STORMWATER MANAGEMENT REPORT

FOR

ROLESVILLE CROSSFIT

WAKE COUNTY, NORTH CAROLINA

October 24, 2019

PREPARED BY:

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Appendices

1.0 Introduction

McArn Realty LLC is proposing a 7,394-square-foot crossfit gym building with associated site improvements at 850 Granite Falls Blvd in Rolesville, North Carolina. This report describes how the project complies with the Wake County Stormwater Ordinance. The following sections include descriptions of the existing site, the proposed development, and the stormwater management summary for the project.

2.0 Existing Site

The existing approximately 1.78-acre parcel is vacant and wooded. The property is bordered on the east and south by Granite Falls Blvd, the west by vacant property, and the north by a swim and athletic club. Based on review of FEMA Firm Panel No. 3720175900J, the property does not appear to contain any flood prone areas. The FEMA Flood Insurance Rate Map (FIRM) Panel is included in Appendix A. The site lies within the Lower Neuse River watershed.

The property was investigated by Carolina Ecosystems, Inc. for the presence of wetlands and streams. The delineation results include buffered streams along the northern and western property boundaries and several small wetlands throughout. The North Carolina Division of Water Resources (NCDWR) and United States Army Corps of Engineers (USACE) determinations are pending. An excerpt from the United States Geological Survey (USGS) Rolesville topographic 7.5' quadrangle map is included in Appendix B, and the Wake County Soil Survey map is included in Appendix C.

The site drains from Granite Falls Blvd to the northwest. Topography on the site ranges from elevation 387' to elevation 358'. Soils on the site are Hydrologic Soil Group (HSG) C and D. The soil types are described in the National Resources Conservation Service (NRCS) soils report in Appendix D.

3.0 Proposed Development

The proposed development will consist of a 7,394-square-foot building, a 1,500-square-foot concrete outdoor fitness area, a parking lot, and sidewalks connecting the buildings and parking. The total proposed impervious surface for the site is 22,658 square feet, or 29.5%.

4.0 Stormwater Management Summary

The stormwater management summary describes the design data and methodologies, the pre- and post-development analyses and summary and the nutrient loading results.

4.1 Design Data and Methodologies

The design of the proposed stormwater management facilities was performed in accordance with Wake County requirements and following the North Carolina Department of Environmental Quality (NCDEQ) Stormwater Design Manual. Wake County stipulates that the proposed development shall not result in a net increase in peak flow leaving the site from pre-development conditions for the one-year, 24-hour storm event.

The Wake County Stormwater Municipal Tool spreadsheet was used to calculate target curve numbers. HydroCAD Version 8.50, a computer modeling software package, was used for the analysis of stormwater routing and hydrology of the proposed watershed. The hydrology calculations were performed using the Natural Resources Conservation Service (NRCS) Soil Conservation Service (SCS) Technical Release 55 (TR-55) methodology. Wake County lies within the Type II rainfall distribution. The rainfall amounts for the site were obtained from the National Oceanic and Atmospheric Administration (NOAA) and are included in Appendix E.

4.2 Pre-development Analysis

The pre-development watershed was approximated based on recent aerial photography and Wake County topographic data. The peak flow rate for the one-year, 24-hour storm event is based on the land use cover (such as open space, grass, woods, etc.) and soil type. Refer to Appendix F for the pre-development watershed map.

4.3 Post-development Analysis

An analysis of the post-development runoff was performed using the same methods, parameters, and assumptions as described in the pre-development analysis above. Based upon the calculations, the project does not create an increase in the peak runoff rate for the one-year, 24-hour storm event.

One stormwater wetland is proposed to provide total suspended solids (TSS) removal and runoff volume storage as required by the Wake County Stormwater Municipal Tool. The post-development watershed map is included in Appendix G.

The Wake County Stormwater Hybrid Tool was used to calculate the pre-, post-, and post-development with BMPs nutrient loads and is included in Appendix H. The DA-1 post-development hydrologic model to support the tool is included in Appendix I.

The proposed stormwater wetland has been designed in accordance with the North Carolina Stormwater Design Manual. The supplemental form for the wetland is included in Appendix J. Appendix K includes the drawdown calculations for the wetland's water quality orifice.

4.4 Pre- and Post-Development Summary

As shown in the Wake County Stormwater Hybrid Tool, this project meets the Wake County target curve number requirements and reduces the peak flow rate in the post-development to less than that in the pre-development condition. Stormwater facilities that do not increase the peak flow rate help prevent adverse downstream impacts from flooding and erosion.

4.5 Operations and Maintenance

An Operations and Maintenance Agreement to ensure that the stormwater wetland operates as designed has been prepared for this site. Refer to Appendix L for the agreement.

5.0 Erosion & Sediment Control Summary

Erosion and sediment control measures are provided for the construction of the site and generally include a construction entrance, one skimmer basin, two diversion ditches, silt fence with silt fence outlets, and inlet protection. The skimmer basin will be converted to the stormwater wetland after the site is stabilized.

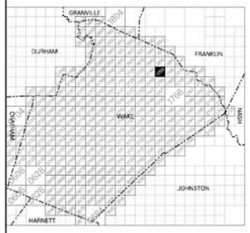
6.0 Limitations

This work was performed in a manner consistent with the level of care and skill ordinarily exercised by other members of FLM Engineering's (FLM) profession practicing in the same locality, and under similar conditions, as of the date any services were provided. FLM's opinions and recommendations were necessarily based on a limited number of data and observations. It is possible that actual conditions could vary beyond the data evaluated. Therefore, FLM makes no guarantee or warranty, express or implied, regarding any services, communications, reports, opinions, or instruments of service provided.

APPENDIX A

FEMA MAP

STATE OF NORTH CAROLINA FIRM PANEL LOCATOR DIAGRAM



DATUM INFORMATION

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

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

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

County Average Vertical Datum Offset Table

County	Vertical Datum Offset (ft)
Wake	– 0.88

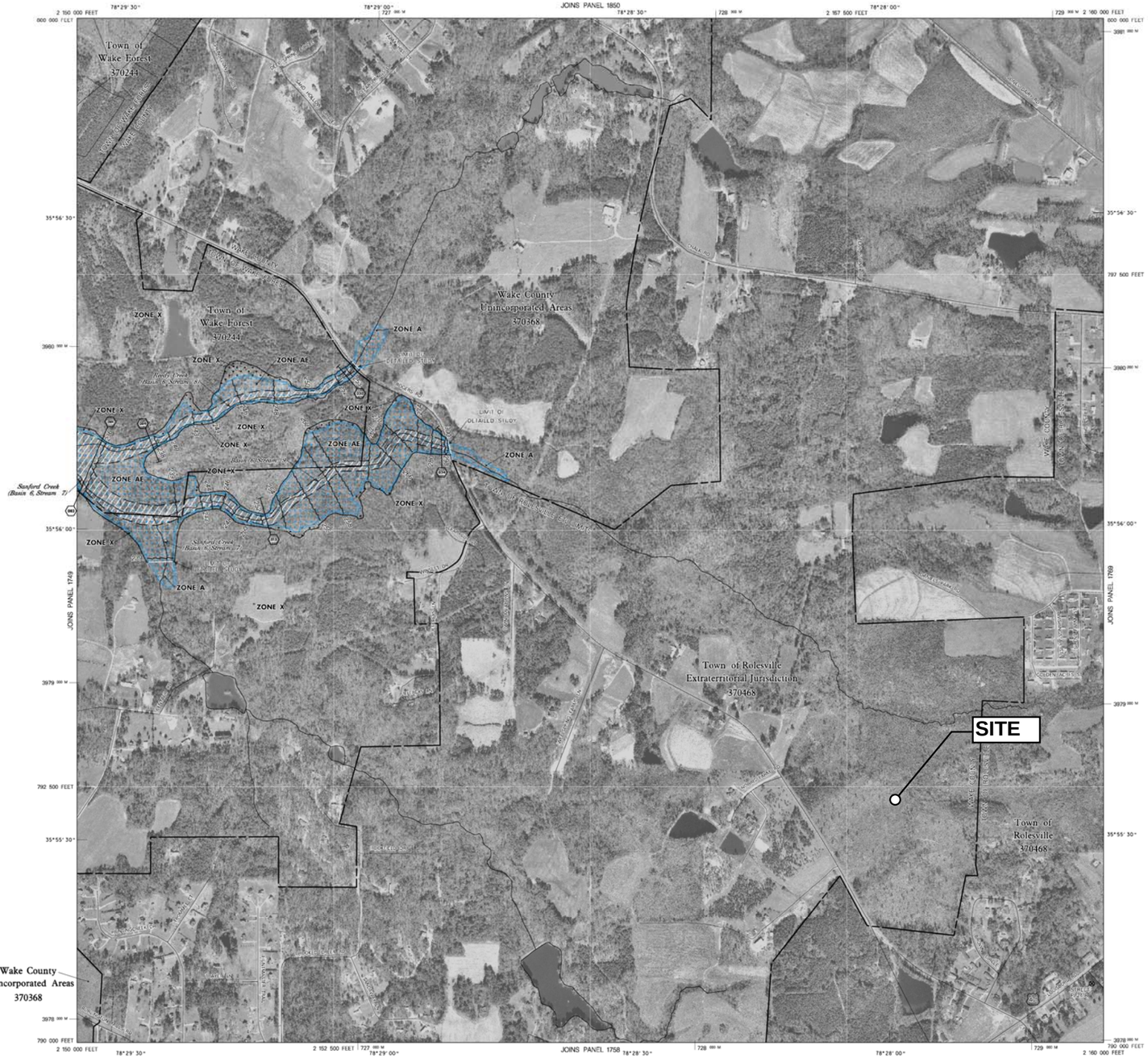
Example: NAVD 88 = NGVD 29 + (–0.88)

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

FLOOD HAZARD DATA TABLE

Cross Section	Stream Station	Flood Discharge (cfs)	1% Annual Chance (100-year) Water-Surface Elevation (feet NAVD 88)	Floodway Width (feet) Left/Right Distance From the Center of Stream to Encroachment Boundary (Looking Downstream) or Total Floodway Width
BASIN 6, STREAM 9				
012	1,260[1]	NA	252.4	95
034	3,400[1]	NA	297.8	90
REEDY CREEK (BASIN 6, STREAM 8)				
001	80[1]	NA	235.8	500[3]
009	860[1]	NA	237.9	110
030	3,040[1]	NA	252.7	50
SANFORD CREEK (BASIN 6, STREAM 7)				
082	8,230[2]	NA	235.8	500[3]

[1] Feet above confluence with Sanford Creek (Basin 6, Stream 7) [2] Feet above mouth
[3] Combined Sanford Creek (Basin 6, Stream 7)/ Reedy Creek (Basin 6, Stream 8) floodway



LEGEND

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

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

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

FLOODWAY AREAS IN ZONE AE

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

OTHER FLOOD AREAS

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

OTHER AREAS

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

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

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

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

*Referenced to the North American Vertical Datum of 1988

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

GRID NORTH

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

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles, Floodway Data, Limited Detailed Flood Hazard Data, and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Boundaries of **regulatory floodways** shown on the FIRM for flooding sources studied by detailed methods were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data for flooding sources studied by detailed methods as well as **non-encroachment widths** for flooding sources studied by limited detailed methods are provided in the FIS report for this jurisdiction. The FIS report also provides instructions for determining a floodway using non-encroachment widths for flooding sources studied by limited detailed methods. Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 4.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures in this jurisdiction.

Base map information and geospatial data used to develop this FIRM were obtained from various organizations, including the participating local community(ies), state and federal agencies, and/or other sources. The primary base for this FIRM is aerial imagery acquired by Wake County. The time period of collection for the imagery is 1999. Information and geospatial data supplied by the local community(ies) that met FEMA base map specifications were considered the preferred source for development of the base map. See geospatial metadata for the associated digital FIRM for additional information about base map preparation.

Base map features shown on this map, such as **corporate limits**, are based on the most up-to-date data available at the time of publication. **Changes in the corporate limits may have occurred since this map was published**. Map users should consult the appropriate community official or website to verify current conditions of jurisdictional boundaries and base map features. This map may contain roads that were not considered in the hydraulic analysis of streams where no new hydraulic model was created during the production of this statewide format FIRM.

This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels, community map repository addresses, and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

If you have **questions about this map**, or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at www.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 www.ncfloodmaps.com, or contact the **FEMA Map Service Center** at 1-800-358-9616 for information on all related products associated with this FIRM. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at www.msc.fema.gov.

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

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

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

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

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

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

NORTH CAROLINA Cooperating Technical State
FEMA'S COOPERATING TECHNICAL PARTNER

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

www.ncfloodmaps.com

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1759J

FIRM
FLOOD INSURANCE RATE MAP
NORTH CAROLINA

PANEL 1759

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

CONTAINS:

COMMUNITY	CID No.	PANEL	SUFFIX
ROLESVILLE, TOWN OF	370468	1759	J
WAKE COUNTY	370368	1759	J
WAKE FOREST, TOWN OF	370244	1759	J

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

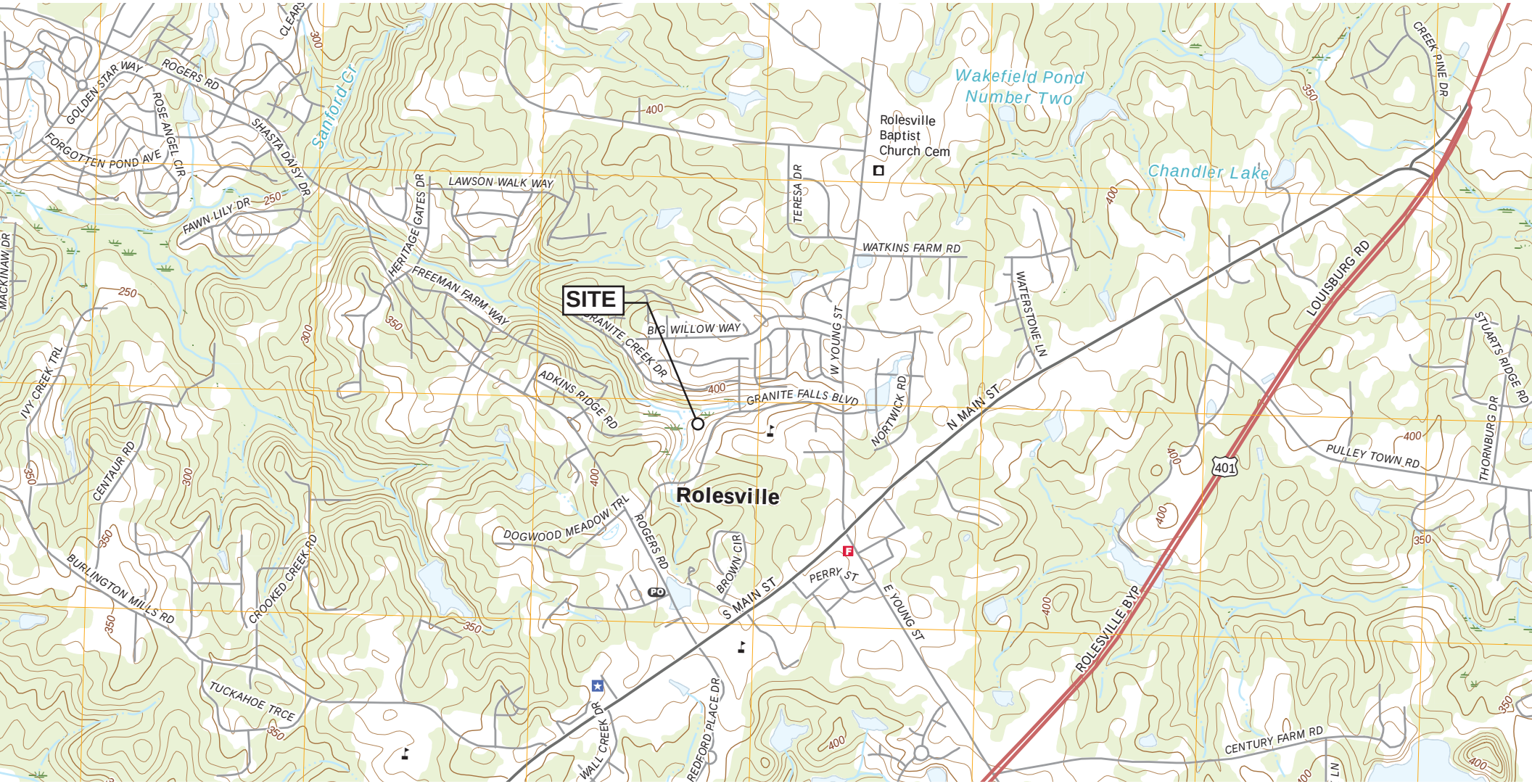
EFFECTIVE DATE
MAY 2, 2006

MAP NUMBER
3720175900J

State of North Carolina
Federal Emergency Management Agency

APPENDIX B

USGS MAP


SITE
Rolesville
Rolesville Baptist Church Cem
Wakefield Pond Number Two
Chandler Lake
Samford Gr
GOLDEN STAR WAY
ROGERS RD
ROSE ANGEL CIR
SHASTA DAISY DR
FORGOTTEN POND AVE
FAWN LILY DR
MACKINAW DR
IVY CREEK TRL
CENTAUR RD
BURLINGTON MILLS RD
CROOKED CREEK RD
TUCKAHOE TRCE
HERITAGE GATES DR
LAWSON WALK WAY
FREEMAN FARM WAY
GRANITE CREEK DR
ADKINS RIDGE RD
BIG WILLOW WAY
GRANITE FALLS BLVD
DOGWOOD MEADOW TRL
ROGERS RD
BROWN CIR
S MAIN ST
PERRY ST
E YOUNG ST
W YOUNG ST
NORTWICK RD
WATKINS FARM RD
TERESA DR
WATERSTONE LN
N MAIN ST
LOUISBURG RD
ROLESVILLE BYP
401
PULLEY TOWN RD
CENTURY FARM RD
WALL CREEK RD
REDFORD PLACE DR
STUARTS RIDGE RD
THORNBURG DR
CREEK PINE DR
250
300
350
400

APPENDIX C

SOIL MAP

WAKE COUNTY, NORTH CAROLINA — SHEET NUMBER 22

22

N

SITE

Walkers Crossroads

Rolesville

Rolesville Church

(Joins sheet 15)

(Joins sheet 21)

(Joins sheet 23)

(Joins sheet 31)

1 Mile

5000 Feet

Scale 1:15840

1 0 1000 2000 3000 4000 5000

APPENDIX D

NRCS SOILS REPORT

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

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

Custom Soil Resource Report for Wake County, North Carolina

Rolesville Crossfit

August 13, 2019

Preface

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

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

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

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

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

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

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

How Soil Surveys Are Made

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

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

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

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

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

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

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

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

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

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

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

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

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

Soil Map

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

Custom Soil Resource Report
Soil Map

Map Scale: 1:1,320 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 15 30 60 90

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Wake County, North Carolina
Survey Area Data: Version 17, Sep 10, 2018

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

Date(s) aerial images were photographed: Oct 29, 2014—Dec 9, 2017

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
HeB	Helena sandy loam, 2 to 6 percent slopes	0.5	5.9%
RgC	Rawlings-Rion complex, 6 to 10 percent slopes	0.0	0.6%
RgD	Rawlings-Rion complex, 10 to 15 percent slopes	2.8	34.8%
Ur	Urban land	0.7	8.2%
WaD	Wake-Rolesville complex, 10 to 15 percent slopes, very rocky	4.1	50.4%
Totals for Area of Interest		**8.2**	**100.0%**

Map Unit Descriptions

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

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

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

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

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

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

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

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

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

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

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

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

Wake County, North Carolina

HeB—Helena sandy loam, 2 to 6 percent slopes

Map Unit Setting

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

Map Unit Composition

Helena and similar soils: 92 percent
Minor components: 8 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Helena

Setting

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

Typical profile

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

Properties and qualities

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

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Vance

Percent of map unit: 8 percent

Landform: Interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

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

Map Unit Setting

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

Map Unit Composition

Rawlings and similar soils: 55 percent
Rion and similar soils: 35 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rawlings

Setting

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

Typical profile

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

Properties and qualities

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

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Hydric soil rating: No

Description of Rion

Setting

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

Typical profile

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

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Helena

Percent of map unit: 7 percent
Landform: Interfluves
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Saw

Percent of map unit: 3 percent
Landform: Interfluves
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex

Hydric soil rating: No

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

Map Unit Setting

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

Map Unit Composition

Rawlings and similar soils: 55 percent
Rion and similar soils: 35 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rawlings

Setting

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

Typical profile

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

Properties and qualities

Slope: 10 to 15 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Hydric soil rating: No

Description of Rion

Setting

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

Typical profile

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

Properties and qualities

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

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Helena

Percent of map unit: 7 percent
Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Saw

Percent of map unit: 3 percent
Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Ur—Urban land

Map Unit Setting

National map unit symbol: 2qwpc
Elevation: 70 to 1,400 feet
Mean annual precipitation: 39 to 51 inches
Mean annual air temperature: 54 to 63 degrees F
Frost-free period: 190 to 250 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Urban Land

Setting

Parent material: Impervious layers over human-transported material

Interpretive groups

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

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

Map Unit Setting

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

Map Unit Composition

Wake, very rocky, and similar soils: 50 percent
Rolesville, very rocky, and similar soils: 40 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wake, Very Rocky

Setting

Landform: Interfluves

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

Typical profile

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

Properties and qualities

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

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: D
Hydric soil rating: No

Description of Rolesville, Very Rocky

Setting

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

Typical profile

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

Properties and qualities

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

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Rock outcrop

Percent of map unit: 5 percent
Hydric soil rating: No

Ashlar, very rocky

Percent of map unit: 5 percent
Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group

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.

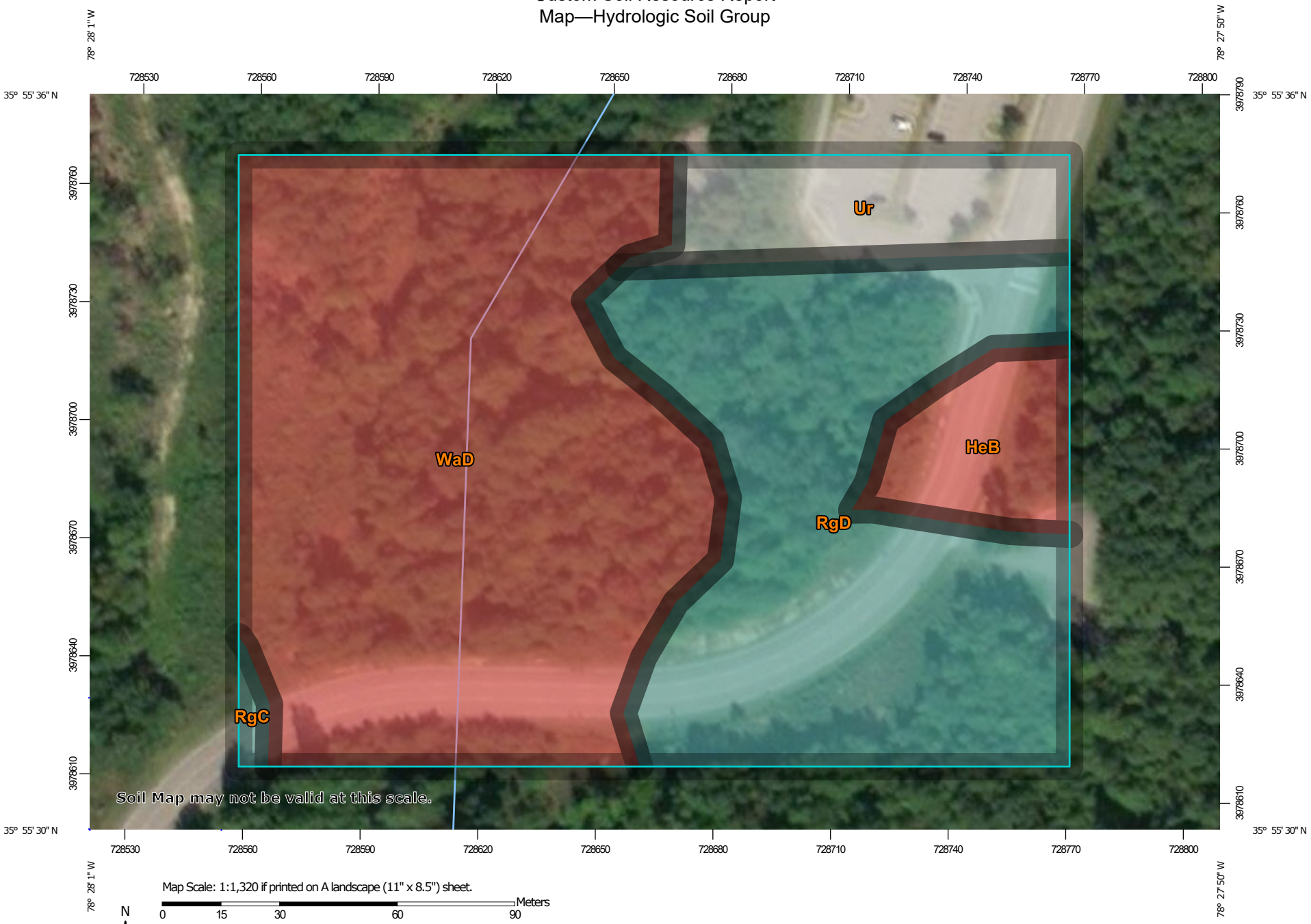
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

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.

Custom Soil Resource Report
Map—Hydrologic Soil Group



Map Scale: 1:1,320 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 15 30 60 90

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 1:24,000.

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Wake County, North Carolina
Survey Area Data: Version 17, Sep 10, 2018

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

Date(s) aerial images were photographed: Oct 29, 2014—Dec 9, 2017

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.

Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
HeB	Helena sandy loam, 2 to 6 percent slopes	D	0.5	5.9%
RgC	Rawlings-Rion complex, 6 to 10 percent slopes	C	0.0	0.6%
RgD	Rawlings-Rion complex, 10 to 15 percent slopes	C	2.8	34.8%
Ur	Urban land		0.7	8.2%
WaD	Wake-Rolesville complex, 10 to 15 percent slopes, very rocky	D	4.1	50.4%
Totals for Area of Interest			**8.2**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

References

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

APPENDIX E

NOAA RAINFALL DATA

NOAA Atlas 14, Volume 2, Version 3
Location name: Rolesville, North Carolina, USA*
Latitude: 35.9257°, Longitude: -78.4655°
Elevation: 372.68 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.403** (0.369-0.441)	**0.468** (0.429-0.511)	**0.534** (0.489-0.582)	**0.599** (0.548-0.653)	**0.665** (0.605-0.725)	**0.717** (0.650-0.781)	**0.763** (0.688-0.831)	**0.804** (0.720-0.877)	**0.849** (0.755-0.928)	**0.890** (0.784-0.973)
10-min	**0.644** (0.590-0.704)	**0.749** (0.687-0.818)	**0.855** (0.784-0.933)	**0.958** (0.877-1.05)	**1.06** (0.965-1.16)	**1.14** (1.03-1.24)	**1.21** (1.09-1.32)	**1.27** (1.14-1.39)	**1.34** (1.19-1.47)	**1.40** (1.24-1.53)
15-min	**0.804** (0.738-0.880)	**0.942** (0.863-1.03)	**1.08** (0.991-1.18)	**1.21** (1.11-1.32)	**1.34** (1.22-1.46)	**1.45** (1.31-1.58)	**1.53** (1.38-1.67)	**1.61** (1.44-1.76)	**1.69** (1.50-1.85)	**1.76** (1.55-1.92)
30-min	**1.10** (1.01-1.21)	**1.30** (1.19-1.42)	**1.54** (1.41-1.68)	**1.76** (1.61-1.92)	**1.99** (1.81-2.17)	**2.18** (1.97-2.37)	**2.35** (2.12-2.56)	**2.50** (2.24-2.73)	**2.69** (2.39-2.94)	**2.85** (2.51-3.12)
60-min	**1.38** (1.26-1.50)	**1.63** (1.50-1.78)	**1.97** (1.81-2.15)	**2.29** (2.09-2.49)	**2.65** (2.41-2.89)	**2.95** (2.68-3.22)	**3.23** (2.92-3.52)	**3.51** (3.15-3.83)	**3.86** (3.43-4.22)	**4.16** (3.67-4.55)
2-hr	**1.61** (1.46-1.77)	**1.91** (1.75-2.10)	**2.34** (2.13-2.56)	**2.74** (2.49-3.01)	**3.22** (2.91-3.53)	**3.65** (3.27-3.98)	**4.05** (3.61-4.42)	**4.46** (3.95-4.87)	**5.00** (4.39-5.46)	**5.47** (4.76-5.99)
3-hr	**1.71** (1.55-1.89)	**2.03** (1.85-2.24)	**2.49** (2.26-2.74)	**2.94** (2.67-3.23)	**3.49** (3.15-3.83)	**3.98** (3.57-4.37)	**4.47** (3.97-4.90)	**4.97** (4.39-5.45)	**5.65** (4.93-6.19)	**6.26** (5.40-6.88)
6-hr	**2.05** (1.87-2.26)	**2.44** (2.23-2.68)	**2.99** (2.72-3.29)	**3.53** (3.22-3.88)	**4.22** (3.81-4.61)	**4.83** (4.33-5.28)	**5.44** (4.84-5.94)	**6.08** (5.36-6.63)	**6.96** (6.05-7.58)	**7.76** (6.66-8.47)
12-hr	**2.41** (2.21-2.66)	**2.88** (2.64-3.15)	**3.54** (3.24-3.88)	**4.21** (3.84-4.61)	**5.06** (4.59-5.52)	**5.83** (5.24-6.34)	**6.61** (5.89-7.19)	**7.46** (6.56-8.09)	**8.61** (7.46-9.35)	**9.68** (8.26-10.5)
24-hr	**2.86** (2.66-3.08)	**3.45** (3.22-3.72)	**4.34** (4.04-4.67)	**5.04** (4.68-5.42)	**5.99** (5.55-6.44)	**6.75** (6.23-7.26)	**7.53** (6.93-8.11)	**8.34** (7.65-8.98)	**9.45** (8.62-10.2)	**10.3** (9.38-11.2)
2-day	**3.32** (3.09-3.57)	**3.99** (3.73-4.30)	**4.97** (4.63-5.36)	**5.75** (5.35-6.19)	**6.80** (6.30-7.32)	**7.63** (7.05-8.22)	**8.49** (7.82-9.14)	**9.37** (8.59-10.1)	**10.6** (9.65-11.4)	**11.5** (10.5-12.5)
3-day	**3.52** (3.28-3.77)	**4.23** (3.95-4.53)	**5.24** (4.89-5.62)	**6.04** (5.63-6.48)	**7.13** (6.62-7.65)	**8.00** (7.41-8.58)	**8.89** (8.20-9.54)	**9.81** (9.01-10.5)	**11.1** (10.1-11.9)	**12.1** (11.0-13.0)
4-day	**3.72** (3.48-3.97)	**4.46** (4.17-4.77)	**5.51** (5.15-5.88)	**6.34** (5.91-6.76)	**7.47** (6.94-7.98)	**8.37** (7.76-8.95)	**9.30** (8.58-9.95)	**10.2** (9.43-11.0)	**11.6** (10.6-12.4)	**12.6** (11.5-13.5)
7-day	**4.31** (4.04-4.60)	**5.15** (4.82-5.49)	**6.27** (5.87-6.70)	**7.17** (6.70-7.65)	**8.40** (7.82-8.96)	**9.38** (8.71-10.0)	**10.4** (9.61-11.1)	**11.4** (10.5-12.2)	**12.8** (11.8-13.7)	**13.9** (12.7-15.0)
10-day	**4.91** (4.60-5.23)	**5.84** (5.48-6.22)	**7.03** (6.59-7.49)	**7.96** (7.45-8.48)	**9.22** (8.61-9.83)	**10.2** (9.51-10.9)	**11.2** (10.4-12.0)	**12.2** (11.3-13.1)	**13.6** (12.6-14.6)	**14.7** (13.5-15.8)
20-day	**6.58** (6.20-7.01)	**7.78** (7.32-8.27)	**9.20** (8.65-9.79)	**10.3** (9.70-11.0)	**11.9** (11.1-12.6)	**13.1** (12.2-13.9)	**14.3** (13.3-15.2)	**15.5** (14.4-16.5)	**17.2** (15.9-18.4)	**18.5** (17.0-19.8)
30-day	**8.18** (7.72-8.68)	**9.62** (9.07-10.2)	**11.2** (10.6-11.9)	**12.4** (11.7-13.2)	**14.0** (13.2-14.9)	**15.3** (14.3-16.3)	**16.5** (15.4-17.6)	**17.8** (16.6-18.9)	**19.4** (18.0-20.7)	**20.7** (19.1-22.1)
45-day	**10.4** (9.89-11.0)	**12.2** (11.6-12.9)	**14.0** (13.3-14.7)	**15.4** (14.5-16.2)	**17.1** (16.2-18.1)	**18.5** (17.5-19.5)	**19.8** (18.7-20.9)	**21.1** (19.9-22.3)	**22.9** (21.4-24.2)	**24.2** (22.6-25.6)
60-day	**12.5** (11.9-13.1)	**14.6** (13.9-15.3)	**16.5** (15.7-17.4)	**18.0** (17.1-18.9)	**19.9** (18.9-21.0)	**21.4** (20.2-22.5)	**22.7** (21.5-24.0)	**24.1** (22.7-25.4)	**25.9** (24.3-27.3)	**27.2** (25.5-28.8)

[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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APPENDIX F

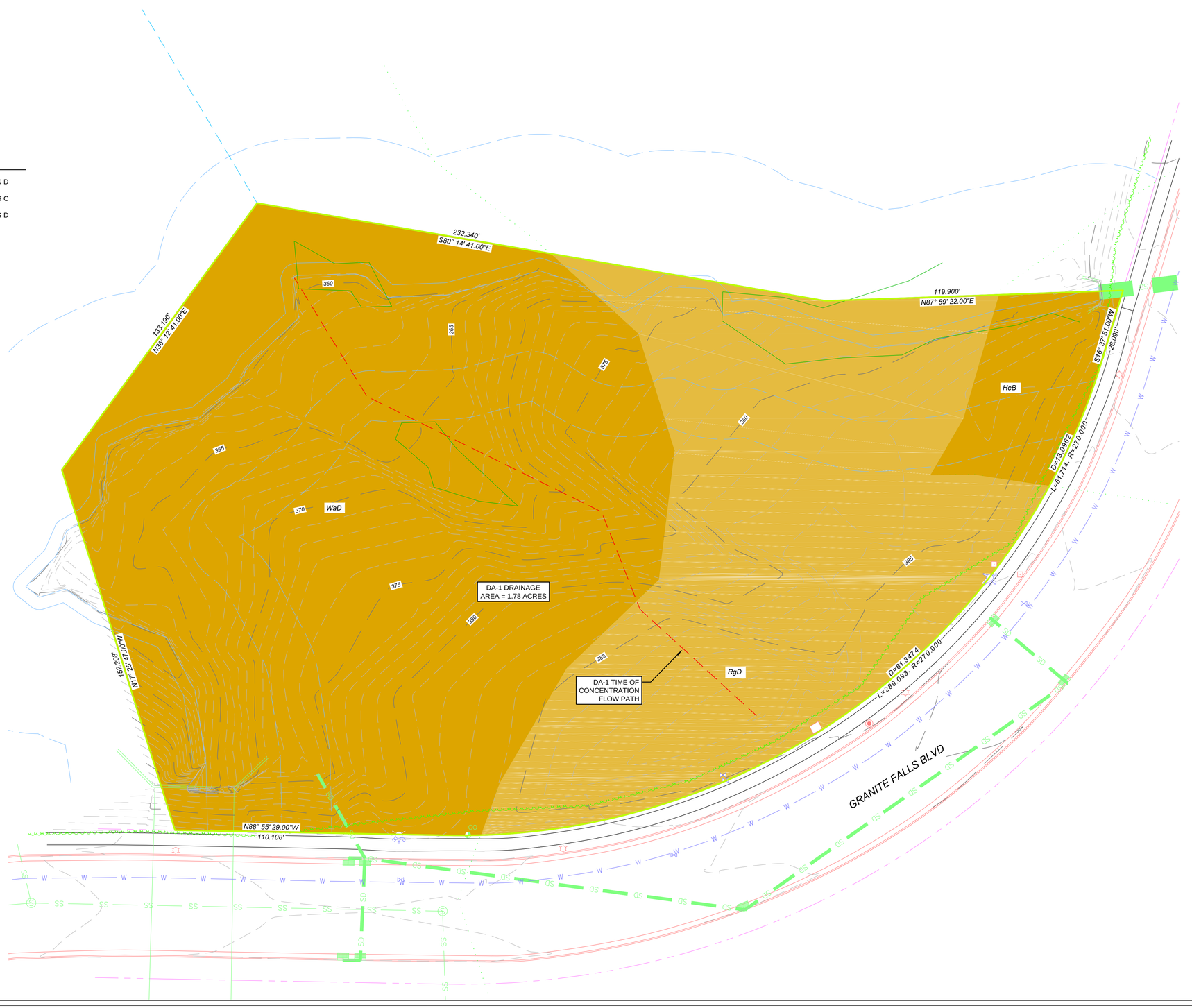
PRE-DEVELOPMENT WATERSHED MAP

LEGEND

- EX. PROPERTY LINE
- EX. RIGHT-OF-WAY
- EX. ADJACENT OWNERS
- 450 EX. MAJOR CONTOUR (5')
- EX. MINOR CONTOUR (1')
- EX. CHANNEL/STREAM
- EX. CHANNEL/STREAM BUFFER
- EX. SOIL LINE
- EX. TREE LINE
- PRE-DEVELOPMENT DRAINAGE BOUNDARY
- PRE-DEVELOPMENT FLOW SEGMENT
- WOODED LAND COVER, HSG C
- WOODED LAND COVER, HSG D

SOILS

HeB	HELENA SANDY LOAM, 2 TO 6 PERCENT SLOPES	HSG D
RgD	RAWLINGS-RION COMPLEX, 10 TO 15 PERCENT SLOPES	HSG C
WaD	WAKE-ROLESVILLE COMPLEX, 10 TO 15 PERCENT SLOPES, VERY ROCKY	HSG D



FLM ENGINEERING

POST OFFICE BOX 91727
RALEIGH, NORTH CAROLINA 27675
PHONE: 919.610.1051
FIRM NC LICENSE NUMBER C-4222

REVISION HISTORY

REV #	DESCRIPTION	DATE	BY

ORIGINAL PLAN SIZE: 24" X 36"

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

20 10 0 20
SCALE: 1 INCH = 20 FEET

N

SCALE ADJUSTMENT

THIS BAR IS 1 INCH IN LENGTH ON ORIGINAL DRAWING

0 1"

IF IT IS NOT 1 INCH ON THIS SHEET, ADJUST YOUR SCALE ACCORDINGLY

EXHIBIT

ROLESVILLE CROSSFIT

DATE:	10-22-2019
SCALE:	AS SHOWN
DESIGNED BY:	FLM
APPROVED BY:	FLM
PROJECT NO.:	19036

PRE-DEVELOPMENT DRAINAGE AREA MAP

M-1

SHEET 1 OF 1

APPENDIX G

POST-DEVELOPMENT WATERSHED MAP

LEGEND

- EX. PROPERTY LINE
- EX. RIGHT-OF-WAY
- EX. ADJACENT OWNERS
- 450 EX. MAJOR CONTOUR (5')
- EX. MINOR CONTOUR (1')
- EX. CHANNEL/STREAM
- EX. CHANNEL/STREAM BUFFER
- EX. SOIL LINE
- EX. TREE LINE
- PROP. SETBACK LINE
- PROP. EASEMENT
- 450 PROP. MAJOR CONTOUR (5')
- PROP. MINOR CONTOUR (1')
- PROP. STORM SEWER
- POST-DEVELOPMENT DRAINAGE BOUNDARY
- POST-DEVELOPMENT SUB-DRAINAGE BOUNDARY
- WOODED LAND COVER, HSG C
- WOODED LAND COVER, HSG D
- GRASSED LAND COVER, HSG C
- GRASSED LAND COVER, HSG D
- IMPERVIOUS COVER

SOILS

HeB	HELENA SANDY LOAM, 2 TO 6 PERCENT SLOPES	HSG D
RgD	RAWLINGS-RION COMPLEX, 10 TO 15 PERCENT SLOPES	HSG C
WaD	WAKE-ROLESVILLE COMPLEX, 10 TO 15 PERCENT SLOPES, VERY ROCKY	HSG D

FLM ENGINEERING

POST OFFICE BOX 91727
RALEIGH, NORTH CAROLINA 27675
PHONE: 919.610.1051
FIRM NC LICENSE NUMBER C-4222

REVISION HISTORY

REV #	DESCRIPTION	DATE	BY

ORIGINAL PLAN SIZE: 24" X 36"

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

20 10 0 20
SCALE: 1 INCH = 20 FEET

N

SCALE ADJUSTMENT

THIS BAR IS 1 INCH IN LENGTH ON ORIGINAL DRAWING

0 1"

IF IT IS NOT 1 INCH ON THIS SHEET, ADJUST YOUR SCALE ACCORDINGLY

EXHIBIT

ROLESVILLE CROSSFIT

DATE:	10-22-2019
SCALE:	AS SHOWN
DESIGNED BY:	FLM
APPROVED BY:	FLM
PROJECT NO.:	19036

POST-DEVELOPMENT DRAINAGE AREA MAP

M-1

SHEET 1 OF 1

APPENDIX H

WAKE COUNTY STORMWATER HYBRID TOOL

SITE DATA

Project Information	
Project Name:	**Rolesville Crossfit**
Applicant:	FLM Engineering
Applicant Contact Name:	Jon Frazier, PE
Applicant Contact Number:	919.610.1051
Contact Email:	jfrazier@flmengineering.com
Municipal Jurisdiction (Select from dropdown menu):	Rolesville
Last Updated:	
Site Data:	
Total Site Area (Ac):	1.78
Existing Lake/Pond Area (Ac):	0.00
Proposed Disturbed Area (Ac):	0.93
Impervious Surface Area (acre):	0.53
Type of Development (Select from Dropdown menu):	Non-Residential
Percent Built Upon Area (BUA):	30%
Project Density:	High
Is the proposed project a site expansion?	No
Number of Drainage Areas on Site:	1
NOAA — **1-Year, 24-Hour Storm (inches) (See NOAA Website):**	2.86
2-Year, 24-Hour Storm (inches) (See NOAA Website):	3.45
10-Year, 24-Hour Storm (inches) (See NOAA Website):	5.04
Lot Data (if applicable):	
Total Acreage in Lots:	N/A
Number of Lots:	
Average Lot Size (SF):	
Total Impervious Surface Area on Lots (SF):	
Average Impervious Surface Area Per Lot (SF):	

Stormwater Narrative (limit to 1,200 characters - attach additional pages with submittal if necessary):

Rolesville Crossfit is a proposed 7,394 SF commercial building with associated site improvements including sidewalks, parking and drive aisles, and a concrete outdoor fitness area. Stormwater management on the site will be accomplished by one stormwater wetland.

Project Name: Rolesville Crossfit

DRAINAGE AREA 1
STORMWATER PRE-POST CALCULATIONS

LAND USE & SITE DATA	PRE-DEVELOPMENT				POST-DEVELOPMENT			
Drainage Area (Acres)=	1.78				1.78			
Site Acreage within Drainage=	1.78				1.78			
One-year, 24-hour rainfall (in)=	2.86							
Two-year, 24-hour rainfall (in)=	3.45							
Ten-year, 24-hour storm (in)=	5.04							
Total Lake/Pond Area (Acres)=	0.00				0.00			
Lake/Pond Area not in the Tc flow path (Acres)=	0.00				0.00			
Site Land Use (acres):	A	B	C	D	A	B	C	D
Pasture								
Woods, Poor Condition								
Woods, Fair Condition			0.63	1.15			0.28	0.64
Woods, Good Condition								
Open Space, Poor Condition								
Open Space, Fair condition								
Open Space, Good Condition							0.11	0.22
Reforestation (in dedicated OS)								
Connected Impervious								0.53
Disconnected Impervious								

SITE FLOW	PRE-DEVELOPMENT T_c	POST-DEVELOPMENT Tc
Sheet Flow		
Length (ft)=	63.00	
Slope (ft/ft)=	0.080	
Surface Cover:	Woods	
n-value=	0.400	
T_t (hrs)=	0.150	
Shallow Flow		
Length (ft)=	203.00	
Slope (ft/ft)=	0.120	
Surface Cover:	Unpaved	
Average Velocity (ft/sec)=	5.59	
T_t (hrs)=	0.01	
Channel Flow 1		
Length (ft)=		
Slope (ft/ft)=		
Cross Sectional Flow Area (ft^2)=		
Wetted Perimeter (ft)=		
Channel Lining:		
n-value=		
Hydraulic Radius (ft)=		
Average Velocity (ft/sec)=		
T_t (hrs)=		

Project Name: Rolesville Crossfit

DRAINAGE AREA 1
STORMWATER PRE-POST CALCULATIONS

Channel Flow 2		
Length (ft)=		
Slope (ft/ft)=		
Cross Sectional Flow Area (ft^2)=		
Wetted Perimeter (ft)=		
Channel Lining:		
n-value=		
Hydraulic Radius (ft)=		
Average Velocity (ft/sec)=		
T_t (hrs)=		
Channel Flow 3		
Length (ft)=		
Slope (ft/ft)=		
Cross Sectional Flow Area (ft^2)=		
Wetted Perimeter (ft)=		
Channel Lining:		
n-value=		
Hydraulic Radius (ft)=		
Average Velocity (ft/sec)=		
T_t (hrs)=		
Tc (hrs)=	0.15	0.10
RESULTS	**PRE-DEVELOPMENT**	**POST-DEVELOPMENT**
Composite Curve Number=	77	84
Disconnected Impervious Adjustment		
Disconnected impervious area (acre) =		
$CN_{adjusted\ (1\text{-}year)}$=	**84**	
High Density Only		
Volume of runoff from 1" rainfall for DA HIGH DENSITY REQUIREMENT = (ft^3) =	2,055	
1-year, 24-hour storm (Peak Flow)		
Runoff (inches) = $Q^*_{1\text{-}year}$=	0.97	1.37
Volume of runoff (ft^3) =	6,259	8,852
Volume change (ft^3) =	2,593	
Peak Discharge (cfs)= $Q_{1\text{-}year}$=	2.156	3.849
2-year, 24-hour storm (LID)		
Runoff (inches) = $Q^*_{2\text{-}year}$=	1.39	1.86
Volume of runoff (ft^3) =	8,953	12,000
Peak Discharge (cfs)= $Q_{2\text{-}year}$=	3.084	5.217
10-year, 24-hour storm (DIA)		
Runoff (inches) = $Q^*_{10\text{-}year}$=	2.65	3.26
Volume of runoff (ft^3) =	17,096	21,073
Peak Discharge (cfs)= $Q_{10\text{-}year}$=	5.890	9.161

Project Name: Rolesville Crossfit

DA SITE SUMMARY
STORMWATER PRE-POST CALCULATIONS

SITE SUMMARY

DRAINAGE AREA SUMMARIES

DRAINAGE AREA:	DA1	DA2	DA3	DA4	DA5	DA6	DA7	DA8	DA9	DA10
Pre-Development (1-year, 24-hour storm)										
Runoff (in) = $Q_{pre,1\text{-}year}$ =	0.97									
Peak Flow (cfs)=$Q_{1\text{-}year}$ =	2.156									
Post-Development (1-year, 24-hour storm)										
Proposed Impervious Surface (acre) =	0.53									
Runoff (in)=$Q_{1\text{-}year}$ =	1.37									
Peak Flow (cfs)=$Q_{1\text{-}year}$ =	3.849									
Increase in volume per DA (ft^3)_1-yr storm=	2,593									
Minimum Volume to be Managed for DA HIGH DENSITY REQUIREMENT = (ft^3) =	2,055									

TARGET CURVE NUMBER (TCN)

Site Data

SITE \SOIL COMPOSITION

HYDROLOGIC SOIL GROUP	Site Area	%	Target CN
A	0.00	0%	N/A
B	0.00	0%	N/A
C	0.39	22%	N/A
D	1.39	78%	N/A

Total Site Area (acres) =	1.78
Percent BUA (Includes Existing Lakes/Pond Areas) =	30%
Project Density =	High
Target Curve Number (TCN) =	N/A
$CN_{adjusted\ (1\text{-}year)}$=	84
Minimum Volume to be Managed (Total Site) Per TCN Requirement= ft^3 =	N/A

Site Nitrogen Loading Data

HSG	TN export coefficient (lbs/ac/yr)	Site Acreage	N Export
Pasture	1.2	0.00	0.00
Woods, Poor Condition	1.6	0.00	0.00
Woods, Fair Condition	1.2	0.92	1.10
Woods, Good Condition	0.8	0.00	0.00
Open Space, Poor Condition	1.0	0.00	0.00
Open Space, Fair Condition	0.8	0.00	0.00
Open Space, Good Condition	0.6	0.33	0.20
Reforestation (in dedicated OS)	0.6	0.00	0.00
Impervious	21.2	0.53	11.24
SITE NITROGEN LOADING RATE (lbs/ac/yr)=	7.04		
Nitrogen Load (lbs/yr)=	12.54		
TOTAL SITE NITROGEN TO MITIGATE (lbs/yr)_Wendell Only=	6.13		

Site Nitrogen Loading Data For Expansions Only

	Existing	New
Impervious(acres)=	NA	NA
"Expansion Area" (acres=)		
Nitrogen Load (lbs/yr)=	NA	NA
SITE NITROGEN LOADING RATE (lbs/ac/yr)=	NA	NA
Total Site loading rate (lbs/ac/yr)		
TOTAL SITE NITROGEN TO MITIGATE (lbs/yr)=	NA	

Project Name: **Rolesville Crossfit**

DRAINAGE AREA 1
BMP CALCULATIONS

DRAINAGE AREA 1 - BMP DEVICES AND ADJUSTMENTS				
DA1 Site Acreage=	1.78			
DA1 Off-Site Acreage=				
Total Required Storage Volume for Site TCN Requirement (ft^3)=	N/A			
Total Required Storage Volume for DA1 1" Rainfall for High Density (ft^3)=	2,055			
Will site use underground detention/cistern?	No	Enter % of the year water will be reused=		Note: Supporting information/details should be submitted to demonstrate water usage.

ENTER ACREAGE FOR ALL SUB-DRAINAGE AREAS IN DA

HSG	Sub-DA1(a) (Ac)		Sub-DA1(b) (Ac)		Sub-DA1(c) (Ac)		Sub-DA1(d) (Ac)		Sub-DA1(e) (Ac)	
	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site	Site	Off-site
Pasture										
Woods, Poor Condition										
Woods, Fair Condition			0.92							
Woods, Good Condition										
Open Space, Poor Condition										
Open Space, Fair Condition										
Open Space, Good Condition	0.13		0.20							
Reforestation (in dedicated OS)										
Impervious	0.52		0.01							

Sub-DA1(a) BMP(s)

Device Name (As Shown on Plan)	Device Type	Water Quality Volume for Sub-DA (ft^3)	Provided Volume that will drawdown 2-5 days (ft^3)	Nitrogen Removal Efficiency	Sub-DA Nitrogen (lbs)	Nitrogen Removed (lbs)	Drawdown Time (hours)
Wetland 1	Stormwater Wetlands	738	2,131	40%	11.10	4.44	61.9
				0%	6.66	0.00	
				0%	6.66	0.00	
				0%	6.66	0.00	
				0%	6.66	0.00	
Total Nitrogen remaining leaving the subbasin (lbs):		**6.66**					

Sub-DA1(b) BMP(s)

If Sub-DA1(b) is connected to upstream subbasin(s), enter the nitrogen leaving the most upstream subbasin(lbs):

Device Name (As Shown on Plan)	Device Type	Water Quality Volume for Sub-DA (ft^3)	Provided Volume that will drawdown 2-5 days (ft^3)	Nitrogen Removal Efficiency	Sub-DA Nitrogen (lbs)	Nitrogen Removed (lbs)	Drawdown Time (hours)
		226		0%	1.44	0.00	
				0%	1.44	0.00	
				0%	1.44	0.00	
				0%	1.44	0.00	
				0%	1.44	0.00	
Total Nitrogen remaining leaving the subbasin (lbs):		**1.44**					

Sub-DA1 (c) BMP(s)

If Sub-DA1(c) is connected to upstream subbasin(s), enter the nitrogen leaving the most upstream subbasin(lbs):

Device Name (As Shown on Plan)	Device Type	Water Quality Volume for Sub-DA (ft^3)	Provided Volume that will drawdown 2-5 days (ft^3)	Nitrogen Removal Efficiency	Sub-DA Nitrogen (lbs)	Nitrogen Removed (lbs)	Drawdown Time (hours)
				0%	0.00	0.00	
				0%	0.00	0.00	
				0%	0.00	0.00	
				0%	0.00	0.00	
				0%	0.00	0.00	
Total Nitrogen remaining leaving the subbasin (lbs):							

Project Name: Rolesville Crossfit

DRAINAGE AREA 1
BMP CALCULATIONS

Sub-DA1(d) BMP(s)							
If Sub-DA1(d) is connected to upstream subbasin(s), enter the nitrogen leaving the most upstream subbasin(lbs):							
Device Name (As Shown on Plan)	Device Type	Water Quality Volume for Sub-DA (ft^3)	Provided Volume that will drawdown 2-5 days (ft^3)	Nitrogen Removal Efficiency	Sub-DA Nitrogen (lbs)	Nitrogen Removed (lbs)	Drawdown Time (hours)
				0%	0.00	0.00	
				0%	0.00	0.00	
				0%	0.00	0.00	
				0%	0.00	0.00	
				0%	0.00	0.00	
Total Nitrogen remaining leaving the subbasin (lbs):							
Sub-DA1(e) BMP(s)							
If Sub-DA1(e) is connected to upstream subbasin(s), enter the nitrogen leaving the most upstream subbasin(lbs):							
Device Name (As Shown on Plan)	Device Type	Water Quality Volume for Sub-DA (ft^3)	Provided Volume that will drawdown 2-5 days (ft^3)	Nitrogen Removal Efficiency	Sub-DA Nitrogen (lbs)	Nitrogen Removed (lbs)	Drawdown Time (hours)
				0%	0.00	0.00	
				0%	0.00	0.00	
				0%	0.00	0.00	
				0%	0.00	0.00	
				0%	0.00	0.00	
Total Nitrogen remaining leaving the subbasin (lbs):							

DA1 BMP SUMMARY	
Total Volume Treated (ft^3)=	2,131
Nitrogen Mitigated(lbs)=	4.44
1-year, 24-hour storm	
Post BMP Volume of Runoff (ft^3)$_{(1\text{-year})}$=	6,721
Post BMP Runoff (inches) = $Q^*_{(1\text{-year})}$=	1.04
Post BMP $CN_{(1\text{-year})}$=	78
Post BMP Peak Discharge (cfs)= $Q_{1\text{-year}}$=	2.120
2-year, 24-hour storm (LID)	
Post BMP Volume of Runoff (ft3)$_{(2\text{-year})}$=	9,869
Post BMP Runoff (inches) = $Q^*_{(2\text{-year})}$=	1.53
Post BMP $CN_{(2\text{-year})}$=	79
Post BMP Peak Discharge (cfs)= $Q_{(2\text{-year})}$=	3.150
10-year, 24-hour storm (DIA)	
Post BMP Volume of Runoff (ft^3)$_{(10\text{-year})}$=	18,942
Post BMP Runoff (inches) = $Q^*_{(10\text{-year})}$=	2.93
Post BMP $CN_{(10\text{-year})}$=	95
Post BMP Peak Discharge (cfs)= $Q_{(10\text{-year})}$=	5.820

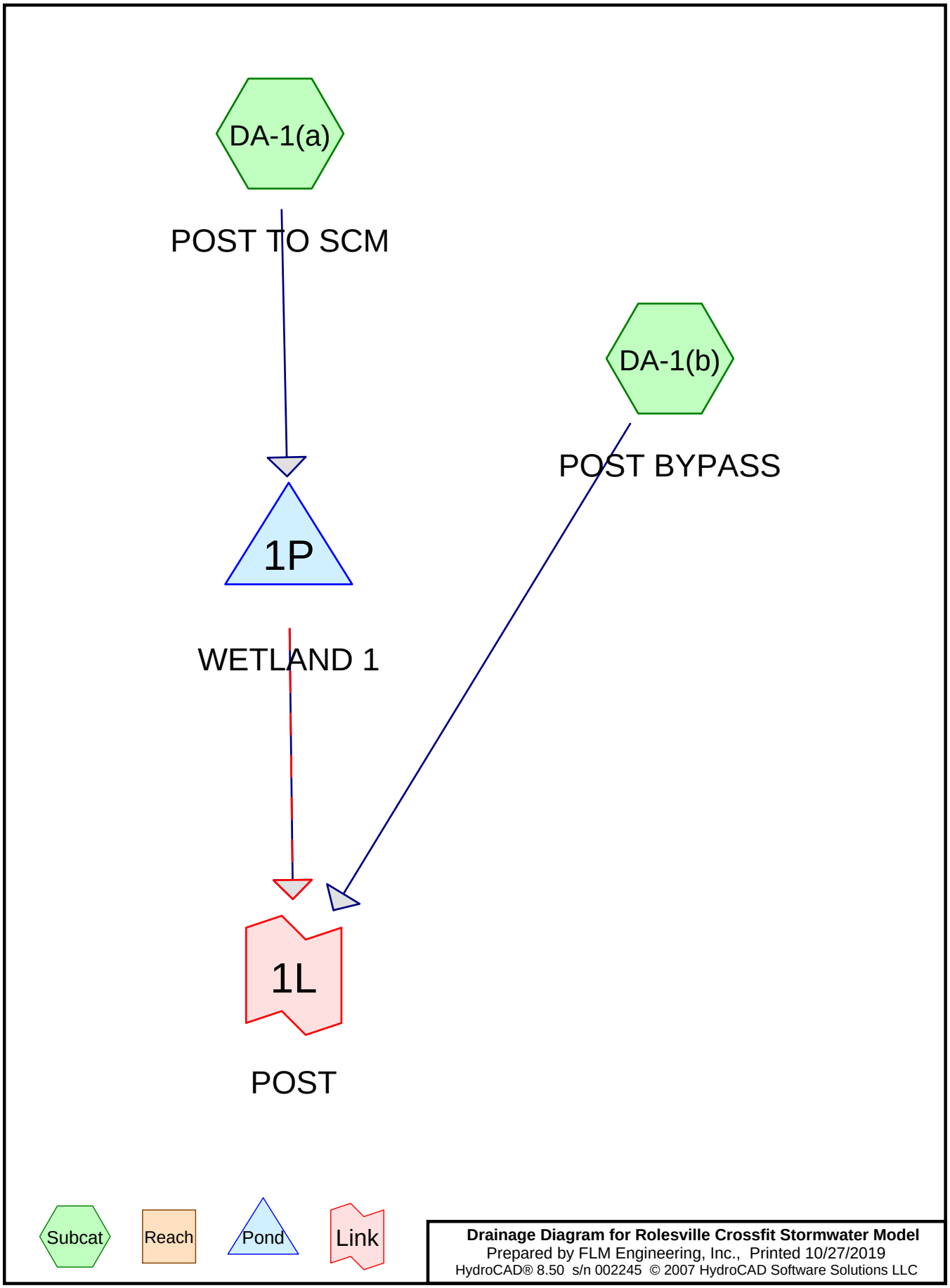
Project Name: Rolesville Crossfit

DA SITE SUMMARY
BMP CALCULATIONS

BMP SUMMARY										
DRAINAGE AREA SUMMARIES										
DRAINAGE AREA:	DA1	DA2	DA3	DA4	DA5	DA6	DA7	DA8	DA9	DA10
Pre-Development (1-year, 24-hour storm)										
Runoff (in)=$Q^*_{1\text{-year}}$ =	0.97									
Peak Flow (cfs)=$Q_{1\text{-year}}$ =	2.156									
Post-Development (1-year, 24-hour storm)										
Target Curve Number (TCN) =	NA									
Post BMP Runoff (inches) = $Q^*_{(1\text{-year})}$=	1.04									
Post BMP Peak Discharge (cfs)= $Q_{1\text{-year}}$=	2.120									
Post BMP $CN_{(1\text{-year})}$=	78									
Post-BMP Nitrogen Loading										
TOTAL SITE NITROGEN MITIGATED (lbs)=	4.44									
SITE NITROGEN LOADING RATE (lbs/ac/yr)=	4.55									
TOTAL SITE NITROGEN LEFT TO MITIGATE_Wendell Only (lbs)=	**1.69**									

APPENDIX I

POST-DEVELOPMENT HYDROLOGIC MODEL



Drainage Diagram for Rolesville Crossfit Stormwater Model
Prepared by FLM Engineering, Inc., Printed 10/27/2019

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.280	73	Woods, Fair, HSG C (DA-1(b))
0.110	79	50-75% Grass cover, Fair, HSG C (DA-1(a),DA-1(b))
0.640	79	Woods, Fair, HSG D (DA-1(b))
0.220	84	50-75% Grass cover, Fair, HSG D (DA-1(a),DA-1(b))
0.530	98	Paved parking & roofs (DA-1(a),DA-1(b))
1.780		**TOTAL AREA**

Summary for Subcatchment DA-1(a): POST TO SCM

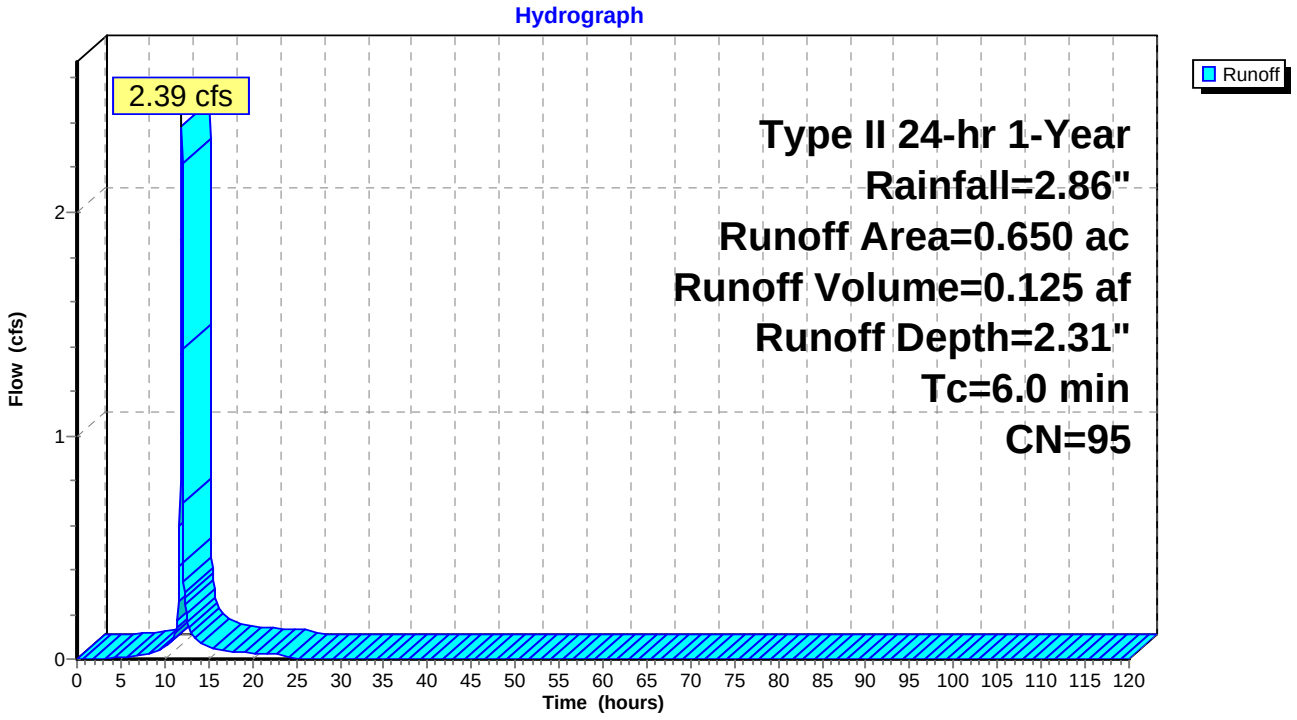
Runoff = 2.39 cfs @ 11.96 hrs, Volume= 0.125 af, Depth= 2.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
Type II 24-hr 1-Year Rainfall=2.86"

Area (ac)	CN	Description
0.520	98	Paved parking & roofs
0.040	84	50-75% Grass cover, Fair, HSG D
0.090	79	50-75% Grass cover, Fair, HSG C
0.650	95	Weighted Average
0.130		Pervious Area
0.520		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment DA-1(a): POST TO SCM



Hydrograph for Subcatchment DA-1(a): POST TO SCM

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
2.50	0.08	0.00	0.00
5.00	0.18	0.01	0.01
7.50	0.31	0.06	0.02
10.00	0.52	0.18	**0.05**
12.50	2.10	1.58	**0.19**
15.00	2.44	1.91	0.06
17.50	2.61	2.07	0.04
20.00	2.72	2.18	0.02
22.50	**2.81**	**2.27**	0.02
25.00	**2.86**	**2.31**	0.00
27.50	2.86	2.31	0.00
30.00	2.86	2.31	0.00
32.50	2.86	2.31	0.00
35.00	2.86	2.31	0.00
37.50	2.86	2.31	0.00
40.00	2.86	2.31	0.00
42.50	2.86	2.31	0.00
45.00	2.86	2.31	0.00
47.50	2.86	2.31	0.00
50.00	2.86	2.31	0.00
52.50	2.86	2.31	0.00
55.00	2.86	2.31	0.00
57.50	2.86	2.31	0.00
60.00	2.86	2.31	0.00
62.50	2.86	2.31	0.00
65.00	2.86	2.31	0.00
67.50	2.86	2.31	0.00
70.00	2.86	2.31	0.00
72.50	2.86	2.31	0.00
75.00	2.86	2.31	0.00
77.50	2.86	2.31	0.00
80.00	2.86	2.31	0.00
82.50	2.86	2.31	0.00
85.00	2.86	2.31	0.00
87.50	2.86	2.31	0.00
90.00	2.86	2.31	0.00
92.50	2.86	2.31	0.00
95.00	2.86	2.31	0.00
97.50	2.86	2.31	0.00
100.00	2.86	2.31	0.00
102.50	2.86	2.31	0.00
105.00	2.86	2.31	0.00
107.50	2.86	2.31	0.00
110.00	2.86	2.31	0.00
112.50	2.86	2.31	0.00
115.00	2.86	2.31	0.00
117.50	2.86	2.31	0.00
120.00	2.86	2.31	0.00

Summary for Subcatchment DA-1(b): POST BYPASS

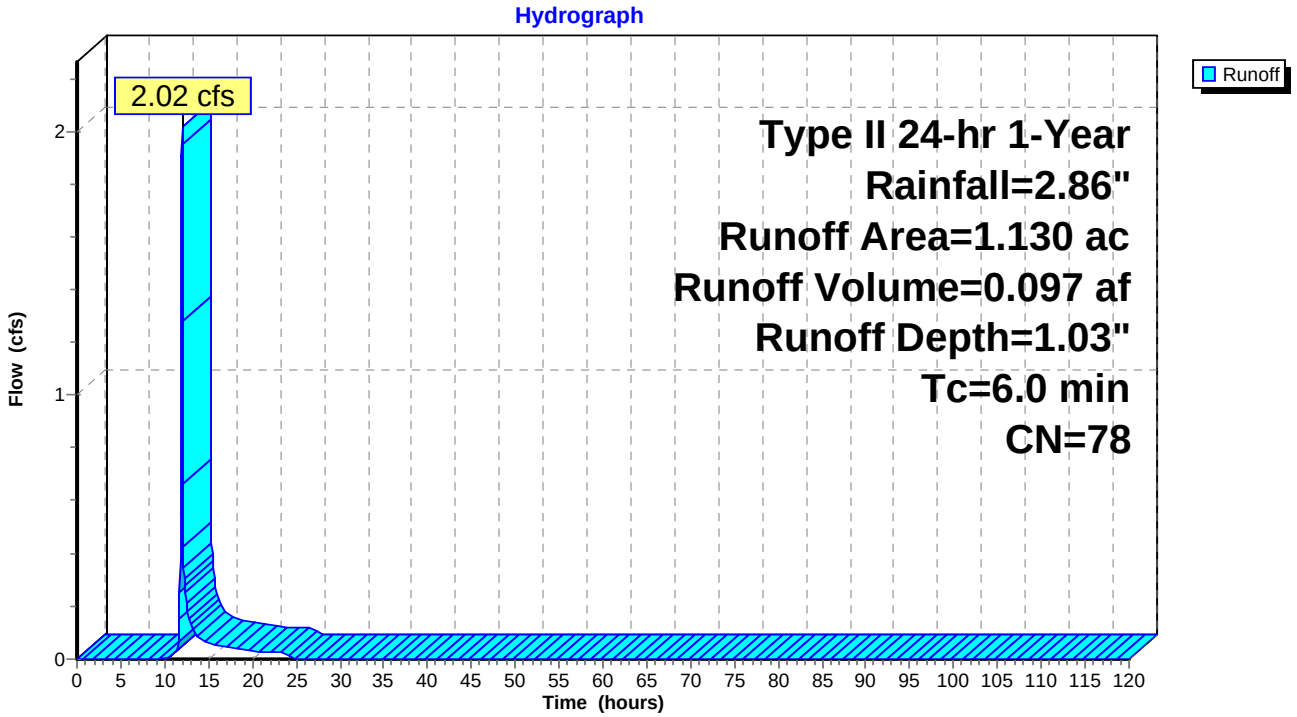
Runoff = 2.02 cfs @ 11.98 hrs, Volume= 0.097 af, Depth= 1.03"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
Type II 24-hr 1-Year Rainfall=2.86"

Area (ac)	CN	Description
0.010	98	Paved parking & roofs
0.180	84	50-75% Grass cover, Fair, HSG D
0.020	79	50-75% Grass cover, Fair, HSG C
0.280	73	Woods, Fair, HSG C
0.640	79	Woods, Fair, HSG D
1.130	78	Weighted Average
1.120		Pervious Area
0.010		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment DA-1(b): POST BYPASS



Hydrograph for Subcatchment DA-1(b): POST BYPASS

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
2.50	0.08	0.00	0.00
5.00	0.18	0.00	0.00
7.50	0.31	0.00	0.00
10.00	0.52	0.00	**0.00**
12.50	2.10	0.54	**0.20**
15.00	2.44	0.75	0.06
17.50	2.61	0.86	0.04
20.00	2.72	0.94	0.03
22.50	**2.81**	**1.00**	0.03
25.00	**2.86**	**1.03**	0.00
27.50	2.86	1.03	0.00
30.00	2.86	1.03	0.00
32.50	2.86	1.03	0.00
35.00	2.86	1.03	0.00
37.50	2.86	1.03	0.00
40.00	2.86	1.03	0.00
42.50	2.86	1.03	0.00
45.00	2.86	1.03	0.00
47.50	2.86	1.03	0.00
50.00	2.86	1.03	0.00
52.50	2.86	1.03	0.00
55.00	2.86	1.03	0.00
57.50	2.86	1.03	0.00
60.00	2.86	1.03	0.00
62.50	2.86	1.03	0.00
65.00	2.86	1.03	0.00
67.50	2.86	1.03	0.00
70.00	2.86	1.03	0.00
72.50	2.86	1.03	0.00
75.00	2.86	1.03	0.00
77.50	2.86	1.03	0.00
80.00	2.86	1.03	0.00
82.50	2.86	1.03	0.00
85.00	2.86	1.03	0.00
87.50	2.86	1.03	0.00
90.00	2.86	1.03	0.00
92.50	2.86	1.03	0.00
95.00	2.86	1.03	0.00
97.50	2.86	1.03	0.00
100.00	2.86	1.03	0.00
102.50	2.86	1.03	0.00
105.00	2.86	1.03	0.00
107.50	2.86	1.03	0.00
110.00	2.86	1.03	0.00
112.50	2.86	1.03	0.00
115.00	2.86	1.03	0.00
117.50	2.86	1.03	0.00
120.00	2.86	1.03	0.00

Summary for Pond 1P: WETLAND 1

Inflow Area = 0.650 ac, 80.00% Impervious, Inflow Depth = 2.31" for 1-Year event
Inflow = 2.39 cfs @ 11.96 hrs, Volume= 0.125 af
Outflow = 0.28 cfs @ 12.28 hrs, Volume= 0.125 af, Atten= 88%, Lag= 19.2 min
Primary = 0.28 cfs @ 12.28 hrs, Volume= 0.125 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
Peak Elev= 368.80' @ 12.28 hrs Surf.Area= 1,705 sf Storage= 3,076 cf

Plug-Flow detention time= 872.2 min calculated for 0.125 af (100% of inflow)
Center-of-Mass det. time= 871.9 min (1,653.1 - 781.2)

Volume	Invert	Avail.Storage	Storage Description
#1	367.00'	8,525 cf	**Custom Stage Data (Irregular)** Listed below

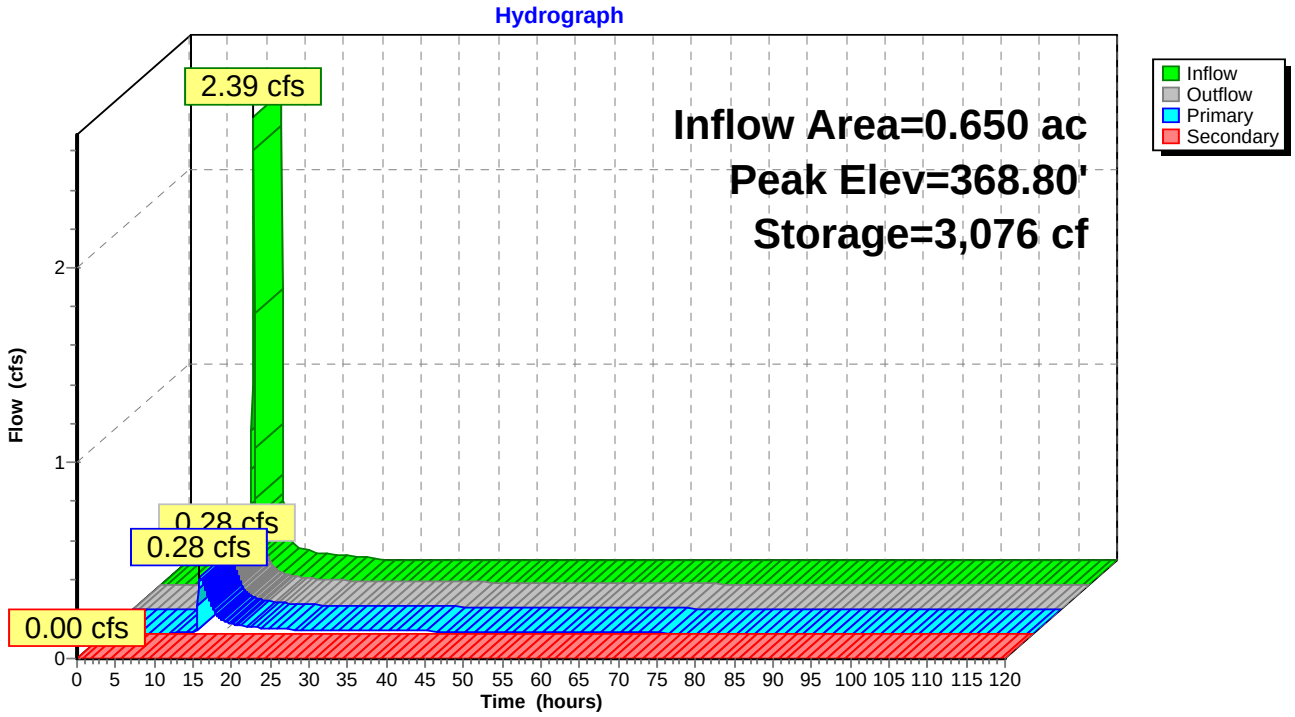
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
367.00	1,705	161.5	0	0	1,705
368.00	1,705	161.5	1,705	1,705	1,867
369.00	1,705	161.5	1,705	3,410	2,028
370.00	1,705	161.5	1,705	5,115	2,190
371.00	1,705	161.5	1,705	6,820	2,351
372.00	1,705	161.5	1,705	8,525	2,513

Device	Routing	Invert	Outlet Devices
#1	Primary	365.00'	**15.0" x 24.0' long Culvert** RCP, groove end projecting, Ke= 0.200 Outlet Invert= 364.00' S= 0.0417 '/' Cc= 0.900 n= 0.013
#2	Device 1	367.00'	**0.8" Vert. Orifice** C= 0.600
#3	Device 1	368.25'	**4.0" Vert. Orifice** C= 0.600
#4	Device 1	370.50'	**5.00' x 5.00' Horiz. Grate** Limited to weir flow C= 0.600
#5	Secondary	371.00'	**20.0' long x 8.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Primary OutFlow Max=0.28 cfs @ 12.28 hrs HW=368.80' (Free Discharge)
└**1=Culvert** (Passes 0.28 cfs of 13.17 cfs potential flow)
  ├**2=Orifice** (Orifice Controls 0.02 cfs @ 6.41 fps)
  ├**3=Orifice** (Orifice Controls 0.26 cfs @ 3.00 fps)
  └**4=Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=367.00' (Free Discharge)
└**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: WETLAND 1



Hydrograph for Pond 1P: WETLAND 1

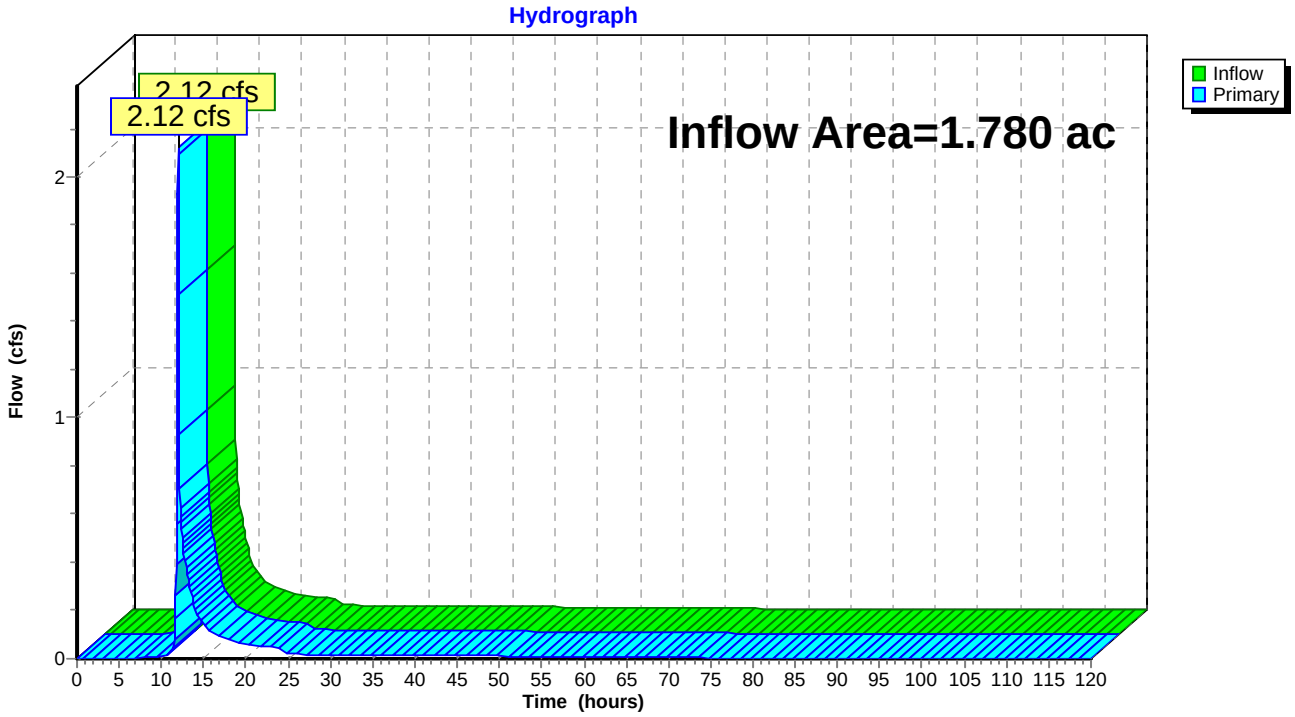
Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Primary (cfs)	Secondary (cfs)
0.00	0.00	0	367.00	0.00	0.00	**0.00**
2.50	0.00	0	367.00	0.00	0.00	0.00
5.00	0.01	19	367.01	0.00	0.00	0.00
7.50	0.02	117	367.07	0.00	0.00	0.00
10.00	**0.05**	**352**	**367.21**	**0.01**	**0.01**	0.00
12.50	**0.19**	**3,042**	**368.78**	**0.28**	**0.28**	0.00
15.00	0.06	2,403	368.41	0.08	0.08	0.00
17.50	0.04	2,296	368.35	0.04	0.04	0.00
20.00	0.02	2,240	368.31	0.03	0.03	0.00
22.50	0.02	2,207	368.29	0.02	0.02	0.00
25.00	0.00	2,123	368.25	0.02	0.02	0.00
27.50	0.00	1,960	368.15	0.02	0.02	0.00
30.00	0.00	1,804	368.06	0.02	0.02	0.00
32.50	0.00	1,654	367.97	0.02	0.02	0.00
35.00	0.00	1,511	367.89	0.02	0.02	0.00
37.50	0.00	1,374	367.81	0.01	0.01	0.00
40.00	0.00	1,245	367.73	0.01	0.01	0.00
42.50	0.00	1,122	367.66	0.01	0.01	0.00
45.00	0.00	1,006	367.59	0.01	0.01	0.00
47.50	0.00	896	367.53	0.01	0.01	0.00
50.00	0.00	794	367.47	0.01	0.01	0.00
52.50	0.00	698	367.41	0.01	0.01	0.00
55.00	0.00	608	367.36	0.01	0.01	0.00
57.50	0.00	526	367.31	0.01	0.01	0.00
60.00	0.00	450	367.26	0.01	0.01	0.00
62.50	0.00	380	367.22	0.01	0.01	0.00
65.00	0.00	318	367.19	0.01	0.01	0.00
67.50	0.00	262	367.15	0.01	0.01	0.00
70.00	0.00	213	367.13	0.01	0.01	0.00
72.50	0.00	171	367.10	0.00	0.00	0.00
75.00	0.00	136	367.08	0.00	0.00	0.00
77.50	0.00	108	367.06	0.00	0.00	0.00
80.00	0.00	86	367.05	0.00	0.00	0.00
82.50	0.00	69	367.04	0.00	0.00	0.00
85.00	0.00	55	367.03	0.00	0.00	0.00
87.50	0.00	44	367.03	0.00	0.00	0.00
90.00	0.00	35	367.02	0.00	0.00	0.00
92.50	0.00	28	367.02	0.00	0.00	0.00
95.00	0.00	22	367.01	0.00	0.00	0.00
97.50	0.00	18	367.01	0.00	0.00	0.00
100.00	0.00	14	367.01	0.00	0.00	0.00
102.50	0.00	11	367.01	0.00	0.00	0.00
105.00	0.00	9	367.01	0.00	0.00	0.00
107.50	0.00	7	367.00	0.00	0.00	0.00
110.00	0.00	6	367.00	0.00	0.00	0.00
112.50	0.00	5	367.00	0.00	0.00	0.00
115.00	0.00	4	367.00	0.00	0.00	0.00
117.50	0.00	3	367.00	0.00	0.00	0.00
120.00	0.00	2	367.00	0.00	0.00	0.00

Summary for Link 1L: POST

Inflow Area = 1.780 ac, 29.78% Impervious, Inflow Depth = 1.50" for 1-Year event
Inflow = 2.12 cfs @ 11.99 hrs, Volume= 0.222 af
Primary = 2.12 cfs @ 11.99 hrs, Volume= 0.222 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs

Link 1L: POST



Hydrograph for Link 1L: POST

Time (hours)	Inflow (cfs)	Elevation (feet)	Primary (cfs)
0.00	0.00	**0.00**	0.00
2.50	0.00	0.00	0.00
5.00	0.00	0.00	0.00
7.50	0.00	0.00	0.00
10.00	**0.01**	0.00	**0.01**
12.50	**0.48**	0.00	**0.48**
15.00	0.14	0.00	0.14
17.50	0.08	0.00	0.08
20.00	0.06	0.00	0.06
22.50	0.05	0.00	0.05
25.00	0.02	0.00	0.02
27.50	0.02	0.00	0.02
30.00	0.02	0.00	0.02
32.50	0.02	0.00	0.02
35.00	0.02	0.00	0.02
37.50	0.01	0.00	0.01
40.00	0.01	0.00	0.01
42.50	0.01	0.00	0.01
45.00	0.01	0.00	0.01
47.50	0.01	0.00	0.01
50.00	0.01	0.00	0.01
52.50	0.01	0.00	0.01
55.00	0.01	0.00	0.01
57.50	0.01	0.00	0.01
60.00	0.01	0.00	0.01
62.50	0.01	0.00	0.01
65.00	0.01	0.00	0.01
67.50	0.01	0.00	0.01
70.00	0.01	0.00	0.01
72.50	0.00	0.00	0.00
75.00	0.00	0.00	0.00
77.50	0.00	0.00	0.00
80.00	0.00	0.00	0.00
82.50	0.00	0.00	0.00
85.00	0.00	0.00	0.00
87.50	0.00	0.00	0.00
90.00	0.00	0.00	0.00
92.50	0.00	0.00	0.00
95.00	0.00	0.00	0.00
97.50	0.00	0.00	0.00
100.00	0.00	0.00	0.00
102.50	0.00	0.00	0.00
105.00	0.00	0.00	0.00
107.50	0.00	0.00	0.00
110.00	0.00	0.00	0.00
112.50	0.00	0.00	0.00
115.00	0.00	0.00	0.00
117.50	0.00	0.00	0.00
120.00	0.00	0.00	0.00

Summary for Subcatchment DA-1(a): POST TO SCM

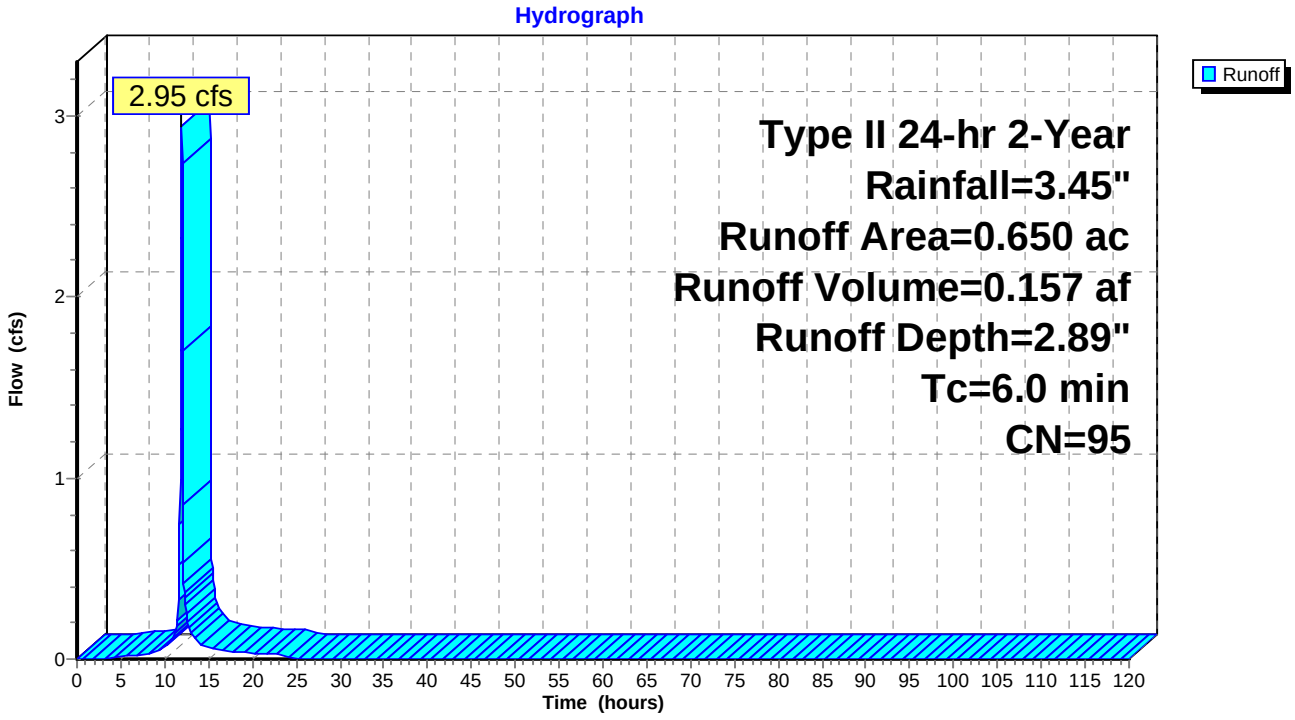
Runoff = 2.95 cfs @ 11.96 hrs, Volume= 0.157 af, Depth= 2.89"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.45"

Area (ac)	CN	Description
0.520	98	Paved parking & roofs
0.040	84	50-75% Grass cover, Fair, HSG D
0.090	79	50-75% Grass cover, Fair, HSG C
0.650	95	Weighted Average
0.130		Pervious Area
0.520		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment DA-1(a): POST TO SCM



Hydrograph for Subcatchment DA-1(a): POST TO SCM

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
2.50	0.10	0.00	0.00
5.00	0.22	0.02	0.01
7.50	0.38	0.09	0.03
10.00	0.62	0.26	**0.06**
12.50	2.54	2.00	**0.24**
15.00	2.94	2.40	0.07
17.50	3.15	2.59	0.04
20.00	3.28	2.73	0.03
22.50	**3.39**	**2.83**	0.03
25.00	**3.45**	**2.89**	0.00
27.50	3.45	2.89	0.00
30.00	3.45	2.89	0.00
32.50	3.45	2.89	0.00
35.00	3.45	2.89	0.00
37.50	3.45	2.89	0.00
40.00	3.45	2.89	0.00
42.50	3.45	2.89	0.00
45.00	3.45	2.89	0.00
47.50	3.45	2.89	0.00
50.00	3.45	2.89	0.00
52.50	3.45	2.89	0.00
55.00	3.45	2.89	0.00
57.50	3.45	2.89	0.00
60.00	3.45	2.89	0.00
62.50	3.45	2.89	0.00
65.00	3.45	2.89	0.00
67.50	3.45	2.89	0.00
70.00	3.45	2.89	0.00
72.50	3.45	2.89	0.00
75.00	3.45	2.89	0.00
77.50	3.45	2.89	0.00
80.00	3.45	2.89	0.00
82.50	3.45	2.89	0.00
85.00	3.45	2.89	0.00
87.50	3.45	2.89	0.00
90.00	3.45	2.89	0.00
92.50	3.45	2.89	0.00
95.00	3.45	2.89	0.00
97.50	3.45	2.89	0.00
100.00	3.45	2.89	0.00
102.50	3.45	2.89	0.00
105.00	3.45	2.89	0.00
107.50	3.45	2.89	0.00
110.00	3.45	2.89	0.00
112.50	3.45	2.89	0.00
115.00	3.45	2.89	0.00
117.50	3.45	2.89	0.00
120.00	3.45	2.89	0.00

Summary for Subcatchment DA-1(b): POST BYPASS

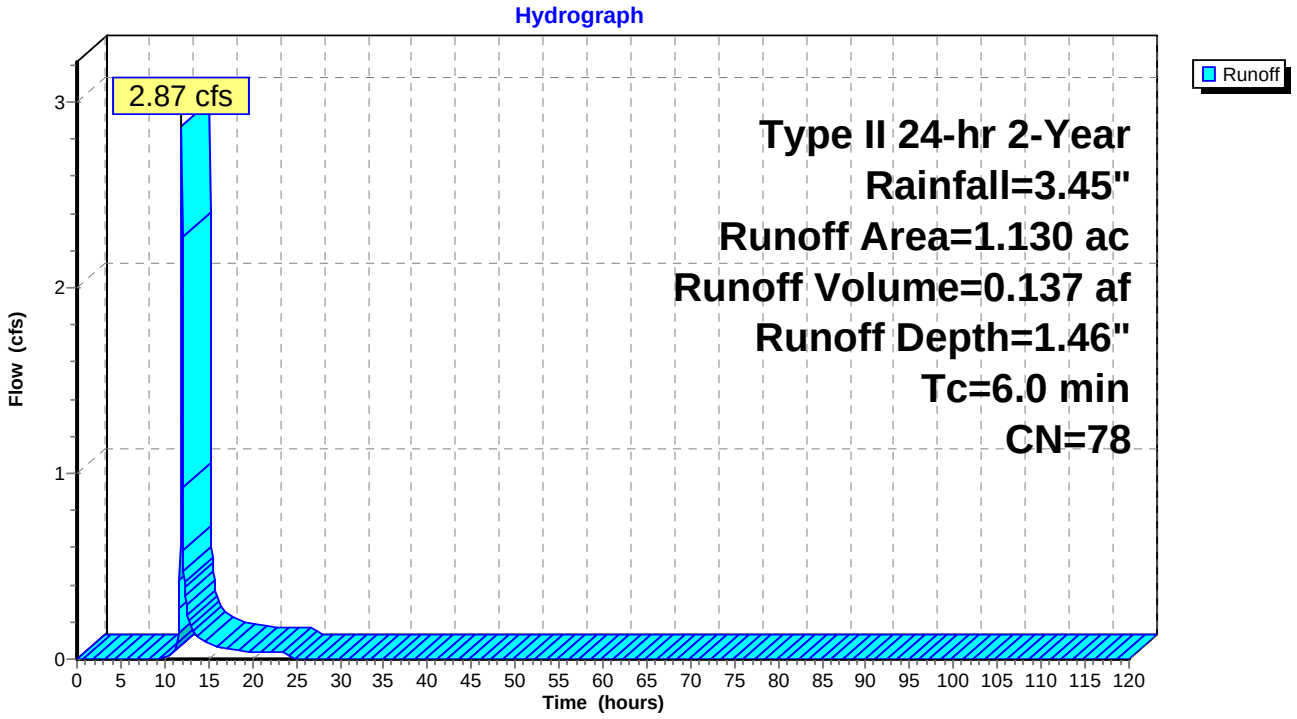
Runoff = 2.87 cfs @ 11.98 hrs, Volume= 0.137 af, Depth= 1.46"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=3.45"

Area (ac)	CN	Description
0.010	98	Paved parking & roofs
0.180	84	50-75% Grass cover, Fair, HSG D
0.020	79	50-75% Grass cover, Fair, HSG C
0.280	73	Woods, Fair, HSG C
0.640	79	Woods, Fair, HSG D
1.130	78	Weighted Average
1.120		Pervious Area
0.010		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment DA-1(b): POST BYPASS



Hydrograph for Subcatchment DA-1(b): POST BYPASS

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
2.50	0.10	0.00	0.00
5.00	0.22	0.00	0.00
7.50	0.38	0.00	0.00
10.00	0.62	0.00	**0.01**
12.50	2.54	0.81	**0.28**
15.00	2.94	1.09	0.08
17.50	3.15	1.23	0.06
20.00	3.28	1.34	0.04
22.50	**3.39**	**1.42**	0.03
25.00	**3.45**	**1.46**	0.00
27.50	3.45	1.46	0.00
30.00	3.45	1.46	0.00
32.50	3.45	1.46	0.00
35.00	3.45	1.46	0.00
37.50	3.45	1.46	0.00
40.00	3.45	1.46	0.00
42.50	3.45	1.46	0.00
45.00	3.45	1.46	0.00
47.50	3.45	1.46	0.00
50.00	3.45	1.46	0.00
52.50	3.45	1.46	0.00
55.00	3.45	1.46	0.00
57.50	3.45	1.46	0.00
60.00	3.45	1.46	0.00
62.50	3.45	1.46	0.00
65.00	3.45	1.46	0.00
67.50	3.45	1.46	0.00
70.00	3.45	1.46	0.00
72.50	3.45	1.46	0.00
75.00	3.45	1.46	0.00
77.50	3.45	1.46	0.00
80.00	3.45	1.46	0.00
82.50	3.45	1.46	0.00
85.00	3.45	1.46	0.00
87.50	3.45	1.46	0.00
90.00	3.45	1.46	0.00
92.50	3.45	1.46	0.00
95.00	3.45	1.46	0.00
97.50	3.45	1.46	0.00
100.00	3.45	1.46	0.00
102.50	3.45	1.46	0.00
105.00	3.45	1.46	0.00
107.50	3.45	1.46	0.00
110.00	3.45	1.46	0.00
112.50	3.45	1.46	0.00
115.00	3.45	1.46	0.00
117.50	3.45	1.46	0.00
120.00	3.45	1.46	0.00

Summary for Pond 1P: WETLAND 1

Inflow Area = 0.650 ac, 80.00% Impervious, Inflow Depth = 2.89" for 2-Year event
Inflow = 2.95 cfs @ 11.96 hrs, Volume= 0.157 af
Outflow = 0.40 cfs @ 12.22 hrs, Volume= 0.156 af, Atten= 86%, Lag= 15.4 min
Primary = 0.40 cfs @ 12.22 hrs, Volume= 0.156 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
Peak Elev= 369.22' @ 12.22 hrs Surf.Area= 1,705 sf Storage= 3,793 cf

Plug-Flow detention time= 725.6 min calculated for 0.156 af (100% of inflow)
Center-of-Mass det. time= 725.3 min (1,500.6 - 775.3)

Volume	Invert	Avail.Storage	Storage Description
#1	367.00'	8,525 cf	**Custom Stage Data (Irregular)** Listed below

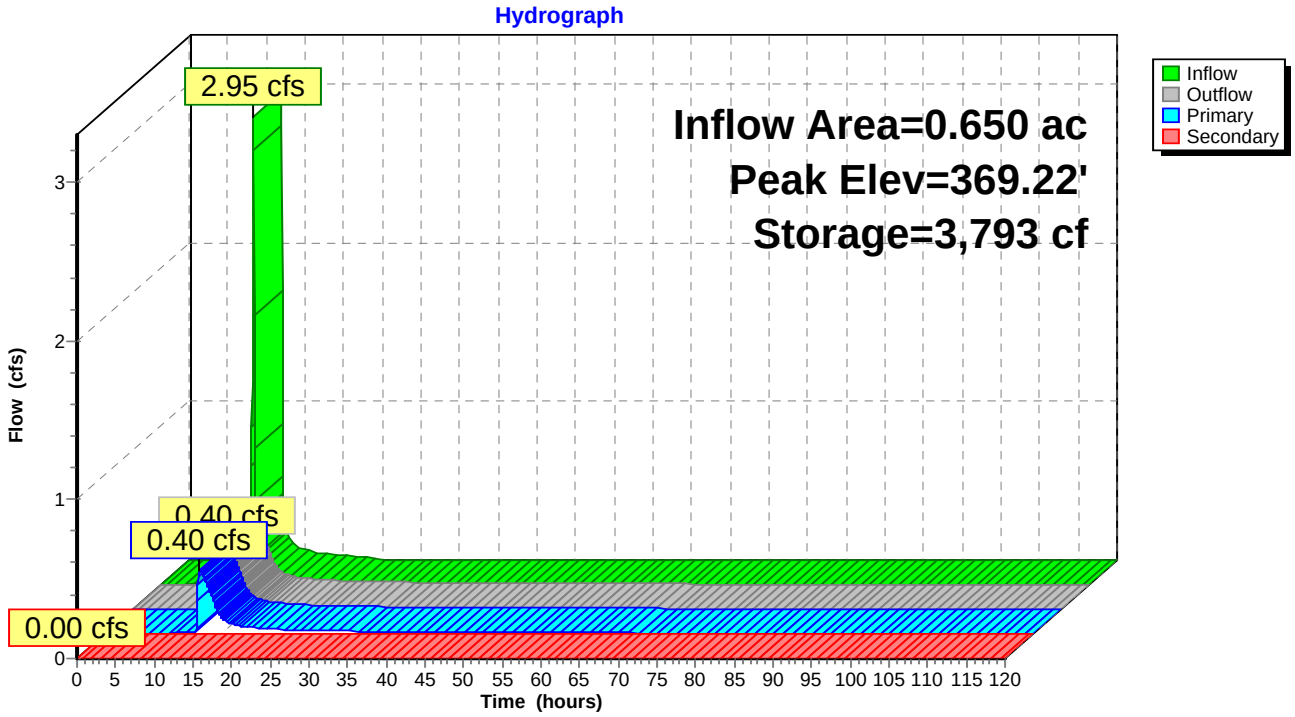
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
367.00	1,705	161.5	0	0	1,705
368.00	1,705	161.5	1,705	1,705	1,867
369.00	1,705	161.5	1,705	3,410	2,028
370.00	1,705	161.5	1,705	5,115	2,190
371.00	1,705	161.5	1,705	6,820	2,351
372.00	1,705	161.5	1,705	8,525	2,513

Device	Routing	Invert	Outlet Devices
#1	Primary	365.00'	**15.0" x 24.0' long Culvert** RCP, groove end projecting, Ke= 0.200 Outlet Invert= 364.00' S= 0.0417 '/' Cc= 0.900 n= 0.013
#2	Device 1	367.00'	**0.8" Vert. Orifice** C= 0.600
#3	Device 1	368.25'	**4.0" Vert. Orifice** C= 0.600
#4	Device 1	370.50'	**5.00' x 5.00' Horiz. Grate** Limited to weir flow C= 0.600
#5	Secondary	371.00'	**20.0' long x 8.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Primary OutFlow Max=0.40 cfs @ 12.22 hrs HW=369.22' (Free Discharge)
└**1=Culvert** (Passes 0.40 cfs of 14.01 cfs potential flow)
  ├**2=Orifice** (Orifice Controls 0.02 cfs @ 7.13 fps)
  ├**3=Orifice** (Orifice Controls 0.38 cfs @ 4.32 fps)
  └**4=Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=367.00' (Free Discharge)
└**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: WETLAND 1



Hydrograph for Pond 1P: WETLAND 1

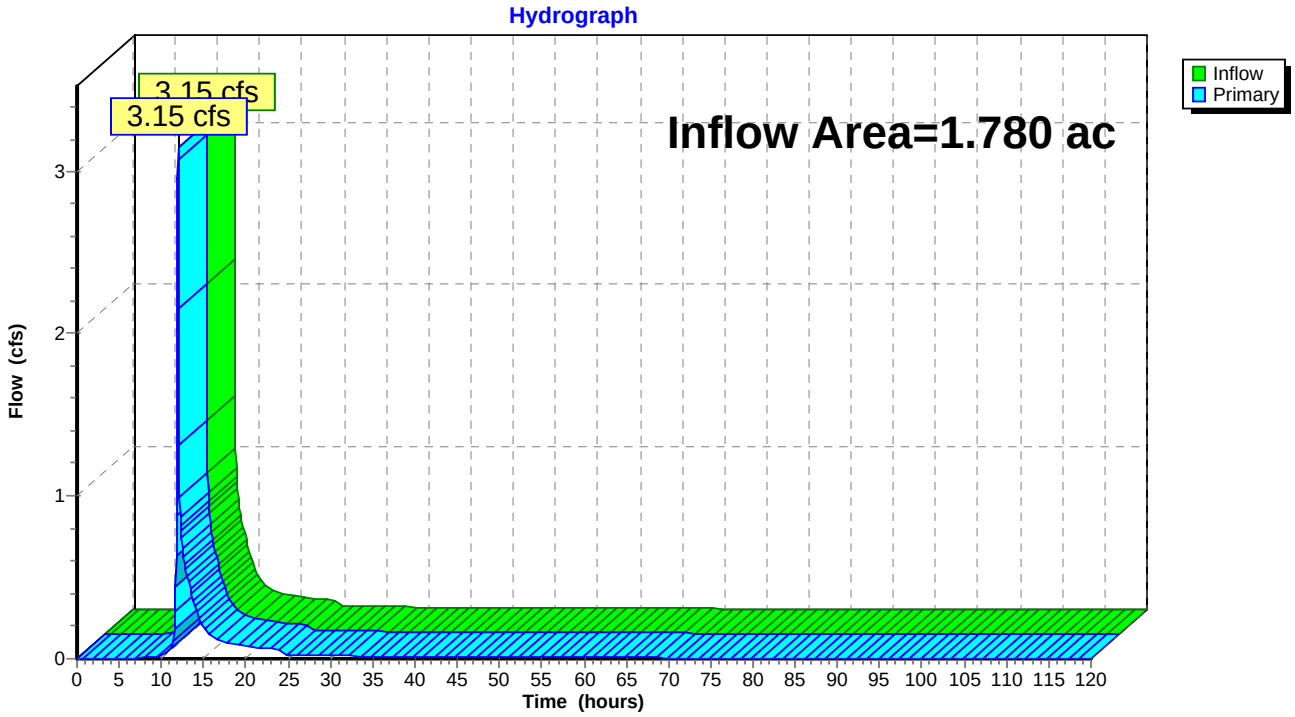
Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Primary (cfs)	Secondary (cfs)
0.00	0.00	0	367.00	0.00	0.00	**0.00**
2.50	0.00	0	367.00	0.00	0.00	0.00
5.00	0.01	40	367.02	0.00	0.00	0.00
7.50	0.03	183	367.11	0.00	0.00	0.00
10.00	**0.06**	**502**	**367.29**	**0.01**	**0.01**	0.00
12.50	**0.24**	**3,702**	**369.17**	**0.39**	**0.39**	0.00
15.00	0.07	2,484	368.46	0.11	0.11	0.00
17.50	0.04	2,326	368.36	0.05	0.05	0.00
20.00	0.03	2,269	368.33	0.04	0.04	0.00
22.50	0.03	2,232	368.31	0.03	0.03	0.00
25.00	0.00	2,148	368.26	0.02	0.02	0.00
27.50	0.00	1,983	368.16	0.02	0.02	0.00
30.00	0.00	1,825	368.07	0.02	0.02	0.00
32.50	0.00	1,675	367.98	0.02	0.02	0.00
35.00	0.00	1,531	367.90	0.02	0.02	0.00
37.50	0.00	1,394	367.82	0.01	0.01	0.00
40.00	0.00	1,263	367.74	0.01	0.01	0.00
42.50	0.00	1,139	367.67	0.01	0.01	0.00
45.00	0.00	1,022	367.60	0.01	0.01	0.00
47.50	0.00	912	367.53	0.01	0.01	0.00
50.00	0.00	808	367.47	0.01	0.01	0.00
52.50	0.00	711	367.42	0.01	0.01	0.00
55.00	0.00	620	367.36	0.01	0.01	0.00
57.50	0.00	537	367.31	0.01	0.01	0.00
60.00	0.00	460	367.27	0.01	0.01	0.00
62.50	0.00	390	367.23	0.01	0.01	0.00
65.00	0.00	327	367.19	0.01	0.01	0.00
67.50	0.00	270	367.16	0.01	0.01	0.00
70.00	0.00	220	367.13	0.01	0.01	0.00
72.50	0.00	177	367.10	0.00	0.00	0.00
75.00	0.00	141	367.08	0.00	0.00	0.00
77.50	0.00	112	367.07	0.00	0.00	0.00
80.00	0.00	89	367.05	0.00	0.00	0.00
82.50	0.00	71	367.04	0.00	0.00	0.00
85.00	0.00	57	367.03	0.00	0.00	0.00
87.50	0.00	45	367.03	0.00	0.00	0.00
90.00	0.00	36	367.02	0.00	0.00	0.00
92.50	0.00	29	367.02	0.00	0.00	0.00
95.00	0.00	23	367.01	0.00	0.00	0.00
97.50	0.00	18	367.01	0.00	0.00	0.00
100.00	0.00	15	367.01	0.00	0.00	0.00
102.50	0.00	12	367.01	0.00	0.00	0.00
105.00	0.00	9	367.01	0.00	0.00	0.00
107.50	0.00	7	367.00	0.00	0.00	0.00
110.00	0.00	6	367.00	0.00	0.00	0.00
112.50	0.00	5	367.00	0.00	0.00	0.00
115.00	0.00	4	367.00	0.00	0.00	0.00
117.50	0.00	3	367.00	0.00	0.00	0.00
120.00	0.00	2	367.00	0.00	0.00	0.00

Summary for Link 1L: POST

Inflow Area = 1.780 ac, 29.78% Impervious, Inflow Depth = 1.98" for 2-Year event
Inflow = 3.15 cfs @ 11.98 hrs, Volume= 0.294 af
Primary = 3.15 cfs @ 11.98 hrs, Volume= 0.294 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs

Link 1L: POST



Hydrograph for Link 1L: POST

Time (hours)	Inflow (cfs)	Elevation (feet)	Primary (cfs)
0.00	0.00	**0.00**	0.00
2.50	0.00	0.00	0.00
5.00	0.00	0.00	0.00
7.50	0.00	0.00	0.00
10.00	**0.01**	0.00	**0.01**
12.50	**0.67**	0.00	**0.67**
15.00	0.19	0.00	0.19
17.50	0.11	0.00	0.11
20.00	0.07	0.00	0.07
22.50	0.06	0.00	0.06
25.00	0.02	0.00	0.02
27.50	0.02	0.00	0.02
30.00	0.02	0.00	0.02
32.50	0.02	0.00	0.02
35.00	0.02	0.00	0.02
37.50	0.01	0.00	0.01
40.00	0.01	0.00	0.01
42.50	0.01	0.00	0.01
45.00	0.01	0.00	0.01
47.50	0.01	0.00	0.01
50.00	0.01	0.00	0.01
52.50	0.01	0.00	0.01
55.00	0.01	0.00	0.01
57.50	0.01	0.00	0.01
60.00	0.01	0.00	0.01
62.50	0.01	0.00	0.01
65.00	0.01	0.00	0.01
67.50	0.01	0.00	0.01
70.00	0.01	0.00	0.01
72.50	0.00	0.00	0.00
75.00	0.00	0.00	0.00
77.50	0.00	0.00	0.00
80.00	0.00	0.00	0.00
82.50	0.00	0.00	0.00
85.00	0.00	0.00	0.00
87.50	0.00	0.00	0.00
90.00	0.00	0.00	0.00
92.50	0.00	0.00	0.00
95.00	0.00	0.00	0.00
97.50	0.00	0.00	0.00
100.00	0.00	0.00	0.00
102.50	0.00	0.00	0.00
105.00	0.00	0.00	0.00
107.50	0.00	0.00	0.00
110.00	0.00	0.00	0.00
112.50	0.00	0.00	0.00
115.00	0.00	0.00	0.00
117.50	0.00	0.00	0.00
120.00	0.00	0.00	0.00

Summary for Subcatchment DA-1(a): POST TO SCM

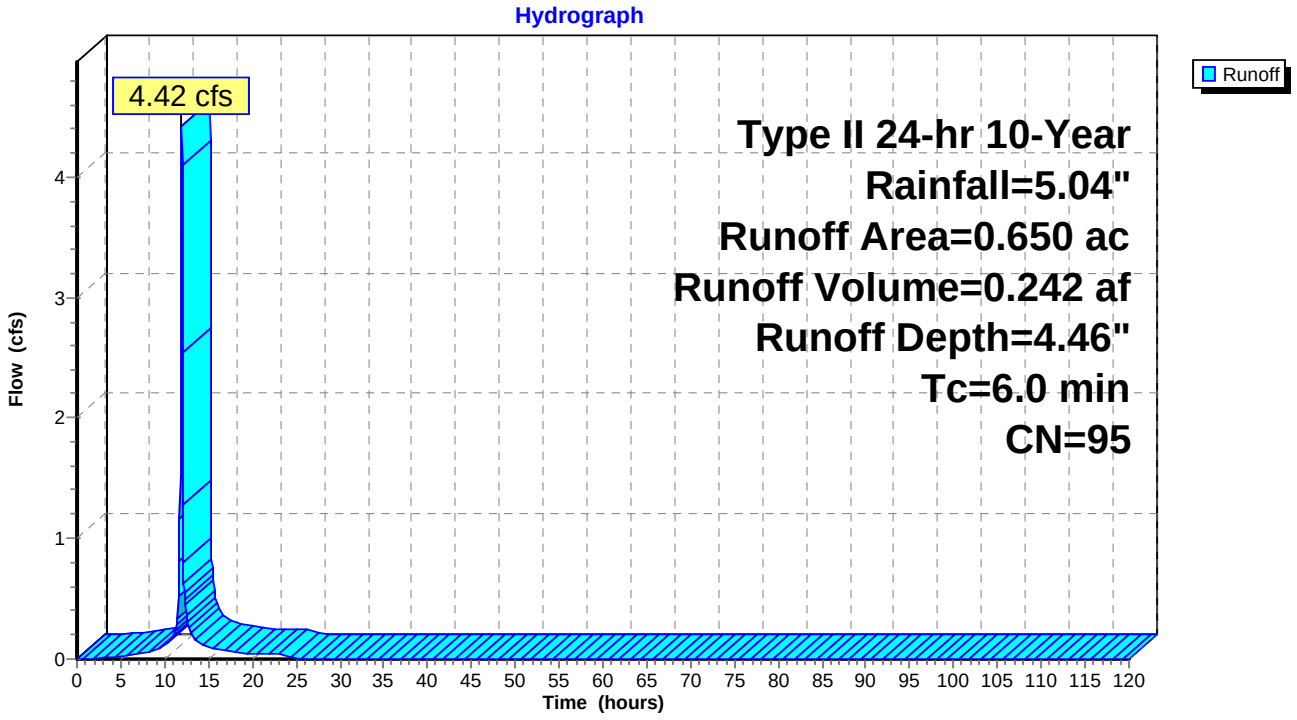
Runoff = 4.42 cfs @ 11.96 hrs, Volume= 0.242 af, Depth= 4.46"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=5.04"

Area (ac)	CN	Description
0.520	98	Paved parking & roofs
0.040	84	50-75% Grass cover, Fair, HSG D
0.090	79	50-75% Grass cover, Fair, HSG C
0.650	95	Weighted Average
0.130		Pervious Area
0.520		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment DA-1(a): POST TO SCM



Hydrograph for Subcatchment DA-1(a): POST TO SCM

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
2.50	0.14	0.00	0.00
5.00	0.32	0.06	0.03
7.50	0.55	0.20	0.05
10.00	0.91	0.49	**0.11**
12.50	3.70	3.14	**0.35**
15.00	4.30	3.73	0.10
17.50	4.59	4.02	0.06
20.00	4.80	4.22	0.04
22.50	**4.95**	**4.37**	0.04
25.00	**5.04**	**4.46**	0.00
27.50	5.04	4.46	0.00
30.00	5.04	4.46	0.00
32.50	5.04	4.46	0.00
35.00	5.04	4.46	0.00
37.50	5.04	4.46	0.00
40.00	5.04	4.46	0.00
42.50	5.04	4.46	0.00
45.00	5.04	4.46	0.00
47.50	5.04	4.46	0.00
50.00	5.04	4.46	0.00
52.50	5.04	4.46	0.00
55.00	5.04	4.46	0.00
57.50	5.04	4.46	0.00
60.00	5.04	4.46	0.00
62.50	5.04	4.46	0.00
65.00	5.04	4.46	0.00
67.50	5.04	4.46	0.00
70.00	5.04	4.46	0.00
72.50	5.04	4.46	0.00
75.00	5.04	4.46	0.00
77.50	5.04	4.46	0.00
80.00	5.04	4.46	0.00
82.50	5.04	4.46	0.00
85.00	5.04	4.46	0.00
87.50	5.04	4.46	0.00
90.00	5.04	4.46	0.00
92.50	5.04	4.46	0.00
95.00	5.04	4.46	0.00
97.50	5.04	4.46	0.00
100.00	5.04	4.46	0.00
102.50	5.04	4.46	0.00
105.00	5.04	4.46	0.00
107.50	5.04	4.46	0.00
110.00	5.04	4.46	0.00
112.50	5.04	4.46	0.00
115.00	5.04	4.46	0.00
117.50	5.04	4.46	0.00
120.00	5.04	4.46	0.00

Summary for Subcatchment DA-1(b): POST BYPASS

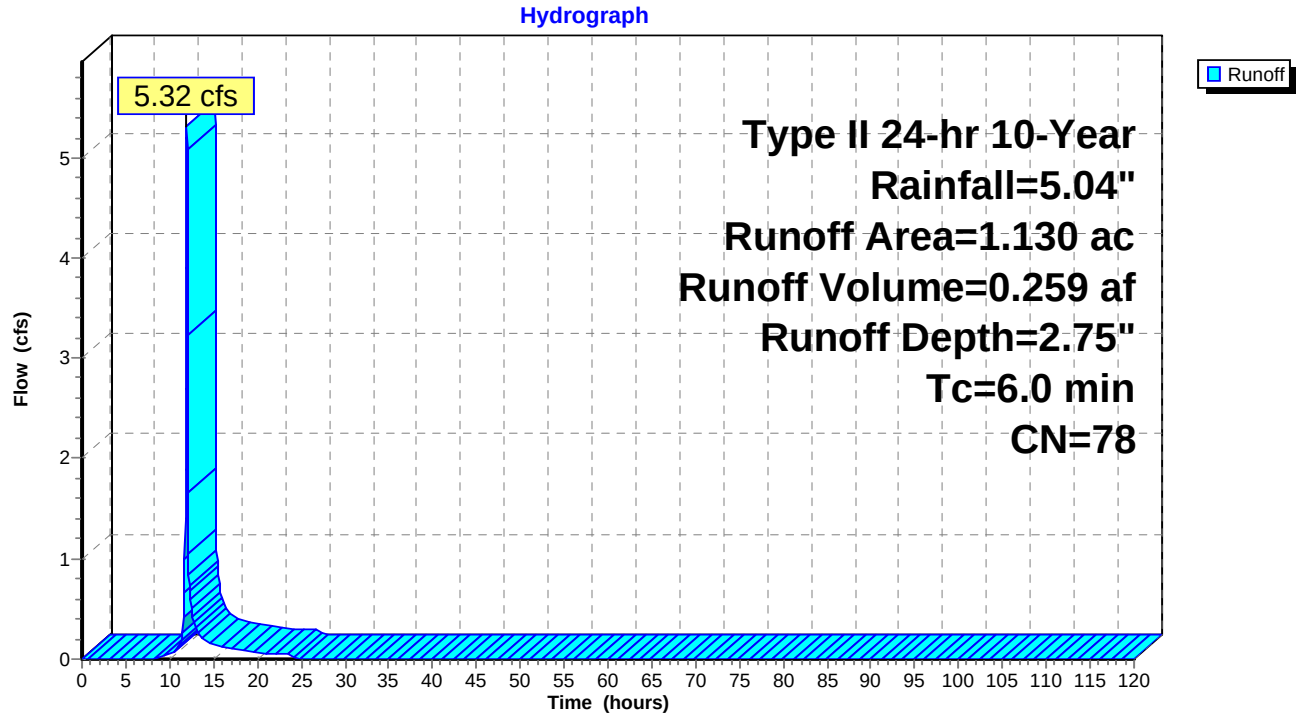
Runoff = 5.32 cfs @ 11.97 hrs, Volume= 0.259 af, Depth= 2.75"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=5.04"

Area (ac)	CN	Description
0.010	98	Paved parking & roofs
0.180	84	50-75% Grass cover, Fair, HSG D
0.020	79	50-75% Grass cover, Fair, HSG C
0.280	73	Woods, Fair, HSG C
0.640	79	Woods, Fair, HSG D
1.130	78	Weighted Average
1.120		Pervious Area
0.010		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment DA-1(b): POST BYPASS



Hydrograph for Subcatchment DA-1(b): POST BYPASS

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
2.50	0.14	0.00	0.00
5.00	0.32	0.00	0.00
7.50	0.55	0.00	0.00
10.00	0.91	0.04	**0.04**
12.50	3.70	1.65	**0.48**
15.00	4.30	2.13	0.14
17.50	4.59	2.37	0.09
20.00	4.80	2.54	0.06
22.50	**4.95**	**2.67**	0.06
25.00	**5.04**	**2.75**	0.00
27.50	5.04	2.75	0.00
30.00	5.04	2.75	0.00
32.50	5.04	2.75	0.00
35.00	5.04	2.75	0.00
37.50	5.04	2.75	0.00
40.00	5.04	2.75	0.00
42.50	5.04	2.75	0.00
45.00	5.04	2.75	0.00
47.50	5.04	2.75	0.00
50.00	5.04	2.75	0.00
52.50	5.04	2.75	0.00
55.00	5.04	2.75	0.00
57.50	5.04	2.75	0.00
60.00	5.04	2.75	0.00
62.50	5.04	2.75	0.00
65.00	5.04	2.75	0.00
67.50	5.04	2.75	0.00
70.00	5.04	2.75	0.00
72.50	5.04	2.75	0.00
75.00	5.04	2.75	0.00
77.50	5.04	2.75	0.00
80.00	5.04	2.75	0.00
82.50	5.04	2.75	0.00
85.00	5.04	2.75	0.00
87.50	5.04	2.75	0.00
90.00	5.04	2.75	0.00
92.50	5.04	2.75	0.00
95.00	5.04	2.75	0.00
97.50	5.04	2.75	0.00
100.00	5.04	2.75	0.00
102.50	5.04	2.75	0.00
105.00	5.04	2.75	0.00
107.50	5.04	2.75	0.00
110.00	5.04	2.75	0.00
112.50	5.04	2.75	0.00
115.00	5.04	2.75	0.00
117.50	5.04	2.75	0.00
120.00	5.04	2.75	0.00

Summary for Pond 1P: WETLAND 1

Inflow Area = 0.650 ac, 80.00% Impervious, Inflow Depth = 4.46" for 10-Year event
Inflow = 4.42 cfs @ 11.96 hrs, Volume= 0.242 af
Outflow = 0.62 cfs @ 12.21 hrs, Volume= 0.241 af, Atten= 86%, Lag= 14.9 min
Primary = 0.62 cfs @ 12.21 hrs, Volume= 0.241 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs
Peak Elev= 370.40' @ 12.21 hrs Surf.Area= 1,705 sf Storage= 5,793 cf

Plug-Flow detention time= 519.4 min calculated for 0.241 af (100% of inflow)
Center-of-Mass det. time= 521.2 min (1,285.6 - 764.4)

Volume	Invert	Avail.Storage	Storage Description
#1	367.00'	8,525 cf	**Custom Stage Data (Irregular)** Listed below

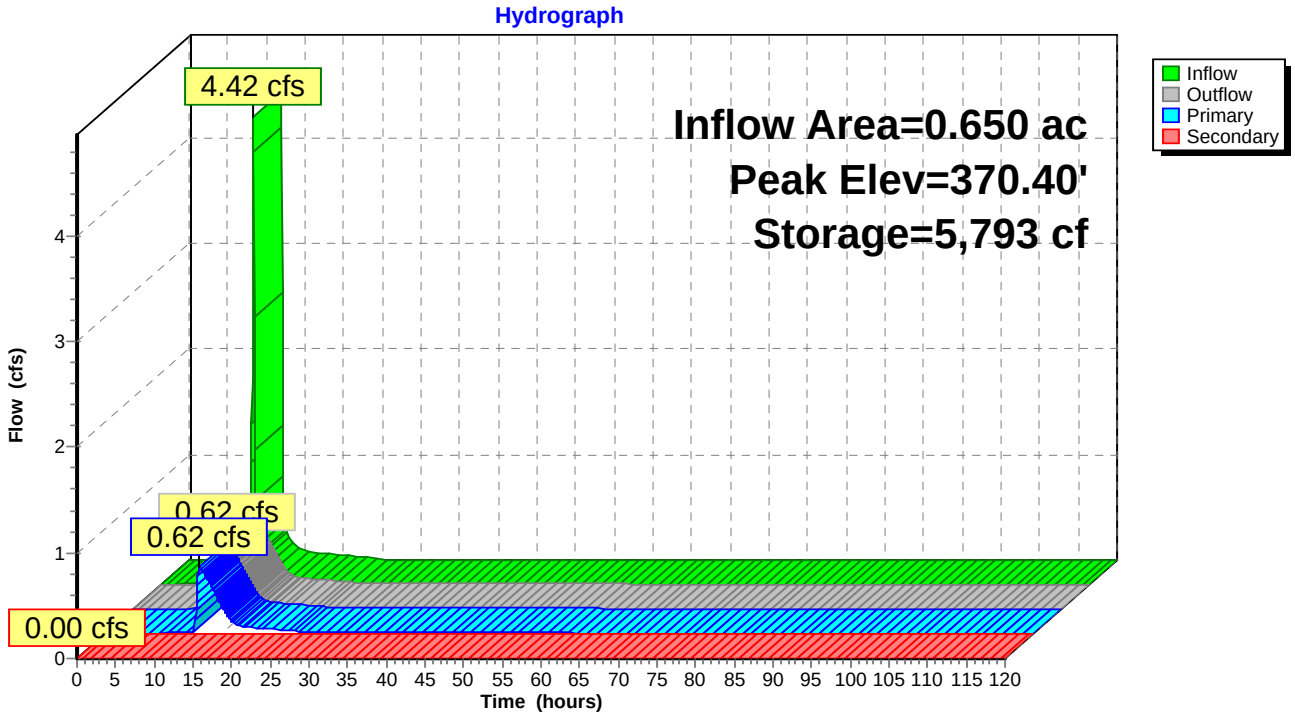
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
367.00	1,705	161.5	0	0	1,705
368.00	1,705	161.5	1,705	1,705	1,867
369.00	1,705	161.5	1,705	3,410	2,028
370.00	1,705	161.5	1,705	5,115	2,190
371.00	1,705	161.5	1,705	6,820	2,351
372.00	1,705	161.5	1,705	8,525	2,513

Device	Routing	Invert	Outlet Devices
#1	Primary	365.00'	**15.0" x 24.0' long Culvert** RCP, groove end projecting, Ke= 0.200 Outlet Invert= 364.00' S= 0.0417 '/' Cc= 0.900 n= 0.013
#2	Device 1	367.00'	**0.8" Vert. Orifice** C= 0.600
#3	Device 1	368.25'	**4.0" Vert. Orifice** C= 0.600
#4	Device 1	370.50'	**5.00' x 5.00' Horiz. Grate** Limited to weir flow C= 0.600
#5	Secondary	371.00'	**20.0' long x 8.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Primary OutFlow Max=0.62 cfs @ 12.21 hrs HW=370.40' (Free Discharge)
└**1=Culvert** (Passes 0.62 cfs of 16.13 cfs potential flow)
  ├**2=Orifice** (Orifice Controls 0.03 cfs @ 8.83 fps)
  ├**3=Orifice** (Orifice Controls 0.59 cfs @ 6.77 fps)
  └**4=Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=367.00' (Free Discharge)
└**5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: WETLAND 1



Hydrograph for Pond 1P: WETLAND 1

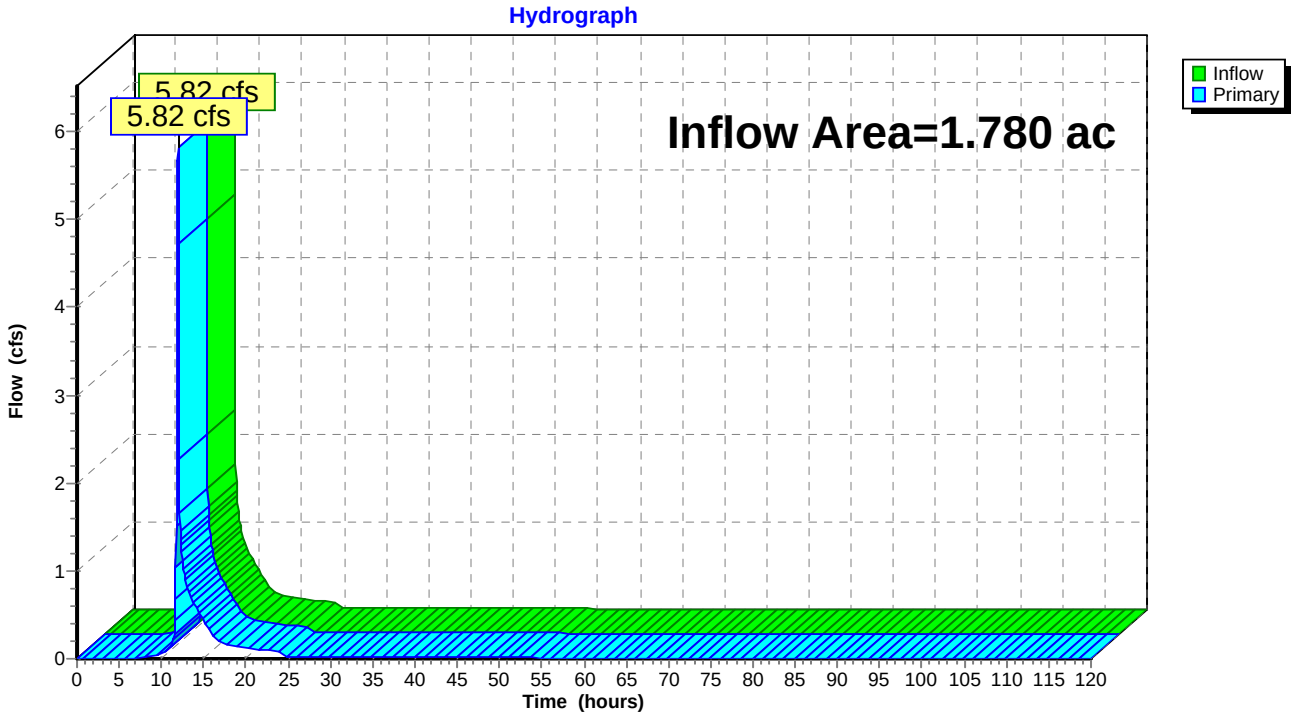
Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Primary (cfs)	Secondary (cfs)
0.00	0.00	0	367.00	0.00	0.00	**0.00**
2.50	0.00	4	367.00	0.00	0.00	0.00
5.00	0.03	124	367.07	0.00	0.00	0.00
7.50	0.05	405	367.24	0.01	0.01	0.00
10.00	**0.11**	**967**	**367.57**	**0.01**	**0.01**	0.00
12.50	**0.35**	**5,632**	**370.30**	**0.61**	**0.61**	0.00
15.00	0.10	3,052	368.79	0.28	0.28	0.00
17.50	0.06	2,407	368.41	0.08	0.08	0.00
20.00	0.04	2,326	368.36	0.05	0.05	0.00
22.50	0.04	2,292	368.34	0.04	0.04	0.00
25.00	0.00	2,186	368.28	0.02	0.02	0.00
27.50	0.00	2,016	368.18	0.02	0.02	0.00
30.00	0.00	1,857	368.09	0.02	0.02	0.00
32.50	0.00	1,705	368.00	0.02	0.02	0.00
35.00	0.00	1,559	367.91	0.02	0.02	0.00
37.50	0.00	1,421	367.83	0.02	0.02	0.00
40.00	0.00	1,289	367.76	0.01	0.01	0.00
42.50	0.00	1,164	367.68	0.01	0.01	0.00
45.00	0.00	1,045	367.61	0.01	0.01	0.00
47.50	0.00	933	367.55	0.01	0.01	0.00
50.00	0.00	828	367.49	0.01	0.01	0.00
52.50	0.00	730	367.43	0.01	0.01	0.00
55.00	0.00	638	367.37	0.01	0.01	0.00
57.50	0.00	553	367.32	0.01	0.01	0.00
60.00	0.00	475	367.28	0.01	0.01	0.00
62.50	0.00	404	367.24	0.01	0.01	0.00
65.00	0.00	339	367.20	0.01	0.01	0.00
67.50	0.00	281	367.16	0.01	0.01	0.00
70.00	0.00	229	367.13	0.01	0.01	0.00
72.50	0.00	185	367.11	0.00	0.00	0.00
75.00	0.00	147	367.09	0.00	0.00	0.00
77.50	0.00	117	367.07	0.00	0.00	0.00
80.00	0.00	94	367.05	0.00	0.00	0.00
82.50	0.00	75	367.04	0.00	0.00	0.00
85.00	0.00	60	367.03	0.00	0.00	0.00
87.50	0.00	48	367.03	0.00	0.00	0.00
90.00	0.00	38	367.02	0.00	0.00	0.00
92.50	0.00	30	367.02	0.00	0.00	0.00
95.00	0.00	24	367.01	0.00	0.00	0.00
97.50	0.00	19	367.01	0.00	0.00	0.00
100.00	0.00	15	367.01	0.00	0.00	0.00
102.50	0.00	12	367.01	0.00	0.00	0.00
105.00	0.00	10	367.01	0.00	0.00	0.00
107.50	0.00	8	367.00	0.00	0.00	0.00
110.00	0.00	6	367.00	0.00	0.00	0.00
112.50	0.00	5	367.00	0.00	0.00	0.00
115.00	0.00	4	367.00	0.00	0.00	0.00
117.50	0.00	3	367.00	0.00	0.00	0.00
120.00	0.00	3	367.00	0.00	0.00	0.00

Summary for Link 1L: POST

Inflow Area = 1.780 ac, 29.78% Impervious, Inflow Depth = 3.37" for 10-Year event
Inflow = 5.82 cfs @ 11.97 hrs, Volume= 0.500 af
Primary = 5.82 cfs @ 11.97 hrs, Volume= 0.500 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-120.00 hrs, dt= 0.05 hrs

Link 1L: POST



Hydrograph for Link 1L: POST

Time (hours)	Inflow (cfs)	Elevation (feet)	Primary (cfs)
0.00	0.00	**0.00**	0.00
2.50	0.00	0.00	0.00
5.00	0.00	0.00	0.00
7.50	0.01	0.00	0.01
10.00	**0.06**	0.00	**0.06**
12.50	**1.09**	0.00	**1.09**
15.00	0.42	0.00	0.42
17.50	0.17	0.00	0.17
20.00	0.11	0.00	0.11
22.50	0.10	0.00	0.10
25.00	0.02	0.00	0.02
27.50	0.02	0.00	0.02
30.00	0.02	0.00	0.02
32.50	0.02	0.00	0.02
35.00	0.02	0.00	0.02
37.50	0.02	0.00	0.02
40.00	0.01	0.00	0.01
42.50	0.01	0.00	0.01
45.00	0.01	0.00	0.01
47.50	0.01	0.00	0.01
50.00	0.01	0.00	0.01
52.50	0.01	0.00	0.01
55.00	0.01	0.00	0.01
57.50	0.01	0.00	0.01
60.00	0.01	0.00	0.01
62.50	0.01	0.00	0.01
65.00	0.01	0.00	0.01
67.50	0.01	0.00	0.01
70.00	0.01	0.00	0.01
72.50	0.00	0.00	0.00
75.00	0.00	0.00	0.00
77.50	0.00	0.00	0.00
80.00	0.00	0.00	0.00
82.50	0.00	0.00	0.00
85.00	0.00	0.00	0.00
87.50	0.00	0.00	0.00
90.00	0.00	0.00	0.00
92.50	0.00	0.00	0.00
95.00	0.00	0.00	0.00
97.50	0.00	0.00	0.00
100.00	0.00	0.00	0.00
102.50	0.00	0.00	0.00
105.00	0.00	0.00	0.00
107.50	0.00	0.00	0.00
110.00	0.00	0.00	0.00
112.50	0.00	0.00	0.00
115.00	0.00	0.00	0.00
117.50	0.00	0.00	0.00
120.00	0.00	0.00	0.00

APPENDIX J

SUPPLEMENTAL FORM

SUPPLEMENT-EZ FORM COVER PAGE

Please indicate the types, quantities and locations of SCMs that will be used on this project:

	Quantity	Location(s)
Infiltration System		
Bioretention Cell		
Wet Pond		
Stormwater Wetland	1	Northwest Corner of Site
Permeable Pavement		
Sand Filter		
Rainwater Harvesting		
Green Roof		
Level Spreader-Filter Strip		
Disconnected Impervious Surface		
Treatment Swale		
Dry Pond		

Project Name:

Rolesville Crossfit

Address

850 Granite Falls Blvd

City / Town

Rolesville, NC

Designer information for this project:

Name and Title:	Jon Frazier, Principal
Organization:	FLM Engineering, Inc.
Street address:	8218 Creedmoor Road, Suite 201
City, State, Zip:	Raleigh, NC 27675
Phone number(s):	919.610.1051
Email:	jfrazier@flmengineering.com

Applicant:

Company:	McArn Realty LLC
Contact:	Mark McArn
Mailing Address:	403 N Cheatham St
City, State, Zip:	Franklinton, NC 27525
Phone number(s):	919.632.5374
Email:	mcarn@brassfieldcommercial.com

Designer

Seal

Signature of Designer

Date

Certification Statement:

I certify, under penalty of law: that this Supplement-EZ form and all supporting information were prepared under my direction or supervision;

- that the information provided in the form is, to the best of my knowledge and belief, true, accurate, and complete; and

- that the engineering plans, specifications, operation and maintenance agreements and other supporting information are consistent with the information provided here.

I am aware that there are significant penalties for submitting false information including the possibility of fines and imprisonment for knowing violations as well as a report being made to my professional board.

STORMWATER WETLAND

Rolesville Crossfit

THE DRAINAGE AREA				1
Drainage area number	DA-1	**Break down of BUA in the drainage area (both new and existing):**		
Total coastal wetlands area (sq ft)		- Parking / driveway (sq ft)	13706 sf	
Total surface water area (sq ft)		- Sidewalk (sq ft)	2842 sf	
Total drainage area (sq ft)	28300 sf	- Roof (sq ft)	6110 sf	
BUA associated with existing development (sq ft)		- Roadway (sq ft)		
Proposed new BUA (sq ft)	22658 sf	- Other, please specify in the comment box below (sq ft)		
Percent BUA of drainage area	80%	**Total BUA (sq ft)**	22658 sf	
COMPLIANCE WITH THE APPLICABLE STORMWATER PROGRAM				
Stormwater program(s) that apply (please specify):		Design rainfall depth (in)	1.0 in	
Wake County		Minimum volume required (cu ft)	1817 cf	
		Design volume of SCM (cu ft)	2131 cf	
GENERAL MDC FROM 02H .1050				
#1 Is the SCM sized to treat the SW from all surfaces at build-out?	Yes	#7 If applicable, with the SCM be cleaned out after construction?	Yes	
#2 Is the SCM located on or near contaminated soils?	No	#8 Does the mainetenance access comply with General MDC (8)?	Yes	
#3 What are the side slopes of the SCM (H:V)?	N/A	#9 Does the drainage easement comply with General MDC (9)?	Yes	
#3 Does the SCM have retaining walls, gabion walls or other engineered side slopes?	Yes	#10 If the SCM is on a single family lot, does the plat comply with General MDC (10)?		
#4 Are the inlets, outlets, and receiving stream protected from erosion (10-year storm)?	Yes	#11 Is there an O&M Agreement that complies with General MDC (11)?	Yes	
#5 Is there a a bypass for flows in excess of the design flow?	No	#12 Is there an O&M Plan that complies with General MDC (12)?	Yes	
#6 What is the method for dewatering the SCM for maintenance?	Pump (preferred)	#13 Was the SCM designed by an NC licensed professional?	Yes	
STORMWATER WETLAND MDC FROM 02H .1054				
#1 Permanent pool elevation (fmsl)	367.00 ft	#8 Total surface area of the shallow water zone at temporary pool (square feet)	600 sf	
#1 Temporary pool elevation (fmsl)	368.25 ft	#8 SW wetland surface area comprised of shallow water zone at temporary pool (%)	35%	
#1 Ponding depth (inches)	15.0 in	#8 Depth of the shallow water zone below permanent pool (inches)	9 in	
#2 Is the SW wetland designed for peak attenuation?	Yes	#8 Elevation of bottom of the shallow water zone (fmsl)	366.25 ft	
#2 If so, peak attenuation depth (inches)	40.8 in	#9 Total surface area of the temporary inundation zone at temporary pool (square feet)	745 sf	
#3 Surface area of SW wetland at temporary pool (square feet)	1705 sf	#9 SW wetland surface area comprised of temp inundation zone at temp pool (%)	44%	
#4 Depth of soil amendment (inches)	4 in	#9 Height of the temporary inundation zone above permanent pool (inches)	15.0 in	
#4 Describe how the soil is being amended to promote plant growth:		#9 Elevation of bottom of the temporary inundation zone (fmsl)	367.00 ft	
The pH, compaction, and other attributes of the first 12-inch depth of the soil shall be analyzed by a soil scientist and/or landscape architect during construction. Amendments shall be recommended as needed.		#10 Drawdown time for the temporary pool (hours)	61.9 hrs	
		#10 Does the orifice drawdown from below the top surface of the permanent pool?	Yes	
		#11 Does the pond minimize impacts to the receiving channel from the 1-yr, 24-hr storm?	Yes	
#6 Are the inlet(s) and outlet located in a manner that avoids short-circuiting?	Yes	#12 Has a landscaping plan that meets SW Wetland MDC (12) been provided?	Yes	
#6 Describe any measures, such as berms or baffles, that will be taken to improve the flow path:		#13 Number of plants per 200 square feet (#) in the shallow water zone:	50	
Forebays & deep pools are proposed to improve the flow path.		#13 Describe the planting plan for the shallow water zone:		
		As shown on development plans		
#6 Surface area of the forebay at temporary pool (square feet)	175 sf			
#6 Overall SW wetland surface area comprised of forebay at temporary pool (%)	10%			
#6 Depth of forebay below permanent pool (inches)	24 in	#14 Does planting for the temporary inundation zone comply with SW Wetland MDC (14)?	Yes	
#6 Elevation of bottom of forebay (fmsl)	365 ft	#14 Describe the planting plan for the temporary inundation zone:		
#6 Will the forebay be cleaned out when depth is reduced to 15 inches or less?	Yes	As shown on development plans		
#7 Total surface area of the non-forebay deep pools at temporary pool (square feet)	185 sf			
#7 SW wetland surface area comprised of non-forebay deep pools at temporary pool (%)	11%	#15 Are the dam structure and temporary fill slopes planted in non-clumping turfgrass?	Yes	
#7 Depth of non-forebay deep pools below permanent pool (inches)	24 in	#16 Will cattails be planted in the wetland?	No	
#7 Elevation of bottom of non-forebay deep pools (fmsl)	365 ft	#17 Is a trash rack or other device provided to protect the outlet system?	Yes	
ADDITIONAL INFORMATION				
Please use this space to provide any information about this stormwater wetland that you think is relevant to the review:				

APPENDIX K

DRAWDOWN CALCULATIONS

Orifice Drawdown Calculations

Volume provided at 15"	2131	ft^3

Orifice Equation

Outlet Diameter	0.75	in
Cd =	0.6	
Ho / 3 =	0.42	ft
g =	32.2	ft / sec^2
A =	0.003	sf
Q =	0.010	cfs

	222707.544	seconds
Drawdown Time	61.9	hours

APPENDIX L

OPERATION AND MAINTENANCE AGREEMENT

Operation & Maintenance Agreement

Project Name:	**Rolesville Crossfit**
Project Location:	**850 Granite Falls Blvd, Rolesville, NC**

Cover Page

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

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

Bioretention Cell	Quantity:		Location(s):	
Dry Detention Basin	Quantity:		Location(s):	
Grassed Swale	Quantity:		Location(s):	
Green Roof	Quantity:		Location(s):	
Infiltration Basin	Quantity:		Location(s):	
Infiltration Trench	Quantity:		Location(s):	
Level Spreader/VFS	Quantity:		Location(s):	
Permeable Pavement	Quantity:		Location(s):	
Proprietary System	Quantity:		Location(s):	
Rainwater Harvesting	Quantity:		Location(s):	
Sand Filter	Quantity:		Location(s):	
Stormwater Wetland	Quantity:	1	Location(s):	Northwest side of site
Wet Detention Basin	Quantity:	0	Location(s):	
Disconnected Impervious Area	Present:	No	Location(s):	
User Defined BMP	Present:	No	Location(s):	

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

* Responsible Party:	
Title & Organization:	
Street address:	
City, state, zip:	
Phone number(s):	
Email:	

Signature: _____ Date: _____

I, _____, a Notary Public for the State of _____

County of _____, do hearby certify that _____

personally appeared before me this _____ day of _____ and

acknowledge the due execution of the Operations and Maintenance Agreement .

Witness my hand and official seal, _____.

Seal

My commission expires _____

Stormwater Wetland Maintenance Requirements

Important maintenance procedures:

- Immediately following construction of the stormwater wetland, bi-weekly inspections will be conducted and wetland plants will be watered bi-weekly until vegetation becomes established (commonly six weeks).
- No portion of the stormwater wetland will be fertilized after the first initial fertilization that is required to establish the wetland plants.
- Stable groundcover will be maintained in the drainage area to reduce the sediment load to the wetland.
- Once a year, a dam safety expert should inspect the embankment.

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

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

BMP element:	Potential problem:	How I will remediate the problem:
Entire BMP	Trash/debris is present.	Remove the trash/debris.
The perimeter of the BMP	Areas of bare soil and/or erosive gullies have formed.	Regrade the soil if necessary to remove the gully, and then plant a ground cover and water until it is established. Provide lime and a one-time fertilizer application.
	Vegetation is too short or too long.	Maintain vegetation at a height of approximately six inches.
Forebay	Sediment has accumulated in the forebay to a depth that inhibits the forebay from	Search for the source of the sediment and remedy the problem if possible. Remove the sediment and dispose of it in a location where it will not cause impacts to streams or the BMP.
	Erosion has occurred.	Provide additional erosion protection such as reinforced turf matting or riprap if needed to prevent future erosion problems.
	Weeds are present.	Remove the weeds, preferably by hand. If a pesticide is used, wipe it on the plants rather than spraying.
The inlet device	The pipe is clogged.	Unclog the pipe. Dispose of the sediment off-site.
	The pipe is cracked or otherwise damaged.	Replace the pipe.
	Erosion is occurring in the swale.	Regrade the swale if necessary to smooth it over and provide erosion control devices such as reinforced turf matting or riprap to avoid future problems with erosion.
	Stone verge is clogged or covered in sediment (if applicable).	Remove sediment and replace with clean stone.

Stormwater Wetland Maintenance Requirements (Continued)

Deep pool, shallow water and shallow land areas	Algal growth covers over 50% of the deep pool and shallow water areas.	Consult a professional to remove and control the algal growth.
	Cattails, phragmites or other invasive plants cover 50% of the deep pool and shallow	Remove invasives by physical removal or by wiping them with pesticide (do not spray) – consult a professional.
	Shallow land remains flooded more than 5 days after a storm event.	Unclog the outlet device immediately.
	Plants are dead, diseased or dying.	Determine the source of the problem: soils, hydrology, disease, etc. Remedy the problem and replace plants. Provide a one-time fertilizer application to establish the ground cover if necessary.
	Best professional practices show that pruning is needed to maintain optimal plant	Prune according to best professional practices.
	Sediment has accumulated and reduced the depth to 75% of the original design depth of	Search for the source of the sediment and remedy the problem if possible. Remove the sediment and dispose of it in a location where it will not cause impacts to streams or the BMP.
Embankment	A tree has started to grow on the embankment.	Consult a dam safety specialist to remove the tree.
	An annual inspection by appropriate professional shows that the embankment	Make all needed repairs.
	Evidence of muskrat or beaver activity is present.	Consult a professional to remove muskrats or beavers.
Micropool	Sediment has accumulated and reduced the depth to 75% of the original design depth.	Search for the source of the sediment and remedy the problem if possible. Remove the sediment and dispose of it in a location where it will not cause impacts to streams or the BMP.
The outlet device	Clogging has occurred.	Clean out the outlet device. Dispose of the sediment off-site.
	The outlet device is damaged	Repair or replace the outlet device.
The receiving water	Erosion or other signs of damage have occurred at the outlet.	Contact the local NC Department of Environment and Natural Resources Regional Office.