City of Creedmoor Stormwater Program for New Development

As Required by the Falls New Development Stormwater Rule
15A NCAC 2B .0277

City of Creedmoor North Carolina

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Contents

Appendices

INTRODUCTION TO THE NEW DEVELOPMENT RULES

1.1 Background of Falls Nutrient Strategy

Falls of the Neuse Reservoir (a.k.a. Falls Lake) is a man-made reservoir filled in 1983. The 770 square-mile watershed to Falls Lake is located in the northeastern Piedmont of North Carolina and comprises the upper end of the Neuse River Basin. The watershed spans portions of six counties including parts of Durham and Raleigh. Over 90,000 people reside in the watershed with the population projected to double by the year 2025. Nine water supply reservoirs in the watershed, including Falls Lake, serve 450,000 people. Land cover in the watershed is approximately 58 percent forest, 18 percent agriculture, and 11 percent developed.

In 2005 the NC General Assembly passed SL 2005-190 (S981), which includes a requirement for the Commission to adopt a nutrient strategy for Falls Lake based on a calibrated nutrient response model. The 2009 regular legislative session produced Senate Bill 1020, a bill devoted to water quality improvements in Falls Lake. This bill revises the Commission adoption deadline to January 15, 2011 and added requirements aimed at water quality improvements in the watershed.

This mandate prompted a monitoring and modeling process that began in 2005. Lake monitoring from 2005 to 2007, conducted under the direction of a Technical Advisory Committee (TAC), was used to develop the watershed and lake models that helped characterize conditions and the nutrient reductions needed to achieve nutrient related water quality standards throughout the lake. The watershed and lake modeling were completed by NCDENR DWQ (Division of Water Quality) staff, with review and input from the TAC, in November 2008 and February 2009, respectively. Model results indicated the need for controls addressing a range of point and nonpoint sources.

DWQ also conducted an extensive stakeholder input process beginning in 2008 that carried through a formal public comment period on draft rules in summer 2010. The resulting set of rules was approved by the Commission in November 2010, followed by approval of the Rules Review Commission in December 2010. The approved rules went into effect on January 15, 2011.

The Falls Nutrient Strategy is generally designed to reduce excess nutrients impacts, specifically nitrogen and phosphorus, into Falls Lake to reduce algal growth and other nutrient related water quality problems. The requirements of the strategy are similar to those already in place in the Neuse and Tar-Pamlico River Basins. The rules require major

sources of nutrients to reduce loading that makes its way to Falls Lake to meet specific model-established percent reduction goals needed to restore water quality standards and full uses of the lake. The Falls strategy goes beyond previous strategies in requiring *all* local governments in the watershed to implement new development permitting requirements, in requiring load reductions from existing developed lands, and in directly regulating state and federal entities for stormwater control from both new and existing development.

1.2 Purpose of the New Development Rule

The Purpose Item of the New Development Rule sets out its purposes:

> *"(a) To achieve and maintain the nitrogen and phosphorus loading objectives established for Falls Reservoir in Rule 15A NCAC 02.0275 from lands in the Falls watershed on which new development occurs;"*

The applicable loading goals in the referenced Falls Purpose and Scope Rule are defined in terms of percent reductions in annual mass loading of nitrogen and phosphorus in the Falls watershed, relative to a modeled baseline condition, with 2006 being the baseline year. These percentage goals are as follows:

Table 2

Reduction Goals[(a)]		Loading Rate Targets[(b)] (lbs./ac/yr.)	
N	P	N	P
40%	77%	2.2	0.33

(a) From Falls Purpose and Scope rule, 15A NCAC 2B .0275
(b) From Falls New Development rule, Item (4)(a)

> *"(b) To provide control for stormwater runoff from new development in Falls watershed to ensure that the integrity and nutrient processing function of receiving waters and associated riparian buffers are not compromised by erosive flows;" and*

Peak flow rates matching requirements included in the rule are intended to limit erosive flows.

> *"(c) To protect the water supply uses of Falls Reservoir and of designated water supplies throughout the Falls watershed from the potential impacts of new development."*

The rule identifies specific elements of Water Supply Watershed Rules that retain applicability in addition to nutrient reduction requirements imposed by this rule. Chief among those are the density thresholds at which treatment is required and the development density ceilings.

1.3 Applicability of the New Development Rule

The rule requires all local governments in the Falls watershed to implement requirements on new development activities within their planning jurisdictions as state in Items 2 and 3 of the rule:

> *"(2) APPLICABILITY. This Rule shall apply to those areas of new development that lie within the Falls watershed and the planning jurisdiction of a municipality or county that is identified in 15A NCAC 02B .0275."*
>
> *"(3) REQUIREMENTS. All local governments subject to this Rule shall develop stormwater management programs for submission to and approval by the Commission, to be implemented in areas described in Item (2) of this Rule. Nothing in this Rule preempts local governments from establishing requirements that are more restrictive than those set forth in this Rule. Local government stormwater programs shall include the following elements and the standards contained in Item (4):"*

The affected local governments that are listed in the Falls Purpose and Scope Rule, 15A NCAC 02B .0275, and are the following

Municipalities
Butner
Creedmoor
Durham
Hillsborough
Raleigh
Roxboro
Stem
Wake Forest

Counties
Durham
Franklin
Granville
Orange
Person
Wake

1 PROGRAM FOR NEW DEVELOPMENT – Creedmoor, NC

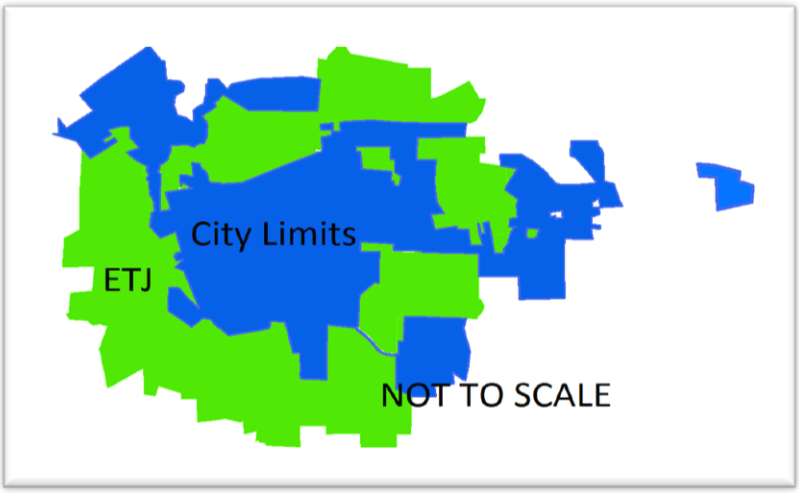
1.1 Effective Date of this Program

This program shall become effective and implementation will commence on July 12, 2012.

1.2 Areas of Applicability

The Local Stormwater Management Program for New Development applies to all areas within the City of Creedmoor's Planning Jurisdiction, both incorporated territorial and extraterritorial acreage.

Total Land Area in Creedmoor Jurisdiction	**9.36**	**square miles**
Land Area of ETJ and Primary Corporate Limits	9.27	square miles
Land Area of Primary Corporate Limits	4.53	square miles
Land Area of Satellite incorporation	0.09	square miles



1.3 State and Federal Projects

The Falls State and Federal Rule [Rule 15A NCAC 02B .0281] establishes stormwater requirements to be implemented by DWQ for new development on state and federal lands beginning upon Commission approval of the Jordan/Falls Accounting Tool (See Appendix P). Upon approval of this Local Stormwater Management Program for New Development and in accordance with the City Board of Commissioners' interpretation of Session Law 2006-246, this program applies to all State and Federal entities that do not have a Phase II NPDES stormwater permit.

1.4 Riparian Buffer Ordinance Compliance Required

The City of Creedmoor currently prohibits land development activities within the Neuse River Basin's statutorily required 50' buffer zone by means of City Code §155.11. The text of this ordinance language describing current regulation of the riparian buffer area is included as Appendix W in the appendices section this stormwater management plan.

Once the proposed **Creedmoor Development Ordinance** (a unified development ordinance) is adopted by the governing board, riparian buffer protection as required by NC DENR DWQ will be fully integrated in **Article 19: *Watershed Protection Ordinance*.**

1.5 Stormwater Management for Existing Development

Currently the City of Creedmoor manages stormwater using on-site facilities that were required based on the time of development. Many areas use "sheet flow", "grassed swales", and newer developments have detention systems in place. The Main Street area has stormwater collectors (grates, inlets) that discharge directly into a nearby tributary stream. A pair of Stormwater BMPs is proposed at strategic locations within the planned reconfiguration of the Main Street District (see Appendix U). Once sited, an additional pair will be proposed on other parcels of land within this redevelopment district in order to address stormwater runoff from our high density urban core.

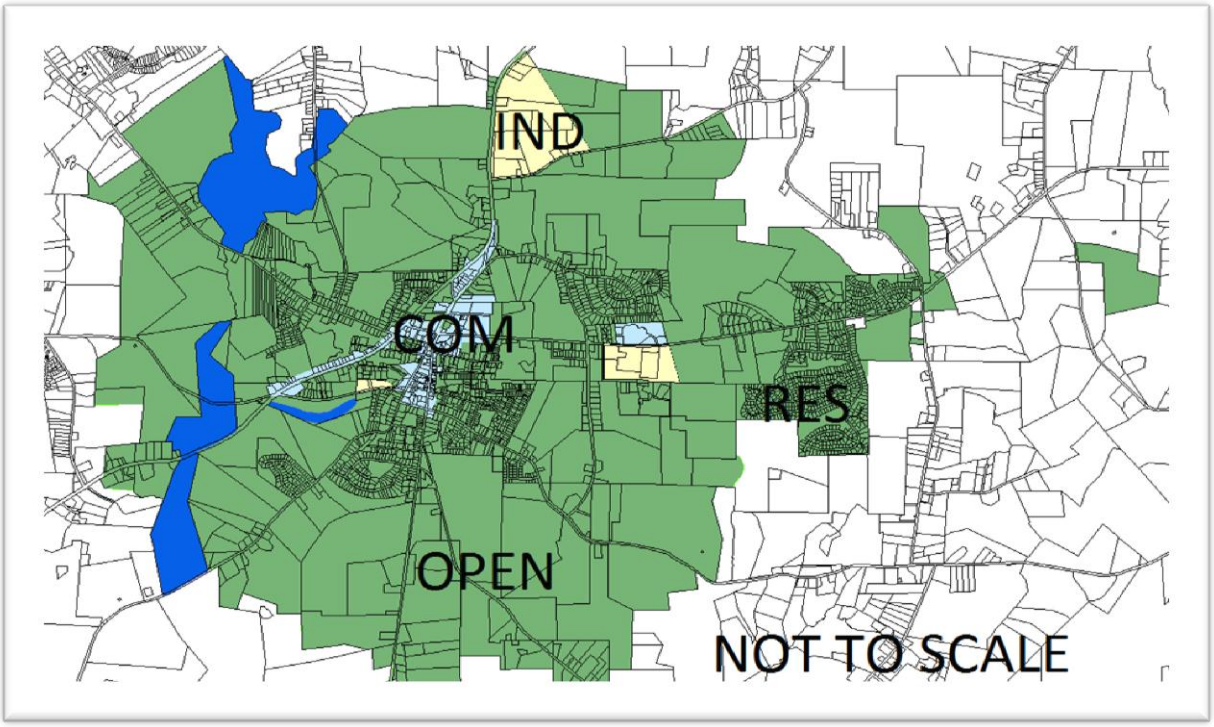
The **Watershed Protection Ordinance** (Appendix L) is in draft format and is scheduled for adoption as Article 19 of the Creedmoor Development Ordinance (CDO). Once the proposed is adopted, the essential elements of the local stormwater ordinance for new development will be fully integrated.

1.6 Status of NPDES Phase II Permit Implementation

At present, the City of Creedmoor's application has been filed, the draft version submitted to the EPA, and will be available for public comment in February 2012.

1.7 Land Use Composition Estimates

Residential Land Use:	1.61 square miles	**17.2%**
Commercial Land Use:	0.27 square miles	**2.9%**
Industrial Land Use:	0.28 square miles	**2.9%**
Open Space:	7.20 square miles	**76.9%**

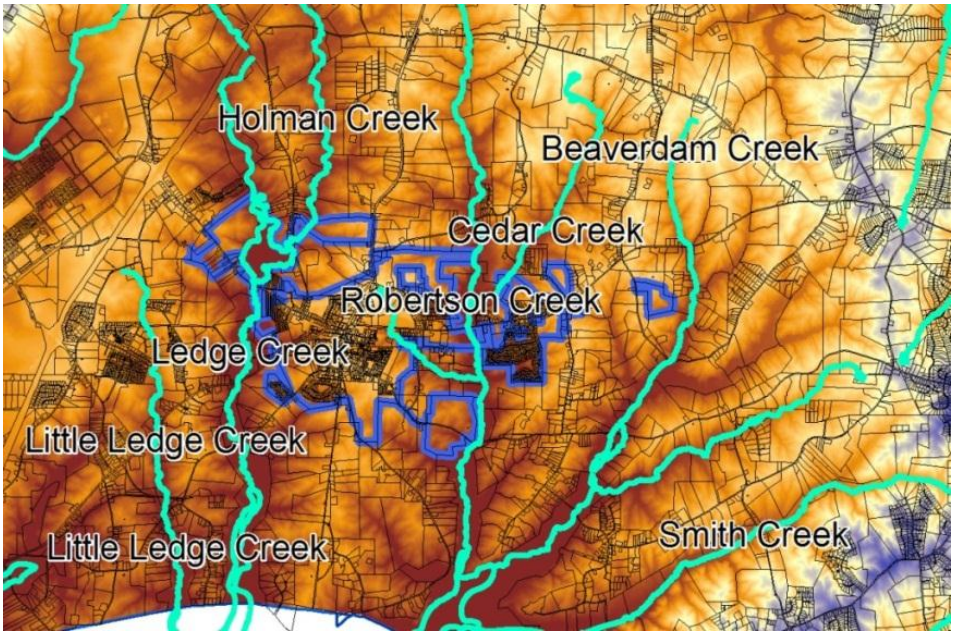


1.8 Estimate Methodology

GIS mapping information was used to determine the area and ratio of land uses. Simple land area calculations were completed using the following logic:

Residential Areas	Areas with single family and multifamily homes with lot size less than five acres
Commercial Areas:	Areas currently (July 2011) zoned for Commercial Use
Industrial Areas:	Areas currently (July 2011) zoned for Industrial Use
Open Space:	[Residential, Commercial and Industrial] Use subtracted from [Total land area in Creedmoor Jurisdiction (ETJ + Primary Corporate Limits + Satellite Incorporated Areas)]

1.9 Major Streams Receiving Stormwater Runoff



The Major Streams that affect this area are (as noted on the above topological map):

- Holman Creek
- Beaverdam Creek
- Cedar Creek
- Robertson Creek
- Ledge Creek

1.10 Existing Local Water Quality Programs

Local Nutrient Sensitive Waters Strategy:	**YES**
Local Water Supply Watershed Program:	**YES**
Delegated Erosion and Sediment Control Program:	**NO**

1.11 State Programs

Erosion and Sediment Control Program:	**YES**

1.12 Proposed Regional Stormwater Utility

Granville and Person Counties, along with the municipalities of Creedmoor, Butner, and Stem are finalizing plans for a regional stormwater utility. A copy of the July 2011 draft proposal is included in this plan in Appendix X.

1.13 Local Ordinances Containing Stormwater Regulations

- City of Creedmoor Code of Ordinances Chapter 155: STORMWATER MANAGEMENT, *adopted January 26, 2010* (see Appendix W)
- City of Creedmoor Code of Ordinances Chapter 155.11: RIPARIAN BUFFERS, *adopted February 2010* (see Appendix W)

2 STORMWATER ADMINISTRATION UNDER LOCAL PROGRAM

2.1 Minimum Qualifications required for Stormwater Administrator

The minimum qualifications of the personnel including the Stormwater Administrator and/or designated individuals, performing services only in their area of competence, who will be responsible for implementing the City of Creedmoor's Local Stormwater Program, including stormwater plan review and BMP inspection are as follows:

- A person certified by the North Carolina Cooperative Extension Service to approve stormwater management plans or to inspect BMPs
- Registered North Carolina Professional Engineers with stormwater experience
- Registered North Carolina Professional Surveyor, Landscape Architect, Soil Scientist, or Aquatic Biologist.

3 BMP MAINTENANCE/INSPECTION PROGRAM

3.1 Requirements

Where BMPs are implemented to achieve the nitrogen and phosphorus loading and flow attenuation requirements for a development within the corporate limits or extraterritorial jurisdiction area, the City of Creedmoor is responsible for ensuring that BMPs continue to function for the life of the development. To that end, the City requires annual inspection of both privately owned and publicly held BMPs by qualified personnel to ensure ongoing performance. The City will offer owners of privately owned engineered stormwater controls the option to either pay the City an annual inspection fee, or to contract the services of qualified personnel at their own expense. Persons performing Stormwater BMP inspection must maintain one of the following credentials on an ongoing basis:

- Certification by the North Carolina Cooperative Extension Service to approve stormwater management plans or to inspect BMPs
- Registration as a North Carolina Professional Engineer (preferably with stormwater experience)
- Registration as a North Carolina Professional Surveyor, Landscape Architect, Soil Scientist, or Aquatic Biologist.

Regardless of which option owners of private engineered Stormwater Controls choose, the City of Creedmoor shall establish an inspection oversight program designed to conduct routine review of all inspection reports submitted as well as site review of all permitted projects at least once every five (5) years, or site inspections on a minimum of 20% of permitted projects each year.

3.2 Recordkeeping Requirements for Stormwater Administrator

The City of Creedmoor shall maintain a database of BMPs installed within the City's jurisdictional boundaries to comply with the requirements of the Falls Rule, to track activities associated with those BMPs, and to assist in preparation of required annual reports to be provided to DWQ. The following elements, at a minimum, shall be kept in a database maintained by the Stormwater Administrator in regards to all publicly owned and privately owned BMPs (not dedicated to the City for maintenance purposes) constructed in accordance with criteria and specifications in the Design Manual *(NCDENR Stormwater BMP Manual, July 2007 Edition)*, permitted, and maintained in conjunction with an approved local stormwater plan:

- Owner name and mailing address
- Recorded deed book and page number of the lot that contains each engineered stormwater control
- A statement that an inspection was made of all engineered stormwater controls either by a person performing services only in their area of competence in at least one of the following types listed:
    - A person certified by the North Carolina Cooperative Extension Service to approve stormwater management plans or to inspect BMPs (shall include Certificate Number of inspector)
    - Registered North Carolina Professional Engineers with stormwater experience
    - Registered North Carolina Professional Surveyor, Landscape Architect, Soil Scientist, or Aquatic Biologist.
- The date the inspection was made
- A statement that all inspected engineered stormwater controls are performing properly and are in compliance with the terms and conditions of the approved maintenance agreement required by the City of Creedmoor's Stormwater Ordinance for New Development; and
- The original signature and seal of the engineer, surveyor, or landscape architect (on file as a permanent record on a form provided by the Stormwater Administrator)

- A photocopy of the financial surety for long-term function for each engineered stormwater control installed on a parcel of land associated with the permit
- Database of practices installed
- A listing of stormwater controls subject to the local government inspection and oversight program, including frequency of local government inspections of city owned stormwater controls

This database, in its entirety, shall be made available to DWQ for examination upon request.

Forms to be used in Permitting and Compliance Process

Appendix Q contains the following forms proposed for use in the permitting process

- Stormwater Permit Application
- Stormwater As-Built Submission Form
- Retention Pond Statement of Certification
- Stormwater Operation and Maintenance Agreement

For Homeowner's and Other Associations:

For BMPs that are to be maintained by an association of owners, to address the need for major repair or complete replacement, a copy of all maintenance agreements shall be maintained on file by the Stormwater Administrator. This file shall include all of the following elements:

- A statement of acknowledgment by the association that recognizes the necessity of the continuously operating and maintaining the installed stormwater control and management facilities. This statement should specifically address the need for eventual repair and/or replacement of controls installed by the initial developer of the property by the current association and all subsequent owners.
- A copy of the financial surety for long-term function for each engineered stormwater control installed on property maintained by the homeowner's association
- Document(s) verifying the establishment of an escrow account funded entirely by both developer contributed and annual sinking funds, accrued to be spent solely for maintenance or repairs/replacement of components of the engineered stormwater control for its useful life.
- A document granting the City of Creedmoor the right of entry to inspect, monitor, maintain, repair, and reconstruct engineered stormwater controls
- Associated documentation required by the City of Creedmoor that covers all special requirements for operations and maintenance of engineered stormwater controls.

4 ILLICIT DISCHARGE DETECTION & ELIMINATION

Pursuant to Federal Regulations 40 CFR Section 122.34 (b) the City must:

a) Develop, implement and enforce a program to detect and eliminate illicit discharges (as defined at Sec. 122.26(b)(2)) into our MS4;
b) Develop a storm sewer system map, showing the location of all outfalls and the names and location of all waters of the United States that receive discharges from those outfalls;
c) Effectively prohibit, through ordinance, or other regulatory mechanism, non-stormwater discharges into our storm sewer system and implement appropriate enforcement procedures and actions;
d) Develop and implement a plan to detect and address non-stormwater discharges, and illegal dumping into our system;
e) Inform public employees, businesses, and the general public of hazards associated with illegal discharges and improper disposal of waste; and
f) Address the following categories of non-stormwater discharges or flows (i.e., illicit discharges) if we identify them as significant contributors of pollutants into our MS4:
    1) water line flushing,
    2) landscape irrigation (including lawn watering & irrigation water)
    3) diverted stream flows,
    4) rising ground waters,
    5) uncontaminated ground water infiltration (as defined at 40 CFR 35.2005(20)),
    6) uncontaminated pumped ground water,
    7) discharges from potable water sources,
    8) foundation drains,
    9) air conditioning condensation,
    10) springs,
    11) water from crawl space pumps,
    12) footing drains,
    13) individual residential car washing,
    14) flows from riparian habitats and wetlands,
    15) de-chlorinated swimming pool discharges, and
    16) street wash water
g) Exceptions include: discharges or flows from fire-fighting activities (excluded from the effective prohibition against non-stormwater and will only be addressed where they are identified as significant sources of pollutants to waters of the United States).

Under the proposed draft permit the City shall implement the following BMPs, to the extent authorized by law, to meet the objectives of the Illicit Discharge Detection and Elimination Program and shall notify the Division prior to modification of any goals:

a) Annually review and revise as necessary the City's IDDE ordinances or other regulatory mechanisms, or adopt any new ordinances or other regulatory mechanisms that provide the permittee with adequate legal authority to prohibit illicit connections and discharges and enforce the approved IDDE Program.
b) Maintain, assess, and update as necessary a map identifying major outfalls.
c) Develop and implement a program for conducting regular dry weather flow field observations in accordance with written field screening procedure for detecting and tracing the sources of illicit discharges and for removing the sources or reporting the sources to the State to be properly permitted.
d) Maintain, assess annually, and update as necessary written procedures for conducting investigations into the source of all identified illicit discharges, including approaches to requiring such discharges to be eliminated.
e) Track all investigations and document the date(s) the illicit discharge was observed; the results of the investigation; any follow-up of the investigation; and the date the investigation was closed.
f) Implement and document a training program for appropriate municipal staff.
g) Inform public employees, businesses, and the general public of hazards associated with illegal discharges and improper disposal of waste.
h) Promote, publicize, and facilitate a reporting mechanism for the public and staff to report illicit discharges and establish and implement citizen request response procedures.
i) Conduct reactive inspections in response to complaints and follow-up inspections as needed to ensure that corrective measures have been implemented by the responsible party to achieve and maintain compliance.
j) Establish and implement, assess annually and update as necessary written procedures to identify and report to the County health department failed septic systems located within the City's planning jurisdiction.
k) Establish and implement assess annually and update as necessary written procedures to identify and report sanitary sewer overflows and sewer leaks to the system operator.
l) Track the issuance of notices of violation and enforcement actions.
m) Identify chronic violators for initiation of actions to reduce noncompliance.
n) Maintain, assess annual and update as necessary written spill/dumping response procedures.

5 THE NEW DEVELOPMENT FALLS STORMWATER RULE

The Falls Rule for New Development, 15A NCAC 02B .0276, provides these definitions for the terms used in the rule:

> *"(16) 'New development' means any development project that does not meet the definition of existing development set out in this Rule"*
>
> *"(7) 'Existing development' means development, other than that associated with agricultural or forest management activities that meets one of the following criteria:*
>
> > *a) It either is built or has established a vested right based on statutory or common law as interpreted by the courts, for projects that do not require a state permit, as of the effective date of either local new development stormwater programs implemented under Rule 15A NCAC 02b .0277 [Falls New Stormwater Rule] or, for projects requiring a state permit, as of the applicable compliance date established in Rule 15A NCAC 02B .0281 (5) and (6)* [Falls State and Federal Entities Stormwater Rule]*.; or*
> >
> > *b) It occurs after the compliance date set out in Sub-Item (5)(d) of Rule .0277* [New Development Rule] *but does not result in a net increase in built-upon area."*

The Falls Definitions Rule refers to another rule in the same section of administrative code, Rule 15A NCAC 2B .0202, to define the following term:

> *"(23) Development means any land disturbing activity which adds to or changes the amount of impervious or partially impervious cover on a land area or which otherwise decreases the infiltration of precipitation in the soil."*

In short, "new development" under the Falls New Development rule is any development that is not vested and that results in a net increase in built-upon area. This applies equally to development on previously undeveloped lands, or Greenfield development, and redevelopment.

Rule 2B .0202 also defines built-upon area, which is used in the definition of "existing development" above:

> *"(13) Built-upon area means that portion of a development project that is covered by impervious or partially impervious cover including buildings, pavement, gravel areas (e.g. roads, parking lots, paths), recreation*

facilities (e.g. tennis courts), etc. (Note: Wooden slatted decks and the water area of a swimming pool are considered pervious.)"

5.1 Land Disturbance Thresholds

The Rule establishes land disturbance thresholds that any activity that meets the definition of new development must exceed before a stormwater management plan is required:

> *"(3)(a) The requirement that a stormwater management plan shall be submitted for local government approval based on the standards in Item (4) for all proposed new development disturbing one-half acre or more for single family and duplex residential property and recreational facilities, and 12,000 square feet or more for commercial, industrial, institutional, multifamily residential, or local government property;"*

The definition of "land-disturbing activity" in Rule 2B .0202 reads as follows:

> *"(37) Land-disturbing activity means any use of the land that results in a change in the natural cover or topography that may cause or contribute to sedimentation."*

DWQ interprets these land disturbance thresholds as cumulative disturbances. If the project is part of a larger common plan of development or sale, and the larger common plan would exceed the applicable half-acre or acre threshold, even though multiple, separate or distinct activities take place at different times on different schedules, the development would require a stormwater plan.

5.2 Summary of Permitting Thresholds

City of Creedmoor's permitting thresholds are defined by narrowing from the broadest terms included in the definition to the most selective. That is, to require a stormwater plan under this rule, an activity must be land-disturbing, it must additionally be new development (in short, not vested and resulting in a net increase in built-upon area), and it must disturb at least the applicable acreage threshold of one-half or one acre. This logic would apply to not only to previously undeveloped, Greenfield development but also to redevelopment projects.

Once a stormwater management plan is required, the proposed activity may be subject to nutrient reduction requirements, depending on whether it exceeds the rule's loading rate targets. This will depend on the untreated nutrient loading rates estimated for that development.

Example: A proposal to build a house on an undeveloped 2-acre lot of record in the city. Plan proposes to disturb 1.1 acres to build a 3,000 square foot house with a 1,000 square foot shed and 2,000 square feet of driveway. Assuming it is not vested, this would add impervious and would be residential that disturbs more than one acre, so it would qualify as "new development" and require a stormwater plan. Would it need to reduce nutrient loads? The Jordan/Falls accounting tool estimates untreated loads of approximately 1.63 lb. N/ac/yr. and .32 lb. P/ac/yr., so no load reduction is necessary. (Note that impervious footprints could vary significantly and affect the load value)

The land disturbance thresholds of one-half acre and 12,000 square feet effectively set aside small-scale development such that its loads are not addressed under 15A NCAC 02B .0278, nor under the strategy except to the extent that such lands are previously developed. Such previously developed lands will potentially be captured in existing development load reduction assignments made to the City of Creedmoor by DWQ. At a future date, the City may choose to adopt lower disturbance thresholds in order to close any gap in regulation on stormwater runoff.

Where below-threshold development occurs on previously developed lands, there is a potential opportunity for the City of Creedmoor to achieve load reductions creditable under the existing development requirements provided such development reduces loads relative to the previous development. Conversely, below-threshold development on previously developed lands presents a potential liability to the City of Creedmoor under the existing development requirements if it increases loads relative to the previous development.

5.3 Table 3: Stormwater BMP Performance Specifications

Planning measures can be used to reduce nutrient runoff from new development. However, on-site nutrient-reducing BMPs are often necessary. Each BMP has different load reduction capabilities. BMPs can be selected in the Jordan/Falls Accounting Tool to see the reductions they achieve. Table 3 (below) lists the set of current BMPs that can be used to achieve nutrient reductions. BMPs may be added to this list as better science is established. The rule requires that BMPs be built in accordance with the DWQ's Stormwater BMP Manual, which is available at:
http://portal.ncdenr.org/web/wq/ws/su/bmp-manual

Table 3

BMP	TSS Removal Efficiency [a]	*Volume Reduction (Piedmont)* [b]	*Volume Reduction (Triassic)* [b]	*TN Effluent Concentration* [b] *(mg/L)*	*TP Effluent Concentration* [b] *(mg/L)*
Stormwater Wetland	85%	20%	15%	1.08	0.12
Bioretention w/o IWS	85%	35%	15%	1.00	0.12
Bioretention w/ IWS	85%	50%	0%	0.95	0.12
Wet Detention Basin	85%	10%	0%	1.01	0.11
Dry Extended Detention Basin	50%	0%	0%	1.20	0.20
Permeable Pavement*	0%	0%	0%	1.44	0.39
Rainwater Harvesting*	n/a	User defined	User defined	1.08	0.15
Grassed Swale	35%	0%	0%	1.21	0.26
Infiltration Device	85%	n/a	n/a	n/a	n/a
Restored Riparian Buffer	60%	n/a	n/a	n/a	n/a
Level Spreader/ Filter Strip	40%	40%	20%	1.20	0.15
Sand Filter	85%	5%	5%	0.92	0.14
Greenroof*	0%	50%	50%	1.08	0.12

[a] From DWQ Stormwater BMP Manual
[b] From Jordan/Falls Lake Stormwater Load Accounting Tool
* DWQ will continue to evaluate data on BMP practices.
**For Piedmont Physiographic/Geologic Region

While the NC Stormwater BMP Manual provides nitrogen and phosphorus percent removal efficiencies for these BMPs, the new Jordan/Falls Accounting Tool (Appendix M) introduces a new innovation that moves away from these fixed percent nutrient removal efficiencies. It instead assumes the fixed effluent concentrations shown in the table specific to each BMP regardless of the influent concentration. The designers of the tool have determined the need for this innovation to more accurately represent actual stormwater treatment processes, as supported by research nationwide and in other countries that study these practices. This design shift has at least two notable effects for the user. One, higher inflow nutrient concentrations result in great treatment efficiencies, and two, effluent concentration is one of two key factors in BMP selection for nutrient control.

A second improvement in the new tool is that it accounts for infiltration that occurs as stormwater passes through a BMP, crediting this loss of volume toward nutrient load reduction. This function varies across BMPs, as also shown in Table 3. This function

raises another implication for users considering a series of BMPs. An additional BMP that does not have a lower effluent concentration than the previous BMP may still reduce loading further through infiltration.

In addition to nutrient reducing planning measures and BMP implementation, developers have the option of providing full treatment onsite or using off-site options to partially offset their nitrogen and phosphorus reduction requirements, if specific onsite treatment reductions are first met. Full treatment onsite may require more than one BMP in series depending on the level of impervious cover.

5.4 Onsite Treatment Criteria

Sub-Items (4)(b)(i) through (iv) establish the onsite treatment criteria required for New Development prior to using an offsite offset option.

> *"(4)(b) The developer shall have the option of offsetting part of the nitrogen and phosphorus load by implementing or funding offsite offset measures. Before using an offsite offset option, a development shall implement onsite structural stormwater controls that achieve one of the following levels of reductions:*
>
> *(i) Proposed new development activity disturbing at least one-half acre but less than one acre of land for single family and duplex residential property and recreational facilities, except as stated in Sub-Item (4)(b)(iv), shall achieve 30 percent or more of the needed load reduction in both nitrogen and phosphorus loading onsite and shall meet any requirements for engineered stormwater controls described in Sub-Item (4)(e) of this Rule;*
>
> *(ii) Proposed new development activity disturbing at least 12,000 but less than one acre of land for commercial, industrial, institutional, multifamily residential, or local government property, except as stated in Sub-Item (4)(b)(iv), shall achieve 30 percent or more of the needed load reduction in both nitrogen and phosphorus loading onsite and shall meet any requirements for engineered stormwater controls described in Sub-Item (4)(e) of this Rule;*
>
> *(iii) Except as stated in Sub-Item (4)(b)(iv), proposed new development activity that disturbs one acre of land or more shall achieve 50 percent or more of the needed load reduction in both nitrogen and phosphorus loading onsite*

and shall meet any requirements for engineered stormwater controls described in Sub-Item (4)(e) of this Rule; or

(iv) Proposed development that would replace or expand structures or improvements that existed as of December 2006 and that increases impervious surface within a local government's designated downtown area, regardless of area disturbed, shall achieve 30 percent of the needed load reduction in both nitrogen and phosphorus onsite, and shall meet any requirements for engineered stormwater controls described in Sub-Item (4)(e) of this Rule;"

The rule's onsite BMP requirements include the following:

> *"(4)(e) Stormwater systems shall be designed to control and treat the runoff generated from all surfaces by one inch of rainfall…"*

Taken together, DWQ interprets these passages to mean that if a development exceeds the nutrient loading rate targets described in the Falls Rule before any BMPs are added, then onsite treatment must be provided for runoff from all surfaces to the level of nutrient reduction described in Sub-Item (4)(b) of the Falls Stormwater Rule.

The interpretation above does not fully answer the question of the spatial extent of site area that should be treated. While the offsite loading rate thresholds described in the Rule provide some level of backstop, DWQ's expectation is that runoff from at least all impervious surfaces is to be captured, along with resulting attendant pervious areas within the drainage envelope of the stormwater practices, and treated for nutrient removal, recognizing practical limitations, and that the offsite nutrient thresholds must at least be met. This policy is consistent with DWQ policy under Phase II NPDES stormwater and WSW stormwater.

5.5 Offsite Run-On

In many projects, adjacent lands drain onto the project site, either overland or in defined conveyances. Designers have an option for dealing with this "offsite run-on". They may choose to divert this runoff around or through their site without co-mingling it with site drainage. In this case, they are not required to provide any treatment or attenuation but need to be sure to respect down gradient property rights. Alternatively, they may choose to accept the offsite run-on and treat and attenuate it. In this case, they are required to size their practices to treat the entire catchment draining to them, including the offsite portion.

If a site is designed to allow offsite run-on to drain to a BMP but the BMP is sized to handle only the onsite portion of the catchment, that BMP is in effect undersized and is not meeting requirements.

5.6 Offsite Partial Offset Options

Section (4)(b) and (c) of the New Development Rule allows for developers to achieve portions of their nutrient reduction needs through off-site offsets and reads in part as follows:

> *"(b) The developer shall have the option of offsetting part of the nitrogen and phosphorus load by implementing or funding offsite offset measures. Before using an offsite offset option, a development shall implement onsite structural stormwater controls that achieve one of the following levels of reductions:"*
>
> *"(c) Offsite offsetting measures shall achieve at least equivalent reductions in nitrogen and phosphorus loading to the remaining reduction needed onsite to comply with the loading rate targets set out in Sub-Item (4)(a) of this Item. A developer may use any measure that complies with the requirements of Rules .0240 and .0282. of this Section;"*

Any development that first achieves the onsite load reduction requirements as described in Sub-Items (4)(b)(i) through (iv) of the Falls New Development Rule, may implement or fund offsite management measures that achieve the remaining nitrogen and phosphorus loading reductions needed to achieve the loading rate targets of Table 2 as opposed to providing additional BMPs onsite.

5.7 Offsets Approvals

All nutrient offset projects are required to obtain DWQ approval to sell credits, and DWQ oversees the depletion of credits by banks. The City of Creedmoor will be responsible for verifying developers' calculated offsite reduction needs and that developers have obtained approved credits before approving their project applications.

The last sentence of the Sub-Item (4)(c) quoted above states that all offsets shall meet the requirements of rule 2B .0282, *Options for Offsetting Nutrient Loads*, also referred to as the Falls trading rule, which is provided in Appendix C. The trading rule lays out basic requirements for parties who wish to buy or sell credits in Falls watershed. It applies to all parties in the watershed who wish to do so. It includes the following geographic restrictions to be adhered to by prospective buyers and sellers of credit:

> *"(i) Impacts in the upper Falls watershed as defined in Item (19) of 15A NCAC 02B .0276 may be offset only by load reductions achieved in the upper Falls watershed;"* and
> *"(ii) Impacts in the lower Falls watershed as defined in Item (20) of 15A NCAC 02 .0276 shall be offset by load reductions achieved anywhere within the Falls watershed."*

All nutrient offsets for impacts must be located within the Falls watershed. The Sub-items of the trading rule noted above further refine the geographic requirements of nutrient offsets within the Falls watershed.

Nutrient offset purchasers and providers are also required to comply with the *Nutrient Offset Payment Rule,* 15A NCAC 2B .0240. This rule applies to all watersheds in the state where the offset option is in place and sets procedural requirements for all nutrient offset buyers, sellers and projects. The rule was amended effective September 2010 and revised procedures that had been mandated by session law up to that point. Local governments will need to ensure that developers meet certain requirements identified in this rule. The rule is provided in Appendix J.

A related rule, 15A NCAC 2B .0274, *Nutrient Offset Payment Rates for the NC Ecosystem Enhancement Program,* also effective September 2010, does not set requirements that local governments must implement, but it does dictate the price of offsets provided by the NC Ecosystem Enhancement Program. That rule establishes a process for the EEP to set its offset rates in all watersheds that have the offset option. That rule is provided in Appendix K. See the following webpage for a description of the EEP in-lieu payment process: http://www.nceep.net/pages/pay.htm

5.8 Redevelopment

The rule sets out the following treatment expectations for redevelopment projects under Sub-Item (4)(a):

> *"Proposed development that would replace or expand structures or improvements that existed as of December 2006, the end of the baseline period, and that would not result in a net increase in built-upon area shall not be required to meet the nutrient loading targets or high-density requirements except to the extent that the developer shall provide stormwater control at least equal to the previous development. Proposed development that would replace or expand existing structures or improvements and would*

result in a net increase in built-upon area shall have the option either to achieve at least the percentage loading reduction objectives stated in 15A NCAC 02B .0275 as applied to nitrogen and phosphorus loading from the previous development for the entire project site, or to meet the loading rate targets described in this Item. These requirements shall supersede those identified in 15A NCAC 02B .0104(q)."

The two options for treatment of redevelopment that increases built-upon area as described in Sub-Item (4)(a) above and exceed the land disturbance thresholds described are further explained as follows:

1. The pre-existing nitrogen and phosphorus loading rates shall first be determined by using the Accounting Tool found in Appendix M. Then the strategy percent reduction goals found in Table 2 (page 2) shall be applied to the pre-development loading rates to determine the post-development nutrient loading target rates that must be achieved by the entire site; or
2. The entire site must meet the loading rate targets listed in Table 2 (page 2).

The first option becomes the less stringent option as the percent impervious cover of redevelopment sites increases above some threshold. Given that the majority of redevelopment sites subject to the rule may be commercial/industrial in nature, the first option may be developers' overwhelming choice in practice.

To be clear, where there is a net increase in built-upon area, the Rule calls for the entire redevelopment project to meet the nutrient requirements, not just the net increased built upon area. All impervious should be captured and treated. In this case, this would be all impervious on the project site. This is a departure from the way redevelopment that increases built-upon area is handled under Phase II and WSW stormwater.

5.9 Meeting Other Regulations

The Falls New Development Rule describes how new development in the Falls watershed is affected by other regulations in addition to the Rule:

"(4)(d) *Proposed new development subject to NPDES, water supply, and other state-mandated stormwater regulations shall comply with those regulations in addition to the other requirements of this Sub-Item. Proposed new development in any water supply watershed in the Falls watershed designated WS-II, WS-III, or WS-IV shall comply with the density-based restrictions, obligations, and requirements for engineered*

stormwater controls, clustering options, operation and maintenance responsibilities, vegetated setbacks, land application, and landfill provisions described in Section (3)(b)(i) and (3)(b)(ii) of the applicable Rule among 15A NCAC 02B .0214 through .0216. Provided, the allowance in watersupply watershed rules for 10 percent of jurisdiction to be developed at up to 70 percent built-upon area without stormwater treatment shall not be available in the Falls watershed;"

In accordance with this sub-item, new development will continue to have to comply with the other state regulations including NPDES Stormwater and Water Supply Watershed Rules. Rules .0214 through .0216 are the Water Supply Rules for Class WS-II, WS-III, and WS-IV respectively. Section (3)(b)(i) of each of the rules lays out the WS requirements throughout the WS Watershed, including the low and high density options and the 10/70 provision. Item (3)(b)(ii) of each rule lays out the requirements for areas within the critical area of the WS watershed, including low and high density options. These three WS rules are located in Appendices F through I.

Probably the most important aspects of the retained Water Supply Watershed requirements, once overlaid with requirements of this rule, are the density thresholds requirement treatment and the density ceilings. Since this rule sets no absolute limit on built-upon area, the Water Supply Watershed density ceilings serve as an additional limitation in all cases.

5.10 Calculating Peak Runoff Volume

Item (4)(e) and (f) of the Falls Rule describes the peak flow requirements:

"(4)(e) Stormwater systems shall be designed to control and treat the runoff generated from all surfaces by one inch of rainfall. The treatment volume shall be drawn down pursuant to standards specific to each practice as provided in the July 2007 version of the ***Stormwater Best Management Practices Manual*** *published by the Division, or other at least technically equivalent standards acceptable to the Division.*
"(4)(f) To ensure that the integrity and nutrient processing functions of receiving waters and associated riparian buffers are not compromised by erosive flows, stormwater flows from the new development shall not contribute to degradation of waters of the State. At a minimum, the new development shall not result in a net increase in peak flow leaving the site from pre-development conditions for the one-year, 24-hour storm event;"

The main reason that the rule requires a one-year design storm for peak flow control is to protect stream channels from erosion. Development on land causes many changes in stormwater hydrology. One of the major causes of streambank erosion in urban streams is the increase in the frequency of the bankfull-flooding event. The bankfull-flooding event generally occurs at approximately a one and a half year frequency. The Rule requires control of the one-year storm to predevelopment levels to insure that the rate of release will be below bankfull and therefore less erosive to the stream channel.

Protecting streambanks from erosion is a crucial part of the overall Falls Strategy. Riparian buffers are protected under this program because in most situations they are effective at removing nitrogen resulting from nonpoint source pollution. The use of nitrogen reducing BMPs on new development does not obviate the need to maintain valuable riparian buffers.

Refer to Chapter 3.2 and 3.3 of the NC DWQ Stormwater BMP Manual for guidance on calculating peak flow: http://portal.ncdenr.org/web/wq/ws/su/bmp-manual

6 LOCAL EFFORTS

6.1 Land Use Planning Provisions

The site performance standard design of the Falls Rule provides local governments the opportunity to potentially aid developers from the standpoint of reducing a project's untreated loading rates via modifications to various ordinances that reflect improved growth management practices. For a period of approximately one year, the City of Creedmoor's Planning Staff have been in the process of rewriting all existing land use ordinances to create a new unified development ordinance. While the project is ongoing, substantial improvement over current ordinances has been achieved by proposing recommendations that include:

- Reducing road widths; offering alternatives to divided streets with open swale medians
- Reducing minimum parking requirements (currently waived in the B-1 downtown Business district, but formulaic in the B-2 Highway Business district)
- Minimizing use of curb and gutter outside of the Main Street Business District
- Cluster or open-space developments particularly in heavily wooded corridors that currently frame the periphery of the corporate boundaries
- Traditional neighborhood and Mixed-use developments

6.2 Public Education & Outreach on Stormwater Impacts

Pursuant to Federal Regulations 40 CFR Section 122.34 (b) the City of Creedmoor must implement a public education program to distribute educational materials to the community or conduct equivalent outreach activities about the impacts of stormwater discharges on water bodies and the steps that the public can take to reduce pollutants in stormwater runoff.

Under the proposed draft permit the City will implement the following BMPs to meet the objectives of the Public Education and Outreach Program and shall notify the Division prior to modification of any goals:

a) Defined goals and objectives of the Local Public Education and Outreach Program based on at least three high priority community wide issues including:
    1) To effectively communicate with the citizens and businesses of Creedmoor for the purpose of educating people about surface water quality,
    2) To educate the public with an improved understanding the importance of the protection of surface water quality, and
    3) To develop an active citizenry in the protection of the surface waters of the City's planning jurisdiction.
b) Maintain a description of the target pollutants and/or stressors and likely sources.
c) Identify, assess annually and update as necessary target audiences likely to have significant stormwater impacts and why they were selected.
d) Identify and describe issues, such as specific pollutants, the sources of those pollutants, impacts on biology, and the physical attributes of stormwater runoff, in their education/outreach program.
e) Identify and describe watersheds in need of protection and the issues that may threaten the quality of these waters.
f) Promote and maintain, assess and update as necessary internet web site.
g) Distribute public education materials to identified target audiences and user groups.
h) Promote and maintain a stormwater hotline/helpline.
i) Implement a Public Education and Outreach Program.
j) Assess its stormwater education/outreach program and update as necessary.
k) Adjust its educational materials and the delivery of such materials to address any shortcomings found as a result of this assessment
l) Assess changes in public awareness and behavior resulting from the implementation of the program.

6.3 Public Involvement & Participation

Pursuant to Federal Regulations 40 CFR Section 122.34 (b) the City must, at a minimum, comply with State and local public notice requirements when implementing a public involvement/ participation program.

Under the proposed draft permit the City shall implement the following BMPs to meet the objectives of the Public Involvement and Participation Program and shall notify the Division prior to modification of any goals:

a) Conduct at least one public meeting during the term of the permit to allow the public an opportunity to review and comment on the Stormwater Program for New Development.
b) Include and promote volunteer opportunities as part of its stormwater program designed to promote ongoing citizen participation.
c) Provide and promote a mechanism for public involvement that provides for input on stormwater issues and the stormwater program.
d) Promote and maintain hotline/helpline.

APPENDIX

APPENDIX A

Falls Water Supply Nutrient Strategy:

Stormwater Management for New Development

APPENDIX A

15A NCAC 02B .0277 FALLS RESERVOIR WATER SUPPLY NUTRIENT STRATEGY: STORMWATER MANAGEMENT FOR NEW DEVELOPMENT

The following is the stormwater strategy, as prefaced in 15A NCAC 02B .0275, for new development activities within the Falls watershed:

(1) PURPOSE. The purposes of this Rule are as follows:

(a) To achieve and maintain the nitrogen and phosphorus loading objectives established for Falls Reservoir in 15A NCAC 02B .0275 from lands in the Falls watershed on which new development occurs;
(b) To provide control for stormwater runoff from new development in Falls watershed to ensure that the integrity and nutrient processing functions of receiving waters and associated riparian buffers are not compromised by erosive flows; and
(c) To protect the water supply, aquatic life and recreational uses of Falls Reservoir from the potential impacts of new development.

(2) APPLICABILITY. This Rule shall apply to those areas of new development that lie within the Falls watershed and the planning jurisdiction of a municipality or county that is identified in 15A NCAC 02B .0275. This Rule shall not apply to development activities on state and federal lands that are set out in Rule .0281 of this Section.

(3) REQUIREMENTS. All local governments subject to this Rule shall develop stormwater management programs for submission to and approval by the Commission, to be implemented in areas described in Item (2) of this Rule. Nothing in this Rule preempts local governments from establishing requirements that are more restrictive than those set forth in this Rule. Local government stormwater management programs shall include the following elements and the standards contained in Item (4):

(a) The requirement that a stormwater management plan shall be submitted for local government approval based on the standards in Item (4) for all proposed new development disturbing one-half acre or more for single family and duplex residential property and recreational facilities, and 12,000 square feet or more for commercial, industrial, institutional, multifamily residential, or local government property;
(b) A plan to ensure maintenance of best management practices (BMPs) implemented to comply with this rule for the life of the development; and
(c) A plan to ensure enforcement and compliance with the provisions in Item (4) of this Rule for the life of the new development.

(4) PLAN APPROVAL REQUIREMENTS. A developer's stormwater plan shall not be approved by a subject local government unless the following criteria are met:

(a) Nitrogen and phosphorus loads contributed by the proposed new development activity shall not exceed the following unit-area mass loading rates for nitrogen

and phosphorus, respectively, expressed in units of pounds/acre/year: 2.2 and 0.33. Proposed development that would replace or expand structures or improvements that existed as of December 2006, the end of the baseline period, and that would not result in a net increase in built-upon area shall not be required to meet the nutrient loading targets or high-density requirements except to the extent that the developer shall provide stormwater control at least equal to the previous development. Proposed development that would replace or expand existing structures or improvements and would result in a net increase in built-upon area shall have the option either to achieve at least the percentage loading reduction objectives stated in 15A NCAC 02B .0275 as applied to nitrogen and phosphorus loading from the previous development for the entire project site, or to meet the loading rate targets described in this Item. These requirements shall supersede those identified in 15A NCAC 02B .0104(q). The developer shall determine the load reductions needed to meet these loading rate targets by using the loading calculation method called for in Sub-Item (5)(a) or other equivalent method acceptable to the Division;

(b) The developer shall have the option of offsetting part of the nitrogen and phosphorus load by implementing or funding offsite offset measures. Before using an offsite offset option, a development shall implement onsite structural stormwater controls that achieve one of the following levels of reductions:

(i) Proposed new development activity disturbing at least one-half acre but less than one acre of land for single family and duplex residential property and recreational facilities, except as stated in Sub-Item (4)(b)(iv), shall achieve 30 percent or more of the needed load reduction in both nitrogen and phosphorus loading onsite and shall meet any requirements for engineered stormwater controls described in Sub-Item (4)(e) of this Rule;

(ii) Proposed new development activity disturbing at least 12,000 but less than one acre of land for commercial, industrial, institutional, multifamily residential, or local government property, except as stated in Sub-Item (4)(b)(iv), shall achieve 30 percent or more of the needed load reduction in both nitrogen and phosphorus loading onsite and shall meet any requirements for engineered stormwater controls described in Sub-Item (4)(e) of this Rule;

(iii) Except as stated in Sub-Item (4)(b)(iv), proposed new development activity that disturbs one acre of land or more shall achieve 50 percent or more of the needed load reduction in both nitrogen and phosphorus loading onsite and shall meet any requirements for engineered stormwater controls described in Sub-Item (4)(e) of this Rule; or

(iv) Proposed development that would replace or expand structures or improvements that existed as of December 2006 and that increases impervious surface within a local government's designated downtown area, regardless of area disturbed, shall achieve 30 percent of the needed load reduction in both nitrogen and phosphorus onsite, and shall meet any requirements for engineered stormwater controls described in Sub-Item (4)(e) of this Rule;

(c) Offsite offsetting measures shall achieve at least equivalent reductions in nitrogen and phosphorus loading to the remaining reduction needed onsite to comply with the loading rate targets set out in Sub-Item (4)(a) of this Item. A developer may use any measure that complies with the requirements of Rules .0240 and .0282. of this Section;

(d) Proposed new development subject to NPDES, water supply, and other state-mandated stormwater regulations shall comply with those regulations in addition to the other requirements of this Sub-item. Proposed new development in any water supply watershed in the Falls watershed designated WS-II, WS-III, or WS-IV shall comply with the density-based restrictions, obligations, and requirements for engineered stormwater controls, clustering options, operation and maintenance responsibilities, vegetated setbacks, land application, and landfill provisions described in Sub-Items (3)(b)(i) and (3)(b)(ii) of the applicable rule among 15A NCAC 02B .0214 through .0216. Provided, the allowance in water supply watershed rules for 10 percent of a jurisdiction to be developed at up to 70 percent built-upon area without stormwater treatment shall not be available in the Falls watershed;

(e) Stormwater systems shall be designed to control and treat at a minimum the runoff generated from all surfaces in the project area by one inch of rainfall. The treatment volume shall be drawn down pursuant to standards specific to each practice as provided in the July 2007 version of the *Stormwater Best Management Practices Manual* published by the Division, or other at least technically equivalent standards acceptable to the Division;

(f) To ensure that the integrity and nutrient processing functions of receiving waters and associated riparian buffers are not compromised by erosive flows, at a minimum, the new development shall not result in a net increase in peak flow leaving the site from pre-development conditions for the one-year, 24-hour storm event;

(g) New development may satisfy the requirements of this Rule by meeting the post-development hydrologic criteria set out in Chapter 2 of the North Carolina Low Impact Development Guidebook dated June 2009, or the hydrologic criteria in the most recent version of that guidebook;

(h) Proposed new development shall demonstrate compliance with the riparian buffer protection requirements of 15A NCAC 02B .0233 and .0242 or subsequent amendments or replacements to those requirements.

(5) RULE IMPLEMENTATION. This Rule shall be implemented as follows:

(a) No later than March 15, 2011, the Division shall submit a model local stormwater program, including a model local ordinance that embodies the criteria described in Items (3) and (4) of this Rule to the Commission for approval. The model program shall include a tool that will allow developers to account for nutrient loading from development lands and loading changes due

to BMP implementation to meet the requirements of Items (3) and (4) of this Rule. The accounting tool shall utilize nutrient efficiencies and associated design criteria established for individual BMPs in the July 2007 version of the Stormwater Best Management Practices Manual published by the Division, or other more precise standards acceptable to the Division. At such time as data quantifying nutrient loads from onsite wastewater systems is made available, the new development nutrient export accounting tool shall be revised to require accounting for nutrient loading from onsite wastewater from newly developed lands that use such systems. Should research quantify significant loading from onsite wastewater systems, the Division may also make recommendations to the Commission for Public Health to initiate rulemaking to reduce nutrient loading to surface waters from these systems. The Division shall work in cooperation with subject local governments and other watershed interests in developing this model program;

(b) Within five months after the Commission's approval of the model local stormwater program and model ordinance, subject local governments shall submit stormwater management programs, in conjunction with similar requirements in 15A NCAC 02B .0278, to the Division for preliminary approval. These local programs shall meet or exceed the requirements in Items (3) and (4) of this Rule;

(c) Within 10 months after the Commission's approval of the model local stormwater program, the Division shall provide recommendations to the Commission on local stormwater programs. The Commission shall either approve the programs or require changes based on the standards set out in Items (3) and (4) of this Rule. Should the Commission require changes, the applicable local government shall have two months to submit revisions, and the Division shall provide follow-up recommendations to the Commission within two months after receiving revisions;

(d) Within six months after the Commission's approval of a local program, or upon the Division's first renewal of a local government's NPDES stormwater permit, whichever occurs later, the affected local government shall complete adoption of and implement its local stormwater management program; and

(e) Upon implementation, subject local governments shall submit annual reports to the Division summarizing their activities in implementing each of the requirements in Items (3) and (4) of this Rule, including changes to nutrient loading.

(6) EQUIVALENT PROGRAM OPTION. A local government may in its program submittal under Sub-Item (5)(b) of this Rule request that the Division accept the local government's implementation of another stormwater program or programs as satisfying one or more of the requirements set forth in Items (3) and (4) of this Rule. The Division shall provide determination on the acceptability of any such alternative prior to requesting Commission approval of local programs as required in Sub-Item (5)(c) of this Rule. Should a local government propose alternative requirements to achieve and maintain the rate targets described in Sub-Item (4)(a) of this Rule, it shall include in its

program submittal technical information demonstrating the adequacy of those requirements. Should an alternative program propose monitoring of watersheds to compare measured loading to expected loading, it shall at a minimum include the following:

(a) Engineering calculations that quantify expected loading from new development projects based on stormwater controls currently enforced;
(b) At least three years of continuous flow and nutrient monitoring data demonstrating that watershed loading rates are at or below rates that would result from meeting the requirements of this Rule and Rule .0278 of this Section based on the land cover composition of the watershed;
(c) An ongoing water quality monitoring program based on continuous flow and concentration sampling to be performed indefinitely into the future with results reported annually to the Division for review and approval;
(d) A corrective action plan to be implemented should data collected under the ongoing monitoring program demonstrate watershed loading is within 10 percent of the rate estimated in compliance with this Item; and
(e) Should a local government submit an alternate program for consideration that includes areas within its jurisdiction outside of the monitored watershed it shall submit technical information demonstrating the areas outside of the monitored watershed can reasonably be expected to load at equal or lesser rates than those estimated in compliance with this Item based on comparative analysis of land uses and other factors affecting nutrient loading.

History Note: *Authority G.S. 143-214.1; 143-214.3; 143-214.5; 143-214.7; 143-215.1; 143-215.3; 143-215.3(a)(1); 143-215.6A; 143-215.6B; 143-215.6C; 143-215.8B; 143B-282(c); 143B-282(d); S.L. 2005-190; S.L. 2006-259; S.L. 2009-337; S.L. 2009-486;*
Eff. January 15, 2011 (this permanent rule replaces the temporary rule approved by the RRC on December 16, 2010).

APPENDIX B

Falls Water Supply Nutrient Strategy: Definitions

APPENDIX B

15A NCAC 02B .0276 FALLS WATER SUPPLY NUTRIENT STRATEGY: DEFINITIONS

(a) Unless the context indicates otherwise, the following words and phrases, which are not defined in G.S. 143, Article 21, shall be interpreted as follows for the purposes of the Falls nutrient strategy:

(1) "Allocation" means the mass quantity of nitrogen or phosphorus that a discharger, group of dischargers, nonpoint source, or collection of nonpoint sources is assigned. For point sources, possession of allocation does not authorize the discharge of nutrients but is prerequisite to such authorization through a NPDES permit, and allocation may be further distinguished as follows:

(A) "Active" allocation means that portion of an allocation that has been applied toward and is expressed as a nutrient limit in an individual NPDES permit;

(B) "Reserve" allocation means allocation that is held by a permittee or other person but which has not been applied toward and is not expressed as a nutrient limit in an individual NPDES permit;

(2) "Applicator" means the same as defined in 15A NCAC 02B .0202(4);

(3) "Atmospheric nitrogen" means total oxidized nitrogen (NO_y) which includes all nitrogen oxides (including NO_2, NO, N_2, nitrogen trioxide [N_2O_3], nitrogen tetroxide [N_2O_4], dinitrogen pentoxide [N_2O_5], nitric acid (HNO3) peroxyacl nitrates (PAN)), the sum of which is referred to as reduced nitrogen (NH_x));

(4) "Delivered," as in delivered allocation, load, or limit, means the allocation, load, or limit that is measured or predicted at Falls Reservoir;

(5) "Development" means the same as defined in 15A NCAC 02B .0202(23);

(6) "Discharge," as in discharge allocation, load, or limit means the allocation, load, or limit that is measured at the point of discharge into surface waters in the Falls watershed;

(7) "Existing development" means development, other than that associated with agricultural or forest management activities that meets one of the following criteria:

(A) It either is built or has established a vested right based on statutory or common law as interpreted by the courts, as of the effective date of either local new development stormwater programs implemented under 15A NCAC 02B .0277 for projects that do not require a state permit or, as of the applicable compliance date established in 15A NCAC 02B .0281(5) and (6); or

(B) It occurs after the compliance date set out in Sub-Item (5)(d) of Rule .0277 but does not result in a net increase in built-upon area;

(8) "Falls nutrient strategy," or "Falls water supply nutrient strategy" means the set of 15A NCAC 02B .0275 through .0282 and .0315(p);

(9) "Falls Reservoir" means the surface water impoundment operated by the US Army Corps of Engineers and named Falls of Neuse Reservoir;

(10) "Upper Falls Reservoir" means that portion of the reservoir upstream of State Route 50;

(11) "Upper Falls Watershed" means that area of Falls watershed draining to Upper Falls Reservoir;

(12) "Lower Falls Reservoir" means that portion of the reservoir downstream of State Route 50;

(13) "Lower Falls Watershed" means that are of Falls watershed draining to lower falls Reservoir without first passing through Upper Falls Reservoir;

(14) "Load" means the mass quantity of a nutrient or pollutant released into surface waters over a given time period. Loads may be expressed in terms of pounds per year and may be expressed as "delivered load" or an equivalent "discharge load;"

(15) "Load allocation" means the same as set forth in federal regulations 40 CFR 130.2(g), which is incorporated herein by reference, including subsequent amendments and editions. These regulations may be obtained at no cost from http://www.epa.gov/lawsregs/search/40cfr.html or from the U.S. Government Printing Office, 732 North Capitol St. NW, Washington D.C., 20401;

(16) "New development" means any development project that does not meet the definition of existing development set out in this Rule;

(17) "Nitrogen" means the sum of the organic, nitrate, nitrite, and ammonia forms of nitrogen in a water or wastewater;

(18) "NPDES" means National Pollutant Discharge Elimination System, and connotes the permitting process required for the operation of point source discharges in accordance with the requirements of Section 402 of the Federal Water Pollution Control Act, 33 U.S.C. Section 1251 et seq;

(19) "Nutrients" means total nitrogen and total phosphorus;

(20) "Phosphorus" or "total phosphorus" means the sum of the orthophosphate, polyphosphate, and organic forms of phosphorus in a water or wastewater;

(21) "Stream" means a body of concentrated flowing water in a natural low area or natural channel on the land surface;

(22) "Surface waters" means all waters of the state as defined in G.S. 143-212 except underground waters;

(23) "Technical specialist" means the same as defined in 15A NCAC 06H .0102(9);

(24) "Total nitrogen" means the same as 'nitrogen' defined in Item (17);

(25) "Total phosphorus" means the same as 'phosphorus' defined in Item (20);

(26) "Wasteload" means the mass quantity of a nutrient or pollutant released into surface waters by a wastewater discharge over a given time period. Wasteloads may be expressed in terms of pounds per year and may be expressed as "delivered wasteload" or an equivalent "discharge wasteload;" and

(27) "Wasteload allocation" means the same as set forth in federal regulations 40 CFR 130.2(h), which is incorporated herein by reference, including subsequent amendments and editions. These regulations may be obtained at no cost from http://www.epa.gov/lawsregs/search/40cfr.html or from the U.S. Government Printing Office, 732 North Capitol St. NW, Washington D.C., 20401.

(b) The definitions in Rule .0279 shall also apply throughout these Falls Water Supply Nutrient Strategy rules.

History Note: *Authority G.S. 143-214.1; 1432-214.3;143-214.5; 143-214.7; 143-215.1; 143215.3; 143-215.3(a)(1); 143-215.6A; 143-215.6B; 143-215.6C; 143-215.8B; 143B-282(c); 143B-282(d); S.L. 2005-190; S.L. 2006-259; S.L 2009-337; S.L 2009-486;*
Eff. January 15, 2011 (this permanent rule replaces the temporary rule approved by the RRC on December 16, 2010).

APPENDIX C

Falls Water Supply Nutrient Strategy:

Options for Offsetting Nutrient Loads

APPENDIX C

15A NCAC 02B .0282 FALLS WATER SUPPLY NUTRIENT STRATEGY: OPTIONS FOR OFFSETTING NUTRIENT LOADS

PURPOSE. This Rule provides parties subject to other rules within the Falls nutrient strategy with options for meeting rule requirements by obtaining or buying credit for nutrient load-reducing activities conducted by others (sellers). It provides the potential for parties who achieve excess load reductions under the Falls nutrient strategy to recover certain costs by selling such credits, and it provides opportunity for third parties to produce reductions and sell credits. Overall it provides the potential for more cost-effective achievement of strategy reduction objectives. Accounting is required to ensure and track the availability and use of trading credits. This accounting will be compared against compliance accounting required under other rules of the Falls nutrient strategy to ensure that crediting is properly accounted for. This Rule furthers the adaptive management intent of the strategy to protect the water supply, aquatic life, and recreational uses of Falls Reservoir. The minimum requirements for the exchange of load reduction credits are:

(1) PREREQUISITES. The following buyers shall meet applicable criteria identified here and in rules imposing reduction requirements on them before utilizing the option outlined in this Rule:

- (a) Agriculture Rule .0280: Owners of agricultural land shall receive approval from the Watershed Oversight Committee to obtain offsite credit pursuant to the conditions of Sub-Item (7)(b)(vii) of Rule .0280;
- (b) New Development Rule .0277: Developers shall meet onsite reduction requirements enumerated in Sub-Item (4)(b) of Rule .0277 before obtaining offsite credit;
- (c) Wastewater Rule .0279: New and expanding dischargers shall first make all reasonable efforts to obtain allocation from existing dischargers as stated in Sub-Items (7)(a)(ii) and (8)(a)(ii), respectively of Rule .0279; and
- (d) State and Federal Entities Stormwater Rule .0281:
  - (i) Non-DOT entities shall meet onsite new development reduction requirements enumerated in Sub-Item (4)(b) of Rule .0281; and
  - (ii) NC DOT shall meet onsite non-road new development reduction requirements enumerated in Sub-Item (9)(c) of Rule .0281 before obtaining offsite credit.

(2) The party seeking approval to sell load reduction credits pursuant to this Rule shall demonstrate to the Division that such reductions meet the following criteria:

- (a) Load reductions eligible for credit shall not include reductions that result from actions required to mitigate nutrient load-increasing actions under any regulation, except where a rule in this Section expressly allows such credit; and
- (b) The party seeking to sell credits shall define the nature of the activities that would produce reductions and define the magnitude and duration of those reductions to the Division, including addressing the following items:
  - (i) Quantify and account for the relative uncertainties in reduction need estimates and load reduction estimates;

(ii) Ensure that load reductions shall take place at the time and for the duration in which the reduction need occurs; and

(iii) Demonstrate means adequate for assuring the achievement and claimed duration of load reduction, including the cooperative involvement of any other involved parties;

(c) Geographic Restrictions. Eligibility to use load reductions as credit is based on the following geographic criteria:

(i) Impacts in the upper Falls watershed as defined in Item (19) of 15A NCAC 02B .0276 may be offset only by load reductions achieved in the upper Falls watershed; and

(ii) Impacts in the lower Falls watershed as defined in Item (20) of 15A NCAC 02B .0276 shall be offset by load reductions achieved anywhere within the Falls watershed.

(3) The party seeking approval to sell load reduction credits shall provide for accounting and tracking methods that ensure genuine, accurate, and verifiable achievement of the purposes of this Rule, and shall otherwise meet the requirements of Rule .0240 of this Section, which establishes procedural requirements for nutrient offset payments. The Division shall work cooperatively with interested parties at their request to develop such accounting and tracking methods to support the requirements of Item (2) of this Rule.

(4) Local governments have the option of combining their reduction needs from NPDES dischargers assigned allocations in 15A NCAC 02B .0279 and existing development as described in 15A NCAC 02B .0278, including loads from properly functioning and malfunctioning septic systems and discharging sand filters, into one reduction and allocation requirement and meet them jointly.

(5) Proposals for use of offsetting actions as described in this Rule shall become effective after determination by the Director that the proposal contains adequate scientific or engineering standards or procedures necessary to achieve and account for load reductions as required under Items (2) and (3) of this Rule, and that specific accounting tools required for these purposes in individual rules have been adequately established. In making this determination, the Director shall also evaluate the potential for load offset elsewhere that results in localized adverse water quality impacts that contribute to impairment of classified uses of the affected waters.

(6) A party seeking to purchase nutrient offset credit from the NC Ecosystem Enhancement Program or from a public or private seller of reduction credit shall meet the applicable requirements of Rule .0240 of this Section, which establishes procedural requirements for nutrient offset payments, in addition to applicable requirements of this Rule. Requirements of Rule .0240 include, but are not limited to, the requirement for non-governmental entities to purchase credit from a provider other than the NC Ecosystem Enhancement Program if such credit is available.

(7) The Watershed Oversight Committee under Rule 15A NCAC 02B .0280 may satisfy the seller requirements of Items (2) and (3) of this Rule and the trading provisions of Rule

.0280 for individual agricultural land owners by submitting to the Division for approval a trading program, or revisions to such a program, that demonstrates how individual trades shall meet the requirements of this Rule and Rule .0280, and by subsequently including in annual reports required under Rule .0280 separate tracking and accounting for such trades.

History Note: *Authority G S. 143-214.1; 1432-214.3;143-214.5; 143-214.7; 143-215.1; 1432-15.3; 143-215.3(a)(1); 143-215.6A; 143-215.6B; 143-215.6C; 143-215.8B; 143B-282(c); 143B-282(d); S.L. 2005-190; S.L. 2006-259; S.L. 2009-337; S.L. 2009-486;*
Eff. January 15, 2011 (this permanent rule replaces the temporary rule approved by the RRC on December 16, 2010).

APPENDIX D

Falls Water Supply Nutrient Strategy:

Purpose and Scope

APPENDIX D

15A NCAC 02B .0275 FALLS WATER SUPPLY NUTRIENT STRATEGY: PURPOSE AND SCOPE

PURPOSE. The purpose of this Rule and Rules 15A NCAC 02B .0276 through .0282 and .0315(q) shall be to attain the classified uses of Falls of the Neuse Reservoir set out in 15A NCAC 02B .0211 from current impaired conditions related to excess nutrient inputs; protect its classified uses as set out in 15A NCAC 02B .0216, including use as a source of water supply for drinking water; and maintain and enhance protections currently implemented by local governments in existing water supply watersheds encompassed by the watershed of Falls of the Neuse Reservoir. The reservoir, and all waters draining to it, have been supplementally classified as Nutrient Sensitive waters (NSW) pursuant to 15A NCAC 02B .0101(e)(3) and 15A NCAC 02B .0223. These Rules, as enumerated in Item (6) of this Rule, together shall constitute the Falls water supply nutrient strategy, or Falls nutrient strategy, and shall be implemented in accordance with 15A NCAC 02B .0223. The following items establish the framework of the Falls nutrient strategy:

(1) SCOPE AND LIMITATION. Falls of the Neuse Reservoir is hereafter referred to as Falls Reservoir. All lands and waters draining to Falls Reservoir are hereafter referred to as the Falls watershed. The Falls nutrient strategy rules require controls that reduce nitrogen and phosphorus loads from significant sources of these nutrients throughout the Falls watershed. These Rules do not address atmospheric emission sources of nitrogen that is deposited into the watershed but do include provisions to account for reductions in such deposition as the water quality benefits of air quality regulations are quantified. Neither do these Rules address sources on which there is insufficient scientific knowledge to base regulation, other sources deemed adequately addressed by existing regulations, sources currently considered minor, or nutrient contributions from lake sediments, which are considered outside the scope of these Rules. The Commission may undertake additional rulemaking in the future or make recommendations to other rulemaking bodies as deemed appropriate to more fully address nutrient sources to Falls Reservoir. While the scope of these Rules is limited to the reduction of nutrient loads to surface waters, practitioners are encouraged to maximize opportunities for concurrently benefiting other ecosystem services where feasible in the course of achieving the nutrient objectives.

(2) CRITICAL WATER SUPPLY WATERSHED DESIGNATION. Water supply waters designated WS-II, WS-III, and WS-IV within the Falls watershed shall retain their classifications. The remaining waters in the Falls watershed shall be classified WS-V. The requirements of all of these water supply classifications shall be retained and applied except as specifically noted elsewhere within the Falls nutrient strategy. In addition, pursuant to G.S. 143-214.5(b), the entire Falls watershed shall be designated a critical water supply watershed and through the Falls nutrient strategy given additional, more stringent requirements than the state minimum water supply watershed management requirements. Water supply requirements of 15A NCAC 02B .0104 apply except to the extent that requirements of the Falls nutrient strategy are more stringent than provisions addressing agriculture, forestry, and existing development. These requirements supplement the water quality standards applicable to Class C waters, as described in Rule .0211 of this Section, which apply throughout the Falls watershed. Water supply watershed requirements shall be as follows:

(a) For WS-II, WS-III, and WS-IV waters, the retained requirements of Rules 15A NCAC 02B .0214 through .0216 are characterized as follows:

(i) Item (1) addressing best usages;
(ii) Item (2) addressing predominant watershed development conditions, discharges expressly allowed watershed-wide, general prohibitions on and allowances for domestic and industrial discharges, Maximum Contaminant Levels following treatment, and the local option to seek more protective classifications for portions of existing water supply watersheds;
(iii) Sub-Item (3)(a) addressing wastewater discharge limitations;
(iv) Sub-Item (3)(b) addressing nonpoint source and stormwater controls; and
(v) Sub-Items (3)(c) through (3)(h) addressing aesthetic and human health standards.

(b) For waters classified WS-V, the requirements of water supply Rule 15A NCAC 02B .0218 shall be applied.

(3) GOAL AND OBJECTIVES. To achieve the purpose of the Falls nutrient strategy, the Commission establishes the goal of attaining and maintaining nutrient-related water quality standards identified in 15A NCAC 02B .0211 throughout Falls Reservoir pursuant to G.S. 143-215.8B and 143B-282(c) and (d) of the Clean Water Responsibility Act of 1997. The Commission establishes a staged and adaptive implementation plan, outlined hereafter, to achieve the following objectives. The objective of Stage I is to, at minimum, achieve and maintain nutrient-related water quality standards in the Lower Falls Reservoir as soon as possible but no later than January 15, 2021 and to improve water quality in the Upper Falls Reservoir.

The objective of Stage II is to achieve and maintain nutrient-related water quality standards throughout Falls Reservoir. This is estimated to require a reduction of 40 and 77 percent in average annual mass loads of nitrogen and phosphorus respectively, delivered from the sources named in Item (6) in the Upper Falls Watershed from a baseline of 2006. The resulting Stage II allowable loads to Falls Reservoir from the watersheds of Ellerbe Creek, Eno River, Little River, Flat River, and Knap of Reeds Creek shall be 658,000 pounds of nitrogen per year and 35,000 pounds of phosphorus per year.

(4) STAGED IMPLEMENTATION. The Commission shall employ the staged implementation plan set forth below to achieve the goal of the Falls nutrient strategy:

(a) STAGE I. Stage I requires intermediate or currently achievable controls throughout the Falls watershed with the objective of reducing nitrogen and phosphorus loading, and attaining nutrient-related water quality standards in the Lower Falls Reservoir as soon as possible but no later than January 15, 2021, while also improving water quality in the Upper Falls Reservoir as described in this Item. Implementation timeframes are described in individual rules, with full implementation occurring no later than January 15, 2021;

(b) STAGE II. Stage II requires implementation of additional controls in the Upper Falls Watershed beginning no later than January 15, 2021 to achieve nutrient-related water quality standards throughout Falls Reservoir by 2041 to the maximum extent technically and economically feasible, with progress toward this overall objective as described in Sub-Item (5)(a); and

(c) MAINTENANCE OF ALLOCATIONS. Sources shall maintain the load reductions required under these Rules beyond the implementation stages.

(5) ADAPTIVE IMPLEMENTATION. The Commission shall employ the following adaptive implementation plan in concert with the staged implementation approach described in this Rule:

(a) The Division shall perform water quality monitoring throughout Falls Reservoir and shall accept reservoir water quality monitoring data provided by other parties that meet Division standards and quality assurance protocols. The Division shall utilize this data to estimate load reduction achieved and to perform periodic use support assessments pursuant to 40 CFR 130.7(b). It shall evaluate use support determinations to judge progress on and compliance with the goal of the Falls nutrient strategy, including the following assessments:

(i) Attainment of nutrient-related water quality standards downstream of Highway NC-98 crossing of Falls Reservoir no later than January 15, 2016;
(ii) Attainment of nutrient-related water quality standards in the Lower Falls Reservoir no later than January 15, 2021;
(iii) Attainment of nutrient-related water quality standards in the Lick Creek arm of Falls Reservoir and points downstream no later than January 15, 2026;
(iv) Attainment of nutrient-related water quality standards in the Ledge and Little Lick Creek arms of Falls Reservoir and points downstream no later than January 15, 2031;
(v) Attainment of nutrient-related water quality standards at points downstream of the Interstate 85 crossing of Falls Reservoir no later than January 15, 2036;
(vi) Attainment of nutrient-related water quality standards throughout Falls Reservoir no later than 2041;
(vii) Where the Division finds that acceptable progress has not been made towards achieving nutrient-related water quality standards throughout Falls Reservoir defined in Sub-Items (i) through (vi) of this Item or that conditions have deteriorated in a segment of Falls Reservoir as described in this Item, at any time, it shall evaluate compliance with the Falls nutrient strategy rules, and may request Commission approval to initiate additional rulemaking;
(viii) Where the Division finds, based on reservoir monitoring, that nutrient-related water quality standards are attained in a previously impaired segment of Falls Reservoir, as described in this Item, and are met for sufficient time to demonstrate sustained maintenance of standards, as

specified in individual rules of this strategy, it shall notify affected parties in that segment's watershed that further load reductions are not required and of requirements for maintenance of measures to prevent loading increases. Sufficient time is defined as at least two consecutive use support assessments demonstrating compliance with nutrient-related water quality standards in a given segment of Falls Reservoir.

(b) The Division, to address resulting uncertainties including those related to technological advancement, scientific understanding, actions chosen by affected parties, loading effects, and loading effects of other regulations, shall report to the Commission and provide information to the public in January 2016 and every five years thereafter as necessary. The reports shall address all of the following subjects:

(i) Changes in nutrient loading to Falls Reservoir and progress in attaining nutrient-related water quality standards as described in Sub-Items (5)(a)(i) through (vi) of this Rule;
(ii) The state of wastewater and stormwater nitrogen and phosphorus control technology, including technological and economic feasibility;
(iii) Use and projected use of wastewater reuse and land application opportunities;
(iv) The utilization and nature of nutrient offsets and projected changes. This shall include an assessment of any load reduction value derived from preservation of existing forested land cover;
(v) Results of any studies evaluating instream loading changes resulting from implementation of rules;
(vi) Results of any studies evaluating nutrient loading from conventional septic systems and discharging sand filter systems;
(vii) Assessment of the instream benefits of local programmatic management measures such as fertilizer or pet waste ordinances, improved street sweeping and the extent to which local governments have implemented these controls;
(viii) Results of applicable studies, monitoring, and modeling from which a baseline will be established to address changes in atmospheric deposition of nitrogen;
(ix) Recent or anticipated changes in regulations affecting atmospheric nitrogen emissions and their projected effect on nitrogen deposition;
(x) Results of any studies evaluating nutrient loading from groundwater;
(xi) Updates to nutrient loading accounting tools; and

(c) The Division shall submit a report to the Commission in July 2025 that shall address the following subjects in addition to the content required elsewhere under this Item:

(i) The physical, chemical, and biological conditions of the Upper Falls Reservoir including nutrient loading impacts;

(ii) Whether alternative regulatory action pursuant to Sub-Item (5)(g) would be sufficient to protect existing uses as required under the Clean Water Act;

(iii) The impact of management of the Falls Reservoir on water quality in the Upper Falls Reservoir;

(iv) The methodology used to establish compliance with nutrient-related water quality standards in Falls Reservoir and the potential for using alternative methods;

(v) The feasibility of achieving the Stage II objective; and

(vi) The estimated costs and benefits of achieving the Stage II objective;

(d) The Division shall make recommendations, if any, on rule revisions based on the information reported pursuant to Sub-Items (b) and (c) of this Rule;

(e) In developing the reports required under Sub-Items (b) and (c) of this Rule, the Division shall consult with and consider information submitted by local governments and other persons with an interest in Falls Reservoir. Following receipt of a report, the Commission shall consider whether revisions to the requirements of Stage II are needed and may initiate rulemaking or any other action allowed by law;

(f) Recognizing the uncertainty associated with model-based load reduction targets, to ensure that allowable loads to Falls Reservoir remain appropriate as implementation proceeds, a person may at any time during implementation of the Falls nutrient strategy develop and submit for Commission approval supplemental nutrient response modeling of Falls Reservoir based on additional data collected after a period of implementation. The Commission may consider revisions to the requirements of Stage II based on the results of such modeling as follows:

(i) A person shall obtain Division review and approval of any monitoring study plan and description of the modeling framework to be used prior to commencement of such a study. The study plan and modeling framework shall meet any Division requirements for data quality and model support or design in place at that time. Within 180 days of receipt, the division shall either approve the plan and modeling framework or notify the person seeking to perform the supplemental modeling of changes to the plan and modeling framework required by the Division;

(ii) Supplemental modeling shall include a minimum of three years of lake water quality data unless the person performing the modeling can provide information to the Division demonstrating that a shorter time span is sufficient;

(iii) The Commission may accept modeling products and results that estimate a range of combinations of nitrogen and phosphorus percentage load reductions needed to meet the goal of the Falls

nutrient strategy, along with associated allowable loads to Falls Reservoir, from the watersheds of Ellerbe Creek, Eno River, Little River, Flat River, and Knap of Reeds Creek and that otherwise comply with the requirements of this Item. Such modeling may incorporate the results of studies that provide new data on various nutrient sources such as atmospheric deposition, internal loading, and loading from tributaries other than those identified in this Sub-item. The Division shall assure that the supplemental modeling is conducted in accordance with the quality assurance requirements of the Division;

(iv) The Commission shall review Stage II requirements if a party submits supplemental modeling data, products and results acceptable to the Commission for this purpose. Where supplemental modeling is accepted by the Commission, and results indicate allowable loads of nitrogen and phosphorus to Falls Reservoir from the watersheds of Ellerbe Creek, Eno River, Little River, Flat River, and Knap of Reeds Creek that are substantially different than those identified in Item (3), then the Commission may initiate rulemaking to establish those allowable loads as the revised objective of Stage II relative to their associated baseline values;

(g) Nothing in this strategy shall be construed to limit, expand, or modify the authority of the Commission to undertake alternative regulatory actions otherwise authorized by state or federal law, including the reclassification of waters of the State pursuant to G.S. 143-214.1, the revision of water quality standards pursuant to G.S. 143-214.3, and the granting of variances pursuant to G.S. 143-215.3.

(6) RULES ENUMERATED. The Falls nutrient strategy rules consists of the following rules titled as follows:

(a) Rule .0275 Purpose and Scope;
(b) Rule .0276 Definitions. An individual rule may contain additional definitions for terms that are used in that rule only;
(c) Rule .0277 Stormwater Management for New Development;
(d) Rule .0278 Stormwater Management for Existing Development;
(e) Rule .0279 Wastewater Discharge Requirements;
(f) Rule .0280 Agriculture;
(g) Rule .0281 Stormwater Requirements for State and Federal Entities;
(h) Rule .0282 Options for Offsetting Nutrient Loads; and
(i) Rule .0315 Neuse River Basin.

(7) APPLICABILITY. Categories of parties required to implement the Falls nutrient strategy rules and, as applicable, their geographic scope of responsibility, are identified in each rule. The specific local governments responsible for implementing Rules .0277, .0278, and .0282 shall be as follows:

(a) All incorporated municipalities, as identified by the Office of the Secretary of State, with planning jurisdiction within or partially within the Falls watershed. Those municipalities are currently:

(i) Butner;
(ii) Creedmoor;
(iii) Durham;
(iv) Hillsborough;
(v) Raleigh;
(vi) Roxboro;
(vii) Stem; and
(viii) Wake Forest;

(b) All counties with jurisdiction in Falls watershed and for land where municipalities listed in Sub-Item (7)(a) do not have an implementation requirement:

(i) Durham;
(ii) Franklin;
(iii) Granville;
(iv) Orange;
(v) Person; and
(vi) Wake;

(c) A unit of government may arrange through interlocal agreement or other instrument of mutual agreement for another unit of government to implement portions or the entirety of a program required or allowed under any rule of this strategy to the extent that such an arrangement is otherwise allowed by statute. The governments involved shall submit documentation of any such agreement to the Division. No such agreement shall relieve a unit of government from its responsibilities under these Rules.

(8) ENFORCEMENT. Failure to meet requirements of Rules .0275, .0277, .0278, .0279, .0280, .0281, or .0282 of this Section may result in imposition of enforcement measures as authorized by G.S. 143-215.6A (civil penalties), G.S. 143-215.6B (criminal penalties), and G.S. 143-215.6C (injunctive relief).

History Note: *Authority G.S. 143-214.1; 143-214.3; 143-214.5; 143-214.7; 143-215.1; 143-215.3; 143-215.3(a)(1); 143-215.6A; 143-215.6B; 143-215.6C; 143-215.8B; 143B-282(c); 143B-282(d); S.L. 2005-190; S.L. 2006-259; S.L. 2009-337; S.L. 2009-486;*
Eff. January 15, 2011 (this permanent rule replaces the temporary rule approved by the RRC on December 16, 2010).

APPENDIX E

Falls Water Supply Nutrient Strategy:

Stormwater Requirements for State and Federal Entities

APPENDIX E

15A NCAC 02B .0281 FALLS WATER SUPPLY NUTRIENT STRATEGY: STORMWATER REQUIREMENTS FOR STATE AND FEDERAL ENTITIES

The following is the stormwater strategy, as prefaced in Rule 02B .0275, for the activities of state and federal entities within the Falls watershed.

(1) PURPOSE. The purposes of this Rule are as follows.

(a) To achieve and maintain, on new non-road development lands, the nonpoint source nitrogen and phosphorus percentage reduction objectives established for Falls Reservoir in 15A NCAC 02B .0275 relative to the baseline period defined in Rule, to provide the highest practicable level of treatment on new road development, and to achieve and maintain the percentage objectives on existing developed lands by reducing loading from state-maintained roadways and facilities, and from lands controlled by other state and federal entities in the Falls watershed;

(b) To ensure that the integrity and nutrient processing functions of receiving waters and associated riparian buffers are not compromised by erosive flows from state-maintained roadways and facilities and from lands controlled by other state and federal entities in the Falls watershed; and

(c) To protect the water supply, aquatic life, and recreational uses of Falls Reservoir.

(2) APPLICABILITY. This Rule shall apply to all existing and new development, both as defined in 15A NCAC 02B .0276, that lies within or partially within the Falls watershed under the control of the NC Department of Transportation (NCDOT), including roadways and facilities, and to all lands controlled by other state and federal entities in the Falls watershed.

(3) NON-NCDOT REQUIREMENTS. With the exception of the NCDOT, all state and federal entities that control lands within the Falls watershed shall meet the following requirements:

(a) For any new development proposed within their jurisdictions that would disturb one quarter acre or more, non-NCDOT state and federal entities shall develop stormwater management plans for submission to and approval by the Division;

(b) The non-NCDOT state or federal entity shall include measures to ensure maintenance of best management practices (BMPs) implemented as a result of the provisions in Sub-Item (a) of this Item for the life of the development; and

(c) A plan to ensure enforcement and compliance with the provisions in Sub-Item (4) of this Rule for the life of the new development.

(4) PLAN APPROVAL REQUIREMENTS. A developer's stormwater plan shall not be approved unless the following criteria are met:

(a) Nitrogen and phosphorus loads contributed by the proposed new development activity shall not exceed the following unit-area mass loading rates for nitrogen and phosphorus, respectively, expressed in units of pounds/acre/year: 2.2 and 0.33. Proposed development that would replace or expand structures or improvements that existed as of December 2006, the end of the baseline period, and that would not result in a net increase in built-upon area shall not be required to meet the nutrient loading targets or high-density requirements except to the extent that the developer shall provide stormwater control at least equal to the previous development. Proposed development that would replace or expand existing structures or improvements and would result in a net increase in built-upon area shall have the option either to achieve at least the percentage loading reduction objectives stated in 15A NCAC 02B .0275 as applied to nitrogen and phosphorus loading from the previous development for the entire project site, or to meet the loading rate targets described in this item. These requirements shall supersede those identified in 15A NCAC 02B .0104(q). The developer shall determine the need for engineered stormwater controls to meet these loading rate targets by using the loading calculation method called for in Sub-Item (4)(a) of 15A NCAC 02B .0277 or other equivalent method acceptable to the Division;

(b) The developer shall have the option of offsetting part of their nitrogen and phosphorus loads by implementing or funding offsite offset measures. Before using an offsite offset option, a development shall implement onsite structural stormwater controls that achieve one of the following levels of reductions:

(i) Proposed new development activity disturbing at least one quarter acre but less than one acre of land, except as stated in this Item, shall achieve 30 percent or more of the needed load reduction in both nitrogen and phosphorus loading onsite and shall meet any requirements for engineered stormwater controls described in this item;

(ii) Except as stated in this Item, proposed new development activity that disturbs one acre of land or more shall achieve 50 percent or more of the needed load reduction in both nitrogen and phosphorus loading onsite and shall meet any requirements for engineered stormwater controls described in this Item; or

(iii) Proposed development that would replace or expand structures or improvements that existed as of December 2006, the end of the baseline period, and that increases impervious surface within a designated downtown area, regardless of area disturbed, shall achieve 30 percent of the needed load reduction in both nitrogen and phosphorus onsite, and shall meet any requirements for engineered stormwater controls described in this Item;

(c) Offsite offsetting measures shall achieve at least equivalent reductions in nitrogen and phosphorus loading to the remaining reduction needed onsite to

comply with the loading rate targets set out in this Item. A developer may use any measure that complies with the requirements of Rules .0240 and .0282 of this Section;

(d) Proposed new development subject to NPDES, water supply, and other state-mandated stormwater regulations shall comply with those regulations and with applicable permit limits in addition to the other requirements of this sub-item. Proposed new development in any water supply watershed in the Falls watershed designated WS-II, WS-III, or WS-IV shall comply with the density-based restrictions, obligations, and requirements for engineered stormwater controls, clustering options, operation and maintenance responsibilities, vegetated setbacks, land application, and landfill provisions described in Sub-Items (3)(b)(i) and (3)(b)(ii) of the applicable rule among 15A NCAC 02B .0214 through .0216. Provided, the allowance in water supply watershed rules for 10 percent of a jurisdiction to be developed at up to 70 percent built-upon area without stormwater treatment shall not be available in the Falls watershed;

(e) Stormwater systems shall be designed to control and treat at a minimum the runoff generated from all surfaces in the project area by one inch of rainfall. The treatment volume shall be drawn down pursuant to standards specific to each practice as provided in the July 2007 version of the *Stormwater Best Management Practices Manual* published by the Division, or other at least technically equivalent standards acceptable to the Division;

(f) To ensure that the integrity and nutrient processing functions of receiving waters and associated riparian buffers are not compromised by erosive flows, at a minimum, the new development shall not result in a net increase in peak flow leaving the site from pre-development conditions for the one-year, 24-hour storm event;

(g) New development may satisfy the requirements of this Rule by meeting the post-development hydrologic criteria set out in Chapter 2 of the *North Carolina Low Impact Development Guidebook* dated June 2009, or the hydrologic criteria in the most recent version of that guidebook; and

(h) Proposed new development shall demonstrate compliance with the riparian buffer protection requirements of 15A NCAC 02B .0233 and .0242.

(5) NON-NCDOT STAGED AND ADAPTIVE IMPLEMENTATION REQUIREMENTS. For existing development, non-NCDOT state and federal entities shall develop and implement staged load reduction programs for achieving and maintaining nutrient load reductions from existing development based on the standards set out in this Item. Such entities shall submit these load-reducing programs for approval by the Commission that include the following staged elements and meet the minimum standards for each stage of implementation:

(a) In Stage I, entities subject to this rule shall implement a load reduction program that provides estimates of, and plans for offsetting by calendar year 2020,

nutrient loading increases from lands developed subsequent to the baseline (2006) and not subject to the requirements of the Falls Lake new development stormwater program. For these existing developed lands, the current loading rate shall be compared to the loading rate for these lands prior to development for the acres involved, and the difference shall constitute the load reduction need in annual mass load, in pounds per year. Alternatively, a state or federal entity may assume uniform pre-development loading rates of 2.89 pounds per acre per year N and 0.63 pounds per acre per year P for these lands. The entity shall achieve this stage one load reduction by calendar year 2020. This Stage I program shall meet the criteria defined in Item (4) of 15A NCAC 02B.0278; and

(b) By January 15, 2021, and every five years thereafter, a state or federal entity located in the Upper Falls Watershed as defined in Item (11) of 15A NCAC 02B .0276 shall submit and begin implementing a Stage II load reduction program or revision designed to achieve the percent load reduction objectives from existing developed lands under its control, that includes timeframes for achieving these objectives and that meets the criteria defined in Items (5) and (6) of this Rule.

(6) ELEMENTS OF NON-NCDOT LOAD REDUCTION PROGRAMS. A non-NCDOT state or federal entity load reduction program shall address the following elements:

(a) State and federal entities in the Eno River and Little River subwatersheds shall, as part of their Stage I load reduction programs, begin and continuously implement a program to reduce loading from discharging sand filters and malfunctioning septic systems owned or used by state or federal agencies discharging into waters of the State within those subwatersheds;

(b) State and federal entities in any Falls subwatershed in which chlorophyll a levels have exceeded 40 ug/L in more than seventy-five percent of the monitoring events in any calendar year shall, as part of their Stage I load reduction programs, begin and continuously implement a program to reduce nutrient loading into the waters of the State within that subwatersheds;

(c) The total amount of nutrient loading reductions in Stage I is not increased for state and federal entities by the requirements to add specific program components to address loading from malfunctioning septic systems and discharging sand filters or high nutrient loading levels pursuant to Sub-Items (a) and (b) of this Item;

(d) In preparation for implementation of their Stage I and Stage II load reduction programs, state and federal entities shall develop inventories and characterize load reduction potential to the extent that accounting methods allow for the following:

(i) Wastewater collection systems;
(ii) Discharging sand filter systems, including availability of or potential for central sewer connection;
(iii) Properly functioning and malfunctioning septic systems;

(iv) Restoration opportunities in utility corridors;

(v) Fertilizer management plans for state and federally owned lands;

(vi) Structural stormwater practices, including intended purpose, condition, potential for greater nutrient control; and

(vii) Wetlands and riparian buffers including potential for restoration opportunities.

(e) A state or federal entities load reduction need shall be based on the developed lands owned or used by the state or federal entity within the Falls watershed;

(f) Nitrogen and phosphorous loading from existing developed lands, including loading from onsite wastewater treatment systems to the extent accounting methods allow, shall be calculated by applying the accounting tool described in Item (13) and shall quantify baseline loads of nitrogen and phosphorus to surface waters from the lands under the entity's control as well as loading changes post-baseline. It shall also calculate target nitrogen and phosphorus loads and corresponding reduction needs;

(g) Nitrogen and phosphorus loading from existing developed lands, including loading from onsite wastewater treatment systems to the extent accounting methods allow, shall be calculated by applying the accounting too described in Item (13) of this Rule and shall quantify baseline loads of nitrogen and phosphorus to surface waters from state and federal entities as well as loading changes post-baseline. It shall calculate target nitrogen and phosphorus loads and corresponding load reduction needs;

(h) The Commission shall recognize reduction credit for implementation of policies and practices implemented after January 1, 2007 and before January 15, 2011, to reduce runoff and discharge of nitrogen and phosphorus per Session Law 2009-486. The load reduction program shall identify specific load-reducing practices implemented subsequent to the baseline period and for which the entity is seeking credit. It shall estimate load reductions for these practices and their anticipated duration using methods provided for in Item (13);

(i) The program shall include a proposed implementation schedule that includes annual implementation expectations. The load reduction program shall identify the types of activities the state or federal entity intends to implement and types of existing development affected, relative proportions or prioritization of practices, relative magnitude of reductions it expects to achieve from each, and the relative costs and efficiencies of each activity to the extent information is available. The program shall identify the duration of anticipated loading reductions, and may seek activities that provide long-term reductions;

(j) The load reduction program shall identify anticipated funding mechanisms or sources and discuss steps taken or planned to secure such funding;

(k) The program shall address the extent of load reduction opportunities intended from the following types of lands:

(i) Lands owned or otherwise controlled by the state or federal entity; and
(ii) Lands other than those on which the entity's load reduction need is based as described in this Item, including lands both within and outside its jurisdiction and third party sellers.

(l) The program shall address the extent of load reduction proposed from, at a minimum, the following stormwater and ecosystem restoration activities:
(i) Bioretention;
(ii) Constructed wetland;
(iii) Sand filter;
(iv) Filter Strip;
(v) Grassed swale;
(vi) Infiltration device;
(vii) Extended dry detention;
(viii) Rainwater harvesting system;
(ix) Treatment of Redevelopment;
(x) Overtreatment of new development;
(xi) Removal of impervious surface;
(xii) Retrofitting treatment into existing stormwater ponds;
(xiii) Off-line regional treatment systems;
(xiv) Wetland or riparian buffer restoration; and
(xv) Reforestation with conservation easement or other protective covenant.

(m) The program shall evaluate the load reduction potential from the following wastewater activities:

(i) Creation of surplus relative to an allocation established in 15A NCAC 02B .0279;
(ii) Expansion of surplus allocation through regionalization;
(iii) Connection of discharging sand filters and malfunctioning septic systems to central sewer or replacement with permitted non-discharge alternatives;
(iv) Removal of illegal discharges; and
(v) Improvement of wastewater collection systems.

(n) A state or federal entity may propose in its load reduction program the use of the following measures in addition to items listed in (l) and (m), or may propose other measures for which it can provide equivalent accounting methods acceptable to the Division:

(i) Redirecting runoff away from impervious surfaces;
(ii) Soil amendments;
(iii) Stream restoration;
(iv) Improved street sweeping; and

(v) Source control, such as waste and fertilizer controls.

(o) The program shall include evaluation of load reduction potential relative to the following factors:

(i) Extent of physical opportunities for installation;
(ii) Landowner acceptance;
(iii) Incentive and education options for improving landowner acceptance;
(iv) Existing and potential funding sources and magnitudes;
(v) Practice cost-effectiveness (e.g., cost per pound of nutrient removed);
(vi) Increase in per capita cost of a non-NCDOT state or federal entity's stormwater management program to implement the program;
(vii) Implementation rate without the use of eminent domain; and
(viii) Need for and projected role of eminent domain.

(7) The Commission shall approve a non-NCDOT Stage I load reduction program if it meets the requirements of Items (5) and (6) of this Rule. The Commission shall approve a Stage II load reduction program if it meets the requirements of Items (5) and (6) of this Rule unless the Commission finds that the local non-NCDOT state or federal entity can, through the implementation of reasonable and cost-effective measures not included in the proposed program, meet the Stage II nutrient load reductions required by this Rule by a date earlier than that proposed by the non-NCDOT state or federal entity. If the Commission finds that there are additional or alternative reasonable and cost-effective measures, the Commission may require the non-NCDOT state or federal entity to modify its proposed program to include such measures to achieve the required reductions by the earlier date. If the Commission requires such modifications, the non-NCDOT state or federal entity shall submit a modified program within two months. The Division shall recommend that the Commission approve or disapprove the modified program within three months after receiving the modified program. In determining whether additional or alternative load reduction measures are reasonable and cost effective, the Commission shall consider factors including, but not limited to those identified in Sub-Item (6)(o) of this Rule. The Commission shall not require additional or alternative measures that would require a non-NCDOT state or federal entity to:

(a) Install a new stormwater collection system in an area of existing development unless the area is being redeveloped; or
(b) Reduce impervious surfaces within an area of existing development unless the area is being redeveloped.

(8) A non-NCDOT state or federal entity shall have the option of working with the county or counties in which it falls, or with a municipality or municipalities within the same subwatershed, to jointly meet the loading targets from all lands within their combined jurisdictions within a subwatershed. The entity may utilize private or third party sellers. All reductions involving trading with other parties shall meet the requirements of 15A NCAC 02B .0282.

(9) NCDOT REQUIREMENTS. The NCDOT shall develop a single Stormwater Management Program that will be applicable to the entire Falls watershed and submit this program

for approval by the Division according to the standards set forth below. In addition, the program shall, at a minimum, comply with NCDOT's then-current stormwater permit. This program shall:

(a) Identify NCDOT stormwater outfalls from Interstate, US, and NC primary routes;
(b) Identify and eliminate illegal discharges into the NCDOT's stormwater conveyance system;
(c) Establish a program for post-construction stormwater runoff control for new development, including new and widening NCDOT roads and facilities. The program shall establish a process by which the Division shall review and approve stormwater designs for new NCDOT development projects. The program shall delineate the scope of vested projects that would be considered as existing development, and shall define lower thresholds of significance for activities considered new development. In addition, the following criteria shall apply:

    (i) For new and widening roads, weigh stations, and replacement of existing bridges, compliance with the riparian buffer protection requirements of Rules 15A NCAC 02B .0233 and .0242 shall be deemed as compliance with the purposes of this Rule;

    (ii) New non-road development shall achieve and maintain the nitrogen and phosphorus percentage load reduction objectives established in 15A NCAC 02B .0275 relative to either area-weighted average loading rates of all developable lands as of the baseline period defined in 15A NCAC 02B .0275, or to project-specific pre-development loading rates. Values for area-weighted average loading rate targets for nitrogen and phosphorus, respectively, are expressed in units of pounds per acre per year: 2.2 and 0.33. The NCDOT shall determine the need for engineered stormwater controls to meet these loading rate targets by using the loading calculation method called for in Item (13) of this Rule or other equivalent method acceptable to the Division. Where stormwater treatment systems are needed to meet these targets, they shall be designed to control and treat the runoff generated from all surfaces by one inch of rainfall. Such systems shall be assumed to achieve the nutrient removal efficiencies identified in the July 2007 version of the *Stormwater Best Management Practices Manual* published by the Division provided that they meet associated drawdown and other design specifications included in the same document. The NCDOT may propose to the Division nutrient removal rates for practices currently included in the BMP Toolbox required under its NPDES stormwater permit, or may propose revisions to those practices or additional practices with associated nutrient removal rates. The NCDOT may use any such practices approved by the Division to meet loading rate targets identified in this Sub-item. New non-road development shall also control runoff flows to meet the purpose of this Rule regarding protection of the nutrient functions and integrity of receiving waters; and

(iii) For new non-road development, the NCDOT shall have the option of offsetting part of their nitrogen and phosphorus loads by implementing or funding offsite management measures. Before using an offsite offset option, a development shall implement structural stormwater controls that achieve 50 percent or more of the needed load reduction in both nitrogen and phosphorus loading onsite and shall meet any requirements for engineered stormwater controls described in this Item. Offsite offsetting measures shall achieve at least equivalent reductions in nitrogen and phosphorus loading to the remaining reduction needed onsite to comply with the loading rate targets set out in this Item. The NCDOT may use any measure that complies with the requirements of Rules .0240 and .0282 of this Section.

(d) Establish a program to identify and implement load-reducing opportunities on existing development within the watershed. The long-term objective of this effort shall be for the NCDOT to achieve the nutrient load objectives in 15A NCAC 02B .0275 as applied to existing development under its control, including roads and facilities:

(i) The NCDOT may achieve the nutrient load reduction objective in 15A NCAC 02B .0275 for existing roadway and non-roadway development under its control by the development of a load reduction program that addresses both roadway and non-roadway development in the Falls watershed. As part of the accounting process described in Item (13) of this Rule, baseline nutrient loads shall be established for roadways and industrial facilities using stormwater runoff nutrient load characterization data collected through the National Pollutant Discharge Elimination System (NPDES) Research Program under NCS0000250 Permit Part II Section G;

(ii) The program shall include estimates of, and plans for offsetting, nutrient load increases from lands developed subsequent to the baseline period but prior to implementation of its new development program. It shall include a technical analysis that includes a proposed implementation rate and schedule. This schedule shall provide for proportionate annual progress toward reduction objectives as practicable throughout the proposed compliance period. The program shall identify the types of activities NCDOT intends to implement and types of existing roadway and non-roadway development affected, relative proportions or a prioritization of practices, and the relative magnitude of reductions it expects to achieve from each;

(iii) The program to address roadway and non-roadway development may include stormwater retrofits and other load reducing activities in the watershed including: illicit discharge removal; street sweeping; source control activities such as fertilizer management at NCDOT facilities; improvement of existing stormwater structures; use of rain barrels and

cisterns; stormwater capture and reuse; and purchase of nutrient reduction credits;

(iv) NCDOT may meet minimum implementation rate and schedule requirements by implementing a combination of at least six stormwater retrofits per year for existing development in the Falls watershed or some other minimum amount based on more accurate reduction estimates developed during the accounting tool development process;

(v) To the maximum extent practicable, retrofits shall be designed to treat the runoff generated from all surfaces by one inch of rainfall, and shall conform to the standards and criteria established in the most recent version of the Division-approved NCDOT BMP Toolbox required under NCDOT's NPDES stormwater permit. To establish removal rates for nutrients for individual practices described in the Toolbox, NCDOT shall submit technical documentation on the nutrient removal performance of BMPs in the Toolbox for Division approval. Upon approval, NCDOT shall incorporate nutrient removal performance data into the BMP Toolbox. If a retrofit is proposed that is not described in the NCDOT BMP Toolbox, then to the maximum extent practicable, such retrofit shall conform to the standards and criteria set forth in the July 2007 version of the *Stormwater Best Management Practices Manual* published by the Division, or other technically equivalent guidance acceptable to the Division;

(e) Initiate a "Nutrient Management Education Program" for NCDOT staff and contractors engaged in the application of fertilizers on highway rights of way. The purpose of this program shall be to contribute to the load reduction objectives established in 15A NCAC 02B .0275 through proper application of nutrients, both inorganic fertilizer and organic nutrients, to highway rights of way in the Falls watershed in keeping with the most current state-recognized technical guidance on proper nutrient management; and

(f) Address compliance with the riparian buffer protection requirements of 15A NCAC 02B .0233 and .0242 through a Division approval process.

(10) NON-NCDOT RULE IMPLEMENTATION. For all state and federal entities that control lands within the Falls watershed with the exception of the NCDOT, this Rule shall be implemented as follows:

(a) Upon Commission approval of the accounting methods required in Item (13) of this Rule, subject entities shall comply with the requirements of Items (3) and (4) of this Rule;

(b) By July 15, 2013, the Division shall submit a Stage I model local program to the Commission for approval that embodies the criteria described in Items (5) and (6) of this Rule. The Division shall work in cooperation with subject state and

federal entities and other watershed interests in developing this model program, which shall include the following:

(i) Methods to quantify load reduction requirements and resulting load reduction assignments for individual entities;
(ii) Methods to account for discharging sand filters, malfunctioning septic systems, and leaking collection systems; and
(iii) Methods to account for load reduction credits from various activities;

(c) Within six months after the Commission's approval of the Stage I model local program, subject entities shall submit load reduction programs that meet or exceed the requirements of Items (5) and (6) of this Rule to the Division for review and preliminary approval and shall begin implementation and tracking of measures to reduce nutrient loads from existing developed lands owned or controlled by the responsible state or federal entity;

(d) Within 20 months of the Commission's approval of the Stage I model local program, the Division shall provide recommendations to the Commission on existing development load reduction programs. The Commission shall either approve the programs or require changes based on the standards set out in Item (4) of this Rule. Should the Commission require changes, the applicable state or federal entity shall have two months to submit revisions, and the Division shall provide follow-up recommendations to the Commission within two months after receiving revisions;

(e) Within three months after the Commission's approval of a Stage I existing development load reduction program, the affected entity shall complete adoption of and begin implementation of its existing development Stage I load reduction program;

(f) Upon implementation of the programs required under Item (4) of this Rule, state and federal entities subject to this Rule shall provide annual reports to the Division documenting their progress in implementing those requirements within three months following each anniversary of program implementation date until such time the Commission determines they are no longer needed to ensure maintenance of reductions or that standards are protected. State and federal entities shall indefinitely maintain and ensure performance of implemented load-reducing measures;

(g) By January 15, 2021 and every five years thereafter until either accounting determines load reductions have been achieved, standards are met, or the Commission takes other actions per 15A NCAC 02B .0275, state and federal entities located in the upper Falls watershed as defined in Item (3) of 15A NCAC 02B .0275 shall submit and begin implementation of Stage II load reduction program or program revision to the Division. Within nine months after submittal, the division shall make recommendations to the Commission on approval of these programs. The Commission shall either approve the programs or require changes based on the standards set out in this Rule. Should the

Commission require changes, the applicable state or federal entity shall submit revisions within two months, and the Division shall provide follow-up recommendations to the Commission within three months after receiving revisions. Upon approval, the state or federal entity shall adjust implementation based on its approved program;

(h) A state or federal entity may, at any time after commencing implementation of its load reduction program, submit program revisions to the Division for approval based on identification of more cost-effective strategies or other factors not originally recognized;

(i) Once either load reductions are achieved per annual reporting or water quality standards are met in the lake per 15A NCAC 02B .0275, state and federal entities shall submit programs to ensure no load increases and shall report annually per Sub-Item (10)(f) on compliance with no increases and take additional actions as necessary; and

(j) Beginning January 2016 and every five years thereafter, the Division shall review the accounting methods stipulated under Sub-Item (10)(a) to determine the need for revisions to those methods and to loading reductions assigned using those methods. Its review shall include values subject to change over time independent of changes resulting from implementation of this Rule, such as untreated export rates that may change with changes in atmospheric deposition. It shall also review values subject to refinement, such as nutrient removal efficiencies.

(11) NCDOT RULE IMPLEMENTATION. For the NCDOT, this Rule, shall be implemented as follows:

(a) By July 2013, the NCDOT shall submit the Stormwater Management Program for the Falls watershed to the Division for approval. This Program shall meet or exceed the requirements in Item (9) of this Rule;

(b) By January 15, 2014, the Division shall request the Commission's approval of the NCDOT Stormwater Management Program;

(c) By January 15, 2014, the NCDOT shall implement the Commission-approved Stormwater Management Program; and

(d) Upon implementation, the NCDOT shall submit annual reports to the Division summarizing its activities in implementing each of the requirements in Item (9) of this Rule. This annual reporting may be incorporated into annual reporting required under NCDOT's NPDES stormwater permit.

(12) RELATIONSHIP TO OTHER REQUIREMENTS. A party may in its program submittal request that the Division accept its implementation of another stormwater program or programs, such as NPDES stormwater requirements, as satisfying one or more of the requirements set forth in Items (4) or (5) of this Rule. The Division shall provide determination on acceptability of any such alternatives prior to requesting Commission

approval of programs under this Rule. The party shall include in its program submittal technical information demonstrating the adequacy of the alternative requirements.

(13) ACCOUNTING METHODS. By July 15, 2012, the Division shall submit a nutrient accounting framework to the Commission for approval. This framework shall include tools for quantifying load reduction assignments on existing development for parties subject to this Rule, load reduction credits from various activities on existing developed lands, and a tool that will allow subject parties to account for loading from new and existing development and loading changes due to BMP implementation. The Division shall work in cooperation with subject parties and other watershed interests in developing this framework. The Division shall periodically revisit these accounting methods to determine the need for revisions to both the methods and to existing development load reduction assignments made using the methods set out in this Rule. It shall do so no less frequently than every 10 years. Its review shall include values subject to change over time independent of changes resulting from implementation of this Rule, such as untreated export rates that may change with changes in atmospheric deposition. It shall also review values subject to refinement, such as BMP nutrient removal efficiencies.

History Note: *Authority G.S. 143-214.1; 143-214.3; 143-214.5; 143-214.7; 143-215.1; 143-215.3; 143-215.3(a)(1); 143-215.6A; 143-215.6B; 143-215.6C; 143-215.8B; 143B-282(c); 143B-282(d); S.L. 2005-190; S.L. 2006-259; S.L. 2009-337; S.L. 2009-486;*
Eff. January 15, 2011 (this permanent rule replaces the temporary rule approved by the RRC on December 16, 2010).

APPENDIX F

Considerations/Assigning/Implementing Water Supply Classifications

Appendix F

15A NCAC 02B .0104 CONSIDERATIONS/ASSIGNING/IMPLEMENTING WATER SUPPLY CLASSIFICATIONS

(a) In determining the suitability of waters for use as a source of water supply for drinking, culinary or food processing purposes after approved treatment, the Commission will be guided by the physical, chemical, and bacteriological maximum contaminant levels specified by Environmental Protection Agency regulations adopted pursuant to the Public Health Service Act, 42 U.S.C. 201 et seq., as amended by the Safe Drinking Water Act, 42 U.S.C. 300(f) et seq. In addition, the Commission shall be guided by the requirements for unfiltered and filtered water supplies and the maximum contaminant levels specified in the North Carolina Rules Governing Public Water Supplies, 15A NCAC 18C .1100, .1200 and .1500 and comments provided by the Division of Environmental Health.

(b) All local governments that have land use authority within designated water supply watersheds shall adopt and enforce ordinances that at a minimum meet the requirements of G.S. 143-214.5 and this Subchapter. The Commission shall approve local water supply protection programs if it determines that the requirements of the local program equal or exceed the minimum statewide water supply watershed management requirements adopted pursuant to this Section. Local governments may adopt and enforce more stringent controls. Local management programs and modifications to these programs must be approved by the Commission and shall be kept on file by the Division of Environmental Management, Division of Environmental Health and the Division of Community Assistance.

(c) All waters used for water supply purposes or intended for future water supply use shall be classified to the most appropriate water supply classification as determined by the Commission. Water supplies may be reclassified to a more or less protective water supply classification on a case-by-case basis through the rule-making process. A more protective water supply classification may be applied to existing water supply watersheds after receipt of a resolution from all local governments having land use jurisdiction within the designated water supply watershed requesting a more protective water supply classification. Local government(s) requesting the Future Water Supply classification must provide to the Division evidence of intent which may include one or a combination of the following: capital improvement plans, a Water Supply Plan as described in G.S. 143-355(l), bond issuance for the water treatment plant or land acquisition records. A 1:24,000 scale USGS topographical map delineating the location of the intended water supply intake is also required. Requirements for activities administered by the State of North Carolina, such as the issuance of permits for landfills, NPDES wastewater discharges, land application of residuals and road construction activities shall be effective upon reclassification for future water supply use. The requirements shall apply to the critical area and balance of the watershed or protected area as appropriate. Upon receipt of the final approval letter from the Division of Environmental Health for construction of the water treatment plant and water supply intake, the Commission shall initiate rule-making to modify the Future Water Supply supplemental classification. Local government implementation is not required until 270 days after the Commission has modified the Future Water Supply (FWS) supplemental classification through the rule-making process and notified the affected local government(s) that the appropriate local government land use requirements applicable for the water supply classifications are to be adopted, implemented and submitted to the Commission for approval. Local governments may also adopt land use ordinances that meet or exceed the state's minimum requirements for water supply watershed protection prior to the end of the 270 day deadline. The requirements for FWS may also be applied to waters formerly

used for drinking water supply purposes, and currently classified for water supply use, at the request of local government(s) desiring protection of the watershed for future water supply use.

(d) In considering the reclassification of waters for water supply purposes, the Commission shall take into consideration the relative proximity, quantity, composition, natural dilution and diminution of potential sources of pollution to determine that risks posed by all significant pollutants are adequately considered.

(e) For the purposes of implementing the water supply watershed protection rules (15A NCAC 2B .0100, .0200 and .0300) and the requirements of G.S. 143-214.5, the following schedule of implementation shall be applicable:

> August 3, 1992 - Activities administered by the State of North Carolina, such as the issuance of permits for landfills, NPDES wastewater discharges, and land application of sludge/residuals, and road construction activities, shall become effective regardless of the deadlines for municipal and county water supply watershed protection ordinance adoptions;
>
> By July 1, 1993 - Affected municipalities with a population greater than 5,000 shall adopt and submit the appropriate drinking water supply protection, maps and ordinances that meet or exceed the minimum management requirements of these Rules;
>
> By October 1, 1993 -Affected municipalities with a population less than 5,000 shall adopt and submit the appropriate drinking water supply protection, maps and ordinances that meet or exceed the minimum management requirements of these Rules;
>
> By January 1, 1994 -Affected county governments shall adopt and submit the appropriate drinking water supply protection, maps and ordinances that meet or exceed the minimum management requirements of these Rules.

Affected local government drinking water supply protection ordinances shall become effective on or before these dates. Local governments may choose to adopt, implement and enforce these provisions prior to this date. Three copies of the adopted and effective relevant ordinances shall be sent to the Division along with a cover letter from the municipal or county attorney, or its designated legal counsel, stating that the local government drinking water supply protection ordinances shall meet or exceed the rules in 15A NCAC 2B .0100, .0200 and .0300. If the rules in 15A NCAC 2B .0100, .0200 and .0300 are revised, the Division shall modify and distribute to local governments, as appropriate, a revised model ordinance. The Division shall approve the amended local maps and ordinances, or request the Commission to take appropriate action under G.S. 143-214.5.

(f) Wherever in this Subchapter it is provided that local governments assume responsibility for operation and maintenance of engineered stormwater control(s), this shall be construed to require responsible local governments to inspect such controls at least once per year, to determine whether the controls are performing as designed and intended. Records of inspections shall be maintained on forms supplied by the Division. Local governments may require payment of reasonable inspection fees by entities which own the controls, as authorized by law. In the event inspection shows that a control is not performing adequately, the local government shall order the owning entity to take corrective actions. If the entity fails to take sufficient corrective actions, the local government may impose civil penalties and pursue other available remedies in accordance with the law. The availability of new engineered stormwater controls as an alternative to lower development density and other measures under the provisions of this Subchapter and local ordinances approved by the Commission shall be

conditioned on the posting of adequate financial assurance, in the form of a cash deposit or bond made payable to the responsible local government, or other acceptable security. The establishment of a stormwater utility by the responsible local government shall be deemed adequate financial assurance. The purpose of the required financial assurance is to assure that maintenance, repairs or reconstruction necessary for adequate performance of the controls may be made by the owning entity or the local government which may choose to assume ownership and maintenance responsibility.

(g) Where higher density developments are allowed, stormwater control systems must use wet detention ponds as described in 15A NCAC 2H .1003(g)(2), (g)(3), (i), (j), (k), and (l). Alternative stormwater management systems consisting of other treatment options, or a combination of treatment options, may be approved by the Director. The design criteria for approval shall be 85 percent average annual removal of Total Suspended Solids. Also the discharge rate shall meet one of the following criteria:

(1) the discharge rate following the 1-inch design storm shall be such that the runoff draws down to the pre-storm design stage within five days, but not less than two days; or

(2) the post development peak discharge rate shall equal the predevelopment rate for the 1-year, 24 hour storm.

(h) Where no practicable alternative exists, discharge from groundwater remediation projects addressing water quality problems shall be allowed in accordance with other applicable requirements in all water supply classifications.

(i) To further the cooperative nature of the water supply watershed management and protection program provided for herein, local governments with jurisdiction over portions of classified watersheds and local governments which derive their water supply from within such watersheds are encouraged to establish joint water quality monitoring and information sharing programs, by interlocal agreement or otherwise. Such cooperative programs shall be established in consultation with the Division.

(j) Where no practicable alternative exists other than surface water discharge, previously unknown existing unpermitted wastewater discharges shall incorporate the best possible technology treatment as deemed appropriate by the Division.

(k) The Commission may designate water supply watersheds or portions thereof as critical water supply watersheds pursuant to G.S. 143-214.5(b).

(l) A more protective classification may be allowed by the Commission although minor occurrences of nonconforming activities are present prior to reclassification. When the Commission allows a more protective classification, expansions of existing wastewater discharges that otherwise would have been prohibited may be allowed if there is no increase in permitted pollutant loading; other discharges of treated wastewater existing at the time of reclassification may be required to meet more stringent effluent limitations as determined by the Division. Consideration of all practicable alternatives to surface water discharge must be documented.

(m) The construction of new roads and bridges and non-residential development shall minimize built-upon area, divert stormwater away from surface water supply waters as much as possible, and employ best management practices (BMPs) to minimize water quality impacts. To the extent practicable, the construction of new roads in the critical area shall be avoided. The Department of Transportation shall use BMPs as outlined in their document entitled "Best Management Practices for the Protection of

Surface Waters" which is hereby incorporated by reference including all subsequent amendments and editions. This material is available for inspection at the Department of Environment, Health, and Natural Resources, Division of Environmental Management, Water Quality Planning Branch, 512 North Salisbury Street, Raleigh, North Carolina.

(n) Activities within water supply watersheds are also governed by the North Carolina Rules Governing Public Water Supplies, 15A NCAC 18C .1100, .1200 and .1500. Proposed expansions of treated wastewater discharges to water supply waters must be approved by the Division of Environmental Health.

(o) Local governments shall correctly delineate the approximate normal pool elevation for backwaters of water supply reservoirs for the purposes of determining the critical and protected area boundaries as appropriate. Local governments must submit to the Division a 1:24,000 scale U.S.G.S. topographic map which shows the local government's corporate and extraterritorial jurisdiction boundaries, the Commission's adopted critical and protected area boundaries, as well as the local government's interpreted critical and protected area boundaries. All revisions (expansions or deletions) to these areas must be submitted to the Division and approved by the Commission prior to local government revision.

(p) Local governments shall encourage participation in the Agricultural Cost Share Program. The Soil and Water Conservation Commission is the designated management agency responsible for implementing the provisions of the rules in 15A NCAC 2H .0200 pertaining to agricultural activities. Agricultural activities are subject to the provisions of the Food Security Act of 1985 and the Food, Agriculture, Conservation and Trade Act of 1990 (Public Law 101-624) and 15A NCAC 2H .0217). The following shall be required within WS-I watersheds and the critical areas of WS-II, WS-III and WS-IV watersheds:

(1) Agricultural activities conducted after January 1, 1993 shall maintain a minimum 10 foot vegetated buffer, or equivalent control as determined by the Soil and Water Conservation Commission, along all perennial waters indicated on the most recent versions of U.S.G.S. 1:24,000 (7.5 minute) scale topographic maps or as determined by local government studies; and

(2) Animal operation deemed permitted and permitted under 15A NCAC 2H .0217 are allowed in all classified water supply watersheds.

(q) Existing development is not subject to the requirements of these Rules. Redevelopment is allowed if the rebuilding activity does not have a net increase in built-upon area or provides equal or greater stormwater control than the previous development, except that there are no restrictions on single family residential redevelopment. Expansions to structures classified as existing development must meet the requirements of the rules in 15A NCAC 2B .0100, .0200 and .0300; however, the built-upon area of the existing development is not required to be included in the density calculations. Expansions to structures other than existing development must meet the density requirements of these Rules for the entire project site. If a nonconforming lot of record is not contiguous to any other lot owned by the same party, then that lot of record shall not be subject to the development restrictions of these Rules if it is developed for single-family residential purposes. Local governments may, however, require the combination of contiguous nonconforming lots of record owned by the same party in order to establish a lot or lots that meet or nearly meet the development restrictions of the rules under 15A NCAC 2B. Any lot or parcel created as part of a family subdivision after the effective date of these Rules shall be exempt from these Rules if it is developed for one single-family detached residence and if it is exempt

from local subdivision regulation. Any lot or parcel created as part of any other type of subdivision that is exempt from a local subdivision ordinance shall be subject to the landuse requirements (including impervious surface requirements) of these Rules, except that such a lot or parcel must meet the minimum buffer requirements to the maximum extent practicable. Local governments may also apply more stringent controls relating to determining existing development, redevelopment or expansions.

(r) Development activities may be granted minor variances by local governments utilizing the procedures of G.S. 153A Article 18, or G.S. 160A, Article 19. A description of each project receiving a variance and the reason for granting the variance shall be submitted to the Commission on an annual basis by January 1. For all proposed major and minor variances from the minimum statewide watershed protection rules, the local Watershed Review Board shall make findings of fact showing that:

(1) there are practical difficulties or unnecessary hardships that prevent compliance with the strict letter of the ordinance;

(2) the variance is in harmony with the general purpose and intent of the local watershed protection ordinance and preserves its spirit; and

(3) in granting the variance, the public safety and welfare have been assured and substantial justice has been done.

The local Watershed Review Board may attach conditions to the major or minor variance approval that support the purpose of the local watershed protection ordinance. If the variance request qualifies as a major variance, and the local Watershed Review Board decides in favor of granting the major variance, the Board shall then prepare a preliminary record of the hearing and submit it to the Commission for review and approval. If the Commission approves the major variance or approves with conditions or stipulations added, then the Commission shall prepare a Commission decision which authorizes the local Watershed Review Board to issue a final decision which would include any conditions or stipulations added by the Commission. If the Commission denies the major variance, then the Commission shall prepare a Commission decision to be sent to the local Watershed Review Board. The local Watershed Review Board shall prepare a final decision denying the major variance. For all proposed major and minor variances the local government considering or requesting the variance shall notify and allow a reasonable comment period for all other local governments having jurisdiction within the watershed area governed by these Rules and the entity using the water supply for consumption. Appeals from the local government decision on a major or minor variance request are made on certiorari to the local Superior Court. Appeals from the Commission decision on a major variance request are made on judicial review to Superior Court. When local ordinances are more stringent than the state's minimum water supply protection rules a variance to the local government's ordinance is not considered a major variance as long as the result of the variance is not less stringent than the state's minimum requirements.

(s) Cluster development is allowed on a project-by-project basis as follows:

(1) Overall density of the project meets associated density or stormwater control requirements under 15A NCAC 2B .0200;

(2) Buffers meet the minimum statewide water supply watershed protection requirements;

(3) Built-upon areas are designed and located to minimize stormwater runoff impact to the receiving waters, minimize concentrated stormwater flow, maximize the use of sheet flow through vegetated areas, and maximize the flow length through vegetated areas;

(4) Areas of concentrated density development are located in upland areas and away, to the maximum extent practicable, from surface waters and drainageways;

(5) Remainder of tract to remain in vegetated or natural state;

(6) The area in the vegetated or natural state may be conveyed to a property owners association; a local government for preservation as a park or greenway; a conservation organization; or placed in a permanent conservation or farmland preservation easement. A maintenance agreement shall be filed with the property deeds; and

(7) Cluster developments that meet the applicable low density requirements shall transport stormwater runoff by vegetated conveyances to the maximum extent practicable.

(t) Local governments may administer oversight of future development activities in single family residential developments that exceed the applicable low density requirements by tracking dwelling units rather than percentage built-upon area, as long as the wet detention pond or other approved stormwater control system is sized to capture and treat runoff from all pervious and built-upon surfaces shown on the development plan and any off-site drainage from pervious and built-upon surfaces, and when an additional safety factor of 15 percent of built-upon area of the project site is figured in.

(u) All new development shall meet the development requirements on a project-by-project basis except local governments may submit ordinances and ordinance revisions which use density or built-upon area criteria averaged throughout the local government's watershed jurisdiction instead of on a project-by-project basis within the watershed. Prior to approval of the ordinance or amendment, the local government must demonstrate to the Commission that the provisions as averaged meet or exceed the statewide minimum requirements, and that a mechanism exists to ensure the orderly and planned distribution of development potential throughout the watershed jurisdiction.

(v) Silviculture activities are subject to the provisions of the Forest Practices Guidelines Related to Water Quality (15A NCAC 1I .0101 - .0209). The Division of Forest Resources is the designated management agency responsible for implementing the provisions of the rules in 15A NCAC 2B .0200 pertaining to silviculture activities.

(w) Local governments shall, as the existing laws allow, develop, implement, and enforce comprehensive nonpoint source and stormwater discharge control programs to reduce water pollution from activities within water supply watersheds such as development, forestry, landfills, mining, on-site sanitary sewage systems which utilize ground adsorption, toxic and hazardous materials, transportation, and water based recreation.

(x) When the Commission assumes a local water supply protection program as specified under G.S. 143-214.5(e) all local permits authorizing construction and development activities as regulated by the statewide minimum water supply watershed protection rules of this Subchapter must be approved by the Commission prior to local government issuance.

(y) In the event that stormwater management systems or facilities may impact existing waters or wetlands of the United States, the Clean Water Act requires that these systems or facilities be consistent with all federal and state requirements.

(z) A model local water supply watershed management and protection ordinance, as approved by the Commission in accordance with G.S. 143-214.5, is on file with the Office of Administrative Hearings and may be obtained by writing to: Water Quality Planning Branch, Division of Environmental Management, Post Office Box 29535, Raleigh, North Carolina 27626-0535.

(aa) The Commission may delegate such matters as variance approval, extension of deadlines for submission of corrected ordinances and assessment of civil penalties to the Director.

History Note: Authority G.S. 143-214.1; 143-215.3(a)(1);

Eff. February 1, 1976;

Amended Eff. August 1, 1995; August 3, 1992; March 1, 1991; October 1, 1989.

APPENDIX G

Fresh Water Quality Standards for Class C WS-II Waters

Appendix G

15A NCAC 02B .0214 FRESH SURFACE WATER QUALITY STANDARDS FOR CLASS WS-II WATERS

The following water quality standards apply to surface waters within water supply watersheds that are classified WS-II. Water quality standards applicable to Class C waters as described in Rule .0211 of this Section also apply to Class WS-II waters.

(1) The best usage of WS-II waters are as follows: a source of water supply for drinking, culinary, or food-processing purposes for those users desiring maximum protection for their water supplies where a WS-I classification is not feasible and any best usage specified for Class C waters.

(2) The conditions related to the best usage are as follows: waters of this class are protected as water supplies which are in predominantly undeveloped watersheds and meet average watershed development density levels as specified in Sub-Items (3)(b)(i)(A), (3)(b)(i)(B), (3)(b)(ii)(A) and (3)(b)(ii)(B) of this Rule; discharges which qualify for a General Permit pursuant to 15A NCAC 2H .0127, trout farm discharges, recycle (closed loop) systems that only discharge in response to 10-year storm events and other stormwater discharges are allowed in the entire watershed; new domestic and industrial discharges of treated wastewater are not allowed in the entire watershed; the waters, following treatment required by the Division of Environmental Health, shall meet the Maximum Contaminant Level concentrations considered safe for drinking, culinary, and food-processing purposes which are specified in the national drinking water regulations and in the North Carolina Rules Governing Public Water Supplies, 15A NCAC 18C .1500; sources of water pollution which preclude any of these uses on either a short-term or long-term basis shall be considered to be violating a water quality standard. The Class WS-II classification may be used to protect portions of Class WS-III and WS-IV water supplies. For reclassifications of these portions of Class WS-III and WS-IV water supplies occurring after the July 1, 1992 statewide reclassification, the more protective classification requested by local governments shall be considered by the Commission when all local governments having jurisdiction in the affected area(s) have adopted a resolution and the appropriate ordinances to protect the watershed or the Commission acts to protect a watershed when one or more local governments has failed to adopt necessary protection measures.

(3) Quality standards applicable to Class WS-II Waters are as follows:

(a) Sewage, industrial wastes, non-process industrial wastes, or other wastes: none except for those specified in either Item (2) of this Rule and Rule .0104 of this Subchapter; and none which shall have an adverse effect on human health or which are not effectively treated to the satisfaction of the Commission and in accordance with the requirements of the Division of Environmental Health, North Carolina Department of Environment and Natural Resources; any discharger may be required upon request by the Commission to disclose all chemical constituents present or potentially present in their wastes and chemicals which could be spilled or be present in runoff from their facility which may have an adverse impact on downstream water quality; these facilities may be required to have spill and treatment failure control plans as well as perform special monitoring for toxic substances;

(b) Nonpoint Source and Stormwater Pollution: none that would adversely impact the waters for use as a water supply or any other designated use;

(i) Nonpoint Source and Stormwater Pollution Control Criteria For Entire Watershed:

(A) Low Density Option: Development density must be limited to either no more than one dwelling unit per acre of single family detached residential development (or 40,000 square foot lot excluding roadway right-of-way) or 12 percent built-upon area for all other residential and non-residential development in the watershed outside of the critical area; Stormwater runoff from the development shall be transported by vegetated conveyances to the maximum extent practicable;

(B) High Density Option: If new development exceeds the low density option requirements as stated in Sub-Item (3)(b)(i)(A) of this Rule, then engineered stormwater controls must be used to control runoff from the first inch of rainfall; new residential and non-residential development shall not exceed 30 percent built-upon area;

(C) Land within the watershed shall be deemed compliant with the density requirements if the following condition is met: The density of all existing development at the time of reclassification does not exceed the density requirement when densities are averaged throughout the entire watershed area at the time of classification;

(D) Cluster development is allowed on a project-by-project basis as follows:

(I) overall density of the project meets associated density or stormwater control requirements of this Rule;

(II) buffers meet the minimum statewide water supply watershed protection requirements;

(III) built-upon areas are designed and located to minimize stormwater runoff impact to the receiving waters, minimize concentrated stormwater flow, maximize the use of sheet flow through vegetated areas; and maximize the flow length through vegetated areas;

(IV) areas of concentrated development are located in upland areas and away, to the maximum extent practicable, from surface waters and drainageways;

(V) remainder of tract to remain in vegetated or natural state;

(VI) area in the vegetated or natural state may be conveyed to a property owners association; a local government for preservation as a park or greenway; a conservation organization; or placed in a permanent conservation or farmland preservation easement;

(VII) a maintenance agreement for the vegetated or natural area shall be filed with the Register of Deeds;

(VIII) cluster development that meets the applicable low density option requirements shall transport stormwater runoff from the development by vegetated conveyances to the maximum extent practicable;

(E) A maximum of 10 percent of each jurisdiction's portion of the watershed outside of the critical area as delineated on July 1, 1993 may be developed with new development projects and expansions of existing development of up to 70 percent built-upon surface area in addition to the new development approved in compliance with the appropriate requirements of Sub-Item (3)(b)(i)(A) or Sub-Item (3)(b)(i)(B) of this Rule. For expansions to existing development, the existing built-upon surface area is not counted toward the allowed 70 percent built-upon surface area. A local government having jurisdiction within the watershed may transfer, in whole or in part, its right to the 10 percent/70 percent land area to another local government within the watershed upon submittal of a joint resolution and review by the Commission. When the water supply watershed is composed of public lands, such as National Forest land, local governments may count the public land acreage within the watershed outside of the critical area in calculating the acreage allowed under this provision. For local governments that do not choose to use the high density option in that WS-II watershed, each project must, to the maximum extent practicable, minimize built-upon surface area, direct stormwater runoff away from surface waters and incorporate best management practices to minimize water quality impacts; if the local government selects the high density development option within that WS-II watershed, then engineered stormwater controls must be employed for the new development;

(F) If local governments choose the high density development option which requires stormwater controls, then they shall assume ultimate responsibility for operation and maintenance of the required controls as outlined in Rule .0104 of this Subchapter;

(G) Minimum 100 foot vegetative buffer is required for all new development activities that exceed the low density option requirements as specified in Sub-Items (3)(b)(i)(A) and Sub-Item (3)(b)(ii)(A) of this Rule; otherwise a minimum 30 foot vegetative buffer for development activities is required along all perennial waters indicated on the most recent versions of U.S.G.S. 1:24,000 (7.5 minute) scale topographic maps or as determined by local government studies; nothing in this Rule shall stand as a bar to artificial streambank or shoreline stabilization;

(H) No new development is allowed in the buffer; water dependent structures, or other structures such as flag poles, signs and security lights, which result in only diminimus increases in impervious area and public projects such as road crossings and greenways may be allowed where no practicable alternative exists; these activities shall minimize built-upon surface area, direct runoff away from the surface waters and maximize the utilization of BMPs;

(I) No NPDES permits shall be issued for landfills that discharge treated leachate;

(ii) Critical Area Nonpoint Source and Stormwater Pollution Control Criteria:

(A) Low Density Option: New development is limited to either no more than one dwelling unit of single family detached residential development per two acres (or 80,000 square foot lot excluding roadway right-of-way) or six percent built-upon area for all other residential and non-residential development; Stormwater runoff from the development shall be transported by vegetated conveyances to the maximum extent practicable;

(B) High Density Option: If new development density exceeds the low density requirements specified in Sub-Item (3)(b)(ii)(A) of this Rule, then engineered stormwater controls must be used to control runoff from the first inch of rainfall; new residential and non-residential development density not to exceed 24 percent built-upon area

(C) No new permitted sites for land application of residuals or petroleum contaminated soils are allowed;

(D) No new landfills are allowed;

(c) MBAS (Methylene-Blue Active Substances): not greater than 0.5 mg/l to protect the aesthetic qualities of water supplies and to prevent foaming;

(d) Odor producing substances contained in sewage or other wastes: only such amounts, whether alone or in combination with other substances or wastes, as will not cause taste and odor difficulties in water supplies which cannot be corrected by treatment, impair the palatability of fish, or have a deleterious effect upon any best usage established for waters of this class;

(e) Phenolic compounds: not greater than 1.0 ug/l (phenols) to protect water supplies from taste and odor problems from chlorinated phenols;

(f) Total hardness: not greater than 100 mg/l as calcium carbonate;

(g) Total dissolved solids: not greater than 500 mg/l;

(h) Toxic and other deleterious substances:

(i) Water quality standards (maximum permissible concentrations) to protect human health through water consumption and fish tissue consumption for non-carcinogens in Class WS-II waters:

(A) Barium: 1.0 mg/l;
(B) Chloride: 250 mg/l;
(C) Manganese: 200 ug/l;
(D) Nickel: 25 ug/l;
(E) Nitrate nitrogen: 10 mg/l;
(F) 2,4-D: 100 ug/l;
(G) 2,4,5-TP: 10 ug/l;
(H) Sulfates: 250 mg/l;

(ii) Water quality standards (maximum permissible concentrations) to protect human health through water consumption and fish tissue consumption for carcinogens in Class WS-II waters:

(A) Aldrin: 0.127 ng/l;
(B) Arsenic: 10 ug/l;
(C) Benzene: 1.19 ug/l;
(D) Carbon tetrachloride: 0.254 ug/l;
(E) Chlordane: 0.575 ng/l;
(F) Chlorinated benzenes: 488 ug/l;
(G) DDT: 0.588 ng/l;
(H) Dieldrin: 0.135 ng/l;
(I) Dioxin: 0.000013 ng/l;
(J) Heptachlor: 0.208 ng/l;
(K) Hexachlorobutadiene: 0.445 ug/l;
(L) Polynuclear aromatic hydrocarbons: 2.8 ng/l;
(M) Tetrachloroethane (1,1,2,2): 0.172 ug/l;
(N) Tetrachloroethylene: 0.8 ug/l;
(O) Trichloroethylene: 3.08 ug/l
(P) Vinyl Chloride: 2 ug/l.

History Note: Authority G.S. 143-214.1; 143-215.3(a)(1);

Eff. May 10, 1979;

Amended Eff. May April 1, 2003; January 1, 1996; October 1, 1995.

APPENDIX H

Fresh Water Quality Standards for Class C WS-III Waters

Appendix H

15A NCAC 02B .0215 FRESH SURFACE WATER QUALITY STANDARDS FOR CLASS WS-III WATERS

The following water quality standards apply to surface water supply waters that are classified WS-III. Water quality standards applicable to Class C waters as described in Rule .0211 of this Section also apply to Class WS-III waters;

(1) The best usage of WS-III waters are as follows: a source of water supply for drinking, culinary, or food-processing purposes for those users where a more protective WS-I or WS-II classification is not feasible and any other best usage specified for Class C waters;

(2) The conditions related to the best usage are as follows: waters of this class are protected as water supplies which are generally in low to moderately developed watersheds and meet average watershed development density levels as specified in Sub-Items (3)(b)(i)(A), (3)(b)(i)(B), (3)(b)(ii)(A) and (3)(b)(ii)(B) of this Rule; discharges that qualify for a General Permit pursuant to 15A NCAC 2H .0127, trout farm discharges, recycle (closed loop) systems that only discharge in response to 10-year storm events, and other stormwater discharges are allowed in the entire watershed; treated domestic wastewater discharges are allowed in the entire watershed but no new domestic wastewater discharges are allowed in the critical area; no new industrial wastewater discharges except non-process industrial discharges are allowed in the entire watershed; the waters, following treatment required by the Division of Environmental Health, shall meet the Maximum Contaminant Level concentrations considered safe for drinking, culinary, or food-processing purposes which are specified in the national drinking water regulations and in the North Carolina Rules Governing Public Water Supplies, 15A NCAC 18C .1500; sources of water pollution which preclude any of these uses on either a short-term or long-term basis shall be considered to be violating a water quality standard; the Class WS-III classification may be used to protect portions of Class WS-IV water supplies. For reclassifications of these portions of WS-IV water supplies occurring after the July 1, 1992 statewide reclassification, the more protective classification requested by local governments shall be considered by the Commission when all local governments having jurisdiction in the affected area(s) have adopted a resolution and the appropriate ordinances to protect the watershed or the Commission acts to protect a watershed when one or more local governments has failed to adopt necessary protection measures;

(3) Quality standards applicable to Class WS-III Waters are as follows:

> (a) Sewage, industrial wastes, non-process industrial wastes, or other wastes: none except for those specified in Item (2) of this Rule and Rule .0104 of this Subchapter; and none which shall have an adverse effect on human health or which are not effectively treated to the satisfaction of the Commission and in accordance with the requirements of the Division of Environmental Health, North Carolina Department of Environment and Natural Resources; any discharger may be required by the Commission to disclose all chemical constituents present or potentially present in their wastes and chemicals which could be spilled or be present in runoff from their facility which may have an adverse impact on downstream water quality; these facilities may be required to have spill and treatment failure control plans as well as perform special monitoring for toxic substances;

(b) Nonpoint Source and Stormwater Pollution: none that would adversely impact the waters for use as water supply or any other designated use;

(i) Nonpoint Source and Stormwater Pollution Control Criteria For Entire Watershed:

(A) Low Density Option: Development density must be limited to either no more than two dwelling units of single family detached residential development per acre (or 20,000 square foot lot excluding roadway right-of-way) or 24 percent built-upon area for all other residential and non-residential development in watershed outside of the critical area; Stormwater runoff from the development shall be transported by vegetated conveyances to the maximum extent practicable;

(B) High Density Option: If new development density exceeds the low density option requirements specified in Sub-Item (3)(b)(i)(A) of this Rule then development must control runoff from the first inch of rainfall; new residential and non-residential development shall not exceed 50 percent built-upon area;

(C) Land within the watershed shall be deemed compliant with the density requirements if the following condition is met: The density of all existing development at the time of reclassification does not exceed the density requirement when densities are averaged throughout the entire watershed area;

(D) Cluster development is allowed on a project-by-project basis as follows:

(I) overall density of the project meets associated density or stormwater control requirements of this Rule;

(II) buffers meet the minimum statewide water supply watershed protection requirements;

(III) built-upon areas are designed and located to minimize stormwater runoff impact to the receiving waters, minimize concentrated stormwater flow, maximize the use of sheet flow through vegetated areas; and maximize the flow length through vegetated areas;

(IV) areas of concentrated development are located in upland areas and away, to the maximum extent practicable, from surface waters and drainageways;

(V) remainder of tract to remain in vegetated or natural state;

(VI) area in the vegetated or natural state may be conveyed to a property owners association; a local government for preservation as a park or greenway; a conservation organization; or placed in a permanent conservation or farmland preservation easement;

(VII) a maintenance agreement for the vegetated or natural area shall be filed with the Register of Deeds; and

(VIII) cluster development that meets the applicable low density option requirements shall transport stormwater runoff from the development by vegetated conveyances to the maximum extent practicable;

(E) A maximum of 10 percent of each jurisdiction's portion of the watershed outside of the critical area as delineated on July 1, 1993 may be developed with new development projects and expansions of existing development of up to 70 percent built-upon surface area in addition to the new development approved in compliance with the appropriate requirements of Sub-Item (3)(b)(i)(A) or Sub-Item (3)(b)(i)(B) of this Rule. For expansions to existing development, the existing built-upon surface area is not counted toward the allowed 70 percent built-upon surface area. A local government having jurisdiction within the watershed may transfer, in whole or in part, its right to the 10 percent/70 percent land area to another local government within the watershed upon submittal of a joint resolution and review by the Commission. When the water supply watershed is composed of public lands, such as National Forest land, local governments may count the public land acreage within the watershed outside of the critical area in figuring the acreage allowed under this provision. For local governments that do not choose to use the high density option in that WS-III watershed, each project must, to the maximum extent practicable, minimize built-upon surface area, direct stormwater runoff away from surface waters, and incorporate best management practices to minimize water quality impacts; if the local government selects the high density development option within that WS-III watershed, then engineered stormwater controls must be employed for the new development;

(F) If local governments choose the high density development option which requires engineered stormwater controls, then they shall assume ultimate responsibility for operation and maintenance of the required controls as outlined in Rule .0104 of this Subchapter;

(G) Minimum 100 foot vegetative buffer is required for all new development activities that exceed the low density requirements as specified in Sub-Item (3)(b)(i)(A) and Sub-Item (3)(b)(ii)(A) of this Rule, otherwise a minimum 30 foot vegetative buffer for development is required along all perennial waters indicated on the most recent versions of U.S.G.S. 1:24,000 (7.5 minute) scale topographic maps or as determined by local government studies; nothing in this Rule shall stand as a bar to artificial streambank or shoreline stabilization;

(H) No new development is allowed in the buffer; water dependent structures, or other structures such as flag poles, signs and security lights, which result in only diminimus increases in impervious area and public projects such as road crossings and greenways may be allowed where no practicable alternative exists; these activities shall minimize built-upon surface area, direct runoff away from surface waters and maximize the utilization of BMPs;

(I) No NPDES permits shall be issued for landfills that discharge treated leachate;

(ii) Critical Area Nonpoint Source and Stormwater Pollution Control Criteria:

(A) Low Density Option: New development limited to either no more than one dwelling unit of single family detached residential development per acre (or 40,000 square foot lot excluding roadway right-of-way) or 12 percent built-upon area for all other residential and non-residential development; Stormwater runoff from the development shall be transported by vegetated conveyances to the maximum extent practicable;

(B) High Density Option: If new development exceeds the low density requirements specified in Sub-Item (3)(b)(ii)(A) of this Rule, then engineered stormwater controls must be used to control runoff from the first inch of rainfall; development shall not exceed 30 percent built-upon area;

(C) No new permitted sites for land application of residuals or petroleum contaminated soils are allowed;

(D) No new landfills are allowed;

(c) MBAS (Methylene-Blue Active Substances): not greater than 0.5 mg/l to protect the aesthetic qualities of water supplies and to prevent foaming;

(d) Odor producing substances contained in sewage, industrial wastes, or other wastes: only such amounts, whether alone or in combination with other substances or wastes, as shall not cause taste and odor difficulties in water supplies which cannot be corrected by treatment, impair the palatability of fish, or have a deleterious effect upon any best usage established for waters of this class;

(e) Phenolic compounds: not greater than 1.0 ug/l (phenols) to protect water supplies from taste and odor problems from chlorinated phenols;

(f) Total hardness: not greater than 100 mg/l as calcium carbonate;

(g) Total dissolved solids: not greater than 500 mg/l;

(h) Toxic and other deleterious substances:

(i) Water quality standards (maximum permissible concentrations) to protect human health through water consumption and fish tissue consumption for non-carcinogens in Class WS-III waters:

(A) Barium: 1.0 mg/l;
(B) Chloride: 250 mg/l;
(C) Manganese: 200 ug/l;
(D) Nickel: 25 ug/l;
(E) Nitrate nitrogen: 10 mg/l;
(F) 2,4-D: 100 ug/l;
(G) 2,4,5-TP (Silvex): 10 ug/l;
(H) Sulfates: 250 mg/l;

(ii) Water quality standards (maximum permissible concentrations) to protect human health through water consumption and fish tissue consumption for carcinogens in Class WS-III waters:

(A) Aldrin: 0.127 ng/l;
(B) Arsenic: 10 ug/l;
(C) Benzene: 1.19 ug/l;
(D) Carbon tetrachloride: 0.254 ug/l;
(E) Chlordane: 0.575 ng/l;
(F) Chlorinated benzenes: 488 ug/l;
(G) DDT: 0.588 ng/l;
(H) Dieldrin: 0.135 ng/l;
(I) Dioxin: 0.000013 ng/l;
(J) Heptachlor: 0.208 ng/l;
(K) Hexachlorobutadiene: 0.445 ug/l;
(L) Polynuclear aromatic hydrocarbons: 2.8 ng/l;
(M) Tetrachloroethane (1,1,2,2): 0.172 ug/l;
(N) Tetrachloroethylene: 0.8 ug/l;
(O) Trichloroethylene: 3.08 ug/l
(P) Vinyl Chloride: 2 ug/l.

History Note: Authority G.S. 143-214.1; 143-215.3(a)(1);

Eff. September 9, 1979;

Amended Eff. May 1, 2007; April 1, 2003; January 1, 1996; October 1, 1995; October 1, 1989.

APPENDIX I

Fresh Water Quality Standards for Class C WS-IV Waters

Appendix I

15A NCAC 02B .0216 FRESH SURFACE WATER QUALITY STANDARDS FOR WS-IV WATERS

The following water quality standards apply to surface water supply waters that are classified WS-IV. Water quality standards applicable to Class C waters as described in Rule .0211 of this Section also apply to Class WS-IV waters.

(1) The best usage of WS-IV waters are as follows: a source of water supply for drinking, culinary, or food-processing purposes for those users where a more protective WS-I, WS-II or WS-III classification is not feasible and any other best usage specified for Class C waters.

(2) The conditions related to the best usage are as follows: waters of this class are protected as water supplies which are generally in moderately to highly developed watersheds or protected areas and meet average watershed development density levels as specified in Sub-Items (3)(b)(i)(A), (3)(b)(i)(B), (3)(b)(ii)(A) and (3)(b)(ii)(B) of this Rule. Discharges which qualify for a General Permit pursuant to 15A NCAC 02H 0127, trout farm discharges, recycle (closed loop) systems that only discharge in response to 10-year storm events, other stormwater discharges and domestic wastewater discharges shall be allowed in the protected and critical areas. Treated industrial wastewater discharges are allowed in the protected and critical areas; however, new industrial wastewater discharges in the critical area shall be required to meet the provisions of 15A NCAC 02B .0224(1)(b)(iv), (v) and (vii), and 15A NCAC 02B .0203. New industrial connections and expansions to existing municipal discharges with a pretreatment program pursuant to 15A NCAC 02H .0904 are allowed. The waters, following treatment required by the Division of Environmental Health, shall meet the Maximum Contaminant Level concentrations considered safe for drinking, culinary, or food-processing purposes which are specified in the national drinking water regulations and in the North Carolina Rules Governing Public Water Supplies, 15A NCAC 18C .1500. Sources of water pollution which preclude any of these uses on either a short-term or long-term basis shall be considered to be violating a water quality standard. The Class WS-II or WS-III classifications may be used to protect portions of Class WS-IV water supplies. For reclassifications of these portions of WS-IV water supplies occurring after the July 1, 1992 statewide reclassification, the more protective classification requested by local governments shall be considered by the Commission when all local governments having jurisdiction in the affected area(s) have adopted a resolution and the appropriate ordinances to protect the watershed or the Commission acts to protect a watershed when one or more local governments has failed to adopt necessary protection measures.

(3) Quality standards applicable to Class WS-IV Waters are as follows:

> (a) Sewage, industrial wastes, non-process industrial wastes, or other wastes: none shall be allowed except for those specified in Item (2) of this Rule and Rule .0104 of this Subchapter and none shall be allowed which shall have an adverse effect on human health or which are not effectively treated to the satisfaction of the Commission and in accordance with the requirements of the Division of Environmental Health, North Carolina Department of Environment and Natural Resources. Any discharges or industrial users subject to pretreatment standards may be required by the Commission to disclose all chemical constituents present or potentially present in their wastes and chemicals which could be spilled or be present in runoff from their facility which may have an adverse impact on downstream water supplies. These

facilities may be required to have spill and treatment failure control plans as well as perform special monitoring for toxic substances;

(b) Nonpoint Source and Stormwater Pollution: none shall be allowed that would adversely impact the waters for use as water supply or any other designated use.

(i) Nonpoint Source and Stormwater Pollution Control Criteria For Entire Watershed or Protected Area:

(A) Low Density Option: Development activities which require a Sedimentation/Erosion Control Plan in accordance with 15A NCAC 4 established by the North Carolina Sedimentation Control Commission or approved local government programs as delegated by the Sedimentation Control Commission shall be limited to no more than either: two dwelling units of single family detached development per acre (or 20,000 square foot lot excluding roadway right-of-way) or 24 percent built-upon on area for all other residential and non-residential development; or three dwelling units per acre or 36 percent built-upon area for projects without curb and gutter street systems in the protected area outside of the critical area; Stormwater runoff from the development shall be transported by vegetated conveyances to the maximum extent practicable;

(B) High Density Option: If new development activities which require a Sedimentation/Erosion Control Plan exceed the low density requirements of Sub-Item (3)(b)(i)(A) of this Rule then development shall control the runoff from the first inch of rainfall; new residential and non-residential development shall not exceed 70 percent built-upon area;

(C) Land within the critical and protected area shall be deemed compliant with the density requirements if the following condition is met: The density of all existing development at the time of reclassification does not exceed the density requirement when densities are averaged throughout the entire area;

(D) Cluster development shall be allowed on a project-by-project basis as follows:

(I) overall density of the project meets associated density or stormwater control requirements of this Rule;

(II) buffers meet the minimum statewide water supply watershed protection requirements;

(III) built-upon areas are designed and located to minimize stormwater runoff impact to the receiving waters, minimize concentrated stormwater flow, maximize the use of sheet flow through vegetated areas, and maximize the flow length through vegetated areas;

(IV) areas of concentrated development are located in upland areas and away, to the maximum extent practicable, from surface waters and drainageways;

(V) remainder of tract to remain in vegetated or natural state;

(VI) area in the vegetated or natural state may be conveyed to a property owners association; a local government for preservation as a park or greenway; a conservation organization; or placed in a permanent conservation or farmland preservation easement;

(VII) a maintenance agreement for the vegetated or natural area shall be filed with the Register of Deeds, and;

(VIII) cluster development that meets the applicable low density option requirements shall transport stormwater runoff from the development by vegetated conveyances to the maximum extent practicable;

(E) If local governments choose the high density development option which requires engineered stormwater controls, then they shall assume ultimate responsibility for operation and maintenance of the required controls as outlined in Rule .0104 of this Subchapter;

(F) Minimum 100 foot vegetative buffer is required for all new development activities that exceed the low density option requirements as specified in SubItem (3)(b)(i)(A) or Sub-Item (3)(b)(ii)(A) of this Rule, otherwise a minimum 30 foot vegetative buffer for development shall be required along all perennial waters indicated on the most recent versions of U.S.G.S. 1:24,000 (7.5 minute) scale topographic maps or as determined by local government studies;

(G) No new development shall be allowed in the buffer; water dependent structures, or other structures, such as flag poles, signs and security lights, which result in only diminimus increases in impervious area and public projects such as road crossings and greenways may be allowed where no practicable alternative exists; these activities shall minimize built-upon surface area, divert runoff away from surface waters and maximize the utilization of BMPs;

(H) For local governments that do not use the high density option, a maximum of 10 percent of each jurisdiction's portion of the watershed outside of the critical area as delineated on July 1, 1995 may be developed with new development projects and expansions to existing development of up to 70 percent built-upon surface area in addition to the new development approved in compliance with the appropriate requirements of Sub-Item (3)(b)(i)(A) of this Rule. For expansions to existing development, the existing built-upon surface area shall not be counted toward the allowed 70 percent built-upon surface area. A local government having jurisdiction within the watershed may transfer, in whole or in part, its right to the 10 percent/70 percent land area to another local government within the watershed upon submittal of a joint resolution for review by the Commission. When the designated water supply watershed area is composed of public land, such as National Forest land, local governments may count the public land acreage within the designated watershed area outside of the critical area in figuring the acreage allowed under this provision. Each project shall, to the maximum extent practicable, minimize built-upon surface

area, direct stormwater runoff away from surface waters and incorporate best management practices to minimize water quality impacts;

(ii) Critical Area Nonpoint Source and Stormwater Pollution Control Criteria:

(A) Low Density Option: New development activities which require a Sedimentation/Erosion Control Plan in accordance with 15A NCAC 4 established by the North Carolina Sedimentation Control Commission or approved local government programs as delegated by the Sedimentation Control Commission shall be limited to no more than two dwelling units of single family detached development per acre (or 20,000 square foot lot excluding roadway right-of-way) or 24 percent built-upon area for all other residential and non-residential development; Stormwater runoff from the development shall be transported by vegetated conveyances to the maximum extent practicable;

(B) High Density Option: If new development density exceeds the low density requirements specified in Sub-Item (3)(b)(ii)(A) of this Rule engineered stormwater controls shall be used to control runoff from the first inch of rainfall; new residential and non-residential development shall not exceed 50 percent built-upon area;

(C) No new permitted sites for land application of residuals or petroleum contaminated soils shall be allowed;

(D) No new landfills shall be allowed;

(c) MBAS (Methylene-Blue Active Substances): not greater than 0.5 mg/l to protect the aesthetic qualities of water supplies and to prevent foaming;

(d) Odor producing substances contained in sewage, industrial wastes, or other wastes: only such amounts, whether alone or in combination with other substances or waste, as will not cause taste and odor difficulties in water supplies which cannot be corrected by treatment, impair the palatability of fish, or have a deleterious effect upon any best usage established for waters of this class;

(e) Phenolic compounds: not greater than 1.0 ug/l (phenols) to protect water supplies from taste and odor problems due to chlorinated phenols shall be allowed. Specific phenolic compounds may be given a different limit if it is demonstrated not to cause taste and odor problems and not to be detrimental to other best usage;

(f) Total hardness shall not exceed 100 mg/l as calcium carbonate;

(g) Total dissolved solids shall not exceed 500 mg/l;

(h) Toxic and other deleterious substances:

(i) Water quality standards (maximum permissible concentrations) to protect human health through water consumption and fish tissue consumption for non-carcinogens in Class WS-IV waters shall be allowed as follows:

(A) Barium: 1.0 mg/l;

(B) Chloride: 250 mg/l;
(C) Manganese: 200 ug/l;
(D) Nickel: 25 ug/l;
(E) Nitrate nitrogen: 10.0 mg/l;
(F) 2,4-D: 100 ug/l;
(G) 2,4,5-TP (Silvex): 10 ug/l;
(H) Sulfates: 250 mg/l;

(ii) Water quality standards (maximum permissible concentrations) to protect human health through water consumption and fish tissue consumption for carcinogens in Class WS-IV waters shall be allowed as follows:

(A) Aldrin: 0.127 ng/l;
(B) Arsenic: 10 ug/l;
(C) Benzene: 1.19 ug/l;
(D) Carbon tetrachloride: 0.254 ug/l;
(E) Chlordane: 0.575 ng/l;
(F) Chlorinated benzenes: 488 ug/l;
(G) DDT: 0.588 ng/l;
(H) Dieldrin: 0.135 ng/l;
(I) Dioxin: 0.000013 ng/l;
(J) Heptachlor: 0.208 ng/l;
(K) Hexachlorobutadiene: 0.445 ug/l;
(L) Polynuclear aromatic hydrocarbons: 2.8 ng/l;
(M) Tetrachloroethane (1,1,2,2): 0.172 ug/l;
(N) Tetrachloroethylene: 0.8 ug/l;
(O) Trichloroethylene: 3.08 ug/l
(P) Vinyl Chloride: 2 ug/l.

History Note: Authority G.S. 143-214.1; 143-215.3(a)(1);

Eff. February 1, 1986;

Amended Eff. May 1, 2007; April 1, 2003; June 1, 1996; October 1, 1995; August 1, 1995; June 1, 1994.

APPENDIX J

Nutrient Offset Payments

Appendix J

15A NCAC 02B .0240 NUTRIENT OFFSET PAYMENTS

(a) The purpose of this Rule is to establish procedures for the optional payment of nutrient offset fees to the NC Ecosystem Enhancement Program, subsequently referred to as the Program, or to other public or private parties where the Program or such parties implement projects for nutrient offset purposes and accept payments for those purposes, and where either of the following applies:

(1) The following rules of this Section allow offsite options or nutrient offset payments toward fulfillment or maintenance of nutrient reduction requirements:

(A) .0234 and .0235 of the Neuse nutrient strategy,

(B) .0258 of the Tar-Pamlico nutrient strategy, and

(C) applicable rules of the Jordan nutrient strategy, which is described in Rule .0262; and

(2) Other rules adopted by the Commission allow this option toward fulfillment of nutrient load reduction requirements.

(b) Offset fees paid pursuant to this Rule shall be used to achieve nutrient load reductions subject to the following geographic restrictions:

(1) Load reductions shall be located within the same 8-digit cataloguing unit, as designated by the US Geological Survey, as the loading activity that is being offset;

(2) The Division shall track impacts by 10-digit watershed, as designated by the US Geological Survey and providers shall locate projects proportional to the location of impacts to the extent that the projects would meet the least cost alternative criterion per S.L. 2007-438. The location of load reduction projects shall be reviewed during the approval process described in Paragraph (c) of this Rule;

(3) Impacts that occur in the watershed of Falls Lake in the upper Neuse River Basin may be offset only by load reductions in the same watershed; Impacts in the Neuse 01 8-digit cataloguing unit below the Falls watershed, as designated by the US Geological Survey, may be offset only by load reductions in that same lower watershed;

(4) Restrictions established in the Jordan nutrient strategy, which is described in Rule 15A NCAC 02B .0262; and

(5) Any further restrictions established by the Commission through rulemaking.

(c) The Program and other parties shall obtain Division approval of proposed nutrient offset projects prior to construction. Other parties shall sell credits in compliance with approved credit release schedules and with the requirements of this Rule. Project approval shall be based on the following standards:

(1) Load reductions eligible for credit shall not include reductions used to satisfy other requirements under the same nutrient strategy;

(2) The Program and other parties shall agree to provide adequate financial assurance to protect and maintain load reductions for the stated duration, including for maintenance, repair and renovation of the proposed measure;

(3) The Program and other parties shall agree that once credits are established for a measure and until they are exhausted, they shall provide a credit/debit ledger to the Division at regular intervals;

(4) The Program and other parties shall agree that the party responsible for a measure shall allow the Division access to it throughout its lifetime for compliance inspection purposes;

(5) The Program or other party seeking approval shall obtain a site review from Division staff prior to Division approval to verify site conditions suitable to achieve the proposed load reductions through the proposed measure; and

(6) The Program shall submit a proposal, and other parties shall submit a proposal or a draft banking instrument, addressing the following items regarding a proposed load-reducing measure:

(A) Identify the location and site boundaries of the proposed measure, the geographic area to be served by credits in compliance with the requirements of Paragraph (b) of this Rule, existing conditions in the contributing drainage area and location of the measure, and the nature of the proposed measure with sufficient detail to support estimates of load reduction required in this Paragraph;

(B) Provide calculations of the annual magnitudes of load reductions and identify final credit values incorporating any delivery factors or other adjustments required under rules identified in Paragraph (a) of this Rule;

(C) Define the duration of load reductions, and provide a conservation easement or similar legal mechanism to be recorded with the County Register of Deeds and that is sufficient to ensure protection and maintenance of load reductions for the stated duration;

(D) Identify the property owner and parties responsible for obtaining all permits and other authorizations needed to establish the proposed measure, for constructing and ensuring initial performance of the proposed measure, for reporting on and successfully completing the measure, for holding and enforcing the conservation easement, and for ensuring protection and maintenance of functions for its stated duration;

(E) Provide a plan for implementing the proposed measure, including a timeline, a commitment to provide an as-built plan and report upon establishment of the measure, elements to be included in the as-built plan and report, a commitment to provide a bond or other financial assurance sufficient to cover all aspects of establishment and initial performance prior to the release of any credits, and criteria for successful completion; and

(F) Provide a monitoring and maintenance plan designed to achieve successful completion, that commits to annual reporting to the Division until success is achieved, that recognizes the Division's authority to require extension or re-initiation of monitoring depending on progress toward success, and that commits to a final report upon completion. The final report shall reaffirm the party that shall hold and enforce the conservation easement or other legal instrument.

(d) The Program shall establish and revise nutrient offset rates as set out in Rule .0274 of this Section. Offset payments accepted by the Program shall be placed into the Riparian Buffer Restoration Fund administered by the Department pursuant to G.S. 143-214.21

(e) Persons who seek to pay nutrient offset fees under rules of this Section shall do so in compliance with such rules, the requirements of Paragraph (b) of this Rule, and the following:

(1) A non-governmental entity shall purchase nutrient offset credit from a party other than the Program if such credit is available in compliance with the criteria of this Rule at the time credit is sought, and shall otherwise demonstrate to the permitting authority that such credit is not available before seeking to make payment to the Program;

(2) Offset payments made to the Program shall be contingent upon acceptance of the payment by the Program. The financial, temporal and technical ability of the Program to satisfy the mitigation request will be considered to determine whether the Program will accept or deny the request;

(3) Where persons seek to offset more than one nutrient type, they shall make payment to address each type;

(4) The offset payment shall be an amount sufficient to fund 30 years of nutrient reduction.

(5) Persons who seek offsets to meet new development stormwater permitting requirements shall provide proof of offset credit purchase to the permitting authority prior to approval of the development plan; and

(6) A wastewater discharger that elects to purchase offset credits for the purpose of fulfilling or maintaining nutrient reduction requirements shall submit proof of offset credit acquisition or a letter of commitment from the Program or third party provider with its request for permit modification. Issuance of a permit that applies credits to nutrient limits shall be contingent on receipt of proof of offset credit acquisition. A discharger may propose to make incremental payments for additional nutrient allocations, contingent upon receiving a letter of commitment from the Program or third party provider to provide the offset credit needed for permit issuance. In that event the Division may issue or modify that permit accordingly, and shall condition any flow increase associated with that incremental purchase on payment in full for the additional allocation. Offset responsibility for nutrient increases covered under this Paragraph shall be transferred to the Program or third party provider when it has received the entire payment.

(f) Credits associated with load reducing activities funded under this Rule shall be awarded exclusively to the person, municipality, discharger, or group of dischargers who paid the offset fee.

History Note: *Authority G.S. 143-214.1; 143-214.20; 143-214.21; S.L. 1995, c. 572; S.L. 2007, c. 438; S.L. 2009, c. 337; S.L. 2009, c. 484; S.L. 2009, c. 486;*
Eff. August 1, 1998;
Amended Eff. August 1, 2006;
Amended Eff. September 1, 2010.

APPENDIX K

Nutrient Offset Payment Rates for the North Carolina Ecosystem Enhancement Program

Appendix K

15A NCAC 02B .0274 NUTRIENT OFFSET PAYMENT RATES FOR THE NC ECOSYSTEM ENHANCEMENT PROGRAM

(a) The purpose of this Rule is to establish actual cost rates for the payment of nutrient offset fees to the NC Ecosystem Enhancement Program, subsequently referred to as the Program, where rules adopted by the Commission allow this option toward fulfillment of nutrient load reduction requirements and where the Program implements projects to achieve nutrient reductions. Wherever the term "cost" or "costs" is used in this Rule, it means the Program's costs associated with nutrient offset projects in a given rate area, as described below. For this purpose, the Program shall operate according to the requirements in this Rule.

(b) The Program shall calculate and publish general offset payment rates applicable to each river basin where Commission rules allow such nutrient offsets and special rates for specific watersheds as identified in Paragraph (d) of this Rule. All rates shall be based on the actual and complete per-pound nutrient reduction costs incurred by implementing projects in those watersheds.

(c) Payment rates shall be developed for nitrogen, phosphorus, or other nutrients as dictated by Commission rule requirements for each river basin.

(d) Special Watershed Rates. The Program shall apply special watershed rates to:

(1) The Neuse 03020201 cataloging unit below the Falls watershed, the Jordan Lake watershed, and the Falls Lake watershed; and

(2) Any eight digit cataloging unit or smaller watershed subject to nutrient management rules where costs are 40 percent greater than costs in the larger watershed or river basin in which that cataloging unit is located.

The initial rate for a special watershed with fewer than two nutrient reduction projects that have reached the design stage shall be the highest rate in effect under the Program for the applicable nutrient. The initial rate shall be revised for a special watershed the quarter following a quarter in which at least two nutrient reduction projects in that watershed have reached design stage.

(e) Once an area has been established as an area with Special Watershed Rates, it shall remain a Special Watershed Rate area.

(f) Rate Adjustment Frequency. Initial rates shall be effective as of the effective date of this Rule. They shall be adjusted quarterly whenever the rate increases ten percent above the existing rate. The rates shall also be adjusted annually. Annual calculations and adjusted rates shall be published by June 1 on the Program's Web site, www.nceep.net, and shall become effective July 1. Any quarterly rate adjustments shall become effective on the first day of October, January, or April as applicable, and shall be published on the same Web site two weeks prior to that date.

(g) Payment rates for each nutrient shall be determined for a rate area using the following equation and presented in per pound values:

$$ActualCostRate = \frac{ActualCosts_{PresentDay}}{TotalPoundsOffset_{PresentDay}} + AdjustmentFactor$$

Where:

(1) Actual $Costs_{PresentDay}$ means the sum of all costs adjusted for inflation as described in this Sub-Item. Costs are project costs and administrative costs. Projects in the calculation are completed projects, terminated projects and projects in process. At the time the rate is set, to ensure that collected payments are sufficient to implement new projects, all completed land acquisition contracts and expenditures shall be adjusted to present day values using the current North Carolina Department of Agriculture and Consumer Services' Agricultural Statistics Farm Real Estate Values. All other completed contracts and expenditures shall be adjusted to present day values using the annual composite USACE Civil Works Construction Cost Index. Future land acquisition contract costs for projects in process are calculated using the Program's per credit contract costs of the same type adjusted to the inflated future value when the contracts will be encumbered using the North Carolina Department of Agriculture and Consumer Services' Agricultural Statistics Farm Real Estate Values. All other future contracts shall be calculated using the Program's per credit contract costs of the same type adjusted to the inflated future value when the contracts will be encumbered using the current composite USACE Civil Works Construction Cost Index. For projects in process where the contract type has not been determined, the cost of the project shall be calculated using the Program's average per pound cost adjusted to the future inflated value when the project will be initiated. Future year annual inflation rates shall be drawn from either the North Carolina Department of Agriculture and Consumer Services' Agricultural Statistics Farm Real Estate Values or the USACE Civil Works Construction Cost Index. If not available from either source, they shall be calculated using the average annual percentage change over the last three year period;

(2) As used in this Rule:

(A) Project Costs are the total costs associated with development of nutrient reduction projects including identification, land acquisition, project design, project construction, monitoring, maintenance and long-term stewardship;

(B) Administrative Costs are costs associated with administration of the Program including staffing, supplies and rent; and

(C) The cost for projects in process is the sum of expenditures of project contracts to date, contracted cost to complete existing contracts, and the projected cost of future contracts needed to complete those projects required to fulfill Program nutrient reduction obligations in the rate area;

(3) Total $Pounds\ Offset_{PresentDay}$ means the total number of pounds of a nutrient reduced by projects in the rate area at the time of calculation. If the Total $Pounds\ Offset_{PresentDay}$ for an existing or completed project is reduced, the Actual $Costs_{PresentDay}$ for that existing or completed project shall be proportionally adjusted; and

(4) $$Adjustment Factor = \frac{(Actual Costs - Actual Receipts)}{Number of Pounds Paid During Adjustment Period}$$

Where:

(A) The Adjustment Factor is a per-pound value used to bring actual costs and actual receipts into balance, ensuring that future payments are sufficient to cover the cost of implementing the Program in the rate area. The Adjustment Factor shall be applied in only those calculation periods where actual costs are calculated to be greater than actual receipts;

(B) Actual Costs are the same as Actual CostsPresentDay as defined in Subparagraph (1) of this Paragraph, except that existing contracts and completed land acquisitions are not adjusted for inflation;

(C) Actual Receipts are the sum of all offset payments made to the Program to date in the rate area at the time of calculation; and

(D) Number of Pounds Paid during Adjustment Period is the average number of pounds of a nutrient paid to the Program over the last three years in the rate area, multiplied by the adjustment period. If no payments have been made to the Program in a rate area, the number of pounds paid shall be set to 1,000 pounds until greater than 1,000 pounds have been purchased in that rate area.

(5) Adjustment Period is one to four years determined as follows for a rate area:

(A) One year if Actual Costs exceed Actual Receipts by less than five percent;

(B) Two years if Actual Costs exceed Actual Receipts by five percent or more but less than 15 percent;

(C) Three years if Actual Costs exceed Actual Receipts by 15 percent or more but less than 25 percent; and

(D) Four years if Actual Costs exceed Actual Receipts by 25 percent or more.

(h) When individual projects produce more than one type of nutrient reduction, the project costs shall be prorated for each nutrient being offset by the project.

(i) In cases where an applicant is required to reduce more than one nutrient type and chooses to use the Program to offset nutrients, the applicant shall make a payment for each nutrient.

History Note: *Authority G.S. 143-214.1; 143-214.20; 143-214.21; S.L. 1995, c. 572; S.L. 2006, c. 215; S.L. 2007, c. 438; S.L. 2009, c. 337; S.L. 2009, c. 484; S.L. 2009, c. 486;*
Eff. September 1, 2010.

APPENDIX

L

Article 19: Watershed Protection Ordinance

Creedmoor Development Ordinance 2012

ARTICLE 19

WATERSHED PROTECTION ORDINANCE

SECTION 1: GENERAL PROVISIONS

19.1 Title

This Ordinance shall be officially known as "The Creedmoor Watershed Protection Ordinance", but it may also be referred to as "The Stormwater Ordinance." It may be furthermore referred to herein as "this Ordinance."

19.2 Purpose and Authority

The purpose of this Ordinance is to protect, maintain and enhance the public health, safety, environment and general welfare by establishing minimum requirements and procedures to control the adverse effects of issues related to increased *stormwater runoff* and nonpoint and point source pollution, *buffer* protection, and illicit discharges into municipal stormwater systems. It has been determined that proper management of construction-related and post-*Development stormwater runoff*, illicit discharges, and *buffer* protection will minimize damage to public and private property and infrastructure; safeguard the public health, safety, and general welfare; and protect water and aquatic resources. This Ordinance also applies to all properties within the City of Creedmoor and its extraterritorial jurisdiction, regardless of whether the property is currently being "developed" or not.

The City Board of Commissioners of the City of Creedmoor is authorized to adopt this Ordinance pursuant to North Carolina law, including but not limited to Article 14, Section 5 of the Constitution of North Carolina; North Carolina General Statutes §143-214.7 and rules promulgated by the Environmental Management Commission thereunder; Session Law 2004-163; Chapter §160A, §§ 174, 185; as well as Chapter §113A, Article 4 (Sedimentation Pollution Control); Article 21, Part 6 (Floodway Regulation); Chapter §160A, Article 19 (Planning and Regulation of *Development*); Article 19, Part 4, Chapter §160A; G.S. §160A-372 (Open Space).

19.3 Findings

It is hereby determined that:

19.3-1 *Development* and Re-*Development* alter the hydrologic response of local *watershed*s and increase *stormwater runoff* rates and volumes, flooding, soil erosion, *stream* channel erosion, nonpoint and point source pollution, and sediment transport and deposition, as well as reducing groundwater recharge;

19.3-2 These changes in *stormwater runoff* contribute to increased quantities of water-borne pollutants and alterations in hydrology that are harmful to public health and safety as well as to the natural environment; and

19.3-3 These effects can be managed and minimized by applying proper design and well-planned controls to manage *stormwater runoff* from *Development* sites.

19.3-4 Further, the Federal Water Pollution Control Act of 1972 ("Clean Water Act") and federal Phase II Stormwater Rules promulgated under it, as well as rules of the North Carolina Environmental Management Commission (EMC) promulgated in response to federal Phase II requirements, compel certain urbanized areas, including this jurisdiction, to adopt minimum stormwater controls such as those included in this Ordinance. Further, the EMC has identified Falls of Neuse reservoir, a water supply reservoir, as nutrient sensitive waters; has identified all or a portion of the reservoir as impaired waters under the federal Clean Water Act due to exceedances of the chlorophyll a standard; and has promulgated rules (the "Falls Rules") to reduce the average annual loads of nitrogen and phosphorus delivered to Falls Reservoir from all point and nonpoint sources of these nutrients located within its watershed, including stormwater from new development in this jurisdiction;

19.3-5 Therefore, the City of Creedmoor City Board of Commissioners establishes this set of water quality and quantity regulations to meet the requirements of state and federal law regarding control of *stormwater runoff* and discharge.

19.4 Specific

This Ordinance seeks to meet its general purpose through the following specific objectives and means:

19.4-1 Establishing decision-making processes for *Development* that protects the integrity of *watershed*s and preserves the health of water resources.

19.4-2 Requiring that *new Development* and Re-*Development* maintain the pre-*Development* hydrologic response in their post-*Development* state as nearly as practicable for the applicable design storm to reduce flooding, *stream*bank erosion, nonpoint and point source pollution and increases in *stream* temperature, and to maintain the integrity of *stream* channels and aquatic habitats;

19.4-3 Establishing minimum post-*Development* stormwater management standards and design criteria for the regulation and control of *stormwater runoff* quantity and quality;

19.4-4 Establishing design and review criteria for the construction, function, and use of structural stormwater *Best Management Practices (BMPs)* that may be used to meet the minimum post-*Development* stormwater management standards;

19.4-5 Encouraging the use of better management and site design practices, such as the use of vegetated conveyances for stormwater and the preservation of greenspace, riparian *buffer*s and other conservation areas to the maximum extent practicable;

19.4-6 Establishing provisions for the long-term responsibility for and maintenance of structural and nonstructural stormwater *Best Management Practices (BMPs)* to ensure that they continue to function as designed, are maintained appropriately, and pose no threat to public safety;

19.4-7 Establishing administrative procedures for the submission, review, approval and disapproval of stormwater management plans, for the inspection of approved projects, and to assure appropriate long-term maintenance.

19.4-8 Coordinating site design plans that include open space and natural areas with the City of Creedmoor Development Ordinance and the 2030 Comprehensive Land Development Plan, and any other plans as adopted by the City of Creedmoor.

19.4-9 Controlling illicit discharges into the municipal separate stormwater system.

19.4-10 Controlling erosion and sedimentation from construction activities.

19.4-11 Assigning responsibility and processes for approving the creation and maintenance of adequate drainage and flood damage prevention measures.

19.5 Applicability and Jurisdiction

19.5-1 General. Beginning with and subsequent to its effective date, this Ordinance shall be applicable to all properties in the City of Creedmoor and its extraterritorial jurisdiction, including, but not limited to, site plan applications, subdivision applications, and grading applications, unless exempt pursuant to Subsection 19-5.2 of this Section, Exemptions. Properties need not be "under *development*" to be subject to the standards of this Ordinance.

19.5-2 Exemptions. The following are exempt from the requirements of this Article. The exemption shall not be construed to permit uses prohibited in the primary and/or overlay zoning district, or otherwise prohibited by this Ordinance.

(A.) Single family and duplex residential and recreational development and redevelopment that cumulatively disturbs less than one half acre and is not part of a larger common plan of development or sale is exempt from the provisions of this ordinance.

(B.) Commercial, industrial, institutional, multifamily residential or local government development and redevelopment that cumulatively disturbs less than 12,000 square feet and is not part of a larger common plan of development or sale is exempt from the provisions of this ordinance..

(C.) Development and redevelopment that disturbs less than the above thresholds are not exempt if such activities are part of a larger common plan of development or sale and the larger common plan exceeds the relevant threshold, even though multiple, separate or distinct activities take place at different times on different schedules.

(D.) Development that is exempt from permit requirements of Section 404 of the federal Clean Water Act as specified in 40 CFR 232 (primarily, ongoing farming and forestry activities) are exempt from the provisions of this ordinance.

(E.) No lot or property shall be exempt from the *buffer* protection requirements of this Ordinance.

19.5-3 No *Development* or re-*Development* Until Compliance and Permit. No *Development* or Re-*Development* shall occur except in compliance with the provisions of this Ordinance or unless exempted. No *Development* for which a permit is required pursuant to this Ordinance shall occur except in compliance with the provisions, conditions, and limitations of the permit.

19.5-4 Map. The provisions of this Article shall apply within the areas designated on the map titled "Falls Watershed Stormwater Map of the City of Creedmoor, North Carolina " ("the Stormwater Map"), which is adopted simultaneously herewith. The Stormwater Map and all explanatory matter contained thereon accompanies and is hereby made a part of this Ordinance. The Stormwater Map shall be kept on file by the Stormwater Administrator and shall be updated to take into account changes in the land area covered by this Ordinance and the geographic location of all structural BMPs permitted under this Ordinance. In the event of a dispute, the applicability of this Ordinance to a particular area of land or BMP shall be determined by reference to the North Carolina Statutes, the North Carolina Administrative Code, and local zoning and jurisdictional boundary ordinances.

19.5-5 Definitions. Definitions may be found in Article 3 “Definitions.”

19.6 Interpretation

19.6-1 Meaning and Intent. All provisions, terms, phrases, and expressions contained in this Ordinance shall be construed according to the general and specific purposes set forth in Section 19.2, Purpose and Authority. If a different or more specific meaning is given for a term defined elsewhere in the City of Creedmoor Development Ordinance, the meaning and application of the term in this Ordinance shall control for purposes of application of this Ordinance.

19.6-2 Text Controls in Event of Conflict. In the event of a conflict or inconsistency between the text of this Ordinance and any heading, caption, figure, illustration, table, or map, the text shall control.

19.6-3 Authority for Interpretation. The Stormwater Administrator has authority to determine the interpretation of this Ordinance. Any person may request an interpretation by submitting a written request to the Stormwater Administrator, who shall respond in writing within 30 days. The Stormwater Administrator shall keep on file a record of all written interpretations of this Ordinance.

19.6-4 References to Statutes, Regulations, and Documents. Whenever reference is made to a resolution, ordinance, statute, regulation, manual (including the *Design Manual*), or document, it shall be construed as a reference to the most recent edition of such that has been finalized and published with due provision for notice and comment, unless otherwise specifically stated.

19.6-5 Computation of Time. The time in which an act is to be done shall be computed by excluding the first day and including the last day. If a deadline or required date of action falls on a Saturday, Sunday, or holiday observed by the City of Creedmoor, the deadline or required date of action shall be the next day that is not a Saturday, Sunday or holiday observed by the City of Creedmoor. References to days are calendar days unless otherwise stated.

19.7 Delegation of Authority

Any act authorized by this Ordinance to be carried out by the Stormwater Administrator of City of Creedmoor may be carried out by his or her designee.

19.8 Usage

19.8-1 Mandatory and Discretionary Terms. The words "shall," "must," and "will" are mandatory in nature, establishing an obligation or duty to comply with the particular provision. The words "may" and "should" are permissive in nature.

19.8-2 Conjunctions. Unless the context clearly indicates the contrary, conjunctions shall be interpreted as follows: The word "and" indicates that all connected items, conditions, provisions and events apply. The word "or" indicates that one or more of the connected items, conditions, provisions or events apply.

19.8-3 Tense, Plurals, and Gender. Words used in the present tense include the future tense. Words used in the singular number include the plural number and the plural number includes the singular number, unless the context of the particular usage clearly indicates otherwise. Words used in the masculine gender include the feminine gender, and vice versa.

19.9 Measurement and Computation

Lot area refers to the amount of horizontal land area contained inside the lot lines of a lot or site. Lot area does not include those portions of a lot or tract of land lying within a public street and/or roadway right-of-way existing upon the effective date of this Ordinance.

19.10 Design Manual

19.10-1 References to *Design Manual*. The Stormwater Administrator shall use the policy, criteria, and information, including technical specifications and standards, in the most recent edition of the **NC DWQ Stormwater BMP Manual** (hereinafter referred to as the *Design Manual*) as the basis for decisions about stormwater permits and about the design, implementation and performance of structural and non-structural stormwater BMPs.

The *Design Manual* includes a list of acceptable stormwater treatment practices, including specific design criteria for each stormwater practice. Stormwater treatment practices that are designed, constructed, and maintained in accordance with these design and sizing criteria will be presumed to meet the minimum water quality performance standards of the Falls Rules.

19.10-2 Relationship of *Design Manual* to Other Laws and Regulations. If the specifications or guidelines of the *Design Manual* are more restrictive or apply a higher standard than other laws or regulations, that fact shall not prevent application of the specifications or guidelines in the *Design Manual*.

19.10-3 Changes to Standards and Specifications. If the standards, specifications, guidelines, policies, criteria, or other information in the *Design Manual* are amended subsequent to the submittal of an application for approval pursuant to this Ordinance but prior to approval, the new information shall control and shall be utilized in reviewing the application and in implementing this Ordinance with regard to the application.

19.11 Relationship to Other Laws, Regulations and Private Agreements

19.11-1 Conflicts of laws. This Ordinance is not intended to modify or repeal any other ordinance, rule, regulation or other provision of law. The requirements of this Ordinance are in addition to the requirements of any other ordinance, rule, regulation or other provision of law. Where any provision of this Ordinance imposes restrictions different from those imposed by any other ordinance, rule, regulation or other provision of law, whichever provision is more restrictive or imposes higher protective standards for human or environmental health, safety, and welfare shall control.

19.11-2 Private Agreements. This Ordinance is not intended to revoke or repeal any easement, covenant, or other private agreement. However, where the regulations of this Ordinance are more restrictive or impose higher standards or requirements than such an easement, covenant, or other private agreement, the requirements of this Ordinance shall govern. Nothing in this Ordinance shall modify or repeal any private covenant or deed restriction, but such covenant or restriction shall not legitimize any failure to comply with this Ordinance. In no case shall the City of Creedmoor be obligated to enforce the provisions of any easements, covenants, or agreements between private parties.

19.12 Severability

If the provisions of any section, subsection, paragraph, subdivision or clause of this Article shall be adjudged invalid by a court of competent jurisdiction, such judgment shall not affect or invalidate the remainder of any section, subsection, paragraph, subdivision or clause of this Ordinance.

19.13 Effective Date and Transitional Provisions

19.13-1 Effective Date. This Article shall take effect on the same date as the larger document, known as the Creedmoor Development Ordinance, of which this Article is a part, shall become effective.

19.13-2 Final Approvals. Complete Applications. All *Development* and Re-*Development* projects for which complete and full applications were submitted and approved by the City of Creedmoor prior to the effective date of this Ordinance and which remain valid, unexpired, unrevoked and not otherwise terminated at the time of *Development* or Re-*Development* shall be exempt from complying with all provisions of this Ordinance dealing with the control and/or management of post-construction runoff, but shall be required to comply with all other applicable provisions, including but not limited to illicit discharge provisions.

A phased *development* plan shall be deemed approved prior to the effective date of this Ordinance if it has been approved by all necessary government units, it remains valid, unexpired, unrevoked and not otherwise terminated, and it shows:

(A.) For the initial or first phase of *development*, the type and intensity of use for a specific parcel or parcels, including at a minimum, the boundaries of the project and a subdivision plan that has been approved.

(B.) For any subsequent phase of *development*, sufficient detail so that implementation of the requirements of this Ordinance to that phase of *development* would require a material change in that phase of the plan.

19.13-3 Violations Continue. Any violation of provisions existing on the effective date of this Ordinance shall continue to be a violation under this Ordinance and be subject to penalties and enforcement under this Ordinance unless the use, *Development*, construction, or other activity complies with the provisions of this Ordinance.

SECTION 2: ADMINISTRATION AND PROCEDURES

19.14 Review and Decision-Making Entities

19.14-1 Stormwater Administrator.

Stormwater Administrator shall be designated by the City of Creedmoor Board of Commissioners to administer and enforce this Article. The minimum qualifications of the Stormwater Administrator and/or designated individuals, performing services only in their area of competence, who will be responsible for administering this ordinance and of implementing the City of Creedmoor's Local Stormwater Program, including stormwater plan review and BMP inspection are as follows:

(A) A person certified by the North Carolina Cooperative Extension Service to approve stormwater management plans or to inspect BMPs

(B) Registered North Carolina Professional Engineers with stormwater experience

(C) Registered North Carolina Professional Surveyor, Landscape Architect, Soil Scientist, or Aquatic Biologist.

19.14-2 Powers and Duties. In addition to the powers and duties that may be conferred by other provisions of the City of Creedmoor Development Ordinance and other laws, the Stormwater Administrator shall have the following powers and duties under this Ordinance.

(A.) To review and approve, approve with conditions, or disapprove applications for approval of plans pursuant to this Ordinance.

(B.) To make determinations and render interpretations of this Ordinance.

(C.) To establish application requirements and schedules for submittal and review of applications and appeals, to review and make recommendations to the City Board of Commissioners on applications for *Development* or Re-*Development* approvals.

(D.) To enforce the provisions of this Ordinance in accordance with its enforcement provisions.

(E.) To maintain records, maps, forms and other official materials as relate to the adoption, amendment, enforcement, and administration of this Ordinance.

(F.) To provide expertise and technical assistance to the City Board of Commissioners, upon request.

(G.) To designate appropriate other person(s) who shall carry out the powers and duties of the Stormwater Administrator.

(H.) To take any other action necessary to administer the provisions of this Ordinance.

19.15 Review Procedures

19.15-1 Permit Required; Must Apply for *Watershed* Approval (or Permit). An approved *Watershed* Plan (which may be used interchangeably with the term "stormwater permit" or "permit") is required for all *development* and re-*development* unless exempt pursuant to this Ordinance. Approval may only be issued subsequent to a properly submitted and reviewed permit application, or plan, pursuant to this section.

19.15-2 Effect of Permit. A stormwater permit shall govern the design, installation, and construction of stormwater management and control practices on the site, including structural BMPs and elements of site design for stormwater management other than structural BMPs.

The permit is intended to provide a mechanism for the review, approval, and inspection of the approach to be used for the management and control of stormwater for the *Development* or Re-*Development* site consistent with the requirements of this Ordinance, whether the approach consists of structural BMPs or other techniques such as low-impact or low-density design. The permit does not continue in existence indefinitely after the completion of the project; rather, compliance after project construction is assured by the maintenance provisions of this Ordinance.

19.15-3 Authority to File Applications. All applications required pursuant to this Code shall be submitted to the Stormwater Administrator by the land owner or the land owner's duly authorized agent. An original signature of the property owner shall be required on the cover sheet of the site plan submittal or application.

19.15-4 Application Contents and Form. The Stormwater Administrator shall establish requirements for the content and form of all applications and shall amend and update those requirements from time to time. At a minimum, the stormwater permit application shall describe in detail how post-*development stormwater runoff* will be controlled and managed, the design of all stormwater facilities and practices, and how the proposed project will meet the requirements of this Ordinance.

19.15-5 Submission Schedule. The Stormwater Administrator shall establish a submission schedule for applications. The schedule shall establish deadlines by which complete

applications must be submitted for the purpose of ensuring that there is adequate time to review applications, and that the various stages in the review process are accommodated.

19.15-6 Review Fees. The City Board of Commissioners shall establish review fees as well as policies regarding refund of any fees upon withdrawal of an application, and may amend and update the fees and policies from time to time.

Administrative Manual. For applications required under this Article, the Stormwater Administrator shall compile the application requirements, submission schedule, fee schedule, a copy of this Ordinance, and information on how and where to obtain the Design Manual in an Administrative Manual, which shall be made available to the public.

19.15-7 Submittal of Complete Application. Applications shall be submitted to the Stormwater Administrator pursuant to the application submittal schedule in the form established by the Stormwater Administrator, along with the appropriate fee established pursuant to this section.

An application shall be considered as timely submitted only when it contains all elements of a complete application pursuant to this Ordinance, along with the appropriate fee. If the Stormwater Administrator finds that an application is incomplete, the applicant shall be notified of the deficient elements and shall be provided with an opportunity to submit a complete application. However, the submittal of an incomplete application shall not suffice to meet a deadline contained in the submission schedule established above.

19.15-8 Review. The Stormwater Administrator shall review the application and determine whether the application complies with the standards of this Ordinance.

19.15-9 Approval. If the Stormwater Administrator finds that the application complies with the standards of this Ordinance, the Stormwater Administrator shall approve the application. The Stormwater Administrator may impose conditions of approval as needed to ensure compliance with this Ordinance. The conditions shall be included as part of the approval.

19.15-10 Application Fails to Comply. If the Stormwater Administrator finds that the application fails to comply with the standards of this Ordinance, the Stormwater Administrator shall notify the applicant and shall indicate how the application fails to comply. The applicant shall have an opportunity to submit a revised application.

19.15-11 Revision and Subsequent Review. A complete revised application shall be reviewed by the Stormwater Administrator after its re-submittal and shall be approved, approved with conditions, or disapproved.

If a revised application is not re-submitted within sixty (60) calendar days from the date the applicant was notified, the application shall be considered withdrawn, and a

new submittal for the same or substantially the same project shall be required along with the appropriate fee for a new submittal.

Up to two (2) re-submittals of a revised application may be submitted without payment of an additional permit review fee. Any re-submittal after the second re-submittal shall be accompanied by an additional review fee, as established pursuant to this Ordinance.

19.16 Applications for Approval

19.16-1 Concept Plan and Consultation Meeting. Before a stormwater management permit application is deemed complete, the Stormwater Administrator or developer may request a consultation on a concept plan for the post-construction stormwater management system to be utilized in the proposed *Development* project. This consultation meeting should take place at the time of the preliminary plan/plat of subdivision or other early step in the *Development* process. The purpose of this meeting is to discuss the post-construction stormwater management measures necessary for the proposed project, as well as to discuss and assess constraints, opportunities and potential approaches to stormwater management designs before formal site design engineering is commenced. Local *watershed* plans, the City of Creedmoor Development Ordinance, "City Plan 2030 – Comprehensive Land Use Plan" as amended from time to time, and other relevant resource protection plans should be consulted in the discussion of the concept plan. Fees for such a meeting may be required.

To accomplish this goal, the following information should be included in the concept plan, which should be submitted in advance of the meeting.

19.16-2 Conditions / Proposed Site Plans. Existing conditions and proposed site layout sketch plans, which illustrate at a minimum: existing and proposed topography; *perennial and intermittent streams*; mapping of predominant soils from soil surveys (if available); boundaries of existing predominant vegetation; proposed limits of clearing and grading; and location of existing and proposed roads, buildings, parking areas and other *impervious surface*s.

19.16-3 Natural Resources Inventory. A written or graphic inventory of natural resources at the site and surrounding area as it exists prior to the commencement of the project. This description should include a discussion of soil conditions, forest cover, geologic features, topography, *wetlands*, and native vegetative areas on the site, as well as the location and boundaries of other natural feature protection and conservation areas such as lakes, ponds, floodplains, *stream buffer*s and other setbacks (e.g., drinking water well setbacks, septic setbacks, etc.). Particular attention should be paid to environmentally sensitive features that provide particular opportunities or constraints

for *Development* and stormwater management.

19.16-4 Stormwater Management System Concept Plan. A written or graphic concept plan of the proposed post-*Development* stormwater management system including: preliminary selection and location of proposed structural stormwater controls; low-impact design elements; location of existing and proposed conveyance systems such as grass channels, swales, and storm drains; flow paths; location of floodplain/floodway limits; relationship of site to upstream and downstream properties and drainages; and preliminary location of any proposed *stream* channel modifications, such as bridge or culvert crossings.

19.16-5 Stormwater Management Permit Application. The stormwater management permit application shall detail how post-*Development stormwater runoff* will be controlled and managed and how the proposed project will meet the requirements of this Ordinance, including "Section 3, Standards". All such plans shall be prepared by a qualified registered North Carolina professional engineer, surveyor, or landscape architect, and the engineer, surveyor, or landscape architect shall perform services only in their area of competence, and shall verify that the design of all stormwater management facilities and practices meets the submittal requirements for complete applications, that the designs and plans are sufficient to comply with applicable standards and policies found in the *Design Manual*, and that the designs and plans ensure compliance with this Ordinance. The submittal shall include all of the information required in the submittal checklist established by the Stormwater Administrator. Incomplete submittals shall be treated pursuant to Section 19.15-10 (Application Fails to Comply).

19.16-6 As-Built Plans and Final Approval. Upon completion of a project, and before a certificate of occupancy shall be granted, the applicant shall certify that the *completed* project is in accordance with the approved stormwater management plans and designs, and shall submit actual "as built" plans for all stormwater management facilities or practices after final construction is *completed*.

The plans shall show the final design specifications for all stormwater management facilities and practices and the field location, size, depth, and planted vegetation of all measures, controls, and devices, as installed. The designer of the stormwater management measures and plans shall certify, under seal, that the as-built stormwater measures, controls, and devices are in compliance with the approved stormwater management plans and designs and with the requirements of this Ordinance. A final inspection and approval by the Stormwater Administrator shall occur before the release of any performance securities.

19.16-7 Other Permits. No certificate of compliance or occupancy shall be issued by the City of Creedmoor or Granville County without final as-built plans and a final

inspection and approval by the Stormwater Administrator, except where multiple units are served by the stormwater practice or facilities, in which case the City of Creedmoor or Granville County may elect to withhold a percentage of permits or certificates of occupancy until as-built plans are submitted and final inspection and approval has occurred.

19.16-8 Plans Required for *Buffer* Encroachments. Site plans, prepared by a licensed professional engineer, professional land surveyor, or landscape architect are required to be submitted to the City of Creedmoor prior to any encroachment into a required *buffer*. Fees may apply to such a review by the City of Creedmoor.

19.17 Approvals

19.17-1 Effect of Approval. Approval authorizes the applicant to go forward with only the specific plans and activities authorized in the permit. The approval shall not be construed to exempt the applicant from obtaining other applicable approvals from local, state, and federal authorities.

19.17-2 Time Limit/Expiration/Extension. An approved plan shall become null and void if the applicant fails to make *substantial progress* (i.e. building permits must be open and active) on the site within one year after the date of approval. The Stormwater Administrator may grant a single, one-year extension of this time limit, for good cause shown, upon receiving a written request from the applicant before the expiration of the approved plan. In granting an extension, the Stormwater Administrator may require compliance with standards adopted since the original application was submitted unless there has been substantial reliance on the original permit and the change in standards would infringe the applicant's vested rights.

19.18 Appeals

19.18-1 Filing of Appeal and Procedures. Appeals shall be taken within 30 days by filing a notice of appeal and specifying the grounds for appeal on forms provided by the City of Creedmoor. The Stormwater Administrator shall transmit to the Board of Adjustment all documents constituting the record on which the decision appealed from was taken. The hearing conducted by the Board of Adjustment shall be conducted in the nature of a quasi-judicial proceeding with all findings of fact supported by competent, material evidence.

19.18-2 Review by Superior Court. Every decision of the Board of Adjustment shall be subject to Superior Court review by proceedings in the nature of certiorari. Petition for review by the Superior Court shall be filed with the Clerk of Superior Court within thirty (30) days after the latter of the following:

(A.) The decision of the Board of Adjustment is filed; or

(B.) A written copy of the decision is delivered to every aggrieved party who has filed a written request for such copy with the Chair of the Board of Adjustment at the time of its hearing of the case.

SECTION 3: STANDARDS

19.19 General Standards

All development and redevelopment to which this ordinance applies shall comply with the standards of this section. The approval of the stormwater permit shall require an enforceable restriction on property usage that runs with the land, such as a recorded deed restriction or protective covenants, to ensure that future development and redevelopment maintains the site consistent with the approved project plans.

NITROGEN AND PHOSPHORUS LOADING

(a) Nitrogen and phosphorus loads contributed by the proposed new development shall not exceed the following unit-area mass loading rates: 2.2 and 0.33 pounds per acre per year for nitrogen and phosphorus, respectively.

(b) Notwithstanding 15A NCAC 2B.104(q), redevelopment subject to this ordinance that would replace or expand existing structures or improvements and would result in a net increase in built-upon area shall have the option of either meeting the loading standards identified in subsection (a) or meeting a loading rate that achieves the following nutrient loads compared to the existing development: 40 percent and 77 percent reduction for nitrogen and phosphorus, respectively.

(c) The developer shall determine the need for engineered stormwater controls to meet these loading rate targets by using the approved accounting tool.

NITROGEN AND PHOSPHORUS STANDARD IS SUPPLEMENTAL

The nitrogen and phosphorus loading standards in this ordinance are supplemental to, not replacements for, stormwater standards otherwise required by federal, state or local law, including without limitation any riparian buffer requirements applicable to the location of the development. This includes, without limitation, the riparian buffer protection requirements of 15A NCAC 2B.0233 and .0242.

CONTROL AND TREATMENT OF RUNOFF VOLUME

Stormwater systems shall be designed to control and treat the runoff generated from all surfaces by one inch of rainfall. The treatment volume shall be drawn down pursuant to standards specific to each practice as provided in the Design Manual. To ensure that the integrity and nutrient processing functions of receiving waters and associated riparian buffers are not compromised by erosive flows, stormwater flows from the development shall not contribute to degradation of waters of the State. At a minimum, the development shall not result in a net increase in peak flow leaving the site from pre-development conditions for the one-year, 24-hour storm event.

PARTIAL OFFSET OF NUTRIENT CONTROL REQUIREMENTS

Development subject to this ordinance shall attain nitrogen and phosphorus loading rate reductions on-site that meet the following criteria prior to using an offsite offset measure:

1. 30 percent or more reduction in both nitrogen and phosphorus loading from the untreated conditions for any single-family, detached and duplex residential development disturbing one half acre but less than one acre.
2. 50 percent or more reduction in both nitrogen and phosphorus loading from the untreated conditions for any single-family, detached and duplex residential development disturbing more than one acre.
3. 30 percent or more reduction in both nitrogen and phosphorus loading from the untreated condition for other development, including multi-family residential, commercial and industrial development disturbing 12,000 square feet but less than one acre.
4. 50 percent or more reduction in both nitrogen and phosphorus loading from the untreated condition for other development, including multi-family residential, commercial and industrial development disturbing more than one acre.
5. 30 percent or more reduction in both nitrogen and phosphorus loading from the untreated condition for proposed redevelopment activities in a designated downtown area that would replace or expand structures or improvements that existed as of December 2006.

A developer subject to this Ordinance may either achieve the additional reductions in nitrogen and phosphorus loading required by this Article by making offset payments to the NC Ecosystem Enhancement Program contingent upon acceptance of payments by that Program, or may use an offset option provided by the City of Creedmoor. A

developer may propose other offset measures to the City of Creedmoor, including providing his or her own offsite offset or utilizing a private seller. All offset measures permitted by this ordinance shall meet the requirements of 15A NCAC 02B .0282 and 15A NCAC 02B .0240.

19.20 Standards for Stormwater Control Measures

19.20-1 Evaluation According to Contents of Design Manual. All stormwater control measures and stormwater treatment practices (also referred to as Best Management Practices, or BMPs) required under this Ordinance shall be evaluated by the Stormwater Administrator according to the policies, criteria, and information, including technical specifications and standards and the specific design criteria for each stormwater practice, in the *Design Manual*. The Stormwater Administrator shall determine whether proposed BMPs will be adequate to meet the requirements of this Ordinance.

19.20-2 Determination of Adequacy; Presumptions and Alternatives. Stormwater treatment practices that are designed, constructed, and maintained in accordance with the criteria and specifications in the *Design Manual* will be presumed to meet the minimum water quality and quantity performance standards of this Ordinance. Whenever an applicant proposes to utilize a practice or practices not designed and constructed in accordance with the criteria and specifications in the *Design Manual,* the applicant shall have the burden of demonstrating that the practice(s) will satisfy the minimum water quality and quantity performance standards of this Ordinance. The Stormwater Administrator may require the applicant to provide the documentation, calculations, and examples necessary for the Stormwater Administrator to determine whether such an affirmative showing is made.

19.20-3 Nitrogen and Phosphorus loading

(A) Nitrogen and phosphorus loads contributed by the proposed new development shall not exceed the following unit-area mass loading rates: 2.2 and 0.33 pounds per acre per year for nitrogen and phosphorus, respectively.

(B) Notwithstanding 15A NCAC 2B.104(q), redevelopment subject to this ordinance that would replace or expand existing structures or improvements and would result in a net increase in built-upon area shall have the option of either meeting the loading standards identified in subsection (a) or meeting a loading rate that achieves the following nutrient loads compared to the existing development: 40 percent and 77 percent reduction for nitrogen and phosphorus, respectively.

(C) The developer shall determine the need for engineered stormwater controls to meet these loading rate targets by using the approved Falls Rules accounting tool.

19.20-4 NITROGEN AND PHOSPHORUS STANDARD IS SUPPLEMENTAL

The nitrogen and phosphorus loading standards in this ordinance are supplemental to, not replacements for, stormwater standards otherwise required by federal, state or local law, including without limitation any riparian buffer requirements applicable to the location of the development. This includes, without limitation, the riparian buffer protection requirements of 15A NCAC 2B.0233 and .0242.

19.20-5 CONTROL AND TREATMENT OF RUNOFF VOLUME

Stormwater systems shall be designed to control and treat the runoff generated from all surfaces by one inch of rainfall. The treatment volume shall be drawn down pursuant to standards specific to each practice as provided in the Design Manual. To ensure that the integrity and nutrient processing functions of receiving waters and associated riparian buffers are not compromised by erosive flows, stormwater flows from the development shall not contribute to degradation of waters of the State. At a minimum, the development shall not result in a net increase in peak flow leaving the site from pre-development conditions for the one-year, 24-hour storm event.

19.20-6 PARTIAL OFFSET OF NUTRIENT CONTROL REQUIREMENTS

Development subject to this ordinance shall attain nitrogen and phosphorus loading rate reductions on-site that meet the following criteria prior to using an offsite offset measure:

1. 30 percent or more reduction in both nitrogen and phosphorus loading from the untreated conditions for any single-family, detached and duplex residential development disturbing one half acre but less than one acre.

2. 50 percent or more reduction in both nitrogen and phosphorus loading from the untreated conditions for any single-family, detached and duplex residential development disturbing more than one acre.

3. 30 percent or more reduction in both nitrogen and phosphorus loading from the untreated condition for other development, including multi-family residential, commercial and industrial development disturbing 12,000 square feet but less than one acre.

4. 50 percent or more reduction in both nitrogen and phosphorus loading from the untreated condition for other development, including multi-family residential, commercial and industrial development disturbing more than one acre.

5. 30 percent or more reduction in both nitrogen and phosphorus loading from the untreated condition for proposed redevelopment activities in a designated downtown area that would replace or expand structures or improvements that existed as of December 2006.

A developer subject to this ordinance may achieve the additional reductions in nitrogen and phosphorus loading required by this ordinance by making offset payments to the NC Ecosystem Enhancement Program contingent upon acceptance of payments by that Program. A developer may use the offset option provided by the City of Creedmoor in Section 19.21 of this article. A developer may propose other offset measures to the City of Creedmoor, including providing his or her own offsite offset or utilizing a private seller. All offset measures permitted by this ordinance shall meet the requirements of 15A NCAC 02B .0282 and 15A NCAC 02B .0240.

19.20-7 Surface Water Buffers.

Perennial and Intermittent Surface Water Buffers Required: A surface water buffer shall be maintained with a minimum width as specified in Table 19.20-9 (Surface Water Buffers) below and measured landward from the normal pool elevation of water supply impoundment and from the bank of each side of perennial and intermittent streams, lakes and ponds. These waters are indicated on the most recent version of either the United States Geological Survey 1:24,000 scale (7.5 minute quadrangle) topographic maps or the Soil Survey maps developed by the USDA Natural Resource Conservation Service. In addition, other site specific evidence may indicate to the NC *Division* of Water Quality the presence of waters not shown correctly on either of these two maps. Where these two maps show waters where no actual stream or waterbody exists, or where waters exist that are not shown on these maps, a developer may submit site-specific evidence in support of such claim to the Technical Review Committee. If the Committee determines that a discrepancy exists, the evidence may be submitted to the NC *Division* of Water Quality for a determination in water supply watersheds. For streams in non-water supply watersheds, the Committee will use the maps referenced above or a classification study in accordance with the U.S Army Corps of Engineers or the N.C. *Division* of Water Quality methodology to determine stream classification. All surface water buffers shall be depicted as provided for in the stormwater guidelines for water quality and flood control.

Table 19.20-9

Surface Water Buffers

15A NCAC 02B .0233 NEUSE RIVER BASIN: NUTRIENT SENSITIVE WATERS MANAGEMENT STRATEGY: PROTECTION AND MAINTENANCE OF EXISTING RIPARIAN BUFFERS

Classification	Required Buffer	
Perennial Surface Waters (Streams, Lakes, and Ponds)	50 feet	
	Zone 1 30 Feet	Zone 2 20 Feet
Intermittent Surface Waters (Streams, Lakes and Ponds)	50 Feet	
	Zone 1 30 Feet	Zone 2 20 Feet

Buffer Zones: Under 15A NCAC 02B .0233, required surface water buffers consist of two zones as shown in Table 19.20-9. Zone 1 shall be the first 30 feet landward from the top of the stream bank or mean high water line of other water bodies. Zone 2 shall begin at the outer edge of Zone 1 and extend landward a minimum of 20 feet. Zones 1 shall be undisturbed except as designated in 15A NCAC 02B .0233 of the State's Rules on Riparian Buffers. Zone 2 may be "maintained" but only if the landowner has obtained proper permits from NC DENR.

(A.) Channelization: Channelization of perennial or intermittent streams shall be prohibited, except for access crossings, erosion control devices and runoff control devices.

(B.) New Lots in the Surface Water Buffer: No new single-family or two-family residential lots shall be created which are entirely or partly contained within the surface water buffer.

(C.) Removing vegetation in Buffers: Removal of trees, shrubs, or other vegetation from required undisturbed buffers may result in a Notice of Violation. This violation need not occur in conjunction solely with new development. Encroachment, unless

approved by the City of Creedmoor, the US Army Corp of Engineers, the NCDENR *Division* of Water Quality, or any combination of these entities, shall be deemed a violation of this Ordinance. Violators are required to reestablish trees, shrubs, and vegetation as required by the City of Creedmoor. Trees and shrubs shall be replanted at the rate of 320 stems per acre. If disturbed areas were previously grassed areas, those areas may be reestablished with grass. Guidelines for reestablishment of riparian buffers may be obtained from NCDENR *Division* of Water Quality.

19.21 Regional Stormwater Control

19.21-1 Participation in a Regional Stormwater Control Program

(A.) Public Regional Stormwater Control Program:

(1.) Where a regional stormwater control program has been established by one or more local governments, or by an authority operating on behalf of one or more local governments, a *development* shall participate in said program in lieu of certification of stormwater control required by this Article, provided that:

(a.) The *development* is within an area covered by a public regional stormwater control program;

(b.) Stormwater from the *development* drains to an existing or funded public regional engineered stormwater control structure (BMP) which is proposed to be built and is part of said program;

(c.) Participation is in the form of contribution of funds, contribution of land, contribution of engineered stormwater control structure (BMP) construction work, or a combination of these, the total value of which shall be in accordance with a fee schedule adopted by the City or in accordance with an intergovernmental agreement; and

(d.) The Technical Review Committee finds that the *watershed development* plan is in compliance with all other applicable requirements of this Ordinance.

(2.) *Developments* participating in a public regional stormwater control program are required to maintain pre-*development* hydrology at the project site.

(3.) Use of Contributions: Each contribution from a *development* participating in a public regional engineered stormwater control structure (BMP) program shall be used for acquisition, engineering, construction and/or maintenance of one or more such structures in the same water supply *watershed* in which *development* lies. The use of contributions for these purposes does not preclude the use or imposition of other revenue sources for these purposes.

(B.) Private Regional Stormwater Control Program:

(1.) Where Permitted: Participation in a private regional engineered stormwater

control program is permitted where a private off-site stormwater control program (BMP) has been established by one or more property owners and approved by the Technical Review Committee. A *development* may participate in said program in lieu of any certification of runoff control required by this Article, provided that:

(a.) The *development* is within an area covered by an off-site engineered stormwater control structure;

(b.) Runoff from the *development* drains to an existing engineered stormwater control structure;

(c.) The parties agree to share the cost of any required maintenance and/or construction;

(d.) The agreement runs with the property;

(e.) The agreement is recorded with the county Register of Deeds in accordance with this Article;

(f.) The *Stormwater Administrator* finds that the *watershed development* plan is in compliance with all other applicable requirements of this Ordinance.

(2.) *Developments* participating in a private regional stormwater control program are required to maintain pre-*development* hydrology at the project site.

19.22 Variances and Modifications

19.22-1 *Watershed* Variances

(A.) Any person may petition the City of Creedmoor for a variance granting permission to use the person's land in a manner otherwise prohibited by this Ordinance. To qualify for a variance, the petitioner must show all of the following:

(1.) Unnecessary hardships would result from strict application of this Ordinance.

(2.) The hardships result from conditions that are peculiar to the property, such as the location, size, or topography of the property.

(3.) The hardships did not result from actions taken by the petitioner.

(4.) The requested variance is consistent with the spirit, purpose, and intent of this Ordinance; will secure public safety and welfare; and will preserve substantial justice.

(B.) The City of Creedmoor may impose reasonable and appropriate conditions and safeguards upon any variance it grants.

(C.) Minor Variances.

The Technical Review Committee (TRC) shall review and decide requests for minor variances to the standards and restrictions pertaining to *Watershed* Protection. In order to approve a requested minor variance, the Technical Review Committee shall

make findings of fact showing that:

(1.) There are practical difficulties or unnecessary hardships that would result from carrying out the strict letter of this Ordinance;

(2.) The variance is in harmony with the general purpose and intent of this Ordinance and preserves its spirit; and

(3.) The granting of the variance assures the public safety and welfare and does substantial justice.

The Technical Review Committee may attach conditions to the minor variance approval that support the purpose of this Ordinance. In addition, in the case of *water supply watersheds*, the City shall notify and allow a reasonable comment period for all other local governments having jurisdiction in the applicable designated *watershed* and the entity using the water supply for consumption where the minor variance is being considered.

(D.) Major Variances.

Requests for major variances to the standards and restrictions pertaining to Article 19 (*Watershed* Protection) shall be to the N.C. Environmental Management Commission (EMC), following review and favorable recommendation by City Board of Commissioners and after review and recommendation by the Technical Review Committee in accordance with the procedure set forth above. The major variance request shall be forwarded to the EMC with a report containing the findings of fact for City Board of Commissioners' favorable recommendation, conclusions of law, a recommended decision, recommended conditions and a record of the Board of Commissioners' hearing of the request. Requests for major variances that do not receive a favorable recommendation shall be deemed denied and shall not be forwarded to the EMC.

(E.) Annual Report of *Watershed* Variances. The *Stormwater Administrator* shall keep a record of all *watershed* variances and this record shall be submitted for each calendar year to the North Carolina *Division* of Water Quality in accordance with Section 19.22, *Watershed* Variances and Modifications.

(F.) Conditions. In approving a *watershed* variance, the Technical Review Committee may prescribe such reasonable and appropriate conditions and safeguards as will assure that the use of the property will be compatible with surrounding properties and will not alter the essential character of the neighborhood. Violations of conditions and safeguards that are part of the terms of a variance shall be deemed a violation of this Ordinance.

(G.) Appeals. Appeals may be made pursuant to Section 19.18, Appeals.

(H.) Duration. An approved *watershed* variance is part of an approved plan and shall have the same duration as the plan approval.

SECTION 4: MAINTENANCE

19.23 General Standards for Maintenance

(A.) Function of BMPs As Intended.

The owner of each structural BMP installed pursuant to this Ordinance shall maintain and operate it so as to preserve and continue its function in controlling stormwater quality and quantity at the degree or amount of function for which the structural BMP was designed.

(B.) Annual Maintenance Inspection and Report.

Generally, the City of Creedmoor will make an annual inspection of structural BMP's to ensure compliance with this Ordinance. However, some existing BMP's are not accessible by the City of Creedmoor. In this case, the person responsible for maintenance of any structural BMP installed pursuant to this Ordinance may be required to submit to the Stormwater Administrator an inspection report from one of the following persons performing services only in their area of competence: a qualified registered North Carolina professional engineer, surveyor, landscape architect, soil scientist, aquatic biologist, or person certified by the North Carolina Cooperative Extension Service for stormwater treatment practice inspection and maintenance. The inspection report shall contain all of the following.

(1.) The name and address of the land owner;

(2.) The recorded book and page number of the lot of each structural BMP;

(3.) A statement that an inspection was made of all structural BMPs;

(4.) The date the inspection was made;

(5.) A statement that all inspected structural BMPs are performing properly and are in compliance with the terms and conditions of the approved maintenance agreement required by this Ordinance; and

(6.) The original signature and seal of the engineer, surveyor, or landscape architect.

All inspection reports shall be on forms supplied by the Stormwater Administrator. An original inspection report shall be provided to the Stormwater Administrator beginning one year from the date of as-built certification and each year thereafter on or before the date of the as-built certification.

19.24 Operation and Maintenance Agreement

(A.) In General.

Prior to the conveyance or transfer of any lot or building site to be served by a structural BMP pursuant to this Ordinance, and prior to issuance of any permit for *Development* or Re-*Development* requiring a structural BMP pursuant to this Ordinance, the applicant or owner of the site must execute an operation and maintenance agreement that shall be binding on all subsequent owners of the site, portions of the site, and lots or parcels served by the structural BMP. Until the transference of all property, sites, or lots served by the structural BMP, the original owner or applicant shall have primary responsibility for carrying out the provisions of the maintenance agreement. Agreements made for the purpose of assigning responsibility for operations and maintenance to anyone other than the original applicant and/or owner shall be three party agreements requiring the approval by the City of Creedmoor prior to assignment. Assignment of responsibilities without prior approval are a violation of this Ordinance and shall be deemed null and void for the purposes of the requirements of this Ordinance, unless authorized and executed by the City of Creedmoor.

The operation and maintenance agreement shall require the owner or owners to maintain, repair and, if necessary, reconstruct the structural BMP, and shall state the terms, conditions, and schedule of maintenance for the structural BMP. In addition, it shall grant to the City of Creedmoor a right of entry in the event that the Stormwater Administrator has reason to believe it has become necessary to inspect, monitor, maintain, repair, or reconstruct the structural BMP; however, in no case shall the right of entry, of itself, confer an obligation on the City of Creedmoor to assume responsibility for the structural BMP.

The operation and maintenance agreement must be approved by the Stormwater Administrator prior to plan approval, and it shall be referenced on the final plat and shall be recorded with the county Register of Deeds upon final plat approval. A copy of the recorded maintenance agreement shall be given to the Stormwater Administrator within fourteen (14) days following its recordation.

(B.) Special Requirement for Homeowners' and Other Associations.

For all structural BMPs required pursuant to this Ordinance and that are to be or are owned and maintained by a homeowners' association (HOA), property owners' association (POA), or similar entity, the required operation and maintenance agreement shall include all of the following provisions.

(1.) Acknowledgment that the association shall continuously operate and maintain the stormwater control and management facilities.

(2.) Establishment of an escrow account, which can be spent solely for sediment removal, structural, biological or vegetative replacement, major repair, or reconstruction of the structural BMPs. If structural BMPs are not performing adequately or as intended or are not properly maintained, the City of Creedmoor, in its sole discretion, may remedy the situation, and in such instances the City of Creedmoor shall be fully reimbursed from the escrow account. Escrowed funds may be spent by the association for sediment removal, structural, biological or vegetative replacement, major repair, and reconstruction of the structural BMPs, provided that the City of Creedmoor shall first consent to the expenditure.

(3.) The City of Creedmoor requires that both developer contribution and annual membership funds fund the escrow account. Prior to plat recordation or issuance of construction permits, whichever shall first occur, the developer shall pay into the escrow account an amount equal to fifteen (15%) per cent of the initial construction cost of the structural BMPs, based on a cost estimate from a professional engineer (signed and sealed by the engineer). Two-thirds (2/3) of the total amount of fund budget shall be deposited into the escrow account within the first five (5) years and the full amount shall be deposited within ten (10) years following initial construction of the structural BMPs. Funds calculated to meet these funding thresholds shall be deposited each year into the escrow account. A portion of the annual membership assessments of the association shall include an allocation into the escrow account. Any funds drawn down from the escrow account shall be replaced in accordance with the schedule of anticipated work used to create the fund budget.

(4.) The percent of developer contribution and lengths of time to fund the escrow account may be varied by the engineer's cost estimate, depending on the design and materials of the stormwater control and management facility.

(5.) Granting to the City of Creedmoor a right of entry to inspect, monitor, maintain, repair, and reconstruct structural BMPs.

(6.) Allowing the City of Creedmoor to recover from the association and its members any and all costs the City of Creedmoor expends to maintain or repair the structural BMPs or to correct any operational deficiencies. Failure to pay the City of Creedmoor all of its expended costs, after forty-five days written notice, shall constitute a breach of the agreement. In case of a deficiency, the City of Creedmoor shall thereafter be entitled to bring an action against the association and its members to pay. Failure to pay shall be a lien against the real property upon which the cost was incurred, which lien shall be filed, have the same priority, and be collected as the lien for special assessment provided in Article 10 of Chapter 160A of the General Statutes of North Carolina.

(7.) A statement that this agreement shall not obligate the City of Creedmoor to maintain or repair any structural BMPs, and the City of Creedmoor shall not be liable to any person for the condition or operation of structural BMPs.

(8.) A statement that this agreement shall not in any way diminish, limit, or restrict the right of the City of Creedmoor to enforce any of its ordinances as authorized by law.

(9.) A provision indemnifying and holding harmless the City of Creedmoor for any costs and injuries arising from or related to the structural BMP, unless the City of Creedmoor has agreed in writing to assume the maintenance responsibility for the BMP and has accepted dedication of any and all rights necessary to carry out that maintenance.

(10.) HOA and POA documents shall also address how the required *buffer*s shall be maintained and preserved.

19.24-1 Inspection Program.

Inspections and inspection programs by the City of Creedmoor may be conducted or established on any reasonable basis, including but not limited to routine inspections; random inspections; inspections based upon complaints or other notice of possible violations; and joint inspections with other agencies inspecting under environmental or safety laws. Inspections may include, but are not limited to, reviewing maintenance and repair records; sampling discharges, surface water, groundwater, and material or water in BMPs; and evaluating the condition of BMPs.

The City of Creedmoor reserves the right to require owners to hire a registered professional engineer licensed to practice in the state of North Carolina for the purposes of inspecting devices in the event that the City of Creedmoor cannot access the BMP or for the purposes of certified sediment levels, soil medium efficiency, or other requirements to ensure that the BMP is operating as designed.

If the owner or occupant of any property refuses to permit such inspection, the Stormwater Administrator shall proceed to obtain an administrative search warrant pursuant to NCGS 15-27.2 or its successor. No person shall obstruct, hamper or interfere with the Stormwater Administrator while carrying out his or her official duties.

19.24-2 Performance Security for Installation and Maintenance

The City of Creedmoor may, at its discretion, require the submittal of a performance security or bond with surety, cash escrow, letter of credit or other acceptable legal arrangement prior to issuance of a permit in order to ensure that the structural BMPs are:

(A.) installed by the permit holder as required by the approved stormwater management plan, and/or

(B.) maintained by the owner as required by the operation and maintenance agreement.

The amount of an installation performance security shall be the total estimated construction cost of the BMPs approved under the permit, plus a contingency amount to be determined by the City of Creedmoor, not to exceed 150% of the total project cost.

The amount of a maintenance performance security shall be the present value of an annuity of perpetual duration based on a reasonable estimate of the annual costs of inspection, operation and maintenance of the BMPs approved under the permit, at a discount rate that reflects the jurisdiction's cost of borrowing minus a reasonable estimate of long-term inflation. This estimate shall be based on a cost estimate prepared (and signed and sealed) by a professional engineer licensed to operate in North Carolina.

The performance security shall contain forfeiture provisions for failure, after proper notice, to complete work within the time specified, or to initiate or maintain any actions which may be required of the applicant or owner in accordance with this Ordinance, approvals issued pursuant to this Ordinance, or an operation and maintenance agreement established pursuant to this Ordinance.

Upon default of the owner to construct, maintain, repair and, if necessary, reconstruct any structural BMP in accordance with the applicable permit or operation and maintenance agreement, the Stormwater Administrator shall obtain and use all or any portion of the security to make necessary improvements based on an engineering estimate. Such expenditure of funds shall only be made after requesting the owner to comply with the permit or maintenance agreement. In the event of a default triggering the use of installation performance security, the City of Creedmoor shall not return any of the unused deposited cash funds or other security, which shall be retained for maintenance.

If the City of Creedmoor takes action upon such failure by the applicant or owner, the City of Creedmoor may collect from the applicant or owner the difference between the amount of the reasonable cost of such action and the amount of the security held, in addition to any other penalties or damages due.

Within sixty days of the final approval, the installation performance security shall be refunded to the applicant or terminated, except any amount attributable to the cost (plus % contingency) of ongoing construction associated with the BMPs covered by the security (i.e.- Landscaping). Any such ongoing construction or landscaping shall be inspected within six (6) months after installation for compliance with the approved plans and specifications and, if in compliance, the portion of the financial security attributable to landscaping shall be released.

19.24-3 Notice to Owners

The applicable operations and maintenance agreement, conservation easement, or

dedication and acceptance into public maintenance (whichever is applicable), pertaining to every structural BMP and required *buffer*s shall be referenced on the final plat and shall be recorded with the county Register of Deeds upon final plat approval. If no subdivision plat is recorded for the site, then the operations and maintenance agreement, conservation easement, or dedication and acceptance into public maintenance, whichever is applicable, shall be recorded with the county Register of Deeds so as to appear in the chain of title of all subsequent purchasers under generally accepted searching principles.

19.24-4 Records of Installation and Maintenance Activities.

The owner of each structural BMP should keep records of inspections, maintenance, and repairs for at least five years from the date of creation of the record and shall submit the same upon reasonable request to the Stormwater Administrator.

19.24-5 Nuisance.

The owner of each stormwater BMP, whether structural or non-structural BMP, shall maintain it so as not to create or result in a nuisance condition.

19.24-6 Maintenance Easement

Every structural BMP installed pursuant to this Ordinance shall be made accessible for adequate maintenance and repair by an access easement. The easement shall be recorded on a final plat at the Granville County Register of Deeds.

SECTION 5: ENFORCEMENT AND VIOLATIONS

19.25 General

(A.) Authority to Enforce.

The provisions of this Ordinance shall be enforced by the Stormwater Administrator, his or her designee, or any authorized agent of the City of Creedmoor. Whenever this section refers to the Stormwater Administrator, it includes his or her designee as well as any authorized agent of the City of Creedmoor.

(B.) Violation Unlawful.

Any failure to comply with an applicable requirement, prohibition, standard, or limitation imposed by this Ordinance, or the terms or conditions of any permit or other *Development* or Re-*Development* approval or authorization granted pursuant to this Ordinance, is unlawful and shall constitute a violation of this Ordinance.

(C.) Each Day a Separate Offense.

Each day that a violation continues shall constitute a separate and distinct violation or offense.

(D.) Responsible Persons/Entities.

Any person who erects, constructs, reconstructs, alters (whether actively or passively), or fails to erect, construct, reconstruct, alter, repair or maintain any structure, BMP, practice, or condition in violation of this Ordinance shall be subject to the remedies, penalties, and/or enforcement actions in accordance with this section. Persons subject to the remedies and penalties set forth herein may include any architect, engineer, builder, contractor, developer, agency, or any other person who participates in, assists, directs, creates, causes, or maintains a condition that results in or constitutes a violation of this Ordinance, or fails to take appropriate action, so that a violation of this Ordinance results or persists; or an owner, any tenant or occupant, or any other person, who has control over, or responsibility for, the use or *Development* of the property on which the violation occurs.

For the purposes of this article, responsible person(s) shall include but not be limited to:

(1.) Person Maintaining Condition Resulting In or Constituting Violation.

An architect, engineer, builder, contractor, developer, agency, or any other person who participates in, assists, directs, creates, causes, or maintains a condition that constitutes a violation of this Ordinance, or fails to take appropriate action, so that a violation of this Ordinance results or persists.

(2.) Responsibility for Land or Use of Land.

The owner of the land on which the violation occurs, any tenant or occupant of the property, any person who is responsible for stormwater controls or practices pursuant to a private agreement or public document, or any person, who has control over, or responsibility for, the use, *Development* or Re-*Development* of the property.

19.25-1 Remedies and Civil Penalties.

The remedies and penalties provided for violations of this Ordinance, whether civil or criminal, shall be cumulative and in addition to any other remedy provided by law, and may be exercised in any order.

(A.) Remedies

(1.) Withholding of Certificate of Occupancy.

The Stormwater Administrator or other authorized agent shall withhold a certificate of occupancy (CO) for the building or other improvements constructed

or being constructed on the site and served by the stormwater practices in question until the applicant or other responsible person has taken the remedial measures set forth in the notice of violation or has otherwise cured the violations described therein.

(2.) Disapproval of Subsequent Permits and *Development* Approvals.

As long as a violation of this Ordinance continues and remains uncorrected, the Stormwater Administrator or other authorized agent shall withhold, and the City of Creedmoor Planning Board, City Board of Commissioners, and/or TRC may disapprove, any request for permit or *Development* approval or authorization provided for by this Ordinance or the City of Creedmoor Development Ordinance for the land on which the violation occurs.

(3.) Injunction, Abatements, etc.

The Stormwater Administrator, with the written authorization of the City Board of Commissioners, may institute an action in a court of competent jurisdiction for a mandatory or prohibitory injunction and order of abatement to correct a violation of this Ordinance. Any person violating this Ordinance shall be subject to the full range of equitable remedies provided in the General Statutes or at common law.

(4.) Correction as Public Health Nuisance, Costs as Lien, etc.

If the violation is deemed dangerous or prejudicial to the public health or public safety and is within the geographic limits prescribed by North Carolina G.S. § 160A-193, the Stormwater Administrator, with the authorization of the City Board of Commissioners, may cause the violation to be corrected and the costs to be assessed as a lien against the property.

(5.) Stop Work Order.

The Stormwater Administrator may issue a stop work order to the person(s) violating this Ordinance. The stop work or "notice of violation" order shall remain in effect until the person has taken the remedial measures set forth in the notice of violation or has otherwise cured the violation or violations described therein. The stop work order may be withdrawn or modified to enable the person to take the necessary remedial measures to cure such violation or violations.

(B.) Civil Penalties

Violations of this Ordinance may subject the violator to a civil penalty to be recovered in a civil action in the nature of a debt if the violator does not pay the penalty within 30 days after notice of the violation is issued by the Stormwater Administrator. Civil penalties may be assessed up to the full amount of penalty to which the City of Creedmoor is subject for violations of its Phase II Stormwater permit, or if no Phase II Stormwater permit exists for the jurisdiction, civil penalties may be assessed up to the full amount allowed by law.

19.25-2 Procedures.

(1.) Initiation/Complaint.

Whenever a violation of this Ordinance occurs, or is alleged to have occurred, any person may file a written complaint. Such complaint shall state fully the alleged violation and the basis thereof, and shall be filed with the Stormwater Administrator, who shall record the complaint. The complaint shall be investigated promptly by the Stormwater Administrator, Public Works Engineer, and/or by the Zoning *Enforcement Officer*.

(2.) Inspection.

The Stormwater Administrator shall have the authority, upon presentation of proper credentials, to enter and inspect any land, building, structure, or premises to ensure compliance with this Ordinance.

(3.) Notice of Violation and Order to Correct.

When the Stormwater Administrator finds that any building, structure, or land is in violation of this Ordinance, the Stormwater Administrator shall notify, in writing, the property owner and/or other person violating this Ordinance. The notification shall indicate the nature of the violation, contain the address or other description of the site upon which the violation is occurring, order the necessary action to abate the violation, and give a deadline for correcting the violation. If civil penalties are to be assessed, the notice of violation shall also contain a statement of the civil penalties to be assessed, the time of their accrual, and the time within which they must be paid or be subject to collection as a debt.

The Stormwater Administrator may deliver the notice of violation and correction order personally; by the Zoning *Enforcement Officer*; by first class mail; by certified or registered mail with return receipt requested, or by any means authorized for the service of documents by Rule 4 of the North Carolina Rules of Civil Procedure.

If a violation is not corrected within a reasonable period of time, as provided in the notification, the Stormwater Administrator, Public Works Engineer, and/or by the Zoning *Enforcement Officer* may take appropriate action under this Ordinance to correct and abate the violation and to ensure compliance with this Ordinance.

(4.) Extension of Time

A person who receives a notice of violation and correction order, or the owner of the land on which the violation occurs, may submit to the Stormwater Administrator a written request for an extension of time for correction of the violation. On determining that the request includes enough information to show that the violation cannot be corrected within the specified time limit for reasons

beyond the control of the person requesting the extension, the Stormwater Administrator, Public Works Engineer, and/or by the Zoning *Enforcement Officer* may extend the time limit as is reasonably necessary to allow timely correction of the violation, up to, but not exceeding 180 days. The Stormwater Administrator, Public Works Engineer, and/or by the Zoning *Enforcement Officer* may grant 30-day extensions in addition to the foregoing extension if the violation cannot be corrected within the permitted time due to circumstances beyond the control of the person violating this Ordinance. The Stormwater Administrator, Public Works Engineer, and/or by the Zoning *Enforcement Officer* may grant an extension only by written notice of extension. The notice of extension shall state the date prior to which correction must be made, after which the violator will be subject to the penalties described in the notice of violation and correction order.

(5.) Enforcement After Time to Correct.

After the time has expired to correct a violation, including any extension(s) if authorized by the Stormwater Administrator, Public Works Engineer, and/or by the Zoning *Enforcement Officer*, the Stormwater Administrator, Public Works Engineer, and/or by the Zoning *Enforcement Officer* shall determine if the violation is corrected. If the violation is not corrected, the Stormwater Administrator, Public Works Engineer, and/or by the Zoning *Enforcement Officer* may act to impose one or more of the remedies and penalties authorized by this Ordinance.

(6.) Emergency Enforcement.

If delay in correcting a violation would seriously threaten the effective enforcement of this Ordinance or pose an immediate danger to the public health, safety, or welfare, then the Stormwater Administrator, Public Works Engineer, and/or by the Zoning *Enforcement Officer* may order the immediate cessation of a violation. Any person so ordered shall cease any violation immediately. The Stormwater Administrator, Public Works Engineer, and/or by the Zoning *Enforcement Officer* may seek immediate enforcement, without prior written notice, through any remedy or penalty authorized by this article.

SECTION 6: ILLICIT DISCHARGES

Illicit Discharges and Connections, Spills and Nuisance

The federal EPA Phase II rule specifies that local communities shall prohibit any discharge to a municipal separate storm sewer system (MS4) unless it:

-consists of a discharge pursuant to an NPDES permit; or

-consists of a discharge from firefighting activities; or

-consists of a discharge in any of the following categories, and the operator of the small MS4 has not identified that category as a significant contributor of pollutants to its small MS4: Water line flushing; landscape irrigation; diverted *stream* flows; rising ground waters; uncontaminated ground water infiltration (as defined at 40 CFR 35.2005(20)); uncontaminated pumped ground water; discharges from potable water sources; foundation drains; air conditioning condensation; irrigation water; springs; water from crawl space pumps; footing drains; lawn watering; individual residential car washing; flows from riparian habitats and *wetlands*; dechlorinated and/or salinated swimming pool discharges; and street wash water.

19.25-3 Illicit Discharges.

No person shall cause or allow the discharge, emission, disposal, pouring, or pumping directly or indirectly to any stormwater conveyance, the waters of the State, or upon the land in manner and amount that the substance is likely to reach a stormwater conveyance or the waters of the State, any liquid, solid, gas, or other substance, other than stormwater; provided that non-stormwater discharges associated with the following activities are allowed and provided that they do not significantly impact water quality.

(1.) Water line flushing;
(2.) Landscape irrigation;
(3.) Diverted *stream* flows;
(4.) Rising ground waters;
(5.) Uncontaminated ground water infiltration (as defined at 40 CFR 35.2005(20));
(6.) Uncontaminated pumped ground water;
(7.) Discharges from potable water sources;
(8.) Foundation drains;
(9.) Air conditioning condensation;
(10.) Irrigation water;

(11.) Springs;

(12.) Water from crawl space pumps;

(13.) Footing drains;

(14.) Lawn watering;

(15.) Individual residential car washing;

(16.) Flows from riparian habitats and *wetlands*;

(17.) Dechlorinated swimming pool discharges;

(18.) Street wash water; and

(19.) Other non-stormwater discharges for which a valid NPDES discharge permit has been approved and issued by the State of North Carolina, and provided that any such discharges to the municipal separate storm sewer system shall be authorized by the City of Creedmoor.

Prohibited substances include but are not limited to: oil, anti-freeze, chemicals, animal waste, paints, garbage, and litter.

19.25-4 Illicit Connections

(1.) Connections to a stormwater conveyance or stormwater conveyance system that allow the discharge of non-stormwater, other than the exclusions described in subsection (A) above, are unlawful. Prohibited connections include, but are not limited to: floor drains, waste water from washing machines or sanitary sewers, wash water from commercial vehicle washing or steam cleaning, and waste water from septic systems.

(2.) Where such connections exist in violation of this section and said connections were made prior to the adoption of this provision or any other ordinance prohibiting such connections, the property owner or the person using said connection shall remove the connection within one year following the effective date of this Ordinance. However, the one-year grace period shall not apply to connections which may result in the discharge of *hazardous material*s or other discharges which pose an immediate threat to health and safety, or are likely to result in immediate injury and harm to real or personal property, natural resources, wildlife, or habitat.

(3.) Where it is determined that said connection:

(a.) May result in the discharge of *hazardous material*s or may pose an immediate threat to health and safety, or is likely to result in immediate injury and harm to real or personal property, natural resources, wildlife, or habitat, or

(b.) The Stormwater Administrator shall designate the time within which the connection shall be removed. In setting the time limit for compliance, the

Stormwater Administrator shall take into consideration:

(i.) The quantity and complexity of the work,

(ii.) The consequences of delay,

(iii.) The potential harm to the environment, to the public health, and to public and private property, and

(iv.) The cost of remedying the damage.

19.25-5 Spills.

Spills or leaks of polluting substances released, discharged to, or having the potential to released or discharged to the stormwater conveyance system, shall be contained, controlled, collected, and properly disposed. All affected areas shall be restored to their preexisting condition.

Persons in control of the polluting substances immediately prior to their release or discharge, and persons owning the property on which the substances were released or discharged, shall immediately notify the City of Creedmoor Public Works Engineer, City Board of Commissioners, or Fire Department of the release or discharge, as well as making any required notifications under state and federal law.

Notification shall not relieve any person of any expenses related to the restoration, loss, damage, or any other liability which may be incurred as a result of said spill or leak, nor shall such notification relieve any person from other liability which may be imposed by State or other law.

19.25-6 Nuisance.

Illicit discharges and illicit connections which exist within the City of Creedmoor and/or its extraterritorial planning jurisdiction are hereby found, deemed, and declared to be dangerous or prejudiced to the public health or public safety and are found, deemed, and declared to be public nuisances. Such public nuisances shall be abated in accordance with the procedures set forth in this Ordinance, the City of Creedmoor Development Ordinance, the General Codes of the City of Creedmoor, or any other applicable laws, rules, or regulations.

19.26 Additional Standards for Special Situations

19.26-1 Pet Waste.

(A.) Pets At Large Prohibited

It shall be unlawful for the owner of any pet to allow the animal to be off the premises of his owner in the City of Creedmoor.

(B.) Restrictions on Pet Waste

(1.) It shall be unlawful for the owner or custodian of any pet to take it off the owner's own property limits without the means to properly remove and dispose of the pet's feces from any public or private property.

(2.) It is the responsibility of a pet's owner or custodian to clean up the pet's feces from any public or private property outside of the pet's owner's own property limits. Such property includes, but is not limited to, parks, rights-of-way, paths, and public access areas.

(3.) "Means to properly remove and dispose of feces" shall consist of having on or near one's person a device such as a plastic bag, or other suitable plastic or paper container, that can be used to clean up and contain pet waste until it can be disposed of in an appropriate container. Such a device must be produced and shown, upon request, to anyone authorized to enforce these ordinances.

(4.) This provision shall not apply to handicapped persons assisted by trained guide or assistance pets.

(5.) "Public nuisance" is defined to include "a pet which deposits feces on public property or on private property without the consent of the owner or person in lawful possession of the private property, and the person owning, possessing, harboring or having the care, charge, control or custody of the pet fails to remove the feces so deposited. Provided, however, this definition shall not apply to any pet assisting a handicapped person.

19.26-2 Onsite Wastewater Septic Systems.

(A.) Standards for Operation and Maintenance

Onsite systems for domestic wastewater covered by this Ordinance shall be operated and maintained so as to avoid adverse effects on surface water and groundwater, including eutrophication of surface water and microbial or nitrate contamination of groundwater. Septic tank residuals shall be pumped whenever necessary to assure the proper operation of the system to meet these standards, and the septage shall be reused or disposed of in a manner that does not present significant risks to human health, surface water or groundwater.

APPENDIX M

Jordan/Falls Accounting Tool Worksheets and User Manual

Appendix M

Falls / Jordan Accounting Tool Worksheets and Users' Manual

Section 2-B of the Model Program Guidance Document describes the nutrient loading rate targets that new development must meet. It also describes the accounting tool that was developed in accordance with rule requirements that may be used to estimate nutrient loading from new development and loading reductions due to BMP implementation. The Division contracted with the Stormwater Team of North Carolina State University, Department of Biological and Agricultural Engineering to develop this accounting tool. This appendix includes a print-out of the accounting tool and the tool's user's manual. A 2003 and 2007 excel version of the accounting tool can be found at the following website: http://portal.ncdenr.org/web/wq/ps/nps/Fallslake.

Jordan/Falls Lake Stormwater Nutrient Load Accounting Tool

Proceed to Watershed Characteristics | Skip to BMP Characteristics | Skip to Summary

I. General Model Instructions

- Details of the development should be entered in the first two tabs (Watershed Characteristics and BMP Characteristics); results may be viewed on the third tab (Development Summary).
- The cells shaded grey are those that allow/require user input.
- Selecting the physiographic/geologic region and precipitation location most appropriate for the development of interest is essential in producing accurate results. Maps have been provided (see right) to assist in this selection, but soil maps should be consulted, or soil tests performed, to verify the presence of Triassic or sandhill/coastal plain soils. A list of counties located within, or partially within, each region has also been provided for convenience.
- Each tab has detailed instructions and guidelines for entering the necessary information (this information is also included below).
- To remove an entry in a cell with a dropdown list, select the blank row from the dropdown menu or select the cell and press the 'delete' button.

II. Specific Tab Guidelines

Watershed Characteristics

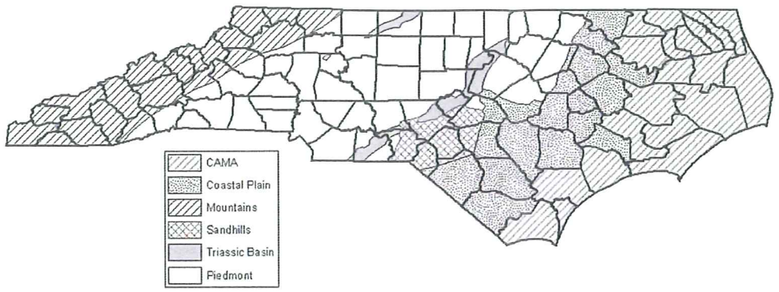
- For non-residential watersheds, indicate areas of each land use type in Column 1 for both pre- and post-development conditions.
- For residential watersheds, complete the required information in Column 2 for both pre- and post-development conditions.
- If a given land use is not present in the given watershed, leave the cell blank or enter a zero.
- Ensure that land use areas entered for both pre- and post-development conditions match the total development area entered in cell O21.
- Residential areas may be entered by average lot size (column, part A), or may be separated into individual land uses (column 2, part B) -- do NOT list out individual land uses within an area already described by lot size.
- Unless runoff flowing onto the development from offsite is routed separately around or through the site, the offsite catchment area draining in must be included in the acreage values of the appropriate land use(s) and treated.

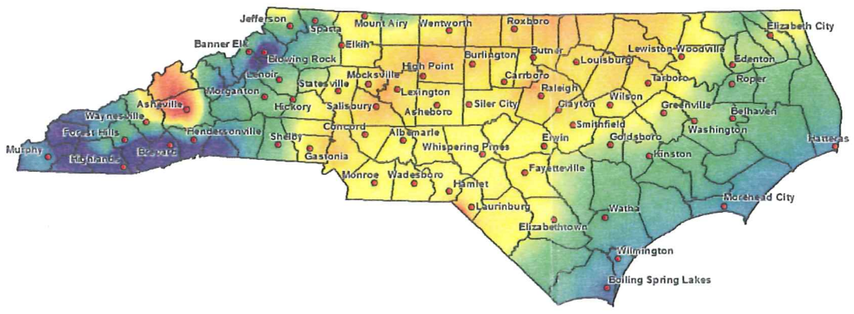
BMP Characteristics

- This spreadsheet allows the development to be divided into as many as 6 smaller catchments.
- BMPs 1, 2, and 3 for a given catchment are assumed to operate in series, with the outflow from 1 serving as the inflow to 2, etc.
- If the outflow from an entire catchment (including outflow from selected BMPs) drains to another BMP, indicate this in the drop down menu below the BMP type and leave all cells for individual land uses blank.
- Not all BMP or catchments must be utilized. Simply leave fields blank in the columns not needed.
- Leave cells blank or insert zeroes if a land use is not present in the area draining to the BMP.
- For water harvesting BMPs, be sure to enter the percent volume reduction that will be achieved by your system. Volume detention (catch-and-release mechanisms) will not be considered - only proven volume reductions are valid inputs.
- Volume reduction efficiencies for undersized BMPs are calculated based on a 1:1 ratio (a BMP that is 60% smaller than the required design size the assigned removal efficiency is 60% of the standard efficiency value). Effluent concentrations remain the same as full-sized BMPs.
- IMPORTANT: for the land area calculation checks to occur, you MUST press enter after entering a value for area to be treated by a BMP (not just click on the next cell).
- See User's Manual for instructions on modeling oversized BMPs.

III. Model Methodology (more detailed information in User's Manual)

- *Calculating Runoff Volumes – Simple Method (CWP, 2007)*
  - A fraction of impervious cover was assigned to each land use based on literature review and field exploration.
  - A runoff coefficient, Rv, is calculated for each land use using the designated impervious cover fractions. The total volume of runoff is then calculated based on the land use area, Rv, and the precipitation depth of the water quality event.
- *Calculating Pollutant Loadings – Simple Method (CWP, 2007)*
  - An event mean concentration of TN and TP is assigned for each land use type based on an extensive literature review.
  - The total load of a given pollutant for a defined drainage area is calculated based on the average annual rainfall depth, the runoff coefficient Rv, and the representative event mean concentration value.
  - The fraction of rainfall events that produce runoff is assumed to be 1.0.
- *BMP Removal Calculations*
  - Each BMP is assigned a representative event mean concentration for the treated outflow leaving the system, as well as percentages of inflow that leave the system as infiltration, evapotranspiration, overflow and outflow.
  - The total mass of pollutant leaving the BMP is calculated using the following equation: $Mass_{out} = (EMC_{outflow} * Volume_{outflow}) + (EMC_{inflow} * Volume_{overflow})$
  - The percent mass removal achieved by the BMP system is calculated using the following equation:
    $\%Removal = ((EMC_{inflow} * Volume_{inflow}) - Mass_{out}) \div (EMC_{inflow} * Volume_{inflow}) * 100$





Locations for which rainfall data is available. Choose the location that most closely represents the site's precipitation characteristics (not necessarily the location that is geographically the closest) on the "Watershed Characteristics" page.

Table 1. List of counties located within, or partially within, each region.

PIEDMONT & MOUNTAIN		COASTAL PLAIN	CAMA Counties	TRIASSIC BASIN	SANDHILLS
Rockingham	Lee	Bladen	Beaufort	Durham	Montgomery
Alamance	Lincoln	Columbus	Bertie	Granville	Moore
Alexander	Macon	Cumberland	Brunswick	Wake	Lee
Alleghany	Madison	Duplin	Camden	Chatham	Harnett
Anson	McDowell	Edgecombe	Carteret	Lee	Cumberland
Ashe	Mecklenburg	Halifax	Chowan	Moore	Hoke
Avery	Mitchell	Harnett	Craven	Montgomery	Robeson
Buncombe	Montgomery	Hoke	Currituck	Richmond	Scotland
Burke	Moore	Johnston	Dare	Anson	Richmond
Cabarrus	Nash	Jones	Gates	Union	
Caldwell	Northampton	Martin	Hertford	Rockingham	
Caswell	Orange	Moore	Hyde	Stokes	
Catawba	Person	Nash	New Hanover	Davie	
Chatham	Polk	Northampton	Onslow		
Cherokee	Randolph	Pitt	Pamlico		
Clay	Richmond	Richmond	Pasquotank		
Cleveland	Rowan	Robeson	Pender		
Davidson	Rutherford	Sampson	Perquimans		
Davie	Stanley	Scotland	Tyrrell		
Durham	Stokes	Wake	Washington		
Forsyth	Surry	Wayne			
Franklin	Swain				
Gaston	Transylvania				
Graham	Union				
Granville	Vance				
Guilford	Wake				
Halifax	Warren				
Harnett	Watauga				
Haywood	Wilkes				
Henderson	Wilson				
Iredell	Yadkin				
Jackson	Yancey				
Johnston					

Physiographic/Geologic Region:	
Soil Hydrologic Group	
Precipitation location:	

Total Development Area (ft^2):	
Development Name:	
Model Prepared By:	

COLUMN 1 -- NON-RESIDENTIAL LAND USES

	TN EMC (mg/L)	TP EMC (mg/L)	Pre-Development (ft^2)	Post-Development (ft^2)
COMMERCIAL				
Parking lot	1.44	0.16		
Roof	1.08	0.15		
Open/Landscaped	2.24	0.44		
INDUSTRIAL				
Parking lot	1.44	0.39		
Roof	1.08	0.15		
Open/Landscaped	2.24	0.44		
TRANSPORTATION				
High Density (interstate, main)	3.67	0.43		
Low Density (secondary, feeder)	1.4	0.52		
Rural	1.14	0.47		
Sidewalk	1.4	1.16		
PERVIOUS				
Managed pervious	3.06	0.59		
Unmanaged (pasture)	3.61	1.56		
Forest	1.47	0.25		
JURISDICTIONAL LANDS*				
Natural wetland	--	--		
Riparian buffer	--	--		
Open water	--	--		
LAND TAKEN UP BY BMPs	1.08	0.15		

*Jurisdictional land uses are not included in nutrient/flow calculations.

COLUMN 2 -- RESIDENTIAL LAND USES

	Custom Lot Size (ac)	Age (yrs)	TN EMC (mg/L)	TP EMC (mg/L)	Pre-Development (ft^2)	Post-Development (ft^2)
PART A						
⅛-ac lots	--		--	--		
¼-ac lots	--		--	--		
½-ac lots	--		--	--		
1-ac lots	--		--	--		
2-ac lots	--		--	--		
Multi-family	--		--	--		
Townhomes	--		--	--		
Custom Lot Size			--	--		
PART B						
Roadway		--	1.4	0.52		
Driveway		1.0	1.44	0.39		
Parking lot		--	1.44	0.39		
Roof		--	1.08	0.15		
Sidewalk/Patio		--	1.4	1.16		
Lawn		--	2.24	0.44		
Managed pervious		--	3.06	0.59		
Forest		--	1.47	0.25		
Natural wetland*		--	--	--		
Riparian buffer*		--	--	--		
Open water*		--	--	--		
LAND TAKEN UP BY BMPs		--	1.08	0.15		

LAND USE AREA CHECK	
Total Development Area Entered (ft^2):	0
Total Pre-Development Calculated Area (ft^2):	0

	CATCHMENT 1			CATCHMENT 2			CATCHMENT 3			CATCHMENT 4			CATCHMENT 5			CATCHMENT 6			
	BMP #1	BMP #2	BMP #3	BMP #1	BMP #2	BMP #3	BMP #1	BMP #2	BMP #3	BMP #1	BMP #2	BMP #3	BMP #1	BMP #2	BMP #3	BMP #1	BMP #2	BMP #3	
Type of BMP:																			
If BMP is undersized, indicate the BMP's size relative to the design size required to capture the designated water quality depth (i.e. 0.75 = BMP is 75% of required design size):																			
*For water harvesting BMP, enter percent volume reduction in decimal form.																			
	Does BMP accept the outflow from another Catchment? If so, indicate which one(s). (Land use areas entered below are in addition to the watershed areas treated by contributing catchment(s).)																		
Catchment 1:	--	--	--	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	
Catchment 2:	no	no	no	--	--	--	no	no	no	no	no	no	no	no	no	no	no	no	
Catchment 3:	no	no	no	no	no	no	--	--	--	no	no	no	no	no	no	no	no	no	
Catchment 4:	no	no	no	no	no	no	no	no	no	--	--	--	no	no	no	no	no	no	
Catchment 5:	no	no	no	no	no	no	no	no	no	no	no	no	--	--	--	no	no	no	
Catchment 6:	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	--	--	--	
Drainage Area Land Use	Area Treated by BMP (ft^2)	Area treated by BMP #2 that is not treated by BMP #1 (ft^2)	Area treated by BMP #3 that is not treated by BMPs #1 or #2 (ft^2)	Area Treated by BMP (ft^2)	Area treated by BMP #2 that is not treated by BMP #1 (ft^2)	Area treated by BMP #3 that is not treated by BMPs #1 or #2 (ft^2)	Area Treated by BMP (ft^2)	Area treated by BMP #2 that is not treated by BMP #1 (ft^2)	Area treated by BMP #3 that is not treated by BMPs #1 or #2 (ft^2)	Area Treated by BMP (ft^2)	Area treated by BMP #2 that is not treated by BMP #1 (ft^2)	Area treated by BMP #3 that is not treated by BMPs #1 or #2 (ft^2)	Area Treated by BMP (ft^2)	Area treated by BMP #2 that is not treated by BMP #1 (ft^2)	Area treated by BMP #3 that is not treated by BMPs #1 or #2 (ft^2)	Area Treated by BMP (ft^2)	Area treated by BMP #2 that is not treated by BMP #1 (ft^2)	Area treated by BMP #3 that is not treated by BMPs #1 or #2 (ft^2)	Total Land Use Area Treated By All BMPs (ft^2)
COMMERCIAL																			
Parking lot																			0
Roof																			0
Open/Landscaped																			0
INDUSTRIAL																			
Parking lot																			0
Roof																			0
Open/Landscaped																			0
TRANSPORTATION																			
High Density (interstate, main)																			0
Low Density (secondary, feeder)																			0
Rural																			0
Sidewalk																			0
MISC. PERVIOUS																			
Managed pervious																			0
Unmanaged (pasture)																			0
Forest																			0
RESIDENTIAL																			
2-ac lots (New)																			0
2-ac lots (Built after 1995)																			0
2-ac lots (Built before 1995)																			0
1-ac lots (New)																			0
1-ac lots (Built after 1995)																			0
1-ac lots (Built before 1995)																			0
½-ac lots (New)																			0
½-ac lots (Built after 1995)																			0
½-ac lots (Built before 1995)																			0
¼-ac lots (New)																			0
¼-ac lots (Built after 1995)																			0
¼-ac lots (Built before 1995)																			0
⅛-ac lots (New)																			0
⅛-ac lots (Built after 1995)																			0
⅛-ac lots (Built before 1995)																			0
Townhomes (New)																			0
Townhomes (Built after 1995)																			0
Townhomes (Built before 1995)																			0
Multi-family (New)																			0
Multi-family (Built after 1995)																			0
Multi-family (Built before 1995)																			0
Custom Lot Size (New)																			0
Custom Lot Size (Built after 1995)																			0
Custom Lot Size (Built before 1995)																			0
Roadway																			0
Driveway																			0
Parking lot																			0
Roof																			0
Sidewalk																			0
Lawn																			0
Managed pervious																			0
Forest																			0
LAND TAKEN UP BY BMP																			0
TOTAL AREA TREATED BY BMP (ft^2):	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
TOTAL AREA TREATED BY SERIES (ft^2):		0			0			0			0			0			0		

Development:
Prepared By:
Date: April 11, 2011

WATERSHED SUMMARY

REGION:
TOTAL DEVELOPMENT AREA (ft^2): 0

	Pre-Development Conditions	Post-Development Conditions	Post-Development w/ BMPs
Percent Impervious (%)	0.0%	0.0%	0.0%
Annual Runoff Volume (c.f.)	#N/A	#N/A	#N/A
Total Nitrogen EMC (mg/L)	#N/A	#N/A	#N/A
Total Nitrogen Loading (lb/ac/yr)	#N/A	#N/A	#N/A
Total Phosphorus EMC (mg/L)	#N/A	#N/A	#N/A
Total Phosphorus Loading (lb/ac/yr)	#N/A	#N/A	#N/A

Percent Difference Between:

	Pre-Dev. & Post-Dev. without BMPs	Pre-Development & Post-Development with BMPs	Post-Dev without BMPs & Post-Dev with BMPs
Percent Impervious (%)	0%	0%	0%
Annual Runoff Volume (c.f.)	#N/A	#N/A	#N/A
Total Nitrogen EMC (mg/L)	#N/A	#N/A	#N/A
Total Nitrogen Loading (lb/ac/yr)	#N/A	#N/A	#N/A
Total Phosphorus EMC (mg/L)	#N/A	#N/A	#N/A
Total Phosphorus Loading (lb/ac/yr)	#N/A	#N/A	#N/A

*Negative percent difference values indicate a decrease in runoff volume, pollutant concentration or pollutant loading. Positive values indicate an increase.

BMP VOLUME REDUCTIONS/EFFLUENT CONCENTRATIONS

	Volume Reduction (%)	TN Effluent Concen. (mg/L)	TP Effluent Concen. (mg/L)
Bioretention with IWS	#N/A	0.95	0.12
Bioretention without IWS	#N/A	1.00	0.12
Dry Detention Pond	#N/A	1.20	0.20
Grassed Swale	#N/A	1.21	0.26
Green Roof	#N/A	1.08	0.15
Level Spdr, Filter Strip	#N/A	1.20	0.15
Permeable Pavement*	#N/A	1.44	0.39
Sand Filter	#N/A	0.92	0.14
Water Harvesting	user defined	1.08	0.15
Wet Detention Pond	#N/A	1.01	0.11
Wetland	#N/A	1.08	0.12

*if treating commercial parking lot, TP effluent concentration = 0.16 mg/L

Return to Instructions
Return to Watershed Characteristics
Return to BMP Characteristics
Print Summary

BMP SUMMARY

	CATCHMENT 1			CATCHMENT 2			CATCHMENT 3			CATCHMENT 4			CATCHMENT 5			CATCHMENT 6		
	BMP 1	BMP 2	BMP 3	BMP 1	BMP 2	BMP 3	BMP 1	BMP 2	BMP 3	BMP 1	BMP 2	BMP 3	BMP 1	BMP 2	BMP 3	BMP 1	BMP 2	BMP 3
	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Area Treated (ac)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Inflow Volume (c.f.)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Percent Volume Reduced (%)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Inflow Nitrogen EMC (mg/L)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Inflow Nitrogen (lb/ac/yr)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Inflow Phosphorus EMC (mg/L)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Inflow Phosphorus (lb/ac/yr)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BMP Outflow Nitrogen (lbs/ac/yr)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BMP Outflow Phosphorus (lbs/ac/yr)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Catchment Outflow Nitrogen EMC (mg/L)		--			--			--			--			--			--	
Catchment Outflow Total Nitrogen (lb/ac/yr)		--			--			--			--			--			--	
Percent Reduction in Nitrogen Load (%)		--			--			--			--			--			--	
Catchment Outflow Phosphorus EMC (mg/L)		--			--			--			--			--			--	
Catchment Outflow Total Phosphorus (lb/ac/yr)		--			--			--			--			--			--	
Percent Reduction in Phosphorus Load (%)		--			--			--			--			--			--	

3-10-11

Jordan/Falls Lake Stormwater Load Accounting Tool (Version 1.0)

User's Manual

(revised January 31, 2011)

NC STATE UNIVERSITY
Bio&Ag ENGINEERING

ncdenr
North Carolina Department of Environment and Natural Resources

Introduction

This accounting tool was developed by North Carolina State University in coordination with NCDENR to be used with the Jordan Lake Nutrient Strategy Rules. While the original application of this tool is the Jordan Lake Nutrient Strategy, it may also be applied to any location within the state of North Carolina. This tool is intended to be used for new developments (NCDENR is developing a separate tool for existing developments within the Jordan Lake watershed), but can be also be applied to existing developments that are incorporating retrofit best management practices (BMPs).

Important Notes:

Some BMPs included in the tool may not currently be used for meeting nutrient reduction requirements. Please check with the Division and the Division's Stormwater BMP Manual for more details.

While the tool provides the option of undersizing BMPs, this option cannot currently be used to meet the Jordan New Development requirements. This option may potentially be used if the tool is used to calculate nutrient reductions for retrofits on existing development.

Using the Client/Master Files

To prevent manipulation of the Jordan/Falls Lake Stormwater Load Accounting Tool (JLSLAT) and its outputs, a system has been developed involving two Excel files: a Client file and a Master file. The Client file will be distributed to the general public and the Master file will be distributed to regulators by NCDENR. The Master file is NOT designed to run scenarios and analyze developments. Its only use is for regulators to extract input data from the Client file and view results. To ensure that both files function properly and produce accurate results, do NOT attempt to change any formatting, data or formulas within the files.

Client File

Developers (or anyone submitting the results from the JLSLAT for regulatory review) may use the Client file to run any and all scenarios for a given development. When they are ready to submit a given scenario/development for review, they will save the Client file and send it to the appropriate regulatory agency. The agency's Master file will extract the input data from the Client file and produce its own results. Regulators will use these results to review the development.

Master File

The Master file extracts the input data from a specified Client sheet and produces its own set of results. Again, the Master file is NOT designed to run scenarios and analyze developments. It is strongly recommended that the regulatory agency use the "Save As" feature to have a separate Master file for each Client file. To establish the connection between the Master and Client files, go to the Instructions worksheet and click on Data → Connections → Edit Links. Browse files and select the client sheet you want to extract the data from. Click on the Update Values button. The files should update automatically and any time the Master Sheet is opened it will extract the data from the specified Client file. You may check the status of the connection by clicking Data → Connections → Edit Links → Check Status. If for some reason the link is broken, simply repeat the steps described above.

Glossary of Terms

water quality depth – The depth of rainfall that a BMP is designed to capture and treat (generally 1 inch for all regions except CAMA; for CAMA, it is generally 1.5 inches).

physiographic region – Broad-scale subdivision based on terrain texture, rock type and geologic structure and history. In North Carolina, there are five main physiographic regions: coastal plain, sandhills, piedmont, Triassic basin, and mountains. (In the JLSAT, the region "CAMA" refers to the region of the state where Coastal Area Management Act applies – see NCDENR's website for more information about this region and the stormwater requirements)

hydrologic soil group – Soils are classified into hydrologic soil groups (HSGs) to indicate the minimum rate of infiltration obtained for bare soil after prolonged wetting.

median effluent concentration – The median concentration of a given constituent that is released from a best management practice. This value is independent of the inflow concentration.

internal water storage zone – Subsurface portion of a bioretention cell that provides water storage in the bottom of the cell. Water stored in this layer is principally released by exfiltration. The IWS zone is created by elevating the underdrain, usually with a 90-degree PVC elbow.

I. Using the Jordan/Falls Lake Stormwater Load Accounting Tool (JLSLAT)

This section covers the use and interpretation of the JLSLAT. There are four worksheet tabs within the Excel spreadsheet that users will need to access: Instructions, Watershed Characteristics, BMP Characteristics, and Development Summary. The Instructions tab provides background information and general instructions for using the JLSLAT. The Watershed Characteristics and BMP Characteristics tabs allow users to enter their development and BMP data. Finally, the Development Summary is where all outputs are displayed. Users may navigate between these four tabs by either clicking the buttons at the top of the worksheets (Figure 1A) or by clicking on the tab name at the bottom of the screen (Figure 1B). Each tab and its corresponding instructions, assumptions and uses are discussed in the next four sections.

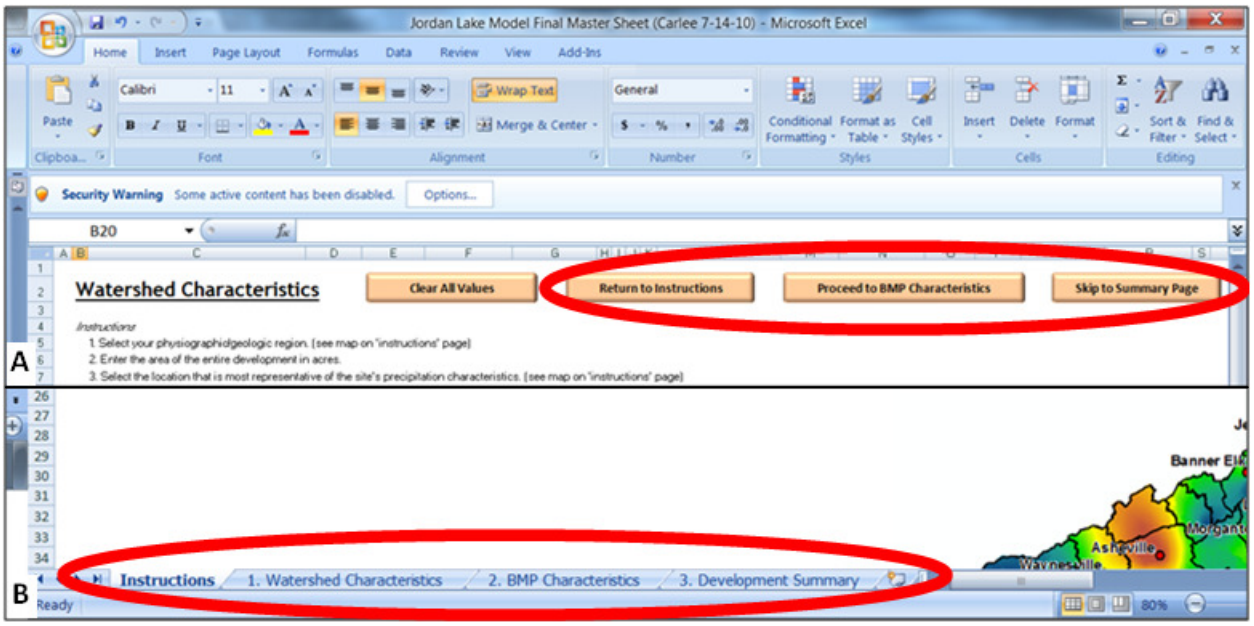


Figure 1. Methods of navigating between worksheet tabs.

Instructions

The Instructions tab is the first worksheet one sees when opening the JLSLAT Excel file. This tab contains all instructions and assumptions regarding the JLSLAT and its use. Specific instructions are stated again in subsequent tabs so users can refer to them easily.

This worksheet contains two maps: a physiographic region map (Figure 2) and an annual precipitation map (Figure 3). These maps are provided for users to reference when choosing their physiographic region and precipitation location on the "Watershed Characteristics" tab. There is also a table (Table 1) of counties located within, or partially within, each physiographic region. Table 1 allows users to get a general idea of what region their site is located in. For users whose county is located within multiple regions, it is crucial that they determine which region the site of interest pertains to, as this affects calculations and outputs from the JLSLAT. This will be discussed in greater detail in the "Watershed Characteristics" section.

Cells shaded grey are those designated for data input.

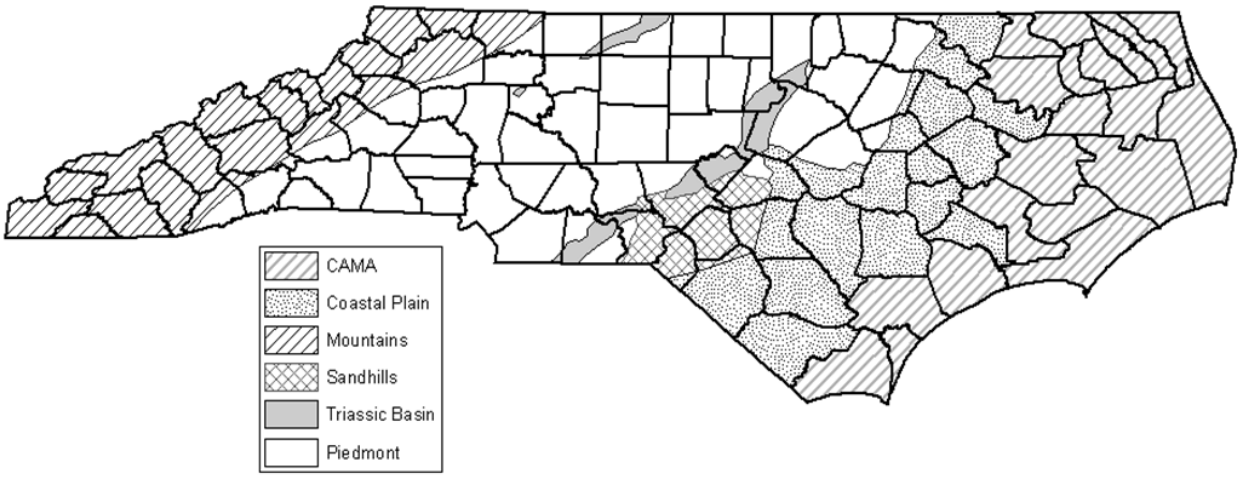


Figure 2. Map of physiographic regions within the state of North Carolina (also located in the JLSLAT on the Instructions worksheet).

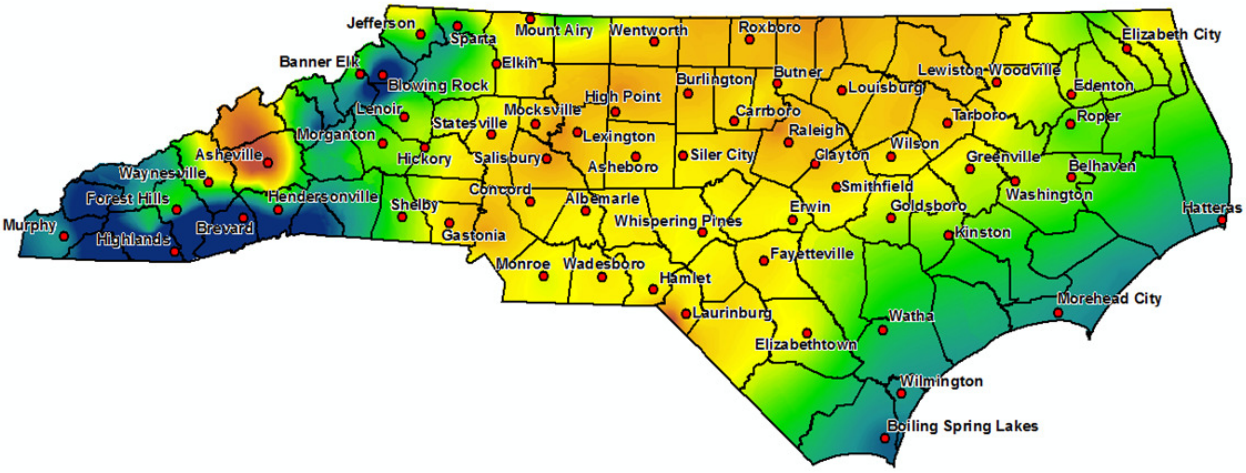


Figure 3. Average annual precipitation map for the state of North Carolina. Labeled towns/cities are available in the dropdown menu for 'precipitation location' (also located in the JLSLAT on the Instructions worksheet).

Table 1. List of counties located within, or partially within, each physiographic region.

PIEDMONT & MOUNTAIN		COASTAL PLAIN	CAMA COUNTIES	TRIASSIC BASIN	SANDHILLS
Rockingham	Lee	Bladen	Beaufort	Durham	Montgomery
Alamance	Lincoln	Columbus	Bertie	Granville	Moore
Alexander	Macon	Cumberland	Brunswick	Wake	Lee
Alleghany	Madison	Duplin	Camden	Chatham	Harnett
Anson	McDowell	Edgecombe	Carteret	Lee	Cumberland
Ashe	Mecklenburg	Halifax	Chowan	Moore	Hoke
Avery	Mitchell	Harnett	Craven	Montgomery	Robeson
Buncombe	Montgomery	Hoke	Currituck	Richmond	Scotland
Burke	Moore	Johnston	Dare	Anson	Richmond
Cabarrus	Nash	Jones	Gates	Union	
Caldwell	Northampton	Martin	Hertford	Rockingham	
Caswell	Orange	Moore	Hyde	Stokes	
Catawba	Person	Nash	New Hanover	Davie	
Chatham	Polk	Northampton	Onslow		
Cherokee	Randolph	Pitt	Pamlico		
Clay	Richmond	Richmond	Pasquotank		
Cleveland	Rowan	Robeson	Pender		
Davidson	Rutherford	Sampson	Perquimans		
Davie	Stanley	Scotland	Tyrrell		
Durham	Stokes	Wake	Washington		
Forsyth	Surry	Wayne			
Franklin	Swain				
Gaston	Transylvania				
Graham	Union				
Granville	Vance				
Guilford	Wake				
Halifax	Warren				
Harnett	Watauga				
Haywood	Wilkes				
Henderson	Wilson				
Iredell	Yadkin				
Jackson	Yancey				
Johnston					

Watershed Characteristics

On the Watershed Characteristics worksheet users enter all information pertaining to the site of interest, including both pre- and post-developed conditions. General development information is entered in the upper section of the worksheet (shown in Figure 4).

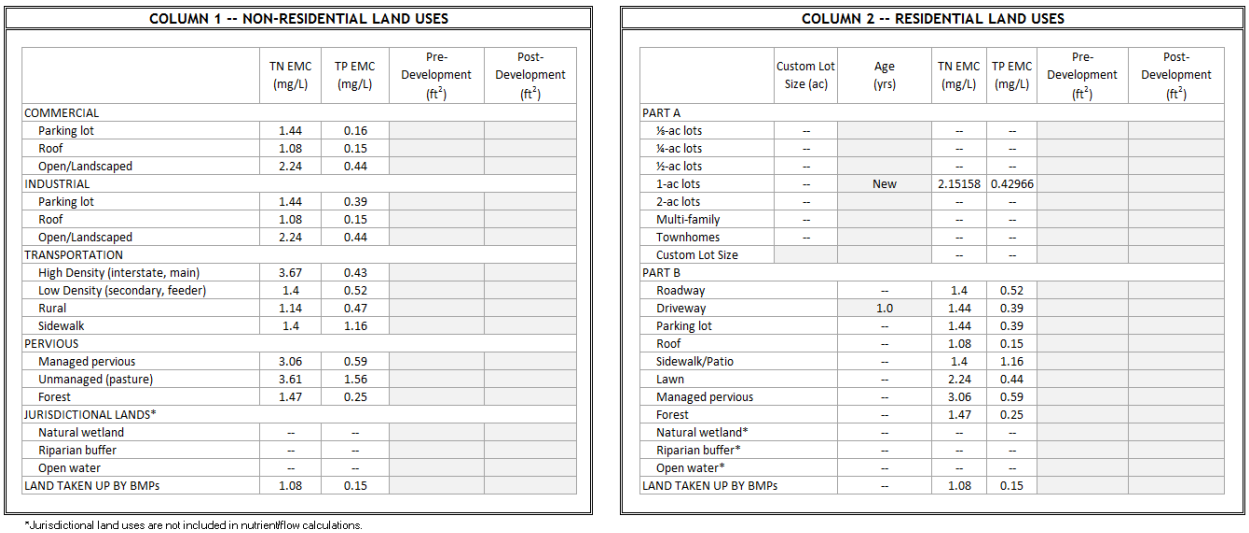
Physiographic/Geologic Region:	
Soil Hydrologic Group	
Precipitation location:	

Total Development Area (ft^2):	
Development Name:	
Model Prepared By:	

Figure 4. General development information section of Watershed Characteristics worksheet.

- Physiographic/Geologic Region **(required)**: This is the physiographic region in which the site is located. Select the appropriate region from the drop-down menu. Regions to select from include: CAMA (coastal area management act), Coastal, Sandhills, Piedmont, Triassic Basin, and Mountains. Users may reference Figure 2 or Table 1 (both located in the Instructions worksheet) to determine the appropriate physiographic region. The region of a site dictates the volume reduction capabilities of BMPs.
- Hydrologic Soil Group **(required)**: The hydrologic soil group (HSG) is the predominant type of soil located on the site. Select the appropriate HSG (A, B, C or D) from the drop-down menu. Users may use on-site soil tests or soil maps to determine the appropriate HSG; however, one must be careful that the HSG does not vary throughout the site and truth-checking soil maps is highly encouraged (sometimes required). The HSG is a reference for regulators to make sure the selected BMPs are acceptable for the given HSG.
- Precipitation Location **(required)**: Users should select a location from the drop-down menu that most closely represents the rainfall patterns of the site. Note that this may not necessarily be the closest location to the site. Figure 3 shows trends for North Carolina regarding average annual rainfall depths and can be used to choose the most appropriate precipitation location. The location selected is used to determine stormwater runoff volumes for the site.
- Total Development Area **(required)**: Enter the total number of square feet comprising the site to be analyzed. It is important that this value equal the sum of all areas entered in the pre- and post-development land use columns. In the event that these values do not match, a warning will appear at the bottom of the worksheet alerting the user of this fact.
- Development Name (optional): The name assigned to the site/development to be analyzed. This name will appear on the summary sheet with the JLSLAT outputs.
- Model Prepared By (optional): The name of the person using the JLSLAT for a site/development. This name will appear on the summary sheet with the JLSLAT outputs.

The lower section of the Watershed Characteristics worksheet (Figure 5) is where users enter land use data for pre- and post-development conditions.



COLUMN 1 -- NON-RESIDENTIAL LAND USES

	TN EMC (mg/L)	TP EMC (mg/L)	Pre-Development (ft^2)	Post-Development (ft^2)
COMMERCIAL				
Parking lot	1.44	0.16		
Roof	1.08	0.15		
Open/Landscaped	2.24	0.44		
INDUSTRIAL				
Parking lot	1.44	0.39		
Roof	1.08	0.15		
Open/Landscaped	2.24	0.44		
TRANSPORTATION				
High Density (interstate, main)	3.67	0.43		
Low Density (secondary, feeder)	1.4	0.52		
Rural	1.14	0.47		
Sidewalk	1.4	1.16		
PERVIOUS				
Managed pervious	3.06	0.59		
Unmanaged (pasture)	3.61	1.56		
Forest	1.47	0.25		
JURISDICTIONAL LANDS*				
Natural wetland	--	--		
Riparian buffer	--	--		
Open water	--	--		
LAND TAKEN UP BY BMPs	1.08	0.15		

*Jurisdictional land uses are not included in nutrientflow calculations.

COLUMN 2 -- RESIDENTIAL LAND USES

	Custom Lot Size (ac)	Age (yrs)	TN EMC (mg/L)	TP EMC (mg/L)	Pre-Development (ft^2)	Post-Development (ft^2)
PART A						
⅛-ac lots	--		--	--		
¼-ac lots	--		--	--		
½-ac lots	--		--	--		
1-ac lots	--	New	2.15158	0.42966		
2-ac lots	--		--	--		
Multi-family	--		--	--		
Townhomes	--		--	--		
Custom Lot Size			--	--		
PART B						
Roadway		--	1.4	0.52		
Driveway		1.0	1.44	0.39		
Parking lot		--	1.44	0.39		
Roof		--	1.08	0.15		
Sidewalk/Patio		--	1.4	1.16		
Lawn		--	2.24	0.44		
Managed pervious		--	3.06	0.59		
Forest		--	1.47	0.25		
Natural wetland*		--	--	--		
Riparian buffer*		--	--	--		
Open water*		--	--	--		
LAND TAKEN UP BY BMPs		--	1.08	0.15		

Figure 5. Section of Watershed Characteristics worksheet where pre- and post-development land use areas are entered.

Users may enter land use information in two sections: Non-residential land uses (Column 1) and residential land uses (Column 2). Land uses associated with commercial, industrial, or transportation categories are listed on the left of the screen, while land uses associated with the residential category are found on the right of the screen. Miscellaneous pervious land uses, as well as land that is taken up by BMPs, are also listed in the non-residential section of this worksheet. Land areas designated to BMPs, whether they exist in pre-development conditions, or whether they will be incorporated with the development, should be entered in the "Land Taken Up By BMPs" category. Natural wetlands, riparian buffers and open water (dubbed "Jurisdictional Land Uses") are included in the model; however, these land uses are not considered in the runoff volume or concentration calculations, nor may they be treated by BMPs.

Land area values do not have to be entered in only one of the columns – they may be mixed among the two columns if necessary.

Users should enter the total area within the site/development for each type of land use. This should be done for both pre- and post-development conditions. If a particular land use is not present on the site, the cells may be left blank or a zero may be entered. The TN EMC and TP EMC values listed beside each land use are the representative concentrations of total nitrogen (TN) and total phosphorus (TP) found in stormwater runoff leaving that particular land use. The methods used to establish percent impervious assignments and representative pollutant concentrations for individual land uses are discussed in Part II of this document. The percent impervious value for the driveway land use is adjustable. This value defaults to 1 (100% impervious); however uses may adjust this in the gray-shaded cell in the "Age of Development" column. Note that the percent impervious value entered must be validated and may or may not be accepted by the reviewing agency.

It is important that the areas entered for both the pre- and post-development condition sum to equal the "Total Development Area" entered in the upper section of the Watershed Characteristics worksheet. A chart displaying the totals for each of these values is located below Column 1 ("Land Use Area Check"). If these values do not equal each other, a warning will be displayed below Column 2 to alert the user that there is a discrepancy.

Residential Land Uses. There are two options for entering land use information for residential sites. The first option is entering area values in Part A of Column 2. This section gives several lot size options, including ⅛-, ¼-, ½-, 1- and 2-acre lots, as well as multi-family and townhome lots. If the site conforms to one of these specific lot sizes, the appropriate area may be entered in the gray-shaded cells next to the appropriate land use. Average percent impervious values and representative TN and TP concentrations for these lot sizes are built in to the JLSLAT. The method by which these values were determined is discussed in Part II of this document.

If the site's lot sizes fall between the given lot sizes, users may use the "Custom Lot Size" option. To do so, the user will enter the lot size for the development in the gray-shaded cell in the "Custom Lot Size" column. This value must fall between ⅛ acre and 2 acres, as the JLSLAT linearly interpolates the percent imperviousness and representative pollutant concentrations from the given lot sizes. If the values fall outside this range, or the user prefers (or is required) to report individual residential land uses within a development, Part B of Column 2 should be used. Part B lists out all types of land uses that may be found within a residential area and allows the user to enter the total number of acres of each land use present for the site of interest.

To avoid inaccurate results, do NOT list out individual land uses in Part B within an area already described by lot size in Part A.

When using Part A of Column 2 to enter land use area information, users must specify the age of the development in the column labeled "Age of Development". It is expected that the majority of developments analyzed with the JLSLAT will be new developments; however, should the JLSLAT be applied to existing developments, users have the option of choosing an age of "Before 1995" and "After 1995". For new developments, users should select "New". **Results will not be displayed if a development age is not selected.**

Users may clear all entries by clicking the "Clear All Values" button at the top of the worksheet. The other buttons – "Return to Instructions", "Proceed to BMP Characteristics" and "Skip to Summary Page" – allow users to navigate among the different worksheets. **In order for the "Clear All Values" button to work, macros MUST be enabled.** An additional note regarding the "Clear All Values" button: When using the Client and Master files, clicking the "Clear All Values" button in the Master file will only clear values that were entered in the Master file in addition to those values carried over from the Client file. All values that were entered in the Client file (and thus carried over to the Master file) will remain. To clear these values, the user must click the "Clear All Values" button in the Client file. **To avoid confusion, it is best to work entirely within the Client File. It is unnecessary to perform any actions within the Master file.**

BMP Characteristics

All details pertaining to the BMPs that will be used to treat runoff from the development are entered in the BMP Characteristics worksheet. Users may divide the development into as many as 6 catchments, and each catchment may be treated with up to 3 BMPs.

BMPs are selected by clicking on the appropriate cell in the row of the worksheet labeled "BMP Type" (indicated by an arrow in Figure 6). After clicking on the cell, an arrow will appear on the right side of the cell. Click this arrow and a dropdown menu will appear with the available BMP choices: Bioretention

with IWS (Internal Water Storage Zone), Bioretention without IWS, Dry Detention Pond, Grassed Swale, Green Roof, Level Spreader/Filter Strip, Permeable Pavement, Sand Filter, Water Harvesting, Wet Detention Pond, and Wetland. Click on the appropriate BMP. To clear a BMP choice, either click on the cell and press the 'delete' key, or select the blank row in the dropdown menu.

If more than 1 BMP is assigned to a single catchment, the BMPs are assumed to operate in series (i.e. the outflow from BMP 1 flows into BMP 2, etc.)

The JLSLAT allows the user to designate additional drainage areas for the second and third BMP in the series. If additional drainage area was designated for BMP 2 of the series, BMP 2 would treat not only the outflow from BMP 1, but also the runoff from the designated drainage area. To designate this additional drainage area, simply enter the square footage for each type of land use within the area in the column for BMP 2 (more details on how to specify land uses within BMP drainage areas will be provided later in this section).

	CATCHMENT 1			CATCHMENT 2		
	BMP #1	BMP #2	BMP #3	BMP #1	BMP #2	BMP #3
Type of BMP:						
If BMP is undersized, indicate the BMP's size relative to the design size required to capture the designated water quality depth (i.e. 0.75 = BMP is 75% of required design size):						
*For water harvesting BMP, enter percent volume reduction in decimal form.						
				Does BMP accept the outflow from		
Catchment 1:	--	--	--	no	no	no
Catchment 2:	no	no	no	--	--	--
Catchment 3:	no	no	no	no	no	no
Catchment 4:	no	no	no	no	no	no
Catchment 5:	no	no	no	no	no	no
Catchment 6:	no	no	no	no	no	no

Figure 6. Section of the BMP Characteristics worksheet where information regarding type of BMP, undersizing/oversizing and catchment routing is entered.

Undersized BMPs. The JLSLAT allows for BMPs to be undersized to a minimum of 50% of the size required to treat the water quality event. When a BMP is undersized, the volume reduction provided by the BMP is reduced using a 1:1 ratio (i.e. if the BMP size required to treat the water quality event is reduced by 40%, the assigned volume reduction will be reduced by 40%). However, the median effluent concentrations assigned to the BMP remain the same. To specify that a BMP is undersized, the user should enter the BMP's size relative to the design size required to capture the designated water quality depth in decimal form (i.e. 75% of required design size = 0.75) in the appropriate row of the worksheet (circled in Figure 6). **(While the tool provides the option of undersizing BMPs, this option cannot currently be used to meet the Jordan New Development requirements. This option may potentially be used if the tool is used to calculate nutrient reductions for retrofits on existing development – check with DWQ.)**

Oversized BMP. The JLSLAT does not include a direct method of oversizing BMPs; however, users can model oversized BMPs. To do so, users must enter two BMPs of the same type in series (the outflow from the first BMP flows into the second BMP). The BMP type should be that of the BMP the user wishes to oversize. The percent by which the user wishes to oversize the BMP should be added to 100%, then divided by 2. This value will be entered in the same row that undersized values are entered (circled in Figure 6) for both BMPs. For example, if a BMP was to be 50% greater than the size required to treat the water quality depth, it would be a total of 150% of the design size. Divide this value by 2, and the two BMPs in series would be assigned an 'undersized' value of 0.75 each.

Catchment Routing. Any catchment within the development may be routed to any other BMP or catchment. The section in which this information is entered is highlighted by a box in Figure 6. To indicate that a BMP is accepting the outflow from another catchment, select "yes" from the dropdown menu in the cell corresponding to the BMP that is accepting the outflow. For example, if BMP 2 of Catchment 1 is accepting the outflow from Catchment 3, the cell corresponding with the column for BMP 2 of Catchment 1 and the row for Catchment 3 should be changed to display "yes" instead of "no". To route one catchment to another catchment, simply route the catchment outflow to the first BMP within the catchment accepting the outflow.

Water Harvesting BMP. Water harvesting is a BMP given as an option within the JLSLAT. Users must enter a volume reduction for the water harvesting BMP in the appropriate row within the BMP Characteristics worksheet. This is the volume reduction used to calculate volume and nutrient outputs from the system. It is important to note that the water harvesting BMP is NOT modeled as a catch-and-release system in the JLSLAT; it is assumed that volumes reduced by the system are NOT released to the stormwater network. It is up to the developer to prove that this is in fact the case and that the reported volume reduction is accurate.

To aid with the selection of BMPs, a table ("BMP Details") is located at the top of the worksheet and displays the volume reduction and median effluent concentrations for each type of BMP for the physiographic region indicated in the Watershed Characteristics page. (Note the values will change if the region is changed.) Figure 7 shows this table with the Coastal physiographic region as the selected region. Users may use this table to determine which types of BMPs would provide the most treatment for their development. As permeable pavement, green roofs and water harvesting BMPs are not assigned a nutrient removal credit, their effluent concentrations default to the value of the land use they are replacing (parking lot, roof, etc.). **(Water harvesting, permeable pavement and green roofs may not currently be used for meeting nutrient reduction requirements in the Jordan Lake watershed. Please check with the Division and the Division's Stormwater BMP Manual for applicability details.)**

BMP DETAILS			
BMP	**Volume Reduction (%)**	**TN Effluent Concen. (mg/L)**	**TP Effluent Concen. (mg/L)**
Bioretention with IWS	50%	0.95	0.12
Bioretention without IWS	35%	1.00	0.12
Dry Detention Pond		1.20	0.20
Grassed Swale		1.21	0.26
Green Roof	50%	1.08	0.15
Level Spreader, Filter Strip	40%	1.20	0.15
Permeable Pavement*		1.44	0.39
Sand Filter	5%	0.92	0.14
Water Harvesting	user defined	1.08	0.15
Wet Detention Pond	10%	1.01	0.11
Wetland	20%	1.08	0.12

*if treating commercial parking lot, TP effluent concentration = 0.16 mg/L

Figure 7. "BMP Details" table displaying values for the Piedmont physiographic region (blank cells indicate 0% volume reduction).

The lower portion of the BMP Characteristics worksheet (Figure 8) allows the user to define the watershed draining to each BMP. The user should enter the total area of each land use type that drains to each BMP in the appropriate column. **Note that when entering residential land use information the user MUST be sure to enter the land area values in the appropriate row for the age of the development (New, Before 1995 and After 1995 ages are listed out separately, unlike the Watershed Characteristics worksheet).** The size of the BMP itself should be entered in the very last land use row – "Land taken up by BMP" – as all of the rainfall that falls on the BMP enters the BMP.

The areas entered in a given land use MUST be less than or equal to the total area of that land use entered in the Watershed Characteristics worksheet.

To ensure this is the case, there is a built-in check in the worksheet. If the user enters a value that exceeds the total available area of that particular land use, the model displays an error message. **However, in order for this check to function, users must press the "Enter" key on the keyboard after entering the land use area; clicking on a different cell will NOT trigger the check to occur.**

The two columns to the right of the Catchment 6 area show the user how many acres of a given land use are available and how many are currently being treated. The two rows below the grey-shaded cells shows how many total acres are being treated by each BMP as well as by the series. **Remember that entering land areas for BMPs 2 or 3 in a series indicate that the BMP is accepting runoff from this area IN ADDITION TO the outflow from the previous BMP.** Not all of the watershed must be treated by a BMP; the Jordan Lake Nutrient Strategy requirements will dictate how much treatment needs to be included.

Two other checks have been incorporated into the BMP Characteristics worksheet. The first displays a warning message if a BMP is specified but there are no land areas entered. This prevents the user from inadvertently erasing land use areas and forgetting to the clear the BMP selection. The second warning is displayed if a BMP has not been selected but another catchment is being routed to it. Again, this is in

case the user forgets to clear the catchment routing after a BMP is removed. To clear all entries in this worksheet, both land areas as well as catchment routing and BMPs, click the "Clear All Values" button at the top of the worksheet. **In order for the "Clear All Values" button to work macros, MUST be enabled.**

	CATCHMENT 1			CATCHMENT 2		
	BMP #1	BMP #2	BMP #3	BMP #1	BMP #2	BMP #3
Drainage Area Land Use	Area Treated by BMP (ft^2)	Area treated by BMP #2 that is not treated by BMP #1 (ft^2)	Area treated by BMP #3 that is not treated by BMPs #1 or #2 (ft^2)	Area Treated by BMP (ft^2)	Area treated by BMP #2 that is not treated by BMP #1 (ft^2)	Area treated by BMP #3 that is not treated by BMPs #1 or #2 (ft^2)
COMMERCIAL						
Parking lot						
Roof						
Open/Landscaped						
INDUSTRIAL						
Parking lot						
Roof						
Open/Landscaped						
TRANSPORTATION						
High Density (interstate, main)						
Low Density (secondary, feeder)						
Rural						
Sidewalk						
MISC. PERVIOUS						
Managed pervious						
Unmanaged (pasture)						
Forest						
RESIDENTIAL						
2-ac lots (New)						
2-ac lots (Built after 1995)						
2-ac lots (Built before 1995)						
1-ac lots (New)						
1-ac lots (Built after 1995)						
1-ac lots (Built before 1995)						
½-ac lots (New)						
½-ac lots (Built after 1995)						
½-ac lots (Built before 1995)						
¼-ac lots (New)						
¼-ac lots (Built after 1995)						
¼-ac lots (Built before 1995)						
⅛-ac lots (New)						
⅛-ac lots (Built after 1995)						
⅛-ac lots (Built before 1995)						
Townhomes (New)						
Townhomes (Built after 1995)						
Townhomes (Built before 1995)						
Multi-family (New)						
Multi-family (Built after 1995)						
Multi-family (Built before 1995)						
Custom Lot Size (New)						
Custom Lot Size (Built after 1995)						
Custom Lot Size (Built before 1995)						
Roadway						
Driveway						
Parking lot						
Roof						
Sidewalk						
Lawn						
Managed pervious						
Forest						
LAND TAKEN UP BY BMP						
TOTAL AREA TREATED BY BMP (ft^2):	0	0	0	0	0	0
TOTAL AREA TREATED BY SERIES (ft^2):		0			0	

Figure 8. Section of the BMP Characteristics worksheet where information regarding land use of BMP drainage area(s) is entered.

Development Summary

The final worksheet in the JLSLAT is the Development Summary; it displays all outputs for the development of interest. The worksheet is separated into 2 sections: Watershed Summary and BMP Summary.

Watershed Summary. The Watershed Summary section (Figure 9) displays outputs for 'pre-development' and 'post-development' conditions, as well as 'post-development' conditions with BMPs incorporated. These outputs include percent impervious, annual runoff volume, TN median effluent concentration, TN loading rate, TP median effluent concentration and TP loading rate. Values reported for the 'post-development with BMPs' condition account for portions of the watershed not treated by BMPs. The Documentation portion of this document explains how each of these values are calculated. The watershed TN and TP loading values are those that correspond with the required target loading rates set forth by the Jordan Lake Nutrient Strategy.

The lower portion of the Watershed Summary section reports percent differences between the various watershed conditions, including 'pre-development' and 'post-development' without BMP incorporation, 'pre-development' and 'post-development' with BMP incorporation, and 'post-development' without BMPs, and 'post-development with BMPs'.

REGION:	Piedmont
TOTAL DEVELOPMENT AREA (ft²):	1,393,920

	Pre-Development Conditions	Post-Development Conditions	Post-Development w/ BMPs
Percent Impervious (%)	2.2%	21.0%	21.0%
Annual Runoff Volume (c.f.)	375,361	1,365,521	1,208,257
Total Nitrogen EMC (mg/L)	2.63	1.88	1.33
Total Nitrogen Loading (lb/ac/yr)	1.93	4.72	2.16
Total Phosphorus EMC (mg/L)	1.01	0.42	0.27
Total Phosphorus Loading (lb/ac/yr)	0.74	1.06	0.31

Percent Difference Between:

	Pre-Dev. & Post-Dev. without BMPs	Pre-Development & Post-Development with BMPs	BMPs & Post-Development with
Percent Impervious (%)	19%	19%	0%
Annual Runoff Volume (c.f.)	264%	222%	-12%
Total Nitrogen EMC (mg/L)	-28%	-50%	-30%
Total Nitrogen Loading (lb/ac/yr)	145%	12%	-54%
Total Phosphorus EMC (mg/L)	-58%	-73%	-36%
Total Phosphorus Loading (lb/ac/yr)	44%	-58%	-71%

*Negative percent difference values indicate a decrease in runoff volume, pollutant concentration or pollutant loading. Positive values indicate an increase.

Figure 9. Watershed Summary section of the Development Summary worksheet.

BMP Summary. The BMP Summary section of the Development Summary (Figure 10) worksheet displays information regarding the BMPs treating the development. The total area treated by each BMP includes the area treated by previous BMPs in the series, as well as additional area draining to the BMP itself. The inflow volume is the total amount of water flowing into the BMP. The percent volume reduction is the volume reduction potential assigned to the BMP types within the specified physiographic region (the same value displayed in Figure 7). The inflow concentrations and loadings for TN and TP are displayed

for each BMP. Additionally, outflow loadings for TN and TP are also displayed for each BMP. Details on how these are calculated may be found in the Documentation portion of this document.

	CATCHMENT 1			CATCHMENT 2		
	BMP 1	BMP 2	BMP 3	BMP 1	BMP 2	BMP 3
	Grassed Swale	Bioretention with IWS	--	Wetland	--	--
Total Area Treated (ac)	2.00	2.00	--	24.79	--	--
Total Inflow Volume (c.f.)	319,814	319,814	--	828,400	--	--
Percent Volume Reduced (%)	0%	50%	--	20%	--	--
Inflow Nitrogen EMC (mg/L)	1.40	1.21	--	2.15	--	--
Total Inflow Nitrogen (lb/ac/yr)	13.98	12.05	--	4.49	--	--
Inflow Phosphorus EMC (mg/L)	0.520	0.258	--	0.430	--	--
Total Inflow Phosphorus (lb/ac/yr)	5.19	2.57	--	0.90	--	--
BMP Outflow Nitrogen (lbs/ac/yr)	12.05	4.99	--	2.02	--	--
BMP Outflow Phosphorus (lbs/ac/yr)	2.57	0.74	--	0.26	--	--
Catchment Outflow Nitrogen EMC (mg/L)	1.00			1.21		
Catchment Outflow Total Nitrogen (lb/ac/yr)	4.99			2.02		
Percent Reduction in Nitrogen Load (%)	62%			40%		
Catchment Outflow Phosphorus EMC (mg/L)	0.148			0.156		
Catchment Outflow Total Phosphorus (lb/ac/yr)	0.735			0.260		
Percent Reduction in Phosphorus Load (%)	81%			14%		

Figure 10. BMP Summary section of the Development Summary worksheet.

This section of the worksheet also displays outflow data for each catchment. These data include outflow concentrations, loadings and percent reductions for TN and TP for each catchment. The last BMP in each of the series releases water of this quality and these values account for any catchment routing that is specified in the BMP Characteristics tabs. **Note that these values are NOT the watershed outflow values – these are only pertinent to the outflow leaving each catchment treated by BMPs**. Overall watershed outflow information is displayed in the Watershed Summary section of the Development Summary worksheet under the 'post-development with BMPs' condition.

The buttons to the right of the Watershed Summary tables allow the user to navigate among the various worksheets, as well as print the Development Summary worksheet. The "Print Summary" button, when clicked, will print the Watershed Summary portion of the worksheet on page 1 and the BMP Summary portion of the worksheet on page 2. Note that the button will only print to the default printer. **Macros MUST be enabled for this button to work.**

II. Model Documentation

Governing Principles and Limitations

Calculations performed within the model are governed by two basic principles: Simple Method (for runoff volume and pollutant loading calculations) and the median effluent concentration BMP efficiency metric (for BMP reduction calculations). Each of these principles is described below.

Simple Method

The Simple Method is a method for estimating the volume of stormwater runoff and the pollutant load exported within that runoff leaving a small urban catchment. Volume calculations are based upon impervious cover of a catchment, which is represented by the runoff coefficient Rv:

$$R_v = 0.05 + (0.009 * I) \quad (1)$$

where R_v = Simple Method runoff coefficient; and
I = percent impervious cover of the catchment (%).

The volume is a function of the runoff coefficient, Rv, the area of the catchment and the annual rainfall amount. Some variations of the Simple Method are applied on an individual storm basis, in which case the precipitation value would be the depth of rainfall that one wishes to estimate runoff for. For JLSLAT applications, annual precipitation values are used.

$$V = R_v * A * (P/12) \quad (2)$$

where V = volume of runoff (ft^3),
A = area of catchment (ft^2), and
P = average annual rainfall depth (in).

To estimate the mass of pollutant that leaves the catchment on an annual basis, Equation 3 is used.

$$L = (P * Pj * R_v) \div (12 * C * A * 2.72) \quad (3)$$

where L = average annual pollutant load (lbs),
Pj = fraction of rainfall events that produce runoff, and
C = event mean concentration of the pollutant (mg/L).

CWP, 2007 recommends a Pj value of 0.9, indicating that 90% of rainfall events produce runoff. However, for the JLSLAT a value of 1.0 was used in order to provide a conservative estimate of the pollutant load leaving the site. The event mean concentrations used for certain land uses will be discussed in detail in the "Watershed Characteristics" section of this document.

Several assumptions/limitations accompany the Simple Method (taken from CWP, 2007):

(1) The Simple Method should be used on catchments with areas of 1 square mile (640 acres) or less; and
(2) The Simple Method only estimates pollutants loads leaving the catchment via stormwater runoff.

Determining Representative Pollutant Concentrations for Various Types of Land Uses

A literature review was conducted to establish representative pollutant concentrations for various land use types. Only peer-reviewed literature was considered in this endeavor; however, geographic limitations were not imposed. Only data that were reported for the specific land use of interest (i.e. not multi-use watersheds) were used. If multiple data were available, the average of the data was taken as the representative pollutant concentration (unless otherwise noted). Table 2 displays the representative TN and TP concentration values for various land uses, as well as the references from which the values were derived. Raw data from individual studies used to compute these values may be found in Appendix A.

Determining Percent Imperviousness for Various Residential Lot Sizes

This section was compiled by the Center for Watershed Protection, Inc. (the Center) and presents the methodology for identifying types of impervious cover (IC) in suburban residential land uses. The polygons used in this study were suburban in nature and most of the development was constructed after 1970 and before 2001. Although these estimates were developed using data from the Chesapeake Bay region, it is assumed that these numbers provide a reasonable estimate suburban development trends that can be transferred to other regions outside this watershed. However, the IC estimates presented herein apply to recent suburban development, and may not be transferrable to ultra-urban or older development areas.

Using GIS data from Baltimore County (MD), Howard County (MD), James City County (VA), and Lancaster County, (PA), the Center analyzed IC coefficients for single family residential suburban land uses. Homogenous land use polygons were analyzed using Geographic Information Systems (GIS) data. Land use polygons were defined using the descriptions presented in Table 3.

The following criteria were used to select single family residential polygons for analysis:

- For residential land uses, the parcel boundary information was used to first classify parcels based on acreage (shown in the description in Table 3). Development patterns that most closely matched the land use category (e.g., ¼ acre lots) were selected for sampling. Because most subdivisions do not have uniform lot sizes, subdivisions were selected if the majority of lots or average lot size met the general criteria for the land use category.
- Because of difficulty in finding subdivisions that met the above criteria for polygon delineation, no minimum area was set for the polygon size for residential areas. Instead, it was decided that each residential polygon must include a minimum of 5 lots.
- Polygons were drawn by following the lot lines of contiguous parcels and excluding areas of "unbuildable" land located in the interior of the polygon. Stream valleys that did not originate within the subdivision were excluded from the land use polygons, as were other "unbuildable" lands such as floodplains, wetlands, and conservation areas. The basis behind this rule is that not all development sites include these types of characteristics. When predicting future impervious cover, a planner could estimate the areas based on existing mapping and based on local codes and ordinances that determine "unbuildable" acreage. This acreage could then be removed from the total acreage of the planning area.
- Stormwater ponds and open water were not considered to be impervious cover because they are generally small in area and are not always associated with a single land use. While water surfaces do act as impervious surfaces in a hydrologic sense, they do not generally have similar consequences on stream quality, watershed health, or pollutant loading as more conventional impervious cover such as roads, parking lots, and rooftops.

Table 2. Representative TN and TP concentrations for various land uses.

Land Use Type	TN (mg/L)	TP (mg/L)	Reference
Residential			
Driveway	1.44	0.39	Passeport et al. (2009) (using industrial values)
Roof	1.08**	0.15*	*Moran (2004) and Bannerman (1993) **Moran (2004)
Lawn	2.24	0.44	Skipper (2008) and NCDENR Tar-Pam Model
Commercial/Ultra-Urban			
Parking lot	1.44**	0.16*	*Bannerman (1993) and Passeport et al. (2009); **Passeport et al. (2009)
Roof	1.08**	0.15*	*Moran (2004) and Bannerman (1993), **Moran (2004)
Open/Landscaped	2.24	0.44	Skipper (2008) and NCDENR Tar-Pam Model
Industrial			
Parking lot	1.44**	0.39*	*Bannerman (1993); **Passeport et al. (2009)
Roof	1.08**	0.15*	*Moran (2004) and Bannerman (1993), **Moran (2004)
Open/Landscaped	2.24	0.44	Skipper (2008) and NCDENR Tar-Pam Model
Transportation			
High density (interstate, main)	3.67	0.43	Wu et al. (1998), urban
Low density (secondary, feeder)	1.4	0.52	Wu et al. (1998), semi-urban
Rural	1.14	0.47	Wu et al. (1998), rural
Sidewalks	1.43**	1.16*	*Bannerman (1993); Passport et al. (2009)
Other			
Woods	1.47	0.25	Line et al. (2002) median
Maintained grass	3.06	0.59	Skipper (2008)
Pasture	3.61	1.56	Line et al. (2002) median

Table 3. Land Use Categories and Descriptions

Residential Land Use	Description
2 Acre Lots	Lot size ranges from 1.70 to 2.30 acres
1 Acre Lots	Lot size ranges from 0.75 to 1.25 acres
1/2 Acre Lots	Lot size ranges from 0.40 to 0.60 acres
1/4 Acre Lots	Lot size ranges from 0.20 to 0.30 acres
1/8 Acre Lots	Lot size ranges from 0.10 to 0.16 acres, includes duplexes
Townhomes	5-10 units/acre, attached single family units that include a lot area
Multifamily	10-20 units/acre, residential condominiums and apartments with no lot area associated with the units

Once a development area was selected, the criteria used to delineate the polygons were generally as follows:

- Parcel lines were used as guides for drawing the polygon boundaries.
- "Unbuildable" land such as floodplains, steep slopes, and conservation areas were not included in the polygons.
- Subdivision lots that were not built out were not included in the polygons.
- Large forested areas located outside parcel boundaries were not included in the polygons.
- Local and arterial roads were included in the polygons if the parcels bordering each side of the road had the same land use.
- If a local or arterial road bordering a parcel had a different land use bordering the other side of the road, only half the road was included in the polygon. Interstate and state highways were not included in the polygons.
- Parcel data such as a business or owner name was used to verify land use.
- Orthophotos were also used to verify land use.

A direct measurement technique was used to assess the IC for each land use polygon. This involved clipping planimetric IC layers (e.g., buildings, roads, parking lots) to the land use polygons using GIS. For IC types not available as planimetric data (e.g., sidewalks, driveways), the following major assumptions were made:

Other Impervious Surfaces
Orthophotos were used to digitize an impervious cover layer that included tennis courts, garages, and other impervious surfaces not included in the buildings, parking lots, roads, driveways, or sidewalks layers. This layer was included in the processing and calculation of total impervious cover.

Sidewalk Estimation
Sidewalks were identified only as lines in the GIS layers, so orthophotos were used to measure the length of sidewalks in each polygon, which was then multiplied by 4 feet (assumed sidewalk width). The resulting numbers were added to the data table for calculation of total impervious cover.

Driveway Estimation
Driveway data was not available so GIS orthophotos were used to determine an average driveway size for each polygon, which was then multiplied by the number of homes within the polygon. The resulting numbers were added to data table for calculation of total impervious cover.

Results for each land use polygon were used to compute an average IC by type for various suburban residential land uses. More detailed information on the sampling protocol and impervious cover measurement can be found in Cappiella and Brown, 2001.

The current zoning code classifications for the City of Durham, NC are shown in Table 4. The information in this table can be used to guide the application of the IC coefficients to residential zoning classifications in North Carolina.

Table 4. Zoning Classifications for Durham, NC (City of Durham, N.C.)

Durham Zoning Code	Minimum Lot Area (square feet)	Minimum Lot Area (acre)	Equivalent Land Use from Analysis
R-20	**20,000**	**0.46**	**1/2 ac**
R-15	**15,000**	**0.34**	
R-10	**10,000**	**0.23**	**1/4 ac**
R-8	**8,000**	**0.18**	
R-5	**5,000**	**0.11**	**1/8 ac**
R-3	**3,000**	**0.07**	

The results of the analysis are presented in Table 5. For single family residential categories, driveways consistently made up about 4% of the polygon area, while roads and buildings comprised an equal percentage that progressively increased with development density. Sidewalks in residential areas composed from <1% to 2% of the polygon area, and this number also increased with development density.

Table 5. Results of the IC Analysis by Land Use and Type of IC

Land Use	Number of Polygons	Total % IC	% Roads	% Buildings	% Parking	% Driveways	% Sidewalks	% Other Impervious
2 Acre Lots	12	10.6%	3.4%	3.3%	0.0%	3.8%	0.0%	0.1%
1 Acre Lots	23	14.3%	4.8%	5.1%	0.0%	4.1%	0.1%	0.2%
1/2 Acre Lots	20	21.2%	7.5%	7.9%	0.0%	4.4%	1.2%	0.2%
1/4 Acre Lots	23	27.8%	10.8%	11.0%	0.0%	4.4%	1.6%	0.1%
1/8 Acre Lots	10	32.6%	13.4%	12.2%	0.0%	4.7%	2.2%	0.0%
Townhomes	20	40.9%	12.6%	16.4%	6.4%	2.1%	2.7%	0.6%
Multifamily	18	44.4%	13.1%	15.9%	13.0%	0.0%	1.4%	1.0%

Determining Percent Imperviousness for Residential Lots of Various Ages
This section was compiled by the Center for Watershed Protection, Inc. (the Center) and presents the methodology for identifying impervious cover (IC) values in suburban residential land uses for a sampling of developments in four age ranges: developments built prior to 1995 (older than 15 years), developments built after 1995 (0-15 years old), developments built prior to 1985 (older than 25 years) and developments built after 1985 (0-25 years old).

The land use polygons used in this study were suburban in nature and most of the development was constructed after 1970 and before 2005. Although these estimates were developed using data from the Chesapeake Bay region, it is assumed that these numbers provide a reasonable estimate of suburban development trends that can be transferred to other regions outside this watershed. The IC estimates presented herein apply to relatively recent suburban development, and may not be transferrable to ultra-urban or older development areas.

Using GIS data from Frederick County, MD, the Center analyzed IC coefficients for single family residential suburban land uses. Homogenous land use polygons were analyzed using Geographic Information Systems (GIS) data. Land use polygons were defined using the descriptions presented in Table 6.

Table 6. Land Use Categories and Descriptions

Residential Land Use	Description
Very Low Density Residential (VLDR)	Lot sizes greater than 1 acre (less than 1 dwelling unit per acre)
Low Density Residential (LDR)	Lot size ranges from 0.25 to 1 acre (1 to 4 dwelling units per acre)
Medium Density Residential (MDR)	Lot size ranges from 0.1 to 0.2 acres (5 to 10 dwelling units per acre)
High Density Residential (HDR)	Lot sizes less than 0.1 acre (greater than 10 dwelling units per acre)

The current zoning code classifications for the City of Durham, NC are shown in Table 7. The information in this table can be used to guide the application of the IC coefficients to residential zoning classifications in North Carolina.

Table 7. Zoning Classifications for Durham, NC (City of Durham, N.D.)

Durham Zoning Code	Minimum Lot Area (square feet)	Minimum Lot Area (acre)	Equivalent Land Use from This Analysis
R-20	**20,000**	**0.46**	**LDR**
R-15	**15,000**	**0.34**	**LDR**
R-10	**10,000**	**0.23**	**LDR**
R-8	**8,000**	**0.18**	**MDR**
R-5	**5,000**	**0.11**	**MDR**
R-3	**3,000**	**0.07**	**HDR**

The following criteria were used to select residential polygons for analysis:

- Residential polygons were selected at random by using a Random Number Generator in Excel to assign a numerical number to each subdivision in the County's GIS data. The random selection process was limited to subdivisions built after 1973. Subdivisions were then analyzed in numerical order of the random numbers.
- For each subdivision, the parcel boundary information was used to first classify parcels based on acreage (shown in the description in Table 6). Development patterns that most closely matched the land use category (e.g., ¼ acre lots) were selected for sampling. Because most subdivisions do not have uniform lot sizes, subdivisions were selected if the majority of lots or average lot size met the general criteria for the land use category.
- Because of difficulty in finding subdivisions that met the above criteria for polygon delineation, no minimum area was set for the polygon size for residential areas. Instead, it was decided that each residential polygon must include a minimum of 5 lots unless it was in the very low density residential category.
- Stormwater ponds and open water and pools were not considered to be impervious cover because they are generally small in area and are not always associated with a single land use. While water surfaces do act as impervious surfaces in a hydrologic sense, they do not generally have similar consequences on stream quality, watershed health, or pollutant loading as more conventional impervious cover such as roads, parking lots, and rooftops.

Once a development area was selected, the following methods were used to delineate land use polygons:

- Residential polygons generally included individual lots as well as common land owned by the homeowner's association or developer. The subdivision names in the County's subdivision layer were used to determine which residential areas to include within a given land use polygon. Lots that were not yet built were not included as part of the subdivision.
- Interstate/state highways were not included in the polygons. Interior roads (e.g., subdivision roads) were included within the land use polygons. Local and arterial roads were included in the polygons if the parcels bordering each side of the road had the same land use. If a local or arterial road bordering a parcel had a different land use bordering the other side of the road, only half the road was included in the polygon.
- Sample polygons were drawn by following the lot lines of contiguous parcels.
- After delineating each polygon, the appropriate land use type (i.e., VLDR, LDR, MDR, or HDR) was assigned. The owner listed in the tax map data, as well as 2007 aerial photos supplied by the County were used to verify land use.
- The age range of each neighborhood (0-15 years, 0-25 years, older than 25 years or older than 15 years) was determined by using the build date in the County's tax map data. Age range was assigned based on the most common build dates of the lots within each subdivision.

After the delineation of sample polygons, the following methods were used to determine impervious cover based on residential land use type and age:

- Impervious cover data was obtained from a 2007 planimetric layer provided by the County. This layer included impervious cover in the form of buildings, driveways, roads, sidewalks, and parking lots.
- The impervious cover data was intersected with the residential sample polygons to determine the total percentage of impervious cover on each polygon. These percentages were then analyzed by residential land use type and included the mean, median, minimum, maximum, first and third

quartiles, and standard deviation. The results are represented by box and whisker plots, as well as tables in the following section.

Results of the analysis are shown in Figure 11 below. For neighborhoods older than 15 years, median impervious cover coefficients were 7.2%, 20.2%, 30.3% and 36.0% for VLDR, LDR, MDR, and HDR, respectively (Figure 12, Table 8). For neighborhoods newer than 15 years, median impervious cover coefficients were 2.7%, 27.8%, 36.1% and 35.9% for VLDR, LDR, MDR, and HDR, respectively (Figure 13, Table 9). With the exception of the VLDR land use, median impervious cover coefficients were greater in developments newer than 15 years. It should be noted that the number of polygons for the developments newer than 15 years is relatively small, particularly for the LDR land use category.

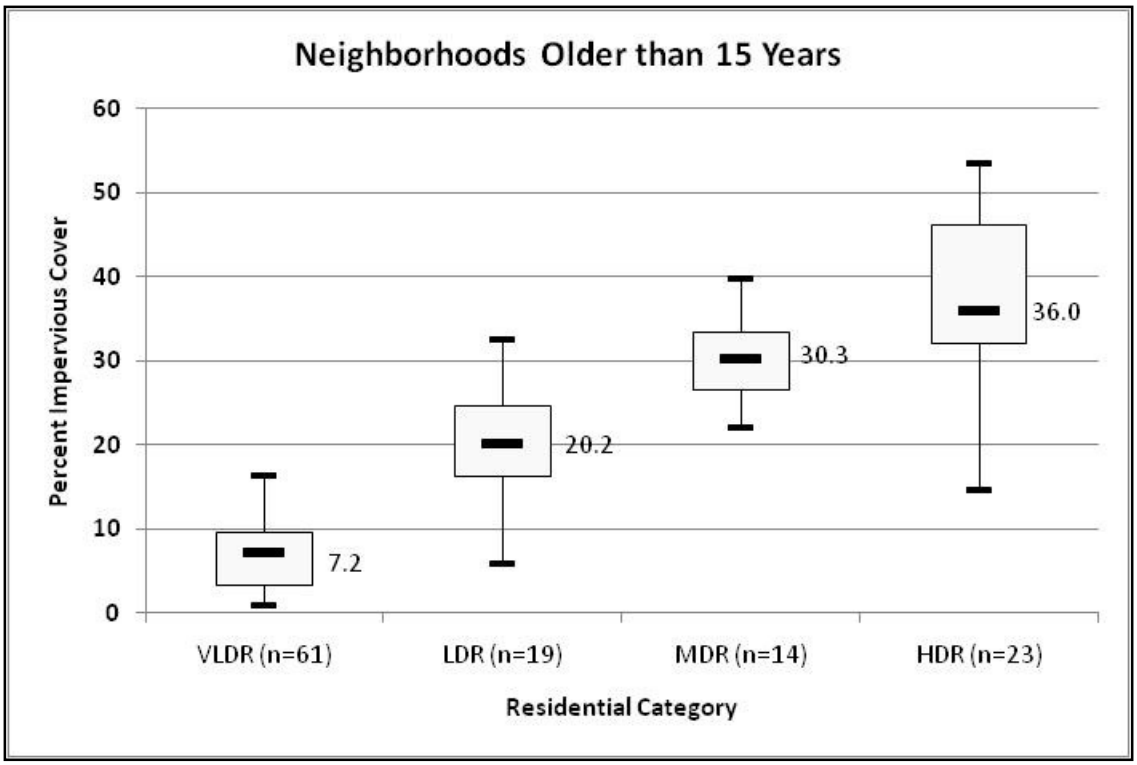


Figure 11. Median, 25% quartile (Q1), 75% quartile (Q3), minimum, and maximum values for neighborhoods older than 15 years.

Table 8. Percent Impervious Cover for Neighborhoods Older than 15 Years

Statistic	VLDR	LDR	MDR	HDR
Q1	3.4	16.2	26.6	32.1
Min	0.9	5.9	22.1	14.6
Median	7.2	20.2	30.3	36.0
Max	16.3	32.5	39.9	53.6
Q3	9.5	24.6	33.4	46.1
Mean	7.0	20.0	30.1	37.4
STD	3.9	7.6	5.3	9.9
n	61	19	14	23

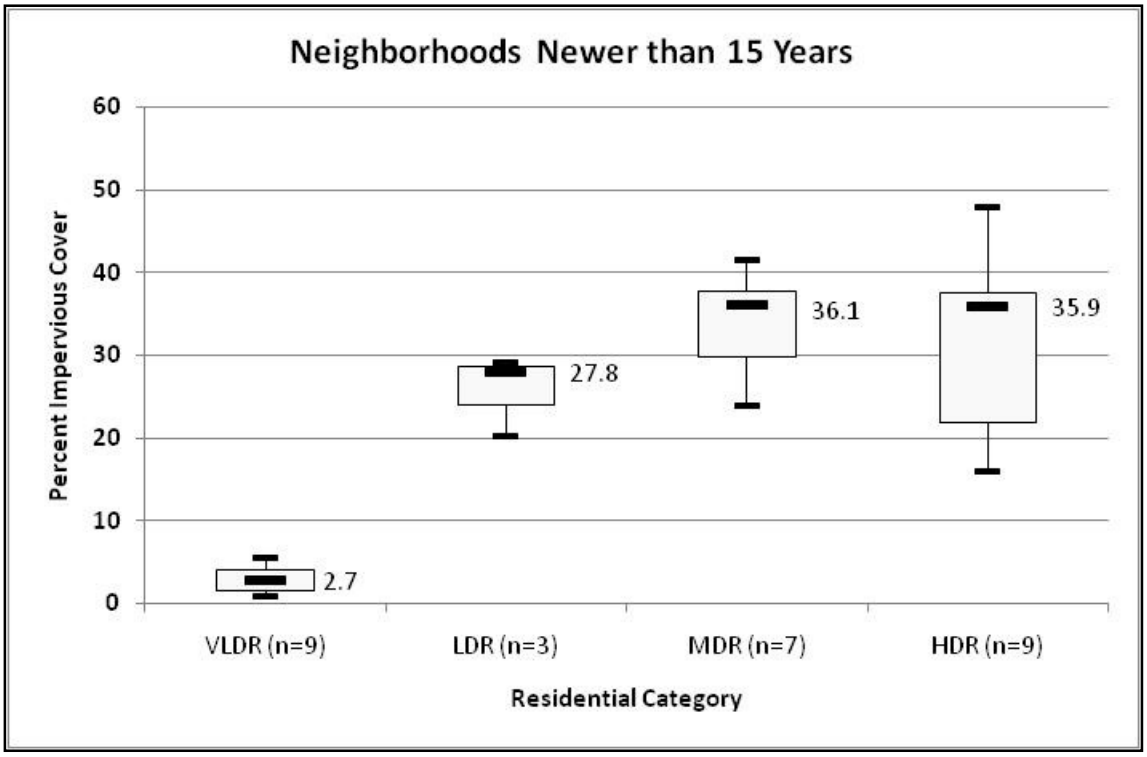


Figure 12. Median, Q1, Q3, minimum, and maximum values for neighborhoods newer than 15 years.

Table 9. Percent Impervious Cover for Neighborhoods Newer than 15 Years

Statistic	VLDR	LDR	MDR	HDR
Q1	1.4	24.0	29.7	21.9
Min	0.9	20.2	23.8	15.9
Median	2.7	27.8	36.1	35.9
Max	5.5	29.2	41.5	47.9
Q3	4.0	28.5	37.7	37.6
Mean	3.0	25.7	33.8	32.3
STD	1.7	4.9	6.2	10.7
n	9	3	7	9

In order to increase the sample size for "newer" development, differences between IC values for neighborhoods newer and older than 25 years were also evaluated. For neighborhoods older than 25 years, median impervious cover coefficients were 8.7%, 16.3%, 30.0%, and 41.7% for VLDR, LDR, MDR, and HDR, respectively (Figure 14, Table 10). For neighborhoods newer than 25 years, median impervious cover coefficients were 4.1%, 23.2%, 32.3% and 35.9% for VLDR, LDR, MDR, and HDR, respectively (Figure 15, Table 11). For this analysis, median impervious cover coefficients for the LDR and MDR were greater in developments newer than 25 years. Median impervious cover coefficients for the VLDR and HDR were greater in developments older than 25 years.

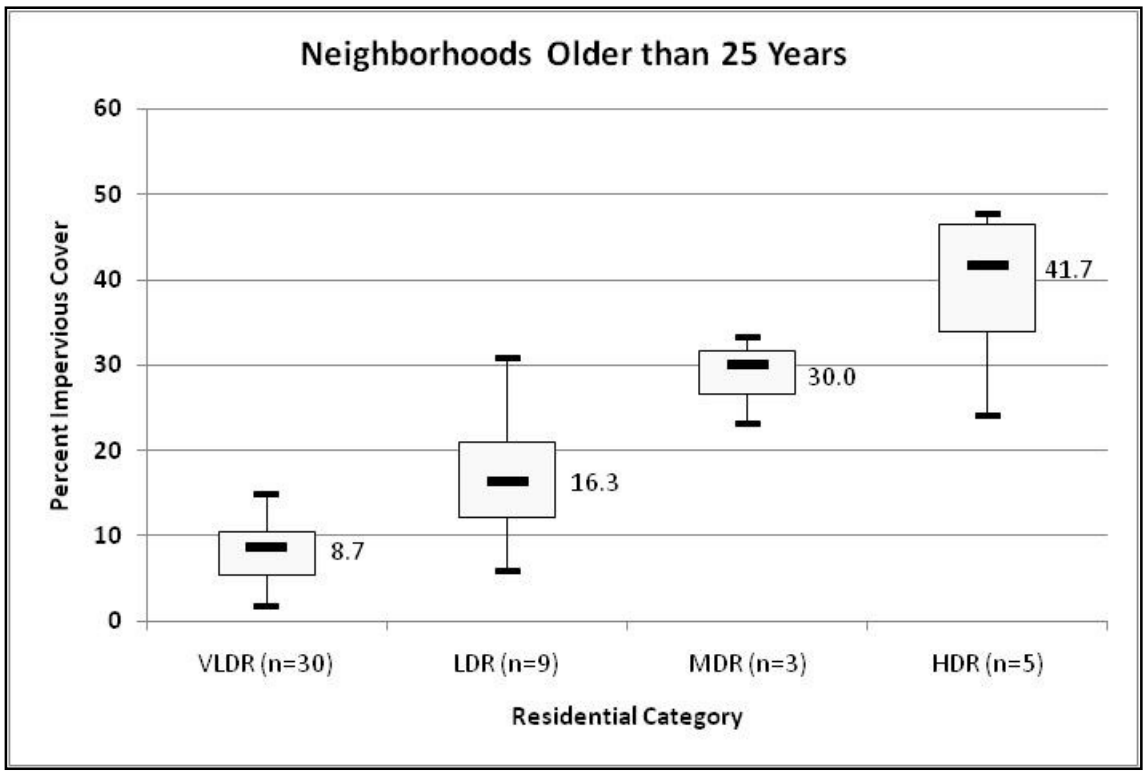


Figure 13. Median, Q1, Q3, minimum, and maximum values for neighborhoods older than 25 years.

Table 10. Percent Impervious Cover for Neighborhoods Older than 25 Years

Statistic	VLDR	LDR	MDR	HDR
Q1	5.4	12.2	26.6	33.9
Min	1.7	5.9	23.2	24.0
Median	8.7	16.3	30.0	41.7
Max	14.9	30.9	33.3	47.6
Q3	10.4	21.0	31.7	46.5
Mean	8.0	17.3	28.8	38.7
STD	3.4	7.9	5.2	9.8
n	30	9	3	5

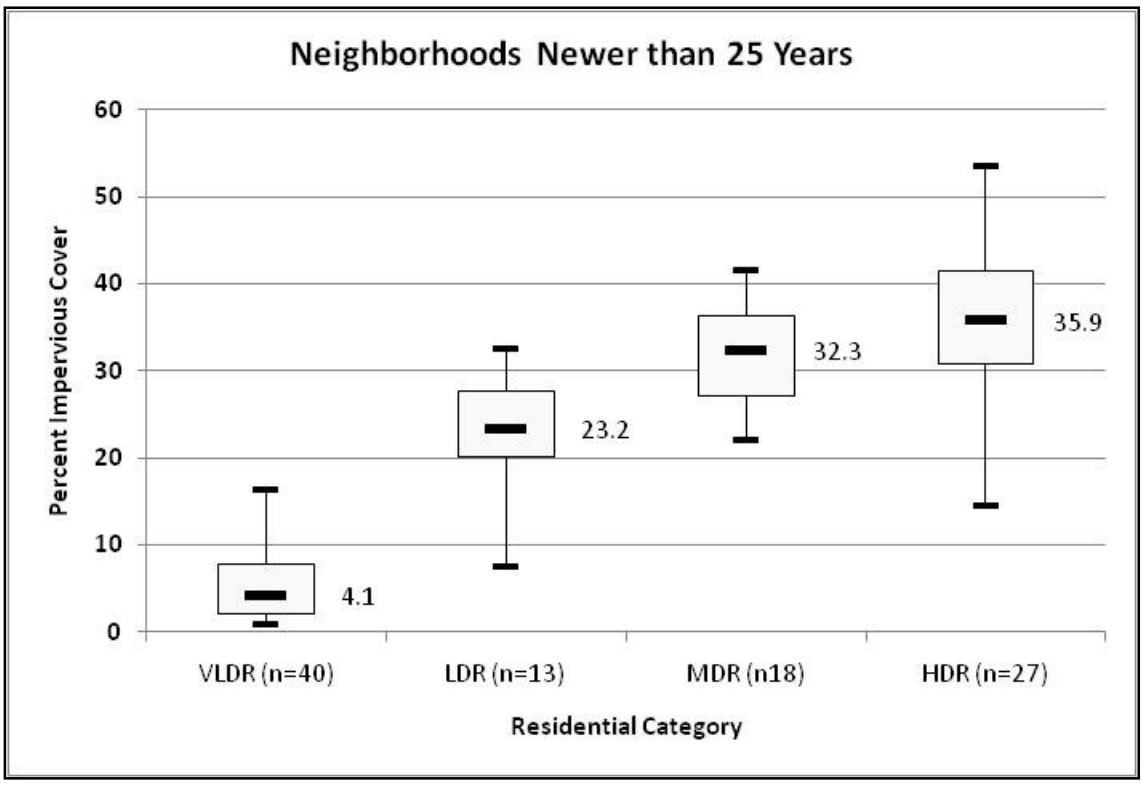


Figure 14. Median, Q1, Q3, minimum, and maximum values for neighborhoods newer than 25 years.

Table 11. Percent Impervious Cover for Neighborhoods Newer than 25 Years

Statistic	VLDR	LDR	MDR	HDR
Q1	2.1	20.2	27.1	30.8
Min	0.9	7.5	22.1	14.6
Median	4.1	23.2	32.3	35.9
Max	16.3	32.5	41.5	53.6
Q3	7.8	27.6	36.4	41.5
Mean	5.4	23.3	31.7	35.5
STD	3.9	6.3	5.9	10.4
n	40	13	18	27

Based on changes in development patterns over the years, the results showed that older developments were likely to have lower IC than newer developments; however, this was only true for the MDR and LDR land use categories. This may be due in part to the range of ages sampled (nothing prior to 1970), or to changes made by Frederick County MD as a result of a Site Planning Roundtable in 2000, or the nature of the VLDR category (estate homes). Further analysis is needed to hypothesize the specific reason for the lack of IC increase for the newer VLDR and HDR land use categories.

The data provided by the Center for Watershed Protection regarding the breakdown of different types of impervious surfaces within residential land uses were used to calculate a composite pollutant concentration. The concentrations assigned to a specific land use, coupled with the percent of watershed comprised of that particular land use, allowed for a weighted average concentration to be calculated. These results are displayed in Table 12.

Table 12. Representative pollutant concentrations for residential land uses of various ages.

	After 1995		Before 1995	
	TN	**TP**	**TN**	**TP**
2-ac lots	2.22	0.44	2.19	0.43
1-ac lots	2.12	0.43	2.15	0.43
½-ac lots	2.06	0.43	2.11	0.43
¼-ac lots	2.00	0.42	2.07	0.43
⅛-ac lots	1.98	0.43	2.02	0.43
Townhomes	1.94	0.42	1.94	0.42
Multi-family	1.92	0.41	1.92	0.41

BMP Efficiency: Median Effluent Concentration Method

There are several methods for quantifying the efficiency of a best management practice (BMP). The method used by the JLSLAT is based upon a median effluent concentration of a given pollutant for a given BMP. This value will vary based upon the pollutant and the type of BMP. The concentrations used for the JLSLAT application will be explained in detail in the "Watershed Characteristics" section of this document.

To apply this BMP efficiency method, one must know the volume of water flowing into a BMP, the inflow concentration of the pollutant of interest, the percent of inflow volume that leaves the BMP as treated outflow and untreated overflow, as well as the outflow pollutant concentration for both of these outflow components. Assumptions made regarding these variables for the JLSLAT are discussed in detail in the "Watershed Characteristics" section of this document. Equation 4 is used to calculate total mass of pollutant leaving the BMP and Equation 5 is used to calculate the percent mass removal by the BMP.

$$Mass_{out} = (EC_{outflow} * Volume_{outflow} * 6.2297E\text{-}5) + (EC_{overflow} * Volume_{overflow} * 6.2297E\text{-}5) \quad (4)$$

where $Mass_{out}$ = average annual mass of pollutant leaving the BMP (lbs),
$EC_{outflow}$ = event median concentration for treated outflow portion of outflow (mg/L),
$Volume_{outflow}$ = volume of water leaving the BMP as treated outflow (ft^3),
$EC_{overflow}$ = event median concentration for untreated overflow portion of outflow (mg/L), and
$Volume_{overflow}$ = volume of water leaving the BMP as untreated overflow (ft^3).

$$BMP_{\%rem} = ((EC_{inflow} * Volume_{inflow} * 6.2297E\text{-}5) - Mass_{out}) \div (EC_{inflow} * Volume_{inflow} * 6.2297E\text{-}5) * 100 \quad (5)$$

where EC_{inflow} = event median concentration for inflow (mg/L), and
$Volume_{inflow}$ = volume of water entering the BMP (ft^3).

There are some assumptions regarding this BMP efficiency metric:

(1) The effluent concentration is the median value of the concentrations exiting the BMP. This metric does not take into account maximum or minimum concentrations and the representative EC does not vary with storm size or intensity.
(2) This metric assumes the BMP is designed and constructed appropriately to capture and treat the first flush (1 inch for non-CAMA locations, 1.5 inch for CAMA locations).
(3) The outflow EC is not dependent upon the inflow EC, nor the inflow volume or outflow volume.
(4) Due to the nature of the metric, the pollutant removal is controlled primarily by the volume reduction provided by the BMP; thus, BMPs with higher volume reductions will have greater pollutant removal capabilities.

Determining BMP Median Effluent Concentrations

A literature review was conducted to establish representative effluent concentrations for the BMPs in the JLSLAT. Only peer-reviewed literature was considered in this endeavor and only studies conducted in the Mid-Atlantic states were used (Georgia, South Carolina, North Carolina, Virginia, Maryland). Outliers were excluded from data sets for each BMP type and the median of the reported effluent concentrations was calculated. Green roofs, permeable pavement, and water harvesting effluent values were assumed to be the same as the concentrations entering the BMP. These results are shown in Table 13.

Table 13. Median effluent concentrations assigned to BMPs.

BMPs	TN EMC (mg/L)	TP EMC (mg/L)
Bioretention with IWS	0.95	0.12
Bioretention without IWS	1.00	0.12
Dry Detention Pond	1.20	0.20
Grassed Swale	1.21	0.26
Green Roof	1.08	0.15
Level Spreader, Filter Strip	1.20	0.15
Permeable Pavement	1.44	0.39*
Sand Filter	0.92	0.14
Water Harvesting	1.08	0.15
Wet Detention Pond	1.01	0.11
Wetland	1.08	0.12

*If replacing commercial parking lot, value is 0.16 mg/L.

Volume reductions were an integral part of calculating effluent loads from a given BMP. The volume reduction values assigned to each BMP type varied based upon the physiographic region. These assignments are displayed in Table 14 and are expressed as percent of the inflow volume.

Table 14. Fate of BMP inflow in terms of treated outflow, overflow and loss via ET/infiltration.

BMP Type	Treated Outflow (%)	Bypass (Overflow) (%)	Volume Reduction (%)
CAMA Region			
Bioretention with IWS	10	10	80
Bioretention without IWS	40	10	50
Dry Detention Pond	80	10	10
Grassed Swale	90	0	10
Green Roof	0	50	50
Level Spreader, Filter Strip	45	5	50
Permeable Pavement	38	2	60
Sand Filter	85	10	5
Wet Detention Pond	75	10	15
Wetland	65	10	25
Coastal Region			
Bioretention with IWS	10	10	80
Bioretention without IWS	40	10	50
Dry Detention Pond	80	10	10
Grassed Swale	90	0	10
Green Roof	0	50	50
Level Spreader, Filter Strip	45	5	50
Permeable Pavement	38	2	60
Sand Filter	85	10	5
Wet Detention Pond	75	10	15
Wetland	65	10	25
Mountains Region			
Bioretention with IWS	40	10	50
Bioretention without IWS	55	10	35
Dry Detention Pond	90	10	0
Grassed Swale	100	0	0
Green Roof	0	50	50
Level Spreader, Filter Strip	55	5	40
Permeable Pavement	98	2	0
Sand Filter	85	10	5
Wet Detention Pond	80	10	10
Wetland	70	10	20

BMP Type	Treated Outflow (%)	Bypass (Overflow) (%)	Volume Reduction (%)
Piedmont Region			
Bioretention with IWS	40	10	50
Bioretention without IWS	55	10	35
Dry Detention Pond	90	10	0
Grassed Swale	100	0	0
Green Roof	0	50	50
Level Spreader, Filter Strip	55	5	40
Permeable Pavement	98	2	0
Sand Filter	85	10	5
Wet Detention Pond	80	10	10
Wetland	70	10	20
Sandhills Region			
Bioretention with IWS	10	10	80
Bioretention without IWS	40	10	50
Dry Detention Pond	80	10	10
Grassed Swale	90	0	10
Green Roof	0	50	50
Level Spreader, Filter Strip	45	5	50
Permeable Pavement	38	2	60
Sand Filter	85	10	5
Wet Detention Pond	75	10	15
Wetland	65	10	25
Triassic Basin Region			
Bioretention with IWS	55	10	35
Bioretention without IWS	75	10	15
Dry Detention Pond	80	20	0
Grassed Swale	100	0	0
Green Roof	0	50	50
Level Spreader, Filter Strip	75	5	20
Permeable Pavement	98	2	0
Sand Filter	85	10	5
Wet Detention Pond	85	10	5
Wetland	75	10	15

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Appendix A.

Table A1. Raw data used to compute representative pollutant concentrations for various land uses.

Land Use Type	Site	TN (mg/L)	TP (mg/L)	Reference
Residential				
Driveway	industrial pl/driveway	0.39	1.44	Bannerman 2003; Passeport and Hunt, 2009
Roof	residential roof	0.15		Bannerman, 1993
	commercial roof	0.20		Bannerman, 1993
	industrial roof	0.11		Bannerman, 1993
	Gold 5/6	0.35		Moran, 2004
	Gold 7/23	0.05	2.10	Moran, 2004
	Gold 9/4	0.05	1.29	Moran, 2004
	Gold 9/18	0.05	0.71	Moran, 2004
	Gold 12/10	0.05	0.80	Moran, 2004
	Gold	0.05	0.70	Moran, 2004
	Raleigh	0.17	0.93	Hunt thesis
	Raleigh	0.13	1.11	Hunt thesis
	Raleigh	0.16	0.91	Hunt thesis
	Raleigh	0.46	1.39	Hunt thesis
	Raleigh	0.18	0.83	Hunt thesis
Lawn		0.28	1.42	Tar-Pamlico Nutrient Loading Model
		0.59	3.06	Skipper, 2008
Commercial				
Parking Lot	Char	0.20	1.83	Passeport and Hunt, 2009
	Kin1	0.10	1.13	Passeport and Hunt, 2009
	Kin2	0.07	1.14	Passeport and Hunt, 2009
	Gre	0.18	1.57	Passeport and Hunt, 2009
	Gold	0.20	1.52	Passeport and Hunt, 2009
	Comm. Lot	0.19		Bannerman, 1993

Roof	residential roof		0.15	Bannerman, 1993
	commercial roof		0.20	Bannerman, 1993
	industrial roof		0.11	Bannerman, 1993
	Gold 5/6		0.35	Moran, 2004
	Gold 7/23	2.10	0.05	Moran, 2004
	Gold 9/4	1.29	0.05	Moran, 2004
	Gold 9/18	0.71	0.05	Moran, 2004
	Gold 12/10	0.80	0.05	Moran, 2004
	Gold	0.70	0.05	Moran, 2004
	Raleigh	0.93	0.17	Hunt thesis
	Raleigh	1.11	0.13	Hunt thesis
	Raleigh	0.91	0.16	Hunt thesis
	Raleigh	1.39	0.46	Hunt thesis
	Raleigh	0.83	0.18	Hunt thesis
Lawn		1.42	0.28	Tar-Pamlico Nutrient Loading Model
		3.06	0.59	Skipper, 2008
Industrial				
Driveway	Parking Lot		0.39	Bannerman, 1993
	Char	1.83		Passeport and Hunt, 2009
	Kin1	1.13		Passeport and Hunt, 2009
	Kin2	1.14		Passeport and Hunt, 2009
	Gre	1.57		Passeport and Hunt, 2009
	Gold	1.52		Passeport and Hunt, 2009

Roof	residential roof		0.15	Bannerman, 1993
	commercial roof		0.20	Bannerman, 1993
	industrial roof		0.11	Bannerman, 1993
	Gold 5/6		0.35	Moran, 2004
	Gold 7/23	2.10	0.05	Moran, 2004
	Gold 9/4	1.29	0.05	Moran, 2004
	Gold 9/18	0.71	0.05	Moran, 2004
	Gold 12/10	0.80	0.05	Moran, 2004
	Gold	0.70	0.05	Moran, 2004
	Raleigh	0.93	0.17	Hunt thesis
	Raleigh	1.11	0.13	Hunt thesis
	Raleigh	0.91	0.16	Hunt thesis
	Raleigh	1.39	0.46	Hunt thesis
	Raleigh	0.83	0.18	Hunt thesis
Lawn		1.42	0.28	Tar-Pamlico Nutrient Loading Model
		3.06	0.59	Skipper, 2008
Transportation				
High Density (interstate, main)		3.67	0.43	Wu et al., 1998
Low Density (secondary, feeder)		1.40	0.52	Wu et al., 1998
Rural		1.14	0.47	Wu et al., 1998
Sidewalk			1.16	Bannerman, 1993
		1.43		Passeport and Hunt, 2009
Other				
Woods		1.47	0.25	Line et al., 2002, median value
Maintained Grass		3.06	0.59	Skipper, 2008
Pasture		3.61	1.56	Line et al., 2002, median value

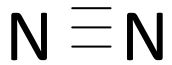
APPENDIX N

The Nitrogen Cycle

Appendix N
The Nitrogen Cycle

Forms of Nitrogen

Although nitrogen is the major pollutant of concern for the Tar-Pamlico River Estuary, it is also a nutrient that is essential for life. The majority of nitrogen on the planet exists as N_2 gas in the atmosphere. In fact, 78% of the volume of the air we breathe is nitrogen. Nitrogen is not a natural constituent of rocks or minerals.



The N_2 molecule has a triple bond, which is the most stable bond known to science. Plants obtain all of the oxygen and carbon they need from the air. However, it is very difficult for a plant to obtain nitrogen from the atmosphere because N_2 gas is so non-reactive.

Very special circumstances are required to break the triple bond in N_2 gas and to convert the nitrogen into forms that most plants can use, as described in the next section. The majority of plants obtain nitrogen from the soil as either nitrate (NO_3) or ammonium (NH_4).

Once in the plant, ammonium can be used directly but nitrate is transformed to the ammonium form using energy derived from photosynthesis. The plant uses nitrogen to form proteins that act primarily to control plant growth processes. A good supply of nitrogen is associated with vigorous growth and a deep green color. Plants deficient in nitrogen become stunted and yellow in appearance.

Nitrogen in plant-available forms is generally scarce under natural conditions. In other words, under natural conditions, nitrogen is a limiting growth factor. Only recently have humans upset the balance by the addition of nitrogen fertilizers and NO_X emissions and by artificially concentrating nitrogen sources such as human and livestock wastes.

Nitrogen is classified as either inorganic or organic nitrogen. At any given time, most of the nitrogen in the soil is in the organic form. Inorganic nitrogen compounds are unstable and nitrogen is constantly returning to the atmosphere in gaseous forms.

Inorganic Forms of Nitrogen

N2: Inert nitrogen gas found in the atmosphere

NO2: Nitrous oxides, is found in the atmosphere and is a component of automobile exhaust and industrial processes

NH3: Ammonia is a volatile gas and often is lost from soil applied ammonium fertilizer and animal manure into the atmosphere

NH4+: Ammonium, is a positively charge cation found in the soil

NO2-: Nitrite, is a negatively charge anion found in the soil

NO3-: Nitrate, is a negatively charge anion found in the soil and at times in the atmosphere

Organic Forms of Nitrogen

Organic sources of nitrogen include proteins and other complex compounds found in living, dead, or decomposing plants and animals.

The Nitrogen Cycle

The conversion of N2 to N compounds and from nitrogen compounds back to N2 is the nitrogen cycle. It has been estimated that it takes from 44 to 220 million years for all nitrogen to pass through the cycle. In 1982, it was estimated that human activities have caused an imbalance in the nitrogen cycle that causes an accumulation of nine million metric tons per year. This accumulated nitrogen can cause pollution problems.

Figure C1 shows a simplified nitrogen cycle in an undisturbed, forested area. In an urban area, human activities add sources of nitrogen other than the ones shown here. Modified nitrogen cycles are shown in Chapter 4 for each of the appropriate nitrogen sources.

Losses of Nitrogen

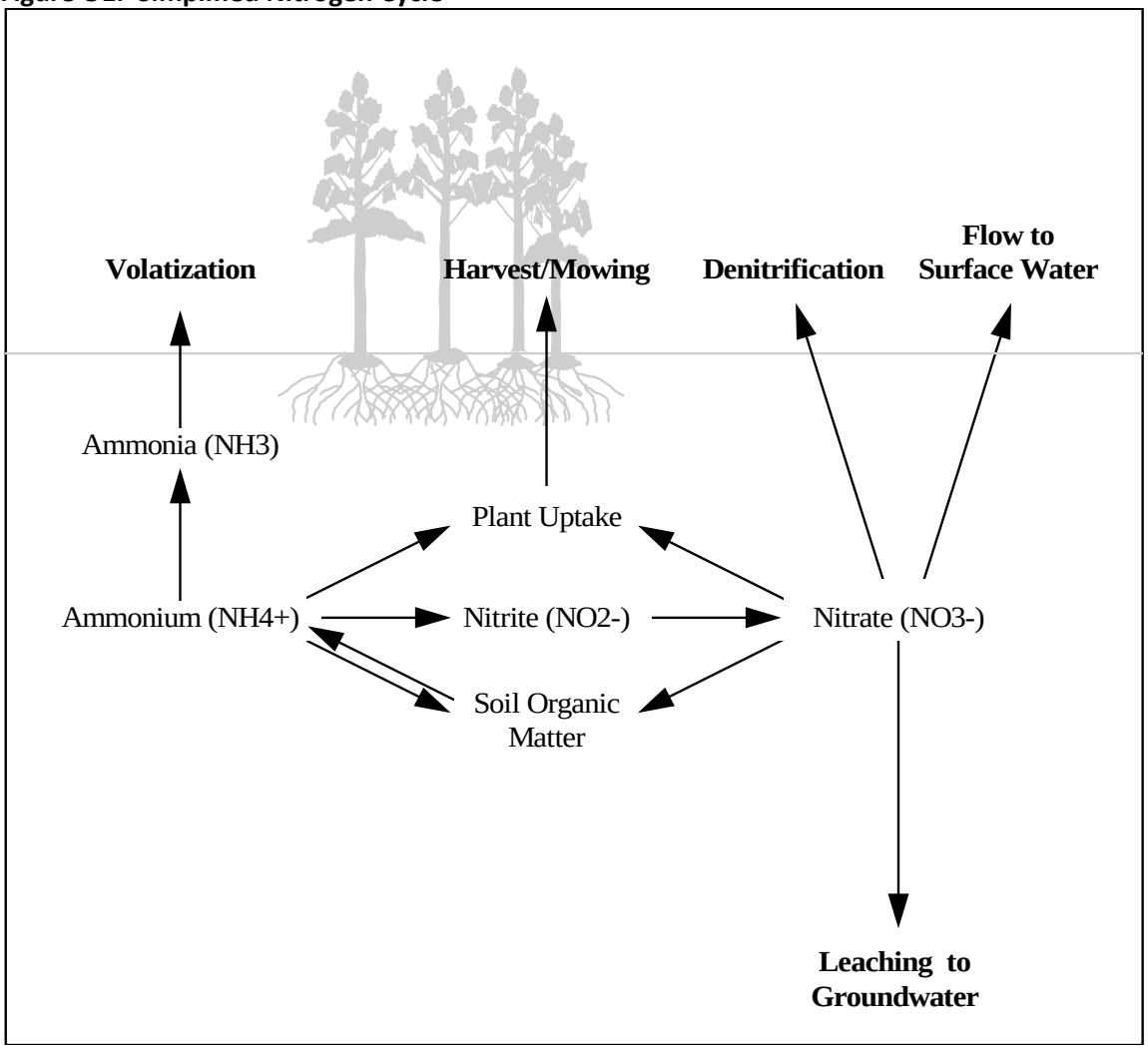
Nitrogen can be easily lost into the environment by various pathways. Those pathways include volatilization, leaching and runoff, and crop removal.

Volatilization, or the gaseous loss of ammonia, may occur under certain conditions with ammonia fertilizers. In situations where the soil is pH alkaline, or where limestone has recently been applied on acid soils, applications of ammonium fertilizer may result in the transformation of ammonium (NH4) to ammonia (NH3) which may be lost to the atmosphere. Urea fertilizers are particularly likely to volatilize. This situation can be avoided by incorporating these fertilizers into the soil in the case of soils with alkaline pH or waiting at least one month after limestone applications to surface apply ammonium fertilizers.

Leaching and Runoff are other important sources of nitrogen loss. Leaching occurs when inorganic forms of nitrogen, particularly nitrite (NO2) and nitrate (NO3) are solubilized and carried with water through the soil profile or with surface waters. Factors that contribute to nitrite and nitrate leaching or runoff include the following:

- Heavy, one-time applications of N fertilizers on sandy textured soils.
- Over applications of manure or sludge to land.
- Improperly timed applications of N fertilizer.
- Poorly designed or nonexistent soil conservation measures.
- Periods of exceptionally heavy rain.

Figure O1. Simplified Nitrogen Cycle



Harvest and Mowing are very important ways that nitrogen is lost. If crops are harvested and removed, there is a net loss to the farm's balance sheet for nitrogen. However, if crop residues or lawn clippings are saved and returned to the soil, some of the nitrogen will be recycled.

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APPENDIX O

Sources of Nitrogen in Developed Areas

Appendix O
Sources of Nitrogen in Developed Areas

Sources of Nitrogen

Water quality data from large municipalities in North Carolina clearly show that nitrogen loading is a problem in streams with entirely urban watersheds. Therefore, it is necessary and equitable for urban areas to address their nonpoint sources of nitrogen. An additional benefit of implementing practices to control nitrogen is that these practices are effective for a wide range of other pollutants, such as sediment, heavy metals, oil and grease, and bacteria.

Based on the present research, it appears that there are four major sources of nitrogen contributed by urban areas. These sources are:

- Atmospheric deposition
- Fertilizer
- Human waste
- Animal waste

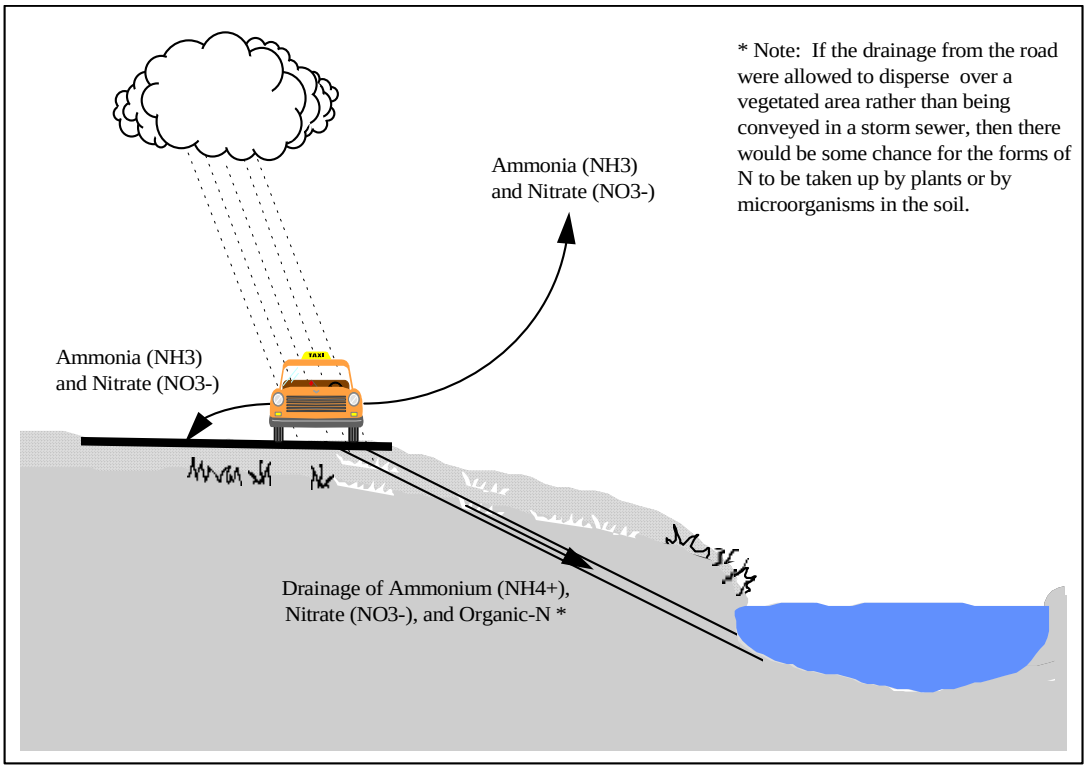
Atmospheric Deposition

Scientific evidence shows that atmospheric deposition is a significant source of nitrogen loading in urban areas. In fact, researchers in the Metropolitan Washington area believe that have shown that washoff of nitrate deposited on impervious surfaces from the atmosphere account for the *majority* of nitrogen in urban streams (MWCOG 1983).

Although atmospheric deposition occurs on all types of land areas, nitrogen deposited on urban areas is more likely to enter surface waters than nitrogen deposited on forests and farms. Urban areas contain impervious surfaces such as roofs, driveways and roads that quickly channel runoff and associated pollutants directly to surface waters with no opportunity for interception or uptake. Impervious surfaces that are drained by storm sewer systems generally have pollutants carried directly into surface waters. Urban roads also have a greater number of local emissions sources, resulting in greater deposition on them than on the landscape as a whole. Figure P1 illustrates nitrogen pathways for impervious areas drained by curb and gutter.

Another reason why atmospheric deposition is a more significant source of nitrogen in urban areas is that urban soils are often heavily compacted and thus can function almost as an impervious surface themselves. Information on how to maintain urban soils and lawns is offered in the next section.

Figure P1. Nitrogen Pathways for Impervious Areas Drained by Curb and Gutter



Impervious areas associated with transportation, such as driveways, roads, and parking lots are usually greater sources of nitrogen than rooftops. Rooftop runoff, particularly in residential areas, is usually spread out over pervious yards that are not directly connected to the storm drain system. During smaller storms, rooftop runoff can infiltrate into the soil, and less runoff and pollutants are delivered to the stream.

Scientists from the Center for Watershed Protection estimate that the annual TN load from a parking lot is 15.4 lb/ac/yr (Schueler 1995). It is likely that roads with curb and gutter have similar export coefficients. According to recent DWQ estimates, the overall annual TN load from urban areas is 6.7 lb/ac/yr (1996). DWQ's estimated annual TN load includes not only contributions from parking lots and roads, but also nitrogen from construction areas, onsite wastewater treatment, and solid waste disposal (DWQ 1996). The large difference between the estimated loads suggests that transportation-related imperviousness is a significant source of nitrogen.

There is also evidence that nitrogen loads increase as average daily traffic volume increases. Runoff monitoring by the Federal Highway Administration (1990) indicates that highways with average daily traffic volume below 30,000 were found to have a 40% lower concentration of nitrate-N than highways with average daily traffic volume exceeding 30,000.

In summary, the available data indicate that:

- The transport of atmospheric nitrogen from land to surface waters is a major contributor of nitrogen to urban streams, and
- Reducing transport-related imperviousness in urban areas is likely to play an important role in reducing the deposited nitrogen that moves from urban land to surface waters.
- Minimizing the use of curb and gutter with storm sewer will also reduce the deposited nitrogen that moves from urban land to surface waters, and
- Reducing vehicle use in urban areas will reduce the amount of deposited nitrate nitrogen that could possibly be transported to surface waters.

In addition to reducing the amount of nitrogen moving into surface waters, reducing transportation-related imperviousness, minimizing curb and gutter, and reducing vehicle use all save money. For example, the cost of providing residential infrastructure such as roads, sidewalks, driveways, and parking spaces, generally constitutes about half of the cost of residential subdivision (Schueler 1995).

Reducing road widths, parking lot sizes, and the use of curb and gutter are important steps to reduce the contribution of nitrogen from atmospheric deposition. In addition, these measures will reduce loadings of many other pollutants, including phosphorous, bacteria, oxygen-demanding substances, and heavy metals. The next chapter on new approaches for planning development describes steps that can be taken on a larger scale to reduce overall impervious area.

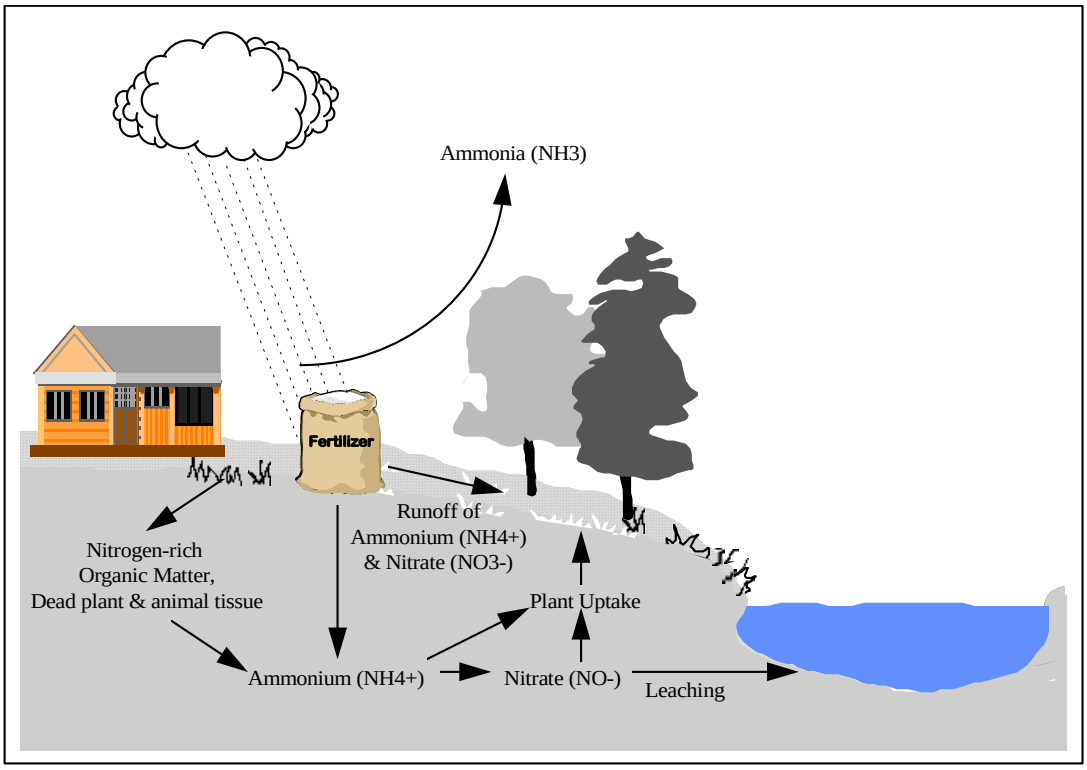
Fertilizers

Well-managed lawns and landscaped areas help protect water quality in urban areas by reducing soil erosion, moderating air temperatures, and filtering pollutants. However, the fertilizers used to maintain these natural areas can pollute urban waters. An important component of improving fertilizer and pesticide use in urban areas is public awareness and education.

Studies suggest that a large number of lawn acres are regularly fertilized without determining the need for nutrient addition. A study found that 79% of Virginia homeowners use fertilizers, but less than 20% of them had their soil tested (Aveni 1994). This study found that product labels are the number one information source for homeowners, while the Cooperative Extension Service ranked last. While all labels indicate how many square feet the label should cover, each takes a different approach on how often the product should be applied. Most label instructions do not mention soil testing.

The nitrogen cycle of fertilizer used on urban lawns is diagrammed in Figure P2.

Figure P2. N Cycle of Fertilizer Use on Urban Lawns



Considering privately and publicly managed lawns, Schueler estimates that about a third of all vegetated areas in the urban landscape can be classified as "high input," meaning that they receive high rates of irrigation and fertilizer application (1995).

Based on studies by the Center for Watershed Protection (Barth 1995):

- homeowners fertilizing their own lawns apply 44-261 pounds/acre/year of nitrogen
- home lawn companies apply 194-258 pounds/acre/year of nitrogen.

Although many homeowners are applying fertilizers with incomplete information, lawn care companies appear to be applying an equal or greater amount of fertilizer. Lawn care companies usually offer service plans that consist of five or more visits per year. Unless a customer specifically requests a soil test or a special application rate, most lawn companies give every lawn serviced the same rate of fertilization (Morton 1988).

The travel distance between lawns and impervious areas can be short. Lawns with compacted soil, bare spots, steep slopes, and channelized areas have increased flow of fertilizer off the lawn. Leaching can also be a significant source of nitrogen in areas with sandy soils where lawns are overwatered and overfertilized (Cohen et al. 1990). In areas where soils are highly compacted, fertilizer can run off lawns

easily. Also, lawns in urban areas are frequently interlaced with driveways, roads, and parking lots, which increase the chance for fertilizer to enter into storm sewers.

A review of three nitrate-leaching studies by turfgrass researchers generally shows that grass, when managed properly, can retain nitrogen fertilizer at the soil surface or within the root zone and thus prevent soluble nitrates from percolating downward into the environment. All soils were sandy or silty loam. The results of the study are given in Table P1. This research strongly suggests that efforts to educate homeowners about lawn care should stress the critical connection between fertilization and overwatering. The concept that careless watering can flush nitrogen throughout the soil and away from the grass should be strongly emphasized on both economic and environmental grounds.

Another important factor that affects fertilizer use is soils. Development usually involves grading the entire site, removing topsoil, erosion during construction, compaction by heavy equipment, and filling of depressions. Thus, urban soils tend to be highly compacted, poor in structure, and low in permeability. As a result, urban areas often produce more runoff than before they were disturbed and thus have more potential to lose fertilizer. A good lawn care program should also address soil building.

Some management strategies that would contribute to a reduction in urban nitrogen from fertilizer use are:

- Use fertilizers that are composed of slow-release sources of nitrogen. Products containing slow-release sources of nitrogen are usually called one or more of the following terms: water-insoluble, slow-release, controlled-release, or slowly-available water soluble.

- Lightly water after fertilizer application to allow penetration and reduce the potential for runoff.

- Use drop (gravity) type spreaders rather than centrifugal (rotary) type spreaders so that fertilizer will not be deposited on impervious surfaces.

- Aerate lawns to reduce surface runoff. Also, aeration results in a healthier lawn that does not require as many nutrient inputs. Aerating the soil can reduce the potential for nitrogen export when the soil is compacted or the lawn is on a slope or in a natural drainage area.

- Select the appropriate grass species to reduce the need to add nitrogen to the lawn.

- Water lawns only when they need it. When lawns are very thirsty, grass will lie flat and leave footprints when walked on, shrubs will droop or drop leaves and look wilted. Watering less often actually promotes deeper, more tolerant root systems (Alliance for the Chesapeake Bay 1994).

- Do not fill fertilizer applicators over a hard surface. Make sure that the spreader is off when passing over driveway, sidewalk, patio, etc. Clean up any spills immediately.

- Expansive lawn areas can be replace with equally attractive, efficient landscape alternatives, such as appropriate shrubs or ground covers that require less maintenance (Alliance for the Chesapeake Bay 1994).

- Involve the public and golf community in decisions that affect water quality. Perhaps they would be willing to accept a few brown patches in exchange for knowing that the course is not harming water quality.

Table P1. Nitrate Levels in Soil Water Depending on Turf Management Strategies *(from Schueler 1994)*

Grass type	**Irrigation**	**Management**	**N applied (lbs/ac/yr)**	**N conc. (mg/l)**	*Researcher*
Tall Fescue/ Bluegrass	not watered	Clippings removed	none	0.33	Gross et al. 1990 Maryland
Bluegrass	overwatered	Clippings left	none	0.36	Morton et al. 1988 Rhode Island
Bluegrass	slightly watered	Clippings left	none	0.51	Morton et al. 1988 Rhode Island
Tall Fescue/ Bluegrass	not watered	Granular fert. Clippings removed	196	0.85	Gross et al. 1990 Maryland
Bluegrass	slightly watered	Clippings left	86	0.87	Morton et al. 1988 Rhode Island
Tall Fescue/ Bluegrass	not watered	Liquid fert. Clippings removed	196	1.02	Gross et al. 1990 Maryland
Kentucky bluegrass	watered	Seeded clippings left	194	1.09	Geron et al. 1993 Ohio

Bluegrass	slightly watered	Clippings left	217	1.24	Morton et al. 1988 Rhode Island
Bluegrass	overwatered	Clippings left	86	1.77	Morton et al. 1988 Rhode Island
Kentucky bluegrass	watered	slow release clippings left	194	1.84	Geron et al. 1993 Ohio
Kentucky bluegrass	watered	early season fert. Clippings left	194	2.27	Geron et al. 1993 Ohio
Kentucky bluegrass	watered	late season fert. Clippings left	194	2.30	Geron et al. 1993 Ohio
Kentucky bluegrass	watered	fast release clippings left	194	2.74	Geron et al. 1993 Ohio
Kentucky bluegrass	watered	Sodded clippings left	194	3.50	Geron et al. 1993 Ohio
Bluegrass	overwatered	Clippings left	217	4.02	Morton et al. 1988 Rhode Island

Human Waste

Conventional septic systems are comprised of a septic tank, a distribution system, and a soil absorption system. In the septic tank, anaerobic bacteria digest organic matter, solids settle to the bottom, and low-density compounds such as oil and grease float to the water surface. Partially-treated wastewater then leaves the septic tank and enters the distribution box, where it is discharged into the soil absorption systems, also known as the drainage field.

In the drainage field, effluent percolates through the soil and remaining pollutants -- nutrients, suspended solids, bacteria, viruses, and organic/inorganic compounds -- are removed by filtration, adsorption, and microbial degradation (AGWT 990). The absorption system consists of a network of perforated pipes located in shallow trenches covered with backfill. Gravel usually surrounds the piped to encourage even distribution of the effluent into soil.

Even properly functioning septic systems can deliver significant pollutant loads to groundwater. The most common shortcoming of conventional septic systems is their inability to remove much nitrogen. It is not uncommon for the effluent leaving a typical system to have a total nitrogen concentration of 40 to 60 mg/l, primarily in the form of ammonia and organic nitrogen (CBO 1992). Once in the drainage field, organic nitrogen forms are easily converted into nitrates, which are quite soluble and easily mobilized, thus increasing the potential for ground and surface water contamination.

Some problems with septic system performance are related to what goes into them. Household chemicals entering a septic tank can kill organic-consuming bacteria or cause sludge and scum to be flushed out into the drainfield. Such chemicals can include various readily available septic system additives, which ironically are advertised as having the ability to improve system performance. Not only are some household chemicals detrimental to the septic system itself, but they often reach ground or surface waters where they cause toxicity problems.

Normal amounts of detergents, bleaches, drain cleansers, and toilet bowl deodorizers, however, can be used without causing harm to bacterial action in the septic tank (AGWT 1990). Properly operating septic systems must be located in a way to ensure both lateral distance between surface waters and vertical separation to groundwater. Also, drainfield areas must become larger when soils are not permeable or slopes are steep. Larger volumes of wastewater require larger drainfields.

Unfortunately, many conventional septic systems have been constructed in areas poorly suited for their proper operation. Many were installed before the need for separation distance was understood or because no other wastewater treatment option was available.

Septic systems are suspected of contributing nutrients through subsurface flow. Malfunctioning systems may increase the nutrient loading beyond the assimilative capacity of the site soils and vegetation. This may result in excess nutrients being conveyed to surface waters via groundwater and subsurface flow of infiltrated stormwater.

While alternative systems have some benefits over conventional septic systems, it is important to recognize that no system can simply be installed and forgotten. Regular inspection and maintenance is a necessity. For example, septic tanks should be periodically pumped out, since solids and sludge tend to accumulate over time. North Carolina does not require regular pumpouts of conventional septic systems.

Alternative on-site wastewater treatment designs are attractive because of their decreased reliance on site conditions and their ability to remove pollutants that cannot be removed by conventional systems. Two options that are particularly promising for nitrogen removal are recirculating sand filters and constructed wetlands.

Table P2. Pollutant loadings from Septic Systems (Schueler, 1995)

On-site wastewater treatment system	TN (%)	TSS (%)	BOD (%)	Pathogens (Logs)	Capital ($/house)	Maint. ($/house/yr)
Conventional septic system	28	72	45	3.5	$4,500	$70
Recirculating sand filter	64	90	92	2.9	$3,900	$145
Constructed wetlands	90	80	81	4.0	$710	$25

To reduce the contribution of nitrogen from septic systems, the following measures are recommended:

- Homeowners should not use garbage disposals or pour grease down the drain.

- Septic systems should be inspected at least once every two years and pumped as needed (time interval varies with size, use, and operation).

- DWQ, DEH, and local health departments should increase educational efforts for homeowners to properly operate and maintain septic systems and other on-site wastewater treatment systems.
- DWQ, DEH, and local health departments should encourage installation of innovative on-site wastewater treatment systems where they are appropriate and where there is a commitment to ongoing care and maintenance.

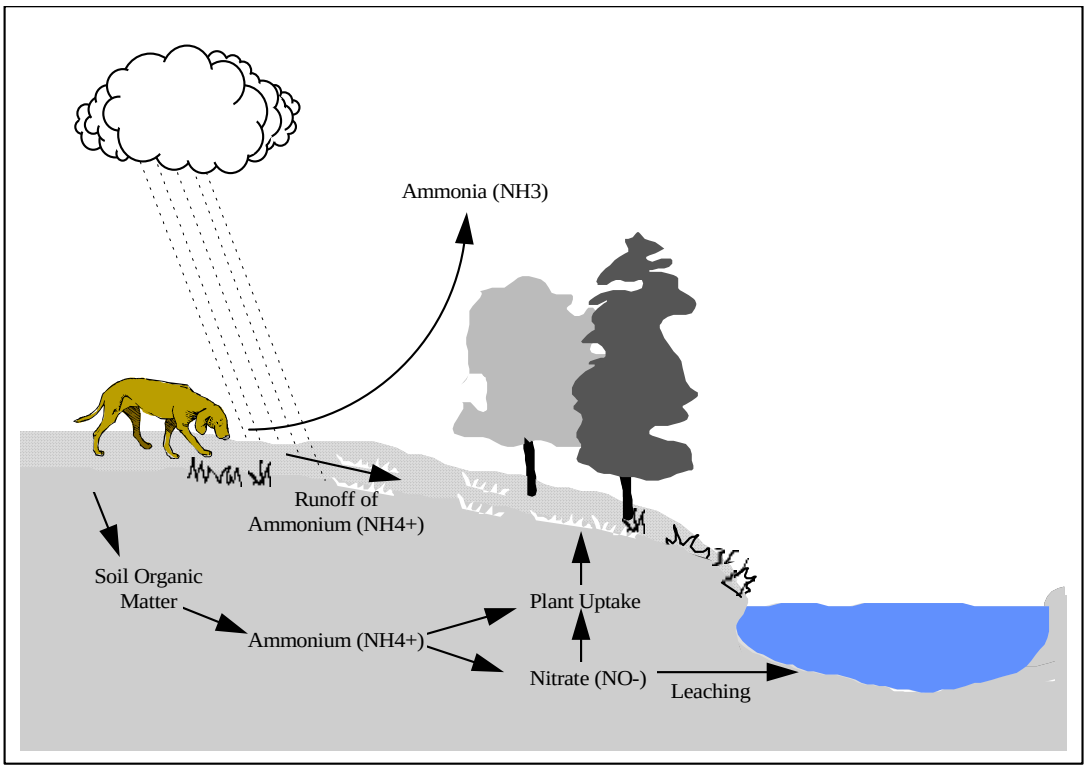
- DWQ, DEH, local health departments, and community groups should increase surveillance of their local streams to help to identify areas where on-site wastewater treatment systems are failing.

Another source of nitrogen from human waste is overflowing sanitary sewers. Often, maintaining infrastructure such as sanitary sewers does not receive a high priority for funding. Sometimes flow data at wastewater treatment plants indicates that there is a problem with leaking sewer lines, however it is extremely difficult to pinpoint the sources of the problem. It is recommended that this issue be addressed in this model program by educating citizens about how to detect and report an overflowing sanitary sewer line.

Animal Waste

Like human wastes, pet wastes also present a concentrated source of nutrients, bacteria, and oxygen-demanding substances. If these wastes are not disposed of properly, they often enter storm sewers without any treatment. In fact, some pet owners actually deposit their pet's waste into storm drains. Figure P3 shows the nitrogen cycle of pet wastes in urban areas.

Figure P3. N Cycle of Pet Waste in Urban Areas



To reduce the contribution of nitrogen from pet wastes, the following measures are recommended:

- Pet owners should use proper disposal methods such as putting waste in the trash (some landfills prohibit animal wastes) or burying waste in the yard or using a pre-fabricated pet waste disposal unit (this may relocate the contribution from surface to subsurface nutrient loading).
- The public should be educated about proper methods of disposing of pet wastes.
- Storm drain stenciling can remind citizens that storm drains go directly to streams.
- Local ordinances should require proper pet waste disposal.

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APPENDIX P

Land Use Planning and Design Techniques

Appendix P
Land Use Planning and Design Techniques

Reducing Road Widths

In many instances, road widths are required to be wider than needed to safely convey traffic through residential and commercial areas. Although these wide widths are often adopted to increase safety for automobiles, they often increase speeds through residential areas and, in so doing, may decrease safety for pedestrians and cyclists. Also, some jurisdictions require curb and gutter for aesthetic reasons where it is not actually necessary to control stormwater runoff. This can result in increased flooding and also eliminates the potential for stormwater runoff control and treatment that can occurs in properly designed and maintained roadside swales.

Most local governments model their residential street design standards after state and/or federal highway criteria, although the traffic capacity and function of their street system is considerably different from highways. Very few communities recognize any local road categories that are different from established state and federal street categories. Many local traffic engineers have simply accepted the notion that wider streets adequately address these concerns and that wide streets are safe streets (Schueler 1995).

Narrower road widths can reduce the road surface area by up to 35 percent.

A number of communities have implemented standards that promote narrower residential streets and have concluded this to be an attractive, safe and environmentally beneficial alternative.

Communities should also review their standards for turnarounds to reduce the need or unnecessary road surface. One of the most common types of turnaround is a cul-de-sac that may have a diameter of 80 to 100 feet or more (Schueler 1995). Some communities are recognizing that this is excessive and are choosing alternatives that create less impervious cover, such as T-shapes. A 60-foot by 30-foot T-shaped turnaround creates only about 36% as much impervious area as an 80-foot diameter cul-de-sac and is more than adequate for most vehicles.

Local governments should: (1) examine community regulations governing road width and turnaround size; (2) evaluate if the specified widths are necessary; and (3) where feasible, make changes to reduce unnecessary road surfaces.

Reducing Minimum Parking Requirements

Parking lots are often designed to accommodate parking needs on the busiest days of the year. For example, shopping center parking areas are often big enough to handle the busy holiday times, but then sit vacant for much of the rest of the year. This can result in increased nitrogen load (as opposed to maintaining open space).

Some management strategies that would contribute to a reduction in urban nitrogen from parking lots:

- Use angles and smaller parking spaces.

- Use more pervious construction materials in seldom-used parking areas (Land of Sky 1995).
- Provide public transportation to shopping centers during the peak holiday times and encourage people to use it.
- Design parking areas to drain in sheet flow into stable vegetated areas.

Minimizing Use of Curb and Gutter

Runoff is conveyed along streets and parking areas in one of two ways, either (a) in an open drainage channel located in the right of way, or (b) in an enclosed storm drain located under the street or right of way. The use of an open channel or storm drain in a particular street is determined by a number of factors, such as drainage area, slope, length, housing density, and street type. Open channels can be used on smaller streets, but at some point runoff velocities become too erosive to be adequately handled in an earthen channel and they must be enclosed in a storm drain. This erosive velocity is typically around 4 feet per second. A channel's maximum velocity is generally defined and computed using the peak discharge rate under the two year design storm event.

Open vegetated channels can have many water resource protection benefits. For example, a portion of stormwater pollutants may be removed through grass and soil as they pass through the channel. Performance monitoring has shown that open channels only realize these benefits under ideal conditions (e.g., low slope, sandy soils, dense grass cover, etc.). When these conditions are not met, drainage channels can have a low or even negative removal capability for many pollutants.

Only recently have engineers recognized the value of designing open channels explicitly for pollutant removal during small and moderate-sized storm events. Depending on the depth to the water table, they are known as either grass channels, dry swales or wet swales. Checkdams, underdrains, stone inlets, prepared soil mixes and landscaping are also used to enhance the pollutant removal capability of swales. The use of grass channels or swales along residential streets can be an economical and effective element of a BMP system, as long as the critical erosive velocity is not exceeded. In addition, open channels must be designed to prevent standing water, to ensure that mowing is convenient, and to avoid odors, mosquitoes, or other nuisances associated with standing water.

Even the moderate vertical break of a curb shelters airborne pollutants that blow in by the wind. Thus, dust, pollen, leaves, grass clippings, and other nitrogen-rich organic matter can be trapped by the curb, where they remain until they are washed into the storm drain system.

Some management strategies that may contribute to a reduction in urban nitrogen from roadside drainage systems are:

- Minimize the use of curb and gutter and maximize the use of vegetated swales where feasible.

- If curb and gutter is necessary, consider frequent curb cuts to divert manageable quantities of runoff into stable vegetated areas for infiltration. (Land of Sky 1995).

- Develop a site/landscaping plan that uses landscaped areas for infiltration or detention/retention areas (bioretention).

- Instead of grass that requires chemical applications, use trees, shrubs, ground cover, mulch or other materials that require little or no chemical applications.

Allowing Cluster or Open-Space Developments

Cluster or open-space developments rearrange density on each development tract so that a lower percentage of the tract is covered by impervious surfaces. This results in more land being retained in a natural state.

This approach respects private property rights and the ability of developers to create new homes for the expanding population. Such developments are "density-neutral" since the overall number of dwellings allowed is not less than it would be in a conventional development. This lessens the adverse impact on the remaining natural areas and cultural resources that make our communities such special places to live, work, and recreate.

The most important step in designing an "open space subdivision" is to identify the land to preserve. "Primary Conservation Areas" include unbuildable wetlands, waterbodies, floodplains, and steep slopes. "Secondary Conservation Areas" include mature woodlands, upland buffers around wetlands and waterbodies, prime farmland, natural meadows, critical wildlife habitats, and sites of historic, cultural or archeological significance.

Cluster developments can reduce road lengths by 50 to 70 percent (Arendt 1993). At an average cost of over $100 to construct a linear foot of road, such reductions are extremely cost-effective. The reduction in road length may also reduce the overall capital costs for stormwater controls. The developer may realize a significant savings in the reduced need for storm drain pipes and best management practices. It has been reported that in some cases the overall reduction in capital costs associated with these developments can be 10 to 33 percent (Schueler 1995).

Property owners can realize indirect economic benefits from reduced impervious cover. While a host of factors influence future residential property values, some evidence indicates that homes located adjacent to well designed and maintained open or green space do appreciate at a faster rate than traditional subdivision properties. This premium has been found to range from 5 to 32 percent, according to Land Ethics (1994). Another study in Massachusetts indicated that homes in cluster subdivisions with open space appreciated 13% more in value than similar homes in conventional subdivisions over a 21-year period (Arendt 1993).

For local governments, it is typically more expensive to provide public services on large residential lot developments compared to smaller ones. Clustered developments can greatly reduce the length of water and sewer pipes and roads that local governments have to construct and maintain.

Allowing Traditional Neighborhood Developments

Traditional neighborhood developments (TNDs) are designed so that dwellings, shops, and workplaces are in close proximity. They typically follow a rectilinear pattern of streets and blocks arranged to provide interesting routes of travel that also accommodate and promote pedestrian travel and bicycle travel rather than automobile travel. These developments also include greenways, landscaped streets, churches, stores, schools, and parks woven into the neighborhood for social activity, recreation, aesthetics, and environmental enhancement. See Figure G1 for a diagram of a TND.
One of the most important features of TNDs that affects water quality is their compactness. As these developments expand, they maintain their compact, rectilinear layout and their accessibility. Another environmental advantage offered by TNDs is that they may reduce automobile traffic and promote increased use of alternative forms of transportation, such as mass transit.

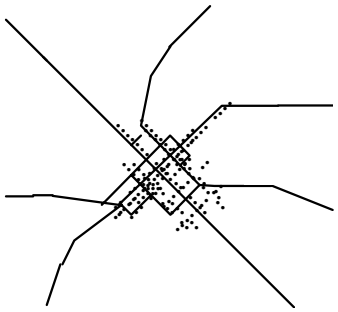
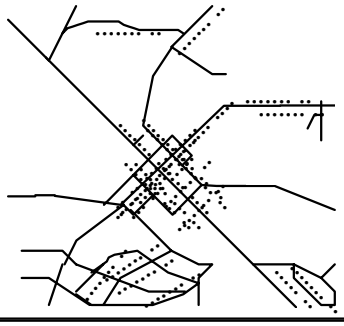
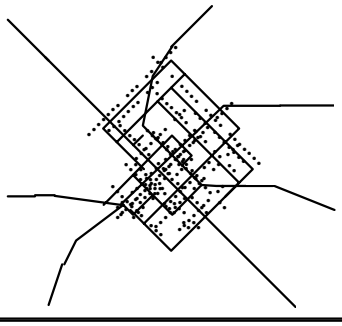
Environmental impacts of TNDs are affected by site conditions and the development intensity and design. Those TNDs that offer environmental benefits may also offer economic benefits. The increased value of real estate in a traditional development is illustrated in Raleigh. The "inside the beltline" neighborhoods in Raleigh that have city blocks, greenways, and accessibility to shopping areas, on the average, sell for 40 percent more per square foot than homes in North Raleigh subdivisions (pers. comm. Marilyn Marks, Simpson and Underwood Realtors, 1997).

Other Techniques

In many instances, subdivision codes contain rigid requirements that govern setbacks from the property lines. These requirements increase the length of driveways, roads, and sidewalks and thus increase the proportion of impervious cover to housing units. These requirements can inadvertently increase impervious surfaces and cause expense for developers and homeowners.

Large-lot zoning also impacts overall imperviousness. Although large-lot zoning reduces rooftop impervious cover in a watershed and spreads development over a wider geographic area, it can increase transport-related impervious cover because of longer road networks. Although large-lot zoning may be wise for individual sensitive watersheds, it is probably not practical as a uniform standard. An alternative is forming more compact neighborhoods in order to decrease impervious surfaces associated with transportation, a factor that has long been overlooked. Another advantage to compact neighborhoods is that they decrease automobile use by allowing better accessibility for walkers and cyclists and facilitating public transportation.

Figure Q1. Maytown Before and After (adapted from Stimmel Associates, 1993)

A. Maytown in 1900	B. Maytown today.	C. Maytown as it could have been.
		
A. Maytown developed around a central square with a grid street pattern. Development was compact and there was a distinct separation between the village and the surrounding countryside.	B. The development that has occurred over the past 30 years is not compatible with the original village. Curvilinear street and cul-de-sacs have replaced the traditional grid street pattern. The separation between the village and the surrounding countryside have been lost.	C. The same amound of development could have been accommodated in a pattern that complements the original village. All residents could have been within walking distance of the center square, community facilities, and parks.

APPENDIX Q

Example forms to be used in Permitting and Compliance Process

Section A. SUMMARY INFORMATION

DEVELOPMENT NAME: _____

LOCATION: _____

MAP/TAX ID NUMBER: _____

TOTAL ACREAGE: _____ TOTAL NUMBER OF DWELLING UNITS: _____

TOTAL DU/Acre: _____ % Built Upon Area_____ Total Built Upon Area _____

❑ LOW DENSITY (Less than 24% built-upon area)

❑ HIGH DENSITY (More than 25% built upon)

Section B. APPLICANT INFORMATION

OWNER: _____ Phone Number: _____

Company: _____

Address: _____

City:_____ State: _____Zip Code: _____

Fax Number: _____ Email: _____

Contact Name: _____ Phone Number: _____

Company: _____

Address: _____

City:_____ State: _____Zip Code: _____

Fax Number: _____ Email: _____

For Office Use only:

Review Fee: $_____ Stormwater Permit Number: _____

Date Issued: _____ Received by: _____

ALL ITEMS ON THIS APPLICATION MUST BE ADDRESSED PRIOR TO SUBMITTAL. INCOMPLETE SUBMITTALS WILL BE RETURNED.

Section C. REQUIRED ITEMS CHECKLIST

The following checklists outline submittal requirements. Applicants' initials in the space provided indicate the submittal requirement has been met and supporting data required is attached to this application.

GENERAL REQUIREMENTS:

Applicant's initials

_____ 1. Sheets submitted shall be no larger than 36" x 24" plan and profile paper.

_____ 2. Minimum text size shall be 1/8".

_____ 3. Scale on plan view shall be no smaller than 1" = 50'

_____ 4. All drawings submitted to be in North Carolina State Plane Coordinate System

_____ 5. Cover Sheet shall have a vicinity map at a scale no smaller than 1" = 200'

_____ 6. Legend indicating existing and proposed lines, features and symbols.

_____ 7. Cover Sheet shall include all general notes, owner's name, mailing address and telephone number

_____ 8. All elevations shall be given in relation to mean sea level; elevations in profile view shall be labeled in 10' intervals

_____ 9. Benchmark elevations and locations shall be shown on plan view

_____ 10. Plan views shall have a north arrow on each drawing

_____ 11. Each drawing shall have the following information on the title block: Street or project title, limits, horizontal and vertical scales, original date, revision dates, drawing number, engineer's name and seal. Recommended placement of this title block is the lower right-hand corner.

_____ 12. All drawings sealed, signed, and dated by an NC Professional Engineer or Landscape Architect

_____ 13. A signed, sealed statement on the plans certifying that the design of all engineered stormwater controls will capture and treat runoff from the first inch of rain over the total drainage area, and that the design and plans are sufficient to comply with standards and policies found in NCDENR's **Stormwater BMP Manual (July 2007 edition)**, and the City of Creedmoor's Stormwater Plan for New Construction.

_____ 14. Plan view shall show all actual assigned street names. State road numbers shall

be shown if applicable. Plan view should indicate the road composition (asphalt, concrete, gravel, etc.)

_____15. _ Plan view shall show proposed and existing curb and gutter, pavement, storm sewers, drainage structures, driveway pipes, water mains, sanitary sewer mains, etc. All available elevations shall be shown on the profile view. Direction of flow shall be shown on plan view for all sanitary sewers and storm drains. Materials and pipe sizes shall be labeled.

_____16. _ Existing utility lines shall be shown and labeled on plan view and indicated in the legend.

_____17. _ Plans shall show final proposed locations and dimensions of all water, storm drain, and sanitary sewer lines, devices to be installed on the system, catch basins, culverts, ditches, including grades, pipes sizes, elevations, assumptions, calculations, invert elevations for all inlets and manholes and profiles of sanitary sewer lines.

_____18. _ All existing and proposed water, storm drainage and sanitary sewer easements shall be shown on all applicable sheets

_____19. _ Number of dwelling units

_____20. _ Existing and proposed topographic lines (minimum 2-foot intervals)

_____21. City limits, county lines, and other jurisdiction lines, if any.

_____22. _ Streams, ponds, wetlands, etc. on the project site and within 50 feet of the property lines

_____23. Location of floodplain and floodway (if applicable)

_____24. Location of drainage ways and easements

SITE DRAINAGE FEATURES:

_____25. Existing and planned drainage patterns (include off-site areas that drain through project)

_____26. _ Any existing stormwater control systems

_____27. Sub-watershed delineation showing drainage areas.

_____28. Show extent and number of disturbed acres.

_____29. Proposed impervious areas

_____30. Soil information: type, special characteristics

_____31. _ Name and classification of receiving water course

_____32. Type of BMP (wet pond, rain-garden, etc)

_____33. Designer's certification

_____34. _ Narrative description of proposed stormwater system (where runoff originates (e.g. roofs, roads, parking lots etc.), its conveyance within the project, its treatment, and its conveyance from the project to the receiving water body)

_____35. _ Profile along the centerline of the principal spillway/outfall pipe extending below the protected outfall or to the downstream structure

_____36. _ Elevations of the "water quality" surface, temporary storage water surface, and the 10 and 100 year storms

_____37. _ Stage-storage table for each BMP

_____38. If BMP is to be used to treat construction site runoff, provide steps necessary to restore BMP to original design condition

_____39. _ All necessary construction specifications

_____40. _ Sequence of construction

_____41. _ Individual drainage areas for each stormwater BMP

_____42. _ Construction drawings and details for permanent measures

_____43. _ Size and location of culverts

_____44. _ Size and location of subsurface drainage conveyances

_____45. _ Disclosure of party ultimately responsible for operation and maintenance of the stormwater system

STORMWATER CALCULATIONS:

_____46. _ Narrative description of calculations (methods, variables, assumptions, etc.) and results

_____47. _ Stormwater BMPs designed in accordance with North Carolina Department of the Environment and Natural Resources-Division of Water Quality's *Manual of Stormwater Best Management Practices*

_____48. Time of concentration for pre/post development conditions

_____49. _ Pre-construction and post-construction runoff calculations for each outlet from the site (at peak discharge points)

_____50. _ Pre-construction and post-construction design calculations and hydrographs

_____51. _ Design calculations of culverts and storm sewers

_____52. _ Discharge and velocity calculations for open channel and ditch flows (easement & rights-of-way)

_____53. _ Design calcs of cross sections and method of stabilization of existing and planned channels (include temporary linings)

_____54. _ Design calcs and construction details of energy dissipaters below culvert and storm sewer outlets (diameters & apron dimensions)

_____55. Amount and type of existing and proposed land use

OPERATION AND MAINTENANCE MANUAL (FOR EACH BMP):

_____56. _ Narrative description of the purpose and operation of the BMP

_____57. Detailed list, description, and procedure of routine maintenance items

_____58. Detailed list, description, and procedure of non-routine maintenance items

_____59. Maintenance schedule

_____60. Steps needed to restore BMP in the event of a failure

_____61. Maintenance checklist and inspection form

_____62. _ BMP construction drawings (replace with record drawings when BMP is complete)

_____63. Latitude and longitude of each stormwater BMP

Section D. ATTACHMENTS

- ❑ Three Sets of Plans
- ❑ One Set of Calculations
- ❑ Operation and Maintenance Manual
- ❑ Application Fee

APPLICANT'S CERTIFICATION

I hereby certify that the design related information submitted with this application for permit coverage was prepared under my direction or supervision and that the information is, in the exercise of my reasonable professional judgment, true, accurate, and complete. I furthermore certify that the stormwater collection, treatment, and control system design submitted with this application complies with all requirements of the City's Stormwater Plan for New Construction under the Falls Rule.

_____ _____

Original signature of Engineer Title

_____ (seal)

Type or print name

OWNER'S CERTIFICATION

I hereby certify that I have read this application and agree to abide by any terms of any Stormwater Permit issued by the City of Creedmoor.

_____ _____

Original signature of Owner or Authorized Agent Title

_____

Type or print name

Stormwater Permit # _____

Prior to obtaining a Certificate of Occupancy, the following items must be provided to the Creedmoor Stormwater Administrator for approval. These items will be compared to the approved Stormwater Permit application for conformity with the approved plan.

- ❑ As-Built Drawings (2 paper copies)
- ❑ Electronic As-Built Drawings (pdf format only)
- ❑ Designer's Stormwater BMP Certification

The As-Built drawings shall reflect the final condition of the engineered stormwater control, and shall include sufficient information to demonstrate conformance with the approved stormwater permit. Significant deviations from the approved plan shall be considered violations of the Stormwater Ordinance and constitute grounds for withholding the release of any bond pending the completion of corrective actions on the part of the permit holder. A civil penalty may be assessed in addition to requiring submittal of a revised stormwater permit application.

In the event the Administrator requires submittal of a revised stormwater permit, the revision shall include a description of the discrepancies between actual site conditions and the prior approved stormwater permit, along with engineered calculations that demonstrate how the As-Built conditions comply with the City of Creedmoor's Stormwater Ordinance. Should the As-Built conditions be shown to have negative impacts in regards to flooding, maintenance, soil erosion, degradation of water quality, the Administrator has the authority to require additional mitigation measures or require engineered plans to mitigate any potential impacts from the development.

Submitted by: _____ Date: _____

_____ Seal (NC P.E or ASLA)

(Print Name)

Description	Design	As-Built
Slope of embankments (3:1)		
Elevations of the following:		
Bottom of the pond		
Bottom of riser		
Top of riser		
Water Quality Hole		
Invert of inflow and outflow pipes		
Top of dam: Elevation and Width		
Width of maintenance benches		
Anti-seep collars – size		
Size and material of riser/barrel		
Verification of volume		
Permanent Sediment Storage (CF)		
Permanent Water Quality (SF)		
Temporary Water Quality (CF)		
Baffle location and top elevation		
Emergency Spillway – Width		
Emergency Spillway - Elevation		

To the best of my knowledge the permanent structural engineered Stormwater Best Management Practice(s) for _____ will control and treat runoff from the first inch of rain over the total drainage area. A copy of the plat is duly recorded in the Granville County Register of Deeds. The construction of this Stormwater control has been completed in conformance with the approval of the plans and specifications dated _____, 20 __.

Signature: _____ Date: _____

Seal (NC P.E or ASLA)

(Print Name)

THIS AGREEMENT, made this ____ day of _____, 20____, by and between _____, hereinafter referred to as the "OWNER(S)" and the City of Creedmoor, North Carolina, hereinafter referred to as the "CITY",

WITNESSETH, that

WHEREAS, the OWNER is the owner of certain real property described as _____ as recorded by deed in the land records of Granville County,
(Granville County Map/Parcel Identification Number)
Deed Book _____ Page _____, Parcel Identification Number _____ hereinafter called the "Property".

WHEREAS, the OWNER is proceeding to build on and develop the property; and

WHEREAS, the Site Plan/Subdivision Plan known as _____,
(Name of Plan/Development) hereinafter called the "Plan", which is expressly made a part hereof, as approved or to be approved by the CITY, provides for treatment of stormwater within the confines of the property; and

WHEREAS, the CITY and the OWNER, its successors and assigns, including any homeowners association, agree that the health, safety, and welfare of the residents of Creedmoor, North Carolina, require that on-site structural stormwater BMP facilities be constructed and maintained on the Property; and

WHEREAS, the CITY requires that on-site structural stormwater Management facilities as shown on the Plan be constructed and adequately maintained by the OWNER, its successors and assigns, including any homeowners association.

NOW, THEREFORE, in consideration of the foregoing premises, the mutual covenants contained herein, and the following terms and conditions, the parties hereto agree as follows:

1. The on-site structural stormwater Management facilities shall be constructed by the OWNER, its successors and assigns, in accordance with the plans and specifications identified in the Plan.

2. The OWNER, its successors and assigns, including any homeowners association, shall adequately maintain the structural stormwater BMP facilities in accordance with the approved Operation and Maintenance Manual(s). This includes all pipes and channels built to convey stormwater to the facility, as well as all structures, improvements, and vegetation provided to control the quantity and quality of the stormwater. Adequate maintenance is herein defined as good working condition so that these facilities are performing their design functions.

3. The OWNER, its successors and assigns, shall ensure the structural stormwater BMP facility is inspected by a qualified professional and shall submit an inspection report. The inspection report shall be due annually 30 days from the date of the final structural stormwater Management facilities construction inspection. The purpose of the inspection is to assure safe and proper functioning of the facilities. The inspection shall cover the entire facilities, berms,

outlet structure, pond areas, access roads, etc. Deficiencies shall be noted in the inspection report.

4. The OWNER, its successors and assigns, hereby grant permission to the CITY, its authorized agents and employees, to enter upon the Property and to inspect the structural stormwater Management facilities whenever the CITY deems necessary. The purpose of inspection is to follow-up on reported deficiencies and/or to respond to citizen complaints. The CITY shall provide the OWNER, its successors and assigns, copies of the inspection findings and a directive to commence with the repairs if necessary.

5. In the event the OWNER, its successors and assigns, fails to maintain the structural stormwater Management facilities in good working condition acceptable to the CITY, the CITY may enter upon the Property and take whatever steps necessary to correct deficiencies identified in the inspection report and to charge the costs of such repairs to the OWNER, its successors and assigns. This provision shall not be construed to allow the CITY to erect any structure of permanent nature on the land of the OWNER outside of the easement for the structural stormwater Management facilities. It is expressly understood and agreed that the CITY is under no obligation to routinely maintain or repair said facilities, and in no event shall this Agreement be construed to impose any such obligation on the CITY.

6. For all structural stormwater Management facilities which are to be or are owned and maintained by a property owner's association or similar entity, the OWNER and the association shall enter into an escrow agreement with CITY. The agreement shall contain all of the following provisions:

   a. Acknowledgment that the association shall continuously operate and maintain the structural stormwater Management facilities.

   b. Establishment of an escrow account which can be spent solely for sediment removal, structural, biological or vegetative replacement, major repair, or reconstruction of the stormwater control measures and devices of the particular site plan or subdivision. If structural stormwater Management facilities are not performing adequately or as intended or are not properly maintained, the CITY, in its sole discretion, may remedy the situation, and in such instances the CITY shall be fully reimbursed from the escrow account. Escrowed funds may be spent by the association for sediment removal, structural, biological or vegetative replacement, major repair, and reconstruction of the structural stormwater Management facilities; provided that, the CITY shall first consent to the expenditure.

   c. Both OWNER contribution and annual sinking funds shall fund the escrow account. Prior to plat recordation or issuance of stormwater permits, whichever shall first occur, the OWNER shall pay into the escrow account an amount equal to fifteen (15) per cent of the initial construction cost of the structural stormwater Management facilities. Two-thirds (2/3) of the total amount of sinking fund budget shall be deposited into the escrow account within the first five (5) years and the full amount shall be deposited within ten (10) years following initial construction of the stormwater control measure or device. Funds shall be deposited each year into the escrow account. A portion of the annual assessments of the property owners association shall include an allocation into the escrow

account. Any funds drawn down from the escrow account shall be replaced in accordance with the schedule of anticipated work used to create the sinking fund budget.

d. Granting to the CITY a right of entry to inspect, monitor, maintain, repair, and reconstruct structural stormwater Management facilities.

e. Allowing the CITY to recover from the association and its members any and all costs the CITY expends to maintain or repair the stormwater control and management facility or to correct any operational deficiencies. Failure to pay to the CITY all of its expended costs, after thirty (30) days written notice, shall constitute a breach of the agreement. The CITY shall thereafter be entitled to bring an action against the association and its members to pay, or foreclose upon the lien herein authorized by the agreement against the property, or both in the case of a deficiency. Interest, collection costs, and attorney fees shall be added to the recovery.

f. A statement that this agreement shall not obligate the CITY to maintain or repair any stormwater control measure or device, and that the CITY shall not be liable to any person for the condition or operation of structural stormwater Management facilities.

g. A statement that this agreement shall not in any way diminish, limit, or restrict the right of the CITY to enforce any of its ordinances as authorized by law.

7. The OWNER, its successors and assigns, will perform the work necessary to keep these facilities in good working order as appropriate. In the event a maintenance schedule for the structural stormwater Management facilities (including sediment removal) is outlined on the approved plans, the schedule will be followed.

8. In the event the CITY, pursuant to this Agreement, performs work of any nature, or expends any funds in performance of said work for labor, use of equipment, supplies, materials, and the like, the OWNER, its successors and assigns, shall reimburse the CITY upon demand, within thirty (30) days of receipt thereof for all actual costs incurred by the CITY hereunder.

9. This Agreement imposes no liability of any kind whatsoever on the CITY and the OWNER agrees to hold the CITY harmless from any liability in the event the structural stormwater Management facilities fail to operate properly.

10. This Agreement shall be recorded among the land records of Alamance County, North Carolina, and shall constitute a covenant running with the land, and shall be binding on the OWNER, its administrators, executors, assigns, heirs and any other successors in interests, including any homeowners association.

IN WITNESS WHEREOF, the parties have executed this agreement on the day and year first above written:

_____

Name of Company/Corporation/Partnership/Individuals (Seal if corporation)

By: _____

(Type Name and Title)

STATE OF NORTH CAROLINA
CITY OF CREEDMOOR

The foregoing Agreement was acknowledged before me this day of _____ , 20__ ,

By _____

_____
NOTARY PUBLIC
My Commission expires _____

CITY OF CREEDMOOR, NORTH CAROLINA

_____
City of Creedmoor (Seal)

By: _____
(Type Name)

_____
(Type Title)

STATE OF NORTH CAROLINA
CITY OF CREEDMOOR

The foregoing Agreement was acknowledged before me this day of _____ , 20__ ,

By _____

_____
NOTARY PUBLIC
My Commission expires _____

Approved as to Form:

_____ _____
City Attorney Date

APPENDIX R

Example Conservation Easement

Appendix R
Example Conservation Easement

This appendix provides an example conservation easement. All conservation easements are case-specific documents. This example suggests elements that drafters of a conservation easement may wish to consider. This example was taken from the Clean Water Management Trust Fund. It is designed as an agreement between the state and a county to place a conservation easement on a riparian buffer for specific purposes. It would require modification for use between a developer and a local government for land conservation, and greater modification to conserve the functions of a stormwater facility. As stated in Section 2-B of the supplemental guidance document when entering land use information into the tool, forested land must be considered as “managed pervious” or “lawn”” unless it is subject to a conservation easement or another mechanism to insure it will not be managed by mowing, logging, fertilization etc.

DRAFT

Tax Parcel ID #_____

STATE OF NORTH CAROLINA
COUNTY OF _____

CONSERVATION EASEMENT
Property name

THIS [CWD31]CONSERVATION EASEMENT ("Conservation Easement") is made on this _____ day of _____, 2001, by and between _____, with an address at ___ (“Grantor”) and the STATE OF NORTH CAROLINA, with its address c/o State Property Office, 1321 Mail Service Center, Raleigh, NC 27699-1321 ("State" or “Grantee”), acting solely through the North Carolina Clean Water Management Trust Fund, with its address at 1651 Mail Service Center, Raleigh, NC 27699-1651 (“Fund”).

RECITALS & CONSERVATION PURPOSES

A. Grantor is the sole owner in fee simple of the property being approximately _____ acres in _____ County, State of North Carolina and being all of that certain tract as more particularly described in Exhibit A attached hereto and by this reference incorporated herein ("Property"); and

B. The State of North Carolina will be the Grantee and holder of this Conservation easement; and,

C. Fund is authorized by Article 13A, Chapter 113 of the General Statutes of North Carolina (“N.C.G.S.”) to finance projects and to acquire land and interests in land, including conservation easements for riparian buffers for the purposes of providing environmental protection for surface waters and urban drinking water supplies and establishing a network of riparian greenways for environmental, educational, and recreational uses; and

D. The Grantor has received a grant from the Fund for acquisition of the Property in consideration of which Grantor has agreed that it will be conserved and managed in a manner that will protect the quality of the waters of _____ and otherwise promote the public purposes authorized by Article 13A, Chapter 113 of the N.C.G.S; and,

E. The parties hereto recognize the conservation and water quality values of the Property in its present state as a riparian shoreline and intend that said conservation values of the Property be preserved and maintained.

F. The characteristics of the Property, its current use and state of improvement are described in Exhibit A, which is the appropriate basis for monitoring compliance with the objectives of preserving the conservation and water quality values; the Exhibit A is not intended to

preclude the use of other evidence (e.g. surveys, appraisals) to establish the present condition of the Property if there is a controversy over its use.

NOW, THEREFORE, in consideration of the premises and the mutual benefits recited herein, together with other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged by the parties hereto, the Grantor hereby unconditionally and irrevocably gives, grants and conveys forever and in perpetuity to the Grantee, its successors and assigns, and the Grantee hereby accepts, a Deed of Conservation Easement of the nature and character and to the extent hereinafter set forth in, over, through and across the Property, together with the right to preserve and protect the conservation values thereof as described in the Recitals herein.

The purposes of this Conservation Easement are to provide environmental protection for surface waters and to protect the wildlife and natural heritage values and it shall be so held, maintained, and used therefore. It is the further purpose of this Easement to prevent any use of the Property that will significantly impair or interfere with the preservation of said conservation values. Grantor intends that this easement will restrict use of the Property to such activities as are consistent with the purposes of conservation.

ARTICLE I. DURATION OF EASEMENT

This Conservation Easement shall be perpetual. It is an easement in gross, runs with the land, and is enforceable by Grantee against Grantor, its representatives, successors, assigns, lessees, agents and licensees.

ARTICLE II. RIGHTS RESERVED TO GRANTOR

Grantor reserves certain rights accruing from ownership of the Property, including the right to engage in or permit others to engage in uses of the Property that are not inconsistent with the purpose(s) of this Easement. All rights reserved by Grantors are reserved for Grantors, their representatives, successors, and assigns, and are considered to be consistent with the conservation purposes of this Conservation Easement. The following rights are expressly reserved:

What is appropriate? Perhaps the following?

A. To engage in passive recreational uses of the Property (requiring no surface alteration of the land and posing no threat to conservation values), including, without limitation, walking, fishing, or animal and plant observation; and,

B. To allow public access to the property for the purpose of conducting educational tours, scientific study, maintenance of the Property and any other purpose consistent with maintaining the conservation value.

Notwithstanding the foregoing, Grantor and Grantee have no right to agree to any activity that would result in the termination of this Conservation Easement.

ARTICLE III. PROHIBITED AND RESTRICTED ACTIVITIES

Any activity on, or use of, the Property inconsistent with the purposes of this Conservation Easement is prohibited. The Property shall be maintained in its natural, scenic, wooded and open condition and restricted from any development or use that would impair or interfere with the conservation purposes of this Conservation Easement set forth above.

Without limiting the generality of the foregoing, the following activities and uses are expressly prohibited or restricted.

A. Industrial and Commercial Use. Industrial and commercial activities and any right of passage for such purposes are prohibited on the Property within the 300 foot corridor.

B. Agricultural, Timber Harvesting, Grazing and Horticultural Use. Agricultural, timber harvesting, grazing, horticultural and animal husbandry operations are prohibited on the Property within the 300 foot corridor.

C. Disturbance of Natural Features, Plants and Animals. There shall be no cutting or removal of trees, or the disturbance of other natural features within the 300 foot corridor except for the following: (1) as incidental to boundary marking, fencing, signage, construction and maintenance of nature trails and public access allowed hereunder; (2) selective cutting and prescribed burning or clearing of vegetation and the application of mutually approved pesticides for fire containment and protection, disease control, restoration of hydrology, wetlands enhancement and/or control of non-native plants; subject however, to the prior approval of Fund, and (3) hunting and fishing pursuant to applicable rules and regulations.

D. Construction of Buildings and Recreational Use. There shall be no constructing or placing of any building, mobile home, asphalt or concrete pavement, billboard or other advertising display, antenna, utility pole, tower, conduit, line, pier landing, dock or any other temporary or permanent structure or facility on or above the Property except for the following: placing and display of no trespassing signs, local, state or federal traffic or similar informational signs, for sale or lease signs, fencing, signs identifying the conservation values of the Property, and/or signs identifying the Grantor as owner of the Property and State as holders of this Conservation Easement and as the source of funding for the acquisition of this Property, educational and interpretative signs, identification labels or any other similar temporary or permanent signs, reasonably satisfactory to the Fund.

E. Mineral Use, Excavation, Dredging. There shall be no filling, excavation, dredging, mining or drilling; no removal of topsoil, sand, gravel, rock, peat, minerals or other materials, and no change in the topography of the land in any manner except as necessary for the purpose of combating erosion or incidental to any conservation management activities otherwise permitted in this Conservation Easement.

F. Wetlands and Water Quality. There shall be no pollution or alteration of water bodies and no activities that would be detrimental to water purity or that would alter natural water levels, drainage, sedimentation and/or flow in or over the Property or into any surface waters, or cause soil degradation or erosion nor diking, dredging, alteration, draining, filling or removal of

wetlands, except activities to restore natural hydrology or wetlands enhancement as permitted by state and any other appropriate authorities.

G. Dumping. Dumping of soil, trash, ashes, garbage, waste, abandoned vehicles, appliances, or machinery, or other materials on the Property is prohibited.

H. Conveyance and Subdivision. The Property may not be subdivided, partitioned nor conveyed, except in its current configuration as an entity or block of property.

ARTICLE IV. ENFORCEMENT AND REMEDIES

A. Enforcement. To accomplish the purposes of this Easement, Grantee is allowed to prevent any activity on or use of the Property that is inconsistent with the purposes of this Easement and to require the restoration of such areas or features of the Property that may have been damaged by such activity or use. Upon any breach of the terms of this Conservation Easement by Grantor that comes to the attention of the Grantee, the Grantee shall, except as provided below, notify the Grantor in writing of such breach. The Grantor shall have ninety (90) days after receipt of such notice to correct the conditions constituting such breach. If the breach remains uncured after ninety (90) days, the Grantee may enforce this Conservation Easement by appropriate legal proceedings including damages, injunctive and other relief. The Grantee shall also have the power and authority, consistent with its statutory authority: (a) to prevent any impairment of the Property by acts which may be unlawful or in violation of this Conservation Easement; (b) to otherwise preserve or protect its interest in the Property; or (c) to seek damages from any appropriate person or entity. Notwithstanding the foregoing, the Grantee reserves the immediate right, without notice, to obtain a temporary restraining order, injunctive or other appropriate relief if the breach of the term of this Conservation Easement is or would irreversibly or otherwise materially impair the benefits to be derived from this Conservation Easement. The Grantor and Grantee acknowledge that under such circumstances damage to the Grantee would be irreparable and remedies at law will be inadequate. The rights and remedies of the Grantee provided hereunder shall be in addition to, and not in lieu of, all other rights and remedies available to Grantee in connection with this Conservation Easement, including, without limitation, those set forth in the Grant Agreement under which this Conservation Easement was obtained.

B. Inspection. Grantee, its employees and agents and its successors and assigns, have the right, with reasonable notice, to enter the Property at reasonable times for the purpose of inspecting the Property to determine whether the Grantor, Grantor's representatives, or assigns are complying with the terms, conditions and restrictions of this Conservation Easement.

C. Acts Beyond Grantor's Control. Nothing contained in this Conservation Easement shall be construed to entitle Grantee to bring any action against Grantor for any injury or change in the Property caused by third parties, resulting from causes beyond the Grantor's control, including, without limitation, fire, flood, storm, and earth movement, or from any prudent action taken in good faith by the Grantor under emergency conditions to prevent, abate, or mitigate significant injury to life, damage to property or harm to the Property resulting from such causes.

D. Costs of Enforcement. Any costs incurred by Grantee in enforcing the terms of this Conservation Easement against Grantor, including, without limitation, any costs of restoration necessitated by Grantor's acts or omissions in violation of the terms of this Conservation Easement, shall be borne by Grantor.

E. No Waiver. Enforcement of this Easement shall be at the discretion of the Grantee and any forbearance by Grantee to exercise its rights hereunder in the event of any breach of any term set forth herein shall not be deemed or construed to be a waiver by Grantee of such term or of any subsequent breach of the same or of any other term of this easement or of Grantee's rights. No delay or omission by Grantee in exercise of any right or remedy shall impair such right or remedy or be construed as a waiver.

ARTICLE V. DOCUMENTATION AND TITLE

A. Property Condition. The parties acknowledge that the Property is currently undeveloped land, with no improvements other than as described in Exhibit A and easements and rights of way of record.

B. Title. The Grantor covenants and represents that the Grantor is the sole owner and is seized of the Property in fee simple and has good right to grant and convey the aforesaid Conservation Easement; that there is legal access to the Property, that the Property is free and clear of any and all encumbrances, except easements of record, none of which would nullify, impair or limit in any way the terms or effect of this Conservation Easement; Grantor shall defend its title against the claims of all persons whomsoever, and Grantor covenants that the Grantee shall have the use of and enjoy all of the benefits derived from and arising out of the aforesaid Conservation Easement.

ARTICLE VI. MISCELLANEOUS

A. Subsequent Transfers. Grantor hereby covenants and agrees, that in the event it transfers or assigns the Property, the transferee of the Property will be a qualified organization as that term is defined in Section 170(h)(3) of the Internal Revenue Code of 1986, as amended, or any successor section, and the regulations promulgated thereunder (the Internal Revenue Code"), which is organized or operated primarily for one of the conservation purposes specified in Section 170 (h)(4)(A) of the Internal Revenue Code. Grantor agrees for itself, its successors and assigns, to notify Grantee in writing of the names and addresses of any party to whom the Property, or any part thereof, is to be transferred at or prior to the time said transfer is consummated. Grantor, for itself, its successors and assigns, further agrees to make specific reference to this Conservation Easement in a separate paragraph of any subsequent lease, deed or other legal instrument by which any interest in the Property is conveyed.

B. Conservation Purpose.

(1) Grantee, for itself, its successors and assigns, agrees that this Conservation Easement shall be held exclusively for conservation purposes.

(2) The parties hereto recognize and agree that the benefits of this Conservation Easement are in gross and assignable, provided, however that the Grantee hereby covenants and agrees, that in the event it transfers or assigns this Conservation Easement, the organization receiving the interest will be a qualified organization as that term is defined in Section 170(h)(3) of the Internal Revenue Code, which is organized or operated primarily for one of the conservation purposes specified in Section 170 (h)(4)(A) of the Internal Revenue Code, and Grantee further covenants and agrees that the terms of the transfer or assignment will be such that the transferee or assignee will be required to continue to carry out in perpetuity the conservation purposes that the contribution was originally intended to advance, set forth in the Recitals herein.

(3) Unless otherwise specifically set forth in this Conservation Easement, nothing herein shall convey to or establish for the public a right of access over the Property.

C. Construction of Terms. This Conservation Easement shall be construed to promote the purposes of the North Carolina enabling statute set forth in N.C.G.S. 121-34 et. seq. which authorizes the creation of Conservation Easements for purposes including those set forth in the Recitals herein, and the conservation purposes of this Conservation Easement, including such purposes as are defined in Section 170(h)(4)(A) of the Internal Revenue Code.

D. Recording. State shall record this instrument and any amendment hereto in timely fashion in the official records of _____ County, North Carolina, and may re-record it at any time as may be required to preserve its rights.

E. Notices. All notices, requests or other communications permitted or required by this Agreement shall be sent by registered or certified mail, return receipt requested, addressed to the parties as set forth above, or to such other addresses such party may establish in writing to the other. All such items shall be deemed given or made three (3) days after being placed in the United States mail as herein provided. In any case where the terms of this Conservation Easement require the consent of any party, such consent shall be requested by written notice. Such consent shall be deemed denied unless, within ninety (90) days after receipt of notice, a written notice of approval and the reason therefore has been mailed to the party requesting consent.

F. Amendments. Grantor and Grantee are free to jointly amend this Conservation Easement to meet changing conditions, provided that no amendment will be allowed that is inconsistent with the purposes of this Conservation Easement or affects the perpetual duration of this Conservation Easement. Such amendment(s) require the written consent of both Grantor and Grantee and shall be effective upon recording in the public records of ____ County, North Carolina.

G. Environmental Condition of Property. The Grantor warrants, represents and covenants to the Grantee that to the best of its knowledge after appropriate inquiry and investigation that: (a) the Property described herein is and at all times hereafter will continue to be in full compliance with all federal, state and local environmental laws and regulations, and (b) as of the date hereof there are no hazardous materials, substances, wastes, or environmentally regulated substances (including, without limitation, any materials containing asbestos) located on, in or under the Property or used in connection therewith, and that there is no environmental condition existing

on the Property that may prohibit or impede use of the Property for the purposes set forth in the Recitals and the Grantor will not allow such uses or conditions.

H. Entire Agreement. This instrument sets forth the entire agreement of the parties with respect to the Conservation Easement and supersedes all prior discussions, negotiations, understandings or agreements relating to the Conservation Easement. If any provision is found to be invalid, the remainder of the provisions of this Conservation Easement, and the application of such provision to persons or circumstances other than those as to which it is found to be invalid, shall not be affected thereby. The party(ies) hereto intend this document to be an instrument executed under seal. If any party is an individual, partnership or limited liability company, such party hereby adopts the word "SEAL" following his/her signature and the name of the partnership or limited liability company as his/her/its legal seal. The Recitals set forth above and the Exhibits attached hereto are incorporated herein by reference.

I. Indemnity. The Grantors agree to the fullest extent permitted by law, to defend, protect, indemnify and hold harmless the State from and against all claims, actions, liabilities, damages, fines, penalties, costs and expenses suffered as a direct or indirect result of any violation of any federal, state, or local environmental or land use law or regulation or of the use or presence of any hazardous substance, waste or other regulated material in, on or under the property.

J. Interpretation. This Conservation Easement shall be construed and interpreted under the laws of the State of North Carolina, and any ambiguities herein shall be resolved so as to give maximum effect to the conservation purposes sought to be protected herein.

K. Parties. Every provision of this Conservation easement that applies to the Grantors or to the Grantee shall likewise apply to their respective heirs, executors, administrators, assigns, and grantees, and all other successors in interest herein.

L. Merger. The parties agree that the terms of this Conservation Easement shall survive any merger of the fee and easement interest in the Property.

M. Subsequent Liens. No provisions of this Conservation Easement shall be construed as impairing the ability of Grantors to use this Property for collateral for borrowing purposes, provided that any mortgage or lien arising therefrom shall be subordinated to this Easement.

TO HAVE AND TO HOLD unto THE STATE OF NORTH CAROLINA, its successors and assigns, forever. The covenants agreed to and the terms, conditions, restrictions and purposes imposed as aforesaid shall be binding upon Grantor, Grantor's representatives, successors and assigns, and shall continue as a servitude running in perpetuity with the Property.

IN WITNESS WHEREOF, Grantor, by authority duly given, has hereunto caused these presents to be executed by its officers and its seal affixed, to be effective the day and year first above written.

GRANTOR:

By: Don’t sign this version, it is a draft document
Title:_____

ATTEST:

_____
Title:_____

[SEAL]

STATE OF _____
COUNTY OF _____

I, _____, Notary Public, do hereby certify that _____ personally came before me this day and acknowledged that he/she is _____of _____, a _____, and that by authority duly given and as the act of the _____, the foregoing instrument was signed in its name by its _____, sealed with its _____ seal, and attested by him/herself as its _____.

Witness my hand and notarial seal, this the ____ day of _____, 2000.

_____
Notary Public
My commission expires:_____

STATE OF NORTH CAROLINA
_____ COUNTY

The foregoing certificate of _____, Notary Public, is certified to be correct. This _____day of _____, 2000.

_____
Register of Deeds

This instrument prepared by and should be returned to: _____

EXHIBIT A

[Add legal description of Property along with description of property condition, improvements, structures, and major features]

[CWD31]Comment 1 Issues in co-holding:
Grantee(s), its/theirs/them
State as Primary Grantee, others as local Grantees
Only Primary Grantee can pursue legal enforcement
Identify who monitors compliance, who is chief liason w/Grantor
Article IV – Paragraph A – The Primary Grantee shall have the right to prevent and correct violations of the terms of this easement. The Local Grantee(s) will monitor the Property and communicate with the Grantor regarding any potential or perceived breach of the easement …attention of (add) any Grantee, such Grantee shall immediately notify the other Grantees, and the Local Grantee shall, except as provided below, notify the Grantor in writing of such breach.

APPENDIX S

Self-Assessment Tool

Appendix S
Self Assessment Tool

1. Street Width

a. What is the minimum pavement width allowed for streets in low density residential developments that have less than 500 average daily trips (ADT)?

*If the answer is between **18-22 feet**, award **4** points* ☐

b. At higher densities are parking lanes allowed to also serve as traffic lanes (i.e., queuing streets)?

***I**f the answer is **YES**, award **3** points* ☐

2. Street Length

a. Do street standards promote the most efficient street layouts that reduce overall street length?

*If the answer is **YES**, award **1** point* ☐

3. Right-of-Way Width

a. What is the minimum right-of-way (ROW) width for a residential street?

*If the answer is **less than 45 feet**, award **3** points* ☐

b. Does the code allow utilities to be placed under the paved section of the ROW?

*If the answer is **YES**, award **1** point* ☐

4. Cul-de-Sacs

a. What is the minimum radius allowed for cul-de-sacs?

*If the answer is **less than 35 feet**, award **3** points* ☐

*If the answer is **36 feet to 45 feet**, award **1** point* ☐

b. Can a landscaped island be created within the cul-de-sac?

*If the answer is **YES**, award **1** point* ☐

c. Are alternative turn arounds such as "hammerheads" allowed on short streets in low density residential developments?

*If the answer is **YES**, award **1** point* ☐

5. Vegetated Open Channels

a. Are curb and gutters required for most residential street sections?

*If the answer is **NO**, award **2** points*

b. Are there established design criteria for swales that can provide stormwater quality treatment (i.e., dry swales, biofilters, or grass swales)?

*If the answer is **YES**, award **2** points*

6. Parking Ratios

a. What is the minimum parking ratio for a professional office building (per 1000 ft^2 of gross floor area)?

*If the answer is **less than 3.0 spaces**, award **1** point*

b. What is the minimum required parking ratio for shopping centers (per 1,000 ft^2 gross floor area)?

*If the answer is **4.5 spaces or less**, award **1** point*

c. What is the minimum required parking ratio for single family homes (per home)?

*If the answer is **less than or equal to 2.0 spaces**, award **1** point*

d. Are the parking requirements set as maximum or median (rather than minimum) requirements?

*If the answer is **YES**, award **2** points*

7. Parking Codes

a. Is the use of shared parking arrangements promoted?

*If the answer is **YES**, award **1** point*

b. Are model shared parking agreements provided?

*If the answer is **YES**, award **1** point*

c. Are parking ratios reduced if shared parking arrangements are in place?

*If the answer is **YES**, award **1** point*

d. If mass transit is provided nearby, is the parking ratio reduced?

*If the answer is **YES**, award **1** point*

8. Parking Lots

a. What is the minimum stall width for a standard parking space?

*If the answer is **9 feet or less**, award **1** point* ☐

b. What is the minimum stall length for a standard parking space?

*If the answer is **18 feet or less**, award **1** point* ☐

c. Are at least 30% of the spaces at larger commercial parking lots required to have smaller dimensions for compact cars?

*If the answer is **YES**, award **1** point* ☐

d. Can pervious materials be used for spillover parking areas?

*If the answer is **YES**, award **2** points* ☐

9. Structured Parking

a. Are there any incentives to developers to provide parking within garages rather than surface parking lots?

*If the answer is **YES**, award **1** point* ☐

10. Parking Lot Runoff

a. Is a minimum percentage of a parking lot required to be landscaped?

*If the answer is **YES**, award **2** points* ☐

b. Is the use of bioretention islands and other stormwater practices within landscaped areas or setbacks allowed?

*If the answer is **YES**, award **2** points* ☐

11. Open Space Design

a. Are open space or cluster development designs allowed in the community?

*If the answer is **YES**, award **3** points* ☐

*If the answer is **NO**, skip to question No. 12* ☐

b. Is land conservation or impervious cover reduction a major goal or objective of the open space design ordinance?

*If the answer is **YES**, award **1** point* ☐

c. Are the submittal or review requirements for open space design greater than those for conventional development?

*If the answer is **NO**, award **1** point* ☐

d. Is open space or cluster design a by-right form of development?

*If the answer is **YES**, award **1** point* ☐

e. Are flexible site design criteria available for developers that utilize open space or cluster design options (e.g, setbacks, road widths, lot sizes)

*If the answer is **YES**, award **2** points* ☐

12. Setbacks and Frontages

a. Are irregular lot shapes (e.g., pie-shaped, flag lots) allowed in the community?

*If the answer is **YES**, award **1** point* ☐

b. What is the minimum requirement for front setbacks for a **one half (½) acre** residential lot?

*If the answer is **20 feet or less**, award **1** point* ☐

c. What is the minimum requirement for rear setbacks for a **one half (½) acre** residential lot?

*If the answer is **25 feet or less**, award **1** point* ☐

d. What is the minimum requirement for side setbacks for a **one half (½) acre** residential lot?

*If the answer is **8 feet or less**, award **1** points* ☐

e. What is the minimum frontage distance for a **one half (½) acre** residential lot?

*If the answer is **less than 80 feet**, award **2** points* ☐

13. Sidewalks

a. What is the minimum sidewalk width allowed in the community?

*If the answer is **4 feet or less**, award **2** points* ☐

b. Are sidewalks always required on both sides of residential streets?

*If the answer is **NO**, award **2** points* ☐

c. Are sidewalks generally sloped so they drain to the front yard rather than the street?

*If the answer is **YES**, award **1** point* ☐

d. Can alternate pedestrian networks be substituted for sidewalks (e.g., trails through common areas)?

*If the answer is **YES**, award **1** point* ☐

14. Driveways

a. What is the minimum driveway width specified in the community?

*If the answer is **9 feet or less (one lane) or 18 feet (two lanes)**, award **2** points* ☐

b. Can pervious materials be used for single family home driveways (e.g., grass, gravel, porous pavers, etc)?

*If the answer is **YES**, award **2** points* ☐

c. Can a "two track" design be used at single family driveways?

*If the answer is **YES**, award **1** point* ☐

d. Are shared driveways permitted in residential developments?

*If the answer is **YES**, award **1** point* ☐

15. Open Space Management

a. Does the community have enforceable requirements to establish associations that can effectively manage open space?

*If the answer is **YES**, award **2** points* ☐

b. Are open space areas required to be consolidated into larger units?

*If the answer is **YES**, award **1** point* ☐

c. Does a minimum percentage of open space have to be managed in a natural condition?

*If the answer is **YES**, award **1** point* ☐

d. Are allowable and unallowable uses for open space in residential developments defined?

*If the answer is **YES**, award **1** point* ☐

e. Can open space be managed by a third party using land trusts or conservation easements?

*If the answer is **YES**, award **1** point* ☐

16. Rooftop Runoff

a. Can rooftop runoff be discharged to yard areas?

*If the answer is **YES**, award **2** points* ☐

b. Do current grading or drainage requirements allow for temporary ponding of stormwater on front yards or rooftops?

*If the answer is **YES**, award **2** points* ☐

17. Buffer Systems

a. Is there a stream buffer ordinance in the community?

*If the answer is **YES**, award **2** points* ☐

b. If so, what is the minimum buffer width?

*If the answer is **75 feet or more**, award **1** point* ☐

c. Is expansion of the buffer to include freshwater wetlands, steep slopes or the 100-year floodplain required?

*If the answer is **YES**, award **1** point* ☐

18. Buffer Maintenance

a. Does the stream buffer ordinance specify that at least part of the stream buffer be maintained with native vegetation?

*If the answer is **YES**, award **2** points* ☐

b. Does the stream buffer ordinance outline allowable uses?

*If the answer is **YES**, award **1** point* ☐

c. Does the ordinance specify enforcement and education mechanisms?

*If the answer is **YES**, award **1** point* ☐

19. Clearing and Grading

a. Is there any ordinance that requires or encourages the preservation of natural vegetation at residential development sites?

*If the answer is **YES**, award **2** points* ☐

b. Do reserve septic field areas need to be cleared of trees at the time of development?

*If the answer is **NO**, award **1** point* ☐

20. Tree Conservation

a. If forests or specimen trees are present at residential development sites, does some of the stand have to be preserved?

*If the answer is **YES**, award **2** points* ☐

b. Are the limits of disturbance shown on construction plans adequate for preventing clearing of natural vegetative cover during construction?

*If the answer is **YES**, award **1** point* ☐

21. Land Conservation Incentives

a. Are there any incentives to developers or landowners to conserve non-regulated land (open space design, density bonuses, stormwater credits or lower property tax rates)?

*If the answer is **YES**, award **2** points* ☐

b. Is flexibility to meet regulatory or conservation restrictions (density compensation, buffer averaging, transferable development rights, off-site mitigation) offered to developers?

*If the answer is **YES**, award **2** points* ☐

22. Stormwater Outfalls

a. Is stormwater required to be treated for quality before it is discharged?

*If the answer is **YES**, award **2** points* ☐

b. Are there effective design criteria for stormwater best management practices (BMPs)?

*If the answer is **YES**, award **1** point* ☐

c. Can stormwater be directly discharged into a jurisdictional wetland without pretreatment?

*If the answer is **NO**, award **1** point* ☐

d. Does a floodplain management ordinance that restricts or prohibits development within the 100 year floodplain exist?

*If the answer is **YES**, award **2** points* ☐

Total

Scoring

90 - 100	Community has above-average provisions that promote the protection of streams, lakes and estuaries.
80 - 89	Local development rules are good, but could use minor adjustments or revisions in some areas.
70 - 79	Opportunities exist to improve development rules. Consider creating a site planning roundtable.
60 - 69	Development rules are likely inadequate to protect local aquatic resources. A site planning roundtable would be very useful.
less than 60	Development rules are definitely not environmentally friendly. Serious reform is needed.

APPENDIX T

City of Creedmoor Stormwater Administrative Staff

APPENDIX T

Stormwater Administration Team

Contact: **Randall K. Cahoon, AICP CZO**
Title: City Planner/Stormwater Administrator
Street Address: 111 Masonic Street
Mailing Address: PO Box 765, Creedmoor. North Carolina 27522
Telephone: (919) 764-1016
Fax Number: (919) 528-3052
E-mail Address: rcahoon@cityofcreedmoor.org
Stormwater BMP Inspections & Maintenance Certificate #315 *NC Cooperative Extension Service*

Contact: **Brian M. Wilson, P.E.**
Title: Public Works Director/Engineer
Street Address: 111 Masonic Street
Mailing Address: PO Box 765, Creedmoor. North Carolina 27522
Telephone: (919) 764-1036
Fax Number: (919) 528-3052
E-mail Address: bwilson@cityofcreedmoor.org

APPENDIX U

City of Creedmoor Main Street District Map

APPROXIMATE AREA OF
LAND REQUIRED FOR
BMP = 8.60AC+/- (15%)

WEST DOWNTOWN
DRAINAGE BASIN =
57.5AC+/-

ACTUAL DRAINAGE BASINS

MAKE ELM A BIO-STREET

WILTON AVENUE
CVS
LAKE ROAD
PARK AVENUE
FLEMING STREET
ELM STREET
MAIN STREET
MILL STREET
MASONIC STREET
City Hall
SANDERFORD STREET
LYON STREET
HILLSBORO STREET
CHURCH STREET

100' 50' 0 100' 200'

SCALE NTS

City of Creedmoor
Planning Department

Creedmoor Main Street District

Downtown Drainage Basins
Appendix "U"

July 11, 2011

APPROXIMATE AREA OF LAND REQUIRED FOR BMP = 8.60AC+/- (15%)

WEST DOWNTOWN DRAINAGE BASIN = 57.5AC+/-

ACTUAL DRAINAGE BASINS

WILTON AVENUE
CVS
LAKE ROAD
Gateway
Long Term Infrastructure (Phone)
Commercial Mixed-use
Residential Development
Commercial Office
PARK AVENUE
FLEMING STREET
ELM STREET
MAIN STREET
Park / Open Space
Residential Development
Commercial Mixed-use
Possible Storm Water/Water Quality
Mixed-use Development
MAKE ELM A BIO-STREET
Farmers Market Location
MILL STREET
MASONIC STREET
Future Civic - Public Parking
City Hall
Community Space / Historic
High Density Residential
Possible Storm Water/Water Quality Amenity
Commercial Mixed-use
'Town Square Park'
Future Civic
High Density Residential
Possible Realignment of Hillsboro to Lyon Street
Gateway
LYON STREET
HILLSBORO STREET
Civic
Institutional - Historic
Commercial
Institutional - Church
Institutional - Church
CHURCH STREET
Existing Established Residential
Gateway
Medium Density Residential
Commercial
Raleigh Commuters
ACTUAL DRAINAGE BASINS

100' 50' 0 100' 200'

SCALE NTS

City of Creedmoor
Planning Department

Creedmoor Main Street District

Downtown Drainage Basins
Appendix "U"

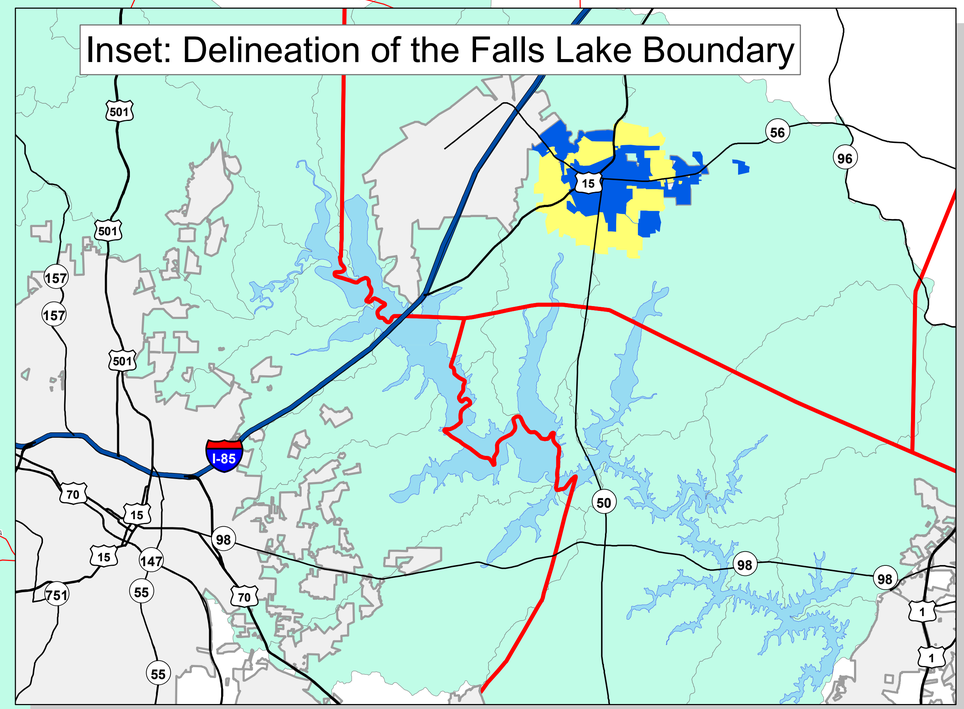
July 11, 2011

City of Creedmoor
Granville County North Carolina
1903

APPENDIX V

Creedmoor City Limits and ETJ Map

The City of Creedmoor, NC intends to enforce all applicable Water Quality Regulations within the City Limits and ETJ.



Legend

Water Quality Enforcement Areas

Type

- Primary Corporate Limits
- City Limit Satellite
- Creedmoor ETJ

State Road Network

Route Classification

- Interstate
- NC Route
- US Route
- All Other Municipalities
- County Boundary
- Regional Water Supplies
- falls_mgmnt_wbd_20100421

City of Creedmoor, NC
Falls Lake Water Quality Management Area

City of Creedmoor, NC
Planning Department
111 Masonic Street
Creedmoor, NC 27522
(919) 528-3332

June 8, 2011

0 485 970 1,940 2,910 3,880 Feet

APPENDIX W

Riparian Buffer Regulations – City of Creedmoor Code of Ordinances

APPENDIX W

CHAPTER 155: STORMWATER MANAGEMENT

Section

§ 155.01 PURPOSE.

(A) The purpose of this section is to establish minimum criteria to control and minimize quantitative and qualitative impacts of stormwater runoff from development within the city, a nutrient management program for new development in accordance with 15A NCAC 2B .0235 Neuse River Basin - Nutrient Sensitive Waters Management Strategy: Basin wide stormwater requirements and to establish regulations to provide additional protection within the city.

(B) Further, prudent site planning should include special consideration for the purposes of preserving natural drainage ways, maximizing infiltration, and slowing stormwater runoff from individual sites in route to streams and rivers by use of effective runoff management, structural and non-structural best management practices, drainage structures, and stormwater facilities.
(Ord. 2010-O-02, passed 1-26-10)

§ 155.02 APPLICABILITY.

The provisions of this section shall apply to all areas within the planning jurisdictional limits of the city that:

(A) Disturbs more than one acre of land to establish, build, expand, modify or replace a residential structure, residential development or recreational facility. For individual single-family lots of record not in a recorded subdivision, the activity must result in greater than 10% built-upon area;

(B) That disturbs more than half of an acre of land to establish, build, expand, modify or replace a multi-family structure or development, or a non-residential, commercial, or industrial use or facility.

(C) *Exceptions to applicability.* The provisions of this chapter shall not apply to:

(1) Developers/property owners that can demonstrate that they have vested rights as of the adoption date of the revised stormwater ordinance shall be exempt from the revised stormwater ordinance.

(2) Redevelopment. Any project replacing or expanding existing structures or improvements that does not result in a net increase in built upon area is exempt from the nutrient loading requirements.

(3) *Exemption from storm.* Developments that meet one of the following requirements shall be exempt from storm attenuation:

(a) The increase in peak flow between pre- and post-development conditions does not exceed 10%; or

(b) The proposed development meets all of the following criteria: overall impervious surface is less than 15% outside the ES and 12% inside the ES, and the pervious portions of the site are utilized to the extent practical to convey and control stormwater runoff.

(c) Note: Nutrient management and/or reduction shall still be required.
(Ord. 2010-O-02, passed 1-26-10)

§ 155.03 DEFINITIONS.

For the purpose of this section, the following terms, phrases and words, and their derivatives shall have the meaning given herein:

APPLICANT. An owner or developer of a site who executes the stormwater permit application pursuant to this chapter is considered the applicant.

BEST MANAGEMENT PRACTICES (BMP'S). A wide range of practices that have been demonstrated to effectively manage the quality and/or quantity of stormwater runoff and which are compatible with the planned land use. BMP's can be structural (detention ponds, wetlands, and the like) or non-structural (reduced road pavement width, cluster development, and the like).

CHANNEL BANK. The location of the upper edge of the active channel above which the water spreads into the over banks on either side of the channel or the elevation of the two year frequency storm. Where the channel bank is not well defined, the channel bank shall be considered the edge of the waterline as defined by the line of normal high water.

DESIGN STORM. The specific frequency and, if necessary, duration of the rainfall event to be used in design to meet the criteria established in the Stormwater Design Manual.

DEVELOPMENT. Any of the following actions taken by a public or private individual or entity:

(1) The division of a lot, tract or parcel of land into two or more lots, plots, sites, tracts, parcels or other divisions by plat or deed; or

(2) Any land change, including, without limitation, clearing, tree removal, grubbing, stripping, dredging, grading, excavating, transporting and filling of land.

DRAINAGE STRUCTURES. Shall include swales, channels, storm sewers, curb inlets, yard inlets, culverts and other structures designed to convey stormwater.

EXISTING DEVELOPMENT. An individual non-residential site with site plan approval by the Planning Department or a non-residential or residential subdivision with preliminary subdivision approval from the city.

IMPERVIOUS SURFACE. A surface composed of any material that impedes or prevents natural infiltration of water into the soil. Gravel areas shall be considered impervious.

ILLEGAL DISCHARGES. Any unlawful disposal, placement, emptying, dumping, spillage, leakage, pumping, pouring, or other discharge of any substance other than stormwater into a stormwater conveyance system, the waters of the state or upon the land such that the substance is likely to reach a stormwater conveyance system or waters of the state constitutes an illegal discharge.

LAND DISTURBANCE. Removal of topsoil, grubbing, stump removal and/or grading.

NATURAL DRAINAGE WAY. Incised channel with a defined channel bed and banks that are part of the natural topography. Construction channels such as drainage ditches shall not be considered a natural drainage way unless the constructed channel was a natural drainage way that has been relocated, widened, or otherwise improved.

NEW DEVELOPMENT. For the purposes of this section, new development shall be defined as:

(1) Any activity that disturbs more than one acre of land or creates more than 17,000 square feet of impervious surfaces for a single family or duplex residential development, recreational facility, or multifamily, institutional, commercial or industrial development; and

(2) New development shall not include mining, agricultural or forestry activities.

RIPARIAN BUFFER. An area of trees, shrubs, or other forest vegetation, that is adjacent to surface waters. For purposes of this chapter, surface water shall be present if the feature is approximately shown on either the most recent version of the Granville County soil survey report prepared by the NRCS OR the most recent version of the 1:24,000 scale (7.5 min.) quadrangle topographic maps prepared by the United States Geological Survey.

STORMWATER. Flow resulting from and occurring after any form of precipitation.

STORMWATER ADMINISTRATOR. The person designated by the City Manager to have authority to review and approve stormwater permits and stormwater management plans. The Stormwater Administrator shall also be responsible for inspecting development and enforcing the provisions of this chapter.

STORMWATER CONVEYANCE SYSTEM OR STRUCTURE. Any feature, natural or man-made, that collects and transports stormwater, including but not limited to roadways with collection systems, catch basins, man-made and natural channels, streams, pipes and culverts, and any other structure or system designed to transport runoff.

STORMWATER DESIGN MANUAL. The manual of design, performance, and review criteria adopted by the Board of Commissioners for the administration of the Stormwater Program.

VEGETATIVE BUFFER. An area that has a dense ground cover of herbaceous or woody species, which provides for diffusion and infiltration of runoff and filtering of pollutants.

VESTED RIGHTS FOR STORMWATER. Vested rights shall be based upon the following criteria:

(1) Having an outstanding valid building permit in compliance with G.S. § 153A-344.1 or G.S. § 160A-385.1; or

(2) Having an approved site specific or phased development plan in compliance with G.S. § 153A-344.1 or G.S. § 160A-385.1.

(3) Projects that require a state permit, such as landfills, NPDES wastewater discharges, land application or residuals and road construction activities, shall be considered to have vested rights if a state permit was issued prior to the effective date of the adoption of the revised Stormwater Ordinance.

WATER DEPENDENT STRUCTURES. Those structures that require the access or proximity to, or sitting within surface waters to fulfill its basic purpose, such as boat ramps, boathouses, docks, and bulkheads. Ancillary facilities such as restaurants, outlets for boat supplies, parking lots, and commercial boat storage areas are not considered water-dependent structures.
(Ord. 2010-O-02, passed 1-26-10)

§ 155.04 INTERPRETATION.

(A) In interpreting and applying this chapter, the requirements are intended to be minimum requirements, which are imposed and are to be conformed to, and are in addition to, and not in lieu of, all other legal requirements.

(B) This chapter shall not be deemed to interfere with or annul or otherwise affect in any manner whatsoever any ordinance, rules, regulations, permits, or easements, covenants, or other agreements between parties, provided, however, that where this chapter imposes greater restrictions and controls with respect to stormwater management, the provisions of this section shall prevail.
(Ord. 2010-O-02, passed 1-26-10)

§ 155.05 STORMWATER PERMIT.

(A) Except where provided elsewhere, land-disturbing activities shall not commence without obtaining a stormwater permit pursuant to the provisions of this chapter and in compliance with the provisions of the Stormwater Design Manual.

(B) The stormwater permit application shall be made by, or on behalf of, the owner(s) or developer(s) of the site for which the permit is sought. The application shall be filed with the county on a form supplied by the county and shall be accompanied with the information identified in the Stormwater Design Manual.

(C) A stormwater permit shall not be issued until the following conditions are met:

(1) Approval of the stormwater management plan by the Stormwater Administrator.

(2) Submission and approval of any required easements and impervious area statements on a map to be recorded.

(3) Submission and approval of any required inspection and maintenance agreement and/or escrow account or other legal instrument established to ensure long-term maintenance of BMP's.

(4) Payment of all fees. If the development requires approval of an erosion and sediment control plan, the stormwater permit will be conditional upon the owner receiving such erosion and sediment control approval.

(5) If needed, buffer approval from NCDENR-DWQ.

(D) The stormwater permit will be valid for one year from the date of issuance or until significant changes in the development are made that change the intent of the permit. The Stormwater Administrator

shall determine significant changes. If significant changes are made, the original Stormwater Permit shall not be valid, and a new permit shall be required.
(Ord. 2010-O-02, passed 1-26-10)

§ 155.06 FEES.

A list of fees associated with this section is available at the office of the Clerk to the Board of Commissioners in the City Hall. The cost of the City Engineer's review of stormwater management plans are the responsibility of the applicant.
(Ord. 2010-O-02, passed 1-26-10)

§ 155.07 STORMWATER MANAGEMENT.

(A) Stormwater shall be conveyed from development in an adequately designed drainage system of natural drainage ways, grass swales, storm sewers, culverts, inlets, and channels. Drainage systems shall be designed, constructed, and maintained to encourage natural infiltration, control velocity, control flooding, and extend the time of concentration of stormwater runoff. The post-development runoff rate for the one-year storm event, or ten-year storm event, as determined by the city, shall be attenuated to the pre-development runoff rate for the one-year or ten-year storm.

(B) The nitrogen loading contributed by new development shall be restricted to three point six points of nitrogen per acre per year. Methodologies for determining nitrogen loading are outlined in the Stormwater Design Manual. A developer has the option of offsetting the nitrogen loading from a development by paying into the State Wetlands Restoration Program. Procedures for offset payments are outlined in the Stormwater Design Manual. When using the offset payment, the total nitrogen loading from a development shall not exceed six pounds per acre per year for residential development and ten pounds per acre per year for non-residential development.
(Ord. 2010-O-02, passed 1-26-10)

§ 155.08 STORMWATER MANAGEMENT PLANS.

(A) Stormwater management plans shall:

(1) Include drawings, maps, supporting calculations, specifications, and summaries as outlined in the Stormwater Design Manual.

(2) Demonstrate through accepted engineering practices described in the Stormwater Design Manual the impacts of the proposed development. Impacts of the proposed development shall include:

(a) Effects on existing upstream and/or downstream drainage systems and property;

(b) Ability of the natural drainage way to handle additional stormwater runoff; and

(c) Site-specific criteria supporting the analysis of any impacts noted in divisions (a) and (b) above.

(3) Demonstrate through accepted engineering practices described in the Stormwater Design Manual that stormwater runoff is adequately conveyed through the development in a drainage system designed to meet the criteria described in the Stormwater Design Manual.

(4) Demonstrate through accepted engineering practices described in the Stormwater Design Manual that stormwater facilities required to control the impacts of the development are designed to meet the criteria described in the Stormwater Design Manual.

(5) Demonstrate that the nitrogen loading from the new development does not exceed the limits set forth in § 155.07.
(Ord. 2010-O-02, passed 1-26-10)

§ 155.09 STORMWATER BMP INSPECTION, MAINTENANCE AND EASEMENT REQUIREMENTS.

(A) *Maintenance agreement.* A written inspection and maintenance agreement in a form acceptable to the City Attorney and executed by the applicant and the owner(s) of the BMP, if different than the applicant, shall be provided prior to receiving a stormwater permit. The agreement shall:

(1) Bind the parties thereto and all subsequent owners, successors, and assigns to maintenance and inspection of the system or structure;

(2) State that if the city directs the correction, repair, replacement, or maintenance of the system or structure in writing and the actions are not satisfactorily performed within a reasonable time (but not greater than 120 days), the city (or its contractors) may, after reasonable notice, enter the land and perform all the necessary work and may assess the owner(s) of the facility with the cost of the work performed, or the city can seize all or part of the escrow or other fund set aside by the applicant for perpetual maintenance. The owner(s) served by the facility shall be jointly responsible to the city for the maintenance of the facility and liable for any costs incurred by the city pursuant to the said agreement. All properties are jointly subject to the imposition of the liens for said costs.

(3) The inspection and maintenance agreement shall be recorded in the Register of Deeds at the expense of the applicant.

(B) *Easements.* Easements for stormwater BMP's shall include the area of the BMP, area of ponded water, and enough area for access and maintenance as determined by the city. The easement shall be

recorded in the Register of Deeds at the expense of the applicant and shall be depicted on the final plat or recorded map.
(Ord. 2010-O-02, passed 1-26-10)

§ 155.10 ILLEGAL DISCHARGE AND CONNECTIONS.

(A) *Illegal discharge.*

(1) No person shall cause or allow the discharge, disposal, pouring or pumping directly or indirectly to any stormwater conveyance structure, stormwater conveyance system, stream, lake, pond, wetland or other body of water, or upon the land in proximity to the same, any fluid, solid or other substance (other than stormwater).

(2) Prohibited substances include, but are not limited to oil, anti-freeze, chemicals, animal waste, paints, garbage and litter. Examples of illegal discharges are:

(a) Dumping of oil, anti-freeze, paint or cleaning fluids.

(b) Untreated commercial carwash wash water.

(c) Industrial discharges.

(d) Contaminated foundation drains.

(e) Cooling waters, unless no chemicals added and has valid NPDES permit.

(f) Wash water from commercial and industrial activities.

(g) Chlorinated backwash and draining associated with swimming pools.

(h) Domestic wastewater.

(i) Septic system effluent.

(j) Washing machine discharges.

(B) *Allowable discharges.* Examples of allowed discharges are:

(1) Water line flushing.

(2) Irrigation.

(3) Uncontaminated groundwater pumping.

(4) Street washed water.

(5) De-chlorinated backwash and drainage associated with swimming pools.

(6) NPDES permitted discharges.

(C) *Illegal connections.* Connections to a stormwater conveyance system or structure that allow the discharge of non-stormwater are unlawful. Prohibited connections include but are not limited to:

(1) Floor drains.

(2) Wastewater from washing machines or sanitary sewers.

(3) Wash water from commercial vehicle washing or steam cleaning.

(4) Waste water from septic systems.

(D) *Determination of connection.* Upon determining that said connection:

(1) May result in the discharge of hazardous materials, may pose a threat to public health and safety, or is likely to result in immediate injury or harm to human or animal life, natural resources, to real or personal property, or habitat; or

(2) Was made in violation of any applicable regulation or ordinance, The Stormwater Administrator shall outline in a notice of violation, sent by certified mail, the time in which the connection shall be removed. Failure to comply with the terms and deadlines set in the notice of violation will constitute a violation of this chapter.
(Ord. 2010-O-02, passed 1-26-10)

§ 155.11 RIPARIAN BUFFERS.

(A) Fifty foot wide riparian buffers shall be maintained along both sides of a stream, river or other water body as required by the Neuse River Basin: Nutrient Sensitive Waters Management Strategy: Protection and Maintenance of Riparian Buffers, Section 3.

(B) Riparian buffers shall be noted on the maps submitted for Stormwater Management Plan approval and shall be noted on the final, recorded map. Determinations of exemptions (as noted in 15A NCAC 2B.0233 Neuse River Basin: Nutrient Sensitive Waters Management Strategy: Protection and Maintenance of Riparian Buffers, Section 3(a-b)) shall be made by the NCDENR Division of Water Quality.
(Ord. 2010-O-02, passed 1-26-10)

§ 155.12 RIGHT TO ENTER.

(A) Any city personnel, or contractors for the city, shall be permitted to enter upon public or private property for the purposes of inspection, sampling, monitoring, testing or otherwise verifying compliance. Should the city personnel, or contractor for the city, be denied reasonable access to any property, the Stormwater Administrator shall obtain an administrative search warrant.

(B) No person shall obstruct, hamper or interfere with any such representative while carrying out his/her official duties.
(Ord. 2010-O-02, passed 1-26-10)

§ 155.13 VARIANCES.

The Board of Adjustment shall consider all variance requests as set out in § 154.185.
(Ord. 2010-O-02, passed 1-26-10)

§ 155.14 ENFORCEMENT.

(A) Violations. Whenever, by the provisions of this section, the performance of any act is required, or the performance of any act is prohibited, or whenever any regulation or limitation is imposed on the use of any land, or on the erection, alteration, or the use or change of use of a structure, a failure to comply with such provisions shall constitute a violation of this chapter.

(B) The owner, tenant, or occupant of any land or structure, or part thereof, and any architect, engineer, builder, contractor, agent, or other person who participates in, assists, directs, creates, or maintains any situation that is contrary to the requirements of this section may be held responsible for the violation and be subject to the penalties and remedies provided in § 154.168.

(C) Failure to follow an approved stormwater management plan or permit shall constitute a violation of this chapter and subject to the penalties and remedies provided in § 154.168.
(Ord. 2010-O-02, passed 1-26-10)

APPENDIX X

Proposed Regional Stormwater Utility

Basics

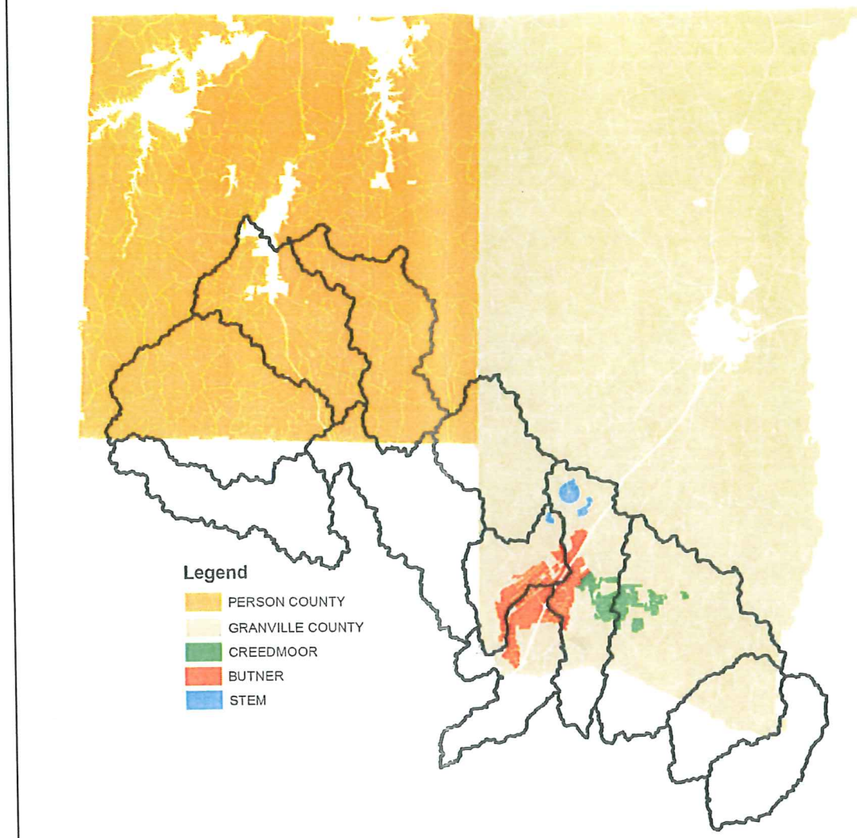
•For the operation and maintenance of the system, the utility will charge and collect a fee throughout the entire service area.
•Fees within the service area will vary based on geography because different services and levels of service are required and will be provided in different geographies.
•Rates in each geography, in each jurisdiction, will be set and adopted by the governing board in each jurisdiction based on the cost of providing stormwater services in the jurisdiction's geographies.
•The five jurisdictions will adopt enterprise funds within their local governments, into which fee revenues will be deposited and from which expenditures will be made.
•Fees will be billed by one or more billing agents (most likely one in each County in the service area).
•The utility will be defined through interlocal agreement, and could be structured in one of several ways (see options table)

Board

One of the challenges associated with a multi-jurisdictional organization is providing an opportunity for input and oversight (as needed) by the member governments for shared services, policies, and, potentially, contracting and employment. We would recommend a utility advisory board under option 1 as follows:
•Recommends Executive Director (Granville County Department Head-level Position)
•Participates in and advises on service procurements
•Reviews and provides input on matters of common interest
•Represents the utility to underlying elected bodies
•Can appoint a technical advisory board if desired
•5-member board (one from each jurisdiction)

Option 1	Option 2	Option 3
No brick and mortar	No brick and mortar	Brick and mortar institution
Department head level manager or director employed a member government	No staff	Staff and rolling stock
Director serves as staff, coordinates services; Services will provided as in option 2	Services will be provided by the member local governments (defined through interlocal agreements)	Utility staffed and provides services itself and through contractors
Services provided by member governments using own staff or contractors	Services provided by member governments using own staff or contractors	Services provided by utility employees or contractors hired by the utility

LOS Name	**Countywide**	**Falls (Upper, Lower)**	**Municipal**
Covered Geography	*Upper, Lower, Non-Falls*	*Upper, Lower*	*Butner, Creedmoor*
Services Needed	Billing and Collections	Billing and Collections	Billing and Collections
	Data Maintenance	Data Maintenance	Data Maintenance
	Customer service	Customer service	Customer service
	Funds disbursement and collection	Funds disbursement and collection	Funds disbursement and collection
	Contracting	Contracting	Contracting
	Floodplain management	Floodplain management	Floodplain management
			Stormwater quantity management
			- system maintenance
			- capital improvements
			NPDES Phase II compliance
			- public education
			- public involvement
	Construction site runoff (1 acre +)	Construction site runoff (1 acre +)	- construction site runoff
			- post-construction runoff
	Septic system management	Septic System Management	- illicit discharge detection/elimination
			- municipal goodhousekeeping
		Group advocacy	
		BMP and related inspections	
		Plans development	
		Inventories	
		Strategies development	
		Source tracking	
		Offset credits tracking	
		Ordinance development	
		Development plans review	
		Retrofits (plan, design, install, maintain)	
		Coordination of NPDES and Falls reporting	



Rough Estimates:

GEOGRAPHY	Total_Parcels	Total_NSFR	Total_SFR	Total_MH	Total_Vacant
Creedmoor (Upper Falls Lake)	832	67	509	24	232
Creedmoor (Lower Falls Lake)	1,309	70	853	14	372
Stem (Upper Falls Lake)	529	16	170	16	327
Butner (Upper Falls Lake)	2,470	240	1,487	146	597
Granville County (Upper Falls Lake)	1,896	81	698	309	808
Granville County (Lower Falls Lake)	3,836	111	1,843	538	1,344
Granville County	15,726	668	5,452	2,325	7,281
Person County (Upper Falls Lake)	8,837	1,055	3,132	1,731	2,919
Person County	13,450	1,616	5,035	1,984	4,815
Total	**48,885**	**3,924**	**19,179**	**7,087**	**18,695**
Total Upper + Lower	**19,709**	**1,640**	**8,692**	**2,778**	**6,599**
Total Non-Falls	**29,176**	**2,284**	**10,487**	**4,309**	**12,096**