

Chapter 12

Water Quality Management Strategies

12.1 The Role of State Government

Several commissions, agencies and programs handle state policies governing actions and activities in coastal areas. The *Environmental Management Commission* (EMC) is a 19-member panel that is appointed by the governor and legislative officials and is responsible for adopting rules for the protection, preservation and enhancement of the state's water and air. Water related rules include stormwater management, basinwide planning, nutrient management strategies and discharge permits.

The North Carolina Coastal Area Management Act (CAMA) established a cooperative program of coastal area management between local and state governments. The Act states that local governments shall have the initiative for planning, while the state government establishes areas of environmental concern. With regard to planning, the state government is directed to act primarily in a supportive, standard-setting, and review capacity, except in situations where local governments do not elect to exercise their initiative. In addition, the CAMA established the *Coastal Resource Commission* (CRC) within the Department of Environment and Natural Resources, whose duties include approval of Coastal Habitat Protection Plans and designation of Areas of Environmental Concern (AEC). After designation of these areas, the Commission is responsible for issuing all permits and establishes regulations to control development. The CRC is a 15-member board appointed by the governor to adopt rules and policies for coastal development and certify local land use plans for the 20 coastal counties and their communities. These regulations are implemented and permitted by the Division of Coastal Management (DCM) (see website <http://dcm2.ehn.state.nc.us/>). An example of these rules is the establishment of a 30-foot buffer zone for building along estuarine waters.

The Division of Marine Fisheries is responsible for the stewardship of the state's marine and estuarine resources, which encompasses all coastal waters and extends to 3 miles offshore. Agency policies are established by the 9-member *Marine Fisheries Commission* and the Secretary of the Department of Environment and Natural Resources.

The N.C. Divisions of Water Quality, Coastal Management, Land Resources, Marine Fisheries, Soil and Water Conservation, Parks and Recreation and Environmental Health are responsible for many coastal activities and policies including stormwater management, development permits, erosion control programs, agriculture and land preservation, shellfish protection and recreation monitoring, just to name a few. Additional state programs include the Albemarle-Pamlico National Estuary Program (APNEP) and many inter-agency and group partnerships that work together to protect the resources found in coastal waters and communities.

The Coastal Zone Management Act requires NOAA to evaluate the performance of federally approved state coastal management programs. During the review of NC's CAMA specific recommendations call for the assessment of existing NC laws and regulations to minimize redundancy and avoid conflict with other regulations, prioritize emerging coastal issues and use adaptive management based on lessons learned.

12.2 Coastal Habitat Protection Plan

North Carolina has approximately 2.9 million acres of estuarine and marine waters, comprising the largest estuarine system of any state along the Atlantic coast. North Carolina has a billion-dollar commercial and recreational fishing industry and ranks among the nation's highest seafood-producing states. Fish and shellfish species important to these industries depend on the quality and quantity of habitats found along our rivers, sounds and ocean waters. Pressures from development, loss of habitat, pollution and degraded water quality threaten fish habitats. Shellfish beds, mud flats, marshes, sea grass beds, freshwater streams and swamps are in jeopardy. The loss of these vital fish habitats threatens fishing industry central to North Carolina's history and economic growth.

Recognizing these threats, the N.C. General Assembly passed the Fisheries Reform Act of 1997. Included within this law is a requirement for three of the state's regulatory commissions (Marine Fisheries, Environmental Management, and Coastal Resources commissions) to adopt a plan to manage and restore aquatic habitats critical to North Carolina's commercial and recreational fisheries resources. The DENR developed the Coastal Habitat Protection Plan (CHPP) through a cooperative, multi-agency effort with public input. The CHPP was adopted by the three commissions in December 2004 and sets the stage for unprecedented improvements in fish habitat protection and restoration in North Carolina.

The CHPP is a detailed document describing the six major fish habitats and providing scientific information on their ecological functions and importance to the species that inhabit them. It identifies threats and management needs for each habitat and recommends administrative, regulatory and non-regulatory steps necessary to protect, restore and enhance each habitat. These recommendations are a result of scientific studies, deliberations of the three commissions and input from citizens who attended 20 public meetings held during the development of the CHPP. The CHPP identifies six habitats that need protection or enhancement:

- Water Column
- Shell Bottom
- Submerged Aquatic Vegetation (SAV)
- Wetlands
- Soft Bottom
- Hard Bottom

DENR and the three commissions developed and adopted specific plans to implement the CHPP recommendations, with a focus on actions that could be taken based on existing resources and within the 2005-2007 budget cycle. The implementation actions are organized according to four habitat management goals:

GOAL 1. Improve effectiveness of existing rules and programs protecting coastal fish habitats

North Carolina has a number of programs already in place to protect coastal fisheries and the natural resources that support them. The Marine Fisheries Commission (MFC) has adopted rules addressing the impacts of certain types of fishing gear and fishing practices that may damage fish habitats. The Coastal Resources Commission (CRC) regulates development impacts on certain types of critical coastal habitats, such as saltwater marshes and primary nursery areas. The Environmental Management Commission (EMC) has issued water quality standards that address

pollution of coastal waters from both direct discharges and runoff. The Coastal Habitat Protection Plan (CHPP) identifies a number of gaps in the protection provided for critical fish habitats under these programs, but also notes that these habitats would benefit from stronger enforcement of existing regulations and better coordination among agencies.

Recommendation 1.1 Enhance enforcement of, and compliance with, Coastal Resources Commission, Environmental Management Commission and Marine Fisheries Commission rules and permit conditions.

Recommendation 1.2 Coordinate and enhance water quality, physical habitat and fisheries resource monitoring (including data management) from headwaters to the nearshore ocean.

Recommendation 1.3 Enhance and expand educational outreach on the value of fish habitat, threats from human activities, effects of non-native species and reasons for management measures.

Recommendation 1.4 Coordinate rulemaking and enforcement among regulatory commissions and agencies.

GOAL 2. Identify, designate and protect strategic habitat areas

Maintaining healthy coastal fisheries requires consideration of the entire ecosystem and the way different types of fish habitat work together. For example, coastal marshes help prevent erosion of soft bottom habitat. Unobstructed passage through the water column allows certain fish species to reach their spawning grounds in inland wetlands. Fragmenting these habitats, or damaging one of a series of interrelated habitats makes it more difficult for aquatic systems to support strong and healthy coastal fisheries. In 1998, the EMC, CRC, and MFC defined Strategic Habitat Areas. These areas are complexes of fisheries habitat that “provide exceptional functions that are particularly at risk due to imminent threats, vulnerability or rarity.” These areas merit special attention and should be given high priority for conservation.

Recommendation 2.1 Evaluate potential Strategic Habitat Areas (SHAs) by a) coordinating, completing and maintaining baseline habitat mapping (including sea grass, shell bottom and other bottom types) using the most appropriate technology; b) selective monitoring of the status of those habitats; and c) assessing effects of land use and human activities on those habitats.

Recommendation 2.2 Identify and designate SHAs using ecologically based criteria, analyze existing rules and enact measures needed to protect SHAs and improve programs for conservation (including voluntary actions) and acquisition of areas supporting SHAs.

GOAL 3. Enhance habitat and protect it from physical impacts

The CHPP identifies a number of ways in which fish habitats can be damaged by direct physical impacts. Some examples include filling of wetlands, dredging of soft bottom habitat, destruction of shell bottom and hard bottom areas, damage to submerged aquatic vegetation by use of certain types of fishing gear, and physical obstructions that block fish movement to and from spawning areas. While large impacts can directly contribute to the loss of habitat functions, the accumulation of many small impacts can make a habitat more vulnerable to damage from which it might otherwise recover quickly. In some cases, historic damage to a habitat can be mitigated through the creation of sanctuaries where the resource can recover. One such program involves creation of protected oyster reefs. In other cases, the cumulative impacts of multiple projects can be more effectively managed through comprehensive planning and plan implementation.

Recommendation 3.1 Greatly expand habitat restoration.

Recommendation 3.2 Prepare and implement a comprehensive beach and inlet management plan that addresses ecologically based guidelines, socioeconomic concerns and fish habitat.

Recommendation 3.3 Protect submerged aquatic vegetation (SAV), shell bottom and hard bottom areas from fishing gear effects through improved enforcement, establishment of protective buffers around habitats and further restriction of mechanical shellfish harvesting.

Recommendation 3.4 Protect fish habitat by revising estuarine and public trust shoreline stabilization rules using best available information, considering estuarine erosion rates, and the development and promotion of incentives for use of alternatives to vertical shoreline stabilization measures.

Recommendation 3.5 Protect and enhance habitat for anadromous fishes by: a) incorporating the water quality and quantity needs of fish in surface water use planning and rule making and b) eliminating obstructions to fish movements, such as dams, locks and road fills.

GOAL 4. Enhance and Protect Water Quality

Good water quality is essential to coastal fisheries because water is the common element in all fish habitats. The water conditions necessary to support coastal fisheries include the right combination of temperature and salinity, as well as the absence of harmful pollutants. Achieving and maintaining good water quality for purposes of fisheries productivity requires management of both direct discharges of pollutants and stormwater runoff. The CHPP provides additional support for policies directed toward better management of point and non-point sources of water pollution. In doing so, the CHPP recognizes a need to go beyond relying on regulatory programs alone. Addressing water quality impacts will also require targeted use of land acquisition programs, incentives for conservation, development of effective BMPs, and assistance for local governments to upgrade wastewater and stormwater management infrastructure. Maintaining the water quality necessary to support vital coastal fisheries will not only benefit the commercial fishing industry – it will benefit a large sector of the entire coastal economy built around travel and tourism, and recreational fishing.

Recommendation 4.1 Reduce point source pollution from wastewater.

Recommendation 4.2 Adopt or modify rules or statutes to prohibit ocean wastewater discharges.

Recommendation 4.3 Prohibit new or expanded stormwater outfalls to coastal beaches and to coastal shellfishing waters (EMC surface water classifications SA and SB) except during times of emergency when public safety and health are threatened, and continue to phase out existing outfalls by implementing alternative stormwater management strategies.

Recommendation 4.4 Enhance coordination with, and financial/technical support for, local government actions to better manage stormwater and wastewater.

Recommendation 4.5 Improve land-based strategies throughout the river basins to reduce non-point pollution and minimize cumulative losses to wetlands and streams through voluntary actions, assistance and incentives.

Recommendation 4.6 Improve land-based strategies throughout the river basins to reduce non-point pollution and minimize cumulative losses to wetlands and streams through rule making.

Recommendation 4.7 Develop and implement a comprehensive coastal marina and dock management plan and policy for the protection of shellfish harvest waters and fish habitat.

Recommendation 4.8 Reduce non-point source pollution from large-scale animal operations by the following actions: a) support early implementation of environmentally superior alternatives to the current lagoon and sprayfield systems as identified under the Smithfield Agreement and continue the moratorium on new/expanded swine operations until alternative waste treatment technology is implemented; b) seek additional funding to phase-out large-scale animal operations

in sensitive areas and relocate operations from sensitive areas; and c) use improved siting criteria to protect fish habitat.

Visit <http://www.ncdmf.net/habitat/index.html> to learn more about the CHPP or to download a copy of the plan. Questions and comments can be directed to chpps@ncmail.net or by calling (252) 726-7021 or (800) 682-2632.

12.3 Oyster Action Plan

Over the past several years efforts to restore North Carolina's native oyster have increased significantly and annual oyster harvests have also increased. However, since the early 1900's, the oyster population has declined an estimated 90 percent due to a variety of factors – habitat loss, pollution, diseases, and harvest pressure. Recognizing the need for concerted action to reverse this trend and the value of a healthy oyster population, an Oyster Forum was sponsored by the North Carolina Coastal Federation in 2003 and is supported by the state's CHPP. The forum participants, including scientists, fishermen, policymakers and educators, drafted the *Oyster Restoration and Protection Plan for North Carolina: A Blueprint for Action*. Goals of this plan include:

- To restore and protect North Carolina's native oyster populations, and habitat so that estuaries are again robust, diverse, & resilient ecosystems,
- To build broad public awareness & support for the value of estuarine conservation & sustainable fisheries, and
- To work with a strong coalition to make significant, demonstrable & meaningful progress towards oyster restoration in the next 3-5 years.

Within the Pasquotank River Basin, the Oyster Action Plan has identified priority areas where restoration and protection efforts will start.

- Low Priority areas include: Stumpy Point (H3)
- Medium Priority areas include: Hatteras (H4), Outer Banks (H5), Roanoke Sound & Croatan Sound (H1/H2)

To achieve the goals of oyster protection and restoration there needs to be an increase in funding and resources allocated to oyster research, public education, regulation enforcement and land acquisition. The Blueprint identifies a need to increase resources available to the Division of Marine Fisheries' Shellfish Rehabilitation Program, planning oyster hatcheries at the NC Aquariums, and designating more oyster sanctuaries. Public education activities could focus on individual actions to include oyster shell recycling and oyster gardening. To promote a sustainable oyster industry opportunities for increasing mariculture are sought. Cleaning up existing sources of point and nonpoint source pollution in shellfish waters and watersheds is essential along with improving enforcement of discharge regulations. Communities not under stormwater regulations should voluntarily implement effective stormwater rules and include them in their CAMA Land Use Plans. DEH Shellfish Sanitation surveys are a valuable source for identifying water quality concerns and areas that threaten oyster health; supporting these surveys with resources and expanding their mapping capabilities is important for oyster restoration and protection.

12.4 NC Coastal Nonpoint Source Program

Section 6217 of the Federal 1990 Coastal Zone Act Reauthorization Amendments (CZARA) requires every state participating in the Coastal Zone Management Act Program to develop a Coastal Nonpoint Source Program (CNPSP). The purpose of this requirement, as stated in the Act, is to "strengthen the links between Federal and State coastal zone management and water quality management programs and to enhance State and local efforts to manage land use activities that degrade coastal waters and coastal habitats." To accomplish these goals, the federal agencies established 56 Management Measures that are to be used by each state to address the following nonpoint source pollution categories (first five items) and that provide tools to address the various sources of nonpoint pollution (last item):

- Agricultural Sources
- Forestry
- Urban Areas (*urban runoff; construction activities; existing development; on-site disposal systems; pollution prevention; and roads, highways and bridges*)
- Marinas and Recreational Boating (*siting and design; and marina and boat operation/maintenance*)
- Hydrologic Modification (*channelization and channel modification; dams; and streambank and shoreline erosion*)
- Wetlands, Riparian Areas and Vegetated Treatment Systems

Detailed descriptions of the management measures, where they are intended to be applied, their effectiveness, and their costs can be found in EPA's *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters* at the following website:

<http://www.epa.gov/owow/nps/MMGI/>.

Within North Carolina, Coastal Nonpoint Source Program (CNPSP) is administered by the Division of Water Quality (DWQ) and the Division of Coastal Management (DCM).

The core of the state's CNPSP is increased communication and coordination between DWQ and key state agencies that have regulatory responsibilities for controlling nonpoint sources of pollution. This increased dialogue is facilitated in part by the state's CNPSP Coordinator and promotes identification of gaps, duplications, inadequacies and/or inefficiencies of existing programs and policies. Responsibilities of the state program coordinator also include developing the 15-year Strategy Plan, serving as a liaison between DWQ and DCM, and participating in the development of nonpoint source outreach and educational activities. For more information, contact the NC Coastal Nonpoint Source Program Coordinator at (919) 733-5083, ext. 567.

CNPSP Evaluation

Since obtaining federal approval of its program in 2003, North Carolina made significant progress in implementing the management measures of the state's CNPSP. This finding is based on a review of a range of programs, actions and initiatives of state agencies, local governments, cooperating federal agencies and regulatory and non-regulatory programs between 2002 (the year the State's plan received preliminary federal approval) and 2006, which focus directly or indirectly on avoiding, reducing, and/or treating nonpoint source pollution in the coastal counties.

North Carolina met three of the four objectives of its CNPSP Five-Year Action Plan: 2004-2008, as a result of program improvements and initiatives listed below:

- Working with other agencies to improve data management capabilities and distribution to more effectively address nonpoint source impacts;
- Improving implementation and enforcement of existing regulations and programs and
- Developing effective and dynamic education and outreach programs.

Progress on the fourth objective, reducing fecal loading into impaired SA waters, continues to be challenging. North Carolina faces enormous environmental challenges as a consequence of population growth and development. With most of the state's oceanfront developed, large tracts along the estuarine shoreline and adjacent to the Intracoastal Waterway are being developed. The CNPSP's greatest challenges for the foreseeable future lie in strengthening the state's stormwater management programs to achieve real protection for unimpaired waters, while facilitating significant restoration of impaired waters coast-wide. The NC CNPSP will continue working to establish and strengthen programs and tools to offset the impacts associated with growth in this sensitive and vital region of the state.

Coastal population growth and development will continue to strain local and state government resources. Of great concern is the fact that current state and local land use planning and environmental management programs are not sufficient to address coastal nonpoint source pollution. Therefore, the NC CNPSP intends to pursue improvements in the following major program areas:

I. Developing Partnerships and NPS Implementation Tools with Local Governments

In North Carolina, local governments have primary responsibility for planning and managing growth within the framework of state law and regulations. Most development activities are reviewed by, approved or denied by appointed and elected local government boards comprised of citizens. They are volunteers often with some or limited training on the technical issues of land use, transportation and stormwater management.

Neither state agencies nor local governments alone can address the complexities of development and environmental sustainability. An integrated approach that incorporates training and the development of implementation tools with more formalized technical assistance and grants, as incentives should be explored. Some excellent building blocks for an integrated local government assistance program include DCM's land use planning program and community planners; the University of North Carolina's School of Government training programs; the NC Chapter of the American Planning Association citizen planners training program, Sea Grant's Water Quality Planner; the NC National Estuarine Research Reserve's Coastal Training Program, the Cooperative Extension Service's Growth Readiness program, the county Cooperative Extension Service programs, the Clean Water Management Trust Fund, the Ecosystem Enhancement Program's local watershed plans and the Clean Water State Revolving Loan Fund.

II. Improving Stormwater Management

While progress has been significant, major challenges to managing and eliminating stormwater impacts remain. Although North Carolina's coastal stormwater rules have been in effect for over 15 years, DWQ staff, other resource management agencies and many citizens believe the rules are ineffective. In January 2007, DWQ issued rules for a new stormwater program for local governments, the Universal Stormwater Management Program (USMP).

The USMP improves on the current rules by essentially eliminating the ability to avoid use of stormwater best management practices (BMPs) by staying below certain impervious thresholds. USMP strengthens other provisions as well, including treatment of a larger stormwater volume and providing attenuation of larger flows. While USMP would improve protections, it is only a voluntary option.

In recognition of the inability of existing rules to reduce the water quality impacts of stormwater and the need for stronger minimum mandatory measures, the DWQ is proposing changes to the coastal stormwater rules that are similar to the USMP but not quite as protective, requiring instead engineered stormwater treatment devices for all development adjacent to high quality coastal waters that have more than 12 percent built-upon area. The rules will also require the use of control measures that result in fecal coliform die off and control sources of fecal coliform.

Compliance with the stormwater rules is a significant issue. NC CNPSP funded inspections of a significant number of permit renewal sites in DWQ's Wilmington Regional Office region and found that approximately 35 percent were not in compliance. Approximately 8 percent of the sites had installation problems or design deficiencies and 2 percent exceeded the impervious area limits. Lack of routine maintenance was the main cause of non-compliance in the majority of inspected sites.

There is not enough DWQ field staff to inspect every site, and this situation is compounded by insufficient and incorrect information on these sites in DWQ's permit tracking system. A grant from the CNPSP is funding a DWQ effort to develop a field inspection form, inspect a subset of permitted sites that will be up for renewal in 2007 and 2008 and develop a consistent method for processing renewal permits and entering the data in DWQ's tracking system. This work should be completed by December 2007.

The increase in development in the coastal counties has resulted in the construction of hundreds of roads servicing subdivisions. Under current state law the state Department of Transportation (DOT) can be petitioned to designate roads as public and be maintained by DOT. DOT District Engineers review subdivision maps and/or plats for conformance with the state's minimum construction standards. They also review the stormwater facilities operations and maintenance plan required as part of this process. Coordination between the regional offices of DWQ and the appropriate DOT district offices on pending state stormwater permits could result in improvements in the proposed drainage plans and implementation of appropriate stormwater BMPs, including minimizing stormwater through site design.

Local governments have primary responsibility to plan for and manage growth in their jurisdictions. While many coastal counties and municipal governments are making progress on stormwater management, a 2006 UNC School of Government survey of local ordinances found that while 18 of the 20 coastal counties have subdivision ordinances, only eight have stormwater ordinances effective throughout their jurisdiction, two have partial coverage and only seven have erosion and sediment control ordinances. Without improvements to local government development ordinances, local stormwater management and enforcement, coastal water quality will continue to be compromised.

III. Improving Management of Marinas and Recreational Boating

There are approximately 450 marinas in coastal North Carolina and over 100 shops where boats are built. There are thousands of private docks and piers as well. In the first seven months of 2006, DCM approved 53 major permit applications that added 340 private boat slips to coastal waters. Of these almost 90 were new residential multi-slip docking facilities. In addition, DCM issued approximately 1200 general permits in 2006 for small docks/piers of one or two slips (GP 07H .1200). At a minimum, these general permits added 1200 new residential boat slips in the state's coastal waters in one year.

The CNPSP funded a unified marina policy project, and the project Steering Committee concluded that the state should focus on improving management of facilities with 3-10 slips. These multi-slip docking facilities currently are not subject to the more comprehensive state regulatory review required of marinas; yet their locations and numbers are believed to have significant impact on water quality and fragile coastal habitat. The DCM and Marine Fisheries are cooperatively developing guidance on placement of structures in shallow waters and the DCM has made changes to its major permit application for marinas and multi-slip docking facilities to capture more detailed information.

The DWQ is conducting a marina and boatyard study to: 1) better understand the services and activities common to marinas, boatyards, and manufacturers, 2) determine if these facilities are properly covered by a NPDES stormwater permit (NCG190000), 3) understand types/frequency of process wastewater discharges that occur at these facilities and 4) sample process wastewater in order to understand and characterize waste streams.

The state law governing the designation of no-wake zones should be amended to allow designation to protect estuarine and river shorelines and shallow water habitats.

IV. Developing Best Management Practices Guidance for Hydromodification Projects

Many ditches and canals in coastal North Carolina were first excavated for agriculture and forestry. Their management and maintenance continues to be exempt from state environmental review even though many are now managed for flood control purposes. Coastal counties and local governments have developed, or are in the process of developing stormwater management plans that include maintaining some existing drainage canals and ditches to avoid flooding of residential and commercial development. These maintenance activities can adversely impact water quality as well as riparian vegetation and fresh water and estuarine resources. Routine maintenance to remove debris from these canals and ditches, and cleanup in response to storm damage, is done in the absence of comprehensive guidance that could minimize the environmental impacts.

The DENR should establish an interagency working group to develop guidance on best management practices for routine and emergency maintenance activities. Adherence to this guidance should be required, at a minimum, for maintenance and management projects funded under the state's water resources development grants and the Clean Water Management Trust Fund. The working group could also consider developing a hands-on training program for contractors who conduct snagging and clearing activities, similar in intent to the Clear Water Contractor workshops conducted by the Division of Land Resources.

The working group should include representatives of the Divisions of Water Resources, DWQ, Forest Resources, Division of Soil and Water Conservation, Marine Fisheries, DCM, the Wildlife Resources Commission and the Ecosystem Enhancement Program, along with the U.S. Army Corps of Engineers, the Fish and Wildlife Service and the Natural Resources Conservation Service.

V. Updating Information for Decision Making

The most recent land-cover information for North Carolina is based on 1997 imagery. Given the significant increases in population and development in the coastal counties, the use of ten-year old information does not allow for analysis of current conditions. North Carolina needs to update the state's land cover information and develop a funding and planning mechanism for continued updating on a 3-5 year basis.

12.5 Community Conservation Assistance Program

The landscape of North Carolina is changing and Soil and Water Conservation Districts have voiced concern about a void in program areas to address the growing threat of nonpoint source pollution issues on non-agricultural lands. In the summer of 2005, a survey was distributed to all districts to inventory their level of interest and best management practices (BMP) needs on urban, suburban and rural lands. Many districts completed surveys about their needs for this program, and they requested over \$6.5 million for local projects. Division staff used the survey responses to develop two grant applications for program funding. In July 2006, while the grant applications were still under review, the legislature unanimously passed H2129, creating the Community Conservation Assistance Program (CCAP). Shortly after, both grants were approved at 100 percent funding. An additional survey was completed in fall 2006, and 40 districts responded with needs for CCAP BMPs. A grant was submitted on behalf of those districts during the March 2007 application cycle for the Clean Water Management Trust Fund. If awarded, this grant will impact several counties in this river basin.

Current Status

CCAP will support the installation of stormwater BMPs. This program is an innovative approach to controlling the amount and quality of stormwater runoff that enters our surface waters. Through locally led conservation, the Division of Soil and Water Conservation (DSWC) and Soil and Water Conservation Districts (SWCD) have been successful in implementing voluntary agricultural BMPs, which have addressed many different water quality parameters. The intent is for CCAP to operate under the same guidance and accountability as the NC Agriculture Cost Share Program and achieve the same successes.

CCAP will focus its efforts on stormwater retrofits to existing land uses. It will not be used to assist in new development sites to meet state and federal stormwater mandates. Districts have the technical expertise to install stormwater BMPs and a successful history of promoting voluntary conservation practices. The program will give the districts the structure and financial assistance to carry out this mission. CCAP will encourage local governments, individual landowners and businesses to incorporate stormwater BMPs within their landscape. The economic incentive, 75 percent of average installation costs, will encourage voluntary conservation.

Standards and specifications for 15 CCAP BMPs have been approved by the Soil and Water Conservation Commission. These practices include: impervious surface conversion, permeable

pavement, grassed swale, critical area planting, bioretention areas, backyard rain gardens, stormwater wetlands, backyard wetlands, diversion, riparian buffer, stream restoration, streambank and shoreline protection, cisterns, abandoned well closure and pet waste receptacles.

Funding

The DSWC was recently awarded two grants that will fund CCAP implementation in 17 counties across the state. The DSWC received a grant from the Clean Water Management Trust Fund in the sum of \$557,000 and an award from the Section 319 Clean Water Act grant program for \$277,425. Since this is a grant funded program to date, only districts that participated in the surveys will receive an allocation. The maximum amount of assistance per practice is limited to \$50,000. It is the program's goal to seek additional funding sources, including recurring state appropriations, to offer this program statewide in the future. The DSWC and districts are excited about the possibilities that this program offers in addressing current stormwater pollution issues.

12.6 The Role of Local Government in Land Use Planning

As residential and commercial development expands inward from the coast, many local governments are now faced with making land use decisions to limit the extent and areas of land development. Several coastal counties still have no zoning ordinances, or have large areas of the county that are not under zoning ordinances. In addition, property owners are being faced with the decision to continue historical uses of their land or sell their property for development. This is happening in both rural and coastal communities. According to a recent survey conducted by the Raleigh News and Observer, more than 34,000 houses and condominiums are planned or underway in the 20-county area of the coast from Currituck County to Brunswick County.

12.6.1 Land Use Plans

The Coastal Area Management Act (CAMA) requires each of the 20 coastal counties to have a local Land Use Plan (LUP) in accordance with guidelines established by the Coastal Resources Commission (CRC). A land use plan is a collection of policies, maps, and implementation actions that serves as a community's blueprint for growth. Each land use plan includes an inventory and assessment of existing environmental conditions along with local policies and a future land use map that address growth issues related to designated Management Topics: land use compatibility, infrastructure carrying capacity, natural hazards, public access, areas of local concern, and water quality.

Inventory and assessment specific to water quality include the identification of existing surface water quality, current situations and trends on permanent and temporary closures of shellfish waters, areas with chronic wastewater treatment system malfunctions, areas with water quality or public health problems related to nonpoint source pollution, and locations where land use and water quality conflicts exist. Policies to address water quality issues are prepared based on the management goal, CRC planning objective, and land use plan requirements specified for the water quality Management Topic. For water quality, the management goal is to maintain, protect, and where possible enhance water quality in all coastal wetlands, rivers, streams, and estuaries. The CRC's planning objective is for communities to adopt policies for coastal waters within the planning jurisdiction to help ensure that water quality is maintained if not impaired and improved if impaired. Local communities are required to devise policies that help prevent or control nonpoint source discharges (sewage and stormwater) through strategies such as impervious surface limits, vegetated riparian buffers, maintenance of natural areas, natural area

buffers, and wetland protection. They are also required to establish policies and future land use map categories that are aimed at protecting open shellfishing waters and restoring closed or conditionally closed shellfishing waters.

The CRC's guidelines provide a common format for each plan and a set of issues that must be considered during the planning process; however, the policies included in the plan are those of the local government, not of the CRC. By law, the role of the CRC is limited to determining that plans have been prepared consistent with State Land Use Plan guidelines, do not conflict with State or federal rules, and are consistent with the State's Coastal Management program. Once a land use plan is certified by the CRC, the Division of Coastal Management uses the plan in making CAMA permit decisions and federal consistency determinations. Proposed projects and activities must be consistent with the policies of a local land use plan or DCM cannot permit a project to go forward.

At the local level, land use plans provide guidance for both individual projects and a broad range of policy issues, such as the development of regulatory ordinances and public investment programs. Although DCM monitors use of the land use plans through an implementation status report, strict adherence to land use plan policies and implementation actions is largely up to the local government. For this reason, community and local official support of the land use plan is critical to successfully achieving the goals for each management topic, including water quality.

12.6.2 Land Use Plans for Communities in the Pasquotank River Basin

More information and a list of CAMA LUPs are available from the Division of Coastal Management website: <http://www.nccoastalmanagement.net/Planning/planning.htm>. Table 28 presents counties and their municipalities within the Pasquotank River basin. The status of each CAMA Land Use Plan is also indicated.

Table 28 Local Planning Jurisdictions

Multi-County Planning Region R The Albemarle Commission		CAMA Land Use Plan CRC Certification Progress (as of March 2007)				
County	Municipalities	CRC Certified	Review & Revisions	Under State Review	In Process	Updates in 2008
Camden		2005				
Currituck			X			
Dare						X
Gates		2005				
Pasquotank	Elizabeth City		X			
Perquimans	Hertford, Winfall		X			
Tyrrell	Columbia				X	
Washington					X	
Dare	Town of Duck	2005				
	Town of Southern Shores				X	
	Town of Kitty Hawk	2005				
	Town of Kill Devil Hills					X
	Town of Nags Head				X	
	Town of Manteo	2007				

Camden County

The LUP states the county will develop a shoreline access plan. The plan supports the reduction of soil erosion, sedimentation, runoff to protect water quality. It also takes into consideration countywide soil erosion and sedimentation control ordinance and a stormwater ordinance to include retention facilities and limits to impervious surface development. The county supports the use of BMPs for agriculture and forestry land uses. Vegetated buffers are encouraged between any right-of-ways. The county supports the use of package sewage treatment plants outside of proposed sewer service areas. These package plants must have a plan to assimilate into a public plan if private operation fails. The county opposes the installation of package sewage treatment plants and septic systems near areas classified as wetlands or natural heritage areas, with the exception of constructed wetlands. Strict enforcement of lot size requirements is needed for houses using septic systems.

Specific policies aimed to protect water quality include: establishing buffers along Joyce, Areneuse and Sawyer's Creeks and reducing nutrient runoff from developing areas along these waterways. The county supports state water quality and coastal management policies, including stormwater regulations. The county will rely on state and federal agencies to promote protection of aquatic nursery habitats and the Great Dismal Swamp. The county supports cluster development.

Currituck County

The LUP separates the county into three areas to include: Knott's Island, the Outer Banks, and the mainland. Knott's Island is expected to have modest residential development and is development limited by the soil suitability for septic systems. Many of the new residential developments along the Outer Banks are large vacation rental units, which limit stormwater infiltration and pose concerns for the need to establish new wastewater treatment plants. Redevelopment includes replacing older beach cottages with large structures leading to intensification of land use and increased residential density. The coastline of the mainland is experiencing modest development as it is a less expensive alternative to development on the Outer Banks. Development is likely to move inland to agricultural tracts that are already cleared, leveled and well drained.

There are no large central sewer systems in Currituck County, but there are nine large surface sewage treatment plants and 64 on-site wastewater treatment systems. Septic systems are the predominate wastewater treatment option, however poor soil suitability leaves many of these systems failing. The LUP water and sewer policies include encouraging utility service extension to areas that are in existing developed areas and potential growth zones, where development densities make a public system more efficient, in new areas to support new industry and economic growth and away from environmentally sensitive areas and farmland. Package plants are supported to allow more efficient land use; these plants will be permanently managed on an organizational basis and may require assimilation into a central sewer system once established.

The LUP states its policy is to support actions to prevent soil erosion and sedimentation from entering the estuarine waters, controlling quality and quantity of stormwater runoff into the estuary, runoff from land use activities should be close to natural conditions and new developments are required to not exceed predevelopment runoff conditions. Stormwater management for new development requires engineering plans to include 10- year storm or 4.3 inches management. Natural vegetation, wetlands and open spaces are encouraged to maintain pervious surface areas and vegetated buffers are encouraged to help protect water quality. A

countywide drainage and flood management plan is to be developed to help resolve stormwater problems.

Manteo LUP

Town of Manteo anticipates continued growth, with a higher percentage of people being retired. Goals included in the LUP as identified by citizens of Manteo include: maintaining a small town character, sense of community and history, protect wetlands and environmentally fragile areas while providing public green spaces, improve water quality in Shallowbag Bay, and limit or reduce growth to prevent exceeding the wastewater treatment plant's capacity. With the recognition that meeting many of the town's goals is dependent on improving and protecting water quality, the LUP identifies stormwater runoff, marinas, and discharge from their WWTP as threats to water quality. In 2000 Manteo developed a Stormwater Management Plan which identifies their stormwater conveyances as open ditches that lack capacity to convey during peak flows and they do not treat the polluted runoff before it is discharged into surface waters. They now have a stormwater management ordinance requiring new and redevelopment management plans that include onsite stormwater treatments. The town is also pursuing green spaces for use as stormwater treatment via bioretention and filtration. Shallowbag Bay was identified as one site where stormwater management improvements could improve water quality.

Water quality and conservation policies include, encouraging low water consumption to reduce the amount of wastewater needed to be treated, increase efficiency of the WWTP, limit impervious surfaces, limit additional WWTP intake to the current planned and permitted developments and encourage vegetated riparian buffers and wetlands. The LUP states one of the main constraints to development is the limited capacity of the WWTP. The town acknowledges that growth includes increased marina use and is encouraging marinas to become Clean Marina Certified. The town supports island-wide water quality planning to help address environmental protection issues that impact Manteo, but are outside the towns planning zone.

Perquimans County

Growth in Perquimans County is anticipated to occur mainly in the subdivision areas of Hertford and Windfall. The county developed strategies to encourage residential development along internal access roads and to discourage strip development along state roads. Development, without the use of a centralized public sewer system, is limited because of poor soil conditions causing technical difficulties with septic tank drain fields. The unincorporated portions of Perquimans County rely on septic systems and Hertford currently operates a municipal wastewater treatment system that is being improved. Windfall's wastewater is collected and sent to Hertford for treatment. Wastewater treatment package plants will be considered in certain zones.

Specific water quality policies call for the enforcement of new ordinances regarding land use, development and redevelopment activities to protect the Perquimans River, Little River, Yeopin River and the Albemarle Sound. The LUP states the county will consider establishing criteria for cluster housing, vegetated buffers, impervious surface limits, stormwater management alternatives, erosion and sediment controls. The county may also amend zoning designations of permitted and condition use density and intensity criteria. The LUP identifies stormwater management and treatment is dependent on structures, swales and ditches associated with the transportation system and ponds and natural areas. The county suggests a stormwater study be completed to evaluate flood conditions and land use activities that contribute to intensified flooding.

Land Use Plan Critique

After review of several CAMA Land Use Plan drafts, DWQ recommends that all communities adopt low impact development strategies and technologies for both new development and as options in retrofitting existing infrastructure. It is important for communities to undertake stronger stormwater controls and to update old or failing wastewater systems (e.g., on-site and treatment plants) to prevent future deterioration in water quality. Communities need to address development issues in regards to water quality by implementing the best available control options and by implementing enforcement. DWQ views LUPs as a tool to improve and protect the water quality that these communities' economies depend on. Unfortunately, many of the reviewed LUPs do not adequately reflect proactive planning above and beyond state minimum criteria. DWQ also recognizes and supports the importance of low impact development and appropriate technologies trainings for developers and local leaders. Overall, LUP policy framework is too general. A large number of policies address adoption of ordinances and procedures by the local government, or defer to the State and Federal agencies' rules to meet the LUP requirements. The policies should provide specific guidance to aid in the development of local ordinances and procedures, not merely state that they will be adopted.

An evaluation of 40 CAMA LUPs written during the mid 1990's concluded, "local planning efforts are procedurally strong, addressing the ranges of issues they are required to cover, but analytically and substantively weak, providing little meaningful attention to regional environmental protection concerns" (Norton, 2005). This evaluation found that many LUPs completed the various required analyses in regards to identifying hazards, flood zones, soil limitations and environmentally sensitive areas, but later in the plan made future land classifications for development with no reference to these analyses (e.g., high density development on oceanfront property zoned as high hazard) (Norton, 2005). The plans did not adequately explain how land was determined suitable for future growth and development and did not adequately address potential adverse environmental impacts, beyond state compliance standards (Norton, 2005). Almost all the communities addressed the environmental impacts and thus need for improved wastewater systems, but "they uniformly failed to discuss the potential growth-inducing effects and resulting environmental impacts that come with infrastructure expansions" (Norton, 2005). In addition, stormwater management was addressed for controlling runoff and associated flooding, but did not address the water quality related issues associated with stormwater management (Norton, 2005). In conclusion, regional environmental concerns and cumulative and secondary impacts of development were not addressed with specific management strategies in the LUPs.

12.7 Management Recommendations for Local Governments

Below is a summary of management actions recommended for local authorities, followed by discussions on large, watershed management issues. These actions are necessary to address current sources of impairment and to prevent future 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 (NCDENR-DWQ, 2003).

- (1) Feasible and cost-effective stormwater retrofit projects should be implemented throughout the watershed to mitigate the hydrologic effects of development (e.g., increased stormwater volumes and increased frequency and duration). This should be viewed as a long-term process.
 - (a) Over the short term, currently feasible retrofit projects should be identified and implemented.
 - (b) In the long 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 EPA Section 319 funds, or the North Carolina Clean Water Management Trust Fund.
- (2) A watershed scale strategy to address inputs should be developed and implemented, including a variety of source reduction and stormwater treatment methods. As an initial framework for planning input reduction efforts, the following general approach is proposed:
 - (a) Implementation of available best management practice (BMP) opportunities for control of stormwater volume and velocities. As recommended above to improve aquatic habitat potential, these BMPs will also remove pollutants 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) Actions recommended above (e.g., stormwater quantity and quality retrofit BMPs) are likely to reduce nutrient/organic/bacterial loading, and to some extent, its impacts. 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, animal and human waste management, and the installation of additional BMPs targeting biological oxygen demand (BOD) and nutrient removal at appropriate sites.
- (4) Prevention of further degradation will require effective post-construction stormwater management for all new development in the study area.
- (5) 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 also be beneficial.

- (6) 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;
 - (d) Reducing and properly managing pesticide and fertilizer use;
 - (e) Reducing and properly managing animal waste; and
 - (f) Reducing and properly managing septic systems.

12.8 Planning for Sea Level Changes

Sea level rise will adversely impact North Carolina's coastline and specifically the northern coastline because of its underlying geologic structure (Riggs and Ames, 2003). There is a predicted acceleration in coastal erosion and an increase in estuarine shoreline erosion if oceanic processes are altered by increased barrier island elevation through natural or human modifications (Riggs and Ames, 2003). Major loss of land is predicted in Currituck, Camden, Dare, Hyde, Tyrrell, Pamlico and Carteret counties if glacial melting rates increase significantly, as projected by the Intergovernmental Panel on Climate Change (Riggs and Ames, 2003; IPCC, 2001).

Drowning the North Carolina Coast: Sea-Level Rise and Estuarine Dynamics by S. Riggs and D. Ames (2003) published by North Carolina Sea Grant provides information specifically addressing northeastern NC. This book provides images and figures explaining sea level rise and coastal erosion. This book should be used as a resource for coastal town and municipality planners as new developments, utility infrastructure and other land use decisions are made. Several universities are researching the impacts of sea level rise on North Carolina's coastal economy, more information about their findings can be found at the website: <http://econ.appstate.edu/climate/>. Information about sea level forecasts being developed by National Oceanic and Atmospheric Association and several universities in North Carolina can be found at: <http://www.cop.noaa.gov/stressors/climatechange/current/slr/welcome.html>.

12.9 Using Land Use Planning as a Tool to Reduce Impacts of Future Development

Many communities are looking at the challenges and opportunities that development offers to their communities seriously. Camden County extended a moratorium on new subdivisions until a new school can be completed to hold the additional students resulting from the developments. Outside of the Pasquotank River basin, the town of Bath approved a 6-month moratorium on new subdivisions to allow them time to assess how the town wanted to develop its remaining waterfronts lots and where the town needed to protect its resources. In addition, Pamlico County approved an ordinance to limit density and height of developments along the water. The neighborhood of Woodsong in Shallotte drains to Lockwoods Folly, which is Impaired for shellfish harvesting. The development will use pervious concrete to collect stormwater and a man-made wetland to help treat it, as well as courtyard gardens to treat runoff before it goes to a collection system. The developer notes that degradation of the environment does not have to

follow development, but believes a quality lifestyle is being sold by clustering home sites and creating large common areas. These types of development activities point to a growing market for developments like these; socially, financially and environmentally viable.

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 can 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. DWQ's review of draft CAMA Land Use Plans finds that the planning efforts do not adequately protect water quality. Many plans do not consider the cumulative impact from development on water quality. Land Use Plans need to incorporate proactive measures to meet future growth demands to prevent water quality deterioration.

To prevent further impairment 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.

***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.

Action needs 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 information regarding environmental stewardship for coastal homeowners is available at <http://www.soil.ncsu.edu/assist/coastindex.html>. Further public education is also needed in the Pasquotank River basin in order for citizens to understand the value of urban planning and stormwater management. For an example of local community planning effort to reduce stormwater runoff, visit <http://www.charneck.org/Home.htm>.

12.10 The Importance of Local Initiatives

As the Basinwide Planning Program completes its third cycle of plan development, there are many efforts being undertaken at the local level to improve water quality. DWQ encourages local agencies and organizations to learn about and become active in their watersheds.

An important benefit of local initiatives is that local people make decisions that affect change in their own communities. There are a variety of limitations local initiatives can overcome

including: state government budgets, staff resources, lack of regulations for nonpoint sources, the rulemaking process, and many others.

These local organizations and agencies are able to combine professional expertise in a watershed. This allows groups to holistically understand the challenges and opportunities of different water quality efforts. Involving a wide array of people in water quality projects also brings together a range of knowledge and interests, and encourages others to become involved and invested in these projects. By working in coordination across jurisdictions and agency lines, more funding opportunities are available, and it is easier to generate necessary matching or leveraging funds. This will potentially allow local entities to do more work and be involved in more activities because their funding sources are diversified. The most important aspect of these local endeavors is that the more localized the project, the better the chances for success. Federal and State government agencies are interested in assisting local governments and citizen groups in developing their water quality management programs.

The collaboration of these local efforts are key to water quality improvements. There are good examples of local agencies and groups using these cooperative strategies throughout the state. The following local organizations and agencies are highlighted to share their efforts towards water quality improvement.

12.10.1 Federal Clean Water Act – Section 319 Program

Section 319 of the Clean Water Act provides grant money for nonpoint source demonstration and restoration projects (Table 29). Through annual base funding, there is approximately \$1 million available for demonstration and education projects across the state. An additional \$2 million is available annually through incremental funds for restoration projects. All projects must provide nonfederal matching funds of at least 40 percent of the project’s total costs. Project proposals are reviewed and selected by the North Carolina Nonpoint Source Workgroup made up of state and federal agencies involved in regulation or research associated with nonpoint source pollution (NPS). Information on the North Carolina Section 319 Grant Program application process is available online at http://h2o.enr.state.nc.us/nps/application_process.htm. Descriptions of projects and general Section 319 Program information are available at http://h2o.enr.state.nc.us/nps/Section_319_Grant_Program.htm.

Many Section 319 projects are demonstration projects and educational programs that allow for the dissemination of information to the public through established programs at NC State University (NCSU) and the NC Cooperative Extension. Other projects fund stream restoration activities that improve water quality.

Table 29 Section 319 Grant Funded Projects in the Pasquotank River Basin

Fiscal Year	Name	Description	Agency	Amount
2002	Effects of Drainage Ditches and Roads on Watershed Ecology Hydrology and Water Quality within the Emily and Richardson Pryer-Buckridge Coastal Reserve	Wetlands & Hydrologic Modification	NC DENR, DCM & NCSU	\$200,000
2000	Promote Responsible nutrient management by developing a procedure to document forage crop realistic yield expectations (RYE)		NCSU	

2003 - 2004	Manteo Stormwater Retrofit (not a 319 Project)	Urban Stormwater, Planning	CWMTF	\$247,500
2004	Adapt a Site Evaluation Tool (SET) for use by local governments in Upper Neuse Basin in determining w/stormwater performance standards for new development		Upper Neuse River Basin Association	
2005	Phytoremediation to Prevent NPS Discharge of Gasoline Contaminated Groundwater to the Pasquotank River	Groundwater Protection, Stream Restoration	NCSU	\$145,054
2005	Kitty Hawk Stormwater Education	Urban Stormwater, Education	DCM-NERR Manteo	\$11,590
2005 - 2006	OBX LID Project	Urban Stormwater, Planning, Education	Coastal Studies Institute	\$58,300
Total Funding				\$662,444

12.10.2 Pasquotank River Watershed Project

In 2005, Congress approved a multi-year Pasquotank River Watershed Project led by the Albemarle Regional Health Services Agency, NCSU's College of Agriculture and Life Sciences and Cooperative Extension. The Project will demonstrate the application of Integrated Water Designs (IWD), which addresses all aspects of water management such as: septic systems, stormwater, water table management, flood control and erosion and sedimentation control. IWD concepts will be developed; appropriate technologies selected and designed, and a demonstration community will be selected. Existing baseline water quality conditions and water quantity impacts (e.g. storm water removal, flooding, etc.) will be monitored, including assessment and tracking of key water quality pollutants as they move through the ground water. Bacterial source tracking (BST) techniques will be investigated to determine if they can help identify key microbial pollutant sources. More advanced types of septic systems than are currently in use will be evaluated to determine their potential use as IWDs for repair of failing septic systems. NC State University team, working in partnership with the Pasquotank County Cooperative Extension office and the local Albemarle Agency staff will coordinate technology transfer training in the county. Water management professionals throughout the state will also be trained at the NCSU's training centers located throughout the state. New hands-on demonstrations and training materials will be developed to describe the IWD approach to practicing professionals such as soil scientists, planners, technology designers, installers and service providers. Cooperative Extension will lead public educational programming efforts for community decision makers and field practitioners.

12.10.3 Clean Water Management Trust Fund

The Clean Water Management Trust Fund (CWMTF) offers approximately \$40 million annually in grants for projects within the broadly focused areas of restoring and protecting state surface waters and establishing a network of riparian buffers and greenways. In the Pasquotank River basin, 34 projects have been funded for a total of \$34,157,005 (Table 30). For more information on the CWMTF or these grants, call (252) 830-3222 or visit the website at www.cwmtf.net.

Table 30 Clean Water Management Trust Fund Projects in the Pasquotank River Basin

Project Number	Application Name	Proposed Project Description	Amount Funded
1997B-006	NC Div Coastal Management - Buckridge Tract Acq&Restor/Alligator R	Restore and enhance 10,000 acres of wetlands at Buckridge Tract. Monitor results.	\$3,858,500
1998A-008	NC Wildlife Resources Commission - Hassell Tract Acq/ Whitehurst's Ck	Acquire through fee simple purchase 491 acres along Whitehurst Creek.	\$169,000
1998A-010	NC Wildlife Resources Commission - Tice Tract Acq/ NW River & Tulls Bay	Acquire through fee simple purchase 473 acres along the Northwest River, Tulls Bay, and Crosses Creek.	\$250,000
1998A-011	NC Wildlife Resources Commission -Midgett Marsh Tract Acq/ Roanoke S.	Acquire through fee simple purchase 574 acres along Roanoke Sound.	\$620,000
1998A-403	Roper- Roper Site Acq and Env Cleanup/ Kendrick Ck	Purchase, clean up and preserve a waterfront greenway property of 4.8 acres and 10,000 linear feet along Kendricks Creek.	\$60,000
1998A-413	Pasquotank Co-Constructed Wetlands/CE/Ag BMPs/Newland	Construct a series of "in-stream" wetlands along the 7 mile canal, modify and stabilize canal (6,000 acre drainage). Restore riparian wetlands, and secure easements on 278 acres buffers. Install water control structures and ag BMPs.	\$413,600
1998A-414	Currituck County- Constructed Wetlands/CE/Ag BMPs/Guinea Mill	Construct a series of instream wetlands, restore 35 acres of hardwood swamp, acquire 50 foot easements on both sides of the canal. Implement ag BMPs in 6,000 acre watershed.	\$352,610
1998B-507	Roanoke Villas Clean Water Found. -Land Ap/WWTP upgrade	Design, construct and operate infiltration pond alternative to surface water discharge. Remove 60,000 GPD permitted discharge into SA waters.	\$245,568
2000A-010	NC Wildlife Resources Commission - Harrison Tract Acq/North R	Acquire through fee simple purchase 3,915 acres along the North River. CWMTF funds to acquire the 720 acres of riparian buffers.	\$534,360
2000A-018	NC Wildlife Resources Commission - Roanoke Island Greenway I	Acquire through fee simple purchase 38 acres on Roanoke Island. Tract to become part of a greenway system.	\$1,207,000
2000B-006	Nags Head & Nature Conservancy- Nags Head Woods Acq	Acquire through fee simple purchase 49 acres along Roanoke Sound in the Nags Head Wood-Jockeys Ridge conservation complex.	\$693,000
2000B-010	NC Div Coastal Management - Roper Island Acq	Acquire through permanent conservation easements 8,274 acres on Roper Island along the Alligator River. CWMTF funds to be combined with other funds to acquire the CE.	\$285,220
2000B-013	NC Wildlife Resources Commission - Circle Tract/Alligator River Acq	Acquire through fee simple purchase 5,401 acres along the Alligator River and Second Creek.	\$1,715,000
2000B-015	NC Wildlife Resources Commission - Roanoke Island II Acq & Greenway	Acquire through fee simple purchase 46 riparian and wetland acres along Roanoke Sound. Tract represents Phase II of the Roanoke Island Greenway project.	\$2,707,000
2001B-023	NC Aquarium Society- Acquisition & Stormwater/ Whalebone Junction	Acquire 5 acres along Atlantic Ocean and treat stormwater runoff from 30 acres to Roanoke Sound.	\$4,600,000
2001B-042	Perquimans Co. Restoration Assc.-Acquisition/ Perquimans River	Acquire through fee simple purchase 38 acres on the Perquimans River. Includes riparian buffer installation, created wetland demonstration, nature trail construction, and environmental education.	\$345,000

2001B-502	Camden County/Currituck County -Sawyer's Creek	Provide funds to design and obtain permits for a regional wastewater collection and land application systems to address failing and straight-piped septic systems draining to Sawyers Creek.	\$3,564,000
2002A-014	Nags Head - Acq/ Catfish Farm Open Space	Acquire 11.4 acres through fee simple purchase along the Roanoke Sound and tributary creeks. CWMTF would fund purchase of 46% of the tract.	\$300,000
2002B-017	NC Wildlife Resources Commission - Acq./Risky Business, Roanoke Sound	Acquire through fee simple purchase 250 acres along the Roanoke Sound, Johns Sand Beach and Broad Creeks.	\$375,000
2002B-608	Tyrrell County Water & Sewer District 1 - Septic Systems/Scuppernong II	Eliminate failing septic tanks in Districts 1&2 of the County by constructing a collection system and pumping waste to the Town of Creswell's WWTP. The Town of Creswell's WWTP would be expanded. Would reduce pollutant delivery to the Scuppernong River.	\$1,203,647
2003A-029	NC Div Parks & Recreation - Acq./ Pettigrew State Park, Scuppernong River	Acquire through fee simple purchase 1,864 acres along the Scuppernong River and add the property to Pettigrew State Park.	\$890,000
2003A-031	NC Wildlife Resources Commission- Acq./ Davis Tract, Alligator River	Acquire through fee simple purchase 340 acres draining to the Little Alligator River. The tract contains areas of ditched cropland which will be restored when the tract becomes part of the adjoining Alligator River Game Lands.	\$374,000
2003A-032	NC Wildlife Resources Commission- Acq./ GMS Tract, Alligator River	Acquire through fee simple purchase 8,476 acres, including 4,860 riparian and wetland acres, along Second Creek and Alligator River (both ORWs) and Little Alligator River. The tract will be managed as part of WRC's Game Lands Program.	\$1,700,000
2004A-702	Manteo, Town of - Storm./ Shallowbag Bay	Design, permit, & acquire stormwater easements for pocket stormwater infiltration areas and/or construction of pocket infiltration areas to treat runoff from 147 ac in the Shallowbag Bay drainage area.	\$379,500
2004B-046	NC Wildlife Resources Commission-Acq/ Pipkin Tract, Broad Creek	Protect through fee simple purchase 120.5 acres along Broad Creek and Roanoke Sound. The tract is adjacent to open shellfish waters and would become part of the Roanoke Marshes Game Lands.	\$200,000
2004B-604	Stumpy Point Water & Sewer District - Septic/ Stumpy Point and Lake Worth Septic Tanks	Construct 8 miles of a septic tank effluent pump sewer collection system to connect 110 failing septic systems to a tertiary WWTP with UV disinfection. Project will reduce fecal coliform and nutrient delivery to Stumpy Bay and Pamlico Sound.	\$1,728,000
2004B-802	Creswell, Town of - Plan/ Stormwater Management, Scuppernong River	Develop a plan to address stormwater management needs for the Scuppernong River and a tributary canal. Plan to consider wetland pond modification, wetland construction, pump station modification, and canal widening.	\$25,000
2005A-024	NC Wildlife Resources Commission - Acq/ Roanoke Island Greenway, Amended Project	Provide additional funds to finalize the purchase of 39 acres along Croatan Sound that were previously approved by CWMTF (2000B-015). The tract has increased in value since the original award. Tract will be managed as part of the Game Lands program.	\$1,746,000
2005A-804	Manteo, Town of - Plan/WW/ Wastewater Treatment Feasibility Plan, Shallowbag Bay	Develop a feasibility study of nutrient removal options for wastewater discharged to Shallowbag Bay.	\$65,000
2005A-806	NC Coastal Federation - Plan/Acq/ Currituck Sound Protection Plan	Develop a plan to prioritize acquisition and restoration efforts in Currituck Sound. Project to include landowner outreach and development of funding proposals for top two priority sites identified by the study.	\$40,000

2005B-504	Elizabeth City, City of - WW/ Hughes Boulevard Force Main, Knobs Creek	Address infiltration & inflow problems by constructing 16,200 lf of force main to serve 2,200 residences. Would reduce fecal coliform bacteria and nutrient contamination to the Pasquotank River. Includes pump station upgrade and standby power generation.	\$2,000,000
2006A-024	NC Coastal Land Trust - Ac/ Indian Creek Tracts	Protect a total of 1,027 acres along the Indiantown Creek through purchase of 702 acres in fee and of a 325-acre fee simple donation.	\$528,000
2006A-406	Perquimans County- Rest/ Newbold- White House and Greenway, Perquimans River	Design, permit and construct natural channel design shoreline stabilization project along 2,000 linear feet of the Perquimans River. Construct 3 stormwater wetlands and link to county greenway system.	\$340,000
2006B-706	Kitty Hawk, Town of - Storm/Rest/ Stormwater BMPs, Kitty Hawk Bay	Design and permit BMPs to improve water quality along 4,100 linear feet of shoreline in Kitty Hawk Bay. Potential BMPs include a breakwater system, reestablishment of the fringe marsh, and infiltration and bioretention areas.	\$543,000
2006B-816	Washington County - Plan/Acq/ Sustainable Development Planning, Albermarle Sound	Fund the development of a long-term sustainable development plan for the southern Albemarle Sound shoreline between Mackey's Ferry and Leonard's Point. Includes inventory of existing conditions, vision statement, implementation strategies.	\$100,000
Total Funded			\$34,157,005

This list does not include:

- all projects are in the CWMTF's Northern Coastal Plain region
- regional or statewide projects that were in multiple river basins, or
- projects that were funded and subsequently withdrawn.

12.10.4 North Carolina Ecosystem Enhancement Program (NCEEP)

The NC Ecosystem Enhancement Program (NCEEP) combines an existing wetlands-restoration initiative by the NC DENR with ongoing efforts by the NC Department of Transportation (DOT) to offset unavoidable environmental impacts from transportation-infrastructure improvements. The U.S. Army Corps of Engineers joined as a sponsor in the historic agreement, which is committed to restoring, enhancing and protecting the wetlands and waterways across the State of North Carolina. NCEEP can provide:

- High-quality, cost-effective projects for watershed improvement and protection;
- Compensation for unavoidable environmental impacts associated with transportation-infrastructure and economic development; and
- Detailed watershed-planning and project-implementation efforts within North Carolina's threatened or degraded watersheds.

NCEEP can perform restoration projects cooperatively with other state or federal programs or environmental groups. For example NCEEP efforts can complement projects funded through the Section 319 Program. Integrating wetlands or riparian area restoration components with Section 319 funded or proposed projects will often improve the overall water quality and habitat benefits of the project. The NCEEP actively seeks landowners throughout the state that have restorable wetland, riparian, and stream restoration sites. For more information about NCEEP, visit <http://www.nceep.net/> or call (919) 715-7452.

12.10.5 Coastal and Estuarine Land Conservation Program

The Coastal and Estuarine Land Conservation Program (CELCP) was established by Congress “for the purpose of protecting important coastal and estuarine areas that have significant

conservation, recreation, ecological, historical, or aesthetic values, or that are threatened by conversion from their natural or recreational state to other uses.” The program provides funding for projects that ensure conservation of these areas for the benefit of future generations, giving priority lands which can be effectively managed and protected, and that have significant ecological value. The Division of Coastal Management administers the CELCP program in North Carolina. For more information on funding opportunities and guidelines see <http://www.nccoastalmanagement.net/Facts/CELCP.htm>.

12.10.6 Oyster Shell Recycling

The North Carolina Oyster Shell Recycling Partnership is encouraging restaurants, seafood dealers, community organizations and individuals to participate in the effort to collect oyster shells and use them to build oyster reefs in protected oyster sanctuaries. More information about this recycling effort can be found at <http://www.ncfisheries.net/shellfish/recycle1.htm>. Oyster recycling sites within the Pasquotank River Basin include:

- Nags Head: Jockey’s Ridge State Park (Hwy 158)
- Kill Devil Hills: Nature Conservancy, Nags Head Woods (701 West Ocean Acres Dr.)
- Wanchese: NCDMF office, Wanchese Seafood Industrial Park (604 Harbor Rd.)
- Avon: Village Grocery (40618 Hwy. 12)
- Hatteras Village: Burrus Red & White (57196 Kanlar Rd.)
- Rodanthe/Waves/Salvo: Recycling Center, Rodanthe Harbor (Myrna Peters Rd.)

12.10.7 Clean Marina Program

The Clean Marina Program is a voluntary program that began in the summer of 2000. The program is designed to show that marina operators can help safeguard the environment by using management and operations techniques that go above and beyond regulatory requirements. This is a nationwide program developed by the National Marine Environmental Education Foundation, a nonprofit organization that works to clean up waterways for better recreational boating. The foundation encourages states to adapt Clean Marina principles to fit their own needs. North Carolina joins South Carolina, Florida and Maryland as states with Clean Marina programs in place.

Marina operators who choose to participate must complete an evaluation form about their use of specific best management practices. If a marina meets criteria developed by N.C. Marine Trades Services and the Division of Coastal Management, it will be designated as a Clean Marina. Such marinas will be eligible to fly the Clean Marina flag and use the logo in their advertising. The flags will signal to boaters that a marina cares about the cleanliness of area waterways. Marinas that do not meet the standards will be able to learn about improvements needed for Clean Marina designation. Marina owners can reapply after making the necessary changes.

The International Yachting Center in Columbia, NC is the only Clean Marina in the Pasquotank River basin, while there are 14 other marinas with pump-out facilities in the basin. For more information about the program, please see <http://dcm2.enr.state.nc.us/Marinas/clean.htm> or <http://www.nccoastalmanagement.net/Marinas/marinas.htm>

Or contact N.C. Coastal Reserve Education Office at 252-728-2170 or Coastal Management at 919-733-2293.

12.10.8 Currituck Sound Restoration Feasibility Study

The Army Corps of Engineers and the State of North Carolina are partnering to conduct a Feasibility Study on the Currituck Sound to identify ways to improve water quality and restore the Sound. The ongoing study is being cost shared between the US Army Corps of Engineers (USACE) and the NC Department of Environment and Natural Resources (DENR). Each cost share partner pays 50 percent of the feasibility phase costs.

The Currituck Sound Restoration Coordination Team is collecting data and formulating recommendations necessary to meet the established restoration goals and objectives. Data collection efforts are being conducted as part of multiple individual studies within the Currituck Sound as well as in the surrounding watersheds that impact the Sound, including Back Bay. A Feasibility Report and NEPA document recommending viable restoration projects and management measures will be the products of the study.

The Currituck Sound Restoration Coordination Team is composed of multiple agencies and organizations including, but not limited to: USACE, Wilmington District, DENR, Division of Water Resources (DWR), Elizabeth City State University (ECSU), USACE Coastal and Hydraulics Laboratory (CHL), NC National Estuarine Research Reserve (NERR), US Fish and Wildlife Service (USFWS), US Geological Survey (USGS), USACE Engineer Research and Development Center (ERDC), Hampton Roads Planning District Commission, Division of Coastal Management (DCM), NC Coastal Federation (NCCF), Virginia Department of Conservation and Recreation (VADCR), Currituck County, The Nature Conservancy (TNC), Wildlife Resources Commission (WRC), Division of Water Quality (DWQ), Pasquotank River Basin Regional Council, Virginia Department of Environmental Quality (VADEQ), Virginia Marine Resources Commission (VAMRC), and Albemarle Pamlico National Estuary Program (APNEP). The entities composing the restoration team participate in one or more of three Workgroups, which are: Hydrologic, Hydrodynamics, and Water Quality Modeling Workgroup; the Living Resources Workgroup; and the Planning and Public Involvement Workgroup.

The Hydrologic, Hydrodynamics, and Water Quality Modeling Workgroup is using a model to characterize existing hydrologic and water quality conditions in Currituck Sound, develop a baseline, and produce a model for use in determining the condition in which to restore the Sound. This Workgroup is developing and using a modeling package based on modeling requirements of the USGS in cooperation with USACE ERDC, DWR, and ECSU to develop a comprehensive and cost effective data collection and monitoring plan for Currituck Sound, including site locations, data type, frequency, and purpose of the data to be collected. The model will characterize the effects of internal and external factors such as freshwater flow, tides, wind, suspended and bottom sediments, nutrient inputs, land use, etc., on water quality and the health of the biological communities in Currituck Sound.

The Living Resources Workgroup consists of four subgroups, which have individual data collection efforts underway. The four subgroups and subject matter areas are as follows: the Vegetation Subgroup (Submerged Aquatic Vegetation (SAV), forests, wetlands, marshes, invasive species); the Survey/GIS Subgroup (land and hydrologic surveys, aerial photography, mapping, and geographic analysis); the Fisheries Subgroup (freshwater and saltwater fisheries and crabs); and the Waterfowl Subgroup (nesting water birds and waterfowl).

The Vegetation and Survey/GIS Subgroups have completed data collection efforts for historic and existing SAV within the Currituck Sound and surrounding watershed. This is a critical component of the Currituck Sound Feasibility Study because the abundance of SAV has undergone several long-term downward trends since early 1900's and has not fully recovered to former abundant conditions of the past century. The SAV Habitat Cooperative Mapping Project at ECSU has completed and will continue with field surveys, as well as recording data on water clarity, temperature, salinity, DO, pH Distribution, density and species composition of SAV. Also collaborative efforts to digitize the findings reported in the Sincock Master Surveys were completed by USACE, ECSU, and others. The result of this effort is an interactive site, "The Sincock Master Survey Internet Mapping Service & Website," and is available at: http://155.82.232.43/website/Currituck_Sincock_MS/viewer.htm.

The Planning and Public Involvement Workgroup serves to gather information from the public for incorporation into the study and to disseminate information from ongoing study findings out to the public. This Workgroup is requesting historical information and records, fishing and hunting logbooks, and old photographs and maps of the Sound and Shoreline. This Workgroup will hold future Public Meetings; the public will be informed in advance. The planning function of this Workgroup serves to balance the interests of all involved entities as well as produce the Currituck Sound Restoration Feasibility Report. This report will capture and document the Currituck Sound Restoration Coordination Team's findings and make recommendations for alternatives and management measures to improve water quality and restore the Sound.

For further information or inquiries regarding the Currituck Sound Restoration Feasibility Study, you may visit http://www.saw.usace.army.mil/Currituck_Sound/main.htm or contact Tara Anderson, Lead Planner, at 910-251-4694 or 1-800-626-8449, ext 4694.

12.10.9 Albemarle-Pamlico National Estuary Program (APNEP)

In February 1987, Congress established the National Estuary Program (NEP) through amendments to the Clean Water Act. A unique approach to resource management, its hallmark of using science to inform and engage broad-based community involvement, collaborative decision-making, outreach and education, distinguishes the NEP from other programs.

As the first NEP to be designated "an estuary of national significance" in November of 1987, the Albemarle-Pamlico National Estuary Program (APNEP) was known then as the Albemarle-Pamlico Estuarine Study (APES). The APNEP has since been joined by 27 other NEPs located in 18 coastal states and Puerto Rico spanning the United States' three coastlines. It is estimated 15 percent of all Americans reside in a NEP designated watershed.

Each NEP is mandated to develop a Comprehensive Conservation and Management Plan (CCMP) that details deteriorating/threatened environmental conditions in their estuarine region and the strategies required for rectifying them. In November 1994, the Administrator of the EPA accepted APNEP's CCMP on behalf of the citizens of the United States, and Governor James B. Hunt, Jr., accepted it on behalf of the citizens of North Carolina.

Estuaries are of significant economic value to the states under whose governance they fall, as well as to the entire nation. It is estimated that estuaries provide habitat for approximately 75 percent of commercial fish catches in the United States and 80-90 percent of the recreational fishery, totaling more than \$1.9 billion annually. Recreation and tourism in coastal areas

generate an additional \$8 to \$12 billion. Clearly, it behooves us to protect these fragile, beautiful, and valuable places.

In the Pasquotank River basin APNEP has supported a number of research, restoration, and demonstration projects. Several demonstration projects are designed to mitigate the effects of stormwater runoff and pollution. Recently, in the Pasquotank River basin, the APNEP funded projects in three locations intended to improve water quality and to aid in environmental education: Manteo, Winfall and Hertford.

The Perquimans County High School constructed wetland and environmental education project in Hertford is a collaborative effort led by Perquimans County Schools, and the Perquimans County Soil and Water Conservation District. The project reshaped and restored natural wetlands located on the grounds of the school and included the construction of an access boardwalk, pedestrian bridges and an observation deck. The now accessible wetlands are used as the basis for an outdoor education program for 570 high school science students and their teachers. This phase of the project builds on the successful first stage of the Jennie's Gut constructed wetlands project, also funded in part with an APNEP grant.

The goal of the Manteo Middle School demonstration project, to create two attractive stormwater gardens (with signage) in a highly visible schoolyard site, included the labor of students, teachers, and community volunteers. The gardens serve as a point of collections for stormwater coming off the school's parking lots and roof. The project also includes curriculum development utilizing information on stormwater pollution.

The Town of Winfall's drinking water treatment plant was exceeding water quality standards in its backwash waters for some time. Regular monitoring showed high levels of iron, manganese, magnesium, calcium, chlorides and sand. To remove the offending elements and treat the discharge, a constructed wetland system with salt and iron tolerant plants was installed adjacent to the plant. Two wetland cells were built using rock check dams and a third cell was built using logs for the check dam. A boardwalk, with an observation platform at its center, allows the wetland to be used as an outdoor environmental education classroom for the Perquimans County Middle School adjacently located to the wetland. It should also be noted that an added benefit of the wetland system is the diversion of runoff (showing high levels of nitrogen and phosphorus) from an abandoned fertilizer plant across the road, and from school grounds, roads and parking lots adjacent to it.

For information on the APNEP, visit www.apnep.org.

12.10.10 Albemarle-Pamlico Regional Water Quality Study

The study will identify regional water quality, water management, and recreational concerns resulting from land-use changes associated with unprecedented development in Chowan, Perquimans, Pasquotank, Camden, Gates, Currituck, Dare, Hyde, Tyrrell, and Washington counties. This work will build on county-wide drainage studies and water quality projects that the Albemarle Resource Conservation and Development Council (RC&D) and its partners have implemented, or are implementing, in the Albemarle-Pamlico region. Projects identified and implemented as a result of the study will help create a region-wide infrastructure for maintaining the integrity of water resources and improving drainage. Components of the regional study will include:

- Identify and prioritize streams and canals for a 5-year recurrence interval for clearing and snagging in major watersheds.
- Identify opportunities to develop or upgrade stormwater ordinances in each county to address water quality and drainage concerns associated with rapid commercial and residential development. Ordinances would include standards for 1) evaluating upstream and downstream drainage at the watershed level, 2) determining flooding consequences for existing and new developments, and 3) reconstructing drainage systems on commercial, residential and public/ agricultural properties using innovative techniques including constructed wetlands, buffers, and water table management.
- Identify a commercial, residential and public/agricultural property in each county to reconstruct drainage systems for demonstrating innovative stormwater management.
- Identify opportunities for establishing a water quality/water management advisory committee in each county to provide technical information, public education, and research support.
- Identify opportunities for establishing Special Use Water Management Districts (SUWMD) in each county to provide a mechanism for public input to prioritize and implement drainage and water quality improvement projects.
- Identify opportunities for establishing a regional Stewardship Development Program similar to the Lower Cape Fear Stewardship Development Program. The program would recognize innovative residential and commercial development projects that protect the environment.
- Identify key issues and costs associated with monitoring and evaluating water quality and reconstructed drainage projects at the local and regional level.

Each of the 10 counties in the region is at a different stage of developing the study components listed above. For example, with assistance from NCRS and the Albemarle RC&D, Pasquotank County is developing a stormwater ordinance that includes specifications for evaluating upstream and downstream drainage at the watershed level, and reconstructing drainage systems using innovative techniques such as constructed wetlands instead of detention and retention ponds. Perquimans County is beginning the process of developing a stormwater ordinance, and may be able to save time and money by using Pasquotank County's ordinance as a model. The same scenario may apply to other counties in the region that will have to develop ordinances to help manage stormwater runoff from residential and commercial development.

The regional study will help identify specific project opportunities in each county, and progress toward maintaining the integrity of regional water quality and improving drainage. Conducting the study and coordinating projects on a regional level will also allow the sharing of experiences and information, and thus help avoid costly mistakes and duplication of effort.