

# WAKE COUNTY STORMWATER DESIGN MANUAL

Version 3 | September 2025

*Submittal  
and Design  
Guidance*



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## Chapter 1 – Design Manual Introduction

The purpose of this document is to provide standards and guidance for the management of stormwater runoff from development in Wake County’s jurisdiction. This manual provides support to Articles [9](#), [10](#), [11](#) and [14](#) of the Wake County Unified Development Ordinance (UDO) and applicable State regulations which establish minimum requirements to address impacts of stormwater runoff associated with new development and expansions. It is fully incorporated into the County’s UDO under [UDO Section 9-23](#).

Note, this design manual is considered a “living document” and updates will be made as needed to incorporate regulatory and programmatic changes.

Wake County has adopted and enforces the Neuse River Basin requirements within both the Neuse and Cape Fear River basins. Both residential and non-residential developments must adhere to the Neuse Rules requirements for nutrient management and riparian buffers. The Neuse Stormwater Rule limits nutrient runoff from new development projects and is implemented by local governments that are named in the Rule. A few local governments (including Wake County) were included in the earlier version of the Rule and will continue to implement the older version of the Rule (15A NCAC 02B .0235) until they start implementing the new Rule (tbd). Proposed projects located within the Falls Lake watershed must adhere to the Falls Lake Nutrient Management Strategy (Falls Lake Rules).

While the implementation of the Jordan Lake Nutrient Management Strategy (Jordan Lake Rules) for new development has been placed on hold by the State legislature, projects within the Jordan Lake watershed shall comply with the Neuse Stormwater rule for nutrient loading. The Jordan Lake riparian buffer rules are effective and shall apply. The Jordan Lake new development rules shall become effective and enforceable upon the end of all applicable legislative delays.

There are seven water supply watersheds within the jurisdiction of Wake County: Cape Fear (Lillington and Sanford), Falls Lake, Jordan Lake, Little River, Richland Creek, Smith Creek, and Swift Creek. Wake County elected the low-density option under the State Water Supply Watershed regulations and the associated requirements are found throughout the zoning provisions of the County’s ordinance. Development in the Swift Creek Water Supply Watershed is also subject to the requirements of the [Swift Creek Land Management Plan](#).

Wake County requires “volume-control” stormwater management with target curve number runoff volume limits for residential development, as well as a peak flow management and a downstream assessment requirement for both residential and non-residential developments. Using Wake County Target Curve Number Module is required to demonstrate compliance with this requirement, if applicable.

Wake County requires the use of the Wake County Hybrid Stormwater for all stormwater management submittals, with the exception for submittals for Falls Lake – which requires the SNAP Tool required – and individual lot stormwater deviations. For each regulatory requirement, Wake County adheres to design standards accepted by the State of North Carolina Department of Environmental Quality (NCDEQ), although additional County specific requirements may apply. In the case of any conflict between County and State standards or requirements, the more stringent shall apply.

## Chapter 2 – Overall Stormwater Process and Requirements

Site plans within Wake County's planning jurisdiction must be reviewed and approved by the Watershed Management Program to ensure compliance with Articles [9](#), [10](#), [11](#), and [14](#) of the Unified Development Ordinance and applicable State and Federal regulations.

In addition, Wake County administers an urban stormwater ordinance adopted by the Town of Rolesville, the Town of Wendell, and the Town of Zebulon that focuses on water quality and prevention of downstream flooding impacts. The urban stormwater ordinance is a result of recommendations made by a Countywide Stormwater Task Force and approved by the Wake County Board of Commissioners in 2007.

Note: This stormwater manual has been created for developments within in Wake County (non-municipal planning jurisdictions), although sedimentation and erosion control requirements in Chapter 5 are applicable to submittals in all jurisdictions. For stormwater process information specific to Rolesville, Wendell, or Zebulon, visit our [website](#) and review the appropriate local government ordinance.

The general stormwater process in Wake County may include all or a portion of the following steps:

- pre-submittal meeting (preferred)
- preliminary plan review
- construction/permitting plan review and approval
- preconstruction meeting
- permit issuance
- plat recordation and required documents
- permit completion; comply with conditions of approval
- post-construction maintenance

Prior to initiating an application, the applicant should be familiar with the *Wake County Unified Development Ordinance (UDO)* - [Article 9 Stormwater Management](#), [Article 10 Erosion and Sedimentation Control](#), [Article 11 Environmental Standards](#) and [Article 14 Flood Hazard Areas](#).

## 2.1 Submittal Checklists and Required Elements

Checklists are available to applicants and consultants to aid in the development and submittal of plans to Wake County by identifying major required and/or often overlooked components. However, they are not a substitute for understanding and meeting all requirements of the UDO or this manual. Checklists are living documents which may be updated over time, and applicants should ensure that they have downloaded the current version from the County's [website](#). Available submittal checklists are identified below for reference and will be updated based on changes to UDO and this manual.

### **Preliminary Plan Review**

Preliminary Plan Submittal Checklist (Excluding Falls Lake)

Preliminary Plan Submittal Checklist (Falls Lake Only)

### **Construction/Permitting Plan Reviews**

Construction Drawings (Combined erosion control, stormwater, floodplain)

Construction Drawing Submittal Checklist (Excluding Falls Lake)

Construction Drawing Submittal Checklist (Falls Lake Only)

Erosion Control (Only) Plan Submittal Checklist – Subdivision and Non-residential

Erosion Control (Only) – Single Family Residential Lot

Stormwater (Only) Plan Submittal Checklist (Excluding Falls Lake)

Stormwater (Only) Plan Submittal Checklist (Falls Lake Only)

Flood Study Submittal Checklist

HEC-RAS Submittal Checklist

HEC-RAS Figure 1 (visual guide)

### **Record Plats**

Exempt Plat Submittal Checklist

Final Plat Submittal Checklist

Minor and Minor-Limited Plat Submittal Checklist

### **Permit Completion Items/Conditions of Approval**

As-built Stormwater Control Measure (SCM) Checklist

SCM Specific Field Inspection Checklist

FEMA Elevation Certificate

Wake County Flood Certification Form

### **Stormwater Deviations**

Stormwater Deviation Submittal Checklist

### **Post-Construction Stormwater**

Stormwater Control Measure (SCM) Annual Inspection Form – Single Family Lot

Stormwater Control Measure (SCM) Annual Inspection Form – Subdivision and Non-Residential

## 2.2 Additional Resources for Submittals

In addition to County developed checklists, there are several resources online for use in developing plans to meet the requirements of the Wake County UDO. Each of these reference materials are required for any development project submitted for review, excepting lot-by-lot erosion control plans\* and stormwater deviations (see Chapter 4).

- [United States Geological Survey \(USGS\) 7.5 Minute Quadrangle Map](#) – A legible copy of this map shall be provided with the project boundary clearly shown to scale. This map is required for surface water identification purposes and identification of potential buffered features. Note that this may now also be downloaded from the new NCDEQ mapping tool: [USGS Topo/NRCS Published Soil Survey Mapping Tool \(arcgis.com\)](#). If the DEQ mapping tool is used, ensure that the map is zoomed to the appropriate level to obtain the correct map. The USGS quadrangle and 1970 Soil Survey map will show at different levels.
- [Wake County 1970 NRCS Soil Survey Map](#) – A legible copy of this map shall be provided with the project boundary clearly shown to scale. This map is required for surface water identification purposes and identification of potential buffered features. Note that this may now also be downloaded from the new NCDEQ mapping tool: [USGS Topo/NRCS Published Soil Survey Mapping Tool \(arcgis.com\)](#). If the DEQ mapping tool is used, ensure that the map is zoomed to the appropriate level to obtain the correct map. The USGS quadrangle and 1970 Soil Survey map will show at different levels.
- [Web Soil Survey Map](#) - A legible copy of this map shall be provided with the project boundary clearly shown to scale. This map may be used to show soil classification and shall include a reference table that describes the hydrologic soil group classification. This map shall not be used for surface water identification purposes or identification of potential buffered features.
- [FEMA National Flood Insurance Program \(NFIP\) Flood Insurance Rate Map](#) – A legible copy of this map, including map number, map date shall be provided with the project boundary clearly shown to scale. The effective FEMA 100-year floodplain, with base flood elevations, if applicable, shall be shown on the plans. The copy of the map can be pulled from the actual FEMA Flood map, a FEMA FIRMette or a map export from the [North Carolina FRIS website](#).
- [National Oceanic and Atmospheric Administration \(NOAA\) Atlas 14 Point Precipitation Frequency Estimates](#) - Data shall be specific to the site location and include hydrographs. A legible copy of the printout from the Atlas 14 website shall be provided with the project boundary clearly shown to scale. Hydrographs shall be downloaded and presented graphically. Atlas 14 generally works best when opened in Google Chrome or Firefox web browsers.

*\*Note: While USGS Quad Maps and the Wake County 1970 NRCS Soil Survey Map are not required for lot by lot erosion control submittals that disturb less than 1 acre within a common plan of development, they are a required component of NCDEQ's [NCG01 General Construction Stormwater Permit](#). If these items are not provided with the lot-by-lot erosion control plan, then staff must identify on the approval*

*letter that the plans are not NCG01 compliant and NCDEQ will require revisions to the County approved plan or submittal (to DEQ) of a separate compliant plan for review and approval before issuing NCG01 coverage.*

## 2.3 Stormwater Impact Analysis (SIA)

A stormwater impact analysis (SIA) sealed by a North Carolina licensed design professional shall be provided with any development project submitted for review, excepting lot-by-lot erosion control plans and stormwater deviations. Stormwater impact analyses shall contain the following general components, as well as any site-specific information necessary to demonstrate compliance with County, State, and Federal requirements. SIAs should be revised as needed based on staff review comments and a complete, updated, and sealed version provided with any resubmittal for review. Erosion control compliance calculations may be included as a section of the SIA or may be submitted separately.

It is important for the SIA submitted to be organized well and structured to provide clear, concise summaries of compliance information with supporting documentation attached and easily referenced. The SIA shall include a table of contents, and numbered pages. Note that the information below is not required to be submitted in this order or a standardized format, if the applicable information is within the provided SIA.

### 1. General Project Information

- a. Project Name
- b. Parcel Identification Numbers (PINs)
- c. Parcel address(es) and/or cross street location information
- d. River Basin (Neuse or Cape Fear) and Watershed (ex: Black Creek, Crabtree Creek, etc.)
- e. Water Supply Watershed Area (ex: N/A or Falls Lake, Little River, etc.)
- f. General Site Information (topography, existing vegetation, soil types, land uses, etc.)
- g. Existing easements onsite (access, drainage, backwater, utility, etc.)

2. **Site History** – A brief site history shall be provided to include any previous/existing development and associated dates, as well as any existing stormwater control measures.

### 3. Project Description

- a. Type of proposed development (single family homes, etc.)
- b. Number of lots (existing and proposed)
- c. Changes in land use and drainage patterns onsite
- d. Summary of applicable regulations (ex: Neuse Nutrient strategy, Neuse Basin Riparian buffers, Water Supply Watershed Buffers, etc.)

### 4. Land Disturbance and Impervious Surfaces

- a. Total proposed land disturbance (acres AND square feet)
- b. Total existing impervious area (acres AND square feet)
- c. Proposed impervious area (acres AND square feet)
- d. Overall project density (%) – impervious area/project area
- e. Existing recorded maximum impervious limitations, if applicable
- f. For projects within the Neuse (outside of Falls Lake) and Cape Fear [refer to Section 3.3.2.1 of this manual for specific definitions of terms below]:
  - i. Existing impervious surface area
  - ii. Regulated impervious surface area

- iii. New impervious surface area
- iv. Net increase in impervious surface area
- v. Cumulative impervious surface area

## 5. Streams, Buffers, and Wetlands

- a. Describe all streams (including [classifications](#)) or drainageways onsite, or within 100 feet of the project boundary, and their associated buffers (Neuse, Jordan, or Water Supply Watershed).
  - i. Reference any buffer determinations that have been obtained and their date
  - ii. For proposed Water Supply Watershed buffers, identify the type of feature, as well as the drainage area to the feature to justify the buffer described unless it has already been reviewed and platted. Reference [UDO Article 11](#).
- b. Describe any wetlands onsite. Refer to any State or Federal jurisdictional determinations, as applicable, and [iMaps](#) ESRI USGS National Map Basemap. Provide site specific wetland and/or geotechnical report as needed.
- c. Describe any proposed impacts to streams, buffers, or wetlands onsite. Refer to any State or Federal approvals, as applicable.
- d. Describe any drainage easements (existing or proposed, widths, etc.) for drainage features onsite.

## 6. Flood Hazard Areas

- a. Describe any flood hazard areas onsite including impoundments, or within 100 feet of the project boundary (FEMA, flood prone soils, backwater easements, etc.). Identify the appropriate base flood elevation (BFE) and regulatory flood protection elevation (RFPE), as applicable, as well as the method of determination.
- b. Describe and summarize any proposed impacts to these areas (Note: Wake County has stringent limits on impacts to flood prone areas – refer to [UDO Article 14](#) for allowed impacts).
- c. Describe any flood study permit submission that is part of the project. Identify general information, including whether major or minor, etc. Provide applicable permit number(s) for associated flood study(ies), once available.
- d. Reference any approved flood hazard soil redelineation for the site, and provide a copy of the redelineation in reference documentation.

## 7. Methodologies and Compliance Conclusions – Summarize methodologies for each calculation component and provide conclusions demonstrating how each required component has been met (includes proposed SCMs, nutrient mitigation payments, etc.). Include reference to supporting calculations and documentation as needed.

- a. *Target Curve number, if applicable (residential only)* – include required and provided volumes for treatment, or exemption (ex: recorded minor subdivision MISA of  $\leq 15\%$  impervious). If SCMs are proposed to meet this requirement, identify and describe.
- b. *Nutrient Loading* – include target nutrient loading requirements, whether the project complies with low- or high-density stormwater designs (specify criteria), proposed SCMs, summary table of post-development nutrient loading (with and without SCMs), and identify any required nutrient mitigation payments.
- c. *Downstream Assessment* – include a tabular summary of pre-development, post-development without SCMs, and post-development with SCMs flows for each node.

- d. *Peak Flow* – include a table to summarize the pre-development, post-development without SCMs, and post-development with SCMs flow rates by drainage area/discharge point. If SCMs are proposed to meet this requirement, identify and describe.
- e. *Buffers* – include a narrative to demonstrate compliance with any applicable State Riparian buffers, Wake County Water Supply Watershed Buffers, or required Wake County drainage easements. If impacts to any buffers are proposed, reference and document the required State or County approvals or how an exemption has been met.
- f. *Flood hazard requirements* – include a narrative which summarizes any impacts to flood hazard areas (including road or driveway crossings) and the results of any required flood studies for the project.

**8. Supporting Calculations and Drainage Area Maps**

- a. Target Curve Number (for Residential Development) with Wake County Target Curve Number Module
- b. Wake County Hybrid Stormwater Tool
- c. Downstream Assessment, with exhibit of 10% point and all points of analysis
- d. Peak Flow Calculations, routing, and exhibits
- e. Maps/exhibits which delineate pre/post drainage areas and landcovers for each point of discharge. Data provided in exhibits should clearly match that provided in calculations.

**9. Reference and Supplemental Documents\***

- a. Atlas 14 precipitation data and hydrographs
- b. USGS Quad Map with site shown to scale
- c. Wake County 1970 NRCS Soil Survey Map with site shown to scale
- d. Stream and/or Buffer Determinations, as applicable
- e. Buffer Authorizations for impacts, including approved impact maps, as applicable\*\*
- f. Pre-development drainage area maps to support widths of Water Supply Watershed Buffers, as applicable
- g. 401/404 approvals, including approved impact maps, as applicable\*\*
- h. USACE jurisdictional determination for wetlands and surface waters, as applicable\*\*
- i. NCDOT encroachments or other approvals, as applicable, for work in the NCDOT ROW\*\*
- j. Temporary construction easements or encroachment agreements for offsite work\*\*
- k. Written approvals for work within recorded easements, including utility or power easements\*\*
- l. NCDEQ Dam safety approvals, as applicable\*\*
- m. Web Soil Survey Map
- n. FIRM map panel with site shown to scale
- o. No-rise documentation, as applicable\*\*
- p. Flood study, as applicable\*\*
- q. Flood hazard soil redelineation/verification, as applicable

\* These items are required for the SIA submittal to be considered complete.

\*\* These items are recommended, but not required, as part of an SIA submitted with a preliminary plan. They are required, if applicable to the project, to be submitted as part of the SIA at the time of construction drawing/permitting review.

## 2.4 Application Submittal

All applications shall be submitted online through the [Wake County Permit Portal](#). Instructions and tutorials may be found on the County's [website](#) to:

- Set up an account; an account is needed for the applicant and FRP / owner
- Apply for a permit (Land Disturbance, Stormwater or Flood)
- Submit additional information, revise plans, or pay invoices; and
- Get your issued permit and inspection results.

With the exception of individual lot erosion control permits and stormwater deviations, most applications for erosion control, stormwater, or flood hazard review and permitting will be submitted under a “parent” submittal. For example, a planning (PLG-) submittal or through a building permit submittal (residential or commercial).

The application and all required checklist items must be uploaded to the original/parent permit. Wake County staff will then create and invoice fees for required erosion control, stormwater, or flood hazard reviews or permits.

All review fees (including certification review fees) are required to be paid before the review cycle will begin for a submittal. Permit fees may be paid upfront but shall be paid prior to permit issuance.

## 2.5 Permit Approval and Issuance

Please read your approval letter carefully, as it will highlight any conditions of approval for your project. All regular subdivisions, individual residential lot disturbances, and non-residential development and redevelopment projects are required to obtain an erosion control and/or stormwater permit through Wake County if certain land disturbance thresholds are met. Disturbance thresholds are set by the type of project and the location of the project (i.e., Neuse River Basin, Falls Lake Watershed, etc.). The general process for permit issuance is as follows. Please refer to Section 4.2.2 of this manual for specifics on the process for “lot-by-lot” permits for residential lots within a common plan of development.

Following staff review and approval of permits for construction drawings, a pre-construction meeting must be scheduled and held prior to any land disturbance. Before a pre-construction meeting can be scheduled, these items must occur:

1. Once all project specific conditions of approval have been met, the applicant shall upload the final plan set (with permit numbers completed in the signature block). The plan reviewer shall verify and complete the signature block electronically, and these signed plans will be available on the Permit Portal.
2. One full size and two half-size (12” x 18”) hard copy sets of the approved and signed plans must be provided to the Watershed Management field consultant so that they may review before the preconstruction meeting.
3. Projects requiring [NCG01 \(General Construction Stormwater Permit\)](#) coverage must apply for and obtain this coverage from NCDEQ.
4. A copy of the NCG01 Certificate of Coverage must be uploaded to the associated land disturbance (SEC) permit through the [Wake County Permit Portal](#).
5. Materials needed to install the initial required sedimentation and erosion control measures to receive a Certificate of Compliance (including risers and skimmers), shall be obtained.

The site contractor(s) and a representative of the financially responsible party shall be present at the pre-construction meeting. The design engineer should also attend to address technical questions and stormwater completion.

At or before the pre-construction meeting, any outstanding permit fees for erosion control, flood, and/or stormwater permits must be paid. Permit fees may not be paid over the phone. The options for payment are:

1. Pay through the online [permit portal](#). Note that only billing contacts for the permit will be able to view and pay invoices through the portal.
2. Pay in person at the 7<sup>th</sup> floor of the [Wake County Office Building](#) via check or credit card.

3. Mail a check to:  
Wake County Environmental Services  
Suite 718  
P.O. Box 550  
Raleigh, NC 27602

Please ensure that if you mail in a check, you reference the permit(s) and/or invoice number(s) so that Customer Support Center staff can apply the payment correctly. Failure to do so may result in a delay in processing.

The preconstruction meetings for the land disturbance (SEC) permit and any stormwater (SWF) permit may be held separately. If there is an SEC permit associated with the project, the applicant need only request the preconstruction meeting for the SEC permit and Wake County staff will coordinate notification to post-construction stormwater staff.

Once your permits have been issued, you may begin to install the initial required erosion and sedimentation control measures only. Land disturbance and clearing should be limited to that necessary to install these measures (Phase 1 of the approved plans). After the initial erosion control measures have been installed per the approved plans, you must contact your field consultant to request a Certificate of Compliance inspection.

If the field consultant verifies that the initial erosion control measures have been installed with temporary stabilization per the approved plans including construction entrance, perimeter measures and required basins and conveyances, they will issue a Certificate of Compliance. Once the Certificate of Compliance has been received, the contractor may proceed with further disturbance and grading of the site. *Note that the Certificate of Compliance must be issued prior to County approval of any building permit* – either in the County jurisdiction or any municipal areas of the County subject to Article 10 of the UDO (reference [UDO 10-30-7\(D\)](#)). The municipal areas currently served by the County include: Garner (erosion control only), Morrisville (erosion control only), Research Triangle Park (RTP), Rolesville, Wendell, and Zebulon.

## 2.6 Plat Recordation and Required Documents

Some projects will require the installation of stormwater control measures, conveyances, or other stormwater improvements to demonstrate compliance with State and County regulations.

Conditions of approval related to these improvements may include but are not limited to:

- Recordation of a Stormwater Agreement
- Recordation of a Maintenance Agreement and Operation and Maintenance Plan (O&M)
  - OPTION 1: WC Maintenance Agreement and Custom O&M Plan
  - OPTION 2: State generated Maintenance Agreement including maintenance requirements
- Recordation of a Plat (see appropriate checklist for additional requirements)
  - Identifying any maximum impervious limitations for individual lots
  - Identifying required SCM access and maintenance, drainage, or backwater easements
  - Referencing the book and page of the required stormwater agreement, maintenance agreement and O&M plan
- As-built Certifications (stormwater control measures and conveyances and flood hazard crossings) and/or Impervious Surface Area surveys

An inspection will be conducted prior to plat approval to determine whether the project stormwater controls and conveyances have been installed. The Certificate of Compliance for a project must be issued prior to approval of the plat to record lots.

Note that if all stormwater improvements (including stormwater control measures and permanent conveyances) for a subdivision are not completed prior to plat recordation, a performance guarantee shall be required to be posted before County approval of the final plat. Non-residential developments shall record an exempt plat to address required stormwater easements and documentation. A recorded plat showing the stormwater measure(s) and associated access and maintenance easements is required. No Certificate of Occupancy (CO) shall be granted for a non-residential development until the stormwater improvements have been completed.

Completion of stormwater improvements includes removal of all temporary erosion control measures (including baffles and skimmer), permanent stabilization of the device, field inspection by Wake County staff and as built survey approval. Refer to [UDO 8-22](#) for Performance Guarantee requirements.

### 2.6.1 Procedure for Posting a Performance Guarantee

The general performance guarantee process is as follows:

1. The owner/developer shall contact the Wake County plan reviewer to indicate that stormwater improvements are not complete, and that a performance guarantee will be provided.
2. The owner/developer's engineer shall perform a field inspection and submit (via the County Permit Portal) an Engineer's Estimate of the cost to construct stormwater improvements. This estimate shall be itemized and sealed by the engineer. Both "hard" and "soft" costs should be detailed thoroughly in the estimate – including but not limited to installation, stabilization, engineering, project management, surveying, etc. *Note: The performance guarantee shall be 125% of the amount of the final approved Engineer's Estimate.*
3. The Watershed Management plan reviewer shall review the sealed estimate, and revisions may be required prior to acceptance and approval of the estimate.
4. The Watershed Management plan reviewer shall approve the amount of the financial guarantee and issue a memo documenting the amount of the required guarantee.
5. The owner/developer shall furnish the County with a draft financial guarantee for the approved amount.
  - a. The performance guarantee shall be in the form of a performance bond, letter of credit, cash, or cashiers/certified check.
  - b. Drafts of Letters of Credit or Bonds require additional review and approval through the County Attorney's Office. The draft shall be submitted to the Watershed Management plan reviewer to begin this process.
    - Irrevocable Letter of Credit Option: The letter of credit must be obtained from a bank doing business and having a location in Wake County. The expiration date on the letter of credit is to be at least one year from the date of execution. The letter of credit must be automatically renewed on an annual basis, until the Stormwater Certificate of Completion has been issued and the County authorizes release of the performance guarantee.
    - Bond Option: Documentation must be provided that names Wake County as having power of attorney. The bond shall be with a NC company. Annual proof of coverage shall be provided to Wake County.
  - c. A [Stormwater Improvements Performance Guarantee Agreement Form](#) shall be submitted with the Performance Guarantee. Item #24 in the agreement should have the name of an individual, not the LLC alone. *Note: As with any legal binding agreement, the Stormwater Improvements Performance Guarantee Agreement should be read over carefully before it is signed and notarized by the owner / developer. Changes to the typewritten text of the agreement are not permitted.*
6. The owner/developer shall furnish the County with the original Stormwater Performance Guarantee Agreement and financial surety.

7. Once all required signatures have been obtained and the original Stormwater Performance Guarantee and surety have been accepted by the County, the Watershed Management plan reviewer may approve the plat or issue a building permit (if no plat is required). Reference [UDO 9-31-1](#). Note that:
  - a. A Disclosure Statement will be required on the Final Plat.
  - b. Required Maintenance and Stormwater Agreement forms shall be submitted for review during the plat process. Once the plan reviewer has approved the agreements, the applicant may proceed to record the forms at the Register of Deeds. The agreements must be recorded prior to recording the plat mylars.
  - c. The recorded Book and Page numbers for the Stormwater and Maintenance agreements shall be referenced on the plat mylars.
  
8. Non-compliance
  - a. Failure to renew a letter of credit or bond will be considered a non-compliant permit condition.
  - b. Failure to complete the stormwater improvements by the date designated in the signed Performance Agreement will be considered a non-compliant permit condition.
  - c. A revised Cost Estimate, financial surety and Performance Guarantee will be required to bring the permit into compliance.
  - d. The County may review the agreement annually for consistency in Financial Responsible Owner, viability of financial surety, status of SCMs, etc.; non-compliance and/or changes in the FRO will required a new agreement (see section c above)

### 2.6.2 Procedure for Release of a Performance Guarantee

Once all of the required stormwater improvements have been completed and any required as-built certifications and other required documentation are received and accepted by County staff, the performance guarantee may be released.

The as-built certification process generally includes:

- The engineer's certification that improvements have been installed per approved plans and in accordance with all regulations;
- 3<sup>rd</sup> party inspection of the SCM and associated conveyances (may be performed by the certifying engineer); field inspection checklists are available at [wake.gov/scm](http://wake.gov/scm);
- Field inspection by Wake County post-construction stormwater staff;
- Review and approval of as-built documentation by Wake County plan review staff; and
- Verification of the recorded plat, easements, and recorded documents.

Refer to Section 2.8.2 of this manual for more information on the as-built certification process.

Once at least 50% of the required improvements have been made, the owner/developer may request for the performance guarantee to be reduced by the ratio of the completed improvements to the total required improvements. However, no more than one reduction shall be permitted prior to release of the full performance guarantee.

A revised Engineer's Estimate of the cost to complete the remaining stormwater improvements must be provided and accepted by Watershed Management staff prior to County approval to reduce the performance guarantee. This revised estimate shall be itemized and sealed by the engineer.

*Note: The reduced performance guarantee shall be 125% of the amount of the revised approved Engineer's Estimate.*

To document release of the performance guarantee, both the owner/developer and Watershed Management staff must sign the Release of Performance Guarantee form, which will be supplied to the Wake County Finance Department. The project is then ready for stormwater permit completion if all other conditions of approval have been met.

## 2.7 Permit Completion

### 2.7.1 Land Disturbance Permits

When all items listed below have been completed, the Financially Responsible Party shall contact the Watershed Management field consultant to request a Certificate of Completion inspection for the land disturbance permit.

- All conditions of the land disturbance permit have been met
- All proposed roads, utilities, or other infrastructure have been installed according to the approved plans
- Design engineer to provide approval of utility installation
- All temporary erosion and sedimentation control measures have been removed with approval of the Watershed Management field consultant
- All disturbed areas are stabilized with established permanent groundcover or impervious surfaces
- All conditions and requirements of any associated stormwater permit have been met, as outlined in Section 2.8.2
- All conditions and requirements of any associated flood permit have been met, including as-builts of any flood crossings, elevation certifications, or letters of map revision

Refer to Chapter 5, Erosion and Sedimentation Control, for more information regarding land disturbance permits and stabilization requirements.

Once the Certificate of Completion for the land disturbance permit has been obtained, the Financially Responsible Party may request termination of their General Construction Stormwater Permit (NCG01) from NCDEQ. Refer to “[How to Terminate a Certificate of Coverage](#)” at the NCDEQ website.

### 2.7.2 Stormwater Permits

The process outlined below applies to all stormwater permits other than stormwater deviations. For close out of stormwater permits associated with a stormwater deviation on a single-family residential lot, please refer to Section 4.4.2 of this manual.

The stormwater permit for a project cannot be closed out until all required conditions of its approval have been met. Required conditions of approval are identified within the project approval letter issued by the Watershed Management plan reviewer.

These include but are not limited to:

- Stormwater Agreement has been signed, notarized, and recorded with the Register of Deeds
- Operation and Maintenance Plan and Maintenance Agreement have been signed, notarized, and recorded with the Register of Deeds
- Plat has been recorded which shows all required easements and references the Stormwater and Operation and Maintenance Plan and Maintenance Agreements by book and page.
- As-built plans, third party inspection report and engineer's certification have been submitted, reviewed, and accepted by the Watershed Management plan reviewer
- As-built inspection has been approved by the Wake County field consultant
- Contact information has been provided for Homeowner's Association and/or management company responsible for maintenance of SCMs
- Provide copies of the O&M manual, construction plan and as built package to the HOA or property owner/manager

As-built plans are required to be submitted, along with an Engineer's Certification, to verify that all stormwater improvements have been completed in accordance with the approved plan and County regulations.

Refer to the [as-built checklist](#) for general submittal requirements. Sufficient information must be provided to ensure that:

- Target Curve Number Volume requirements have been met (*for residential projects only*)
- Peak Flow requirements have been met
- Required Nutrient treatment has been provided
- Assumptions of any downstream assessments have been met
- Stormwater control measures are installed per the approved plans (design vs. as-built elevations for water quality, 1-year, 10-year, and 100-year storms shall be provided on cross section)
- All Minimum Design Criteria have been met for each stormwater control measure
- County specific criteria (including well and septic setbacks) have been met for each stormwater control measure
- Required plantings/stabilization has been provided
- Stormwater conveyances and drainage facilities are installed per the approved plans and capture the required drainage areas
- All stormwater improvements (including drainage facilities and stormwater control measures) are located within the recorded stormwater access and maintenance or drainage easements

- All backwater from the stormwater system is contained within the recorded stormwater, drainage, or backwater easements
- Any other project specific requirements have been met

As-builts shall not be submitted for County review and approval until the stormwater control measures and all of their conveyances have been permanently stabilized.

When ready, the as-built submittal package and associated Engineer's Certification shall be uploaded to the stormwater permit through the [Wake County Permit Portal](#). If the submittal is complete, the Watershed Management plan reviewer shall request an as-built inspection be performed by the field consultant(s) and will begin the 10-day initial review cycle.

When the initial review is complete, the Watershed Management plan reviewer shall provide a Stormwater As-built Review Checklist to the responsible party and certifying engineer which either notes approval or rejection of the as-built submittal. If the as-built submittal is not approved, specific comments shall be provided which must be addressed before resubmittal through the Portal. Upon approval of the as built submittal, including inspection approval, the responsibility of the device transfers to the permanent owner, homeowners' association, etc.

Until the as-built package has been approved and accepted by Wake County staff, and the stormwater permit has been closed out, the developer will continue to be responsible for maintenance of all stormwater improvements and resolution of any non-compliant items identified.

### 2.7.3 Flood Certification and Flood Study Permits

To close out a flood certification permit or a flood study permit, all conditions of its approval must be met. These conditions will be clearly identified in the approval letter issued by the Wake County plan reviewer.

Flood certification permits may require elevation certificates to verify that structures have been built at or above the required elevation. These elevation certificates may be required before construction, during construction, and post-construction.

Flood studies which involve roadways, driveways, or other encroachments are required to provide an engineered study demonstrating no increase in the base flood elevation. In order to verify that those crossings or encroachments were constructed according to the approved design, an as-built survey will be required. The survey shall be submitted prior to final plat approval for subdivisions or prior to Certificate of Occupancy for non-residential projects or single family lots.

Any required elevation certificates, as-builts, or other condition of approval for a flood certification/permit or flood study should be uploaded to the associated flood permit through the [Wake County Permit Portal](#). This action will initiate staff review of the documents.

If the Watershed Management plan reviewer accepts the documentation provided and all conditions of approval have been met, the flood certification permit or flood study permit may be closed out.

## 2.8 Post-Construction Responsibilities

Stormwater improvements include not only any stormwater control measures, but also drainage facilities (ex: conveyances) and easements. All stormwater improvements are required to be maintained into perpetuity so that they continue to function and meet the purpose and requirements of the County's stormwater ordinance.

The developer/permit holder is responsible for initial construction and as-built of any stormwater improvements that are required as part of the permitted development. Once as-builts are accepted and the stormwater permit closed out, responsibility for SCMs and their conveyances and easements in new residential subdivisions will transfer to a property owners or homeowners association. Responsibility for maintenance passes automatically to new property owners upon the sale of the property(ies) as noted in the Stormwater Agreement recorded with the Register of Deeds. All owners should familiarize themselves with any Operations and Maintenance Plan and/or Maintenance Agreement for the measures for which they are responsible. It is important for owners of stormwater improvements to ensure that they have budgeted appropriately to pay for third party inspections as well as routine and future maintenance needs. Owners shall register in the [County Permit Portal](#) and notify the County when there are changes in the ownership of a stormwater control measure.

Note that the lot owner/homeowners association/property owners association is required to update the maintenance plans for stormwater control measures at least once every 10 years ([UDO 9-23-3\(B\)](#)). These updated plans shall be recorded with the Register of Deeds, and a copy uploaded to the associated permit record on the [Wake County Permit Portal](#).

**Owners of stormwater control measures are required to submit an annual inspection report for each measure by June 30<sup>th</sup> of each year.**

- Annual inspections for stormwater control measures that were installed as part of a stormwater deviation approval to increase the maximum impervious surface area (MISA) limitation on an individual lot are not required to be performed by a qualified professional. These inspections may be performed by the individual property owners. The exceptions to this are underground devices and permeable pavement, which both require a qualified professional to inspect and certify each year.
- All other annual inspections for stormwater control measures shall be performed by a qualified professional working within their area of competence. These professionals may include: a licensed North Carolina Professional Engineer, Surveyor, or Landscape Architect; soil scientist; aquatic biologist; or other person certified by the North Carolina Cooperative Extension Service for stormwater control measure inspection and maintenance.
- The inspection report(s) shall be submitted via the [Wake County Permit Portal](#) by uploading it to the associated stormwater permit.
  - To upload documents to the Portal, owners and their representatives must register for an account and be linked to the appropriate permit(s) in the system. Please contact Watershed Management at [watershedmanagement@wake.gov](mailto:watershedmanagement@wake.gov) to request access to your permit case files (Subject Line: Add Case Contact).

- All inspection reports shall be on a form provided by or approved by Wake County. An example of an approved annual inspection report form may be found on the County website:
  - [Homeowner form \(stormwater deviation only – but not for use with underground measures or permeable pavement\)](#)
  - [Subdivision or Non-residential project form](#)

Wake County Watershed Management staff have the right to inspect sites to determine whether the stormwater improvements have been installed and are being properly maintained (Refer to [UDO Article 9, Part 6](#)). Failure to maintain improvements so that they continue to function is a violation of the County stormwater ordinance that is subject to fines and other enforcement activities.

## **Chapter 3 – Stormwater Compliance Principles**

The following sections provide detailed design methodology, supporting data, and further guidance on complying with Wake County stormwater design requirements.

### 3.1 Target Curve Number

Important Notes:

1. Minor and Minor-Limited Residential Subdivisions may elect to limit the proposed subdivision’s impervious surfaces to a maximum of 15% in lieu of showing compliance with target curve number requirements. All other applicable stormwater regulations would still apply. Reference [UDO 9-12-2](#).
2. Commercial development projects are not required to show compliance with target curve number requirements. Reference [UDO 9-20](#).

#### 3.1.1 Concept

Wake County [UDO Section 9-20](#) requires that developers must manage residential runoff for post-development to ensure the site will not exceed the designated curve numbers, in accordance with procedures specified in the *United States Department of Agriculture, Natural Resource Conservation Service, Technical Release 55, Urban Hydrology for Small Watersheds (TR-55)*. The target curve numbers (TCNs) are provided in Table 3.1 below. If the proposed development does not meet the “target” curve number, then the difference in runoff volume for 3 inches of precipitation between the target curve number and the proposed development curve number must be retained and infiltrated or stored and drawn down over a period of 2 to 5 days.

The Wake County Hybrid Design Tool is required to be submitted for all residential development subject to this requirement. Engineers using the module will input land uses and hydrologic soil groups (HSGs) by drainage area, and the module calculates the target curve number and post development curve number for the site as a whole. The difference between the two numbers translates to a volume that must be detained for the site. The Wake County Hybrid Tool calculates and flags the volume that is the developer’s responsibility to detain. The Wake County Hybrid Design Tool is required for TCN calculations and the NCDEQ SNAP Tool is required for Jordan and Falls Lake submittals.

Table 3.1 Wake County Target Curve Numbers

| Zoning District   | Maximum Composite Curve Number by Soil Group |    |    |    |
|---|--|----|----|----|
|   | A  | B  | C  | D  |
| R-80W and R-80  | 37   | 60 | 73 | 79 |
| R-40W and R-40  | 41   | 62 | 75 | 80 |
| R-30, R-20, R-15, R-10, R-5, Residential Highway, General Business and Office and Institutional | 43   | 63 | 76 | 81 |

The Curve Number (CN) concept was developed by the Soil Conservation Service to estimate runoff volume for specific rainfall events. Curve number values are whole numbers ranging from 30 to 98 –

lower values correspond to smaller runoff volumes and higher values correspond to larger runoff volumes. CN is determined using two factors: hydrologic soil group (HSG) and land use.

Soil classifications are divided into four hydrologic soil groups (A, B, C, and D) according to their minimum infiltration rate. Soils that are HSG “A” soils are those which have high infiltration capacity and subsequently low runoff rates. HSG “D” soils are those with very low infiltration capacity and very high runoff rates. The hydrologic soil groups for the soil classifications found in Wake County are listed in Table A-1 In Appendix A.

Land use is the second contributor to determining a curve number. The curve number for wooded area is lower and therefore corresponds to a smaller runoff volume than impervious surface which has a higher curve number. Curve number values for proposed development conditions in Wake County in all four hydrologic soil groups are provided in Table A-2 in Appendix A.

### 3.1.2 Design Methodology

A composite curve number (CN) is calculated to represent the hydrologic characteristics of the site as a whole. To calculate a composite curve number, the soil types, proposed land uses, and the proposed acreage of each should be known. The land use types listed in Table A-2 are representative of most developments in Wake County. The Wake County Module calculates the CN, TCN and required volume storage for the site. The below examples demonstrate the calculations used in the Module.

#### **Example 3.a Composite Curve Number**

The proposed R-40 development is a 10-acre site with the below land uses. Using Table A-2, the curve number can be determined for each area of land use.

Proposed land uses:

- Woods, HSG B (CN = 55) = 4 acres
- Managed Pervious (Open Space), HSG B (CN = 61) = 1.5 acres
- Managed Pervious (Open Space), HSG C (CN = 74) = 2 acres
- Roof, HSG B (CN = 98) = 1.5 acres
- Roadway, HSG C (CN=98) = 0.5 acres
- Grassed ROWs, HSG C (CN=80) = 0.5 acres

Solution:

*Multiply the acreage by the curve number and sum the products.*

$$\begin{aligned}
 55 * 4 \text{ acres} &= 220 \\
 61 * 1.5 \text{ acres} &= 91.5 \\
 74 * 2 \text{ acres} &= 148 \\
 98 * 1.5 \text{ acres} &= 147 \\
 98 * 0.5 \text{ acres} &= 49 \\
 80 * 0.5 \text{ acres} &= 40 \\
 220 + 91.5 + 148 + 147 + 49 + 40 &= 695.5
 \end{aligned}$$

*Divide the sum by the total site acreage to determine the composite curve number.*

$$695.5 / (10 \text{ acres}) = 69.55$$

**A curve number must be a whole number – therefore the composite curve number is 70.**

Based on Table 3.1, this site would have also have a TCN of **66**:

Solution:

*Multiply the HSG acreages by the **Maximum Composite Curve Number by Soil Group**, sum the products, and divide by the total site acreage.*

$$\begin{aligned}
 \text{B Soils} = 7 \text{ acres} &\Rightarrow 7*62 = 434 \\
 \text{C soils} = 3 \text{ acres} &\Rightarrow 3*75 = 225
 \end{aligned}$$

$$(434+225) = 65.9$$

$$10$$

**The proposed development CN of 70 is greater than the TCN of 66.**

### TCN Volume Requirement - SCS Runoff Method

In cases where the proposed development composite CN is higher than the TCN for the site, the additional volume of runoff must be stored. Runoff volumes shall be calculated using the SCS runoff equation as follows:

$$Q^* = \text{Runoff depth (in)}$$

$$P = \text{Rainfall depth (in)}$$

$$S = \text{Potential maximum retention after rainfall begins (in)}$$

$$Q = \frac{(P - 0.2S)^2}{P + 0.8S}$$

$$S = \frac{1000}{CN} - 10$$

**Example 3.b Determination of Runoff Volume**

In **Example 3.a**, the proposed CN for the site was determined to be 70 and the TCN was determined to be 66. Using the proposed and target curve numbers –determine the volume to be stored on this site. This will be done by calculating the runoff in inches for each curve number and then multiplying the difference between the two runoff values by the acreage of the site.

Runoff for Proposed CN:

Determine the value of S first. Divide 1000 by the composite curve number and subtract 10.

$$S = (1000 / CN) - 10$$

$$S = (1000 / 70) - 10 = 4.29 \text{ inches}$$

Now calculate the runoff by using the SCS runoff equation. Per the Wake County rules, P = 3 inches.

$$Q^* = \frac{(P - 0.2S)^2}{P + 0.8S}$$

$$Q^* = \frac{(3 - (0.2 * 4.29))^2}{3 + (0.8 * 4.29)} = \frac{(2.14)^2}{6.43} = 4.45 / 6.43$$

$$Q^*_{\text{Proposed}} = \mathbf{0.71 \text{ inches}}$$

Runoff for TCN:

$$S = (1000 / CN) - 10$$

$$S = (1000 / 66) - 10 = 5.15 \text{ inches}$$

$$Q^* = \frac{(P - 0.2S)^2}{P + 0.8S}$$

$$Q^* = \frac{(3 - (0.2 * 5.15))^2}{3 + (0.8 * 5.15)} = \frac{(3 - (0.99))^2}{3 + (3.94)} = \frac{(2.01)^2}{6.94} = 4.04 / 6.94$$

$$Q^*_{\text{Target}} = \mathbf{0.55 \text{ inches}}$$

Runoff Volume to be Stored:

Subtract the runoff produced by TCN by the runoff produced by the proposed CN to determine the runoff in inches that exceeds the allowed amount.

$$Q^*_{\text{Proposed}} - Q^*_{\text{Target}} = 0.71 - 0.55 = 0.16 \text{ inches}$$

Convert the runoff to a volume

$$0.16 \text{ inches} * (1/12) \text{ feet/inches} = 0.01 \text{ feet}$$

Multiply the site acreage by the runoff to determine the volume required to be stored.

$$10 \text{ acres} * 0.01 \text{ feet} = 0.10 \text{ acre-feet}$$

Convert volume to cubic feet.

$$0.10 \text{ acre-feet} * 43,560 \text{ square feet} = 4,356 \text{ cubic feet}$$

**Therefore, the volume required to be stored by the Wake County Stormwater Ordinance is 4,356 cubic feet.**

**Note: The total volume required is for the site and can be spread across multiple drainage areas.**

### 3.1.3 Stormwater Crediting

Land use practices involve stormwater management strategies to reduce the volume of runoff without the use of structural controls. Practices such as wooded area preservation and disconnected impervious area increase opportunities for infiltration and stormwater runoff absorption. Land use practices help to decrease the proposed curve number of a site therefore reducing hydrological impacts, as well as achieving additional environmental benefits.

#### 3.1.3.1 Preservation of Wooded Areas and Reforestation

The preservation of wooded areas or creation of woods by reforestation is an important management tool to lower the proposed curve number of a site. Wooded areas are assigned a lower curve number than any other land use (See Table A-2). Therefore, when determining a composite curve number for a proposed site, increasing the area of woods decreases the proposed curve number. Preserving existing wooded areas is recommended over creation of woods by reforestation. Effort should be made to maintain existing woods in a proposed subdivision.

#### 3.1.3.2 General Design Criteria

In order for a wooded area to be considered as “woods” in the calculation of the proposed site curve number, it must be designated as preserved woods or reforested area, a Neuse River Riparian Buffer (Zone 1) or Wake County Water Supply Watershed Buffer. This concept is consistent with the NCDEQ SNAP Tool designation of “*protected forest*”, and the area designated as such should match in the Wake County Hybrid Design Tool and the NCDEQ SNAP Tool.

#### **Protected Forest**

A protected forest any wooded/forested area that is neither periodically/regularly mowed nor fertilized, is not managed according to a deferment for use value under forestry or a forest management plan, and where understory and groundcover are allowed to develop. Such areas tend to have minimal use (such as pervious-surface trails) and little management other than control of invasive species and disease. These areas are protected by covenants, easements, or other regulations that prevent their conversion to other pervious uses. This includes forests with conservation easements, Riparian Buffer Zone 1, forested riparian zones protected by other regulations, and protected wetlands.

The areas claimed as “woods” or “protected forest” on the lots must be designated by a boundary on the construction plan and recorded plat. This is required so that the developer, builder, and homeowner are all aware of the area that cannot be disturbed and must remain forested. This boundary may be moved by the builder or homeowner provided that an equivalent area of existing woods or reforested area is provided, and the plat is modified and recorded to reflect the new boundary.

### *3.1.3.3 Reforestation Design Criteria*

In areas that are not naturally wooded, the creation of wooded areas by reforestation is allowed. The reforested area counts as “woods” in the proposed curve number calculation. Areas that are reforested must be planted with trees and/or shrubs and mulched properly as specified in the following standards.

#### **Tree/shrub Density and Spacing**

Planted trees or shrubs must meet the minimum density and spacing standards of the Natural Resources Conservation Service. Existing trees or shrubs may be used towards meeting the planting standard. Standards regarding seedling quality and planting instructions and considerations are included in the [Field Office Technical Guide, Standard 612](#) published by the Natural Resources Conservation Service.

#### **Mulching**

An initial application of mulch is required for the area designated for reforestation. Existing groundcover may be used towards meeting the mulching standard. The site should be prepared and mulch spread and anchored per the standards included in the [Field Office Technical Guide, Standard 484](#) published by the Natural Resources Conservation Service.

In addition, the reforested area must also meet the definition of “protected forest” from NCDEQ’s SNAP Tool as described in the section above to qualify for this credit.

### 3.1.3.4 Disconnected Impervious

**Important Note:**

Information from the section below is intended for use in the Wake County Target Curve Number module only. For these calculations, the disconnected impervious surface (DIS) is NOT considered a stormwater control measure when the credit taken is 50% or less. To receive additional disconnected credit, the designer must comply with all NCDEQ Minimum Design Criteria and additional County SCM requirements (refer to Chapter 5 of this manual). Disconnected impervious surface as a SCM is considered a secondary device and cannot be used within a “shared” stormwater management plan, such as a regular subdivision as a standalone measure

Disconnected impervious is a term used to describe runoff from an impervious area that has been directed over a pervious surface, such as lawn or woods, as sheet flow to allow infiltration. Connected impervious describes an impervious area in which the runoff is directed on to another impervious surface, a pipe, or a channel without an opportunity for infiltration or absorption. TR-55 recognizes that disconnected impervious areas produce less runoff than connected impervious area when the total impervious area is less than 30 percent. Once over 30 percent impervious, the absorptive capacity of the remaining pervious areas will not significantly affect runoff. TR-55 gives credit for this practice by reducing the composite curve number and provides an equation to determine the composite curve number when using disconnected impervious:

$$CN_{\text{adjusted}} = CN_p + [(P_{\text{imp}}/100) * (98 - CN_p) * (1 - (0.5 * R))]$$

Where:

$CN_{\text{adjusted}}$  = Composite Curve Number

$CN_p$  = Pervious runoff curve number

$P_{\text{imp}}$  = Percent Imperviousness % (expressed as whole number)

$R$  = ratio of unconnected impervious area to total impervious area (decimal)

This equation reduces the curve number by counting half of the disconnected impervious area as pervious. Therefore, if considering the effects on a single lot in which the entire roof was disconnected impervious, half of the roof would be assigned a curve number of 98 and half of the roof would be assigned the curve number for the pervious portion of the lot.

Each subdivision has a maximum allowable assumption of disconnected impervious for the whole site based on zoning as shown in Table 3.2. The maximum assumption is the percent of the total impervious surface of the site that is considered disconnected.

Table 3.2 Maximum Allowable Assumption of Disconnected Impervious Surface

| Zoning District   | Maximum Assumption of Disconnection without Designation |
|---|---|
| R-80W, R-80, R-40W, R40, R-30   | 50%   |
| R-20, R-15, R-10, R-5, Residential Highway, General Business and Office and Institutional | 25%   |

If this maximum allowable assumption is exceeded, disconnected impervious surface will be considered an SCM and details must be provided showing that each impervious surface that is considered disconnected meets the design criteria as described below. Stormwater and Maintenance Agreements will be required.

Rooftop Disconnection Design Criteria:

- No more than 500 square feet of roof area should contribute to one downspout.
- Downspout must be installed with a splash block or equivalent length and width of gravel to establish sheet flow.
- From downspout, a minimum of 50 feet should be provided in the direction of flow across a vegetated surface before intercepted by a grassed channel, pipe, or another impervious surface.

Non-Rooftop Disconnection Design Criteria:

- Maximum length of flow across the impervious surface is 75 feet.
- A flow length across a vegetated surface should be provided that is equal to or greater than the flow path across the contributing impervious surface.
- The maximum slope for the vegetated surface is 5%.
- Pervious pavers are automatically disconnected and do not need to meet the additional criteria above.

### 3.2 Nutrient Loading

**Important Note:**

Wake County currently applies the Neuse Stormwater Rules for nutrient loading County-wide, except in those areas subject to Falls Lake Stormwater Rules. Once the Jordan Lake Rules for new development are no longer legislatively delayed, they will be applicable within the Jordan Lake watershed.

#### 3.2.1 Nutrient Loading Targets

Nutrient loading requirements and targets vary depending on the project location within Wake County’s jurisdiction.

Table 3.3 Current Nutrient Targets (2023) for Nitrogen and Phosphorous

| Nutrient Strategy Area  | Nutrient Reduction Target   | Thresholds (future)  |
|---|---|--|
| <u>Neuse and Cape Fear River Basins</u>                                       | 3.6 N lb/ac/yr & No P target  | Low density ( $\leq 24\%$ Cumulative Impervious): Projects may meet nutrient rate targets entirely by nutrient offsets (no SCMs required), but must also meet low density stormwater requirements of 02H .1003   |
| <u>Jordan Lake Watershed</u><br>Upper New Hope<br>Lower New Hope<br>Haw River | 3.6 N lb/ac/yr & No P target (Neuse requirements must be met while Jordan Lake Rules are delayed) | High density ( $> 24\%$ Cumulative Impervious): onsite SCMs required to treat for all cumulative impervious if the project density, and meet other low-density, high-density and other stormwater requirements of DEMLR’s 02H .1003<br><br>Projects meeting the definition of runoff volume match do not need to address nutrient export further |
| <u>Falls Lake Watershed</u>   | 2.2 N lb/ac/yr & 0.33 P lb/ac/yr  | 30% of N & P reduction must be provided onsite for projects less than one acre or expansions;<br><br>50% of N & P reduction must be provided onsite for projects disturbing one acre or more   |

Projects within the Cape Fear River basin (including Jordan Lake) will need to plan to treat down to the targets listed above, as there will likely not be mitigation credits available for purchase in this area.

### 3.2.2 Nutrient Loading Calculations

Applicants shall submit nutrient loading calculations using the current version of the NCDEQ SNAP (Stormwater Nitrogen and Phosphorus) tool or the Wake County Hybrid Design Tool. The [SNAP Tool, user manual, and additional guidance](#) may be found on NCDEQ’s website. In local jurisdictions (such as Wake County) where older Neuse or Tar-Pamlico Stormwater Rules are still in effect, developers should continue to use the calculation method laid out in the [Neuse Model Program](#).

#### 3.2.2.1 SNAP Tool Guidance for Wake County

In addition to the general NCDEQ guidance for the SNAP Tool, the following specific information is provided for Falls Lake submittals. If a field or worksheet is not directly referenced below, that does not imply that it is not required to be completed. The information provided here is intended to give guidance on certain specific expectations for completion of the SNAP tool.

#### **SNAP Project Info Worksheet (Required)**

- Project Name: Should match Part A-1 of Financial Responsibility/Ownership Form
- Parcel ID: Complete with all PINs
- Project Latitude/Longitude: Provide in decimal degrees
- Nitrogen Delivery Zone: If your project is in the Cape Fear River Basin, enter **xxxx**
- Local govt cutoff date for Existing BUA: Enter **xx/xx**/2024 (Neuse/Cape Fear); **xx/xx/xxxx** (Falls Lake)
- Nitrogen Export Rate Target: Should be 3.6 lb/ac/yr for all locations other than Falls Lake; Should be 2.2 lb/ac/yr for Falls Lake
- Phosphorous Export Rate Target: Should be blank for all locations other than Falls Lake; should be 0.33 lb/ac/yr for Falls Lake

#### **SNAP Land Cover Characteristics Worksheet**

- Precipitation Station: Should be “Raleigh”, “Neuse”, or “Zebulon”, depending on the closest location to your project. Refer to the map linked in this worksheet.
- The category of “Roof” shall be used for any impervious surface elevated above the surrounding ground. For example, the roof of a home, or the roof of an accessory structure like a garage or shed.
- The category of “Roadway” shall be used for any public or private road surface (not including a personal or shared driveway).
- The category of “Parking/Driveway/Sidewalk” shall be used for impervious surfaces at ground level and miscellaneous uses. These would include parking pads, driveways, sidewalks, graveled areas, patios, retaining walls, and HVAC pads. Note that permeable pavement designed as an SCM for infiltration will be entered under “Land Taken Up By SCM” in the SNAP Tool.
- The category of “Protected Forest” may be used for the following:
  - Zone 1 of the Neuse Riparian Buffer
  - Areas designated as preserved woods or reforested area on both the construction drawings and recorded plat
  - May be used for Wake County Water Supply Watershed Buffers and Tree & Vegetation Protection Zones, but labeled separately

- The category of “Managed Pervious/Landscaping shall be used for all pervious area that is not designated as Protected Forest”.
- Pools and open water (ponds, lakes, etc.) shall be entered as a Custom Land Cover with values of Impervious – 0, TN EMC (mg/L) = 1.18, TP EMC (mg/L) = 0.11.

**SNAP SCM Characteristics Worksheet**

- The “Hydrologic soil group (HSG) at SCM location” shall be the HSG specifically at the location of the SCM – not the overall HSG of the site. If the SCM is located between two HSGs, then the one with the lower infiltration rate shall be used.
- The “SCM description” should be the name of the SCM and should match the submitted plans and Stormwater Impact Analysis (SIA) for the project. For example, “Dry Pond #1”.
- The “Design Storm Size (inches/24 hours)” shall be 1 inch for the purposes of the SNAP tool’s nutrient calculations. Note that the SCM may also be required to comply with the County’s Target Curve Number Requirements, and the Wake County Target Curve Number Module will be used for that calculation.
- The “Percent of Full Size” field should be 100% for any SCM being used for regulatory compliance with State Stormwater Rules.

### 3.2.2.2 Nutrient Loading Calculation Guidance for the Neuse Stormwater Rule

Detailed guidance on the use of the SNAP Tool may be found on the NCDEQ website [here](#) and above. The following overview is intended as general guidance on concepts for the calculations subject to the Neuse Stormwater Rule. Additional information may be found in [Appendix B of the Neuse and Tar-Pamlico Local Program Development Guide](#). In cases where there may be conflict in terms or requirements between NCDEQ and Wake County, the more stringent shall apply. Impervious surface is defined in [UDO 21-11](#). Note that the terms impervious and built upon area (BUA) are used interchangeably below.

**Existing Impervious** (AKA “existing development”): Impervious built/vested prior to **xx/xx/2024**. To qualify as existing impervious, any built impervious must have been properly approved and permitted under the applicable stormwater regulations at the time it was installed (or met an available exemption). *\*Note: Impervious/BUA is considered “still present” if demolished but still remains impermeable (such as reduced to a gravel parking area). Impervious can be permanently removed in one area and replaced in another area for no net change in impervious. Impervious is permanently removed from the total area of Existing Impervious if demolished/removed and followed up with planting, seeding and strawing, or other work to restore rain infiltration, such as deep soil ripping.*

**New Impervious:** New impervious/BUA the applicant is seeking a permit to install. This can include replacement of Existing Impervious. This area is part of the total Disturbed Area.

**Net Increase Impervious:** New Impervious minus any impervious that is demolished and replaced with impervious anywhere onsite. Net Increase in impervious must be  $> 0$  for the Neuse Nutrient Stormwater Rules to apply.

**Cumulative Impervious:** Includes all Existing Impervious and Net Increase Impervious – Cumulative Impervious is used for calculating Project Density (% Impervious/BUA) for Neuse stormwater compliance, and is subject to Stormwater Rules and Nutrient Targets, depending on provided stormwater treatment, nutrient offsets, and other exemptions and exceptions that may apply.

#### NCGS 143 214.7D. Limitations on built upon area requirements:

- A. As used in this section, the term "built upon area" means impervious surface and partially impervious surface to the extent that the partially impervious surface does not allow water to infiltrate through the surface and into the subsoil.
- B. For the purposes of implementing State or local government stormwater programs, none of the following surfaces shall be considered "built upon area" or an impervious or partially impervious surface:
  - 1) A slatted deck
  - 2) The water area of a swimming pool
  - 3) A surface of number 57 stone, as designated by the American Society for Testing and Materials, laid at least 4 inches thick over a geotextile fabric.

- 4) A trail as defined in G.S. 113A 85 that is either unpaved or paved as long as the pavement is porous with a hydraulic conductivity greater than 0.001 centimeters per second (1.41 inches per hour).
- 5) Landscaping material, including, but not limited to, gravel, mulch, sand, and vegetation, placed on areas that receive pedestrian or bicycle traffic or on portions of driveways and parking areas that will not be compacted by the weight of a vehicle, such as the area between sections of pavement that support the weight of a vehicle.
- 6) Artificial turf, manufactured to allow water to drain through the backing of the turf, and installed according to the manufacturer's specifications over a pervious surface. Note: artificial turf requires land use approval from the Planning Department

An additional Item (7) is included in the Wake County UDO: Stormwater Control Measures, excluding underground detention stormwater control measures, designed in accordance with the Wake County Stormwater Design Manual.

Stormwater Control Measures means permanent structural devices that are designed, constructed, and maintained to control flow from stormwater runoff before the water reaches downstream bodies of water. These devices remove pollutants from stormwater and help reduce flooding and erosion to downstream properties when designed in accordance with the Wake County Stormwater Design Manual

NCGS 143-214.7 bars the State or local governments from requiring stormwater treatment for existing development. It also establishes that the area of Existing Impervious, or the equivalent amount if it is rebuilt, is to be removed from calculations of project area and project density with respect to stormwater requirements.

Note that the total impervious surface coverage (including existing impervious surfaces) must be considered when meeting Wake County zoning requirements, which is a separate regulation.

### 3.2.3 Neuse (outside of Falls Lake) and Cape Fear Requirements

Refer to Sections 3.3.2.1 and 2 of this Manual for guidance on nutrient loading calculations for the Neuse River Basin. Wake County implements the Neuse Stormwater Rules Countywide (outside of Falls Lake), including within the Cape Fear Basin. The Jordan Lake Stormwater Rules for new development are currently under legislative delay but will become effective and enforceable upon the end of all applicable legislative delays ([UDO 9-21-3](#)). At that time, other areas of the Cape Fear Basin, outside of Jordan Lake, will continue to demonstrate compliance with the Neuse Stormwater Rules.

The tables below provide a high-level summary of Neuse Stormwater requirements for various scenarios. All scenarios assume that there is a net increase in impervious surface (or built upon area, BUA). A greenfield development is assumed to have no impervious surface or built upon area, whether existing or regulated. Where low- or high-density stormwater design is required for compliance with the Neuse Rules, this design shall be based on all Cumulative Built Upon Area (Cumulative BUA).

Please note that additional County stormwater requirements, including downstream assessments and target curve number for residential developments, will also apply. These additional requirements may require a stormwater control measure to be proposed onsite, even if the Neuse Stormwater Rules do not.

Some key items to understand include:

- Required stormwater treatment must be installed onsite or using regional offsite SCMs, treating runoff volume from all Cumulative BUA or equivalent volume. This is regardless of already-acquired nutrient offsets.
- Treatment of runoff volume from Existing BUA can be used in place of treatment of runoff volume from Cumulative BUA.
- New or redesigned stormwater control measures (SCMs) must be sized for the total volume draining to them. This may include more than the required volume.
- Nutrient offsets may be used to meet remaining nutrient reduction need after determining reduction provided by stormwater treatment and any previous offsets.
- It is recommended to contact the NC Division of Water Resources for guidance on nutrient calculation, especially if existing SCMs are present or previous nutrient offsets exist.

Note also that a minor or minor-limited subdivision will be required to show compliance with the Neuse Stormwater Rules at the time of subdivision if it is determined to be a common plan of development (refer to definition below, and in Appendix B). If a minor or minor-limited subdivision has shared elements – for example, a road – or otherwise meets the definition below, then it will be determined to be a common plan of development.

**Common plan of development (from 15A NCAC 02H .1002):** means a site where multiple separate and distinct development activities may be taking place at different times on different schedules but governed by a single development plan regardless of ownership of the parcels. Information that may be used to determine a "common plan of development" include plats, blueprints, marketing plans, contracts, building permits, public notices or hearings, zoning requests, and infrastructure development plans.

*DEQ's Operational application: We interpret "proposed development activity" (from the .1002 definition of "project") to include the entirety of a common plan of development, whether different builders*

*implement individual lots or phases, or an institutional/campus situation where there may be ongoing development expansion over a long period of time. A construction or land disturbing activity is part of a larger common plan of development if it is completed in one or more of the following ways: in separate stages, in separate phases, or in combination with other construction activities.*

Table 3.4 Neuse Stormwater Compliance for Isolated Single-Family Residence/Duplex, not part of a Common Plan of Development (future)

| Isolated Single-Family Residence/Duplex, not part of a Common Plan of Development |                |                |                            |                        |  |
|---|----------------|----------------|----------------------------|------------------------|--|
|   | Disturbed Area | Cumulative BUA | SNAP Calculations Required | SCM Treatment Required | Comments   |
| <b>Greenfield/<br/>No Existing BUA</b>  | < 1 ac         | Any            | Exempt                     |                        |  |
|   | ≥ 1 ac         | ≤ 5%           | Exempt                     |                        | Final as-built impervious survey may be required to verify exemption   |
|   |                | > 5% but ≤ 24% | Yes                        | No                     | Low Density Stormwater Design; Buydown Only Allowed; Low density as-built certification required; Final as-built impervious survey may be required to demonstrate compliance |
|   |                | > 24%          | Yes                        | Yes                    | High Density Stormwater Design, SCM Treatment or Runoff Match Required   |
| <b>Existing BUA<br/>Present</b>   | < 1 ac         | Any            | Exempt                     |                        |  |
|   | ≥ 1 ac         | ≤ 5%           | Exempt                     |                        | Final as-built impervious survey may be required to verify exemption   |
|   |                | > 5% but ≤ 24% | Yes                        | No                     | Low Density Stormwater Design; Buydown Only Allowed; Low density as-built certification required; As-built impervious survey may be required to demonstrate compliance       |
|   |                | > 24%          | Yes                        | Yes                    | High Density Stormwater Design, SCM Treatment or Runoff Match Required   |

Note: Notwithstanding the cumulative built upon area (BUA) thresholds above, the total impervious surface coverage or BUA of any residential lot may not exceed 30%, per Wake County’s UDO. More stringent limitations may apply in specific watershed areas within the County. If maximum impervious surface area limitations (MISAs) are recorded on the plat for a lot (or lots), those MISAs shall not be exceeded unless the property is eligible for a stormwater deviation.

Table 3.5 Neuse Stormwater Compliance for Residential Development within a Common Plan of Development (future)

| Residential Development, Part of a Common Plan of Development   |  |                 |                            |              |  |
|---|--|-----------------|----------------------------|--------------|--|
|   | Disturbed Area*  | Cumulative BUA* | SNAP Calculations Required | SCM Required | Comments   |
| <b>Greenfield/<br/>No Existing BUA</b>                          | < 1 ac   | Any             | Exempt                     |              |  |
|   | ≥ 1 ac   | ≤ 24%           | Yes                        | No           | Low Density Stormwater Design; Buydown Only Allowed; Low density as-built certification required; As-built impervious survey of lots may be required to demonstrate compliance |
|   |  | > 24%           | Yes                        | Yes          | High Density Stormwater Design, SCM Treatment or Runoff Match Required; SCM as-built certification required  |
| <b>Existing BUA Present</b>                                     | < 1 ac   | Any             | Exempt                     |              |  |
|   | ≥ 1 ac   | ≤ 24%           | Yes                        | No           | Low Density Stormwater Design; Buydown Only Allowed; Low density as-built certification required; As-built impervious survey of lots may be required to demonstrate compliance |
|   |  | > 24%           | Yes                        | Yes          | High Density Stormwater Design, SCM Treatment or Runoff Match Required; SCM as-built certification required  |
| <b>Incremental Increase in BUA within Existing Developments</b> | Incremental Expansion on Existing Lots within a Common Plan of Development will be limited to the BUA limits recorded on the associated plat. Parcels with a recorded perpetuity statement on the plat will be held strictly to those recorded limits. Lots without a recorded perpetuity statement may be eligible for a stormwater deviation to increase BUA up to 30% Total Proposed Built Upon Area with additional stormwater treatment measures, but in no case shall be allowed to exceed the zoning limitations on impervious area within the Wake County UDO. |                 |                            |              |  |

Note: Notwithstanding the Cumulative Built Upon Area (BUA) thresholds above, the total impervious surface coverage or BUA of any residential lot or project may not exceed 30% (or its recorded MISA), per Wake County’s UDO. More stringent limitations may apply in specific watershed areas within the County.

\*Disturbed Area and Cumulative BUA of the Entire Common Plan of Development

Table 3.6 Neuse Stormwater Compliance for Commercial/Non-Residential Development (future)

| Commercial/Non-Residential Development     |                 |                 |                            |              |  |
|--|-----------------|-----------------|----------------------------|--------------|--|
|  | Disturbed Area* | Cumulative BUA* | SNAP Calculations Required | SCM Required | Comments   |
| <b>Greenfield/<br/>No Existing<br/>BUA</b> | < 0.5 ac        | Any             | Exempt                     |              |  |
|  | ≥ 0.5 ac        | ≤ 24%           | Yes                        | No           | Low Density Stormwater Design; Buydown Only Allowed; Low density as-built certification required; Final as-built impervious survey may be required to demonstrate compliance |
|  |                 | > 24%           | Yes                        | Yes          | High Density Stormwater Design, SCM Treatment or Runoff Match Required; SCM as-built certification required  |
| <b>Existing BUA<br/>Present</b>            | < 0.5 ac        | ≤ 24%           | Exempt                     |              | Final as-built impervious survey may be required to verify exemption   |
|  |                 | > 24%           | Yes                        | Yes          | High Density Stormwater Design, SCM Treatment or Runoff Match Required; SCM as-built certification required  |
|  | ≥ 0.5 ac        | ≤ 24%           | Yes                        | No           | Low Density Stormwater Design; Buydown Only Allowed; Low density as-built certification required; Final as-built impervious survey may be required to demonstrate compliance |
|  |                 | > 24%           | Yes                        | Yes          | High Density Stormwater Design, SCM Treatment or Runoff Match Required; SCM as-built certification required  |

Note: Notwithstanding the cumulative built upon area (BUA) thresholds above, the total impervious surface coverage or BUA of any residential lot or project may not exceed the specified limits for the associated zoning districts per Wake County’s UDO. More stringent limitations may also apply in specific watershed areas within the County.

\*Disturbed Area and Cumulative BUA of the Entire Common Plan of Development

### 3.3 Downstream Impact Analysis

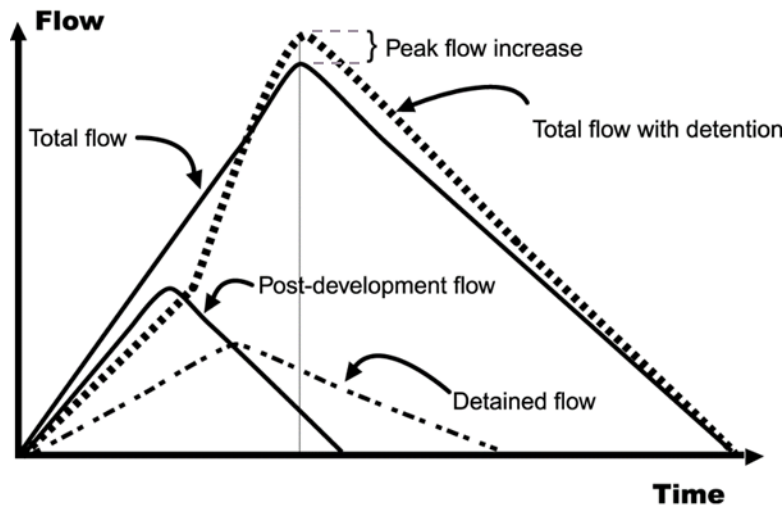
**Important Note:**

All projects which must demonstrate compliance with the Neuse, Jordan, or Falls Lake Stormwater Rules shall also perform the required downstream impact analysis. Minor subdivisions are not required to perform the downstream impact analysis at the time of subdivision if they limit their overall impervious to 15% AND are not considered part of a common plan of development. However, if individual lot disturbances trigger compliance with State Stormwater Rules, the downstream assessment will be required to be performed as part of those development plans.

**All SCMs shall discharge to field verified public conveyances, i.e. an adequately sized pipe network or Waters of the State.**

Per Wake County Unified Development Ordinance [Article 9-22](#), a Downstream Impact Analysis must be performed in accordance with the "ten percent rule" using the steps set forth below. A copy of the analysis must be provided with the permit application. The purpose of the Downstream Impact Analysis is to determine if the project will cause any unintentional additional impacts of flooding or channel degradation downstream of the project site.

The timing of flows is a critical consideration in the placement of stormwater control measures for water quantity. If not considered during planning, then the stormwater control measure may increase the peak flows downstream, making downstream flooding worse than if no detention had been performed. In Figure 3.1 below, the peak flow from the site is reduced appropriately, but the timing of the flow is such that the combined detained peak flow (the larger dashed triangle) is higher than if no detention were required.

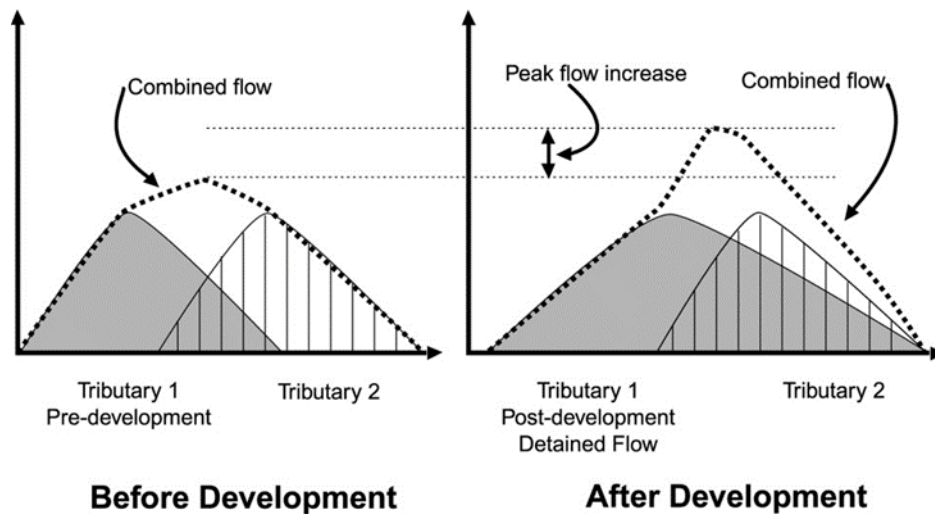


**Figure 3.1: Detention Timing Example; Reprinted with permission from the North Central Texas Council of Governments [iSWM™ Technical Manual – Hydrology](#)**

In this case, the shifting of flows to a later time brought about by the detention measures makes the downstream flooding worse than if the post-development flows were not detained. This is most likely to happen if detention is placed on tributaries toward the bottom of the watershed, holding back peak flows and adding them as the peak from the upper reaches of the watershed arrives.

Another important impact of new development is an increase in the total runoff volume of flow. Thus, even if the peak flow is effectively attenuated, the longer duration of higher flows due to the increased volume may combine with downstream tributaries to increase the downstream peak flows.

Figure 3.2 illustrates this concept. The figure shows the pre- and post-development hydrographs from a development site (Tributary 1). The post-development runoff hydrograph meets the flood protection criteria (i.e., the post-development peak flow is equal to the pre-development peak flow at the outlet from the site). However, the post-development combined flow at the first downstream tributary (Tributary 2) is higher than pre-development combined flow. This is because the increased volume and timing of runoff from the developed site increases the combined flow and flooding downstream. In this case, the detention volume would have to have been increased to account for the downstream timing of the combined hydrographs to mitigate the impact of the increased runoff volume.



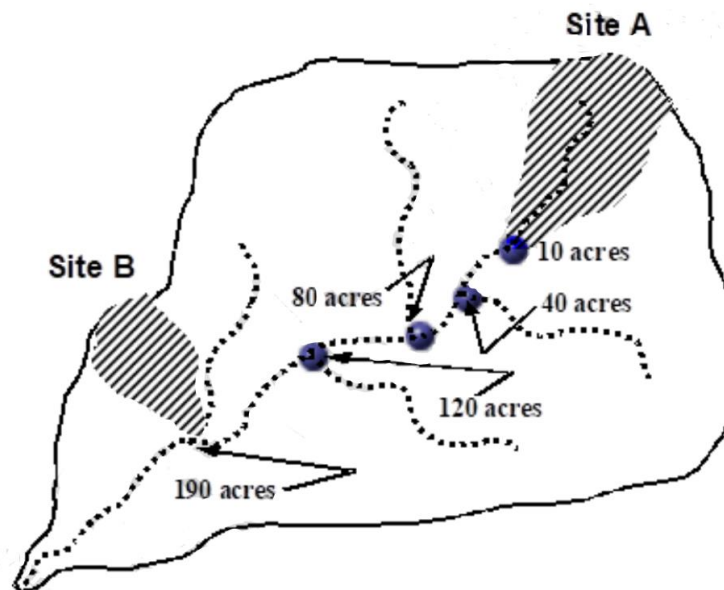
**Figure 3.2: Effect of Increased Post-Development Runoff Volume with Detention on a Downstream Hydrograph, Reprinted with permission from the North Central Texas Council of Governments [iSWM™ Technical Manual – Hydrology](#)**

The downstream impact analysis must include the assumptions, results and supporting calculations to show safe passage of post-development design flows downstream for the 10-year design storm. This analysis shall be performed at the outlet(s) of the site, and downstream at each tributary junction to the point(s) in the conveyance system where the area of the portion of the site draining into the system is less than or equal to ten percent of the total drainage area above that point. A summary table with the pre-and post-development flows for each analysis point is required. The general procedure is as follows:

1. Determine all points of discharge from the site. These points will be used as the first point(s) of analysis for the downstream impact assessment. Identify pre- and post-development site conditions.

Note that if the discharge point(s) from the site do not have a clearly defined cross section, they shall be considered as either shallow concentrated flow or channelized flow. Sheet flow discharges will not be accepted for analysis purposes. Field verify the path of discharge to public conveyances, i.e. an adequately sized pipe network or Waters of the State. Obtain drainage easements as needed.

- Using a topographic map, determine the point(s) downstream where the proposed site area – or the portion of the site area in that drainage area - equals ten percent of the total drainage area, called the 10% point (or “zone of influence”). Identify all tributary junctions between the downstream site boundary/site outlet(s) and the 10% point. All points identified, as well as the outlet(s) of the site, are known as 10% rule comparison points.



**Figure 3.3: Example of the 10% Rule, Reprinted with permission from the North Central Texas Council of Governments [iSWM™ Technical Manual – Hydrology](#)**

In the figure above, Sites A and B are located within a 250 acre watershed. Site A is a 10-acre development which discharges to a tributary. The 10% point would be the point at which the total drainage area which includes the project is 100 acres. This would be located somewhere between the 80- and 120-acre junction points of the tributary. In this case, the downstream analysis would need to end at the junction labeled 120 acres, which is the closest junction past the 10% point. The 10% rule comparison points would include the site outlet, the 40-acre junction, the 80-acre junction, and the 120-acre junction.

Site B is a 6-acre development which is located further downstream. Its outlet is to the tributary at the point where the total drainage area of the watershed is 190 acres. The 10% point (or “zone of influence”) of Site B would be the point at which the total drainage area that includes the development is equal to or greater than 60 acres. Since the outlet of the site includes a total drainage area of much greater than 60 acres, the only 10% rule comparison point would be the outlet of Site B.

3. Using a hydrologic model with existing land uses, determine the pre-development peak runoff rate (cubic feet per second) for the 10-year, 24-hour design storm event at each comparison point. Note that the same hydrologic analysis method shall be used for both pre- and post-development discharge calculations.
  - a. Offsite areas should be modeled as “full build-out” for both the pre-and post-development cases.
  - b. An accurate estimation of the time of concentration is key in the downstream impact analysis. Large detention structures (including stormwater control measures) within the drainage area will impact the time of concentration and should be considered in the analysis. For projects that discharge directly into a FEMA studied stream, these structures should already be accounted for in the hydrologic models used by those studies. For projects that do not discharge directly to a FEMA studied stream, the engineer performing the analysis will need to use best available information (aerial topography information, field visits, surveys, or existing plans) to model and account for these structures within the watershed.
  - c. An approximate curve number is used because the actual peak flow is not key for initial analysis. Only the increase or decrease is important. The accuracy in CN determination is not as significant as an accurate estimate of the time of concentration.
4. Insert the proposed site design and proposed stormwater control measures (SCMs) for the project into the land uses and determine the post-development peak runoff rate for the 10-year, 24-hour design storm at each comparison point.
5. If the post-development peak discharge rate is equal to or less than pre-development conditions at all comparison points, no further analysis is required.
6. If the 10-year, 24-hour post-development peak discharge rate is greater than the pre-development peak discharge rate at any comparison point, then one of the following actions must be taken:
  - a. Revise the site plan for the proposed site to incorporate better use of natural features, design additional structural control facilities, reduce impervious cover, or alter the timing of peak flows to lower post-development flows at each comparison point to pre-development levels; or
  - b. Obtain a flow easement from downstream property owners through the ten percent point where the post-development peak discharge rate is higher than the pre-development peak discharge rate. See Section 7.4.4 Flow Easements.

Example scenarios for finding the 10% point and points of analysis for a downstream impact analysis may be found in Appendix C of this manual.

## 3.4 Peak Flow

### Important Note:

Wake County currently operates under the .0235 Neuse Rules. All projects are subject to peak flow control. The peak flow control for the 1 year 24 hour storm and the downstream analysis of the 10 year storm are two separate ordinance requirements.

### 3.4.1 Concept

The Falls Rules [[15ANCAC 02B .0277](#), Section 4(f)] state “ and the Neuse Rules 15 NCAC .02B .0235, state “new development shall not result in a net increase in peak flow leaving the site from the pre-development conditions for the 1-yr, 24-hr storm event.” The purpose of peak flow control for stormwater runoff from new development is to ensure that the integrity and nutrient processing function of receiving waters and associated riparian buffers are not compromised by erosive flows.

The Design Engineer must calculate the pre- and post-development discharges for each point of discharge from the site (i.e., by drainage area) based on the site boundary to determine whether a stormwater control measure is needed to attenuate an increase in peak flow. If runoff leaves the site at several locations, the engineer must conduct a separate analysis for each point. Engineers are required to provide drainage area maps, stormwater model, and supporting calculations to demonstrate peak flow compliance.

The initial peak flow analysis to determine whether a measure is needed is based on the drainage area(s) within the site limits; however, if a measure is needed in a particular drainage area it must be designed and sized for the entire drainage area (including offsite drainage). The development will need to demonstrate no net change in peak flow for the total drainage area to the SCM and its bypass areas (pre- to post-development with SCM).

In the cases where stormwater runoff discharges into a stream, the design engineer must also ensure that these streams are protected from erosive flows.

If a stormwater control measure (SCM) is required, the SCM must be designed for the actual drainage area coming to the device (which includes existing conditions for offsite run on):

- If an SCM is designed to treat offsite drainage as well, the engineer must provide calculations for Pre, Post, and Post-SCM peak flow for the entire drainage area (including offsite).
- Post-SCM peak flow must be equal or less than pre-development peak flow.

### 3.4.2 Design Methodology

#### **Time of Concentration**

Time of concentration (Tc), as described by TR-55, is the time required for runoff to travel from the hydraulically most distant point of the watershed to a point of interest within the watershed. A higher Tc corresponds to a lower peak flow since the longer flow time stretches out the hydrograph and a lower Tc corresponds to a higher peak flow. Tc is computed by calculating the travel time for each type of flow (sheet, shallow, or channel) separately and then summing the calculations. As stated in TR-55, any flow over a lake or reservoir can be neglected since the travel time is very close to zero. The minimum value for a time of concentration is 5 minutes. There are multiple methods which may be used to calculate time of concentration. One example method (from TR-55) is provided below.

$$T_c = T_t \text{ Sheet} + T_t \text{ Shallow} + T_t \text{ Channel}$$

#### **Sheet Flow**

Sheet flow occurs as flow over plane surfaces. Calculation of the travel time for sheet flow requires that the flow length, slope, and Manning’s roughness coefficient for sheet flow be determined. The maximum flow length for sheet flow is 100 feet. The Manning’s roughness coefficients (n values) are in Table 3.7.

**Table 3.7 Manning’s Roughness Coefficients for Sheet Flow (flow depth generally ≤ 0.1 ft)**

| SURFACE DESCRIPTION                           | Manning's roughness coefficient<br>n |
|---|--------------------------------------|
| Smooth Surfaces - Paved, Gravel, or Bare Soil | 0.011                                |
| Fallow (no residue)                           | 0.05                                 |
| Cultivated Soils                              |                                      |
| Residue Cover ≤ 20%                           | 0.06                                 |
| Residue Cover > 20%                           | 0.17                                 |
| Grass   |                                      |
| Short grass prairie                           | 0.15                                 |
| Dense grasses*                                | 0.24                                 |
| Bermuda grass                                 | 0.41                                 |
| Range (natural)                               | 0.13                                 |
| Woods**                                       |                                      |
| Light underbrush                              | 0.40                                 |
| Dense underbrush                              | 0.80                                 |

\* Dense grasses include species such as weeping love grass, bluegrass, buffalo grass, blue gamma grass, and native grass mixtures.

\*\* When selecting an n-value from the table, consider the cover to a height of about 0.1-foot since this is the only part of the plant that will obstruct sheet flow.

$$T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5}s^{0.4}}$$

$T_t$  = travel time (hr)  
 $n$  = Manning's roughness coefficient  
 $L$  = flow length (ft)  
 $P_2$  = 2-year 24-hour rainfall (in)  
 $s$  = slope of the land surface (ft/ft)

**Shallow Flow**

After a maximum of 100 feet of sheet flow, the runoff usually becomes shallow concentrated flow. The average velocity of this flow should be determined using the equations below.

Unpaved:  $V = 16.1345(s)^{0.5}$   
 Paved:  $V = 20.3282(s)^{0.5}$

$V$  = Average Velocity (ft/s)  
 $s$  = slope of hydraulic grade line (watercourse slope, ft/ft)

$$T_t = \frac{L}{3600V}$$

$T_t$  = travel time (hr)  
 $L$  = flow length (ft)  
 $V$  = average velocity (ft/s)  
 3600 = conversion factor from seconds to hours

**Channel Flow**

Open channels include, but are not limited to, channels that are assumed to begin where surveyed cross section data has been obtained, where channels are visible on aerial photographs, or where blue lines appear on the United States Geological Survey (USGS) quadrangle sheets. Manning’s equation should be used to estimate average flow velocity. Average flow velocity is usually determined for the bank-full elevation.

Manning’s equation is:

$$V = \frac{1.49r^{2/3}s^{1/2}}{n}$$

V=Average Velocity (ft/s)

r = hydraulic radius (ft)

s = slope of hydraulic grade line (channel slope, ft/ft)

n = Manning's roughness coefficient for open channel flow

$$r = \frac{a}{p_w}$$

$$T_t = \frac{L}{3600V}$$

a = cross sectional flow area (ft<sup>2</sup>)

p<sub>w</sub>=wetted perimeter (ft)

T<sub>t</sub> =travel time (hr)

L = flow length (ft)

V = average velocity (ft/s)

3600 = conversion factor (sec-hrs)

**Table 3.8 Representative Manning's Roughness Coefficients for Open Channel Flow**

| CHANNEL LINING             | n     |
|----------------------------|-------|
| Asphalt                    | 0.016 |
| Concrete, finished         | 0.012 |
| Concrete, unfinished       | 0.014 |
| Grass                      | 0.035 |
| Gravel Bottom/riprap sides | 0.033 |
| Weeds                      | 0.040 |

### 3.4.3 Peak Flow Calculations

Design engineers shall provide sealed calculations to demonstrate pre-development, post-development (without SCMs), and post-development (with SCMs) peak flow rates from each point of discharge from the site using an acceptable methodology.

The Rational Method and the SCS (NRCS) Unit Hydrograph method may be used for hydrologic analyses. Design engineers should be aware of the limitations for each methodology and select one which is appropriate to use in the hydrologic analysis for a particular site. It should be noted that the Rational Method cannot be used for any application requiring storage design – including the routing of flows through stormwater control measures.

Rainfall intensity data shall be obtained for the specific location of the project site from [NOAA Atlas 14](#). Peak flow calculations shall be accompanied by pre-and post- drainage area maps.

The following programs are acceptable to be used and submitted for hydrologic analysis:

- HEC-HMS
- Hydraflow by Autodesk
- WinTR-55
- HydroCAD
- PondPack
- XP SWMM
- EPA SWMM
- PC SWMM
- Infoworks ICM
- Civil Storm

Other programs not listed above may be requested on a case-by-case basis at the discretion of Watershed Management plan review staff; however, the Chainsaw Routing Method is not an accepted method for hydrologic analysis.

Regardless of the program chosen for routing of flows, the sealed calculation package shall include all model assumptions and inputs used for the calculations.

When setting up the hydrologic model and evaluating the site for peak flow requirements, the designer should also consider the project's compliance with the required Downstream Impact Analysis (Section 3.4 of this manual) as well as requirements for stormwater outlet protection ([UDO 10-21](#)).

- Development with a net change in peak flow in excess of 10% the pre-development peak will be required to provide mitigation in the drainage area showing an increase. Note: An increase in runoff rates less than 10% does not automatically mean that a project will not be required to provide detention or make drainage improvements.
- If an SCM is required, the SCM must be designed for the actual drainage area coming to the device (existing conditions for offsite).

- If the SCM is designed to treat offsite as well, the engineer must provide calculations for Pre, Post, and Post SCM peak for the entire drainage area (including offsite).
- Post SCM peak flow must be equal or less than Pre peak flow

While discharge points generally should be placed at the low points on the project, if there is not an existing conveyance care shall be taken in discharging concentrated flows to avoid negative impacts on downstream property owners. Any disputes over runoff shall be worked out between the downstream property owner and the developer.

### 3.5 Stormwater Control Measures

Stormwater Control Measures (SCMs) are devices used to control and treat stormwater runoff that flows onto a property when it rains. These devices remove pollution from stormwater and help reduce flooding and erosion to downstream properties.

Because they are permanent features, choosing the correct SCM or group of SCMs for a site is an important decision that should be thoroughly and carefully considered at the outset. Because every site is unique and has its own challenges, there is no one SCM solution that is best suited for every site.

When selecting a SCM for a site, it is important to:

- Understand which SCMs will work within the physical constraints of the site,
- Evaluate how the possible SCMs address the regulatory requirements relevant to the site, including pollutant removal and water quantity control, and
- Consider other factors such as construction costs, maintenance and access, ownership issues, safety, aesthetic, and environmental factors (buffers, floodplain, depth to water table, etc.) at the site.
- Field verify the discharge points and downstream structures which may be impacted

Please refer to [Section A-8 of the NCDEQ Stormwater Design Manual](#) for additional guidance on SCM selection.

Note that primary SCMs may be used as stand-alone measures to treat a new development site (when 100% sized), or as a retrofit. Secondary SCMs may be used in series with a primary SCM – either to provide pretreatment for the primary SCM or to reduce the volume of runoff (and therefore the size) of the primary SCM. Secondary SCMs may also be used as a retrofit, or in series with another secondary SCM to treat the design storm IF that “treatment train” can be shown to meet or exceed the required performance standards.

| Stormwater Control Measure Designations |                                 |
|---|---------------------------------|
| Primary SCMs                            | Secondary SCMs                  |
| Bioretention Cell                       | Disconnected Impervious Surface |
| Infiltration System                     | Dry Pond                        |
| Permeable Pavement                      | Green Roof                      |
| Rainwater Harvesting*                   | Level Spreader-Filter Strip     |
| Sand Filter                             | Treatment Swale                 |
| Stormwater Wetland                      |                                 |
| Wet Pond                                |                                 |

\* To be considered a primary treatment SCM, a rainwater harvesting measure must be sized to capture a minimum of 85% of the total annual runoff volume as demonstrated through water balance calculations.

Requirements for primary and secondary SCMs apply to compliance with state stormwater rules. Any appropriate SCM may be used to meet county stormwater volume requirements for Target Curve Number or deviations.

### 3.5.1 General Design Criteria

Stormwater control measures (SCMs) in Wake County may be designed to meet multiple requirements including but not limited to target curve number, downstream assessments, peak flow, and/or nutrient loading.

| Design Storm Requirements                  |   |
|--|---|
| Compliance Goal                            | Design Storm                            |
| Target Curve Number                        | 3-inch rainfall                         |
| Peak Flow                                  | 1-year, 24-hour                         |
| Downstream Assessment                      | 10-year, 24-hour                        |
| Water Quality Volume<br>(Nutrient Loading) | 1-inch rainfall (1 <sup>st</sup> flush) |
| Stormwater Deviation                       | 3-inch rainfall*                        |

*\*The Swift Creek requirements apply for the portion of impervious between 12% and 15%. Above 15% impervious surface area, the 3-inch design criteria shall apply.*

SCMs shall be designed according to the latest version of NCDEQ Minimum Design Criteria (MDC) and must comply with the entirety of the [NCDEQ Stormwater Design Manual](#) and requirements, including but not limited to locating devices in proper soil types and meeting the required depth to seasonal high water table (SHWT). In the case of any conflict between State and County requirements, the more stringent shall apply.

All stormwater control measures within Wake County must also comply with the following general criteria:

General Minimum Design Criteria and County Clarifications/Requirements:

- All SCMs shall comply with [Chapter C-0 “Minimum Design Criteria for All SCMs”](#) of the NCDEQ Stormwater Design Manual.
  - General MDC 3: Vegetated slopes shall not be steeper than 3:1.
  - General MDC 5: Stable bypass shall be provided for SCMs, and this bypass shall not be directed straight toward a downstream structure.
  - General MDC 5: All stormwater control measures with a drainage area of 4 acres or more shall perform a backwater analysis to determine the 100-year backwater. This backwater must be entirely contained within the stormwater control measure or its associated easement unless a backwater easement is recorded on a record plat. Upstream properties shall not be inundated due to the SCM’s failure to pass storms greater than the design storm.
- All SCMs shall comply with [Chapter A-5 “Common Structures & Materials”](#) of the NCDEQ Stormwater Design Manual, including the following requirements for embankments:
  - Embankments of all stormwater control measures shall comply with State Dam Safety Regulations.
  - The height of an embankment dam must consider freeboard and compensation for settlement. The basin’s freeboard should be a minimum of 1 foot above the elevation of the highest stage calculated based on the 100-year storm.

- Permanent stormwater conveyances shall be designed to safely pass the 10-year storm event (25-year storm event in Water Supply Watersheds) without causing scour, rills, gullies, or other reasonably expected failure, unless otherwise specified in this manual or the County UDO.
  - The maximum side slopes for vegetated conveyances shall be 3:1, with a minimum longitudinal slope of 1%.
- All SCMs, with the exception of underground rainwater harvesting measures, shall flow by gravity and not require a pump to function.
- Structures such as docks, piers, diving platforms, or bridges shall not be allowed in a stormwater control measure.
- Plans for projects with stormwater control measures shall include a separate sheet(s) that includes a site specific, detailed construction or conversion sequence, plan and profile construction details with elevations of applicable storm events, and a landscape plan/planting plan for each stormwater control measure.

Location of Stormwater Control Measures:

- Stormwater control measures that are proposed for the “shared” compliance of a subdivision or development shall be located in a common area/open space lot of the development and shall be maintained by a property owners' or homeowners' association. SCM access and maintenance easements shall also be in common areas/open space to the maximum extent practicable.
- Stormwater control measures shall not be located in a required landscape buffer ([UDO 16-10-2\(j\)](#)).
- All measures shall be located a minimum of 10 feet from any structure. The only exception to this requirement will be rainwater harvesting devices located on a single-family residential lot.
- All stormwater control measures shall be setback from septic systems (including repair areas) in accordance with the requirements below:

| Stormwater Control Measure (SCM) Required Setbacks from Septic Systems |  |
|--|--|
| SCM Type   | Minimum Setback                            |
| Bioretention Cell  | 25 ft**                                    |
| Cistern  | Contact Wake County Environmental Services |
| Dry Pond   | 25 ft**                                    |
| Infiltration System  | 25 ft**                                    |
| Permeable Pavement   | 25 ft**                                    |
| Sand Filter  | 25 ft**                                    |
| Stormwater Wetland*  | 50 ft                                      |
| Wet Pond*  | 50 ft                                      |

\* Indicates that the SCM will have a permanent pool

\*\* Indicates a Wake County requirement

- Locating SCMs in flood hazard areas is discouraged, as these areas will likely have high water tables. Any SCM proposed within a flood hazard area will require a flood study permit. Modeling will be required to demonstrate no impact to flood levels, in accordance with [UDO Article 14](#).
- SCMs shall not be located in stream channels; clean water diversions shall be installed as needed.
- All SCMs shall discharge to field verified public conveyances, i.e. an adequately sized pipe network or Waters of the State, riparian buffers, wetlands, etc.

The pages below identify common stormwater control measures and their specific design requirements. Although not discussed below, the County does accept the “New Stormwater Technologies” identified in the [NCDEQ Stormwater Design Manual](#). Designs and crediting for those measures shall conform to NCDEQ standards, as well as the general County criteria above. Minimum septic setbacks for these measures shall be evaluated on a case-by-case basis.

### 3.5.2 SCM Specific Design Criteria

#### 3.5.2.1 Infiltration System



| Description   |
|---|
| <p>Infiltration systems are designed to capture stormwater runoff and allow it to infiltrate into the soil over a specific period of time. There are two major types of infiltration systems – infiltration trenches and infiltration basins. These systems work best for smaller, highly impervious drainage areas. Pervious surfaces within the drainage area can contribute fines that will clog the soil and remove infiltration capabilities. Infiltration systems are generally installed at a shallow depth and require specific media (either stone or an engineered soil mix).</p>   |
| NCDEQ Design Criteria   |
| <p><a href="#">NCDEQ MDC C-1: Infiltration System</a></p>   |
| Additional County Requirements  |
| <ul style="list-style-type: none"> <li>• Infiltration SCM construction shall avoid the use of heavy equipment on the bottom of the basin, or any areas of the SCM where infiltration is a design component.</li> <li>• For infiltration trenches, medium or coarse sand, or crushed stone (i.e., uniformity coefficient of 2 or smaller) is required as a drainage medium. Trench media shall be hard, durable, inert particles, free from slate, shale, clay, silt, and organic matter.</li> <li>• For infiltration basins, drainage media shall be enclosed on all sides by a geotextile filter. The top surface of the geotextile shall be 6 to 12 inches below the upper surface of the drainage media. The other surfaces of the geotextile shall be in contact with the in-situ soil.</li> <li>• Infiltration SCMs shall meet a minimum 25 ft setback from any existing or proposed septic system or repair area.</li> <li>• Infiltration SCMs shall not be located in flood hazard areas.</li> </ul> |

3.5.2.2 *Bioretention Cell (or Rain Garden)*



**Description**

Bioretention cells are excavated areas that are filled with specialized soil media and plants, or grass/sod. They are designed to temporarily pond and filter stormwater runoff. Bioretention cells are highly effective at removing pollutants and can be installed in a wide variety of soil types from clay to sand.

Rain gardens are generally smaller versions of a bioretention cell and are allowed to be installed as part of a stormwater deviation on eligible single family residential lots. Rain gardens proposed for stormwater deviations will be designed to capture the required volume, and typically do not have an underdrain and shall be less than 12 inches deep.

**NCDEQ Design Criteria**

[NCDEQ MDC C-2: Bioretention Cell](#)

**Additional County Requirements**

- Flow should enter a bioretention cell via disperse flow or an energy dissipater at a velocity of less than 1 ft/s for mulched cells or 3 ft/s for grassed cells to prevent erosion. Dispersed flow can be provided via a gently sloping parking lot that drains toward a bioretention cell. If the inflow to the cell is concentrated in a swale or pipe, then a riprap lined entrance, a forebay, or other energy dissipating device should be used. If a forebay is used, it can both dissipate energy and provide pre-treatment.
- Bioretention cells shall have a pretreatment area which can be a forebay or grass/gravel combination as described in the NCDEQ Recommendation #2 in the Stormwater Manual section linked above.
- Bioretention cells shall meet a minimum 25 ft setback from any existing or proposed septic system or repair area.
- Bioretention cells shall not be located in flood hazard areas.
- Plants and spacing shall be denoted on SCM construction plan

3.5.2.3 *Wet Pond*



**Description**

Wet ponds are designed to capture the design storm and release it slowly over a period of two to five days via a properly designed outlet structure. The first outlet in the structure is designed to be above the bottom of the pond, thus creating a permanent pool of water. The captured runoff shall have an adequate flow path to bring about the removal of TSS through dilution and settling.

**NCDEQ Design Criteria**

[NCDEQ MDC C-3: Wet Pond](#)

**Additional County Requirements**

- Measures shall be provided along the principal spillway to prevent piping.
- Durable materials, such as reinforced concrete, are required.
- An emergency spillway shall be provided to prevent failure of the embankment structure during large storm events.
- Embankments shall comply with State Dam Safety regulations.
- The permanent pool elevation shall be at approximately the same elevation as the SHWT elevation. When a wet detention basin is to be located in highly permeable soils like gravelly sands or fractured bedrock, or when the permanent pool elevation proposed is greater than six (6) inches above the SHWT, the designer may need to incorporate a liner to sustain a permanent pool of water. A liner shall be constructed or compacted such that the infiltration rate is no more than 0.01 in/hr. When a liner is proposed, topsoil for vegetation must be placed on top of the liner.
- A permanent pool shall be maintained; a minimum depth of 3 feet is recommended
- Wet ponds shall meet a minimum 25 ft setback from any existing or proposed septic system or repair area.
- Compliance with MDC 11: Drought tolerant wetland vegetation required as needed based on field conditions

3.5.2.4 Stormwater Wetland



| <b>Description</b>  |
|---|
| <p>Stormwater wetlands are manmade systems designed to mimic the function of a natural wetland by temporarily storing water in shallow pools that support specific wetland/riparian vegetation. The mix of physical, chemical, and biological processes in a constructed stormwater wetland provide significant stormwater treatment and pollutant removal. Stormwater wetlands are designed with an outlet structure that will release temporarily ponded water over a period of two to five days.</p> |
| <b>NCDEQ Design Criteria</b>  |
| <p><a href="#">NCDEQ MDC C-4: Stormwater Wetland</a></p>  |
| <b>Additional County Requirements</b>   |
| <ul style="list-style-type: none"> <li>• Landscape/planting plans for stormwater wetlands shall specify any unacceptable months for planting wetland plants.</li> <li>• Stormwater wetlands shall meet a minimum 50 ft setback from any existing or proposed septic system or repair area.</li> </ul>   |

3.5.2.5 Sand Filter



| Description  |
|--|
| <p>Sand filters can be located above or below ground, and they primarily function by sending stormwater through a sand media which filters out pollutants. Treatment and pollutant removal can occur through settling, filtering, and adsorption processes in the sand filter. Since water drains through the sand media so quickly, the stormwater is treated by the sand filter while the storm event is occurring. For this reason, NCDEQ allows them to be designed to treat 0.75 times the design volume to receive nutrient removal credits. Underground sand filters may be considered built upon area.</p> |
| NCDEQ Design Criteria  |
| <p><a href="#">NCDEQ MDC C-6: Sand Filter</a></p>  |
| Additional County Requirements   |
| <ul style="list-style-type: none"> <li>• Pervious areas in C and D soils shall be graded to drain away from the sand filter to prevent clogging of the measure.</li> <li>• Sand filters shall meet a minimum 25 ft setback from any existing or proposed septic system or repair area.</li> <li>• Sand filters shall not be located in flood hazard areas.</li> </ul>  |

3.5.2.6 Rainwater Harvesting



**Description**

Rainwater harvesting devices include many different types of measures designed to collect, store, and use rainwater. These measures typically collect rainwater from the roof of structures but may be used to collect runoff from other impervious areas, including parking lots.

Rainwater harvesting, in the form of rain barrels or underground tanks, is one of the most commonly used measures installed on eligible residential lots as part of an approved stormwater deviation. These may range from 55-gallon rain barrels to 1500-gallon above ground tanks to 2500-gallon underground cisterns. When these measures are approved as part of a stormwater deviation, they are designed for capture of a particular volume of water (rather than State Minimum Design Criteria) which must be captured and then drawn down over a specific period of time. Underground rain water harvesting placed under impervious area may be considered built upon area.

**NCDEQ Design Criteria**

[NCDEQ MDC C-7: Rainwater Harvesting](#)

**Additional County Requirements**

- Rainwater harvesting measures used for stormwater deviations are not required to meet NCDEQ Minimum Design Criteria. Drawdown of the required volume is required to provide for storage for the next rain and may be accomplished through a programmed irrigation system, passive drawdown, etc. Maintaining many rain barrels on an individual site can be cumbersome as each will need to be cleaned out after pollen season.
- Rain barrels installed on single family lots as part of a stormwater deviation do not have a required minimum setback from any existing or proposed septic system or repair area. However, discharge from the rain barrels must be directed away from the septic areas.
- If other forms of rainwater harvesting are proposed, Environmental Services Wastewater staff shall determine the required setback from septic systems and repair areas. A wastewater information specialist may be contacted at [wastewater@wake.gov](mailto:wastewater@wake.gov) or 919-856-7434.

3.5.2.7 Green Roof



**Description**

A green roof consists of low growing plants with shallow root systems that are grown in a shallow (3-4 inch) layer of light-weight media. During small rain events, there is very little runoff. During larger events, rainwater will first saturate the growing media, and once its capacity is filled the green roof will begin to drain water as runoff through gutters, drains, and spouts. Green roofs are considered secondary SCMs.

**NCDEQ Design Criteria**

[NCDEQ MDC C-8: Green Roof](#)

**Additional County Requirements**

- Discharge from the green roof shall be directed away from septic areas.

3.5.2.8 *Level Spreader-Filter Strip*



| Description   |
|---|
| <p>A level spreader-filter strip (LS-FS) consists of a hardened (typically concrete) level lip and a filter strip that is graded and vegetated so that it filters and allows infiltration of stormwater. The level spreader itself disperses and diffuses flow, and the filter strip performs the pollutant removal function of the system. Level spreader-filter strips are considered secondary SCMs.</p>   |
| NCDEQ Design Criteria   |
| <p><a href="#">NCDEQ MDC C-9: Level Spreader-Filter Strip</a></p>   |
| Additional County Requirements  |
| <ul style="list-style-type: none"> <li>• Level spreader-filter strip systems shall be provided pretreatment via a forebay when it receives flow directly from the drainage area. Refer to Recommendation 1 in the NCDEQ manual section linked above.</li> <li>• Non-clumping, native, deep-rooted grasses shall be specified in the filter strip. For the Piedmont, appropriate grasses include tall Fescue or Common Bermuda.</li> <li>• Sod used for the filter strip shall be washed or grown in non-clayey soils. Frequent watering shall be provided during the first three weeks after sod installation to ensure that the first 1.5 inches of soil is kept moist.</li> <li>• Discharge from the level spreader-filter strip shall be directed away from septic areas.</li> </ul> |

3.5.2.9 *Disconnected Impervious Surface*



**Description**

Disconnected impervious surface (DIS) is a practice of directing stormwater runoff from impervious/built upon areas to properly size, sloped, and vegetated pervious areas. This is a low-cost stormwater control measure that can help to restore hydrology of streams and reduce pollutants in stormwater runoff.

The vegetated receiving areas cannot be installed until the impervious areas that drain to them are completed. Downspout systems must be installed correctly, and their drainage areas verified not to exceed the approved design. It is extremely important that the vegetated receiving area is uniformly graded with no gullies, low spots, or lateral slopes. A one-time fertilizer application and regular watering should be provided to help to establish the vegetated area of the DIS system.

Disconnected impervious surface areas are considered secondary SCMs. O&M agreements are required per the NC MDC Manual.

**NCDEQ Design Criteria**

[NCDEQ MDC C-10: Disconnected Impervious Surface](#)

**Additional County Requirements**

- Discharge from the downspouts of these measures shall be directed away from septic areas.
- Disconnected impervious surface credit over 50% will be tracked as a SCM and annual inspections required.

3.5.2.10 Treatment Swale



| Description  |
|--|
| <p>Treatment swales are designed to filter pollutants as stormwater runoff moves through the grass in the swale. Note that swales designed primarily to convey stormwater from a project (rather than to remove nutrients) do not have to meet the NCDEQ minimum design criteria below. Instead, they must be designed per the minimum requirements of Rule .1003(2)(c). Setbacks from septic areas apply to all swales, regardless of whether designed to remove pollutants.</p> <p>Treatment swales are considered secondary SCMs.</p> |
| NCDEQ Design Criteria  |
| <p><a href="#">NCDEQ MDC C-11: Treatment Swale</a></p>   |
| Additional County Requirements   |
| <ul style="list-style-type: none"> <li>• A minimum freeboard of 6 inches for the 10-year storm shall be provided.</li> <li>• Treatment swales shall meet a minimum 25 ft. (measured from the center of the swale) setback from any existing or proposed septic system or repair area.</li> <li>• <b>Recommend fencing to prevent vehicle encroachment</b></li> </ul>   |

3.5.2.11 Dry Pond



| Description   |
|---|
| <p>Dry ponds are primarily designed to attenuate and delay peak flows from stormwater runoff. They are designed to pond and hold water immediately after a storm event, draining down over a specified amount of time. Dry ponds should not hold a permanent pool of water but should instead remain dry between storm events. Dry ponds receive very little nutrient removal credit and are considered a secondary SCM.</p>  |
| NCDEQ Design Criteria   |
| <p><a href="#">NCDEQ MDC C-12: Dry Pond</a></p>   |
| Additional County Requirements  |
| <ul style="list-style-type: none"> <li>• A minimum freeboard of 1 foot shall be provided between the design elevation and the emergency spillway elevation to minimize overtopping of the dam and to protect the structural integrity of the pond.</li> <li>• Dry ponds shall be provided with permanent vegetation. Shrubs, trees, and other landscaping of the dry pond shall not be allowed.</li> <li>• Dry ponds shall meet a minimum 25 ft setback from any existing or proposed septic system or repair area.</li> <li>• Dry ponds shall not be located in flood hazard areas.</li> </ul> |

3.5.2.12 Permeable Pavement



| Description   |
|---|
| <p>Permeable pavement is designed to control quality and/or quantity of stormwater runoff while still allowing for parking, foot traffic, or other uses. It captures stormwater through voids in the pavement and then filters that water through an underlying aggregate reservoir which ultimately allows infiltration into the soil subgrade. If the underlying soils are not suitable for infiltration, permeable pavement may be designed to meet detention requirements. However, only permeable pavement designed for infiltration per NCDEQ standards is eligible to receive built upon area (BUA) credit.</p>  |
| NCDEQ Design Criteria   |
| <p><a href="#">NCDEQ MDC C-5: Permeable Pavement</a></p>  |
| Additional County Requirements  |
| <ul style="list-style-type: none"> <li>• Permeable pavement designed for infiltration may receive a built upon area credit of 100%</li> <li>• Permeable pavers must adhere to the following required setbacks:                         <ul style="list-style-type: none"> <li>○ Permeable pavement shall meet a minimum 25 ft setback from any existing or proposed septic system or repair area.</li> <li>○ If there is no foundation drain on a structure, then a 5 ft setback is required from a structure. If there is no foundation drain, then the setback is determined by slope.                                 <ul style="list-style-type: none"> <li>▪ A 10 foot setback is required if the SCM is downslope from the structure.</li> <li>▪ A 15 foot setback is required for an even slope between the SCM and structure.</li> <li>▪ A 25 foot setback is required if the SCM is upslope of the structure.</li> </ul> </li> </ul> </li> <li>• <i>Geogrids, geotextiles, and geomembranes shall not be allowed over the subgrade on permeable pavers designed for infiltration.</i></li> <li>• An engineer must certify that the pervious pavement does not affect structural foundations.</li> <li>• All permeable pavement systems shall be reviewed and permitted as stormwater control measures and require annual 3<sup>rd</sup> party inspections by a qualified professional. For pavers designed for infiltration, these annual inspections shall include verification (via acceptable testing methods) that the pavement still meets minimum infiltration rates to qualify for BUA credit.</li> </ul> |

### 3.5.3 SCM Easements

Easements are required for all other stormwater control measures in accordance with [UDO 9-20-4\(B\)](#) and the [NCDEQ Stormwater Manual](#) and its associated minimum design criteria. In the case of any conflicts, the more stringent requirements shall apply. These stormwater access and maintenance easements are permanent easements that must be recorded on the record plat for the project or development. For projects which do not otherwise require a final plat, an exempt plat may be used to record the required easements.

These easements will be labeled as “*Stormwater Access and Maintenance Easement*” and shall:

- Include the width(s) of the easement
- Extend to the nearest public right of way
- Include a minimum width of 20 feet for any access from the public right of way (note that DEQ recommends 25 feet for maintenance access for measures that require larger equipment, such as wet ponds)
- Show and identify the stormwater control measure (show the entire footprint of the SCM and label it to match plans, i.e., “Dry Pond #1”)
- Include the entire footprint of the stormwater control measure system including side slopes, forebay, riser structure, stormwater control measure, outlet, dam embankment, emergency spillway, etc.
- Provide a minimum of 10 feet around the footprint of the stormwater control measure system to provide enough room to complete maintenance tasks
- Not include lateral or incline slopes that exceed 3:1 (horizontal to vertical)
- Include direct maintenance access to any forebay for any measures utilizing a forebay
- Include access for cleaning underdrain piping for any measures which utilize underdrains
- Be granted in favor of the party responsible for enforcing the stormwater program under which the SCM is being approved (i.e., Wake County)
- Be protected for SCM access and maintenance and not include development

For stormwater control measures installed as part of an approved stormwater deviation (residential lot), no access and maintenance easement is required to be recorded. Note that stormwater control measures located on individual residential lots (for isolated lots not within a common plan of development) have additional requirements. Plats for these residential lots that contain a stormwater control measure shall also include:

- The specific location of the stormwater control measure on the lot
- A typical detail for the stormwater control measure to be used
- A note that the stormwater control measure on the property has been required to meet stormwater regulations and that the property owner may be subject to enforcement actions if the stormwater control measure is removed, relocated, or altered without prior approval.

### 3.5.4 Stormwater Agreement

All stormwater control measures shall complete and submit for review a copy of the required [Stormwater Agreement](#). This agreement:

- Acknowledges that the maintenance of the stormwater control measure(s) is the sole responsibility of the owner;
- Indicates that this responsibility for maintenance of the measure(s) passes in the chain of title to any future owners;
- Grants access to Wake County to inspect the stormwater control measure(s); and
- Acknowledges that the owner of the stormwater control measure(s) shall provide an annual inspection report for each measure to the County by June 30<sup>th</sup> of each year.

County staff shall review the completed draft signed and notarized stormwater agreement prior to recordation. Once approved by staff, the agreement can be recorded with the Register of Deeds. The stormwater agreement, and its book and page, shall be referenced on any recorded plat for the project.

### 3.5.5 Operations and Maintenance Agreement and Plan

All owners of stormwater control measures shall enter into a binding Operation and Maintenance (O&M) Agreement with Wake County that complies with [15A NCAC .02H .1050\(11\)](#) and County requirements (reference [UDO 9-32-4](#)). This O&M Agreement requires the owner to maintain, repair, or reconstruct the stormwater control measure(s) in accordance with the approved design plans and the O&M Plan.

This O&M Agreement shall be referenced on the recorded plat for the development/project and shall be recorded with the Register of Deeds. For measures installed as part of a stormwater deviation (which do not require a plat), the O&M Agreement shall be recorded with the Register of Deeds to that it appears in the chain of title for subsequent purchasers of the property.

Excepting those measures installed as part of a stormwater deviation, all owners of stormwater control measures shall also record an Operations and Maintenance Plan that complies with [15A NCAC .02H .1050\(12\)](#) and County requirements (reference [UDO 9-32-3](#)). The Operations and Maintenance Plan shall specify all operation and maintenance work necessary for the function of all stormwater control measure components, including the stormwater conveyance system, perimeter of the device, inlet(s), pretreatment measures, main treatment area, outlet, vegetation, and discharge point. The Operations and Maintenance Plan is a separate document from the aforementioned O&M Agreement.

More information on SCM Operations and Maintenance may be found in [Section A-7](#) of the NCDEQ Stormwater Design Manual.

### 3.5.6 As-built Certifications and Surveys

Upon project completion, the County shall require submitting as-built documentation to verify compliance with all applicable stormwater regulations. A field inspection of all stormwater device(s) and conveyances shall be completed and sealed by the design engineer and/or a certified 3<sup>rd</sup> party SCM inspector.

Before an as-built stormwater improvement submission may be made to the County, the County field consultant shall verify, via inspection, that:

- any temporary erosion control measures (skimmer, etc.) have been removed,
- the stormwater control measure has generally been converted to its final form and is stabilized and non-erosive, and
- that the permanent conveyances to the measure(s) are stabilized, non-erosive, and generally in the correct locations.

Once verified, the Wake County field consultant shall provide a completed form to the applicant which shall be submitted with the as-built package. The as-built stormwater submittal checklist may be found [here](#).

### 3.5.6.2 Stormwater Control Measures and Other Improvements

As-built plans are required to be submitted, along with an Engineer's Certification and 3<sup>rd</sup> party field inspection, to verify that all stormwater improvements have been completed in accordance with the approved plan and County regulations.

Refer to the [as-built checklist](#) for general submittal requirements. Sufficient information must be provided to ensure that:

- Target Curve Number Volume requirements have been met (for residential projects only)
- Peak Flow requirements have been met
- Required Nutrient treatment has been provided
- Assumptions of any downstream assessments have been met
- Stormwater control measures are installed per the approved plans (design vs. as-built elevations for water quality, 1-year, 10-year, and 100-year storms shall be provided on cross section)
- Permanent pool elevation (design vs. as-built elevation) for applicable SCMs
- All Minimum Design Criteria have been met for each stormwater control measure
- Required plantings/stabilization has been provided
- Stormwater conveyances and drainage facilities are installed per the approved plans and capture the required drainage areas
- All stormwater improvements (including drainage facilities and stormwater control measures) are located within the recorded stormwater access and maintenance or drainage easements
- All backwater from the stormwater system is contained within the recorded stormwater, drainage, or backwater easements
- Any other project specific requirements have been met

As-builts shall not be submitted for County review and approval until the stormwater control measures and all of their conveyances have been permanently stabilized. Any and all temporary erosion control measures within the SCMs shall be removed including skimmers and baffles, and permanent stabilization and/or landscaping of the SCM completed. When ready, the as-built submittal and associated Engineer's Certification shall be uploaded to the stormwater permit through the [Wake County Permit Portal](#). If the submittal is complete, the Watershed Management plan reviewer shall request an as-built inspection be performed by the post-construction staff and will begin the 10-day initial review cycle.

When the initial review is complete, the Watershed Management plan reviewer shall provide a Stormwater As-built Review Checklist to the responsible party and certifying engineer which either notes approval or rejection of the as-built submittal. If the as-built submittal is not approved, specific comments shall be provided which must be addressed before resubmittal through the Portal. Upon approval of the as built submittal, including inspection approval, the responsibility of the device transfers to the permanent owner, homeowners' association, etc. The permanent owner shall register in the [Wake County Permit Portal](#) to enable submission of the annual inspection through the Permit Portal.

### 3.5.6.3 Impervious Surveys

As-built impervious surveys are not required for every project but may be required as a condition of a project's approval to verify that the actual constructed project complied with any maximum impervious

limitations, specific design assumptions, certain exemptions (no increase in BUA) or thresholds (low-density) that were critical to the plan approval.

For example, if disturbance thresholds for a project subject to the Neuse or Falls Lake Rules were met, then a stormwater management plan and permit are required to verify compliance with the Rule. If compliance was shown via no increase in impervious, then no calculations or SCMs are required BUT an as-built impervious survey may be required to verify that the completed project did not in fact increase impervious.

If an as-built impervious survey is required as a condition of approval, the submitted survey must be sealed by a North Carolina licensed surveyor. The as-built impervious survey shall be uploaded to the stormwater permit through the [Wake County Permit Portal](#).

As-built impervious surveys may also be required by Wake County Planning, Development, and Inspections staff as part of their reviews in specific watersheds, particularly in Swift Creek.

### 3.5.7 Post-Construction Owner Requirements

Stormwater improvements include not only any stormwater control measures, but also drainage facilities (ex: conveyances) and easements. While the developer is responsible for the initial completion of stormwater control measures and any other stormwater improvements, the responsibility for long-term maintenance passes to future owners – which may be a homeowners’ or property owners’ association. All stormwater improvements are required to be maintained into perpetuity so that they continue to function and meet the purpose and requirements of the County’s stormwater ordinance. It is the responsibility of the developer to provide the approved as built package, construction plan and maintenance documents including the O&M manual to the HOA, management company or property owner.

All owners should familiarize themselves with any Operations and Maintenance Plan and/or Maintenance Agreement for the measures for which they are responsible. It is also important for owners of stormwater improvements to ensure that they have budgeted appropriately to pay for annual third-party inspections as well as routine and future maintenance needs. Owners shall register in the [County Permit Portal](#) and notify the County when there are changes in the ownership of a stormwater control measure.

Wake County Watershed Management staff have the right to inspect sites to determine whether the stormwater improvements have been installed and are being properly maintained (Refer to [UDO Article 9, Part 6](#)). Enforcement actions, including but not limited to Notices of Violation or civil penalties, may be issued for failure to submit annual inspections, failure to maintain SCMs, removal of SCMs, or any other violations of Wake County’s UDO.

Owners may wish to view additional information, including videos, regarding operation and maintenance of specific types of stormwater control measures at NCDEQ’s website [here](#).

#### **Annual Inspections**

Owners of stormwater control measures are required to submit an annual inspection report for each measure by June 30<sup>th</sup> of each year.

- Annual inspections for stormwater control measures that were installed as part of a stormwater deviation approval to increase the maximum impervious surface area (MISA) limitation on an individual lot are not typically required to be performed by a qualified professional. These inspections may be performed by the individual property owners. The exceptions to this are underground devices and permeable pavement, which both require a qualified professional to inspect and certify each year.
- All other annual inspections for stormwater control measures shall be performed by a qualified professional working within their area of competence. These professionals may include: a licensed North Carolina Professional Engineer, Surveyor, or Landscape Architect; soil scientist; aquatic biologist; or other person certified by the North Carolina Cooperative Extension Service for stormwater control measure inspection or maintenance.
- The inspection report(s) shall be submitted via the [Wake County Permit Portal](#) by uploading it to the associated stormwater permit via Attachments

- To upload documents to the Portal, owners and their representatives must register for an account and be linked to the appropriate permit(s) in the system. Please contact Watershed Management at [watershedmanagement@wake.gov](mailto:watershedmanagement@wake.gov) to request access to your permit case files (Subject Line: Add Case Contact). The Watershed Management [Contact Change Request Form](#) must be attached to this email request. This form is available through the Permit Portal.
- All inspection reports shall be on a form provided by or approved by Wake County. Current approved annual inspection forms may be downloaded from the County’s website under “Stormwater Management” [here](#).

### **Records of Maintenance**

The owner of the stormwater control measure(s) is responsible for maintaining it so that it continues to serve the intended functions. Specific operation and maintenance requirements, including inspections at certain timeframes or after rainfall events, for each measure are identified in the Operation and Maintenance Plan(s) for the SCMs. Owners of SCMs shall keep all maintenance records for a minimum of 5 years, and these records shall be made available to the County upon request. Reference [UDO 9-32-1](#).

### **Operation and Maintenance Plans**

The owner of an SCM (lot owner/home owners association/property owners association) is required to update the operations and maintenance plans for stormwater control measures at least once every 10 years ([UDO 9-23-3\(B\)](#)). This provision does not apply to measures installed as part of an approved stormwater deviation.

### **Change of Ownership**

While legal responsibility for the maintenance of SCMs automatically transfers to successive owners with property transfer in accordance with the recorded Stormwater Agreement, the County requests notification of any change in ownership. The County requests to be notified in writing within 30 days of any change in ownership/responsibility for stormwater control measures. Contact information for the new owner should be included within the notification.

## Chapter 4 – Single Family Residential Lot Process and Requirements

This chapter is intended to provide specific requirements and guidance for builders and/or property owners on the development (or redevelopment) of existing single-family residential lots.

In the sections below, you will find information regarding the review and permitting processes for land disturbance (removing the soil cover), stormwater and impervious areas, and work in or around flood hazard areas (FEMA or other County regulated areas). Depending on the specifics of the lot or overall development, some or all of these processes may be necessary for construction or projects on your residential lot.

It is important to understand what requirements apply to your lot before submittal of building or land user permits to avoid delays in the overall review or permitting of your project.

## 4.1 Land Disturbance for Individual Lots

If the developer and builder are the same entity, then the individual lot (lot-by-lot) erosion control plan may be submitted as the final phase of the overall subdivision grading permit. The information in this section of the manual is for use when the builder and developer are not the same entity, or if the builder/developer chooses to permit the lot construction separate from the subdivision grading permit (which may only cover the roads, stormwater control measures, and other common elements).

Per [UDO 10-13-1\(A\)](#), All builders and developers disturbing land in a subdivision (common plan of development) are required to have a land disturbance permit, even if the disturbance is less than 1 acre.

**Common Plan of Development or Sale:** A contiguous area where multiple separate and distinct construction activities may be taking place at different times on different schedules under one common plan. The "common plan" of development or sale is broadly defined as any announcement or piece of documentation (including a sign, public notice or hearing, sales pitch, advertisement, drawing, permit application, zoning request, computer design, etc.) or physical demarcation (including boundary signs, lot stakes, surveyor markings, etc.) indicating construction activities may occur on a specific plot.

Builders outside a subdivision shall obtain a permit if land disturbance is equal to or greater than 1 acre. Even if no land disturbance permit is required, projects are required to install minimum measures, including a stone construction entrance and silt fence as needed to prevent sediment loss to stream buffers, adjacent lots, or roads.

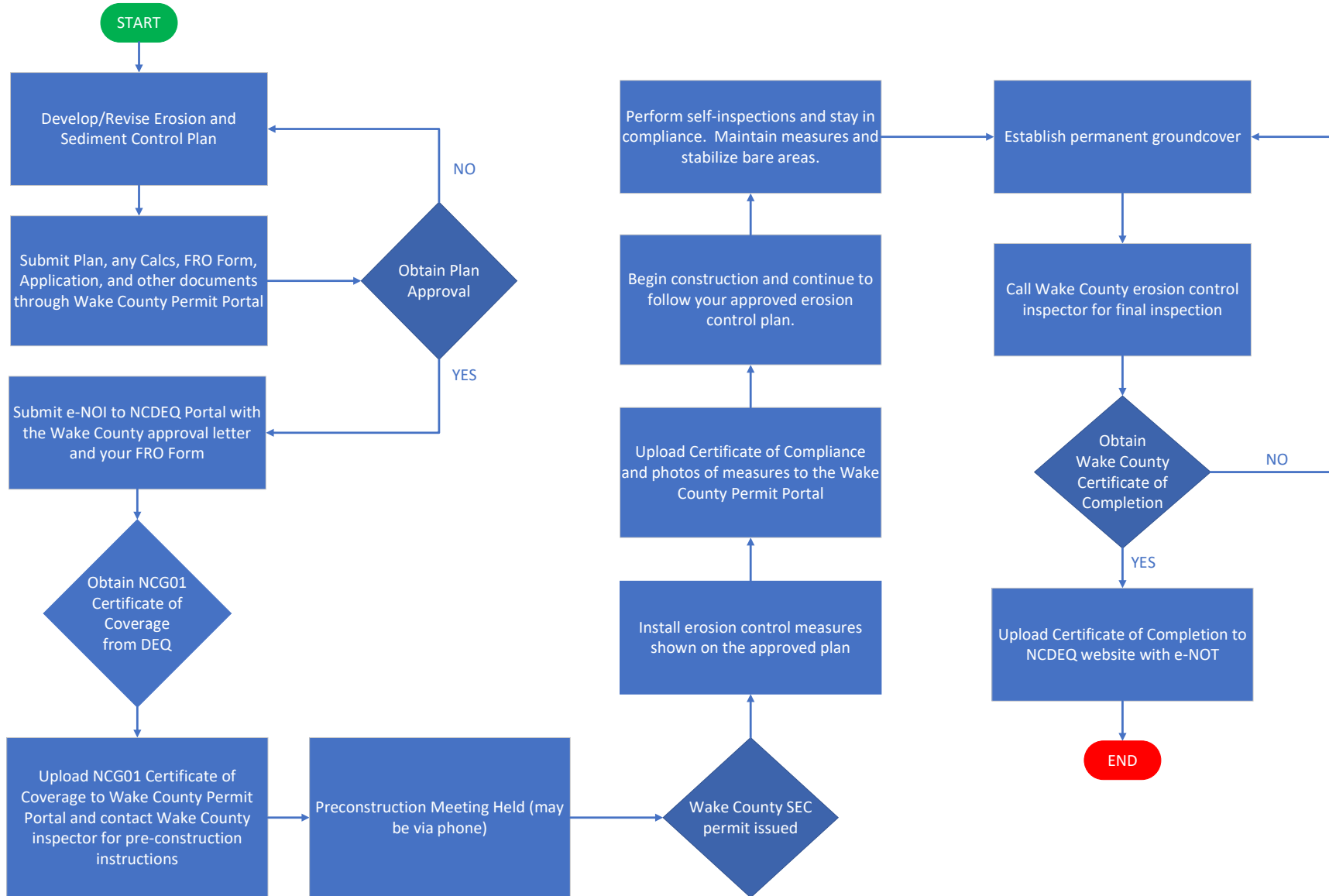
A flow chart of the overall process and terminology can be found below, and also on the County website [here](#). The process and information in the sections below is intended to ensure that the erosion and sedimentation control plan submitted to and approved by Wake County will be compliant with NCG01 requirements so that you can obtain coverage under that general permit from NCDEQ.

| <b>Wake County Terminology</b> |   |
|--------------------------------|---|
| <b>Term</b>                    | <b>Description</b>  |
| E&SC Plan                      | Erosion and Sedimentation Control Plan – must be SWPPP compliant to obtain NCG01 coverage   |
| Certificate of Compliance      | Document issued once initial E&SC measures are installed per the approved plans. This is required prior to grading and larger land disturbance on the project.  |
| Certificate of Completion      | Document issued once construction is complete and the project has permanent stabilization. This is required to close out the land disturbance (SEC) permit and required for upload to the State’s e-NOT |

| <b>State of NC Construction Stormwater Permit Terminology</b> |                    |
|---|--------------------|
| <b>Term</b>   | <b>Description</b> |

|       |  |
|-------|--|
| e-NOI | Electronic Notice of Intent. This is the required application to obtain NCG01 permit coverage from NCDEQ DEMLR. It must be completed and submitted online via the NCDEQ website.   |
| SWPPP | Stormwater Pollution Prevention Plan. This plan is required in order to obtain NCG01 permit coverage. Your E&SC Plan approval from Wake County can serve as this document and NCG01 Certificate of Coverage, if your submittal to the County included required NCG01 elements. |
| COC   | Certificate of Coverage. This document is proof that your project is covered by the NCG01 construction stormwater permit.  |
| DEMLR | NC Division of Energy, Mineral, and Land Resources. This is the Division of the NCDEQ that issues the NCG01 permit.  |
| NCDEQ | NC Department of Environmental Quality   |
| E&SC  | Erosion and sedimentation control  |
| e-NOT | Electronic Notice of Termination. This is the required application to close out your NCG01 permit with NCDEQ. It must be completed and submitted online via the NCDEQ website.   |

## Single Family Lot Erosion Control Process (Land Disturbance Permit)



#### 4.1.1 Individual Lot (Lot by Lot) Application Submittal

The County has developed a standard erosion and sedimentation control plan which may be used without the assistance of a design professional on lots disturbing less than 1 acre. Alternatively, a custom erosion and sedimentation control plan may be developed by a design professional for submission. Additional information on the submittal and review process for individual residential lots, including required documents, may be found on the County webpage [here](#).

The Wake County Standard Plan assumes that the entirety of the lot will be disturbed. If you wish to use the [Wake County Standard Plan](#) but do NOT intend to disturb the whole lot, then a plot plan for the lot shall be submitted to show the specific location of the limits of disturbance. (If you have a 1-acre lot but only intend to disturb 0.5 acres, staff need to know where those 0.5 acres are.) Disturbed areas include all areas that will be cleared for construction activity including septic and well installation and tree removal.

The following documents shall be uploaded to the [Wake County permit portal](#) for review of an individual lot (Lot by Lot) erosion control plan:

#### Wake County Financial Responsibility/Ownership (FRO) Form

- Note that a copy of the **Deed** must be submitted with the FRO form. The deed can be downloaded for the property from [iMaps](#).
- Signed and notarized **landowner consent**, if the owner of the property is not the same person as the financially responsible party. The owner must give consent for the FRP to permit and construct on their property. The County has developed a [sample form](#) which may be used.
- Signed and notarized **signature authority form**, if the financially responsible party is a company and the person signing on their behalf is not a company officer. This signed and notarized document gives authority for a non-officer to sign on behalf of the company. The County has developed a [sample form](#) which may be used. If used, this sample form should be printed on company letterhead.

Residential Lot Application requires:

**USGS Topographic Map\*** with the site location shown (to scale)

- Note that this may now also be downloaded from the new NCDEQ mapping tool: [USGS Topo/NRCS Published Soil Survey Mapping Tool \(arcgis.com\)](#). If the DEQ mapping tool is used, ensure that the map is zoomed to the appropriate level to obtain the correct map. The USGS quadrangle and 1970 Soil Survey map will show at different levels.

**NRCS Soil Survey\*** (1970, hardbound) Map with the site location shown (to scale)

- Note that this may now also be downloaded from the new NCDEQ mapping tool: [USGS Topo/NRCS Published Soil Survey Mapping Tool \(arcgis.com\)](#). If the DEQ mapping tool is used, ensure that the map is zoomed to the appropriate level to obtain the correct map. The USGS quadrangle and 1970 Soil Survey map will show at different levels.
- If a potential feature is shown on the lot(s) on the USGS Topo or NRCS Soil Survey map, provide 50 ft undisturbed buffer to water feature OR an NCDEQ - Division of Water Resources **Stream/Buffer Determination Letter**. Builders may wish to contact the original developer of their subdivision to obtain a copy of any buffer determination letters, as they should have been submitted with the original subdivision. Buffer determination letters from NCDEQ are valid for 5 years. If impacts are present

within the buffer, provide Impact map and permitting from NCDEQ - Division of Water Resources may be required. See the following web site for allowable impacts by clicking [here](#).

- **Plot plan** (with limits of disturbance shown, if the entire lot will not be disturbed AND the Wake County Standard Plan is to be used). Erosion and Sediment Control measures should be shown on the plot plan.

**Wake County Standard Plan OR custom erosion and sedimentation control plan**

- If the [Wake County Standard Plan](#) is used, and the entirety of the lot is not proposed to be disturbed, then a plot plan shall be submitted to show the specific location of the limits of disturbance.
- If a custom erosion control plan is used, it must be sealed by a design professional and should be submitted with all items (including any necessary calculations) from the [Wake County Erosion Control checklist](#). NCG01 Detail Sheets ([Ground Stabilization & Materials Handling](#) and [Inspection, Recordkeeping, & Recording](#)) or Standard details for structural best management practices (BMPs) to be installed to manage the anticipated materials listed in Part II, Section F such as construction debris management, concrete washout, paint washout, petroleum product storage and pesticide/herbicide handling, along with spill prevention practices.

A flood certification review may be required if there is a buffered feature or a flood hazard area, stormwater control measure on the lot, flood backwater, etc. Refer to [Section 4.4](#) of this manual for more information.

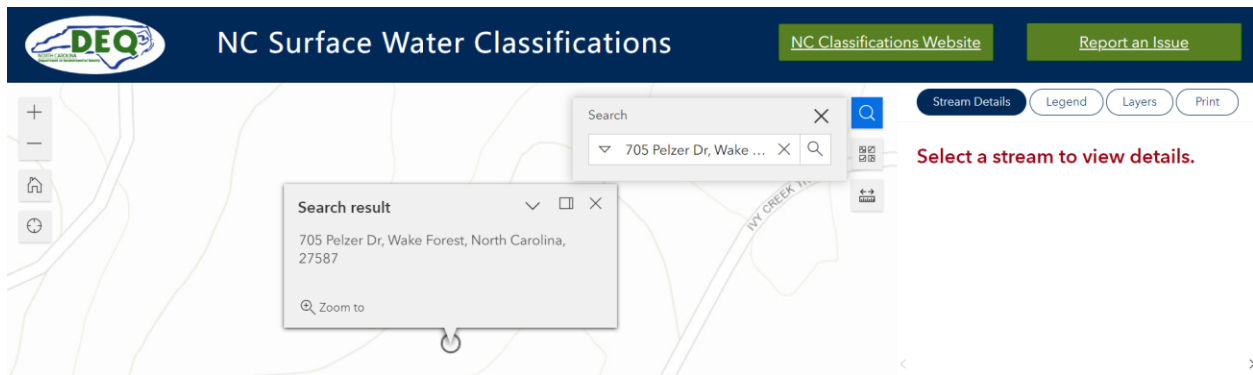
*\*Note: While USGS Quad Maps and the Wake County 1970 NRCS Soil Survey Map are not required for lot by lot erosion control submittals that disturb less than 1 acre within a common plan of development, they are a required component of NCDEQ's [NCG01 General Construction Stormwater Permit](#). If these items are not provided with the lot-by-lot erosion control plan, then staff must identify on the approval letter that the plans are not NCG01 compliant and NCDEQ will require revisions to the County approved plan or submittal (to DEQ) of a separate compliant plan for review and approval before issuing NCG01 coverage.*

***Helpful Hints for the Residential Lot Application:***

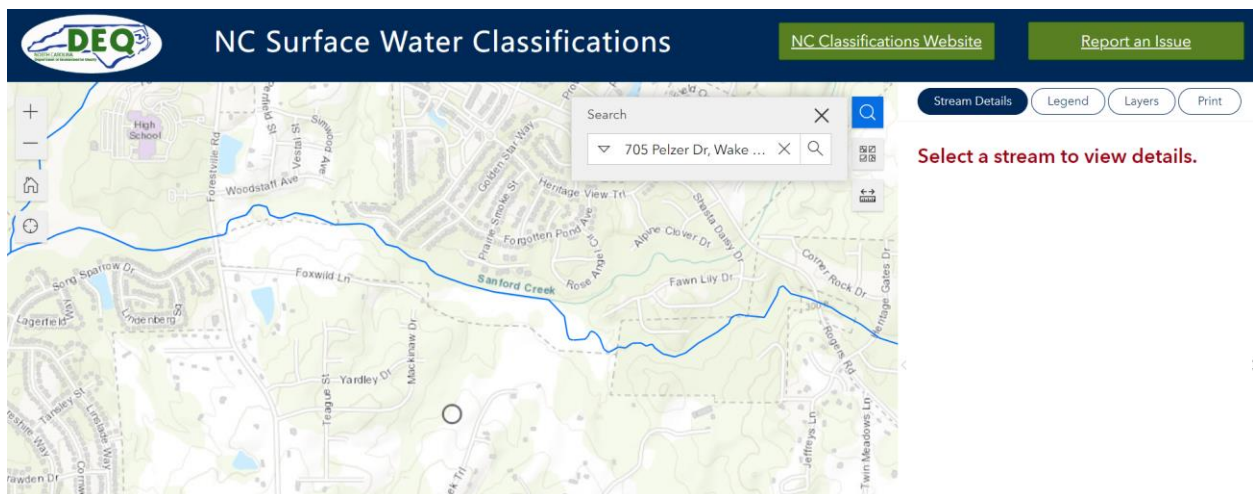
One of the most common difficulties that applicants have in completing the application is the completion of the “Waterbody Index” (Item I-8). This is not only required for the Wake County application, but it – along with the Receiving Waterbody Name – will also be required when submitting for NCG01 coverage through NCDEQ.

The [NC Surface Water Classifications \(arcgis.com\)](https://www.deq.nc.gov/nc-surface-water-classifications) map from DEQ should be used to identify your Waterbody Index and Receiving Waterbody Name by doing the following steps. We will use the address of 704 Pelzer Drive in Wake Forest, NC, as an example.

1. Enter the address of your lot on the [NC Surface Water Classifications \(arcgis.com\)](https://www.deq.nc.gov/nc-surface-water-classifications) map. This map shows streams/waterbodies with a bright blue line and will also show topography with gray colored lines.



2. Zoom out from your lot until you can see nearby streams or waterbodies.



3. Make sure to look at the topographic lines to see which way your lot is draining. In this example, the lot drains toward Sanford Creek (the bright blue line). If it is difficult to read the topography on this mapper, you may wish to use iMaps and its topography layer to be sure you know where the water from your lot flows.

- Click on the bright blue line that represents the stream to which your lot drains. [You MUST click on the actual blue line for any information to show.] When you do that, the bright blue line will be highlighted, and the stream details will show in both a pop-up as well as the right-hand side of the application.

|                             |                            |
|-----------------------------|----------------------------|
| Stream Index:               | 27-23-5                    |
| Stream Name:                | Sanford Creek              |
| Description:                | From source to Smith Creek |
| Classification:             | C;NSW                      |
| Date of Class.:             | April 30, 1988             |
| What does this Class. mean? | View                       |
| River Basin:                | Neuse                      |

In this example, the Waterbody Index (or stream index) is 27-23-5. The receiving waterbody is the Stream Name – Sanford Creek.

If your site drains to more than one waterbody, both should be identified.

#### 4.1.2 Individual Lot (Lot by Lot) Permit Approval and Issuance

After a complete application is received (including required review fees), Wake County will review your plans and request additional information as needed until the plan submission is determined to be compliant and approvable. Once you have received an approval letter for your “lot by lot” erosion control plan, the building permit review process for your lot may continue. *However, the following process shall be followed in order for Wake County to be able to issue the SEC permit BEFORE any land disturbance associated with the project can begin.*

1. Obtain your letter of approval from the Wake County plan reviewer. Read it carefully for any special conditions of approval. These must be met before a preconstruction meeting can be held.
2. Obtain NCG01 Coverage from NCDEQ. See “[How to Apply for a Certificate of Coverage.](#)”
3. Upload a copy of the NCG01 Certificate of Coverage to the SEC permit in the [Wake County Permit Portal](#).
4. Contact your Environmental Consultant for preconstruction meeting (precon) – their name and phone number will be your approval letter. This precon is generally held over the phone for lot construction.
5. The Environmental Consultant will issue the SEC permit, and the permit status in the County’s Portal will change from approved to issued.
6. Install the erosion control measures shown on the approved plan (construction entrance, silt fence, etc.).
7. Upload the [Certificate of Compliance](#) (along with pictures of the measures) to the SEC permit in the portal. Your Environmental Consultant will receive an automatic notification that this has been done. The builder shall notify Environmental Consultant via email, text, or phone call.

### 4.1.3 Individual Lot (Lot by Lot) Ownership Changes and Permit Transfers

If lot ownership changes during the review or construction process, a new Financial Responsibility Ownership (FRO) form and deed shall be provided to the County ([UDO 10-30-9\(F\)](#)). If new landowner and the financially responsible party are not the same person/entity, a signed and notarized letter of landowner consent shall be provided with the updated FRO form and deed. The County has developed a [sample landowner consent](#) form which may be used.

If lot ownership changes during the construction process AND the financial responsible party wishes to transfer the SEC permit to the new property owners, the following steps must occur to modify the permit:

- Updated documentation shall be submitted to the SEC permit via the [Wake County Permit Portal](#). This documentation includes:
  - Signed transfer request letter from the current permittee
  - Updated [Financial Responsibility/Ownership \(FRO\) Form](#), with a copy of the new deed
  - A signed and notarized statement from the new property owner(s)/FRP that they have received a copy of the approved plans and understand that they are responsible for compliance with the approved plans and the Wake County UDO.
  - **Note: The County has a [template form](#) which may be used as part of the transfer request for lots disturbing less than 1 acre, where the builder/developer is both the landowner and the financially responsible party.**
- The new Financially Responsible Party (new owner) shall register for an account on the Wake County Permit portal and be added as a contact on the existing SEC permit record.
- A permit revision fee (\$75) shall be invoiced and paid.
- Wake County inspection staff shall conduct a site inspection to document current conditions onsite.
- The Wake County plan reviewer shall review the documentation associated with the transfer and, if acceptable, shall issue a letter of approval/transfer to the new permittee. A corresponding inspection report shall be issued documenting the transfer between permittees.

Once the SEC permit has been transferred with the County, updated [NCG01 coverage must be addressed through NCDEQ](#). DEQ does not allow for the transfer of NCG01 coverage between owners. Therefore, the new permittee/owner must apply for and obtain NCG01 coverage for themselves. Only after new coverage has been obtained by the new permittee will DEQ accept and process a Notice of Termination from the original permittee.

After the new NCG01 permit coverage has been obtained by the new permittee, the *new permittee must upload a copy of that coverage to the SEC permit on the Wake County permit portal*. At that point, all responsibility for compliance with both the SEC permit and NCG01 permit (including establishment of permanent stabilization at project completion) lies with the new owner/permittee.

#### 4.1.4 Individual Lot (Lot by Lot) Permit Completion

When all items listed below have been completed, the Financially Responsible Party shall contact the Watershed Management field consultant to request a Certificate of Completion inspection for the land disturbance permit.

- All conditions of the land disturbance permit have been met
- All temporary erosion and sedimentation control measures have been removed with approval of the Watershed Management field consultant
- All disturbed areas are stabilized with established permanent groundcover and landscaping or impervious surfaces
- All conditions and requirements of any associated flood certifications have been met, including elevation certificates if required

Permanent stabilization of disturbed areas shall be required prior to close out of any land disturbance permit, and may be achieved by one or more of the following methods (refer to Chapter 5, Erosion and Sedimentation Control, for more information):

##### **Grass**

- Where grass is used to meet stabilization requirements, permanent groundcover must be applied over 100% of the disturbed area.
- Permanent stabilization will be considered achieved when 80% density of the permanent groundcover is established with no evidence of large bare patches or erosion. Annual rye is NOT a permanent groundcover.

##### **Sod**

- Sod should be laid across the slope working from the bottom to the top of a slope
- Sod strips should be placed so that there are snug, even joints. Joints should be staggered to prevent gaps or voids which may allow roots to dry out or be more susceptible to erosion.
- Roll or tamp sod immediately after placement to ensure that there is solid contact between the sod and the ground.
- On steep slopes, sod may need to be stapled to the surface of the soil.
- Sod should be watered immediately once secured, and regularly as needed to ensure sod grows.
- Sod should not be applied to compact soil. Till the soil to a depth of four to six inches below sod placement.

##### **Mulch**

- Pine straw and mulch may be applied at a minimum depth of 6 inches to achieve permanent stabilization on level areas.

##### **Impervious surface**

- Impervious surfaces such as gravel, rip rap, asphalt, etc. may be used for permanent stabilization. All such impervious surfaces must be permitted appropriately.

Once the Wake County Certificate of Completion for the land disturbance permit has been obtained, the Financially Responsible Party may request termination of their General Construction Stormwater Permit (NCG01) from NCDEQ. Refer to “[How to Terminate a Certificate of Coverage](#)” at the NCDEQ website.

## 4.2 State and County Stormwater for Residential Lots

**For projects within a common plan of development**, State and County stormwater compliance has already been addressed through the developer's plans for the overall subdivision – which include proposed stormwater control measures and maximum impervious limitations on lots within the development.

- The builder/property owner will be required to obtain a land disturbance permit for the lot and comply with the recorded impervious limitations for the lot, as well as any assumed drainage patterns (ex: if impervious from the lot was intended to drain to a stormwater control measure, lot grading should allow this to happen). No further stormwater compliance is required for the lot development.

**For isolated lots not within a common plan of development** (including many created through minor or minor-limited subdivisions), projects on individual residential lots may trigger larger State and County stormwater requirements if certain disturbance thresholds are met. These disturbance thresholds are as follows for residential projects not within a common plan of development:

- Falls Lake: ½ acre of disturbance

If you have questions regarding whether your lot may County stormwater requirements, please reach out to [Watershed Management staff](#) prior to submitting building permits for review. This will avoid delays in the review and permitting process.

### 4.3 Exceeding Recorded Maximum Impervious Limitations on Individual Residential Lots

In Wake County, each residential zoning district generally has a maximum impervious limitation ranging between 6% and 30%. All lots within a new residential subdivision, other than exempt subdivisions or lots greater than 10 acres created by a minor or minor-limited subdivision, have maximum impervious surface area (MISA) limitations on their record plat.

Since approximately 2006, new residential developments have had a perpetuity statement recorded on their plats which notes that the MISA will be strictly enforced into perpetuity. The perpetuity statement ensures that future expansions do not exceed the assumptions that were made when permitting and that the overall development remains compliant with UDO requirements. Lots with perpetuity statements have two options for increasing their impervious allocations:

1. Obtain impervious from other landowners (from their recorded MISA) and undergo a County review and re-recording process to document the exchange. To transfer impervious between lots that are within the same development/phase, an exempt subdivision application and plat must be submitted for review and approval.
2. Apply for a new stormwater permit for the subdivision/phase. A qualified professional must develop and permit a new stormwater management plan for the subdivision/phase, install any additional measures, and re-record all lots with any new MISAs.

Prior to approximately 2006, MISAs on lots were recorded without a perpetuity statement. These lots may apply for a stormwater deviation (see below). The stormwater deviation will allow an individual lot to exceed the recorded MISA but remain below its zoning-based impervious limitation. As part of the deviation approval, individual lots are required to install an approved stormwater treatment device for a certain treatment volume based on the 1-year, 24-hour storm (approximately 3 inches). Within Swift Creek, this volume requirement may vary from ½ inch to 3 inches per square foot of impervious overage, based on the [Swift Creek Land Management Plan](#) regulations and the percentage of impervious proposed. Stormwater deviations are not allowed on newer recorded lots which have a perpetuity statement recorded on their plats.

The information below is meant for individual residential lot landowners with small drainage areas only.

### 4.3.1 Stormwater Certification Process

The first step in the process is a stormwater certification review, which is initiated through a building permit submission and will determine whether a property is eligible to apply for a deviation.

If there is no recorded perpetuity statement on the plat, individual lot stormwater management may be permitted by the installation of approved stormwater treatment device(s). A treatment volume will be calculated by the permit reviewer. This volume will be based upon capturing the 1- year, 24-hour storm event (approximately 3”) for projects in Wake County’s jurisdiction and subject to the Neuse River Stormwater Rules and or any combination of other applicable stormwater requirements. Projects located in the Swift Creek Watershed must meet state stormwater rules and the [Swift Creek Land Management Plan](#).

*Note: The Swift Creek requirements apply for the portion of impervious between 12% and 15%. Above 15% impervious surface area, the three (3) inch design criteria shall apply. Only lots created via subdivisions after July 1, 2001, are required to mitigate 3” for impervious above 15% if there was not a perpetuity statement on the plat. Impervious existing prior to the Swift Creek Rules adoption (October 22, 1998) and deemed nonconforming would also be deemed grandfathered.*

The stormwater certification process is described below:

1. The applicant will apply for a building permit (RBPR or RABS) through the [Permit Portal](#).
2. Wake County Planning, Development, and Inspections (PDI) staff will flag the project for exceeding maximum impervious surface area (MISA) and will add a review item for Watershed Management within the building permit review.
3. The Customer Support Center staff will invoice the applicant a \$50 fee for Stormwater Certification review and create a stormwater certification (SFR-) permit for the Watershed Management staff review. This SFR- permit will be linked to the building permit.
4. The applicant must pay the invoiced \$50 fee before the stormwater certification review begins.
5. Once the invoice is paid, Customer Support Center staff will route the stormwater certification for Watershed Management staff review.
6. Watershed Management staff will review the proposed plan, verify the MISA and check for a perpetuity statement on the recorded plat.
7. If eligible to deviate from the recorded MISA, the plan reviewer will send a review checklist to owner with the volume required to be captured for the impervious proposed. The checklist will be uploaded to the Permit Portal and emailed to the applicant.
  - If the lot is not eligible to deviate, the plan reviewer will send a review checklist to the applicant/owner and indicate that they do not qualify to submit a deviation. The SFR permit review will be disapproved.

8. The stormwater certification (SFR-) permit will be approved and completed. A pre-issuance hold will be placed on the building permit for the project pending the applicant's submission of a stormwater deviation application.

### 4.3.2 Stormwater Deviation Process

If the applicant was found to be eligible to deviate from their recorded MISA via the stormwater certification permit review, the next step will be submission of the stormwater deviation application and required documents, including the proposed stormwater management plan. Depending on the complexity of the design and the measure(s) chosen, a design professional may need to be engaged in the development of the stormwater management plan.

When designing the stormwater management plan, note that discharges from stormwater devices must flow to an appropriate downhill location. It is important to identify where the septic and repair fields are onsite, as the design cannot negatively impact these areas. In addition, upstream property owners may be held responsible for downstream property damaged. Such drainage issues are a private civil matter between the parties.

The most common devices used for stormwater deviations are rainwater harvesting (rain barrels, cisterns, or underground detention tanks) and rain gardens. Legislative changes adopted in 2025 clarified the definition of impervious and allow the use of artificial turf or permeable pavement as pervious. Artificial turf requires a land use permit from the Planning Department. Permeable pavement shall be permitted with a Stormwater Deviation Permit, must be designed by a licensed professional and meet all requirements of the NC Minimum Design Criteria for permeable pavement and designed as an infiltrating system.

#### **Example Single Lot Photos**



Rain Barrels with Roof Drains



Raingarden (Bioretention)

**Example Single Lot Photos continued**

Underground Detention Tanks

All applications to deviate are reviewed by Watershed Management staff. Applicants shall apply through the [Permit Portal](#) and will upload the deviation application, a drawn to-scale plot plan showing the lot and its existing and proposed impervious features (driveway, sidewalk, house, patios, porches, outbuildings, etc.), and a stormwater mitigation plan; a design by a licensed professional is required for underground systems and permeable pavement.

1. The applicant will apply for a stormwater deviation permit (SWF- permit, work class = Stormwater Individual Lot) through the [Permit Portal](#) and will upload the [deviation application](#), plot plan, and proposed stormwater management plan. Refer to the [stormwater deviation submittal checklist](#) for all required items. The owner must sign the application.
2. Customer Support Center staff will perform an application completeness check to verify that the required documents have been uploaded and will invoice the applicant for \$400 permit review fee.
3. The applicant must pay the invoiced \$400 fee before the stormwater deviation review begins.
4. Once the invoice is paid, Customer Support Center Staff will route the stormwater deviation to Watershed Management staff for review.
5. Watershed Management staff will review the plan and provide a review checklist with comments or approval, including requirements for completing the permit. The checklist will be uploaded to the Portal and emailed to the applicant. The checklist will either disapprove the deviation and request additional information or it will approve the proposed stormwater management plan and authorize construction.
6. Once the stormwater management plan is approved, the Watershed Management plan reviewer will approve the stormwater deviation (SWF-) permit. At this point, issuance of the building permit can proceed.

7. The Watershed Management plan reviewer will place the building permit on a Pre-Final Hold pending receipt of a final as built survey and recorded maintenance agreement.
8. Once all permits have been issued, the project may proceed, and the applicant shall comply with the approved stormwater management plan.
9. When the stormwater control measure has been completed, the applicant shall notify the stormwater inspector that the measure has been installed and is ready for inspection. Note that for underground devices, the stormwater inspector must be informed prior to the date of installation so that they may inspect the measure during the installation process.
10. The applicant shall submit all required as-built documentation and agreements through the Wake County permit portal for staff review. This shall include:
  - a. If the parcel is less than 5 acres, scales of 1" = 30', 40', 50', 60' or 100' are acceptable.
  - b. A detailed impervious summary for the lot.
  - c. Plan and profile views of the stormwater device(s) (an addendum documented by the designer may also be provided).
  - d. Indicate impervious areas from which stormwater is collected (an addendum documented by the designer may also be provided).
  - e. Conveyance system for routing stormwater from impervious area to device (an addendum documented by the designer may also be provided).
  - f. Location of wells, septic and repair areas.
  - g. Property setbacks, buffers, flood zones or any existing easements.
  - h. Location of the stormwater devices.
  - i. Note: Permeable pavement must be designed and installed by licensed professionals.
11. Once the as-built documentation and field inspection are acceptable, the plan reviewer will indicate that the documents are ready to be recorded with the Register of Deeds.
12. The applicant shall record both agreements, as well as the as-built with new MISA, with the Register of Deeds and upload proof of recordation through the SWF permit on the Permit Portal.
13. The plan reviewer will then issue an as-built acceptance document, complete the stormwater deviation permit, and release the pre-final hold on the building permit.

***\*No Building permit shall be completed, or Certificate of Occupancy issued, until Stormwater Management Plan is approved, implemented and any required as-built documentation accepted and recorded\****

### 4.3.2 Post-Construction Owner Requirements

Stormwater improvements include not only any stormwater control measures, but also drainage facilities (ex: conveyances) and easements. While the developer is responsible for the initial completion of stormwater control measures and any other stormwater improvements, the responsibility for long-term maintenance passes to future owners – which may be a homeowners’ or property owners’ association. All stormwater improvements are required to be maintained into perpetuity so that they continue to function and meet the purpose and requirements of the County’s stormwater ordinance.

All owners should familiarize themselves with any Operations and Maintenance Plan and/or Maintenance Agreement for the measures for which they are responsible. It is also important for owners of stormwater improvements to ensure that they have budgeted appropriately to pay for third party inspections as well as routine and future maintenance needs. Owners shall register in the County Permit Portal and notify the County when there are changes in the ownership of a stormwater control measure.

Wake County Watershed Management staff have the right to inspect sites to determine whether the stormwater improvements have been installed and are being properly maintained (Refer to [UDO Article 9, Part 6](#)). Enforcement actions, including but not limited to Notices of Violation or civil penalties, may be issued for failure to submit annual inspections, failure to maintain SCMs, removal of SCMs, or any other violations of [Article 9](#) of Wake County’s UDO.

#### **Annual Inspections**

Owners of stormwater control measures are required to submit an annual inspection report for each measure by June 30<sup>th</sup> of each year.

- Annual inspections for stormwater control measures that were installed as part of a stormwater deviation approval to increase the maximum impervious surface area (MISA) limitation on an individual lot are not typically required to be performed by a qualified professional. These inspections may be performed by the individual property owners. The exceptions to this are underground devices and permeable pavement, which both require a qualified professional to inspect and certify each year.
- The inspection report(s) shall be submitted via the Wake County Permit Portal by uploading it to the associated stormwater permit via Attachments.
- To upload documents to the Portal, owners and their representatives must register for an account and be linked to the appropriate permit(s) in the system. Please contact Watershed Management staff at [watershedmanagement@wake.gov](mailto:watershedmanagement@wake.gov) to request access to your permit case files (Subject Line: Add Case Contact).
- All inspection reports shall be on a form provided by or approved by Wake County. An example of an approved annual inspection report form may be found on the County website below:  
[Stormwater Control Measure \(SCM\) Annual Inspection Form – Single Family Lot](#)  
[Stormwater Control Measure \(SCM\) Annual Inspection Form – Subdivision and Non-Residential](#)

#### **Records of Maintenance**

The owner of the stormwater control measure(s) is responsible for maintaining it so that it continues to serve the intended functions. Specific operation and maintenance requirements, including inspections at certain timeframes or after rainfall events, for each measure are identified in the Operation and

Maintenance Plan(s) for the SCMs. Owners of SCMs shall keep all maintenance records for a minimum of 5 years, and these records shall be made available to the County upon request. Reference [UDO 9-32-1](#).

### **Operation and Maintenance Plans**

The owner of an SCM (lot owner/home owners association/property owners association) is required to update the operations and maintenance plans for stormwater control measures at least once every 10 years ([UDO 9-32-3\(B\)](#)). This provision does not apply to measures installed as part of an approved stormwater deviation.

### **Change of Ownership**

While legal responsibility for the maintenance of SCMs automatically transfers to successive owners with property transfer in accordance with the recorded Stormwater Agreement, the County requests notification of any change in ownership. The County requests to be notified in writing within 30 days of any change in ownership/responsibility for stormwater control measures. Contact information for the new owner should be included within the notification.

Owners may wish to view additional information, including videos, regarding operation and maintenance of specific types of stormwater control measures at NCDEQ's website.

## 4.4 Flood Hazards and Residential Lots

Wake County prohibits development, including fill, in special flood hazard areas except for certain limited uses specified in [UDO Article 14](#). Special flood hazard areas include:

- flood hazard soils,
- FEMA flood zones,
- delineated backwater areas,
- Impoundments and dam breach areas, and
- other hazard areas as required by the Wake County Floodplain Administrator.

Permits for new construction, substantial improvements, substantial repairs, or other development proposed in an area of special flood hazard areas shall not be issued until plans for the development have been reviewed by Watershed Management staff and are found to comply with Wake County's UDO. If it is found that the improvements or developments were completed without a permit, the site shall be found to be in violation and may be subject to civil penalties and/or other enforcement action.

#### 4.4.1 Flood Certification Review and Permit

The applicant for any building, manufactured home, or land use permits shall identify all flood hazards on the site plan submitted for review to the County.

A flood certification review is required for a lot where any of the following are identified:

- Any proposed structure is within 100 feet of flood hazard soils or FEMA flood hazard area.
- There is FEMA floodplain on or adjacent to the lot.
- Development is proposed in or near a stream buffer or water feature (dam, flood backwater, stormwater control measure, etc.)
- A road or driveway crosses a flood hazard area.
- Fill is proposed within a flood hazard area.

When a development application is submitted to the County, Planning, Development, and Inspections (PDI) staff shall confirm the hazards for the lot using iMAPS and/or the recorded plat. A residential lot may have been identified for potential flood hazard during subdivision construction plan or minor subdivision review. Flood hazard restricted lots are designated on the record plat with an asterisk (\*). Fill is proposed within a flood hazard area.

Lots or projects which meet the criteria listed above are referred to Watershed Management for flood certification review. The review process will continue until the project is exempted from further review, approved, or denied. The process for this review is detailed below:

1. The applicant will apply for a building permit, manufactured home permit, or land use permit through the [Permit Portal](#). The plans submitted should identify all flood hazards.
2. Wake County Planning, Development, and Inspections (PDI) staff confirm any flood hazards for the lot using iMaps and the plat.
3. Lots meeting the criteria listed at the beginning of this section will be routed to Watershed Management staff for flood certification review.
4. Customer Support Center staff will invoice the applicant a \$50 fee for Flood Certification review and create a flood certification (SFR-) permit for the Watershed Management staff review. This SFR-permit will be linked to the building permit.
5. The applicant must pay the invoiced \$50 fee before the flood certification review begins.
6. Once the invoice is paid, Customer Support Center staff will route the flood certification for Watershed Management staff review. The initial benchmark review time is 5 business days.
7. Watershed Management staff will review the proposed plan and flood hazards.
  - The plan reviewer may exempt the project from further review if the structure is set back and naturally elevated from the flood hazard and/or if the drainage area of the flood hazard is less than 5 acres.

- If more information is needed, the reviewer will complete a review checklist and contact the applicant. A hold will be placed on the building or land use permit until:
  - a revised site plan is received,
  - a flood hazard soil redelineation is completed modifying the boundaries of the flood hazard soils, or
  - a flood study has been submitted, reviewed, and approved.

Depending on the circumstances, an applicant may be required to move the proposed structure outside of the special flood hazard area. For example, structures proposed in FEMA flood zones **MUST** be relocated outside of the FEMA special flood hazard areas.

**Driveway Crossings:**

If there is a driveway crossing a flood hazard area, a separate flood study permit will also be required. However, driveways in flood hazard soils with a drainage area of less than 5 acres are exempted from this requirement. See Chapter 6 for more information on flood studies.

If there is an existing culvert crossing, we will review our records for a prior flood study and field check to ensure the culvert meets the approved study requirements. Replacements of existing permitted culverts require new permits if the pipe size and materials are modified.

#### 4.4.2 Required Documentation

During the flood certification review, Watershed Management staff will identify whether additional documentation (ex: elevation certifications) will be required as a condition of approval.

There are three potential elevation certifications that may be required. All must be performed by an NC licensed surveyor. It is strongly recommended that an applicant engages a surveyor with experience with floodplain requirements. North Carolina participates in the [Certified Floodplain Surveyor \(CFS\) Program](#), and a list of those certified may be found [here](#).

**Pre-construction elevation survey:** An elevation survey will be required to determine the ground elevations at the proposed structure. Example form may be found [here](#).

- A pre-issuance hold will be placed on the building permit until the pre-construction elevation certificate is received.
- Based on the elevation survey, staff may approve the flood certification or require additional information.

**During construction elevation survey:** A second elevation survey will be required prior to the foundation inspection, if the first elevation survey result is lower than the required elevation. The finished floor elevation may have to be set at 2 feet above the highest adjacent grade.

- A pre-final hold will be placed on the structure permit until this certificate is received.

**Post-construction elevation survey:** If the elevation is still found to be too low, a post-construction elevation certificate will be required to ensure the structure meets its required minimum finished floor elevation.

- The Certificate of Occupancy will not be issued until this is received.

### 4.4.3 Drainage

Wake County Watershed Management does not regulate lot drainage except for requiring drainage easements to be shown on the construction plan and record plat. These easements and any associated conveyances within them should be installed by the developer or builder. Positive drainage from structures is required through the NC Building Code.

Storm drainage issues between property owners are a private civil matter and must be resolved between the property owners as private parties, through private legal action if necessary. If you plan improvements or modifications to your landscape or property which impact the flow of water leaving your property, you should take the potential impact to your neighbor's property into consideration. If you make improvements or modifications to your landscape or property which impact the flow of water off your property and cause damage to your neighbor's property, your neighbor may choose to pursue private legal action against you, which could result in you being held liable for damages to your neighbor's property.

Please keep in mind:

- It is a violation of State law (see NCGS Chapter 77, Article 2: Obstructions in Streams and Drainage Ditches) to block the natural flow of water in certain circumstances. For example, fences across easements must allow water to flow.
- Any land-disturbing activity that may cause erosion or sedimentation must be controlled at the source.
- Drainage modifications within the right of way (ROW) of a public road may require NCDOT approval.

Additional information may be found within the "[Frequently Asked Questions](#)" on Wake County's website.

## Chapter 5 – Sedimentation and Erosion Control

The Sediment Pollution Control Act (SPCA) of 1973 is a performance-oriented law. It was created to prevent pollution by sedimentation while still allowing development within our state. The SPCA is the enabling legislation that gives authority to the Sedimentation Control Commission (SCC) and [the Land Quality Section \(LQS\) - Erosion and Sediment Control \(E&SC\) Program](#).

The NC Sedimentation Control Commission may delegate authority to implement the Sedimentation Pollution Control Act (SPCA) to cities and counties that adopt a local qualifying erosion and sediment control ordinance in compliance with North Carolina state requirements. The staff of the delegated Local Programs perform plan reviews and enforce compliance of the SPCA within their jurisdictions.

Per [Wake County Unified Development Ordinance Article 10](#), land-disturbing activities within the County's jurisdiction must control accelerated erosion and sedimentation to prevent the pollution of water and other damage to lakes, watercourses, and other public and private property by sedimentation. Sedimentation and erosion control devices must be installed and maintained to prevent any offsite sedimentation for any development regardless of the size of the land disturbance.

Unless exempted by our UDO, Article 10, new development shall submit an application for land disturbance permit including plans, maps and calculations. All erosion and sediment control plans and measures must conform to the minimum applicable standards specified in both [North Carolina's Erosion and Sediment Control Planning and Design Manual](#) and this manual. In the case of any conflict, the more stringent criteria shall apply.

## 5.1 Land Disturbance

### 5.1.1 Land Disturbances Requiring an Approved Plan and Permit

Unless it meets one of the listed exemptions of [UDO 10-13-2](#), land disturbance requires both an approved erosion and sedimentation control plan and an issued land disturbance permit when:

- the disturbed area for the project will equal or exceed 1 acre
- the disturbed area for the project is less than 1 acre but is part of a larger common plan of development which will have a total cumulative disturbance that will equal or exceed 1 acre
- sediment control measures are needed to protect against offsite damage (this may be required by the County, per [UDO 10-30-1\(B\)](#) when determined to be necessary)

When calculating the area of proposed land disturbance, it should be noted that associated activities including access and haul roads, borrow and waste areas (if conducted by the same person), roadside shoulders and ditches for individual lots, septic fields, and utility construction must be included within the limits of disturbance unless they are covered under another approved erosion and sedimentation control plan and permit. Reference [UDO 10-13-1\(A\)](#) for more details. If any of these areas are covered under another SEC permit, the project name(s) and permit number(s) shall be identified on the erosion control plan sheets.

No land disturbing activities (including clearing, logging, or timbering) may begin on a site which requires a land disturbance permit until the required erosion and sedimentation control plan is approved and the required land disturbance permit has been issued by the County. The County does not allow “early grading” or logging/clearing/grading of a site for projects within its jurisdiction prior to County approval of construction drawings and issuance of associated permits.

### 5.1.2 Land Disturbances Not Requiring an Approved Plan and Permit

Per [UDO 10-20-5\(B\)](#), projects which are not required to obtain an approved erosion control plan and permit are still required to provide and maintain sufficient measures to retain sediment onsite, in order to protect all public and private property from sedimentation and erosion damage caused by the land disturbing activities. Failure to do so may result in enforcement actions, including civil penalties, if an inspection identifies that the sedimentation has left the site.

Minimum required measures include:

- Construction entrance(s), 10 feet wide and 30 feet long, or equivalent, at all points where construction vehicles will enter or exit the project.
- Silt fences on the low sides of the lot/disturbance. For all projects that require a building permit, this silt fence must be installed prior to the initial footing inspection conducted by the County Building Inspections Division.
- Measures shall conform to Wake County standard details

Note that additional measures may be necessary and required to be installed and maintained in order to retain sediment generated by the disturbance on the property/tract. It is the property owner's responsibility to ensure that sufficient stabilization/groundcover or protective measures have been installed to restrain accelerated erosion and to prevent offsite sedimentation.

Prior to any Certificate of Occupancy (CO) being issued, all areas within 25 feet of the edge of pavement or gravel of the road must be permanently stabilized.

## 5.2 Financial Responsibility/Ownership (FRO) Form and Landowner Consent

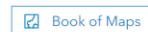
The [Wake County Financial Responsibility/Ownership Form](#) is required to be included with any application for a sedimentation and erosion control (SEC) permit. A plan submittal is not complete if this form is missing or incomplete. The form must be fully and accurately completed, signed, and notarized in order to be reviewed and accepted by the County. Items on the FRO Form which are not applicable should not be left blank, but should be indicated as “N/A.”

Common mistakes on FRO forms which cause them to be rejected include:

- Project name on the FRO form does not match other submitted paperwork, including the plans and application. Note that it is requested that the following naming convention be used for individual lot construction within a larger subdivision – *Subdivision Name Lot X* or *Subdivision Name Lots X-Z*.
- Latitude and longitude are not provided in decimal degrees.
- Total disturbed acreage on the FRO form does not match other submitted paperwork, including the plans and application.
- Copies of the current deed(s) of all property covered under the plans and permit application have not been provided. A copy of the deed(s) can be downloaded from the [iMaps](#) property record.

### Deeds

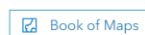
|                      |   |
|----------------------|---|
| Book                 | 009549  |
| Page                 | 00800   |
| Deed Date            | 8/20/2002                                       |
| Deed Acres           | 8.39  |
| Property Description | STONEY HILL FIRE<br>DEPARTMENT BM2001<br>-00781 |



- Deed book and page number of deeds have not been listed on the FRO form. The Deed book and Page number can be found from a copy of the deed, or from iMaps. From [iMaps](#), under “Deeds”:

### Deeds

|                      |   |
|----------------------|---|
| Book                 | 009549  |
| Page                 | 00800   |
| Deed Date            | 8/20/2002                                       |
| Deed Acres           | 8.39  |
| Property Description | STONEY HILL FIRE<br>DEPARTMENT BM2001<br>-00781 |



- Landowner(s) of record on the FRO form does not match County tax records (refer to [iMaps](#)) and/or does not use the correct, legal names listed as the property owner(s).
- An individual's name is listed as the financially responsible party, but that person is signing the form on behalf of a company which is actually intended to be the financially responsible party.
  - For example, "John Smith" is listed as the financially responsible party under Part B1 of the form, but he has signed the FRO form as "Manager" of ABC Builders, LLC. In this case, "ABC Builders, LLC" should be listed as the financially responsible party in Part B1.
- The company listed as the financially responsible party does not match the legal name of the company as registered with the [NC Secretary of State](#).
  - [For example, "ABC Builders" was listed on the FRO form when the legal company name is "ABC Builders, LLC."](#)
- The person signing the form on behalf of the financially responsible party (FRP) is not listed as a company officer or registered agent with the [NC Secretary of State](#).
  - The form must be signed by the Financially Responsible Party if an individual (or his attorney-in-fact).
  - If the FRP is a company, then the form must be signed by a company officer, director, partner, or registered agent with the authority to execute instruments for the Financially Responsible Party. Alternatively, a company officer may give authority for another person to sign on behalf of the company via a signed and notarized signature authority form or other documentation. The County has developed a [sample form](#) which may be used. If used, this sample form should be printed on company letterhead.
- The financially responsible party is not a resident of Wake County but has not provided a designated Wake County agent to receive notices, etc.
  - Companies and corporations are legally required to provide a registered agent to the NC Secretary of State as part of business registration. A registered agent is a person or company that is designated to receive legal correspondence on behalf of and relay important messages to the Financial Responsible Party in a timely manner. Part B.2(b) of the FRO must be completed with the information provided to the NC Secretary of State when applicable.
  - If the financially responsible party is not the same person or entity as the property owner(s), then a signed and notarized statement of landowner consent is required to be submitted with the FRO form. This statement must be signed by all owners of the property and must clearly provide consent for the financially responsible party to submit the draft erosion control plan and to conduct the anticipated land disturbing activity on their property. Landowner consent is a requirement of the North Carolina Sedimentation Pollution Control Act of 1973 G.S. 113A+54.1(a) and the Wake County UDO Article 10-30-2(B)(2)(c). A sample landowner consent form may be found [here](#).

### 5.3 Basic Control Objectives

Erosion and sedimentation control plans shall be designed to address the following objectives, as required by [15A NCAC 04B .0106](#) and [UDO 10-30-4](#). Plans which fail to adequately address these objectives shall be disapproved.

### 5.3.1 Identify Critical Areas

Onsite areas that are subject to severe erosion, and off-site areas that are especially vulnerable to damage from erosion and/or sedimentation, must be identified and receive special attention.

[UDO 10-30-4\(A\)\(1\)](#)

When developing an erosion and sedimentation control plan, it is recommended that the designer walk the site to be developed. This site visit can help to check for potential drainage features; note existing vegetation and cover; note any lakes, potential streams or wetlands; and check for existing erosion or drainage problems onsite. It is important to look downstream for potential impacts from development so that a plan can be made to prevent or mitigate these impacts.

To meet this basic control objective, it is necessary to:

- Identify any jurisdictional streams, buffers (County or State), or wetlands on or adjacent to the property(ies) being developed. Excavation below the water table for the installation of measures should not occur.
- Identify any proposed impacts to any of these features.
- Ensure that adequate erosion and sedimentation control measures are proposed to protect these features.
- Consider downstream receiving waters or ponds. Turbidity curtains or other measures may need to be specified for protection of these waters.

The erosion and sedimentation control plan should include:

- Pre- and post-development contours and drainage patterns
- Identification of sensitive or critical areas (streams, buffers, wetlands, etc.) and approvals for any proposed impacts provided. Buffers should be labeled with their type and width specified.
- Identification of areas of steep slope
- Soils data
- 401/404 permitting information and corresponding Stream and Wetland Impact Maps
- Adequate erosion and sedimentation control measures and/or stabilization techniques to protect these critical areas
- Plans for adequate access throughout the site, especially as related to temporary stream crossings and additional erosion and sediment control measures, details and/or construction sequences needed during construction around these sensitive areas

### 5.3.2 Limit Time of Exposure

All land disturbing activities must be planned and conducted to limit exposure to the shortest feasible time.  
[UDO 10-30-4\(A\)\(2\)](#)

Limiting the time that a disturbed area remains unstabilized and subject to accelerated erosion is an important factor in developing an adequate erosion and sedimentation control plan. Temporary or permanent stabilization is the key to limiting the time of exposure of bare areas subject to accelerated erosion.

Erosion and sedimentation control devices like basins and diversions should be stabilized immediately upon construction to avoid interior erosion of the measures which will require maintenance/rework and otherwise contribute to sedimentation. Steep slopes or areas which are difficult to reach may need special techniques specified to achieve stabilization.

To meet this basic control objective, it is necessary to:

- Plan work so that exposure of disturbed areas is kept to the shortest feasible time.
- Stabilize certain measures and areas below them immediately upon construction, and other areas within minimum specified timeframes.
- Utilize both temporary and permanent groundcover effectively to minimize the time that disturbed areas are exposed.
- Provide proper seed bed preparation and amendments to ensure adequate vegetative stabilization. Rolled erosion control products may be specified to assist with stabilization. Special care should be given to areas of steep slopes, which may benefit from more specific techniques like hydroseeding/mulching.
- Maximize work area efficiency through a detailed construction sequence.

The erosion and sedimentation control plan should include:

- Stabilization timeframes to meet County ([UDO 10-20-10\(B\)](#)) and State [NCG01 requirements](#)
- [Annotation of slopes to facilitate implementation of stabilization timeframes](#)
- A detailed construction sequence that includes any special vegetative considerations or techniques
- Requirements that sediment basins and diversion channels and the areas downgradient of these devices be stabilized immediately upon construction (rolled erosion control products should be specified as needed)
- Access road, parking and material laydown area proposed locations and stabilization
- Location(s) where mulch grindings from clearing and topsoil stockpiling will be located onsite and the plan for sediment control and groundcover for these stockpiles
- Method of seed bed preparation
- Seeding specifications, including seed type and rates (both temporary and permanent) and special provisions for any special areas, including steep slopes or riparian buffers, as needed.
- Amendment types and rates (lime, fertilizer, etc.)
- Mulch type and rates (including method of anchoring)

- Detailed sequencing and specifications for special stabilization methods such as hydroseeding, hydromulching, chemical soil stabilization, and use of native warm season grasses
- Specifications for temporary/permanent liners or rolled erosion control products as needed

### 5.3.3 Limit Exposed Areas

All land disturbing activities must be planned and conducted to minimize the size of area to be exposed at any one time. [UDO 10-30-4\(A\)\(3\)](#)

When designing a plan to protect against erosion and sedimentation, care should be taken to limit the size of area exposed and subject to accelerated erosion at any given time. A project should have a site-specific construction sequence and adequate phasing to address erosion and sedimentation control needs as the site is changing during development. Larger graded projects will benefit from phasing construction to limit the extent and duration of disturbed area open at one time to no more than 20 (in high quality water zones) to 50 acres. Linear projects should be planned to stabilize the disturbed area at the end of each workday or after a specified length of work (linear feet). Temporary stabilization is the key to limiting the exposed bare areas subject to accelerated erosion during active grading.

To meet this basic control objective, it is necessary to:

- Develop a site-specific construction sequence.
- Limit initial clearing and/or land disturbance to only the area necessary to install the initial permitted perimeter measures for the site (construction entrances, silt fence/silt fence outlets, sediment basins, diversion channels, etc.).
- Phase construction activities to limit the amount of area disturbed and unstabilized at any given time.
- Consider the minimum disturbance needed to balance cut and fill onsite.
- Consider preserving the topsoil onsite in a stockpile to facilitate better vegetation establishment.
- Consider selective clearing and specify that areas will not be cleared until ready to grade. If clearing onsite, it is strongly recommended to grind the material onsite and retain it for mulch to be used as groundcover.

The erosion and sedimentation control plan should include:

- A detailed, site-specific construction sequence, as described in Section 5.4 of this manual
- Phasing of larger projects which will limit the maximum amount of acreage disturbed at any one time without stabilization. This can be done with a flexible or “rolling” limit to specify a maximum area disturbed and unstabilized at any given time during the project. For example, a larger project may propose to limit disturbed areas to no more than 50 acres at any given time during construction.
  - Note: Uncovered areas in High Quality Water (HQW) zones must be limited at any time to a maximum total area of 20 acres within the boundaries of the tract. Reference [UDO 10-20-11](#). Only the portion of the land disturbing activity with an HQW zone is governed by this rule.
- For stage seeding, provide temporary stabilization along project perimeter to allow for additional area within the limits of disturbance to be graded.

### 5.3.4 Control Surface Water

Surface runoff originating upgrade of exposed areas must be controlled to reduce erosion and sediment loss during the period of exposure. [UDO 10-30-4\(A\)\(4\)](#)

Plans should be designed to control surface water and provide for its stable conveyance in both the temporary and permanent (final) condition.

To meet this basic control objective, it is necessary to:

- Divert offsite water around land disturbance via clean water diversions where possible.
- Ensure positive drainage to measures through all phases of construction.
- Consider early installation of culverts and storm drainage onsite.
- Specify stable conveyances of runoff for channels, slopes, and at transitions into basins.

The erosion and sedimentation control plan should include:

- Clean water diversions to divert clean water around areas of disturbance where possible, addressing immediate groundcover upon installation through use of rolled erosion control products, and non-erosive discharge for the outlets
- Positive drainage to treatment measures through all phases of construction
- Stable conveyance of runoff in channels and over slopes
- Stable conveyance of runoff to sedimentation control measures through temporary and permanent diversions or slope drains
- Stable transitions into basins (impermeable liners, riprap, slopes drains, etc.)
- Check dams as a velocity check in diversions
- Slope breaks as needed
- Permanent stormwater drainage facilities, including channels, swales, pipes, and culverts
- Berms located at top of slopes with slope drains for slopes greater than 10 ft in height

### 5.3.5 Control Sedimentation

All land disturbing activity must be planned and conducted to prevent offsite sedimentation damage.

[UDO 10-30-4\(A\)\(5\)](#)

The primary objective of the County and State erosion and sedimentation control regulations is to prevent offsite sedimentation damage to streams, other environmental features, and adjacent properties.

To meet this basic control objective, it is necessary to:

- Provide a site-specific construction sequence to guide work onsite, with particular attention given to onsite stream crossings and downstream lakes or natural watercourses, etc.
- Provide for adequate perimeter control measures and equipment access for their maintenance, repair, or replacement.
- Provide for treatment of silt-laden runoff as close to the source as practical.
- Select and locate measures as needed to provide treatment through all phases of construction based on drainage areas, soil types, slopes, etc.
- Minimize exposure and subsequent erosion.
- Install stable outlets to prevent erosive discharge from the site.
- Provide for decommissioning and dewatering of basins upon completion of construction.

The erosion and sedimentation control plan should include:

- Existing and proposed elevation contours, with major measures (including basins) shown tying into these contours
- Stable construction entrances/exits at all points where construction traffic will enter or exit the project
- Stable material laydown, staging and stockpile areas within the limits of disturbance. Plan should include notes for the Wake County Stockpile ([Wake County Stockpile Requirements](#))
- Properly designed erosion and sedimentation control measures to provide stable conveyance or runoff and treatment/storage through all phases of construction, with supporting calculations and drainage area maps. Design of measures shall conform to the standards specified in the [NC Erosion and Sedimentation Control Planning and Design Manual](#) or this manual, whichever is more stringent.
- Outlet protection to ensure non-erosive discharges
- Stable road shoulders and swales. Silt fence installation behind back of curb or anchored RECP adjacent this area. Stable lots if not active.
- Summaries of basic dimensions for erosion control measures (length, width, depth, side slopes, etc.) provided in tabular form on the plans
- Tables with basin measurements (required and proposed basin length, width, and depth, spillway length and depth, side slopes, Skimmer size and orifice dimensions,) and diversion channels (Bottom width, depth, side slopes, shear stress, groundcover proposed) Clear, consistent labels for all measures (ex: SB-1, TD-1, etc.)
- Additional measures (not just silt fence) below graded slopes that are more than 10 feet high
- Berms and slope drains to collect and convey runoff down slopes greater than 10 feet high

- Berms to route runoff to inlets (note that asphalt berms may be used in later phases of construction when roads have been installed).
  - Rolled earthen berms shall be provided and maintained immediately down gradient of the protected inlet until the roadway is stoned.
  - A road subbase berm shall be maintained until the road is paved.
  - A six-inch minimum height asphalt berm shall be maintained until the roadway surface receives its final coat.
- Inlet protection with excavated storage when treatment is still needed for an area
- Appropriate construction and maintenance details for all proposed measures. Wake County details should be used if available.
- A site-specific construction sequence addressing all phases of construction
- A multi-phased erosion and sediment control plan to address existing conditions, changes to the site during construction, and final grading conditions. More information on phasing requirements can be found in Section 5.4 of this manual. At a minimum, at least three phases will generally be required for an adequate erosion and sedimentation control plan:
  - The initial phase is for the installation of initial/perimeter ESC measures only, as well as the limited clearing/grubbing/disturbance associated with that installation.
  - The intermediate phase(s) will include measures for mass grading, infrastructure, roads, etc.
  - The final phase will be final grading conditions for development and stormwater management.
- Special sequencing and appropriate measures at stream crossings or other sensitive areas to include additional erosion and sediment control measures, details and/or construction sequences. Rock Ford crossings for temporary stream crossings are not allowed.
- Basin dewatering/decommissioning sequence to be used prior to removal or conversion to post-construction measures
- The use of flocculants and/or turbidity curtains when soil conditions warrant to reduce the amount of suspended sediments from the construction activity and impacts to adjacent freshwater bodies
- Detailed construction sequence for conversion of basins from temporary to permanent stormwater devices. Details shall include a landscape/planting plan for each device.

As previously noted, design and specification of all erosion and sedimentation control measures shall conform to the standards specified in the [NC Erosion and Sedimentation Control Planning and Design Manual](#) or this manual, whichever is more stringent. Listed below are some important requirements for proper design of certain commonly used measures that are often overlooked or missing from initial plan submittals.

### Construction Entrances



Construction entrances are often the most visible areas of a construction site to the public. Construction entrances provide an area where mud can be removed from tires prior to entering the public roadway. A well-maintained construction entrance reduces the amount of mud tracked off site, keeps roadways looking neat, improves public perception and complies with State and Wake County requirements.

- Construction entrances must be installed at every point where construction traffic leaves the site.
- When possible, the entrance should be located on level ground and at locations with appropriate sight distance.
- All surface water flowing off the construction entrance should be directed to a sediment control measure (ex: check dam within a roadside ditch) or directed away from the right of way.
- If the construction entrance crosses a depression (ex: a roadside ditch) a culvert pipe should be installed.
- Construction entrances within the NCDOT Right of Way require a temporary driveway permit from NCDOT.
- Construction entrances shall be installed in accordance with the Wake County construction details, including installation of geotextile fabric underlayment.
- Construction entrances should not be used for parking of vehicles or employees. Separate stabilized areas for equipment or vehicular parking should be provided within the limits of disturbance.
- The sides of the construction entrance may need to be blocked off onsite to prevent vehicles from cutting across the entrance.

**Silt Fence**



Silt fence is one of the most often used measures on a site, but there are several limitations to its use.

To function properly, silt fence should be:

- Placed along contours to capture sheet flow, with the ends of the fence tying into higher ground to prevent flow around the ends of the fence.
- Installed in accordance with the Wake County construction detail.
- Provided with excavated storage as needed for deposition and to prevent failure of the fencing.
- Provided with silt fence outlets as needed to provide relief and to prevent failure of the fencing.
- Located at least 5-10 feet beyond the toe of the slope to provide adequate storage area for sedimentation and to facilitate maintenance of the measure.
- Used below small, disturbed areas based on the slope and slope length in accordance with the specifications in the [NC Erosion and Sedimentation Control Planning and Design Manual](#) below:

| <b>Slope</b> | <b>Slope Length (ft)</b> | <b>Maximum Area (ft<sup>2</sup>)</b> |
|--------------|--------------------------|--------------------------------------|
| <2%          | 100                      | 10,000                               |
| 2 to 5%      | 75                       | 7,500                                |
| 5 to 10%     | 50                       | 5,000                                |
| 10 to 20%    | 25                       | 2,500                                |
| >20%         | 15                       | 1,500                                |

Note that installation of a double row of silt fence does not allow for additional drainage area to be captured by the fence. Super silt fence may be used as needed at the toe of slope to prevent sediment loss to buffers or water features.

Silt fence should never be specified or installed across streams, ditches, waterways, or other areas of concentrated flow. Silt fence may not be used alone below graded slopes greater than 10 feet in height.

**Sediment Basin Design**

Wake County sediment basin design and construction requirements are unique and County specific. The County requirements are more stringent and differ from the EPA, NCDEQ, and other municipalities. Federal guidelines require all sediment basins with 1 acre or more of drainage area to drain (dewater) from the top of the water column. Below are Wake County's minimum requirements for sizing the sediment basin and the associated weir (if utilized).

- The required volume of the sediment basin shall be calculated by 1,800 cf/acre of drainage area.
- The required surface area (sf) shall be calculated as  $435 \times Q_{10}$  for all types of sediment basins. A minimum c-value of 0.5 shall be used for areas draining to the basin.
  - Note that a 25-year design storm must be used for measures located in High Quality Waters and Falls Lake. Refer to section 5.3.5.1 of this manual, below, for specific design requirements for measures in these areas.
- The maximum depth allowed is 4 feet from the bottom of the basin to the weir.
- The minimum depth required is 2 feet from the bottom of the basin to the weir.
- The floor of all basins should be roughly level.
- Basins should be designed to dewater the required (not provided) volume in 3-5 days.
- The required (not provided) sediment basin volume shall be used to size the skimmer and orifice diameter.
- The minimum weir length is 10 feet.
- When using the weir equation,  $Q = C * L * H^{(3/2)}$ 
  - The maximum C shall be 3.0.
  - H for Q is not to exceed 0.5 feet.
  - An additional 1 foot of weir capacity is required for conveyance of larger storm events; therefore, the total weir depth will be 1.5 feet.

Use the [Wake County Hybrid Sediment Basin Design Spreadsheet](#) available on the web site. Calculations must be provided for skimmer sizing and drawdown, as well as for the sizing of the anti-flotation block of the permanent riser. Materials for the permanent riser shall be specified on the construction plan. Additional requirements for the sequencing of dewatering, decommissioning or conversion of sediment basins may be found in Section 5.7 of this manual.

### **Diversion Channels**

Diversion channels, both temporary and permanent, should be stabilized immediately upon construction to prevent interior erosion and sedimentation from the measures themselves. It is strongly recommended that rolled erosion control products be used as part of this stabilization. A temporary diversion shall be designed to convey no more than 5 acres of drainage area and its length shall be no longer than 3,000 linear feet. Care should be given to provide positive drainage and to show contours for diversions that cross drainageways.

Calculations for all diversions should be done for two conditions:

- “Temporary” bare earth condition: Both velocity and shear stress should be calculated for the peak flow from a 2-year storm event in a bare earth condition to determine whether a temporary liner is required. If this temporary condition results in a velocity over 2 ft/s, a temporary liner shall be specified.
- “Proposed” condition: Both velocity and shear stress should be calculated based on the proposed stabilization for the channel (grass, riprap, etc.) and the peak flow from a 10-year storm event (25-year storm event in High Quality Waters and Falls Lake Watershed). The plan designer must confirm that the proposed stabilization is adequate for both the velocity and shear stress.

### Temporary Stream Crossings

Stream crossings should be specified and given particular consideration when developing an adequate erosion control plan so that the stream or waterway is protected from sedimentation damage. The sequencing and details for stream crossings are critical elements to the success of a plan.

A few key considerations for stream crossings on the plan include:

- Crossings should be perpendicular to the stream.
- Prior to conducting work, ensure that all necessary materials for temporary stream crossing installation (including pipes, headwalls, etc.) are located onsite and ready for installation.
- A site-specific construction sequence should be shown on the plans with details to allow for successful completion of the activities at the stream crossings. At minimum it should address: erosion and sediment control device installation upstream of stream crossing area, damming of stream, 24-hr stream bypass, work area in dry conditions, temporary equipment crossings, and immediate groundcover of slopes.
- A coffer dam or other proposed dam should be installed upstream and downstream of the work area. Details should be included to allow for consistent installation.
- A method of stream bypass should be specified to divert stream flow around the work area and supporting calculations submitted. Supporting details and construction sequence of the stream bypass should be included in the plans, such as: good housekeeping to keep operation clean, dimensions, and rolled erosion control products.
- The work area should be addressed to allow for construction in dry conditions. Pumping of the work area to a stable discharge downstream of the crossing is typical.
- Adequate sediment storage and containment measures should be provided, i.e., the “Four Corners defense” which specifies sediment traps or basins at the corners of the crossing. Stable conveyance of runoff shall be provided to these containment measures.
- Silt fence should be specified over and around the top of any pipe(s)/culverts for the crossing and along the top of streambanks.
- Groundcover/stabilization should be provided immediately on the embankment. Rolled erosion control products should be specified for the slopes.
- If timber mats are specified for a stream crossing the plans should provide a detail that notes no gaps between boards, provides side rails, geotextile underlayment, and includes gravel approaches on both sides of the crossing.
- Rock fords are not allowed for a temporary equipment crossing of the stream.

**Inlet Protection**

- Inlet protection alone does not provide adequate treatment of sediment laden runoff. To be used as an effective treatment or containment device, excavated storage must be specified with the proposed inlet protection. This is often necessary when a project still has larger disturbed areas that are draining to inlets onsite in later phases of construction.
- A rolled earthen berm shall be provided and maintained immediately down gradient of the protected inlet until the roadway is stoned.
- A road subbase berm shall be maintained until the roadway is paved.
- A six-inch minimum height asphalt berm shall be maintained until the roadway surface receives its final coat.

Excavated storage at these inlet protections may be beneficial even if the inlets drain to a sediment basin. Additional benefits of excavated storage include reduced clogging and/or maintenance of the inlet protection, reduced maintenance for any sediment basins, and less sediment to flush from pipe systems before conversion of basins to final stormwater measures.

Excavated storage provided with inlet protection should be sized for a minimum of 1,800 cf/acre of drainage area.

#### *5.3.5.1 Specific Requirements for High Quality Water Zones and Falls Lake*

Measures for land-disturbing activities to be conducted in High Quality Water Zones and Falls Lake Watershed must be designed as follows:

- Uncovered areas in High Quality Water (HQW) zones must be limited at any time to a maximum total area of 20 acres within the boundaries of the tract.
- Erosion and sedimentation control measures, structures, and devices must be planned, designed, and constructed to provide protection from the runoff of the 25-year storm.
- Sediment basins within HQW zones must be designed and constructed so that the basin will have a settling efficiency of at least 70% for the 40-micron (0.04mm) size soil particle transported into the basin which produces the maximum peak rate of runoff. For the basins in HQW zones and Water Supply Watersheds, use the runoff of a 25-year storm.
- The angle for side slopes must be sufficient to restrain accelerated erosion. Side slopes shall be no steeper than two (2) horizontal to one (1) vertical if a vegetative cover is used for stabilization unless soil conditions permit a steeper slope or where the slopes are stabilized by using mechanical devices, structural devices, or other acceptable ditch liners.

### 5.3.6 Manage Stormwater Runoff

When the increase in the velocity of stormwater runoff resulting from a land-disturbing activity is sufficient to cause accelerated erosion of the receiving watercourse, plans must include measures to control the velocity at the point of discharge to minimize accelerated erosion of the site and increased sedimentation of the stream.

[UDO 10-30-4\(A\)\(6\)](#)

Plans shall be designed so that any increase in velocity of stormwater runoff resulting from the land disturbing activity will not result in accelerated erosion at the point of discharge from the site or in any receiving stormwater conveyance. Plans should include measures to prevent accelerated erosion within the project boundary and at the point of discharge.

To meet this basic control objective, it is necessary to:

- Identify and evaluate all points of discharge from the project, including discharges to any environmental features which may be present within the site such as streams.
- If a permanent stormwater control exceeds management of the ten year storm, the corresponding erosion control plan should meet the same design requirement. For example, if the 25 year storm or greater is required for stormwater design, then the erosion control plan shall be designed for a 25 year storm or greater. Management of the 25-year storm for temporary erosion and sediment control measures is required for developments in the Falls Lake Watershed, Swift Creek Watershed and areas of High-Quality Waters.

The erosion and sedimentation control plan should include:

- Identification of all points of discharge from the project
- Calculations to demonstrate that discharges from the project are non-erosive for the 10-year storm event (or 25-year storm event in landfills, High Quality Waters and Wake County Water Supply Watersheds)
- Adequately designed measures (temporary or permanent) as needed to prevent erosive velocities from the project, including discharges to any streams or other environmental features internal to the site.
- A Table with dimensions for energy dissipators (length, width, depth, NCDOT stone size and stone depth)

## 5.4 Construction Sequence and Phasing

All land disturbing activities shall be planned and conducted to prevent erosion, which may result in sedimentation damage to streams, waterways, buffers, or adjacent properties. To accomplish this, erosion and sedimentation control plans must address the changing nature of construction activities and identify the necessary measures throughout multiple phases of construction. The number of phases required for a project will be site-specific and based on the complexity and/or sequencing of the site development.

Each project shall also have a site-specific construction sequence, with specific sequences tied to each phase and its plan sheet(s).

### 5.4.1 Certificate of Compliance Phase

The first phase of any erosion and sedimentation control plan shall be the installation of perimeter measures required to obtain a Certificate of Compliance from the Wake County field consultant. Clearing and land disturbance shall be limited only to those areas necessary to install these initial measures. Examples of initial perimeter measures include, but are not limited to, silt fence, silt fence outlets, construction entrance(s), basins, diversion ditches, and check dams.

The limits of disturbance shown in this first phase of construction shall be limited to the area necessary for installation of these measures and any upgradient areas of the site that will need to bypass site E&SC measures.

The construction sequence for this first phase of construction shall include, but is not limited to:

- Obtain NCG01 (Construction Stormwater) coverage from NCDEQ and upload a copy of the Certificate of Coverage to the land disturbance permit on Wake County's Permit Portal.
- Schedule a preconstruction meeting with the Environmental Consultant.
- Ensure that all necessary materials for initial measure installation (including risers, skimmers, etc.) are available and ready for installation onsite.
- Pay any outstanding land disturbing permit fees and obtain the land disturbing permit.
- Install construction entrance(s), silt fence, sediment basins, temporary diversions, or other measures shown on the Certificate of Compliance (initial) phase of the approved plan. Clear only as necessary to install these measures. Stabilize all temporary diversions, berms, and basins, and the bare areas downstream of these devices immediately upon construction.
- Call the Environmental Consultant for an onsite inspection to obtain a Certificate of Compliance. This step should be the last item on the construction sequence for this initial phase of the erosion control plan.

The dimensions and stabilization requirements for these erosion and sediment control devices should be shown on the same drawing as the construction sequence for this initial phase.

This Certificate of Compliance Inspection is required to ensure that the initial erosion and sedimentation control measures have been installed per the plans prior to larger disturbances (or mass grading) on the project.

### 5.4.2 Intermediate Phases

Projects must provide adequate intermediate phasing to address evolving construction activities. When developing the phases of an erosion control plan, the design engineer shall consider and address changes to the site during the construction process, both in topography and development/construction activities. Some of these intermediate phasing activities include, but are not limited to, bypass of off-site and on-site water, stream crossings, rough grading of the site, installation of infrastructure, fine grading, and installation of pavement and buildings.

Intermediate phasing and the associated construction sequencing may also need to address the relocation or resizing of specific erosion control measures. Additional as-needed E&SC measures may be added to the plans during intermediate phasing, including but not limited to, inlet protection, slope drains, basins, silt fence, silt fence outlets, etc.

The construction sequence for intermediate phases of the erosion control plan will be highly site specific. At a minimum, the following items must be addressed:

- Begin clearing and grubbing the site. Provide and maintain positive drainage to erosion and sedimentation control measures.
- Rough grade site.
- Relocate or resize specific erosion control measures as needed.
- Install storm sewer (if applicable) and protect inlets with inlet protection, with or without excavated storage, or other approved measures as shown on the plan.
- Begin vertical construction, building, etc.
- Stabilize site as areas are brought up to final grade with vegetation, paving, ditch linings, etc. Seed and mulch denuded areas per required ground stabilization time frames. The County recommends temporary stabilization of at least the first 30 feet interior to the exterior silt fence.
- Excess soil to be exported offsite shall be taken to a site with an approved sediment and erosion control plan and be a permitted facility. Provide name and address of the permitted facility to the Environmental Consultant and Watershed Manager at least 2 weeks prior to beginning the export operation.

If the erosion control plan for a residential subdivision is intended to cover all individual lot construction (not just roads and common elements), then one phase of construction should be the individual lot development with appropriate lot details provided to contain sediment on individual lots.

### 5.4.3 Final Phase

The final phase of an erosion and sedimentation control plan should include conversion of any temporary measures into post-construction stormwater control measures (SCMs) as well as permanent stabilization of the site.

No conversion or removal of erosion control measures to SCMs shall occur without the approval of the Wake County field consultant. E&SC plans shall address conversion of devices within the construction sequence - refer to the required conversion sequence in Section 5.7 of this manual.

The construction sequence for the final phase of construction shall include conversion of any measures onsite to their permanent forms, provision of any information or certifications required prior to final close out of permits and/or Certificate of Occupancy, and final stabilization of the site.

Steps in the final phase of the erosion control plan sequence include but are not limited to:

- When construction is complete and all areas are permanently stabilized, the Environmental Consultant should be called to perform a site inspection.
  - Where grass is used to meet stabilization requirements, permanent groundcover must be applied over 100% of the disturbed area. Permanent stabilization will be considered achieved when 80% density of the permanent groundcover is established with no evidence of large bare patches or erosion.
- If the Environmental Consultant provides approval, remove all temporary erosion control measures, and permanently stabilize any resulting bare areas. Include the basin removal/conversion sequence from Section 5.7 of this manual.
- All remaining permanent erosion control devices, such as velocity dissipators, should now be installed. Submit required certifications and documentation to satisfy conditions of any stormwater or flood permit approval, including:
  - as-built certifications for all post-construction proposed stormwater control measures
  - as-built impervious surveys (if required to verify that development is within its maximum impervious limitation)
  - as-built drawings and certification for any work requiring a flood study (ex: road or driveway crossings)
  - elevation certificates, if required by a flood certification permit
  - floodproofing certification, if required by a flood certification permit
- Once permanent vegetation has been established and all conditions of approval for any stormwater or flood permits have been met, the Environmental Consultant should be called to perform a final site inspection and issue the Certificate of Completion.

## 5.5 Stockpile Requirements

Proposed stockpile footprints must be shown on the erosion and sediment control plan with a 25-foot maintenance and access area surrounding them. Silt fence with silt fence outlets or other perimeter erosion and sediment control measures should be placed downslope of the stockpile on the erosion and sediment control plan and in the field. The following sets of notes should be included in the erosion and sediment control plan:

### **Design Criteria**

1. A 25-foot temporary maintenance and access area shall be shown around all proposed stockpiles (erosion control measures surrounding the stockpile shall be shown at the outer limit of this area).
2. Stockpile footprints shall be setback a minimum of 25' from adjacent property lines.
3. A note shall be provided on the approved plan that stockpile height shall not exceed 35 feet.
4. Stockpile slopes shall be 2:1 or flatter.
5. Approved BMPs shall be shown on a plan to control any potential sediment loss from a stockpile.
6. Stockpiling materials adjacent to a ditch, drainageway, watercourse, wetland, stream buffer, or other body of water shall be avoided unless an alternative location is demonstrated to be unavailable.
7. Any concentrated flow likely to affect the stockpile shall be diverted to an approved BMP.
8. Off-site spoil or borrow areas must follow the Wake County UDO and State Regulations. ***All spoil areas over an acre are required to have an approved sediment control plan.*** Developer/Contractor shall notify Wake County of any offsite disposal of soil, prior to disposal. Fill of FEMA Floodways and Non-encroachment Areas are prohibited except as otherwise provided by subsection [14-19-2](#) of the Wake County Unified Development Ordinance (certifications and permits required).

### **Maintenance Requirements to be Noted on the Erosion and Sediment Control Plan**

1. Seeding or covering stockpiles with tarps or mulch is required and will reduce erosion problems. Tarps should be keyed in at the top of the slope to keep water from running underneath the plastic.
2. If a stockpile is to remain for future use after the project is complete (builders, etc.), the financial responsible party must notify Wake County of a new responsible party for that stockpile.
3. The approved plan shall provide for the use of staged seeding and mulching on a continual basis while the stockpile is in use.
4. Establish and maintain a vegetative buffer at the toe of the slope (where practical).

## 5.6 Seeding Specifications

Temporary and permanent seeding specifications should be included in the erosion and sediment control plan. Proper seedbed preparation is the key to establishing temporary and permanent ground cover. The following seedbed preparation and temporary and permanent seeding schedule, or equivalent alternative, should be included in the erosion and sediment control plan.

### **Seedbed Preparation**

1. Chisel compacted areas and spread topsoil three inches deep over adverse soil conditions, if available.
2. Rip the entire area to six inches deep.
3. Provide site topsoil from stockpile retained earlier in construction.
4. Remove all loose rock, roots, and other obstructions, leaving surface reasonably smooth and uniform.
5. Apply agricultural lime, fertilizer, and superphosphate uniformly and mix with soil (see mixture below).
6. Continue tillage until a well-pulverized, firm, reasonably uniform seedbed is prepared four to six inches deep.
7. Seed on a freshly prepared seedbed and cover seed lightly with seeding equipment or cultipack after seeding.
8. Mulch area uniformly at a 2 ton/acre rate of small grain straw or 3 ton/acre rate of hay immediately after seeding. Anchor mulch per rate specified in plan or North Carolina Erosion & Sediment Control Planning & Design Manual.
9. The use of anchored rolled erosion control products (RECPs) or matting is acceptable. Note that RECPs that have little to no straw or mulch material should be removed and not utilized onsite. The RECPs used should be consistent with a 2 ton/acre rate of small grain straw. In HQWs, asphalt is not recommended as a binding agent, use an approved hydraulically applied binding agent (NCDOT 4.9.2).
10. Inspect all seeded areas and make necessary repairs or reseedings within the planting season, if possible. If stand should be more than 60% damaged, reestablish following the original lime, fertilizer and seeding rates.
11. Management of the stand of vegetation based on soil conditions and weather will allow for quicker and denser establishment. Note that grasses or legumes may need to be mowed to facilitate a stand of permanent vegetation.
12. Consult Wake County Soil & Water Conservation District or NC State Cooperative Extension on maintenance treatment and fertilization after permanent cover is established.

**Amendment Mixture**

Agricultural Limestone: 2 tons/acre (3 tons/acre in clay soils)

Fertilizer: 1,000 lbs/acre – 10-10-10

Superphosphate 500 lbs/acre – 20% analysis

Mulch: 2 tons/acre – small grain straw

Anchor: Asphalt emulsion at 400 gals/acre

**Seeding Schedule - For Shoulders, Side Ditches, Slopes (Max 3:1):**

| Date                   | Type  | Planting Rate  |
|------------------------|---|--|
| August 15 – November 1 | Tall Fescue   | 300 lbs/acre   |
| November 1 – March 1   | Tall Fescue & Abruzzi Rye                                   | 300 lbs/acre   |
| March 1 – April 15     | Tall Fescue   | 300 lbs/acre   |
| April 15 – June 30     | Hulled Common Bermudagrass                                  | 25 lbs/acre  |
| July 1 – August 15     | Tall Fescue and Browntop Millet or Sorghum-Sudan Hybrids*** | 125 lbs/acre (Tall Fescue); 35 lbs/acre (Browntop Millet); 30 lbs/acre (Sorghum-Sudan Hybrids) |

**Seeding Schedule - For Shoulders, Side Ditches, Slopes (3:1 to 2:1):**

| Date                  | Type  | Planting Rate  |
|-----------------------|---|--|
| March 1– June 1       | Sericea Lespedeza (scarified) and use the following combinations: | 50 lbs/acre (Sericea Lespedeza)  |
| March 1 – April 15    | Add Tall Fescue   | 120 lbs/acre   |
| March 1– June 30      | Or add Weeping Love Grass   | 10 lbs/acre  |
| March 1– June 30      | Or add Hulled Common Bermudagrass                                 | 25 lbs/acre  |
| June 1– September 1   | Tall Fescue and Browntop Mullet or Sorghum-Sudan Hybrids***       | 120 lbs/acre (Tall Fescue); 35 lbs/acre (Browntop Mullet); 30 lbs/acre (Sorghum-Sudan Hybrids) |
| September 1 – March 1 | Sericea Lespedeza (unhulled – unscarified) and Tall Fescue        | 70 lbs/acre (Sericea Lespedeza); 120 lbs/acre (Tall Fescue)                                    |
| November 1 – March 1  | and Abruzzi Rye   | 25 lbs/acre  |

Consult the Wake County Soil & Water Conservation District or the NC State Cooperative Extension for additional information concerning other alternatives for vegetation of denuded areas. The above vegetation rates are those that do well under local conditions; other seeding rate combinations are possible.

**Temporary Seeding Schedule:** Reseed according to optimum season for desired permanent vegetation. Do not allow temporary cover to grow more than 12" in height before mowing; otherwise, fescue may be shaded out.

Permanent stabilization of disturbed areas shall be required prior to close out of any land disturbance permit, and may be achieved by one or more of the following methods:

**Grass**

- Where grass is used to meet stabilization requirements, permanent groundcover must be applied to over 100% of the disturbed area.
- Permanent stabilization will be considered achieved when 80% density of the permanent groundcover is established with no evidence of large bare patches or erosion. Annual rye is NOT a permanent groundcover.

**Sod**

- Sod should be laid across the slope working from the bottom to the top of a slope
- Sod strips should be placed so that there is snug, even joints. Joints should be staggered to prevent gaps or voids which may allow roots to dry out or be more susceptible to erosion.
- Roll or tamp sod immediately after placement to ensure that there is solid contact between the sod and the ground.
- On steep slopes, sod may need to be stapled to the surface of the soil.
- Sod should be watered immediately once secured, and regularly as needed to ensure sod grows.
- Sod should not be applied to compacted soil. Till the soil below sod placement.

**Mulch**

- Triple shredded hardwood mulch may be applied at a minimum depth of 6 inches to achieve permanent stabilization on level areas.

**Impervious surface**

- Impervious surface such as gravel, rip rap, asphalt, etc. may be used for permanent stabilization. All such impervious surfaces must be permitted appropriately.

## 5.7 Basin Removal Sequence

The following Sediment Basin Removal and Conversion Sequence should be included in the erosion and sediment control plan:

1. Schedule a site meeting with the Environmental Consultant to determine if a basin can be removed. Install silt fencing or other temporary erosion control measures as needed prior to removal of the basin.
2. Contact the NCDEQ – Raleigh Regional Office at (919) 791-4200 to determine the Division of Energy, Mineral and Land Resources contact person to receive dewatering notifications. At least 10 days prior to beginning dewatering activity, send an email to the NCDEQ-DEMLR contact person and copy the Environmental Consultant that met you onsite. The email should include: E&SC Jurisdiction: Wake County, Wake County Project: Name, Number, and Location (city/town), Environmental Consultant Name, and address the following: a) Reason for conversion, b) Basin #, c) Dewatering method, and d) all other necessary info from Part II, Section G, Item 4 of the NCG01. Keep a copy of this email for your NPDES monitoring documentation.
3. After receiving positive confirmation from NCDEQ-DEMLR, you may remove the basin OR on  $\geq$  Day 11, whichever is sooner. Look for a forecasted pattern of dry weather of 3 - 5 days before beginning basin removal. Using a floating intake, begin pumping operation and take into account any additional requirements per NCDEQ email notification. Remove Basin(s) and associated temporary diversion ditches. If pipes need to be extended, perform this operation at this time. Fine grade the area in preparation for seeding.
4. Perform seedbed preparation, then seed, mulch, and anchor any resulting bare areas immediately.
5. Install velocity dissipators and/or level spreaders as required on the Erosion Control Plan.
6. When the site is fully stabilized, call the Environmental Consultant for approval to remove the remaining temporary erosion control measures and advice on when the site can be issued a Certificate of Completion. Note: A meeting should also be scheduled with the Environmental Consultant to determine when a basin may be converted for stormwater use. Some municipalities may also require this.

## 5.8 Standard Details

Wake County has developed a set of standard drawings for commonly specified sedimentation and erosion control measures which may be downloaded from County's web site [here](#).

If there is no Wake County standard detail for a particular measure being proposed, details from the following may be used with County approval:

- NCDOT construction and maintenance details
- NCDEQ Division of Energy, Mineral and Land Resources (DEMLR) construction and maintenance details
- Construction and maintenance details from another local delegated erosion and sedimentation control program within North Carolina.

Customized, site-specific details may also be necessary depending on the features (i.e., environmental features, topography, etc.) of the development site and could be allowed with County approval.

## Chapter 6 – Flood Hazard Areas

The responsibility for reducing flood losses is shared by all units of government—Local, State, and Federal— and the private sector. To fulfill this responsibility, landowners and/or professionals planning any “development” activity within the flood hazard areas should have the knowledge and skills to plan, design, and construct their project in compliance with flood hazard regulations.

For purposes of flood hazard areas management, “development” means any man-made change to improved and unimproved real estate, including, but not limited to, buildings or other structures, mining, dredging, filling, grading, paving, excavating, or drilling operations. Good management of flood hazard areas begins with an effective set of regulations that have as their ultimate goal to effectively promote public health, safety, and general welfare and minimize losses to life and property due to flood conditions. This should result in a safe and viable community, while providing for lower flood insurance premiums for policyholders.

Wake County seeks to promote public health, safety, and general welfare and to minimize public and private losses due to flood conditions within flood prone areas by implementing the ordinance provisions of UDO [Article 14](#) designed to:

- Restrict or prohibit uses that are dangerous to health, safety, and property due to water or erosion hazards or that result in damaging increases in erosion, flood heights or velocities;
- Require that uses vulnerable to floods, including facilities that serve such uses, be protected against flood damage at the time of initial construction;
- Control the alteration of natural floodplains, stream channels and natural protective barriers, which are involved in the accommodation of flood waters;
- Control filling, grading, dredging and all other development that may increase erosion or flood damage; and
- Prevent or regulate the construction of flood barriers that will unnaturally divert flood waters or that may increase flood hazards to other lands.

The current floodplain ordinance was adopted by the Board of Commissioners on May 19, 2003 through RESOLUTION R-2003-29:

INTRODUCING AN ORDINANCE AMENDING THE WAKE COUNTY ZONING ORDINANCE  
TO ADDRESS FLOOD HAZARD AREAS

WHEREAS limiting development in the floodplain minimizes the amount of property damage that will occur during storms and protects lives; and

WHEREAS undeveloped floodplains filter sediment and other pollutants and help protect water quality; and

WHEREAS the Wake County Watershed Management Plan recommends that county regulations be revised to prohibit development and filling in the 100-year floodplain;

The Board unanimously adopted an amendment to the Wake County Zoning Ordinance prohibiting development and fill within the 100-year floodplain.

## 6.1 Exceeding FEMA Minimum Standards

Wake County enforces flood protection with higher standards than those required by the State and Federal ordinances.

The flood hazard areas regulations for Wake County exceed the FEMA minimum floodplain management standards to reduce the vulnerability due to flood events that will occur in the future. Adoption of these higher standards will reduce the risk of loss of life and decrease the amount of damage in future floods. The existence of these higher standards has also provided for reduced flood insurance premiums for all policy holders in the community.

The general factors for exceeding the FEMA minimum Floodplain requirements include:

- Elevate structures (FFE) to at least the Regulatory Flood Protection Elevation; 1 foot above BFE is recommended for properties adjacent to FEMA food zones (State Model Ordinance recommends 2-4 feet above BFE)
- Elevate structures (FFE) 1 foot above flood hazard contour for Flood Soils; 2 feet above highest adjacent grade as needed
- Fill in the special flood hazard area is prohibited
- CFM certifications for staff
- Restrict development in flood hazard soils
- Require Flood elevation certificates for structures near flood hazard areas
- Require 100-year backwater elevations be shown on plans
- Require 100-year backwater easements for encroachments

In addition, Wake County has several standards to minimize flooding and protecting flood hazard areas, such as:

- Limiting residential built upon area based on zoning (6% to 30% per UDO)
- Requiring volume control for all new subdivisions
- Requiring a Downstream Impact Analysis as part of a Stormwater Management Permit
- Requiring impoundments retained within subdivisions be constructed or upgraded to accommodate and safely pass the 100-year storm and require jurisdictional determination. See Article 14 of Wake County UDO.
- Enforcing Neuse River Riparian Buffers County-wide
- Purchasing of floodplains for open space protection by the County
- Preserving natural, undisturbed vegetation within water supply watershed areas with additional buffer requirements

## 6.2 Flood Hazard Areas

Wake County currently regulates two primary types of flood hazard areas: FEMA Flood Zones (Special Flood Hazard Areas) identified on Digital Flood Insurance Rate Maps provided by the National Flood Insurance Program arm of the Federal Emergency Management Agency (FEMA) and Flood Hazard Soils Areas identified in "The Soil Survey, Wake County, North Carolina". Wake County also has development requirements for other flood hazard sources. Any development within these areas is subject to the standards of this chapter.

### 6.2.1 FEMA Flood Zones

The FEMA Flood Zones is often referred to as the floodplain, a land area susceptible to being inundated by water from the base flood. The FEMA Flood Zones consist of the floodway or non-encroachment area and the floodway fringe. FEMA employs a “floodway” concept for detail studied streams to regulate development within a specified distance to the creek centerline. This method employs engineering modeling which sets the location of FEMA floodway encroachment lines on both sides of the stream. On streams that have a Limited Detail Study a non-encroachment area is defined that is regulated the same as a floodway on a stream with a Detail Study ([National Flood Insurance Program](#)). FEMA mapping includes only areas with a contributing drainage area of a least one square mile (640 acres). The current FEMA maps were adopted July 19, 2022. There are 260 panels in Wake County. See Figure 6.3.1. For the most current panel, go to the Effective Index Map at the [NC FRIS website](#).

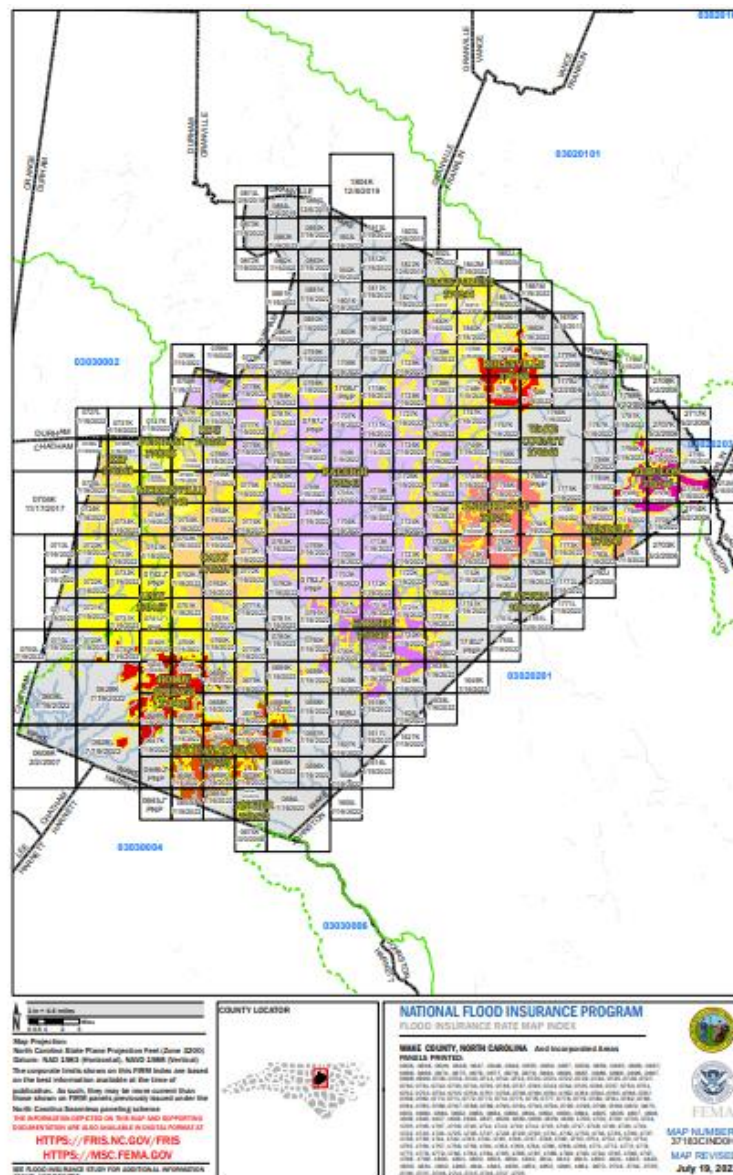


Figure 6.3.1 Wake County NFIP Map Panels

### 6.2.2 Flood Hazard Soils

Flood hazard soils are those soils with the characteristic of flooding, or the temporary inundation of an area caused by overflowing streams or by runoff from adjacent slopes, as indicated in the Soil Survey of Wake County and the Web Soil Survey. Wake County regulates those areas specified as flood hazard soils as having severe limitations for sites due to the risk of flooding. Best available information is used in reviewing plans.

Flood hazard soil boundaries may be modified by field investigation by a North Carolina licensed soil scientist. The report of the field investigation must conclude with a description of the actual soil horizons which were encountered on the site. These soils must be placed in a soil complex or major soil association as prescribed by the standards and guidelines of the American Registry of Certified Professionals in Agronomy, Crops, and Soils, or the checklist of the Department of Environmental Services (see 6.4.3 Development Located in Flood Hazard Soils for list to re-delineate the flood hazard area). Alternatively, a North Carolina licensed surveyor may survey and seal the extent of flood hazard soils adjusted for topography, either as determined by a soil scientist or as verified from the published Wake County Soil Survey Map. A Flood Study may be used in lieu of a soil scientist at the discretion of the Watershed Management staff. More guidance on flood hazard soils may be found in UDO Article 14.

The 1970 Soil Survey must be used for buffer delineation. Revised soils maps have been provided through the Web Soil Survey (WSS). North Carolina participated in the National Cooperative Soil Survey by providing technical support in Wake County update. Approximately 185,000 acres of the survey (or 35% of the county) has been re-mapped to represent the soil types and changes more accurately in land use. The mapping has been updated using ArcGIS supported by data collection in the field and data analysis.

Wake County has added the Web Soil Survey (WSS) soils layer to internal iMAPS is using the more restrictive of the soils layers (1970 or web soil survey) in evaluating permits. Soil studies with borings to accurately map soils on a project site are accepted for staff review and approval.

### 6.2.3 Impoundments and Dams

Dams are owned and operated by individuals, private and public organizations, and various levels of government. The responsibility for operating and maintaining a safe dam rests with the owner(s). The North Carolina Dam Safety Law of 1967 defines a dam as “a structure and appurtenant works erected to impound or divert water.” Maintaining a safe dam is a key element in preventing failure and limiting the liability that an owner could face. Owners can be fiscally and criminally liable for any failure of a dam and all damages resulting from its failure. Any uncontrolled release of the reservoir, whether the result of an intentional release or dam failure, can have devastating effects on persons, property, and the environment.

Dams are classified to identify their potential hazard by North Carolina Dam Safety. Owners of High and Intermediate Hazard dams are required to prepare and update annually Emergency Action Plans. Plans shall be submitted to the North Carolina Dam Safety Program.

Dams created for erosion control and stormwater measures may be subject to the NC Dam Safety Act. Construction plans shall be submitted to the State for a jurisdictional review. Any construction, repair, alteration, or removal of a jurisdictional dam shall obtain approval from appropriate jurisdictional authorities. Impoundments retained or constructed in subdivisions are required to accommodate the 100-year, 24-hour storm event. Minor and minor-limited subdivisions have the option of obtaining jurisdictional determination/hazard classification from the North Carolina Dam Safety Program in place upgrading impoundments to meet the 100-year, 24-hour storm event. If applicable, the provided dam state identification number must be recorded on the subdivision plat along with a note regarding responsibility for dam maintenance and repair.

Construction below dams is reviewed as a flood hazard and is discouraged. Additional analyses may be requested on a case-by-case basis to identify hazard areas and set finished floor elevations. Data shall be submitted to the State Dam Safety office for review.

#### 6.2.4 Other Potential Flood Hazards

In addition to restricting development from FEMA mapped areas and areas of flood hazard soils, Wake identifies and restricts development in other high hazard areas. These include areas below high hazard dams, adjacent to water features (buffered and non-buffered), backwater areas from culverts, and stormwater devices and other site-specific features that may increase flood potential. Drainage basins that have a contributing drainage area of 640 acres or greater may require a study to identify flood hazards. The County requires these items to be noted on record plats and submitted development plans. Lots that are wholly or substantially in a flood hazard area may not be considered for Minor Subdivisions per Wake County UDO Article 19-32-2(f).

## 6.3 Permitting

As a participant in the National Flood Insurance Program, Wake County is required by FEMA to regulate development within FEMA flood zones. Any allowable development within flood hazard areas must comply with applicable regulations and procedures. Development is defined as “any man-made change to improved or unimproved real estate, including, but not limited to, buildings or other structures, mining, dredging, filling, grading, paving, excavation or drilling operations, or storage of equipment or materials.”

Any activity in the flood hazard areas that goes beyond routine maintenance, gardening, and farming requires Watershed Management approval prior to beginning to work. Passive land use activities, typically on-going and routine in nature are allowable uses without a permit. The following section contains a list of activities allowable without a permit provide the uses and/or activities in the flood hazard areas will not alter the topography and drainage by construction, increase the base flood elevation and does not involve development. Even though a project may not require a flood permit, additional permits may be required from per UDO Article 19-42 Permits.

### 6.3.1 Uses Allowed Without a Flood Permit

The following uses are allowed within a special flood hazard areas without a permit provided the existing topography and drainage is not altered by construction, the level of the base flood is not increased, and the use does not involve any man-made change to improved or unimproved real estate (including, but not limited to, buildings or other structures, mining, dredging, filling, grading, paving, excavation, drilling operations, or storage of equipment or materials):

- General farming, pasture, outdoor plant nurseries, horticulture, forestry, wildlife sanctuary, game farm, and other similar agricultural, wildlife and related uses;
- Ground level loading areas, parking areas, rotary aircraft ports and other similar ground level area uses;
- Lawns, gardens, play areas, and similar uses; and
- Golf courses, tennis courts, driving ranges, archery ranges, picnic grounds, parks, hiking or horseback riding trails, open space and other similar private and public recreational uses.

Permits are required for all other projects that do not meet the requirements of those listed in Uses Allowed Without a Flood Permit. Residential projects are reviewed through the building permit review process. Non-residential projects are subject to review by the Floodplain Administrator and may require a Floodplain Encroachment Permit.

### 6.3.2 Building Permits and Flood Hazard Areas Review

The North Carolina Building Code establishes minimum regulations to govern the construction and maintenance of buildings and structures and is adopted and maintained by the Building Code Council. Additional building requirements can be found in Article 5 – Lot and Building Standards of the Wake County UDO. All buildings or structures in the special flood hazard area must comply with all applicable requirements in the NC Building Code. Please note that the NC Building Code does not supersede the requirements of the special flood hazard areas, as some requirements may be more restrictive.

Construction of new buildings and structures adjacent to or within flood hazard areas require flood permitting. Any proposed new buildings and structures on a lot that has flood hazard areas on the property will be required to have a Flood Certification review for compliance with the flood hazard areas regulations as part of the building permitting process. UDO Article 14-14-2 outline items that should accompany the building permit application. In most cases, additional information is not necessary, and the building permit will not be delayed from being issued. In other cases, survey information or a separate Flood Permit is necessary to ensure compliance with the flood hazard areas regulations.

The typical steps for permitting residential structures within the flood hazard areas on the property can be found in Section 4.4. Non-residential and utility projects with flood encroachment that do not cause an increase in flood levels such as underground utilities and power pole replacements shall apply through the Permit Portal for a Flood Encroachment Permit. Additional information such as a site plan and/or No Rise Certification may be required. If the utility project causes a change in base flood elevations, then a flood study will be required. Applicants shall contact the Floodplain Administrator for direction.

### 6.3.3 Flood Hazard Elevation Certification

The Flood Hazard Elevation Certificate is an important administrative tool for Wake County. It is to be used to provide elevation information necessary to ensure compliance with Wake County's Unified Development Ordinance. A Flood Hazard Elevation Certificate may be required if any development activity has been proposed for property located in areas of flood hazard areas. All Flood Certifications must be performed by a North Carolina licensed Land Surveyor and reviewed by Wake County Watershed Management Staff.

#### **Development Located Within 100 Feet of Flood Hazard Areas**

If structures are located within 100 feet of a flood hazard area, the Professional Land Surveyor may need to complete pre-construction Flood Hazard Elevation Certification Form prior to construction to verify the structure is located outside of the flood hazard area. Inspections and permits may be placed on hold until the pre-construction certification form is received. A post-construction Flood Hazard Elevation Certificate Form will be required to verify the structure is not within the flood hazard area. The post-construction form is required prior to receiving the Certificate of Occupancy.

#### **Development Located Within Flood Hazard Soil**

If structures or fill are to be placed within the limits of flood hazard soils and have a drainage area of five or more acres, there are two options available: re-delineation of flood hazard soil boundary or completion of a flood study to determine the flood boundary and set the base flood elevation.

To re-delineate the flood hazard area, a Licensed Soil Scientist may modify flood hazard soil boundaries by means of field investigation. The report must include a narrative of how the soil evaluations were conducted, method of sampling, and profile/pedon descriptions of major soil series (indicate dominant soil series or complex of soil series). Soils are to be described in accordance with the Field Book for Describing and Sampling Soils, reference USDA-NRCS. Information supporting the field investigation is to include a map to scale with legend, which delineating soils limits per the Wake County Soil Survey, location of soil borings/samples, and the re-delineated soil series areas. Re-delineation of soil areas is also to be supported by field flagging.

When the flood hazard area has been re-delineated, The Professional Land Surveyor should record a new plat to document the revised flood hazard condition.

Where flood soils are associated with wetlands rather than riverine conditions, modeling may not be an option to remove the flood soils. Proposed construction activity may require wetland delineations, soil surveys to determine depth to water table, etc. Fill placed in these areas may be subject to 401/404 permitting and would require a flood study to determine the impact of fill on adjacent properties. Construction in these areas is not recommended. Protection as open space should be considered.

### 6.3.4 Flood Studies

A flood study must be performed if the proposed construction activity involves a roadway, driveway and/or other encroachments into or through Wake County Flood hazard soils, FEMA floodplain or other areas identified as flood hazards.

Minor subdivisions with proposed road crossing of flood hazard areas, shall submit for flood study permit prior to plat approval. Flood backwater areas shall be delineated on the plat as BFE plus one foot. Regular subdivisions with proposed road crossings or share driveways crossing flood hazard areas, shall submit for flood study permit prior to construction plan approval. Stormwater devices are allowed in flood hazard areas on a case-by-case basis and will require flood study permit approval. See the SCM section for restrictions on device types.

A flood study must show compliance with Article 14 of the Wake County Unified Development Ordinance and accomplish the following:

1. Ensure flood depths are not increased on neighboring properties. Off-site easements may be required as needed to document and establish MFFE.
2. Ensure the lowest building level is built above the 1% annual chance flood elevation (MFFE shall be recorded on adjacent lots).
3. The 100-year backwater elevation shall be defined and recorded on the subdivision plat.
4. Determine if flood waters will top the foundation pilings/piers under the house during the 1% annual chance storm and required freeboard; provide a minimum of one (1) foot of vertical freeboard for flood hazard soils and two (2) feet of vertical freeboard as by recommendation from FEMA. If the foundation will be topped by floodwaters (i.e., natural ground elevation at the building site is below the 1% annual chance flood elevation), a special foundation design is required. The foundation must be designed to withstand the various forces it will be subjected to during the 1% annual chance storm event.
5. Public roads may not be overtopped; private roads and driveways may not be overtopped by more than six inches during the 1% annual chance event.
6. An as built survey is required for each approved flood crossing. Building permits may be required for bridges.

A flood study must be performed by a Professional Engineer and reviewed by Wake County Watershed Management Staff. Applicants shall apply for a permit through the Permit Portal and select "Flood Study". The Wake County Checklist for Flood Study Submittal is required.

| <b>Fees per crossing</b> | <b>Drainage area</b> | <b>Permit Fee</b> |
|--------------------------|----------------------|-------------------|
| Minor                    | < 100 acres          | \$500             |
| Major                    | >100 acres           | \$1,000           |

**Minor flood studies** for drainage area between 5 acres and 100 acres may use design flows based on [NCDOT Guidelines for Drainage Studies and Hydraulic Design](#).

The design must be based upon the establishment of a temporary or permanent benchmark and an analysis of the effects of the proposed encroachment to establish a base flood elevation or depth of flow, using Manning's Equation, field surveyed cross-sections including channel slope, Wake County Topographic Maps, and, where appropriate, use of Culvert Headwater Charts.

Benchmarks are not required when establishing a depth of flow. A minimum of one vertical foot must be added to the calculated base flood elevation or depth of flow to provide a factor of safety due to the potential backwater effects of the encroachment. The analysis must conclude that no existing structures, proposed structures or offsite properties will be inundated by the base flood. An as-built certification of compliance with the construction drawings must be provided prior to receiving a footing inspection from the Wake County Building Inspections Division on any structures on any lots involved in the analysis. The as-built certification with the construction drawings is in addition to any elevation certifications which may be required for the structures.

Structure design shall be for at least the Q10 storm, Q25 in watershed water supply areas. The flood evaluation shall be for the Q100 storm.

**Submittal Requirements for Minor Flood Studies:**

1. Current Submittal Checklist
2. Narrative / Discussion of methods and results
3. Drainage area maps
4. Site plan with location, plan and profile of crossing
5. Location photos
6. Calculations and/or modeling

**Major flood studies** for drainage areas greater than 100 acres and FEMA crossings require FEMA no rise certification or map revision must conduct modeling analysis using HEC-RAS and follow the HEC-RAS submittal checklist. Areas with greater than 640 acres of drainage shall be modeled in a manner consistent with FEMA methods.

*The design must be based upon the establishment of a temporary or permanent benchmark based on National Geodetic Vertical Datum and an analysis of the effects of the proposed encroachment to establish a base flood elevation; using Manning's Equation, the Standard Step Method to analyze backwater effect, field surveyed cross sections including channel slope, and where appropriate, use of Culvert Headwater Charts. The analysis must conclude that no existing or proposed structures, or offsite properties will be inundated by the base flood. As-built certification of compliance with the construction drawings must be provided prior to receiving a footing inspection from the Wake County Building Inspections Division on any structures on any lots involved in the analysis. The as-built certification with the construction drawings is in addition to any elevation certifications which may be required for the structures (UDO Article 14).*

Crossings shall be designed for at least the Q10 storm, Q25 in watershed water supply areas. The flood study evaluation shall be for the Q100 storm. Larger conveyances may be needed to avoid offsite impacts.

**Submittal Requirements for Major Flood Studies:**

- HEC RAS submittal checklist (this is in addition to the County Flood Submittal checklist)
- Submittal in the format provided by the HEC RAS Study Format Figure 1 image
- Cover Page
- Table of Contents
- Narrative / Discussion
- Drainage area maps
- Site plan with location, plan and profile of crossing
- Location photos
- Calculations and modeling output

**Permit Details**

- Flood Hazard regulations are outlined in the Wake County Unified Development Ordinance, Article 14. For Flood Hazard Soils Areas, the following rules and procedures apply:
- Encroachments may be exempt if there is less than 5 acres of drainage (may require Professional Land Surveyor or Professional Engineer to check the drainage area and certify that the drainage area is less than 5 acres).
- Flood Hazard Soil Boundaries may be modified by a field investigation by a Licensed Soil Scientist. The report of the field investigation shall conclude with a description of the actual soil horizons that were encountered on the site.
- A flood study may be performed by a licensed design professional (professional engineer, landscape architect or surveyor) to delineate the 1% annual chance floodplain. This is the most accurate way to determine the actual flood limits for a floodplain area. In Zone A, a flood study is required for subdivisions with greater than 50 lots or 5 acres of drainage to establish BFE. Flood boundaries and elevations shall be delineated on the recorded plat and Minimum Finished Floor Elevations (MFFE) identified on lots as needed.
- Note: The options above are performed at the applicant's expense. Wake County Flood Permit fees apply.

For FEMA-Identified Special Flood Hazard Areas, the following rules and procedures apply:

- Flood studies, prepared by a Registered Professional Engineer from field-surveyed information supplied by a Registered Professional Land Surveyor.
- If the mapping error involves an area of high land that was not reflected on the FEMA FIRM maps, it is possible to correct these errors with the assistance of a Registered Professional Land Surveyor only. Changes to FEMA maps require FEMA approval through a Letter of Map Amendment (LOMA). Please note, Wake County does not allow fill in FEMA flood hazard areas and LOMR-F may not be recognized by the Floodplain Administrator.
- The applicant is responsible for the expense of flood studies and LOMAs. There are review fees charged by both FEMA and Wake County for flood studies as well as fees for changes to the FIRM maps, if required.

### 6.3.5 Letters of Map Revision and No Rise Certifications

Prior to issuing any permits involving activities in a FEMA-Flood Zones, Wake County may require a no-rise certification stating the proposed development will not impact the pre-project base flood elevations, floodway elevations, or floodway data widths. No Rise Certifications for allowable encroachments (typically road projects) will be submitted through the Permit Portal with the construction plans. Technical reviews of any No Rise modeling will also be conducted by NC DPS staff. To establish a “No-Rise”, a Registered Professional Engineer will perform hydraulic modeling in accordance with standard engineering practice to determine the impacts on the stream.

Required model runs ([NC NFIP Guidance Document #1: NC NFIP Review of No-Rise Submittals](#)) include:

- Effective Model
- Duplicate Effective Model
- Corrected Effective Model
- Existing Conditions
- Proposed Conditions

For some cases in which a no-rise certification is achieved but the FEMA-Flood Zones is significantly affected, the Floodplain Administrator may require a Letter of Map Revision after construction.

When a project causes a rise in the FEMA-Flood Zones, it will need to undergo the Conditional Letter of Map Revision (CLOMR) process and receive comments regarding the impacts of the proposed project. A CLOMR is FEMA's comment on a proposed project that would, upon construction, affect the hydrologic or hydraulic characteristics of a flooding source and thus result in the modification of the existing regulatory floodway, the effective Base Flood Elevations (BFEs), or the Special Flood Hazard Area (SFHA). The letter does not revise an effective NFIP map, it indicates whether the project, if built as proposed, would be recognized by FEMA. FEMA charges a fee for processing a CLOMR to recover the costs associated with the review. Building permits cannot be issued based on a CLOMR, because a CLOMR does not change the NFIP map.

Once a project has been completed, the community (local government) must request a revision to the Flood Insurance Rate Map (FIRM) to reflect the project. "As-built" certification and other data must be submitted to FEMA to support the revision request. Once accepted, the official Digital Flood Insurance Rate Map (DFIRM), Flood Boundary and Floodway Map (FBFM), or both, are updated by FEMA to reflect the new FEMA-Flood Zones conditions.

Wake County signs off on MT-2 forms for Letters of Map Revision for any projects submitted in Wake County. The permitting authority stays with the local government (Apex, Cary, Raleigh, etc.). Wake County will provide Property Owner Notification (PON) letters on County letterhead for impacted residents in the unincorporated areas. Mass mailings will be handled by the permitting local government or their consultant.

**Engineering Analysis**

The following section outlines the procedures for completing an engineering analysis of flood hazard area impacts. It includes paths to conducting an analysis for FEMA-Flood Zones by: (1) verification of no adverse impacts to FEMA-Flood Zones and (2) verification of known adverse impacts and the subsequent map and model updates. Analysis for flood hazard soils can be complete by using culvert headwater charts for inlet and outlet computations or the standard step-backwater computer model.

In addition to the Flood Study Submittal Checklist, there are several documents that must be submitted for review to confirm compliance with UDO Article 14.

Below is a summary of the documentation that may be required to be submitted with a permit application:

**Local, State and Federal Permits:** State and federal permits may be required for some types of development, such as compliance with Endangered Species Act requirements or permits through the U.S. Army Corps of Engineers or the North Carolina Department of Environmental Quality for working within Waters of the United States. If required, all applicable state and federal permits must be submitted prior to the permit being approved. Permit numbers for other locally required permits (e.g. building permit, land disturbance permit) must also be provided.

**Site Plan:** A site plan must be provided for all proposed development in and adjacent to the flood hazard area. The site plan must show the type of flood hazard, setback distances from the flood hazard to the building(s) (if applicable), footprint of proposed development, scale bar, north arrow, property information (e.g., address, PIN), existing land use/land cover, and topography data matching what was used in the flood analysis.

**Engineering Report:** The Engineering Report is a concise statement of the study including the general location, purpose, objectives, a brief history, any observations or engineering judgments, and property documentation. The report must show all relevant calculations associated with the proposed development.

- The report must also contain one copy of the flood study. All hydrologic and hydraulic analyses shall be signed and sealed by a Professional Engineer licensed in North Carolina, and all topographic maps, grading plans, and construction drawings shall be signed and sealed by a licensed professional.

**Engineering Drawings:** Drawings sealed by a design engineer shall include plan and profile views of the crossing design and include materials.

- For any hydraulic analysis, field surveyed cross-sections must be submitted on signed and sealed engineering drawings with a title block and a true scale. A cross-section location plan showing topography, extent, and orientation of each cross-section is also required.

### 6.3.5 FEMA Elevation Certificate

For structures located on properties with FEMA flood hazard areas, three FEMA Elevation Certificates providing elevation and flood vent information shall be provided. The most current [FEMA Elevation Certificate \(EC\) form](#) shall be used. The EC is an important administrative tool for the NFIP, as it is used to determine the proper flood insurance premium rate, to document elevation information necessary to ensure compliance with SFHA regulations and to support a request for a Letter of Map Change (LOMC).

The certification process is as follows:

- The first EC form shall be submitted with the permit application indicating the proposed lowest floor based on drawings,
- The second EC form shall be submitted after the lowest floor has been constructed. This EC form must be approved by Watershed Management staff before vertical construction may continue, and
- The third EC form shall be submitted after final construction has been completed, and must be approved by Watershed Management staff prior to the Certificate of Occupancy being issued.

### 6.3.6 Flood Hazard Encroachment Permit

The intent of the Flood Hazard Encroachment Permit is to document uses or activities in the flood hazard area which inherently will not increase or will result in no technically measurable increase in base flood elevations for projects. The projects may consist of construction activities, typically underground or above ground activities that are not technically measurable in hydraulic modeling or construction and maintenance activities, typically above ground and known to not increase flood levels. These projects are all approved under the Flood Hazard Encroachment Permit. To obtain a Flood Hazard Encroachment Permit, a completed application must be submitted along with a site plan. Contact the Floodplain Administrator for additional guidance on specific activities that may be considered under the Flood Hazard Encroachment Permit.

### 6.3.7 Floodproofing Certificate

While Wake County prohibits fill and development in the floodway and flood fringe, Wake County is required to include the State minimum floodplain language for compliance with NFIP.

The NFIP regulations require buildings to be designed and constructed to resist flood damage, which is achieved primarily through elevation. The floodproofing of non-residential buildings may be permitted as an alternative to elevating to or above the base flood elevation; however, a floodproofing design certification is required. For insurance rating purposes, a building's floodproofed design elevation must be at least one foot above the base flood elevation to receive full rating credit for the floodproofing. If the building is floodproofed only to the base flood elevation, the flood insurance rates will be considerably higher.

When floodproofing is used, the certification shall be prepared by or under the direct supervision of a North Carolina Licensed Professional Engineer or Architect and certified by same. The Floodplain Administrator shall review the certificate data submitted. Deficiencies identified during the review shall be corrected by the applicant prior to permit approval. If the building is not constructed in accordance with the certified plans, the Certificate of Occupancy could be withheld.

### 6.3.8 Emergency Authorization

In some cases, development must be conducted immediately to protect the environment and/or public health, safety, or welfare, and the applicant does not have time to first apply for permits. In such cases, the applicant may request an Emergency Authorization. If the Floodplain Administrator issues an Emergency Authorization, the applicant must still apply for a Flood Permit and ensure that all development complies with UDO Article 14 after the Emergency Authorization is granted.

## 6.4 Specific Development Activities and Requirements

This section is intended to provide additional guidance on specific development activities and requirements outlined in Article 14. - Flood Hazard Areas of the UDO. This does not include all types of development, nor does it include all ordinance requirements that apply within flood hazard areas.

### 6.4.1 Substantial Improvements or Substantial Damage

Substantial damages and substantial improvements require that structures be brought into compliance with the current requirements for new construction with UDO Article 14. Substantial Improvement is any improvement to a structure where the cost of the improvements is greater than or equal to 50% of the market value of the structure before the start of construction of the improvement. A Substantial Damage is damage to a structure from any origin, not just flooding, where the cost to repair the structure to the pre-damaged value equals or exceeds 50% of the market value of the structure before the damage occurred. By definition, a substantial damage is also considered a substantial improvement. Additional information is available in FEMA's Substantial Improvement/ Substantial Damage Desk Reference.

If existing violations of state or local health, sanitary, or safety codes were identified through the county's code enforcement process before a substantial damage or substantial improvement occurs, the costs to address the violation may not be incorporated into the substantial damage or substantial improvement determination. However, the violation must have been documented in writing and must be the minimum improvements necessary to assure safe living conditions.

### 6.4.2 Flood Insurance

Wake County has a State approved floodplain ordinance so that its residents may qualify for flood insurance through the National Flood Insurance Program (NFIP).

FEMA is focused on building a culture of preparedness by closing the insurance gap. Recognizing that purchasing flood insurance can be confusing and time-consuming, the National Flood Insurance Program (NFIP) is redesigning its risk rating plan to improve the policyholder experience. Historically, FEMA flood maps have been the basis of flood insurance rates. Risk Rating 2.0 aims to deliver rates that are fair, easy to understand, and better reflect a property's unique flood risk.

Risk Rating 2.0 will fundamentally change the way FEMA rates a property's flood risk and prices insurance. The previous rating methodology had not changed since the 1970s and FEMA's rates were based predominantly on Flood Insurance Rate Map zone and Base Flood Elevation. With Risk Rating 2.0, FEMA is pairing state-of-the-art industry technology with the NFIP's mapping data to establish a more comprehensive understanding of risk at both the community and individual level.

Risk Rating 2.0 will help customers better understand their flood risk and provide them with more accurate rates based on their unique risk. This will include determining a customer's flood risk by incorporating multiple, logical rating characteristics—like different types of floods, the distance a building is from the coast or another flooding source, or the cost to rebuild a home. The new rating plan will also aim to ensure customers will no longer face dramatic rate increases during map changes or at the edge of flood zones. By reflecting the cost to rebuild, the new rating plan will also aim to deliver fairer rates for owners of lower-value homes.

Risk Rating 2.0 will comply with existing statutory caps on premium increases. This will help transition policyholders who may face otherwise substantial rate increases. The goal through Risk Rating 2.0 is to help people better understand their flood risk so they can make informed decisions when it comes to protecting the financial investments that they have made in their homes.

Risk Rating 2.0 will initially provide credits for three mitigation actions:

- Installing flood openings per the 44 CFR 60.3 criteria;
- Elevating structures onto posts, piles, and piers;
- Elevating machinery and equipment above the lowest floor.

## Chapter 7 – Buffers and Easements

### 7.1 Neuse River Basin Riparian Buffers

**Important Note:**

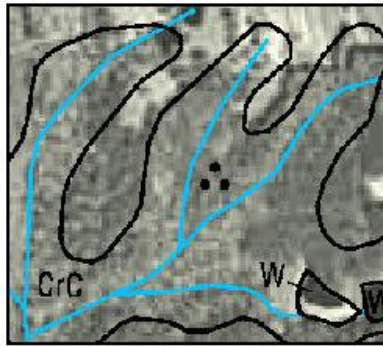
Wake County applies the Neuse Riparian buffer rules County-wide, except in those areas subject to the Jordan Lake Buffer Rules. These required buffers are separate from and in addition to any required Wake County Water Supply Watershed Buffers. [UDO 10-22-1](#).

The NC Division of Water Resources has in place riparian buffer rules to protect vegetated areas adjacent to intermittent and perennial streams, lakes, reservoirs, ponds, estuaries and modified natural streams. With the Neuse River Basin, specific rules were enacted to protect the water quality of estuaries and downstream lakes through their buffer nutrient removal function. Wake County implements these [Neuse Riparian buffer rules](#) countywide in both the Neuse and Cape Fear River Basins, except in areas subject to the Jordan Lake Riparian buffer rules. Note that the Neuse and Jordan Riparian buffer rules are entirely separate requirements from the County Water Supply Watershed buffers.

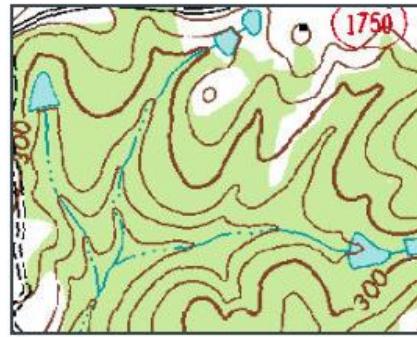
The Neuse buffers are enforced by the State of NC, Raleigh Regional Office. Enforcement of the Jordan Lake Buffers has been delegated to the local governments including Wake County. The Wake County Planning Department is responsible for the Watershed Water Supply Buffers (see UDO Article 11).

### 7.1.1 Determination of Buffers

To determine whether a potentially Neuse Riparian buffered feature is onsite, the project location must be identified on both the [USGS Quad Map](#) (1:24,000 scale) and the most recent printed version of the [NRCS Soil Survey Map](#) (1970 Wake County). The Web Soil Survey map may not be used for the purposes of determining potentially buffered features. Refer to the [NCDEQ Buffer Interpretation/Clarification Memo #2007-008](#).

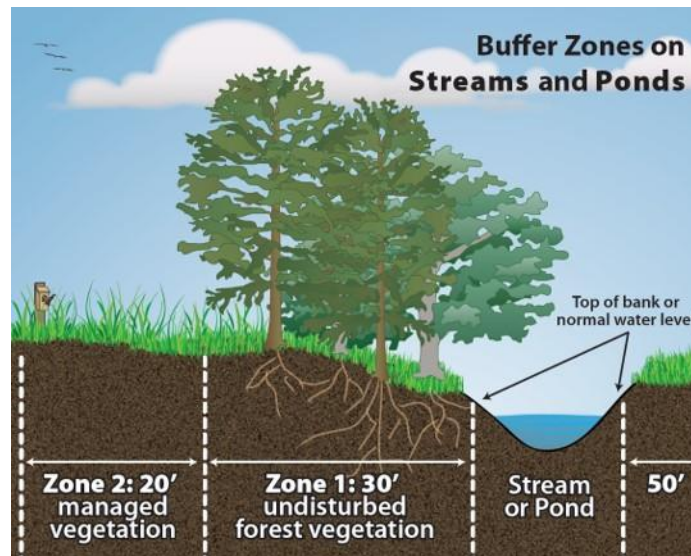


Sample NRCS Soil Survey Map



Sample USGS Topographic Map

The Neuse Riparian Buffer Rules require a 50-foot buffer (with Zones 1 and 2) on each side of the feature, generally measured from top of bank or normal water level of an impoundment. These zones are described in more detail in the Rule.



If a feature is shown on either of the two referenced maps, then it shall be assumed to be subject to the Neuse Riparian Buffer Rules unless a formal written buffer determination is obtained from the NC Division of Water Resources stating otherwise and this determination provided to the County. To obtain a buffer determination from the NCDEQ Raleigh Regional Office, please complete and submit to them

the “[Stream Origin/Buffer Applicability Determination](#)” form. This form may also be submitted to the Raleigh Regional Office [online](#). Buffer determinations are valid for 5 years from the date of issuance.

For Cape Fear and Jordan Buffers, requests shall be made to Wake County, Watershed Management staff.

More information and clarification of the Neuse Riparian Buffer Rules may be found on the NCDEQ website [here](#).

### 7.1.2 Proposed Impacts to the Buffer

Impacts to the Neuse Riparian Buffer must comply with all requirements of the Rule. Refer also to the [Table of Uses in the Rule](#) for activities which fall into these general categories:

- **Deemed Allowable** uses are allowed in the riparian buffer without approval from the Division of Water Resources.
- **Allowable upon Authorization** uses may occur in the buffer after written authorization from DWR. Some of these impacts may require mitigation for the impacts and the uses are therefore considered **Allowable with Mitigation upon Authorization**.
- **Prohibited** uses are not allowed in the buffer unless a variance is granted from the NC Environmental Management Commission.
- Activities not listed in the Table of Uses are **Allowable with Exception** (see below).

Per Rule, uses which are **deemed allowable** shall be designed, constructed, and maintained to minimize vegetation and soil disturbance and to provide the maximum water quality protection practicable, including construction, monitoring, and maintenance activities. In addition, deemed allowable uses shall meet any specific requirements listed in Table of Uses for the particular use.

Projects seeking approval for activities within the Neuse Riparian buffer which **require authorization** but do not impact surface waters (streams, wetlands, open waters) shall submit a buffer authorization application and associated documentation to the NC Division of Water Resources for review and approval (including level spreader/filter strips). Projects which do have impacts to surface waters and require a 401 certification shall complete the Pre-Construction Notification (PCN) form. Links to the applications and help documents for buffer authorizations and PCNs may be found on NCDEQ's website [here](#).

Any activities not listed in the Table of Uses may be "**Allowable upon Exception**" if the specific hardship criteria of the Rule can be shown. These activities must be approved by the Division of Water Resources as either a major or minor exception and will require mitigation. Exceptions are meant to be for unique and rare situations where there are no other reasonable options. Note that:

- Minor exceptions are those less than or equal to 1/3 acre of buffer impacts, and
- Major exceptions are those greater than 1/3 acre of buffer impacts.

Projects with uses that are **prohibited** in the Table of Uses require a variance to be approved through the NC Environmental Management Commission. Mitigation may be required as part of any approved variance. Links to the applications and help documents for both buffer authorizations and PCNs may be found on NCDEQ's website [here](#).

Any authorizations, mitigation, exceptions, or variances required for proposed Neuse Riparian Buffer impacts shall be obtained from the State and copies provided to Wake County prior to County approval and permitting of the impacts. For Cape Fear and Jordan Buffers, these requests shall be made to Wake County, Watershed Management staff.

### 7.1.3 Stormwater Runoff Into the Buffer

Note that the Neuse Riparian Buffer Rule also requires that stormwater runoff into the buffer must meet [dispersed flow](#) unless otherwise specified. Specific scenarios related to drainage conveyances (drainage ditches, roadside ditches, stormwater conveyances) are defined as “deemed allowable” or “allowable upon authorization” provided that they do not erode through the riparian buffer and do not cause erosion to the receiving waterbody.

Any scenarios not addressed by the Rule may be “allowable with exception” as defined in the Rule. The applicant shall be responsible for showing compliance with dispersed flow or criteria for any specific allowances for drainage conveyance in the Rule.

More information and clarification of the Neuse Riparian Buffer Rules may be found on the NCDEQ website [here](#).

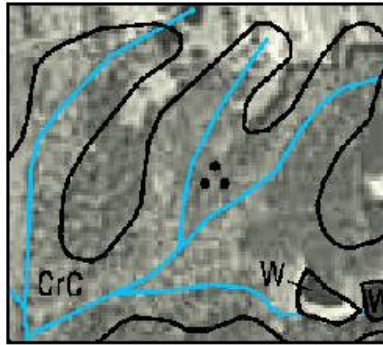
## 7.2 Jordan Lake Riparian Buffers

The Jordan Lake Buffer Program was delegated to Wake County in 2012 and mirrors the requirements of the Neuse Buffer Rules. The rules are required to protect and preserve existing Riparian buffers throughout the Jordan Watershed as described in Rule [15A NCAC 02B .0267](#) in order to maintain their nutrient removal and stream protection functions. The buffers help to protect the water supply uses of Jordan Lake Reservoir and of designated water supplies throughout the Jordan Lake watershed. Like the Neuse Riparian Buffer Rules, the Jordan Lake Riparian Buffer Rules designate a 50-foot buffer with two zones and contain a table of uses.

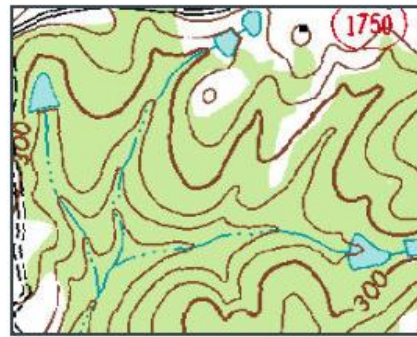
The Jordan Lake Buffer Rules only apply to intermittent and perennial streams and perennial waterbodies (lakes, ponds, or reservoirs) within natural drainage ways or in-line with a stream. During the on-site review staff can only identify and confirm the presence of the mapped stream as approximately shown. Any unmapped streams located on the property are not subject to the Jordan Buffer Rules but may be subject to County water supply watershed buffers through [UDO Article 11 Environmental Standards](#).

### 7.2.1 Determination of Buffers

Development plans in the Jordan Lake watershed shall show the Jordan Lake riparian buffers based the features shown on the [USGS Quad Map](#) (1:24,000 scale) and the most recent printed version of the [NRCS Soil Survey Map](#) (1970 Wake County). The Web Soil Survey map may not be used for the purposes of determining potentially buffered features. Refer to the [NCDEQ Buffer Interpretation/Clarification Memo #2007-008](#).

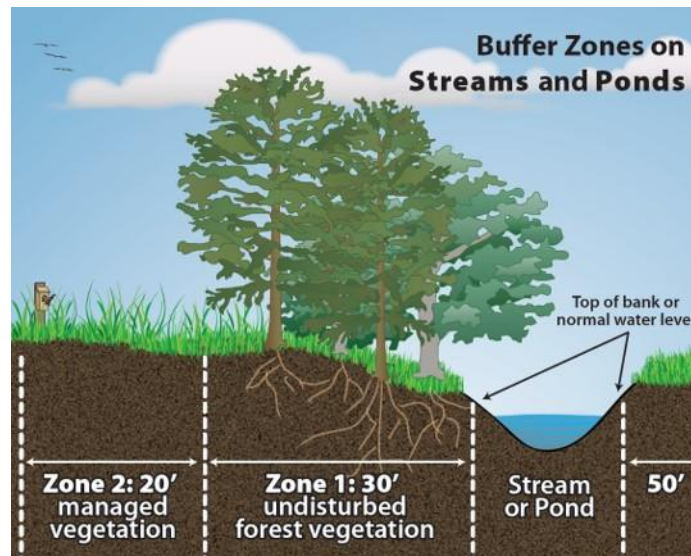


Sample NRCS Soil Survey Map



Sample USGS Topographic Map

The Jordan Lake Riparian Buffer Rules require a 50-foot buffer (with Zones 1 and 2) on each side of the feature, generally measured from top of bank or normal water level of an impoundment. These zones are described in more detail in the Rule. If a feature (intermittent or perennial stream, pond, lake, or reservoir) is shown on either of the two referenced maps, then it shall be assumed to be subject to the Jordan Lake Riparian Buffer Rules unless a formal written buffer determination is obtained from Wake County.



More information and clarification of the Jordan Lake Riparian Buffer Rules may be found on the NCDEQ website [here](#).

Property owners who dispute the presence of the mapped stream may request a buffer determination by Wake County staff within the Watershed Management Section utilizing the [Request for Buffer Determination Form](#).

The dispute process is generally as follows:

1. The property owner shall hire a certified professional to delineate the buffers.
2. The consultant's proposed buffer delineation maps shall be submitted to Wake County along with a request for a stream determination to approve the revised buffer locations. This request shall include the Request for Buffer Determination Form.
3. Wake County staff will schedule a site visit with the consulting scientist.
4. Upon completion of the site visit, Wake County will send a buffer determination letter to the applicant.
5. If the applicant disagrees with the findings, they may appeal the County's buffer determination to the Director of the NC Division of Water Resources.

### 7.2.2 Proposed Impacts to the Buffer

Impacts to the Jordan Lake Riparian Buffer (or uses just outside of the buffer which may impact it) must comply with all requirements of the Rule. Refer also to the [Table of Uses in the Rule](#) for activities which fall into these general categories:

- **Exempt** uses are allowed in the riparian buffer without approval from Wake County. However, exempt uses shall be designed, constructed, and maintained to minimize soil disturbance and to provide the maximum water quality protection practicable, including construction, monitoring, and maintenance activities.
- **Allowable** uses require written authorization from Wake County and may only be allowed if there are no practical alternatives.
- **Allowable with Mitigation** uses require written authorization from Wake County and may only be allowed if there are no practical alternatives AND a mitigation strategy has been approved in accordance with the Rule.

For listed uses to qualify as one of the three designations above, the activities must also adhere to any limitations give for that use and other requirements of the Rule.

Any activities not listed in the Table of Uses are considered **prohibited** and may not be allowed within the buffer, or outside of the buffer if the use would impact dispersed flow through the buffer, unless a variance is granted. Any proposed variance would be required to demonstrate “practical difficulties or unnecessary hardships that prevent compliance” and follow the procedures as described in [15A NCAC 02B .0267\(12\)](#). Minor variances for activities which will only impact zone 2 of the buffer may be granted by the County. Major variances for activities involving any impact to zone 1 or any portion of both zones 1 and 2 must first receive a preliminary finding by the County regarding whether the criteria for a variance have been met. The County’s preliminary findings are then submitted to the NC Environmental Management Commission for approval and final action.

If impacts associated with uses that are allowable or allowable with mitigation are proposed to the buffer, the applicant shall submit to Wake County the NC Division of Water Resources (DWR)’s PCN form and the County’s Request for Buffer Authorization/No Practical Alternatives Determination (including required associated documents). The applicant must demonstrate that there are [No Practical Alternatives](#) to the proposed impacts and certify that:

1. The basic project purpose cannot be practically accomplished in a manner that would better minimize disturbance, preserve aquatic life and habitat, and protect water quality;
2. The use cannot practically be reduced in size or density, reconfigured, or redesigned to better minimize disturbance, preserve aquatic life and habitat, and protect water quality; and
3. Best management practices shall be used if necessary to minimize disturbance, preserve aquatic life and habitat, and protect water quality.

Within 60 days of receipt of the request for buffer authorization/no practical alternatives determination, Wake County must review and make a finding of fact as to whether the criteria for finding “no practical alternatives” has been met. The County may:

- Issue an Authorization Certificate if a finding of “no practical alternatives” is made, OR
- Notify the applicant that the application is incomplete and request more information.

If the County fails to take action within 60 days, the impacts automatically be considered as a finding of “no practical alternatives” and an Authorization Certificate issued, unless:

- The applicant agrees, in writing, to a longer period,
- The County determines that the applicant has failed to furnish requested information necessary to make a decision,
- The final decision is to be made pursuant to a public hearing, or
- The applicant refuses access to its records or premises for the purpose of gathering information necessary to the County’s decision.

Appeals of County determinations regarding Authorization Certificates must be made in writing to the Director of the NC Division of Water Resources.

If the County finds that the criteria of “no practical alternatives” has been met and issues an Authorization Certificate, it may attach conditions to the approval that support the purpose and intent of the buffer protection program. These conditions may include but are not limited to:

- The design and installation of stormwater control measures
- Mitigation Requirements/schedule/monitoring etc.
- Restoration of temporarily disturbed areas

### 7.2.3 Stormwater Runoff Into the Buffer

Note that the Jordan Lake Riparian Buffer Rule also requires that stormwater runoff into the buffer must meet dispersed flow requirements unless otherwise specified. Refer to [15A NCAC 02B .0267\(8\)](#) for specific requirements, including:

- Concentrated runoff must be converted to dispersed flow at non-erosive velocities before the runoff enters zone two of the riparian buffer.
- No new stormwater conveyances are allowed through the buffers except for those specifically allowed in the [Table of Uses](#) which address stormwater management ponds, drainage ditches, roadside ditches, and stormwater conveyances. The applicant shall be responsible for showing compliance with dispersed flow or criteria for any specific allowances for drainage conveyance in the Rule.

More information and clarification of the Jordan Lake Riparian Buffer Rules may be found on the NCDEQ website [here](#).

### 7.3 Water Supply Watershed Buffers

Water Supply Watersheds (WSWs) are comprised of a reservoir or proposed reservoir used for drinking water and surrounding land areas that often act as a habitat for rare, endangered, or threatened species, a place for parks and recreation, and larger lots for homesites. To protect these valuable natural and life-sustaining assets, State and local governments apply additional development controls such as restricting certain polluting units and limiting density.

There are seven water supply watersheds that are located either fully or partially within the jurisdiction of Wake County:

- Cape Fear (Lillington and Sanford),
- Falls Lake,
- Jordan Lake,
- Little River,
- Richland Creek,
- Smith Creek, and
- Swift Creek.

Water supply watershed buffers (WSWBs) provide strips of natural vegetation that remove pollutants from stormwater runoff before they reach a water supply source or a watercourse that drains to a water supply source. They do so by allowing infiltration of runoff and filtration of pollutants through the ground and soil, slowing runoff flow to allow settling and deposition of pollutants, and providing vegetation that absorbs pollutants through root systems. The provision of vegetated, undisturbed buffers within water supply watersheds, therefore, is an important and effective means of maintaining the quality of public water supply sources and protecting those sources from potential polluting activities associated with development.

Wake County implements requirements for Water Supply Watershed Buffers (WSWBs) through [Article 11](#) of its UDO. While these buffers are required and enforced by Planning staff for the County, they are included in this manual to assist in understanding the requirement and its implementation for development plans.



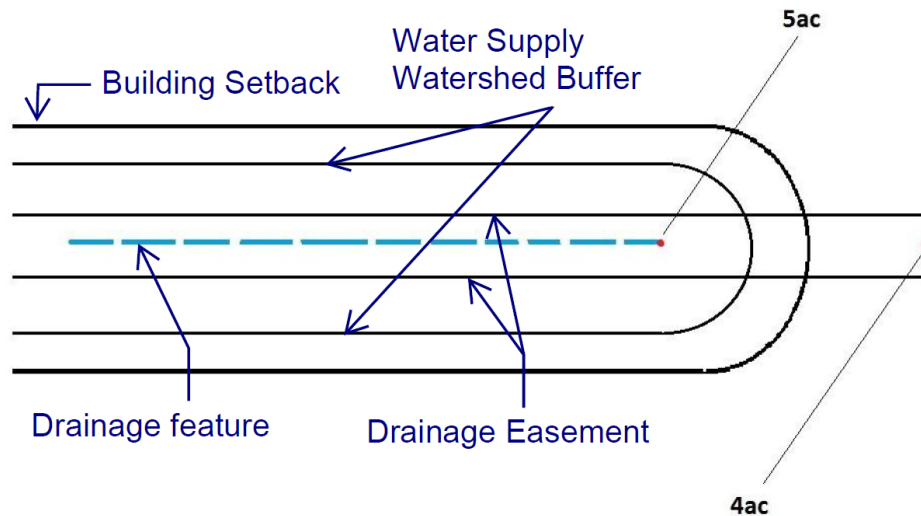


Figure 7.3.1 Wake County Water Supply Watershed Buffers

Furthermore, when analyzing drainage areas to a feature/location, the applicable drainage maps based on the site PRIOR to any grading or development of the site must be used to make the determination of whether the feature had a drainage area of 5 or more acres. Any modifications to the site after the lot was recorded that affected the area draining to the lot/feature or relocated the drainage feature cannot be taken into consideration.

Buffers described in [UDO Sections 11-21-6 and 11-21-3](#) were previously identified and platted as "drainageway buffers." Because they serve the same function and are subject to the same limitations as water supply watershed buffers, they have been re-designated as "water supply watershed buffers."

More information on Wake County Water Supply Watershed Buffers may be found in [Article 11](#) of the UDO or by contacting the Wake County Planning Department (919-856-6335), which is responsible for implementation and enforcement of these buffers.

### 7.3.1 Removal of Water Supply Watershed Buffers

To remove a Wake County Water Supply Watershed Buffer, an applicant must go through an exempt plat review and recordation process. With the exempt plat submittal, applicable drainage maps based on the site conditions PRIOR TO any grading or development of the site must be provided for staff to make the determination of whether the feature in question originally drained 5 or more acres. Any modifications to the site/parcel from development or associated grading – including changes that affected the acreage draining to the feature or any relocation of the drainage feature – cannot be taken into consideration.

Note that a buffer determination from NCDEQ in lieu of the above requirement is not acceptable documentation to justify removal of a Wake County Water Supply Watershed Buffer. A feature may not be determined to be jurisdictional for NCDEQ Neuse or Jordan Lake buffers but will still require a Wake County Water Supply Watershed buffer unless it can be demonstrated that pre-development the feature did not meet the 5-acre drainage threshold.

## 7.4 Easements

There are several different types of easements that may be required for a property or project. It is the responsibility of any individual property owner(s) or the home/property owners' association to maintain the easements and any features or structures therein, to maintain the integrity of the drainage system and to ensure positive drainage. Easements may not be piped without receiving prior approval from Wake County and/or NCDOT.

Recordation of these easements must also grant right of access to Wake County for any necessary inspections and enforcement related to the easement to ensure compliance with the County's Unified Development Ordinance. Wake County is not responsible for maintenance of any drainage easements or stormwater structures located within an easement.

Removal or relocation of a recorded drainage easement requires submittal of an exempt plat for Wake County Planning Department approval. Approved changes shall be recorded with the Register of Deeds.

### 7.4.1 Drainage Easements

Drainage easements must be provided to allow for passage of stormwater and stormwater conveyances on residential and non-residential developments in the County ([UDO 9-20-4\(B\)](#) and [UDO 8-37-2](#)).

Drainage easements are required for natural or manmade features beginning at the point draining 4 or more lots or 4 or more acres, whichever is less. Drainage easements are also required for any permanent conveyance of water to stormwater control measures, regardless of the size of its drainage area. The minimum width of any provided drainage easement is 20 feet, centered over the drainage feature. Drainage easements are required to be shown and labeled (type and width) on a recorded plat for the site. Easement locations should be field verified by the applicant prior to platting. Easements may not be piped without receiving approval from Wake County.

Drainage easement types shall be labeled as follows:

**Private drainage easement:** Easements for drainage that will be maintained by the private property owners (or owners association). Private drainage easements are not made to Wake County but are irrevocably made to the subsequent owners of any and all of the associated properties for their use. Most drainage easements fall into this category.

**Public drainage easement:** Easements identified by NCDOT as easements to be held by NCDOT and easements held by public entities other than NCDOT, when identified by those entities.

### 7.4.2 Stormwater Control Measure Easements

Easements are also required for stormwater control measures in accordance with UDO [9-20-4\(B\)](#) and the [NCDEQ Stormwater Manual](#) and its associated minimum design criteria. In the case of any conflicts, the more stringent requirements shall apply. These stormwater access and maintenance easements are permanent easements that must be recorded on the record plat for the project or development.

These easements will be labeled as “*Stormwater Access and Maintenance Easement*” and shall:

- Include the width(s) of the easement
- Extend to the nearest public right of way
- Include a minimum width of 20 feet for any access from the public right of way (note that DEQ recommends 25 feet for maintenance access for measures that require larger equipment, such as wet ponds)
- Show and identify the stormwater control measure (show the entire footprint of the SCM and label it to match plans, i.e., “Dry Pond #1”)
- Include the entire footprint of the stormwater control measure system including side slopes, forebay, riser structure, stormwater control measure, outlet, dam embankment, emergency spillway, etc.
- Provide a minimum of 10 feet around the footprint of the stormwater control measure system to provide enough room to complete maintenance tasks
- Not include lateral or incline slopes that exceed 3:1 (horizontal to vertical)
- Include direct maintenance access to any forebay for any measures utilizing a forebay
- Include access for cleaning underdrain piping for any measures which utilize underdrains

Note that stormwater control measures located on individual residential lots (for isolated lots not within a common plan of development) have additional requirements. Plats for residential lots that contain a stormwater control measure shall also include:

- The specific location of the stormwater control measure on the lot
- A typical detail for the stormwater control measure to be used
- A note that the stormwater control measure on the property has been required to meet stormwater regulations and that the property owner may be subject to enforcement actions if the stormwater control measure is removed, relocated, or altered without prior approval.

### 7.4.3 Backwater Easements

Backwater calculations (for the 100-year, 24-hour design storm) are required to be performed for all pipes, culverts, and Stormwater Control Measures (SCMs) draining 4 or more acres. They are also required for crossings within flood prone areas (FEMA floodplain or flood hazard soils). The 100-year backwater easement and elevation shall be shown and labeled on a record plat for the site.

For crossings in flood prone areas that require flood studies, the backwater easement shall be shown and labeled with the backwater easement elevation. A minimum of one vertical foot must be added to the calculated elevation providing a factor of safety due to the potential backwater effects. For all other pipes, culverts, and SCMs, the backwater easement elevation is the calculated elevation with no additional required freeboard. Note that if the 100-year backwater is fully contained within the stormwater control measure, no backwater easement is required to be recorded.

These easements shall be labeled as “100-year Backwater Easement” and shall have the backwater elevation identified.

Lots with backwater easements shall be provided with an asterisk (\*) and minimum finished floor elevations at or above the backwater easement elevation/regulatory flood protection elevation on the recorded plat.

The backwater easement must:

1. Include language that clearly states that the upstream property owner(s) are consenting to the proposed development increasing flows onto their property throughout the easement.
2. Identify the location/boundaries of the easement to include the areas of 100 year backwater defined by a flood study or backwater calculation.
3. Identify the 100 year backwater elevation.

#### 7.4.4 Flow Easements

Many projects are required to perform the downstream impact analysis as described in Section 3.4 of this manual. If the project analysis indicates that the 10-year, 24-hour post-development peak discharge rate is greater than the pre-development peak discharge rate at any comparison point, then the plans must be revised to either reduce those peak flows OR obtain a flow easement from downstream property owners from each outfall showing the increase through the 10% point.

This type of easement will be labeled on a plat as a "*flow easement.*"

The draft deed of easement must be drawn up by an attorney for the applicant. The attorney can ensure that it is put into the proper form and format, and meets certain other requirements (for example, indicating that the easement will run with the land).

The flow easement must:

1. Include language that clearly states that the downstream property owner(s) are consenting to the proposed development increasing flows onto their property throughout the easement.
2. Identify the location/boundaries of the easement to include the areas between the outlet(s) of the development and the 10% point(s) for each point of discharge from the site where the calculations are showing an increase in peak flow.

## Chapter 8 – Appendices

## Appendix A – Wake County Hydrologic Soil Groups and Proposed Development Curve Numbers

**Table A-1 Wake County Hydrologic Soil Groups**

| <b>MAP SYMBOL</b> | <b>SOIL SERIES &amp; DESCRIPTION</b>                                   | <b>HYDROLOGIC SOIL GROUPS (HSG)*</b> |
|-------------------|--|--------------------------------------|
| AaA               | Altavista fine sandy loam, 0 to 4 percent slopes, rarely flooded       | C                                    |
| ApB               | Appling sandy loam, 2 to 6 percent slopes                              | B                                    |
| ApC               | Appling sandy loam, 6 to 10 percent slopes                             | B                                    |
| AuA               | Augusta fine sandy loam, 0 to 2 percent slopes, rarely flooded         | C/D                                  |
| BbA               | Bibb sandy loam, 0 to 2 percent slopes, frequently flooded             | A/D                                  |
| CaB               | Carbonton-Brickhaven complex, 2 to 6 percent slopes                    | D                                    |
| CaC               | Carbonton-Brickhaven complex, 6 to 10 percent slopes                   | D                                    |
| CaD               | Carbonton-Brickhaven complex, 10 to 15 percent slopes                  | D                                    |
| CcC               | Carbonton-Brickhaven- Urban land complex, 0 to 10 percent slopes       | D                                    |
| CeB               | Cecil sandy loam, 2 to 6 percent slopes                                | A                                    |
| CeC               | Cecil sandy loam, 6 to 10 percent slopes                               | A                                    |
| CfC               | Cecil-Urban land complex, 2 to 10 percent slopes                       | A                                    |
| ChA               | Chewacla and Wehadkee soils, 0 to 2 percent slopes, frequently flooded | B/D                                  |
| CrB               | Creedmoor-Green Level complex, 2 to 6 percent slopes                   | C/D                                  |
| CrC               | Creedmoor-Green Level complex, 6 to 10 percent slopes                  | C/D                                  |
| CrD               | Creedmoor-Green Level complex, 10 to 15 percent slopes                 | C/D                                  |
| CuC               | Creedmoor-Green Level-Urban land complex, 2 to 10 percent slopes       | C/D                                  |
| DaA               | Dorian sandy loam, 0 to 4 percent slopes, rarely flooded               | C                                    |
| DAM               | Dam  |                                      |
| DoA               | Dothan loamy sand, 0 to 2 percent slopes                               | C                                    |
| DoB               | Dothan loamy sand, 2 to 6 percent slopes                               | C                                    |
| DuB               | Dothan-Urban land complex, 0 to 6 percent slopes                       | C                                    |
| EnB               | Enon fine sandy loam, 2 to 6 percent slopes                            | C                                    |
| EnC               | Enon fine sandy loam, 6 to 10 percent slopes                           | C                                    |
| EnD               | Enon fine sandy loam, 10 to 15 percent slopes                          | C                                    |
| FrB               | Fuquay loamy sand, 0 to 6 percent slopes                               | A                                    |
| FuB               | Fuquay-Urban land complex, 0 to 6 percent slopes                       | A                                    |
| GeB               | Georgeville silt loam, 2 to 6 percent slopes                           | C                                    |
| GeC               | Georgeville silt loam, 6 to 10 percent slopes                          | C                                    |
| GoA               | Goldsboro sandy loam, 0 to 2 percent slopes                            | C                                    |
| GrC               | Gritney sandy loam, 6 to 10 percent slopes                             | D                                    |
| HeB               | Helena sandy loam, 2 to 6 percent slopes                               | D                                    |
| HrB               | Herndon silt loam, 2 to 6 percent slopes                               | B                                    |

| MAP SYMBOL | SOIL SERIES & DESCRIPTION   | HYDROLOGICAL SOIL GROUPS (HSG)* |
|------------|---|---------------------------------|
| HrC        | Herndon silt loam, 6 to 10 percent slopes                               | B                               |
| HrD        | Herndon silt loam, 10 to 15 percent slopes                              | B                               |
| LyA        | Lynchburg sandy loam, 0 to 2 percent slopes                             | C/D                             |
| MaB        | Madison sandy loam, 2 to 6 percent slopes                               | C                               |
| MaC        | Madison sandy loam, 6 to 10 percent slopes                              | C                               |
| MaD        | Madison sandy loam, 10 to 15 percent slopes                             | C                               |
| MaE        | Madison sandy loam, 15 to 25 percent slopes                             | C                               |
| MdB        | Mayodan sandy loam, 2 to 6 percent slopes                               | C                               |
| MdC        | Mayodan sandy loam, 6 to 10 percent slopes                              | C                               |
| MrA        | Merry Oaks-Moncure complex, 0 to 2 percent slopes, occasionally flooded | C/D                             |
| NaD        | Nanford silt loam, 10 to 15 percent slopes                              | C                               |
| NaE        | Nanford silt loam, 15 to 25 percent slopes                              | C                               |
| PaC        | Pacolet sandy loam, 6 to 10 percent slopes                              | B                               |
| PaD        | Pacolet sandy loam, 10 to 15 percent slopes                             | B                               |
| PaE        | Pacolet sandy loam, 15 to 25 percent slopes                             | B                               |
| PbD        | Pacolet-Urban land complex, 10 to 15 percent slopes                     | B                               |
| PkD        | Pinoka gravelly fine sandy loam, 4 to 15 percent slopes                 | B                               |
| PkF        | Pinoka gravelly fine sandy loam, 15 to 30 percent slopes                | B                               |
| RaA        | Rains sandy loam, 0 to 2 percent slopes                                 | A/D                             |
| RgB        | Rawlings-Rion complex, 2 to 6 percent slopes                            | C                               |
| RgC        | Rawlings-Rion complex, 6 to 10 percent slopes                           | C                               |
| RgD        | Rawlings-Rion complex, 10 to 15 percent slopes                          | C                               |
| RkA        | Riverview fine sandy loam, 0 to 2 percent slopes, occasionally flooded  | B                               |
| RoA        | Roanoke loam, 0 to 2 percent slopes, occasionally flooded               | C/D                             |
| UdE        | Udorthents loamy, 0 to 25 percent slopes                                | C                               |
| Ur         | Urban land  |                                 |
| VaB        | Vance sandy loam, 2 to 6 percent slopes                                 | D                               |
| VaC        | Vance sandy loam, 6 to 10 percent slopes                                | D                               |
| W          | Water   |                                 |
| WaB        | Wake-Rolesville complex, 2 to 6 percent slopes, very rocky              | D                               |
| WaC        | Wake-Rolesville complex, 6 to 10 percent slopes, very rocky             | D                               |
| WaD        | Wake-Rolesville complex, 10 to 15 percent slopes, very rocky            | D                               |
| WaE        | Wake-Rolesville complex, 15 to 25 percent slopes, very rocky            | D                               |
| WeB        | Wedowee sandy loam, 2 to 6 percent slopes                               | B                               |
| WeC        | Wedowee sandy loam, 6 to 10 percent slopes                              | B                               |
| WeD        | Wedowee sandy loam, 10 to 15 percent slopes                             | B                               |
| WeE        | Wedowee sandy loam, 15 to 25 percent slopes                             | B                               |

| MAP SYMBOL | SOIL SERIES & DESCRIPTION                            | HYDROLOGIC SOIL GROUPS (HSG)* |
|------------|--|-------------------------------|
| WfB        | Wedowee-Saw complex, 2 to 6 percent slopes           | B                             |
| WgB        | Wedowee-Urban land complex, 2 to 6 percent slopes    | B                             |
| WgC        | Wedowee-Urban land complex, 6 to 15 percent slopes   | B                             |
| WhB        | White Store-Polkton complex, 2 to 6 percent slopes   | D                             |
| WhC        | White Store-Polkton complex, 6 to 10 percent slopes  | D                             |
| WhD        | White Store-Polkton complex, 10 to 15 percent slopes | D                             |
| WkF        | Wilkes loam, 15 to 30 percent slopes                 | D                             |

\*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.

Note: Web Soil Survey (series info) <http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm>

**Table A-2 Wake County Proposed Development Curve Numbers**

| LAND USE                           | Curve Numbers by Hydrolic Soil Group |    |    |    |
|------------------------------------|--------------------------------------|----|----|----|
|                                    | A                                    | B  | C  | D  |
| <b>COMMERCIAL</b>                  |                                      |    |    |    |
| Parking lot                        | 98                                   | 98 | 98 | 98 |
| Roof                               | 98                                   | 98 | 98 | 98 |
| Open/Landscaped                    | 39                                   | 61 | 74 | 80 |
| <b>INDUSTRIAL</b>                  |                                      |    |    |    |
| Parking lot                        | 98                                   | 98 | 98 | 98 |
| Roof                               | 98                                   | 98 | 98 | 98 |
| Open/Landscaped                    | 39                                   | 61 | 74 | 80 |
| <b>TRANSPORTATION</b>              |                                      |    |    |    |
| High Density (interstate, main)    | 98                                   | 98 | 98 | 98 |
| High Density Grassed Right-of-ways | 80                                   | 80 | 80 | 80 |
| Low Density (secondary, feeder)    | 98                                   | 98 | 98 | 98 |
| Low Density Grassed Right-of-ways  | 80                                   | 80 | 80 | 80 |
| Rural                              | 98                                   | 98 | 98 | 98 |
| Rural Grassed Right-of-ways        | 80                                   | 80 | 80 | 80 |
| Sidewalk                           | 98                                   | 98 | 98 | 98 |
| <b>MISC. PERVIOUS</b>              |                                      |    |    |    |
| Managed pervious (Open Space)      | 39                                   | 61 | 74 | 80 |
| Unmanaged (pasture)                | 39                                   | 61 | 74 | 80 |
| Woods                              | 30                                   | 55 | 70 | 77 |
| <b>RESIDENTIAL</b>                 |                                      |    |    |    |
| Roadway                            | 98                                   | 98 | 98 | 98 |
| Grassed Right-of-ways              | 80                                   | 80 | 80 | 80 |
| Driveway                           | 98                                   | 98 | 98 | 98 |
| Parking lot                        | 98                                   | 98 | 98 | 98 |
| Roof                               | 98                                   | 98 | 98 | 98 |
| Sidewalk                           | 98                                   | 98 | 98 | 98 |
| Lawn                               | 39                                   | 61 | 74 | 80 |
| Managed pervious (Open Space)      | 39                                   | 61 | 74 | 80 |
| Woods                              | 30                                   | 55 | 70 | 77 |
| <b>LAND TAKEN UP BY BMP</b>        | 39                                   | 61 | 74 | 80 |
| <b>JURISDICTIONAL LANDS</b>        |                                      |    |    |    |
| Natural wetland                    | 30                                   | 55 | 70 | 77 |
| Riparian buffer                    | 39                                   | 61 | 74 | 80 |
| Open water                         | 0                                    | 0  | 0  | 0  |

Note: Wake County's policy regarding the right-of-way areas includes an assumption of compaction of these areas. Therefore, the grassed portion of the right-of-way is assigned the curve number for open space in D soils to account for this assumption of compaction.

## Appendix B – Downstream Impact Analysis Scenarios Using the 10% Rule

**Purpose:** The purpose of the Downstream Impact Analysis is to determine if the project will cause any unintentional additional impacts on flooding or channel degradation downstream of the project site.

**Zone of Influence:** The point downstream from a proposed development where the discharge from that development no longer has a significant impact on the receiving stream or storm drainage system. Beyond this zone of influence, stormwater effects of the site become relatively small and insignificant compared to the runoff from the total drainage area. The general rule of thumb is that the zone of influence for a project can be considered to be the point where the project/site area is equal to (or less than) 10% of the total drainage area to that point.

**To Determine Zone of Influence:**

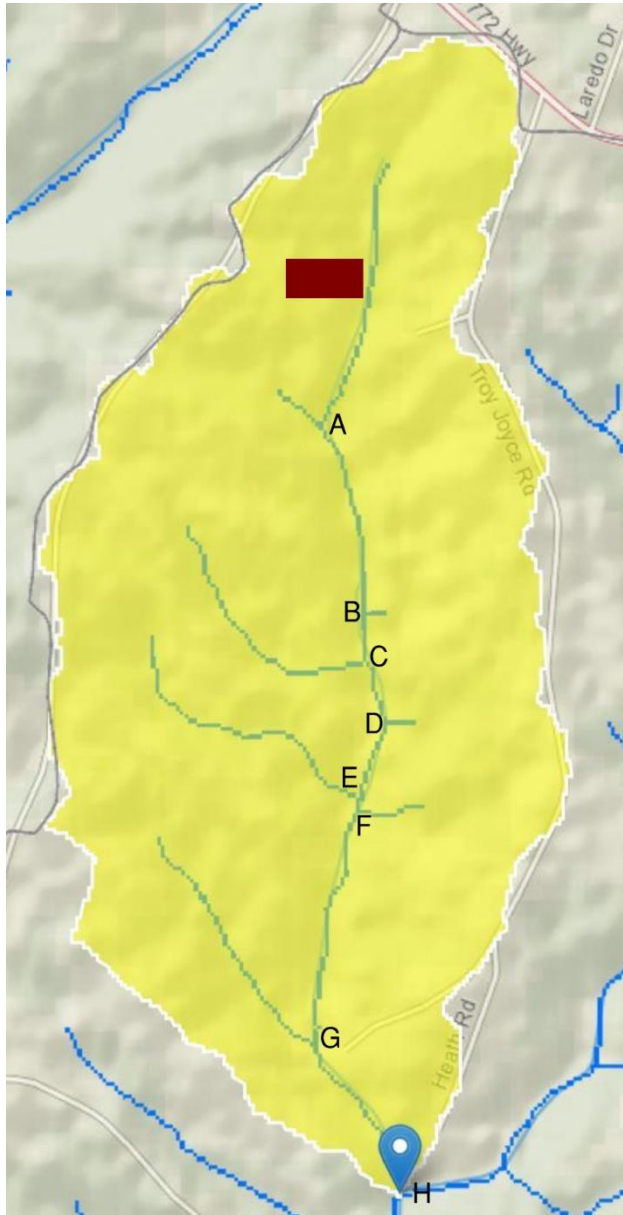
The following examples are used to illustrate how to determine the Zone of Influence (or 10% point) and the points which must be used for the downstream impact analysis.

Note that both the size of the development project AND its location within the overall watershed are key factors in determining the limits of the required downstream impact analysis.

These examples are very simplified but are intended to illustrate the concepts involved in these determinations.

**Example 1:** Project Apple is a 30-acre proposed development located within the hypothetical watershed above junction A as shown below.

For a 30-acre site, its proposed zone of influence – or 10% point – would be at 300 acres of drainage area. So we must look downstream of Project Apple to find the point where the drainage acre that includes the project is at least 300 acres. This will be somewhere between junction D and E in our hypothetical watershed. The downstream analysis should then be completed through junction E – since it is the first junction that would meet or exceed the necessary 300-acre zone of influence.



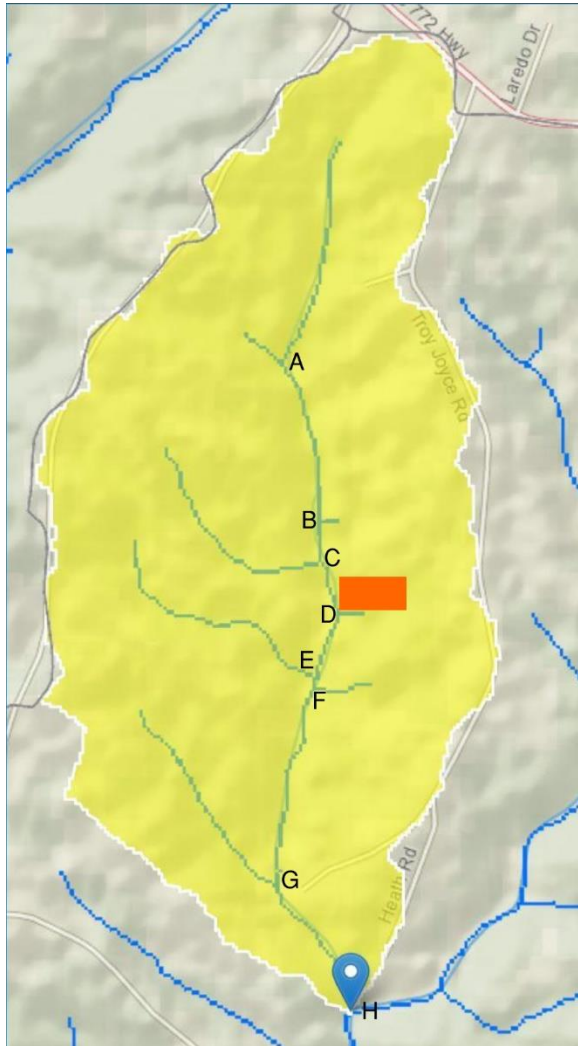
| Junction in Watershed | Total Drainage Area |
|-----------------------|---------------------|
| A                     | 102.4 ac            |
| B                     | 166.4 ac            |
| C                     | 224.0 ac            |
| D                     | 249.6 ac            |
| E                     | 313.6 ac            |
| F                     | 339.2 ac            |
| G                     | 454.4 ac            |
| H                     | 486.4 ac            |

For 30-acre Project Apple, the downstream analysis would include the following points of analysis:

- Outlet of Project Apple
- Junction A
- Junction B
- Junction C
- Junction D
- Junction E

**Example 2:** Project Orange is another 30-acre proposed development located within the hypothetical watershed just above junction D.

For a 30-acre site, it's proposed zone of influence – or 10% point – would also be at 300 acres of drainage area. So we must look downstream of Project Orange to find the point where the drainage acre that includes the project is at least 300 acres. This will be somewhere between junction D and E in our hypothetical watershed. The downstream analysis should then be completed through junction E – since it is the first junction that would meet or exceed the necessary 300-acre zone of influence.

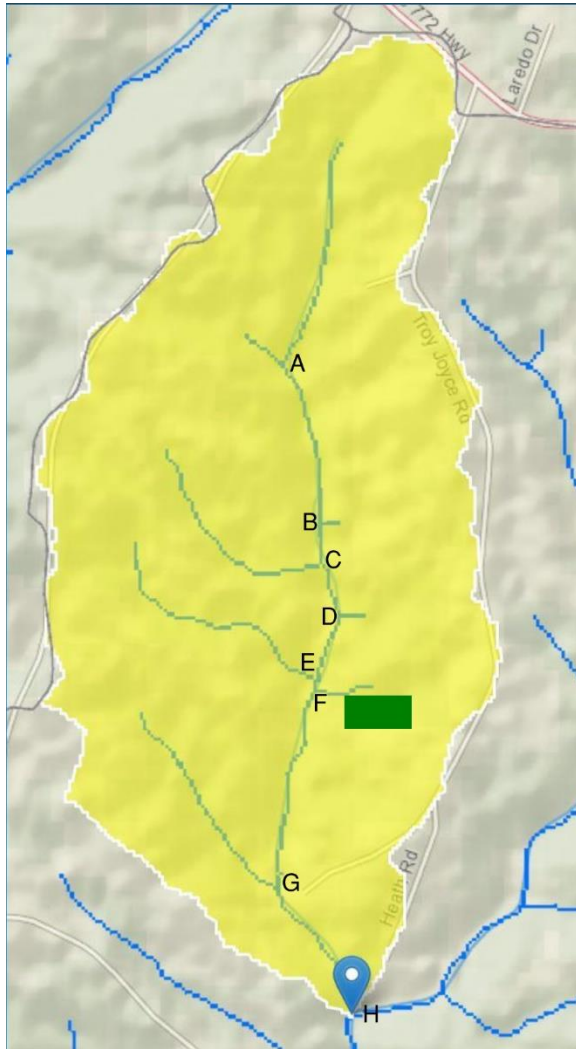


| Junction in Watershed | Total Drainage Area |
|-----------------------|---------------------|
| A                     | 102.4 ac            |
| B                     | 166.4 ac            |
| C                     | 224.0 ac            |
| D                     | 249.6 ac            |
| E                     | 313.6 ac            |
| F                     | 339.2 ac            |
| G                     | 454.4 ac            |
| H                     | 486.4 ac            |

For 30-acre Project Orange, the downstream analysis would include the following points of analysis:

- Outlet of Project Orange
- Junction D
- Junction E

**Example 3:** Project Kiwi is another 30-acre proposed development located along a tributary draining toward junction F within the hypothetical watershed. For a 30-acre site, its proposed zone of influence – or 10% point – would also be at 300 acres of drainage area. So we must look downstream of Project Kiwi to find the point where the drainage acre that includes the project is at least 300 acres. In this case, project outlets into a tributary, and junction F is the first downstream junction. At this point, the total drainage area is 339.2 acres. For Project Kiwi, the downstream impact analysis will end at junction F.



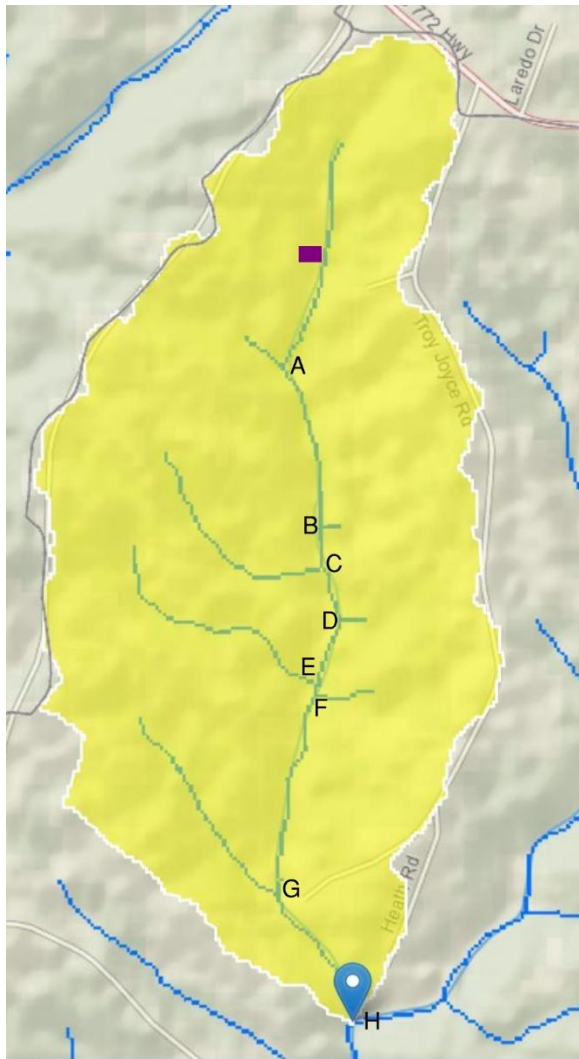
| Junction in Watershed | Total Drainage Area |
|-----------------------|---------------------|
| A                     | 102.4 ac            |
| B                     | 166.4 ac            |
| C                     | 224.0 ac            |
| D                     | 249.6 ac            |
| E                     | 313.6 ac            |
| <b>F</b>              | <b>339.2 ac</b>     |
| G                     | 454.4 ac            |
| H                     | 486.4 ac            |

For 30-acre Project Kiwi, the downstream analysis would include the following points of analysis:

- Outlet of Project Kiwi
- Junction F

**Example 4:** Project Plum is a 5-acre proposed development located along a tributary draining toward junction A within the hypothetical watershed. The engineer of record has performed a delineation showing that, at the project’s outlet to the tributary, there is a total drainage area of 47.2 acres.

Unfortunately, for a 5-acre project, the 10% point would be at a location where the total drainage area including the project was at least 50 acres. So we must look downstream of Project Plum to find the point where the drainage acre that includes the project is at least 50 acres. At the first junction after the project (junction A), the total drainage area is 102.4 acres. For Project Plum, the downstream impact analysis will end at junction A.



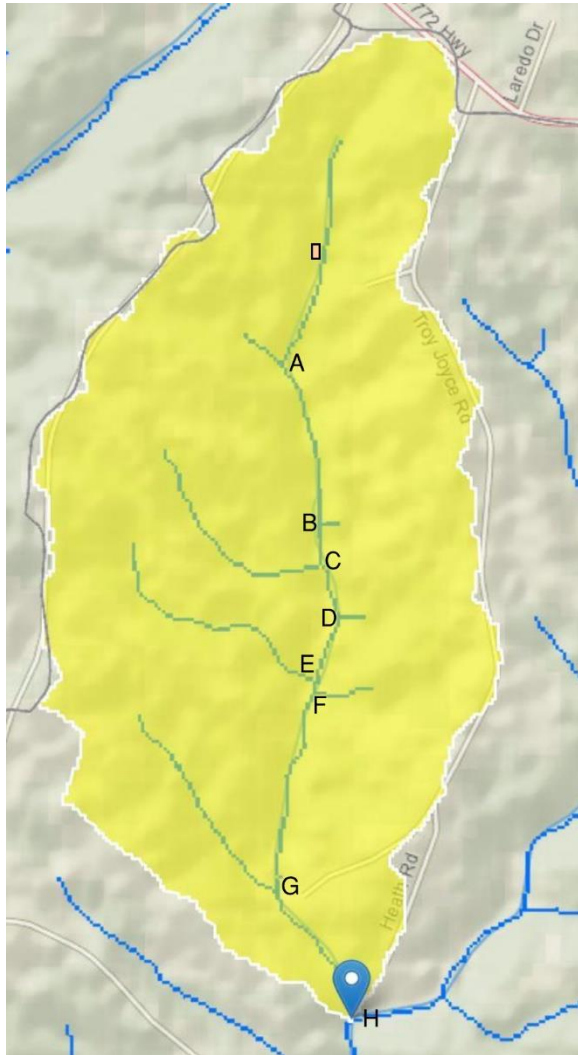
| Junction in Watershed | Total Drainage Area |
|-----------------------|---------------------|
| A                     | 102.4 ac            |
| B                     | 166.4 ac            |
| C                     | 224.0 ac            |
| D                     | 249.6 ac            |
| E                     | 313.6 ac            |
| F                     | 339.2 ac            |
| G                     | 454.4 ac            |
| H                     | 486.4 ac            |

For 5-acre Project Plum, the downstream analysis would include the following points of analysis:

- Outlet of Project Plum
- Junction A

**Example 5:** The funding for Project Plum (Example 4) fell through. A new developer now plans a smaller 2-acre development called Project Peach at that same location along a tributary draining toward junction A within the hypothetical watershed. The engineer of record has performed a delineation showing that, at its outlet to the tributary, there is a total drainage area of 47.2 acres.

For a 2-acre project, the 10% point would be at a location where the total drainage area including the project was at least 20 acres. For Project Peach, this means that only its outlet to the tributary must be analyzed in the downstream analysis.



|   |          |
|---|----------|
| E | 313.6 ac |
| F | 339.2 ac |
| G | 454.4 ac |
| H | 486.4 ac |

For 2-acre Project Peach, the downstream analysis would include the following points of analysis:

- Outlet of Project Peach

| Junction in Watershed | Total Drainage Area |
|-----------------------|---------------------|
| A                     | 102.4 ac            |
| B                     | 166.4 ac            |
| C                     | 224.0 ac            |
| D                     | 249.6 ac            |

**Downstream Impact Analysis Process:**

The downstream impact analysis must include the assumptions, results and supporting calculations to show safe passage of post-development design flows downstream for the 10-year design storm. This analysis shall be performed at the outlet(s) of the site, and downstream at each tributary junction to the point(s) in the conveyance system where the area of the portion of the site draining into the system is less than or equal to ten percent of the total drainage area above that point.

The general procedure is as follows:

1. Determine all points of discharge from the site. These points will be used as the first point(s) of analysis for the downstream impact analysis. Identify pre- and post-development site conditions.

Note that if the discharge point(s) from the site do not have a clearly defined cross section, they shall be considered as either shallow concentrated flow or channelized flow. Sheet flow discharges will not be accepted for analysis purposes.

2. Using a topographic map, determine the point(s) downstream where the proposed site area – or the portion of the site area in that drainage area - equals ten percent of the total drainage area, called the 10% point (or “zone of influence”). Identify all tributary junctions between the downstream site boundary/site outlet(s) and the 10% point. All points identified, as well as the outlet(s) of the site, are known as 10% rule comparison points. *[For assistance with this concept, please refer to the examples in the previous section of this document.]*
3. Using a hydrologic model with existing land uses, determine the pre-development peak runoff rate (cubic feet per second) for the 10-year, 24-hour design storm event at each comparison point. Note that the same hydrologic analysis method shall be used for both pre- and post-development discharge calculations.
  - d. Offsite areas should be modeled as “full build-out” for both the pre-and post-development cases.
  - e. An accurate estimation of the time of concentration is key in the downstream impact analysis. Large detention structures (including stormwater control measures) within the drainage area will impact the time of concentration and should be considered in the analysis. For projects that discharge directly into a FEMA studied stream, these structures should already be accounted for in the hydrologic models used by those studies. For projects that do not discharge directly to a FEMA studied stream, the engineer performing the analysis will need to use best available information (aerial topography information, field visits, surveys, or existing plans) to model and account for these structures within the watershed.
  - f. An approximate curve number is used because the actual peak flow is not key for initial analysis. Only the increase or decrease is important. The accuracy in curve number determination is not as significant as an accurate estimate of the time of concentration.
4. Insert the proposed site design and proposed stormwater control measures (SCMs) for the project into the land uses and determine the post-development peak runoff rate for the 10-year, 24-hour design storm at each comparison point.

5. If the post-development peak discharge rate is equal to or less than pre-development conditions at all comparison points, no further analysis is required.
6. If the 10-year, 24-hour post-development peak discharge rate is greater than the pre-development peak discharge rate at any comparison point, then one of the following actions must be taken:
  - a. Revise the site plan for the proposed site to incorporate better use of natural features, design additional structural control facilities, reduce impervious cover, or alter the timing of peak flows to lower post-development flows at each comparison point to pre-development levels; or
  - b. Obtain a flow easement from downstream property owners through the ten percent point where the post-development peak discharge rate is higher than the pre-development peak discharge rate.

**Additional Resources:**

The following resources may clarify the general process of downstream impact analyses (or downstream assessments). Note, however, that the standards and requirements identified in these resources may differ from those of Wake County's required analysis. These links are being provided to assist with conceptual understanding only.

[Integrated Stormwater Management \(iSWM\) \(nctcog.org\)](#) - "Downstream Assessment Analysis"  
[Georgia Stormwater Shorts: Episode 2: Downstream Analysis - YouTube](#)

## Appendix C – Wake County Hybrid Tool

Engineers complete the Wake County Stormwater Hybrid Design Tool by inputting site information, site land uses and time of concentration data by drainage area for pre and post-development conditions.

### Target Curve Number (TCN)

Developers must manage residential runoff for post- development to ensure the site will not exceed the designated curve numbers, in accordance with procedures specified in the *United States Department of Agriculture, Natural Resource Conservation Service, Technical Release 55, Urban Hydrology for Small Watersheds (TR-55)* [*Wake County UDO, Article 9*]. While land uses and hydrologic soil groups (HSGs) are input by engineers by drainage area, the tool calculates the target curve number and post development curve number for the site as a whole. The difference between the two numbers translates to a volume that must be detained for the site. The hybrid tool calculates and flags the volume that is the developer's responsibility to detain. For more information on TCN see Section 4, [Stormwater Design Principles](#).

### Peak Flow

Engineers are responsible for inputting land use and time of concentration information and the Tool will calculate the associated peak flows for pre and post development. If runoff leaves the site at several locations, the engineer must conduct a separate analysis for each outfall and enter site information by individual drainage areas.

The hybrid tool calculates and flags peak flow increases requiring potential attenuation using the TR-55 Graphical Peak Discharge Method for Type II Distribution. The tool does not calculate and perform routing for BMP design and engineers are required to provide their own drainage area maps, stormwater model and supporting calculations to show peak flow compliance with state rules. For more information on peak flow see Section 4, [Stormwater Design Principles](#).

### Nutrient Loading

Nutrient loading calculations are directly from the Jordan/Fall Nutrient Accounting Tool and were reviewed and approved by the NC Department of Water Quality as part of Wake County's submittal for compliance with the Falls Lake and Jordan Lake Nutrient Strategies. For more information on nutrient loading see Section 4, [Stormwater Design Principles](#).