PARKERS RIDGE

82 SCHOOL STREET
ROLESVILLE, NC 27571

STORMWATER MANAGEMENT
CALCULATIONS

PREPARED FOR:

LENNAR CORPORATION
11PP Perimeter Park Drive, Suite 112
Morrisville, NC 27560

PREPARED BY:

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Raleigh, NC 27607

03-05-2024

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INTRODUCTION

On behalf of our client, Lennar Corporation, BGE, Inc. (BGE) submits this Engineer's Report in support of Parker Ridge project. This report contains the approach and results of the stormwater design for the subject property. The subject property is located at 82 School Street in the Town of Rolesville (Town), North Carolina. The site is comprised of four (4) parcels identified by the following parcel identification numbers (PINs): 1758-98-8411, 1758-98-3710, 1758-88-4270 E, and 1758-88-4270 W. The project area is approximately 86.89-acre (see project aerial map).

EXISTING CONDITIONS

The existing site condition is primarily undeveloped and tree-covered with several existing ponds. The predominant soil types within the proposed limit of construction are Rawlings-Rion complex (RgD), Urban land (Ur), and Wake-Rolesville complex (WaD) as taken from the Web Soil Survey 2.1 – National Cooperative Soil Survey by NRCS).

For the western parcel most of the site drains to the stream that runs through the site and into the southwest corner shown as POA #1 on the Pre-Development Exhibit. For the east parcel most of the site drains into the existing pond located in the center of the east parcel and flows into Harris Creek exiting south of our site with a small portion draining to a more southern stream connection. These areas are shown on the Pre-Development Exhibit as POA#3 and POA#2. There is a large drainage area upstream of both the east and west that drains through the site. Most of these areas drain directly to the streams. The rest of the site runs off in smaller areas shown through POA #4, POA #5 and POA #6.

FLOODPLAIN, FLOODWAY AND WATERSHED

The proposed site does not lie within a 100-year floodplain boundary as determined by FEMA FIRM Panel(s): #3720176800K and #3720175800K dated July 18, 2022.

PROPOSED DEVELOPMENT

The overall proposed project will include the development of 114 attached townhouse lots and 161 single-family lots with associated infrastructure. The proposed impervious buildout for the development is as follows:

Table 1 Impervious Area

POST-DEVELOPMENT IMPERVIOUS AREAS		
PAVEMENT – ROADS & DRIVEWAYS	23.07	AC
SIDEWALK	3.35	AC
LOTS - TOWNHOMES	5.7	AC
LOTS - SINGLE-FAMILY (MAX.)	9.66	AC
TOTAL ONSITE IMPERVIOUS AREA:	41.78	AC

STORM DRAINAGE DESIGN

The existing topographic information was used to grade the property and identify the contributing drainage areas to the stormwater devices.

This project includes four (4) separate drainage systems that will drain to four (4) different proposed wet ponds located throughout the site. All four (4) of the proposed ponds will discharge to the existing Harris Creek located at the southern portion of both parcels. With Bypass also flowing into Harris Creek. The on-site storm sewer collection system was designed to capture and convey the 1-, 10-, and 25- year storm event for the proposed development. Per local design standards, the Rational Method and Manning's Equation will be used for the storm sewer system design utilizing AutoDesk's Hydraflow Storm Sewers software. A Manning's n value of 0.013 will be used for the reinforced concrete pipe and 0.024 for HDPE. Runoff coefficients (C) used for open space and impervious cover were 0.35 and 0.95, respectively. The starting HGL used for the 10 yr calculations is the 10 yr WSE for the detention pond, and the starting HGL for the 25 yr WSE for the 25 yr calculations.

WATER QUALITY

The proposed wet detention ponds (SCM's) have been designed based on the town's water quantity requirements to attenuate the post-development peak runoff rates for the 1-, 10-, and 25-year storm events to pre-developed rates. The ponds are designed with weirs to safely pass the 25-year storm event and provides a minimum of one foot of freeboard above the peak stage to the top of the embankment.

The pre-development drainage area that was established for the project area includes stormwater runoff that will be conveyed to 6 points of analysis (POA's). The post-development drainage area was established based on proposed grading conditions, where all stormwater is either conveyed into a pond, and into a post-POA. The curve numbers (CN) and time of concentration (Tc) for each drainage basin were calculated based on existing and proposed conditions using the TR-55 method. The 4 proposed ponds (SCM's) were analyzed with Hydraflow modeling software for verification that the proposed design meets the Town of Rolesville's and NCDEQ's minimum requirements. The Wake County Stormwater Design Tool was used for this project. DA #s 1 - 6 match the pre and post development maps. SCM 1 and SCM2 correlate to POA 1 and POA 2 respectively. However, SCM#s 3 and 4 both drain to POA 3. In addition, the offsite drainage for POA 1&2 includes existing drainage from Redford Place Drive while POA 3 includes offsite drainage from the future Young Street connector.

WATER QUANTITY

The proposed wet detention ponds (SCM's) have been designed based on both the NCDEQ's MDC and the town's water quantity requirements to attenuate the post-development peak runoff rates for the 1-, 10, and 25- year, 24-hour storm events. The post development flows are required to be less than the pre-developed rates by means of stormwater detention. The wet pond is designed to reduce the flows of each storm event mentioned above with a weir, the riser and an emergency spillway to safely pass the 25-year storm event.

The post-development drainage area was established based on existing and proposed site conditions. The curve numbers (CN) and time of concentration (Tc) for each drainage basin were calculated based on existing and proposed conditions using the TR-55 method. The 4 proposed ponds (SCM's) were

analyzed with Hydraflow modeling software for verification that the proposed design meets the Town of Rolesville and NCDEQ's minimum requirements. For the pre-development condition and the tree save areas, the curve # of roughly 77 was used while 80 was used for the open space (grass) and 98 was used for the impervious areas. Information on Peak Flow Analysis is available below in Table 2.

Table 2 Peak Flow Analysis

	Pre-Development (cfs)	Pre-Development (cfs)	Post-Development (cfs)	Post-Development (cfs)	% Change	% Change
POA #	**1-yr**	**10-yr**	**1-yr**	**10-yr**	**1-yr**	**10-yr**
POA #1	28.98	78.74	16.42	62.32	-43%	-21%
POA #2	28.42	72.37	3.552	40.35	-88%	-44%
POA #3	81.67	205.26	34.15	139.99	-58%	-32%
POA #4	11.33	30.47	1.562	4.134	-86%	-86%
POA #5	3.499	9.033	1.504	3.883	-57%	-57%
POA #6	1.689	4.418	1.03	2.659	-39%	-40%

SUMMARY

Based on the results of the stormwater models, all points of analysis are reduced in the post development condition. As a result, the proposed design meets the requirements for the Town of Rolesville and NCDEQ for stormwater conveyance, and stormwater treatment and detention. The stormwater detention information is as follows:

SCM #1

Drainage Area:	9.62 ac
Impervious Area:	5.13 ac
Average Pond Depth:	3.5 feet
Surface Area Required:	7305 sf
Surface Area Proposed:	8489 sf
1" Detention Volume:	18506 cf
Top of Dam El:	390 at 10' wide

SCM #2

Drainage Area:	21.79 ac
Impervious Area:	10.42 ac
Average Pond Depth:	3.5 feet
Surface Area Required:	19643 sf
Surface Area Proposed:	20384 sf
1" Detention Volume:	37997 cf
Top of Dam El:	357 at 10' wide

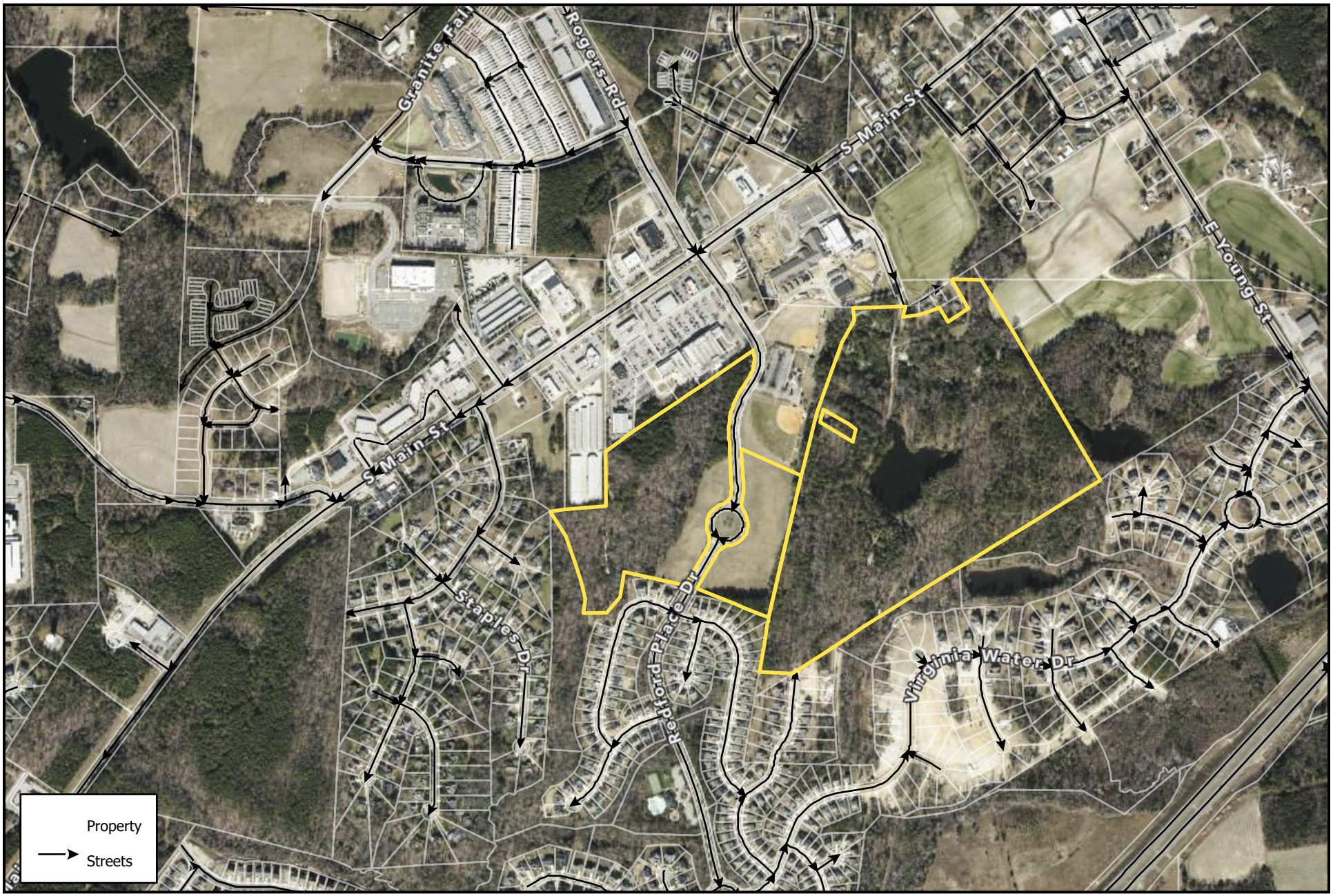
SCM #3

Drainage Area:	12.93 ac
Impervious Area:	4.53 ac
Average Pond Depth:	3.5 feet
Surface Area Required:	6850 sf
Surface Area Proposed:	11217 sf
1" Detention Volume:	17146 cf
Top of Dam El:	390 at 10' wide

SCM #4

Drainage Area:	9.78 ac
Impervious Area:	4.45 ac
Average Pond Depth:	3.5 feet
Surface Area Required:	8678 sf
Surface Area Proposed:	14636 sf
1" Detention Volume:	16313 cf
Top of Dam El:	386 at 10' wide

ATTACHMENT 1: PROJECT AERIAL MAP



N

0 400 800 1600 ft

1 inch equals 800 feet

Disclaimer

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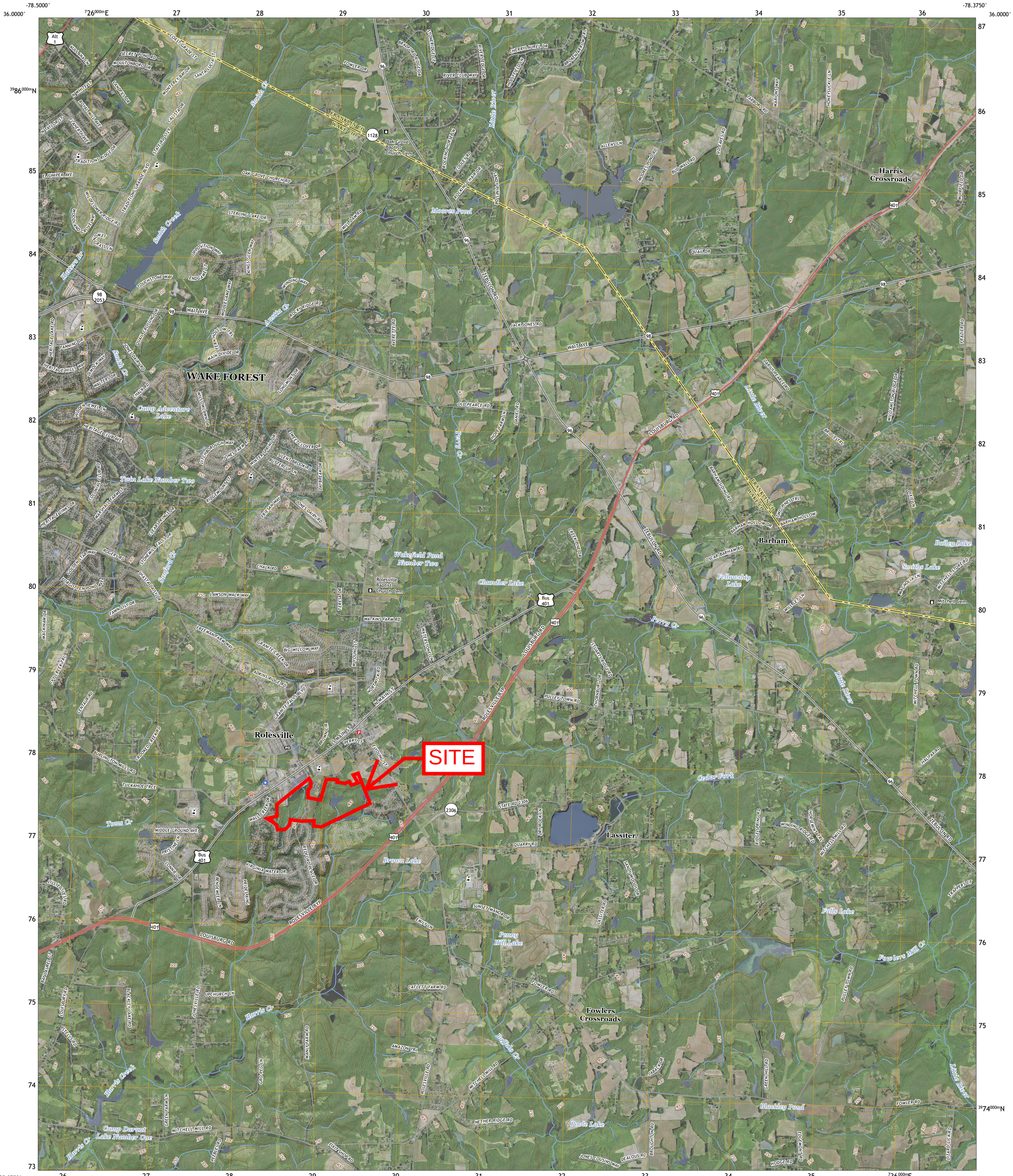
ATTACHMENT 2: USGS TOPO MAP

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

The National Map US Topo

ROLESVILLE QUADRANGLE
NORTH CAROLINA
7.5-MINUTE SERIES



Produced by the United States Geological Survey
North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and
1 000-meter grid:Universal Transverse Mercator, Zone 17S

This map is not a legal document. Boundaries may be generalized for this map scale. Private lands within government reservations may not be shown. Obtain permission before entering private lands.

Imagery	NAIP,	July 2020 - July 2020
Roads	U.S. Census Bureau,	2016
Names	GNIS,	1980 - 2022
Hydrography	National Hydrography Dataset,	2001 - 2021
Contours	National Elevation Dataset,	2008
Boundaries	Multiple sources; see metadata file	2019 - 2021
Wetlands	FWS National Wetlands Inventory	Not Available

MN
GN
9°23′ 167 MILS
1½° 27 MILS
UTM GRID AND 2019 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

U.S. National Grid
100,000 - m Square ID
QV
Grid Zone Designation 17S

SCALE 1:24 000

1 0.5 0 KILOMETERS 1 2
1000 500 0 METERS 1000 2000
1 0.5 0 MILES 1
1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000 FEET

CONTOUR INTERVAL 10 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

This map was produced to conform with the National Geospatial Program US Topo Product Standard.

NORTH CAROLINA
QUADRANGLE LOCATION

1	2	3
4		5
6	7	8

ADJOINING QUADRANGLES
1 Grissom
2 Franklinton
3 Louisburg
4 Wake Forest
5 Bunn West
6 Raleigh East
7 Knightdale
8 Zebulon

ROAD CLASSIFICATION
Expressway
Secondary Hwy
Ramp
Local Connector
Local Road
4WD
Interstate Route
US Route
State Route

ROLESVILLE, NC
2022

NSN 7643016379170
NGA REF NO. USGSX24K38453

ATTACHMENT 3: SOIL SURVEY REPORT

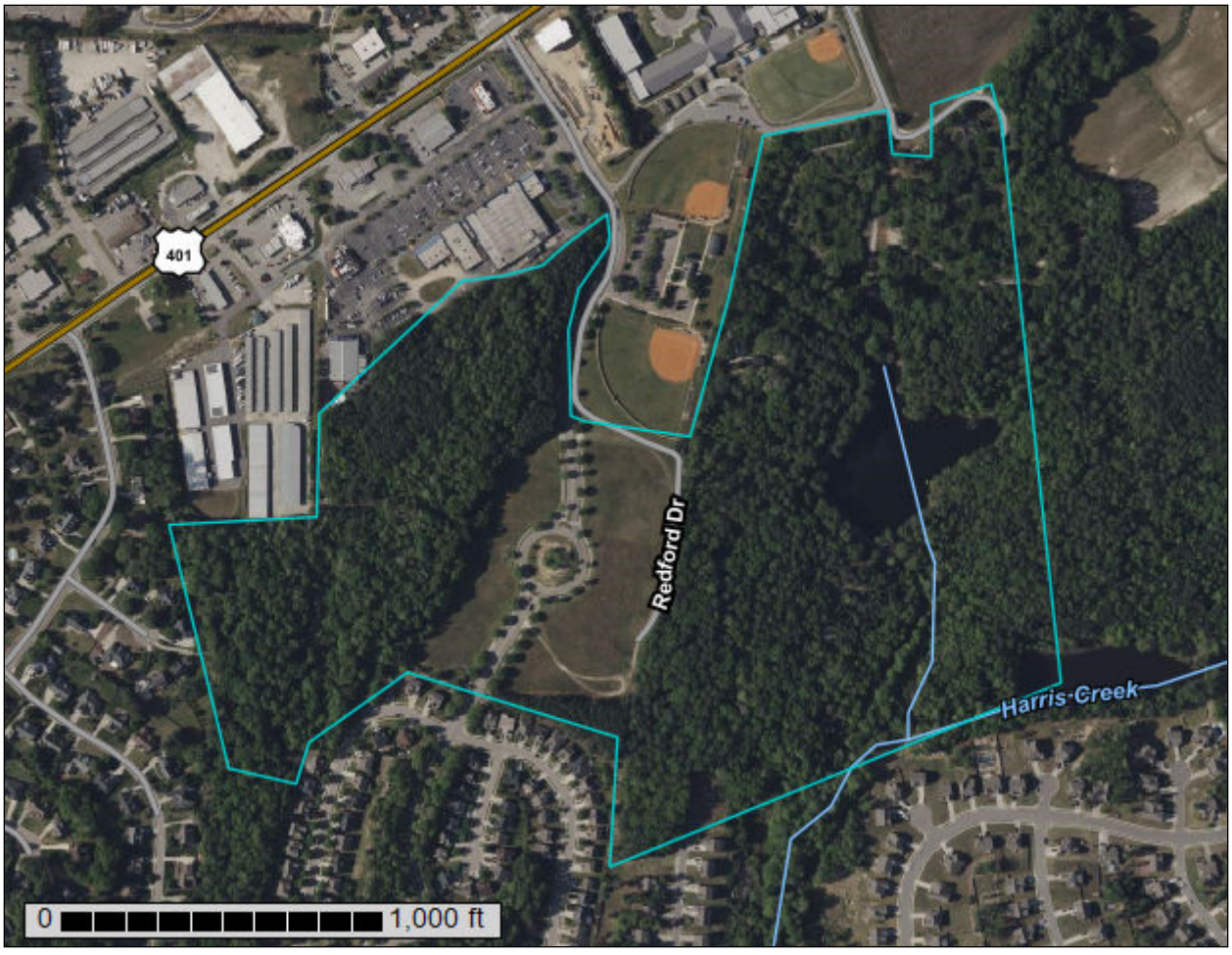
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Wake County, North Carolina



March 29, 2023

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:6,270 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 300 600 1200 1800

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N 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 1:24,000.

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:
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: Wake County, North Carolina
Survey Area Data: Version 23, Sep 12, 2022

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

Date(s) aerial images were photographed: Apr 24, 2022—May 9, 2022

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

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
HeB	Helena sandy loam, 2 to 6 percent slopes	11.1	13.2%
RgB	Rawlings-Rion complex, 2 to 6 percent slopes	6.1	7.2%
RgC	Rawlings-Rion complex, 6 to 10 percent slopes	0.6	0.7%
RgD	Rawlings-Rion complex, 10 to 15 percent slopes	17.4	20.5%
Ur	Urban land	16.4	19.4%
W	Water	3.9	4.6%
WaD	Wake-Rolesville complex, 10 to 15 percent slopes, very rocky	13.4	15.8%
WaE	Wake-Rolesville complex, 15 to 25 percent slopes, very rocky	11.6	13.7%
WfB	Wedowee-Saw complex, 2 to 6 percent slopes	1.2	1.4%
WgB	Wedowee-Urban land complex, 2 to 6 percent slopes	2.8	3.4%
WgC	Wedowee-Urban land complex, 6 to 15 percent slopes	0.1	0.2%
Totals for Area of Interest		**84.7**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties

and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Wake County, North Carolina

HeB—Helena sandy loam, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: 2qqgq
Elevation: 70 to 560 feet
Mean annual precipitation: 39 to 47 inches
Mean annual air temperature: 55 to 63 degrees F
Frost-free period: 200 to 250 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Helena and similar soils: 92 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Helena

Setting

Landform: Interfluves
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from granite and gneiss

Typical profile

Ap - 0 to 12 inches: sandy loam
BE - 12 to 19 inches: sandy clay loam
Bt1 - 19 to 39 inches: clay
Bt2 - 39 to 43 inches: clay loam
BCg - 43 to 46 inches: clay loam
C - 46 to 80 inches: sandy loam

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 8.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: D
Ecological site: F136XY810SC - Acidic upland forest, seasonally wet
Hydric soil rating: No

RgB—Rawlings-Rion complex, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: 2xhb9
Elevation: 70 to 560 feet
Mean annual precipitation: 39 to 47 inches
Mean annual air temperature: 55 to 63 degrees F
Frost-free period: 200 to 250 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Rawlings and similar soils: 55 percent
Rion and similar soils: 35 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rawlings

Setting

Landform: Interfluves
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from granite

Typical profile

Ap - 0 to 8 inches: sandy loam
Bt - 8 to 20 inches: sandy clay loam
C - 20 to 40 inches: gravelly sandy loam
R - 40 to 80 inches: bedrock

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: F136XY830NC - Acidic upland forest, dry-moist
Hydric soil rating: No

Description of Rion

Setting

Landform: Interfluves
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Saprolite derived from granite and gneiss

Typical profile

Ap - 0 to 8 inches: sandy loam
Bt1 - 8 to 17 inches: sandy clay loam
Bt2 - 17 to 38 inches: sandy loam
C - 38 to 80 inches: sandy loam

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Ecological site: F136XY820GA - Acidic upland forest, moist
Hydric soil rating: No

RgC—Rawlings-Rion complex, 6 to 10 percent slopes

Map Unit Setting

National map unit symbol: 2xhbb
Elevation: 70 to 560 feet
Mean annual precipitation: 39 to 47 inches
Mean annual air temperature: 55 to 63 degrees F
Frost-free period: 200 to 250 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Rawlings and similar soils: 55 percent
Rion and similar soils: 35 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rawlings

Setting

Landform: Interfluves
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from granite

Typical profile

Ap - 0 to 8 inches: sandy loam
Bt - 8 to 20 inches: sandy clay loam
C - 20 to 40 inches: gravelly sandy loam
R - 40 to 80 inches: bedrock

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: F136XY830NC - Acidic upland forest, dry-moist
Hydric soil rating: No

Description of Rion

Setting

Landform: Interfluves
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Saprolite derived from granite and gneiss

Typical profile

Ap - 0 to 8 inches: sandy loam
Bt1 - 8 to 17 inches: sandy clay loam
Bt2 - 17 to 38 inches: sandy loam
C - 38 to 80 inches: sandy loam

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches

Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: F136XY820GA - Acidic upland forest, moist
Hydric soil rating: No

RgD—Rawlings-Rion complex, 10 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2xhb8
Elevation: 70 to 560 feet
Mean annual precipitation: 39 to 47 inches
Mean annual air temperature: 55 to 63 degrees F
Frost-free period: 200 to 250 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Rawlings and similar soils: 55 percent
Rion and similar soils: 35 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rawlings

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from granite

Typical profile

Ap - 0 to 8 inches: sandy loam
Bt - 8 to 20 inches: sandy clay loam
C - 20 to 40 inches: gravelly sandy loam
R - 40 to 80 inches: bedrock

Properties and qualities

Slope: 10 to 15 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Available water supply, 0 to 60 inches: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: F136XY830NC - Acidic upland forest, dry-moist
Hydric soil rating: No

Description of Rion

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Saprolite derived from granite and gneiss

Typical profile

Ap - 0 to 8 inches: sandy loam
Bt1 - 8 to 17 inches: sandy clay loam
Bt2 - 17 to 38 inches: sandy loam
C - 38 to 80 inches: sandy loam

Properties and qualities

Slope: 10 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: F136XY820GA - Acidic upland forest, moist
Hydric soil rating: No

Ur—Urban land

Map Unit Setting

National map unit symbol: 2qwpc
Elevation: 70 to 1,400 feet
Mean annual precipitation: 39 to 51 inches
Mean annual air temperature: 54 to 63 degrees F
Frost-free period: 190 to 250 days

Farmland classification: Not prime farmland

Map Unit Composition
Urban land: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting
Parent material: Impervious layers over human-transported material

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: No

W—Water

Map Unit Setting
National map unit symbol: 2qqjv
Elevation: 70 to 450 feet
Mean annual precipitation: 39 to 51 inches
Mean annual air temperature: 55 to 63 degrees F
Frost-free period: 200 to 250 days
Farmland classification: Not prime farmland

Map Unit Composition
Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Water

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: No

WaD—Wake-Rolesville complex, 10 to 15 percent slopes, very rocky

Map Unit Setting
National map unit symbol: 2xhbf
Elevation: 70 to 560 feet
Mean annual precipitation: 39 to 47 inches
Mean annual air temperature: 55 to 63 degrees F
Frost-free period: 200 to 250 days
Farmland classification: Not prime farmland

Map Unit Composition

Wake, very rocky, and similar soils: 50 percent
Rolesville, very rocky, and similar soils: 40 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wake, Very Rocky

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from granite and gneiss

Typical profile

Ap - 0 to 7 inches: gravelly loamy coarse sand
C - 7 to 11 inches: gravelly loamy sand
R - 11 to 80 inches: bedrock

Properties and qualities

Slope: 10 to 15 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Drainage class: Excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to low (0.00 to 0.01 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 1.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: D
Ecological site: F136XY870GA - Outer piedmont acidic upland woodlands and glades, dry
Hydric soil rating: No

Description of Rolesville, Very Rocky

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from granite and gneiss

Typical profile

Ap - 0 to 12 inches: loamy sand
Bw - 12 to 26 inches: loamy sand
C - 26 to 32 inches: loamy coarse sand
Cr - 32 to 38 inches: bedrock
R - 38 to 80 inches: bedrock

Properties and qualities

Slope: 10 to 15 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock; 20 to 80 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to low (0.00 to 0.01 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 6.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Ecological site: F136XY870GA - Outer piedmont acidic upland woodlands and glades, dry
Hydric soil rating: No

WaE—Wake-Rolesville complex, 15 to 25 percent slopes, very rocky

Map Unit Setting

National map unit symbol: 2xhbg
Elevation: 70 to 560 feet
Mean annual precipitation: 39 to 47 inches
Mean annual air temperature: 55 to 63 degrees F
Frost-free period: 200 to 250 days
Farmland classification: Not prime farmland

Map Unit Composition

Wake, very rocky, and similar soils: 50 percent
Rolesville, very rocky, and similar soils: 40 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wake, Very Rocky

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from granite and gneiss

Typical profile

Ap - 0 to 7 inches: gravelly loamy coarse sand
C - 7 to 11 inches: gravelly loamy sand
R - 11 to 80 inches: bedrock

Properties and qualities

Slope: 15 to 25 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Drainage class: Excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to low (0.00 to 0.01 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 1.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: D
Ecological site: F136XY870GA - Outer piedmont acidic upland woodlands and glades, dry
Hydric soil rating: No

Description of Rolesville, Very Rocky

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from granite and gneiss

Typical profile

Ap - 0 to 12 inches: loamy sand
Bw - 12 to 26 inches: loamy sand
C - 26 to 32 inches: loamy coarse sand
Cr - 32 to 38 inches: bedrock
R - 38 to 80 inches: bedrock

Properties and qualities

Slope: 15 to 25 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock; 20 to 80 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to low (0.00 to 0.01 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 6.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: F136XY870GA - Outer piedmont acidic upland woodlands and glades, dry
Hydric soil rating: No

WfB—Wedowee-Saw complex, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: 2xn42
Elevation: 70 to 560 feet
Mean annual precipitation: 39 to 47 inches
Mean annual air temperature: 55 to 63 degrees F
Frost-free period: 200 to 250 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Wedowee and similar soils: 60 percent
Saw and similar soils: 35 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wedowee

Setting

Landform: Interfluves
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Saprolite residuum weathered from granite and gneiss and/or saprolite residuum weathered from schist

Typical profile

Ap - 0 to 4 inches: sandy loam
E - 4 to 7 inches: sandy loam
BC - 23 to 35 inches: clay loam
C - 35 to 80 inches: sandy clay loam

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 6.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Ecological site: F136XY820GA - Acidic upland forest, moist
Hydric soil rating: No

Description of Saw

Setting

Landform: Interfluves
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from granite and gneiss

Typical profile

Ap - 0 to 8 inches: sandy loam
Bt - 8 to 20 inches: clay
BC - 20 to 26 inches: sandy clay loam
C - 26 to 29 inches: sandy loam
R - 29 to 80 inches: bedrock

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to low (0.00 to 0.01 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: F136XY830NC - Acidic upland forest, dry-moist
Hydric soil rating: No

WgB—Wedowee-Urban land complex, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: 2xn43
Elevation: 70 to 560 feet
Mean annual precipitation: 39 to 47 inches
Mean annual air temperature: 55 to 63 degrees F
Frost-free period: 200 to 250 days
Farmland classification: Not prime farmland

Map Unit Composition

Wedowee and similar soils: 55 percent
Urban land: 40 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wedowee

Setting

Landform: Interfluves
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Saprolite residuum weathered from granite and gneiss and/or saprolite residuum weathered from schist

Typical profile

Ap - 0 to 4 inches: sandy loam
E - 4 to 7 inches: sandy loam
BC - 23 to 35 inches: clay loam
C - 35 to 80 inches: sandy clay loam

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 6.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Ecological site: F136XY820GA - Acidic upland forest, moist
Hydric soil rating: No

Description of Urban Land

Setting

Parent material: Impervious layers over human transported material

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: No

WgC—Wedowee-Urban land complex, 6 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2xn44
Elevation: 70 to 560 feet
Mean annual precipitation: 39 to 47 inches

Mean annual air temperature: 55 to 63 degrees F
Frost-free period: 200 to 250 days
Farmland classification: Not prime farmland

Map Unit Composition

Wedowee and similar soils: 55 percent
Urban land: 40 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wedowee

Setting

Landform: Interfluves
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Saprolite residuum weathered from granite and gneiss and/or saprolite residuum weathered from schist

Typical profile

Ap - 0 to 4 inches: sandy loam
E - 4 to 7 inches: sandy loam
BC - 23 to 35 inches: clay loam
C - 35 to 80 inches: sandy clay loam

Properties and qualities

Slope: 6 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 6.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: F136XY820GA - Acidic upland forest, moist
Hydric soil rating: No

Description of Urban Land

Setting

Parent material: Impervious layers over human transported material

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: No

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

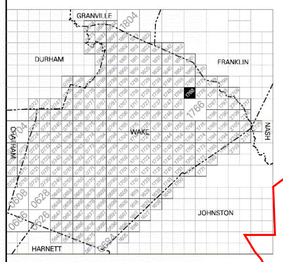
United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

ATTACHMENT 4: FEMA FLOOD MAP

STATE OF NORTH CAROLINA FIRM PANEL LOCATOR DIAGRAM



DATUM INFORMATION

The **projection** used in the preparation of this map was the North Carolina State Plane (FIPSZONE 3200). The **horizontal datum** was the North American Datum of 1983, GRS80 ellipsoid. Differences in datum, ellipsoid, projection, or Universal Transverse Mercator zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdictional boundaries. These differences do not affect the accuracy of this FIRM. All coordinates on this map are in U.S. Survey Feet, where 1 U.S. Survey Foot = 1200/3937 Meters.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988 (NAVD 88). These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. An average offset between NAVD 88 and the National Geodetic Vertical Datum of 1929 (NGVD 29) has been computed for each North Carolina county. This offset was then applied to the NGVD 29 flood elevations that were not revised during the creation of this statewide format FIRM. The offsets for each county shown on this FIRM panel are shown in the vertical datum offset table below. Where a county boundary and a flooding source with unrevised NGVD 29 flood elevations are coincident, an individual offset has been calculated and applied during the creation of this statewide format FIRM. See Section 6.1 of the accompanying Flood Insurance Study report to obtain further information on the conversion of elevations between NAVD 88 and NGVD 29. To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the North Carolina Geodetic Survey at the address shown below. You may also contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242**, or visit its website at www.ngs.noaa.gov.

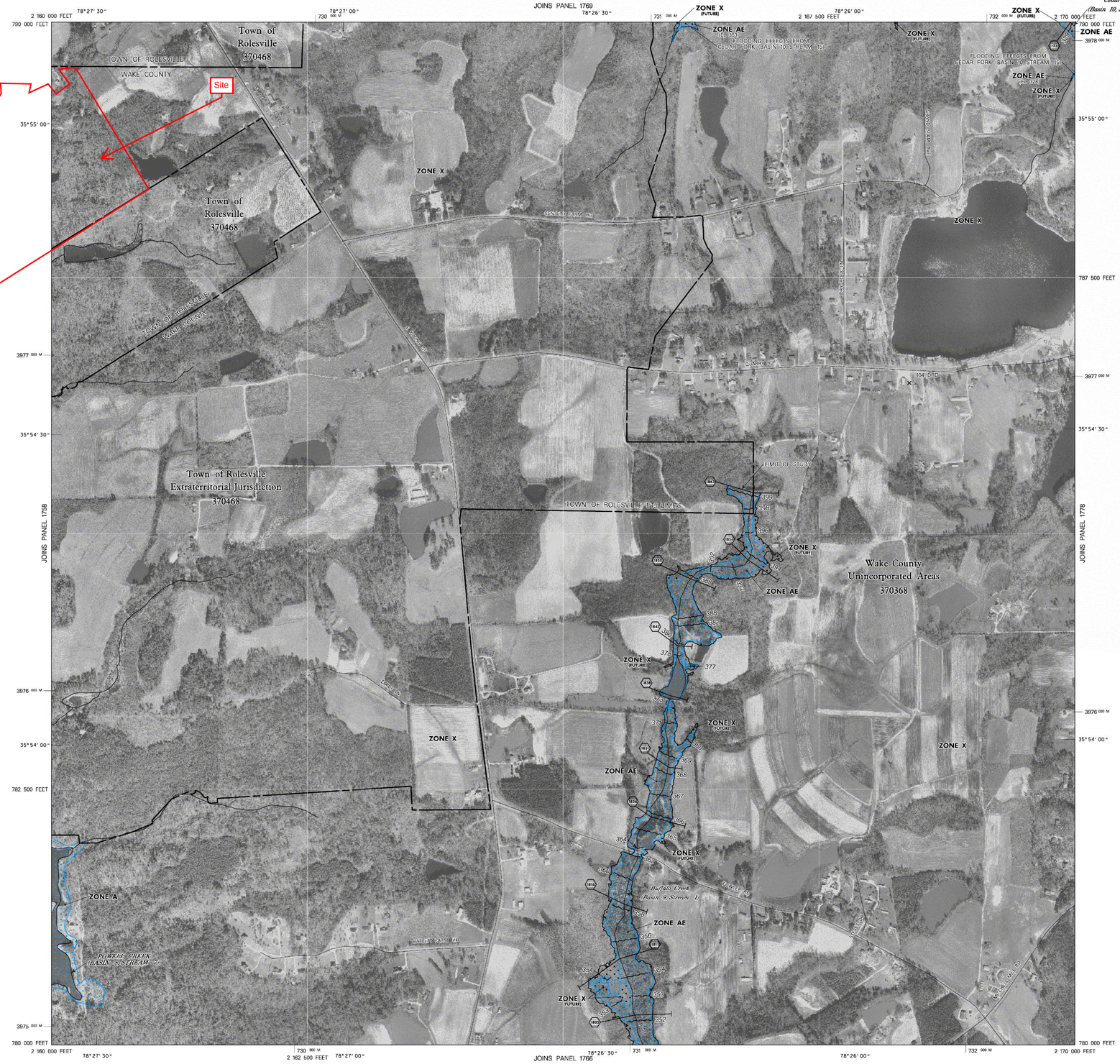
North Carolina Geodetic Survey
121 West Jones Street
Raleigh, NC 27601
(919) 733-3836
www.ncgs.state.nc.us

County Average Vertical Datum Offset Table

County	Vertical Datum Offset (ft)
Wake	– 0.88

Example: NAVD 88 = NGVD 29 + (–0.88)

All streams listed in the **Flood Hazard Data Table** below were studied by detailed methods using field survey. Other flood hazard data shown on this map may have been derived using either a coastal analysis or limited detailed riverine analysis. More information on the flooding sources studied by these analyses is contained in the Flood Insurance Study report.



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

- **ZONE A** No Base Flood Elevations determined.
- **ZONE AE** Base Flood Elevations determined.
- **ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
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- **ZONE AR** Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
- **ZONE A99** Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
- **ZONE VE** Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

- **ZONE X** Areas of 0.2% annual chance flood; areas of future conditions 1% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

- **ZONE X** Areas determined to be outside the 0.2% annual chance and future conditions 1% annual chance floodplain.
- **ZONE D** Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- 1% annual chance floodplain boundary
- 0.2% annual chance floodplain boundary and future conditions 1% annual chance floodplain boundary
- Floodway boundary
- Zone D Boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
- 513 Base Flood Elevation line and value; elevation in feet*
- (EL. 987) Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

- Cross section line
- Transect line
- 97°07' 30", 32°22' 30" Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
- 4278 000 M 1000-meter Universal Transverse Mercator grid ticks, zone 17
- 1 477 500 FEET 2500-foot grid values: North Carolina State Plane coordinate system (FIPSZONE 3200, State Plane NAD 83 feet)
- BM5510 North Carolina Geodetic Survey bench mark (see explanation in the Datum Information section of this FIRM panel).
- BM5510 National Geodetic Survey bench mark (see explanation in the Datum Information section of this FIRM panel).
- M1.5 River Mile

GRID NORTH

MAP SCALE 1" = 500' (1 : 6,000)
250 0 500 1000 FEET
150 0 150 300 METERS

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MAP REPOSITORY
Refer to listing of Map Repositories on Map Index or visit www.ncfloodmaps.com.

EFFECTIVE DATE OF FLOOD INSURANCE RATE MAP PANEL
MAY 2, 2006

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to statewide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent, the North Carolina Division of Emergency Management or the National Flood Insurance Program at the following phone numbers or websites:

NC Division of Emergency Management (919) 715-8000 www.nccrimecontrol.org/nfip
National Flood Insurance Program 1-800-638-6620 www.fema.gov/nfip

NORTH CAROLINA Cooperating Technical State
FEMA'S COOPERATING TECHNICAL PARTNER

This digital Flood Insurance Rate Map (FIRM) was produced through a unique cooperative partnership between the State of North Carolina and the Federal Emergency Management Agency (FEMA). The State of North Carolina has implemented a long term approach of floodplain management to decrease the costs associated with flooding. This is demonstrated by the State's commitment to map floodplain areas at the local level. As a part of this effort, the State of North Carolina has joined in a Cooperating Technical State agreement with FEMA to produce and maintain this digital FIRM.

www.ncfloodmaps.com

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1768J

FIRM
FLOOD INSURANCE RATE MAP
NORTH CAROLINA

PANEL 1768

(SEE LOCATOR DIAGRAM OR MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	CID No.	PANEL	SUFFIX
ROLESVILLE, TOWN OF	370468	1768	J
WAKE COUNTY	370368	1768	J

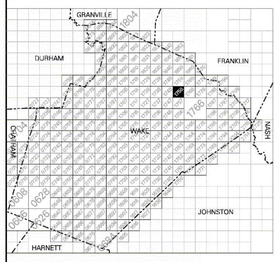
Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

EFFECTIVE DATE
MAY 2, 2006

MAP NUMBER
3720176800J

State of North Carolina
Federal Emergency Management Agency

STATE OF NORTH CAROLINA FIRM PANEL LOCATOR DIAGRAM



DATUM INFORMATION

The **projection** used in the preparation of this map was the North Carolina State Plane (FIPSZONE 3200). The **horizontal datum** was the North American Datum of 1983, GRS80 ellipsoid. Differences in datum, ellipsoid, projection, or Universal Transverse Mercator zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdictional boundaries. These differences do not affect the accuracy of this FIRM. All coordinates on this map are in U.S. Survey Feet, where 1 U.S. Survey Foot = 1200/3937 Meters.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988 (NAVD 88). These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. An average offset between NAVD 88 and the National Geodetic Vertical Datum of 1929 (NGVD 29) has been computed for each North Carolina county. This offset was then applied to the NGVD 29 flood elevations that were not revised during the creation of this statewide format FIRM. The offsets for each county shown on this FIRM panel are shown in the vertical datum offset table below. Where a county boundary and a flooding source with unrevised NGVD 29 flood elevations are coincident, an individual offset has been calculated and applied during the creation of this statewide format FIRM. See Section 6.1 of the accompanying Flood Insurance Study report to obtain further information on the conversion of elevations between NAVD 88 and NGVD 29. To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the North Carolina Geodetic Survey at the address shown below. You may also contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242**, or visit its website at www.ngs.noaa.gov.

North Carolina Geodetic Survey
121 West Jones Street
Raleigh, NC 27601
(919) 733-3836
www.ncgs.state.nc.us

County Average Vertical Datum Offset Table

County	Vertical Datum Offset (ft)
Wake	– 0.88

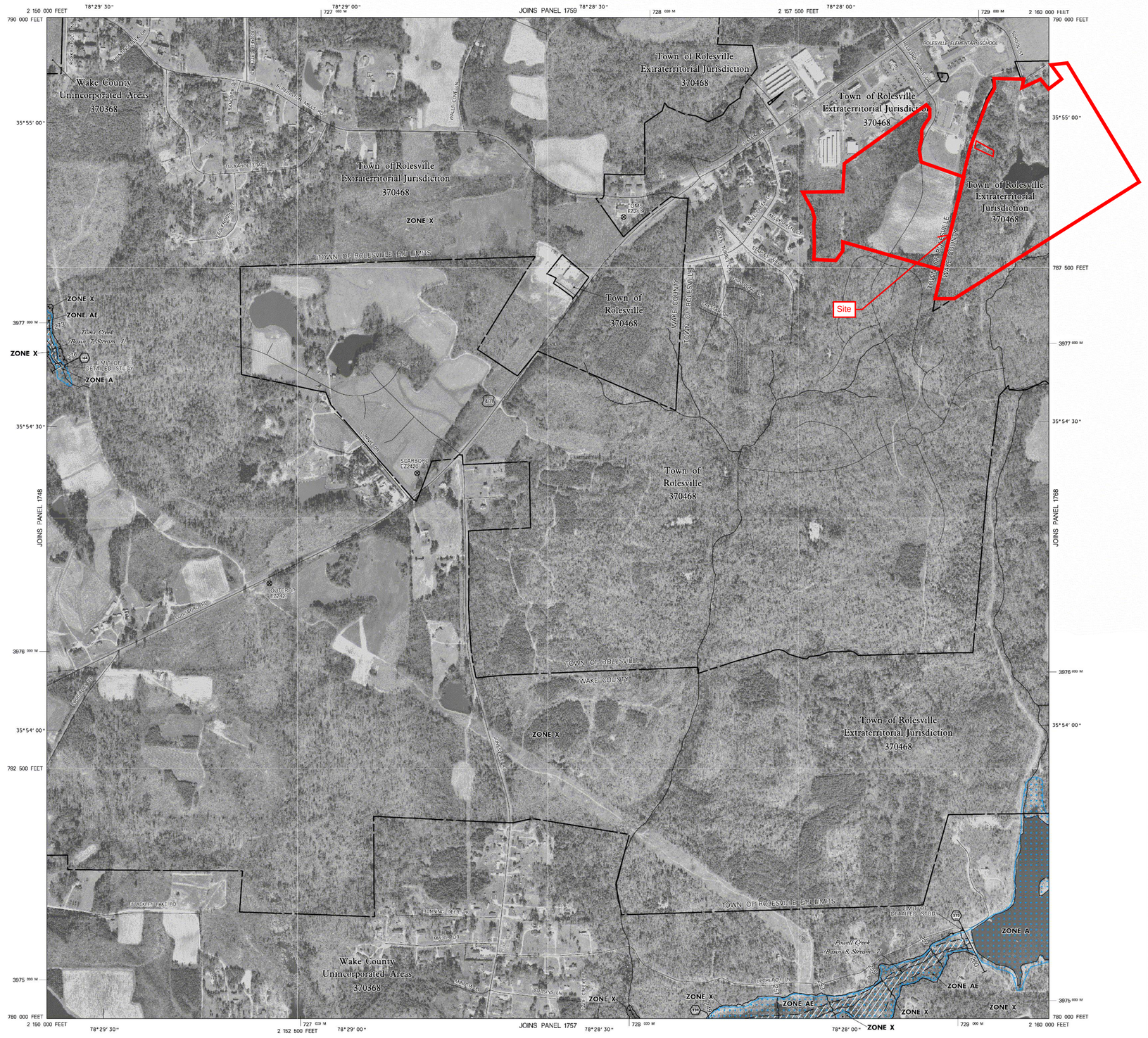
Example: NAVD 88 = NGVD 29 + (–0.88)

All streams listed in the **Flood Hazard Data Table** below were studied by detailed methods using field survey. Other flood hazard data shown on this map may have been derived using either a coastal analysis or limited detailed riverine analysis. More information on the flooding sources studied by these analyses is contained in the Flood Insurance Study report.

FLOOD HAZARD DATA TABLE

Cross Section	Stream Station	Flood Discharge (cfs)	1% Annual Chance (100-year) Water-Surface Elevation (feet NAVD 88)	Floodway Width (feet) Left/Right Distance From the Center of Stream to Encroachment Boundary (Looking Downstream) or Total Floodway Width
TOMS CREEK (BASIN 7, STREAM 1)				
164	16,350[1]	NA	275.5	50
POWELL CREEK (BASIN 8, STREAM 7)				
239	23,890[2]	NA	248.7	120
272	27,200[2]	NA	259.9	110

[1] Feet above confluence with Neuse River (Basin 15, Stream 1)
[2] Feet above confluence with Hodges Creek (Basin 8, Stream 1)



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

- **ZONE A** No Base Flood Elevations determined.
- **ZONE AE** Base Flood Elevations determined.
- **ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
- **ZONE AO** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- **ZONE AR** Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
- **ZONE A99** Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
- **ZONE VE** Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

- **ZONE X** Areas of 0.2% annual chance flood; areas of future conditions 1% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

- **ZONE X** Areas determined to be outside the 0.2% annual chance and future conditions 1% annual chance floodplain.
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COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- 1% annual chance floodplain boundary
- 0.2% annual chance floodplain boundary and future conditions 1% annual chance floodplain boundary
- Floodway boundary
- Zone D Boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
- 513 — Base Flood Elevation line and value; elevation in feet*
- (EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

- (23) — Cross section line
- 23 — 23 — Transect line
- 97°07' 30", 32°22' 30" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
- 4278000 M — 1000-meter Universal Transverse Mercator grid ticks, zone 17
- 1 477 500 FEET — 2500-foot grid values: North Carolina State Plane coordinate system (FIPSZONE 3200, State Plane NAD 83 feet)
- BM5510 — North Carolina Geodetic Survey bench mark (see explanation in the Datum Information section of this FIRM panel).
- BM5510 — National Geodetic Survey bench mark (see explanation in the Datum Information section of this FIRM panel).
- M1.5 — River Mile

GRID NORTH

MAP SCALE 1" = 500' (1 : 6,000)
250 0 500 1000 FEET
150 0 150 300 METERS

PANEL 1758J

FIRM
FLOOD INSURANCE RATE MAP
NORTH CAROLINA

PANEL 1758

(SEE LOCATOR DIAGRAM OR MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	CID No.	PANEL	SUFFIX
ROLESVILLE, TOWN OF	370468	1758	J
WAKE COUNTY	370368	1758	J

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EFFECTIVE DATE
MAY 2, 2006

MAP NUMBER
3720175800J

State of North Carolina
Federal Emergency Management Agency

NATIONAL FLOOD INSURANCE PROGRAM

NORTH CAROLINA Cooperating Technical State
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An accompanying Flood Insurance Study report, Letter of Map Revision (LOMR) or Letter of Map Amendment (LOMA) revising portions of this panel, and digital versions of this FIRM may be available. Visit the **North Carolina Floodplain Mapping Program** website at www.ncfloodmaps.com, or contact the **FEMA Map Service Center** at 1-800-358-9616 for information on all related products associated with this FIRM. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at www.msc.fema.gov.

MAP REPOSITORY
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EFFECTIVE DATE OF FLOOD INSURANCE RATE MAP PANEL
MAY 2, 2006

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

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ATTACHMENT 5: RAINFALL DATA

NOAA Atlas 14, Volume 2, Version 3
Location name: Rolesville, North Carolina, USA*
Latitude: 35.9195°, Longitude: -78.4618°
Elevation: m/ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.403** (0.369-0.441)	**0.468** (0.429-0.512)	**0.534** (0.489-0.582)	**0.599** (0.548-0.654)	**0.665** (0.606-0.725)	**0.718** (0.651-0.782)	**0.764** (0.689-0.832)	**0.805** (0.722-0.879)	**0.851** (0.756-0.929)	**0.892** (0.786-0.976)
10-min	**0.644** (0.590-0.704)	**0.749** (0.687-0.818)	**0.855** (0.783-0.933)	**0.959** (0.877-1.05)	**1.06** (0.965-1.16)	**1.14** (1.04-1.25)	**1.21** (1.09-1.32)	**1.28** (1.14-1.39)	**1.35** (1.20-1.47)	**1.41** (1.24-1.54)
15-min	**0.805** (0.738-0.880)	**0.942** (0.863-1.03)	**1.08** (0.991-1.18)	**1.21** (1.11-1.32)	**1.34** (1.22-1.46)	**1.45** (1.31-1.58)	**1.53** (1.38-1.67)	**1.61** (1.44-1.76)	**1.69** (1.51-1.85)	**1.76** (1.55-1.93)
30-min	**1.10** (1.01-1.21)	**1.30** (1.19-1.42)	**1.54** (1.41-1.68)	**1.76** (1.61-1.92)	**1.99** (1.81-2.17)	**2.18** (1.98-2.38)	**2.35** (2.12-2.56)	**2.51** (2.25-2.74)	**2.70** (2.40-2.94)	**2.86** (2.52-3.12)
60-min	**1.38** (1.26-1.51)	**1.63** (1.50-1.78)	**1.97** (1.81-2.15)	**2.29** (2.09-2.50)	**2.65** (2.41-2.89)	**2.95** (2.68-3.22)	**3.24** (2.92-3.53)	**3.52** (3.15-3.84)	**3.87** (3.44-4.22)	**4.17** (3.67-4.56)
2-hr	**1.61** (1.46-1.78)	**1.91** (1.75-2.10)	**2.34** (2.13-2.56)	**2.74** (2.49-3.01)	**3.23** (2.91-3.53)	**3.65** (3.28-3.99)	**4.06** (3.62-4.43)	**4.47** (3.96-4.89)	**5.01** (4.40-5.48)	**5.49** (4.78-6.02)
3-hr	**1.71** (1.55-1.89)	**2.03** (1.85-2.24)	**2.49** (2.26-2.74)	**2.94** (2.67-3.24)	**3.49** (3.15-3.84)	**3.99** (3.57-4.38)	**4.47** (3.97-4.91)	**4.99** (4.40-5.46)	**5.67** (4.94-6.21)	**6.29** (5.42-6.91)
6-hr	**2.05** (1.87-2.26)	**2.44** (2.23-2.68)	**2.99** (2.72-3.28)	**3.54** (3.22-3.88)	**4.22** (3.81-4.62)	**4.83** (4.34-5.28)	**5.45** (4.85-5.95)	**6.10** (5.37-6.65)	**6.98** (6.07-7.61)	**7.79** (6.68-8.50)
12-hr	**2.41** (2.21-2.66)	**2.87** (2.64-3.15)	**3.54** (3.24-3.88)	**4.21** (3.84-4.61)	**5.06** (4.59-5.53)	**5.84** (5.25-6.35)	**6.62** (5.90-7.20)	**7.47** (6.57-8.11)	**8.64** (7.48-9.37)	**9.72** (8.29-10.6)
24-hr	**2.86** (2.66-3.08)	**3.45** (3.22-3.72)	**4.34** (4.04-4.68)	**5.04** (4.68-5.43)	**6.00** (5.56-6.46)	**6.77** (6.25-7.28)	**7.56** (6.95-8.14)	**8.37** (7.67-9.02)	**9.50** (8.66-10.2)	**10.4** (9.42-11.2)
2-day	**3.32** (3.09-3.57)	**3.99** (3.72-4.30)	**4.98** (4.63-5.36)	**5.76** (5.35-6.20)	**6.81** (6.31-7.34)	**7.65** (7.06-8.24)	**8.51** (7.84-9.17)	**9.40** (8.62-10.1)	**10.6** (9.68-11.5)	**11.6** (10.5-12.6)
3-day	**3.52** (3.28-3.77)	**4.23** (3.95-4.53)	**5.24** (4.89-5.62)	**6.05** (5.63-6.48)	**7.15** (6.63-7.67)	**8.02** (7.42-8.60)	**8.91** (8.22-9.57)	**9.84** (9.03-10.6)	**11.1** (10.1-12.0)	**12.1** (11.0-13.1)
4-day	**3.72** (3.48-3.98)	**4.46** (4.17-4.77)	**5.51** (5.15-5.89)	**6.34** (5.91-6.77)	**7.48** (6.95-7.99)	**8.39** (7.77-8.97)	**9.32** (8.60-9.97)	**10.3** (9.45-11.0)	**11.6** (10.6-12.4)	**12.6** (11.5-13.6)
7-day	**4.31** (4.04-4.60)	**5.15** (4.82-5.50)	**6.28** (5.88-6.70)	**7.18** (6.71-7.66)	**8.41** (7.83-8.98)	**9.39** (8.72-10.0)	**10.4** (9.63-11.1)	**11.4** (10.5-12.3)	**12.9** (11.8-13.8)	**14.0** (12.8-15.0)
10-day	**4.91** (4.61-5.23)	**5.84** (5.48-6.23)	**7.04** (6.59-7.49)	**7.97** (7.46-8.49)	**9.24** (8.62-9.84)	**10.2** (9.53-10.9)	**11.2** (10.4-12.0)	**12.3** (11.4-13.1)	**13.7** (12.6-14.6)	**14.7** (13.5-15.8)
20-day	**6.59** (6.20-7.01)	**7.78** (7.32-8.28)	**9.21** (8.66-9.80)	**10.3** (9.71-11.0)	**11.9** (11.1-12.6)	**13.1** (12.2-13.9)	**14.3** (13.3-15.2)	**15.5** (14.4-16.6)	**17.2** (15.9-18.4)	**18.5** (17.0-19.8)
30-day	**8.18** (7.72-8.68)	**9.62** (9.07-10.2)	**11.2** (10.6-11.9)	**12.4** (11.7-13.2)	**14.1** (13.2-14.9)	**15.3** (14.3-16.3)	**16.6** (15.5-17.6)	**17.8** (16.6-19.0)	**19.5** (18.1-20.8)	**20.7** (19.2-22.2)
45-day	**10.4** (9.89-11.0)	**12.2** (11.6-12.9)	**14.0** (13.3-14.8)	**15.4** (14.6-16.2)	**17.2** (16.2-18.1)	**18.5** (17.5-19.5)	**19.9** (18.7-21.0)	**21.2** (19.9-22.4)	**22.9** (21.4-24.3)	**24.2** (22.6-25.7)
60-day	**12.5** (11.9-13.1)	**14.6** (13.9-15.3)	**16.5** (15.7-17.4)	**18.0** (17.1-19.0)	**20.0** (18.9-21.0)	**21.4** (20.2-22.5)	**22.8** (21.5-24.0)	**24.2** (22.8-25.5)	**25.9** (24.4-27.4)	**27.3** (25.6-28.8)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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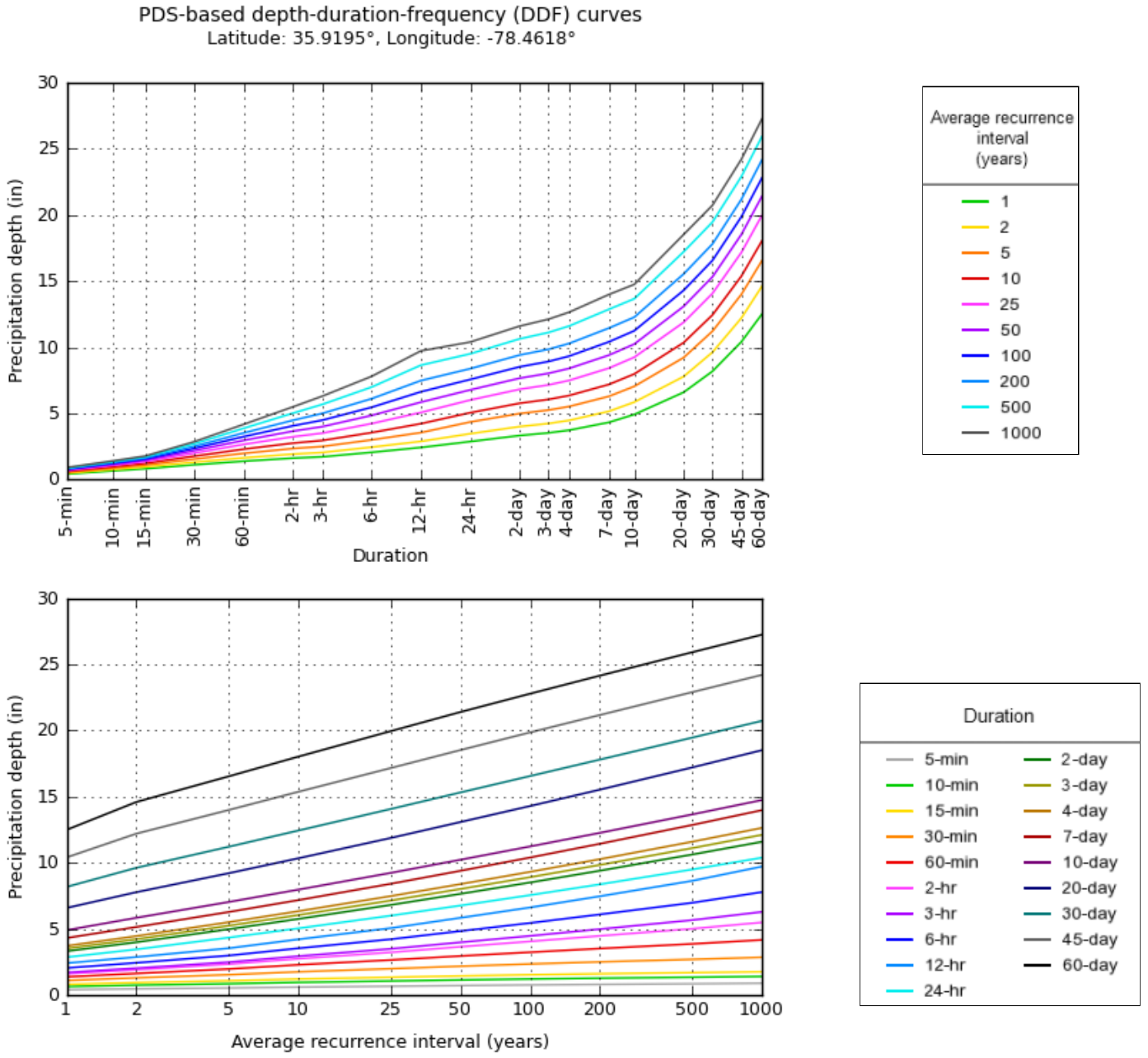
PF graphical



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Created (GMT): Mon Apr 24 20:01:43 2023

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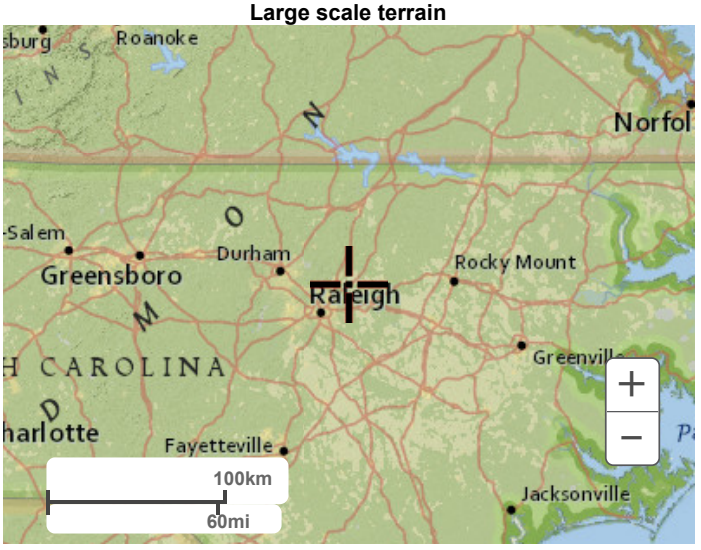
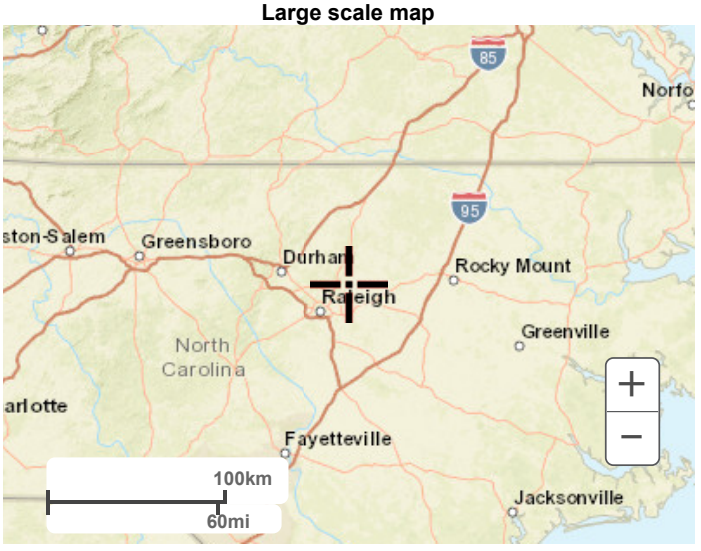
Maps & aerials

Small scale terrain

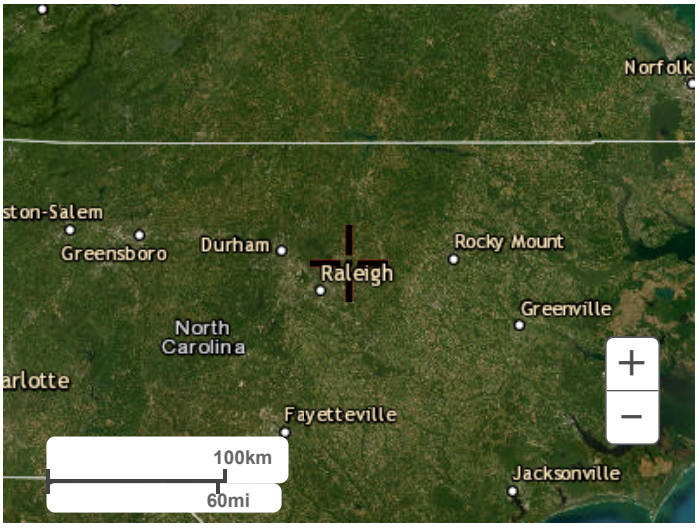
Large scale terrain



Large scale map



Large scale aerial



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National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
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Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

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NOAA Atlas 14, Volume 2, Version 3
Location name: Rolesville, North Carolina, USA*
Latitude: 35.9195°, Longitude: -78.4618°
Elevation: 426 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**4.84** (4.43-5.29)	**5.62** (5.15-6.14)	**6.41** (5.87-6.98)	**7.19** (6.58-7.85)	**7.98** (7.27-8.70)	**8.62** (7.81-9.38)	**9.17** (8.27-9.98)	**9.66** (8.66-10.5)	**10.2** (9.07-11.1)	**10.7** (9.43-11.7)
10-min	**3.86** (3.54-4.22)	**4.49** (4.12-4.91)	**5.13** (4.70-5.60)	**5.75** (5.26-6.27)	**6.36** (5.79-6.93)	**6.86** (6.22-7.47)	**7.28** (6.56-7.94)	**7.66** (6.86-8.36)	**8.08** (7.18-8.82)	**8.43** (7.43-9.22)
15-min	**3.22** (2.95-3.52)	**3.77** (3.45-4.12)	**4.32** (3.96-4.72)	**4.85** (4.44-5.29)	**5.38** (4.89-5.86)	**5.79** (5.25-6.31)	**6.14** (5.53-6.69)	**6.44** (5.77-7.03)	**6.78** (6.02-7.40)	**7.05** (6.22-7.72)
30-min	**2.21** (2.02-2.41)	**2.60** (2.38-2.84)	**3.07** (2.82-3.35)	**3.51** (3.21-3.83)	**3.98** (3.62-4.34)	**4.36** (3.95-4.75)	**4.70** (4.24-5.12)	**5.02** (4.49-5.47)	**5.39** (4.79-5.89)	**5.71** (5.03-6.25)
60-min	**1.38** (1.26-1.50)	**1.63** (1.50-1.78)	**1.97** (1.80-2.15)	**2.29** (2.09-2.50)	**2.65** (2.41-2.89)	**2.95** (2.68-3.22)	**3.24** (2.92-3.53)	**3.52** (3.15-3.84)	**3.87** (3.44-4.22)	**4.17** (3.67-4.56)
2-hr	**0.804** (0.731-0.887)	**0.957** (0.874-1.05)	**1.17** (1.06-1.28)	**1.37** (1.24-1.50)	**1.61** (1.45-1.76)	**1.82** (1.64-2.00)	**2.03** (1.81-2.22)	**2.24** (1.98-2.44)	**2.51** (2.20-2.74)	**2.75** (2.39-3.01)
3-hr	**0.567** (0.516-0.629)	**0.676** (0.617-0.746)	**0.827** (0.753-0.913)	**0.979** (0.888-1.08)	**1.16** (1.05-1.28)	**1.33** (1.19-1.46)	**1.49** (1.32-1.63)	**1.66** (1.46-1.82)	**1.89** (1.65-2.07)	**2.09** (1.80-2.30)
6-hr	**0.341** (0.311-0.377)	**0.406** (0.372-0.448)	**0.498** (0.454-0.548)	**0.590** (0.537-0.648)	**0.704** (0.636-0.771)	**0.807** (0.724-0.882)	**0.909** (0.809-0.993)	**1.02** (0.897-1.11)	**1.16** (1.01-1.27)	**1.30** (1.12-1.42)
12-hr	**0.200** (0.183-0.220)	**0.238** (0.219-0.261)	**0.293** (0.269-0.321)	**0.349** (0.318-0.382)	**0.420** (0.380-0.458)	**0.484** (0.435-0.527)	**0.549** (0.489-0.597)	**0.620** (0.545-0.673)	**0.716** (0.620-0.778)	**0.806** (0.687-0.876)
24-hr	**0.119** (0.110-0.128)	**0.143** (0.134-0.155)	**0.180** (0.168-0.194)	**0.210** (0.195-0.226)	**0.250** (0.231-0.269)	**0.282** (0.260-0.303)	**0.314** (0.289-0.338)	**0.348** (0.319-0.375)	**0.395** (0.360-0.426)	**0.432** (0.392-0.467)
2-day	**0.069** (0.064-0.074)	**0.083** (0.077-0.089)	**0.103** (0.096-0.111)	**0.119** (0.111-0.129)	**0.141** (0.131-0.152)	**0.159** (0.147-0.171)	**0.177** (0.163-0.190)	**0.195** (0.179-0.211)	**0.221** (0.201-0.239)	**0.241** (0.219-0.261)
3-day	**0.048** (0.045-0.052)	**0.058** (0.054-0.062)	**0.072** (0.067-0.078)	**0.084** (0.078-0.090)	**0.099** (0.092-0.106)	**0.111** (0.103-0.119)	**0.123** (0.114-0.132)	**0.136** (0.125-0.146)	**0.154** (0.140-0.166)	**0.168** (0.152-0.181)
4-day	**0.038** (0.036-0.041)	**0.046** (0.043-0.049)	**0.057** (0.053-0.061)	**0.066** (0.061-0.070)	**0.077** (0.072-0.083)	**0.087** (0.080-0.093)	**0.097** (0.089-0.103)	**0.107** (0.098-0.114)	**0.120** (0.110-0.129)	**0.131** (0.119-0.141)
7-day	**0.025** (0.024-0.027)	**0.030** (0.028-0.032)	**0.037** (0.034-0.039)	**0.042** (0.039-0.045)	**0.050** (0.046-0.053)	**0.055** (0.051-0.059)	**0.061** (0.057-0.066)	**0.068** (0.062-0.072)	**0.076** (0.070-0.082)	**0.083** (0.075-0.089)
10-day	**0.020** (0.019-0.021)	**0.024** (0.022-0.025)	**0.029** (0.027-0.031)	**0.033** (0.031-0.035)	**0.038** (0.035-0.041)	**0.042** (0.039-0.045)	**0.046** (0.043-0.049)	**0.051** (0.047-0.054)	**0.056** (0.052-0.060)	**0.061** (0.056-0.065)
20-day	**0.013** (0.012-0.014)	**0.016** (0.015-0.017)	**0.019** (0.018-0.020)	**0.021** (0.020-0.022)	**0.024** (0.023-0.026)	**0.027** (0.025-0.029)	**0.029** (0.027-0.031)	**0.032** (0.030-0.034)	**0.035** (0.033-0.038)	**0.038** (0.035-0.041)
30-day	**0.011** (0.010-0.012)	**0.013** (0.012-0.014)	**0.015** (0.014-0.016)	**0.017** (0.016-0.018)	**0.019** (0.018-0.020)	**0.021** (0.019-0.022)	**0.022** (0.021-0.024)	**0.024** (0.023-0.026)	**0.027** (0.025-0.028)	**0.028** (0.026-0.030)
45-day	**0.009** (0.009-0.010)	**0.011** (0.010-0.011)	**0.012** (0.012-0.013)	**0.014** (0.013-0.015)	**0.015** (0.015-0.016)	**0.017** (0.016-0.018)	**0.018** (0.017-0.019)	**0.019** (0.018-0.020)	**0.021** (0.019-0.022)	**0.022** (0.020-0.023)
60-day	**0.008** (0.008-0.009)	**0.010** (0.009-0.010)	**0.011** (0.010-0.012)	**0.012** (0.011-0.013)	**0.013** (0.013-0.014)	**0.014** (0.014-0.015)	**0.015** (0.014-0.016)	**0.016** (0.015-0.017)	**0.018** (0.016-0.019)	**0.018** (0.017-0.020)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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PF graphical

PDS-based intensity-duration-frequency (IDF) curves
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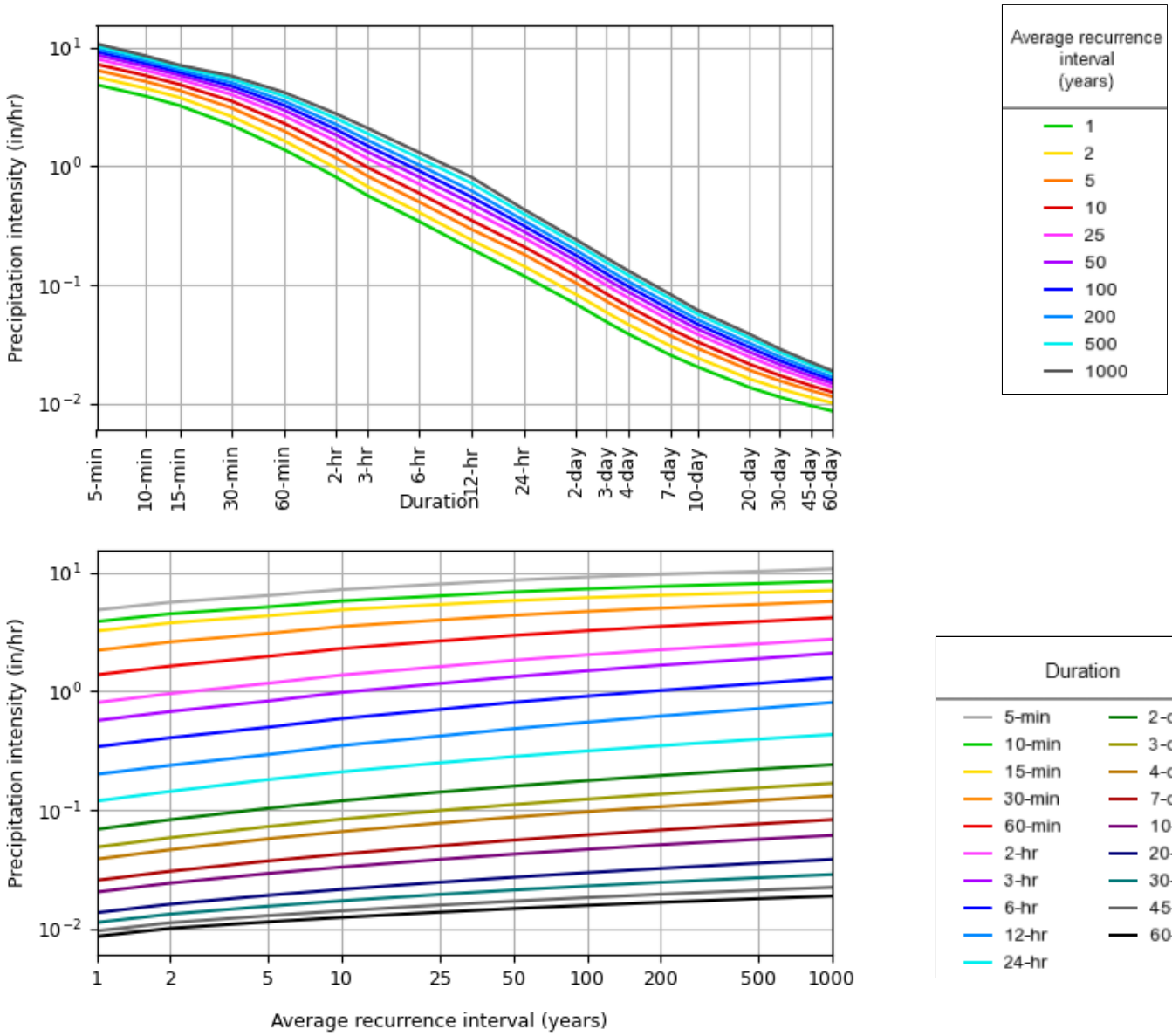

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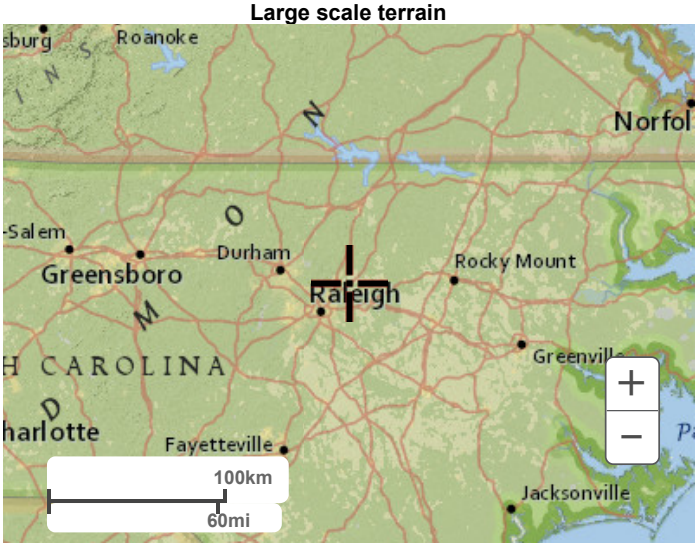
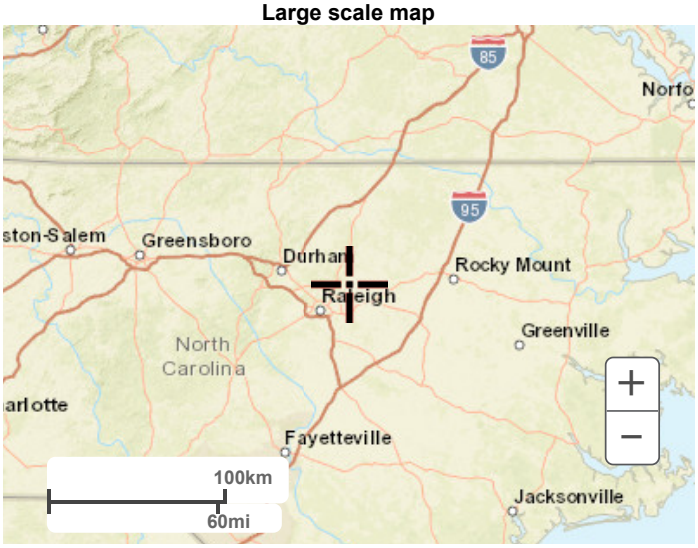
Maps & aerials

Small scale terrain

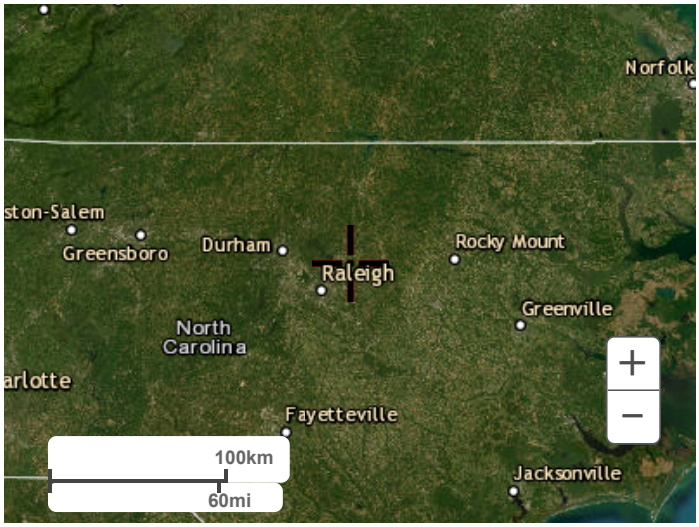
Large scale terrain



Large scale map



Large scale aerial



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National Weather Service
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Questions?: HDSC.Questions@noaa.gov

ATTACHMENT 6: PRE- AND POST-DEVELOPMENT DRAINAGE AREA MAPS

NORTH

OFFSITE DA
±20.14 AC

OFFSITE DA
±45.52 AC

OFFSITE DA
±4.07 AC

OFFSITE DA
±0.38 AC

DRAINAGE AREA #4
±6.01 AC TOTAL

DRAINAGE
AREA #3
±41.92 AC
TOTAL

DRAINAGE
AREA #1
±19.86 AC
TOTAL

DRAINAGE
AREA #2
±15.64 AC
TOTAL

IRINA DRIVE

POA #4

POA #5

DRAINAGE AREA #5
±2.14 AC TOTAL

POA #1

POA #3

POA #6

DRAINAGE
AREA #6
±1.30 AC
TOTAL

CONCORD

POA #2

LEGEND

- BASIN LIMIT
- FLOW DIRECTION
- SHEET FLOW
- SHALLOW FLOW

BGE
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RALEIGH NC 27607
www.bgeinc.com
NC LICENSE #C-4397

PRE DEVELOPMENT DRAINAGE AREA

DATE: 2/12/2024

0 150' 300' 450'
SCALE: 1" = 150'

G:\NCA\Projects\Lennar\8430-03 - Lennar - School Street - Rolesville\04 - Calculations\Storm\CAD FILES - WORKING\PRE DRAINAGE AREA MAP.dwg

NORTH

REFER TO CULVERT CALCULATIONS TO SEE FULL AREA

OFFSITE BYPASS #2 ±14.96 AC

BYPASS #3C ±0.83 AC

OFFSITE BYPASS #3 ±45.87 AC

BYPASS #3A ±1.71 AC

DRAINAGE AREA #3 ±12.93 AC TOTAL

SCM #3

OFFSITE BYPASS #1 ±4.07 AC

BYPASS #1A ±4.61 AC

BYPASS #5A ±0.48 AC

DRAINAGE AREA #4 ±9.78 AC TOTAL

BYPASS #4 ±1.01 AC

BYPASS #1B ±0.99 AC

DRAINAGE AREA #1 ±9.62 AC TOTAL

BYPASS #3B ±20.38 AC

SCM #4

BYPASS #1C ±4.98 AC

SCM #1

DRAINAGE AREA #2 ±21.79 AC TOTAL

POA #4

POA #5

BYPASS #5B ±0.43 AC

SCM #2

POA #1

POA #3

POA #6

BYPASS #6 ±0.63 AC

BYPASS #2 ±1.76 AC

POA #2

LEGEND

- DRAINAGE AREA
- BYPASS
- OFFSITE

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POST DEVELOPMENT DRAINAGE AREA

DATE: 3/5/2024

0 150' 300' 450'
SCALE: 1" = 150'

G:\NCA\Projects\Lennar\8430-03 - Lennar - School Street - Rolesville\04 - Calculations\Storm\CAD FILES - WORKING\Post Drainage Area Map.dwg

ATTACHMENT 7: SCM CALCULATIONS

Project Name: Parker Ridge
City/State: Rolesville, NC
Project #: 8430-03
Date: 2/12/24

SCM 1

Table 1 Surface Area to Drainage Area Ratio for Permanent Pool Sizing

Piedmont and Mountain SA/DA Table (Adapted from Driscoll, 1986)

	Permanent Pool Depth (feet)					
% Impervious	3.0	4.0	5.0	6.0	7.0	8.0
10	0.51	0.43	0.37	0.30	0.27	0.25
20	0.84	0.69	0.61	0.51	0.44	0.40
30	1.17	0.94	0.84	0.72	0.61	0.56
40	1.51	1.24	1.09	0.91	0.78	0.71
50	1.79	1.51	1.31	1.13	0.95	0.87
60	2.09	1.77	1.49	1.31	1.12	1.03
70	2.51	2.09	1.80	1.56	1.34	1.17
80	2.92	2.41	2.07	1.82	1.62	1.40
90	3.25	2.64	2.31	2.04	1.84	1.59
100	3.55	2.79	2.52	2.34	2.04	1.75

Source: NCDEQ Stormwater Design Manual Minimum Design Criteria C-3 Wet Pond (4.18.2017)

Drainage Area Information

Total Drainage Area =	9.62 acres
Total Impervious Area =	5.13 acres
% Impervious Surface Area =	**53.33 %**

Normal Pool Information

Minimum Required Permanent Pool Surface Area			Provided Permanent Pool Surface Area	
Avg Depth =	3.50 ft		Normal Pool Elevation =	384.5
SA/DA ratio =	1.74	*From Table 1*	Main Pool SA Provided =	**8489 sq. ft.**
				0.195 acres

$$\text{Minimum pond surface area } (SA) = \frac{DA \times SA \div DA\ ratio}{100}$$

SA = 7305 sq. ft.
0.168 acres

Water Quality Information

1-Inch Runoff Volume Calculation (Water Quality Volume)		Provided Water Quality Volume	
Using "Simple Method" Runoff Volume Calculations		Water Quality Pool Elev =	386.00 ft
As described by Schueler (1987)		Overflow Elev =	387.90 ft
$Rv = 0.05 + 0.9 \times I$	Where: Rv = Runoff coefficient (in./in.) I = Percent impervious	Storage Volume Provided =	66349 cu. ft.
			1.523 acre-ft
Rv = 0.53 in/in			

Total runoff volume from 1-inch precipitation:

$$\text{Runoff Volume } (S) = \text{Design Rainfall} \times Rv \times \text{Drainage Area}$$

S = 18506 cu. ft.
0.425 acre-ft

Project Name: **Parker Ridge** Project #: 8430-03

City/State: Rolesville, NC Date: 2/12/24

SCM 1

Total Drainage Area = 9.62

AVERAGE DEPTH

Per NCDEQ "Stormwater Design Manual" Minimum Design Criteria:

The average depth of a wet pond is to be calculated by one of these two options:

	Below Normal Pool Contours (feet)	Contour Area (SF)	Incremental Contour Volume (CF)	Accumulated Contour Volume (CF)	
A_{bot_pond} →	379.00	4017			
	380.00	4627	4318	4318	←**Sediment Storage Volume**
	381.00	5266	4943	9261	
A_{bot_shelf} →	384.00	7367	18862	28123	
$A_{perm\ pool}$ →	384.50	8489	3961	32084	←**Total Pond Volume**

V_{perm_pool} = Total Volume - Sediment Storage Volume = 27,765 cf

OPTION 1: Use the following equation:

$$D_{avg} = \frac{V_{perm\_pool}}{A_{perm\_pool}}$$

Where: D_{avg} = Average Depth (ft)

V_{perm_pool} = Volume of Permanent Pool (ft^3)

A_{perm_pool} = Area of Permanent Pool (ft^2)

D_{avg} = 3.27 ft

OPTION 2: Use the following equation:

$$D_{avg} = 0.25 \text{ x } \left(1 + \frac{A_{bot\_shelf}}{A_{perm\_pool}}\right) + \frac{A_{bot\_shelf} + A_{bot\_pond}}{2} \text{ x } \frac{Depth}{A_{bot\_shelf}}$$

Where: D_{avg} = Average Depth (ft)

A_{bot_shelf} = Area of Wet Pond at the Bottom of the Shelf (ft^2)

A_{bot_pond} = Area of Wet Pond Bottom above Sediment Storage (ft2)

A_{perm_pool} = Area of Permanent Pool (ft^2)

Depth = Depth of Wet Pond from Bottom of Shelf to Sediment Storage (ft)

D_{avg} = 3.72 ft

Use Average Depth = 3.50 ft

Project Name: **Parker Ridge** Project #: 8430-03
City/State: Rolesville, NC Date: 2/12/24

SCM 1

Total Drainage Area =

FOREBAY DESIGN

Per NCDEQ "*Stormwater Design Manual* " Minimum Design Criteria:

The forebay volume shall be 15-20% of the main pool.

Project Name: **Parker Ridge** Project #: 8430-03
City/State: Rolesville, NC Date: 2/12/24

70 Runoff Storage Volume Information

Pond Area	Countour Elevation (ft)	Contour Area (sf)	Incremental Contour Volume	Accumulated Contour Volume	
Storage Volume	390.00	20,196	19,318	85,667	←**Top of Dam**
	389.00	18,453	17,603	66,349	
	388.00	16,767	15,946	48,746	
	387.00	15,138	14,344	32,800	
	386.00	13,565	12,800	18,456	
	385.00	12,050	5,656	5,656	
Normal Pool	384.50	10,590	0	0	←**Normal Pool**

70 Pond Volume Information

Pond Area	Countour Elevation (ft)	Contour Area (sf)	Incremental Contour Volume (cf)	Accumulated Contour Volume (cf)	
Main Pool	384.50	8,489	3,961	32,109	←**Normal Pool**
	384.00	7,367	7,001	28,148	←**Bottom of Litoral Shelf**
	383.00	6,641	6,287	21,147	
	382.00	5,939	5,599	14,861	
	381.00	5,266	4,943	9,261	
	380.00	4,627	4,318	4,318	←**Sediment Storage Volume**
	379.00	4,017	0	0	←**Pond Bottom**
Forebay	384.50	2,101	927	5,775	←**Normal Pool**
	384.00	1,617	1,470	4,848	←**Bottom of Litoral Shelf**
	383.00	1,328	1,194	3,378	
	382.00	1,064	942	2,184	
	381.00	826	718	1,242	
	380.00	616	523	523	←**Sediment Storage Volume**
	379.00	436	0	0	←**Forebay Bottom**
Total	384.50	10,590	4,888	37,887	
	384.00	8,984	8,471	32,999	
	383.00	7,969	7,481	24,528	
	382.00	7,003	6,542	17,047	
	381.00	6,092	5,662	10,505	
	380.00	5,243	4,843	4,843	
	379.00	4,453	0	0	

Project Name: **Parker Ridge** Project #: 8430-03

City/State: Rolesville, NC Date: 2/12/24

SCM 1

Total Drainage Area = 9.62 acres

OS-A Anti-Floatation Sizing Calulations

Outlet Structure Dimension

Inside Riser Width:	4	**ft**	**Outside Riser Width:**	5 **ft**
Wall Thickness:	6	**in**		
Top Elevation:	387.9	**ft**		
Invert Elevation:	384.5	**ft**		
Bottom Elevation:	379	**ft**		
Extended Base:	12	**in**	**Extended Base Width**	7 **ft**

Displaced Volume:	222	**cu ft**
Displaced Weight:	13884	**lbs**
Volume of Actual Structure:	31	**cu ft**
Weight of Concrete Structure:	4590	**lbs**
Weight of Earth with Extended Base:	4488	**lbs**
Weight of Extra Depth:	20625	**lbs**
Total Weight of Structure:	29703	**lbs**
Factor of Safety:	2.1	OK

Project Name: **Parker Ridge** Project #: 8430-03

City/State: Rolesville, NC Date: 2/12/24

SCM 1

Total Drainage Area =

ORIFICE CALCULATOR

Per NCDEQ "*Stormwater Design Manual* " Minimum Design Criteria:

The design volume shall draw down to the permenant pool level in 2-5 days.

$$Q = C_d A\sqrt{2gh}$$

1" WATER QUALITY STORM VOLUME

Variables				**Constants**	
WQ Volume:	0.425 Acre-ft	18506 cf		g =	32.2 ft/s2
Head / Driving Head:	1.50 ft	0.50 ft		Cd=	0.6
Draw down time:	48 hrs	172800 s			
Orifice Area =	0.031 sq. ft	4.524 sq. in			
Orifice Diameter =	2.400 in				

USE 2 INCH DIAMETER ORIFICE

Project Name: Parker Ridge
City/State: Rolesville, NC
Project #: 8430-03
Date: 2/12/24

SCM 2

Table 1 Surface Area to Drainage Area Ratio for Permanent Pool Sizing
Piedmont and Mountain SA/DA Table (Adapted from Driscoll, 1986)

	Permanent Pool Depth (feet)					
% Impervious	3.0	4.0	5.0	6.0	7.0	8.0
10	0.51	0.43	0.37	0.30	0.27	0.25
20	0.84	0.69	0.61	0.51	0.44	0.40
30	1.17	0.94	0.84	0.72	0.61	0.56
40	1.51	1.24	1.09	0.91	0.78	0.71
50	1.79	1.51	1.31	1.13	0.95	0.87
60	2.09	1.77	1.49	1.31	1.12	1.03
70	2.51	2.09	1.80	1.56	1.34	1.17
80	2.92	2.41	2.07	1.82	1.62	1.40
90	3.25	2.64	2.31	2.04	1.84	1.59
100	3.55	2.79	2.52	2.34	2.04	1.75

Source: NCDEQ Stormwater Design Manual Minimum Design Criteria C-3 Wet Pond (4.18.2017)

Drainage Area Information

Total Drainage Area = 21.79 acres
Total Impervious Area = 10.42 acres
% Impervious Surface Area = **47.82 %**

Normal Pool Information

Minimum Required Permanent Pool Surface Area		Provided Permanent Pool Surface Area	
Avg Depth =	3.50 ft	Normal Pool Elevation =	351.5
SA/DA ratio =	2.07 *From Table 1*	Main Pool SA Provided =	**20384 sq. ft.**
			0.468 acres

$$\text{Minimum pond surface area } (SA) = \frac{DA \times SA \div DA\ ratio}{100}$$

SA = **19643 sq. ft.**
0.451 acres

Water Quality Information

1-Inch Runoff Volume Calculation (Water Quality Volume)		Provided Water Quality Volume	
Using "Simple Method" Runoff Volume Calculations		Water Quality Pool Elev =	352.88 ft
As described by Schueler (1987)		Overflow Elev =	355.50 ft
$Rv = 0.05 + 0.9 \times I$	Where: Rv = Runoff coefficient (in./in.) I = Percent impervious	Storage Volume Provided =	138278 cu. ft.
			3.174 acre-ft
Rv =	**0.48 in/in**		

Total runoff volume from 1-inch precipitation:

$$\text{Runoff Volume } (S) = \text{Design Rainfall} \times Rv \times \text{Drainage Area}$$

S = **37997 cu. ft.**
0.872 acre-ft

Interpolation from table 10.1:

% impervious	Permanent Pool Depth			
		3.0	3.5	4.0
	40.0	1.51		1.24
	47.8	1.73	**2.07**	2.41
	50.0	1.79		1.51

Project Name: **Parker Ridge** Project #: 8430-03

City/State: Rolesville, NC Date: 2/12/24

SCM 2

Total Drainage Area =

AVERAGE DEPTH

Per NCDEQ "Stormwater Design Manual" Minimum Design Criteria:

The average depth of a wet pond is to be calculated by one of these two options:

	Below Normal Pool Contours (feet)	Contour Area (SF)	Incremental Contour Volume (CF)	Accumulated Contour Volume (CF)	
A_{bot_pond} →	346.00	12020			
	347.00	13231	12621	12621	←**Sediment Storage Volume**
	348.00	14468	13845	26466	
A_{bot_shelf} →	351.00	18329	49081	75547	
$A_{perm\ pool}$ →	351.50	20384	9674	85221	←**Total Pond Volume**

V_{perm_pool} = Total Volume - Sediment Storage Volume = 72,600 cf

OPTION 1: Use the following equation:

$$D_{avg} = \frac{V_{perm\_pool}}{A_{perm\_pool}}$$

Where: D_{avg} = Average Depth (ft)

V_{perm_pool} = Volume of Permanent Pool (ft^3)

A_{perm_pool} = Area of Permanent Pool (ft^2)

D_{avg} = 3.56 ft

OPTION 2: Use the following equation:

$$D_{avg} = 0.25 \text{ x } \left(1 + \frac{A_{bot\_shelf}}{A_{perm\_pool}}\right) + \frac{A_{bot\_shelf} + A_{bot\_pond}}{2} \text{ x } \frac{Depth}{A_{bot\_shelf}}$$

Where: D_{avg} = Average Depth (ft)

A_{bot_shelf} = Area of Wet Pond at the Bottom of the Shelf (ft^2)

A_{bot_pond} = Area of Wet Pond Bottom above Sediment Storage (ft2)

A_{perm_pool} = Area of Permanent Pool (ft^2)

Depth = Depth of Wet Pond from Bottom of Shelf to Sediment Storage (ft)

D_{avg} = 3.92 ft

Use Average Depth = 3.50 ft

Project Name: **Parker Ridge** Project #: 8430-03
City/State: Rolesville, NC Date: 2/12/24

SCM 2

Total Drainage Area =

FOREBAY DESIGN

Per NCDEQ "*Stormwater Design Manual* " Minimum Design Criteria:

The forebay volume shall be 15-20% of the main pool.

Project Name: **Parker Ridge** Project #: 8430-03
City/State: Rolesville, NC Date: 2/12/24

50 Runoff Storage Volume Information

Pond Area	Countour Elevation (ft)	Contour Area (sf)	Incremental Contour Volume	Accumulated Contour Volume	
Storage Volume	357.00	37,716	36,604	174,882	←Top of Dam
	356.00	35,504	34,421	138,278	
	355.00	33,350	32,295	103,857	
	354.00	31,251	30,224	71,562	
	353.00	29,209	28,211	41,337	
	352.00	27,224	13,127	13,127	
Normal Pool	351.50	25,295	0	0	←Normal Pool

50 Pond Volume Information

Pond Area	Countour Elevation (ft)	Contour Area (sf)	Incremental Contour Volume (cf)	Accumulated Contour Volume (cf)	
Main Pool	351.50	20,384	9,674	85,272	←Normal Pool
	351.00	18,329	17,669	75,598	←Bottom of Litoral Shelf
	350.00	17,017	16,369	57,929	
	349.00	15,730	15,095	41,560	
	348.00	14,468	13,845	26,466	
	347.00	13,231	12,621	12,621	←Sediment Storage Volume
	346.00	12,020	0	0	←Pond Bottom
Forebay	351.50	4,911	2,185	12,993	←Normal Pool
	351.00	3,849	3,477	10,809	←Bottom of Litoral Shelf
	350.00	3,117	2,768	7,332	
	349.00	2,434	2,111	4,564	
	348.00	1,803	1,504	2,453	
	347.00	1,224	949	949	←Sediment Storage Volume
	346.00	698	0	0	←Forebay Bottom
Total	351.50	25,295	11,860	98,288	
	351.00	22,178	21,148	86,428	15.2%
	350.00	20,134	19,141	65,281	
	349.00	18,164	17,209	46,140	
	348.00	16,271	15,354	28,931	
	347.00	14,455	13,577	13,577	
	346.00	12,718	0	0	

Project Name: **Parker Ridge** Project #: 8430-03

City/State: Rolesville, NC Date: 2/12/24

SCM 2

Total Drainage Area =

OS-A Anti-Floatation Sizing Calulations

Outlet Structure Dimension

Inside Riser Width:	4	**ft**	**Outside Riser Width:**	5	**ft**
Wall Thickness:	6	**in**			
Top Elevation:	356	**ft**			
Invert Elevation:	351.5	**ft**			
Bottom Elevation:	347	**ft**			
Extended Base:	12	**in**	**Extended Base Width**	7	**ft**

Displaced Volume:	225	**cu ft**
Displaced Weight:	14040	**lbs**
Volume of Actual Structure:	41	**cu ft**
/eight of Concrete Structure:	6075	**lbs**
›f Earth with Extended Base:	5940	**lbs**
Weight of Extra Depth:	16875	**lbs**
Total Weight of Structure:	28890	**lbs**
Factor of Safety:	2.1	OK

Project Name: **Parker Ridge** Project #: 8430-03

City/State: Rolesville, NC Date: 2/12/24

SCM 2

Total Drainage Area =

ORIFICE CALCULATOR

Per NCDEQ "*Stormwater Design Manual* " Minimum Design Criteria:

The design volume shall draw down to the permenant pool level in 2-5 days.

$$Q = C_d A\sqrt{2gh}$$

1" WATER QUALITY STORM VOLUME

Variables				**Constants**	
WQ Volume:	0.872 Acre-ft	37997 cf		g =	32.2 ft/s2
Head / Driving Head:	1.38 ft	0.46 ft		Cd=	0.6
Draw down time:	48 hrs	172800 s			
Orifice Area =	0.067 sq. ft	9.690 sq. in			
Orifice Diameter =	3.513 in				

USE 4 INCH DIAMETER ORIFICE

Project Name: Parker Ridge
City/State: Rolesville, NC
Project #: 8430-03
Date: 3/5/24

SCM 3

Table 1 Surface Area to Drainage Area Ratio for Permanent Pool Sizing
Piedmont and Mountain SA/DA Table (Adapted from Driscoll, 1986)

	Permanent Pool Depth (feet)					
% Impervious	3.0	4.0	5.0	6.0	7.0	8.0
10	0.51	0.43	0.37	0.30	0.27	0.25
20	0.84	0.69	0.61	0.51	0.44	0.40
30	1.17	0.94	0.84	0.72	0.61	0.56
40	1.51	1.24	1.09	0.91	0.78	0.71
50	1.79	1.51	1.31	1.13	0.95	0.87
60	2.09	1.77	1.49	1.31	1.12	1.03
70	2.51	2.09	1.80	1.56	1.34	1.17
80	2.92	2.41	2.07	1.82	1.62	1.40
90	3.25	2.64	2.31	2.04	1.84	1.59
100	3.55	2.79	2.52	2.34	2.04	1.75

Source: NCDEQ Stormwater Design Manual Minimum Design Criteria C-3 Wet Pond (4.18.2017)

Drainage Area Information

Total Drainage Area =	12.93 acres
Total Impervious Area =	4.53 acres
% Impervious Surface Area =	**35.03 %**

Input
Output

Normal Pool Information

Minimum Required Permanent Pool Surface Area		Provided Permanent Pool Surface Area	
Avg Depth =	3.50 ft	Normal Pool Elevation =	384.5
SA/DA ratio =	1.22 *From Table 1*	Main Pool SA Provided =	**11217 sq. ft.**
Minimum pond surface area $(SA) = \frac{DA \times SA \div DA\ ratio}{100}$			0.258 acres
SA =	**6850 sq. ft.**		
	0.157 acres		

Water Quality Information

1-Inch Runoff Volume Calculation (Water Quality Volume)		Provided Water Quality Volume	
Using "Simple Method" Runoff Volume Calculations		Water Quality Pool Elev =	385.60 ft
As described by Schueler (1987)		Overflow Elev =	387.80 ft
$Rv = 0.05 + 0.9 \times I$	Where: Rv = Runoff coefficient (in./in.) I = Percent impervious	Storage Volume Provided =	60436 cu. ft.
			1.387 acre-ft
Rv =	**0.37 in/in**		
Total runoff volume from 1-inch precipitation:			
Runoff Volume (S) = Design Rainfall × Rv × Drainage Area			
S =	**17146 cu. ft.**		
	0.394 acre-ft		

Project Name: **Parker Ridge** Project #: 8430-03

City/State: Rolesville, NC Date: 3/5/24

SCM 3

Total Drainage Area =

AVERAGE DEPTH

Per NCDEQ "Stormwater Design Manual" Minimum Design Criteria:

The average depth of a wet pond is to be calculated by one of these two options:

	Below Normal Pool Contours (feet)	Contour Area (SF)	Incremental Contour Volume (CF)	Accumulated Contour Volume (CF)	
A_{bot_pond} →	379.00	6368			
	380.00	7038	6700	6700	←**Sediment Storage Volume**
	381.00	7730	7381	14082	
A_{bot_shelf} →	384.00	9960	26464	40546	
A_{perm_pool} →	384.50	11217	5291	45837	←**Total Pond Volume**

V_{perm_pool} = Total Volume - Sediment Storage Volume = 39,137 cf

OPTION 1: Use the following equation:

$$D_{avg} = \frac{V_{perm\_pool}}{A_{perm\_pool}}$$

Where: D_{avg} = Average Depth (ft)

V_{perm_pool} = Volume of Permanent Pool (ft^3)

A_{perm_pool} = Area of Permanent Pool (ft^2)

D_{avg} = 3.49 ft

OPTION 2: Use the following equation:

$$D_{avg} = 0.25 \text{ x } \left(1 + \frac{A_{bot\_shelf}}{A_{perm\_pool}}\right) + \frac{A_{bot\_shelf} + A_{bot\_pond}}{2} \text{ x } \frac{Depth}{A_{bot\_shelf}}$$

Where: D_{avg} = Average Depth (ft)

A_{bot_shelf} = Area of Wet Pond at the Bottom of the Shelf (ft^2)

A_{bot_pond} = Area of Wet Pond Bottom above Sediment Storage (ft2)

A_{perm_pool} = Area of Permanent Pool (ft^2)

Depth = Depth of Wet Pond from Bottom of Shelf to Sediment Storage (ft)

D_{avg} = 3.89 ft

Use Average Depth = 3.50 ft

Project Name: **Parker Ridge** Project #: 8430-03
City/State: Rolesville, NC Date: 3/5/24

SCM 3

Total Drainage Area = 12.93

FOREBAY DESIGN

Per NCDEQ "*Stormwater Design Manual* " Minimum Design Criteria:
The forebay volume shall be 15-20% of the main pool.

Project Name: **Parker Ridge Subdivision** Project #: 8430-03
City/State: Rolesville, NC Date: 3/5/24

70 Runoff Storage Volume Information

Pond Area	Countour Elevation (ft)	Contour Area (sf)	Incremental Contour Volume	Accumulated Contour Volume	
Storage Volume	390.00	23,096	22,278	103,393	←**Top of Dam**
	389.00	21,469	20,679	81,115	
	388.00	19,899	19,137	60,436	
	387.00	18,385	17,651	41,299	
	386.00	16,928	16,222	23,647	
	385.00	15,527	7,425	7,425	
Normal Pool	384.50	14,183	0	0	←**Normal Pool**

70 Pond Volume Information

Pond Area	Countour Elevation (ft)	Contour Area (sf)	Incremental Contour Volume (cf)	Accumulated Contour Volume (cf)	
Main Pool	384.50	11,217	5,291	45,850	←**Normal Pool**
	384.00	9,960	9,573	40,559	←**Bottom of Litoral Shelf**
	383.00	9,192	8,817	30,986	
	382.00	8,448	8,087	22,168	
	381.00	7,730	7,381	14,082	
	380.00	7,038	6,700	6,700	←**Sediment Storage Volume**
	379.00	6,368	0	0	←**Pond Bottom**
Forebay	384.50	2,965	1,274	8,035	←**Normal Pool**
	384.00	2,153	1,976	6,760	←**Bottom of Litoral Shelf**
	383.00	1,804	1,639	4,785	
	382.00	1,480	1,328	3,145	
	381.00	1,181	1,041	1,818	
	380.00	907	777	777	←**Sediment Storage Volume**
	379.00	653	0	0	←**Forebay Bottom**
Total	384.50	14,182	6,567	53,891	
	384.00	12,113	11,550	47,324	
	383.00	10,996	10,458	35,774	
	382.00	9,928	9,415	25,317	
	381.00	8,911	8,423	15,902	
	380.00	7,945	7,478	7,478	
	379.00	7,021	0	0	

Project Name: **Parker Ridge** Project #: 8430-03

City/State: Rolesville, NC Date: 3/5/24

SCM 3

Total Drainage Area =

OS-A Anti-Floatation Sizing Calulations

Outlet Structure Dimension

Inside Riser Width:	4	**ft**	**Outside Riser Width:**	5	**ft**
Wall Thickness:	6	**in**			
Top Elevation:	388.35	**ft**			
Invert Elevation:	384.5	**ft**			
Bottom Elevation:	380	**ft**			
Extended Base:	12	**in**	**Extended Base Width**	7	**ft**

Displaced Volume:	209	**cu ft**
Displaced Weight:	13026	**lbs**
Volume of Actual Structure:	35	**cu ft**
/eight of Concrete Structure:	5198	**lbs**
›f Earth with Extended Base:	5082	**lbs**
Weight of Extra Depth:	16875	**lbs**
Total Weight of Structure:	27155	**lbs**
Factor of Safety:	2.1	OK

Project Name: **Parker Ridge** Project #: 8430-03

City/State: Rolesville, NC Date: 3/5/24

SCM 3

Total Drainage Area =

ORIFICE CALCULATOR

Per NCDEQ "*Stormwater Design Manual* " Minimum Design Criteria:

The design volume shall draw down to the permenant pool level in 2-5 days.

$$Q = C_d A\sqrt{2gh}$$

1" WATER QUALITY STORM VOLUME

Variables				**Constants**	
WQ Volume:	0.394 Acre-ft	17146 cf		g =	32.2 ft/s2
Head / Driving Head:	1.10 ft	0.37 ft		Cd=	0.6
Draw down time:	48 hrs	172800 s			
Orifice Area =	0.034 sq. ft	4.902 sq. in			
Orifice Diameter =	2.498 in				

USE 2 INCH DIAMETER ORIFICE

LEVEL SPREADER FILTER STRIP CALCULATIONS

Drawdown Rate:	0.10 cfs	
LS Length:	10 feet	(min)

Project Name: Parker Ridge
City/State: Rolesville, NC
Project #: 8430-03
Date: 2/12/24

SCM 4

Table 1 Surface Area to Drainage Area Ratio for Permanent Pool Sizing
Piedmont and Mountain SA/DA Table (Adapted from Driscoll, 1986)

	Permanent Pool Depth (feet)					
% Impervious	3.0	4.0	5.0	6.0	7.0	8.0
10	0.51	0.43	0.37	0.30	0.27	0.25
20	0.84	0.69	0.61	0.51	0.44	0.40
30	1.17	0.94	0.84	0.72	0.61	0.56
40	1.51	1.24	1.09	0.91	0.78	0.71
50	1.79	1.51	1.31	1.13	0.95	0.87
60	2.09	1.77	1.49	1.31	1.12	1.03
70	2.51	2.09	1.80	1.56	1.34	1.17
80	2.92	2.41	2.07	1.82	1.62	1.40
90	3.25	2.64	2.31	2.04	1.84	1.59
100	3.55	2.79	2.52	2.34	2.04	1.75

Source: NCDEQ Stormwater Design Manual Minimum Design Criteria C-3 Wet Pond (4.18.2017)

Drainage Area Information

Total Drainage Area =	9.78 acres
Total Impervious Area =	4.45 acres
% Impervious Surface Area =	**45.50 %**

Input
Output

Normal Pool Information

Minimum Required Permanent Pool Surface Area			Provided Permanent Pool Surface Area	
Avg Depth =	3.50 ft		Normal Pool Elevation =	380.5
SA/DA ratio =	2.04	*From Table 1*	Main Pool SA Provided =	**14636 sq. ft.**
				0.336 acres

$$\text{Minimum pond surface area } (SA) = \frac{DA \times SA \div DA\ ratio}{100}$$

SA = 8678 sq. ft.
0.199 acres

Water Quality Information

1-Inch Runoff Volume Calculation (Water Quality Volume)		Provided Water Quality Volume	
Using "Simple Method" Runoff Volume Calculations		Water Quality Pool Elev =	381.51 ft
As described by Schueler (1987)		Overflow Elev =	384.00 ft
$Rv = 0.05 + 0.9 \times I$	Where: Rv = Runoff coefficient (in./in.) I = Percent impervious	Storage Volume Provided =	84687 cu. ft.
			1.944 acre-ft
Rv =	**0.46 in/in**		

Total runoff volume from 1-inch precipitation:

$$\text{Runoff Volume } (S) = \text{Design Rainfall} \times Rv \times \text{Drainage Area}$$

S = 16313 cu. ft.
0.375 acre-ft

Project Name: **Parker Ridge** Project #: 8430-03

City/State: Rolesville, NC Date: 2/12/24

SCM 4

Total Drainage Area =

AVERAGE DEPTH

Per NCDEQ "Stormwater Design Manual" Minimum Design Criteria:

The average depth of a wet pond is to be calculated by one of these two options:

	Below Normal Pool Contours (feet)	Contour Area (SF)	Incremental Contour Volume (CF)	Accumulated Contour Volume (CF)	
A_{bot_pond} →	375.00	5047			
	376.00	5697	5369	5369	←**Sediment Storage Volume**
	377.00	6373	6032	11401	
A_{bot_shelf} →	380.00	8550	22305	33705	
A_{perm_pool} →	380.50	10901	4851	38556	←**Total Pond Volume**

V_{perm_pool} = Total Volume - Sediment Storage Volume = 33,187 cf

OPTION 1: Use the following equation:

$$D_{avg} = \frac{V_{perm\_pool}}{A_{perm\_pool}}$$

Where: D_{avg} = Average Depth (ft)

V_{perm_pool} = Volume of Permanent Pool (ft^3)

A_{perm_pool} = Area of Permanent Pool (ft^2)

D_{avg} = 3.04 ft

OPTION 2: Use the following equation:

$$D_{avg} = 0.25 \text{ x } \left(1 + \frac{A_{bot\_shelf}}{A_{perm\_pool}}\right) + \frac{A_{bot\_shelf} + A_{bot\_pond}}{2} \text{ x } \frac{Depth}{A_{bot\_shelf}}$$

Where: D_{avg} = Average Depth (ft)

A_{bot_shelf} = Area of Wet Pond at the Bottom of the Shelf (ft^2)

A_{bot_pond} = Area of Wet Pond Bottom above Sediment Storage (ft2)

A_{perm_pool} = Area of Permanent Pool (ft^2)

Depth = Depth of Wet Pond from Bottom of Shelf to Sediment Storage (ft)

D_{avg} = 3.78 ft

Use Average Depth = 3.50 ft

Project Name: **Parker Ridge** Project #: 8430-03
City/State: Rolesville, NC Date: 2/12/24

SCM 4

Total Drainage Area = 9.78

FOREBAY DESIGN

Per NCDEQ "*Stormwater Design Manual* " Minimum Design Criteria:

The forebay volume shall be 15-20% of the main pool.

Project Name: **Parker Ridge** Project #: 8430-03
City/State: Rolesville, NC Date: 2/12/24

70 Runoff Storage Volume Information

Pond Area	Countour Elevation (ft)	Contour Area (sf)	Incremental Contour Volume	Accumulated Contour Volume	
Storage Volume	386.00	24,300	23,419	108,106	←**Top of Dam**
	385.00	22,548	21,695	84,687	
	384.00	20,853	20,028	62,992	
	383.00	19,214	18,418	42,964	
	382.00	17,634	16,864	24,546	
	381.00	16,105	7,682	7,682	
Normal Pool	380.50	14,636	0	0	←**Normal Pool**

70 Pond Volume Information

Pond Area	Countour Elevation (ft)	Contour Area (sf)	Incremental Contour Volume (cf)	Accumulated Contour Volume (cf)	
Main Pool	380.50	10,901	4,851	38,576	←**Normal Pool**
	380.00	8,550	8,172	33,725	←**Bottom of Litoral Shelf**
	379.00	7,799	7,433	25,554	
	378.00	7,073	6,720	18,121	
	377.00	6,373	6,032	11,401	
	376.00	5,697	5,369	5,369	←**Sediment Storage Volume**
	375.00	5,047	0	0	←**Pond Bottom**
Forebay	380.50	3,735	1,638	9,851	←**Normal Pool**
	380.00	2,839	2,566	8,212	←**Bottom of Litoral Shelf**
	379.00	2,302	2,054	5,647	
	378.00	1,816	1,592	3,592	
	377.00	1,379	1,181	2,000	
	376.00	993	819	819	←**Sediment Storage Volume**
	375.00	657	0	0	←**Forebay Bottom**
Total	380.50	14,636	6,489	48,435	
	380.00	11,389	10,739	41,946	
	379.00	10,101	9,489	31,208	
	378.00	8,889	8,314	21,719	
	377.00	7,752	7,214	13,405	
	376.00	6,690	6,190	6,190	
	375.00	5,704	0	0	

Project Name: **Parker Ridge** Project #: 8430-03

City/State: Rolesville, NC Date: 2/12/24

SCM 4

Total Drainage Area =

OS-A Anti-Floatation Sizing Calulations

Outlet Structure Dimension

Inside Riser Width:	4	**ft**	**Outside Riser Width:**	5	**ft**
Wall Thickness:	6	**in**			
Top Elevation:	386	**ft**			
Invert Elevation:	380.5	**ft**			
Bottom Elevation:	375	**ft**			
Extended Base:	12	**in**	**Extended Base Width**	7	**ft**

Displaced Volume:	275	**cu ft**
Displaced Weight:	17160	**lbs**
Volume of Actual Structure:	50	**cu ft**
/eight of Concrete Structure:	7425	**lbs**
›f Earth with Extended Base:	7260	**lbs**
Weight of Extra Depth:	20625	**lbs**
Total Weight of Structure:	35310	**lbs**
Factor of Safety:	2.1	OK

Project Name: **Parker Ridge** Project #: 8430-03

City/State: Rolesville, NC Date: 2/12/24

SCM 4

Total Drainage Area =

ORIFICE CALCULATOR

Per NCDEQ "*Stormwater Design Manual* " Minimum Design Criteria:

The design volume shall draw down to the permenant pool level in 2-5 days.

$$Q = C_d A\sqrt{2gh}$$

1" WATER QUALITY STORM VOLUME

Variables				**Constants**	
WQ Volume:	0.375 Acre-ft	16313 cf		g =	32.2 ft/s2
Head / Driving Head:	1.01 ft	0.34 ft		Cd=	0.6
Draw down time:	48 hrs	172800 s			
Orifice Area =	0.034 sq. ft	4.862 sq. in			
Orifice Diameter =	2.488 in				

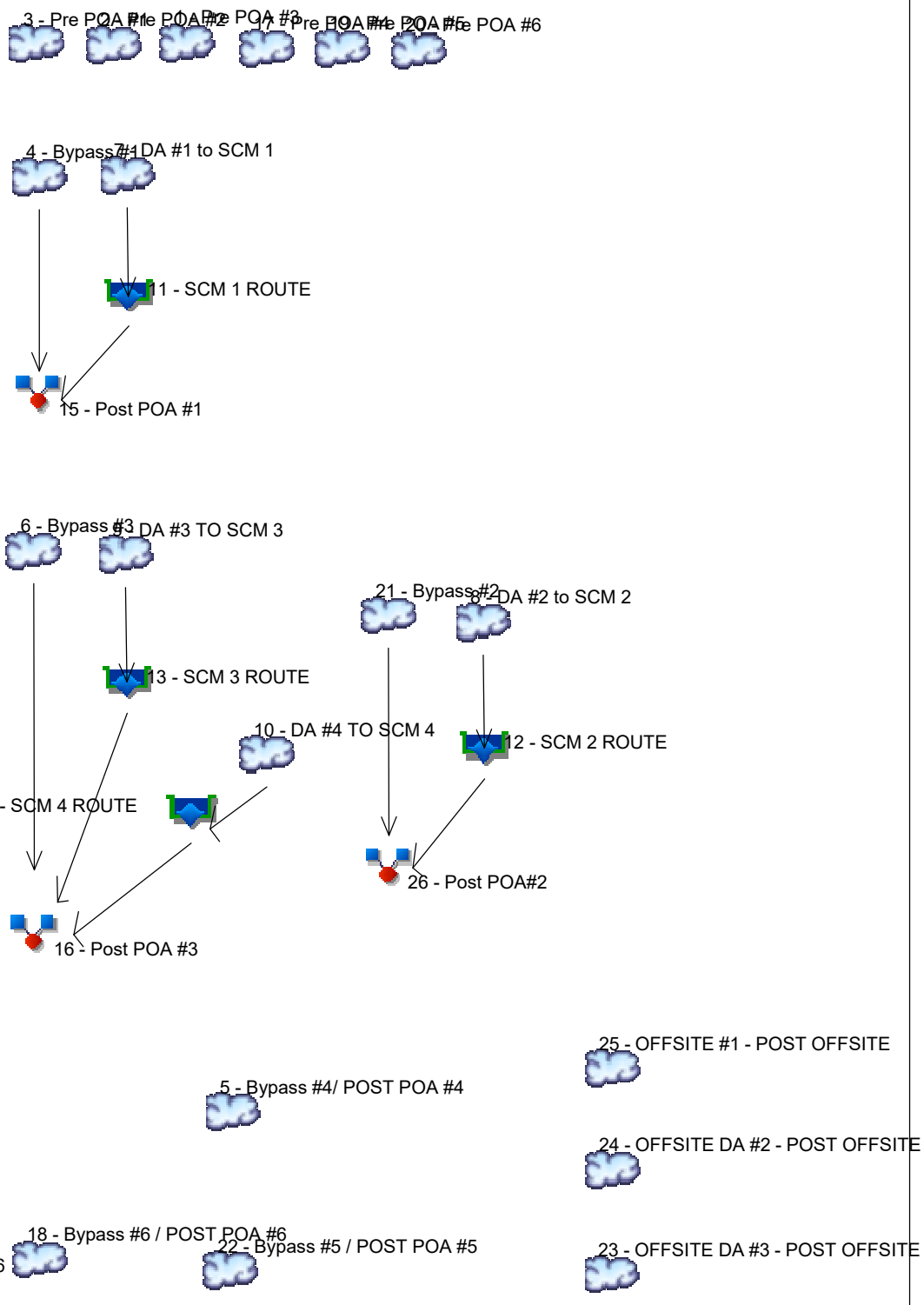
USE 2 INCH DIAMETER ORIFICE

Hydraflow Table of Contents

SCMs.gpw

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023 Tuesday, 03 / 5 / 2024

Watershed Model Schematic



Legend

Hyd.	Origin	Description
1	SCS Runoff	Pre POA #3
2	SCS Runoff	Pre POA #2
3	SCS Runoff	Pre POA #1
4	SCS Runoff	Bypass #1
5	SCS Runoff	Bypass #4/ POST POA #4
6	SCS Runoff	Bypass #3
7	SCS Runoff	DA #1 to SCM 1
8	SCS Runoff	DA #2 to SCM 2
9	SCS Runoff	DA #3 TO SCM 3
10	SCS Runoff	DA #4 TO SCM 4
11	Reservoir	SCM 1 ROUTE
12	Reservoir	SCM 2 ROUTE
13	Reservoir	SCM 3 ROUTE
14	Reservoir	SCM 4 ROUTE
15	Combine	Post POA #1
16	Combine	Post POA #3
17	SCS Runoff	Pre POA #4
18	SCS Runoff	Bypass #6 / POST POA #6
19	SCS Runoff	Pre POA #5
20	SCS Runoff	Pre POA #6
21	SCS Runoff	Bypass #2
22	SCS Runoff	Bypass #5 / POST POA #5
23	SCS Runoff	OFFSITE DA #3 - POST OFFSITE
24	SCS Runoff	OFFSITE DA #2 - POST OFFSITE
25	SCS Runoff	OFFSITE #1 - POST OFFSITE
26	Combine	Post POA#2

Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	------	81.67	113.03	-------	-------	205.26	262.81	-------	357.13	Pre POA #3
2	SCS Runoff	------	28.42	39.57	-------	-------	72.37	92.84	-------	126.43	Pre POA #2
3	SCS Runoff	------	28.98	41.45	-------	-------	78.74	102.35	-------	141.40	Pre POA #1
4	SCS Runoff	------	16.36	23.17	-------	-------	43.30	55.96	-------	76.83	Bypass #1
5	SCS Runoff	------	1.562	2.212	-------	-------	4.134	5.342	-------	7.334	Bypass #4/ POST POA #4
6	SCS Runoff	------	35.44	50.20	-------	-------	93.81	121.23	-------	166.44	Bypass #3
7	SCS Runoff	------	22.45	29.54	-------	-------	48.93	60.66	-------	79.63	DA #1 to SCM 1
8	SCS Runoff	------	44.48	58.55	-------	-------	97.08	120.39	-------	158.10	DA #2 to SCM 2
9	SCS Runoff	------	27.61	36.02	-------	-------	58.92	72.73	-------	95.04	DA #3 TO SCM 3
10	SCS Runoff	------	21.79	28.93	-------	-------	48.59	60.52	-------	79.85	DA #4 TO SCM 4
11	Reservoir	7	2.367	5.049	-------	-------	30.15	47.92	-------	67.47	SCM 1 ROUTE
12	Reservoir	8	3.322	6.636	-------	-------	38.40	77.60	-------	122.59	SCM 2 ROUTE
13	Reservoir	9	2.125	4.857	-------	-------	41.68	57.71	-------	82.52	SCM 3 ROUTE
14	Reservoir	10	1.869	3.951	-------	-------	11.91	29.47	-------	58.21	SCM 4 ROUTE
15	Combine	4, 11,	16.42	24.81	-------	-------	62.32	97.10	-------	139.47	Post POA #1
16	Combine	6, 13, 14,	35.49	51.61	-------	-------	122.17	179.97	-------	281.92	Post POA #3
17	SCS Runoff	------	11.33	16.22	-------	-------	30.47	39.44	-------	54.44	Pre POA #4
18	SCS Runoff	------	1.030	1.447	-------	-------	2.659	3.417	-------	4.663	Bypass #6 / POST POA #6
19	SCS Runoff	------	3.499	4.914	-------	-------	9.033	11.61	-------	15.84	Pre POA #5
20	SCS Runoff	------	1.689	2.390	-------	-------	4.418	5.690	-------	7.782	Pre POA #6
21	SCS Runoff	------	2.878	4.042	-------	-------	7.429	9.547	-------	13.03	Bypass #2
22	SCS Runoff	------	1.504	2.113	-------	-------	3.883	4.990	-------	6.809	Bypass #5 / POST POA #5
23	SCS Runoff	------	19.41	28.80	-------	-------	56.90	74.96	-------	105.14	OFFSITE DA #3 - POST OFFSITE
24	SCS Runoff	------	13.17	18.67	-------	-------	34.69	44.81	-------	61.49	OFFSITE DA #2 - POST OFFSITE
25	SCS Runoff	------	7.529	10.53	-------	-------	19.35	24.91	-------	34.06	OFFSITE #1 - POST OFFSITE
26	Combine	12, 21,	3.552	7.118	-------	-------	40.35	82.04	-------	130.29	Post POA#2

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

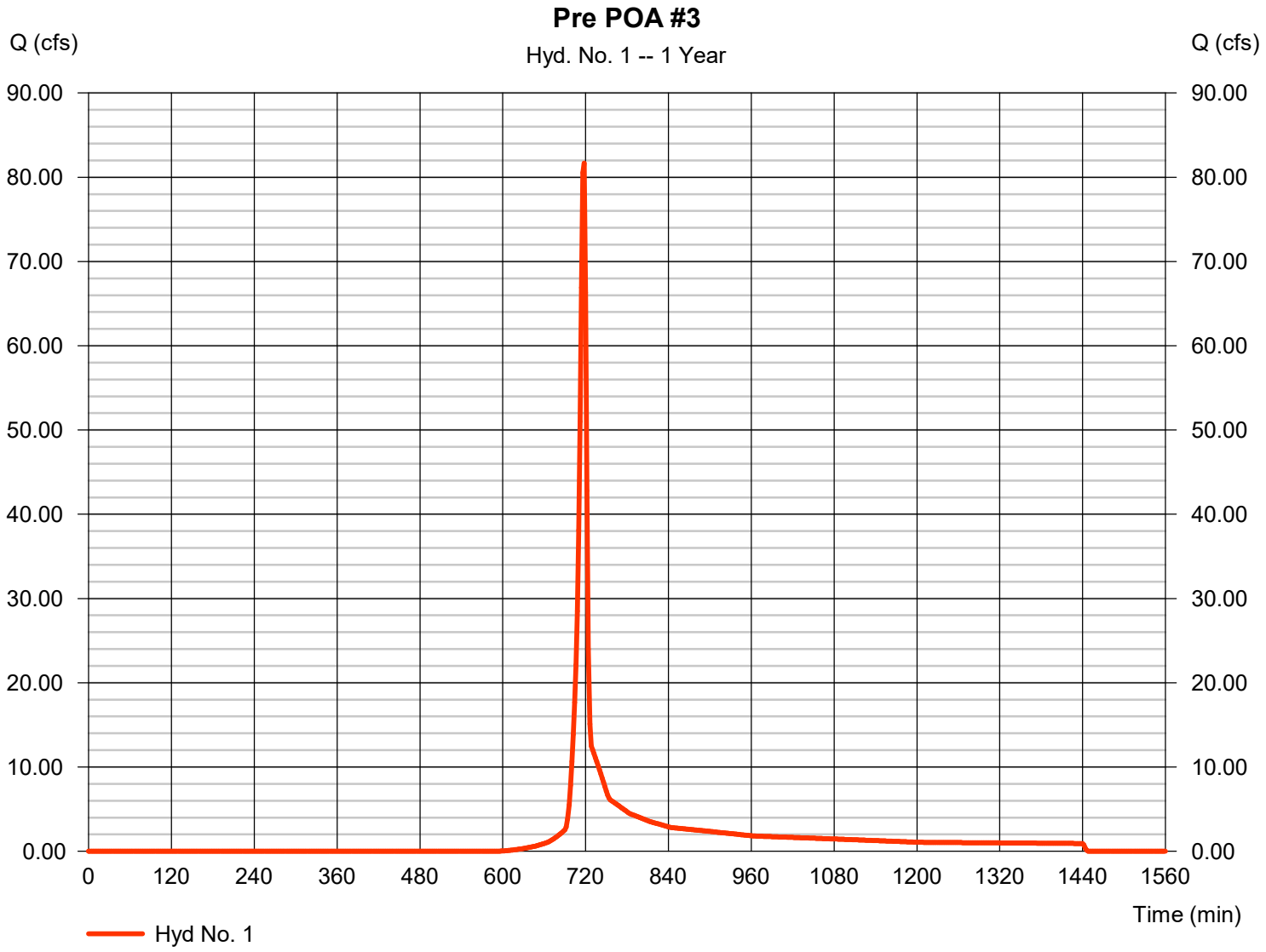
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	81.67	2	718	163,488	------	------	------	Pre POA #3
2	SCS Runoff	28.42	2	720	65,063	------	------	------	Pre POA #2
3	SCS Runoff	28.98	2	722	76,593	------	------	------	Pre POA #1
4	SCS Runoff	16.36	2	722	43,058	------	------	------	Bypass #1
5	SCS Runoff	1.562	2	722	4,110	------	------	------	Bypass #4/ POST POA #4
6	SCS Runoff	35.44	2	722	93,278	------	------	------	Bypass #3
7	SCS Runoff	22.45	2	720	58,248	------	------	------	DA #1 to SCM 1
8	SCS Runoff	44.48	2	722	124,740	------	------	------	DA #2 to SCM 2
9	SCS Runoff	27.61	2	722	77,535	------	------	------	DA #3 TO SCM 3
10	SCS Runoff	21.79	2	720	56,498	------	------	------	DA #4 TO SCM 4
11	Reservoir	2.367	2	754	38,346	7	386.90	31,308	SCM 1 ROUTE
12	Reservoir	3.322	2	784	83,377	8	354.00	71,504	SCM 2 ROUTE
13	Reservoir	2.125	2	780	45,577	9	387.24	45,186	SCM 3 ROUTE
14	Reservoir	1.869	2	764	38,422	10	382.31	30,764	SCM 4 ROUTE
15	Combine	16.42	2	722	81,404	4, 11,	------	------	Post POA #1
16	Combine	35.49	2	722	177,278	6, 13, 14,	------	------	Post POA #3
17	SCS Runoff	11.33	1	717	21,275	------	------	------	Pre POA #4
18	SCS Runoff	1.030	2	722	2,703	------	------	------	Bypass #6 / POST POA #6
19	SCS Runoff	3.499	2	722	9,181	------	------	------	Pre POA #5
20	SCS Runoff	1.689	2	726	5,408	------	------	------	Pre POA #6
21	SCS Runoff	2.878	2	722	7,550	------	------	------	Bypass #2
22	SCS Runoff	1.504	2	722	3,947	------	------	------	Bypass #5 / POST POA #5
23	SCS Runoff	19.41	2	762	161,494	------	------	------	OFFSITE DA #3 - POST OFFSITE
24	SCS Runoff	13.17	2	736	61,527	------	------	------	OFFSITE DA #2 - POST OFFSITE
25	SCS Runoff	7.529	2	718	15,058	------	------	------	OFFSITE #1 - POST OFFSITE
26	Combine	3.552	2	778	90,928	12, 21,	------	------	Post POA#2

Hydrograph Report

Hyd. No. 1

Pre POA #3

Hydrograph type	=	SCS Runoff	Peak discharge	=	81.67 cfs
Storm frequency	=	1 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	163,488 cuft
Drainage area	=	41.920 ac	Curve number	=	80
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	5.80 min
Total precip.	=	2.86 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



TR55 Tc Worksheet

Hyd. No. 1

Pre POA #3

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.011		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.45		0.00		0.00		
Land slope (%)	= 2.00		0.00		0.00		
Travel Time (min)	**= 2.81**	**+**	**0.00**	**+**	**0.00**	**=**	**2.81**
Shallow Concentrated Flow							
Flow length (ft)	= 493.00		0.00		0.00		
Watercourse slope (%)	= 3.50		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=3.02		0.00		0.00		
Travel Time (min)	**= 2.72**	**+**	**0.00**	**+**	**0.00**	**=**	**2.72**
Channel Flow							
X sectional flow area (sqft)	= 30.00		0.00		0.00		
Wetted perimeter (ft)	= 16.00		0.00		0.00		
Channel slope (%)	= 5.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=33.84						
			0.00				
					0.00		
Flow length (ft)	({0})500.0		0.0		0.0		
Travel Time (min)	**= 0.25**	**+**	**0.00**	**+**	**0.00**	**=**	**0.25**

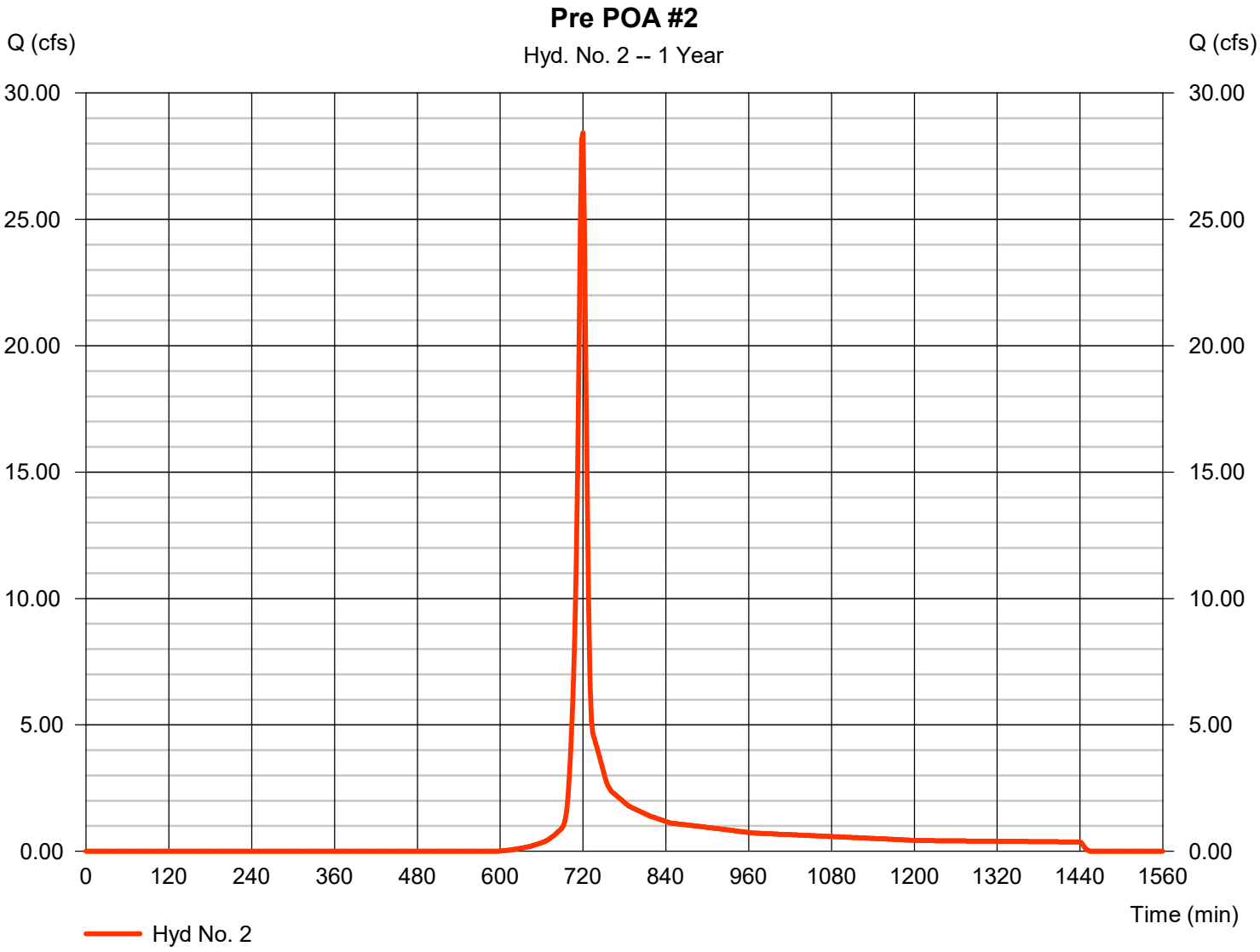
Total Travel Time, Tc ..... 5.80 min

Hydrograph Report

Hyd. No. 2

Pre POA #2

Hydrograph type	=	SCS Runoff	Peak discharge	=	28.42 cfs
Storm frequency	=	1 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	65,063 cuft
Drainage area	=	15.640 ac	Curve number	=	80
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	7.80 min
Total precip.	=	2.86 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



TR55 Tc Worksheet

Hyd. No. 2

Pre POA #2

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.011		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.45		0.00		0.00		
Land slope (%)	= 4.64		0.00		0.00		
Travel Time (min)	**= 2.01**	**+**	**0.00**	**+**	**0.00**	**=**	**2.01**
Shallow Concentrated Flow							
Flow length (ft)	= 1356.00		0.00		0.00		
Watercourse slope (%)	= 5.88		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=3.91		0.00		0.00		
Travel Time (min)	**= 5.78**	**+**	**0.00**	**+**	**0.00**	**=**	**5.78**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

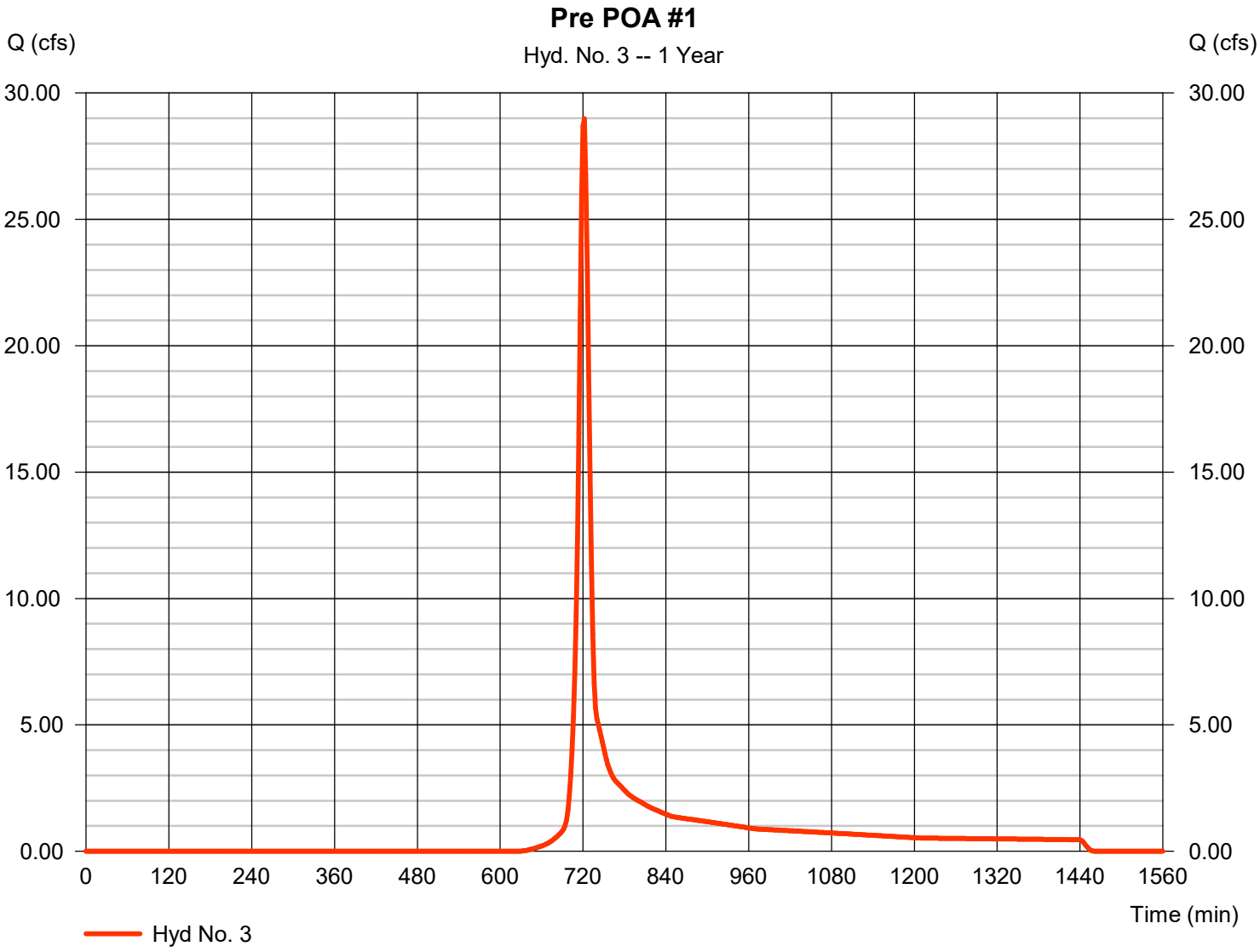
Total Travel Time, Tc ..... 7.80 min

Hydrograph Report

Hyd. No. 3

Pre POA #1

Hydrograph type	=	SCS Runoff	Peak discharge	=	28.98 cfs
Storm frequency	=	1 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	76,593 cuft
Drainage area	=	19.860 ac	Curve number	=	78
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	10.00 min
Total precip.	=	2.86 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



TR55 Tc Worksheet

Hyd. No. 3

Pre POA #1

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.011		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.20		0.00		0.00		
Land slope (%)	= 4.60		0.00		0.00		
Travel Time (min)	**= 2.52**	**+**	**0.00**	**+**	**0.00**	**=**	**2.52**
Shallow Concentrated Flow							
Flow length (ft)	= 150.00		0.00		0.00		
Watercourse slope (%)	= 1.67		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.09		0.00		0.00		
Travel Time (min)	**= 1.20**	**+**	**0.00**	**+**	**0.00**	**=**	**1.20**
Channel Flow							
X sectional flow area (sqft)	= 16.00		0.00		0.00		
Wetted perimeter (ft)	= 20.00		0.00		0.00		
Channel slope (%)	= 1.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=8.55						
			0.00				
					0.00		
Flow length (ft)	({0})3240.0		0.0		0.0		
Travel Time (min)	**= 6.31**	**+**	**0.00**	**+**	**0.00**	**=**	**6.31**

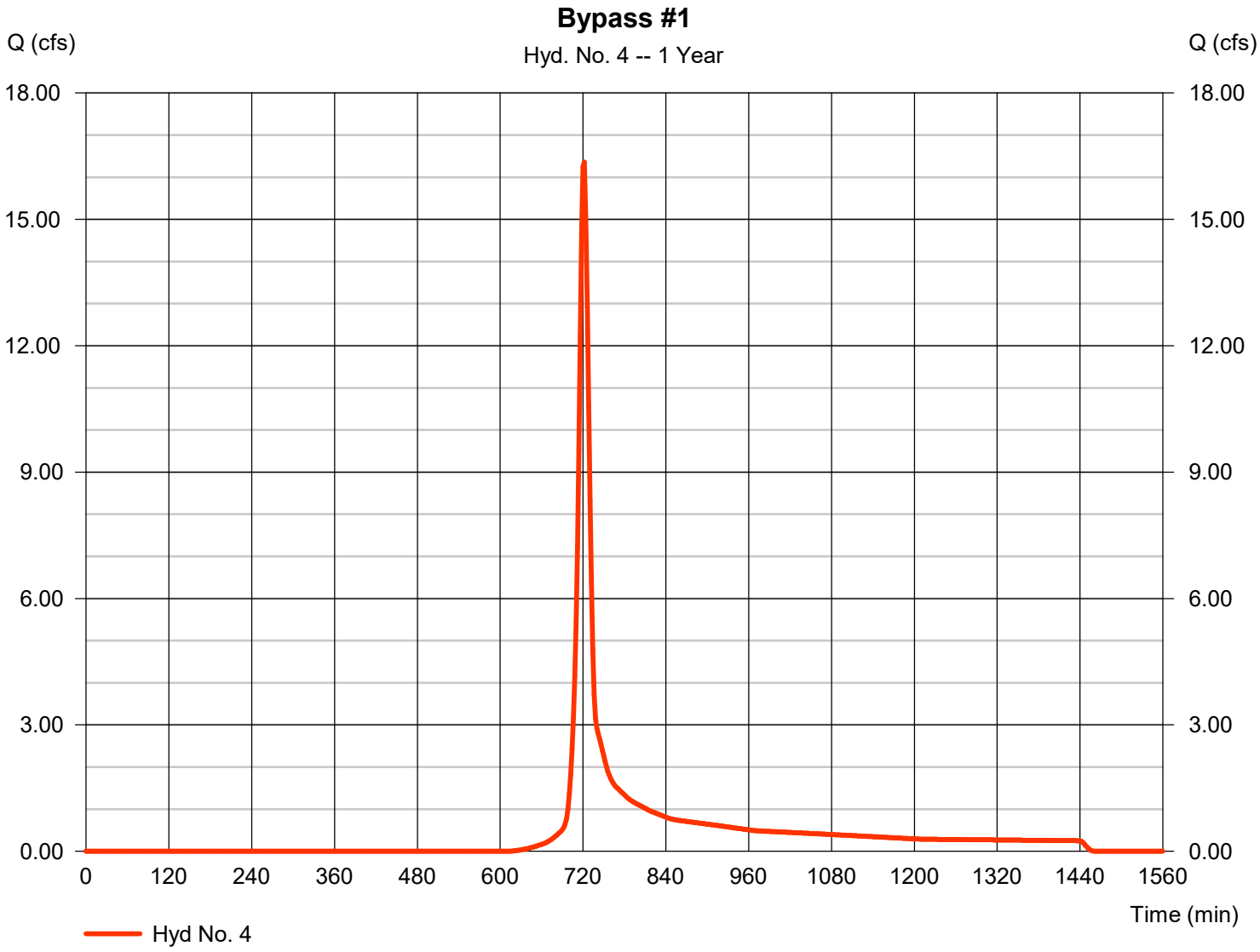
Total Travel Time, Tc ..... 10.00 min

Hydrograph Report

Hyd. No. 4

Bypass #1

Hydrograph type	=	SCS Runoff	Peak discharge	=	16.36 cfs
Storm frequency	=	1 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	43,058 cuft
Drainage area	=	10.580 ac	Curve number	=	79
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	2.86 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

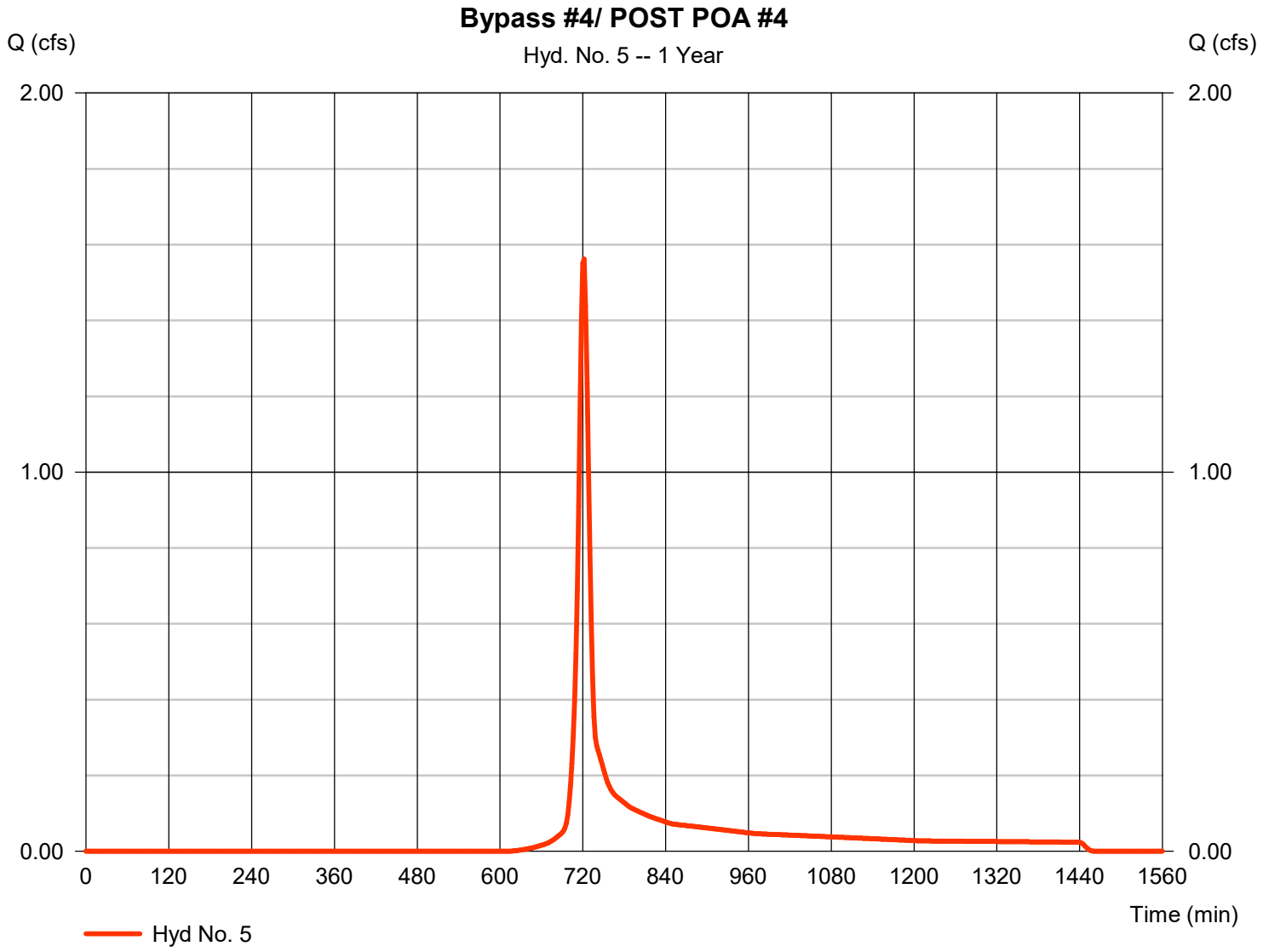


Hydrograph Report

Hyd. No. 5

Bypass #4/ POST POA #4

Hydrograph type	= SCS Runoff	Peak discharge	= 1.562 cfs
Storm frequency	= 1 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 4,110 cuft
Drainage area	= 1.010 ac	Curve number	= 79
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 2.86 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

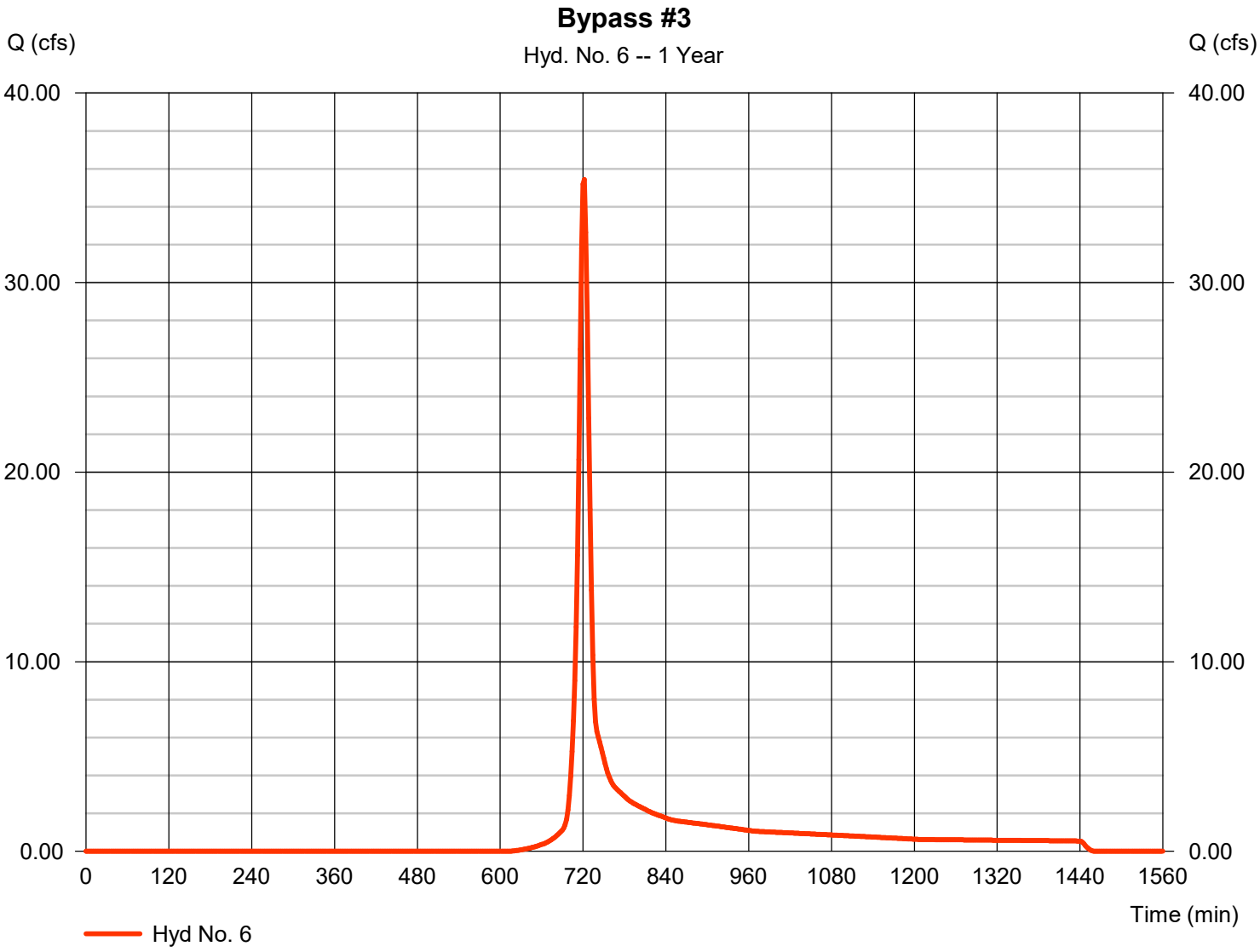


Hydrograph Report

Hyd. No. 6

Bypass #3

Hydrograph type	=	SCS Runoff	Peak discharge	=	35.44 cfs
Storm frequency	=	1 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	93,278 cuft
Drainage area	=	22.920 ac	Curve number	=	79
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	2.86 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



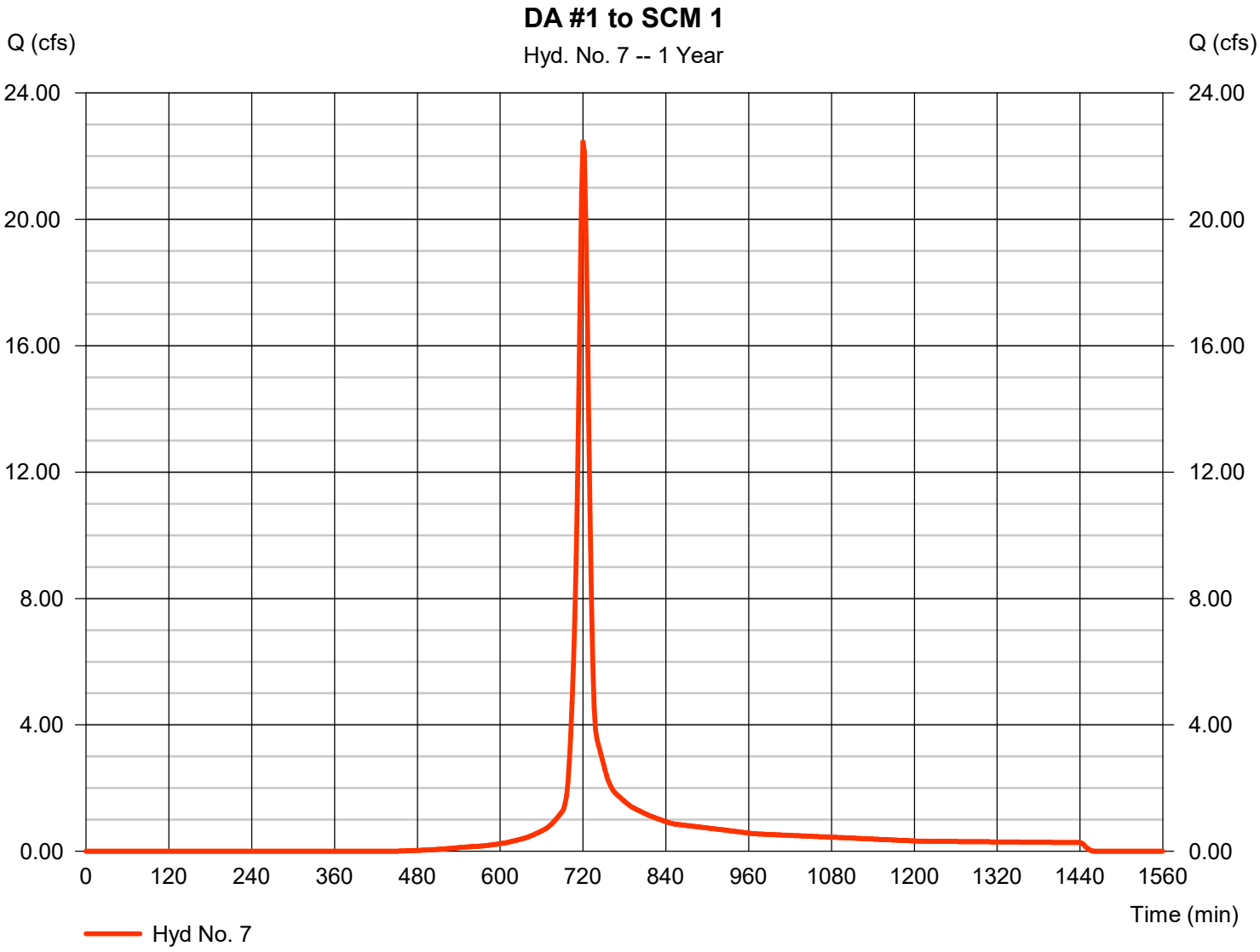
Hydrograph Report

Hyd. No. 7

DA #1 to SCM 1

Hydrograph type	=	SCS Runoff	Peak discharge	=	22.45 cfs
Storm frequency	=	1 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	58,248 cuft
Drainage area	=	9.620 ac	Curve number	=	87*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	2.86 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(5.130 x 98) + (4.090 x 80)] / 9.620

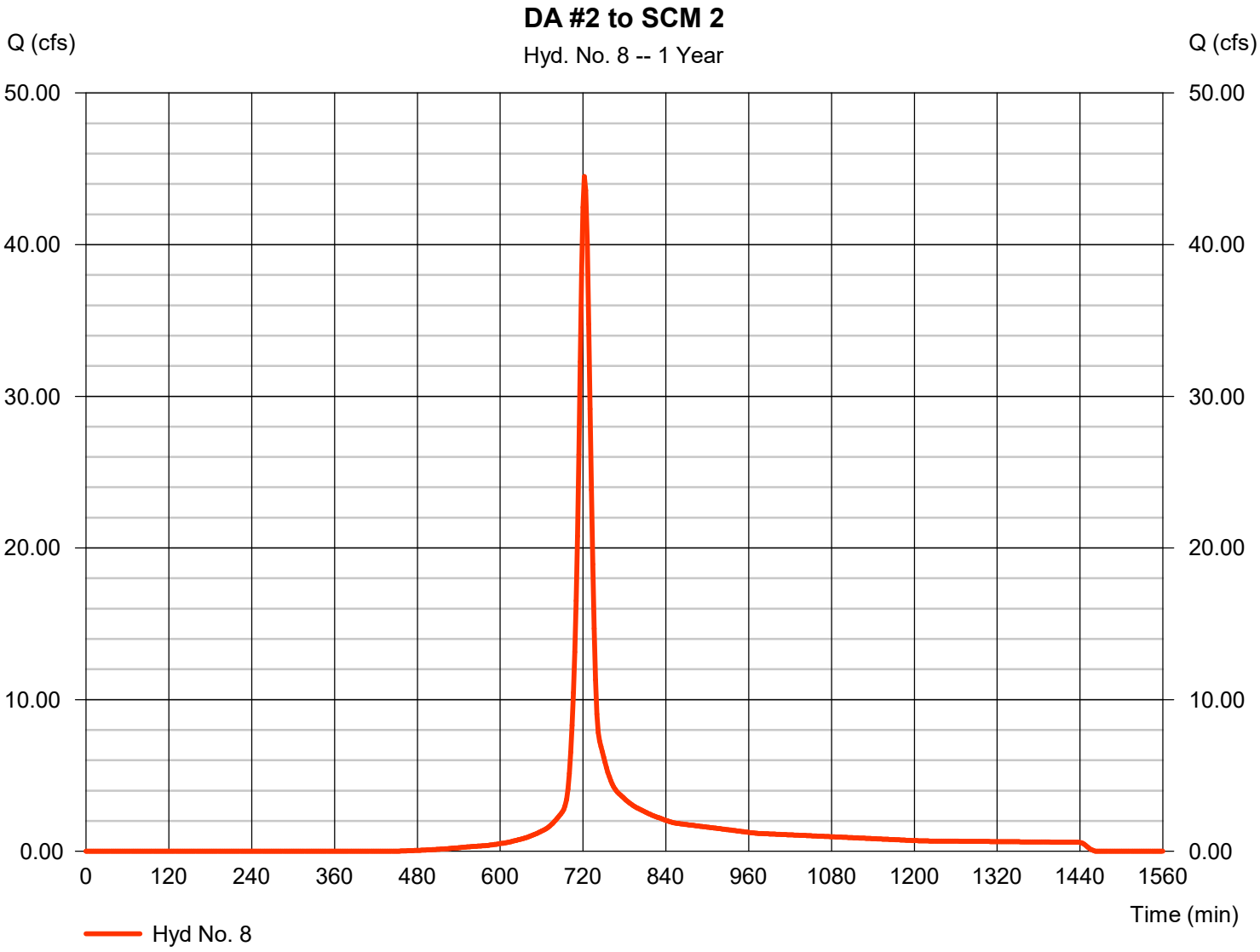


Hydrograph Report

Hyd. No. 8

DA #2 to SCM 2

Hydrograph type	=	SCS Runoff	Peak discharge	=	44.48 cfs
Storm frequency	=	1 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	124,740 cuft
Drainage area	=	21.790 ac	Curve number	=	87
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	15.00 min
Total precip.	=	2.86 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

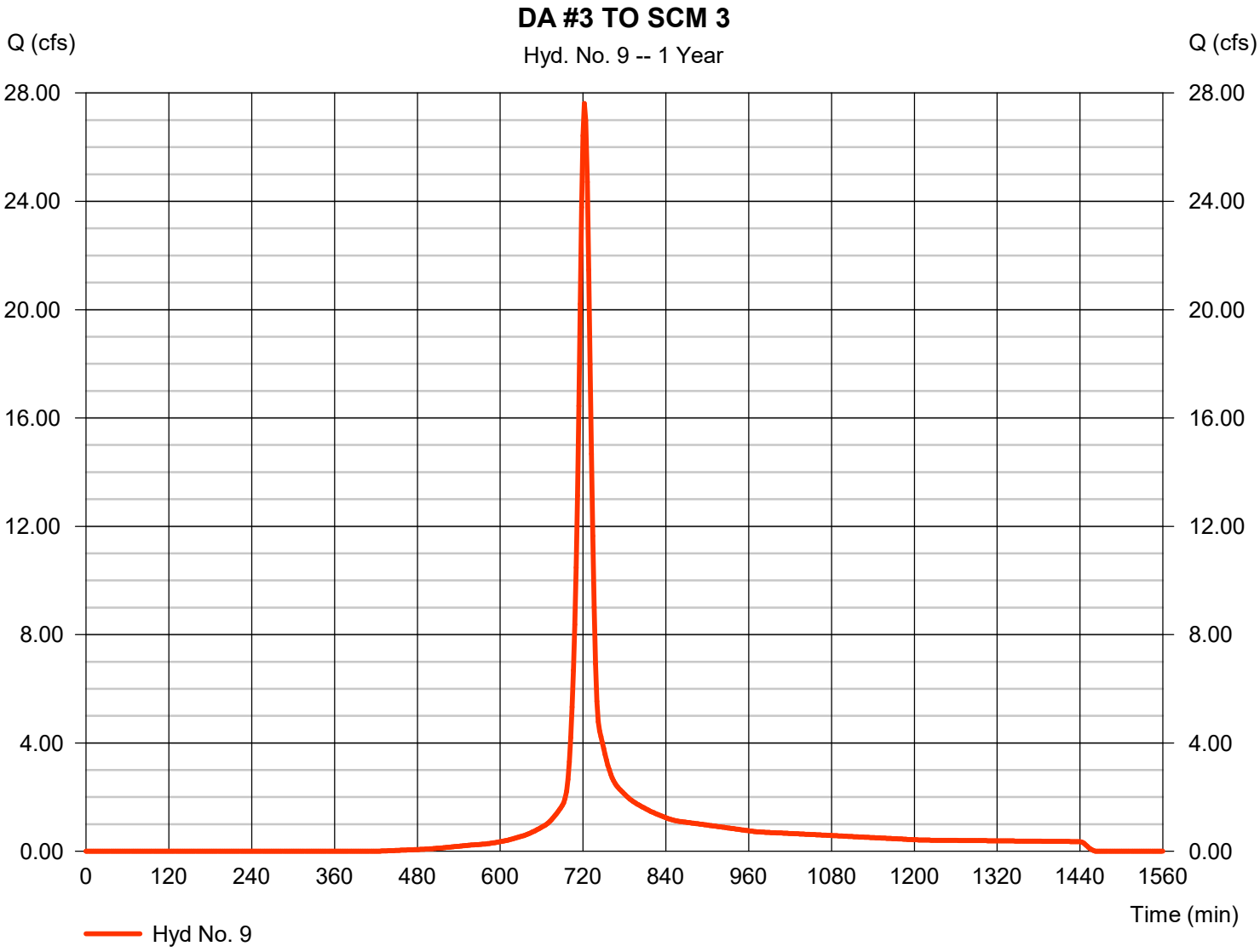


Hydrograph Report

Hyd. No. 9

DA #3 TO SCM 3

Hydrograph type	=	SCS Runoff	Peak discharge	=	27.61 cfs
Storm frequency	=	1 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	77,535 cuft
Drainage area	=	12.930 ac	Curve number	=	88
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	15.00 min
Total precip.	=	2.86 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

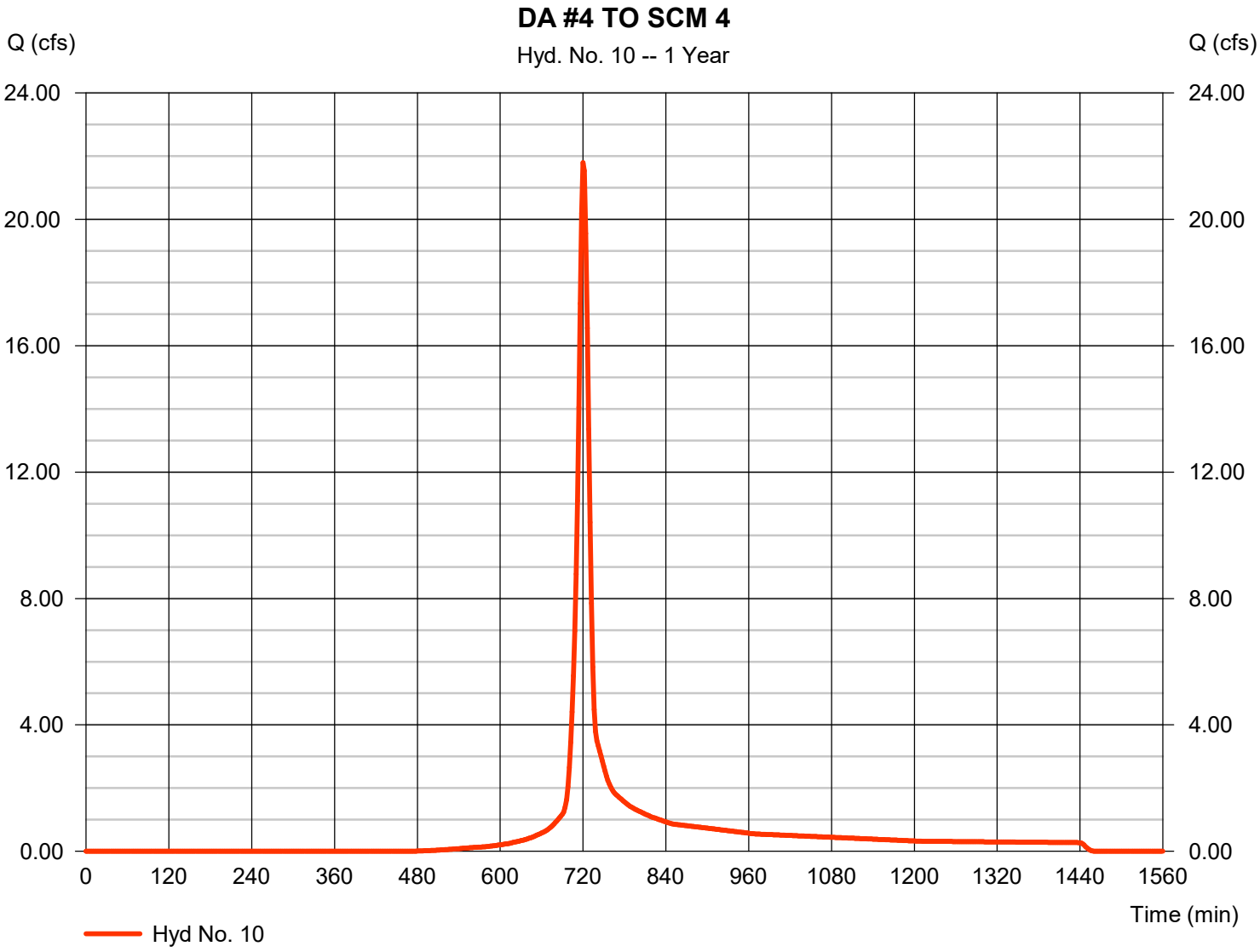


Hydrograph Report

Hyd. No. 10

DA #4 TO SCM 4

Hydrograph type	=	SCS Runoff	Peak discharge	=	21.79 cfs
Storm frequency	=	1 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	56,498 cuft
Drainage area	=	9.780 ac	Curve number	=	86
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	2.86 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



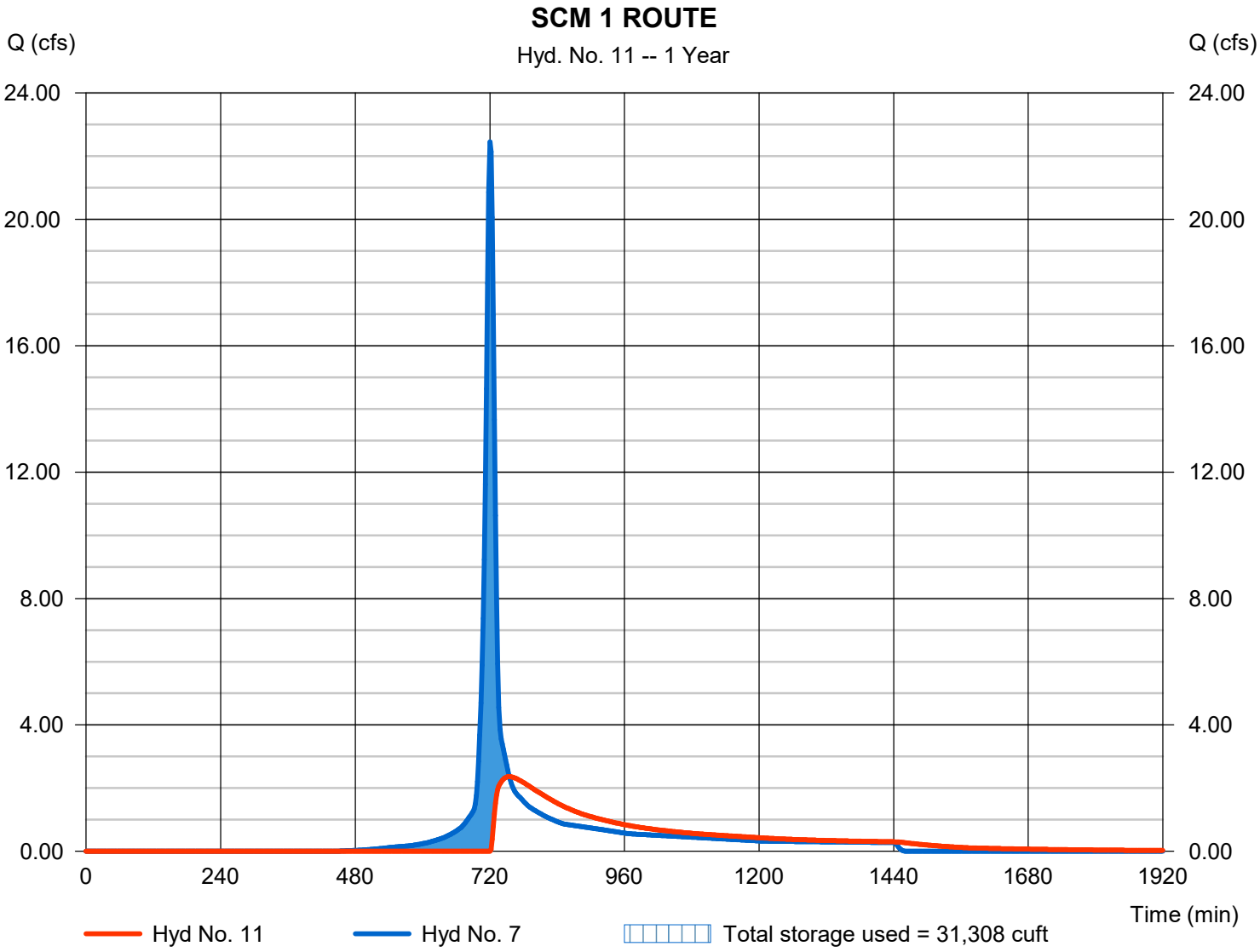
Hydrograph Report

Hyd. No. 11

SCM 1 ROUTE

Hydrograph type	=	Reservoir	Peak discharge	=	2.367 cfs
Storm frequency	=	1 yrs	Time to peak	=	754 min
Time interval	=	2 min	Hyd. volume	=	38,346 cuft
Inflow hyd. No.	=	7 - DA #1 to SCM 1	Max. Elevation	=	386.90 ft
Reservoir name	=	SCM 1	Max. Storage	=	31,308 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - SCM 1

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 384.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	384.50	10,590	0	0
0.50	385.00	12,050	5,656	5,656
1.50	386.00	13,565	12,799	18,454
2.50	387.00	15,138	14,343	32,797
3.50	388.00	16,767	15,944	48,741
4.50	389.00	18,453	17,602	66,343
5.50	390.00	20,196	19,316	85,659

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	2.00	0.00	0.00
Span (in)	= 24.00	0.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 379.00	384.50	0.00	0.00
Length (ft)	= 165.00	1.00	0.00	0.00
Slope (%)	= 0.61	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

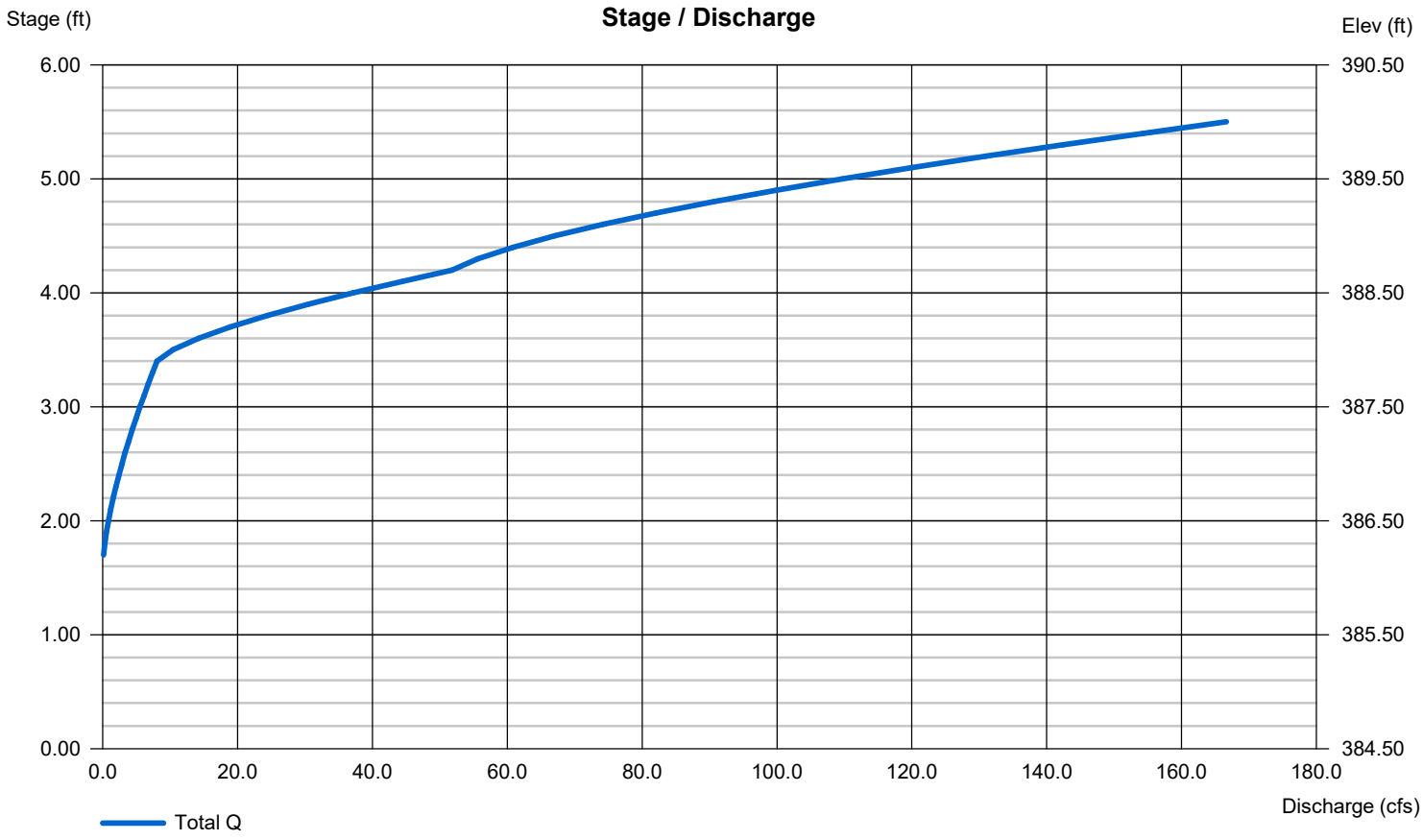
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 16.00	1.00	20.00	Inactive
Crest El. (ft)	= 387.90	386.10	388.70	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	Rect	Rect	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Contour)

TW Elev. (ft) = 0.00

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



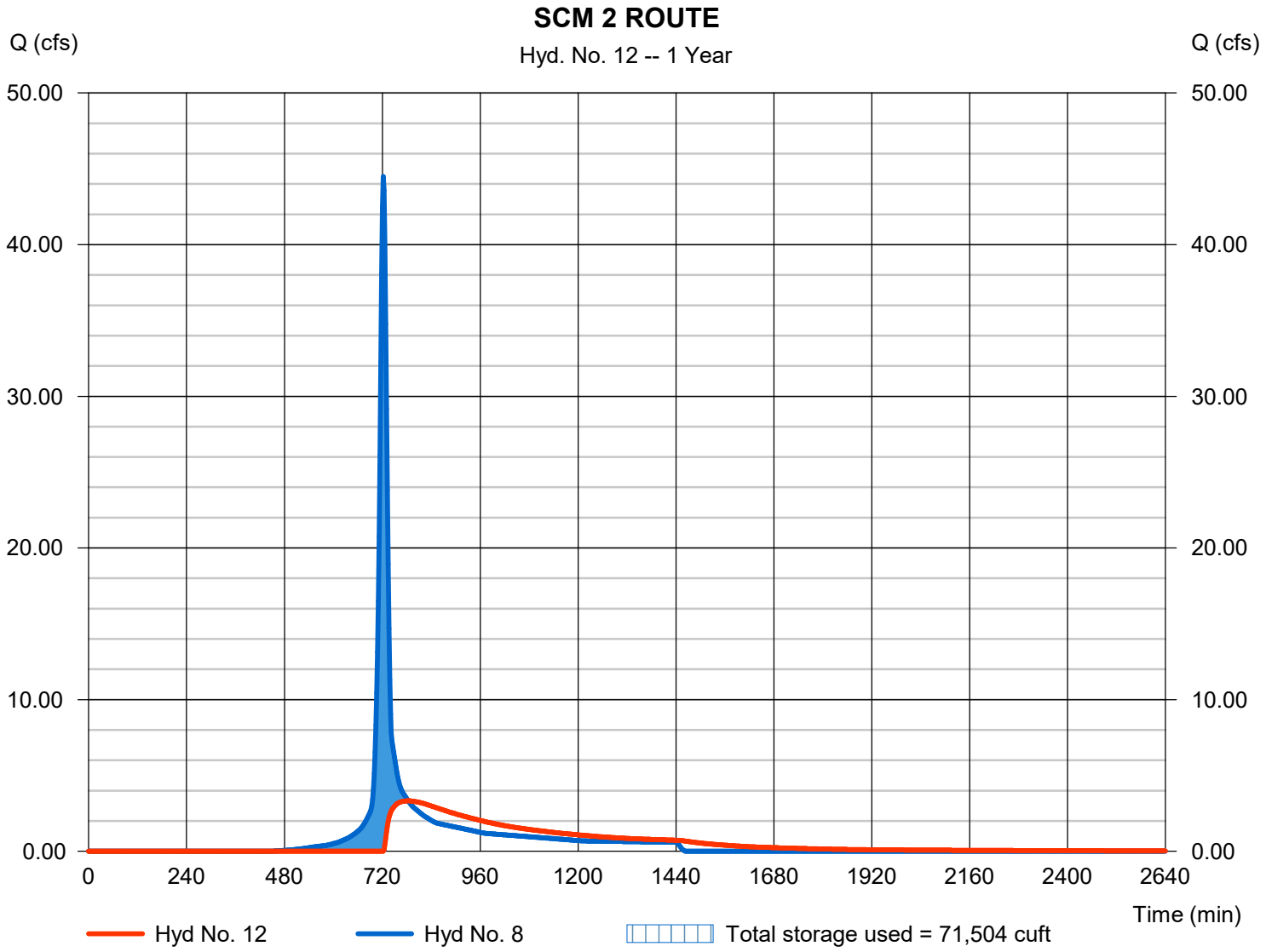
Hydrograph Report

Hyd. No. 12

SCM 2 ROUTE

Hydrograph type	=	Reservoir	Peak discharge	=	3.322 cfs
Storm frequency	=	1 yrs	Time to peak	=	784 min
Time interval	=	2 min	Hyd. volume	=	83,377 cuft
Inflow hyd. No.	=	8 - DA #2 to SCM 2	Max. Elevation	=	354.00 ft
Reservoir name	=	SCM 2	Max. Storage	=	71,504 cuft

Storage Indication method used.



Pond Report

Pond No. 2 - SCM 2

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 351.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	351.50	25,295	0	0
0.50	352.00	27,224	13,125	13,125
1.50	353.00	29,209	28,208	41,333
2.50	354.00	31,251	30,221	71,555
3.50	355.00	33,350	32,292	103,846
4.50	356.00	35,504	34,418	138,264
5.50	357.00	37,716	36,601	174,865

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	4.00	0.00	0.00
Span (in)	= 24.00	0.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 346.00	351.50	0.00	0.00
Length (ft)	= 87.00	1.00	0.00	0.00
Slope (%)	= 1.15	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

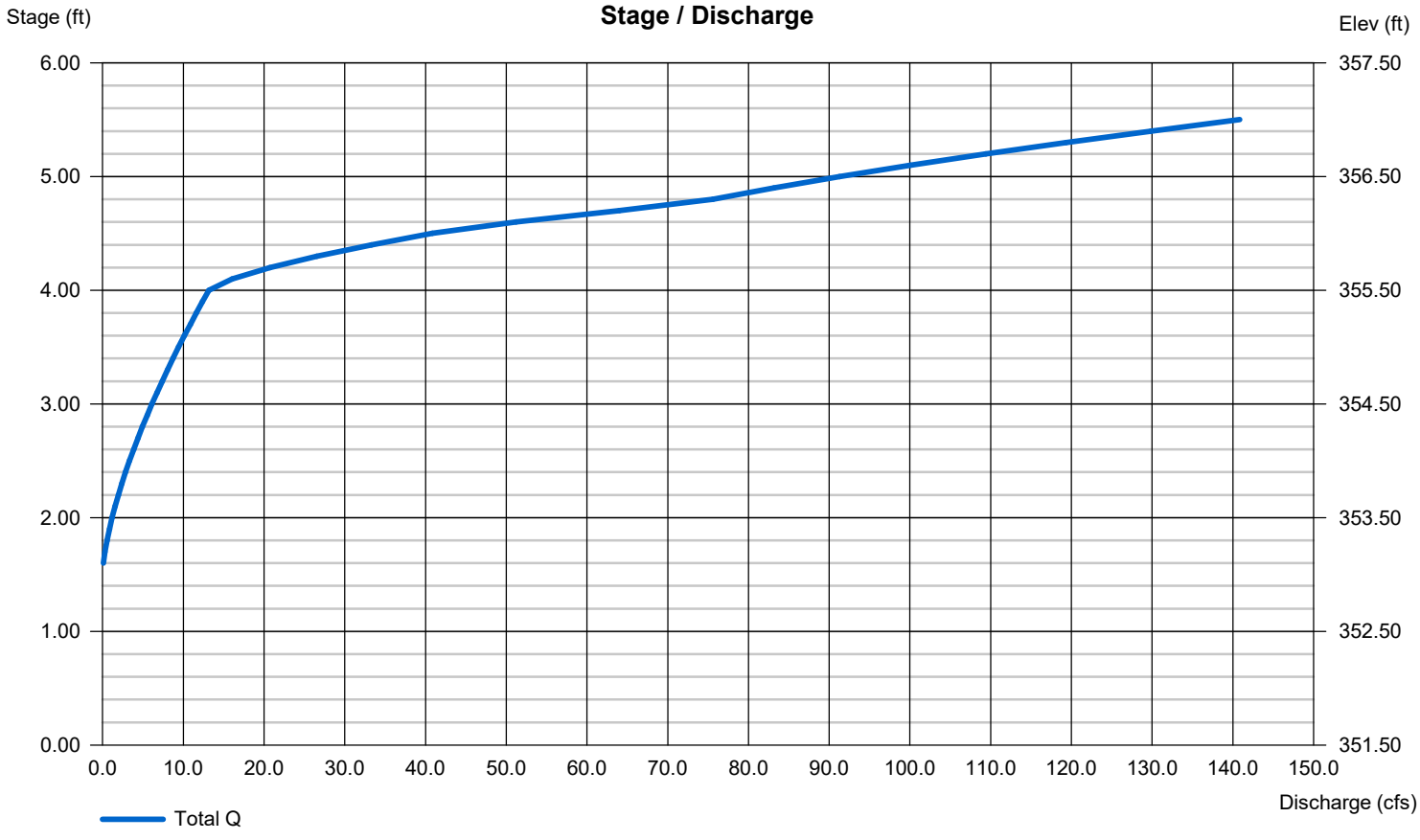
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 20.00	1.00	20.00	Inactive
Crest El. (ft)	= 355.50	353.00	356.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	Rect	Rect	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Contour)

TW Elev. (ft) = 0.00

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



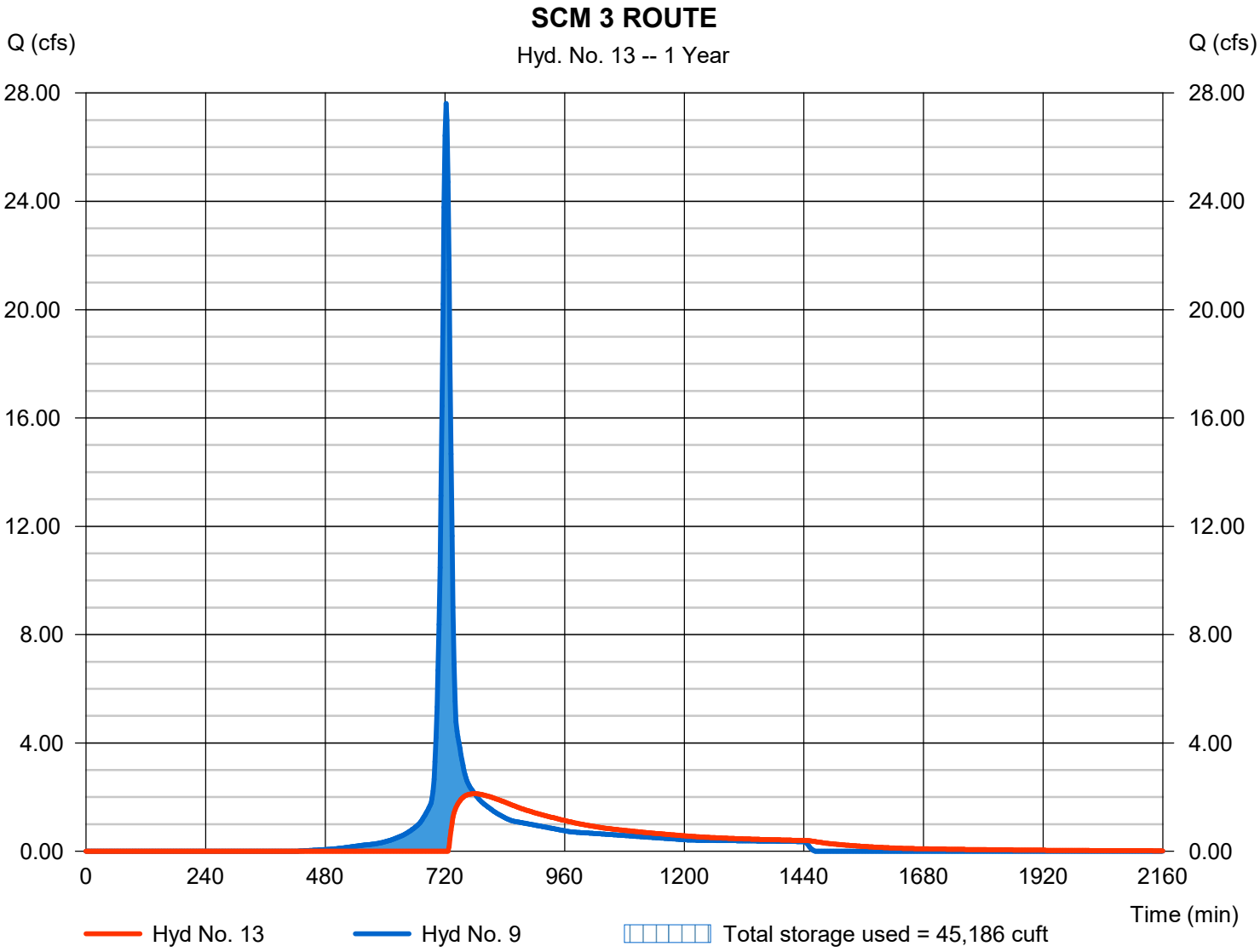
Hydrograph Report

Hyd. No. 13

SCM 3 ROUTE

Hydrograph type	=	Reservoir	Peak discharge	=	2.125 cfs
Storm frequency	=	1 yrs	Time to peak	=	780 min
Time interval	=	2 min	Hyd. volume	=	45,577 cuft
Inflow hyd. No.	=	9 - DA #3 TO SCM 3	Max. Elevation	=	387.24 ft
Reservoir name	=	SCM 3	Max. Storage	=	45,186 cuft

Storage Indication method used.



Pond Report

Pond No. 3 - SCM 3

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 384.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	384.50	14,183	0	0
0.50	385.00	15,527	7,424	7,424
1.50	386.00	16,222	15,872	23,296
2.50	387.00	18,385	17,290	40,586
3.50	388.00	19,899	19,135	59,721
4.50	389.00	20,679	20,286	80,007
5.50	390.00	22,278	21,471	101,479

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	3.00	0.00	0.00
Span (in)	= 24.00	0.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 379.00	384.50	0.00	0.00
Length (ft)	= 74.00	1.00	0.00	0.00
Slope (%)	= 4.00	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

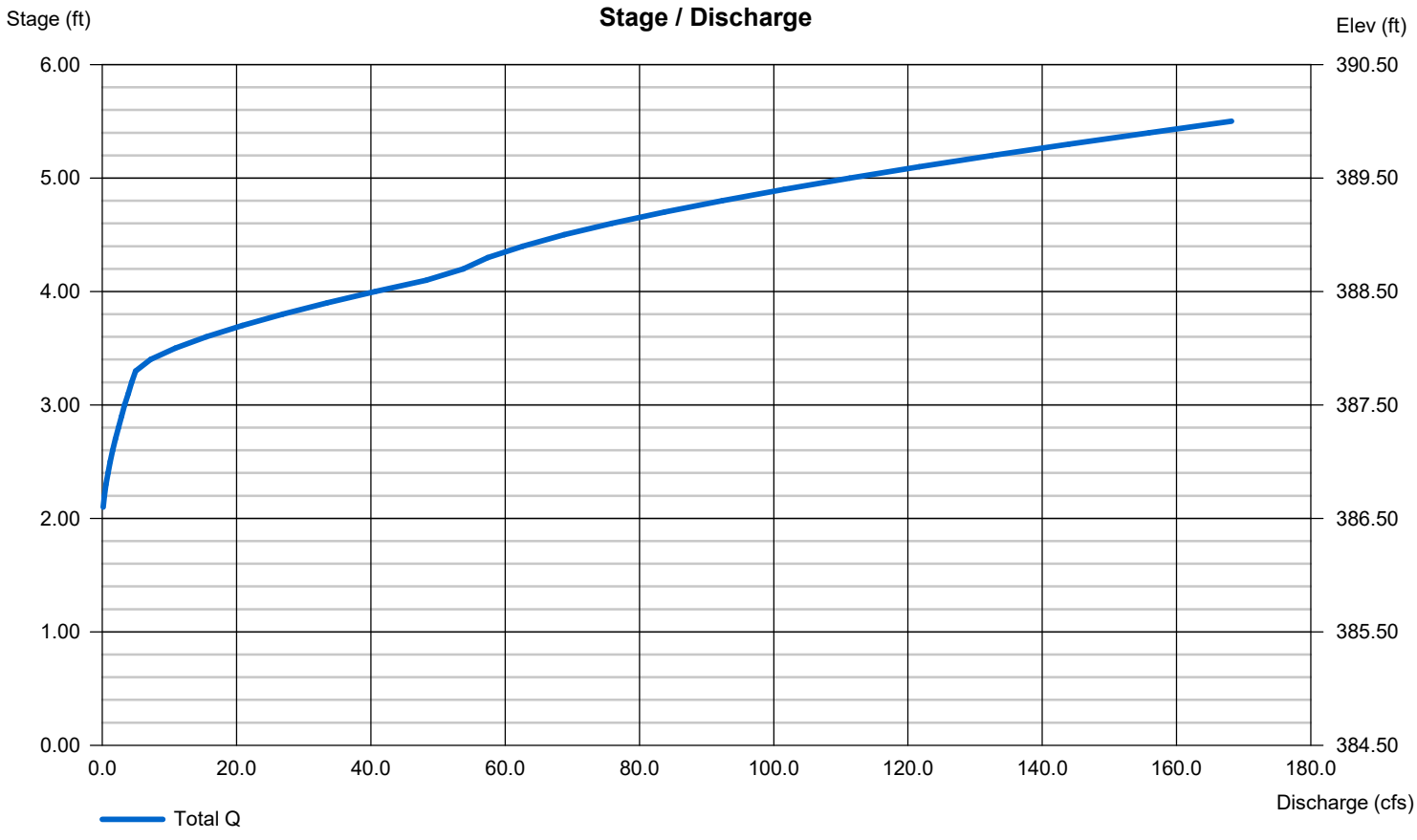
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 16.00	1.00	20.00	Inactive
Crest El. (ft)	= 387.80	386.50	388.70	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	Rect	Rect	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Contour)

TW Elev. (ft) = 0.00

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



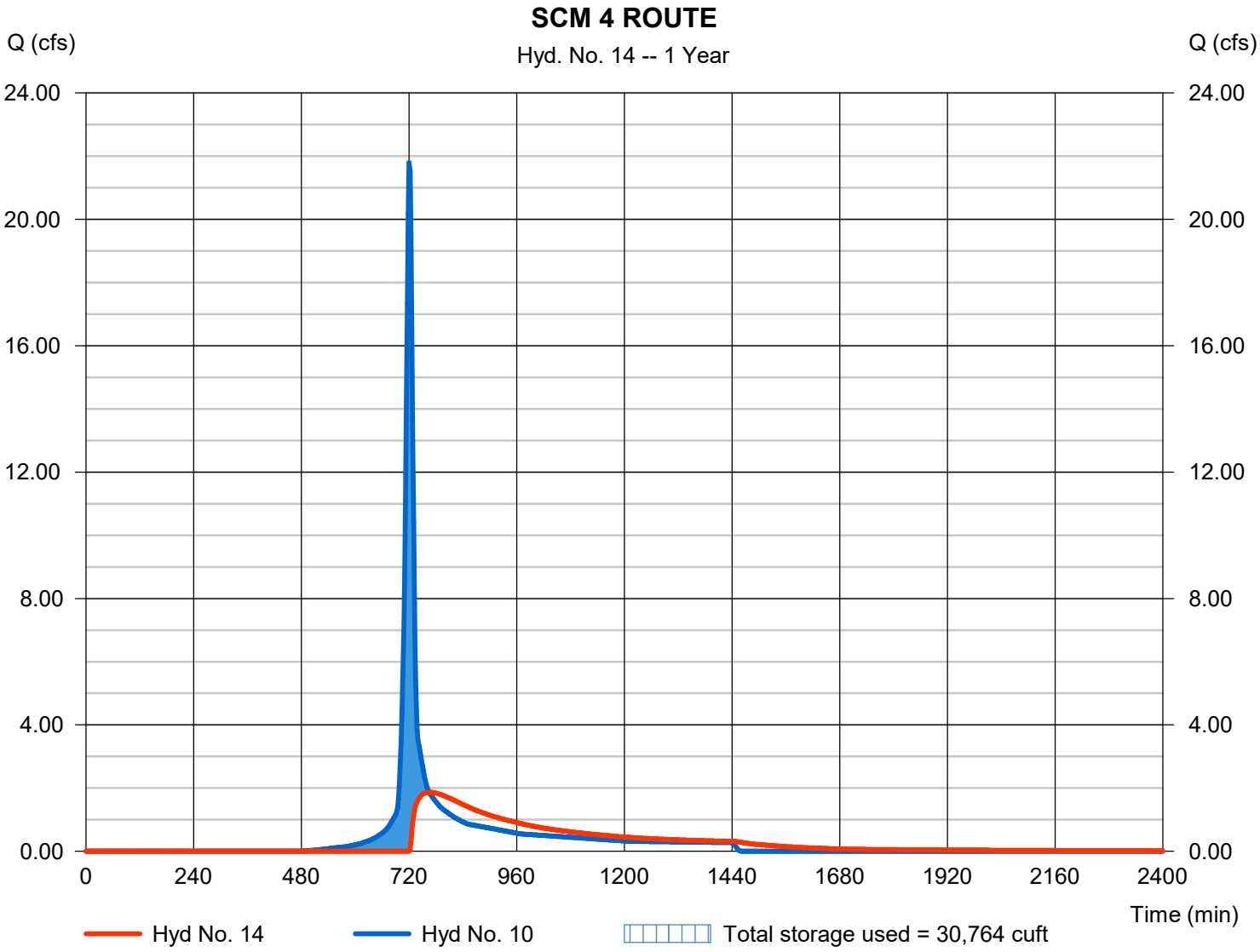
Hydrograph Report

Hyd. No. 14

SCM 4 ROUTE

Hydrograph type	=	Reservoir	Peak discharge	=	1.869 cfs
Storm frequency	=	1 yrs	Time to peak	=	764 min
Time interval	=	2 min	Hyd. volume	=	38,422 cuft
Inflow hyd. No.	=	10 - DA #4 TO SCM 4	Max. Elevation	=	382.31 ft
Reservoir name	=	SCM 4	Max. Storage	=	30,764 cuft

Storage Indication method used.



Pond No. 4 - SCM 4

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 380.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	380.50	14,636	0	0
0.50	381.00	16,358	7,744	7,744
1.50	382.00	18,005	17,173	24,917
2.50	383.00	19,735	18,862	43,778
3.50	384.00	21,522	20,620	64,398
4.50	385.00	22,548	22,031	86,429
5.50	386.00	24,300	23,416	109,845

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	2.00	0.00	0.00
Span (in)	= 24.00	0.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 375.00	380.50	0.00	0.00
Length (ft)	= 63.00	1.00	0.00	0.00
Slope (%)	= 1.60	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

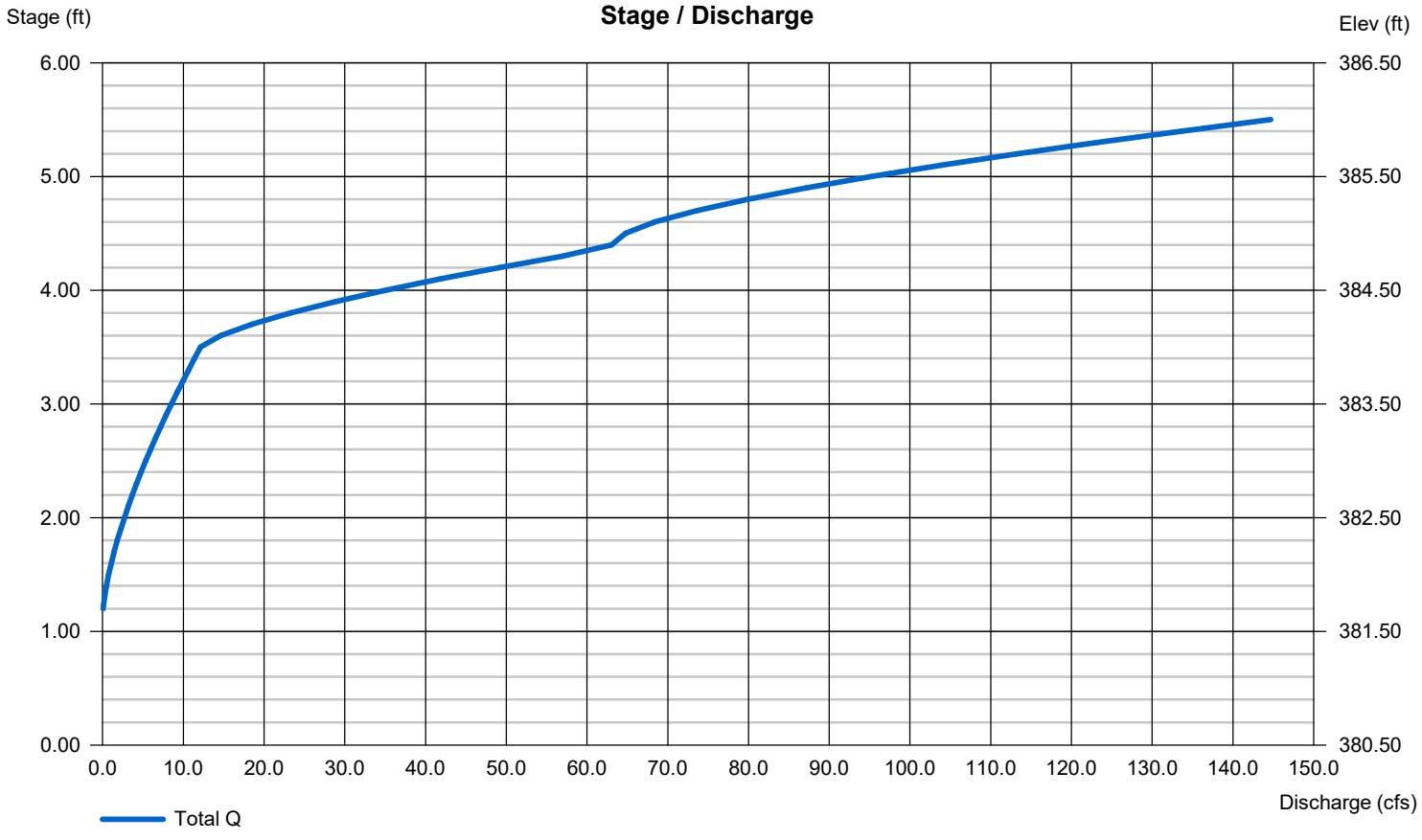
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 16.00	1.00	20.00	Inactive
Crest El. (ft)	= 384.00	381.63	385.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	Rect	Rect	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Contour)

TW Elev. (ft) = 0.00

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

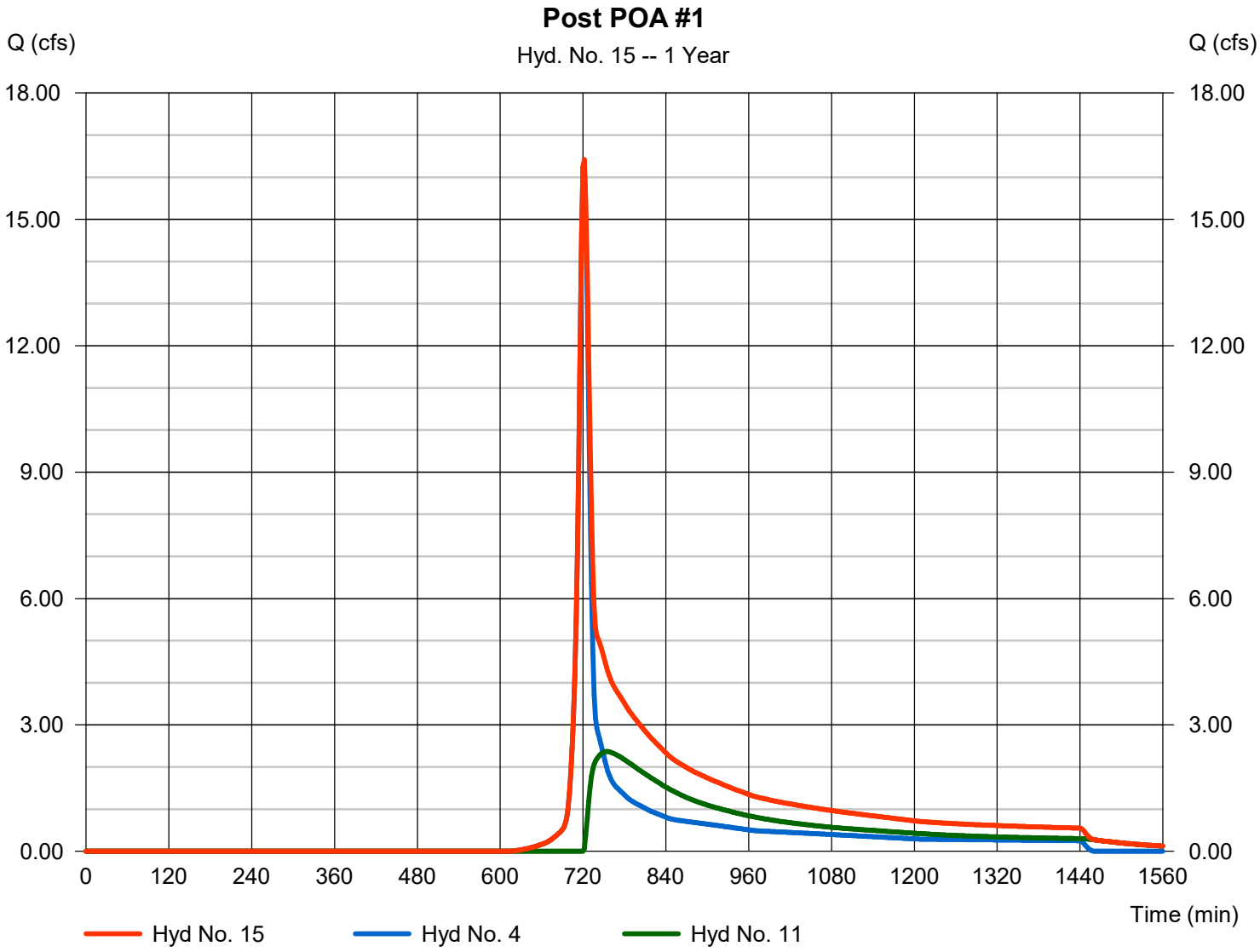


Hydrograph Report

Hyd. No. 15

Post POA #1

Hydrograph type	= Combine	Peak discharge	= 16.42 cfs
Storm frequency	= 1 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 81,404 cuft
Inflow hyds.	= 4, 11	Contrib. drain. area	= 10.580 ac

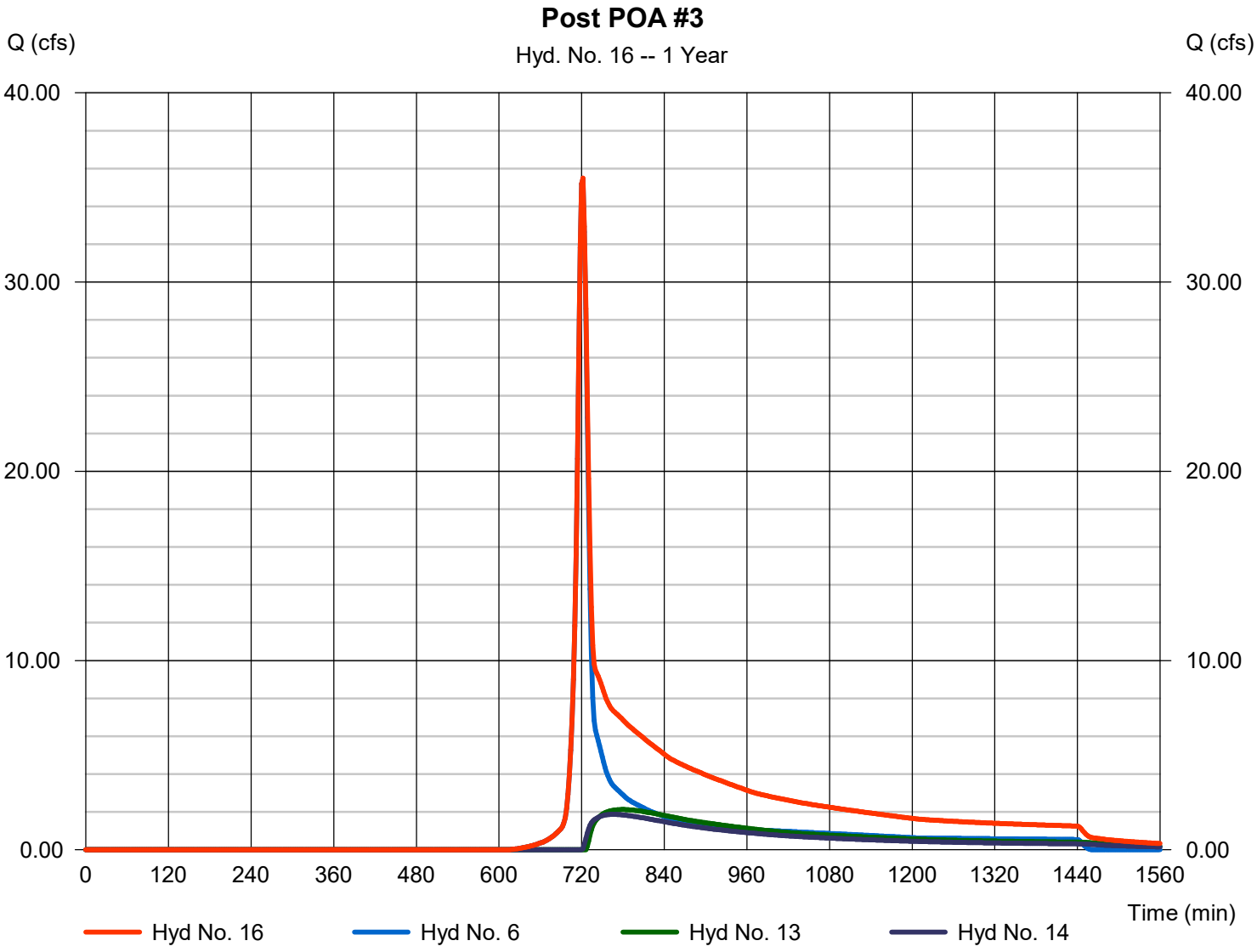


Hydrograph Report

Hyd. No. 16

Post POA #3

Hydrograph type	= Combine	Peak discharge	= 35.49 cfs
Storm frequency	= 1 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 177,278 cuft
Inflow hyds.	= 6, 13, 14	Contrib. drain. area	= 22.920 ac

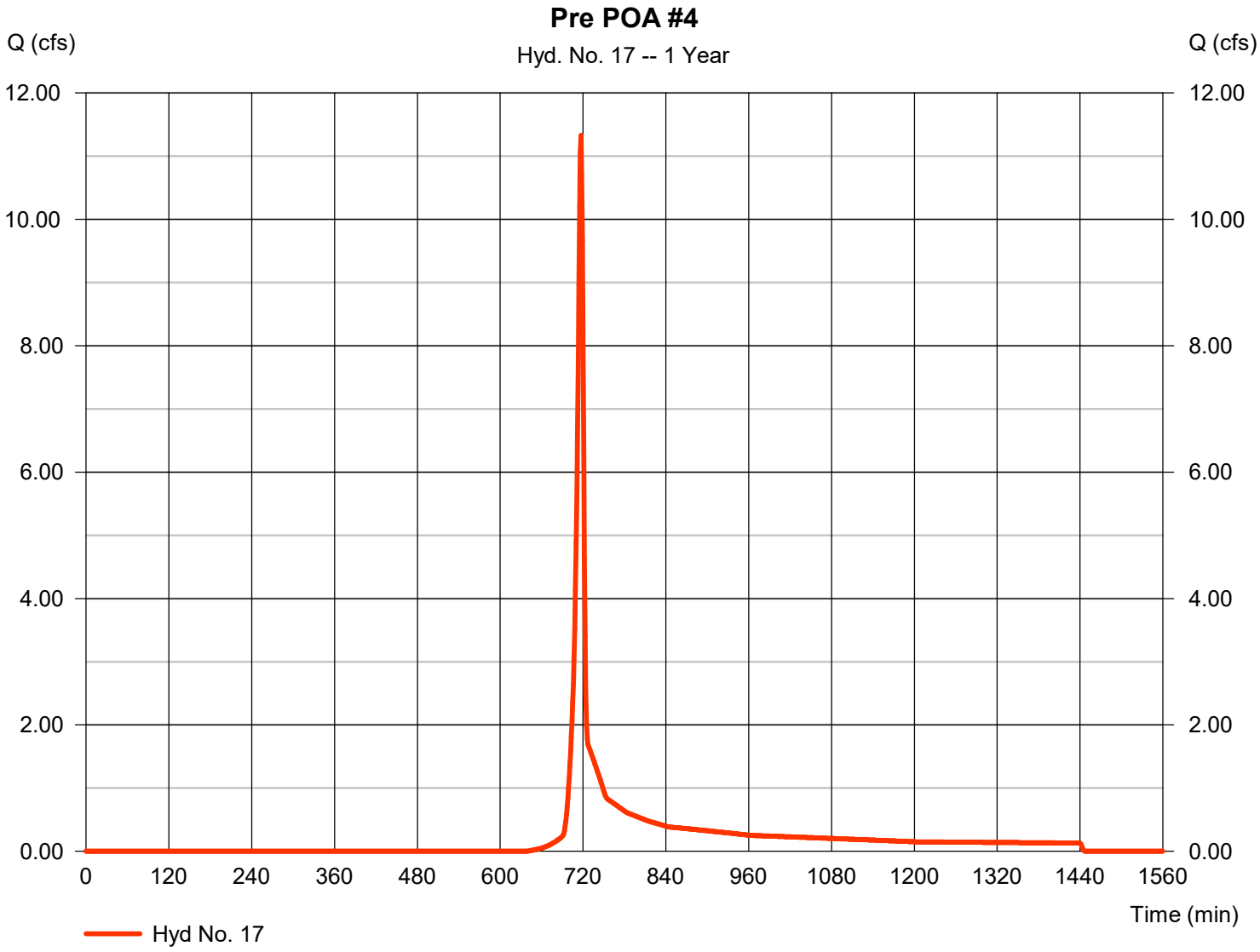


Hydrograph Report

Hyd. No. 17

Pre POA #4

Hydrograph type	=	SCS Runoff	Peak discharge	=	11.33 cfs
Storm frequency	=	1 yrs	Time to peak	=	717 min
Time interval	=	1 min	Hyd. volume	=	21,275 cuft
Drainage area	=	6.010 ac	Curve number	=	77
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	3.40 min
Total precip.	=	2.86 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



TR55 Tc Worksheet

Hyd. No. 17

Pre POA #4

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.011		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.20		0.00		0.00		
Land slope (%)	= 8.00		0.00		0.00		
Travel Time (min)	**= 2.02**	**+**	**0.00**	**+**	**0.00**	**=**	**2.02**
Shallow Concentrated Flow							
Flow length (ft)	= 30.00		0.00		0.00		
Watercourse slope (%)	= 0.05		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=0.36		0.00		0.00		
Travel Time (min)	**= 1.39**	**+**	**0.00**	**+**	**0.00**	**=**	**1.39**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

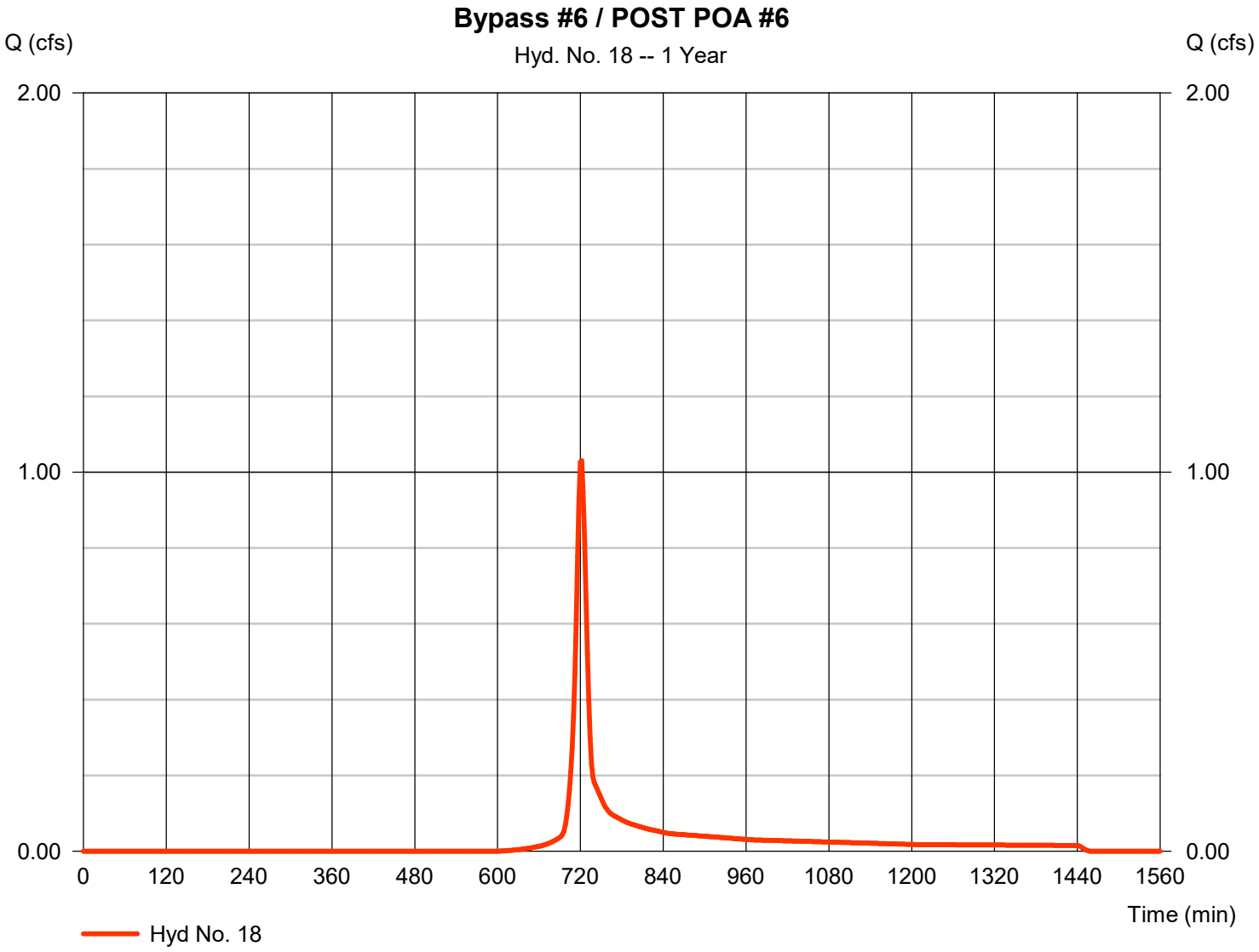
Total Travel Time, Tc ..... 3.40 min

Hydrograph Report

Hyd. No. 18

Bypass #6 / POST POA #6

Hydrograph type	= SCS Runoff	Peak discharge	= 1.030 cfs
Storm frequency	= 1 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 2,703 cuft
Drainage area	= 0.630 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 2.86 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

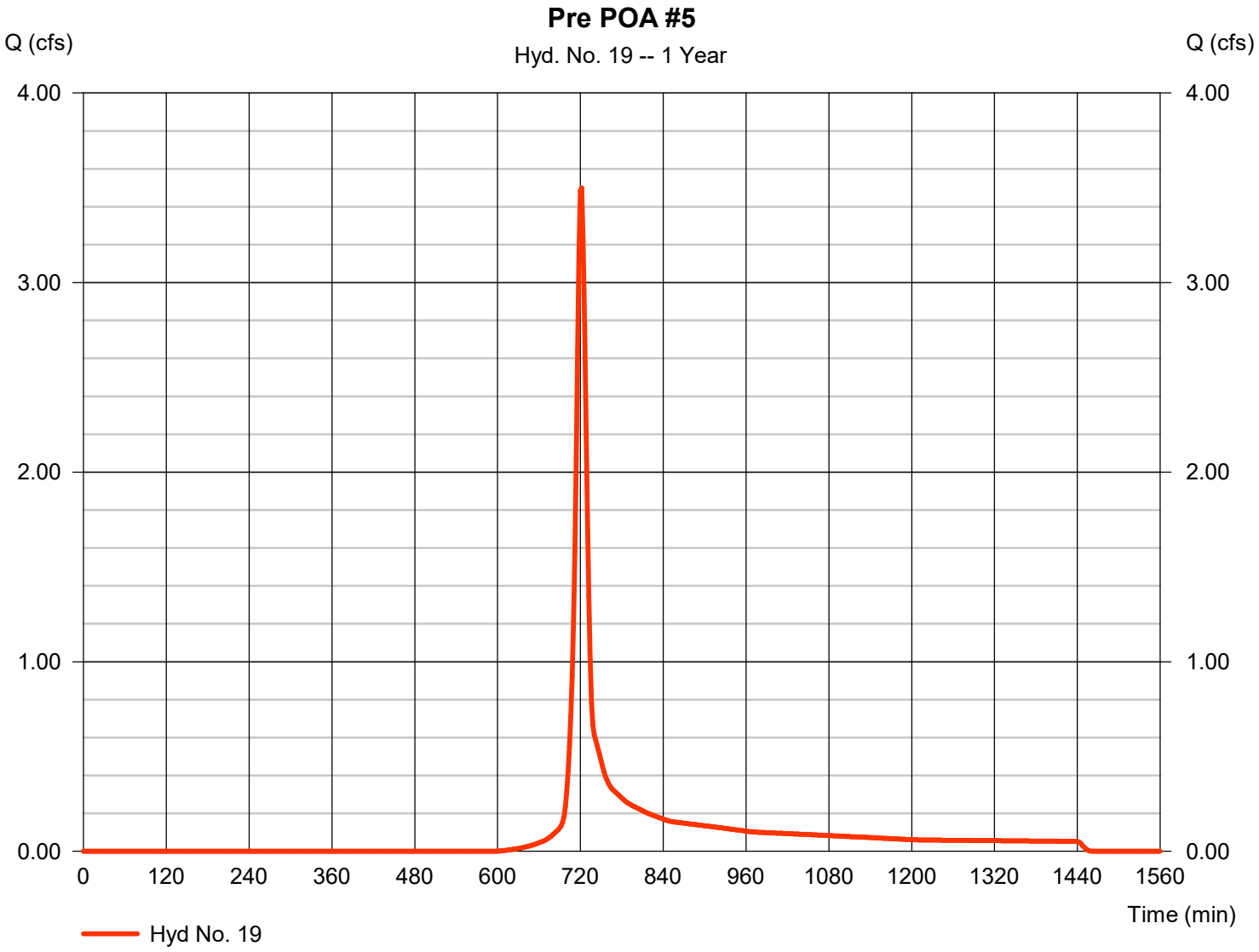


Hydrograph Report

Hyd. No. 19

Pre POA #5

Hydrograph type	=	SCS Runoff	Peak discharge	=	3.499 cfs
Storm frequency	=	1 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	9,181 cuft
Drainage area	=	2.140 ac	Curve number	=	80
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	12.00 min
Total precip.	=	2.86 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



TR55 Tc Worksheet

Hyd. No. 19

Pre POA #5

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.011		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.45		0.00		0.00		
Land slope (%)	= 2.09		0.00		0.00		
Travel Time (min)	**= 2.76**	**+**	**0.00**	**+**	**0.00**	**=**	**2.76**
Shallow Concentrated Flow							
Flow length (ft)	= 253.00		0.00		0.00		
Watercourse slope (%)	= 0.05		0.00		0.00		
Surface description	= Paved		Paved		Paved		
Average velocity (ft/s)	=0.45		0.00		0.00		
Travel Time (min)	**= 9.28**	**+**	**0.00**	**+**	**0.00**	**=**	**9.28**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

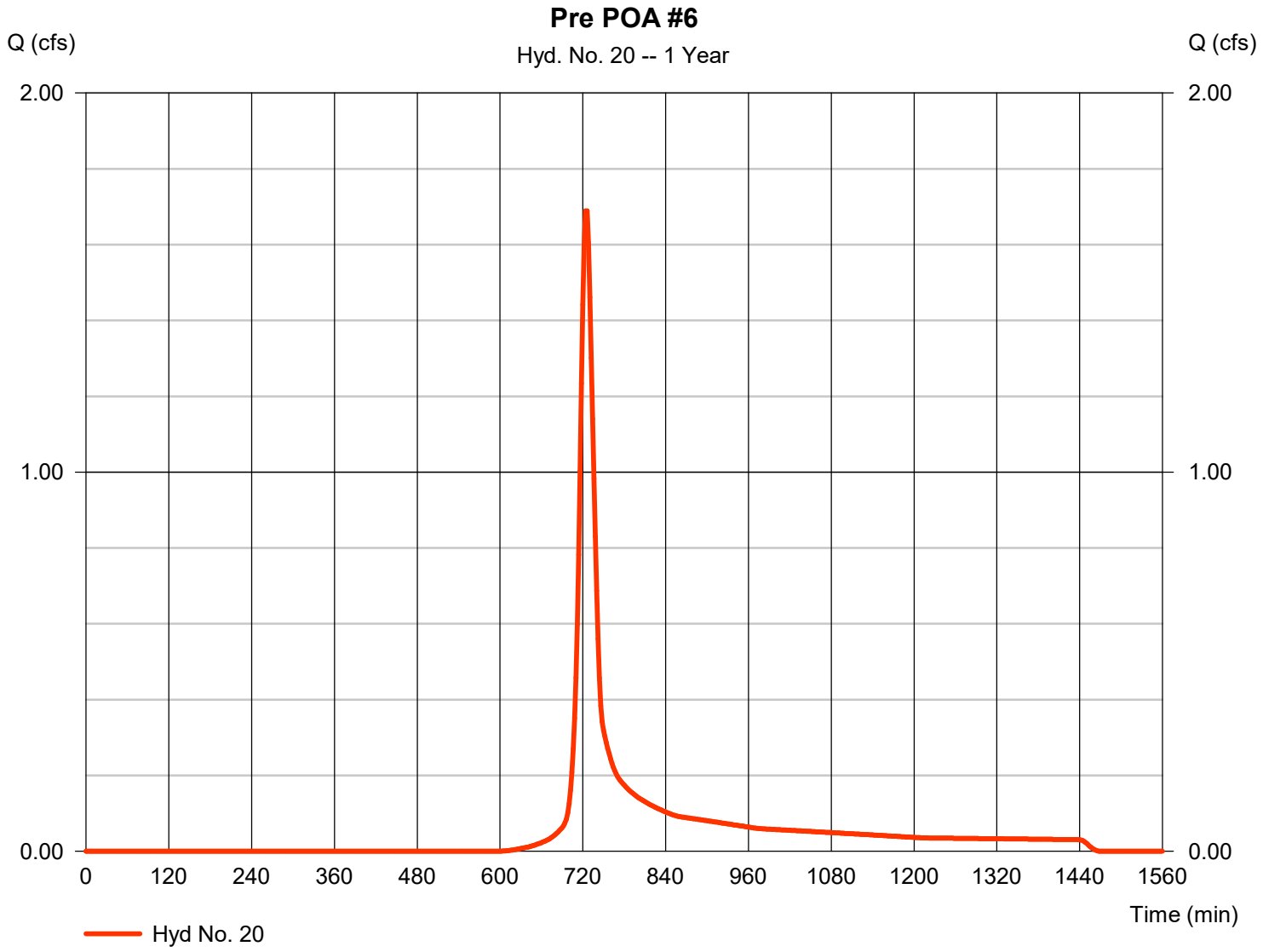
Total Travel Time, Tc ..... 12.00 min

Hydrograph Report

Hyd. No. 20

Pre POA #6

Hydrograph type	= SCS Runoff	Peak discharge	= 1.689 cfs
Storm frequency	= 1 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 5,408 cuft
Drainage area	= 1.300 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 17.20 min
Total precip.	= 2.86 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Hyd. No. 20

Pre POA #6

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.011		0.011		0.011		
Flow length (ft)	= 146.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.45		0.00		0.00		
Land slope (%)	= 3.87		0.00		0.00		
Travel Time (min)	**= 1.21**	**+**	**0.00**	**+**	**0.00**	**=**	**1.21**
Shallow Concentrated Flow							
Flow length (ft)	= 437.00		0.00		0.00		
Watercourse slope (%)	= 0.05		0.00		0.00		
Surface description	= Paved		Paved		Paved		
Average velocity (ft/s)	=0.45		0.00		0.00		
Travel Time (min)	**= 16.02**	**+**	**0.00**	**+**	**0.00**	**=**	**16.02**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

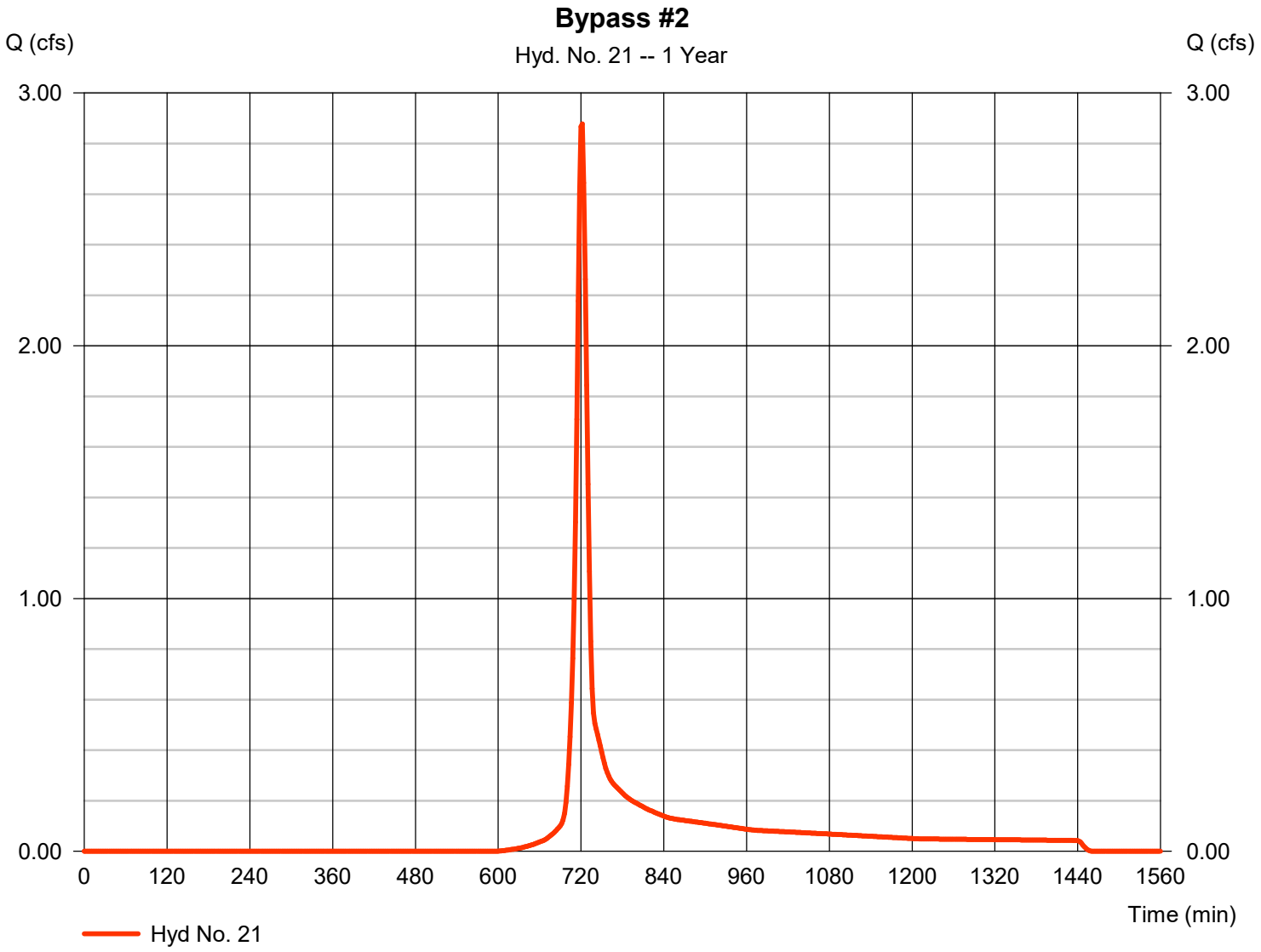
Total Travel Time, Tc ..... 17.20 min

Hydrograph Report

Hyd. No. 21

Bypass #2

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.878 cfs
Storm frequency	=	1 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	7,550 cuft
Drainage area	=	1.760 ac	Curve number	=	80
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	2.86 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

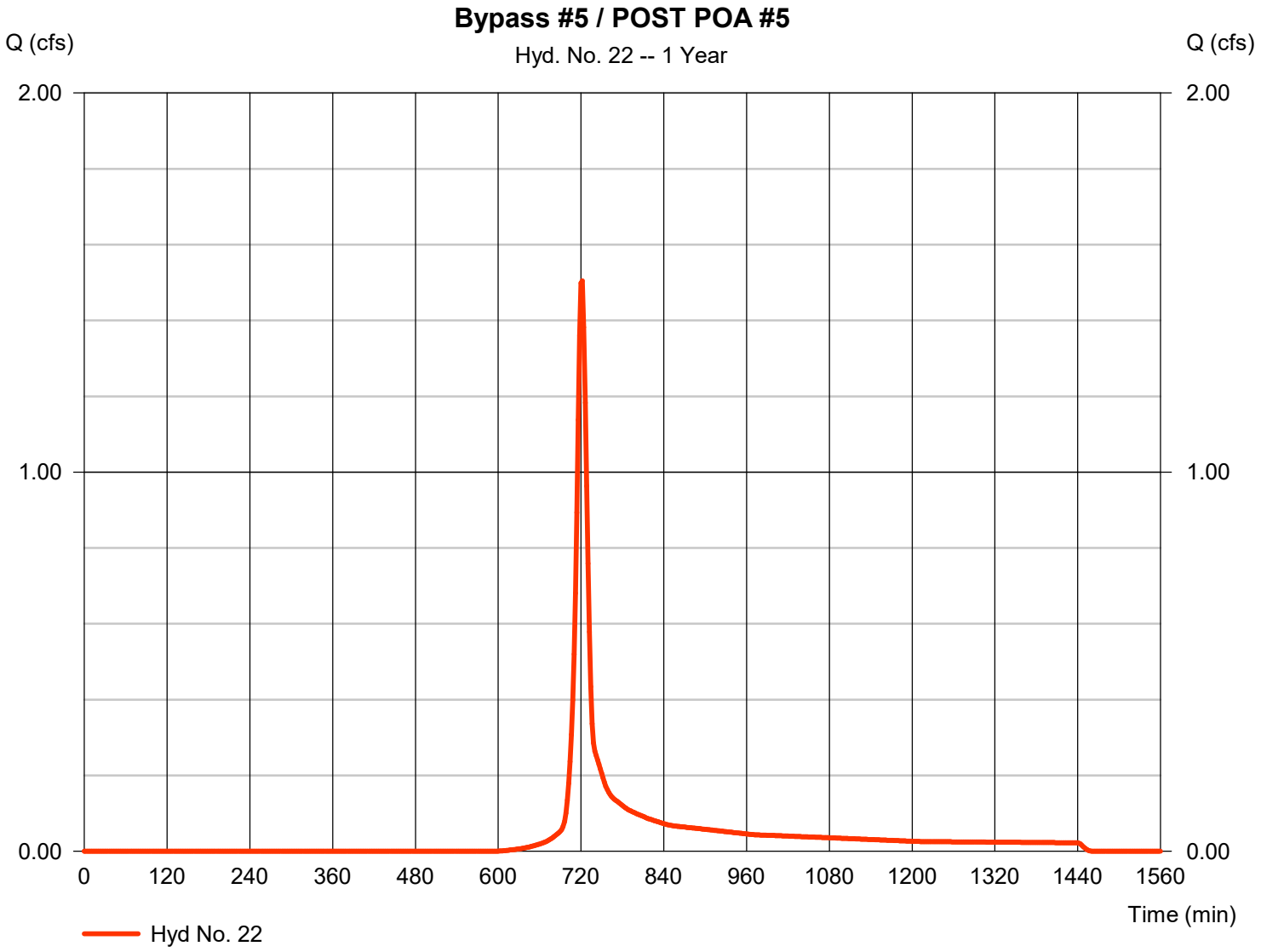


Hydrograph Report

Hyd. No. 22

Bypass #5 / POST POA #5

Hydrograph type	=	SCS Runoff	Peak discharge	=	1.504 cfs
Storm frequency	=	1 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	3,947 cuft
Drainage area	=	0.920 ac	Curve number	=	80
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	2.86 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

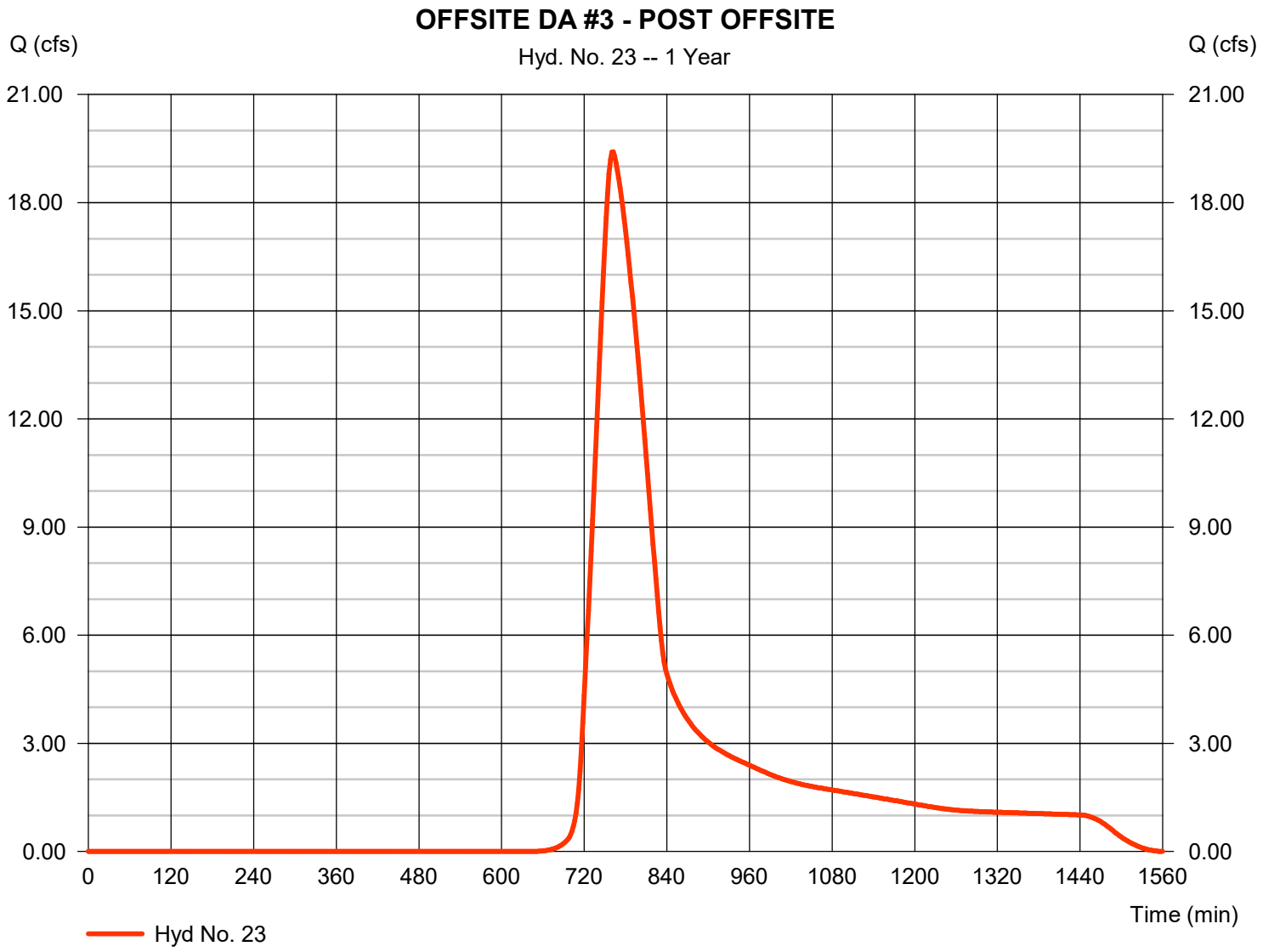


Hydrograph Report

Hyd. No. 23

OFFSITE DA #3 - POST OFFSITE

Hydrograph type	= SCS Runoff	Peak discharge	= 19.41 cfs
Storm frequency	= 1 yrs	Time to peak	= 762 min
Time interval	= 2 min	Hyd. volume	= 161,494 cuft
Drainage area	= 45.870 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 77.70 min
Total precip.	= 2.86 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Hyd. No. 23

OFFSITE DA #3 - POST OFFSITE

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.011		0.011		0.011		
Flow length (ft)	= 0.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 0.00		0.00		0.00		
Land slope (%)	= 0.00		0.00		0.00		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**
Shallow Concentrated Flow							
Flow length (ft)	= 1641.00		0.00		0.00		
Watercourse slope (%)	= 0.03		0.00		0.00		
Surface description	= Paved		Paved		Paved		
Average velocity (ft/s)	=0.35		0.00		0.00		
Travel Time (min)	**= 77.68**	**+**	**0.00**	**+**	**0.00**	**=**	**77.68**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

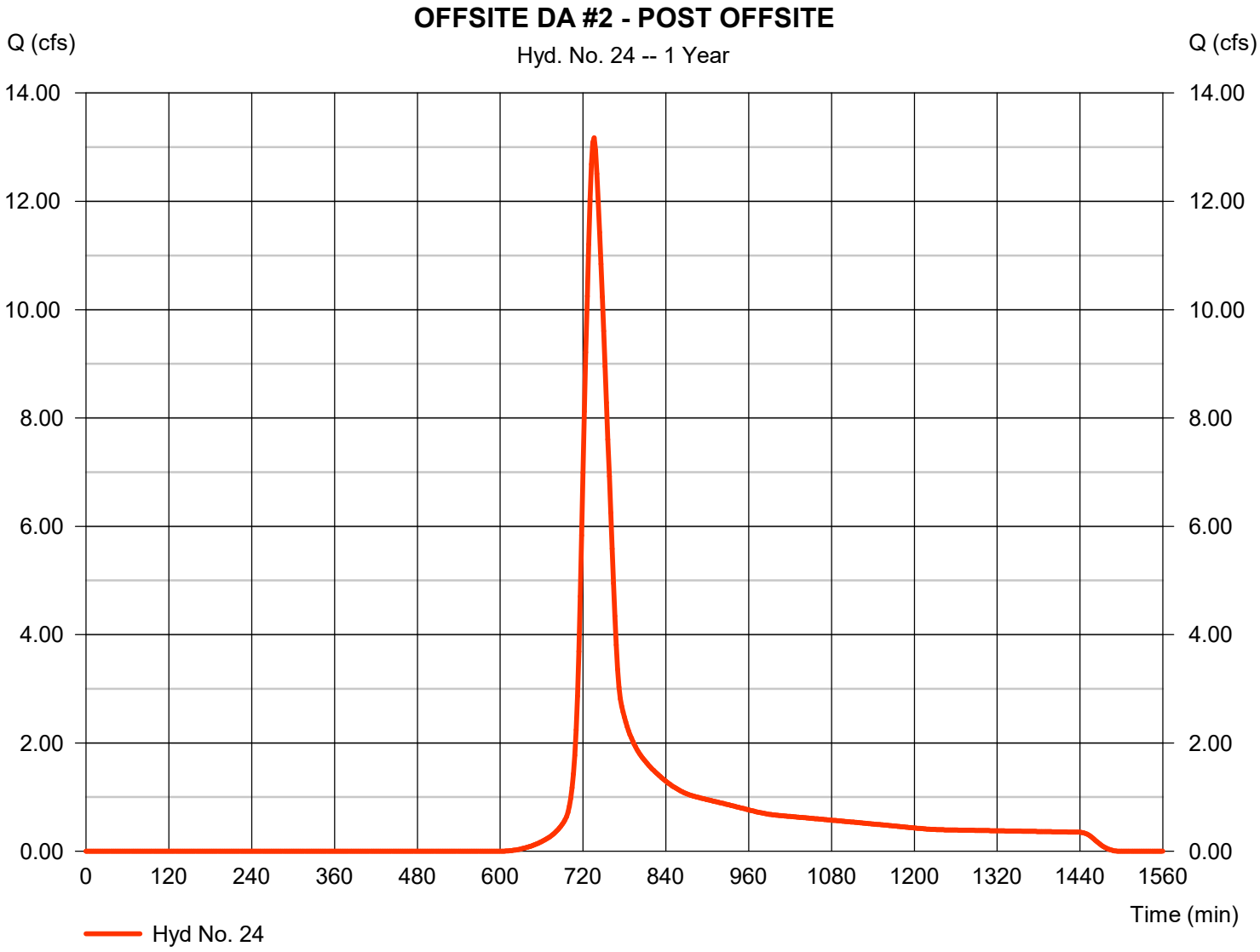
Total Travel Time, Tc ..... 77.70 min

Hydrograph Report

Hyd. No. 24

OFFSITE DA #2 - POST OFFSITE

Hydrograph type	= SCS Runoff	Peak discharge	= 13.17 cfs
Storm frequency	= 1 yrs	Time to peak	= 736 min
Time interval	= 2 min	Hyd. volume	= 61,527 cuft
Drainage area	= 14.960 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 36.40 min
Total precip.	= 2.86 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Hyd. No. 24

OFFSITE DA #2 - POST OFFSITE

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.011		0.011		0.011		
Flow length (ft)	= 0.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 0.00		0.00		0.00		
Land slope (%)	= 0.00		0.00		0.00		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**
Shallow Concentrated Flow							
Flow length (ft)	= 992.00		0.00		0.00		
Watercourse slope (%)	= 0.05		0.00		0.00		
Surface description	= Paved		Paved		Paved		
Average velocity (ft/s)	=0.45		0.00		0.00		
Travel Time (min)	**= 36.37**	**+**	**0.00**	**+**	**0.00**	**=**	**36.37**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

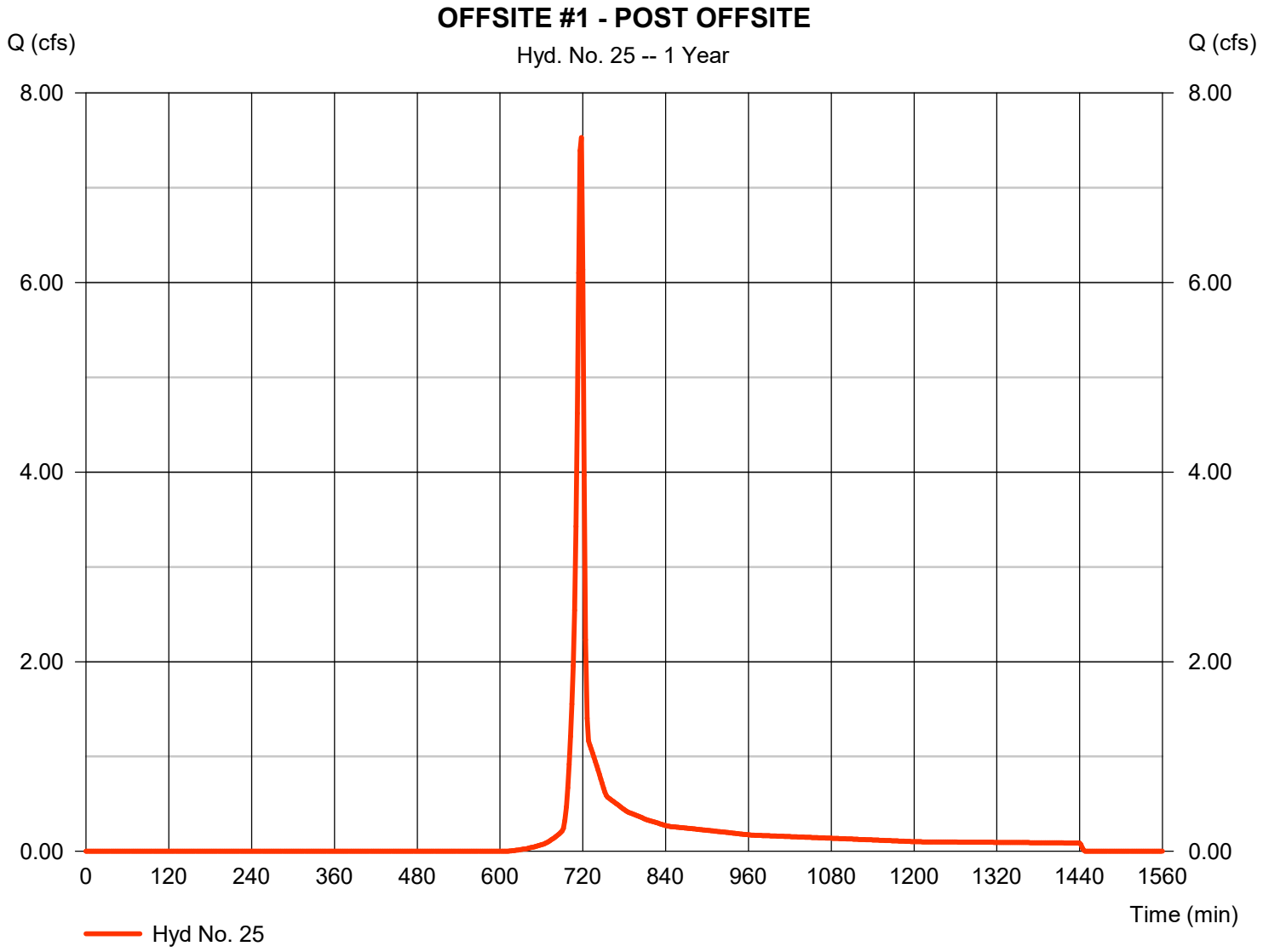
Total Travel Time, Tc ..... 36.40 min

Hydrograph Report

Hyd. No. 25

OFFSITE #1 - POST OFFSITE

Hydrograph type	= SCS Runoff	Peak discharge	= 7.529 cfs
Storm frequency	= 1 yrs	Time to peak	= 718 min
Time interval	= 2 min	Hyd. volume	= 15,058 cuft
Drainage area	= 4.070 ac	Curve number	= 79
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 4.00 min
Total precip.	= 2.86 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Hyd. No. 25

OFFSITE #1 - POST OFFSITE

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.011		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.45		0.00		0.00		
Land slope (%)	= 1.89		0.00		0.00		
Travel Time (min)	**= 2.87**	**+**	**0.00**	**+**	**0.00**	**=**	**2.87**
Shallow Concentrated Flow							
Flow length (ft)	= 150.00		0.00		0.00		
Watercourse slope (%)	= 2.00		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.28		0.00		0.00		
Travel Time (min)	**= 1.10**	**+**	**0.00**	**+**	**0.00**	**=**	**1.10**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

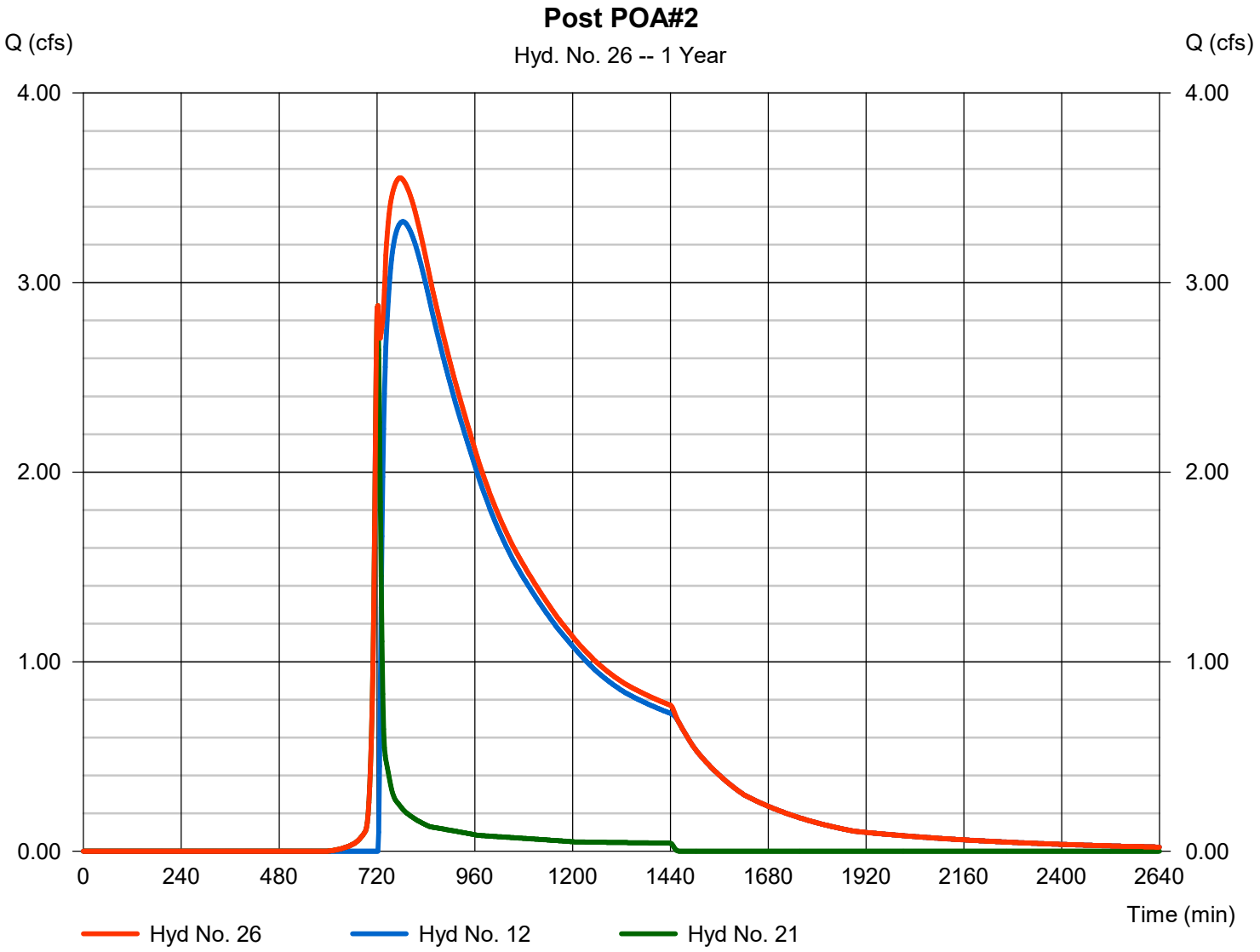
Total Travel Time, Tc ..... 4.00 min

Hydrograph Report

Hyd. No. 26

Post POA#2

Hydrograph type	= Combine	Peak discharge	= 3.552 cfs
Storm frequency	= 1 yrs	Time to peak	= 778 min
Time interval	= 2 min	Hyd. volume	= 90,928 cuft
Inflow hyds.	= 12, 21	Contrib. drain. area	= 1.760 ac



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

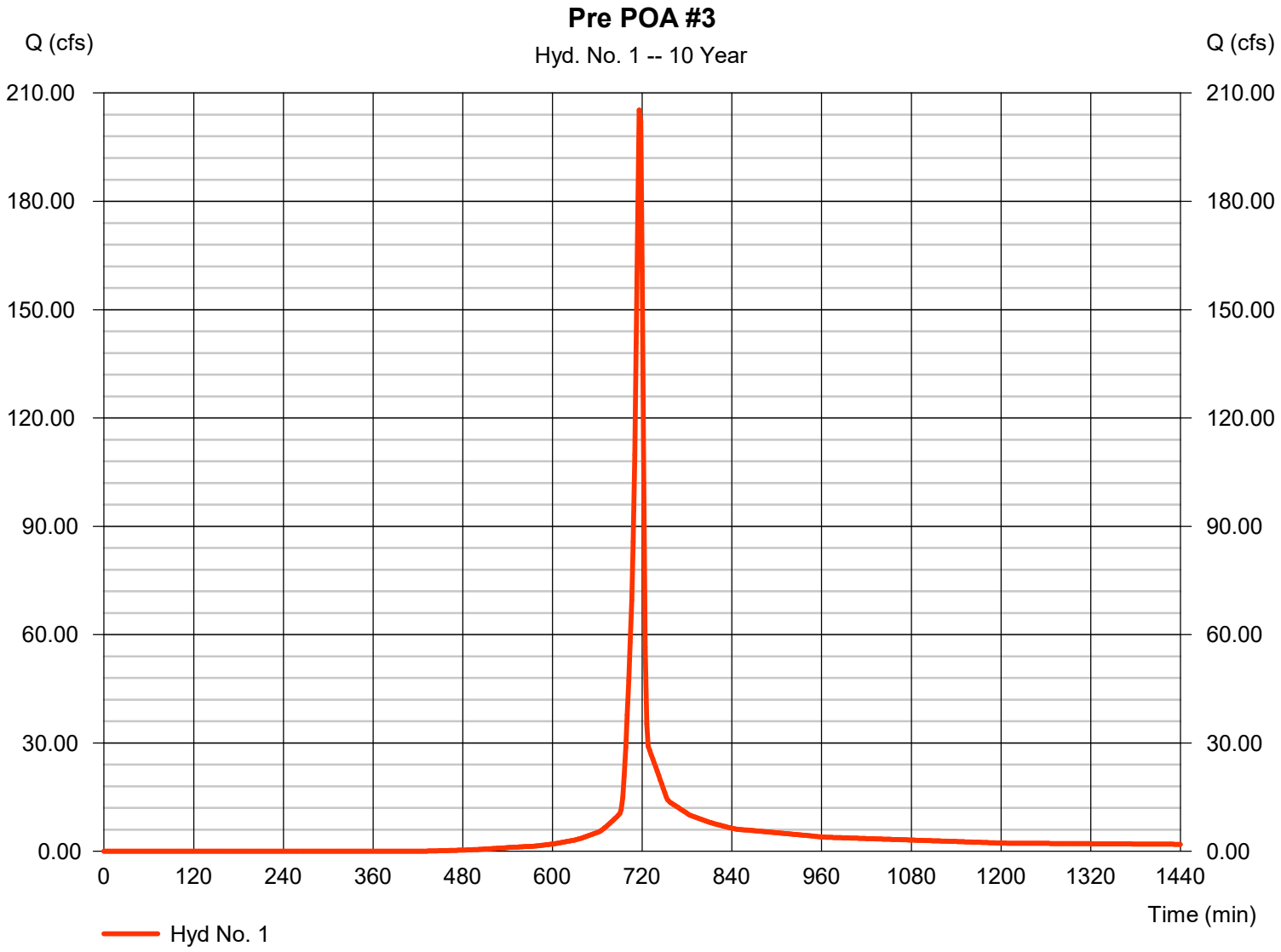
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	205.26	2	716	417,675	------	------	------	Pre POA #3
2	SCS Runoff	72.37	2	718	166,220	------	------	------	Pre POA #2
3	SCS Runoff	78.74	2	720	204,127	------	------	------	Pre POA #1
4	SCS Runoff	43.30	2	720	112,326	------	------	------	Bypass #1
5	SCS Runoff	4.134	2	720	10,723	------	------	------	Bypass #4/ POST POA #4
6	SCS Runoff	93.81	2	720	243,338	------	------	------	Bypass #3
7	SCS Runoff	48.93	2	720	129,822	------	------	------	DA #1 to SCM 1
8	SCS Runoff	97.08	2	722	278,017	------	------	------	DA #2 to SCM 2
9	SCS Runoff	58.92	2	722	169,639	------	------	------	DA #3 TO SCM 3
10	SCS Runoff	48.59	2	720	128,297	------	------	------	DA #4 TO SCM 4
11	Reservoir	30.15	2	728	109,920	7	388.39	55,693	SCM 1 ROUTE
12	Reservoir	38.40	2	734	236,655	8	355.97	137,147	SCM 2 ROUTE
13	Reservoir	41.68	2	728	137,681	9	388.51	70,145	SCM 3 ROUTE
14	Reservoir	11.91	2	734	110,222	10	383.97	63,737	SCM 4 ROUTE
15	Combine	62.32	2	724	222,246	4, 11,	------	------	Post POA #1
16	Combine	122.17	2	724	491,240	6, 13, 14,	------	------	Post POA #3
17	SCS Runoff	30.47	1	717	57,955	------	------	------	Pre POA #4
18	SCS Runoff	2.659	2	720	6,905	------	------	------	Bypass #6 / POST POA #6
19	SCS Runoff	9.033	2	720	23,454	------	------	------	Pre POA #5
20	SCS Runoff	4.418	2	724	13,816	------	------	------	Pre POA #6
21	SCS Runoff	7.429	2	720	19,290	------	------	------	Bypass #2
22	SCS Runoff	3.883	2	720	10,083	------	------	------	Bypass #5 / POST POA #5
23	SCS Runoff	56.90	2	760	439,923	------	------	------	OFFSITE DA #3 - POST OFFSITE
24	SCS Runoff	34.69	2	734	157,186	------	------	------	OFFSITE DA #2 - POST OFFSITE
25	SCS Runoff	19.35	2	716	39,282	------	------	------	OFFSITE #1 - POST OFFSITE
26	Combine	40.35	2	734	255,944	12, 21,	------	------	Post POA#2

Hydrograph Report

Hyd. No. 1

Pre POA #3

Hydrograph type	= SCS Runoff	Peak discharge	= 205.26 cfs
Storm frequency	= 10 yrs	Time to peak	= 716 min
Time interval	= 2 min	Hyd. volume	= 417,675 cuft
Drainage area	= 41.920 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 5.80 min
Total precip.	= 5.04 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

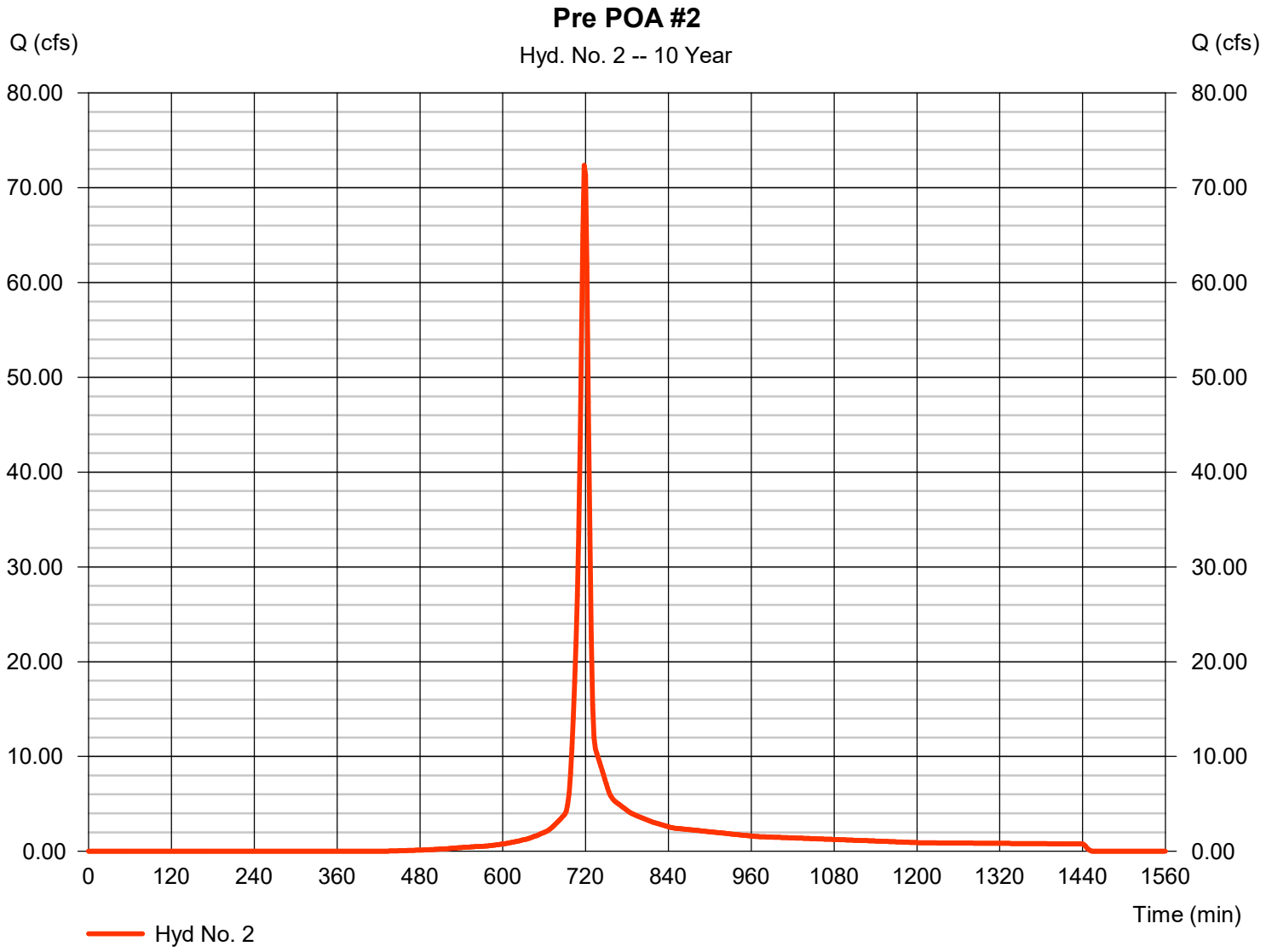


Hydrograph Report

Hyd. No. 2

Pre POA #2

Hydrograph type	=	SCS Runoff	Peak discharge	=	72.37 cfs
Storm frequency	=	10 yrs	Time to peak	=	718 min
Time interval	=	2 min	Hyd. volume	=	166,220 cuft
Drainage area	=	15.640 ac	Curve number	=	80
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	7.80 min
Total precip.	=	5.04 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

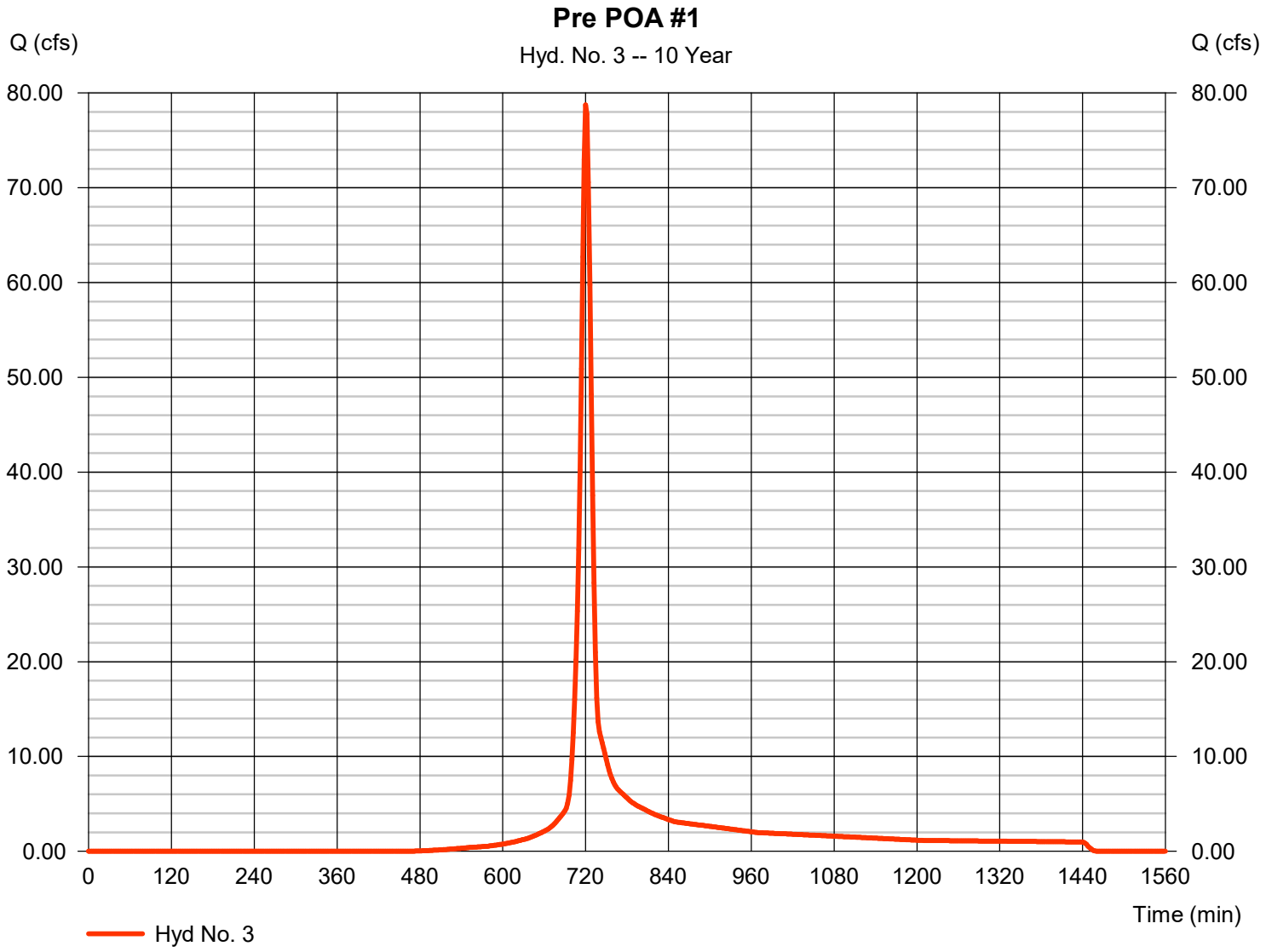


Hydrograph Report

Hyd. No. 3

Pre POA #1

Hydrograph type	=	SCS Runoff	Peak discharge	=	78.74 cfs
Storm frequency	=	10 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	204,127 cuft
Drainage area	=	19.860 ac	Curve number	=	78
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	10.00 min
Total precip.	=	5.04 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

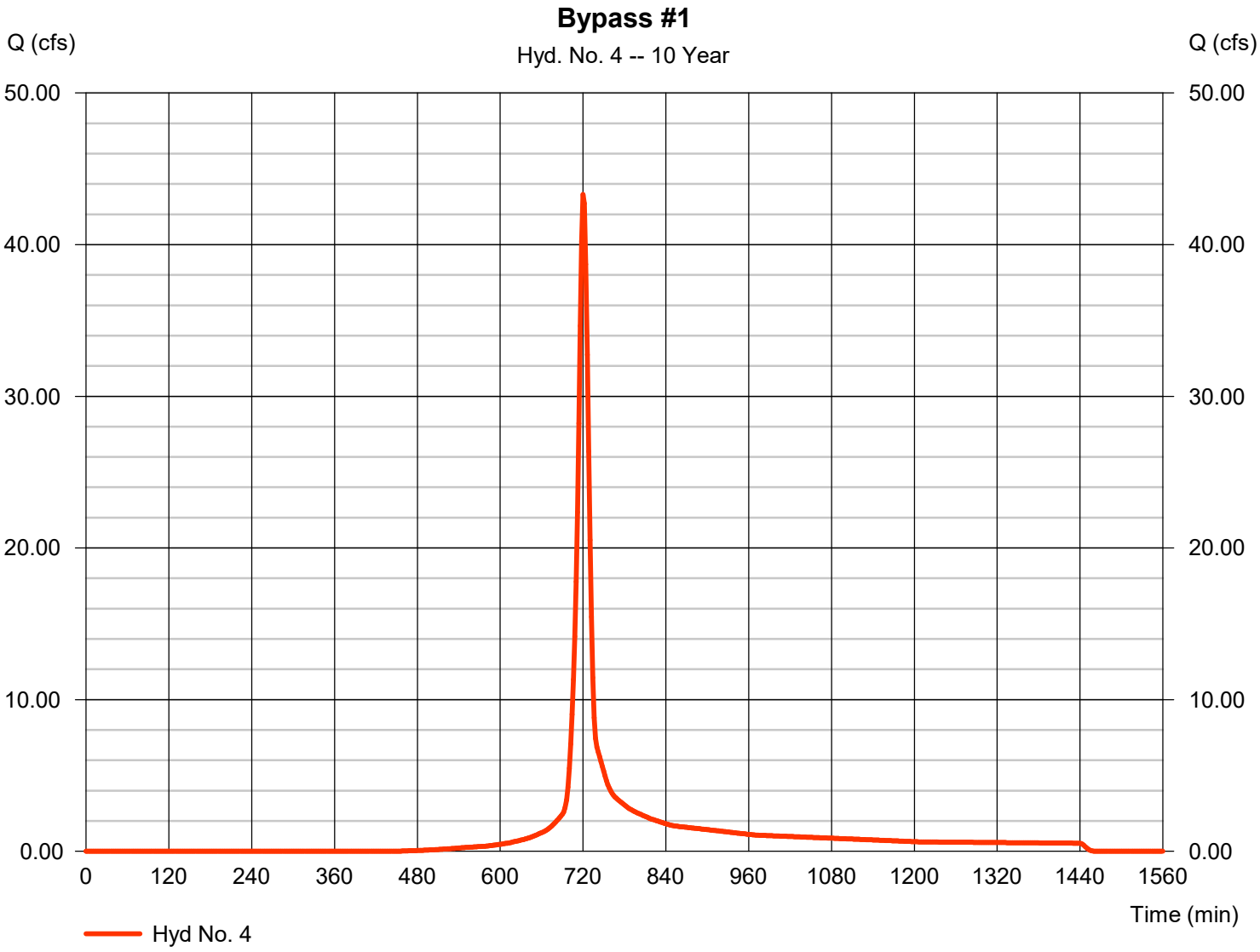


Hydrograph Report

Hyd. No. 4

Bypass #1

Hydrograph type	=	SCS Runoff	Peak discharge	=	43.30 cfs
Storm frequency	=	10 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	112,326 cuft
Drainage area	=	10.580 ac	Curve number	=	79
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	5.04 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

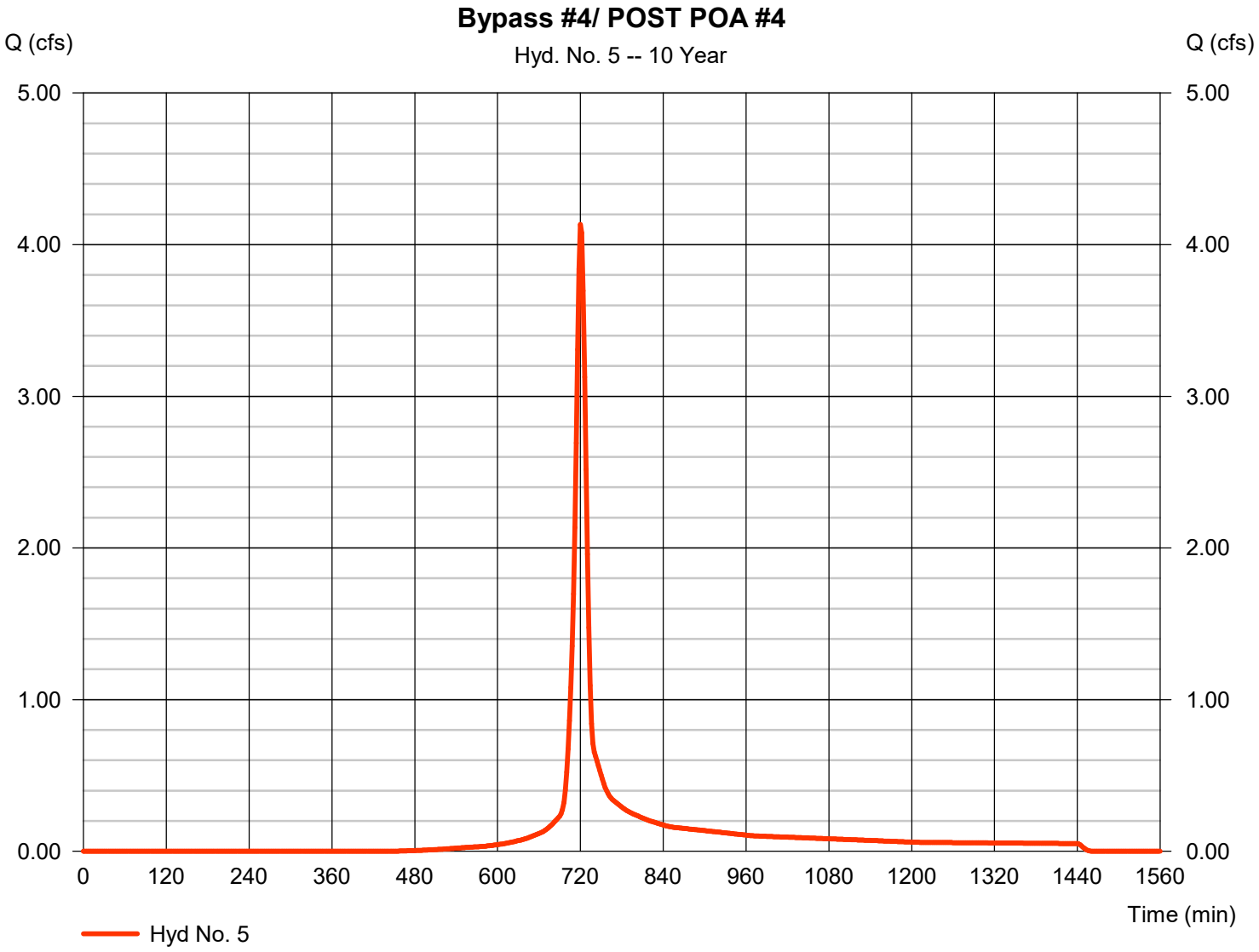


Hydrograph Report

Hyd. No. 5

Bypass #4/ POST POA #4

Hydrograph type	=	SCS Runoff	Peak discharge	=	4.134 cfs
Storm frequency	=	10 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	10,723 cuft
Drainage area	=	1.010 ac	Curve number	=	79
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	5.04 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

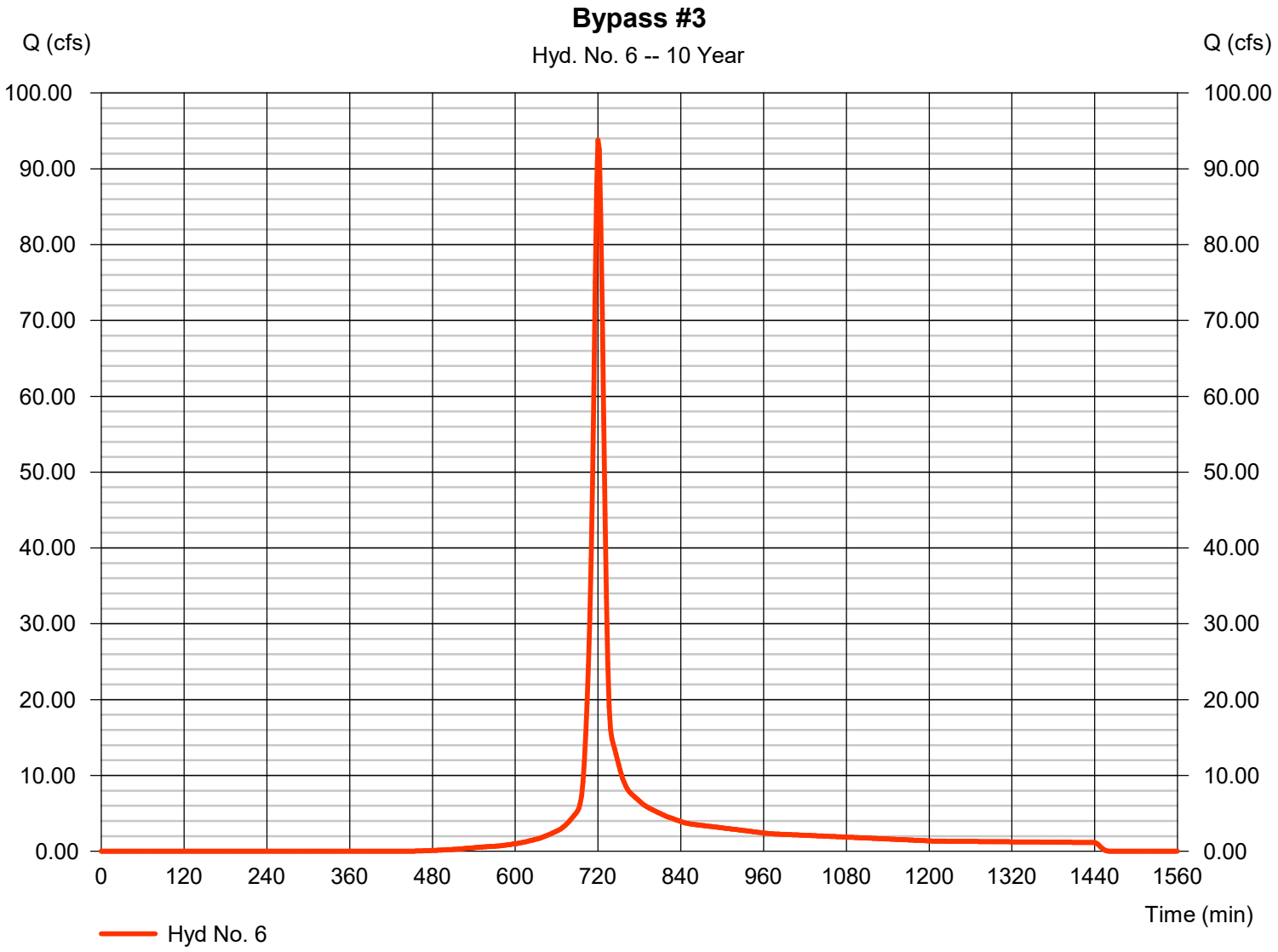


Hydrograph Report

Hyd. No. 6

Bypass #3

Hydrograph type	=	SCS Runoff	Peak discharge	=	93.81 cfs
Storm frequency	=	10 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	243,338 cuft
Drainage area	=	22.920 ac	Curve number	=	79
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	5.04 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



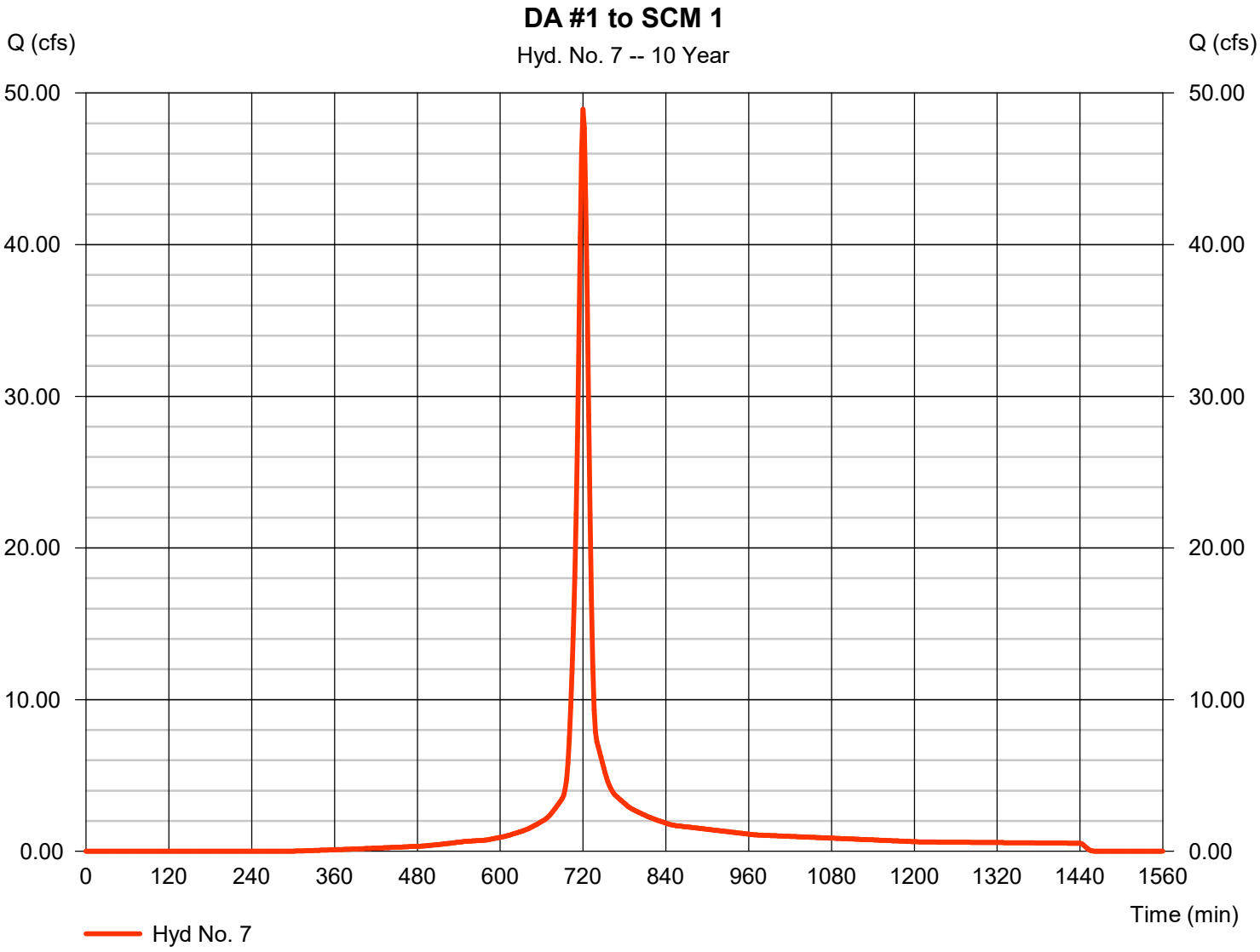
Hydrograph Report

Hyd. No. 7

DA #1 to SCM 1

Hydrograph type	=	SCS Runoff	Peak discharge	=	48.93 cfs
Storm frequency	=	10 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	129,822 cuft
Drainage area	=	9.620 ac	Curve number	=	87*
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	5.04 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

* Composite (Area/CN) = [(5.130 x 98) + (4.090 x 80)] / 9.620

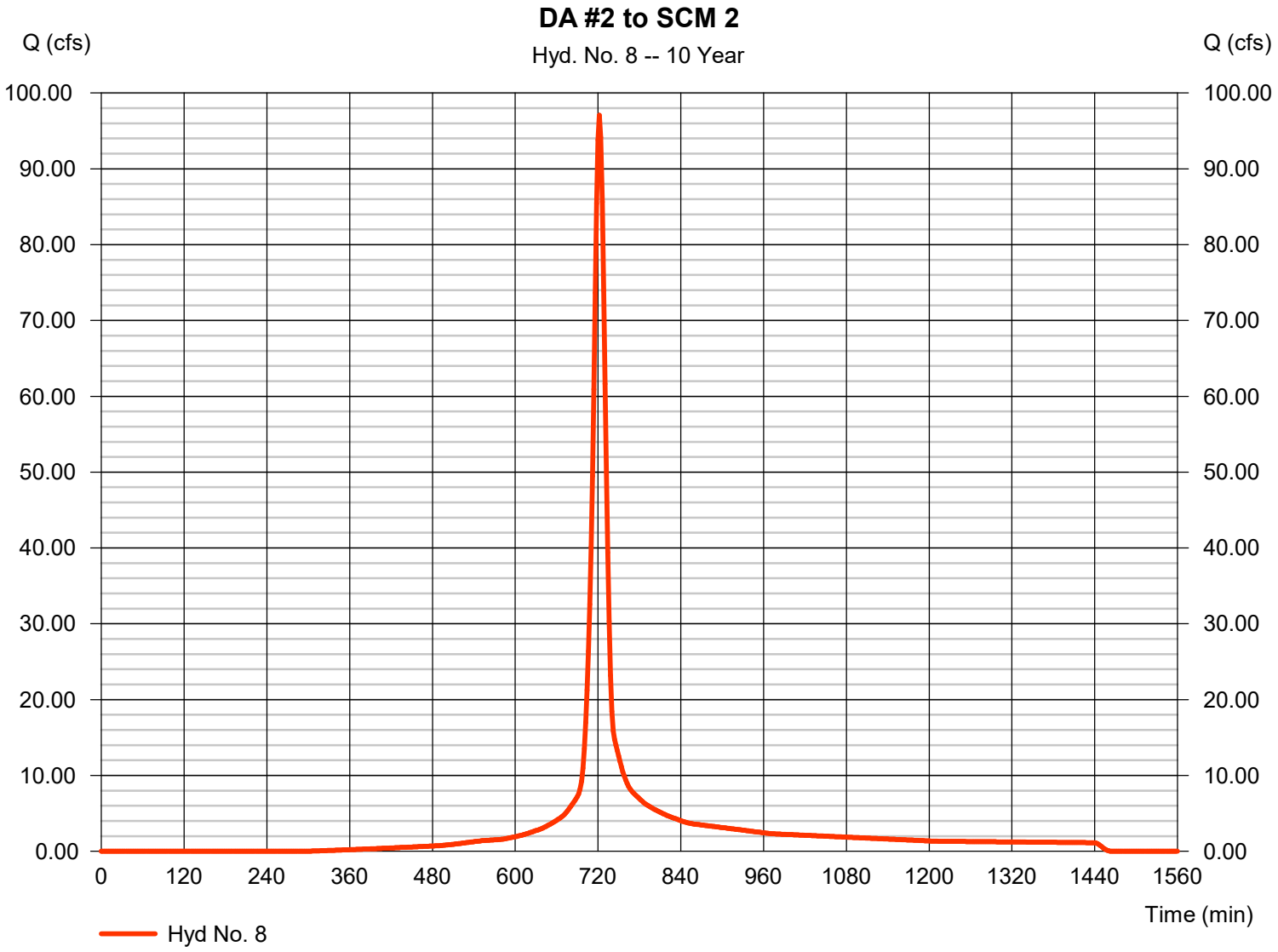


Hydrograph Report

Hyd. No. 8

DA #2 to SCM 2

Hydrograph type	= SCS Runoff	Peak discharge	= 97.08 cfs
Storm frequency	= 10 yrs	Time to peak	= 722 min
Time interval	= 2 min	Hyd. volume	= 278,017 cuft
Drainage area	= 21.790 ac	Curve number	= 87
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 15.00 min
Total precip.	= 5.04 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

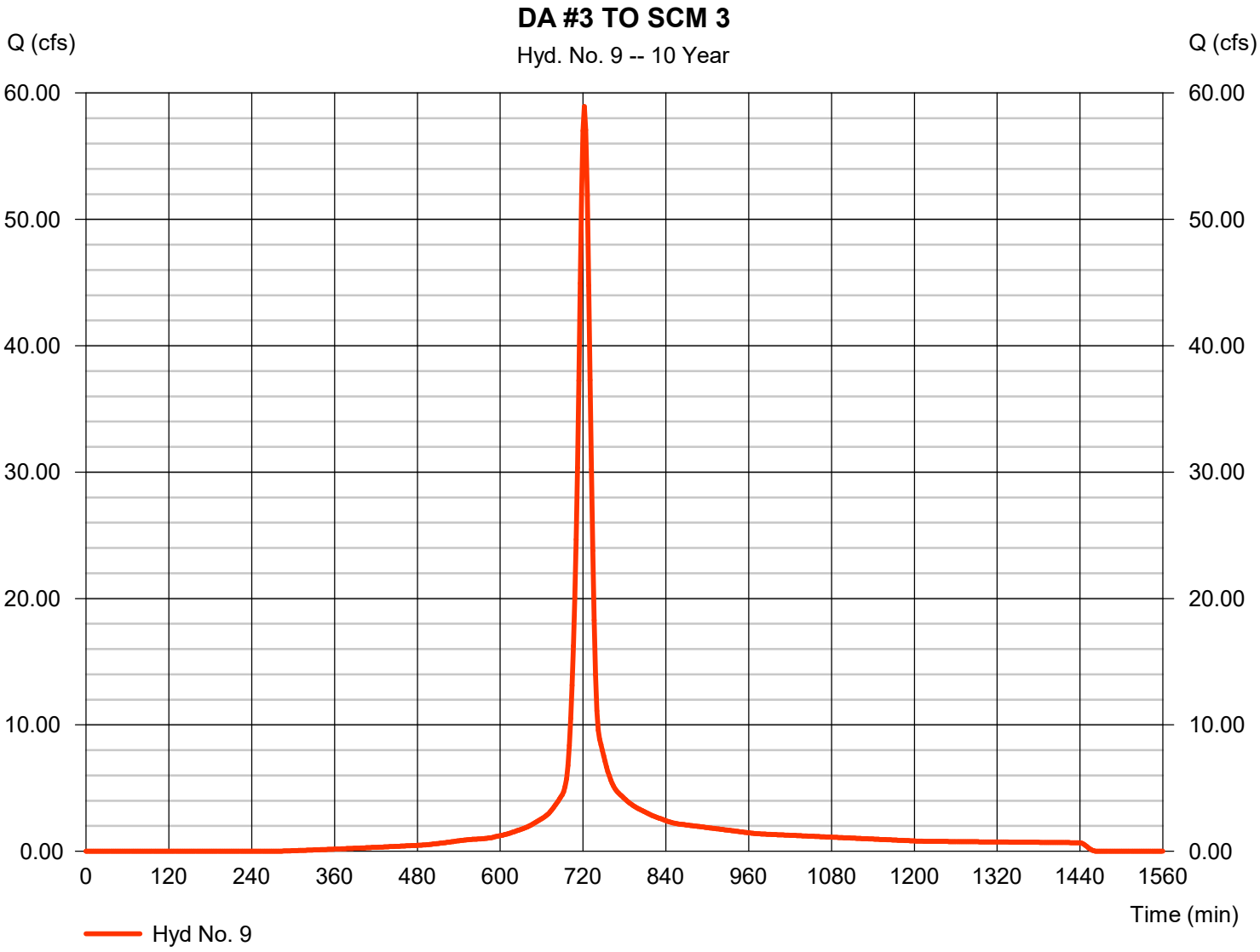


Hydrograph Report

Hyd. No. 9

DA #3 TO SCM 3

Hydrograph type	=	SCS Runoff	Peak discharge	=	58.92 cfs
Storm frequency	=	10 yrs	Time to peak	=	722 min
Time interval	=	2 min	Hyd. volume	=	169,639 cuft
Drainage area	=	12.930 ac	Curve number	=	88
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	15.00 min
Total precip.	=	5.04 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

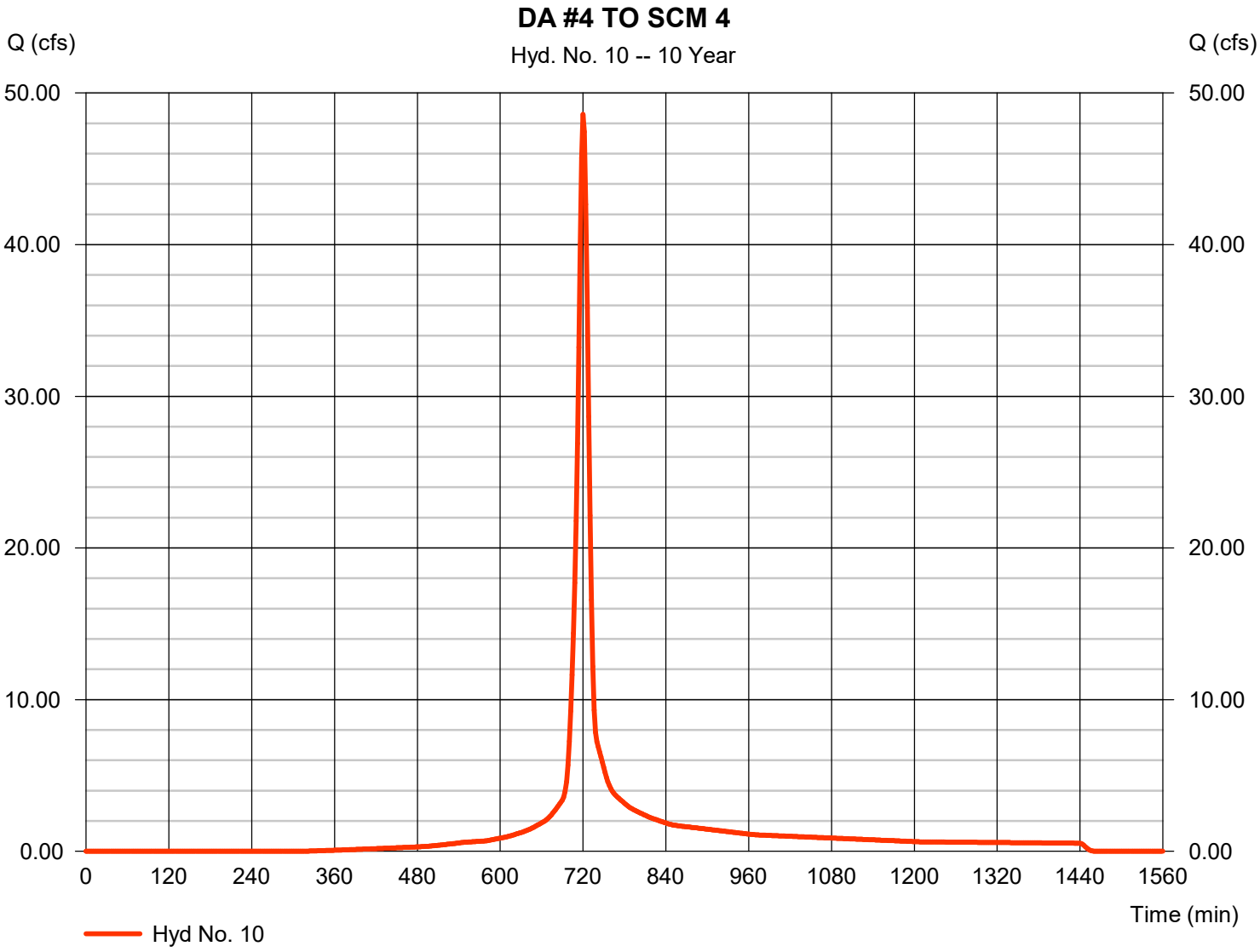


Hydrograph Report

Hyd. No. 10

DA #4 TO SCM 4

Hydrograph type	=	SCS Runoff	Peak discharge	=	48.59 cfs
Storm frequency	=	10 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	128,297 cuft
Drainage area	=	9.780 ac	Curve number	=	86
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	5.04 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



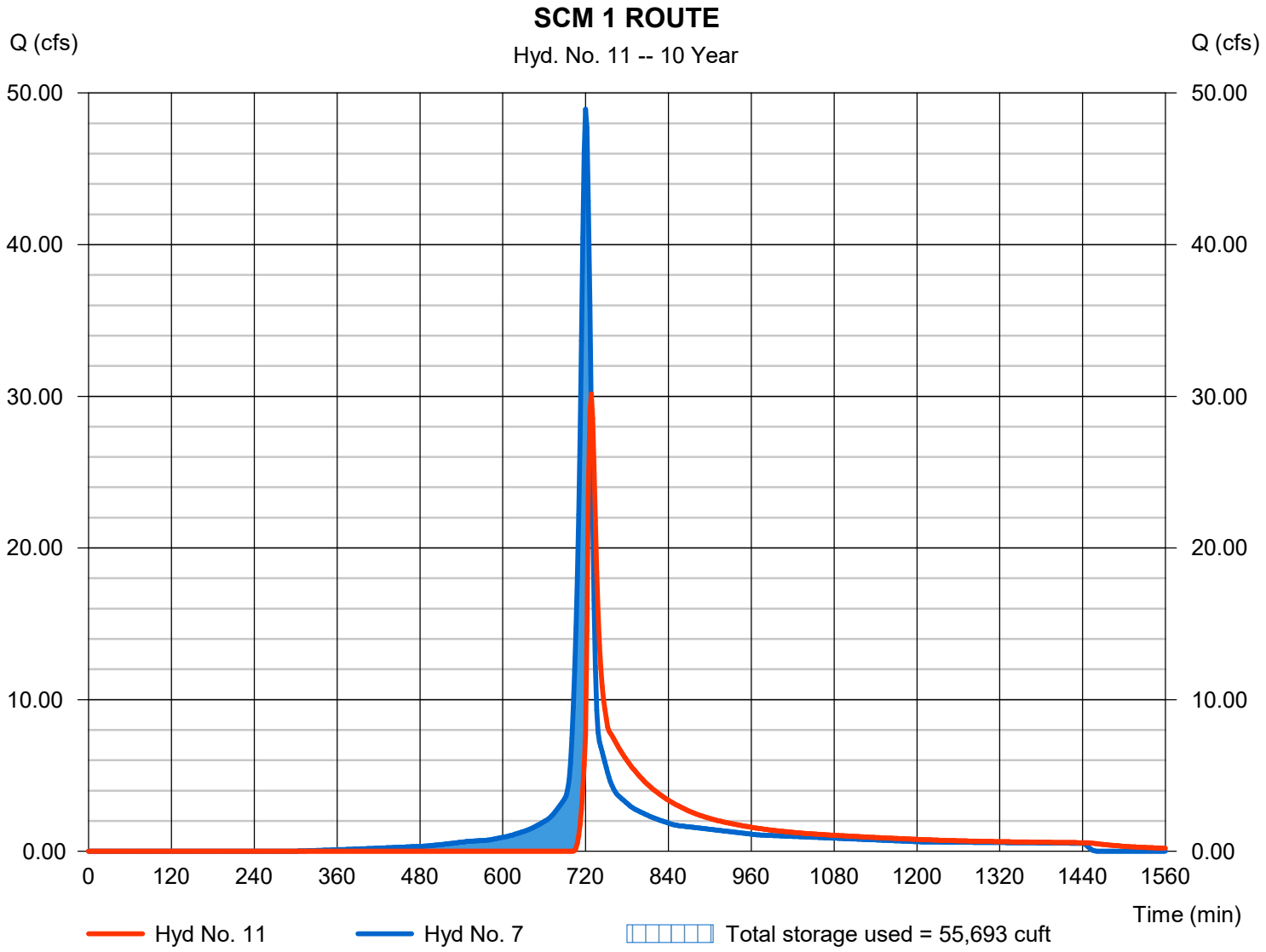
Hydrograph Report

Hyd. No. 11

SCM 1 ROUTE

Hydrograph type	=	Reservoir	Peak discharge	=	30.15 cfs
Storm frequency	=	10 yrs	Time to peak	=	728 min
Time interval	=	2 min	Hyd. volume	=	109,920 cuft
Inflow hyd. No.	=	7 - DA #1 to SCM 1	Max. Elevation	=	388.39 ft
Reservoir name	=	SCM 1	Max. Storage	=	55,693 cuft

Storage Indication method used.



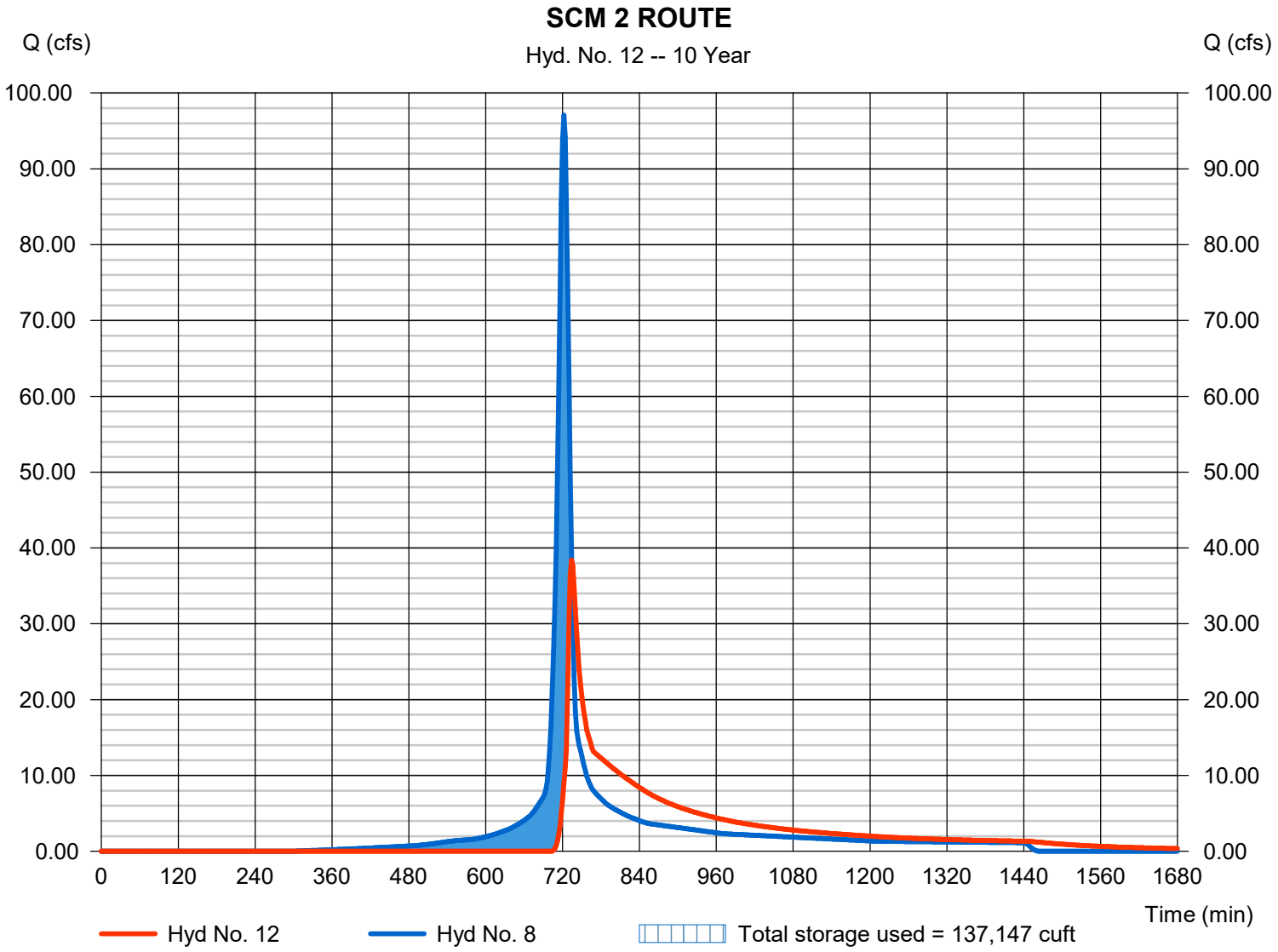
Hydrograph Report

Hyd. No. 12

SCM 2 ROUTE

Hydrograph type	=	Reservoir	Peak discharge	=	38.40 cfs
Storm frequency	=	10 yrs	Time to peak	=	734 min
Time interval	=	2 min	Hyd. volume	=	236,655 cuft
Inflow hyd. No.	=	8 - DA #2 to SCM 2	Max. Elevation	=	355.97 ft
Reservoir name	=	SCM 2	Max. Storage	=	137,147 cuft

Storage Indication method used.



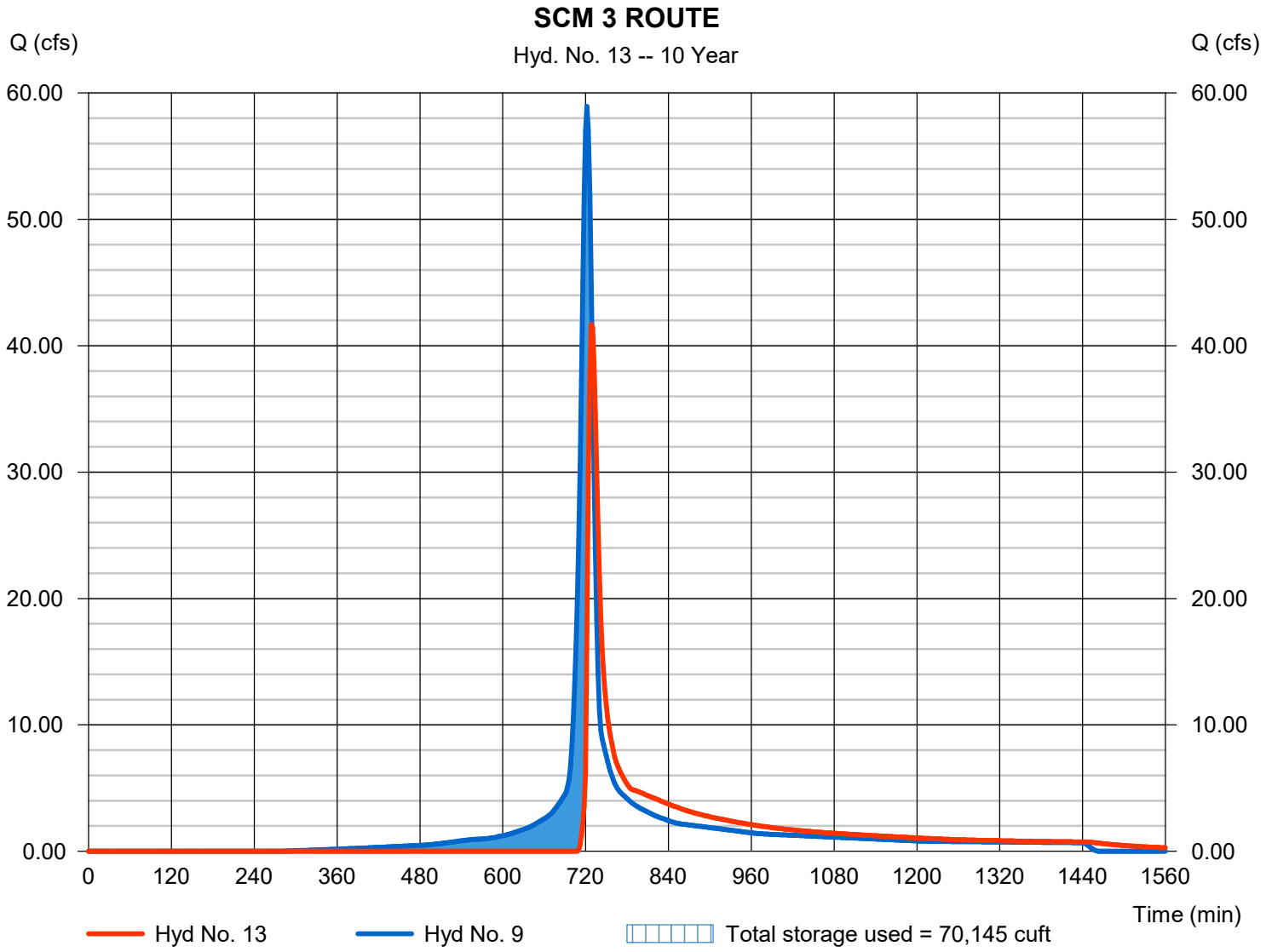
Hydrograph Report

Hyd. No. 13

SCM 3 ROUTE

Hydrograph type	=	Reservoir	Peak discharge	=	41.68 cfs
Storm frequency	=	10 yrs	Time to peak	=	728 min
Time interval	=	2 min	Hyd. volume	=	137,681 cuft
Inflow hyd. No.	=	9 - DA #3 TO SCM 3	Max. Elevation	=	388.51 ft
Reservoir name	=	SCM 3	Max. Storage	=	70,145 cuft

Storage Indication method used.



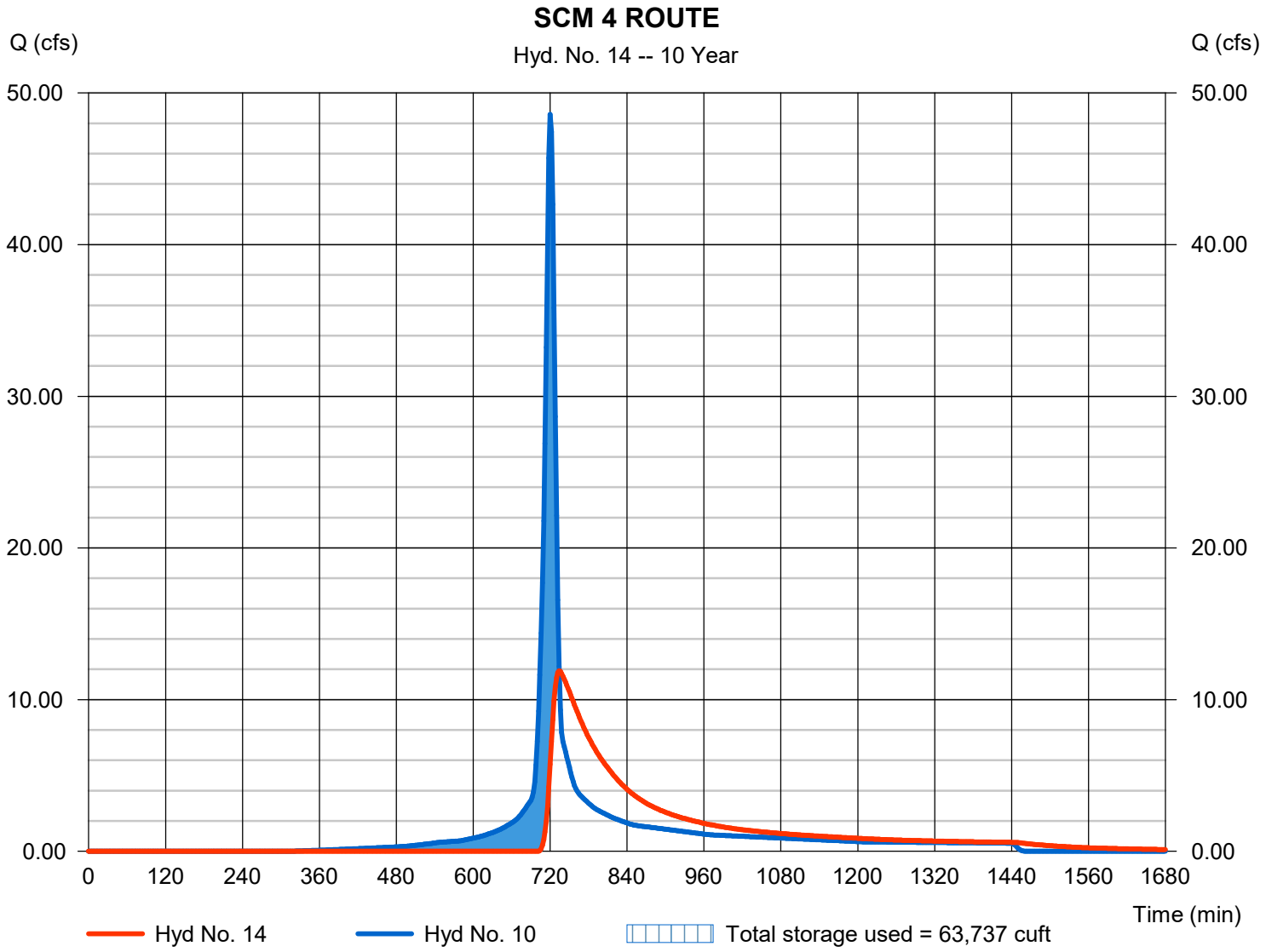
Hydrograph Report

Hyd. No. 14

SCM 4 ROUTE

Hydrograph type	=	Reservoir	Peak discharge	=	11.91 cfs
Storm frequency	=	10 yrs	Time to peak	=	734 min
Time interval	=	2 min	Hyd. volume	=	110,222 cuft
Inflow hyd. No.	=	10 - DA #4 TO SCM 4	Max. Elevation	=	383.97 ft
Reservoir name	=	SCM 4	Max. Storage	=	63,737 cuft

Storage Indication method used.

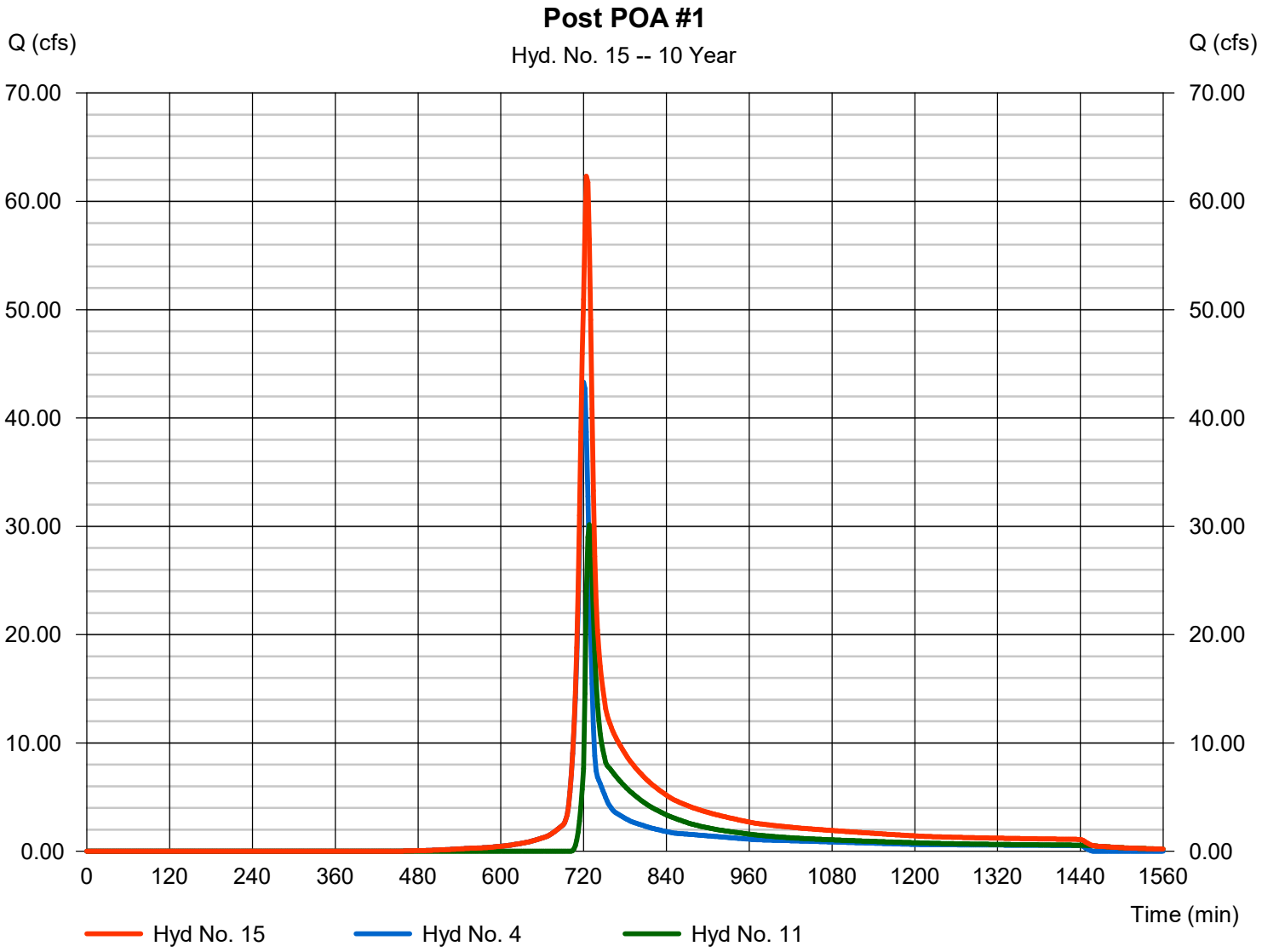


Hydrograph Report

Hyd. No. 15

Post POA #1

Hydrograph type	= Combine	Peak discharge	= 62.32 cfs
Storm frequency	= 10 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 222,246 cuft
Inflow hyds.	= 4, 11	Contrib. drain. area	= 10.580 ac

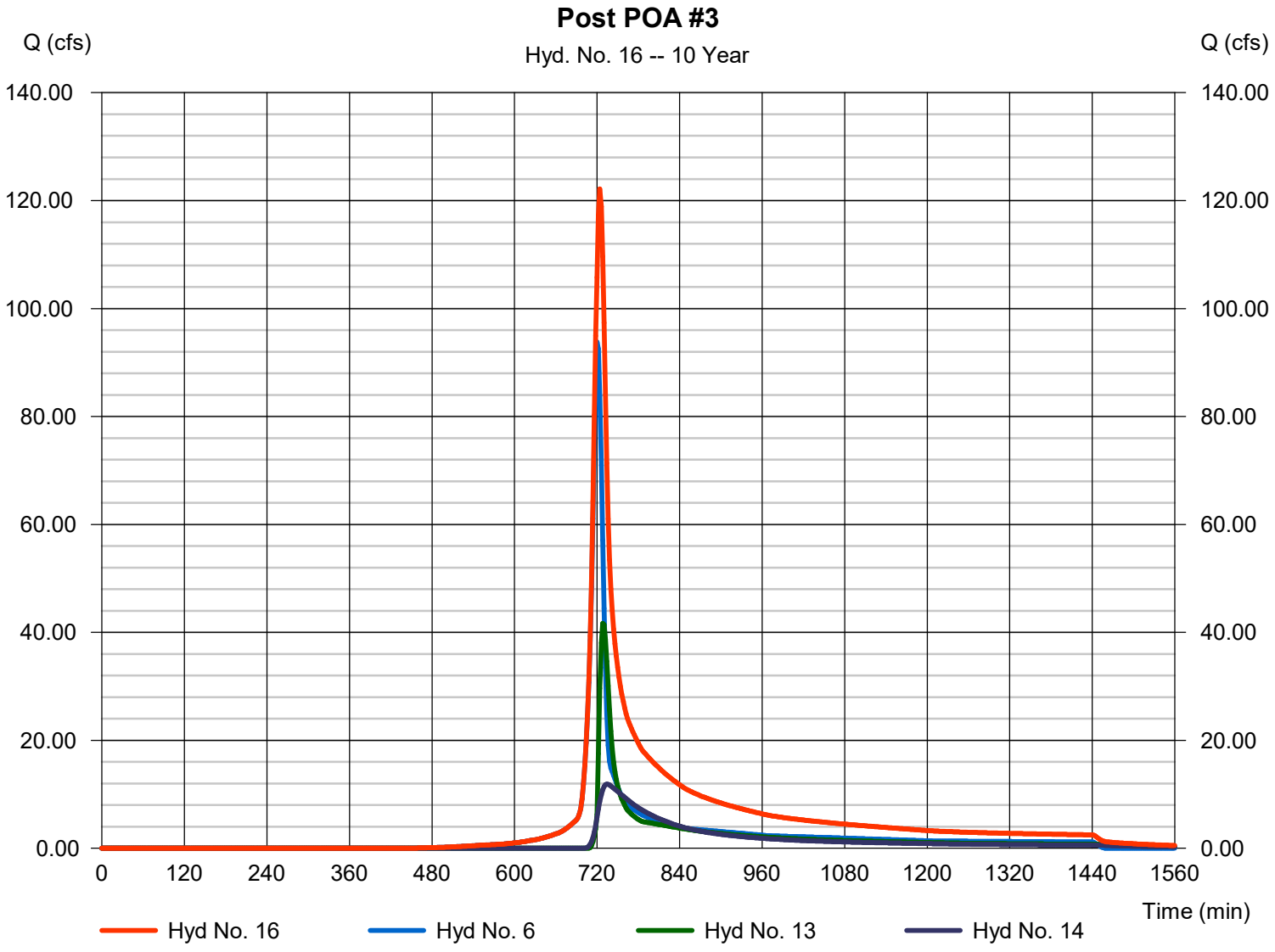


Hydrograph Report

Hyd. No. 16

Post POA #3

Hydrograph type	= Combine	Peak discharge	= 122.17 cfs
Storm frequency	= 10 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 491,240 cuft
Inflow hyds.	= 6, 13, 14	Contrib. drain. area	= 22.920 ac

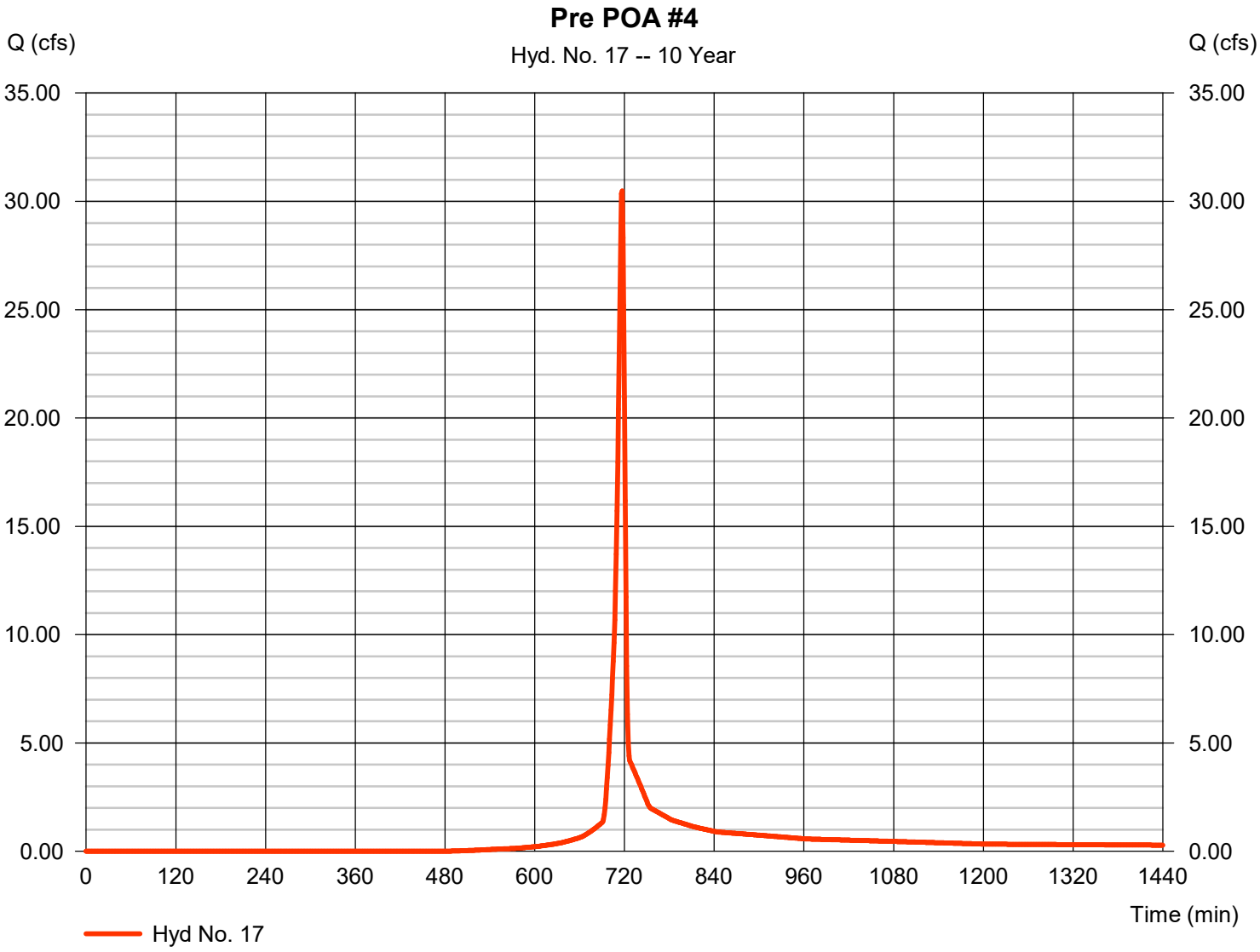


Hydrograph Report

Hyd. No. 17

Pre POA #4

Hydrograph type	=	SCS Runoff	Peak discharge	=	30.47 cfs
Storm frequency	=	10 yrs	Time to peak	=	717 min
Time interval	=	1 min	Hyd. volume	=	57,955 cuft
Drainage area	=	6.010 ac	Curve number	=	77
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	3.40 min
Total precip.	=	5.04 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

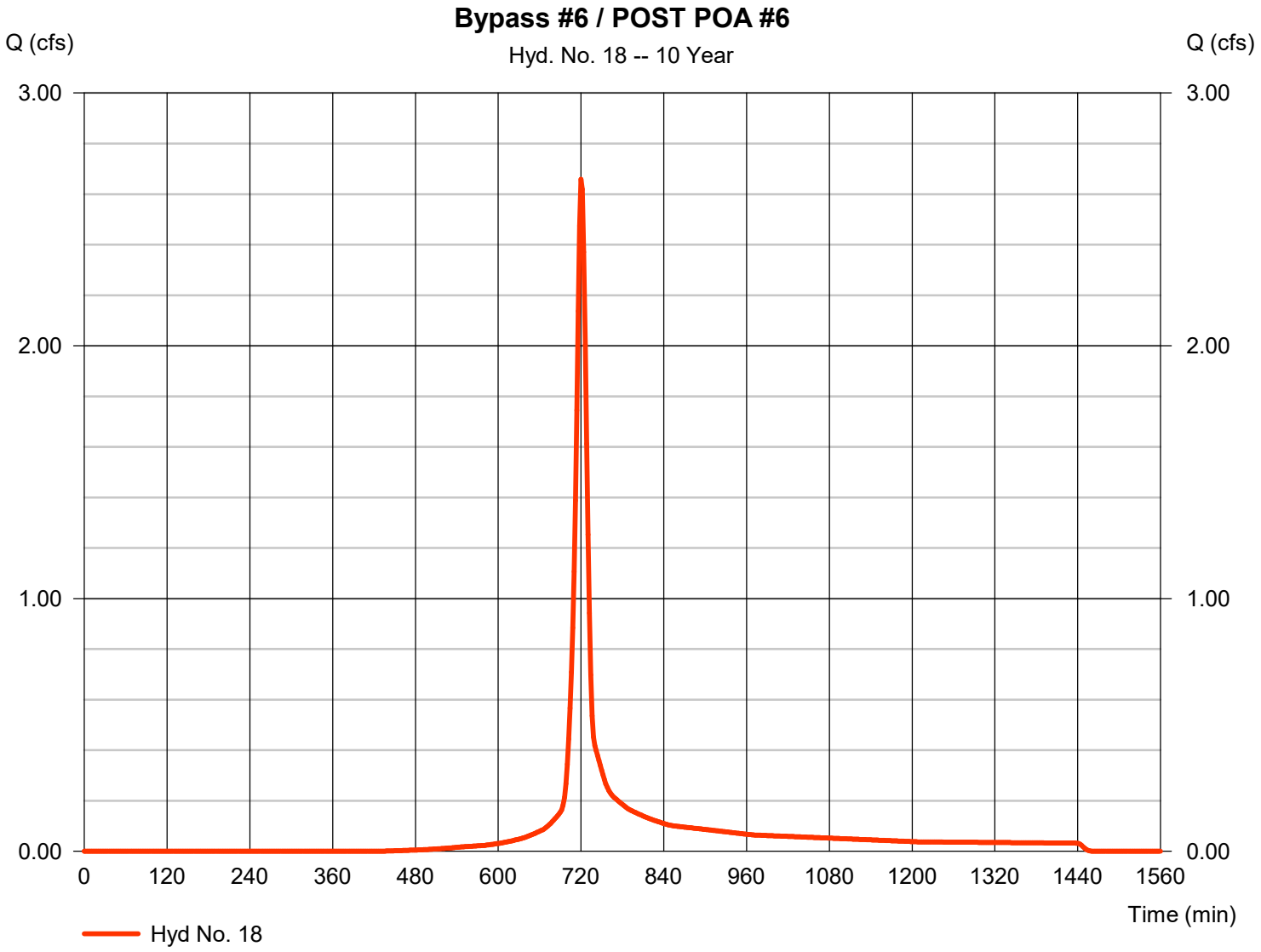


Hydrograph Report

Hyd. No. 18

Bypass #6 / POST POA #6

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.659 cfs
Storm frequency	=	10 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	6,905 cuft
Drainage area	=	0.630 ac	Curve number	=	80
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	5.04 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

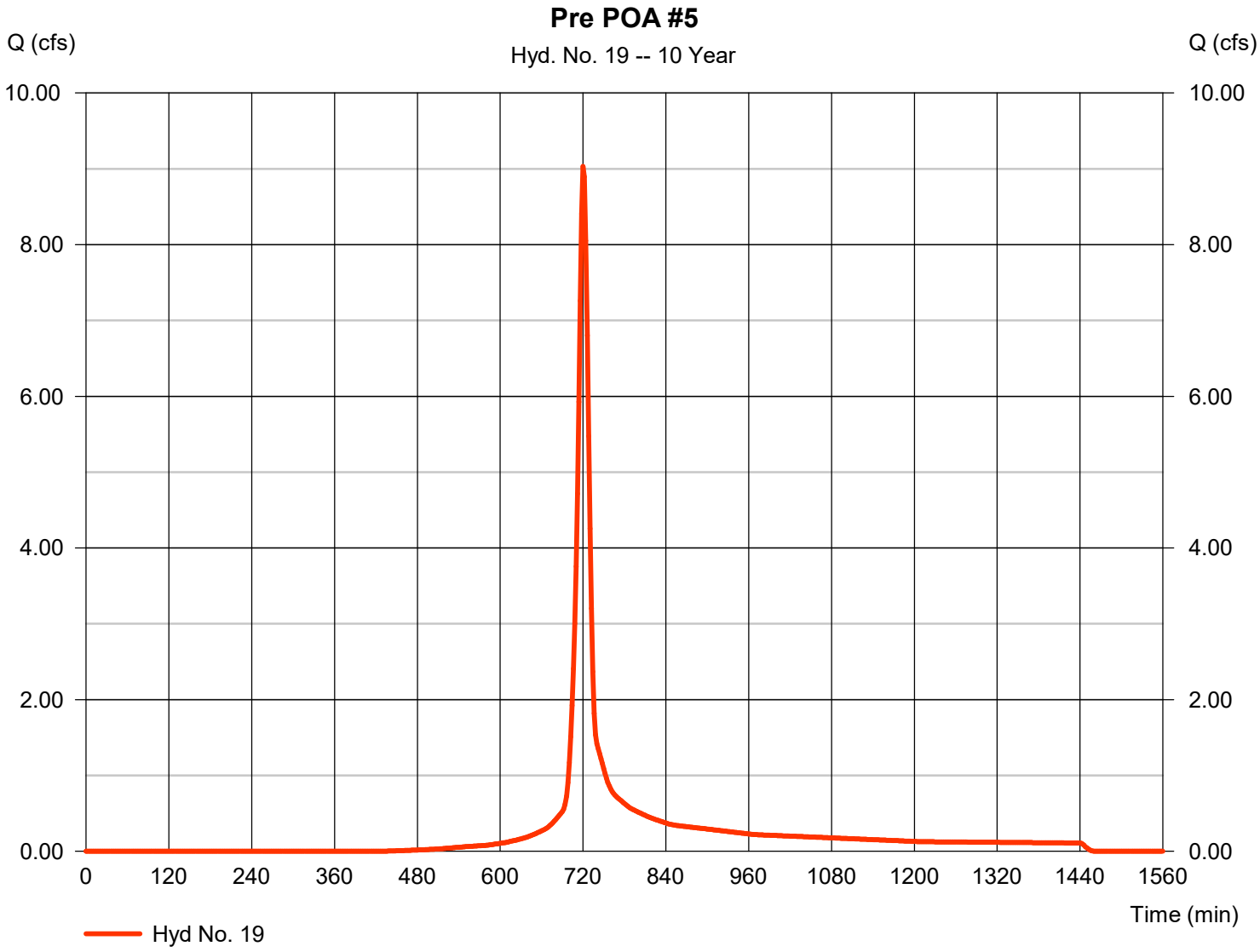


Hydrograph Report

Hyd. No. 19

Pre POA #5

Hydrograph type	=	SCS Runoff	Peak discharge	=	9.033 cfs
Storm frequency	=	10 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	23,454 cuft
Drainage area	=	2.140 ac	Curve number	=	80
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	12.00 min
Total precip.	=	5.04 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

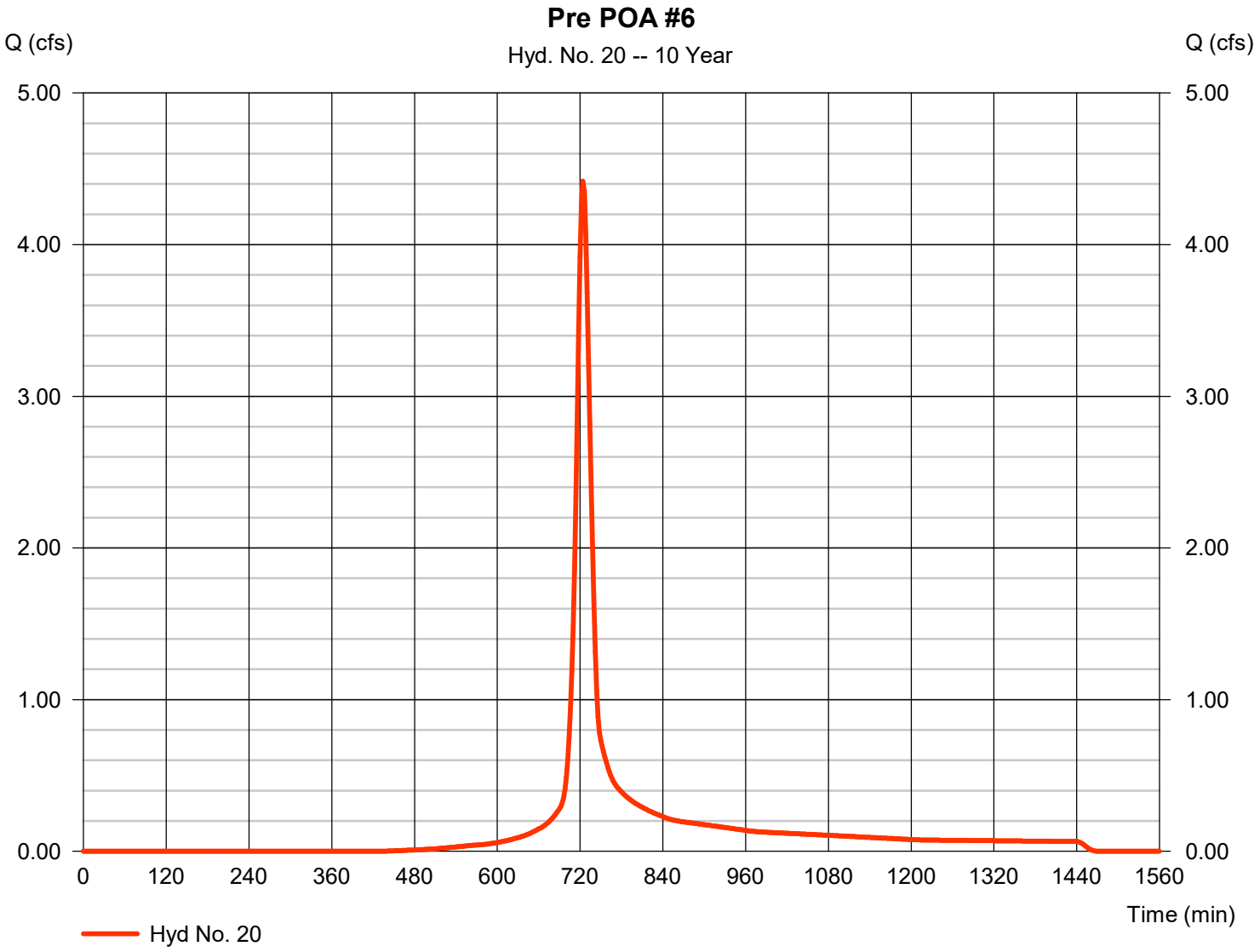


Hydrograph Report

Hyd. No. 20

Pre POA #6

Hydrograph type	= SCS Runoff	Peak discharge	= 4.418 cfs
Storm frequency	= 10 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 13,816 cuft
Drainage area	= 1.300 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 17.20 min
Total precip.	= 5.04 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

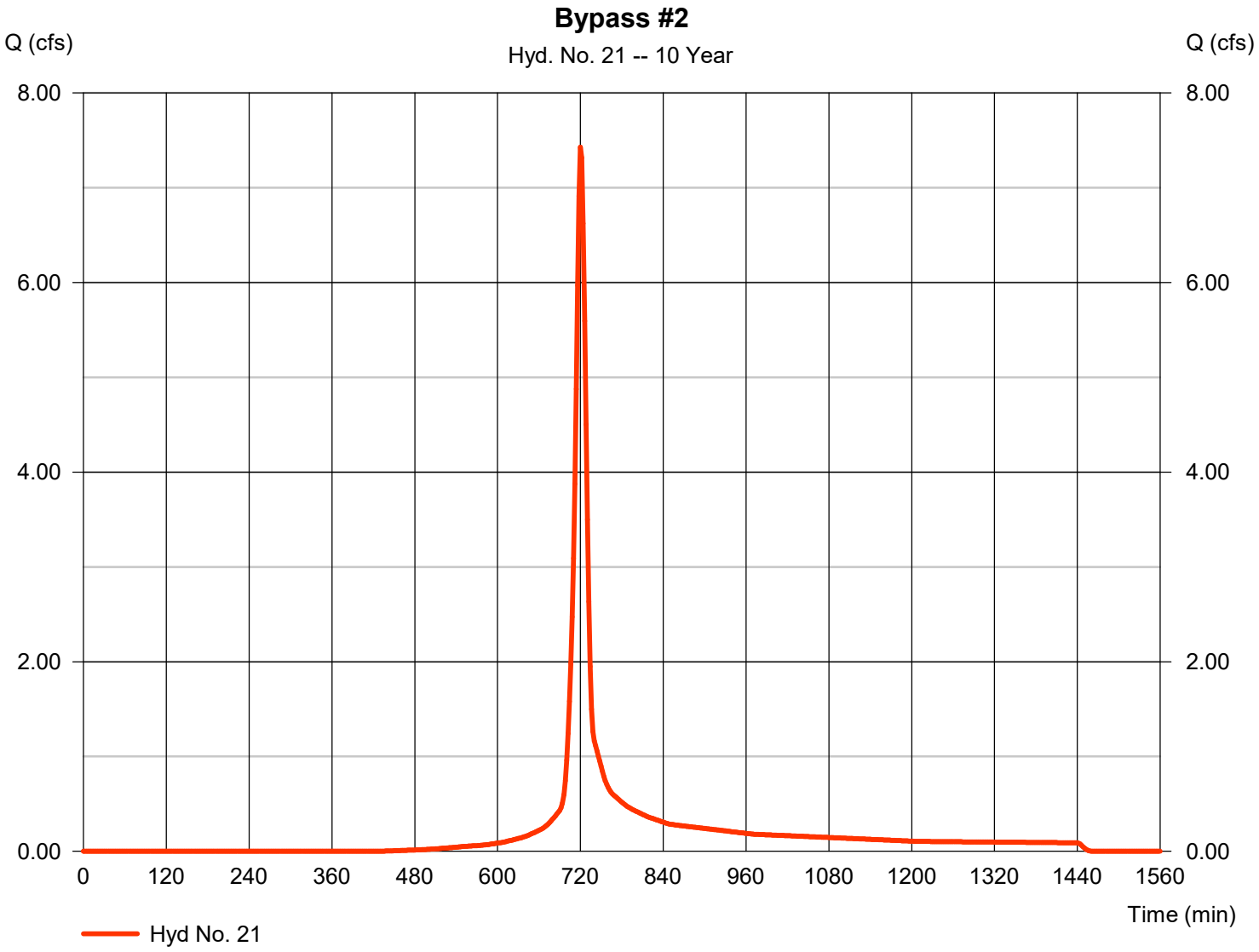


Hydrograph Report

Hyd. No. 21

Bypass #2

Hydrograph type	=	SCS Runoff	Peak discharge	=	7.429 cfs
Storm frequency	=	10 yrs	Time to peak	=	720 min
Time interval	=	2 min	Hyd. volume	=	19,290 cuft
Drainage area	=	1.760 ac	Curve number	=	80
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	5.04 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

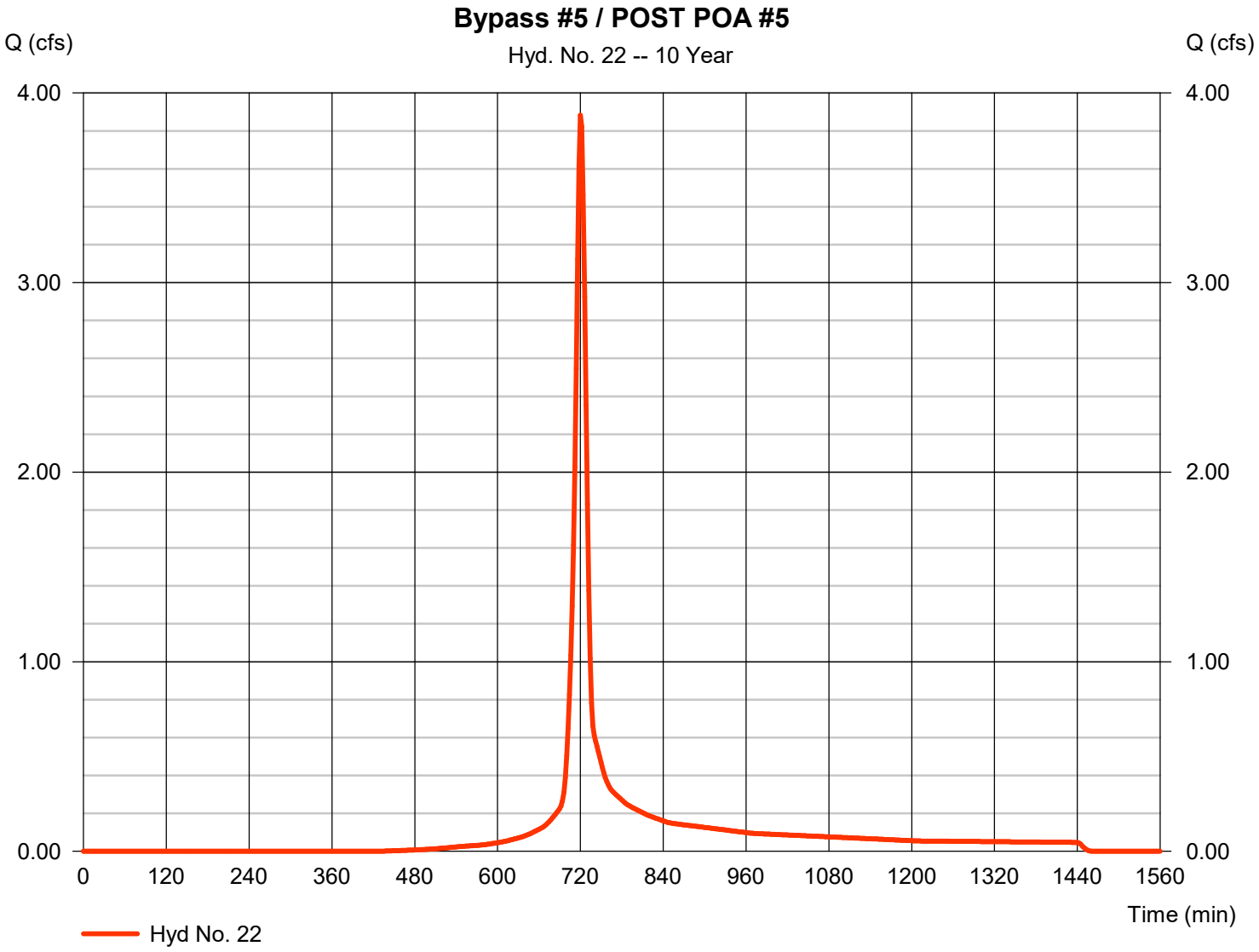


Hydrograph Report

Hyd. No. 22

Bypass #5 / POST POA #5

Hydrograph type	= SCS Runoff	Peak discharge	= 3.883 cfs
Storm frequency	= 10 yrs	Time to peak	= 720 min
Time interval	= 2 min	Hyd. volume	= 10,083 cuft
Drainage area	= 0.920 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 5.04 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

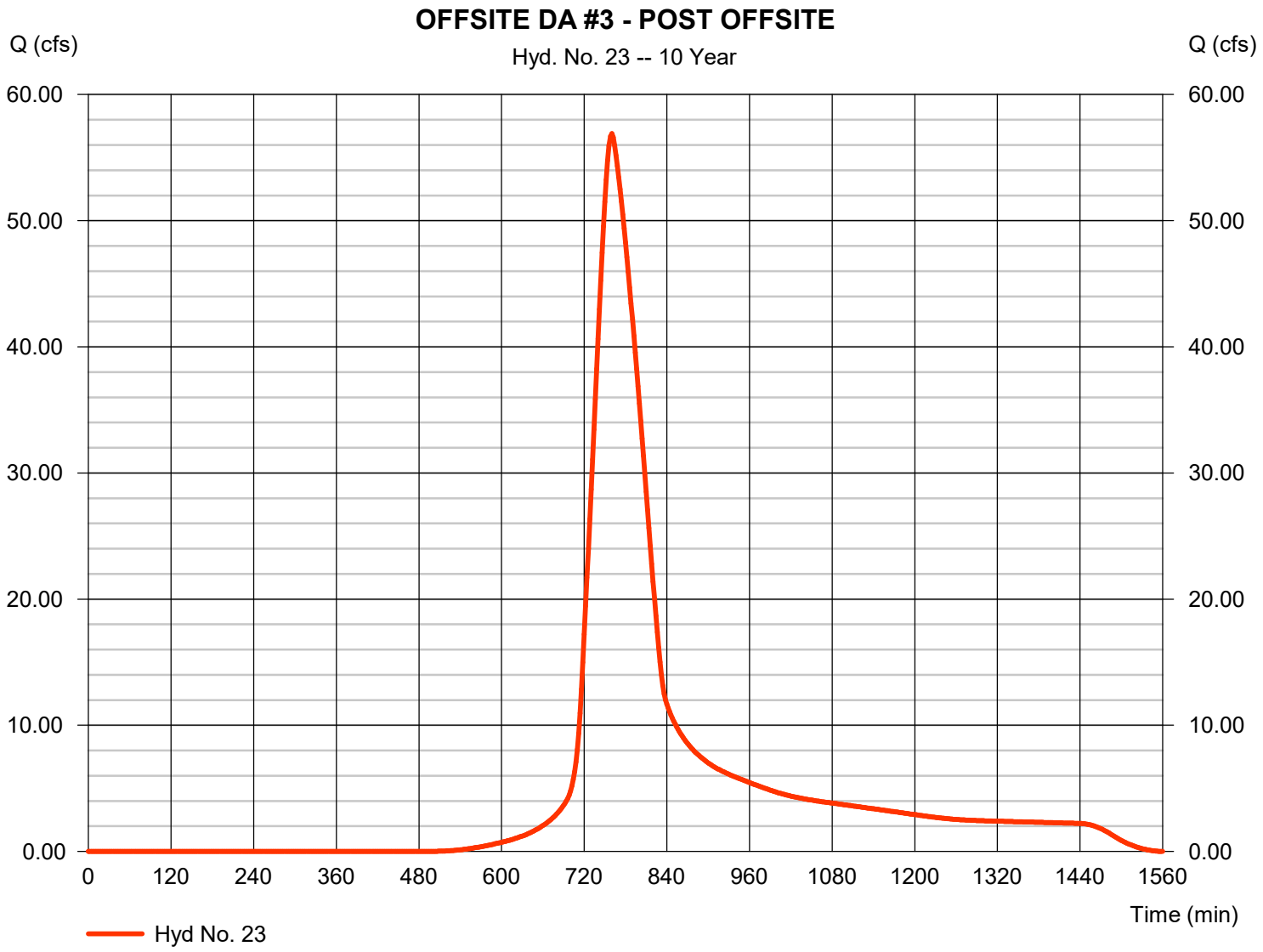


Hydrograph Report

Hyd. No. 23

OFFSITE DA #3 - POST OFFSITE

Hydrograph type	= SCS Runoff	Peak discharge	= 56.90 cfs
Storm frequency	= 10 yrs	Time to peak	= 760 min
Time interval	= 2 min	Hyd. volume	= 439,923 cuft
Drainage area	= 45.870 ac	Curve number	= 77
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 77.70 min
Total precip.	= 5.04 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

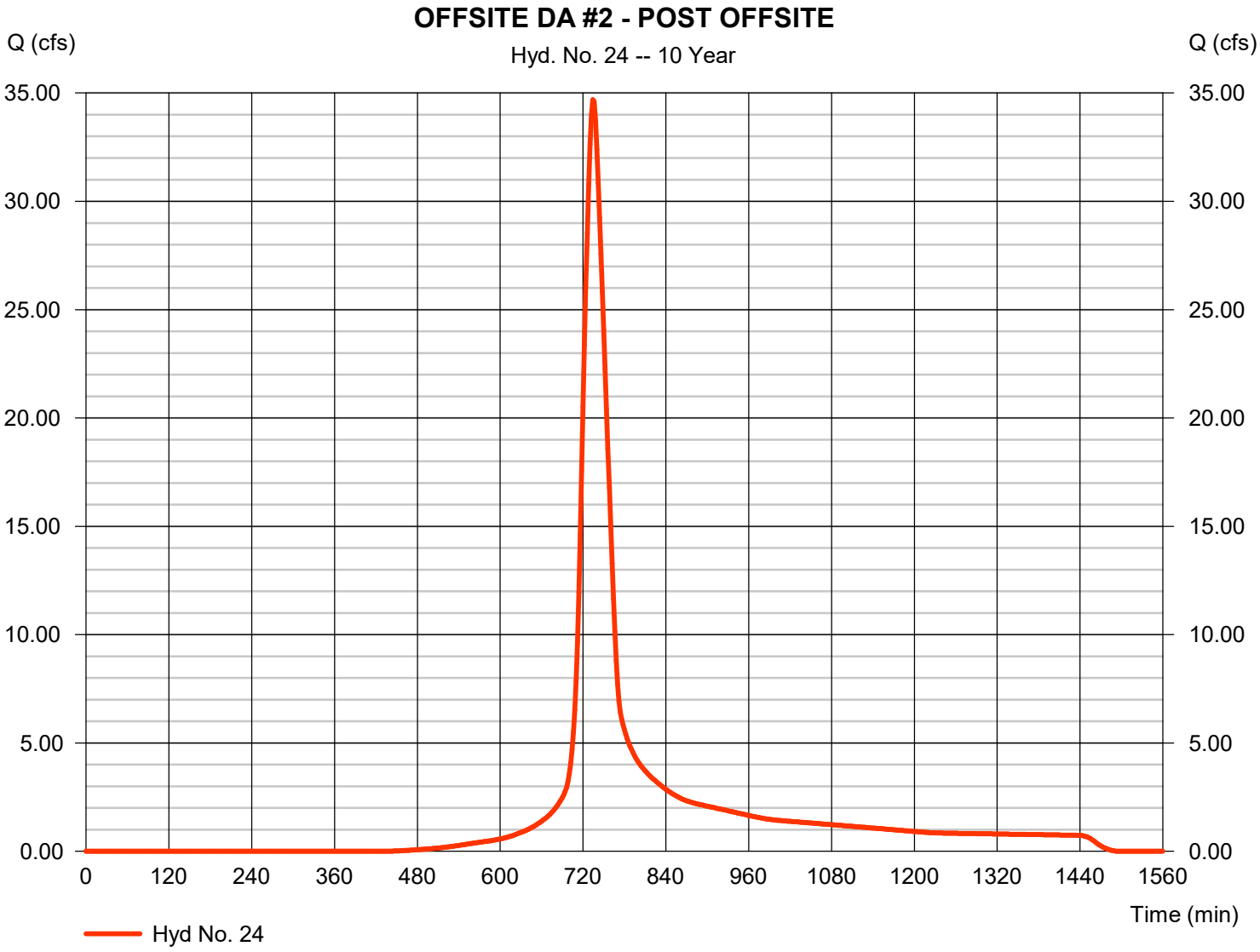


Hydrograph Report

Hyd. No. 24

OFFSITE DA #2 - POST OFFSITE

Hydrograph type	= SCS Runoff	Peak discharge	= 34.69 cfs
Storm frequency	= 10 yrs	Time to peak	= 734 min
Time interval	= 2 min	Hyd. volume	= 157,186 cuft
Drainage area	= 14.960 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 36.40 min
Total precip.	= 5.04 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

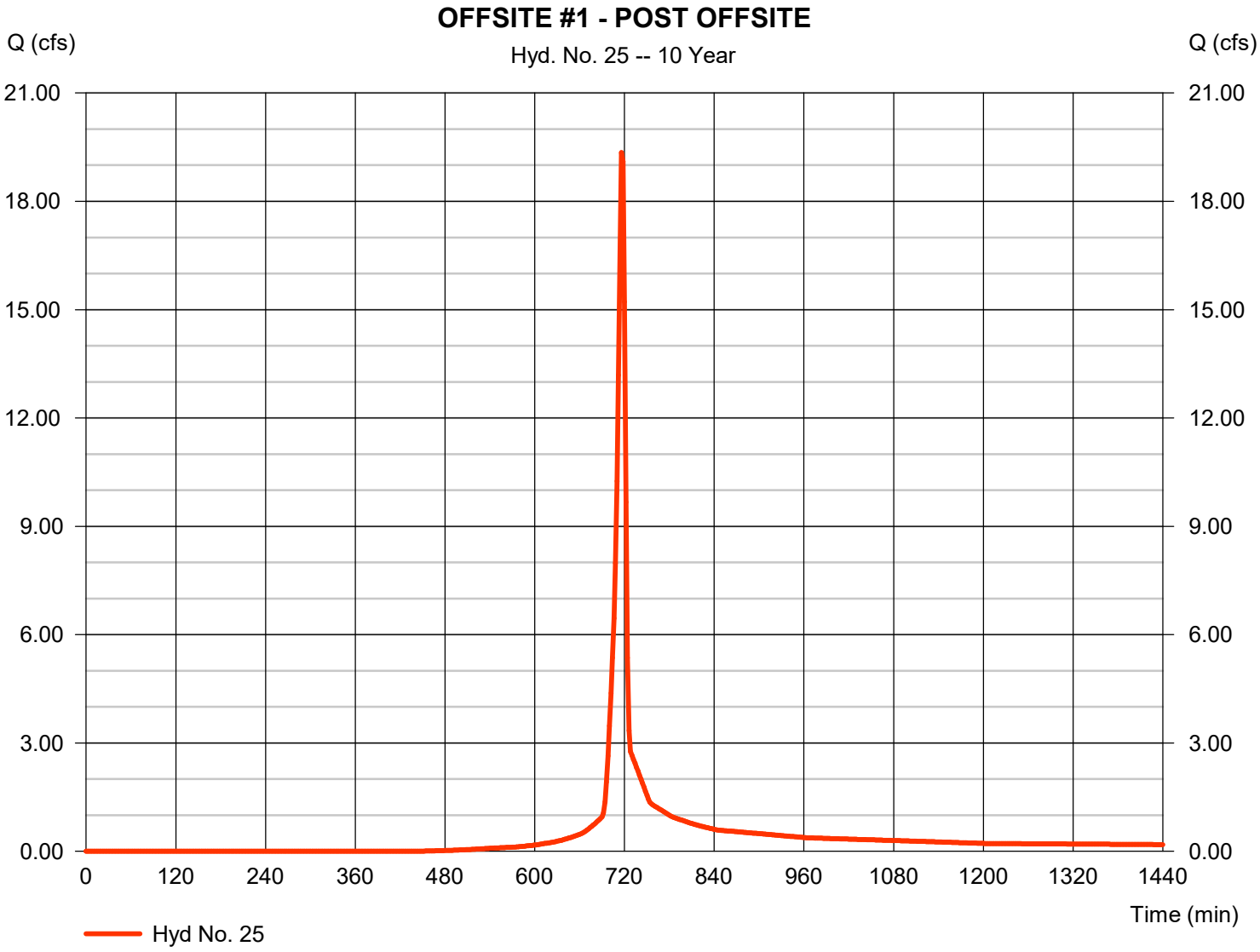


Hydrograph Report

Hyd. No. 25

OFFSITE #1 - POST OFFSITE

Hydrograph type	=	SCS Runoff	Peak discharge	=	19.35 cfs
Storm frequency	=	10 yrs	Time to peak	=	716 min
Time interval	=	2 min	Hyd. volume	=	39,282 cuft
Drainage area	=	4.070 ac	Curve number	=	79
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	4.00 min
Total precip.	=	5.04 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

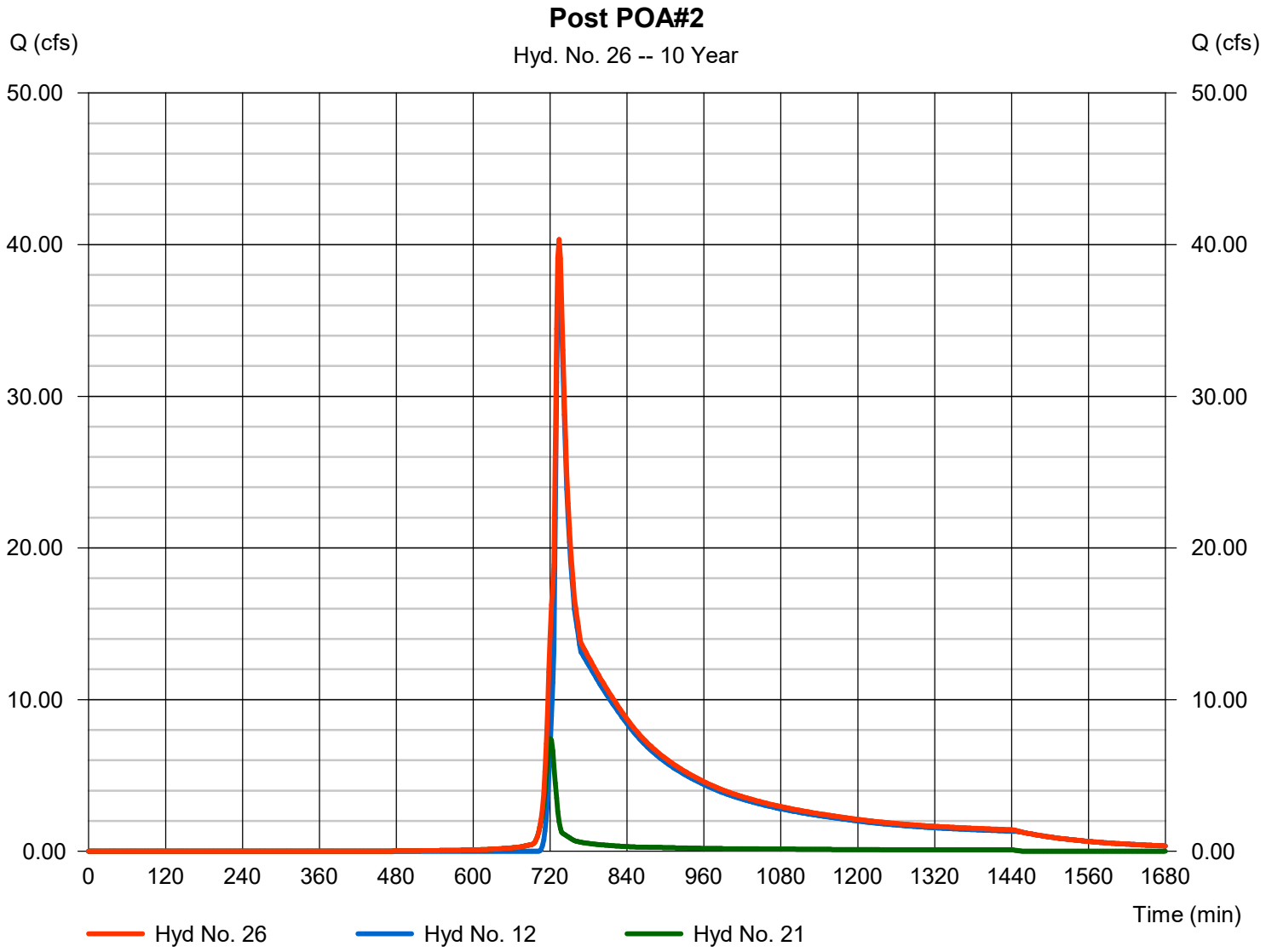


Hydrograph Report

Hyd. No. 26

Post POA#2

Hydrograph type	= Combine	Peak discharge	= 40.35 cfs
Storm frequency	= 10 yrs	Time to peak	= 734 min
Time interval	= 2 min	Hyd. volume	= 255,944 cuft
Inflow hyds.	= 12, 21	Contrib. drain. area	= 1.760 ac



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	0.0000	0.0000	0.0000	--------
2	51.0918	10.3000	0.8101	--------
3	0.0000	0.0000	0.0000	--------
5	49.6368	10.3000	0.7553	--------
10	51.1095	10.4000	0.7327	--------
25	54.6954	10.5000	0.7118	--------
50	58.0360	10.6000	0.7004	--------
100	61.9189	10.8000	0.6926	--------

File name: rolesville.IDF

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	5.61	4.46	3.73	3.22	2.85	2.56	2.33	2.14	1.98	1.85	1.73	1.63
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	6.33	5.11	4.33	3.78	3.36	3.04	2.79	2.57	2.40	2.24	2.11	2.00
10	6.89	5.61	4.78	4.19	3.75	3.40	3.12	2.89	2.70	2.53	2.39	2.26
25	7.77	6.37	5.46	4.80	4.31	3.92	3.61	3.35	3.14	2.95	2.79	2.65
50	8.47	6.97	5.99	5.29	4.75	4.34	4.00	3.72	3.48	3.28	3.10	2.94
100	9.16	7.57	6.52	5.77	5.20	4.75	4.38	4.08	3.82	3.60	3.41	3.24

Tc = time in minutes. Values may exceed 60.

name: G:\NCA\Projects\Lennar\8430-03 - Lennar - School Street - Rolesville\04 - Calculations\Storm\rolesville prec.pcp

Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	2.86	3.45	0.00	3.30	5.04	6.00	6.80	7.56
SCS 6-Hr	2.04	2.44	0.00	0.00	3.54	4.22	0.00	5.45
Huff-1st	0.00	0.00	0.00	2.75	0.00	0.00	6.50	0.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	0.00	0.00	0.00	2.80	0.00	0.00	6.00	0.00

ATTACHMENT 8: NUTRIENT CALCULATIONS – STORMWATER DESIGN TOOL

SITE DATA

Project Information	
Project Name:	**Parker Ridge**
Permit No (if known):	
Applicant:	Lennar Corporation
Applicant Contact Name:	Michael Taylor
Applicant Contact Number:	(919) 863-6461
Contact Email:	michael.taylor@lennar.com
Last Modified Date:	Wednesday, October 4, 2023
Site Data:	
River Basin:	Neuse
Regulatory Watershed:	N/A
Physiographic/Geologic Region:	Piedmont
Type of Development (Select from Dropdown menu):	Residential
Zoning:	R-5
Total Site Area (Ac):	90.64
Existing Lake/Pond Area (Ac):	4.22
Proposed Disturbed Area (Ac):	62.90
Proposed Impervious Surface Area from DA Sheets (acre):	26.20
Percent Built Upon Area (BUA):	29%
Is the proposed project a site expansion?	No
Number of Drainage Areas on Site (Points of Analysis):	6
Annual Rainfall (in):	45.41
One-year, 24-hour rainfall (in):	3.00
Two-year, 24-hour rainfall (in):	3.60
Proposed Residential Stormwater Details (if applicable):	
Site Square Footage:	3,948,278
Total Acreage in Lots:	28.52
Lot Square Footage:	1,242,331
Number of Lots:	275
Average Lot Size (SF):	4,518
Proposed Impervious Surface Area from DA sheets (SF):	1,141,272
Proposed Impervious Surface Area Devoted to Lots (SF):	815,008
Total Impervious Surface Area Devoted to Roads (SF):	176,418
Other Impervious Surface Area (SF):	145,926

Project Name: Parker Ridge

DRAINAGE AREA 1
STORMWATER PRE-POST CALCULATIONS

LAND USE & SITE DATA	PRE-DEVELOPMENT								POST-DEVELOPMENT							
Drainage Area (Acres)=	23.93								24.36							
Site Acreage within Drainage=	19.86								20.02							
One-year, 24-hour rainfall (in)=	3.00															
Land Use (acres) by Soil Group:	**A Soils**		**B Soils**		**C Soils**		**D Soils**		**A Soils**		**B Soils**		**C Soils**		**D Soils**	
Commercial	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite
Parking lot								3.72								3.72
Roof																
Open/Landscaped								0.35								0.47
Industrial	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite
Parking lot																
Roof																
Open/Landscaped																
Transportation	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite
High Density (interstate, main)																
High Density (Grassed Right-of-ways)																
Low Density (secondary, feeder)																
Low Density (Grassed Right-of-ways)																
Rural																
Rural (Grassed Right-of-ways)																
Sidewalk																
Misc. Pervious	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite
Managed pervious (Open Space)							3.89									
Unmanaged (pasture)							13.30									
Woods (not on lots)																
Residential	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite
Roadway															1.80	0.15
Grassed Right-of-ways																
Driveway																
Parking lot																
Roof															2.75	
Sidewalk (Includes Patios)															0.90	
Lawn															1.10	
Managed pervious (Open Space)															10.34	
Woods (on lots)																
Land Taken up by BMP															0.46	
JURISDICTIONAL LANDS	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite
Natural wetland							0.05								0.05	
Riparian buffer (Zone 1 only)							2.62								2.62	
Open water																
Totals (Ac)=	0.00	0.00	0.00	0.00	0.00	0.00	19.86	4.07	0.00	0.00	0.00	0.00	0.00	0.00	20.02	4.34

SITE FLOW	PRE-DEVELOPMENT T_c	POST-DEVELOPMENT Tc
Sheet Flow		
Length (ft)=	300.00	
Slope (ft/ft)=	0.05	
Surface Cover:	Paved, Gravel, or Bare Soil	
n-value=	0.01	
T_t (hrs)=	0.03	0.00
Shallow Flow		
Length (ft)=	150.00	
Slope (ft/ft)=	0.02	
Surface Cover:	Unpaved	
Average Velocity (ft/sec)=	2.10	0.00
T_t (hrs)=	0.02	0.00
Channel Flow 1		
Length (ft)=	3240.00	
Slope (ft/ft)=	0.01	
Cross Sectional Flow Area (ft^2)=	16.00	
Wetted Perimeter (ft)=	20.00	
Channel Lining:	Asphalt	
n-value=	0.02	
Hydraulic Radius (ft)=	0.80	0.00
Average Velocity (ft/sec)=	8.03	0.00
T_t (hrs)=	0.11	0.00
Tc (hrs)=	0.16	0.17
RESULTS	**PRE-DEVELOPMENT**	**POST-DEVELOPMENT**
Site Impervious Surface Area (Ac) =	0.00	5.45
Lot Impervious Surface Area (Ac) =	0.00	3.65
1-year, 24-hour storm (Peak Flow)		
Volume of runoff (ft^3) =	129,050	161,865
Volume change (ft^3) =	32,814	
Runoff (inches) = Q*=	1.4856	1.8305
Peak Discharge (cfs)= Q=	47.0283	59.6483
Composite Curve Number (DA)=	83	87
Composite Curve Number (Site only)=	80	85

DISCONNECTED IMPERVIOUS - Credit given only to residential development with drainage area with less than 30% impervious	
Percent Disconnected Impervious Credit (Residential Only) =	
Disconnected impervious area (Ac) =	0.00
Drainage Area $CN_{adjusted}$=	87
Site Only $CN_{adjusted}$=	85

Post-development peak flow exceeds pre-development peak flow for this DA!

Project Name: Parker Ridge

DRAINAGE AREA 2
STORMWATER PRE-POST CALCULATIONS

LAND USE & SITE DATA	PRE-DEVELOPMENT	POST-DEVELOPMENT
Drainage Area (Acres)=	16.02	23.55
Site Acreage within Drainage=	15.64	21.99
One-year, 24-hour rainfall (in)=	3.00	

Land Use (acres) by Soil Group:	A Soils		B Soils		C Soils		D Soils		A Soils		B Soils		C Soils		D Soils	
Commercial	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite
Parking lot																
Roof																
Open/Landscaped																
Industrial	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite
Parking lot																
Roof																
Open/Landscaped																
Transportation	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite
High Density (interstate, main)																
High Density (Grassed Right-of-ways)																
Low Density (secondary, feeder)																
Low Density (Grassed Right-of-ways)																
Rural																
Rural (Grassed Right-of-ways)																
Sidewalk																
Misc. Pervious	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite
Managed pervious (Open Space)							4.37									1.56
Unmanaged (pasture)																
Woods (not on lots)							10.91	0.38								
Residential	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite
Roadway															3.02	
Grassed Right-of-ways																
Driveway																
Parking lot																
Roof															6.37	
Sidewalk (Includes Patios)															0.96	
Lawn															2.89	
Managed pervious (Open Space)															7.52	
Woods (on lots)																
Land Taken up by BMP															0.87	
JURISDICTIONAL LANDS	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite
Natural wetland							0.03								0.03	
Riparian buffer (Zone 1 only)							0.33								0.33	
Open water																
Totals (Ac)=	0.00	0.00	0.00	0.00	0.00	0.00	15.64	0.38	0.00	0.00	0.00	0.00	0.00	0.00	21.99	1.56

SITE FLOW	PRE-DEVELOPMENT T_c	POST-DEVELOPMENT Tc
Sheet Flow		
Length (ft)=	300.00	
Slope (ft/ft)=	0.05	
Surface Cover:	Paved, Gravel, or Bare Soil	
n-value=	0.01	
T_t (hrs)=	0.03	0.00
Shallow Flow		
Length (ft)=	1356.00	
Slope (ft/ft)=	0.06	
Surface Cover:	Unpaved	
Average Velocity (ft/sec)=	3.95	0.00
T_t (hrs)=	0.10	0.00
Channel Flow 1		
Length (ft)=		
Slope (ft/ft)=		
Cross Sectional Flow Area (ft^2)=		
Wetted Perimeter (ft)=		
Channel Lining:		
n-value=		
Hydraulic Radius (ft)=	0.00	0.00
Average Velocity (ft/sec)=	0.00	0.00
T_t (hrs)=	0.00	0.00
Tc (hrs)=	0.13	0.17
RESULTS	**PRE-DEVELOPMENT**	**POST-DEVELOPMENT**
Site Impervious Surface Area (Ac) =	0.00	10.35
Lot Impervious Surface Area (Ac) =	0.00	7.33
1-year, 24-hour storm (Peak Flow)		
Volume of runoff (ft^3) =	65,236	163,880
Volume change (ft^3) =	98,644	
Runoff (inches) = Q*=	1.1218	1.9170
Peak Discharge (cfs)= Q=	25.3263	59.9646
Composite Curve Number (DA)=	78	88
Composite Curve Number (Site only)=	78	88

DISCONNECTED IMPERVIOUS - Credit given only to residential development with drainage area with less than 30% impervious	
Percent Disconnected Impervious Credit (Residential Only) =	
Disconnected impervious area (Ac) =	0.00
Drainage Area $CN_{adjusted}$=	88
Site Only $CN_{adjusted}$=	88

Post-development peak flow exceeds pre-development peak flow for this DA!

Project Name: Parker Ridge

DRAINAGE AREA 3
STORMWATER PRE-POST CALCULATIONS

LAND USE & SITE DATA	PRE-DEVELOPMENT								POST-DEVELOPMENT							
Drainage Area (Acres)=	106.07								110.23							
Site Acreage within Drainage=	41.92								46.08							
One-year, 24-hour rainfall (in)=	3.00															
Land Use (acres) by Soil Group:	**A Soils**		**B Soils**		**C Soils**		**D Soils**		**A Soils**		**B Soils**		**C Soils**		**D Soils**	
Commercial	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite
Parking lot																
Roof																
Open/Landscaped																
Industrial	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite
Parking lot																
Roof																
Open/Landscaped																
Transportation	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite
High Density (interstate, main)																
High Density (Grassed Right-of-ways)																
Low Density (secondary, feeder)																
Low Density (Grassed Right-of-ways)																
Rural																
Rural (Grassed Right-of-ways)								9.77								9.77
Sidewalk																
Misc. Pervious	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite
Managed pervious (Open Space)								50.87								50.87
Unmanaged (pasture)																
Woods (not on lots)							31.70	3.51								3.51
Residential	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite
Roadway															2.67	
Grassed Right-of-ways																
Driveway							0.13									
Parking lot																
Roof															6.24	
Sidewalk (Includes Patios)															1.49	
Lawn															3.12	
Managed pervious (Open Space)															21.62	
Woods (on lots)																
Land Taken up by BMP															1.05	
JURISDICTIONAL LANDS	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite
Natural wetland							0.78								0.74	
Riparian buffer (Zone 1 only)							5.73								5.57	
Open water							3.58								3.58	
Totals (Ac)=	0.00	0.00	0.00	0.00	0.00	0.00	41.92	64.15	0.00	0.00	0.00	0.00	0.00	0.00	46.08	64.15

SITE FLOW	PRE-DEVELOPMENT T_c	POST-DEVELOPMENT Tc
Sheet Flow		
Length (ft)=	300.00	
Slope (ft/ft)=	0.02	
Surface Cover:	Paved, Gravel, or Bare Soil	
n-value=	0.01	
T_t (hrs)=	0.05	0.00
Shallow Flow		
Length (ft)=	483.00	
Slope (ft/ft)=	0.04	
Surface Cover:	Unpaved	
Average Velocity (ft/sec)=	3.02	0.00
T_t (hrs)=	0.04	0.00
Channel Flow 1		
Length (ft)=	500.00	
Slope (ft/ft)=	0.05	
Cross Sectional Flow Area (ft^2)=	30.00	
Wetted Perimeter (ft)=	16.00	
Channel Lining:	Concrete, unfinished	
n-value=	0.01	
Hydraulic Radius (ft)=	1.88	0.00
Average Velocity (ft/sec)=	36.19	0.00
T_t (hrs)=	0.00	0.00
Tc (hrs)=	0.09	0.17
RESULTS	**PRE-DEVELOPMENT**	**POST-DEVELOPMENT**
Site Impervious Surface Area (Ac) =	0.13	10.40
Lot Impervious Surface Area (Ac) =	0.13	7.73
1-year, 24-hour storm (Peak Flow)		
Volume of runoff (ft^3) =	397,558	492,704
Volume change (ft^3) =	95,146	
Runoff (inches) = Q*=	1.0325	1.2313
Peak Discharge (cfs)= Q=	169.7900	172.0596
Composite Curve Number (DA)=	76	79
Composite Curve Number (Site only)=	71	78

DISCONNECTED IMPERVIOUS - Credit given only to residential development with drainage area with less than 30% impervious	
Percent Disconnected Impervious Credit (Residential Only) =	
Disconnected impervious area (Ac) =	0.00
Drainage Area $CN_{adjusted}$=	79
Site Only $CN_{adjusted}$=	78

Post-development peak flow exceeds pre-development peak flow for this DA!

WAKE COUNTY
NORTH CAROLINA

Project Name: Parker Ridge

DRAINAGE AREA 4
STORMWATER PRE-POST CALCULATIONS

LAND USE & SITE DATA	PRE-DEVELOPMENT	POST-DEVELOPMENT
Drainage Area (Acres)=	6.01	1.01
Site Acreage within Drainage=	6.01	1.01
One-year, 24-hour rainfall (in)=	3.00	

Land Use (acres) by Soil Group:	A Soils		B Soils		C Soils		D Soils		A Soils		B Soils		C Soils		D Soils	
Commercial	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite
Parking lot																
Roof																
Open/Landscaped																
Industrial	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite
Parking lot																
Roof																
Open/Landscaped																
Transportation	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite
High Density (interstate, main)																
High Density (Grassed Right-of-ways)																
Low Density (secondary, feeder)																
Low Density (Grassed Right-of-ways)																
Rural																
Rural (Grassed Right-of-ways)																
Sidewalk																
Misc. Pervious	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite
Managed pervious (Open Space)																
Unmanaged (pasture)																
Woods (not on lots)							5.81									
Residential	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite
Roadway																
Grassed Right-of-ways																
Driveway																
Parking lot																
Roof																
Sidewalk (Includes Patios)																
Lawn																
Managed pervious (Open Space)															0.81	
Woods (on lots)																
Land Taken up by BMP																
JURISDICTIONAL LANDS	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite
Natural wetland																
Riparian buffer (Zone 1 only)							0.20								0.20	
Open water																
Totals (Ac)=	0.00	0.00	0.00	0.00	0.00	0.00	6.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.01	0.00

SITE FLOW	PRE-DEVELOPMENT T_c	POST-DEVELOPMENT Tc
Sheet Flow		
Length (ft)=	300.00	
Slope (ft/ft)=	0.08	
Surface Cover:	Paved, Gravel, or Bare Soil	
n-value=	0.01	
T_t (hrs)=	0.03	0.00
Shallow Flow		
Length (ft)=	30.00	
Slope (ft/ft)=	0.00	
Surface Cover:	Paved	
Average Velocity (ft/sec)=	0.45	0.00
T_t (hrs)=	0.02	0.00
Channel Flow 1		
Length (ft)=		
Slope (ft/ft)=		
Cross Sectional Flow Area (ft^2)=		
Wetted Perimeter (ft)=		
Channel Lining:		
n-value=		
Hydraulic Radius (ft)=	0.00	0.00
Average Velocity (ft/sec)=	0.00	0.00
T_t (hrs)=	0.00	0.00
Tc (hrs)=	0.04	0.17
RESULTS	**PRE-DEVELOPMENT**	**POST-DEVELOPMENT**
Site Impervious Surface Area (Ac) =	0.00	0.00
Lot Impervious Surface Area (Ac) =	0.00	0.00
1-year, 24-hour storm (Peak Flow)		
Volume of runoff (ft^3) =	23,490	4,583
Volume change (ft^3) =	-18,907	
Runoff (inches) = Q*=	1.0767	1.2500
Peak Discharge (cfs)= Q=	12.3806	1.6255
Composite Curve Number (DA)=	77	80
Composite Curve Number (Site only)=	77	80

DISCONNECTED IMPERVIOUS - Credit given only to residential development with drainage area with less than 30% impervious	
Percent Disconnected Impervious Credit (Residential Only) =	
Disconnected impervious area (Ac) =	0.00
Drainage Area $CN_{adjusted}$=	80
Site Only $CN_{adjusted}$=	80

Project Name: Parker Ridge

DRAINAGE AREA 5
STORMWATER PRE-POST CALCULATIONS

LAND USE & SITE DATA	PRE-DEVELOPMENT	POST-DEVELOPMENT
Drainage Area (Acres)=	2.14	0.91
Site Acreage within Drainage=	2.14	0.91
One-year, 24-hour rainfall (in)=	3.00	

Land Use (acres) by Soil Group:	A Soils		B Soils		C Soils		D Soils		A Soils		B Soils		C Soils		D Soils	
Commercial	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite
Parking lot																
Roof																
Open/Landscaped																
Industrial	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite
Parking lot																
Roof																
Open/Landscaped																
Transportation	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite
High Density (interstate, main)																
High Density (Grassed Right-of-ways)																
Low Density (secondary, feeder)																
Low Density (Grassed Right-of-ways)																
Rural																
Rural (Grassed Right-of-ways)																
Sidewalk																
Misc. Pervious	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite
Managed pervious (Open Space)							2.14									
Unmanaged (pasture)																
Woods (not on lots)																
Residential	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite
Roadway																
Grassed Right-of-ways																
Driveway																
Parking lot																
Roof																
Sidewalk (Includes Patios)																
Lawn																
Managed pervious (Open Space)															0.91	
Woods (on lots)																
Land Taken up by BMP																
JURISDICTIONAL LANDS	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite
Natural wetland																
Riparian buffer (Zone 1 only)																
Open water																
Totals (Ac)=	0.00	0.00	0.00	0.00	0.00	0.00	2.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.91	0.00

SITE FLOW	PRE-DEVELOPMENT T_c	POST-DEVELOPMENT Tc
Sheet Flow		
Length (ft)=	300.00	
Slope (ft/ft)=	0.02	
Surface Cover:	Paved, Gravel, or Bare Soil	
n-value=	0.01	
T_t (hrs)=	0.04	0.00
Shallow Flow		
Length (ft)=	258.00	
Slope (ft/ft)=	0.00	
Surface Cover:	Unpaved	
Average Velocity (ft/sec)=	0.36	0.00
T_t (hrs)=	0.20	0.00
Channel Flow 1		
Length (ft)=		
Slope (ft/ft)=		
Cross Sectional Flow Area (ft^2)=		
Wetted Perimeter (ft)=		
Channel Lining:		
n-value=		
Hydraulic Radius (ft)=	0.00	0.00
Average Velocity (ft/sec)=	0.00	0.00
T_t (hrs)=	0.00	0.00
Tc (hrs)=	0.24	0.17
RESULTS	**PRE-DEVELOPMENT**	**POST-DEVELOPMENT**
Site Impervious Surface Area (Ac) =	0.00	0.00
Lot Impervious Surface Area (Ac) =	0.00	0.00
1-year, 24-hour storm (Peak Flow)		
Volume of runoff (ft^3) =	9,710	4,129
Volume change (ft^3) =	-5,581	
Runoff (inches) = Q*=	1.2500	1.2500
Peak Discharge (cfs)= Q=	2.9755	1.4646
Composite Curve Number (DA)=	80	80
Composite Curve Number (Site only)=	80	80

DISCONNECTED IMPERVIOUS - Credit given only to residential development with drainage area with less than 30% impervious	
Percent Disconnected Impervious Credit (Residential Only) =	
Disconnected impervious area (Ac) =	0.00
Drainage Area $CN_{adjusted}$=	80
Site Only $CN_{adjusted}$=	80

Project Name: Parker Ridge

DRAINAGE AREA 6
STORMWATER PRE-POST CALCULATIONS

LAND USE & SITE DATA	PRE-DEVELOPMENT	POST-DEVELOPMENT
Drainage Area (Acres)=	1.30	0.63
Site Acreage within Drainage=	1.30	0.63
One-year, 24-hour rainfall (in)=	3.00	

Land Use (acres) by Soil Group:	A Soils		B Soils		C Soils		D Soils		A Soils		B Soils		C Soils		D Soils	
Commercial	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite
Parking lot																
Roof																
Open/Landscaped																
Industrial	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite
Parking lot																
Roof																
Open/Landscaped																
Transportation	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite
High Density (interstate, main)																
High Density (Grassed Right-of-ways)																
Low Density (secondary, feeder)																
Low Density (Grassed Right-of-ways)																
Rural																
Rural (Grassed Right-of-ways)																
Sidewalk																
Misc. Pervious	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite
Managed pervious (Open Space)							1.30									
Unmanaged (pasture)																
Woods (not on lots)																
Residential	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite
Roadway																
Grassed Right-of-ways																
Driveway																
Parking lot																
Roof																
Sidewalk (Includes Patios)																
Lawn																
Managed pervious (Open Space)															0.63	
Woods (on lots)																
Land Taken up by BMP																
JURISDICTIONAL LANDS	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite
Natural wetland																
Riparian buffer (Zone 1 only)																
Open water																
Totals (Ac)=	0.00	0.00	0.00	0.00	0.00	0.00	1.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.63	0.00

SITE FLOW	PRE-DEVELOPMENT T_c	POST-DEVELOPMENT Tc
Sheet Flow		
Length (ft)=	146.00	
Slope (ft/ft)=	0.04	
Surface Cover:	Paved, Gravel, or Bare Soil	
n-value=	0.01	
T_t (hrs)=	0.02	0.00
Shallow Flow		
Length (ft)=	437.00	
Slope (ft/ft)=	0.00	
Surface Cover:	Unpaved	
Average Velocity (ft/sec)=	0.36	0.00
T_t (hrs)=	0.34	0.00
Channel Flow 1		
Length (ft)=		
Slope (ft/ft)=		
Cross Sectional Flow Area (ft^2)=		
Wetted Perimeter (ft)=		
Channel Lining:		
n-value=		
Hydraulic Radius (ft)=	0.00	0.00
Average Velocity (ft/sec)=	0.00	0.00
T_t (hrs)=	0.00	0.00
Tc (hrs)=	0.36	0.08
RESULTS	**PRE-DEVELOPMENT**	**POST-DEVELOPMENT**
Site Impervious Surface Area (Ac) =	0.00	0.00
Lot Impervious Surface Area (Ac) =	0.00	0.00
1-year, 24-hour storm (Peak Flow)		
Volume of runoff (ft^3) =	5,899	2,859
Volume change (ft^3) =	-3,040	
Runoff (inches) = Q*=	1.2500	1.2500
Peak Discharge (cfs)= Q=	1.5204	1.2896
Composite Curve Number (DA)=	80	80
Composite Curve Number (Site only)=	80	80

DISCONNECTED IMPERVIOUS - Credit given only to residential development with drainage area with less than 30% impervious	
Percent Disconnected Impervious Credit (Residential Only) =	
Disconnected impervious area (Ac) =	0.00
Drainage Area $CN_{adjusted}$=	80
Site Only $CN_{adjusted}$=	80

Project Name: Parker Ridge

DA SITE SUMMARY
STORMWATER PRE-POST CALCULATIONS

SITE SUMMARY						
DRAINAGE AREA SUMMARIES						
DRAINAGE AREA:	DA1	DA2	DA3	DA4	DA5	DA6
Pre-Development (1-year, 24-hour storm)						
Runoff (in)=Q* =	1.486	1.122	1.033	1.077	1.250	1.250
Peak Flow (cfs)=Q_{post} =	47.028	25.326	169.790	12.381	2.975	1.520
Post-Development (1-year, 24-hour storm)						
Proposed Impervious Surface (acre) =	5.45	10.35	10.40			
Runoff (in)=Q* =	1.830	1.917	1.231	1.250	1.250	1.250
Peak Flow (cfs)=Q_{post} =	59.648	59.965	172.060	1.626	1.465	1.290

TARGET CURVE NUMBER (TCN) - Residential Only			
SITE \SOIL COMPOSITION			
HYDROLOGIC SOIL GROUP	Site Area	%	Target CN
A	0.00	0%	43
B	0.00	0%	63
C	0.00	0%	76
D	90.64	100%	81

Total Site Area (acres) =	90.64
Zoning =	R-5
Target Curve Number (TCN) =	81
% Impervious =	29%
Post Development $CN_{adjusted}$ =	82
Required Volume to be Managed (TCN)= ft^3 =	21,904

SITE NITROGEN AND PHOSPHORUS LOADING	
Nitrogen and Phosphorus Targets (Based on Regulatory Watershed)	
Target Nitrogen Load (lb/ac/yr)=	**3.6**
Target Phosphorus Load (Falls and Jordan Lakes Only) (lb/ac/yr)=	**N/A**
% N Loading Reduction Option for Expansions (Falls and Jordan Lakes Only) =	N/A
% Loading Reduction Nitrogen Target (Falls and Jordan Lakes Only) (lb/ac/yr)=	N/A
% P Loading Reduction Option for Expansions (Falls and Jordan Lakes Only) =	N/A
% Loading Reduction Phosphorus Target (Falls and Jordan Lakes Only) (lb/ac/yr)=	N/A
Pre Development Nitrogen and Phosphorus Load	
Total Nitrogen (lb/ac/yr)=	**1.07**
Total Phosphorus (lb/ac/yr)=	**N/A**
Post Development Nitrogen and Phosphorus Load	
Total Nitrogen (lb/ac/yr)=	**4.79**
Total Phosphorus (lb/ac/yr)=	**N/A**

Project Name: Parker Ridge

DRAINAGE AREA 1
BMP CALCULATIONS

DRAINAGE AREA 1 - BMP DEVICES AND ADJUSTMENTS				
DA1 Site Acreage=	20.02			
DA1 Off-Site Acreage=	4.34			
Total Required Storage Volume for Site TCN Requirement (ft^3)=	21,904			
Will site use underground water harvesting?	No	Enter % volume reduction in decimal form=		Note: Supporting information/details should be submitted to demonstrate water usage.

ENTER AREA TREATED BY BMP

Land Use (acres)	Sub-DA1(a) (Ac)		Sub-DA1(b) (Ac)		Sub-DA1(c) (Ac)		Sub-DA1(d) (Ac)		Sub-DA1(e) (Ac)	
Commercial	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site
Parking lot				3.72						
Roof										
Open/Landscaped		0.12		0.35						
Industrial	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site
Parking lot										
Roof										
Open/Landscaped										
Transportation	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site
High Density (interstate, main)										
High Density (Grassed Right-of-ways)										
Low Density (secondary, feeder)										
Low Density (Grassed Right-of-ways)										
Rural										
Rural (Grassed Right-of-ways)										
Sidewalk										
Misc. Pervious	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site
Managed pervious										
Unmanaged (pasture)										
Woods (not on lots)										
Residential	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site
Roadway	1.73	0.15	0.07							
Grassed Right-of-ways										
Driveway										
Parking lot										
Roof	2.75									
Sidewalk	0.50		0.40							
Lawn	1.10									
Managed pervious	2.81		7.44							
Woods (on lots)										
Land Taken up by BMP	0.46									
JURISDICTIONAL LANDS	Site	Off-site	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite
Natural wetland			0.05							
Riparian buffer (Zone 1 only)			2.62							
Totals (Ac)=	9.35	0.27	10.58	4.07	0.00	0.00	0.00	0.00	0.00	0.00

Sub-DA1(a) BMP(s)

Device Name (As Shown on Plan)	Device Type	Water Quality Volume (c.f.)	Inflow N EMC (mg/L)	Total Inflow N (lb/ac/yr)	Inflow P EMC (mg/L)	Total Inflow P (lb/ac/yr)	Outflow N EMC (mg/L)	Total Outflow N (lb/ac/yr)	Outflow P EMC (mg/L)	Total Outflow P (lb/ac/yr)	Provided Volume Managed (c.f.)
SCM 1	Wet Detention Pond	18,506	1.27	7.53	0.37	2.17	1.04	5.53	0.14	0.75	85,659
Outflow Total Nitrogen (lb/ac/yr)=		5.53		Outflow Total Phosphorus (lb/ac/yr)=						0.75	

Sub-DA1(b) BMP(s)

If Sub-DA1(b) is connected to upstream sub-basin(s), select all contributing sub-basin(s from dropdown menus):											
Device Name (As Shown on Plan)	Device Type	Water Quality Volume (c.f.)	Inflow N EMC (mg/L)	Total Inflow N (lb/ac/yr)	Inflow P EMC (mg/L)	Total Inflow P (lb/ac/yr)	Outflow N EMC (mg/L)	Total Outflow N (lb/ac/yr)	Outflow P EMC (mg/L)	Total Outflow P (lb/ac/yr)	Provided Volume Managed (c.f.)
Bypass #1		15,863		1.91		0.71					
Outflow Total Nitrogen (lb/ac/yr)=				Outflow Total Phosphorus (lb/ac/yr)=							
Sub-DA1 (c) BMP(s)											
If Sub-DA1(c) is connected to upstream sub-basin(s), select all contributing sub-basin(s):											
Device Name (As Shown on Plan)	Device Type	Water Quality Volume (c.f.)	Inflow N EMC (mg/L)	Total Inflow N (lb/ac/yr)	Inflow P EMC (mg/L)	Total Inflow P (lb/ac/yr)	Outflow N EMC (mg/L)	Total Outflow N (lb/ac/yr)	Outflow P EMC (mg/L)	Total Outflow P (lb/ac/yr)	Provided Volume Managed (c.f.)
Outflow Total Nitrogen (lb/ac/yr)=				Outflow Total Phosphorus (lb/ac/yr)=							
Sub-DA1 (d) BMP(s)											
If Sub-DA1(d) is connected to upstream sub-basin(s), select all contributing sub-basin(s):											
Device Name (As Shown on Plan)	Device Type	Water Quality Volume (c.f.)	Inflow N EMC (mg/L)	Total Inflow N (lb/ac/yr)	Inflow P EMC (mg/L)	Total Inflow P (lb/ac/yr)	Outflow N EMC (mg/L)	Total Outflow N (lb/ac/yr)	Outflow P EMC (mg/L)	Total Outflow P (lb/ac/yr)	Provided Volume Managed (c.f.)
Outflow Total Nitrogen (lb/ac/yr)=				Outflow Total Phosphorus (lb/ac/yr)=							
Sub-DA1 (e) BMP(s)											
If Sub-DA1(e) is connected to upstream sub-basin(s), select all contributing sub-basin(s):											
Device Name (As Shown on Plan)	Device Type	Water Quality Volume (c.f.)	Inflow N EMC (mg/L)	Total Inflow N (lb/ac/yr)	Inflow P EMC (mg/L)	Total Inflow P (lb/ac/yr)	Outflow N EMC (mg/L)	Total Outflow N (lb/ac/yr)	Outflow P EMC (mg/L)	Total Outflow P (lb/ac/yr)	Provided Volume Managed (c.f.)
Outflow Total Nitrogen (lb/ac/yr)=				Outflow Total Phosphorus (lb/ac/yr)=							

DA1 BMP SUMMARY	
Total Volume Treated (c.f.)=	85659
DA1 Outflow Total Nitrogen (lb/ac/yr)=	5.53
DA1 Outflow Total Phosphorus (lb/ac/yr)=	0.75
1-year, 24-hour storm	
Pre Development Peak Discharge (cfs)= $Q_{1\text{-year}}$=	47.03
Post BMP Peak Discharge (cfs)= $Q_{1\text{-year}}$=	16.85

Project Name: Parker Ridge

DRAINAGE AREA 2
BMP CALCULATIONS

DRAINAGE AREA 2 - BMP DEVICES AND ADJUSTMENTS				
DA2 Site Acreage=	21.99			
DA2 Off-Site Acreage=	1.56			
Total Required Storage Volume for Site TCN Requirement (ft^3)=	21,904			
Will site use underground water harvesting?	No	Enter % volume reduction in decimal form=		Note: Supporting information/details should be submitted to demonstrate water usage.

ENTER AREA TREATED BY BMP

Land Use (acres)	Sub-DA2(a) (Ac)		Sub-DA2(b) (Ac)		Sub-DA2(c) (Ac)		Sub-DA2(d) (Ac)		Sub-DA2(e) (Ac)	
Commercial	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site
Parking lot										
Roof										
Open/Landscaped										
Industrial	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site
Parking lot										
Roof										
Open/Landscaped										
Transportation	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site
High Density (interstate, main)										
High Density (Grassed Right-of-ways)										
Low Density (secondary, feeder)										
Low Density (Grassed Right-of-ways)										
Rural										
Rural (Grassed Right-of-ways)										
Sidewalk										
Misc. Pervious	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site
Managed pervious		1.56								
Unmanaged (pasture)										
Woods (not on lots)										
Residential	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site
Roadway	3.02									
Grassed Right-of-ways										
Driveway										
Parking lot										
Roof	6.37									
Sidewalk	0.96									
Lawn	2.89									
Managed pervious	6.09		1.43							
Woods (on lots)										
Land Taken up by BMP	0.87									
JURISDICTIONAL LANDS	Site	Off-site	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite
Natural wetland	0.03									
Riparian buffer (Zone 1 only)			0.33							
Totals (Ac)=	20.23	1.56	1.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Sub-DA2(a) BMP(s)

Device Name (As Shown on Plan)	Device Type	Water Quality Volume (c.f.)	Inflow N EMC (mg/L)	Total Inflow N (lb/ac/yr)	Inflow P EMC (mg/L)	Total Inflow P (lb/ac/yr)	Outflow N EMC (mg/L)	Total Outflow N (lb/ac/yr)	Outflow P EMC (mg/L)	Total Outflow P (lb/ac/yr)	Provided Volume Managed (c.f.)
SCM 2	Wet Detention Pond	37,763	1.26	7.14	0.34	1.95	1.04	5.29	0.14	0.71	174,865
Outflow Total Nitrogen (lb/ac/yr)=		5.29		Outflow Total Phosphorus (lb/ac/yr)=						0.71	

Sub-DA2(b) BMP(s)

If Sub-DA2(b) is connected to upstream sub-basin(s), select all contributing sub-basin(s from dropdown menus):											
Device Name (As Shown on Plan)	Device Type	Water Quality Volume (c.f.)	Inflow N EMC (mg/L)	Total Inflow N (lb/ac/yr)	Inflow P EMC (mg/L)	Total Inflow P (lb/ac/yr)	Outflow N EMC (mg/L)	Total Outflow N (lb/ac/yr)	Outflow P EMC (mg/L)	Total Outflow P (lb/ac/yr)	Provided Volume Managed (c.f.)
Bypasss #2		260		1.42		0.27					
Outflow Total Nitrogen (lb/ac/yr)=				Outflow Total Phosphorus (lb/ac/yr)=							
Sub-DA2 (c) BMP(s)											
If Sub-DA2(c) is connected to upstream sub-basin(s), select all contributing sub-basin(s):											
Device Name (As Shown on Plan)	Device Type	Water Quality Volume (c.f.)	Inflow N EMC (mg/L)	Total Inflow N (lb/ac/yr)	Inflow P EMC (mg/L)	Total Inflow P (lb/ac/yr)	Outflow N EMC (mg/L)	Total Outflow N (lb/ac/yr)	Outflow P EMC (mg/L)	Total Outflow P (lb/ac/yr)	Provided Volume Managed (c.f.)
Outflow Total Nitrogen (lb/ac/yr)=				Outflow Total Phosphorus (lb/ac/yr)=							
Sub-DA2 (d) BMP(s)											
If Sub-DA2(d) is connected to upstream sub-basin(s), select all contributing sub-basin(s):											
Device Name (As Shown on Plan)	Device Type	Water Quality Volume (c.f.)	Inflow N EMC (mg/L)	Total Inflow N (lb/ac/yr)	Inflow P EMC (mg/L)	Total Inflow P (lb/ac/yr)	Outflow N EMC (mg/L)	Total Outflow N (lb/ac/yr)	Outflow P EMC (mg/L)	Total Outflow P (lb/ac/yr)	Provided Volume Managed (c.f.)
Outflow Total Nitrogen (lb/ac/yr)=				Outflow Total Phosphorus (lb/ac/yr)=							
Sub-DA2 (e) BMP(s)											
If Sub-DA2(e) is connected to upstream sub-basin(s), select all contributing sub-basin(s):											
Device Name (As Shown on Plan)	Device Type	Water Quality Volume (c.f.)	Inflow N EMC (mg/L)	Total Inflow N (lb/ac/yr)	Inflow P EMC (mg/L)	Total Inflow P (lb/ac/yr)	Outflow N EMC (mg/L)	Total Outflow N (lb/ac/yr)	Outflow P EMC (mg/L)	Total Outflow P (lb/ac/yr)	Provided Volume Managed (c.f.)
Outflow Total Nitrogen (lb/ac/yr)=				Outflow Total Phosphorus (lb/ac/yr)=							

DA2 BMP SUMMARY	
Total Volume Treated (c.f.)=	174865
DA2 Outflow Total Nitrogen (lb/ac/yr)=	5.29
DA2 Outflow Total Phosphorus (lb/ac/yr)=	0.71
1-year, 24-hour storm	
Pre Development Peak Discharge (cfs)= $Q_{1\text{-year}}$=	25.33
Post BMP Peak Discharge (cfs)= $Q_{1\text{-year}}$=	3.46

Project Name: Parker Ridge

DRAINAGE AREA 3
BMP CALCULATIONS

DRAINAGE AREA 3 - BMP DEVICES AND ADJUSTMENTS				
DA3 Site Acreage=	46.08			
DA3 Off-Site Acreage=	64.15			
Total Required Storage Volume for Site TCN Requirement (ft^3)=	21,904			
Will site use underground water harvesting?	No	Enter % volume reduction in decimal form=		Note: Supporting information/details should be submitted to demonstrate water usage.

ENTER AREA TREATED BY BMP

Land Use (acres)	Sub-DA3(a) (Ac)		Sub-DA3(b) (Ac)		Sub-DA3(c) (Ac)		Sub-DA3(d) (Ac)		Sub-DA3(e) (Ac)	
Commercial	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site
Parking lot										
Roof										
Open/Landscaped										
Industrial	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site
Parking lot										
Roof										
Open/Landscaped										
Transportation	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site
High Density (interstate, main)										
High Density (Grassed Right-of-ways)										
Low Density (secondary, feeder)										
Low Density (Grassed Right-of-ways)										
Rural										
Rural (Grassed Right-of-ways)						9.77				
Sidewalk										
Misc. Pervious	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site
Managed pervious		3.13				47.74				
Unmanaged (pasture)										
Woods (not on lots)						3.51				
Residential	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site
Roadway	1.49		0.98		0.20					
Grassed Right-of-ways										
Driveway										
Parking lot										
Roof	2.52		3.12		0.60					
Sidewalk	0.52		0.35		0.62					
Lawn	1.26		1.56		0.30					
Managed pervious	3.52		3.21		14.89					
Woods (on lots)										
Land Taken up by BMP	0.49		0.56							
JURISDICTIONAL LANDS	Site	Off-site	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite
Natural wetland					0.74					
Riparian buffer (Zone 1 only)					5.57					
Totals (Ac)=	9.80	3.13	9.78	0.00	22.92	61.02	0.00	0.00	0.00	0.00

Sub-DA3(a) BMP(s)

Device Name (As Shown on Plan)	Device Type	Water Quality Volume (c.f.)	Inflow N EMC (mg/L)	Total Inflow N (lb/ac/yr)	Inflow P EMC (mg/L)	Total Inflow P (lb/ac/yr)	Outflow N EMC (mg/L)	Total Outflow N (lb/ac/yr)	Outflow P EMC (mg/L)	Total Outflow P (lb/ac/yr)	Provided Volume Managed (c.f.)
SCM 3	Wet Detention Pond	17,146	1.29	6.79	0.37	1.97	1.04	4.94	0.14	0.67	101,479
Outflow Total Nitrogen (lb/ac/yr)=		4.94		Outflow Total Phosphorus (lb/ac/yr)=						0.67	

Sub-DA3(b) BMP(s)

If Sub-DA3(b) is connected to upstream sub-basin(s), select all contributing sub-basin(s from dropdown menus):											
Device Name (As Shown on Plan)	Device Type	Water Quality Volume (c.f.)	Inflow N EMC (mg/L)	Total Inflow N (lb/ac/yr)	Inflow P EMC (mg/L)	Total Inflow P (lb/ac/yr)	Outflow N EMC (mg/L)	Total Outflow N (lb/ac/yr)	Outflow P EMC (mg/L)	Total Outflow P (lb/ac/yr)	Provided Volume Managed (c.f.)
SCM 4	Wet Detention Pond	16,313	1.24	6.57	0.30	1.61	1.04	4.92	0.13	0.64	109,845
Outflow Total Nitrogen (lb/ac/yr)=		4.92		Outflow Total Phosphorus (lb/ac/yr)=						0.64	
Sub-DA3 (c) BMP(s)											
If Sub-DA3(c) is connected to upstream sub-basin(s), select all contributing sub-basin(s):											
Device Name (As Shown on Plan)	Device Type	Water Quality Volume (c.f.)	Inflow N EMC (mg/L)	Total Inflow N (lb/ac/yr)	Inflow P EMC (mg/L)	Total Inflow P (lb/ac/yr)	Outflow N EMC (mg/L)	Total Outflow N (lb/ac/yr)	Outflow P EMC (mg/L)	Total Outflow P (lb/ac/yr)	Provided Volume Managed (c.f.)
Bypass #3		18,729		2.01		0.63					
Outflow Total Nitrogen (lb/ac/yr)=				Outflow Total Phosphorus (lb/ac/yr)=							
Sub-DA3 (d) BMP(s)											
If Sub-DA3(d) is connected to upstream sub-basin(s), select all contributing sub-basin(s):											
Device Name (As Shown on Plan)	Device Type	Water Quality Volume (c.f.)	Inflow N EMC (mg/L)	Total Inflow N (lb/ac/yr)	Inflow P EMC (mg/L)	Total Inflow P (lb/ac/yr)	Outflow N EMC (mg/L)	Total Outflow N (lb/ac/yr)	Outflow P EMC (mg/L)	Total Outflow P (lb/ac/yr)	Provided Volume Managed (c.f.)
Outflow Total Nitrogen (lb/ac/yr)=				Outflow Total Phosphorus (lb/ac/yr)=							
Sub-DA3 (e) BMP(s)											
If Sub-DA3(e) is connected to upstream sub-basin(s), select all contributing sub-basin(s):											
Device Name (As Shown on Plan)	Device Type	Water Quality Volume (c.f.)	Inflow N EMC (mg/L)	Total Inflow N (lb/ac/yr)	Inflow P EMC (mg/L)	Total Inflow P (lb/ac/yr)	Outflow N EMC (mg/L)	Total Outflow N (lb/ac/yr)	Outflow P EMC (mg/L)	Total Outflow P (lb/ac/yr)	Provided Volume Managed (c.f.)
Outflow Total Nitrogen (lb/ac/yr)=				Outflow Total Phosphorus (lb/ac/yr)=							

DA3 BMP SUMMARY	
Total Volume Treated (c.f.)=	211324
DA3 Outflow Total Nitrogen (lb/ac/yr)=	4.92
DA3 Outflow Total Phosphorus (lb/ac/yr)=	0.64
1-year, 24-hour storm	
Pre Development Peak Discharge (cfs)= $Q_{1\text{-year}}$=	169.79
Post BMP Peak Discharge (cfs)= $Q_{1\text{-year}}$=	34.43

Project Name: Parker Ridge

DRAINAGE AREA 4
BMP CALCULATIONS

DRAINAGE AREA 4 - BMP DEVICES AND ADJUSTMENTS				
DA4 Site Acreage=	1.01			
DA4 Off-Site Acreage=	0.00			
Total Required Storage Volume for Site TCN Requirement (ft^3)=	21,904			
Will site use underground water harvesting?	No	Enter % volume reduction in decimal form=		Note: Supporting information/details should be submitted to demonstrate water usage.

ENTER AREA TREATED BY BMP

Land Use (acres)	Sub-DA4(a) (Ac)		Sub-DA4(b) (Ac)		Sub-DA4(c) (Ac)		Sub-DA4(d) (Ac)		Sub-DA4(e) (Ac)	
Commercial	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site
Parking lot										
Roof										
Open/Landscaped										
Industrial	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site
Parking lot										
Roof										
Open/Landscaped										
Transportation	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site
High Density (interstate, main)										
High Density (Grassed Right-of-ways)										
Low Density (secondary, feeder)										
Low Density (Grassed Right-of-ways)										
Rural										
Rural (Grassed Right-of-ways)										
Sidewalk										
Misc. Pervious	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site
Managed pervious										
Unmanaged (pasture)										
Woods (not on lots)										
Residential	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site
Roadway										
Grassed Right-of-ways										
Driveway										
Parking lot										
Roof										
Sidewalk										
Lawn										
Managed pervious										
Woods (on lots)										
Land Taken up by BMP										
JURISDICTIONAL LANDS	Site	Off-site	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite
Natural wetland										
Riparian buffer (Zone 1 only)										
Totals (Ac)=	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Sub-DA4(a) BMP(s)

Device Name (As Shown on Plan)	Device Type	Water Quality Volume (c.f.)	Inflow N EMC (mg/L)	Total Inflow N (lb/ac/yr)	Inflow P EMC (mg/L)	Total Inflow P (lb/ac/yr)	Outflow N EMC (mg/L)	Total Outflow N (lb/ac/yr)	Outflow P EMC (mg/L)	Total Outflow P (lb/ac/yr)	Provided Volume Managed (c.f.)
Outflow Total Nitrogen (lb/ac/yr)=				Outflow Total Phosphorus (lb/ac/yr)=							

Sub-DA4(b) BMP(s)

If Sub-DA4(b) is connected to upstream sub-basin(s), select all contributing sub-basin(s from dropdown menus):											
Device Name (As Shown on Plan)	Device Type	Water Quality Volume (c.f.)	Inflow N EMC (mg/L)	Total Inflow N (lb/ac/yr)	Inflow P EMC (mg/L)	Total Inflow P (lb/ac/yr)	Outflow N EMC (mg/L)	Total Outflow N (lb/ac/yr)	Outflow P EMC (mg/L)	Total Outflow P (lb/ac/yr)	Provided Volume Managed (c.f.)
Outflow Total Nitrogen (lb/ac/yr)=				Outflow Total Phosphorus (lb/ac/yr)=							
Sub-DA4 (c) BMP(s)											
If Sub-DA4(c) is connected to upstream sub-basin(s), select all contributing sub-basin(s):											
Device Name (As Shown on Plan)	Device Type	Water Quality Volume (c.f.)	Inflow N EMC (mg/L)	Total Inflow N (lb/ac/yr)	Inflow P EMC (mg/L)	Total Inflow P (lb/ac/yr)	Outflow N EMC (mg/L)	Total Outflow N (lb/ac/yr)	Outflow P EMC (mg/L)	Total Outflow P (lb/ac/yr)	Provided Volume Managed (c.f.)
Outflow Total Nitrogen (lb/ac/yr)=				Outflow Total Phosphorus (lb/ac/yr)=							
Sub-DA4 (d) BMP(s)											
If Sub-DA4(d) is connected to upstream sub-basin(s), select all contributing sub-basin(s):											
Device Name (As Shown on Plan)	Device Type	Water Quality Volume (c.f.)	Inflow N EMC (mg/L)	Total Inflow N (lb/ac/yr)	Inflow P EMC (mg/L)	Total Inflow P (lb/ac/yr)	Outflow N EMC (mg/L)	Total Outflow N (lb/ac/yr)	Outflow P EMC (mg/L)	Total Outflow P (lb/ac/yr)	Provided Volume Managed (c.f.)
Outflow Total Nitrogen (lb/ac/yr)=				Outflow Total Phosphorus (lb/ac/yr)=							
Sub-DA4 (e) BMP(s)											
If Sub-DA4(e) is connected to upstream sub-basin(s), select all contributing sub-basin(s):											
Device Name (As Shown on Plan)	Device Type	Water Quality Volume (c.f.)	Inflow N EMC (mg/L)	Total Inflow N (lb/ac/yr)	Inflow P EMC (mg/L)	Total Inflow P (lb/ac/yr)	Outflow N EMC (mg/L)	Total Outflow N (lb/ac/yr)	Outflow P EMC (mg/L)	Total Outflow P (lb/ac/yr)	Provided Volume Managed (c.f.)
Outflow Total Nitrogen (lb/ac/yr)=				Outflow Total Phosphorus (lb/ac/yr)=							

DA4 BMP SUMMARY	
Total Volume Treated (c.f.)=	0
DA4 Outflow Total Nitrogen (lb/ac/yr)=	
DA4 Outflow Total Phosphorus (lb/ac/yr)=	
1-year, 24-hour storm	
Pre Development Peak Discharge (cfs)= $Q_{1\text{-year}}$=	12.38
Post BMP Peak Discharge (cfs)= $Q_{1\text{-year}}$=	1.63

Project Name: Parker Ridge

DRAINAGE AREA 5
BMP CALCULATIONS

DRAINAGE AREA 5 - BMP DEVICES AND ADJUSTMENTS				
DA5 Site Acreage=	0.91			
DA5 Off-Site Acreage=	0.00			
Total Required Storage Volume for Site TCN Requirement (ft^3)=	21,904			
Will site use underground water harvesting?	No	Enter % volume reduction in decimal form=		Note: Supporting information/details should be submitted to demonstrate water usage.

ENTER AREA TREATED BY BMP

Land Use (acres)	Sub-DA5(a) (Ac)		Sub-DA5(b) (Ac)		Sub-DA5(c) (Ac)		Sub-DA5(d) (Ac)		Sub-DA5(e) (Ac)	
Commercial	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site
Parking lot										
Roof										
Open/Landscaped										
Industrial	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site
Parking lot										
Roof										
Open/Landscaped										
Transportation	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site
High Density (interstate, main)										
High Density (Grassed Right-of-ways)										
Low Density (secondary, feeder)										
Low Density (Grassed Right-of-ways)										
Rural										
Rural (Grassed Right-of-ways)										
Sidewalk										
Misc. Pervious	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site
Managed pervious										
Unmanaged (pasture)										
Woods (not on lots)										
Residential	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site
Roadway										
Grassed Right-of-ways										
Driveway										
Parking lot										
Roof										
Sidewalk										
Lawn										
Managed pervious										
Woods (on lots)										
Land Taken up by BMP										
JURISDICTIONAL LANDS	Site	Off-site	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite
Natural wetland										
Riparian buffer (Zone 1 only)										
Totals (Ac)=	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Sub-DA5(a) BMP(s)

Device Name (As Shown on Plan)	Device Type	Water Quality Volume (c.f.)	Inflow N EMC (mg/L)	Total Inflow N (lb/ac/yr)	Inflow P EMC (mg/L)	Total Inflow P (lb/ac/yr)	Outflow N EMC (mg/L)	Total Outflow N (lb/ac/yr)	Outflow P EMC (mg/L)	Total Outflow P (lb/ac/yr)	Provided Volume Managed (c.f.)
Outflow Total Nitrogen (lb/ac/yr)=				Outflow Total Phosphorus (lb/ac/yr)=							

Sub-DA5(b) BMP(s)

If Sub-DA5(b) is connected to upstream sub-basin(s), select all contributing sub-basin(s from dropdown menus):											
Device Name (As Shown on Plan)	Device Type	Water Quality Volume (c.f.)	Inflow N EMC (mg/L)	Total Inflow N (lb/ac/yr)	Inflow P EMC (mg/L)	Total Inflow P (lb/ac/yr)	Outflow N EMC (mg/L)	Total Outflow N (lb/ac/yr)	Outflow P EMC (mg/L)	Total Outflow P (lb/ac/yr)	Provided Volume Managed (c.f.)
Outflow Total Nitrogen (lb/ac/yr)=				Outflow Total Phosphorus (lb/ac/yr)=							
Sub-DA5 (c) BMP(s)											
If Sub-DA5(c) is connected to upstream sub-basin(s), select all contributing sub-basin(s):											
Device Name (As Shown on Plan)	Device Type	Water Quality Volume (c.f.)	Inflow N EMC (mg/L)	Total Inflow N (lb/ac/yr)	Inflow P EMC (mg/L)	Total Inflow P (lb/ac/yr)	Outflow N EMC (mg/L)	Total Outflow N (lb/ac/yr)	Outflow P EMC (mg/L)	Total Outflow P (lb/ac/yr)	Provided Volume Managed (c.f.)
Outflow Total Nitrogen (lb/ac/yr)=				Outflow Total Phosphorus (lb/ac/yr)=							
Sub-DA5 (d) BMP(s)											
If Sub-DA5(d) is connected to upstream sub-basin(s), select all contributing sub-basin(s):											
Device Name (As Shown on Plan)	Device Type	Water Quality Volume (c.f.)	Inflow N EMC (mg/L)	Total Inflow N (lb/ac/yr)	Inflow P EMC (mg/L)	Total Inflow P (lb/ac/yr)	Outflow N EMC (mg/L)	Total Outflow N (lb/ac/yr)	Outflow P EMC (mg/L)	Total Outflow P (lb/ac/yr)	Provided Volume Managed (c.f.)
Outflow Total Nitrogen (lb/ac/yr)=				Outflow Total Phosphorus (lb/ac/yr)=							
Sub-DA5 (e) BMP(s)											
If Sub-DA5(e) is connected to upstream sub-basin(s), select all contributing sub-basin(s):											
Device Name (As Shown on Plan)	Device Type	Water Quality Volume (c.f.)	Inflow N EMC (mg/L)	Total Inflow N (lb/ac/yr)	Inflow P EMC (mg/L)	Total Inflow P (lb/ac/yr)	Outflow N EMC (mg/L)	Total Outflow N (lb/ac/yr)	Outflow P EMC (mg/L)	Total Outflow P (lb/ac/yr)	Provided Volume Managed (c.f.)
Outflow Total Nitrogen (lb/ac/yr)=				Outflow Total Phosphorus (lb/ac/yr)=							

DA5 BMP SUMMARY	
Total Volume Treated (c.f.)=	0
DA5 Outflow Total Nitrogen (lb/ac/yr)=	
DA5 Outflow Total Phosphorus (lb/ac/yr)=	
1-year, 24-hour storm	
Pre Development Peak Discharge (cfs)= $Q_{1\text{-year}}$=	2.98
Post BMP Peak Discharge (cfs)= $Q_{1\text{-year}}$=	1.46

Project Name: Parker Ridge

DRAINAGE AREA 6
BMP CALCULATIONS

DRAINAGE AREA 6 - BMP DEVICES AND ADJUSTMENTS				
DA6 Site Acreage=	0.63			
DA6 Off-Site Acreage=	0.00			
Total Required Storage Volume for Site TCN Requirement (ft^3)=	21,904			
Will site use underground water harvesting?	No	Enter % volume reduction in decimal form=		Note: Supporting information/details should be submitted to demonstrate water usage.

ENTER AREA TREATED BY BMP

Land Use (acres)	Sub-DA6(a) (Ac)		Sub-DA6(b) (Ac)		Sub-DA6(c) (Ac)		Sub-DA6(d) (Ac)		Sub-DA6(e) (Ac)	
Commercial	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site
Parking lot										
Roof										
Open/Landscaped										
Industrial	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site
Parking lot										
Roof										
Open/Landscaped										
Transportation	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site
High Density (interstate, main)										
High Density (Grassed Right-of-ways)										
Low Density (secondary, feeder)										
Low Density (Grassed Right-of-ways)										
Rural										
Rural (Grassed Right-of-ways)										
Sidewalk										
Misc. Pervious	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site
Managed pervious										
Unmanaged (pasture)										
Woods (not on lots)										
Residential	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site
Roadway										
Grassed Right-of-ways										
Driveway										
Parking lot										
Roof										
Sidewalk										
Lawn										
Managed pervious										
Woods (on lots)										
Land Taken up by BMP										
JURISDICTIONAL LANDS	Site	Off-site	Site	Offsite	Site	Offsite	Site	Offsite	Site	Offsite
Natural wetland										
Riparian buffer (Zone 1 only)										
Totals (Ac)=	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Sub-DA6(a) BMP(s)

Device Name (As Shown on Plan)	Device Type	Water Quality Volume (c.f.)	Inflow N EMC (mg/L)	Total Inflow N (lb/ac/yr)	Inflow P EMC (mg/L)	Total Inflow P (lb/ac/yr)	Outflow N EMC (mg/L)	Total Outflow N (lb/ac/yr)	Outflow P EMC (mg/L)	Total Outflow P (lb/ac/yr)	Provided Volume Managed (c.f.)
Outflow Total Nitrogen (lb/ac/yr)=				Outflow Total Phosphorus (lb/ac/yr)=							

Sub-DA6(b) BMP(s)

If Sub-DA6(b) is connected to upstream sub-basin(s), select all contributing sub-basin(s from dropdown menus):											
Device Name (As Shown on Plan)	Device Type	Water Quality Volume (c.f.)	Inflow N EMC (mg/L)	Total Inflow N (lb/ac/yr)	Inflow P EMC (mg/L)	Total Inflow P (lb/ac/yr)	Outflow N EMC (mg/L)	Total Outflow N (lb/ac/yr)	Outflow P EMC (mg/L)	Total Outflow P (lb/ac/yr)	Provided Volume Managed (c.f.)
Outflow Total Nitrogen (lb/ac/yr)=				Outflow Total Phosphorus (lb/ac/yr)=							
Sub-DA6 (c) BMP(s)											
If Sub-DA6(c) is connected to upstream sub-basin(s), select all contributing sub-basin(s):											
Device Name (As Shown on Plan)	Device Type	Water Quality Volume (c.f.)	Inflow N EMC (mg/L)	Total Inflow N (lb/ac/yr)	Inflow P EMC (mg/L)	Total Inflow P (lb/ac/yr)	Outflow N EMC (mg/L)	Total Outflow N (lb/ac/yr)	Outflow P EMC (mg/L)	Total Outflow P (lb/ac/yr)	Provided Volume Managed (c.f.)
Outflow Total Nitrogen (lb/ac/yr)=				Outflow Total Phosphorus (lb/ac/yr)=							
Sub-DA6 (d) BMP(s)											
If Sub-DA6(d) is connected to upstream sub-basin(s), select all contributing sub-basin(s):											
Device Name (As Shown on Plan)	Device Type	Water Quality Volume (c.f.)	Inflow N EMC (mg/L)	Total Inflow N (lb/ac/yr)	Inflow P EMC (mg/L)	Total Inflow P (lb/ac/yr)	Outflow N EMC (mg/L)	Total Outflow N (lb/ac/yr)	Outflow P EMC (mg/L)	Total Outflow P (lb/ac/yr)	Provided Volume Managed (c.f.)
Outflow Total Nitrogen (lb/ac/yr)=				Outflow Total Phosphorus (lb/ac/yr)=							
Sub-DA6 (e) BMP(s)											
If Sub-DA6(e) is connected to upstream sub-basin(s), select all contributing sub-basin(s):											
Device Name (As Shown on Plan)	Device Type	Water Quality Volume (c.f.)	Inflow N EMC (mg/L)	Total Inflow N (lb/ac/yr)	Inflow P EMC (mg/L)	Total Inflow P (lb/ac/yr)	Outflow N EMC (mg/L)	Total Outflow N (lb/ac/yr)	Outflow P EMC (mg/L)	Total Outflow P (lb/ac/yr)	Provided Volume Managed (c.f.)
Outflow Total Nitrogen (lb/ac/yr)=				Outflow Total Phosphorus (lb/ac/yr)=							

DA6 BMP SUMMARY	
Total Volume Treated (c.f.)=	0
DA6 Outflow Total Nitrogen (lb/ac/yr)=	
DA6 Outflow Total Phosphorus (lb/ac/yr)=	
1-year, 24-hour storm	
Pre Development Peak Discharge (cfs)= $Q_{1\text{-year}}$=	1.52
Post BMP Peak Discharge (cfs)= $Q_{1\text{-year}}$=	1.29

Project Name: Parker Ridge

DA SITE SUMMARY
BMP CALCULATIONS

BMP SUMMARY						
DRAINAGE AREA SUMMARIES						
DRAINAGE AREA:	DA1	DA2	DA3	DA4	DA5	DA6
Post-Development (1-year, 24-hour storm)						
Peak Flow (cfs)=$Q_{1\text{-year}}$ =	59.65	59.97	172.06	1.63	1.47	1.29
Post-Development with BMPs (1-year, 24-hour storm)						
% Impervious =	**29%**					
Volume Managed (CF)=	471,848					
Post BMP Peak Discharge (cfs)= $Q_{1\text{-year}}$=	16.85	3.46	34.43	1.63	1.47	1.29
Have Target Curve Number Requirements been met?	YES					
Pre Development Nitrogen and Phosphorus Load						
Total Nitrogen (lb/ac/yr)=	1.07					
Total Phosphorus (lb/ac/yr)=	N/A					
Post Development Nitrogen and Phosphorus Load						
Total Nitrogen (lb/ac/yr)=	4.79					
Total Phosphorus (lb/ac/yr)=	N/A					
Post-BMP Nitrogen Loading						
Outflow Total Nitrogen (lb/ac/yr)=	2.98					
Outflow Total Phosphorus (lb/ac/yr)=	0.40					
Has site met the Target?	YES					
Has site met requirements for offsetting?	YES					