South Main

403 South Main

Rolesville, NC
Wake County

STORMWATER MANAGEMENT ANALYSIS

July 25, 2022

NORTH CAROLINA
PROFESSIONAL
SEAL
036913
ENGINEER
KEITH P. GETTLE

7/24/22

Prepared for:

Toy Storage, LLC
2700 Gresham lake Rd.
Raleigh, NC 27615

South Main
Rolesville, NC

Table of Contents

Attachments:

South Main
Stormwater Management Analysis

Project Name:	**South Main**
Project Address:	**403 South Main Street** **Rolesville, NC**
Pins:	**1758784708**
Latitude: **Longitude:**	**N 35.916120** **W -78.468430**
Zoning:	**GC**
River Basin:	**Neuse**
Watershed:	**Milburnie Lake**
HUC:	**0302020107**
Developer:	**Toy Storage, LLC** **2700 Gresham lake Rd.** **Raleigh, NC 27615**
Telephone:	**(919) 604-0505**
Email:	**Storit@AOL.com**

Site Description

The project consists of a single parcel located at the intersection of Wall Creek Drive and South Main Street in downtown Rolesville. The lot is approximately 1.80 acres (78,408 sq feet) and a portion of the lot on the south property line will be used for the BMP. The parcel is vacant with grassy vegetation with approximately 4195 sq ft of impervious area. The project will consist of a 13,500 sq. feet commercial building. The impervious area post development will be 1.38 acres.

The site is in the Neuse River Basin, Milburnie Lake Watershed and subject to those rules regarding nutrient management and post storm water runoff.

The parcel is not located within a flood zone as noted per FEMA map 3720175800K, Dated July 19, 2022.

Based on the Wake County SCS soils map (attached) the onsite soils are primarily Durham Series (DuB), soil group B, throughout the tract. The Durham Series soil type is considered to be well drained soils and based on information in the Soil Survey the SHWT depth is around 10+feet.

Proposed Development

The stormwater analysis considers a proposed development that will include one commercial building on the site.

The proposed stormwater facility for the project will consist of one Bioretention device. Drainage from the majority of the property will be collected within the storm pipe system and routed to the BMP. The device is designed in accordance with NCDENR DWR's BMP Manual, and is designed to manage the 2, 10, and 100 year, 24-hour storm events as noted below. The post development runoff from the noted storm events is less than the pre-development rates for the site. As a result, per the Town of Rolesville UDO 7.5.4, a Downstream Impact Analysis is not required since the post development runoff rate is less than pre-development.

The proposed BMP will capture the runoff from the majority of impervious area from the lot. However, a small portion of the site and impervious does not drain to the device; but the device has been designed to treat all the impervious are as a part of the WQV. The impervious associated with the development has been accounted for treatment within the BMP.

Methodology (Peak Flow and Nutrient Management)

The project is located within the Town of Rolesville's / Wake County permitting authority, and within the Neuse River / Milburnie Lake watershed and the project is subjected to those rules listed in the LDO, Appendix B, Section 1.2 Stormwater Management, Adopted 6-1-2021.

Proposed Stormwater Management

The project is located within the Town of Rolesville's permitting authority, and within the Neuse River Basin; the project is subjected to those rules. Under the Town's LDO stormwater requirements as noted below. The project is considered a High-Density project.

Development Standards for High-Density

Projects High-Density Projects shall implement stormwater control measures that comply with each of the following standards, in addition to the General Standards found in subsection B of this section:

a. The measures shall control and treat runoff from the first inch of rain. Runoff volume drawdown time shall be a minimum of 48 hours, but not more than 120 hours.
b. All structural stormwater treatment systems used to meet these requirements shall be designed to have a minimum of 85 percent average annual removal for Total Suspended Solids (TSS).
c. All Development and Redevelopment projects required to manage storm water shall provide permanent on-site BMPs to lower the nitrogen export amounts as part of the storm water management plan. BMPs are to be in accordance with and as specified in the Design Manual
d. Structural and Non-structural BMPs shall be used to ensure there is no net increase in peak flow leaving the site from the pre-Development conditions for the one-year, 24-hour storm. Runoff volume drawdown time shall be a minimum of 48 hours, but not more than 120 hours.
e. General engineering design criteria for all projects shall be in accordance with 15A NCAC 2H .1008(c), as explained in the Design Manual

Peak flow – The methodology used to determine the runoff is the Rational Method.
Time of Concentration used in the analysis is 5 minutes.

The POI (point of interest) for the project is at the southwest corner of the site

Based on the proposed stormwater management for the project no adverse impact is anticipated on adjacent parcels. The BMP system and drainage point from the project does encroach on another property with new development and grading operations. The impacted property is owned by the same company involved with this projected.

Using the Rational Method, the modeling of the BMP at the POI provides the following results in peak flow management.

Total site peak runoff in cfs (noted in the attached Hydraflow report) is as follows.

Storm Event	**Pre**	**Post**
Q2	**3.11**	**.34**
Q10	**3.90**	**.41**
Q100	**5.25**	**.52**

Nutrient Management

The BMP provides treatment for drainage area within the project and also provides the TSS removal of 85%.

O&M Manual

A sample copy of the project's O&M manual is attached for the Bioretention device.

Seasonal High-Water Table (SHWT)

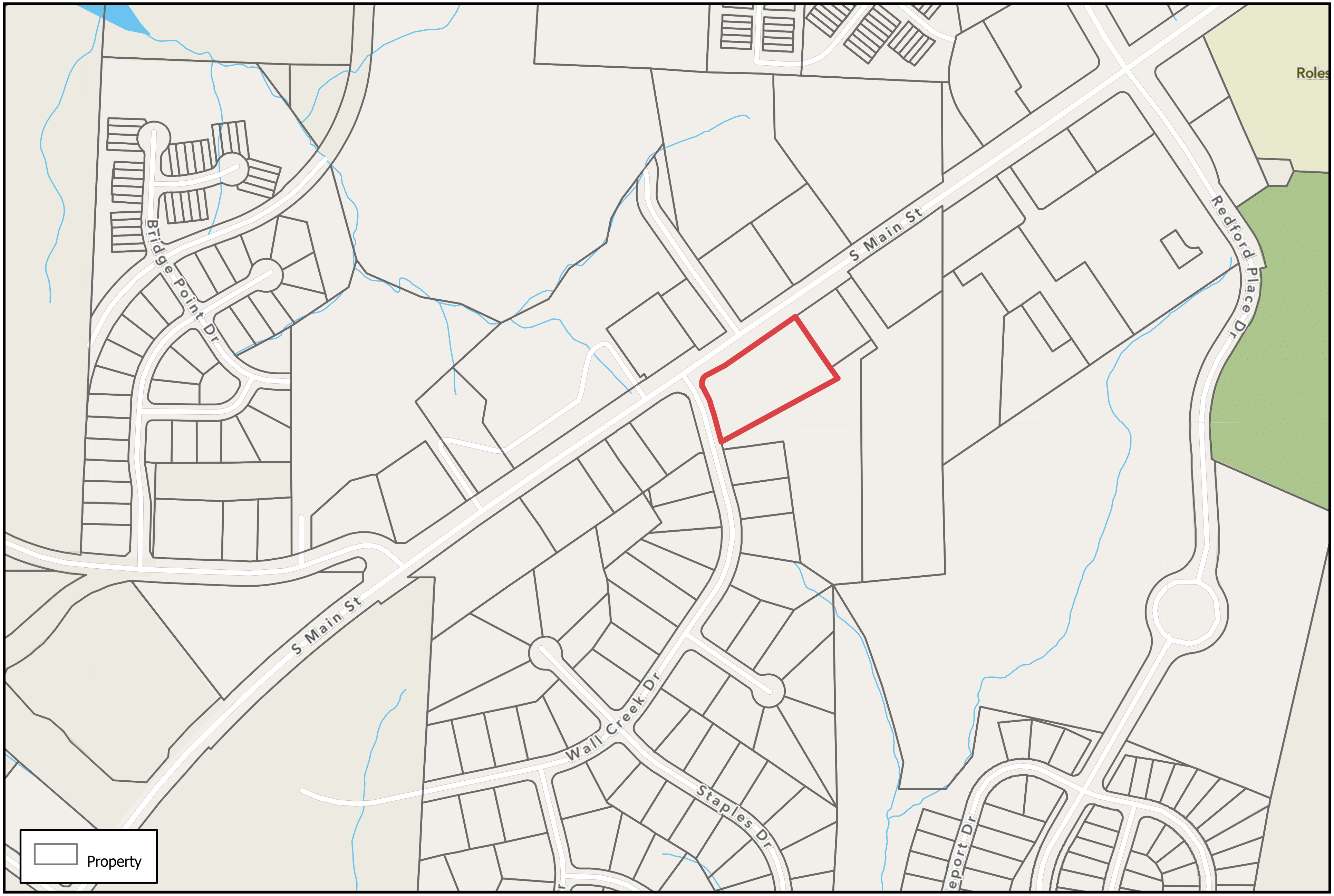
Based on the information provided by "Protocol Sampling Service", report dated TBD the SHWT is approximately TBD in the Bioretention area (attached).

Flood Hazard Area (Soils)

There are no Flood Hazard Soils on site (see attached GIS map).

Q100 Backwater Effect at BMP (13. Z Wake County Checklist)

There is no storm pipe from the ROW that discharges to the BMP and as a result Q100 backwater review not needed.



Site Map

N

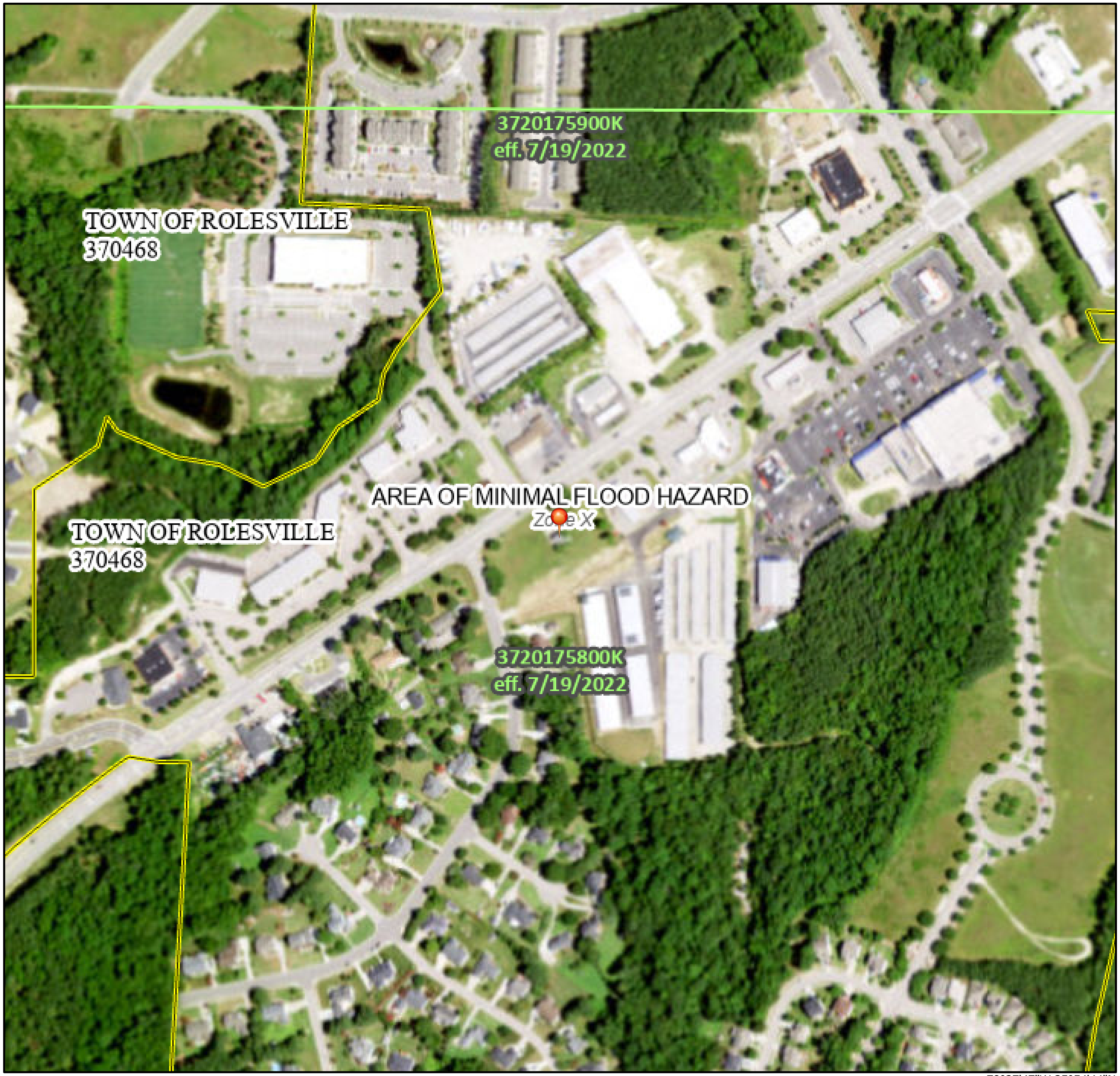
0 200 400 800 ft

1 inch equals 400 feet

National Flood Hazard Layer FIRMette

FEMA

78°28'25"W 35°55'13"N



78°27'47"W 35°54'44"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS

- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD

- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS

- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES

- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES

- B 20.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS

- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

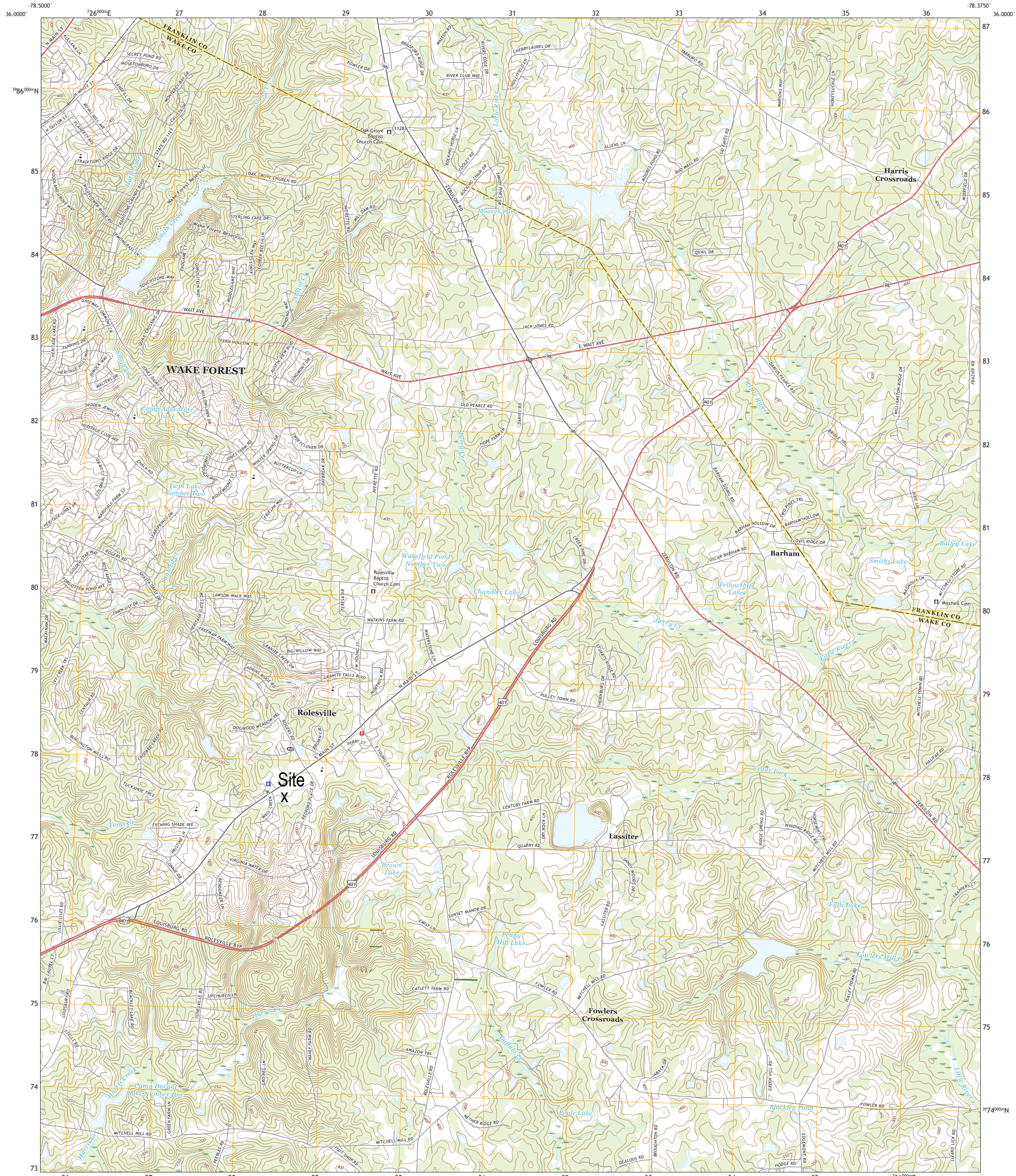
The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 7/22/2022 at 4:32 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

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, May 2016 - November 2016
Roads........U.S. Census Bureau, 2016
Names........GNIS, 1980 - 2019
Hydrography........National Hydrography Dataset, 1899 - 2018
Contours........National Elevation Dataset, 2008
Boundaries........Multiple sources; see metadata file 2017 - 2018
Wetlands........FWS National Wetlands Inventory 1983

MN
GN
9°28´
168 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
KILOMETERS
METERS
MILES
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, 2011.
A metadata file associated with this product is draft version 0.6.18

NORTH CAROLINA
QUADRANGLE LOCATION

1	2	3
4		5
6	7	8

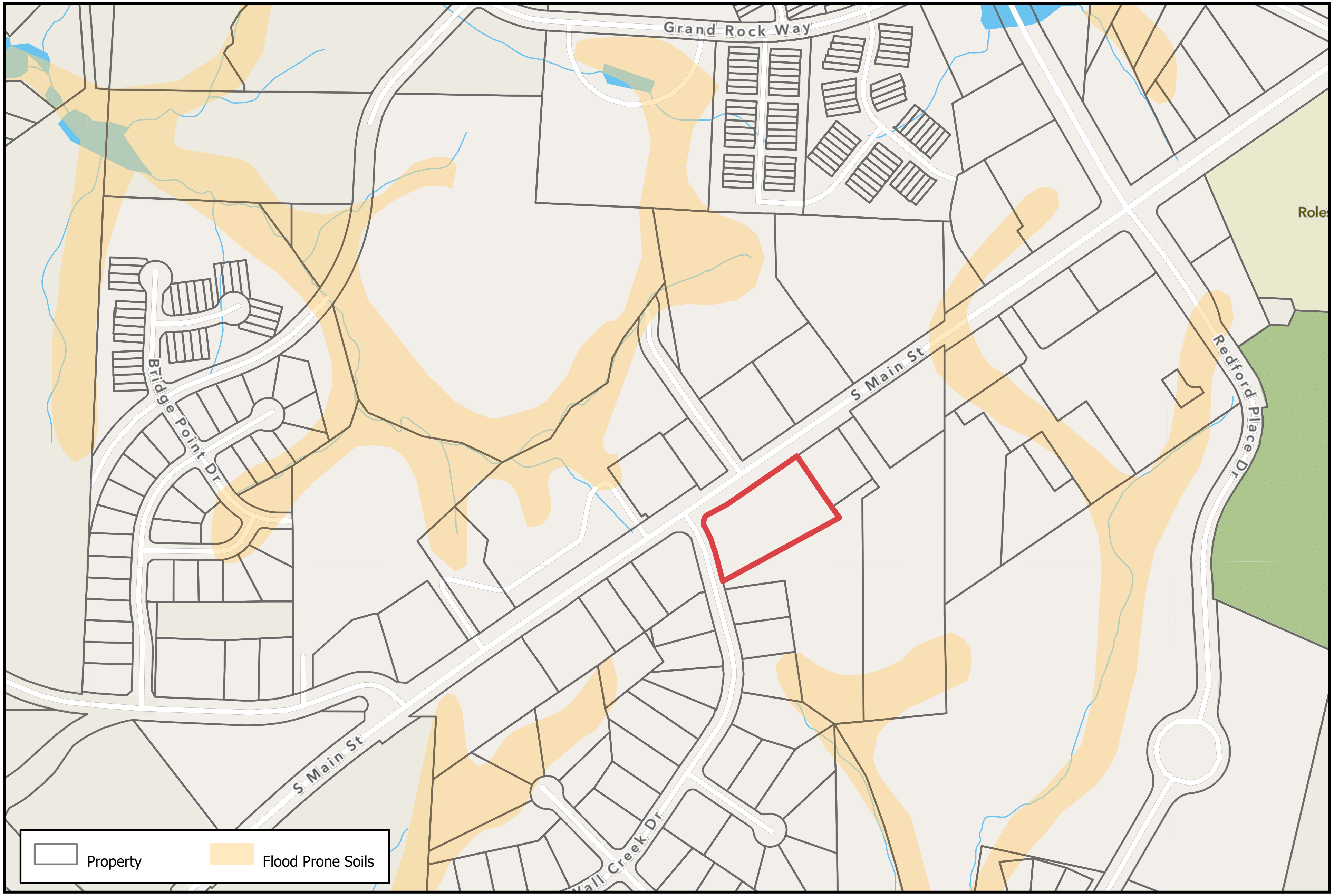
1 Grissom
2 Franklinton
3 Louisburg
4 Wake Forest
5 Bunn West
6 Raleigh East
7 Knightdale
8 Zebulon

ADJOINING QUADRANGLES

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

ROLESVILLE, NC
2019

NSN. 7643016379170
NGA REF NO. USGSX24K38453



Flood Prone Soils Map

N

0 200 400 800 ft

1 inch equals 400 feet

Disclaimer
*iMaps makes every effort to produce and publish the most current and accurate information possible. However, the maps are produced for information purposes, and are **NOT** surveys. No warranties, expressed or implied ,are provided for the data therein, its use,or its interpretation.*


Rolesville
Rolesville Church
401
B.P.

Table 3: HSGs for North Carolina Soil Types
(Malcom 1989)

Alaga	A	Dragston	D/C	Louisa	B	Ridgeland	C
Alamance	B	Dunbar	D/B	Louisburg	B	Rimini	C
Albany	C/A	Duplin	C/B	Lucy	A	Roanoke	D
Altavista	C/B	Durham	B	Lumbee	D/C	Rosman	B
Americus	A	Dykes	B	Lynchburg	C/B	Rumford	B
Appling	B	Edneyville	B	Lynn Haven	D/C	Ruston	B
Ashe	B	Elbert	D	Madison	B	Ruttege	D/B
Augusta	C	Elioak	B	Magnolia	B	Saluda	C/B
Avery	B	Elsinboro	B	Mantachie	C/B	Scranton	D/B
Aycock	B	Enon	C	Manteo	D	Seneca	C/B
Barclay	C	Eustis	A	Marlboro	B	Starr	B
Barth	C	Exum	C/B	Masada	B	State	B
Bayboro	D/C	Faceville	B	Maxton	B	Suncook	A
Bertie	C/B	Fannin	B	Mayodan	B	Surry	B
Bibb	D/B	Fletcher	B	McColl	D/C	Talladega	C
Bladen	D/C	Fuquay	B	Mecklenburg	C	Tallepoosa	C
Blaney	B	Georgeville	B	Meggett	D/C	Tate	B
Blanton	A	Gilead	C	Molena	A	Taturn	B
Bowie	B	Goldsboro	C/B	Musella	B	Thurmont	B
Braddock	B	Goldston	C	Myatt	D/C	Toccoa	B
Bradley	B	Granville	B	Nahunta	C/B	Toisnot	C/B
Brandywine	B	Grover	B	Nason	C	Torhuna	C/A
Brevard	B	Guin	A	Nixonton	B	Toxaway	D
Bucks	B	Gwinnett	B	Norfolk	B	Transylvania	B
Buncombe	A	Hartsells	B	Ochlockonee	B	Troup	A
Burton	B	Hatboro	D/C	Ocilla	C/B	Tuckerman	D/C
Byars	D	Hayesville	B	Olustee	D/C	Tusquitee	B
Cahaba	B	Haywood	B	Onslow	B	Unison	B
Cape Fear	D/B	Helena	C	Orange	D	Vance	C
Caroline	C	Herndon	B	Orangeburg	B	Varina	C
Cartecay	C	Hiwassee	B	Osier	D	Vaucluse	C
Cataula	C	Hoffman	C	Pacolet	B	Wadesboro	B
Cecil	B	Hulett	B	Pactolus	C/A	Wagram	A
Chandler	B	Hyde	D/C	Pamlico	D/C	Wahee	D/C
Chastain	D	Invershiel	C	Pantego	D/C	Wake	D
Chester	B	Iredell	D	Pasquotank	D/B	Watauga	B
Chesterfield	B	Iuka	C	Pelham	D/C	Wedowee	B
Chewacla	C	Izagora	C	Pender	D		
Chipley	C/A	Johnston	D/B	Penn	C/B		
Clifton	B	Johus	C/B	Pinkston	C		

NOAA Atlas 14, Volume 2, Version 3
Location name: Wake Forest, North Carolina, USA*
Latitude: 35.8975°, Longitude: -78.454°
Elevation: 320.63 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** (0.369-0.442)	**0.469** (0.430-0.512)	**0.534** (0.489-0.583)	**0.600** (0.549-0.654)	**0.666** (0.606-0.726)	**0.719** (0.652-0.783)	**0.766** (0.690-0.834)	**0.807** (0.723-0.881)	**0.854** (0.759-0.932)	**0.896** (0.789-0.980)
10-min	**0.644** (0.590-0.705)	**0.750** (0.687-0.819)	**0.855** (0.783-0.933)	**0.960** (0.877-1.05)	**1.06** (0.966-1.16)	**1.15** (1.04-1.25)	**1.22** (1.10-1.33)	**1.28** (1.15-1.40)	**1.35** (1.20-1.48)	**1.41** (1.24-1.54)
15-min	**0.806** (0.738-0.882)	**0.942** (0.864-1.03)	**1.08** (0.991-1.18)	**1.21** (1.11-1.32)	**1.35** (1.23-1.47)	**1.45** (1.31-1.58)	**1.54** (1.39-1.68)	**1.62** (1.45-1.76)	**1.70** (1.51-1.86)	**1.77** (1.56-1.94)
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)	**2.36** (2.12-2.57)	**2.51** (2.25-2.74)	**2.70** (2.40-2.95)	**2.87** (2.53-3.14)
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** (2.42-2.89)	**2.96** (2.68-3.22)	**3.24** (2.92-3.54)	**3.53** (3.16-3.85)	**3.88** (3.45-4.24)	**4.18** (3.69-4.58)
2-hr	**1.61** (1.46-1.78)	**1.92** (1.75-2.10)	**2.34** (2.13-2.57)	**2.75** (2.49-3.01)	**3.23** (2.91-3.54)	**3.66** (3.29-4.00)	**4.07** (3.63-4.45)	**4.49** (3.98-4.91)	**5.04** (4.42-5.51)	**5.53** (4.81-6.06)
3-hr	**1.71** (1.55-1.89)	**2.03** (1.85-2.24)	**2.49** (2.26-2.74)	**2.95** (2.67-3.24)	**3.50** (3.15-3.84)	**4.00** (3.58-4.39)	**4.49** (3.99-4.92)	**5.01** (4.41-5.49)	**5.70** (4.97-6.24)	**6.33** (5.46-6.95)
6-hr	**2.05** (1.87-2.26)	**2.44** (2.23-2.68)	**2.99** (2.72-3.28)	**3.54** (3.22-3.89)	**4.22** (3.82-4.62)	**4.85** (4.35-5.30)	**5.47** (4.87-5.97)	**6.12** (5.39-6.67)	**7.01** (6.10-7.64)	**7.83** (6.72-8.55)
12-hr	**2.41** (2.21-2.66)	**2.87** (2.64-3.15)	**3.54** (3.24-3.88)	**4.22** (3.84-4.62)	**5.07** (4.59-5.53)	**5.85** (5.26-6.37)	**6.64** (5.91-7.22)	**7.50** (6.59-8.14)	**8.67** (7.51-9.42)	**9.77** (8.32-10.6)
24-hr	**2.86** (2.66-3.08)	**3.46** (3.22-3.73)	**4.35** (4.04-4.69)	**5.06** (4.69-5.45)	**6.03** (5.58-6.50)	**6.81** (6.28-7.33)	**7.61** (6.99-8.20)	**8.45** (7.73-9.11)	**9.60** (8.73-10.4)	**10.5** (9.52-11.4)
2-day	**3.32** (3.08-3.57)	**3.99** (3.72-4.30)	**4.99** (4.64-5.37)	**5.77** (5.36-6.21)	**6.84** (6.33-7.37)	**7.69** (7.09-8.29)	**8.57** (7.88-9.24)	**9.48** (8.68-10.2)	**10.7** (9.77-11.6)	**11.7** (10.6-12.7)
3-day	**3.52** (3.28-3.77)	**4.23** (3.94-4.54)	**5.25** (4.89-5.63)	**6.06** (5.64-6.50)	**7.17** (6.65-7.70)	**8.06** (7.45-8.65)	**8.97** (8.26-9.63)	**9.91** (9.09-10.7)	**11.2** (10.2-12.1)	**12.2** (11.1-13.2)
4-day	**3.72** (3.47-3.98)	**4.46** (4.17-4.77)	**5.52** (5.15-5.90)	**6.36** (5.92-6.79)	**7.51** (6.97-8.02)	**8.43** (7.80-9.01)	**9.37** (8.64-10.0)	**10.3** (9.50-11.1)	**11.7** (10.7-12.5)	**12.8** (11.6-13.7)
7-day	**4.31** (4.04-4.61)	**5.15** (4.82-5.50)	**6.29** (5.89-6.72)	**7.20** (6.72-7.68)	**8.44** (7.86-9.01)	**9.43** (8.76-10.1)	**10.5** (9.67-11.2)	**11.5** (10.6-12.3)	**13.0** (11.9-13.9)	**14.1** (12.9-15.1)
10-day	**4.91** (4.61-5.24)	**5.85** (5.49-6.23)	**7.05** (6.61-7.51)	**7.99** (7.48-8.51)	**9.27** (8.64-9.87)	**10.3** (9.56-11.0)	**11.3** (10.5-12.1)	**12.3** (11.4-13.2)	**13.7** (12.7-14.7)	**14.8** (13.6-15.9)
20-day	**6.59** (6.20-7.02)	**7.79** (7.33-8.29)	**9.23** (8.67-9.82)	**10.4** (9.73-11.0)	**11.9** (11.1-12.7)	**13.1** (12.3-14.0)	**14.4** (13.4-15.3)	**15.6** (14.5-16.6)	**17.3** (16.0-18.5)	**18.6** (17.1-20.0)
30-day	**8.19** (7.72-8.69)	**9.63** (9.08-10.2)	**11.2** (10.6-11.9)	**12.5** (11.7-13.3)	**14.1** (13.2-15.0)	**15.4** (14.4-16.3)	**16.6** (15.5-17.7)	**17.9** (16.7-19.1)	**19.6** (18.2-20.9)	**20.9** (19.3-22.3)
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** (16.3-18.2)	**18.6** (17.5-19.6)	**19.9** (18.8-21.1)	**21.3** (20.0-22.5)	**23.0** (21.5-24.4)	**24.3** (22.7-25.8)
60-day	**12.5** (11.9-13.1)	**14.6** (13.9-15.4)	**16.6** (15.7-17.4)	**18.1** (17.1-19.0)	**20.0** (19.0-21.1)	**21.5** (20.3-22.6)	**22.9** (21.6-24.1)	**24.3** (22.9-25.6)	**26.1** (24.5-27.6)	**27.4** (25.7-29.0)

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

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

Please refer to NOAA Atlas 14 document for more information.

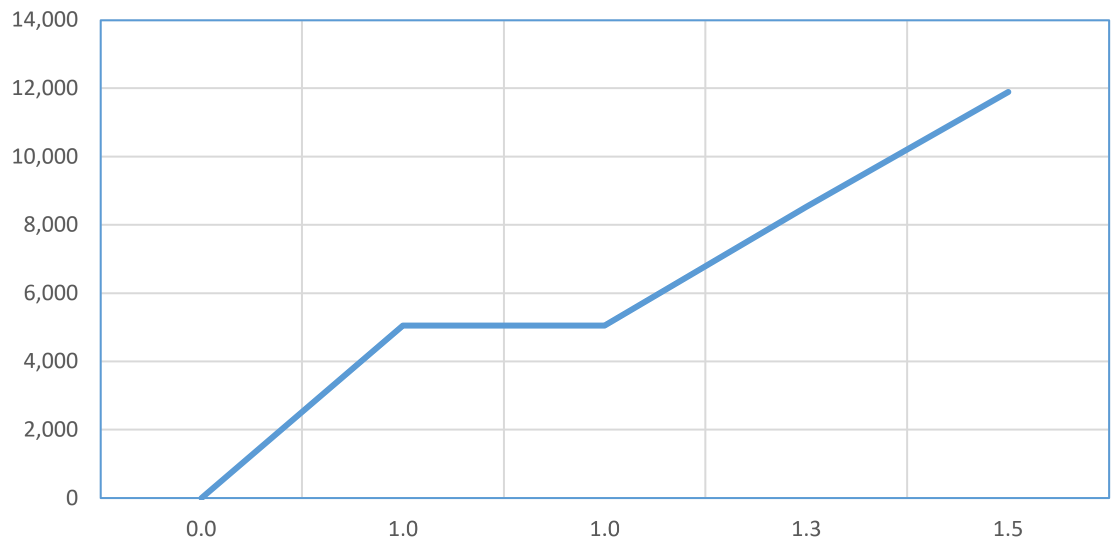
Back to Top

PF graphical

Calculate Stage-Storage of Bioretention Basin

Stage	Contour	Contour Area (sf)	Incremental Volume (cf)	S, Accumulated Volume (cf)	0.5
Media Volume					
0.0	409	4,195	1,000	1,000	
-1.0	408	3,637	2,000	3,000	
-2.0	407	3,095	3,000	6,000	
Water Volume					
0.0	409	4,195	-	0	*Top of Media*
1.0	410	5,911	5,053	5,053	*1" storm volume pool elevation*
1.0	410	7,776	-	5,053	*Top of Riser*
1.3	410.3	15,408	3,478	8,531	*Emergency Spillway*
1.5	410.5	18,253	3,366	11,897	*Top of embankment*

S, Accumulated Volume (cf) by Stage



Calculate the runoff coefficient, Rv

Impervious portion of drainage area	1.38	acres	
Drainage area	1.53	acres	$I_A = \frac{Impervious\ portion\ of\ drainage\ area\ (acre)}{Drainage\ area\ (acre)}$
IA	90%		
Rv	0.86		$R_v = 0.05 + 0.9 \times I_A$

Calculate the volume of runoff to be controlled, V

RD	1	inch	*Design storm rainfall depth*
A	1.53	acres	*Watershed area*
V required	4,786	cf	$V = 3630 \times R_D \times R_v \times A$
V provided	5,053	cf	

Operation & Maintenance Agreement

Project Name:	**South Main**
Project Location:	**Rolesville NC**

Cover Page

Maintenance records shall be kept on the following SCM(s). This maintenance record shall be kept in a log in a known set location. Any deficient SCM elements noted in the inspection will be corrected, repaired, or replaced immediately. These deficiencies can affect the integrity of structures, safety of the public, and the pollutant removal efficiency of the SCM(s).

The SCM(s) on this project include (check all that apply & corresponding O&M sheets will be added automatically):

Infiltration Basin	Quantity:		Location(s):	
Infiltration Trench	Quantity:		Location(s):	
Bioretention Cell	Quantity:	1	Location(s):	Project Site
Wet Pond	Quantity:		Location(s):	
Stormwater Wetland	Quantity:		Location(s):	
Permeable Pavement	Quantity:		Location(s):	
Sand Filter	Quantity:		Location(s):	
Rainwater Harvesting	Quantity:		Location(s):	
Green Roof	Quantity:		Location(s):	
Level Spreader - Filter Strip	Quantity:		Location(s):	
Proprietary System	Quantity:		Location(s):	
Treatment Swale	Quantity:		Location(s):	
Dry Pond	Quantity:		Location(s):	
Disconnected Impervious Surface	Present:	No	Location(s):	
User Defined SCM	Present:	No	Location(s):	
Low Density	Present:	No	Type:	

I acknowledge and agree by my signature below that I am responsible for the performance of the maintenance procedures listed for each SCM above, and attached O&M tables. I agree to notify NCDEQ of any problems with the system or prior to any changes to the system or responsible party.

Responsible Party:	
Title & Organization:	**Toy Storage LLC**
Street address:	**2700 Gresham Lake Drive**
City, state, zip:	**Raleigh, NC 27615**
Phone number(s):	**919-604-0505**
Email:	**Storit@AOL.com**

Signature: ______________________________ Date: ____________

I, ______________________________, a Notary Public for the State of ____________________

County of ______________________________, do hereby certify that ______________________________

personally appeared before me this __________ day of ______________________________ and

acknowledge the due execution of the Operations and Maintenance Agreement .

Witness my hand and official seal, ______________________________.

Bioretention Maintenance Requirements

Important operation and maintenance procedures:

- Immediately after the bioretention cell is established, the plants will be watered twice weekly if needed until the plants become established (commonly six weeks).
- Snow, mulch or any other material will NEVER be piled on the surface of the bioretention cell.
- Heavy equipment will NEVER be driven over the bioretention cell.
- Special care will be taken to prevent sediment from entering the bioretention cell.
- Once a year, a soil test of the soil media will be conducted.
- Remove top layer of fill media when the pool does not drain quickly. Based on the media specification, the pool should drain within 24 hours.

After the bioretention cell is established, it will be inspected **quarterly and within 24 hours after every storm event greater than 1.0 inches (or 1.5 inches if in a Coastal County)**. Records of operation and maintenance shall be kept in a known set location and shall be available upon request.

Inspection activities shall be performed as follows. Any problems that are found shall be repaired immediately.

SCM element:	Potential problem:	How to remediate the problem:
The entire bioretention cell	Trash/debris is present.	Remove the trash/debris.
The perimeter of the bioretention cell	Areas of bare soil and/or erosive gullies have formed.	Regrade the soil if necessary to remove the gully, plant ground cover and water until it is established. Provide lime and a one-time fertilizer application.
The flow diversion structure (if applicable)	The structure is clogged.	Unclog the structure and dispose of any sediment off-site.
	The structure is damaged.	Make any necessary repairs or replace if the damage is too much for repair.
The inlet device	The inlet pipe is clogged (if applicable).	Unclog the pipe and dispose of any sediment in a location where it will not cause impacts to streams or the SCM.
	The inlet pipe is cracked or otherwise damaged (if applicable).	Repair or replace the pipe.
	Erosion is occurring in the swale (if applicable).	Regrade the swale if necessary and provide erosion control devices such as reinforced turf matting or riprap to avoid future erosion problems.
	Stone verge is clogged or covered in sediment (if applicable).	Remove sediment and clogged stone and replace with clean stone.
The pretreatment area	Flow is bypassing pretreatment area and/or gullies have formed.	Regrade if necessary to route all flow to the pretreatment area. Restabilize the area after grading.
	Sediment has accumulated to a depth greater than three inches.	Search for the source of the sediment and remedy the problem if possible. Remove the sediment and dispose of it in a location where it will not cause impacts to streams or the SCM.

	Erosion has occurred.	Provide additional erosion protection such as reinforced turf matting or riprap if needed to prevent future erosion problems.
	Weeds are present.	Remove the weeds, preferably by hand. If pesticide is used, wipe it on the plants rather than spraying.

Bioretention Maintenance Requirements (continued)		
SCM element:	**Potential problem:**	**How to remediate the problem:**
Bioretention cell vegetation	Best professional practices show that pruning is needed to maintain optimal plant health.	Prune according to best professional practices. Maintain lines of sight between 2'-6'.
	Plants are dead, diseased or dying.	Determine the source of the problem: soils, hydrology, disease, etc. Remedy the problem and replace plants. Provide a one-time fertilizer application to establish the ground cover if a soil test indicates it is necessary. If sod was used, check to see that it was not grown on clay or impermeable soils. Replace sod if necessary.
	Weeds are present.	Remove the weeds, preferably by hand. If pesticide is used, wipe it on the plants rather than spraying.
	Tree stakes/wires are present six months after planting.	Remove tree stake/wires (which can kill the tree if not removed).
Bioretention cell mulch and media	Mulch is breaking down or has floated away.	Spot mulch if there are only random void areas. Replace whole mulch layer if necessary. Remove the remaining mulch and replace with triple shredded hard wood mulch at a maximum depth of four inches.
	Soils and/or mulch are clogged with sediment.	Determine the extent of the clogging - remove and replace either just the top layers or the entire media as needed. Dispose of the spoil in an appropriate off-site location. Use triple shredded hard wood mulch at a maximum depth of four inches. Search for the source of the sediment and remedy the problem if possible.
	An annual soil test shows that pH has dropped or heavy metals have accumulated in the soil media.	Dolomitic lime shall be applied as recommended per the soil te and toxic soils shall be removed, disposed of properly and replaced with new planting media.
The underdrain, filter fabric element, and outlet system	Clogging has occurred.	Wash out the underdrain system.
	Clogging has occurred.	Clean out the drop inlet. Dispose of the sediment in a location where it will not cause impacts to streams or the SCM..
	The drop inlet is damaged	Repair or replace the drop inlet.
The receiving water	Erosion or other signs of damage have occurred at the outlet.	Repair the damage and improve the flow dissipation structure.
	Discharges from the bioretention cell are causing erosion or sedimentation in the receiving water.	Contact the local NCDEQ Regional Office.

STORMWATER CONTOL STRUCTURE
BIORETENTION MAINTENANCE AGREEMENT

PROJECT: SOUTH MAIN
RESPONSIBLE PARTY: JOY STORAGE LLC **PHONE #:** 919-604-0505
ADDRESS: 403 SOUTH MAIN
ROLESVILLE NC

I. **Monthly** or after every runoff producing rainfall, whichever comes first:
   a. Remove debris from bioretention area.
   b. Inspect for ponding, washed-out areas, and soil conditions.
   c. Check for eroded areas of bioretention area and repair before next rainfall.
   d. Check vegetation conditions within the bioretention area and replace if necessary any damaged plant materials.

II. **Quarterly**
   a. Inspect the collection system (i.e., catch basin, piping, grassed swales) for proper functioning.
   b. Clear accumulated trash from basin grates, and basin bottoms, and check piping for obstructions.
   c. Check bioretention inlet pipes for undercutting. Repair if necessary.
   d. Repair any broken pipes.
   e. Remulch any void areas by hand whenever needed.
   f. Replace rip rap at out let pipe that is choked with sediment.

III. **Semi-Annually**
   a. Reseed grass swale or border twice yearly.
   b. Apply new mulch twice yearly.

IV. **General**
   a. All components of bioretention area to be kept in working order.
   b. This property and bioretention area is also subject to the Operations and Maintenance Manual filed in relation to this project.
   c. The maintenance of the stormwater device(s) shall be the sole responsibility of the Owner.The responsibility for the maintenance of the stormwater device shall pass in the chain of title to the Owner's successor in interest.

I, E. ALLEN MASSEY, hereby acknowledge that I am the financially responsible party for maintenance of this stormwater device.

I will perform the maintenance as outlined above, as part of the Certificate of Compliance with Stormwater Regulations received for this project.

Signature: E. Allen Massey Date: 7·27·22

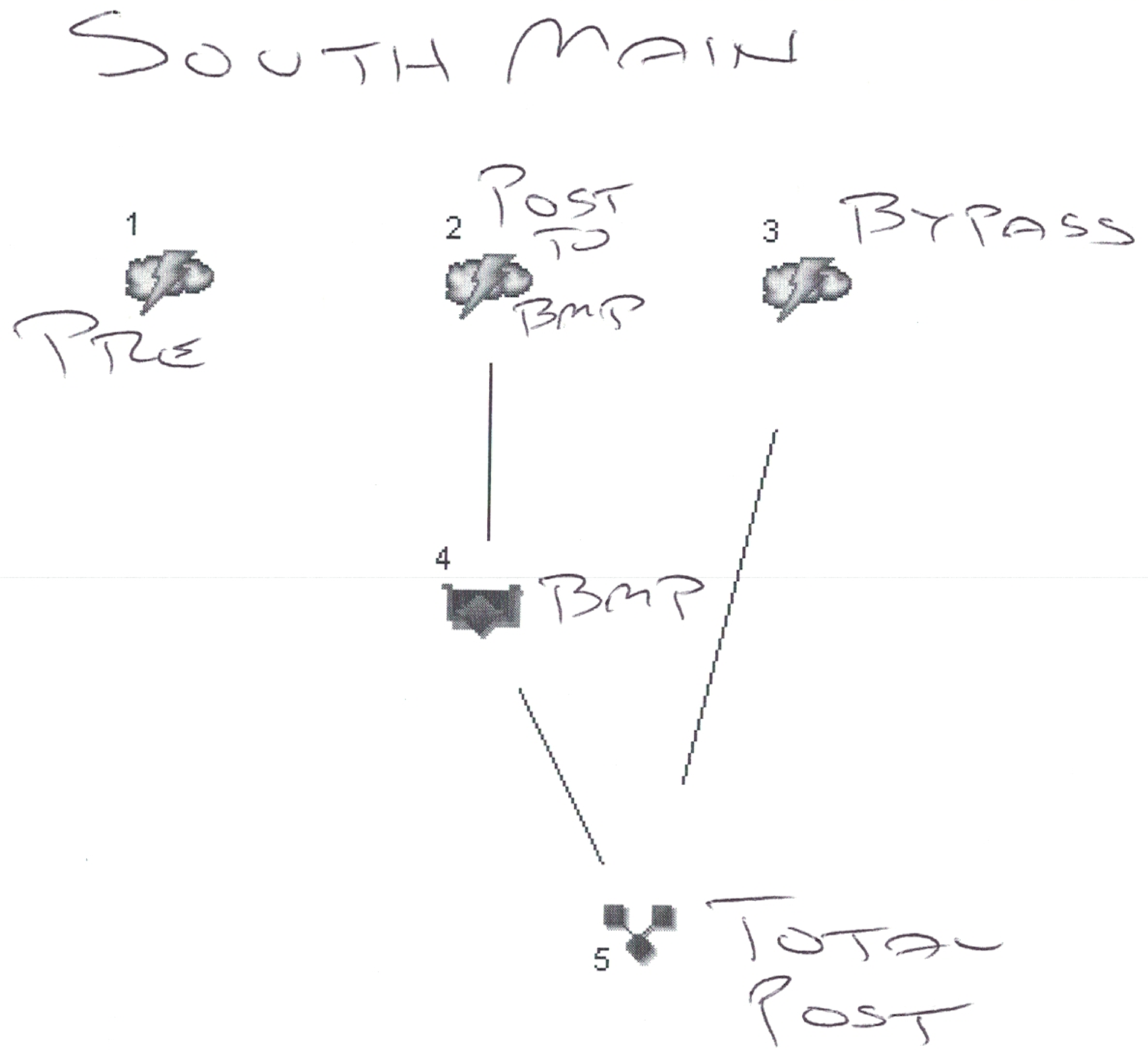
I JANET C MILLS do hereby certify that E. ALLEN MASSEY personally appeared before me this 27 day of JULY, 2022 and acknowledge due execution of the foregoing instrument. Witness my hand and official seal,

Janet C Mills

JANET C MILLS
NOTARY
PUBLIC
WAKE COUNTY, NC

Seal

My commission expires: 4·29·27



Legend

Hyd.	Origin	Description
1	Rational	Pre Development
2	Rational	Post Development
3	Rational	Post Bypass
4	Reservoir	pond
5	Combine	Post Runoff

Table of Contents

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	Rational	-------	-------	3.11	-------	-------	3.90	-------	-------	5.25	Pre Development
2	Rational	-------	-------	8.37	-------	-------	10.49	-------	-------	14.12	Post Development
3	Rational	-------	-------	0.22	-------	-------	0.27	-------	-------	0.37	Post Bypass
4	Reservoir	2	-------	0.16	-------	-------	0.18	-------	-------	0.21	pond
5	Combine	3, 4	-------	0.34	-------	-------	0.41	-------	-------	0.52	Post Runoff

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	Rational	3.11	1	5	932	----	------	------	Pre Development
2	Rational	8.37	1	5	2,510	----	------	------	Post Development
3	Rational	0.22	1	5	66	----	------	------	Post Bypass
4	Reservoir	0.16	1	10	2,503	2	409.48	2,450	pond
5	Combine	0.34	1	5	2,569	3, 4	------	------	Post Runoff

Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

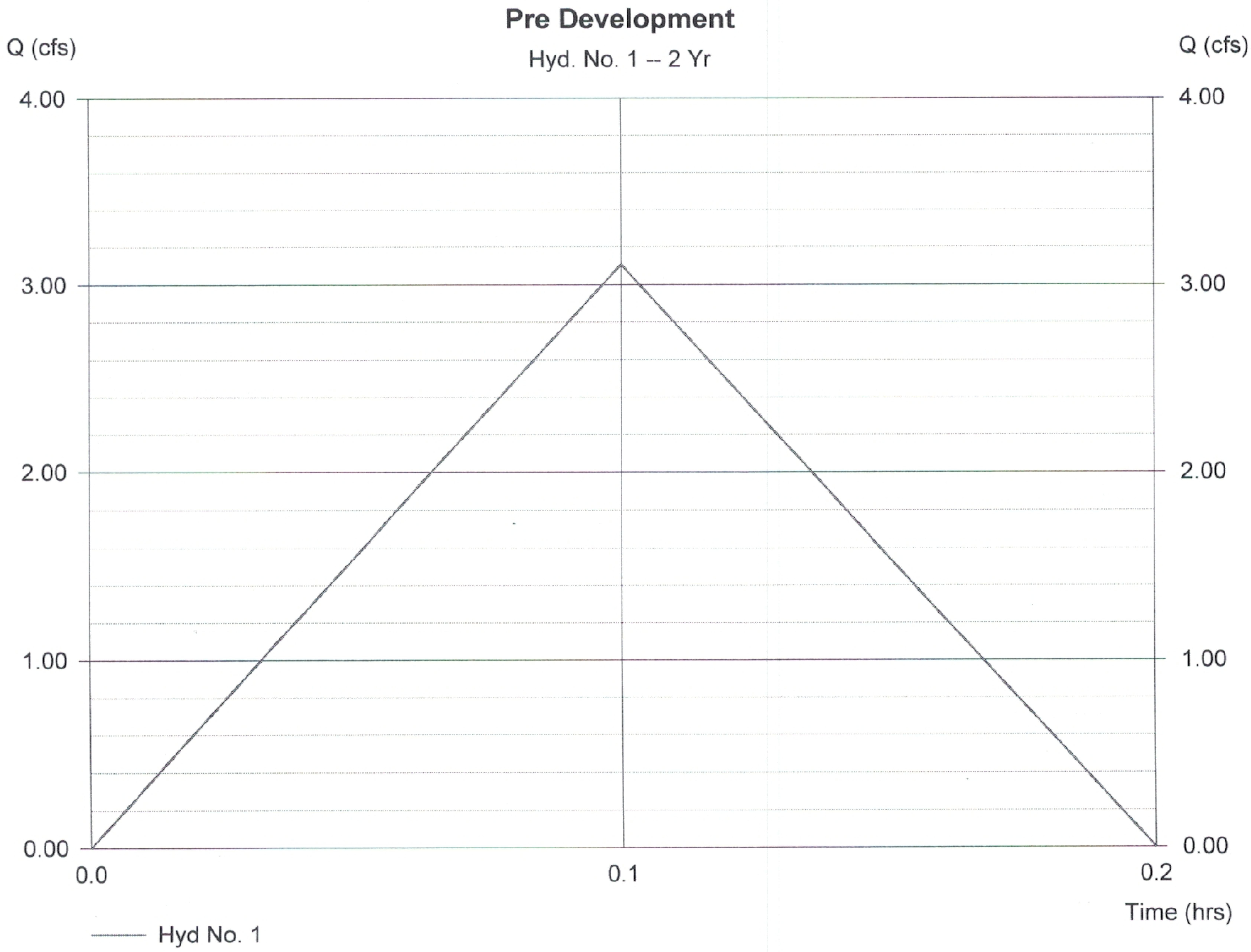
Monday, Jul 25 2022, 9:50 AM

Hyd. No. 1

Pre Development

Hydrograph type	= Rational	Peak discharge	= 3.11 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Drainage area	= 1.8 ac	Runoff coeff.	= 0.3
Intensity	= 5.755 in/hr	Tc by User	= 5 min
IDF Curve	= Raleigh-2002.IDF	Asc/Rec limb fact	= 1/1

Hydrograph Volume = 932 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

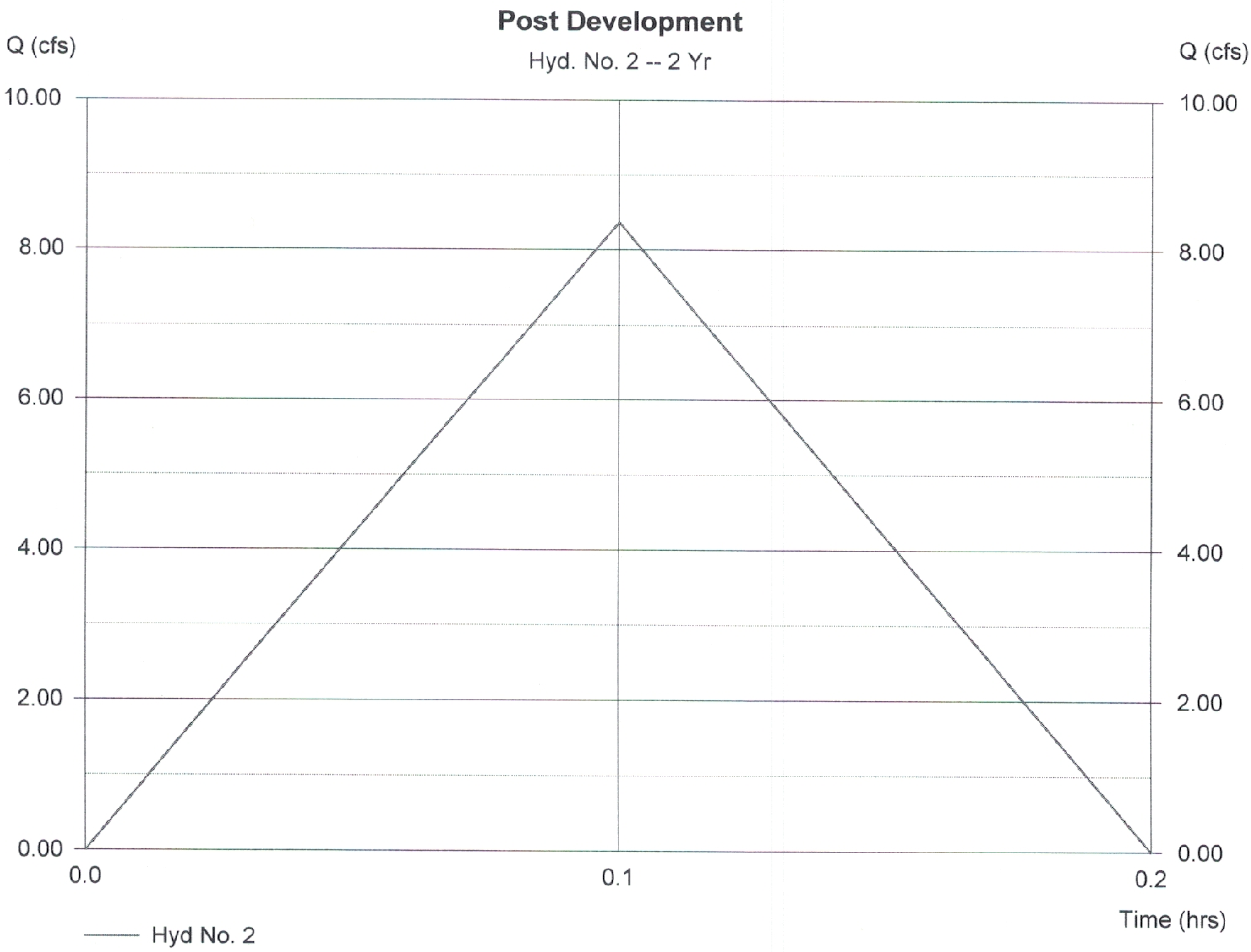
Monday, Jul 25 2022, 9:50 AM

Hyd. No. 2

Post Development

Hydrograph type	=	Rational	Peak discharge	=	8.37 cfs
Storm frequency	=	2 yrs	Time interval	=	1 min
Drainage area	=	1.5 ac	Runoff coeff.	=	0.95
Intensity	=	5.755 in/hr	Tc by User	=	5 min
IDF Curve	=	Raleigh-2002.IDF	Asc/Rec limb fact	=	1/1

Hydrograph Volume = 2,510 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

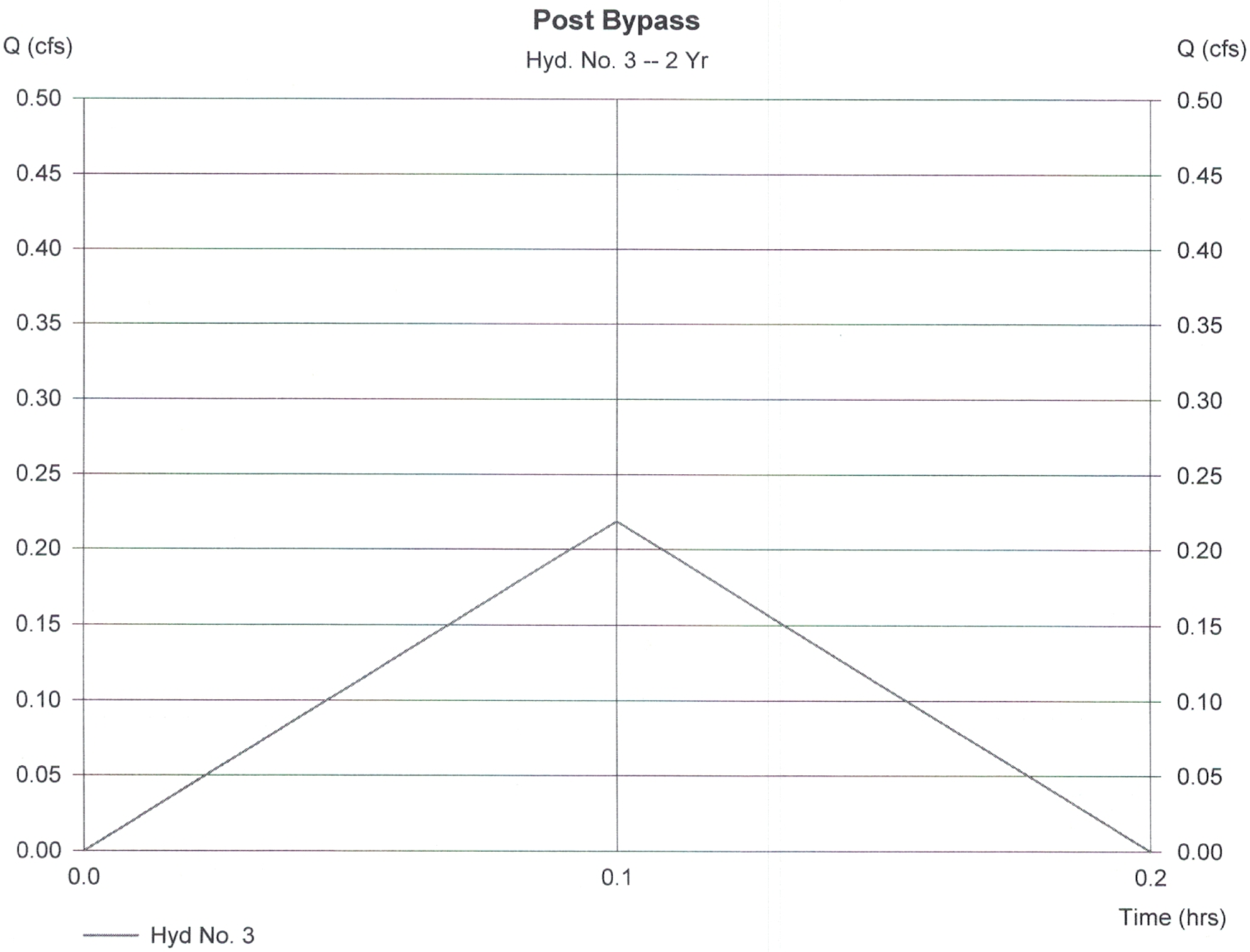
Monday, Jul 25 2022, 9:50 AM

Hyd. No. 3

Post Bypass

Hydrograph type	= Rational	Peak discharge	= 0.22 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Drainage area	= 0.0 ac	Runoff coeff.	= 0.95
Intensity	= 5.755 in/hr	Tc by User	= 5 min
IDF Curve	= Raleigh-2002.IDF	Asc/Rec limb fact	= 1/1

Hydrograph Volume = 66 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Monday, Jul 25 2022, 9:50 AM

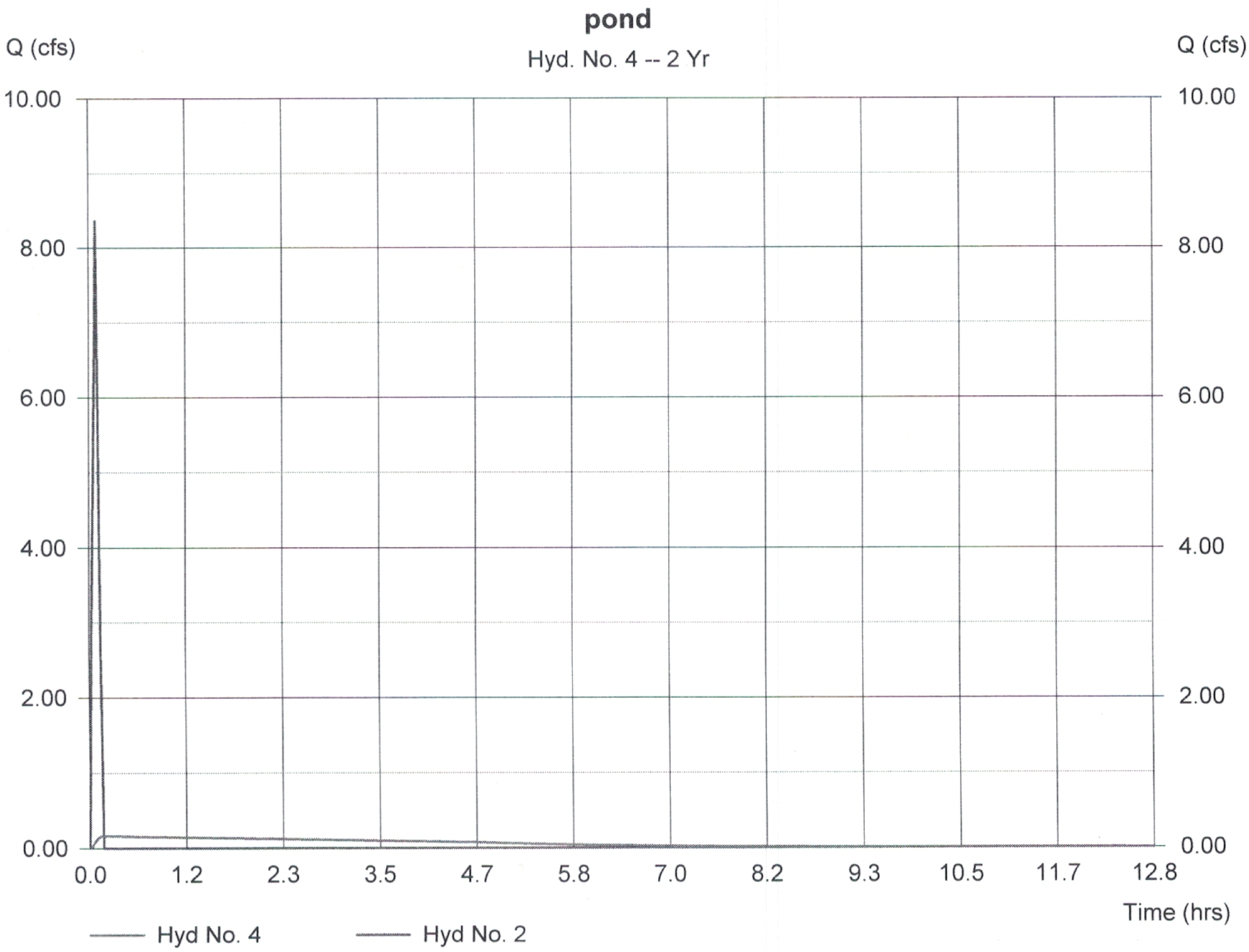
Hyd. No. 4

pond

Hydrograph type	= Reservoir	Peak discharge	= 0.16 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Inflow hyd. No.	= 2	Max. Elevation	= 409.48 ft
Reservoir name	= Bioretention	Max. Storage	= 2,450 cuft

Storage Indication method used.

Hydrograph Volume = 2,503 cuft



Pond Report

Hydraflow Hydrographs by Intelisolve — Monday, Jul 25 2022, 9:50 AM

Pond No. 1 - Bioretention

Pond Data

Pond storage is based on known contour areas. Average end area method used.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	409.00	4,195	0	0
1.00	410.00	5,911	5,053	5,053
2.00	410.00	7,900	6,906	11,959

Culvert / Orifice Structures

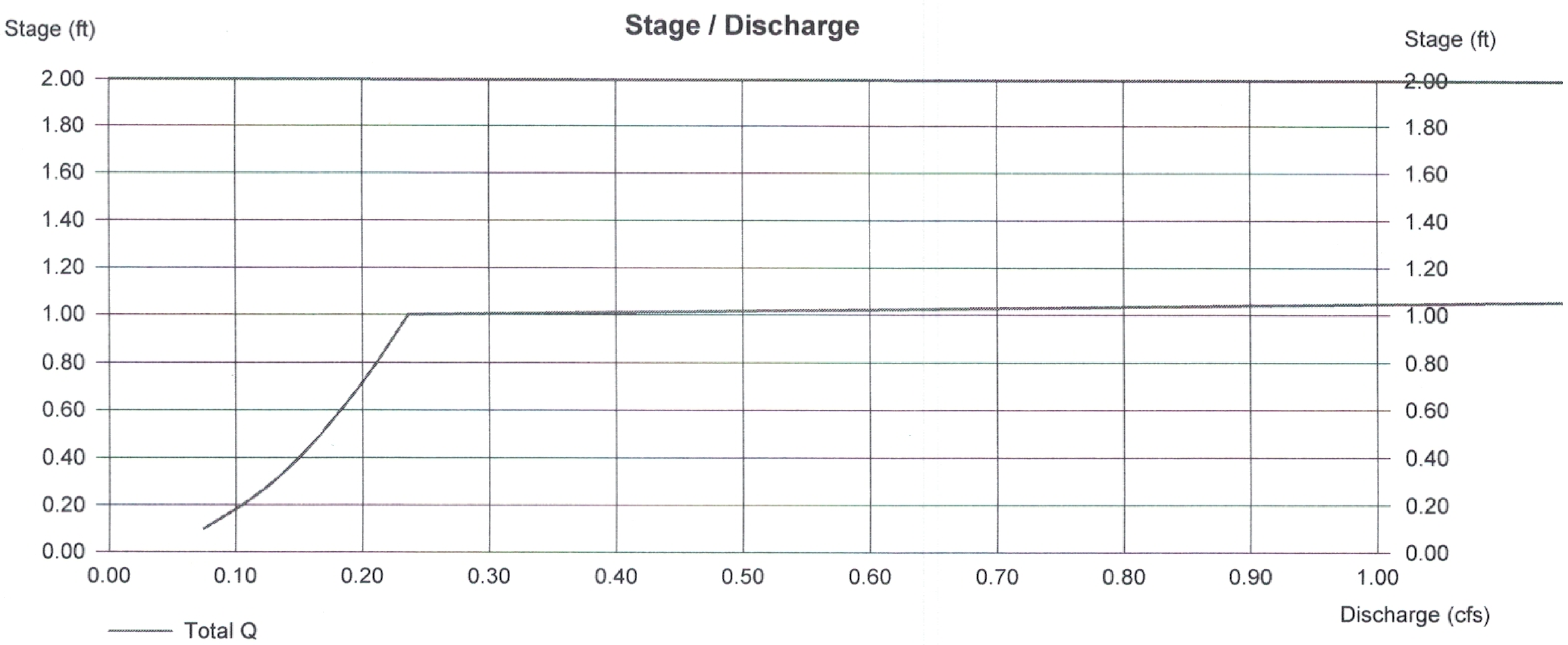
	[A]	[B]	[C]	[D]
Rise (in)	= 18.00	3.00	0.00	0.00
Span (in)	= 18.00	3.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 406.00	408.00	0.00	0.00
Length (ft)	= 50.00	0.50	0.00	0.00
Slope (%)	= 1.00	0.50	0.00	0.00
N-Value	= .013	.013	.000	.000
Orif. Coeff.	= 0.60	0.60	0.00	0.00
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 16.00	10.00	0.00	0.00
Crest El. (ft)	= 410.00	410.30	0.00	0.00
Weir Coeff.	= 3.33	2.60	0.00	0.00
Weir Type	= Riser	Broad	---	---
Multi-Stage	= Yes	No	No	No

Exfiltration = 0.000 in/hr (Contour) **Tailwater Elev.** = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

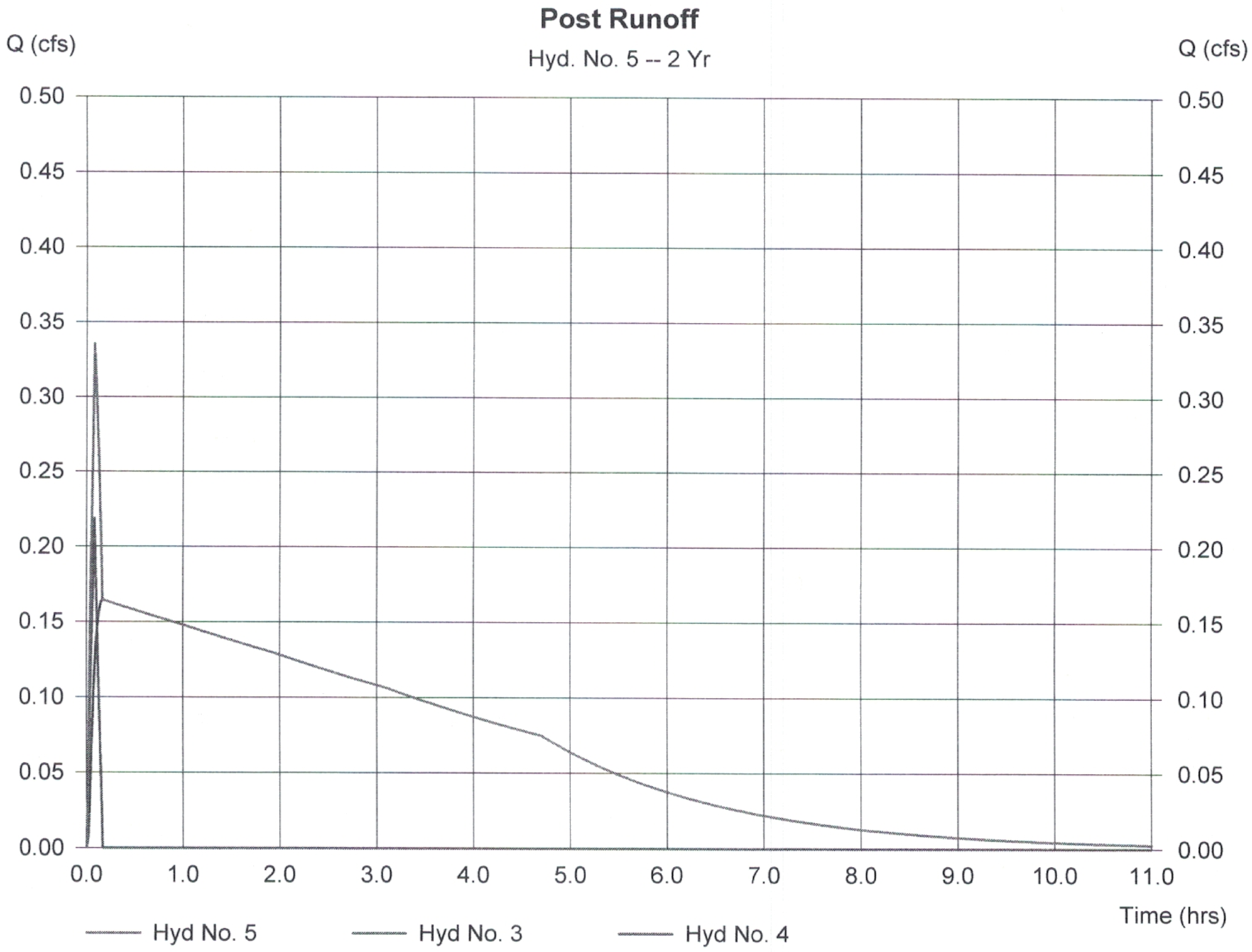
Monday, Jul 25 2022, 9:50 AM

Hyd. No. 5

Post Runoff

Hydrograph type	= Combine	Peak discharge	= 0.34 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Inflow hyds.	= 3, 4		

Hydrograph Volume = 2,569 cuft



Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	Rational	3.90	1	5	1,169	----	------	------	Pre Development
2	Rational	10.49	1	5	3,147	----	------	------	Post Development
3	Rational	0.27	1	5	82	----	------	------	Post Bypass
4	Reservoir	0.18	1	10	3,140	2	409.61	3,079	pond
5	Combine	0.41	1	5	3,222	3, 4	------	------	Post Runoff

Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

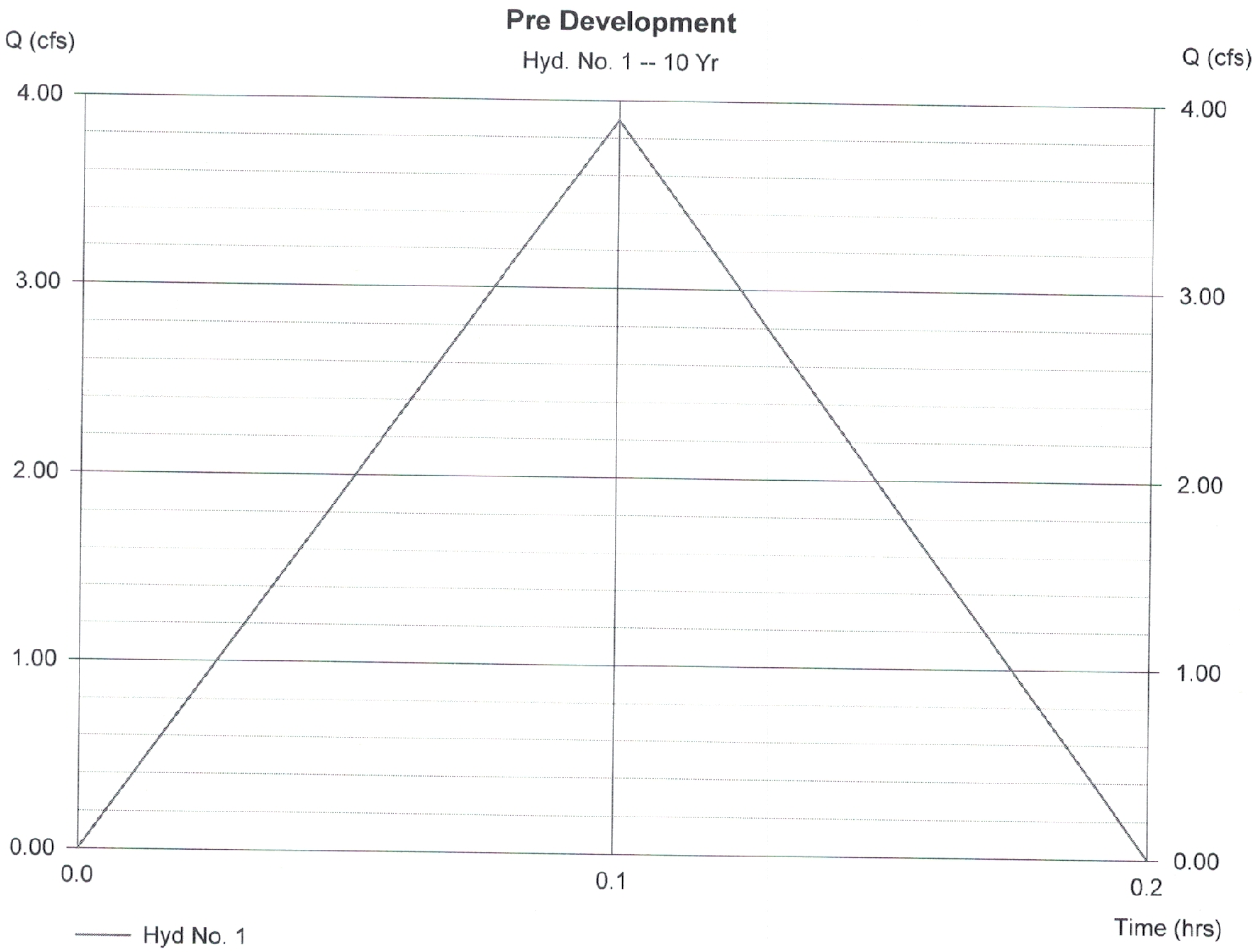
Monday, Jul 25 2022, 9:50 AM

Hyd. No. 1

Pre Development

Hydrograph type	= Rational	Peak discharge	= 3.90 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Drainage area	= 1.8 ac	Runoff coeff.	= 0.3
Intensity	= 7.217 in/hr	Tc by User	= 5 min
IDF Curve	= Raleigh-2002.IDF	Asc/Rec limb fact	= 1/1

Hydrograph Volume = 1,169 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

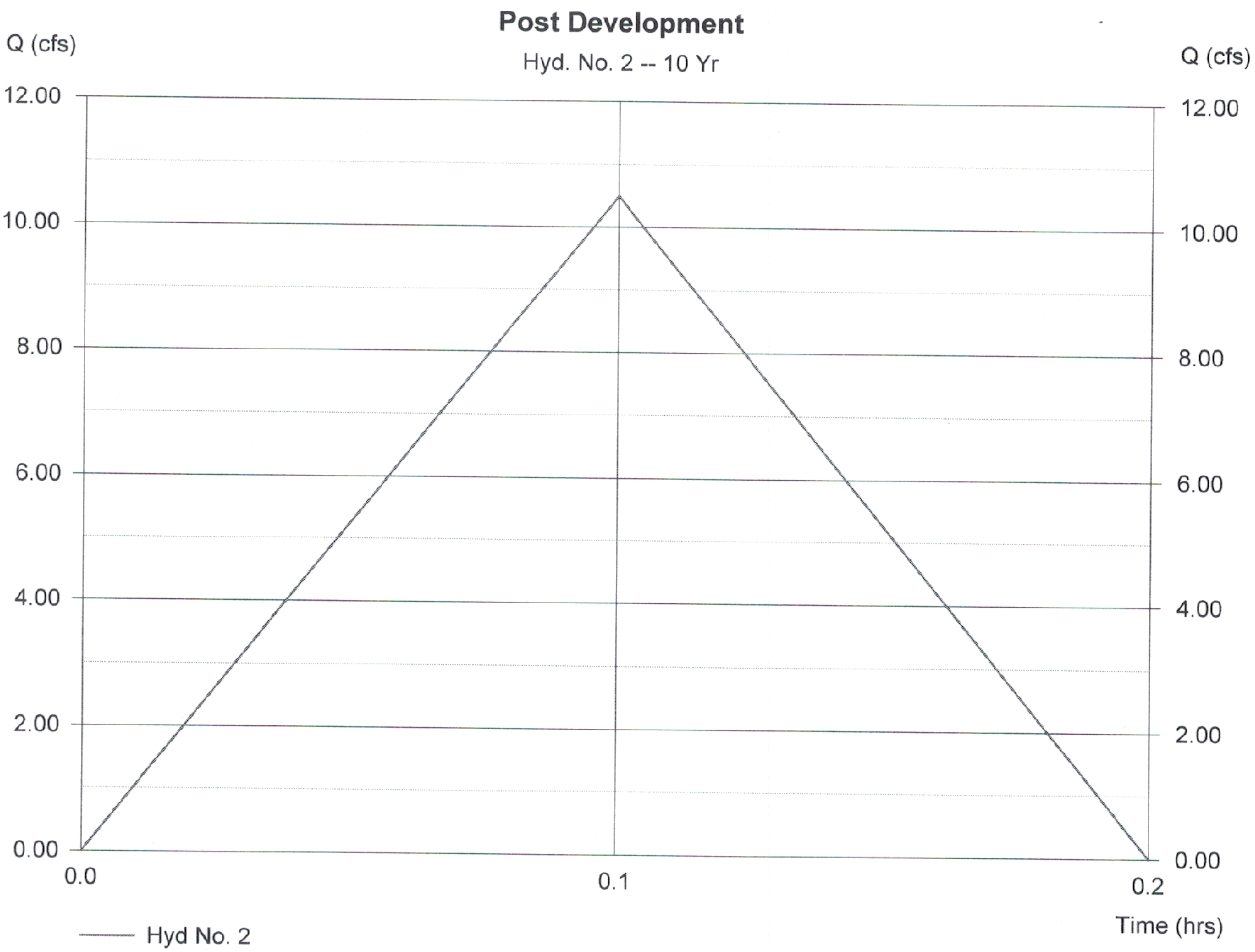
Monday, Jul 25 2022, 9:50 AM

Hyd. No. 2

Post Development

Hydrograph type	=	Rational	Peak discharge	=	10.49 cfs
Storm frequency	=	10 yrs	Time interval	=	1 min
Drainage area	=	1.5 ac	Runoff coeff.	=	0.95
Intensity	=	7.217 in/hr	Tc by User	=	5 min
IDF Curve	=	Raleigh-2002.IDF	Asc/Rec limb fact	=	1/1

Hydrograph Volume = 3,147 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

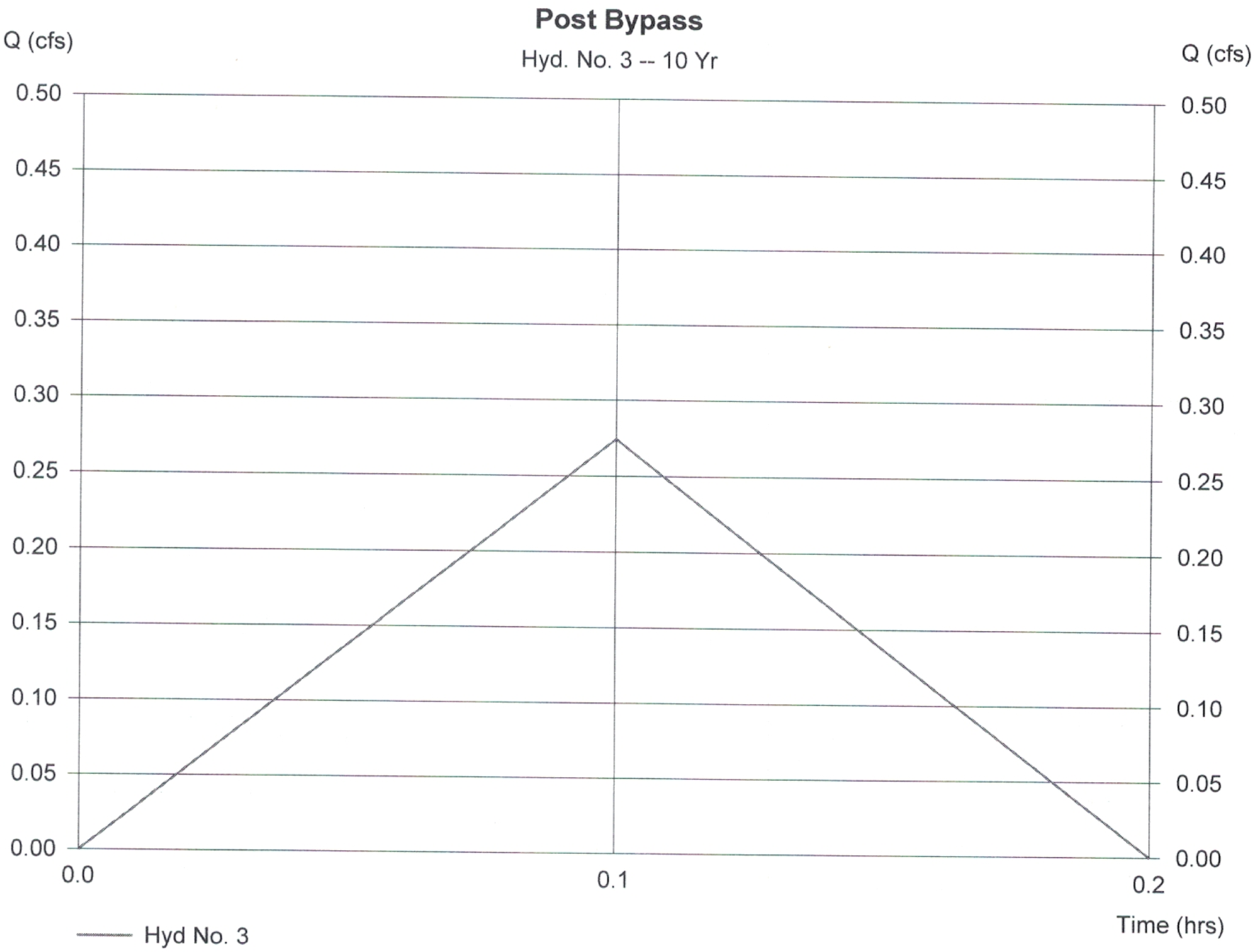
Monday, Jul 25 2022, 9:50 AM

Hyd. No. 3

Post Bypass

Hydrograph type	= Rational	Peak discharge	= 0.27 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Drainage area	= 0.0 ac	Runoff coeff.	= 0.95
Intensity	= 7.217 in/hr	Tc by User	= 5 min
IDF Curve	= Raleigh-2002.IDF	Asc/Rec limb fact	= 1/1

Hydrograph Volume = 82 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

Monday, Jul 25 2022, 9:50 AM

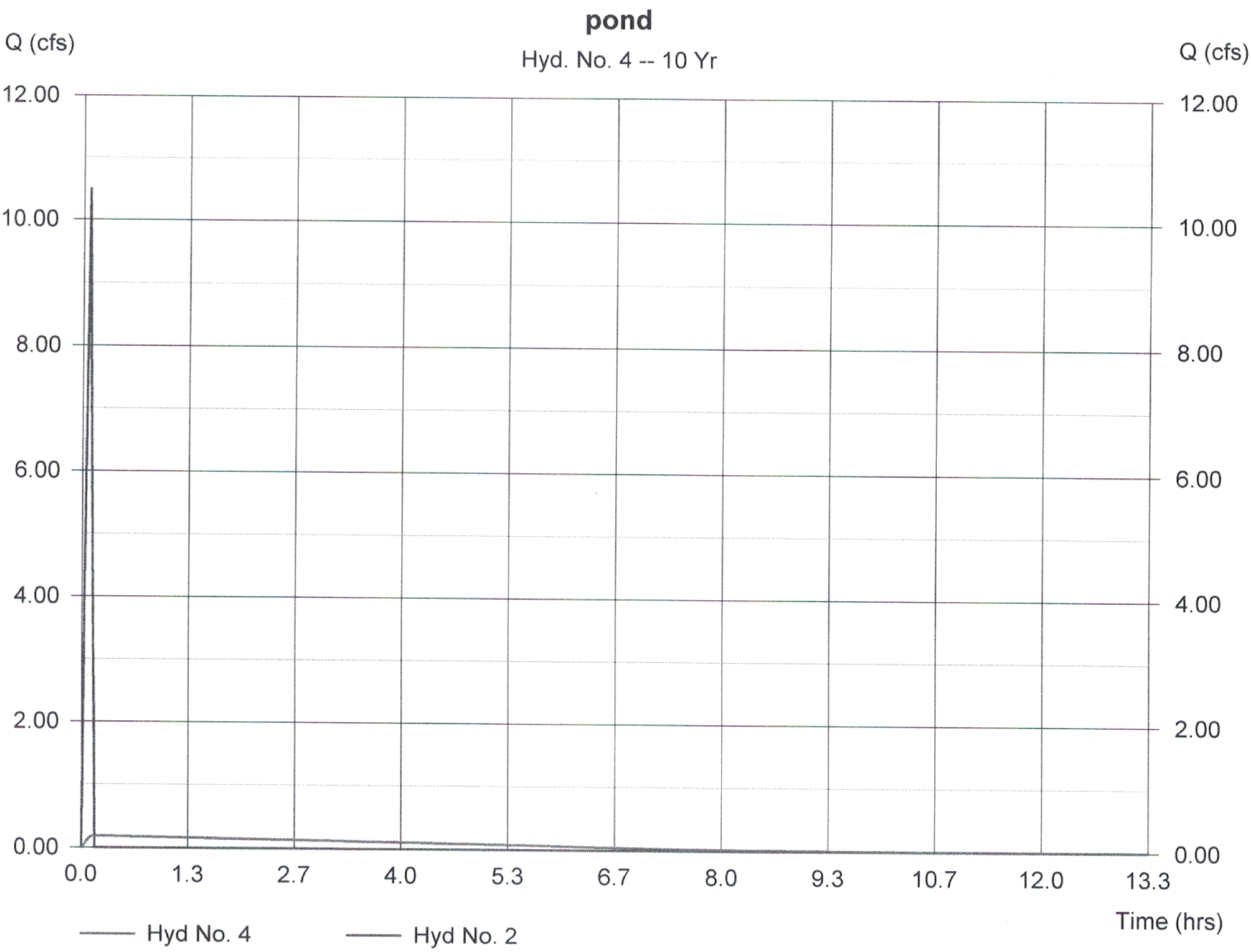
Hyd. No. 4

pond

Hydrograph type	=	Reservoir	Peak discharge	=	0.18 cfs
Storm frequency	=	10 yrs	Time interval	=	1 min
Inflow hyd. No.	=	2	Max. Elevation	=	409.61 ft
Reservoir name	=	Bioretention	Max. Storage	=	3,079 cuft

Storage Indication method used.

Hydrograph Volume = 3,140 cuft



Pond Report

Hydraflow Hydrographs by Intelisolve

Monday, Jul 25 2022, 9:50 AM

Pond No. 1 - Bioretention

Pond Data

Pond storage is based on known contour areas. Average end area method used.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	409.00	4,195	0	0
1.00	410.00	5,911	5,053	5,053
2.00	410.00	7,900	6,906	11,959

Culvert / Orifice Structures

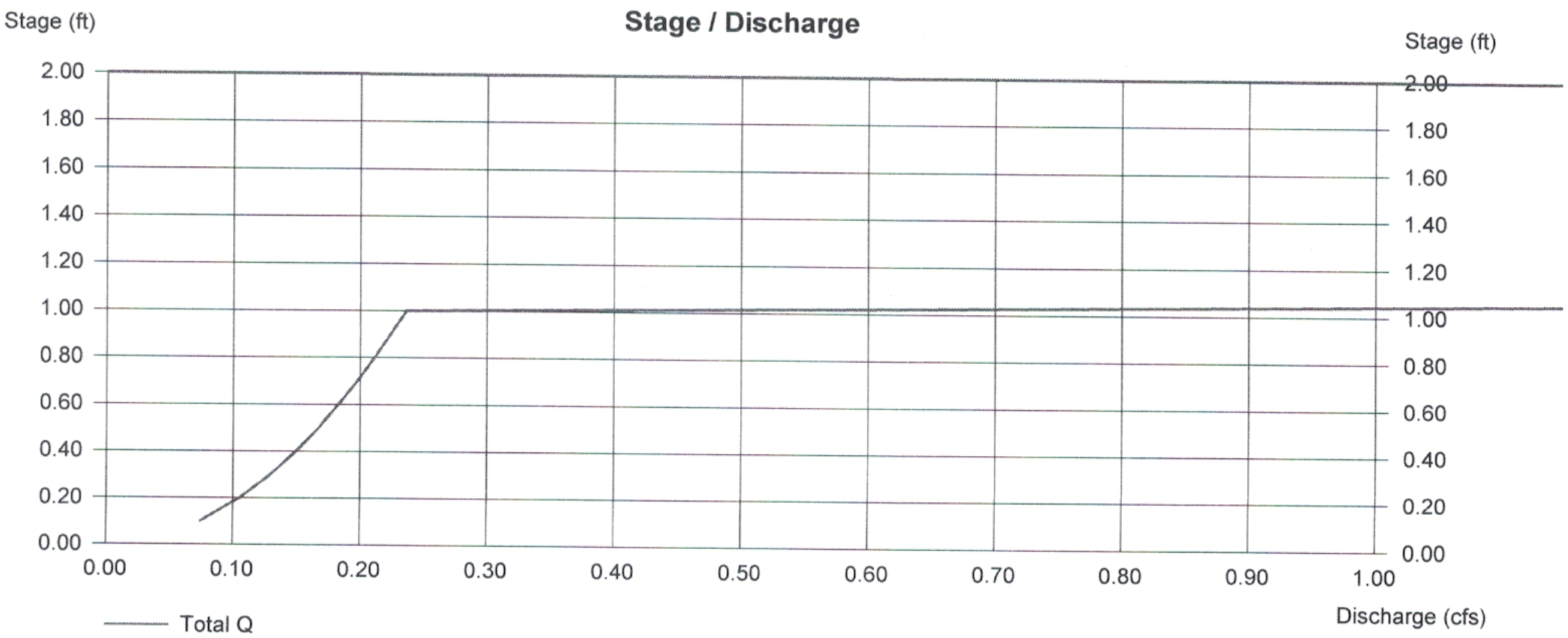
	[A]	[B]	[C]	[D]
Rise (in)	= 18.00	3.00	0.00	0.00
Span (in)	= 18.00	3.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 406.00	408.00	0.00	0.00
Length (ft)	= 50.00	0.50	0.00	0.00
Slope (%)	= 1.00	0.50	0.00	0.00
N-Value	= .013	.013	.000	.000
Orif. Coeff.	= 0.60	0.60	0.00	0.00
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 16.00	10.00	0.00	0.00
Crest El. (ft)	= 410.00	410.30	0.00	0.00
Weir Coeff.	= 3.33	2.60	0.00	0.00
Weir Type	= Riser	Broad	---	---
Multi-Stage	= Yes	No	No	No

Exfiltration = 0.000 in/hr (Contour) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

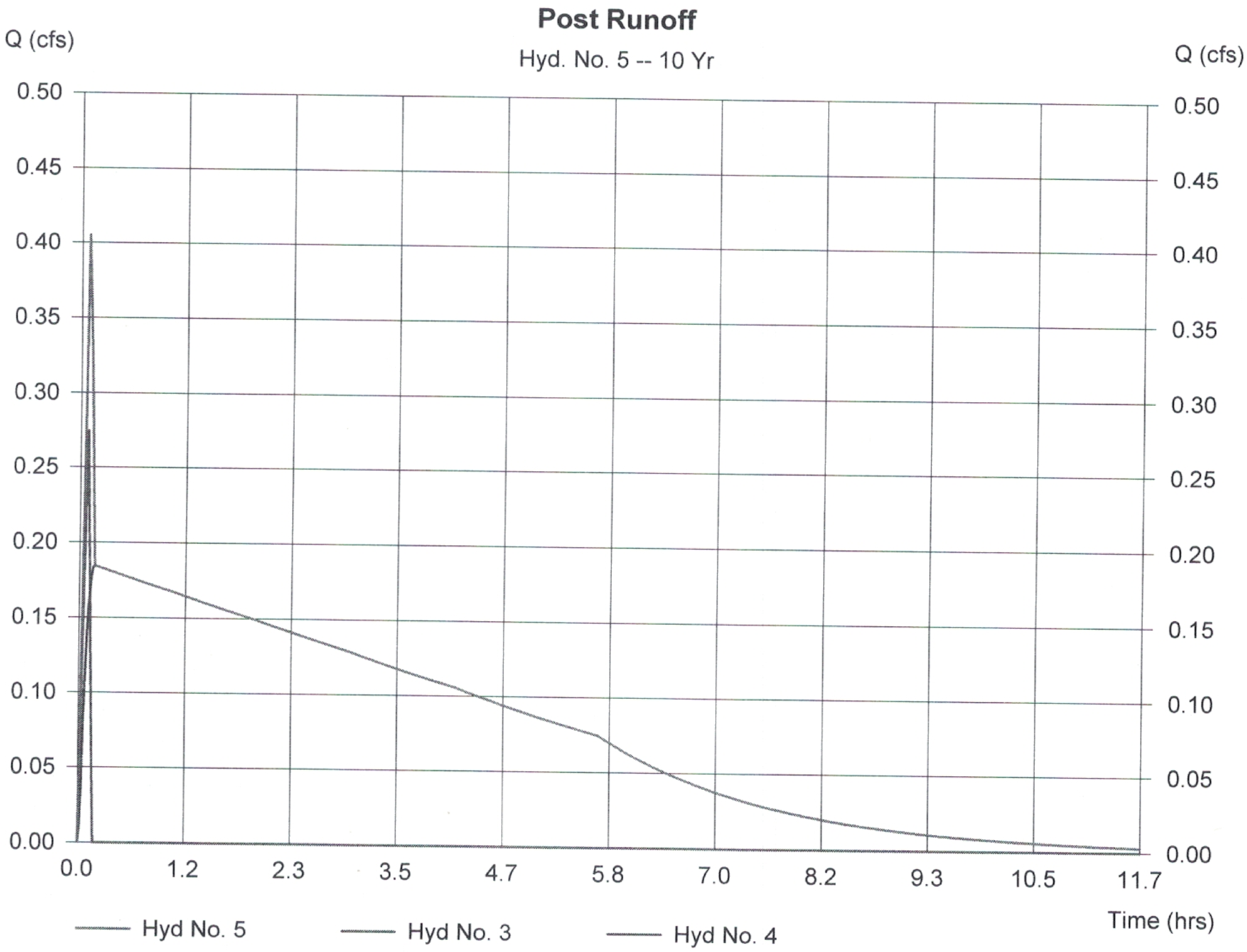
Monday, Jul 25 2022, 9:50 AM

Hyd. No. 5

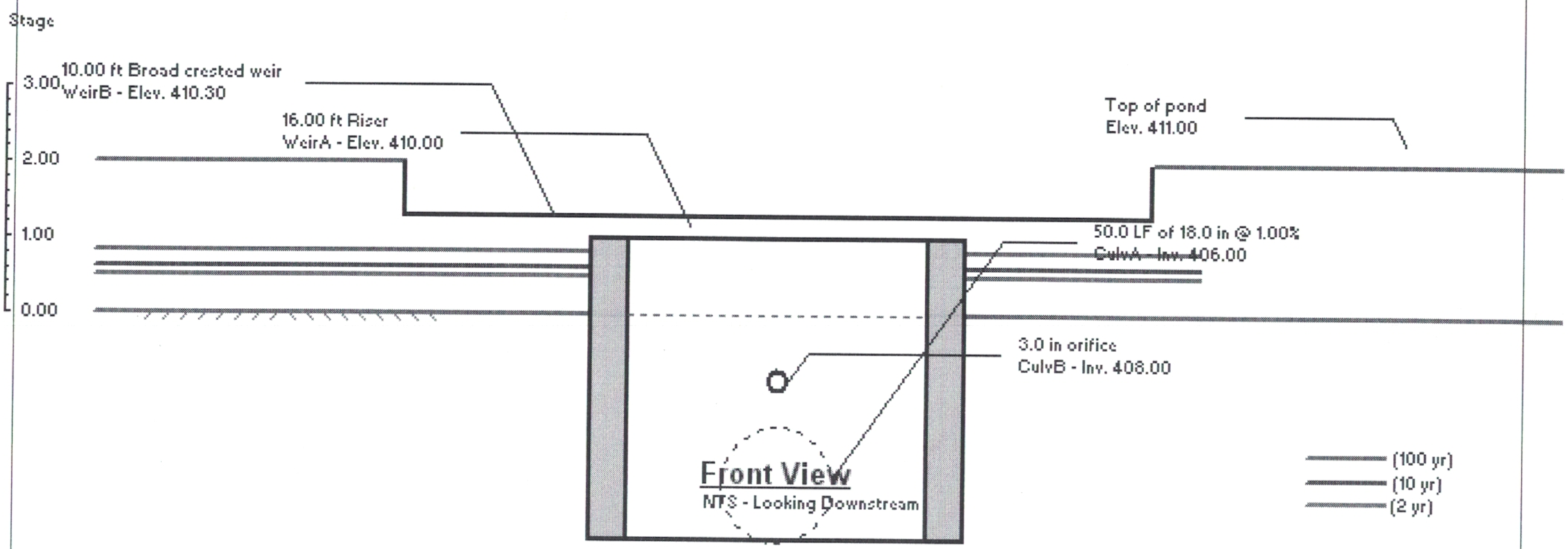
Post Runoff

Hydrograph type	= Combine	Peak discharge	= 0.41 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Inflow hyds.	= 3, 4		

Hydrograph Volume = 3,222 cuft



Bioretention



Schematic only. Not for construction.

Hydraflow Hydrographs Pond Draw	Project: Rolesville Massey.gpw	Monday, Jul 25 2022, 9:52 AM

WAKE COUNTY
NORTH CAROLINA

SITE DATA

Project Information	
Project Name:	**South Main**
Permit No (if known):	
Applicant:	Toy Storage LLC
Applicant Contact Name:	Allen Massey
Applicant Contact Number:	919-604-0505
Contact Email:	Storit@AOL.com
Last Modified Date:	July 26 2022
Site Data:	
River Basin:	Neuse
Regulatory Watershed:	N/A
Physiographic/Geologic Region:	Piedmont
Type of Development (Select from Dropdown menu):	Non-Residential
Zoning:	General Business
Total Site Area (Ac):	1.80
Existing Lake/Pond Area (Ac):	0.00
Proposed Disturbed Area (Ac):	2.01
Proposed Impervious Surface Area from DA Sheets (acre):	1.38
Percent Built Upon Area (BUA):	77%
Is the proposed project a site expansion?	No
Number of Drainage Areas on Site (Points of Analysis):	1
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:	78,408
Total Acreage in Lots:	1.80
Lot Square Footage:	78,408
Number of Lots:	1
Average Lot Size (SF):	78,408
Proposed Impervious Surface Area from DA sheets (SF):	60,113
Proposed Impervious Surface Area Devoted to Lots (SF):	
Total Impervious Surface Area Devoted to Roads (SF):	
Other Impervious Surface Area (SF):	

Project Name: South Main

DRAINAGE AREA 1
STORMWATER PRE-POST CALCULATIONS

LAND USE & SITE DATA	PRE-DEVELOPMENT								POST-DEVELOPMENT							
Drainage Area (Acres)=	1.80								1.80							
Site Acreage within Drainage=	1.80								1.80							
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			0.01								1.07					
Roof											0.31					
Open/Landscaped											0.22					
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)			1.79								0.20					
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)																
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	1.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.80	0.00	0.00	0.00	0.00	0.00

SITE FLOW	PRE-DEVELOPMENT T_c	POST-DEVELOPMENT Tc
Sheet Flow		
Length (ft)=	50.00	50.00
Slope (ft/ft)=	0.03	0.03
Surface Cover:	Grass	Paved, Gravel, or Bare Soil
n-value=	0.24	0.011
T_t (hrs)=	0.11	0.01
Shallow Flow		
Length (ft)=	370.00	211.00
Slope (ft/ft)=	0.03	0.03
Surface Cover:	Unpaved	Paved
Average Velocity (ft/sec)=	2.79	3.52
T_t (hrs)=	0.04	0.02
Channel Flow 1		
Length (ft)=	0.00	160.00
Slope (ft/ft)=	0.03	0.01
Cross Sectional Flow Area (ft^2)=	0.75	0.74
Wetted Perimeter (ft)=		3.16
Channel Lining:		Concrete, finished
n-value=		0.012
Hydraulic Radius (ft)=	0.00	0.23
Average Velocity (ft/sec)=	0.00	4.72
T_t (hrs)=	0.00	0.01
Tc (hrs)=		
RESULTS	**PRE-DEVELOPMENT**	**POST-DEVELOPMENT**
Site Impervious Surface Area (Ac) =	0.01	1.38
Lot Impervious Surface Area (Ac) =	0.00	0.00
1-year, 24-hour storm (Peak Flow)		
Volume of runoff (ft^3) =	2,473	14,424
Volume change (ft^3) =	11,951	
Runoff (inches) = Q*=	0.3785	2.2075
Peak Discharge (cfs)= Q=		
Composite Curve Number (DA)=	61	89
Composite Curve Number (Site only)=	61	89

DISCONNECTED IMPERVIOUS - Credit given only to residential development with drainage area with less than 30% impervious	
Percent Disconnected Impervious Credit (Residential Only) =	0%
Disconnected impervious area (Ac) =	0.00
Drainage Area $CN_{adjusted}$=	89
Site Only $CN_{adjusted}$=	89

Project Name: South Main

WAKE COUNTY
NORTH CAROLINA

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* =	0.378					
Peak Flow (cfs)=Q_{post} =						
Post-Development (1-year, 24-hour storm)						
Proposed Impervious Surface (acre) =	1.38					
Runoff (in)=Q* =	2.208					
Peak Flow (cfs)=Q_{post} =						

TARGET CURVE NUMBER (TCN) - Residential Only			
SITE \SOIL COMPOSITION			
HYDROLOGIC SOIL GROUP	Site Area	%	Target CN
A	0.00	0%	N/A
B	1.80	100%	N/A
C	0.00	0%	N/A
D	0.00	0%	N/A
Total Site Area (acres) =	1.80		
Zoning =	General Business		
Target Curve Number (TCN) =	N/A		
% Impervious =	77%		
Post Development $CN_{adjusted}$ =	89		
Required Volume to be Managed (TCN)= ft^3 =	N/A		

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)=	**1.64**
Total Phosphorus (lb/ac/yr)=	**N/A**
Post Development Nitrogen and Phosphorus Load	
Total Nitrogen (lb/ac/yr)=	**10.50**
Total Phosphorus (lb/ac/yr)=	**N/A**

WAKE COUNTY
NORTH CAROLINA

Project Name: South Main

DRAINAGE AREA 1
BMP CALCULATIONS

DRAINAGE AREA 1 - BMP DEVICES AND ADJUSTMENTS

DA1 Site Acreage=	1.80			
DA1 Off-Site Acreage=	0.00			
Total Required Storage Volume for Site TCN Requirement (ft^3)=				
Will site use underground water harvesting?		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	1.07									
Roof	0.31									
Open/Landscaped	0.42									
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)=	1.80	0.00	0.00	0.00	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.)
BMP 1	Bioretention with IWS	4,835	1.37	10.46	0.16	1.24	1.03	3.93	0.13	0.49	
Outflow Total Nitrogen (lb/ac/yr)=		3.93		Outflow Total Phosphorus (lb/ac/yr)=						0.49	

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.)
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.)=	0
DA1 Outflow Total Nitrogen (lb/ac/yr)=	3.93
DA1 Outflow Total Phosphorus (lb/ac/yr)=	0.49

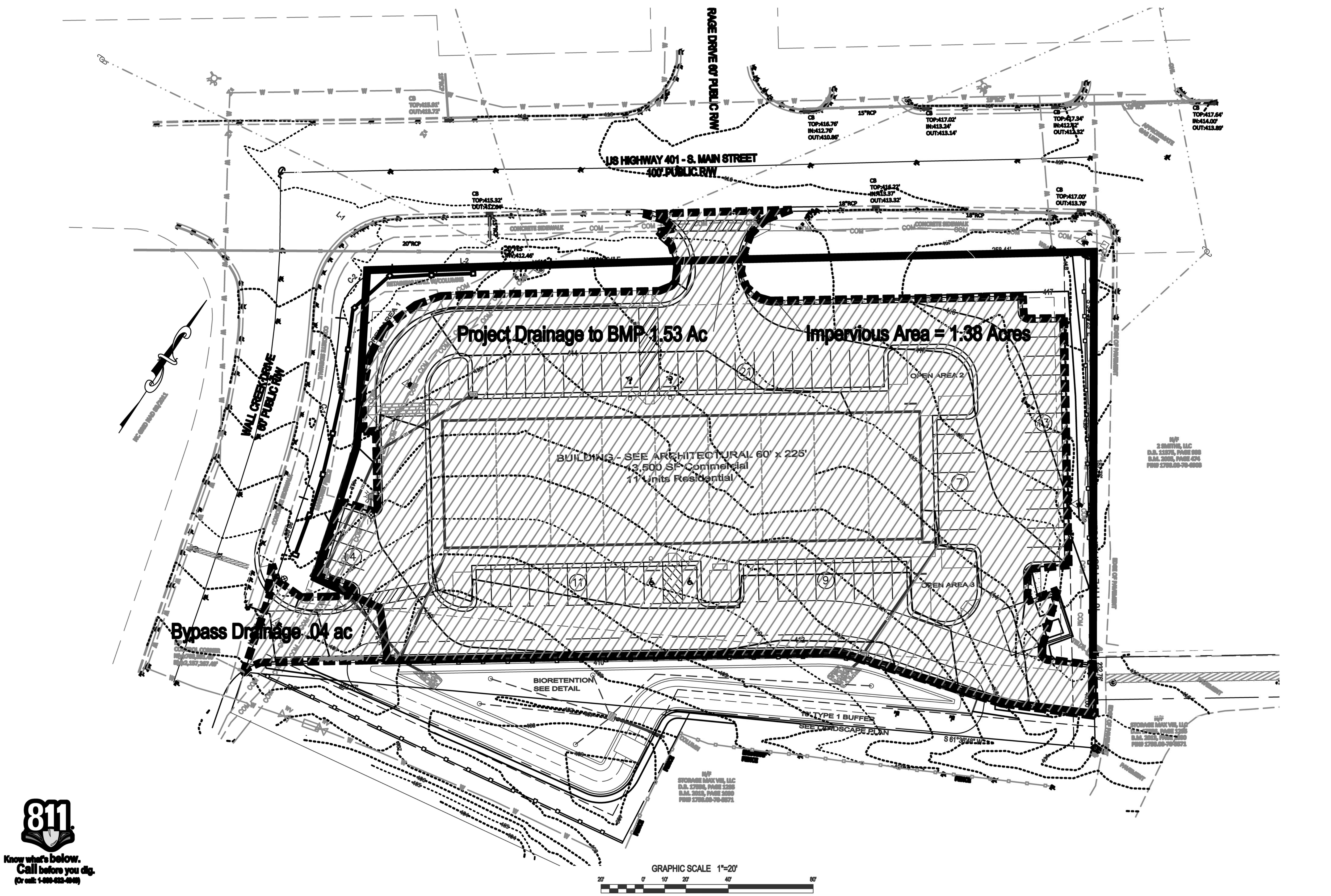
1-year, 24-hour storm

Pre Development Peak Discharge (cfs)= $Q_{1\text{-}year}$=	
Post BMP Peak Discharge (cfs)= $Q_{1\text{-}year}$=	

Project Name: South Main

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)= $Q_{1\text{-year}}$ =						
Post-Development with BMPs (1-year, 24-hour storm)						
% Impervious =	**77%**					
Volume Managed (CF)=	0					
Post BMP Peak Discharge (cfs)= $Q_{1\text{-year}}$=						
Have Target Curve Number Requirements been met?	N/A					
Pre Development Nitrogen and Phosphorus Load						
Total Nitrogen (lb/ac/yr)=	1.64					
Total Phosphorus (lb/ac/yr)=	N/A					
Post Development Nitrogen and Phosphorus Load						
Total Nitrogen (lb/ac/yr)=	10.50					
Total Phosphorus (lb/ac/yr)=	N/A					
Post-BMP Nitrogen Loading						
Outflow Total Nitrogen (lb/ac/yr)=	3.98					
Outflow Total Phosphorus (lb/ac/yr)=	0.50					
Has site met the Target?	NO					
Has site met requirements for offsetting?	YES					



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NO.	DATE	REVISION DESCRIPTION	BY
1	07-26-2022	INITIAL SUBMITTAL	KPG
2	DATE	COMMENT	BY
3	DATE	COMMENT	BY
3	DATE	COMMENT	BY
4	DATE	COMMENT	BY
5	DATE	COMMENT	BY
6	DATE	COMMENT	BY
8	Date	Comment	By

NORTH CAROLINA PROFESSIONAL SEAL 030913 ENGINEER KEITH P. GETTLE
7/26/22

Drainage Map
South Main
503 South Main Street
Rolesville, Wake County, North Carolina

Project No. XXXXX
Dwg No. EX1