

**FINAL EVALUATION FINDINGS
NORTH INLET-WINYAH BAY
NATIONAL ESTUARINE RESEARCH RESERVE
SOUTH CAROLINA**

February 2005 – September 2010

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I. EXECUTIVE SUMMARY

The Coastal Zone Management Act (CZMA) of 1972, as amended, established the National Estuarine Research Reserve System (NERRS). Sections 315 and 312 of the CZMA require the National Oceanic and Atmospheric Administration (NOAA) to conduct periodic performance reviews or evaluations of all federally approved National Estuarine Research Reserves (NERRs). The review described in this document examined the operation and management of the North Inlet-Winyah Bay National Estuarine Research Reserve (NI-WB NERR or Reserve) during the period of February 2005 through September 2010. The NI-WB NERR is administered by the University of South Carolina Belle W. Baruch Institute for Marine and Coastal Sciences (USC-BI). The USC-BI also operates the Baruch Marine Field Laboratory (BMFL) which is the site of the Reserve headquarters.

This document describes the evaluation findings of the Director of NOAA's Office of Ocean and Coastal Resource Management (OCRM) with respect to NI-WB NERR during the review period. These evaluation findings include discussions of major accomplishments as well as recommendations for program improvement. The fundamental conclusion of the findings is that the University of South Carolina is successfully implementing and enforcing its federally approved NERR.

The Reserve has continued to build on strong sector programs and the evaluation team documented a number of NI-WB NERR accomplishments during this review period. Notable Reserve efforts include construction of the Hobcaw Barony Discover Center and providing visitors with a place to learn more about the Reserve and local ecology and history; addressing stormwater management issues through research, coastal trainings, education, and stewardship; and growing the Reserve's volunteer program through the development of a Winyah Bay watershed focused Master Naturalist Program.

In addition to these numerous accomplishments, the evaluation team identified several areas where the Reserve and its programming could be strengthened. The recommendations for NI-WB NERR are in the form of one necessary action that is mandatory and seven program suggestions. The one necessary action requires the Reserve to complete a site profile by December 31st, 2011.

Seven program suggestions describe actions that OCRM believes USC-BI and NI-WB NERR could take to improve or enhance the Reserve but that are not mandatory. The Reserve has continued to grow and strengthen its programs and partnerships and its programs are in demand. Suggestions thus focus on improving coordination mechanisms; developing specific growth plans for the education and volunteer programs; conducting a visitor use survey to better understand and manage human impacts in the marsh; and expanding monitoring and research in Winyah Bay.

II. PROGRAM REVIEW PROCEDURES

A. Overview

NOAA began its review of the North Inlet-Winyah Bay National Estuarine Research Reserve (NI-WB NERR or Reserve) in July 2010. The §312 evaluation process involves four distinct components:

1. An initial document review and identification of specific issues of particular concern;
2. A site visit to South Carolina including interviews and a public meeting;
3. Development of draft evaluation findings; and
4. Preparation of the final evaluation findings, partly based on comments from the state regarding the content and timetables of recommendations specified in the draft document.

The recommendations made by this evaluation appear in boxes and bold type and follow the findings section where facts relevant to the recommendation are discussed. The recommendations may be of two types:

Necessary Actions address programmatic requirements of the CZMA's implementing regulations and of the NI-WB NERR approved by NOAA. These must be carried out by the date(s) specified;

Program Suggestions denote actions that the OCRM believes would improve the program, but which are not mandatory at this time. If no dates are indicated, the state is expected to have considered these Program Suggestions by the time of the next CZMA §312 evaluation.

A complete summary of accomplishments and recommendations are outlined in Appendix A.

Failure to address Necessary Actions may result in future finding of non-adherence and the invoking of interim sanctions, as specified in CZMA §312(c). Program Suggestions that are reiterated in consecutive evaluations to address continuing problems may be elevated to Necessary Actions. The findings in this evaluation document will be considered by NOAA in making future financial award decisions relative to the NI-WB NERR.

B. Document Review and Issue Development

The evaluation team reviewed a wide variety of documents prior to the site visit, including (1) the federally approved 1992 Management Plan and program documents; (2) the draft 2011-2016 Management Plan; (3) financial assistance awards and work products; (4) semi-annual performance reports; (5) official correspondence; (6) previous evaluation findings; and (7) relevant publications on natural resource management issues in South Carolina.

Based on this review and on discussions with OCRM's Estuarine Reserves Division, the evaluation team identified the following priority issues:

- The Reserve's general administration, including grants and fiscal management
- Implementation and status of the Management Plan
- Facilities development and operations planning
- Implementation of the Reserve's research, stewardship, monitoring, coastal training, and education programs
- Reserve staffing and needs
- The manner in which the Reserve coordinates with other governmental and non-governmental organizations and programs in the state and region
- Major accomplishments and challenges during the review period
- The state's response to the previous evaluation findings dated July 2006
- Partnership with the Belle W. Baruch Foundation

C. Site Visit to South Carolina

Notification of the scheduled evaluation was sent to the University of South Carolina Belle W. Baruch Institute for Marine and Coastal Sciences, NI-WB NERR, and was published in the *Georgetown Times*, a regional newspaper, July 30, 2010. In addition, a notice of NOAA's "Intent to Evaluate" was published in the *Federal Register* on July 23rd, 2010.

The site visit to South Carolina was conducted September 13-17, 2010. Carrie Hall, Evaluation Team Leader, OCRM National Policy and Evaluation Division; Bree Murphy, NI-WB NERR Program Specialist, OCRM Estuarine Reserves Division; Matt Chasse, Program Specialist, OCRM Estuarine Reserves Division; and Dave Ruple, Reserve Manager, Grand Bay NERR, Mississippi formed the evaluation team.

During the site visit, the evaluation team interviewed NI-WB NERR staff, University of South Carolina staff and other state officials, coastal researchers, nongovernmental representatives, and representatives from a local school, local government, and business. Appendix B lists persons and institutions contacted during this review.

As required by the CZMA, NOAA held an advertised public meeting during the evaluation on September 15, 2010, at 6 p.m., at the Hobcaw Barony Discovery Center, 22 Hobcaw Road, Georgetown, South Carolina. The public meeting gives members of the general public the opportunity to express their opinions about the overall operation and management of NI-WB NERR. No persons attended the public meeting.

The excellent support of NI-WB NERR staff with the site visit planning and logistics is gratefully acknowledged.

III. RESERVE PROGRAM DESCRIPTION

NOAA's Office of Ocean and Coastal Resource Management designated the North Inlet-Winyah Bay National Estuarine Research Reserve in 1992. The Reserve is administered through the University of South Carolina Belle W. Baruch Institute for Marine and Coastal Sciences (USC-BI). The USC-BI also operates the Baruch Marine Field Laboratory (BMFL) where the Reserve headquarters is located.

One of two reserves in the State of South Carolina, the Reserve is in the southernmost estuarine system in the Northern Carolinas section of the Carolinian Biogeographical Classification Scheme. It consists of parts of two estuarine systems, an undisturbed estuary (North Inlet) and portions of an estuary which has been influenced by human activities (Winyah Bay). The Reserve, located in Georgetown County, South Carolina, is situated 30 miles south of Myrtle Beach and 50 miles north of Charleston.

Key land and water areas of the Reserve include 18,916 acres of tidally flushed wetlands, riparian habitats, portions of open water of North Inlet Estuary and Winyah Bay, and a limited amount of upland habitats. Surrounding the core area is a buffer zone of 11,173 acres is a buffer zone of 7,743 acres of transitional vegetation and state controlled waters. The core consists of land owned by the Belle W. Baruch Foundation, a private foundation, established in perpetuity, to use the land for the purposes of teaching and research in forestry and marine biology and to conserve and preserve the ecological and environmental qualities of the Hobcaw Barony.

The North Inlet estuary portion of the Reserve is a semi-enclosed body of water, surrounded by Waccamaw Neck, North Island, and Debidue Island, with a major aquatic connection to the Atlantic Ocean and minor connections to Winyah Bay. Other areas in the Reserve include portions of the wetlands bordering Winyah Bay on the southern side of Waccamaw Neck including the Thousand Acre Rice Field, and the Marsh Islands, Malady Bush Island, Pumpkinseed Island, and Ranger Islands.

The Reserve is home to threatened and endangered species, including sea turtles, least terns, and bald eagles. Reserve resources range from tidal and transitional marshes to oyster reefs and inter-tidal flats and from coastal island forests to open waterways.

The North Inlet-Winyah Bay NERR has traditionally been used for boating, fishing, hunting, and recreational harvesting of oysters and clams. Restricted land access to the core areas is maintained on an activity specific basis to protect the area's integrity for research and education and to maintain traditional access policies established by the Foundation. However, the access by water to the wetland areas of the Reserve is permissible by boat and is open to the public for uses that are compatible with Reserve goals and objectives.

IV. REVIEW FINDINGS, ACCOMPLISHMENTS, AND RECOMMENDATIONS

A. Operations and Management

1. Reserve Administration and Staffing

USC-BI administers the Reserve and provides the Reserve with extensive support including facilities maintenance, information technology and grants management, logistical aid for researchers, and access to lab space and equipment such as boats. BMFL and Reserve staff work together to ensure the efficient implementation of Reserve activities. OCRM commends the University of South Carolina and BMFL for their strong support of the Reserve.

The Belle W. Baruch Foundation (Baruch Foundation) owns and manages core Reserve lands which are located within Hobcaw Barony. The Baruch Foundation is dedicated to *managing and using the lands of the Hobcaw Barony for the purposes of teaching and/or research in forestry, marine biology, and the care and propagation of wildlife, flora, and fauna in connection with colleges and/or universities in the state of South Carolina*. To further this mission, the Foundation has agreements with USC-BI and the Clemson University's Belle W. Baruch Institute of Coastal Ecology and Forest Science (Clemson's Baruch Institute).

USC-BI, Clemson's Baruch Institute, Baruch Foundation, and NI-WB NERR have many common interests and concerns and are engaged in many similar types of activities. In previous years, semi-annual directors meetings were held to help increase synergies between the organizations but these meetings have lapsed. The evaluation team noted opportunities for information sharing and closer coordination and collaboration on activities such as GIS. OCRM encourages USC-BI to pursue reinvigorating the directors meetings to improve efforts to identify common priorities, better coordinate activities, and encourage collaboration on new initiatives.

Program Suggestion: OCRM encourages USC-BI to pursue reviving semi-annual directors meetings to increase synergies between USC-BI and its field lab, Clemson's Baruch Institute, Baruch Foundation, and NI-WB NERR.

The Reserve has a 26 member Advisory Committee, with 24 voting members, which meets twice a year. The membership is broad and includes representatives from the Baruch Foundation, Clemson University, education community, recreational fishing community, Georgetown Chamber of Commerce, DeBordieu Community Association, Waccamaw Council of Governments, Georgetown City and County Councils, South Carolina Sea Grant Consortium, environmental interest groups, harbor related industries, and other groups. The Advisory Committee is chaired by the director of the Baruch Institute. The Advisory Committee represents the interests of the users of the Reserve, its neighbors, and the users of information and education materials generated by the Reserve; assists in seeking support for the research and education programs; and advises the Reserve on matters of policy relating to the planning and operation of the Reserve.

At the time of the evaluation site visit, the Reserve had a staff of 11 including a reserve manager who provides oversight of the Reserve's programs and works with partners at the local, state, and federal levels to improve cooperation and coordination. In addition, the administration of the Reserve is supported by a communications system administrator, funded in part by the Reserve, who is responsible for maintaining network servers and other communication equipment and services at BMFL and Reserve facilities and providing technical support to Reserve staff.

Reserve staff are highly valued in the region for their expertise and ability to bring partners together to implement projects. The evaluation team found staff to be highly regarded in their fields and heard repeatedly from program partners that the support and involvement of Reserve staff were key to the success of their efforts.

The Reserve has identified three priority issues in the draft management plan and Reserve staff have made a targeted effort to collaborate across sectors to address these priority issues. This emphasis on cross-sector integration has been formalized in the management plan. OCRM finds that the Reserve staff are successfully implementing the cross-sector priority programmatic initiatives pursued by NI-WB NERR.

The Reserve, in partnership with the other Reserves in the region, has also demonstrated leadership in regional cooperation and hosted the first regional meeting of southeast NERR sites in 2007. This was the first regional meeting held by reserves in the system. At the meeting, the reserves identified common issues and initiated a collaborative effort to address invasive species (see *Section E. 4. Invasive Species*). Reserve staff are also leaders at the national level and have been instrumental in moving national initiatives forward. The findings highlight some of the Reserve's efforts in support of the national program.

2. Management of Cooperative Agreements

OCRM awards the University of South Carolina (USC) federal funds through annual cooperative agreements for the implementation and enhancement of the NI-WB NERR and the Reserve is required to submit semi-annual performance reports. USC provides matching funds for the NOAA cooperative agreement through a waiver of indirect costs. OCRM finds that the NI-WB NERR satisfactorily managed its federal funding, submitted complete performance reports in a timely manner, and achieved desired results from funded tasks during this evaluation period.

3. Facilities

The Reserve greatly enhanced its visitor and educational facilities during the evaluation period with the construction of the Hobcaw Barony Discovery Center and pond shelter and associated pier. The new facilities have allowed the Reserve to expand and enhance its programming and provide a place for visitors to learn about the Reserve and NERRS, history of Hobcaw Barony, and the local environment. The Discovery Center is open Monday through Friday and is staffed by volunteers and Baruch Foundation staff. Over 4,000 people visited the new center during its first six months of operation.

The Discovery Center is about 12,500 square feet in size and includes 1,800 feet of exhibit space, a seminar room, classroom, reception/gift shop area, and offices. Reserve and Baruch Foundation staff worked with members of a local exhibit planning team to develop exhibits for the center that weave in art, aquaria, and research instruments to tell the story of the people and history of the area and the ecology. The exhibits also provide information on sea-level rise in the area and potential impacts to the Reserve. The building includes many green building elements such as automated lights and use of natural lighting and Low Impact Development (LID) landscape design elements such as a pervious parking lot and permeable paver walkways.

The Discovery Center was the result of a partnership between the Reserve and Baruch Foundation to expand the Foundation's existing visitor center and create a building that would serve the needs of both entities. The construction of the center was funded through two NOAA construction awards which were matched by Baruch Foundation resources. The Baruch Foundation is responsible for the day-to-day operations of the building and operational costs are shared based on space usage. The building houses the public education staffs of the NERR and Baruch Foundation as well as staff of the NERRS Centralized Data Management Office (CDMO). The responsibilities of the University of South Carolina and Baruch Foundation are laid out in a joint agreement. OCRM commends the Reserve for successfully partnering with the Baruch Foundation to create a joint use facility that greatly benefits both programs.

In 2009, the Reserve also completed a screened in pond shelter and pier that provides access to a pond adjacent to Kimbel Lodge for educational activities such as water sampling. The project was funded through a NOAA construction award and matching funds were provided by the Baruch Foundation. The pond shelter is not currently being fully utilized and there are opportunities to enhance its usability, such as the construction of a nature trail, and expand its use.

Accomplishment: Completion of the Hobcaw Barony Discovery Center and pond shelter and associated pier has enabled NI-WB NERR to provide new experiential educational experiences for students, teachers, and the general public.

4. Management Plan

Reserves are required by Federal regulation to have a current NOAA-approved management plan (15 C.F.R. 921.13 and 921.30(a)(4)). The plans describe the reserves' goals, objectives, and management issues, as well as strategies for research, education and interpretation, public access, construction, acquisition and resource preservation, and, if applicable, restoration and habitat manipulation. A management plan has four valuable functions (1) to provide a vision and framework to guide reserve activities during a five year period; (2) to enable the reserve and NOAA to track progress and realize opportunities for growth; (3) to present reserve goals, objectives, and strategies to constituents; and (4) to guide program evaluations. Regulations also require that a reserve's plan be updated every five years.

At the time of the site visit, NI-WB NERR's management plan was overdue. The previous evaluation findings included a necessary action that the Reserve was to provide a schedule for

the submission of the reserve management plan and complete the management plan within 18 months. The Reserve provided OCRM with a schedule and a draft management plan was submitted in 2008. After receiving comments on the draft plan from the Estuarine Reserves Division (ERD) a new draft was submitted to OCRM in May of 2009. ERD provided comments which were incorporated by the Reserve and the management plan was formally approved by OCRM in January 2011. The Reserve has been focusing on achieving the goals of the new management plan throughout much of the evaluation period and this evaluation focuses on the Reserve's progress towards meeting the goals of the new management plan.

The new management plan is well written with an emphasis on joint sector goals, objectives, and strategies that support Reserve efforts to address priority issues. The Reserve successfully incorporated management plan guidance from ERD to create a plan that will serve as a model for other Reserves. The plan's three major goals are (1) understand and minimize the impacts of coastal growth on water and habitat quality and ecological communities; (2) understand and communicate the impacts of naturally occurring short-term, stochastic and long-term, large-scale climate events on coastal ecosystems and human communities; and (3) understand and reduce the impacts of invasive species and habitat loss on biodiversity. Each of the Reserve program areas contribute to integrated approaches and strategies to achieve these goals.

Accomplishment: NI-WB NERR has developed an excellent management plan that emphasizes sector integration to address priority issues and clearly articulates sector goals, objectives, and strategies. The management plan will serve as a model for other Reserves.

5. Visibility

NI-WB NERR successfully increased its visibility during the evaluation period and the evaluation team heard from multiple evaluation participants that the opening of the Discovery Center was key to the Reserve's success. With the construction of the Discovery Center, visitors can now see and access a Reserve facility directly from the main road without obtaining permission to enter through a locked gate. The Discovery Center has allowed the Reserve to serve drop-in visitors and provide additional programming for the community. With the opening of the Discovery Center, the Baruch Foundation has also incorporated information on the Reserve's mission and activities into the training of volunteers who staff the center.

The Reserve developed a new electronic quarterly newsletter *Estuaries Illustrated* which highlights activities and accomplishments of the Reserve, and provides a venue for educational outreach. The newsletter is available on the website and is distributed by email to a Reserve 'friends' list. In addition, the Reserve has a well designed and informative website, created and maintains a new Facebook page, and developed a base of core volunteers. OCRM commends the Reserve for raising its visibility within the community.

Although the Reserve has increased its visibility, some evaluation participants noted there is still confusion in the surrounding communities as to the role of the Reserve and NERRS. The Reserve may wish to explore and continue to pursue additional opportunities to highlight the role and activities of the Reserve. The evaluation team noted some opportunities for increasing the

visibility of the Reserve including (1) signage on the main road that acknowledges the Reserve; (2) further developing Reserve merchandise for sale in the gift shop, such as hats, t-shirts, and informational materials; (3) promoting the newsletter through more venues such as providing printed copies of the newsletter or rack cards with information on signing up at the gift shop and/or community events; and (4) promoting the new Facebook page at the gift shop and community events.

6. Partnerships

The Reserve continues to build and maintain strong partnerships throughout the region and examples are highlighted throughout the evaluation findings. Key partners that the Reserve regularly works with include the South Carolina Sea Grant Consortium, Department of Health and Environmental Control Office of Ocean and Coastal Resource Management (DHEC-OCRM), ACE Basin NERR, and other southeastern Reserves. In addition, the Reserve actively participates in numerous regional groups including the Coastal Waccamaw Stormwater Education Consortium and Beach Vitex Task Force and local committees such as the Surfside Stormwater Committee.

During the evaluation period, the Reserve increased its level of collaboration with Clemson's Baruch Institute. The Institute has a new focus on public outreach and has hired several new researchers interested in making connections between their research and public policy decision-making on topics such as stormwater run-off, water quality, and the impacts of climate change on ecosystem health. The new researchers split their time between research (75 percent) and extension (25 percent). Examples of collaboration include a research project looking at short-term sediment deposition at the NI-WB NERR vegetation biomonitoring site; Institute scientists teaching a Spring Swamp Walk master naturalist class; and partnering to host a low impact development (LID) workshop for local decision-makers highlighting LID projects at the Discovery Center and the Institute's new LEED gold certified building. OCRM encourages the Reserve to continue to seek out collaborative partnerships with Clemson's Baruch Institute field staff that further the mission and goals of the Reserve.

B. Research and Monitoring Program

The Reserve System's research and monitoring program provides a stable environment for research through long-term protection of reserve resources; addresses coastal management issues through coordinated estuarine research within the System; and collects and makes available information necessary for improved understanding and management of estuarine areas.

The focus areas of the NI-WB NERR's research and monitoring program, as stated in the new Management Plan are (1) continue, and where possible enhance, the characterization of physical, chemical, biological and ecological conditions within the Reserve; (2) facilitate and conduct research at the Reserve that is relevant to coastal resource management needs and increases the basic understanding of estuarine ecosystem function; and (3) ensure that the scientific, coastal management and education communities have access to, and use the data, synthesis products,

tools and techniques generated at the Reserve. The research program is successfully addressing the three focus areas and the Reserve's goals.

During the evaluation period, the research and monitoring program has increased its focus on applied research and monitoring that informs coastal decision-making, in particular stormwater management. The research and monitoring program works closely with the CTP and education program to ensure research results are disseminated to coastal decision-makers, students, and the general public. The research and monitoring program has also developed a monitoring system to enable the Reserve to serve as a sentinel site for salt marsh response to sea level change and has continued to maintain a monitoring program that exceeds the requirements of the System-wide Monitoring Program (SWMP).

The Reserve's research and monitoring program is staffed by a research coordinator who oversees the program, conducts research, and facilitates research and monitoring by other investigators; a monitoring research specialist who manages the SWMP dataloggers, emergent vegetation monitoring project, and day-to-day operation of the monitoring laboratory; a nutrient research specialist who collects and analyzes water samples for nutrients, carbon, and chlorophyll and manages analytical laboratory services; a SWMP technical specialist who maintains the meteorological sampling station, participates in monitoring programs, and conducts statistical analysis and interpretation of monitoring data; and a part-time research assistant who assists with monitoring of emergent vegetation, fauna, and water quality.

1. Research Program

The research program benefits greatly from its location within the Baruch Marine Field Laboratory (BMFL) and the support and facilities provided to Reserve staff and visiting researchers. BMFL provides access to lodging, laboratory space, boats, vehicles, meeting facilities, equipment, wireless internet, and the ability to host classes of up to 30 students for two weeks. BMFL also publishes an annual list of research projects that includes the title, investigator(s), affiliation, and a project abstract. The compilation of research activities assists the Reserve with meeting an OCRM request that Reserves track research occurring on Reserve lands and provides scientists with information on other potentially complimentary or overlapping research activities. Researchers the evaluation team met with noted the facilities and staff support, along with the extensive monitoring data available, as being very important to their decision to conduct research at North Inlet and Winyah Bay. OCRM commends BMFL for its strong support of the Reserve's research program.

During the summer, BMFL is at full capacity with visiting researchers and students, including many who conduct their research within the Reserve boundary. Approximately 150 scientists from 31 universities use BMFL's facilities annually. In order to better track research projects and reduce the potential for conflicting projects and negative impacts on the environment, researchers are required to obtain approval from the Baruch Foundation before conducting research on the Hobcaw Barony property.

During the evaluation period, the research program has increased applied research that informs coastal management. The research coordinator works closely with the CTP coordinator to engage coastal managers and other end users in the planning and implementation of research projects to ensure that the projects provide information that can be used by coastal decision-makers.

In July of 2004, a hypoxia event occurred in the coastal waters of Long Bay. In order to better understand the cause of the hypoxia event, DHEC-OCRM convened a group of scientists and decision-makers from academic institutions and local and state government agencies who then formed the Long Bay Hypoxia Workgroup. The Reserve is a member of the workgroup and partnered with researchers from the University of South Carolina and Coastal Carolina University to conduct research on the occurrence of hypoxia and the factors that influence rates of oxygen consumption in nearshore waters. The cooperative efforts of the partners have resulted in a better understanding of what drives water quality dynamics in Long Bay—a combination of physical oceanographic drivers (upwelling and stratification) and stormwater discharges from urban areas. The workgroup also developed a better baseline of ambient conditions that will enable it to evaluate pre- and post-conditions for any additional stormwater discharges or infrastructure changes in the area. The CTP coordinator worked with local decision-makers and researchers to ensure that researchers understood how local stormwater was managed and that local decision-makers had access to and understood the most current knowledge.

The research, coastal training, and stewardship programs are working with volunteers from the DeBordieu community (some graduates of the Winyah Master Naturalist Program) to investigate the impact of stormwater ponds on coastal water quality. Concerns about the impact of stormwater management were raised when the DeBordieu community began considering changing its stormwater management practices from spraying treated effluent on a golf course that drains into ponds and eventually into North Inlet to instead, transporting the treated effluent to the Waccamaw River. The results of the monitoring demonstrated that the stormwater ponds in the community were impacting water quality in the North Inlet estuary. The CTP worked with the home-owner association and local decision-makers to engage them in the development and conduct of the research and communicated the results to community members and public leaders. Based on the Reserve's research results, BMFL wrote a letter in support of the DeBordieu community's effort to change its stormwater management practices, as it would lead to improved water quality in North Inlet.

In 2009, the Reserve received a two-year grant from Sea Grant to expand the stormwater pond study to the greater Waccamaw Neck region. As part of this study, research staff and the stewardship coordinator are undertaking an effort to construct a geospatial inventory of all artificial ponds within the coastal zone of South Carolina which will provide information on the extent of stormwater ponds and serve as a means of extrapolating pond research results to the broader geographic region.

In 2010, the research, coastal training, and stewardship programs built upon their previous work and developed a proposal for the new NERRS Science Collaborative, *Determining the role of*

estuarine ‘swashes’ on water quality impairment along the Grand Strand of South Carolina: Impacts of land use and stormwater runoff. The three-year award for \$872,732 was one of several projects that were selected for funding. The project will investigate the role that land use and stormwater inputs have on the biogeochemical dynamics of estuarine tidal creeks (locally known as swashes) and how this impacts the extent to which swashes serve as sources of organic matter and nutrient inputs to the coastal waters. This information will be key to determining the contribution of swash discharges to low oxygen conditions in the waters directly off the Grand Strand and understanding hypoxia in Long Bay.

Accomplishment: NI-WB NERR’s research and monitoring program conducts research that informs local coastal management decisions and works with the CTP and education programs to engage and inform local community members and decision-makers.

2. System-wide Monitoring Program (SWMP)

The goal of the NERRS System-wide Monitoring Program is to identify and track short-term variability and long-term changes in estuarine water quality, habitat, and land use in each reserve. The data gathered through SWMP provides standardized information about how estuaries function and change over time, enabling scientists to gain a better understanding of how human activities and natural events can change coastal ecosystems.

The Reserve has a fully functioning SWMP and submits quality and timely data to CDMO. Geostationary Operational Environmental Satellite (GOES) telemetry systems for near real-time data transmission of meteorological and water quality data were installed in 2006 at Oyster Landing and for water quality data in 2009 at Debidue Creek. In 2007, all four SWMP stations were upgraded with ROX optical dissolved oxygen sensors.

The North Inlet estuary has been extensively monitored for many years. In 1980, the North Inlet was one of six initial sites chosen by the National Science Foundation to receive funding as part of the Long Term Ecological Research Network (LTER) and was part of the program for thirteen years. The network received funding to develop an extensive monitoring program and a tremendous amount of monitoring data was collected during this time. The original data has needed to be translated for archiving and compatibility with the latest technology. In the past, USC-BI acquired a grant to support the conversion and updating of various databases but additional information remains unarchived.

Several evaluation participants noted their interest in having the Reserve maintain additional monitoring programs and assist with archiving older datasets, while acknowledging that both these efforts were resource intensive. The Reserve has continued to make a significant investment in monitoring and maintains several long-term monitoring efforts that are appropriate given the Reserve’s goals and objectives. Although maintaining long-term monitoring programs and archiving older datasets is important, the Reserve must continue to balance its goals and objectives and funding with maintaining and undertaking new efforts. OCRM encourages the Reserve to pursue funding opportunities for archiving data and maintaining monitoring programs where appropriate.

In addition to the required elements of SWMP, the Reserve conducts additional monitoring including:

- More frequent (20-day instead of 30-day) water chemistry sampling.
- Sampling for additional nutrient parameters: total nitrogen, total phosphorus, total and organic suspended sediments, and dissolved organic carbon.
- Diel nutrient sampling is conducted at all four SWMP stations (versus one station).
- Biweekly monitoring of zooplankton and intertidal nekton, continuing a database that has been collected for over 25 years. The dataset provides insights into short-term variability and long-term change in the composition and abundances of resident and transient species of the North Inlet ecosystem.
- Since 2005, monitoring of microplankton community metabolism (microplankton community respiration and bacterioplankton production) in conjunction with SWMP water chemistry monitoring at Oyster Landing. These measures will yield insight into how organic matter exchange between salt marshes and the coastal ocean may respond to changes associated with predicted climate alterations and sea level rise.
- In 2005, the Reserve established a series of permanent sampling transects in the Crabhaul Creek basin (upstream of the Oyster Landing SWMP station) for the long-term biomonitoring of emergent marsh vegetation according to NERRS protocols. This was expanded in 2007 to include measures of sediment elevation and porewater chemistry. The Reserve also installed SET tables in the monitoring transects, in partnership with the NOAA National Geodetic Survey in 2008. These monitoring efforts position the Reserve to act as a sentinel site for salt marsh response to sea level rise in an area where marsh transgression of the uplands is not impeded by coastal development.

Over the past 30 plus years, the Reserve and other state and federal monitoring efforts have focused on North Inlet, a relatively pristine watershed that can serve as a valuable reference point when looking at more impacted waters. Much less is known about Winyah Bay which is the third largest estuary on the east coast with extensive development within its watershed. The Reserve has, and is continuing to seek, outside funding to establish an additional SWMP station in the central channel portion of Winyah Bay to complement the Thousand Acre SWMP station located in a tidal creek, but has so far been unsuccessful. In addition, the Reserve is also encouraging additional research and monitoring of Winyah Bay to better understand this ecosystem and the differences between the two systems.

Program Suggestion: OCRM encourages NI-WB NERR to continue to pursue partnerships and seek funding to expand monitoring and research in Winyah Bay.

The Reserve is co-located with the CDMO which has been beneficial for the Reserve, CDMO, and the NERRS. The Reserve has taken a leadership role in SWMP and the research coordinator has served as the chair of the NERRS SWMP Oversight Committee, Data Management Committee, and NERRS Plankton Biomonitoring Workgroup. The Reserve hosts the annual week long training for SWMP technicians from across the System. In addition, the Reserve has piloted new equipment and the CDMO Director noted that Reserve staff are available to answer

any questions or provide assistance. OCRM commends the Reserve for its support of the national SWMP and CDMO.

3. Site Profile

NERRS implementing regulations require each reserve to develop a comprehensive site profile. A site profile is designed to (1) compile scientific datasets relating to the reserve, (2) characterize the physical and biotic components of the environment, (3) synthesize the known ecological relationships within the reserve and its watershed, (4) trace the impact of natural and human disturbances, and (5) explore the need for future research, education, and management initiatives.

NI-WB NERR has not completed its site profile and a necessary action was included in the previous evaluation calling for the Reserve to develop a schedule for submission and to complete its site profile within the review period. The Reserve submitted a schedule and has completed a draft of the majority of the document but a few chapters remain to be written. A site profile can be a valuable tool in attracting research, and it was noted by an evaluation participant that a completed site profile could help move BMFL to a new level and the assessment of research and monitoring needs would be particularly valuable.

Necessary Action: NI-WB NERR must complete the final site profile by December 31st, 2011.

4. Graduate and Undergraduate Research Fellowships

The Reserve continues to be actively engaged in the education and training of both undergraduate and graduate students. The NERRS GRF Program is a system-wide program that supports masters or doctoral students' management-related research projects that enhance scientific understanding of the reserve system, provide information needed by reserve managers and coastal decision-makers, and improve public awareness and understanding of estuarine ecosystems and management issues. The Reserve provides logistical, administrative, and research information support to the GRF students and encourages GRFs to participate in Reserve activities when they are onsite.

NERRS GRF research projects include:

Year	Fellow	Project Title
2007	W. Wang	<i>Investigations of below ground carbon dynamics in east coast salt marshes, USA</i>
2008	E. Wear	<i>Heterotrophic bacterioplankton community structure and function related to dissolved organic carbon quality in upper Winyah Bay</i>
2009	E. Lawrenz	<i>The relative influence of underwater light and oyster grazing on phytoplankton community composition in the North Inlet Estuary</i>

C. Education and Outreach 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.” The reserve system provides a range of educational programming to key audiences depending on watershed and community needs and the specific capacity of each reserve.

The focus areas of the NI-WB NERR’s education program, as described in the new Management Plan, are to (1) increase estuarine and ocean literacy and educate the community and general public audiences of all ages about the value of estuarine ecosystems and ways to protect them; (2) make North Inlet-Winyah Bay NERR the go-to resource for local estuarine information; (3) raise local awareness of global climate change and its effects; and (4) raise awareness of native species conservation and restoration. The education program offers programming for the general public, teacher workshops, and informal and formal education for children. The new Discovery Center and pond shelter and pier and the Reserve’s strong partnerships has enabled the Reserve to expand and enhance its programming.

The education program is staffed by a full-time education coordinator who oversees the education program; plans, designs, conducts, and evaluates the Reserve’s core education programs for different audiences; and develops instructional and interpretive materials incorporating the results of estuarine research and monitoring. In addition, an education specialist (who also supports the CTP) assists in the implementation of educational programming and development and implementation of community education and teacher professional development programs.

1. K-12 Education

The Reserve focuses on providing formal educational opportunities for 6th – 12th graders which complements the Baruch Foundation’s focus on 1st – 5th graders. The Reserve offers salt marsh field studies for middle and high school students that include a research sampling field trip with monitoring of fish and select invertebrates and water quality monitoring. The Reserve also continues to offer programming based on Estuary-Net, a pilot project that was initiated in 1996, that includes water quality monitoring data and research activities along with stewardship concepts that enforce the NERRS Estuaries 101 curriculum. The Reserve also conducts on-site programs at schools. Reserve educational programs are aligned with state and national science education standards but the Estuaries 101 curriculum is not formally incorporated into the local school districts’ curriculums. OCRM encourages the education program to work with local teachers and school districts to encourage the formal incorporation of the Estuaries 101 curriculum into school district curricula.

The Reserve has incorporated SWMP monitoring data and research results into some of its formal educational programming but opportunities remain for further integrating reserve research and monitoring data. OCRM encourages the education program to pursue opportunities for incorporating reserve research and monitoring data into formal education programs.

The education program has capitalized on partnerships with other providers in the region to offer additional programming for students and teachers and to further the Reserve's goals. The education program has worked with the Coastal Waccamaw Stormwater Education Consortium (*see Section D. Coastal Training*) to develop a variety of programming around the Reserve's goal to minimize the impacts of coastal growth on water and habitat quality. For example, with the support of grant funds, the education program works with local elementary, middle, and high schools in Georgetown and Horry Counties to install rain gardens and rain barrels in schools and educate students about stormwater management.

The Reserve partnered with ACE Basin NERR and the Department of Natural Resources (DNR) to bring DNR's education vessel, *Discovery*, to the Reserve to conduct school programs focused on South Carolina marine ecosystems. DNR staff provided educational programming for students on the boat while Reserve staff provided land based water quality activities to maximize the number of students able to participate.

The education program hosted an Estuary Live broadcast in September 2007 in partnership with ACE Basin NERR. Estuary Live is a NERRS event held in honor of National Estuaries Day and every year, Reserves take turns hosting. Estuary Live provides students virtual field trips to explore and learn about estuaries, the creatures that live there, and issues that affect these beautiful places. Over 2,800 students from ten states participated in the two-day event hosted by the South Carolina Reserves.

The education program is engaged in efforts to better coordinate the regional provision of environmental education. The education staff and reserve manager assisted with the development, and participate in, the Georgetown Horry Regional Environmental Education Network. The network of education providers began meeting in 2009 and members are working to coordinate existing and future programs to provide a variety of learning experiences and a continuum of preK-12th grade science education that supports and enhances established learning standards. The group developed a brochure for teachers and administrators that allows them to quickly see what types of programs are offered and by whom.

The Reserve and Baruch Foundation education staff meet twice a year to develop a six-month plan for the use of educational facilities. Although the coordination of programming and use of facilities has been going fairly smoothly, there have been areas where further guidance and clarity could be beneficial. The Reserve and Foundation could benefit from working together to develop an 'operations plan' for the facility that defines roles and responsibilities for respective staff and volunteers, fees, classroom rental, space uses including use of space by CTP, fees, program evaluation, and staffing requirements for the public spaces of the facility.

Program Suggestion: OCRM encourages NI-WB NERR to work with the Baruch Foundation to develop an “operations plan” for the new Discovery Center that further clarifies the use and management of the facility for educational purposes.

With the construction of the Discovery Center and pond shelter and closer working relationship with Baruch Foundation education staff, the education program has many new opportunities for growth. The education program offers a variety of programs and there are competing demands for education staff time including formal education programs onsite, in school education programs, public education programs, teacher trainings, and community events. The management plan lays out clear focus areas and strategies but does not highlight priority areas for growth. The Reserve has the opportunity to be selective in the educational activities it conducts and therefore, could benefit from a specific implementation strategy for the education program. The Reserve is participating in the national K-12 Estuarine Education Program (KEEP) and is currently conducting a market analysis and a needs assessment is planned. OCRM encourages the Reserve to use the market analysis and needs assessment to help guide the development of an implementation strategy for the education program that identifies priority areas of growth that will maximize the impact of the education program.

Program Suggestion: OCRM encourages NI-WB NERR to prioritize educational activities based on local needs and program strengths and to develop an implementation strategy for activities that specifies priority areas and strategies for growth.

The Reserve’s administrative, research, CTP, and stewardship staff offices remain in the BMFL facility. As the education staff is no longer located in the same office, opportunities for informal coordination and information sharing has decreased and will continue to be more challenging. OCRM encourages Reserve staff to pay attention to cross-sector communication and collaboration and the impacts of separate facilities and consider if new mechanisms are needed to ensure that staff continue to maintain a high level of collaboration.

2. Teacher Workshops

During the summer, the education program offers teacher workshops that are aligned with state standards, in partnership with other organizations. For example, in 2008 the Reserve partnered with ACE Basin NERR, SEWEE Association, and South Carolina Sea Grant Consortium to host an ACE Basin Adventure Teacher workshop designed for teachers from Horry, Georgetown, and Florence counties. In 2009, the Reserve hosted the Center for Ocean Sciences and Education Excellence Southeast (COSEE-SE) summer institute for teachers focused on climate change and the coast. In 2009 and 2010, the Reserve partnered with COSEE-SE and the SEWEE Association, and Waccamaw National Wildlife Refuge to host a three day teacher workshop incorporating science, art, and literature called Photographs, Poems, Pencils and Pluff Mud.

3. Public Education

The Reserve has a strong public education program that offers the public a variety of opportunities to learn more about the Reserve. The Reserve has developed new programs over

the evaluation period such as kayak trips, wildflower walks, and a class What's in your Watershed? The Reserve also regularly hosts such programs as the Fishes of North Inlet Estuary, Carolina Crabbing, and Winter Birds of Hobcaw. The education staff have incorporated research and monitoring data into public education programs. For example, the Fishes of North Inlet engages participants directly in Reserve monitoring efforts. The Reserve also participates in community festivals such as the Winyah Bay Heritage Festival and Wildlife and History Day hosted by Huntington Beach State Park.

The completion of the shared Discovery Center has led to an increase in collaboration between the Baruch Foundation and Reserve education programs. The education programs have developed and offered joint public programs in the summer, in particular the "Wild Wednesday" and "Feeding Frenzy" programs which target multi-generational family units.

Accomplishment: The NI-WB NERR education program has developed popular new public programming that is increasing the number of repeat visitors to the center.

D. Coastal Training Program

The CTP is designed to inform coastal decision-making, improve coastal stewardship at local and regional levels through the application of science-based knowledge, and increase dialogue and collaboration among decision-makers. Planning for the program includes establishing a training advisory committee, conducting a market survey of training providers and an audience needs assessment, developing a program strategy that outlines priority coastal issues to be addressed, prioritizing target audiences, and creating a marketing plan.

NI-WB NERR's CTP was fully implemented in November of 2003 and an updated strategy was approved in January of 2009. The overall goal of the Reserve's CTP, taken from the 2008-2011 Coastal Training Program Strategic Document is: "to promote informed, forward-thinking decision making related to coastal resources in order to preserve the value and function of the coastal ecosystems." The CTP provides high quality classroom and field based trainings along with additional technical assistance to help participants implement the knowledge gained at trainings. The CTP has a strong focus on watershed and stormwater management and as a Coastal Waccamaw Stormwater Education Consortium training provider, works with local governments and citizen committees to improve local policies and regulations.

The CTP is staffed by a full-time CTP coordinator who develops, markets, and implements training activities and provides or facilitates technical assistance for decision-maker audiences. In addition, part-time support for workshop planning and program implementation is provided by the education specialist. During the evaluation period, the education specialist position evolved from a part-time to a full-time position that also provides support to the CTP. OCRM commends USC-BI for creating a full-time position to support the growing demand for educational programming and decision-maker workshops.

The CTP is a highly valued partner in the community and evaluation participants noted the integral role of the program in connecting scientific information to local coastal management

issues and the importance of having someone to translate technical information for decision-makers. Evaluation participants also described the CTP as a go-to resource for unbiased science based information; providing support to municipal planning efforts; and hosting valuable workshops.

1. Watershed and Stormwater Management

During the evaluation period, a large focus of the CTP has been on understanding and minimizing the impacts of coastal growth on water quality. The CTP has been an integral partner in the Coastal Waccamaw Stormwater Education Consortium. The Consortium was formed by local education and training programs in the region in 2004 to maximize stormwater education efforts using a collaborative and watershed-based approach. The Consortium has since expanded to include representatives from Horry and Georgetown counties and local municipalities. The CTP is a core education provider and provides training and technical assistance to municipalities on stormwater related topics. In addition, the CTP coordinator has been the lead for updating and maintaining the Consortium's website.

The CTP has led and supported many projects as part of the Consortium including:

- Partnering with the City of Myrtle Beach Stormwater Department to host a series of technical design seminars on LID stormwater practices for local professionals. The seminars featured presentations by professionals experienced with designing, sourcing, and installing LID practices and demonstrations of installation techniques.
- NI-WB NERR along with partners hosted three days of training workshops on bioswale design and installation. The training was attended by over 70 engineers, architects, designers, planners, stormwater managers, developers, and others who traveled from as far away as Savannah, Georgia to attend.
- Providing technical assistance to Horry County in the form of comments on their stormwater ordinance and serving as a member of the Horry County Ad Hoc Committee on Floodplains and Stream/Wetland Buffers.
- Serving on the Surfside Beach Stormwater Committee and providing technical support to the committee regarding on-the-ground installations of stormwater best management practices demonstration projects, information on water quality monitoring, and other high priority stormwater issues.
- Serving on the Stormwater Committee for the Section 208 Water Quality Plan Update for the Waccamaw Region.
- Engaging local government staff and officials in providing input into research regarding stormwater ponds and water quality and communicated the results of the research to decision-makers (*see Section B. 1. Research Program*).
- Mobile Stormwater Workshops that take participants to various sites to highlight innovative stormwater practices that have been implemented in the target area.
- Demonstration and installation of pervious concrete at the Georgetown County Chamber of Commerce by contractors and trade experts attracted a diverse audience including stormwater managers, planners, engineers, educators, architects, and landscape architects.

The event gained extensive state-wide media coverage and as a result, at least several others projects were installed or planned around the community.

The CTP coordinator has significant expertise in stormwater management. In addition to providing training workshops, the coordinator also has been able to provide local government officials and citizen committees with technical assistance to help them implement lessons learned during training experiences. The CTP coordinator has worked with local communities and assisted them with identifying gaps in ordinances and policies; developing new ordinances and policies to promote better resource management; and exploring the needs of coastal communities related to low impact development.

Accomplishment: The NI-WB NERR CTP has provided high quality training and technical assistance to local communities and businesses that have led to the adoption of new policies and on-the-ground installation of Low Impact Development practices.

2. Training

The CTP has also offered a variety of other popular training throughout the evaluation period including:

- **Getting to Know Wetlands** a day-long seminar designed to help local elected and appointed officials, government staff, and local professionals understand why wetland issues are important; the laws and rules governing them; and how well-informed decision making can adequately protect coastal resources while meeting land use and development needs.
- **Fostering Sustainable Behavior** hosted in partnership with ACE Basin and Sapelo Island NERRs, featured an expert in community-based social marketing.
- **High Performance Building: Balancing Environmental and Economic Sustainability** was offered in partnership with ACE Basin NERR and Coastal Carolina University's Campus and Community Sustainability Initiative.
- **Green Building Series** focused on residential construction and neighborhood design. One workshop included a home buyer's perspective panel which gave the design professional in attendance a chance to explore consumer interest in green alternatives.
- Three **Shoreline Change Workshops** were held, in partnership with ACE Basin NERR, South Carolina Sea Grant Consortium, DHEC-OCRM, and NOAA's Coastal Services Center, for coastal decision-makers. The purpose of the seminars was to provide current knowledge on climate change, sea level, and erosion impacts on the shoreline of South Carolina, as well as to initiate dialogue at the local scale on the needs of communities.
- **NOAA Coastal Services Center trainings** such as the Habitat Priority Planner Tool.
- Individual and small group tours of communities and watersheds for new committee members and staff to help them learn about priority natural resource issues about which they will be making decisions.

3. Partnerships

The CTP has brought diverse groups together to address coastal issues and support grassroots community initiatives. In 2006, at the request of the Town of Pawleys Island, the CTP conducted a rapid environmental assessment and presented their findings and recommendations to community officials. The environmental assessment resulted in significant local media coverage of stormwater and watershed related topics and the Town subsequently adopted an ordinance requiring the use of pervious materials in driveways and parking areas and explicitly cited the CTP as the motivation for the policy change. The community leaders were then interested in creating other relevant ordinances to promote watershed protection. In 2009, the CTP helped to bring together the Friends of Pawleys Creek, the town mayor and council, and Georgetown County Stormwater Division for a roundtable discussion to create a vision and plan for addressing water quality, with the ultimate goal of once again being able to open the area for shellfish harvesting.

The CTP partners with other organizations to deliver training and technical assistance and is an active partner in the South Carolina Coastal Information Network (SCCIN), a collaborative group of training providers in South Carolina who work together to increase their reach, leverage resources, and minimize duplication of efforts. The group meets every two months and provides a forum for collaborative planning. SCCIN also hosts a website where members post planned training events.

The CTP partnered with ACE Basin NERR to complete the *Training Needs Assessment of Professional Decision Makers in the Coastal Counties of South Carolina* which was completed in 2006. The survey was developed and sent to approximately 1,500 municipal and county elected, appointed and staff officials as well as over 200 developers, engineers and architects. The assessment provides current and targeted information on important coastal issues, information needs, and the workshop style and timing preferences of target audiences. The assessment has not only served as a resource to guide the development of both South Carolina CTPs, it was highlighted by other partners as a valuable resource they used to guide their program development.

The CTP has also actively supported national efforts to grow and improve the national CTP. In 2006, the CTP coordinator completed a working draft of a CTP Guidance Document which is intended to be an ever-expanding snapshot of the CTP experience and a source of new information for new and veteran coordinators. The CTP coordinator has been a member of the NERRS CTP-SWMP Integration Workgroup, NERRS IOOS (Integrated Ocean Observing System) Workgroup, and NERRS CTP Planning and Implementation Workgroup, and co-chaired the CTP Visioning Workgroup that is revising program themes, outcomes and performance measures for the system, and the CTP logic model.

4. Capacity

The CTP is in high demand and the program struggles to balance providing quality workshops that reach a wide audience with time-intensive, yet high impact, technical assistance for decision-makers looking for assistance to put their training into practice. The program is not

currently able to meet all the requests for training and technical assistance that it receives. The CTP coordinator also spends a considerable amount of time working with partners to develop and support joint trainings. These partnerships often help to maximize the reach of the partners but at times it may be more efficient for partners to divide the workload. In addition, several evaluation participants noted that it would be beneficial if the CTP expanded efforts to work with home owner associations.

At the time of the site visit, the CTP coordinator had accepted a new job and since then a new CTP coordinator has been hired. The CTP Strategy is also due to be revised by January 2012. These changes offer the program an opportunity to reflect and strategize, as to how the coordinator may most effectively use their time to reach the Reserve's goals and how other partners can assist with filling gaps.

The CTP is staffed by a full-time CTP coordinator and is supported part-time by the education specialist who assists with the logistics of training events and other tasks. As demand for the CTP is likely to continue to grow, OCRM encourages the Reserve to explore opportunities for additional support of the CTP. The Reserve may wish to involve the education specialist in more aspects of the CTP and/or provide more involvement around a particular issue area and should more clearly define the CTP duties for this position. In addition, raising the visibility and responsibilities of the education specialist may also provide more of a bridge if the CTP coordinator leaves the program. The Reserve may also wish to pursue additional support for the CTP through other avenues such as the development of a graduate internship program or the hiring of a CTP assistant.

<p>Program Suggestion: OCRM encourages the Reserve to consider the needs of the Coastal Training Program, the role of the education specialist in supporting the program, and ways to grow the program.</p>
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D. Stewardship Program

Many Reserves in the NERRS have developed a stewardship component to complement their existing research and education programs. Stewardship staff participate in activities that might include research, monitoring, education, and implementation of resource management actions.

The Reserve's stewardship focus areas, as described in the new management plan, are (1) protect the water quality of NI-WB Reserve through community education and outreach in the Reserve target watershed; (2) promote stewardship and good coastal conservation practices in the communities of the North Inlet and Winyah Bay watersheds; (3) evaluate habitat quality and species distributions within the NI-WB NERR to identify current and potential conservation issues; and (4) monitor and control invasive species and maintain biodiversity. During the evaluation period, the stewardship program has helped lead the NERRS habitat mapping and change initiative, strengthened the Reserve's monitoring of key species, created the Winyah Master Naturalist Program, trained and supervised a cadre of Reserve volunteers, and furthered regional efforts to address invasive species. The stewardship program has also worked with partners on several research projects whose results will inform land management decisions.

The stewardship program is staffed by a full-time stewardship coordinator and was staffed by a part-time GIS Analyst from the beginning of the evaluation period to May 2006. During the evaluation period, stewardship at NI-WB has focused on regional invasive species management, developing the Winyah Master Naturalist Program and growing a volunteer base, monitoring activities, and developing and applying GIS tools and products to address resource conservation issues. In addition, the Reserve is becoming more actively engaged in regional land acquisition planning activities.

1. Geographic Information Systems

The Stewardship program has developed new GIS products to support the Reserve's research, stewardship, education, and coastal training programs and to assist partners with their projects and programs. The stewardship coordinator completed a habitat map of the North Inlet estuary as part a NERRS initiative to develop baseline habitat maps for all Reserves. The habitat map will enable the Reserve to track and evaluate short-term variability and long-term changes in the extent and types of habitats within the Reserve and to examine how these changes are related to anthropogenic and climate stressors.

The stewardship coordinator has been a leader in the NERRS habitat mapping and change initiative. The Reserve piloted guidelines developed by the NERRS' Habitat Mapping and Change Committee to create a baseline habitat map and a *Land Use, Cover, and Change Plan*. The stewardship coordinator has shared lessons learned and successes with other stewardship coordinators throughout the system, helping facilitate the national effort. The stewardship coordinator has also shared the baseline map with BMFL and Reserve staff and solicited ideas for future applications and products.

Accomplishment: The NI-WB NERR stewardship program has been a leader in the NERRS habitat mapping and change initiative.

The stewardship coordinator has used the habitat maps and other GIS products to support Reserve and partner activities. A virtual 'map room' (www.northinlet.sc.edu/about/maps.html) serves as a resource for educators and researchers and provides user friendly access to NI-WB Reserve map products. The maps are available for download and GIS data is available by request. Maps and sea level rise visualizations were created for the new exhibits in the Discovery Center. The stewardship coordinator has also developed GIS products to support partner efforts including mapping locations of the invasive beach vitex for the Beach Vitex Task Force. The stewardship coordinator is also continuing to explore ways to use web mapping applications to make Reserve spatial data more accessible to users.

In addition to the Reserve, Clemson's Baruch Institute and Baruch Foundation collect and use GIS data. The GIS data is stored in multiple places and a comprehensive list of available data does not exist. Several evaluation participants noted that they and others could benefit from better coordination and sharing of GIS data. OCRM encourages the Reserve in its efforts to make Reserve spatial data more accessible to users and to explore opportunities to coordinate or

increase sharing of information between the Foundation and Universities. For example, the Reserve may wish to work with partners to create a common GIS library or develop other mechanisms to promote sharing of information and leveraging of resources for future projects. As the demand for GIS products grows, the Reserve may wish to consider expanding support of the program through the development of an internship program, volunteers, or the hiring of a part- or full-time GIS staff member.

2. Monitoring

The stewardship program leads and participates in a number of ongoing monitoring projects. The stewardship, coastal training, and research programs have all supported the development of a secretive marsh bird monitoring program. In 2007, the Reserve partnered with the ACE Basin and Grand Bay NERRs to host a training by the U.S. Geological Survey on standardized monitoring protocols. Monitoring began in 2008 and volunteers assist Reserve staff. The results will be used to estimate the population of clapper rails and to examine the relationships between the landscape and clapper rail distribution. The ACE Basin NERR and Cape Romain National Wildlife Refuge are now undertaking similar monitoring efforts. The stewardship coordinator and other Reserve staff also regularly participate in the national Christmas Bird Count and state-wide monitoring efforts such as surveying Wilson's Plovers.

The stewardship coordinator is also involved in monitoring and supporting efforts to conserve the diamondback terrapin. The stewardship coordinator has worked with a visiting researcher and his students to conduct terrapin surveys in North Inlet. The stewardship coordinator also participates in the Diamondback Terrapin Working Group, a group dedicated to the long-term conservation of the diamondback terrapin. The stewardship and CTP coordinators partnered with ACE Basin, Sapelo Island and North Carolina CTPs to jointly host the Southeast Regional Diamondback Terrapin Workshop in 2009. The workshop brought together researchers, managers, educators, and local government staff to learn more about research, education, and conservation efforts and to discuss local needs, next steps, and identify leads for new initiatives on priority topics.

In 2010, the stewardship coordinator, Reserve manager, and other reserve staff worked with the Department of Natural Resources, U.S. Fish and Wildlife Service, and local sea turtle volunteers to pilot a sea turtle nesting project on North Island. The two-week study was conducted during peak nesting period for sea turtles and tested the efficacy of different nest protection strategies against the primary predator, feral hogs.

The stewardship coordinator is currently developing a marine debris monitoring program for the Reserve. The stewardship coordinator partnered with the South Carolina Sea Grant Consortium to facilitate three marine debris focus groups throughout the state and the results were used to design a marine debris monitoring program for the coast. The stewardship coordinator is leading the development of a marine debris monitoring training manual and field assessment rubric. Volunteers will be recruited and trained as spotting teams to systematically cover three study areas.

3. Winyah Naturalist Program and Volunteer Program

The stewardship coordinator established the Winyah Master Naturalist Program to help create a trained core of volunteers to assist the Reserve with monitoring projects and other activities. The stewardship coordinator developed an estuary focused Master Naturalist Program manual, as the original program content focused on uplands. The Master Naturalist Program has also been supported by other Reserve, BMFL, Baruch Foundation, and Clemson's Baruch Institute staff who have helped design and lead class sessions. The 13-week program has been offered once a year for the past three years and 27 community members have graduated. The Reserve has also held advance training courses for interested participants.

Accomplishment: The NI-WB NERR stewardship program developed a locally relevant Winyah Master Naturalist Program and a trained cadre of volunteers.

The Master Naturalist Program draws many of its participants from the nearby DeBordieu community and most are retirees. After completion of the program, about half of the master naturalists have become volunteers with the Reserve and participate regularly in monitoring and stewardship activities. The Reserve's volunteer program is growing and the stewardship coordinator is looking to develop additional opportunities for volunteers, such as marine debris monitoring, that will help the Reserve meet its goals while providing a quality experience for volunteers.

In addition to the stewardship program, the Reserve also benefits from a number of volunteer hours that support the research program, in particular the Fishes of North Inlet monitoring program. The education program also benefits from a small amount of volunteer support. The stewardship, research, and education programs are very interested in expanding opportunities for volunteers to contribute to their programs.

The Reserve does not have a volunteer coordinator on staff and existing staff work with volunteers and develop volunteer opportunities in addition to their other responsibilities. The lack of a volunteer coordinator limits opportunities for the Reserve to take advantage of volunteers. Evaluation participants noted that there were other natural resource and environmental organizations in the area that offered more numerous volunteer opportunities. In addition, they noted that Reserve staff had to let them on to the property and escort them while conducting volunteer activities, due to Foundation public access policies, limiting their ability to take on tasks of greater responsibility and autonomy, which was something they valued.

An active volunteer program can be very beneficial but it also takes a significant amount of time to develop activities and manage volunteers. The Master Naturalist Program has been successful in creating a pool of educated volunteers but the Reserve has been unable to take full advantage of this resource. The establishment of the Master Naturalist Program, ongoing research and monitoring projects, and the new education facilities provide additional opportunities for volunteers to be meaningfully engaged. OCRM encourages the Reserve to (1) assess the volunteer needs and opportunities for each sector; (2) prioritize opportunities and strategies for growing the program; and (3) identify budget needs and levels of staff support for the current

program and what will be needed as the program grows. This information could be used develop a volunteer program plan that could also benefit from considering position descriptions, recruitment strategies, volunteer screening, orientation and training, supervision, and retention. The Foundation is also interested in expanding its volunteer program and the Reserve should consider engaging the Foundation in its planning and potentially identify a mechanism to ensure volunteers are aware of volunteer opportunities at each organization and/or identify and facilitate opportunities for leveraging resources.

Program Suggestion: OCRM encourages the NI-WB NERR in its efforts to grow the volunteer program and to pursue the development of a volunteer program plan to guide future growth.

4. Invasive Species

Reserve staff, and in particular the stewardship coordinator, have played a key role in supporting efforts to address invasive species in the region. The stewardship coordinator and Reserve manager are members of the Carolinas Beach Vitex Task Force which was created in 2004 to address the spread of beach vitex. In the early 1990s, beach vitex was planted for erosion control on South Carolina beaches and by the mid 1990s it had spread and started to crowd out native species.

Volunteers with the South Carolina United Turtle Enthusiasts (SCUTE) first raised concerns about the possible impacts of the thick mats of beach vitex on loggerhead sea turtle nesting habitat and behavior. To investigate the issue further, NI-WB NERR hosted a workshop of private citizens, personnel from state and federal agencies, and representatives from nonprofits. The workshop led to the formation of the South Carolina Beach Vitex Task Force and North Carolina joined in 2005 to form the Carolinas Beach Vitex Task Force. The Task Force is led by a local citizen volunteer, a member of SCUTE.

Since 2004, the Task Force has pursued funding and partnerships to treat and remove beach vitex. The Task Force also works to alert citizens to watch for and report sightings of beach vitex. The stewardship coordinator maintains and designs the Task Force's website and participates in monitoring efforts and Reserve staff have provided support for Task Force meetings, workshops, and annual symposiums.

Through the Task Force's efforts the North Carolina Board of Agriculture has listed beach vitex as a Class B State Noxious Weed which bans the sale, transport, and possession of beach vitex by nurseries, garden shops, and private property owners. In addition, numerous South Carolina beach communities have banned the use of the plant.

The Reserve is also supporting other regional efforts to address invasive species. The first meeting of the southeast regional Reserves led to a commitment to work together to address invasive species. The Reserves have held joint workshops and conducted a targeted survey of green industry professionals to gauge their knowledge and interest in invasive plant issues and the promotion of native plants. The survey will be used to identify opportunities for working

with green industry professionals to reduce the use of invasives. The stewardship coordinator is also the secretary for the South Carolina Exotic Pest Plant Council, a nonprofit that provides a forum for the exchange of scientific, educational, and technical information.

5. Land Management and Public Access

The Baruch Foundation actively manages and stewards the Hobcaw Barony property. Reserve and Foundation staff communicate informally in order to minimize conflicting uses of resources and to take advantage of partnership opportunities to protect resources on the property, such as addressing invasive species. At times though, staff are not always aware of the other's planned activities. A more formal communication mechanism, such as regular meetings a few times a year, or reporting/tracking system could help ensure that Reserve and Foundation staff are aware of the other's planned activities and have the opportunity to increase synergies and benefit from each other's capabilities.

Program Suggestion: OCRM encourages the stewardship program to work with Foundation land managers to develop a formal communication mechanism to discuss stewardship issues and take advantage of synergies, and where appropriate, work together to protect resources on the property and within the North Inlet watershed.

The stewardship program has worked with the Foundation and other partners to pilot and study innovative land management techniques. A former stewardship coordinator worked with the Baruch Foundation and other Reserve staff to conduct a pilot study of an alternative shoreline stabilization project at Oyster landing. The Baruch Foundation received funding from DHEC-OCRM to install a concrete block product that allows for the growth of native salt marsh vegetation and can be installed on a slope. Prior to the study, only vertical bulkheads had been used in South Carolina to prevent erosion on property which can lead to the erosion of marshes in front of bulkheads and the loss of important nesting and nursery grounds for wildlife. The pilot study will allow DHEC-OCRM to determine if this alternative technique can both prevent erosion and optimize intertidal and aquatic habitat.

The stewardship coordinator has also collaborated with the Coastal Services Center and Waccamaw National Wildlife Refuge on a project using SLAMM (Sea Level Affecting Marshes Model) as a visualization tool to investigate the potential impacts of sea level rise on coastal habitats. The project is using Reserve generated elevation and accretion data along with high resolution elevation data (LIDAR). The Reserve plans to use the results to identify and prioritize areas for conservation and management action.

At the time of the site visit, the Reserve was interested in identifying an area that could be dedicated to educational activities including student research projects. Since the site visit, an area for conducting educational activities has been identified. The stewardship program will be looking at the impacts of human use on this area and will collect baseline data and study changes over time. OCRM encourages the Reserve in its efforts to monitor and understand the impacts of human use and to adjust management strategies accordingly.

6. Land Conservation

The areas surrounding the Reserve have seen significant population growth and associated development over the past ten years and several large development projects have been permitted but not constructed. If these projects are built and other areas are developed in the future, there could be a significant impact on the natural resources of the Reserve.

In order to reduce the threat of potential impacts from development on North Inlet and protect key habitat corridors, the Reserve has identified three target areas for conservation in its draft 2011-2016 Management Plan: Sampit Project area which encompasses 23,349 ha in southern Georgetown County; Winyah Project area which includes 27,152 ha in northern Georgetown County and includes portions of the Black, Pee Dee, and Waccamaw Rivers; and North Inlet Watershed Project Area which includes 2,086 ha within the watershed of the North Inlet estuary.

The Coastal and Estuarine Land Conservation Program (CELCP), administered by OCRM, provides federal matching funds to state and local governments to protect coastal and estuarine lands considered important for their ecological, conservation, recreational, historical, or aesthetic values. At the state level, CELCP is managed by the DHEC-OCRM. Since 2009, at least 15 percent of CELCP allocations are for acquiring Reserve buffer areas and areas within the watershed. This change in CELCP has heightened local awareness of the leveraging role the Reserve can contribute towards land acquisition projects. The Reserve was invited by the City of Conway to support a CELCP proposal to protect forested wetlands in the Winyah Bay watershed in FY2010 and again in FY2011.

In 2009, the Reserve was invited to join the Winyah Bay Focus Area Task Force, a coalition of public and private organizations that was founded in 1992 under the Atlantic Coast Joint Venture of the North American Waterfowl Management Plan to seek landscape-level solutions to the watershed's problems. A major focus of the Task Force's work has been protecting land through fee acquisition and conservation easements. The Reserve is becoming increasingly involved in land acquisition efforts that promote the protection of the Reserve's natural resources and OCRM encourages the Reserve to consider what its role in promoting land acquisition should be and to potentially increase its role and level of effort.

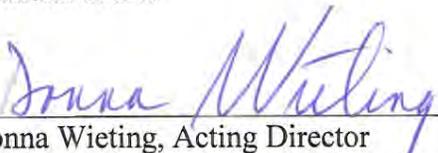
V. CONCLUSIONS

For the reasons stated herein, I find that the South Carolina is adhering to the programmatic requirements of the National Estuarine Research Reserve System in the operation of its approved North Inlet-Winyah Bay National Estuarine Research Reserve.

NI-WB NERR has made notable progress in the following areas: infrastructure development including construction of the Hobcaw Barony Discovery Center; development of an excellent management plan; conducting applied research that informs coastal decision-makers; conducting high quality stormwater trainings and providing technical assistance that has resulted in the adoption of new local policies; development of new popular educational programs for the general public; providing leadership to the NERRS Habitat Mapping and Change effort; and developing a Winyah Master Naturalist Program and trained cadre of volunteers.

The findings contain eight recommendations in the form of one necessary action and seven program suggestions. The University of South Carolina must address the necessary action by the date indicated. The program suggestions should be addressed before the next regularly scheduled program evaluation, but they are not mandatory at this time. Summary tables of program accomplishments and recommendations are provided in the Appendix A.

This is a programmatic evaluation of NI-WB NERR that may have implications regarding the state's financial assistance awards. However, it does not make any judgment on or replace any financial audits.



Donna Wieting, Acting Director
Office of Ocean and Coastal Resource Management

MAY 23 2011

Date

VI. APPENDICES

Appendix A. Summary of Accomplishments and Recommendations

Accomplishments

Issue Area	Accomplishment
Facilities	Completion of the Hobcaw Barony Discovery Center and pond shelter and associated pier has enabled NI-WB NERR to provide new experiential educational experiences for students, teachers, and the general public.
Management Plan	NI-WB NERR has developed an excellent management plan that emphasizes sector integration to address priority issues and clearly articulates sector goals, objectives, and strategies. The management plan will serve as a model for other Reserves.
Research and Monitoring	NI-WB NERR's research and monitoring program conducts research that informs local coastal management decisions and works with the CTP and education programs to engage and inform local community members and decision-makers.
Education	The NI-WB NERR education program has developed popular new public programming that is increasing the number of repeat visitors to the center.
Coastal Training Program	The NI-WB NERR CTP has provided high quality training and technical assistance to local communities and businesses that have led to the adoption of new policies and on-the-ground installation of Low Impact Development practices
Habitat Mapping	The NI-WB NERR stewardship program has been a leader in the NERRS habitat mapping and change initiative.
Stewardship	The NI-WB NERR stewardship program developed a locally relevant Winyah Master Naturalist Program and a trained cadre of volunteers

Recommendations

Recommendations are in the form of Necessary Actions (NA) or Program Suggestions (PS).

Issue Area	Recommendation
Site Profile	NA: NI-WB NERR must complete the final site profile by December 31 st , 2011.
Administration	PS: OCRM encourages USC-BI to pursue reviving semi-annual directors meetings to increase synergies between USC-BI and its field lab, Clemson's Baruch Institute, Baruch Foundation, and NI-WB NERR.
Monitoring	PS: OCRM encourages NI-WB NERR to continue to pursue partnerships and seek funding to expand monitoring and research in Winyah Bay.
Administration	PS: OCRM encourages NI-WB NERR to work with the Baruch Foundation to develop an "operations plan" for the new Discovery Center that further clarifies the use and management of the facility for educational purposes
Education	PS: OCRM encourages NI-WB NERR to prioritize educational activities based on local needs and program strengths and to develop an implementation strategy for activities that specifies priority areas and strategies for growth

Coastal Training Program	PS: OCRM encourages the Reserve to consider the needs of the Coastal Training Program, the role of the education specialist in supporting the program, and ways to grow the program.
Volunteers	PS: OCRM encourages the NI-WB NERR in its efforts to grow the volunteer program and to pursue the development of a volunteer program plan to guide future growth.
Stewardship	PS: OCRM encourages the stewardship program to work with Foundation land managers to develop a formal communication mechanism to discuss stewardship issues and take advantage of synergies, and where appropriate, work together to protect resources on the property and within the North Inlet watershed.

Appendix B. Persons and Institutions Contacted

North Inlet Winyah Bay Reserve

NAME	Title
Wendy Allen	Manager
Beth Thomas	Education Coordinator
Dr. Jen Plunkett	Stewardship Coordinator
Nicole Saladin	CTP Coordinator
Dr. Erik Smith	Research Coordinator
Lindsay Thomas	Education Specialist
Nick Stines	Communication Systems Analyst and USC campus staff
Evelyn Lawrenz	Graduate Research Fellow

University of South Carolina

NAME	Title
Dr. Jim Morris	Baruch Institute Director
Paul Kenny	Research Resource Specialist
Ginger Ogburn-Matthews	Research Data Manager/Analyst
Margaret Bergin	Grant Administrator
Evelyn Lawrenz	Ph.D. student
Dr. Dennis Allen	BMFL Director

Belle W. Baruch Foundation

NAME	Title
George Chastain	Executive Director
Richard Camlin	Senior Interpreter
Lee Brockington	Senior Interpreter

State Agency Partners

NAME	Title	Organization
Kattie McMillan	Education Specialist	SC DNR ACE Basin NERR
Becky Walker	CTP Coordinator	SC DNR ACE Basin NERR
Lauton Sutley	CTP Fellow	SC DNR ACE Basin NERR
Phil Maier	Manager	SC DNR ACE Basin NERR
Curtis Joyner	Coastal Projects Manager	SCDHEC-OCRM

Nonprofit Partners

NAME	Title	Organization
Amy Weinmeister	Education Coordinator	Longleaf Environmental Learning Center, USC Development Foundation
Betsy Brabson	Coordinator	Beach Vitex Task Force

University Partners

NAME	Title	Organization
Karen Fuss	Coordinator, CWSEC and Environmental Educator	Coastal Carolina University
Dr. Susan Libes	Director, Waccamaw Watershed Academy and Professor of Marine Science and Chemistry	Coastal Carolina University
April Turner	Extension Specialist	SC Sea Grant Consortium
Dr. Denise Sanger	Assistant Director for Research and Planning	SC Sea Grant Consortium
Dr. Eric Koepfler	Professor of Marine Science	Coastal Carolina University
Dr. Dwayne Porter	Chair, Dept. of Environmental Health Sciences and Director, NERRS CDMO	University of South Carolina
M. Richard DeVoe	Executive Director	SC Sea Grant Consortium
Dr. William Conner	Professor, Forestry and Natural Resources	Clemson University Baruch Institute
Dr. Alex Chow	Assistant Professor, Biosystems Engineering	Clemson University Baruch Institute
Dr. Dan Hitchcock	Assistant Professor, Biosystems Engineering	Clemson University Baruch Institute
Dr. Anand Jayakaran	Assistant Professor, Biosystems Engineering	Clemson University Baruch Institute

Other

NAME	Organization
Melodye Lane-Laveglia	Surfside Beach Stormwater Committee
Ray Funnye	Director Public Services Georgetown County
Ken Harbin	Chair, Surfside Beach Stormwater Committee
Carolyn Harbin	Surfside Beach Resident
Steve Williams	The Earthworks Group
Dr. David Wylie	Georgetown High School
Tom Marshall	Winyah Master Naturalist and Marsh Bird Volunteer
John Kiesling	Winyah Master Naturalist and Marsh Bird Volunteer
Jamie Dozier	Chair, Winyah Bay Focus Area Task Force and Manager, Tom Yawkey Wildlife Center, SC DNR

Appendix C: Persons Attending the Public Meeting

No persons attended the public meeting.

Appendix D: NOAA's Response to Written Comments

NOAA did not receive any comment regarding the evaluation of the North Inlet-Winyah Bay NERR, South Carolina.

Appendix E: NI-WB NERR'S Response to 2005 Evaluation Findings

1. Necessary Action: NI-WB NERR must submit a schedule for the submission of the Reserve Site Profile to NOAA OCRM within three months of the receipt of final findings and complete the site profile within the next review period.

Reserve Response: Site profile schedule was submitted to OCRM within three months of receipt of the final findings. Significant progress was made on sections of the site profile during the ensuing months. The schedule was revised in Site Profile task descriptions for annual operations awards for the NI-WB NERR. Semi-annual progress reports provide details on efforts made to complete this task. As of August 2010, most of the chapters for the document have been written. A few outstanding chapters need to be completed before a synthesis section can be completed by the co-editors. The latest revised Site Profile schedule (included in the operations grant for FY2010) lists a completion date of December 31, 2010.

2. Program Suggestion: NI-WB NERR should consider the needs of the programmatic requirements for the growth and development of its education program, particularly as they relate to sufficient staffing and facilities as well as the development of a volunteer program.

Reserve Response: Discussions during the last 312 Evaluations that resulted in this suggestion provided the impetus for the NI-WB NERR to partner with the Belle W. Baruch Foundation on a major construction project to enhance the visibility and educational programming of both groups. The Reserve was successful in securing NOAA construction funds in FY2006 (\$2,879,972), FY 2007 (\$606,650) and FY 2008 (\$368,391), matched by the Belle W. Baruch Foundation, to complete different phases of an education and training center project. Construction of the main education center, named the Hobcaw Barony Discovery Center, was completed in May 2009, exhibits were installed in June, and the new center opened to the public in July 2009. This facility is a major expansion of an existing 1,800 square foot Hobcaw Barony Visitor Center formerly owned and solely operated by the Baruch Foundation. The new 12,500 square foot building is a joint-use education facility for the NERR and Baruch Foundation and includes 1,800 square feet of dedicated exhibit space, a seminar room, classroom, reception area, gift shop, and offices for reserve and Baruch Foundation education staff. Employees of the NERRS Centralized Data Management Office (CDMO), also have office space in the new complex. In addition to the Discovery Center building, an outdoor classroom referred to as the "Pond Shelter" was also completed in 2009. These educational facilities, complete with new exhibits that highlight the natural history and research that takes place on Hobcaw Barony, have greatly enhanced public visibility of the NERR.

Also during the period since the last review, the Reserve hired a full-time Education Specialist to support the public education and Coastal Training Program efforts of the NERR. The Reserve and Baruch Foundation both benefit from a core group of dedicated Hobcaw volunteers who serve in a variety of capacities including covering the reception desk, taking reservations for programs, and assisting with educational programs.

3. Program Suggestion: NI-WB NERR should consider support for applied research projects which have implications to and provide recommendations for actions which preserve coastal resources and result in appropriate resource use.

Reserve Response: The Reserve has been very successful in recent years in conducting additional research in support of coastal resource management. A pilot study is underway in cooperation with SC-OCRM and the Belle W. Baruch Foundation to evaluate an alternative marsh shoreline stabilization product at the Oyster Landing site in the Reserve. The standard practice in South Carolina is to erect vertical bulkheads to prevent shoreline erosion and SC-OCRM is interested in the feasibility and benefits of alternative shoreline solutions. The Reserve also has received funding from SC Sea Grant to evaluate the role of stormwater ponds in coastal nutrient dynamics; is partnering with a number of groups to examine hypoxia causes and dynamics along the northern coast of the state; and recently received news that its NERRS Science Collaborative project would be funded. All of these projects involve coastal managers and other end users in the planning and implementation phases of the work.

4. Program Suggestion: NI-WB NERR should work to develop a singular identity as it works to coordinate its activities within and among the various actors at the Reserve. At a minimum, there should be some signage which articulates the Barony as a Partnership among the NI-WB NERR/NOAA, the Baruch Foundation, USC Baruch and Clemson University. Likewise actions which lead to the development of cohesive community support, such as a “Friends Group” should be taken in concert with efforts of the partners within the greater Reserve area. Any such group development should take into account, and to the highest extent possible, coordinate with the existing efforts of the partners.

Reserve Response: The completion of the Hobcaw Barony Discovery Center, and joint programming that is occurring, contribute greatly to enhancing the identity of the NI-WB NERR and its partners on Hobcaw Barony. The exhibits are an excellent resource for visitors to the property to learn about the NERR, its research, and the rich natural and cultural resources of the Hobcaw property where the Reserve is located. New signage has also been placed at the entrance to the Hobcaw Barony property since the last review period and a new sign for the Hobcaw Barony Discovery Center is currently being designed to replace a temporary sign that identified the partners on the project. The NERR benefits from a Hobcaw Barony volunteer program that the Baruch Foundation established several years ago. These volunteers support the activities of the new joint-use education center. Separate from the Hobcaw volunteers, the NERR has cultivated different volunteers through a Master Naturalist program. Some of the graduates of this program, offered by the NERR in partnership with others, help the Reserve with various monitoring projects, including one designed to assess the distribution and population of marsh birds.

5. Necessary Action: NI-WB NERR must provide NOAA OCRM a schedule for the submission of the Reserve Management Plan within one month of the receipt of the final findings and complete the management plan within 18 months.

Reserve Response: A schedule for completing the Reserve Management Plan was provided to NOAA OCRM within a month of receipt of the final findings. This schedule was periodically updated, based on shifting timelines, and included under a Management Plan task in annual operations grant proposals. Progress on the Management Plan was also reported under this task category in semi-annual reports. A complete formatted copy of the revised Management Plan was submitted to the NOAA Estuarine Reserves Division (ERD) in May 2010. It was formally reviewed by a NOAA team and combined comments were provided to the Reserve in July. These comments were addressed and a revised document was submitted to ERD before the end of August 2010.

6. Program Suggestion: As the NI-WB NERR develops its Management Plan it should also consider the implications of an expanded boundary addressing: how to best preserve the integrity of the core reserve site through the use of placing adjacent properties in protected status; whether those adjacent areas should be identified as within the boundary of the Reserve or not; how the integrity of the partnered programs will be maintained if their lands become incorporated within the Reserve boundary.

Reserve Response: Soon after the last 312 Evaluation, the Reserve sought clarification from ERD on the benefits and any potential disadvantages of expanding a buffer. This was a result of questions raised by land owners with whom we had engaged in discussions about this idea during the 312 site visit. There did not seem to be any clear advantages in terms of enhanced protection, especially in areas that already have some kind of conservation status. The Reserve decided not to pursue boundary changes at this time but indicated in the revised Management Plan that it may wish to examine this issue in the future.

7. Program Suggestion: As part of the considerations made in development of the Reserve Management Plan, NI-WB NERR should define future needs for office, laboratory, and program space, taking into consideration future resources for operation and maintenance. Likewise, major purchases to support Reserve activities and programs should be identified and documented.

Reserve Response: The revised Management Plan addresses future needs for facilities. These include a cottage for visiting scientists, a laundry or laundry/recreation area for the housing complex, an interpretive trail to complement the Kimbel Pond and Pond Shelter education site, and improved access to Winyah Bay from the Hobcaw Barony property. Major equipment needs, especially related to research and monitoring, have been built into the Reserve's annual operations budgets, as funds were available.

Appendix F: NI-WB NERR Accomplishments Report

North Inlet – Winyah Bay National Estuarine Research Reserve Program Accomplishments since last NOAA 312 Evaluation

February 2005 – August 2010

This document is designed to capture significant accomplishments of the North Inlet – Winyah Bay National Estuarine Research Reserve (NI-WB NERR) over roughly the past five years since the last NOAA 312 Evaluation was conducted. Accomplishments are grouped by NERR programmatic categories including operations (staffing, facilities and NOAA programmatic requirements), research and monitoring, education (K12 and community education and the Coastal Training Program), and stewardship. Accomplishments in terms of contributions to the NERR System are also addressed.

Operations

Staffing

- Education Specialist position established (full-time with benefits) to serve the public education program and Coastal Training Program (2007).

Facilities

- Hobcaw Barony Discovery Center (HBDC) construction project completed in May 2009. New exhibits for the center were designed, constructed and then installed in June 2009. This is a joint-use education facility of the NI-WB NERR and the Belle W. Baruch Foundation. It is about 12,500 square feet in size and includes 1,800 square feet of dedicated exhibit space, a seminar room, classroom, reception/gift shop area and offices. Public education staffs of the NERR and the Baruch Foundation as well as staff of the NERRS Centralized Data Management Office (CDMO) occupy offices in the new facility. (NOAA construction awards in FY 2006 - \$2,879,972 and FY 2007 - \$606,650 were matched with Belle W. Baruch Foundation resources for the building construction, and exhibit construction phases respectively).
- Outdoor classroom called the “Pond Shelter” was also completed in 2009. It is located adjacent to the University of South Carolina’s Kimbel Lodge and includes a fixed pier that provides access for water sampling by educational groups. (NOAA construction award in FY 2008 - \$368,391, matched by the Belle W. Baruch Foundation).

NOAA programmatic requirements

- Semi-annual progress reports for all NI-WB NERR grants were submitted on time. Performance measures for these periods were included with the reports.
- Operation grant proposals were submitted on or before deadlines
- Management Plan was submitted for formal NOAA review. Consolidated comments from NOAA's Estuarine Reserve's Division were addressed and a final copy was submitted to NOAA in August 2010.

Research and Monitoring

- Installation of GOES telemetry systems for near real-time data transmission of meteorological and water quality data at Oyster Landing (2006) and water quality data at Debidue Creek (2009) SWMP stations.
- YSI dataloggers at all four SWMP stations were upgraded with ROX optical DO sensors beginning in 2007.
- Nutrient sampling continues to exceed minimum requirements of the SWMP: Diel nutrient sampling is conducted at all four SWMP stations (versus one station); In addition to required SWMP analyses include total nitrogen, total phosphorus, total and organic suspended sediments, and dissolved organic carbon, in addition to required SWMP parameters.
- In 2006, the Reserve enhanced its capacity to process chlorophyll *a* samples in-house through the purchase of a Turner Trilogy fluorometer to replace its aging and outdated Turner Sequoia fluorometer.
- SWMP data were consistently submitted to the Centralized Data Management Office (CDMO) on schedule throughout the period. Data submission for MET and WQ consistently exceeded 85% data submission requirements throughout the period and no QA/QC points have been accumulated for MET and WQ during this period. Data submission for NUT has also exceeded 85% submission requirements with the exception of Chl *a* data, which were not submitted for 2006 due to an incorrect filter module supplied by the fluorometer manufacturer. Although this resulted in the Reserve accumulating 3 QA/QC points for 2006, we have developed a post-correction scheme for the data and are now confident we can restore these data to the SWMP time-series.

Other Research and Monitoring activities supported by NOAA 315 funds:

- In 2005, the Reserve established a series of permanent sampling transects in the Crabhaul Creek basin (upstream of the Oyster Landing SWMP station) for the long-term biomonitoring of emergent marsh vegetation according to NERRS protocols. This was expanded in 2007 to include measures of sediment elevation and porewater chemistry. These efforts position the Reserve to act as a sentinel site for salt marsh response to sea

level rise in an area where marsh transgression of the uplands is not impeded by coastal development.

- In 2005, the Reserve began monitoring microplankton community metabolism (bacterioplankton production and community respiration) in conjunction with 20-day SWMP water chemistry monitoring at Oyster Landing. These measures serve to track the integrated ecological response of subtidal creeks to variability in the magnitude and form of salt marsh exports and yield insight into how organic matter exchange between salt marshes and the coastal ocean may respond to changes associated with predicted climate alterations and sea level rise.
- The Reserve has continued its commitment to the biological monitoring of nekton and plankton communities. Monitoring at biweekly intervals has been maintained for over 25 years and provides insights into short-term variability and long-term change in the composition and abundances of both resident and transient species of these key components of the North Inlet ecosystem.

Research activities primarily supported with external grant funding:

- The Reserve, through its Research Coordinator, has been a key member of the “Long Bay Work Group,” since its inception in 2005. The LBWG is a partnership involving scientists and decision-makers from academic institutions and local and state government agencies, which was formed to facilitate the sharing and synthesis of information regarding water quality conditions and the formation of hypoxia in the nearshore waters of Long Bay, SC.
- In partnership with researchers from USC and Coastal Carolina University, the Reserve, through its Research Coordinator, has been conducting research on the occurrence of hypoxia in Long Bay and the factors that influence rates of oxygen consumption in nearshore waters. This work has been funded by South Carolina Sea Grant (2006-2008) and the South Carolina Department of Health and Environmental Control (2010-2011).
- Beginning in 2008, the Reserve, in partnership with local residents, initiated new research on the ecological dynamics of residential stormwater detention ponds in the North Inlet watershed, and the implications these dynamics have for the impacts of pond discharges on coastal water quality conditions. In 2009, this work was expanded to the greater Waccamaw Neck region through the successful funding of a proposal submitted to South Carolina Sea Grant (“Linking residential development and organic matter loading to the coastal zone: the role of stormwater detention ponds as sources of bioreactive carbon and nitrogen” with funding of \$127,125 for two years.). This research represents a collaborative effort between the RC (lead PI), the SC (spatial analyses and GIS products) and CTP (outreach to home-owner associations and local decision makers).
- In conjunction with our stormwater detention pond research, the Reserve (as a collaboration between RC and SC) is currently undertaking an effort to construct a

geospatial inventory of all artificial ponds within the coastal zone of South Carolina, which will serve as both context and as a means of extrapolating pond research results to the broader geographic region.

- In 2010, the Reserve, with the RC as Principle Investigator and the SC and CTP playing key project roles, was awarded \$872,732 from NERRS Science Collaborative for a three-year project entitled “Determining the role of estuarine ‘swashes’ on water quality impairment along the Grand Strand of South Carolina: Impacts of land use and stormwater runoff.” This research will investigate the role that land use and stormwater inputs have on the biogeochemical dynamics of estuarine tidal creeks (locally known as swashes) and the consequences this has on the extent to which swashes serve as sources of organic matter and nutrient inputs to the coastal waters. This information is key to determining the contribution of swash discharges in fueling the oxygen demand that leads to low oxygen conditions in the waters directly off the Grand Strand. As such, this research links to ongoing efforts at understanding hypoxia in Long Bay.

Education

K12 and Community Education

- ‘NOAA in the Carolinas’ Estuary Live broadcast in September 2007 hosted with the ACE Basin NERR in Charleston, SC. Two day event with over 2,800 individual students participating from ten states.
- Public events including seminars, short courses, and field studies, in addition to new exhibits highlighting long-term research and monitoring efforts, serve as effective ways to share scientific findings with a variety of public audiences.
- Hosted a dedication event for the new Hobcaw Barony Discovery Center and an open house of the HBDC and BMFL for National Estuaries Day in September 2009. Over 200 people participated in this Estuaries Day event.
- Website redesign and enhancements (www.northinlet.sc.edu), that includes online event calendars and a new Reserve newsletter, as well as a presence on social media (i.e. Facebook) and other web-based community calendars. This has increased Reserve visibility and connectivity with public, K12, and other audiences.
- Hosted two successful multi-day teacher workshops combining art, literature, and science in partnership with COSEE-SE and Waccamaw National Wildlife Refuge/SEWEE Association and two summer ACE Adventure multi-day teacher workshops with the ACE Basin NERR at the ACE Basin.
- Shared resources, in particular staff and volunteers of the Baruch Foundation and from the USC Prince George Longleaf Project, have enabled increased and more diverse joint programming opportunities; new programs such as ‘Wild Wednesday’ and ‘Friday

Feeding Frenzy’ appeal to multi-generational family units and are increasing repeat visitors to education programs at HBDC.

- Partnered in 2008-2010 with the SCDNR to offer land and water based programs for Title I schools in northern coastal counties in SC; used the education vessel ‘Discovery’ to take local students (and a public trip for ‘Winyah Bay Appreciation Day’ in Nov. 2008) on Winyah Bay; NIWB NERR hosted land based estuary programs.
- Partner with ACE/SCDNR on their ‘Coastal Exploration Series’ to offer co-sponsored programs.
- Rain gardens with environmental monitoring stations were constructed in several local elementary, middle and high schools in Georgetown and Horry Counties through partnerships with the Coastal Waccamaw Stormwater Education Consortium (CWSEC) and county stormwater agencies and with grant funding from district area Walmart stores; Georgetown WalMart also hosted a rain barrel show and sale in the garden center for an on-going project with Georgetown High School’s environmental science and art classes.
- Strong partnerships continue with the CWSEC, Waccamaw National Wildlife Refuge/ SEWEE Association, the Center for Ocean Science Education Excellence Southeast (COSEE-SE), ACE Basin NERR, SCDNR, City and County non-profits and environmental education groups, and local school districts

Coastal Training Program

- **Classroom-Based Training:** CTP has provided many classroom-based, seminar-style workshops to a variety of decision makers (municipal staff and officials, and private sector audiences) on topics such as wetlands, low impact development, invasive species, and shoreline change.
- **Technical Assistance:** CTP has expanded the reach and impact of its training by providing a variety of technical assistance to decision makers as follow-up from training workshops. Technical assistance activities include identifying gaps in ordinances and policies and assisting communities with filling in those gaps to promote better resource management; developing grassroots community initiatives to engage citizens and gain public support for municipal efforts towards better stormwater practices; exploring the needs of coastal communities related to low impact development and laying a foundation for pursuing an LID manual for coastal SC.
- **Field-Based Training:** CTP has incorporated field components and field trips into its training and technical assistance activities. Field activities have included a mobile stormwater workshop to highlight innovative stormwater practices that have been implemented in the CTP target area; individual and small group tours of communities and watersheds for new committee members and staff to help them learn about the priority natural resource issues about which they will be making decisions.

- Presentations: CTP has delivered presentations on a variety of natural resource topics or about the Reserve in general to local rotary clubs, master gardener clubs, civil engineering clubs, and other professional organizations and civic groups, increasing the visibility of the Reserve and the reach of the CTP.
- Program Documentation: Training Needs Assessment of Professional Decision Makers in the Coastal Counties of South Carolina completed in 2006. Second Coastal Training Program Strategy Document for the Reserve completed in 2007. Biannual program evaluation data and performance narrative submitted each January and July in accordance with the CTP performance monitoring system.
- Partnerships: CTP continues to serve as a key education provider in the Coastal Waccamaw Stormwater Education Consortium to provide training and technical assistance to municipalities on stormwater-related topics. CTP is an active partner in the South Carolina Coastal Information Network, a collaborative group of training providers in SC who work together to increase their reach, leverage resources, and minimize duplication of efforts. CTP partners regularly with Coastal Carolina University, the ACE Basin NERR, and Clemson University on training and technical assistance activities.
- Websites: The Coastal Waccamaw Stormwater Education Consortium (www.cwsec-sc.org) was previously housed by the Reserve. It has been overhauled and is now housed on an external server, but is still maintained by the Coastal Training Program Coordinator, who serves as a core education provider for the Consortium. The CTP Coordinator also manages the training pages on the Reserve's main website.
- General: CTP continues to serve its community as a go-to resource and contact for citizen groups, decision makers, and the general public for information on natural resource issues, speaker needs, municipal support, etc.

Stewardship

- The North Inlet estuary habitat map was completed to the NERR system-wide habitat mapping SOPs. This baseline habitat map will help the Reserve to track and evaluate short-term variability and long-term changes in the extent and type of habitats within the Reserve and to examine how these changes are related to anthropogenic and climate stressors. The map was created by hand delineating habitat types over aerial IR photographs in a GIS, and was ground-truthed at 124 points. The process of completing this map also served as a test for the application of the methods and classification scheme suggested by the NERRs Habitat Mapping and Change Committee.
- A “Map Room” was created on the NI-WB website as a resource to educators and researchers to access NI-WB NERR map products. Maps are available for download as .pdf or .jpg files with associated metadata. The SC is also exploring ways to use web mapping applications to make Reserve spatial data more accessible to users.

- The Beach Vitex Task Force website was re-designed in 2009 to make the site more in-line with the needs of the Task Force. NI-WB NERR serves as an active member of the Task Force by maintaining the website and posting monthly updates, and by participating in beach vitex monitoring efforts.
- The Winyah Naturalist Program was established in the fall of 2007. This program provides training opportunities for community members to develop the skills necessary to become active volunteer stewards of coastal South Carolina habitats. Three 13-week Master Naturalist courses have been offered and graduated 27 volunteers, 4 day courses were attended by 25 participants, and 3 advanced training courses were attended by 34 participants. Some of the graduates have gone on to assist the Reserve with the clapper rail monitoring project.
- NI-WB Reserve newsletter *Estuaries Illustrated* was created (Spring 2008). This newsletter increases the visibility of the Reserve in the community, highlights activities and accomplishments of the Reserve, and provides a venue for educational outreach. Seven issues have been produced and are available on the website and distributed by email to a Reserve ‘friends’ list.
- Clapper rails have been monitored in North Inlet over three springs, the past two of which have involved volunteers who were graduates of the Winyah Naturalist program. Three secretive marsh bird training workshops have been hosted by the NI-WB NERR at the Kimbel Lodge and one at the ACE Basin NERR. The results of this research will be used to estimate the population of clapper rails in North Inlet and to examine the relationships between landscape and rail distribution.

NERR System-wide Contributions

- Hosted regional meeting of South Atlantic NERR sites (2007). The Southeast reserves identified common issues and approaches for working on these issues at this meeting. Efforts were continued, particularly around the issue of invasive species and the southeast reserves partnered with the Southeast Exotic Pest Plant Council to host a conference on the subject in 2009.
- NERRS CDMO staff is provided space in the Hobcaw Barony Discovery Center and receive facility and administrative support for the program through the Baruch Institute, University of South Carolina.
- Host site for Technical Training Workshops provided for all NERR sites by the CDMO each year and also meetings of the NERRS Data Management Committee.
- NERRS Committees and Workgroup participation - Reserve staff members have served and continue to serve on numerous NERRS committees and workgroups.