COMPREHENSIVE CONSERVATION AND MANAGEMENT PLAN

Technical Document

Albemarle-Pamlico Estuarine Study - November 1994

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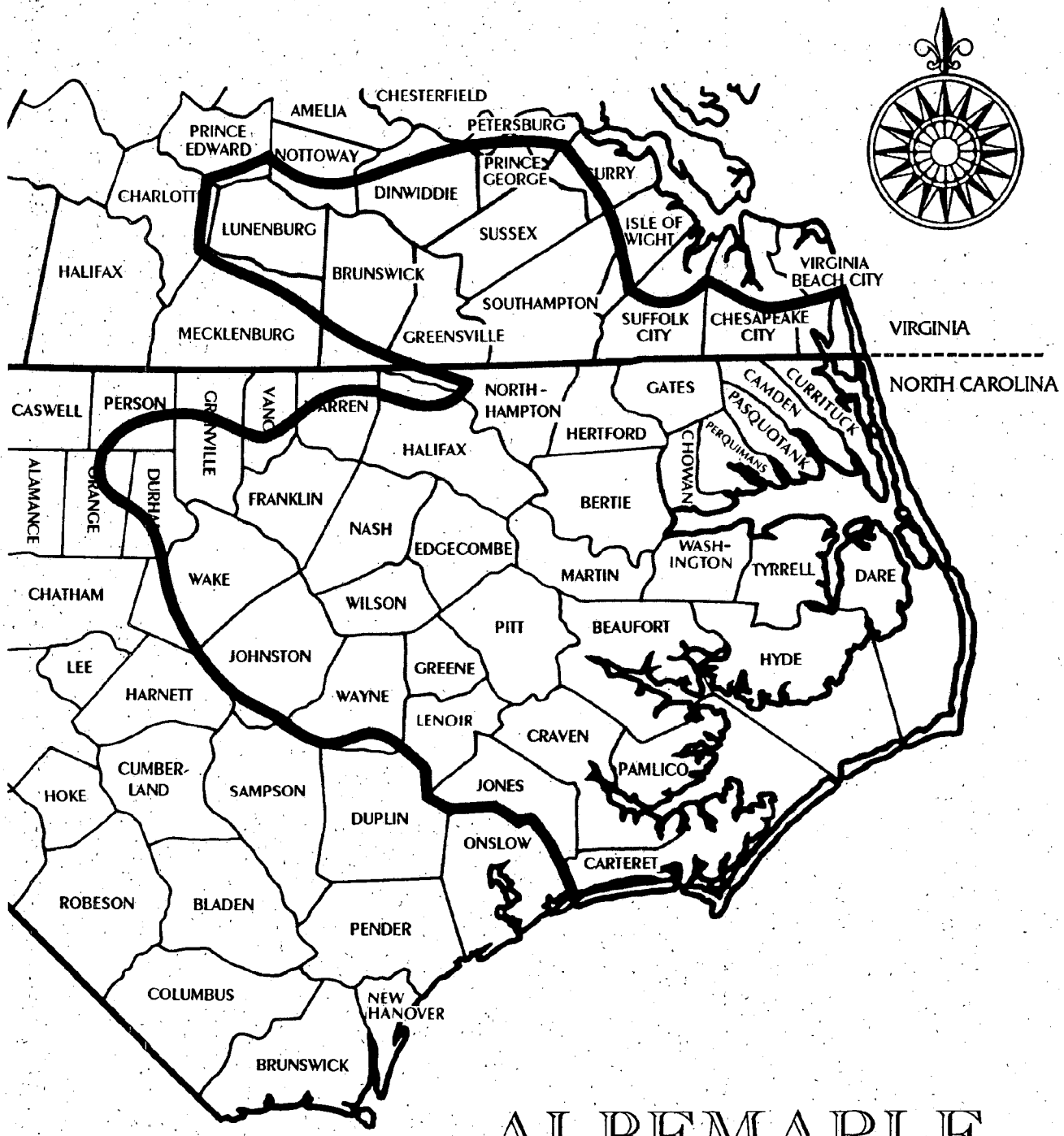

ALBEMARLE-PAMLICO STUDY REGION

COMPREHENSIVE CONSERVATION AND MANAGEMENT PLAN

TECHNICAL DOCUMENT

ALBEMARLE-PAMLICO ESTUARINE STUDY

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We acknowledge and appreciate the cooperation and understanding of all those who contributed to the development of this Plan, and our most special appreciation goes to the members of the Citizen Advisory Committees, the Technical Committee and the Policy Committee, all of whom are listed in Appendix F of the Plan. Finally, we would be remiss is we did not recognize the untiring effort demonstrated by the thousands of citizens in the region who attended numerous public meetings, workshops and other activities held during the past six years.

The development of the CCMP was often a difficult task and was successfully completed only because of the dedication of those listed, whose love of North Carolina's coastal resources is unsurpassed.

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INTRODUCTION

OVERVIEW OF THE ALBEMARLE-PAMLICO ESTUARINE STUDY

The Albemarle-Pamlico estuary forms a complex and dynamic ecosystem which provides an invaluable bounty of natural resources. The sounds, rivers, creeks, wetlands, and terrestrial areas in the watershed of the system support a variety of uses. We depend on the system to supply food, recreation, jobs, a mode of transportation, and vital habitat for fish and shellfish. In addition, its diverse ecological communities provide a rich natural heritage for humans and wildlife.

Economically, the Albemarle and Pamlico Sounds system represents the estuarine region's key resource base through commercial fishing, tourism, recreation, and resort development. Economic benefits are also derived from uses of the natural resources for mining, forestry, and agriculture. In coastal areas around the nation, human populations and uses of the coastal resources are increasing. The Albemarle-Pamlico estuarine region is no exception. Increases in population and resource use can result in higher conflicts among various groups.

Fortunately, the Albemarle-Pamlico ecosystem is relatively healthy, especially when compared to heavily populated and industrialized estuarine systems in other parts of the country such as Boston Harbor or Long Island Sound. However, several signs of environmental stress have been recognized in the Albemarle-Pamlico system, including: declining fisheries, recent outbreaks of fish and crab disease, frequent blooms of algae, closures of shellfish waters to harvest, losses of historic shellfish and submerged aquatic vegetation beds, and degradation of wetland, fish, and upland habitats. Proactive management efforts can be employed now to avert future, more costly and potentially less effective restoration and recovery measures. This plan responds to current signs of environmental stress with recommendations for protecting the health of the invaluable estuarine system, for both its important ecological role and to support sustainable resource use.

THE ALBEMARLE-PAMLICO ESTUARINE SYSTEM

The Albemarle-Pamlico estuarine system is the second largest estuarine complex in the United States. The system supports an abundant and rich variety of organisms. It encompasses important habitat areas for fish and shellfish including key nursery areas for east coast fisheries. The extent of the Albemarle-Pamlico estuarine system is illustrated in Figure 1 (page 4). The system is composed of seven sounds: Albemarle, Currituck, Croatan, Pamlico, Bogue, Core, and Roanoke, and is drained by several major river basins:

FIGURE 1 *THE ALBEMARLE-PAMLICO ESTUARINE SYSTEM*

Chowan, Tar-Pamlico, Neuse, Roanoke, Pasquotank, Perquimans, Little, North, Pungo, and Alligator. The rivers drain a basin of over 30,000 square miles including 36 counties in northeastern North Carolina and 16 counties and independent cities in southeastern Virginia and discharge fresh water largely into the western side of the sounds.

The sounds of North Carolina are uniquely characterized by wind-driven tides which effect circulation patterns within the sounds and saltwater concentrations in their tributaries. In contrast to lunar tides, wind tides are more variable and contribute to unpredictable changes along the coast. On the eastern side of the sounds, a chain of islands with only a few inlets form a barrier with the Atlantic Ocean.

The Albemarle-Pamlico estuarine system supports an array of ecological, economic, recreational, and aesthetic functions which are of regional and national importance. The critical importance of sustaining the system in order to fulfill these functions is reflected in its nomination by the Governor of North Carolina and its designation as an estuary of national significance in the National Estuary Program by the Administrator of the Environmental Protection Agency.

CONCERNS ABOUT THE APES SYSTEM

WATER QUALITY

Support for Water Uses

The Clean Water Act seeks to maintain important human and ecological uses by restoring and maintaining water quality. Water quality can be evaluated on how well a body of water supports its best uses. Best uses include aquatic life propagation and maintenance, wildlife utilization, secondary recreation, water supply (freshwater), and shellfishing (saltwater). All waters of the state should support, at a minimum, secondary recreation and fish propagation.

The Division of Environmental Management (DEM) classifies state surface waters based on their designated best uses for public interest. Primary freshwater classifications include water supply (WS) and classes B and C. In saltwater, classifications include SA, SB, and SC. Class C and SC waters are maintained for fish propagation and secondary recreation. These water quality classifications set the basic protection level for all state surface waters. Class B and SB waters should support the minimum requirements and primary recreation (frequent use for swimming).

The highest quality fresh and salt waters are distinguished by their respective classifications, WS and SA. The water supply (WS) classification has subcategories with different requirements to distinguish and protect the most critical water supplies. Class SA waters are maintained for safe shellfish harvesting. These high quality state waters provide water and shellfish safe for human consumption.

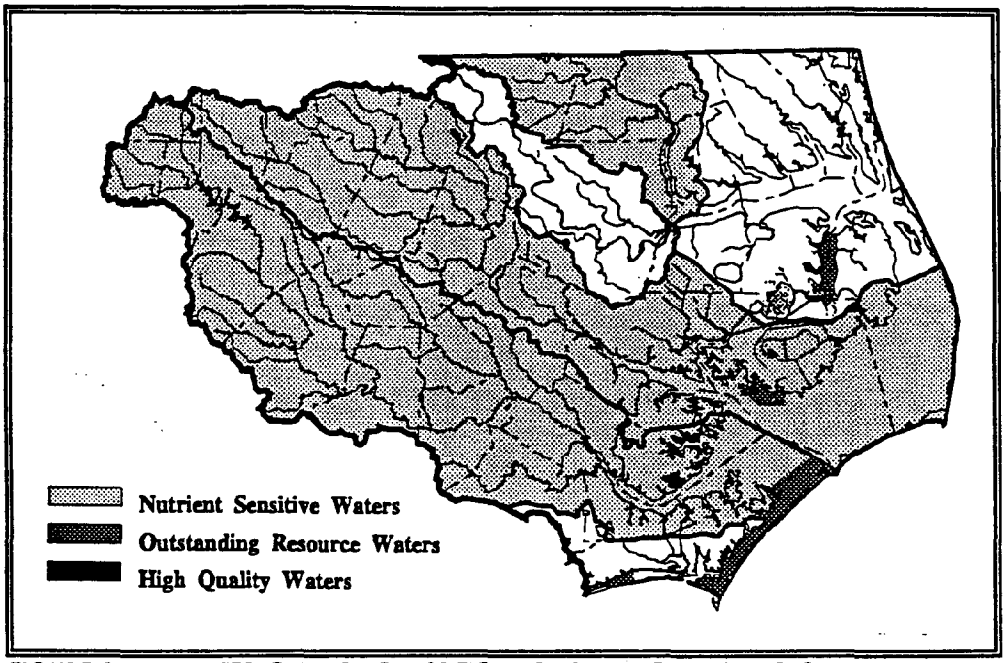

FIGURE 2 *WATER QUALITY CLASSIFICATIONS IN THE APES REGION*

DEM has developed supplemental classifications designed to preserve sensitive and highly valuable resource waters. Most waters will have one primary and one or more supplemental classifications. These supplemental classifications include High Quality Waters (HQW), Outstanding Resource Waters (ORW), Nutrient Sensitive Waters (NSW), Trout Waters (TW), and Swamp Waters (SW) (DEM 1993). Figure 2 shows DEM's supplemental water quality classifications in the APES region. DEM takes steps to protect these waters through state stormwater management practices. DEM's comprehensive stormwater program addresses priority areas including sensitive waters (SA, WSI-WSV, HQW, ORW, etc.). DEM also administers the federal NPDES stormwater program to reduce pollutant loads in stormwater runoff. The Water Supply programs cover both coastal and inland counties in the Albemarle-Pamlico region, and basinwide planning efforts will continue to address concerns on a basin scale. Expansion of stormwater regulations to encompass all surface waters would be a benefit to the state. DEM evaluates surface waters of the state using physical, chemical, and biological parameters. These parameters, or water quality indicators, include fecal coliform, chlorophyll a, dissolved oxygen, biological oxygen demand (BOD), nutrients, sediment and turbidity, pH, and temperature. From this information, DEM can determine if state waters are supporting their designated uses, support threatened, partially supporting, or not supporting their designated uses. A set of water quality standards are established for each primary and supplemental classification outlining the level of water quality that must be maintained to support designated uses. In the Albemarle-Pamlico region, there are 9,299 miles of fresh water rivers and streams and 1,831,900 acres of brackish, estuarine waters. In the fresh water streams, 18% of the stream miles are fully supporting their uses, 32% are support threatened, 34% are partially supporting, and 8% are not supporting. Another 8% of the fresh water stream miles were not evaluated. In the estuarine areas, 88% of the area is fully supporting of its uses, 4% is support threatened, and 8% is partially supporting. No brackish areas are considered not supporting of their uses (DEM, 1992a).

DEM defines an impaired system as a water body that is either partially or not supporting its designated uses. Impairment of water quality in fresh water streams and rivers in the Albemarle-Pamlico region is attributed to high sediment levels for one third of the impaired waters. Low dissolved oxygen is the cause of impairment in 10% of the impaired waters. Other less frequent causes of impairment include high levels of nutrients, toxicants, biological oxygen demand, fecal coliform, metals, turbidity, ammonia, and dioxin (DEM, 1992a). A much smaller percentage of saltwater areas are impaired. The greatest cause of impairment in the saltwater areas is chlorophyll a (49% of impaired waters). Other causes of saltwater impairment include fecal coliform, dioxin, and low dissolved oxygen (DEM, 1992).

Nonpoint sources are the greatest cause of impairment for both salt and fresh water. Forestry, construction, urban and agricultural runoff, and land disposal of wastes make significant nonpoint source contributions to water quality impairment. Of these nonpoint sources, agriculture has the greatest affect on water quality. Figure 3 shows the three major sources of nutrient inputs in the APES region. For fresh water, the source of impairment was determined to be nonpoint sources for 85% of the impaired miles. Of the nonpoint sources affecting fresh water, 74% is attributed to agricultural runoff, 4% to forestry, 6% to construction, 9% to urban runoff, and 7% for other sources. Impairment of brackish areas is attributed to nonpoint sources for 60% of the impaired acres. Nonpoint sources of pollution can cause elevation of a variety of parameters including sediment, toxicants, biological oxygen demand, and fecal coliform (DEM, 1992). Point sources also contribute to the degradation of water quality and impairment of best uses. The analysis of best use support in the Albemarle-Pamlico system indicates that the highest levels of water quality impairment are in freshwater rivers and streams. While only 8% of total estuarine acres are deemed impaired, 42% of the total freshwater stream miles are considered impaired.

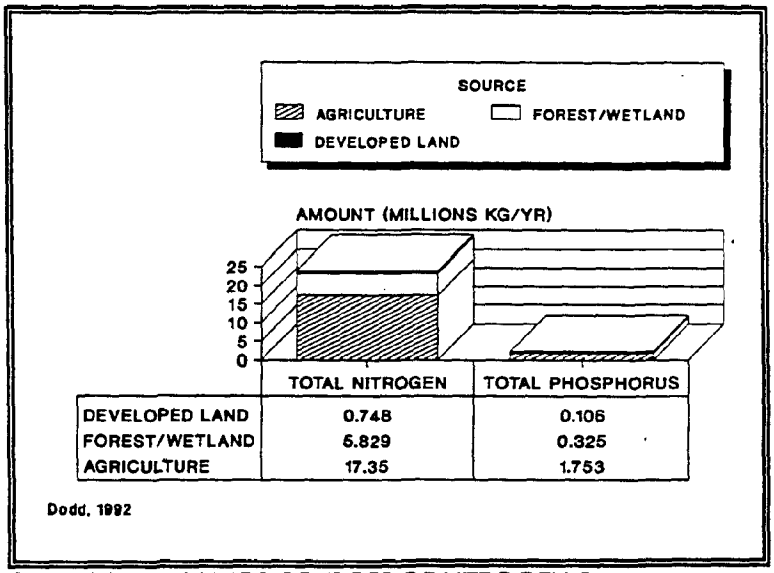

FIGURE 3 *MAJOR SOURCES OF NITROGEN & PHOSPHORUS LOADING IN THE APES REGION*

Nutrients

Three of the major river basins in the Albemarle-Pamlico region are designated as "nutrient sensitive." In these waters, the lower Neuse River, the Tar-Pamlico, and the Chowan River, high levels of nutrient loadings are of particular concern. High nutrient levels can create a natural imbalance in the water and result in the stimulation of frequent algal blooms. Figure 4 demonstrates the total nitrogen and phosphorus loading from nonpoint sources in the study area. These blooms can cause dissolved oxygen levels to dip and may result in fish kills. Across the APES region, nonpoint sources are the largest source of nutrient loadings to the

waters, and of these sources, agricultural runoff contributes the highest levels of nutrient loadings (Dodd, 1992). Significant levels of nutrients in these basins also come from point sources and atmospheric inputs.

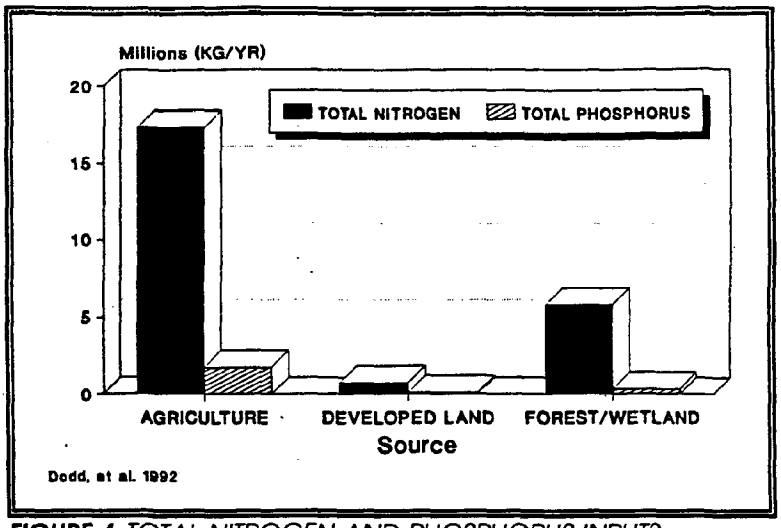

FIGURE 4 TOTAL NITROGEN AND PHOSPHORUS INPUTS FROM NONPOINT SOURCES

Toxic Contamination

An assessment of the potential for toxic contamination in the APES region has been recently conducted. First, this analysis assessed the total loadings of toxics from point sources in the region. Loadings only indicate what is entering the system and do not indicate which toxics that enter the system will be a contamination problem. It was determined that loadings of toxics in the region are highest for three metals, zinc, copper, and lead. The single largest source of toxic loadings was the loading of fluoride from the Texasgulf facility in the Pamlico River system which has been largely eliminated by changes in the facility's wastewater treatment system.

Toxic loadings were highest overall for the Albemarle region including the Chowan, Pasquotank, and Roanoke river systems. Next, the analysis determined where discharges may have the potential to exceed water quality standards for toxics at low flow and average flow conditions. For low-flow conditions, twenty-one dischargers were found to have the potential to exceed water quality standards, and for average flows, 12 dischargers were found to have the potential to exceed standards. A majority of the discharges identified for the potential to exceed standards were municipal, as opposed to industrial, wastewater treatment facilities. The likely source of toxics in the municipal facilities is, however, industrial wastes (Cunningham, et al. 1992(a)).

This assessment examined water quality samples and fish samples to determine potential toxicity for both wildlife and human consumption. Water quality data from across the region during 1988-1991 were examined for the pollutant levels that exceeded state standards or EPA chronic water quality criteria. Exceedances of standards were most common in the headwater areas of the major river systems of the APES region. In freshwater areas, exceedances were most common in the upper Neuse River basin. Exceedances were minimal in the Chowan, Roanoke, and Tar-Pamlico Rivers. In the saltwater areas, there were few standards exceedances, and most occurred in tributaries to the lower Pamlico and Neuse basins. The examination of fish tissue samples indicated that a total of 75 sites had levels of toxic contamination that exceeded levels of concern for wildlife. The most common contaminants found to exceed levels of concern were copper, mercury, lead, and cadmium. Twelve sites, primarily in the Albemarle region exceeded levels of concern for wildlife for dioxin. The examination of fish fillet data indicated that mercury and dioxin were the two toxic

pollutants most frequently found in fish tissues at levels that may pose a hazard to human health. The sources of dioxin in the region are primarily pulp and paper mills that use a chlorine bleach processing. The sources of mercury are less well understood and may be from a variety of point, nonpoint, and atmospheric sources (Cunningham, et al. 1992 (a)). For shellfish tissues, zinc, arsenic, and lead were the contaminants most frequently found.

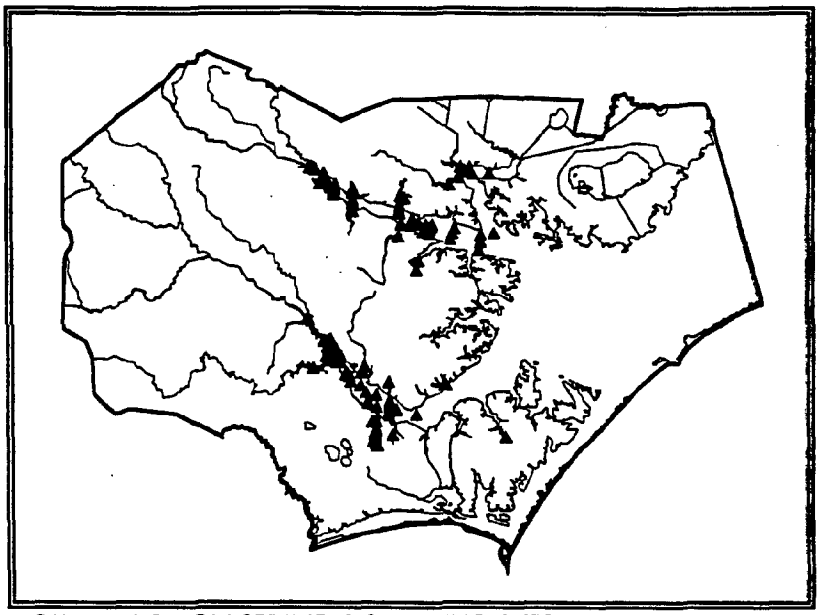

FIGURE 5 *BOTTOM SEDIMENT SAMPLING SITES WITH LEAD CONCENTRATIONS GREATER THAN 35 PPM IN THE LOWER PAMLICO AND NEUSE RIVER BASINS*

Toxic contamination of the sediments has also been examined in the APES region. Only a small number of sediment samples was available for freshwater areas, and no toxic contamination was found at these sites (Cunningham, et al.1992 (a)). In the saltwater areas of the APES region, a number of sites with enriched levels of metals in the sediment have been identified (Riggs et al. 1989, 1991, 1992). Of these sites, 51 were found to exceed concentrations at which toxic effects are likely. Figure 5 illustrates lead contamination greater than 35ppm in sediment at sampling sites located in the lower Neuse and Pamlico basins. These sites were most frequently found in the lower portions of the major river basins and in tributaries to the primary estuarine areas.

Shellfish Closures

The closure of waters to the harvesting of shellfish is an important water quality concern in coastal areas. In the APES region, 337,809 acres or 17% of a total 1,957,250 estuarine acres are closed to shellfish harvesting. This is misleading due to the fact that most of these closures occur in 607,200 brackish, lower salinity acres, primarily in the Albemarle Sound region, that do not support significant quantities of hard clams, oysters, and bay scallops. In these areas, generally only Rangia clams are available for harvest, and the demand for Rangia clams is quite low.

There are 1,350,050 higher salinity acres that do support harvestable populations of hard clams, oysters, and bay scallops, of which 21,611 acres, or 2%, are closed to shellfish harvesting (Shellfish Sanitation Branch data). The amount of shellfish closures in these waters is somewhat low. However, it is important to recognize that most of these closures occur in shallow, nearshore areas that are often high quality shellfish habitat. The closed areas usually continue to produce shellfish, but are considered unfit for human consumption, consequently these closures have the greatest impact on shellfish harvesters. Additional

shellfish closures are made on a temporary basis after rainstorm events cause high levels of nonpoint source runoff. Approximately 15,000 additional acres are frequently subject to such temporary closures (P. Fowler, Shellfish Sanitation Branch, personal communication). In recent years, the area affected by temporary closures has increased.

Shellfish closures have been attributed to a variety of point and nonpoint sources. Bacteria from agricultural and urban runoff and from septic tanks in unsuitable soils have contributed to shellfish closures. Development along the barrier island has caused the closure of some shellfish beds (DEM, 1992). Another source of bacteria that leads to closures is wastewater treatment plants. There are eight such plants in the APES region that could impact shellfish waters. Shellfish closures are made by rule within a certain distance of all wastewater treatment plants and marinas.

Fish and Shellfish Kills and Diseases

A prominent water quality-related concern is the occurrence of fish and shellfish kills and diseases in the APES region. In many cases, the causes of kills and diseases are unknown, and the relationship of human impacts to their occurrence is difficult to assess. Recent emphasis on water quality in the APES area has brought closer attention to the number of fish kills, as evidenced by increased reporting. However, there is insufficient data to determine if there has been an actual increase in fish kills. Fish kills may be an indicator of general ecosystem stress. Many fish kills are attributed to low dissolved oxygen and algal blooms (DEM 1990, 1988). In 1987, a Red Tide algal bloom caused extensive mortality in the bay scallop population, but it is unlikely that this algae has persisted in the system (Tyler 1989). Recently, a toxic dinoflagellate (*Pfiesteria piscimorte*) has been discovered in the APES system which has been shown to have caused at least 25% of the fish kills in the Pamlico and Neuse Rivers over the past two years (Burkholder and Noga 1993). The possible impact of nutrient levels on the blooms of this dinoflagellate is being investigated. Figure 6 illustrates mortality rates of fish exposed to three categories of stress.

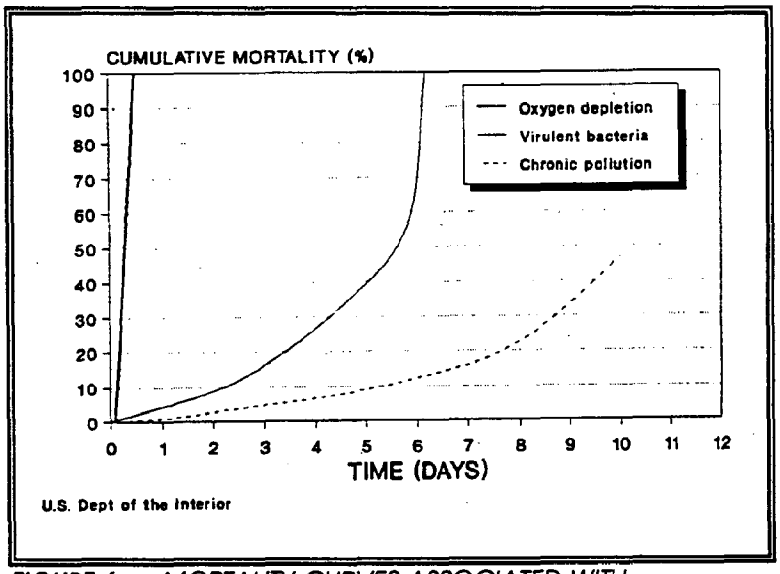

FIGURE 6 *MORTALITY CURVES ASSOCIATED WITH THREE MAJOR CATEGORIES OF STRESS TO FISH POPULATIONS*

Various finfish and shellfish disease epidemics have been reported in the Albemarle-Pamlico system since the 1970s. These diseases include ulcerative diseases that affect finfish, shell disease that affects blue

crabs, and two oyster diseases (Levine et al. 1990a, 1990b, Noga et al. 1990, Morrison et al. 1990, Sherman et al. 1991). The causes of diseases and their impacts on fish and shellfish populations are generally not well understood. The potential for impact, however, may be considerable (Steel 1991). It is known that the impact of disease on oysters has been severe in recent years.

There are insufficient water chemistry and long-term monitoring data to implicate or refute the contention that specific pollutants are the cause of the increase in the prevalence of disease. The occurrence of fish and shellfish diseases is not limited to polluted areas, and disease outbreaks have been observed far from any pollutant sources (Steel 1991). As with fish and shellfish kills, disease may be an indicator of general ecosystem health (Sindermann 1988). In unpolluted environments, fish and shellfish disease rarely affects greater than 10% of the organisms (Brown et al. 1977, Couch 1985). Higher prevalence in the APES system suggests the possible contribution of human impacts. The number and magnitude of diseases which affect fish and shellfish in the APES region suggest that these populations are exposed to abnormally high stress. Skin ulcers and shell disease are believed to be associated with reduced water quality (Sindermann 1983, 1989). However, it is not known to what degree stress on fish populations can be attributed to anthropogenic or natural causes (Steel 1991). Additional studies are also looking at the possible link between the newly discovered toxic dinoflagellate and some disease epidemics.

	TOTAL NITROGEN	TOTAL PHOSPHORUS
RUNOFF	23,927,169	2,183,668
POINT SOURCES	2,731,370	1,263,233
DEPOSITION	12,479,840	854,185
RESERVOIR RELEASE	4,056,000	196,700
TOTAL	43,194,380	4,297,786

Dodd, et al. 1992

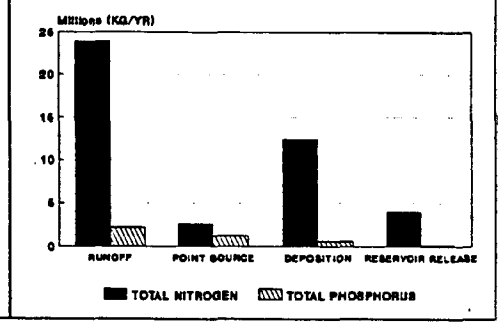

FIGURE 7 *TOTAL NITROGEN AND PHOSPHORUS LOADING BY SOURCE IN THE APES REGION*

Summary

In summary, the primary water quality concern in the Albemarle-Pamlico region is the inability of 42% of the freshwater miles and 8% of the saltwater acres to fully support their designated uses. An additional 32% of the fresh water miles and 4% of the saltwater acres are threatened in their ability to continue to support their uses. Much of the impairment of waters in the APES system can be attributed to nonpoint sources of pollution. The most prominent of these sources has been agricultural runoff, but runoff from construction, forestry, urban runoff, waste disposal areas, and airborne pollutants also make significant contributions to the impairment of APES region waters. A smaller, but still significant amount of water quality impairment in the region can be attributed to point source dischargers. Figure 7 shows total nitrogen and phosphorus loadings

from all sources in the region. These sources of pollution contribute to the elevation of sediment, nutrients, biological oxygen demand, toxicants, and fecal coliform in the water. These factors all cause degradation of habitat for living marine organisms and of the ability of the water to support human uses. Nutrient levels are of specific concern in several APES region river basins. The impacts of toxicants and bacteria have been shown to cause localized water quality problems across the APES system.

Water Quality Management Initiatives

The importance of a systemwide strategy in effective resource management has been emphasized in the Comprehensive Conservation and Management Plan. Basinwide water quality management is a new approach being implemented by DEM to improve the efficiency, effectiveness, and consistency of its water quality protection program. It is not a new regulatory program,rather it is a watershed based approach which provides a vehicle for basinwide permitting and integration of point and nonpoint source controls through existing regulatory and cooperative programs.

The Neuse River Basinwide Management Plan which has already been released is the first in a series of seventeen basinwide plans being prepared by DEM over the next five years. In this plan, specific areas of the Neuse Basin have been targeted for intensive study and immediate implementation of remediation projects. Additionally, all permits are on the same renewal cycle. The basinwide plans for the remaining basins in the APES region will be released in 1995 for the Tar-Pamlico, 1997 for the Roanoke, 1998 for Chowan-Pasquotank.

Pollution from nonpoint sources contribute to the greatest cause of water quality impairment in the Albemarle-Pamlico region. To combat this problem, DEM adopted new Water Supply Watershed Protection Rules in 1992 which require municipalities and/or counties to develop management plans for protecting raw water supply watersheds. These plans must meet minimum requirements which include the use of buffers, land use planning, and stormwater controls; however, local entities will be involved in making environmentally and economically sound decisions regarding growth and development in their communities and counties.

Other nonpoint source management initiatives have been implemented in the Albemarle-Pamlico region. Concentrated animal feedlot rules were amended in 1992 to establish procedures for properly managing and reusing animal wastes to prevent them from reaching the waters of the state. Since 1980, state stormwater rules have been in effect in the 20 coastal counties. DEM and the Department of Transportation (DOT) coordinate their efforts to address environmental concerns on highway projects providing for increased environmental protection. A result of this effort is the adoption of formal best management practices to control nonpoint source pollution from highway projects (DEM 1992b).

Activities to control sedimentation from construction sites and mining projects are regulated by the Sedimentation Pollution Control Act and administered through the Division of Land Resources (DLR). The Land Quality Section is heavily involved in DEM's Section 319 Nonpoint Source Management Program. The Land Quality Section works closely with other agencies to address sedimentation and erosion concerns throughout the state. This agency has assisted DOT in developing their highway BMP program and also the Division of Forest Resources (DFR) in developing the forestry BMP manual. Educational efforts have

received international acclaim for environmental achievements. Recently published erosion and sediment control field manuals and inspector's guides are focused to help contractors, while grants are awarded to various institutions and facilities throughout North Carolina to fund erosion and sedimentation control projects and educational exhibits. New rulings through the Sedimentation Control Commission have increased the amount of money reclaimed by the state for mining reclamation bonds, which will affect newly abandoned mine sites.

Section 6217 of the Coastal Zone Act Reauthorization Amendments of 1990 (CZARA) requires coastal states with approved coastal zone management programs to protect coastal waters from nonpoint source pollution. Coordinating with other agencies, such as DEM's Nonpoint Source Management Program, the Division of Coastal Management (DCM) is currently preparing plans to implement the required management measures to achieve specified levels of control.

Due to enhanced levels of nutrients and chronic eutrophic conditions, the Chowan, Tar-Pamlico, and Neuse rivers are classified as Nutrient Sensitive Waters (NSW) by the DEM. Nutrient reduction goals set in the 1980's for the North Carolina portion of the Chowan River have been obtained. Innovative methods, such as nutrient trading strategies, are reaching nutrient reductions in the Tar-Pamlico Basin. A statewide ban on phosphorus detergents and limits to phosphorus discharge at NPDES facilities have lead to a reduction in total phosphorus inputs from 57% in 1986 to 21% in 1990 in the Neuse River.

The Tar-Pamlico Basin Association, a coalition of permitted dischargers with support from the Division of Environmental Management, Environmental Defense Fund, and the Pamlico Tar River Foundation, is implementing an experimental point/nonpoint nutrient trading strategy for the Tar-Pamlico River Basin. The Tar-Pamlico Nutrient Sensitive Waters Implementation Strategy allows point source dischargers to meet nutrient reduction goals by paying for agricultural nonpoint source controls rather than implementing expensive nutrient removal technology in their wastewater treatment plants. This effort is a cost-effective and flexible approach to reduce nutrient input into these waters. Members of the Association could provide up to $11 million for agricultural BMP implementation and have contributed $400,000 to develop a basinwide hydrodynamic model for determining nutrient target levels.

VITAL HABITATS

The Natural Heritage of the Albemarle-Pamlico Region

The Albemarle-Pamlico region embodies a wide expanse of intact natural areas (Figure 8) that endow the region with a rich natural heritage. These areas provide habitat for wildlife, protection for rare plant and animal species, and natural water quality buffers for streams and rivers. Wetlands habitats in the region serve a variety of important functions including: water quality protection, water storage, flood protection, wildlife habitat, nursery areas for fisheries, aesthetics, and recreation. The region also has a great amount of vital fisheries habitats--including nursery areas, spawning areas, shellfish beds, and submerged aquatic vegetation beds, all of which support extensive commercial and recreational fisheries in North Carolina and make a large contribution to supporting fish populations along the entire east coast.

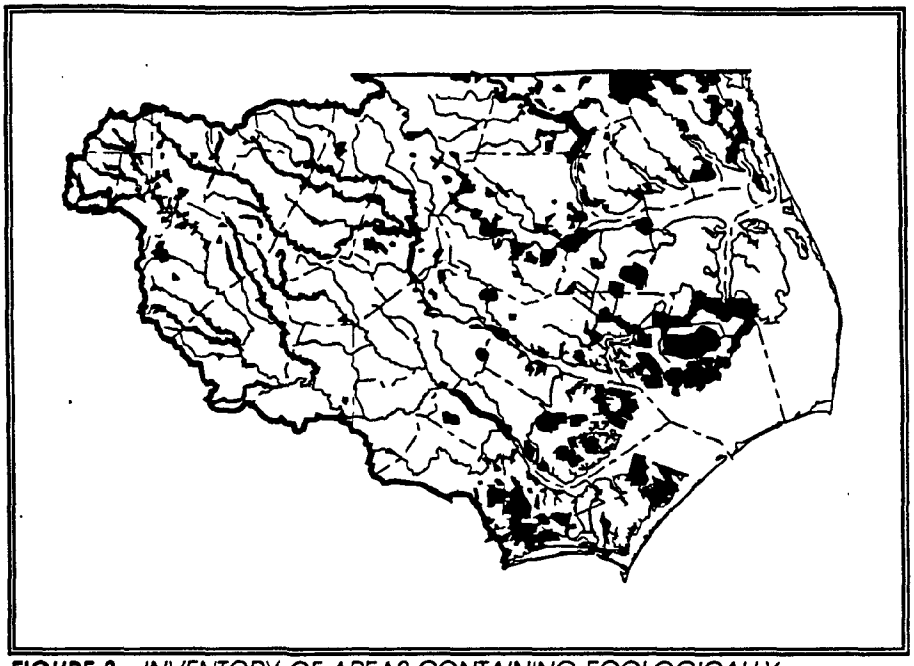

FIGURE 8 INVENTORY OF AREAS CONTAINING ECOLOGICALLY SIGNIFICANT NATURAL COMMUNITIES OR RARE SPECIES

This natural heritage is threatened by potentially extensive alteration of natural areas for human activities including residential, commercial, and industrial development; transportation; agriculture; and forestry. For example, the functions of vital fisheries habitats can be jeopardized by activities on the land as well as by marine-based activities such as dredging and some boating and fishing practices. These alterations affect the ecological functions of natural communities through changes such as drainage, removal of vegetation, and installation of surfaces while land conversions result in different levels of impairment. It is important to note that "alteration" of habitat areas does not always result in the complete destruction of habitat functioning. Instead, some natural functions may be retained. For example, wetlands which have been altered for pine plantations have changed original hydrology and vegetation patterns, but are still able to provide some wildlife habitat, flood control, groundwater recharge, nutrient removal, and aquatic habitat. Alternatively, some natural areas are so extensively altered that they lose their important ecological functions.

Rare Plants, Animals, and Natural Communities

Maintaining the natural heritage of the APES region requires a special emphasis on the protection of rare plants, animals, and natural communities. There are many land and aquatic habitats in the APES region which are vital to the survival of rare plant and animal species. As of May 1992, 14 endangered species, five threatened species, two proposed endangered species and one proposed threatened species of the APES region were federally-listed. Several other species were candidates for listing. As of March 19, 1992, North Carolina cataloged 27 species as endangered, 24 species as threatened, and 21 species of special concern in the APES region (LeGrand 1991, Weakley 1991, figures updated by the APES Staff 1992). In Virginia, 9 endangered species, 10 threatened species, and 1 candidate species are listed. The survival of threatened and endangered species depends upon protection of their habitats.

In North Carolina, the state Natural Heritage Program (NHP) recognizes 100 natural communities, and 65 are located within the APES region. NHP designated rare plants, animals and natural communities are

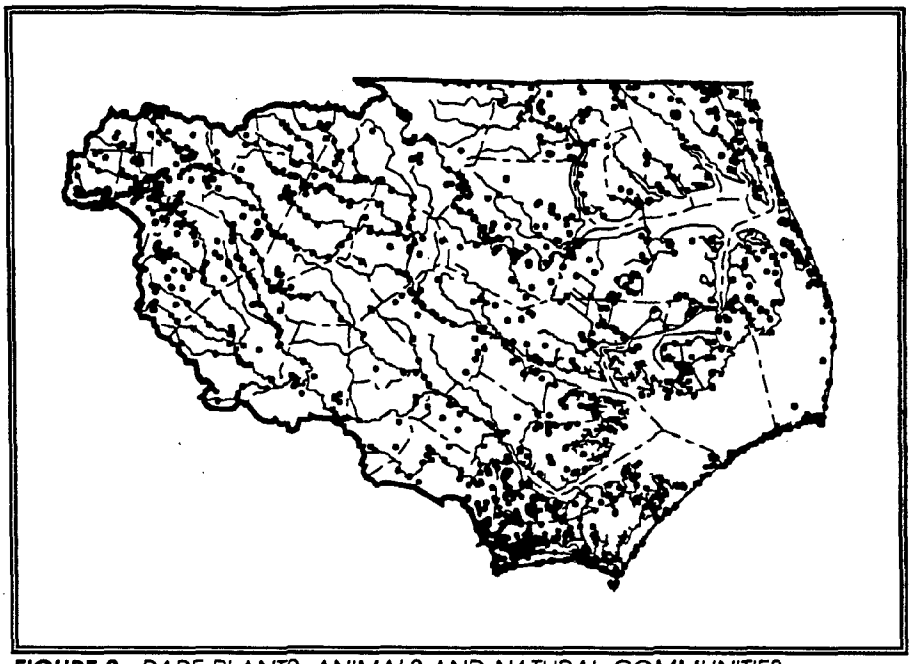

FIGURE 9 *RARE PLANTS, ANIMALS AND NATURAL COMMUNITIES IN THE APES REGION*

illustrated in Figure 9. Of the 65 natural communities in the APES region, 25 are considered impaired or critically impaired because of their vulnerability and potential destruction. Protection of these natural communities from conversion to other land uses is vital to the maintenance of the region's natural heritage. Many natural features in the APES region are considered rare nationally. Habitat destruction and fire suppression have resulted in the near loss of some forest habitat types. In some cases, wildlife habitat has been reduced to nearly a functional minimum, threatening the survival of some species.

Historically, habitat changes have been caused largely by land clearing for agriculture and by some forestry practices. But other uses, including road construction and urban development have also played a significant role. Some improvements in habitat protection have been made in recent years, and many natural areas are protected through government ownership and voluntary private protection agreements; however, many important and rare natural areas remain unprotected. The maintenance of the natural heritage of the APES region requires that future land use activities be carefully managed to protect rare natural communities (Schafale and Weakley, 1990, Frost et al. 1990, LeGrand et al. 1992, Smith et al. 1993).

Wetlands

Wetland habitats in the Albemarle-Pamlico region include freshwater marshes, bottomland hardwood forests, salt marshes, pocosins, pine savannas, nonalluvial wetland forests, and wet pine flats. Several different studies have examined changes in wetlands habitats in North Carolina. In general, these studies indicate a steady decline in wetland acreage.

A variety of studies have estimated wetlands "losses" for North Carolina, the Southeast, and the United States. Most studies have a different definition of "loss", and therefore, comparisons are difficult. Between the mid 1950s and the mid 1970s, an estimated 9 million wetland acres were drained or otherwise converted in the continental 48 states (Frayer et al. 1983). Of these 9 million acres, 8 million were in the southeast

(Hefner and Brown 1985). During this time, there was a 7% loss of estuarine wetlands and a 15% loss of freshwater related wetlands in the southeast (Hefner and Brown 1985). Many of these wetlands were converted to use for agriculture (Hefner and Brown 1985).

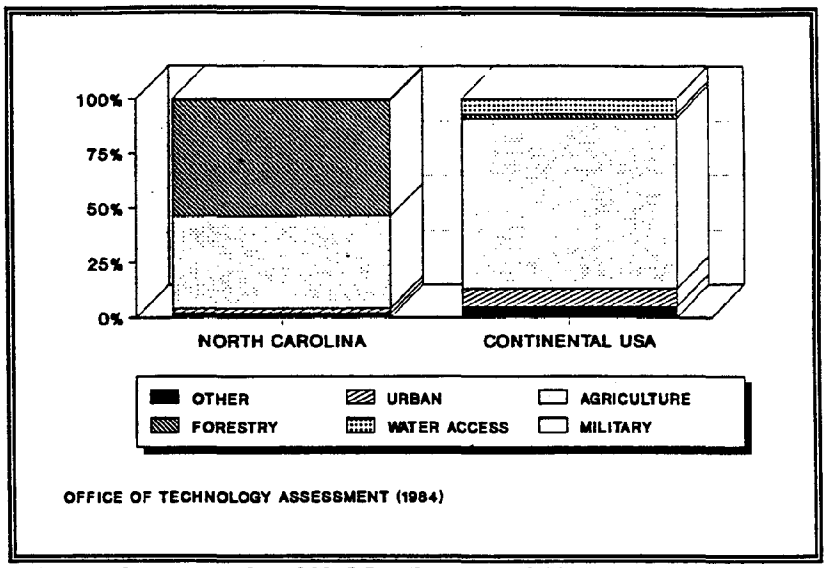

FIGURE 10 *CAUSES OF WETLAND LOSS IN NORTH CAROLINA AND THE CONTINENTAL USA*

In the 48 contiguous states, it has been estimated that there were 221 million acres of wetlands in colonial times. Over 200 years, the 48 states lost an estimated 53% of their original wetland acreage. Between 1780 and 1980, this rate of loss equals more than 60 acres per hour. (Dahl 1990). Similar estimates made for North Carolina estimate a decrease of 49% from 11.1 million acres of wetlands to 5.7 million acres over the same time period (Dahl 1990). Causes of wetlands losses in North Carolina and the Continental United States are illustrated in Figure 10. Several studies have indicated that conversion of wetlands to agricultural uses has caused the greatest amount of wetlands decline, particularly for freshwater wetlands (Hefner and Brown 1985, Frayer et al. 1983).

Another study indicated similar results using different estimates of the total original wetlands coverage. It has been estimated that the state of North Carolina had 7.8 million acres of wetlands in presettlement times (DEM APES Report #91-01). Of these wetlands, about 95% occurred in the coastal plain, 2% in the piedmont, and 3% in the mountains. In the coastal plain, wetlands covered about 52% of the land area (DEM 1991). The most common wetland types were pine savannas, bottomland hardwood forests, and pocosins. Salt marshes represented a much smaller percentage of the original wetland area, although reports of the exact acreage differ (DEM 1992). A large portion of these wetland areas was found in the Albemarle-Pamlico region.

The same study estimated that by the 1950s, 34% of the original wetland acreage in North Carolina had been altered to other uses and that by the 1980s, another 15% of the original wetland acreage had been altered (DEM 1992, Cashin 1990). Of these altered areas, about half continued to partially support some of their wetland functions and retain their status as wetlands. Many of these areas were altered for forestry. The other half was altered to a level such that their wetlands functions were effectively lost. These areas were commonly altered for agricultural and urban uses (DEM 1991). Wetlands alterations have had the greatest impacts on pine savannas and pocosins. Since the 1950s, alteration rates have been higher for inland wetland types (18%) than for estuarine marsh areas (10%) (DEM 1992). It has been estimated that forestry caused 53% of post settlement wetlands alteration in North Carolina (DEM 1991, Cashin 1990). However, as noted above, wetlands altered to forestry may retain some of their ecological functions. On the other

hand, alteration for agriculture and urban uses, which accounts for 44% of alterations since presettlement times, usually result in the effective loss of wetland functions. The remaining 3% of wetlands altered have been attributed to other causes such as military facilities (DEM 1991, Cashin 1990).

Fisheries Nursery Areas

Primary nursery areas for fisheries cover almost 25,000 acres, or 1.5%, of the Albemarle-Pamlico estuarine system's total water area (Steel 1991, updated by DMF data). Nursery areas are generally found in tributary creeks and embayments, where shallow, mid to high salinity waters lay over muddy or grassy bottoms. Distribution of primary, secondary and special secondary nursery areas are illustrated in Figure 11. These areas are of critical importance to the propagation of over 75 species of fish and shellfish in North Carolina and along the east coast. The functioning of nursery areas can be impaired by freshwater drainage, land use changes, or eutrophication, but the extent of that impairment is difficult to estimate (Stanley, 1992). Nursery areas receive a special protective designation; however, no significant fluctuations in juvenile abundance have been observed since 1978. Nursery areas are generally protected from potentially harmful water uses including some commercial fishing practices and development activities. The functions of nursery areas are most threatened by nonpoint sources of pollution and development on land near nursery areas (Stanley, 1992).

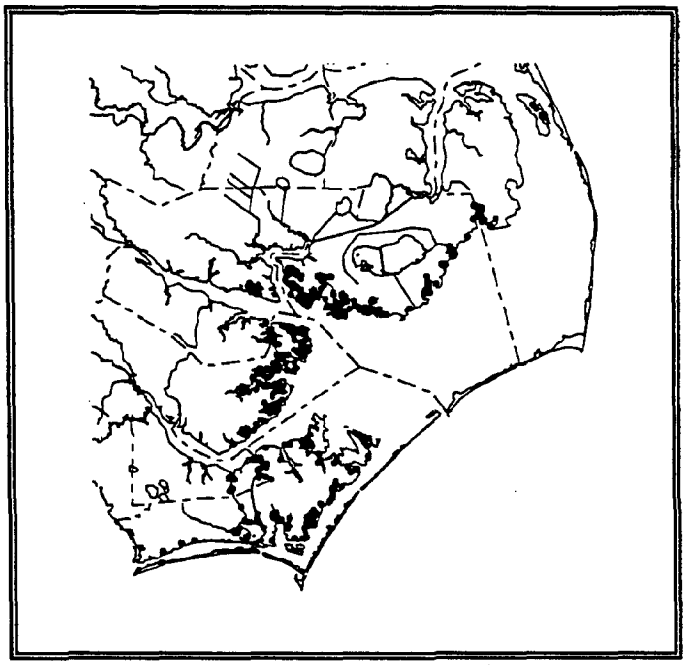

FIGURE 11 *ALL MAPPED FISHERIES NURSERY AREAS IN THE APES REGION*

Submerged Aquatic Vegetation

Submerged aquatic vegetation (SAV) provides important habitat for many estuarine species because the vegetation helps to reduce current velocities, provides an attachment surface, reduces turbidity, and provides refuge and food. Information on the coverage of submerged aquatic vegetation is limited. The APES program has initiated a SAV mapping project, administered by the National Oceanic and Atmospheric Administration (NOAA), covering a limited area which is depicted in Figure 12. At this time there are no baseline data available on the extent of SAV. Anecdotal information indicates that there may have been large losses of SAV from historic levels, particularly in the rivers, creeks, and western sounds. Threats to SAV habitat include direct physical disturbance such as dredging, mechanical clam harvesting, and changes in water quality. Submerged aquatic vegetation is also sensitive to declines in water transparency (Kenworthy

and Haunert 1991). One species of SAV, eelgrass, may be declining rapidly as a result of high levels of nitrate in the water (Burkholder 1993).

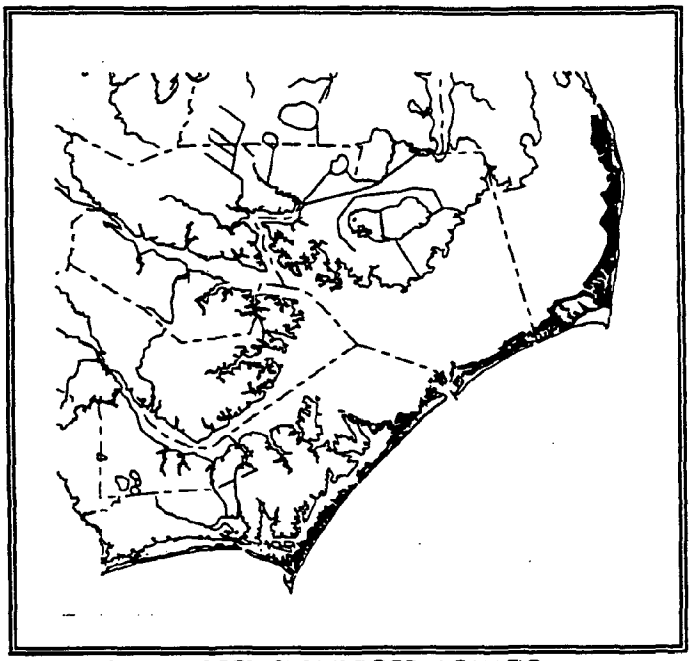

FIGURE 12 *MAPPED SUBMERGED AQUATIC VEGETATION*

Spawning Areas

The rivers of the APES system provide spawning habitat for anadromous species (Figure 13) such as striped bass, shad, and herring. Anadromous fish live in the oceans but migrate up freshwater rivers to spawn. The spawning success of anadromous fish has declined as evidenced by reduced adult landings (Steel 1991) and reduced juvenile abundance (DMF). Recently, there has been a high level of concern for striped bass which spawn in the Roanoke River. It has been established that the success of their spawning is impaired by changes in water flows and the water quality impacts that result from discharges from the Roanoke Rapids dam (Rulifson 1990, Rulifson et al. 1990). Throughout the APES region, access to historical spawning areas has frequently been blocked by dams and road crossing culverts (Collier and Odom 1989).

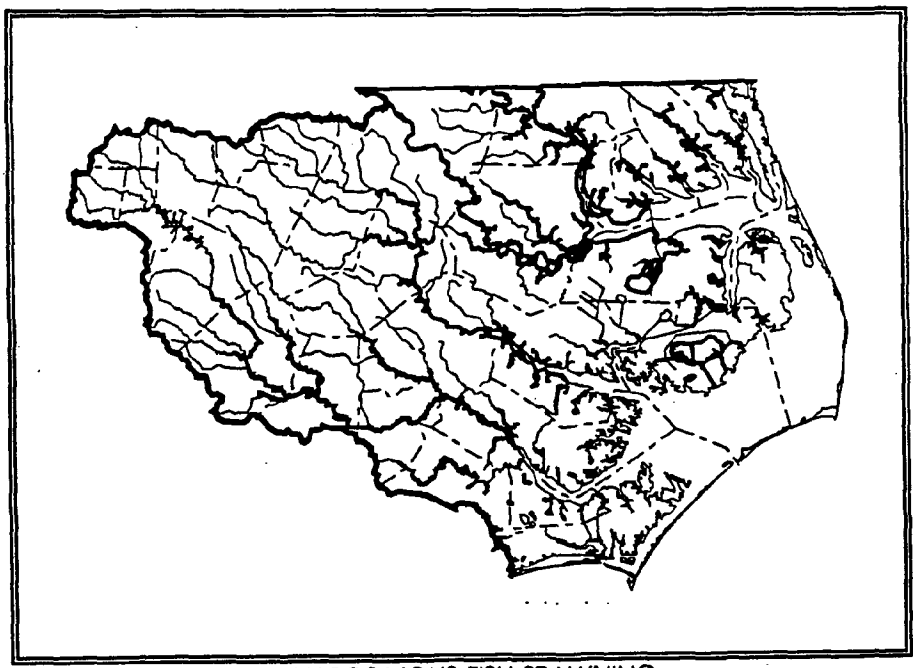

FIGURE 13 *ANADROMOUS FISH SPAWNING AREAS IN THE APES REGION*

Shellfish Beds

Clams, oysters, and bay scallops have supported important fisheries throughout the history of North Carolina commercial fishing. However, the productivity of these shellfish beds has declined as indicated by landings data. As filter feeders, shellfish contribute positively to water quality as they remove nutrients and suspended particles from the water and convert them to a food supply for other bottom dwelling organisms. However, this contribution is believed to be significantly reduced because of declines, particularly for oysters, over the last 100 years. It has been proposed that restoring oyster stocks through careful management and aquaculture will result in water quality improvement (Newell 1988, Ulanowicz and Tuttle 1992). Destruction of shellfish habitat occurs as a result of direct physical disturbances (such as clam kicking, mechanical dredging, and some trawling practices) and indirect disturbances that affect water quality. Oysters have been severely impacted in recent years by the parasitic diseases Dermo and MSX (Morrison et al. 1990, Sherman et al. 1991). In general, there is insufficient data to comment in detail on the trends in water quality and substrate quality and their affect on the habitats of bay scallops, clams, and oysters.

Summary

All of the habitats described above provide vital ecological functions in the APES region. Damage to vital habitat areas affect human uses of resources as well. For example, the disappearance of SAV beds may cause declines in fish stocks which may in turn cause fishermen to lose jobs. People are attracted to North Carolina in the first place because of its many treasured natural areas and wildlife. Maintaining the diversity of species and the rich natural heritage of the APES region is dependent upon the careful management of land and water uses.

FISHERIES

The APES region not only provides important habitat for the production of fishery resources, but also supports several fishing industries. Recreational and commercial fishermen use an assortment of gear and methods to pursue a variety of species (Cunningham et al. 1992b). The total annual value of North Carolina's coastal fisheries, commercial and recreational, has been estimated to be approximately $1 billion (Street and McClees 1981, modified by federal inflation figures). The recreational and commercial fishing industries also provide thousands of full-time jobs for coastal residents (DMF data, Sport Fishing Institute 1988).

A greater demand for fisheries products and for recreational fishing opportunities has resulted in increased fishing pressure. Downward trends in commercial landings of finfish species may indicate declining stocks. The overall catch per unit effort is declining despite improvements in fishing gear and methods (Steel 1991). Eight species of finfish and shellfish, important commercially and recreationally, are believed to be overfished or severely depleted: Atlantic croaker, Atlantic sturgeon, Eastern oyster, red drum, striped bass, summer flounder, weakfish, and herring (DMF data). Fisheries declines may be attributed to a variety of factors: habitat loss, physical damage, natural events and cycles, excessive harvest pressure, changes in stream flows, and water quality degradation. Table 1 lists the status of several important recreational and commercial species of the region. In general, overfishing is believed to be a major cause of declines in catch.

Compared to other states, North Carolina allows a wide variety of fishing activities with relatively little regulation. As a result, the Albemarle-Pamlico system is one of the most intensively fished areas on the Atlantic coast. Approximately one million recreational fishermen fish the North Carolina coastal waters annually (DMF data). These fishermen pursue many of the same species as commercial fishermen and often use commercial gear. Use conflicts between commercial and recreational fishermen and between different sectors of commercial fishing seem to be increasing.

SPECIES	HARVEST STATUS	CONCERNS
ATLANTIC STURGEON	SEVERELY DEPLETED	DISEASE, IMPACTS OF DREDGING ON HABITAT, OVERFISHING
OYSTERS	SEVERELY DEPLETED	BYCATCH, LACK OF INFORMATION FOR MANAGEMENT
ATLANTIC CROAKER	OVER-FISHED	OVERFISHING, BYCATCH
RIVER HERRING	OVER-FISHED	OVERFISHING
STRIPED BASS	OVER-FISHED	OVERFISHING, HYPOXIA, ALGAL BLOOMS, FISH KILLS, USER GROUP CONFLICTS
BAY SCALLOPS	STRESSED	IMPACTS OF HARVESTING ON HABITAT, EARLY OPENING OF SEASON
BLUEFISH	STRESSED	POTENTIAL FOR OVERFISHING
CATFISH	STRESSED	INSUFFICIENT DATA FOR MANAGEMENT
HARD CLAM	STRESSED	POSSIBLE OVERFISHING, HARVEST AREA CLOSURES, USER GROUP CONFLICTS
SPOT	STRESSED	OVERFISHING, BYCATCH
BLUE CRABS	HEALTHY	DISEASE, IMPACTS OF CRAB TRAWLING ON HABITAT, BYCATCH

Table 1 STATUS OF IMPORTANT COMMERCIAL AND RECREATIONAL ESTUARINE SPECIES: APES REGION

The bycatch and waste of non-target organisms is also believed to have a significant impact on important finfish stocks including spot, croaker, weakfish, southern flounder, and summer flounder. This impact is difficult to assess. Fisheries which may present a bycatch problem include the shrimp fishery, menhaden purse seine fishery, the gill net fishery, and the blue crab fishery in the estuarine waters of North Carolina (Skilleter, et. all 1993). It has been shown that shrimp trawls may take from a half pound to over 15 pounds of bycatch for each pound of shrimp caught (McKenna and Clark 1993). For weakfish, population modeling has estimated a significant impact on the stock (Linda Mercer, DMF personal communication). Research conducted by the Division of Marine Fisheries (DMF) and UNC Sea Grant College Program has shown that for several fisheries, bycatch is controllable through modifications to fishing gear and practices.

FUTURE POPULATION, GROWTH AND DEVELOPMENT

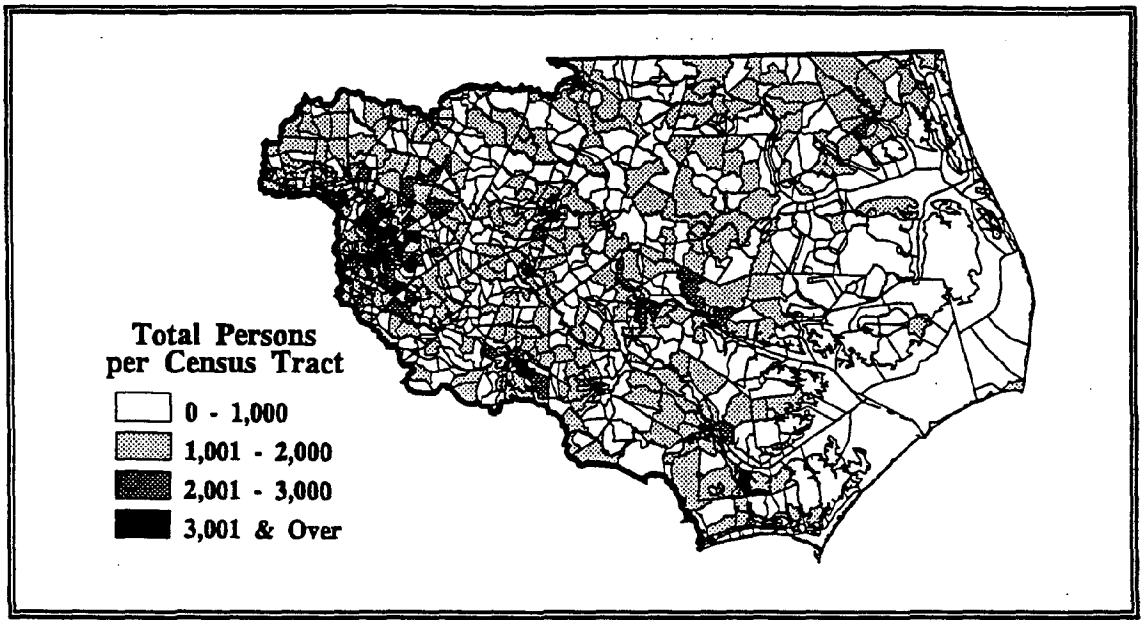

FIGURE 14 *1990 CENSUS POPULATION : APES REGION*

The population of the APES region grew at double the national rate between 1980 and 1990, increasing by 19.4% (Holman 1992). Between 1990 and 2000, a 13.4% increase in population is expected. While this projected rate is lower than the previous decade, it is still high compared to the national average. Projections suggest that five counties will likely lose population over this period, while nine counties could grow at rates of 20% or more (Holman 1992). In addition, coastal areas are experiencing high levels of seasonal population growth which may have a greater relative impact on the estuarine resources of the region. Changes in land uses are likely to result. Development activities that meet the housing, employment, and service needs of the increasing population will likely result in decreased agricultural land area, forested land area, and natural communities. Population increases may also lead to greater conflicts among resource user groups in the region. Figure 14 illustrates the distribution of population in the region in 1990. As population increases, a greater demand for public access will be made on the public trust areas of the region. Environmental planning must consider the potential degradation of public trust resources.

Unplanned growth and development also has substantial impacts on the natural resources of the region and results in increased conflicts over their use, either private or public. The cumulative impacts of growth and development are difficult to observe on an individual project basis. Environmental planning will be essential to conserve and protect the region's water quality, vital habitats, natural heritage, and fisheries.

ADDRESSING ALBEMARLE-PAMLICO ESTUARINE REGIONAL CONCERNS

Since 1987, estuarine and natural resource degradation in the APES region have been the focus of the Albemarle-Pamlico Estuarine Study (APES). The Study is a cooperative effort jointly sponsored by the North Carolina Department of Environment, Health, and Natural Resources (DEHNR) and the U.S. Environmental Protection Agency (EPA). It is one of twenty-one estuary projects nationwide that are a part of the EPA National Estuary Program (NEP). The NEP aims to protect the local, state, and national interest in maintaining the ecological integrity of the important estuaries through long-term planning and management.

Important components of the NEP and APES are the consideration of water quality, fisheries resources, land and water habitats, and the interaction of humans with the natural resources of the estuarine system. The objective of the research end of the APES program was to look at this system as a whole and to consider all aspects of its ecological integrity. The APES program has adopted a basinwide approach to management in order to encompass all inputs to the estuarine system. As is apparent from Figure 1 page 4, the Commonwealth of Virginia is an important part of this system. Representatives from Virginia have therefore been involved in the development of the management plan and will continue to be included in the plan's implementation. Over the past six years, the APES program has generated research information and public awareness to support the development of this Comprehensive Conservation and Management Plan (CCMP). This plan is composed of recommendations for management strategies that address concerns in the APES region and protect the system's estuarine resources.

The CCMP is the product of a collaborative, consensus-building effort involving numerous federal, state, and local agencies, interest groups, organizations, and individuals. In the effort to develop a CCMP, APES has been guided by a Management Conference, composed of 95 members who are divided into four committees: a Policy Committee, a Technical Committee, an Albemarle Citizens Advisory Committee, and a Pamlico Citizens Advisory Committee. The members of these committees represent government agencies, university researchers, and the public. Public members represent a variety of interests: environmental groups, agriculture, forestry, developers, industry, fishermen, and local elected officials--including representatives from Virginia. The committees are responsible for identifying problems in the estuarine system, generating research where gaps in knowledge existed, increasing public awareness of environmental issues, and finding solutions to address those issues. As a result of these efforts, more is known about the Albemarle-Pamlico estuary than ever before.

The Management Conference has determined the most pressing resource protection issues in the Albemarle-Pamlico system and the most effective strategies to address them. While some recommended management actions reflect the consensus of the numerous interests involved in the development process, other management actions reflect compromises. The recommended actions presented herein are believed to be the most effective, the most feasible, and the most urgent actions necessary to protect the health of the Albemarle-Pamlico estuarine system.

APES has supported research where there are gaps in scientific knowledge. For example, scientists are now aware of a "phantom algae" that has been responsible for at least 25 percent of the fish kills in the Pamlico and Neuse rivers over the past two years. Life supporting sea grasses have been identified and mapped so that these important habitats can be protected. Also, a new computerized mapping system has been developed to help local governments quickly assess the environmental impact of proposed projects.

APES has funded demonstration projects which illustrate new methods of protecting marshes, aquatic habitats, and private property from erosion; control systems that protect rivers and streams from stormwater runoff; composting techniques that turn waste from agriculture and crab processing into fertile soil; and new fishing gear that reduces the unintended capture of non-targeted species. Other projects include opening historic spawning areas for shad and herring that had been blocked by dams and roads and replenishing scallop beds that were decimated by the 1987 Red Tide.

STRUCTURE OF THE TECHNICAL DOCUMENT

The CCMP contains general management plans to address regional concerns. They are as follows: the Water Quality Plan, Vital Habitats Plan, Fisheries Plan, Stewardship Plan, and Implementation Plan. Each plan begins with a goal statement, intended to outline the purpose of the plan itself. Underneath the goal, one will find the subheading "Objective." Objectives list the purposes of recommended actions. A general description of how each objective is to be addressed follows under the subheading "strategy." Strategies also may describe existing programs and illustrate how they may be integrated with newer recommendations. "Management Actions" are listed below each strategy. They describe what general action state agencies would take to achieve the broader objectives of the plan. The implementation of each management action is explained with "Critical Steps." The critical steps specifically state which measures would need to be taken to implement a management action. The potential economic costs and considerations of management actions are also described here.

The recommendations contained in the CCMP may require redirecting existing authorities or funding sources of state and federal agencies. The document includes discussion of funding strategies for how agencies could meet the costs of the recommended management actions. As part of the CCMP development process, a Financial Planning Committee met to discuss funding options. Although the document currently relies primarily on existing authorities or expansions of current budgets to fund recommendations, options such as those discussed by this Financial Planning Committee should be considered during the implementation phase. Some of these strategies involve innovative approaches to generating revenue and may require establishment of new programs. The most highly recommended funding options were the creation of local "Environmental Improvement Funds;" the institution of saltwater fishing licenses; the institution of a license to sell saltwater catches; and the institution of on-site sewage fees.

The first Appendix to the technical document contains summaries of the sub-regions of the Albemarle-Pamlico estuary. Sub-regions are characterized by their major river basins and sounds. The five sub-regions are as follows:

Chowan River Basin
Roanoke River Basin
Albemarle Sound - Currituck Sound - Pasquotank River Drainage Basin
Tar-Pamlico River - Pamlico Sound Drainage Basin
Neuse River - Core Sound - Bogue Sound Drainage Basin.

Each sub-region summary will describe specific local concerns and how they will be addressed by the CCMP. Additional appendices to the technical document contain the following information: 1) A review of public comments during the development of the CCMP; 2) a glossary and list of acronyms; 3) an administrative cost evaluation matrix; 4) a description of agricultural best management practices under the cost share program; 5) a complete list of APES committee members; 6) a list of APES publications; and 7) a review of National Estuary Program CCMP content and approval requirements.

WATER QUALITY PLAN

GOAL

Restore, maintain or enhance water quality in the Albemarle-Pamlico region so that it is fit for fish, wildlife and recreation.

OBJECTIVE A: IMPLEMENT A COMPREHENSIVE BASINWIDE APPROACH TO WATER QUALITY MANAGEMENT.

Strategy: Effective management of water resources ultimately relies on the consideration of system-wide processes and the cumulative impacts of activities across a river basin. To this end, the Division of Environmental Management (DEM) is approaching water quality research, management, and discharge permitting from a basinwide scale. This approach allows for a balancing of point and nonpoint source contributions and control strategies. The goal of the Department of Environment, Health, and Natural Resources (DEHNR) is to protect the basin's surface waters while accommodating reasonable growth and development. Using this framework requires the availability of river basin models. Several agencies are working to develop models that can be used to demonstrate how all these factors affect water quality. The Water Quality Section of DEM has recently initiated a basinwide approach to water quality management. The Neuse River Basinwide Management Plan is the first of a series of basinwide plans that will be prepared by DEM for all seventeen of the state's major river basins over the next five years. Table 2 represents the basinwide permitting schedule for the river basins located in the APES region, denoting when discharge permit issuance begins in each basin. The basinwide approach to water management considers the assimilative capacity of a river basin as well as the relationship between wetlands and water bodies.

BASIN	MONTH/YEAR
Neuse	April 1993
Tar Pamlico	January 1995
Roanoke	January 1997
White Oak * (Core/Bogue Sounds)	June 1997
Chowan	January 1998
Pasquotank	January 1998
Neuse (2nd Cycle)	April 1998

* The APES study area includes portions of the White Oak River drainage basin, including Core and Bogue Sounds. See Appendix A, Regional Summaries of Bogue and Core Sounds for more information.

Table 2 Basinwide Permitting Schedule for River Basins of the APES Region

Figure 15 demonstrates the differential contribution of point and nonpoint sources to impaired waters in each basin. Water quality modeling at the basin and sub-basin scale enhances the ability to establish realistic pollutant loading estimates for development of proper management strategies and will eventually assist in the prediction of impacts to water quality and flows from land use alterations including wetland loss and restorations.

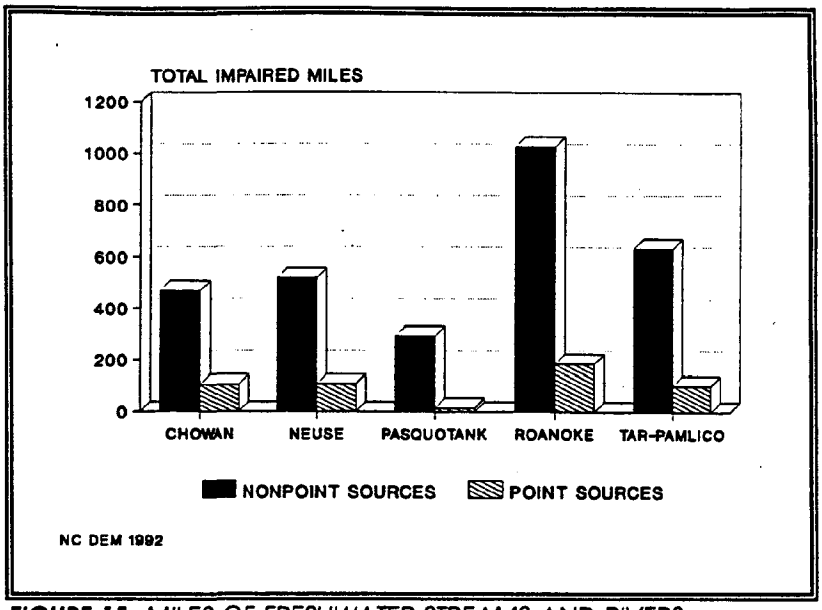

FIGURE 15 *MILES OF FRESHWATER STREAMS AND RIVERS IMPAIRED BY POINT AND NONPOINT SOURCES FOR EACH RIVER BASIN IN THE APES REGION*

Management Action 1: Develop and begin implementing basinwide plans to protect and restore water quality in each basin according to the schedule established by the Division of Environmental Management's Water Quality Section. The plans would include provisions for basinwide wetland protection and restoration.

Explanation: *Basinwide plans are comprehensive, targeted strategies for managing water quality. They assess the cumulative impact of individual projects on water quality within a basin. They can identify and manage pollutants in a way that protects water quality while accommodating economic growth. Basinwide protection and restoration also can help assess and preserve wetlands functions.*

Critical Steps:

1. The Division of Environmental Management (DEM) will continue to utilize the combined expertise of state and federal staff (U.S. Environmental Protection Agency-EPA, U.S. Geological Survey-USGS, National Oceanic and Atmospheric Association-NOAA, U.S. Fish and Wildlife Service-USFWS, Division of Marine Fisheries- DMF, and Division of Coastal Management-DCM) to develop comprehensive basinwide plans that will provide mechanisms to characterize water quality and biological resources within basins, target problematic watersheds, and manage water resources to support long-term growth.

2. With input from the Regional Councils (see Implementation Plan), DEM will continue to establish total maximum daily loads (TMDLs) for each targeted watershed, synchronize the National Pollution Discharge Elimination System (NPDES) permitting process, and include nonpoint source controls in each basinwide plan.

3. DEM with the assistance of other state and federal agencies (U.S. Army Corps of Engineers-USACE, DMF, DCM, EPA, and USFWS), would refine a wetlands evaluation system to better classify wetlands function on a basinwide scale.

4. The basinwide plans should include information (maps and graphics) that promotes an understanding of the importance of wetland types to overall water management.

5. DEM will use agricultural cost share and other non-regulatory programs to increase the restoration of degraded wetlands. The Division will incorporate effective best management practices such as the Forested Wetlands BMP document (Division of Forest Resources-DFR) into wetland management programs.

6. DEM would consider the efforts by DCM in wetlands identification and evaluation on a county level basis (See Vital Habitats Plan, Objective C, Management Action 3).

7. DEM would include the delineated wetlands information (maps and graphics) in basinwide plans that promotes an understanding of the importance of wetland types to overall water quality management.

Evaluation Methods

1. DEM will track the completion of each critical step. The Division currently plans to review basinwide plans and management strategies every five years following implementation. At that time modifications and additions will be made as necessary in the plans to provide continued water quality improvement and maintenance.
2. The basinwide comprehensive baseline data set characterizing the water quality and biological resources would be used to evaluate the success of management strategies. Limited degradation of the water quality and improvements in degraded waters would indicate successful management practices.

Costs and Economic Considerations

Program costs of this action are estimated at $50,000 per year to fund an environmental planner with skills in modeling to work in DEM. This management action would result in an increase in water quality improvements achieved per dollar spent on the planning, administration, implementation, and monitoring of water quality programs. Improved coordination of activities to protect and restore water quality within each basin would allow geographical targeting of resources spent on environmental protection and identification of the most cost-effective control strategies, which in turn would result in cost savings to the public and private sectors. The development of a system for evaluating the impact of wetlands alterations on basinwide hydrology and water quality would allow those who administer wetlands permitting programs to consider the basinwide and cumulative impacts of permitting decisions. In addition, it would help decision makers to focus regulatory and mitigation efforts on those wetlands most important for water quality, and to channel and concentrate mitigation and protection efforts to areas where the need is greatest. By incorporating wetlands impacts into basinwide planning, government agencies, private firms, and individual landowners can better tell where development will be most compatible with protecting water and wetland resources. This reduction in uncertainty should lower the overall costs of the permitting process over time for both the public and private sector. Other benefits of deliberate, coordinated, and scientifically based wetlands management on a basinwide scale could include avoided, reduced, or postponed expenditures on flood control structures and waste treatment facilities. Planning allows local governments to assess the physical capacity of land in their jurisdiction and to plan ahead for the highest quality growth possible within the constraints of the natural resource base. At a regional level, planning maximizes the effectiveness of efforts to identify and protect habitats vital to wildlife, rare species, rare natural communities, and fisheries (see the Vital Habitat Section). Finally, this

approach would help local governments and landowners understand how land use decisions made elsewhere in their river basin affect the values of their land. For instance, a number of wetlands alterations which individually do not have a critical impact on water quality could cumulatively increase the intensity or periodicity of flooding for a downstream landowner or community. Understanding and measuring these effects is critical to sound basinwide management and to reducing future conflicts over land use.

Funding Strategy

An environmental planner with modeling skills would require a $50,000 appropriation by the General Assembly.

Management Action 2: Establish total maximum daily loads (TMDLs) and associated control strategies for all impaired streams in the Albemarle-Pamlico region by 1999.

Explanation: *Total maximum daily loads estimate the amount of pollution that can safely enter a body of water. To determine limits to these daily loads, current and projected levels of pollution must be considered in relation to what the system can absorb. Proper use of TMDLs will allow development of management strategies to ensure long-term sustainable growth that does not harm the state's water resources.*

Critical Steps:

1. The Division of Environmental Management (DEM) will continue to establish total maximum daily loads (TMDLs) for targeted watersheds within a basin to be used in the development of water quality management plans. DEM will continue to evaluate physical, chemical, and biological parameters basinwide and amend management strategies as necessary to ensure limited degradation of water resources.

2. Using total maximum daily loads (TMDLs) as guidelines, and input from the Regional Councils (see Implementation Plan), the Division will target critical point and nonpoint source inputs for priority management efforts.

Evaluation Methods

1. Continued basinwide monitoring of water quality parameters will be used to assess ecosystem integrity within each river basin and determine if established TMDLs are effective in preventing degradation of water resources and improving impaired systems.
2. The success of this management action can be determined by documented improvements in water quality.

Costs and Economic Considerations

Under the Clean Water Act, the state is required to establish TMDLs to determine the total pollutant loadings that a degraded water body can assimilate while still maintaining its water quality classification and standards. DEM will require two modelers to establish TMDLs for the Albemarle-Pamlico region. An estimated $100,000 per year is needed to fund these positions. TMDLs are used as a tool in developing point source control strategies and targeting areas for nonpoint source management. When new permit levels are set, point source dischargers may have to pay increased costs of secondary treatment to comply with these new limits, and additional costs may be incurred by the private and public sector to reduce nonpoint source pollution. While TMDLs may require increased investments in pollution control, they can also facilitate cost savings by allowing DEM and the Division of Soil and Water Conservation (DSWC) to focus efforts and resources on geographically targeted areas of concern. This can help minimize governmental expenditures and better utilize taxpayers' dollars, while at the same time increasing environmental benefits per dollar spent on point and nonpoint source controls.

Funding Strategy

Two modelers to develop TMDLs for each river basin in the APES region would require a $100,000 appropriation from the General Assembly.

Management Action 3: Renew all discharge permits in a river basin simultaneously by 1999.

Explanation: *Renewing permits simultaneously allows the Division of Environmental Management (DEM) to consider the total impact from all dischargers when determining how much pollution each may release into the basin.*

Critical Steps:

1. DEM will place expiration dates on all permits within a basin that expire in the same year.

2. New or revised limits will be incorporated into permits, as appropriate, to meet safe wasteload allocations developed under the basinwide plans.

Evaluation Methods

1. DEM will cross-reference on a yearly basis the permit expiration date for each discharger with its basin location and the basinwide schedule to ensure synchronous renewal.
2. The success of this management action can be determined by decreases in permit processing backlogs.

Costs and Economic Considerations

In the past, permits have been reissued randomly as they came up for renewal. Synchronous renewal of NPDES permits is now a major part of the basinwide initiative through the DEM. In 1990, to allow for better water quality management, the Water Quality Section of DEM began implementing a basinwide NPDES permitting schedule. In 1993, the Neuse River Basin became the first basin where all discharge permits expire and are renewed in the same year. DEM's schedule will allow for synchronous renewal of discharge permits for the other river basins in the Albemarle-Pamlico region and across the state. Permits will be reviewed and reissued at 5 year intervals. This is a cost effective measure of reducing

administrative costs and averting some potential environmental costs. Synchronous renewal will facilitate data gathering for water quality and wasteload modelling, TMDL development, and basin plan development. It allows the Water Quality Section to allocate staff and resources more efficiently.

Funding Strategy
No increased funding is necessary to continue this initiative.

Management Action 4: Consider the potential for long-term growth and its impacts when determining how a basin's assimilative capacity will be used.

Explanation: *Assimilative capacity is the ability of a river basin to safely absorb pollutants. Basinwide planning should ensure that this capacity is used in a way that sustains long-term growth. However, planning for long-term growth also must consider how secondary impacts such as runoff from new roads will affect water quality.*

Critical Steps

1. The Division of Environmental Management (DEM), based on best available data, will establish a cap on wasteload allocations to point and nonpoint sources.

2. The Division will review existing permits to determine how much of the utilizable capacity has been distributed.

3. The Division will not issue a permit if it is determined that a discharge will result in loss of any existing use or result in violations of established water quality standards in receiving waters. DEM will consult with the Division of Coastal Management (DCM) during the permitting process to ensure all state resources are conserved and secondary impacts are considered.

Evaluation Method
The success of this action can be determined by documented improvements in water quality and continued environmentally sound economic growth in each of the basins.

Costs and Economic Considerations
No new governmental costs are expected to be associated with this action. However, if managing assimilative capacity involves setting new permit levels, then dischargers may have to pay increased costs of advanced treatment to comply with these new limits. The remaining assimilative capacity of water bodies could be increased by reducing the amount of allocated discharge as well as the pursuit and utilization of technology to improve secondary treatment. This would protect water bodies from unforeseen cumulative impacts and would establish a margin of safety.

Funding Strategy
No funding increases are required for this management action.

Management Action 5: Improve the scientific models for understanding the estuarine system, the effects of human activities on the system and the viability of alternative management strategies.

Explanation: *Scientists use models to understand how systems work. Models for the Albemarle-Pamlico's river basins have been developed, but further refinement and calibration are needed to determine how much pollution can be safely released into the estuary (i.e., total maximum daily loads). This would allow regulators to focus on the most critical sources of pollution, thereby reducing the cost of regulation, monitoring and enforcement. Increased knowledge gained from models will help planners manage water resources to allow for future growth.*

Critical Steps

1. A work group would be assembled to coordinate current and future hydrologic and water quality modeling by responsible agencies, including the Division of Environmental Management (DEM), Division of Water Resources (DWR), U.S. Geological Survey, U.S. Army Corps of Engineers, U.S. Soil Conservation Service, Water Resources Research Institute, and the state university system. This group would choose specific models for each basin system. The models would consider terrestrial and airborne nutrient loadings; surface and ground water cycling; toxicant loadings, fate and transport; cumulative effects of loadings of different constituents on water quality and biotic health; functions of wetlands on a landscape level; the impact of drainage and other hydro-modifications; and the cumulative impacts of marina siting. The work group also would identify additional research that improves and integrates current area-wide databases, such as tracking hydrologic modifications, stream channelization, ditching, and subsurface and/or control systems.

2. The work group would determine which agencies will conduct monitoring and modeling efforts for each basin. The responsible agencies then would request sufficient funding to accomplish the work. DEM would be the lead agency in coordinating the modeling effort. All modeling would be accomplished in five years.

3. Water quality and hydrodynamic models would then be used to make permitting decisions (such as point source discharges, dredge and fill of wetlands, channelization projects, and dams) to target nonpoint source control efforts and to support long-term comprehensive planning.

Evaluation Method

Agencies would report annually on their progress toward completing the models. Once these models have been incorporated into the basinwide plans, their success will be evaluated in accordance with DEM's basinwide schedule.

Costs and Economic Considerations

Average cost for this action is estimated at $400,000 per year for five years to refine and develop hydrodynamic and water quality models for the A-P region. A model that has already been developed for the Tar-Pamlico Basin will be refined and adapted as needed for use in the other river basins of the A-P region. The additional cost for each basin is expected to be considerably less than the cost of developing the original model. Improved

information on the effect of specific loadings, cumulative impacts, surface and ground water cycling, wetland functions, and the impacts of drainage and other hydromodifications would allow policy makers to set appropriate discharge limits and to target policy and implementation efforts at the most damaging discharges and loadings. This could reduce the cost of regulation, monitoring, enforcement, and compliance while at the same time reducing the most harmful loadings.

Funding Strategy

Money to develop scientific models for four river basins in the APES area would be acquired from USGS Cooperative Funds. This program provides 100% matching funds and would be available to DEM upon receipt of an expansion budget item from the General Assembly. Another possibility for funding would be through federal Grants applications.

Management Action 6: Continue long-term, comprehensive monitoring of water quality in the APES system, collecting data to assess general system health and target regional problems.

Explanation: *On a system-wide basis, water quality monitoring allows managers to assess the effectiveness of management strategies. In addition, monitoring data may be used to develop scientific models or other methods of evaluating water quality on a smaller scale. Continued monitoring also would assess long-term trends.*

Critical Steps

1. The Division of Environmental Management (DEM) and the U.S. Geological Survey (USGS) would continue monitoring water quality through the network of fixed stations throughout the system. This would help assess general and long-term trends and identify possible problems. At these stations, DEM collects grab samples and the USGS monitors continuously.

2. The EPA Environmental Monitoring and Assessment Program and the APES Citizens Water Quality Monitoring Network would collect grab samples to supplement data collected by USGS and DEM.

3. DEM's basinwide planning initiative, along with USGS' National Water Quality Assessment Program, would make area-intensive assessments of water quality on a rotating basis. Data collected through these assessments would be used to revise management strategies in specific basins.

4. DEM, USGS, the Citizen Water Quality Monitoring Network (CWQMN), and other appropriate agencies and organizations would collect water quality data as needed in response to possible concerns. This data would identify immediate problems, guide corrective management strategies, and measure the effectiveness of those strategies.

5. Water quality data collected through the fixed station network would be expanded to include biological monitoring in estuarine waters and pesticide monitoring. Area intensive assessments would be used to characterize water quality inputs during high flow periods when loadings are greatest to target regional problems and to evaluate the effects of management actions.

Evaluation Method

DEM and USGS would annually review station locations in the monitoring network and change them as necessary to give a representative picture of system health.

Costs and Economic Considerations

In addition to currently funded monitoring programs, annual costs to DEM would be $50,000 for an environmental field technician to perform water quality sampling and $100,000 to maintain the ambient water monitoring network in the APES region. The implementation of this management action is critical to the successful implementation of several other elements of the CCMP and to the protection of water quality in the APES region. Water quality monitoring allows agencies to assess the effectiveness of pollution control programs, land and water use planning, and other resource management programs.

Funding Strategy

Money to fund the expanded ambient water quality network in the APES area would be acquired from USGS Cooperative Funds. This program provides 100% matching funds and would be available to DEM upon receipt of an expansion budget item from the General Assembly. The environmental field technician position would require a $50,000 appropriation from the General Assembly.

OBJECTIVE B: REDUCE SEDIMENTS, NUTRIENTS AND TOXICANTS FROM NONPOINT SOURCES.

Strategy: Nonpoint sources of pollution are varied and are usually difficult to regulate. Targeted reductions can be accomplished by building on present programs and efforts. A three-pronged approach consisting of research and demonstration projects, incentive-based programs, and regulatory action and enforcement is necessary to accomplish true reductions. As part of the basinwide management plan, a nonpoint source pollution control plan would be developed for each river basin to address all sources of nonpoint source pollution. By characterizing individual basins, this plan would create management strategies that identify problem areas and implement control measures necessary to reduce nonpoint source pollution. Figure 16 demonstrates the amount of freshwater miles from each river basin impaired due to nonpoint sources. Research and demonstration of on-site control methods for nonpoint sources, often referred to as best management practices, provide increased opportunities for the reduction of nonpoint source loadings. Incentive programs, such as cost share programs, would be used whenever possible to control existing sources of pollution. Regulatory enforcement action would be used as a tool whenever water quality violations occur or when established minimum criteria are not met in spite of available cost share assistance. Therefore, the nonpoint source pollution enforcement program within the Division of Environmental Management (DEM) would be strengthened. Other efforts to reduce basinwide nonpoint

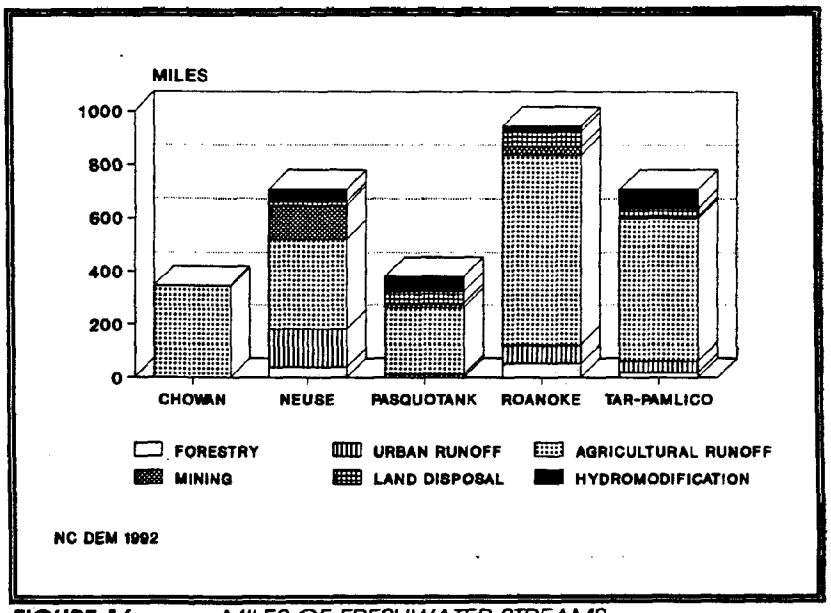

FIGURE 16 *MILES OF FRESHWATER STREAMS AND RIVERS IMPAIRED FROM NONPOINT SOURCES FOR EACH BASIN IN THE APES REGION*

sources of pollution would include changes in the management of marinas, stormwater runoff, wastewater treatment, and forestry practices. Additionally, the development and implementation of nonpoint source control plans on a basinwide level will support future initiatives required by Section 6217 of the Coastal Zone Act Reauthorization Amendments of 1990.

Management Action 1: For each river basin, develop and implement a plan to control nonpoint source pollution as part of the basinwide management plans.

Explanation: *Plans would address all nonpoint sources of pollution in each basin, targeting the most critical areas for controls. These plans would identify the nonpoint source pollution problems specific to each basin. Implementation would vary according to each basin's needs. Plans also would include strategies to control nonpoint source pollution in accordance with the total maximum daily loads (TMDLs) established for each basin. Possible measures include targeted funds for implementation of BMPs, buffer strips along waterways, and continued use of BMPs for highway construction.*

Critical Steps

1. The Department of Environment, Health, and Natural Resources (DEHNR), in cooperation with state and federal agencies, the Regional Councils, universities, and other members of the public and private sector, will develop a comprehensive nonpoint source control plan specific to each river basin.

2. These basinwide plans will develop methods of controlling pollution from land-disturbing activities, such as agriculture, forestry, and construction and other types of potential pollution sources, such as urban runoff and on-site wastewater disposal.

3. Highly degraded areas would be targeted for immediate nonpoint source pollution controls, while the entire river basin would be monitored by comprehensive measures. The plans will consider all control options including new regulations, incentive programs, and locally implemented programs as necessary.

4. A central database compiling all available information about each river basin would be established to better characterize the nonpoint source pollution parameters on a basinwide scale. This data would be highlighted through the use of Geographic Information Systems (GIS) capabilities.

Evaluation Method

Lead nonpoint source pollution control agencies, as identified in the Nonpoint Source Management Program (319 Report), would report on an annual basis the number of controls applied, the amount of acres treated, and provide a map of the areas treated. New controls applied to reduce nonpoint source pollution should be monitored to evaluate their effectiveness. Total load reductions for sediment and nutrients would be calculated based on performance expectations and actual data for each basin. This data could be used to compare data generated previous to the newly implemented controls. The success of this management action would be determined by documented improvements in water quality.

Costs and Economic Considerations

A basinwide nonpoint source control plan would function as part of an integrated point and nonpoint source control and management plan for each basin. A comprehensive plan for each basin utilizing incentive and regulatory based programs should help to lower the costs and increase the effectiveness of resources spent on reducing nonpoint source pollution. Planning would allow incentives for implementation of BMPs in geographically specific areas important for the protection of water quality in each basin. In addition, it would focus resources on ensuring that measures are taken to control and reduce nonpoint source pollution in areas of the river basin where water quality is at greatest risk.

Funding Strategy

Any additional costs of this management action are addressed under previous management actions.

Management Action 2: Expand funding to implement nonpoint source pollution controls, particularly agricultural best management practices through the N.C. Agriculture Cost Share Program, and also to develop a broader Water Quality Cost Share Program. Expand the cost share programs to include wetlands restoration. Increase cost share funds to problem areas.

Explanation: *Economic incentives and technical assistance have been effective in promoting nonpoint source pollution controls in agriculture. Under this initiative, the Agriculture Cost Share Program would expand and a new Water Quality Cost Share Program, modeled after the one for agriculture, would be created. Cost-sharing would give farmers, marina owners, forestry operations and individual land owners greater incentive to reduce nonpoint source pollution.*

Critical Steps

1. The General Assembly would be asked to increase appropriations to the Division of Soil and Water Conservation (DSWC) for the existing Agriculture Cost Share Program in the 1994 session. Funding is necessary for technical assistance and installation of best management practices. A list of best management practices eligible for the Agriculture Cost Share Program and a description of practices as outlined in a detailed implementation plan for nonpoint source pollution control is presented in Appendix E.

2. DSWC would pursue avenues to target the increased funding and technical assistance to priority areas identified through the basinwide nonpoint source control plans.

3. The General Assembly would be asked to authorize and appropriate funding for a new Water Quality Cost Share Program in the 1995

session. Funding is necessary for technical assistance, administration, public outreach, and installation of best management practices.

4. The Water Quality Cost Share Program will be set up in DEHNR and administered by a division selected by the Department. Upon receipt of authorization and funding, DEHNR would hire technical and outreach staff to implement the programs. Technical assistance staff would be located in offices throughout the APES region.

5. Using technical experts from the Department as well as from other agencies and from private industry, DEHNR will develop a manual of acceptable controls for the land uses managed under the Water Quality Cost Share Program. The Department will include effective best management practices that will protect wetlands. Information, such as the Forested Wetlands BMP document from the Division of Forest Resources (DFR), will be revised, updated, and incorporated.

6. DEHNR would target the most cost-effective controls on a case by case basis to achieve desired reductions of nonpoint source pollution in critical areas identified by the basinwide nonpoint source control plans based on water quality standards.

7. Using the existing Agriculture Cost Share Program as a model, land owners would share in the cost of nonpoint source controls at a rate of 25 percent of the total cost of the controls on their property. The program would supply the other 75 percent. Technical assistance is provided through funding from local districts with matching funds from the state.

Evaluation Methods

1. Report on an annual basis the number of controls applied, the amount of acres treated, and map the areas treated.
2. Conduct demonstration site monitoring to evaluate the effectiveness of each type of practice.
3. Calculate the total load reductions for sediment and nutrients based on performance expectations and actual data for each basin.
4. Regulatory enforcement action would be used as a tool whenever water quality violations and rule infractions occur in spite of available cost share assistance.

Costs and Economic Considerations

A total of $5,000,000 per year would be needed to implement this action. The Agriculture Cost Share program for the APES region requires an

additional estimated $2.5 million in fiscal year 1994-95 to hire additional technical outreach personnel and provide ample support for BMPs. Funding needs for the broader Water Quality Cost Share Program are estimated at $2.5 million per year. For each of the programs, $500,000 would be used to fund administration and technical assistance, $2 million would be used to fund on-the-ground practices. The agricultural cost share program offers farmers not only strong economic incentives to implement BMPs (the program will pay 75 percent of implementation costs), but technical assistance to help them determine the most appropriate BMPs for each farming operation. In addition, technical assistance personnel who are familiar with local conditions would be located in each district office. These factors help control the cost of reducing nonpoint source pollution from agricultural operations. As is the case in the agricultural BMP program, BMP implementation through the broader Water Quality Cost Share Program is intended to improve water quality on the landowner's property as well as in adjacent areas and downstream. In the same way the agricultural program aims to improve the efficiency of farm operations, the same would be true for homeowners and foresters. For example, upgrading obsolete and non-compliant septic systems would also improve the efficiency of the homeowner's septic system. Controlling soil erosion can save topsoil and increase the productivity of forester's soil. If pesticide use is reduced, pesticide costs for urban and suburban homeowners, as well as foresters, may be lowered. In addition to the above benefits, urban and suburban homeowners could benefit from an increase in land value due to upgrading obsolete and non-compliant septic systems. Private foresters may benefit from an increase in land value through the use of BMP's which decrease erosion. BMPs that reduce erosion of construction site areas and of forestry logging and replanting sites could reduce turbidity caused by sediment loadings, and thus benefit fish and other aquatic life who are harmed by it. Reduction of water pollution from suburban and urban nonpoint sources, which would lower bacteria and pathogen inputs, can lessen the threat of groundwater and drinking water contamination and algal blooms which result in fish kills and diseases thereby reducing the risk of harm to shellfish, finfish and human health.

Funding Strategy

The expansion of the Agriculture Cost Share Program in the APES region would require a $2.5 million increase to the present program by the General Assembly. Other potential funding sources would include the USDA Agriculture Conservation Program to restore wetlands. Additional funding may be obtained from the Tar-Pamlico Basin Association. The development of a Water Quality Cost Share Program would require an additional $2.5 million appropriation from the General Assembly.

Management Action 3: Continue to research and develop alternative septic systems and new best management practices to reduce nonpoint source pollution.

Explanation: *Alternative septic systems will help protect the environment and support long-term growth by providing effective waste treatment for eastern North Carolina. BMPs improve septic system performance and reduce costly repairs. Developing and demonstrating additional BMPs for other sources of pollution, such as runoff from agricultural lands, urban lands, and highways, would provide proactive, cost-effective means to reduce nonpoint source pollution.*

Critical Steps

1. The General Assembly would be asked to consider requests by the Division of Environmental Health (DEH) to establish a research center in the coastal plain of North Carolina. This would facilitate efforts by the On-site Wastewater Section to develop and demonstrate alternative septic systems for porous soils of this region.

2. Demonstration projects would be set up in counties within the Albemarle-Pamlico region. These projects would determine the effectiveness of alternative systems under a variety of site and soil conditions. The demonstration projects would be modelled after successful demonstration projects that already exist in Chatham and Craven counties.

3. The demonstration projects would include outreach components to educate the public about alternative systems. These efforts would emphasize the importance of maintenance for effective system operation.

4. The Division of Soil and Water Conservation (DSWC), would meet with the Cooperative Extension Service, North Carolina State University, Division of Water Resources (DWR), and others to determine priority research initiatives and to aid in securing funding to research the effects of best management practices on groundwater.

5. The federal Agricultural Research Service, North Carolina State University Agricultural Research Service, DSWC, Department of Agriculture (DA), Cooperative Extension Service, and farm organizations would provide information on, and help to develop, agricultural and non-agricultural BMPs to reduce nonpoint source pollution caused by the leaching of nitrates, salts, and pesticides. Agricultural BMPs that can help reduce this pollution include: controlling the rate, method, and timing of manure, fertilizer, and pesticide applications; scheduling irrigation to minimize water use and excessive leaching, which also may reduce runoff if infiltration capacity is not exceeded; and tilling conservatively for runoff and erosion control.

6. The Groundwater Section and Wellhead Protection Program of the Division of Environmental Management (DEM) would work with other relevant agencies and local governments to develop non-agricultural BMPs. Non-agricultural BMPs that can help to reduce groundwater pollution include improved siting, installation, and maintenance of septic systems. In addition, minimum lot size requirements reduce the risk of drinking water contamination by preventing the concentration of wastewater and sewage treatment near water supplies. Non-agricultural BMPs to protect surface water and groundwater resources also include the adequate management and maintenance of stormwater structures.

7. Stream-side buffer strips would be promoted for both agricultural and non-agricultural land use practices to help minimize groundwater and surface water pollution. The transport of discharging waters through these buffer areas reduces nitrates, other nutrients, and sediments before they enter the surface waters.

8. The Environmental Management Commission (EMC), Wildlife Resources Commission (WRC), Coastal Resources Commission (CRC), Division of Forest Resources (DFR), Soil and Water Conservation Commission (SWCC), US Fish and Wildlife Service, and US Soil Conservation Service will form a task force to develop technical specifications for stream-side buffer strips. These specifications will include buffer width and type of vegetation to be used while incorporating ecological function

as a primary design criterion. These specifications should also consider the amount and type of land disturbance allowed within the buffer zone.

9. The task force will use Geographic Information Systems (GIS) technology to analyze the current extent of stream-side buffers in critical sub-basins. This information would be used to target those areas that lack buffer strips for outreach and technical assistance.

Evaluation Methods

1. Research would be evaluated to determine whether the alternative septic systems are effective in the soils of the Piedmont and in those soils of the coastal plain that are not suitable for conventional septic systems.
2. The costs of the alternative systems would be compared to the costs of conventional systems to determine whether the systems are price competitive.
3. Groundwater and well water would be monitored and tested for pollutants before, during and after experimental best management practices were implemented.
4. Data collected on water quality and hydrologic research will be analyzed to determine the effectiveness of the best management practices in pollutant removal. The results will be provided to the public through technical assistance and education on the proper usage of best management practices.

Costs and Economic Considerations

It is anticipated that $350,000 per year for five years will be needed to fund a research center for DEH in the coastal region of North Carolina. A portion of this total may be used to fund research on the development of alternative septic systems. BMPs such as improved siting, installation, and maintenance of septic systems, and proper construction, operation, and maintenance of stormwater structures offer ground and surface water protection as well as cost savings. These preventative BMPs not only improve the performance of septic systems and stormwater structures, they also are less costly than repairing or replacing systems and structures. Many agricultural BMPs have been effective in increasing productivity as well as reducing nonpoint source pollution. For example, agricultural BMPs such as erosion control techniques that can retain fertile topsoil also help to maximize yield. Yield can also be improved by controlling the rate, method, and timing of fertilizer and pesticide application while reducing agricultural runoff. Demonstration of the effectiveness of best management

practices that offer ease of integration into existing practices and that provide economic or labor saving benefits can help to increase the understanding, acceptance, and use of these practices by local citizens.

Funding Strategy

To fund a research center and conduct research on alternative septic systems, a $350,000 appropriation would be needed from the General Assembly. An additional amount of money is necessary to research the effects of BMPs on groundwater. This funding would be sought as grant money opportunities become available.

Management Action 4: Strengthen current enforcement to detect and correct ground and surface water quality violations from nonpoint sources.

Explanation: *Although current enforcement authority exists, nonpoint sources of water quality violations are difficult to identify because they are varied and often widespread. The Division of Environmental Management's (DEM's) Water Quality and Groundwater Sections would strengthen enforcement to ensure that these violations are identified and corrected.*

Critical Steps

1. The General Assembly would be asked to authorize increased funding to DEM to hire three additional staff members for the Washington regional office.

2. The additional staff members would be responsible for addressing concerns related to nonpoint source pollution, including inspections and enforcement procedures.

3. The additional staff members would use the basinwide monitoring data to evaluate water quality violations and prioritize these violations according to severity.

4. The Division would respond with technical assistance and education initiatives to promote the use of best management practices by landowners.

5. Notice of Violations (NOVs) and assessments would be issued according to the severity and frequency of water quality standard violations.

6. Based on staff assessment of contaminated sites, DEM would recommend appropriate remedial action.

Evaluation Method

DEM would evaluate the number of exceedances of water quality standards to determine the effectiveness of best management practices and overall enforcement efforts. The success of this strategy can be measured by documented water quality improvement due to remediation and enforcement efforts.

Costs and Economic Considerations

Funding needs are estimated at $200,000 per year for staffing, administration, and implementation. This would include three additional staff members to be hired by DEM, as well as equipment and supplies. The staff would be stationed in the regional office in Washington, NC and provided with continuous monitoring equipment. Enforcing regulations would protect the public's drinking water and water resources from nonpoint source violations that otherwise could threaten human and environmental health, with associated health, environmental, and economic costs. Enforcement that begins by identifying nonpoint source pollution violations and is solution-oriented can help reduce future violations. By doing so, the future costs of enforcement and pollution are reduced.

Funding Strategy

To fund three additional staff members and operational support, a $200,000 appropriation would be required from the General Assembly.

Management Action 5: Strengthen implementation of forestry best management practices through training, education, technical assistance and enforcement.

Explanation: *Proper use of forestry best management practices is critical for water quality protection in the APES region. Additional professional foresters would provide needed outreach and technical assistance to forestry operators and landowners regarding implementation of BMPs. Enhanced enforcement would ensure proper use of forestry BMPs and help to eliminate improper forestry practices. Participation by loggers and landowners in education programs, such as the Professional Loggers Program, is vital to the expanding goals of the forest products industry. Forestry workshops create an opportunity for landowners to learn about forestry management and the use of acceptable forestry BMPs.*

Critical Steps

1. The General Assembly would be asked to authorize increased funding to the Division of Forest Resources (DFR) to hire five professional foresters, one for each district in the APES region, to provide outreach and technical assistance on forestry best management practices.

2. The General Assembly would be asked to authorize increased funding to the Division of Land Resources (DLR) to hire two additional staff members to enforce the requirements of the Sedimentation Pollution Control Act as it relates to forestry requirements.

3. DFR, the Forestry Association, and the Cooperative Forest Extension Service would continue to promote and conduct educational workshops, such as the Professional Loggers Program, to expand knowledge and

encourage industry to continue promoting activities that ensure environmentally sound forestry practices. The intention of these educational workshops is to "pull together" the broad interest of the forest products industry while expanding upon the necessity for compliance with forestry performance standards. Previous workshops have focused on sediment control, wetland issues, wildlife considerations, preharvest planning, and critical habitat protection.

Evaluation Method

To determine the rate of noncompliance, the DFR and the DLR would compile enforcement data through their inspection process to determine the number of sites penalized for not following best management practices or found in violation of the Sedimentation Pollution Control Act. A best management practice noncompliance rate would demonstrate the success of this action. The effectiveness of education workshops would also be reflected by this rate.

Costs and Economic Considerations

The DFR would require $250,000 to hire five professional foresters. The DLR would need $100,000 to hire two additional staff members for enforcement activities. Possible benefits may include more profitable logging operations if operators learn techniques that make their operations more economically efficient. As a result of best management practices being implemented, landowners may benefit from a decrease of soil loss and erosion on their property. The benefits to water quality from the implementation of forestry best management practices include decreased sediment pollution of estuarine waters as a result of BMP implementation, with a resulting decrease in damage to aquatic life, including ecologically, commercially, and recreationally valuable fish.

Funding Strategy

The hiring of additional staff members by DLR and DFR would require a $350,000 appropriation from the General Assembly.

Management Action 6: Enhance stormwater runoff control by strengthening existing regulations and developing new ones, if needed, by 1995. Improve enforcement to ensure that stormwater management systems are properly installed and regularly maintained.

Explanation: *At present, the North Carolina Stormwater Management Program targets priority areas and high risk pollutant sources. Additional benefits from this program may be realized by evaluating expansion of the areas of coverage to target more -- or potentially all -- waters. Under this initiative, various regulating agencies would coordinate their efforts to protect all state waters. The Division of Environmental Management (DEM) would dedicate more staff time to monitoring the installation, operation and maintenance of stormwater systems. A critical part of enforcement would be providing education and technical assistance to private land owners, industries, municipalities and others required to comply with these regulations.*

Critical Steps

1. DEM will evaluate current stormwater management rules for comprehensive coverage of all state waters and to ensure that all current stormwater programs are integrated.

2. The Division of Coastal Management (DCM) will evaluate current enforcement of its rules for Outstanding Resource Waters as they apply to stormwater management within the CAMA permitting process.

3. DEM will evaluate the effectiveness of management practices in protection of water quality in coastal areas.

4. DEM would hire more staff to monitor the construction, operation, and maintenance of stormwater control facilities. In addition, the state stormwater control program would dedicate more staff to education and technical assistance of private land owners, industries, municipalities, and regions required to comply with the state or federal stormwater control regulations, so that these parties understand the reasons for the regulations and how to improve maintenance.

Evaluation Method

The state would hold biannual meetings between the regulating agencies to discuss goals and strategies and to determine if the stormwater runoff program is being implemented properly. At this time, changes may be made as necessary to meet the goals of the program. Changes in water quality within significant water body classifications will be analyzed using trend analysis to determine whether pollutant loads have been reduced or water quality improved.

Costs and Economic Considerations

DEM would require $150,000 per year for three staff persons to evaluate current stormwater management rules; monitor coastal and inland stormwater control facilities to ensure proper construction, operation, and maintenance; and to provide outreach education and technical assistance to private landowners, industries, municipalities, and counties to ensure proper maintenance of stormwater management facilities. Improvement of stormwater management through education, technical assistance, monitoring, and certification could reduce loadings of sediment and toxicants from stormwater runoff from inland as well as coastal sources. This could provide more comprehensive water quality protection for estuarine and coastal waters, and would also benefit inland waters. Proper maintenance of stormwater systems such as wet detention ponds provides for continued flood control and retention of sediment and other pollutants associated with particulates that settle in the ponds.

Funding Strategy

The hiring of additional staff members by DEM would require a $150,000 appropriation from the General Assembly.

Management Action 7: Implement an inter-agency state policy that addresses marina siting and integrates best management practices through permitting and better public education.

Explanation: *There is no consensus on the cumulative impact of marinas on the estuary or on how to manage marina development. A state marinas policy would coordinate agencies concerned with regulating and planning for marinas. It would address such issues as public trust rights and siting, and would integrate new best management practices. New BMPs include designing marinas to contain oil spills and pollution, minimizing the impact of turbulence from boating outside marinas, and controlling pollution from fish wastes and boat cleansers. A marinas policy, along with the appropriate regulations, would be a guide for local government planning. Public education, particularly boater education, plays an integral role in encouraging best management practices.*

Critical Steps

1. The current permitting process allows for interagency coordination for the review of new marina permits; however, consensus between the agencies has not been achieved regarding the cumulative impacts of marinas on the coastal zone. Therefore, the Division of Coastal Management (DCM), Division of Environmental Management (DEM), Division of Marine Fisheries (DMF), and Division of Environmental Health's Shellfish Sanitation Branch (SSB) (forming a marina policy committee) would address cumulative impacts of marina siting by: a) defining potential impacts of marina development, b) assessing the impact of multiple marinas in terms of conflicting public trust issues, effects on water quality, nursery areas, degradation of habitat, coastal

erosion, and coastal land use planning, and c) defining the difference in impacts of existing marinas on the marine environment from the impacts of new marinas.

2. The marina policy committee would create a comprehensive state marina policy, outlining its goals, scope, and the role of each agency in its implementation.

3. The Coastal Resources Commission (CRC), Environmental Management Commission (EMC), and Marine Fisheries Commission (MFC) would expand current permit requirements or develop supporting regulations to meet the goals of the aforementioned policy.

4. To define a state marina policy, the marina policy committee would outline specific criteria for evaluating the implementation of policy goals.

5. In defining a comprehensive marinas policy, the staff of DCM, DEM, DMF, and SSB would require permits to include best management practices. Some best management practices which have not yet been addressed in permitting procedures include, for example: marina design to include oil spill and pollution containment; the impacts of turbulence from boating outside the marina; and control over pollutants such as boat sewage, fish wastes, and boat cleansers.

6. The comprehensive state marinas policy would promote additional programs to broaden public understanding of what individuals can do to assist in marina management (such as proper disposal of fish wastes, boat sewage disposal, or the use of safe cleansing agents). Current approaches for educating the public would be assessed in terms of its effectiveness and scope. DCM would continue this process by providing information on pump-out stations within marinas.

Evaluation Method

Information collected from the evaluation of permit compliance would be used to determine whether best management practices have been implemented, operated, and maintained properly at marinas. The marina policy committee would meet annually using pre-established evaluation criteria to assess the implementation of the program. Any changes in policy or management practices could be added at this time. Enforcement mechanisms may be discussed and assessed for their effectiveness.

Costs and Economic Considerations

No additional program costs for this coordinating action are anticipated. A comprehensive, interagency, statewide approach to marina siting and management can help reduce user conflicts, increase total economic benefits, and preserve and enhance the natural resources of the area for future production of goods and services. In addition, implementation of the marinas policy could serve to enhance the economic vitality of coastal, estuarine, river and lakeside areas of the state by contributing to the quality of the region's amenities, providing an attractive inducement for continued growth of tourism and water related recreation. Although marinas would incur some additional short-term costs to implement additional best management practices, most of these measures are preventative, and can actually reduce costs in the long-term. For example, design criteria for marina fueling stations protect the public and the environment from serious health risks and costs when they require that design allows for the containment of spills in a limited area.

Funding Strategy

Not applicable.

OBJECTIVE C: REDUCE POLLUTION FROM POINT SOURCES, SUCH AS WASTEWATER TREATMENT FACILITIES AND INDUSTRY.

Strategy: In addition to the reduction of point source impacts gained through the utilization of basinwide management planning (see Objective A), further gains can be made through the use of proactive management strategies such as pollution prevention and increased emphasis on facility inspections and monitoring. In general, focus would be placed on reducing waste at the source. Figure 17 shows all permitted point source dischargers in the APES region. Pollution Prevention Programs are an excellent means of achieving waste reductions and, in some cases, production cost reductions. The Department of Environment, Health, and Natural Resources' (DEHNR) Office of Waste Reduction's (OWR) Pollution Prevention Program provides multi-media waste reduction technical assistance to industries. The Division of Environmental Management's (DEM) Pretreatment Program works to protect municipal or publicly owned wastewater treatment works and their receiving waters from the detrimental impacts of industrial users. Locations of wastewater treatment systems in the region are illustrated in Figure 18. Better use of these programs would be instrumental in helping reduce inputs to all systems operating under regulatory water quality control. The Department's goal is to incorporate pollution prevention into all aspects of environmental protection programs. A 1991 grant

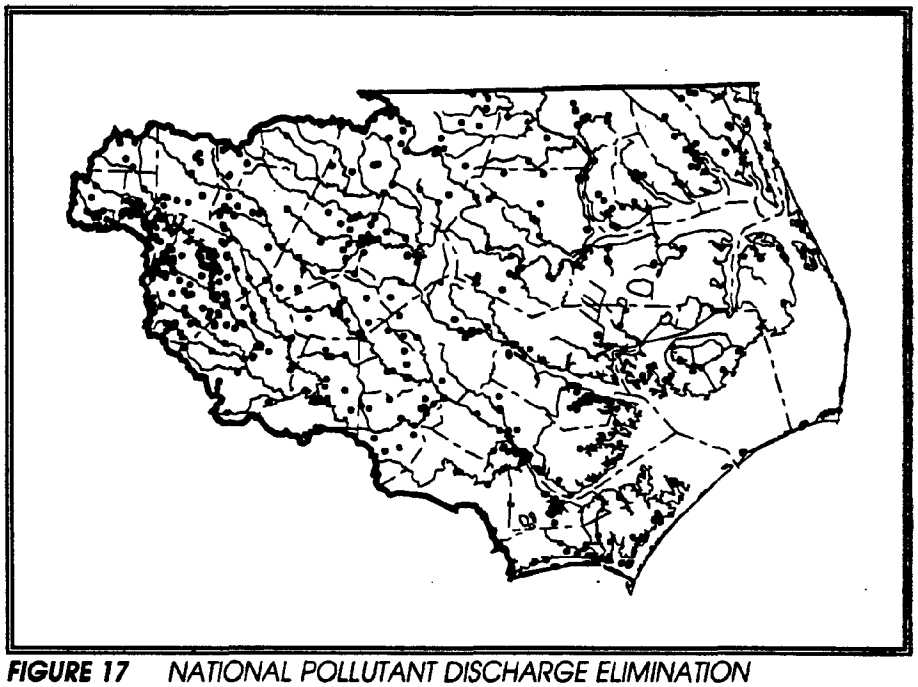

FIGURE 17 *NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEMS (NPDES) PERMIT LOCATIONS IN THE APES REGION*

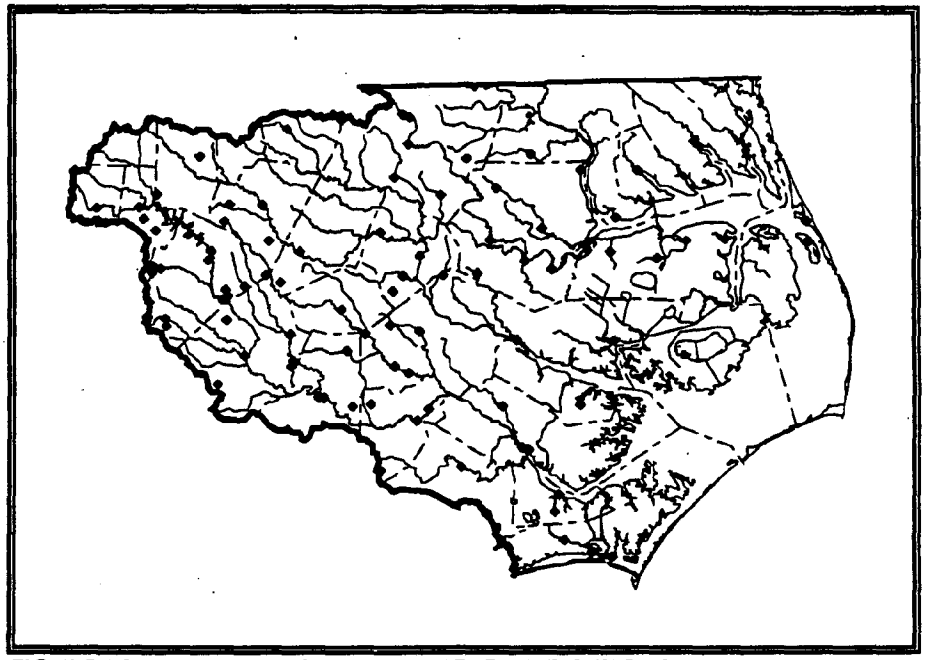

FIGURE 18 *WASTEWATER TREATMENT SYSTEMS IN THE APES REGION*

from the U.S. Environmental Protection Agency (EPA) is supporting pollution prevention projects in Winston-Salem and Troy. According to records maintained in the DEM's Compliance Monitoring System, the percentage of dischargers found operating in violation of their permit (out-of-compliance) has decreased over the years. Increased computerization of DEM's compliance monitoring activities have assisted in an increase in administrative assessments and civil penalty cases. However, in order to be more proactive in preventing permit violations and resulting water quality degradation, the Division requires more staff for review of monitoring data and for conducting inspections. Increased inspections provide the benefit of improved communication between the Division and dischargers and early detection of potential problems which prevents some violations before they occur.

Management Action 1: Promote pollution prevention planning and alternatives to discharge, where feasible, for all point sources to reduce the volume and toxicity of discharges.

Explanation: *Environmental problems surface when inadequately controlled or treated wastewater is discharged into the system. Pollution prevention programs are a proactive measure aimed at reducing waste at its source. These programs make treatment more efficient, reduce pollutants in the waste stream, and lower cleanup costs for industry and government. When appropriate, alternatives to discharge should be encouraged.*

Critical Steps

1. OWR's Pollution Prevention Program and DEM's Facility Assessment Unit would strengthen coordination to provide technical and regulatory assistance.

2. With assistance from DEM, OWR would prioritize and target those facilities found in violation of their NPDES permit or municipal pretreatment permit.

3. OWR would coordinate with all permitted facilities concerning the implementation of pollution prevention planning.

4. To establish compliance with NPDES and municipal pretreatment permits and to reduce waste generation, industries would seek technical assistance and policy support from DEM and OWR.

5. Municipal wastewater treatment plants, with state approved pretreatment programs, would be encouraged to develop pollution prevention programs to assist indirect dischargers with implementing industrial pollution prevention programs.

6. DEM would require the use of non-discharge alternatives where feasible.

Evaluation Methods

1. Once a pollution prevention program has been established at a facility, periodic inspections by DEM would document the status (improvement) of that facility's compliance record.
2. Comparisons can be made of previous compliance records versus present status. Documentation of improvement in plant performance could be the result.
3. Timely reports would be prepared by DEM and OWR including updated compliance information.

Economic Costs and Considerations

With recent increases in staffing, this action is not anticipated to require an additional increase in staff or funding in OWR or in DEM's Facility Assessment Unit. Better inter-governmental coordination and cooperation can help reduce the costs of ensuring compliance with environmental regulations. In addition, coordinating DEM's Compliance Group and OWR is a cost-effective method that uses existing government programs to target firms that may need technical assistance and training to establish pollution prevention methods and technology in their plants. Although costs may be incurred to establish pollution prevention programs in industrial plants, many firms have found that waste reduction often results in savings in operating costs that more than offset the costs of implementing the plan.

Funding Strategy

No additional funding is necessary to implement this management action.

Management Action 2: Expand and strengthen enforcement of National Pollutant Discharge Elimination System (NPDES) permits. Increase site inspections and review of self-monitoring data to improve facility compliance by 1995.

Explanation: *Increasing the staff of the Division of Environmental Management's (DEM) Compliance Group would allow for more frequent site inspections and would enhance enforcement. More frequent inspections would improve communication between the Division and*

dischargers, and would help prevent some violations before they occur. Stronger enforcement would dampen incentives for dischargers to violate their permits.

Critical Steps

1. The General Assembly would be asked to increase permit fees for DEM in order to hire additional personnel for their compliance program.

2. DEM would increase personnel in their central and regional offices to provide for more frequent and comprehensive inspections of permitted dischargers and provide more staff time to the Notice of Violation and assessment process.

3. As required by the U.S. Environmental Protection Agency (EPA), DEM would maintain its Enforcement Management System, which is a complete set of written enforcement policies ensuring consistent and adequate enforcement procedures.

4. When a facility is found in violation of its discharge permit, DEM's Facility Assessment Unit would investigate appropriate enforcement actions to achieve compliance as quickly as feasible.

5. DEM would review the permits and effluent data for all facilities identified whose effluent concentrations could result in potential water quality exceedances.

6. DEM would continue to investigate and propose innovative methods of enforcement to increase efficiency.

Evaluation Methods

DEM would continue to track on a quarterly basis the percentage of NPDES dischargers operating in violation of their permit. A decrease in permit violations would be considered successful implementation of this management action.

Economic Costs and Considerations

DEM would require $300,000 per year to hire six additional personnel and to purchase additional monitoring equipment. If facilities were aware that more frequent and comprehensive inspections of permitted dischargers were taking place, higher rates of compliance could be expected, which would result in lower governmental costs of pollution clean-up.

Funding Strategy

The hiring of six staff members by DEM would require a $300,000 appropriation from the General Assembly. Another possible source of funding for this action would be revenues generated from permit fees.

OBJECTIVE D: REDUCE THE RISK OF TOXIC CONTAMINATION TO AQUATIC LIFE AND HUMAN HEALTH.

Strategy: Several sites within the APES area were identified as exceeding levels of concern for toxic contaminants in ambient water, sediment, and/or fish tissue using protocols suggested by Cunningham, et al. (1992a). For example, concentrations of mercury exceeding 0.15 ppm in sediments of the Albemarle sound and its tributaries are illustrated in Figure 19. The Division of Environmental Management (DEM), U.S. Fish and Wildlife Service (USFWS), and other state or federal agencies should coordinate monitoring efforts for these environmental media to provide the maximum geographic and most cost-effective monitoring coverage. Resources should be concentrated to evaluate the potential impact to aquatic life, wildlife, and human health, and to identify additional contaminated sites.

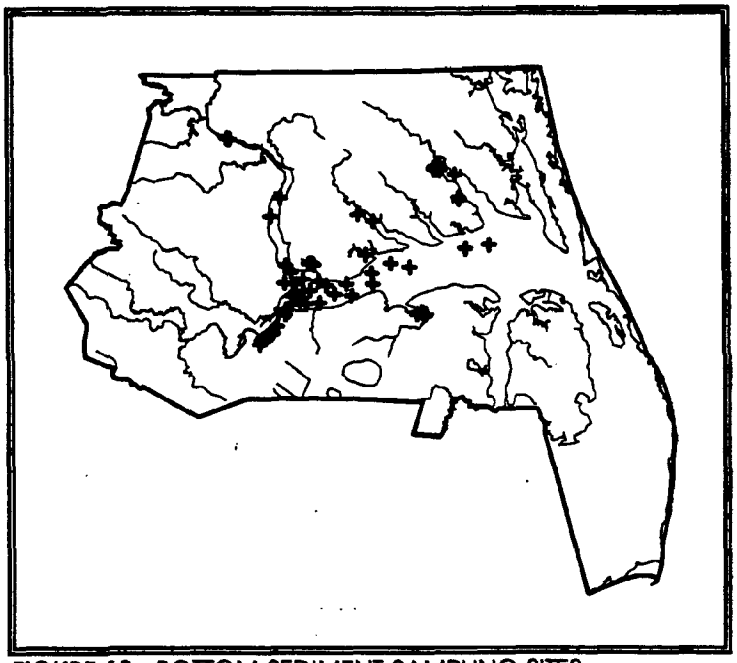

FIGURE 19 *BOTTOM SEDIMENT SAMPLING SITES WITH MERCURY CONCENTRATIONS EXCEEDING 0.15 PPM IN THE ALBEMARLE SOUND DRAINAGE REGION*

Management Action 1: Increase efforts to assess and monitor the extent of estuarine sediment contamination, fish and shellfish tissue contamination, water quality violations, and to identify the causes and sources of these problems.

Explanation: *Several areas within the Albemarle-Pamlico region have been identified as exceeding levels of concern for toxicity in water, sediment and fish tissue. Any additional contaminated sites should be identified. Existing contaminated sites would be evaluated to determine the extent of the problem and its impact on aquatic life, wildlife and human health. Management actions should focus on reducing or eliminating further contamination in areas of concern.*

Critical Steps

1. DEM will remain current on developing U.S. Environmental Protection Agency (EPA) and National Oceanic and Atmospheric Administration (NOAA) protocols for collection, analyses, and criteria for sediment toxicity; and incorporate EPA approved protocols into existing programs.

2. Once EPA protocols are approved and adopted, DEM would conduct sediment toxicity testing at sites identified as being most contaminated or where specific pollutants (e.g., mercury) repeatedly occur at toxic levels.

3. DEM will continue ambient water quality monitoring at those sites identified as being most contaminated.

4. DEM, using products produced by the Center for Geographic Information and Analysis (CGIA), would analyze data concerning water quality standards exceedances and their proximity to known point and nonpoint source pollution and enter this information into a geographic database

using quality assured layers. DEM would review this information and attempt to determine the potential sources and causes.

5. DEM would utilize the information in the geographic database concerning sites identified as exceeding water quality standards and target them for sediment toxicity analyses (once sediment criteria are adopted).

6. DEM, with assistance from the Office of Waste Reduction (OWR), would initiate action to reduce or eliminate further pollutant loading to the identified contaminated sediment and ambient water quality sites; considering possible remedial efforts of the contaminated area. (Refer to Objective D, Management Action 3)

7. To determine the extent of fish and shellfish contamination, DEM and USFWS would increase efforts to monitor the concentrations of chemical contaminants in fish and shellfish tissues to identify additional areas where fisheries resources are contaminated. The Division would target areas where contaminant loadings are most likely to occur (e.g., areas where sediment or ambient water quality exceedances have been identified or where point source loadings or nonpoint sources of pollutants are greatest).

8. The Environmental Epidemiology Section (EES) will continue to evaluate fish data and develop criteria for appropriate action to protect public health.

9. DEM will continue to conduct intensive monitoring of fish and shellfish at those sites where tissue concentrations are a human health concern based on criteria developed by EES.

Evaluation Methods

1. Upon adoption of EPA and NOAA protocol currently under development, DEM would utilize the EPA and NOAA methodology and draft guidance to evaluate analytical techniques and sediment criteria relative to the character of North Carolina sediment and make appropriate amendments to its methodology.

2. Map reports would be generated annually from Geographic Information Systems (GIS) data layers of contaminated sediment and ambient water quality sites to track the extent of point and nonpoint source pollution throughout each basin.

3. DEM would report on a periodic basis (e.g., as part of the State of North Carolina biennial 305(b) Water Quality Report or according to the five year

basinwide review schedule), the number of sites where exceedances of sediment (once adopted) and ambient water quality standards were detected. Documented improvements in overall water quality would indicate successful management practices.

Costs and Economic Considerations

This action would require an additional $150,000 to fund contract analysis for toxic contamination evaluation and risk assessment. Monitoring and GIS mapping of sediment toxicity, point source dischargers, marinas, treatment, storage, and disposal facilities (TSDFs), Superfund sites and landfills may be a cost-effective method to assist DEM in identifying possible sources of pollutants near contaminated sites, and in beginning actions to reduce or eliminate pollutant emissions from those sites. Enhanced inter-governmental coordination and cooperation can help reduce the costs of monitoring fish contamination and issuing public health advisories. In addition, coordination among DEM, CGIA, SSB, DMF, DWR, EPA, and the Research Triangle Institute is a cost-effective method that uses existing government programs and research institutions to target areas and populations of concern.

Funding Strategy

To fund additional water quality analyses, a $150,000 appropriation would be needed from the General Assembly.

Management Action 2: Continue to issue fish advisories as necessary to protect public health. Improve communication and education about the risks associated with eating contaminated fish and shellfish.

Explanation: *Regional fish advisories alert the public to the potential health hazards of eating contaminated fish. The Environmental Epidemiology Section (EES) would continue to review fish tissue analyses and issue advisories as necessary.*

Public outreach and education should stress the risks associated with eating contaminated seafood to the general population and sensitive populations (e.g., women of child-bearing age and children).

Critical Steps

1. The Division of Environmental Management (DEM) will continue to conduct intensive monitoring of fish and shellfish at those sites where tissue concentrations are of concern to human health based on criteria developed by EES.

2. EES will continue to evaluate the Environmental Protection Agency (EPA) risk assessment approach for issuing fish consumption advisories and adopt as appropriate. It affords the state flexibility to adjust various parameters (e.g., consumption rate, body weight, risk level).

3. The Wildlife Resources Commission (WRC) and/or Division of Marine Fisheries (DMF) would conduct creel surveys of fishermen at sites where elevated concentrations of contaminants have exceeded levels of concern to determine the consumption rate of recreational and subsistence fishermen, the fish species most often consumed, and the method of cleaning and cooking used to prepare the fish. Participation from citizen groups, such as the APES Citizens Water Quality Monitoring Network, would be considered in this effort.

4. EES will continue to conduct a risk assessment for consumption of fish and shellfish at sites where contaminated fish are identified and disseminate information on fish consumption advisories to reach the widest audience of the fish-consuming public. Fish consumption advisories will be posted at affected water body sites. Information regarding advisories would be disseminated to purchasers of fishing licenses. The Department of Environment, Health, and Natural Resources (DEHNR) will arrange public meetings, issue press releases, and public information announcements and will notify the local health department of the fish consumption advisory.

Evaluation Methods

1. DEM will report results of fish tissue analyses to EES to evaluate human health risks associated with consumption of contaminated fish.

2. Additional contaminated sites (those sites where fish tissue samples exceed human screening values) would be added to the existing Geographic Information Systems (GIS) data layer of contaminated fish sites by CGIA as they are identified by DEM. Map reports would be generated annually to track the extent of waters with fishing advisories or potentially needing advisories.
3. EES will report on a periodic basis the issuance of any new fish consumption advisories to DEM. DEM would include this data as part of the State of North Carolina biennial 305(b) Report. EES will also report new advisories to the National Fish Advisory Database maintained by the EPA Office of Science and Technology and the Research Triangle Institute.

Costs and Economic Considerations

No additional program costs are anticipated for this action. Protecting public health through the activities mentioned in this recommendation could result in preventing or lowering the incidence of illness due to ingestion of chemically contaminated fish and shellfish, and consequently lowering the costs of health care for those individuals who might otherwise require treatment for chemical poisoning.

Funding Strategy

This action will not require additional costs to implement.

Management Action 3: Remediate toxic contamination where necessary and feasible.

Explanation: *Considerable efforts should be made to remedy contamination that is an immediate threat to human health and aquatic life. The Division of Environmental Management (DEM) would proceed with sediment cleanup only where necessary and where remediation activities would not cause further damage to ecological communities.*

Critical Steps

1. DEM, in conjunction with the Division of Solid Waste Management (DSWM), would evaluate remediation actions, including containment or removal options for those sites deemed to be contaminated at levels hazardous to aquatic life or of human health concern.

2. DEM and DSWM would identify responsible parties, where possible, and proceed with sediment cleanup only where necessary and where remediation activities would not cause further impacts. Remediation can have a greater impact on ecological communities than allowing the system to assimilate and detoxify in-place contaminants.

3. If responsible parties are not identified for sediment contamination, then the Superfund Program of DSWM would consider placement of that site on the National Priority List (NPL).

Evaluation Method

DEM would require responsible parties to implement an environmental impact assessment at priority sites before conducting any remediation activities. Continued monitoring of remediated sites will provide DEM with important data that can be used in evaluating future sites for clean-up.

Costs and Economic Considerations

Costs of remediation will be determined by monitoring and evaluation efforts (see Objective D, Management Action 1). Where sediments are contaminated with toxic pollutants, one method of remediation is the removal of the contaminated sediment. This can be extremely costly, both in terms of the environment and the economy. The overall cost of remediation could be reduced by using feasibility studies to determine whether sediment cleanup is necessary and whether the cleanup will cause further damage.

Funding Strategy

The cost of remediation of contaminated sites would be sought from those parties found responsible for the contamination.

OBJECTIVE E: EVALUATE INDICATORS OF ENVIRONMENTAL STRESS IN THE ESTUARY AND DEVELOP NEW TECHNIQUES TO BETTER ASSESS WATER QUALITY DEGRADATION.

Strategy: Several highly visible indicators of environmental stress include chronic algal blooms, fish and shellfish kills, and fish and shellfish diseases. The Division of Environmental Management (DEM), Division of Marine Fisheries (DMF), National Marine Fisheries Service (NMFS), Shellfish Sanitation Branch (SSB), various academic and private sector researchers, and citizen monitoring groups would coordinate monitoring efforts to track these indicators of environmental stress to provide the widest geographic and most cost-effective monitoring coverage of the APES area. Resources should be concentrated to establish a response network to identify and collect data on algal blooms, fish and shellfish kills, and fish and shellfish disease outbreaks; improve management tools to address shellfish contamination; and accelerate the development and application of new bio-assessment techniques to evaluate cumulative environmental impacts in estuarine waters. Algal blooms and fish and shellfish kills and disease outbreaks have been monitored by various groups including DEM, DMF, Wildlife Resources Commission (WRC), the U.S. Fish and Wildlife Service (USFWS), NMFS, Pamlico Environmental Response Team (PERT), and academic and private researchers. However, this effort has not been fully coordinated to cover all waters of the APES area. SSB has monitored the extent of bacterial contamination in shellfish harvest areas, identifying potential sources of contamination and issuing shellfish harvest area closures as necessary to protect the public health. Bio-assessment techniques have the advantage of detecting water quality problems that chemical or toxicological monitoring may miss or underestimate. The resident estuarine biota act as continuous monitors of environmental quality, increasing the likelihood of detecting episodic events (e.g., spills), nonpoint sources, or other highly variable impacts that chemical sampling often misses. Bio-assessments also provide a means of directly assessing the biological integrity of the estuarine community. This assessment can serve as a basis for identifying high quality water deserving special protection, implementing state anti-degradation policies, confirming in-stream impacts predicted by fate and transport modeling (e.g., waste load allocation), and toxicity testing. The advantage of bio-assessments is their ability to assess ecosystem health -- one of the principal goals of the Clean Water Act.

Management Action 1: Continue to track and evaluate indicators of environmental stress, including algal blooms, fish kills, and fish and shellfish diseases.

Explanation: *Biological assessments are useful in evaluating the integrity of the estuarine system. Traditional biological indicators such as algal blooms and fish kills can signify water quality problems that chemical and toxicological monitoring may have missed or underestimated.*

Critical Steps

1. DMF, DEM, NMFS, USFWS, and other researchers would establish an environmental stress indicators response network to collect the data necessary to determine the sources and causes of these events. DMF would be the lead agency responsible for developing and maintaining the response network.

2. The information collected would be used to establish a database to help develop management strategies concerning algal blooms, fish and shellfish kills, and outbreaks of fish and shellfish diseases.

3. The response network program would incorporate relevant experts with the technical expertise necessary to collect appropriate data for studying each type of environmental stress indicator.

4. The network would standardize the investigation and reporting of these environmental stress indicator events by preparing protocols and standardized reporting sheets so that causes and trends are reliably documented. Investigations also would sample a standard set of water quality parameters and collect biological samples for examination and/or autopsy.

5. The environmental stress indicators network would consider the role of private citizens, such as the APES Citizen Water Quality Monitoring Network (CWQMN), in acquiring data for algal blooms, fish and shellfish kills, and fish and shellfish diseases.

6. The response network will continue necessary research to determine the causes of algal blooms, fish and shellfish kills, and fish and shellfish diseases, and to determine the role of anthropogenic activities in the occurrence of these events.

7. The information on geographic location and other environmental attributes for each event would be sent to the Center for Geographic Information and Analysis (CGIA). CGIA staff would create maps for each of the environmental stress indicators (only algal blooms currently have been mapped). As the database evolves, DEM with CGIA assistance, would conduct Geographic Information Systems (GIS) evaluations to assess potential pollutant sources in proximity to the event site that could have triggered an event.

8. Additional event sites periodically would be added to the existing GIS data layer of environmental stress indicators as they are identified. Map reports would be generated periodically to track the extent and occurrence of the appropriate environmental stress indicators.

Evaluation Method

CGIA would oversee the database. The divisions conducting the monitoring would update network data at least annually. Data would be analyzed and reported in the biennial 305(b) report.

Costs and Economic Considerations

$125,000 per year would be allocated to DEM and DMF for two additional staff members for regional offices, equipment, and data base establishment. Costs would include sampling costs and contracts to research institutions. Using a response network that includes and promotes information sharing, skills and management tools can help reduce the cost of monitoring, evaluation, and source identification, as well as reduce response time. The network and database would document the magnitude and probable cause of a kill so an attempt to recover costs associated with the resource injury can be made. Major data elements for each event can include location, land use cause, source, incident, direct cause, and specific pollutant. The data can provide useful insights to analysts and decision makers regarding

problem areas and sources. For example, fish kill data can be used to identify and correct discharge problems from single sources, or can lead to more in-depth investigations of water quality problems.

Funding Strategy
To fund two additional staff members for DEM and DMF, a $100,000 appropriation would be needed from the General Assembly. An additional $25,000 for equipment, sampling, and research contracts would also be needed.

Management Action 2: Improve the techniques for evaluating the overall environmental health of estuarine waters.

Explanation: *The sensitivity and diversity of organisms inhabiting an area can be an indication of the system's overall environmental health. Further research is needed to target these "indicator species" in the estuary. Once found, these organisms could be used to monitor the general state of the system and indicate areas that warrant further attention.*

Critical Steps

1. The Division of Environmental Management (DEM) would conduct a comprehensive survey and evaluate the current extent of development and application of bio-assessment techniques in estuarine waters. Bioassessment techniques often are based on the use of biotic community indices for a given water body to establish a baseline for such properties as species richness, abundance, and composition as well as trophic structure.

2. DEM would select appropriate bio-assessment techniques for the area based on best professional judgement and would prepare standardized protocols for the bio-assessment technique chosen.

3. DEM would continue to develop standard protocols for selecting unpolluted reference sites with similar hydrologic, physical, and chemical characteristics, and for calculating norms for these reference sites against which potentially degraded sites may be compared.

4. DEM would continue to develop statistical procedures and biocriteria (if data warranted) for evaluating whether sites differed significantly from the norm or showed indications of biological impairment. DEM and Environmental Management Commission (EMC) would establish narrative or numerical criteria for bio-assessment techniques in estuarine waters.

Evaluation Method
DEM would report periodically (e.g., as part of the State of North Carolina 305(b) Water Quality Report) the results of the application and evaluation of bio-assessment techniques in estuarine waters.

Costs and Economic Considerations
Program costs for this action are estimated at $100,000 per year to improve DEM's techniques for evaluating cumulative environmental impacts in estuarine waters. This action would help researchers, planners and regulators understand and monitor health indicators and water quality in the APES region, and would provide better protection for special communities from chronic and acute toxicity and general cumulative degradation. These efforts may help focus efforts to protect water quality, which could reduce the costs of regulation and compliance.

Funding Strategy
To fund research within DEM, a $100,000 appropriation would be needed from the General Assembly. Funds required by CGIA relating to this management action are addressed in the Stewardship Plan, Objective A, Management Action 2.

Management Action 3: Develop and adopt better indicators of shellfish contamination as soon as possible.

Explanation: *The presence of fecal coliform bacteria currently is used to detect sewage contamination in shellfish beds. This practice has been criticized, however,*

and the National Oceanic and Atmospheric Administration's (NOAA) National Indicator Study is investigating better indicator tests. These tests, which assess both bacterial and viral contamination, better indicate the health risk from eating contaminated shellfish. They also would establish more reliable criteria for closing shellfish areas or re-opening previously closed areas.

Critical Steps

1. The Department of Environment, Health, and Natural Resources (DEHNR) would fully adopt appropriate new indicator tests for assessing bacterial or viral contamination currently under evaluation and development by NOAA's National Indicator Study after these tests receive approval by the U.S. Food and Drug Administration (FDA) and the Interstate Shellfish Sanitation Conference.

2. The Division of Environmental Health's Shellfish Sanitation Branch (SSB) will continue to monitor bacterial contamination levels in water and shellfish to identify areas where these resources are contaminated at levels of concern to public health. SSB would adopt, upon FDA approval, indicators to replace or be used in conjunction with the existing broad-spectrum fecal coliform test.

3. SSB, in conjunction with the Center for Geographic Information Analysis (CGIA) would continue to develop Geographic Information Systems (GIS) maps of shellfish closure areas for all shellfish harvesting waters in the region.

Evaluation Methods

1. Map reports would be generated annually to track the extent of shellfish producing waters closed to harvesting and evaluate trends in the amount of acreage closed to harvesting.
2. SSB would continue to report on a periodic basis (e.g., in the State of North Carolina biennial 305(b) Water Quality Report) the closure of any new areas, reopening of previously closed areas or other changes in status of

harvestable shellfish waters. Sanitary survey reports containing information on shoreline surveys of septic tanks, municipal facilities, and livestock operations would continue to be prepared triennially.

Costs and Economic Considerations

Economic, as well as public health benefits, would be provided by the establishment of more reliable criteria for the closure of shellfish areas and/or the re-opening of previously closed areas. Development of more precise indicators to test for sewage contamination in shellfish beds and to assess the risk to human health from the consumption of shellfish from these beds would help researchers, planners, and regulators understand and monitor health indicators and water quality for better protection. Economic benefits would result if tests using an improved indicator found that shellfish from formerly closed beds are safe for public consumption. In addition, better indicators may help focus efforts to protect water quality, which could reduce the costs of regulation and compliance. If indicators demonstrate that formerly opened beds should be closed, public health benefits would result in terms of reduced health care expenses.

Funding Strategy

Funds required by CGIA relating to this management action are addressed in the Stewardship Plan, Objective A, Management Action 2.

VITAL HABITATS PLAN

GOAL

Conserve and protect vital fish and wildlife habitats and maintain the natural heritage of the Albemarle-Pamlico region.

OBJECTIVE A: PROMOTE REGIONAL PLANNING TO PROTECT AND RESTORE THE NATURAL HERITAGE OF THE APES REGION.

Strategy: Regional planning would guide the acquisition, protection and restoration of vital habitats. Plans would include goals for ensuring that protection efforts do not become fragmented but are consolidated and targeted toward regional needs for the survival of wildlife and fisheries and the protection of natural heritage. Ecosystem plans would be developed for each major drainage basin in the region. This approach would consider the value of each site proposed for protection at the watershed and regional levels. Plans would consider important ecological processes as well as regional economic activities which rely on those processes at the landscape scale. Plans would also consider broader watershed protection goals, management strategies such as protected corridors and buffers, and basinwide water quality planning initiatives. Maps of the region's vital habitats and land uses, such as Figure 20 showing ecologically significant natural communities rare species, would be completed and updated in order to develop basin-specific ecosystem plans.

Management Action 1: Develop ecosystem protection and restoration plans (basinwide ecosystem plans) for each river basin in the region. Individual basinwide ecosystem plans will be completed and implemented according to the schedule established for basinwide water quality management plans. (See Objective A in the Water Quality Plan.) Plans should establish coordinated priorities for protecting habitats and critical areas in each basin, and should target areas most vital to the survival of wildlife and fisheries and the protection of natural heritage.

Explanation: *Protecting vital habitats involves a great number of agencies and organizations. The coordination of their efforts with strategies that target management at the most critical areas would be best accomplished through basinwide ecosystem planning. Planning on a river basin level encompasses important ecological habitats that do not correspond to local jurisdictional boundaries. Restoration plans for river basins would provide a means for assessing the sources and causes of habitat damage and enable the appropriate agencies and organizations to coordinate priorities within the entire basin.*

Critical Steps

1. The primary agencies involved with vital habitat protection in the APES region include: the Wildlife Resources Commission (WRC); the Division of Marine Fisheries (DMF); the Division of Parks and Recreation (DPR); the Division of Coastal Management (DCM); the Division of Forest Resources (DFR); the Forestry Advisory Council; the U.S. Fish and Wildlife Service (USFWS); and the National Oceanic and Atmospheric Administration (NOAA). These agencies would form an inter-agency committee to develop ecosystem protection plans for each drainage basin. This committee would work closely with the Regional Councils (See Implementation Plan Objective A Management Action 1).

2. Under the auspices of The Nature Conservancy (TNC), USFWS, WRC, U.S. Army Corps of Engineers (USACE) and DPR, in coordination with local governments, a vital habitat plan is being developed for the Roanoke basin. This plan should serve as a model for the development of plans for each of the remaining basins.

3. Basinwide ecosystem plans would be developed consecutively, working as closely as possible with water quality basinwide plans, with all five to be developed by 1999. Ecosystem plans would include a formal endorsement and agreement by all management agencies to implement the plans.

4. The interagency committee would consider basinwide and regional needs for protecting wildlife, fisheries and natural heritage. Issues, such as developing processes that address old-growth, biodiversity, and water quality forestry issues; providing protective buffers and corridors; and managing in-holdings, will be evaluated. Buffers protect particularly sensitive natural communities or rare species habitat. Protected corridors link natural areas and allow wildlife to move safely within a landscape. Corridors also protect the health of whole populations within a landscape by reducing inbreeding or allowing species exterminated in one area to recolonize in another. Incorporating in-holdings, or "holes" into protected areas, can reduce threats to species that are particularly sensitive to habitat fragmentation.

5. A Forestry, Fish and Wildlife (FFW) Coordinating Committee would be created to promote the availability and distribution of forestry resource information and management to maximize silvicultural production and fish and wildlife habitat value. The FFW would also provide technical assistance to the interagency committee for considering local site-specific needs for protecting rare species habitat as described in the USFWS Endangered Species Recovery Plans for federally listed species and equivalent plans for state listed species.

6. Plans would include criteria for setting priorities and assessing protection and restoration efforts and would detail the types and amounts of habitats in the region requiring protection (See Objective B, Management Action 6 for details of a fishery habitat restoration and a wetlands habitat restoration program.)

7. Involved agencies would make every effort to coordinate basinwide ecosystem plans with basinwide water quality plans developed by the Division of Environmental Management (DEM).

8. The interagency committee would also consider the purchase of lands adjacent to waters designated as vital fisheries habitats as a means of habitat conservation.

Evaluation Method

This Management Action would be evaluated by assessing the progress of the interagency committee in completing each ecosystem plan. The degree to which regional goals are met and outlined in each individual basin plan will also be considered.

Costs and Economic Considerations

In general, better coordination and planning focused on the APES region will not result in significant incremental costs to the existing agencies and programs involved. DPR will be considered the lead agency for this management action and one additional staff member would be needed at an annual cost of $50,000 to coordinate planning activities. Additional costs to state and federal agencies from planning and coordinating activities would be met with existing resources. Costs of materials, data acquisition, mapping, and other miscellaneous resources are covered in the other management actions in the Vital Habitat Plan. These activities have the potential to generate savings and/or greater efficiency by redirecting and sharing agency resources to achieve common goals. Because of these factors, the net impact on the costs of actual management and administration cannot be determined. The most likely impact is improved efficiency or productivity rather than a change in overall spending. The goal of this Management Action, like that of the CCMP as a whole, is to better manage government in order to achieve the greatest environmental benefit for a given level of public spending. Ecosystem planning in and of itself would not be expected to affect land values. All acquisitions of natural areas discussed in this plan (see Management Actions 1 and 2 of Objective B) would be obtained through voluntary sales or donations of land and easements. Ecosystem plans could help direct the focus of regulatory programs, but they would not necessarily change the overall economic impact of regulations or lead to more stringent regulations. The main economic impact of this Management Action is likely to be more efficiently used public funds. Making habitat protection goals and priorities a better focus in the public eye would make people more aware of the value of surrounding ecological resources. Basinwide ecosystem plans, for instance, could serve as guides to landowners, communities, local governments and others wishing to protect these resources in their areas. Basinwide ecosystem plans could also help in the development of more detailed environmental impact analyses, species protection plans, etc., which need to be developed by government agencies, developers, and others. A better planning process and clear plans for the future would tend to reduce uncertainties regarding major habitat protection projects, allowing communities to avoid unexpected negative impacts and to capitalize as much as possible on the opportunities these projects present, such as nature-based tourism, recreation, and sustainable forestry and agriculture.

Funding Strategy

The DPR would apply for funds from the National Park Service's Statewide Outdoor Recreational Planning Grants. If grants are unavailable, a $50,000 appropriation would be needed from the General Assembly.

Management Action 2: Develop and maintain accurate maps and records of wetlands, fisheries habitats, federal and state endangered species and their habitats, natural areas, and natural communities.

Explanation: *Accurate maps of natural areas are essential to the development of basinwide ecosystem plans. They allow for more accurate analysis of protection and enhancement priorities for various habitat types. A biological inventory of the region was part of the Albemarle-Pamlico Study and additional detailed inventory and monitoring projects would be completed for individual counties and for the most significant natural areas. This information would be kept current and accurate. Up-to-date, readily available biological inventories, maps, and data would provide local governments, planners, land managers, and private citizens with the information they need to protect habitats.*

Critical Steps

1. The Department of Environment, Health, and Natural Resources (DEHNR) would develop coordinated policies and definitions for habitat mapping to ensure the compatibility of data sets.

2. The Division of Marine Fisheries (DMF) would complete maps of shellfish beds and update them at least every 10 years, or sooner if appropriate, to analyze changes in their status.

3. DMF would update maps of nurseries and anadromous fish spawning areas at least every 10 years, or sooner if appropriate, to assess trends and analyze threats.

4. DMF, with the assistance of the Division of Coastal Management (DCM), would continue efforts made by the National Oceanic and Atmospheric Administration (NOAA) to map submerged aquatic vegetation throughout the APES region and update the maps as necessary to be useful for tracking changes.

5. The Division of Parks and Recreation's (DPR) Natural Heritage Program (NHP) would continue to maintain regional maps of ecologically significant areas, known as Natural Heritage Priority Areas, including rare plant and animal habitat and rare or representative natural communities and continue to maintain updated Geographic Information Systems (GIS) database layers indicating areas that are managed by the public or private sector for preservation. The regional maps would be continuously revised as information becomes available. This information would allow for a regional assessment of ecological change.

6. To complement the existing regional survey of natural communities, and to allow for a closer assessment of important habitats, the NHP would work with the region's 36 counties to complete local natural heritage surveys. These surveys would be completed by 2005.

7. The U.S. Fish and Wildlife Service (USFWS) would complete National Wetland Inventory maps for the APES region. National Wetlands Inventory maps would be updated regularly to analyze changes in habitat status and trends. Other federal and state programs that map wetlands - including the NOAA Coastal Ocean Program, Environmental Protection Agency (EPA) and DCM's Advanced Identification (ADID) program, U.S. Forestry Service's (USFS) Forest Inventory and Analysis Database, U.S. Soil Conservation Service (SCS) Swampbuster maps and Landsat Thematic Mapper - would continue to complement USFWS efforts and make available additional region-specific analyses of the status and trends of wetland habitats.

8. SCS would complete and digitize soil survey maps for any remaining unmapped county in the APES region.

9. DEM and the Center for Geographic Information and Analysis (CGIA) would work toward completing an updated land use and land cover database that would aid in protecting wetlands and other habitats throughout the watershed. CGIA would update the database at least every 10 years, and every five years if feasible.

10. The Nature Conservancy (TNC) would aid in mapping ecologically significant areas on lands they own or help manage. The Conservancy's efforts to map ecologically significant areas in the lower Roanoke River basin will enhance the natural areas database by providing more intensive survey information for this important region.

11. DMF, Wildlife Resources Commission (WRC), DPR, and USFWS would identify and list by 1995 the essential habitats of all endangered and threatened species.

12. DEM and DCM, with assistance form the Army Corps of Engineers (USACE), would map and track permits to assess the impact of coastal land use on vital habitats by 1995.

13. The maps and mapping updates described in this management action would be stored in CGIA's Geographic Information Systems (GIS) to promote availability for conservation planning.

14. CGIA would build coordinated databases to strengthen the flow of information between agencies and between government and non-government organizations interested in habitat protection.

Evaluation Method

Relevant agencies will monitor their respective maps in the CGIA GIS database to ensure that they are completed and regularly updated.

Costs and Economic Considerations

The NHP would require approximately $85,000 per year in order to complete inventories for all counties in the APES region on a 10 year cycle. CGIA would require $50,000 per year to support a technical staff member responsible for producing necessary maps. SCS would require funding, based on the average cost of $1.25 per acre, to complete soil survey maps. Most other elements of this action are expected to be funded through existing authorizations (for instance, by redirecting budget priorities). The information and data processing capability generated by this strategy will improve the productivity of resource management agencies and others who use geographic data. GIS can provide an efficient way to track and analyze complex environmental data from thousands of geographic points in an area over time. This capability can facilitate management, planning, enforcement, and research.

Funding Strategy

DPR would apply for funds from the State Recreation and Natural Heritage Trust Fund. If funds are unavailable, an $85,000 appropriation would be needed from the General Assembly. CGIA would acquire funding from EPA's State Development Fund for Wetlands Protection and through existing cost-recovery based agreements. SCS would acquire funding from existing federal sources and from the state Division of Soil and Water Conservation (DSWC). Additional funding would be provided by the individual counties in which mapping was performed.

Management Action 3: Expand programs to identify wetlands on a regional scale and to evaluate and rank wetland function.

Explanation: *An accurate identification and evaluation of wetlands, in advance of proposed activities that disturb wetlands, improves our ability to protect the most critical wetlands and to make wetlands permitting more predictable for developers and local governments. An Advanced Identification (ADID) program is a multi-agency effort that tests a variety of methods to evaluate wetlands. Under this program, wetlands regulations would not be expanded. Instead, the wetlands permitting process would become more efficient.*

Critical Steps

1. Expand programs that 1) develop wetlands mapping methods and 2) assess wetlands functions. An ADID program is currently evaluating wetlands in Carteret County. Results from this ADID can be used to determine wetlands with the highest functional significance which should be avoided and those with lower functional significance which may be altered, with appropriate mitigation strategies, resulting in minimal regional impacts on water quality, hydrology and habitat. Federal and state agencies involved in the current ADID project include the Division of Coastal Management (DCM), the Division of Environmental

Management (DEM), the U.S. Environmental Protection Agency (EPA), the U.S. Army Corps of Engineers (USACE), and the U.S. Fish and Wildlife Service (USFWS).

2. DCM is planning to use ADID wetland evaluation methods in all coastal counties. The appropriate agencies would expand this methodology in the remaining counties in the APES region.

3. Other methods that comprehensively identify and evaluate wetlands should be considered.

Evaluation Method

Effectiveness of ADID or other wetland identification and evaluation programs would be assessed to determine the following: 1) whether all wetlands in the region were accurately mapped and 2) whether all wetland functions were considered.

Costs and Economic Considerations

The cost to DCM and DEM for evaluating the ADID project in Carteret County is estimated to be $50,000. Expanded ADID efforts would be funded through federal grants. The economic impact of implementing ADID region-wide is contingent on how the ADID program is designed and how resulting data and maps are used by state, federal, and local governments. As a general statement, wetlands identification and mapping at the county and regional scale can help reduce landowners' uncertainty about the likelihood of receiving permits for development and would allow local governments more latitude in planning for growth that does not degrade important ecological resources.

Funding Strategy

To evaluate the existing ADID project, DCM would acquire funding from Section 309 of the federal Coastal Zone Management Act (CZMA) supplied by NOAA. DCM would also apply for an additional $70,000 from CZMA Section 309 to fund expected local projects within Carteret County.

OBJECTIVE B: PROMOTE THE RESPONSIBLE STEWARDSHIP, PROTECTION, AND CONSERVATION OF VALUABLE NATURAL AREAS IN THE APES REGION.

Strategy: Protecting habitats that are vital to the survival of fish and wildlife has been successful in North Carolina. Preserving natural areas also enhances environmental quality and provides socioeconomic benefits. A cooperative effort among many federal and state agencies, private resource and conservation groups, and local land trusts has provided a variety of regulatory and nonregulatory measures that protect habitats. Nonregulatory measures include acquisition, conservation easements, registry and dedication of land as natural areas, technical assistance for conservation, cooperative management agreements and incentives to landowners to maintain, restore, and enhance important natural resources. Impacts of land acquisition on the local tax base should be considered when preserving natural areas. Stewardship and cost share programs would be expanded with assistance from the Forest Stewardship Program, the Department of Agriculture (DA), USDA Agricultural Stabilization and Conservation Service, and local U.S. Soil and Water Conservation Districts. Public education and technical assistance would be provided to assist public and private landowners with responsible management of natural resources.

Management Action 1: Bring areas identified as having the highest priority for protection into public ownership and/or management. Expand funding for public acquisition of park lands, gamelands, coastal reserves, and other natural areas.

Explanation: *Natural areas that are most vital to maintaining the region's natural heritage have been identified. Further priorities will be determined through basinwide ecosystem planning. Where possible,*

voluntary acquisition is an important tool for protecting these areas. In addition to preserving rare species and natural communities, public areas that are managed by different agencies can serve a variety of purposes such as recreation, education, or hunting.

Critical Steps

1. The basinwide ecosystem plans would identify priority areas for the protection of rare species habitat and rare or representative natural communities. Public agencies and private conservation organizations would target these priority areas for voluntary acquisition and conservation easements. While voluntary acquisition involves willing sellers or donors, the impacts of land acquisition on the local tax base should always be considered when preserving natural areas. Acquired lands would be dedicated and managed as protected natural areas.

2. The Division of Parks and Recreation's (DPR) Natural Heritage Program (NHP) has surveyed the APES region's natural areas and identified specific rare species habitat and rare or representative natural communities warranting the fullest protection possible (Frost et al. 1990, LeGrand et al. 1992, Smith et al. 1993). The surveys identified at least 23,000 acres of habitat that would be considered as top priority for protection in basinwide ecosystem plans.

   These areas include the following natural communities:

basic mesic forest (coastal plain subtype)
basic mesic forest (piedmont subtype)
coastal fringe evergreen forest
non-riverine swamp forest
non-riverine wet hardwood forest
peatland Atlantic white cedar forest
pine savanna
small depression pond
tidal freshwater marsh (freshwater variant)
coastal fringe sandhill
coastal plain marl outcrop
diabase glade
floodplain pool
granitic flatrock
piedmont/mountain swamp forest
small depression pocosin
ultramafic outcrop barren
upland depression swamp forest

and maritime forest and other high-priority barrier island natural communities, including:

interdune pond
maritime dry grassland
maritime shrub swamp
maritime wet grassland
maritime deciduous forest
maritime evergreen forest
maritime swamp forest

3. Additional areas to target for voluntary acquisition and conservation easements in the basinwide ecosystem plans have been identified in the National Wetlands Priority Conservation Plan (NWPCP). This plan was developed by the U.S. Fish and Wildlife Service (USFWS) with input from more than 70 state and federal agencies, organizations and individuals knowledgeable of the state's wetlands. The primary purpose of the NWPCP is to aid decision makers in the identification of the types and locations of wetlands that warrant consideration for acquisition using Land and Water Conservation Fund appropriations. In the APES region, it identifies 13 areas that include the region's best examples of wetlands. These areas include approximately 164,000 acres that were privately owned as of December 1992. Some of these areas include rare species habitat or rare or representative natural communities listed in Critical Step 2 above. These areas would be targeted for voluntary acquisition and conservation easements. Purchases made in these targeted areas would be preceded by consideration of the impacts of that purchase to the local community.

4. The voluntary sale or donation of conservation easements would be encouraged in circumstances where acquiring full title to a tract of land is less critical from a conservation standpoint. Acquiring easements also would be appropriate when the current owner wishes to retain at least partial interest in the property. A conservation easement is a voluntary, binding legal agreement in which the land owner sells or donates some or all of her or his rights to develop or use the land, while still maintaining ownership. Conservation easements prohibit development or limit certain activities in order to protect important natural, cultural or open-space resources.

5. Vital habitats owned by the state, as identified through basinwide ecosystem plans, would be dedicated under the North Carolina Nature Preserves Act, the State Nature and Historic Preserve Dedication Act or other appropriate mechanism as soon as possible to ensure their permanent protection.

6. Federally-owned vital habitats identified through the basinwide ecosystem plans would be given similar protective status.

7. Once a dedicated natural area has been placed in public ownership, the responsible agency would develop and implement a management plan as soon as possible.

Evaluation Method

These steps would be evaluated by monitoring changes in acreage as classified by habitat type, current use and management, functional status and owner type. Priorities would be reevaluated periodically, taking into consideration new research as well as changes in habitat threats, policy goals and market conditions.

Costs and Economic Considerations

Funding for administrative costs of acquisition and management activities would continue to come from existing sources. Cost estimates for acquisitions and management of acquired land will depend on the priorities set through the basinwide ecosystem planning process. Using current estimates of the types and amounts of natural areas that are likely to be recommended for protection, acquisition costs to acquire approximately 25,000 acres over the next ten years would fall between $35 million and $55 million. However, the actual numbers are likely to change as the ecosystem plans are developed. Some acquisitions could initially be made by private non-profit organizations rather than by government agencies, but nearly all lands are typically sold to government agencies over the long term. Areas of regional importance might be protected by local governments, but in terms of overall acreage these land areas are likely to be relatively small. Because these acquisitions would be entirely voluntary, any willing sale or donation would result in some positive benefit (monetary and/or non-monetary) to participating landowners. Large-scale acquisitions would need to consider any potential negative economic impacts if important economic opportunities are reduced. In areas where a large proportion of the land base is unsuitable or is already restricted from such uses, removing land from potential commercial use could in turn reduce potential local employment as well as reduce the local tax base. These impacts would have to be considered in any decision to purchase large tracts of land in any one area. When considered from a regional perspective, the impacts of these acquisitions on employment and local tax bases would not be large. This is because the overall acreage being acquired is small relative to other available tracts of land in most counties and since, in most cases, expected levels of development could be accommodated on these other available tracts. The value of (and tax

revenues from) some properties adjacent to those protected could rise. However, in some cases farmland adjacent to protected natural areas could decrease in value due to pest problems, potential fire hazards, extensive public use of adjacent lands or the loss of customary uses such as hunting or fishing. In addition to providing many environmental benefits, this Management Action would likely boost economic activity related to recreation and tourism. Facilities such as public access boat ramps, beaches, visitor and interpretive centers, etc. would generate revenue for local economies and could improve recreational opportunities for nearby residents.

Funding Strategy

To cover any additional administrative costs of public acquisition and management of important natural areas, funding may be acquired from the following potential sources:

Conservation land trusts

USDA - Agricultural Conservation Program, Conservation Reserve Program, Wetlands Reserve Program, Small Watersheds and Flood Protection Program

NOAA - Coastal Reserve Program, National Estuarine Research Reserve Program (NOAA has provided matching funds for both the Coastal Reserve System and the National Estuarine Research Reserve. Matching funds have come from state appropriations, the N.C. Recreation and Natural Area Trust Fund, and donations)

US Fish and Wildlife Service - Federal Aid to Wildlife Restoration (Pittman-Robinson), Cooperative Endangered Species Conservation Fund, North American Wetland Grant, Land and Water Conservation Fund

NC Nongame and Endangered Wildlife Fund

NC Recreation and Natural Heritage Trust Fund

NC Wildlife Resources Commission gamelands acquisitions

Special state appropriations/bond issues for natural areas and parks

Sources of funding for acquisitions should be identified as part of the planning process.

Management Action 2: Provide incentives and technical assistance for the protection of privately owned vital habitats.

Explanation: *High-priority natural areas that are not brought into public ownership can be targeted for private conservation. Efforts would be expanded to inform private land owners of the ecological values of their land, to advise them on appropriate management strategies, and to help them explore options for voluntary protection. Where possible, conservation organizations could acquire vital habitats in order to consolidate management and protection efforts.*

Critical Steps

1. Important natural areas would be obtained and managed by private conservation groups such as the National Audubon Society (NAS), The Nature Conservancy (TNC), the Conservation Trust of North Carolina, the Coastal Land Trust, local land trusts, and individual landowners.

2. Lead agencies would expand existing stewardship programs and other conservation and incentive programs in the region. These programs would focus on vital habitats identified through the basinwide ecosystem plans described under Objective A. Programs include:

   Forest Stewardship Program (lead agency - Division of Forest Resources-DFR)
   Wetlands Reserve Program and Conservation Reserve Program (lead agencies - Department of Agriculture-DA, USDA Agricultural Stabilization and Conservation Service, and local Soil and Water Conservation Districts)
   Natural Heritage Program (NHP) Registry and Dedication of private land under the Nature Preserves Act (lead agency - Division of Parks and Recreation-DPR)
   Partners for Wildlife (lead agency - U.S. Fish and Wildlife Service-

USFWS)
Wildlife Resources Commission (WRC)

3. DPR would need two staff persons for the NHP to coordinate private outreach and incentive programs that would assist land owners in registering or dedicating their land.

4. The Division of Coastal Management (DCM) will continue to develop a guide for managing privately-owned wetlands. Funding will be provided through NOAA Coastal Zone Management Act Section 306 and 309 Grants.

Evaluation Method

The NHP would monitor changes in protected acreage as classified by habitat and owner type, current use and management, functional status, and by tracking landowner participation in habitat protection programs.

Costs and Economic Considerations

The cost of this Management Action to state and federal agencies is estimated to be $524,000 per year and would include the hiring of personnel, site visits, mapping, manuals, plan preparation and certification, and other administrative costs. This figure is based solely on the following anticipated activities: expansion of the Forest Stewardship Program (cost= $370,000); development of the USFWS' private land stewardship plan (cost=$50,000); increased staff for the NHP (cost=$100,000); and publication by DCM of a land use guide for private land owners (cost=$4,000). Private landowners would incur the costs of planning and implementing conservation measures on their land. However, because their participation is voluntary, landowners presumably get at least enough benefits to induce them to participate. These benefits could be monetary (tax advantages, cost share reimbursements) and/or non-monetary (the satisfaction of helping to conserve resources for future generations). At the same time, the general public derives several environmental benefits from these efforts, particularly when public conservation and stewardship programs are targeted at high priority natural areas. When this occurs, the public gets the greatest level of environmental benefit per dollar spent on technical assistance and incentives to private landowners.

Funding Strategy

The expansion of the Forestry Stewardship Program would require an expansion appropriation from the General Assembly. The USFWS would provide funding from their "Partners for Wildlife" program for private land stewardship plan development. Two additional staff positions in the NHP would require an expansion appropriation from the General Assembly. The National Wetlands Reserve Program is currently not funded. There is, however, strong support for this program from the Soil Conservation Service, as well as private landowners, and funding should be considered for developing this program.

OBJECTIVE C: MAINTAIN, RESTORE, AND ENHANCE VITAL HABITAT FUNCTIONS TO ENSURE THE SURVIVAL OF WILDLIFE AND FISHERIES.

Strategy: Better coordination among public agencies including the Division of Parks and Recreation (DPR), the Wildlife Resources Commission (WRC), the Division of Marine Fisheries (DMF), the Division of Coastal Management (DCM), and the Division of Forest Resources (DFR), along with priority-setting objectives included in basinwide ecosystem plans, would improve the effectiveness of future restoration and enhancement projects. Attempts at protecting a region's vital fisheries, rare species habitat, rare or representative natural communities, and other vital wildlife habitat would be directed to where it is most needed and cost-effective. Protection of fisheries habitats, including submerged aquatic vegetation, shellfish beds, and spawning areas, would be modeled after existing protection given to nurseries. Efforts to develop effective restoration and protection technologies would continue. The Wetlands Enhancement, Restoration and Creation (WERC) program sets priorities for type- and site-specific wetlands restoration projects and would help focus the highest level of protection on those wetlands most vital to water quality and habitat. The feasibility of a mitigation bank and other mechanisms for coordinating and consolidating mitigation efforts would be evaluated.

Management Action 1: Enhance the ability of state and federal agencies to enforce existing wetlands regulations by 1995.

Explanation: *Strengthening enforcement of current wetlands regulations and ensuring compliance with the existing permitting process are essential to minimizing inappropriate development in wetlands areas.*

Aerial monitoring would be expanded to increase coverage and ensure efficient enforcement. Enhanced enforcement would prevent some actors from gaining an unfair advantage through their failure to comply with wetlands regulations.

Critical Steps

1. In coastal areas, aerial compliance monitoring allows for the sighting of wetlands permit violations in an efficient and comprehensive manner. This technique could improve monitoring statewide if expanded in coverage. Enhanced wetlands data collection and mapping efforts including overflights and aerial photography would be performed by DEM and DCM. Technical assistance would also be provided by the Center for Geographic Information and Analysis (CGIA) and the Soil Conservation Service (SCS).

2. The General Assembly would be asked to provide funds to increase staff in DEM to enhance and coordinate enforcement efforts of the 401 Water Quality Certification Program with the Army Corps of Engineers (USACE).

Evaluation Method

Wetlands trend analysis, conducted on regular intervals by DEM, will help to identify significant wetland changes and to evaluate and revise permitting and monitoring activities.

Costs and Economic Considerations

In order to develop a more effective 401 Certification Program under the auspices of a General Permit, three new positions in DEM would be created to review and enforce wetlands regulations. One staff member would be stationed in a regional office for enforcement through groundtruthing efforts, and the remaining two staff members would be involved in enforcement efforts in Raleigh. The annual cost of these new positions, will be $150,000. This action would accelerate wetland permitting decisions, improve water quality, and focus regulatory and mitigative efforts on valuable wetlands. Costs are associated with compliance, yet the failure of individuals to correct regulatory violations incurs costs to those already in compliance. Enhanced enforcement ensures that all actors are affected

equally. The benefits of enhanced enforcement efforts are improvements in wildlife habitat, water quality, and overall river basin functioning arising from retarding or halting the degradation of wetlands. The magnitude of these benefits would depend on the success of enforcement efforts and the cumulative negative environmental impacts that are avoided because of better compliance. It is important to note that these benefits should be judged not in comparison to the current state of wetlands, but to the level of degradation that would be expected in the absence of improved enforcement efforts.

Funding Strategy

DEM would request an expansion budget from the General Assembly for the fiscal year 1994-1995.

Management Action 2: Strengthen regulatory programs to protect vital fisheries habitats, which include submerged aquatic vegetation, shellfish beds, and spawning areas by 1995.

Explanation: *Vital fisheries habitats are threatened by water quality degradation, physical destruction and the cumulative impacts of development in the region. Protecting areas in which aquatic organisms breed, live, and feed is essential to the successful propagation of many finfish and shellfish species. Increased protection for vital fisheries habitats will help maintain healthy fish populations for abundant commercial and recreational harvests.*

Critical Steps

1. The Marine Fisheries Commission (MFC) would designate submerged aquatic vegetation and shellfish beds as vital fisheries habitats. MFC and the Wildlife Resources Commission (WRC) jointly would designate anadromous fish spawning areas, also as vital fisheries habitats. MFC recently has taken initial steps toward this action.

2. The Division of Marine Fisheries (DMF) would delineate these vital fisheries habitats with assistance from the WRC and approval from the MFC. Delineation would be accomplished through intensive, site-specific evaluations as currently is the procedure for primary and secondary nurseries. To sufficiently protect vital fisheries, delineation boundaries would include adequate aquatic buffers.

3. After vital fisheries habitats have been designated, appropriate use standards would be applied by regulatory commissions. Several practices already are restricted in these areas. For example, the Coastal Resources Commission (CRC) protects nurseries, shellfish beds and submerged aquatic vegetation from navigation channels and dredging for boat basins. The following practices would be considered for restriction by regulatory commissions in and near designated spawning areas, shellfish beds and submerged aquatic vegetation beds: long haul seine fishing, trawling, clam kicking, dredging, and boating practices that disturb habitats. These policies would build on a protection base provided by existing CAMA and MFC rules.

4. The Environmental Management Commission (EMC) would consider specific water quality protection for vital fisheries habitats. A supplemental water quality classification such as High Quality Water (HQW) could be used for designated spawning, shellfish and submerged aquatic vegetation areas, as is done for primary nurseries. In applying specific criteria or classifications, the EMC would consider maintaining appropriate levels for the following parameters:

   a. In anadromous spawning areas - dissolved oxygen, nutrients, pH, suspended sediment, water flows, temperature, inorganic solids, salinity, lead, chlorine and aluminum.

   b. For submerged aquatic vegetation - light transparency, salinity and nitrate levels.

   c. For submerged aquatic vegetation and shellfish areas - concentrations of inorganic suspended solids and nutrients.

5. The CRC, EMC and MFC would coordinate policies and rules regarding vital fisheries habitats. The DCM, DEM, DMF, and the Department of Transportation (DOT) would enhance and coordinate research, monitoring, permitting and enforcement.

6. Vital fisheries habitats would be considered and protected during the design and siting of agricultural, forestry and other best management practices. Point source dischargers would be located to minimize impacts on vital fisheries habitats.

7. The DCM would consider and address potential cumulative impacts to designated vital fisheries in its Coastal Area Management Act permit review process.

8. The cumulative impacts of fishing, boating and development on vital fisheries habitats would continue to be investigated by DCM, DEM, WRC, DMF, and appropriate federal agencies.

9. DOT would aim to minimize the effects of its construction projects on designated vital fisheries habitats in the design phase.

Evaluation Method

Inventories of designated areas, including acreage and assessments of habitat health, would be necessary to evaluate success of protection measures. Juvenile abundance, shellfish closures, and landings data would aid in habitat protection evaluation.

Costs and Economic Considerations

Delineation and designation of vital fisheries habitats will cost state and federal agencies an estimated $200,000 per year. This figure is equivalent to four additional staff members and includes the study of cumulative impacts from various sources of disturbance and other research, mapping, and development of specific rules. The main economic impacts of this Management Action will come from any restrictions on the siting or operation of point source pollution generators, from requirements for best management practices in agriculture, forestry and urban development, and from restrictions on fishing practices. Such restrictions or requirements might be recommended in areas likely to impact vital fisheries resources, but any recommendations could only be developed after the study of potential sources of disturbance are completed. In some areas, a large number of restrictions could potentially restrict development, reduce land values, make fishing, farming or forestry more expensive and therefore less profitable, or have other impacts. The potential for these impacts should be fully considered as any new rules are developed and applied. The potential economic costs of vital fisheries habitat protection are offset by many potential environmental and economic benefits. Higher quality fisheries habitats could help generate larger harvests or lower harvest costs over the long run throughout the APES region and perhaps beyond. Recreational

fishing could also benefit to the extent that protection leads to improved fish stocks which may then lead to increased revenues from recreational fishermen. Finally, protected vital fisheries habitats could help provide important habitats for many other plants and animals as well as significant water quality benefits. Increases in environmental quality can also provide incentives that promote natural resource-based tourism. In weighing the costs and benefits, it is critical to consider the cost of delaying improvements to vital fisheries habitat protection. If destroyed, habitats may not be replaceable. Efforts to replace lost habitats in the future may be much more costly than efforts to protect them now. The effectiveness of this strategy depends on the successful implementation of other strategies in the CCMP. To achieve the long-term benefit of an increase in fish and shellfish populations, habitat protection needs to be complemented by strategies that protect from the overharvest of future surplus and protect water quality in general.

Funding Strategy
DMF would apply for funding from the Sport Fish Restoration Fund in order to support habitat mapping. Additional funding may be needed from the General Assembly.

Management Action 3: Enhance existing efforts to restore the functions and values of degraded wetlands and vital fisheries habitats. Develop and begin implementing an expanded program to restore wetlands.

Explanation: *Natural areas that have been slightly or moderately damaged may be restored by means such as replanting vegetation, repairing hydrological systems and improving water quality. Expanding restoration will increase the region's acreage of valuable, functioning vital habitats. Research and development of successful restoration techniques will ensure that these efforts are cost-effective.*

Critical Steps

1. Mapping data collected through Objective A, Management Action 2 would be used to determine sites for restoration projects. As they are developed, basinwide ecosystem plans would guide restoration toward those areas that are most vital to the watershed or region.

2. Agencies such as the U.S. Fish and Wildlife Service (USFWS), Wildlife Resources Commission (WRC), Division of Forest Resources (DFR), and Division of Environmental Management (DEM), and the Division of Coastal Management (DCM), among others, would seek funds to develop and demonstrate restoration technology. Restoration demonstration projects should emphasize endemic species such as Atlantic white cedar and longleaf pine. For example, the USFWS is now planning to use a two-year EPA 319 Clean Water Fund grant to develop and conduct restoration projects in the Pocosin Lakes National Wildlife Refuge.

3. The National Marine Fisheries Service (NMFS) would evaluate the potential for expanding efforts to restore submerged aquatic vegetation (SAV) beds, taking into consideration whether sources of degradation have been reduced enough to allow for successful restoration.

4. Cooperative efforts to restore impeded migration routes of anadromous fish (particularly American shad, river herring and striped bass) would continue. An APES-funded research project identified certain dams, culverts, stream channelizations and artificial drainages as obstructing the migration of these species. Through a multi-agency effort coordinated by APES with funding from the federal Coastal America program and technical assistance and hydrologic support from the Army Corps of Engineers (USACE), plans have been made to remove two obstructions. USFWS, WRC and DMF would set priorities for future restorations, taking into consideration the amount, quality and potential use of the habitat.

5. Results and data obtained from the Wetlands Enhancement, Restoration and Creation (WERC) Program [currently being developed by DCM and DEM, with funding from the EPA] for restoration feasibility studies and demonstration projects will be used to establish effective wetlands restoration strategies. WERC is being created to develop and implement a comprehensive wetlands restoration plan for the state and to sponsor wetlands restoration research. Under this management action, implementing the WERC program would allow state priorities to

be set for type- and site-specific restoration under existing state regulatory jurisdiction. WERC would direct restoration spending to where it would generate the greatest environmental benefit. DCM has already budgeted $21,550 for fiscal year 1993-1994 to continue the WERC program. Funding will come from NOAA federal Coastal Zone Management Act Section 309 grants.

Evaluation Method

Restoration goals and priorities would be incorporated into the basinwide ecosystem plans as they are developed. The feasibility and potential effectiveness of restoring submerged aquatic vegetation in the region would be evaluated. The success of these steps also would be evaluated by monitoring the number of landowners participating in habitat restoration or enhancement. Voluntary restoration would be evaluated based on the number of acres, by habitat type, enrolled and successfully restored. An overall evaluation of the effectiveness of these programs in meeting regional goals would be needed.

Costs and Economic Considerations

USFWS would need an additional $100,000 in order to further develop and demonstrate restoration technology in the APES region. Coordination and planning considered in Objective A would help assure that public funds are used where the benefits of restoration would be greatest. Costs of restoration can vary greatly depending on the type of habitat and restoration needed. For instance, a recent review of representative wetlands restoration projects revealed a range from $40 per acre for seeding in a bottomland forest to over $2,500 per acre for restoring a major riparian wetland, including extensive grading, riprap installations and plantings. To evaluate the feasibility of any specific restoration project or program, information would be needed on the effectiveness of different technologies in specific applications, on potential restoration sites and on the question of whether restoration would be successful based on the level of original damage. Because the costs and benefits of restoration vary greatly, the additional expense of careful feasibility studies is justified. Enhancing vital wetlands also can play a critical role in regulating the storage and movement of water in a river basin, and restoring wetlands as part of basinwide water quality initiatives could generate large savings by reducing the costs for flood and wave control structures, stormwater control and treatment, water quality maintenance and vital fisheries habitat protection.

Funding Strategy
USFWS would acquire funding through an expanded budget request to the U.S. Congress and through the creation of partnerships with private industry.

Management Action 4: Establish by 1995 a consistent and effective mitigation program to compensate for unavoidable permitted wetlands losses.

Explanation: *Mitigation compensates for the loss of smaller, fragmented wetlands with the acquisition, enhancement or restoration of larger, contiguous wetlands. A practical and coordinated system of mitigating wetlands damage, that is permitted only after all efforts to avoid and minimize alteration of wetlands have been considered, would ensure the greatest possible long-term benefit to vital habitats. Mitigation banking is a mechanism that allows land developers to alter wetlands in exchange for financial contributions toward the acquisition, enhancement, restoration, or creation of wetlands with similar value. This practice would be evaluated for expanded use in the region.*

Critical Steps

1. The Division of Environmental Management (DEM), in conjunction with the Division of Coastal Management (DCM), the Army Corps of Engineers (USACE), the U.S. Environmental Protection Agency (EPA), the U.S. Fish and Wildlife Service (USFWS), and other involved agencies would continue to develop effective wetland mitigation procedures. State level research and development of nursery techniques for wetland tree species would be encouraged.

2. New mechanisms that coordinate and consolidate wetlands mitigation efforts would be pursued.

3. DEM would explore the feasibility of a mitigation bank in consultation, as appropriate, with agencies, potential mitigation bank users, wetlands restoration specialists and others. If a bank is determined to be feasible, efficient, and effective, wetlands mitigation banks would be created on a manageable scale to compensate for unavoidable losses of wetlands resulting from economic development projects. If mitigation banks are created, DEM, DCM, USACE, EPA, USFWS and other involved agencies would form an interagency team to evaluate wetlands sites and potential bank sites within each basin. Bank sites would be acquired by public or private means. The interagency team would review all proposed projects with anticipated impacts on identified wetlands for compliance and permit authorization. Mitigation of wetlands sites would be completed prior to commencement of a proposed wetlands-disturbing project. The interagency team would identify and incorporate an evaluation methodology for classifying disrupted and mitigated sites to determine mitigation credits and debits. All involved parties would agree to credit and debit procedures as well as restrictions on use of bank credits.

4. Education and public awareness of new state wetland mitigation procedures would be undertaken by DEM and DCM.

Evaluation Method

Individual projects would be evaluated through site inspections and tracked by the interagency team to insure compliance with the mitigation bank agreement. Basinwide wetlands inventories (Objective A, Management Action 2) would be updated on a regular basis to identify trends in wetland type, extent, and function.

Costs and Economic Considerations

In support of this option approximately $500,000 would be needed by DEM to establish a coordinated, statewide mitigation program. One third of this amount, $170,000, would allow the development of a well-managed mitigation program that would coordinate wetland restoration activities associated with both regulatory and non-regulatory programs as well as provide a full accounting of wetlands losses in the APES region. While wetlands regulations can have important economic impacts that should be carefully considered by policy makers, this Management Action does not change current wetlands regulations. It is instead focused on encouraging the most cost-effective use of public and private funds spent on wetlands

mitigation. It would not, in and of itself, change the amount of mitigation that would be required under existing or future regulations. To the extent that consolidation and careful planning of mitigation-driven restoration efforts (such as using some form of mitigation bank) make restoration, management and monitoring more efficient, this Action would yield benefits in the form of more effective public administration and greater water quality from each restoration undertaken. For instance, enhanced water quality supports recreational and commercial activity associated with wetlands, especially recreational fishing and downstream commercial fishing.

Funding Strategy

The development of a mitigation program by DEM would require an expansion budget from the General Assembly. Once established, any mitigation program would be partially funded by entities (public or private) that are required to compensate for the development or alteration of wetlands.

FISHERIES PLAN

GOAL

Restore or maintain fisheries and provide for their long-term, sustainable use, both commercial and recreational.

OBJECTIVE A: CONTROL OVER-FISHING BY DEVELOPING AND IMPLEMENTING FISHERY MANAGEMENT PLANS FOR ALL IMPORTANT ESTUARINE SPECIES.

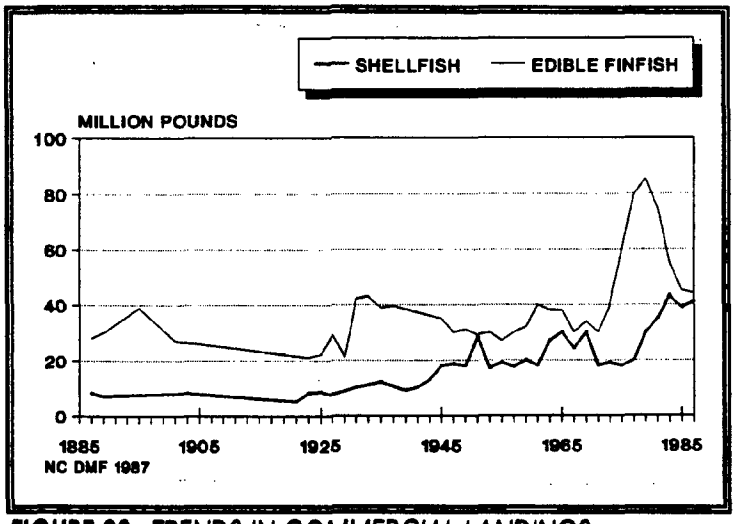

FIGURE 20 *TRENDS IN COMMERCIAL LANDINGS FOR EDIBLE FINFISH & SHELLFISH IN THE APES REGION*

Strategy: The Marine Fisheries Commission (MFC) and Wildlife Resources Commission (WRC) would develop management plans, modeled after those currently used at the federal level, to help ensure the long-term availability of important commercial and recreational species. Figures 21 and 22 illustrate commercial and recreational fishing effort which will be considered in the development of fishery management plans. Where necessary, additional management controls would be recommended to conserve the resource. Recent efforts by the Division of Marine Fisheries (DMF) to develop a state strategic plan lay a good foundation. However, improved and expanded data collection and analysis are necessary. These could be provided in part by modifying the existing marine fisheries license structure.

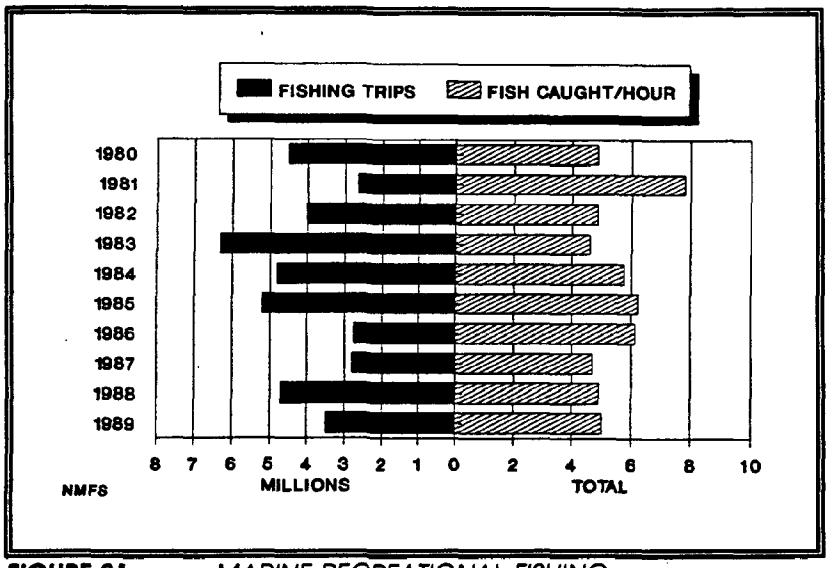

FIGURE 21 *MARINE RECREATIONAL FISHING STATISTICS: NORTH CAROLINA*

Management Action 1: Develop and implement management plans for fisheries that are important to recreational and commercial fishing interests. These plans would include recovery objectives for severely depleted stocks by 1999.

***Explanation**: State fishery management plans will allow the Marine Fisheries Commission (MFC) and Wildlife Resources Commission (WRC) to identify and maintain healthy stocks of important commercial and recreational fish. The plans will enhance depleted and declining stocks and restore economically important species for future harvest.*

Critical Steps

1. DMF has been working to establish a strategic plan to manage important North Carolina fisheries. A comprehensive state framework for fisheries management would be developed in accordance to the Magnuson Fishery Conservation and Management Act of 1976 (Magnuson Act 1976) to include both marine and estuarine species. These plans, developed by DMF and WRC, would set objectives for management of each important species or group of species and recommend management measures to achieve those objectives. Some management plans are currently under development or have been developed. Those which have not been developed will be completed by 1998.

2. The General Assembly would be asked to support financially and in principle the development of additional fishery management plans, including the support staff necessary to develop plans.

3. A Memorandum of Agreement would be considered between DMF, WRC, National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife Service (USFWS), and National Wildlife Service (NWS) to ensure long term cooperation and coordination on sustainable fisheries management plans within the APES region. In accordance with this agreement, state fishery management plans would agree to achieve the objectives of federal inter-jurisdictional fisheries management plans.

4. DMF would collect and analyze data as necessary to conduct stock assessments for the preparation of each management plan. Adequate data exists for several species. But for others, data gaps hinder management decisions. For an analysis of data needs, see the APES report, "Scoping Study of Data Requirements for Fisheries Stock Assessments in North Carolina," by Street and Phalen (1989).

5. Fishery management plans would include goals and recommendations for each fishery. These strategies may include effort control measures such as individual vessel limits, annual trip limits, vessel quotas, individual transferable quotas, time restrictions, area restrictions, various gear restrictions, and limited entry. Strategies would also include habitat protection or bycatch reduction measures. MFC and WRC would adopt and develop rules for each state fishery management plan.

6. The state fishery management plans would guide rule making for the following important commercial and recreational species:

American eel (*Anguilla rostrata*)
American shad (*Alosa sapidissima*)
Atlantic croaker (*Micropogonias undulatus*)
Atlantic menhaden (*Brevoortia tyrannus*)
Atlantic sturgeon (*Acipenser oxyrhynchus*)
Bay scallops (*Argopectan irradians*)
Blue crabs (*Callinectes sapidus*)
Bluefish (*Pomatomus saltatrix*)
Catfish (*Ictalurus* sp.)
Hard clam (*Mercenaria mercenaria*)
Mullet (*Mugil cephalus*)
Oysters (*Crassostrea virginica*)
Red drum (*Sciaenops ocellatus*)
River herring (*Alosa* sp.)
Shrimp (*Penaeus* sp.)
Southern flounder (*Paralichthys lethostigma*)
Spanish mackerel (*Scomberomorus maculatus*)
Spot (*Leiostomus xanthurus*)
Spotted seatrout (*Cynoscion nebulosus*)
Striped bass (*Morone saxatilis*)
Summer flounder (*Paralichthys entatus*)
Weakfish (*Cynoscion regalis*)
White perch (*Morone americana*)
Largemouth bass (*Micropterus salmoides*)

The MFC and WRC would establish requirements and schedules for preparing, updating and evaluating fishery management plans.

7. The WRC would work closely with the MFC in developing and implementing rules for managing estuarine species which overlap in jurisdiction.

8. Where appropriate, management plans would consider restocking severely depleted native species such as Atlantic and shortnose sturgeon. The DMF, WRC, and USFWS would conduct these efforts.

9. The General Assembly would be asked to require fisheries managers to consider the economic and social impact of effort control measures in a manner similar to that required in and consistent with the federal Magnuson Act (1976). Members of the coastal fishing industry (commercial and recreational) would be involved in planning and evaluating these measures. Careful attention would be given to the nature of existing fisheries, with special consideration given to those small-scale fishermen who depend on a variety of seasonal fisheries over the course of a year.

10. The General Assembly would be asked to grant MFC and WRC authority to limit entry in fisheries as necessary to prevent over-fishing.

11. DMF would consider and recommend measures to restore shellfish populations (hard clams, oysters and bay scallops) within fishery management plans. Currently, shellfish population enhancement is done through a seeding program at the University of North Carolina Institute of Marine Sciences (funded by the General Assembly and APES) and

the Oyster Rehabilitation program of DMF. Oyster seeding projects would target historical oyster beds and would include potential high-growth sites as identified by Ortega and Sutherland (1990) in an APES funded project. Oyster aquaculture (intensive production on rafts or other artificial structures) would be promoted as another way to increase oyster populations. The state would evaluate the feasibility of an oyster hatchery to enhance populations.

12. Management planning for striped bass would address recommendations made in the Striped Bass Management Board report on species recovery in the region. These recommendations would be evaluated and implemented as necessary. This is a complex issue that demands the continued cooperation of North Carolina, Virginia, and federal agencies.

13. Management plans would be subject to external peer review to provide for a high level of scientific quality.

14. Management plans would be subject to public review in public meetings to consider the effectiveness and impact of proposed strategies, as well as possible alternative strategies.

15. A schedule would be set for future updates of management plans.

Evaluation Method

Evaluation of fishery management plans would occur during the annual development of management rules by the MFC and WRC. The effectiveness of regulatory methods to limit entry would be assessed in terms of social and economic costs to the fishing community and impact on fish stocks. For severely depleted stocks, or those for which replenishment has been recommended, evaluation should be based upon the status of the stock. Plans for the above listed species should be completed by 1998.

Costs and Economic Considerations

Administrative costs for developing a fishery management planning process have been estimated at $300,000 per year for five years. Staff requirements to implement planning include at least one biologist, one economist, one population dynamics specialist and three data collection technicians. Fishery management would result in long-term benefits through improved stocks. These benefits could include larger harvests, greater profits for commercial fishermen, lower prices for consumers, better trips for recreational fishermen, and economic benefits to communities with ties to commercial and recreational fishing. Shellfish enhancement, for

example, would benefit not only the fishery but potentially benefit water quality through increased filter feeding. Where management plans result in greater restrictions, some fishermen may experience short-term economic losses. Consideration of socioeconomic characteristics can help address the equity of such regulations.

Funding Strategy

Although the federal sources of grant money are appropriate for the development of fishery management plans, much of this action would need to be funded by expanding DMF's budget. If modifications in the fishing license structure are made and revenues are generated, money collected from license fees could be used in lieu of state appropriations. WRC would use existing resources to complete the development of freshwater and interjurisdictional fishery management plans.

Management Action 2: Modify the existing marine fisheries license structure to improve data collection with respect to landings, demographics and fishing effort, and to generate increased revenues for fisheries management.

Explanation: *A license system that enhances fisheries data collection is critical to developing and implementing state fishery management plans. The data collected is necessary for additional research on how regulations impact the fisheries. License revenues can support fisheries research, habitat restoration and other management improvements.*

Critical Steps

1. The General Assembly would continue efforts by a legislative study committee to determine how to modify the marine fisheries license structure to improve data collection and generate additional revenues. Options include establishing a saltwater recreational fishing license, expanding or modifying existing gear license fees (such as modifying the

license fees to account for differences in fishing effort), integrating new license requirements with existing ones, and simplifying the overall licensing process and structure.

2. The Marine Fisheries Commission (MFC) would consider using its existing authority to issue gear licenses. Other new licensing procedures may be flexible, considering allocation and equity issues and be implemented as necessary to conform to new fishery management plans.

3. Revenues generated by the new license sales would be directed toward fisheries management and enhancement.

Evaluation Method

Modifications to the license structure would be completed by 1995. DMF would evaluate the new structure's ability to collect data and the simplicity of license requirements.

Costs and Economic Considerations

The costs of modifying the existing marine fisheries license structure will depend on how data gathering is improved and whether new licenses are implemented. A bill to establish a license to sell fish has already been passed by the legislature. If a recreational salt water fishing license is implemented, start up funds may be needed, however, the amount of funds required will depend on how the license structure is modified. Once the license is implemented, revenues from license fees should more than offset government costs of operating and enforcing new license programs and managing data. In fact, in other states that have implemented a recreational salt water fishing license, revenues have far exceeded the cost of administering the license, and have funded data collection and research to improve recreational fishing. For example, in South Carolina, Virginia, and Florida, 5 to 10 percent of the revenues from marine recreational fishing license fees go to administration. The rest are earmarked for fisheries research, public education, enforcement, habitat protection, acquisition and other programs to benefit recreational fishing. In addition to facilitating better data collection and generating revenue to fund marine recreational fishing enhancement, revenues from the implementation of a marine recreational fishing license would help the state secure more federal Sport Fish Restoration matching funds for fisheries management enhancement.

License fees would have some impact on fishermen; the effect depends on which licenses are implemented and what fees are established. Setting reasonable fees would minimize the impact on tourism. Modifying the license structure would benefit the public by supporting fisheries management that is both biologically and socioeconomically sound.

Funding Strategy

No additional state agency program costs are anticipated to modify the existing marine fisheries license structure. Establishing a new marine recreational fishing license would entail first-year start-up costs. These costs could be offset by revenues from the license program. After the first year, revenues from license fees would cover administration of the licenses as well as research and other initiatives to enhance marine recreational fishing.

OBJECTIVE B: PROMOTE THE USE OF BEST FISHING PRACTICES THAT REDUCE BYCATCH AND IMPACTS ON FISHERIES HABITATS.

Strategy: The Division of Marine Fisheries (DMF) and the UNC Sea Grant Program would continue to develop effective methods to reduce bycatch. New measures would be considered as they are proven effective. Commercial and recreational fishermen would be closely involved in developing bycatch reduction measures. DMF would develop best fishing practices, similar to agricultural best management practices, to preserve fisheries stocks and habitats. The model of cost sharing for agricultural best management practices would be employed for developing a similar program for best fishing practices.

Management Action 1: Continue and expand the development of bycatch reduction gear and practices, and require their use as practicality is demonstrated. Aim to reduce inside trawl, long haul seine, pound net, and gill net bycatch by at least 50 percent by 1995.

Explanation: *Minimizing non-targeted harvests will preserve the diversity of fish populations and support the long-term use of fisheries resources. Implementing efficient and effective measures to reduce bycatch eventually may result in lower costs to commercial fisherman.*

Critical Steps

1. The General Assembly would be asked to provide stable, long-term funding for a bycatch reduction program in DMF.

2. DMF would use this funding to create a bycatch reduction program and achieve the above bycatch reduction objective. The program especially would pursue methods that minimize capture of non-target organisms and loss of the target catch. (These measures also may improve the efficiency of some commercial fishing practices by reducing unnecessary weight in hauls and time required for sorting catches.)

3. The DMF would improve bycatch estimates so that progress toward the above objective can be accurately assessed.

4. Commercial fishermen would be closely involved in developing bycatch reduction methods, since they can provide valuable information. Their involvement also provides an opportunity to evaluate the social and economic impacts of new measures. (The cost share program discussed in the next management action would compensate fishermen for their time and effort.)

5. When a bycatch reduction practice is demonstrated to be practical and effective, the Marine Fisheries Commission (MFC) would require its use. (The cost share program discussed also would help implement such requirements.)

6. MFC would evaluate the need to reduce current bycatch allowances or would enhance enforcement efforts to achieve the above objective. (Currently, estuarine trawl fisheries are allowed to take 1,000 pounds of finfish per vessel, plus an unlimited quantity of flounder of legal size. Pound net and long haul seine operations may land 5,000 pounds of scrap fish per vessel per day.)

Evaluation Method

The program would use gear and fishing practice testing results, as well as bycatch estimates, to calculate the projected reduction of each new required practice.

Costs and Economic Considerations

An average of $200,000 per year for five years is needed to establish a gear development program in the DMF and to fund gear research in the trawl, long haul seine, pound net and gill net fisheries. Fishermen would

have to pay for equipment to comply with new restrictions, although much of these costs would be offset by the cost share program described below. A greater ability to target the catch may result in lower culling and towing costs. Possible increased catches may mean lower overall fuel and equipment costs although reduced catches may result in some cases if new gear results in increased fishing time. Stock increases may mean lower fish prices for consumers, and better trips and increased spending by recreational fishermen.

Funding Strategy

Some federal funding sources are eligible for this action but are largely unavailable. Costs of this action would need to be covered through an expansion of the DMF's budget. License fees may contribute to funding research of bycatch reduction gear if available.

Management Action 2: Institute a cost share program for best fishing practices for commercial fishing gear by 1995.

Explanation: *A cost share program would help alleviate the financial burden and encourage commercial fishermen to implement best fishing practices.*

Critical Steps

1. The General Assembly would be asked to establish and fund a Best Fishing Practices Cost Share Program, using the N.C. Agriculture Cost Share Program as a model.

2. The Best Fishing Practices Cost Share Program would:

    a. make funds available to develop best fishing practices. These funds would encourage fishermen to become involved in experiments with new fishing gear or methods by compensating them for their time, effort and the use of equipment;

b. share costs with fishermen who voluntarily use approved best fishing practices; and

c. share costs with fishermen to implement new requirements for the use of best fishing practices. In the second and third tiers, cost share funding would be available to existing fishermen only, since the program is intended to mitigate the costs of modifying existing gear and practices. New fishermen can adopt these measures as they begin fishing.

3. Where cost sharing involves purchasing new gear, fishermen receiving funds would trade in their old gear to remove it from use.

4. For practices in the third tier, funding should be fair and equal, rather than on a first-come, first-served basis.

5. The Marine Fisheries Commission (MFC) would develop a policy for implementing the Best Fishing Practices program. The Commission would approve practices as eligible for cost sharing, determine levels of funding for each approved practice and compensate fishermen who help develop these practices. In making such policy decisions, the MFC would consult its regional advisory committees.

6. In the establishment of this program, the use of alternatives to direct cost sharing, such as income or property tax breaks, would be considered.

Evaluation Method

The cost share program should be established by the end of 1995. The program's effectiveness could be evaluated by assessing compliance with regulatory best fishing practices and by estimating use of voluntary practices.

Costs and Economic Considerations

An average of $200,000 per year for five years is needed to establish and implement a cost share program for best fishing practices for commercial fishermen through the Division of Marine Fisheries (DMF). Program costs include start up costs, yearly administrative costs, leasing of commercial fishermen's boats and payment for their participation in gear research projects, technical assistance and the provision of cost share funding to commercial fishermen to phase in gear changes and modifications for their trawls, long haul seines, and pound nets. The 25 percent share borne by fishermen has been estimated at $5 to $10 per net for installing revised

finfish excluder devices on trawls, $37.50 per rig for long haul seine modifications, and $12.50 per net for pound net modifications (RAI 1993, draft).

Funding Strategy

Establishing a cost share program would require an appropriation from the General Assembly to cover start-up costs, annual administrative costs, and the costs of gear changes and modifications.

STEWARDSHIP PLAN

GOAL

Promote responsible stewardship of the natural resources of the Albemarle-Pamlico region.

OBJECTIVE A: PROMOTE LOCAL AND REGIONAL PLANNING THAT PROTECTS THE ENVIRONMENT AND ALLOWS FOR ECONOMIC GROWTH.

Strategy: Different planning requirements affect the cities, towns and counties of the APES region. In North Carolina, coastal communities must prepare land use plans. Counties that provide public water service must prepare water supply plans. And counties with water supply watersheds must plan for protecting those areas. Virginia requires comprehensive planning for all counties, and tidewater counties have specific environmental standards. While these requirements result in environmental planning for many parts of the region, many local communities -- as well as local natural resources -- would benefit from expanded comprehensive planning aimed at meeting both environmental and economic goals. To accommodate future growth and change while preserving the quality of life within the estuarine area, North Carolina would augment existing regulations with a proactive, voluntary planning initiative. Specifically, in the APES region, the state would fund local plans that address the combined goals of economic growth and environmental protection. The state would provide six planners proficient with Geographic Information Systems (GIS) who would provide technical assistance for local economic and environmental planning. As an incentive, the state would give localities with approved environmental plans higher priority for construction funds from the State Revolving Fund. To support local environmental and economic planning, the state GIS in the Center for Geographic Information and Analysis (CGIA) would be more accessible and affordable. The APES program has funded the development of numerous data layers on this system. Within the region, a few councils of government, counties, and municipalities already have GIS systems in place. Local government planning would benefit from affordable and up-to-date GIS data. The state would fund CGIA sufficiently to provide access to the standardized GIS database at affordable rates. CGIA would update GIS data layers as needed. (See Management Action 2 under Objective A in the Vital Habitats Plan.) Providing GIS work stations at the three DEHNR regional offices that serve the APES region would make the system even more accessible.

Management Action 1: Support local planning by providing funding and economic incentives to local governments to integrate environmental and economic planning by 1999.

Explanation: *Local planning gives governments the opportunity to direct their own growth and enables private investors and local citizens to make informed decisions. Comprehensive planning also promotes economic development and environmental protection that are compatible. Financial assistance to local communities would encourage land and water uses that have the least impact on natural resources while promoting sound economic growth, including increased opportunities for nature-based tourism.*

Critical Steps

1. DEHNR would work with the Department of Commerce (DOC) to introduce legislation in support of a local government planning program. This legislation would include the addition of six new staff members to the Division of Community Assistance (DCA) within the DOC to provide technical assistance to local planners and establish a grant program to fund 80 percent of the cost to local governments for the development of local economic and environmental plans.

2. In the 1995-1996 legislative planning year, the General Assembly would be asked to approve funding for this proactive planning initiative for the APES region, covering costs of grants to support local environmental and economic planning and regional planners to assist local governments.

3. Once legislation is approved, DCA would hire six regional planners to provide technical assistance to local governments in the APES region. These planners would be GIS-proficient so that they could aid in the use

of the APES GIS data base. Planners would be located in the DCA regional offices in Washington, Raleigh and Wilmington. They would provide local governments with GIS and planning expertise, and would act as liaisons for the state while supporting local governments in environmental planning.

4. Funding for local plans would be available through DCA grants. In exchange for grant funds, local governments would agree to prepare integrated environmental and economic plans in accordance with planning guidelines. DCA grants would cover 80 percent of the cost of developing plans. Coastal counties and municipalities would be eligible for funding to augment existing Coastal Area Management Act (CAMA) land use plans. Coastal counties could use funding for additional maps (such as standardized land classification maps), additional implementation strategies and/or water use plans.

5. DCA would form a Joint Committee with the Division of Coastal Management (DCM) and the Division of Environmental Management (DEM). This committee would oversee the grant process and develop planning and implementation guidelines. The planning liaisons would act as staff for the Joint Committee.

6. By 1996, the Joint Committee would develop a targeting strategy for funding local plans, via a grant application and approval process that considers such factors as special regional environmental and economic concerns, population and development trends, land use conversion trends, and innovative planning and implementation strategies.

7. By 1996, the Joint Committee would develop an incentive strategy, based on giving localities with approved environmental plans higher priority for construction moneys from the State Revolving Fund.

8. By 1996, the Joint Committee would design and implement a review process for local plans, implementation strategies, and updates. This process would review local implementation strategies for consistency with local environmental plans. The following agencies would be included in the review process: DCA (to consider commerce-related issues), DCM (to review plans from coastal counties and municipalities), and DEM (to review plans for compliance with environmental guidelines).

9. Planning and implementation guidelines would be developed by the regional planners under the Joint Committee oversight. Guidelines for development would include frequent opportunities for input from local officials and planners. Guidelines would ensure that participating local governments address issues vital to protecting the natural and economic values of the estuarine area. General planning guidelines would incorporate requirements for data collection and analysis, community participation, policy development, implementation and evaluation, and land classification maps based on the State Land Use Classification System. To receive full funding, environmental plans would be required to incorporate land use, public water supply, and water disposal elements. Where environmental plans have already been developed, some funding may be available for the implementation of the plans. Availability and distribution of grant money would be determined by the Joint Committee. Plans also would be required to explore options for balancing public access to public trust areas with the preservation of public resources (in conjunction with 15A NCAC 7M 0300. G.S. 113A-1334.1 et seq; and Section 315 of the federal Coastal Zone Management Act of 1972). Water use planning, including public access planning for the ocean, estuarine, and riverine shoreline would be encouraged. (see APES Publication Number 90-10, Clark, "A Pilot Study for Managing Multiple Use in the State's Public Trust Waters".) Guidelines would address concerns for vital area and water quality protection described elsewhere in this document (see Vital Habitats Plan, Fisheries Plan and Water Quality Plan). Plans would address potential water use conflicts and access to public trust areas. Guidelines would be flexible enough to allow for innovative planning and implementation strategies, such as eco-tourism designs and land-use-guidance systems (LUGS). (For model Land Use Guidance Systems, see Burke County, N.C. "Land Use Management Ordinance" or Bedford County, Virginia LUGS plan; for eco-tourism designs, see "Eco-Tourism in Tyrrell County", Chapel Hill, N.C.,1993; or Coastal Initiative Committee, "A Guide for the Development and Revitalization of the Waterfront", Columbia, N.C., 1992.) Planning guidelines would require consistency between implementation strategies and environmental plans. Implementation strategies could include infrastructure investment designs, subdivision ordinances, zoning, land use guidance systems (LUGS), and/or other devices.

10. Because environmental planning must consider entire water bodies and drainage basins to effectively protect natural resources, the six planners would encourage local jurisdictions to coordinate with adjacent counties and municipalities and other agencies to promote regional planning

efforts. Guidelines would be designed to allow for the possibility of eventual coordination with a state-wide planning effort (such as revival of the Land Policy Act or legislative action on the Partnership for Growth).

11. The regional planners would encourage local governments to coordinate other local planning efforts (such as economic development plans, land development plans, policy development plans, and strategic plans) with environmental plans.

12. The state of Virginia would work with the state of North Carolina to ensure a similar level of local planning in the Virginia portion of the APES watershed.

Evaluation Method

DCA would maintain an ongoing count and inventory of local planning documents and implementation strategies funded by this program to determine the extent to which funding is being used to develop and implement local environmental plans. DCA would perform a periodic survey of local governments and the public to assess local government perception of the effectiveness of environmental planning liaisons, determine the perceived value of services provided, and to estimate unmet demands for local environmental planning. DCA would examine each Albemarle-Pamlico river basin in five-year increments to determine whether population, development, and land use conversion pressures and public access needs have been managed effectively by local planning and implementation strategies. In determining the effectiveness of local growth management on environmental protection, DCA would use relevant DEM indicators (from water quality monitoring data) to determine the effect of local environmental plans on water quality in the region.

Costs and Economic Considerations

Twenty North Carolina counties would need full funding for planning. Sixteen coastal North Carolina counties would need partial funding to augment existing plans. Local plans and implementation strategies would receive funding for 80% of the cost of developing plans. Assuming that municipalities are covered under county plans, and that there is full participation by all counties that are eligible, it would cost state government an estimated $450,000 per year to implement this Management Action. It would cost local governments an additional $38,000 per year per county to develop individual plans. Other local government costs would be incurred for ordinance updates, enforcement, and other administrative costs. (Note that the costs of planning in Virginia communities have not been included

here.) Local planning serves the local economy by helping government and private citizens predict and guide future development patterns in their community, making it a more desirable place to live. Guiding growth is also important to local fiscal stability -- rapid development can, in many cases, lead to higher infrastructure and public service costs, and in turn, to higher taxes. Effective local environmental planning can provide for such public amenities as resource preservation, open space, park land, and public access to public trust areas. Planning can give local citizens more control over resources and activities within their government's jurisdiction. Environmental planning can help preserve and enhance the value of land and other resources for the future production of both market and non-market goods and services desired by the community. In addition, local planning enhances total economic benefits of land by reducing conflicts between incompatible land uses. For each plan that is developed, these benefits should be estimated and weighed against the economic impacts of the plan. In certain circumstances, land use controls (such as zoning) that could result from the environmental planning process can reduce the relative value of regulated land. In some cases, housing costs could increase and the availability of low-cost housing could decrease if restrictions on land or water use are very broadly applied (for instance, if they do not allow for construction demand to be fully shifted from regulated areas to unregulated areas). Typically, land use controls related to environmental protection would not have this impact since development demand can usually be met on less environmentally sensitive lands in the same area. Water use controls, if needed, would similarly reduce the options for development for landowners. This would need to be judged in comparison to the benefits to the community that any water use controls would generate in terms of water quality. Another important consideration in environmental planning is the need to ensure that land and water use plans are as fair and equitable as possible, balancing the rights of individual landowners, public trust users, and others with the public's interest in maintaining environmental quality.

Funding Strategy

DEHNR would take the initiative to develop legislation for an economic and environmental management program. State appropriations would be needed to cover the costs of hiring 6 regional planners and the money necessary to fund grants to local governments. Although at this time federal grants are not available to fund this action, DCA would seek out and use any appropriate federal funds to augment state appropriations. The cost of GIS regional workstations and maintenance will be discussed in the following management action. The Joint Committee, including DCA, DCM, and DEM will be formed using existing staff and resources.

Management Action 2: Provide to local governments affordable and accessible data from the state Geographic Information System (GIS) for use in planning and public education within the region by 1996.

Explanation: *Local comprehensive plans influence private and public development and management decisions, and should be supported with accurate and timely geographic information. Increasing the availability of state GIS data to local governments will help in environmental and economic planning.*

Critical Steps

1. The General Assembly would be asked to authorize and appropriate funding for the Center for Geographic Information and Analysis (CGIA) sufficient to allow the Center to provide easy and inexpensive access to APES' GIS database. Using these funds, CGIA would provide an accessible, affordable GIS database to local, regional, and state agencies by 1996. CGIA would continue as the state agency responsible for the APES GIS database and would oversee regular updates of land use, land cover, and other relevant databases.

2. The General Assembly would be asked to authorize and appropriate funding for CGIA to maintain new GIS systems for use in the study area and to hire three additional staff members: one in the central office to provide assistance to local, regional, and state agencies and two in regional offices to train and assist the six planners from the Division of Community Assistance (DCA) with GIS systems.

3. CGIA would develop and implement a reasonable pricing system for access and use of the CGIA database by 1995.

4. CGIA would establish three GIS work stations in the regional offices of the Department of Environment, Health, and Natural Resources (DEHNR), by 1995. The six planners from the DCA (described in Step 4, Management Action 1) would provide GIS assistance to local governments in accessing GIS planning information. For example, the planners would work with local governments, upon request, to perform GIS suitability analyses, environmental assessments, demographic characterizations, and other environmental and economic planning functions. (Refer to Vital Habitats, Objective A, of this document for more information on GIS data base updates that would be available for use at the regional work stations.)

5. The two new regional CGIA staff members would work with the six DCA planners to provide outreach into the APES study area. CGIA would coordinate with the six planners to provide technical assistance, including workshops, in the use of GIS and the APES database, by 1995. The planners would travel, as needed, to municipal, county, Council of Governments (COG), or state offices to provide workshops and ongoing GIS assistance to government staff for use in developing environmental plans.

6. To educate the public on the potential values of GIS technology relative to environmental and economic considerations (soil suitability, inventory of existing land uses and so forth), CGIA would provide public displays and demonstrations of GIS systems at a pilot "education station" in an aquarium or other eco-tourism location within the region by 1995.

7. CGIA would develop a database plan for geographic information that scales maps with greater resolutions.

8. Beginning in 1996, CGIA would oversee the process of updating all existing and new databases as needed, including a periodic statewide land use/land cover inventory. CGIA would oversee updating Land Cover maps every five years. (See Vital Habitats, Objective A)

Evaluation Method

During review of local plans, DCA would evaluate the effectiveness of the GIS system in providing relevant, useful, accurate and timely information for local environmental planning and implementation. DCA would conduct a periodic survey of local governments to assess the accessibility, affordability, and usefulness of the GIS system in plan development.

Costs and Economic Considerations

CGIA is not currently funded directly through state appropriations. Instead, CGIA supports the state's geographic information management program through cost-recovery based agreements. This project calls for ongoing funding to ensure long-term maintenance and operation of the APES GIS database and to support a training and education program that promotes the APES geographic information system capabilities. Additional annual funding would support the universal needs of the state's geographic information system user community and enhance communication links among government agencies. Initial costs of implementing this action would be $200,000 for equipment and installation of GIS systems. Annual administrative costs to implement this action would be $460,000. This figure includes $180,000 annually to fund three additional staff members, $200,000 annually to oversee and update all existing and new databases under the land use/land cover initiative, $30,000 annually for maintenance of three new regional GIS workstations, and $50,000 in support and operations fees for other database layers. Local governments wishing to use CGIA services and data would incur some costs, but the rates would be lower than at present. Providing to local governments affordable, accessible GIS data would reduce local costs of data gathering, storage, analysis, and presentation. GIS technology has the potential to greatly improve efficiency in the provision of many public services, including land use planning and natural resource management. For instance, GIS has been successfully used to improve fire and police protection, as well as public works planning and maintenance. With respect to environmental protection, local governments would have access to a vast library of reliable GIS data. Local officials could use the system to analyze the potential impacts of new development proposals, new regulations, or new land use ordinances on the local economy and tax base, thereby identifying potential opportunities, problems, costs and benefits of various scenarios.

Funding Strategy

CGIA activities has been funded by fees for the services they provide. In order to expand the program to meet the planning needs of the Albemarle-Pamlico region, additional staff members would have to be funded by state appropriations. The USGS Innovative Partnerships Program and the federal Geographic Data Commission's competitive grants for coordination of state-wide uses may be possible funding sources for the maintenance of data, but the amount actually available will vary. State appropriations would have to cover additional operation costs in order to keep costs low to local governments.

Management Action 3: Implement a comprehensive, coordinated and proactive approach to managing the state's public trust waters by 1996.

Explanation: *North Carolina holds the waters, the lands beneath them and the resources living in them in trust for its citizens. The state has the authority and responsibility to preserve their natural value as a part of our common heritage. Several state agencies are responsible for the stewardship of this public trust. As the region's population continues to grow, public use of the sounds and waterways will increase as well. Greater conflicts are likely between various groups, including those who use the resources of public trust areas for profit. Therefore, closer coordination is necessary between the agencies that manage these resources. Public trust policy should be proactive and should consider issues related to future population growth, including public access and compensation for uses of public trust resources.*

Critical Steps

1. A management committee consisting of state government departments and agencies involved in managing public trust waters would be formed. This committee would be comprised of the Department of Environment, Health, and Natural Resources (DEHNR), Department of Administration (DOA), and Department of Justice (DOJ). In DEHNR, the following divisions would participate: the Division of Environmental Management (DEM), the Division of Coastal Management (DCM), Wildlife Resources Commission (WRC), and the Division of Marine Fisheries (DMF). Coordination with private conservation groups as well as other involved state agencies such as the Division of Water Resources (DWR) and the Division of Parks and Recreation (DPR) would be important.

2. The committee would ensure that there is coordination in the development of state policies for public trust waters.

3. The committee would evaluate the feasibility and practicality of establishing a system that provides compensation for activities which affect and use public trust resources. For example, fees might be charged for marinas and piers and license fees might be paid by recreational saltwater fishermen.

4. The committee would promote and balance efforts to balance access and use with public resource preservation.

Evaluation Method

Implementation would be indicated by the development of policies which consider and improve management of public trust issues.

Costs and Economic Considerations

This Management Action would cost the state agencies involved an estimated additional $75,000 over the next two years for feasibility studies of compensation mechanisms for the private use of public trust resources. Other components of this Management Action would incur no incremental costs to government unless some compensation mechanism is established. If so, a fee system would incur additional administrative costs that would be determined by the complexity of the system. Fees or other forms of compensation that the interagency committee might recommend could have a significant economic impact on the most directly affected users. The magnitude of this impact is entirely dependent on the fees that could be proposed; they might be nominal or they might be large enough to significantly reduce profitability of private operations or inhibit new development in public trust areas. These impacts are unlikely to be large from a regional perspective but could be important locally if there is a strong likelihood of marina development, commercial oyster bed development, or other public trust use development and if there are only a limited number of alternative sites for this development. Balancing this economic cost is the fact that funds raised by compensation mechanisms could be reinvested by the state into improving public access to estuarine areas and other improvements in public trust management. Any compensation mechanism should be designed to assure that the economic and environmental benefits outweigh the expected economic costs. This would include taking into consideration the impact on local communities as well as on vital estuarine resources. For instance, a fee system could be used to minimize the impacts of new development on vital fisheries habitats that would be affected (see Management Action 4, Objective B of the Vital Habitats Plan).

Reduced threats to these habitats could help commercial and recreational fishing.

Funding Strategy

The coordinating function of this management committee should not impose additional agency costs. If incremental costs arise, the agencies involved will absorb those costs into existing authorities. The management committee will determine which agencies are to conduct feasibility studies. Feasibility studies would require state appropriations for some of the administering agencies. Where possible, federal grants, such as the U.S. National Park Service's Land and Water Conservation Fund, will be used.

Management Action 4: Provide support to organizations that promote nature-based tourism and environmental education as a way of fostering environmentally sound economic development in the region.

Explanation: *The mission of the recently formed Partnership for the Sounds is to promote economic development through environmental conservation, education and nature-based tourism. The Partnership seeks to educate people who come to the Albemarle-Pamlico region to enjoy its natural environment. The more people know about the ecological balance of a region where they vacation or earn a living, the more invested they will be in the stewardship of its resources.*

Critical Steps

1. The General Assembly would be asked to support, both financially and in principle, the development of the Partnership for the Sounds. The Partnership would pursue a mission of regional economic development through nature-based tourism, as well as provide administrative oversight for three new environmental education centers which will be built in the Albemarle-Pamlico watershed. A non-profit, non-advocacy

Board of Directors comprised of representatives from local government, non-profit organizations, businesses, and resource managers would direct the Partnership.

2. The General Assembly would be asked to support the establishment of new environmental education/interpretive centers in the APES region by appropriating funds to help staff and operate these centers. Local, federal, and private/philanthropic funds would also be utilized in this effort. Three new environmental education facilities that are already in planning stages and have funding efforts underway are:

    1. An Estuarine Education Center -- Where the Rivers Meet the Sea (located in Washington, NC) -- whose prototype originated in an APES-funded project and is envisioned to include interactive displays that would attract and educate regional residents, students, and tourists;

    2. The Walter B. Jones Sr. Center for the Sounds (located in Columbia, NC), which will be a visitor's center focusing on the Pocosin Lakes-Alligator River national wildlife refuge area;

    3. Refurbishment of the old pumping station at Lake Mattamuskeet (in Hyde County) to serve as a university field research station and retreat for conferences.

    These centers, and the numerous other local, state, and national parks, refuges, forests, and natural areas in the region would be the main attractions for the ecotourism initiative. Educational centers and activities taking place in natural areas would stimulate economic opportunities in the region, thus creating an economic reason for conserving and protecting the natural systems. At the same time, broader knowledge of the systems' ecological value would promote a greater sense of stewardship among the public.

Evaluation Method

The establishment and long-term existence of the Partnership and the educational centers are easily measurable and would reflect the relative success of the effort.

Costs and Economic Considerations

A state appropriation of $846,000 has been allocated for design work on the three proposed facilities and initial staffing for the Partnership. Federal and philanthropic grants have supplemented this appropriation and funded the

development of a regional strategy for nature-based tourism. The strategy will include environmental education and marketing plans for the region. State, federal, local, and philanthropic/non-profit support would continue to be needed in the future. The intent of the Partnership is to stimulate economic opportunities in the private sector related to nature-based tourism and associated activities. Also, numerous job opportunities would be created through staffing for the Partnership and the educational centers. Economic benefits should accrue in the region due to this effort.

Funding Strategy

Long-term funding for the Partnership and the educational centers will require a diverse funding strategy. In addition to the anticipated state and federal assistance, allocations from some local governments, businesses, individuals, and philanthropic foundations would be required. Federal granting programs under the U.S. Environmental Protection Agency (EPA), National Oceanic and Atmospheric Administration (NOAA), and U.S. Fish and Wildlife Service (USFWS) are likely sources for federal funding. Private foundations, including the Bryan Family Foundation and the Z. Smith Reynolds Foundation, have been supportive of planning efforts for the educational facilities. Other broad-based fund-raising efforts among citizens in the region would need to be pursued by the Partnership's Director and board.

OBJECTIVE B: INCREASE PUBLIC UNDERSTANDING OF ENVIRONMENTAL ISSUES AND CITIZEN INVOLVEMENT IN ENVIRONMENTAL POLICY MAKING.

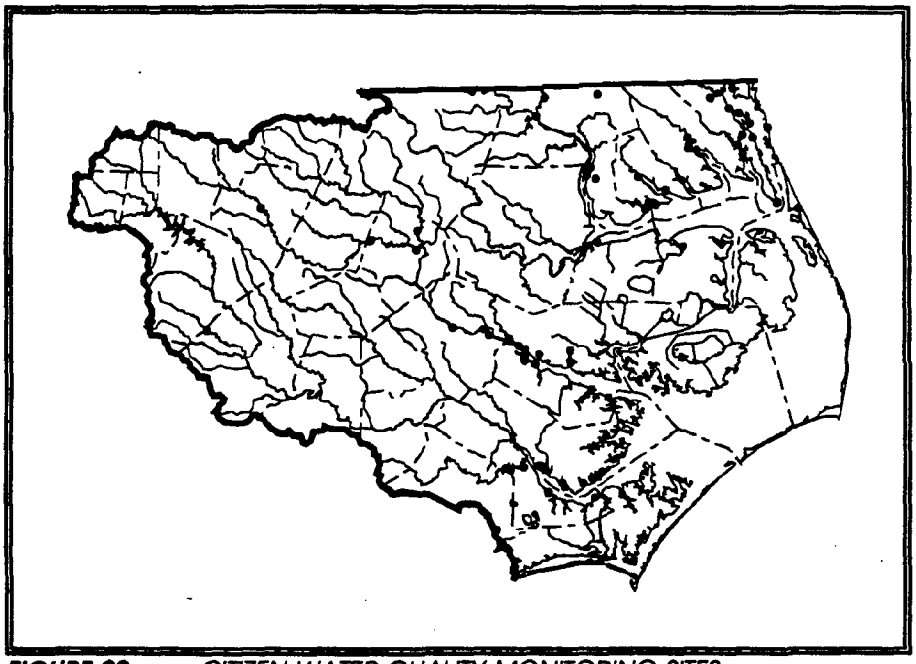

FIGURE 22 *CITIZEN WATER QUALITY MONITORING SITES IN THE APES REGION*

Strategy: A combination of state, federal, and local efforts would be undertaken to broaden opportunities for the public to learn about the Albemarle-Pamlico estuary and management issues surrounding it. APES has been the stimulus for a variety of recent proposals and initiatives involving estuarine education, some of which are already underway, like the Citizen's Water Quality Monitoring Program (CWQMP). Figure 23 shows CWQMP sites in the region. Continuation of these initiatives beyond the Study, in addition to several new efforts, would form the basis of a long-term program of public involvement and education. Information about economic and cultural issues as they relate to estuarine protection would be integral to this undertaking. Efforts should be made to coordinate programs as much as possible with the Coastal Futures Committee and Year of the Coast activities which will occur during 1994 and will focus public attention on coastal issues.

Management Action 1: Expand and coordinate education projects about the Albemarle-Pamlico estuary, focusing on both environmental and economic issues.

Explanation: *The future security of the estuary depends on whether people who live, work, and vacation there understand its environmental challenges. These education efforts must be innovative, must include adults as well as children, and must take place outside of traditional school settings as well in the classroom.*

Critical Steps

1. The Department of Environment, Health, and Natural Resources (DEHNR) Office of Environmental Education (OEE) would expand its function to work with environmental education programs both within DEHNR and external groups (community colleges, educational centers, non-profit and citizen groups, and other interested organizations) to provide accurate and unbiased education about the estuarine region. Much of OEE's efforts would be directed toward coordinating and distributing materials which have already been produced through APES and many other programs, but are not reaching a wide enough audience. Seminars, classes, public forums, and similar activities would be other ways of providing necessary public education. The best way to administer this expanded effort would be to locate an OEE staff position in each of the two DEHNR regional offices (Washington and Raleigh), as well as an additional staff person in the central OEE office.

2. OEE would promote and coordinate partnerships between government, user groups, interest groups, and the public to provide environmental education experiences for people of all ages. Too often there is a lack of knowledge among groups as to the variety of efforts to protect the estuary being undertaken by other groups.

Fostering partnerships and more interaction between differing interests would lessen the tension caused by this lack of knowledge, as well as open up avenues of greater cooperation and understanding in the future.

3. In addition to expanded environmental education programs, published information about the estuarine environment, including related economic and cultural concerns, would continue to be produced and distributed to the public on a regular basis. This would include a newsletter that would contain articles on estuarine functions and on estuarine management and opportunities for citizen input into that management. There is currently no publication devoted to providing an overview of all agencies involved in estuarine management. This newsletter could be mailed to the mailing list of the APES newsletter, which now reaches nearly 16,000 people. Any interested citizen could request to be placed on the mailing list.

Evaluation Method

There is no simple way to determine if education efforts are successful. Conducting a baseline survey of public attitudes and knowledge now and reassessing those at a later date would be one potential method of quantifying the success of educational efforts. Greater participation at hearings and other windows for public input in the policy-making process would be another way to gauge effectiveness, but cannot be considered a sure measure.

Costs and Economic Considerations

The addition of an OEE position in the two APES-area regional offices, as well as a new position in the main office to coordinate the newsletter and other environmental education efforts in the APES region, would cost about $50,000 per position, or $150,000 annually. In addition, publication and postage of a newsletter to a mailing list of 16,000 would cost about $4,000 per issue ($16,000 a year for a quarterly distribution).

Funding Strategy

All of these positions would require additional appropriations from the General Assembly. Federal and philanthropic grants are widely available to assist with the production of environmental education materials.

Management Action 2: Increase opportunities for citizens to communicate with members of environmental agencies and policy-making commissions.

Explanation: *Citizens are more likely to support environmental protection and be involved in decision making when they feel governments and regulatory agencies are working with them as equal partners. Increased opportunities for public participation and education will promote citizen involvement in environmental policy making.*

Critical Steps

1. State agencies involved with estuarine and environmental protection would increase their efforts to provide education to the public about their mission and the resources they manage. Some specific educational goals would be to:

   -- Increase the state's effort to provide education on wetlands and other important habitats to broaden the public's understanding of the extent, significance, delineation, and regulation of these areas. (Primarily involves the Division of Environmental Management-DEM, Division of Coastal Management-DCM, and the Division of Soil and Water Conservation-DSWC.)

   -- Enhance outreach and education to small landowners and small logging operators to increase the use of forestry best management practices. (Primarily involves the Division of Forest Resources-DFR, and the Division of Land Resources-DLR.)

-- Enhance outreach to commercial fishermen to promote more widespread understanding of fisheries management programs and goals. Also, provide more opportunity for joint meetings of commercial and recreational fishermen where concerns can be aired and common ground can be established. (Primarily involves the Division of Marine Fisheries-DMF and the Wildlife Resources Commission-WRC.)

2. The Department of Environment, Health, and Natural Resources (DEHNR) would immediately look for cost-effective ways that public participation in environmental policy-making could be enhanced. Currently all DEHNR divisions and their oversight citizen commissions must run notification of public hearings, meetings, and permit applications in the legal notice section of local newspapers. News releases are also distributed to area media prior to hearings and meetings. Several DEHNR divisions maintain mailing lists of "interested parties" to whom news releases and meeting agendas are mailed directly. Any interested citizen can request to be put on the lists. Two avenues DEHNR would consider for expanding the effort to advise the public of division and commission activities are:

   -- Distributing press releases after meetings to report any votes or actions taken at the meeting, and other pertinent information as necessary.

   -- Using display ads instead of the legal notice section to announce upcoming commission and division meetings.

Evaluation Method

Evaluating the extent to which these actions may increase public participation would be difficult, as there is no simple way to determine why people become active in the public policy process. The public is more apt to be involved when it feels agencies are working with them in good faith and as equal partners. All educational efforts would be reviewed regularly to ensure that accurate information is being distributed and that target audiences are being reached effectively.

Costs and Economic Considerations

The benefits of this Management Action would be to increase the availability of information available to citizens and provide policy makers with better sources of feedback from the public. Like the previous Management Action, this would help to improve the decisions made regarding resources in the region.

Funding Strategy

While display ads may be somewhat more expensive to run than legal notices, the costs of these actions would be relatively minor and absorbed in the general DEHNR budget.

Management Action 3: Enhance and heighten local public involvement in issues affecting the estuary.

Explanation: *Public involvement in local policy processes can be promoted through Environmental Advisory Boards. These boards would not have a regulatory role. Instead, they would provide credible information and insight to local governments on the environmental issues surrounding projects such as landfill and roadway siting, water supply and sewage discharge, land use planning and stormwater control.*

Critical Steps

1. Local governments would form Environmental Advisory Boards (EABs) to serve as focal points for discussions on environmental aspects of local projects. An EAB would not have a regulatory role, but would exist to provide credible information and insight to local governing bodies on the environmental concerns surrounding activities such as landfill and roadway siting, water supply and sewage discharge, land use planning, and stormwater control. General Statutes already allow for the creation of local EABs. EABs would particularly call upon local citizens with backgrounds in natural sciences, public health, and resource management.

Evaluation Method
Local governments would evaluate the effectiveness of their EABs individually. The extent to which the EAB can act autonomously and provide legitimate insight on environmental issues that the local government needs to consider would be the measure of their success.

Costs and Economic Considerations
The administration of EABs would pose only minimal costs to local governments in the form of the usual incidental expenses associated with public meetings. EABs could benefit the community by fostering creative thinking, conflict resolution, and consensus on ways to deal with local environmental concerns. It would provide another avenue for citizens to provide input to important decisions regarding environmental issues as well as for citizens to become involved in the decision making process.

Funding Strategy
To implement this action, local governments would form the Environmental Advisory Boards using existing staff and resources.

Management Action 4: Expand involvement in the Citizen's Water Quality Monitoring Program (CWQMP) and make the program more interactive with regulatory agencies.

Explanation: *Citizen monitoring gauges the estuary's health and is an important education tool. In the Albemarle-Pamlico region, the CWQMP has served both purposes. The CWQMP would continue and broaden efforts to provide accurate data to water quality management agencies, thereby expanding their ability to track potential problems.*

Critical Steps

1. The CWQMP would need to secure a long-term funding source. The program currently is housed at East Carolina University and is funded through APES. Future funding would have to come from another source.

2. Upon securing funding, the CWQMP would focus its efforts on intensive monitoring in areas of particular concern, with the goal of collecting data that water quality agencies could use as a basis for pursuing further investigation or initiating mitigation steps. The CWQMP would work closely with water quality agencies to identify ways the program could best complement agency activities; e.g., by monitoring in areas with high urban runoff or by focusing on tributary streams, which the agencies often can not monitor well due to lack of personnel.

3. CWQMP would work with state and federal agencies to cultivate ways its volunteers could be involved in other types of monitoring, such as observing changes in submerged aquatic vegetation and other habitats or recording the presence of various types of wildlife.

Evaluation Method

The primary goal for the CWQMP would be for its data to be usable -- and used -- by resource managers. Achieving and sustaining that would be the measure of the program's success.

Costs and Economic Considerations

The CWQMP would require $75,000 a year for staff, equipment for routine monitoring; and housing/administration. In addition to the benefits of water quality monitoring, this management action would have the further advantage of providing for significant citizen involvement in the stewardship of the region's water resources. Such local participation would broaden public understanding of water quality issues in general.

Funding Strategy

Given that the CWQMP's primary goal is establishing a long-term database, the best funding option for the program would be to secure institutional funding rather than having to depend on short-term grants. Several other states operate citizen monitoring efforts through their Cooperative Extension Service, and that would be an excellent alternative here as well. Continuing the program through ECU's Institute of Coastal and Marine Research or the

UNC Sea Grant program would be alternative possibilities. An additional alternative would be operating the program through the Partnership for the Sounds (see Stewardship Plan, Objective A, Management Action 3). This would likely require the frequent pursuit of grants from foundations or from programs like the EPA's Section 106 grants which could threaten the maintenance of a continuous database. This funding avenue may be the most likely and should be pursued if others do not work out.

Management Action 5: Create a citizen ombudsman position within the Department of Environment, Health, and Natural Resources (DEHNR).

Explanation: *A citizen ombudsman is an independent advocate for citizen concerns within a government agency. An ombudsman would respond to and track these concerns, and would serve as the public's "eyes and ears" with regard to activities of DEHNR divisions.*

Critical Steps

1. A citizen ombudsman is an independent advocate for citizen concerns within a government agency. The ombudsman would be appointed by the Governor through the Office of Citizen Affairs and housed within DEHNR, but would be independent and work as an advocate for citizen concerns.

Evaluation Method

The ombudsman's role as a liaison between the public and DEHNR makes the position answerable to citizen opinion.

Costs and Economic Considerations

This action would require funding of $50,000 a year to staff the position and

its ancillary needs. The benefits of having an ombudsman in DEHNR would be greater accountability of state employees to the public.

Funding Strategy

In order to ensure the ombudsman's independence, the position would not be funded from within DEHNR. However, DEHNR would in effect need to release the necessary funding to the Governor's Office of Citizen Affairs in order to create this position.

OBJECTIVE C: ENSURE THAT STUDENTS, PARTICULARLY IN GRADES K-5, ARE EXPOSED TO SCIENCE AND ENVIRONMENTAL EDUCATION.

Strategy: The Department of Public Instruction (DPI) is currently updating its statewide science curriculum requirements. DPI expects to include a significant environmental education component at all grade levels, though the specific focus in each grade will vary. The Office of Environmental Education (OEE) within DEHNR would assist DPI in the effort to make environmental education an important part of every student's learning experience. Also, OEE would work with DPI and individual school systems to increase opportunities for teachers to gain a background in environmental education and to have access to environmental education materials.

Management Action 1: Support the development of a comprehensive environmental science and education curriculum.

Explanation: *The Division of Environment, Health, and Natural Resources (DEHNR) will expand the operation of the Office of Environmental Education (OEE) to establish an ongoing liaison between DPI and OEE. DPI must address a variety of concerns in developing curriculum. However, OEE would provide assistance as needed in targeting environmental education components.*

Critical Steps

1. OEE would establish an ongoing liaison between DPI and OEE. DPI has a variety of concerns it must address in developing curriculum, but OEE would provide assistance as needed to DPI in helping to refine environmental education components.

2. OEE would act as a statewide clearinghouse and repository for environmental education materials and resources, including maintaining a speakers bureau, computerizing a database of existing programs, and developing new environmental education programs. OEE would maintain regular contact with DPI regarding the needs for particular resources.

Evaluation Method
Cooperative and ongoing communication between OEE and DPI would be an important measure of success. A more quantifiable way of determining the effectiveness of the effort would be to keep track of where environmental education curriculums are implemented and how extensively various materials, speakers, and programs are used.

Costs and Economic Considerations
The work of this position would be included in the additional staff position recommended for the OEE in Objective B, Management Action 1.

Funding Strategy
See Objective B, Management Action 1.

Management Action 2: Provide for teachers at all levels ongoing opportunities to gain renewal credits in workshops on environmental and estuarine education.

Explanation: *OEE would assist DPI and other state agencies, such as the Wildlife Resources Commission (WRC), Division of Parks and Recreation (DPR), and the Division of Soil and Water Conservation (DSWC), in conducting*

teacher in-service workshops that provide renewal credits. These workshops not only would help teachers stay current in environmental science but would provide broad perspectives on the relationship between the estuary and human activities.

Critical Steps

1. OEE would assist DPI and other state agencies (e.g., WRC, DPR, DSWC, etc.) in conducting teacher in-service workshops which provide renewal credits.

Evaluation Method

A specific number of annual workshops would be set as a goal by OEE, thus making this objective fairly easily measurable. DPI and local school systems would assist OEE in determining areas of need.

Costs and Economic Considerations

This effort would be directed by the OEE liaison with DPI, described in Objective B Management Action 1. An additional $10,000 per year would be required to pay for travel expenses, materials, and other needs of the OEE liaison with DPI. Local school districts would bear the costs of time spent by teachers in in-service workshops, which would be run by the OEE/DPI liaison. The benefits of this activity would be to develop an awareness of environmental issues among teachers and their students. Developing critical thinking skills and exposing students to the difficult problems faced in the management and wise use of natural resources can improve their ability to make future decisions that best serve a variety of interests.

Funding Strategy

Expansion of state appropriations to OEE would be required to help cover the incidental expenses, but federal and philanthropic grants are also widely available to assist environmental education programs. OEE will devote considerable effort to grant-writing.

IMPLEMENTATION PLAN

GOAL

Implement the Comprehensive Conservation and Management Plan in a way that protects environmental quality while using the most cost-effective and equitable strategies.

OBJECTIVE A: COORDINATE PUBLIC AGENCIES INVOLVED IN RESOURCE MANAGEMENT AND ENVIRONMENTAL PROTECTION TO IMPLEMENT THE RECOMMENDATIONS OF THE CCMP.

Strategy: The APES Management Conference has for several years provided a unique forum for communication and cooperation among a broad range of agencies, organizations, and interests to protect the resources of the Albemarle-Pamlico estuarine region. Once the CCMP is approved, there will be an even greater need for coordination and cooperation during the implementation phase. A Coordinating Council would be created to promote cooperation and coordination among agencies, organizations, and individuals involved in implementing the plan. The Council, which would have no regulatory authority, would consult with five Regional Councils comprised of elected and/or appointed local government officials, citizens, and representatives from various economic sectors. Each county in the Albemarle-Pamlico region, including those in Virginia, would be represented. This would allow for the fullest exchange of information and for developing strategies that combine existing programs with new initiatives. The Coordinating Council also would pursue funding to support CCMP implementation and provide an annual assessment of its progress.

Management Action 1: Create a Coordinating Council and five Regional Councils through executive order by the Governor of North Carolina upon approval of the CCMP.

Explanation: *The APES program has provided extensive opportunities for interaction between government agencies, private organizations, citizens and local governments. Continued coordination in implementing recommendations in the CCMP would be provided through a Coordinating Council and five Regional Councils. The Regional Councils would include representatives from each county in the region, including elected and/or appointed local government officials, interest groups, and members of the general public in each river basin. The Coordinating Council would include fifteen representatives from the Regional Councils (ten of whom will be local elected and/or appointed officials), seven representatives of citizen commissions and councils, four representatives of federal resource agencies and three representatives of state government. This structure would provide continued opportunity for interagency coordination and citizen and local government input.*

Critical Steps

1. The Governor of North Carolina would create a Coordinating Council and five Regional Councils by executive order. The appropriate federal agencies would develop Memoranda of Agreement to continue coordination efforts.

2. A Regional Council corresponding to each of the following major river basins of the APES region will be formed:

   Neuse (including Bogue and Core Sounds)
   Pasquotank/Albemarle/Currituck
   Roanoke (below Roanoke Rapids Dam)
   Tar-Pamlico/Pamlico Sound
   Chowan

   Each Regional Council would include at least three representatives from each county in the river basin and would represent a variety of local interests. Membership from each county would include: one elected or appointed county official selected by the county commission; one elected or appointed municipal official selected by the county commission in consultation with municipalities in the county (counties without municipalities would appoint a second county official); and one person appointed by the Secretary of DEHNR. In making his appointments to each Council, the Secretary shall, to the greatest extent possible, seek to ensure demographic and social balance, as well as balance among the following interests:

agriculture	conservation
silviculture	environmental science
commercial fishing	business/industry
recreational fishing	tourism
Soil and Water Conservation Districts	at large

   Each Regional Council can expand its membership as it deems necessary.

3. The Coordinating Council would include:

   a. Fifteen representatives from the five Regional Councils. (Each Regional Council will elect two elected and/or appointed government officials and one other representative from any background).

   b. Seven representatives of citizen commissions and councils. The Chair of each of the following groups would select a representative.

Marine Fisheries Commission
Soil and Water Conservation Commission
Environmental Management Commission
Coastal Resources Commission
Wildlife Resources Commission
Forestry Advisory Council
Sedimentation Control Commission

c. Four representatives of federal resource agencies would be selected by appropriate federal administrators.

U.S. Environmental Protection Agency
U.S. Army Corps of Engineers
U.S. Fish and Wildlife Service
National Oceanic and Atmospheric Administration

d. Three representatives of state government.
The Secretary of the Department of Environment, Health and Natural Resources, or his designee (Chair to the Council)
The Secretary of the Department of Commerce, or his designee
The Commissioner of Agriculture, or his designee

4. The Coordinating Council would serve to promote continued coordination and cooperation among agencies, local governments, and private and public interest groups for CCMP implementation. The Regional Councils provide a local forum for input into the implementation process by public and private interests.

5. The Coordinating Council would consult the Regional Councils for guidance on coordinating implementation strategies at a local level. The role of the Regional Councils would be to develop partnerships between the public and private sector, and between local, state, and federal governments, on a regional scale. They would inform the public and public officials about matters related to CCMP implementation and would convey to the Coordinating Council public and local government sentiment regarding CCMP implementation.

6. A minimal staff would serve the Coordinating Council and Regional Councils. This staff would be responsible for communications, organization, and progress reports.

Evaluation Method
The structure of the Coordinating Councils and its effectiveness in facilitating the implementation process will be assessed in a program review, detailed in Objective B, Management Action 2 of this section.

Costs and Economic Considerations
The Coordinating Council would need approximately $300,000 per year for meetings and support staff. The Council would serve as a focal point for attracting grant funds to support implementation projects in the region.

Funding Strategy
Implementation grant money would be sought from the EPA and matching funds would be needed from state appropriations.

Management Action 2: Coordinate implementation of the CCMP.

Explanation: *The best way to ensure efficient operation of government is to increase the coordination and cooperation of existing agencies. Each agency should fulfill its responsibilities without duplicating the efforts of other agencies. The Coordinating Council would take advantage of existing resources and staff, establishing connections between public and private interests and all levels of government, rather than creating another layer of government. The Coordinating Council will guide the implementation process to ensure the highest level of cooperation and coordination among interested parties, as was demonstrated by the original APES Management Conference during the plan's development.*

Critical Steps

1. The Coordinating Council would pursue adopting a Memorandum of Agreement between North Carolina and Virginia to ensure continued cooperation and coordination in implementing the CCMP. The agreement would detail Virginia's implementation strategy for pertinent CCMP recommendations (such as enhanced land use plans and nonpoint source reduction plans).

2. The Coordinating Council would assist in the pursuit of funding to implement CCMP recommendations.

3. Council members would promote CCMP implementation by informing their respective commissions, agencies, and organizations, and by pursuing actions on recommended strategies that relate to the mission of their commission, agency, or organization.

4. The Council would set annual priorities for implementing sections of the CCMP and make necessary strategy revisions based on progress and success.

5. The Council would develop a research agenda during the first year of implementation that addresses the outstanding information needs described in the CCMP and update it annually. The Council would seek researchers and funding. The research agenda would include investigations of the economic and sociological impacts of CCMP strategies.

6. The Council would identify experts who could serve, as needed, on special committees to address complex scientific or technical issues.

7. The Council would brief the Environmental Review Commission of the General Assembly semi-annually on CCMP implementation and highlight legislative concerns. The Council would also track legislative developments.

8. The Council would conduct consistency reviews of federal programs as required in Section 320 (b)(7) of the Clean Water Act.

9. Council members would develop Memoranda of Agreement as necessary to support implementation of management strategies according to the time lines listed within them.

10. The Council would sponsor public education, outreach, and involvement programs concerning the regions' estuarine resources.

11. The Councils would sponsor workshops for cross-training individuals involved in enforcement, permit review, and other activities. These workshops will promote inter-agency cooperation in resource management.

Evaluation Method

The following section recommends an annual program review which would provide a mechanism for evaluating the success of the Coordinating Council. Through this process, all interested parties (including the general public) would have the opportunity to assess the program's ability to coordinate the public agencies involved and the program's success of implementation overall.

Economic Costs and Considerations

Most costs of this Management Action are included in the more detailed break-downs of other Management Actions. Cross-training workshops and other special projects pursued by the Council (e.g., public education, support for research) would entail additional costs of approximately $50,000 per year.

Funding Strategy

The additional cost relating to education efforts would be partially funded by the EPA through implementation funding and would need to be matched by state appropriations.

OBJECTIVE B: ASSESS THE PROGRESS AND SUCCESS OF IMPLEMENTING CCMP RECOMMENDATIONS AND THE STATUS OF ENVIRONMENTAL QUALITY IN THE ALBEMARLE-PAMLICO REGION.

Strategy: The yardstick by which the CCMP must be measured is the quality of the environment in the Albemarle-Pamlico region. An annual progress review would be developed to allow for flexibility in the implementation process, to monitor the success of the CCMP, and to measure changes in the environment. In addition, the Coordinating Council may use the annual progress review to assess whether its objectives and recommended management actions are in concert with the changing environmental challenges. The progress review would allow any interested party to comment on the process and the success (or failure) of implementation strategies or structure. Reporting progress to the public and receiving comments from it is essential to the success of implementing the CCMP. The progress review would make the process dynamic and flexible, enabling changes to be made when and where necessary. Each Management Action within the plan includes an evaluation statement. These statements are designed to initiate a review of the environmental impacts of the Actions. The agencies and organizations responsible for each action would submit evaluation results to the Coordinating Council to determine whether the actions are having the intended effects on the environment. Much of the environmental review effort is dependent on the monitoring efforts of the appropriate agencies.

Management Action 1: Develop an annual "progress review" of the implementation of CCMP recommendations.

Explanation: *The most critical stage of the management program is its implementation. Without carefully thought-out and monitored implementation, the goals of the management plan may never be achieved. A progress review would allow the Coordinating Council, or any interested party to comment on the implementation process. It also allows corrections or changes to be made as necessary.*

Critical Steps

1. Each participating agency, institution, and organization would submit annual reports evaluating the progress made in implementing CCMP recommendations and the success of implementation strategies. Council members would report to the Council on progress made by their agencies, institutions, and organizations. The Council would then assess the success of the implementation strategies within each section based on the recommendations of the implementing organizations.

2. An annual progress report would be developed by APES and would include the success of the implementing organizations and the effectiveness of the Coordinating Council. The report would be distributed to the public and any adjustments to the strategy or structure necessary to improve success would be made.

Evaluation Method

The "progress review" is in itself an evaluation. Once the progress of implementation of the CCMP is complete, changes to the process should be made.

Costs and Economic Considerations
The costs to participating agencies of this Management Action are considered to be in-kind contributions from them and would not require additional budget authorizations.

Funding Strategy
Not applicable for this management action.

Management Action 2: Assess the health of the Albemarle-Pamlico Estuary and the success of CCMP recommendations in protecting the environment.

Explanation: *Assessing the success of the implementation of the CCMP also requires monitoring of the environment and a thorough evaluation of the results. The CCMP must be flexible to adapt to natural conditions. Data gathered on the state of water quality, habitats, and fisheries may be used to adjust strategies as necessary.*

Critical Steps

1. The Council would report on monitoring efforts such as water quality monitoring from the Division of Environmental Management (DEM) and the U.S. Geological Survey, monitoring of fish stocks and habitats by the Division of Marine Fisheries (DMF), and vital habitat mapping by the Division of Parks and Recreation (DPR) and other appropriate agencies. Information gained from the appropriate agencies would be presented to the Council for review of broad scale and long term environmental trends. *(For monitoring requirements, refer to the following management actions: Water Quality, Objective D, MA 1 and Objective E, MA 1; Vital Habitats, Objective A, MA 2; and Fisheries Objective A, MA 1.)*

2. Data obtained by monitoring reports would be used to assess the effectiveness of management actions and identify target areas requiring further action.

3. The Council would continue to support and enhance public outreach and education efforts as outlined in the stewardship plan.

Evaluation Method
The annual progress review would help the Council assess the effectiveness of the CCMP. This review would determine if CCMP goals are being met in a manner that is proactive, cost-effective, and equitable. The Council also would review its membership at least annually to ensure that all parties involved in implementing the CCMP are represented.

Costs and Economic Considerations
The costs of these actions are included in other Management Actions of the CCMP.

Funding Strategy
Not applicable for this management action.

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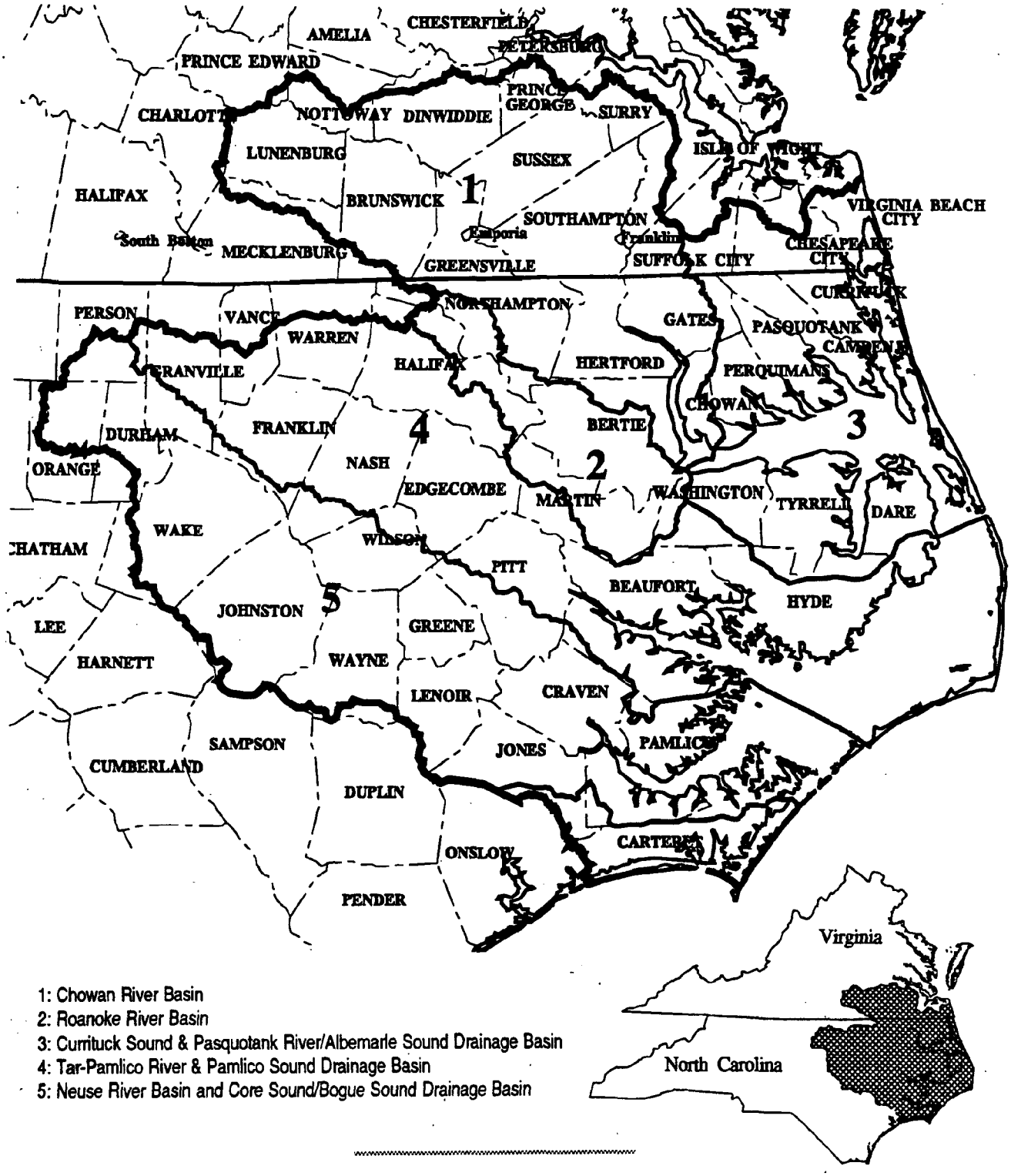
REGIONAL SUMMARIES

APPENDIX A

MAJOR RIVER BASINS OF THE ALBEMARLE-PAMLICO WATERSHED



1: Chowan River Basin
2: Roanoke River Basin
3: Currituck Sound & Pasquotank River/Albemarle Sound Drainage Basin
4: Tar-Pamlico River & Pamlico Sound Drainage Basin
5: Neuse River Basin and Core Sound/Bogue Sound Drainage Basin

CHOWAN RIVER BASIN

Regional Summary

RIVER BASIN OVERVIEW

The headwaters of the Chowan River are in Virginia where the Nottoway, Blackwater and Meherrin Rivers originate and run south toward the North Carolina border. The Nottoway and the Blackwater merge at the state line to form the Chowan River which is soon joined by the Meherrin. The Chowan flows fifty miles through five North Carolina counties before draining into Albemarle Sound at Edenton. The Chowan originates with narrow streams, but broadens to over two miles as it enters the sound. Though it is fed by a large network of North Carolina rivers and streams, most of the Chowan's flow comes from Virginia. Like the Roanoke, the Chowan contributes significant quantities of fresh water to Albemarle Sound.

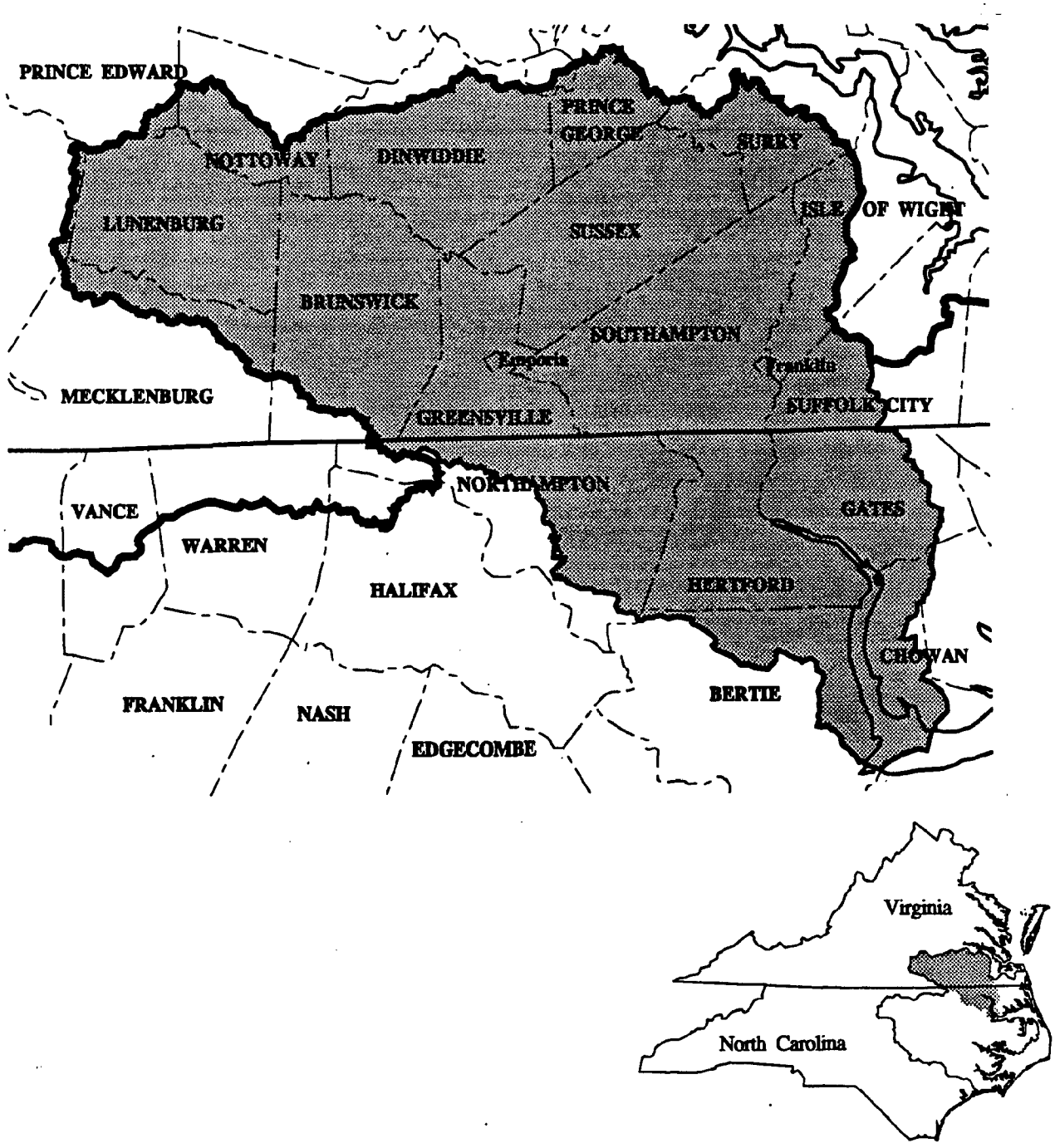
Within the state of North Carolina, the Chowan River Basin is about the same size as the lower Roanoke basin, encompassing close to 800,000 acres of land. The Chowan basin's population and density, with just over 55,000 people, is sparse compared to other major APES river basins. Of the basin's total land area in North Carolina, almost half is covered with forest and close to 40% is dedicated to agriculture. The Chowan basin has very few marinas.

ENVIRONMENTAL CONCERNS

WATER QUALITY

Water quality in the Chowan basin is a widespread concern. The use of the streams and rivers for fishing and/or swimming is impaired in approximately 67% of the total stream miles. The most common causes of this impairment are sediment which affects 38% of the impaired miles, low dissolved oxygen which affects 19% of the impaired freshwater miles, and dioxin which accounts for 10%. Even though dioxin is responsible for only 10% of impairment in the entire basin, it is concentrated entirely within the 50 mile stretch of the

CHOWAN RIVER BASIN



Chowan River from the Virginia/North Carolina border to the mouth of the Chowan River at Albemarle Sound. Impairment of all fresh waters results primarily from nonpoint sources (82%) and to a lesser extent, point sources (18%). Agriculture is the dominant nonpoint source of impairment accounting for 73% of nonpoint loading in the basin. As a result of frequent algal blooms during the 1960's and 1970's, waters of the Chowan basin have been designated as nutrient sensitive. While some nutrient reductions have been made in the basin, particularly for point sources, a major algal bloom occurred in the Chowan River during the summer of 1993. Continued efforts between North Carolina and Virginia are necessary to meet nutrient reduction goals. Compared to the Neuse, Pamlico, and Roanoke Rivers, contamination of water, sediments, and fish tissues with toxic metals in the Chowan is moderate. Sediment contamination with lead is of concern at one site in the basin, on the main stem of the river near Winton.

Only one discharger in the Chowan basin has been identified as contributing metal loadings. Other potential sources of toxic pollutants to the Chowan River Basin include seven Superfund sites and two solid waste sites. Two of the Superfund sites are located close to the Chowan and Meherrin Rivers. The contamination of fish tissues with mercury and dioxin is of concern for both wildlife and humans at several sites in the basin. Fish tissue samples indicate that metal contamination is of particular concern for wildlife near Riddicksville. Because of widespread dioxin contamination of fish fillet samples in the basin, the state of North Carolina has issued a fish consumption advisory for the entire Chowan River from the Virginia/North Carolina border to Albemarle Sound, and the state of Virginia has issued an advisory for the Nottoway River from the Union Camp Paper Mill at Franklin downstream to the state border.

In the Chowan, the Union Camp plant on the Blackwater River in Virginia has been the major source of dioxin. In general, the highest levels of dioxin found in fish tissues in the Chowan basin were observed downstream at Winton and at the Highway 17 bridge in Bertie County. Dioxin levels are expected to improve, however, because this paper mill has modified its manufacturing process and no longer discharges dioxin. Union Camp will now utilize a new ozone bleaching process as well as improve effluent quality using holding ponds for sludge, by oxygenating wastewater, and by limiting releases during low flow periods.

Recommended Management Actions

The development of a basinwide plan for the Chowan River Basin will further improve the coordination of point source management in the basin, target nonpoint source pollution reduction, and improve wetlands protection. A strategy for the nutrient sensitive Chowan River has already been developed. The objectives of the plan include: 1)reducing phosphorus input by 35 percent; 2)reducing nitrogen input by 20 percent; 3)returning the watershed to pre-1970 chlorophyll a levels; and 4)establishing effluent limits for total nitrogen and total phosphorus. To achieve nutrient reduction in the basin, cooperative implementation of the nonpoint reduction strategies in this plan between North Carolina and Virginia will be very important. Cost share funding for best management practices would be targeted at sources throughout the basin in both North Carolina and Virginia. Toxics contamination in the basin would be addressed through increased monitoring and improved planning. Sources of toxics contamination would be evaluated using GIS map layers to analyze contaminated sites.

VITAL HABITATS

The Chowan basin includes a variety of areas vital for wildlife and the region's natural heritage. The Chowan River Basin contains large swamps of tupelo-gum and cypress trees. Wetlands habitats in the basin provide flood control and safeguard wildlife habitat and water quality. Relatively little of the Chowan basin in North Carolina is owned by the government for habitat protection. State-owned game lands and parks each account for less than 1% of the basin area, and there are no federal wildlife refuges in the basin.

Recommended Management Actions

Ecosystem protection plans would target programs to identify and evaluate wetlands for protection, enhancement, restoration, and acquisition. Mapping would also be needed to facilitate information dissemination and to identify vital habitats for protection. Priority areas in the North Carolina portion of the Chowan region have been identified for voluntary acquisition and conservation incentives. These vital habitat areas include: 315 acres of nonriverine swamp forest; 200 acres of nonriverine wet hardwood forest; 88 acres of tidal freshwater marsh; and 65 acres of Atlantic white cedar forest.

FISHERIES

Since colonial times, fishing has been a popular activity in the Chowan River Basin, particularly for shad, herring, and striped bass. These species belong to a class of fish known as anadromous fish which live in marine waters, but migrate up freshwater rivers each spring to spawn. The region includes over 230 miles of rivers and streams that function as spawning habitat for these fish. Access to additional potential spawning areas is blocked by six dams and culverts throughout the basin. Several types of equipment are used by the basin's commercial fisherman, including pound nets, sink gill nets, drift gill nets, catfish pots, eel pots, and trotlines.

Recommended Management Actions

Removing impediments to anadromous fish and re-establishing declining fisheries, such as herring and catfish, are priority fisheries issues in the river basin.

ROANOKE RIVER BASIN

Regional Summary

RIVER BASIN OVERVIEW

The Roanoke River flows from the foothills of Virginia's Blue Ridge Mountains to North Carolina's northern coast flowing through several counties in Virginia and North Carolina before emptying into the Albemarle Sound at the junction of Bertie, Martin, and Washington counties. Spanning close to 400 miles, the Roanoke carries more water than any other river in North Carolina, supplying over half of Albemarle Sound's fresh water. As it flows from the Appalachian foothills to the flat coastal plains of North Carolina, the river changes from narrow and lively to broad and slow. In the coastal lands, its swampy floodplains are sometimes five miles wide. With its springtime tendency to overflow, the river nourishes the basin with a rich blanket of organic sediment.

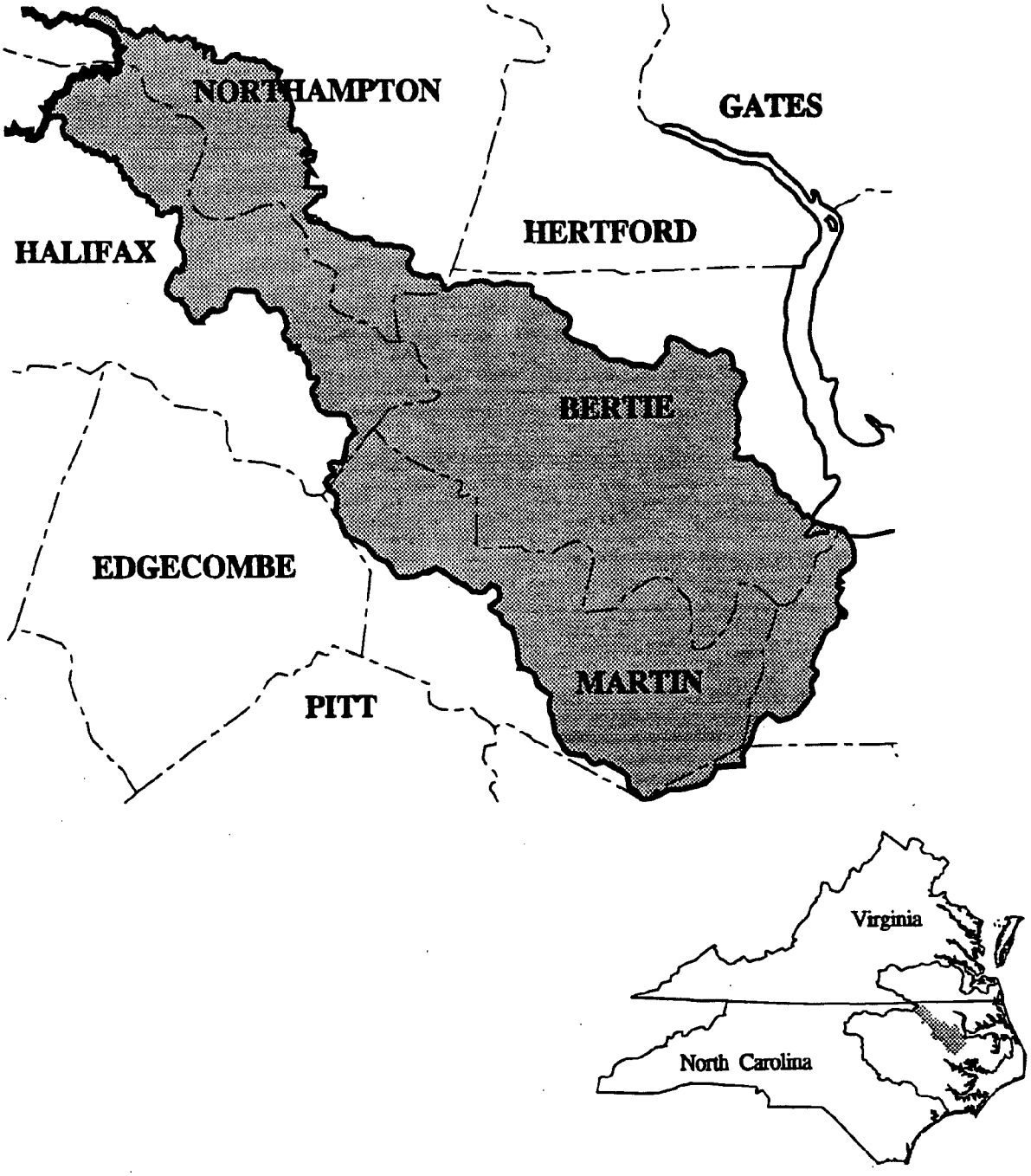
The Roanoke basin below the dam at Roanoke Rapids, NC, comprises parts of five counties and over 800,000 acres. The Roanoke River Basin is moderately populated compared to the other river basins within the APES region, with a population of approximately 80,000 in North Carolina. Almost half of the basin's acreage (370,000 acres) in North Carolina is forested and close to a third (267,000 acres) is agricultural. The federal government owns over 6,000 acres, nearly all of which is wildlife refuge. The state of North Carolina owns about 15,000 acres of game lands in the region as well.

ENVIRONMENTAL CONCERNS

WATER QUALITY

Over 53% of the waters in the Roanoke River Basin are impaired. Nonpoint sources, accounting for 85% of the pollutant input in the river basin, are by far the most important. Suspended sediments, toxics contaminations, excessive nutrient loadings, and fecal contamination are the primary causes of impairment.

ROANOKE RIVER BASIN



Sediment accounts for about 27% of impaired waters, nutrients account for 12.5% and toxicants for 11%. State ambient water quality standards and metal concentration limits have been exceeded at many sites along the Roanoke River, possibly due to the relatively high level of industry in the basin. A major region for pollutant loading is the Roanoke Rapids area. Low levels of oxygen are also a problem downstream of Plymouth. Other potential nonpoint sources of toxic pollutants in the Roanoke basin include 10 Superfund sites and 4 solid waste sites. These sources of contamination are primarily concentrated in the headwaters near Roanoke Rapids (3 sites) and at the mouth of the Roanoke River (5 sites).

While sediments have been sampled on very few sites in the region, at least one area indicated a potential violation of mercury and chromium concentration standards. Significant levels of metals and other toxic contaminants were found in fish tissue in the Scotland Neck area and in Welch Creek. Because of high levels of dioxin found in fish samples in the lower Roanoke River, the state has issued a health advisory against consumption of fish taken from the river from Williamston to Albemarle Sound, and from Welch Creek.

Water quality in the Roanoke River Basin is also highly influenced by dams. Fluctuations in flow from these dams cause water quality problems in the downstream portion of the river basin. Low flow periods can lead to conditions that are inadequate for dilution or flushing of wastewater. During low flow periods, areas of standing waste may accumulate causing some operations to be temporarily shut down. In addition, excessive releases from reservoirs can create flooding and sewer leakage problems for industry.

Recommended Management Actions

The Division of Environmental Management is planning to develop a basinwide plan for the Roanoke River Basin by 1997. This plan will help to improve coordination of the management of water quality in the basin. This plan would be used as a base for targeting priority areas for nonpoint source cost share funding. The plan would be further expanded to set basinwide goals for wetlands protection that recognize the importance of wetlands to basinwide hydrology and water quality. With both urban and agricultural runoff creating significant water quality problems in the Roanoke River, increased cost share funding for urban and agricultural best management practices (BMPs) will be critical for managing water quality. Additional controls of nonpoint source water pollution would help reduce loadings of nutrients and toxics in the system and would help improve the quality of fish, among other benefits. Reducing the production of toxic substances at their source would be another important part of the toxic reduction effort.

The most important components of toxic contamination control in the Roanoke basin include the continued monitoring and assessment of the toxicity of sediments (especially near the mouth of the river), fish tissues (especially for mercury), and ambient water quality, especially in areas which are known to have problems or potential for problems. The Division of Environmental Management would evaluate potential sources of these problems using geographic information systems (GIS) information on point source dischargers and nonpoint sources. The use of GIS would allow agencies and local governments to efficiently organize, analyze and access the information needed to monitor the effects of point source polluters and to plan for runoff controls in the Roanoke basin. This application of GIS will be especially important for restoring water quality in the lower section of the river and in Welch Creek.

VITAL HABITATS

Significant natural communities abound within the Roanoke River Basin. The basin supports both high quality and rare natural communities as well as rare species habitat. It contains large expanses of bottomland hardwood forests as well as vast swamps of bald cypress and tupelo-gum. More than 200 species of birds can be found within the basin alongside dense populations of white-tailed deer, wild turkey, and herons. Migrating hawks are frequently sighted in the fall. The Roanoke basin's extensive wetlands help protect wildlife habitat, enhance water quality, and provide flood control.

Recommended Management Actions

In 1989, 33,000 acres of land were acquired for the Roanoke River National Wildlife Refuge. The refuge represents a ten-year effort by The Nature Conservancy, US Fish and Wildlife Service, and the Wildlife Resources Commission. Acquisition of the valuable bottomland hardwood habitat resulted from a combination of donation, sale, and land swapping. Acquisition of additional acreage is needed to complete the refuge. Many other natural areas of the region also need to be protected for the purpose of safeguarding rare species, rare or representative natural communities, other vital wildlife habitats, and fisheries habitat. Basinwide habitat management plans would coordinate efforts to identify and protect, preserve, and enhance important natural areas. Priority natural areas in the Roanoke basin have been identified for voluntary acquisition and conservation incentives. The most significant of these priority areas is 1,500 acres of nonriverine swamp forests. Over 40,000 acres of wetlands along the Roanoke River floodplain have also been targeted for acquisition for their wildlife value. Acquisition also provides many water quality and downstream habitat protection services of enormous value.

FISHERIES

Both recreational and commercial fishing are important activities in the Roanoke basin. Commercial fisherman use sink gill nets, drift gill nets, pound nets, catfish pots, eel pots and trotlines to harvest striped bass, river herring, catfish and eel. There are some indications, however, that important fisheries resources are being degraded. Three significant fish kills were reported in the region from 1986 to 1989, and commercial catches of striped bass and herring have declined in recent years. The area is one of the most important spawning areas in the APES region for anadromous fish, of which striped bass is a familiar example. The Roanoke basin's rivers and streams include close to 500 miles of spawning areas for anadromous fish.

Recommended Management Actions

Basinwide management plans for recreational and commercial fisheries would be developed and implemented by 1995. The plans, a cooperative effort between the Marine Fisheries Commission and the Wildlife Resources Commission, would include recovery objectives for striped bass and herring. Additional data on declining fish stocks and expanded research on the impacts of regulations on fisheries could be acquired through a modified marine fisheries license structure.

CURRITUCK SOUND AND PASQUOTANK RIVER / ALBEMARLE SOUND DRAINAGE BASIN REGION

Regional Summary

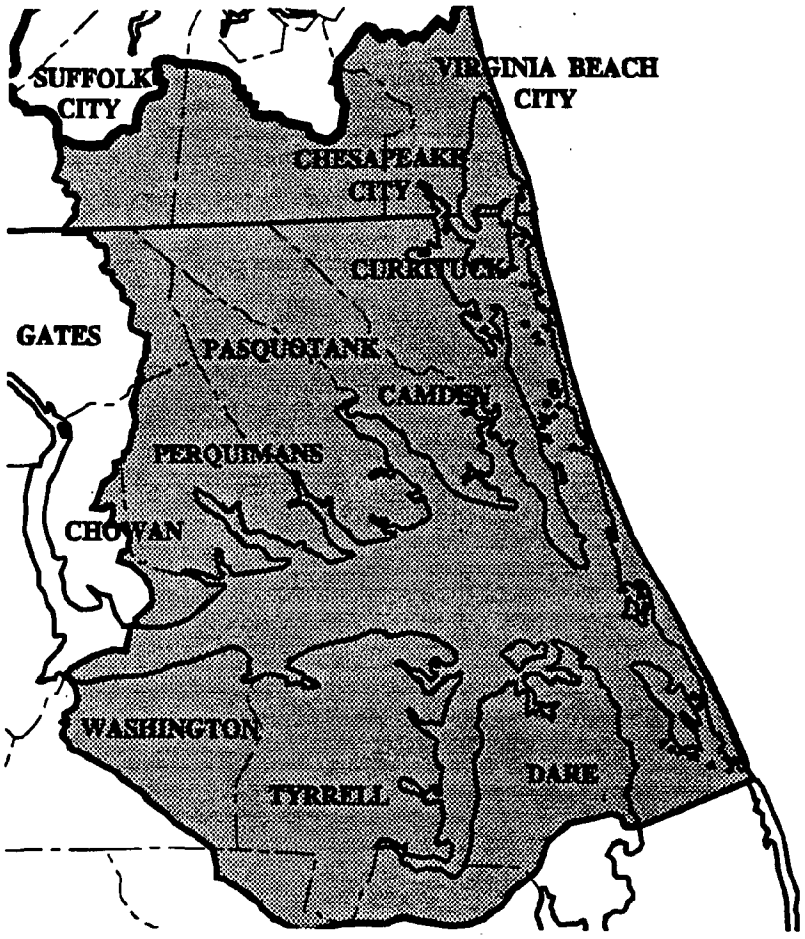
REGIONAL BASIN OVERVIEW

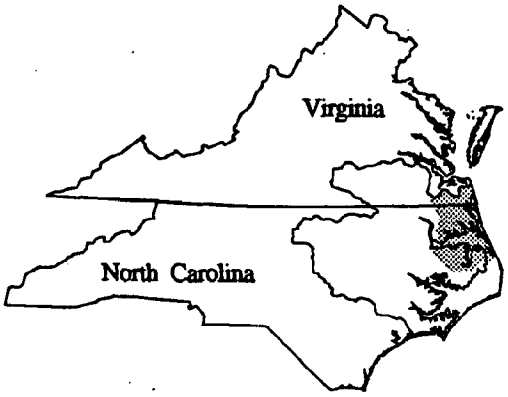
This region contains Albemarle and Currituck Sounds and their respective drainage basins. The Roanoke and Chowan, two major rivers that flow into Albemarle Sound are addressed in their own regional summaries. Albemarle Sound is surrounded by ten North Carolina counties with Croatan and Roanoke Sounds to the southeast. Currituck Sound is bordered by Back Bay, Virginia to the north, Currituck County to the west, and Currituck Banks to the east. The Pasquotank River, an important drainage source in this region and a major tributary of Albemarle Sound, will be discussed in the Albemarle Sound drainage basin.

The Alligator, Perquimans, Little, Pasquotank, and North Rivers, along with many other smaller tributaries, drain over 2600 square miles in North Carolina and Virginia and flow into Albemarle Sound. Currituck Sound receives water from three sources in Virginia: the North Landing River, the Northwest River, and tributaries from Back Bay estuary. The entire drainage region covers approximately 1.7 million acres. The Currituck Sound drainage basin contains 469,000 acres; 220,000 acres in northeastern North Carolina and 249,000 acres in southeastern Virginia. The Albemarle Sound basin accounts for over 1,200,000 acres within North Carolina and Virginia. Of the region's total acreage, over a third is devoted to agriculture and another third is forested. Wetlands, military land, and developed areas make up the remaining third. While most of the drainage region is rural in nature, some densely populated areas are located on the region's fringe.

Both Albemarle and Currituck Sounds are shallow, relative to their area, and circulation of the fresh to brackish water is governed by wind movement. The closest inlet to the ocean is Oregon Inlet, and saltwater from this source is quickly diluted by the fresh water delivered by the rivers that drain into the sounds. Since

CURRITUCK SOUND AND PASQUOTANK RIVER/ALBEMARLE SOUND DRAINAGE BASIN





1585, however, at least six tidal inlets have cut channels through Currituck Banks linking Currituck Sound with the Atlantic Ocean. On Currituck Banks, a new inlet has the highest probability of occurring between Back Bay, Virginia and Corolla, North Carolina. An inlet resulting from a major coastal storm would most likely be rapidly filled, however, due to development and transportation pressures in the region. In such a scenario, only temporary and regional impacts on the water chemistry and ecosystem of the sounds would occur.

The population of the North Carolina portion of the region is 101,000; 86,000 residents in the Albemarle Sound drainage basin and 15,000 in the Currituck Sound Drainage Basin. While the North Carolina region has a relatively low population density, large regional and seasonal population increases are typical. In contrast to the predominantly rural nature of the North Carolina drainage region, Virginia Beach, VA, located on the northern edge of the Currituck Sound Drainage Basin, is highly urbanized with a population of over 262,000. The eastern-most land boundary of the drainage basin, the Outer Banks of North Carolina, is currently experiencing rapid development rates. The proximity of the Outer Banks to the heavily populated cities of the northeast makes it a popular vacation destination. Urban and residential areas, to support a high level of tourism and recreation, are more common in this region. Twenty-four marinas are located in the waters of the Albemarle Sound drainage basin while the Currituck Sound drainage basin has only two.

ENVIRONMENTAL CONCERNS

WATER QUALITY

In general, water quality in both Albemarle and Currituck Sounds is good and waters of the basin support intended uses. Point and nonpoint source pollution from agriculture, forestry, and development are responsible for most estuarine and fresh water impairment in the region. Particulate matter, dissolved nutrients, toxic metals, turbidity, and salinity are the most important concerns in the region.

Currituck Sound Drainage Basin

Assessments of water quality indicate that the waters of the Currituck Sound Drainage Basin fully support their uses. This conclusion, however, is based on minimal data and sampling. Recent investigations indicate that the waters of Currituck Sound are potentially threatened by four primary sources: 1)nonpoint source runoff from agriculture, logging, and development; 2)septic waste contamination from increased development on Currituck Banks; 3)increased turbidity levels caused by maintenance dredging of the Intracoastal Waterway channel; and 4)saltwater intrusion and increased pollution loading from several canals linking the sound to drainage basins in southeast Virginia. Interbasin diversions of water from agricultural practices has also affected freshwater inflow to Currituck Sound.

Toxic pollutant loading in the basin is minimal and the Currituck drainage basin is one of the least polluted in the APES region. No direct dischargers of heavy metals have been identified as contributing directly to the basin. Nonpoint sources of toxic metals have also been determined to be minimal. Toxic contamination and potentially dangerous levels of metals in fish tissues, however, have been identified in Tull's Bay. Additional sampling may be needed to fully assess toxic contamination in the Currituck Sound area.

Recommended Management Actions

Protection of the water quality in the Currituck area would require better control of nonpoint source pollution and hydrological modifications. Basinwide planning by the Division of Environmental Management in this region would address these concerns. Planning would involve evaluating total maximum daily loads and reviewing discharge permits for renewal in order to identify the impacts of dischargers on water quality and to accommodate economic growth and development. Best management practices and cost share programs would address nonpoint source pollution and provide economical ways of protecting and enhancing water quality in this basin. Enforcement would ensure compliance with existing regulations. Continued and expanded monitoring of water quality in the Currituck region would support continued evaluation of toxic contamination, salinity fluctuations, and turbidity increases.

Pasquotank River/Albemarle Sound Drainage Basin

Of the 464 miles of freshwater rivers and streams that make up the Pasquotank River/Albemarle Sound drainage basin, 66% are impaired. The three major causes are low dissolved oxygen, nutrients, and turbidity. Impairment in the freshwater areas of the basin is largely attributed to nonpoint source agricultural runoff. While the Roanoke and Chowan Rivers are not included in discussions regarding the quality of fresh water within the drainage basin, they have a considerable influence and impact upon the Albemarle Sound estuarine water quality.

Water quality in the estuarine waters of the Albemarle Sound drainage basin is generally good. Overall, support of the basin's estuarine water uses is fairly high with 14% of the basin's estuarine waters impaired. Dioxin, low dissolved oxygen, chlorophyll a, and heavy metal contamination accounts for most of the impairment in the estuarine basin. Point source pollution is the largest contributor to water quality impairment in the estuarine waters of the Albemarle Sound drainage basin, affecting approximately 11% of the basin's waters. Nonpoint sources contaminate approximately 3% of the basin's estuarine waters.

An exception to the generally good water quality in the estuarine waters of this basin occurs at the mouths of the Roanoke and Chowan Rivers. In this area, eutrophication and dioxin contamination result in impaired water quality for all of the waters of the Yeopim River, at Sandy Point, at Leonard's Point, and at Plymouth. Overall toxics loadings from all tributary rivers to the Albemarle estuarine system are higher than those in the Pamlico and Neuse estuaries. The Albemarle basin receives the greatest amount of toxic pollutants from the Roanoke River. To a lesser extent, the Pasquotank and Chowan River Basins also provide a source of toxic loading to Albemarle Sound. Of particular concern are concentrations of heavy metals in sediments in the Pasquotank River, especially in the Elizabeth City area. This location accounts for the largest concentration of toxic metal-contaminated sediment sites in the APES region. Sediment metal concentrations were also of concern at one site in the Scuppernong River and one site near Edenton.

Toxic concentrations of heavy metals and other pollutants observed in water, sediments, and fish tissues collected in several areas of the western Albemarle basin have raised concern about the potential impacts that these contaminants may have on aquatic life and human health and this area currently has a fish

consumption advisory in effect for dioxin contamination. Two sites of greatest concern for human health in the Albemarle basin are Phelps Lake and the Corapeake Ditch off the Great Dismal Swamp, both of which are contaminated with mercury. The greatest concerns for wildlife are observed at Phelps Lake and New Lake, both of which are contaminated by metals, and in Albemarle Sound near the Norfolk and Southern Railroad Bridge, which is contaminated by dioxin. In Croatan and Roanoke Sounds, shellfish closures increased by 98% and 62% respectively between 1980 and 1990.

Discharge from the Dare County Landfill has been identified as having the potential to produce toxic concentrations of metals during low flow conditions. In addition, other potential nonpoint sources of toxic pollutants include twenty-one marinas. The largest concentration of marinas occurs near Elizabeth City and on Roanoke Island. The Albemarle basin also contains two hazardous waste treatment, storage, and disposal sites, six Superfund sites, and five solid waste sites.

Recommended Management Actions

Basinwide water quality planning for rivers which drain into Albemarle Sound would help to provide protection in this region. The Division of Environmental Management would prepare basin plans for the Pasquotank, Chowan, and Roanoke Rivers. (For more information on the Roanoke and Chowan rivers, see their individual basin summaries.) Pollution prevention strategies would be important for the reduction of water quality impairment in the estuarine waters of this basin. Control of point source pollution, by focusing on proactive management options, would reduce waste at the source. DEM would assist dischargers with implementing pollution reduction methods. Efforts to develop pollution prevention plans would also be expanded.

Better control of nonpoint source runoff and the development of alternative septic systems would address the shellfish closures in the eastern part of this region. In the freshwater areas, increased control of nonpoint source runoff, particularly agricultural, would help to improve water quality. Toxic contamination in the Albemarle region would be addressed with continued assessment and improved planning. The most contaminated sediment sites, particularly those in the upper Pasquotank River, would be assessed to determine whether the levels of contamination are dangerous to aquatic life. The extent of mercury contamination in Phelps Lake, most likely from aerial inputs, and New Lake would also be evaluated. Analysis of these contaminated areas using GIS maps may identify possible sources of contamination. Pollution prevention strategies would be targeted at discharges that contribute significantly to toxic loading in the basin. Fishermen that use the waters of the region would be surveyed to better assess human health risks for recreational and subsistence fishermen. Fish advisories would continue as necessary to protect public health.

VITAL HABITATS

A moderate amount of the region's vital habitats are protected through government and public ownership. Almost 46,000 acres are reserved for state game lands and 30,000 acres are in state parks. Federal wildlife refuges occupy 106,000 acres and an additional 6,000 acres are considered federal seashore lands. The

region's wetlands are a valuable environment for migratory waterfowl. Scattered throughout the drainage basin, wetlands support flood control, provide wildlife habitat, and enhance water quality. In most of the region, agricultural runoff is filtered through wetlands before entering the sounds. This natural filtering mechanism removes a portion of the nutrient load from the runoff, thereby reducing the amount of agricultural nutrients entering the sound system. Although submerged aquatic vegetation provide most of the food for waterfowl in the area, marshes are also a significant source.

Currituck Sound Drainage Basin

The Currituck area provides an important winter habitat for waterfowl. Marshes within the basin are also popular sites for waterfowl hunting and sports fisheries. Populations, however, have been steadily declining in recent decades. There are two federally-listed endangered species in the ecosystem, the bald eagle and the peregrine falcon, and a federally threatened species, the piping plover. A diversity of submerged aquatic vegetation (SAV) species is present but concentrations are low. Historical observation records indicate an almost complete disappearance of SAV in Back Bay. In Currituck Sound, major shifts in density and SAV species assemblages have occurred. Currently, SAV beds are much less dense. High turbidity appears to be a potential cause of this decline. Damage to SAV habitat is also caused by eutrophication and changing salinity patterns.

Recommended Management Actions

Basinwide ecosystem planning would guide the acquisition and protection of vital habitats. Priority areas in the North Carolina portion of the Currituck basin have been identified for the targeting of voluntary acquisition and conservation incentives. These vital habitat areas include: 4200 acres of nonriverine swamp forest; 955 acres of nonriverine wet hardwood forest; 100 acres of Atlantic white cedar forest; and 50 acres of coastal fringe evergreen forest. Wetlands in the Currituck Outer Banks have also been identified as a priority natural area for protection efforts. Accurate records and maps of vital habitat areas including wetlands, SAV, and uplands would be maintained or developed. Biological and field inventories, as well as monitoring, should be performed to provide up-to-date and readily available information. Regulatory programs would be strengthened to protect SAV areas. Restoration efforts would also be targeted at the most critical SAV habitats. Official designation and protection for SAV will also aid in protecting vital fisheries habitat. Improvement of water quality may also help to support the recovery of SAV in this basin.

Pasquotank River/Albemarle Sound Drainage Basin

The Albemarle Sound region is home to a great variety of natural communities, including rare natural communities and rare species habitats. The basin provides a winter home to at least seventeen kinds of waterfowl, including Canada and snow geese, black duck, and scaup. Herons, alligators, bears, and white-tailed deer live in the basin's forests and swamps.

Recommended Management Actions

Ecosystem protection plans would set coordinated priorities for critical habitat protection and acquisition. Priority areas in the Albemarle region have been identified for the targeting of voluntary acquisition and conservation incentives. These vital habitat areas include: 1500 acres of nonriverine swamp forests, 1640 acres of maritime forests, 1700 acres of nonriverine wet hardwood forests, and 400 acres of Atlantic white cedar forest. In addition, existing regulatory programs would be strengthened and effectively enforced to help protect vital habitats.

FISHERIES

The region supports a variety of important freshwater and brackish species such as largemouth bass, bluegill, catfish, and perch. Both commercial and recreational fishing are important activities in the sounds and throughout the waters of the region. This area is especially important for recreational freshwater fishing. Striped bass, herring, and shad, anadromous species which live in marine waters but migrate into freshwater to spawn each spring, also enter the Currituck/Albemarle region. While this region is one of the most important for the spawning runs of anadromous species, it contains the most obstructions to spawning areas.

Currituck Sound Drainage Basin

In the Currituck area, anadromous species use 60 miles of the rivers and streams to spawn. Commercial fishermen in this area use mostly sink gill nets, river herring pound nets, and eel pots.

Pasquotank River/Albemarle Sound Drainage Basin

The waters of Albemarle Sound have over 160 acres of nursery areas for estuarine fish species. The region includes almost 400 miles of spawning areas for anadromous fish. Striped bass are of particular concern in the Albemarle region. Much research and policy attention has addressed the depressed status of this fish population. Habitat loss, fishing pressure, and water quality concerns are all believed to be factors that have contributed to the decline of this species and need to be further explored. Commercial fishermen working in the Pasquotank River/ Albemarle Sound Drainage Basin region employ pound nets, crab pots, sink gill nets, catfish pots, eel pots, and trotlines to harvest fish.

Recommended Management Actions for the Region

The importance of recreational freshwater fisheries in both drainage basins makes cooperative planning by the Wildlife Resources Commission and the Division of Marine Fisheries very important for this area. The development of joint fisheries management plans for species such as catfish, largemouth bass, perch, and anadromous fish will help to protect and improve these fisheries. In Albemarle Sound, planning and protection for striped bass is of particular concern. The cooperative implementation of recommendations resulting from the Striped Bass Management Board studies is an important strategy for addressing the decline

of this species. Cooperative planning for the removal of obstructions to anadromous fish migration is another strategy for this region. It is important that such planning also aims to prevent future obstructions. Anadromous fish spawning areas in the region would receive greater protection through official designation and protection by the Wildlife Resources Commission and other state agencies. Bycatch reductions from the development of improved gear along with financial assistance from a cost share program to facilitate implementation, are also important.

Tar-Pamlico River and Pamlico Sound Drainage Basins

Regional Summary

REGIONAL DRAINAGE BASIN OVERVIEW

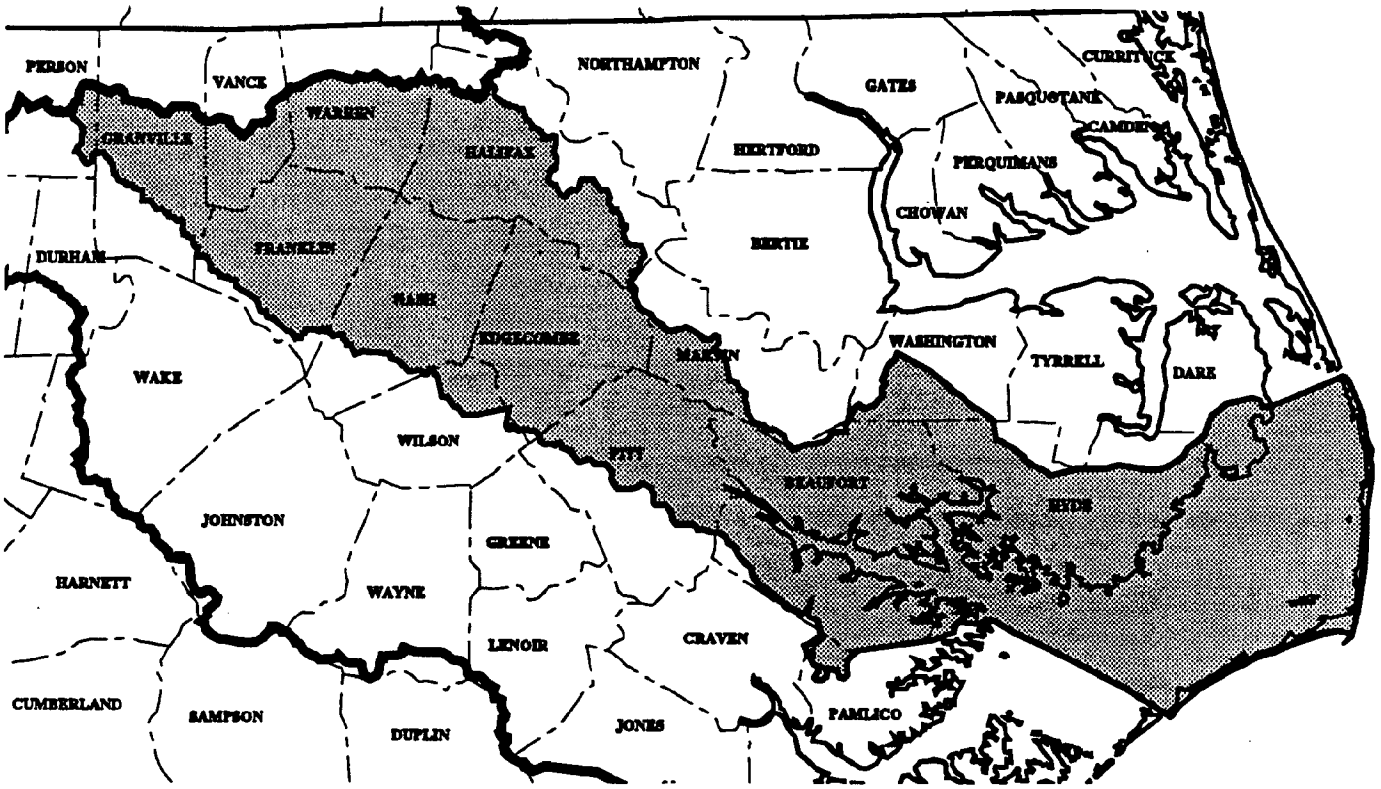
Tar-Pamlico River Drainage Basin

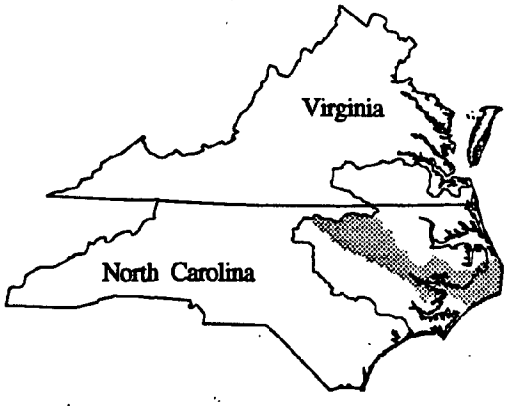
The Tar-Pamlico River drains the second largest river basin in the North Carolina portion of the APES region. The Tar and Pamlico Rivers are consecutive segments of a single river system. The Tar River portion extends 140 miles from Person County to the town of Washington in Beaufort County where it becomes the Pamlico River. For most of its length the Tar River is less than 150 yards wide, has a fairly swift current, and is freshwater. The Pamlico segment, slower and broader than the Tar, flows 37 miles from Beaufort County, NC, into Pamlico Sound, widening from 500 yards at Washington, NC, to nearly five miles at its mouth. Salinity levels increase as the river approaches Pamlico Sound. The Tar-Pamlico River Basin encompasses all or part of fifteen counties, is over 2.5 million acres in size, and has a drainage area of 5,400 square miles. The estuarine portion consists of 634,400 acres. With a population of around 400,000, the Tar-Pamlico is the second most populated major river basin within the APES region. Population density in the basin is moderate, however, compared to the other basins. Fishing, farming, forestry, and phosphate mining are the most important economic activities in the basin, with agriculture and forest cover each accounting for slightly over 40% of the total land area.

Pamlico Sound Drainage Basin

Pamlico Sound serves as the main receiving basin of the APES region, covering parts of four counties and over 370,000 acres of land. Including the sound itself, there are close to a million acres of inland waters and estuaries in this area. Water from Albemarle Sound and its rivers flows through Croatan and Roanoke Sounds into Pamlico Sound. The Neuse and Pamlico Rivers also drain directly into the sound. Interaction with the Atlantic takes place through Oregon, Hatteras, Ocracoke, and Swash inlets. Pamlico Sound stretches almost 100 miles from north to south and varies in width, expanding up to 25 miles in places. Like

TAR-PAMLICO RIVER AND PAMLICO SOUND DRAINAGE BASIN





Albemarle Sound, Pamlico Sound is moderately shallow, with a mean depth of 15 feet. Continuously influenced by wind and tide, Pamlico Sound has an abundance of constantly changing shoals. Urban development has had little impact on the region. With a population of 12,600, the Pamlico Sound drainage basin has the lowest population density in the study area. Of the basin's total land area, forests covers 33%, wetlands, swamps, and marshes cover 28%, agriculture comprises 25%, and urban land accounts for under 1 percent. Military land covers about 200 acres and 21 marinas are located in the waters of the Pamlico Sound drainage basin.

ENVIRONMENTAL CONCERNS

WATER QUALITY

Tar-Pamlico River Drainage Basin

Thirty-three percent of the freshwater streams and rivers within the basin are impaired. For this reason, the entire river basin is considered nutrient sensitive due to elevated nitrogen and phosphorus levels. Sedimentation is the primary cause of water quality degradation in freshwater segments of the basin. Heavily influenced by sediment-attached nutrient inputs, the Tar-Pamlico basin has the second greatest nonpoint source loading of pollution in the APES region. Agriculture contributes the greatest nonpoint source load (70%) while developed lands contribute relatively little (6%). Elevated nitrogen and phosphorus concentrations, primarily from agricultural practices in the basin, are responsible for accelerated eutrophication in the lower Tar-Pamlico River. The highest nitrogen concentrations are found in the upper riverine stations at Tarboro, Grimesland, and Washington. Short retention times in the swiftly moving upper Tar River, however, prevent excessive phytoplankton growth. As the river mixes with the salty water of Pamlico Sound, settling, assimilation, and dilution with nitrogen-poor seawater cause reduced nitrogen levels in the Pamlico River tributaries of Van Swamp, Pungo River, and Durham, Pungo, and Pantego Creeks. Total phosphorus values are generally highest in the mainstream Pamlico River from Tarboro to the Pamlico Sound. The highest mean concentrations of phosphorus are found just downstream of Texasgulf Chemicals in Beaufort County. However, changes in the treatment system are expected to reduce phosphorus discharges by 90%.

Water quality in the estuarine part of the basin is poor where waters are impacted by algal blooms and bacterial contamination. All waters from Bath Creek to Washington are impaired. Fish kills, fish diseases, and low oxygen levels are chronic problems. Low dissolved oxygen concentrations attributed to algal blooms have occurred predominately in the waters between Washington and Bath. Persistent problems occur in Blounts Creek, Bath Creek, Pungo Creek near Belhaven, and in the tributaries near Campbell and Eastham Creeks. There are 128 permitted surface water dischargers to both fresh and salt water in the basin. The majority of these dischargers are municipal wastewater treatment plants located in the headwater counties of Granville, Franklin, and Nash. Seven dischargers in the Tar-Pamlico basin have toxics loadings that exceed 1000 pounds per year. Three dischargers may produce instream metal concentrations in exceedance of water quality standards during low flow conditions. Five of the most common toxicants found in the river basin include zinc, cyanide, nickel, copper, and lead. However, nearly one million pounds of fluoride are discharged yearly into the Tar-Pamlico River making it the most prevalent toxicant found in the system.

The Tar-Pamlico Basin Association, a coalition of permitted dischargers with support from the Division of Environmental Management, Environmental Defense Fund, and the Pamlico Tar River Foundation, is working to reduce nutrient loading to the basin through an innovative point/nonpoint trading strategy. The Association works to fund nonpoint source controls on agricultural lands in exchange for flexibility in point source nutrient requirements. Association members have been able to achieve group nutrient reductions at relatively low cost through engineering evaluations and plant modifications.

Recommended Management Actions

The Division of Environmental Management will develop a basinwide plan for the Tar-Pamlico river basin by 1995. Interim goals, however, include a 64% reduction in phosphorus and a 10% reduction in nitrogen loading to the system. This will be achieved by expanding current strategies, such as limiting wastewater treatment plant outputs on a seasonal basis, continuing a system of transferable nutrient loading allowances, and by further developing in-plant reduction techniques. The plans provide an important tool for managing point sources within the basin, for targeting priority areas for nonpoint source cost sharing, and for expanding basinwide goals for wetlands protection. Increasing cost-share funding for agricultural BMPs will help reduce nutrient loadings.

The most important efforts to control toxic contamination in the Tar-Pamlico basin would include the continued assessment of the toxicity of sediments (especially near the mouth of the river), fish tissues (especially for mercury), and ambient water quality, especially in areas which are known to have elevated levels of toxicants. The Division of Environmental Management would evaluate potential sources of these problems using geographic information system (GIS) data on point source dischargers and nonpoint sources. The use of GIS would allow agencies and local governments to more efficiently organize, analyze and access the information needed to monitor water quality at the basinwide level and on a cumulative basis. This application of GIS would be especially important to efforts to manage nonpoint source pollution control measures.

Pamlico Sound Drainage Basin

Water quality is one of the main focuses in the Pamlico Sound drainage basin. Although the water quality of the open waters of Pamlico Sound is quite good, almost 500 acres are closed to shellfish harvesting indicating that the system is unable to support all of its designated uses. Closer to land, in the vicinity of Swanquarter, Wysocking Bay, and Englehard, 1388 acres of shellfish waters were closed between 1980 and 1990. The amount of acreage closed during that time represents an increase of 109% over previous years. The acreage closed to shellfish harvesting near Ocracoke increased 27% during the same time period. Even though shellfish closures represent a small portion of the sound's approximately 900,000 acres of water, toxic concentrations of heavy metals represent an additional important water quality concern. Samples of fish tissues from the region indicated several sites where toxic contamination may be of concern for human health and wildlife. Some fish tissues collected from the inland basin portion of Lake Mattamuskeet show potentially dangerous levels of mercury for human consumption. Toxic levels in fish tissues collected from Knoll Island, Stumpy Point Bay, Great Island, and Lake Mattamuskeet also indicate some level of water contamination.

The Tar-Pamlico and Neuse River basins contribute directly to the loading of excess nutrients and toxic pollutants to Pamlico Sound. (See the individual basin summaries for these rivers.) Few direct dischargers of toxic pollution to the sound can be identified indicating that nonpoint sources of pollution are probably more significant. Potential nonpoint sources of pollutants include marinas, river basin discharge and solid and hazardous waste sites. Seventeen marinas exist within the drainage basin, with the largest concentrations occurring at Hatteras, Ocracoke, and in Rose Bay. Two Superfund sites are located along the Outer Banks near Salvo and Buxton.

Recommended Management Actions

A basinwide water quality management plan would be developed by 1999. Water quality in the Pamlico Sound area would benefit from improvements in nonpoint source controls and reductions in toxics loadings from the Neuse and Pamlico Rivers. Establishing total maximum daily loads and associated control strategies for all impaired rivers and streams within the drainage basin is also an important step. Determining the basin's assimilative capacity with respect to long-term growth and development would also improve water quality management within the basin. Nonpoint source pollution reduction controls including BMPs and cost share programs would also significantly reduce sediment, nutrient, and toxics inputs to basin waters. Continued monitoring of toxic levels and nutrient loading in water bodies, sediment, and shellfish would be used to evaluate the extent and threat of toxic contamination in the Pamlico Sound area. It is important that the risk from mercury contamination in Lake Mattamuskeet be further evaluated as well. Alternatives to septic systems and the implementation of other nonpoint source controls (such as comprehensive marinas management) would help to address shellfish closures in the immediate Pamlico Sound area.

VITAL HABITATS

Tar-Pamlico River Drainage Basin

The Tar-Pamlico basin has several rare natural communities and rare species habitats. Wetlands are vital to water quality enhancement, wildlife habitat protection, and flood control. Historical observation records indicate that SAV has almost completely disappeared in the Pamlico River. The primary causes of decline are thought to be related to increased freshwater runoff, increased turbidity (from sediment-laden runoff, bottom-disturbing practices, and algal blooms), and encrustation by algae. Recent research also suggests that nitrate over-enrichment may be a factor. Government parks and refuges offer protection to some of the basin's vital habitats. Approximately 12,000 acres are held in National Wildlife Refuges. The state retains 6,500 acres for game lands, and an additional 3,500 acres for parks.

Recommended Management Actions

A basinwide ecosystem protection and restoration plan would be developed by 1995. The plan would set coordinated priorities for habitats and critical areas protection in the basin. Many natural areas of the region need to be protected for the purpose of safeguarding rare species, rare or representative natural

communities, other vital wildlife habitats, and fisheries habitat. Priority natural areas in the Tar-Pamlico basin have been identified for the targeting of voluntary acquisition and conservation incentives including: 6250 acres of nonriverine wet hardwood forest, 100 acres of tidal freshwater marsh, 85 acres of basic mesic forest, 46 acres of granitic flatrock, 2 acres of a floodplain pool community, and 1360 acres of nonriverine swamp forests. Also targeted for protection are 11,000 acres of wetlands in the Swift Creek floodplain and in the Scranton Woods area. Acquisition also protects water quality and downstream habitats of enormous value. All acquisitions would be voluntary, from willing sellers or donors. Accurate maps and records would be maintained for identification of state endangered species and their habitats, including wetlands. Programs that expand the advanced identification and evaluation of wetlands on a regional basis would be promoted. Wetlands restoration and mitigation efforts would also be expanded.

Pamlico Sound Drainage Basin

Fish nursery areas of the basin embody close to 40,000 acres. Considered vital habitat areas, they support fish populations throughout North Carolina and all along the east coast. About 125 miles of the drainage basin's rivers and streams are used by anadromous fish for spawning. The Pamlico Sound drainage basin is also home to a great variety of natural communities, including rare natural communities and rare species habitats. The region's extensive wetlands are vital to the health of the basin as they enhance water quality, nourish wildlife habitat, and provide flood control. Some habitat areas in the region are protected by public ownership. The state owns over 30,000 acres and conserves them as game lands. The federal government owns 90,000 acres of wildlife refuges. These and other conservation efforts would be continued.

Recommended Management Actions

It is important to protect land areas of the region for the purpose of safeguarding rare species, rare or representative natural communities, nearby fisheries habitat, and other wildlife habitats. Ecosystem protection and restoration plans would be developed by 1999. Wetlands would be identified and evaluated on a regional basis to preserve the most vital areas. Existing wetlands regulations would be enforced to make permitting more predictable for developers and governments. Priority areas in the Pamlico Sound basin have been identified for voluntary acquisition and conservation incentives. These vital habitat areas include: 1205 acres of nonriverine swamp forests, 450 acres of maritime forests, 20 acres of coastal fringe evergreen forest, and 100 acres of nonriverine wet hardwood forest. Priority wetland areas in the region that would also be targeted include Outer Banks sites such as Buxton Woods.

FISHERIES

Tar-Pamlico River Drainage Basin

Both commercial and recreational fishing are important uses of Tar-Pamlico River Basin waters. The Tar-Pamlico Basin encompasses extensive vital fisheries habitats which support important economic activity in the region. Commercial fishing practices in the basin include the use of long haul seines, shrimp and crab

trawls, crab pots, drift gill nets, pound nets, eel pots, and oyster dredges. Approximately 5,500 acres of primary and secondary nursery areas support the continued production of coastal fisheries. Many of the algal blooms noted earlier are occurring in or near these nursery areas. Increased agricultural activities, resulting in the draining of large expanses of land into the Pamlico's brackish waters, have caused concern that freshwater intrusion may be harmful to primary nursery areas. Spawning areas for anadromous fish are also of special concern in the river basin. The rivers and streams of the basin provide close to 400 miles of spawning areas for anadromous species such as American shad, river herring and striped bass. Pathways to the spawning grounds of these fish are frequently obstructed by dams and culverts. Other concerns regarding fisheries in the region include an increase in the number and severity of fish kills, especially from ulcerative mycosis, since 1984. Most occurrences were in the lower half of the basin, particularly in the main Pamlico River, Pungo Creek, and various canals and tributaries. Suspected causes included low dissolved oxygen, disease, sediment, and salinity. Researchers have recently discovered a toxic dinoflagellate that may be causing at least 25% of the kills and may be related to disease outbreaks.

Recommended Management Actions

Management plans for fisheries would be developed and implemented for recreational and commercial fishing interests. The designation of vital fisheries habitats in the region and the removal or alteration of obstacles to anadromous fish migration would be important parts of regional efforts to maintain and enhance fisheries resources.

Pamlico Sound Drainage Basin

Commercial and recreational fishing represent important activities for the sound and adjacent waters. Within Pamlico Sound there is an abundance of blue crabs, oysters, shrimp, and finfish. The quantity and diversity of the area's fisheries population significantly enhance local and state economies. The habitats of the drainage basin also provide ideal reproductive environments for several species of fish and shellfish. Commercial fishing practices in the basin include pound nets, long haul seines, shrimp trawl and crab trawls, crab pots, and sink gill nets. Shellfish (including crabs, oysters and bay scallops) are taken by tonging, raking, bull raking, hand harvesting, and dredging.

Recommended Management Actions

The designation and protection of vital fisheries habitats will ensure a healthy marine environment and viable fisheries industry. The great importance of commercial and recreational fisheries in this area emphasizes the need for coordinated and comprehensive fisheries management planning. An individual management plan would be developed for each important fishery or group of fisheries by 1999. The reduction of bycatch would be addressed through the implementation of best fisheries practices and would include a cost share program and the use of bycatch reducing gear to help to protect and enhance the region's fisheries. Oyster populations along the western edge of Pamlico Sound have suffered from over-harvest and disease. Harvests of oysters have declined drastically since the early 1900's. Restoration of oyster beds is especially important for enhancing shellfish populations in the region.

Neuse River and Core Sound/ Bogue Sound Drainage Basins

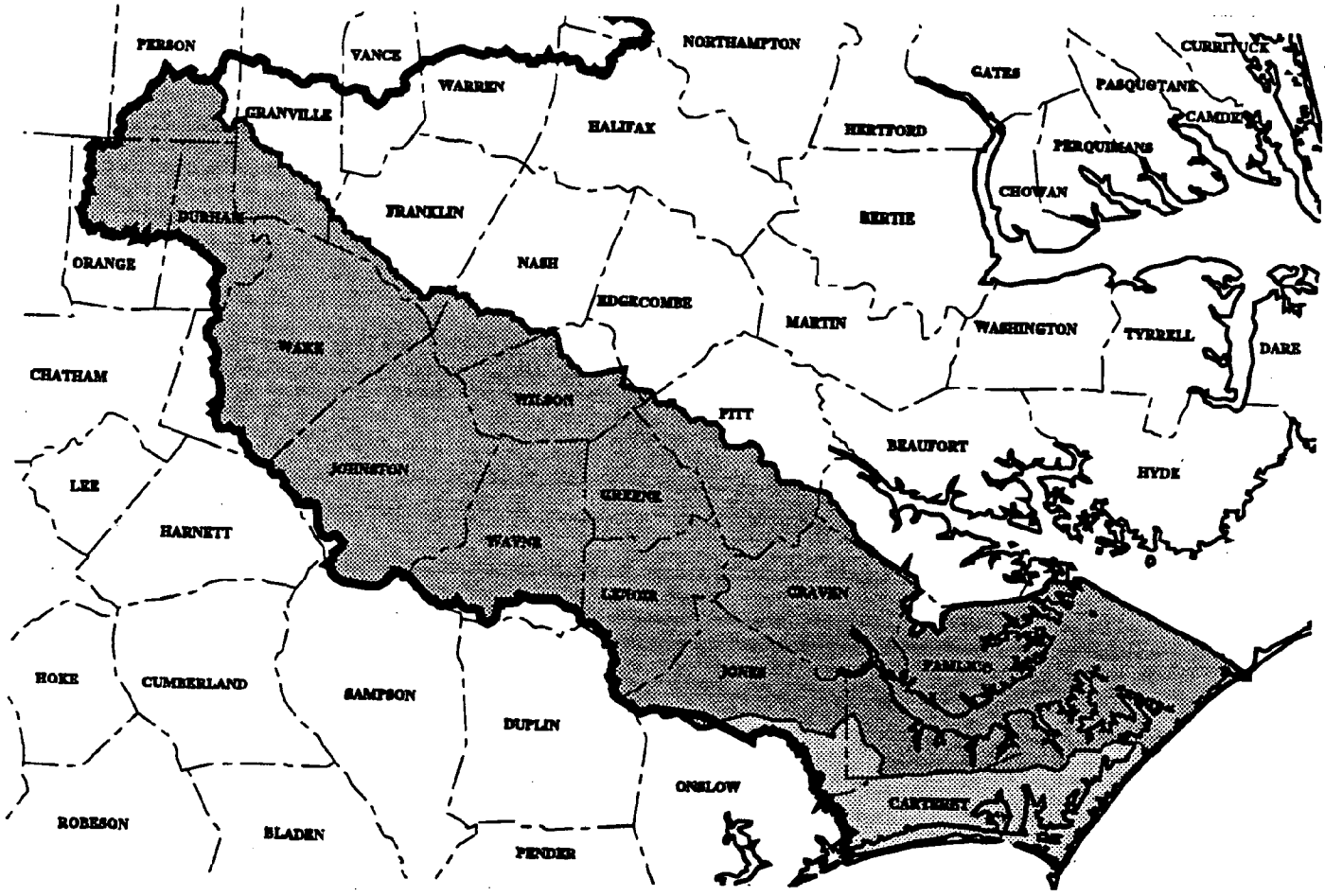
Regional Summary

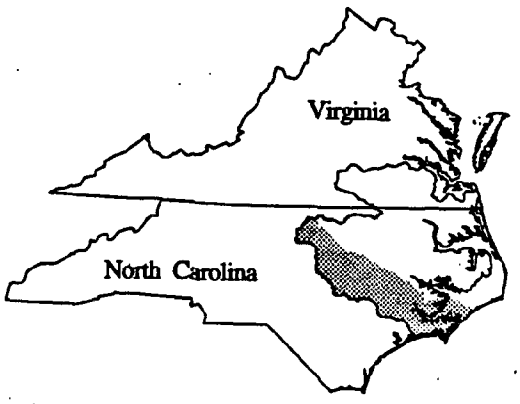
REGIONAL DRAINAGE BASIN OVERVIEW

Neuse River Drainage Basin

The Neuse River is one of two major rivers that enter Pamlico Sound. The Neuse River Basin extends from Durham County in the Piedmont to the mouth of the Neuse River near New Bern in the Pamlico Sound estuary. The watershed for this river encompasses all or part of 19 counties and almost 3.5 million acres making it the largest drainage basin within the APES region. The rivers, streams, and estuarine waters of the basin cover over 145,000 acres. Freshwater flow in the river covers about 150 miles from its source to the city of New Bern. In this stretch, the river is usually less than 150 yards wide, and the current is fairly rapid. Above Raleigh, flows of the Neuse have been significantly altered by the construction of Falls Lake Reservoir. At New Bern, freshwater begins mixing with saltwater as the river flows another 40 miles to its mouth at the southern end of Pamlico Sound. Over this stretch, the river moves more sluggishly across the flat Coastal Plain. The width of the river increases from about a mile at New Bern to over 5 miles at its mouth. In addition to being the largest, the Neuse River watershed is the most populated among the major drainage basins in the APES region. Population in the watershed is now slightly over 1.5 million. Land cover in the basin is primarily forest (36%) and agriculture (35%). Compared with other basins in the Albemarle-Pamlico region, the Neuse River Basin is highly industrialized. The military owns over 21,000 acres and there are 13 marinas in this basin.

NEUSE RIVER AND CORE SOUND/ BOGUE SOUND DRAINAGE BASIN





Core Sound/Bogue Sound Drainage Basin

Core and Bogue Sounds drain about 215,000 acres of land in the southeastern portion of the APES region. The drainage area consists of low-lying coastal plains and includes about two-thirds of Carteret County and a portion of eastern Pamlico County. The Core-Bogue drainage basin is relatively small, has no major rivers feeding into it, and encompasses over 260,000 acres of water. Salt water flows into the sounds through Bogue, Beaufort, and Drum Inlets, and the overall salinity of both Core and Bogue Sounds is higher than that of either Albemarle or Pamlico Sound. Bogue and Core Sounds provide a valuable resource in terms of spawning grounds, nursery areas, submerged aquatic vegetation, and shellfish habitat. Since these two bodies of water influence, and are influenced by, the processes that occur in Pamlico Sound, they are included within the Albemarle-Pamlico Study region. While the Bogue and Core Sound drainage area is in DEM's White Oak River Basin, approximately half of this area is in the APES region.

The basin has a permanent population of almost 45,000 and is one of the most densely populated basins in the APES region. Bogue Banks, which separates Bogue Sound from the Atlantic Ocean, accommodates a large annual influx of seasonal visitors while Core Banks, located between Core Sound and the Atlantic Ocean, is a National Seashore. Typical of most of the basins in the APES region, a third of the Core/Bogue Basin is forested. However, the basin has the lowest percentage of farmland in the APES region, with only 17% of its area used for agriculture. A large proportion of the basin is within the Croatan National Forest and about 4% of the land is in military use. With a total of 78 marinas, this basin has significantly more marinas than any other basin in the region.

ENVIRONMENTAL CONCERNS

WATER QUALITY

Neuse River Drainage Basin

Compared to the other river basins in the Albemarle-Pamlico region, the impairment of water uses in the Neuse basin affects less area, but the basin is affected by more severe localized problems. Water use impairment affects 30% of the freshwater stream miles and 9% of the estuarine area. In the freshwater portion, the most widespread causes of impairment are high levels of sediment and low dissolved oxygen. In the estuarine area, the most widespread causes of impairment are high levels of chlorophyll a, reflecting algal growth, and high levels of nutrient runoff from both urban areas and agriculture.

Due to eutrophication in the estuarine area, the lower Neuse River Basin was classified as nutrient sensitive waters (NSW) in 1988. The upper Neuse River basin above Falls Lake has been classified NSW since 1983. In eutrophic water bodies, such as the lower Neuse River, frequent algal blooms reduce available dissolved oxygen and result in fish kills and general environmental stress for aquatic organisms. The waters between Minnesott Beach and New Bern are highly use impaired as a result of frequent algal blooms. Such symptoms of eutrophication in the Neuse estuary have resulted in special concern for nutrient loadings in the basin.

Closures of shellfish harvesting areas are another consequence of impairment in the estuarine portion of the basin. Closures result when concentrations of fecal coliform indicate a possible health hazard for human consumption. This has resulted in the closure of shellfish waters in the lower Neuse estuary. Since 1980, substantial increases in the acreage of shellfish closures occurred in the South River and Oriental areas. Local concentrations of toxic substances, particularly metals and dioxin, have been identified at several sites in the Neuse basin. Samples of water, sediments, and fish tissues have indicated areas of concern for impacts on aquatic life and human health. Compared to the other major river basins of the APES region, toxic concentrations of metals in the water column were highest in the Neuse, particularly in the upper portion of the basin in Durham and Wake counties. Concentrations of metals in sediments are of particular concern in the estuarine portion of the Neuse basin in the New Bern-Bridgeton, Slocum Creek, Lawson Creek-Trent River, and Oriental Harbor areas. Fish tissues sampled at 13 sites had concentrations of metals and other substances at levels of concern for human health. The area of greatest concern is Slocum Creek. Concentrations of metals in fish tissues were of particular concern for wildlife along Contentnea Creek at Wilson and along the Neuse River at New Bern and Kinston. Dioxin concentrations that may be of concern for human health and for wildlife were found in the Neuse near the Weyerhauser facility at New Bern. The Weyerhauser plant has since changed its bleaching process in an effort to minimize this source of dioxin. Contamination levels for dioxin in the Neuse were generally lower than in the Chowan, Roanoke, and Albemarle basins.

Toxic substances enter the basin through both point and nonpoint sources. The point sources in the APES region have been evaluated for their potential to cause toxicity. There are at least 21 dischargers in the Neuse basin that contribute loadings of four metals: zinc, copper, lead, and chromium. Eleven dischargers in the Neuse basin may contribute to instream water quality concentrations of toxics that exceed acceptable levels during low flow conditions. Seven dischargers in the basin have been identified that may potentially exceed such levels under average flow conditions. These dischargers are in Orange, Durham, Wake, and Johnston counties. Another cause of concern for the water quality of the basin is the occurrence of fish and shellfish diseases and kills. Between late 1986 and late 1989, 41 fish kills were reported in the Neuse basin. About two-thirds of these kills occurred in the upper half of the river basin. Low dissolved oxygen, disease, and suspended sediments were suspected of causing the kills. Another possible cause of fish kills in the Neuse basin is a toxic dinoflagellate recently discovered in the Albemarle-Pamlico region. This organism is thought to have been responsible for at least 25% of the fish kills in the Neuse basin over the last two years. The relationship of this organism's behavior to phosphate levels is now under investigation.

The largest source of nonpoint source pollution in the basin is agriculture. Several urban areas in the basin provide another source of runoff. These areas include Durham, Raleigh, Smithfield, Wilson, Goldsboro, Kinston, New Bern, and Havelock. In urban areas, there is a high potential for stormwater to move rapidly into streams and rivers without adequate filtration. Waste disposal sites are another source of polluted runoff. The Neuse basin has over 70 solid and hazardous waste sites, most of which are concentrated in the upper basin counties. There are almost 400 permits for point source discharges in the Neuse basin.

Recommended Management Actions

DEM has already developed a basinwide plan for the Neuse River. Objectives of the plan include: 1) reducing springtime nitrogen inputs by 30%; 2) reducing annual phosphorus inputs by 50%; and 3) restricting total phosphorus levels in wastewater treatment plant discharges. The Falls Lake portion of the river basin is also considered nutrient sensitive and limits on phosphorus inputs have been set. With agriculture as the dominant land use in the basin, increased cost share funding for agricultural best management practices (BMPs) will be critical for the Neuse. Because of the high level of urban development in this basin, funding for nonagricultural BMP cost sharing will also be of critical importance. The additional controls of nonpoint source water pollution would reduce loadings of nutrients and toxics to the Neuse and reduce shellfish closures in the estuarine region of the basin, in addition to other benefits. In the South River area, where shellfish closures are of particular concern, nonpoint source controls would be targeted to reduce bacterial contamination. Enforcement of water quality standards would also help to ensure compliance with water quality standards.

The most important components of efforts to control toxic contamination in the Neuse basin include the continued assessment of the toxicity of sediments, fish tissues, and ambient water quality, especially in areas which are known to have elevated levels of toxicants. The Division of Environmental Management would evaluate potential sources of contamination using geographic information systems information on point source dischargers, nonpoint sources, and ambient water quality data. The plan would also expand basinwide goals for wetlands protection that recognize the importance of wetlands to the basinwide hydrology and water quality.

Core Sound/Bogue Sound Drainage Basin

Compared to the other drainage basins in the APES region, the waters of the Core-Bogue Sound drainage basin are clean and maintain relatively healthy estuarine habitats. The waters of Core Sound and portions of Bogue Sound have been designated as "Outstanding Resource Waters" because of exceptional water quality and recreational value. Overall, only about 7.6% of the waters of the Core-Bogue region are considered impaired. Nearly all of the water use impairment is attributed to bacterial (fecal coliform) contamination, with a small area of metal contamination in the Newport River. There are, however, some significant localized problems and indicators of water quality concerns in the basin. For instance, 25% of the waters of the Newport River only partially support their uses. From 1980 to 1990, closures of shellfish harvesting beds in the region increased by 54% to over 4000 acres. The region is also subject to frequent temporary shellfish closures following periods of heavy rainfall.

The major sources of impairment are pollution coming from urban and agricultural runoff, defective septic tanks, marinas, a state port, and waste water treatment plants. Nonpoint source pollution is responsible for approximately 80% of the area's impaired water quality. A great portion of this nonpoint source runoff comes from urban development where there is a high potential for stormwater to move rapidly into estuaries and sounds without adequate filtration. Urbanized areas in the region include Morehead City, Beaufort, and several areas of development along Bogue Banks from Atlantic Beach to Emerald Isle. There are a few

incorporated areas in the eastern part of Carteret County which are not highly urbanized but may have a level of residential development and supporting services that presents a potential nonpoint source pollution problem. With respect to toxic contamination, the Core and Bogue Sound area is considered one of the least polluted basins in the APES region. No facility was identified as contributing metals directly to the basin and no toxic contamination at levels of concern was found. Nonpoint sources, however, may become a large source of toxic pollutants. Further sampling is needed to document the lack of contamination. The heavy concentration of marinas in this area is another source of possible pollution. Marinas are particularly concentrated near Harkers Island, Atlantic, and Davis in Core Sound and near Beaufort, Morehead City, Atlantic Beach, Cales Creek, Pine Knoll Shores, and Salter Path in Bogue Sound. No solid waste disposal, hazardous waste, or Superfund sites are located in the basin.

Recommended Management Actions

Basinwide management plans will be completed by 1999 in which better nonpoint source pollution control will be needed to address water quality issues in the Core-Bogue area. A nonpoint source cost share program to support non-agricultural as well as agricultural best management practices would contribute to improved water quality. Stormwater runoff controls would be enhanced by strengthening existing regulations by 1995. More comprehensive planning for marinas, through the implementation of an inter-agency state policy that addresses marina siting and best management practices, would help to address the potential for cumulative water quality impacts. Coordinated permitting and public education efforts would be expanded.

VITAL HABITATS

Neuse River Drainage Basin

The Neuse River Basin includes a variety of important natural areas including habitat for rare species, rare natural communities, and high quality examples of other natural communities. Wetlands habitats throughout the basin provide water quality protection, wildlife habitat, flood control, and other important functions. The estuarine waters include approximately 2,750 acres of primary nursery areas and 1,250 acres of secondary nursery areas which are essential to the continued production of coastal fisheries. The rivers and streams of the basin provide spawning areas for anadromous fish, such as shad and herring which are saltwater species that migrate up rivers to spawn in fresh water. Many habitats are protected through government holdings in parks and refuges. State parks encompass 48,000 acres, or 1.4% of the basin. The Wildlife Resources Commission holds approximately 110,000 acres, or 3.2% of the basin, in gamelands. There are no National Wildlife Refuges in the basin, but almost 58,000 acres (1.7%) of the basin is National Forest.

Recommended Management Actions

It is important to protect many land areas of the region as well for the purpose of safeguarding rare species, rare or representative natural communities, nearby fisheries habitat, and other wildlife needs. Priority areas in the Neuse basin have been identified for the targeting of voluntary acquisition and conservation incentives.

These priority areas include: 90 acres of basic mesic forest, 70 acres of coastal plain marl outcrop, 100 acres of nonriverine wet hardwood forest, 100 acres of coastal fringe evergreen forest, 5 acres of diabase glade, 30 acres of upland depression swamp forest, and 35 acres of granitic flatrock. Other vital habitats of special concern in the Neuse area are spawning areas for anadromous fish. Currently, the APES program is working to remove two dams which obstruct the migration of anadromous fish to their spawning grounds on the Neuse. The use of geographic information systems (GIS) would allow agencies and local governments to much more efficiently organize, analyze, and access the information needed to plan runoff controls in the Neuse Basin. This application of GIS will be especially important to efforts in the South River area, where reductions in nonpoint source pollution will help maintain and enhance shellfish populations. The use of this technology will help agencies provide the greatest level of environmental benefits per tax dollar spent.

Core Sound/Bogue Sound Drainage Basin

The Core and Bogue Sound drainage basin is home to a great variety of natural areas, including rare natural communities and rare species habitats. The Core-Bogue area is the home, as well as an important migratory stopover, for several endangered birds including bald eagles, peregrine falcons and the red-cockaded woodpecker. Alligators, which are threatened in North Carolina, inhabit wetland areas, while endangered sea turtles make their nests on area beaches. Important game animals such as duck and deer range throughout the region. Wetlands are especially important, providing wildlife habitat and flood control, while contributing considerably to water quality maintenance. Submerged aquatic vegetation (SAV) is also abundant in this area providing the sole habitat for the bay scallop in North Carolina. SAV is also an important habitat and nursery area for a variety of other fishery species. Some vital habitats in the area are protected through the large amount of government holdings in parks and forest lands. Over 10% of the basin is state gamelands, and another 10% is national forest. Federal seashore land covers 7% of the basin, and federal wildlife refuge lands cover about 6%. State parks cover less than 1% of the basin.

Recommended Management Actions

It is important to protect many land areas of the region as well for the purpose of safeguarding rare species, rare or representative natural communities, protecting nearby fisheries habitat, and for other wildlife protection needs. Programs that expand the advanced identification and evaluation of wetlands on a regional basis would be undertaken to preserve valuable habitats. Priority areas in the Core-Bogue region have been identified for the targeting of voluntary acquisition and conservation incentives. These vital habitat areas include: 242 acres of maritime forests, 65 acres of small depression ponds, and 50 acres of coastal fringe sandhills. The protection of submerged aquatic vegetation is especially important to assuring a viable fisheries industry as well as a healthy marine environment. Restoration of submerged aquatic vegetation and oyster beds is especially important for enhancing shellfish populations in the region. This measure would be complemented by the designation of vital fisheries habitats and the strengthening of regulatory programs by 1995. The use of geographic information systems (GIS) would allow agencies and local governments to easily share and update information which is critical to the management of important resources in the Core-Bogue area such as shellfish beds, submerged aquatic vegetation, and rare species habitat. Maps of these

resources on GIS, in conjunction with other map layers, such as land uses and development permits, would allow assessment of water quality concerns.

FISHERIES

Neuse River Drainage Basin

Recreational and commercial fishing are important economic activities in the estuarine and fresh water portions of the basin. Important fisheries include flounder, catfish, bass, blue crabs and oysters. Commercial fishing in the Neuse basin is conducted with long haul seines, shrimp trawls, crab trawls, crab pots, oyster dredging, drift gill nets, bait fish pound nets, and eel pots.

Recommended Management Actions

Fisheries management plans would address declines and include recovery objectives for severely depleted stocks. In addition, best fishing practices (BFP) that reduce bycatch and impacts on fisheries habitat will be evaluated along with the implementation of a cost share program to encourage use of BFPs.

Core Sound/Bogue Sound Drainage Basin

Core and Bogue Sounds are very important estuarine fishing areas for both recreational and commercial fishermen. Commercial fishing is an important component of the economy in this area, and commercial fishermen harvest a wide variety of fish with many different gear types. Commercial fishing practices in the sounds include pound nets, long haul seines, shrimp and crab trawls, crab pots, sink gill nets, and channel nets. Shellfish are taken by tonging, raking, bull raking, hand harvesting, dredging, and clam kicking. The region is also a popular destination for recreational fishing, providing another important component of the regional economy.

The waters of Core and Bogue Sounds are particularly important for their shellfish beds. Almost all of the state's bay scallops and many of its hard clams and oysters are harvested here using both hand and mechanical means. The Bogue and Core Sound area has an abundance of vital fisheries habitats. Next to the Pamlico Sound Basin, the Core/Bogue Basin possesses more fish nursery areas than any other basin in the APES region. Nursery areas in Core and Bogue Sounds and their tributaries comprise the greatest percentage of the basin. The importance of commercial and recreational fisheries in the region emphasizes the need for coordinated and comprehensive fisheries management planning. The modification of the existing marine fisheries license structure would improve data collection and generate increased revenues for improved fisheries management. The reduction of bycatch attained with bycatch reducing gear and the best fishing practices cost share program would also help to protect and enhance the region's fisheries.

PUBLIC COMMENT and PUBLIC PARTICIPATION

APPENDIX B

SUMMARY OF PUBLIC PARTICIPATION
DURING THE DEVELOPMENT OF THE CCMP

The goal of public involvement within the Albemarle-Pamlico Estuarine Study (APES) was to establish the public consensus necessary to ensure long-term support for, and implementation of, the Comprehensive Conservation and Management Plan (CCMP). Consensus signifies substantive agreement among four component groups: elected officials, environmental managers, scientists and the public. Those groups had to concur on what was technically well-founded, fair, feasible and most likely to succeed within the management strategies described in the CCMP. Consensus also implies the willingness of participants to work together and to compromise to achieve mutual goals.

Informing/involving the public and securing their concurrence for support of a program as varied and widespread as the APES was no small undertaking. Public participation, as defined and demonstrated within the APES, meant involving citizens to all practicable levels in the decision-making process. To achieve this, and it was achieved to an unprecedented degree, required several important elements. Paramount among them was the need for the dissemination of timely and relevant information pertaining to the Management Conference and the issues and needs of the region. In order to accomplish this a Public Involvement Office was established in the region in November, 1987 and a Public Involvement Coordinator was hired.

The Public Involvement Coordinator, in concert with the Citizens Advisory Committees (A-CAC and P-CAC), created a Public Involvement Plan. The Plan recognized the need for a comprehensive mailing list, a slide show, newsletter, printed and electronically transmitted information pieces, and public meetings. Because the Public Involvement staff consisted of the Public Involvement Coordinator only, a "call for proposals" was issued for assistance in attaining the Plan's objectives.

The materials and activities produced for and by APES targeted a comprehensive array of users. Included in those products were print pieces entitled: A Citizens's Guide to Coastal Water Resource Management; Where the Rivers Meet the Sea; A Guide to Estuaries; A Blueprint for Action; Fact Sheets (on the Albemarle, Pamlico and Virginia portions of the Study); Environmental Management Program for the Southeastern Virginia Portion of the APES Watershed; Nature's Caretakers; and a non-technicalHandbook on Water Quality and Non-point Source Pollution.

Other print pieces produced included: posters emphasizing the physical aspects of estuarine areas and the human impact on them; a series of bumper stickers; a companion piece to the T.V. public service announcement (PSA) campaign entitled Yes,in Your Back Yard; and the synopses of ten technical research projects, the selection of which were determined by the Citizens Advisory Committees.

Electronically transmitted pieces for radio and T.V. included:(Radio) a five-part series about the sounds which was aired on National Public Radio; eight PSAs consisting of interviews with area environmental experts which aired on radio stations around the APES region; six radio programs which were developed and aired on ten radio stations in North Carolina and Virginia, that stressed estuarine health and good stewardship. Issues which were the focus of the shows included point and non-point sources of pollution, wetlands, waste treatment, human impacts, economics, public participation, fisheries, and fish diseases. These were live interactive radio broadcasts with public phone-in capabilities.

Another radio PSA campaign consisted of eight programs (25 broadcasts) on the state syndicated radio program Weekdays with Barbara King. The series consisted of taped interviews and suggestions for public actions to help preserve the estuarine system.

Additionally, a heavy penetration into T.V. was undertaken. Those efforts consisted of four PSAs dealing with area environmental issues; two campaigns entitled State of the Estuary (five spots) and Yes, In Your Back Yard (five spots) which were distributed to every T.V. market in North Carolina; and an intense campaign entitled Inside North Carolina which consisted of five T.V. shows, of one hour's duration each, that highlighted the various sections contained in the CCMP. These shows were broadcast live over the cable network in North Carolina and were received in over 10,000 households. Phone-in capabilities were provided to the public and a panel of environmental experts involved with the Management Conference fielded questions by the viewers calling-in. And finally, a broadcast on the local ABC affiliate entitled Newsleader Sunday which featured a point, counterpoint format. Participating were the APES Program Director and a representative of the economic development community.

Workshops and public meetings were an important part of the APES public participation effort. Extending from the designation ceremony establishing APES as the first NEP in November, 1987, to the signing ceremony formally accepting the APES CCMP into implementation, the public has been closely and continually involved. In addition to the two mentioned, other examples of meetings and activities include: the Institutional Enhancement, Public Involvement, and Information Exchange which encouraged and facilitated public participation, information exchanges and technical evaluations in southeastern Virginia; a media tour for regional and local reporters (newspaper, T.V. and radio); APES Annual Meetings; a workshop on Water Quality and Non-point Source Pollution; a public forum on management needs (series of three held around the region) where citizens voiced their concerns on a variety of environmental issues; two series of user-group meetings to determine their concerns and to elicit their suggestions for management recommendations; and public meetings devoted to receiving public comment on the draft versions of the CCMP.

Other APES efforts targeted at public involvement and education included the creation of a slide show which focused on the watersheds of the Albemarle and Pamlico sounds (chronicling the path of water from the mountains of North Carolina to the sounds), a video which dealt with the issues of pollution, fisheries and waterfowl migration, and the APES newsletter, The Albemarle-Pamlico Advocate, circ. 16,000+ with quarterly publication.

The establishment of permanent exhibits at two of the state's three aquaria was another APES educational contribution. They are entitled, Striped Bass and Precious Waters and depict, through the use of graphics, interactive computers and large aquaria, the life history of striped bass and an appreciation and awareness of the region's fragile coastal environment, respectively.

Completing the array of APES public involvement and educational activities were the workshops devoted to teacher environmental education and visits/presentations to public officials.

Teacher workshops focused on providing teachers with an understanding of the aquatic environment and its management, and the ability/opportunity to develop creative ways of integrating those concepts into their curricula.

Visits/presentations to area public officials were aimed at apprising them of the status of the Management Conference, impending recommendations of the CCMP, answering their questions, quelling misinformation, eliciting their input, and assuring them that the CCMP was not adding "another layer of bureaucracy" to their already overly burdened compliance with regulations. The APES region consists of the 36 most northeastern counties in North Carolina and 16 of the most southeastern counties in Virginia. Included in this area are approximately 250 municipalities and unincorporated communities. Personal visitations were made to 135-150 of those locations.

The broad goal of public involvement, to establish public consensus, suggested several specific objectives, namely:

-to provide adequate, timely information about the sounds, the problems and opportunities North Carolina faces in managing them, and progress being made in the Albemarle-Pamlico Estuarine Study;

-to expand educational programs to inform the public, (youth and adult populations) about the values of the Albemarle-Pamlico system and the importance of good management/stewardship;

-to ensure that the interested public had ample opportunity to participate in the policy-making process related to the sounds, especially the development of the CCMP; and

-to initiate a process for involving local elected officials in the APES program

The public has been actively involved in all phases of the Comprehensive Conservation and Management Plan (CCMP) development. Participation by members of the Management Conference, and most especially the two Citizens Advisory Committees (A-CAC, P-CAC), local governments, fisheries auxiliaries, League of Women Voters, environmental organization members, general citizenry, and others provided input at every stage of development. (See Public Comment Summary).

Included in APES outreach were numerous presentations to civic/community groups and school children. Extensive participation in environmental field days in the region, APES' presence at festivals and other outdoor activities, coordination and presentation of several in-service teacher training workshops and a heavy media presence that included the print and electronic media coverage described earlier, were all a part of outreach/involvement activities.

In addition to the approximately twenty- five APES funded public participation projects a citizens' water quality monitoring program (including more than 100 volunteers and 65 collection sites) and an environmental education day-camp for middle school aged students, complemented staff public participation efforts.

The most specific CCMP input and public comment was received during the numerous presentations to local governments (approximately 135-150 on both the county and municipal level); at the two series of "user-group" workshops with facilitated leadership; and at the three rounds (consisting of at least four locations each) of public hearings held in September, 1992, and January and October, 1993. Phoned-in and written comments were also received at the program offices.

As a first step toward developing the CCMP, the Management Conference committees (the Policy, Technical and Citizen committees) produced a list of suggested management actions they felt should be included in the CCMP. Following that, in the winter of 1992, the first series of "user-group" workshops was held to gather input from those that might be affected by the suggested actions. Dischargers, developers, fishermen, local officials, environmentalists, agricultural and silvicultural representatives and others were invited and homogeneously grouped, to discuss which actions they could support, which they perceived as controversial, and other actions they deemed important, but which might not have been listed. Feedback from these workshops formed the foundation of the first CCMP draft which was presented to the public in September, 1992.

A second CCMP draft was developed based upon comments received from the first round of public hearings and in January, 1993 it was released for public comment.

In late June and early July, 1993 the second series of six "user-group" workshops was held around the study area to elicit response to an internal CCMP third draft and to gather input preparatory to producing the third public draft. This time, however, the participants were grouped heterogeneously for the purposes of identifying potential areas of conflict among them and to promote the consensus needed to drive development and ownership of the CCMP.

Attendance at each of the six workshops consisted of approximately 15 participants which again, represented a variety of interests. Included in the mix were representatives from agriculture, economic development, fishing communities, local government, environmental organizations, industry, and others. While not every meeting had participants from every group, the overall participation by these interested parties was well represented.

Attendees were asked to offer general comment on the organization and content of the draft CCMP which had been distributed to them at an earlier date. They then were asked to offer comment on the individual plans contained in the draft, and finally to rate their overall reaction to the plan and specific management action priorities. These recommendations were entertained and incorporated in the third public draft.

In addition to the "user-group" workshops, the third round in the series of public hearings was held in October of 1993 to obtain comment on the third public draft. Held at appropriate locations within the study area, each of the meetings was attended, on average, by approximately eighty-five persons.

All public comments are summarized in this document. Each draft of the CCMP is discussed separately so that the reader may understand how different each version was and how much public comment influenced these changes.

SUMMARY OF PUBLIC COMMENT
DURING THE DEVELOPMENT OF THE CCMP

The development of a Comprehensive Conservation and Management Plan (CCMP) for the estuarine system of North Carolina has been a highly public process from its inception, beginning with a kickoff meeting in 1987 which was attended by over 500 people. That commitment to widespread involvement continued through the course of the Study. Agencies at all levels of government, citizens and members of organized interest groups participated throughout.

The goal of the public involvement campaign has been to increase local government and public understanding of the extent and causes of the region's environmental problems, thereby building consensus for ways to address those problems (Giordano 1989). This public involvement goal has dictated the structure and tone of the CCMP throughout its development.

The public involvement effort was heightened as production of the CCMP began in 1992. as a result of concern about insufficient involvement by local governments, staff was added to contact each county in the region. Local government liaisons provided information on the APES program and responded to concerns and comments from local governments.

North Carolina's APES program has actively involved the public. It has been guided by a Management Conference, composed of 95 members who are divided into four committees: a Policy Committee, a Technical Committee, an Albemarle Citizens Advisory Committee, and a Pamlico Citizens Advisory Committee. The members of these committees represent government agencies, university researchers, and the public. Citizens represent a variety of interests: environmental groups, agriculture, forestry, industry, fishermen, and local elected officials.

The two Citizen Advisory Committees provided input to the Study from various interests, and over $1 million was awarded to public participation projects during APES' research phase (1988-92). Three public hearings and over 100 meetings involving various sectors of the public were held. Staff in the Department of Environment, Health, and Natural Resources (DEHNR) offices in Raleigh and Washington served as contacts for the public.

PREPARING THE CCMP

The CCMP has gone through three full public drafts.

As a first step toward developing the CCMP, the Management Conference committees (the Policy, Technical and Citizen committees) produced a list of suggested management actions they felt should be included in the CCMP. Following that, a series of "user group" workshops was held to get input from groups that might be affected by the suggested actions. Dischargers, developers, fishermen, local officials, environmentalists, farmers and others were invited to discuss which actions they could support, which they perceived as controversial, and other actions they deemed important, but that had not been listed. (Armingeon 1992) Feedback from these workshops formed the foundation of the first draft.

That draft was delivered to the Management Conference in June of 1992. Upon review by the Management Conference committees, it was decided that major changes were needed to the document before it went out for a general public review. Those changes were made during the Summer of 1992. The Plan went for its first public review in September of 1992. Comments received during that period were incorporated into a second draft which went out for review in January of 1993.

Originally it was anticipated that the document would be completed following this review, but the intensity of reaction to the Plan prompted the Management Conference to approve a third draft and review. Based on public comments, an internal third draft was produced in the Spring of 1993 and reviewed in another series of "user group" workshops in June. Changes based on those workshops were then incorporated into a third public draft, which went out for review in October of 1993. Final changes were made over the next month and the Study's Policy Committee approved the Plan for delivery to the Governor and the EPA Administrator on November 30, 1993.

Throughout the entire drafting process, written and phoned-in comments were received and considered in subsequent drafts. All public review periods were followed by a Management Conference meeting to discuss public comment and appropriate recommendations. Management Conference hearings were always open to the public.

All public comments are summarized in this document. Each draft is discussed separately so the reader may understand how different each draft was and how much public comment influenced these changes.

SUMMARY OF PUBLIC COMMENT:
FIRST PUBLIC DRAFT, SEPTEMBER 1992

Public hearings were held in New Bern, Rocky Mount, Elizabeth City, and Franklin, VA.

Extensive public comment was received on this draft regarding its style and readability. Overwhelmingly in public hearings, individuals described the CCMP as too complicated and technical and difficult for the average citizen to read and understand. A list of main issues follows:

GENERAL COMMENTS

- Complex and bureaucratic, too technical
- Focuses excessively on regulation and mandates
- Use incentives, technical assistance and compensation (take advantage of programs such as the Tar-Pamlico Basin Association's pollution trading program)
- Prioritize problems and solutions to better focus implementation
- Set clearer and better-defined goals
- Develop more actions involving Virginia

WATER QUALITY PLAN

- Eliminate mandatory buffers
- Expand mandatory buffer zone
- No need for notice of intent to harvest forested areas
- Recommend stronger enforcement of water quality standards (e.g., a comprehensive, enforceable marinas policy)

VITAL TERRESTRIAL AREAS AND WETLANDS ACTION PLAN

- Ensure that land acquisition is a voluntary program
- Don't limit amount of lands to be acquired
- Reimburse counties for loss to tax base if land acquired
- Statewide wetlands policy unnecessary -- federal policy exists
- Define protective designations for SAV beds

HUMAN ENVIRONMENT PLAN

- Oppose mandatory land and water use planning
- Need to recognize vital role that farmers play in human environment as food providers
- Use of Geographic Information Systems is cost prohibitive for municipalities to fund on their own

PUBLIC ACTION AND INVOLVEMENT PLAN

- Acknowledge volunteer programs

FISHERIES ACTION PLAN

- No written comment

IMPLEMENTATION PLAN

- Too many DEHNR representatives
- Not enough local government representation
- Not enough citizen representation
- People involved with Management Conference should be included in post-APES structure
- Ensure ongoing documentation of the progress of implementation

RESPONSE TO PUBLIC COMMENT ON FIRST DRAFT

GENERAL

Throughout development of the second draft, any detail-oriented comments on the first draft were usually integrated into the text. Changes to wording or definition of technical terms submitted by experts replaced existing language. Other technical comments, such as those which questioned the validity of statistical figures, graphs or statements, were re-confirmed by the staff and kept in the text if verifiable. Attention to an individual's specific comments occurred at every stage of the process. The following reviews responses to general public comment:

To address the complexity of the document, management actions were defined more clearly in the second draft. The structure of the text was modified to be more explanatory. Some technical background information was taken out and placed in an appendix. Many of the regulatory recommendations were modified to be more incentive-based. Some management actions were redrafted to accommodate concerns of user groups who presented substantive rebuttal. For example, an action requiring logging operators to file a notice of intent to harvest was removed. An action calling for mandatory land use planning was transformed into incentives for county planners to integrate environmental planning into economic development plans, and providing grant funding for them to do so.

WATER QUALITY PLAN

In the Water Quality Plan, the most controversial item was the recommendation for mandatory 20-foot vegetative buffer strips along all estuarine/river shorelines. The buffer strips had been recommended as a best management practice (BMP) that would cost-effectively control nutrient and sediment pollution in the region's waters. This action was both supported and opposed. Many people who desired strong controls for water quality supported the buffers but cited research demonstrating that buffers of at least 50 feet were needed to ensure adequate protection. Others were concerned that mandatory buffers would limit the use of their land. They considered the action a taking of property and would therefore require compensation. The 20-foot buffer strips remained in the Plan at this stage.

In addressing other water quality concerns, most mandatory programs were modified to encourage resource managers to develop interagency policies or better integrate best management practices.

VITAL TERRESTRIAL AREAS AND WETLANDS ACTION PLAN

Many of the suggestions given for this section were taken into consideration. Responses to public comment took the form of changes to wording or structure of the document. Many clarifications to the actions were added to dispel fears of hidden agendas.

IMPLEMENTATION PLAN

Instead of just departmental representatives, the new implementation structure included a "Coordinating Council" which had broader representation and was intended to work in tandem with three other advisory councils -- a Local Government Advisory Council, a Citizen's Advisory Council and Technical Advisory Council. Each advisory council would have representation on the Coordinating Council.

SUMMARY OF PUBLIC COMMENT:
SECOND PUBLIC DRAFT, JANUARY 1993

Public hearings were held in Morehead City, Greenville, Manteo, and Raleigh.

Many comments indicated that the second draft appeared little improved from the first. Although some of the stronger, more regulatory actions were removed, the predominance of comments received indicated that the document still focused too much on new regulation. County governments in particular voiced their concerns over this and the lack of attention to economic impacts in the document. Environmental groups asked again for more clarity in the type of actions the CCMP was recommending. Many individuals continued to describe the Plan as too technical and hard to read. They said it was difficult to determine the main goals and objectives of the study. As noted earlier, the intensity of reaction to the Plan at this stage led the Management Conference to call for a third draft and public review rather than going to a final version from this point.

GENERAL

- Many comments from 1st draft were not adequately addressed
- Falls short of expectations
- Reduce regulation and controls (minimize state influence on land use planning), enforce existing laws better
- Support for greater focus on nonpoint source pollution control
- Strongly suggest recommending more stringent nonpoint source pollution controls
- Contains no thorough cost-benefit analysis or assessment of impacts on tax base and jobs
- No specific requirements for waste minimization
- Plan initially flawed because Management Conference committees aren't diverse enough
- Streamline bureaucracies and support/acknowledge successful programs
- Balance environmental protection with human activities
- Develop basin action plans with specific goals, priorities and actions
- Expand outreach efforts to make contents of the CCMP clear
- Must prioritize problems and solutions
- Make monitoring program more scientifically sound (Quality Assurance/Quality Control, include air deposition)
- Reference other APES research better
- Improve structure: shorter in length, better graphics, references and citations
- Economic considerations: caution about long-term costs to the public, respond to value of tourist industry, don't be anti-growth (balance land development), costs should be shared across watershed, assess costs of compliance
- Add finance section to each action

WATER QUALITY PLAN

- Support buffer strips; increase them to 50 feet
- Support education for logging industry instead of requiring notice of intent to harvest

- Need better logging BMPs
- Create enforcement program for nonpoint source pollution, expand controls
- Evaluate effectiveness of agricultural cost share program
- Continue to investigate causes of fish & shellfish kills & disease

VITAL TERRESTRIAL AREAS AND WETLANDS ACTION PLAN

- Revise definitions of wetlands degradation and loss
- Recognize private property rights, re: compensation for publicly acquired lands
- Regulation in vital areas more effective than tax incentives
- Include data on Virginia critical natural areas, wetlands & endangered species
- Develop Memorandum Of Agreement between VA and NC to continue research and cooperate

FISHERIES PLAN

- Examine socioeconomic impacts of regulation on fishermen
- Promote aquaculture as a defined Best Fishing Practice (BFP)
- Concern that a government-sponsored BFP cost-share program would be inefficient and unfairly administered
- Support license to sell fish, but differentiate between commercial and recreational
- Support license to sell only if 50% of income comes from sale of fish
- Consider prohibiting the use of trawls in the Sounds
- Include those who make a living fishing in the development of fishery management plans
- Include baseline catch estimate for bycatch reduction
- Don't reduce access to fishery
- Develop a separate education effort for those involved in commercial fishing
- Modify license structure to allow for control of fishing effort and/or gear where necessary

HUMAN ENVIRONMENT PLAN

- Don't duplicate efforts of CAMA
- Help instill an environmental ethic
- Oppose mandatory land use planning

IMPLEMENTATION PLAN

- Oppose the implementation of anything which does not use existing resources and funding
- Coordinating Council as described is unmanageable and still does not have adequate citizen representation
- Include implementation actions and timelines
- Needs more local government representation
- Keep at least 1 staff member to coordinate implementation and keep public informed
- Retain committee structure
- Develop regional Advisory Councils
- Council needs representatives from regulated community

REVIEW OF RESPONSE TO PUBLIC COMMENT ON THE SECOND DRAFT

GENERAL

The third public draft was dramatically restructured from the second due to overwhelming public comment. Several activities were undertaken to bring this about. In addition to public meetings and the receipt of written comment, another series of user group workshops was conducted in the Summer of 1993 to review an internal redrafting of the Plan (Waters 1993). These workshops were very effective in determining the path to consensus, and they helped further push the document toward a simpler and more accessible format. Whereas the first two drafts focused on the vast amount of scientific research supported by the APES program, it was decided that the technical and scientific data could be found in project reports and did not need to be repeated in depth in the Plan itself. Therefore the main section of the CCMP was structured to provide only a basic explanation of what each management action was expected to achieve and what steps would be necessary to implement it. The third draft also reflected more movement to consensus and compromise in order to broaden public support of it.

The following specific changes were made to the Plan:

Monitoring requirements and procedures were included in each management action and were no longer listed as a separate section. A breakdown of estimated program costs of each recommendation was included with each action. Sources of funding to support each action were listed as well. The five sub-plans were renamed and reorganized to enhance understanding and public perception of the issues. Vital Terrestrial Areas and Wetlands Action Plan became the Vital Habitats Plan. This plan recognizes the unique nature of habitat areas without placing an undue emphasis on wetlands management. The Human Environment and Public Education and Involvement Plan were combined into one Stewardship Plan, intended to promote responsible stewardship of our natural resources. Water quality, viewed by most as the highest priority of the CCMP, was placed first among the individual plans.

Ultimately, the third draft became more oriented toward incentives and better coordination of existing efforts. Recommendations emphasized best management practices and interagency policies to coordinate common problems.

The issue of prioritizing problems and solutions was addressed in the implementation section of the Plan. However, the most significant change the third draft made was to emphasize a basinwide approach to management of water quality and habitat protection. Each major river basin in the APES region is characterized by a unique set of problems. Members of the Management Conference determined that the best way to achieve flexibility (and consensus) was to consider recommended management actions on a basinwide scale. The third public draft included regional summaries of these individual river basins. These summaries describe problems specific to each basin area and suggest how the recommended actions would be applied to the region. Each river basin will go through individual, intensive analyses to determine its own priorities and timetables.

WATER QUALITY PLAN

The requirement to have mandatory buffer strips, the most controversial issue of the CCMP, was removed from this draft. Due to the new focus on basinwide management, it was determined by the Management Conference that a regionwide standard control would be ineffective. The use of buffer strips still takes high priority as a best management practice to control nonpoint source pollution, but it may now be used to accommodate varying circumstances.

The Management Conference also determined that an educational program to control damage from silviculture practices was insufficient. The requirement that loggers file a notice of intent to harvest with the Division of Forest Resources was reinstated at the recommendation of the Management Conference. The Agricultural Cost Share program was evaluated by APES and determined to be both effective and worth expanding. Shellfish disease will continue to be investigated.

VITAL TERRESTRIAL AREAS AND WETLANDS ACTION PLAN

The section on these habitat areas was greatly reorganized for the third draft. Protecting vital areas was promoted with an emphasis on voluntary conservation or management of privately owned lands. Wetlands actions were modified and remain consistent with existing programs at a federal and state level. The Wetlands Action Plan was combined with the Vital Habitats Plan to reduce concerns about the creation of a regulatory structure separate from existing federal and state programs. Information from and cooperation with Virginia is integrated into this section.

FISHERIES PLAN

The Fisheries Plan was structured to closely mirror recent activities of the Division of Marine Fisheries and the Marine Fisheries Commission, which had been in the process of developing new recommendations that are feasible and supported by the fishing community. This section encouraged existing authorities to develop individual management plans as appropriate for species, taking into consideration biological and socioeconomic impacts to the fisheries. Stronger controls (such as the prohibition of inshore trawling) were inappropriate at this time due to a lack of sufficient supporting data.

HUMAN ENVIRONMENT PLAN

The intention of this section, modified as the Stewardship Plan for the third draft, was to promote individual protection of natural resources. It recognizes that land use planning is a valuable tool for integrating the environment into economic development and allows local governments to adopt this strategy---not through mandatory land use planning but by providing funds to enable local governments to develop or update environmental planning. The effort is designed to complement CAMA requirements for planning instead of creating new ones.

Two-thirds of the Stewardship Plan is dedicated to promoting an environmental ethic for the protection of the sounds through educating the public. This section extends outreach efforts, calls for the establishment of environmental education centers, integrates science into school curricula, and illustrates successful volunteer and non-profit organizations that serve the region.

IMPLEMENTATION PLAN

Consensus was perhaps the hardest to reach in this section, primarily due to continuing concerns over the structure of the Coordinating Council. The Coordinating Council as described in the second public draft was reorganized to include Regional Advisory Councils. Regional Advisory Councils would include local government officials and members of other interest groups who would in turn be represented on the Coordinating Council by an individual chosen by the region. The Coordinating Council as described would perform much of the same function as the present Management Conference and would include a small support staff.

The management actions in the third draft now described how each action would be implemented by the appropriate parties. The Implementation Plan would then provide consistency and forward progress. The Coordinating Council would be charged to oversee implementation, set priorities and evaluate success of the actions.

SUMMARY OF PUBLIC COMMENT:
THIRD PUBLIC DRAFT, OCTOBER 1993

Hearings were held in Morehead City, Greenville, Raleigh, Edenton, and Kill Devil Hills

Public responses to the third public draft were much more favorable than to earlier drafts. Some groups who opposed certain sections went on record in support of the Plan as a whole, recognizing that it was a document that reflected consensus and necessary compromise. Three issues remained contentious -- the notice of intent to harvest for loggers, the lack of local government representation on the Coordinating Council, and a fear that the implementation of the Plan would create an additional layer of bureaucracy. The Plan in similar form with modifications to address these issues, was accepted by the Management Conference's Policy Committee on November 30, 1993.

GENERAL

- Support for basinwide approach
- Much improved over last draft
- Support for cost share programs
- The Plan has no teeth, lacks specific recommendations
- Must now provide the public with more information on stewardship from an individual level
- Format is more user friendly
- Lacks priorities and deadlines
- Still doesn't provide a thorough cost-benefit analysis of proposals

WATER QUALITY PLAN

- Some specific water issues are excluded (attention to water quantity, effects of air deposition)
- Incentives for compliance are weak--need stronger nonpoint source pollution controls
- Lack of attention to forestry issues
- Reject requiring a notice of intent to harvest
- Pleased to see mandatory buffers removed
- Disappointed that buffers were removed
- Needs more emphasis on best management practices requirements and how they relate to the APES CCMP
- Recognize incentive programs to address point source pollution

VITAL HABITAT PLAN

- Shouldn't promote the public acquisition of lands because the government poorly manages currently owned lands

FISHERIES PLAN

- Fishing rules are inconsistently enforced
- Support sound management of fisheries
- Make license fees variable depending on fishing practices, gear used and size of operation
- Prohibit trawling in the sounds
- Don't let Division of Marine Fisheries research on new bycatch-reducing gears lapse

STEWARDSHIP PLAN

- Concern for how regulation will affect development
- Concern for impact on local planning process and government
- Ensure that environmental education includes attention to the interrelationship between the environment and the economy

IMPLEMENTATION

- Concern that the implementing structure adds a layer of bureaucracy
- Concern that costs associated with implementation will continue to expand
- Not enough local government representation on the Coordinating Council

RESPONSE TO PUBLIC COMMENT ON THE THIRD DRAFT (TO PRODUCE THE FINAL DRAFT)

GENERAL

Much of the general comment received from the Plan was supportive. In terms of the Plan not being strong enough, or not having enough "teeth," it was determined by the Management Conference that it was still an excellent framework for protection of the estuarine region. In its present form, more groups could support it and pledge to implement its recommendations. Specific control strategies tailored to the needs of each basin would be developed during the implementation process.

WATER QUALITY PLAN

A meeting was held immediately after the public meetings to address the forestry intent to harvest issue. Representatives from the forestry industry and government convened to discuss options and determined that an education effort, privately funded training program, and increased enforcement would be more effective.

Other comments referring to issues which were excluded at that time were considered and referenced in the CCMP in an appropriate location. For example, one may find a description of the Tar-Pamlico Association's pollution trading program and how it works in the introduction.

VITAL HABITATS PLAN

The Vital Habitats Plan was not modified. It is the position of the Management Conference that the public acquisition is still a good tool for habitat conservation. This section of the plan should enhance existing public management programs.

FISHERIES PLAN

The Fisheries Plan was not modified. A response to similar issues may be found with the response to the second draft.

STEWARDSHIP PLAN

The section on land use planning in the Stewardship Plan specifically makes local governments responsible for any action taken. The recommendation calls for financial and technical assistance. Also, a management action recommending support for a public-private organization called the Partnership for the Sounds was shifted from its place in the section's educational objective to its planning/economic development objective, reflecting the economic emphasis of the Partnership.

IMPLEMENTATION PLAN

The structure of the Coordinating Council was modified to include more local government representation. The membership of each Regional Council has at least two elected/appointed local government officials representing every county in each basin. Each Regional Council will then choose three members to represent it on the Coordinating Council; at least two of which must be elected/appointed local government officials.

CONCLUSION

Public comment has had a tremendous impact on the APES program throughout its existence, for it is understood that the public has to live with the Plan and that implementation will fail if there is no public support for it. It is important to note that the final version of the CCMP recognizes this clearly and in fact calls for continuing and increasing public involvement in environmental policy-making during the implementation phase.

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GLOSSARY AND LIST OF ACRONYMS

APPENDIX C

acquisition	To obtain or procure vital habitats, through purchase, donation or other means, for protection, enhancement, and restoration.
acute toxicity	Lethal or having other harmful effects to organisms in controlled toxicity tests with short-term exposure to specific substances or mixtures.
aerobic	Living or occurring only in the presence of oxygen.
agriculture cost share	A program that provides financial assistance for implementation of best management practices.
algae	Plants that are aquatic, nonflowering, and have no roots. Algae convert carbon dioxide and inorganic nutrients such as nitrogen and phosphorus into organic matter through photosynthesis and form the basis of the marine food chain. Common algae include dinoflagellates, diatoms, seaweeds, and kelp.
algal bloom	A condition which occurs when excessive nutrient levels and other physical and chemical conditions enable algae to reproduce rapidly. Algal blooms often cause a change in water color, and the decay of the algal bloom may reduce dissolved oxygen levels in the water.
anadromous	Fish species, such as shad, herring, and striped bass, which migrate from their primary habitats in the oceans up freshwater rivers and streams to spawn.
anaerobic	Able to live or occurring in the absence of oxygen.
anoxia	The absence of oxygen.
anthropogenic	Effects or processes that are derived from human activity.
aquaculture	The controlled cultivation and harvest of aquatic plants or animals.

aquifer	An underground layer of rock or soil in which groundwater is stored.
assimilative capacity	The amount of pollutants that a water body may absorb while maintaining corresponding water quality standards including the protection of best use.
bathymetry	The measurement of the depth of large bodies of water.
benthic	Living in or on the bottom of a body of water.
benthos	Collectively, all organisms living in, on, or near the bottom substrate in aquatic habitats.
best fishing practices (BFP)	Techniques that reduce unwanted or non-targeted fish harvests in an economically feasible manner.
best management practice (BMP)	A method, activity, maintenance procedure, or other management practice for reducing the amount of pollution entering a body of water.
best uses	Designated uses for a water body which include aquatic life propagation and maintenance (including fishing, fish and functioning primary nursery areas), wildlife and secondary recreation, water supply (freshwaters), and shellfishing (saltwaters).
bioaccumulation	The process by which a contaminant accumulates in the tissues of an organism.
biological integrity	The capability of supporting and maintaining a balanced, integrated, adaptive community of organisms having a species composition and functional organization comparable to that of the natural habitat in the region.

biological oxygen demand (BOD)	The measurement of oxygen required by aerobic biological processes to break down organic matter in water. (Conventional wastewater treatment aims to reduce BOD to prevent a significant reduction in the oxygen content of the receiving water body.)
biota	The animals, plants, and microbes that live in a particular location or region.
brackish	Having a salt content in the range between fresh and salt water.
buffer strips	A management practice that reduces runoff and nonpoint source pollution loading by maintaining a protective border around critical habitats or water bodies.
bycatch	Due to the use of certain gear or fishing practices, fish harvested in addition to the species targeted for harvest.
catch per unit effort	The amount of fish caught with a given amount of effort (e.g., number of boats/people, amount of gear/time fished).
chronic toxicity	Any harmful effects to organisms in controlled toxicity tests with long-term exposure during a sensitive period of the life cycle to specific substances or mixtures. Early life stages or reproductive toxicity tests may be used to determine chronic impacts.
chlorophyll a	A green pigment, found in all plants that undergo photosynthesis, that is used as an indicator of algal growth in a water body.
community	See natural community.

critical habitat — Areas which are essential to the conservation of an officially-listed endangered or threatened species and which may require special management considerations or protection.

crustacean — Invertebrates of the phylum Arthropoda, including shrimps, crabs, copepods, barnacles, and other animals which have segmented bodies, jointed legs, and hard external shells.

cultch — A hard substrate, such as oyster shells, on which larval oysters ("spat") attach and mature.

database — A collection of data arranged for ease and speed of retrieval.

dinoflagellate — Minute organisms, chiefly marine protozoans of the class Dinoflagellata. Dinoflagellates usually have two flagella and an outer envelope of cellulose. These organisms are one of the main constituents of plankton.

dioxin — A chemical by-product of the paper bleaching process.

dissolved oxygen (DO) — Oxygen available to organisms and chemical processes in an aquatic environment.

easement — A voluntary, legally binding agreement in which the land owner sells or donates some or all of her or his rights to develop or use the land.

ecotourism — Maintaining and preserving natural resources as a basis for promoting economic growth and development in vital natural areas.

eelgrass (*Zostera marina*) — A type of submerged aquatic vegetation. Eelgrass is a flowering marine plant that grows on intertidal and shallow subtidal sand or mudflats.

effluent	Treated or untreated waste material that is discharged into the environment from a point source, such as a wastewater treatment plant or an industrial facility.
epiphyte	A plant which grows on another plant and depends on that plant for mechanical support but not for nutrients.
estuary	A coastal water system in which ocean water mixes with fresh water from rivers and streams; where the river meets the sea.
eutrophication	A process in which a water body becomes rich in dissolved nutrients, often leading to algal blooms, low dissolved oxygen, and changes in community composition. This occurs naturally, but can be accelerated by human activity which increases nutrient inputs to the water body.
exotic	Not native. Introduced from another location.
fecal coliform	Bacteria from the intestinal tracts of warm blooded animals. High numbers of fecal coliform bacteria in a water body may indicate a recent release of untreated wastewater and/or the presence of animal feces. Fecal coliform is used as an indicator for managing the closure of shellfish beds to harvest to protect the public health.
fishery management plan (FMP)	A documented strategy for the sustainable use of a fishery resource, which considers the biological limits of a fish species and the socioeconomic impacts of restricting fishing effort.
fishing gear	Fish and shellfish harvesting devices.
flux	A fluctuation or change.

geographic information system (GIS) — A system of computer hardware and software that is used for compilation, storage, analysis, and display of geographic and associated tabular data. This system can be used to produce maps which overlay information layers of locations of various environmental and physical features.

gill net — A net which traps fish by entangling them as they pass through the net.

ground water — The water which occurs beneath the earth's surface between saturated soil and rock and which supplies wells and springs.

growth overfishing — The overharvest of fish that are below optimal size.

habitat — A specific area in which a particular type of plant or animal lives. An organism's habitat must provide the basic requirements for survival.

haul seine — A long fishing net which is pulled between two boats and brought together around a stake to encircle fish.

high quality waters — Waters which are rated as excellent based on biological/physical/chemical characteristics through the Division of Environmental Monitoring.

hypoxia — A condition of low dissolved oxygen in aquatic systems.

impaired waters — Surface waters that are negatively impacted by pollution resulting in decreased water quality.

impervious surface — A surface such as pavement that cannot be easily penetrated by water.

interjurisdictional — Within the boundaries of more than one state (or other level of government).

juvenile — Physiologically or sexually immature.

land and water use plans — Documents which are produced by a local government and its citizens to identify the preferred uses of land and water within a community and to serve as a tool for guiding growth.

macrophyte — A macroscopic plant in an aquatic environment.

marine sanitation device (MSD) — A device installed on a boat to treat or hold sewage. All vessels with installed toilets are required by the federal Clean Water Act, Section 312, to have approved MSDs.

mesohaline — Moderately saline water, generally having salinity levels of 8 to 15 parts per thousand (ppt) (freshwater = 0 ppt; seawater = 35 ppt).

metals (also heavy metals) — A group of elements found in rocks and minerals that are naturally released to the environment by erosion as well as generated by human activities. Some metals (e.g., mercury, lead, nickel, zinc, and cadmium) are of environmental concern because they are released by human activity and can produce toxic effects in animals and plants.

mitigation — The process of making the impacts of a particular action less severe or intense.

mitigation bank — Habitat protection or improvement actions taken expressly for the purpose of compensating for unavoidable, necessary losses from specific future development actions.

model ordinance — A sample regulation which contains elements and language necessary to achieve a desired effect.

natural community — A distinct and reoccurring assemblage of populations of plants, animals, bacteria, fungi, and viruses naturally associated with each other and their physical environment.

nitrate (NO_3^-) — A form of nitrogen which is readily available to plants as a nutrient. Generally, nitrate is the primary inorganic form of nitrogen in aquatic systems.

nonpoint source — Pollution that enters the natural environment through runoff with no discrete point or discharge.

nursery areas — Areas where young finfish and shellfish spend their early life because of an abundance of food, the presence of protective cover, and favorable conditions of salinity, temperature, and other factors.

nutrients — Chemicals which are needed by plants and animals for growth (e.g., nitrogen, phosphorus).

nutrient-sensitive waters — Waters subject to excessive growths of microscopic or macroscopic vegetation requiring limitations on nutrient inputs.

oligohaline — Low salinity water, generally having salinity levels of 0.5 to 5 parts per thousand (ppt) (freshwater = 0 ppt; seawater = 35 ppt).

ombudsman — One that investigates complaints from citizens, relates their concerns to the relevant state agencies and assists in achieving fair settlements.

on-site wastewater treatment systems — Systems including septic tanks and package plants which treat wastewater where it is produced. These systems are smaller scale than municipal central sewer and treatment plants.

palustrine — Swampy, related to freshwater.

pathogen — An agent such as a virus, bacterium, or fungus that can cause diseases in humans.

phytoplankton — Aquatic, unicellular plants which are free-floating or weakly motile.

point source	Any confined and discrete conveyance from which pollutants are or may be discharged. These include pipes, ditches, channels, tunnels, conduits, wells, containers, and concentrated animal feeding operations.
polyhaline	High salinity water, generally having salinity levels of 18 to 30 parts per thousand (ppt) (freshwater = 0 ppt; seawater = 35 ppt).
pound net	A large net suspended from poles driven into the bottom of the water body. Fish enter the net through a funnel entrance and become trapped.
pretreatment	The treatment of industrial wastewater to remove pollutants prior to discharge into municipal sewage systems.
primary treatment	The level of wastewater treatment which uses settling, skimming, and often, chlorination, to remove solids, floating materials, and pathogens.
public trust areas	Land and water areas in which the public has certain rights including the right to navigation and recreation.
renewal credits	A system used by professional educators to maintain certification.
restoration	Renewing or repairing a natural system so that its functions and qualities are comparable to its original, unaltered state.
riparian	Relating to the bank or shoreline of a body of water.
runoff	Water which is not absorbed by soil and drains off the land into bodies of water.
salinity	The amount of dissolved salts in water, generally expressed in parts per thousand (ppt).

secondary treatment	The level of wastewater treatment which involves biological treatment in addition to the primary treatment.
sediment	Particles of mud, clay, silt, and organic material which are carried in water and compose the bottom material (substrate).
sedimentation	The deposition of sediment, such as sand, silt, or clay.
siltation	The deposition or accumulation of fine soil particles.
silviculture	The area of forestry which deals with establishment, development, reproduction, and management of trees.
spawn	To deposit fish eggs.
stock assessment	The estimate of the size and productivity of a fish stock based on age, growth, harvest, reproduction, and mortality data.
stormwater	Water which is generated by rainfall, causes runoff, and often is routed into drain systems.
submerged aquatic vegetation (SAV) (also: seagrass)	Beds of underwater marine and estuarine plants. SAV is characterized by high productivity and species diversity. It serves as nursery area for juveniles and supports adult populations of economically important seafood species. SAV beds also enhance water quality by reducing turbidity and stabilizing sediments. Species of SAV include: eelgrass (*Zostera marina*), shoalgrass (*Halodule wrightii*), and widgeongrass (*Ruppia maritima*), Sago pondweed (*Potamogetan pectinatus*), leafy pondweed (*Potamogetan foliosus*), widgeongrass (*Ruppia maritima*), horned pondweed (*Zannichellia palustris*), bushy pondweed/southern naiad (*Najas guadalupensis*), wild celery (*Vallisneria americana*), spatterdock (*Nuphar luteum*), and bladderwort (*Ultricularia* sp.).

substrate	A surface or medium in or on which an organism lives.
suspended solids	Organic and inorganic particles, such as solids from wastewater, sand, clay, and mud, that are suspended and carried in water.
sustainable use	Conserved use of a resource such that it may be used in the present and by future generations.
Total Maximum Daily Loads	The loading capacity is the maximum amount of pollution that a water body can receive without violating water quality standards. Total Maximum Daily Loads are the sum of point and nonpoint source loads.
toxic	Poisonous, carcinogenic, or otherwise directly harmful to life.
toxic substance, toxicant or toxin	A substance or mixture which has the potential to cause death, disease, behavioral abnormalities, cancer, genetic mutations, physiological malfunctions (including malfunctions or suppression in reproduction or growth), or physical deformities in organisms or their offspring. Organisms are exposed to toxicants after discharge and upon exposure, ingestion, inhalation, or assimilation into any organism, either directly from the environment or indirectly by ingestion through food chains.
tributary	A stream or river that flows into a larger stream or river.
turbidity	The measurement of the amount of material suspended in water.
vital	Necessary to the continuation of life; life-sustaining.

wasteload allocations	Set of limitations and monitoring requirements specific to each discharge which protects the best uses of the surface waters of the state through implementation of the state water quality standards and the anti-degradation policy.
watershed	The geographic region within which water drains to a particular river, stream, or body of water.
water table	The depth or level below which the ground is saturated with water.
wetland degradation	The process of transition of a wetland from a higher to a lower natural value or to a condition of decreased natural function.
wetland loss	The degradation of a wetland area through draining or other conversion to the degree that the area no longer supports natural wetlands functions or uses.

ACRONYMS

ADID	Advanced Identification
BMP	Best Management Practice
CGIA	Center for Geographic Information and Analysis
CRC	Coastal Resources Commission
CWQMN	Citizen's Water Quality Monitoring Network
CWQMP	Citizens Water Quality Monitoring Program
DA	Department of Agriculture
DCA	Division of Community Assistance
DCM	Division of Coastal Management
DEH	Division of Environmental Health
DFR	Division of Forest Resources
DLR	Division of Land Resources
DMF	Division of Marine Fisheries
DOC	Department of Commerce
DOT	Department of Transportation
DPI	Department of Public Instruction
DPR	Division of Parks and Recreation
DSWC	Division of Soil and Water Conservation
EAB	Environmental Advisory Board
EES	Environmental Epidemology Section
EMC	Environmental Management Commission
ERC	Environmental Resources Commission
FDA	U.S. Food and Drug Administration
GIS	Geographic Information Systems
MFC	Marine Fisheries Commission
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
OEE	Office of Environmental Education
OWR	Office of Waste Reduction
PERT	Pamlico Environmental Response Team
SAV	Submerged Aquatic Vegetation
SCS	Soil Conservation Service
SSB	Shellfish Sanitation Branch
SWCC	Soil and Water Conservation Commission
TMDL	Total Maximum Daily Load
TNC	The Nature Conservancy
TSDF	Treatment, Storage, and Disposal Facility
USACE	Army Corps of Engineers
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	U.S Geological Survey
WERC	Wetlands Enhancement, Restoration and Creation
WRC	Wildlife Resources Commission

COST MATRIX

APPENDIX D

WATER QUALITY PLAN

MANAGEMENT ACTION	ANNUAL STATE AGENCY ADMINISTRATIVE COSTS
ACTION A1: Basinwide planning for water quality and wetland protection and restoration.	$50,000
ACTION A2: Establish TMDLs.	$100,000
ACTION A3: Complete synchronous permit renewal for each basin.	No additional costs are anticipated.
ACTION A4: Determine assimilative capacity allocation considering sustainable growth and secondary impacts of wastewater capacity.	No additional costs are anticipated.
ACTION A5: Improve scientific models.	$400,000
ACTION A6: Continued comprehensive water quality monitoring to assess system health and target regional problems.	$150,00
ACTION B1: Develop NPS pollution control plan for each basin to address surface and ground water quality.	No additional costs are anticipated

ACTION B2: Expand funding for the NC Agriculture Cost Share Program in the APES region including wetlands restoration to control NPS pollution and fund a new water quality cost share program for additional NPS controls.	$5,000,000
ACTION B3: Develop alternative septic systems and new BMPs.	$350,000
ACTION B4: Strengthen current enforcement programs to detect and remediate NPS caused violations of ground and surface water quality.	$200,000
ACTION B5: Strengthen implementation of forestry BMPs.	$350,000
ACTION B6: Enhance the stormwater runoff control program.	$150,000
ACTION B7 Implement an interagency state marinas policy to address cumulative siting and BMP's.	No additional costs are anticipated.
ACTION C1: Require pollution prevention plans for all point sources.	No additional costs are anticipated.
ACTION C2: Expand and strengthen enforcement of NPDES.	$300,000

ACTION D1: Monitor and evaluate sediment toxicity; continue to monitor fish & shellfish toxic contamination, ambient WQ and identify sources of WQ standard exceedances.	$150,000
ACTION D2: Continue to issue fish advisories to protect public health.	No additional costs are anticipated.
ACTION D3: Remediate toxic contamination where necessary and feasible.	Costs to be determined. See Action D1
ACTION E1: Continue to monitor & evaluate environmental stress indicators including blooms, fish kills, diseases.	$125,000
ACTION E2: Improve techniques for evaluating cumulative impacts in estuarine waters.	$100,000
ACTION E3: Develop better indicators of shellfish contamination.	See Stewardship Plan Objective A, Management Action 2.
WATER QUALITY TOTAL:	***$7,425,000***

VITAL HABITAT PLAN

MANAGEMENT ACTION	ANNUAL STATE AGENCY ADMINISTRATIVE COSTS
ACTION A1: Habitat plans.	$50,000
ACTION A2: Mapping	$135,000
ACTION A3: ADID evaluation	$50,000
ACTION B1: Acquisition/Management	No additional costs anticipated.
ACTION B2: Incentives/assistance	$524,000
ACTION C1: Wetlands evaluation	$150,000
ACTION C2: Fisheries habitat	$200,000
ACTION C3: Restoration	$100,000
ACTION C4: Wetlands mitigation	$170,000
HABITAT TOTAL:	***$1,379,000***

FISHERIES PLAN

MANAGEMENT ACTION	ANNUAL STATE AGENCY ADMINISTRATIVE COSTS
ACTION A1: Develop and implement state fishery management plans.	$300,000
ACTION A2: Modify the existing marine fisheries license structure to improve data collection.	No additional annual administrative costs anticipated.
ACTION B1: Continue to expand and develop bycatch reduction gear & practices and require their use.	$200,000
ACTION B2: Institute cost share program for BMP's in commercial fishing.	$200,000
FISHERIES TOTAL:	***$700,000***

STEWARDSHIP PLAN

MANAGEMENT ACTION	ANNUAL STATE ADMINISTRATIVE COSTS
ACTION A1: Local planning	$450,000
ACTION A2: Provide local governments with affordable and accessible GIS.	$460,000
ACTION A3: Managing public trust waters: conduct feasibility studies.	$37,500
ACTION A4: Promote environmentally sound economic development in the region.	Unknown
ACTION B1: Increase efforts to coordinate & foster environmental education outside school settings.	$166,000
ACTION B2: Citizens communications with agencies & commissions	No additional costs anticipated.
ACTION B3: Local government environmental advisory boards.	Unknown
ACTION B4: Citizen's water quality monitoring program	$75,000
ACTION B5: Citizen ombudsman in DEHNR	$50,000

ACTION C1: Science/environmental curriculum	See Objective B, Management Action 1
ACTION C2: Teacher training	$10,000
STEWARDSHIP TOTAL	***$1,248,500***

IMPLEMENTATION PLAN

MANAGEMENT ACTION	**ANNUAL STATE AGENCY ADMINISTRATIVE COSTS**
ACTION A1: Management Conference	$300,00
ACTION A2: Initiate implementation of the CCMP	$50,000
ACTION B1: Progress report	No additional costs are anticipated.
ACTION B2: Support assessment	Costs included in other management actions.
IMPLEMENTATION TOTAL:	***$350,000***

PLAN TOTALS	ANNUAL COSTS
WATER QUALITY	***$7,425,000***
VITAL HABITAT	***$1,379,000***
FISHERIES	***$700,000***
STEWARDSHIP	***$1,248,500***
IMPLEMENTATION	***$350,000***
CCMP ADMINISTRATIVE COST TOTAL	***$11,102,500***

N.C. AGRICULTURE COST SHARE PROGRAM BEST MANAGEMENT PRACTICES

APPENDIX E

LIST OF BEST MANAGEMENT PRACTICES FOR COST SHARING UNDER THE NORTH CAROLINA AGRICULTURE COST SHARE PROGRAM

EROSION / NUTRIENT CONTROL

Conservation Tillage
Terraces
Diversions
Critical Area Planting
Sod-Based Rotation
Stripcropping
Cropland Conversion to Grass
Cropland Conversion to Trees
Cropland Conversion to Wildlife Plantings
Cropland Conversion to Christmas Trees
Grade Stabilization Structures

SEDIMENT / NUTRIENT CONTROL

Filter Strips
Field Borders
Grassed Waterways
Water Control Structures

CONFINED ANIMAL OPERATIONS CONTROL

Lagoons
Dry Stacks
Litter Storage
Heavy Use Area Protection
Stock Trails
Pesticide Load Areas
Ponds
Pads
Composters
Spring Development
Stream Crossings
Wells
Livestock Water Facilities (Tank/Trough)
Nutrient Reduction Management
Portable Watering Facilities (Livestock)
Land Application of Animal Waste
Solid Set Waste Management System for Land Application
Wetlands Development for Land Application
Dry Hydrant Waste Management System for Land Application

NORTH CAROLINA AGRICULTURE COST SHARE PROGRAM FOR NONPOINT SOURCE POLLUTION CONTROL

Definition of Practices:

(1) Conservation Tillage System means a form of noninversion tillage that retains protective amounts of residue mulch on the surface throughout the year. These include notillage, strip tillage, stubble mulching, and other types of non-inversion tillage which maintain a minimum of 50 percent ground cover at planting or a minimum surface residue of 2000, 1500, and 1000 pounds per acre for corn, soybeans, and small grain, respectively.

(2) Critical Area Planting means planting trees, shrubs, grasses, or legumes on critically eroding agricultural areas in order to reduce erosion, sediment delivery, and nonpoint source pollution to receiving waters.

(3) Critical Erosion as applied to critical areas means erosion so severe that other than normal agricultural BMPs must be used to stabilize the area of concern.

(4) Cropland Conversion means the establishment of perennial grasses, trees, or permanent wildlife plantings on excessively eroding cropland. Cost share will be based on 75 percent of the average cost of establishing fescue.

(5) Diversion means a channel with a supporting ridge on the lower side constructed across the slope to divert excess water from cropland areas.

(6) Excessive Erosion means sheet, rill and/or concentrated erosion on agricultural lands occurring at an annual rate greater than the soil loss tolerance (T).

(7) Field Border means a strip of perennial vegetation established at the edge of the field to control erosion.

(8) Filter Strip means a strip or area of perennial vegetation for removing sediment, organic matter, and other pollutants from cropland or as a part of waste management systems for treating runoff from concentrated waste areas.

(9) Grade Stabilization Structure means a structure to stabilize the grade of agricultural cropland or pasture land where concentrated and high velocity runoff results in head cutting and gully formation.

(10) Grassed Waterway means a natural waterway or outlet, shaped or graded, and established in suitable vegetation used to route excess water from cropland, reduce gully erosion, and to reduce nonpoint source pollutant delivery to receiving waters. As a condition for cost sharing, the field or treatment unit draining into the waterway must have installed, or the farmer must agree to install as a part of the agreement, erosion control measures necessary to prevent damage from washout or excessive sedimentation in the waterway.

(11) Heavy Use Area Protection means stabilizing high concentration areas for livestock to reduce stream loading of sediment and/or animal waste.

(12) Livestock Exclusion means permanent fencing used to exclude livestock from an area and is to be used in conjunction with animal waste treatment systems, stream crossings, streambank protection, or other areas as needed to protect surface water quality.

(13) Pastureland Conversion means establishing trees or perennial wildlife plantings on excessively eroding pasture that is too steep to mow or maintain with conventional equipment. (Class VII Land)

(14) Rock-lined Waterways or Outlets means a water way or outlet having an erosion-resistant lining of permanent material used to provide for safe disposal of runoff where unlined or grasses waterways would be inadequate.

(15) Sediment Control Structure means a temporary or permanent basin constructed to collect and store sediment and other agricultural nonpoint source pollution.

(16) Sod-based Rotation means establishing perennial grasses and\or legumes or a mixture of them on excessively eroding cropland and maintaining at least a four year rotation. A one-time incentive payment per field will be made for establishment.

(17) Spring Development means improving springs and seeps by excavating, cleaning, capping or providing collection and storage facilities. Springs are to be developed as a source for livestock watering in conjunction with livestock exclusion from streams.

(18) Stock Trails and Walkways means a system used to control erosion where livestock cross ditches, streams, or other areas where surface water quality needs to be protected. Must be used in conjunction with livestock exclusion.

(19) Stripcropping means growing crops in a systematic arrangement of strips or bands across the general slope. The crops are arranged so that a strip of grass or close-growing crop is alternated with a clean-tilled crop or a crop under a conservation tillage system. Cost sharing will be based on a one-time payment of 75 percent of the average cost of establishing fescue multiplied by the acres in sod and an incentive payment for the establishment of the strips.

(20) Terrace means an earth embankment, a channel, or a combination ridge and channel constructed across the slope.

(21) Trough or Tank means constructing a device for livestock watering in conjunction with livestock exclusion from streams.

(22) Waste Management System means a planned system for managing liquid and solid waste and runoff from concentrated waste areas. System components may include:

(A) Waste Storage Pond means an impoundment made by excavation or earthfill for temporary storage of animal or other agricultural waste.

(B) Waste Storage Structure means a fabricated structure for temporary storage of animal or agricultural waste.

(C) Waste Treatment Lagoon means an impoundment made by excavation or earthfill for biological treatment of animal or other agricultural waste.

(D) Land Application of Wastes means the application of agricultural wastes on land in an environmentally acceptable manner.

(23) Water Control Structure means a human-made structure installed in on-farm water management systems to reduce the delivery of nonpoint source pollutants into main water courses.

Best Management Practices Eligible for Cost Share Payments

(1) Best Management Practices eligible for cost sharing include the practices listed below and any approved District BMPs. District BMPs shall be reviewed by the Division for technical merit in achieving the goals of this program. Upon approval by the Division, the District BMPs will be eligible to receive cost share funding.

Best Management Practices Eligible for Cost Sharing Under the Nutrient Sensitive Waters Program

Practice	***Minimum Life Expectancy (years)***
Conservation Tillage System	1
Critical area Planting	10
Cropland Conversion (Trees, Grasses, or Permanent Wildlife Plantings)	10
Diversion	10

Field Border	10
Filter Strip	10
Grassed Waterway	10
Heavy Use Area Protection	10
Livestock Exclusion	10
Pastureland Conversion	10
Rock-lined Waterways or Outlets	10
Sediment Control Structure	10
Sod-based Rotation	4 or 5
Spring Development	10
Stock Trails and Walkways	10
Stripcropping	5
Terrace	10
Trough or Tank	10
Waste Management System	10
Waste Storage Pond	10
Waste Storage Structure	10
Waste Treatment Lagoon	10
Land Application of Waste	1
Grade Stabilization Structure	10
Water Control Structure	10

(2) The minimum life expectancy of the BMPs shall be that listed in the previous table. Practices designated by a District shall meet the life expectancy requirement established by the Division for that District BMP.

(3) The list of BMPs eligible for cost sharing may be revised by the Commission as deemed appropriate in order to meet program purposes and goals.

Cost Share and Incentive Payments

(1) Conservation tillage systems, sod-based rotation, stripcropping, and land application of animal wastes shall be funded under a cost share incentive payment. Payments for conservation tillage systems and land application of animal wastes shall be limited to a maximum of three years per farm.

MANAGEMENT CONFERENCE MEMBERS

APPENDIX F

Albemarle-Pamlico Estuarine Study
Policy Committee

CURRENT MEMBERS

Dan Ashe	*House of Representatives: Merchant Marine Fisheries Commission*
Brewster Brown	*Albemarle Citizen's Advisory Committee*
Don Bryan	*Citizen*
Keith Buttleman	*Virginia Council on the Environment*
Col. George Cajigal	*U.S. Army Corps of Engineers*
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John Costlow	*Retired Professor of Duke University*
Ford "Bud" Cross	*National Oceanic and Atmospheric Administration: Southeast Fisheries Center*
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L. K. Gantt	*U.S. Fish and Wildlife Service*
Jonathan Howes	*N.C. Department of Environment, Health and Natural Resources (DEHNR)*
William Queen	*Institute of Marine and Coastal Resources*

FORMER MEMBERS

William Coby	*N.C. Department of Environment, Health, and Natural Resources (DEHNR)*
Lee Dehihns	*U.S. Environmental Protection Agency*
Dirk Frankenberg	*University of North Carolina, Department of Marine Sciences*
Thomas S. Rhodes	*N.C. Department of Natural Resources and Community Development*
Parker Chesson	*Albemarle Citizen's Advisory Committee*

Albemarle-Pamlico Estuarine Study Technical Committee

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Richard Hamilton	*Wildlife Resources Commission*
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Don Hoss	*National Oceanic and Atmospheric Administration: Southeast Fisheries Center*
Preston Howard	*N.C. DEHNR: Division of Environmental Management*
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Dave Moreau	*University of North Carolina: Water Resources Research Institute*
Mitchell Norman	*Virginia Department of Game and Inland Fisheries*
Michael Orbach	*Duke University: Beaufort Marine Lab*
Rich Pepino	*U.S. Environmental Protection Agency: Region 3*
Lawrence Saunders	*U.S. Army Corps of Engineers*
Roger Schecter	*N.C. DEHNR: Division of Coastal Management*
Cecil Settle	*U.S. Soil Conservation Service*
David Sides	*N.C. DEHNR: Division of Soil and Water Conservation*
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James Turner	*U.S. Geological Survey*
Fred White	*N.C. DEHNR: Division of Forest Resources*

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Pamlico Citizens' Advisory Committee

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Buddy Swain	*At Large*
Stanford White	*At Large*
Scott Whitford	*At Large*

PUBLICATIONS LIST

APPENDIX G

I	Information Acquisition Document Executive Summaries are available for all Information Documents
P	Public Participation/Program Documents
*	Not an APES document, but material is related to the Study

No.	Abbreviated Title	Author/Editor (Affiliation)	Status
86-01(I)	Existing Management Programs	Brower (UNC)	Available
87-01(P)	Source Document	Rader et al. (APES)	Available
87-02(P)	Five Year Workplan	Rader et al. (APES)	Available
87-03(I)	Proceedings: Modeling Workshop	Stewart/Duffy (WRRI/SCI)	Available
87-04(I)	Proceedings: Remote Sensing Workshop	Stewart (WRRI)	Available
87-05(I)	Proceedings: Fish Disease Workshop	Stewart (WRRI)	Available
87-06(P)	Citizens' Monitoring Pilot	Lekson (PTRF)	Available
88-01/02(P)	Baseline Monitoring Network	Rader/Holman et al. (APES)	Available
88-03 (P)	A Citizen's Guide to Coastal Water Resource Management: Second Edition	Kennedy (NCCF)	Available
88-04(P)	Status Report: March 1988	Rader (APES)	Available
88-06(I)	Water Quality/Hydrology Bibliography	Bales (USGS)	Available
88-07(I)	Trawl Excluder Device	Pearce/Street (Mariners' Marine/DMF)	Available

88-08(P)	Project Abstracts for the Period 1987-89	Holman, et al. (APES)	Available
88-09(I)	Red Tide Persistence	Tyler (Versar)	Available
88-10(I)	Submerged Aquatic Vegetation (Eastern)	Ferguson (NOAA)	Available
88-11(P)*	Can Albemarle and Pamlico Be Saved?	Taylor (Wildlife of NC)	Available
88-12(I)	Obstructions to Anadromous Fish Migration	Collier/Odom (USF&WS)	Available
88-13(I)	Value of Recreational Fishing A/P Estuaries	K. Smith (NCSU)	Available
88-14(I)	Analysis of Fringe Wetlands in A/P Sounds	Brinson (ECU)	Available
89-01(P)	Progress Report for 1989	Holman (APES)	Available
89-02(I)	Fish Stock Assessment	Phalen (DMF)	Available
89-03(I)	Baseline Demographic Trends	Tschetter (ECU)	Available
89-04(P)	Public Involvement Plan 1989	Giordano (APES)	Available
89-05(I)	Scoping of Water-Column and Bottom Sediments	Wells (UNC)	Available
89-06(I)	Heavy Metal/Mud Pollutants in Pamlico River Estuary	Riggs (ECU)	Available
89-07(P)	State & Federal Interrelated Programs To The APES	Holman, et al. (APES)	Available
89-08(P)	Project Abstracts For The Period 1989-1990	Holman, et al. (APES)	Available (Affiliation)
89-09(I)	Evaluation of Nursery Area Data	Noble (DMF)	Available
89-10(I)	Submerged Aquatic Vegetation (Currituck Sound and Western APES Region)	Davis (ECU)	Available

89-11(I)	Water Quality Trends	Harned (USGS)	Available
89-12(P)	Where the River Meets the Sea	Okun (UNC)	Available ($3/copy)
90-00(P)	A Guide to Estuaries	Gale (PTRF)	Available ($1/copy)
90-01(I)	Inventory of Natural Areas: Phase I Report	Frost, et al. DPR-NHP	Available
90-02(I)	Evaluation of Environmental Management and Resource Protection Programs in the APES Region	Nichols (RTI)	Available
90-03(I)	Abundance and Viability of Striped Bass Eggs Spawned in the Roanoke River, N.C. in 1988	Rulifson (ECU)	Available
90-03(I) (DEM)	Synoptic Survey (WQ)	NC Div. Env. Management	Available
90-04(P)	Coastal Satellite Scene	National Geographic/KRS	Available ($10/copy)
90-05(P)	Progress Report for 1990	Holman (APES)	Available
90-06(I)	Data Management and Analysis System	Siderelis (CGIA)	Available
90-07(I)	Heavy Metals-Neuse River	Riggs (ECU)	Available
90-08(I)	Oyster Recruitment & Growth in Pamlico	Ortega (Duke Univ. Marine Lab)	Available
90-09(I)	Effects of Water Mgmt. and Land Use Practices on Hydrology and W.Q. in the APES Region	Chescheir (NCSU)	Available

90-10(I)	A Pilot Study for Managing Multiple Use in the State's Public Trust Waters	Clark (UNC Sea Grant)	Available
90-11(I)	Abundance and Viability of Striped Bass Eggs Spawned in the Roanoke River, N.C. in 1989	Rulifson (ECU)	Available
90-12(I)	WQ as a Function of Discharge From The Roanoke River Reservoir During Hydropower Generation	Rulifson (ECU)	Available
90-13(I)	A-P Coupling Study	Pietrafesa (NCSU)	Available
90-14(I)	Reduction of Nutrient Loading	Kuenzler (UNC)	Available
90-15(I)	Eutrophication and Nutrients Algal Blooms	Paerl (UNC)	Available
90-16(I)	Food/Feeding Larval Fishes	Rulifson (ECU)	Available
90-18(P)	Project Abstracts FY 89 & 90	Holman (APES)	Available
90-19(I)	A Comprehensive Env. Mgmt. Plan...Currituck Sound Drainage Basin	Rideout (NCSU)	Available
90-20(I)	Federal Consistency Review for the APES Area	Duffin (RTI)	Available
90-21(I)	Functional Description Document	Siderelis (CGIA)	Available
90-22(I)	Shell Disease in Blue Crab (NCSU)	Noga (NCSU)	Available
90-23(I)	Animal Waste Management	Lewis (Va. SWCS)	Available
90-24(P)	Educational Handbook For Nonpoint-Source Pollution	Hoban (NCSU)	Available
90-25(P)	Teacher Training in WQ Issues	Okun (UNC)	Available

90-26(P)	Blueprint for Action APES Citizens Advisory Committees	Albemarle/ Pamlico CACs/ Armingeon(NCCF)	Available
90-27(I)	Public Attitudes Regarding WQ Phase I	Hoban (NCSU)	Available
90-28(I)	Data Inventory	Sideralis (CGIA)	Available
90-29(I)	Anemic Blue Crabs (Interim Report)	Brouwer (Duke Univ.)	Available
91-00(P)	APES Projects Funded	Steel (APES)	Available
91-01(I)	Albemarle-Pamlico Estuarine System: Technical Analysis of the Status and Trends (Technical Document)	Steel (APES)	Available
91-02(I)	Albemarle-Pamlico Estuarine System: Technical Analysis of the Status and Trends (Executive Summary)	Steel (APES)	Available
91-03(I)	Abundance and Viability of Striped Bass Eggs Spawned in the Roanoke River, NC 1990	Rulifson (ECU)	Available
91-05(I)	APES Fish Tissue Baseline Study 1989	Tedder (DEM)	Available
91-06(I)	W.Q. Data/Pamlico Neuse 89-90	Garrett/ Bales (USGS)	Available
91-07(P)	Estuarine Resource Center	McNaught (PTRF)	Available
91-08(I)	GIS Development Land Use and Land Cover Categories	Siderelis Khorran (CGIA/NCSU)	Available
91-09(P)	1991 Annual Report	Steel (APES)	Available
91-10(I)	Water Quality Data from Continuously Monitored Sites in the Pamlico and Neuse River Estuaries: 1990-1991	Garrett (USGS)	Available

92-01(I)	Environmental Management Strategies	Bartholomew/ Ridgeway (CPN)	Available
92-01(I) (DEM)	Albemarle-Pamlico Baseline Water Quality Monitoring Data Quality Section Summary: 1988-1991	NC DEM - Water	Available
92-02(P)	Citizens W.Q. Monitoring Program	Blinkoff (APES)	Available
92-03(I)	Urban BMPs: A Stormwater Demonstration Project	Belk, et al. (Cty. of Greenville)	Available
92-04(I)	Watershed Planning in the A-P Estuarine System: Toxics Analysis	Cunningham, et al. (RTI)	Available
92-05(I)	Watershed Planning in the A-P Estuarine System: Fishing Practices Mapping	Cunningham (RTI)	Available
92-06(I)	Sediment Toxicity report	Gulf Breeze	Available
92-07(I)	Inventory of Natural Areas: Phase II report[1]	LeGrand, et al. DPR-NHP	Available
92-08(I)	An Examination of the Blue Crab Fishery in the Pamlico River Estuary	McKenna, Camp	Available
92-09(I)	Hemocyanin Concentrations in Blue Crabs	Engel, et al. (NOAA)	Available
92-10(I)	Watershed Planning in the A/P System: Annual Average Nutrient Budgets	Dodd, et al. (RTI)	Available
92-11(P)	EDUCATION MODULES: Please specify module: *Environmental Awareness: *Teacher's Guide and Student Activity Sheets* *Aqueous: *Teacher's Guide and Student Activity Sheets* *Flora and Fauna: *Teacher's Guide and Student Activity Sheets*	Meiggs	Available

[1] Regional Inventories are also available for the following counties upon request: Beaufort, Carteret, Craven, Hyde, Jones, Pamlico, and Pitt. (Please specify county.)

92-12(I)	Interim Report on Flows in the Lower Roanoke River, and Water Quality Hydrodynamics of Albemarle-Pamlico	Bales, Strickland, Garrett (USGS)	Available
92-13(I)	Public Attitudes Toward Water Quality and Management Alternatives in the A/P Estuarine System (Phase II Report)	Hoban, Clifford (NCSU)	Available
92-14(I)	Hydrologic and Water Quality Data from Three Agricultural Basins in Hyde County, Three Agricultural Basins in Beaufort County and Campbell Creek, NC	Treece, Bales (USGS)	Available
92-15(I)	Determining the Relationship Between WQ and Ulcerative Mycosis in Atlantic Menhaden	Noga, et al. (ECU, NCSU)	Available
92-16(I)	Evaluation of the Apes Area Utilizing Population, Land Use, and WQ Information	Holman (NCSU)	Available
92-17(P)	A Citizen's Guide to Wastewater Management in Carteret County	Rowles (APES)	Available
92-18(I)	Southeastern Virginia Institution and Public Involvement	Carlock (HRPDC)	Available
92-19(I)	Southeastern Virginia Env. Mgmt. Program	Carlock (HRPDOC)	Available
92-20(I)	Watershed Planning in the A-P Estuarine System: Report 7- Geographic Targeting for Nonpoint Source Programs	Dodd, et al (RTI)	Available
92-21(ES) (I)	Regional Inventory: Phase 3 EXECUTIVE SUMMARY	Smith, et al. DPR-NHP	Available
92-21(I)	Inventory of Natural Areas: Phase 3 [2]	Smith, et al. DPR-NHP	Available
92-22(I)	Currituck Sound Investigations	Riggs (ECU)	Available
93-01(I)	Watershed Planning in the A/P System: Subbasin Profiles	Dodd, et al. (RTI)	Available

[2] Regional Inventories are also available for the following counties upon request: Durham, Edgecombe, Franklin, Granville, Halifax, Johnston, Northampton, Orange, Vance, and Wake. (Please specify county.)

93-02(I)	Heavy Metals in the Albemarle Sound	Riggs (ECU)	Available
93-03(I)	Watershed Planning in the A/P System: Subbasin PC Database	Tippett, Dodd (RTI)	Available
93-04(I)	Striped Bass in Roanoke River: 1991	Rulifson (ECU)	Available
93-05(I)	Groundwater Discharge and Groundwater Quality	Liddle (RTI)	Available
93-06(I)	Flow and Transport Modeling for the London Bridge Creek-West Neck Creek Systems	Overton, McAllister (NCSU)	Available
93-07(I)	Water Quality Data from Continuously Monitored Sites in the Albemarle Sound Estuarine Sys., 1989-91	Garrett (USGS)	Available
93-08(I)	The Role of a New Dinoflagellate...	Burkholder (NCSU)	Available
93-09(I)	Submerged Aquatic Vegetation and Nitrates	Burkholder (NCSU)	Available
93-10(I)	Hydrologic and Water Quality Data from Beaufort and Hyde Counties: 1990-1992	Treece (USGS)	Available
93-11(I)	Alternative Fishing Devices for the Estuarine Crab Trawl Fisheries	McKenna, Clark (DMF)	Available
93-12(I)	A/P Baseline Water Quality Monitoring Data Summary: 1991-1992	DEM	Available
93-13(I)	Inventory and Protection Plan for Southeast Virginia's Critical Natural Areas, Exemplary Wetlands, and Endangered Species Habitat	Rawinski, Fleming (Va. Nat. Heritage Division)	Available
93-14	Albemarle-Pamlico Estuarine Study: Comprehensive Conservation and Management Plan Technical Document *(A shorter summary document and brochure are available upon request.)*	A/P Study	Available

93-15	APES Descriptions of Related Government Programs, Agencies, and Entities	A/P Study, RAI	Available
93-16	Economic Characterization of the APES Comprehensive Conservation and Management Plan	RAI	Available
93-17	Riparian Buffers Report	Dodd, et al.	Available
93-18	Roanoke River Water Flow Committee Report: 1991-1993	Rulifson, Manooch	Available
94-01	Water Quality from Continuously Monitored Sites in the Pamlico-Neuse River Estuaries, NC 1991-1992	Garrett (USGS)	Available
94-02	Rooted Vascular Aquatic Beds in the A/P System	Ferguson, Wood (NOAA)	Available
94-03	Marsh Grass Protection with Low-Cost Breakwaters: Shoreline Erosion Control Demonstration Project	Rogers (UNC/NCSU)	Available
94-04	Flow and Salinity in West Neck Creek, VA., 1898-1992, and Salinity in the North Landing River, NC and VA 1991-1992	Bales, et. al.	Available
94-05	Scallop Recruiting Report	Peterson	Available
94-06	Effects of Trawling on Benthos and Bycatch	Ambrose, et. al.	Available
94-07	Pollutant Removal by a Demonstration Detention Pond	Stanley (ECU)	Available
94-08	Demonstration of Agricultural BMPs for Water Quality Protection	DSWC	Available

Additional Publications	*Author/Editor (Affiliation)*
* *Fact Sheets (Albemarle Region)*	*AEA*
* *Fact Sheets (Pamlico Region)*	*PTRF*
* *Fact Sheets (Virginia)*	*HRPDC*
* *Fact Sheets ("A-P Wetlands")*	*USFWS*
* *Information Sheets (Various topics of interest)*	*NCCF*

*	*Educational Poster (Human Impact) on A/P Estuary*	*PTRF*
*	*Projects Funded by the A-P Study- Updated July 24, 1992*	*Steel, Scully*
*	*Comprehensive Conservation Management Plan: Second Public Draft*	*APES*
*	*Draft Economic Characterization*	*RAI*
*	*Draft Financing Options Plan*	*Smutko, Cox*
*	*APES Workshops (Report on six June-July 1993 Consensus Workshops)*	*Waters*
*	*A-P Environmental Education Activity Kit*	*USFWS*
*	*Nature's Caretakers: You Can Be One!*	*AEA*

Videotapes

*	*A Coastal County in 2010 A. D GIS - Develop the Future*	*GIS*

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CONTENT AND APPROVAL REQUIREMENTS

APPENDIX H

National Estuary Program Content and Approval Requirements: A Response

The following summary addresses content and approval requirements for the Comprehensive Conservation and Management Plan, as identified in the Clean Water Act of 1987. Each National Estuary Program is unique in its form, allowing programs to modify the national recommendations and structures in order to custom design the CCMP to meet an individual region's needs. The direction that each CCMP takes is molded by local environmental conditions, public needs and political climate. Foremost, each plan must be consistent with state programs and goals in order for it to be acceptable by the public and other regulatory agencies.

The following are statutory required components of the CCMP:

Management Conference Membership List
Summary of Characterization Findings
Statement of Priority Findings
Environmental Quality Goals and Objectives
Base Program Analysis
Action Plans
Finance Plan and Implementation Strategy
Monitoring Program Plan
Federal Consistency Review
Summary of Public Involvement and Review

Management Conference Membership List: A list including the member's affiliation is included in the document in Appendix F.

Summary of Characterization Findings: The introduction to the technical document summarizes the results of just over five years of scientific research in the Albemarle-Pamlico estuarine system. Research was conducted to determine priority problems in the estuarine system, to characterize the nature of environmental degradation and to establish pilot studies to examine management alternatives. A comprehensive list of all the studies sponsored by the program can be found in the CCMP in Appendix G. All publications are available to the public and have been subject to an external peer review.

Statement of Priority Findings: Priority findings serve as the basis for establishing the goals and objectives of each Action Plan. These priorities are integrated into each Action Plan.

Environmental Quality Goals and Objectives: Goals and Objectives for addressing priority problems and environmental quality are included in each Action Plan.

Base Program Analysis: This requirement is addressed in a variety of ways. The Albemarle-Pamlico Estuarine Study funded two analyses of existing state and Federal programs which have jurisdiction in the region. These reports entitled, "State and Federal Interrelated Programs to the A/P Study" and " Descriptions of Related Government Programs, Agencies, and Entities" may be found in the publications list, Appendix G.The effectiveness of the existing management framework was assessed by the Management

Conference and recommendations were developed to enhance existing programs. The results of program analyses were integrated into Action Plans through "strategies" and "critical steps."

Action Plans: Five Actions Plans constitute the body of the Albemarle-Pamlico CCMP: Water Quality Plan, Vital Habitats Plan, Fisheries Plan, Stewardship Plan and Implementation Plan. These plans outline priority problems; goals and objectives established to correct those problems and to maintain a high standard of environmental quality; and management actions, evaluations and funding strategies necessary to meet the goals and objectives.

Finance Plan and Implementation Strategy: Each recommended action in the Action Plans contains a section entitled, "funding strategy," which explains how the proposed recommendation may be implemented financially. The Implementation Plan describes in great detail how the implementation of the CCMP will involve local governments and other interest groups on a regional level to carry out the recommendations in the plan.

Monitoring Program Plan:
Programmatic and environmental monitoring procedures and methods used to track the progress made during CCMP implementation have been incorporated into the body of the Technical Document. The environmental monitoring program provides information on environmental benefits resulting from CCMP implementation. The programmatic monitoring system will help reveal the effective programs and projects that are working well, help identify potentially advantageous estuary management programs, provide accountability to elected officials and the public relating to the progress towards estuary protection, and provide a framework for the overall assessment of the CCMP.

Environmental Monitoring
An environmental monitoring program has been created by developing implementation strategies that incorporate and complement existing monitoring programs. Since a significant amount of important data pertaining to estuarine processes, functions, problems, and issues has resulted from the Albemarle-Pamlico Estuarine Study, it was utilized as a foundation upon which an effective environmental monitoring program was developed. This comprehensive monitoring program will be closely tied to data management and analysis activities and will communicate monitoring results to a broad range of audiences.

The environmental monitoring program covers water quality monitoring, the monitoring of vital habitat and natural heritage protection efforts, and the development of fisheries management plans.

Water Quality
Long-term, comprehensive monitoring and assessment of Albemarle-Pamlico system-wide water quality is presented in Objective A, Management Action 6 of the Water Quality Plan. Utilizing a three-pronged approach, water quality monitoring will incorporate the following components:

- Long-Term Water Quality Trend and Ecosystem Health Assessment:
Data from a fixed station network will be used to assess the system's long-term water quality trends. The network will include stations with

continuous monitors and stations monitored through grab samples. The monitor network will be administered by the U.S. Geological Survey (USGS) for the continuous monitors and by the N.C. Division of Environmental Management (DEM) for the grab sample stations in an arrangement similar to that which has been effective in the APES program to date. Additional grab sample stations will be provided in a coordinated manner through the efforts of EPA's Environmental Monitoring and Assessment Program (EMAP) and the APES Citizen's Water Quality Monitoring Network (CWQMN). Fixed station monitoring will be expanded to include biological and pesticide monitoring.

- *Targeted Assessment:*
Area intensive assessments will be made on a rotating basis and will be used to characterize water quality inputs during high flow periods. These assessments will be conducted through the coordination of such efforts by DEM in basin-wide planning and the USGS National Water Quality Assessment (NAWQA) program. These data will be used to revise management strategies in specific basins.

- *Problem Identification and Management Success Monitoring:* Data will be collected on an as-needed, response basis at problem area sites. These efforts will be conducted by DEM, USGS, and the CWQMN. These data will be used to identify sources of immediate problems, guide corrective management strategies, and to assure the effectiveness of those strategies.

Vital Habitats
Assessment of the status of vital habitats in the APES region will rely on the collection and analysis of comprehensive locational information concerning critical areas and human land uses. Specifically, data on land use/land cover, wetlands, rare natural communities, and essential habitat for threatened and endangered species is required.

Vital habitat conservation and mitigation efforts will be monitored by periodic reports from the most active agencies and organizations involved in wetlands mitigation and restoration, critical area acquisition, and management of habitat for conservation purposes. Habitat mapping and periodic updates, promoted in Objective A of the Vital Habitats Plan, will be used to monitor the status of baseline information and change detection. Assessing the effectiveness of protection efforts as well as the changes and extent of vital habitats within the APES region will rely upon a monitoring process that includes the following parameters:

- *Baseline Information:*
Some baseline locational information is available for each of the data types. Land use/land cover maps are available through the N.C. Center for Geographic Information and Analysis' (CGIA) Geographic Information System (GIS). Wetlands baseline information and maps are available in several forms including the U.S. Fish and Wildlife Service National Wetlands Inventory (NWI), CGIA Land Use/Land Cover data layers, and the U.S. Forest Service Forestry Inventory and Analysis. Locational information is available on the essential habitats of threatened and endangered species through federal Recovery Plans for listed species and through the N.C. Natural Heritage Program (NHP) database on known occurrences of these species. Locational information and some large-scale maps on high quality rare and natural communities is available

through the NHP. Additional baseline data is needed in the form of more comprehensive listings of locations of essential habitat and more precise and comprehensive mapping of rare natural communities.

- Change Detection:
For each data type, change detection monitoring will be conducted to update locational information (and maps) on at least a five year basis. This information will be used to determine trends in land uses and the status of critical areas. This data will be collected by the appropriate divisions of the Department of Environment, Health, and Natural Resources (DEHNR) (e.g., NHP, DEM, Wildlife Resources Commission).

Fisheries
Assessment of the Albemarle-Pamlico region's fisheries requires monitoring that is closely linked with efforts outlined in both the Water Quality and Vital Habitats Plans. Monitoring to assess the occurrence and causes of fish kills and diseases is covered in Objectives D and E of the Water Quality Plan. Objective D focuses on reducing the risk of toxic contamination to aquatic life and human health while Objective E describes improved monitoring and evaluation of environmental stress indicators in the estuary. In addition, the extent and status of critical fish habitat will be monitored through mapping updates included in the change detection section of the Vital Habitats monitoring program.

Within the Fisheries Plan of the CCMP, Objectives A and B propose that fisheries management plans be monitored through stock assessments and bycatch reduction evaluations.

- Disease and Kills Monitoring:
A continuous database of information on the occurrence and possible causes of fish kills and diseases will be established. Data will be collected on a response to event basis by DEM and the N.C. Division of Marine Fisheries (DMF). Disease surveys will also be conducted. These data are necessary to detect trends in the occurrence of diseases and kills. An environmental stress indicators network consisting primarily of DMF, DEM, NMFS, and USFWS will standardize the investigation and reporting of important environmental indicators such as algal blooms, kills, and disease. This network may include private citizens such as the Citizens Water Quality Monitoring Network and will eventually be used to develop management strategies.

- Critical Fish Habitat:
As with critical habitat information discussed in the Vital Habitat Plan above, baseline and change detection data are needed for the following types of fish habitat: shellfish areas, submerged aquatic vegetation (SAV) beds, spawning areas, and primary and secondary nursery areas (PNAs and SNAs). Baseline information is available on the location of each of these. Change detection monitoring will be conducted by updating maps of these areas on at least a five year basis. Interim monitoring of problem areas will be conducted on an as needed basis.

- Stock Assessments:
Information on status of fish stocks to support the development of fishery management plans requires the collection of fishery dependent and independent data. Fishery dependent data is currently collected through commercial and recreational fishery surveys. This data set can

be expanded through the collection of additional recreational fishing data by citizens in the CWQMN. Additional collection of fishery independent data (e.g., age and size composition, year class abundance, and life history information) by the DMF is needed to support the development of fishery management plans.

- Bycatch Reduction

To preserve fish populations and diversity, a reduction in bycatch of at least 50 percent by 1995 is recommended. This reduction in non-targeted harvests will be assessed by DMF through the use of gear and fishing practice testing results and bycatch estimates. Commercial fisherman would also be closely involved in the monitoring of bycatch reduction.

Programmatic Monitoring

The Technical Document incorporates a functional programmatic monitoring system for assessing all the management actions contained in the CCMP. Within each management action is an evaluation method that describes the agency or organization responsible for implementing the management action, the procedures that will used by that organization to evaluate the success of implementing the management action, and a description of how evaluation results can be used to improve the effectiveness and efficiency of the management action.

As outlined in Management Action 1, Objective B of the CCMP's Implementation Plan, an annual progress report will be produced describing the overall progress of CCMP implementation, as well as the success achieved in implementing specific management actions. The progress report will help agencies effectively focus their management efforts and resources by identifying areas in need of immediate attention, successful management actions, effective implementation techniques and procedures, and interagency coordination and communication problems. The annual progress report will also provide a vehicle for assessing the effectiveness of public outreach and education efforts.

Data Management

All programmatic and environmental monitoring results will be compiled by the responsible reporting organization and forwarded to the APES office for inclusion in the annual progress report. The report will be distributed to all involved resource management agencies at the Annual Summit, as described in Objective B of the Implementation Plan, for review of broad scale and long term environmental actions, to assess monitoring program performance, and to assess past and current estuarine resource management efforts. The annual progress report will also guide the development and focus of a research agenda that will address outstanding information needs and the economic and sociological impacts of CCMP strategies. Both the annual progress report and the research agenda will be available to the general public.

The estimated costs associated with specific monitoring activities listed in the CCMP can be found within the Funding Strategy section located at the end of each Management Action description.

Federal Consistency Review: Several studies have been promoted by the Albemarle-Pamlico Estuarine Study to assess Federal consistency. See the following reports for details: "Federal Consistency Review for the Albemarle-Pamlico Estuarine Study," "State and Federal Interrelated Programs to the A/P Study," and Description of Related Government Programs, Agencies and Entities." The Federal Consistency Review report was published in 1991, before recommendations for the plan were written. The Management Conference, which includes representatives from several federal agencies was able to consider consistency with federal programs while writing the CCMP recommendations. A consistency review of the state's Coastal Area Management Act is included in the CCMP approval process.

Summary of Public Involvement and Review:
A summary of public involvement and review is included in Appendix B.

The Comprehensive Conservation and Management Plan of the Albemarle-Pamlico Estuarine Study has involved a collaborative effort between public and private local groups, citizens and government agencies. It embodies a proactive management framework for the protection of the Albemarle-Pamlico watershed and was developed in the spirit of cooperation and consensus-building. As a result, the river drainage basin approach was generated as an effort to provide management flexibility. The APES management framework is unique in this way, and reflects that nature in its recommendations. Each sub-basin of the APES region will be able to determine basinwide specific goals, priorities and actions. The true success of the plan can be demonstrated only during its implementation.

MANAGEMENT ACTION IMPLEMENTATION TIMELINE

APPENDIX I

IMPLEMENTATION TIMELINE
FOR CCMP MANAGEMENT ACTIONS

Appendix I presents a graphical illustration of the anticipated implementation timeframes for each Management Action contained in the CCMP. Five tables, each representing a section of the CCMP, have been completed to summarize the important information pertaining to each individual Management Action found in the CCMP.

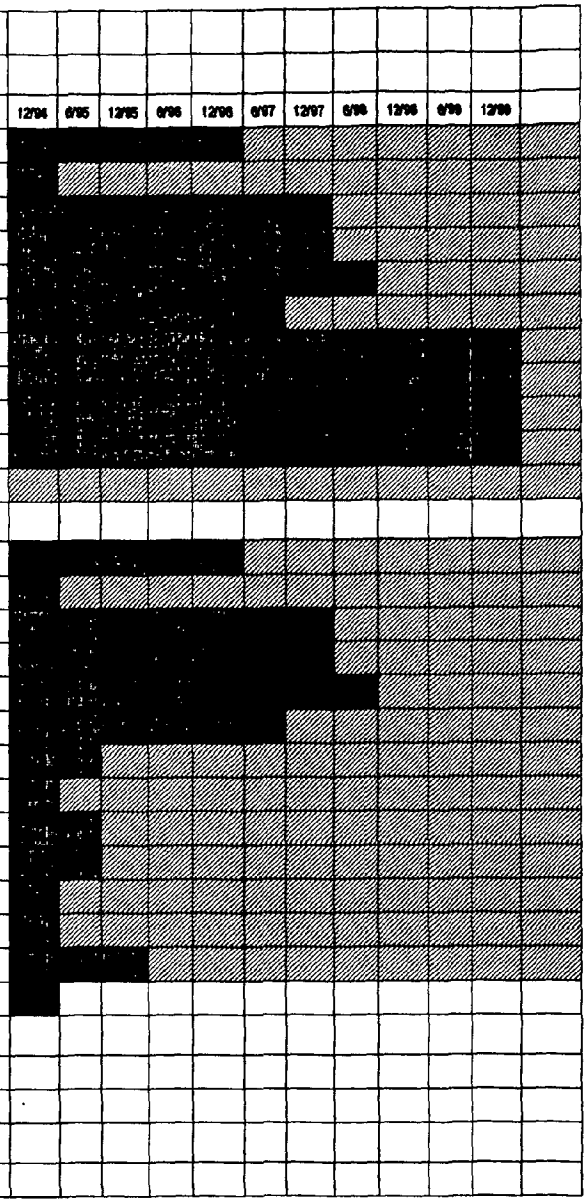
For each Management Action, information that is presented includes: 1) The CCMP Plan that contains the Management Action, 2) The corresponding Objective and Management Action number, 3) The activity described by the Management Action, 4) the lead agency that will have the primary responsibilities of implementing or continuing the activity, 5) a brief description of the activity including the types of events that are anticipated (i.e. begin a new activity, continue with a current activity, enhance or refine an existing activity, complete an activity, etc), 6) the target date (month and year) for achieving the Management Action's goals, and 7) a graphical representation of the time that each Management Action will be started, continued, or completed.

The darkest shading in the tables show the period of time that the lead agency will need to develop specific policies and procedures related to implementation of a Management Action. The lighter shading represents the implementation time for a Management Action. Management Actions that require a continued implementation effort contain a period of dark shading followed by the lighter shading continuing through 12/99. Management Actions that will result in a final product have a period of dark shading followed by no shading at all.

As an example, in the creation of a specific management plan, plan development will be represented by the dark shading while plan implementation will be represented by the lighter shading.

WATER QUALITY PLAN

MGMT. ACTION	ACTIVITY	LEAD	DESCRIPTION OF ACTIVITY	MONTH	YEAR
A1	ROANOKE RIVER BASINWIDE WQ PLAN	DEM	5 YEAR CYCLE (INITIAL PLAN DUE)	1	97
	TAR-PAMLICO RIVER BASINWIDE WQ PLAN	DEM	5 YEAR CYCLE (INITIAL PLAN DUE)	1	95
	NEUSE RIVER BASINWIDE WQ PLAN	DEM	5 YEAR CYCLE (SECOND CYCLE DUE)	1	98
	PASQUOTANK RIVER BASINWIDE WQ PLAN	DEM	5 YEAR CYCLE (INITIAL PLAN DUE)	1	98
	CHOWAN RIVER BASINWIDE WQ PLAN	DEM	5 YEAR CYCLE (INITIAL PLAN DUE)	6	98
	WHITE OAK RIVER BASINWIDE WQ PLAN	DEM	5 YEAR CYCLE (INITIAL PLAN DUE)	6	97
A2	BASINWIDE DETERMINATION OF TMDLs	DEM	COMPLETE ALL INITIAL PLANS BY	12	99
A3	SIMULTANEOUS PERMITTING BY BASIN	DEM	COMPLETE FOR ALL BASINS BY	12	99
A4	CONSIDER LONG-TERM IMPACTS OF ASSIM. CAP.	DEM	COMPLETE FOR ALL BASINS BY	12	99
A5	WATER QUALITY MODELING BY BASIN	DEM	COMPLETE FOR ALL BASINS BY	12	99
A6	WATER QUALITY MONITORING	DEM/USGS	CONTINUE COMPREHENSIVE MONITORING		
B1	ROANOKE RIVER BASINWIDE WQ PLAN	DEM	5 YEAR CYCLE (INITIAL PLAN DUE)	1	97
	TAR-PAMLICO RIVER BASINWIDE WQ PLAN	DEM	5 YEAR CYCLE (INITIAL PLAN DUE)	1	95
	NEUSE RIVER BASINWIDE WQ PLAN	DEM	5 YEAR CYCLE (INITIAL PLAN DUE)	1	98
	PASQUOTANK RIVER BASINWIDE WQ PLAN	DEM	5 YEAR CYCLE (INITIAL PLAN DUE)	1	98
	CHOWAN RIVER BASINWIDE WQ PLAN	DEM	5 YEAR CYCLE (INITIAL PLAN DUE)	6	98
	WHITE OAK RIVER BASINWIDE WQ PLAN	DEM	5 YEAR CYCLE (INITIAL PLAN DUE)	6	97
B2	WATER QUALITY COST SHARE PROGRAM	DEHNR	BEGIN NEW PROGRAM BY	7	95
	AGRICULTURE COST SHARE PROGRAM	SWC	INCREASE AG. COST SHARE PROGRAM BY	12	94
B3	DEVELOP ALTERNATIVE SEPTIC SYSTEMS	ENV HEALTH	BEGIN RESEARCH BY	7	95
	R & D BMPs TO REDUCE NPS POLLUTION	SWC	BEGIN RESEARCH BY	7	95
B4	ENFORCEMENT OF WATER QUALITY VIOLATIONS	DEM	BEGIN INCREASED ENFORCEMENT BY	12	94
B5	STRENGTHEN FORESTRY BMPs	DFR	INCREASE TRAINING/EDUCATION BY	12	94
B6	ENFORCE STORMWATER RUNOFF CONTROLS	DEM	STRENGTHEN CURRENT REGULATIONS BY	12	95
B7	CREATE A MARINA SITING POLICY	DCM	COMPLETE BY	12	94



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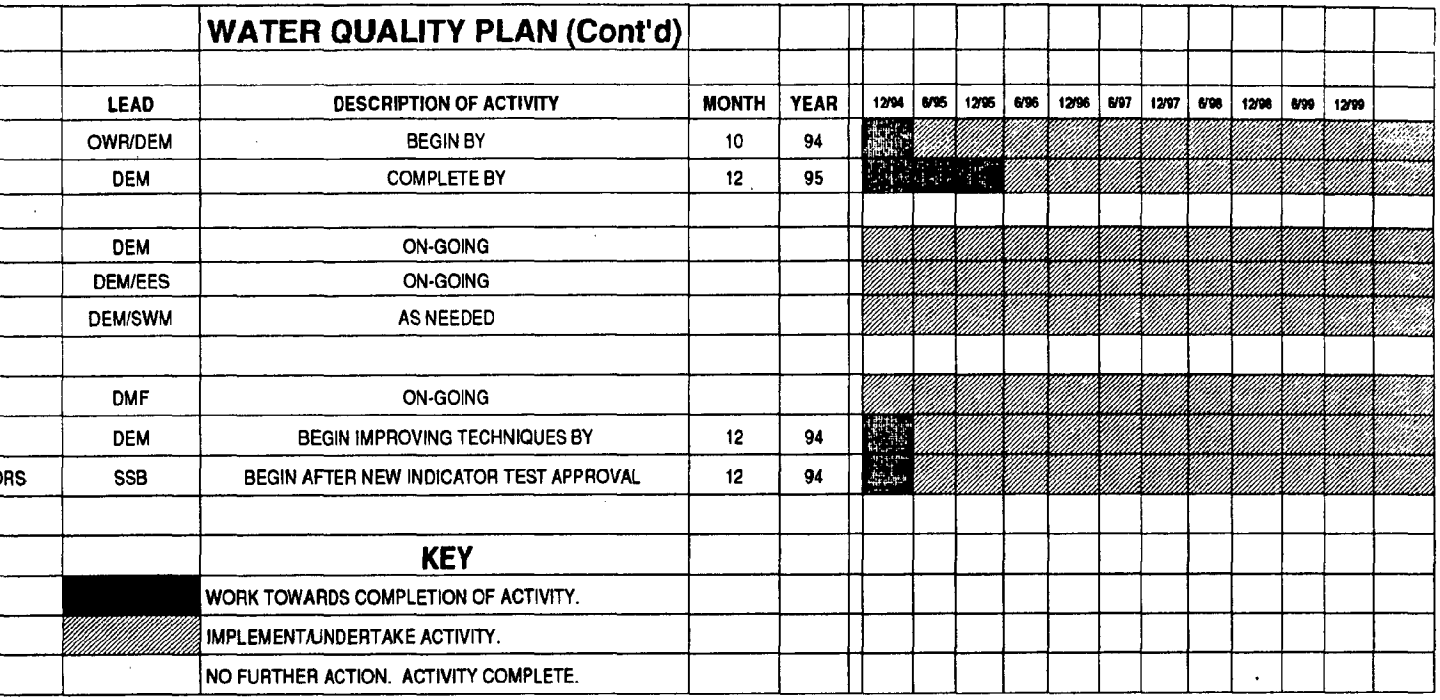
	WORK TOWARDS COMPLETION OF ACTIVITY.
	IMPLEMENT/UNDERTAKE ACTIVITY.
	NO FURTHER ACTION. ACTIVITY COMPLETE.

WATER QUALITY PLAN (Cont'd)

MGMT. ACTION	ACTIVITY	LEAD	DESCRIPTION OF ACTIVITY	MONTH	YEAR
C1	PROMOTE POLLUTION PREVENTION PLANNING	OWR/DEM	BEGIN BY	10	94
C2	STRENGTHEN NPDES ENFORCEMENT	DEM	COMPLETE BY	12	95
D1	MONITOR & ASSESS ESTUARINE CONTAMINATION	DEM	ON-GOING		
D2	ISSUE FISH ADVISORIES	DEM/EES	ON-GOING		
D3	REMEDIATE TOXIC CONTAMINATION	DEM/SWM	AS NEEDED		
E1	TRACK ENVIRONMENTAL STRESS INDICATORS	DMF	ON-GOING		
E2	IMPROVE ESTUARINE HEALTH EVALUATIONS	DEM	BEGIN IMPROVING TECHNIQUES BY	12	94
E3	DEVELOP & ADOPT SHELLFISH CONTAM. INDICATORS	SSB	BEGIN AFTER NEW INDICATOR TEST APPROVAL	12	94



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	WORK TOWARDS COMPLETION OF ACTIVITY.
	IMPLEMENT/UNDERTAKE ACTIVITY.
	NO FURTHER ACTION. ACTIVITY COMPLETE.

VITAL HABITAT PLAN

MGMT. ACTION	ACTIVITY	LEAD	DESCRIPTION OF ACTIVITY	MONTH	YEAR
A1	WHITE OAK RIVER BASINWIDE HABITAT PLAN	WRC	5 YEAR CYCLE (INITIAL PLAN DUE)	6	97
	NEUSE RIVER BASINWIDE HABITAT PLAN	WRC	5 YEAR CYCLE (INITIAL PLAN DUE)	4	98
	PASQUOTANK RIVER BASINWIDE HABITAT PLAN	WRC	5 YEAR CYCLE (INITIAL PLAN DUE)	1	98
	CHOWAN RIVER BASINWIDE HABITAT PLAN	WRC	5 YEAR CYCLE (INITIAL PLAN DUE)	6	98
	TAR-PAMLICO RIVER BASINWIDE HABITAT PLAN	WRC	5 YEAR CYCLE (INITIAL PLAN DUE)	1	95
	ROANOKE RIVER BASINWIDE HABITAT PLAN	WRC	5 YEAR CYCLE (INITIAL PLAN DUE)	1	97
A2	DEVELOP HABITAT MAPPING STANDARDS	JOINT	CONTINUE ALONG WITH HABITAT PLANS		
	DEVELOP BASINWIDE HABITAT MAPS/RECORDS	JOINT	UPDATE BASIN MAPS AT LEAST EVERY 5 YEARS		
A3	EXPAND WETLANDS IDENTIFICATION PROGRAMS	DCM	COMPLETE ALL COASTAL COUNTIES W/ DATA BY	12	96
B1	EXPAND PUBLIC HAB. OWNERSHIP/ MANAGEMENT	DPR	DEVELOP ALONG WITH HABITAT PLANS	7	95
B2	EXPAND PRIVATE HABITAT MANAGEMENT	DPR	DEVELOP ALONG WITH HABITAT PLANS	7	95
C1	ENHANCE WETLANDS REGULATION ENFORCEMENT	DEM/DCM	COMPLETE BY	12	95
C2	STRENGTHEN REGULATIONS FOR FISHERIES HABS	DMF	COMPLETE BY	12	95
C3	EXPAND WETLANDS RESTORATION PROGRAM	DEM/DCM	EXPAND RESTORATION ACTIVITIES BY	10	94
C4	ESTABLISH WETLANDS MITIGATION PROGRAM	DEM/DCM	ESTABLISH AN EFFECTIVE PROGRAM BY	12	95

FISHERIES PLAN

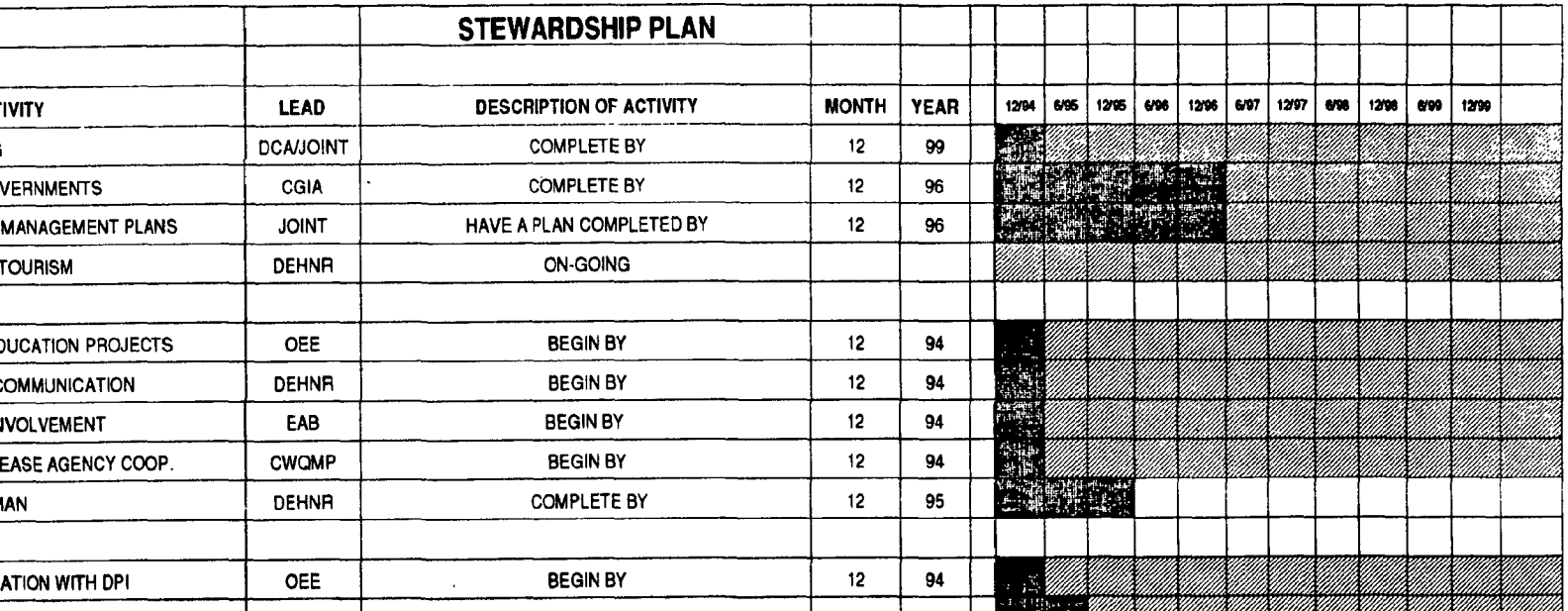
MGMT. ACTION	ACTIVITY	LEAD	DESCRIPTION OF ACTIVITY	MONTH	YEAR
A1	DEV. & IMPLEMENT MGMT. PLANS FOR FISHERIES	DMF	COMPLETE BY	12	99
A2	MODIFY MARINE FISHERIES LICENSE	MFC	COMPLETE BY	12	95
B1	REDUCE BYCATCH BY 50%	DMF	COMPLETE BY	12	95
B2	ESTABLISH A COST SHARE PROGRAM FOR BFPs	MFC	BEGIN A PROGRAM BY	12	95

KEY

■	WORK TOWARDS COMPLETION OF ACTIVITY.
▨	IMPLEMENT/UNDERTAKE ACTIVITY.
	NO FURTHER ACTION. ACTIVITY COMPLETE.

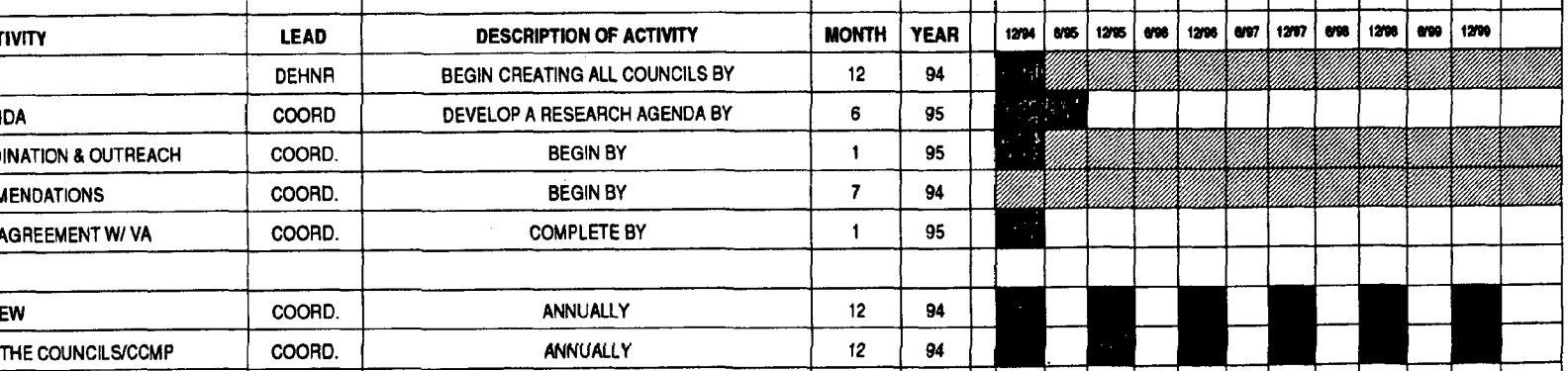
STEWARDSHIP PLAN

MGMT. ACTION	ACTIVITY	LEAD	DESCRIPTION OF ACTIVITY	MONTH	YEAR
A1	SUPPORT LOCAL PLANNING	DCA/JOINT	COMPLETE BY	12	99
A2	PROVIDE GIS TO LOCAL GOVERNMENTS	CGIA	COMPLETE BY	12	96
A3	IMPLEMENT PUBLIC TRUST MANAGEMENT PLANS	JOINT	HAVE A PLAN COMPLETED BY	12	96
A4	PROMOTE NATURE-BASED TOURISM	DEHNR	ON-GOING		
B1	EXPAND & COORD. ENV. EDUCATION PROJECTS	OEE	BEGIN BY	12	94
B2	INCREASE CITIZEN/GOVT. COMMUNICATION	DEHNR	BEGIN BY	12	94
B3	INCREASE LOCAL PUBLIC INVOLVEMENT	EAB	BEGIN BY	12	94
B4	EXPAND CWQMP AND INCREASE AGENCY COOP.	CWQMP	BEGIN BY	12	94
B5	CREATE CITIZEN OMBUDSMAN	DEHNR	COMPLETE BY	12	95
C1	EXPAND OEE AND COOPERATION WITH DPI	OEE	BEGIN BY	12	94
C2	PROVIDE RENEWAL CREDITS FOR TEACHERS	OEE	BEGIN BY	7	95



IMPLEMENTATION PLAN

MGMT. ACTION	ACTIVITY	LEAD	DESCRIPTION OF ACTIVITY	MONTH	YEAR
A1	CREATE ALL COUNCILS	DEHNR	BEGIN CREATING ALL COUNCILS BY	12	94
A2	DEVELOP RESEARCH AGENDA	COORD	DEVELOP A RESEARCH AGENDA BY	6	95
	PROMOTE AGENCY COORDINATION & OUTREACH	COORD.	BEGIN BY	1	95
	IMPLEMENT CCMP RECOMMENDATIONS	COORD.	BEGIN BY	7	94
	ADOPT MEMORANDUM OF AGREEMENT W/ VA	COORD.	COMPLETE BY	1	95
B1	DEVELOP PROGRESS REVIEW	COORD.	ANNUALLY	12	94
B2	ASSESS THE SUCCESS OF THE COUNCILS/CCMP	COORD.	ANNUALLY	12	94



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	IMPLEMENT/UNDERTAKE ACTIVITY
	NO FURTHER ACTION. ACTIVITY COMPLETE

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