

## **Stormwater Ordinance**

**City of Roxboro, North Carolina**

**April 15, 2003**

**Revised April 30, 2003**

**Revised July 2, 2003**

### **Section I. New Development Review/Approval**

#### **1A. Requirements in the Ordinance**

The City of Roxboro Stormwater Ordinance has the following requirements for new development located within the planning and zoning jurisdictions of the City of Roxboro Subject to these rules:

- The nutrient load contributed by new development activities is held at 3.6 pounds per acre per year. This is equivalent to 70 percent of the estimated average nitrogen load contributed by the non-urban areas in the Roanoke and Neuse river basins (as defined using 1995 LANDSAT data). The Environmental Management Commission may periodically update the performance standard based on the availability of new scientific information.
- Property owners shall have the option of partially offsetting projected nitrogen loads by funding wetland or riparian area restoration through the North Carolina Wetland Restoration Program. However, the total nitrogen-loading rate cannot exceed 6.0 pounds per acre per year for residential development or 10 pounds per acre per year for non-residential development.
- There is less than ten percent net increase in peak flow leaving the site from the predevelopment conditions for the 1-year, 24-hour storm.
- City of Roxboro must review new development plans to assure compliance with requirements for protecting and maintaining riparian areas. Refer to the City of Roxboro's Buffer Ordinance for requirements and guidelines.

#### **1B. Protecting Riparian Areas on New Development**

The City of Roxboro Stormwater Ordinance requires that riparian areas be protected on new development in accordance with the Riparian Buffer rule. The Riparian Buffer Rule requires that 50-foot riparian buffers be maintained on all sides of intermittent and perennial streams, ponds, lakes and estuaries in the Roanoke and Neuse River Basins. The rule includes some uses that are allowable within the riparian buffer, such as utility crossings.

The City of Roxboro has the following two choices for ensuring that riparian buffers are protected on new developments.

1. Receive a delegated program and implement all applicable provisions of the Riparian Buffer Rule within its jurisdiction, or
2. Disapprove any new development activity that is proposed to take place within the first 50 feet adjacent to a waterbody that is shown on the current USGS 7.5 minute maps unless the owner can show that the activity has been approved by DWQ. DWQ approval may consist of the following:
  - An Authorization Certificate that documents that DWQ has approved an allowable use such a road crossing or utility line. A detailed list of allowable uses is included in the Riparian Buffer Rule.
  - An opinion from DWQ that vested rights has been established for the proposed development activity.
  - A letter from DWQ documenting that a variance has been approved for the proposed development activity.

### **1C. Calculating N Export from New Development**

For the purposes of the City of Roxboro Stormwater Program, new development shall be defined as to include the following:

- Any Activity that disturbs greater than one acre of land in order to establish, expand or modify a single family or duplex residential development or a recreational facility.
- Any activity that disturbs greater than one-half an acre of land in order to establish, expand or modify a multifamily residential development or a commercial, industrial or institutional facility.

New development shall NOT include agriculture, mining or forestry activities. Land disturbance is defined as grubbing, stump removal and/or grading.

Property owners that can demonstrate that they have vested rights as of the effective date of the City of Roxboro Stormwater Program for Nitrogen Control (expected July 2003) will not be subject to the requirements for new development. Vested rights may be based on at least one of the following criteria:

- (a) Substantial expenditures of resources (time, labor, money) based on a good faith reliance upon having received a valid local government approval to proceed with the project, or

- (b) Having an outstanding valid building permit in compliance with G.S. 160A-385.1, or
- (c) Having approved site specific or phased development plan in compliance with G.S. 160A-385.1

Projects that require a state permit, such as landfills, NPDES wastewater discharges, land application of 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 City of Roxboro Stormwater Program for Nitrogen Control.

The Nitrogen export from each new development must be calculated. This export will be calculated in pounds per acre per year (lbs/ac/yr). Model methodologies that may be used to make this calculation are presented below; however, City of Roxboro will evaluate alternative approaches where it can be demonstrated to be equivalent. There are two different methodologies proposed for calculating nitrogen export from new developments. These are as follows:

- Method 1 is intended for residential developments where lots are shown but the actual footprint of buildings are not shown on site plans. This method does not require calculation of the area of building footprints. Rather, the impervious surface resulting from building footprints are estimated based on typical impervious areas associated with a given lot size. This method is shown in Figure 1A.
- Method 2 is for residential, commercial and industrial developments when the entire footprint of the roads, parking lots, buildings and any other built-upon area is shown on the site plans. This method is simpler and more accurate since it does not require estimating the impervious surface based on lot size like Method 1 does. Method 2 is shown in Figure 1b.

One situation that is not addressed in either of these methods is a non-residential subdivision where the impervious surfaces are not shown on the plans at the time of submittal. In this case, the City of Roxboro will require that the property owner specify the areas of impervious surface, undisturbed open space and managed open space on the property in a restrictive covenant or other legal, enforceable mechanism. Then, Method 2 could be applied. An alternative is for the City of Roxboro to determine a worst-case scenario for the areas of impervious surface and managed open space for the type of development specified and then apply Method 2.

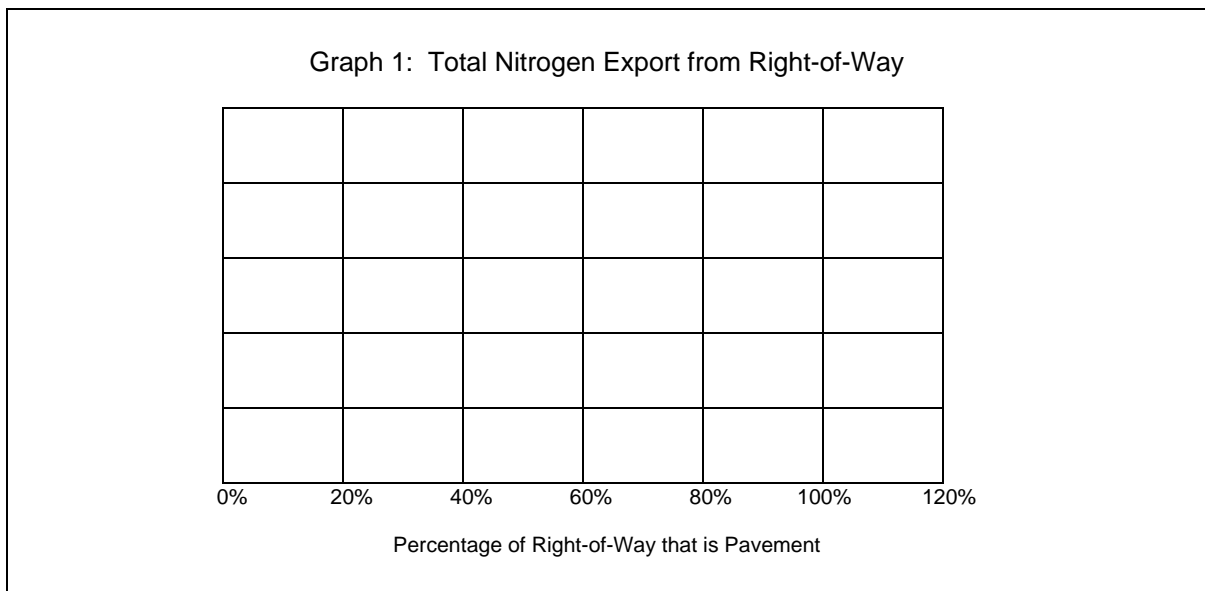
**Figure 1a. Method 1 for Quantifying TN Export from Residential Development when Building and Driveway Footprints are Not Shown**

- Step 1: Determine area for each type of land use and enter in Column (2).
- Step:2 Total the areas for each type of land use and enter at the bottom of Column (2).

- Step 3 Determine the TN coefficient associated with right-of-way using Graph 1.
- Step 4 Determine the TN export coefficient associated with lots using Graph 2.
- Step 5 Multiply the areas in Column (2) by the TN export coefficients in Column (3) and enter in Column (4)
- Step 6 Total the TN exports for each type of land use and enter at the bottom of Column (4).
- Step 7: Determine the export coefficient for site by dividing the total TN export from uses at the bottom of Column (4) by the total area at the bottom of Column (2).

(1) Type of Land Cover	(2) Area (acres)	(3) TN export coeff. (lbs/ac/yr)	(4) TN export from use (lbs/yr)
<b>Permanently protected undisturbed open space</b> (forest, unmown meadow)		0.6	
<b>Permanently protected managed open space</b> (grass, landscaping, etc.)		1.2	
<b>Right-of-way</b> (read TN export from Graph 1)			
<b>Lots</b> (read TN export from Graph 2)			
<b>SUB-TOTAL</b>			
<b>TOTAL = (4) / (2)</b>			

Graph 1: **Total Nitrogen Export from Right-of-Way**



Graph 2: **Total Nitrogen Export from Lots**



Figure 1b: **Method 2 for Quantifying TN Export from Residential/Industrial/Commercial Developments when Footprints of all Impervious Surfaces are Show**

- Step 1: Determine area for each type of land use and enter in Column (2).
- Step 2: Total the areas for each type of land use and enter at the bottom of Column (2).
- Step 3: Multiply the areas in Column (2) by the TN export coefficients in Column (3) and enter in Column (4).
- Step 4: Total the TN exports for each type of land use and enter at the bottom of Column (4).
- Step 5: Determine the export coefficient for site by dividing the total TN export from uses at the bottom of column (4) by the total area at the bottom of Column (2).

(1) Type of Land Cover	(2) Area (acres)	(3) TN export Coeff. (lbs/ac/yr)	(4) TN export from use (lbs/yr)
<b>Permanently protected undisturbed open space</b> (forest, unmown meadow)		0.6	
<b>Permanently protected managed open space</b> (grass, landscaping, etc.)		1.2	
Right-of-way (read TN export from Graph 1)			
Lots (read TN export from Graph 2)			
<b>SUB-TOTAL</b>			

TOTAL = (4) / (2)

**Graph 1: Total Nitrogen Export from Right-of Way**

See graph in book

**Graph 2: Total Nitrogen Export from Lots**

See graph in book

**Figure 1b: Method 2 for Quantifying TN Export from Residential/Industrial/Commercial Developments when Footprints of all Impervious Surfaces are Show**

- Step 1: Determine area for each type of land use and enter in Column (2).
- Step 2: Total the areas for each type of land use and enter at the bottom of Column (2).
- Step 3: Multiply the areas in Column (2) by the TN export coefficients in Column (3) and enter in Column (4).
- Step 4: Total the TN exports for each type of land use and enter at the bottom of Column (4).
- Step 5: Determine the export coefficient for site by dividing the total TN export from uses at the bottom of column (4) by the total area at the bottom of Column (2).

(1) Type of Land Cover	(2) Area (acres)	(3) TN export coeff. (lbs/ac/yr)	(4) TN export from use (lbs/yr)
Permanently protected undisturbed open space (forest, unmown meadow)		0.6	
Permanently protected managed open space (grass, landscaping, etc.)		1.2	
Impervious surfaces (roads, parking lots, driveways, roofs, paved storage areas, etc.)		21.2	
<b>SUB-TOTALS</b>			
<b>TOTAL = (4) / (2)</b>			

The rule requires that all new developments achieve a nitrogen export of less than or equal to 3.6 pounds per acre per year. If the development contributes greater than 3.6 lbs/ac/yr of nitrogen, then the options show in Table 1a are available based on whether the development is residential or non-residential.

**Table 1a: Nitrogen Export Reduction Options**

Residential	Commercial / Industrial
If the computed export is 3.6 to 6.0 lbs/ac/yr, then the owner may either: <ol style="list-style-type: none"> <li>1. Install BMPs to remove enough nitrogen to bring the development</li> </ol>	If the computed export is 3.6 to 10.0 lbs/ac/yr, then the owner may either: <ol style="list-style-type: none"> <li>1. Install BMPs to remove enough nitrogen to bring the development down to 3.6 lbs/ac/yr.</li> </ol>

<p>down to 3.6 lbs/ac/yr.</p> <ol style="list-style-type: none"> <li>2. Pay a one-time offset payment of \$330/lb to bring the nitrogen down to the 3.6 lbs/ac/yr.</li> <li>3. Do a combination of BMPs and offset payment to achieve a 3.6 lbs/ac/yr export.</li> </ol>	<ol style="list-style-type: none"> <li>2. Pay a one-time offset payment of \$330/lb to bring the nitrogen down to the 3.6 lbs/ac/yr.</li> <li>3. Do a combination of BMPs and offset payment to achieve a 3.6 lbs/ac/yr export.</li> </ol>
<p>If the computed export is greater than 6.0 lbs/ac/yr, then the owner must use on-site BMPs to bring the development's export down to 6.0 lbs/ac/yr. Then, the owner may use one of the three options above to achieve the reduction between 6.0 and 3.6 lbs/ac/yr.</p>	<p>If the computed export is greater than 10.0 lbs/ac/yr, then the owner must use on-site BMPs to bring the development's export down to 10.0 lbs/ac/yr. Then, the owner may use one of the three options above to achieve the reduction between 10.0 and 3.6 lbs/ac/yr.</p>

The table above discusses the option of using offset fees to meet the nitrogen export levels set for new development activities. These offset fees go to the Wetland Restoration Program (WRP). The WRP will utilize these fees in accordance with the WRPs Basinwide Wetlands and Riparian Restoration plans. It is the policy of the WRP to utilize the funds where they are generated to the maximum extent possible as long as they can obtain the cooperation of the City of Roxboro.

#### **1D. Calculating Peak Runoff Volume**

The City of Roxboro Stormwater Ordinance requires there be no net increase in peak flow leaving the site from the predevelopment conditions for the 1-year, 24-hour storm. Each jurisdiction affected by the rule may specify the methodology(ies) that shall be used when determining peak flows from new development activities.

Acceptable methodologies for computing the pre-and and post-development conditions for the 1-year, 24-hour storm include:

- The Rational Method.
- The Peak Discharge Method as described in USDA Soil Conservation Services' Technical Release Number 55 (TR-55).
- The Putnam Method.

The same method must be used for both the pre-and post-development conditions.

Division of Water Quality staff have computed rainfall depths for the 1-year, 24-hour storm for use with hydrologic computation methods. This information is provided in Table 1b below. City of Roxboro may continue to develop rainfall intensity information and other technical information that may be necessary to assist in the implementation of this requirement.

**Table 1b: Rainfall depths for the 1-year, 24-hour storm**

Location	1yr-24 hr depth (inches)	1yr 24 hr intensity (in/hr)
Raleigh	3.00	To be developed
Wilmington	3.70	To be developed
Roxboro	To be developed	To be developed
Washington	3.40	To be developed

\*This information is currently being developed

The flow control requirement is not required for developments that met one or all of the following requirements:

- The increase in peak flow between pre-and post-development conditions does not exceed ten percent.
- The proposed new development meets all of the following criteria: overall impervious surface is less than fifteen percent, and the remaining pervious portions of the site are utilized to the maximum extent practical to convey and control the stormwater runoff.

Designing best management practices that remove nitrogen from stormwater is a developing field. Researchers throughout the country, particularly in the Southeast, are conducting studies to determine effective means of controlling nitrogen. At the present time, current data indicate that most BMPs remove only 20 to 40 percent of total nitrogen on a consistent basis. All BMPs require regular maintenance and some have varying performance depending on soil type and the season. It is crucial to consider the issues of aesthetics, long-term maintenance, safety and reliability in BMP design.

Since it is relatively difficult to design and maintain BMPs that remove nitrogen, the TN accounting method in C. was designed to provide credits for site planning practices that reduce nitrogen loadings from new development. These planning measures include reducing impervious surfaces and protecting open spaces. More detail on planning measures that reduce nitrogen loading is given in Appendix G.

The following BMPs may be utilized for reducing nitrogen from new developments:

- Wet detention ponds
- Constructed wetlands
- Open channel practices
- Riparian buffers
- Bioretention
- Proprietary BMPs

The City of Roxboro estimated total nitrogen removal rates for various BMPs by

conducting a literature search of studies performed on BMPs. The total nitrogen BMP removal rates based on current literature studies are provided in Table 1c Below.

**Table 1c: BMP Types, TN Removal Rates and Design Standards**

<b>BMP Type</b>	<b>TN Removal Rate Based on Current Literature Studies</b>	<b>Appropriate Design Standards</b>
Wet detention ponds	25%	NC and MD Design Manuals
Constructed wetlands	40%	NC and MD Design Manuals
Open channel practices	30%	NC and MD Design Manuals
Riparian buffers	30%	Neuse Riparian Buffer Rule
Vegetated filter strips with level spreader	20%	NC and MC Design Manuals and other literature information
Bioretention	25%	NC and MD Design Manuals
Sand Filters	35%	NC and MD Design Manuals
Proprietary BMPs	Varies	Per manufacturer subject to DWQ approval
Other BMPs	Varies	Subject to DWQ approval

**1F. BMP Maintenance**

If BMPs are implemented to achieve the nitrogen loading and flow attenuation requirements for development, then the City of Roxboro must require a maintenance plan for the BMPs. The stormwater management plan must describe the local government’s selected approach for assuring BMP maintenance. Possible options to be considered include, but are not limited to, the following:

- The jurisdiction can charge a stormwater maintenance fee and assume the responsibility of maintaining the stormwater BMP itself, including providing annual inspection.
- The jurisdiction will notify the owner upon finding that maintenance is needed on a BMP. If the owner does not complete the maintenance himself in a timely manner, then the jurisdiction can contract out the maintenance itself and recover costs in the manner it determines most appropriate.
- The jurisdiction can require that escrow accounts be set up to provide sufficient resources to completely replace the BMP in the event of failure.
- The City of Roxboro will require a legal maintenance agreement for the BMP with the owner.

The City of Roxboro will inspect all BMPs on an annual basis. The resources needed for this will be recovered through an inspection fee or other funding source(s) determined appropriate and necessary by Roxboro. The City of Roxboro will keep a database of BMPs and their locations to assist in the inspection process.

BMPs shall not be included on a separate lot, but should be part of the development site.

## **1I. References**

Arendt, R. Open Space Design Guidebook: Albermarle-Pamlico Estuarine Region. 1993. Prepared for the NC Association of County commissioners. National Lands Trust. Media, PA 259pp.

Environmental Protection Agency. Office of Water. November 1994. Section 319 Success Stories.

Environmental Protection Agency. Office of Water. January 1993. Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters. Washington, DC.

Land of Sky Regional council 1995. Stormwater Fact Sheet Number 8: Plan Early for Stormwater in Your New Development. Asheville, NC. 4pp.

Neuse River Basin. Model Stormwater Program for Nitrogen Control. August 30, 1999.

Schueler, T.S. December 1995. Site Planning for Urban Stream Protection. Metropolitan Washington Council of Governments. Silver Spring, MC 231pp.

Stimmel Associates. 1993. Traditional Neighborhood Development Design Guidelines. Chapel Hill, NC

## **Section 2. Public Education**

### **2A. Requirements in the Rule**

The City of Roxboro Stormwater Ordinance requires the affected jurisdictions in the Basin to develop a locally administered environmental education program to address nitrogen loading issues.

### **2B. Public Education Action Plan**

The City of Roxboro is required to develop a Public Education Action Plan. The purpose of the Action Plan is to provide a platform to design a unique public education effort. The Action Plan will outline the proposed education activities for the upcoming year, identifying target audiences and anticipated costs of the program. The City of Roxboro shall submit an annual Action Plan to DWQ for approval prior to October 1 of each year.

The Action Plan shall consist of activities from two categories listed below in Table 2a. Innovative public education activities not included in this list may be considered for approval on a case-by-case basis. All activities must be designed

to raise awareness and educate the audience about water quality, nonpoint source pollution, and the effects of everyday activities on water quality and nutrient loading. The ultimate goal of the public education program is to utilize major media advertising (television, radio, and newspaper) to reach a broad audience.

**Table 2a: Public Education Action Plan Categories**

<b>Category 1</b>
Quarterly local newspaper articles
Storm drain marking
Recognition Program (recognize environment friendly participants)
Web page

**2C. Flexibility of Implementation / Alternative Programs**

Communities surrounding Roxboro may develop a locally unique program designed to meet their needs as long as the activities meet or exceed the minimum requirements set forth above. While it is not a requirement, targeted communities are encouraged to work with each other to make use of existing resources and stormwater education efforts in their efforts in their areas to meet the requirements. Working together will provide a more consistent education effort for communities of all sizes, will be an efficient use of resources and will reduce duplication of efforts.