NORTH CAROLINA
NATIONAL ESTUARINE RESEARCH RESERVE

MANAGEMENT PLAN
2009-2014

This management plan was developed in accordance with NOAA regulations, including all provisions for public involvement. It is consistent with the congressional intent of Section 315 of the Coastal Zone Management Act of 1972, as amended, and the provisions of the North Carolina Coastal Management Program.

TABLE OF CONTENTS

TABLE OF CONTENTS ..... **I**

ACKNOWLEDGEMENTS ..... **V**

ACRONYMS ..... **VII**

FIGURES ..... **IX**

TABLES ..... **XI**

EXECUTIVE SUMMARY ..... **XIII**

I. INTRODUCTION **1**

A. NORTH CAROLINA ENVIRONMENTAL SETTING 1
1. The Coastal Plain *1*
2. Climate and Weather *4*
3. Estuaries *6*
B. PROTECTION OF ESTUARIES AND COASTS: THE COASTAL ZONE MANAGEMENT ACT 7
1. National Coastal Zone Management Program *7*
2. National Estuarine Research Reserve System *8*
a. Mission 8
b. Goals 8
c. Administrative Framework of NERRS 9
d. NERRS Strategic Goals 2005-2010 9
e. Designation and Operation of NERRS 11
f. Reserve Management Plans 11
C. NORTH CAROLINA NATIONAL ESTUARINE RESEARCH RESERVE 12
1. Establishment of the Reserve *12*
2. State Management Authority *13*
3. NCNERR Focus for 2009-2014 ..... *15*
a. Vision 15
b. Mission 15
c. Goals 15
d. Guiding Principles 17
e. NCNERR Programs 17
4. Coastal Management Issues in North Carolina *17*
5. NCNERR Component Descriptions *20*
a. Currituck Banks 21
b. Rachel Carson 24
c. Masonboro Island 27
d. Zeke's Island 30

II. ADMINISTRATION PLAN **35**

A. ADMINISTRATIVE PLAN OVERVIEW 35
B. ADMINISTRATIVE FRAMEWORK 35
1. NOAA *35*
a. Estuarine Reserves Division 35
b. National Policy and Evaluation Division 36
c. Center for Coastal Fisheries and Habitat Research 36
2. North Carolina Division of Coastal Management *37*
3. University of North Carolina at Wilmington *38*
4. Local Advisory Committees *39*
5. Carolina Estuarine Reserve Foundation *39*
6. Partnerships *40*
C. FACILITIES PLAN 40
1. Maintenance of Buildings and Public Use Areas *40*

2. Construction Principles *41*
3. Northern Sites Office in Kitty Hawk (Currituck Banks) *41*
a. Office Space 41
b. Equipment 42
c. On-site Facilities 43
4. Headquarters Office in Beaufort (Rachel Carson) *43*
a. Office Space 43
b. Equipment 44
c. On-site Facilities 44
5. Southern Sites Office in Wilmington (Masonboro and Zeke's Islands) *45*
a. Office Space 45
b. Equipment 45
c. On-Site Facilities 46
D. STAFFING PLAN 47
1. Current Staff Responsibilities and Duties *48*
2. Staffing Needs *51*
E. NCNERR ADMINISTRATIVE OBJECTIVES 53
F. ACTIVITIES IN SUPPORT OF NCNERR ADMINISTRATIVE OBJECTIVES 53
1. The NCNERR will strengthen its relationship with NOAA-ERD (5.1) *53*
2. The NCNERR will strengthen its relationship with DCM (5.2) *54*
3. The NCNERR will strengthen its relationship with UNCW and CCFHR (5.3) *55*
4. The NCNERR will assess use of the components by various education, research, and commercial entities (5.4) *56*
5. The NCNERR will ensure its operating infrastructure is adequate to fulfill its mission (5.5) *57*
6. The NCNERR will ensure its staff has the skills necessary to perform their jobs and are able to do so safely (5.6) *58*
7. The community will recognize the NCNERR and understand how the Reserve serves the citizens and visitors of North Carolina (5.7) *58*
8. The NCNERR needs will be more fully met by volunteers and volunteers will be trained in coastal issues (5.8) *59*

III. EDUCATION PLAN 61

A. EDUCATION PROGRAM OVERVIEW 61
1. National Education Program *61*
a. Reserve System Education Goals 61
b. Reserve System Education Objectives 62
c. Reserve System Coastal Training Program 62
2. North Carolina NERR Education Plan Overview *63*
a. K-12 Student Education Program 64
b. Teacher Professional Development Program 64
c. Community Education and Outreach Program 65
d. Coastal Training Program 66
B. NCNERR EDUCATION OBJECTIVES 66
C. ACTIVITIES IN SUPPORT OF NCNERR EDUCATION OBJECTIVES 67
1. Education programs will deliver information on N.C. coastal resources to formal and informal educators, and K-12 and college students to foster environmental stewardship and decision-making (1.1) *67*
2. The greater community, including the general public, visitors, and pre-school children will receive educational programming (1.2) *70*
3. CTP activities will deliver science-based knowledge and skills appropriate to the needs of target audiences and relevant to sustainable coastal management (1.3) *72*
4. NCNERR research products will be used by the coastal management community (2.1) *73*
5. Coastal systems and their value will be interpreted and access to the Reserves will be directed to representative habitats to reduce impacts on sensitive habitats (4.3) *74*
6. The NCNERR will assess use of the sites by various education, research and commercial entities (5.4) *74*
7. The community will recognize the NCNERR and understand how the Reserve serves the citizens and visitors of North Carolina (5.7) *74*
8. NCNERR needs will be more fully met by volunteers and volunteers will be trained in local issues (5.8) *75*

D. COORDINATION AND PARTNERSHIPS 76
1. Coordination *76*
a. NCNERR Components 76
b. National and Regional NERRs 76
c. North Carolina Division of Coastal Management 77
2. Partnerships *78*
a. K-12 Student Education Program 78
b. Teacher Professional Development Program 78
c. Community Education and Outreach Program 79
d. Coastal Training Program 79

IV. RESEARCH AND MONITORING PLAN 81

A. RESEARCH PROGRAM OVERVIEW 81
1. National Research Program *81*
a. Reserve System Research Funding Priorities 81
b. Reserve System Research Goals 82
c. System-Wide Research Funding Opportunities 82
d. System-wide Monitoring Program 83
2. North Carolina NERR Research Plan Overview *84*
B. NCNERR RESEARCH OBJECTIVES 85
C. ACTIVITIES IN SUPPORT OF NCNERR RESEARCH OBJECTIVES 85
1. Education programs will deliver information on N.C. coastal resources to formal and informal educators, and K-12 and college students to foster environmental stewardship and informed decision-making (1.1) *85*
2. NCNERR research products are used by the coastal management community (2.1) *86*
3. NCNERR will enhance implementation of the System-Wide Monitoring Program (2.2) *88*
4. NCNERR habitat and watershed maps will improve understanding of ecosystem connections (3.1) *91*
5. NCNERR will assess use of the sites by various education, research and commercial entities (5.4) *92*
D. COORDINATION AND PARTNERSHIPS 93
1. Coordination *93*
a. NCNERR Components 93
b. National and Regional NERRs 93
c. North Carolina Division of Coastal Management 93
2. Partnerships *94*

V. STEWARDSHIP PLAN 95

A. STEWARDSHIP PROGRAM OVERVIEW 95
B. NCNERR STEWARDSHIP OBJECTIVES 95
C. PUBLIC ACCESS ACTIVITIES IN SUPPORT OF NCNERR STEWARDSHIP OBJECTIVES 96
1. Education programs will deliver information on N.C. coastal resources to formal and informal educators, and K-12 and college students to foster environmental stewardship and informed decision-making (1.1) *96*
2. The greater community, including the general public, visitors, and pre-school children, will receive educational programming (1.2) *97*
3. Coastal systems and their value will be interpreted and access to the Reserve sites will be directed to representative habitats to reduce impacts on sensitive habitats (4.3) *97*
D. RESOURCE PROTECTION AND RESTORATION ACTIVITIES IN SUPPORT OF NCNERR STEWARDSHIP OBJECTIVES 98
1. NCNERR research products will be used by the coastal management community (2.1) *98*
2. NCNERR habitat and watershed maps will inform management of the sites and improve understanding of watershed connections (3.1) *99*
3. Restored NCNERR habitats will provide improved water quality and ecological function (3.2) *100*
4. Effective Reserve site management will ensure a suitable environment for research and education (4.1) *100*
5. The NCNERR will assess use of the components by various education, research, and commercial entities (5.4) *101*
6. NCNERR needs will be more fully met by volunteers and volunteers will be trained in coastal issues (5.8) *102*

E. COORDINATION AND PARTNERSHIPS 103
1. Coordination *103*
a. NCNERR Components 103
b. National and Regional NERRs 103
c. North Carolina Division of Coastal Management 104
2. Partnerships *104*

VI. LAND ACQUISITION AND BOUNDARY EXPANSION PLAN 107

A. NCNERR LAND ACQUISITION AND BOUNDARY EXPANSION OBJECTIVES 107
B. ACTIVITIES IN SUPPORT OF NCNERR LAND ACQUISITION OBJECTIVES 107
1. Boundary expansion and acquisition will be completed to effectively protect Reserve core and buffer areas (4.2) *107*

REFERENCES 109

APPENDICES 111

APPENDIX A: FEDERAL RESEARCH RESERVE REGULATIONS 111
APPENDIX B: NATIONAL ESTUARINE RESEARCH RESERVE SYSTEM STRATEGIC PLAN 133
APPENDIX C: NORTH CAROLINA NERR CORE AND BUFFER AREA DESCRIPTIONS AND SITE MAPS 149
APPENDIX D: PUBLIC INPUT PROCESS 155
APPENDIX E: STATE ASSIGNMENT OF MANAGEMENT RESPONSIBILITIES 157
APPENDIX F: STATE RESERVE STATUTES 159
APPENDIX G: STATE RESERVE RULES 161
APPENDIX H: STATE NATURE PRESERVE DESIGNATION 165
APPENDIX I: COUNTY AND MUNICIPAL ZONING REGULATIONS 171
APPENDIX J: RESERVE MEMORANDA OF UNDERSTANDING 173
i. U.S. Fish and Wildlife Service, The Nature Conservancy and the Division of Coastal Management (DCM) *173*
ii. National Oceanic and Atmospheric Administration (NOAA) and DCM *178*
iii. University of North Carolina at Wilmington and DCM* *182*
iv. Center for Coastal Fisheries and Habitat Research (NOAA) and DCM *184*
v. Duke University Marine Laboratory and DCM *185*
vi. Division of Marine Fisheries and DCM *187*
vii. North Carolina Maritime Museum and DCM *194*
viii. Division of Parks and Recreation and DCM *197*
ix. University of North Carolina Sea Grant College Program and DCM *200*
x. Wildlife Resources commission and DCM *203*
xi. NOAA, National Park Service and DCM *206*
xii. Dominion Power and DCM *213*
xiii. Kitty Hawk Office Lease Agreement *220*
APPENDIX K: CAROLINA ESTUARINE RESERVE FOUNDATION STRATEGIC PLAN 225
APPENDIX L: NCNERR PARTNERSHIPS 229
APPENDIX M: STATE FISCAL SUPPORT FOR THE NORTH CAROLINA NERR 235
APPENDIX N: NORTH CAROLINA NERR SAFETY PLAN 239
APPENDIX O: NERRS RESEARCH AND MONITORING PLAN 247
APPENDIX P: NORTH CAROLINA COASTAL HABITAT PROTECTION PLAN 287
APPENDIX Q: NORTH CAROLINA RESEARCH POLICIES AND PERMIT 299
APPENDIX R: STEWARDSHIP POLICIES 303

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- Jill Fegley, Education Coordinator
- John Fear, Research Coordinator
- Hope Sutton, Stewardship Coordinator and Southern Sites Manager
- Whitney Jenkins, Coastal Training Program Coordinator
- Jacquie Ott, GIS Specialist
- Lori Davis, Education Specialist
- Heather Wells, Research Specialist

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ACRONYMS

- APNEP Albemarle-Pamlico National Estuary Program
- BHIC Bald Head Island Conservancy
- CAMA Coastal Area Management Act
- C-CAP Coastal Change Analysis Program
- CCFHR Center for Coastal Fisheries and Habitat Research
- CDMO Centralized Data Management Office
- CERF Carolina Estuarine Reserve Foundation
- CFR Code of Federal Regulations
- CHPP Coastal Habitat Protection Plan
- CICEET Cooperative Institute for Coastal and Estuarine Environmental Technology
- CMS Center for Marine Science
- CTP Coastal Training Program
- CWMTF Clean Water Management Trust Fund
- CZMA Coastal Zone Management Act
- CZMP Coastal Zone Management Program
- DCM North Carolina Division of Coastal Management
- DENR North Carolina Department of Environment and Natural Resources
- DMF North Carolina Division of Marine Fisheries
- DUML Duke University Marine Lab
- DVD Digital Video Disc
- ECSU Elizabeth City State University
- ERD Estuarine Reserves Division
- GIS Geographic Information Systems
- GRF Graduate Research Fellow
- IMS Institute of Marine Sciences (UNC-CH)
- IOOS Integrated Ocean Observing Systems
- KEEP K-12 Estuarine Education Program
- LAC Local Advisory Committees
- MA Market Analysis
- MOU Memorandum of Understanding
- NA Needs Assessment
- N.C. North Carolina
- NCERT National Coastal and Estuarine Research and Technology
- NCNERR North Carolina National Estuarine Research Reserve
- NCNHP North Carolina Natural Heritage Program
- NERRS National Estuarine Research Reserve System
- NOAA National Oceanic and Atmospheric Administration
- OCRM Office of Ocean and Coastal Resource Management
- SAV Submerged Aquatic Vegetation
- SECOORA Southeast Coastal Ocean Observations Regional Association
- SWMP System-Wide Monitoring Program

- UNC University of North Carolina
- UNC-CH University of North Carolina at Chapel Hill
- UNCW University of North Carolina at Wilmington
- U.S. United States
- USC United States Code
- USGS United States Geological Survey
- WRC North Carolina Wildlife Resources Commission

FIGURES

Figure 1: Summary of NCNERR Goals 1-5 with objectives and activities……..xvi

Figure 2: North Carolina geological regions and biogeographical provinces……1

Figure 3: North Carolina coastal regions and back barrier sounds……2

Figure 4: Ocean currents off of the coast of North Carolina……5

Figure 5: National Estuarine Research Reserve System map and biogeographic region……10

Figure 6: Map of the locations of NCNERR components on the North Carolina coast……14

Figure 7: Currituck Banks site map……22

Figure 8: Rachel Carson site map……25

Figure 9: Masonboro Island site map……29

Figure 10: Zeke's Island site map……31

Figure 11: DENR/DCM Organizational Chart……38

Figure 12: North Carolina NERR Organizational Chart with employer and location……47

TABLES

Table 1: NCNERR goals and objectives.……..15

Table 2: NCNERR goals and objectives that address the priority coastal management issues in N.C. ……..20

Table 3: Programmatic priorities based on existing infrastructure, staffing and site-specific needs.……..21

EXECUTIVE SUMMARY

The North Carolina National Estuarine Research Reserve (NCNERR) protects approximately 10,500 acres of estuarine habitats in coastal North Carolina for the purposes of research and education. The NCNERR is part of the National Estuarine Research Reserve System (NERRS), a network of protected areas established to promote informed management of the Nation's estuaries and coastal habitats. The NERRS addresses nationally significant and locally relevant issues through national and local research, education, and stewardship programs. The NERRS currently consists of 27 Reserves in 22 states and territories, protecting over one million acres of estuarine lands and water.

The NCNERR is managed as a federal-state partnership between the National Oceanic Atmospheric Administration's (NOAA) Office of Ocean and Coastal Resource Management (OCRM) and the North Carolina Department of Environment and Natural Resources' (DENR) Division of Coastal Management (DCM). OCRM implements the National Coastal Zone Management Program and the NERRS with authorization from the Coastal Zone Management Act of 1972 (CZMA). OCRM provides funding, technical assistance, and national coordination and oversight to Reserves within the NERRS. The DCM carries out the state's Coastal Area Management Act, the Dredge and Fill Law and the Federal CZMA of 1972 in the 20 coastal North Carolina counties, using rules and policies of the N.C. Coastal Resources Commission. As the state partner, the DCM provides land ownership and management, staff, programming, and matching funds for implementation of the NCNERR. The DCM is well-suited as the NCNERR's state partner as both organizations have similar missions of protecting coastal resources, albeit via different mechanisms. Both the DCM and NCNERR are able to take advantage of respective programmatic expertise in planning, permitting, scientific research, educational translation, and coastal land management to form a complementary and comprehensive coastal management program as originally envisioned by the CZMA.

Coastal North Carolina is unique in that it includes both the Virginian and Carolinian biogeographic regions as well as the three regions of the N.C. Coastal Plain. The NCNERR was established as a multi-component Reserve to take advantage of this unique biogeography and is comprised of four geographically disparate components representing diverse estuarine habitats:

1. The 965-acre Currituck Banks component located in Currituck County, just north of the village of Corolla at the end of North Carolina (N.C.) 12;
2. The 2,315-acre Rachel Carson component located in Carteret County between the town of Beaufort, Harkers Island and the Cape Lookout National Seashore;
3. The 5,653-acre Masonboro Island component, an undeveloped barrier island, situated in New Hanover County between the towns of Wrightsville Beach and Carolina Beach; and
4. The 1,635-acre Zeke's Island component, encompassing tracts in both New Hanover and Brunswick counties, reached via United States (U.S.) 421 south of Kure Beach.

The NCNERR is operationally divided into three distinct sectors to support its mission of *promoting informed management and stewardship of North Carolina's estuarine and coastal habitats through research, education, and example*: education, research, and stewardship. Each sector is devoted to fostering that aspect of the program, under the guidance of the Reserve Manager and according to the management plan.

- The Education sector, through programs and activities, strives to increase understanding and awareness of estuarine systems and improve decision-making to promote stewardship of North Carolina's coastal resources among the general public, K-12 students and teachers, and coastal decision-makers.
- The Research sector addresses scientific and technical aspects of coastal management problems through a comprehensive, interdisciplinary, and coordinated research program including site-directed research, monitoring, and the Graduate Research Fellowship Program.
- The Stewardship sector is involved in a wide range of activities including land acquisition, ecological restoration, resource inventories, watershed management projects, endangered species protection, visitor use management, regional planning, policy development and more.

Each sector utilizes the four components of the NCNERR to implement its respective programs, promoting site-based management of the Reserve.

The OCRM requires each Reserve within the NERRS to prepare a written management plan that describes the Reserve's goals, objectives and management issues, and identifies the Reserve's intended actions for education, research, stewardship and public access, acquisition, and facilities. The plan must be approved by OCRM and periodically updated. The initial NCNERR management plan was prepared and approved in 1983 with revisions in 1990 and 1998. This document is the third revision of that plan.

Each Reserve is periodically evaluated by OCRM for compliance with NERRS goals and its approved management plan, funding awards, and work plans. The NCNERR was last evaluated in 2005. The evaluation findings acknowledged Reserve accomplishments in the areas of research and monitoring, education, and stewardship. The findings also included actions and recommendations to: develop a new management plan that addresses programmatic priorities, future direction, minimal state support of the NCNERR, facilities, staffing, and safety; complete the NCNERR site profile; take advantage of the many research partnership opportunities available; evaluate the local advisory committees so they may better serve the Reserve and its customers, and work with the Reserve's local and national non-profit groups.

Since its designation in 1985 (Currituck Banks, Rachel Carson, and Zeke's Island) and 1991 (Masonboro Island), the NCNERR has provided high quality education, research, and stewardship programs to the coastal management community, 20 coastal North Carolina counties, and visitors alike. This premise has been the cornerstone of Reserve operations even through periods of transition. Today the Reserve comprises one of three sections within DCM, an increase in the vertical placement of the program on the DCM organizational chart; enjoys a more mutually-beneficial relationship with DCM resulting in collaborative programming and decision-making; boasts two new office facilities with the new Beaufort office now serving as

the Reserve headquarters; implements an updated management philosophy that promotes the Reserve and its sites and programs, and recognizes the need for Reserve programs at all sites; and provides more robust, diverse, and integrated programs that build heavily on partnerships.

This management plan provides a framework for the Reserve to continue, enhance, and expand its operations and programs for 2009-2014 to better address high priority coastal management issues and serve NCNERR customers, thereby promoting healthy estuaries and watersheds. The following five goals and resultant objectives and activities will guide Reserve management during this period (Figure 1).

1. Humans understand the natural systems, their connections to them, and the benefits derived from them.
2. Applicable research informs coastal policy.
3. NCNERR habitats and land use of associated watersheds are characterized and connections understood.
4. Habitat is protected and the public has directed access to NCNERR components.
5. NCNERR operations, infrastructure, and stature are improved.

There are several overarching issues faced by the entire North Carolina coast that threaten all components of NCNERR. These include both anthropogenic as well as natural processes. Issues affecting all NCNERR components include coastal population increase, altered land use, storm water runoff and eutrophication, invasive species, tropical and coastal storm impacts, and sea level rise. In addition to these overarching issues, individual Reserves have specific local challenges as well.

The administration, education, research, and stewardship plans contained herein detail how each program will address the relevant goals, objectives, and activities in Figure 1 and the evaluation recommendations. The plans also identify the types of projects the NCNERR will undertake in an effort to address the threats facing its components and N.C. coastal communities in general.

A coordinated approach will be taken to implement this management plan; this will involve OCRM and DCM, the Reserve's administrative and programmatic partners, local advisory committees, volunteers, and the local non-profit organization, the Carolina Estuarine Reserve Foundation.

Figure 1a: Summary of NCNERR Goal 1 with Objectives and Activities

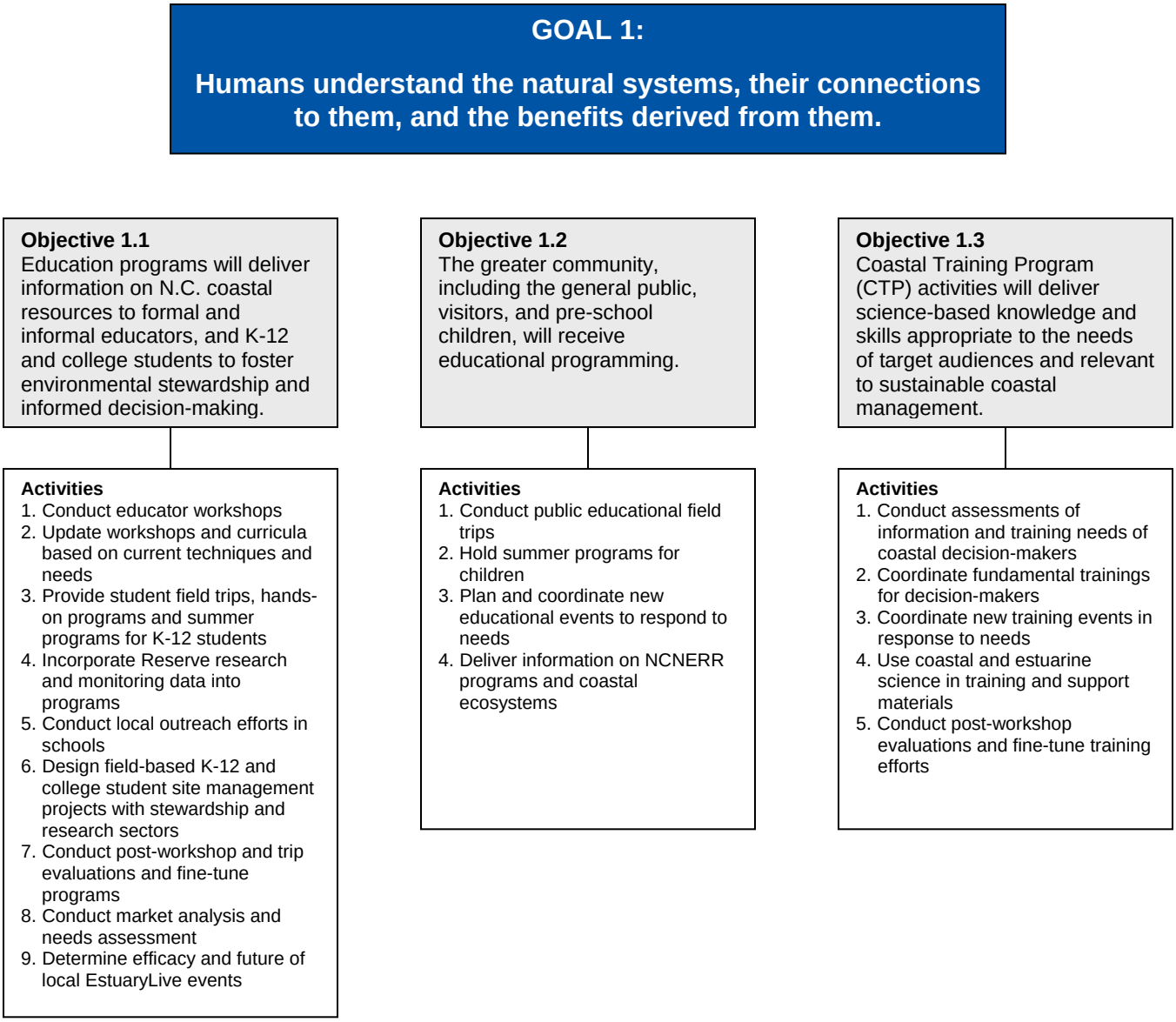


Figure 1b: Summary of NCNERR Goal 2 with Objectives and Activities

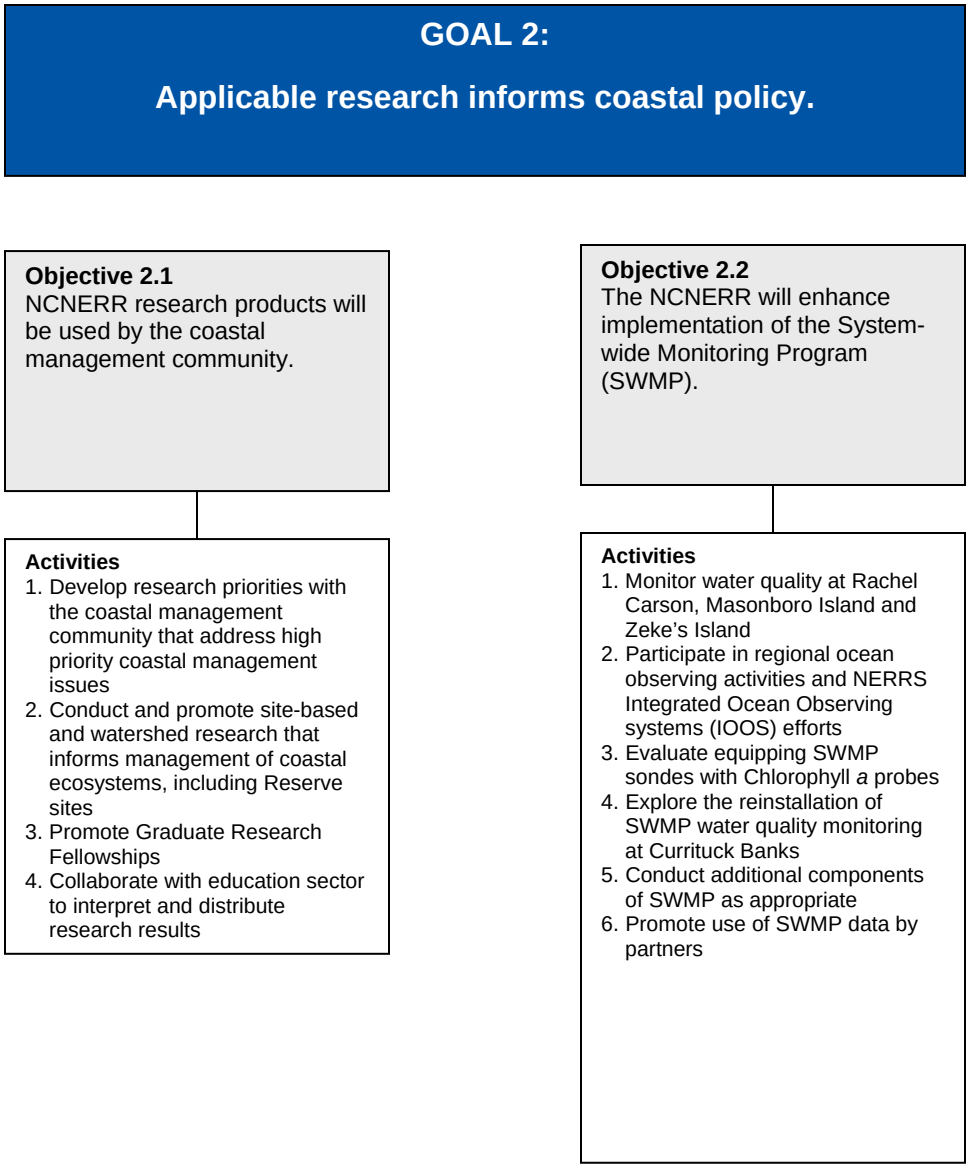


Figure 1c: Summary of NCNERR Goal 3 with Objectives and Activities

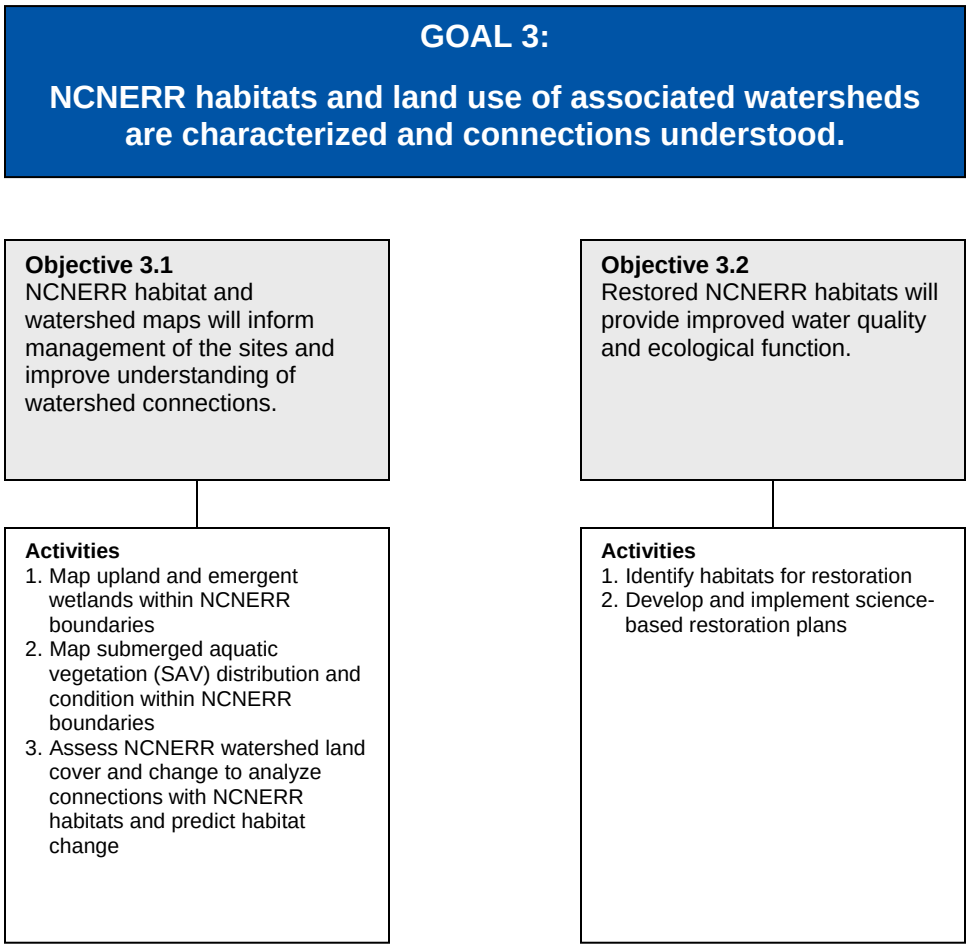


Figure 1d: Summary of NCNERR Goal 4 with Objectives and Activities

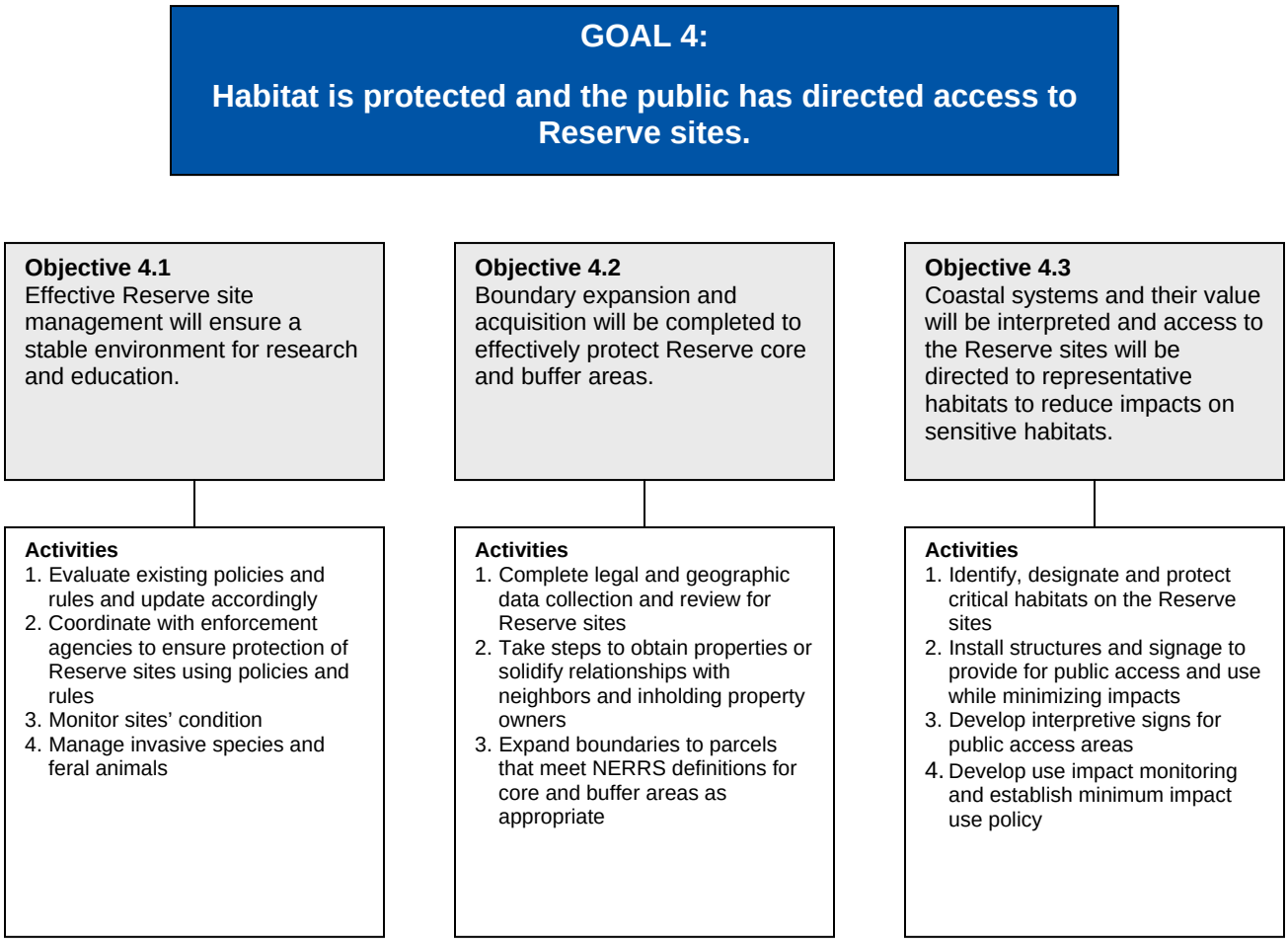


Figure 1e: Summary of NCNERR Goal 5 with Objectives and Activities

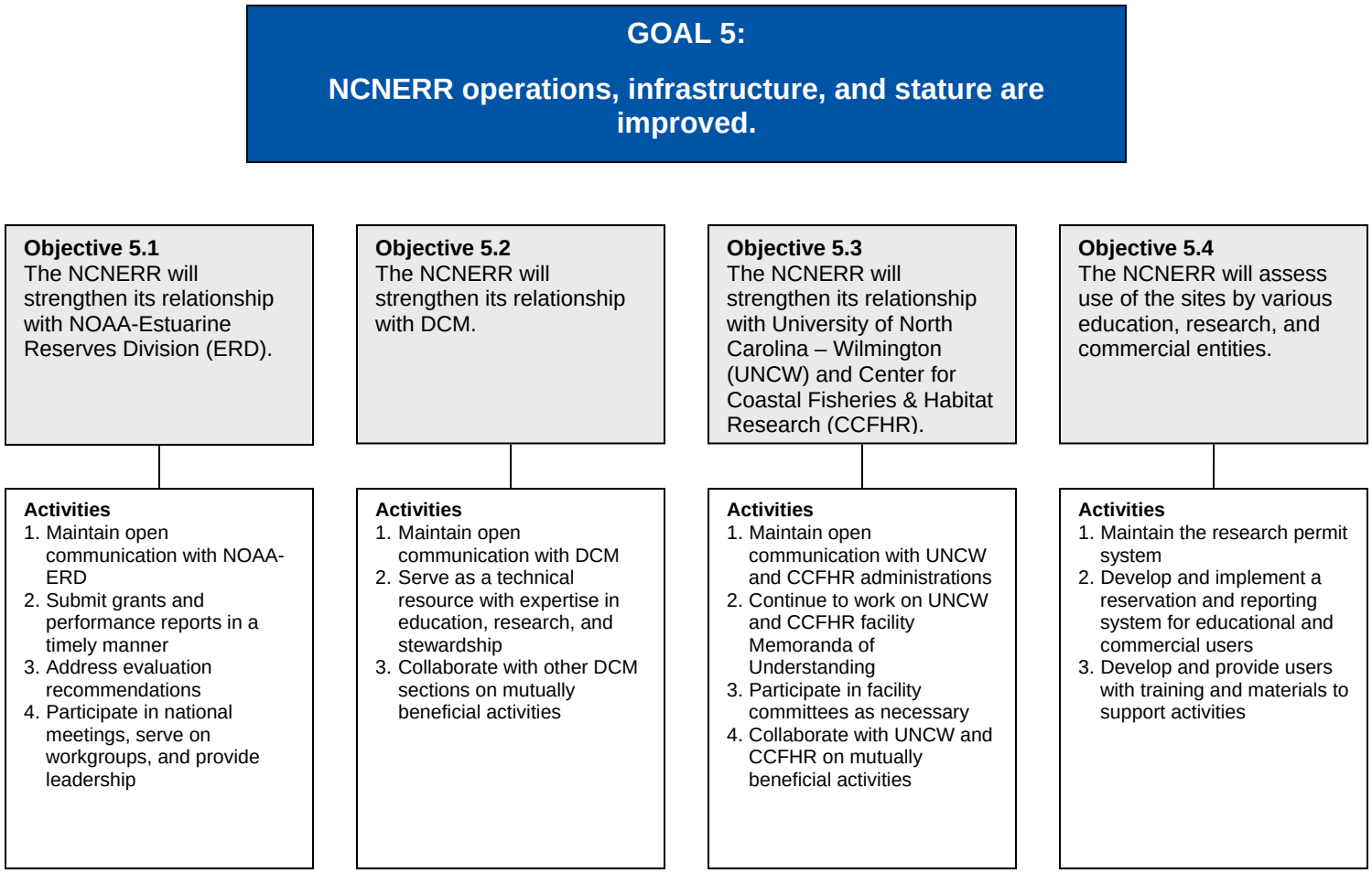
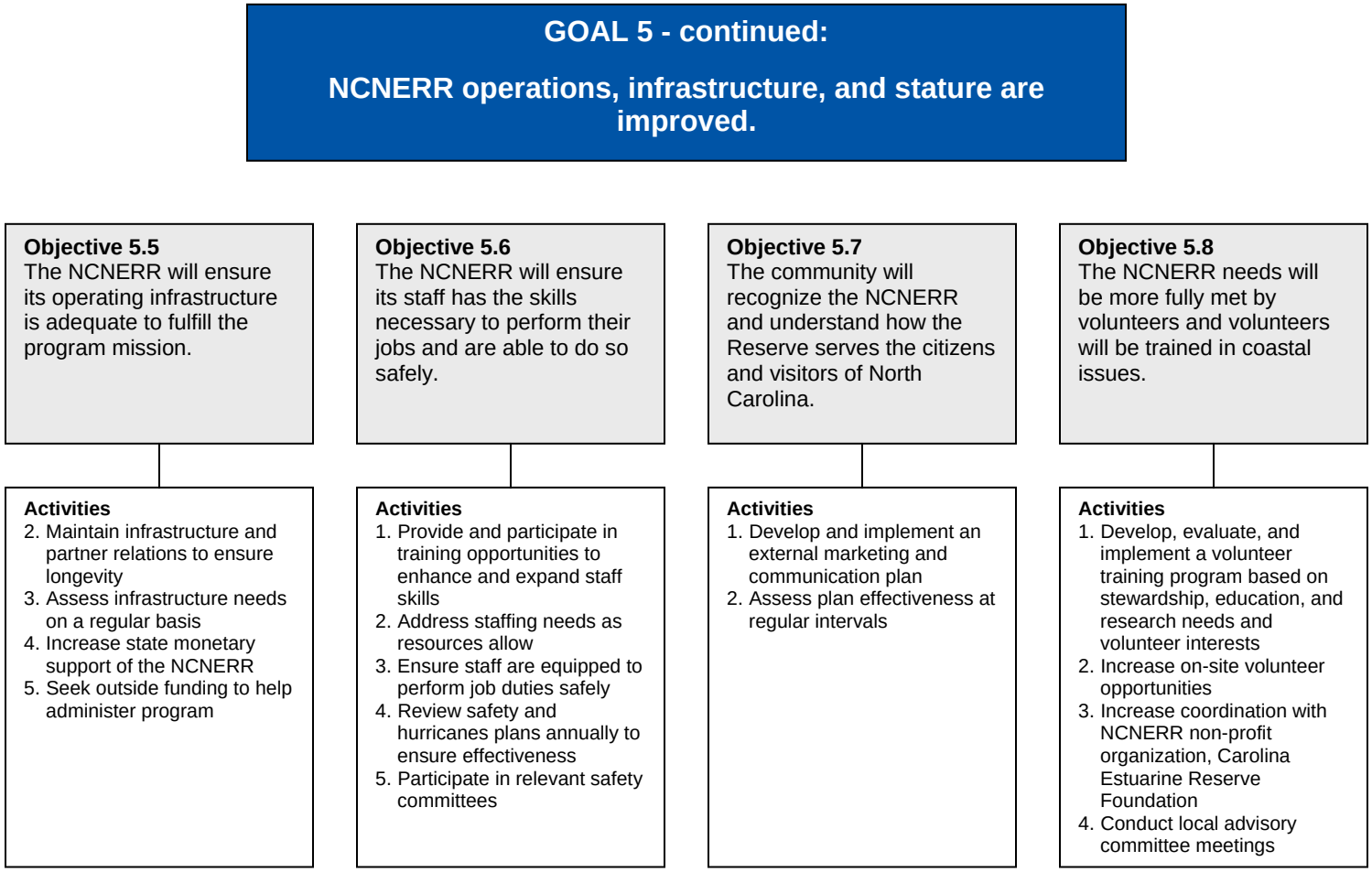


Figure 1f: Continuation of NCNERR Goal 5 with Objectives and Activities



I. INTRODUCTION

A. North Carolina Environmental Setting

North Carolina (N.C.) lies between 33.5° and 37° north latitude and between 75° and 84.5° west longitude midway along the U.S. Eastern seaboard (Figure 2). The total area of the State is 52,669 square miles (136,524 km^2), of which 48,843 square miles (127,278 km^2) are land and 3,826 square miles (9,246 km^2) are water (State Library of North Carolina 2008). The state is divided into three distinct topographical regions (the Coastal Plain, the Piedmont Plateau, and the Blue Ridge/Appalachian Mountains) and two unique biogeographical provinces (the Virginian and Carolinian) (Figure 2).

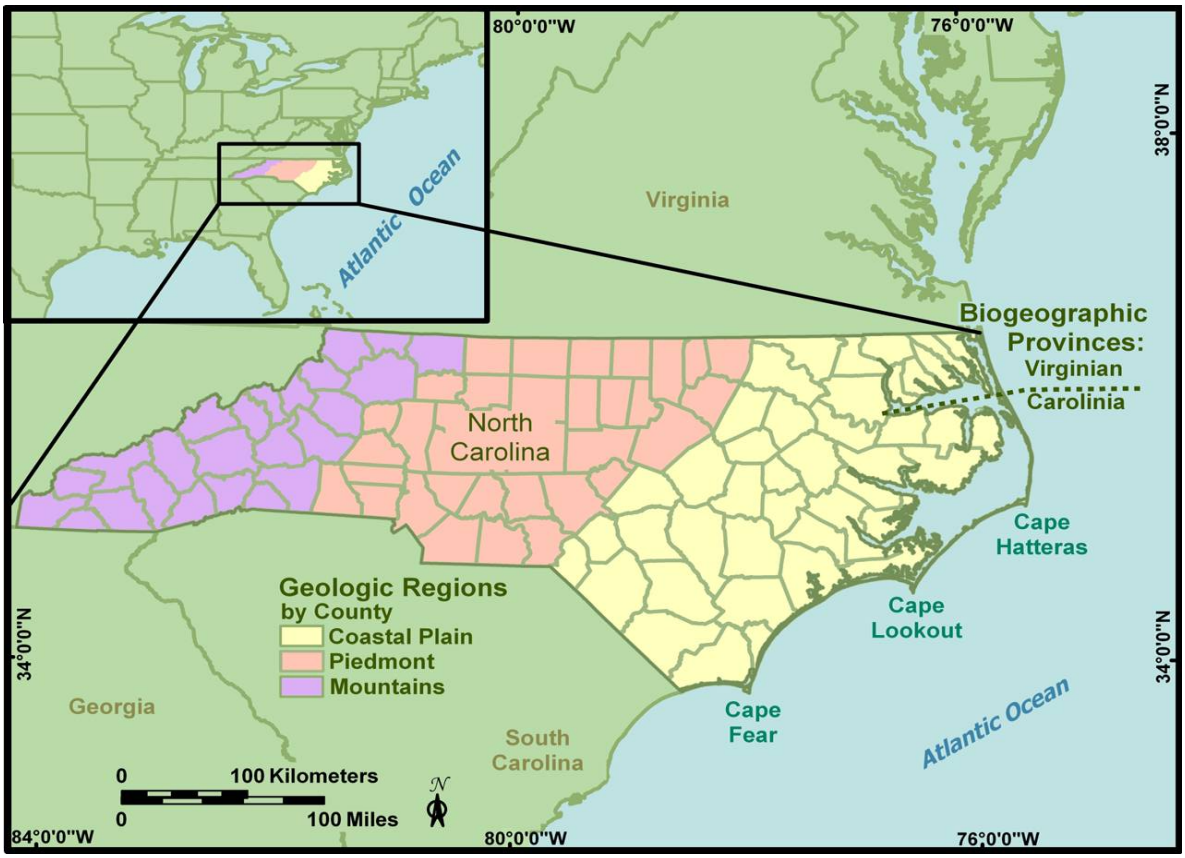


Figure 2: North Carolina geological regions and biogeographical provinces

1. The Coastal Plain

North Carolina's coastal plain juts out from the East Coast of the United States into the Atlantic Ocean and the Gulf Stream. It runs from Virginia to South Carolina and extends inward approximately 100 miles, where the land rises imperceptibly into the Piedmont or foothills. The land and water areas of the coastal plain comprise nearly half the area of the State. The coastline is further subdivided into three distinct regions (Northern, Central and Southern) based on geomorphological and ecological features (Figure 3). Each region has a unique geologic

framework that results in distinctive types of barrier islands, inlets and estuaries influenced by different wave and tidal processes (Pilkey et al. 1998). The underlying geology leads to distinctive coastal habitat types with different biological and anthropogenic influences.

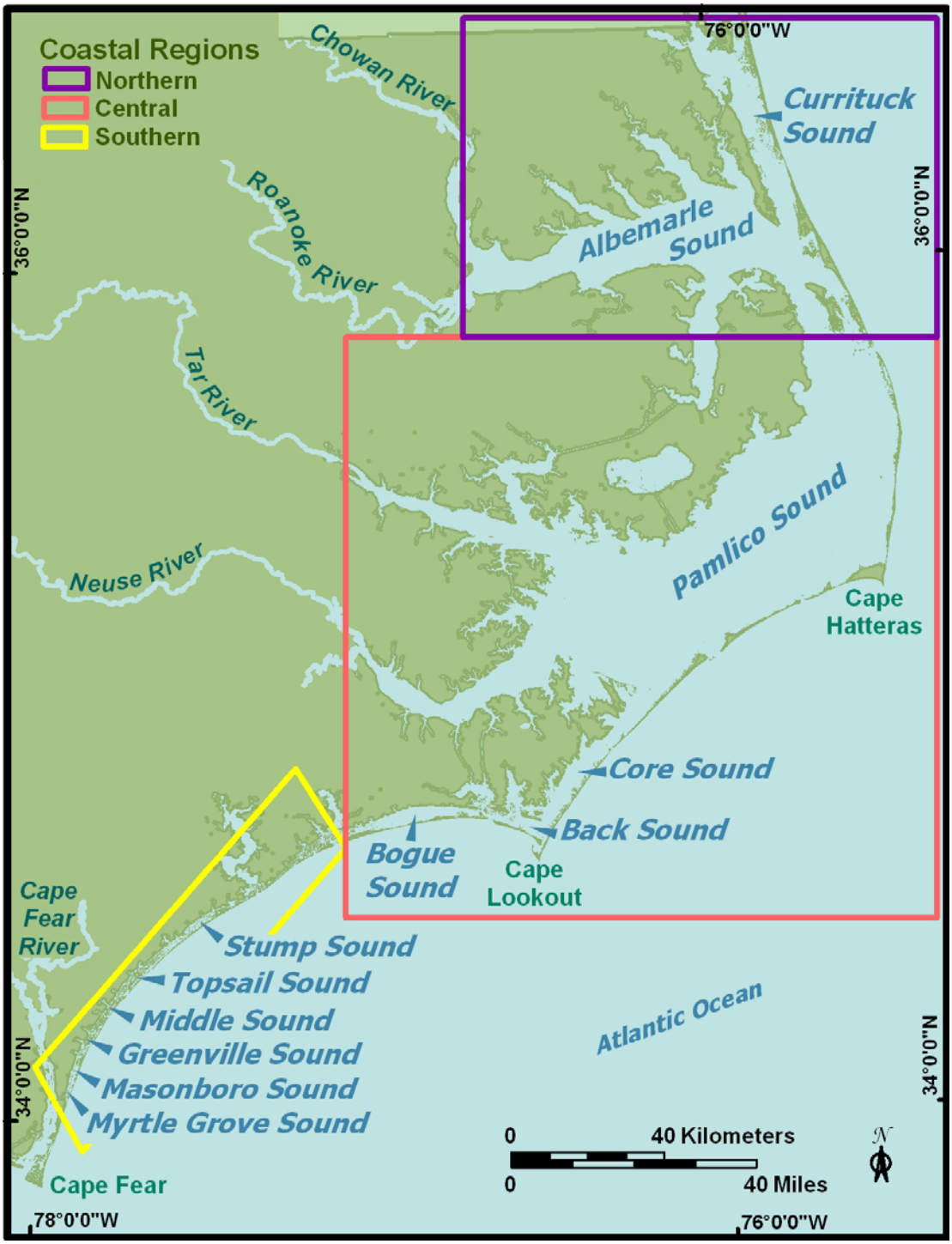


Figure 3: North Carolina coastal regions and back barrier sounds

The Northern coastal plain drains the Pasquotank, Chowan and Roanoke River Basins and is characterized by Quaternary age sediment deposits that occurred during the numerous sea level fluctuations in the past 1.6 million years (Pilkey et al. 1998). The sediments consist of unconsolidated mud, muddy sand, sand and peat sediments that thicken northward to fill the subsiding Albemarle Embayment. The consequence is a gently sloping topography with an average slope of only 0.2 feet per mile (Pilkey et al. 1998). Rising sea level combined with the gentle slope of the region has produced long barrier islands with drowned lowlands that lie behind the islands (Pilkey et al. 1998). In the north the long barrier islands project seaward and isolate the Albemarle Sound from the ocean. There are currently no inlets along the Northern coastline; the nearest inlets to Albemarle Sound are Lynnhaven Bay, Virginia (60 miles north of Kitty Hawk) and Oregon Inlet in Dare County, North Carolina (25 miles south of Kitty Hawk). Many ocean inlets existed throughout the history of the northern Outer Banks, however, by 1828, New Currituck Inlet, the last of the inlets, closed. This caused a transformation in Currituck and Albemarle Sounds from a high salinity estuarine environment to a low salinity (rarely exceeding 10 ppt salinity) estuarine environment that is affected by wind-dominated tides owing to the considerable distance from salt water. Albemarle Sound is connected to Pamlico Sound (in the Central region) and together they comprise the second largest estuarine complex in the continental U.S.

This region is rural but has recently experienced rapid population growth and development which is concentrated on the barrier islands. The mainland portion of the Northern coastal plain has also experienced a regional population increase but, for the most part, remains rural. The inland area of this region has been extensively cleared for agriculture and silviculture. Very few upland forests remain; however, there are swamp forests and extensive marshes that are associated with the major rivers and the sounds. Representative natural communities on the barrier islands include maritime shrub, maritime evergreen forest, estuarine fringe loblolly pine forest, and tidal freshwater marsh (North Carolina Natural Heritage Program (NCNHP) 1990).

The Central and Southern coastlines are underlain primarily by rocks dating from the Upper Cretaceous (about 90 million years ago) through Pliocene (about 1.6 million years ago) periods (Pilkey et al. 1998). The Central region drains the Tar, Neuse and White Oak River Basins into Pamlico Sound which is part of the Albemarle-Pamlico estuarine system. The Albemarle-Pamlico estuarine system is bounded to the east by long barriers islands with flooded lowlands behind the islands and covers more than 3,594 square miles (9,308 km^2) (Paerl et al. 2001). This region is characterized by shallow slopes and numerous inlets allowing the mixing of freshwater from the rivers and saltwater from the oceans.

The Central region is also a mostly rural region with a low-medium population density and numerous small towns. The agriculture and fishing industries are a major component of the local economy, though coastal communities are a destination for tourism and retirement, with new housing built primarily along the ocean, rivers and sounds. The region's topography is largely flat and poorly-drained. The coastal sites contain the following community types: maritime shrub forests, maritime evergreen forests, maritime dry grasslands, salt flats, dune grass communities and salt marshes. Just inland from these are the coastal edge sites, which contain coastal fringe evergreen forests, coastal fringe sandhills and maritime wet grasslands. Finally, away from the

tidal zone there are several types of inland communities, including pocosins, longleaf pine forests, nonriverine wetlands, and floodplain forests (NCNHP 1999).

The Southern coastal plain is associated with a large geologic structure called the Carolina Platform which has risen slightly during the geologic past causing the rocks to dip toward the north and east (Pilkey et al. 1998). Due to the unique uplifting of the Carolina Platform the Southern coastal plain is characterized by an average slope of 3 feet per mile (Pilkey et al. 1998). Rising sea level in this part of the State has led to the production of short, stubby barrier islands and narrow back-barrier estuaries (Pilkey et al. 1998). The Southern coastal plain drains the Cape Fear and Lumber River Basins and contains numerous inlets through the barrier islands allowing the rivers to fully mix with the ocean. As such the estuaries in the south are generally much smaller than those in the north and highly brackish (18-30 ppt).

The Southern region is the most highly developed along the North Carolina coastline and continues to experience substantial population growth. From 2000 to 2006, the coastal counties in this region saw a 22% increase in population (U.S. Census Bureau 2008). Despite development pressures, natural areas can still be found throughout the region. The mainland portion of the Southern region is characterized by nearly flat topography, with occasional bluffs along the rivers. There are extensive elevated peatland areas that support pocosin communities. Relict dune ridge-and-swale systems formed by an ancient ocean shoreline are present and support longleaf pine communities on the ridges and pocosin or swamp communities in the swales. In the southeastern part of the region, limesink ponds were formed by the localized underground collapse of limestone deposits, creating surface depressions. These elliptical depressions encircled by sand ridges support pocosin communities in the interior and longleaf pine communities along the bay rims. Along the Atlantic coast are barrier islands, which support significant tidal wetland and maritime forest communities (NCNHP 1995).

North Carolina's coastal plain is also divided into two different biogeographic regions (the Virginian and the Carolinian – Figure 2). Biogeographic regions are characterized chiefly by the dominant forms of plant life and the prevailing climate. The patterns of species distribution at the regional level can usually be explained through a combination of historical factors such as speciation, extinction, continental drift, and glaciation (and associated variations in sea level, river routes, and so on), in combination with the area and isolation of landmasses (geographic constraints) and available energy supplies. Each biogeographic region contains several types of estuarine ecosystems.

2. Climate and Weather

North Carolina, in the warm temperate zone, has a generally mild climate, with abundant and well distributed rainfall. Summer precipitation is typically highest, with July being the wettest month. Autumn is the driest season, with November the driest month. Precipitation during winter and spring occurs mostly in connection with migratory low pressure storms, which appear with greater regularity and in a more even distribution than summer showers. Snow and sleet are rare on the coastal plain (State Climate Office of North Carolina 2008).

Air temperature in North Carolina is extremely variable and depends on many factors such as altitude and the influence of oceanic currents. In all seasons, the average air temperature varies more than 20 °F (~11 °C) from the eastern most coastal areas compared to the highest mountain peaks. Winter air temperatures in the eastern portions of the coastal plain are modified by the Atlantic Ocean, which raises the average winter temperature and decreases the average day-to-night range compared to more inland areas. Average air temperature in summer (June-August) is 79 °F whereas the average winter air temperature (December-February) is 48 °F (State Climate Office of North Carolina 2008).

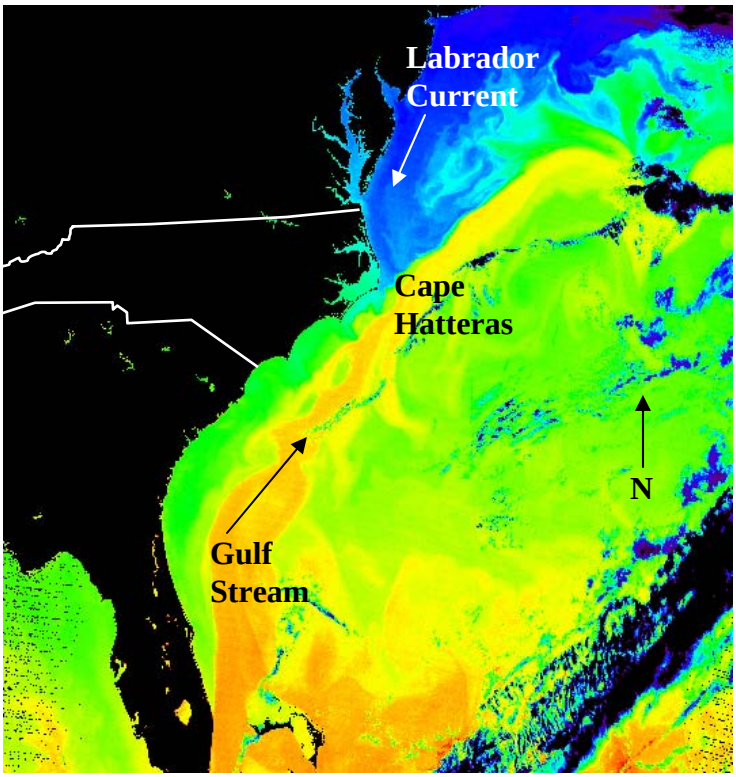


Figure 4: Ocean currents off of the coast of North Carolina. The warm waters of the Gulf Stream show up in yellow and move northward, the cold waters of the Labrador Current show up in blue and move southward

The immediate coastal regions of North Carolina are influenced greatly by the prevailing ocean currents. Two ocean currents, the Gulf Stream and the Labrador Current, converge off of Cape Hatteras (Figure 4). The Gulf Stream provides a warming effect to the southern coastal areas, and the Labrador Current provides a cooling effect for the northern coastal section. In the immediate coastal areas this can cause several degrees of difference between the northern (cooler) and southern (warmer) coastal areas. The convergence of these currents provides a rich biological region off the North Carolina coast where species from both the Carolinian (warmer) and Virginian (cooler) biogeographic provinces coexist. The mixing of the warm and cold waters also helps fuel oceanic storms off the coast of North Carolina. North Carolina is subject to two types of oceanic storms, tropical storm/hurricanes and Nor'easters. Both types of storms can produce large amounts of precipitation and gale force winds. Tropical storms and hurricanes are warm-cored systems with a closed circulation containing a defined eye wall structure. These storms are a yearly threat from June through November, and feed off the warm waters of the Gulf Stream. Nor'easters typically form during the winter months when a cold-cored low pressure system, associated with a front, moves up the coast and intensifies due to gradients in atmospheric conditions along the Labrador/Gulf Stream interface. Both storm types can influence areas well inland from the coast.

3. Estuaries

Estuaries are partially enclosed bodies of water, such as bays, sounds, lagoons and sloughs, where freshwater from rivers mixes with salt water from the oceans. North Carolina's 4,531 square miles (11,735 km^2) of estuarine and marine waters comprise the largest estuarine system of any state along the Atlantic coast (Paerl et al. 2001). The Albemarle-Pamlico estuarine system located in the Northern and Central regions is the second largest estuarine complex in the United States' lower 48 states and covers approximately 3,594 square miles (9,308 km^2). This estuarine system is composed of two very large sounds (Albemarle and Pamlico) and several small ones in the north (Currituck, Roanoke and Croatan) and south (Core, Back, and Bogue). The tidal range in these sounds is from 0.5 to 3.5 ft (~0.2 – 1 m) depending on distance from an ocean inlet. Salinity in the sounds also varies based on distance from an ocean inlet. Typical values range between 2-25 ppt (2-7 ppt in Albemarle Sound and 15-25 ppt in Pamlico Sound). The sounds in the southern region of North Carolina (Stump, Topsail, Middle, Greenville, Masonboro, and Myrtle Grove) are smaller than those to the north as the barrier islands tend to be much closer to the mainland than those northward. Consequently, their tidal range is closer to the coastal ocean values which in this region range from three to six ft (~0.9 – 1.8 m). Salinity in these sounds is also much closer to coastal ocean values ranging from 25-35 ppt. These differences in North Carolina's back barrier sounds make the estuarine environments in the northern, central and southern parts of the state very different.

The North Carolina coast includes almost 8,900 miles of estuarine shoreline, with a wide range of habitats. Estuaries and the lands surrounding them are places of transition from land to sea, and from fresh to saltwater. Estuarine environments are influenced by the tides yet are protected from the full force of ocean waves by barrier islands, reefs, or sand formations on the seaward boundary. Estuaries are among the most productive environments on earth and contain many different habitat types.

The state's central location on the East coast, vast estuarine system and extensive shoreline all play an important role in the health of fishery populations along the Atlantic coast. North Carolina is geographically situated at the convergence of the warm Gulf Stream flowing north and the cool Labrador Current flowing south. These two currents bring a wide variety of fish species into North Carolina's coastal waters. North Carolina's coastal waters support an abundant and vast assortment of marine life. Shrimp, flounder, trout, oysters, clams and hundreds of other species of fish and shellfish depend on the estuaries for all or some part of their lives. Many fish that live their lives in the ocean come to estuaries to lay eggs or give birth to young. The combination of shallow water and abundant vegetated habitat (marshes and submerged aquatic vegetation) makes excellent nursery habitat for fish, providing both food and refuge. Ninety-five percent of all commercial fish species caught in North Carolina utilize the estuary at some point during their life cycle. North Carolina, with its billion-dollar commercial and recreational fishing industries, ranks among the nation's highest seafood-producing states (State Library of North Carolina 2008).

Besides serving as important habitat for wildlife, the marshes that fringe estuaries also perform other valuable services. Stormwater runoff from the uplands carries sediments, nutrients, and other pollutants. As the runoff reaches the estuary it is filtered by the adjacent marsh. The

filtration process creates cleaner and clearer water thereby maintaining high water quality for both marine life and human enjoyment. Wetlands also act as a natural buffer during storms by absorbing flood waters and dissipating storm surges. Estuaries also provide many recreational opportunities, such as swimming, boating, fishing and bird watching.

B. Protection of Estuaries and Coasts: The Coastal Zone Management Act

To protect North Carolina's and the Nation's valuable estuarine resources, Congress passed the Coastal Zone Management Act (CZMA) and its subsequent reauthorizations to officially recognize that resources of the coastal zone are of national significance and that these resources are rapidly disappearing. The CZMA also recognizes the interrelationships between uplands and tidelands: the "coastal zone" was defined in the Act as including all uplands "to the extent necessary to control shoreland." A portion of the 1996 reauthorization of the CZMA states:

> *The increasing and competing demands upon the lands and water of our coastal zone...have resulted in the loss of living marine resources, wildlife, nutrient-rich areas, permanent and adverse changes to ecological systems, decreasing open space for public use, and shoreline erosion.*
>
> *The habitat areas of the coastal zone, the fish, shellfish, other living marine resources, and wildlife therein, are ecologically fragile and consequently extremely vulnerable to destruction by man's alteration.*

In recognition of these growing problems, the CZMA established a national goal:

> *...to preserve, protect, develop and, where possible, to restore and enhance the resources of the Nation's coastal zone for this and succeeding generations.*

The CZMA also recognized that coastal waters are significantly affected by land uses:

> *Land uses in the coastal zone, and the uses of adjacent lands which drain into the coastal zone, may significantly affect the quality of coastal waters and habitats, and efforts to control water pollution from land use activities must be improved.*

The CZMA authorizes two national programs: 1) the National Coastal Zone Management Program; and 2) the National Estuarine Research Reserve System.

1. National Coastal Zone Management Program

The National Coastal Zone Management Program (CZMP) is dedicated to comprehensive, sustainable management of the nation's coasts, seeking to manage and protect coastal resources while balancing often competing land and water uses. Coastal states must develop a coastal management program that will accomplish the following:

- Define the coastal zone boundary and permissible land and water uses;
- Outline methods by which the state will exert control over the uses;
- Define the organizational structure of the program and responsibilities of agencies involved; and
- Establish a planning process to address public access, energy facilities, and assessing shoreline erosion rates.

A National Oceanic Atmospheric Administration (NOAA) approved coastal management plan also gives states some control over federal actions affecting the state's coastal zone. Reauthorizations of the CZMA have incorporated the Coastal Nonpoint Pollution Control Program, for states to manage the effects of nonpoint source pollution, and Management Program Enhancements, for states to make improvements to their coastal programs. States utilize a variety of tools to implement the coastal management programs including planning, permitting, and enforcement. The CZMP provides federal technical assistance, funding, and national coordination to support states' coastal zone management planning and plan implementation.

As a consequence, the North Carolina General Assembly passed the Coastal Area Management Act (CAMA) in 1974, creating one of the first state coastal programs in the nation. The N.C. Division of Coastal Management carries out the CAMA, in addition to the Dredge and Fill Law and the Federal CZMA of 1972, in the 20 coastal North Carolina counties using rules and policies of the N.C. Coastal Resources Commission.

2. National Estuarine Research Reserve System

The National Estuarine Research Reserve System (NERRS) was created by the CZMA of 1972, as amended, 16 United States Code (USC) Section 1461, to augment the CZMP. The Reserve System is a network of protected areas established to promote informed management of the Nation's estuaries and coastal habitats. The Reserve System currently consists of 27 Reserves in 22 states and territories, protecting over one million acres of estuarine lands and waters (Figure 5).

a. Mission

As stated in the NERRS regulations (Appendix A), 15 Code of Federal Regulations (CFR) Part 921.1(a), the NERRS mission is:

> *…the establishment and management, through Federal-state cooperation, of a national system of Estuarine Research Reserves representative of the various regions and estuarine types in the United States. Estuarine Research Reserves are established to provide opportunities for long-term research, education, and interpretation.*

b. Goals

Federal regulations, 15 CFR Part 921.1(b), provide five specific goals for the Reserve System:

1. Ensure a stable environment for research through long-term protection of National Estuarine Research Reserve resources.
2. Address coastal management issues identified as significant through coordinated estuarine research within the System.
3. Enhance public awareness and understanding of estuarine areas and provide suitable opportunities for public education and interpretation.
4. Promote Federal, state, public and private use of one or more Reserves within the System when such entities conduct estuarine research.

5. Conduct and coordinate estuarine research within the System, gathering and making available information necessary for improved understanding and management of estuarine areas.

c. Administrative Framework of NERRS

The Estuarine Reserves Division (ERD) of the Office of Ocean and Coastal Resource Management (OCRM) administers the Reserve System. ERD establishes standards for designating and operating Reserves, provides support for Reserve operations and system-wide programming, undertakes projects that benefit the Reserve System, and integrates information from individual Reserves to support decision-making at the national level. As required by Federal regulation, 15 CFR Part 921.40, OCRM periodically evaluates Reserves for compliance with federal requirements and with the individual Reserve's Federally-approved management plan.

ERD currently provides support for three system-wide programs: the System-Wide Monitoring Program (SWMP), the Graduate Research Fellowship Program (GRF), and the Coastal Training Program (CTP). They also provide support for Reserve initiatives on restoration science, invasive species, K-12 education, and Reserve specific research, monitoring, education and resource stewardship initiatives and programs.

d. NERRS Strategic Goals 2005-2010

The Reserve System began a strategic planning process in 1994 in an effort to help NOAA achieve its environmental stewardship mission to "sustain healthy coasts." In conjunction with the strategic planning process, ERD and Reserve staff has conducted a multi-year action planning process on an annual basis since 1996. The resulting three-year action plan provides an overall vision and direction for the Reserve System. As part of this process, the Reserve System developed a vision: Healthy estuaries and watersheds where coastal communities and ecosystems thrive; and mission: To practice and promote coastal and estuarine stewardship through innovative research and education, using a system of protected areas. The following goals are outlined in the 2005-2010 Strategic Plan (Appendix B):

1. Strengthen the protection and management of representative estuarine ecosystems to advance estuarine conservation, research and education.
2. Increase the use of Reserve science and sites to address priority coastal management issues.
3. Enhance people's ability and willingness to make informed decisions and take responsible actions that affect coastal communities and ecosystems.

High priority science and training needs for coastal managers were selected based on their appropriateness to the NERRS mission to focus the System's efforts locally and nationally. These topics will be addressed by implementing the strategic goals.

Figure 5: National Estuarine Research Reserve System map and biogeographic region



Acadian – Southern Gulf of Maine
Wells Reserve, Maine (1984)
Great Bay Reserve, New Hampshire (1989)
Virginian – Southern New England
Waquoit Bay Reserve, Massachusetts (1988)
Narragansett Bay Reserve, Rhode Island (1980)
Hudson River Reserve, New York (1982)
Virginian – Middle Atlantic
Jacques Cousteau Reserve, New Jersey (1998)
Delaware Reserve (1993)
Virginian – Chesapeake Bay
Chesapeake Bay Reserve, Maryland (1985,1990)
Chesapeake Bay Reserve, Virginia (1991)
Virginian & Carolinian – North Carolina
North Carolina Reserve (1985, 1991)
Carolinian – South Atlantic
North Inlet-Winyah Bay Reserve, South Carolina (1992)
ACE Basin Reserve, South Carolina (1992)
Sapelo Island, Georgia (1976)
Carolinian – East Florida
Guana Tolomato Matanzas Reserve, Florida (1999)
West Indian – Caribbean
Jobos Bay Reserve, Puerto Rico (1981)
West Indian – West Florida
Rookery Bay Reserve, Florida (1978)

Louisianan – Panhandle Coast
Apalachicola Reserve, Florida (1979)
Weeks Bay Reserve, Alabama (1986)
Louisianan – Mississippi Delta
Grand Bay Reserve, Mississippi (1999)
Louisianan – Western Gulf
Mission-Aransas Reserve, Texas (Proposed)
Californian – Southern California
Tijuana River Reserve, California (1982)
Californian – Central California
Elkhorn Slough Reserve, California (1979)
Californian – San Francisco Bay
San Francisco Bay, California (2003)
Columbian – Middle Pacific
South Slough Reserve, Oregon (1974)
Columbian – Puget Sound
Padilla Bay Reserve, Washington (1980)
Great Lakes – Lake Erie
Old Woman Creek, Ohio (1980)
Great Lakes – Lake Ontario
St. Lawrence River, New York (Proposed)
Fjord – Aleutian Islands
Kachemak Bay Reserve, Alaska (1999)

Reserve System Priority Coastal Management Issues:

1. Land Use and Population Growth
2. Habitat Loss and Alteration
3. Water Quality Degradation
4. Changes in Biological Communities

e. Designation and Operation of NERRS

Under Federal law (16 USC Section 1461), a State can nominate an estuarine ecosystem for Research Reserve status so long as the site meets the following conditions:

1. The area is representative of its biogeographic region, is suitable for long-term research and contributes to the biogeographical and typological balance of the System;
2. The law of the coastal State provides long-term protection for the proposed Reserve's resources to ensure a stable environment for research;
3. Designation of the site as a Reserve will serve to enhance public awareness and understanding of estuarine areas, and provide suitable opportunities for public education and interpretation; and
4. The coastal State has complied with the requirements of any regulations issued by the Secretary [of Commerce].

Reserve boundaries must include an adequate portion of the key land and water areas of the natural system to approximate an ecological unit and to ensure effective conservation (Appendix C).

If the proposed site is accepted into the Reserve System, it is eligible for NOAA financial assistance on a cost-share basis with the State. The State exercises administrative and management control, consistent with its obligations to NOAA, as outlined in a Memorandum of Understanding (MOU). A Reserve may apply to NOAA's ERD for funds to help support operations, research, monitoring, education/interpretation, stewardship, development projects, facility construction, and land acquisition.

NOAA has identified eleven distinct biogeographic regions and 29 sub-regions in the United States (U.S.), each of which contains several types of estuarine ecosystems (15 CFR Part 921). When complete, the Reserve System will contain examples of estuarine hydrologic and biological types characteristic of each biogeographic region. As of 2008, the Reserve System includes 27 Reserves (Figure 5). The Reserves are listed in Figure 5 by biogeographic region and sub-region with their designation date denoted in parentheses. Three components of the North Carolina National Estuarine Research Reserve (NCNERR) were designated in 1985 (Currituck Banks, Rachel Carson, and Zeke's Island) and Masonboro Island was designated six years later in 1991.

f. Reserve Management Plans

Every Reserve is required by Federal Regulation to have an ERD-approved management plan. The plan must describe the Reserve's goals, objectives and management issues, and must identify the Reserve's intended strategies or actions for research,

education/interpretation, public access, construction, acquisition, and resource management. Staff roles in each of these areas must also be addressed. Reserve management plans are important for a variety of reasons, including:

- Provide a framework to direct and evaluate Reserve programs;
- Gauge how successfully Reserve goals have been met and determine necessary changes in direction; and,
- Guide Section 312 programmatic evaluations of the Reserve.

To serve these purposes, management plans are currently required by NOAA to be updated every five years. This revised management plan for the North Carolina National Estuarine Research Reserve has been developed in accordance with NOAA regulations, including all provisions for public involvement (Appendix D). It is consistent with the Section 315 of the CZMA of 1972, as amended, and the provisions of the North Carolina Coastal Management Program.

C. North Carolina National Estuarine Research Reserve

As the regulatory and planning programs of CAMA were implemented by the Division of Coastal Management (DCM) in the late 1970s, it became apparent that an effective, comprehensive coastal management program must include a land acquisition program. To fill this gap, two land acquisition programs – the beach access and North Carolina Coastal Reserve programs – were incorporated into CAMA in the 1980s. The NCNERR was the precursor to the North Carolina Coastal Reserve; the NCNERR's success in protecting coastal and estuarine habitats for research and education inspired the State to protect additional coastal and estuarine habitats thus creating the North Carolina Coastal Reserve.

1. Establishment of the Reserve

North Carolina's diverse estuarine systems include more than 2.9 million acres and represent two biogeographic regions, the Virginian and the Carolinian, which converge just north of Cape Hatteras (Figure 2). The diverse range of habitats in North Carolina noted above make it an ideal location for a National Estuarine Research Reserve. In order to capture the full breadth of this diversity, a multi-component NERR was planned for the State. This approach allowed all the estuarine ecosystems present in the State to be represented and protected. In 1982 the State of North Carolina received its first federal award toward the establishment of the NCNERR. Four properties were selected to become components of NCNERR. These properties protect approximately 10,500 acres of land and water habitat from the northern, central and southern parts of North Carolina.

Three of the components were designated in 1985 (Currituck Banks, Rachel Carson, and Zeke's Island) and Masonboro Island was designated six years later in 1991. The four components are owned in fee simple by the State of North Carolina. The four components include:

1. The 965-acre Currituck Banks component located in Currituck County, just north of the village of Corolla at the end of N.C. 12;
2. The 2,315-acre Rachel Carson component located in Carteret County between the town of Beaufort, Harkers Island and the Cape Lookout National Seashore;

3. The 5,653-acre Masonboro Island component, an undeveloped barrier island, situated in New Hanover County between the towns of Wrightsville Beach and Carolina Beach; and
4. The 1,635-acre Zeke's Island component, encompassing tracts in both New Hanover and Brunswick counties, reached via U.S. 421 south of Kure Beach (Figure 6).

The NCNERR is a federal-state partnership between NOAA and the North Carolina Department of Environment and Natural Resources' DCM (Appendix E). Refer to the Administration Plan within this document for more information regarding the administrative framework of the NCNERR.

2. State Management Authority

North Carolina state law (General Statutes 113A-129.1-.3; Article 7, Coastal Area Management Act) complements and reinforces the federal NERRS regulations by declaring that management of the NCNERR, as part of the Coastal Reserve, is state policy (Appendix F). The 1989 statute also establishes the basic Reserve purpose:

> *Important public purposes will be served by the preservation of certain areas in an undeveloped state. Such areas would thereafter be available for research, education, and other consistent public uses. These areas would also continue to contribute perpetually to the natural productivity and biological, economic, and aesthetic values of North Carolina's coastal area.*

The Department of Environment and Natural Resources (DENR) promulgated rules in 1986 for the Reserve sites within the North Carolina Administrative Code (T15: 7O). These rules were established to further define the purpose, responsibilities, functions, components, and use requirements for the Reserve components (Appendix G). The Coastal Reserve includes the four NCNERR components (Currituck Banks, Rachel Carson, Masonboro Island, and Zeke's Island) plus six state sites: Kitty Hawk Woods (Dare County), Buxton Woods (Dare County), Buckridge (Tyrrell and Hyde Counties), Permuda Island (Onslow County), Bald Head Woods (Brunswick County), and Bird Island (Brunswick County) (Figure 6).

The NCNERR is also designated as a State Nature Preserve, which is a limited use area that serves to preserve and portray the natural features unique to the region (Appendix H). Some Reserve components are subject to county and municipal zoning regulations (see Appendix I for these applicable regulations).

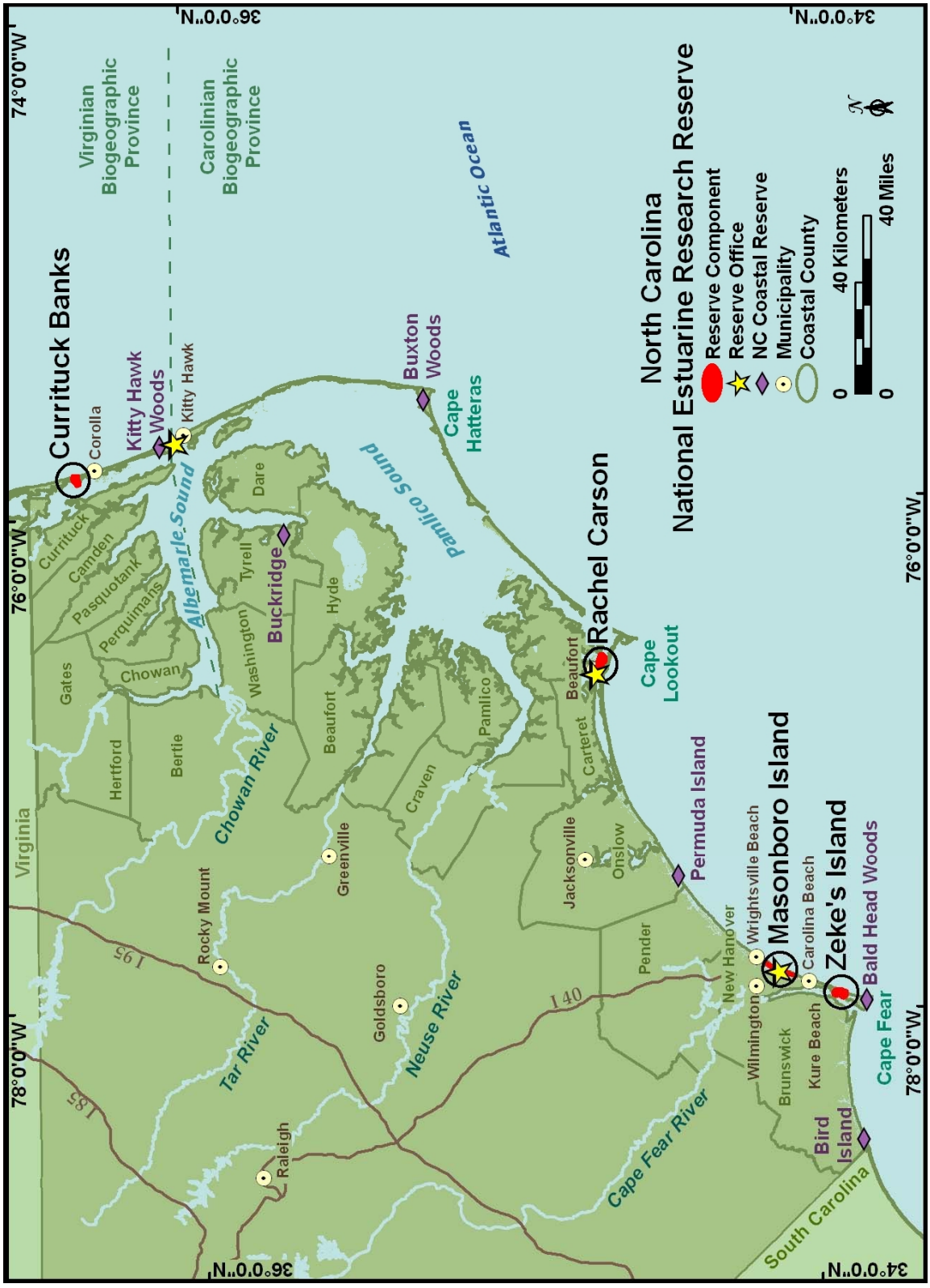


Figure 6: Map of the locations of NCNERR components on the North Carolina coast

3. NCNERR Focus for 2009-2014

The vision, mission, and goals below were developed by NCNERR staff through strategic planning and logic model tools with the assistance of the NOAA Coastal Services Center.

a. Vision

Healthy estuaries and coastal watersheds where ecological communities thrive and the human community benefits in North Carolina.

b. Mission

To promote informed management and stewardship of North Carolina's estuarine and coastal habitats through research, education, and example.

c. Goals

The goals and objectives integrate NCNERR programs, obscuring the lines between education, research, and stewardship. Table 1 details the Reserve-specific goals and objectives and demonstrates the interconnectedness of the NCNERR. The subsequent chapters of the management plan (administration, education, research, stewardship, and land acquisition) parse the objectives and activities into the program areas. For example, objective 1.2 involves both the education and stewardship sectors and thus, the objective is included in both the education and stewardship chapters with program-appropriate activity descriptions in each.

Table 1: NCNERR goals and objectives

Goal 1. Humans understand the natural systems, their connections to them, and the benefits derived from them.
Objective 1.1 - Education programs will deliver information on N.C. coastal resources to formal and informal educators, and K-12 and college students to foster environmental stewardship and informed decision-making.
Objective 1.2 - The greater community, including the general public, visitors, and pre-school children, will receive educational programming.
Objective 1.3 – Coastal Training Program (CTP) activities will deliver science-based knowledge and skills appropriate to the needs of target audiences and relevant to sustainable coastal management.
Goal 2. Applicable research informs coastal policy.
Objective 2.1 - NCNERR research products will be used by the coastal management community.
Objective 2.2 - The NCNERR will enhance implementation of the System-Wide Monitoring Program.

Table 1 continued: NCNERR goals and objectives

Goal 3. NCNERR habitats and land use of associated watersheds are characterized and connections understood.
Objective 3.1 - NCNERR habitat and watershed maps will inform management of the sites and improve understanding of watershed connections.
Objective 3.2 - Restored NCNERR habitats will provide improved water quality and ecological function.
Goal 4. Habitat is protected and the public has directed access to Reserve sites.
Objective 4.1 - Effective Reserve site management will ensure a stable environment for research and education.
Objective 4.2 - Boundary expansion and acquisition will be completed to effectively protect Reserve core and buffer areas.
Objective 4.3 - Coastal systems and their value will be interpreted and access to the Reserve sites will be directed to representative habitats to reduce impacts on sensitive habitats.
Goal 5. NCNERR operations, infrastructure, and stature are improved.
Objective 5.1 - The NCNERR will strengthen its relationship with NOAA-Estuarine Reserves Division (ERD).
Objective 5.2 - The NCNERR will strengthen its relationship with DCM.
Objective 5.3 - The NCNERR will strengthen its relationship with University of North Carolina – Wilmington (UNCW) and Center for Coastal Fisheries and Habitat Research (CCFHR).
Objective 5.4 - The NCNERR will assess use of the sites by various education, research, and commercial entities.
Objective 5.5 - The NCNERR will ensure its operating infrastructure is adequate to fulfill the program mission.
Objective 5.6 - The NCNERR will ensure its staff has the skills necessary to perform their jobs and are able to do so safely.
Objective 5.7 - The community will recognize the NCNERR and understand how the Reserve serves the citizens and visitors of North Carolina.
Objective 5.8 - The NCNERR needs will be more fully met by volunteers and volunteers will be trained in coastal issues.

Goals 1-4 above directly support the 2005-2010 NERRS Strategic Plan goals as outlined in Appendix B. NCNERR goal 1 is a broadly defined educational goal which addresses NERRS Strategic Goals 2 and 3 by fostering environmental stewardship and informed decision-making. NCNERR goal 2 focuses on increasing the use of Reserve research to inform and address priority coastal management issues (NERRS Goal 2). NCNERR goals 3 and 4 strengthen the protection and management of North Carolina's estuarine ecosystems (NERRS Goal 1). NCNERR goal 5 supports the other goals through improved operations and infrastructure.

d. Guiding Principles

The guiding principles detail how the NCNERR conducts its business, providing a filter through which programs are developed, implemented, and evaluated. These principles apply to all programs and sites.

- Strong partnerships between the NCNERR, federal and state agencies, universities, other local partners, and the Carolina Estuarine Reserve Foundation are critical to the success of the NCNERR.
- The NCNERR integrates science, education, and stewardship on relevant topics to maximize the benefits to coastal management.
- The NCNERR engages local communities and citizens to improve stewardship of coastal areas.
- Reserve programs capitalize on the physical setting of the Reserve to inspire questions, learning, and conscious decision-making.
- The management and programs of the Reserve demonstrate good environmental practices.

e. NCNERR Programs

NCNERR is operationally divided into three distinct sectors: education, research, and stewardship. Each sector is devoted to fostering that aspect of the program, under the guidance of the Reserve manager and according to the management plan. The Education sector, through programs and activities, strives to increase understanding and awareness of estuarine systems and improve decision-making among key audiences to promote stewardship of North Carolina's coastal resources. The Research sector addresses scientific and technical aspects of coastal management problems through a comprehensive, interdisciplinary, and coordinated research program including site-directed research, monitoring, and the Graduate Research Fellowship Program. The Stewardship sector is involved in a wide range of activities including land acquisition, ecological restoration, resource inventories, watershed management projects, endangered species protection, visitor use management, regional planning, policy development and more. Each sector supports the overall mission of the Reserve to promote informed management and stewardship of North Carolina's estuarine and coastal habitats.

4. Coastal Management Issues in North Carolina

There are several overarching issues faced by the entire North Carolina coast that threaten all components of the NCNERR. These include both anthropogenic influences as well as natural processes. Issues affecting all NCNERR components include coastal population increase, altered land use, storm water runoff and eutrophication, invasive species, tropical and coastal storm impacts, and sea level rise. Objectives that address these overarching issues are summarized in Table 2 and are discussed in more detail in the education, research and stewardship plans. In addition to these overarching issues, individual Reserves have specific local issues that are threats as well. These individual Reserve-specific issues are documented within each of the

subsequent Reserve component descriptions and are addressed in detail in relevant objectives in the education, research and stewardship plans. All of these issues are interconnected. Changes in one induce changes in another and vice versa. The following paragraphs provide a brief summary of how these threats impact the NCNERR properties.

Coastal Population Increase

The NCNERR properties are especially vulnerable to impacts associated with increased coastal population. The counties that contain the NCNERR properties have witnessed dramatic population increases over the 2000 to 2006 time period. Currituck County (includes Currituck Banks) has seen a 31% increase, Carteret County (includes Rachel Carson) has seen a 7% increase, New Hanover County (includes Masonboro Island and a portion of Zeke's Island) has seen a 14% increase and, Brunswick County (includes the other portion of Zeke's Island) has seen a 30% increase (U.S. Census Bureau 2008).

As the human population increases, so do the impacts upon the environment including increased storm water runoff and eutrophication (see below), increased sewage, trash, and emissions. The increased population also leads to increases in the number of people using the Reserve properties. While most visitor use of the Reserves is benign and causes no harm, occasional misuse of the properties does occur. These are usually associated with visitors not knowing the allowed uses for the properties and include things like, illegal hunting and camping, dogs off leash, and accumulation of trash.

Land Use and Eutrophication

Altered land use and cover is a critical issue because how the land is used and the type of cover on it has large impacts on its ability to sequester nutrients and pollution rather than convey them to surface waters. Natural land covers such as forest and marsh have large buffering capacities. They tend to trap nutrients and sediment prior to their entering surface waters. Developed land tends to have very little capacity to absorb nutrients and pollution (Mallin et al. 2000a). This is because developed land has increased impervious surfaces such as roofs, roads, and parking lots. These surfaces do not allow water to infiltrate the ground and high percentages of impervious surfaces have been correlated with degraded water and sediment quality (Mallin et al. 2000a; Holland et al. 2004). Consequently runoff from these surfaces, especially during storm events, picks up whatever contaminants and nutrients are on them and rapidly moves these materials to surface waters (Mallin et al. 2000a; Mallin et al. 2001). This stormwater runoff has the ability to severely impact receiving waters by increasing eutrophication.

Eutrophication is a process through which natural waters receive too many nutrients. Nutrients, especially nitrogen and phosphorus, stimulate phytoplankton production. This increased production can lead to a multitude of water quality problems including hypoxia, decreased light penetration, altered community composition, loss of submerged aquatic vegetation (SAV), and decreased fish and shellfish populations. Recovery from eutrophication can take long periods of time even if the causes of the eutrophication are immediately halted (Nixon 1995; Paerl et al. 1998; Mallin et al. 2000b; Niemi et al. 2004). Because of the population increases noted above

and the associated land use changes, the NCNERR properties are vulnerable to water quality declines as a result of eutrophication.

Invasive Species

Invasive species is one of the largest and most pervasive problems facing not only NCNERR but also the nation. An invasive species is one that begins to live and reproduce in an area where it is not naturally found. This is problematic because when this happens there usually are not any natural predators capable of keeping the invader in check, and the new species tends to utilize resources at the expense of an existing native one. Invasive species are usually very opportunistic and hard to get rid of once established. The Reserve also has several animal species that were once domesticated but are now wild or feral. Feral animals are also problematic in that they are often not native to Reserve habitats. Invasive and feral species known to occur on the Reserve properties include Beach Vitex (*Vitex rotundifolia*), French Tamarisk (*Tamarix gallica*), Red Fox (*Vulpes vulpes*), Nutria (*Myocastor coypus*), Common Reed (*Phragmites australis*), Feral Pig (*Sus scrofa*), and Feral Horse (*Equus caballus*).

Storms

North Carolina's geography makes it prone to strikes by tropical and coastal storm systems. The North Carolina coast has been impacted by 14 named storms since 2000. These storms can bring tremendous amounts of wind and rain to the coastal region. They also are capable of causing significant shoreline erosion and can even cause new inlets to form. All of these potential impacts are important for the properties of NCNERR which are all coastal barriers located at the interface between the ocean and land.

Sea Level Rise

Sea level rise is occurring along the North Carolina coast. Estimates for the amount of rise range from 0.3 to 3.0 mm/year, with most values between 1-2 mm/year (Gormitz 1995). There are many potential problems associated with an increase in sea level. The most important in terms of the Reserve properties is loss of marsh or habitat. If the sea level rise is faster than the ability of the marsh to accrete sediment and build itself up, then the marshes will be flooded (Moorhead & Brinson 1995). This would cause not only a decrease in the size of all the Reserve properties, but also would represent a loss of vital nursery habitat and other values of marshes. Increased sea level will also enhance shoreline erosion within the Reserve properties potentially leading to loss of upland areas as well.

The issues described above are ubiquitous along the coast of North Carolina and the implementation of the objectives outlined in this management plan, though focused on NCNERR sites, is transferable to other resource managers and partners in North Carolina. A matrix of where the Reserve addresses these overarching issues within the Management Plan is found below (Table 2).

Table 2: NCNERR goals and objectives that address the priority coastal management issues in N.C.

	COASTAL MANAGEMENT ISSUES IN N.C.				
GOALS & OBJECTIVES	**Population Increase**	**Land Use & Eutrophication**	**Invasive Species**	**Storms**	**Sea Level Rise**
Goal 1 – Humans understand…					
Obj. 1.1 – K-12 educ. programs	X	X	X	X	X
Obj. 1.2 – General public	X	X	X	X	X
Obj. 1.3 – CTP	X	X	X	X	X
Goal 2 – Research informs…					
Obj. 2.1 – Coastal management	X	X	X	X	X
Obj. 2.2 – SWMP		X			
Goal 3 – Habitats and land use…					
Obj. 3.1 – Habitat maps		X	X		
Obj. 3.2 – Restored habitats	X	X	X	X	X
Goal 4 – Habitat is protected…					
Obj. 4.1 – Site management	X	X	X	X	X
Obj. 4.2 – Boundary expansion					
Obj. 4.3 – Directed access	X		X		
Goal 5 – Operations improved…					
Obj. 5.1 – NOAA-ERD					
Obj. 5.2 – DCM					
Obj. 5.3 – UNCW & CCFHR					
Obj. 5.4 – Site usage	X				
Obj. 5.5 – Infrastructure					
Obj. 5.6 – Staff development					X
Obj. 5.7 – Recognize NCNERR					
Obj. 5.8 – Volunteer program					

5. NCNERR Component Descriptions

The North Carolina NERR was established as a multi-component Reserve to include sites in both the Virginian and Carolinian biogeographic region as well as the three regions of the coastal plain. As a consequence the Reserve is made up of four geographically disparate components consisting of unique representative estuarine habitats. During the formative years of NCNERR, there was not enough staff to conduct research, education and stewardship activities at all components. This problem was alleviated by concentrating sector activities at certain Reserve components. The research staff and activities were concentrated in Wilmington, N.C. at the Masonboro and Zeke's Islands components. Education programs, including the Coastal Training Program (CTP) which focuses on adult decision-makers, and staff were concentrated in the Beaufort, N.C. area at the Rachel Carson component. The stewardship staff and activities were located in Kitty Hawk, N.C. and primarily worked at the Currituck Banks component.

A recent internal evaluation of programs, facilities, current staffing levels, and projected staffing needs revealed there are needs and opportunities for core programs at all offices. Through staff reorganization, creation of new positions and new partnerships the NCNERR is working toward a new philosophy where research, education and stewardship activities are conducted at all locations. Program priorities were established for each component based on existing

infrastructure, staffing, site-specific needs, and current program resources (Table 3). The matrix below will be used as an internal planning tool to focus our limited resources.

Table 3: Programmatic capabilities based on existing infrastructure, staffing and site-specific needs.

NCNERR Component	Stewardship	Community Education and Outreach	K-12 Education	Coastal Training Program	Research
Currituck Banks	High	Medium	Low	Medium	Medium
Rachel Carson	Medium	High	High	High	Medium
Masonboro Island	High	High	Low	Medium	High
Zeke's Island	Medium	Low	Medium	Low	High

A description of each component including location, biogeographic province, landform type, habitat type, representative native and non-native species, site-specific issues and program priorities, is given below. All components are described in detail in the Reserve's Site Profile (www.nccoastalreserve.net). Specific information on core and buffer area requirements and maps of these areas for each component can be found in Appendix C.

a. Currituck Banks

Location and Description

The Currituck Banks component of the NCNERR is the northern most component and is the only component located in the Virginian biogeographic province (Figure 6). Currituck Banks encompasses 965 acres (3.9 km^2) in the northeastern corner of North Carolina in Currituck County, just north of the unincorporated village of Corolla, ten miles (16 km) south of the Virginia border. The nearest population center is Elizabeth City, N.C., approximately 20 miles (~32 km) to the west across Currituck Sound. The Nature Conservancy and U.S. Fish and Wildlife Service properties bound Currituck Banks to the north (Appendix J), the Atlantic Ocean to the east, the Currituck Sound to the west, and private subdivisions of Corolla to the south (Figure 7).

Currituck Banks is located in the Pasquotank River Basin. Currituck Banks is accessible by foot traffic and boat. The nearest boat ramp is located next to the Currituck Lighthouse in Corolla. The ocean beach portion of the Reserve is accessible by four-wheel drive along the beach corridor after N.C. 12 terminates at the beach access ramp. Two walking trails exist at the southern portion of the site just off state route N.C. 12 where public parking and handicap access is available.

The Currituck Banks component is included in the NCNERR because it is an excellent example of an undisturbed cross-section of a barrier island in a low-salinity estuarine system. The delimited portion of Currituck Sound and the associated marshes constitute the core area proper (721 acres) of the component. The sound waters contain extensive mud and sand flats covered in some areas by submerged aquatic vegetation. Ocean beaches, upland dunes, shrub thickets, maritime forests, and interdune ponds comprise the buffer communities (244 acres) of the component. The mature maritime deciduous forest within the component's boundaries is one of the rarest habitat types on the U.S. east coast (Schafale & Weakley 1990). The interior uplands are characterized by dense woody vegetation intermingled with numerous seasonal wetlands. This mosaic of habitats effectively restricts public use to the ocean beach area. The 1/3-mile boardwalk, walking trail and parking site are in the buffer area of this component.

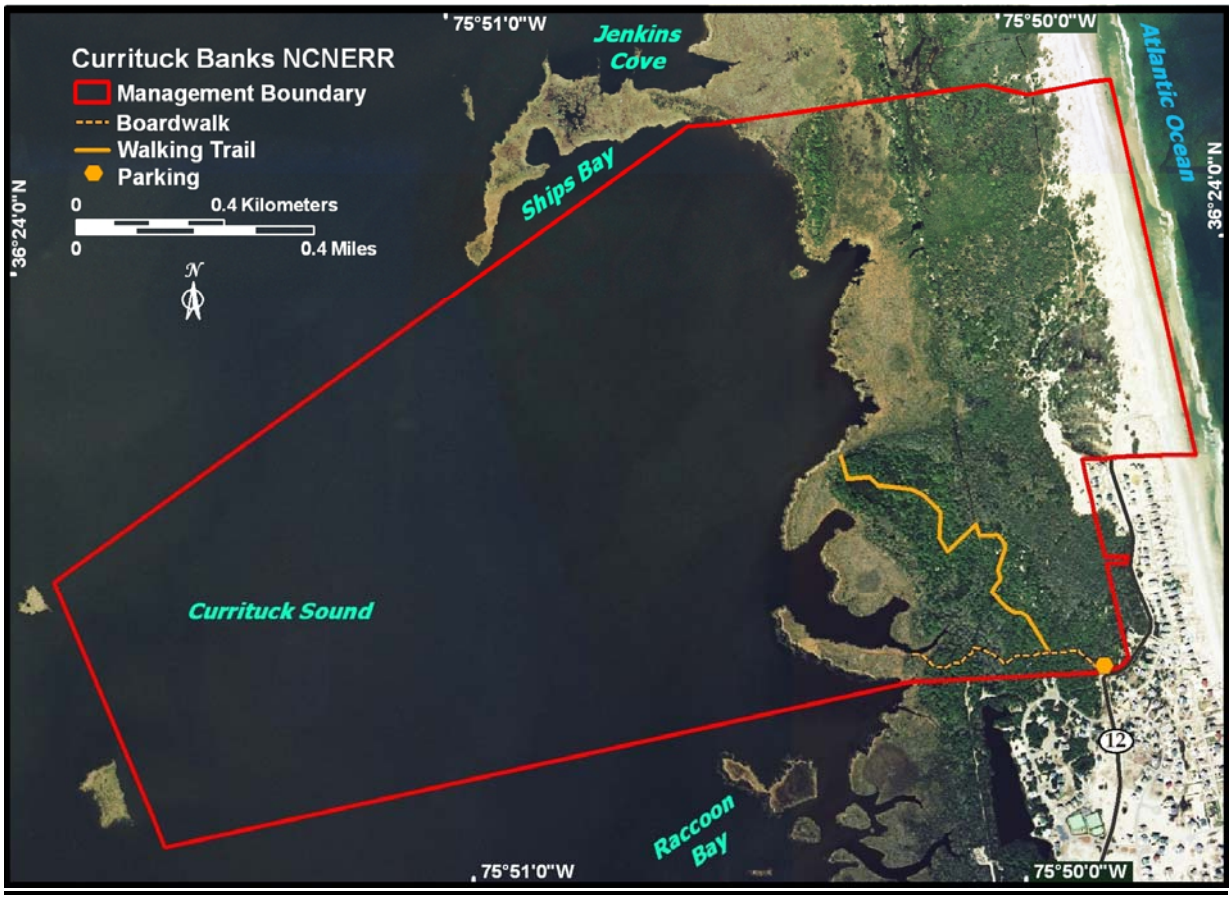


Figure 7: Currituck Banks site map

Throughout recent geologic time, the barrier landform that includes Currituck Banks has been very dynamic. It has migrated inland in response to sea level changes, and several inlets have opened and closed. Currently the landform is a solid barrier spit that extends about 70 miles (113 km) from Virginia Beach, V.A. to Oregon Inlet, N.C. This limits sound to ocean exchange and because of the distance to the Oregon Inlet, Currituck Sound is a wind driven, predominately fresh body of water. Extensive areas of brackish marshes border Currituck

Sound, and vast meadows of submerged aquatic vegetation exist in the shallower regions. These features provide research opportunities that cannot be found anywhere else in North Carolina.

The weather of Currituck Banks is typical of a maritime climate on the Outer Banks where the ocean has a strong moderating effect on air temperature compared to the mainland areas. Climatologically, Currituck Banks is classified as subtropical with humid, warm summers and mild winters. The mixing of the warm Gulf Stream Current and cooler Labrador Current off Currituck Banks creates a climate where northern species reach the southern limit of their ranges and southern species reach the northern limit of their ranges. As a result, a diversity of species from both regions is found here. Birds found in the area that are of special concern include the black skimmer, least tern, common tern and tri-colored heron. Piping plovers, a threatened species, and Wilson's plovers, a significantly rare species, are also found on the Currituck Banks component (NCNHP 2008). Currituck Sound is located within the Atlantic Flyway and the site is especially important for migrating waterfowl.

Issues

There are several unique pressures and issues associated with managing the Currituck Banks component. Populations of feral pigs and horses are present on the site and can stress the native ecosystems of the site. Invasive *Phragmites australis* (Common reed) is also present and poses a risk to native marsh communities. Off-road vehicles, which are driven on the beach side of the site, can have great impacts on the site, including disruption of colonial nesting birds and enhancement of erosion. Enforcement of the Reserve's visitor use policies on the site is an issue. Public usage at all four Reserve components has increased over time resulting in the need for additional enforcement of the visitor use policies. Enforcement of the Reserve's policies is provided by partner agencies which are hampered by limited resources. Changes in water quality and the salinity of Currituck Sound is also an issue of concern. Historically, Currituck Sound has switched between a saline environment and a freshwater environment, depending on the presence of an inlet opening in the barrier island. The last inlet closed in 1828. Since then, the system has been predominately freshwater, but recent human-induced landscape alterations have caused the salinity to increase. Increasing salinity along with a decrease in water quality has led to changes in the biological community (*e.g.* loss of largemouth bass and submerged aquatic vegetation), causing profound impacts on species diversity and community composition. The largest and perhaps most challenging issue facing this Reserve component is development of nearby land areas and the resulting increase in stormwater runoff that will ensue and the increased pressure the Reserve will face for access to developed areas north of the site.

Program Priorities

The program priorities for Currituck Banks include in order: stewardship, community education and outreach/Coastal Training Programs/research and monitoring, and K-12 education. Stewardship is the highest priority because of the issues at the site and the expertise of staff managing the site. There is a medium priority for community education and Coastal Training programs. The recent addition of a boardwalk with interpretive signs makes the site more accessible and provides more opportunities for public interpretive field trips and public access. Coastal Training Programs are hosted in the area a few times a year, often in a workshop series, with the same training occurring in the central and southern parts of the state. Both of these programs provide opportunity to build understanding within the community regarding what the Reserve is and its purpose as well as promoting proper stewardship for better protection of the site and its environs. Research and monitoring is a medium priority activity given the capacity the site has for such activities, local partners, and recent activities. External funding was utilized from 2005 to 2007 to conduct component I SWMP monitoring at Currituck Banks. While limited in nature, this effort provided the first comprehensive multi-year water quality dataset for Currituck Banks which can be compared with future monitoring efforts. Additionally, atmospheric deposition and nutrient monitoring have also occurred at the site. K-12 educational programs are a low priority at Currituck Banks. Occasional site visits from professional development educator workshops, K-12 teacher field trips, and student field trips occur here, often with assistance from local stewardship staff.

b. Rachel Carson

Location and Description

The Rachel Carson component is located near the mouth of the Newport River in southern Carteret County, directly across Taylor's Creek from the historic Town of Beaufort (Figure 8). The 2,315-acre site consists of several small islands (Carrot Island, Town Marsh, Bird Shoal, Horse Island, and Middle Marsh) and extensive salt marshes and intertidal and subtidal flats. The Rachel Carson component is part of the NCNERR because of its extensive pristine salt marshes and intertidal/subtidal flats, which are ideal nursery areas for estuarine species. One of the two State ports, Morehead City, is located three miles to the west. Rachel Carson is bounded to the north by Taylor’s Creek and the Town of Beaufort, to the east by Back Sound, to the south by the Cape Lookout National Seashore, and to the west by Pivers and Radio Islands (Figure 8). The Rachel Carson Reserve is located in the White Oak River Basin which is located in the Carolinian biogeographical province. The site is accessible only by boat. The state Wildlife Resources Commission (WRC) operates a public boat ramp and parking lot along Taylor's Creek at Lennoxville Road. Several private ferry companies offer access to the island from Beaufort. A walking trail is available on the west end of Town Marsh and a boardwalk with interpretive signs is located on the east end of Carrot Island across from the WRC’s Lennoxville Road boat ramp in the Town of Beaufort.

The Rachel Carson component core areas consist of sound waters, tidal flats, creeks, and marshes that occur within the five islands that comprise the site: Middle Marsh, Carrot Island, Town Marsh, Bird Shoal, and Horse Island (2,107 acres). The primary example of

buffer area within the component is the dredge material deposits along Taylor's Creek on the north edge of the complex. There are also areas of beaches, dunes, shrub thickets, and a remnant of maritime forest at the east end of Carrot Island in the buffer area. These buffer areas total 208 acres.

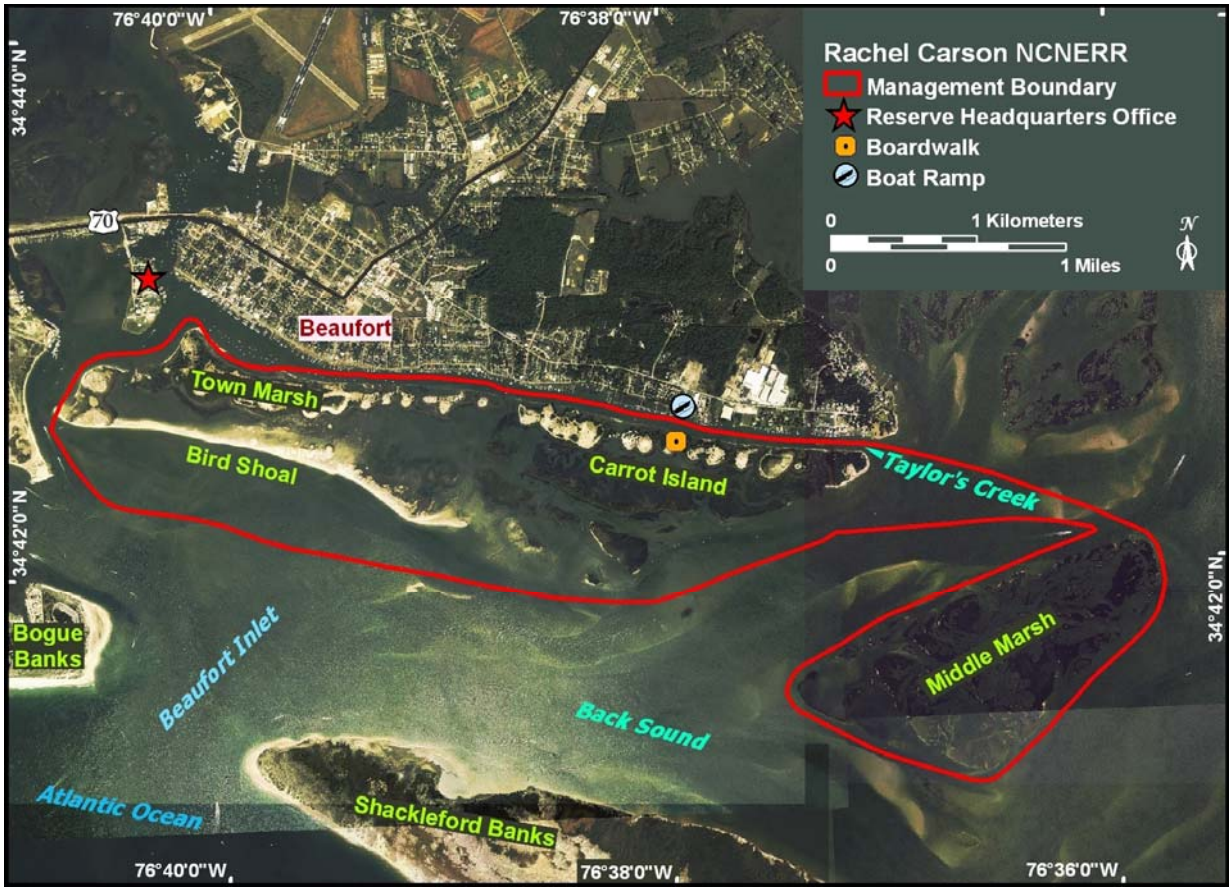


Figure 8: Rachel Carson site map

The islands and tidal flats comprising Rachel Carson consist of Recent (less than ~11,550 years old) and Pleistocene (1.8 million to ~ 11,550 years ago) sediments (Atkinson et al. 1998). Unlike the other components that make up the NCNERR, Rachel Carson is not a true barrier island. The underlying sediments are from a relict flood tide delta from a now closed inlet. These sediments raised the estuarine bottom enough to produce several shoals and small islands. Over time this area was colonized by marsh plants which stabilized the sediments. During the 1930s the Army Corps of Engineers placed spoils from the dredging of Taylor's Creek on areas of these shoals. These areas now make up the upland portions of the Reserve, which provide habitat for many upland plant and animal species.

The area around the Rachel Carson site is a center of marine research and education. The marine laboratories of Duke University, University of North Carolina at Chapel Hill, and North Carolina State University are located here, as is the NOAA's Center for Coastal Fisheries and Habitat Research. The headquarters of the North Carolina Divisions of Coastal Management and Marine Fisheries are also located in nearby Morehead City.

The islands and estuarine waters at the Rachel Carson site are strongly influenced by river and inlet dynamics and twice-daily tides. The site is an important feeding area for Wilson's plovers in the summer and piping plovers in the winter. The shrub thicket of Middle Marsh supports an egret and heron rookery. In addition to feral horses, gray fox, raccoon, and marsh rabbit inhabit the islands. The Atlantic bottlenose dolphin swims in the waters around the islands, along with many species of fish.

Issues

There are several unique pressures and issues associated with managing the Rachel Carson component. Since all upland areas of the site are man-made dredge spoil deposits, an opportunity to study the stability of man-made islands in relation to natural processes exists. A study of plant succession on the dredge spoil deposits is of interest since the Army Corps of Engineers maintains a dredge spoil easement on the Reserve site. This easement presents an ongoing management challenge since the dredge spoil deposits destroy existing natural communities and it take decades for plant succession to occur on the deposits due to high soil salinities. In addition, surrounding estuarine environments may be at risk due to increased sedimentation from deposition material. A survey of the islands on the east end has revealed an erosion rate of about 3.25ft y^{-1}. A living shoreline will be installed at this location as part of a collaborative estuarine shoreline stabilization project to test the efficacy of this type of structure in a highly erosive environment. The Rachel Carson site is also home to a resident population of feral horses. These horses, the descendents of a domestic population once owned by a Beaufort resident, are isolated on the island and thus provide a chance to study the impact of these animals on a coastal island ecosystem. The town of Beaufort's wastewater treatment plant's sewage outfall is located in the waters adjacent to the Rachel Carson component. Occasional raw sewage overflows occur from this facility and result in shellfish bed harvesting closures and swimming advisories. There are several invasive species found on the islands of the Rachel Carson site, including Tamarisk tree (or salt cedar, *Tamarix sp.*), Russian olive (*Elaeagnus sp.*) and nutria (*Myocastor coypus*). For more information regarding these and other issues please see the NCNERR site profile. Finally, enforcement of the Reserve's visitor use policies on the site remains an issue of concern. Public usage at the Rachel Carson component has increased over time resulting in the need for additional enforcement of the visitor use policies. The enforcement of the Reserve's policies at all sites is provided by partner agencies which have limited time and resources to devote to this effort. Enforcement of this site is particularly difficult because of boat and staffing resources.

Program Priorities

Since all of the Reserve's education resources are located in Beaufort, K-12 student and teacher education, community education and outreach, and Coastal Training Program activities are the highest priority for this site. There are numerous opportunities for the interpretation of this site for K-12 and public audiences, including a walking trail, public field trips, summer camps, and a boardwalk with interpretive signs on Carrot Island. The site is easily accessible by boat from the Town of Beaufort and the Reserve office on Pivers Island. Additionally, there are two water taxi vendors that service the Rachel Carson component, which enables school groups and the public to easily access the islands. Many Coastal Training Program activities are also conducted in the area near the Rachel Carson component. Both stewardship and research and monitoring programs are medium priorities for the site. The site is routinely used for field studies by local academic and government institutions including the Duke University Marine Laboratory, NOAA's Center for Coastal Fisheries and Habitat Research (CCFHR), and the University of North Carolina-Chapel Hill's (UNC-CH) Institute of Marine Sciences (IMS). SWMP component I was initiated at the Rachel Carson component in the mid-1990s. This was the first attempt to expand the monitoring to Reserve components outside the Wilmington area. This effort was discontinued in 2003 when the staff position needed to maintain the monitoring equipment was cut for budgetary reasons. A recent partnership between the National Park Service and the NCNERR reestablished SWMP component I monitoring at the Rachel Carson Reserve in 2007 and is ongoing. Stewardship of the site is important because of the heavy use by outside researchers and the high seasonal visitation.

c. Masonboro Island

Location and Description

Masonboro Island is the largest NCNERR component and was designated in 1991. It is located in New Hanover County between the barrier island towns of Wrightsville Beach and Carolina Beach (Figure 9). It is bounded by Masonboro Inlet to the north, the Atlantic Ocean to the east, Carolina Beach Inlet to the south, and Masonboro and Myrtle Grove Sounds (part of the Atlantic Intracoastal Waterway) to the west. The city of Wilmington lies approximately five miles to the northwest. Masonboro Island is the largest undisturbed barrier island along the southern part of the North Carolina coast and is located within the Carolinian biogeographic province. It is approximately 8.4 miles (13.5 km) long and the management boundary encompasses 5,653 acres (20.4 km^2) of subtidal soft bottoms, tidal flats, salt marshes, shrub thicket, maritime forest, dredge spoil areas, grasslands, ocean beach and sand dunes. Masonboro Island is the only NCNERR component that has in-holdings (privately owned property) within the management boundary. There are 12 remaining privately owned properties totaling approximately 17 acres of Masonboro Island proper.

Masonboro Island is only accessible by boat. Similar to the Rachel Carson Reserve, private operators provide fee-based ferry service to the Reserve site. Most visitors land on the sound side of the northern and southern ends of the island where there are large sandy beaches. Many other landings on the sound side within the middle portion of the island are only accessible at or near high tide.

Masonboro Island is included in the NCNERR because it is the largest undisturbed barrier island along the southern part of North Carolina, which provides an ideal location to study natural barrier island geological movement and its effect upon biological community assemblages. The back-island sounds plus associated tidal creeks and salt marshes occupy a core area of 4,194 acres. Masonboro Island proper and spoil islands along the Intracoastal Waterway constitute the buffer area (1,459 acres). Habitats within these areas include ocean beaches, dunes, shrub thicket, and maritime forest. The buffer area also includes 50 acres owned by University of North Carolina-Wilmington (UNCW) located across the waterway from the island. This is the site of the Reserve office, housed at UNC-Wilmington's Center for Marine Sciences, for the Masonboro Island and Zeke's Island components (Figure 9).

The Masonboro Island component consists of Recent (less than ~11,550 years old) and Pleistocene (~1.8 million to ~11,550 years before present) sediments (Atkinson et al. 1998, Moorefield 1978). The upland areas include natural and dredge spoil built areas. These are mostly found on the back side of the island adjacent to the Intracoastal waterway. Masonboro Inlet is stabilized by jetties and the northern end of Masonboro routinely receives spoil deposits from inlet dredging via a U.S. Army Corps of Engineers easement. Carolina Beach Inlet, at the southern end, is an artificially created waterway to enhance boater access to the Atlantic Ocean.

Masonboro Island supports a myriad of estuarine species. Loggerhead and green sea turtles nest on the beaches, where seabeach amaranth plants grow on the foredunes. All of these species are listed as threatened by the Federal government. Other species of concern are black skimmers, Wilson's plovers, and least terns all of which routinely utilize Masonboro Island for nesting. The waters of Masonboro Sound are an important local source of shellfish and serve as an important nursery area for numerous finfishes including spot, mullet, summer flounder, pompano, menhaden, and bluefish.

Issues

There are several unique pressures and issues associated with managing the Masonboro Island component. One issue is that inholdings, or portions of the Island owned by private entities, remain within the management boundary. It is difficult to manage a site appropriately when properties within the management area are privately owned. Inappropriate visitor use of the Island is also a major management problem. Visitor use issues associated with the Island include irresponsible camping, litter, and theft of personal boating equipment. Excessive alcohol use and partying are also recurring problems. Visitor use issues are greater at this Reserve site than others due to Masonboro Island's close proximity to the city of Wilmington and the Intracoastal Waterway. As the coastal population has increased so has the public usage at this Reserve component resulting in the need for additional enforcement of the visitor use policies. Enforcement is difficult due to limited resources of the Reserve's partnering agencies and due to the fact that the site can only be accessed by boat and boat and staffing resources are limited. Masonboro Island is also affected by occasional raw sewage contamination from failures in or disturbances to the city of Wilmington's sewer system. This sewage contamination can result in shellfish bed harvesting closures and swimming advisories. Additionally, dredge spoil is routinely deposited on the Island to ameliorate the loss of sediment transport and natural buildup due

to the hardening of Masonboro Inlet. This application of dredge spoil can disrupt colonial nesting birds and sea turtle nesting. Invasive species are also an important management issue for Masonboro Island. Recently, beach vitex (*Vitex rotundifolia*) has been found on Masonboro. This plant has tremendous potential to displace native dune species and destroy sea turtle nesting habitat.



Figure 9: Masonboro Island site map

Program Priorities

Research and monitoring, stewardship, and community education are the highest priorities at the Masonboro Island component. Two of the long-term SWMP stations and the weather station are located at this site. Additionally, the site is used regularly by researchers at UNCW. Stewardship is a high priority at the site as a result of the high seasonal visitation and misuse by some visitors. Stewardship activities have increased on the Island with the addition of the Southern Sites Manager in 2005, including sea turtle nest monitoring and delineation of colonial nesting shorebird habitat. Community education is also a high priority at the site because of the high visitation and misuse, yet the Reserve does not currently have the resources to adequately implement a robust community education program. Coastal Training Program activities are a medium priority for Masonboro due to the close proximity of the large population center of Wilmington. Coastal Training Programs are hosted in the Wilmington area a few times a year, often in a workshop series, with the same training occurring in the northern and central parts of the state. K-12 educational programs at Masonboro Island are a low priority, primarily because the site is only accessible by boat and transportation of large groups to the site is difficult. Some student field trips, student field studies, professional development educator workshops, and teacher field trips do occur here, with help from the Wilmington Reserve office staff.

d. Zeke's Island

Location and Description

The Zeke's Island component of the NCNERR is located in portions of both Brunswick and New Hanover counties, in southeastern North Carolina just south of Kure Beach (Figure 10). The nearest population center is Wilmington, N.C. located 22 miles (35 km) to the north. Southport, N.C. is located across the Cape Fear River 10 miles (16 km) to the south-southwest. Zeke's Island is bounded to the north by Federal Point (encompasses Fort Fisher State Park and the North Carolina Aquarium at Fort Fisher), to the east by the Atlantic Ocean, the Cape Fear River to the west, and the Smith Island Complex to the south. Zeke's Island is located in the Cape Fear River basin and on a broader scale is located in the Carolinian biogeographic province. Zeke's Island is accessible by both foot traffic and boat. A boat ramp is present at the northern end of the Reserve providing nearby boat access to the 1,635 acre Reserve (Figure 10). Walking trails overlooking the Reserve are provided through a partnership with the North Carolina Fort Fisher State Park.

The boundary line for the Zeke's Island component on the west is a late 19th century rock jetty. The jetty was installed as a sediment control structure to minimize shoaling of the shipping channel in the Cape Fear River. The area to the east of the jetty has become lagoonal in nature (Figure 10). The core area in the Zeke's Island component is 1,411 acres of estuarine habitats with tidally influenced basin waters, creeks, and intertidal and supratidal marsh communities. The buffer areas for the Zeke's Island component comprise 224 acres, of which 39 acres is ocean beach habitat along the Atlantic Ocean shoreline. Buffer areas also include 185 acres of upland habitats distributed between Zeke's Island (14 acres), North Island (76 acres) and the barrier spit (95 acres) along the Atlantic Ocean. Zeke's Island has

elevations of only several feet. North Island has several scattered dune systems, one of which reaches to twenty feet above sea level.



Figure 10: Zeke's Island site map

The Zeke's Island component contains surface sediments representative of the coastal plain. These sediments are varying combinations of sand, silt and clay, from terrestrial and marine sources. Some of these deposits are considered Recent (less than ~11,550 years old) and some are of Pleistocene (~1.8 million to ~11,550 years before present) origin (Atkinson et al. 1998, Moorefield 1978). The Pleistocene deposits are thin blankets of marine and estuarine sands and clays occurring in a series of terraces and scarps related to previous shoreline locations. These deposits overlay layers of Cretaceous (~140 to ~70 million years before

present) and Tertiary (~70 to ~1.8 million years before present) terrigenous and carbonate deposits (Atkinson et al. 1998, Moorefield 1978).

The Cape Fear region is representative of coastal cape formations along North and South Carolina. Shoals often extend seaward from these cape areas. Frying Pan Shoals extends seaward from the Cape Fear estuary area outward to approximately 31 miles (50 km). Barrier island formations generally extend north and southwest off these cape regions. The accepted theory is that the capes have maintained their basic positions and morphologies throughout the Pleistocene and Holocene (~11,550 years ago to present) by migrating landward or seaward in response to sea level changes (Moorefield 1978).

Ocean inlets have historically formed, migrated, and closed within the barrier-spit area of Zeke's Island. The last oceanic inlet in this area, New Inlet, closed in March 1999 (Cleary & Marden 2001). Currently water exchange is dependent on the adjacent Cape Fear River. Coastal processes continue to change and rework the beach environments that produce the barrier island and estuarine features found around Zeke's Island.

The unusual characteristics of the site have created a variety of habitats, including tidal flats, salt marshes, shrub thicket, maritime forest, sand dunes, ocean beach, and the hard surface of the rock jetty. The surrounding estuarine waters are highly productive and used regularly for sport/commercial fishing and recreational purposes. Fish, shrimp, crabs, clams, and oysters also use the estuary as a nursery ground. Both the Atlantic loggerhead and green sea turtles, federally protected threatened species, occasionally nest on the site's open beaches. Seabeach amaranth, a threatened plant species, has also been found on the site's foredune areas.

Issues

There are several unique pressures and issues associated with managing the Zeke's Island component. There is anecdotal evidence from fisherman and other users of the component that there is increased sedimentation occurring around the site. Areas are silting in and water depths are much shallower than what they were ten years ago. There are also several visitor use issues including litter, safety (people walking along the jetty), and access (people disturbing research plots). Similar to the other components, enforcement of the visitor use policies at Zeke's Island remains an issue of concern. Beach Vitex (*Vitex rotundifolia)* has also been found within Zeke's Island. This will certainly become a very important management issue within the next 5 years. Changing water quality of the Cape Fear River is also a great concern for this Reserve. The Cape Fear River is the largest river basin within N.C. and drains approximately 23,310 km^2 through 100 counties.

Program Priorities

Research and monitoring is a high priority for the Zeke's Island component because of the long-term location of two SWMP stations at the site. K-12 educational programs are a medium priority at Zeke's Island because part of the component is on the mainland and may be accessed by foot and boat, facilitating easy access by large groups. The focus of these programs is student field trips, student field studies, professional development educator

workshops, and teacher field trips conducted with help from the Wilmington Reserve office staff. Stewardship of the site is a medium priority given the presence of the Stewardship Coordinator at the Wilmington office and the species monitoring that occurs at the site. Coastal Training Programs are hosted in the Wilmington area a few times a year, often in a workshop series, with the same training occurring in the northern and central parts of the state. Community education is a lower priority at the site given the close proximity of the Fort Fisher Aquarium and State Park.

II. ADMINISTRATION PLAN

A. Administrative Plan Overview

The goal of the North Carolina National Estuarine Research Reserve (NCNERR) administration is to improve the operations, infrastructure, and stature of the NCNERR to better support and enable the education, research, and stewardship programs. The administration of the NCNERR supports and enables the implementation of the education, research, and stewardship programs to fulfill its mission. The administration team includes the Reserve Manager, the Education, Coastal Training Program, Research, and Stewardship Coordinators, and the Geographic Information Systems (GIS) Specialist. Administration is defined for the purposes of this management plan as working with the National Oceanic and Atmospheric Administration (NOAA), Division of Coastal Management (DCM) and partner agencies to fulfill the NCNERR mission and meet agency mandates, assessing and addressing infrastructure needs, appropriately staffing the Reserve and providing staff with the skills and resources necessary to perform their jobs. Reserve administration also provides long-term direction and vision for the program. These duties form the administration plan and include the staffing plan.

B. Administrative Framework

The administration of the NCNERR is achieved through a collaborative process involving the following agencies and organizations: NOAA, DCM, the University of North Carolina at Wilmington, component Local Advisory Committees, the Carolina Estuarine Reserve Foundation, and partners.

1. NOAA

The National Estuarine Research Reserve System (NERRS) operates as a federal-state partnership. State partners manage the individual Reserves and NOAA's Office of Ocean and Coastal Resource Management provides direction, funding, and review for the System and individual Reserves through the Estuarine Reserves Division and the National Policy and Evaluation Division. The Center for Coastal Fisheries and Habitat Research (CCFHR), part of NOAA's National Ocean Service's National Centers for Coast and Ocean Science, shares the administration building on Pivers Island in Beaufort with NCNERR.

a. Estuarine Reserves Division

Direction is provided by the Estuarine Reserves Division (ERD) through the NERRS Strategic Plan and regular interaction with Reserve managers and sector coordinators. Daily coordination between the federal and state partners is provided by ERD program specialists. The program specialist communicates directly and regularly with Reserve staff building a level of trust between the partners and familiarizing the federal and state personnel with Reserve management procedures and policies.

Section 315 of the Coastal Zone Management Act (CZMA) provides non-competitive operations funding and competitive construction and acquisition funding for the System. ERD administers these funding programs and program specialists review operations work

plans and performance reports to ensure compliance with program policies and special award conditions. ERD also provides technical assistance and oversight of system-wide programs such as the System-wide Monitoring Program, Graduate Research Fellowship, and the Coastal Training Program.

b. National Policy and Evaluation Division

The National Policy and Evaluation Division conducts performance evaluations on the operation and management of individual Reserves pursuant to sections 312 and 315 of the CZMA. The purpose of NOAA review is to ensure that a state partner is complying with NERRS goals, approved funding awards and work plans, and Reserve management plans. Deficiency findings must be addressed in operation awards and management plan updates in an appropriate and timely manner to avoid withdrawal of National Estuarine Research Reserve designation.

c. Center for Coastal Fisheries and Habitat Research

The CCFHR is part of NOAA's National Ocean Service's National Centers for Coast and Ocean Science. Located on Pivers Island in Beaufort, CCFHR and NCNERR share the administration building on the CCFHR campus. The administration building was constructed in 2007 and it houses the NCNERR headquarters and provides quick access to the Rachel Carson component. The building includes office space for 11 Reserve staff, a teaching laboratory, and an auditorium. The NCNERR and CCFHR are currently updating their Memorandum of Understanding (MOU) and it will be added when the agreement is complete (Appendix J).

Co-locating the Reserve with CCFHR also provides mutual benefit to the parties in fulfilling NOAA's mission within the Ecosystem goal to foster "*healthy and productive coastal and marine ecosystems that benefit society*" and "*a well informed public that acts as stewards of coastal and marine ecosystems.*" This partnership also supports the DCM's mission to "*protect, conserve, and manage North Carolina's coastal resources through an integrated program of planning, permitting, education, and research*" and the Reserve's mission to "*promote informed management and stewardship of North Carolina's estuarine and coastal habitats through research, education, and example."*

The Reserve will provide a science to management relationship between the CCFHR and the coastal decision-maker community and a science to education connection between the CCFHR and K-12 and community audiences. The Reserve and the CCFHR will enhance their respective research capabilities through collaborative partnerships addressing relevant, coastal habitat and management related questions consistent with their respective management plans.

The Research and Education Coordinators recently partnered with researchers from the University of North Carolina-Wilmington (UNCW), University of North Carolina-Chapel Hill (UNC-CH) and CCFHR in a Cooperative Institute for Coastal and Estuarine Environmental Technology (CICEET) grant titled, "Sustainable Estuarine Shoreline Stabilization: Research, Education and Public Policy in North Carolina". In addition, the

temporary Rachel Carson site manager collaborated with CCFHR scientists on a marine debris study conducted on the Rachel Carson component. Productive and beneficial collaborations such as these will continue to be pursued in the future.

2. North Carolina Division of Coastal Management

The state partner in the NCNERR federal-state partnership is the North Carolina Department of Environment and Natural Resources' DCM. The DCM carries out the state's Coastal Area Management Act, the Dredge and Fill Law and the Federal CZMA of 1972 in the 20 coastal North Carolina counties, using rules and policies of the N.C. Coastal Resources Commission. The organizational chart for DCM is presented in Figure 11. The division is organized into three sections: Policy and Planning, Permitting and Enforcement, and the North Carolina Coastal Reserve (NCCR). The NCNERR is included within the North Carolina Coastal Reserve.

The DCM is an appropriate state partner for the NCNERR because:

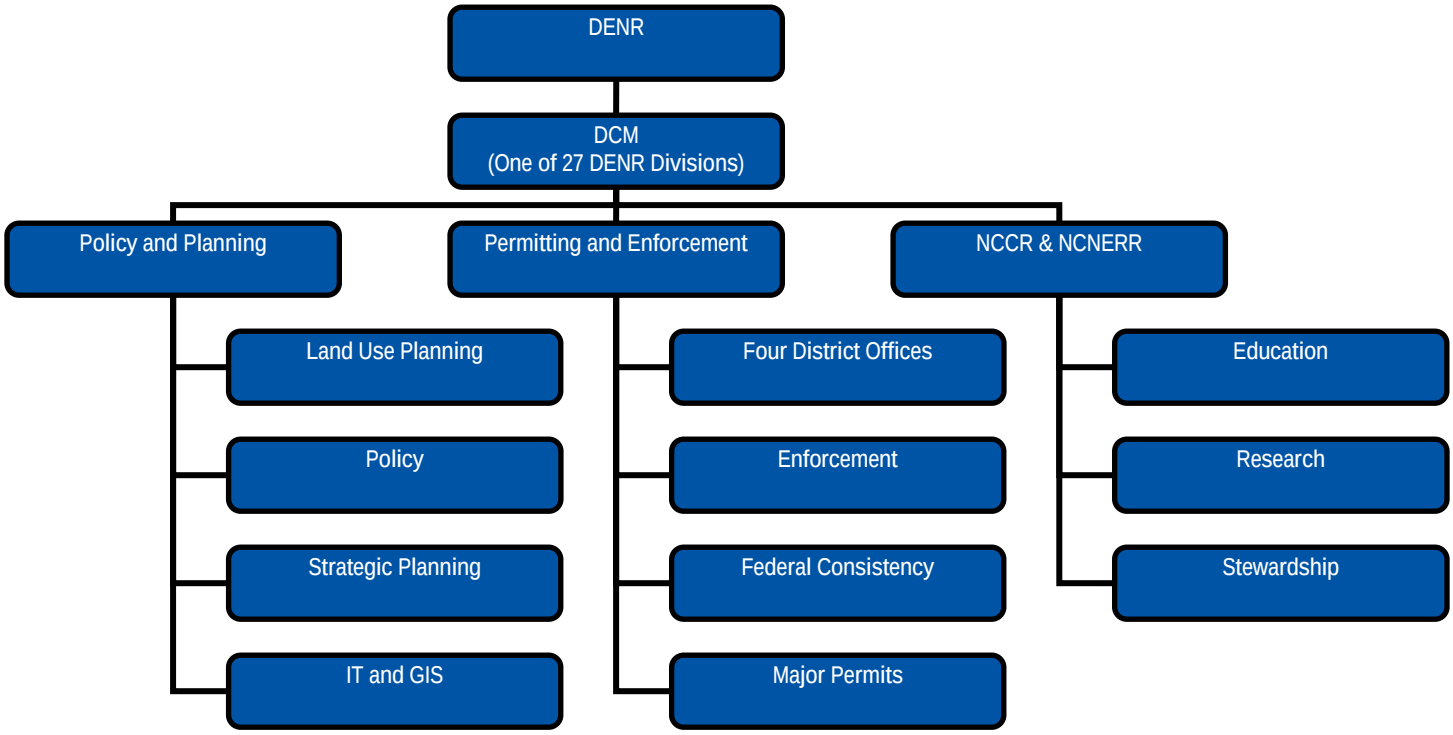
- Both organizations have similar missions as both are authorized by CZMA legislation to protect coastal resources through education, research, and stewardship programs, albeit the mechanisms through which these programs are conducted are different;
- DCM administers associated CZMA authorized programs that receive funding under sections 306, 306A, 309, and 310;
- Reserve education, research, and stewardship programs seek to address pertinent coastal management issues;
- The results of Reserve education, research, and stewardship programs are directly accessible to the DCM and the coastal management community; and
- The Reserve benefits from the 309 program, land use planning, policy and regulatory programs, and has direct involvement in coastal management issues.

As the NCNERR and DCM partnership grew and evolved over the years, it became apparent that opportunities existed to strengthen this relationship. The September 2005 312 NCNERR Evaluation Findings recommended the following:

- Identify ways to improve communication between the NCNERR and DCM;
- Identify specific needs and expectations the organizations have of each other and strategic projects to collaborate on rather than the current opportunistic approach;
- Seek ways to raise the visibility of the NCNERR within DCM, Department of Environment and Natural Resources (DENR), and the state; and
- Evaluate the vertical placement of the NCNERR within the DCM organizational chart.

In July 2006, a new section was created within the DCM for the North Carolina Coastal Reserve and NCNERR (Figure 11). Elevated from the Policy and Planning section, the NCNERR now experiences increased visibility within the division and improved communication with the division director and assistant directors. As a result, there is an increase in cross-section collaborations; opportunities for such collaboration are identified throughout this plan. The complementary missions and programs of the DCM and NCNERR form the basis of a model partnership. Through the continued commitment and efforts of NCNERR and DCM management, the administrative objectives and activities in this management plan articulate steps to achieve such a partnership.

Figure 11: DENR/DCM Organizational Chart



3. University of North Carolina at Wilmington

The NCNERR has a long-standing relationship with the UNCW, which has provided administrative and staffing support for the NCNERR since 1989. A large percentage of the NCNERR annual operations award is contracted to UNCW to fund six full-time permanent contract positions and to house four of these staff at the UNCW's Center for Marine Science. This relationship allowed the NCNERR to expand its staff when the state was not able to create more staff positions and it provides a staff presence near the southern components. The NCNERR and UNCW are also currently updating their MOU which will be added when the agreement is complete (Appendix J).

Co-locating the Reserve with the UNCW's Center for Marine Science provides mutual benefit to the parties since the mission of the University and its Center for Marine Science is to *"promote basic and applied research."* This partnership also supports the Reserve's mission to "*promote informed management and stewardship of North Carolina's estuarine and coastal habitats through research, education, and example."*

The Reserve provides a science to management relationship between the University and the coastal decision-maker community and a science to education connection between the University and K-12 and community audiences. The Reserve and the University enhance their respective research capabilities through collaborative partnerships addressing relevant, coastal habitat and management related questions consistent with their respective missions.

This partnership with UNCW also allows for collaboration with UNCW's Biology and Marine Biology, and Environmental Studies departments. Faculty and graduate and undergraduate students conduct research projects on the southern sites and NCNERR staff consult with faculty on site management and coastal resource issues. For example, the Reserve has funded Dr. Amanda Southwood, a UNCW faculty member, during the past several years to monitor sea turtle activity on the Masonboro Island component.

4. Local Advisory Committees

Local Advisory Committees (LAC) serve as advisory groups through which local citizens work with NCNERR staff to provide feedback and recommendations on site management, research, and education activities at the components, and review management plan policies and implementation strategies. Committee members are expected to discuss relevant issues with the local community.

Each component has, by State law, a LAC. Committee composition consists of representatives from the following public sectors as appropriate based on the Reserve component: citizen, adjacent landowner, local government, state government, research, education, volunteer, commercial business that operates on the component, traditional user, law enforcement, and non-profit organization. Members are appointed by the Secretary of DENR to serve as long as they wish. Replacement members are appointed as needed. The LACs meet on an annual basis at the request of the Reserve.

5. Carolina Estuarine Reserve Foundation

The Carolina Estuarine Reserve Foundation (CERF) is a non-profit organization that works exclusively to support the preservation, development and cooperation of the North Carolina Coastal Reserve and NCNERR for charitable, educational, and scientific purposes. CERF is a voice to speak on behalf of the Reserve and works to sustain and increase funding for the Reserve programs.

CERF moved headquarters from Beaufort to Kitty Hawk in 2004 and back to Beaufort in 2006 in an effort to provide better geographic representation on the board of directors. The board is comprised of representatives from the northern, central, and southern regions of the coast to reflect the distribution of Reserve components and the Reserve Manager in an ex-officio capacity. The Reserve Manager ensures that CERF is aware of and is addressing NCNERR needs and is coordinating with existing NCNERR programs. The direction and foci of CERF are articulated in its strategic plan and the goals and actions address high priority Reserve needs (Appendix K).

6. Partnerships

Partnerships are essential to organization relevancy and growth. The NCNERR maintains a variety of partnerships to accomplish its mission and will continue to do so through current Memoranda of Understanding and collaborative projects (Appendix J). The September 2005 312 Evaluation Findings recognize the accomplishments of the education and stewardship programs through partnerships and suggest seeking additional partnerships to leverage and strengthen the research program. Significant progress has been made on the research partnerships since the last 312 evaluation. Projects reflecting new research partnerships include the NCNERR's involvement in the Currituck Sound Study to monitor water quality at the Currituck Banks component (N.C. Division of Water Resources and United States Geologic Survey), atmospheric deposition monitoring at the Currituck Banks component (N.C. State University, United States Fish and Wildlife Service, and UNC Institute of Marine Science), reinstituting SWMP-like monitoring at the Rachel Carson component (National Park Service), and state-wide collaboration on an estuarine shoreline stabilization project (CCFHR, UNCW, and UNC Institute of Marine Sciences). Additional organizations with which the Reserve currently works and how are listed in Appendix L.

C. Facilities Plan

The NCNERR has a responsibility to provide the facilities necessary to implement the education, research and monitoring, and stewardship programs of the NCNERR in accordance with federal and state guidelines and laws. The Reserve currently operates from three offices due to the geographic distribution of the components: the Northern Sites office in Kitty Hawk supports the Currituck Banks component; the Headquarters office in Beaufort supports the Rachel Carson component and serves as the headquarters for the Reserve due to its central location; and the Southern Sites office in Wilmington supports the Masonboro and Zeke's Islands components.

All buildings are located off-site to avoid impacts to the components. The buildings are leased or shared with partners to promote collaborative opportunities and maintain economical prudence.

1. Maintenance of Buildings and Public Use Areas

The NCNERR does not employ maintenance staff. Upkeep of buildings and grounds is included in lease and service fees. Public use areas are patrolled by the Stewardship Coordinator and the site managers as time allows. Vandalism and misuse is reported to DENR and appropriate local law enforcement. Volunteers participate in Reserve clean-up events and assist in the upkeep of the boardwalks and trails.

All facilities recycle and employ 'green' techniques and technology where appropriate. For example, in November 2003 the NCNERR, along with DCM, CCFHR and Duke University Marine Laboratory, received a $40,000 planning grant from the N.C. Clean Water Management Trust Fund (CWMTF) to develop a plan to reduce stormwater management and aquaculture effluent into estuarine waters surrounding Pivers Island in Beaufort, N.C. This plan was completed in February 2008. In early 2009, $496,000 was awarded by the CWMTF to implement the plan, which includes installation of cisterns, bioretention areas, stormwater

wetlands and several proprietary devices on Pivers Island. The grant also includes funding for a trail around the island to highlight the various stormwater control devices for educational purposes. The facility in Beaufort also recently received a NOAA Green Mini-Grant ($29,500) to 'green' the aging facility. Funds from this grant will: 1) retrofit four diesel emergency generators and a seawater heater to biodiesel; 2) replace all faucets and showerheads with low-flow units; 3) install solar hot water systems; and 4) convert substantial parts of the campus to 'no-mow' with native wildflower development.

2. Construction Principles

All construction activities will be completed under the guidance of the following principles to ensure the Reserve meets its guiding principle of promoting good environmental stewardship and to meet the NERRS Sustainable Design Guidelines.

1. Facilities and access routes will create minimum visual or environmental impacts both within and beyond the component boundaries.
2. Facilities will be designed and located to support multiple Reserve goals to the greatest extent possible.
3. Planning for significant new facilities will solicit input from representatives of user groups or those to be affected by the facilities.
4. Facilities construction and equipment shall strive for energy efficiency, incorporate green building materials and techniques, and anticipate technological advances.

The facilities for each office and NCNERR component are listed below. Needs are identified and are based on current capabilities at the offices and components and program priorities for 2009-2014.

3. Northern Sites Office in Kitty Hawk (Currituck Banks)

The program priorities for the Currituck Banks site and Northern Sites office are listed in order of priority: stewardship, community/visitor education, research, K-12 education/Coastal Training Program (CTP) (Table 3).

a. Office Space

i. *Existing:* Office space is leased from the Town of Kitty Hawk to house the Northern Sites Manager (Appendix J), who manages the Currituck Banks component of the NCNERR and two state sites (Kitty Hawk Woods and Buxton Woods Coastal Reserves). The office is located approximately 25 miles south of the Currituck Banks component. The office is approximately 900 square feet and contains field and office storage space, common meeting space (for up to 6 people), and four work stations. Boat and vehicle storage is also provided at the office. Laboratory space is informally provided by the UNC-Coastal Studies Institute, located in Manteo, as needed for research and stewardship activities. Public meetings and education events are held at partner facilities such as the Town of Kitty Hawk meeting room.

ii. *Needs:* The office space currently leased from the Town of Kitty Hawk does not meet the needs of the staff or the program priorities of the site. The plans the Town of Kitty Hawk has for the office are unknown, but eviction is not an immediate concern as the lease for the office was recently renewed through 2011 (Appendix J).

The desired facilities for the Northern Sites office include the following to support the aforementioned priorities:

- Three to five offices to house staff;
- Small laboratory area in which to conduct basic research activities;
- Small visitor interpretive center showcasing the Currituck Banks component, and its importance, unique habitats, and history;
- Indoor and outdoor storage capacity for field equipment and boats;
- Lodging accommodations for one to two researchers. The high cost and limited availability of housing in the area is prohibitive for researchers and students wishing to conduct work at Currituck Banks; and
- Community meeting room in which to hold workshops and meetings. This room also supports the results of a recent Town of Kitty Hawk needs assessment that identified the need of such a meeting room for use by community groups.

It is desired that the new facility be located in Kitty Hawk and will serve the Kitty Hawk Woods and Buxton Woods components of the NCCR in addition to the Currituck Banks component of the NCNERR. Given the limited Reserve staff and the lack of maintenance staff, it is the preference of the DCM to maintain a long-term partnership agreement with a local or state agency for such a facility in which the agency maintains ownership of the facility and the DCM pays an established fee for use. The Reserve Manager, Northern Sites Manager, and DCM staff will work to locate permanent, suitable office and lab space within an existing facility to accommodate the needs of Currituck Banks. The Reserve has approached Dare County regarding a possible partnership facility in the Town of Kitty Hawk and will continue to investigate other partnership opportunities for the office needs.

b. Equipment

i. *Existing:* The Northern Sites office has one boat used for stewardship and research, a 16 ft. Jones Brother semi-V hull equipped with a four-stroke 50 hp Johnson outboard engine. The N.C. Division of Motor Fleet leased vehicle is a 2007 four wheel-drive Grand Jeep Cherokee. The Northern Sites office is equipped with computers, Geographic Information System (GIS)/ Global Positioning System and tools needed for land management and maintenance.

ii. *Needs:* The Northern Sites office is in need of a new copier.

c. On-site Facilities

i. *Existing:* A pervious parking lot provides access to the Currituck Banks component from N.C. 12. From the parking lot, visitors may walk along the 1/3 mile boardwalk through the maritime forest to Currituck Sound. Plants and trees are identified by small signs along the boardwalk. Interpretive signs were installed along the boardwalk in 2006. A 1.5 mile primitive trail departs from the boardwalk and heads north through the maritime forest with benches located along the trail. Visitors may also access the component via the North Beach Access ramp at the end of N.C 12.

ii. *Needs:* To increase visitor awareness of the Reserve and its appropriate use, a variety of signage needs exist. Much of the existing signage on the Reserve is outdated, damaged or aged to the point that it is no longer effective, with the exception of the boardwalk and plant signs. Types of signage needed include: rules signs, placename signs, informational signs, boundary identification signs, and trail markers. The Reserve will also evaluate opportunities for increased public access.

4. Headquarters Office in Beaufort (Rachel Carson)

The program priorities for the Rachel Carson site and Headquarters office are listed in order of priority: education (K-12, community/visitor, and CTP), stewardship, and research (Table 3).

a. Office Space

i. *Existing:* The joint CCFHR-NCNERR administration building on Pivers Island was completed in 2007 and Reserve staff has been operating from this facility since July of that year. This location provides quick access to the Rachel Carson component that is located across the Beaufort Channel from the island. The facility is two stories and totals 17,270 ft^2. The Reserve occupies 2,405 ft^2 of office space including the teaching laboratory space. The auditorium and large conference room are shared with CCFHR for workshops and meetings. The NCNERR office space contains eight offices, two cubicles, a reception area and a small conference room providing space for the Reserve Manager, Education Coordinator, Education Specialist, Coastal Training Program Coordinator, and Research Coordinator as well as temporary staff and interns.

ii. *Needs:* The administration building was designed as an education facility prior to the Reserve's reorganization in the early 2000s. As a result, the headquarters office does not comprehensively serve all program needs and new needs have arisen since occupation of the building. The Reserve Manager participated in the recent development of the CCFHR Master Plan which seeks to address facility and program needs of all parties on the CCFHR campus on Pivers Island. The following needs exist and were incorporated into the plan:

a. *Research lab and office space*: The research program does not currently have designated research space at the headquarters office. Eight hundred

square feet of laboratory space and three offices are needed to support the Research Coordinator and research activities at the Rachel Carson Reserve. The Research Coordinator currently uses laboratory space at the UNC Institute of Marine Sciences, located nearby in Morehead City, when needed.

b. *Field storage area*: The headquarters office does not have appropriate space to store field research and stewardship gear. This gear is currently stored in a shed located on Pivers Island and a dedicated storage area will better address Reserve needs and allow for removal of the temporary shed.
c. *Outdoor classroom*: Education is the top priority at the Rachel Carson component and an outdoor classroom will support Reserve K-12 and public education programs, taking advantage of the natural setting and close proximity of the Rachel Carson Reserve and Gallants Channel. A touch tank in the outdoor classroom will provide education experiences that incorporate live animals and are not currently feasible in the indoor teaching laboratory.
d. *Boat docks*: The Reserve has two boats and currently leases dock space from the Duke University Marine Laboratory because CCFHR docks are not able to easily and safely accommodate students and the general public. Dock facilities are needed to accommodate the boats and Reserve programming and CCFHR is interested in collaborating with the Reserve in redesigning the eastern docks to address this need.

b. Equipment

i. *Existing:* The Beaufort office is well equipped for the programs offered. Laptop computers, projectors and slideshow software are available for presentations. Copiers and color printers are available to create handouts for programs. Water quality testing equipment is maintained for use with student groups. The Reserve owns two boats for field trip transportation to the Reserve component, a 17 ft. Jones Brothers boat equipped with a Suzuki outboard motor and a 24 ft. Carolina Skiff boat equipped with a Yamaha outboard motor. The office also has a N.C. Division of Motor Fleet leased 2007 four wheel-drive Dodge Durango, and two kayaks.

ii. *Needs:* No needs were identified at the time of publication of this plan.

c. On-site Facilities

i. *Existing:* The Rachel Carson interpretive trail is a one-mile primitive loop that guides visitors through representative habitats found within the component. A brochure describes posted points of interest. A boardwalk on Rachel Carson was constructed in 2007 across from the Town of Beaufort public boat ramp. The boardwalk is approximately 500 feet in length crossing Carrot Island and terminating with an observation deck overlooking the North River Channel. The boardwalk is constructed of composite decking and railings. Interpretive signs highlight the different habitats and species located along the boardwalk.

ii. *Needs:*

a. *Signage:* To increase visitor awareness of the Reserve and its appropriate use, a variety of signage needs exist. Much of the existing signage on the Reserve is outdated, damaged or aged to the point that it is no longer effective, with the exception of the boardwalk signs. Types of signage needed include: rules signs, placename signs, informational signs, boundary identification signs, and trail markers.

b. *Kiosks:* Information kiosks will greet visitors at the ferry drop-off locations at the Rachel Carson component to orient them to the site and to appropriate use of the site.

c. *Interpretive trail redesign:* The interpretive trail can only be used at low tide and needs to be redesigned to avoid wet habitats so that it may be used throughout the tidal cycle.

5. Southern Sites Office in Wilmington (Masonboro and Zeke's Islands)

The program priorities for the Wilmington office are organized per site and listed in order of priority (Table 3):

- Masonboro Island: stewardship, research, community/visitor education, and K-12 education/Coastal Training Program, and
- Zeke's Island: research, K-12 education/Coastal Training Program, stewardship, and community/visitor education.

a. Office Space

i. *Existing:* The Reserve's Wilmington-based staff moved into their new quarters at UNCW's Center for Marine Science (CMS), across the Intracoastal Waterway from the Masonboro Island component, in May 2008. The office space is approximately 1450 ft^2 and contains four offices, a large laboratory for research and monitoring operations, a common area/workspace for shared equipment, computers, and supplies, and a storage area/mud room. The office houses the GIS Specialist, two Research Specialists, and the Stewardship Coordinator.

ii. *Needs:* No needs were identified at the time of publication of this plan.

b. Equipment

i. *Existing:* The Wilmington office is equipped for research, stewardship, and GIS tasks. The NCNERR owns three boats designated for research and stewardship that are housed at the Wilmington office. They include a 19 ft. Jones Brother's Bateau equipped with a Yamaha four-stroke 60 hp outboard engine, a 16 ft. Carolina Skiff outfitted with a Yamaha four-stroke 25 hp outboard engine, and a 16 ft. aluminum Jon boat with a 15 hp Yamaha four-stroke outboard engine. In addition, the office has a N.C. Division of Motor Fleet leased four wheel-drive Dodge Durango. Computers, water quality and meteorological dataloggers, autosamplers, color printers, a plotter, telemetry equipment, necessary software, and supplies needed for maintaining equipment are on location.

Needs:

a. *24 ft. Carolina skiff boat:* The Wilmington office is in need of a 24 ft. Carolina Skiff boat to support research and stewardship activities that cannot currently be accommodated safely in the smaller boats the office has and to support transport of students and volunteers to the sites. The boats the office currently has are too small to transport the numbers of students or volunteers necessary for programming needs.

b. *Boat lift:* The Wilmington office is in need of a boat lift at the UNCW's CMS boat dock. It is not possible to keep the Reserve boats in the water at all times since the dock is located along a narrow section of the Intracoastal Waterway because of potential damage from boat wakes. Furthermore, the boat ramps located near the components are problematic due to heavy traffic and little to no parking. A boat lift will provide quick access to the boat for field work and reduce staff time needed to manage field operations. Reserve staff has discussed this need with UNCW personnel and the Reserve and UNCW are interested in collaborating on the installation of several boat lifts at the dock, one of which will solely support the Reserve.

c. On-Site Facilities

i. *Existing*:
   a. *Masonboro Island:* There are currently no on-site facilities.
   b. *Zeke's Island:* The Zeke's Island Basin Area is used to access the component and the Basin for Reserve operations and by recreational users. This area is located outside of the component boundary and is operated by the N.C. Wildlife Resources Commission. The Federal Point group, a collection of agencies and organizations with interests in the Zeke's Island Basin Area, has designed improvement plans, including interpretive signage, and funding has been received by the State to implement the plans. A rock jetty, commonly known as "The Rocks," extends from the parking lot at the Basin Area several miles separating the Basin from the Cape Fear River. The Rocks, under the control of the N.C. Department of Cultural Resources, is a sediment control structure and is hazardous to public safety.

ii. *Needs:*
   a. *Masonboro Island:*

      1. *Signage:* To increase visitor awareness of the Reserve and its appropriate use, a variety of signage needs exist. Much of the existing signage on the Reserve is outdated, damaged or aged to the point that it is no longer effective. Types of signage needed include: rules signs, placename signs, informational signs, boundary identification signs, and trail markers.

2. *Camping sites:* Masonboro Island is the only component at which camping is allowed. Currently, there are no designated camping areas and visitor impacts from camping are evident at many locations on the island. Design and installation of designated primitive camping sites and signage will direct visitors to these locations reducing visitor impacts.

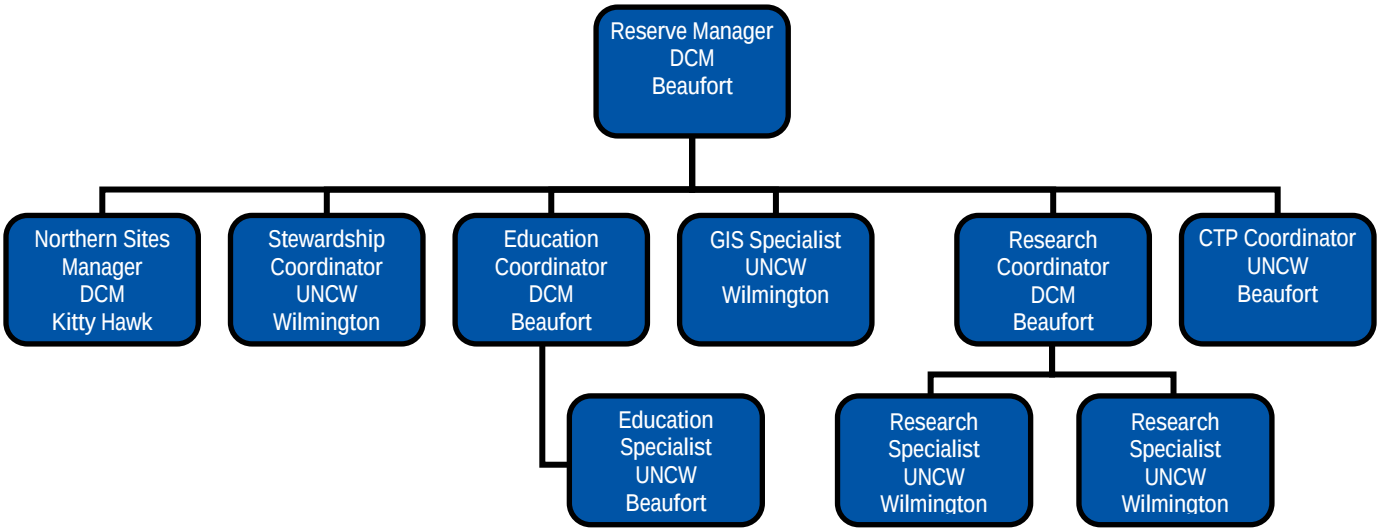
b. Zeke's Island:

1. *Signage:* To increase visitor awareness of the Reserve and its appropriate use, a variety of signage needs exist. Much of the existing signage on the Reserve is outdated, damaged or aged to the point that it is no longer effective. Types of signage needed include: rules signs, placename signs, informational signs, interpretive signs, boundary identification signs, and trail markers.

D. Staffing Plan

An adequate staff is necessary to implement the management plan and to achieve the NCNERR's education, research, and stewardship objectives. The NCNERR is currently staffed by ten full-time permanent positions employed by the DCM or UNCW. Figure 12, the NCNERR organizational chart, indicates the employer and location of each position. Current staff responsibilities and duties are outlined below as are rationale for future staffing needs.

Figure 12: North Carolina NERR Organizational Chart with Employer and Location



1. Current Staff Responsibilities and Duties

Reserve Manager:

- Fulfill Reserve mission, goals, and objectives
- Ensure the policies in the management plan are followed and that Reserve programs successfully meet the mandates of the NERRS and the DCM
- Seek and administer federal and other grants, contracts, and state budget appropriations
- Provide oversight and coordination of education, research and monitoring, and stewardship programs
- Develop and maintain partnerships with local, state, and federal agencies, groups and individuals to enhance NCNERR exposure and capacity
- Supervise the following positions: GIS Specialist, Education Coordinator, CTP Coordinator, Research Coordinator, Stewardship Coordinator, and Northern Sites Manager
- Responsible for all activities, lands, and facilities within the Reserve boundaries and for office and laboratory facilities leased from partners
- Receive and evaluate input from Local Advisory Committees with site managers

Geographic Information Systems (GIS) Specialist:

- Manage the GIS program and database
- Support NCNERR programs through dataset and product development
- Provide technical support to staff
- Maintain and update GIS equipment
- Manage the GIS budget
- Assist with education, research, and stewardship programs as needed

Education Staff

Education Coordinator:

- Manage the K-12, teacher professional development, community outreach and summer camp programs, bringing estuarine and watershed concepts and science to these audiences, in accordance with the NCNERR management plan and NERRS and DCM mandates
- Develop and maintain partnerships to enhance education programs
- Represent the NCNERR at local, state, and national levels
- Supervise the Education Specialist and temporary Rachel Carson site management staff
- Manage the education budget
- Coordinate with the Coastal Training Program Coordinator to ensure education programs are complementary
- Translate research and monitoring results for incorporation into education programs with research staff
- Assist with field trips and workshops as needed
- Oversee development of all educational materials
- Manage the Rachel Carson component of the NCNERR in the absence of site management staff

- Assist with Rachel Carson site management and research and stewardship programs as needed

Coastal Training Program Coordinator:

- Develop and produce workshops for coastal decision-makers based on formal and informal needs assessments in accordance with the NCNERR management plan and NERRS and DCM mandates
- Develop and maintain partnerships to enhance the CTP
- Represent the NCNERR at local, state, and national levels
- Manage the CTP budget
- Coordinate with the Education Coordinator to ensure education programs are complementary
- Translate research and monitoring results for incorporation into the CTP with research staff
- Develop CTP-related materials
- Assist with field trips, Rachel Carson site management, and other education program events as needed

Education Specialist:

- Conduct K-12 student field trips and outreach programs
- Develop and implement summer camp programs
- Develop materials for K-12 and teacher programs
- Manage the volunteer program at the Rachel Carson component in conjunction with temporary Rachel Carson site management staff
- Manage the public field trip program
- Provide presentations to civic groups about the NCNERR
- Represent NCNERR at festivals and meetings
- Develop display boards for festivals and meetings for NCNERR staff
- Assist the Coastal Training Program Coordinator with workshop preparation
- Assist with Rachel Carson site management and stewardship and research programs as needed

Research Staff

Research Coordinator:

- Manage the research and monitoring programs, focusing on high priority coastal management needs, in accordance with the NCNERR management plan and NERRS and DCM mandates
- Develop and maintain partnerships to further research programs
- Represent the NCNERR at local, state, and national levels
- Supervise two Research Specialists
- Manage the research budget
- Translate research and monitoring results for incorporation into education programs with education staff

- Assist with boat management and transportation, site management of Rachel Carson component, and stewardship and education programs as needed

Research Specialists (2):

- Implement the System-wide Monitoring Program in accordance with NERRS and the Centralized Data Management Office (CDMO) requirements
- Procure and maintain SWMP equipment and supplies
- Deploy equipment as scheduled
- Quality Assurance /Quality Control data and prepare annual reports for submittal to CDMO
- Perform data analysis with Research Coordinator
- Assist the Research Coordinator with developing and maintaining partnerships to further research programs
- Assist the Research Coordinator with managing the research budget
- Assist the Research Coordinator with grant proposals, preparation of manuscripts for publication, presentations and other outreach activities
- Assist with Reserve research projects
- Assist with stewardship, GIS, and education programs as needed

Stewardship Staff

Stewardship Coordinator:

- Manage the stewardship program (managing the NCNERR components for research, education, and compatible traditional uses) in accordance with the NCNERR management plan and NERRS and DCM mandates
- Manage the Masonboro and Zeke's Islands components of the NCNERR
- Develop and maintain partnerships to enhance stewardship programs
- Represent the NCNERR at local, state, and national levels
- Manage the stewardship budget
- Coordinate with the Northern Sites Manager and the Rachel Carson Site Manager (see Education Coordinator) on site management policies and issues
- Conduct Local Advisory Committee meetings with Reserve Manager
- Provide community outreach and education programs as resources allow
- Facilitate and assist with research at the components in conjunction with research staff

Northern Sites Manager:

- Manage the Currituck Banks component of the NCNERR
- Develop and maintain partnerships to enhance stewardship programs
- Represent the NCNERR at local, state, and national levels
- Coordinate with the Stewardship Coordinator and the Rachel Carson Site Manager (see Education Coordinator) on site management policies and issues
- Conduct Local Advisory Committee meetings with Reserve Manager
- Provide community outreach and education programs as resources allow
- Facilitate and assist with research at the component in conjunction with research staff

2. Staffing Needs

The geographic distribution of the NCNERR components resulted in a regional parsing out of programs due to program priorities and location of staff as discussed previously in section I, C, 5. A recent internal evaluation of programs, facilities, current staffing levels, and projected staffing needs revealed there are needs and opportunities for core programs at all offices as well as administrative assistance to facilitate operation of the NCNERR. The following staffing needs are critical for implementation of core education, research, and stewardship programs at all four NCNERR components. The Reserve Manager will work to develop position descriptions, seek funding and establish the positions through DCM or UNCW as funding resources allow, without detriment to current programs.

Administrative Assistant

The NCNERR does not currently have any designated administrative assistance. The staff in each office has taken on many of the duties themselves to ensure operation of the office. As the program has grown, however, the time spent handling administrative duties such as ordering supplies, making copies, managing mail, and maintaining office equipment and vehicles, has increased. With the establishment of the Reserve headquarters in Beaufort, occupation of the Pivers Island facility, and the majority of the staff operating from this office, an administrative assistant will relieve headquarters staff of these duties and will assist the northern and southern sites offices when necessary. This will provide staff with more time for program development and implementation.

Assistant Manager

The implementation of Reserve goals and programs at the four NCNERR components given the differences and distances between the components will benefit from the addition of an Assistant Manager. The purpose of this position will be to support the Reserve Manager with daily operation of the Reserve as well as maintain responsibility for discrete tasks based on need and skill. This will provide the Reserve Manager with more time for broader partnership development, coordination at the state, regional, and national levels, and fundraising. This position will be located at the Reserve headquarters in Beaufort.

Northern Sites Research and Education Specialist

The Currituck Banks component offers many exciting research, stewardship, and education opportunities. The Northern Sites Manager is not able to fully take advantage of these opportunities without the creation of a Northern Sites Research and Education Specialist position in the Kitty Hawk office. Establishment of the Specialist position will allow for the reintroduction of SWMP water quality monitoring at the component and additional research, education and outreach activities. The remoteness of the component also presents a safety concern when the Northern Sites Manager is in the field alone and the two positions will support each other while in the field. The Northern Sites Research and Education Specialist's duties will draw from the Wilmington Research Specialist and Beaufort Education Specialist's duties, be supervised by the Northern Sites Manager, and work closely with the Research and Education Coordinators.

Rachel Carson Site Manager

The Rachel Carson component is currently managed by a part-time temporary staff person and education program staff when the site manager is not in the office. The temporary staff person is funded by salary savings created by staff vacancies; this is not a sustainable scenario by which to manage the Rachel Carson component. Limited financial resources have prohibited the creation and hiring of a full-time site manager. In the absence of a temporary staff person, it is unrealistic for the education staff to manage the education program and appropriately manage Rachel Carson with the level of oversight and continuity the component needs. Effective management of both the component and the education program requires the establishment of a full-time, permanent Rachel Carson Site Manager position. This position will emulate the Northern Sites Manager responsibilities and also assist with research, education and boat management activities at the site.

Southern Sites Manager

The Stewardship Coordinator is currently responsible for managing stewardship activities at all four components in conjunction with other stewardship staff and managing the daily activities of the two southern components, Masonboro Island and Zeke's Island. Given the complexity of the issues at the two southern components and the distance between all four components, it is necessary to create a Southern Sites Manager position. This will allow the Southern Sites Manager to focus on Masonboro and Zeke's Islands and the Stewardship Coordinator to focus on managing the activities at all of the components. This position will emulate the Northern Sites Manager duties and will be supervised by the Stewardship Coordinator. Once established, the Reserve Manager will explore opportunities for locating the Stewardship Coordinator in the Beaufort office so the position is more centrally located and in the same location as the other Reserve Coordinators.

Wilmington Education Specialist

Many educational opportunities exist at the Masonboro Island and Zeke's Island components managed from the Wilmington office. Education staff located at the Beaufort office are not able to fully take advantage of these opportunities because of the distance between the Beaufort and Wilmington offices and the workload of the small education staff. Additionally, Wilmington office staff already have full workloads and are not able to fully develop educational programming for the components. The Wilmington Education Specialist will fill this critical gap; duties will emulate the Beaufort Education Specialist and the position will conduct general public, K-12, and coastal decision-maker education programs relevant to the components under the supervision of the Education Coordinator. Expanding educational programming in the Wilmington area is important because it is the most densely-populated area of the coast and two of the four NCNERR components are located in this area.

Volunteer Coordinator

A Volunteer Coordinator is needed to manage the Reserve's volunteer program. The Volunteer Coordinator will: produce a volunteer needs assessment; write duty statements for each volunteer position or function; streamline the policies and procedures for recruiting, screening, and placing volunteers; determine volunteer recognition procedures and award scales; develop volunteer orientation and training programs, including a comprehensive docent training program; track and report volunteer hours; and recruit new volunteers through outreach to schools, non-profits, civic

organizations, and businesses near the Reserve components. This position will be located at the Reserve headquarters in Beaufort and will support volunteer activities at all four components.

E. NCNERR Administrative Objectives

NCNERR administration activities address the following Reserve objectives (Figure 1; Table 1):

- **Objective 5.1:** The NCNERR will strengthen its relationship with NOAA-ERD.
- **Objective 5.2:** The NCNERR will strengthen its relationship with DCM.
- **Objective 5.3:** The NCNERR will strengthen its relationship with UNCW and CCFHR.
- **Objective 5.4:** The NCNERR will assess use of the sites by various education, research, and commercial entities.
- **Objective 5.5:** The NCNERR will ensure its operating infrastructure is adequate to fulfill the program mission.
- **Objective 5.6:** The NCNERR will ensure its staff has the skills necessary to perform their jobs and are able to do so safely.
- **Objective 5.7:** The community will recognize the NCNERR and understand how the Reserve serves the citizens and visitors of North Carolina.
- **Objective 5.8:** The NCNERR needs will be more fully met by volunteers and volunteers will be trained in coastal issues.

F. Activities in Support of NCNERR Administrative Objectives

Administrative objectives are presented in bold, italic text with the objective number that refers to Figure 1 in parentheses. Objective activities are presented beneath each objective.

1. The NCNERR will strengthen its relationship with NOAA-ERD (5.1)

The NCNERR has maintained a healthy working relationship with NOAA-ERD since its designation. This relationship is mutually beneficial in that NOAA funds and guides the Reserve through the NOAA and NERRS strategic plans and system-wide programs and the Reserve implements NERRS policies as set by ERD, the NERRS managers, and the Strategic Committee while addressing state needs.

Maintain open communication with NOAA

NCNERR administration will work to maintain and strengthen this relationship by maintaining open and regular communication with ERD and the Office of Ocean and Coastal Resource

Management, keeping staff up-to-date on Reserve progress and relevant local and state issues, and gaining insight from the national perspective.

Submit grants and performance reports in a timely manner

To facilitate open communication, the NCNERR will submit its grants and performance reports in a timely manner to ERD.

Address evaluation recommendations

NCNERR grants, performance reports, and management documents will address evaluation recommendations.

Participate in national meetings, serve on workgroups, and provide leadership

NCNERR staff will continue to participate in national meetings, and will serve on and lead system-wide initiatives and workgroups, providing expertise and a North Carolina and southeast perspective. NCNERR staff will also collaborate with regional NERRs and partners to further NERRS and state coastal management goals.

2. The NCNERR will strengthen its relationship with DCM (5.2)

The NCNERR is uniquely partnered with the DCM in that both entities have similar missions to protect coastal resources through informed management. This relationship is mutually beneficial for the reasons articulated in section II, B, 2 of the Administrative Framework. The NCNERR and DCM partnership has evolved since the designation of the NCNERR and both parties are working together to form a model partnership to manage North Carolina's coastal resources. The September 2005 312 NCNERR Evaluation Findings recommended several ways to improve this relationship and this objective outlines ways the NCNERR will work to achieve such a partnership.

Maintain open communication with DCM

The NCNERR will work to maintain and strengthen this relationship by maintaining open and regular communication with DCM leadership and staff. This will be accomplished through regular, formal and informal communication with the Division director and assistant directors regarding NCNERR needs, initiatives, and issues and activities at the national NERRS level. The NCNERR will also work to build understanding about the NCNERR among DCM staff by working with regional staff and creating opportunities for staff to learn more about the Reserve and its components by participating in research, stewardship, and education projects and events. NCNERR will also inform DCM's Coastal Resources Advisory Council and Coastal Resources Commission about its activities and initiatives to allow further integration of Reserve staff into Division-level activities and issues.

Serve as a technical resource with expertise in education, research, and stewardship

The NCNERR has significant expertise in coastal education, research, and stewardship concepts and techniques. The NCNERR will serve as a technical resource in these arenas to support DCM, DENR, and other relevant state initiatives by advising, participating in, and leading relevant coastal management workgroups and projects. Examples include staff involvement in the DCM's Ocean Policy workgroup, the Coastal Resources Commission's Estuarine Shoreline Stabilization Biological workgroup, the Coastal Habitat Protection Plan's Strategic Habitat Areas and Submerged Aquatic Vegetation workgroups, and DENR's Environmental Education workgroup. The Education and Research Coordinators are developing Division-wide Education and Research Plans to identify common program elements and collaborative opportunities.

Collaborate with other DCM sections on mutually beneficial activities

The NCNERR possesses capabilities through its education, research, and stewardship programs to conduct site-based research and education on coastal management issues. Many of these issues are relevant to the Permitting and Enforcement and Policy and Planning sections within DCM. The NCNERR will conduct education, research, and stewardship projects that address priority issues based on DCM and NCNERR needs and NCNERR capabilities. Regular communication with DCM leadership regarding needs will facilitate this collaboration. Examples of cross-sectoral collaboration and integration include work with the Policy and Planning section to develop and host the Estuarine Shoreline Mapping Summit and with the Permitting and Enforcement section to develop and host workshops to inform marine contractors of changes in the regulatory program and to train Local Permit Officers. Additional collaborative opportunities exist including working more closely with the Planning and Policy's 309 Program Enhancement and Land Use Planning groups.

3. The NCNERR will strengthen its relationship with UNCW and CCFHR (5.3)

The NCNERR shares facility space with UNCW's Center for Marine Science and CCFHR's Beaufort laboratory. As such, it is important to maintain and strengthen its relationship with both entities to ensure adequate infrastructure and operations support.

Maintain open communication with UNCW and CCFHR administration

The NCNERR will work to maintain and strengthen its relationship with UNCW and CCFHR by maintaining open and regular communication with the administrations of both organizations. This will be accomplished through regular, formal and informal communication with UNCW's Center of Marine Science Director and CCFHR's Director. The NCNERR will also work to build understanding about the Reserve program among UNCW and CCFHR staff by working with facility staff and creating opportunities for staff to learn more about the Reserve and its components by participating in research, stewardship, and education projects and events.

Continue to work on UNCW and CCFHR facility Memoranda of Understanding

The NCNERR will continue to work on the UNCW and CCFHR facility Memoranda of Understanding. These documents will be reviewed and updated as necessary.

Participate in facility committees as necessary

Since NCNERR has office and laboratory space at both facilities, Reserve staff at each facility will participate in facility committees as necessary. The Beaufort staff participates in several CCFHR committees including: the Administration Team, Safety Committee, Occupant Emergency Plan Committee and the Emergency Management System Committee.

Collaborate with UNCW and CCFHR on mutually beneficial activities

The NCNERR possesses capabilities through its education, research, and stewardship programs to conduct site-based estuarine research and education. Where appropriate, NCNERR staff will collaborate with UNCW and CCFHR staff on activities that support the Reserve mission. See section II, B, 1 & 3 for examples.

4. The NCNERR will assess use of the components by various education, research, and commercial entities (5.4)

The NCNERR components are utilized by a variety of educational, research, and commercial groups to further the NCNERR mission as well as their own. Increased understanding by the NCNERR regarding the types of groups operating on the components and how they operate will enable the NCNERR to better manage the components, implement NCNERR programs, and allow for additional partnership opportunities with the current user groups.

Maintain the research permit system

The NCNERR will maintain the research permit system to track and report research that is conducted on the components by outside researchers. To make the permit process more efficient an online application will be developed.

Develop and implement a reservation and reporting system for educational and commercial users

The NCNERR will develop a reservation and reporting system for education and commercial users that is complementary to the research permit system. The reservation component of the system will support the Reserve in scheduling internal and external events to protect the components from over usage. The reporting system will gather information from commercial vendors on the number of visitors that utilize the site to inform NCNERR reporting and management. This system will be implemented in a phased approach with input from these users. This process will begin with voluntary reporting of Reserve usage by commercial vendors.

Develop and provide users with training and materials to support activities

The NCNERR will develop materials to support educational, research, and commercial users including informational materials regarding the NCNERR, the individual components and specific rules and appropriate use associated with each, and the reservation, reporting, and permitting systems. Trainings will also be developed for educational and commercial users and conducted on a regular basis to ensure that operators have the most up-to-date information regarding the components and their use. Evaluations of the trainings and materials will be built into the program as appropriate. The materials and trainings will be jointly developed by the education, research, and stewardship programs.

5. The NCNERR will ensure its operating infrastructure is adequate to fulfill its mission (5.5)

Maintain infrastructure and partner relations to ensure longevity

Existing facilities will be maintained in a manner that promotes and supports Reserve use for many years to come. The NCNERR will work with CCFHR and UNCW to provide and maintain appropriate administrative, education, and research space at the Beaufort and Wilmington offices, respectively.

Assess infrastructure needs on a regular basis

Facility needs will be assessed on a regular basis and the NCNERR will work with existing building partners and seek new partnerships, if needed, to address facilities needs.

Increase state monetary support of the NCNERR

To continue successful administration of the NCNERR, the NCNERR and DCM will work with DENR to increase state fiscal support for Reserve operations and DCM staff positions to reduce the heavy reliance on federal funds to operate and staff the Reserve. The limited state fiscal support of the NCNERR was recognized in the 2005 Evaluation findings for the NCNERR. Progress made thus far and future strategies are outlined in Appendix M.

Seek outside funding to help administer program

NCNERR staff will continue to seek external funding to support the education, research and stewardship missions of the Reserve. The Reserve has been successful in this endeavor to date. From 2006 until present, NCNERR has received in excess of $918,000 in competitive NOAA grant awards to support research, education, land acquisition and construction. These additional funds have allowed the Reserve to accomplish objectives that would otherwise not be achieved due to fiscal constraints.

6. The NCNERR will ensure its staff has the skills necessary to perform their jobs and are able to do so safely (5.6)

Safety concerns were identified in the September 2005 312 evaluation of the NCNERR. This management plan addresses those concerns and brings the NCNERR into compliance with the DENR safety program as well.

Provide and participate in training opportunities to enhance and expand staff skills

The Reserve will provide and staff will participate in training to enhance and expand their skills to ensure the NCNERR is equipped to fulfill its mission and address coastal management needs. Training opportunities will span a breadth of topics and may include attendance and presentation at professional conferences, appropriate use of hand tools, boating skills, supervisory training, contract administration, and grant writing. Reserve staff will receive training annually on hurricane preparedness and post-storm recovery.

Address staffing needs as resources allow

The staffing plan is contained within this chapter and articulates staff duties and staffing needs. Staffing needs will be evaluated based on program priorities, geographic coverage of programs, and available resources.

Ensure staff is equipped to perform jobs safely

Education, research and stewardship activities and the environment in which these activities are carried out demand adherence to a safety plan. The NCNERR safety plan is located in Appendix N. Staff will be appropriately trained in first aid and boat handling and have access to the equipment to perform their jobs in a safe manner.

Review safety and hurricane plans annually

The NCNERR safety plan (Appendix N) and DCM, UNCW, and CCFHR hurricane preparedness plans will be reviewed and updated annually as needed.

Participate in relevant safety committees

NCNERR staff will participate in DCM safety subcommittees representing the Reserve in the DENR safety initiative and in CCFHR safety committees as occupants of the CCFHR facility.

7. The community will recognize the NCNERR and understand how the Reserve serves the citizens and visitors of North Carolina (5.7)

This objective addresses the September 2005 312 Evaluation Findings recommendation to increase the NCNERR's visibility to improve programs and stature.

Develop and implement an external marketing and communications plan

In order for the NCNERR to successfully fulfill its mission, the community that the Reserve operates within and serves must recognize the NCNERR name, know where the components are, and understand how the NCNERR serves the citizens and visitors of North Carolina. Community members are defined as the residents of the 20 coastal counties, the coastal management community, coastal decision-makers, the State of North Carolina, the Coastal Resources Commission, NOAA, NCNERR visitors, and relevant non-profit organizations. To accomplish this, the NCNERR will develop and implement an external marketing and communications plan to address these goals and audiences. The plan will include activities geared towards these audiences such as publishing the newsletter and accomplishments report, marketing the new logo and Web site, organizing facility dedication and anniversary celebrations; relevant activities will include measures to evaluate performance. Sector-specific communication needs will also be identified to support program marketing and address sector challenges. The plan will also outline strategies for working with the DCM Public Information Officer and ERD's Communications Specialist to ensure appropriate engagement at both the state and federal levels.

Assess plan effectiveness at regular intervals

The marketing and communications plan will be reviewed at regular intervals (*e.g.*, every two years) using measures to evaluate the activities and strategies. Activities and strategies will be refined and the plan updated based on these evaluations.

8. The NCNERR needs will be more fully met by volunteers and volunteers will be trained in coastal issues (5.8)

Increase coordination with NCNERR non-profit organization, Carolina Estuarine Reserve Foundation (CERF)

The Reserve Manager serves as an ex-officio member on the CERF board to guide the direction of the non-profit group based on the activities and needs of the NCNERR, and to assist in implementing CERF's strategic plan. CERF updates are provided at the quarterly NCNERR staff meetings to keep the rest of the staff informed and Reserve updates are provided at quarterly CERF board meetings.

Conduct local advisory committee meetings

The Reserve Manager and stewardship staff will hold annual LAC meetings to solicit feedback and recommendations on site management, research, and education activities and policies at the components. Meetings will be held more frequently as need dictates. The Reserve Manager will evaluate the need for a Reserve-wide advisory committee to provide input and oversight of the entire NCNERR in addition to the local committees for each component.

III. EDUCATION PLAN

A. Education Program Overview

1. National Education Program

National Estuarine Research Reserves are federally designated to "enhance public awareness and understanding of estuarine areas, and provide suitable opportunities for public education and interpretation" (NERRS 2008). The National Estuarine Research Reserve System (NERRS) is one of only four programs within the National Oceanic and Atmospheric Administration (NOAA) in which education is federally mandated, and the NERRS provides a wide range of educational programs to fulfill that mandate.

The Reserve System provides a vehicle to increase understanding and awareness of estuarine systems and improve decision-making among key audiences to promote stewardship of the nation's coastal resources. Education and interpretation in the Reserves incorporates a range of programs and methodologies that are systematically tailored to key audiences around priority coastal resource issues and incorporate science-based content. Reserve staff members work with local communities and regional groups to address coastal resource management issues, such as non-point source pollution, habitat restoration and invasive species. Through integrated research and education programs, the Reserves help communities develop strategies to deal successfully with these coastal resource issues.

Formal and non-formal education and training programs in the NERRS target K-12 students, teachers, university and college students and faculty, as well as coastal decision-maker audiences such as environmental groups, professionals involved in coastal resource management, municipal and county zoning boards, planners, elected officials, landscapers, eco-tour operators and professional associations.

K-12 and professional development programs for teachers include the use of established coastal and estuarine science curricula aligned with state and national science education standards and frequently involves both on-site and in-school follow-up activities. Reserve education activities are guided by national plans that identify goals, priorities, and implementation strategies for these programs. Education and training programs, interpretive exhibits and community outreach programs integrate elements of NERRS science, research and monitoring activities and ensure a systematic, multi-faceted, and locally focused approach to fostering stewardship.

a. Reserve System Education Goals

The National Estuarine Research Reserve System's mission includes an emphasis on education, interpretation, and outreach. Education policy at the North Carolina National Estuarine Research Reserve is designed to fulfill the Reserve System goals as defined in the regulations (15 C.F.R Part 921(b)). Education goals include:

- Enhance public awareness and understanding of estuarine areas and provide suitable opportunities for public education and interpretation;

- Conduct and coordinate estuarine research within the system, gathering and making available information necessary for improved understanding and management of estuarine areas.

b. Reserve System Education Objectives

Education-related objectives in the Reserve System Strategic Plan 2005-2010 include:

1. People are aware of the ecological, economic, historical, and cultural importance of estuarine resources.
2. People understand how human choices and natural disturbances impact social, economic, and estuarine ecological systems.
3. People apply science-based information when making decisions that could impact coastal and estuarine resources.

c. Reserve System Coastal Training Program

The Coastal Training Program (CTP) provides up-to-date scientific information and skill-building opportunities to coastal decision-makers who are responsible for making decisions that affect coastal resources. Through this program, National Estuarine Research Reserves can ensure that coastal decision-makers have the knowledge and tools they need to address critical resource management issues of concern to local communities.

Coastal Training Programs offered by Reserves relate to coastal habitat conservation and restoration, biodiversity, water quality and sustainable resource management and integrate Reserve-based research, monitoring and stewardship activities. Programs target a range of audiences, such as land-use planners, elected officials, regulators, land developers, community groups, environmental non-profits, business and applied scientific groups. These training programs provide opportunities for professionals to network across disciplines, and develop new collaborative relationships to solve complex environmental problems. Additionally, the CTP provides a critical feedback loop to ensure that professional audiences inform local and regional science and research agendas. Programs are developed in a variety of formats ranging from seminars, hands-on skill training, participatory workshops, lectures, and technology demonstrations. Participants benefit from opportunities to share experiences and network in a multidisciplinary setting, often with a Reserve-based field activity.

Partnerships are important to the success of the program. Reserves work closely with State Coastal Programs, Sea Grant College extension and education staff, and a host of local partners in determining key coastal resource issues to address, as well as the identification of target audiences. Partnerships with local agencies and organizations are critical in the exchange and sharing of expertise and resources to deliver relevant and accessible training programs that meet the needs of specific groups.

The CTP requires a systematic program development process, involving periodic review of the Reserve niche in the training provider market, audience assessments, development of a three to five year program strategy, a marketing plan and the establishment of an advisory

group for guidance, program review and perspective in program development. The Coastal Training Program implements a performance monitoring system, wherein staff report data in operations progress reports according to a suite of performance indicators related to increases in participant understanding, applications of learning and enhanced networking with peers and experts to inform programs.

2. North Carolina NERR Education Plan Overview

The North Carolina National Estuarine Research Reserve (NCNERR) offers educational programs for K-12 school groups, the general public, special interest groups, teachers, and coastal decision-makers. Components of the education program include student curricula, field trips, adult lectures, teacher workshops, volunteer programs, summer camps, and a wide variety of printed media. All education, training, and outreach activities are designed to enhance public awareness of the importance of estuarine systems and provide opportunities for public education and interpretation. A critical aspect of these efforts is the linkage of education to science and stewardship. The overall aim of the education program is to translate scientific information into language that can be understood and applied by program audiences.

The NCNERR's education programs are developed and administered by the education staff located in Beaufort, in the central part of the North Carolina coast. These education programs are conducted in concert with other Reserve staff, including the Reserve Manager, research staff in Wilmington and Beaufort, and stewardship staff in Wilmington and Kitty Hawk. Partnerships with other organizations are an integral part of the Reserve's ability to educate a broader population along the 300 miles of North Carolina's coast. Partners include N.C. Sea Grant, Albemarle-Pamlico National Estuary Program, the N.C. Wildlife Resources Commission, Southeast Center for Ocean Sciences and Education Excellence, the N.C. Office of Environmental Education and various divisions within the N.C. Department of Environment and Natural Resources, to name a few. All education programs are administered in accordance with NERRS education goals and objectives as outlined in the NERRS Strategic Plan (Appendix B).

The NCNERR education program goal is to promote estuarine literacy by increasing humans understanding of natural estuarine systems, their connections to them, and the benefits derived from them. In order to accomplish this goal education programs will deliver information on N.C. coastal resources to formal and informal educators, and K-12 and college students to foster environmental stewardship and inform decision-making. In addition, Coastal Training Program activities will deliver science-based knowledge and skills appropriate to the needs of the target audiences and relevant to sustainable coastal management. The greater community, including the general public, visitors, and pre-school children, will also receive educational programming to meet the education program goal.

As the educational needs and services in the state changes, the Reserve's education program will adapt to meet those needs and fill identified gaps. Market analyses (MA) and needs assessments (NA) will be conducted on a regular basis and are an integral part of identifying target audience needs and planning future programs. In the past, site-based programs have been popular. Although the Reserve will continue to offer site-based programs, online training opportunities and web-based educational resources will also be made available. In addition, the Reserve

education program is focusing on engaging schools in the tri-county area instead of conducting programs in an opportunistic, ad-hoc manner. As resources become available education programs will be expanded to other areas of the coast.

a. K-12 Student Education Program

The K-12 student education program provides students with hands-on, inquiry-based learning opportunities where the content is focused on estuarine habitats, organisms or coastal issues. Field trips and field studies are held primarily at the Rachel Carson component. Teachers bring their classes to the Reserve for two-hour interpretive nature hikes. Education staff also offer hands-on learning activities such as seining for fish, conducting shore profiles, or testing water quality. The education program goal is to have students actively engaged in their learning experience and the best way to accomplish this is through hands-on opportunities. All Reserve K-12 education programs are aligned to the North Carolina Standard Course of Study and National Science Standards. National Ocean Literacy Essential Principles and Estuarine Principles and Concepts are also incorporated into all programs.

Students and teachers can also learn about estuaries by participating in the EstuaryLive Program, which is an interactive, web-based, field trip available nationwide. These live broadcasts are designed for classroom use and can be viewed by anyone. Participating Reserves host different sessions on a variety of estuarine topics. Pre- and post-session classroom activities enhance the live broadcast experience for both teachers and students.

For schools that cannot travel, the Reserve offers a variety of classroom-based programs that are led by Reserve education staff on estuarine-related topics. The Reserve also provides K-12 teachers with written, estuarine-based, curricular material for both classroom and field-based activities. In addition to the curriculum, the Reserve produces educational posters, activity books, Newspapers in Education inserts, Digital Video Discs (DVDs) and a variety of estuarine-based informational brochures. Web resources are also available and include basic estuarine information, curricula, videos, field guides, and archived EstuaryLive sessions.

b. Teacher Professional Development Program

The purpose of the teacher professional development program is to increase the number of teachers trained to teach students about estuaries and coastal ecosystems thus increasing estuarine literacy in both teachers and students. The Reserve accomplishes this through workshops and by providing supplementary curricular materials.

Teacher professional development workshops target formal and informal educators across the State as well as pre-service teachers. All educator workshops are based on curricula developed either locally by NCNERR educators or by the NERRS. All North Carolina teacher workshop participants are eligible to receive teaching certificate renewal credits and/or North Carolina Environmental Education Certification credits. A new national curriculum was recently developed for K-12 students and teachers as part of NERRS' K-12 Estuarine Education Program (KEEP). This curriculum, called Estuaries 101, teaches key

principles and concepts of estuarine ecology and illustrates how estuaries relate to other human and ecological systems, while teaching to national and state science standards. KEEP not only teaches students about coastal and estuarine processes, but it also develops and strengthens data literacy, critical thinking, team building, and problem solving skills in students of all ages. KEEP uses a multifaceted approach that is designed to provide teachers with appropriate estuarine-based lessons plans as well as hands-on field experiences for teachers and students within the Reserves.

Post-workshop evaluations are conducted for every workshop to ensure that the content and delivery are meeting participant needs. Many teacher professional development workshops are conducted in partnership with other organizations.

c. Community Education and Outreach Program

The community education and outreach program strives to increase public awareness of the goals and mission of the NCNERR and to enhance an understanding of estuarine systems and processes among the general public including pre-school children, local citizens, and visitors of coastal North Carolina. The intent of the outreach program is to increase estuarine literacy and foster environmental stewardship in citizens of all ages. Outreach activities include: public field trips; summer camps; workshops, seminars, science symposia on coastal topics; participation at environmental festivals and fairs; and production of educational materials.

Every summer the Reserve offers naturalist-led public field trips twice a week to the Rachel Carson Reserve. These outings are led by trained volunteers and/or education staff. Public nature hikes have also been offered at the Currituck Banks site in the summer as staff and resources allow. Public field trips are also offered on National Estuaries Day and during Take A Child Outside Week (late September).

In 2008, as part of the Outreach Program, the Reserve offered four different summer programs for children: Preschool Story time and Crafts (ages 3-5); Adventures in the Estuary summer camp (grades 1-3); Saltwater Science Camp (grades 5-6); and a Junior Naturalist Camp (grades 4-8). These programs were held in the Reserve's new facility in Beaufort with daily field trips to the Rachel Carson Reserve where the students conducted field investigations and learned from hands-on activities.

The Reserve has held several workshops, seminars and science symposia on coastal management issues and topics for the general public including Beach Nourishment, Coastal Birds, and Coastal Mammals. In addition, public presentations on a variety of topics are given year-round to an assortment of organizations including: Boys and Girls Clubs; Boy Scout Troops; church groups; garden clubs; science clubs; preschools; colleges and universities; and other interested parties.

To inform local citizens and visitors about the Reserve and estuarine habitats, informational brochures, posters, pamphlets, interpretive signs, DVDs and display boards have been developed. Web resources are also available and include basic estuarine information, curricula, and field guides.

d. Coastal Training Program

The North Carolina CTP's mission is to promote informed coastal decisions through science-based training for professionals. This is accomplished through assessments of audience needs as well as incorporating emerging science, technology, and policy into trainings. The CTP is successful in providing scientific data, practical training, and outreach materials on a variety of topics including grant writing, septic systems, stormwater management, alternative land use practices, and marina management. Positive impacts of CTP events include educating realtors on septic systems and stormwater management; helping coastal communities obtain grant funding to install stormwater control devices and purchase conservation easements; and helping state agencies disseminate information to those they regulate. Information is mainly delivered through workshops.

The CTP uses assessments and training evaluations to improve its ability to meet audience needs. The CTP undertakes periodic formal needs assessments to help the program provide current and targeted information to coastal decision-makers. Training evaluations shape future programs and provide the data for the NERRS CTP performance measures. Performance measures create a standardized reporting method for CTPs across the country and justify CTP funding to the federal government.

To strengthen the trainings offered throughout North Carolina's 20 coastal counties, the CTP works closely with Reserve staff and established partners (Appendix L). Reserve and Division of Coastal Management (DCM) staff and CTP partners provide technical expertise, including serving as workshop presenters, to help the CTP stay abreast of emerging science, technology, and policy. The CTP is responsible for drawing the attention of coastal decision-makers to these emerging issues and their implications for coastal management.

Workshop design is based on knowledge of education techniques that effectively engage adult audiences. Training events give participants the opportunity to network with others who are dealing with the same issues. These opportunities may breed new partnerships to solve coastal problems and identify barriers in implementing effective coastal management techniques and policies.

B. NCNERR Education Objectives

The NCNERR education activities address the following Reserve objectives (Figure 1; Table 1):

- **Objective 1.1:** Education programs will deliver information on N.C. coastal resources to formal and informal educators, and K-12 and college students to foster environmental stewardship and informed decision-making.

- **Objective 1.2:** The greater community, including the general public, visitors, and pre-school children, will receive educational programming.

- **Objective 1.3:** Coastal Training Program activities will deliver science-based knowledge and skills appropriate to the needs of target audiences and relevant to sustainable coastal management.

- **Objective 2.1:** NCNERR research products will be used by the coastal management community.

- **Objective 4.3:** Coastal systems and their value will be interpreted and access to the Reserve sites will be directed to representative habitats to reduce impacts on sensitive habitats.

- **Objective 5.4:** The NCNERR will assess use of the sites by various education, research and commercial entities.

- **Objective 5.7:** The community will recognize the NCNERR and understand how the Reserve serves the citizens and visitors of North Carolina.

- **Objective 5.8:** NCNERR needs will be more fully met by volunteers and volunteers will be trained in coastal issues.

C. Activities in Support of NCNERR Education Objectives

Education objectives are presented in bold, italic text with the objective number that refers to Figure 1 in parentheses. Objective activities are presented beneath each objective.

1. Education programs will deliver information on N.C. coastal resources to formal and informal educators, and K-12 and college students to foster environmental stewardship and decision-making (1.1)

Conduct Educator Workshops

As a way to foster estuarine literacy and stewardship, the Reserve's teacher professional development program will seek to increase the number of formal and informal educators as well as pre-service teachers that participate in Reserve workshops. As more teachers become estuarine literate they can impart their knowledge to their students and thus increase estuarine literacy in the State. Through expanded partnerships the Reserve will be able to conduct professional development educator workshops in other coastal regions (north and south) thus increasing the Reserve's programmatic impact. Education staff will develop workshop content, deliver programming, and increase educational resources through grant writing or partnership opportunities. Several teacher workshops will be offered targeting elementary, middle and high school teachers from the 20 coastal counties

The new national Estuaries 101 curriculum will be integrated into existing workshops and a new series of Teachers on the Estuary workshops will be developed that meet national NERRS education standards as well as the State of North Carolina's environmental education standards. Emerging coastal issues such as the environmental impact of population growth, the effect of

invasive species on natural areas, and the effect of sea level rise will be incorporated into teacher training workshops. All workshops will be evaluated to determine their effectiveness in communicating estuarine concepts and will be modified or refined to improve relevancy and better serve future participants.

Update Workshops and Curricula based on current techniques and needs

The NCNERR is currently updating its curricular activities which were originally developed in the early 1990s. Old activities have been updated in content and format and new activities are being written to address current coastal issues such as development pressures, coastal water quality, barrier island dynamics, and habitat conservation. Additionally, up-to-date educational methods that better address different learning styles, such as inquiry-based activities have been incorporated into the new curriculum. New technologies, including Global Positioning Systems/Geographic Information Systems and the NCNERR's System-wide Monitoring Program data are also being incorporated into new curricula. The Reserve's teacher workshops are also being redesigned to meet the new North Carolina Environmental Education Standards.

An education program market analysis and needs assessment will be conducted to identify gaps in curricula, topic areas, and programs to better serve the needs of the teachers in the State of North Carolina.

Provide Field Trip Experiences

The Reserve's K-12 student education program will continue to provide field trip and/or field study experiences for students. Reserve student field trips are ecology-based nature hikes that present basic estuarine information. Most field trips are conducted on the Rachel Carson site due to it close proximity to the education staff. Teachers are provided with pre- and post-field trip resources to supplement the outdoor experience. As staff and resources allow, the education program will work to increase field trip opportunities for student groups at the other Reserve components (Zeke's Island, Masonboro Island, and Currituck Banks). Emerging coastal issues including stormwater runoff, eutrophication, invasive species and sea level rise will be discussed with students when appropriate.

Incorporate Research and Monitoring Data into Programs

As the NERRS System-wide Monitoring Program develops more accessible online water quality data and the Integrated Ocean Observing System broadens their partnerships, the education program will incorporate these user-friendly data interfaces into student and teacher activities. In addition, the Estuaries 101 curriculum which utilizes SWMP data will be incorporated into teacher and student education programs.

The Education Coordinator is currently analyzing the Reserve's 13 years of SWMP and nutrient data to identify water quality trends and to observe how past events have affected local estuaries. Based on the data analysis new educational products will be developed for teachers, students, researchers, coastal decision-makers and the general public.

As current research results become available the education staff will work to translate, distill and incorporate the new research information about estuaries and watersheds into educational programs and products assisting in the implementation of goal 2.1.4. The education staff will focus on the overarching issues facing the North Carolina coast as outlined in section I, C, 4.

Conduct Local Outreach Efforts in Schools

The K-12 student education program will expand local outreach efforts in schools. These outreach efforts include conducting hands-on, inquiry-based activities in the classroom, giving classroom presentations on the Reserve and its habitats, and distributing estuarine curricula to teachers. This increased outreach effort will be marketed to teachers through workshops, seminars, personal communications, and the web. The education program will also focus on strengthening their relationship with the local school system by providing district-wide teacher professional development workshops, allowing the Reserve's classroom space to be used for in-service teacher training, and offering in-classroom experiences for local schools. In addition, the Reserve will work with individual teachers and students on research and senior projects and will partner with the local high school environmental club to help them fulfill their mission (*e.g.*, Earth Day fair, Clean Sweep, and trash clean-ups).

Design Field-based Site Management Projects

The education staff will seek to integrate field-based site management projects into student programs, in coordination with Reserve stewardship staff. Field-based projects provide students with hands-on experience in the field and a heightened sense of appreciation of estuarine resources, while enhancing site management of the NCNERR sites. Past projects included trash clean ups, invasive species management (*e.g.*, Tamarisk tree mapping and removal), bird and horse surveys, and osprey nest platform construction. These efforts are currently focused on the Rachel Carson site due to its proximity to the Reserve education staff, yet the Reserve hopes to expand these activities to the other Reserve components based on need and available staffing and funding.

Fine-tune Programs based on Evaluations

All education programs will periodically be examined to determine how effective they are at increasing participant knowledge of basic estuarine ecology and the major pressures on coastal habitats. Post field trip and workshop assessments will be given to teachers and students to help education staff create more effective learning experiences for students and to respond to teacher needs. The number of programs offered and the timing of these events will also routinely be evaluated to deliver the most effective programs possible. Performance measures, which the NERRS has begun to collect, will be applied to some programs, including field trips, to measure program impact. The State of North Carolina has also begun to collect annual performance measures which apply to all of the Reserve's education programs. Assessment tools are developed and analyzed in-house by the Education Coordinator.

Conduct Market Analysis and Needs Assessment

A market analysis (MA) and needs assessment (NA) of the education program will be conducted with the guidance of the Education Advisory Committee and will incorporate recommendations from the NERRS KEEP MA/NA workgroup. The market analysis will allow the Reserve to determine what other educational programs and teacher professional development opportunities exist in the state and how this program can complement existing programs or fill identified needs. The results from the needs assessment will allow the Reserve to develop relevant and effective education and training programs and marketable and useful educational products.

Determine Efficacy and Future of Local EstuaryLive Events

EstuaryLive has been a part of the NCNERR's K-12 student education program since the fall of 1998. Increasing production costs combined with reductions in budgets and staffing has led the Reserve to reevaluate the efficacy of the local EstuaryLive program. The local EstuaryLive program will be evaluated in the needs assessment and by the Education Advisory Committee.

2. The greater community, including the general public, visitors, and pre-school children will receive educational programming (1.2)

Conduct Public Educational Field Trips

Summer public field trips are a core component of the community education and outreach program. These field trips are currently conducted bi-weekly on the Rachel Carson component during the summer months. Increasing the number and types of field trips will further promote stewardship of North Carolina's estuaries, particularly as awareness of and demand for these types of trips increases. An additional public field trip was added in 2008 following the completion of the Rachel Carson boardwalk on Carrot Island. All summer field trips are offered in the mornings due to extremely high air temperatures in the afternoon hours. Two types of field trips are offered: 1) 2-hour nature hike across the western part of the Rachel Carson Reserve or 2) a 2-hour boat trip to the Rachel Carson boardwalk at the eastern end of the Reserve. The type of summer bi-weekly field trip offered depends on the tide. Nature hikes are dependent upon low tide whereas a boardwalk trip is tide independent.

Expansion of summer public field trips to Zeke's Island and Masonboro Island components in the Wilmington area and Currituck Banks on the Outer Banks are priorities for this program. To accomplish this expansion, the education staff will work closely with the Stewardship Coordinator and Northern Sites Manager to schedule and advertise trips, arrange transportation, and recruit volunteers or partners to lead these trips. Scheduling additional educational field trips for summer camps, day care centers, and visiting adult groups will also be a priority. These trips may be led by Reserve staff, trained volunteers, or partner organizations (*e.g.,* Ft. Fisher Aquarium, Carolina Ocean Studies, and Outer Banks Center for Wildlife Education) depending on the audience and focus of the trip.

Hold Summer Programs for Children

Summer estuarine ecology programs will be offered to pre-kindergarten through middle school-aged children at the new Reserve headquarters facility in Beaufort. Participants will have hands-on opportunities in the classroom and field. A small fee will be charged to cover program materials. These programs will be marketed through brochures distributed in the local area, advertisements in area visitor magazines, and the Reserve Web site.

In 2008 four different summer programs for children were offered: Preschool Story time and Crafts (ages 3-5); Adventures in the Estuary summer camp (grades 1-3); Saltwater Science Camp (grades 5-6); and a Junior Naturalist Camp (grades 4-8). As interest in these programs increases the number and size of the program offerings will be expanded.

Plan and Coordinate New Education Events in Response to Needs

The community education and outreach program will coordinate educational events to respond to emerging coastal issues and needs. Requests by groups will be fulfilled as time and staffing resources allow. These requests may include field trips in addition to the summer public trips, estuarine ecology programs, and presentations for visiting groups.

All-day science symposia for the general public will periodically be held on local coastal management issues such as stormwater runoff, eutrophication, invasive species and sea level rise. These symposia will be planned in collaboration with university scientists, relevant state agencies and partnering organizations.

Deliver Information on NCNERR Programs and Coastal Ecosystems

To inform local citizens and visitors about the Reserve and coastal habitats, informational brochures, posters, newsletters and displays will be produced and updated regularly. Reserve site brochures are in the process of being updated and will include a new design and format with specific information on site location, habitats, natural history, allowable visitor uses, and a trail map. All brochures will be updated as new information regarding estuarine ecosystems is discovered, as Reserve boundaries expand, or when contact information changes. New flyers will be developed as the NCNERR programs and activities evolve and expand. For example, flyers will be produced for summer public field trips and student summer camps. Bird lists, field guides, and trail brochures will also be updated as needed. Additional posters on estuarine habitats, plants, and animals will be developed as resources allow.

The North Carolina Reserve's Geographic Information System (GIS) program will be utilized by the community education and outreach program, as one of the goals of the GIS program is to improve community awareness of NCNERR through effective geographic products. Reserve GIS and education staff will work together to conceptualize geographic products to be incorporated in the Reserve informational brochures, posters, interpretive signs, curricular activities and displays. The GIS Specialist will prepare appropriate products based on the identified needs.

In addition to the outreach activities in the central part of the state, the NCNERR will continue to expand outreach activities to northern and southern Reserve sites with the help of the Northern Site Manager and Stewardship Coordinator as time and resources allow. These efforts will include coordinating displays at fairs and festivals, volunteer programs, public field trips, after school and summer activities for children and families, and presentations for civic organizations and visitor groups.

3. CTP activities will deliver science-based knowledge and skills appropriate to the needs of target audiences and relevant to sustainable coastal management (1.3)

Conduct Assessments of Information and Training Needs of Coastal Decision-Makers

CTP workshops are based on the following: training needs identified through informal needs assessments, training needs prioritized in the formal CTP needs assessment, and emerging issues identified through research at the Reserve and elsewhere. The CTP uses assessments and training evaluations to improve its ability to meet audience needs. The CTP undertakes periodic formal needs assessments to help the program provide current and targeted information to coastal decision-makers. Future needs assessments will focus on updating past needs assessments of land use planners and planning board members as well as targeting new audiences such as elected local government officials, DCM staff, N.C. Coastal Resources Commission and Coastal Resources Advisory Council members, and Local Permit Officers.

Coordinate Fundamental Trainings for Decision-Makers

The North Carolina CTP regularly offers trainings on grant writing, land use planning, septic systems, and stormwater management. These fundamental trainings are targeted at realtors, land use planning board members, and other decision-makers in need of basic information. Realtor trainings on septic systems and stormwater management are offered in partnership with the North Carolina Cooperative Extension and realtors receive four continuing education credits. Other training topics that are appropriate to offer regularly include barrier island and estuarine shoreline development. The CTP will work with partners, such as North Carolina Sea Grant and NOAA's Center for Coastal Fisheries and Habitat Research, to coordinate trainings on these topics.

Coordinate New Training Events in Response to Needs

Based on needs assessments and post-workshop evaluations, the CTP will coordinate several new trainings each year for coastal decision-makers. A needs assessment of municipality planning board members in Carteret County was completed in the spring of 2006. A workshop on stormwater and sustainable development was delivered in November 2006 and a workshop on barrier island development was delivered in June 2007 based on the survey results. Future trainings for this audience are being developed based on these data and the following topics were identified for future workshops: coastal area planning, coastal erosion, and beach restoration.

Additional workshops may arise from researchers that need to disseminate their results and from state agencies that need to educate staff and people whom they regulate. Post-workshop

evaluations always ask participants if there are other topics where training is needed and occasionally these answers provide new workshop ideas.

Use Coastal and Estuarine Science in Training and Support Materials

Every CTP activity aims to accurately communicate coastal and estuarine scientific information, coastal management research results, new ideas, practical tools, and solutions to coastal management problems. New trainings will be coordinated based on emerging coastal management issues, such as estuarine shoreline stabilization, stormwater runoff, water quality and sea level rise. Expert speakers, including researchers, resource managers, and policy makers, will be called upon to present the most up-to-date information at training events. Support materials will also be developed to inform coastal decision-makers of new coastal and estuarine research results.

Conduct Post-Workshop Evaluations and Fine-Tune Training Efforts

Post-workshop evaluations will be administered at every training event to determine the effectiveness of the workshop, if the participants intend to apply the knowledge they learned, and if the participants intend to apply diverse perspectives gained from the training in their work. These evaluations fine-tune training efforts by ensuring the CTP is meeting participant needs in an effective way. Workshop evaluations will also be used to report on performance measures established by the NERRS.

Training efforts will also be fine-tuned through workshop participant discussions. Often the questions asked by participants or their reactions to information provide valuable insight on training content and delivery. For example, at a past stormwater workshop for realtors (some of whom were developers), many participants voiced frustration over state regulations as obstacles in implementing low impact development. This discussion helped to refine this workshop as well as design a future stormwater management workshop for planning board members. The future stormwater management workshop will include a panel discussion of various state regulatory agencies to answer questions regarding low impact development implementation.

4. NCNERR research products will be used by the coastal management community (2.1)

Interpretation and Distribution of Research Results

The CTP will work with the North Carolina Reserve's research sector to interpret and distribute NCNERR research products to the coastal management community. This will be accomplished by coordinating training events and technical publications. In addition, education staff will assist in the translation, distillation and incorporation of complex science and research information into educational programs and products. The Education staff will focus on the overarching issues facing the North Carolina coast as outlined in the Introduction (section I, C, 4). The Education and Coastal Training Programs will also work with the Reserve's research sector and other area researchers to develop outreach activities for grant proposals.

5. Coastal systems and their value will be interpreted and access to the Reserves will be directed to representative habitats to reduce impacts on sensitive habitats (4.3)

Install structures and signage to provide public access and use

An increase in coastal population leads to an increase in the number of people using the Reserve properties. While most visitor use of the Reserves is benign, occasional misuse of the properties does occur. Stewardship staff will determine site-specific signage needs to educate the public about acceptable visitor uses. Once the signage needs are identified the Stewardship staff will work with the Education staff to design appropriate signs based on site-specific needs.

Develop Interpretive Signs for Public Access Areas

Reserve site signage is an important aspect of delivering information about and creating awareness of the North Carolina Reserve. Reserve GIS, education, and stewardship staff will work together to identify proper location, information, and maps to be included on signage. Education staff will then design the signs with assistance from other sectors.

6. The NCNERR will assess use of the sites by various education, research and commercial entities (5.4)

Develop and Implement a Reservation and Reporting System

The Education sector will work with the Stewardship Coordinator to develop and implement a reservation and reporting system to better assess site usage. Usage statistics will then be used to inform site management decisions.

Develop and Provide Users with Training and Materials

The Education sector will work with the Stewardship Coordinator to design and implement training materials to support educational and commercial uses of Reserve components. Individuals and organizations using Reserve components for these types of activities will receive training regarding: NCNERR and its mission, the ecosystems, communities and organisms of the specific site, appropriate use of the site, and the reservation and reporting system.

7. The community will recognize the NCNERR and understand how the Reserve serves the citizens and visitors of North Carolina (5.7)

Develop and implement an external marketing and communication plan

In order for the NCNERR to successfully fulfill its mission, the community that the Reserve operates within and serves must recognize the NCNERR name, know where the components are, and understand how the NCNERR serves the citizens and visitors of North Carolina. To accomplish this, the NCNERR will develop and implement an external marketing and communications plan to address these goals and audiences. The education staff will play an

integral role in the development and implementation of this plan. The plan will include activities geared towards these audiences such as publishing the newsletter and accomplishments report, marketing the new logo and Web site, organizing facility dedication and anniversary celebrations; relevant activities will include measures to evaluate performance. Sector-specific communication needs will also be identified to support program marketing and address sector challenges.

8. NCNERR needs will be more fully met by volunteers and volunteers will be trained in local issues (5.8)

Develop and Evaluate Volunteer Training Program

The Education sector will work with the Stewardship sector to design and implement a community volunteer program. These individuals will work with the Reserve, other partners, and within their communities to champion the protection of coastal resources. Volunteers are an excellent source of help and necessary given that site management, stewardship, education and research tasks require more resources than are available internally. Recruitment of volunteers is most easily done by drawing interested parties to the Reserve through a field trip or publicly announced volunteer workday.

The first task is to identify volunteer needs of the Reserve and volunteer interests (phase 1) and develop a Reserve-wide training program (phase 2), recognizing that one reason people volunteer is to gain more knowledge about the natural environment. This Reserve-wide training program will be similar to the training currently offered to Rachel Carson component volunteers, which prepares volunteers for leading summer field trips and includes plant and animal species identification. Training will be specific to the volunteer opportunity and will be conducted in concert with the other Reserve component volunteer efforts. The training effort will reward volunteers and in turn benefit the NCNERR with a more knowledgeable group of volunteers serving as community stewards. Additionally, a coordinated program will provide continuity across the Reserve sites. As part of this task, evaluations of training and volunteer programs will be conducted (phase 3). Doing so will foster a sense of volunteer inclusion and will provide valuable feedback. Evaluations will be done at the program level to include all sites.

Implement Volunteer Program at all NCNERR Sites

Given the time, energy and organization required for the volunteer project above, implementation of the volunteer program will proceed in phases as articulated above. The program will also require proper planning regarding volunteer recruiting, training, and recognition. Continued support is essential. Due to the lack of full-time volunteer support systems at the Reserve, it is important that a program-wide plan be put in place to help support volunteer programs at each site. A volunteer email list will be kept for each site. Volunteer forms that include contact information, skills, interests and availability will be used consistently across sites.

NCNERR staff will plan to ensure how continued support of volunteers will take place. Staff will also develop on-site volunteer opportunities. There will be both publicly announced volunteer

workdays and tasks where volunteers will be personally asked to participate based on skill level. Some examples of volunteer activities include leading field trips, conducting field studies, clearing trails, cleaning parking areas, etc. The Reserve will work with the Carolina Estuarine Reserve Foundation (CERF) to develop volunteer recruitment, retention, and recognition programs per CERF's strategic plan. All of these opportunities will allow volunteers to continue their efforts with NCNERR, meeting the fifth management goal of enhancing Reserve capacity through collaboration.

Increase On-Site Volunteer Opportunities

As programs and facilities expand, volunteers will have more opportunities to help with program needs, visitor needs, and administrative tasks. Expanding opportunities for the geographic range of Reserve volunteers will be an ongoing activity of this program. In addition to individual volunteers, the community education and outreach program will maintain current partnerships and seek to create new partnerships with environmental and service organizations to carry out Reserve-based projects.

D. Coordination and Partnerships

1. Coordination

a. NCNERR Components

To enhance the North Carolina Reserve's abilities through collaboration, the education staff seeks to foster communication and program consistency between Reserve sectors and sites to ensure cohesive and integrated Reserve education programs. The Reserve Manager will encourage this enhanced integration among NCNERR sectors through regular staff meetings and encouraging participation of other sector staff in education programs. Education staff will be notified of educational events undertaken by other sectors to offer help and guidance and to count the event's contact hours. Education staff will aid with the creation of display boards and the distribution of education and outreach materials. These activities will encourage the sectors to work together more efficiently as well as create a more integrated education program throughout North Carolina's 20 coastal counties.

b. National and Regional NERRs

The North Carolina Reserve's education programs are consistently reported to NOAA's Estuarine Reserves Division (ERD) through biannual progress reports and through performance monitoring data. Additionally, upcoming education programs are outlined in the annual NCNERR 315 grant application. The NERRS annual meeting and winter education sector meetings are attended by the appropriate education staff as funds allow. The Reserve's education staff regularly communicates with ERD's Education Coordinator and the Program Specialist who oversees the CTP to ensure the NCNERR education programs are consistent with national initiatives. Education staff also advertise program events on the NERRS education calendar. The North Carolina Reserve Education Coordinator serves on numerous

NERRS workgroup including the MA/NA workgroup, the EstuaryLive workgroup, and the Evaluation workgroup. The Education Coordinator is also the Education Sector representative on the NERRS Strategic Committee. The CTP Coordinator has served on the CTP Oversight Committee.

In 2004, the Southeast region education staff began meeting to coordinate education efforts among these Reserves. The Southeast region NERRs are North Carolina, North Inlet-Winyah Bay (SC), ACE Basin (SC), Sapelo Island (GA), and GTM (FL). In 2005, the regional CTP Coordinators collaborated on a series of three green building trainings for coastal decision-makers, held in North Carolina, South Carolina, and Georgia. In 2007, the regional meeting, held in Georgetown, South Carolina, expanded to include all sectors and in 2008 another all sector regional meeting was held in St. Augustine, Florida. In 2008 the regional CTP Coordinators held the Southeast Regional Diamondback Terrapin Workshop, which provided a forum for diamondback terrapin resource managers to discuss their successes and needs in managing this species. Also in 2008 the Education Coordinators from North Carolina and South Carolina met in Beaufort, N.C. to review, edit and exchange regionally-based K-12 curricular activities. The Southeast region will also be hosting an invasive species symposium for resource managers in 2009. This event, similar to the diamondback terrapin workshop, will bring together those managing aquatic and terrestrial flora and fauna in the Southeast region.

c. North Carolina Division of Coastal Management

Coordination with the North Carolina DCM includes incorporation of emerging coastal management issues in education programs, DCM staff help with education programs and site management, and support from the DCM Public Information Officer. DCM staff are routinely expert speakers at CTP events. DCM staff provide manpower for site management activities at all Reserve components, including Reserve trash clean-ups. DCM staff also develop concepts for CTP workshops, such as the Promoting Sustainable Communities Using Smart Growth Principles workshop series that addressed the DCM priority issue of cumulative and secondary impacts. The DCM Public Information Officer assists the education staff by advertising education programs and reviewing outreach publications on the NCNERR and North Carolina Coastal Reserve.

Many opportunities exist to educate the public about why and how coastal resources are regulated, and how the DCM accomplishes this through its programs. Addressing Division regulatory needs is a new focus for the Reserve education staff and reflects the importance and benefit of complementary regulatory and education programs. Several examples of how the Education staff are supporting the Division include:

- Developing a Division-wide education plan;
- Developing an estuarine shoreline stabilization education plan;
- Hosting workshops for marine contractors on permitting rules;
- Providing technical training to Local Permit Officers on wetland plants at Division Local Permit Officer workshops; and
- Serving as a consultant to the Division on education-related initiatives.

2. Partnerships

The audience, topical, and geographic diversity of the Reserve's education programs offers many opportunities for partnerships throughout coastal North Carolina. While many of the Reserve's partners help facilitate education programs, others routinely provide facilities for professional development educator workshops and CTP events. The use of these facilities is necessary due to the lack of NCNERR meeting space at the northern and southern locations.

Descriptions of representative education program partnerships follow, with a more detailed list in Appendix L.

a. K-12 Student Education Program

The K-12 student education program partners with a variety of organizations in a variety of ways. Some organizations, such as University of North Carolina-Chapel Hill (UNC-CH), Duke University, NOAA, N.C. Division of Marine Fisheries, and N.C. Division of Water Quality, provide scientific information and expertise that forms the basis of new curricular activities or student programs. Other organizations share resources and assist with the production of educational materials. Recently NCNERR partnered with the Albemarle-Pamlico National Estuary Program to produce a twelve-page Newspaper in Education insert on estuaries. One-hundred and eighty thousand copies of this document were distributed state-wide to K-12 students. North Carolina Sea Grant, North Carolina Wildlife Resources Commission, North Carolina Museum of Natural Science and the North Carolina Aquariums also enhance the Reserve's K-12 student education program through resource sharing.

Education staff hope to increase local K-12 partnership opportunities with the Carteret County Schools, the North Carolina Maritime Museum, Carolina Ocean Studies and Fort Macon State Park. Expansion of the K-12 student education program to other areas of the coast will require additional partnerships as the Reserve has no education staff in these locations. Current partnerships will also be examined to determine their effectiveness in providing programming, pooling resources, and reaching target audiences. Additional partnerships identified by the education sector needs assessment will be pursued.

b. Teacher Professional Development Program

It is imperative that the education program continue to seek partnership opportunities and creative collaborative solutions to extend the Reserve's programmatic impact despite fiscal challenges. Many of the Reserve's teacher professional development workshops are already conducted in partnership with other organizations including: the N.C. Wildlife Resources Commission; The Bald Head Island Conservancy; the Southeast Center for Ocean Sciences & Education Excellence; the Mid-Atlantic Marine Educators Association; Carteret County Schools; and the North Carolina Office of Environmental Education.

Potential partner organizations, such as the North Carolina Center for the Advancement of Teachers located in Ocracoke and Jockey's Ridge State Park in Nags Head, may also be able

to facilitate program collaboration and allow the Reserve's teacher education programs to reach more educators in the Outer Banks.

c. Community Education and Outreach Program

Partnerships with the North Carolina Seafood Festival and the Core Sound Waterfowl Museum have provided opportunities over the past several years to showcase the NCNERR at their annual festivals. In festival education tents, the Reserve has provided attendees with general Reserve information, educational activities, and opportunities to volunteer. Another important partnership for the community outreach and education program is with the National Charity League's mothers and daughters group in Carteret County. Mothers and daughters work as a team to conduct clean-ups on the Rachel Carson component, help staff booths at festivals, and assist with local parades.

Faculty at UNC-CH's Institute of Marine Sciences, Duke University and the Center for Coastal Fisheries and Habitat Research (CCFHR) have participated as scientific experts at numerous seminars and science symposiums held for the general public. Individuals from the Carteret County Shore Protection Office, Carteret Community College, DCM, Division of Marine Fisheries and the U.S. Army Corps of Engineers have also participated in public forums on coastal management issues.

Future partnerships may include those with local libraries as well as local 4-H, Girl Scout, and Boy Scout groups. Library children story times provide an opportunity for Reserve staff to deliver information on estuarine topics, while assisting libraries in providing programming. Libraries may also host displays on the Reserve for their customers, which may include brochures, volunteer opportunities, and upcoming events. Local 4-H, Girl Scout and Boy Scout groups and other civic organizations may assist the NCNERR with site-based service projects and other community activities, such as Reserve trash clean-ups and short-term research projects.

d. Coastal Training Program

Coastal Training Program partners consist mainly of organizations that help develop training programs and organizations whose staff serve as expert speakers at training events. The North Carolina Coastal Nonpoint Source Program has worked with the CTP over the years developing publications and workshops on microbial pollution. The North Carolina Cooperative Extension in Craven County has helped facilitate workshops on septic systems and stormwater management for realtors. Speakers from the following agencies have participated in a variety of workshops: Duke University Marine Laboratory, North Carolina Division of Water Quality, University of North Carolina-Wilmington (UNCW), and the City of Wilmington. The CTP is routinely a host for NOAA's Coastal Services Center trainings, including the Coastal Community Planning and Development training and GIS trainings.

Future program development may include sustainable development, barrier island and estuarine shoreline workshops with North Carolina Sea Grant and shoreline stabilization

workshops with CCFHR. The CTP will continue to strengthen its partnerships with various universities, state agencies, local governments, and business organizations to ensure that CTP events consistently deliver science-based information through regional experts.

IV. RESEARCH AND MONITORING PLAN

A. Research Program Overview

1. National Research Program

The Reserve System provides a mechanism for addressing scientific and technical aspects of coastal management problems through a comprehensive, interdisciplinary, and coordinated approach. Research and monitoring programs, including the development of baseline information, form the basis of this approach. Reserve research and monitoring activities are guided by the Reserve System research and monitoring plan (2006-2011) (Appendix O) which identifies goals, priorities, and implementation strategies. This approach, when used in combination with the education and outreach programs, will help ensure the availability of scientific information that has long-term, system-wide consistency and utility for managers and members of the public to use in protecting or improving natural processes in their estuaries. Research within the Reserves is designed to fulfill the Reserve System goals as defined in program regulations. These include:

- Address coastal management issues identified as significant through coordinated estuarine research within the System;
- Promote Federal, state, public and private use of one or more Reserves within the System when such entities conduct estuarine research; and
- Conduct and coordinate estuarine research within the System, gathering and making available information necessary for improved understanding and management of estuarine areas.

a. Reserve System Research Funding Priorities

To meet the Reserve System goals outlined above, federal regulations (15 Code of Federal Regulations Part 921.50 a) specify the purposes for which research funds are to be used:

- Support management-related research that will enhance scientific understanding of the Reserve ecosystem;
- Provide information needed by Reserve managers and coastal ecosystem policy-makers; and
- Improve public awareness and understanding of estuarine ecosystems and estuarine management issues.

The Reserve System has identified the following five priority research areas to complement the funding priorities outlined above:

1. Habitat and ecosystem processes
2. Anthropogenic influences on estuaries
3. Habitat conservation and restoration
4. Species management
5. Social science and economics

b. Reserve System Research Goals

The Reserve System research goals are embedded in Goal 2 of the Reserve System Strategic Plan 2005-2010, *'Increase the use of Reserve science and sites to address priority coastal management issues,'* and are outlined in the 2006-2011 Reserve System Research and Monitoring Plan (Appendix O). They include:

Goal 1: Biological, chemical, physical, and ecological conditions of Reserves are characterized and monitored to describe reference conditions and to quantify change.

Goal 2: Scientists conduct research at Reserves that is relevant to coastal management needs and increase basic understanding of estuarine processes.

Goal 3: Scientists, educators, and coastal managers have access to National Estuarine Research Reserve System (NERRS) datasets, science products and results.

Goal 4: The scientific, coastal management and education communities, as well as the general public, use data, products, tools, and techniques generated at the NERRS.

c. System-Wide Research Funding Opportunities

Currently, there are two Reserve system-wide efforts to fund estuarine research: the Graduate Research Fellowship (GRF) program and the National Coastal and Estuarine Research and Technology (NCERT) program. The GRF program supports students to produce high quality research in Reserves. The fellowship provides graduate students with funding for 1-3 years to conduct their research, as well as an opportunity to assist with the research and monitoring program at a Reserve. Projects must address coastal management issues identified as having regional or national significance; relate them to the Reserve System research focus areas; and be conducted at least partially within one or more designated Reserve sites. Proposals must focus on the following areas: 1) Eutrophication, effects of non-point source pollution and/or nutrient dynamics; 2) Habitat conservation and/or restoration; 3) Biodiversity and/or the effects of invasive species; 4) Mechanisms for sustaining resources within estuarine ecosystems; or 5) Economic, sociological, and/or anthropological research applicable to estuarine ecosystem management.

Students work with the Research Coordinator or Manager at the host Reserve to develop a plan to participate in the Reserve's research and/or monitoring program. Students are asked to provide up to 15 hours per week of research and/or monitoring assistance to the Reserve; this training may take place throughout the school year or may be concentrated during a specific season.

Secondly, research is funded through the National Coastal and Estuarine Research and Technology (NCERT) program. NCERT funds support collaborative research in the Research Reserves and transform the best available science into practical, innovative tools

that coastal managers can use to detect, prevent, and reverse the impacts of coastal pollution and habitat degradation. NCERT provides funding opportunities for site-based, hypothesis-driven research with broad-scale application. These projects are conducted both by Reserve staff as well as external researchers. Topics include global climate change, sea level rise, invasive species, and estuarine ecology to name just a few. These projects provide the baseline science needed to develop sound management decisions and quality educational material. This program links directly to North Carolina National Estuarine Research Reserve (NCNERR) Objective 2.1 by providing the opportunity to apply for funding for research in N.C. that will be used directly by the coastal management community.

d. System-wide Monitoring Program

It is the policy of the NCNERR to implement each component of the System-wide Monitoring Plan (SWMP) initiated by the Estuarine Reserves Division (ERD) in 1989, and as outlined in the Reserve System regulations and strategic plan:

- Component I: Environmental characterization, including studies necessary for inventory and comprehensive site descriptions;
- Component II: Site profile, to include a synthesis of data and information; and
- Component III: Implementation of the System-wide Monitoring Program.

The SWMP provides standardized data on national estuarine environmental trends while allowing the flexibility to assess coastal management issues of regional or local concern. The principal mission of the monitoring program is to develop quantitative measurements of short-term variability and long-term changes in the integrity and biodiversity of representative estuarine ecosystems and coastal watersheds for the purposes of contributing to effective coastal zone management. The program is designed to enhance the value and vision of the Reserves as a system of national references sites. The program also takes a phased approach and focuses on three different ecosystem characteristics.

1. Abiotic Variables: The monitoring program currently measures pH, conductivity, salinity, temperature, dissolved oxygen, turbidity, water level and atmospheric conditions. In addition, the program collects monthly nutrient and Chlorophyll *a* samples and monthly diel samples at one SWMP data logger station. Each Reserve uses a set of automated instruments and weather stations to collect these data for submission to a centralized data management office.

2. Biotic Variables: The Reserve System is focusing on monitoring biodiversity, habitat and population characteristics by monitoring organisms and habitats as funds are available.

3. Watershed and Land use Classifications: This component attempts to identify changes in coastal ecological conditions with the goal of tracking and evaluating changes in coastal habitats and watershed land use/cover. The main objective of this element is to examine the links between watershed land use activities and coastal habitat quality.

These data are compiled electronically at a central data management “hub”, the Centralized Data Management Office (CDMO) at the Belle W. Baruch Institute for Marine Biology and Coastal Research of the University of South Carolina. The CDMO provides additional

quality control for data and metadata and compiles and disseminates the data and summary statistics via the Web (http://cdmo.baruch.sc.edu) where researchers, coastal managers and educators readily access the information. The metadata meets the standards of the Federal Geographical Data Committee.

2. North Carolina NERR Research Plan Overview

These national programs provide an excellent framework for the research sector of the NCNERR. Yet, local issues and guidance are equally important. The NCNERR must be both nationally significant while at the same time maintaining local relevancy. To accomplish this, locally important issues are also utilized to guide the research sector of the NCNERR.

The NCNERR quantified the locally important issues through a market analysis and needs assessment. The Research and Monitoring program market analysis revealed that 94% of the 50 respondents (51% response rate) are familiar with the NCNERR; 49% of respondents are currently conducting research on Reserve sites or have in the past; and the highest ranked issues that these respondents are currently researching include fisheries, shellfish, coastal/watershed pollution, water quality, and stormwater issues. The needs assessment targeted local managers, scientists and citizens and asked them a series of questions designed to determine what scientific issues needed additional research. The needs assessment revealed that the highest ranked research topics that need more attention are water quality in relation to shellfish, impacts of development (*e.g.*, stormwater, shoreline stabilization, docks and piers, etc.), and effectiveness of beach stabilization methods. The results from this endeavor showed that research was needed in many areas. Additional sector guidance was derived from the research and monitoring needs identified by the Coastal Habitat Protection Plan (Appendix P). This document highlights the need for research in the following areas: strategic habitat areas, fish-habitat relationships, docks and marinas, estuarine erosion and shoreline stabilization, boating related impacts, beach nourishment, fishing gear impacts, managing non-native species, chemical effects, water supply, habitat status and trends, evaluating existing management measures, and comprehensive water quality monitoring.

All of these national and local needs were considered when developing the research objectives and activities outlined above and in Figure 1. The approach of combining national and local needs ensures the work conducted by NCNERR is broadly applicable while at the same time focused enough to assist local managers and policy makers in their endeavor to protect the coastal resources of North Carolina.

B. NCNERR Research Objectives

The NCNERR research activities address the following Reserve objectives (Figure 1):

- **Objective 1.1:** Education programs will deliver information on N.C. coastal resources to formal and informal educators, and K-12 and college students to foster environmental stewardship and informed decision-making.

- **Objective 2.1:** NCNERR research products will be used by the coastal management community.

- **Objective 2.2:** The NCNERR will enhance implementation of the System-Wide Monitoring Program.

- **Objective 3.1**: NCNERR habitat and watershed maps will inform management of the sites and improve understanding of watershed connections.

- **Objective 5.4**: The NCNERR will assess use of the sites by various education, research, and commercial entities.

C. Activities in Support of NCNERR Research Objectives

Research objectives are presented in bold, italic text with the objective number that refers to Figure 1 in parentheses. Objective activities are presented beneath each objective.

1. Education programs will deliver information on N.C. coastal resources to formal and informal educators, and K-12 and college students to foster environmental stewardship and informed decision-making (1.1)

Design field-based K-12 and college student site management projects with stewardship and research sectors

Research staff will work with education and stewardship staff to integrate field-based site management projects into K-12 student education programs. Field-based projects provide students with hands-on experience in the field and a heightened sense of appreciation of estuarine resources, while enhancing site management of the NCNERR sites. Projects may include trash clean ups, invasive species management (*e.g.,* Tamarisk tree mapping and removal), bird surveys, and osprey nest platform construction. Initially these efforts will take place on the Rachel Carson site, due to its proximity to the Reserve education staff, yet may expand to the other Reserve components pending success, need, and resources.

2. NCNERR research products are used by the coastal management community (2.1)

Develop research priorities with the coastal management community that address high priority coastal management issues

Research staff will continue to identify high priority coastal management science needs with the research and coastal management communities in North Carolina. To best accomplish this, a Division of Coastal Management (DCM) research and monitoring plan is under development that identifies high priority research topics. This plan is being developed through the coordinated efforts of NCNERR and the other sections of the DCM. This plan will be revisited every two years so that as the coastal management needs change, the focus of NCNERR's research efforts can change with them. An analogous education plan has been developed.

Conduct and promote site-based and watershed research that informs management of coastal ecosystems, including the Reserve sites

The NCNERR is perfectly suited to both generate and distribute the needed data upon which to base management decisions. The NCNERR contains undeveloped properties where natural processes occur with minimal anthropogenic impacts. Results from studies conducted at the Reserve components serve as reference sites providing baseline data representative of natural conditions. These can then be compared to those from developed areas of the same watershed allowing impacts to be quantified.

In addition to serving as reference sites, the Reserve properties are ideal locations for demonstration projects. The Reserves are very much in the public eye. This, combined with the capabilities of the education and outreach sector, provide an excellent opportunity to show alternatives to generally accepted coastal development and/or management practices. One such demonstration project will be constructed on the east end of the Rachel Carson Reserve which has been experiencing severe erosion. The Reserve will install an erosion control structure at this location as part of a larger project examining estuarine shoreline stabilization. This structure will demonstrate an alternative shoreline stabilization technique to the generally accepted practice of installing a vertical bulkhead. Another demonstration project in place at the Rachel Carson Reserve is the use of recycled building products in the construction of the public boardwalk.

The NCNERR conducts and facilitates original, high-quality research within the components and their associated watersheds as part of the national site research program. The NCNERR supports and recognizes the need for conducting the research program using a watershed management approach. This management approach is widely recognized as necessary for effective coastal management and is utilized by the National Oceanic and Atmospheric Administration (NOAA), U.S. Environmental Protection Agency, and Department of Environment and Natural Resources (DENR). The facilitated work is conducted by outside researchers from academic and other government and non-government agencies. This research focuses on understanding coastal processes, resulting in improved management of the coastal resources in North Carolina. The NCNERR facilitates research through various methods depending on project needs and internal resources. Activities successfully used to facilitate and promote external research projects include providing: access to the Reserve sites; staff time to assist with field sampling; expertise

to guide sample site selection and project design; and an excellent reference site for outside projects. The NCNERR education sector also helps facilitate research by providing an extremely valuable outreach component that many external researchers and institutions do not possess.

Research priorities will be addressed by the NCNERR as expertise and resources allow. External funding and partnership opportunities will be explored to enhance NCNERR capabilities. The research priorities will be communicated to the research community and potential GRFs (see below) through the NCNERR website, newsletter, and seminars. The NCNERR research priorities, current projects and results are also promoted through research staff members participating in local workgroups and advisory panels (see coordination and partnerships section below). This provides a direct link for NCNERR to influence North Carolina coastal policy.

Promote Graduate Research Fellowships

As part of the NERRS GRF program, two graduate student stipends are provided for work conducted within NCNERR. These stipends provide $20,000 per year and are renewable for up to three years. The current focus areas provided by NERRS for the GRF program are: eutrophication, effects of non-point source pollution and/or nutrient dynamics; habitat conservation and/or restoration; biodiversity and/or the effects of invasive species; mechanisms for sustaining resources within estuarine ecosystems; or economic, sociological, and/or anthropological research applicable to estuarine ecosystem management. All of these correlate directly with the overarching threats faced by the NCNERR properties and research priorities fit within these foci.

The NCNERR promotes and fosters this program through three main processes: advertising the funding opportunity, conducting the application review process, and by overseeing graduate students while funded by this fellowship. Advertising the funding opportunity is done by the Reserve through email postings to student list-serves, directed phone calls to Principal Investigators, and advertisement at regional scientific conferences. This effort is designed to increase the competition level for the fellowships by increasing the number of applicants. This should enhance the quality of work proposed and conducted within the NCNERR properties by fellowship recipients. This effort is already yielding successful results. Application rates over the past three years have increased from 1.5 applicants per opening to five applicants per opening. As part of the review process, the research sector forms review panels, secures and compiles all reviews, and ranks candidates for ERD. This activity helps to advertise the NCNERR in general by enhancing the Reserve's visibility to the various experts contacted across the country to participate in the review process. The Research Coordinator is also tasked with overseeing the graduate research fellows. The graduate students that receive the fellowship are required to work within the research and monitoring program of the Reserve. This provides an excellent opportunity for the Reserve to foster their research projects and assist in their training to become estuarine scientists. This program provides an ideal mechanism to address the overarching issues facing N.C. listed in section I, C, 4 and to educate and train graduate level students.

Collaborate with education sector to interpret and distribute research results

The research sector will work to ensure accurate and timely transfer of research results from all three aspects (site research, SWMP, and GRF**)** of the NCNERR research program to the education office assisting in the implementation of goals 1.1.4 and 1.3.4. The recently completed NCNERR site profile is an excellent example of this process. The site profile provides an overview of the NCNERR components and identifies important issues and knowledge gaps that need to be addressed in the future. This is an excellent tool that can be used by the education sector to inform their audiences. Research staff will work with education staff to incorporate high quality data, tools, techniques, and research results into education materials and programs, providing a direct link to the NCNERR customers. The Research and Education Coordinators are currently analyzing the Reserve's 13 years of SWMP and nutrient data to identify water quality trends and to observe how past events have affected local estuaries. Based on the data analysis new educational products will be developed for teachers, students, researchers, coastal decision-makers and the general public. Opportunities for distribution through the education program include incorporation of products into K-12 curricula, CTP technical bulletins, community outreach display boards, newsletters, and presentations at education sector workshops. The research sector will also work to publicize its products through annual reports, seminars, peer-reviewed journal publications, and presentations at conferences and coastal management meetings such as the Coastal Resources Commission meetings. NCNERR staff will encourage outside researchers conducting work on the components to disseminate results and products through these channels as well.

3. NCNERR will enhance implementation of the System-Wide Monitoring Program (2.2)

Monitor water quality at Rachel Carson, Masonboro Island and Zeke's Island

The four NERRS SWMP long-term water quality, Chlorophyll *a* and nutrient monitoring stations are located at the Masonboro Island and Zeke's Island components of the NCNERR. The NCNERR meteorological station is located on Masonboro Island. These sampling sites are maintained to fulfill the long-term monitoring of SWMP component I. These stations have been in place since 1994 and represent one of the best examples of long-term estuarine monitoring in North Carolina. Long-term monitoring is essential to evaluating slow, but continual changes in water quality typically associated with altered land use and eutrophication. Maintenance of these stations is paramount to continuing this valuable dataset. Given these important factors, these stations will be maintained above all else.

A partnership between the NCNERR and the National Park Service supports SWMP component I water quality monitoring at the Rachel Carson component. Through this partnership, codified with a Memorandum of Understanding, the Park Service provides the equipment and necessary consumables and NCNERR provides the manpower to maintain two water quality monitoring locations (Appendix J). One station is located at the Shackleford Banks portion of the Cape Lookout National Seashore and the other is located in the Middle Marsh portion of the Rachel Carson component. The data from these monitoring stations are being used by graduate students and faculty from local marine labs, the Park Service as part of their Inventory and Monitoring

Program, and the NCNERR for comparison with a similar dataset collected at the Middle Marsh site from 1997-2003.

Participate in regional ocean observing and NERRS Integrated Ocean Observing Systems efforts

Integrating the NCNERR SWMP component I into the Integrated Ocean Observing Systems (IOOS) backbone will provide NCNERR data in near real-time nationwide. To facilitate involvement, the research staff will participate in regional ocean observing activities and advertise the near real-time capabilities of the NCNERR to regional IOOS partners, federal and state agencies, and universities. Staff will also seek outside funding to equip additional sampling sites with telemetry hardware. This activity supports SWMP component I. Initial success in this activity has already been achieved. The SWMP station located in Zeke's Basin has been equipped with telemetry hardware via external funding through a partnership with the Carolina Regional Coastal Ocean Observing System. Discussions are currently occurring with this organization to equip an additional NCNERR water quality monitoring station with telemetry hardware at the Rachel Carson component. Providing the SWMP data in near real-time makes the data available to a wider audience. Results from the research needs assessment clearly showed respondents are interested in having the SWMP data telemetered (74% of respondents answered yes).

Evaluate equipping SWMP sondes with Chlorophyll a probes

Currently NCNERR quantifies Chlorophyll *a* once per month as part of the nutrient sampling program. Upgrading the sondes with Chlorophyll *a* probes would allow estimates of Chlorophyll *a* to be obtained every 15 minutes. The State of North Carolina, as well as many other research entities, use Chlorophyll *a* as an indicator of water quality. Having Chlorophyll *a* data every 15 minutes as opposed to once per month will greatly increase the quality and usefulness of the SWMP data. Additional end users of the SWMP data are expected as a result of this additional capacity. The main constraint on this activity is the cost of the Chlorophyll *a* probes. Partnership opportunities are one potential way to alleviate this constraint. Efforts will be made by the research staff to seek collaborators that may be willing to provide external funding to support this activity. This activity supports SWMP components I and II.

Explore reinstallation of SWMP water quality monitoring at the Currituck Banks component

Traditionally, research and monitoring efforts have been focused in the southern components (Masonboro and Zeke's Islands). However, water quality monitoring was recently expanded to the Rachel Carson component (September 2007) and it is desirable to have monitoring at the Currituck Banks component as well because each component is geographically disparate and has very different physical and biological environments. Conclusions reached based on the water quality data from Masonboro and Zeke's are unlikely to be applicable to the Rachel Carson and Currituck Banks components. The only way to assess the water quality at these components is to equip them with instrumentation. Results from the research needs assessment showed that three-quarters of the respondents fully supported this activity. Water quality data from all four Reserve

components will help NCNERR directly assess the threat to water quality associated with increased coastal populations.

Initial successes regarding this activity include a two-year externally funded study that supported SWMP component I monitoring within Currituck Banks from 2005 to October 2007. This effort helped expand the NCNERR research partners to include the United States Geological Survey (USGS), U.S. Army Corps of Engineers, N.C. Division of Water Resources, the University of North Carolina (UNC)- Coastal Studies Institute and Elizabeth City State University. Additionally, this project increased the number of individuals asking for data. Requests have come from the Albemarle-Pamlico National Estuary Program (APNEP) and from graduate students working on harmful algal blooms within Currituck Sound. Currently this instrumentation is not deployed but funding sources and partnerships to support redeployment are being sought.

Conduct additional components of SWMP as appropriate

The SWMP component I represents only one aspect of the required dataset envisioned by the NERRS. The component II or biomonitoring contains several components including: submerged aquatic vegetation (SAV) and emergent marsh spatial and temporal distribution; nekton biodiversity; phytoplankton abundance and community composition; and benthic infauna biodiversity. This activity supports SWMP component II monitoring within NCNERR. The goal of this component of SWMP is to understand how the biological components of the Reserve respond over short- and long-term cycles. Some of these are captured in Objective 3.1 below; however, others like the nekton, phytoplankton and benthic infauna portions are not. NCNERR does not have the capacity to accomplish all of these biomonitoring aspects. Thus, the research sector has focused efforts on the emergent marsh portion. Working with partners from the CCFHR in Beaufort, N.C. the Reserve has initiated marsh monitoring at four locations near the Rachel Carson Reserve. This effort, partially funded by NOAA's Restoration Center is examining how closely restored marshes mimic the function of natural marshes. This work will also allow NCNERR to track the ability of marshes within the Reserve properties to maintain themselves against the threat of sea level rise. Additional marsh monitoring is planned by the stewardship sector for the Wilmington area (see Stewardship Plan). This emergent marsh monitoring is the first step toward implementing this activity. The other portions of SWMP component II will be implemented as funding and staff resources allow. SWMP component III is the mapping of land use and cover in the Reserve properties and associated watersheds (described in section IV, C, 4 below).

Promote use of SWMP data by partners

The SWMP data are used by many outside entities. In response to the needs assessment question "what ways could you use NCNERR SWMP data or what ways have you used NCNERR SWMP data in the past?" there were a multitude of responses. Some of the uses respondents indicated include: assist graduate student thesis preparation; manage shellfish and recreational waters; classroom demonstrations; and preliminary data to support proposal development. Results from the market analysis and needs assessment clearly showed that the SWMP data was extremely

valuable and 77% of respondents desired that all North Carolina Coastal Reserve sites including the NCNERR sites be outfitted with SWMP component I monitoring equipment.

Clearly the SWMP data is being used by outside partners and the NCNERR will continue promote the use of this dataset. Some of the previous activities work toward this goal such as telemetering more sites, and adding additional data parameters. SWMP capabilities and available data are advertised when research staff gives seminars and has one on one conversations with colleagues. An ongoing effort between the research and education sectors to examine and analyze the NCNERR SWMP dataset for long-term trends will also help promote this dataset. This report when completed will be distributed to all of the Reserve's partners and available for download from the NCNERR website. In 2009 a new SWMP brochure will be developed that describes SWMP and the available dataset. This brochure will be available for download from the website and handed out at appropriate venues.

4. NCNERR habitat and watershed maps will improve understanding of ecosystem connections (3.1)

Map upland and emergent wetlands within NCNERR boundaries

The research and stewardship sectors will conduct a joint effort with the Geographic Information System (GIS) Specialist to map the four NCNERR components using the NERRS Habitat Classification scheme. Field surveys and digital image analyses will be conducted to delineate habitats for the Masonboro Island, Zeke's Island, Rachel Carson and Currituck Banks sites, based on NERRS classification protocols and methods developed by the NCNERR. Baseline habitat maps and aerial statistics have been produced for the four NCNERR sites. Methods and results are presented in the NCNERR Site Profile. The habitat classifications will be updated every five to ten years, dependent on availability of appropriate aerial imagery and staff priorities. The updates will be used to evaluate changes in habitat distribution and condition for the four NCNERR components. This activity directly supports SWMP components II and III.

Map SAV distribution and condition within NCNERR boundaries

The North Carolina Coastal Habitat Protection Plan (CHPP) recognizes SAV as one of the six habitats that supports coastal fisheries. Given the pristine nature of the components and staff expertise, the NCNERR is well situated to develop and test mapping protocols within its boundaries. The research and stewardship sectors and the GIS Specialist will collect existing information on SAV distribution within the NCNERR sites, collaborate with researchers and partners (*e.g.*, the North Carolina SAV Monitoring Committee and NERRS Biomonitoring workgroup) to identify appropriate techniques for monitoring SAV, and map distribution and condition within the NCNERR. Field surveys have been completed for the Rachel Carson and Masonboro Island components. Significant SAV beds were mapped and conditions documented at Rachel Carson in the summers of 2006 and 2007. No SAV was found at Masonboro Island in the summer of 2007. Similar field surveys will be conducted for Currituck Banks and Zeke's Island. Significant SAV beds that are identified at any of the NCNERR sites will be periodically re-surveyed for extent and condition. The potential will be investigated for designating existing NCNERR beds as sentinel SAV sites as part of a long-term SAV monitoring program, if

established for the State of North Carolina. This activity also directly supports the SWMP components II and III and is one of the priorities for the CHPP's research and monitoring needs (Appendix P).

Assess NCNERR watershed land cover and change

The GIS Specialist will analyze NOAA Coastal Change Analysis Program (C-CAP) land cover and change data, producing maps and areal statistics of land cover and change in NCNERR component watersheds. Land cover maps and statistics were derived from C-CAP data for the four watersheds from 1991, 1997 and the difference between the two dates. Methods and results are reported in the NCNERR Site Profile. This effort will be repeated and results compared to the existing Land Cover products as future C-CAP data sets become available. This effort will also endeavor to characterize the relationships between NCNERR habitat condition and watershed land cover. This activity supports SWMP component III and addresses the altered land use threat to the Reserve properties. Research staff will assist the GIS Specialist with this project and will interpret the Land Cover information for inclusion in education products.

5. NCNERR will assess use of the sites by various education, research and commercial entities (5.4)

Maintain the research permit system

The NCNERR requires all researchers using the Reserve properties to fill out a research permit. Full details regarding this permit can be found in Appendix Q - Research Policies. In short, the permit system tracks Reserve use by researchers. This tracking is used by NCNERR to inform the performance measures to both NOAA and DENR. It also helps maintain project integrity by preventing project conflicts (*e.g.*, trying to utilize the same sampling location), and conflicts with other Reserve users. This tracking has become even more important as the populations of the coastal counties have increased leading to increased Reserve use. Requiring a permit also provides the Reserve with an excellent opportunity to meet and interact with external researchers. It provides one more way to initiate new partnerships and advertise the capabilities of the Reserve.

The permit system is in the process of being updated. The permit application up to this point had to be filled out in hardcopy format. A new web-based electronic format is being piloted in an effort to increase compliance with this permit requirement. Another part of the permit process that needs improving is the success NCNERR has at getting final reports submitted. As part of the permit, any final reports and or manuscripts that result from the work need to be submitted to NCNERR. Often the Reserve does not receive these final reports. Efforts to improve upon this will be undertaken by the research sector. One option is to use the NCNERR website as a location for researchers to advertise their work and submit electronic versions of their final reports and manuscripts.

D. Coordination and Partnerships

1. Coordination

a. NCNERR Components

To enhance the NCNERR's abilities through collaboration, the research staff seeks to foster communication and program consistency between Reserve sectors and sites to ensure cohesive and integrated Reserve research programs. The Reserve Manager will foster this enhanced integration among NCNERR sectors through regular staff meetings and encouraging participation of other sector staff in research programs. The research sector will notify other Reserve staff of ongoing and upcoming research projects conducted internally and by external partners for potential dissemination through education programs and coordination with stewardship staff. These activities will encourage the sectors to work together more efficiently as well as create a more integrated research program throughout all components of the NCNERR.

b. National and Regional NERRs

The NCNERR research and monitoring programs are consistently reported to NOAA's ERD through biannual progress reports and through performance monitoring data. Additionally, upcoming research activities are outlined in the annual NCNERR 315 grant application. The NERRS annual meeting and winter research sector meetings are attended by the appropriate research staff. The NCNERR SWMP adheres to national data collection and reporting protocols. The NCNERR research staff will continue to serve on NERRS workgroups and attend Southeast Coastal Ocean Observations Regional Association (SECOORA) meetings. SECOORA is one of eleven Regional Associations comprising the coastal component of the IOOS. SECOORA is a 501(c)3 membership non-profit which designs, implements, operates, and improves the provision of data, information, and products for marine and estuarine systems deemed necessary for common uses according to sound scientific practice. SECOORA serves the needs of users with measurements, telemetry, data management and communications, data analysis and modeling, and data visualization and publishing.

c. North Carolina Division of Coastal Management

This management plan outlines increased opportunities for collaboration between DCM and the research sector. The NCNERR research staff participation on panels, such as the DCM Ocean Policy Workgroup, the APNEP indicators workgroup, and attendance at Coastal Resource Commission meetings, will promote interaction between research and DCM staff. This interaction is critical for the success of many of the tasks outlined in this research plan. The research sector will continue to promote Reserve research activities and capabilities within DCM and DENR. This understanding is vital to fulfilling NCNERR Objective 5.2 to strengthen its relationship with DCM.

2. Partnerships

The topical and geographic diversity of the research program offers opportunities for new and expansion of existing partnerships throughout coastal North Carolina. The facilities of the research program are largely met through existing infrastructure at the Reserve's offices and through partnerships with the UNC-Coastal Studies Institute and the UNC-CH Institute of Marine Sciences. Research collaborations with universities and state agencies enhance the topical coverage of the research program and promote the research platform of the NCNERR. Examples of such collaboration include the NCNERR and National Park Service agreement for water quality monitoring at Rachel Carson, and an atmospheric deposition monitoring program with the U.S. Fish and Wildlife Service, the UNC-CH Institute of Marine Sciences, and North Carolina State University. The September 2005 312 Evaluation Findings suggest enhancing research partnerships to capitalize on the diversity and strength of coastal North Carolina's research community. The examples provided throughout the plan demonstrate the progress made since the evaluation and the activities outlined in this chapter will facilitate this. A full listing of existing research NCNERR partnerships is located in Appendix L.

V. STEWARDSHIP PLAN

A. Stewardship Program Overview

Per its authorizing legislation, the Coastal Zone Management Act (CZMA), the 27 National Estuarine Research Reserves are to be managed to ensure that Reserve ecosystems continue to be available for long-term estuarine research, education, and interpretation. The North Carolina National Estuarine Research Reserve (NCNERR) is also directed by state law to maintain, protect, and preserve the designated components for National Estuarine Research Reserve System (NERRS) purposes, while providing public access and allowing compatible traditional uses consistent with primary Reserve objectives. Implementation of the stewardship plan maintains the NCNERR as a scientific and educational resource and information base, designated to foster more informed management of estuaries.

The overall goal of stewardship in the NCNERR is to protect or restore the natural integrity of each site and ensure a suitable environment for coastal research and education. The NCNERR stewardship plan provides a coordinated, proactive framework to address Reserve management responsibilities and federal/state obligations. This plan also constitutes the resource protection plan. Stewardship policies regarding recreation, off-road vehicle access, fishing and hunting, disposal of dredge material, habitat restoration, feral horses, and surveillance, enforcement and maintenance are located in Appendix R.

B. NCNERR Stewardship Objectives

The NCNERR stewardship activities address the following Reserve objectives (Figure 1; Table 1):

- **Objective 1.1**: Education programs will deliver information on N.C. coastal resources to formal and informal educators, and K-12 and college students to foster environmental stewardship and informed decision-making.

- **Objective 1.2**: The greater community, including the general public, visitors, and pre-school children, will receive educational programming.

- **Objective 2.1:** NCNERR research products will be used by the coastal management community.

- **Objective 3.1:** NCNERR habitat and watershed maps will inform management of the sites and improve understanding of watershed connections.

- **Objective 3.2:** Restored NCNERR habitats will provide improved water quality and ecological function.

- **Objective 4.1:** Effective Reserve site management will ensure a suitable environment for research and education.

- **Objective 4.3:** Coastal systems and their value will be interpreted and access to the Reserve sites will be directed to representative habitats to reduce impacts on sensitive habitats.

- **Objective 5.4:** The NCNERR will assess use of the sites by various education, research, and commercial entities.

- **Objective 5.8:** NCNERR needs will be more fully met by volunteers and volunteers will be trained in coastal issues.

Stewardship objectives are presented in bold, italic text with the objective number that refers to Figure 1 in parentheses. Objective activities are presented beneath each objective.

C. Public Access Activities in Support of NCNERR Stewardship Objectives

The goals of public access activities in the NCNERR are to provide access to and educate the public about estuarine systems. An informed public will understand the natural systems found in the NCNERR, the role human activities play in the integrity of these systems, and what relevancy the systems have to their lives. Increased public understanding can lead to increased participation in NCNERR volunteer programs, which can in turn lead to improved collaboration with other groups to which the NCNERR volunteers also belong and to the community at large. To accomplish the public access goals, the NCNERR will utilize several approaches. This section constitutes the public access plan.

1. Education programs will deliver information on N.C. coastal resources to formal and informal educators, and K-12 and college students to foster environmental stewardship and informed decision-making (1.1)

Provide student field trips and hands-on programs

The K-12 student education program provides student field trips to Reserve components, in coordination with site managers. The field trips are ecology-based tours that present basic estuarine concepts. These trips increase exposure of the NCNERR and provide hands-on opportunities for the participants to learn more about estuarine systems. Site managers support this endeavor by captaining the boat and leading the field trips when education staff are unavailable.

Design Field-based Site Management Projects

Stewardship staff will work with education staff to integrate field-based site management projects into K-12 student education programs. Field-based projects provide students with hands-on experience in the field and a heightened sense of appreciation of estuarine resources, while enhancing management of the NCNERR sites. Projects may include trash clean-ups, invasive species management (*e.g.,* Tamarisk tree mapping and removal), bird surveys, and osprey nest platform construction. Initially these efforts will take place on the Rachel Carson site, due to its

proximity to the Reserve education staff, yet may expand to the other Reserve components pending success, need, and resources.

2. The greater community, including the general public, visitors, and pre-school children, will receive educational programming (1.2)

Plan and coordinate public educational field trips

Summer public field trips are currently conducted bi-weekly on the Rachel Carson component during the summer months. The stewardship staff of the Reserve will work in concert with the education staff to expand these public field trips to the Reserve's southern and northern components when resources allow. Field trip manuals will be compiled for use by interns or volunteers assisting with these trips.

Site managers will also look for opportunities to offer occasional public educational programs. These may occur in conjunction with partner organizations or may be centered on a specific stewardship-related topic. Educational programs of this type will further support the goal of increasing public understanding of the NCNERR, its sites and its mission while requiring limited amounts of resources. Where possible, these programs will make use of trained volunteers.

3. Coastal systems and their value will be interpreted and access to the Reserve sites will be directed to representative habitats to reduce impacts on sensitive habitats (4.3)

Identify, designate and protect critical habitats on the Reserve sites

Using the results of the habitat mapping project (Objective 3.1), critical habitats will be identified and management objectives for each habitat type will be developed. These objectives will outline strategies for protection. Known threats such as overuse by visitors, feral and invasive species, and dredging will be addressed.

Install structures and signage to provide for public access and use while minimizing impacts

Using a science-based approach and data obtained from Reserve staff monitoring and external researchers, stewardship staff will provide public access to NCNERR sites. This effort will direct traditional visitor uses of the Reserve to areas that do not interfere in the Reserve's research and education activities and protect critical habitats.

Excessive visitor use can have a detrimental effect on Reserve ecosystems, particularly those that are fragile. Use of barriers, boardwalks and trails will guide visitor activities to those areas best able to withstand heavy use. Where necessary and allowable, site managers will install structures to provide for access and use while minimizing impacts. Examples of structures designed to minimize impacts include camping platforms, ramps, boardwalks, and designated trails. This effort will balance visitor needs and NCNERR habitat and program needs.

Signage is a critical component in guiding visitor use. The stewardship sector will identify opportunities to protect the resources of the Reserve through posting of signs and markers. All

Reserve sites will be properly marked with signage, including boundary markers and visitor use rule signs. Signs at each site will: provide guidance to visitors regarding the rules of and appropriate use of the sites; explain visitor impacts to the resources of the Reserve; identify the NCNERR and its mission; and provide site-specific information regarding protected habitats and species.

As site and seasonally appropriate, signs to designate critical habitats, including bird and turtle nesting areas and special plant areas will be posted. Reserve Geographic Information System (GIS), education, and stewardship staff will work together to identify proper locations for posting boundary signs and maps to be included on signage (*e.g.*, trails, access sites, etc.).

Develop interpretive signs for public access areas

Interpretive signs will be developed for public access areas where appropriate that educate visitors about the Reserve programs, estuarine concepts, local habitats, flora and fauna, proper use of the area, and management concerns. This will promote a better understanding of the resources and will result in better protection of the public access areas. Interpretive signs will be displayed and maintained on trails and boardwalks open to the public, such as the Currituck Banks boardwalk and the Rachel Carson boardwalk.

Develop use impact monitoring and establish minimum impact use policy

The NCNERR will establish a minimum impact visitor use policy. To date, visitors have very few restrictions on the sites. Site managers will identify the heaviest impacts caused by visitor use. Monitoring will take place as needed to quantify impacts and identify a use/impact threshold. These data will inform visitor use strategies for the sites as well as other public sites. If thresholds can be established, policies will be developed to reduce impacts to or below these thresholds. Policies will be developed in a coordinated fashion by stewardship staff, local advisory committees, and land management partners.

D. Resource Protection and Restoration Activities in Support of NCNERR Stewardship Objectives

1. NCNERR research products will be used by the coastal management community (2.1)

Conduct and promote site-based and watershed research that informs management of coastal ecosystems, including Reserve sites

Each Reserve component is a platform for coastal and estuarine research. The research needs assessment stressed the need for research in several areas, including shoreline dynamics, coastal dynamics, wetland restoration, invasive species, and benthic restoration. Working with the research sector, site managers will promote the use of the sites for research, especially in these and other key areas. Future studies on the NCNERR components as identified by the research sector may include understanding the impacts of sea level rise and exploring component historical ecology.

2. NCNERR habitat and watershed maps will inform management of the sites and improve understanding of watershed connections (3.1)

Map upland and emergent wetlands within NCNERR boundaries

The research and stewardship sectors will conduct a joint effort with the GIS Specialist to map the four NCNERR components using the NERRS Habitat Classification scheme. Field surveys and digital image analyses will be conducted to delineate habitats for the Masonboro Island, Zeke's Island, Rachel Carson and Currituck Banks sites, based on NERRS classification protocols and methods developed by the NCNERR. Baseline habitat maps and areal statistics have been produced for the 4 NCNERR sites. Methods and results are presented in the NCNERR Site Profile. The habitat classifications will be updated every 5 – 10 years, dependent on availability of appropriate aerial imagery and staff priorities. The updates will be used to evaluate changes in habitat distribution and condition for the four NCNERR components. This activity directly supports the System-wide Monitoring Program (SWMP) components II and III.

Map SAV distribution and condition within NCNERR boundaries

The North Carolina Coastal Habitat Protection Plan (CHPP) recognizes submerged aquatic vegetation (SAV) as one of the six habitats that supports coastal fisheries. Given the pristine nature of the components and staff expertise, the NCNERR is well situated to develop and test mapping protocols within its boundaries. The research, GIS, and stewardship sectors will collect existing information on submerged SAV distribution within the NCNERR sites, collaborate with researchers and partners (*e.g.*, the North Carolina SAV Monitoring Committee and NERRS Biomonitoring workgroup) to identify appropriate techniques for monitoring SAV, and map distribution and condition within the NCNERR. Field surveys have been completed for the Rachel Carson and Masonboro Island components. Significant SAV beds were mapped and conditions documented at Rachel Carson in the summers of 2006 and 2007. No SAV was found at Masonboro Island in the summer of 2007. Similar field surveys will be conducted for Currituck Banks and Zeke's Island. Significant SAV beds that are identified at any of the NCNERR sites will be periodically re-surveyed for extent and condition. The potential will be investigated for designating existing NCNERR beds as sentinel SAV sites as part of a long-term SAV monitoring program, if established for the State of North Carolina. This activity directly supports SWMP components II and III and also is one of the priorities for the CHPP's research and monitoring needs (Appendix P).

3. Restored NCNERR habitats will provide improved water quality and ecological function (3.2)

Identify habitats for restoration

This activity will identify benthic and wetland habitats in need of restoration within the Reserve. Habitat maps and other relevant data will be used to identify these areas. Potential areas requiring restoration include those impacted by invasive species, rising sea levels, and shoreline erosion.

Develop and implement science-based restoration plans

Following the delineation of areas suitable for restoration, the NCNERR will develop science-based restoration plans in collaboration with partners and other sectors. These plans will be completed in accordance with federal regulation 921.13. This effort will entail working with the NERRS Restoration Science Workgroup and state partners to determine the best approach for restoration. The intermediary product will be the development of specific restoration plans that will then be used to seek funding for restoration activities. These restoration plans will be used to mitigate deleterious impacts caused by increased coastal population, eutrophication, and invasive species.

4. Effective Reserve site management will ensure a suitable environment for research and education (4.1)

Evaluate existing policies and rules and update accordingly

The sites in the NCNERR are protected for research and education. Traditional uses are allowed as long as they do not interfere with these goals. Gaps in policies, rules and enforcement will be identified through systematic review of applicable state, county, and local ordinances. Clear procedures and actions will be developed utilizing the results of this review, as well as site manager experience and program, division, and departmental authority. Stewardship policies will be reviewed at annual local advisory committee meetings. If deemed necessary for protection of the NCNERR, changes or additions to existing policies and rules will be pursued.

Coordinate with enforcement agencies to ensure protection of Reserve sites using policies and rules

Enforcement of rules and policies is conducted through partnerships with municipalities and enforcement agencies. Regular communication with, and coordination between, the agencies will be used to ensure that enforcement gaps are identified and addressed. Gaps in enforcement will be addressed through Memoranda of Understanding (MOUs) with other agencies. Protection does not always require law enforcement action, but an ability to address negative impacts from a variety of agents is necessary, given the geographic range and diverse nature of the Reserve components. Through these agreements the NCNERR will effectively manage the Reserves against the threat of overuse or misuse associated with the increased coastal population.

Monitor condition of sites regularly

To adequately address protection of the NCNERR, the site managers will monitor each site on a regular basis as deemed appropriate based on season and use. Each site has a characteristic suite of communities and species, as well as a unique list of traditional uses and local threats associated with it, requiring that the monitoring schedule and protocols be site-specific. Monitoring may include assessment of any or all of the following: invasive species presence and condition, endangered species presence and condition, visitor use impacts, habitat change as a result of natural or anthropogenic disturbance, and condition of Reserve-owned equipment and structures. All of these monitoring activities will assist in maintaining the Reserves for use by researchers and educators against all of the threats listed in section I, C, 4.

Manage invasive species and feral animals

The NCNERR is host to both invasive plants and animals. Some of these may have the ability to affect ecological functions in the Reserve. To address these possible changes, invasive plant identification and removal efforts are continuous. Invasive plants will be identified within the habitat mapping effort and areas needing restoration will be prioritized.

Problems with invasive and feral animals vary by scale. Nutria are a coastal problem. Feral hogs and non-native red foxes constitute regional problems. Feral horses are a site problem. Each of these species presents challenges for removal from the Reserve components. Eliminating nutria would require a statewide effort. Likewise, removing feral hogs from Currituck Banks would require regional coordination. Eliminating red foxes from the Masonboro Island and Zeke's Island components would likely be ineffective without an ongoing regional effort. Eliminating feral horses from Reserve components is currently not an option due to citizen interest in maintaining their presence on the sites they inhabit. Consequently, ongoing efforts will focus on minimizing impacts to the sites by these animals, including developing and implementing management plans for the invasive and feral animal species at each component.

5. The NCNERR will assess use of the components by various education, research, and commercial entities (5.4)

Develop and implement a reservation and reporting system for educational and commercial users

The stewardship sector will work with the education sector to develop and implement a reservation and reporting system to better assess site usage. Usage statistics will then be used to inform site management decisions.

Develop and provide users with training and materials to support activities

The stewardship sector will work with the education sector to design and implement training and materials to support educational and commercial uses of Reserve components. Individuals and organizations using Reserve components for these types of activities will receive training

regarding: the NCNERR and its mission, the ecosystems, communities and organisms of the specific site, appropriate use of the site, and the reservation and reporting system.

6. NCNERR needs will be more fully met by volunteers and volunteers will be trained in coastal issues (5.8)

Develop, implement and evaluate a volunteer training program based on stewardship, education, and research needs and volunteer interests

The stewardship sector will work with the education sector to design and implement a community volunteer program. These individuals will work with the Reserve, other partners, and within their communities to champion the protection of coastal resources. Volunteers are an excellent source of help and necessary given that site management, stewardship, education and research tasks require more resources than are available internally. Recruitment of volunteers is most easily done by drawing interested parties to the Reserve through a field trip or publicly announced volunteer workday.

The first task is to identify volunteer needs of the Reserve and volunteer interests (phase 1) and develop a Reserve-wide training program (phase 2), recognizing that one reason people volunteer is to gain more knowledge about the natural environment. This Reserve-wide training program will be similar to the training currently offered to Rachel Carson component volunteers, which prepares volunteers for leading summer field trips and includes plant and animal species identification. Training will be specific to the volunteer opportunity and will be conducted in concert with the other Reserve component volunteer efforts. The training effort will reward volunteers and in turn benefit the NCNERR with a more knowledgeable group of volunteers serving as community stewards. Additionally, a coordinated program will provide continuity across the Reserve sites. As part of this task, evaluations of training and volunteer programs will be conducted (phase 3). Doing so will foster a sense of volunteer inclusion and will provide valuable feedback. Evaluations will be done at the program level to include all sites.

Implementation of the volunteer program will proceed in phases articulated above. The program will also require proper planning regarding volunteer recruiting, training, and recognition. A program-wide plan will support volunteer programs at each site, including volunteer forms that include contact information, skills, interests and availability. Specific volunteer job descriptions and required levels of time commitment will help make the volunteer program more effective for the NCNERR and rewarding for the volunteers. To facilitate regular communication, a volunteer email list will be kept for each site.

The Reserve will work with the Carolina Estuarine Reserve Foundation (CERF) to develop volunteer recruitment, retention, and recognition programs per CERF's strategic plan. These opportunities will support volunteers and their efforts with the NCNERR.

Increase on-site volunteer opportunities

Reserve staff from all sectors will work to develop on-site volunteer opportunities. Activities will include publicly announced volunteer workdays and support of specific stewardship and research tasks. Some specific examples of volunteer activities include leading field trips, conducting field studies, clearing and maintaining trails, cleaning parking areas, surveying for invasive species, and assisting with public education events.

Conduct local advisory committee meetings

The Reserve Manager and site managers will hold annual Local Advisory Committee meetings to solicit feedback and recommendations on site management, research, and education activities and policies at the components. Meetings will be held more frequently as need dictates.

E. Coordination and Partnerships

1. Coordination

a. NCNERR Components

Site managers will provide regular email updates to the Stewardship Coordinator and Reserve Manager. This communication will specifically focus on site management issues in order to create an ongoing record of issues and how they are addressed. Site managers and the Stewardship Coordinator will meet to discuss issues and solutions. This will lead to the development of management policies and procedures.

Site managers will consult with education and research staff regarding these activities at their sites. Site managers will seek assistance from education staff in developing and implementing education events and notify the Education Coordinator of outreach and education events conducted in the components under his or her supervision. These notifications will include the number of participants at the events. Site managers will also work with the Research Coordinator regarding plans for research and restoration activities at each site.

b. National and Regional NERRs

The NCNERR stewardship program is consistently reported to the National Oceanic and Atmospheric Administration's Estuarine Reserves Division through biannual progress reports. Additionally, upcoming stewardship activities are outlined in the annual NCNERR 315 grant application. The NERRS annual meeting and winter sector meeting are attended by the appropriate stewardship staff.

c. North Carolina Division of Coastal Management

Specific collaborations within the Division center on acquisition and site management guidance. Examples of current and potential collaborative projects include researching the legalities of property ownership for potential acquisitions and visitor use liability issues, revising policies regarding dredging material deposition methodology, and increasing internal understanding of DCM sections through stewardship presentations.

2. Partnerships

The NCNERR maintains ongoing partnerships with numerous educational, government, and private entities. These partnerships allow for greater community recognition of the NCNERR and its goals. The NCNERR continues to benefit from established partnerships and is continuously seeking additional partnership opportunities. Site managers will assist the Reserve Manager in identifying organizations and finding commonalities between the NCNERR programs and those of potential partners.

Because the NCNERR does not have the resources to offer extensive educational programming at each site, it is in the best interest of NCNERR to target education and outreach efforts to non-profit (*e.g.,* aquariums, museums) and commercial providers of these types of programs. Offering training and informational brochures to these entities will ensure that the NCNERR message is accurate and reaches the widest audience.

The NCNERR will continue working with partners, including CERF, N.C. Big Sweep and the Mother/Daughter Charity League to facilitate Reserve-wide clean-up efforts. The N.C. Big Sweep and other events of this sort can be used as a way to promote the NCNERR mission and programs.

Some NCNERR partners currently work under MOUs with the Reserve (Appendix J). MOUs help promote enforcement of Reserve policies and facilitate research and education. Site managers will facilitate updates or development of MOUs with relevant partners.

One of the primary benefits of the Reserve is that it serves as a natural comparison to surrounding development. As such, the Reserve can provide a platform to address current community-based environmental concerns such as stormwater runoff and water quality. Site managers will work with organizations and communities to share knowledge of the natural coastal systems as a way for citizens to understand current local environmental problems.

The needs assessment conducted by NCNERR identified coastal issues of highest concern and areas that need more attention, including brackish wetlands, freshwater coastal wetlands, non-point source pollution, invasive species, benthic habitats and conservation ownership. Additional key issues can be identified in collaboration with partners such as DCM and others in the coastal management community. Site managers will strengthen partnerships that exist and seek new partnerships with others in order to address the identified key issues.

Additional partnerships are described in the Activities section above. For a full listing of existing NCNERR partnerships, see Appendix L.

VI. LAND ACQUISITION AND BOUNDARY EXPANSION PLAN

A. NCNERR Land Acquisition and Boundary Expansion Objectives

- **Objective 4.2:** Boundary expansion and acquisition will be completed to effectively protect Reserve core and buffer areas.

B. Activities in Support of NCNERR Land Acquisition Objectives

Land acquisition and boundary expansion objectives are presented in bold, italic text with the objective number that refers to Figure 1 in parentheses. Objective activities are presented beneath each objective.

1. Boundary expansion and acquisition will be completed to effectively protect Reserve core and buffer areas (4.2)

Complete legal and geographic data collection and review for Reserve sites

The North Carolina National Estuarine Research Reserve (NCNERR) will complete its review of legal and geographic information for all properties within the Reserve. A full set of deeds and easements will be compiled for each site. County Tax, State Property Office, and Reserve records will be evaluated for accuracy and consistency. Properties surrounding the sites will be evaluated as appropriate to help better protect the habitats within the NCNERR.

Take steps to obtain properties or solidify relationships with neighbors and inholding property owners

The Reserve recently purchased the largest of 13 remaining privately owned properties on Masonboro Island in New Hanover County. Acquisition of this tract added 23.3 acres to the Masonboro Island component of the NCNERR in 2008. Funding for the preservation effort came from the National Oceanic and Atmospheric Administration's National Estuarine Research Reserve System. The only remaining acquisitions within the four components are the 12 properties totally approximately 17 acres on Masonboro Island proper plus any adjacent spoil areas in private ownership. Inclusion of these parcels in the NCNERR will eliminate the threat of development on the island, thereby keeping the ecosystem intact for research and education. No change in current management is anticipated as a result of the acquisitions.

Past discussions with the owners of these remaining properties have indicated that donation of the properties is unlikely. Condemnation is a legal option, but is unpopular with the public and requires that the property owner be paid fair market value. At this time, the approach to further acquisition is to continue contact with individual landowners, both directly and through conservation partners, to pursue potential donation or sale of property or property rights to the NCNERR. This effort is supported by the North Carolina Coastal Land Trust, which absorbed the former Society for Masonboro Island and continues to assist in acquisition efforts through annual landowner contacts.

Expand boundaries to parcels that meet National Estuarine Research Reserve System definitions for core and buffer areas as appropriate

The four land and water areas comprising the NCNERR represent the most tangible and enduring aspects of the program. Permanently preserved, undisturbed examples of various estuarine types are crucial to the underlying concept of the Reserve. Thus, a well-conceived acquisition and boundary plan is essential to ensure proper environmental protection and to anticipate user demands and potential impacts from surrounding activities.

Opportunities to expand current component boundaries to incorporate additional acreage and resources may occur and will be pursued as possible. The Zeke's Island component could be expanded to incorporate the Smith Island marshes and connect the component to the Bald Head Woods Coastal Reserve; the Rachel Carson component could be expanded to include the North River Marshes or Sand Dollar Island. Each of these potential expansions has benefits and challenges. Site managers and the Reserve Manager will continue to explore which options may be of most benefit to the NCNERR.

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APPENDICES

APPENDIX A: FEDERAL RESEARCH RESERVE REGULATIONS

Code of Federal Regulations

Title 15, Volume 3, Revised as of January 1, 2003
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TITLE 15--COMMERCE AND FOREIGN TRADE

CHAPTER IX--NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, DEPARTMENT OF COMMERCE

PART 921--NATIONAL ESTUARINE RESEARCH RESERVE SYSTEM REGULATIONS

Subpart A--General
921.1 Mission, goals and general provisions.
921.2 Definitions.
921.3 National Estuarine Research Reserve System Biogeographic Classification Scheme and Estuarine Typologies.
921.4 Relationship to other provisions of the Coastal Zone Management Act and the Marine Protection, Research and Sanctuaries Act.

Subpart B--Site Selection, Post Site Selection and Management Plan Development
921.10 General.
921.11 Site selection and feasibility.
921.12 Post site selection.
921.13 Management plan and environmental impact statement development.

Subpart C--Acquisition, Development and Preparation of the Final Management Plan
921.20 General.
921.21 Initial acquisition and development awards.

Subpart D--Reserve Designation and Subsequent Operation
921.30 Designation of National Estuarine Research Reserves.
921.31 Supplemental acquisition and development awards.
921.32 Operation and management: Implementation of the management plan.
921.33 Boundary changes, amendments to the management plan, and addition of multiple-site components.

Subpart E--Ongoing Oversight, Performance Evaluation and Withdrawal of Designation
921.40 Ongoing oversight and evaluations of designated National Estuarine Research Reserves.
921.41 Withdrawal of designation.

Subpart F--Special Research Projects
921.50 General.
921.51 Estuarine research guidelines.
921.52 Promotion and coordination of estuarine research.

Subpart G--Special Monitoring Projects
921.60 General.

Subpart H--Special Interpretation and Education Projects
921.70 General.

Subpart I--General Financial Assistance Provisions
921.80 Application information.
921.81 Allowable costs.
921.82 Amendments to financial assistance awards.

Appendix I to Part 921--Biogeographic Classification Scheme
Appendix II to Part 921--Typology of National Estuarine Research Reserves

Authority: Section 315 of the Coastal Zone Management Act, as amended (16 U.S.C. 1461).
Source: 58 FR 38215, July 15, 1993, unless otherwise noted.

Sec. 921.1 Mission, goals and general provisions.

(a) The mission of the National Estuarine Research Reserve Program is the establishment and management, through Federal-state cooperation, of a national system (National Estuarine Research Reserve System or System) of estuarine research reserves (National Estuarine Research Reserves or Reserves) representative of the various regions and estuarine types in the United States. National Estuarine Research Reserves are established to provide opportunities for long-term research, education, and interpretation.

(b) The goals of the Program are to:

1. Ensure a stable environment for research through long-term protection of National Estuarine Research Reserve resources;
2. Address coastal management issues identified as significant through coordinated estuarine research within the System;
3. Enhance public awareness and understanding of estuarine areas and provide suitable opportunities for public education and interpretation;
4. Promote Federal, state, public and private use of one or more Reserves within the System when such entities conduct estuarine research; and
5. Conduct and coordinate estuarine research within the System, gathering and making available information necessary for improved understanding and management of estuarine areas.

(c) National Estuarine Research Reserves shall be open to the public to the extent permitted under state and Federal law. Multiple uses are allowed to the degree compatible with each Reserve's overall purpose as provided in the management plan (see Sec. 921.13) and consistent with paragraphs (a) and (b) of this section. Use levels are set by the state where the Reserve is located and analyzed in the management plan. The Reserve management plan shall describe the uses and establish priorities among these uses. The plan shall identify uses requiring a state permit, as well as areas where uses are encouraged or prohibited. Consistent with resource protection and research objectives, public access and use may be restricted to certain areas or components within a Reserve.

(d) Habitat manipulation for research purposes is allowed consistent with the following limitations. Manipulative research activities must be specified in the management plan, be consistent with the mission and goals of the program (see paragraphs (a) and (b) of this section) and the goals and objectives set forth in the Reserve's management plan, and be limited in nature and extent to the minimum manipulative activity necessary to accomplish the stated research objective. Manipulative research activities with a significant or long-term impact on Reserve resources require the prior approval of the state and the National Oceanic and Atmospheric Administration (NOAA). Manipulative research activities which can reasonably be expected to have a significant adverse impact on the estuarine resources and habitat of a Reserve, such that the activities themselves or their resulting short- and long-term consequences compromise the representative character and integrity of a Reserve, are prohibited. Habitat manipulation for resource management purposes is prohibited except as specifically approved by NOAA as: (1) A

restoration activity consistent with paragraph (e) of this section; or (2) an activity necessary for the protection of public health or the preservation of other sensitive resources which have been listed or are eligible for protection under relevant Federal or state authority (e.g., threatened/endangered species or significant historical or cultural resources) or if the manipulative activity is a long-term pre-existing use (i.e., has occurred prior to designation) occurring in a buffer area. If habitat manipulation is determined to be necessary for the protection of public health, the preservation of sensitive resources, or if the manipulation is a long-term pre-existing use in a buffer area, then these activities shall be specified in the Reserve management plan in accordance with Sec. 921.13(a)(10) and shall be limited to the reasonable alternative which has the least adverse and shortest term impact on the representative and ecological integrity of the Reserve.

(e) Under the Act an area may be designated as an estuarine Reserve only if the area is a representative estuarine ecosystem that is suitable for long-term research. Many estuarine areas have undergone some ecological change as a result of human activities (e.g., hydrological changes, intentional/unintentional species composition changes--introduced and exotic species). In those areas proposed or designated as National Estuarine Research Reserves, such changes may have diminished the representative character and integrity of the site. Although restoration of degraded areas is not a primary purpose of the System, such activities may be permitted to improve the representative character and integrity of a Reserve. Restoration activities must be carefully planned and approved by NOAA through the Reserve management plan. Historical research may be necessary to determine the ``natural'' representative state of an estuarine area (i.e., an estuarine ecosystem minimally affected by human activity or influence). Frequently, restoration of a degraded estuarine area will provide an excellent opportunity for management oriented research.

(f) NOAA may provide financial assistance to coastal states, not to exceed, per Reserve, 50 percent of all actual costs or $5 million whichever amount is less, to assist in the acquisition of land and waters, or interests therein. NOAA may provide financial assistance to coastal states not to exceed 70 percent of all actual costs for the management and operation of, the development and construction of facilities, and the conduct of educational or interpretive activities concerning Reserves (see subpart I). NOAA may provide financial assistance to any coastal state or public or private person, not to exceed 70 percent of all actual costs, to support research and monitoring within a Reserve. Notwithstanding any financial assistance limits established by this Part, when financial assistance is provided from amounts recovered as a result of damage to natural resources located in the coastal zone, such assistance may be used to pay 100 percent of all actual costs of activities carrier out with this assistance, as long as such funds are available. Predesignation, acquisition and development, operation and management, special research and monitoring, and special education and interpretation awards are available under the National Estuarine Reserve Program. Predesignation awards are for site selection/feasibility, draft management plan preparation and conduct of basic characterization studies. Acquisition and development awards are intended primarily for acquisition of interests in land, facility construction and to develop and/or upgrade research, monitoring and education programs. Operation and management awards

provide funds to assist in implementing, operating and managing the administrative, and basic research, monitoring and education programs, outlined in the Reserve management plan. Special research and monitoring awards provide funds to conduct estuarine research and monitoring projects with the System. Special educational and interpretive awards provide funds to conduct estuarine educational and interpretive projects within the System.

(g) Lands already in protected status managed by other Federal agencies, state or local governments, or private organizations may be included within National Estuarine Research Reserves only if the managing entity commits to long-term management consistent with paragraphs (d) and (e) of this section in the Reserve management plan. Federal lands already in protected status may not comprise a majority of the key land and water areas of a Reserve (see Sec. 921.11(c)(3)).

(h) To assist the states in carrying out the Program's goals in an effective manner, NOAA will coordinate a research and education information exchange throughout the National Estuarine Research Reserve System. As part of this role, NOAA will ensure that information and ideas from one Reserve are made available to others in the System. The network will enable Reserves to exchange information and research data with each other, with universities engaged in estuarine research, and with Federal, state, and local agencies. NOAA's objective is a system- wide program of research and monitoring capable of addressing the management issues that affect long-term productivity of our Nation's estuaries.

[58 FR 38215, July 15, 1993, as amended at 62 FR 12540, Mar. 17, 1997; 63 FR 26717, May 14, 1998].

Sec. 921.2 Definitions

(a) Act means the Coastal Zone Management Act of 1972, as amended, 16 U.S.C. 1451 et seq.

(b) Assistant Administrator means the Assistant Administrator for Ocean Services and Coastal Zone Management or delegee.

(c) Coastal state means a state of the United States, in or bordering on, the Atlantic, Pacific, or Arctic Ocean, the Gulf of Mexico, Long Island Sound, or one or more of the Great Lakes. For the purposes of these regulations the term also includes Puerto Rico, the Virgin Islands, Guam, the Commonwealth of the Northern Marianas Islands, the Trust Territories of the Pacific Islands, and American Samoa (see 16 U.S.C. 1453(4)).

(d) State agency means an instrumentality of a coastal state to whom the coastal state has delegated the authority and responsibility for the creation and/or management/operation of a National Estuarine Research Reserve. Factors indicative of this authority may include the power to receive and expend funds on behalf of the Reserve, acquire and sell or convey real and personal property interests, adopt rules for the protection of the Reserve, enforce rules applicable to the Reserve, or develop and implement research and education programs for the reserve. For the purposes of these regulations, the terms ``coastal state'' and ``State agency'' shall be synonymous.

(e) Estuary means that part of a river or stream or other body of water having unimpaired connection with the open sea, where the sea water is measurably diluted with fresh water derived from land drainage. The term also includes estuary-type areas with measurable freshwater influence and having unimpaired connections with the open sea, and estuary-type areas of the Great Lakes and their connecting waters (see 16 U.S.C. 1453(7)).

(f) National Estuarine Research Reserve means an area that is a representative estuarine ecosystem suitable for long-term research, which may include all of the key land and water portion of an estuary, and adjacent transitional areas and uplands constituting to the extent feasible a natural unit, and which is set aside as a natural field laboratory to provide long-term opportunities for research, education, and interpretation on the ecological relationships within the area (see 16 U.S.C. 1453(8)) and meets the requirements of 16 U.S.C. 1461(b). This includes those areas designated as National Estuarine Sanctuaries or Reserves under section 315 of the Act prior to enactment of the Coastal Zone Act Reauthorization Amendments of 1990 and each area subsequently designated as a National Estuarine Research Reserve.

Sec. 921.3 National Estuarine Research Reserve System Biogeographic Classification Scheme and Estuarine Typologies.

(a) National Estuarine Research Reserves are chosen to reflect regional differences and to include a variety of ecosystem types. A biogeographic classification scheme based on regional variations in the nation's coastal zone has been developed. The biogeographic classification scheme is used to ensure that the National Estuarine Research Reserve System includes at least one site from each region. The estuarine typology system is utilized to ensure that sites in the System reflect the wide range of estuarine types within the United States.

(b) The biogeographic classification scheme, presented in appendix I, contains 29 regions. Figure 1 graphically depicts the biogeographic regions of the United States.

(c) The typology system is presented in appendix II..

Sec. 921.4 Relationship to other provisions of the Coastal Zone Management Act, and to the Marine Protection, Research and Sanctuaries Act.

(a) The National Estuarine Research Reserve System is intended to provide information to state agencies and other entities involved in addressing coastal management issues. Any coastal state, including those that do not have approved coastal management programs under section 306 of the Act, is eligible for an award under the National Estuarine Research Reserve Program (see Sec. 921.2(c)).

(b) For purposes of consistency review by states with a federally approved coastal management program, the designation of a National Estuarine Research Reserve is deemed to be a Federal activity, which, if directly affecting the state's coastal zone, must be undertaken in a manner consistent to the maximum extent practicable with the approved state coastal management program as provided by section 1456(c)(1) of the Act, and implementing regulations at 15 CFR part 930, subpart C. In accordance with section 1456(c)(1) of the Act and the applicable regulations NOAA will be responsible for certifying that designation of the Reserve is consistent with the state's approved coastal management program. The state must concur with or object to the certification. It is recommended that the lead state agency for Reserve designation consult, at the earliest practicable time, with the appropriate state officials concerning the consistency of a proposed National Estuarine Research Reserve.

(c) The National Estuarine Research Reserve Program will be administered in close coordination with the National Marine Sanctuary Program (Title III of the Marine Protection, Research and Sanctuaries Act, as amended, 16 U.S.C. 1431-1445), also administered by NOAA. Title III authorizes the Secretary of Commerce to designate discrete areas of the marine environment as National Marine Sanctuaries to protect or restore such areas for their conservation, recreational, ecological, historical, research,

educational or esthetic values. National Marine Sanctuaries and Estuarine Research Reserves may not overlap, but may be adjacent.

Sec. 921.10 General.

(a) A coastal state may apply for Federal financial assistance for the purpose of site selection, preparation of documents specified in Sec. 921.13 (draft management plan (DMP) and environmental impact statement (EIS)), and the conduct of limited basic characterization studies. The total Federal share of this assistance may not exceed $100,000. Federal financial assistance for preacquisition activities under Sec. 921.11 and Sec. 921.12 is subject to the total $5 million for which each Reserve is eligible for land acquisition. Notwithstanding the above, when financial assistance is provided from amounts recovered as a result of damage to natural resources located in the coastal zone, such assistance may be used to pay 100 percent of all actual costs of activities carried out with this assistance, as long as such funds are available. In the case of a biogeographic region (see appendix I) shared by two or more coastal states, each state is eligible for Federal financial assistance to establish a separate National Estuarine Research Reserve within their respective portion of the shared biogeographic region. Each separate National Estuarine Research Reserve is eligible for the full complement of funding. Financial assistance application procedures are specified in subpart I.

(b) In developing a Reserve program, a state may choose to develop a multiple-site Reserve reflecting a diversity of habitats in a single biogeographic region. A multiple-site Reserve allows the state to develop complementary research and educational programs within the individual components of its multi-site Reserve. Multiple-site Reserves are treated as one Reserve in terms of financial assistance and development of an overall management framework and plan. Each individual site of a proposed multiple-site Reserve shall be evaluated both separately under Sec. 921.11(c) and collectively as part of the site selection process. A coastal state may propose to establish a multiple-site Reserve at the time of the initial site selection, or at any point in the development or operation of the Reserve. If the state decides to develop a multiple-site National Estuarine Research Reserve after the initial acquisition and development award is made for a single site, the proposal is subject to the requirements set forth in Sec. 921.33(b). However, a state may not propose to add one or more sites to an already designated Reserve if the operation and management of such Reserve has been found deficient and uncorrected or the research conducted is not consistent with the Estuarine Research Guidelines referenced in Sec. 921.51. In addition, Federal funds for the acquisition of a multiple-site Reserve remain limited to $5,000,000 (see Sec. 921.20). The funding for operation of a multiple-site Reserve is limited to the maximum allowed for any one Reserve per year (see Sec. 921.32(c)) and preacquisition funds are limited to $100,000 per Reserve. Notwithstanding the above, when financial assistance is provided from amounts recovered as a result of damage to natural resources located in the coastal zone, such assistance may be used to pay 100 percent of all actual costs of activities carrier out with this assistance, as long as such funds are available.

[58 FR 38215, July 15, 1993, as amended at 63 FR 26717, May 14, 1998].

Sec. 921.11 Site selection and feasibility.

(a) A coastal state may use Federal funds to establish and implement a site selection process which is approved by NOAA.

(b) In addition to the requirements set forth in subpart I, a request for Federal funds for site selection must contain the following programmatic information:

1. A description of the proposed site selection process and how it will be implemented in conformance with the biogeographic classification scheme and typology (Sec. 921.3);
2. An identification of the site selection agency and the potential management agency; and
3. A description of how public participation will be incorporated into the process (see Sec. 921.11(d)).

(c) As part of the site selection process, the state and NOAA shall evaluate and select the final site(s). NOAA has final authority in approving such sites. Site selection shall be guided by the following principles:

1. The site's contribution to the biogeographical and typological balance of the National Estuarine Research Reserve System. NOAA will give priority consideration to proposals to establish Reserves in biogeographic regions or subregions or incorporating types that are not represented in the system. (see the biogeographic classification scheme and typology set forth in Sec. 921.3 and appendices I and II);
2. The site's ecological characteristics, including its biological productivity, diversity of flora and fauna, and capacity to attract a broad range of research and educational interests. The proposed site must be a representative estuarine ecosystem and should, to the maximum extent possible, be an estuarine ecosystem minimally affected by human activity or influence (see Sec. 921.1(e)).
3. Assurance that the site's boundaries encompass an adequate portion of the key land and water areas of the natural system to approximate an ecological unit and to ensure effective conservation. Boundary size will vary greatly depending on the nature of the ecosystem. Reserve boundaries must encompass the area within which adequate control has or will be established by the managing entity over human activities occurring within the Reserve. Generally, Reserve boundaries will encompass two areas: Key land and water areas (or ``core area'') and a buffer zone. Key land and water areas and a buffer zone will likely require significantly different levels of control (see Sec. 921.13(a)(7)). The term ``key land and water areas'' refers to that core area within the Reserve that is so vital to the functioning of the estuarine ecosystem that it must be under a level of control sufficient to

ensure the long-term viability of the Reserve for research on natural processes. Key land and water areas, which comprise the core area, are those ecological units of a natural estuarine system which preserve, for research purposes, a full range of significant physical, chemical and biological factors contributing to the diversity of fauna, flora and natural processes occurring within the estuary. The determination of which land and water areas are ``key'' to a particular Reserve must be based on specific scientific knowledge of the area. A basic principle to follow when deciding upon key land and water areas is that they should encompass resources representative of the total ecosystem, and which if compromised could endanger the research objectives of the Reserve. The term buffer zone refers to an area adjacent to or surrounding key land and water areas and essential to their integrity. Buffer zones protect the core area and provide additional protection for estuarine-dependent species, including those that are rare or endangered. When determined appropriate by the state and approved by NOAA, the buffer zone may also include an area necessary for facilities required for research and interpretation. Additionally, buffer zones should be established sufficient to accommodate a shift of the core area as a result of biological, ecological or geomorphological change which reasonably could be expected to occur. National Estuarine Research Reserves may include existing Federal or state lands already in a protected status where mutual benefit can be enhanced. However, NOAA will not approve a site for potential National Estuarine Research Reserve status that is dependent primarily upon the inclusion of currently protected Federal lands in order to meet the requirements for Reserve status (such as key land and water areas). Such lands generally will be included within a Reserve to serve as a buffer or for other ancillary purposes; and may be included, subject to NOAA approval, as a limited portion of the core area;

4. The site's suitability for long-term estuarine research, including ecological factors and proximity to existing research facilities and educational institutions;
5. The site's compatibility with existing and potential land and water uses in contiguous areas as well as approved coastal and estuarine management plans; and
6. The site's importance to education and interpretive efforts, consistent with the need for continued protection of the natural system.

(d) Early in the site selection process the state must seek the views of affected landowners, local governments, other state and Federal agencies and other parties who are interested in the area(s) being considered for selection as a potential National Estuarine Research Reserve. After the local government(s) and affected landowner(s) have been contacted, at least one public meeting shall be held in the vicinity of the proposed site. Notice of such a meeting, including the time, place, and relevant subject matter, shall be announced by the state through the area's principal newspaper at least 15 days prior to the date of the meeting and by NOAA in the Federal Register.

(e) A state request for NOAA approval of a proposed site (or sites in the case of a multi-site Reserve) must contain a description of the proposed site(s) in relationship to each of the site selection principals (Sec. 921.11(c)) and the following information:

1. An analysis of the proposed site(s) based on the biogeographical scheme/typology discussed in Sec. 921.3 and set forth in appendices I and II;
2. A description of the proposed site(s) and its (their) major resources, including location, proposed boundaries, and adjacent land uses. Maps are required;
3. A description of the public participation process used by the state to solicit the views of interested parties, a summary of comments, and, if interstate issues are involved, documentation that the Governor(s) of the other affected state(s) has been contacted. Copies of all correspondence, including contact letters to all affected landowners must be appended;
4. A list of all sites considered and a brief statement of the reasons why a site was not preferred; and
5. A nomination of the proposed site(s) for designation as a National Estuarine Research Reserve by the Governor of the coastal state in which the state is located.

(f) A state proposing to reactivate an inactive site, previously approved by NOAA for development as an Estuarine Sanctuary or Reserve, may apply for those funds remaining, if any, provided for site selection and feasibility (Sec. 921.11a)) to determine the feasibility of reactivation. This feasibility study must comply with the requirements set forth in Sec. 921.11 (c) through (e).

Sec. 921.12 Post site selection.

(a) At the time of the coastal state's request for NOAA approval of a proposed site, the state may submit a request for funds to develop the draft management plan and for preparation of the EIS. At this time, the state may also submit a request for the remainder of the predesignation funds to perform a limited basic characterization of the physical, chemical and biological characteristics of the site approved by NOAA necessary for providing EIS information to NOAA. The state's request for these post site selection funds must be accompanied by the information specified in subpart I and, for draft management plan development and EIS information collection, the following programmatic information:

1. A draft management plan outline (see Sec. 921.13(a) below); and
2. An outline of a draft memorandum of understanding (MOU) between the state and NOAA detailing the Federal-state role in Reserve management during the initial period of Federal funding and expressing the state's long-term commitment to operate and manage the Reserve.

(b) The state is eligible to use the funds referenced in Sec. 921.12(a) after the proposed site is approved by NOAA under the terms of Sec. 921.11.

Sec. 921.13 Management plan and environmental impact statement development.

(a) After NOAA approves the state's proposed site and application for funds submitted pursuant to Sec. 921.12, the state may begin draft management plan development and the collection of information necessary for the preparation by NOAA of an EIS. The state shall develop a draft management plan, including an MOU. The plan shall set out in detail:

1. Reserve goals and objectives, management issues, and strategies or actions for meeting the goals and objectives;
2. An administrative plan including staff roles in administration, research, education/interpretation, and surveillance and enforcement;
3. A research plan, including a monitoring design;
4. An education/interpretive plan;
5. A plan for public access to the Reserve;
6. A construction plan, including a proposed construction schedule, general descriptions of proposed developments and general cost estimates. Information should be provided for proposed minor construction projects in sufficient detail to allow these projects to begin in the initial phase of acquisition and development. A categorical exclusion, environmental assessment, or EIS may be required prior to construction;
7. (i) An acquisition plan identifying the ecologically key land and water areas of the Reserve, ranking these areas according to their relative importance, and including a strategy for establishing adequate long-term state control over these areas sufficient to provide protection for Reserve resources to ensure a stable environment for research. This plan must include an identification of ownership within the proposed Reserve boundaries, including land already in the public domain; the method(s) of acquisition which the state proposes to use--acquisition (including less-than-fee simple options) to establish adequate long-term state control; an estimate of the fair market value of any property interest--which is proposed for acquisition; a schedule estimating the time required to complete the process of establishing adequate state control of the proposed research reserve; and a discussion of any anticipated problems. In selecting a preferred method(s) for establishing adequate state control over areas within the proposed boundaries of the Reserve, the state shall perform the following steps for each parcel determined to be part of the key land and water areas (control over which is necessary to protect the integrity of the Reserve for research purposes), and for those parcels required for research and interpretive support facilities or buffer purposes:
   (A) Determine, with appropriate justification, the minimum level of control(s) required [e.g., management agreement, regulation, less-than-fee simple property interest (e.g., conservation easement), fee simple property acquisition, or a combination of these approaches]. This does not preclude the future necessity of increasing the level of state control;
   (B) Identify the level of existing state control(s);
   (C) Identify the level of additional state control(s), if any, necessar to meet the

minimum requirements identified in paragraph (a)(7)(i)(A) of this section;
(D) Examine all reasonable alternatives for attaining the level of control identified in paragraph (a)(7)(i)(C) of this section, and perform a cost analysis of each; and
(E) Rank, in order of cost, the methods (including acquisition) identified in paragraph (a)(7)(i)(D) of this section.

(ii) An assessment of the relative cost-effectiveness of control alternatives shall include a reasonable estimate of both short-term costs (e.g., acquisition of property interests, regulatory program development including associated enforcement costs, negotiation, adjudication, etc.) and long-term costs (e.g., monitoring, enforcement, adjudication, management and coordination). In selecting a preferred method(s) for establishing adequate state control over each parcel examined under the process described above, the state shall give priority consideration to the least costly method(s) of attaining the minimum level of long-term control required. Generally, with the possible exception of buffer areas required for support facilities, the level of control(s) required for buffer areas will be considerably less than that required for key land and water areas. This acquisition plan, after receiving the approval of NOAA, shall serve as a guide for negotiations with landowners. A final boundary for the reserve shall be delineated as a part of the final management plan;

8. A resource protection plan detailing applicable authorities, including allowable uses, uses requiring a permit and permit requirements, any restrictions on use of the research reserve, and a strategy for research reserve surveillance and enforcement of such use restrictions, including appropriate government enforcement agencies;
9. If applicable, a restoration plan describing those portions of the site that may require habitat modification to restore natural conditions;
10. If applicable, a resource manipulation plan, describing those portions of the Reserve buffer in which long-term pre-existing (prior to designation) manipulation for reasons not related to research or restoration is occurring. The plan shall explain in detail the nature of such activities, shall justify why such manipulation should be permitted to continue within the reserve buffer; and shall describe possible effects of this manipulation on key land and water areas and their resources;
11. A proposed memorandum of understanding (MOU) between the state and NOAA regarding the Federal-state relationship during the establishment and development of the National Estuarine Research Reserve, and expressing a long-term commitment by the state to maintain and manage the Reserve in accordance with section 315 of the Act, 16 U.S.C. 1461, and applicable regulations. In conjunction with the MOU, and where possible under state law, the state will consider taking appropriate administrative or legislative action to ensure the long-term protection and operation of the National Estuarine Research Reserve. If other MOUs are necessary (such as with a Federal agency, another state agency or private organization), drafts of such MOUs must be included in the plan. All necessary MOU's shall be signed prior to Reserve designation; and

12. If the state has a federally approved coastal management program, a certification that the National Estuarine Research Reserve is consistent to the maximum extent practicable with that program. See Secs. 921.4(b) and 921.30(b).

(b) Regarding the preparation of an EIS under the National Environmental Policy Act on a National Estuarine Research Reserve proposal, the state and NOAA shall collect all necessary information concerning the socioeconomic and environmental impacts associated with implementing the draft management plan and feasible alternatives to the plan. Based on this information, the state will draft and provide NOAA with a preliminary EIS.

(c) Early in the development of the draft management plan and the draft EIS, the state and NOAA shall hold a scoping meeting (pursuant to NEPA) in the area or areas most affected to solicit public and government comments on the significant issues related to the proposed action. NOAA will publish a notice of the meeting in the Federal Register at least 15 days prior to the meeting. The state shall be responsible for publishing a similar notice in the local media.

(d) NOAA will publish a Federal Register notice of intent to prepare a draft EIS. After the draft EIS is prepared and filed with the Environmental Protection Agency (EPA), a Notice of Availability of the draft EIS will appear in the Federal Register. Not less than 30 days after publication of the notice, NOAA will hold at least one public hearing in the area or areas most affected by the proposed national estuarine research reserve. The hearing will be held no sooner than 15 days after appropriate notice of the meeting has been given in the principal news media by the state and in the Federal Register by NOAA. After a 45-day comment period, a final EIS will be prepared by the state and NOAA.

Sec. 921.20 General.

The acquisition and development period is separated into two major phases. After NOAA approval of the site, draft management plan and draft MOU, and completion of the final EIS, a coastal state is eligible for an initial acquisition and development award(s). In this initial phase, the state should work to meet the criteria required for formal research reserve designation; e.g., establishing adequate state control over the key land and water areas as specified in the draft management plan and preparing the final management plan. These requirements are specified in Sec. 921.30. Minor construction in accordance with the draft management plan may also be conducted during this initial phase. The initial acquisition and development phase is expected to last no longer than three years. If necessary, a longer time period may be negotiated between the state and NOAA. After Reserve designation, a state is eligible for a supplemental acquisition and development award(s) in accordance with Sec. 921.31. In this post-designation acquisition and development phase, funds may be used in accordance with the final management plan to construct research and educational facilities, complete any remaining land acquisition, for program development, and for restorative activities identified in the final management

plan. In any case, the amount of Federal financial assistance provided to a coastal state with respect to the acquisition of lands and waters, or interests therein, for any one National Estuarine Research Reserve may not exceed an amount equal to 50 percent of the costs of the lands, waters, and interests therein or $5,000,000, whichever amount is less, except when the financial assistance is provided from amounts recovered as a result of damage to natural resources located in the coastal zone, in which case the assistance may be used to pay 100 percent of all actual costs of activities carrier out with this assistance, as long as such funds are available.

[58 FR 38215, July 15, 1993, as amended at 62 FR 12540, Mar. 17, 1997; 63 FR 26717, May 14, 1998].

Sec. 921.21 Initial acquisition and development awards.

(a) Assistance is provided to aid the recipient prior to designation in:

1. Acquiring a fee simple or less-than-fee simple real property interest in land and water areas to be included in the Reserve boundaries (see Sec. 921.13(a)(7); Sec. 921.30(d));
2. Minor construction, as provided in paragraphs (b) and (c) of this section;
3. Preparing the final management plan; and
4. Initial management costs, e.g., for implementing the NOAA approved draft management plan, hiring a Reserve manager and other staff as necessary and for other management-related activities. Application procedures are specified in subpart I.

(b) The expenditure of Federal and state funds on major construction activities is not allowed during the initial acquisition and development phase. The preparation of architectural and engineering plans, including specifications, for any proposed construction, or for proposed restorative activities, is permitted. In addition, minor construction activities, consistent with paragraph (c) of this section also are allowed. The NOAA-approved draft management plan must, however, include a construction plan and a public access plan before any award funds can be spent on construction activities.

(c) Only minor construction activities that aid in implementing portions of the management plan (such as boat ramps and nature trails) are permitted during the initial acquisition and development phase. No more than five (5) percent of the initial acquisition and development award may be expended on such activities. NOAA must make a specific determination, based on the final EIS, that the construction activity will not be detrimental to the environment.

(d) Except as specifically provided in paragraphs (a) through (c) of this section, construction projects, to be funded in whole or in part under an acquisition and development award(s), may not be initiated until the Reserve receives formal designation (see Sec. 921.30). This requirement has been adopted to ensure that substantial progress

in establishing adequate state control over key land and water areas has been made and that a final management plan is completed before major sums are spent on construction. Once substantial progress in establishing adequate state control/acquisition has been made, as defined by the state in the management plan, other activities guided by the final management plan may begin with NOAA's approval.

(e) For any real property acquired in whole or part with Federal funds for the Reserve, the state shall execute suitable title documents to include substantially the following provisions, or otherwise append the following provisions in a manner acceptable under applicable state law to the official land record(s):

1. Title to the property conveyed by this deed shall vest in the [recipient of the award granted pursuant to section 315 of the Act, 16 U.S.C. 1461 or other NOAA approved state agency] subject to the condition that the designation of the [name of National Estuarine Reserve] is not withdrawn and the property remains part of the federally designated [name of National Estuarine Research Reserve]; and
2. In the event that the property is no longer included as part of the Reserve, or if the designation of the Reserve of which it is part is withdrawn, then NOAA or its successor agency, after full and reasonable consultation with the State, may exercise the following rights regarding the disposition of the property:
   (i) The recipient may retain title after paying the Federal Government an amount computed by applying the Federal percentage of participation in the cost of the original project to the current fair market value of the property;
   (ii) If the recipient does not elect to retain title, the Federal Government may either direct the recipient to sell the property and pay the Federal Government an amount computed by applying the Federal percentage of participation in the cost of the original project to the proceeds from the sale (after deducting actual and reasonable selling and repair or renovation expenses, if any, from the sale proceeds), or direct the recipient to transfer title to the Federal Government. If directed to transfer title to the Federal Government, the recipient shall be entitled to compensation computed by applying the recipient's percentage of participation in the cost of the original project to the current fair market value of the property; and
   (iii) Fair market value of the property must be determined by an independent appraiser and certified by a responsible official of the state, as provided by Department of Commerce regulations at 15 CFR part 24, and Uniform Relocation Assistance and Real Property Acquisition for Federal and Federally assisted programs at 15 CFR part 11.

(f) Upon instruction by NOAA, provisions analogous to those of Sec. 921.21(e) shall be included in the documentation underlying less-then-fee-simple interests acquired in whole or part with Federal funds.

(g) Federal funds or non-Federal matching share funds shall not be spent to acquire a real property interest in which the state will own the land concurrently with another entity unless the property interest has been identified as a part of an acquisition strategy

pursuant to Sec. 921.13(7) which has been approved by NOAA prior to the effective date of these regulations.

(h) Prior to submitting the final management plan to NOAA for review and approval, the state shall hold a public meeting to receive comment on the plan in the area affected by the estuarine research reserve. NOAA will publish a notice of the meeting in the Federal Register at least 15 days prior to the public meeting. The state shall be responsible for having a similar notice published in the local newspaper(s).

Sec. 921.30 Designation of National Estuarine Research Reserves.

(a) The Under Secretary may designate an area proposed for designation by the Governor of the state in which it is located, as a National Esturaine Research Reserve if the Under Secretary finds:

1. The area is a representative estuarine ecosystem that is suitable for long-term research and contributes to the biogeographical and typological balance of the System;
2. Key land and water areas of the proposed Reserve, as identified in the management plan, are under adequate state control sufficient to provide long-term protection for reserve resources to ensure a stable environment for research;
3. Designation of the area as a Reserve will serve to enhance public awareness and understanding of estuarine areas, and provide suitable opportunities for public education and interpretation;
4. A final management plan has been approved by NOAA;
5. An MOU has been signed between the state and NOAA ensuring a long-term commitment by the state to the effective operation and implementation of the area as a National Estuarine Research Reserve;
6. All MOU's necessary for reserve management (i.e., with relevant Federal, state, and local agencies and/or private organizations) have been signed; and
7. The coastal state in which the area is located has complied with the requirements of subpart B.

(b) NOAA will determine whether the designation of a National Estuarine Research Reserve in a state with a federally approved coastal zone management program directly affects the coastal zone. If the designation is found to directly affect the coastal zone, NOAA will make a consistency determination pursuant to Sec. 307(c)(1) of the Act, 16 U.S.C. 1456, and 15 CFR part 930, subpart C. See Sec. 921.4(b). The results of this consistency determination will be published in the Federal Register when the notice of designation is published. See Sec. 921.30(c).

(c) NOAA will publish the notice of designation of a National Estuarine Research Reserve in the Federal Register. The state shall be responsible for having a similar notice published in the local media.

(d) The term state control in Sec. 921.30(a)(3) does not necessarily require that key land and water areas be owned by the state in fee simple. Acquisition of less-than-fee simple interests e.g., conservation easements) and utilization of existing state regulatory measures are encouraged where the state can demonstrate that these interests and measures assure adequate long-term state control consistent with the purposes of the research reserve (see also Secs. 921.13(a)(7); 921.21(g)). Should the state later elect to purchase an interest in such lands using NOAA funds, adequate justification as to the need for such acquisition must be provided to NOAA.

Sec. 921.31 Supplemental acquisition and development awards.

After National Estuarine Research Reserve designation, and as specified in the approved management plan, a coastal state may request a supplemental acquisition and/or development award(s) for acquiring additional property interests identified in the management plan as necessary to strengthen protection of key land and water areas and to enhance long-term protection of the area for research and education, for facility and exhibit construction, for restorative activities identified in the approved management plan, for administrative purposes related to acquisition and/or facility construction and to develop and/or upgrade research, monitoring and education/interpretive programs. Federal financial assistance provided to a National Estuarine Research Reserve for supplemental development costs directly associated with facility construction (i.e., major construction activities) may not exceed 70 percent of the total project cost, except when the financial assistance is provided from amounts recovered as a result of damage to natural resources located in the coastal zone, in which case the assistance may be used to pay 100 percent of the costs. NOAA must make a specific determination that the construction activity will not be detrimental to the environment. Acquisition awards for the acquisition of lands or waters, or interests therein, for any one reserve may not exceed an amount equal to 50 percent of the costs of the lands, waters, and interests therein of $5,000,000, whichever amount is less, except when the financial assistance is provided from amounts recovered as result of damage to natural resources located in the coastal zone, in which case the assistance may be used to pay 100 percent of all actual costs of activities carrier out with this assistance, as long as such funds are available. In the case of a biogeographic region (see appendix I) shared by two or more states, each state is eligible independently for Federal financial assistance to establish a separate National Estuarine Research Reserve within their respective portion of the shared biogeographic region. Application procedures are specified in subpart I. Land acquisition must follow the procedures specified in Secs. 921.13(a)(7), 921.21(e) and (f) and 921.81.

[58 FR 38215, July 15, 1993, as amended at 62 FR 12540, Mar. 17, 1997; 63 FR 26717, May 14, 1998].

Sec. 921.32 Operation and management: Implementation of the management plan.

(a) After the Reserve is formally designated, a coastal state is eligible to receive Federal funds to assist the state in the operation and management of the Reserve including the management of research, monitoring, education, and interpretive programs. The purpose of this Federally funded operation and management phase is to implement the approved final management plan and to take the necessary steps to ensure the continued effective operation of the Reserve.

(b) State operation and management of the Reserves shall be consistent with the mission, and shall further the goals of the National Estuarine Research Reserve program (see Sec. 921.1).

(c) Federal funds are available for the operation and management of the Reserve. Federal funds provided pursuant to this section may not exceed 70 percent of the total cost of operating and managing the Reserve for any one year, except when the financial assistance is provided from amounts recovered as a result of damage to natural resources located in the coastal zone, in which case the assistance may be used to pay 100 percent of the costs. In the case of a biogeographic region (see Appendix I) shared by two or more states, each state is eligible for Federal financial assistance to establish a separate Reserve within their respective portion of the shared biogeographic region (see Sec. 921.10).

(d) Operation and management funds are subject to the following limitations:

1. Eligible coastal state agencies may apply for up to the maximum share available per Reserve for that fiscal year. Share amounts will be announced annually by letter from the Sanctuary and Reserves Division to all participating states. This letter will be provided as soon as practicable following approval of the Federal budget for that fiscal year.
2. No more than ten percent of the total amount (state and Federal shares) of each operation and management award may be used for construction-type activities.

[58 FR 38215, July 15, 1993, as amended at 62 FR 12541, Mar. 17, 1997].

Sec. 921.33 Boundary changes, amendments to the management plan, and addition of multiple-site components.

(a) Changes in the boundary of a Reserve and major changes to the final management plan, including state laws or regulations promulgated specifically for the Reserve, may be made only after written approval by NOAA. NOAA may require public notice, including notice in the Federal Register and an opportunity for public comment before approving a boundary or management plan change. Changes in the boundary of a Reserve involving the acquisition of properties not listed in the management plan or final EIS require public notice and the opportunity for comment; in certain cases, a categorical exclusion, an environmental assessment and possibly an environmental impact statement may be

required. NOAA will place a notice in the Federal Register of any proposed changes in Reserve boundaries or proposed major changes to the final management plan. The state shall be responsible for publishing an equivalent notice in the local media. See also requirements of Secs. 921.4(b) and 921.13(a)(11).

(b) As discussed in Sec. 921.10(b), a state may choose to develop a multiple-site National Estuarine Research Reserve after the initial acquisition and development award for a single site has been made. NOAA will publish notice of the proposed new site including an invitation for comments from the public in the Federal Register. The state shall be responsible for publishing an equivalent notice in the local newspaper(s). An EIS, if required, shall be prepared in accordance with section Sec. 921.13 and shall include an administrative framework for the multiple-site Reserve and a description of the complementary research and educational programs within the Reserve. If NOAA determines, based on the scope of the project and the issues associated with the additional site(s), that an environmental assessment is sufficient to establish a multiple-site Reserve, then the state shall develop a revised management plan which, concerning the additional component, incorporates each of the elements described in Sec. 921.13(a). The revised management plan shall address goals and objectives for all components of the multi-site Reserve and the additional component's relationship to the original site(s).

(c) The state shall revise the management plan for a Reserve at least every five years, or more often if necessary. Management plan revisions are subject to (a) above.

(d) NOAA will approve boundary changes, amendments to management plans, or the addition of multiple-site components, by notice in the Federal Register. If necessary NOAA will revise the designation document (findings) for the site.

Sec. 921.40 Ongoing oversight and evaluations of designated National Estuarine Research Reserves.

(a) The Sanctuaries and Reserve Division shall conduct, in accordance with section 312 of the Act and procedures set forth in 15 CFR part 928, ongoing oversight and evaluations of Reserves. Interim sanctions may be imposed in accordance with regulations promulgated under 15 CFR part 928.

(b) The Assistant Administrator may consider the following indicators of non-adherence in determining whether to invoke interim sanctions:

1. Inadequate implementation of required staff roles in administration, research, education/interpretation, and surveillance and enforcement. Indicators of inadequate implementation could include: No Reserve Manager, or no staff or insufficient staff to carry out the required functions.
2. Inadequate implementation of the required research plan, including the monitoring design. Indicators of inadequate implementation could include: Not

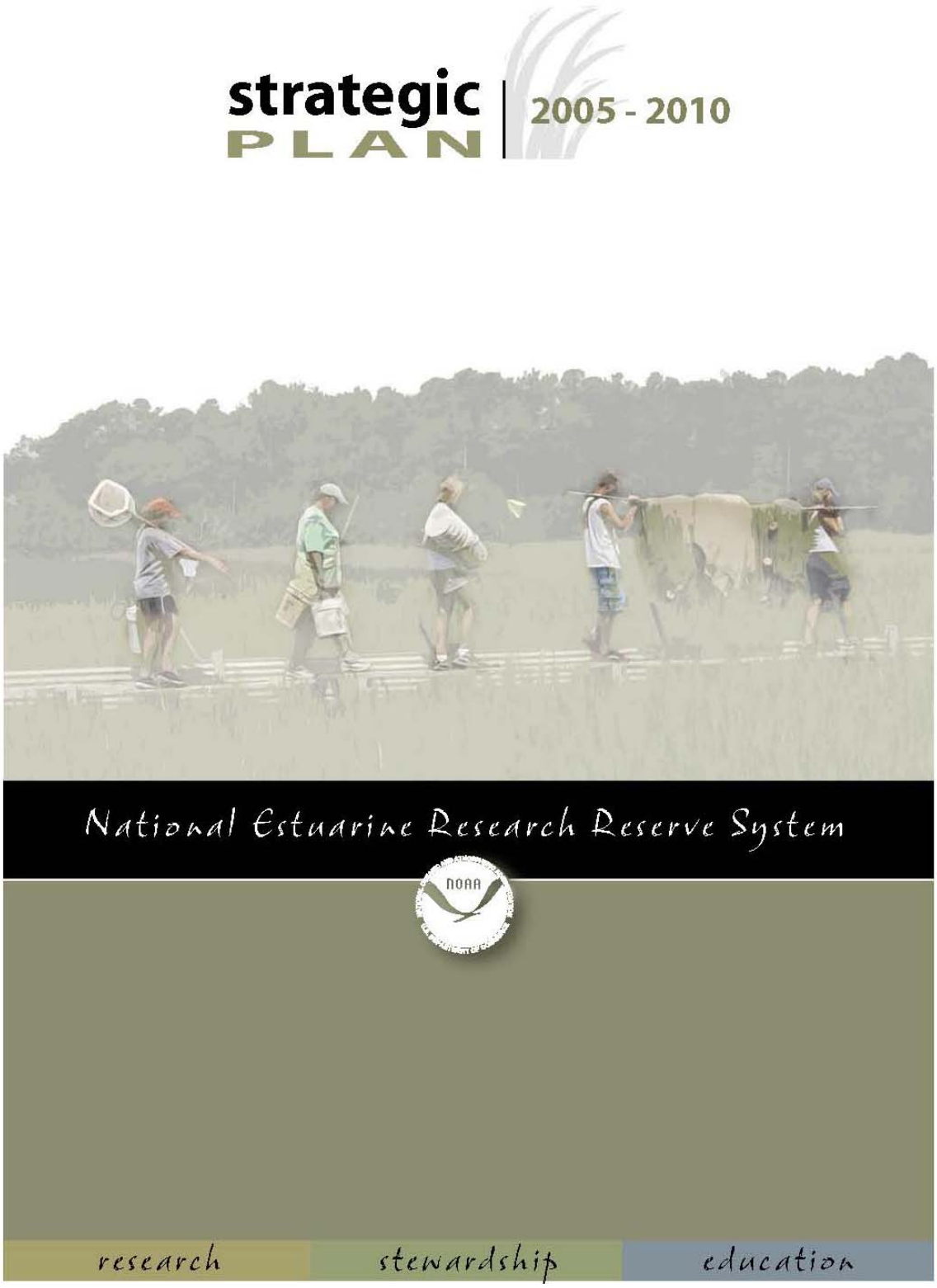
carrying out research or monitoring that is required by the plan, or carrying out research or monitoring that is inconsistent with the plan.

3. Inadequate implementation of the required education/interpretation plan. Indicators of inadequate implementation could include: Not carrying out education or interpretation that is required by the plan, or carrying out education/interpretation that is inconsistent with the plan.
4. Inadequate implementation of public access to the Reserve. Indicators of inadequate implementation of public access could include: Not providing necessary access, giving full consideration to the need to keep some areas off limits to the public in order to protect fragile resources.
5. Inadequate implementation of facility development plan. Indicators of inadequate implementation could include: Not taking action to propose and budget for necessary facilities, or not undertaking necessary construction in a timely manner when funds are available.
6. Inadequate implementation of acquisition plan. Indicators of inadequate implementation could include: Not pursuing an aggressive acquisition program with all available funds for that purpose, not requesting promptly additional funds when necessary, and evidence that adequate long-term state control has not been established over some core or buffer areas, thus jeopardizing the ability to protect the Reserve site and resources from offsite impacts.
7. Inadequate implementation of Reserve protection plan. Indicators of inadequate implementation could include: Evidence of non-compliance with Reserve restrictions, insufficient surveillance and enforcement to assure that restrictions on use of the Reserve are adhered to, or evidence that Reserve resources are being damaged or destroyed as a result of the above.
8. Failure to carry out the terms of the signed Memorandum of Understanding (MOU) between the state and NOAA, which establishes a long-term state commitment to maintain and manage the Reserve in accordance with section 315 of the Act. Indicators of failure could include: State action to allow incompatible uses of state-controlled lands or waters in the Reserve, failure of the state to bear its fair share of costs associated with long-term operation and management of the Reserve, or failure to initiate timely updates of the MOU when necessary.

Sec. 921.41 Withdrawal of designation.

The Assistant Administrator may withdraw designation of an estuarine area as a National Estuarine Research Reserve pursuant to and in accordance with the procedures of section 312 and 315 of the Act and regulations promulgated thereunder.

APPENDIX B: NATIONAL ESTUARINE RESEARCH RESERVE SYSTEM STRATEGIC PLAN



The National Estuarine Research Reserve System is administered by NOAA's National Ocean Service, Office of Ocean and Coastal Resource Management, Estuarine Reserves Division. For more information, visit us online at **www.nerrs.noaa.gov** or contact us at: 1305 East West Highway N/ORM5, Silver Spring, Maryland 20910. Phone number: 301-713-3155

Project Manager: George Cathcart

Writer: Cory Riley

Layout Design: Matt McIntosh



vision | Healthy estuaries and coastal watersheds where coastal communities and ecosystems thrive.



mission | To practice and promote coastal and estuarine stewardship through innovative research and education, using a system of protected areas.



goals

1. Strengthen the protection and management of representative estuarine ecosystems to advance estuarine conservation, research and education.
2. Increase the use of reserve science and sites to address priority coastal management issues.
3. Enhance peoples' ability and willingness to make informed decisions and take responsible actions that affect coastal communities and ecosystems.

Introduction

For thousands of years, coastal and estuarine environments have provided people with food, safe harbors, transportation access, flood control, and a place to play and relax. The pressures on the nation's coast are enormous and the impacts on economies and ecosystems are becoming increasingly evident. Severe storms, climate change, pollution, habitat alteration and rapid population growth threaten the ecological functions that have supported coastal communities throughout history. As a network of 27 protected areas established for long-term research, education and stewardship, the National Estuarine Research Reserve System (NERRS) has a unique role to play in keeping coastal ecosystems healthy and productive.

The reserve system is a partnership program between the National Oceanic and Atmospheric Administration and coastal states that has protected more than one million acres of coastal and estuarine habitat since the program was established by the Coastal Zone Management Act in 1972. NOAA provides funding, national guidance and technical assistance. Each reserve is managed on a daily basis by a lead state agency, non-profit organization or university with input from local partners. Through careful stewardship, innovative science and education, and relevant training programs, the reserves encourage careful management and protection of local estuarine and coastal resources.

The Coastal Zone Management Act created the reserve system to protect estuarine areas, provide educational opportunities, promote and conduct estuarine research and monitoring, and transfer relevant information to coastal managers. For the next five years, core reserve programs will focus on four priority topics: impacts of land use and population growth, habitat loss and alteration, water quality degradation, and changes in biological communities. The National Estuarine Research Reserve System's 2005-2010 Strategic Plan articulates how the strengths of the reserve system will be applied to address the major challenges of coastal management.

A Local Approach to National Priorities

Land use and population growth, water quality degradation, habitat loss and alteration, and changes in biological communities are not the only topics that reserves work on, but these four have risen to the top as deserving of adequate and strategic investment for the national system. These four topics are high priority science and training needs for coastal managers.[3] Reserve scientists, educators and land managers have identified these topics as locally and nationally important and appro-

priate to the mission of the National Estuarine Research Reserve System. Increased understanding about these topics will improve the reserve system's ability to protect and restore coastal watersheds and estuaries and empower individuals to make informed decisions. The nation's coasts and estuaries need to be managed, understood and appreciated at multiple scales. Through a network of locally oriented programs around the country, the reserve system provides insight into common information and management needs as well as data for use by local, regional and federal scientists and decision makers. Working at both the site level and as a national system, reserves have a greater impact than could be achieved through community efforts alone.

The goals, objectives and strategies outlined in this strategic plan will guide and support the National Estuarine Research Reserve System in its nation-wide efforts to improve coastal management, advance estuarine research, and educate current and future generations of coastal stewards.

Stewardship: *The responsible management of coastal resources using the best available information for the purpose of maintaining and restoring healthy, productive and resilient ecosystems.*

Priority Coastal Management Issues

1. Land Use and Population Growth

The United States' exploding coastal population results in competing demands for clean water, beaches, recreational and commercial space, infrastructure and housing. In 2003, an estimated 153 million people lived in coastal counties, which is approximately 53% of the total US population. Pressure to develop land in coastal areas is escalating at more than twice the rate of population growth. Land use changes can significantly impact coastal and estuarine species and habitat. The Pew Ocean Commission reports that when more than 10% of a watershed is covered in impervious surface such as roads, roofs and parking lots, aquatic resources begin to degrade.[1]

Coastal population and land use demands are not only increasing, they also are changing. Demographic and socio-economic trends show that the backgrounds and interests of people who are moving to the coast may be different from those of traditional fishing, commerce, or beach communities. The way people value and understand their relationship to the coast is reflected in the personal, political and professional choices they make. To make wise coastal resource management decisions, we need to understand the relationships among estuarine ecosystems and changing landscapes and attitudes. National Estuarine Research Reserves encourage the development and use of science based knowledge and tools in local land use planning, community development, and stewardship of public and private property.



2. Habitat Loss and Alteration

More than half of the nation's coastal wetlands have vanished since European settlement.[2] Estuarine and coastal environments continue to be altered and eliminated due to dredging, dams, recreational and commercial uses, flood and hazard mitigation, residential and infrastructure development, commercial port activities, and agriculture. Many of these activities disturb the physical, biological and chemical attributes of the estuary and therefore degrade

the plants and animals that depend on the habitat to survive. Seagrass beds, marshes, shellfish, bird and fish populations can be affected by sedimentation, erosion, and hydrological, chemical or physical alteration of the habitat. Estuarine ecosystems also are vulnerable to coastal storms and sensitive to changes in climate and sea level. Coastal managers want to know more about how their choices influence coastal habitat and the species that live there. Better information will ensure that alternatives are considered for permitting, as well as planning and implementing successful restoration and mitigation efforts.[3]

Reserve research and monitoring programs increase the fundamental understanding of estuarine dynamics and add new information about the causes and consequences of changes in habitat quantity and quality. Research and stewardship programs at the NERRs also develop, implement and evaluate new techniques to restore and protect estuarine resources. Training programs and advisory services make this information available to professionals. Through education programs conducted at the reserves, students and citizens learn why these habitats are important and what they can do to keep them healthy.

3. Water Quality Degradation

Improving the condition of coastal water quality is a goal of the Coastal Zone Management Act and an ongoing struggle for all coastal regulatory agencies. Despite continuing local, state and federal investments, more than 20,000 beach closures were enforced in 2004[4] and more than 60% of estuarine waters were classified by the EPA as having degraded water in 2005.[5] Excess nutrients and chemical and biological contamination can cause human health problems and threaten aquatic life.



The Reserve System has been collecting water quality data for ten years to quantify short term variability and long term changes in estuarine waters. Through monitoring and studying changes in water quality, the reserves investigate how human activity, weather patterns, and estuarine characteristics contribute to changes in water quality that affect ecological processes and, consequently, human health. Reserves apply the knowledge generated through research and monitoring to improve water quality through habitat protection, restoration, and training and outreach programs.

4. Changes in Biological Communities

Biological communities are changing as a result of invasive species, over-harvest, climate changes, pollution, and habitat destruction. Invasive species out-compete or consume native organisms; habitat alteration and destruction displace some species and create opportunities for others; and changes in parameters such as temperature and salinity can shift the distribution of plants and animals. Chemical contamination and nutrient enrichment damage habitat and can alter the structure of floral and faunal communities. Over-harvesting biological resources also can change community structure and threaten valuable species. These problems impact natural interactions and linkages and lead to cascading indirect effects throughout the ecosystems.

Reserve research, stewardship, education, and training programs focus on understanding how changes in biological communities affect the way estuaries function. To minimize the negative impact of these changes, reserves investigate and communicate how to balance public needs with the protection of increasingly susceptible natural resources.



Guiding Principles

- Strong partnerships between NOAA, state agencies and universities, and other local partners are critical to the success of the reserve system.
- The reserve system integrates science, education and stewardship on relevant topics to maximize the benefits to coastal management.
- Reserves serve as a catalyst and a focal point for demonstrating and facilitating objective problem solving and best management practices.
- Reserves engage local communities and citizens to improve stewardship of coastal areas.
- Reserves implement an ecosystem-based management approach.

Goal One:

Strengthen the protection and management of representative estuarine ecosystems to advance estuarine conservation, research and education.

Objectives:

1. Biogeographically and typologically representative estuarine ecosystems are protected through the designation of new reserves.

2. Biological, chemical, physical, and community conditions of reserves are characterized and monitored to describe reference conditions and to quantify change.

3. Reserve ecosystems are conserved through land acquisition, natural resource management and restoration.

Strategies:

- Identify and designate new reserves consistent with system-wide policy and available resources.

- Collect system-wide measurements of the short-term variability and long-term changes in the water quality, biotic communities and diversity, land-use and land cover characteristics of estuarine ecosystems to support effective coastal zone management.

- Collect baseline information about the biological, physical, chemical, and socio-economic parameters of reserve biological and human communities.

- Integrate NERRS monitoring, data management, education and training capabilities in regional ocean observing systems.

- Implement land acquisition plans to enhance the long term integrity and diversity of reserve habitats.

- Restore and actively manage reserves' natural resources to meet local habitat and human use goals.

- Work collaboratively with other programs to evaluate and apply advanced technologies and tools to support effective coastal management.

- Provide facilities and support to manage the natural resources within reserve boundaries.

Goal Two:

Increase the use of reserve science and sites to address priority coastal management issues.

Objectives:

1. Scientists conduct estuarine research at reserves that is relevant to coastal management needs.
2. Scientists have access to NERRS datasets, science products and results.
3. The scientific community uses data, tools and techniques generated at the NERRS.

Strategies:

- Understand coastal decision maker science and training needs through needs assessments, coastal management science needs surveys, etc.
- Work collaboratively with other programs to conduct research on priority management issues in the reserves.
- Offer Graduate Research Fellowships to master's and doctoral students to conduct science that is relevant to coastal management and to train students in estuarine science.
- Deliver monitoring and observation data to the scientific community.
- Disseminate reserve science through publications, outreach and technology transfer.
- Generate time-series data and empirical studies to describe the ecological condition of reserve habitats.
- Promote reserve science products through web sites, communication materials, and other avenues to meet the needs of diverse stakeholders.
- Increase visibility and reinforce the credibility of NERRS science through communication efforts about NERRS research and monitoring.
- Attract scientists and practitioners to use reserves as reference sites.
- Conduct and facilitate relevant research in reserve watersheds.
- Synthesize reserve data into information for use in decision making.
- Conduct and facilitate research into education effectiveness and behavior change.
- Ensure that reserves have facilities and research support to meet the needs of visiting scientists and staff.

Scientist: *A person who uses principles and procedures for the systematic pursuit of knowledge involving the recognition and formulation of a problem, the collection of data through observation and experiment, and the formulation and testing of hypotheses.*

Goal Three:

Enhance people's ability and willingness to make informed decisions and take responsible actions that affect coastal communities and ecosystems.

Objectives:

1. People are aware of the ecological, economic, historical, and cultural importance of estuarine resources.

2. People understand how human choices and natural disturbances impact social, economic, and estuarine ecological systems.

3. People apply science-based information when making decisions that could impact coastal and estuarine resources.

Strategies:

- Provide educational opportunities that increase students' understanding of estuarine science and technology.

- Implement and participate in public programs and events to raise awareness and understanding about estuaries and the NERRS.

- Produce and distribute educational materials and web-based products that raise public awareness about estuaries, the NERRS, and NERRS education products.

- Train teachers to educate students about coastal watersheds and estuaries.

- Deliver monitoring and observing data to diverse user groups in a useful format.

- Improve the willingness and ability of communities to restore and protect coastal ecosystems.

- Provide science-based information and training to individuals and organizations.

- Assist restoration practitioners in developing and applying effective restoration techniques.

- Implement volunteer programs to engage local citizens in advancing the goals of the reserves.

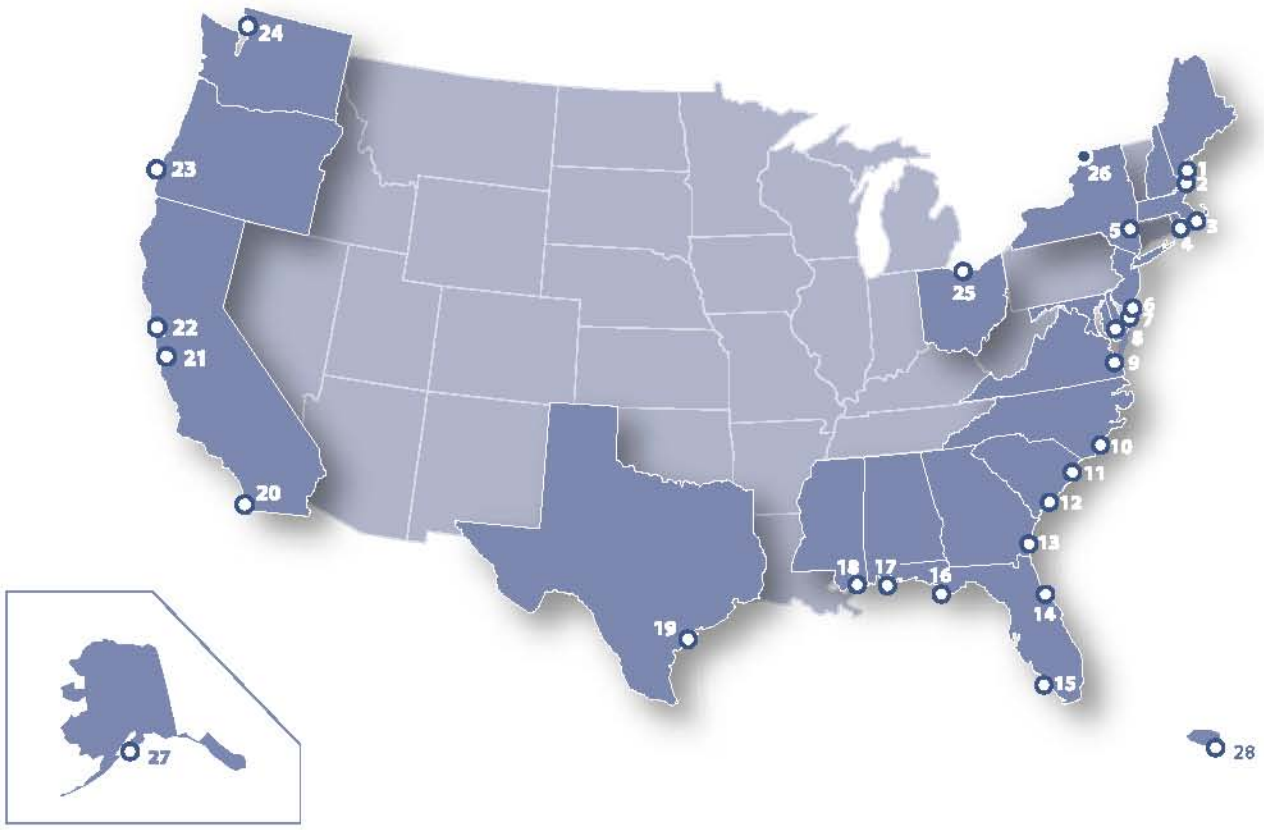
- Conduct programs to encourage people to make personal choices that reduce their impact on coastal resources.

- Evaluate programs to determine how people apply information and knowledge.

- Build and maintain educational facilities and interpretive displays.

Sources

1. Pew Ocean Commission Report
2. United States Commission on Ocean Policy Report
3. NERRS Coastal Training Program Trends Analysis Report, Improving Links Between Science and Coastal Management
4. National Resource Council website
5. EPA Coastal Conditions Report



1. Wells Reserve, Maine
2. Great Bay Reserve, New Hampshire
3. Waquoit Bay Reserve, Massachusetts
4. Narragansett Bay Reserve, Rhode Island
5. Hudson River Reserve, New York
6. Jacques Cousteau Reserve, New Jersey
7. Delaware Reserve
8. Chesapeake Bay Reserve, Maryland
9. Chesapeake Bay Reserve, Virginia
10. North Carolina Reserve
11. North Inlet-Winyah Bay Reserve, South Carolina
12. ACE Basin Reserve, South Carolina
13. Sapelo Island, Georgia
14. Guana Tolomato Matanzas Reserve, Florida
15. Rookery Bay Reserve, Florida
16. Apalachicola Reserve, Florida
17. Weeks Bay Reserve, Alabama
18. Grand Bay Reserve, Mississippi
19. Mission-Aransas, Texas
20. Tijuana River Reserve, California
21. Elkhorn Slough Reserve, California
22. San Francisco Bay, California
23. South Slough Reserve, Oregon
24. Padilla Bay Reserve, Washington
25. Old Woman Creek, Ohio
26. Proposed Reserve—St. Lawrence River
27. Kachemak Bay Reserve, Alaska
28. Jobos Bay Reserve, Puerto Rico

APPENDIX C: NORTH CAROLINA NERR CORE AND BUFFER AREA DESCRIPTIONS AND SITE MAPS

Guidelines for Establishing Proposed Boundaries for NERRs

Boundaries for Reserve components must include "an adequate portion of the key land and water areas of the natural system to approximate an ecological unit and to ensure effective conservation."

These areas must be discrete enough to be effectively managed, but large enough to protect a natural area that will facilitate long-term research and monitoring projects. To help focus management efforts, site component boundaries encompass two zones: key land and water areas (core areas) and buffer zones.

> Core areas are defined as: *"critical estuarine ecological units for research purposes, encompassing a full range of significant physical, chemical, and biological factors contributing to the diversity of fauna, flora, and natural processes occurring within the estuary."*
>
> The core area is *"so vital to the functioning of the estuarine ecosystem that it must be under state control sufficient to ensure the long term viability of the Reserve for research on estuarine processes... [These areas] should encompass resources that are representative of the total ecosystem which, if compromised, could endanger the research objectives of the Reserve."* Subtidal and intertidal sound communities encompass typical core habitats within the Reserve (*e.g.*, sound waters, mud/sand flats, salt marshes -- including supratidal marsh areas).
>
> A buffer zone is defined as an *"area adjacent to or surrounding the core and on which the integrity of the core depends. This area protects the core and provides additional protection for estuarine dependent species."* Within the NCNERR, buffer areas include ocean beaches, dunes, shrub thicket, maritime forest, and dredge material areas.

Early in the planning process for the North Carolina Reserve, site surveys were conducted to determine proposed boundaries for each component. Acquisition strategies to establish adequate state control have been followed to provide long-term protection for Reserve resources within these boundaries. Types of acquisitions have included land donations, bargain sales and fee simple purchases. Condemnation was necessary in a few instances when: 1) the value of a key tract was in irreconcilable dispute and funding was liable to be reverted or 2) there were convoluted title circumstances. Site-specific core and buffer information is discussed in more detail in the individual component descriptions in the introduction of the management plan. Maps of the core and buffer areas of each component can be found in Figures 1-4.

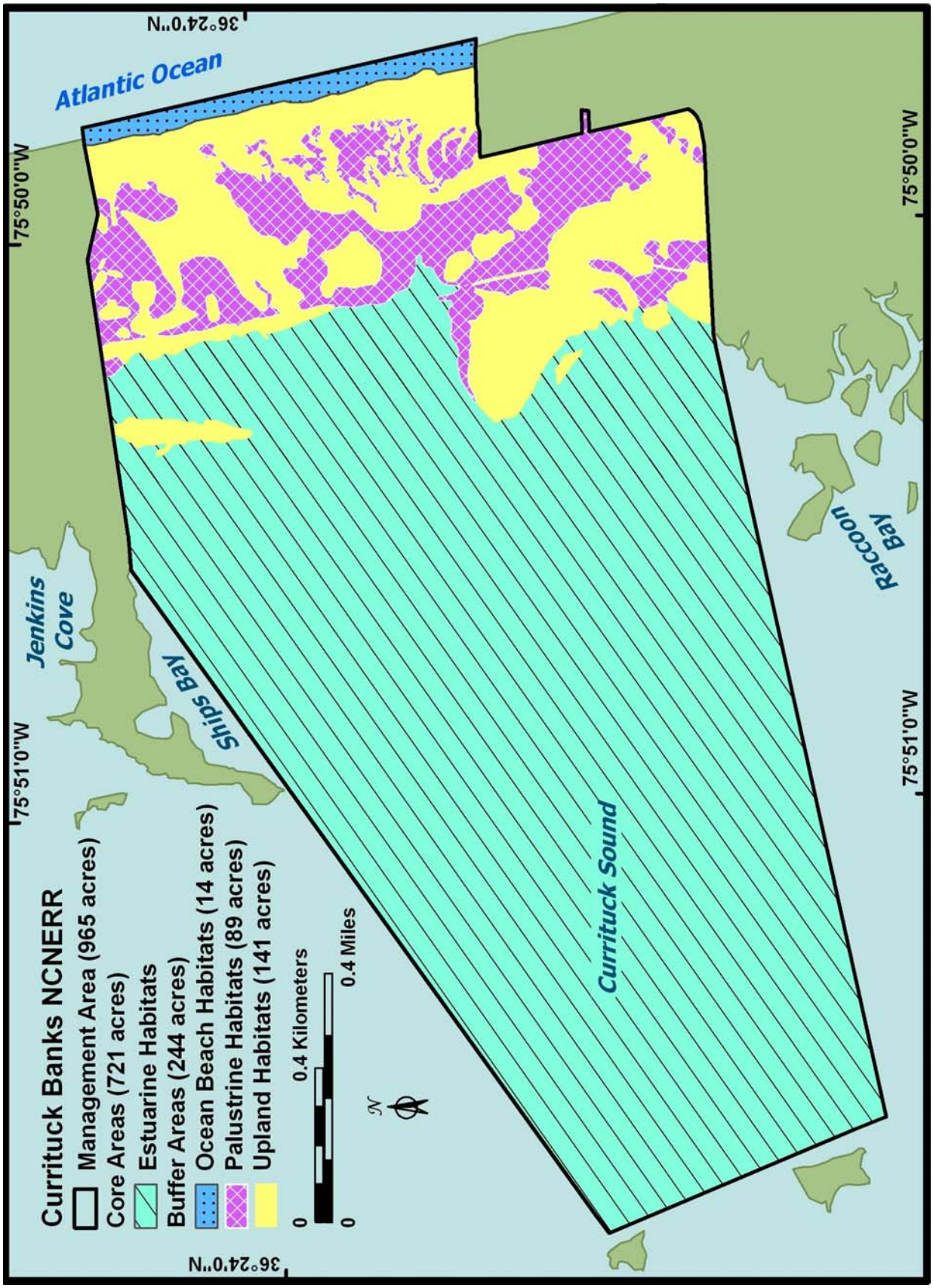


Figure 1: Core and buffer areas of the Currituck Banks NERR component

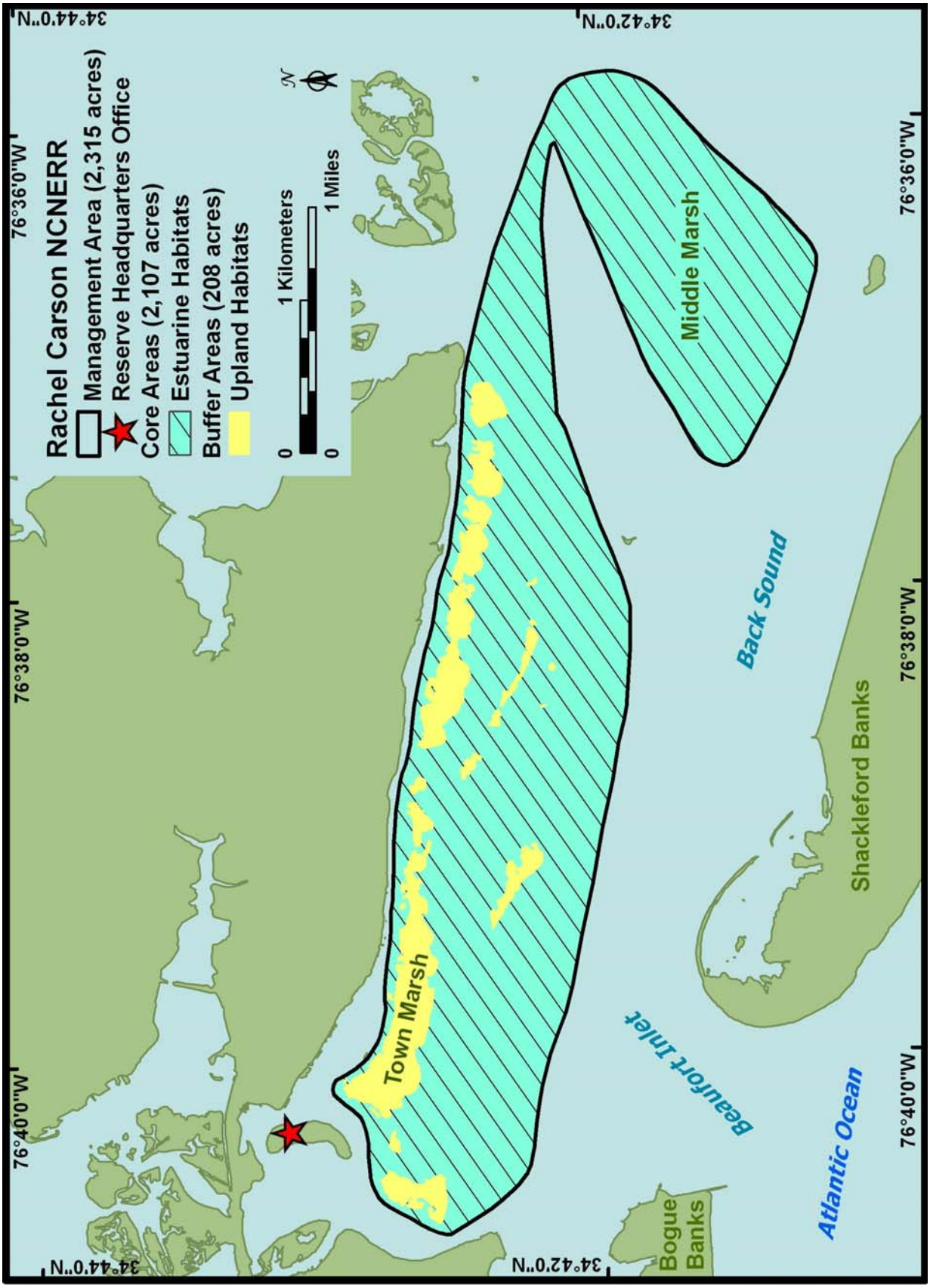


Figure 2: Core and buffer areas of the Rachel Carson NERR component

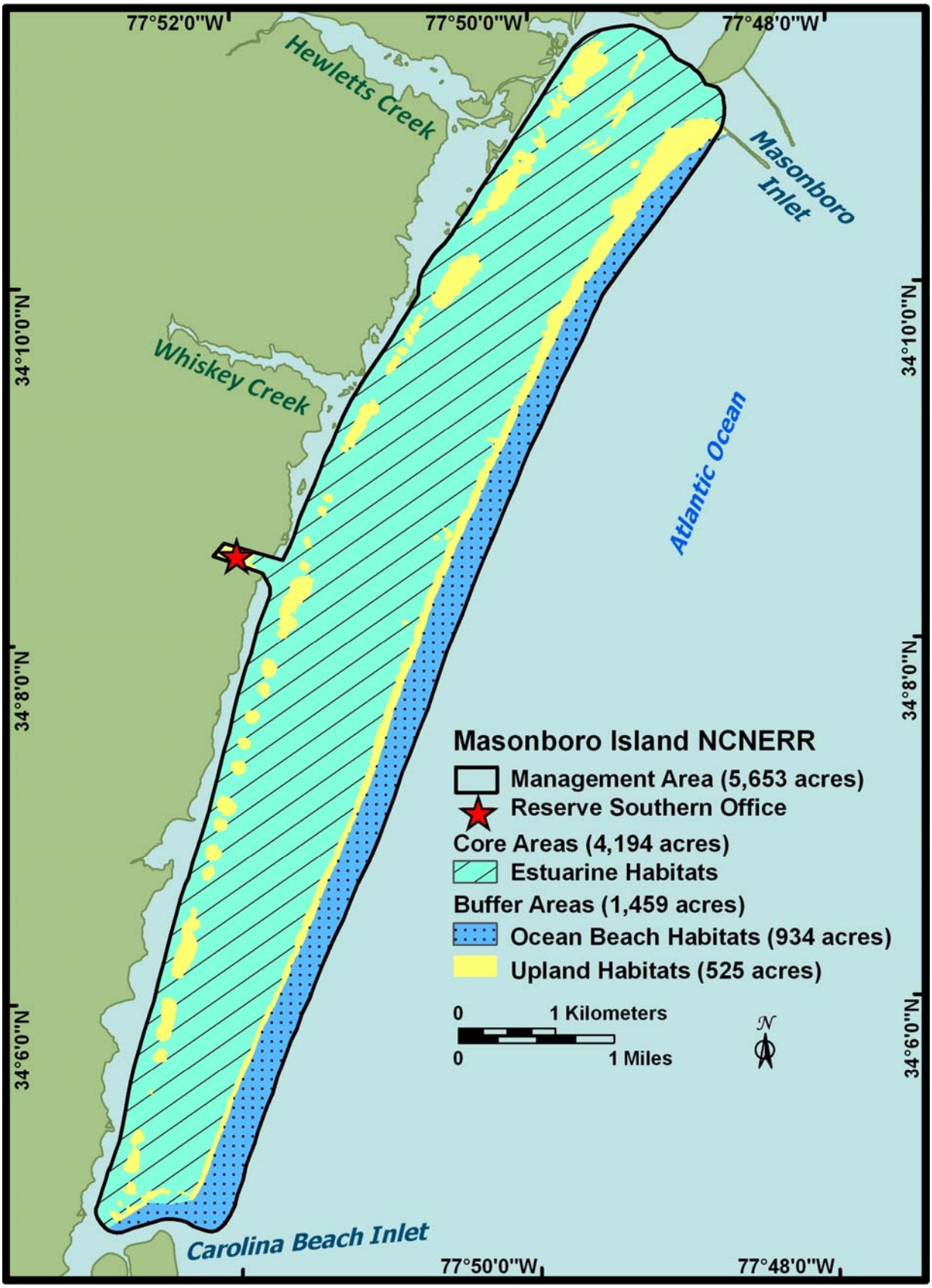


Figure 3: Core and buffer areas of the Masonboro Island NERR component

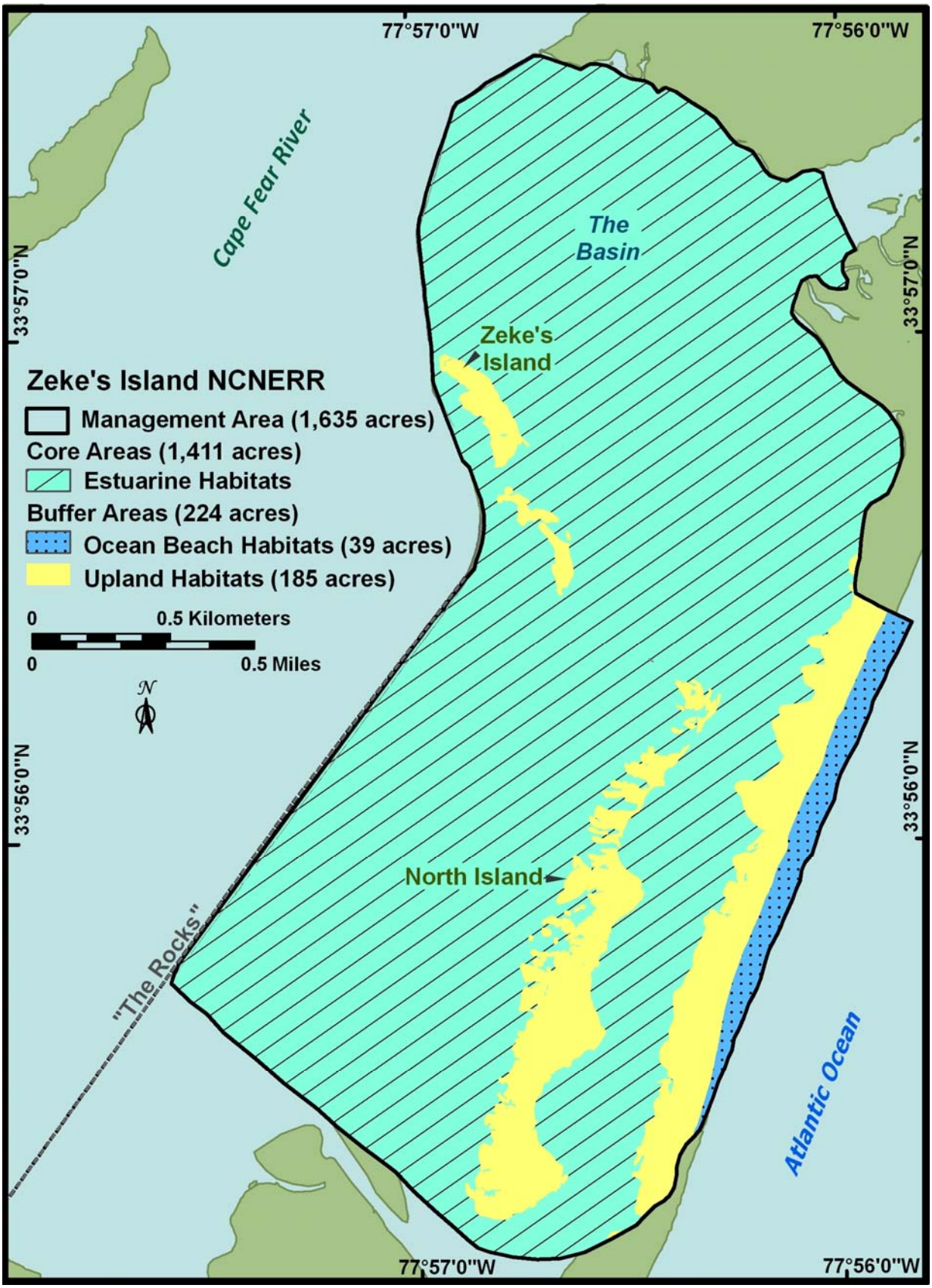


Figure 4: Core and buffer areas of the Zeke's Island NERR component

APPENDIX D: PUBLIC INPUT PROCESS

Development of this plan included direct input from all Reserve staff members, Division of Coastal Management staff, and the Estuarine Reserves Division (ERD) staff. Local Advisory Committee (LAC) members from each component site and Education Advisory Committee (EAC) members helped inform the specific activities listed in the Management Plan. The draft Management Plan was discussed with the four Local Advisory Committees in the fall of 2008 and winter of 2009. Each LAC was given a brief overview of the Management Plan and a copy of Figure 1 to facilitate the discussion. Site-specific issues and suggestions for resolution provided by the LACs were incorporated into the plan.

Following ERD's approval of the final Management Plan, a Federal Register Notice allowing a 30 day public comment period was published. In addition, similar Public Notices were sent to several local newspapers seeking public input on the NCNERR Management Plan. A public meeting on the revised Management Plan was held on 19 August 2009 in Beaufort. After the required 30 day public comment period, revisions to the document were made, where appropriate.

APPENDIX E: STATE ASSIGNMENT OF MANAGEMENT RESPONSIBILITIES

North Carolina Department of Natural Resources & Community Development

James B. Hunt, Jr., Governor — Joseph W. Grimsley, Secretary

March 14, 1983

MEMORANDUM

TO: KEN STEWART

FROM: JOE GRIMSLEY

RE: MANAGEMENT OF ESTUARINE SANCTUARIES

We are now in the final stages of acquiring title to the bulk of our estuarine sanctuary site at Carrot Island and all of the Zeke's Island site is now in state ownership. We will begin acquisition of the Currituck Banks site within the next few months, with Masonboro Island to follow next year.

As we have to be completing the federally required management plans for each sanctuary site in the near future, it is important that we have clearly established lines of responsibility within the Department for the management of these four estuarine sanctuary sites.

I am assigning lead management responsibility for the sites to the Office of Coastal Management. You will have responsibility for funding acquisition, grant administration, liaison with the State Property Office and the Attorney General's office on acquisition, preparation of management, research and education plans for each site, and oversight of the overall system. I am also directing that you carefully coordinate your activities with all affected divisions within the Department. Since the management and use of the sanctuaries, particularly day to day operational requirements, will likely involve several divisions, (particularly Parks and Recreation at Zeke's Island and perhaps Wildlife Resources Commission staff at Currituck) it is important that we carefully and cooperatively work together on this. Where possible, we must use existing management resources so as to avoid duplication and get the best possible use of limited funding for sanctuary management.

JG/ak

APPENDIX F: STATE RESERVE STATUTES

North Carolina General Statutes – Chapter 113A. Article 7.

Coastal Area Management
Part 5. Coastal Reserves

§ 113A-129.1. Legislative Findings and Purposes.

(a) Findings. – It is hereby determined and declared as a matter of legislative finding that the coastal area of North Carolina contains a number of important undeveloped natural areas. These areas are vital to continued fishery and wildlife protection, water quality maintenance and improvement, preservation of unique and important coastal natural areas, aesthetic enjoyment, and public trust rights such as hunting, fishing, navigation, and recreation. Such land and water areas are necessary for the preservation of estuarine areas of the State, constitute important research facilities, and provide public access to waters of the State.

(b) Purposes. – Important public purposes will be served by the preservation of certain of these areas in an undeveloped state. Such areas would thereafter be available for research, education, and other consistent public uses. These areas would also continue to contribute perpetually to the natural productivity and biological, economic, and aesthetic values of North Carolina's coastal area. (1989, c. 344, s. 1.)

§ 113A-129.2. Coastal Reserve Program.

(a) There is hereby created a North Carolina Coastal Reserve System for the purpose of acquiring, improving, and maintaining undeveloped coastal land and water areas in a natural state.

(b) This system shall be established and administered by the Department of Environment and Natural Resources. In so doing the Department shall consult with and seek the ongoing advice of the Coastal Resources Commission. The Department may by rule define the areas to be included in this system and set standards for its use.

(c) This system shall be established within the coastal area as defined by G.S. 113A-103(2).

(d) All acquisitions or dispositions of property for lands within this system shall be in accordance with the provisions of Chapter 146 of the General Statutes.

(e) All lands and waters within the system shall be used primarily for research and education. Other public uses, such as hunting, fishing, navigation, and recreation, shall be allowed to the extent consistent with these primary uses. Improvements and alterations to the lands shall be limited to those consistent with these uses. (1989, c. 344, s. 1; c. 727, s. 218(58); 1997-443, s. 11A.119(a).)

§ 113A-129.3. Coordination.

(a) To the extent feasible, this system shall be carried out in coordination with the National Estuarine Reserve Research System established by 16 U.S.C. § 1461.

(b) To the extent feasible, lands and waters within this system shall be dedicated as components of the "State Nature and Historic Preserve" as provided in Article XIV, Section 5, of the Constitution and as nature reserves pursuant to G.S. 113A-164.1 to G.S. 113A-164.11. (1989, c. 344, s. 1, c. 770, s. 47.)

APPENDIX G: STATE RESERVE RULES

SUBCHAPTER 7O - NORTH CAROLINA COASTAL RESERVE

SECTION .0100 - GENERAL PROVISIONS

15A NCAC 07O .0101 STATEMENT OF PURPOSE

The principal purposes of the North Carolina Coastal Reserve and supporting programs are to:

(1) preserve coastal ecosystems representative of the various biogeographic regions and typologies in North Carolina and to make them available for continuous future study of the processes, functions, and influences which shape and sustain the coastal ecosystems;

(2) provide new information on coastal ecosystem processes to decisionmakers as a basis for the promotion of sound management of coastal resources;

(3) provide a focal point for educational activities that increase the public awareness and understanding of coastal ecosystems, effects of man on them, and the importance of the coastal systems to the state and the Nation;

(4) accommodate traditional recreational activities, commercial fishing, and other uses of the Reserve as long as they do not disturb the Reserve environment and are compatible with the research and educational activities taking place there.

History Note: *Authority G.S. 113-3; 113-8; 143B-10;*
Eff. July 1, 1986;
Amended Eff. April 1, 1988.

15A NCAC 07O .0102 DEFINITIONS AS USED IN THIS SUBCHAPTER

Definitions as used in this Subchapter are:

(1) "Coastal Reserve" means those coastal land and water areas set aside to be maintained in their natural state for research, education and compatible recreation and enjoyment of natural and scenic beauty.

(2) "Estuary" means that part of a river or stream or body of water having unimpaired connection with the open sea, where sea water is measurably diluted with fresh water derived from land drainage.

(3) "Research Reserve" means a group of areas or components, each of which may include all or the key land and water portion of an estuary and adjacent transitional areas and uplands, constituting to the extent feasible a natural unit, set aside as a natural field laboratory to provide long-term opportunities for research, education, and interpretation of the ecological relationships within the area. The Coastal Reserve includes the Estuarine Research Reserve.

(4) "Reserve" means any area designated pursuant to this Subchapter.

History Note: *Authority G.S. 113-3; 113-8; 143B-10;*
Eff. July 1, 1986;
Amended Eff. April 1, 1988.

15A NCAC 07O .0103 RESPONSIBILITIES: DUTIES OF THE COASTAL RESERVE PROGRAM

The Coastal Reserve Program of the Division of Coastal Management shall be responsible for managing and protecting the North Carolina Coastal Reserve; for promoting and coordinating research and educational programs at the components while allowing for compatible traditional uses; for maintaining a management plan for the Reserve; for maintaining cooperative agreements with scientific, educational, and resource management agencies and private citizens that will assist in the management of the Reserve; and for providing new information on coastal processes to coastal management decisionmakers.

History Note: *Authority G.S. 113-3; 113-8; 143B-10;*
Eff. July 1, 1986;
Amended Eff. April 1, 1988.

15A NCAC 07O .0104 STATE AND LOCAL COASTAL RESERVE ADVISORY COMMITTEES

Advisory committees shall be established for each individual Reserve component. The committees shall advise the Reserve coordinator. Members of the committees shall include researchers, educators, managers, and citizens that use or are affected by the Reserve. The committees shall be appointed by the Secretary of the Department of Environment, Health, and Natural Resources.

History Note: *Authority G.S. 113-3; 113-8; 143B-10;*
Eff. July 1, 1986;
Amended Eff. May 1, 1990; April 1, 1988.

15A NCAC 07O .0105 RESERVE COMPONENTS

(a) The North Carolina Coastal Reserve includes the following components:

(1) Zeke's Island;
(2) Rachel Carson;
(3) Currituck Banks;
(4) Masonboro Island;
(5) Permuda Island;
(6) Buxton Woods;
(7) Bald Head Woods;
(8) Kitty Hawk Woods;
(9) Bird Island; and
(10) Emily and Richardson Preyer Buckridge.

The North Carolina National Estuarine Research Reserve includes components in Subparagraphs (1) - (4) of this Rule.

(b) Detailed boundary maps for each component are maintained and available for inspection at the Division of Coastal Management, 400 Commerce Avenue, Morehead City NC 28557.

History Note: *Authority G.S. 113-3; 113-8; 143B-10;*
Eff. July 1, 1986;
Amended Eff. February 1, 2006; April 1, 1999; August 1, 1991; April 1, 1988.

SECTION .0200 - MANAGEMENT: USE AND PROTECTION OF THE NORTH CAROLINA COASTAL RESERVE

15A NCAC 07O .0201 MANAGEMENT PLAN

The Division of Coastal Management shall prepare a management plan for the Reserve. The management plan shall contain specific policies for research, education, and traditional uses at each component. The Secretary of the Department of Environment, Health, and Natural Resources shall approve the management plan and its revisions. The Division of Coastal Management shall monitor and manage the components and report to the secretary violations of the approved plan and any other situations that may be harmful to the natural resources of the Reserve.

History Note: *Authority G.S. 113-3; 113-8; 143-341; 143-342; 143B-10;*
Eff. July 1, 1986;
Amended Eff. May 1, 1990; April 1, 1988.

15A NCAC 07O .0202 RESERVE USE REQUIREMENTS

The following use requirements shall apply to all of the components of the Reserve:

(1) The essential natural character of the Reserve shall be maintained.

(2) Traditional recreational uses within each component shall be allowed to continue as long as the activities do not disrupt the natural integrity of the Reserve or any research or educational projects. Incompatible traditional uses shall include:
   (a) fishing, hunting, or trapping activities not allowed by state rules;
   (b) target shooting;
   (c) hydraulic clam dredging within Reserve boundaries;
   (d) use of vehicles off designated corridors at components where vehicles are allowed for upland transportation according to the management plan; and
   (e) production of noise disruptive to local wildlife and the aesthetic enjoyment of the Reserve as a natural area.

(3) No user shall disturb a research project or research equipment in place at the Reserve.

(4) Camping or any form of habitation, whether on the uplands, wetlands, or waters within Reserve boundaries, shall not be allowed unless written permission is posted by the Division of Coastal Management.

(5) Personal property not authorized by the management agency may not be placed within the boundaries of the Reserve for more than two consecutive days.

(6) Users of the Reserve shall not disturb or remove any live animals, except those allowed by local or state hunting and fishing rules as they apply to the Reserve, or vegetation within the Reserve unless such action is part of a research or educational project approved by the management agency.

(7) Persons wishing to engage in scientific research or collection of natural materials within the Reserve shall first secure written permission from the management agency.

(8) No activity shall be allowed which might pollute any stream or body of water in the Reserve. Acts of pollution shall include:
   (a) Deposition of solid materials not indigenous to the local coastal ecosystem; and
   (b) Discharge of liquids other than uncontaminated estuarine water.

(9) No other acts or uses which are detrimental to the maintenance of the property in its natural condition shall be allowed including, but not limited to, disturbances of the soil, mining, commercial or industrial uses, timber harvesting, ditching and draining, deposition of waste materials.

History Note: *Authority G.S. 143B-10;*
Eff. July 1, 1986;
Amended Eff. April 1, 1999; December 1, 1991; April 1, 1988.

APPENDIX H: STATE NATURE PRESERVE DESIGNATION

North Carolina
Department of Administration

James G. Martin, Governor — James S. Lofton, Secretary

June 5, 1987

Mr. S. Thomas Rhodes, Secretary
NC Department of Natural Resources
and Community Development
512 N. Salisbury Street
Raleigh, NC 27611

Re: Allocation of Property to the Department of Natural Resources and Community Development - Dedication of the North Carolina Natural Estuarine Research Reserve

Dear Secretary Rhodes:

Pursuant to Article 9A, Chapter 113A of the North Carolina General Statutes and pursuant to the authority vested in me by the Administrative Procedures Code approved by the Governor and Council of State on January 28, 1976, all State-owned lands within the areas hereinafter designated are hereby allocated to the Department of Natural Resources and Community Development:

Those State-owned real properties hereinafter collectively known as the North Carolina National Estuarine Research Reserve lands (previously referred to as the North Carolina National Estuarine Sanctuary), consisting of four components:

1. Zeke's Island located in Brunswick and New Hanover Counties;

2. The Rachel Carson component located in Carteret County;

3. Currituck Banks located in Currituck County; and

4. Masonboro Island located in New Hanover County, all of which are more specifically described in Exhibits A, B, C, D and E attached hereto and by reference made a part hereof.

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THIS ALLOCATION IS MADE SUBJECT TO THE FOLLOWING TERMS AND CONDITIONS:

1. As used in this Letter of Allocation the terms "natural area" and "nature preserve" shall have the same meaning as contained in North Carolina General Statutes 113A-164.3(3)(4) respectively.

2. Pursuant to North Carolina General Statutes 113A- 164.8, all State-owned lands lying within the above-designated areas are hereby dedicated as a nature preserve to be known collectively as the North Carolina National Estuarine Research Reserve (hereinafter the "reserve" or "preserve") for the purposes provided in the North Carolina Preserves Act, as amended, and other applicable law, and said State-owned land shall be held, maintained, and used exclusively for said purposes.

3. Primary Custodian. The Primary Custodian of the reserve will be the North Carolina Department of Natural Resources and Community Development, which will be responsible for managing the nature preserve in accordance with this letter of allocation (dedication) and the regulations set forth in 15 NCAC 12H .0301-.0403.

4. Primary Classification. The primary classification and purpose of the preserve shall be research, education, and compatible traditional uses.

5. Rules for Management.
   A. Character of Visitor Activity. The principal visitor activities in the preserve shall be research, walking, observing, fishing, and hunting. These activities shall be regulated to prevent disturbance of the preserve beyond that which it can tolerate without significant environmental degradation. Use of vehicles along designated corridors will be allowed only at the Zeke's Island and Currituck Banks components. Camping will be allowed only with the written permission of the Department of Natural Resources and Community Development.

   Activities and uses which are unrelated to those mentioned above are prohibited except as provided for herein or unless necessary to carry out the purposes of the preserve. Prohibited activities include, but are not limited to, construction not related to the preserve, commercial activities and development, agriculture and grazing of domestic animals, mineral exploration and development, dumping or changes in topography except by existing easements, the gathering of plant products except as provided for in approved research projects, and the removal, disturbance, molestation, or defacement of minerals, archaeological features, or natural features.

No exotic flora and no dogs, cats, or other animals, domestic or exotic, except hunting dogs, shall be brought into the preserve.

There shall be no fires, except as permitted by the Department of Natural Resources and Community Development, and there shall be no littering permitted.

B. Hunting and Fishing. Hunting and fishing shall be permitted on the preserve subject to regulation and management by the North Carolina Wildlife Resources Commission and the North Carolina Division of Marine Fisheries, such regulation and management to be consistent with protection of the natural diversity and primitive character of the preserve.

C. Orientation and Guidance of Visitors. The Custodian may maintain parking and access areas including boat landing and service roads for patrol, fire control, right-of-way, maintenance, and other management activities. Exhibits, programs, and printed materials may be provided by Custodian in service areas. Guide service and labeled nature trails may be provided by Custodian within the preserve.

D. Water Level Control. The purpose of any water level control shall be to maintain the natural water regime of the preserve. Water levels which previously have been altered by man may be changed by the Custodian for the restoration of natural conditions.

E. Disturbance of Natural Features. The cutting or removal of trees, dead or alive, or the disturbance of other natural features is prohibited, except that which is consistent with the purposes of this dedication, or is required under the terms of certain right-of-way easements between the State and public utility companies and governmental agencies, or is necessary for public safety.

F. Visitor Protection. Guardrails, fences, steps, and bridges may be provided by the Custodian when essential to the safety of a reasonably alert and cautious visitor. The Custodian shall have the right to erect such structures as may be necessary to protect the preserve from unwanted or excessive visitor traffic.

G. Control of Vegetational Succession. Control of vegetatational succession may be undertaken if necessary to maintain or restore a particular ecosystem or the preservation of threatened, rare, endangered, or unusual species.

H. Research and Collecting Permits. Any person wishing to engage in scientific research requiring collecting or otherwise affecting anything within the preserve shall first secure written permission from the Department of Natural Resources and Community Development.

I. Fences. Fences and barriers may be installed as necessary to further the purposes of the preserve.

J. Trails. The Custodian shall locate, build, and maintain trails which shall be adequate to provide for permitted use of the preserve, but otherwise such activities shall be kept to a minimum.

K. Other Structures and Improvements. The Custodian shall have the right to erect structures or facilities within the preserve, insofar as the same are consistent with the purposes of the preserve as stated in this dedication.

L. Management Plan. The North Carolina Department of Natural Resources and Community Development, as Primary Custodian of the preserve, shall be required to prepare and submit for approval to the Secretary of Natural Resources and Community Development a management plan for the preserve. This plan shall be subject to all the provisions of this dedication and shall additionally be consistent with the management principles set forth in the North Carolina Administrative Code 15 NCAC 12H .0403, 15 NCAC 70 .0202 and such other regulations as may be established from time to time by the Secretary of Natural Resources and Community Development. In any case where contradictions may arise between this instrument of dedication and other management regulations, the terms of this dedication shall take precedence.

6. Amendment and Modification. The terms and conditions of this dedication may be amended or modified upon approval of the Governor and Council of State. The lands dedicated to the North Carolina National Estuarine Research Reserve pursuant to this instrument may be removed from dedication upon the approval of the Governor and Council of State.

7. Permanent Plaque. The Custodian may erect and maintain a permanent plaque or other appropriate marker at a prominent location on the within described premises bearing the following statement: "This Area is Dedicated as a State Nature Preserve."

The Governor and Council of State have approved the dedication of the State-owned lands hereinabove described as the North Carolina National Estuarine Research Reserve to be held in trust by the Custodian for the uses and purposes expressed in the Nature Preserves Act at a meeting held in the City of Raleigh, North Carolina, on the 3rd day of February, 1987.

This allocation is made at no cost or consideration to the Department of Natural Resources and Community Development.

Best regards.

Sincerely,

James S. Lofton
Secretary of Administration

CONSENTED AND AGREED TO:

S. Thomas Rhodes, Secretary
North Carolina Department of
Natural Resources and
Community Development

North Carolina
Department of Administration

James B. Hunt Jr., Governor

Katie G. Dorsett, Secretary

February 19, 1996

Mr. Jonathan B. Howes, Secretary
North Carolina Department of Environment,
Health, and Natural Resources
512 North Salisbury Street
Raleigh, North Carolina 27603

Re: Dedication of Land, Masonboro Island, New Hanover County

Dear Secretary Howes:

The North Carolina Division of Coastal Management manages Masonboro Island Estuarine Reserve which was dedicated pursuant to the Nature Preserves Act of 1985. This property was dedicated by a Letter of Allocation dated June 5, 1987. Since this date, the State has acquired additional property for the Reserve.

Pursuant to Article 9A, Chapter 113 of the North Carolina General Statutes and pursuant to the authority vested in me by North Carolina General Statute 143-341(4)(g), all state-owned lands within the areas described below are hereby allocated to the Department of Environment, Health, and Natural Resources, Division of Coastal Management subject to the conditions described in the June 5, 1987 Letter of Allocation:

Those lands located on Masonboro Island in New Hanover County, managed by the Division of Coastal Management as of the date of this instrument and those additional properties subsequently purchased as additions to the Reserve and more specifically shown on the attached Exhibit A. The Governor and Council of State have approved the additions to the Masonboro Island Estuarine Reserve dedication described by this document at a meeting in Raleigh, North Carolina on June 6, 1995.

Sincerely,

Katie G. Dorsett

KGD/ljh

CONSENTED AND AGREED TO:

Jonathan B. Howes, Secretary
Department of Environment, Health
and Natural Resources

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State Courier 51-01-00

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APPENDIX I: COUNTY AND MUNICIPAL ZONING REGULATIONS

Land use and zoning

Applicable county and municipal zoning regulations are considered in the operation of the NCNERR. Management is also consistent with land use policies and land classifications adopted as part of local land use plans.

Currituck Banks: Currituck County has zoned upland portions of the component R-01: single family residences or planned unit development. The county land use plan classifies the Reserve land as "Conservation."

Rachel Carson: The Town of Beaufort has zoned this component as OS: open space for public use. The Carteret County land use plan classifies the component as "Conservation – Public Land."

Masonboro Island: The upland areas are zoned R-20: low-density, single family residences. New Hanover County classifies this component as "Conservation" land.

Zeke's Island: This component is bisected by two counties, New Hanover and Brunswick. The New Hanover County portion of the component is not zoned for development since it is prone to flooding. The county includes a "Conservation" classification to encompass coastal areas within the 100-year flood zone or CAMA-defined Areas of Environmental Concern. In Brunswick County, the Zeke's Island component is also not zoned, but is also classified as "Conservation" land.

The northern portion of the Zeke's Island component occupies land within the blast radius of Sunny Point Military Ocean Terminal. Consequently, personnel at the military installation must approve all development activities on the site (and on adjoining properties to the north). These restrictions prohibit construction of vertical structures such as gazebos, information centers, and restroom facilities.

Municipal and county ordinances

Additionally, the individual Reserve components are subject to municipal and county regulations. In some instances, specific ordinances apply to the Reserve sites, such as in New Hanover County, which prohibits use of all-terrain vehicles on Masonboro Island. A goal of the stewardship sector is to determine which counties and municipalities have such ordinances and collate the results into a reference document for each site.

APPENDIX J: RESERVE MEMORANDA OF UNDERSTANDING

i. U.S. Fish and Wildlife Service, The Nature Conservancy and the Division of Coastal Management (DCM)

1448-0004-96-931

MEMORANDUM OF UNDERSTANDING

between

U.S. Fish and Wildlife Service,

The Nature Conservancy

and the

North Carolina Department of Environment,

Health and Natural Resources

This Memorandum of Understanding serves as an expression of intent among three parties-in-interest, hereinafter called the Signatories: the U.S. Fish and Wildlife Service, The Nature Conservancy, and the North Carolina Department of Environment, Health, and Natural Resources/Division of Coastal Management.

The authority to enter into this Memorandum of Understanding is 16 U.S.C. 661 (the Fish and Wildlife Coordination Act) and 16 U.S.C. 715k (the Migratory Bird Conservation Act).

Witnesseth:

WHEREAS, the State of North Carolina has received a grant from the United States Department of Commerce for acquisition and development of four sites on the North Carolina coast known as the North Carolina National Estuarine Research Reserve.

WHEREAS, the Currituck Banks Component has been established just north of Corolla, North Carolina, and

WHEREAS, the North Carolina National Estuarine Research Reserve Management Plan outlines policies for research, education, compatible traditional uses and management practices permitted on the Component, and

WHEREAS, The Nature Conservancy and the U.S. Fish and Wildlife Service own adjacent tracts of land in the area, namely: the U.S. Fish and Wildlife Service has established the Currituck National Wildlife Refuge, and the Nature Conservancy owns lands north of Corolla, and

WHEREAS, a coordinated effort to preserve and protect the Currituck Outer Banks will be to the mutual benefit of all parties.

NOW THEREFORE, in consideration of the mutual benefits to be derived, the Signatories agree to the following:

1. The Signatories will coordinate and cooperate to insure that management activities on their respective areas do not adversely affect the land, its wildlife, natural and scenic values, and each other's management programs.

2. When compatible, the Signatories agree to allow Estuarine Research Reserve research and educational programs on all tracts owned by the Signatories after proper issuance of permits by the appropriate parties. The tracts will be technically included in the Reserve from research and educational standpoints; however, individual management prerogatives will be maintained by each signatory for their respective property.

3. The Coordinator of the Estuarine Research Reserve Program shall regularly discuss proposed and ongoing research and educational activities on the properties managed by the other Signatories.

4. The Signatories agree that emergency upland access may be used by local residents only in the event that high water conditions prohibit the customary use of the ocean beach for access across the properties.

5. The Signatories agree to notify each other if any vandalism, misuse of property or other problems are observed on the respective tracts during routine patrols of the area.

6. The Signatories will be represented on the Currituck Banks Local Advisory Committee which will give input and suggestions concerning management of the Currituck Banks Component.

This Memorandum of Understanding will become effective upon execution of all Signatories and remain in effect for 5 years thereafter. This Memorandum of Understanding can be extended by mutual written agreement of all Signatories. Any Signatory may terminate this agreement by providing sixty (60) day written notice to the other Signatories.

U.S. FISH AND WILDLIFE SERVICE

Date: APR 1 0 1996

For Noreen K. Clough, Regional Director

THE NATURE CONSERVANCY

Date: 3/18/96

Michael L. Andrews, Regional Director

NORTH CAROLINA DEPARTMENT OF ENVIRONMENT, HEALTH, AND NATURAL RESOURCES

Date: 2/27/96

Jonathan B. Howes, Secretary

AGREEMENT NO: 1448-0004-96-931
CHARGE CODE: NO CHANGE
AMOUNT: NO CHANGE
TIN: NONE
DUNS NO: NONE

MODIFICATION NO. 1

To

MEMORANDUM OF UNDERSTANDING

Between

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

And

THE NATURE CONSERVANCY

And

NORTH CAROLINA DEPARTMENT OF ENVIRONMENT,
HEALTH AND NATURAL RESOURCES

The purpose of this modification is to provide for five more years of performance on this Agreement and make minor textual changes to the agreement.

1. The period of performance will become effective upon execution of all Signatories and remain in effect for 5 years.

2. Replace Paragraph 2 to update the authorities with the following:

   The federal authority to enter into this Memorandum of Understanding consists of 16 U.S.C. 661 (the Fish and Wildlife Coordination Act),16 U.S.C. 715k (the Migratory Bird Conservation Act) and 15 CFR Part 921 (National Estuarine Research Reserve Program Regulations). State authority is found under G.S. 113A – 129.3 (Coastal Reserve Statutes) and NCAC T15: 07O .0103 (Coastal Reserve Rules)

3. Replace Paragraph 1 under Witnesseth with the following:

WHEREAS, the State of North Carolina has received federal and state grants for acquisition and development of nine sites or components on the North Carolina coast known as the North Carolina Coastal Reserve; four of these sites also have been designated as the North Carolina National Estuarine Research Reserve, and

4. Replace Paragraph 2 under Witnesseth with the following:

WHEREAS, the Currituck Banks Component of the North Carolina National Estuarine Research Reserve has been established just north of Corolla, North Carolina, and

THE NATURE CONSERVANCY

BY: [signature]

TITLE: Director of Science

DATE: 5/16/01

NORTH CAROLINA DEPARTMENT OF ENVIRONMENT, HEALTH AND NATURAL RESOURCES

BY: [signature]

TITLE: Secretary

DATE: 5/7/01

U.S. DEPARTMENT OF INTERIOR
FISH AND WILDLIFE SERVICE

BY: [signature]

Donald H. Calder

TITLE: Supervisory Contract Specialist

DATE: 05/24/01

APPENDIX J: RESERVE MEMORANDA OF UNDERSTANDING

ii. National Oceanic and Atmospheric Administration (NOAA) and DCM



MEMORANDUM OF UNDERSTANDING
BETWEEN
THE STATE OF NORTH CAROLINA
AND
THE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
CONCERNING THE
ESTABLISHMENT AND ADMINISTRATION OF
THE NORTH CAROLINA NATIONAL ESTUARINE SANCTUARY

WHEREAS, the State of North Carolina has determined that the waters and surrounding coastal habitats of the Zeke's Island, Masonboro Island, Rachel Carson, and Currituck Banks components provide unique opportunities for study of natural and human processes occurring within the estuarine ecosystems of the State and for increased public awareness and understanding of such systems, their natural values and benefits to society, and their susceptibility to degradation through natural phenomena and man's activities; and

WHEREAS, the Natural Oceanic and Atmospheric Administration (NOAA), U. S. Department of Commerce has concurred with that finding and pursuant to its authority under Section 315 of the Coastal Zone Management Act of 1972, as amended (CZMA), P.L. 92-583, 16 U.S.C. 1461, and in accordance with implementing regulations at 15 CFR 921.30, may designate these components as a National Estuarine Sanctuary; and

WHEREAS, the Governor of the State of North Carolina has designated the Division of Coastal Management (DCM) to act on behalf of the State in matters concerning the North Carolina National Estuarine Sanctuary (NCNES), the boundaries of which are delineated in the proposed Sanctuary Management Plan (Plan); and

WHEREAS, the DCM, as the agency designated in the Plan and by the State of North Carolina responsible for managing the NCNES, acknowledges the need and requirement for continuing State-Federal cooperation in the long-term management of the sites in a manner consistent with the purposes originally sought through their designation.

NOW, THEREFORE, in consideration of the mutual covenants contained herein it is agreed by and between the DCM and NOAA -- effective immediately for Sanctuary Components at Currituck Banks, Rachel Carson, and Zeke's Island, and in the case of Masonboro Island, on the date of its designation as a component of the NCNES -- as follows:

ARTICLE I: State-Federal Roles in Sanctuary Management

A. The DCM, as the principal contact for the State of North Carolina in all matters concerning the NCNES, will serve to ensure that the Sanctuary is managed in a manner consistent with the goals of the National Estuarine Sanctuary Program and the management objectives of the Plan. Its responsibilities for Plan implementation will include the following:

(1) Effect and maintain a process for coordinating the roles and responsibilities of all State agencies involved in the management of the Sanctuary, including but not limited to:

(a) Enforcement programs regulating water quality, fish and wildlife habitat protection, sport and commercial fisheries, and non-consumptive recreational activities;

(b) The administration of facilities, programs, and tasks related to Sanctuary management;

(c) Activities and programs conducted pursuant to the State's Federally-approved coastal management program authorized under Section 306 of the CZMA; and

(d) Research agenda developed and implemented in accordance with corresponding elements of the proposed Plan;

(2) As the Governor's designee under 15 CFR 921.50 and recipient State entity in matters concerning all financial assistance awards authorized under Section 315 of the CZMA, apply for, budget, and allocate such funds received for supplemental acquisition and development, operation and management, and research;

(3) Prepare and submit to NOAA for its approval an operational strategy which in coordination with the Plan describes how the State of North Carolina intends to meet its long-term commitment to the management of the Sanctuary. The strategy, at a minimum will describe the following:

(a) Specific mediation procedures and resolution mechanisms, developed, jointly with the Sanctuary Programs Division (SPD) within the Office of Ocean and Coastal Resource Management (OCRM), for reaching mutually acceptable solutions for correcting or avoiding conflicts requiring action under 15 CFR 921.35;

(b) The procedures developed in accordance with SPD guidelines and proposed by the State as a means for prescribing contingency responses to emergency conditions that exceed routine Plan implementation; and

(c) The Plan's continuing function, after Federal financial assistance for operations and management ends, as a vehicle for carrying out the mission of the national program; i.e., (i) how the State intends to coordinate Sanctuary management with its coastal resource management decisionmaking process; (ii) the anticipated work program, priorities, and sources of funding for ensuring the continued maintenance of the Sanctuary; and (iii) the means relied upon by the State to assure NOAA that real property acquired with Federal funds for the purposes of the Sanctuary will continue to be used in a manner consistent with 15 CFR 921.21(e);

(4) Serve as principal negotiator on issues involving proposed boundary changes and/or amendments to the Plan;

(5) Submit annual reports to NOAA on the Sanctuary describing, in accordance with 15 CFR 921.34, program performance in Plan implementation

and a detailed work program for the following year of Sanctuary operations, including budget projections and research efforts;

(6) Respond to NOAA's requests for information and to evaluation findings made pursuant to Section 312 of the CZMA; and

(7) In the event that it should become necessary, based on findings of deficiency, serve as the point-of-contact for the State or North Carolina in actions involving the possible withdrawal of Sanctuary designation, as provided at 15 CFR 921.35, the SPD within NOAA will serve to administer the provisions of Section 315 of the CZMA to ensure that the NCNES is managed in accordance with the goals of the National Estuarine Sanctuary Program and the Plan.

B. In carrying out its responsibilities, the SPD will:

(1) Subject to appropriation, provide financial assistance to the State, consistent with 15 CFR 921 Subparts D, E, and F, for managing and operating the Sanctuary;

(2) Serve as the point-of-contact for NOAA in discussions regarding applications for and any financial assistance received by the State under Section 315 of the CZMA, including any and all performance standards, compliance schedules, or Special Award Conditions deemed appropriate by NOAA to ensure the timely and proper execution of the proposed work program;

(3) Participate in periodic evaluations scheduled by OCRM in accordance with Section 312 of the CZMA to measure the State's performance in implementing the Plan and conditions of the award or complying with the Sanctuary designation and, where required, advise the appropriate OCRM staff of existing or emerging Sanctuary issues which might affect the State's coastal management program; and

(4) Establish an information transfer/exchange network cataloging all available research data and educational material developed on each site included within the national system of estuarine sanctuaries.

ARTICLE II: Real Property acquired for the purposes of the Sanctuary

A. The NCNES agrees to the conditions set forth at 15 CFR 921.21(e) which specify the legal documentation reqirements concerning the use and disposition of real property acquired for Sanctuary purposes with Federal funds under Section 315 of the CZMA.

ARTICLE III: Program Evaluation

A. During the period that Federal financial assistance is available for Sanctuary operations and management, the OCRM will schedule, pursuant to 15 CFR 921.34, periodic evaluations of the State's performance in meeting the conditions of such awards and progress in implementing the Plan and the provisions of this MOU. Where findings of deficiency occur, NOAA may initiate action in accordance with the procedures established at 15 CFR 921.35.

B. After Federal financial assistance under Section 315 of the CZMA is no longer available for the operation and management of the Sanctuary,

the OCRM will continue to evaluate, pursuant to Section 312 of the CZMA and the corresponding provisions of 15 CFR 921, the DCM's performance in implementing the Plan and strategy committing the State to the long-term management of the NCNES. Where findings of deficiency occur, NOAA may initiate action in accordance with the procedures established at 15 CFR 921.35.

IN WITNESS THEREOF, the parties hereto have caused this Memorandum to be executed.

David W. Owens

David W. Owens, Director
Division of Coastal Management
Natural Resources and Community Development
State of North Carolina

9/10/85
Date

S. Thomas Rhodes

S. Thomas Rhodes, Secretary
North Carolina Department of Natural Resources and Community Development
State of North Carolina

9/10/85
Date

Nancy Foster

Dr. Nancy Foster, Chief
Sanctuary Programs Division
Office of Ocean and Coastal Resources Management
National Oceanic and Atmospheric Administration
U. S. Department of Commerce

10/1/85
Date

for Peter L. Tweedt, Director
Office of Ocean and Coastal Resources Management
National Oceanic and Atmospheric Administration
U. S. Department of Commerce

10-10-85
Date

APPENDIX J: RESERVE MEMORANDA OF UNDERSTANDING

iii. University of North Carolina at Wilmington and DCM*

(new MOU is in development)*

MEMORANDUM OF UNDERSTANDING

This memorandum serves as an expression of intent between the North Carolina Department of Natural Resources and Community Development/Division of Coastal Management and the University of North Carolina at Wilmington.

Witnesseth

WHEREAS, the State of North Carolina has received a grant from the United States Department of Commerce for acquisition and development of four sites on the North Carolina coast as the North Carolina National Estuarine Sanctuary, and

WHEREAS, the Zeke's Island and Masonboro Island Components of the North Carolina National Estuarine Sanctuary have been established in New Hanover/ Brunswick Counties, and

WHEREAS, the Department of Natural Resources and Community Development is responsible for developing a program to promote and encourage the use of these and other Sanctuary sites for research and education, and

WHEREAS, the University of North Carolina at Wilmington has for years used both sites for research and educational activities and has faculty members on the State and Local Estuarine Sanctuary Advisory Committees, and

WHEREAS, a coordinated effort to provide and promote research and educational use of the Components will be to the mutual benefit of both parties,

NOW THEREFORE, in consideration of the mutual benefits to be derived, the Signatories agree to the following:

1. The purpose of the Estuarine Sanctuary Program is the protection of lands for use as natural field laboratories and living classrooms in which to gather data and educate the people of North Carolina concerning natural and human processes occurring within North Carolina's estuaries.

2. The Sanctuary Management Plan will provide a framework for conducting research and educational programs on the Sanctuary sites. The Management Plan has been developed by the Estuarine Sanctuary staff and will be periodically reviewed by the State and Local Advisory Committees and concerned citizens and users of the Sanctuary.

3. The Signatories will adhere to the approved Management Plan in their research and educational use of the Sanctuary.

4. The University shall be fully and regularly consulted by the Sanctuary staff regarding research and educational opportunites and information as well as management policies pertaining to the Sanctuary.

5. Educational programs led by the University staff will stay within the area of the site designated for public access and shall not in any way interfere with research projects. However, specific visits to research sites may be accommodated by prior consultation and approval of the researcher(s) and the Estuarine Sanctuary Coordinator.

6. The staff of the University shall keep a log of their visitation to the sites. These records will be filed periodically with the Sanctuary Coordinator. The University staff will further notify the Sanctuary Coordinator as necessary of signs of overuse, vandalism, or other deterioration.

Signed,

UNIVERSITY OF NORTH CAROLINA
AT WILMINGTON

Date 11/25/85

Dr. William H. Wagoner, Chancellor

UNIVERSITY OF NORTH CAROLINA
AT WILMINGTON, OFFICE OF RESEARCH
ADMINISTRATION

Date 11/20/85

Dr. John J. Manock, Director

NORTH CAROLINA DEPARTMENT OF
NATURAL RESOURCES AND COMMUNITY
DEVELOPMENT

Date 11/14/85

S. Thomas Rhodes, Secretary

APPENDIX J: RESERVE MEMORANDA OF UNDERSTANDING

iv. Center for Coastal Fisheries and Habitat Research (NOAA) and DCM

(new MOU is in development)*

Placeholder from new MOU

APPENDIX J: RESERVE MEMORANDA OF UNDERSTANDING
v. Duke University Marine Laboratory and DCM

MEMORANDUM OF UNDERSTANDING

This memorandum serves as an expression of intent between the North Carolina Department of Natural Resources and Community Development/Division of Coastal Management and the Duke University Marine Laboratory.

Witnesseth

WHEREAS, the State of North Carolina has received a grant from the United States Department of Commerce for acquisition and development of four sites on the North Carolina coast as the North Carolina National Estuarine Sanctuary, and

WHEREAS, the Rachel Carson Component of the North Carolina National Estuarine Sanctuary has been established on the Carrot Island-Bird Shoal complex opposite Beaufort, N. C., and

WHEREAS, the Department of Natural Resources and Community Development is responsible for developing a program to promote and encourage the use of this and other sanctuary sites for research and education, and

WHEREAS, the Marine Laboratory has used the site for decades in their research and educational programs and has faculty members serving on the State and Local Estuarine Sanctuary Advisory Committees, and

WHEREAS, a coordinated effort to provide and promote research and educational use of the Rachel Carson Component will be to the mutual benefit of both parties,

NOW THEREFORE, in consideration of the mutual benefits to be derived, the Signatories agree to the following:

1. The purpose of the Estuarine Sanctuary Program is the protection of lands for use as natural field laboratories and living classrooms in which to gather data and educate the people of North Carolina concerning natural and human processes occurring within North Carolina's estuaries.

2. The Sanctuary Management Plan for the Rachel Carson Component will provide a framework for conducting research and educational programs on the Sanctuary site. The Management Plan has been developed by the Estuarine Sanctuary staff and will be periodically reviewed by the State and Local Advisory Committees and concerned citizens and users of the Sanctuary.

3. The Signatories will adhere to the approved Management Plan in their research and educational activities within the Sanctuary.

4. The Marine Laboratory shall be fully and regularly consulted by the Sanctuary staff regarding research and educational opportunities and information as well as management policies pertaining to the Sanctuary.

5. Educational programs led by the Marine Laboratory's staff will stay within the area of the site designated for public access and shall not in any way interfere with research projects. However, specific visits to research sites may be accommodated by prior consultation and approval of the researcher(s) and the Estuarine Sanctuary Coordinator.

6. The staff of Marine Laboratory shall keep a log of their visitation to the site. These records will be filed periodically with the Sanctuary Coordinator. The Marine Laboratory staff will further notify the Sanctuary Coordinator as necessary of signs of overuse, vandalism, or other damage or deterioration.

Signed,

DUKE UNIVERSITY

Date October 23, 1985

H. Keith H. Brodie, President

NORTH CAROLINA DEPARTMENT OF NATURAL RESOURCES AND COMMUNITY DEVELOPMENT

Date 9/20/85

for S. Thomas Rhodes, Secretary

APPENDIX J: RESERVE MEMORANDA OF UNDERSTANDING

vi. Division of Marine Fisheries and DCM

MEMORANDUM OF UNDERSTANDING

This memorandum serves as an expression of intent between the Division of Marine Fisheries and the Division of Coastal Management within the North Carolina Department of Natural Resources and Community Development.

WITNESSETH

WHEREAS, the State of North Carolina has recieved a grant from the United States Department of Commerce for acquisition and development of four components on the North Carolina coast (see Appendix A) as the North Carolina Estuarine Sanctuary, and

WHEREAS, the Division of Coastal Management is responsible for developing programs to promote research, education, and compatible traditional uses of the sites by coordination with other State agencies, and

WHEREAS, the Division of Marine Fisheries has shown support of the sanctuary program by their representation on local and State Sanctuary Advisory Committees, and

WHEREAS, the Division of Marine Fisheries has the responsibility to regulate the taking of fish and shellfish within the marine and estuarine waters of the State, and

WHEREAS, Marine Fisheries Inspectors are given jurisdiction over all offenses involving property owned, leased to, or managed by the Department in connection with the conservation of marine and estuarine resources by General Statute 113-136(b), and,

WHEREAS, a coordinated effort of site surveillance and enforcement of Marine Fisheries regulations and other rules and regulations as applicable to the North Carolina Estuarine Sanctuary will be to the mutual benefit of both Divisions,

NOW THEREFORE, in consideration of the mutual benefits to be derived, the signatories agree to the following:

1. The purpose of the estuarine sanctuary program is the protection of lands and waters for use as natural field laboratories and living classrooms in which to gather data and educate the public concerning North Carolina's estuaries.

2. The Sanctuary Management Plan provides a framework for conducting research and educational programs on the components. The plan has been developed by the estuarine sanctuary staff and will be periodically reviewed by the State and Local Advisory Committees and concerned citizens and users of the sanctuary components.

3. The Management Plan includes policies on sanctuary use, surveillance, and enforcement. The policies pertaining to traditional and commercial fishing shall be in accordance with statutes (GS 113-182 and GS 143B-286) established by the Marine Fisheries Commission for the taking of fish and shellfish in the marine and estuarine waters of North Carolina.

4. Marine Fisheries Inspectors will routinely patrol the Sanctuary components under their jurisdictions. The Estuarine Sanctuary Coordinator will periodically contact the officers to discuss any significant problems associated with fishing or other uses of the sites.

5. The Division of Coastal Management may request the Division of Marine Fisheries to change the patterns of use within a site (e.g., establish a Research Sanctuary area within a sanctuary component) if necessary for research purposes or protection of natural resources.

6. The Estuarine Sanctuary Coordinator or his representative may request assistance from Marine Fisheries Law Enforcement personnel in matters where service of legal papers or arrests are anticipated because of violations of laws or regulations pertaining to use of sanctuary components (15 NCAC 70 .0202).

Signed,

DEPARTMENT OF NATURAL RESOURCES AND COMMUNITY DEVELOPMENT

Date 4/17/87

for S. Thomas Rhodes, Secretary

DIVISION OF MARINE FISHERIES

Date 4/22/87

William T. Hogarth

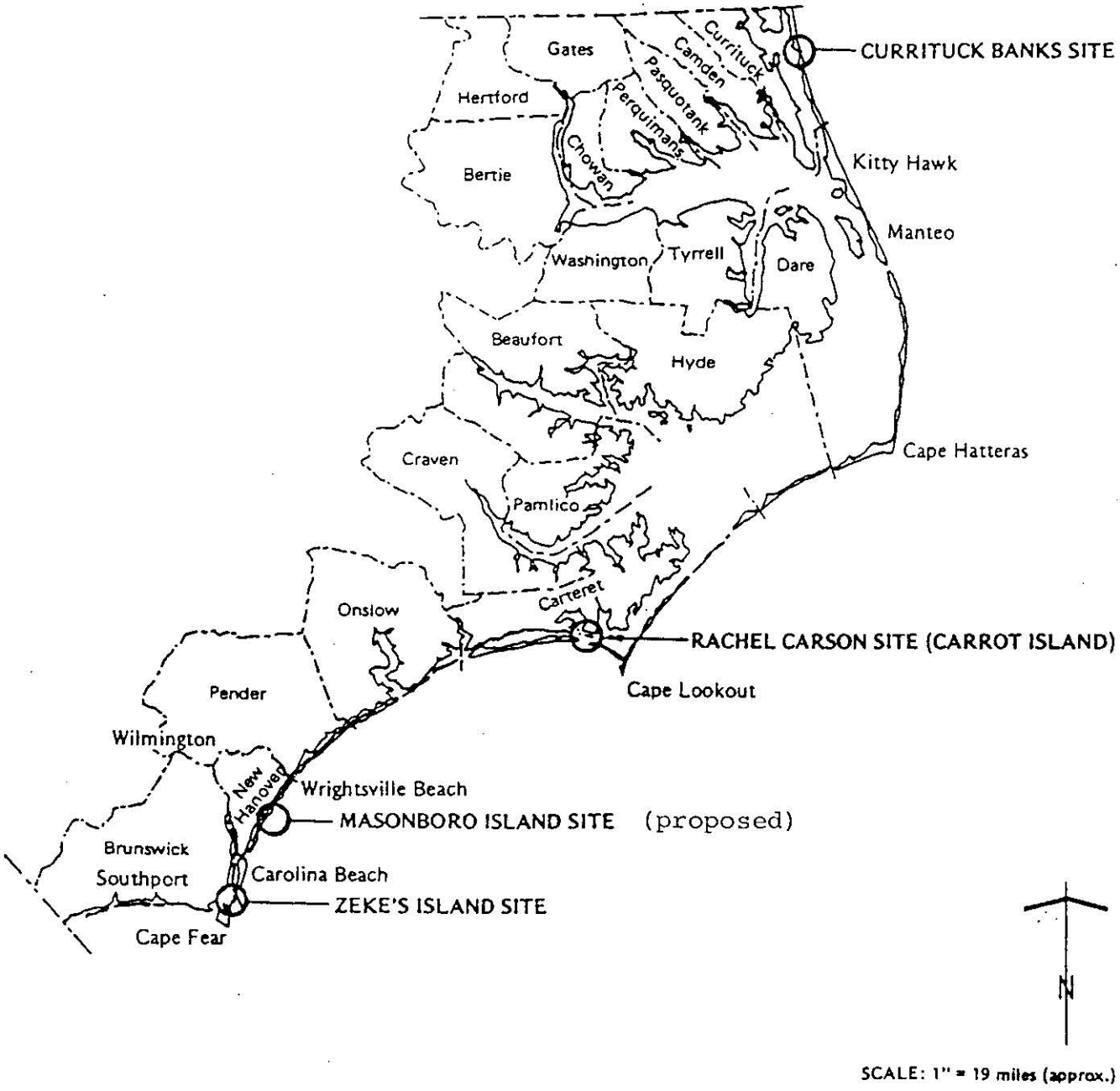
Dr. William T. Hogarth, Director

DIVISION OF COASTAL MANAGEMENT

Date 2/9/87

David W Owens

David W. Owens, Director



APPENDIX A : COMPONENTS OF THE NORTH CAROLINA NATIONAL ESTUARINE SANCTUARY

COOPERATIVE AGREEMENT

BETWEEN

THE NORTH CAROLINA NATIONAL ESTUARINE RESEARCH RESERVE (DIVISION OF COASTAL MANAGEMENT, DEPARTMENT OF ENVIRONMENT, HEALTH AND NATURAL RESOURCES)

AND

THE NORTH CAROLINA DIVISION OF MARINE FISHERIES (DEPARTMENT OF ENVIRONMENT, HEALTH AND NATURAL RESOURCES)

TO

FACILITATE SAMPLING IN NORTH CAROLINA COASTAL WATERS VIA STREAMLINING OF THE SCIENTIFIC COLLECTIONS PERMITTING PROCESS

COOPERATIVE AGREEMENT

The North Carolina National Estuarine Research Reserve (NCNERR, Division of Coastal Management) proposes to enter into an agreement with the North Carolina Division of Marine Fisheries (NCDMF)to facilitate sampling of marine and estuarine biota in coastal waters of North Carolina. In that both parties share a number of purposes, are in the same Department (Dept. Environment, Health and Natural Resources), and both individually require sampling permits, we enter into this cooperative agreement to simplify administrative procedures related to scientific collecting in NC coastal waters.

I. Objective of the Agreement.

A. Simplify administrative procedures by issuing blanket sampling permits that will not require annual reports or renewals.

II. The Agreement.

A. The NCNERR agrees to:

1. Provide the NCDMF (Fisheries Management Chief) a standard NCNERR permit to be completed by NCDMF for sampling in all four components of the NCNERR system.

2. Process and return the permit to NCDMF with an open ending date.

3. Waive the reporting requirments and regular permit renewals except under conditions where extensive projects are

developed utilizing the NCNERR that fall outside of normal sampling programs.

4. Provide the NCDMF Regional Offices with regular information on NCNERR sampling as needed.

B. The NCDMF agrees to:

1. Issue the NCNERR a standard NCDMF scientific collecting permit (261 Permit) for scientific collecting in all waters administered by the NCDMF. Under "Individuals covered by Permit" section the following shall be listed: Dr. Steve W. Ross (Research Coordinator), Susan Lovelace (Education Coordinator), Dr. John Taggart (Reserve Manager), David Wojnowski (Site Manager), and all other permanent or seasonal employees of the NCNERR. Any changes to this list will be provided to the NCDMF.

2. Waive the annual expiration date and annual reporting requirements. Under "Date of Expiration" enter UNLIMITED.

III. Review.

This MOA will be subject to periodic review by both parties. This agreement may be terminated by any party by giving written notice to the other at least sixty days prior to the proposed date of termination.

The NCNERR, and the NCDMF agree to this Cooperative Agreement beginning April 14, 1997.

For the NC National Estuarine Research Reserve

Steve W. Ross 28 Apr 1997

Steve W. Ross, Research Coordinator Date

For the NC Division of Marine Fisheries.

Jess H. Hawkins 4/10/97

Jess H. Hawkins, Fisheries Management Date

Chief

APPENDIX J: RESERVE MEMORANDA OF UNDERSTANDING

vii. North Carolina Maritime Museum and DCM

MEMORANDUM OF UNDERSTANDING

This memorandum serves as an expression of intent between the North Carolina Department of Natural Resources and Community Development/Division of Coastal Management and the North Carolina Department of Agriculture/North Carolina Maritime Museum.

WITNESSETH

WHEREAS, the State of North Carolina has received a grant from the United States Department of Commerce for acquisition and development of four sites on the North Carolina coast as the North Carolina National Estuarine Sanctuary, and

WHEREAS, the Rachel Carson Component of the North Carolina National Estuarine Sanctuary has been established on the Carrot Island-Bird Shoal complex opposite Beaufort, N.C., and

WHEREAS, the Department of Natural Resources and Community Development is responsible for developing a program to promote and encourage the use of this and other sanctuary sites for public education, and

WHEREAS, the Department of Agriculture operates the North Carolina Maritime Museum in Beaufort for the purpose of providing public education on estuarine and marine resources, and

WHEREAS, a coordinated effort to provide and promote public educational use of the Rachel Carson Component of the Sanctuary will be to the mutual benefit of both Departments,

NOW THEREFORE, in consideration of the mutual benefits to be derived, the Signatories agree to the following:

1. The purpose of the estuarine sanctuary program is the protection of lands for use as natural field laboratories and living classrooms in which to gather data and educate the people of North Carolina concerning natural and human processes occurring within North Carolina's estuaries.

2. The Sanctuary Management Plan for the Rachel Carson Component will provide a framework for conducting research and educational programs on the sanctuary site. The management plan has been developed by the estuarine sanctuary staff and will be periodically reviewed by the Local and State Advisory Committees and concerned citizens and users of the Sanctuary.

3. The Signatories will adhere to the approved management plan in their on-site and off-site educational activities within the Sanctuary.

4. The North Carolina Maritime Museum shall be fully and regularly consulted by the sanctuary staff regarding educational opportunities and policies on the sanctuary site.

5. The staff of the Museum will continue existing on-site and off-site educational programs for the Sanctuary. The estuarine sanctuary staff will work with the Museum staff to expand these on-site programs and to develop off-site educational programs and materials (e.g., slide shows, exhibits, brochures) specifically for this site.

6. On-site educational programs led by the Museum's staff will stay within the area of the site designated for public access and shall not in any way interfere with research projects. However, specific visits to research sites may be accommodated by prior consultation and approval of the researcher(s) and the Estuarine Sanctuary Coordinator.

7. The staff of the North Carolina National Estuarine Sanctuary shall provide the Museum staff with periodic updates on the research and educational information available from the sanctuary sites as well as other sanctuary programs which might be applicable to the Museum's educational programs.

8. The staff of the Museum shall keep a log of their visitation to the site. These records will be filed periodically with the Sanctuary Coordinator. They will further notify the Coordinator as necessary of signs of overuse, vandalism, or other damage or deterioration.

Signed,

DEPARTMENT OF AGRICULTURE

DATE 3/1/85

James A. Graham, Commissioner

NORTH CAROLINA MARITIME MUSEUM

DATE 3/10/85

Charles R. McNeill, Director

DEPARTMENT OF NATURAL RESOURCES AND COMMUNITY DEVELOPMENT

DATE 2/26/85

S. Thomas Rhodes, Secretary

DIVISION OF COASTAL MANAGEMENT

DATE 2-26-85

David W. Owens, Director

APPENDIX J: RESERVE MEMORANDA OF UNDERSTANDING

viii. Division of Parks and Recreation and DCM

MEMORANDUM OF UNDERSTANDING

This memorandum serves as an expression of intent between the Division of Coastal Management and the Division of Parks and Recreation within the North Carolina Department of Natural Resources and Community Development.

WITNESSETH

WHEREAS, the State of North Carolina has received a grant from the United States Department of Commerce for acquisition and development of four sites on the coast of North Carolina as the North Carolina National Estuarine Sanctuary, and

WHEREAS, the Zeke's Island Component of the Sanctuary has been established (see Appendix A) south of Fort Fisher, NC., and

WHEREAS, the Division of Coastal Management is responsible for developing programs to promote research, education, and traditional uses of the site by coordination with other state agencies, and

WHEREAS, the Division of Parks and Recreation manages adjacent state-owned lands comprising the Fort Fisher Management Area, and

WHEREAS, a coordinated effort to manage the Zeke's Island Component will be to the mutual benefit of both Divisions.

NOW THEREFORE, in consideration of the mutual benefits to be derived, the signatories agree to the following:

1. The purpose of the estuarine sanctuary program is the protection of lands for use as natural field laboratories and living classrooms in which to gather date and educate the public concerning North Carolina's estuaries.

2. The Sanctuary Management Plan provides a framework for conducting research and educational programs on the sanctuary site. The management plan has been developed by the estuarine sanctuary staff and will be periodically reviewed by the Local Advisory Committee and concerned citizens and users of the Sanctuary.

3. The Division of Parks and Recreation ranger stationed out of Carolina Beach State Park, will provide reconnaissance of the Zeke's Island component on a random basis during the weekly patrol of Baldhead Island. Obvious violations or pertinent management plan regulations will be enforced where practicable. Observed violations which cannot be easily enforced will be reported to other enforcement agencies and/or to the Sanctuary Coordinator. Daily patrol of the barrier spit will be maintained.

4. The Sanctuary Coordinator shall assist the Ranger thru administrative channels (e.g., the Attorney General's Office) with any management issues pertaining to the Component.

5. The Ranger and the Sanctuary Coordinator will regularly discuss the various visitor use issues concerning the Component.

6. This memorandum may be amended to include other cooperative management efforts by the two Divisions.

Signed,

DEPARTMENT OF NATURAL RESOURCES
AND COMMUNITY DEVELOPMENT

Date 7/24/85

Mrs. Thomas Rhodes, Secretary

DIVISION OF PARKS AND RECREATION

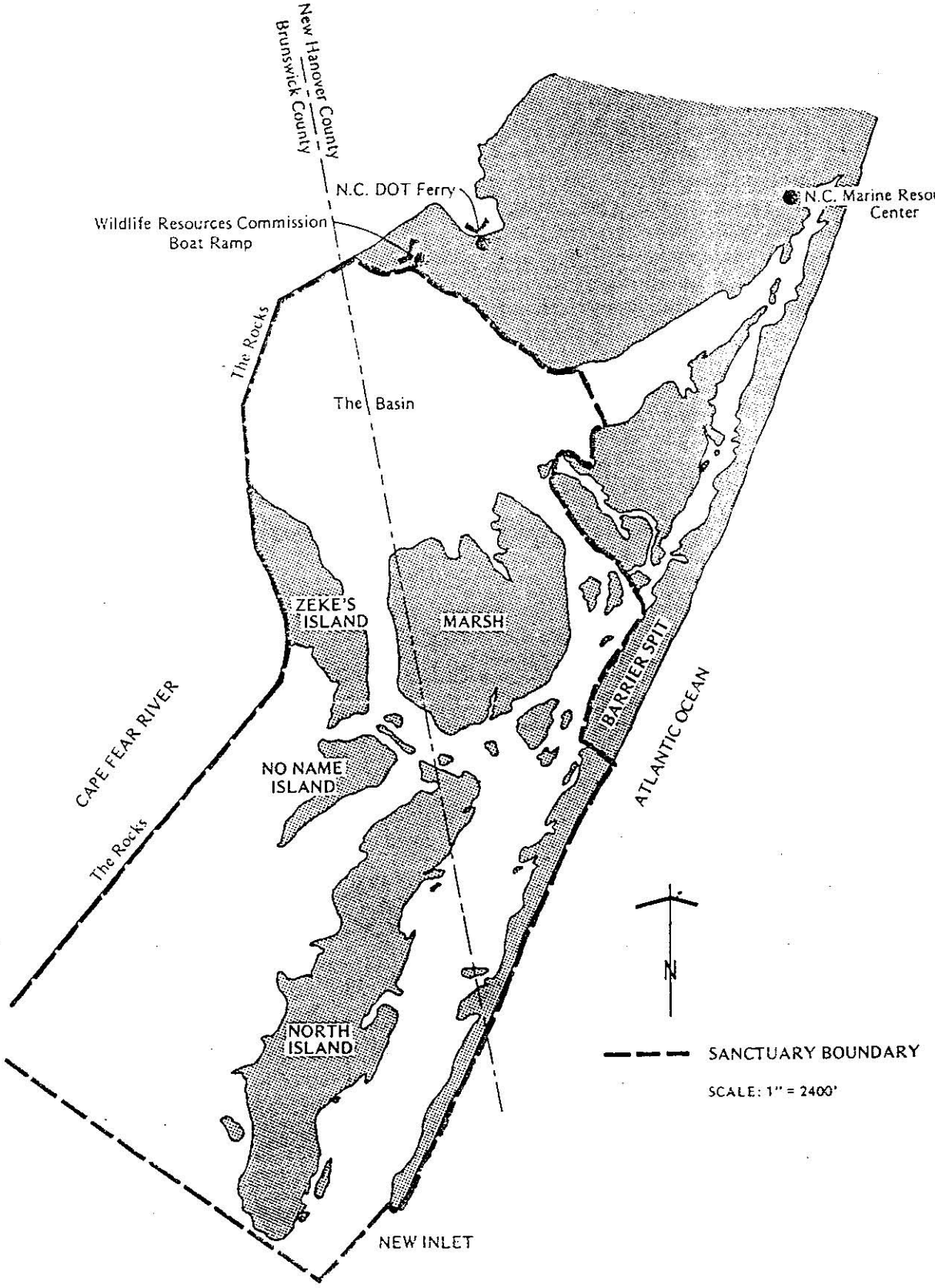
Date 7/16/85

William W. Davis, Director

DIVISION OF COASTAL MANAGEMENT

Date 7.16.85

David W. Owens, Director



APPENDIX A : PHYSIOGRAPHIC FEATURES OF THE ZEKE'S ISLAND SITE

APPENDIX J: RESERVE MEMORANDA OF UNDERSTANDING

ix. University of North Carolina Sea Grant College Program and DCM

MEMORANDUM OF UNDERSTANDING

This memorandum serves as an expression of intent between the North Carolina Department of Natural Resources and Community Development/Division of Coastal Management and the University of North Carolina Sea Grant College Program.

WITNESSETH

WHEREAS, the State of North Carolina has received a grant from the United States Department of Commerce for acquisition and development of four sites (see Appendix A) on the North Carolina coast as the North Carolina National Estuarine Sanctuary, and

WHEREAS, the Department of Natural Resources and Community Development is responsible for developing a program to promote and encourage the use of these sites for public education, and

WHEREAS, the Sea Grant College Program has as one of its goals the education of the public concerning estuarine and marine resources, and

WHEREAS, a coordinated effort to provide and promote research and public educational use of the Sanctuary will be to the mutual benefit of both agencies,

NOW THEREFORE, in consideration of the mutual benefits to be derived, the signatories agree to the following:

1. The purpose of the Estuarine Sanctuary Program is the protection of lands for use as natural field laboratories and living classrooms in which to gather data and educate the public concerning North Carolina's estuaries.

2. The Sanctuary Management Plan provides a framework for conducting research and educational programs on the Sanctuary sites. The management plan has been developed by the Estuarine Sanctuary staff and will be periodically reviewed by the Local and State Advisory Committees and concerned citizens and users of the Sanctuary.

3. The Signatories will adhere to the approved management plan in their on-site and off-site educational activities concerning the Sanctuary.

4. The Sea Grant Program and the Estuarine Sanctuary Program shall encourage the best researchers to conduct their research in and around the sites in accordance with National Estuarine Sanctuary Program regulations.

5. The Estuarine Sanctuary staff will work with the Sea Grant Education Specialist to develop off-site educational programs and materials (e.g., slide shows, exhibits, brochures) specifically for the sites.

6. On-site educational programs led by the Sea Grant staff will stay within the area of the site(s) designated for public access and will not in any way interfere with research projects. However, specific visits to research sites may be accommodated by prior consultation and approval of the researcher(s) and the Estuarine Sanctuary Coordinator.

7. The staff of the North Carolina National Estuarine Sanctuary will provide the Sea Grant Education Specialist with periodic updates on the research and educational information available from the Sanctuary sites which might be applicable to Sea Grant educational programs.

8. The Sea Grant Education Specialist will keep a log of visitation to the Sanctuary. These records will be filed periodically with the Sanctuary Coordinator. The Specialist will further notify the Coordinator if a given site exhibits signs of overuse, vandalism, or other damage or deterioration.

Signed,

UNIVERSITY OF NORTH CAROLINA
SEA GRANT COLLEGE PROGRAM

Date 14 Jan 86

B Copeland
Dr. B. J. Copeland, Director

MARINE ADVISORY SERVICE

Date 1/14/86

James D. Murray
James D. Murray, Director

DEPARTMENT OF NATURAL RESOURCES
AND COMMUNITY DEVELOPMENT

Date 12/30/85

for S. Thomas Rhodes, Secretary

APPENDIX J: RESERVE MEMORANDA OF UNDERSTANDING

x. Wildlife Resources commission and DCM

MEMORANDUM OF UNDERSTANDING

This memorandum serves as an expression of intent between the Wildlife Resources Commission and the Division of Coastal Management within the North Carolina Department of Natural Resources and Community Development.

WITNESSETH

WHEREAS, the State of North Carolina has received a grant from the United States Department of Commerce for acquisition and development of four components on the North Carolina coast (see Appendix A) as the North Carolina National Estuarine Sanctuary, and

WHEREAS, the Division of Coastal Management is responsible for developing programs to promote research, education, and compatible traditional uses of the sites by coordination with other state agencies, and

WHEREAS, the Wildlife Resources Commission has the responsibility to regulate the taking of game and certain fish species, and

WHEREAS, the Wildlife Resources Commission has shown support of the sanctuary program by their representation on the State Sanctuary Advisory Committee, and

WHEREAS, a coordinated effort of site surveillance and enforcement of hunting regulations will be to the mutual benefit of both Divisions,

NOW THEREFORE, in consideration of the mutual benefits to be derived, the signatories agree to the following:

1. The purpose of the estuarine sanctuary program is the protection of lands for use as natural field laboratories and living classrooms in which to gather data and educate the public concerning North Carolina's estuaries.

2. The Sanctuary Management Plan provides a framework for conducting research and educational programs on the sanctuary site. The management plan has been developed by the estuarine sanctuary staff and will be periodically reviewed by the Local Advisory Committee and concerned citizens and users of the Sanctuary.

3. The Management Plan includes policies on sanctuary use, surveillance, and enforcement. The policies pertaining to traditional hunting shall be in accordance with those regulations (General Statues of N. C. Article 22, GS 113, 291-294) established by the Wildlife Resources Commission for the taking of game in North Carolina.

4. Wildlife Resources enforcement officers will routinely patrol the sanctuary sites under their jurisdictions. The Estuarine Sanctuary Coordinator will periodically contact the officers to discuss any significant problems associated with hunting at the sites.

5. The Division of Coastal Management may petition the Wildlife Resources Commission to change the hunting use within a site (e.g., shorten the hunting season in a sanctuary component) if necessary for research purposes or protection of natural resources.

Signed,

DEPARTMENT OF NATURAL RESOURCES AND COMMUNITY DEVELOPMENT

Sarah H. Umstead
Witness

for S. Thomas Rhodes, Secretary

WILDLIFE RESOURCES COMMISSION

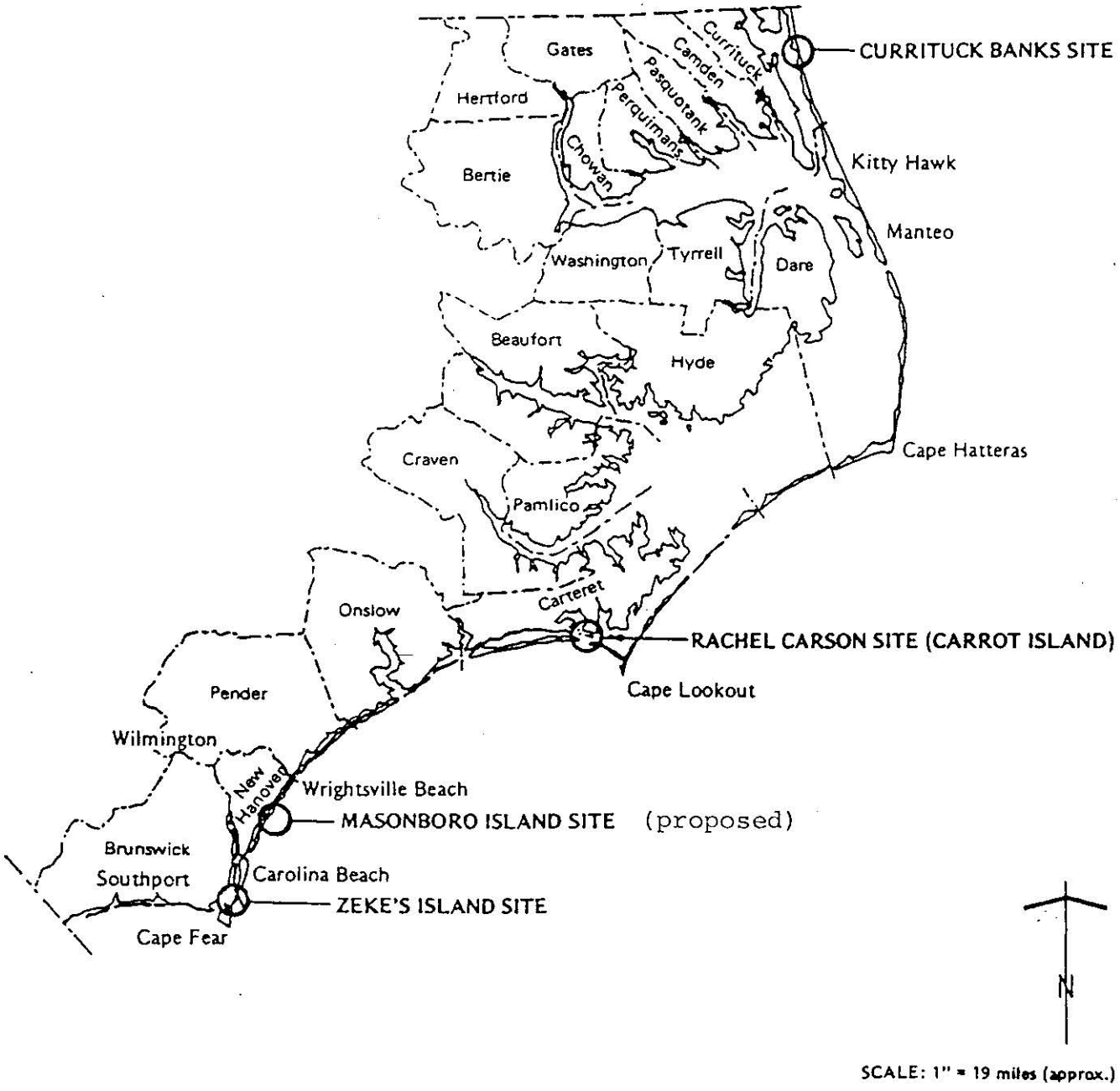
Delphia L. Thomas
Witness 7/17/85

W. Vernon Bevill
W. Vernon Bevill, Executive Director

DIVISION OF COASTAL MANAGEMENT

Date July 8, 1985

David W. Owens
David W. Owens, Director



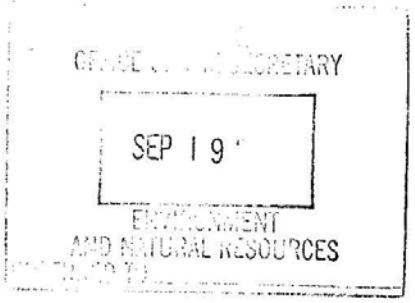
APPENDIX A : COMPONENTS OF THE NORTH CAROLINA NATIONAL ESTUARINE SANCTUARY

APPENDIX J: RESERVE MEMORANDA OF UNDERSTANDING

xi. NOAA, National Park Service and DCM

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE
OFFICE OF OCEAN AND COASTAL RESOURCE MANAGEMENT
Silver Spring, Maryland 20910

September 17, 2007



William G Ross Jr., Secretary
Department of Environment and Natural Resources
1601 Mail Service Center
Raleigh, NC 27699-1601

Dear Mr. Ross,

Please find enclosed a signed memorandum of understanding between the National Park Service, the North Carolina Division of Coastal Management, and the National Oceanic and Atmospheric Administration to operate water quality monitoring stations at the Cape Lookout National seashore in North Carolina.

Please note that the National Ocean and Atmospheric Administration made one "pen-and-ink" change before signing the MOU. An inappropriate authority (1456c) was cited under III. Authorities b. NOAA. I have inked in the correct authority that cites the CZMA in its entirety (1451 et seq.). Please let me know if you have any concerns with this change as soon as possible.

Best regards,

Laurie McGilvray

Laurie McGilvray
Chief, Estuarine Reserves Division

Printed on Recycled Paper

MAY 1 1 2007
Morehead City DCM

Memorandum of Understanding
Among the

U.S. Department of Interior National Park Service

and the

North Carolina Department of Environment and Natural Resources, Division of Coastal Management

and the

U.S. Department of Commerce National Oceanic and Atmospheric Administration

Detailing the state and federal roles in operating water quality monitoring stations at the Cape Lookout National Seashore in North Carolina

I. Parties and Purpose

This Memorandum of Understanding (Agreement) is among the U.S. Department of Interior, National Park Service; State of North Carolina, North Carolina Department of Environment and Natural Resources (NCDENR), Division of Coastal Management (NCDCM); and the U.S. Department of Commerce, National Oceanic and Atmospheric Administration (NOAA), Estuarine Reserves Division (ERD), for the purpose of implementing the goals and strategies articulated in General Agreement Number NOAA-MOA-2006-036/7196 (NOAA General Agreement) among NOAA, the U.S. Fish and Wildlife Service (FWS), and NPS. The NOAA General Agreement encourages NOAA, FWS, and NPS to work collaboratively to conserve coastal and marine resources by means of their protected area programs. The Parties are hereinafter referred to as NPS, NCDCM, and ERD, respectively. The NCDCM is NOAA's state partner for the North Carolina National Estuarine Research Reserve (NCNERR) Program.

The purpose of this agreement is to facilitate long term water quality monitoring at fixed stations within Cape Lookout National Seashore (CALO) following protocols developed by the National Estuarine Research Reserve System (NERRS) System-wide Monitoring Program and adopted by the National Park Service, Southeast Coast Network (SECN). A maximum of two stations will be mutually beneficial to the National Park Service – Southeast Coast Inventory and Monitoring Program and the North Carolina National Estuarine Research Reserve. The System Wide Monitoring Program is a monitoring program begun by the NERRS in 1994. Its overall goal is to monitor weather and water quality within the NERRS system. This long term dataset allows changes in estuarine conditions to be observed. The Southeast Coast Inventory and Monitoring Program is a newly formulated NPS monitoring program with the same overall goals and design as the NERRs System Wide Monitoring Program. The CALO and Rachel Carson component of NCNERR share a common boundary. Thus, it is cost effective and beneficial for us to work together to accomplish the goals of both monitoring programs at the same time without duplication. By implementing the NERRS protocols at CALO, an understanding of short-term variability and long-term trends in water quality will be available for management purposes for both the NPS and the NCDCM.

Continuous data will be taken at each site by a YSI 6600 EDS system. Additionally, monthly samples will be collected to analyze Total Dissolved Nitrogen (TDN), Total Dissolved Phosphorus (TDP),

Chlorophyll *a* (Chl *a*), and secchi depth. Quarterly TDN and TDP will be broken down into organic and inorganic fractions.

II. Roles of Parties

a. The National Park Service will:

i. Establish water quality monitoring stations at locations mutually agreed upon by the parties in this agreement. Provide housing for each site and will arrange in a similar manner as current NPS water quality monitoring stations.

ii. Provide equipment and non-monetary supplies needed for collecting and processing all water quality monitoring data described above. Equipment and supplies will include, but are not limited to: housing lock, data sheets, 2 YSI 6600 EDS units for each station, replacement probes when needed, 1 hand-held YSI 650 unit, YSI 6600 EDS and YSI 650 repair when needed, standards for instrument calibration, secchi disk, Nisken bottle, filtering apparatus, sample bottles and filters.

iii. Contact NCDCM twice annually to ascertain NCDCM's non-monetary supply needs.

iv. Provide contract administration and payments for laboratory services NPS will obtain from its contractor (currently the Chesapeake Biological Laboratory at the University of Maryland) for analysis of the Chl *a* samples to be processed under this agreement.

v. Provide all data (YSI, nutrients, Chl *a*, secchi depth) to NCNERR in an annual report, and on an as requested basis.

vi. Annually service field housing (ie. Change out PVC pipe in order to control bio-fouling).

vii. Manage all data according to the South East Coast Inventory and Monitoring (SECN) Program data management plan, including uploading data into STORET. Annual data will also be sent to NOAAs Centralized Data Management Office to be archived with other System Wide Monitoring Program data.

b. The NCDCM will:

i. Regularly calibrate, deploy and post calibrate datasondes according to SECN/NERRS SWMP protocols and appropriately care for equipment.

ii. Collect and process secchi depth, nutrient and Chl *a* samples monthly according to SECN protocols.

iii. Send all YSI data electronically and all data sheets via fax or pdf document within 1 week of post deployment calibration to: eva_didonato@nps.gov.

iv. Send nutrient and Chl *a* samples overnight/next day delivery to the NPS contracted laboratory (University of Maryland, Chesapeake Biological Laboratory) within 2 weeks of collection, frozen, on blue ice inside a cooler box package provided by NPS.

v. Provide NPS twice annually a list of NCDCM's non-monetary supply needs.

c. The NOAA, Estuarine Reserves Division will:

i. Provide funding and technical support for NCDCM's operations and programs. Funding is congressionally appropriated and subject to availability.

III. Authorities

This agreement is entered into under the following authorities:

a. NPS

National Park Service Organic Act (16 U.S.C. 1, et.seq., as amended and supplemented)

b. NOAA

Coastal Zone Management Act (CZMA 16 U.S.C. ~~1456c~~ 1451 et seq ygm)

Fish and Wildlife Coordination Act (72 Stat.563; 16 U.S.C. 661)

c. NCDCM

NC Coastal Area Management Act (NC GS § 113A-100)

IV. Financial Administration

This agreement does not authorize the transfer of funds, and property contributed to this project by each agency remains the property of the original agency.

Performance of the activities outlined in this Agreement is subject to the availability of appropriated funds and equipment.

V. Duration, Modification, and Termination

This Agreement will become effective upon completion of the last signature and will remain in effect for three years from the date of the last signature.

The Agreement may be amended within the scope of this Agreement or extended at any time, before the expiration, through the written mutual consent of the Parties.

In the event the Agreement is extended beyond the initial term of three years, the Parties will review this Agreement at least once every five years to determine whether it should be revised or terminated.

This Agreement may be terminated by (1) mutual written consent (2) 60 days advance written notice by either Party, or (3) completion of the operation/terms of this Agreement.

VI. Key Officials

d. NPS

Eva DiDonato, Aquatic Ecologist, Southeast Coast I&M Network
Fort Sumter National Monument
1214 Middle Street
Sullivan's Island, SC

843-883-5036
eva_didonato@nps.gov

Joe DeVivo, Program Coordinator, Southeast Coast I&M Network
National Park Service
100 Alabama St., SW
Atlanta, GA 30303

404-562-3113 x739

joe_devivo@nps.gov

e. NCDCM

John Fear, Research Coordinator, North Carolina National Estuarine Research Reserve
North Carolina Division of Coastal Management
400 Commerce Ave.
Morehead City, NC 28557

252-808-2808 x224

john.fear@ncmail.net

Rebecca Ellin, Manager, North Carolina National Estuarine Research Reserve
North Carolina Division of Coastal Management
400 Commerce Ave.
Morehead City, NC 28557

252-808-2808 x225

rebecca.ellin@ncmail.net

f. NOAA

Amy Clark, Program Specialist, Estuarine Reserves Division
Office of Ocean and Coastal Resource Management
NOAA Ocean Service,1305 East West Highway
Silver Spring, MD 20910

301-713-3155 x 135
amy.clark@noaa.gov

Laurie McGilvray, Division Chief, Estuarine Reserves Division
Office of Ocean and Coastal Resource Management
NOAA Ocean Service,1305 East West Highway
Silver Spring, MD 20910

301-713-3155 x 158
laurie.mcGilvray@noaa.gov

VII. Liability

g. NPS and ERD

Liability of the United States for personal injury or property damage resulting from the negligent acts or omissions of its employees acting within the scope of employment will be governed by the Federal Tort Claims Act, 28 U.S.C. §§2671, *et seq.*

h. NCDCM

Liability of the State of North Carolina for personal injury or property damage resulting from the negligent acts or omissions of its employees acting within the scope of employment will be governed by the State of North Carolina's Tort Claims Act, N.C.G.S. 143-291.

VIII. Assignment

No party will transfer or assign this Agreement or any part of the Agreement, either directly or indirectly, voluntarily or involuntarily, without prior written approval of the other parties.

IX. Agency

No party is an agent or representative of any other party to this Agreement. Thus, no party will represent itself to third party as an agent of any other party to this Agreement.

X. Merger

This Agreement contains the parties' sole and entire agreement. No oral representations of any nature that are not recorded in the Agreement form the basis of or may amend the Agreement.

XI. Waiver

The failure to enforce any provision of this Agreement by any party will not constitute a waiver of that provision or a waiver of any other term of the Agreement. The waiver of any provision must be expressed and evidenced in writing.

XII. Compliance with Applicable Laws

This agreement and its performance are subject to all laws, regulations and management policies governing NPS property and resources, whether now in force or later enacted or promulgated. Nothing in this Agreement will be construed in any way as impairing NPS's general powers for supervision, regulation, and control of its property under such applicable laws, regulations, and management policies. Nothing in this Agreement will be deemed inconsistent with or contrary to the purpose of or intent of any Act of Congress.

XIII. Standard Clauses

a. Civil Rights

During the performance of this Agreement, the participants agree to abide by the terms of U.S. Department of the Interior - Civil Rights Assurance Certification, nondiscrimination and will not discriminate against any person because of race, color, religion, sex, or national origin. The participants will take affirmative action to ensure that applicants are employed without regard to their race, color, sexual orientation, national origin, disabilities, religion, age, or sex.

b. Promotions

No party to this agreement will publicize or otherwise circulate promotional material (such as advertisements, sales brochures, press releases, speeches, still and motion pictures, articles, manuscripts, or other publications), which states or implies Governmental, Departmental, bureau or Government employee endorsement of a product, service or position which the (party) represents. No release of information relating to this Agreement may state or imply that the Government approves of the (party's) work product, or considers the (party's) work product to be superior to other products or services.

c. Publication of Results of Studies

No party will unilaterally publish a joint publication without consulting the other party. This restriction does not apply to popular publication of previously published technical matter. Publication pursuant to this Agreement may be produced independently or in collaboration with others; however, in all cases proper credit will be given to the efforts of those parties contributing to the publication. In the event no Agreement is reached concerning the manner of publication or interpretation of results, either party may publish data after due notice and submission of the proposed manuscripts to the other. In such instances, the party publishing the data will give due credit to the cooperation but assume full responsibility for any statements on which there is a difference of opinion.

XIV. Other Provisions

Nothing herein is intended to conflict with current DOI, DOC or NCDENR policies, regulations or directives.

Should disagreement arise as to the interpretation of the provisions of this Agreement, or modifications thereto, that cannot be resolved at the operating level, the area(s) of disagreement shall be stated in writing by each Agency and presented to the other Agencies for consideration.

In WITNESS THEREOF, the parties have caused this MOA to be executed.

Charles S Jones Date 4-23-07

Charles S. Jones, Director
North Carolina Division of Coastal Management
North Carolina Department of Natural and Environmental Resources

Wm G Ross Jr. Date 5-9-07

William G. Ross, Jr, Secretary
North Carolina Department of Natural and Environmental Resources

Patricia A Hooks Date 5/25/07

Patricia Hooks, Director
Southeast Regional Office
National Park Service, U.S. Department of Interior

Laurie McGilvray Date 9/6/07

Laurie McGilvray, Chief
Estuarine Reserves Division
Office of Ocean and Coastal Resource Management
National Oceanic and Atmospheric Administration
U.S. Department of Commerce

APPENDIX J: RESERVE MEMORANDA OF UNDERSTANDING

xii. Dominion Power and DCM

RECEIVED
MAY 22 2007
Morehead City DCM

MEMORANDUM OF AGREEMENT

BETWEEN

NORTH CAROLINA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

AND

VIRGINIA ELECTRIC AND POWER COMPANY d/b/a DOMINION NORTH CAROLINA POWER

THIS MEMORANDUM OF AGREEMENT is made and entered into as of the ____ day of May 2007 (the "Effective Date") by and between the **NORTH CAROLINA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES** (the "Department"), through its **DIVISION OF COASTAL MANAGEMENT** (the "Division"), party of the first part, and **VIRGINIA ELECTRIC AND POWER COMPANY**, a Virginia public service corporation doing business in the State of North Carolina as "Dominion North Carolina Power" ("Dominion"), party of the second part,

RECITALS

The Division is responsible for the management of the Currituck Banks component of the North Carolina National Estuarine Research Reserve, comprising nine hundred sixty (960) acres in Currituck County, North Carolina (the "Reserve").

Under the provisions of N.C.G.S § 113A-129.2, the Division is authorized to administer the North Carolina Coastal Reserve for research, education, and compatible and traditional public uses.

Under the provisions of N.C.G.S. § 113A-129.3, the North Carolina National Estuarine Research Reserve is administered as part of the North Carolina Coastal Reserve that is administered for the same purposes stated above.

NOW THEREFORE, this Agreement is for the cooperative maintenance by Dominion and the Division of the permanent easement granted to Dominion for an electric distribution line right-of-way for installation and maintenance of an underground electrical cable to meet additional power capacity demands and reliability to the Currituck Outer Banks as shown in Exhibit 1 (the "Right-of-Way").

I. DOMINION AGREES:

1. To minimize interference with or harm to the ecological integrity of the Currituck Banks component of the North Carolina National Estuarine Research Reserve, owned by the State of North Carolina, which might foreseeably result from Dominion's use and maintenance of the Right-of-Way, including, but not limited to, any future low canopy shrub community created within the Right-of-Way, and to eliminate any potential impact on existing freshwater ponds located within the Currituck Banks component.

Dominion
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2. To access and conduct all routine inspections of the Right-of-Way via a meandering pathway four (4) feet in width (the "pathway"). Entrance to the pathway is through the approximately one hundred five (105) foot long fence with gate located at the southern terminus of the Right-of-Way. *See* Exhibit 1). An all-terrain vehicle marked with Dominion's name may be used on the pathway for these purposes. Dominion shall use alternate temporary access routes pre-approved by the Division when wet weather prevents, or the location of existing permanent ponds blocks, access via the pathway.

3. To conduct all work performed on the Right-of-Way in conformity with the following specifications:

(a) To the extent possible, Dominion North Carolina Power shall comply with all reasonable requests by the Division to minimize interference with areas that the Division reasonably identifies to be of special ecological concern.

(b) To install and maintain a boundary fence at the southern terminus of the Right-of-Way to deter unwanted trespass and traffic onto the Reserve via the pathway while still allowing Dominion access to the Right-of-Way. Dominion is responsible for maintaining the fence and will address maintenance issues reported by Reserve staff.

(c) To conduct inspections of the pathway before initiating planned work to identify brush trimming necessary to clear the pathway four (4) feet in width of woody vegetation. Hand crews shall complete brush trimming. Bush hogs shall not be used to maintain the pathway.

(d) When, in its sole opinion, it is reasonable to do so, Dominion shall plan all non-emergency line work and routine inspections during the months of January, February and March.

(e) To notify the Division of its intent to perform distribution line maintenance and construction, routine inspections, and brush trimming. Such notification shall be made as far in advance as it is practical, but not less than forty-eight (48) hours before the commencement of work. The Company shall not, however, be required to notify the Division in advance of any work to be performed by Dominion under conditions that Dominion deems to constitute an emergency. Dominion shall notify the Division that work is in progress under emergency conditions no less than twenty-four (24) hours after an emergency has been declared. For purposes of the preceding sentences, an "emergency" shall include, but not be limited to, ice storms, hurricanes, tornadoes, wind storms, fires, vandalism to Dominion's facilities, and any other conditions that, in Dominion's judgment, cause or threaten to cause an interruption of service to Dominion's customers.

(f) That staff or agents of the Division may, at their option, accompany Dominion personnel during any routine work performed on the Right-of-Way.

Dominion

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(g) Approved temporary access locations referred to in I.2 may be impassable due to vegetation. In the event Dominion needs to access the Right-of-Way through an approved temporary access location, vegetation shall be cleared as stated in section 3(c). After work is complete, Dominion shall restore the location to an impassable condition within fourteen (14) days. The preferred method for this restoration is the transplantation of suitable native vegetation from other locations on the Right-of-Way. Division staff will provide guidance and oversight during the transplanting process. The installation of posts, cables, and/or gates also may be used, provided that they are sufficiently substantial to act as a significant deterrent to vehicular trespass at the approved temporary access location. These alternatives shall be removed by Dominion after vegetation has sufficiently established itself to deter unwanted vehicular trespass.

(h) To return surface elevations where electrical cable is to be installed to initial pre-construction contours after construction, maintenance, and repair.

(i) That it will not intentionally introduce any non-native plant species by seeding or planting in the Currituck Banks component of the Reserve.

(j) To minimize the introduction of seeds from non-native plant species by power washing all equipment used in inspection, maintenance, emergency situations, and construction activities before entering the Currituck Banks component of the Reserve.

(k) To post and maintain signage along the Right-of-Way that states:
Conditioned Utility Right-of-Way
Environmentally Sensitive Area
Special Conditions Apply for all Entry
Contact Manager at 252.261.8891

4. To indemnify and save harmless the State of North Carolina, its directors, officers, employees, contractors, subcontractors and agents from and against any and all actions, suits, demands, claims, and judgments, and from and against all costs, expenses, pecuniary or other loss arising out of any damage, injury to or loss of person, life and/or property proximately caused by the negligent acts or omissions of Dominion, its employees, contractors, subcontractors and agents including, without limitation, improper installation or use of equipment or defective equipment by Dominion.

5. To have no liability for debts or other obligations incurred by the Division, its members, employees, contractors, subcontractors or agents during their performance of any act directly or indirectly related to the provisions of this Agreement.

6. That it shall be liable for property damage and bodily injury (including loss of life and worker's compensation claims) proximately caused by negligent actions or omissions of Dominion, its directors, officers, employees, contractors, subcontractors and agents during their performance of work on the Right-of-Way under the terms of this Agreement.

Dominion

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II. THE DIVISION AGREES:

1. If the Division discovers conditions it reasonably believes to be hazardous, it shall provide immediate oral notice to Dominion North Carolina Power, and promptly shall follow up such oral notice with notice in writing. Dominion North Carolina Power shall correct the condition if, in Dominion's sole judgment, such action is warranted.

2. To provide the following assistance to Dominion when it is appropriate:

   (a) Identify temporary access locations in the event the pathway is not passable per stipulations in section I.2.

   (b) Guidance and oversight of restoring temporary access locations.

3. To inform Dominion of any maintenance needed to the fence/gate.

4. That it will not disturb any equipment or maintenance and repair site without Dominion's prior approval.

5. To accompany Dominion personnel on site upon request or at the Division's discretion.

6. To have no liability for debts or other obligations incurred by Dominion, its directors, officers, employees, contractors, subcontractors or agents during their performance of any act directly or indirectly related to the provisions of this Agreement.

III. DOMINION AND THE DIVISION MUTALLY AGREE:

1. To conduct all activities described in this Agreement in conformance with these purposes. All the terms and conditions provided for in this Agreement shall be interpreted to effectuate these goals and objectives.

2. To maintain and update the contact information included in Addendum A as necessary to ensure adequate communication for purposes of this Agreement.

3. That the terms and conditions of this Agreement shall extend to and be binding upon all, employees, agents, contractors, sub-contractors and assigns of either Party.

4. That nothing herein shall be construed to abrogate or diminish the rights held by Dominion under any existing easement agreement.

5. That nothing herein contained shall be construed as limiting or affecting in any way the authority of the Division in connection with the proper administration, management, and protection of the Currituck Banks component of the Reserve in accordance with the laws and documents referenced in this Agreement.

Dominion

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6. That amendments to this Agreement may be proposed by either party and shall become effective upon written approval of both parties.

7. That this Agreement shall become effective following signature by the parties and shall remain in force for five (5) years, at which time it may be reviewed and renewed for another five-year period. The Agreement may be terminated by written notice of one party to the other, but will remain in force until six months after the official termination date for removal of equipment, gates, signs, etc.

[THE REMAINDER OF THIS PAGE INTENTIONALLY HAS BEEN LEFT BLANK. SIGNATURE PAGE FOLLOWS.]

Dominion

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IN WITNESS WHEREOF, Dominion North Carolina Power and the Division have caused this Memorandum of Agreement to be executed by their duly authorized officers and their corporate seals to be affixed and attested by their Assistant Secretaries or Assistant Corporate Secretaries as of the Effective Date.

NORTH CAROLINA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

BY: _____
Charles S. Jones
Director, Division of Coastal Management

BY: _____
William G. Ross, Jr.
Secretary

VIRGINIA ELECTRIC AND POWER COMPANY

BY: _____
P. Rodney Blevins
Vice President – Electric Delivery Operations

ATTEST:

BY: _____
Vice President and Corporate Secretary

Dominion
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ADDENDUM A
CONTACT INFORMATION AND QUALIFIED OBSERVERS

Dominion North Carolina Power:

Michael W. Conner
Manager – Electric Delivery Operations
5300 The Woods Road
Kitty Hawk, NC 27949
(252) 255-2141
Michael.Conner@dom.com

Joseph F. Murphy
Manager – Electric Delivery Construction
5300 The Woods Road
Kitty Hawk, NC 27949
(252) 255-2551
Joe.Murphy@dom.com

Division of Coastal Management &
North Carolina National Estuarine Research Reserve

Ann Wunderly
North Carolina National Estuarine Research Reserve
Northern Sites Office
983 West Kitty Hawk Road
Kitty Hawk, NC 27949
(252) 261-8891
ann.wunderly@ncmail.net

Rebecca Ellin
Reserve Manager
Division of Coastal Management
North Carolina Department of
Environment and Natural Resources
400 Commerce Avenue
Morehead City, NC 28557-3421
(252) 808-2808
rebecca.ellin@ncmail.net

Dominion
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APPENDIX J: RESERVE MEMORANDA OF UNDERSTANDING

xiii. Kitty Hawk Office Lease Agreement

NCDENR

North Carolina Department of Environment and Natural Resources
Division of Purchase and Services

Michael F. Easley, Governor | **Michael G. Bryant, Director** | William G. Ross Jr., Secretary

December 4, 2008

Mr. John Stockton, Town Manager
Town of Kitty Hawk
Post Office Box 549
Kitty Hawk, NC 27949

Re: Lease Agreement
CM-006

Dear Mr. Stockton:

Enclosed is your fully executed duplicate original of the lease agreement between theTown of Kitty Hawk and the Department of Environment and Natural Resources.

Monthly rental invoices must be submitted at least fifteen (15) days prior to the first day of the month for which rent is due to DENR – Office of the Controller, Attention: Ms. Maureen Hollins, Mail Service Center 1606, Raleigh, North Carolina 27699-1606.

Should you have any questions, please contact Mr. Dolan Simmons at 919.715.3877.

Sincerely,

Michael G. Bryant
Director, Division of Purchase & Services

MGB:meb

Enclosure

cc: Maureen Hollins, Office of the Controller (w/enc.)
Arthur Stadiem, Division of Coastal Mgmt. (w/enc.)

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STATE OF NORTH CAROLINA

COUNTY OF **DARE**

LEASE AGREEMENT

THIS LEASE AGREEMENT, made and entered into this the lst day of June, 2007, by and between Town of Kitty Hawk, of Dare County, North Carolina, hereinafter designated as Lessor, and the STATE OF NORTH CAROLINA, hereinafter designated as Lessee;

WITNESSETH:

THAT WHEREAS, authority to approve and execute this lease agreement was delegated to the Department of Administration by resolution adopted by the Governor and Council of State on the 1st day of September, 1981; amended on September 8th, 1999 and April 1, 2003.

WHEREAS, the parties hereto have mutually agreed to the terms of this lease agreement as hereinafter set out,

NOW THEREFORE, in consideration of the rental hereinafter agreed to be paid and the terms and conditions hereinafter set forth, Lessor does hereby let and lease unto Lessee and Lessee hereby takes and leases from Lessor for and during the period of time and subject to the terms and conditions hereinafter set out certain space in **Dare County, North Carolina**, more particularly described as follows:

Being 700 sq. ft. of office space located at 983 Kitty Hawk Road, Dare County, North Carolina, 27949.

THE TERMS AND CONDITIONS OF THIS LEASE AGREEMENT ARE AS FOLLOWS:

1. The term of this lease shall be for a period of **Twenty Four Months (24)** months commencing on the **1st day of February 2009, or as soon thereafter as the leased premises are ceded to the Lessee and terminating on the 31st day of January, 2011.**

2. The Lessee shall pay to the Lessor as rental for said premises the sum of Four Thousand Eight Hundred and no/100 Dollars ($4,800.00) per annum, which sum shall be paid in equal monthly installments of Four Hundred and no/100 Dollars ($400.00), said rental to be payable within fifteen (15) days from receipt of invoice in triplicate.

The Lessee agrees to pay the aforesaid rental to Lessor at the address specified, or, to such other address as the Lessor may designate by a notice in writing at least fifteen (15) days prior to the due date.

3. Lessor agrees to furnish to the Lessee, as a part of the consideration for this lease, the following services and utilities to the satisfaction of the Lessee.

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A. All utilities except telephone.

B. Heating facilities, air conditioning facilities, electrical facilities, adequate lighting fixtures and sockets, hot and cold water facilities, and adequate toilet facilities.

C. Maintenance of lawns, paved areas and disposal of trash.

D. Elevator service if building is elevator equipped.

E. Parking – one space.

4. During the lease term, the Lessor shall keep the leased premises in good repair and tenantable condition, to the end that all facilities are kept in an operative condition. Maintenance shall include, but is not limited to furnishing and replacing electrical light fixture ballasts, air conditioning and ventilating equipment filter pads, if applicable, and broken glass. In case Lessor shall, after notice in writing from the Lessee in regard to a specified condition, fail, refuse, or neglect to correct said condition, or in the event of an emergency constituting a hazard to the health or safety of the Lessee's employees, property, or invitees, it shall then be lawful for the Lessee in addition to any other remedy the Lessee may have, to make such repair at its own cost and to deduct the amount thereof from the rent that may then be thereafter become due hereunder. The Lessor reserves the right to enter and inspect the leased premises, at reasonable times, and to make necessary repairs to the premises.

5. It is understood and agreed that Lessor shall, at the beginning of said lease term as hereinabove set forth, have the leased premises in a condition satisfactory to Lessee, including repairs, painting, partitioning, remodeling, plumbing and electrical wiring suitable for the purposes for which the leased premises will be used by Lessee.

6. The Lessee shall have the right during the existence of this lease, with the Lessor's prior consent, to make alterations, attach fixtures and equipment, and erect additions, structures or signs including a security system in or upon the leased premises. Such fixtures, additions, structures or signs so placed in or upon or attached to the leased premises under this lease or any prior lease of which this lease is an extension or renewal shall be and remain the property of the Lessee and may be removed therefrom by the Lessee prior to the termination of this lease or any renewal or extension thereof, or within a reasonable time thereafter. The Lessee shall have no duty to remove any improvement or fixture placed by it on the premises or to restore any portion of the premises altered by it. In the event Lessee elects to remove his improvements or fixtures and such removal causes damage or injury to the demised premises, Lessee will repair only to the extent of any such damage or injury.

7. If the said premises be destroyed by fire or other casualty without fault of the Lessee, this lease shall immediately terminate and the rent shall be apportioned to the time of the damage. In case of partial destruction or damage by fire or other casualty without fault of the Lessee, so as to render the premises untenantable in whole or in part, there shall be an apportionment of the rent until the damage has been repaired. During such period of repair, Lessee shall have the right to obtain similar office space at the expense of Lessee or the Lessee may terminate the lease by giving fifteen (15) days written notice to the Lessor.

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8. Lessor shall be liable to Lessee for any loss or damages suffered by Lessee which are a direct result of the failure of Lessor to perform an act required by this lease, and provided that Lessor could reasonably have complied with said requirement.

9. Upon termination of this lease, the Lessee will peaceably surrender the leased premises in as good order and condition as when received, reasonable use and wear and damage by fire, war, riots, insurrection, public calamity, by the elements, by act of God, or by circumstances over which Lessee had no control or for which Lessor is responsible pursuant to this lease, excepted.

10. The Lessor agrees that the Lessee, upon keeping and performing the covenants and agreements herein contained, shall at all times during the existence of this lease peaceably and quietly have, hold, and enjoy the leased premises free from the adverse claims of any person.

11. The failure of either party to insist in any instance upon strict performance of any of the terms and conditions herein set forth shall not be construed as a waiver of the same in any other instance. No modification of any provision hereof and no cancellation or surrender thereof shall be valid unless in writing and signed and agreed to by both parties.

12. Any hold over after the expiration of the said term or any extension thereof, shall be construed to be a tenancy from month to month, and shall otherwise be on the terms and conditions herein specified, so far as applicable: however, either party shall give not less than sixty (60) days written notice to terminate the tenancy.

13. The parties to this lease agree and understand that the continuation of this lease agreement for the term period set forth herein, or any extension or renewal thereof, is dependent upon and subject to the appropriation, allocation or availability of funds for this purpose to the agency of the Lessee responsible for payment of said rental. The parties to this lease also agree that in the event the agency of the Lessee or that body responsible for the appropriations of said funds, in its sole discretion, determines, in view of its total local office operations that available funding for the payment of rents are insufficient to continue the operation of its local offices on the premise leased herein, it may choose to terminate the lease agreement set forth herein by giving Lessor written notice of said termination, and the lease agreement shall terminate immediately without any further liability to Lessee.

14. If lack of ADA compliance creates an operational problem for the Lessee, the Lessee reserves the right to terminate this lease upon ninety (90) days prior written notice to the Lessor of the intent to terminate, with no further liability to the Lessee.

15. All premises, including fixtures and appurtenances, provided under this Lease shall function before, during and after the date change of February 1, 2006 at the same level for which the premises were originally leased without additional cost of the Lessee. This includes, but is not limited to, the functioning of mechanical or electrical systems, heating, ventilating, and air conditioning ("HVAC") systems, power supply, water supply, fire control, security, and facility use components such s elevators, timer automated doors, and signage.

16. All notices herein provided to be given, or which may be given by either party to the other, shall be deemed to have been fully given when made in writing and deposited in the United States mail, certified and postage prepaid and addressed as follows: To the Lessor at Town of Kitty Hawk, PO Box 549, Kitty Hawk, North Carolina

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28949 and the Lessee at DENR, Director of Purchase and Services Division, 1605 Mail Service Center, Raleigh, North Carolina 27699-1605. Nothing herein contained shall preclude the giving of such notice by personal service. The address to which notices shall be mailed as aforesaid to either party may be changed by written notice.

IN TESTIMONY WHEREOF, this lease has been executed by the parties hereto, in duplicate originals, as of the date first above written.

WITNESS:

STATE OF NORTH CAROLINA,
Lessee

By: _____
Michael G. Bryant
Division of Purchase and Services

WITNESS:

TOWN OF KITTY HAWK, NC
Lessor

By: _____

Printed Name: JOHN W. STOCKTON

Title: TOWN MANAGER

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APPENDIX K: CAROLINA ESTUARINE RESERVE FOUNDATION STRATEGIC PLAN

Carolina Estuarine Reserve Foundation
Strategic Plan
12.8.2007

Vision
Ecological communities thrive and the human community benefits from healthy estuaries and coastal watersheds in NC.

Mission – Our Core Purpose
To support stewardship of NC's estuarine and coastal habitats through the NC Coastal Reserve's education, research and management programs.

Long Term Outcomes
1. Legislation reflects the need for water, air and ecological quality in the coastal reserves.
2. Reserves are considered an asset by the community.

Mid Term Outcomes
1. Programs have resources to meet objectives
2. Legislature is aware of value and the influence of the estuaries and the Coastal Reserves
3. Public supports the Coastal Reserves
4. Opportunities exist for the public to contribute
5. Research and science inform effective education and outreach

Short Term Outcomes (Strategic Goals)
1. Community Support of CERF and the Coastal Reserves
2. Support of Coastal Reserve Programs
3. Legislation that supports the mission of the Coastal Reserves

Strategic Goal 1: Community Support of CERF and the Coastal Reserves

Objectives
1. Build a strong membership base.
    - Manage the database
    - Provide opportunities
    - Create list of opportunities
    - Mail newsletters to the membership list
    - Fund raising events (8k run)
    - Update website
2. Recruit, recognize and retain volunteers.
    - Create and maintain volunteer board committee
    - Volunteer recruitment form
    - Membership Brochures to include volunteer opportunities
    - Newsletter

- Board and Staff speak to local groups
- Volunteer lunch
- Organize on-site opportunities (big sweep, trail maintenance)

3. Cultivate supportive relationships with entities that have local interests.
    - Board solicits engages local businessmen
    - Partner with identified organizations (Carteret County Crossroads, Surfrider Foundation)
    - Encourage corporate sponsorship (Ducks Unlimited)
    - Personal conversations
    - Organize on site opportunities for interested entities

Strategic Goal 2: Support of Coastal Reserve Programs

Objectives

1. Conduct fund raising activities to support CERF and complement the reserve programs
    - Build relationships with philanthropies
    - Board members will host fund raising activity
    - Solicit invitation list from similar organization
    - Recruit help to organize event
    - Membership mailings
    - Annual 8K run
    - Personal solicitation
2. Cultivate philanthropic board members and relationships
    - Board members identify philanthropists and strategically approach
    - Host recruiting event
3. Recruit, recognize and retain volunteers
    - Create and maintain volunteer board committee
    - Volunteer recruitment form
    - Membership Brochures to include volunteer opportunities
    - Newsletter
    - Board and Staff speak to local groups
    - Volunteer lunch
    - Organize on-site opportunities (big sweep, trail maintenance)
4. Create hands on opportunities for individuals involvement
    - Organize on-site opportunities (big sweep, trail maintenance)
    - Interpretive guides

Strategic Goal 3: Legislation that supports the mission of the Coastal Reserves

Objectives

1. Lobby for support
    - Board develops unified talking points
    - Send Bill Ducker to Raleigh
2. Encourage local officials to make informed decisions
    - Personal contact with local officials
    - Expand distribution of news letters

    - Pointed invitations to workshops (CTP)
3. Motivate membership to be politically informed and active
    - Provide science-based current and relevant information through email and newsletter.
    - Buy space in newspapers to advocate the reserves goals

APPENDIX L: NCNERR PARTNERSHIPS

Listing of NCNERR partners with examples of partnership activities.

Partner	Education	Research	Stewardship	Examples
Albemarle Pamlico National Estuary Program (APNEP)	X	X		NCNERR staff serve on the APNEP Science and Technology Advisory and Management Advisory Committees and on the Water Resources Monitoring Team. Reserve education staff collaborated with APNEP to produce a 'Newspapers in Education' insert on estuaries.
Bald Head Island Conservancy (BHIC)	X	X	X	The BHIC Executive Director serves on the Reserve's Local Advisory Committee. Reserve education staff have held teacher professional development workshops in collaboration with the BHIC.
Beaufort, Town of			X	NCNERR has partnered with the Town of Beaufort during annual Big Sweep events. The provides for disposal of the trash collected on the Rachel Carson component. In addition, the Town of Beaufort co-manages the boardwalk on Carrot Island and responds to law enforcement issues as needed.
Carolina Beach State Park	X		X	Carolina Beach State Park supported the NCNERR's Labor Day public education outreach. There is potential for additional involvement on Masonboro Island or on regional stewardship efforts (*e.g.*, red fox, phragmites).
Carteret Community College	X			Reserve staff have given guest lectures and hosted field trips for Carteret Community College classes. College staff have led grant writing workshop sessions for the Coastal Training Program.
Carteret County Crossroads	X			An environmental non-profit in Carteret County, Crossroads helps advertise Coastal Training Program workshops.
Carteret County School System	X			Reserve education staff held teacher professional development workshops for the School System and provided facility space for other professional development workshops. Reserve staff have also served as advisors on school-based research projects.
Carteret County Shore Protection Office	X			Staff from the Carteret County Shore Protection Office have given public presentations at science symposiums.

Partner	Education	Research	Stewardship	Examples
City of Wilmington Storm Water Services	X			Wilmington's Storm Water Services staff have been speakers at Coastal Training Program events.
Clean Water Management Trust Fund	X	X	X	This organization has provided funding to the Reserve and have participated in the Coastal Training Program's grant writing workshop.
Core Sound Waterfowl Museum	X			NCNERR participates in the annual Decoy Festival to promote NCNERR's programs.
Duke University Marine Laboratory (DUML)	X	X	X	The Reserve has had Graduate Research Fellowship (GRF) recipients from DUML. Faculty members have been invited speakers at Coastal Training Program events and at public science symposiums. The Reserve also leases boat slip space from DUML.
Duke University, Nicholas School of the Environment			X	Students participate annually in stewardship activities such as trash cleanups and trail maintenance.
Eastern Carolina Council of Governments	X			The Eastern Carolina Council of Governments has collaborated with the Coastal Training Program and advertised upcoming programs.
Elizabeth City State University (ECSU)		X		ECSU partnered with the Reserve on the Currituck Sound water quality monitoring project and faculty and staff have conducted SAV mapping within Currituck Banks.
Fort Fisher State Park			X	Fort Fisher State Park is currently participating in a joint effort with the NCNERR and the Fort Fisher Aquarium to revamp Zeke's Basin public access. The Park also manages the beach portion of Zeke’s Island. Potential regional level stewardship efforts exist as does the potential to collaborate on interpretive signs on the Park’s boardwalk and trails.
Fort Macon State Park	X			The Reserve has partnered with Fort Macon State Park on teacher workshops. The Park has provided overnight accommodations and the use of their facility. The Reserve Education Coordinator has identified various algal specimens for the Park naturalist.
Humane Society of the United States			X	The Humane Society of the United States advises the Reserve on horse birth control and provides technical support during horse darting.

Partner	Education	Research	Stewardship	Examples
Mackey Island and Currituck National Wildlife Refuge			X	The Reserve works with the Currituck National Wildlife Refuge on the management of the Corolla horse population and other relevant issues.
Mid-Atlantic Marine Education Association (MAMEA)	X			Reserve education staff have held numerous teacher workshops at MAMEA's regional meetings.
National Charity League, Mothers and Daughters	X		X	The National Charity League frequently assists with education programs and site clean-ups.
National Park Service /Cape Lookout National Seashore		X	X	The National Park Service is partnering with the Reserve on water quality monitoring at Shackleford Banks and Middle Marsh. National Park Service staff also advises the Reserve on horse management issues.
NC Aquarium at Fort Fisher	X		X	The Reserve is currently partnering with the Aquarium and Fort Fisher State Park in an effort to revamp Zeke's Island public boat ramp. Potential regional level stewardship efforts exist as does the potential to collaborate on interpretive signs on the Aquarium's boardwalk and trails.
NC Aquarium at Pine Knoll Shores	X	X	X	The Aquarium has allowed Reserve researchers to access the marsh on their property for the purpose of marsh vegetation monitoring. Occasionally the Reserve collaborates on educational products. Staff at the Pine Knoll Shores Aquarium provided bluestem plants, expertise, and labor for a habitat improvement feasibility study.
NC Audubon			X	NC Audubon assists the Reserve by conducting bird surveys at Masonboro and posting nesting areas.
NC Coastal Federation	X			The Coastal Training Program works with the Coastal Federation to develop and deliver trainings.
NC Coastal Land Trust			X	A staff member from the NC Coastal Land Trust serves on the Masonboro Island Local Advisory Committee. This organization also provides continued support of Masonboro Island acquisition through an annual landowner contact. They also assist in an annual cleanup event.
NC Coastal Nonpoint Source Program	X			The Coastal Training Program has worked with the Coastal Nonpoint Source Program to develop materials and trainings on microbial pollution and on sustainable development for water quality protection.

Partner	Education	Research	Stewardship	Examples
NC Cooperative Extension Service (all 20 NC coastal counties)	X		X	The Coastal Training Program works with Environmental Agents of the NC Cooperative Extension to deliver trainings on septic system function and maintenance and stormwater management for realtors. The Reserve also partners with them during Big Sweep.
NC Department of Environment and Natural Resources, Office of Environmental Education	X			The Reserve partners with the Office of Environmental Education (OEE) on their annual Environmental Education Institute for middle and high school teachers. The Education Coordinator also serves on the State's Environmental Education workgroup. OEE staff have provided technical expertise on curriculum development to the Reserve education staff.
NC Division Of Environmental Health, Shellfish Sanitation and Recreational Water Quality	X			Shellfish Sanitation and Recreational Water Quality staff have been speakers at Coastal Training Programs.
NC Division of Marine Fisheries (DMF)	X	X		NCNERR staff served as a member of DMF's strategic habitat area committee. A member of DMF is also serving on the Reserve's CICEET advisory panel. The Education Coordinator and GIS Specialist also serve on DMF's SAV mapping workgroup. Reserve staff have also participated in a state-wide SAV mapping initiative.
NC Division of Water Quality	X			Division of Water Quality staff have been invited speakers at Coastal Training Programs and public science symposiums.
NC Maritime Museum	X			NCNERR education staff have participated in several of the Museum's educational programs (*e.g.*, Waterside After School, Saltwater Science summer camp).
NC Museum of Natural Science	X			The Reserve education staff has partnered with the Museum on their Girls in Science summer camp.
NC Natural Heritage Program (NHP)			X	The Stewardship Coordinator is working with NHP to update species and communities lists for each site. The Natural Heritage Program has provided funding for acquisitions and the Reserve is working closely with NHP staff to ensure ongoing legal protection of sites through dedication letters.
NC Sea Grant	X	X		NCNERR serves on the Sea Grant advisory panel. The Coastal Training Program works with NC Sea Grant on barrier island issues for realtors and sustainable development for elected officials. The education program has collaborated with NC Sea Grant on teacher workshops.

Partner	Education	Research	Stewardship	Examples
NC Seafood Festival	X			The Reserve has had an information booth at the Seafood Festival where general Reserve information was displayed.
NC State University (NCSU)	X	X		Faculty members from NCSU are partners on the atmospheric deposition project that the Reserve is conducting with Pocosin Lakes NWR and UNC-IMS. Faculty members are also invited speakers at Coastal Training Programs.
NC Wildlife Resources Commission (WRC)	X	X	X	The WRC briefly assisted the Reserve with atmospheric deposition monitoring at Currituck Banks. Staff from their Corolla education center provided NCNERR staff with boat access to Currituck Banks during the Currituck Sound water quality monitoring project. The WRC provide enforcement of hunting, wildlife and some boating related rules. They also provide guidance on species management issues and conduct bird surveys at some sites as part of a regularly scheduled statewide effort. The Reserve also partners with them on teacher professional development and general public workshops.
NOAA's Center for Coastal Fisheries and Habitat Research (CCFHR)	X	X		The Reserve shares an administration building with the Center for Coastal Fisheries and Habitat Research. CCFHR researchers have partnered with NCNERR research and education staff in a CICEET funded project and a marsh monitoring project. CCFHR scientists often speak at the Reserve's general public/outreach events.
NOAA's Coastal Services Center	X	X		CSC staff regularly facilitate meetings for the Reserve. The Coastal Training Program routinely hosts CSC trainings, including Coastal Community Planning and Development training and Geographic Information System (GIS) trainings.
One North Carolina Naturally	X			One North Carolina Naturally staff have been invited speakers at Coastal Training Programs.
Pocosin Lakes National Wildlife Refuge		X		Partners with the Reserve on the atmospheric deposition monitoring project.
Southeast Center for Ocean Sciences and Education Excellence	X			The Southeast Center for Ocean Sciences and Education Excellence has partnered with the Reserve on several teacher workshops.

Partner	Education	Research	Stewardship	Examples
Surfrider Cape Fear Chapter			X	This organization assists with cleanup events several times per year. They have a strong connection to surfing community in the southern part of state.
The Nature Conservancy			X	The Nature Conservancy has been involved with acquisition of many sites. They continue to provide occasional staff support for stewardship projects. There is potential for collaboration on regional stewardship projects, especially in northern part of the state.
UNC-Chapel Hill, Institute Of Marine Sciences	X	X		The Institute of Marine Sciences (IMS) partners with the Reserve on the atmospheric deposition monitoring project. They provide NCNERR with research lab space including access to analytical equipment. Several Graduate Research Fellowship recipients have been students at UNC-IMS. Faculty members have been speakers at Coastal Training Programs and public presentations. The Reserve has also participated in collaborative research with IMS faculty.
UNC-Coastal Studies Institute		X		The Coastal Studies Institute provides NCNERR with research lab space. Staff serve on the Currituck Banks Local Advisory Committee.
UNC-Wilmington, Center for Marine Science	X	X	X	The Reserve has advised numerous student projects through the Environmental Studies, Biology, and Communication departments. Student service groups have helped with public education events, with potential for more involvement. University faculty have served as invited speakers at Coastal Training Program events and participated in collaborative research.
US Army Corps of Engineers (ACOE)	X			The ACOE has given presentations and conducted site visits during the DCM's Local Permit Officer Training, a joint Coastal Training Program event.
US Geological Survey (USGS)		X		The Reserve partnered with the USGS on the Currituck Sound water quality monitoring project.

APPENDIX M: STATE FISCAL SUPPORT FOR THE NORTH CAROLINA NERR

The NCNERR September 2005 Evaluation Findings included the following necessary action.

> **NECESSARY ACTION (State Financial and Administrative Support):** The DCM and the Reserve must address the appropriate use of federal funds and develop options for state support for the NCNERR, including match identification. Written documentation of this effort must be submitted to NOAA in April 2006 for review and approval as part of the draft cooperative agreement application due at that time.

Additionally, the Evaluation Findings required that the updated NCNERR management plan address the limited state financial support of the Reserve.

The requisite written documentation was submitted via a memorandum to ERD in April 2006 and included recognition of the evaluation team's concerns, progress made since the findings were finalized, and additional steps to take in the future. The progress and future strategies sections of the memorandum have been updated and form the basis of this appendix which addresses appropriate use of federal funds and options for increasing state fiscal support. These support Objective 5.5, Activity 3 of this management plan: "increase state monetary support of the NCNERR".

The North Carolina Coastal Reserve (NCCR) includes ten sites, four of which comprise the NCNERR. Because the NCNERR is nested within the NCCR and there is not adequate state fiscal support for the six state sites within the NCCR, staff funded by the 315 award manage and occasionally conduct programs on several of the state sites. The DCM and NCNERR recognize that federal 315 funds are to be used to fund NCNERR staff and to complete tasks outlined in the annual award on NCNERR sites to support NCNERR programs. The DCM and NCNERR also recognize that all programs and products funded by the 315 award must be recognized as such to maintain the NCNERR and NOAA identity.

State match for the NCNERR 315 award has historically included the funding of the Reserve Manager, Education Coordinator, and Research Coordinator, as recommended by the annual 315 funding guidance. Financial shortfalls since 2001 resulted in a series of budget cuts across all state programs to balance the state budget; the DCM budget was reduced by $589,185 between fiscal years 2001-2002 and 2004-2005 and $144,309 or 24% of this amount was taken from the NCCR budget. As such, the traditionally state-funded positions of Research Coordinator, Education Coordinator, and half of the Reserve Manager were moved from state funds to the NCNERR 315 award over a period of 2 years, reducing the amount of state fiscal support available to match the award. During this period, the NCNERR relied on alternative sources of match such as volunteer hours and Rachel Carson boardwalk construction funds to match the 315 awards, since the amount of preferred match of state supported staff was reduced. The state budget stabilized between fiscal years 2005-2006 and 2007-2008 and the Reserve Manager position was moved back to state funding. Recent downturns in the economy have resulted in a 5% reversion of the fiscal year 2008-2009 budget and state agencies are assembling a 15% budget reduction scenario for the 2009-2011 biennial budget. The DCM has sheltered the Reserve from the bulk of the reversion for 2008-2009 and the Reserve budget will not be

impacted by the 2009-2010 reduction scenarios as currently written.

The Reserve has historically relied on waived indirect costs from the University of North Carolina at Wilmington (UNCW) for the 315 funded contract positions to provide a portion of the match for the 315 award. While DCM sincerely appreciates this assistance provided by UNCW and plans to continue to use waived indirect to match the 315 award for the foreseeable future, reliance on waived indirect to match the 315 award on an annual basis is not sustainable and it does not provide cash to the Reserve to fund staff or programs.

Table 1 outlines how the NCNERR matched its 315 awards for fiscal years 2004-2010. The availability of state support has increased during this time period resulting in better matching of the 315 award and reduced reliance on match from other sources, yet there is still much need for improvement as indicated by the high numbers in the match from other sources column. Match from other sources accounts for 44-73% of the total match for the 315 awards.

Table 1. Breakdown of 315 award federal and non-federal match for fiscal years 2004-2010.

Year	Federal	Non-Federal Match	
		State Fiscal Support[1]	Match from Other Sources[2]
2004-2005	$555,000	$64,726	$173,132
2005-2006	$555,000	$95,935	$141,923
2006-2007	$560,000	$104,539	$135,461
2007-2008	$540,000	$93,640	$137,789
2008-2009	$555,000	$132,555	$105,303
2009-2010	$587,190	$114,116	$137,537
[1]Includes relevant state-funded NCNERR staff and cash for operations			
[2]Includes relevant state-funded DCM staff, waived indirect from UNCW, volunteer hours, non-profit organization support, and boardwalk expenses			

Positive steps have been taken by DCM and the Reserve to increase state fiscal support of the NCNERR and to ensure more appropriate use of 315 funds:

- The Reserve Manager position, which oversees both the NCNERR and the NCCR, is now fully supported by state funds. This position was historically state-funded, but was funded by state funds and 315 funds (50:50) from 2003-2005 as a result of state budget cuts. Since 2006 the Reserve Manager's position has been fully funded by state appropriations and 100% of salary was used as State match. In fiscal year 2009-2010 only 75% of the Manager's salary was used as match since 25% of the Manager's time is spent on State site issues.
- The DCM continues to provide state funds to support the operations of the NCNERR which includes building leases, vehicle leases, travel, supplies, and other miscellaneous expenses.
- Supplies and travel for state reserve sites continue to be provided by either state funds

or CZMA 306 funds and are tracked accordingly.

- A portion of the DCM Public Information Officer's salary and fringe continues to match the 315 award for document review and Carolina Estuarine Reserve Foundation newsletter preparation.
- The DCM provided $25,914 in state funds to match construction award NA06NOS4200052 to complete the joint CCFHR-NCNERR administration and education building in Beaufort, North Carolina during fiscal years 2006-2007 and 2007-2008.
- The DCM supported state funding of both the Research Coordinator and Northern Sites Manager positions as its top budget request to DENR for fiscal years 2008-2009 and 2009-2011. Both positions are currently funded by the NCNERR 315 grant. The Research Coordinator was historically funded with state appropriations until fiscal year 2002-2003 when budget cuts forced the position to be funded by the 315 grant. As a core position of the Reserve, it is a high priority to move this position back to state funding to match the 315 grant. The Northern Sites Manager is responsible for managing one NCNERR site (Currituck Banks) and two state sites. State funding of this position will allow for more appropriate use of 315 funds by not using 315 funds to manage the two state sites and one-third of the position may be used to match the 315 grant, providing an additional source of match for the 315 grant. DENR included this item in its 2008-2009 budget for the Governor, but the item was not included in the final gubernatorial budget.
- The DCM supported creation and state funding of a Central Sites Manager for the Reserve as its fourth out of five top budget requests to DENR for fiscal years 2008-2009 and 2009-2011. The Central Sites Manager would manage one NCNERR site (Rachel Carson) and one state site. Creation and funding of this position would fulfill a high priority staffing need and one-half of the position may be used to match the 315 grant, providing an additional source of match for the 315 grant. DENR did not include this budget item in its 2008-2009 or 2009-2011 budget requests to the Governor.
- The Reserve staff continues to remain diligent in clarifying NCCR and NCNERR activities and funding sources. Reserve materials, the new logo, and website reference the appropriate funding source and include the entire Reserve title, "North Carolina Coastal Reserve and National Estuarine Research Reserve," to better recognize the NCNERR part of the program.

Additional steps the DCM and Reserve will pursue to increase state fiscal support to more appropriately match the 315 award, more appropriately use 315 funds, and reduce the Reserve's reliance on waived indirect from UNCW include:

- Continue to support budget requests to DENR for state funding of the Research Coordinator and Northern Sites Manager positions.
- Continue to support budget requests to DENR for creation and state funding of the Central Sites Manager position.
- Seek increased state fiscal support through capital improvement requests for UNCW, CCFHR, and Town of Kitty Hawk facilities and lease expenses.
- Develop and support budget requests to DENR for state funding of the Education Coordinator position. The position was historically funded with state appropriations

until fiscal year 2002-2003 when budget cuts forced the position to be funded by the 315 grant.

- Investigate creating a DCM position for the UNCW contract Stewardship Coordinator position and funding 50% of the position with state funds to provide state funding for the two state sites this position manages.
- Work to develop management tiers for state sites with recommended budget and staffing plans for implementation. Management of the state sites will be adjusted accordingly based on current state budget and staffing levels. State funding will be sought to implement management at the appropriate levels.

APPENDIX N: NORTH CAROLINA NERR SAFETY PLAN

Introduction

This safety plan was developed for the North Carolina Coastal Reserve (NCCR) and the North Carolina National Estuarine Research Reserve (NCNERR). Both organizations are managed as the North Carolina Coastal Reserve Program, which falls under the Division of Coastal Management (DCM) within the North Carolina Department of Environment and Natural Resources (DENR). There are four offices that house staff for the NC Coastal Reserve Program. The northern sites' office for Currituck Banks, Kitty Hawk Woods and Buxton Woods is located in Kitty Hawk, and the office space is leased from the Town of Kitty Hawk. The Buckridge Coastal Reserve office is located in the town of Columbia within Tyrrell County, where the office is shared with Division of Marine Fisheries and leased from a private individual. The headquarters office is located in Beaufort, and shares an office building with the NOAA's Center for Coastal Fisheries and Habitat Research and leases dock space from the Duke University Marine Laboratory. The southern sites' office is located in Wilmington at the University of North Carolina Wilmington's (UNCW) Center for Marine Science (CMS). Reserve staff are employed by both DCM and UNCW and building space is leased from several different entities, all of which have their own safety plans and policies. The UNCW staff at the Wilmington office are governed by UNCW's Center for Marine Science's safety, boating, emergency and hurricane policies. Given the centralized management of DCM/DENR and the local partnerships for office space and employee status, this document will clarify and address reserve wide and office specific safety protocols. Table 1 outlines which safety and hurricane plans the different offices follow.

Table 1. Matrix of Reserve offices, employees, and safety and hurricane plans to follow.

Office	Lease/Partner	Employees	Safety Plan	Hurricane Plan
Kitty Hawk	Town of Kitty Hawk	DCM	DENR	DCM
Beaufort	NOAA-CCFHR	DCM & UNCW	DENR & NOAA	NOAA & DCM
Wilmington	UNCW	UNCW	UNCW	UNCW
Columbia	DMF	DCM	DENR	DMF

Reserve Wide General Safety

All offices and personnel shall adhere to the DENR Workplace Safety Manual. Chapters 1 and 2 cover general safety policies (Appendix A) and chapter 6 refers specifically to the Division of Coastal Management (Appendix B). DENR has developed detailed safe operating procedures (SOPs) for many job site activities, operations, and hazards and those relevant to work on the Reserves are included in Appendix C. The DCM disaster response manual contains a contact list/matrix, staff assignments and hurricane recovery policies (Appendix D). NOAA and UNCW's safety and hurricane plans can also be found in Appendices E and F, respectively. These policies serve as framework for development of the NC Coastal Reserve Program Safety Plan.

The North Carolina Coastal Reserve/NCNERR safety plan provides guidelines and policies to ensure a safe working environment for all Reserve staff both in the office and in the field. The following safety philosophy adapted from DENR forms the basis of the safety plan:

1. Working safely is a condition of employment.
2. Occupational safety and health is part of every employee's total job performance.
3. Management/supervisors are responsible, and will be held accountable for establishing safe workplace conditions that prevent injuries and occupational illnesses.
4. By using proactive measures and actions, every employee can prevent accidents and injuries. It is the responsibility of each employee to report hazards to their supervisors so that the hazards can be addressed in a timely manner.
5. All workplace hazards can be safeguarded.
6. Training employees to work safely is essential and is the responsibility of management/supervisors.
7. Creating and maintaining a safe workplace, combined with the prevention of personal injuries and accidents, is good business.
8. An effective Safety Plan adds value to the Reserve's vision and mission.

Safety and Hurricane Plans

DENR Workplace Safety Manual

The DENR Workplace Safety Manual is a department wide plan that includes standard operating procedures for general, worksite, and equipment safety and chapters for each division, including DCM. The manual is available at http://www.enr.state.nc.us/safety/index.html. The manual also details the structure of department and division safety committees to standardize policies and transfer information. Specifically the committees are designed to:

1. Coordinate and guide the process and progress of the DENR written safety program within DCM;
2. Recommend modifications for specific safety procedures and policies;
3. Exchange safety information on a DCM-wide basis; and
4. Identify and review trends (both positive and negative) and make recommendations for improvement (DENR Workplace Safety Manual, Chapter 2).

The DCM chapter in the manual details the frequency in which the division committee and subcommittees meet (http://www.enr.state.nc.us/safety/WSM%202003/Ch%206/Chapter%206%20Coastal%20Management.html). Due to the small size of DCM, the six subcommittees were combined into three: Incident and Injury Investigation, and Policy and Procedures Review; Safety Audit Review and New Equipment Safety Review; and Safety Programs/Special Activities and Off-the-Job Safety. The Reserve has representatives on each of these committees.

DCM Disaster Response Plan and Procedures Manual

The DCM Disaster Response Plan and Procedures Manual is available for all Reserve staff on the DCM Intranet. The manual is reviewed every spring prior to hurricane season and contains staff roles and responsibilities and a phone tree for distributing information to DCM unit leads and staff. The Reserve also has its own phone tree to contact employees in the event of a disaster or emergency (Appendix D).

UNCW Safety and Hurricane Policies

UNCW provides safety policies and procedures at the Environmental Health and Safety's website, http://www.uncw.edu/ba/safety/. Hurricane preparedness and policies are located at

http://www.uncw.edu/ba/safety/emergency_management.html. UNCW personnel in the Wilmington office must adhere to all UNCW safety and hurricane policies, including safe boating operations. UNCW personnel located at the Beaufort office adhere to both DENR and NOAA safety plans (Appendix E).

NOAA Occupant Emergency Plan and Hurricane Plan

The NOAA Occupant Emergency Plan and Hurricane Plan are available in the administration building on the Pivers Island campus (Appendix F).

Standard Operating Procedures

Table 2 details the relevant standard operating procedures from DENR and UNCW for Reserve relevant categories. DENR procedures are located in the Workplace Safety Manual and UNCW procedures are located at http://www.uncw.edu/ba/safety/policies_procedures.html. Reserve specific supplemental information and forms can be found in Appendix G.

Table 2. Relevant DENR and UNCW SOPs.

	DENR	UNCW
Boat Safety	Marine Vessel-Power Boat, Working In or Around Water, Marine Vessel Painting	Guide for Safe Boating Operations
Field Work	Accident and Injury Response, Inclement Weather Conditions, Cold Weather Safety, Hot Weather Safety, Sun Exposure, First Aid, Field Surveying Activities, Natural Area Survey, Hand Removal of Vegetation, Litter Pick-up, Maintenance-Boundary line, Maintenance-Trail, Poisonous Snakes, Insects and Plants, Working Near Overhead High Voltage Lines, Abrasive and Water Blast Cleaning	
Environmental Hazards	Geographic Hazards, Domestic and Wild Animals, Poisonous Plants and Animals, Herbicides	
Tool Safety	See Ch. 27: Equipment, Tools, Accessories, Mechanic Operations	
Laboratory & Chemical Safety	Laboratory - Chemical Analysis, Laboratory - Physical Testing, Laboratory – Sample Testing	Hazardous Communication; Chemical Hygiene Plan
Automobile	Vehicle Operation, ATV,	

Safety	Vehicle-SUV, Equipment Mounting and Dismounting, Wet Weather	
Office Safety	Office Safety, Housekeeping and Sanitation, Lifting, Stapler-hand and electric, Fire Safety, First Aid, Wet Weather	
Anthropogenic Hazards	Hazardous Materials	
Hostile Interactions	Hostile and Irate Customer	
Personal Protective Equipment	PPE-Field Operations	Respiratory Protection
Ergonomics	Computer Data Entry	Office Ergonomics

Additional Reserve Procedures

Leading Group Tours on the Reserves

1. Leaders will brief the group on safety issues (i.e., no running, stay together as a group) prior to beginning the trip.
2. A DENR approved first aid kit will be carried at all times (Appendix G).
3. Leaders will have at least one form of communication (VHF radio, two-way radio or cell phone) in case of an emergency. Two forms of communication are preferable. Aerial flares are suggested but optional.
4. Appropriate footwear (close toed shoes) for wet and muddy conditions and clothing to coincide with seasonal conditions will be worn by both leaders and participants.
5. If the Reserve transports the group, the trip leader should check with participants to make sure they have water prior to leaving the dock. Bottled water is available for purchase in the Administration Building lounge.
6. Prior to any boat trip a float plan (Appendix G) must be filled out indicating the individuals on the boat (or number of trip participants), the boat destination, and the time of return. The boat captain will designate an on-shore emergency response contact prior to leaving the dock. If the boat is delayed the captain will communicate with the on-shore contact to let them know they are safe and to set another return time. If the boat captain has not returned by the time indicated and has not called to revise their float plan, the on-shore contact will attempt to initiate communication with the boat captain and if there is no response after 15 minutes the contact will personally try and locate the field staff (if nearby). After 45 minutes if the boat captain cannot be reached the on-shore emergency response contact will call 911 (which will alert the Coast Guard) and the Reserve Manager.
7. Leaders will arrive at the pick-up location on-time so as not to delay the ferry or boat captain. If the leader is delayed they will contact the boat captain to notify them of their delay. If the leader fails to show up at the pick-up location on time the boat captain will personally try and locate the field staff (if nearby). After 45 minutes if the boat captain cannot find or reach the trip leader the boat captain will call 911 (which will alert the Coast Guard) and the Reserve Manager.

8. During inclement weather, the boat captain has the final decision making authority as to whether or not the field trip proceeds. Field trips are not to be held in steady rain, strong winds, cold temperatures (< 40 degrees Fahrenheit), and during lightening storms. If inclement weather approaches during a field trip, the leader is to cut short the field trip and return to the pick-up location immediately.

Leading Group Boat Tours

1. Boat captain will brief the group on safety issues (i.e. staying seated for duration of trip, where PFDs are located, keeping limbs inside boat, etc.) prior to beginning the trip. Staff must wear a PFD when using the kayaks or when instructed to do so by the boat captain.
2. A DENR approved first aid kit will be carried at all times (Appendix G).
3. Boat captain will have two forms of communication (preferably a VHF radio and either a two-way radio or cell phone) in case of an emergency. In addition, the following equipment is required: PFDs, oars, flares, anchor and line, manual bilge pump, list of emergency contacts, and appropriate weather gear (*e.g.*, foul weather gear, float coats). Approved float coats will be worn when air temperatures are below 40 degrees Fahrenheit.
4. Trip Leader/Boat Captain should check with participants to make sure they have water prior to leaving the dock. Bottled water is available for purchase in the Administration Building lounge.
5. Children under 13 years of age must wear a life vest (WRC law).
6. Prior to any boat trip a float plan (Appendix G) must be filled out indicating the individuals on the boat (or number of trip participants), the boat destination, and the time of return. The boat captain will designate an on-shore emergency response contact prior to leaving the dock. If the boat is delayed the captain will communicate with the on-shore contact to let them know they are safe and to set another return time. If the boat captain has not returned by the time indicated and has not called to revise their float plan, the on-shore contact will attempt to initiate communication with the boat captain and if there is no response after 15 minutes the contact will personally try and locate the field staff (if nearby). After 45 minutes if the boat captain cannot be reached the on-shore emergency response contact will call 911 (which will alert the Coast Guard) and the Reserve Manager.
7. During inclement weather, the boat captain has the final decision making authority as to whether or not the field trip proceeds. Field trips are not to be held in steady rain, strong winds, cold temperatures (< 40 degrees Fahrenheit), and during lightening storms. If inclement weather approaches during a field trip, the leader is to cut short the field trip and return to the pick-up location immediately.

Boat Activities

1. Prior to any boat trip a float plan (Appendix G) must be filled out indicating the individuals on the boat (or number of trip participants), the boat destination, and the time of return. The boat captain will designate an on-shore emergency response contact prior to leaving the dock. If the boat is delayed the captain will communicate with the on-shore contact to let them know they are safe and to set another return time. If the boat captain has not returned by the time indicated and has not called to revise their float plan, the on-shore contact will attempt to initiate communication with the boat captain and if

there is no response after 15 minutes the contact will personally try and locate the field staff (if nearby). After 45 minutes if the boat captain cannot be reached the on-shore emergency response contact will call 911 (which will alert the Coast Guard) and the Reserve Manager.

Accident and Injury Response Guidelines for Visitors

1. Generally a person is under no duty to aid or render assistance to another who is in danger or in need of help. However, because we invite the public to come on our field trips, we have a duty to aid. A duty to aid is also imposed if the injury or danger is created by our negligence or by an instrumentality under our control. The general rule for Reserve staff is to aid in all circumstances. When rendering aid, reasonable care under the circumstances is the standard that is required. Because of our legal status as an "invitor", a duty is also imposed on us to protect others against risks created by third parties.
2. In the event of any injury or accident follow the procedures outlined in the Tort Claims General Process Flow Chart (Appendix G). Always call 911 in the event of severe injury and/or accident and render aid until emergency personnel arrive. No drugs of any kind (even aspirin or Tylenol) are to be dispensed, by Reserve staff, to visitors. Topical treatments are ok, as long as they are used reasonably as part of first aid.
3. When an accident or injury has occurred and staff members render aid, discuss only the injury and details of the aid being rendered. Do not admit fault or say anything that could be considered an admission of liability or negligence.
4. After the accident has been handled, all staff members involved should immediately fill out the Non-Employee Injury Report Form (Appendix G) with as much detail as possible. Complete this form even if the individual tells you they are not hurt or do not think the injury is serious. This form is for the protection of the staff member, the Reserve and the State of North Carolina. This form should not be filled out in front of the visitor. Use other paper to take notes at the scene of the accident or injury and then complete this form after the visitor has departed. Staff should not volunteer a copy of this form to visitors. This is, however, a public document, so do not deny a copy if one is requested. The Non-Employee Injury Report Form will be kept on file for at least three years.

Field Work Guidelines (Kitty Hawk, Beaufort & Wilmington)

1. Staff will have two forms of communication (preferably a VHF radio and either a two-way radio or cell phone) in case of an emergency. They will also carry a DENR approved first aid kit and plenty of water.
2. Prior to conducting field work, staff will review all appropriate SOPs and will ascertain what safety equipment is needed to complete the task.
3. Staff will designate an emergency response contact prior to conducting field work. The contact must know where the staff is going, why, and how long they plan to be in the field. Staff in the field will communicate with the contact if they will be out longer than anticipated. If the staff in the field has not returned by the time indicated the contact will initiate communication with the staff in the field and if there is no response after 15 minutes the contact will personally try and locate the field staff (if nearby). After 45 minutes if the staff cannot be reached the emergency response contact will call 911,

which will alert the appropriate responder (either the Coast Guard or the Sheriff's office), and the Reserve Manager.

4. At least two people should be involved for most field work activities. Two people should be aboard the boats at all times, except when ferrying people to and from the components and returning a boat to its trailer. Some field activities do not impose safety concerns and therefore, two people are not required for these activities. These include site monitoring, interpretive field trips, and kayak expeditions. Field work policy #3 above is critical when staff are in the field by themselves. Under no circumstances should visitors be confronted about rule violations when staff are by themselves.
5. The following equipment is required for work involving the boat: float plan, PFDs, oars, flares, anchor and line, manual bilge pump, list of emergency contacts, and appropriate weather gear (*e.g.*, foul weather gear, float coats). Approved float coats will be worn when temperatures are below 40 degrees Fahrenheit.
6. Staff must wear a PFD when using the kayaks.

Field Work Guidelines (Buckridge)

1. Buckridge staff will have an appropriate form of communication when conducting field work. Some forms of communication work better than others at this remote site and staff are often incommunicado. Staff will also carry a DENR approved first aid kit and plenty of water.
2. Prior to conducting field work, staff will review all appropriate SOPs and will ascertain what safety equipment is needed to complete the task.
3. When doing work involving the boat, a float plan will be given to DMF staff at the Columbia office. Estimated time of return should be followed as closely as possible so as to not delay DMF staff unnecessarily. Staff will do their best to return to shore before DMF office hours expire and to keep in contact with DMF staff if they are going to be delayed. In addition, the following equipment is required on the boat: PFDs, oars, flares, anchor and line, manual bilge pump, list of emergency contacts, and appropriate weather gear (*e.g.*, foul weather gear, float coats). Approved float coats will be worn when air temperatures are below 40 degrees Fahrenheit.
4. If work is required after normal office hours, a family member and/or a local volunteer will be notified of planned work area(s), expected time of return, and how the long contact should wait before investigating the delay. Some work can cause longer delays than others, so time frames after missed check-ins need to be flexible. As soon as possible after returning from the field, staff should notify their safety contact.
5. Buckridge is a remote site and therefore by nature rarely has two people available for fieldwork. While extra emphasis is placed on finding volunteers whenever boat work is involved, staff are expected to stay as safe as possible and always bear in mind their location and distance from assistance should an accident occur.
6. Staff must wear a PFD when using the kayaks.

Plan Review and Updates

NC Coastal Reserve/NCNERR staff will review the plan on an annual basis to determine its effectiveness and identify areas that need strengthening. Each office will have updated copies of the plan and printed copies of the manuals and standard operating procedures referenced here for easy access.

APPENDIX O: NERRS RESEARCH AND MONITORING PLAN

National Estuarine Research Reserve System

Research and Monitoring Plan (2006-2011)





Table of Contents

Executive Summary 3

Introduction 5

Background 7

Research Plan Framework and Development 15

National Estuarine Research Reserve System Research Plan 19

Implementation Strategy 22

Literature Cited 26

Appendices 28

Executive Summary

This document: 1) describes the current status of research and monitoring efforts within the National Estuarine Research Reserve System (NERRS), 2) describes five research priority areas that the system will focus on over the next five years, and 3) outlines a set of strategies that will enable the system to move forward in conducting and supporting research to address specific coastal management needs as well as improve our basic understanding of estuarine systems.

The five priority research areas were identified with input from a variety of sources including reserve research staff and managers, the NERRS Strategic Plan, and national documents outlining national coastal research needs and priorities. NERRS priority research areas focus on:

- Habitat and Ecosystem Coastal Processes
- Anthropogenic Influences on Estuaries
- Habitat Conservation and Restoration
- Species Management
- Social Science and Economics

Key reserve research goals, objectives, and strategies presented in this research plan will assist the reserve system in addressing the five research priority areas, as well as meeting strategic goals outlined by the system, in the following five years. Social science and economics are disciplines that could engender relevant research related to the priority areas listed. The research goals outlined for this plan include:

Goal 1: Biological, chemical, physical, and ecological conditions of reserves are characterized and monitored to describe reference conditions and to quantify change.

Goal 2: Scientists conduct research at reserves that is relevant to coastal management needs and increases basic understanding of estuarine processes.

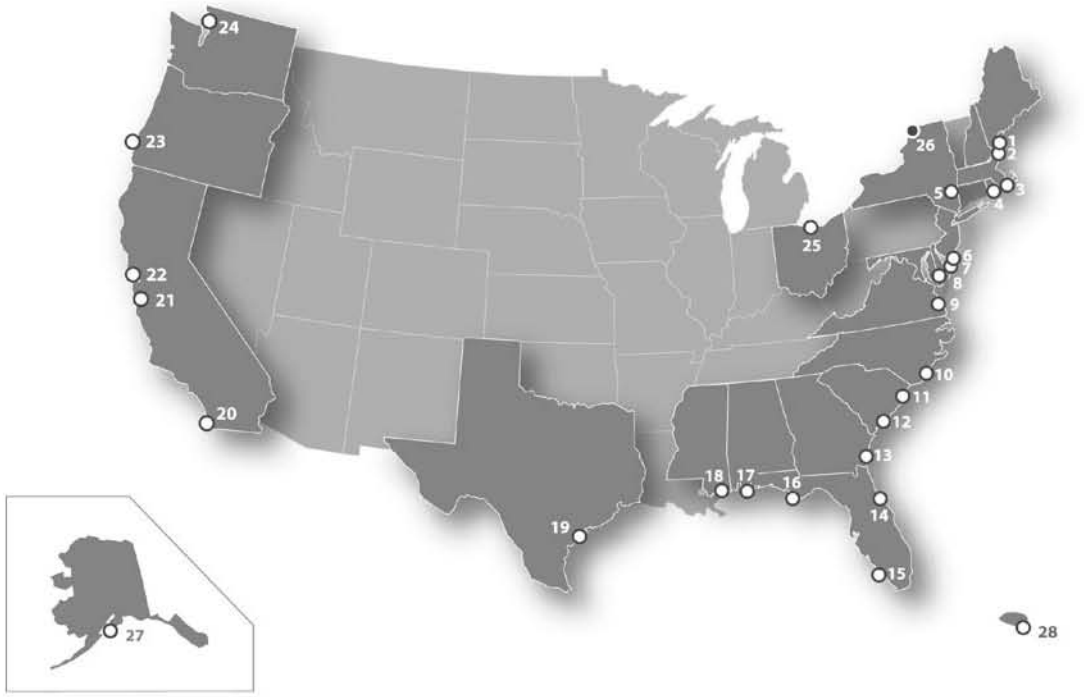
Goal 3: Scientists, educators, and coastal managers have access to NERRS datasets, science products and results.

Goal 4: The scientific, coastal management and education communities, as well as the general public, use data, products, tools, and techniques generated at the NERRS.

The NERRS has developed this research and monitoring plan to guide national, regional, and local research efforts that promote the protection and conservation of estuarine habitats through the provision of improved ecological information.

NATIONAL ESTUARINE RESEARCH RESERVES

A network of 27 protected areas



● designated ○ proposed

1. Wells Reserve, Maine
2. Great Bay Reserve, New Hampshire
3. Waquoit Bay Reserve, Massachusetts
4. Narragansett Bay Reserve, Rhode Island
5. Hudson River Reserve, New York
6. Jacques Cousteau Reserve, New Jersey
7. Delaware Reserve
8. Chesapeake Bay Reserve, Maryland
9. Chesapeake Bay Reserve, Virginia
10. North Carolina Reserve
11. North Inlet-Winyah Bay Reserve, South Carolina
12. ACE Basin Reserve, South Carolina
13. Sapelo Island, Georgia
14. Guana Tolomato Matanzas Reserve, Florida
15. Rookery Bay Reserve, Florida
16. Apalachicola Reserve, Florida
17. Weeks Bay Reserve, Alabama
18. Grand Bay Reserve, Mississippi
19. Mission-Aransas, Texas
20. Tijuana River Reserve, California
21. Elkhorn Slough Reserve, California
22. San Francisco Bay, California
23. South Slough Reserve, Oregon
24. Padilla Bay Reserve, Washington
25. Old Woman Creek, Ohio
26. Proposed Reserve—St. Lawrence River
27. Kachemak Bay Reserve, Alaska
28. Jobos Bay Reserve, Puerto Rico

Introduction

The National Estuarine Research Reserve System (NERRS) is a network of 27 reserves dedicated for long-term research, monitoring, education and resource stewardship. These 27 estuaries and coastal watersheds, representing different biogeographic regions of the United States, were established by the Coastal Zone Management Act of 1972. The reserve system operates as a partnership program between the National Oceanic and Atmospheric Administration (NOAA) and the coastal states and territories. NOAA provides funding, national guidance and technical assistance, while the states provide matching funds, personnel, and managerial oversight. Each reserve is managed on a daily basis by a lead state agency or university, with input from local partners. This partnership program between NOAA and the coastal states and territories protects more than 1.3 million acres of estuarine land and water, which provide essential habitat for wildlife; offer educational opportunities for students, teachers and the public; and serve as living laboratories for scientists.

One of the Guiding Principles of the Estuarine Reserves Division (ERD), as outlined by the NERRS Strategic Plan (2005-2010), is to "demonstrate and facilitate the development of sound science and best practices for improved local and regional coastal resource management." The reserve system is also mandated to provide protection of estuarine and coastal natural resources and to promote research and education activities that lead to greater protection of these systems. To facilitate the development of sound science for improved coastal decision making and the protection of natural resources, the reserve system has developed a research and monitoring plan that focuses on integrating the long term research goals of NOAA with those of the reserve system on local, regional, and national scales. As a system, the NERRS will approach research and monitoring from the perspective of an ecosystem approach to management which includes accounting for ecosystem knowledge and uncertainty, engaging in a collaborative and incremental approach to achieving research goals, employing adaptive techniques to improve research efforts, and balancing diverse environmental and societal objectives to inform coastal management decisions.

The purpose of this research plan is to help set priorities, provide a focus for partnership development, and help allocate financial resources and time to high priority issues. In addition, it will inform coastal resource managers and governmental, non-governmental, and academic scientists of the reserve system's research priorities and capabilities. This will serve to both enhance research collaborations and leverage resources to further the state of coastal research science to support improved coastal management. The research plan will also support reserve research, education, and stewardship staff in their efforts to seek

The National Estuarine Reserve System Research Plan

Audiences	Results
Scientists (governmental, non-governmental, and academic)	Communicates reserve research priorities
	Guides collaborative projects
Coastal resource managers	Leverages research resources within NOAA and external to the reserves

National Estuarine Research Reserve System

Vision: Healthy estuaries and coastal watersheds where human and ecological communities thrive.

Mission: To practice and promote coastal and estuarine stewardship through innovative research and education, using a system of protected areas.

external funding for reserve programs related to coastal resource management. As a living document, this five-year reserve research plan provides a basis for refining research priorities and strategies and also allows for the flexibility that is required to support a national research effort that is implemented primarily at local to regional scales. While this iteration of the plan focuses on natural science research, it is anticipated that this plan will be expanded to include research plans that address reserve needs in social science, restoration science, and education research within five years. Refining and aligning national, regional and local research priorities is challenging, yet efforts to do so will continually improve the relevance and impact of NERRS research efforts. While this research plan guides system-wide priorities, individual reserves will also pursue research and monitoring projects that address questions unique to their sites or regions. Reserve management plans will guide individual site-based research and monitoring priorities.

Background

The National Estuarine Research Reserves were established to provide opportunities for long-term research, education, and stewardship. According to 15 CFR Part 921 National Estuarine Research Reserve System Program Regulations, Subpart A, § 921.1 mission, goals and general provisions, three goals stand out as supporting the development of a coordinated research plan for the NERR system.

- Ensure a stable environment for research through long-term protection of NERR resources,

- Address coastal management issues identified as significant through coordinated estuarine research within the System, and

- Conduct and coordinate estuarine research within the System, gathering and making available information necessary for improved understanding and management of estuarine areas.

The authority to develop a system-wide research plan within the NERRS also resides in Title 16, Chapter 33, §1461 National Estuarine Research Reserve System, of the Coastal Zone Management Act (CZMA). Within the CZMA, specific research guidelines address the need for a plan for coordinated research and the development of related performance measures. Specifically, these guidelines suggest:

- Developing a mechanism for identifying, and establishing priorities among, the coastal management issues that should be addressed through coordinated research within the System,

- Establishing common research principles and objectives to guide the development of research programs within the System, and

- Establishing performance standards upon which the effectiveness of the research efforts and the value of reserves within the System in addressing the coastal management issues identified may be measured.

NOAA has recently redesigned its approach to research to follow a more interdisciplinary, cross-cutting strategy to address defined priority research areas (NOAA, 5-yr Research Plan, 2005). The new infrastructure for NOAA's research focuses on four mission goals: Ecosystem, Climate, Weather and Water, and Commerce and Transportation Goals. The reserve system is a strong contributing member of the Coastal and Marine Resources Program within the Ecosystems Goal Team. The reserve system also contributes indirectly to the Climate Goal as well as the Weather and Water Goal. The mission of the Ecosystems Goal is to protect, restore, and manage the use of coastal and ocean resources through an ecosystem approach to management. Through the integrative and collaborative efforts of reserve research, education, and training activities, coastal ecosystems will be better understood and coastal decision making will improve.

National Oceanic and Atmospheric Administration

Vision: Societally relevant research that forms the scientific basis for more productive and harmonious relationships between humans and their environment.

Mission: To conduct research, develop products, provide scientific understanding and leadershipand to conduct outreach towards fostering NOAA's evolving environmental and economic mission.

NOAA's Ecosystem Goal Team Selected Outcomes

- **Healthy and productive coastal and marine ecosystems that benefit society.**
- **A well informed public that acts as stewards of coastal and marine ecosystems.**

Existing NERRS Research and Monitoring Programs

NERRS System-Wide Monitoring Program

The NERRS System-Wide Monitoring Program (SWMP; pronounced "swamp") was developed in 1995 to provide researchers, resource managers, educators, and other coastal decision makers quantitative measures with which to assess short-term variability and long-term change in estuarine conditions. At present, the program is moving into its second decade of collecting critical estuarine water quality and meterological data. A key feature in establishing SWMP was the implementation of a set of consistent standard operating procedures that ensure the long-term collection of data that is comparable across time and locations. As such, SWMP is able to provide robust data for such things as, for example, trend analysis and change detection of anthropogenic impact assessments, as well as the effects of large-scale forcing (e.g., El Niño/Southern Oscillation and North Atlantic Oscillation, climatic conditions, sea level rise, and global climate change) and localized, stochastic events (e.g., hurricanes and contaminant spills) on estuarine conditions within a reserve. By implementing these standard operating procedures in a coordinated fashion across all 27 reserves, SWMP data can also be used for meaningful comparisons of estuarine conditions at the regional and national levels, thus enhancing the value of the reserves as a system of national reference sites. Thus, SWMP provides valuable short- and long-term data to researchers, natural resource program managers, coastal educators, and other coastal decision-makers.



Photo Credit: NOAA's National Environmental Satellite, Data, and Information Service (NESDIS)

The NERRS System-wide Monitoring Program (SWMP) is able to provide both long-term data for trend analysis and change detection as well as data on the impact of localized, stochastic events such as Hurricane Katrina (2005) on estuarine conditions within reserves.

The NERRS and NOAA established SWMP as a phased monitoring approach that focuses on three different ecosystem characteristics:

Abiotic Factors, including: atmospheric conditions, water quality (nutrients, contaminants, etc.) and physical parameters (salinity, tidal range, groundwater, freshwater inflow, bathymetry, etc.);

Biological Monitoring, including: biodiversity, habitat and population characteristics;

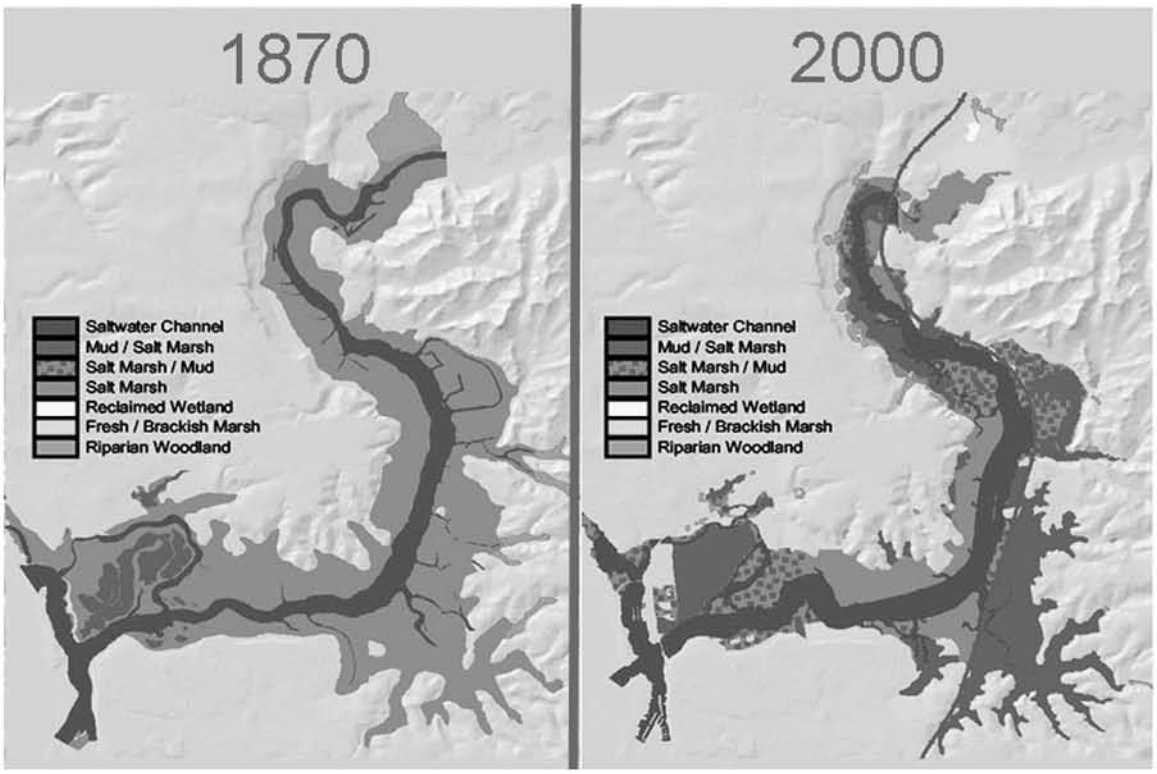
Watershed and Land Use Classifications, including: changes in consumptive and non-consumptive uses.

Phase 1 of SWMP focuses on monitoring a suite of water quality and meterological parameters over a range of spatial (local, regional, national) and temporal (minutes, hours, days, months, years) scales. Data loggers are continuously deployed at a minimum of at least four water quality stations at each reserve to record measurements of conductivity, salinity, temperature, pH, dissolved oxygen, turbidity, and water level at thirty minute intervals. Each reserve also collects monthly measurements of water column nutrients (e.g. nitrate, nitrite, ammonia, and ortho-phosphate) and chlorophyll-a concentrations at the four stations. In addition, diel sampling (2.5 hour sampling intervals over 25 hours) for nutrients and chlorophyll-a occurs at a minimum of one site each month. At least one weather station at each reserve records meteorological measurements of local temperature, wind speed and direction, relative humidity, barometric pressure, rainfall, and Photosynthetic Active Radiation at 15- to 30-minute intervals. Reserve staff have laid the technical groundwork necessary for the phase-one SWMP data collection network to be integrated into the backbone of the United States' Integrated Ocean Observing System (IOOS), with a near-real-time telemetry system for timely dissemination (NOAA 2004).



Photo Credit: Rookery Bay National Estuarine Research Reserve

Conservative estimates for the volume of data collected by the NERRS abiotic sampling program are: 13.5 million data points for water quality, 34.4 million data points for meteorological monitoring, and 31,104 data points for nutrient monitoring.



Wetland change analysis within the Elkhorn Slough, CA NERR utilizing habitat mapping techniques to quantify a 50% loss in marsh vegetation in the past 150 years (Van Dyke and Wasson 2005).

Phase 2 of SWMP focuses on characterizing biotic diversity in reserve estuarine ecosystems by assessing community composition and species abundance and distributions. Reserve projects will explore patterns of inter-annual variability and spatial distribution of estuarine communities, including emergent and submerged vegetation, invasive species, benthic, plankton and nekton communities, as well as targeted monitoring for the occurrence and distribution of invasive species. Since 2004, biomonitoring demonstration projects at 16 reserves have focused on developing baseline information on submerged and emergent vegetation distribution for use in future land use change research, determining changes in the health and distribution of these communities with long-term changes in water quality and quantity, and quantifying changes in estuarine habitat types. Rigorous protocols were established to ensure a national strategy for implementing this biomonitoring initiative, while retaining local flexibility as appropriate for individual reserves (Moore and Bulthius 2003). There are currently plans for a special journal edition focusing on local, regional, and national application of this biological monitoring information.

Phase 3 of SWMP is well-aligned with phase 2, as both of these efforts utilize remote sensing imagery and ground truthing. The central objective focuses on tracking and evaluating changes over time in coastal and estuarine

habitat and land use in the watershed. Reserve staff have developed a common classification system to provide the system with consistent, and thus nationally comparable, habitat and watershed mapping efforts (Kutcher et. al. 2005). The use of a common classification system will enable the NERRS to assess habitat change at local, regional, and national scales and identify the status of coastal habitats (i.e., degrading, improving, or maintaining). In addition, system-wide use of this classification system will provide a baseline of information that can be applied to management and restoration activities and guide conservation and protection of these important habitats. Currently, five reserves have piloted this classification system and the protocol was refined in the fall of 2005. It is anticipated that this classification system will be adopted by the reserves in 2006. Phases 2 and 3 will be implemented as resources become available.

Further details regarding parameters measured, data acquisition, data dissemination, deployment protocols, developing phases of SWMP, and applications of NERRS SWMP data within research, coastal decision making and education communities are available in the NERRS SWMP Plan (NOAA, 2002; Appendix A) and the NERRS SWMP 10th Anniversary Report (Owen and White, 2005). To ensure the collection of accurate, high quality SWMP data, the reserve system established a Centralized Data Management Office (CDMO; http://cdmo.baruch.sc.edu) in 1995. Quality assurance/quality control protocols have been established for the collection of all monitoring parameters and for the metadata (FGDC content compliant) associated with the time-series datasets.

A number of publications use and synthesize SWMP data. A recent special issue of the Journal of Coastal Research highlights a number of reserve research efforts (Kennish and Finkle 2004), and past syntheses have produced additional information regarding patterns within the reserve system (Wenner et. al., 1998 and 2000).

NERRS Graduate Research Fellowships

The NERRS Graduate Research Fellowship (GRF) program provides master's degree students and Ph.D. candidates with an opportunity to conduct research of local and national significance focusing on enhancing coastal zone management. Since its inception in 1997, the program has funded more than 160 fellows from 56 universities across the country. The five research focus areas for the GRF program are: eutrophication, effects of non-point source pollution and/or nutrient dynamics; habitat conservation and/or restoration; biodiversity and/or the effects of invasive species; mechanisms for sustaining resources within estuarine ecosystems; and economic, sociological, and/or anthropological research applicable to estuarine ecosystem management (Figure 1).

Reserve Site-Specific Research

The National Estuarine Research Reserves serve as living laboratories for on-site staff, visiting scientists and graduate students. Since its inception, a primary goal of the program has been to ensure a stable environment for research through long-term protection of reserve resources and ecosystems. Reserve management plans include site-based research

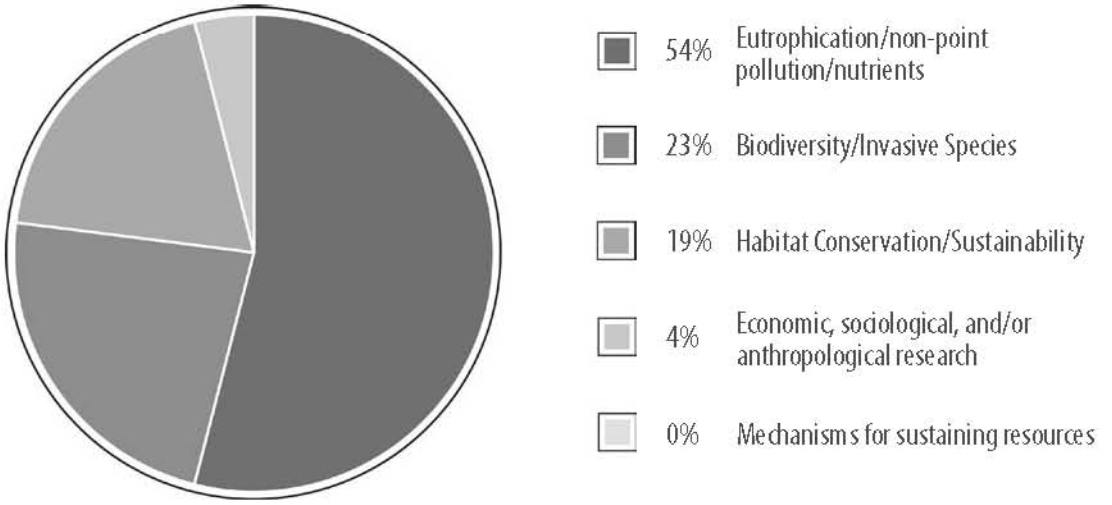


Figure 1. *Snapshot of NERR Graduate Research Fellowship research project focus areas for 2005.*

and monitoring priorities. Research activities within the reserve system occur in a number of ways. Each reserve has a research coordinator who is primarily responsible for coordinating research and monitoring efforts that occur within the reserve. As a group, the research coordinators' scientific expertise encompasses a wide range of subjects including nutrient biogeochemistry, population, community and ecosystem ecology, and physical oceanography. The breadth of knowledge and expertise that is shared among research coordinators constantly improves and pushes the reserve system toward new and successful research opportunities focused on improving coastal management decisions at individual reserves and nationally. In addition, scientists from a variety of backgrounds (e.g. academic, non-governmental, state and federal governments) conduct research within each reserve in coordination with reserve research staff. This also broadens the scientific knowledge base for the NERRS.

Research and Monitoring Partnerships

Additional research and monitoring efforts within the reserves are supported by a series of partnerships within NOAA and other programs. Examples of these partnerships include:

- The Cooperative Institute for Coastal and Estuarine Environmental Technology (CICEET) is supported through a partnership between NOAA and the University of New Hampshire (http://www.ciceet.unh.edu). Research projects funded by CICEET occur within reserve boundaries or the adjacent watershed and focus on a variety of environmental issues from habitat restoration research to developing and piloting new technologies to monitor water quality and contaminants.

- NOAA's Chesapeake Bay Office (NCBO) and the NERRS support specific research and monitoring programs that focus on understanding and restoring Chesapeake Bay communities.

- NOAA's Coastal Services Center (CSC) has supported remote sensing and geographical information system (GIS) tools, training, and development programs within the reserve system.

- NOAA's Center for Operational Oceanographic Products and Services (CO-OPS) has partnered with reserve sites to demonstrate the effectiveness of collaboration to produce an improved, more effective product that will be used by coastal managers and others for improved decision making. CO-OPS National Water Level Observation Network (NWLON) is expanding to include reserve sites in an effort to link SWMP data with more detailed tide, water level, and weather information within the Reserve.

- NOAA's National Weather Service (NWS) and National Environmental Satellite, Information, and Data Service (NESDIS) have partnered with the NERRS to deliver newly telemetered, real-time, SWMP weather and water data through NOAA's Geostationary Operational Environmental Satellites (GOES) and the NWS's Hydrometerological Automated Data System (HADS) to the NERRS Centralized Data Management Office.

- NOAA's Sea Grant Programs, Coastal Zone Management Programs, and National Marine Sanctuary Programs support research projects that address priority research needs within or adjacent to reserve sites.

- The National Atmospheric Deposition Program (NADP)/National Trends Network (NTN) and United States Geological Survey (USGS) have established atmospheric deposition monitoring programs within and close to reserve boundaries.

- The Environmental Protection Agency's National Estuary Program (NEP) and the NERRS collaborate at local scales to accomplish research that is relevant for both programs and at national scales to improve science information exchange bewteen programs.

- The Smithsonian's Environmental Research Center (SERC) and the NERRS have ongoing collaborations that focus on monitoring and forecasting expansion and distribution of invasive species within the reserve system.

- NOAA's National Centers for Coastal Ocean Science (NCCOS) collaborates with the reserve system to investigate long-term trends in eutrophication and contaminants in estuarine systems across the nation. The reserves continue to be involved in NCCOS's national estuarine eutrophication assessments and the Mussel Watch Program.

- NOAA's Educational Partnership Program (EPP) established the Environmental Cooperative Science Center (ECSC) in October 2000 with Florida A&M University in collaboration with Delaware State University, Jackson State University, Morgan State University, South Caro-

lina State University, and the University of Miami Rosenstiel School. The ECSC addresses ecological and management issues through studies and collaboration with several NERR sites and the Florida Keys National Marine Sanctuary. The ECSC NERR partners include: Apalachicola, FL NERR; Grand Bay, MS NERR; ACE Basin, SC NERR; Delaware NERR; and Chesapeake Bay, MD NERR.

- The National Science Foundation's coastal Long-term Ecological Research (LTER) sites offer the NERRS additional research and collaborative opportunities. Sapelo Island NERR is located within the Georgia Coastal Ecosystems LTER site.

Research Plan Framework and Development

The research plan for the NERRS has been developed to address topic areas and technological needs identified at national, regional, and local levels. Considerable challenges must be overcome to develop a coherent national research plan for the reserve system that can simultaneously incorporate and accommodate the flexibility in approaches and design that are necessary to meet local and regional coastal research and management needs, while also addressing nationally significant coastal issues. Scaling research priorities up from a local and regional perspective to address nationally relevant coastal issues requires the reserves to constantly evaluate how individual reserve research can support broader national estuarine information and application needs.

Development of this plan has been coordinated by NOAA's Estuarine Reserves Division with primary input from the individual reserves and NOAA's Office of Coastal Resource Management. Reserve research coordinators and managers contributed directly to the formulation of this plan by identifying the primary research needs and coastal management issues within reserve sites (Appendix B). The plan incorporates information contained in several documents produced by the reserve system including the NERRS Strategic Plan for 2005-2010 (Appendix C), the NERR System-Wide Monitoring Plan, NERR management plans, site profile documents (Appendix D), and local needs assessments conducted by the NERR Coastal Training Programs. Additional research needs and coastal management issues were identified through the findings of several recent compilations including: (a) the CICEET survey of coastal management needs for new and improved technology (2004); (b) the Coastal States Organization (CSO) census of national and regional priorities to improve links between science and coastal management needs (2004); (c) the CSO survey of state coastal observational and monitoring needs (2004); (d) research needs for coastal resource management identified by the Estuarine Research Federation (ERF, 2005); (e) the National Research Council priorities for coastal ecosystem science (1994); (f) the PEW Ocean Commission Report; and (g) findings from the U.S. Commission on Ocean Policy (2004). As an example of the range of coastal management priorities identified, Table 1 presents CSO's results for both national research needs and needs identified by NERRS Manager's as well as key estuarine threats identified by the PEW Ocean Commission. Information provided by these sources has been used to identify a series of reserve research priorities that are both nationally relevant and tailored to meet the regional and site specific needs of individual reserve sites.

Table 1. *Coastal management research needs and threats identified from surveys conducted by the Coastal States Organization and PEW Ocean Commission.*

The Coastal States Organization top ranked research needs:

Top National Level Research Needs	Top NERR Research Priorities
Cumulative Effects	Cumulative impact assessment
Source identification and tracking	Ecosystem indicators
Trends/change analysis	Source identification and tracking
Remote Sensing	Improved models
Improved Models	Rapid detection and monitoring of invasive species
	Risk and vulnerability assessments
	Restoration prioritization
	Ecological characterizations

The PEW Ocean Commission identified the following key estuarine threats and pressures:

Coastal development
Nutrient runoff into coastal rivers and bays
Unsustainable fishing activities impacting nearshore/estuarine systems
Invasive species introductions
Global climate change impacts

The framework for the NERR Research Plan provides a pathway for integration and support of site-based research projects to meet local, regional, and national coastal and estuarine management needs (Figure 2). Science investigations and research projects undertaken at individual NERR sites are supported by state, NOAA, and other sources, and are typically conducted by NERR scientists, graduate students, visiting investigators, contractors, and volunteers to meet the needs identified by local and regional coastal resource managers. Taken collectively, the research effort undertaken within the network of NERR sites contributes in a "bottom-up" manner to the goals and objectives of the NERR Research Plan. Conversely, the NERR Research Plan serves a "top-down" role to provide guidance, coordination, and the national context to support site-based research within the NERRS network. Financial support for the site-based research activities is typically derived from the states, federal agencies, regional programs, non-governmental organizations, and/or other sources depending on the topic and focus of the research problem. As the focal point for coordination of NERRS science activities, the NERR Research Plan serves as an integral element of the NERR Strategic Plan for 2005-2010. The NERR Strategic Plan functions to coordinate the research and monitoring

activities with other elements of the NERRS (e.g., education/outreach, coastal training, resource stewardship, and management). This in turn serves to facilitate investigations undertaken by multiple reserves, and to leverage support for NERRS research internally in cooperation with other NOAA science programs and externally in partnership with outside groups. Science activities completed under the guidance of the NERR Strategic Plan and NERR Research Plan contribute to the objectives of the NOAA-wide Research Plan (2005), and they address the cross-cutting issues identified by the Ecosystem Goal for Coastal and Marine Resources. Collective integration of NERRS science at many levels (e.g., NERRS sites, NERR Research Plan, NERR Strategic Plan, NOAA Research Plan) will help meet a sub-set of the national priorities for coastal and estuarine ecosystem science.

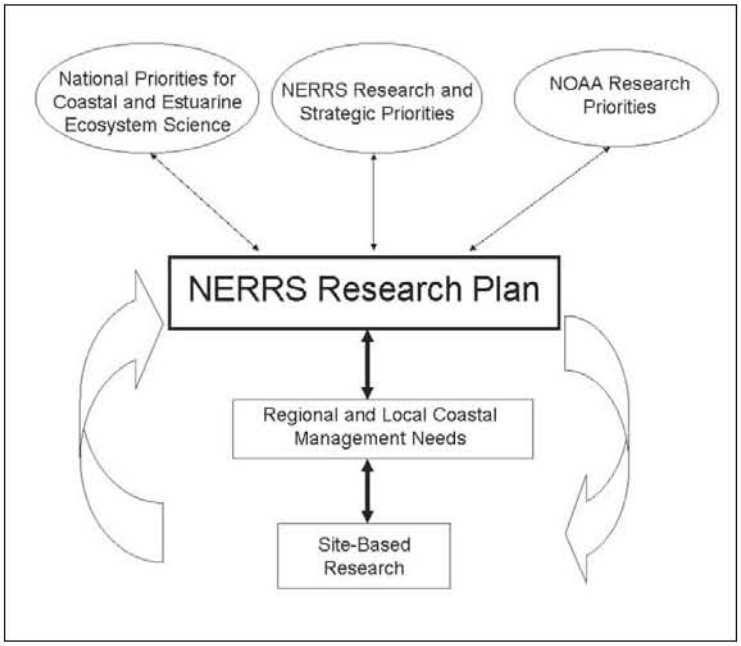


Figure 2. *The development components and anticipated science contributions associated with the NERRS Research and Monitoring Plan at local, regional, and national scales.*

Priority Coastal Management and Research Issues

The U.S. Commission on Ocean Policy recommended that NOAA adopt an ecosystem-based approach to the development of coastal and ocean policy that is based on the best available science for marine and estuarine ecosystems. NOAA's focus on protecting, restoring, and managing the use of coastal and ocean resources through an ecosystem approach is closely aligned with the specific research activities undertaken within the reserve system. The NERR Research Plan nests within the broader, NOAA 5-Year Research Plan, while simultaneously addressing the regional and local needs of the reserves.

The highest priority U.S. coastal management issues identified at both the national and regional levels focus on assessments of impacts due to changing shoreline and watershed land use and coastal habitat change (Table 1). It is clear that nationally and regionally, coastal managers are concerned about increased development pressures in coastal and estuarine areas, and are supportive of research and monitoring efforts that will address the growing need for information to document impacts on the coastal environment. Environmental contamination, habitat

degradation, eutrophication, invasive species, declines in fish species, freshwater diversions, sea level changes, and sediment problems are significant stressors to coastal and estuarine ecosystems. Consequently, it is not surprising that the top-ranked research needs for coastal managers are: (a) new approaches to address the cumulative effects of multiple environmental stressors, and (b) source identification and tracking for coastal environmental pollutants. Priority information needs identified by the U.S. coastal management community include quantitative data to describe temporal trends and changes in land use, coastal habitats, and habitat quality, and the priority needs for new technology focus on development of useful products from remote sensing imagery and improved conceptual and numerical models to predict the consequences of stressors on environmental change.

The priority research needs identified by the estuarine research community (e.g., academia, agencies, NGOs, and private-sector scientists; ERF, 2005) are highly complementary to those identified by the U.S. coastal management community. The highest priority research needs are: (a) investigations of anthropogenic impacts on estuarine ecosystem functions; (b) documentation of linkages among coastal land use activities and estuarine habitats; (c) increased understanding of environmental variability, sensitivity, and resilience; and (d) new infrastructure to link estuarine science, management, and policy (ERF, 2005). These priority estuarine research issues are consistent with the priorities for coastal ecosystem science identified by the National Research Council (i.e., integrated monitoring of coastal habitats; watershed hydrology and ecosystem processes; water quality and aquatic ecosystem functions; ecological restoration and rehabilitation; development of observational and predictive systems). In combination, the priority research needs identified by the U.S. coastal management and research communities clearly articulate a suite of pressing science-management issues that can be addressed by the network of representative reserve sites and the NERRS Research Plan. For example, within individual reserves, program priorities are broadly focused on research regarding habitat change/land use, cumulative impact assessments, tracking of pollutants, development of indicators that link land use with ecosystem impacts, estuarine ecosystem functions, invasive species, land use change analysis, the success of restoration efforts, habitat use by fish and shellfish, integrated monitoring, and improved models that predict and/or simulate changing environmental conditions.

National Estuarine Research Reserve System Research Plan

The NERRS Strategic Plan outlines four priority coastal management issues; land use and population growth, habitat loss and alteration, water quality degradation, and changes in biological communities. The five main NERRS research priority areas clearly address these identified estuarine threats and the supporting research questions, goals and strategies described below will enable the NERRS to better understand estuarine processes, provide scientific data that can be applied and thus improve coastal management decisions and the protection of estuarine habitats (Figure 3).

The five main NERR research priority areas were identified as a result of information complied from within the NERRS, NOAA and external sources as outlined previously. NERR research priority areas include:

- Habitat and Ecosystem Coastal Processes
- Anthropogenic Influences on Estuaries
- Habitat Conservation and Restoration
- Species Management
- Social Science and Economics

Research projects that are designed to tackle NERRS research priority areas will clearly address the four priority coastal management issues identified within the NERRS Strategic Plan and thus support improved coastal decision making and a greater understanding of estuarine systems. The research categories are interrelated on one or more levels. In addition, research can include natural or social science research. For example, social science and economic research can be used as a tool to address natural science issues. In the true ecological sense, this is a web of research topics with threads leading from topic to topic. NERRS- specific research questions are focused on coastal management issues related to these five priority areas.

Key Questions for each priority area might include:

Habitat and Ecosystem Coastal Processes

- What are the natural scales of variability in coastal and estuarine ecosystem processes?
- How do short-term climatic events (e.g., tropical storms and hurricanes), and large-scale events (e.g., El Nino, North Atlantic Oscillation, global climate change) impact estuarine water quality parameters and estuarine habitats?
- How do variable watershed inputs and oceanic physical forcing drive changes in estuarine ecosystems (including nutrient cycling, sediment transport, larval transport, etc.)?

Anthropogenic Influences on Estuaries

- How do human activities impact estuarine water quality, living resources (e.g.,

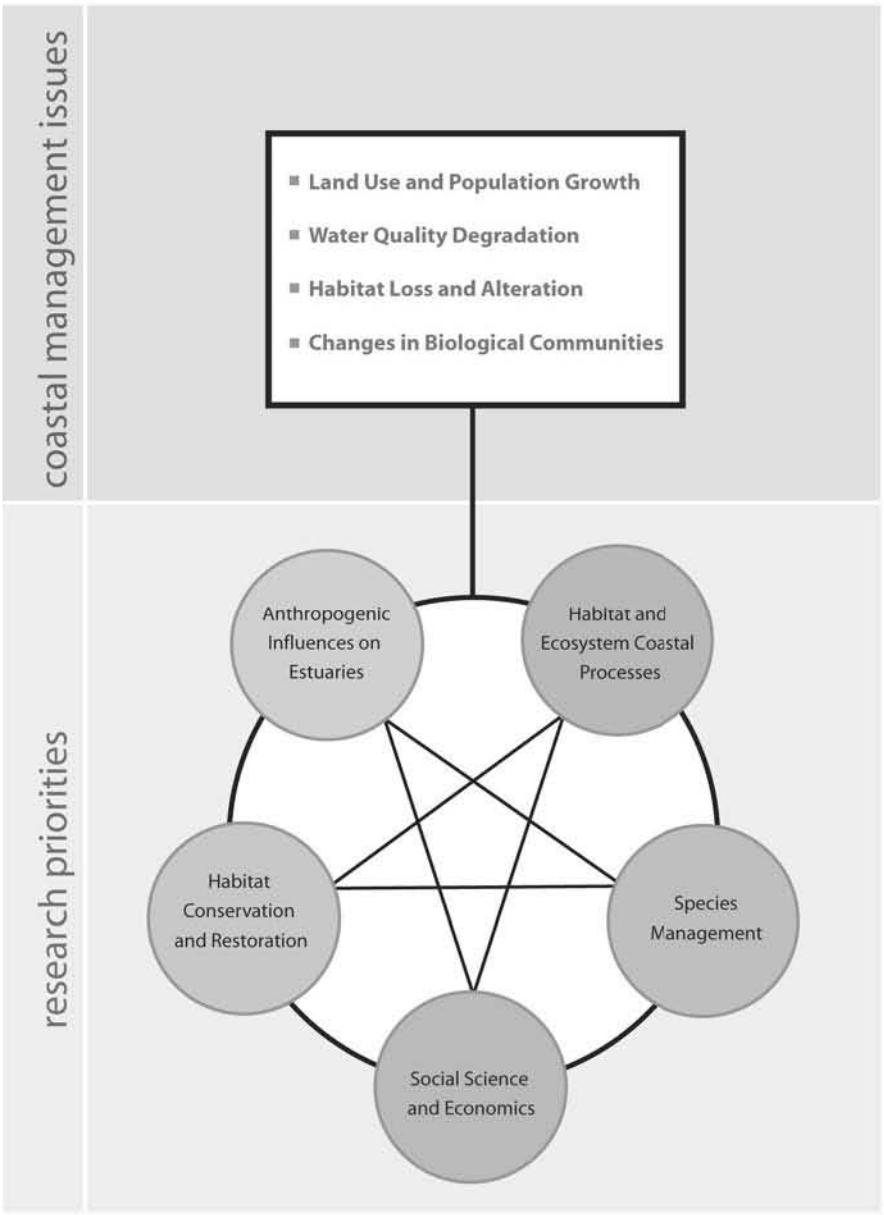


Figure 3. *The 5 NERRS Research Priorities, anthropogenic influences on estuaries, habitat and ecosystem coastal processes, habitat conservation and restoration, species management and social science and economics address key coastal management issues.*

submerged aquatic vegetation, benthic communities, habitat fragmentation), and ecosystem function (or "services")?

- Are current watershed and coastal nutrient management measures effective in minimizing impact to estuarine ecosystems and resources?
- What is the magnitude and impact of atmospheric deposition on estuaries?

Habitat Conservation and Restoration

- What impacts does climate change have on habitat integrity and restoration success?
- How does the restoration of tidal hydrology impact estuarine communities (e.g. colonization of invasive species, resiliency of native species, etc.).
- What are the linkages between adjacent upland habitats and tidal wetlands and how critical are those links to the recovery of wetland function?
- What invasive species control methods are effective?
- How can reserves serve as reference sites for restoration efforts?

Species Management

- How do invasive species affect native species and communities?
- What tools can be developed and used to detect invasive species, respond rapidly and appropriately to these events, and monitor for additional impacts?
- Can natural variations in the distribution and density of organisms be distinguished from human impacts on these populations?
- How do estuarine and coastal communities and individual species populations change under varying environmental conditions?
- How are estuarine species and communities affected by landscape or watershed scale changes (e.g., habitat proximity, subtidal-intertidal linkages, connectivity)?

Social Science and Economics

- How are coastal populations demographics changing and how does this/will this impact natural resource protection and management?
- What are the economic tradeoffs/effects of increasing development and urbanization in the coastal zone on traditional commercial enterprises such as seafood harvesting, etc.?
- How do human perceptions of health risks influence coastal decision making and natural resource protection?
- What are the cumulative impacts of multiple human recreational and economic activities on the coastal environment?

Implementation Strategy

Research Goals

The reserve research and monitoring plan includes a number of priority goals for the system (a few of which are outlined below) to support national and regional efforts toward improving the protection of coastal and estuarine natural resources by conducting research that supports sound coastal decision making. These goals are not meant to be an exhaustive list as by definition this research plan is designed to be supportive of regional and local research initiatives that address reserve system and NOAA research needs. The goals listed below provide a basic foundation on which reserve science efforts can build. It is fully anticipated that these strategies will be modified appropriately over time as the Reserve system continually assesses the quality and impact of research results and products in order to continue to improve and sustain coastal environments (Appendix E). The desired ecosystem approach to management is an iterative process, where results from previous actions and research are used to refine and improve future efforts in research and management decisions. Implementation of some strategies depends on the availability of sufficient resources.

Research Goal 1: Biological, chemical, physical, and ecological conditions of reserves are characterized and monitored to describe reference conditions and to quantify change.

Objectives:

1. Water and weather parameters, biodiversity, and habitats located within the reserve and nearby watershed areas are sufficiently characterized, both spatially and temporally, to support trend analysis efforts.

2. Biological monitoring data collected by the reserve system are incorporated into an accessible database for use.

3. Biological monitoring efforts within the NERRS are synthesized regularly as appropriate at national, regional and local scales.

Strategies:

- Complete site profiles.

- Continue system-wide measurements of the short-term variability and long-term changes in estuarine water quality and meteorological parameters, consider expanding suite of standard water quality parameters tracked (e.g. addition of chlorophyll a to fixed station sampling) as possible.

- Collect system-wide measurements of the short-term variability and long-term changes in submerged aquatic vegetation and emergent vegetation.

- Collect additional appropriate biological monitoring information on important

habitats, species, and ecological functioning within reserves.

- Link system-wide measurements of chemical and physical parameters with biological monitoring information.
- Implement a system-wide habitat classification system that allows for site specific and system-wide analysis.
- Synthesize biological monitoring pilot project data and revise protocol to reflect lessons learned and move toward system-wide operational status.
- Develop a system-wide remote-sensing strategy that supports and enhances ongoing biological monitoring and habitat classification efforts.
- Partner with appropriate university, state agency, federal agency, local government and private entities to bring monitoring of sediment quality, benthic communities, nekton populations and shoreline change into reserves.
- Integrate NERRS monitoring data into the national IOOS program.

Research Goal 2: Scientists conduct estuarine research at reserves that is relevant to coastal management needs and increases basic understanding of estuarine processes.

Objectives:

1. Research efforts focus on understanding the response of estuarine and coastal processes to specific natural and anthropogenic impacts.
2. Research efforts focus on estuarine habitat and species management and the restoration of critical ecosystem function.
3. Research efforts incorporate an ecosystem-based approach to management that involves multiple stakeholders.
4. Scientists from multiple agencies (ie. academic, governmental, NGO's, etc.) utilize reserves as a platform for research.

Strategies:

- Attract CICEET, GRF, and external researchers to reserves to work on priority research topics: habitat and ecosystem coastal processes, anthropogenic influences on estuaries, habitat conservation and restoration, species management, and social science and economics.
- Revisit GRF priority research areas to update them as appropriate to reflect NERRS coastal management needs.
- Utilize SWMP data to drive hypothesis driven research within reserves and adjoining watersheds.

- Support ecosystem-based approaches to coastal research and management projects that incorporate adaptive management strategies to improve research efforts and applications.

- Design and regularly update a database that archives and tracks research projects within the NERRS that are supported by non-Section 315 NERRS funding (i.e. other NOAA monies, academic, NGO, external funding sources, etc.) and address priority coastal management and estuarine research needs.

- Improve current partnerships and explore new opportunities to leverage resources that support reserve priority research efforts.

- Facilitate research efforts between and across NERRS, both regionally and nationally, to address important coastal issues.

- Design a regional or national assessment of the NERRS that integrate research results from the reserves to determine if NERRS environmental conditions are improving or declining and why (i.e. a "report card" for the NERRS).

Research Goal 3: Scientists, educators, and coastal managers have access to NERRS datasets, science products and results.

Objectives:

1. Scientists are aware of available NERRS datasets and research products.

2. Biological monitoring data is available for academic scientists, coastal managers, and educators to use.

3. Data visualization products are available.

Strategies:

- Develop a useful and informative database for accessing past and current research projects, data, and resulting publications and products.

- Establish a data management strategy and database to support biological monitoring and land use/habitat information.

- Disseminate science through publications, outreach and technology transfer.

- Develop and implement appropriate communication tools to increase awareness of science conducted, data application, and data availability within the NERRS.

- Assess CDMO capabilities and needs in relation to expanding NERRS research and monitoring, data accessibility, and data visualization efforts.

Research Goal 4: The scientific, coastal management and education communities, as well as the general public, use data, products, tools, and techniques generated at the NERRS.

Objectives:

1. Researchers and coastal managers identify priority resource needs that will improve research activities at the local, regional, and national scales.

2. Enhance the use of NERRS scientific data in coastal training, stewardship, and education programs within the NERRS.

3. The NERRS are increasingly recognized as a primary source of information about estuaries and coastal areas.

Strategies:

- Re-evaluate priority research needs biennially.
- Revise and update SWMP Plan based on NERRS research and monitoring needs.
- Conduct a SWMP External Review.
- Coordinate with education and outreach professionals early in the formation of research activities, where feasible, to target educational product development and dissemination from research activities.
- Provide science based information and training to individuals and organizations that make decisions about coastal resources on a regular basis in a professional or volunteer capacity.
- Improve the ability of restoration practitioners to restore and protect coastal ecosystems.
- Provide science based information to assist in the production and dissemination of educational materials and web based products that use science generated at the reserve.
- Provide science based information and training to citizens so that they can make informed decisions about protecting coastal resources through their own actions.

Appendices:

A. NERRS SWMP Plan Executive Summary

B. Regional NERRS research priority issues

C. NERRS Strategic Plan (2005-2010)

D. NERRS Site Profile Status

E. Key milestones anticipated for achieving NERRS research goals

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Appendices

Appendix A: NERRS System wide Monitoring Program Plan Executive Summary

THE NATIONAL ESTUARINE RESEARCH RESERVE'S SYSTEM-WIDE MONITORING PROGRAM (SWMP): A SCIENTIFIC FRAMEWORK AND PLAN FOR DETECTION OF SHORT-TERM VARIABILITY AND LONG-TERM CHANGE IN ESTUARIES AND COASTAL HABITATS OF THE UNITED STATES

(Updated Spring 2006)

Executive Summary

Estuaries are among the most dynamic and productive environments known. They are transitional places where salt and fresh water mix and serve as nursery areas for numerous commercial fish and shellfish species. These habitats also act as rest stops for migratory birds, filters for pollution and buffers against coastal erosion. The high value that society places on estuaries for living, working and recreation has made these habitats among the most densely populated in the United States.

An increased awareness of estuarine degradation resulted in the passage of legislation aimed at protecting estuarine ecosystems. A landmark piece of legislation enacted by Congress was the Coastal Zone Management Act (CZMA) of 1972, which was the beginning of what became the National Estuarine Research Reserve System (NERRS). Currently, 27 reserves in 22 states and territories protect over 1.3 million acres of estuarine waters, wetlands and uplands. The NERRS was built on a foundation of partnerships among state and federal agencies and community groups. The reserves have a management framework in place that links stewardship, public education and scientific research and thus provide an ideal vehicle to establish a nationally coordinated monitoring program.

In 1992, the reserve system proposed the establishment of a coordinated monitoring program that would attempt to identify and track short term variability and long term changes in the integrity and biodiversity of representative estuarine ecosystems and coastal watersheds for the purposes of contributing to effective coastal management. The initial phase of the NERR System wide Monitoring Program, known by its acronym SWMP (pronounced "swamp"), began in 1995. The initial focus was on monitoring a suite of water quality and atmospheric variables over a range of spatial and temporal scales. Water quality parameters measured include pH, salinity, conductivity, temperature, dissolved oxygen, turbidity and nitrate,

ammonia, ortho-phosphate, and chlorophyll a. Atmospheric parameters measured include temperature, wind speed and direction, relative humidity, barometric pressure, rainfall, and photosynthetic active radiation.

The purpose of the updated SWMP document is to lay out a revised scientific framework and plan for the NERR SWMP that will assist in guiding the program with the perspective gained over the past 10 years, for the next 10 years. It is not a static document, especially regarding costs and implementation details, but it portrays priority activities for ongoing and future SWMP efforts. This document describes a conceptual framework for NERR SWMP laying out the steps that will assist in addressing coastal management problems. Updates, including steps taken to expand abiotic monitoring within the reserves and initiate the second and third phases (e.g. biological monitoring and watershed and land use classifications) are included. In addition, the SWMP plan contains some general areas for future targeted monitoring including additional expansions of abiotic, biological and watershed/land use components (e.g., contaminant monitoring, monitoring of invasive species, conducting benthic/subtidal mapping, etc.).

The advantages of the NERRS monitoring program are that it:

- Provides an ecosystem-based network for understanding the temporal and spatial variability of ecosystem components and their interactions.
- Provides a long-term database for the estuarine reserves' protected area network.
- Establishes a baseline for measuring changes in environmental conditions and ecological processes.
- Provides a research framework for evaluating ecosystem conditions and interpreting and predicting responses to change.
- Provides the basis for an ecosystem-based approach to managing coastal resources.

The scientific value of NERR SWMP data increases over time because it is through the collection of long-term data that subtle changes in environmental conditions are identified. This established monitoring program continues to be an opportunity to increase our understanding of how various environmental factors influence estuarine processes by collecting high-quality, long-term data.

By understanding how estuaries function and change over time, we can begin to predict how these systems respond to changes in climate and human-induced perturbations. Research is critical to the interpretation of monitoring results and for testing hypotheses generated by monitoring. Whereas monitoring determines whether and how

much the environment has changed from its reference state, research helps establish causal relationships. The reserve system's monitoring program, coupled with NERR-supported research programs, provides a foundation for developing solutions to coastal management problems by answering how estuarine ecosystems change and why.

Appendix B. Regional NERRS Research Priority Issues

		REGIONS							
		NW Pacific	California	Caribbean	Northeast	Mid-Atlantic	Southeast Atlantic	Gulf of Mexico	Great Lakes
	Total Count (Rank Order)	Region Total (N = 3 sites)	Region Total (N = 3 sites)	Region Total (N = 1 site)	Region Total (N = 5 sites)	Region Total (N = 4 sites)	Region Total (N = 5 sites)	Region Total (N = 4 sites)	Region Total (N = 1 site)
Non-point source pollution	15	2	3	1	3	1	3	2	0
Hydrology	12	0	2	1	2	2	2	2	1
Nutrient studies	11	1	0	0	3	2	3	1	1
Restoration	11	1	3	1	2	1	2	1	0
Contaminants	10	1	1	0	2	1	3	1	1
Invasive Species	10	1	3	1	1	1	2	1	0
Sediment Transport / Processes	10	1	0	1	3	1	2	1	1
Physical Oceanography	9	2	0	1	2	1	2	1	0
Land Use (change/planning)	8	0	2	0	2	2	1	1	0
Other	8	0	0	0	3	2	0	3	0
Water Quality	7	1	3	0	2	0	1	0	0
Climate Change	6	0	0	0	3	1	1	0	1
Biodiversity	6	0	0	1	2	0	1	2	0
Energy Flow	4	0	0	0	1	1	1	0	1
Habitat Conservation	4	0	2	1	0	1	0	0	0
Plant/Animal Growth	4	2	0	0	1	1	0	0	0
Indicator Species	3	0	0	0	2	0	0	1	0
Cultural Resources	3	0	0	0	0	1	1	1	0
Human Impacts	3	0	0	0	1	1	0	1	0
Methodology Development	2	0	2	0	0	0	0	0	0
Plant/Animal Interactions	2	0	0	0	0	1	1	0	0
Management of Special Status Species	2	0	2	0	0	0	0	0	0
Storm Impacts	2	0	0	0	0	0	1	0	1
Sustaining Resources	2	0	0	1	0	0	1	0	0
Larval Transport	2	1	0	0	1	0	0	0	0
Community/Population Dynamics	1	0	0	0	1	0	0	0	0
Biological Oceanography	1	1	0	0	0	0	0	0	0

Appendix C: NERRS Strategic Plan (2005-2010)

strategic PLAN 2005 - 2010

vision | Healthy estuaries and coastal watersheds where coastal communities and ecosystems thrive.

mission | To practice and promote coastal and estuarine stewardship through innovative research and education, using a system of protected areas.

goals

1. Strengthen the protection and management of representative estuarine ecosystems to advance estuarine conservation, research and education.
2. Increase the use of reserve science and sites to address priority coastal management issues.
3. Enhance peoples' ability and willingness to make informed decisions and take responsible actions that affect coastal communities and ecosystems.

Introduction

For thousands of years, coastal and estuarine environments have provided people with food, safe harbors, transportation access, flood control, and a place to play and relax. The pressures on the nation's coast are enormous and the impacts on economies and ecosystems are becoming increasingly evident. Severe storms, climate change, pollution, habitat alteration and rapid population growth threaten the ecological functions that have supported coastal communities throughout history. As a network of 26 (soon to be 27) protected areas established for long-term research, education and stewardship, the National Estuarine Research Reserve

System has a unique role to play in keeping coastal ecosystems healthy and productive.

The reserve system is a partnership program between the National Oceanic and Atmospheric Administration and coastal states that has protected more than one million acres of coastal and estuarine habitat since the program was established by the Coastal Zone Management Act in 1972. NOAA provides funding, national guidance and technical assistance. Each reserve is managed on a daily basis by a lead state agency, non-profit organization or university with input from local partners. Through careful stewardship, innovative science and education, and relevant training programs, the reserves encourage careful management and protection of local estuarine and coastal resources.

The Coastal Zone Management Act created the reserve system to protect estuarine areas, provide educational opportunities, promote and conduct estuarine research and monitoring, and transfer relevant information to coastal managers. For the next five years, core reserve programs will focus on four priority topics:

- Impacts of land use and population growth;
- Habitat loss and alteration;
- Water quality degradation;
- Changes in biological communities.

The National Estuarine Research Reserve System's 2005-2010 Strategic Plan articulates how the strengths of the reserve system will be applied to address the major challenges of coastal management.

Priority Coastal Management Issues:

1. Land Use and Population Growth

The United States' exploding coastal population results in competing demands for clean water, beaches, recreational and commercial space, infrastructure and housing. In 2003, an estimated 153 million people lived in coastal counties, which is approximately 53% of the total US population. Pressure to develop land in coastal areas is escalating at more than twice the rate of population growth. Land use changes can significantly impact coastal and estuarine species and habitat. The Pew Ocean Commission reports that when more than 10% of a watershed is covered in impervious surface such as roads, roofs and parking lots, aquatic resources begin to degrade.1

Coastal population and land use demands are not only increasing, they also are changing. Demographic and socio-economic trends show that the backgrounds and interests of people who are moving to the coast may be different from those of traditional fishing, commerce, or beach communities. The way people value and understand their relationship to the coast is reflected in the personal, political and professional choices they make. To make wise coastal resource management decisions, we need to understand the relationships among estuarine ecosystems and changing landscapes and attitudes. National Estuarine Research Reserves encourage the development and use of science based knowledge and tools in local land use planning, community development, and stewardship of public and private property.

2. Habitat Loss and Alteration

More than half of the nation's coastal wetlands have vanished since European settlement.2 Estuarine and coastal environments continue to be altered and eliminated due to dredging, dams, recreational and commercial uses, flood and hazard mitigation, residential and infrastructure development, commercial port activities, and agriculture. Many of these activities disturb the physical, biological and chemical attributes of the estuary and therefore degrade the plants and animals that depend on the habitat to survive. Seagrass beds, marshes, shellfish, bird and fish populations can be affected by sedimentation, erosion, and hydrological, chemical or physical alteration of the habitat. Estuarine ecosystems also are vulnerable to coastal storms and sensitive to changes in climate and sea level. Coastal managers want to know more about how their choices influence coastal habitat and the species that live there. Better information will ensure that alternatives are considered for permitting, as well as planning and implementing successful restoration and mitigation efforts.3

Reserve research and monitoring programs increase the fundamental understanding of estuarine dynamics and add new information about the causes and consequences of changes in habitat quantity and quality. Research and stewardship programs at the NERRs also develop, implement and evaluate new techniques to restore and protect estuarine resources. Training programs and advisory services make this information available to professionals. Through education programs conducted at the reserves, students and citizens learn why these habitats are important and what they can do to keep them healthy.

3. Water Quality Degradation

Improving the condition of coastal water quality is a goal of the Coastal Zone Management Act and an ongoing struggle for all coastal regulatory agencies. Despite continuing local, state and federal investments, more than 20,000 beach closures were enforced in 20044 and more than 60% of estuarine waters were classified by the EPA as having degraded water in 2005.5 Excess nutrients and chemical and biological contamination can cause human health problems and threaten aquatic life.

The Reserve System has been collecting water quality data for ten years to quantify short term variability and long term changes in estuarine waters. Through monitoring and studying changes in water quality, the reserves investigate how human activity, weather patterns, and estuarine characteristics contribute to changes in water quality that affect ecological processes and, consequently, human health. Reserves apply the knowledge generated through research and monitoring to improve water quality through habitat protection, restoration, and training and outreach programs.

4. Changes in Biological Communities

Biological communities are changing as a result of invasive species, over-harvest, climate changes, pollution, and habitat destruction. Invasive species out-compete or consume native organisms; habitat alteration and destruction displace some species and create opportunities for others; and changes in parameters such as temperature and salinity can shift the distribution of plants and animals. Chemical contamination and nutrient enrichment damage habitat and can alter the structure of floral

and faunal communities. Over-harvesting biological resources also can change community structure and threaten valuable species. These problems impact natural interactions and linkages and lead to cascading indirect effects throughout the ecosystems.

Reserve research, stewardship, education, and training programs focus on understanding how changes in biological communities affect the way estuaries function. To minimize the negative impact of these changes, reserves investigate and communicate how to balance public needs with the protection of increasingly susceptible natural resources.

A Local Approach to National Priorities

Land use and population growth, water quality degradation, habitat loss and alteration, and changes in biological communities are not the only topics that reserves work on, but these four have risen to the top as deserving of adequate and strategic investment for the national system. These four topics are high priority science and training needs for coastal managers.3 Reserve scientists, educators and land managers have identified these topics as locally and nationally important and appropriate to the mission of the National Estuarine Research Reserve System. Increased understanding about these topics will improve the reserve system's ability to protect and restore coastal watersheds and estuaries and empower individuals to make informed decisions. The nation's coasts and estuaries need to be managed, understood and appreciated at multiple scales. Through a network of locally oriented programs around the country, the reserve system provides insight into common information and management needs as well as data for use by local, regional and federal scientists and decision makers. Working at both the site level and as a national system, reserves have a greater impact than could be achieved through community efforts alone.

The goals, objectives and strategies outlined in this strategic plan will guide and support the National Estuarine Research Reserve System in its nation-wide efforts to improve coastal management, advance estuarine research, and educate current and future generations of coastal stewards.

Guiding Principles

- Strong partnerships between NOAA, state agencies and universities, and other local partners are critical to the success of the reserve system.
- The reserve system integrates science, education and stewardship on relevant topics to maximize the benefits to coastal management.
- Reserves serve as a catalyst and a focal point for demonstrating and facilitating objective problem solving and best management practices.
- Reserves engage local communities and citizens to improve stewardship of coastal areas.
- Reserves implement an ecosystem-based management approach.

Goal One:

Strengthen the protection and management of representative estuarine ecosystems to advance estuarine conservation, research and education.

Objectives:

1. Biogeographically and typologically representative estuarine ecosystems are protected through the designation of new reserves.

2. Biological, chemical, physical, and community conditions of reserves are characterized and monitored to describe reference conditions and to quantify change.

3. Reserve ecosystems are conserved through land acquisition, natural resource management and restoration.

Strategies:

- Identify and designate new reserves consistent with system-wide policy and available resources.

- Collect system-wide measurements of the short-term variability and long-term changes in the water quality, biotic communities and diversity, land-use and land cover characteristics of estuarine ecosystems to support effective coastal zone management.

- Collect baseline information about the biological, physical, chemical, and socio-economic parameters of reserve biological and human communities.

- Integrate NERRS monitoring, data management, education and training capabilities in regional ocean observing systems.

- Implement land acquisition plans to enhance the long term integrity and diversity of reserve habitats.

- Restore and actively manage reserves' natural resources to meet local habitat and human use goals.

- Work collaboratively with other programs to evaluate and apply advanced technologies and tools to support effective coastal management.

- Provide facilities and support to manage the natural resources within reserve boundaries.

Goal Two:

Increase the use of reserve science and sites to address priority coastal management issues.

Objectives:

1. Scientists conduct estuarine research at reserves that is relevant to coastal management needs.

2. Scientists have access to NERRS datasets, science products and results.

3. The scientific community uses data, tools and techniques generated at the NERRS.

Strategies:

- Understand coastal decision maker science and training needs through needs assessments, coastal management science needs surveys, etc.
- Work collaboratively with other programs to conduct research on priority management issues in the reserves.
- Offer Graduate Research Fellowships to master's and doctoral students to conduct science that is relevant to coastal management and to train students in estuarine science.
- Deliver monitoring and observation data to the scientific community.
- Disseminate reserve science through publications, outreach and technology transfer.
- Generate time-series data and empirical studies to describe the ecological condition of reserve habitats.
- Promote reserve science products through web sites, communication materials, and other avenues to meet the needs of diverse stakeholders.
- Increase visibility and reinforce the credibility of NERRS science through communication efforts about NERRS research and monitoring.
- Attract scientists and practitioners to use reserves as reference sites.
- Conduct and facilitate relevant research in reserve watersheds.
- Synthesize reserve data into information for use in decision making.
- Conduct and facilitate research into education effectiveness and behavior change.
- Ensure that reserves have facilities and research support to meet the needs of visiting scientists and staff.

Scientist: *A person who uses principles and procedures for the systematic pursuit of knowledge involving the recognition and formulation of a problem, the collection of data through observation and experiment, and the formulation and testing of hypotheses.*

Goal Three:

Enhance people's ability and willingness to make informed decisions and take responsible actions that affect coastal communities and ecosystems.

Objectives:

1. People are aware of the ecological, economic, historical, and cultural importance of estuarine resources.

2. People understand how human choices and natural disturbances impact social, economic, and estuarine ecological systems.

3. People apply science-based information when making decisions that could impact coastal and estuarine resources.

Strategies:

- Provide educational opportunities that increase students' understanding of estuarine science and technology.

- Implement and participate in public programs and events to raise awareness and understanding about estuaries and the NERRS.

- Produce and distribute educational materials and web-based products that raise public awareness about estuaries, the NERRS, and NERRS education products.

- Train teachers to educate students about coastal watersheds and estuaries.

- Deliver monitoring and observing data to diverse user groups in a useful format.

- Improve the willingness and ability of communities to restore and protect coastal ecosystems.

- Provide science-based information and training to individuals and organizations.

- Assist restoration practitioners in developing and applying effective restoration techniques.

- Implement volunteer programs to engage local citizens in advancing the goals of the reserves.

- Conduct programs to encourage people to make personal choices that reduce their impact on coastal resources.

- Evaluate programs to determine how people apply information and knowledge.

- Build and maintain educational facilities and interpretive displays.

Appendix D. NERRS Site Profile Status

Sites completed profile

	Year published
ACE Basin, SC	2001
Delaware	1999
Elkhorn Slough, CA	2002
Great Bay, NH	1992
Jobos Bay, PR	2002
Kachemak Bay, AK	2003
Old Woman Creek, OH	2004
Rookery Bay, FL	2003
Sapelo Island, GA	1997
Tijuana River, CA	1992
Waquoit Bay, MA	1996
Weeks Bay, AL	1996
Hudson River, NY	2006

Sites planning profile

	Anticipated publication year
Apalachicola Bay, FL	2006
Chesapeake Bay, MD	2008
Chesapeake Bay, VA	2007
Grand Bay, MS	2006
Guana-Tolomato-Matanzas, FL	2006
Jacques Cousteau, NJ	2007
Narragansett Bay, RI	2007
North Carolina	2006
North Inlet-Winyah Bay, SC	2006
Padilla Bay, OR	2007
San Francisco Bay, CA	2007
South Slough, OR	2006
Texas-Mission Aransas	2009
Wells, MA	2006

Appendix E. Key milestones anticipated for achieving NERRS research goals

Research Goal	Milestones*	Products*	Y1	Y2	Y3	Y4	Y5
1. Biological, chemical, physical, and ecological conditions of reserves are characterized and monitored to describe reference conditions and to quantify change.	Site Profiles completed	3 site profiles/year	x	x	x	x	x
	Revise SAV/Emergent Biomonitoring protocol	Updated protocol	x				
	Summarize initial SAV/Emergent Biomonitoring projects	Synthesis document	x	x			
	Implement NERRS Habitat Classification System	At least 3 sites employ/year	x	x	x	x	x
	Develop a NERRS Remote Sensing Strategy	NERRS remote sensing guidance document	x	x			
	Integrate NERRS monitoring data with national and regional IOOS efforts	Partners use NERRS real-time and archived data	x	x	x	x	x
2. Scientists conduct estuarine research at reserves that is relevant to coastal management needs and increases basic understanding of estuarine processes.	Revise Graduate Research Fellowship (GRF) priority research areas	Updated GRF focal areas	x	x			
	Revise NERRS Research Database that archives and tracks research projects with the NERRS	Functional NERRS Research Database	x				
	Populate NERRS Research Database with research projects that are occuring or have ocarred in the recent past (5 years) at reserves	Current, ongoing, and past research projects with NERRS are archived	x	x	x	x	x
	NERRS works with CICEET to improve coordination and delivery of relevant science	NERRS research products are accessible, CTP workshops deliver information to broad user audiences	x	x	x	x	x
	Complete a regional and/or national assessment of NERRS environmental conditions	A NERRS "Report Card" document			x	x	
3. Scientists have access to NERRS datasets, science products and results.	CDMO capabilities are assessed in relation to expanding NERRS data collection and delivery needs	CDMO and ERD identify options to manage increasing data loads and data visualization needs	x	x	x		
	NERRS Research Database is available for public access onlinez	Searchable database of research projects is available online for public access/information	x	x			
	A NERRS Special Journal Issue is published to highlight biological monitoring and research in the field	Published Special Journal Issue		x			
	A NERRS Special Journal Issue is published to highlight NERRS Habitat mapping/Land use change monitoring and remote sensing research	Published Special Journal Issue					x
	Develop a method to deliver biological monitoring and habitat mapping information to the public through CDMO	Biomonitoring information and habitat maps are made available to the public	x	x	x		
4. The scientific, coastal management and education communities, as well as the general public, use data, products, tools, and techniques generated at the NERRS.	Regularly evaluate NERRS Research priority needs	Up-to-date NERRS research priorities		x		x	
	Revise and update SWMP Plan	Revised SWMP Plan	x	x			
	Conduct a SWMP External Review	Evaluated program to guide future development	x	x			

* Some milestones and products will require additional resources.

RESEARCH AND MONITORING NEEDS IDENTIFIED BY THE NORTH CAROLINA COASTAL HABITAT PROTECTION PLAN

BY

North Carolina Division of Marine Fisheries
Department of Environment and Natural Resources
3441 Arendell Street, Morehead City, NC 28557

August 2005

Introduction

With passage of the Fisheries Reform Act of 1997, the North Carolina General Assembly established the Coastal Habitat Protection Plan (CHPP) program within the North Carolina Department of Environment and Natural Resources (DENR). The Act (General Statute 143B-279.8) requires preparation of a Coastal Habitat Protection Plan, the goal of which is "long-term enhancement of coastal fisheries associated with each coastal habitat." The divisions of Marine Fisheries (DMF), Water Quality (DWQ), and Coastal Management (DCM) were designated as the lead agencies for the development of the CHPP document. Specifically, the CHPP is to:

- Describe fisheries habitats and their biological systems;
- Evaluate the functions, fisheries' values, status, and trends in the habitats;
- Identify existing and potential threats to the habitats and impacts on coastal fishing; and
- Recommend actions to protect and restore the habitats.

To fully attain the CHPP goal, numerous research and monitoring needs were identified by the CHPP Development Team [including staff from the DMF, DWQ, and DCM, the Division of Environmental Health (DEH), and the Wildlife Resources Commission (WRC)] and suggested in the CHPP. By December 31, 2004, the three regulatory commissions responsible under the Act formally adopted the CHPP (Street et al. 2005), including the research and monitoring needs contained therein. The purpose of this research report is to summarize these research and monitoring needs to encourage and facilitate acquisition of this information by the research community. Meeting these research and monitoring needs will aid in implementation of CHPP recommendations.

Current related initiatives

The necessity for conducting cooperative, integrative research and monitoring in coastal settings has been cited in documents recently released by various organizations.

A report generated by the Pew Oceans Commission in May 2003 proposed the following:

"We know the oceans are in crisis. Unfortunately, as the nature, scale, and complexity of threats to marine ecosystems have increased, our national investment in ocean science and research has stagnated…The nation must increase investment in ocean science and research, particularly broader programs to monitor and to understand ecosystems…We need a deeper understanding of the effects of both natural and anthropogenic change on marine ecosystems as well as of the oceans' interaction with terrestrial ecosystems and the atmosphere. Increased capacity is needed in four areas to improve applied ocean science and research:

1. acquisition of new information, knowledge, and understanding;
2. monitoring to evaluate status and trends;
3. capability to integrate and synthesize existing and new information;
4. sharing of information and knowledge with the public."

Released in September 2004, the report of the U.S. Commission on Ocean Policy similarly recommended that the National Oceanic and Atmospheric Administration (NOAA) create an expanded, regionally-based cooperative research program that coordinates and funds collaborative projects between scientists and fishermen.

More recently, another federal document, the Environmental Protection Agency's National Coastal Condition Report II (EPA 2005), emphasized the importance of coordinated monitoring efforts within coastal habitats. The report noted that while trying to make best use of available data to characterize and assess estuarine systems, the assessment was based on a limited number of ecological indicators for which consistent data sets were available to support estimates of ecological condition on regional and national scales. The report goes on to say that a multiagency and multistate effort is needed over the continuing decade, to achieve a truly consistent, comprehensive, and integrated national coastal monitoring program that can accurately assess the health of coastal ecosystems.

In North Carolina, the CHPP identifies topics for coordinated interagency research. Because North Carolina's coastal fishery resources exist within a system of interdependent habitats, it is necessary to approach habitat management on the basis of ecosystem integrity and understanding the linkages among all coastal habitats and the outside forces that affect them. Research needed to provide the basis for ecosystem management is, of necessity, multi-disciplinary. In addition, it is also recognized that no environmental issue can be fully evaluated without considering the economic impact of alternative management actions designed to minimize degradation of the ecosystem. Determining effective management actions will thus require the integration of biological, chemical, physical, social, economic, legal and political sciences.

CHPP Research and Monitoring Needs

Table 1 describes research and monitoring needs identified directly or indirectly within the CHPP document. The purpose of Table 1 is to provide researchers and managers a quick reference guide to support their research/monitoring proposals with needs identified in the CHPP text. Thus, there are page references that serve to provide additional context for each research/monitoring need. For the purpose of clarification, the text of selected research and monitoring opportunities has been rephrased from their appearance within the CHPP, so that particular concepts may better function as discrete, "stand alone" ideas.

The research and monitoring needs in Table 1 are grouped into the following categories:

- Stormwater runoff
- Strategic Habitat Areas
- Fish-habitat relationships
- Docks and marinas
- Estuarine erosion and shoreline stabilization
- Boating related
- Beach nourishment
- Fishing gear impacts
- Managing non-native species

- Chemical effects
- Water supply
- Habitat status and trends
- Evaluating existing management measures
- Comprehensive water quality monitoring

Unfortunately, no fuding mechanisms have been developed specifically intended to support these identified needs. Interested researchers should pursue all available funding sources. The members of the CHPP development team identified in the CHPP are available to discuss these research and monitoring needs.

Literature Cited

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Street, M.W., A.S. Deaton, W.S. Chappell, and P.D. Mooreside. 2005. North Carolina Coastal Habitat Protection Plan. North Carolina Department of Environment and Natural Resources, Division of Marine Fisheries, Morehead City, NC. 656 pp.

U.S. Commission on Ocean Policy. 2004. An Ocean Blueprint for the 21st Century. Final Report of the U.S. Commission on Ocean Policy - Pre-Publication Copy. Washington, DC. 455 p plus appendices.

Table 1. Research needs identified in the North Carolina Coastal Habitat Protection Plan.

Issue	Description of Need	Type^	CHPP page reference*	Status (Aug 05)
Stormwater runoff	***The major cause of water quality degradation in coastal North Carolina today is stormwater runoff. While methods to control direct discharges to surface waters have greatly improved over time, there are still many questions concerning the interaction of stormwater runoff and fish habitat, and how to effectively control non-point runoff of pollutants. Research is needed to identify the causative relationships between ecosystem conditions and land cover, hydrology, and runoff characteristics. Identifying causative relationships will allow managers to predict the impact of increasing development on coastal ecosystem conditions and prescribe management actions.***			
	Complete watershed mapping of hydrology/land cover and monitoring of downstream water quality in order to build models predicting runoff characteristics. Water quality parameters measured should include those determined to affect the survival of sensitive biological indicators (e.g. submerged aquatic vegetation, oysters).	R-M	*49, 69, *75, 77, *88-89, 109-110, 135, 332, 340-343, 412	
	Determine the relationship between changes in drainage characteristics and changes in distribution and status of sensitive biological indicators in receiving waters.	R	78	
	Identify water quality parameters (e.g., TSS, chlorophyll a, nutrients, color) and standards (e.g. average concentration, variation in concentration) that are necessary to support sensitive biological indicators.	R	34, 63, 66, 80, 89, 115, 127, 131, 224-225, *257, *274, *286-287, 335, *340, *472	
	Assess the conditions and ecological functions of black water ecosystems to determine their value as strategic buffers/filters between upland runoff and coastal fisheries habitats.	R-M	319	
	In blackwater swamp systems, assess dissolved oxygen (DO) levels and associated biological impacts, differentiating between DO derived from inflow of swamp waters and DO derived from anthropogenic nutrient loading.	R-M	34-35, 64, 85, 89, 100, *101, *103-104, *223-224	
	Evaluate the cumulative amount and extent of land cover and hydrological changes that can be accommodated by natural ecosystems before reaching some critical threshold of change in ecosystem integrity* within a watershed. ***Ecosystem integrity** is the capability of a system to support services of value to humans.	R	86, 88	
	Determine stormwater control strategies needed to prevent watersheds from reaching the critical threshold of change in ecosystem integrity.	R	79, *88, *100, *111-112, 131	
Strategic Habitat Areas	***All aquatic areas are important for the propagation and production of fish and shellfish resources. However, some specific areas stand out as being of key importance for certain species or biological communities, and the overall maintenance of ecological stability. Identification of these Strategic Habitat Areas (SHAs) is a high priority, but we lack sufficient data and tools to fully identify them. Research items below were noted in the CHPP as being necessary to help fill these information gaps so that North Carolina's coastal ecosystem can be adequately protected.***			
	Develop ecologically based criteria for locating and defining SHAs, including biological indicators of ecosystem integrity.	R	62, 268, *292, 462, 466, *483	Advisory Committee established

^R=Research, M=Monitoring, and R-M=Research that can form the basis of monitoring
*Specific research need extracted from the CHPP (wording very similar).

Table 1. Research needs identified in the North Carolina Coastal Habitat Protection Plan.

Issue	Description of Need	Type^	CHPP page reference*	Status (Aug 05)
Strategic Habitat Areas	Expand and improve juvenile fish sampling programs to provide regional information on status and trends in juvenile utilization of various types of nursery habitat and their contribution to production of fishery stocks. This information could serve as a basis for identifying or validating important strategic habitat areas.	M	263, *272, *380, 383-384	
	Develop techniques/technology to improve and expedite aquatic habitat mapping in order to identify the spatial extent of SHAs.	R	*483	Being addressed by shell bottom and SAV mapping
	Determine if and where foraging or refuge habitat is more limiting to fish production for that area than spawning or nursery habitat.	R	61-62, 209-210, 266, 268, 324-325, 375, 381, 458, 481	
	Identify important spawning areas for key fishery species and demonstrate their importance in terms of contribution to fisheries production.	R	53, 209, 266, 326, 378, 458, 481	
	Assess use and importance of nearshore hard bottom areas as spawning or secondary nursery areas for estuarine-dependent or reef species.	R	*458-459	
	Determine if there are core habitat areas that are key to submerged aquatic vegetation (SAV) expansion, particularly in the Albemarle Sound system, that justify special monitoring and protection.	R	*272	
Fish-habitat relationships	***There are many gaps in information regarding the specific relationships between habitat characteristics and viable fish populations. Few clear cause and effect relationships have been demonstrated between changes in habitat condition and status of fish populations due to the complexity of the coastal system and lack of data. A better understanding of fish-habitat relationsips is the cornerstone to fish habitat protection.***			
	Determine the effect of bivalve shellfish location and filtering capacities on water quality parameters, such as nutrients, sediments, and chlorophyll a.	R	*108, 204	
	Evaluate recruitment enhancement of oysters and other key organisms provided by low-density cultch planting in nursery areas.	R	*210	
	Fully evaluate the role of SAV in the spawning success of red drum, weakfish, spotted sea trout, and other important species.	R	*266	
	Determine spatial and biological characteristics of SAV beds that maximize their ecological value to important finfish and invertebrate species. This information will aid in design of seagrass restoration projects and location of SHAs.	R	*267	
	Examine the effect of spatial connectivity between habitats (ie. marsh edge and SAV) on juvenile predatory fish use, survival, growth, and abundance (i.e. red drum, spotted seatrout).	R	216, *269, *326, 381	

^R=Research, M=Monitoring, and R-M=Research that can form the basis of monitoring
*Specific research need extracted from the CHPP (wording very similar).

Table 1. Research needs identified in the North Carolina Coastal Habitat Protection Plan.

Issue	Description of Need	Type^	CHPP page reference*	Status (Aug 05)
Fish-habitat relationships	Determine if long-term declining trends in bay scallop and blue crab populations are related to declines in, or degradation of, SAV.	R-M	*272	
	Determine what pocosin areas are directly used by estuarine fishes, and the contribution of those areas and fish to overall production in the estuary.	R	*322	
	Assess if reef fish populations in North Carolina are limited by the amount of available hard bottom habitat by comparing differences in fish abundance before and after artificial reefs are added using a Before-After-Control-Impact Paired Series (BACIPS).	R	*463	Coordinate with similar work
	Determine if and to what extent artificial reefs in North Carolina simply concentrate available fish or if they effectively increase fish biomass.	R	*463	
	Determine the critical frequency and extent of hypoxia and anoxia, above which significant changes in biotic community structure occur.	R-M	104, 223, 318	
	Determine the critical amount and quality of living and dead shell bottom in a water body below and above which significant changes in biotic community structure (e.g., SAV, oyster reef) occur.	R-M	*215	
	Identify biological indicators of ecosystem integrity that also indicate viable populations of traditional fishery species.	R	13, 135, 262, 289, 372	Coordinate with existing work (APNEP)
	Locate potential SAV and oyster restoration sites using a combination of seed/larval transport, water quality, physical habitat models, coincidence with watershed restoration efforts, and other available information.	R	*218, 224, 230, *257, *267, *272	Coordinate with existing work
Docks and Marinas	***As coastal, human population increases, there is a continuing demand for additional individual and multi-slip boat docking facilites and marinas, and decreasing availability of highly suitable locations. More answers are needed regarding the direct, indirect, and cumulative effects of these facilities and their use on fish habitat so that future dock and marina siting guidelines can minimize habitat impacts.***			
	Determine if marina basins in freshwater and low-salinity nursery areas produce toxic chemicals at sufficient concentrations and critical times to impact local fish populations (especially considering egg and larval life stages).	R-M	118, *121	
	Determine if existing dock siting criteria allow adequate light beneath dock structures to maintain SAV and coastal wetland habitat. If existing criteria result in adverse effects on SAV or coastal wetlands, modified dock siting specifications that allow adequate light penetration should be identified.	R	*279	Preliminary DMF research available
	Analyze marina development, design, siting and operation to determine the best management practices to minimize impacts of multi-slip docking facilities.	R	*123	Advisory committee established (Sea Grant)

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*Specific research need extracted from the CHPP (wording very similar).

Table 1. Research needs identified in the North Carolina Coastal Habitat Protection Plan.

Issue	Description of Need	Type^	CHPP page reference*	Status (Aug 05)
Docks and Marinas	Quantify the cumulative effect of multi-slip docking facilities and associated development on water quality, characteristics of runoff, and the impacts on adjacent fish habitat.	R-M	*125, *279, *391	Advisory committee established (Sea Grant)
	Evaluate the impact of dock-associated prop dredging on shallow nursery habitats.	R-M	*391	
Boating related	***In addition to the effects of docking structures, information is needed on the individual and cumulative effects of boat use on coastal waters and habitat. As boat use changes over time, additional information may also be needed.***			
	Assess the impact of jetties on successful larval passage through inlets into estuaries, particularly in Pamlico Sound where inlets are limited.	R-M	*83	
	Examine the relative contribution of channel deepening to saltwater intrusion and evaluate subsequent oyster mortality (i.e. from predation) in order to determine appropriate management actions.	R-M	*228	
	In areas of heavy boat traffic and extensive SAV beds, periodically assess the level of damage to SAV from prop scarring.	R-M	*277	Some NOAA work
	Determine what effect the Ocean Dredge Material Disposal Site (ODMDS), located near the mouth of the Cape Fear River, has had or will have on nearby hard bottom habitat.	R	*469	
	Determine the impact of chronic oil pollution from boating and runoff on estuarine nursery areas.	R-M	*122-123	
	Determine the impact of waves propagated from boat operations on adjacent marsh and shell bottom shorelines.	R-M	*222, *350	
Estuarine erosion and shoreline stabilization	***Shallow water habitats adjacent to the estuarine shoreline are critical to North Carolina's coastal fish populations. Therefore, managing shoreline stabilization activities in a manner that minimizes habitat impacts is an important issue. Research that aids in understanding shoreline processes and the effect of man-made structures on the estuarine environment will help in implementing the CHPP recommendation to revise estuarine and public trust shoreline stabilization rules for protecting fish habitat.***			
	Periodically assess where and how much of the estuarine shoreline is hardened. Accurate information is key to assessing the level of impact to fishery resources.	M	*347	Preliminary DMF research available
	Examine if and how oyster shell could be utilized as an alternative to rock or wooden stabilization structures to create “living shorelines” that are effective in stabilizing the shoreline.	R-M	*349, *392	
	Develop accurate coast-wide estuarine erosion rates to assess sea-level rise and storm impacts, determine adequate development guidelines, and shoreline stabilization policies that minimize impacts on fish habitat (e.g., soft bottom, wetlands, shellfish).	R-M	*105, *349	DCM workgroup discontinued

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*Specific research need extracted from the CHPP (wording very similar).

Table 1. Research needs identified in the North Carolina Coastal Habitat Protection Plan.

Issue	Description of Need	Type^	CHPP page reference*	Status (Aug 05)
Beach nourishment	***The demand for beach nourishment projects has greatly increased in recent years. It is therefore increasingly important to fully understand the long-term consequences of this activity to the coastal system and fish populations, so that an ecologically based, comprehensive beach and inlet management plan can be prepared, per the CHPP recommendation.***			
	Compile detailed mapping studies of coastal subtidal bottom in a comprehensive and comparable manner in order to evaluate changes and trends in substrate character.	R-M	*370	Pilot project completed
	Determine if and to what extent sand from nourished beaches is transported onto nearshore hard bottom and the effect of sand deposition on the hard bottom habitat and associated biological community.	R-M	*465	
	Assess the cumulative impact and effectiveness of beach bulldozing and determine appropriate guidelines for inclusion in a coastal beach management plan.	R-M	*393	One study completed
	Assess direct and indirect effects, and cumulative impacts of beach nourishment activities on surf-zone organisms (finfish and invertebrates), their habitats and recovery rates from individual and cumulative nourishment events.	R-M	*398, *402	
Fishing gear impacts	***While most bottom disturbing fishing gears have been restricted from use in highly sensitive areas, the effect of some gears is still uncertain, and more information is needed to determine needed fishery management changes. Information regarding fishing gear impacts will help implement the CHPP recommendation to protect structured habitats from fishing gear effects.***			
	Measure in situ rates of growth, mortality, and recruitment for selected benthic organisms that are regularly exposed to trawling.	R	*405	
	Evaluate the effect of trawling on benthic algal growth and primary productivity overall.	R	*405	
	Conduct large-scale, long-term experiments with and without fishing pressure, rather than short-term, small-scale studies, to examine and quantify cumulative fishing impacts and recovery patterns on estuarine soft bottoms and benthos.	R-M	*407	
	Monitor the impact of hook and line fishing and anchoring on hard bottom.	R-M	*467	
	Determine whether fishing gear impacts and/or other factors are causing the decline observed in bay scallop abundance.	R	*281	
	Assess turbidity impacts to SAV from mechanical shellfish harvesting gear in southeast Pamlico Sound, Core Sound, and other mechanical clam harvest areas.	R-M	*282	
	Assess the effects of shrimp and crab trawling; crab, oyster, clam, or scallop dredging; and clam kicking on SAV, particularly in Core and Bogue sounds.	R-M	*284	
	If turbidity or other gear impacts from operation of bottom disturbing fishing gear degrades nearby SAV habitat, determine what additional protective buffers are needed between SAV and areas where such gear are used in order to minimize impacts.	R	*292	
	Identify the location and duration of trawling over soft bottom habitat, as well as over structured habitats (shell bottom, hard bottom and SAV), and quantify the effects of trawling on the habitats.	R-M	*405	
	Determine turbidity levels generated by different commercial fishing gear configurations and the subsequent rates of redeposition at various distances from the origin under varying wind and current conditions.	R	*405	

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*Specific research need extracted from the CHPP (wording very similar).

Table 1. Research needs identified in the North Carolina Coastal Habitat Protection Plan.

Issue	Description of Need	Type^	CHPP page reference*	Status (Aug 05)
Fishing gear impacts	Compare the significance of natural forms of disturbance on soft bottom habitat to that of trawling effects on soft bottom habitat.	R-M	*405	
	Sample areas normally subjected to trawling to describe the local benthic community, identifying seasonal cycles of species abundance and recruitment, to determine the times of year that benthos would be most sensitive to trawling disturbance.	R-M	*405	
Managing non-native species	***The accidental or intentional introduction of non-native species is a growing issue in natural resources management. Understanding the effect of non-native species on the ecological integrity of our native ecosystems is necessary for effective ecosystem management.***			
	Conduct testing on the aquacultural use of non-spawning, non-native oysters before decisions are made opposing or supporting introduction.	R	*229	Research ongoing
	Compare the fish habitat value of Eurasian watermilfoil relative to native vegetation.	R	*291	
	Develop ways to prevent proliferation of non-native species by sterilizing ballast water, testing non-native species before introduction, and assessing legal mechanisms to prevent introductions.	R-M	*129	
Chemical effects	***Growing use and disposal of chemicals in support of modern lifestyles has undoubtedly had an effect on the viability of organisms in receiving waters. While there is some information available on the toxicity of certain chemicals to selected organisms, under certain conditions, more work is needed to fully evaluate the potential impact of chemical pollution on fisheries resources.***			
	Identify pesticides that are "safe" for spraying over open waters, and for those pesticides whose toxicity is impacted by salinity, appropriate application rates for controlling mosquitoes.	R	*125	
	Determine the sources, prevalence, and effects of hormone-altering chemicals on important fish species in North Carolina's coastal waters.	R-M	*118	
	Examine the effects of existing contaminant levels and other environmental stressors on water quality, benthic food organisms, and fish.	R-M	118, 224, *411, *469	
	Evaluate the biological impact of any new materials (wood, plastic, cement, etc.) used in water-dependent structures on the aquatic ecosystem.	R	*121, *226	
Water supply	***With increasing demands for fresh water, the allocation of existing water resources among direct human uses and the needs of native fish and wildlife species is becoming an increasingly difficult issue.***			
	Assess the impact of increasing municipal, industrial, and/or agricultural surface water withdrawals as well as reservoir management on instream flows (water column habitat) on dependent anadromous fish populations in coastal rivers.	R	*73	
	Assess groundwater supplies in coastal counties to determine the potential environmental consequences of increasing subsurface water withdrawals.	R-M	*74	
	Determine effects of brine effluent disposed from filter backwash and reverse osmosis water treatment facilities on biological communities in coastal receiving waters.	R-M	*128-129	

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*Specific research need extracted from the CHPP (wording very similar).

Table 1. Research needs identified in the North Carolina Coastal Habitat Protection Plan.

Issue	Description of Need	Type^	CHPP page reference*	Status (Aug 05)
Habitat status and trends	***Determining the status and trends in condition of fish habitats is vital in evaluating the need and effectiveness of management actions intended to protect them.***			
	Conduct change analysis of existing shell bottom by DMF's Shellfish Habitat and Abundance Mapping Program on a subset of priority areas. Prioritization should include consideration of functional significance, economic value, and the magnitude of growth and development affecting the area.	R-M	*211	
	Determine the status of hard clams, sheepshead, black drum, and resident non-fishery species (e.g., oyster toadfish) as indicators of shell bottom conditions, using fisheries-independent-data.	R-M	*215	
	Evaluate status and trends in coast-wide distribution and condition of SAV at regular intervals. Comprehensive maps of all existing and potential SAV habitat should also be developed.	M	*272, *291	Workgroup established
	Determine wetland restoration success criteria based on long-term monitoring of hydrology, soil, and vegetation characteristics at established reference sites.	R-M	*332	Coordinate with EEP
	Determine the cumulative impact of small wetland losses on the distribution and abundance of wetland types in selected watersheds. The cumulative losses could then be related to the nature and extent of development pressure in those watersheds in order to formulate a model predicting untracked losses in other watersheds.	R-M	*339	
	Evaluate the susceptibility of freshwater wetlands to soil loss from sulfate metabolism in coastal North Carolina.	R	*352	
	Use biological indicators of habitat condition and coastal ecosystem integrity to help determine overall status and trends for the coastal ecosystem in North Carolina.	M	13, 17-19, 64, 66, 104, 135, 215, 223, 262, 289, 318, 372	Workgroup established
Evaluating existing management measures	***Prior to establishing new or additional management measures, resource agencies must first evaluate and determine if existing management measures are adequate and effective in achieving their intended management goals.***			
	Evaluate the functional viability of shellfish (primarily oysters) in closed shellfishing waters and their value as protected shell bottom habitats.	R-M	*231	
	Assess the N.C. Pesticide Board's policies on aerial drift of pesticides and suggest changes if necessary to ensure adequate protection for aquatic life and water quality from pesticide impacts.	R	*126	
	Evaluate water quality conditions and effectiveness of the nutrient reduction strategies in the Neuse River and the Tar-Pamlico River.	R-M	*133	On-going
	Evaluate effectiveness of ORW and HQW rules in protecting SAV and other habitats.	R-M	135, *292-293, *337	
	Evaluate the CRC's beach nourishment rules and determine changes needed to minimize impacts from beach nourishment and dredge disposal on soft bottom communities.	R	*277	

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*Specific research need extracted from the CHPP (wording very similar).

Table 1. Research needs identified in the North Carolina Coastal Habitat Protection Plan.

Issue	Description of Need	Type^	CHPP page reference*	Status (Aug 05)
Evaluating existing management measures	Examine and propose revisions to current CRC shoreline stabilization rules using best scientific information to minimize impacts from this activity to soft bottom and wetlands, particularly intertidal estuarine shorelines.	R	*391-392	
Comprehensive water quality monitoring	***The overall status of water quality in North Carolina has been difficult to evaluate because of the variety of uncoordinated water quality monitoring efforts covering different areas over different time periods. The gaps in completing a comprehensive evaluation of coastal water quality are many. Some of these needs were noted in the CHPP and are listed below.***			
	Expand water quality monitoring in North Carolina's nearshore ocean waters to improve our understanding of existing conditions and processes in coastal waters and the effect of estuarine inputs and human activities on local water quality.	M	*66	
	Assess water quality trends and causes of degradation in tidal creek systems, particularly in southern coastal counties that are highly important nursery and shellfish areas and are under intense development pressure, and determine effective preventive and restoration measures.	R-M	*100-101	
	Monitor the effect of estuarine water quality, particularly nutrient and sediment loading, on nearshore ocean hard bottom.	R-M	*469	
	Additional water and tissue analysis at hard bottom sites is needed to determine if the benthos of the hard bottom community or the surrounding waters exhibit toxin levels that exceed designated levels of concern.	M	*469-470	
	Assess the impact of historic and recent wetland drainage activities on coastal water quality.	R-M	*80, 222, *340	
	Assess the effects that oceanfront septic systems have on nearshore coastal water quality.	R-M	*116	
	Once the appropriate water quality conditions for protection of SAV are determined, current water quality monitoring stations and methods should be re-evaluated and modified (if necessary) so that data adequately assess if SAV-based water quality criteria are being met (both baseline and potential SAV habitat). The Neuse, Tar-Pamlico and White Oak basins should be a high priority for monitoring of SAV and water clarity.	R-M	*287	Contingent on research results

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*Specific research need extracted from the CHPP (wording very similar).

APPENDIX Q: NORTH CAROLINA RESEARCH POLICIES AND PERMIT

Reserve use and purpose

The Coastal Area Management Act describes the use of the reserves as follows: *the reserves shall be used primarily for research and education. Other public uses, such as hunting, fishing, navigation, and recreation, shall be allowed to the extent consistent with these primary uses. Improvements and alterations to the lands shall be limited to those consistent with these uses."* It also states that the reserves purpose is: *"Important public purposes will be served by the preservation of certain of these areas in an undeveloped state. Such areas would thereafter be available for research, education, and other consistent public uses. These areas would also continue to contribute perpetually to the natural productivity and biological, economic, and aesthetic values of North Carolina's coastal area."* The North Carolina administrative code section 15ANCAC07O.0101 to 15ANAC07O.0202 defines the use and purpose of the reserve further. Specifically, the following use requirements are defined: (1) The essential natural character of the Reserve shall be maintained; (2) Traditional recreational uses within each component shall be allowed to continue as long as the activities do not disrupt the natural integrity of the Reserve or any research or educational projects. Incompatible traditional uses shall include: (a) fishing, hunting, or trapping activities not allowed by state rules; (b) target shooting; (c) hydraulic clam dredging within Reserve boundaries; (d) use of vehicles off designated corridors at components where vehicles are allowed for upland transportation according to the management plan; and (e) production of noise disruptive to local wildlife and the aesthetic enjoyment of the Reserve as a natural area; (3) No user shall disturb a research project or research equipment in place at the Reserve; (4) Camping or any form of habitation, whether on the uplands, wetlands, or waters within Reserve boundaries, shall not be allowed unless written permission is posted by the Division of Coastal Management; (5) Personal property not authorized by the management agency may not be placed within the boundaries of the Reserve for more than two consecutive days; (6) Users of the Reserve shall not disturb or remove any live animals, except those allowed by local or state hunting and fishing rules as they apply to the Reserve, or vegetation within the Reserve unless such action is part of a research or educational project approved by the management agency; (7) Persons wishing to engage in scientific research or collection of natural materials within the Reserve shall first secure written permission from the management agency; (8) No activity shall be allowed which might pollute any stream or body of water in the Reserve. Acts of pollution shall include: (a) Deposition of solid materials not indigenous to the local coastal ecosystem; and (b) Discharge of liquids other than uncontaminated estuarine water; (9) No other acts or uses which are detrimental to the maintenance of the property in its natural condition shall be allowed including, but not limited to, disturbances of the soil, mining, commercial or industrial uses, timber harvesting, ditching and draining, deposition of waste materials. All research activity within the Reserves must adhere to these use requirements.

Research permit

Use requirement 7 above requires persons wishing to engage in scientific research or collection of natural materials within the Reserves shall first secure written permission from the management agency. To address this, NCNERR utilizes a research permit to track research activity on the Reserves. This provides NCNERR an opportunity to review proposed research

and verify that the work complies with all mandated Reserve use requirements. The permit also provides NCNERR with the required data to inform our performance measures to both NOAA and DENR. Researchers wishing to conduct research on the Reserve fill out a two page research permit application form (see below). The research staff in consultation with the Reserve Manager reviews the application forms. Projects that do not meet all the above use requirements are not issued a permit and the project is not allowed to be conducted on Reserve properties.

The NCNERR encourages all investigators to present their work verbally and in writing. Peer-reviewed publications are particularly desirable whenever that format is appropriate. Toward furthering this goal, the NCNERR may periodically request that researchers present preliminary or final results of their work to a variety of local or regional audiences. As specified in the NCNERR research permit conditions and in the award conditions for federally funded research, researchers are obligated to give copies of reports and publications to the Reserve(s) where the work was performed.

Research Permit Conditions

The Research permit is good for the duration of the study or three years, whichever comes first. Permits may be renewed if more time is needed to complete the project. The Permitee must comply with all Reserve rules and regulations as defined by the North Carolina Administrative Code (15ANCAC07O.0101 to 15ANAC07O.0202), the NCNERR Management Plan, and any other applicable state and federal regulations. It is the permitee's responsibility to be aware of legal obligations. All other required permits (*e.g.*, NC Division of Marine Fisheries collecting permits) are the responsibility of the Permitee.

All experiments and equipment left in the field during a project should be clearly marked with the Researcher's name and address, and research permit number. Any items in the Reserve not labeled as above may be removed by reserve staff. All experiments, trash, or equipment related to the project must be removed from the Reserves within three months from the end of the project.

A final project report is required. It may consist of a short review of what was accomplished or a full copy of the paper(s) that resulted from work in the Reserves. Even if a short report is submitted, we would like to receive copies of any subsequent publications, reports, or dissertations/theses that result from work in the Reserve components. These reports will be added to our research bibliography and will be available for distribution through the NCNERR website.

Research permit application

Print Form

Research Permit

N.C. National Estuarine Research Reserve
Dr. John Fear
101 Pivers Island Road
Beaufort, N.C., 28516
Phone: 252-838-0884
Fax: 252-838-0890
www.nccoastalreserve.net
John.Fear@ncmail.net

Date:	
Principal Investigator Name and Title:	
Address:	
City and State:	
Zip Code:	

Phone:		Fax:	
Email:			

Designated contact person and address (if different from above):

If student, give major advisor, school, and degree sought:

Usual number of participants in field work in Reserve:	
Project Title:	
Funding Source(s):	
Funded Amount/Year:	
Project Duration:	

Work Description (Please fill out A-D or attach a concise 1-2 page project summary):

A: Abstract

B: Sampling Locations (list both Reserve and non-Reserve sampling locations)

C: Project Objectives

D: Methods (include sampling devices/methods, frequency, assays, etc...)

Applicant Signature*		Date:	
NC NERR Research Coordinator Approval		Date:	

Permit Expiration Date**	

** maximum duration = 3 years, permits may be renewed

* Submittal of this application indicates that the applicant will abide by the permit conditions and will keep Reserve staff appraised of major permit deviations. Please mail or email this application to Dr. John Fear at the address above.

APPENDIX R: STEWARDSHIP POLICIES

Stewardship of the NCNERR is governed by use requirements in the North Carolina Administrative Code (Appendix G) and county and municipal regulations (Appendix I). Yet, a number of site-specific policies are needed to address the diversity of site conditions and local uses. These policies were developed with the assistance of component local advisory committees and ERD. These policies will be reviewed as part of Objective 4.1, Activity 1 of this management plan and changes will be discussed at component local advisory committee meetings as appropriate.

Recreation

Responsible use of the Reserve by recreational visitors protects the Reserve habitats and organisms and enhances the user experience for subsequent visitors.

> **Policy 1: Traditional recreational uses of each component shall be allowed to continue as long as they do not disrupt the natural integrity of the component or any research or educational activities.**

The four components have long been used by area residents and visitors for swimming, fishing, hunting, nature study, and hiking. These traditional uses have created a strong local pride in and attachment to the natural and aesthetic values of each component. Recreation can be compatible with research and education when properly managed. Allowing recreation to continue promotes full use of the Reserve's resources and meets the legislative requirements for the program. Protection of the components and research and education programs take precedence over recreational activities if such activities are deemed to be impacting the natural integrity of the Reserve or if conflicts arise between these uses.

> **Policy 2: Users of the Reserve shall not disturb or remove any live animals (except for fish, shellfish, game animals, furbearers, or waterfowl per fishing and hunting policies) or vegetation at any component unless it is part of an approved research or educational project and all necessary permits have been obtained**.

Removal and destruction of vegetation can lead to serious long-term damage to the ecosystems found in the Reserve by causing erosion/sedimentation and by decreasing species richness. Disturbing nesting birds and other animals can interfere with their natural habits, potentially causing nesting failure or departure of the animals from the Reserve. Any interpretive trails established within the Reserve will be compatible with this policy of respecting the natural integrity of the components.

> **Policy 3: Pets must be under control at all times.**

Pets on Reserve sites can damage and destroy habitat and disturb wildlife if not properly controlled. In addition, pet wastes can carry potentially damaging bacteria. Pet owners who choose to recreate on the NCNERR must keep their animals under control at all times and collect and properly dispose of pet wastes. Owners are subject to the relevant county and municipal rules regarding leashing and appropriate disposal of wastes.

Policy 4: Camping or fires in designated areas are only allowed by written or posted permission from DCM.

Restriction of camping and fires protects the Reserve's habitats from disturbance and destruction. Camping at Zeke's Island, Rachel Carson and Currituck Banks will be permitted only for research that requires overnight stays for observations or data gathering; written permission must be obtained from the Reserve. Primitive camping on Masonboro Island will be allowed in designated areas according to rules posted on-site.

Policy 5: All visitors must pack out their own trash.

Debris and litter left behind by visitors can negatively impact the NCNERR habitats and organisms. The primary purposes of the Reserve are research and education and as such, recreational facilities such as trashcans and restrooms are not available at the components. Thus, it is the responsibility of visitors to pack out all trash and refuse.

Off-Road Vehicles/Access

Policy 1: No power-driven vehicles shall be used on the uplands and marsh sediments within the Rachel Carson or Masonboro Island components except during emergency, enforcement, management, research, or dredging operations. Motorized boat use within these components, consistent with N.C. Wildlife Resources Commission regulations, is not affected by this policy.

Unauthorized power vehicles (*e.g.*, motorcycles and ORVs) have created problems on the components by destroying dunes, trampling vegetation, and disturbing animals. The Town of Beaufort has an ordinance that prohibits motor vehicles on the Rachel Carson islands.

Policy 2: Reserve operation at the Currituck Banks component shall not reduce current levels and rights of public access to properties located between the component and the Virginia line.

Currently, paved road access north of Corolla terminates at an ocean beach access ramp located within the Reserve component. Landowners, local residents and visitors depend upon this ramp to route them to the beach for access to lands located between the Reserve and the state line. County ORV regulations limit this access to the ocean beach seaward of the foredunes. Federal regulations restrict access through the Back Bay National Wildlife Refuge (VA) to certain permanent residents of Currituck Banks. Thus, the ramp and beach within the Reserve property are vital for public access to the northern banks.

When the beach is impassible due to high water levels, access across the component for property owners to the north will be extended to include back dune areas. The road in the adjacent Ocean Hills development to the south will also be part of this "high water" route. Dominion Power maintains a MOU with DCM for cooperative maintenance of a permanent easement granted to Dominion Power for an electric distribution right-of-way to service the northern banks (Appendix J). The easement is located in the back dune areas of the Currituck Banks component and its location must be considered when delineating “the high water” route.

If at some point in the future driving along the ocean beach conflicts with Reserve goals and objectives (*e.g.*, environmental issues, recreational beach uses, or research/education uses), it

will be the responsibility of the state to make available replacement upland access and to do so prior to any restriction of current beach driving. Any such action will be taken only after full consultation and coordination with the local advisory committee, Currituck County, NOAA, adjacent landowners, and current landowners between the component and the state line.

Access across the component shall be for the purpose of providing a vehicular route to and from properties located between Corolla and the Virginia state line. At no time shall the component be used to provide through access to Virginia (except for enforcement, emergencies, and the currently permitted beach driving access to the north allowed to permanent residents). Should improved access to properties located between the Reserve site and Virginia ever be provided from the north, access across the component may be terminated. Improvement of internal access within those subdivisions north of the component shall not alter provision of access across the Reserve site.

> **Policy 3: Off-road-vehicles at the Zeke's Island and Currituck Banks shall normally operate only on the flat, sandy beach area: driving over dunes and disturbing vegetation is prohibited. Vehicles using the Currituck Banks during flooded beach conditions shall follow interdune flats and avoid vegetated areas. Drivers shall avoid posted areas of nesting birds and observe a 15 miles per hour speed limit.**

The destruction of plants and sand dunes accelerates erosion of barrier beaches and diminishes the Reserve's natural productivity and habitat diversity. The beach and dune areas are important nesting areas for various bird species that cannot find these natural habitats elsewhere along the rapidly developing coast. The Reserve staff will assist the state park ranger in the delimitation of waterbird feeding and nesting sites near New Inlet within the Zeke's Island component.

> **Policy 4: At the Zeke's Island component, power-driven, off-road vehicles (other than boats, emergency vehicles, and law enforcement vehicles) are only allowed in designated areas on the barrier spit. ORV use at the Zeke's Island component is managed by the N.C. Division of Parks and Recreation (DPR) and is restricted to the schedule listed in Table 1 below. A permit must be obtained and the required fee paid to the DPR prior to using ORVs at the component.**

The barrier spit is the only portion of the Zeke's Island component that is easily accessible to users of off-road vehicles (ORVs). This portion of the component overlaps with DPR's Fort Fisher State Recreation Area and DPR manages the ORV use per a long-standing MOU with DCM (Appendix J). Confining ORVs to this area does not diminish other uses within the component. The islands and marshes remain protected, while traditional users, such as fishermen, retain access to the inlet and sound waters. Special areas for bird breeding and wintering will be posted to avoid impacts from vehicles and foot traffic.

September 1 – September 14	**6:00 am – 8:00 pm**
September 15 – March 15	**24 hours**
March 16 – March 31	**8:00 am – 7:00 pm**
April 1– May 31	**8:00 am – 8:00 pm**
June 1 – August 31	**6:00 am – 9:00 pm**

Table 1. Schedule for permitted ORV use at the Zeke's Island component.

ORVs permitted on Masonboro Island (for research, enforcement, or emergency purposes only) will travel in the <u>intertidal</u> beach zone during this time period.

The beaches of Fort Fisher (Zeke's Island) and Masonboro Island are nesting grounds for sea turtles, primarily Atlantic Loggerheads that come ashore to lay eggs at high tides during nesting season. White lights from vehicles or buildings keep the turtles from coming ashore and nesting. Lights also can interfere with turtle hatchlings' journey to the ocean. Tire tracks on the beach can also impede or misdirect the hatchlings.

Fishing and Hunting

Policy 1: Fishing, shellfishing and hunting may occur on the Reserve within the limits of local and state laws. Hydraulic dredging or "clam kicking" is prohibited within the Reserve.

Sport and commercial fishing and hunting will be allowed subject to existing regulations on bag limits, seasons and gear. Collection of all migratory birds requires a U.S. Fish and Wildlife permit and a WRC license. At the Currituck Banks component, traditional hunting and fishing in the sound waters and commercial fishing along the ocean will be allowed per county, WRC, and DMF regulations.

In order to maintain ecosystem diversity and protect the natural integrity of the sites, hunting and trapping of certain species on upland portions of a given component may be necessary. If these rights do not exist currently, they may be extended on a case-by-case basis after consultation with Reserve staff, the local advisory committee, and the WRC.

Hydraulic dredging to harvest shellfish destroys underwater habitats by the severe disturbance of estuarine bottoms and vegetation and by extensive sedimentation of the water column. Such activity is expressly prohibited in the Reserve according to DMF regulations (NCAC T15 3B .0900 and .1000).

Policy 2: Certain areas of the Reserve may be closed to commercial and recreational fishing and shellfishing to provide undisturbed sites for research and fisheries reproduction.

Portions of the components may be closed to fishing and shellfishing once research better documents the Reserve's submerged habitats and species that they support. Such closings would benefit commercial fishing by protecting nursery and spawning areas. Similarly, areas may be

closed for research projects if undisturbed waters are required. Authority to close certain areas of the Reserve rests with DMF. When Reserve staff and the local advisory committee(s) find such a closing warranted, the DCM will petition the DMF for such action in accordance with the existing regulations (*e.g.*, NCAC T15 3B .011). Also, primary nursery areas within the Rachel Carson, Masonboro Island, and Zeke's Island component are protected from bottom-disturbing fishing gear by DMF regulations.

> **Policy 3: Hunting is permitted in the Reserve according to local, state or federal wildlife regulations. More stringent rules may be pursued if hunting conflicts with research and education uses or threatens the Reserve's wildlife populations. Target shooting is not allowed.**

Existing WRC and U.S. Fish and Wildlife Service regulations set season, bag limits, and limits on methods of taking for game species found at Reserve components (*e.g.*, migratory waterfowl, marsh hens, doves, deer, and other game). These regulations, properly enforced, are adequate to maintain wildlife populations in the Reserve. If the Reserve staff and local advisory committees deem more stringent regulations to be necessary, the DCM will petition the WRC and the Secretary of DENR to adopt appropriate restrictions in accordance with departmental procedures. The Currituck Banks component, and other components if deemed appropriate, is registered with the State's Registered Lands program through the Wildlife Resources Commission to allow more effective enforcement of hunting regulations and protection of the Reserve.

Target shooting is prohibited within the Reserve components because it is not formally regulated. Bullets may carry for great distances and cause severe injury or death posing a hazard to staff and research, educational, and recreational users as well as creating a liability hazard for the state. Past problems with target shooting at the components have resulted in damage to vegetation and signs and improper disposal of target materials.

Disposal of Dredge Material – Resource Manipulation Plan

> **Policy 1: Dredge material disposal as part of U.S. Army Corps of Engineers projects shall be allowed to continue at the Rachel Carson and Masonboro Island components, but only within existing disposal areas of designated easements. All operations must comply with the North Carolina Coastal Area Management Act (G.S. 113A-100 et seq.), Dredge and Fill Act (G.S. 113-229), Section 404 of the Federal Water Pollution Control Act (33 USC 1251 et seq.), and the Use Requirements of the N.C. Coastal Reserve (NCAC T15A: 07O). Deposition of dredge material within the Corps easement by private contractors will be allowed only if approved by the Corps, the DCM, and the State Property Office and the contractors have received appropriate permits from the Division of Coastal Management. Disposal sites must be located, designated, and managed to prevent sedimentation of marshes, intertidal flats and submerged lands, and to minimize impacts to ground nesting birds and sea turtle nesting areas. All dredge material shall be placed in a manner consistent the best technology available for prevention of mosquito and other disease vector breeding. All dredging proposals shall be reviewed by the Reserve staff, local advisory committees, and any other interested parties.**

The U.S. Army Corps of Engineers (COE) retains perpetual easements along Taylor's Creek at Rachel Carson and along the Atlantic Intracoastal Waterway (AIWW) at Masonboro Island. Periodic deposition of dredge material has maintained the uplands of the Carrot Island, Town Marsh, and certain portions of Masonboro Island in early stages of plant succession that provide a valuable nesting habitat for many species of birds. Dredge material deposition on the ocean beach at the Masonboro Island component will not affect the estuary (though there may be impacts on surf zone fauna) as the dredge material will be washed back into the natural longshore transport of sediments. This addition of sediment will, to some degree, mitigate the erosion caused by sediment loss to the jetty on the north end of the island. Deposition at Rachel Carson and along the waterway portion of Masonboro Island shall be in diked areas within the existing easements.

> **Policy 2: Dredge material deposition shall not occur during the critical nesting times of sea turtle and ground- nesting shorebirds (May - November). Populations of seabeach amaranth shall also be protected from direct deposition and from vehicular impacts of disposal operations. If dredging is unavoidable during that time period, it shall be contingent upon prior and concurrent monitoring for nesting activity and presence of seabeach amaranth.**

The courting and nesting of shorebirds at the Rachel Carson and Masonboro Island components extends from the end of April through September. This roughly coincides with the sea turtle nesting season, which extends from May 1 - November 15. Thus, deposition of dredge material during the spring and summer months plus the associated activities of bulldozers and other vehicles on the beaches can negatively impact these species. Seabeach amaranth, a federal and state threatened species, occurs on the upper beaches and foredunes of Masonboro Island and deposition of material and associated vehicular activity may disrupt species presence and habitat. Seasonal monitoring of sea turtles and seabeach amaranth shall be a priority activity for the Reserve.

Habitat Restoration

> **Policy 1: Projects to restore estuarine and upland habitats within the Reserve will be reviewed by state and federal Reserve staff, other governmental agencies, local advisory committees, and any other interested parties. Priority shall be given to areas impacted by visitor use, dredge material deposition, and invasive species.**

Given the diversity of habitats and uses within the various components, occasional restoration projects may be necessary. For example, dredge material islands along the waterway side of Masonboro Island represent former salt marshes that have been filled. Portions of these islands located outside of the Corps easement are available for mitigation projects where marsh could be restored and, thus, increase the Reserve estuarine area. Likewise, areas within components that have experienced damage from traditional use or that have been altered by the presence of invasive species may require remedial action. Restoration projects present opportunities for long-term monitoring of structure and function within the restored habitat.

Feral Horses

Policy 1: The state of North Carolina is the lawful owner of the feral horses on the Rachel Carson component. However, the state does not own the horses that roam the Currituck Banks component.

The state Attorney General's Office has determined that the horses found on the islands composing the Rachel Carson component are owned solely by the state. The horses on Currituck Banks roam many properties and, thus, are not claimed by the state.

Policy 2: Scientific studies of population structure, feeding habits, and impacts on Reserve habitats plus information from analogous management programs of feral horses shall be used to manage the horses at the Rachel Carson component. Such information will also be used to consult with key parties concerning feral horse management on the Currituck Banks.

Information gathered from studies of feral horses on the components plus additional data from other populations (*e.g.*, at Cape Lookout National Seashore and Assateague National Seashore) will be used to determine proper management of the horse herds. The primary goal of the North Carolina NERR is to manage the components for research and education. Though the horses are very popular with local residents, the animals represent a management conflict because they are an introduced species that consumes and tramples marsh and dune vegetation vital to estuarine productivity, and their presence, activities, and wastes alter other natural processes. Decisions regarding horse management will be reviewed by DENR, ERD, and members of the local advisory committee as appropriate. Decisions regarding horse management at Currituck Banks will be developed in collaboration with the Currituck Outer Banks Wild Horse Advisory Board, which includes the Corolla Wild Horse Fund, Currituck County, representatives from each of the protected lands utilized by the herd (Reserve and U.S Fish and Wildlife Service), and community members.

Surveillance, Enforcement and Maintenance

Policy 1: The Reserve staff and enforcement personnel from other federal, state and local agencies shall periodically visit each component to identify and investigate possible violations of Reserve regulations. The Reserve also relies on researchers, educators, members of the local advisory committees and other users of the sites to report any problems.

Time and budget limitations keep the DCM and other enforcement agencies from maintaining a continuous presence at each component in the Reserve. Therefore, all users of the Reserve must exercise responsibility for obeying the management policies stated in this plan, for reporting any violations of the policies, and for cooperating with Reserve staff and pertinent enforcement agencies.

Policy 2: The Division of Coastal Management, Division of Marine Fisheries, Division of Parks and Recreation, Wildlife Resources Commission, and local law enforcement agencies shall cooperate in the enforcement of Reserve use standards listed in the North Carolina Administrative Code (see Appendix B) as well as applicable state and local laws and ordinances.

Each component in the North Carolina NERR falls into a number of different, sometimes overlapping jurisdictions involving state and local law enforcement agencies. Such overlap demands strong lines of communication and a strong sense of cooperation on the part of the enforcement agencies. Site managers will maintain regular communication with each of these groups and investigate any rule violations through the appropriate channels.

At Zeke's Island, the DENR has assigned management responsibility for patrol and enforcement of the barrier spit to the DPR (Appendix x). In addition, the New Hanover County Sheriff has jurisdiction throughout the Zeke's Island and Masonboro Island components. The Town of Beaufort Police and Carteret County Sheriff respond to problems at the Rachel Carson component. Currituck Banks is within the jurisdiction of the Currituck County Sheriff, who has a deputy stationed in Corolla. Rangers of the Currituck and Mackay Island National Wildlife Refuge also patrol this component. The WRC has authority to patrol the lands and waters of the entire Reserve for enforcement of their regulations (i.e., hunting and boating) (Appendix x). Likewise, the DMF patrols the components to enforce marine fisheries regulations (Appendix x).

Policy 3: When deemed necessary, the Division of Coastal Management shall enter into cooperative agreements with pertinent law enforcement agencies to clarify enforcement jurisdictions and responsibilities.

Each Reserve component has in the past experienced some difficulty with response to law enforcement calls. This difficulty has arisen largely from a lack of understanding on the part of the enforcement authorities regarding which agency should respond to a given problem. Cooperative agreements will help to clarify each agency's role relative to Reserve management and, thus, coordinate and expedite enforcement of Reserve use standards.