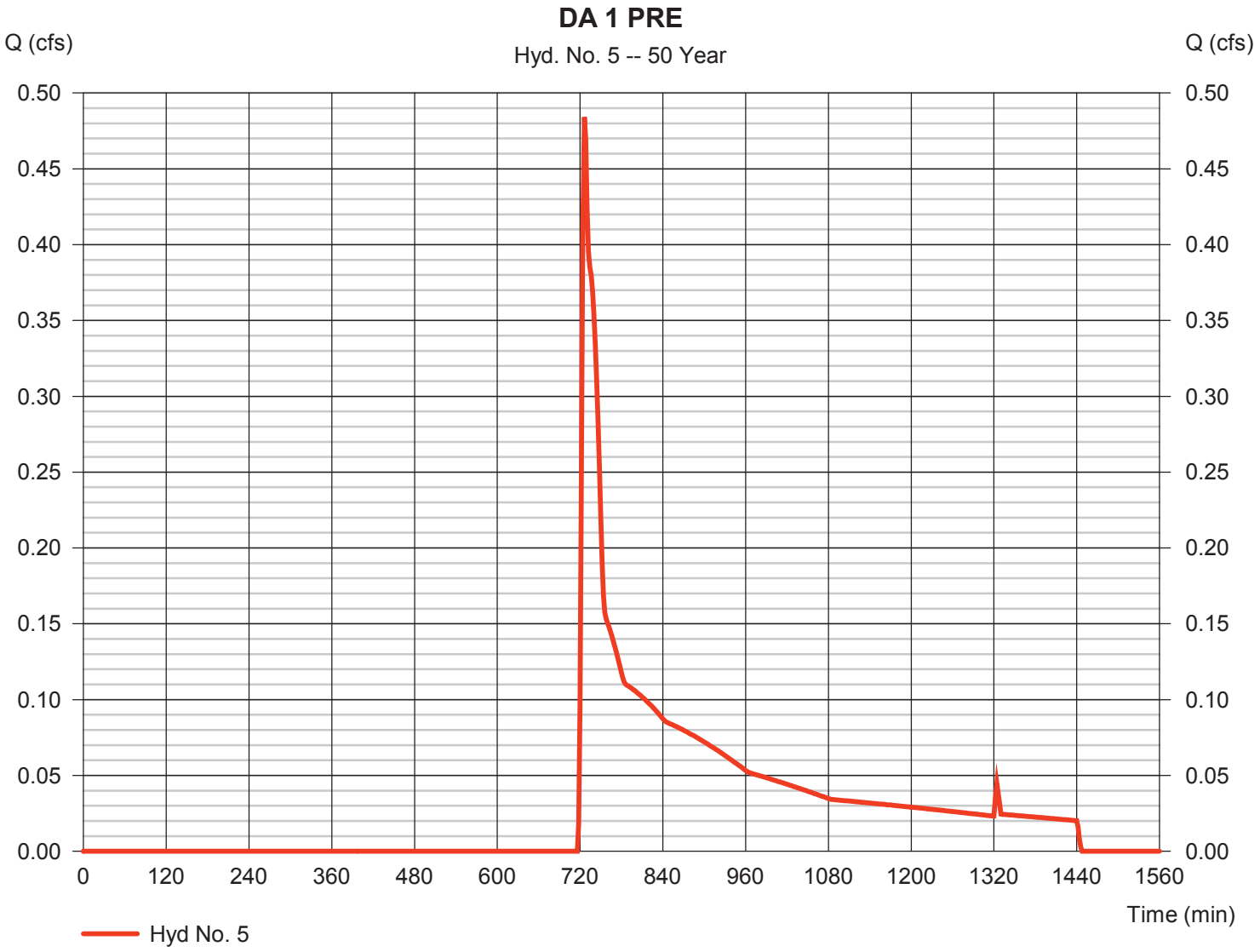


Hydrograph Report

Hyd. No. 5

DA 1 PRE

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.484 cfs
Storm frequency	=	50 yrs	Time to peak	=	726 min
Time interval	=	2 min	Hyd. volume	=	2,689 cuft
Drainage area	=	0.740 ac	Curve number	=	34
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	9.00 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

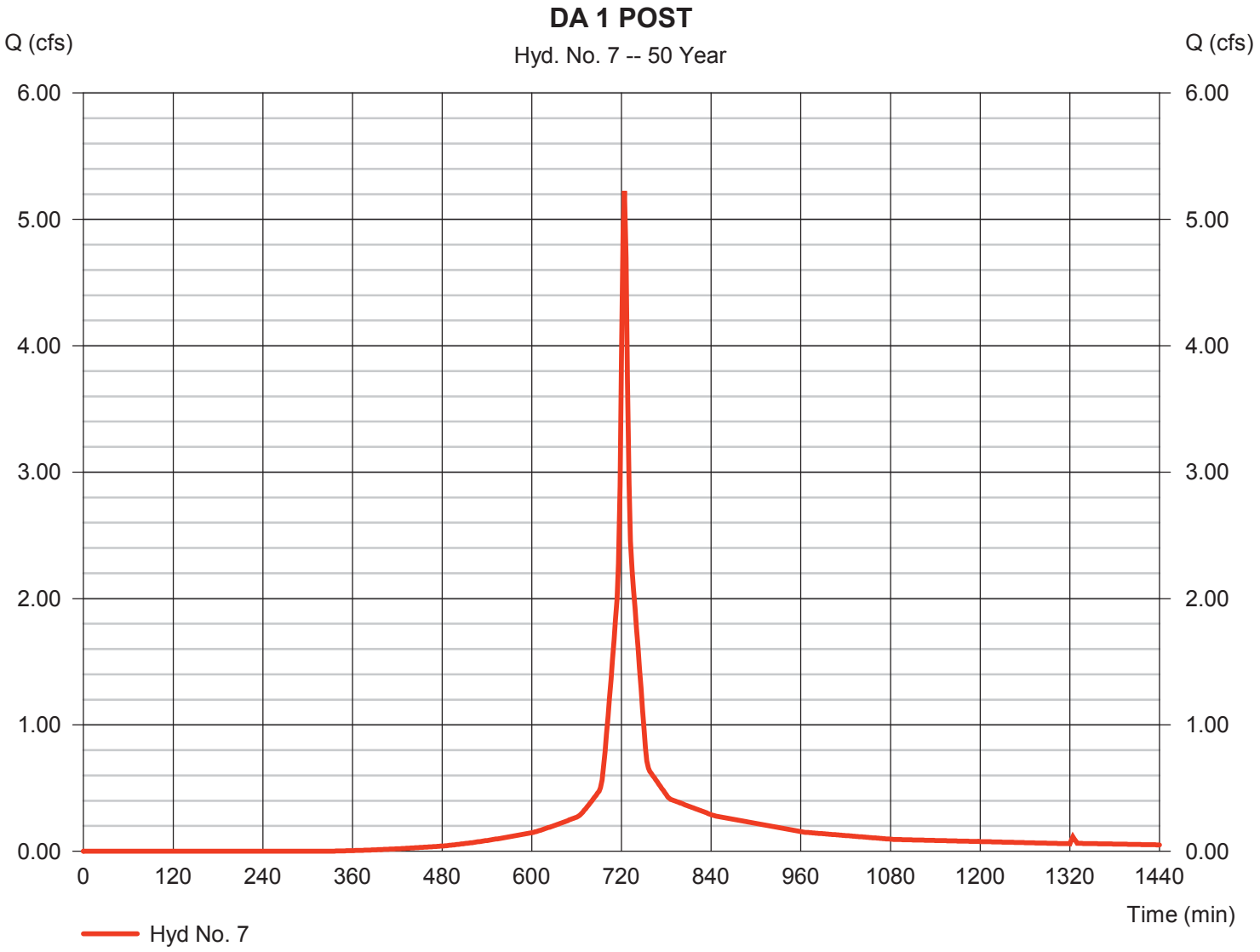


Hydrograph Report

Hyd. No. 7

DA 1 POST

Hydrograph type	=	SCS Runoff	Peak discharge	=	5.226 cfs
Storm frequency	=	50 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	15,921 cuft
Drainage area	=	0.740 ac	Curve number	=	78
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	9.00 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



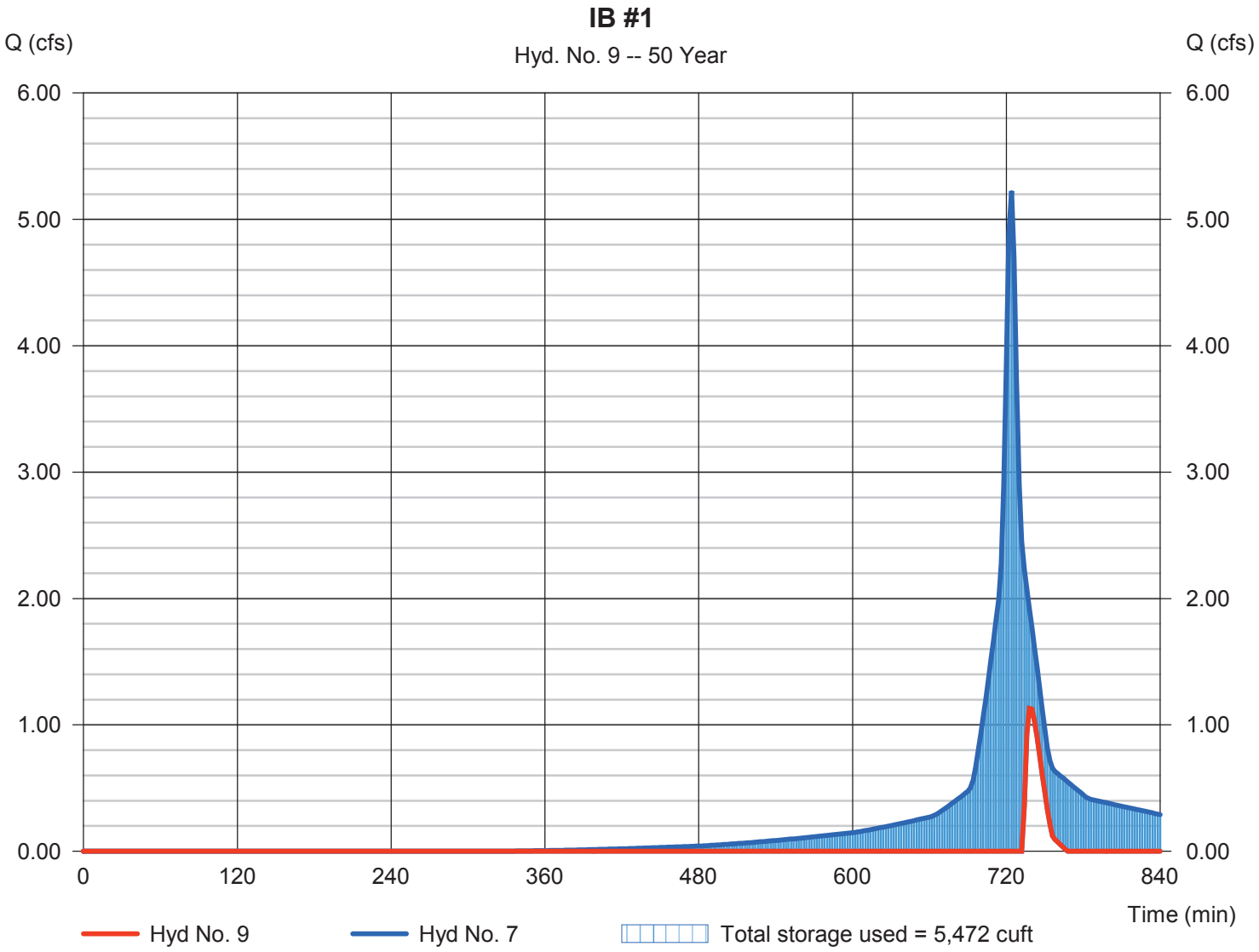
Hydrograph Report

Hyd. No. 9

IB #1

Hydrograph type	=	Reservoir	Peak discharge	=	1.131 cfs
Storm frequency	=	50 yrs	Time to peak	=	738 min
Time interval	=	2 min	Hyd. volume	=	989 cuft
Inflow hyd. No.	=	7 - DA 1 POST	Max. Elevation	=	56.83 ft
Reservoir name	=	IB #1	Max. Storage	=	5,472 cuft

Storage Indication method used. Exfiltration extracted from Outflow.

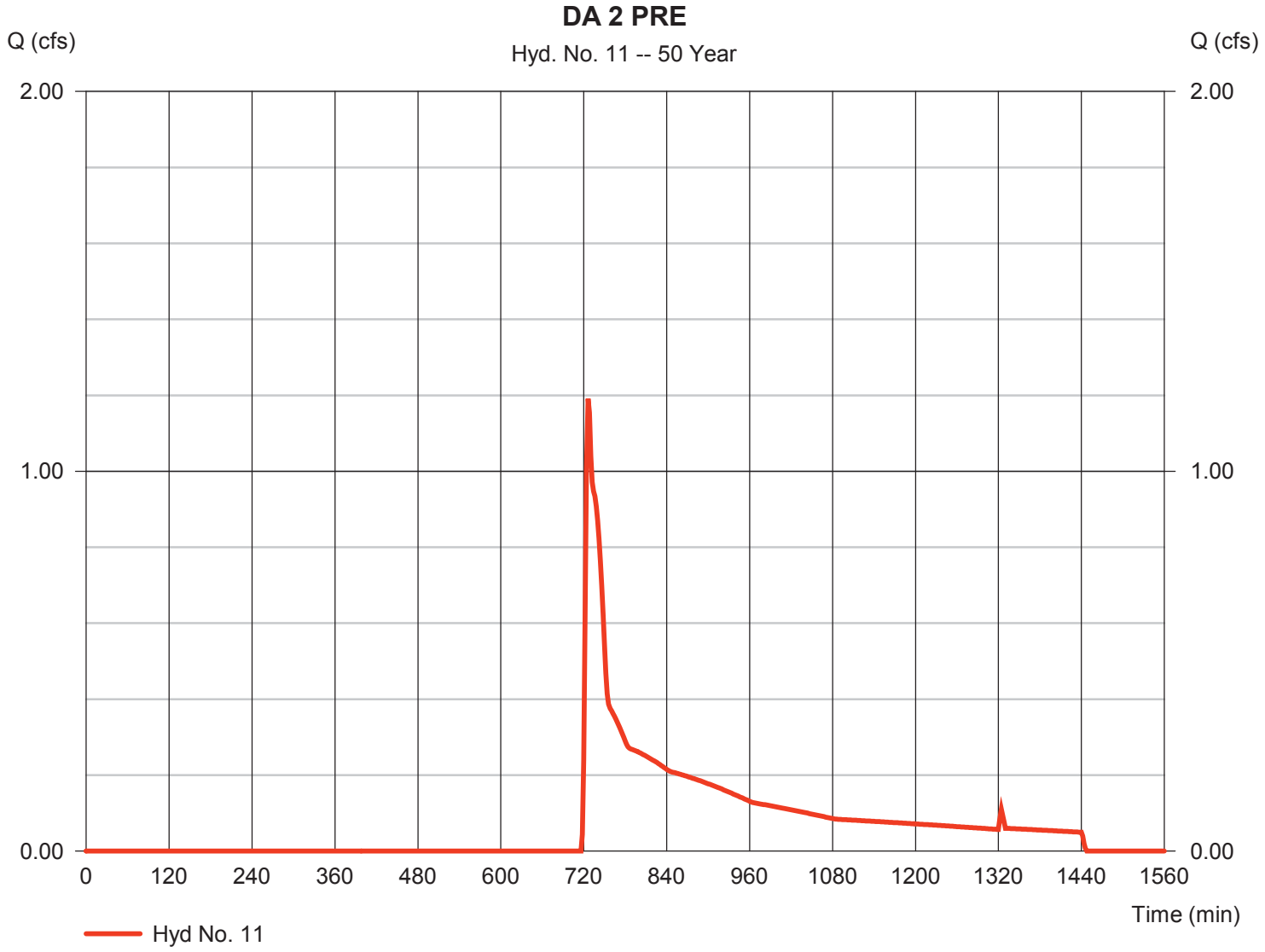


Hydrograph Report

Hyd. No. 11

DA 2 PRE

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.191 cfs
Storm frequency	=	50 yrs	Time to peak	=	726 min
Time interval	=	2 min	Hyd. volume	=	6,613 cuft
Drainage area	=	1.820 ac	Curve number	=	34
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	9.00 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

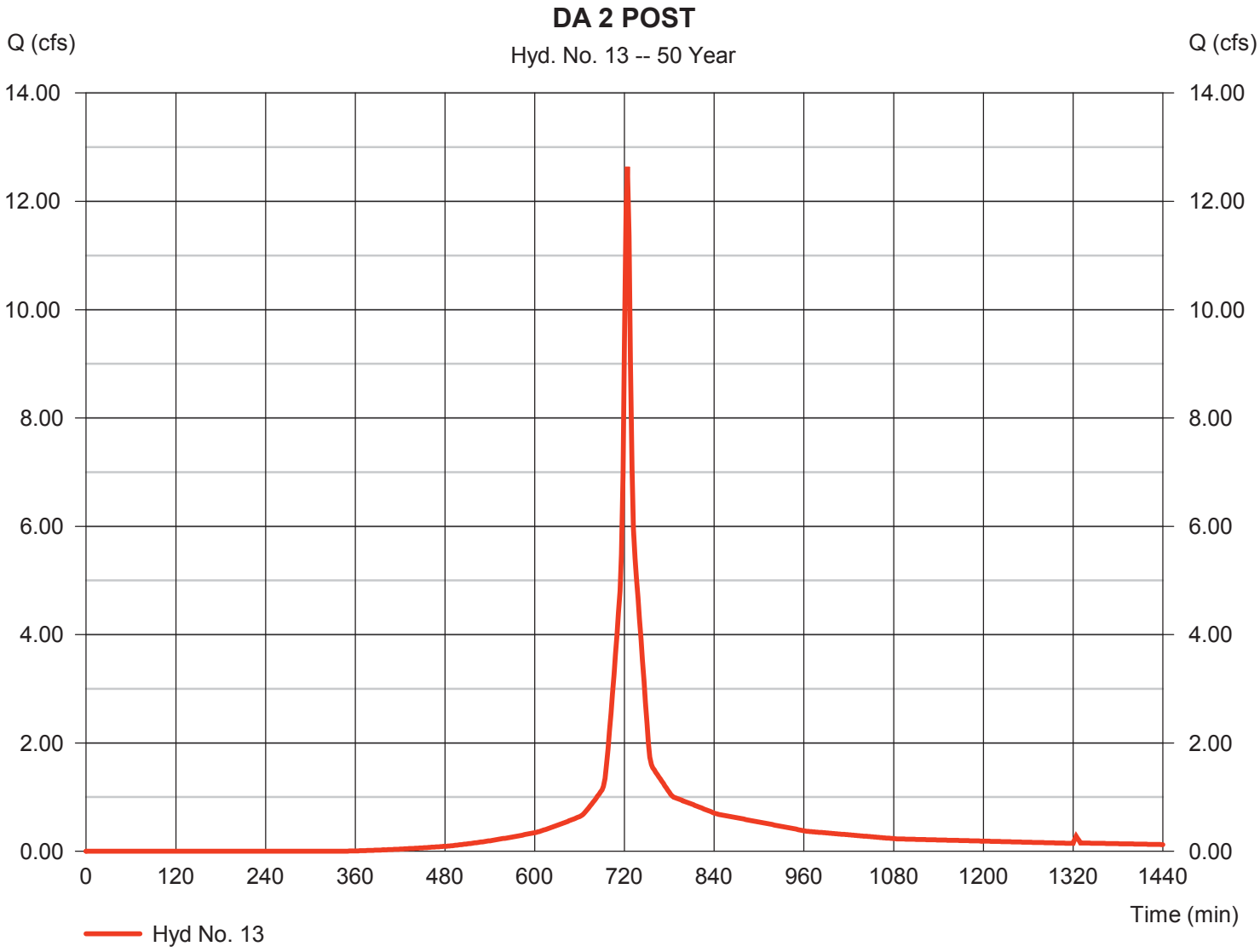


Hydrograph Report

Hyd. No. 13

DA 2 POST

Hydrograph type	=	SCS Runoff	Peak discharge	=	12.64 cfs
Storm frequency	=	50 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	38,394 cuft
Drainage area	=	1.820 ac	Curve number	=	77
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	9.00 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



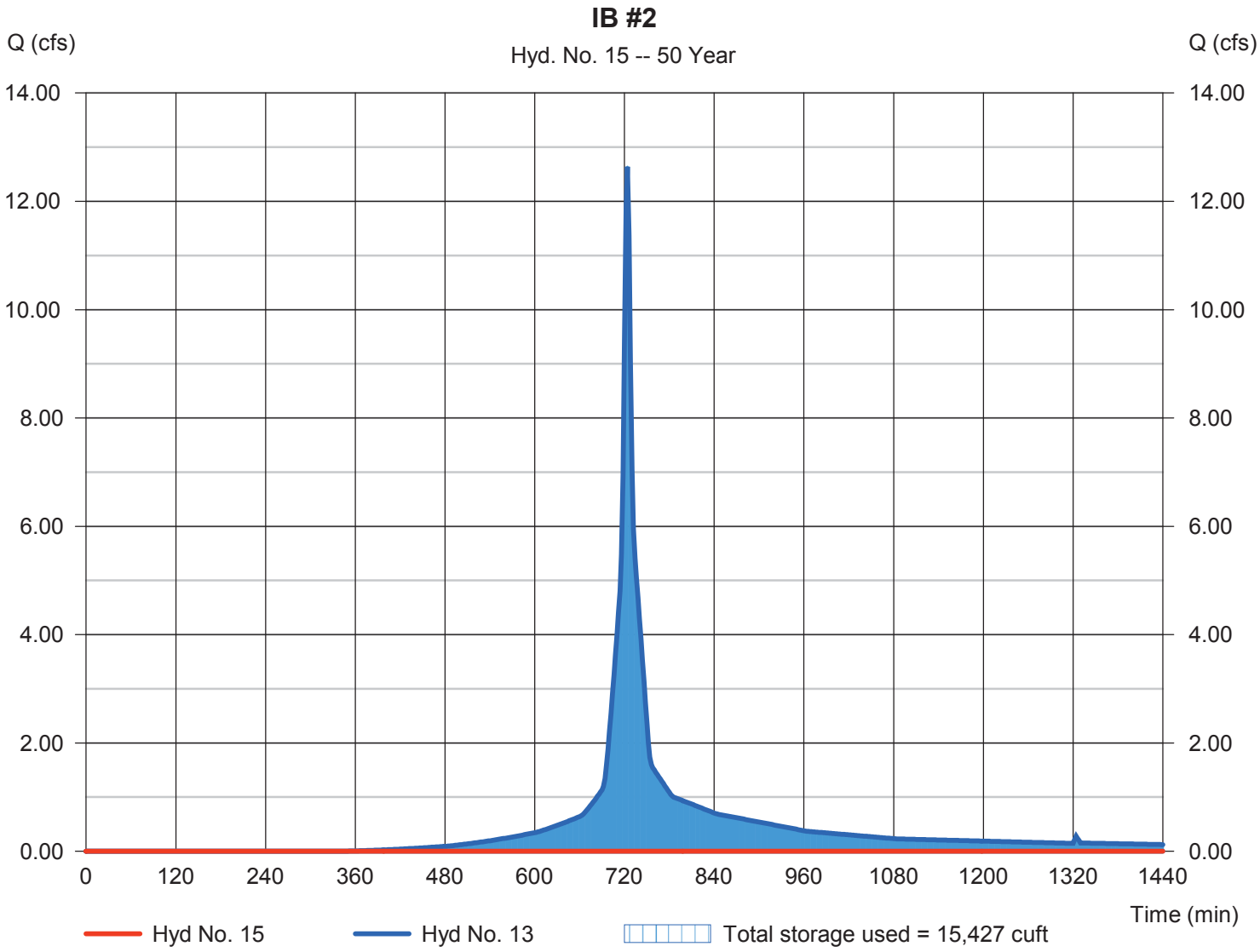
Hydrograph Report

Hyd. No. 15

IB #2

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	50 yrs	Time to peak	=	696 min
Time interval	=	2 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	13 - DA 2 POST	Max. Elevation	=	54.05 ft
Reservoir name	=	IB #2	Max. Storage	=	15,427 cuft

Storage Indication method used. Exfiltration extracted from Outflow.

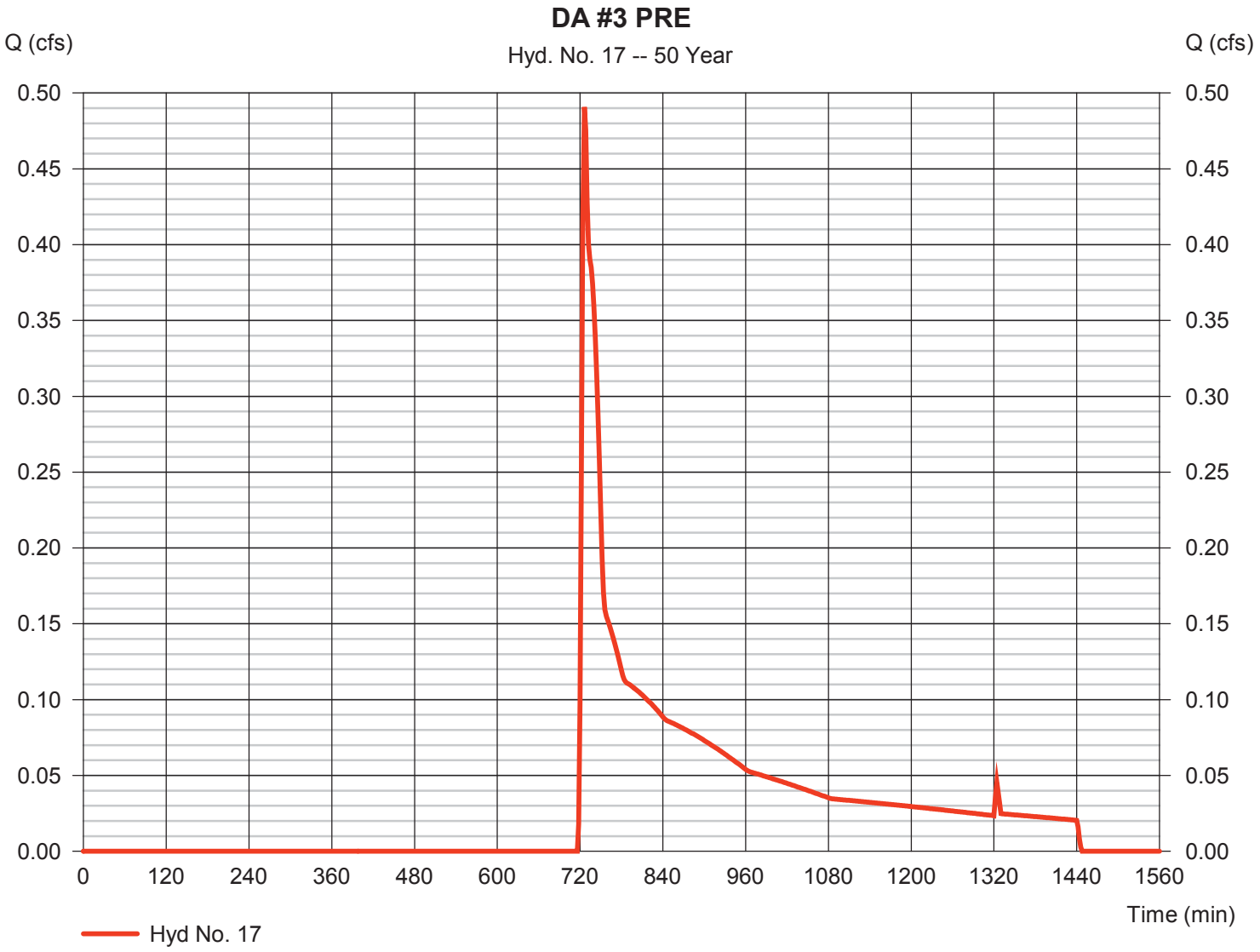


Hydrograph Report

Hyd. No. 17

DA #3 PRE

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.491 cfs
Storm frequency	=	50 yrs	Time to peak	=	726 min
Time interval	=	2 min	Hyd. volume	=	2,725 cuft
Drainage area	=	0.750 ac	Curve number	=	34
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	9.00 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

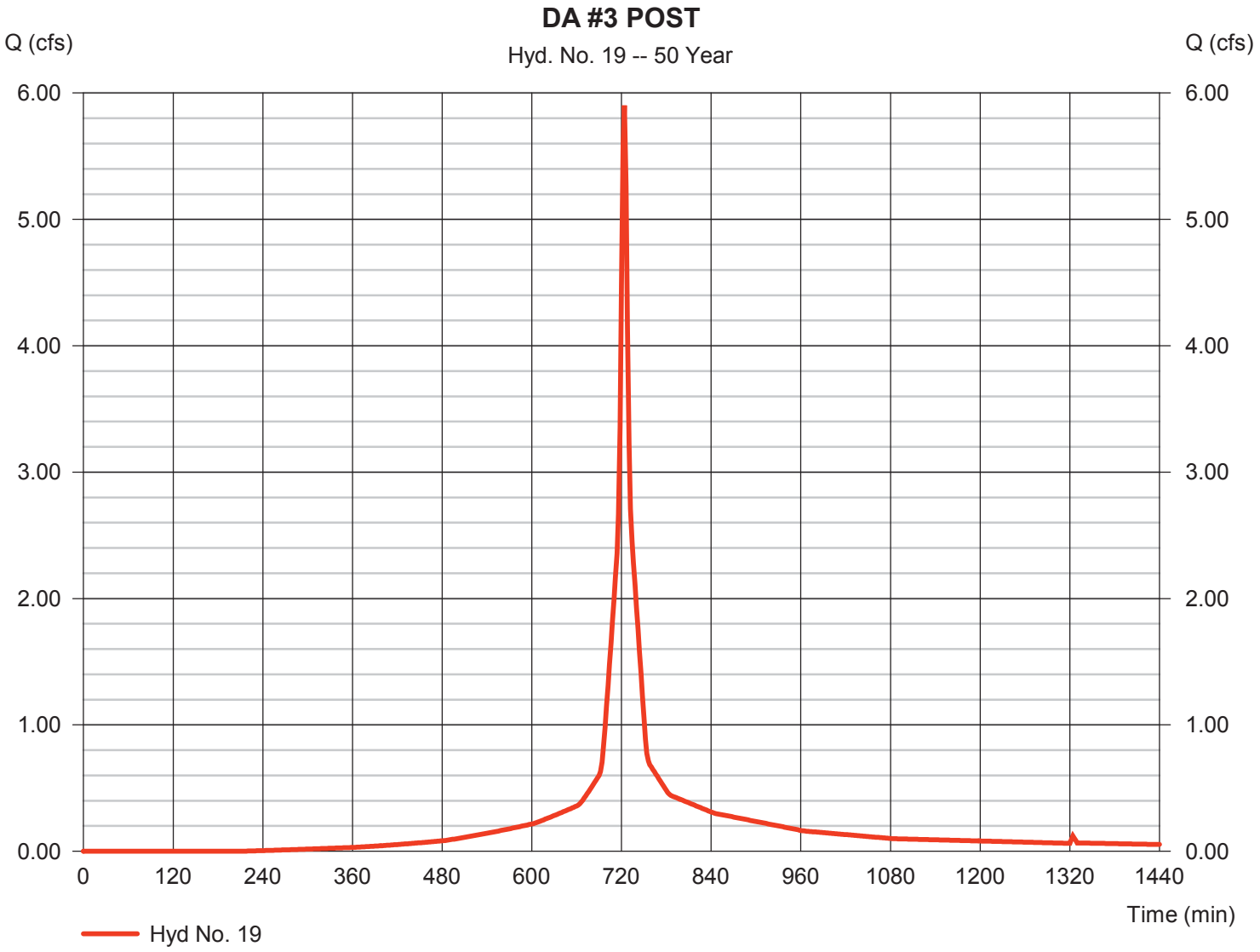


Hydrograph Report

Hyd. No. 19

DA #3 POST

Hydrograph type	= SCS Runoff	Peak discharge	= 5.903 cfs
Storm frequency	= 50 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 18,642 cuft
Drainage area	= 0.750 ac	Curve number	= 86
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 9.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



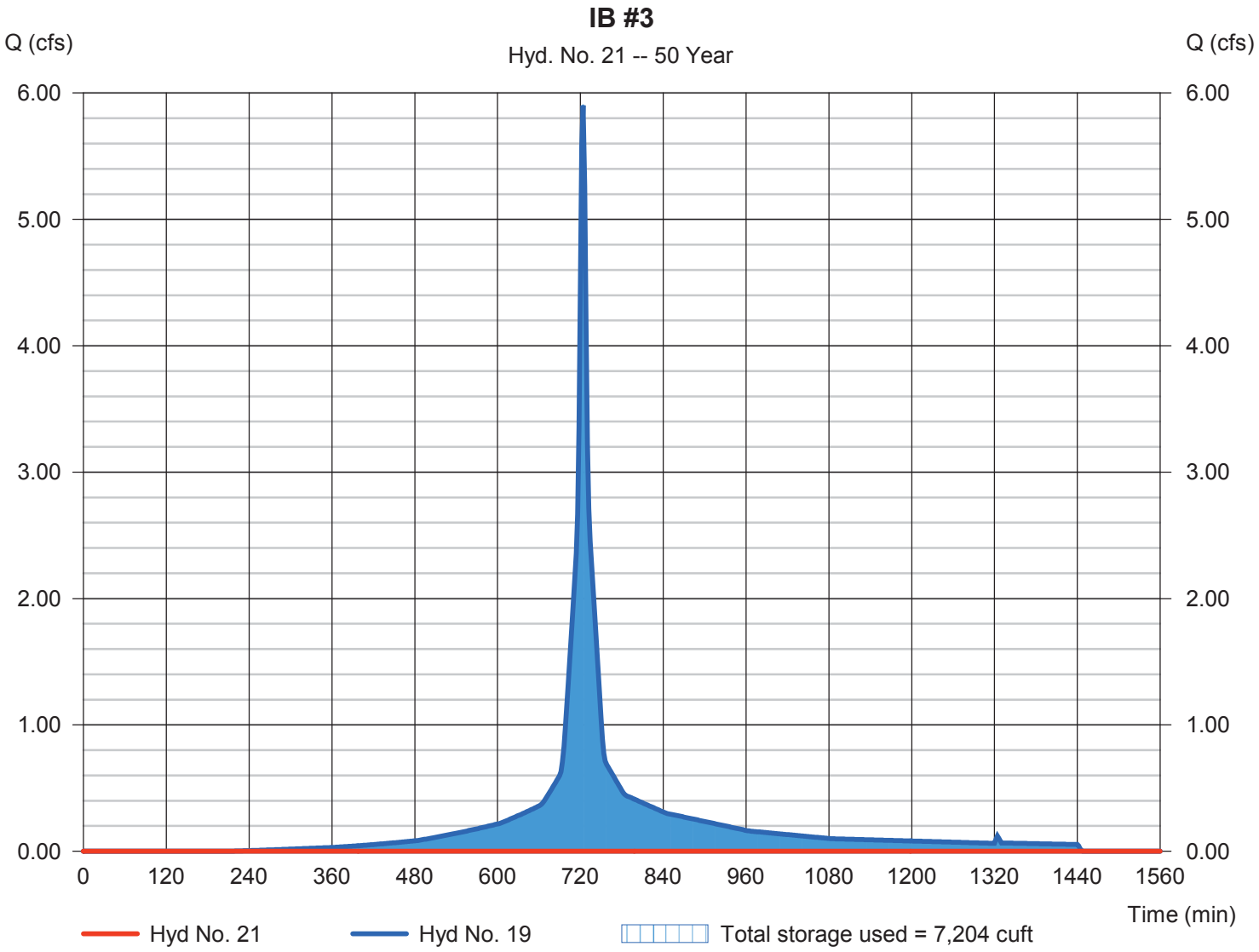
Hydrograph Report

Hyd. No. 21

IB #3

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	50 yrs	Time to peak	=	682 min
Time interval	=	2 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	19 - DA #3 POST	Max. Elevation	=	52.86 ft
Reservoir name	=	IB #3	Max. Storage	=	7,204 cuft

Storage Indication method used. Exfiltration extracted from Outflow.

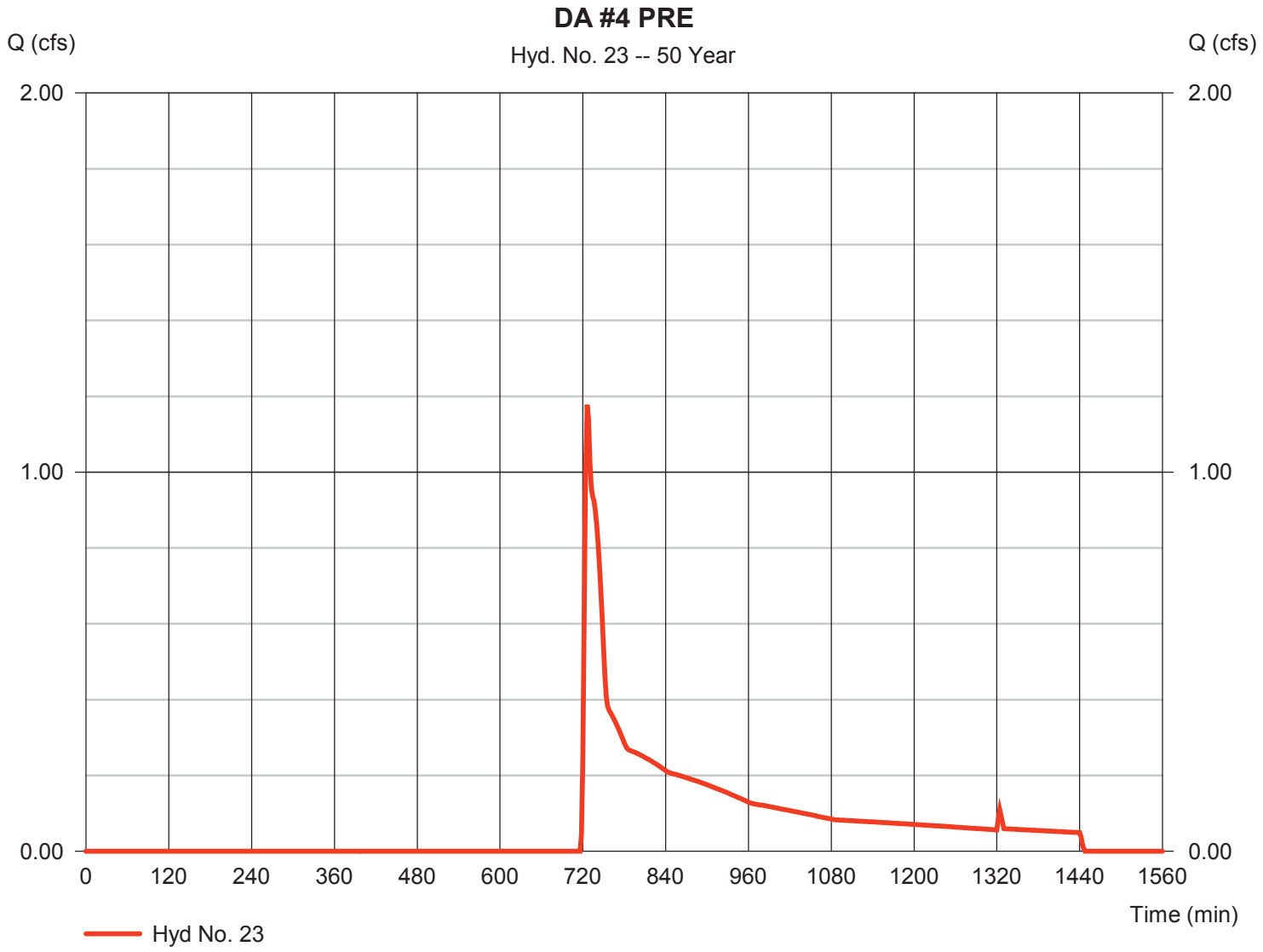


Hydrograph Report

Hyd. No. 23

DA #4 PRE

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.178 cfs
Storm frequency	=	50 yrs	Time to peak	=	726 min
Time interval	=	2 min	Hyd. volume	=	6,540 cuft
Drainage area	=	1.800 ac	Curve number	=	34
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	9.00 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

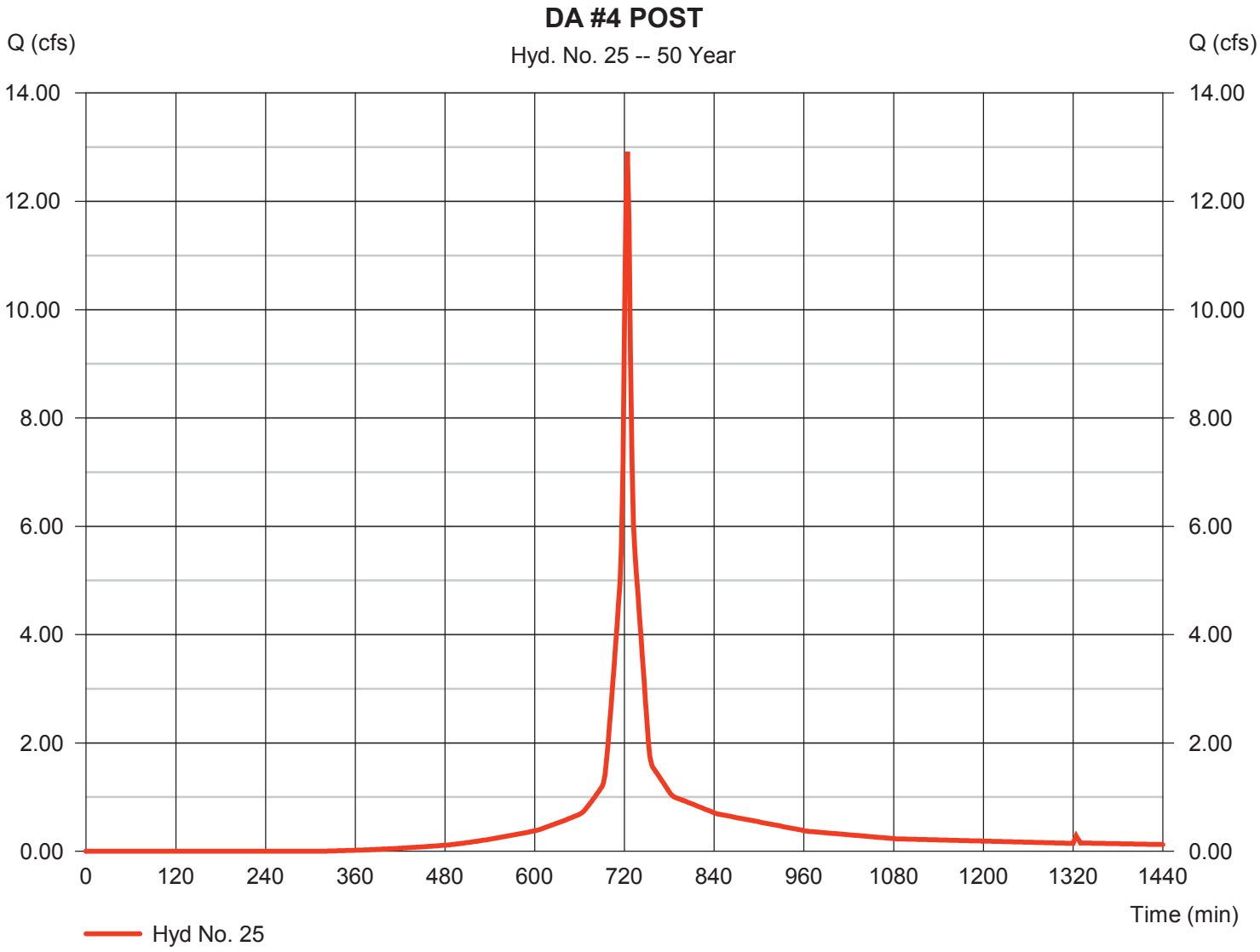


Hydrograph Report

Hyd. No. 25

DA #4 POST

Hydrograph type	= SCS Runoff	Peak discharge	= 12.91 cfs
Storm frequency	= 50 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 39,481 cuft
Drainage area	= 1.800 ac	Curve number	= 79
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 9.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



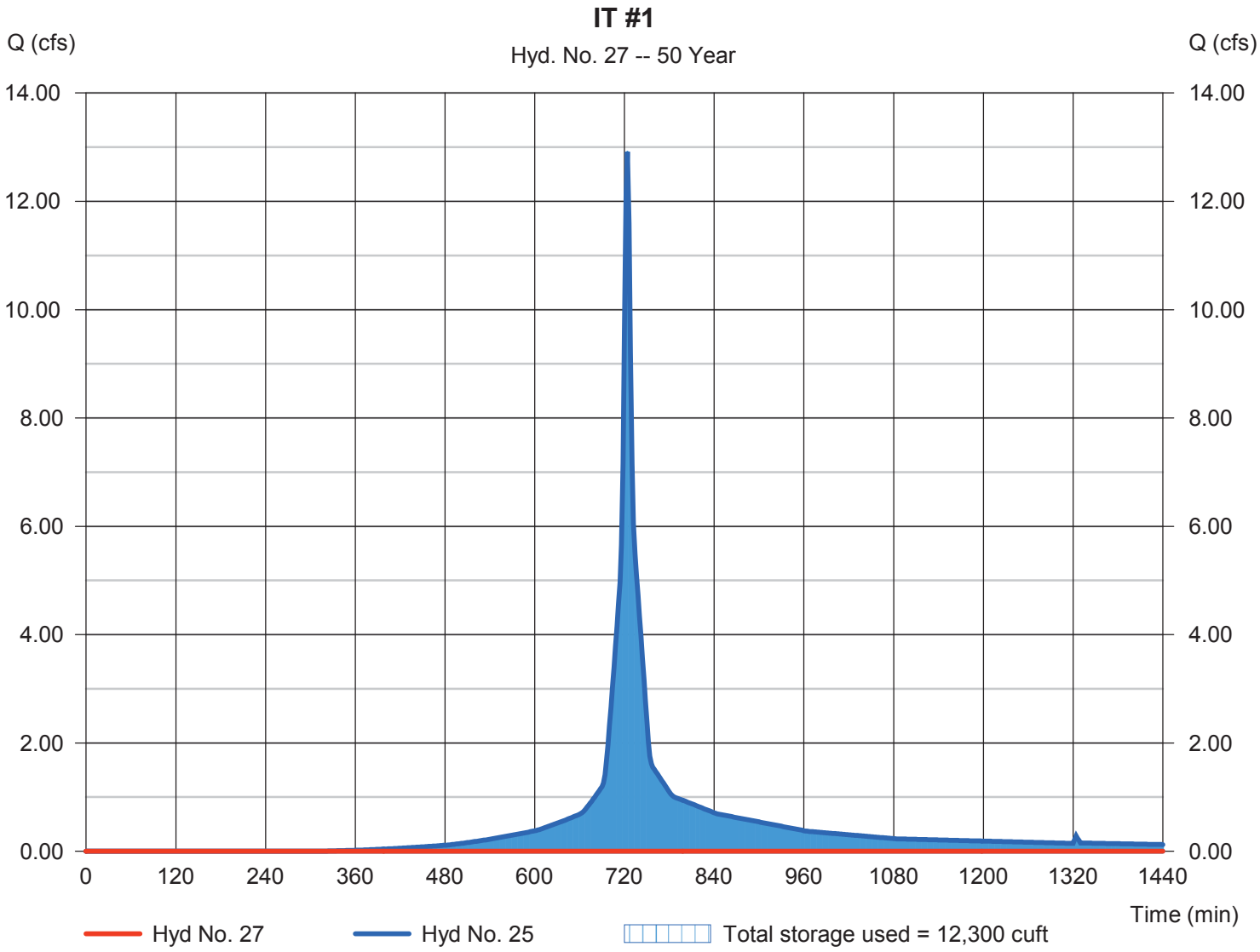
Hydrograph Report

Hyd. No. 27

IT #1

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	50 yrs	Time to peak	=	684 min
Time interval	=	2 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	25 - DA #4 POST	Max. Elevation	=	53.54 ft
Reservoir name	=	IT #1	Max. Storage	=	12,300 cuft

Storage Indication method used. Exfiltration extracted from Outflow.

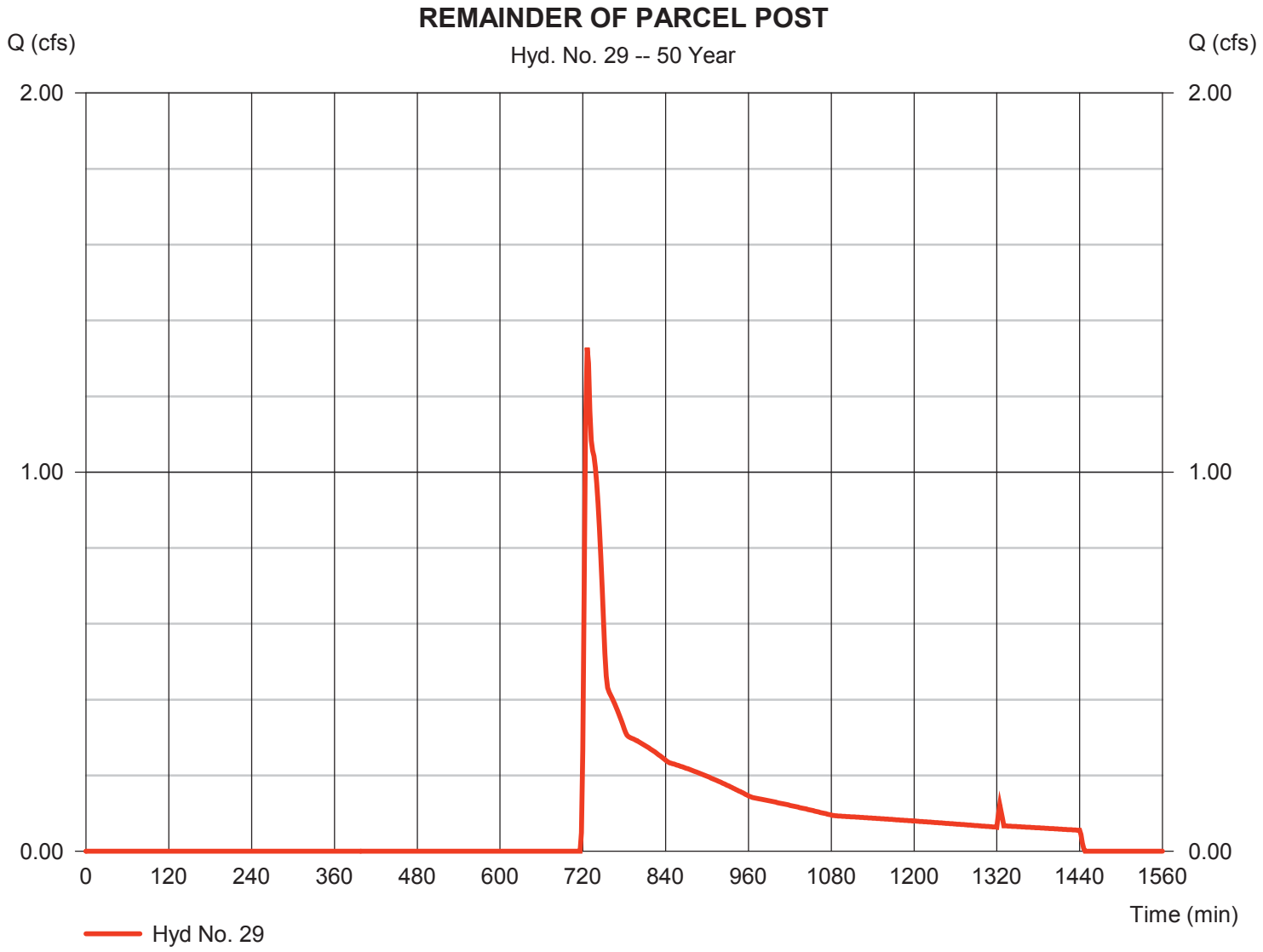


Hydrograph Report

Hyd. No. 29

REMAINDER OF PARCEL POST

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.328 cfs
Storm frequency	=	50 yrs	Time to peak	=	726 min
Time interval	=	2 min	Hyd. volume	=	7,376 cuft
Drainage area	=	2.030 ac	Curve number	=	34
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	9.00 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

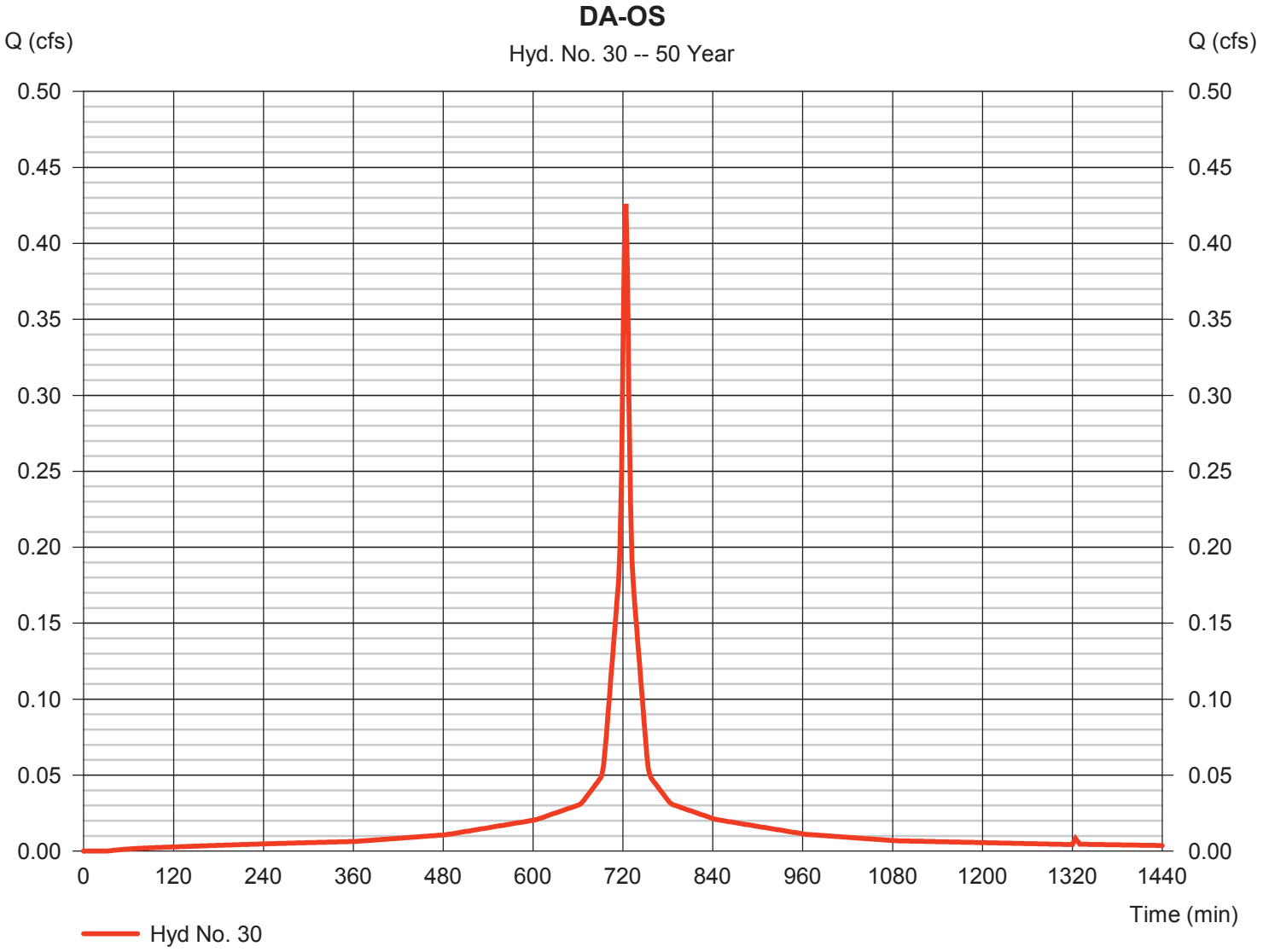


Hydrograph Report

Hyd. No. 30

DA-OS

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.426 cfs
Storm frequency	=	50 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	1,491 cuft
Drainage area	=	0.050 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	9.00 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

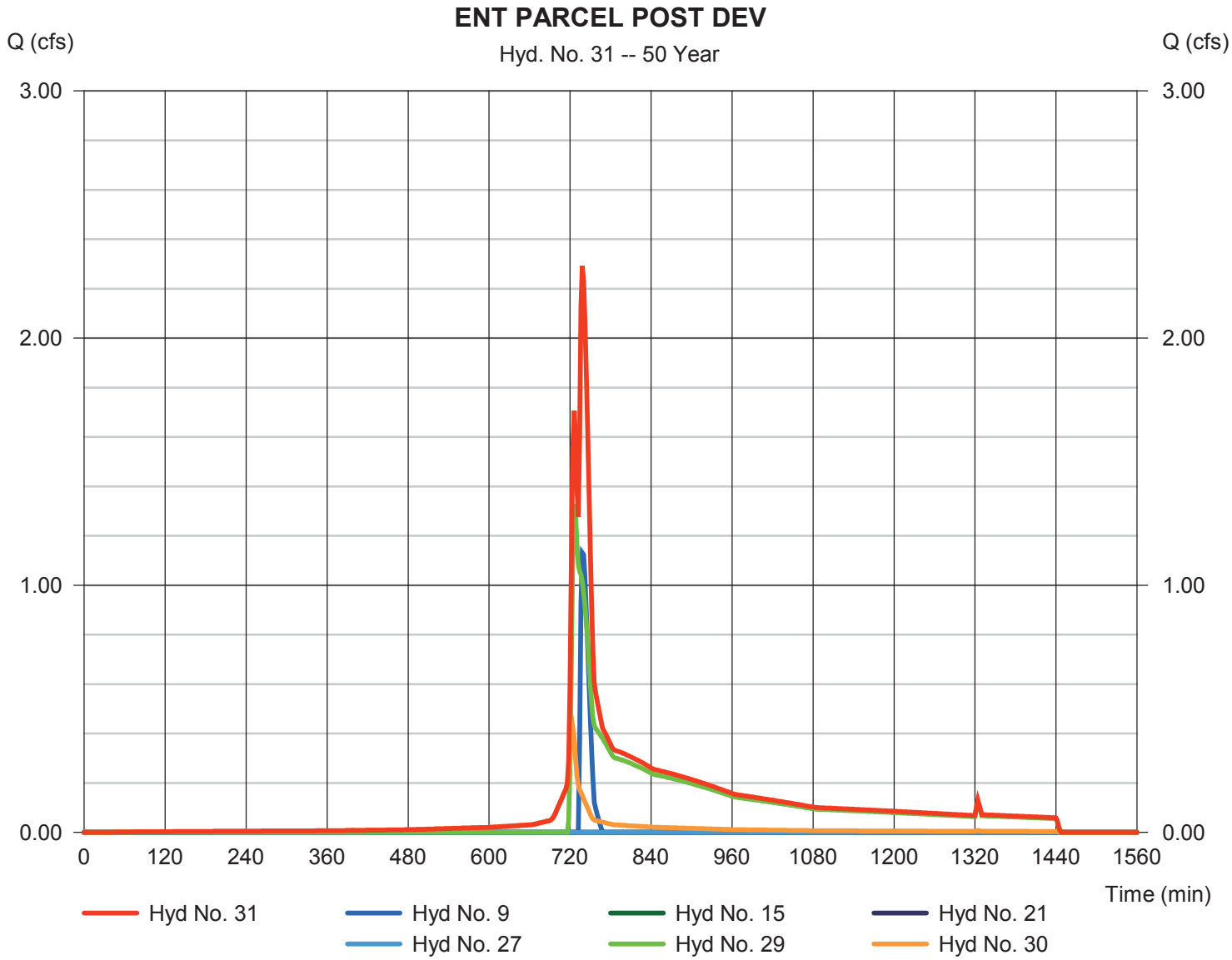


Hydrograph Report

Hyd. No. 31

ENT PARCEL POST DEV

Hydrograph type	= Combine	Peak discharge	= 2.292 cfs
Storm frequency	= 50 yrs	Time to peak	= 738 min
Time interval	= 2 min	Hyd. volume	= 9,855 cuft
Inflow hyds.	= 9, 15, 21, 27, 29, 30	Contrib. drain. area	= 2.080 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

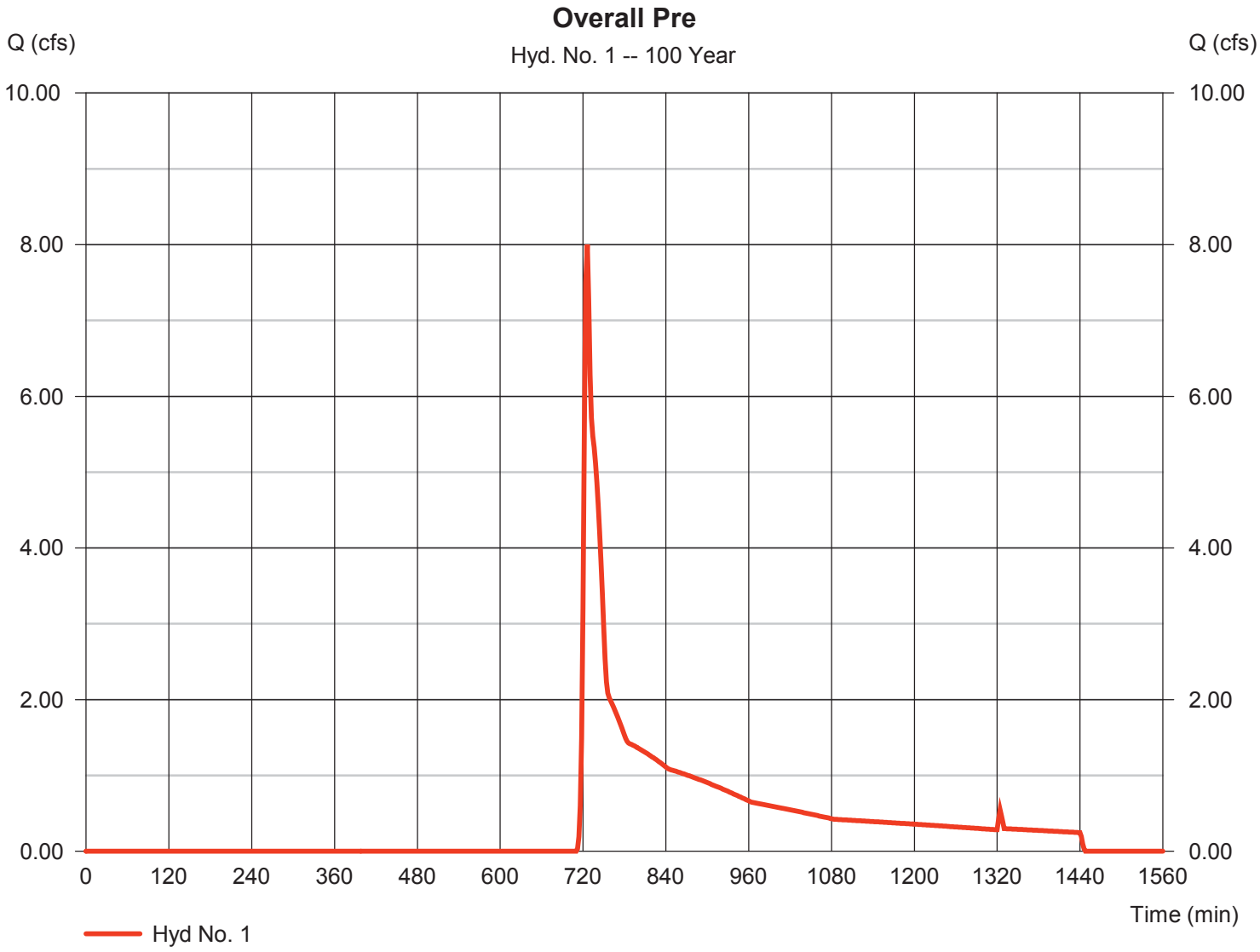
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	8.001	2	726	35,870	------	------	------	Overall Pre
3	SCS Runoff	48.70	2	724	145,876	------	------	------	Overall Post
5	SCS Runoff	0.823	2	726	3,692	------	------	------	DA 1 PRE
7	SCS Runoff	5.968	2	724	18,294	------	------	------	DA 1 POST
9	Reservoir	2.234	2	732	2,148	7	56.88	5,606	IB #1
11	SCS Runoff	2.025	2	726	9,080	------	------	------	DA 2 PRE
13	SCS Runoff	14.47	2	724	44,196	------	------	------	DA 2 POST
15	Reservoir	0.000	2	1052	0	13	54.46	18,145	IB #2
17	SCS Runoff	0.835	2	726	3,742	------	------	------	DA #3 PRE
19	SCS Runoff	6.643	2	724	21,136	------	------	------	DA #3 POST
21	Reservoir	0.000	2	666	0	19	53.26	8,422	IB #3
23	SCS Runoff	2.003	2	726	8,980	------	------	------	DA #4 PRE
25	SCS Runoff	14.72	2	724	45,286	------	------	------	DA #4 POST
27	Reservoir	0.783	2	748	959	25	53.99	14,208	IT #1
29	SCS Runoff	2.259	2	726	10,127	------	------	------	REMAINDER OF PARCEL POST
30	SCS Runoff	0.473	2	724	1,661	------	------	------	DA-OS
31	Combine	4.081	2	730	14,895	9, 15, 21, 27, 29, 30	------	------	ENT PARCEL POST DEV

Hydrograph Report

Hyd. No. 1

Overall Pre

Hydrograph type	=	SCS Runoff	Peak discharge	=	8.001 cfs
Storm frequency	=	100 yrs	Time to peak	=	726 min
Time interval	=	2 min	Hyd. volume	=	35,870 cuft
Drainage area	=	7.190 ac	Curve number	=	34
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	10.00 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



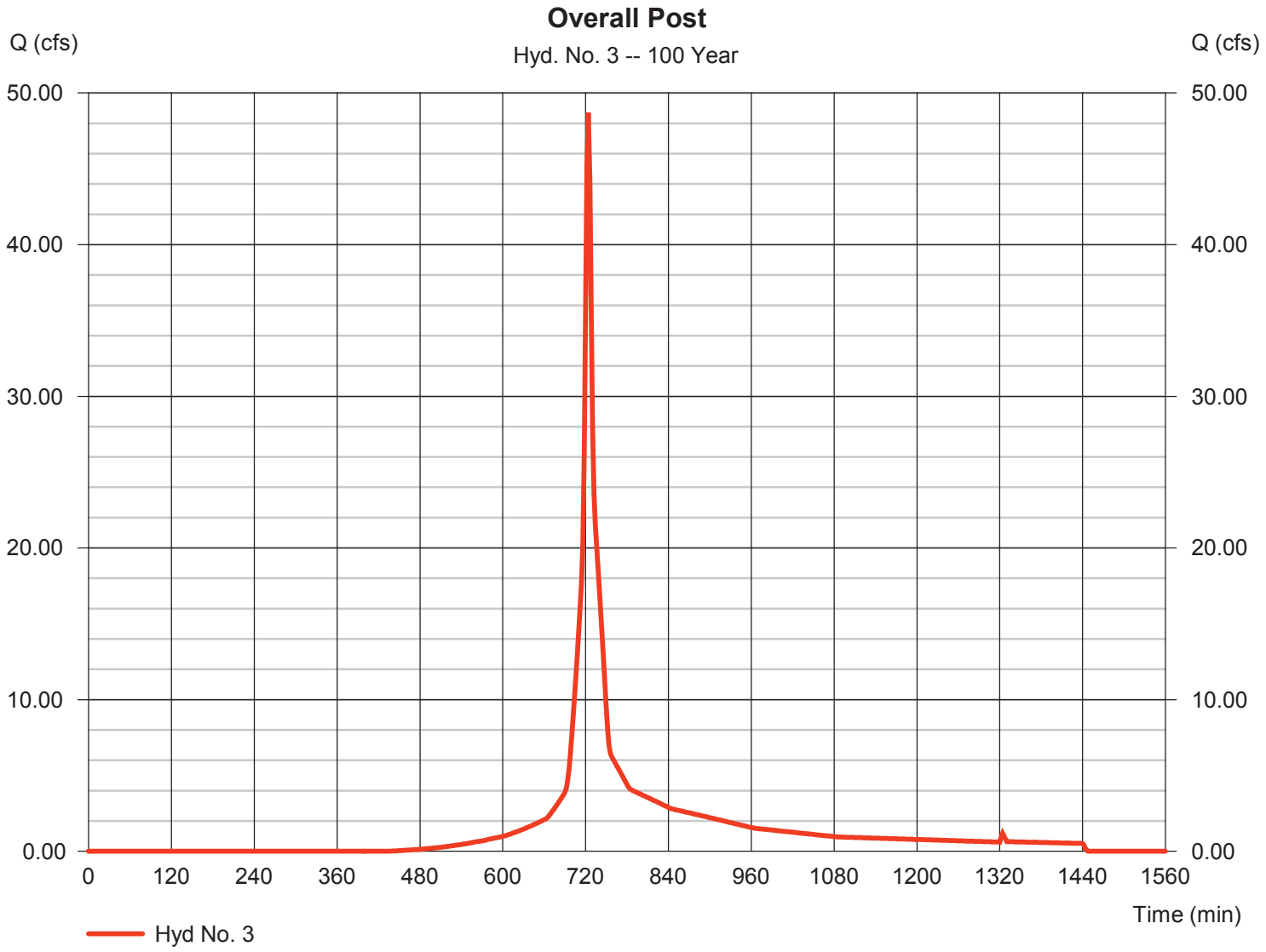
Hydrograph Report

Hyd. No. 3

Overall Post

Hydrograph type	= SCS Runoff	Peak discharge	= 48.70 cfs
Storm frequency	= 100 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 145,876 cuft
Drainage area	= 7.190 ac	Curve number	= 68*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 10.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.740 x 78) + (1.820 x 77) + (0.750 x 86) + (1.800 x 79) + (2.030 x 39) + (0.050 x 98)] / 7.190

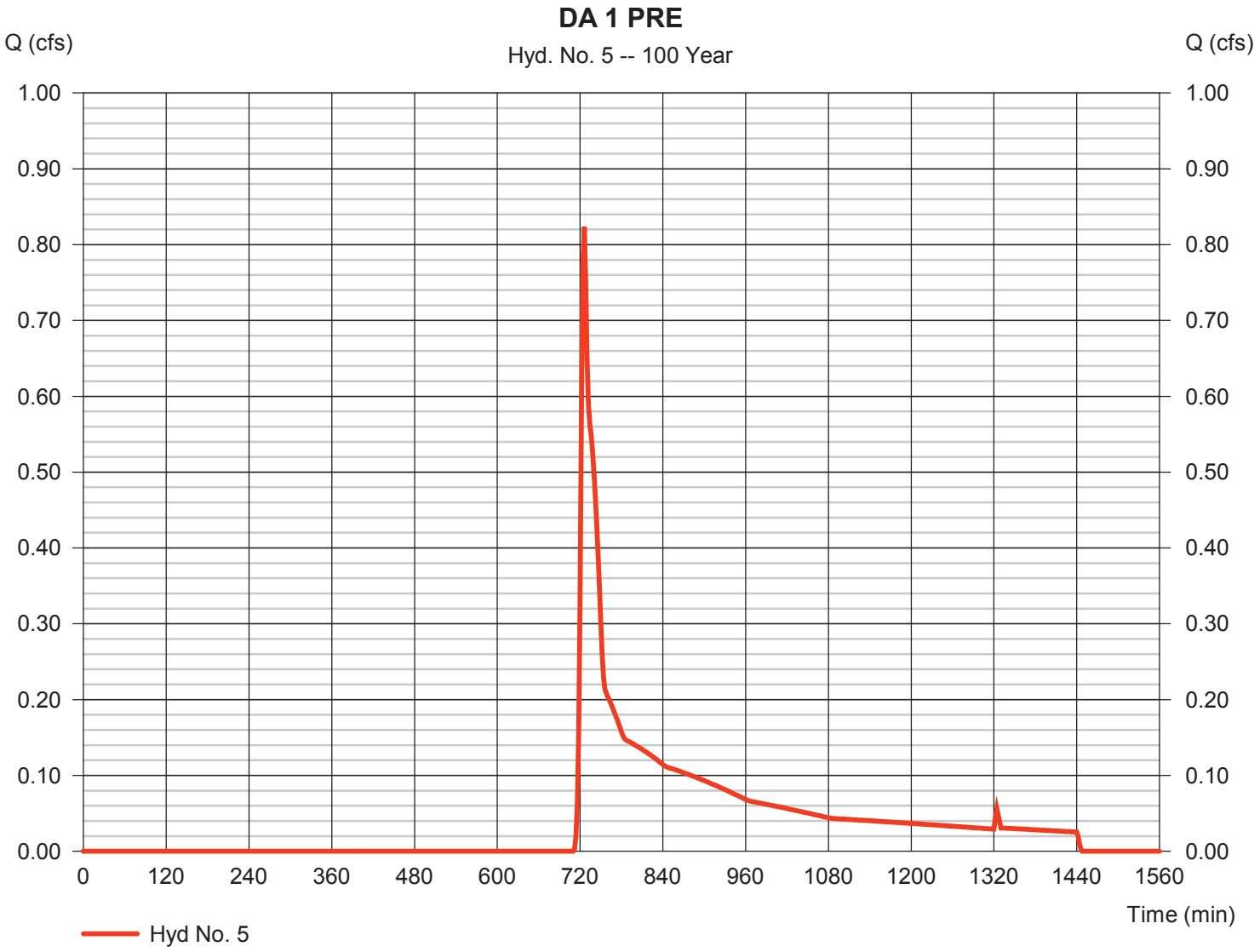


Hydrograph Report

Hyd. No. 5

DA 1 PRE

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.823 cfs
Storm frequency	=	100 yrs	Time to peak	=	726 min
Time interval	=	2 min	Hyd. volume	=	3,692 cuft
Drainage area	=	0.740 ac	Curve number	=	34
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	10.00 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

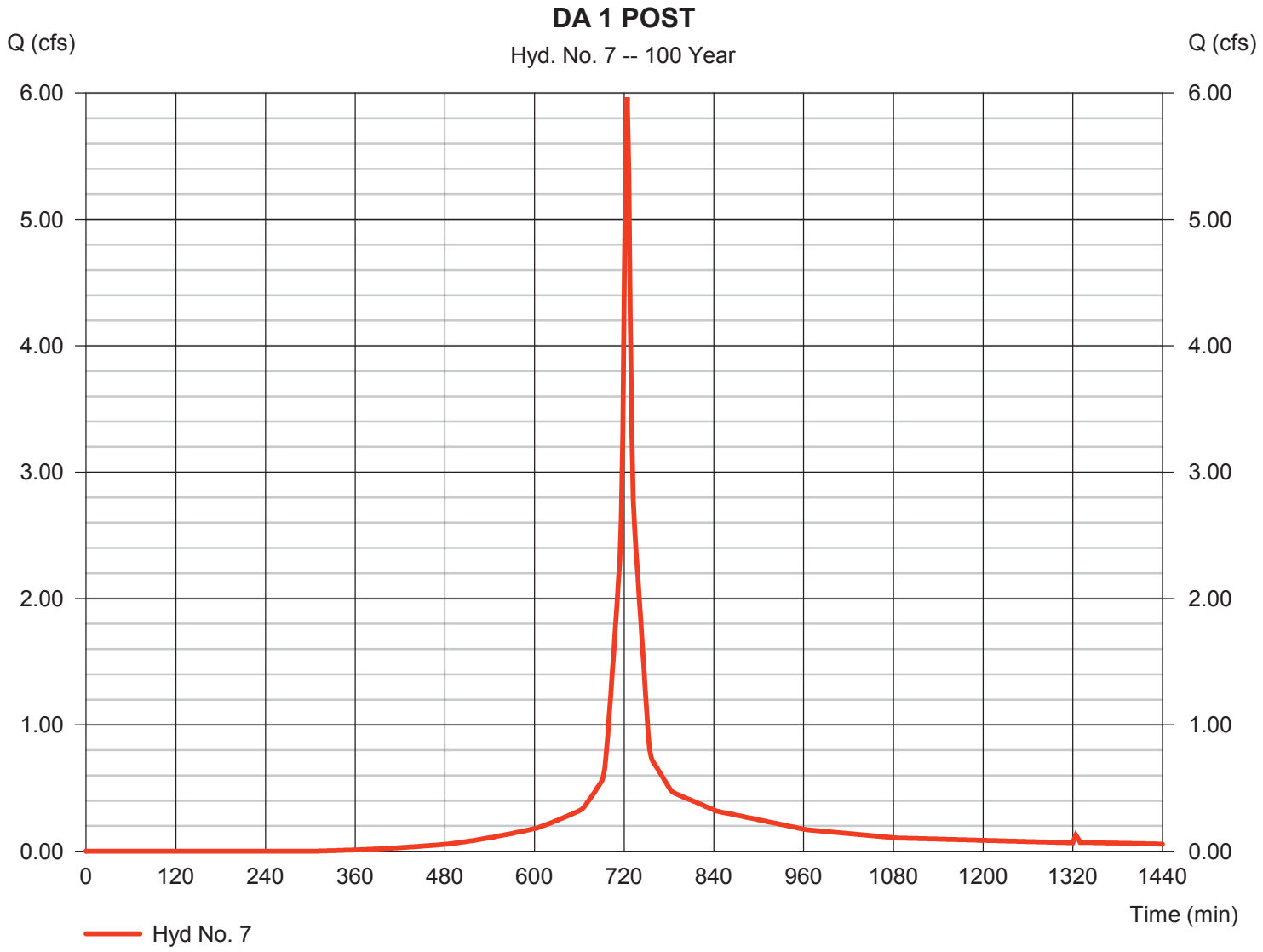


Hydrograph Report

Hyd. No. 7

DA 1 POST

Hydrograph type	= SCS Runoff	Peak discharge	= 5.968 cfs
Storm frequency	= 100 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 18,294 cuft
Drainage area	= 0.740 ac	Curve number	= 78
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 10.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



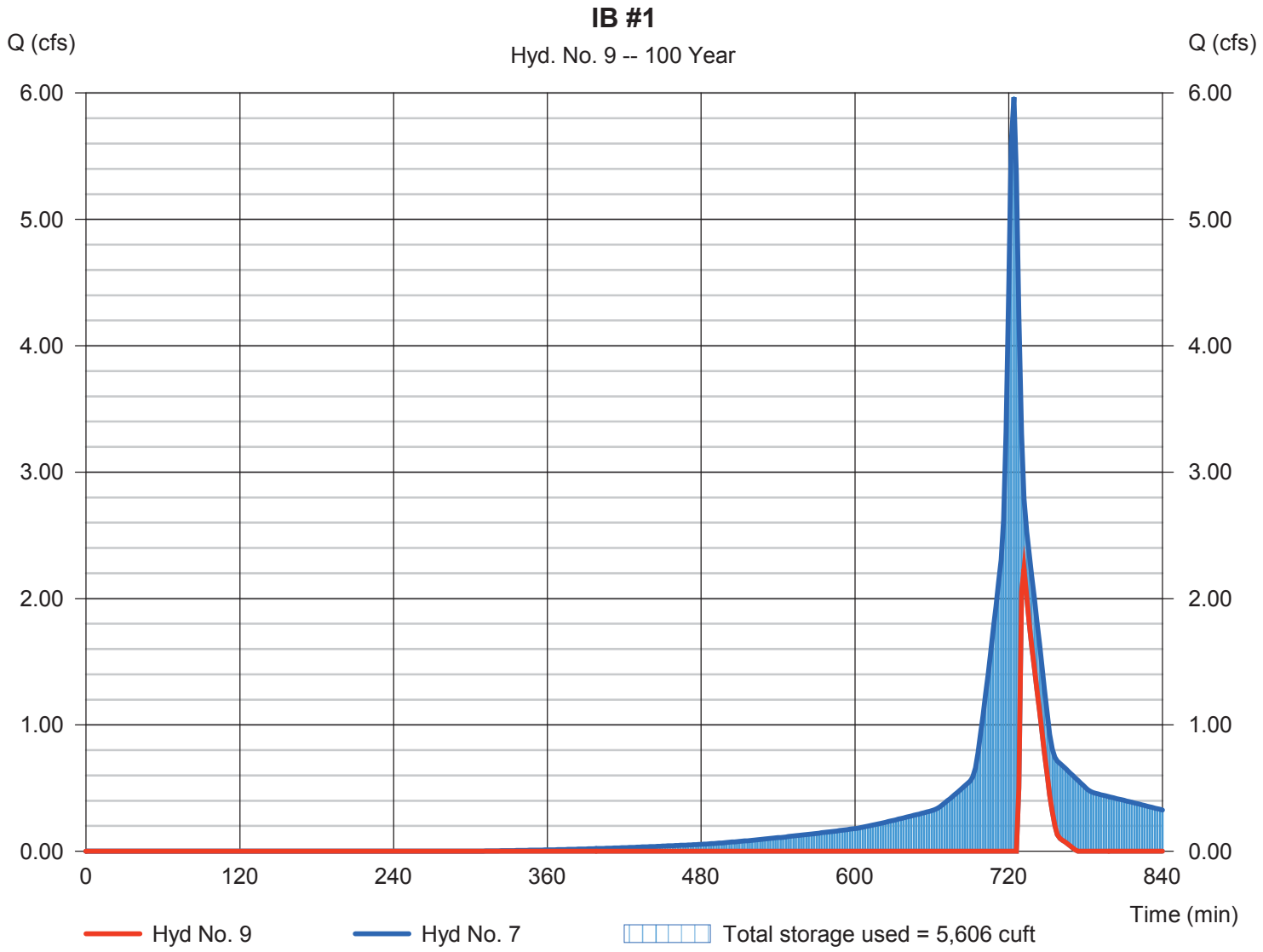
Hydrograph Report

Hyd. No. 9

IB #1

Hydrograph type	=	Reservoir	Peak discharge	=	2.234 cfs
Storm frequency	=	100 yrs	Time to peak	=	732 min
Time interval	=	2 min	Hyd. volume	=	2,148 cuft
Inflow hyd. No.	=	7 - DA 1 POST	Max. Elevation	=	56.88 ft
Reservoir name	=	IB #1	Max. Storage	=	5,606 cuft

Storage Indication method used. Exfiltration extracted from Outflow.

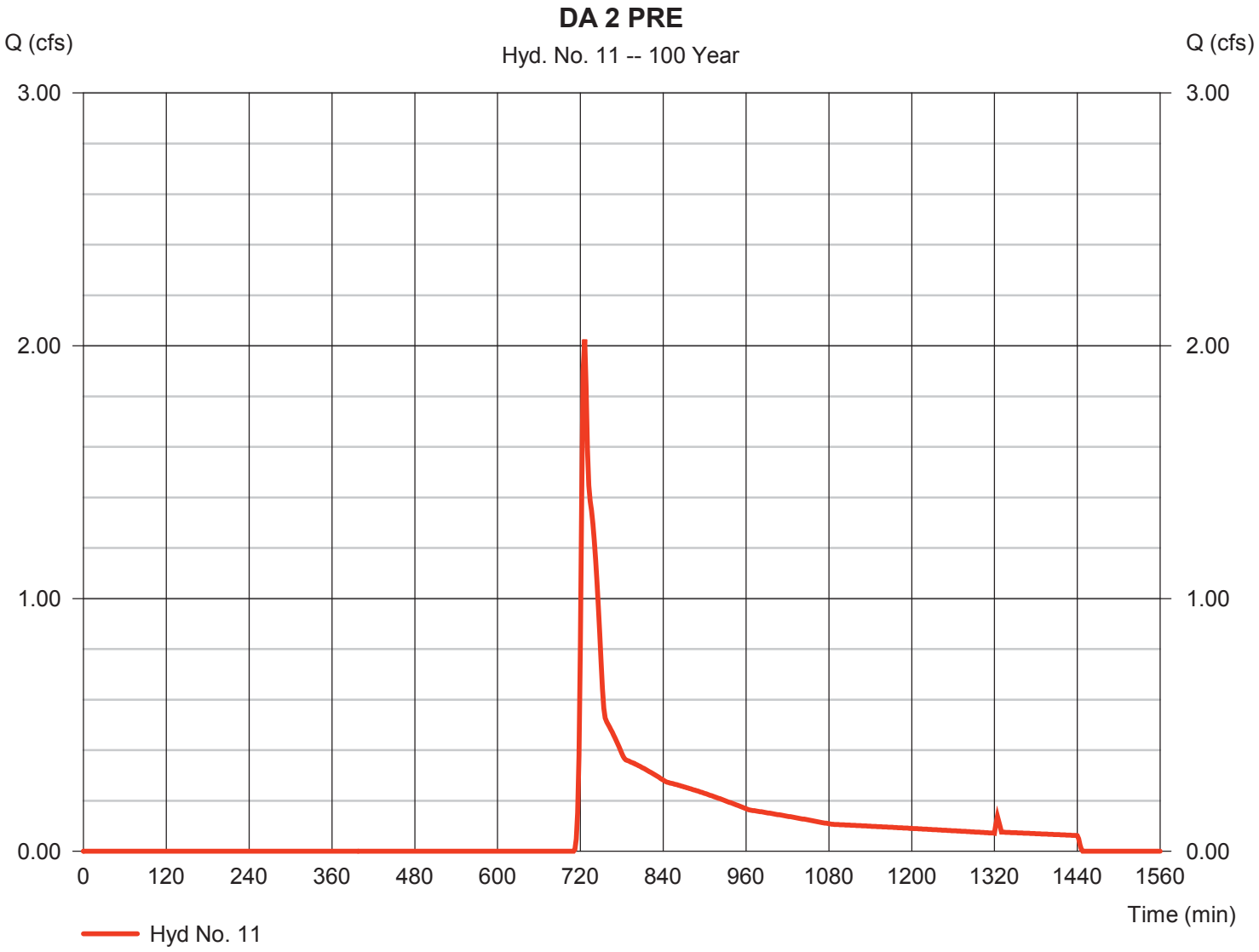


Hydrograph Report

Hyd. No. 11

DA 2 PRE

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.025 cfs
Storm frequency	=	100 yrs	Time to peak	=	726 min
Time interval	=	2 min	Hyd. volume	=	9,080 cuft
Drainage area	=	1.820 ac	Curve number	=	34
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	10.00 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

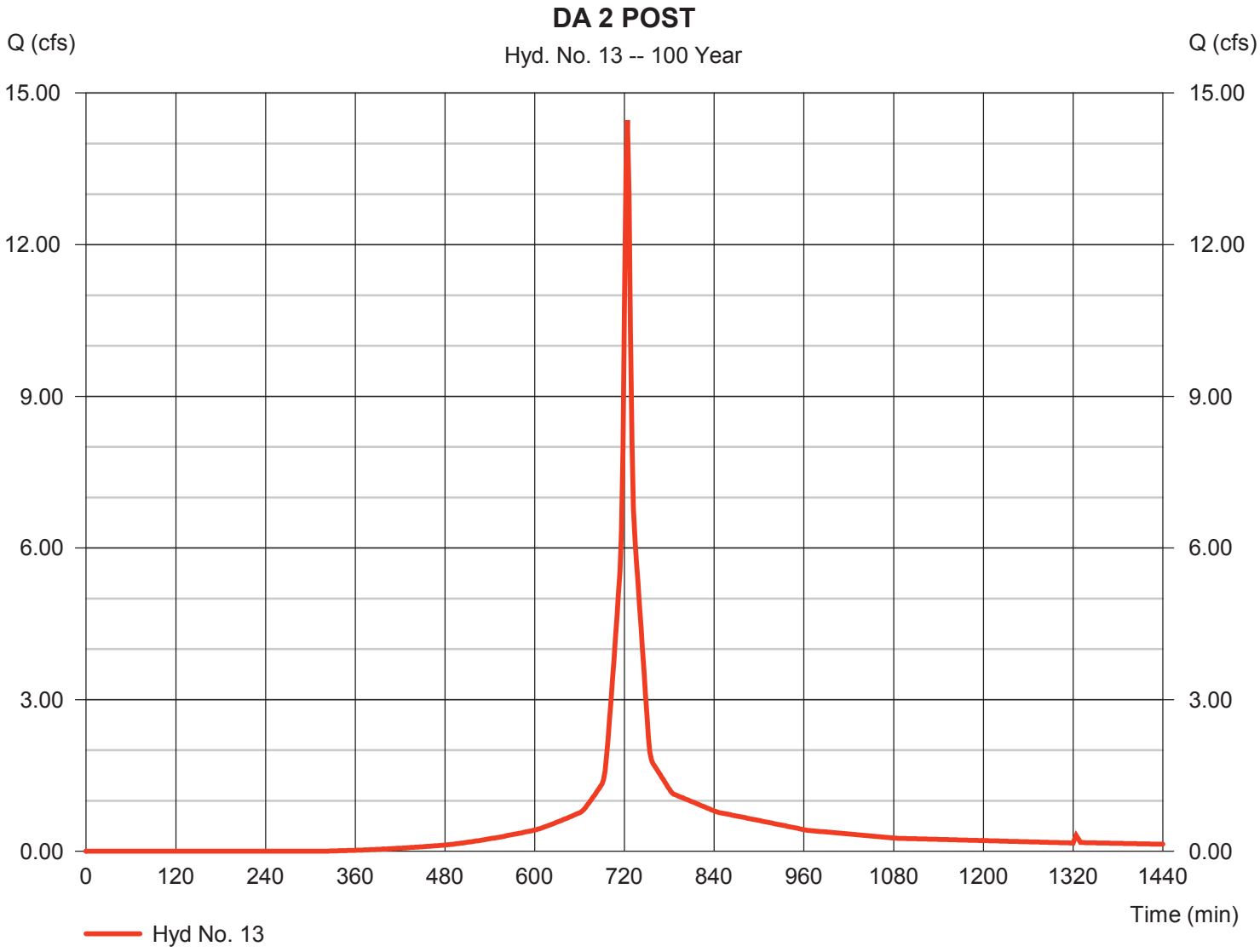


Hydrograph Report

Hyd. No. 13

DA 2 POST

Hydrograph type	=	SCS Runoff	Peak discharge	=	14.47 cfs
Storm frequency	=	100 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	44,196 cuft
Drainage area	=	1.820 ac	Curve number	=	77
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	10.00 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484



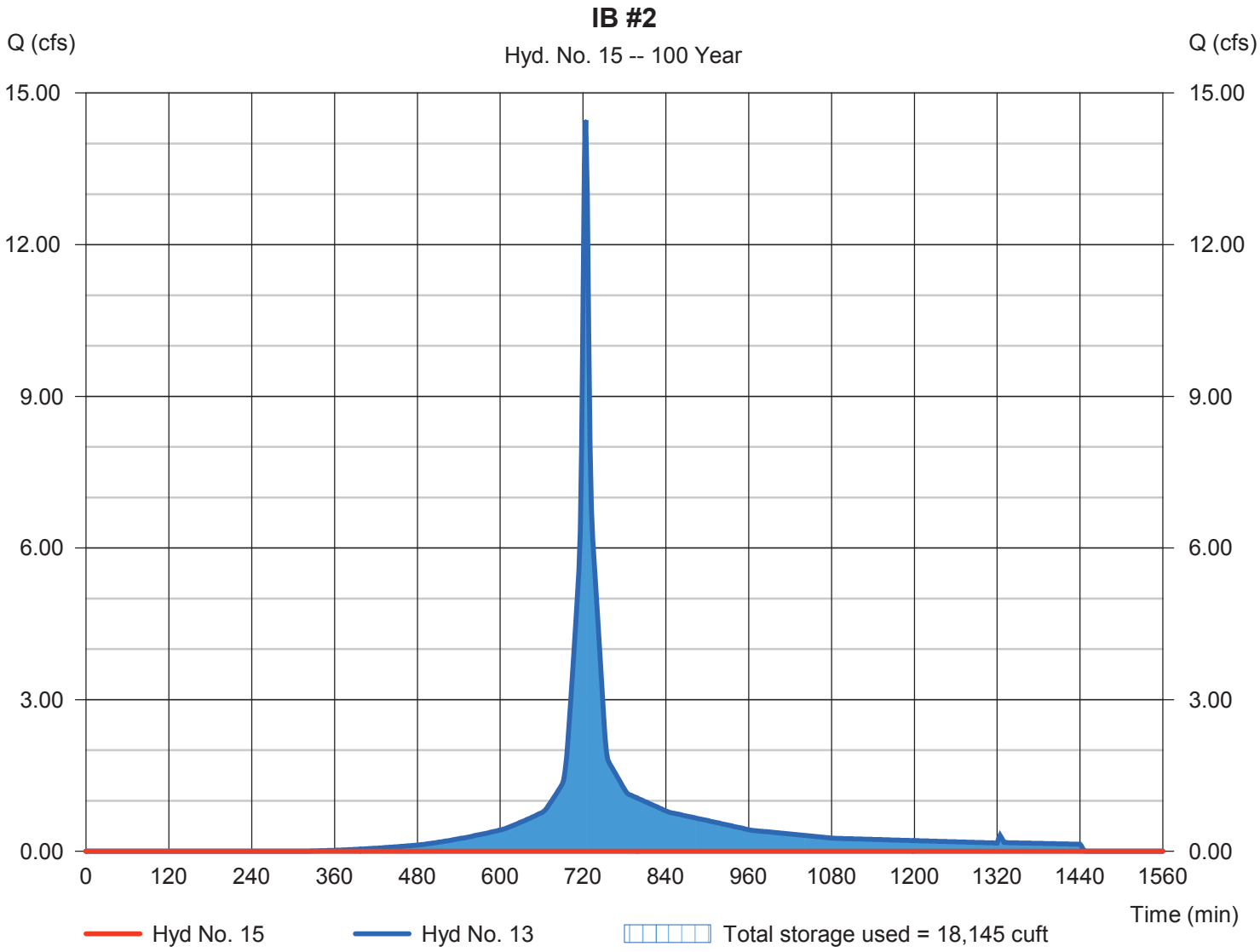
Hydrograph Report

Hyd. No. 15

IB #2

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	100 yrs	Time to peak	=	1052 min
Time interval	=	2 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	13 - DA 2 POST	Max. Elevation	=	54.46 ft
Reservoir name	=	IB #2	Max. Storage	=	18,145 cuft

Storage Indication method used. Exfiltration extracted from Outflow.

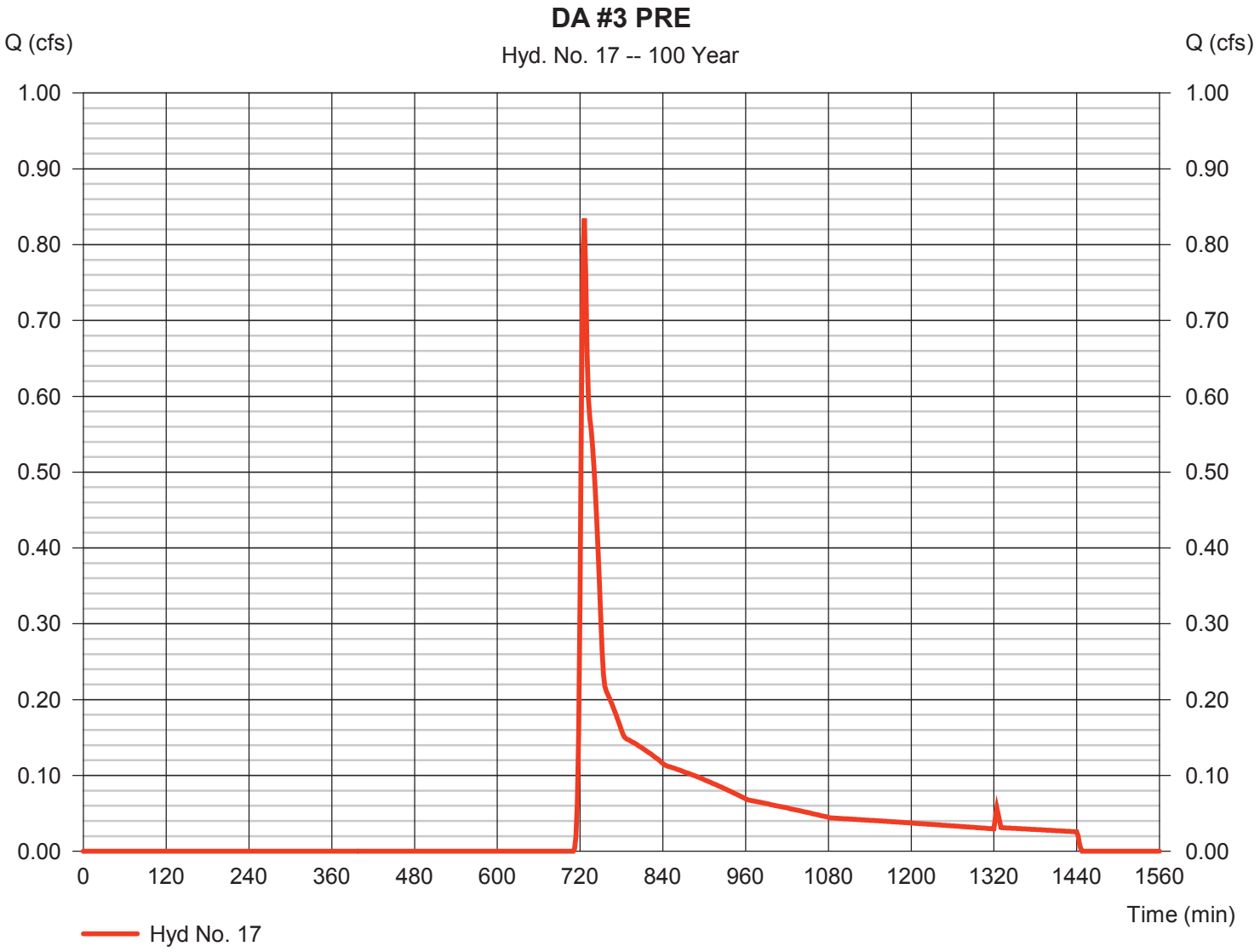


Hydrograph Report

Hyd. No. 17

DA #3 PRE

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.835 cfs
Storm frequency	=	100 yrs	Time to peak	=	726 min
Time interval	=	2 min	Hyd. volume	=	3,742 cuft
Drainage area	=	0.750 ac	Curve number	=	34
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	10.00 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

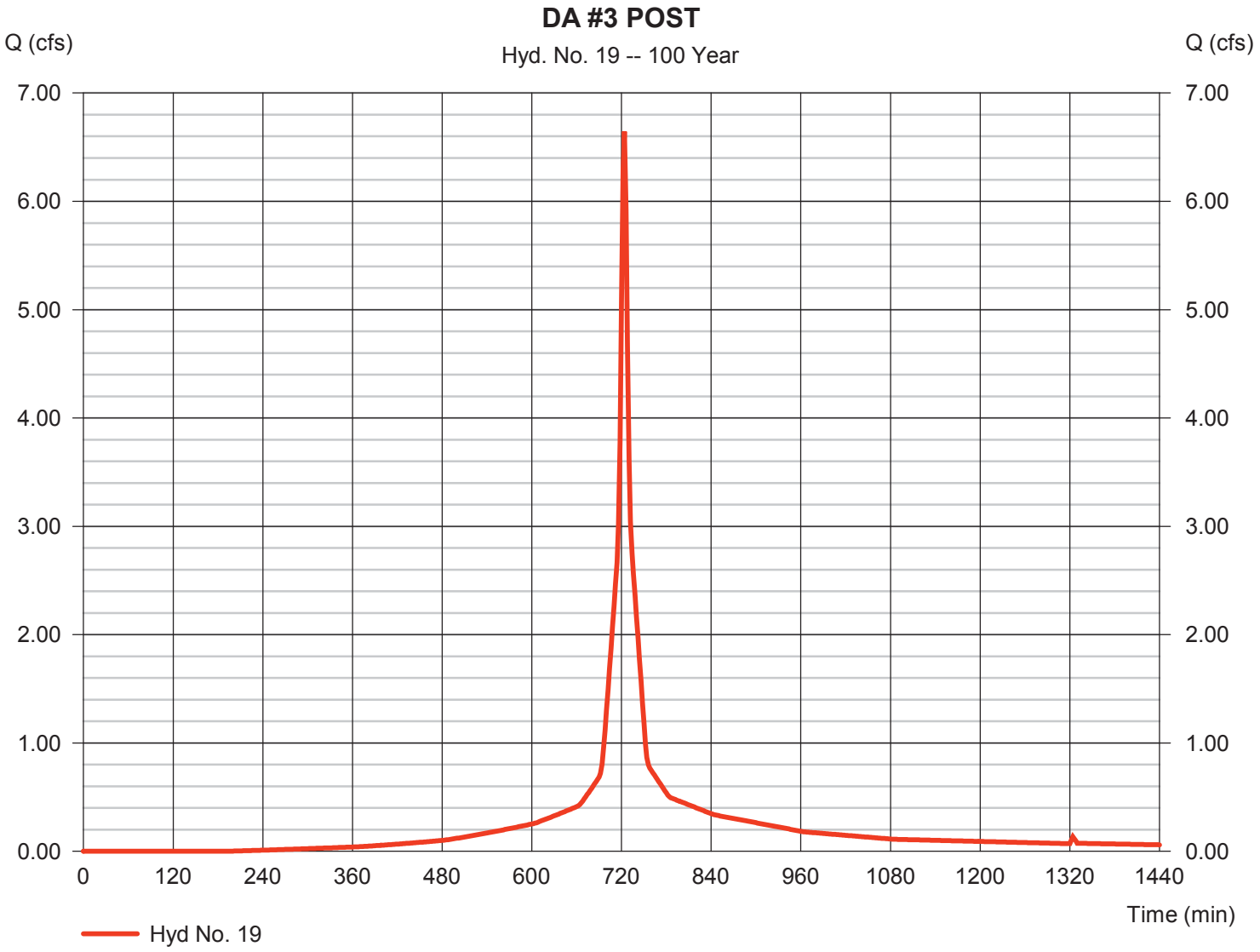


Hydrograph Report

Hyd. No. 19

DA #3 POST

Hydrograph type	= SCS Runoff	Peak discharge	= 6.643 cfs
Storm frequency	= 100 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 21,136 cuft
Drainage area	= 0.750 ac	Curve number	= 86
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 10.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

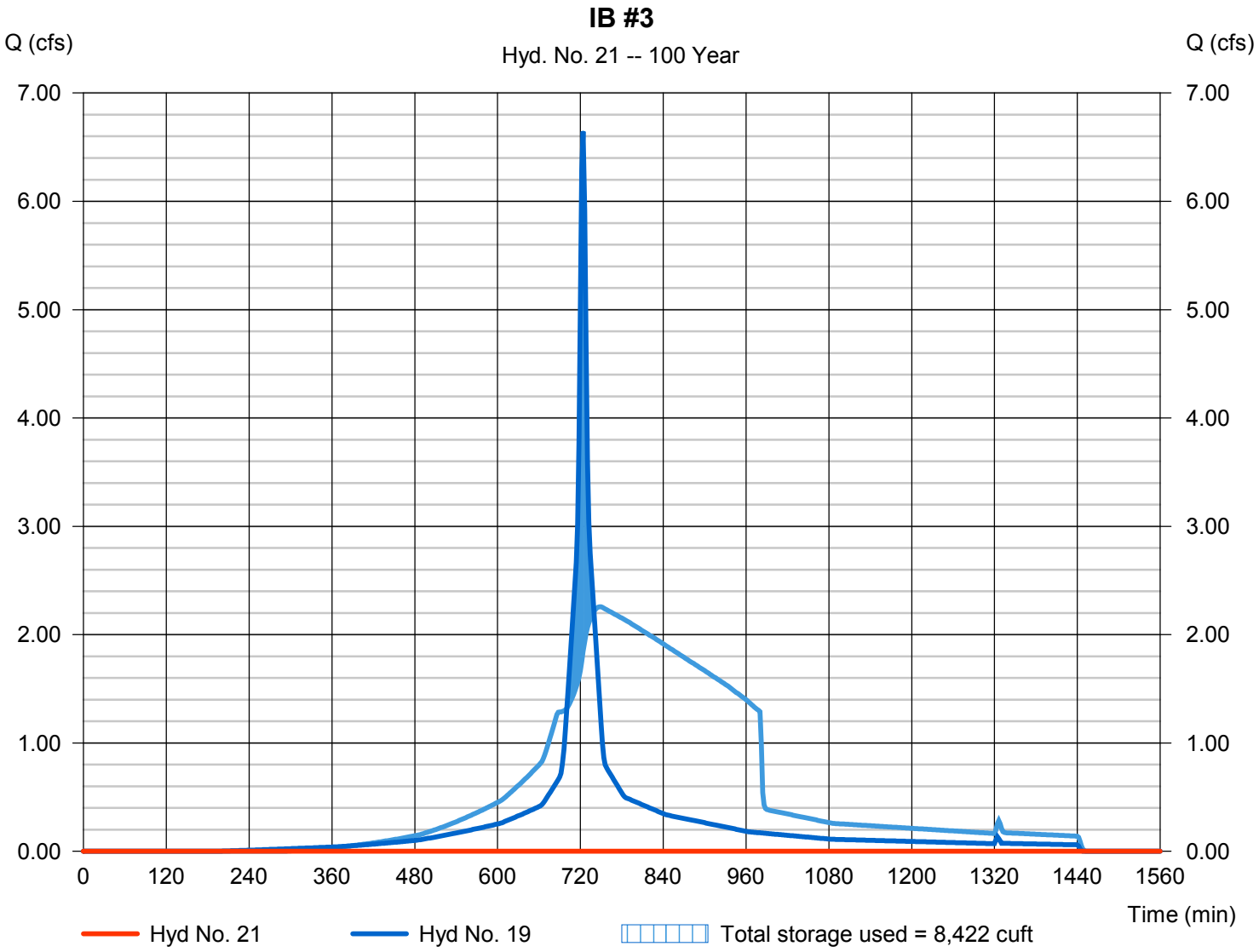
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Wednesday, 10 / 19 / 2016

Hyd. No. 21

IB #3

Hydrograph type	=	Reservoir	Peak discharge	=	0.000 cfs
Storm frequency	=	100 yrs	Time to peak	=	1092 min
Time interval	=	2 min	Hyd. volume	=	0 cuft
Inflow hyd. No.	=	19 - DA #3 POST	Max. Elevation	=	53.26 ft
Reservoir name	=	IB #3	Max. Storage	=	8,422 cuft

Storage Indication method used. Exfiltration extracted from Outflow.

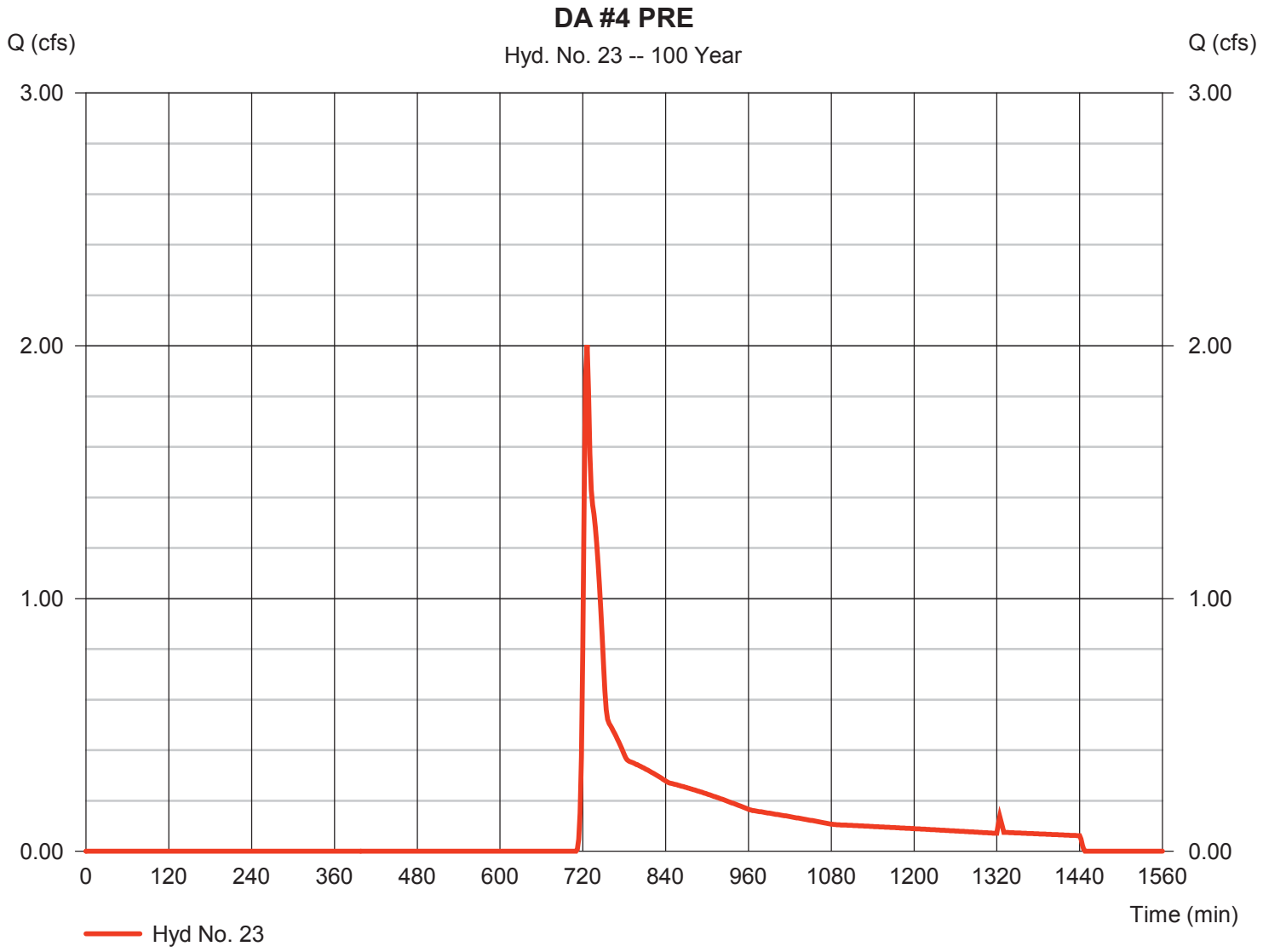


Hydrograph Report

Hyd. No. 23

DA #4 PRE

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.003 cfs
Storm frequency	=	100 yrs	Time to peak	=	726 min
Time interval	=	2 min	Hyd. volume	=	8,980 cuft
Drainage area	=	1.800 ac	Curve number	=	34
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	10.00 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

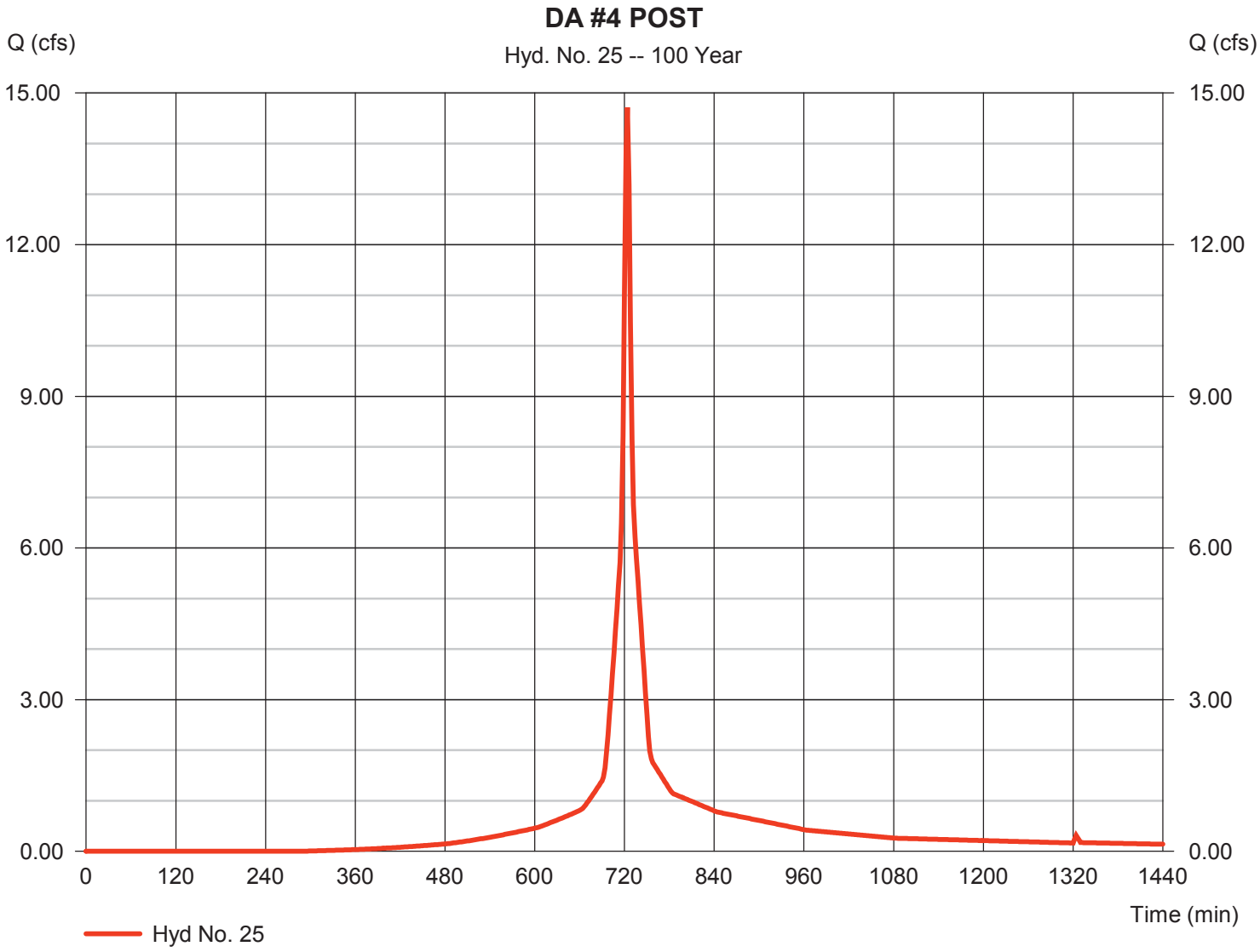


Hydrograph Report

Hyd. No. 25

DA #4 POST

Hydrograph type	= SCS Runoff	Peak discharge	= 14.72 cfs
Storm frequency	= 100 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 45,286 cuft
Drainage area	= 1.800 ac	Curve number	= 79
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 10.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



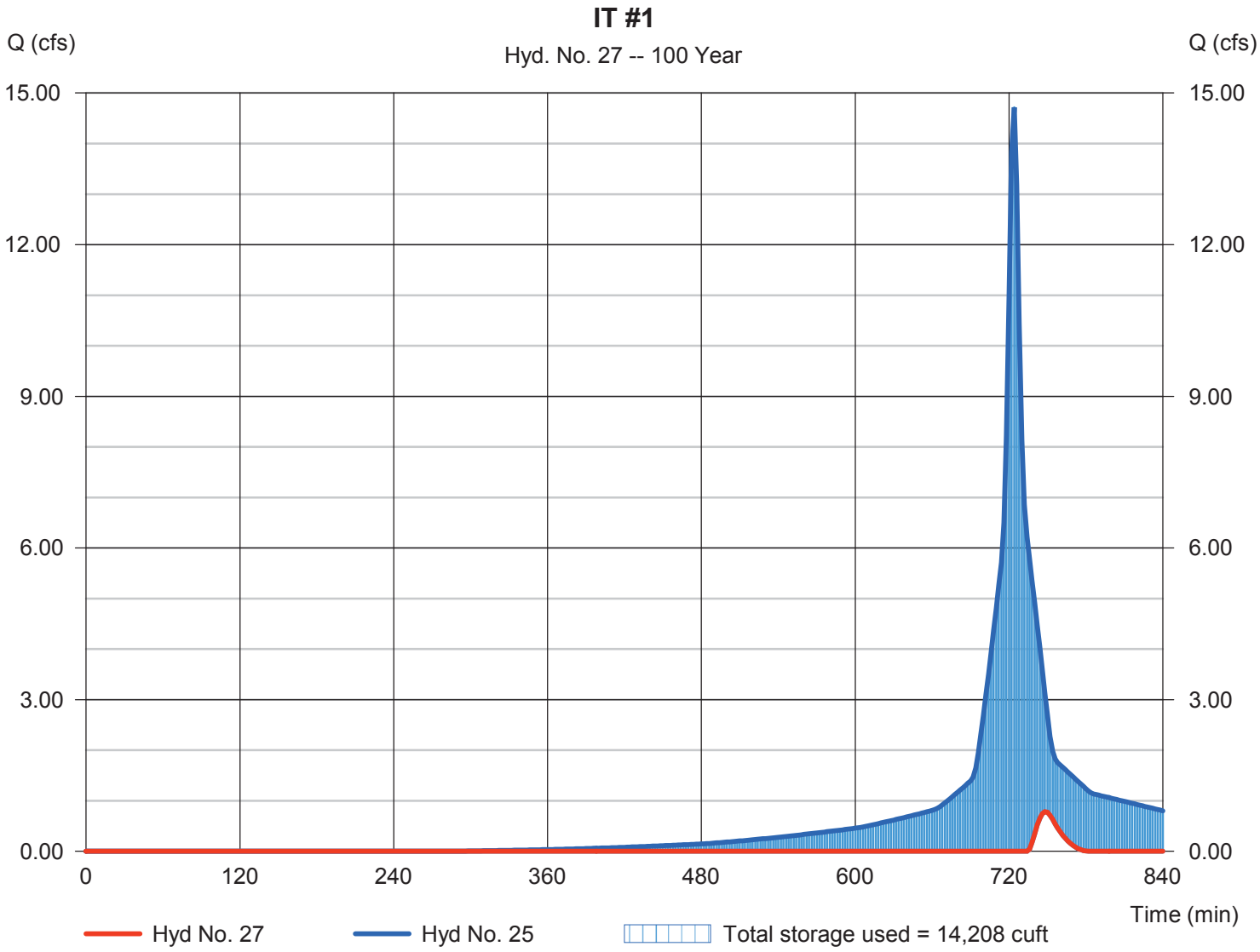
Hydrograph Report

Hyd. No. 27

IT #1

Hydrograph type	= Reservoir	Peak discharge	= 0.783 cfs
Storm frequency	= 100 yrs	Time to peak	= 748 min
Time interval	= 2 min	Hyd. volume	= 959 cuft
Inflow hyd. No.	= 25 - DA #4 POST	Max. Elevation	= 53.99 ft
Reservoir name	= IT #1	Max. Storage	= 14,208 cuft

Storage Indication method used. Exfiltration extracted from Outflow.

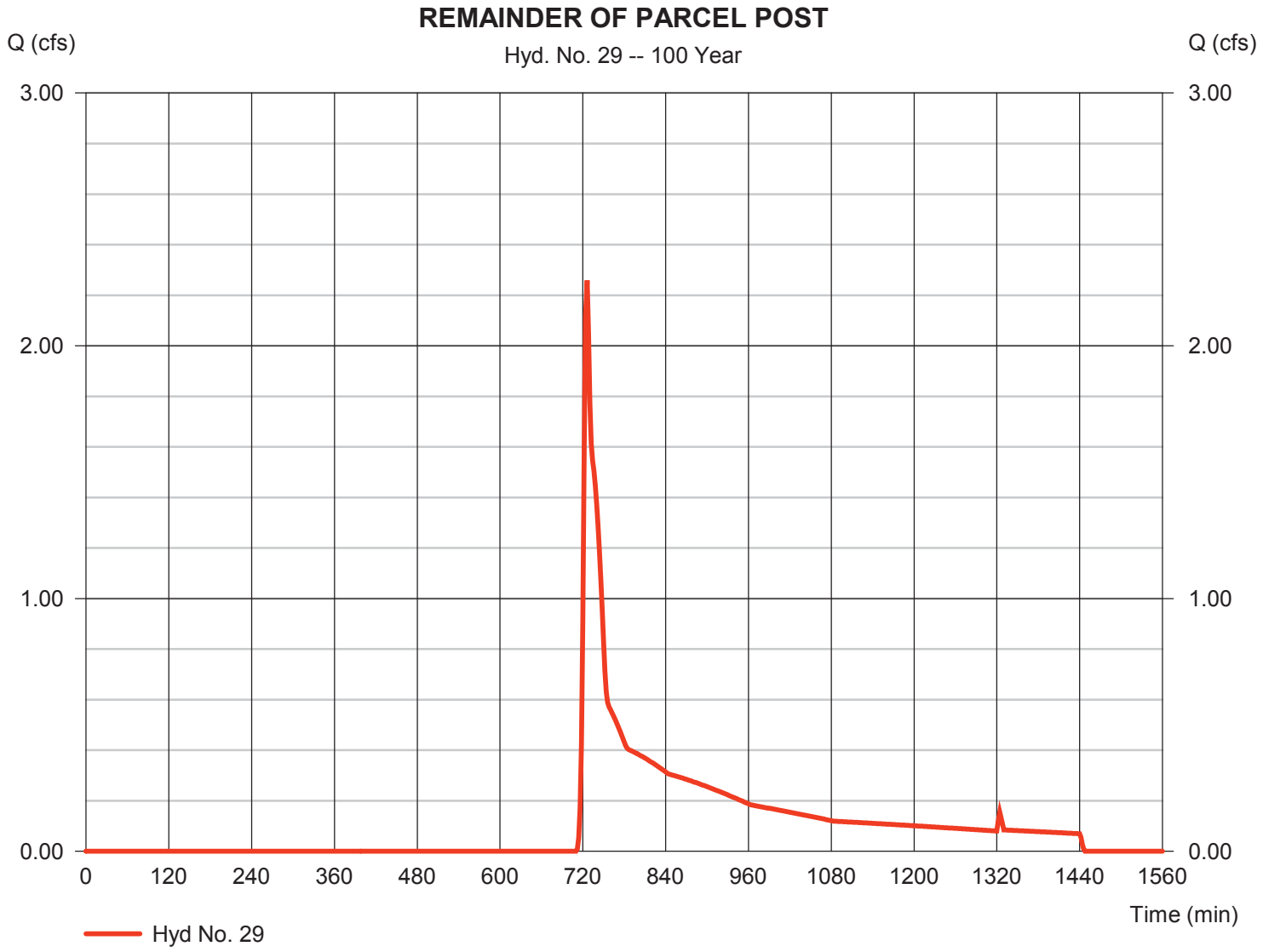


Hydrograph Report

Hyd. No. 29

REMAINDER OF PARCEL POST

Hydrograph type	= SCS Runoff	Peak discharge	= 2.259 cfs
Storm frequency	= 100 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 10,127 cuft
Drainage area	= 2.030 ac	Curve number	= 34
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 10.00 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

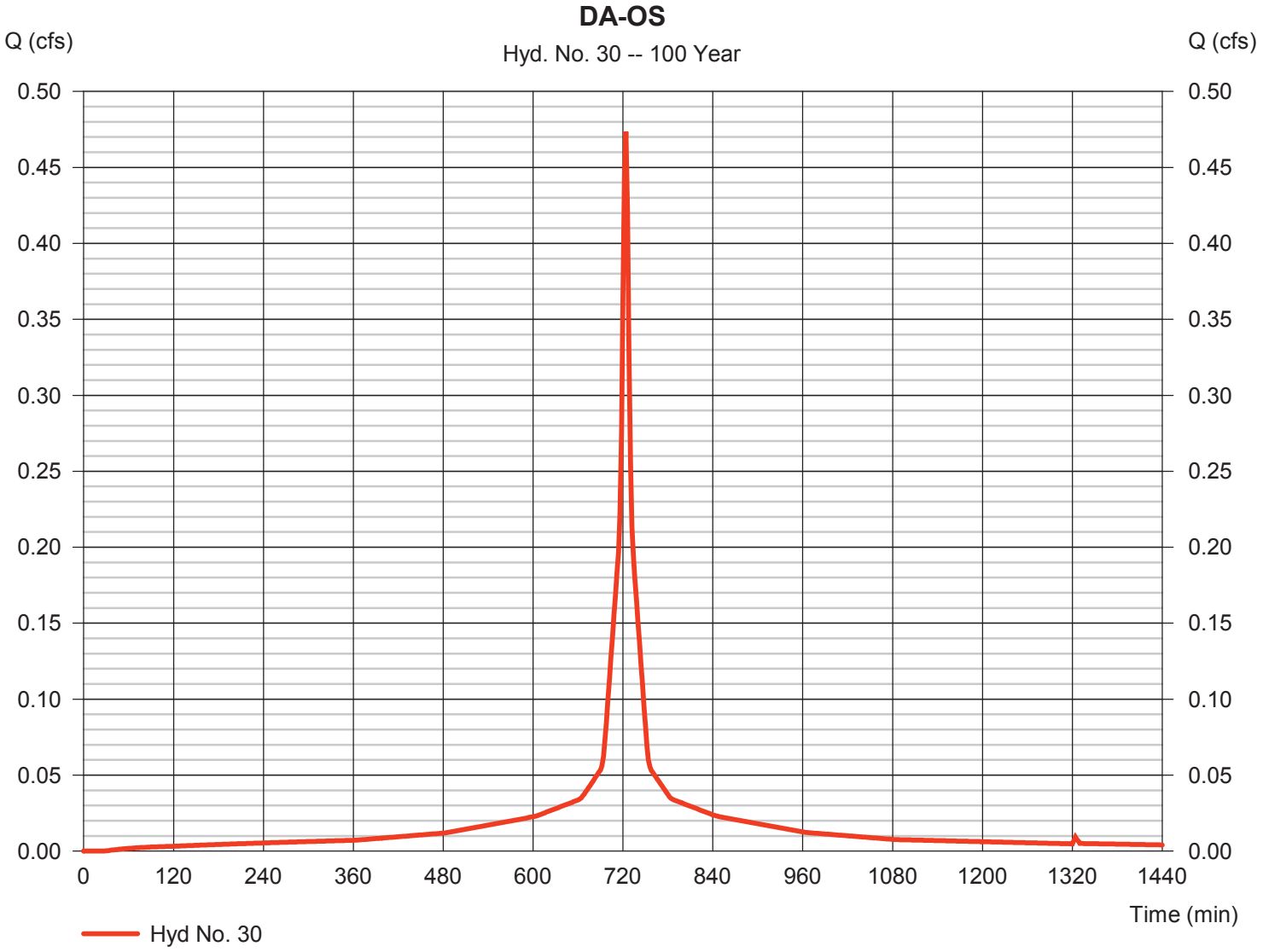


Hydrograph Report

Hyd. No. 30

DA-OS

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.473 cfs
Storm frequency	=	100 yrs	Time to peak	=	724 min
Time interval	=	2 min	Hyd. volume	=	1,661 cuft
Drainage area	=	0.050 ac	Curve number	=	98
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	5.00 min
Total precip.	=	10.00 in	Distribution	=	Type III
Storm duration	=	24 hrs	Shape factor	=	484

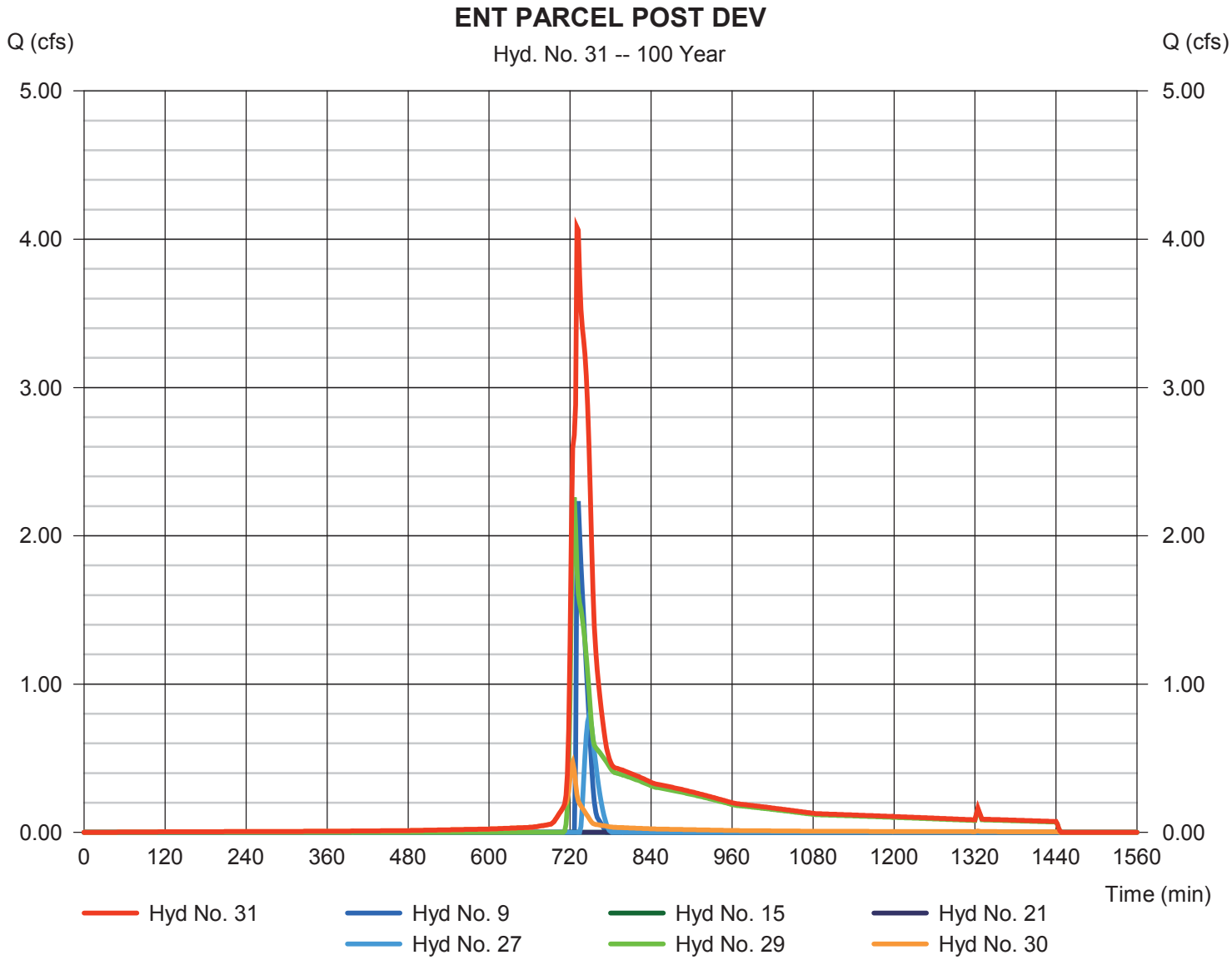


Hydrograph Report

Hyd. No. 31

ENT PARCEL POST DEV

Hydrograph type	= Combine	Peak discharge	= 4.081 cfs
Storm frequency	= 100 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 14,895 cuft
Inflow hyds.	= 9, 15, 21, 27, 29, 30	Contrib. drain. area	= 2.080 ac



VI. STORM PIPES/STRUCTURES

DATE: 10/14/2016
PROJECT: Shipyard Village Apartments
TITLE: 10-YR PIPE DESIGN AND HGL
MODEL: BENTLEY STORMCAD V8i SERIES 4

From (Inlet)	To (Outlet)	Invert (Inlet) (ft)	Invert (Outlet) (ft)	Length (ft)	Diameter (in)	Slope (ft/ft)	System Drainage Area (acres)	System CA (acres)	System Intensity (in/h)	Time (Pipe Flow) (min)	System Flow Time (min)	System Rational Flow (cfs)	Capacity (Full Flow) (cfs)	Rim Elevation (Inlet) (ft)	Hydraulic Grade Line (Inlet) (ft)	Inlet Cover (ft)	Velocity (ft/s)
CB-1	SDMH-2	51.94	51.71	75.70	15.00	0.003	0.09	0.08	7.23	0.60	0.00	0.60	3.56	57.19	52.42	4.00	2.15
SDMH-2	CB-14	51.71	51.45	85.70	15.00	0.003	0.09	0.08	7.23	0.66	0.59	0.60	3.55	57.55	52.42	4.59	2.15
CB-14	CB-13	51.45	51.26	66.10	15.00	0.003	0.17	0.15	7.23	0.42	1.26	1.12	3.51	56.00	52.39	3.30	2.54
CB-13	JB-2	51.26	51.22	12.10	15.00	0.003	0.32	0.28	7.23	0.06	1.68	2.01	3.65	55.67	52.38	3.16	3.04
CB-12	JB-2	51.27	51.22	11.00	15.00	0.005	0.56	0.40	7.23	0.06	0.00	2.93	4.40	55.66	52.39	3.14	3.84
JB-2	IT-1	51.22	51.00	71.90	24.00	0.019	0.95	0.74	7.23	0.00	1.53	5.39	30.78	56.20	52.37	2.98	7.19
CB-3	CB-4	51.82	51.47	115.60	15.00	0.003	0.18	0.16	7.23	0.72	0.00	1.17	3.54	55.49	52.72	2.42	2.59
CB-4	DI-1	51.47	51.05	143.60	18.00	0.003	0.71	0.54	7.23	0.66	0.75	3.93	6.39	54.90	52.69	1.93	3.50
DI-2	DI-1	54.00	52.60	52.60	15.00	0.025	0.15	0.08	7.23	0.18	0.00	0.59	10.20	57.70	54.30	2.45	4.53
DI-1	IT-1	51.05	51.00	28.10	24.00	0.003	0.97	0.68	7.23	0.06	1.42	4.92	12.35	57.28	52.54	4.23	3.71
CB-2	IB-1	53.38	53.25	40.40	18.00	0.003	0.40	0.34	7.23	1.08	0.00	2.46	10.92	57.50	56.28	2.62	0.69
CB-5	CB-6	51.62	51.21	82.70	18.00	0.005	0.61	0.42	7.23	0.36	0.00	3.04	7.38	54.83	52.79	1.71	3.97
CB-8	CB-7	51.98	51.59	78.20	15.00	0.005	0.21	0.17	7.23	0.42	0.00	1.21	4.55	54.57	52.78	1.34	3.13
CB-7	CB-6	51.59	51.21	76.90	18.00	0.005	0.45	0.29	7.23	0.36	0.42	2.10	7.35	54.63	52.76	1.54	3.59
CB-6	IB-2	51.21	51.00	70.70	24.00	0.003	1.46	0.98	7.23	0.30	0.78	7.16	12.34	54.42	52.74	1.21	4.07
CB-9	CB-10	51.18	50.89	95.70	15.00	0.003	0.13	0.13	7.23	0.66	0.00	0.92	3.54	54.57	52.19	2.14	2.42
CB-10	CB-11	50.89	50.57	109.20	15.00	0.003	0.40	0.35	7.23	0.84	0.67	2.56	3.52	54.85	52.17	2.71	2.09
CB-11	IB-3	50.57	50.50	23.50	15.00	0.005	0.65	0.57	7.23	0.06	1.53	4.15	4.39	54.31	52.00	2.49	3.38
CB-15	SDMH-1/EX. CB #2	52.89	52.83	12.30	15.00	0.005	0.12	0.11	7.23	0.06	0.00	0.79	4.71	55.27	53.24	1.13	2.85
SDMH-1	EX. CB #1	52.83	52.45	135.30	15.00	0.003	0.12	0.11	7.23	1.08	0.07	0.79	3.32	55.47	53.24	1.39	2.22
EX. CB #1	EX. CB #3	51.68	50.78	66.30	15.00	0.014	0.33	0.33	7.23	0.18	1.15	2.39	7.55	55.55	52.30	2.62	5.45

< 2.5 fps

DATE: 10/14/2016
PROJECT: Shipyard Village Apartments
TITLE: 50-YR PIPE DESIGN AND HGL
MODEL: BENTLEY STORMCAD V8i SERIES 4

From (Inlet)	To (Outlet)	Invert (Inlet) (ft)	Invert (Outlet) (ft)	Length (ft)	Diameter (in)	Slope (ft/ft)	System Drainage Area (acres)	System CA (acres)	System Intensity (in/h)	Time (Pipe Flow) (min)	System Flow Time (min)	System Rational Flow (cfs)	Capacity (Full Flow) (cfs)	Rim Elevation (Inlet) (ft)	Hydraulic Grade Line (Inlet) (ft)	Inlet Cover (ft)	Velocity (ft/s)
CB-1	SDMH-2	51.94	51.71	75.70	15.00	0.003	0.09	0.08	8.866	0.54	0.00	0.74	3.56	57.19	52.43	4.00	2.29
SDMH-2	CB-14	51.71	51.45	85.70	15.00	0.003	0.09	0.08	8.866	0.60	0.55	0.74	3.55	57.55	52.40	4.59	2.28
CB-14	CB-13	51.45	51.26	66.10	15.00	0.003	0.17	0.15	8.866	0.42	1.18	1.38	3.51	56.00	52.39	3.30	2.68
CB-13	JB-2	51.26	51.22	12.10	15.00	0.003	0.32	0.28	8.866	0.06	1.58	2.47	3.65	55.67	52.36	3.16	3.19
CB-12	JB-2	51.27	51.22	11.00	15.00	0.005	0.56	0.40	8.866	0.06	0.00	3.60	4.40	55.66	52.37	3.14	4.00
JB-2	IT-1	51.22	51.00	71.90	24.00	0.019	0.95	0.74	8.866	0.00	1.65	6.06	30.78	56.20	52.35	2.98	7.62
CB-3	CB-4	51.82	51.47	115.60	15.00	0.003	0.18	0.16	8.866	1.68	0.00	1.44	3.54	55.49	52.86	2.42	2.73
CB-4	DI-1	51.47	51.05	143.60	18.00	0.004	0.71	0.54	8.866	0.84	0.71	4.82	6.39	54.90	52.80	1.93	3.64
DI-2	DI-1	54.00	52.60	52.60	15.00	0.025	0.15	0.08	8.866	0.18	0.00	0.73	10.20	57.70	54.33	2.45	4.81
DI-1	IT-1	51.05	51.00	28.10	24.00	0.003	0.97	0.68	8.866	0.12	1.35	6.03	12.35	57.28	52.50	4.23	3.91
CB-2	IB-1	53.38	53.25	40.40	18.00	0.003	0.40	0.34	8.866	0.84	0.00	3.01	10.92	57.50	56.28	2.62	0.85
CB-5	CB-6	51.62	51.21	82.70	18.00	0.005	0.61	0.42	8.866	0.36	0.00	3.73	7.38	54.83	52.85	1.71	4.19
CB-8	CB-7	51.98	51.59	78.20	15.00	0.005	0.21	0.17	8.866	0.42	0.00	1.48	4.55	55.08	52.83	1.85	3.31
CB-7	CB-6	51.59	51.21	76.90	18.00	0.005	0.45	0.29	8.866	0.36	0.40	2.53	7.35	54.63	52.81	1.54	3.77
CB-6	IB-2	51.21	51.00	70.70	24.00	0.003	1.46	0.98	8.866	0.30	0.74	8.74	12.34	54.42	52.77	1.21	4.26
CB-9	CB-10	51.18	50.89	95.70	15.00	0.003	0.13	0.13	8.866	0.60	0.0	1.13	3.54	55.96	52.32	3.53	2.56
CB-10	CB-11	50.89	50.57	109.20	15.00	0.003	0.40	0.35	8.866	0.72	0.6	3.15	3.52	54.85	52.29	2.71	2.56
CB-11	IB-3	50.57	50.50	23.50	15.00	0.005	0.65	0.57	8.866	0.06	1.3	5.09	4.39	54.31	52.03	2.49	4.14
CB-15	MH-1/EX. C	52.89	52.83	12.30	15.00	0.005	0.12	0.11	8.866	0.06	0.0	0.94	4.71	55.27	53.28	1.13	2.99
SDMH-1	EX. CB #1	52.83	52.45	135.30	15.00	0.003	0.12	0.11	8.866	1.02	0.1	0.94	3.32	55.47	53.29	1.39	2.32
EX. CB #1	EX. CB #3	51.68	50.78	66.30	15.00	0.014	0.33	0.33	8.866	0.18	1.1	2.93	7.55	55.80	52.37	2.87	5.77

Surcharge

DATE: 10/14/2016
PROJECT: Shipyard Village Apartments
TITLE: INLET SPREAD ANALYSIS (4 in/hr)
MODEL: BENTLEY STORMCAD V8i SERIES 4

Inlet	Inlet	Inlet Location	Longitudinal Slope (Inlet) (ft/ft)	Road Cross Slope (ft/ft)	Inlet Drainage Area (acres)	Inlet C	Local Intensity (in/h)	Local Rational Flow (cfs)	Flow (Captured) (cfs)	Bypassed Rational Flow (cfs)	Bypass Target	Elevation (Rim) (ft)	Catalog Gutter	Spread / Top Width (ft)	Depth (Gutter) (in)
CB-8	NCDOT 840.03 Curb Inlet	In Sag	N/A	0.02	0.19	0.77	7.23	1.05	1.05	0		54.57	COW SD 7-01	6.1	0.08
CB-9	NCDOT 840.03 Curb Inlet	In Sag	N/A	0.02	0.11	0.95	7.23	0.75	0.75	0		54.57	COW SD 7-01	4.9	0.07
CB-15	NCDOT 840.03 Curb Inlet	On Grade	0.5	0.02	0.12	0.98	4	0.47	0.46	0.01	EX. CB #1	55.27	COW SD 7-01	2.6	0.05

VII. RIPRAP APRON CALCULATIONS

ENERGY DISSIPATOR DESIGN WORKSHEET

PROJECT:
SHIPYARD VILLAGE APARTMENTS

DESCRIPTION:
RIP-RAP OUTLET ENERGY DISSIPATORS

ENGINEER: McKIM&CREED

PROJECT NO. 07010-0001

DATE PREPARED:
10/14/2016

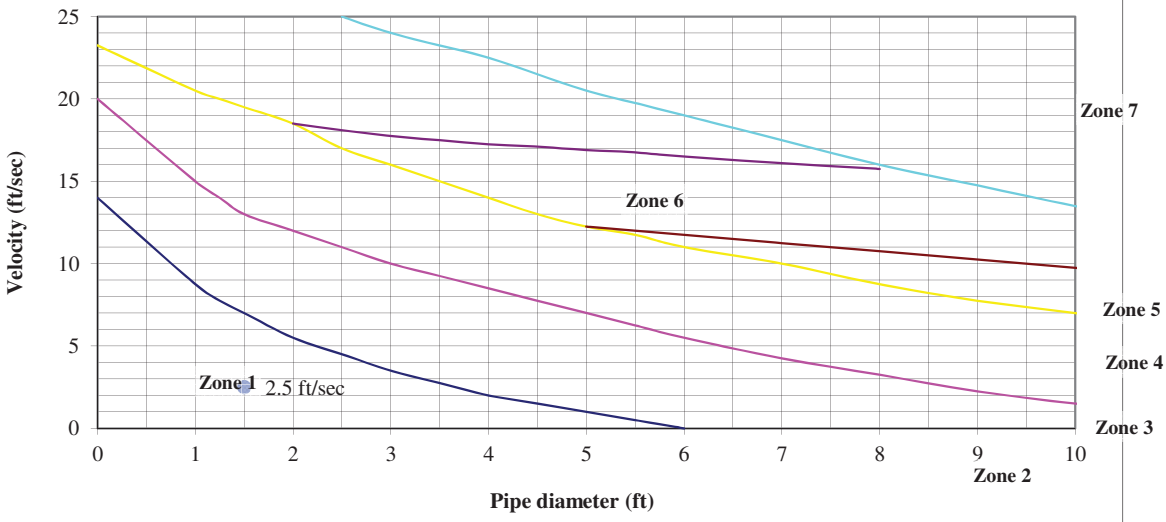
PREPARED FOR :
O-1

PREPARED BY :
TCM

REVIEWED BY :
RMC

Outlet flowrate	0.00	cfs
Pipe diameter	18	inches
Outlet pipe slope	0.52	percent
Des. flow velocity	2.50	ft/sec

Figure 8.06.b.1



Zone from graph above = 1

Outlet pipe diameter	18 in.	Length =	6.0 ft.	
Outlet flowrate	0.0 cfs	Width =	4.5 ft.	
Outlet velocity	2.5 ft/sec	Max. Stone Dia =	6 in.	d50 = 4"
Material =	Class A	Thickness =	9 in.	

Zone	Material	Max Stone Dia.	Thickness	Length	Width
1	Class A	6	9	4 x D(o)	3 x D(o)
2	Class B	12	18	6 x D(o)	3 x D(o)
3	Class I	17	26	8 x D(o)	3 x D(o)
4	Class II	23	35	10 x D(o)	3 x D(o)

Notes:
1. Calculations based on NY DOT method - Section 8.06.05 through 8.06.06 in NCDENR ESC Manual.

McKim Creed, Inc.
243 N Front Street
Wilmington, North Carolina 28401
(910) 343-1048

ENERGY DISSIPATOR DESIGN WORKSHEET

PROJECT:
SHIPYARD VILLAGE APARTMENTS

DESCRIPTION:
RIP-RAP OUTLET ENERGY DISSIPATORS

ENGINEER: McKIM&CREED

PROJECT NO. 07010-0001

DATE PREPARED:
10/14/2016

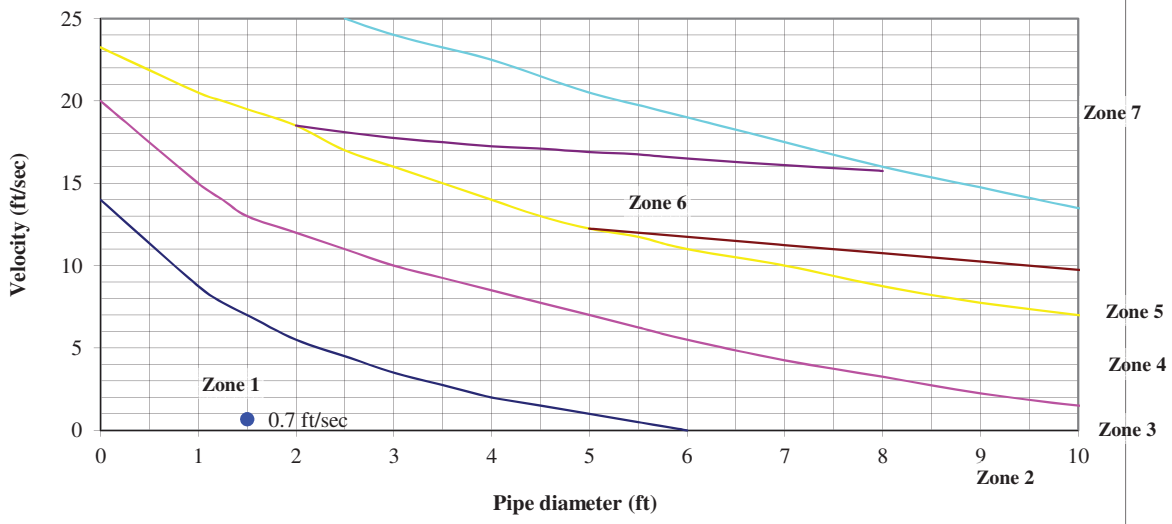
PREPARED FOR :
IB-1

PREPARED BY :
TCM

REVIEWED BY :
RMC

Outlet flowrate	2.46	cfs
Pipe diameter	18	inches
Outlet pipe slope	0.3	percent
Des. flow velocity	0.69	ft/sec

Figure 8.06.b.1



Zone from graph above = 1

Outlet pipe diameter	18 in.	Length =	6.0 ft.	
Outlet flowrate	2.5 cfs	Width =	4.5 ft.	
Outlet velocity	0.7 ft/sec	Max. Stone Dia =	6 in.	d50 = 4"
Material =	Class A	Thickness =	9 in.	

Zone	Material	Max Stone Dia.	Thickness	Length	Width
1	Class A	6	9	4 x D(o)	3 x D(o)
2	Class B	12	18	6 x D(o)	3 x D(o)
3	Class I	17	26	8 x D(o)	3 x D(o)
4	Class II	23	35	10 x D(o)	3 x D(o)

Notes:
1. Calculations based on NY DOT method - Section 8.06.05 through 8.06.06 in NCDENR ESC Manual.

McKim Creed, Inc.
243 N Front Street
Wilmington, North Carolina 28401
(910) 343-1048

ENERGY DISSIPATOR DESIGN WORKSHEET

PROJECT:
SHIPYARD VILLAGE APARTMENTS

DATE PREPARED:
10/14/2016

DESCRIPTION:
RIP-RAP OUTLET ENERGY DISSIPATORS

PREPARED FOR :
IB-2(1)

ENGINEER: McKIM&CREED

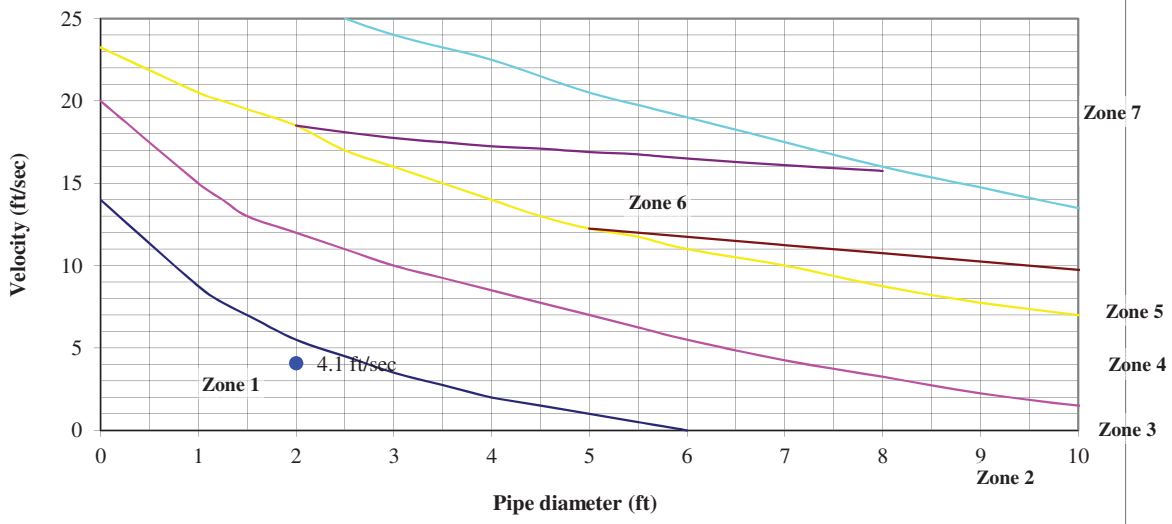
PREPARED BY :
TCM

REVIEWED BY :
RMC

PROJECT NO. 07010-0001

Outlet flowrate	3.58	cfs
Pipe diameter	24	inches
Outlet pipe slope	0.3	percent
Des. flow velocity	4.07	ft/sec

Figure 8.06.b.1



Zone from graph above = 1

Outlet pipe diameter	24 in.	Length =	8.0 ft.	
Outlet flowrate	3.6 cfs	Width =	6.0 ft.	
Outlet velocity	4.1 ft/sec	Max. Stone Dia =	6 in.	d50 = 4"
Material =	Class A	Thickness =	9 in.	

Zone	Material	Max Stone Dia.	Thickness	Length	Width
1	Class A	6	9	4 x D(o)	3 x D(o)
2	Class B	12	18	6 x D(o)	3 x D(o)
3	Class I	17	26	8 x D(o)	3 x D(o)
4	Class II	23	35	10 x D(o)	3 x D(o)

Notes:
1. Calculations based on NY DOT method - Section 8.06.05 through 8.06.06 in NCDENR ESC Manual.

McKim Creed, Inc.
243 N Front Street
Wilmington, North Carolina 28401
(910) 343-1048

ENERGY DISSIPATOR DESIGN WORKSHEET

PROJECT:
SHIPYARD VILLAGE APARTMENTS

DATE PREPARED:
10/14/2016

DESCRIPTION:
RIP-RAP OUTLET ENERGY DISSIPATORS

PREPARED FOR :
IB-2(2)

ENGINEER: McKIM&CREED

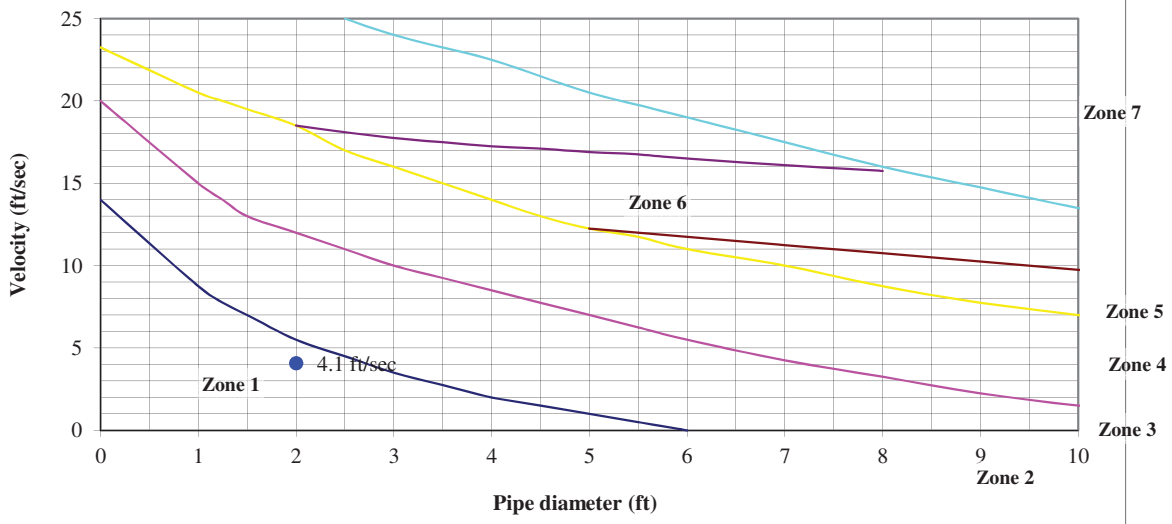
PREPARED BY :
TCM

REVIEWED BY :
RMC

PROJECT NO. 07010-0001

Outlet flowrate	3.58	cfs
Pipe diameter	24	inches
Outlet pipe slope	0.3	percent
Des. flow velocity	4.07	ft/sec

Figure 8.06.b.1



Zone from graph above = 1

Outlet pipe diameter	24 in.	Length =	8.0 ft.	
Outlet flowrate	3.6 cfs	Width =	6.0 ft.	
Outlet velocity	4.1 ft/sec	Max. Stone Dia =	6 in.	d50 = 4"
Material =	Class A	Thickness =	9 in.	

Zone	Material	Max Stone Dia.	Thickness	Length	Width
1	Class A	6	9	4 x D(o)	3 x D(o)
2	Class B	12	18	6 x D(o)	3 x D(o)
3	Class I	17	26	8 x D(o)	3 x D(o)
4	Class II	23	35	10 x D(o)	3 x D(o)

Notes:
1. Calculations based on NY DOT method - Section 8.06.05 through 8.06.06 in NCDENR ESC Manual.

McKim Creed, Inc.
243 N Front Street
Wilmington, North Carolina 28401
(910) 343-1048

ENERGY DISSIPATOR DESIGN WORKSHEET

PROJECT:
SHIPYARD VILLAGE APARTMENTS

DESCRIPTION:
RIP-RAP OUTLET ENERGY DISSIPATORS

ENGINEER: McKIM&CREED

PROJECT NO. 07010-0001

DATE PREPARED:
10/14/2016

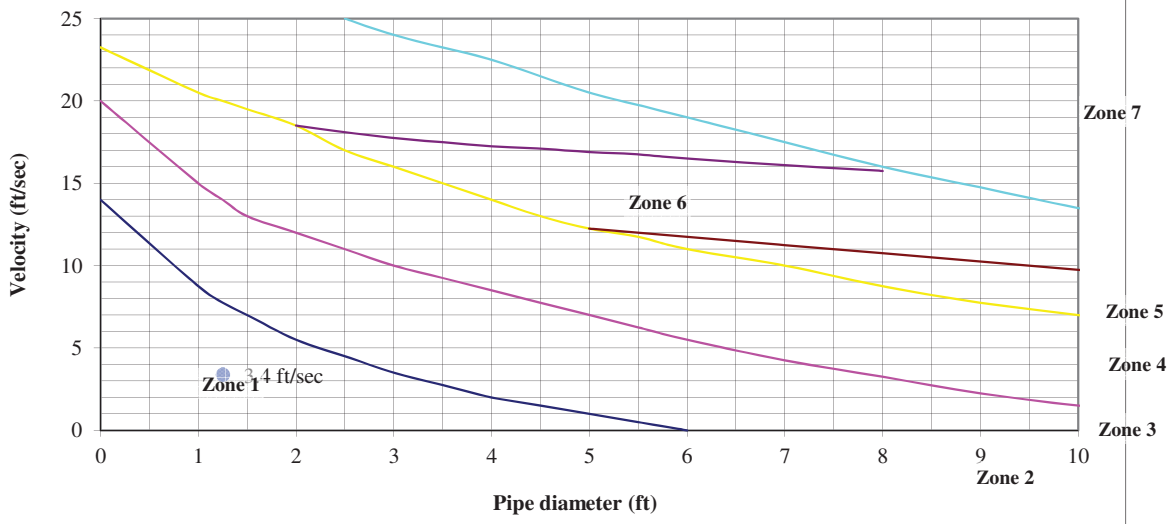
PREPARED FOR :
IB-3

PREPARED BY :
TCM

REVIEWED BY :
RMC

Outlet flowrate	4.15	cfs
Pipe diameter	15	inches
Outlet pipe slope	0.5	percent
Des. flow velocity	3.38	ft/sec

Figure 8.06.b.1



Zone from graph above = 1

Outlet pipe diameter	15 in.	Length =	5.0 ft.	
Outlet flowrate	4.2 cfs	Width =	3.8 ft.	
Outlet velocity	3.4 ft/sec	Max. Stone Dia =	6 in.	d50 = 4"
Material =	Class A	Thickness =	9 in.	

Zone	Material	Max Stone Dia.	Thickness	Length	Width
1	Class A	6	9	4 x D(o)	3 x D(o)
2	Class B	12	18	6 x D(o)	3 x D(o)
3	Class I	17	26	8 x D(o)	3 x D(o)
4	Class II	23	35	10 x D(o)	3 x D(o)

Notes:
1. Calculations based on NY DOT method - Section 8.06.05 through 8.06.06 in NCDENR ESC Manual.

McKim Creed, Inc.
243 N Front Street
Wilmington, North Carolina 28401
(910) 343-1048