STORMWATER IMPACT ANALYSIS

Conditional Zoning Permit

Barbee Chapel Apartments/ TLA-22001/ November 2022

McAdams

BARBEE CHAPEL APARTMENTS

CHAPEL HILL, NORTH CAROLINA

STORMWATER IMPACT ANALYSIS

CONDITIONAL ZONING PERMIT

PROJECT NUMBER:	TLA-22001
DESIGNED BY:	M. TORRES, PE
	O. LEFEVRE, EI

DATE:	SEPTEMBER 2022
REVISED:	NOVEMBER 2022

MCADAMS

621 HILLSBOROUGH STREET, SUITE 500
RALEIGH, NC 27603
NC LIC. # C-0293

BARBEE CHAPEL APARTMENTS

Stormwater Impact Analysis

GENERAL DESCRIPTION

Barbee Chapel Apartments is a multi-family redevelopment at the intersection of Barbee Chapel Road and Pearl Lane in Chapel Hill, North Carolina. The approximately 10.5-acre site will consist of 346 multi-family units and 24 townhome units for a total of 370 units along with surface parking, a clubhouse, and amenity spaces. To meet the Town of Chapel Hill standards, two underground detention vaults with StormFilter systems are proposed.

The project site is located within the Jordan Lake Basin and is not in a watershed protection overlay. Stormwater runoff from the proposed development drains to both Morgan Creek and Little Creek. According to NC Division of Water Resources' NC Surface Water Classifications Map, Morgan Creek (Stream Index #16-41-2-(5.5) is classified as WS-IV;NSW and Little Creek (Stream Index #16-41-1-15-(0.5) is classified as WS-IV;NSW at this location. Per Town of Chapel Hill regulations, stormwater management on this site shall meet the stormwater management performance standards for development set forth in Appendix A, Article 5.4 of the Chapel Hill Code of Ordinances.

The regulations are as follows:

Chapel Hill Code of Ordinances, Article 5, Section 4.1 through 4.9

1. *Applicability (5.4.2)*
    - a. *This section shall apply to all new development and redevelopment projects for which a zoning compliance permit is required.*
    - b. *To prevent the adverse impacts of stormwater runoff, the town has developed a set of performance standards that must be met at all new development and redevelopment sites. The following activities are exempt from these stormwater performance criteria:*
        - i. *Any logging and agricultural activity that is consistent with all federal, state and local regulations;*
        - ii. *Individual single-family and two-family development and redevelopments that do not disturb more than twenty thousand (20,000) square feet of land area, including cumulative disturbance since the adoption of the Land Use Management Ordinance on January 27, 2003, provided they are not part of a larger common plan of development.*
        - iii. *Repairs to any stormwater treatment facility deemed necessary by the town.*
        - iv. *For purposes of this section, "Larger common plan of development" shall be as defined in subsection 5.19.3(h) of this appendix and includes subdivisions that create four (4) or more residential lots.*
    - c. *Individual single-family and two-family residential construction that are exempt from stormwater performance criteria under subsection 5.4.2(b)(2) above shall discharge runoff in an non-erosive and diffuse manner using techniques approved by the town manager. Discharge system/techniques shall be in accordance with the standards established in the town's design manual.*

2. *Design manual and Standard Details (5.4.3)*
    - a. *The town may furnish additional policy, criteria and information, for the proper implementation of the requirements of this section and may provide such information in the design manual and standard details, which manual may include a list of acceptable stormwater treatment practices, including the specific design criteria for each stormwater practice. The manual may be updated and expanded from time to time, at the discretion of the town, based on improvements in engineering, science, monitoring, and local maintenance experience. Stormwater treatment practices that are designed and constructed in accordance with these design and sizing criteria will be presumed to meet the minimum water quality performance standards.*

3. *General Performance Criteria for Stormwater Management (5.4.6)*
    a. *Stormwater treatment shall be designed to achieve average annual eighty-five (85) percent total suspended solids (TSS) removal and must apply to the volume of post-development runoff resulting from the first one-inch of precipitation. Alternative treatment methods to achieve eighty-five (85) percent average annual TSS removal may be acceptable. The eighty-five (85) percent requirement applies to eighty-five (85) percent of the additional suspended solids that are the result of the new development. (Ord. No. 2004-02-23/O-2)*
    b. *The stormwater runoff volume leaving the site post-development shall not exceed the stormwater runoff volume leaving the site pre-development (existing conditions) for the local 2-year frequency, 24-hour duration storm event for all development except single-family and two-family dwellings on lots existing as of January 27, 2003, or on lots pursuant to a preliminary plat that was approved by the town council prior to January 27, 2003. This may be achieved by hydrologic abstraction, recycling and/or reuse, or any other accepted scientific method.*
    c. *The stormwater runoff rate leaving the site post-development shall not exceed the stormwater runoff rate leaving the site pre-development (existing conditions) for the local 1-year, 2-year, and 25-year 24-hour storm events.*
    d. *Land disturbance within the stream channel of any ephemeral stream shall be minimized and prohibited unless explicitly authorized by issuance of a zoning compliance permit after demonstration of the necessity for the disturbance.*

This report contains the calculations detailing the expected stormwater impacts as a result of the proposed redevelopment, along with the design of the underground detention vaults and StormFilter systems that will be used to mitigate impacts. Please refer to the appropriate section of this report for additional information.

CALCULATION METHODOLOGY

- Rainfall data for this area in Chapel Hill, NC region is from the NOAA Atlas 14. This data contains a depth-duration-frequency (DDF) table describing rainfall depth versus time for varying return periods in the area. These rainfall depths are input into the meteorological model within PondPack for peak flow rate calculations. Please reference the precipitation information within the Miscellaneous Site Information section of this report for additional information.

- Using Web Soil Survey, the on-site soils were determined to be hydrological soil group (HSG) 'D' soils. Since the method chosen to compute pre- and post-development peak flow rates and runoff volumes is dependent upon the soil type, care was taken when selecting the appropriate Soil Conservation Service Curve Number (SCS CN).

- Land cover conditions for the pre-development condition were taken from survey performed by McAdams and best available GIS sources. Land cover conditions for the post-development condition were taken from the proposed layout.

- The time of concentration was calculated using SCS TR-55 (Segmental Approach, 1986). The Tc flow path can be divided into multiple segments where applicable: overland flow, concentrated flow, and channel flow. The travel time was then computed for each segment, from which the overall time of concentration was determined by taking the sum of each segmental time.

- Existing topographic information used in this analysis is from survey performed by McAdams.

- PondPack Version V8i was used in determined the pre- & post-development peak flow rates for the 1-, 2-, 10-, 25-, and 100-year storm events, as well as routing calculations for the proposed stormwater control measures.

- For reference only, as the site is located in the Jordan Watershed, total nitrogen and phosphorous export calculations were computed using the Stormwater Nitrogen and Phosphorous Tool v4.1.

DISCUSSION OF RESULTS

PEAK RUNOFF CONTROL REQUIREMENTS

The post-development peak flow for the 1-yr, 2-yr, and 25-yr storms is equal to or less than pre-development flow for the same storm at each POA. Please refer to the Summary of Results in this report.

2-YR VOLUME REDUCTION

The volume difference between the pre- and post- development 2-year runoff is detained to the maximum extent possible and treated entirely through the proposed StormFilter cartridges.

POLLUTANT AND NUTRIENT CONTROL REQUIREMENTS

The increase in impervious for the site meets the 85% TSS removal requirement through the proposed StormFilter systems. Nutrient treatment is not required for this development; water quality calculations are provided in the SNAP tool for reference only.

CONCLUSION

If the development on this tract is built as proposed within this report, then the requirements set forth in Town of Chapel Hill regulations will be met without additional stormwater control measures. However, modifications to the proposed development may require that this analysis be revised. Some modifications that would require this analysis to be revised include:

1. The proposed site impervious surface exceeds the amount accounted for in this report.
2. The post-development watershed breaks change significantly from those used to prepare this report.

The above modifications may result in the assumptions within this report becoming invalid. The computations within this report will need to be revisited if any of the above conditions become apparent as development of the proposed site moves forward.

SUMMARY OF RESULTS

BARBEE CHAPEL APARTMENTS

TLA-22001

SUMMARY OF RESULTS

RELEASE RATE MANAGEMENT RESULTS

POINT OF ANALYSIS #1			
Return Period	**Pre-Dev** [cfs]	**Post-Dev** [cfs]	**Difference** [cfs]
1-Year	8.39	7.51	-10%
2-Year	11.51	10.02	-13%
25-Year	21.98	19.56	-11%

POINT OF ANALYSIS #2			
Return Period	**Pre-Dev** [cfs]	**Post-Dev** [cfs]	**Difference** [cfs]
1-Year	2.80	0.73	-74%
2-Year	3.76	2.09	-44%
25-Year	6.86	5.58	-19%

POINT OF ANALYSIS #3			
Return Period	**Pre-Dev** [cfs]	**Post-Dev** [cfs]	**Difference** [cfs]
1-Year	3.54	0.66	-81%
2-Year	4.84	0.90	-81%
25-Year	9.11	1.68	-82%

POINT OF ANALYSIS #4			
Return Period	**Pre-Dev** [cfs]	**Post-Dev** [cfs]	**Difference** [cfs]
1-Year	0.56	0.08	-86%
2-Year	0.73	0.11	-85%
25-Year	1.26	0.22	-83%

2-Year Volume Management Results

PRE-DEVELOPMENT 2YR-24HR VOLUME SUMMARY

Total On-Site Area =	10.46	acres
Area Weighted On-site SCS CN =	81	
S =	2.30	
P (2-yr / 24-hour) =	3.56	inches
Q* =	1.78	inches
On-site Run-off Volume =	**1.55**	**acre-feet**
=	**67,660**	**cf**

POST-DEVELOPMENT 2YR-24HR VOLUME SUMMARY

Total On-Site Area =	10.46	acres
Area Weighted On-site SCS CN =	93	
S =	0.77	
P (2-yr / 24-hour) =	3.56	inches
Q* =	2.78	inches
Total On-site Run-off Volume =	**2.42**	**acre-feet**
=	**105,440**	**cf**

PRE TO POST-DEVELOPMENT 2YR-24HR VOLUME DIFFERENCE

Pre-Post 2yr Runoff Volume Difference =	**37,781**	**cf**

SUMMARY OF 2YR-24HR VOLUME CAPTURE

SCM A - Volume Captured =	4,950	cf
SCM B - Volume Captured =	41,400	cf
Total Pre-Post 2yr Runoff Volume Detained =	**46,350**	**cf**

STORMWATER CONTROL MEASURE SUMMARY

Design Drainage Area =	2.31	ac
Design Impervious Area =	1.65	ac
% Impervious =	71.4%	
Top of Storage Vault Elev. =	288.00	ft
Bottom of Storage Vault Elev. =	282.75	ft
Vault Height =	5.25	ft
Vault Footprint =	1,800	sf
Total Available Volume =	9,450	cf
WQv =	4,350	cf
WQV Vol. Depth =	1.67	ft
WQV Vol. Elevation =	284.42	ft
Equiv. WQ Orifice =	1	
Orifice Invert Elevation =	282.75	ft
Orifice Diameter =	1.5	in
Weir Length =	10	ft
Weir Crest =	287.00	ft
Area Orifice 1 =	1	
Area Orifice Elevation =	285.50	ft
Orifice Area =	3'L x 0.5'H	ft^2
Stored Volume =	4,950	cf
Barrel Diameter =	24	in
# of Barrels =	1	
Upstream Invert =	282.25	ft
Downstream Invert =	281.30	ft
Length =	84	ft
Slope =	0.0113	ft/ft

STORMWATER CONTROL MEASURE ROUTING RESULTS

Return Period	Inflow [cfs]	Outflow [cfs]	Max. WSE [ft]	Freeboard [ft]
1-Year	8.84	5.77	286.37	1.63
2-Year	10.81	7.49	286.80	1.20
10-Year	14.49	12.38	287.24	0.76
25-Year	16.16	14.69	287.32	0.68
100-year	18.41	17.52	287.42	0.58

STORMWATER CONTROL MEASURE SUMMARY

Design Drainage Area =	6.85	ac
Design Impervious Area =	5.61	ac
% Impervious =	82.0%	
Top of Storage Vault Elev. =	291.00	ft
Bottom of Storage Vault Elev. =	281.50	ft
Vault Height =	9.50	ft
Vault Footprint =	9,200	sf
Total Available Volume =	87,400	cf
WQv =	14,683	cf
WQV Vol. Depth =	1.47	ft
WQV Vol. Elevation =	283.10	ft
Equiv. WQ Orifice =	1	
Orifice Invert Elevation =	281.50	ft
Orifice Diameter =	2.7	in
Weir Length =	15	ft
Weir Crest =	290.25	ft
Area Orifice 1 =	1	
Area Orifice Elevation =	286.0	ft
Orifice Area =	1'L x 0.5'H	ft^2
Stored Volume =	41,400	cf
Barrel Diameter =	24	in
# of Barrels =	1	
Upstream Invert =	281.00	ft
Downstream Invert =	279.00	ft
Length =	250	ft
Slope =	0.0080	ft/ft

STORMWATER CONTROL MEASURE ROUTING RESULTS

Return Period	Inflow [cfs]	Outflow [cfs]	Max. WSE [ft]	Freeboard [ft]
1-Year	27.96	0.63	286.18	4.82
2-Year	33.68	2.04	286.70	4.30
10-Year	44.21	4.37	288.84	2.16
25-Year	48.97	5.32	290.20	0.80
100-Year	55.43	18.02	290.67	0.33

MISCELLANEOUS SITE INFORMATION

N

0 200 400 800 Feet

1 inch = 400 feet

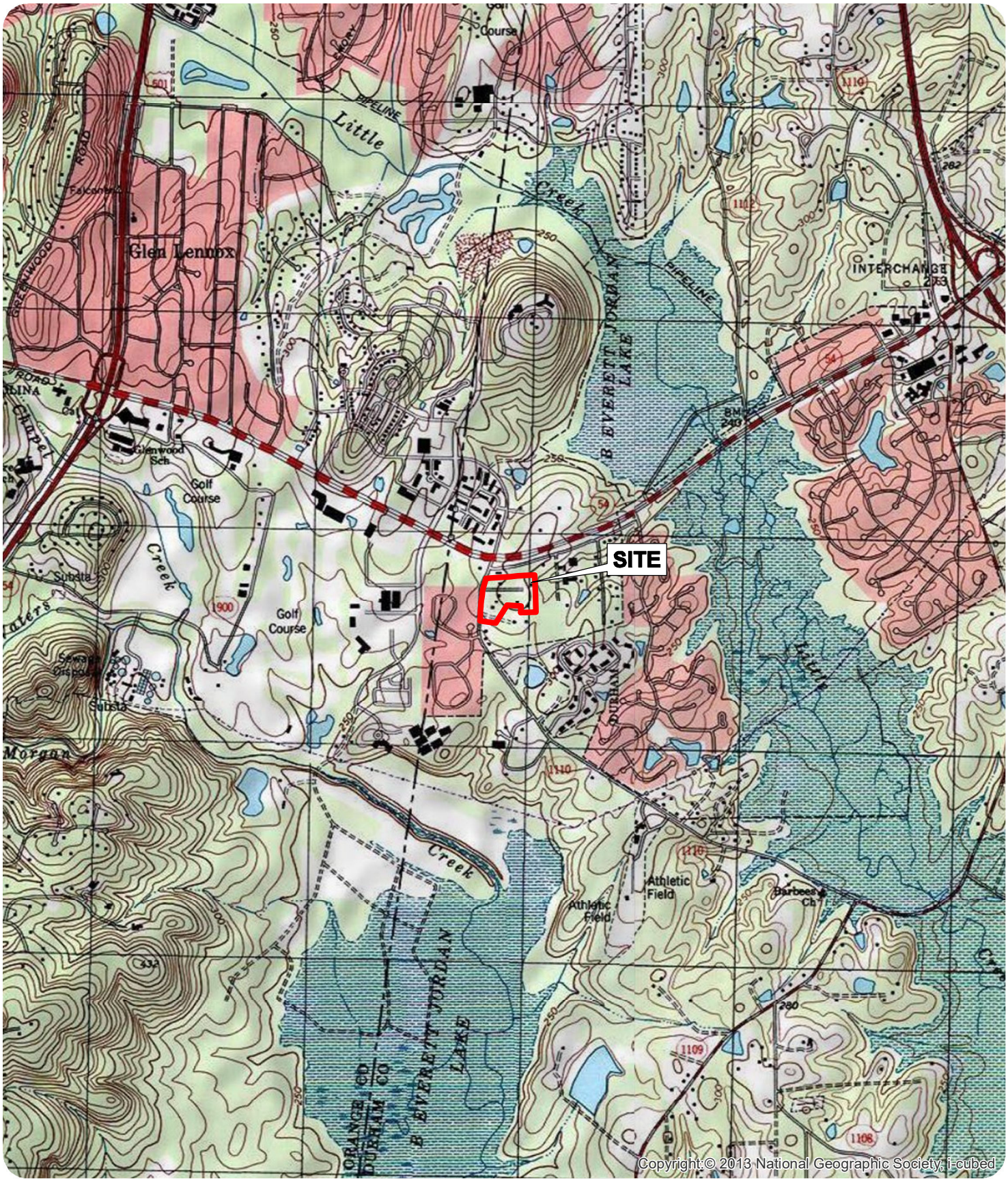
BARBEE CHAPEL APARTMENTS

SITE AERIAL MAP

PROJECT #: TLA-22001

CHAPEL HILL, NORTH CAROLINA

McADAMS



N

0 1,000 2,000 4,000 Feet

1 inch = 2,000 feet

BARBEE CHAPEL

USGS TOPO MAP

PROJECT #: TLA-22001

CHAPEL HILL, NORTH CAROLINA

MCADAMS

Hydrologic Soil Group—Durham County, North Carolina
(XPL)

Map Scale: 1:1,890 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 25 50 100 150

Feet
0 50 100 200 300

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 Rating Polygons

A
A/D
B
B/D
C
C/D
D
Not rated or not available

Soil Rating Lines

A
A/D
B
B/D
C
C/D
D
Not rated or not available

Soil Rating Points

A
A/D
B
B/D
C
C/D
D
Not rated or not available

Water Features

Streams and Canals

Transportation

Rails
Interstate Highways
US Routes
Major Roads
Local Roads

Background

Aerial Photography

MAP INFORMATION

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

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
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: Durham County, North Carolina
Survey Area Data: Version 26, Jan 21, 2022

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

Date(s) aerial images were photographed: Apr 23, 2022—Apr 27, 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.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
WsB	White Store sandy loam, 2 to 6 percent slopes	D	9.1	86.5%
WsC	White Store sandy loam, 6 to 10 percent slopes	D	1.4	13.5%
Totals for Area of Interest			**10.5**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

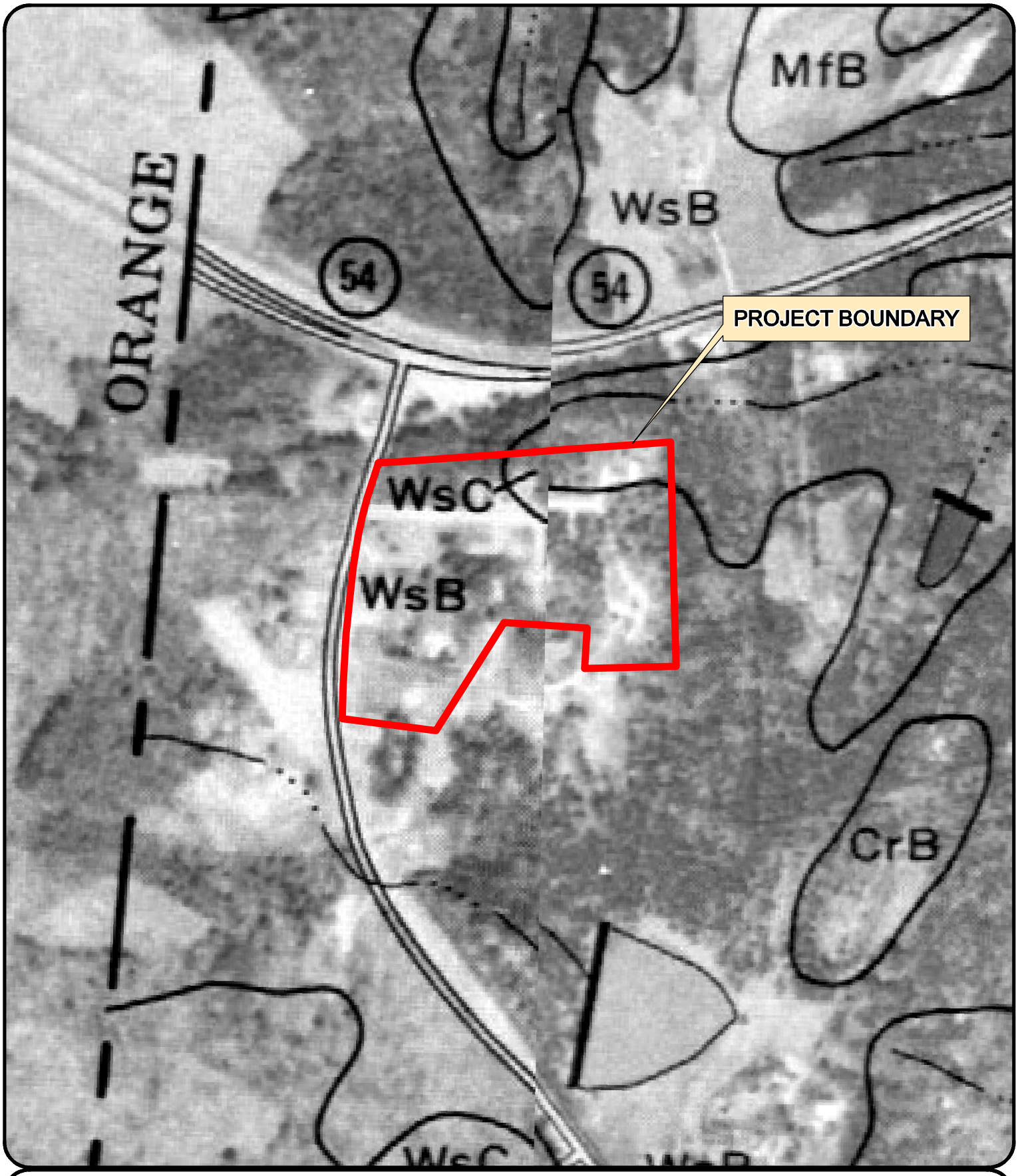
If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher



N

0 162.5 325 650 Feet

1 inch = 325 feet

BARBEE CHAPEL APARTMENTS

SOIL MAP

PROJECT #: TLA-22001

CHAPEL HILL, NORTH CAROLINA

McADAMS

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 to floodplain management to decrease the costs associated with flooding. This is demonstrated by the State's commitment to map flood hazard 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.

FLOOD HAZARD INFORMATION

SEE FIS REPORT FOR ZONE DESCRIPTIONS AND INDEX MAP

THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT HTTP://FRIS.NC.GOV/FRIS

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*

OTHER AREAS
- Areas Determined to be Outside the 0.2% Annual Chance Floodplain *Zone X*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Accredited or Provisionally Accredited Levee, Dike, or Floodwall
- Non-accredited Levee, Dike, or Floodwall
- BM5510 North Carolina Geodetic Survey bench mark
- BM5510 National Geodetic Survey bench mark
- BM5510 Contractor Est. NCFMP Survey bench mark
- 012 18.2 Cross Sections with 1% Annual Chance Water Surface Elevation (BFE)
- 8 Coastal Transect
- Coastal Transect Baseline

OTHER FEATURES
- Profile Baseline
- Hydrographic Feature
- Limit of Study
- Jurisdiction Boundary

NOTES TO USERS

For information and questions about this map, available products associated with this FIRM including historic versions of this FIRM, how to order products or the National Flood Insurance Program in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Map Service Center website at http://msc.fema.gov. 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 http://www.ncfloodmaps.com, or contact the FEMA Map Service Center.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Map Service Center at the number listed above.

For community and countywide map dates refer to the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in the community, contact your Insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

Flood Insurance Study (FIS) means an examination, evaluation, and determination of flood hazards, corresponding water surface elevations, flood hazard risk zones, and other flood data in a community issued by the North Carolina Floodplain Mapping Program (NCFMP). The Flood Insurance Study (FIS) is comprised of the following products used together: the Digital Flood Hazard Database, the Water Surface Elevation Rasters, the digitally derived, autogenerated Flood Insurance Rate Map and the Flood Insurance Survey Report. A Flood Insurance Survey is a compilation and presentation of flood risk data for specific watercourses, lakes, and coastal flood hazard areas within a community. This report contains detailed flood elevation data, data tables and FIRM indices. When a flood study is completed for the NFIP, the digital information, reports and maps are assembled into an FIS. Information shown on this FIRM is provided in digital format by the NCFMP. Base map information shown on this FIRM was provided in digital format by the NCFMP. The source of this information can be determined from the metadata available in the digital FLOOD database and in the Technical Support Data Notebook (TSDN).

ACCREDITED LEVEE NOTES TO USERS: If an accredited levee note appears on this panel check with your local community to obtain more information, such as the estimated level of protection provided (which may exceed the 1-percent-annual-chance level) and Emergency Action Plan, on the levee system(s) shown as providing protection. To mitigate flood risk in residual risk areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures. For more information on flood insurance, interested parties should visit the FEMA Website at http://www.fema.gov/business/nfip/index.shtm.

PROVISIONALLY ACCREDITED LEVEE NOTES TO USERS: If a Provisionally Accredited Levee (PAL) note appears on this panel, check with your local community to obtain more information, such as the estimated level of protection provided (which may exceed the 1-percent-annual-chance level) and Emergency Action Plan, on the levee system(s) shown as providing protection. To maintain accreditation, the levee owner or community is required to submit the data and documentation necessary to comply with Section 65.10 of the NFIP regulations. If the community or owner does not provide the necessary data and documentation or if the data and documentation provided indicates the levee system does not comply with Section 65.10 requirements, FEMA will revise the flood hazard and risk information for this area to reflect de-accreditation of the levee system. To mitigate flood risk in residual risk areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures. For more information on flood insurance, interested parties should visit the FEMA Website at http://www.fema.gov/business/nfip/index.shtm.

LIMIT OF MODERATE WAVE ACTION NOTES TO USERS: For some coastal flooding zones the AE Zone category has been divided by a Limit of Moderate Wave Action (LiMWA). The LiMWA represents the approximate landward limit of the 1.5-foot breaking wave. The effects of wave hazards between the VE Zone and the LiMWA (or between the shoreline and the LiMWA for areas where VE Zones are not identified) will be similar to, but less severe than those in the VE Zone.

Limit of Moderate Wave Action (LiMWA)

COASTAL BARRIER RESOURCES SYSTEM (CBRS) NOTE

This map may include approximate boundaries of the CBRS for informational purposes only. Flood insurance is not available within CBRS areas for structures that are newly built or substantially improved on or after the date(s) indicated on the map. For more information see http://www.fws.gov/cbra, the FIS Report, or call the U.S. Fish and Wildlife Service Customer Service Center at 1-800-344-WILD.

CBRS Area Otherwise Protected Area

SCALE

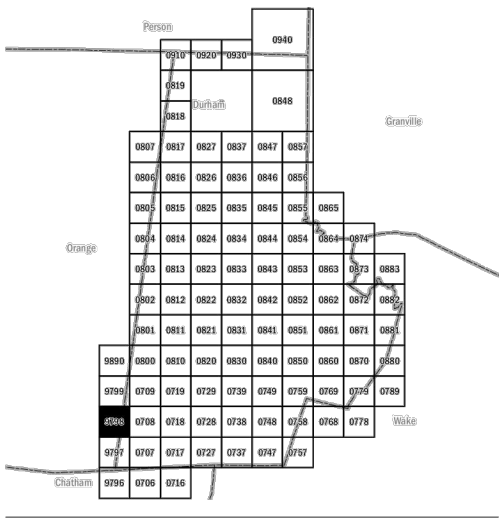
Map Projection:
North Carolina State Plane Projection Feet (Zone 3200)
Datum: NAD 1983 (Horizontal), NAVD 1988 (Vertical)

1 inch = 500 feet 1:6,000

0 250 500 1,000 Feet

0 75 150 300 Meters

PANEL LOCATOR



NORTH CAROLINA FLOODPLAIN MAPPING PROGRAM
NATIONAL FLOOD INSURANCE PROGRAM
FLOOD INSURANCE RATE MAP

NORTH CAROLINA

PANEL 9798

Panel Contains:

COMMUNITY	CID	PANEL	SUFFIX
CHAPEL HILL, TOWN OF	370180	9798	L
DURHAM COUNTY	370085	9798	L
DURHAM, CITY OF	370086	9798	L

FEMA National Flood Insurance Program

VERSION NUMBER
2.3.3.2

MAP NUMBER
3710979800L

MAP REVISED
October 19, 2018

LOGO LOGO

Name of Stream	Description	Class	Class Date	Index No.
Neville Creek	From source to a point 0.5 mile upstream of mouth	WS-II;HQW,NSW	08/03/92	16-41-2-2-1-(1)
Neville Creek	From a point 0.5 mile upstream of mouth to Phils Creek	WS-II;HQW,NSW, CA	08/03/92	16-41-2-2-1-(2)
Pritchards Mill Creek (Mill Creek)	From source to a point 0.5 mile upstream of mouth	WS-II;HQW,NSW	08/03/92	16-41-2-3-(0.5)
Cumbo Creek	From source to Pritchards Mill Creek	WS-II;HQW,NSW	08/03/92	16-41-2-3-1
Pritchards Mill Creek (Mill Creek)	From a point 0.5 mile upstream of mouth to University Lake, Morgan Creek	WS-II;HQW,NSW, CA	08/03/92	16-41-2-3-(2)
Price Creek	From source to University Lake, Morgan Creek	WS-II;HQW,NSW, CA	08/03/92	16-41-2-4
East Branch Price Creek	From source to a point 0.2 mile upstream of mouth	WS-II;HQW,NSW	08/03/92	16-41-2-4-1-(1)
East Branch Price Creek	From a point 0.2 mile upstream of mouth to Price Creek	WS-II;HQW,NSW, CA	08/03/92	16-41-2-4-1-(2)
West Branch Price Creek	From source to a point 0.3 mile upstream of mouth	WS-II;HQW,NSW	08/03/92	16-41-2-4-2-(1)
West Branch Price Creek	From a point 0.3 mile upstream of mouth to Price Creek	WS-II;HQW,NSW, CA	08/03/92	16-41-2-4-2-(2)
Morgan Creek	From dam at University Lake to Orange County SR 1919	WS-V;NSW	08/11/09	16-41-2-(5)
Morgan Creek	From Orange County SR 1919 to Chatham County SR 1726 (Durham County SR 1109)	WS-IV;NSW	08/03/92	16-41-2-(5.5)
Wilson Creek	From source to Morgan Creek	WS-IV;NSW	08/03/92	16-41-2-6
Fan Branch	From source to Wilson Creek	WS-IV;NSW	08/03/92	16-41-2-6-1
Meeting of the Waters	From source to Morgan Creek	WS-IV;NSW	08/03/92	16-41-2-7
Chapel Creek	From source to Morgan Creek	WS-IV;NSW	08/03/92	16-41-2-8
Buck Branch	From source to Morgan Creek	WS-IV;NSW	08/03/92	16-41-2-9
Morgan Creek (including the Morgan Creek Arm of New Hope River Arm of B. Everett Jordan Lake)	From Chatham County SR 1726 (Durham County SR 1109) to New Hope Creek Arm of New Hope River Arm of B. Everett Jordan Lake	WS-IV;NSW,CA	08/03/92	16-41-2-(9.5)
Cub Creek	From source to a point 0.7 mile downstream of Chatham County SR 1008	WS-IV;NSW	08/03/92	16-41-2-10-(0.5)
Big Branch (Clearwater Lake)	From source to Cub Creek	WS-IV;NSW	08/03/92	16-41-2-10-1
Cub Creek	From a point 0.7 mile downstream of Chatham County SR 1008 to Morgan Creek Arm of New Hope River Arm of B. Everett Jordan Lake	WS-IV;NSW,CA	08/03/92	16-41-2-10-(2)
Lick Creek	From source to N.C. Hwy. 751	WS-IV;NSW	08/03/92	16-41-2.5-(1)
Lick Creek	From N.C. Hwy. 751 to New Hope River Arm of B. Everett Jordan Lake	WS-IV;NSW,CA	08/03/92	16-41-2.5-(2)
Folkner Branch	From source to a point 0.5 mile upstream of mouth	WS-IV;NSW	08/03/92	16-41-3-(1)
Folkner Branch	From a point 0.5 mile upstream of mouth to New Hope River Arm of B. Everett Jordan Lake	WS-IV;NSW,CA	08/03/92	16-41-3-(2)

Name of Stream	Description	Class	Class Date	Index No.
New Hope River Arm of B. Everett Jordan Lake (below normal pool elevation)	From source at confluence of Morgan Creek and New Hope Creek Arms of B. Everett Jordan Lake (a east-west line across the southern tip of the formed penisula) to Chatham County SR 1008	WS-IV,B;NSW,CA	08/03/92	16-41-(0.5)
New Hope Creek	From source to a point 0.3 mile upstream of Durham County SR 2220	WS-V;NSW	08/11/09	16-41-1-(0.5)
Long Branch	From source to New Hope Creek	WS-V;NSW	08/11/09	16-41-1-2
Garrett Branch	From source to New Hope Creek	WS-V;NSW	08/11/09	16-41-1-3
Steep Bottom Creek	From source to New Hope Creek	WS-V;NSW	08/11/09	16-41-1-4
Mountain Creek	From source to New Hope Creek	WS-V;NSW	08/11/09	16-41-1-5
Unnamed Tributary at Camp New Hope (Camp New Hope Lake)	From source to New Hope Creek	WS-V;NSW	08/11/09	16-41-1-6
Old Field Creek	From source to New Hope Creek	WS-V;NSW	08/11/09	16-41-1-7
Piney Mountain Creek (Little Creek)	From source to New Hope Creek	WS-V;NSW	08/11/09	16-41-1-8
Church Branch	From source to New Hope Creek	WS-V;NSW	08/11/09	16-41-1-9
Mud Creek	From source to New Hope Creek	WS-V;NSW	08/11/09	16-41-1-10
Sandy Creek	From source to New Hope Creek	WS-V;NSW	08/11/09	16-41-1-11
New Hope Creek	From a point 0.3 mile upstream of Durham County SR 2220 to a point 0.8 mile downstream of Durham County SR 1107	WS-IV;NSW	08/03/92	16-41-1-(11.5)
Third Fork Creek	From source to a point 2.0 miles upstream of N.C. Hwy. 54	WS-V;NSW	08/11/09	16-41-1-12-(1)
Third Fork Creek	From a point 2.0 miles upstream of N.C. Hwy. 54 to New Hope Creek	WS-IV;NSW	08/03/92	16-41-1-12-(2)
Gum Creek	From source to New Hope Creek	WS-IV;NSW	08/03/92	16-41-1-13
New Hope Creek (including New Hope Creek Arm of New Hope River Arm of B. Everett Jordan Lake)	From a point 0.8 mile downstream of Durham County SR 1107 to confluence with Morgan Creek Arm of New Hope River Arm of B. Everett Jordan Lake	WS-IV;NSW,CA	08/03/92	16-41-1-(14)
Little Creek	From source to a point 0.7 mile downstream of Durham County SR 1110	WS-IV;NSW	08/03/92	16-41-1-15-(0.5)
Bolin Creek (Hogan Lake)	From source to U.S. Hwy. 501 Business	WS-V;NSW	08/11/09	16-41-1-15-1-(0.5)
Jones Creek	From source to Bolin Creek	WS-V;NSW	08/11/09	16-41-1-15-1-1
Buckhorn Branch	From source to Jones Creek	WS-V;NSW	08/11/09	16-41-1-15-1-1-1
Jolly Branch	From source to Bolin Creek	WS-V;NSW	08/11/09	16-41-1-15-1-2
Tanbark Branch	From source to Bolin Creek	WS-V;NSW	08/11/09	16-41-1-15-1-3
Bolin Creek	From U.S. Hwy. 501 Business to Little Creek	WS-IV;NSW	08/03/92	16-41-1-15-1-(4)
Booker Creek (Eastwood Lake)	From source to dam at Eastwood Lake	WS-V,B;NSW	08/11/09	16-41-1-15-2-(1)
Crow Branch	From source to Booker Creek	B;NSW	12/01/83	16-41-1-15-2-2

NOAA Atlas 14, Volume 2, Version 3
Location name: Chapel Hill, North Carolina, USA*
Latitude: 35.9001°, Longitude: -79.0068°
Elevation: 302.86 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	**0.409** (0.375-0.447)	**0.481** (0.441-0.525)	**0.552** (0.507-0.604)	**0.612** (0.560-0.667)	**0.672** (0.612-0.733)	**0.716** (0.650-0.780)	**0.755** (0.681-0.822)	**0.788** (0.707-0.859)	**0.823** (0.732-0.899)	**0.852** (0.751-0.932)
10-min	**0.654** (0.599-0.714)	**0.769** (0.705-0.840)	**0.884** (0.812-0.967)	**0.978** (0.895-1.07)	**1.07** (0.976-1.17)	**1.14** (1.03-1.24)	**1.20** (1.08-1.31)	**1.25** (1.12-1.36)	**1.30** (1.16-1.42)	**1.34** (1.18-1.47)
15-min	**0.817** (0.749-0.893)	**0.967** (0.887-1.06)	**1.12** (1.03-1.22)	**1.24** (1.13-1.35)	**1.36** (1.24-1.48)	**1.44** (1.31-1.57)	**1.52** (1.37-1.65)	**1.58** (1.41-1.72)	**1.64** (1.46-1.79)	**1.68** (1.48-1.84)
30-min	**1.12** (1.03-1.22)	**1.34** (1.23-1.46)	**1.59** (1.46-1.74)	**1.79** (1.64-1.96)	**2.01** (1.83-2.19)	**2.17** (1.97-2.37)	**2.32** (2.10-2.53)	**2.45** (2.20-2.68)	**2.61** (2.32-2.85)	**2.73** (2.40-2.98)
60-min	**1.40** (1.28-1.53)	**1.68** (1.54-1.83)	**2.04** (1.87-2.23)	**2.33** (2.14-2.55)	**2.68** (2.44-2.92)	**2.95** (2.67-3.21)	**3.20** (2.89-3.48)	**3.44** (3.09-3.75)	**3.74** (3.33-4.09)	**3.98** (3.51-4.35)
2-hr	**1.67** (1.52-1.83)	**2.00** (1.83-2.20)	**2.46** (2.25-2.70)	**2.84** (2.58-3.11)	**3.30** (2.99-3.61)	**3.68** (3.31-4.02)	**4.04** (3.61-4.42)	**4.40** (3.90-4.81)	**4.86** (4.28-5.32)	**5.25** (4.57-5.75)
3-hr	**1.77** (1.62-1.95)	**2.14** (1.96-2.34)	**2.63** (2.41-2.89)	**3.06** (2.79-3.34)	**3.58** (3.25-3.91)	**4.02** (3.63-4.39)	**4.45** (3.98-4.86)	**4.89** (4.34-5.34)	**5.48** (4.80-5.98)	**5.97** (5.18-6.55)
6-hr	**2.13** (1.96-2.33)	**2.57** (2.36-2.80)	**3.16** (2.90-3.45)	**3.68** (3.37-4.01)	**4.34** (3.95-4.72)	**4.89** (4.42-5.32)	**5.45** (4.88-5.92)	**6.02** (5.34-6.54)	**6.80** (5.94-7.39)	**7.47** (6.44-8.14)
12-hr	**2.52** (2.33-2.75)	**3.03** (2.80-3.31)	**3.76** (3.46-4.09)	**4.40** (4.03-4.78)	**5.24** (4.76-5.67)	**5.95** (5.37-6.43)	**6.68** (5.97-7.21)	**7.46** (6.58-8.03)	**8.52** (7.39-9.18)	**9.44** (8.06-10.2)
24-hr	**2.95** (2.76-3.15)	**3.56** (3.34-3.81)	**4.45** (4.17-4.75)	**5.15** (4.81-5.49)	**6.09** (5.67-6.51)	**6.83** (6.35-7.30)	**7.59** (7.03-8.13)	**8.37** (7.73-8.98)	**9.45** (8.68-10.2)	**10.3** (9.41-11.1)
2-day	**3.44** (3.22-3.68)	**4.15** (3.89-4.44)	**5.14** (4.82-5.50)	**5.91** (5.52-6.32)	**6.94** (6.46-7.43)	**7.76** (7.20-8.30)	**8.58** (7.94-9.20)	**9.43** (8.69-10.1)	**10.6** (9.70-11.4)	**11.5** (10.5-12.4)
3-day	**3.64** (3.41-3.90)	**4.38** (4.10-4.68)	**5.40** (5.06-5.78)	**6.20** (5.80-6.63)	**7.28** (6.78-7.79)	**8.13** (7.55-8.71)	**9.00** (8.32-9.65)	**9.89** (9.11-10.6)	**11.1** (10.2-12.0)	**12.1** (11.0-13.0)
4-day	**3.84** (3.60-4.11)	**4.61** (4.32-4.92)	**5.66** (5.31-6.05)	**6.49** (6.07-6.94)	**7.62** (7.10-8.15)	**8.51** (7.89-9.11)	**9.42** (8.71-10.1)	**10.3** (9.53-11.1)	**11.6** (10.6-12.5)	**12.6** (11.5-13.7)
7-day	**4.41** (4.16-4.70)	**5.26** (4.96-5.61)	**6.40** (6.02-6.82)	**7.29** (6.85-7.77)	**8.51** (7.97-9.07)	**9.47** (8.84-10.1)	**10.5** (9.73-11.2)	**11.5** (10.6-12.3)	**12.9** (11.8-13.8)	**13.9** (12.8-15.0)
10-day	**5.02** (4.74-5.34)	**5.96** (5.63-6.34)	**7.16** (6.75-7.61)	**8.10** (7.62-8.60)	**9.36** (8.78-9.96)	**10.4** (9.69-11.0)	**11.4** (10.6-12.1)	**12.4** (11.5-13.2)	**13.8** (12.7-14.7)	**14.9** (13.7-15.9)
20-day	**6.71** (6.33-7.11)	**7.91** (7.47-8.38)	**9.34** (8.82-9.89)	**10.5** (9.88-11.1)	**12.0** (11.3-12.7)	**13.2** (12.4-14.1)	**14.5** (13.5-15.4)	**15.7** (14.6-16.8)	**17.4** (16.1-18.6)	**18.7** (17.2-20.1)
30-day	**8.33** (7.89-8.82)	**9.80** (9.27-10.4)	**11.4** (10.8-12.0)	**12.6** (11.9-13.3)	**14.2** (13.4-15.1)	**15.5** (14.6-16.4)	**16.7** (15.7-17.7)	**18.0** (16.8-19.1)	**19.6** (18.3-20.9)	**20.9** (19.4-22.3)
45-day	**10.6** (10.1-11.2)	**12.4** (11.8-13.1)	**14.2** (13.5-14.9)	**15.6** (14.8-16.4)	**17.4** (16.5-18.3)	**18.8** (17.8-19.8)	**20.2** (19.0-21.3)	**21.5** (20.2-22.7)	**23.3** (21.8-24.6)	**24.6** (23.0-26.1)
60-day	**12.7** (12.2-13.4)	**14.8** (14.2-15.6)	**16.8** (16.0-17.6)	**18.2** (17.4-19.1)	**20.1** (19.1-21.1)	**21.5** (20.5-22.6)	**22.9** (21.7-24.1)	**24.3** (22.9-25.6)	**26.0** (24.5-27.4)	**27.3** (25.7-28.8)

[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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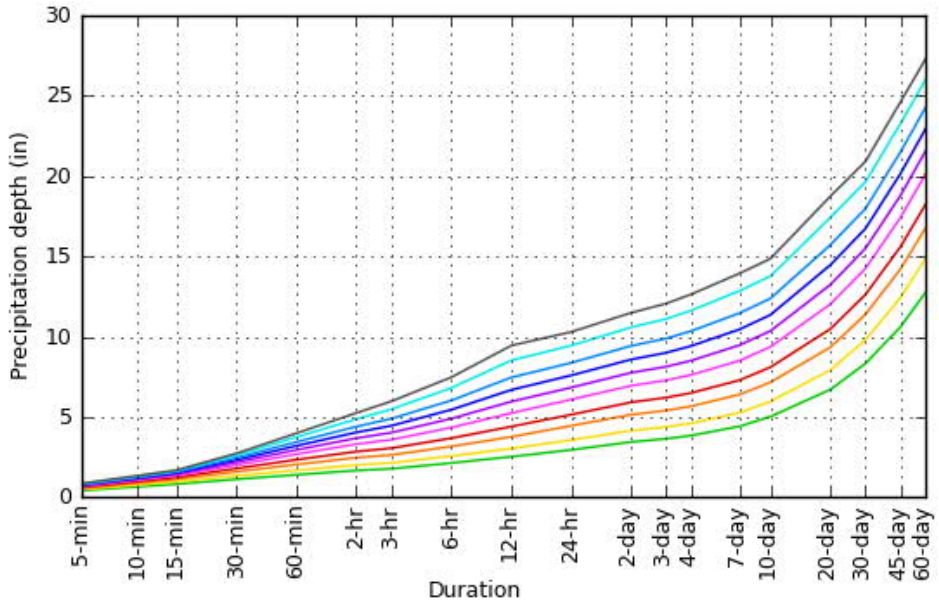
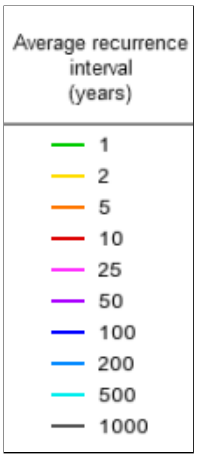
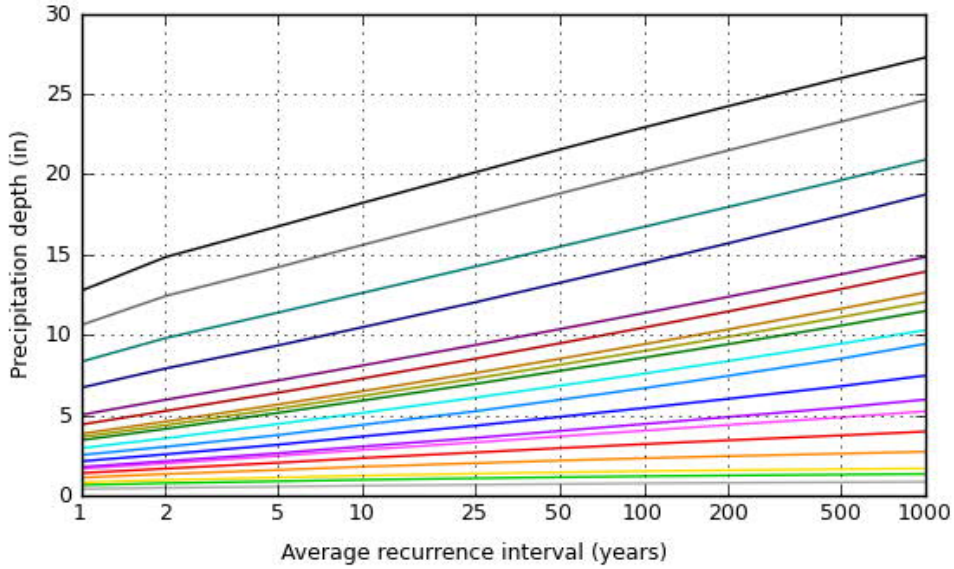
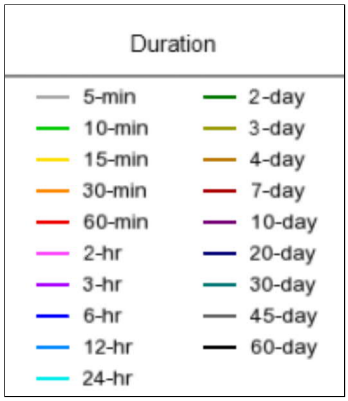
PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 35.9001°, Longitude: -79.0068°









NOAA Atlas 14, Volume 2, Version 3

Created (GMT): Fri Aug 26 14:57:38 2022

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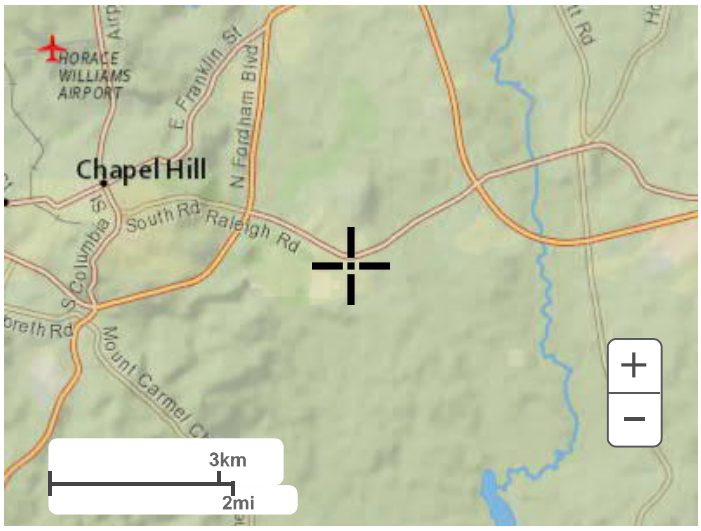
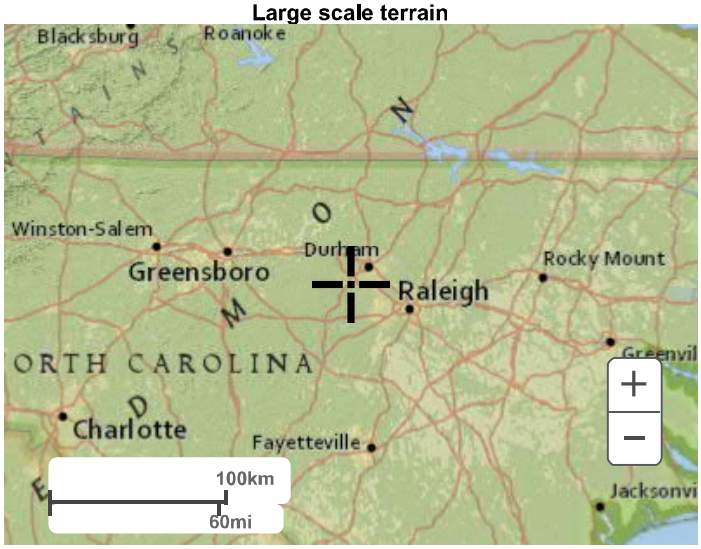
Maps & aerials

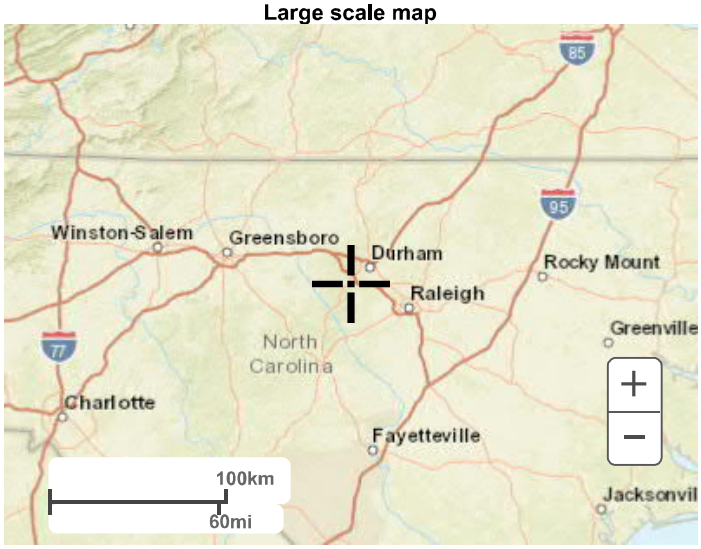
Small scale terrain



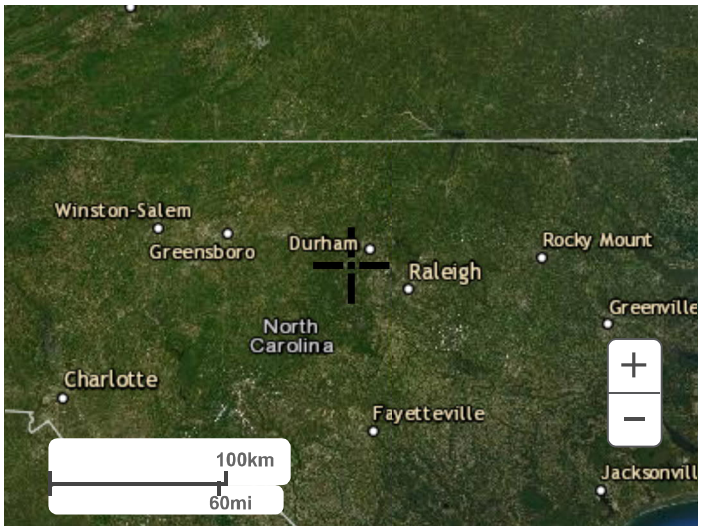
Large scale terrain



Large scale map



Large scale aerial



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National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

PRE-DEVELOPMENT HYDROLOGIC CALCULATIONS

BARBEE CHAPEL APARTMENTS

TLA-22001

BARBEE CHAPEL APTS
TLA-22001

PRE-DEVELOPMENT HYDROLOGY
Summary of Results

O. LEFEVRE, EI
9/27/2022

HYDROLOGY INPUT SUMMARY

Sub-basin ID	Onsite Area [acres]					Offsite Area [acres]					Total Area [acres]	SCS CN	Tc [min]
	Impervious	Open	Wooded	Pond	Total	Impervious	Open	Wooded	Pond	Total			
1	0.91	1.69	3.57	0.00	6.17	0.00	0.14	0.00	0.00	0.14	6.32	81	18.52
2	0.35	0.88	0.48	0.00	1.71	0.00	0.00	0.00	0.00	0.00	1.71	83	15.33
3	0.33	0.56	1.42	0.00	2.31	0.00	0.00	0.00	0.00	0.00	2.31	81	14.11
4	0.10	0.14	0.03	0.00	0.27	0.00	0.00	0.00	0.00	0.00	0.27	86	12.81
Totals =	1.69	3.27	5.50	0.00	**10.46**	0.00	0.14	0.00	0.00	0.14	**10.61**		

NUTRIENT INPUT SUMMARY

****Jordan/Falls Lake Stormwater Nutrient Load Accounting Tool Inputs*

Land Use	Area (sf)	Area (ac)
Roadway Area	18,322	0.42
Driveway / Parking	28,204	0.65
Roof Area	24,391	0.56
Sidewalk / Patio	2,780	0.06
Open	142,541	3.27
Wooded	239,603	5.50
Pond	0	0.00
Total	**455,841**	**10.46**

I. SCS CURVE NUMBERS

Soils from WebSoilSurvey are only inclusive of indirectly connected areas

HSG	Impervious	Open	Wooded
A	98	39	30
B	98	61	55
C	98	74	70
D	98	80	77

Assume:

HSG 'A' =	0.0%
HSG 'B' =	0.0%
HSG 'C' =	0.0%
HSG 'D' =	100.0%

Cover Condition	SCS CN	Comments
Impervious	98	-
Open	80	Assume good condition
Wooded	77	Assume good condition

II. PRE-DEVELOPMENT

A. Onsite Impervious Breakdown

Contributing Area	Area [sf]	Area [ac]
Roadway Area	14,204	0.33
Driveway / Parking Lot	9,251	0.21
Roof	13,872	0.32
Sidewalk / Patio	2,372	0.05
Other	0	0.00
Totals	39,699	0.91

B. Watershed Land Use Breakdown

Contributing Area	SCS CN	Area [sf]	Area [acres]	Comments
Onsite impervious	98	39,699	0.91	-
Onsite open	80	73,713	1.69	Assume good condition
Onsite wooded	77	155,452	3.57	Assume good condition
Onsite pond	100	0	0.00	-
Offsite impervious	98	0	0.00	-
Offsite open	80	6,315	0.14	Assume good condition
Offsite wooded	77	0	0.00	Assume good condition
Offsite pond	100	0	0.00	-

Total area =	6.32	acres
	275,179	sf
Composite SCS CN =	81	
% Impervious =	14.4%	

III. TIME OF CONCENTRATION INFORMATION

Time of concentration is calculated using the SCS Segmental Approach (TR-55).

Segment 1: Overland Flow

Length =	100	ft
Top Elev =	306.50	ft
Bot Elev =	305.00	ft
Height =	1.5	ft
Slope =	0.0150	ft/ft
Manning's n =	0.24	dense grasses
P (2-year/24-hour) =	3.56	inches (Chapel Hill, NC)
Segment Time =	***15.16***	***minutes***

Segment 2: Concentrated Flow

Length =	538	ft
Top Elev =	305.00	ft
Bot Elev =	286.00	ft
Height =	19	ft
Slope =	0.0353	ft/ft
Paved ? =	No	
Velocity =	3.03	ft/sec
Segment Time =	***2.96***	***minutes***

Segment 3: Channel Flow

Length =	125	ft
Top Elev =	286.00	
Bot Elev =	284.00	
Height =	2	ft
Slope =	0.0160	ft/ft
Manning's n =	0.045	natural channel
Flow Area =	15.00	sf (assume 5'w x 3'h channel)
Wetted Perimeter =	11.00	lf (assume 5' x 3' channel)
Channel Velocity =	5.15	ft/sec
Segment Time =	***0.40***	***minutes***

Time of Concentration =	18.52	minutes
SCS Lag Time =	11.11	minutes (SCS Lag = 0.6* Tc)
Time Increment =	3.22	minutes (= 0.29*SCS Lag)

PRE-DEVELOPMENT HYDROLOGY

Subbasin 2

I. SCS CURVE NUMBERS

Soils from WebSoilSurvey are only inclusive of indirectly connected areas

HSG	Impervious	Open	Wooded
A	98	39	30
B	98	61	55
C	98	74	70
D	98	80	77

Assume:

HSG 'A' =	0.0%
HSG 'B' =	0.0%
HSG 'C' =	0.0%
HSG 'D' =	100.0%

Cover Condition	SCS CN	Comments
Impervious	98	-
Open	80	Assume good condition
Wooded	77	Assume good condition

II. PRE-DEVELOPMENT

A. Onsite Impervious Breakdown

Contributing Area	Area [sf]	Area [ac]
Roadway Area	2,943	0.07
Driveway / Parking Lot	7,520	0.17
Roof	4,807	0.11
Sidewalk / Patio	169	0.00
Other	0	0.00
Totals	15,439	0.35

B. Watershed Land Use Breakdown

Contributing Area	SCS CN	Area [sf]	Area [acres]	Comments
Onsite impervious	98	15,439	0.35	-
Onsite open	80	38,342	0.88	Assume good condition
Onsite wooded	77	20,888	0.48	Assume good condition
Onsite pond	100	0	0.00	-
Offsite impervious	98	0	0.00	-
Offsite open	80	0	0.00	Assume good condition
Offsite wooded	77	0	0.00	Assume good condition
Offsite pond	100	0	0.00	-

Total area =	1.71	acres
	74,669	sf
Composite SCS CN =	83	
% Impervious =	20.7%	

III. TIME OF CONCENTRATION INFORMATION

Time of concentration is calculated using the SCS Segmental Approach (TR-55).

Segment 1: Overland Flow			***Segment 2: Concentrated Flow***		
Length =	100	ft	Length =	367	ft
Top Elev =	306.50	ft	Top Elev =	304.50	ft
Bot Elev =	304.50	ft	Bot Elev =	288.50	ft
Height =	2	ft	Height =	16	ft
Slope =	0.0200	ft/ft	Slope =	0.0436	ft/ft
Manning's n =	0.24	dense grasses	Paved ? =	No	
P (2-year/24-hour) =	3.56	inches (Chapel Hill, NC)	Velocity =	3.37	ft/sec
Segment Time =	***13.51***	***minutes***	***Segment Time =***	***1.81***	***minutes***

Time of Concentration =	15.33	minutes
SCS Lag Time =	9.20	minutes (SCS Lag = 0.6* Tc)
Time Increment =	2.67	minutes (= 0.29*SCS Lag)

PRE-DEVELOPMENT HYDROLOGY

Subbasin 3

I. SCS CURVE NUMBERS

Soils from WebSoilSurvey are only inclusive of indirectly connected areas

HSG	Impervious	Open	Wooded
A	98	39	30
B	98	61	55
C	98	74	70
D	98	80	77

Assume:

HSG 'A' =	0.0%
HSG 'B' =	0.0%
HSG 'C' =	0.0%
HSG 'D' =	100.0%

Cover Condition	SCS CN	Comments
Impervious	98	-
Open	80	Assume good condition
Wooded	77	Assume good condition

II. PRE-DEVELOPMENT

A. Onsite Impervious Breakdown

Contributing Area	Area [sf]	Area [ac]
Roadway Area	0	0.00
Driveway / Parking Lot	11,433	0.26
Roof	2,839	0.07
Sidewalk / Patio	0	0.00
Other	0	0.00
Totals	14,272	0.33

B. Watershed Land Use Breakdown

Contributing Area	SCS CN	Area [sf]	Area [acres]	Comments
Onsite impervious	98	14,272	0.33	-
Onsite open	80	24,293	0.56	Assume good condition
Onsite wooded	77	61,869	1.42	Assume good condition
Onsite pond	100	0	0.00	-
Offsite impervious	98	0	0.00	-
Offsite open	80	0	0.00	Assume good condition
Offsite wooded	77	0	0.00	Assume good condition
Offsite pond	100	0	0.00	-

Total area =	2.31	acres
	100,434	sf
Composite SCS CN =	81	
% Impervious =	14.2%	

III. TIME OF CONCENTRATION INFORMATION

Time of concentration is calculated using the SCS Segmental Approach (TR-55).

Segment 1: Overland Flow			***Segment 2: Concentrated Flow***		
Length =	100	ft	Length =	236	ft
Top Elev =	305.00	ft	Top Elev =	302.75	ft
Bot Elev =	302.75	ft	Bot Elev =	293.00	ft
Height =	2.25	ft	Height =	10	ft
Slope =	0.0225	ft/ft	Slope =	0.0413	ft/ft
Manning's n =	0.24	dense grasses	Paved ? =	No	
P (2-year/24-hour) =	3.56	inches (Chapel Hill, NC)	Velocity =	3.28	ft/sec
Segment Time =	***12.91***	***minutes***	***Segment Time =***	***1.20***	***minutes***

Time of Concentration =	14.11	minutes
SCS Lag Time =	8.46	minutes (SCS Lag = 0.6* Tc)
Time Increment =	2.45	minutes (= 0.29*SCS Lag)

I. SCS CURVE NUMBERS

Soils from WebSoilSurvey are only inclusive of indirectly connected areas

HSG	Impervious	Open	Wooded
A	98	39	30
B	98	61	55
C	98	74	70
D	98	80	77

Assume:

HSG 'A' =	0.0%
HSG 'B' =	0.0%
HSG 'C' =	0.0%
HSG 'D' =	100.0%

Cover Condition	SCS CN	Comments
Impervious	98	-
Open	80	Assume good condition
Wooded	77	Assume good condition

II. PRE-DEVELOPMENT

A. Onsite Impervious Breakdown

Contributing Area	Area [sf]	Area [ac]
Roadway Area	1,175	0.03
Driveway / Parking Lot	0	0.00
Roof	2,873	0.07
Sidewalk / Patio	239	0.01
Other	0	0.00
Totals	4,287	0.10

B. Watershed Land Use Breakdown

Contributing Area	SCS CN	Area [sf]	Area [acres]	Comments
Onsite impervious	98	4,287	0.10	-
Onsite open	80	6,198	0.14	Assume good condition
Onsite wooded	77	1,394	0.03	Assume good condition
Onsite pond	100	0	0.00	-
Offsite impervious	98	0	0.00	-
Offsite open	80	0	0.00	Assume good condition
Offsite wooded	77	0	0.00	Assume good condition
Offsite pond	100	0	0.00	-

Total area =	0.27	acres
	11,879	sf
Composite SCS CN =	86	
% Impervious =	36.1%	

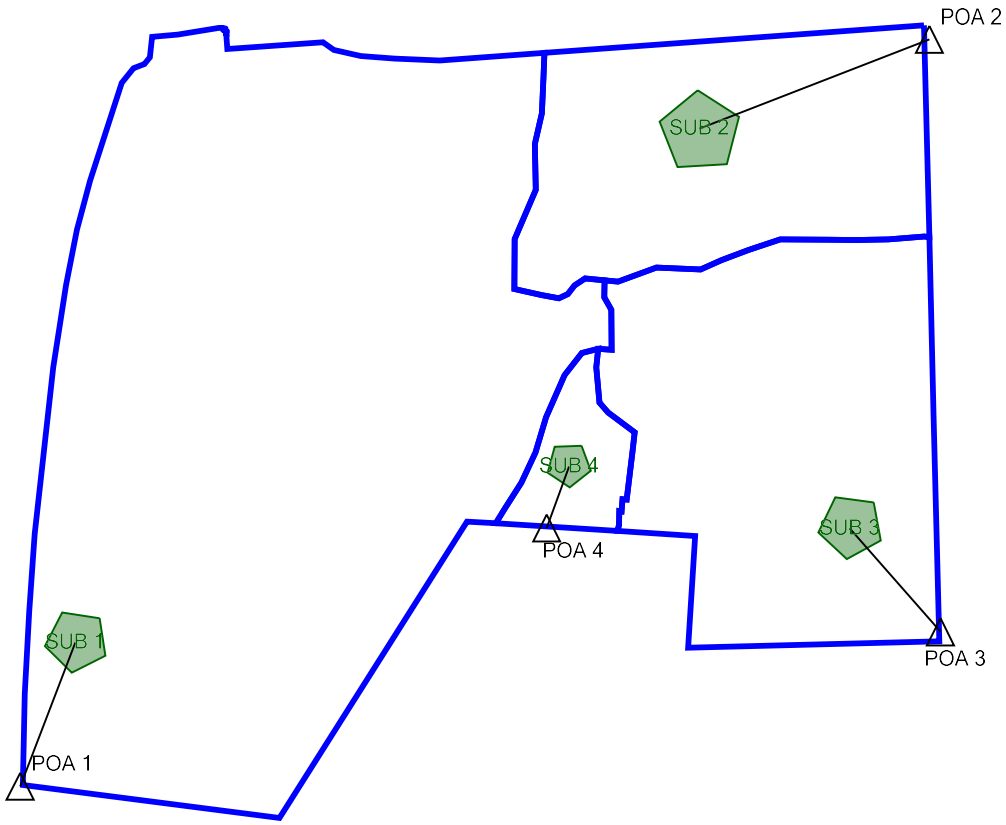
III. TIME OF CONCENTRATION INFORMATION

Time of concentration is calculated using the SCS Segmental Approach (TR-55).

Segment 1: Overland Flow			***Segment 2: Concentrated Flow***		
Length =	58	ft	Length =	115	ft
Top Elev =	306.00	ft	Top Elev =	305.50	ft
Bot Elev =	305.50	ft	Bot Elev =	301.50	ft
Height =	0.5	ft	Height =	4	ft
Slope =	0.0087	ft/ft	Slope =	0.0347	ft/ft
Manning's n =	0.24	dense grasses	Paved ? =	No	
P (2-year/24-hour) =	3.56	inches (Chapel Hill, NC)	Velocity =	3.01	ft/sec
Segment Time =	***12.18***	***minutes***	***Segment Time =***	***0.64***	***minutes***

Time of Concentration =	12.81	minutes
SCS Lag Time =	7.69	minutes (SCS Lag = 0.6* Tc)
Time Increment =	2.23	minutes (= 0.29*SCS Lag)

Scenario: Pre-Dev 1 yr



MCADAMS

FlexTable: Catchment Table (TLA-22001.ppc)

Current Time: 0.00 min

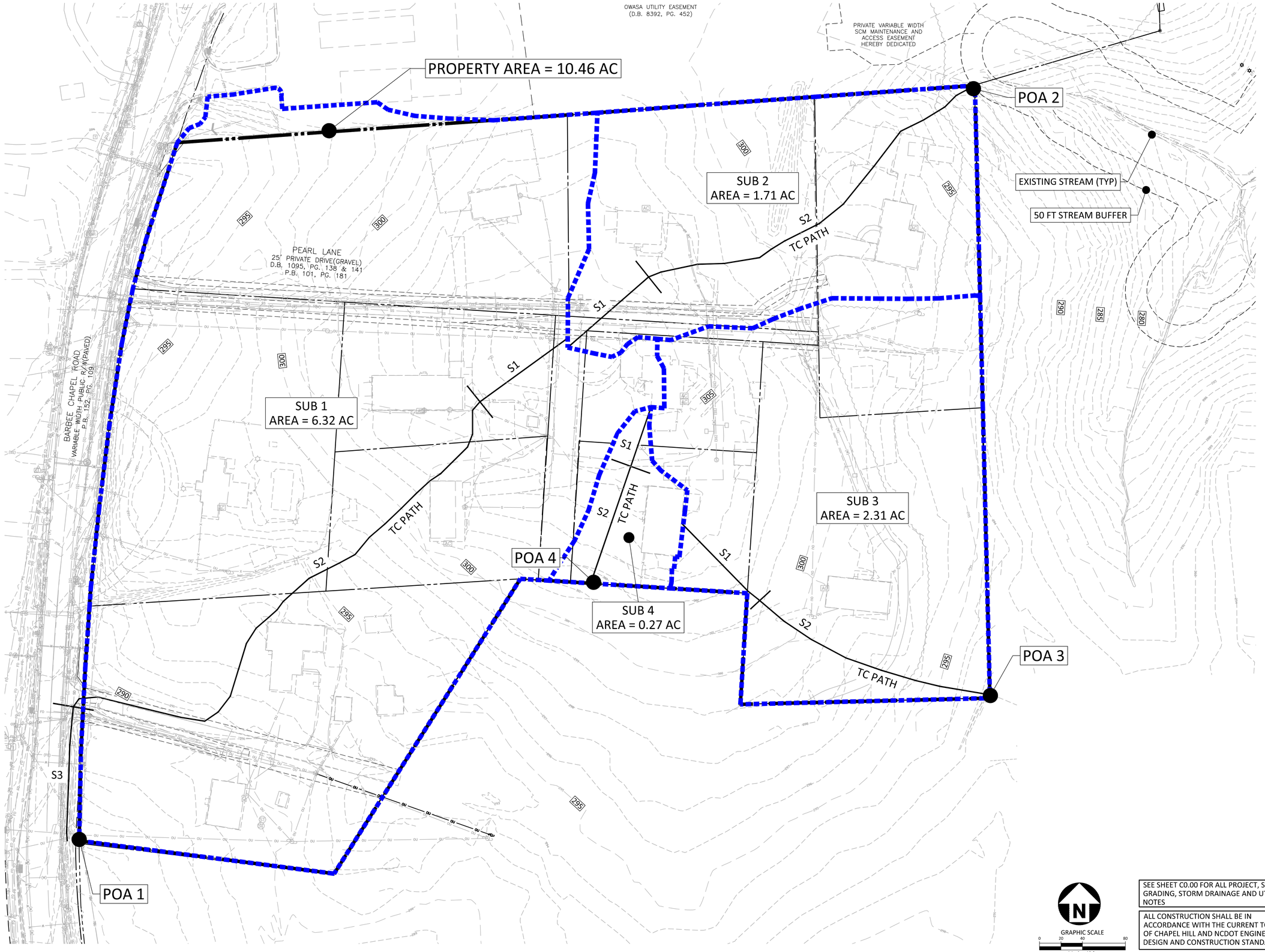
Label	Outflow Node	Area (ft²)	SCS CN	Time of Concentration (min)	Notes
SUB 1	POA 1	275,179	81	18.52	PRE
SUB 3	POA 3	100,434	81	14.11	PRE
SUB 2	POA 2	74,669	83	15.33	PRE
SUB 4	POA 4	11,879	86	12.81	PRE

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (min)	Peak Flow (ft^3/s)
SUB 1	Pre-Dev 1 yr	1	0.668	731.00	8.39
SUB 1	Pre-Dev 2 yr	2	0.921	731.00	11.51
SUB 1	Pre-Dev 25 yr	25	2.079	731.00	21.98
SUB 3	Pre-Dev 1 yr	1	0.244	728.00	3.54
SUB 3	Pre-Dev 2 yr	2	0.336	728.00	4.84
SUB 3	Pre-Dev 25 yr	25	0.760	728.00	9.11
SUB 2	Pre-Dev 1 yr	1	0.200	728.00	2.80
SUB 2	Pre-Dev 2 yr	2	0.272	728.00	3.76
SUB 2	Pre-Dev 25 yr	25	0.594	728.00	6.86
SUB 4	Pre-Dev 1 yr	1	0.037	726.00	0.56
SUB 4	Pre-Dev 2 yr	2	0.049	726.00	0.73
SUB 4	Pre-Dev 25 yr	25	0.102	726.00	1.26

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (min)	Peak Flow (ft^3/s)
POA 1	Pre-Dev 1 yr	1	0.668	731.00	8.39
POA 1	Pre-Dev 2 yr	2	0.921	731.00	11.51
POA 1	Pre-Dev 25 yr	25	2.079	731.00	21.98
POA 3	Pre-Dev 1 yr	1	0.244	728.00	3.54
POA 3	Pre-Dev 2 yr	2	0.336	728.00	4.84
POA 3	Pre-Dev 25 yr	25	0.760	728.00	9.11
POA 2	Pre-Dev 1 yr	1	0.200	728.00	2.80
POA 2	Pre-Dev 2 yr	2	0.272	728.00	3.76
POA 2	Pre-Dev 25 yr	25	0.594	728.00	6.86
POA 4	Pre-Dev 1 yr	1	0.037	726.00	0.56
POA 4	Pre-Dev 2 yr	2	0.049	726.00	0.73
POA 4	Pre-Dev 25 yr	25	0.102	726.00	1.26



McADAMS

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Toll Brothers APARTMENT LIVING

BARBEE CHAPEL APARTMENTS

CONDITIONAL ZONING PERMIT DRAWINGS

5101 BARBEE CHAPEL RD
CHAPEL HILL, NC 27517

REVISIONS

NO.	DATE	
	11.21.2022	REVISED PER 1ST CZP COMMENTS

PLAN INFORMATION

PROJECT NO.	TLA-22001
FILENAME	TLA22001-PRE
CHECKED BY	MCT
DRAWN BY	OVL
SCALE	1" = 40'
DATE	11.17.2022

SHEET

PRE-DEVELOPMENT DRAINAGE AREA MAP

PRE

GRAPHIC SCALE
0 20 40 80
1 inch = 40 ft.

SEE SHEET C0.00 FOR ALL PROJECT, SITE, GRADING, STORM DRAINAGE AND UTILITY NOTES

ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE CURRENT TOWN OF CHAPEL HILL AND NCDOT ENGINEERING DESIGN AND CONSTRUCTION STANDARDS

PRELIMINARY DRAWING - NOT RELEASED FOR CONSTRUCTION

M:\Projects\TLA\TLA22001\04-Production\Water Resources\CZP\Current Drawings\TLA22001-PRE.dwg, 11/18/2022 2:40:19 PM, Maria Torres

POST-DEVELOPMENT HYDROLOGIC CALCULATIONS

BARBEE CHAPEL APARTMENTS

TLA-22001

BARBEE CHAPEL APTS
TLA-22001

POST-DEVELOPMENT HYDROLOGY

Summary of Results

O. LEFEVRE, EI
11/17/2022

HYDROLOGY INPUT SUMMARY

Sub-basin ID	Onsite Area [acres]					Offsite Area [acres]					Total Area [acres]	SCS CN	Tc [min]
	Impervious	Open	Wooded	Pond	Total	Impervious	Open	Wooded	Pond	Total			
Sub 1 Bypass	0.22	0.53	0.00	0.00	0.75	0.00	0.15	0.00	0.00	0.15	0.90	84	5.00
Sub 1 to SCM A	1.65	0.66	0.00	0.00	2.31	0.00	0.00	0.00	0.00	0.00	2.31	93	5.00
Sub 2 Bypass	0.00	0.22	0.00	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.22	80	5.00
Sub 2 to SCM B	5.61	1.23	0.00	0.00	6.85	0.00	0.00	0.00	0.00	0.00	6.85	95	5.00
Sub 3	0.01	0.29	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.30	81	5.00
Sub 4	0.00	0.04	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.04	80	5.00
Totals =	7.49	2.97	0.00	0.00	**10.46**	0.00	0.15	0.00	0.00	0.15	**10.61**		

NUTRIENT INPUT SUMMARY

****Stormwater Nitrogen And Phosphorous Tool Inputs*

Land Use	Area (sf)	Area (ac)
Roadway Area	0	0.00
Driveway / Parking	174,156	4.00
Roof Area	99,215	2.28
Sidewalk / Patio	53,044	1.22
Open	129,426	2.97
Wooded	0	0.00
Pond	0	0.00
Total	**455,841**	**10.46**

BARBEE CHAPEL APTS
TLA-22001

POST-DEVELOPMENT HYDROLOGY

Subbasin 1 Bypass

O. LEFEVRE, EI
11/17/2022

I. SCS CURVE NUMBERS

HSG	Impervious	Open	Wooded
A	98	39	30
B	98	61	55
C	98	74	70
D	98	80	77

Assume:

HSG 'A' =	0.0%
HSG 'B' =	0.0%
HSG 'C' =	0.0%
HSG 'D' =	100.0%

Cover Condition	SCS CN	Comments
Impervious	98	-
Open	80	Assume good condition
Wooded	77	Assume good condition

II. POST-DEVELOPMENT

A. Onsite Impervious Breakdown

Contributing Area	Area [sf]	Area [ac]
Roadway Area	0	0.00
Driveway / Parking Lot	1,681	0.04
Roof	0	0.00
Sidewalk / Patio	7,918	0.18
Other	0	0.00
Totals	9,599	0.22

B. Watershed Land Use Breakdown

Contributing Area	SCS CN	Area [sf]	Area [acres]	Comments
Onsite impervious	98	9,599	0.22	-
Onsite open	80	23,276	0.53	Assume good condition
Onsite wooded	77	0	0.00	Assume good condition
Onsite pond	100	0	0.00	-
Offsite impervious	98	0	0.00	-
Offsite open	80	6,391	0.15	Assume good condition
Offsite wooded	77	0	0.00	Assume good condition
Offsite pond	100	0	0.00	-

Total area =	0.90	acres
	39,266	sf
Composite SCS CN =	84	
% Impervious =	24.4%	

III. TIME OF CONCENTRATION INFORMATION.

Time of concentration assumed to be 5 minutes.

Time of Concentration =	5.00	minutes
SCS Lag Time =	3.00	minutes (SCS Lag = 0.6* Tc)
Time Increment =	0.87	minutes (= 0.29*SCS Lag)

BARBEE CHAPEL APTS
TLA-22001

POST-DEVELOPMENT HYDROLOGY
Subbasin 1 to SCM A

O. LEFEVRE, EI
11/17/2022

I. SCS CURVE NUMBERS

HSG	Impervious	Open	Wooded
A	98	39	30
B	98	61	55
C	98	74	70
D	98	80	77

Assume:

HSG 'A' =	0.0%
HSG 'B' =	0.0%
HSG 'C' =	0.0%
HSG 'D' =	100.0%

Cover Condition	SCS CN	Comments
Impervious	98	-
Open	80	Assume good condition
Wooded	77	Assume good condition

II. POST-DEVELOPMENT

A. Onsite Impervious Breakdown

Contributing Area	Area [sf]	Area [ac]
Roadway Area	0	0.00
Driveway / Parking Lot	44,430	1.02
Roof	19,290	0.44
Sidewalk / Patio	8,022	0.18
Other	0	0.00
Totals	71,742	1.65

B. Watershed Land Use Breakdown

Contributing Area	SCS CN	Area [sf]	Area [acres]	Comments
Onsite impervious	98	71,742	1.65	-
Onsite open	80	28,771	0.66	Assume good condition
Onsite wooded	77	0	0.00	Assume good condition
Onsite pond	100	0	0.00	-
Offsite impervious	98	0	0.00	-
Offsite open	80	0	0.00	Assume good condition
Offsite wooded	77	0	0.00	Assume good condition
Offsite pond	100	0	0.00	-

Total area =	2.31	acres
	100,513	sf
Composite SCS CN =	93	
% Impervious =	71.4%	

III. TIME OF CONCENTRATION INFORMATION

Time of concentration assumed to be 5 minutes.

Time of Concentration =	5.00	minutes
SCS Lag Time =	3.00	minutes (SCS Lag = 0.6* Tc)
Time Increment =	0.87	minutes (= 0.29*SCS Lag)

BARBEE CHAPEL APTS
TLA-22001

POST-DEVELOPMENT HYDROLOGY
Subbasin 2 Bypass

O. LEFEVRE, EI
11/17/2022

I. SCS CURVE NUMBERS

HSG	Impervious	Open	Wooded
A	98	39	30
B	98	61	55
C	98	74	70
D	98	80	77

Assume:

HSG 'A' =	0.0%
HSG 'B' =	0.0%
HSG 'C' =	0.0%
HSG 'D' =	100.0%

Cover Condition	SCS CN	Comments
Impervious	98	-
Open	80	Assume good condition
Wooded	77	Assume good condition

II. POST-DEVELOPMENT

A. Onsite Impervious Breakdown

Contributing Area	Area [sf]	Area [ac]
Roadway Area	0	0.00
Driveway / Parking Lot	0	0.00
Roof	0	0.00
Sidewalk / Patio	0	0.00
Other	0	0.00
Totals	0	0.00

B. Watershed Land Use Breakdown

Contributing Area	SCS CN	Area [sf]	Area [acres]	Comments
Onsite impervious	98	0	0.00	-
Onsite open	80	9,465	0.22	Assume good condition
Onsite wooded	77	0	0.00	Assume good condition
Onsite pond	100	0	0.00	-
Offsite impervious	98	0	0.00	-
Offsite open	80	0	0.00	Assume good condition
Offsite wooded	77	0	0.00	Assume good condition
Offsite pond	100	0	0.00	-

Total area =	0.22	acres
	9,465	sf
Composite SCS CN =	80	
% Impervious =	0.0%	

III. TIME OF CONCENTRATION INFORMATION

Time of concentration assumed to be 5 minutes.

Time of Concentration =	5.00	minutes
SCS Lag Time =	3.00	minutes (SCS Lag = 0.6* Tc)
Time Increment =	0.87	minutes (= 0.29*SCS Lag)

BARBEE CHAPEL APTS
TLA-22001

POST-DEVELOPMENT HYDROLOGY
Subbasin 2 to SCM B

O. LEFEVRE, EI
11/17/2022

I. SCS CURVE NUMBERS

HSG	Impervious	Open	Wooded
A	98	39	30
B	98	61	55
C	98	74	70
D	98	80	77

Assume:

HSG 'A' =	0.0%
HSG 'B' =	0.0%
HSG 'C' =	0.0%
HSG 'D' =	100.0%

Cover Condition	SCS CN	Comments
Impervious	98	-
Open	80	Assume good condition
Wooded	77	Assume good condition

II. POST-DEVELOPMENT

A. Onsite Impervious Breakdown

Contributing Area	Area [sf]	Area [ac]
Roadway Area	0	0.00
Driveway / Parking Lot	128,045	2.94
Roof	79,925	1.83
Sidewalk / Patio	36,498	0.84
Other	0	0.00
Totals	244,468	5.61

B. Watershed Land Use Breakdown

Contributing Area	SCS CN	Area [sf]	Area [acres]	Comments
Onsite impervious	98	244,468	5.61	-
Onsite open	80	53,732	1.23	Assume good condition
Onsite wooded	77	0	0.00	Assume good condition
Onsite pond	100	0	0.00	-
Offsite impervious	98	0	0.00	-
Offsite open	80	0	0.00	Assume good condition
Offsite wooded	77	0	0.00	Assume good condition
Offsite pond	100	0	0.00	-

Total area =	6.85	acres
	298,200	sf
Composite SCS CN =	95	
% Impervious =	82.0%	

III. TIME OF CONCENTRATION INFORMATION

Time of concentration assumed to be 5 minutes.

Time of Concentration =	5.00	minutes
SCS Lag Time =	3.00	minutes (SCS Lag = 0.6* Tc)
Time Increment =	0.87	minutes (= 0.29*SCS Lag)

BARBEE CHAPEL APTS
TLA-22001

POST-DEVELOPMENT HYDROLOGY

Subbasin 3

O. LEFEVRE, EI
11/17/2022

I. SCS CURVE NUMBERS

HSG	Impervious	Open	Wooded
A	98	39	30
B	98	61	55
C	98	74	70
D	98	80	77

Assume:

HSG 'A' =	0.0%
HSG 'B' =	0.0%
HSG 'C' =	0.0%
HSG 'D' =	100.0%

Cover Condition	SCS CN	Comments
Impervious	98	-
Open	80	Assume good condition
Wooded	77	Assume good condition

II. POST-DEVELOPMENT

A. Onsite Impervious Breakdown

Contributing Area	Area [sf]	Area [ac]
Roadway Area	0	0.00
Driveway / Parking Lot	0	0.00
Roof	0	0.00
Sidewalk / Patio	606	0.01
Other	0	0.00
Totals	606	0.01

B. Watershed Land Use Breakdown

Contributing Area	SCS CN	Area [sf]	Area [acres]	Comments
Onsite impervious	98	606	0.01	-
Onsite open	80	12,445	0.29	Assume good condition
Onsite wooded	77	0	0.00	Assume good condition
Onsite pond	100	0	0.00	-
Offsite impervious	98	0	0.00	-
Offsite open	80	0	0.00	Assume good condition
Offsite wooded	77	0	0.00	Assume good condition
Offsite pond	100	0	0.00	-

Total area =	0.30	acres
	13,051	sf
Composite SCS CN =	81	
% Impervious =	4.6%	

III. TIME OF CONCENTRATION INFORMATION

Time of concentration assumed to be 5 minutes.

Time of Concentration =	5.00	minutes
SCS Lag Time =	3.00	minutes (SCS Lag = 0.6* Tc)
Time Increment =	0.87	minutes (= 0.29*SCS Lag)

BARBEE CHAPEL APTS
TLA-22001

POST-DEVELOPMENT HYDROLOGY

Subbasin 4

O. LEFEVRE, EI
11/17/2022

I. SCS CURVE NUMBERS

HSG	Impervious	Open	Wooded
A	98	39	30
B	98	61	55
C	98	74	70
D	98	80	77

Assume:

HSG 'A' =	0.0%
HSG 'B' =	0.0%
HSG 'C' =	0.0%
HSG 'D' =	100.0%

Cover Condition	SCS CN	Comments
Impervious	98	-
Open	80	Assume good condition
Wooded	77	Assume good condition

II. POST-DEVELOPMENT

A. Onsite Impervious Breakdown

Contributing Area	Area [sf]	Area [ac]
Roadway Area	0	0.00
Driveway / Parking Lot	0	0.00
Roof	0	0.00
Sidewalk / Patio	0	0.00
Other	0	0.00
Totals	0	0.00

B. Watershed Land Use Breakdown

Contributing Area	SCS CN	Area [sf]	Area [acres]	Comments
Onsite impervious	98	0	0.00	-
Onsite open	80	1,740	0.04	Assume good condition
Onsite wooded	77	0	0.00	Assume good condition
Onsite pond	100	0	0.00	-
Offsite impervious	98	0	0.00	-
Offsite open	80	0	0.00	Assume good condition
Offsite wooded	77	0	0.00	Assume good condition
Offsite pond	100	0	0.00	-

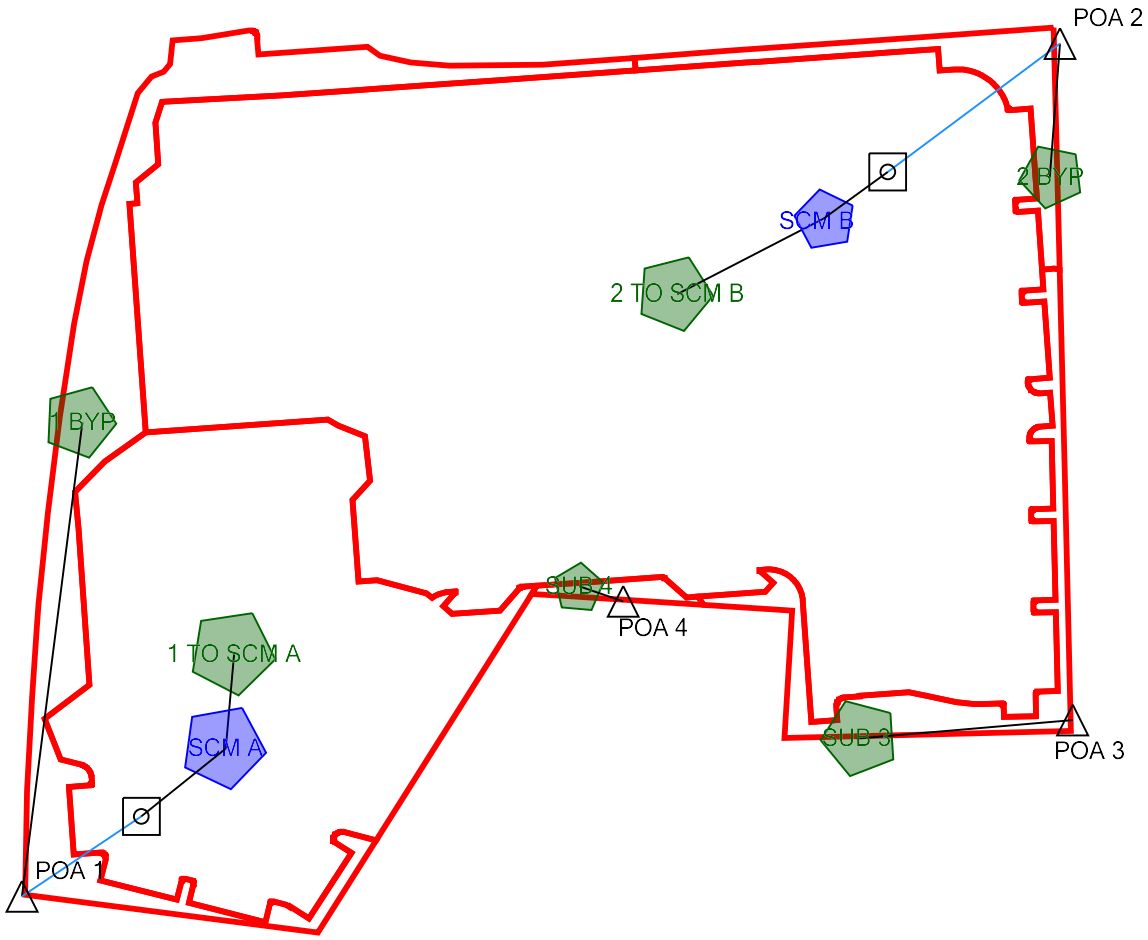
Total area =	0.04	acres
	1,740	sf
Composite SCS CN =	80	
% Impervious =	0.0%	

III. TIME OF CONCENTRATION INFORMATION

Time of concentration assumed to be 5 minutes.

Time of Concentration =	5.00	minutes
SCS Lag Time =	3.00	minutes (SCS Lag = 0.6* Tc)
Time Increment =	0.87	minutes (= 0.29*SCS Lag)

Scenario: Post-Dev 1 yr



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FlexTable: Catchment Table (TLA-22001.ppc)

Current Time: 0.00 min

Label	Outflow Node	Area (ft^2)	SCS CN	Time of Concentration (min)	Notes
1 TO SCM A	SCM A	100,513	93	5.00	POST
1 BYP	POA 1	39,266	84	5.00	POST
2 TO SCM B	SCM B	298,200	95	5.00	POST
2 BYP	POA 2	9,465	80	5.00	POST
SUB 4	POA 4	1,740	80	5.00	POST
SUB 3	POA 3	13,051	81	5.00	POST

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (min)	Peak Flow (ft^3/s)
1 TO SCM A	Post-Dev 1 yr	1	0.424	721.00	8.84
1 TO SCM A	Post-Dev 2 yr	2	0.536	721.00	10.81
1 TO SCM A	Post-Dev 25 yr	25	1.013	721.00	16.16
1 BYP	Post-Dev 1 yr	1	0.111	721.00	2.34
1 BYP	Post-Dev 2 yr	2	0.149	721.00	3.09
1 BYP	Post-Dev 25 yr	25	0.321	721.00	5.41
2 TO SCM B	Post-Dev 1 yr	1	1.368	721.00	27.96
2 TO SCM B	Post-Dev 2 yr	2	1.709	721.00	33.68
2 TO SCM B	Post-Dev 25 yr	25	3.135	721.00	48.97
2 BYP	Post-Dev 1 yr	1	0.022	722.00	0.45
2 BYP	Post-Dev 2 yr	2	0.030	721.00	0.62
2 BYP	Post-Dev 25 yr	25	0.070	721.00	1.19
SUB 4	Post-Dev 1 yr	1	0.004	722.00	0.08
SUB 4	Post-Dev 2 yr	2	0.006	721.00	0.11
SUB 4	Post-Dev 25 yr	25	0.013	721.00	0.22
SUB 3	Post-Dev 1 yr	1	0.032	722.00	0.66
SUB 3	Post-Dev 2 yr	2	0.044	721.00	0.90
SUB 3	Post-Dev 25 yr	25	0.099	721.00	1.68

Node Summary

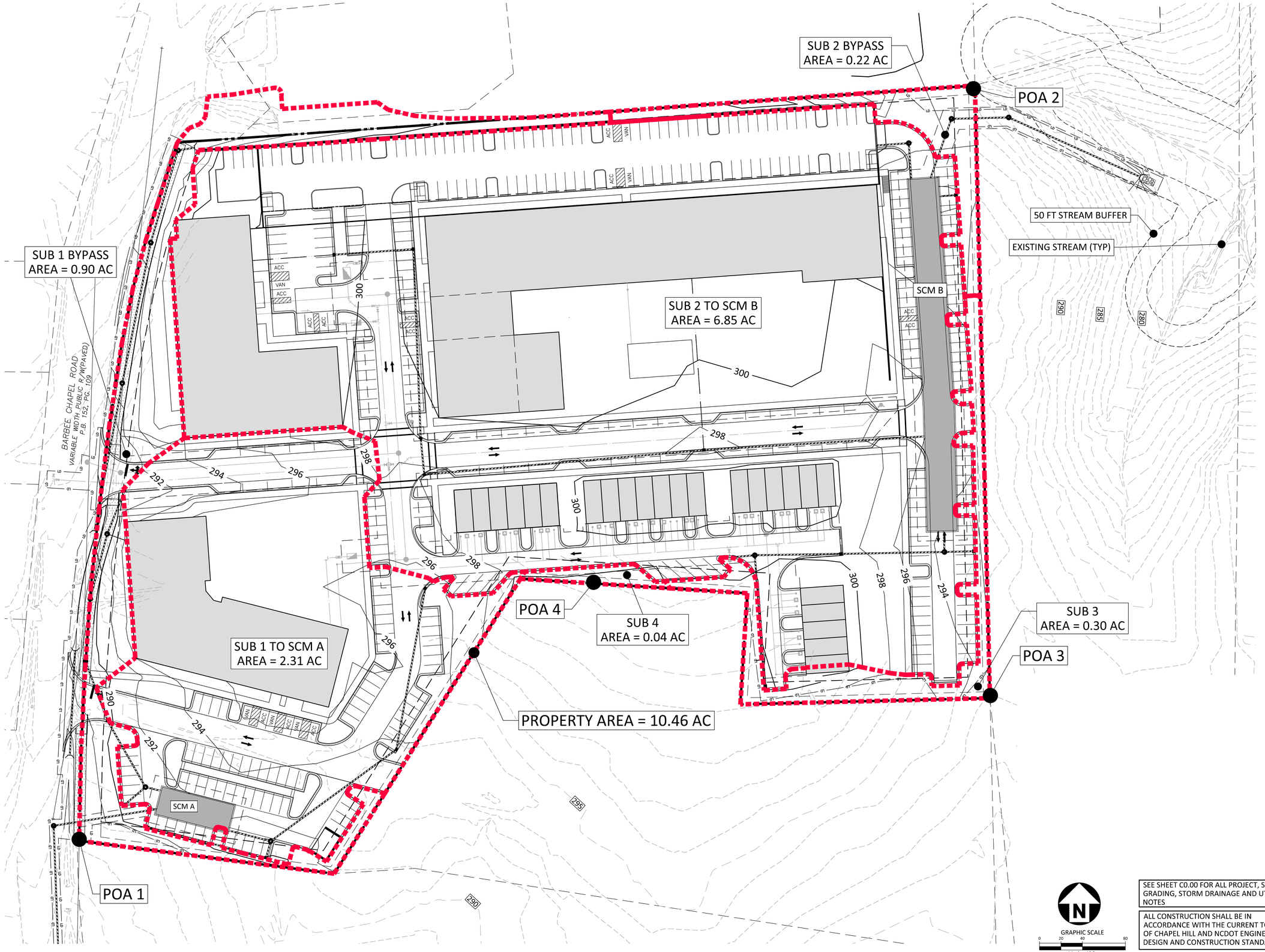
Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (min)	Peak Flow (ft^3/s)
POA 1	Post-Dev 1 yr	1	0.425	724.00	7.51
POA 1	Post-Dev 2 yr	2	0.572	723.00	10.02
POA 1	Post-Dev 25 yr	25	1.219	722.00	19.56
POA 3	Post-Dev 1 yr	1	0.032	722.00	0.66
POA 3	Post-Dev 2 yr	2	0.044	721.00	0.90
POA 3	Post-Dev 25 yr	25	0.099	721.00	1.68
POA 2	Post-Dev 1 yr	1	0.502	722.00	0.73
POA 2	Post-Dev 2 yr	2	0.819	781.00	2.09
POA 2	Post-Dev 25 yr	25	2.234	751.00	5.58
POA 4	Post-Dev 1 yr	1	0.004	722.00	0.08
POA 4	Post-Dev 2 yr	2	0.006	721.00	0.11
POA 4	Post-Dev 25 yr	25	0.013	721.00	0.22

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (min)	Peak Flow (ft^3/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
SCM B (IN)	Post-Dev 1 yr	1	1.368	721.00	27.96	(N/A)	(N/A)
SCM B (OUT)	Post-Dev 1 yr	1	0.480	903.00	0.63	286.18	0.988
SCM B (IN)	Post-Dev 2 yr	2	1.709	721.00	33.68	(N/A)	(N/A)
SCM B (OUT)	Post-Dev 2 yr	2	0.788	782.00	2.04	286.70	1.098
SCM B (IN)	Post-Dev 25 yr	25	3.135	721.00	48.97	(N/A)	(N/A)

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (min)	Peak Flow (ft^3/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
SCM B (OUT)	Post-Dev 25 yr	25	2.164	756.00	5.32	290.20	1.838
SCM A (IN)	Post-Dev 1 yr	1	0.424	721.00	8.84	(N/A)	(N/A)
SCM A (OUT)	Post-Dev 1 yr	1	0.314	726.00	5.77	286.37	0.149
SCM A (IN)	Post-Dev 2 yr	2	0.536	721.00	10.81	(N/A)	(N/A)
SCM A (OUT)	Post-Dev 2 yr	2	0.423	725.00	7.49	286.80	0.167
SCM A (IN)	Post-Dev 25 yr	25	1.013	721.00	16.16	(N/A)	(N/A)
SCM A (OUT)	Post-Dev 25 yr	25	0.898	723.00	14.69	287.32	0.189



PRELIMINARY DRAWING - NOT RELEASED FOR CONSTRUCTION

SEE SHEET C0.00 FOR ALL PROJECT, SITE, GRADING, STORM DRAINAGE AND UTILITY NOTES

ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE CURRENT TOWN OF CHAPEL HILL AND NCDOT ENGINEERING DESIGN AND CONSTRUCTION STANDARDS

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CONDITIONAL ZONING PERMIT
DRAWINGS
5101 BARBEE CHAPEL RD
CHAPEL HILL, NC 27517

REVISIONS

PLAN INFORMATION

PROJECT NO.	TLA-22001
FILENAME	TLA22001-POST
CHECKED BY	MCT
DRAWN BY	OVL
SCALE	1" = 40'
DATE	11.17.2022

SHEET

POST-DEVELOPMENT DRAINAGE AREA MAP

POST

M:\Projects\TLA\TLA22001\04-Production\Water Resources\CDP\Current Drawings\TLA22001-POST.dwg, 11/17/2022 4:39:21 PM, Maria Torres

STORMWATER CONTROL MEASURE 'A'
DESIGN CALCULATIONS

BARBEE CHAPEL APARTMENTS

TLA-22001

Determination of Water Quality Volume (WQV)

Note: The following design calculations are based upon requirements from the Minimum Design Criteria.

$$WQV = (P)(R_V)(A)/12 \times 43{,}560$$

where,

WQV= water quality volume (CF)
R_V = 0.05+0.009(I) where I is percent impervious cover
A = area in acres
P = rainfall (in inches)

Input data:

Total area, A =	2.31	acres
Impervious area =	1.65	acres
Percent impervious cover, I =	71.4	%
Rainfall, P =	1.0	inches

Calculated values:

R_V =	0.69	
WQV =	0.13	acre-ft
=	5799	cf.

Sizing is based upon the adjusted water quality volume, WQV_{adj} (75% of the total WQV).

WQV_{adj} =	4350	cf.

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Subsection: Elevation-Area Volume Curve
Label: SCM A
Scenario: Post-Dev 1 yr

Return Event: 1 years
Storm Event: 1 yr

Elevation (ft)	Planimeter (ft²)	Area (ft²)	A1+A2+sqr (A1*A2) (ft²)	Volume (ac-ft)	Volume (Total) (ac-ft)
282.75	0.00	1,800	0	0.000	0.000
284.50	0.00	1,800	5,400	0.072	0.072
288.00	0.00	1,800	5,400	0.145	0.217

Subsection: Outlet Input Data
Label: SCM A
Scenario: Post-Dev 1 yr

Return Event: 1 years
Storm Event: 1 yr

Requested Pond Water Surface Elevations	
Minimum (Headwater)	282.75 ft
Increment (Headwater)	0.10 ft
Maximum (Headwater)	288.00 ft

Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Orifice-Circular	WQ Orifice	Forward	Culvert - 1	282.75	288.00
Rectangular Weir	Weir - 1	Forward	Culvert - 1	285.50	286.00
Orifice-Area	Orifice - 1	Forward	Culvert - 1	286.00	288.00
Rectangular Weir	Weir - 2	Forward	Culvert - 1	287.00	288.00
Culvert-Circular	Culvert - 1	Forward	TW	282.25	288.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

Subsection: Outlet Input Data
Label: SCM A
Scenario: Post-Dev 1 yr

Return Event: 1 years
Storm Event: 1 yr

Structure ID: Culvert - 1 Structure Type: Culvert-Circular	
Number of Barrels	1
Diameter	24.0 in
Length	84.00 ft
Length (Computed Barrel)	84.01 ft
Slope (Computed)	0.011 ft/ft

Outlet Control Data	
Manning's n	0.013
Ke	1
Kb	0
Kr	1
Convergence Tolerance	0.00 ft

Inlet Control Data	
Equation Form	Form 1
K	0.0098
M	2.0000
C	0.0398
Y	0.6700
T1 ratio (HW/D)	1
T2 ratio (HW/D)	1
Slope Correction Factor	-1

Use unsubmerged inlet control 0 equation below T1 elevation.
Use submerged inlet control 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control,
interpolate between flows at T1 & T2...

T1 Elevation	284.56 ft	T1 Flow	15.55 ft^3/s
T2 Elevation	284.85 ft	T2 Flow	17.77 ft^3/s

Subsection: Outlet Input Data
Label: SCM A
Scenario: Post-Dev 1 yr

Return Event: 1 years
Storm Event: 1 yr

Structure ID: WQ Orifice Structure Type: Orifice-Circular	
Number of Openings	1
Elevation	282.75 ft
Orifice Diameter	1.5 in
Orifice Coefficient	1

Structure ID: Orifice - 1 Structure Type: Orifice-Area	
Number of Openings	1
Elevation	285.50 ft
Orifice Area	1.50 ft²
Top Elevation	286.00 ft
Datum Elevation	285.75 ft
Orifice Coefficient	1

Structure ID: Weir - 2 Structure Type: Rectangular Weir	
Number of Openings	1
Elevation	287.00 ft
Weir Length	10.00 ft
Weir Coefficient	3.00 (ft^0.5)/s

Structure ID: Weir - 1 Structure Type: Rectangular Weir	
Number of Openings	1
Elevation	285.50 ft
Weir Length	3.00 ft
Weir Coefficient	3.00 (ft^0.5)/s

Structure ID: TW Structure Type: TW Setup, DS Channel	
Tailwater Type	Free Outfall

Convergence Tolerances	
Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.001 ft³/s
Flow Tolerance (Maximum)	10.000 ft³/s

Subsection: Composite Rating Curve
Label: SCM A
Scenario: Post-Dev 1 yr

Return Event: 1 years
Storm Event: 1 yr

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
282.75	0.00	(N/A)	0.00	(no Q: WQ Orifice,Weir - 1,Orifice - 1,Weir - 2,Culvert - 1)
282.75	0.00	(N/A)	0.00	(no Q: WQ Orifice,Weir - 1,Orifice - 1,Weir - 2,Culvert - 1)
282.85	0.01	(N/A)	0.00	WQ Orifice,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
282.95	0.02	(N/A)	0.00	WQ Orifice,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
283.05	0.03	(N/A)	0.00	WQ Orifice,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
283.15	0.03	(N/A)	0.00	WQ Orifice,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
283.25	0.04	(N/A)	0.00	WQ Orifice,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
283.35	0.04	(N/A)	0.00	WQ Orifice,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
283.45	0.05	(N/A)	0.00	WQ Orifice,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
283.55	0.05	(N/A)	0.00	WQ Orifice,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
283.65	0.05	(N/A)	0.00	WQ Orifice,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
283.75	0.06	(N/A)	0.00	WQ Orifice,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
283.85	0.06	(N/A)	0.00	WQ Orifice,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
283.95	0.06	(N/A)	0.00	WQ Orifice,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
284.05	0.07	(N/A)	0.00	WQ Orifice,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
284.15	0.07	(N/A)	0.00	WQ Orifice,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
284.25	0.07	(N/A)	0.00	WQ Orifice,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
284.35	0.07	(N/A)	0.00	WQ Orifice,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)

Subsection: Composite Rating Curve
Label: SCM A
Scenario: Post-Dev 1 yr

Return Event: 1 years
Storm Event: 1 yr

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
284.45	0.07	(N/A)	0.00	WQ Orifice,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
284.55	0.08	(N/A)	0.00	WQ Orifice,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
284.65	0.08	(N/A)	0.00	WQ Orifice,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
284.75	0.08	(N/A)	0.00	WQ Orifice,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
284.85	0.08	(N/A)	0.00	WQ Orifice,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
284.95	0.08	(N/A)	0.00	WQ Orifice,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
285.05	0.08	(N/A)	0.00	WQ Orifice,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
285.15	0.09	(N/A)	0.00	WQ Orifice,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
285.25	0.09	(N/A)	0.00	WQ Orifice,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
285.35	0.09	(N/A)	0.00	WQ Orifice,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
285.45	0.09	(N/A)	0.00	WQ Orifice,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
285.50	0.09	(N/A)	0.00	WQ Orifice,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
285.55	0.20	(N/A)	0.00	WQ Orifice,Weir - 1,Culvert - 1 (no Q: Orifice - 1,Weir - 2)
285.65	0.62	(N/A)	0.00	WQ Orifice,Weir - 1,Culvert - 1 (no Q: Orifice - 1,Weir - 2)
285.75	1.21	(N/A)	0.00	WQ Orifice,Weir - 1,Culvert - 1 (no Q: Orifice - 1,Weir - 2)
285.85	1.92	(N/A)	0.00	WQ Orifice,Weir - 1,Culvert - 1 (no Q: Orifice - 1,Weir - 2)
285.95	2.73	(N/A)	0.00	WQ Orifice,Weir - 1,Culvert - 1 (no Q: Orifice - 1,Weir - 2)
286.05	4.05	(N/A)	0.00	WQ Orifice,Orifice - 1,Culvert - 1 (no Q: Weir - 1,Weir - 2)

MCADAMS

Subsection: Composite Rating Curve
Label: SCM A
Scenario: Post-Dev 1 yr

Return Event: 1 years
Storm Event: 1 yr

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
286.15	4.66	(N/A)	0.00	WQ Orifice,Orifice - 1,Culvert - 1 (no Q: Weir - 1,Weir - 2)
286.25	5.20	(N/A)	0.00	WQ Orifice,Orifice - 1,Culvert - 1 (no Q: Weir - 1,Weir - 2)
286.35	5.69	(N/A)	0.00	WQ Orifice,Orifice - 1,Culvert - 1 (no Q: Weir - 1,Weir - 2)
286.45	6.14	(N/A)	0.00	WQ Orifice,Orifice - 1,Culvert - 1 (no Q: Weir - 1,Weir - 2)
286.55	6.56	(N/A)	0.00	WQ Orifice,Orifice - 1,Culvert - 1 (no Q: Weir - 1,Weir - 2)
286.65	6.95	(N/A)	0.00	WQ Orifice,Orifice - 1,Culvert - 1 (no Q: Weir - 1,Weir - 2)
286.75	7.32	(N/A)	0.00	WQ Orifice,Orifice - 1,Culvert - 1 (no Q: Weir - 1,Weir - 2)
286.85	7.67	(N/A)	0.00	WQ Orifice,Orifice - 1,Culvert - 1 (no Q: Weir - 1,Weir - 2)
286.95	8.01	(N/A)	0.00	WQ Orifice,Orifice - 1,Culvert - 1 (no Q: Weir - 1,Weir - 2)
287.00	8.17	(N/A)	0.00	WQ Orifice,Orifice - 1,Culvert - 1 (no Q: Weir - 1,Weir - 2)
287.05	8.67	(N/A)	0.00	WQ Orifice,Orifice - 1,Weir - 2,Culvert - 1 (no Q: Weir - 1)
287.15	10.38	(N/A)	0.00	WQ Orifice,Orifice - 1,Weir - 2,Culvert - 1 (no Q: Weir - 1)
287.25	12.69	(N/A)	0.00	WQ Orifice,Orifice - 1,Weir - 2,Culvert - 1 (no Q: Weir - 1)
287.35	15.43	(N/A)	0.00	WQ Orifice,Orifice - 1,Weir - 2,Culvert - 1 (no Q: Weir - 1)
287.45	18.55	(N/A)	0.00	WQ Orifice,Orifice - 1,Weir - 2,Culvert - 1 (no Q: Weir - 1)
287.55	22.01	(N/A)	0.00	WQ Orifice,Orifice - 1,Weir - 2,Culvert - 1 (no Q: Weir - 1)
287.65	24.85	(N/A)	0.00	WQ Orifice,Orifice - 1,Weir - 2,Culvert - 1 (no Q: Weir - 1)
287.75	27.31	(N/A)	0.00	WQ Orifice,Orifice - 1,Weir - 2,Culvert - 1 (no Q: Weir - 1)

MCADAMS

Subsection: Composite Rating Curve
Label: SCM A
Scenario: Post-Dev 1 yr

Return Event: 1 years
Storm Event: 1 yr

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
287.85	29.53	(N/A)	0.00	WQ Orifice,Orifice - 1,Weir - 2,Culvert - 1 (no Q: Weir - 1)
287.95	30.62	(N/A)	0.00	WQ Orifice,Orifice - 1,Weir - 2,Culvert - 1 (no Q: Weir - 1)
288.00	31.08	(N/A)	0.00	WQ Orifice,Orifice - 1,Weir - 2,Culvert - 1 (no Q: Weir - 1)

Subsection: Level Pool Pond Routing Summary
Label: SCM A (IN)
Scenario: Post-Dev 1 yr

Return Event: 1 years
Storm Event: 1 yr

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	282.75 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	1.00 min

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	8.84 ft³/s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	5.77 ft³/s	Time to Peak (Flow, Outlet)	726.00 min

Elevation (Water Surface, Peak)	286.37 ft
Volume (Peak)	0.149 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	0.424 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.314 ac-ft
Volume (Retained)	0.109 ac-ft
Volume (Unrouted)	0.000 ac-ft
Error (Mass Balance)	0.0 %

MCADAMS

Subsection: Level Pool Pond Routing Summary
Label: SCM A (IN)
Scenario: Post-Dev 2 yr

Return Event: 2 years
Storm Event: 2 yr

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	282.75 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	1.00 min

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	10.81 ft³/s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	7.49 ft³/s	Time to Peak (Flow, Outlet)	725.00 min

Elevation (Water Surface, Peak)	286.80 ft
Volume (Peak)	0.167 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	0.536 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.423 ac-ft
Volume (Retained)	0.114 ac-ft
Volume (Unrouted)	0.000 ac-ft
Error (Mass Balance)	0.0 %

Subsection: Level Pool Pond Routing Summary
Label: SCM A (IN)
Scenario: Post-Dev 10 yr

Return Event: 10 years
Storm Event: 10 yr

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	282.75 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	1.00 min

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	14.49 ft³/s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	12.38 ft³/s	Time to Peak (Flow, Outlet)	723.00 min

Elevation (Water Surface, Peak)	287.24 ft
Volume (Peak)	0.185 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	0.835 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.720 ac-ft
Volume (Retained)	0.114 ac-ft
Volume (Unrouted)	0.000 ac-ft
Error (Mass Balance)	0.0 %

MCADAMS

Subsection: Level Pool Pond Routing Summary
Label: SCM A (IN)
Scenario: Post-Dev 25 yr

Return Event: 25 years
Storm Event: 25 yr

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	282.75 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	1.00 min

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	16.16 ft³/s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	14.69 ft³/s	Time to Peak (Flow, Outlet)	723.00 min

Elevation (Water Surface, Peak)	287.32 ft
Volume (Peak)	0.189 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	1.013 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.898 ac-ft
Volume (Retained)	0.115 ac-ft
Volume (Unrouted)	0.000 ac-ft
Error (Mass Balance)	0.0 %

MCADAMS

Subsection: Level Pool Pond Routing Summary
Label: SCM A (IN)
Scenario: Post-Dev 100 yr

Return Event: 100 years
Storm Event: 100 yr

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	282.75 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	1.00 min

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	18.41 ft³/s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	17.52 ft³/s	Time to Peak (Flow, Outlet)	722.00 min

Elevation (Water Surface, Peak)	287.42 ft
Volume (Peak)	0.193 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	1.298 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	1.183 ac-ft
Volume (Retained)	0.115 ac-ft
Volume (Unrouted)	0.000 ac-ft
Error (Mass Balance)	0.0 %

STORMWATER CONTROL MEASURE B'
DESIGN CALCULATIONS

BARBEE CHAPEL APARTMENTS

TLA-22001

Determination of Water Quality Volume (WQV)

Note: The following design calculations are based upon requirements from the Minimum Design Criteria.

$$WQV = (P)(R_V)(A)/12 \times 43{,}560$$

where,

WQV= water quality volume (CF)
R_V = 0.05+0.009(I) where I is percent impervious cover
A = area in acres
P = rainfall (in inches)

Input data:

Total area, A =	6.85	acres
Impervious area =	5.61	acres
Percent impervious cover, I =	82.0	%
Rainfall, P =	1.0	inches

Calculated values:

R_V =	0.79	
WQV =	0.45	acre-ft
=	19578	cf.

Sizing is based upon the adjusted water quality volume, WQV_{adj} (75% of the total WQV).

WQV_{adj} =	14683	cf.

MCADAMS

Subsection: Elevation-Area Volume Curve
Label: SCM B
Scenario: Post-Dev 1 yr

Return Event: 1 years
Storm Event: 1 yr

Elevation (ft)	Planimeter (ft²)	Area (ft²)	A1+A2+sqr (A1*A2) (ft²)	Volume (ac-ft)	Volume (Total) (ac-ft)
281.50	0.00	9,200	0	0.000	0.000
285.00	0.00	9,200	27,600	0.739	0.739
291.00	0.00	9,200	27,600	1.267	2.006

Subsection: Outlet Input Data
Label: SCM B
Scenario: Post-Dev 1 yr

Return Event: 1 years
Storm Event: 1 yr

Requested Pond Water Surface Elevations	
Minimum (Headwater)	281.50 ft
Increment (Headwater)	0.10 ft
Maximum (Headwater)	291.00 ft

Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Orifice-Circular	Orifice - WQ	Forward	Culvert - 1	281.50	291.00
Rectangular Weir	Weir - 1	Forward	Culvert - 1	286.00	286.50
Orifice-Area	Orifice - 1	Forward	Culvert - 1	286.50	291.00
Rectangular Weir	Weir - 2	Forward	Culvert - 1	290.25	291.00
Culvert-Circular	Culvert - 1	Forward	TW	281.00	291.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

MCADAMS

Subsection: Outlet Input Data
Label: SCM B
Scenario: Post-Dev 1 yr

Return Event: 1 years
Storm Event: 1 yr

Structure ID: Culvert - 1 Structure Type: Culvert-Circular	
Number of Barrels	1
Diameter	24.0 in
Length	250.00 ft
Length (Computed Barrel)	250.01 ft
Slope (Computed)	0.008 ft/ft

Outlet Control Data	
Manning's n	0.013
Ke	1
Kb	0
Kr	1
Convergence Tolerance	0.00 ft

Inlet Control Data	
Equation Form	Form 1
K	0.0098
M	2.0000
C	0.0398
Y	0.6700
T1 ratio (HW/D)	1
T2 ratio (HW/D)	1
Slope Correction Factor	-1

Use unsubmerged inlet control 0 equation below T1 elevation.
Use submerged inlet control 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control,
interpolate between flows at T1 & T2...

T1 Elevation	283.31 ft	T1 Flow	15.55 ft^3/s
T2 Elevation	283.61 ft	T2 Flow	17.77 ft^3/s

Subsection: Outlet Input Data
Label: SCM B
Scenario: Post-Dev 1 yr

Return Event: 1 years
Storm Event: 1 yr

Structure ID: Orifice - WQ Structure Type: Orifice-Circular	
Number of Openings	1
Elevation	281.50 ft
Orifice Diameter	2.7 in
Orifice Coefficient	1

Structure ID: Orifice - 1 Structure Type: Orifice-Area	
Number of Openings	1
Elevation	286.00 ft
Orifice Area	0.50 ft²
Top Elevation	286.50 ft
Datum Elevation	286.25 ft
Orifice Coefficient	1

Structure ID: Weir - 1 Structure Type: Rectangular Weir	
Number of Openings	1
Elevation	286.00 ft
Weir Length	1.00 ft
Weir Coefficient	3.00 (ft^0.5)/s

Structure ID: Weir - 2 Structure Type: Rectangular Weir	
Number of Openings	1
Elevation	290.25 ft
Weir Length	15.00 ft
Weir Coefficient	3.00 (ft^0.5)/s

Structure ID: TW Structure Type: TW Setup, DS Channel	
Tailwater Type	Free Outfall

Convergence Tolerances	
Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.001 ft³/s
Flow Tolerance (Maximum)	10.000 ft³/s

Subsection: Composite Rating Curve
Label: SCM B
Scenario: Post-Dev 1 yr

Return Event: 1 years
Storm Event: 1 yr

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
281.50	0.00	(N/A)	0.00	(no Q: Orifice - WQ,Weir - 1,Orifice - 1,Weir - 2,Culvert - 1)
281.60	0.01	(N/A)	0.00	Orifice - WQ,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
281.70	0.05	(N/A)	0.00	Orifice - WQ,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
281.80	0.08	(N/A)	0.00	Orifice - WQ,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
281.90	0.10	(N/A)	0.00	Orifice - WQ,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
282.00	0.12	(N/A)	0.00	Orifice - WQ,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
282.10	0.13	(N/A)	0.00	Orifice - WQ,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
282.20	0.15	(N/A)	0.00	Orifice - WQ,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
282.30	0.16	(N/A)	0.00	Orifice - WQ,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
282.40	0.17	(N/A)	0.00	Orifice - WQ,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
282.50	0.18	(N/A)	0.00	Orifice - WQ,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
282.60	0.19	(N/A)	0.00	Orifice - WQ,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
282.70	0.20	(N/A)	0.00	Orifice - WQ,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
282.80	0.21	(N/A)	0.00	Orifice - WQ,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
282.90	0.22	(N/A)	0.00	Orifice - WQ,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
283.00	0.23	(N/A)	0.00	Orifice - WQ,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
283.10	0.23	(N/A)	0.00	Orifice - WQ,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
283.20	0.24	(N/A)	0.00	Orifice - WQ,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)

Subsection: Composite Rating Curve
Label: SCM B
Scenario: Post-Dev 1 yr

Return Event: 1 years
Storm Event: 1 yr

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
283.30	0.24	(N/A)	0.00	Orifice - WQ,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
283.40	0.25	(N/A)	0.00	Orifice - WQ,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
283.50	0.25	(N/A)	0.00	Orifice - WQ,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
283.60	0.26	(N/A)	0.00	Orifice - WQ,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
283.70	0.26	(N/A)	0.00	Orifice - WQ,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
283.80	0.27	(N/A)	0.00	Orifice - WQ,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
283.90	0.27	(N/A)	0.00	Orifice - WQ,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
284.00	0.28	(N/A)	0.00	Orifice - WQ,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
284.10	0.28	(N/A)	0.00	Orifice - WQ,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
284.20	0.29	(N/A)	0.00	Orifice - WQ,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
284.30	0.31	(N/A)	0.00	Orifice - WQ,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
284.40	0.32	(N/A)	0.00	Orifice - WQ,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
284.50	0.32	(N/A)	0.00	Orifice - WQ,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
284.60	0.33	(N/A)	0.00	Orifice - WQ,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
284.70	0.33	(N/A)	0.00	Orifice - WQ,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
284.80	0.34	(N/A)	0.00	Orifice - WQ,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
284.90	0.35	(N/A)	0.00	Orifice - WQ,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
285.00	0.35	(N/A)	0.00	Orifice - WQ,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)

MCADAMS

Subsection: Composite Rating Curve
Label: SCM B
Scenario: Post-Dev 1 yr

Return Event: 1 years
Storm Event: 1 yr

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
285.10	0.36	(N/A)	0.00	Orifice - WQ,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
285.20	0.36	(N/A)	0.00	Orifice - WQ,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
285.30	0.37	(N/A)	0.00	Orifice - WQ,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
285.40	0.37	(N/A)	0.00	Orifice - WQ,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
285.50	0.38	(N/A)	0.00	Orifice - WQ,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
285.60	0.38	(N/A)	0.00	Orifice - WQ,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
285.70	0.39	(N/A)	0.00	Orifice - WQ,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
285.80	0.39	(N/A)	0.00	Orifice - WQ,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
285.90	0.40	(N/A)	0.00	Orifice - WQ,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
286.00	0.40	(N/A)	0.00	Orifice - WQ,Culvert - 1 (no Q: Weir - 1,Orifice - 1,Weir - 2)
286.10	0.50	(N/A)	0.00	Orifice - WQ,Weir - 1,Culvert - 1 (no Q: Orifice - 1,Weir - 2)
286.20	0.67	(N/A)	0.00	Orifice - WQ,Weir - 1,Culvert - 1 (no Q: Orifice - 1,Weir - 2)
286.30	0.88	(N/A)	0.00	Orifice - WQ,Weir - 1,Culvert - 1 (no Q: Orifice - 1,Weir - 2)
286.40	1.12	(N/A)	0.00	Orifice - WQ,Weir - 1,Culvert - 1 (no Q: Orifice - 1,Weir - 2)
286.50	1.62	(N/A)	0.00	Orifice - WQ,Orifice - 1,Culvert - 1 (no Q: Weir - 1,Weir - 2)
286.60	1.85	(N/A)	0.00	Orifice - WQ,Orifice - 1,Culvert - 1 (no Q: Weir - 1,Weir - 2)
286.70	2.04	(N/A)	0.00	Orifice - WQ,Orifice - 1,Culvert - 1 (no Q: Weir - 1,Weir - 2)
286.80	2.21	(N/A)	0.00	Orifice - WQ,Orifice - 1,Culvert - 1 (no Q: Weir - 1,Weir - 2)

MCADAMS

Subsection: Composite Rating Curve
Label: SCM B
Scenario: Post-Dev 1 yr

Return Event: 1 years
Storm Event: 1 yr

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
286.90	2.37	(N/A)	0.00	Orifice - WQ,Orifice - 1,Culvert - 1 (no Q: Weir - 1,Weir - 2)
287.00	2.52	(N/A)	0.00	Orifice - WQ,Orifice - 1,Culvert - 1 (no Q: Weir - 1,Weir - 2)
287.10	2.66	(N/A)	0.00	Orifice - WQ,Orifice - 1,Culvert - 1 (no Q: Weir - 1,Weir - 2)
287.20	2.79	(N/A)	0.00	Orifice - WQ,Orifice - 1,Culvert - 1 (no Q: Weir - 1,Weir - 2)
287.30	2.91	(N/A)	0.00	Orifice - WQ,Orifice - 1,Culvert - 1 (no Q: Weir - 1,Weir - 2)
287.40	3.03	(N/A)	0.00	Orifice - WQ,Orifice - 1,Culvert - 1 (no Q: Weir - 1,Weir - 2)
287.50	3.14	(N/A)	0.00	Orifice - WQ,Orifice - 1,Culvert - 1 (no Q: Weir - 1,Weir - 2)
287.60	3.25	(N/A)	0.00	Orifice - WQ,Orifice - 1,Culvert - 1 (no Q: Weir - 1,Weir - 2)
287.70	3.35	(N/A)	0.00	Orifice - WQ,Orifice - 1,Culvert - 1 (no Q: Weir - 1,Weir - 2)
287.80	3.46	(N/A)	0.00	Orifice - WQ,Orifice - 1,Culvert - 1 (no Q: Weir - 1,Weir - 2)
287.90	3.56	(N/A)	0.00	Orifice - WQ,Orifice - 1,Culvert - 1 (no Q: Weir - 1,Weir - 2)
288.00	3.65	(N/A)	0.00	Orifice - WQ,Orifice - 1,Culvert - 1 (no Q: Weir - 1,Weir - 2)
288.10	3.74	(N/A)	0.00	Orifice - WQ,Orifice - 1,Culvert - 1 (no Q: Weir - 1,Weir - 2)
288.20	3.84	(N/A)	0.00	Orifice - WQ,Orifice - 1,Culvert - 1 (no Q: Weir - 1,Weir - 2)
288.30	3.92	(N/A)	0.00	Orifice - WQ,Orifice - 1,Culvert - 1 (no Q: Weir - 1,Weir - 2)
288.40	4.01	(N/A)	0.00	Orifice - WQ,Orifice - 1,Culvert - 1 (no Q: Weir - 1,Weir - 2)
288.50	4.09	(N/A)	0.00	Orifice - WQ,Orifice - 1,Culvert - 1 (no Q: Weir - 1,Weir - 2)
288.60	4.18	(N/A)	0.00	Orifice - WQ,Orifice - 1,Culvert - 1 (no Q: Weir - 1,Weir - 2)

MCADAMS

Subsection: Composite Rating Curve
Label: SCM B
Scenario: Post-Dev 1 yr

Return Event: 1 years
Storm Event: 1 yr

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
288.70	4.26	(N/A)	0.00	Orifice - WQ,Orifice - 1,Culvert - 1 (no Q: Weir - 1,Weir - 2)
288.80	4.34	(N/A)	0.00	Orifice - WQ,Orifice - 1,Culvert - 1 (no Q: Weir - 1,Weir - 2)
288.90	4.41	(N/A)	0.00	Orifice - WQ,Orifice - 1,Culvert - 1 (no Q: Weir - 1,Weir - 2)
289.00	4.49	(N/A)	0.00	Orifice - WQ,Orifice - 1,Culvert - 1 (no Q: Weir - 1,Weir - 2)
289.10	4.57	(N/A)	0.00	Orifice - WQ,Orifice - 1,Culvert - 1 (no Q: Weir - 1,Weir - 2)
289.20	4.64	(N/A)	0.00	Orifice - WQ,Orifice - 1,Culvert - 1 (no Q: Weir - 1,Weir - 2)
289.30	4.71	(N/A)	0.00	Orifice - WQ,Orifice - 1,Culvert - 1 (no Q: Weir - 1,Weir - 2)
289.40	4.78	(N/A)	0.00	Orifice - WQ,Orifice - 1,Culvert - 1 (no Q: Weir - 1,Weir - 2)
289.50	4.86	(N/A)	0.00	Orifice - WQ,Orifice - 1,Culvert - 1 (no Q: Weir - 1,Weir - 2)
289.60	4.92	(N/A)	0.00	Orifice - WQ,Orifice - 1,Culvert - 1 (no Q: Weir - 1,Weir - 2)
289.70	4.99	(N/A)	0.00	Orifice - WQ,Orifice - 1,Culvert - 1 (no Q: Weir - 1,Weir - 2)
289.80	5.06	(N/A)	0.00	Orifice - WQ,Orifice - 1,Culvert - 1 (no Q: Weir - 1,Weir - 2)
289.90	5.13	(N/A)	0.00	Orifice - WQ,Orifice - 1,Culvert - 1 (no Q: Weir - 1,Weir - 2)
290.00	5.19	(N/A)	0.00	Orifice - WQ,Orifice - 1,Culvert - 1 (no Q: Weir - 1,Weir - 2)
290.10	5.26	(N/A)	0.00	Orifice - WQ,Orifice - 1,Culvert - 1 (no Q: Weir - 1,Weir - 2)
290.20	5.32	(N/A)	0.00	Orifice - WQ,Orifice - 1,Culvert - 1 (no Q: Weir - 1,Weir - 2)
290.25	5.35	(N/A)	0.00	Orifice - WQ,Orifice - 1,Culvert - 1 (no Q: Weir - 1,Weir - 2)
290.30	5.89	(N/A)	0.00	Orifice - WQ,Orifice - 1,Weir - 2,Culvert - 1 (no Q: Weir - 1)

MCADAMS

Subsection: Composite Rating Curve
Label: SCM B
Scenario: Post-Dev 1 yr

Return Event: 1 years
Storm Event: 1 yr

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
290.40	8.05	(N/A)	0.00	Orifice - WQ,Orifice - 1,Weir - 2,Culvert - 1 (no Q: Weir - 1)
290.50	11.11	(N/A)	0.00	Orifice - WQ,Orifice - 1,Weir - 2,Culvert - 1 (no Q: Weir - 1)
290.60	14.84	(N/A)	0.00	Orifice - WQ,Orifice - 1,Weir - 2,Culvert - 1 (no Q: Weir - 1)
290.70	19.15	(N/A)	0.00	Orifice - WQ,Orifice - 1,Weir - 2,Culvert - 1 (no Q: Weir - 1)
290.80	23.93	(N/A)	0.00	Orifice - WQ,Orifice - 1,Weir - 2,Culvert - 1 (no Q: Weir - 1)
290.90	28.75	(N/A)	0.00	Orifice - WQ,Orifice - 1,Weir - 2,Culvert - 1 (no Q: Weir - 1)
291.00	33.00	(N/A)	0.00	Orifice - WQ,Orifice - 1,Weir - 2,Culvert - 1 (no Q: Weir - 1)

MCADAMS

Subsection: Level Pool Pond Routing Summary
Label: SCM B (IN)
Scenario: Post-Dev 1 yr

Return Event: 1 years
Storm Event: 1 yr

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	281.50 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	1.00 min

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	27.96 ft³/s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	0.63 ft³/s	Time to Peak (Flow, Outlet)	903.00 min

Elevation (Water Surface, Peak)	286.18 ft
Volume (Peak)	0.988 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	1.368 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.480 ac-ft
Volume (Retained)	0.887 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

Subsection: Level Pool Pond Routing Summary
Label: SCM B (IN)
Scenario: Post-Dev 2 yr

Return Event: 2 years
Storm Event: 2 yr

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	281.50 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	1.00 min

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	33.68 ft³/s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	2.04 ft³/s	Time to Peak (Flow, Outlet)	782.00 min

Elevation (Water Surface, Peak)	286.70 ft
Volume (Peak)	1.098 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	1.709 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.788 ac-ft
Volume (Retained)	0.920 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

MCADAMS

Subsection: Level Pool Pond Routing Summary
Label: SCM B (IN)
Scenario: Post-Dev 10 yr

Return Event: 10 years
Storm Event: 10 yr

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	281.50 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	1.00 min

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	44.21 ft³/s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	4.37 ft³/s	Time to Peak (Flow, Outlet)	756.00 min

Elevation (Water Surface, Peak)	288.84 ft
Volume (Peak)	1.550 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	2.604 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	1.643 ac-ft
Volume (Retained)	0.960 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

MCADAMS

Subsection: Level Pool Pond Routing Summary
Label: SCM B (IN)
Scenario: Post-Dev 25 yr

Return Event: 25 years
Storm Event: 25 yr

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	281.50 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	1.00 min

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	48.97 ft³/s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	5.32 ft³/s	Time to Peak (Flow, Outlet)	756.00 min

Elevation (Water Surface, Peak)	290.20 ft
Volume (Peak)	1.838 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	3.135 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	2.164 ac-ft
Volume (Retained)	0.970 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

MCADAMS

Subsection: Level Pool Pond Routing Summary
Label: SCM B (IN)
Scenario: Post-Dev 100 yr

Return Event: 100 years
Storm Event: 100 yr

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	281.50 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	1.00 min

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	55.43 ft³/s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	18.02 ft³/s	Time to Peak (Flow, Outlet)	731.00 min

Elevation (Water Surface, Peak)	290.67 ft
Volume (Peak)	1.938 ac-ft

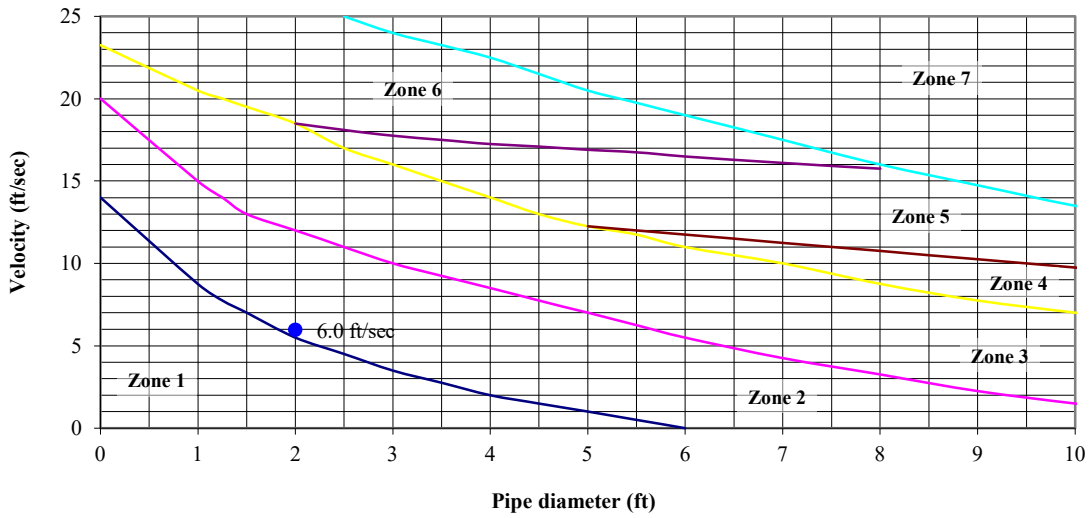
Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	3.987 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	3.010 ac-ft
Volume (Retained)	0.975 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

DESIGN OF RIPRAP OUTLET PROTECTION WORKSHEET

Project	Barbee Chapel	Date	11/16/2022
Project No.	TLA-22001	Designer	O. LEFEVRE, EI
Outlet ID	SCM B		

Flow, $Q_{10\text{-}yr}$	4.4	cfs
Slope, S	1.21	%
Pipe Diameter, D_o	24	inches
Pipe Diameter, D_o	2.0	feet
Number of pipes	1	
Pipe separation	0	feet
Manning's n	0.013	

Figure 8.06.b.1



Zone from graph above = 2

Outlet pipe diameter	24 in.	Length =	12.0 ft.
Outlet flowrate	4.4 cfs	Width =	6.0 ft.
Outlet velocity	6.0 ft/sec	Stone diameter =	6 in.
Material =	Class B	Thickness =	22 in.

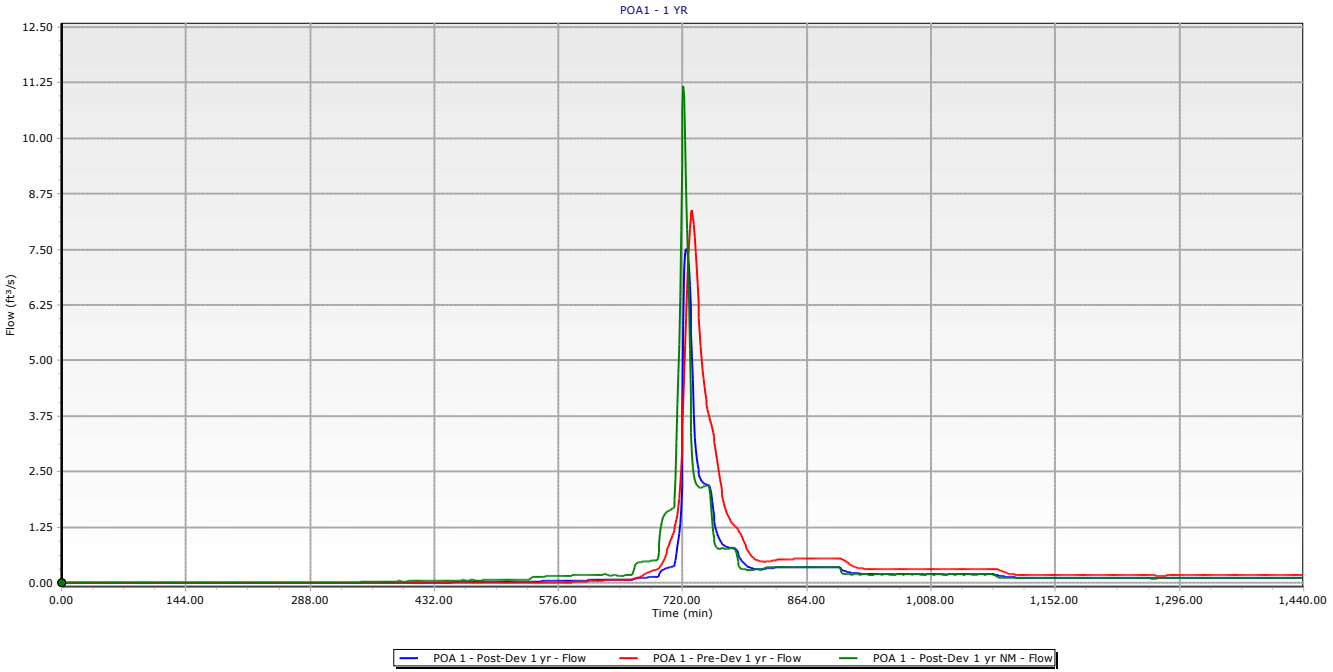
Zone	Material	Diameter	Thickness	Length	Width
1	Class A	3	9	4 x D(o)	3 x D(o)
2	Class B	6	22	6 x D(o)	3 x D(o)
3	Class I	13	22	8 x D(o)	3 x D(o)
4	Class I	13	22	8 x D(o)	3 x D(o)
5	Class II	23	27	10 x D(o)	3 x D(o)
6	Class II	23	27	10 x D(o)	3 x D(o)
7	Special study required				

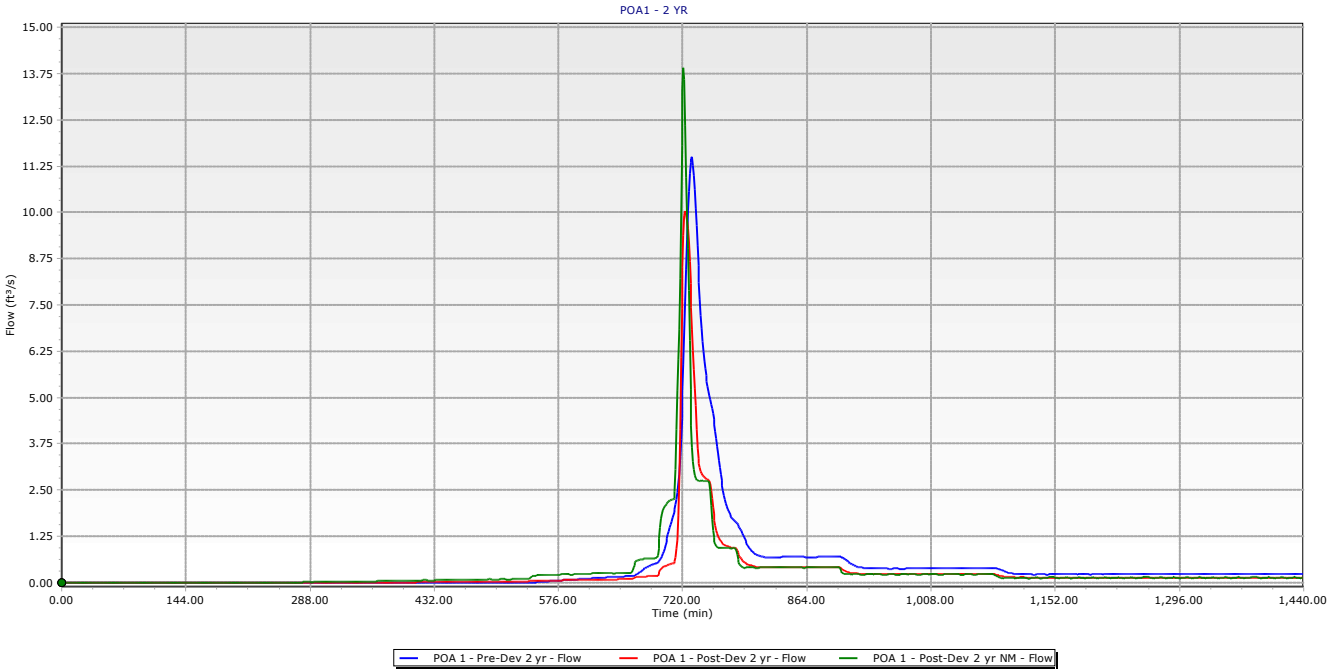
1. Calculations based on NY DOT method - Pages 8.06.05 through 8.06.06 in NC Erosion Control Manual
2. Outlet velocity based on full-flow velocity

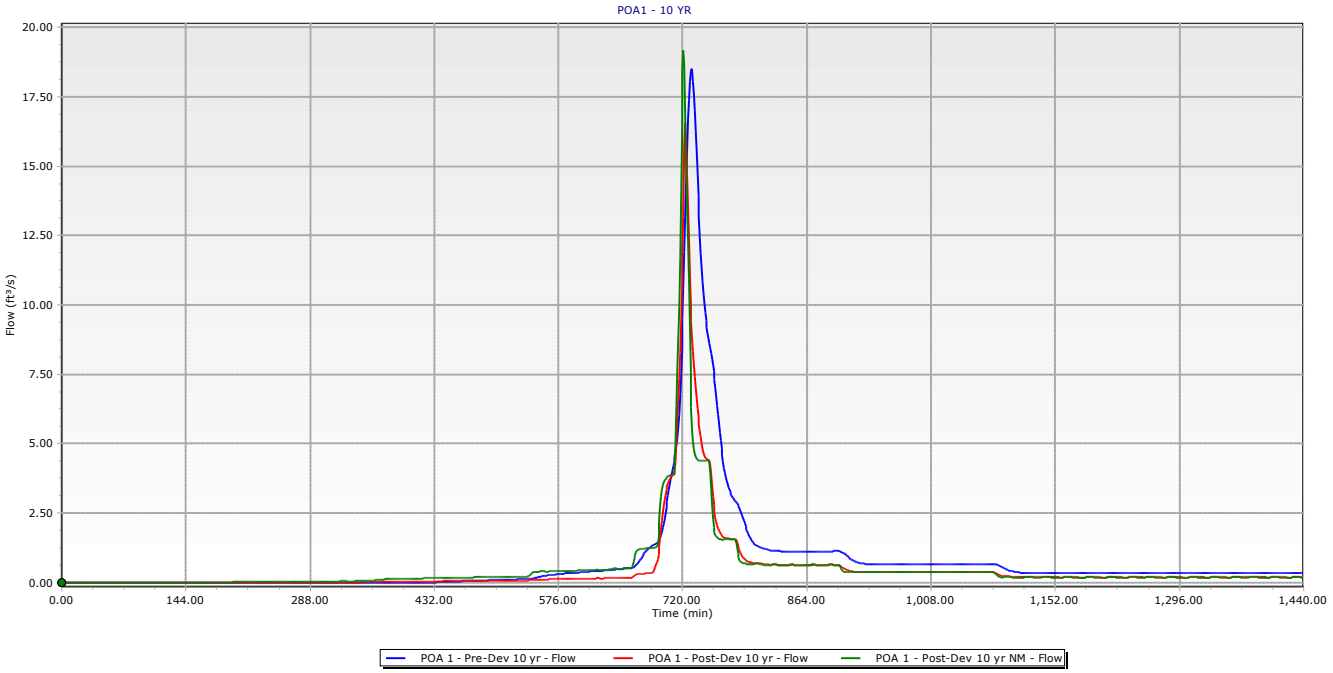
HYDROGRAPH PLOTS

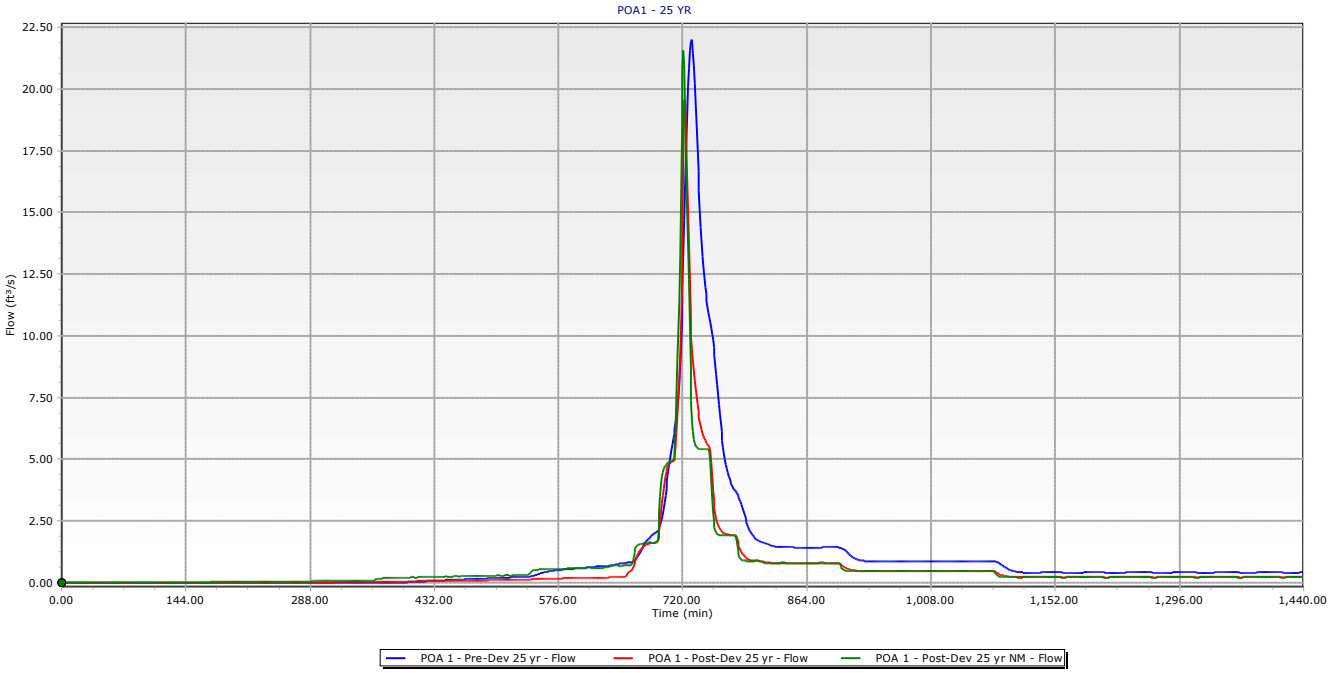
BARBEE CHAPEL APARTMENTS

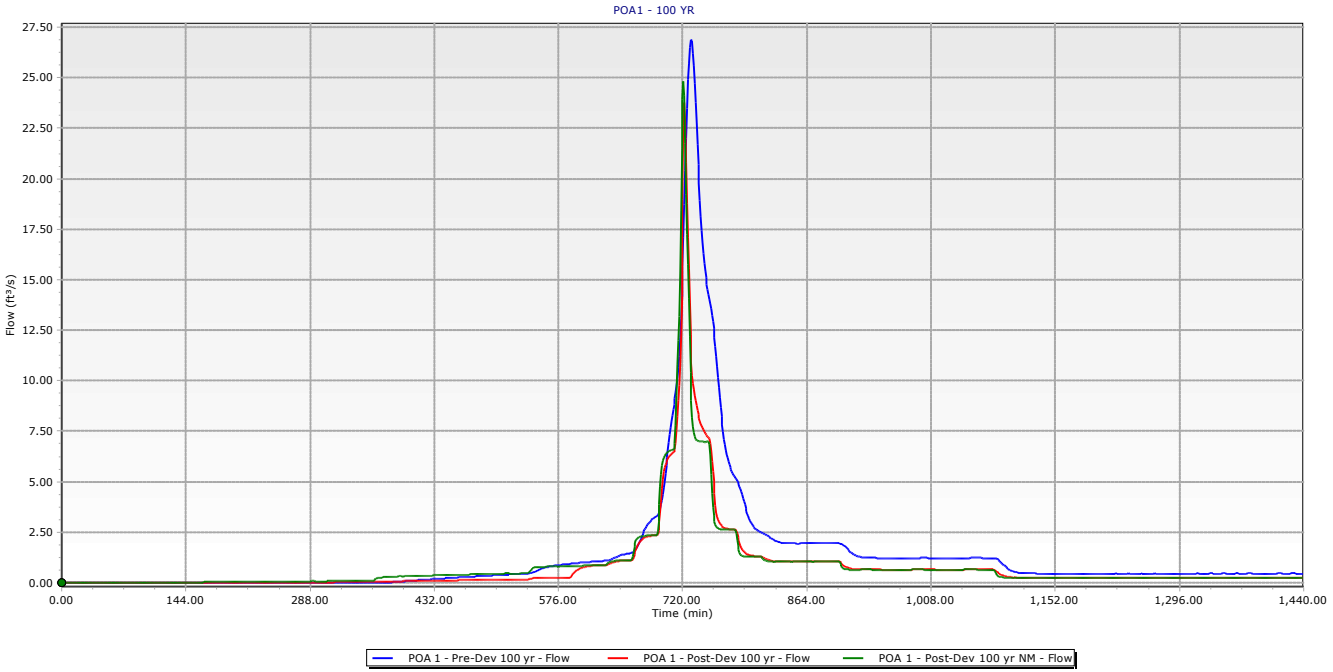
TLA-22001

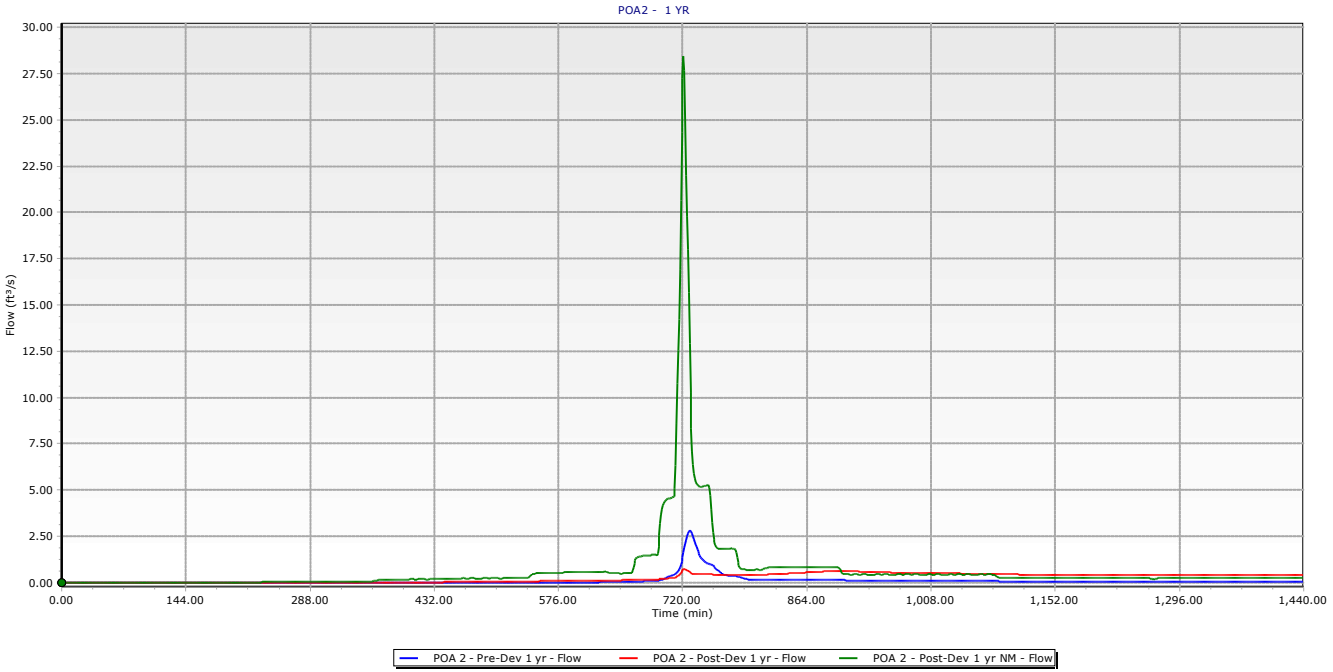

POA1 - 1 YR
12.50
11.25
10.00
8.75
7.50
6.25
5.00
3.75
2.50
1.25
0.00
Flow (ft³/s)
0.00
144.00
288.00
432.00
576.00
720.00
864.00
1,008.00
1,152.00
1,296.00
1,440.00
Time (min)
POA 1 - Post-Dev 1 yr - Flow
POA 1 - Pre-Dev 1 yr - Flow
POA 1 - Post-Dev 1 yr NM - Flow

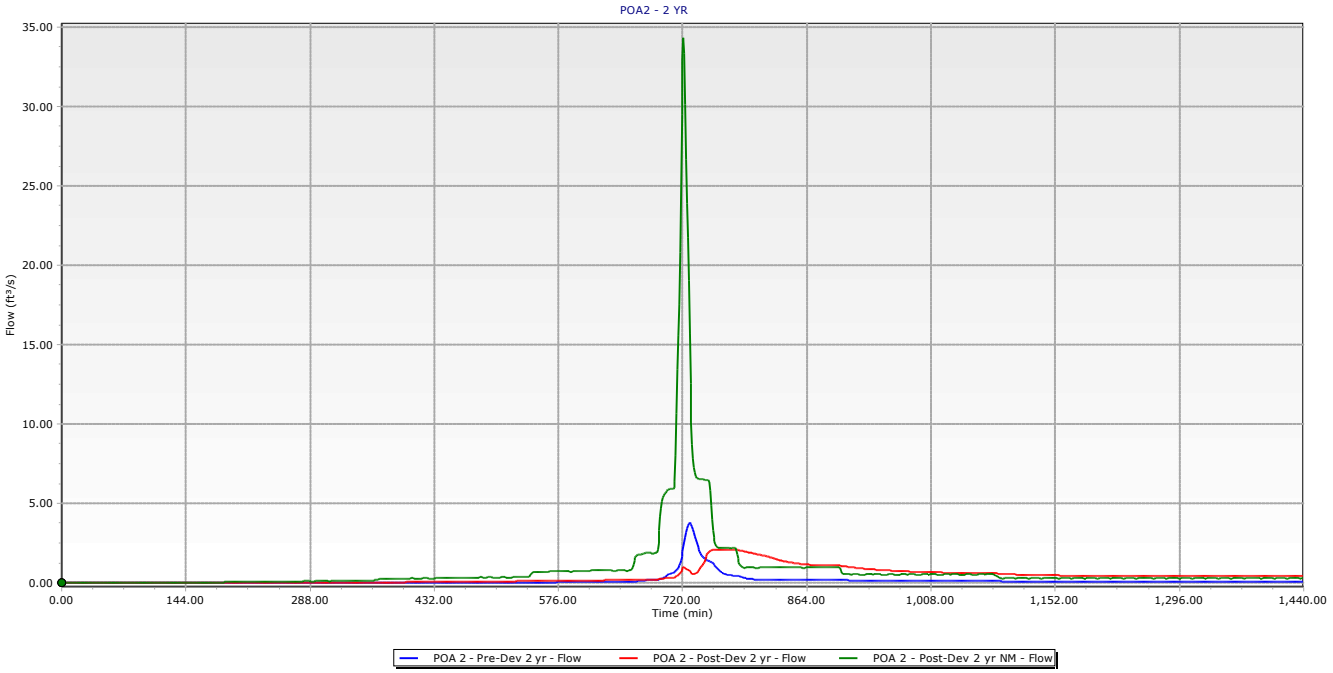

POA1 - 2 YR
15.00
13.75
12.50
11.25
10.00
8.75
7.50
6.25
5.00
3.75
2.50
1.25
0.00
Flow (ft³/s)
0.00
144.00
288.00
432.00
576.00
720.00
864.00
1,008.00
1,152.00
1,296.00
1,440.00
Time (min)
POA 1 - Pre-Dev 2 yr - Flow
POA 1 - Post-Dev 2 yr - Flow
POA 1 - Post-Dev 2 yr NM - Flow

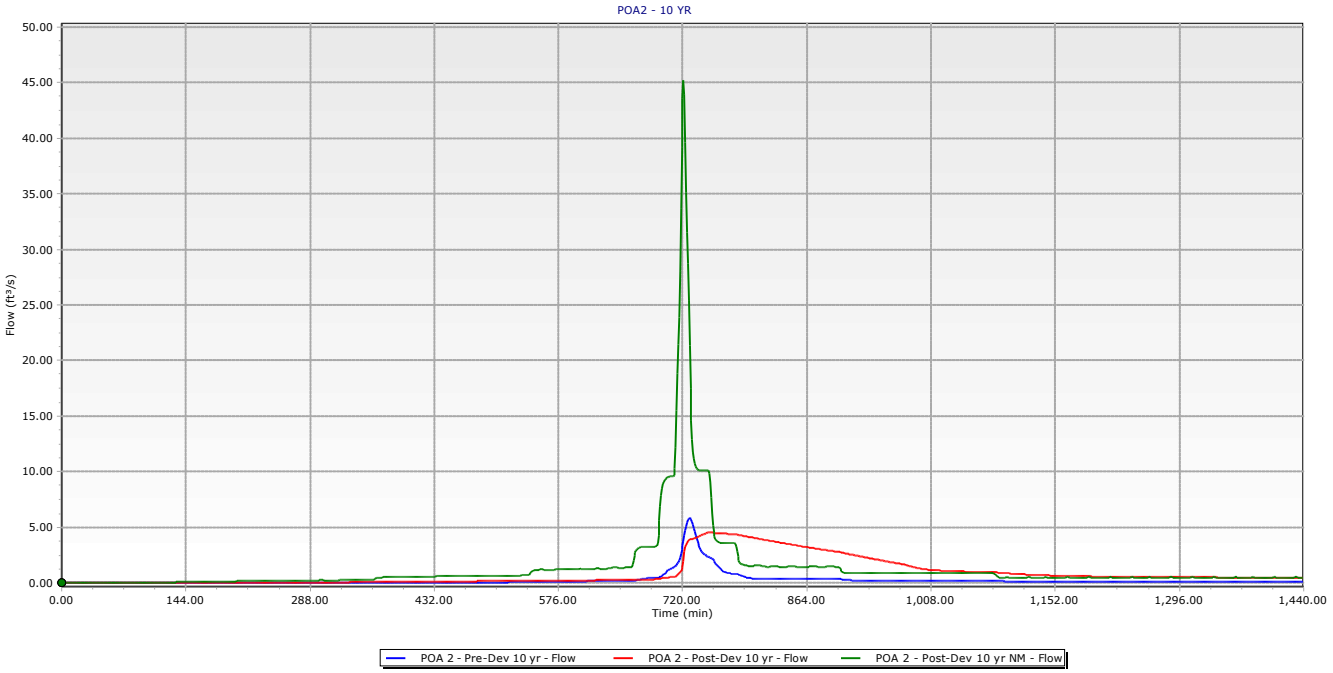

POA1 - 10 YR
Flow (ft³/s)
20.00
17.50
15.00
12.50
10.00
7.50
5.00
2.50
0.00
0.00
144.00
288.00
432.00
576.00
720.00
864.00
1,008.00
1,152.00
1,296.00
1,440.00
Time (min)
POA 1 - Pre-Dev 10 yr - Flow
POA 1 - Post-Dev 10 yr - Flow
POA 1 - Post-Dev 10 yr NM - Flow

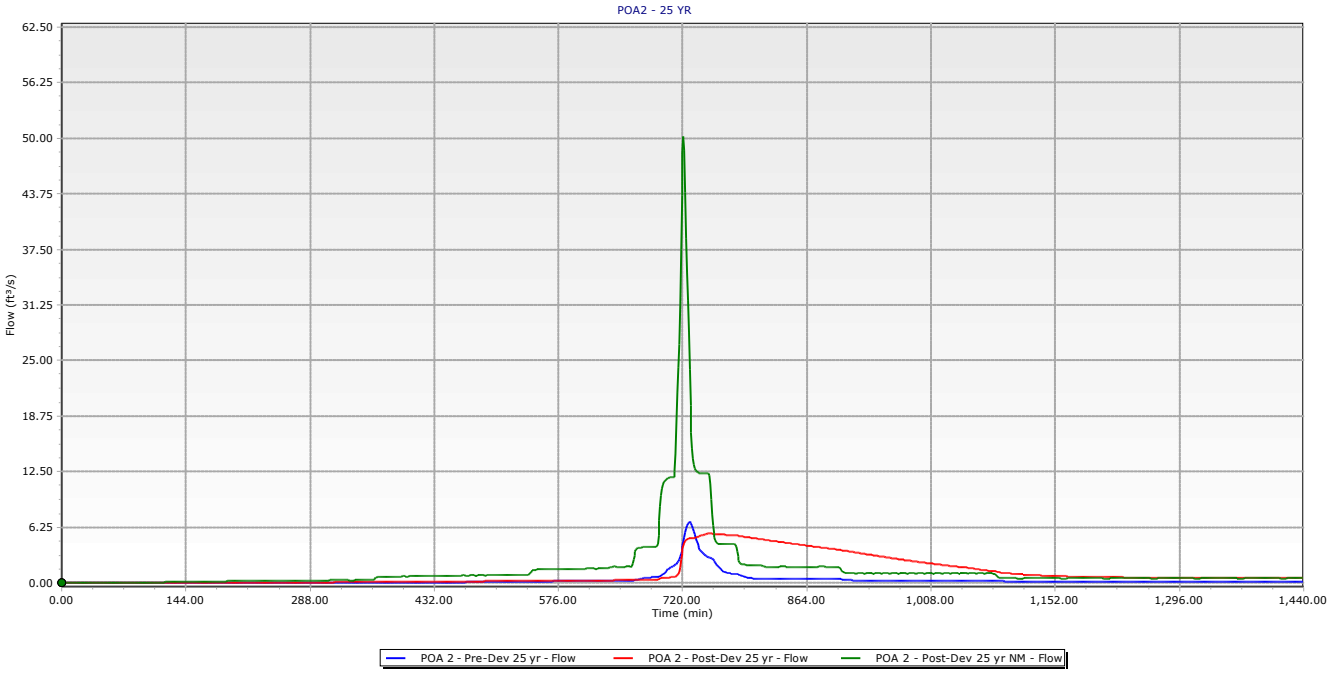

POA1 - 25 YR
Flow (ft³/s)
22.50
20.00
17.50
15.00
12.50
10.00
7.50
5.00
2.50
0.00
0.00
144.00
288.00
432.00
576.00
720.00
864.00
1,008.00
1,152.00
1,296.00
1,440.00
Time (min)
POA 1 - Pre-Dev 25 yr - Flow
POA 1 - Post-Dev 25 yr - Flow
POA 1 - Post-Dev 25 yr NM - Flow

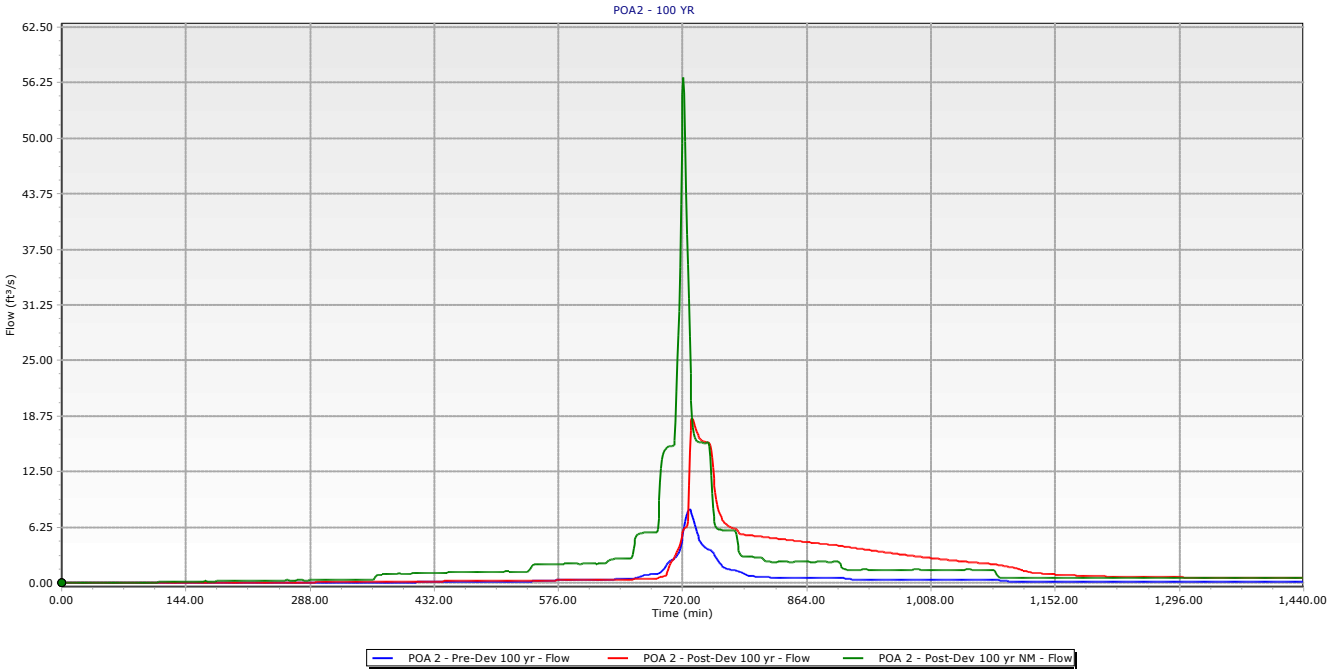

POA1 - 100 YR
Flow (ft³/s)
27.50
25.00
22.50
20.00
17.50
15.00
12.50
10.00
7.50
5.00
2.50
0.00
0.00
144.00
288.00
432.00
576.00
720.00
864.00
1,008.00
1,152.00
1,296.00
1,440.00
Time (min)
POA 1 - Pre-Dev 100 yr - Flow
POA 1 - Post-Dev 100 yr - Flow
POA 1 - Post-Dev 100 yr NM - Flow

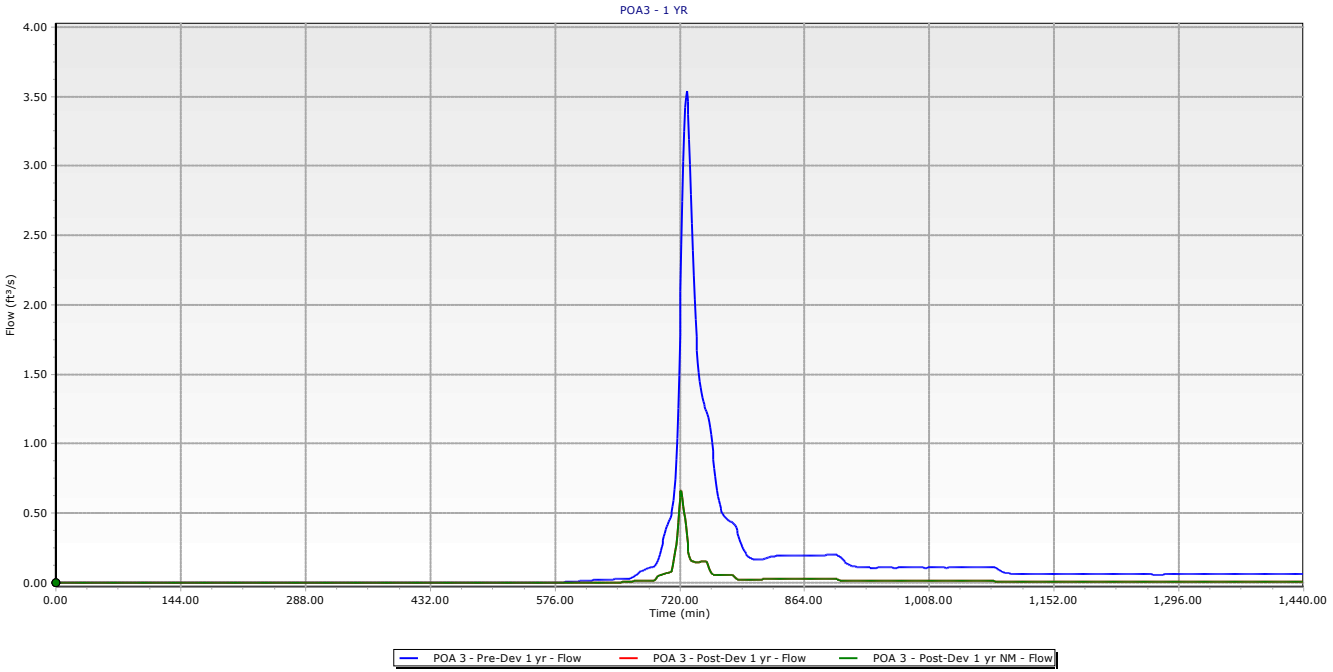

POA2 - 1 YR
30.00
27.50
25.00
22.50
20.00
17.50
15.00
12.50
10.00
7.50
5.00
2.50
0.00
Flow (ft³/s)
0.00
144.00
288.00
432.00
576.00
720.00
864.00
1,008.00
1,152.00
1,296.00
1,440.00
Time (min)
POA 2 - Pre-Dev 1 yr - Flow
POA 2 - Post-Dev 1 yr - Flow
POA 2 - Post-Dev 1 yr NM - Flow

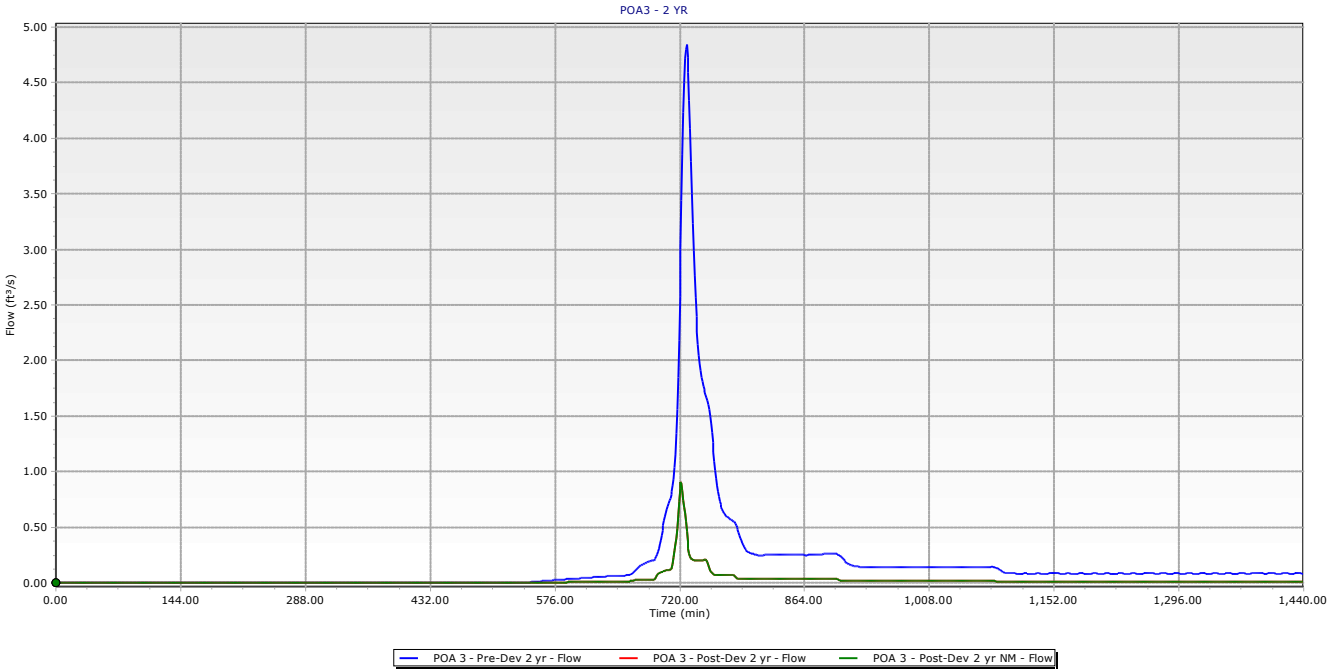

POA2 - 2 YR
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
Flow (ft³/s)
0.00
144.00
288.00
432.00
576.00
720.00
864.00
1,008.00
1,152.00
1,296.00
1,440.00
Time (min)
POA 2 - Pre-Dev 2 yr - Flow
POA 2 - Post-Dev 2 yr - Flow
POA 2 - Post-Dev 2 yr NM - Flow

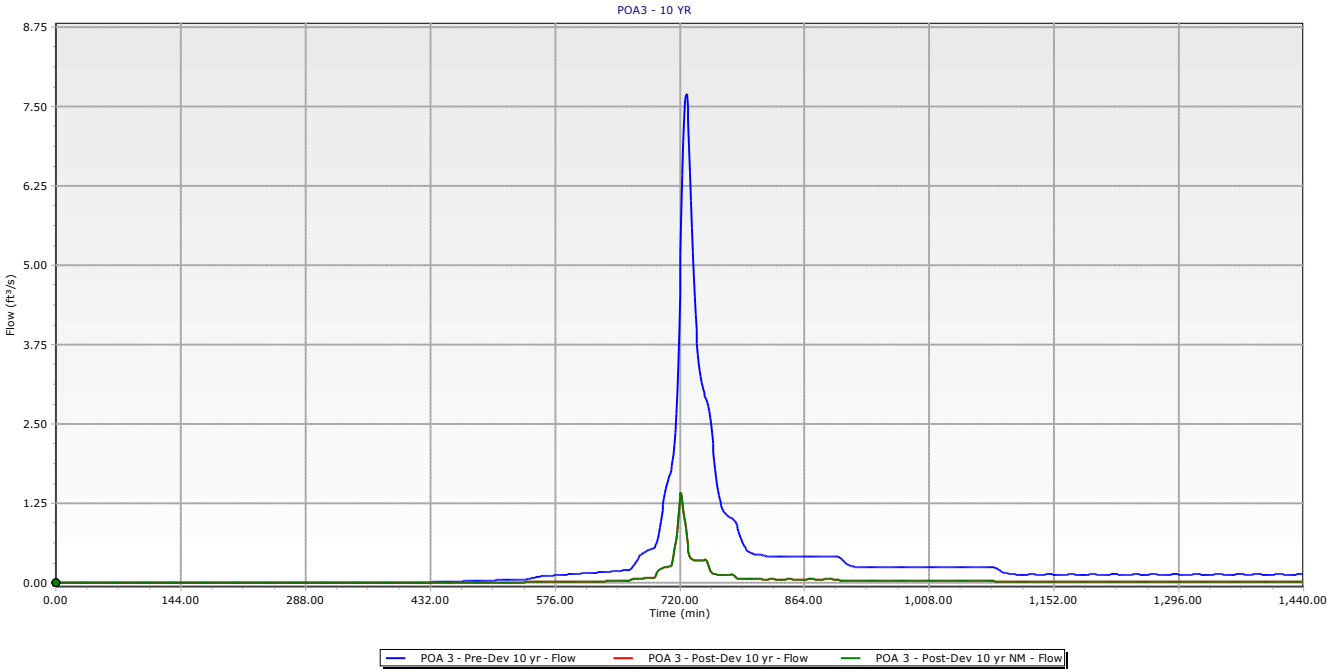

POA2 - 10 YR
Flow (ft³/s)
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
0.00
144.00
288.00
432.00
576.00
720.00
864.00
1,008.00
1,152.00
1,296.00
1,440.00
Time (min)
POA 2 - Pre-Dev 10 yr - Flow
POA 2 - Post-Dev 10 yr - Flow
POA 2 - Post-Dev 10 yr NM - Flow

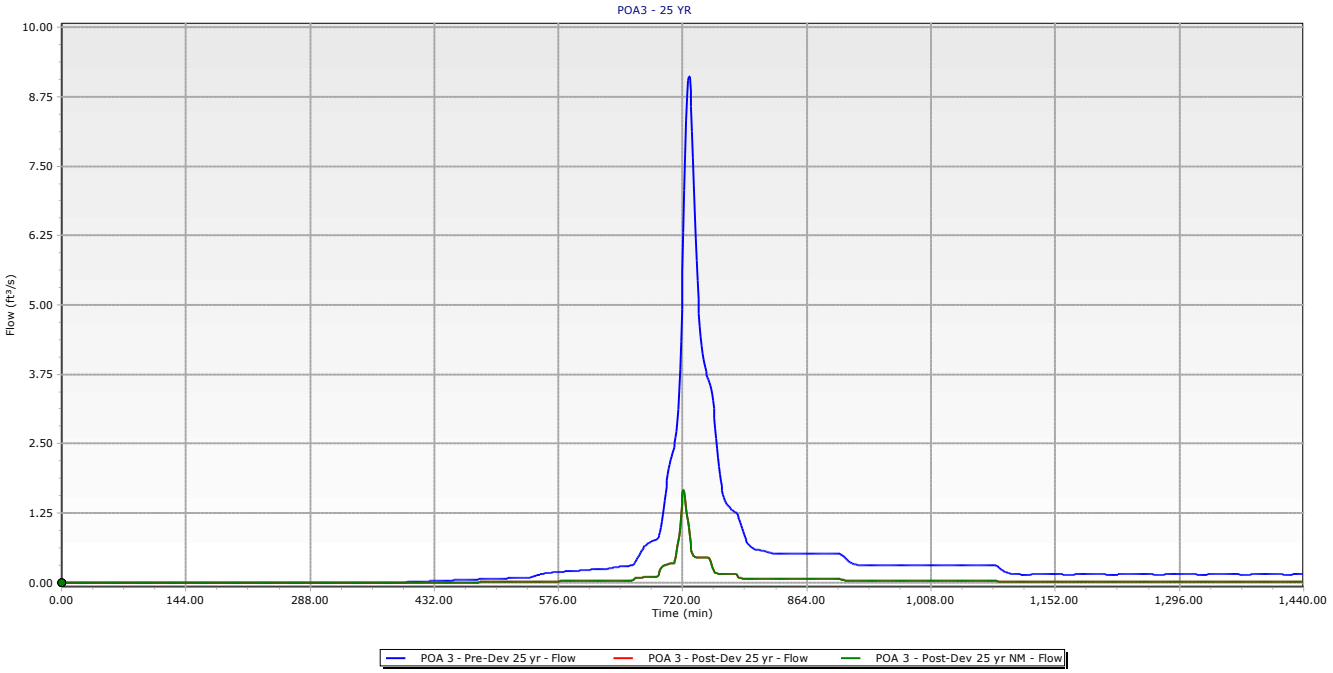

POA2 - 25 YR
62.50
56.25
50.00
43.75
37.50
31.25
25.00
18.75
12.50
6.25
0.00
Flow (ft³/s)
0.00
144.00
288.00
432.00
576.00
720.00
864.00
1,008.00
1,152.00
1,296.00
1,440.00
Time (min)
POA 2 - Pre-Dev 25 yr - Flow
POA 2 - Post-Dev 25 yr - Flow
POA 2 - Post-Dev 25 yr NM - Flow

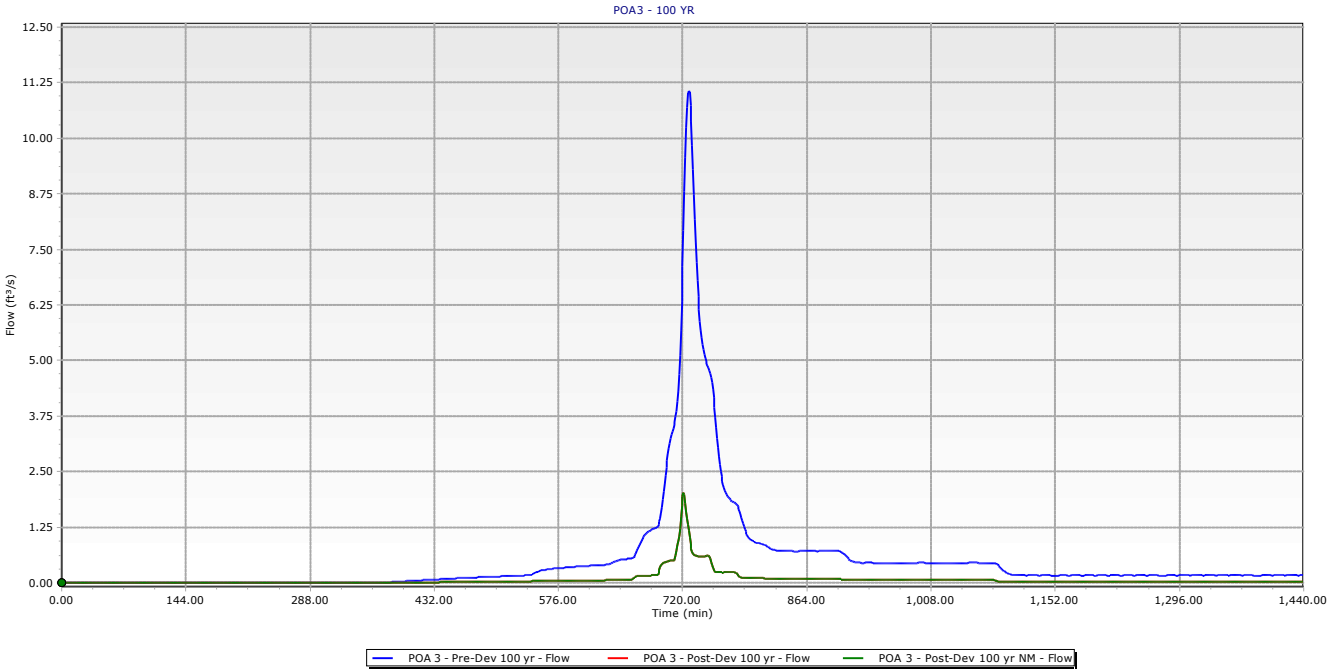

POA2 - 100 YR
62.50
56.25
50.00
43.75
37.50
31.25
25.00
18.75
12.50
6.25
0.00
Flow (ft³/s)
0.00
144.00
288.00
432.00
576.00
720.00
864.00
1,008.00
1,152.00
1,296.00
1,440.00
Time (min)
POA 2 - Pre-Dev 100 yr - Flow
POA 2 - Post-Dev 100 yr - Flow
POA 2 - Post-Dev 100 yr NM - Flow

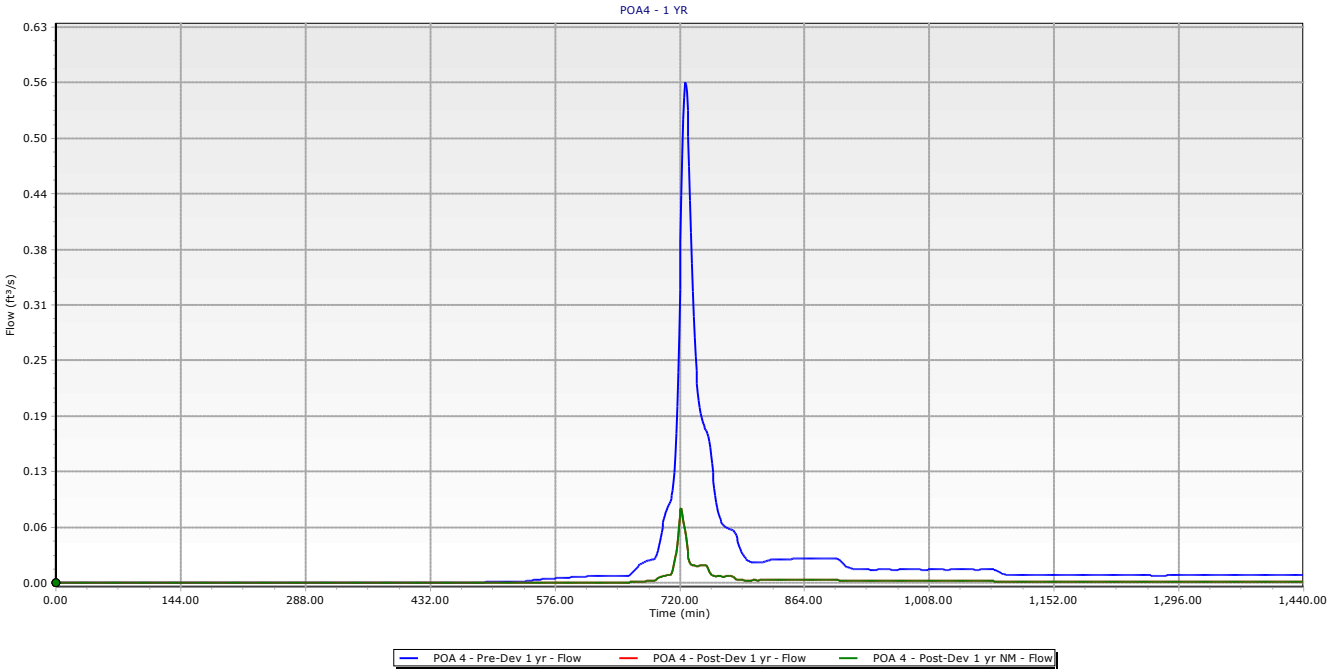

POA3 - 1 YR
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
Flow (ft³/s)
0.00
144.00
288.00
432.00
576.00
720.00
864.00
1,008.00
1,152.00
1,296.00
1,440.00
Time (min)
POA 3 - Pre-Dev 1 yr - Flow
POA 3 - Post-Dev 1 yr - Flow
POA 3 - Post-Dev 1 yr NM - Flow

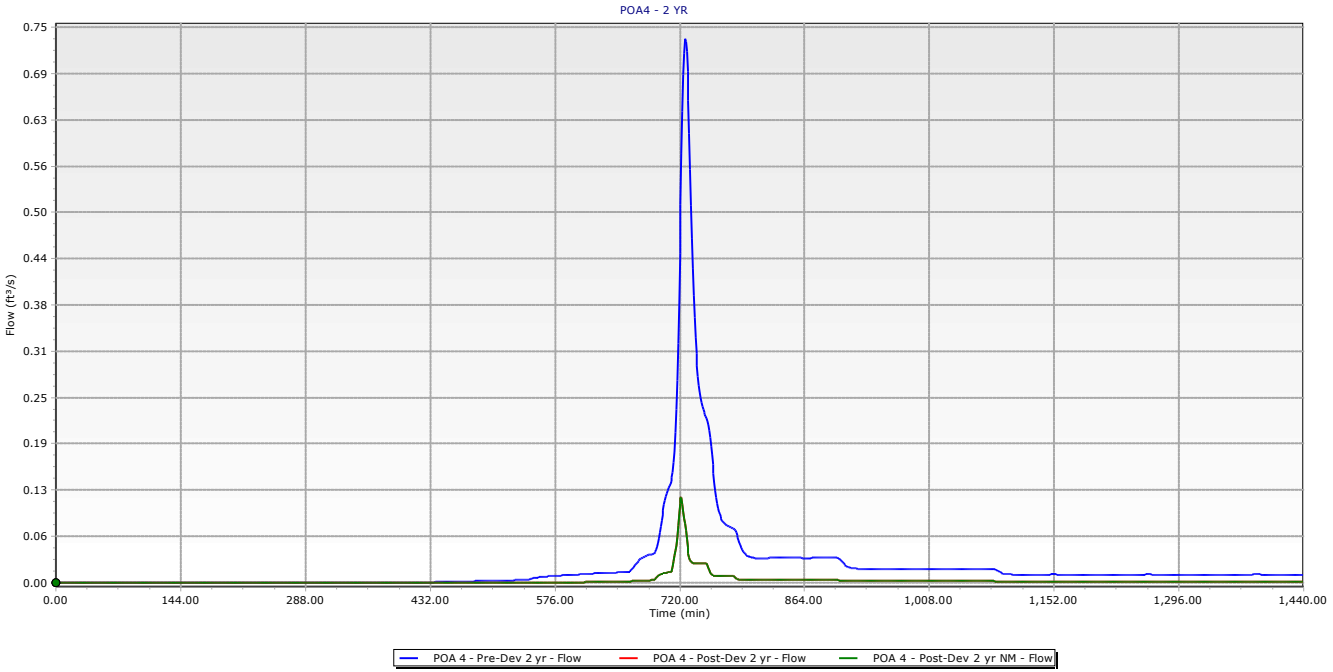

POA3 - 2 YR
Flow (ft³/s)
5.00
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
0.00
144.00
288.00
432.00
576.00
720.00
864.00
1,008.00
1,152.00
1,296.00
1,440.00
Time (min)
POA 3 - Pre-Dev 2 yr - Flow
POA 3 - Post-Dev 2 yr - Flow
POA 3 - Post-Dev 2 yr NM - Flow

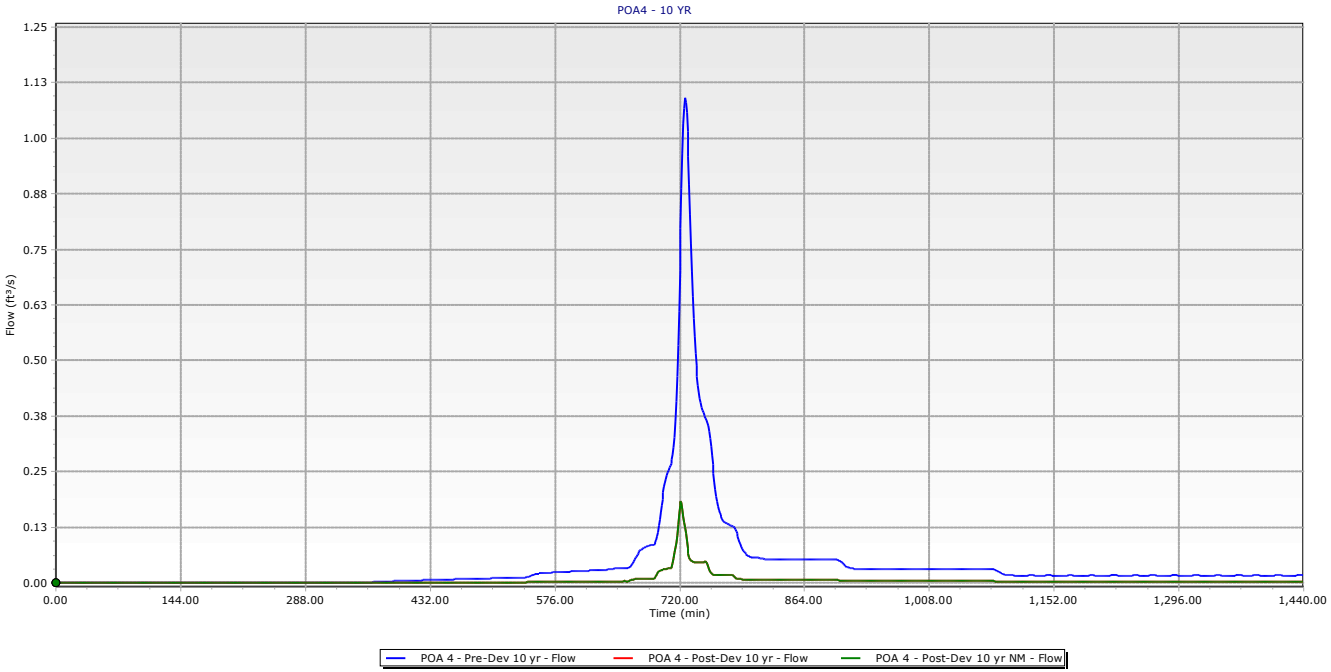

POA3 - 10 YR
8.75
7.50
6.25
5.00
3.75
2.50
1.25
0.00
Flow (ft³/s)
0.00
144.00
288.00
432.00
576.00
720.00
864.00
1,008.00
1,152.00
1,296.00
1,440.00
Time (min)
POA 3 - Pre-Dev 10 yr - Flow
POA 3 - Post-Dev 10 yr - Flow
POA 3 - Post-Dev 10 yr NM - Flow

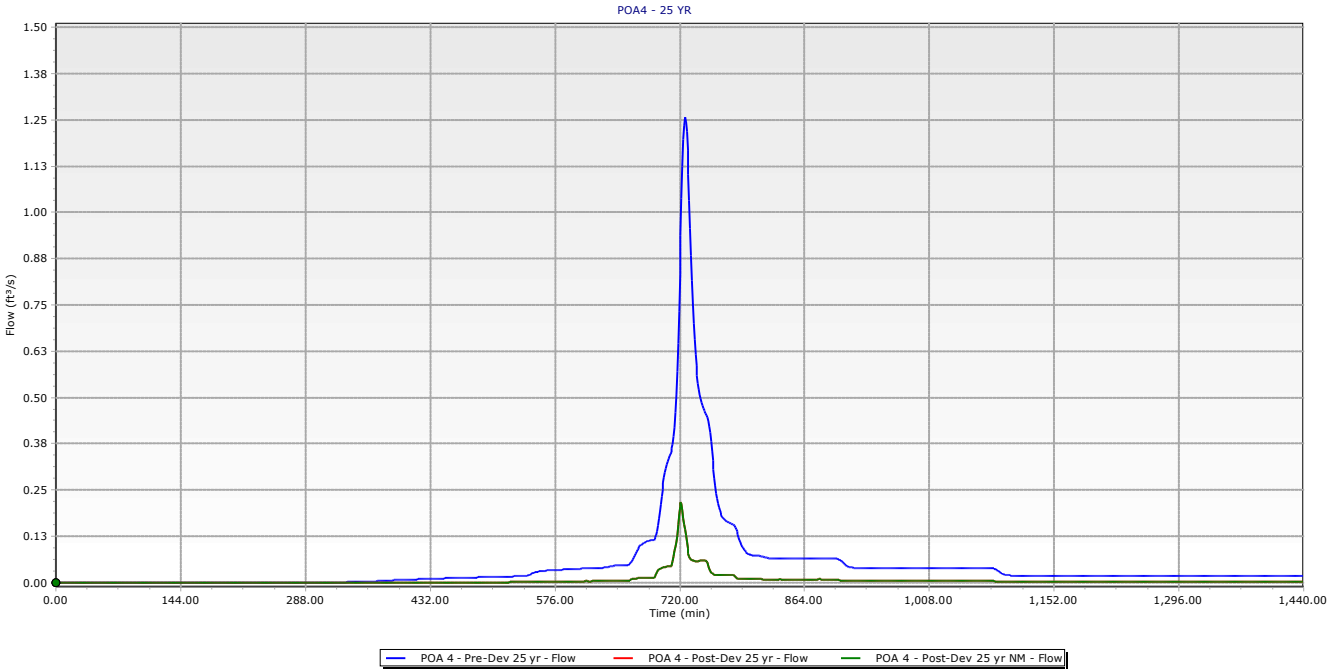

POA3 - 25 YR
10.00
8.75
7.50
6.25
5.00
3.75
2.50
1.25
0.00
Flow (ft³/s)
0.00
144.00
288.00
432.00
576.00
720.00
864.00
1,008.00
1,152.00
1,296.00
1,440.00
Time (min)
POA 3 - Pre-Dev 25 yr - Flow
POA 3 - Post-Dev 25 yr - Flow
POA 3 - Post-Dev 25 yr NM - Flow

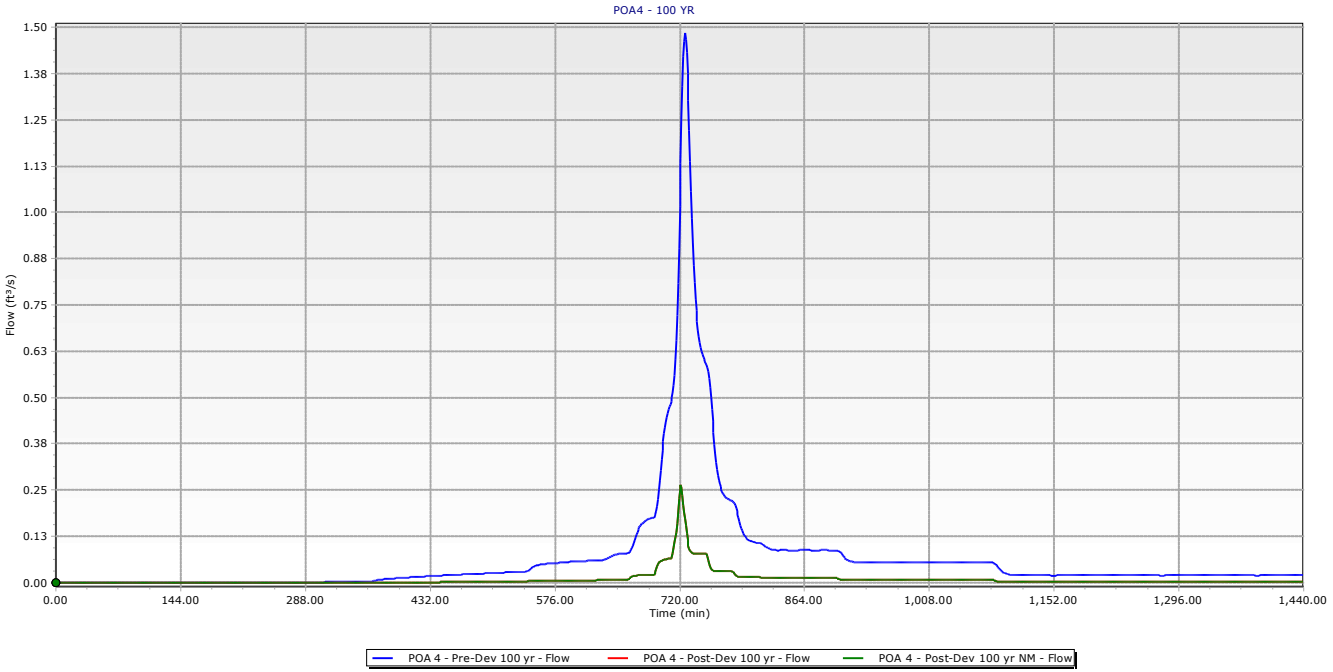

POA3 - 100 YR
12.50
11.25
10.00
8.75
7.50
6.25
5.00
3.75
2.50
1.25
0.00
Flow (ft³/s)
0.00
144.00
288.00
432.00
576.00
720.00
864.00
1,008.00
1,152.00
1,296.00
1,440.00
Time (min)
POA 3 - Pre-Dev 100 yr - Flow
POA 3 - Post-Dev 100 yr - Flow
POA 3 - Post-Dev 100 yr NM - Flow


POA4 - 1 YR
Flow (ft³/s)
0.63
0.56
0.50
0.44
0.38
0.31
0.25
0.19
0.13
0.06
0.00
0.00
144.00
288.00
432.00
576.00
720.00
864.00
1,008.00
1,152.00
1,296.00
1,440.00
Time (min)
POA 4 - Pre-Dev 1 yr - Flow
POA 4 - Post-Dev 1 yr - Flow
POA 4 - Post-Dev 1 yr NM - Flow


POA4 - 2 YR
Flow (ft³/s)
0.75
0.69
0.63
0.56
0.50
0.44
0.38
0.31
0.25
0.19
0.13
0.06
0.00
0.00
144.00
288.00
432.00
576.00
720.00
864.00
1,008.00
1,152.00
1,296.00
1,440.00
Time (min)
POA 4 - Pre-Dev 2 yr - Flow
POA 4 - Post-Dev 2 yr - Flow
POA 4 - Post-Dev 2 yr NM - Flow


POA4 - 10 YR
1.25
1.13
1.00
0.88
0.75
0.63
0.50
0.38
0.25
0.13
0.00
Flow (ft³/s)
0.00
144.00
288.00
432.00
576.00
720.00
864.00
1,008.00
1,152.00
1,296.00
1,440.00
Time (min)
POA 4 - Pre-Dev 10 yr - Flow
POA 4 - Post-Dev 10 yr - Flow
POA 4 - Post-Dev 10 yr NM - Flow


POA4 - 25 YR
Flow (ft³/s)
1.50
1.38
1.25
1.13
1.00
0.88
0.75
0.63
0.50
0.38
0.25
0.13
0.00
0.00
144.00
288.00
432.00
576.00
720.00
864.00
1,008.00
1,152.00
1,296.00
1,440.00
Time (min)
POA 4 - Pre-Dev 25 yr - Flow
POA 4 - Post-Dev 25 yr - Flow
POA 4 - Post-Dev 25 yr NM - Flow


POA4 - 100 YR
Flow (ft³/s)
1.50
1.38
1.25
1.13
1.00
0.88
0.75
0.63
0.50
0.38
0.25
0.13
0.00
0.00
144.00
288.00
432.00
576.00
720.00
864.00
1,008.00
1,152.00
1,296.00
1,440.00
Time (min)
POA 4 - Pre-Dev 100 yr - Flow
POA 4 - Post-Dev 100 yr - Flow
POA 4 - Post-Dev 100 yr NM - Flow

NUTRIENT LOADING CALCULATIONS

BARBEE CHAPEL APARTMENTS

TLA-22001

Project Information

Project Name:	Barbee Chapel Apartments
Submission Date:	
Project Area (ft^2):	455,841 ft^2
Disturbed Area (ft^2):	455,841 ft^2
Development Land Use Type:	Multi-Family Residential
Development Activity Type:	Development - New
Designated Downtown Area?	no
Project Location/Address:	Barbee Chapel Road
County:	Durham
Local Jurisdiction:	Chapel Hill
Project Latitude Coordinates:	35.850978 N
Project Longitude Coordinates:	-78.836007 W
Precipitation Station:	Chapel Hill
Physiographic Region:	Piedmont
Nutrient Management Watershed:	Jordan Lake
Subwatershed:	Jordan - Upper New Hope
Phosphorus Delivery Zone:	Jordan - 060080
Nitrogen Delivery Zone:	Jordan - 060080
Project Designer and Contact Phone Number / Email:	Maria Torres, PE torres@mcadamsco.com
Part of Common Development Plan?	no
Project Owner Type:	Private
Project Description:	

Yellow cells require data for PROJECT AREA RUNOFF and NUTRIENT TREATMENT calculations

Green cells require data for NUTRIENT TARGETS, BUYDOWN, & CREDIT/DEBIT calculations

PROJECT AREA LAND COVERS	TN EMC (mg/L)	TP EMC (mg/L)	Pre-Project Area (ft^2)	Post-Project Area (ft^2)
Roof	1.18	0.11	24,391	99,215
Roadway	1.64	0.34	18,322	0
Parking/Driveway/Sidewalk	1.42	0.18	30,984	227,200
Protected Forest	0.97	0.03	239,603	0
Other Pervious/Landscaping	2.48	1.07	142,541	129,426
CUSTOM LAND COVER 1				
CUSTOM LAND COVER 2				
CUSTOM LAND COVER 3				
LAND TAKEN UP BY SCM	1.18	0.11		

LAND COVER AREA CHECK	
Net Change of Land Covers (ft^2):	**271,040**
Total Project Area Entered (ft^2):	**455,841**
Total Pre-Project Calculated Area (ft^2):	**455,841**
Total Post-Project Calculated Area (ft^2):	**455,841**

Equations Used and Project Area Calculations

SIMPLE METHOD

Runoff Coefficient, R_v

$R_v = 0.05 + (0.009 * I)$

where I = percent impervious (%)

Average Annual Pollutant Load, L

$L = (P_j * R_v * (P/12)) * (C * A * 2.72)$

where C = event mean concentration (mg/L)

Stormwater Runoff Volume Generated, V

$V = P_j * Rv * (P/12) * A$

where A = drainage area (ft^2)

P_j = fraction of rain events with runoff

P = average annual rainfall depth (in)

Pre-Project:			Post-Project:		
A =	**10.4647**	ac	A =	**10.4647**	ac
P =	**47.31**	in.	P =	**47.31**	in.
V =	**316218**	ft^3	V =	**1123254**	ft^3
I =	**16%**		I =	**72%**	
R_v =	**0.20**		R_v =	**0.69**	
P_j =	**0.9**		P_j =	**0.9**	
C_{TN} =	**1.42**	mg/L	C_{TN} =	**1.37**	mg/L
C_{TP} =	**0.24**	mg/L	C_{TP} =	**0.18**	mg/L
L_{TN} =	**28.13**	lb/yr	L_{TN} =	**96.11**	lb/yr
L_{TP} =	**4.82**	lb/yr	L_{TP} =	**12.44**	lb/yr

Catchment ID	1	1	1
SCM ID	101	102	103
Type of SCM	Sand Filter per MDC - Closed	Sand Filter per MDC - Closed	
Predominant hydrologic soil group at SCM location	D	D	
SCM Description			
Design Storm Size (inches/24hrs)			
Percent of Full Size	100%	100%	
Hydrologic Value - Percent Annual Effluent	90%	90%	
Hydrologic Value - Percent Annual Overflow	10%	10%	
Hydrologic Value - Percent Annual ET/Infiltrated	0%	0%	
SCM Effluent TP EMC (mg/L)	0.12	0.12	
SCM Effluent TN EMC (mg/L)	1.20	1.20	
SCM Land Cover TP EMC (mg/L)	0.11	0.11	
SCM Land Cover TN EMC (mg/L)	1.18	1.18	
Drains to SCM ID	102	0	
Catchment Routing (Source Catchment)	Catchments Draining to SCM 101	Catchments Draining to SCM 102	Catchments Draining to SCM 103
Catchment 1			
Catchment 2			
Catchment 3			
Catchment 4			
Catchment 5			
Catchment 6			

SCM ID:	101	102	103			
SCM Drainage Area Land Covers	Area Draining Directly to SCM 101 (ft2)	Area Draining Directly to SCM 102 (ft2)	Area Draining Directly to SCM 103 (ft2)	Total Land Use Area Treated By All SCMs (ft^2)	Allowable Total Land Use Area to be Treated Based on Post-Project Areas (ft^2)	Post-Project Untreated Land Area (ft^2)
Roof	19,290	79,925		99,215	99,215	0
Roadway	0	0		0	0	0
Parking/Driveway/Sidewalk	52,452	164,543		216,995	227,200	10,205
Protected Forest	0	0		0	0	0
Other Pervious/Landscaping	28,771	53,732		82,503	129,426	46,923
CUSTOM LAND COVER 1				0	0	0
CUSTOM LAND COVER 2				0	0	0
CUSTOM LAND COVER 3				0	0	0
LAND TAKEN UP BY SCM				0	0	0
TOTAL AREA DRAINING TO SCM (ft^2):	**100,513**	**298,200**	**0**	**398,713**	**455,841**	**57,128**
CATCHMENT AREA (ft^2):	**398,713**					

Project Summary

Project Name:	Barbee Chapel Apartments				
Project Area (ft^2):	455,841 **ft^2**	10.4647 **acres**		**Submission Date:**	
Disturbed Area (ft^2):	455,841 **ft^2**	10.4647 **acres**			
County:	Durham	**Local Jurisdiction:**		Chapel Hill	
Development Land Use Type:	Multi-Family Residential	**Owner Type:**		Private	
Development Activity Type:	Development - New	**Designated Downtown Area?**		no	
Nutrient Management Watershed:	Jordan Lake	**Subwatershed:**		Jordan - Upper New Hope	
Phosphorus Delivery Zone:	Jordan - 060080	**Nitrogen Delivery Zone:**		Jordan - 060080	
Phosphorus Delivery Factor (%):	45%	**Nitrogen Delivery Factor (%):**		59%	
Phosphorus Loading Rate Target (lb/ac/yr):	*0.82*	***Nitrogen Loading Rate Target (lb/ac/yr):***		*2.20*	
Phosphorus Load Target at Site (lb/yr):	**8.58**	**Nitrogen Load Target at Site (lb/yr):**		**23.02**	
Phosphorus Load Leaving Site w/SCMs (lb/yr):	**9.29**	**Nitrogen Load Leaving Site w/SCMs (lb/yr):**		**85.98**	
P Offsite Buy-Down Threshold Loading Rate (lb/ac/yr):	0.89	**N Offsite Buy-Down Threshold Loading Rate**		10.00	
Total P Load Reduction Needed (lb/yr):	3.86	**Total N Load Reduction Needed (lb/yr):**		73.08	
P Load Treatment Balance at Site (lb/yr):	0.71	**N Load Treatment Balance at Site (lb/yr):**		62.96	
P Load Treatment Balance at Lake (lb/yr):	0.32	**N Load Treatment Balance at Lake (lb/yr):**		37.15	

Nutrient Export Summary

	Pre-Project Whole Site Conditions	Post-Project Whole Site without SCMs	Post-Project Whole Site with SCMs	Post-Project SCM-Treated Area	Post-Project Untreated Area
Percent Impervious (for runoff calculation) (%)	16.2%	71.6%	71.6%	79.3%	17.9%
Percent Built-Upon Area (BUA) (%)	16.2%	71.6%	71.6%	79.3%	17.9%
Annual Runoff Volume (ft^3/yr)	316,218	1,123,254	1,123,254	1,080,530	42,724
Annual Runoff % Change (relative to pre-D)	0%	255%	255%		
Total Nitrogen EMC (mg/L)	1.42	1.37	1.23	1.21	1.63
Total Nitrogen Load Leaving Site (lb/yr)	**28.13**	**96.11**	**85.98**	81.65	4.34
Total Nitrogen Loading Rate (lb/ac/yr)	*2.69*	*9.18*	*8.22*	*8.92*	*3.31*
Total Nitrogen % Change (relative to pre-D)	0%	242%	206%		
Total Phosphorus EMC (mg/L)	0.24	0.18	0.13	0.12	0.35
Total Phosphorus Load Leaving Site (lb/yr)	**4.82**	**12.44**	**9.29**	8.35	0.94
Total Phosphorus Loading Rate (lb/ac/yr)	*0.46*	*1.19*	*0.89*	*0.91*	*0.72*
Total Phosphorus % Change (relative to pre-D)	0%	158%	93%		

SCM/Catchment Summary

SCM ID and Type	Volume Reduction (%)	TN Out (mg/L)	TP Out (mg/L)	*TN Out (lbs/ac/yr)*	*TP Out (lbs/ac/yr)*	TN Reduction (%)	TP Reduction (%)
Catchment 1	0.00%	1.21	0.12	*8.92*	*0.91*	11.01%	27.39%
101: Sand Filter per MDC - Closed	0.00%	1.22	0.13	*8.12*	*0.84*	11.79%	29.98%
102: Sand Filter per MDC - Closed	0.00%	1.21	0.12	*8.92*	*0.91*	8.51%	21.72%
103: NA	0.00%	0.00	0.00	*0.00*	*0.00*	0.00%	0.00%
Catchment 2	0.00%	0.00	0.00	*0.00*	*0.00*	0.00%	0.00%
201: NA	0.00%	0.00	0.00	*0.00*	*0.00*	0.00%	0.00%
202: NA	0.00%	0.00	0.00	*0.00*	*0.00*	0.00%	0.00%
203: NA	0.00%	0.00	0.00	*0.00*	*0.00*	0.00%	0.00%
Catchment 3	0.00%	0.00	0.00	*0.00*	*0.00*	0.00%	0.00%
301: NA	0.00%	0.00	0.00	*0.00*	*0.00*	0.00%	0.00%
302: NA	0.00%	0.00	0.00	*0.00*	*0.00*	0.00%	0.00%
303: NA	0.00%	0.00	0.00	*0.00*	*0.00*	0.00%	0.00%
Catchment 4	0.00%	0.00	0.00	*0.00*	*0.00*	0.00%	0.00%
401: NA	0.00%	0.00	0.00	*0.00*	*0.00*	0.00%	0.00%
402: NA	0.00%	0.00	0.00	*0.00*	*0.00*	0.00%	0.00%
403: NA	0.00%	0.00	0.00	*0.00*	*0.00*	0.00%	0.00%
Catchment 5	0.00%	0.00	0.00	*0.00*	*0.00*	0.00%	0.00%
501: NA	0.00%	0.00	0.00	*0.00*	*0.00*	0.00%	0.00%
502: NA	0.00%	0.00	0.00	*0.00*	*0.00*	0.00%	0.00%
503: NA	0.00%	0.00	0.00	*0.00*	*0.00*	0.00%	0.00%
Catchment 6	0.00%	0.00	0.00	*0.00*	*0.00*	0.00%	0.00%
601: NA	0.00%	0.00	0.00	*0.00*	*0.00*	0.00%	0.00%
602: NA	0.00%	0.00	0.00	*0.00*	*0.00*	0.00%	0.00%
603: NA	0.00%	0.00	0.00	*0.00*	*0.00*	0.00%	0.00%

SCM rows in red have a data entry error for the SCM that makes an error in the calculation.

Nutrient Management Strategy Watershed - Nutrient Offset Credit Reporting Form

Please complete and submit the following information to the local government permitting your development project to characterize it and assess the need to purchase nutrient offset credits. Contact and rule implementation information can be found online at:

http://deq.nc.gov/about/divisions/water-resources/planning/nonpoint-source-management/nutrient-offset-information

PROJECT INFORMATION

Applicant Name:	Toll Brothers Apartment Living		
Project Name:	Barbee Chapel Apartments		
Project Address:	Barbee Chapel Road		
Date: *(mm/dd/yyyy)*	11/17/2022	**Development Land Use Type:**	Multi-Family Residential
County:	Durham	**Development Activity Type:**	Development - New
Pre-Project Built-Upon Area %:	16.17%	**Project Latitude:**	35.850978
Post-Project Built-Upon Area %:	71.61%	**Project Longitude:**	-78.836007

WATERSHED INFORMATION

Nutrient Management Watershed:	Jordan Lake	**N Offsite Threshold Rate (lb/ac/yr):**	10.00
Subwatershed:	Jordan - Upper New Hope	**P Offsite Threshold Rate (lb/ac/yr):**	0.89
Nitrogen Delivery Zone:	Jordan - 060080	**Nitrogen Delivery Factor:**	59%
Phosphorus Delivery Zone:	Jordan - 060080	**Phosphorus Delivery Factor:**	45%

NUTRIENT OFFSET REQUEST

Nitrogen Load Offset Needs

(A) Untreated Loading Rate (lbs/ac/yr)	(B) Treated Loading Rate (lbs/ac/yr)	(C) Loading Rate Target (lbs/ac/yr)	(D) Reduction Need (lbs/ac/yr) B - C	(E) Project Size (ac)	(F) Offset Duration (yrs)	(G) Delivery Factor (%)	(H) State Buy Down Amount (lbs) D * E * F * G	*(L) (Where Applicable)* Local Gov't Buy Down Amount (lbs)
9.18	8.22	2.20	6.02	10.4647	30	59%	**1114.43**	

Phosphorus Load Offset Needs

(A) Untreated Load Rate (lbs/ac/yr)	(B) Treated Load Rate (lbs/ac/yr)	(C) Loading Rate Target (lbs/ac/yr)	(D) Reduction Need (lbs/ac/yr) B - C	(E) Project Size (ac)	(F) Offset Duration (yrs)	(G) Delivery Factor (%)	(H) State Buy Down Amount (lbs) D * E * F * G	*(L) (Where Applicable)* Local Gov't Buy Down Amount (lbs)
1.19	0.89	0.82	0.07	10.4647	30	45%	**9.55**	

LOCAL GOVERNMENT AUTHORIZATION

Local Government Name:	Chapel Hill		
Staff Name:		**Phone:**	
Staff Email:		**Date:**	
Local Government Authorizing Signature:			