Chapter 31
Stormwater Programs

31.1 Introduction

As described in Chapter 26, there have been large increases in population in the Cape Fear River basin. Water quality impacts associated with increased population are numerous. Streams with the worst water quality in the basin are closely associated with existing urban areas. In the Cape Fear River basin, there are over 300 miles of Impaired streams that drain urban or urbanizing watersheds. The following sections describe the various stormwater programs and rules designed to prevent impacts associated with population growth and development as well as recommendations for local governments to further address impacts associated with the increased growth.

31.2 DWQ Stormwater Programs

There are many different stormwater programs administered by DWQ. One or more of these programs affect many communities in the Cape Fear River basin. The goal of the DWQ stormwater discharge permitting regulations and programs is to prevent pollution from entering the waters of the state via stormwater runoff. These programs try to accomplish this goal by controlling the source(s) of pollutants. These programs include NPDES Phase I and II, coastal county stormwater requirements, HQW/ORW stormwater requirements, and requirements associated with the Water Supply Watershed Program. Local governments that are or may be affected by these programs are presented in Table 32.

31.2.1 NPDES Phase I

Phase I of the EPA stormwater program started with Amendments to the Clean Water Act (CWA) in 1990. Phase I required NPDES permit coverage to address stormwater runoff from medium and large stormwater sewer systems serving populations of 100,000 or more people. There are three NPDES Phase I stormwater permits issued to communities in the basin.

Phase I also has requirements for 11 categories of industrial sources to be covered under stormwater permits. Industrial activities which require permitting are defined in categories ranging from sawmills and landfills to manufacturing plants and hazardous waste treatment, storage or disposal facilities. Construction sites disturbing greater than five acres are also required to obtain an NPDES stormwater permit under Phase I of the EPA stormwater program. Excluding construction stormwater general permits, there are 673 general stormwater permits and 47 individual stormwater permits in the Cape Fear River basin. Refer to the subbasin chapters for more information on stormwater programs and permits and a complete listing of individual permits in Appendix VI.

31.2.2 NPDES Phase II

The Phase II stormwater program is an extension of the Phase I program that includes permit coverage for smaller municipalities and covers construction activities down to one acre. The local governments permitted under Phase II will be required to develop and implement a comprehensive stormwater management program that includes six minimum measures.

1) Public education and outreach on stormwater impacts.
2) Public involvement/participation.
3) Illicit discharge detection and elimination.
4) Construction site stormwater runoff control.
5) Post-construction stormwater management for new development and redevelopment.
6) Pollution prevention/good housekeeping for municipal operations.

Construction sites greater than one acre will also be required to obtain an NPDES stormwater permit under Phase II of the EPA stormwater program in addition to erosion and sedimentation control approvals.

Current Status
There are 28 municipalities and 9 counties (Table 32) in the basin that are automatically required (based on 1990 US Census Designated Urban Areas and results of the 2000 US Census) to obtain a Phase II NPDES stormwater permit. These local governments were required to submit applications for NPDES stormwater permits by March 2003. DWQ is currently developing criteria that will be used to determine whether other municipalities should be required to obtain a NPDES permit and how the program will be implemented. DWQ is also working to finalize state rules to implement the Phase II stormwater rules as required by the EPA.

2004 Recommendations
DWQ recommends that the local governments that will be permitted under Phase II proceed with permit applications and develop programs that can go beyond the six minimum measures. Implementation of Phase II, as well as the other stormwater programs, should help to reduce future impacts to streams in the basin. Local governments, to the extent possible, should identify sites for preservation or restoration. DWQ and other NCDENR agencies will continue to provide information on funding sources and technical assistance to support local government stormwater programs.

31.2.3 State Stormwater Program

The State Stormwater Management Program was established in the late 1980s under the authority of the North Carolina Environmental Management Commission (EMC) and North Carolina General Statute 143-214.7. This program codified in 15A NCAC 2H .1000 affects development activities that require either an Erosion and Sediment Control Plan (for disturbances of one or more acres) or a CAMA major permit within one of the 20 coastal counties and/or development draining to Outstanding Resource Waters (ORW) or High Quality Waters (HQW).

The State Stormwater Management Program requires developments to protect these sensitive waters by maintaining a low density of impervious surfaces, maintaining vegetative buffers, and transporting runoff through vegetative conveyances. Low density development thresholds vary

from 12-30 percent built-upon area (impervious surface) depending on the classification of the receiving stream. If low density design criteria cannot be met, then high density development requires the installation of structural best management practices (BMPs) to collect and treat stormwater runoff from the project. High density BMPs must control the runoff from the 1 or 1.5-inch storm event (depending on the receiving stream classification) and remove 85 percent of the total suspended solids.

Current Status

Table 32 shows the 17 counties in the Cape Fear River basin where permits may be required under the state stormwater management program. All development requiring an Erosion and Sediment Control Plan (for disturbances of one or more acres) must obtain a stormwater permit.

2005 Recommendations

DWQ will continue implementing the state stormwater program with the other NCDENR agencies and local governments. Local governments should develop local land use plans that minimize impervious surfaces in sensitive areas. Communities should integrate state stormwater program requirements, to the extent possible, with other stormwater programs in order to be more efficient and gain the most water quality benefits for protection of public health and aquatic life.

Table 32 Communities in the Cape Fear River Subject to Stormwater Requirements

	NPDES Phase I and Phase II	**State Stormwater Program**	**Water Supply Watershed Stormwater Requirements**
Municipalities			
Alamance			**X**
Angier			**X**
Apex	Phase II 1990		**X**
Archdale	Phase II 1990		**X**
Asheboro			**X**
Biscoe			**X**
Broadway			**X**
Burgaw			
Burlington	Phase II 1990		**X**
Calypso			
Cameron			**X**
Candor		**X**	**X**
Carolina Beach	Phase II 2000		
Carrboro	Phase II 1990		**X**
Carthage			**X**
Cary	Phase II 1990		**X**
Chapel Hill	Phase II 1990		

Coats			**X**
Durham	Phase I		**X**
East Arcadia			**X**
Elon	Phase II 1990		
Erwin			**X**
Fayetteville	Phase I		**X**
Franklinville			**X**
Fuquay-Varina	Phase II 2000		**X**
Garland		**X**	
Gibsonville	Phase II 2000		**X**
Goldston			**X**
Graham	Phase II 1990		
Green Level	Phase II 2000		**X**
Greensboro	Phase I		**X**
Haw River	Phase II 1990		**X**
High Point	Phase II 1990		**X**
Holly Springs	Phase II 2000		
Hope Mills	Phase II 1990		
Jamestown	Phase II 1990		**X**
Kernersville	Phase II 2000		**X**
Kure Beach	Phase II 2000		
Leland	Phase II 1990		
Liberty			**X**
Lillington			**X**
Mebane	Phase II 1990		**X**
Morrisville	Phase II 2000		**X**
Navassa	Phase II 2000		
North Topsail Beach		**X**	
Pinehurst			**X**
Pittsboro			**X**
Randleman			**X**
Reidsville			**X**
Robbins			**X**
Sandyfield			**X**
Sanford			**X**
Seagrove			**X**
Siler City			**X**
Southern Pines			**X**
Spring Lake	Phase II 1990		**X**
Staley			**X**

Star			**X**
Stokesdale			**X**
Summerfield			**X**
Swepsonville	Phase II 2000		
Taylortown			**X**
Vass		**X**	**X**
Wade			**X**
Whispering Pines		**X**	**X**
Whitsett			**X**
Wilmington	Phase II 1990	**X**	
Wrightsville Beach	Phase II 1990		
Counties			
Alamance	Phase II 1990		**X**
Bladen		**X**	**X**
Brunswick	Phase II 1990	**X**	
Caswell			**X**
Chatham	Phase II 2000	**X**	**X**
Columbus		**X**	**X**
Cumberland		**X**	**X**
Duplin		**X**	
Durham			**X**
Forsyth	Phase II 1990		**X**
Guilford	Phase II 1990	**X**	**X**
Harnett		**X**	**X**
Hoke		**X**	**X**
Johnston			
Lee		**X**	**X**
Montgomery		**X**	**X**
Moore		**X**	**X**
New Hanover	Phase II 1990	**X**	**X**
Onslow	Phase II 1990	**X**	
Orange	Phase II 1990		**X**
Pender		**X**	**X**
Randolph		**X**	**X**
Rockingham			**X**
Sampson		**X**	
Wake	Phase II 1990		**X**

31.2.4 Water Supply Watershed Stormwater Rules

The purpose of the Water Supply Watershed Protection Program is to provide an effective drinking water supply protection program for communities. Local governments administer the program based on state minimum requirements. There are restrictions on wastewater discharges, development, landfills and residual application sites to control the impacts of point and nonpoint sources of pollution. The program attempts to minimize the impacts of stormwater runoff by utilizing low density development or stormwater treatment in high density areas.

Current Status
All communities in the Cape Fear River basin in water supply watersheds have EMC approved water supply watershed protection ordinances.

2005 Recommendations
DWQ recommends continued implementation of local water supply protection ordinances to ensure safe and economical treatment of drinking water. Communities should also integrate water supply protection ordinances with other stormwater programs, to the extent possible, in order to be more efficient and gain the most water quality benefits for both drinking water and aquatic life.

31.3 Local Government Role in Addressing Runoff Impacts

31.3.1 The Role of Local Governments

A summary of recommended management actions by local authorities is provided here, followed by discussions on large, watershed management issues. These recommended actions are necessary to address current sources of impairment and to prevent continuing degradation in all streams. The intent of these recommendations is to describe the types of actions necessary to improve stream conditions, not to specify particular administrative or institutional mechanisms for implementing remedial practices. Those types of decisions must be made at the local level.

Because of uncertainties regarding how individual remedial actions cumulatively impact stream conditions and in how aquatic organisms will respond to improvements, the intensity of management effort necessary to bring about a particular degree of biological improvement cannot be established in advance. The types of actions needed to improve biological conditions can be identified, but the mix of activities that will be necessary – and the extent of improvement that will be attainable – will only become apparent over time as an adaptive management approach is implemented. Management actions are suggested below to address individual problems, but many of these actions are interrelated.

Actions one through five are important to restoring and sustaining aquatic communities in the watershed, with the first three recommendations being the most important.

1. **Feasible and cost-effective stormwater retrofit projects should be implemented throughout the watershed to mitigate the hydrologic effects of development** (increased stormwater volumes and increased frequency and duration of erosive and scouring flows). This should be viewed as a long-term process. Although there are many uncertainties, costs in the range of $1 million per square mile can probably be anticipated.

a. Over the short-term, currently feasible retrofit projects should be identified and implemented.
b. In the longer term, additional retrofit opportunities should be implemented in conjunction with infrastructure improvements and redevelopment of existing developed areas.
c. Grant funds for these retrofit projects may be available from EPA initiatives, such as Section 319 funds, or the North Carolina Clean Water Management Trust Fund.

2. **A watershed scale strategy to address toxic inputs should be developed and implemented, including a variety of source reduction and stormwater treatment methods.** As an initial framework for planning toxicity reduction efforts, the following general approach is proposed:
    a. Implementation of available BMP opportunities for control of stormwater volume and velocities. As recommended above to improve aquatic habitat potential, these BMPs will also remove toxics from stormwater.
    b. Development of a stormwater and dry weather sampling strategy in order to facilitate the targeting of pollutant removal and source reduction practices.
    c. Implementation of stormwater treatment BMPs, aimed primarily at pollutant removal, at appropriate locations.
    d. Development and implementation of a broad set of source reduction activities focused on: reducing nonstorm inputs of toxics; reducing pollutants available for runoff during storms; and managing water to reduce storm runoff.
3. **Stream channel restoration activities should be implemented in target areas, in conjunction with stormwater retrofit BMPs, in order to improve aquatic habitat.** Before beginning stream channel restoration, a geomorphologic survey should be conducted to determine the best areas for stream channel restoration. Additionally, it would probably be advantageous to implement retrofit BMPs before embarking on stream channel restoration, as restoration is probably best designed for flows driven by reduced stormwater runoff. Costs of approximately $200 per foot of channel should be anticipated (Haupt et *al*., 2002 and Weinkam et *al*., 2001). Grant funds for these retrofit projects may be available from federal sources, such as EPA's Section 319 funds, or state sources including North Carolina Clean Water Management Trust Fund.
4. Actions recommended above (e.g., stormwater quantity and quality retrofit BMPs) are likely to reduce nutrient/organic loading and its impacts to some extent. Activities recommended to address this loading include the identification and elimination of illicit discharges; education of homeowners, commercial applicators, and others regarding proper fertilizer use; street sweeping; catch basin clean-out practices; and the installation of additional BMPs targeting BOD and nutrient removal at appropriate sites.
5. Prevention of further channel erosion and habitat degradation will require effective post-construction stormwater management for all new development in the study area.
6. Effective enforcement of sediment and erosion control regulations will be essential to the prevention of additional sediment inputs from construction activities. Development of improved erosion and sediment control practices may be beneficial.
7. Watershed education programs should be implemented and continued by local governments with the goal of reducing current stream damage and preventing future degradation. At a minimum, the program should include elements to address the following issues:
    a. redirecting downspouts to pervious areas rather than routing these flows to driveways or gutters;

b. protecting existing woody riparian areas on all streams;
c. replanting native riparian vegetation on stream channels where such vegetation is absent; and
d. reducing and properly managing pesticide and fertilizer use.

31.3.2 Maintain and Reestablish Riparian Buffers

The presence of intact riparian buffers and/or wetlands in urban areas can reduce the impacts of urban development. Establishment and protection of buffers should be considered where feasible, and the amount of impervious cover should be limited as much as possible. Wide streets, large cul-de-sacs, and long driveways and sidewalks lining both sides of the street are all features of urban development that create excess impervious cover and consume natural areas. Preserving the natural streamside vegetation (riparian buffer) is one of the most economical and efficient BMPs. Forested buffers in particular provide a variety of benefits including filtering runoff and taking up nutrients, moderating water temperature, preventing erosion and loss of land, providing flood control and helping to moderate streamflow, and providing food and habitat for both aquatic and terrestrial wildlife. To obtain a free copy of DWQ's *Buffers for Clean Water* brochure, call (919) 733-5083, ext. 558.

31.3.3 Protecting Headwaters

Many streams in a given river basin are only small trickles of water that emerge from the ground. A larger stream is formed at the confluence of these trickles. This constant merging eventually forms a large stream or river (Figure 41). Most monitoring of fresh surface waters evaluates these larger streams. The many miles of small trickles, collectively known as headwaters, are not directly monitored and in many instances are not even indicated on maps. These streams account for approximately 80 percent of the stream network and provide many valuable services for quality and quantity of water delivered downstream (Meyer et *al*., 2003). However, degradation of headwater streams can (and does) impact the larger stream or river.

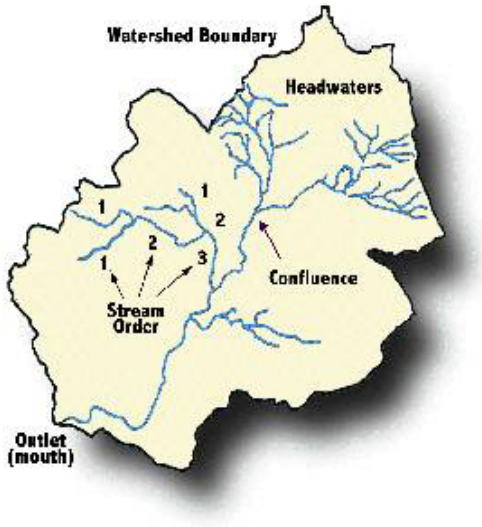

Figure 41 Diagram of Headwater Streams within a Watershed Boundary

There are three types of headwater streams: perennial (flow year-round), intermittent (flow during wet seasons), and ephemeral (flow only after precipitation events). All types of headwater streams provide benefits to larger streams and rivers. Headwater streams control flooding, recharge groundwater, maintain water quality, reduce downstream sedimentation, recycle nutrients, and create habitat for plants and animals (Meyer et *al*., 2003).

In smaller headwater streams, fish communities are not well developed and benthic macroinvertebrates dominate aquatic life. Benthic macroinvertebrates are often thought of as "fish food" and, in mid-sized streams and rivers, they are critical to a healthy fish community. However, these insects, both in larval and adult stages, are also food for small mammals, such as river otter and raccoons, birds and amphibians (Erman, 1996). Benthic macroinvertebrates in headwater streams also perform the important function of breaking down coarse organic matter, such as leaves and twigs, and releasing fine organic matter. In larger rivers, where coarse organic matter is not as abundant, this fine organic matter is a primary food source for benthic macroinvertebrates and other organisms in the system (CALFED, 1999). When the benthic macroinvertebrate community is changed or extinguished in an area, even temporarily, as occurs during land use changes, it can have repercussions in many parts of both the terrestrial and aquatic food web.

Headwater streams also provide a source of insects for repopulating downstream waters where benthic macroinvertebrate communities have been eliminated due to human alterations and pollution. Adult insects have short life spans and generally live in the riparian areas surrounding the streams from which they emerge (Erman, 1996). Because there is little upstream or stream-to-stream migration of benthic macroinvertebrates, once headwater populations are eliminated, there is little hope for restoring a functioning aquatic community. In addition to macroinvertebrates, these streams support diverse populations of plants and animals that face similar problems if streams are disturbed. Headwater streams are able to provide these important ecosystem services due to their unique locations, distinctive flow patterns, and small drainage areas.

Because of the small size of headwater streams, they are often overlooked during land use activities that impact water quality. All landowners can participate in the protection of headwaters by keeping small tributaries in mind when making land use management decisions on the areas they control. This includes activities such as retaining vegetated stream buffers, minimizing stream channel alterations, and excluding cattle from streams. Local rural and urban planning initiatives should also consider impacts to headwater streams when land is being developed. For a more detailed description of watershed hydrology and watershed management, refer to EPA's Watershed Academy website at http://www.epa.gov/OWOW/watershed/wacademy/acad2000/watershedmgt/principle1.html.

31.3.4 Reduce Impacts of Future Development

Proactive planning efforts at the local level are needed to assure that development is done in a manner that maintains water quality. These planning efforts will need to find a balance between water quality protection, natural resource management and economic growth. Growth management requires planning for the needs of future population increases, as well as developing and enforcing environmental protection measures. These actions are critical to water quality management and the quality of life for the residents of the basin.

Areas adjacent to the high growth areas of the basin are at risk of having Impaired biological communities. These biological communities are important to maintaining the ecological integrity in the Cape Fear River basin. These streams will be important as sources of benthic macroinvertebrates and fishes for reestablishment of biological communities in nearby streams that are recovering from past impacts or are being restored.

To prevent further impairment to aquatic life in streams in urbanizing watersheds local governments should:

1. Identify waters that are threatened by development.
2. Protect existing riparian habitat along streams.
3. Implement stormwater BMPs during and after development.
4. Develop land use plans that minimize disturbance in sensitive areas of watersheds.
5. Minimize impervious surfaces including roads and parking lots.
6. Develop public outreach programs to educate citizens about stormwater runoff.

Action should be taken at the local level to plan for new development in urban and rural areas.

For more detailed information regarding recommendations for new development found in the text box (above), refer to EPA's website at www.epa.gov/owow/watershed/wacademy/acad2000/protection, the Center for Watershed Protection website at www.cwp.org, and the Low Impact Development Center website at www.lowimpactdevelopment.org. Additional public education is also needed in the Cape Fear River basin in order for citizens to understand the value of urban planning and stormwater management. DWQ recently developed a booklet that discusses actions individuals can take to reduce stormwater runoff and improve stormwater quality entitled *Improving Water Quality In Your Own Backyard*. To obtain a free copy, call (919) 733-5083, ext. 558. For an example of local community planning, visit the website at http://www.charmeck.org/Home.htm.

Planning Recommendations for New Development

- Minimize number and width of residential streets.
- Minimize size of parking areas (angled parking & narrower slots).
- Place sidewalks on only one side of residential streets.
- Minimize culvert pipe and hardened stormwater conveyances.
- Vegetate road right-of-ways, parking lot islands and highway dividers to increase infiltration.
- Plant and protect natural buffer zones along streams and tributaries.